

## **CHAPTER - 4**

### **RESULTS AND DISCUSSION**

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### **4.1. Socio-Economic Characteristics**

#### **4.1.1. General Characteristics of the Selected Households**

Due to the make-up of the population and dwelling types, water consumption may be evaluated in terms of these urban and socioeconomic differences. The analysis units were chosen to represent a variety of housing types and income levels (Morote et al, 2016). The researcher was interested in learning more about the respondents' social and demographic characteristics, which were divided into three income groups: low-income, middle-income, and high-income. Water consumption varies in each household due to a range of factors such as gender, family size, family type, age, education, and marital status, all of which are important in household research. The general features of the sample households are presented. The following are the demographics of the responders.

**Table 27: General Characteristics of the Selected Urban Households**

Variable	Low-Income Level		Middle-income Level		High-Income Level		Total
	Frequency	per cent	Frequency	per cent	Frequency	per cent	
<b>Gender</b>							
<b>Male</b>	121	38.2	117	47.8	53	59.6	291
<b>Female</b>	196	61.8	128	52.2	36	40.4	360
<b>Total</b>	317	100	245	100	89	100	651
<b>Age</b>							
<b>20 – 40</b>	153	48.3	69	28.2	64	71.9	286
<b>41 – 60</b>	159	50.2	161	65.7	22	24.7	342
<b>60 and above</b>	5	1.6	15	6.1	3	3.4	23
<b>Total</b>	317	100	245	100	89	100	651
<b>Marital Status</b>							
<b>Married</b>	258	81.4	169	69.0	55	61.8	482
<b>Unmarried</b>	53	16.7	67	27.3	32	36.0	152
<b>Widow</b>	4	1.3	7	2.9	2	2.2	13
<b>Separated</b>	2	0.6	2	0.8	0	0.0	4
<b>Total</b>	317	100	245	100	89	100	651
<b>No.of Children</b>							
<b>0 Children</b>	34	10.73	15	6.1	6	6.7	55
<b>1 Child</b>	35	11.04	84	34.3	34	38.2	153
<b>2 Children's</b>	154	48.6	119	48.6	30	33.7	303
<b>3 Children's</b>	90	28.4	27	11.0	19	21.3	136
<b>4 and above</b>	4	1.3	0	0.0	0	0.0	4
<b>Total</b>	317	100.00	245	100.0	89	100.0	651
<b>No.of. elders</b>							
<b>0</b>	275	86.8	191	78.0	74	83.1	540
<b>1</b>	28	8.8	18	7.3	5	5.6	51
<b>2</b>	14	4.4	36	14.7	10	11.2	60
<b>Total</b>	317	100	245	100	89	100	651
<b>Age of children</b>							
<b>NA</b>	34	10.73	15	6.1	6	6.7	55
<b>0-4 years</b>	54	17.03	30	12.2	15	16.9	99
<b>5-8 years</b>	68	21.45	94	38.4	28	31.5	190
<b>9-12 years</b>	72	22.7	77	31.4	18	20.2	167
<b>13 and above</b>	89	28.1	29	11.8	22	24.7	140
<b>Total</b>	317	100.00	245	100.0	89	100.0	651

<b>Community</b>							
<b>OC</b>	17	5.4	19	7.8	28	31.5	64
<b>OBC</b>	207	65.3	188	76.7	47	52.8	442
<b>SC/ST</b>	93	29.3	38	15.5	14	15.7	145
<b>Total</b>	317	100.0	245	100.0	89	100.0	651
<b>Education</b>							
<b>Primary</b>	237	74.8	90	36.7	12	13.5	339
<b>Secondary</b>	53	16.7	122	49.8	30	33.7	205
<b>Degree</b>	17	5.4	30	12.2	41	46.1	88
<b>PG</b>	3	0.9	3	1.2	6	6.7	12
<b>Others</b>	7	2.2	0	0	0	0.0	7
<b>Total</b>	317	100	245	100	89	100	651
<b>Occupation</b>							
<b>Government/ Aided</b>	34	10.7	16	6.5	26	29.2	76
<b>Business</b>	24	7.6	116	47.3	50	56.2	190
<b>Private Staff</b>	81	25.6	41	16.7	10	11.2	132
<b>Cooli</b>	161	50.8	53	21.6	0	0.0	214
<b>Others</b>	17	5.4	19	7.8	3	3.4	39
<b>Total</b>	317	100	245	100	89	100	651
<b>Type of Family</b>							
<b>Nuclear</b>	222	70.0	183	74.7	51	57.3	456
<b>Joint</b>	95	30.0	62	25.3	38	42.7	195
<b>Total</b>	317	100	245	100	89	100	651
<b>Family Size</b>							
<b>2-3 members</b>	60	18.9	29	11.8	51	57.3	140
<b>4 -5 members</b>	212	66.9	178	72.7	26	29.2	416
<b>Above 5 members</b>	45	14.2	38	15.5	12	13.5	95
<b>Total</b>	317	100	245	100	89	100	651

