Research Report No. 3
Statistical Appendix

CHARACTERISTICS OF HOUSEHOLD WATER CONSUMPTION IN THREE NEW HAMPSHIRE COMMUNITIES

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INTRODUCTION

The purpose of this Appendix is to present a detail description of the study design and select estimated regression equations based on the highest R^2 with the most number of significant variables for use by professional workers in water resources fields. Several regression equations for each community are presented for evaluation of the results of the study and to provide alternatives in selection of a most usable equation for some defined purpose. It is felt that no one equation would serve all purposes or be of sufficient explanatory power for developing of confidence in the estimates obtained when applied to practical problems. Each community is treated separately due to an apparent "community" or "neighborhood" influence. The study was not designed to test for this influence on water consumption. Only for Durham and Epping is the "neighborhood" effect even modestly identifiable in statistical analysis. To test for "neighborhood" effect, more identifiable neighborhoods would be required along with more information about the neighborhood and its boundaries.

METHOD OF STUDY

Because few people know the quantity of water they consume, only households located in metered water districts were studied. Some 36 communities were determined to be 90 percent or more metered customers (10). Sampling from these 36 water districts of known metering was considered too costly. Instead, three communities were selected based upon income level of the community, representativeness of the community for New England conditions and the "consistent relationship between total public water use for all purposes and total community population" (11, p. 49).

The three communities selected were Durham, Epping, and Portsmouth. Durham represents a high-medium income professional worker type community with an indicated per capita community consumption of about 60 gallons of water per day. Epping was selected as a medium income community on the edge of urban expansion encroaching northward from the Boston area, but yet of a rural character typical of numerous New Hampshire smaller communities with an average daily per capita community water consumption level of about 30 gallons per day. Portsmouth was considered to be representative of larger communities with considerable variation in family income, size of family, and household characteristics with an average daily per capita community wide consumption of over 150 gallons of water per day (3).

The Sample

Durham and Epping were randomly sampled in such a manner as to insure approximately 50 observations per community. Portsmouth was randomly sampled to insure over 250 usable observations. An excess of these desired number of households were drawn from lists of metered water users in anticipation of persons having moved, householders not available for interviews, refused interviews, and others. The summary of the sample is given in Appendix A.

Household characteristic information was gathered by personal interview and household water consumption from utility records for the year 1968. This survey schedule is found in Appendix B. Information obtained provided for five dependent and 35 independent variables to be analyzed.

Reliability of Data

Inaccuracies due to lack of knowledge on the part of the respondent and personal interrelationships in survey techniques are always present. Through minimizing subjective type questions in the questionnaire, it is believed that this information is about as accurate as possible to obtain.

The meter readings obtained from water district files for Epping and Portsmouth were as correct as possible because both communities employed professionals to read all meters. Although a professional meter reader is employed in Durham, frequently the household members are away during the day. Then meter readings are made by the homeowner and forwarded to the water district office by card. The proportion of readings so obtained is hard to ascertain. Some variability in the length of "year" is possible in Durham and Portsmouth. In Portsmouth, with more accurate data than available for Durham on exact date of meter reading, the length of year ranged in the sample from about 360 days to 373 days. Annual use in these cases was adjusted to a 365-day year, wherever and whenever possible. It was not possible to make such an adjustment for Durham, and Epping did not appear to have a similar length-of-year problem. The only other source of error in measurement of water entering the household is a faulty meter. It was ascertained that all three communities have a definite program of meter replacement. There remains a probability that a small proportion of the meters included in the sample may have been inaccurate.

Other considerations in assessing the data include:

Epping: The community at the time of the survey, and for the period covered in the survey, had no public sewerage collection and processing facilities. Linaweaver, Geyer, and Wolff (6) indicate household water consumption is influenced by reliance on septic tank water disposal systems.

Durham: Durham suffers low water pressure. Some pollution from agricultural sources and possibly septic tank seepage into the watershed drainage system is possible. Charges for water waste disposal are related to water usage.

Portsmouth: McCall's Magazine (7) reported that Portsmouth performed too few bacterial checks and that the level of bacteria in the water was too high. Where this article did not appearuntil late in the year studied and in general probably few people knew about this article during the period of study and because no date as to when this information was applicable was included in the article, the information would have little influence on household consumption of water.

These considerations cause these communities to be more representative of all communities and their water supply and demand situation than would the "perfect" community water system. The meager information available suggests some such consideration would be encountered in most communities.

Period of Meter Readings

The period covered by meter readings differed between the three communities. For Durham, readings were made twice a year, on April 1 and October 1. This provided a clear distinction between winter and summer water use. In Epping, meters were read twice a year, January 1 and July 1.

Again, a two six-month period, but the period divided the year into the first half of the year and the second half of the year. This does not clearly distinguish summer from winter water usage in Epping.

Readings were made three times a year in Portsmouth, each covering a four-month period, and staggered throughout the year. In order to distinguish summer from winter water consumption, when applicable, eight months were used to span the summer months and four were used to span the winter months, staggered on a basis to cover the summer of 1968.