*Source: Compiled from field survey, 2019.*

Gender, age, community, education, employment, family type, and multiple family members are among the social and demographic aspects studied. According to the preliminary Census 2011 statistics, India's total population is 1,21,01,93,422, with 62, 37, 24,248 men and 58, 64, 69,174 females, for a sex ratio of 940 females per 1000 males. The gender of the respondents, whether male or female, is a significant driver of their water usage patterns and opinions of water conservation, thus data on these topics were gathered, evaluated, and provided in the table (27). The Gender wise

distribution of the respondents showed that for the low-income category 61.8 per cent of the respondents were female and 38.2 per cent were male whereas for the middle-income category 52.2 per cent were female and 47.8 per cent were male and for the high-income category respondents' 59.6 per cent were male and 40.4 per cent were female. In the current study female population was dominant among the selected respondents among the category of low-income and middle-income whereas for the high-income community's male population was found to be high. In this majority of the respondents are female also resulted as this confirms the role of the female in sourcing and handling water in households (Sintondji et al., 2017; Akoteyon, 2019).

In India (census 2011), the sex ratios for age categories 0-6, 0-19, 15-45, and 60+ were 918, 908, 944, and 1033, respectively. The respondent's age is a major indicator of water usage and conservation awareness. The age-wise distribution of the respondents showed that for the low-income category 50.2 per cent of the respondents were belonging to the age group 41 years to 60 years, 48.3 per cent were between the age of 20 years to 40 years and 1.6 per cent of the respondents were above the age group of 60 years, whereas for the middle-income category of the respondents 65.7 per cent were between the age group of 41 years to 60 years, 28.2 per cent were between the age group 20 years to 40 years and 6.1 per cent were above the age of 60 years. In the case of the high-income category, 41.6 per cent were between the ages of 20 years to 40 years, 24.7 per cent were above the age group of 60 years and 3.4 per cent were between the age group of 41 years to 60 years. Among the selected respondent's majority of them were found to be between the age group of 41 years to 60 years of age. The dominant age groups are 41-60. The result confirms the targeted group is the household head or their representative who can provide adequate information on household access to water (Bedi, 2015; Suprabha, 2016; Akoteyon, 2019).

The researcher in the study determined the respondents' marital status, and the results are displayed in table (27). In the low-income group, 62.46 per cent of respondents were married, 17.67 per cent were single, 15.46 per cent were widows, and 4.42 per cent were divorced. Respondents in the middle-income group were 51.84 per cent married, 17.96 per cent separated, 15.51 per cent widows, and 14.69 per cent unmarried, whereas respondents in the high-income category were 32.58 per cent married, 26.97 per cent widows, 24.72 per cent separated, and

15.73 per cent unmarried. Thus, from the study, it can be identified that the majority of the respondents were married, and also the number of respondents who had got separated from husband/wife is also high in number and very few were widowed and unmarried respondents.

The investigator discovered information on multiple children in the families of chosen respondents; the results revealed that the low-income group (48.6 per cent), middle-income (48.6 per cent), and high-income (46.5 per cent) had two children in their family, while the remainder had children ranging from 0 to four. Even if the government is enacting tight family planning regulations, the study shows that having children in the family is depending on the desires of the family members. According to data on multiple family members of seniors in the selected home, 86.8 per cent of the low-income group, 78.0 per cent of the middle-income group, and 82.9 per cent of the high-income group did not have any elders.

The researcher looked at the community-wise distribution of respondents across their income groups and found that 65.3 per cent of low-income respondents were from OBC, 29.3 per cent were from SC/ST, and 5.4 per cent were OC, whereas 76.7 per cent of middle-income respondents were from OBC, 15.5 per cent were from SC/ST, and 7.8 per cent were from OC, and 67.9 per cent of high-income respondents were from OBC, 22.3 per cent were SC/ST, and 9.8 per cent were from OC. The majority of respondents across all income levels belonged to the OBC community, according to the information on community among the chosen respondents.

In a country like India, literacy is the foundation for social and economic progress. Only 12 per cent of the population in India was literate when British rule ended in 1947. Over time, India has changed socially, economically, and globally. After the 2011 census, India's literacy rate was estimated to be 74.04 per cent. Education is a key determinant of a person's attitude toward water and conservation.

The survey was conducted during 2011-12. The overall workforce, according to it, is anticipated to be 47.41 crores, with 33.69 crores of rural employees and 13.72 crores of urban workers. He claims that in rural regions, 35.3 per cent of employees are engaged as casual laborers, but in metropolitan areas, the proportion is 14.6 per cent (Economic Times, 2014). Occupation of the respondents is an important variable that determines the water demand and pays for water. Hence data on occupational status is collected and presented. Occupation-wise classification of the

respondents showed that for the low-income category 50.8 per cent have been engaged as coolis whereas 25.6 per cent enrolled in unorganized sector jobs, 10.7 per cent were engaged in government or aided jobs, 7.6 were engaged in private jobs and 5.4 per cent were engaged in other works. For middle-income category respondents, 47.3 per cent were working private jobs, 21.6 per cent were working as coolis, 16.7 were engaged in unorganized sector jobs, 7.8 per cent were enrolled in other jobs and 6.5 per cent were working in government or aided jobs and for the high-income category respondents 48.3 per cent were working in private jobs, 19.1 per cent were unorganized workers, 18 per cent were working other jobs, 7.9 per cent were government or aided employees and 6.7 per cent were coolis. As of the study area majority of them were found to be working as coolis and engaged in some kind of employment activity in private and unorganized sectors.

The type of family group of population covered in the study varies from the nuclear family, which means that surveyed households represented all types of family in various localities. The type of family of the respondents showed that for low-income category respondents 70 per cent were living in a nuclear family and others were living in the joint family system, for middle-income category respondents 74.7 per cent were living in the nuclear family system and 25.3 per cent were from the joint family system and in case of high-income category respondents 57.3 per cent were from nuclear family and 42.7 per cent were from the joint family system. With so many developments taking place across the social division of family is becoming a fashion now and it is been found in the current study that the majority of the respondents were from nuclear family backgrounds whereas very few were living in joint family types.

Family Size determines the demand for water and water usage. With the increase in family size, the demand for water increases, and water use also increases. Hence data on family size is collected, processed, and is presented. Numbers of members living in the family of low-income category respondents showed that 66.9 per cent had 3 members in their family, 18.9 per cent had 4 members in their family and 14.2 per cent had 5 members in their family, for middle-income category respondents 72.7 per cent had 4 members in their family, 15.5 per cent had 5 members in their family and 11.8 per cent had 3 members in their family and for high-income category respondents 57.3 per cent were having 3 members in their family,

29.2 per cent had 4 members in their family and 13.5 per cent had 5 members in their family (Bedi, 2015; Suprabha, 2016; Sintondji et al., 2017). Several members in the family have a direct influence on water consumption and in the current study, it can be found that every household has 3 or more than 3 members in their house which showed that water consumption is needed to take care of the family members will be high.

#### 4.1.2. Consumption Expenditure of the Selected Households

Household final consumption expenditure is the market value of all goods and services purchased by households, including durable objects (such as cars, washing machines, and computers) (previously private consumption). House acquisitions are excluded, however, imputed rent for owner-occupied dwellings is included. Payments and fees for approvals and licenses to governments are also mentioned. Household consumption spending includes non-profit organizations that aid households, even when reported separately by nation. Any statistical discrepancy between resource utilization and resource availability is also included in this category (Aizenman et al., 2015). In 1960, the average figure for India was 69.65 per cent, with a low of 54.72 per cent in 2010 and a high of 87.38 per cent in 1960. 60.29 per cent is the most recent value from 2019.