ANNUAL HOUSEHOLD WATER CONSUMPTION

Many factors are easily hypothesized to influence household water consumption. These factors may be aggregated into traditional economic variables such as income, asset position, and population of the household and that nebulous entity, tastes and preferences. (An analysis of household consumption based upon these economic variables is found elsewhere.) The asset position of the household can be disintegrated into physical characteristics of the house such as water using appliances, number of baths, and kind and nature of baths. Household population can be viewed according to its age and sex composition. Similarly tastes and preferences of the household can be reflected in such activities as lawn watering, car washing, and vacation patterns and amount of entertaining done in the household. The expanded socio-economic variables shed more light on household consumption of water than the more aggregated variables.

Due to sampling procedures, results are reported for each town independently. Of the pooled regressions that were run, Portsmouth tended to dominate due to the large number of observations. Also, little or nothing was gained in the analysis by pooling the three communities in terms of statistical significance. For those familiar with the three communities, information on each community may be more useful for their purposes.

Portsmouth

The select least squares analysis for Portsmouth with annual household consumption as the dependent variable is presented in Tables 1 - 3. Number of people in the household alone explained about 33 percent of the variation between households. When seven house characteristics and practices were added plus the population separated according to age group, almost 48 percent in the variation between household usage of water was explained. For Portsmouth a breakdown of the family composition or age composition added little to the explained variation over taking population of the household as a unit.

Using 13 independent house characteristics, not considering population of the household, explains 23 percent of the variation between households or substantially less than population taken alone. Hence this regression was placed among the many not reported here.

A reasonable and operational equation for determining household water consumption seems to be given in Table 2 where annual household consumption of water is determined by five house characteristics, two behavioral characteristics (unplanned and laundry sent out) and a total house population independent variable. This equation can be summarized for significant variables and be adjusted to meaningful quantities for easy computation

as follows: for the variables not of interest, multiply the B_i value by the mean of X_i and add this to the constant term of intercept. From Table 2 obtain:

$$Y' = 17{,}106 + \underset{(4{,}229)}{9{,}316X_1'} + \underset{(2{,}354)}{6{,}668X_2'} + \underset{(2{,}789)}{8{,}729X_3'} + \underset{(2{,}061)}{4{,}107X_4'} + \underset{(907)}{8{,}581X_5'}$$

where

Y' = Annual household consumption in gallons (not 100 gallons)

X_1' = Presence of dishwasher (0 if none; 1 if present)

X_2' = Number of baths

X_3' = Number of showers (count each shower head)

X_4' = Number of outside faucets

X_5' = Number of persons in household less 1.

The means are included inthe tables so that the desired equation can be obtained from these results.

Durham

The equations for estimating annual household consumption for Durham are given in Tables 4 - 7. Durham with only 52 observations, was somewhat similar to Portsmouth in many aspects. Twelve variables explained 64 percent of the variations between households. Higher explained variation (R^2) were obtained apparently because Durham has a more homogeneous population. Such items as vacation patterns and family living practices became statistically significant.

Of considerable interest for the town of Durham is the fact that certain behavioral variables such as away during the summer and sending laundry out were statistically significant at a fairly high level of significance. But a prime difficulty in Durham was the large number of regression coefficients or "b_i" values were not significantly different from zero.

Epping

Least squares estimates of annual household water consumption for Epping are given in Tables 8 - 10. The same problems that plagued Durham also plagued Epping analyses. High R^2 were obtained but few regression coefficients or "b_i" values were statistically significantly different from zero. About 66 percent of the variation in annual household water consumption could be explained by 13 variables of which family composition made up six. Replacing family composition with total in family reduced the variation between households explained by regression to about 50 percent of the variation. Similar to Portsmouth and Durham, number of people in households explained about 33 percent of the variation in household water use.

The Three Communities

Comparing household water consumption between the three communities indicates that Durham and Portsmouth contain individuals with similar consumption patterns. This is reflected in the variation explained by number in the household. Epping may have a different characteristic dominating. This may be average size of family which is substantially higher than found in either Portsmouth or Durham. The analysis indicates that a house with one person in it tends to represent a fixed overhead quantity of water consumed and the addition of one person to the family does not add the same quantity of water. The addition of another member to the household in

Durham and Portsmouth resulted in an increase of about 30 gallons of water consumed per day where in Epping it added only about 20 gallons of water per day.

There are two concepts dealing with water consumption relevant in the sampling procedures used in this study. One regards the individual household belonging to the same population throughout the three communities. The second concept deals with community characteristics and homogeneity of behavior of the population within the community. . The first question involves the question if a family were to move from Epping to Durham or from Durham to Portsmouth or from Portsmouth to Durham or from Portsmouth to Epping, after a short lapse of time, consumption patterns would be similar to those throughout the community. This would support the idea that each household belonged to the same population.

The second item involves the family once located in a community or a social economic group of families then does the behavior become different. With the present mobility of the population this second concept or approach seems to be more valid in the explaining of differences between Epping and Durham from Portsmouth. Household consumption patterns for Portsmouth as analyzed here probably represent the more cosmopolitan rather than localized community patterns so that the Portsmouth analysis represents more of a complete picture of consumption patterns. The inclusion of family age composition substantially increased R^2 in Durham and Epping but had little effect on the R^2 in a similar comparison of regressions for Portsmouth.

DAILY PER CAPITA WATER CONSUMPTION

Average per capita household daily water consumption were difficult to estimate. R^2 were typically low with few regression coefficients significantly different from zero.