**Table 28: Details of Consumption Expenditure for the Selected Households**

<b>Expenditure</b>	<b>Low-income</b>	<b>Middle-income</b>	<b>High-income</b>
Food	29.8	19.2	31.2
Drinking water	4.3	8.5	13.8
Electricity	2.1	7.5	10.3
Clothes	4	9.3	7
Consumer durables	1.7	4.4	3
Medical	3.5	5.8	3.2
Education	11.3	10.2	12.3
Rent	18.2	9.2	0.1
Fuel	14.4	15.4	13.2
Entertainment	5.3	4.2	3.5
Festival	1.3	3.2	2.1
God worshipping	0.7	1.3	0.2
Others	3.4	1.8	0.1
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>

*Source: Compiled from field survey, 2019.*

It can be identified from the table item-wise break up of expenditure reveals that an expense on food was an important item of expenditure as it was mentioned by 29.8 per cent of low-income respondents group, 19.2 per cent of middle-income respondents and 31.2 per cent of high-income respondents followed by the food it can be noted that the other dominating expenses were made on education, rent, and fuel. These expenses are considered to be mandatory as it occurs frequently among the selected group.

The expense made on drinking water shows that only a small part of the income is been spent by the selected respondent's group on the particular as about 4.3 per cent of low-income, 8.5 per cent of middle-income and 13.8 per cent of high-income is been spent for drinking water. It can be incurred from the study that most of the respondents are not spending much on their drinking water which is evident that the respondents are utilizing government water supply and only when there is a lack of water do, they prefer buying drinking water outside.

The amount spent on leisure items like entertainment, festival, god work ship, cloths, and durables is also less among the respondents as they prefer to spend for them only when there is a need for it. India is one among the developing countries where households spend a disproportionate share of their consumption expenditure on healthcare, with the government's contribution being minimal. Again, in the study area, it can be noted that a very minimum amount is been spent for health care expenditure by the respondents irrespective of their income group.

Thus, the expenditure pattern of the respondents showed that most of the income of the respondents is been spent on food, as it is the basic essential product of life. And there is not much variation seen in the expenditure pattern of the respondents based on their income group.

## **4.2. Living Condition**

### **4.2.1. Type of House in Selected Urban Households**

According to the 2011 Census, there are 236.06 million occupied residential homes and 246.69 million families. There are 487 persons per 100 families and 105 households every 100 occupied residential buildings. Moreover, half of the households live in decent housing, with 86.6 per cent of them owning their home. Furthermore, almost 76 per cent of HHs have access to clean drinking water. One of

the main aspects that help us research water use and trends in the housing pattern in which the respondents reside.

**Table 29: Type of House in Selected Urban Households**

Variable	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	percentage	Frequency	percentage	Frequency	percentage	
<b>Type of House</b>							
Pucca	123	38.8	213	86.94	89	100	425
Semi Pucca	103	32.49	32	13.06	0	0	135
Kutchra	87	27.44	0	0	0	0	87
Others	4	1.26	0	0	0	0	4
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Ownership</b>							
Rent	293	92.43	210	85.71	2	2.2	505
Own	24	7.57	35	14.29	87	98	146
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Own house Value</b>							
Below 1 lakh	24	7.57	3	1.22	0	0	27
01-10 lakh	0	0	9	3.67	2	2.25	11
10 -20 lakh	0	0	17	6.94	2	2.25	19
20-30 lakh	0	0	6	2.45	12	13.48	18
30-40 lakh	0	0	0	0	14	15.73	14
40 and above	0	0	0	0	54	60.67	54
Not Applicable	293	92.43	210	85.71	5	5.62	508
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Monthly Rent</b>							
≤ 1500	183	57.73	0	0	0	0	183
1501-3000	95	29.97	0	0	0	0	95
3001-5000	12	3.79	23	9.39	0	0	35
5000-10000	0	0	89	36.33	0	0	89
Above 10000	3	0.95	98	40	5	5.62	106
Not Applicable	24	7.57	35	14.29	84	94.38	143
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Garden Area</b>							
Yes	20	6.3	24	9.8	53	59.55	82
No	297	93.7	221	90.2	36	40.45	569
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Square feet</b>							
1-5Sq ft	5	1.58	17	6.94	19	21.35	41
5-10 Sqft	0	0	7	2.86	28	31.46	35
10-20 Sqft	0	0	0	0	4	4.49	4
20 and Above	0	0	0	0	2	2.25	2
Not Applicable	312	98.42	221	90.2	36	40.45	569
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>

Source: compiled from field survey, (2019).