Portsmouth

The best all around results were obtained for Portsmouth and are shown in Table 11. Only about 25 percent of the variation in daily per capita water consumption was explained by 13 variables. A number of regression coefficients ("b_i" values) were statistically different from zero. This was not only true of family composition but also of household and behavioral characteristics. The most useful results of this analysis is the determining that house characteristics and family characteristics do influence daily water consumption per capita per day.

A similar regression to that in Table 11 is presented in Table 12 with the main exception being total number in the household substituted for family composition of the household. The loss in explained variation was small.

Durham

Daily per capita household water consumption for Durham is analyzed in Table 13. Sixteen variables explained about 55 percent of the variation in daily per capita household water consumption. Few of the regression coefficients were statistically significantly different from zero. However, this analysis suggests the homogeneity of the Durham population as may be reflected in pier group pressures and status seeking motives of the families.

The total number of people in the household was a poor determinant of per capita daily household consumption. The R^2 when total people in the household was the only independent variable was 0.16.

Epping

The analysis of the determinants of daily per capita household water consumption for Epping is summarized in Table 14. Number of people in the household explained 26 percent of the variation in daily per capita consumption. The addition of 11 other house characteristics and family living patterns raised the percent of variation explained by regression to only about 38 percent but the statistical significance was unacceptable.

Three Communities

The analysis of daily per capita water consumption supports the comparison for annual household consumption described above. The more cosmopolitan community of Portsmouth presented a more varied population than the communities of Durham and Epping. A few key independent variables appeared to be more influential in determining water use per capita per day in Epping and Durham. Although these key variables differ, they do represent different characteristics of households found in the two communities. Number of persons in the household explained more variation between households in daily per capita consumption in Epping than 13 variables in Portsmouth. In Portsmouth with its more cosmopolitan population, the different localized influences appear to offset each other.

SEASONAL WATER USE

Because lawn watering dominated in many studies of household water consumption a special effort was made to analyze seasonal water consumption. The results indicated that families in northern New England do not water their lawn nor use an exceptionally large quantity of water outdoors. Summer water consumption is greater than winter consumption.

Portsmouth

Meters were read three times a year in Portsmouth. In order to insure the summer months were included distinctly different from winter months on a staggered meter reading basis, eight months are included in the summertime period versus four months in the winter. This feature should be taken into account when analyzing seasonal water use for Portsmouth.

Winter water use alone determined 54 percent of the summertime use. The addition of 16 family, house, and behavioral patterns increased the amount of variation explained by regression to only 61 percent. This was only slightly more than the 59 percent explained by winter use, number of outside faucets, and total number in household. This regression is shown in Table 15. All three variables were statistically significant.

In Portsmouth, the analysis based on questions relating to lawn watering were soon found to be insignificant and number of outside faucets was used as a proxy variable for outside water use during the summer months. The regression given in Table 15 does support the hypothesis that there is outside water use during summer months. It also supports the hypothesis that people use more water in the summer than in the winter in addition to the outside water use. This is reflected in the positive and statistically significant coefficient for number in household.

Because Portsmouth is an older community with housing developments added to the periphery in a rather consistent manner the location of a house may have some influence on summer use. Due to the way the sample in Portsmouth was drawn, the record number of the household would reflect distance from the downtown district. Hence, the higher the record number the farther into the outskirts of the community the house would be located and the more likelihood for larger lot size and greater outside use of water. To test this hypothesis annual and summertime water use was regressed on the record number. The results based on R^2 and t values indicated that location as indicated by the record number did not influence either annual or summertime use.

Durham

Meters in Durham were read April 1 and November 1, thus splitting the year into winter months and spring, summer, and fall months. Winter water use alone explained 55 percent (R^2 = 0.55) of the variation in summertime water use. The addition of 14 other variables explained 82 percent of the variation in summertime water consumption. In this equation statistically significant variables included winter water use, lawn watering, the presence of a dishwasher, the age classification of 12 to 18 years, and family members other than those between the ages of 6 and 18 away from home (Table 16). About 28 percent of the households indicated they watered their lawn and when watering their lawn, they used 6,764 gallons of water ("b_i" value). In the other analyses for Durham, lawn watering was a significant determinant of summer use but never did the "b_i" value or regression coefficient rise above 9,000 gallons.

The analysis of water use for Durham indicates that few householders watered their lawn and if they did the average water so used was not great.

Epping

In Epping, meters were read twice yearly, once on July 1 and January 1. This divided the seasons of the year symetrically about in half. For Epping as would be expected, water use during the first half of the year explained 99 percent of the variation in household water use during the second half of the year. Regression Coefficient was nearly one also. This implies that the best indicator of water consumption during the second half of the year to be water consumption during the first half of the year.

APPENDIX A

Sample Description

SUMMARY OF SAMPLE AND DISPOSITION

	Durham	Epping	Portsmouth
Total Services in Community	545	175	5914
Sample	#10, then every 8th	#3, then every 4th	#340, then every 15th
Total Sample Taken	73 (13.4%)	65 (37.1%)	361 (6.1%)
Total Complete Records	52 (71.2%)	54 (83.1%)	263 (72.9%)
Total Household	52	51	258
Apartments and Nursing Homes	0	3	5
Not Households (includes any other commercial use)	2 (2.7%)	1 (1.5%)	16 (4.4%)
Moved	5 (6.8%)	2 (3.0%)	28 (7.8%)
Not Available for Interview	4 (5.5%)	0	20 (5.5%)
Refused Interview	4 (5.5%)	7 (10.8%)	32 (8.9%)
Other*	6 (8.2%)	1 (1.5%)	2 (0.6%)
TOTAL	73 (99.9%)	65 (100%)	361 (100%)

*In Portsmouth and Epping, multi-family dwellings are included with the complete records. In Durham, the three are included in "Other".

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APPENDIX B

Survey Schedule
and
Variable Identification

HOUSEHOLD CONSUMPTION OF WATER

Water Resources Research Center
University of New Hampshire

April 1969

Water use:
District _____
Price _____

_____ _____ _____
_____ _____ _____
_____ _____ _____
_____ _____ _____

Did you live at your present address for the full calendar year 1968? Yes___ No ___ If yes: Please complete questionnaire. If no: Please return unanswered.

I. Mayor Household Using Appliances

A. Please check "yes" beside the following water using household appliances you had in your household and "no" for those you did not have in 1968. (If more than one is in customary use and is on your water meter, please indicate number.)

1. Dishwasher — Yes ____ No ____
2. Washing Machine: (a) Automatic — Yes ____ No ____
   (b) Wringer (Easy spin dryer) — Yes ____ No ____
3. In sink drain garbage disposal — Yes ____ No ____
4. Humidifier: (a) In heating system — Yes ____ No ____
   (b) Separate appliance — Yes ____ No ____
5. Other "major" water using appliance — Yes ____ No ____
   Type: _____ Type: _____

II. Characteristics of House

A. Is your house a "single family" dwelling _____? Duplex _____? More than two family ____? Of the previous, how many family units are served by your water meter?_____(number)

B. How many bathrooms are there in the dwelling served by your water meter? _____(number) Tubs _____(number) Showers ____(number)

C. Did you have a permanently installed swimming pool filled by water that passed through your water meter in 1968? Yes____ No ____

D. Number of outside water faucets. ___ _

E. Did you water your lawn or garden regularly during the summer of 1968 with water that passed through your water meter? Yes ____ No ____
If so, what is the approximate size of the area that you watered?
_____ square feet or (dimensions) _____feet by _____ feet.

F. During 1968, did "unplanned water use" occur in your household such as "serious" leaky faucets, "bleeding of lines", broken water pipes?
Yes ____ No ____

G. Is waste water disposal of a septic tank-drainage field type _____ or community sewer system type _____ (Please check one or other).

III. Family Characteristics

A. Please indicate number in family (household or dwelling unit) by age and approximate time away from household in 1968 (those residing constantly in your household. Please include each individual only once under nearest classification and include all persons on your water meter.)

Age	Number	Weeks Away from Home 1968 (As summer camp, vacation, college, etc.) (0 if less than 3 wks.)	Month When Individual Was Away (As July)
1. [illegible] mos. - 3 yrs.	_____	_____	_____
2. [illegible] yrs. - 6 yrs.	_____	_____	_____
3. 6 yrs. - 12 yrs.	_____	_____	_____
4. 12 yrs - 18 yrs.	_____	_____	_____
5. 18 yrs. - "retirement"	_____	_____	_____
6. In retirement age	_____	_____	_____
7. Roomers (please count succession of roomers in terms of roomers on a year-round basis.)	_____	_____	_____

B. Please indicate if number of visitors to your household is "usual" for your area or "more than usual"? (For examples: children in some neighborhoods tend to congregate at one or two houses and frequently use bathrooms - also, certain occupations impose upon families "more than usual" entertainment.) Please check most appropriate.
Usual number of visitors _____ More than usual number _____

C. Please check closest figure to your household's annual net spendable income. ( ) $1000, ( ) $2000, ( ) $4000, ( ) $6000, ( ) $8000, ( ) $10,000, ( ) $12,000, ( ) $15,000 or over.

D. Of those in your household over 18 but less than retirement age, how many are "away from home" during the day? _____(number)

E. How many in your household are employed in occupations that involve rapid soiling of clothes - such as construction work, farm work, mechanic, etc. and their work clothes are washed as home? _____(number)

F. About what proportion of your laundry is sent out (including diaper service or at laundermat).

_____0 to 9 percent (as husbands shirts only)
_____10-19 percent
_____20-29 percent
_____30-39 percent
_____40-49 percent
_____50-59 percent
_____60-69 percent
_____70-79 percent
_____80-89 percent
_____90-99 percent

IDENTIFICATION OF VARIABLES IN ANALYSIS

DEPENDENT VARIABLES	VARIABLES
Per household consumption of water - annual, 100 gallons	X_1
Per household consumption of water - summer, 100 gallons	X_2
Per household consumption of water - winter, 100 gallons	X_3
Per capita daily consumption of water, 0.1 gallons	X_4
Annual expenditure for water (in 10¢)	X_5