According to the information on the type of housing that the respondents lived in, 38.80 per cent of the low-income group lived in pucca houses, 32.49 per cent in semi-pucca houses, 27.44 per cent in kutchra houses, and 1.26 per cent in another sort

of house. In the middle-income group, 86.94 per cent of respondents lived in pucca houses, while the remaining 13.06 per cent lived in semi-pucca houses, and in the high-income category, 100 per cent of respondents lived in pucca houses. According to the data analysis, the bulk of the respondents lives in pucca homes, with a tiny minority living in other dwellings similar to Kutcha houses. The study conducted by Bedi, 2015; Suprabha, 2016 had also resulted in this.

Over 87 per cent of Indians own their houses, with only 11 per cent renting. The percentage of people who own or rent a home seldom changes between census years. In 2001, owned HH (percentage) was 86.7, and in 2011 it was 86.6. In 2001, rental HH (percentage) was 10.5 and in 2011 it was 11.1. The detail on ownership of house showed that for low-income category 92.43 per cent were living in a rented house and 7.57 per cent were living in their own houses, for middle-income category 85.71 per cent were living in a rented house and 14.29 per cent were living in their own house and for high-income category 2.2 per cent were living in a rented house and 98 per cent were living in own house. Whereas details on the value of the house in which the respondents were living were identified and the result showed that for low-income communities 7.57 per cent were living in a house whose value was below 1 lakh and others were living in a rented house so they were not applicable for this analysis, for middle-income category 6.94 per cent were living in houses with value 10 lakh to 20 lakh, 3.67 per cent were living in the house valuing 01 lakh to 10 lakh, 2.45 per cent were living in a house with value 20 lakh to 30 lakh and others were living in a rented house and the study was not applicable for them and high-income category 60.67 per cent were living in houses 40 lakh and above value, 15.73 per cent were living in houses with value 30-40 lakh, 13.48 per cent were living in house 20 to 30 lakh and others were living in the house from value 1 lakh to 20 lakh. (Bedi, 2015; Suprabha, 2016).

The monthly rent paid by the respondents is found in the study and the information depict that among the low-income category 57.73 per cent were paying less than or equal to 1500Rs, 29.97 per cent were paying 1501rs to Rs 3000, 3.79 per cent were paying Rs 3001 to 5000 Rs and for others, they were living in own house, for middle-income category respondents 40 per cent of them were paying 10,000 above for rent, 36.33 per cent were paying 5000 to 10000rs and 9.39 per cent were paying 3001 to 5000rs and others were living in own house, in case of high-income

category 94.38 per cent were living in own house and only 5.62 per cent were living in a rented house and the rent paid by them for the rent was above Rs.10000.

The researcher had enquired about the availability of gardens in their house for low-income communities only 1.58 per cent had a garden in their house, for the middle-income category only 9.80 per cent were having a garden in their house, and in the laborer's high-income category 59.55 per cent were having a garden in their house. The square feet detail showed that 1.58 per cent of the low-income category has garden from 1 to 5 square feet size, for middle-income category 6.94 per cent were having a garden with size 1-5 square feet, 2.86 per cent were having a garden with 5-10 square feet and for high-income category 31.46 per cent were having garden between 5 to 10 square feet, 21.35 per cent were having garden between 1-5 square feet, 4.49 per cent were having garden between 10-20 square feet and two per cent were having a garden in size of 20 and above square feet.

#### **4.2.2. Housing Facilities**

Water usage is directly proportional to the number of taps in a home. Because numerous taps may be flowing at the same time, water usage rises as the number of taps grows. The water supply is put under strain as a result of this. As a result, a big plot size combined with a high income equates to more taps and higher water use. The number of taps in a home is closely connected to the economic class, the area of locality, and the water consumption habits of the households, just as the size of the housing unit. There's also a link between the size of the property and the number of different types of taps. A considerable number of taps were focused in bathrooms with toilets, out of total taps, followed by kitchen taps and taps for other purposes.