INDEPENDENT VARIABLES

I. Appliances	
Dishwasher (0=no, 1=yes)	X_6
Automatic washing machine (0=no, 1=yes)	X_7
Wringer or reuseable water (0=no, 1=yes)	X_8
Garbage disposal (0=no, 1=yes)	X_9
Other major appliances - e.g., humidifier, cattle, goldfish ponds, plastic swimming pools (0=no, yes=actual number)	X_{10}
II. Characteristics of house	
A. Number of families served by water meter (actual number)	X_{11}
B. Number of bathrooms (number)	X_{12}
Number of tubs (number)	X_{13}
Number of showers, heads (number)	X_{14}
C. Swimming pool (0=no, 1=yes)	X_{15}
D. Number of outside faucets (number)	X_{16}
E. Lawn watering (0=no, 1=yes)	X_{17}
Size of lawn (0=no watering, 1=small, 2=medium, 3=large)	X_{18}
F. Car washed regularly (0=no, 1=yes)	X_{19}
G. Unplanned water use (0=no, 1=yes)	X_{20}
H. Sewage (0=septic tank type, 1=community system)	X_{21}
III. Family Characteristics	
A. Number of children, 6 mos.-3 yrs.	X_{22}
Number of children, 3 yrs.-6 yrs.	X_{23}
Number of children, 6 yrs.-12 yrs.	X_{24}
Number of children, 12 yrs.-18 yrs.	X_{25}
Number of adults, 18-retirement	X_{26}
Number of adults - retirement	X_{27}
Number of roomers and others	X_{28}
Total number in household(s) less 1	X_{29}
Total weeks individuals away from home in summer	
Age 6 - 18	X_{30}
All others	X_{31}
Total weeks individuals away from home in winter	
Age 6 - 18	X_{32}
All others	X_{33}

VARIABLE NUMBER

B. Number of visitors (0=usual, 1=more than usual) X_{34}

C. Income (in $100.) X_{35}

D. Away from home during day (number) X_{36}

E. Occupations (0=other, 1= occupation involving soiled clothing) X_{37}

F. Percent laundry sent out (midpoint as 0-9=5%, 10-19=15%, ... 90-99=95%) X_{38}

IV. Town Code X_{39}

1 = Durham
2 = Portsmouth
3 = Epping

Record Number X_{40}

Code missing information and unknown as 9 in each space

9 for single space
99 for two-column space
999 for three-column space

APPENDIX C

Regression Results

Table 1. Annual household water consumption: Least squares model relating Annual household water consumption to family composition of household by age, physical features of house and activities of household members, Portsmouth, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gal	11.1350[2/]			640.9453
Independent Variable:					
Dishwasher	0 - 1	92.1033	43.4858	2.1180	0.2031
Automatic Washer	0 - 1	47.8510	48.3628	0.9894	0.8555
Baths	No.	63.5842	24.9971	2.5437	1.4102
Showers (Heads)	No.	83.7641	28.2604	2.9640	0.7617
Faucets (Outside)	No.	45.3430	20.9987	2.1593	1.2775
Unplanned	0 - 1	173.0826	52.2452	3.3129	0.1133
People in Household					
6 mos - 3 yrs	No.	67.1756	41.1751	1.6315	0.1367
3 - 6 yrs.	No.	77.0359	30.6693	2.5118	0.2734
6 - 12 yrs.	No.	79.0703	20.6229	3.8341	0.4961
12 - 18 yrs.	No.	81.2157	23.0381	3.5253	0.4688
Adults	No.	106.4204	21.0878	5.0465	1.9570
Retired	No.	75.2352	26.9511	2.7916	0.4375
Laundry Out	Percent	-0.6403	0.8024	-0.7980	14.9219

[1/] Relevant information:
$R^2 = 0.47931$
Computed F. value = 17.1361
Standard error of estimate = 258.7063
N = 256

[2/] Constant of Regression or b_i

Table 2. Annual household water consumption: Least squares model relating annual household water consumption to number of persons in household, physical features of house and activities of household members, Portsmouth, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gal.	109.8428[2/]	———	———	640.9453
Independent Variable:					
Dishwasher	0 - 1	93.1572	42.2890	2.2029	0.2031
Automatic Washer	0 - 1	59.0330	47.0658	1.2543	0.8555
Baths	No.	66.6823	23.5368	2.8331	1.4102
Showers (heads)	No.	87.2882	27.8935	3.1293	0.7617
Faucets (outside)	No.	41.0654	20.6100	1.9925	1.2773
Unplanned	0 - 1	178.7416	51.3931	3.4779	0.1133
Total People	No.[3/]	85.8127	9.0719	9.4592	2.7734
Laundry out	Percent	-0.6393	0.7906	-0.8087	14.9211

[1/] Relevant information:
R^2 = 0.4737
Computed F. Value = 27.7882
Standard error of estimate = 257.4529
N = 256

[2/] Constant of Regression or b_i

[3/] Number in household less 1

Table 3. Annual household water consumption: Least squares model relating annual household water consumption to number of persons in household, Portsmouth, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gal.	354.1001[2/]	_____	_____	640.9453
Independent Variable:					
Total people	No.[3/]	103.8751	9.1513	11.3509	2.7939

[1/] Relevant information:
R^2 = 0.3357
Computed F. Value = 128.8423
Standard error of estimate = 287.3633
N = 257