**Table 30: Housing Facilities of the Selected Households**

Variable	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	percentage	
<b>Number of Rooms</b>							
1 Room	18	5.68	0	0.0	0	0.00	18
2 Rooms	238	75.08	10	4.1	0	0.00	248
3 Rooms	61	19.24	151	61.6	0	0.00	212
4 Rooms	0	0.00	72	29.4	25	28.09	97
5 and above	0	0.00	12	4.9	64	71.91	76
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Number of Bathrooms</b>							
1 bathroom	308	97.16	122	49.80	0	0.0	430
2 bathrooms	9	2.84	96	39.18	0	0.0	105
3 bathrooms	0	0.00	25	10.20	25	28.1	50
4and above	0	0.00	2	0.82	64	71.9	66
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Number of Taps</b>							
No Taps	250	78.86	7	2.86	0	0.00	257
1 Tap	56	17.67	26	10.61	0	0.00	82
2 Taps	11	3.47	79	32.24	0	0.00	90
3 Taps	0	0.00	10	4.08	0	0.00	10
4 Taps	0	0.00	123	50.20	0	0.00	123
5 Taps	0	0.00	0	0.00	13	14.61	13
6 and above	0	0.00	0	0.00	76	85.39	76
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Number of Washbasin</b>							
Nil	308	97.16	56	22.86	0	0.00	364
1 Washbasin	9	2.84	187	76.33	0	0.00	196
2 Washbasins	0	0.00	2	0.82	13	14.61	15
3 and above	0	0.00	0	0.00	76	85.39	76
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Number of Shower</b>							
Nil	312	98.42	56	22.86	0	0.00	368
1 Shower	5	1.58	154	62.86	0	0.00	159
2 Showers	0	0.00	35	14.29	13	14.61	48
3 and above	0	0.00	0	0.00	76	85.39	76
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Number of Bathtub</b>							
Nil	317	100	245	100.0	85	95.51	647
1 Bathtub	0	0	0	0.0	4	4.49	4
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.00</b>	<b>651</b>

*Source: compiled from field survey, (2019).*

In the current study, the researcher has tried to find out the housing pattern of the respondents based on various criteria like type of house, use of water resources in terms of pipelines, bathtub, etc. the result of which can be viewed in the table (30).

Several rooms in the house living by the respondent's households for the low-income category sample 75.08 per cent were having 2 rooms, 19.24 per cent were living in 3 rooms and others were living in 01 room house, for middle-income category respondents 61.63 per cent were had 03 rooms in their house, 29.39 per cent had 4 rooms in their house, 4.90 per cent has 5 and above rooms and 4.08 per cent had 2 rooms in their house and for high-income category respondents 71.91 per cent were living in houses with 5 plus rooms and 28.9 per cent were living in 4 room houses.

The number of bathrooms in the houses of respondents detail showed that for low-income category 97.16 per cent had a single bathroom and 2.84 per cent had 2 bathrooms, for middle-income category respondents 49.80 per cent were having a single bathroom, 39.18 per cent had 2 bathrooms, 10.20 per cent had 3 bathrooms and 0.82 per cent had 4 and above bathrooms in their houses whereas for high-income category respondents 71.91 per cent had more than 4 bathrooms and 28.9 per cent had 3 bathrooms.

In the current study, the researcher tried to find out the housing pattern of the respondents based on various criteria like type of house, use of water resources in terms of pipelines, bathtub, etc. the result of which can be viewed in the table (30).

Several taps in the house are needed to know the usage of water by the respondents so the researcher has made an inquiry on it and it can be seen in the table (30). For low-income category respondents, 78.86 per cent had no taps, 17.67 per cent had 1 tap and 3.47 per cent had 2 taps, for the middle-income category 50.20 per cent had 4 taps in their houses, 32.24 per cent had 2 taps in their houses, 10.61 per cent had 1 tap and 4.08 per cent had 3 taps whereas 2.86 per cent had no taps in their houses and for high-income category 85.39 per cent had 6 and above taps in their houses and 14.61 per cent had 5 taps in their houses.

Information on several washbasins showed for the low-income category 97.16 per cent had no washbasin at all and 2.84 per cent had 1 washbasin in their house, for 76.33 per cent of middle-income category respondents had 1 washbasin and 22.86 per cent had no washbasin at all whereas 0.82 per cent had 2 washbasins in their

house and for high-income category respondents 76 per cent had 3 and above washbasin and 14.61 per cent had 2 washbasins in their house.

Several shower availability in the house of the respondents showed that for 98.42 per cent of low-income category there was no shower at all and 1.58 per cent had 1 shower in their house, for middle-income category 62.86 per cent had 1 shower in their house, 22.86 per cent had no shower and 14.29 per cent had 2 organizations house, for high-income category respondents 85.39 per cent had 3 and above showers in the house and 14.61 per cent had 2 showers.