[2/] Constant of Regression or b_i

[3/] Number in household less 1

Table 4. Annual household water consumption: Least squares model relating annual household water consumption to family composition of household, physical features of house and activities of household members, Durham, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of b_i"	Mean X_i
Dependent Variable: Annual Household Consumption	100 gal.	253.9524[2/]	———	———	788.7114
Independent Variable:					
Dishwasher	0 - 1	75.8725	73.8086	1.1280	0.6923
Other[3/]	0 - 1	160.6205	79.6088	2.0176	0.1923
Baths	No.	90.2362	57.9813	1.5563	2.1154
Showers (heads)	No.	113.7160	57.2777	1.9854	1.3654
Faucets (outside)	No.	-29.3722	44.9944	-0.6528	1.8462
Unplanned	0 - 1	-148.7875	138.8072	-1.0719	0.0577
Total people	No.[4/]	92.9970	22.3262	4.1654	2.9423
Summer weeks spent away from home					
6 - 18 yrs	Weeks	-20.9857	7.9605	-2.6363	1.7697
Other	Weeks	-12.7976	4.4553	-2.8724	5.[illegible]
Visitors	0 - 1	155.4357	99.2496	1.5661	0.1154
Away during day	No.	1.6001	3.1282	0.5115	13.1771
Laundry out	Percent	- 3.4580	1.8113	-1.9091	11.7308

[1/] Relevant information:
R^2 = 0.6412
Computed F Value = 5.8084
Standard error of estimate = 200.7939
N = 52

[2/] Constant of Regression or b_i

[3/] Include humidifier, gold fish ponds, small plastic swimming pools.

[4/] Number in household less 1.

Table 5. Annual household water consumption: Least squares model relating annual household water consumption to family composition of household, physical features of house and activities of household members, Durham, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gal.	123.4658[2/]	———	———	788.7114
Independent Variable:					
Dishwasher	0 - 1	82.3411	97.7537	0.8423	0.6923
Automatic Washer	0 - 1	3.3929	153.4566	0.0221	0.9231
Baths	No.	23.6364	72.4305	0.3263	2.1154
Showers	No.	41.9516	67.4579	0.6219	1.3654
Lawn watering	0 - 1	50.1791	86.2086	0.5821	0.2885
Unplanned	0 - 1	48.2580	162.0854	0.2977	0.0577
People in Household:					
6 mos - 3 yrs	No.	107.6583	182.8808	0.5887	0.0577
3 - 6 yrs	No.	77.4886	98.4517	0.7871	0.1346
6 - 12 yrs	No.	58.3684	42.1611	1.3844	0.7692
12 - 18 yrs	No.	124.2000	51.9628	2.3902	0.5192
Adults	No.	161.5392	50.5302	3.1968	2.2500
Retired	No.	143.0584	84.4510	1.6940	0.1731
Laundry Out	Percent	-2.8713	2.3117	-1.2421	11.7308

[1/] Relevant Information:
R^2 = 0.4879
Computed F Value = 2.7847
Standard error of estimate = 243.0313
N = 52

[2/] Constant of Regression or b_i

Table 6. Annual household water consumption: Least squares model relating annual household water consumption to number of persons in household, physical features of house and activities of household members, Durham, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gal.	338.1436[2/]	———	———	788.7114
Independent Variables:					
Dishwasher	0 - 1	7.8919	91.2600	0.0865	0.6923
Automatic Washer	0 - 1	2.1911	151.5138	0.0145	0.9231
Baths	No.	70.0886	68.1740	1.0281	2.1154
Showers	No.	32.6239	65.3270	0.4994	1.3654
Lawn watering	0 - 1	62.5458	79.1053	0.7907	0.2885
Unplanned	0 - 1	28.4078	152.2969	0.1865	0.0577
Total People	No.[3/]	91.5756	26.0057	3.5214	2.9423
Laundry Out	Percent	-3.3119	2.2858	-1.4489	11.7308

1/Relevant information:
$R^2 = 0.4097$
Computed F Value = 3.7303
Standard error of estimate = 245.2876
N = 52

2/Constant of Regression or b_i

3/Number in household less 1.

Table 7. Annual household water consumption: Least squares model relating annual household water consumption to number in household, Durham, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gal.	461.3894[2/]	_____	_____	788.7114
Independent Variable:					
Total People	No.[3/]	111.2467	23.3106	4.7724	2.9423

[1/] Relevant Information:
R^2 = 0.3130
Computed F Value = 22.7756
Standard error of estimate = 245.4005
N = 52

[2/] Constant of regression or b_i

[3/] Number in household less 1.

Table 8. Annual household water consumption: Least squares model relating annual household water consumption to family composition of household by age, physical features of house and activities of household members, Epping, 1968.[1/]

Variable Name	Units	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gals.	31.4790[2/]	_____	_____	660.0000
Independent Variable:					
Dishwasher	0 - 1	108.2860	98.5544	1.0987	0.1569
Automatic Washer	0 - 1	73.6588	97.6205	0.7545	0.8628
Showers (Head)	No.	67.0346	64.0803	1.0461	0.6667
Baths	No.	51.7664	75.0377	0.6899	1.4314
Faucets (outside)	No.	83.8716	51.1860	1.6386	0.9216
Unplanned	0 - 1	-299.6035	170.3689	-1.7586	0.0392
People in Household					
6 mos - 3 yrs	No.	3.7758	61.9359	0.0610	0.2745
3 - 6 yrs	No.	114.9935	48.5882	2.3667	0.4902
6 - 12 yrs	No.	34.1154	37.5202	0.9093	0.6863
12 - 19 yrs	No.	8.0615	29.8902	0.2697	0.8039
Adults	No.	96.9996	29.5325	3.2845	2.6667
Retired	No.	185.1697	[illegible]	3.4752	0.3529
Laundry Out	Percent	-3.1369	1.8286	-1.7155	15.1961

[1/] Relevant Information:
$R^2 = 0.6555$
Computed F Value = 5.4155
Standard error of estimate = 221.4000
N = 51

[2/] Constant of Regression or b_i

Table 9. Annual household water consumption: Least squares model relating annual household water consumption to number of persons in household, physical features of house and activities of household members, Epping, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Annual Household Consumption	100 gal.	97.3718[2/]	———	———	660.0000
Independent Variable:					
Dishwasher	0 - 1	85.3273	105.9467	0.8054	0.1569
Automatic Washer	0 - 1	119.1057	102.4667	1.1624	0.8628
Baths	No.	116.7300	78.2116	1.4925	1.4314
Showers (head)	No.	72.2545	69.8418	1.0345	0.6667
Faucets (outside)	No.	65.2608	55.0362	1.1858	0.9216
Unplanned	0 - 1	-298.0020	181.2072	-1.6445	0.0392
Total People	No.[3/]	48.0914	15.5348	3.0957	4.2745
Laundry Out	Percent	-1.4997	1.9468	-0.7704	15.1961

[1/] Relevant Information:
$R^2 = 0.5100$
Computed F Value = 5.4636
Standard error of estimate = 247.8389
N = 51

[2/] Constant of Regression or b_i

[3/] Number in household less 1.

Table 10. Annual household water consumption: Least squares model relating annual household water consumption to number of persons in household, Epping, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable: Annual Household Consumption	10^6 gal.	396.8653[2/]			660.0000
Independent Variable: Total People	No.[3/]	61.5592	13.1314	4.6879	4.2745

[1/] Relevant Information:
R^2 = 0.3096
Computed F Value = 21.9767
Standard error of estimate = 272.3477
N = 51

[2/] Constant of regression or b_i

[3/] Number in household less 1.

Table 11. Per capita per day water consumption: Least squares model relating Per Capita per day water consumption to family composition of household by age, physical features of house, and activities of household members, Portsmouth, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error or "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Per capita per day per household consumption	0.1 gal.	498.2446[2/]	_____	_____	521.3125
Independent Variable:					
Dishwasher	0 - 1	79.9274	39.3000	2.0334	2.0338
Automatic Washer	0 - 1	23.3557	43.7076	0.5344	0.8555
Baths	No.	83.6724	22.5910	3.7038	1.4102
Showers (heads)	No.	52.3530	25.5402	2.0498	0.7617
Faucets (outside)	No.	26.7006	18.9775	1.4070	1.2773
Unplanned	0 - 1	69.8636	47.2163	1.4796	0.1133
People in Household					
6 mos - 3 yrs	No.	-75.8761	37.2118	-2.0390	0.1367
3 - 6 yrs.	No.	-67.4669	27.7172	-2.4341	0.2734
6 - 12 yrs	No.	-55.4030	18.6378	-2.9726	0.4961
12 - 18 yrs	No.	-56.1064	20.8206	-2.6948	0.4688
Adults	No.	-43.2339	19.0580	-2.2685	1.9570
Retired	No.	-77.7739	24.3569	-3.1931	0.4375
Laundry Out	Percent	-0.7904	0.7252	-1.0900	14.9219

[1/] Relevant Information:
$R^2 = 0.2534$
Computed F Value = 6.3184
Standard error of estimate = 233.8045
N = 256

[2/] Constant of Regression or b_i

Table 12. Per capita per day water consumption: Least squares model relating per capita per day water consumption to number of persons in household, physical features of house, and activities of household members, Portsmouth, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Per capita per day per household consumption	0.1 gal.	442.0938[2/]	———	———	521.31
Independent variable:					
Dishwasher	0 - 1	83.7689	38.2592	2.1895	0.2031
Automatic Washer	0 - 1	32.6410	42.5808	0.7666	0.8555
Baths	No.	83.3283	21.2940	3.9132	1.4102
Showers (hoads)	No.	53.5847	25.2355	2.1234	0.7617
Faucets (outside)	No.	24.0756	18.6460	1.2912	1.2773
Unplanned	0 - 1	73.8180	46.4958	1.5876	0.1133
Total People	No.[3/]	-54.3354	8.2074	-6.6203	2.7734
Laundry Out	Percent	-0.8351	0.7152	-1.1676	14.99

[1/] Relevant Information:
$R^2 = 0.2437$
Computed F Value = 9.9507
Standard error of estimate = 232.9199
N = 256

[2/] Constant of Regression or b_i

[3/] Number in household less 1.

Table 13. Per capita per day water consumption: Least squares model relating per capita per day water consumption to family composition of household by age, physical features of house, and activities of household members, Durham, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Per capita per day per household consumption	0.1 gal.	508.3977[2/]	———	———	593.8076
Independent Variable:					
Dishwasher	0 - 1	160.1141	67.8365	2.3603	0.6923
Other	No.	120.0635	76.8899	1.5615	0.1923
Baths	No.	46.0975	53.4338	0.8627	2.1154
Showers (head)	No.	78.2322	53.4788	1.4629	1.3654
Faucets (outside)	No.	-16.6900	43.8736	-0.3804	1.8462
Unplanned	0 - 1	-80.1184	127.6802	-0.6275	0.0577
People in Household					
6 mos - 3 yrs	No.	-163.6373	140.5382	-1.1644	0.0577
3 - 6 yrs	No.	-106.4289	74.5602	-1.4274	0.1346
6 - 12 yrs	No.	-72.3586	42.6974	-1.6947	0.7692
12 - 18 yrs.	No.	-63.7322	38.1005	-1.6727	0.5192
Adults	No.	6.9943	44.2541	0.1580	2.2500
Retired	No.	-32.8167	66.0248	-0.4970	0.1731
Summer weeks away from home					
6 - 18 yrs	Weeks	-12.3357	9.8640	-1.2506	1.7692
Others	Weeks	-11.4944	4.5048	-2.5516	5.2308
Visitors	0 - 1	122.4418	92.2679	1.3270	0.1154
Away during day	No.	-3.5785	3.4836	-1.0272	13.1731

[1/] Relevant Information:
R^2 = 0.5493
Computed F Value = 2.6659 (significant at 5 percent level)
Standard error of estimate = 180.2078
N =52

[2/] Constant of Regression or b_i

[3/] See footnote 3, Table 4.

Table 14. Per capita per day water consumption: Least squares model relating per capita per day water consumption to number of persons in household, physical features of house and activities of household members, Epping, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Per capita per day per household Consumption	0.1 gal	532.7666[2/]	———	———	417.3723
Independent Variable:					
Dishwasher	0 - 1	65.8340	104.5999	0.6294	0.1569
Other	No.[3/]	7.2734	78.8814	0.0922	0.2157
Baths	No.	12.6908	75.5698	0.1679	1.4314
Showers (heads)	No.	11.4352	58.7472	0.1946	0.6667
Faucets (outside)	No.	27.9248	49.7259	0.5616	0.9216
Unplanned	0 - 1	-196.5536	154.6179	-1.2712	0.0392
Total People	No.[4/]	-46.2234	13.5847	-3.4026	4.2745
Summer weeks away from home					
6 - 18 yrs.	Weeks	-7.4594	6.8217	-1.0935	1.4902
others	Weeks	2.7866	4.3370	0.6425	4.0588
Visitors	0 - 1	-63.6426	104.5946	-0.6085	0.0980
Away during day	No.	2.2313	2.7633	0.8075	18.5294
Laundry Out	Percent	-0.5806	1.4919	-0.3892	15.1961

[1/] Relevant Information:
$R^2 = 0.3800$
Computed F Value = 1.9408 (not significant at 5 percent level)
Standard error of estimate = 201.3059
N = 51

[2/] Constant of Regression or b_i

[3/] See footnote 3, Table 4.

[4/] Number in household less 1.

Table 15. Summer (seasonal) household water consumption: Least squares model relating summer water consumption (8 months) to winter water use (4 months), number of outside faucets, and number of persons in household, Portsmouth, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Summer Water Consumption	100 gal.	18.5337[2/]	_____	_____	443.6848
Independent Variable:					
Winter water consumption	100 gal.	1.3786	0.1109	12.4354	200.6342
Faucets (outside)	No.	54.3722	12.5389	4.3363	1.2763
Total People	No.[3/]	28.3352	6.4348	4.4034	2.7938

[1/] Relevant Information:
R^2 = 0.5932
Computed F Value = 122.9648
Standard error of estimate = 166.6253
N = 257

[2/] Constant of Regression or b_i

[3/] Number in household less 1.

Table 16. Summer (seasonal) household water consumption: Least square model relating summer (6 months) water consumption to family composition of household by age, winter (6 months) consumption, physical features of house, and activities of household members, Durham, 1968.[1/]

Variable Name	Unit	Regression Coefficient ("b_i")	Standard Error of "b_i"	Computed T Value of "b_i"	Mean X_i
Dependent Variable:					
Summer water Consumption	100 gal.	15.5222[2/]	_____	_____	419.7114
Independent Variable:					
Winter water Consumption	100 gal.	0.5103	0.1314	3.8838	368.9614
Dishwasher	0 - 1	86.7754	33.8304	2.5650	0.6923
Other	No.[3/]	68.0301	37.9069	1.7947	0.1923
Showers (head)	No.	38.6181	25.2837	1.5274	1.3654
Watering lawn	0 - 1	67.6362	31.0756	2.1765	0.2885
People in Household					
6 mos - 3 yrs	No.	-45.0674	75.3521	-0.5981	0.[illegible]
3 - 6 yrs	No.	28.8453	38.2292	0.7545	0.1346
6 - 12 yrs	No.	5.5874	21.2034	0.2635	0.769[illegible]
12 - 18 yrs	No.	65.2887	18.3077	3.5662	0.5192
Adults	No.	37.8903	22.5169	1.6828	2.250[illegible]
Retired	No.	29.8734	33.5157	0.8913	0.1731
Roomers	No.	21.8854	79.3070	0.2760	0.0385
S[illegible] weeks away from home					
6 - 18 yrs.	Weeks	-6.6087	4.6780	-1.4127	1.7
Others	Weeks	-6.7800	2.0848	-3.2522	3.2[illegible]
Laundry Out	Percent	-1.1142	0.7807	-1.4272	11.7308

[1/] Relevant Information:
$R^2 = 0.8153$
Computed F Value = 10.5950
Standard error of estimate = 86.7085
N = 52

[2/] Constant of Regression or b_i

[3/] See footnote 3, Table 4.