Whereas information on bathtubs for the respondents showed that for low-income and middle-income no one had a bathtub in their house whereas for high-income, 95.51 per cent had no bathtub in their house and only 4.49 per cent had 1 bathtub in their house. This table concluded that the type of dwelling units has a direct relation with the level of income. Usually, high-income groups have large houses in comparison to the lower-income group classes. The type of house in the selected localities is not uniform. There are large-scale Intra and inter settlement differences in the localities. The type of dwelling of the respondents is an important factor determining a demand for water as concrete buildings will have more rooms and need more water for cleaning.

#### **4.2.3. Water using utilities**

The water utilities by the respondents were examined by the researcher based on the water-consuming machines available in the houses. As in the modern world washing machine is being a solution for washing clothes and it is been preferred by many females in the country as it reduces the time consumption in washing.

**Table 31: Details of Water using Utilities in Selected Households**

Variable	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	percentage	Frequency	percentage	Frequency	percentage	
<b>Washing Machine</b>							
0	303	95.6	141	57.6	3	3.4	447
1	14	4.4	104	42.4	86	96.6	204
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Type of Washing Machine</b>							
0	303	95.6	141	57.6	3	3.4	447
Automatic	1	0.3	58	23.7	84	94.4	143
Semi-Automatic	13	4.1	46	18.8	2	2.2	61
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Capacity of Washing Machine (Liters)</b>							
0	303	95.6	141	57.6	3	3.4	447
60-80	1	0.3	45	18.4	2	2.2	48
80-120	10	3.2	50	20.4	80	89.9	140
120-150	3	0.9	9	3.7	4	4.5	16
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Dishwasher</b>							
Yes	0	0	242	98.8	15	16.9	257
No	317	100	3	1.2	74	83.1	394
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Capacity of Dishwasher (Liters)</b>							
0	317	100	242	98.8	74	83.1	633
20-40	0	0	3	1.2	9	10.1	12
40-60	0	0	0	0	6	6.7	6
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>

*Source: compiled from field survey, (2019).*

From the table (31), among the selected respondent 95.6 per cent of the low-income category level had no washing machine in their house whereas only 4.4. per cent had some kind of washing machine. For middle-income category respondents, 57.6 per cent did not have a washing machine in their house and 42.4 per cent had some kind of washing machine in their house and for the high-income category 96.6 per cent of the respondents had a washing machine in their house and only 03.4 per cent stated that they did not have a washing machine in their home. In the case of the type of washing machine, the researcher has categorized it as an automatic washing machine and a semi-automatic washing machine to find out the water consumption taken for washing. For the low-income category, 0.3 per cent had an automatic washing machine, for the middle-income category 23.7 per cent had an automatic washing machine and 18.8 per cent had semi-automatic washing machines

and for high-income category respondents 94.4 per cent had an automatic washing machine and 2.2 per cent had semi-automatic washing machines.

The details on liters of water consumption by the washing machine used by the respondents showed that for low-income category respondents 95.6 per cent did not have a washing machine so they are not applicable for this whereas 3.2 per cent used 80 to 120 liters of water for washing, 0.9 per cent used water between 120 to 150 liters of water, 0.3 per cent used water between 60 to 80 liters of water, for middle-income category 57.6 per cent did not have washing machine whereas 20.4 per cent used water between 80-120 liters about 18.4 per cent used water between 60 to 80 liters and only 3.7 per cent used water between 120 to 150 liters of water and for high-income category 89.9 per cent used water between 80 to 120 liters, 4.5 per cent used water between 120-150 liters and 2.2 per cent used water between 60-80 liters.

The respondents were enquired about having a dishwasher for washing dishes at their home it was noted that among the low-income category no one had a dishwasher for washing dishes due to which they did not spend water for this whereas for middle-income category respondents 98.8 per cent had no dishwasher and 1.2 per cent had a dishwasher at their home and they spend 20-40 liters of water for washing dishes and for high-income community 16.9 per cent had a dishwasher at their home for which they were spending 20 to 60 liters of water.

### **4.3. Sources of Water Supply**

In the majority of Indian cities, municipal bodies are the primary source of water. A considerable portion of the population lacks access to water owing to insufficient supply infrastructure, unlawful access, and other issues. The water use trends of the families revealed that consumption was limited across the board. Water usage was insufficient per home and per capita in all economic groups.

#### **4.3.1. Source of Water Supply in Selected Households**

Increased water consumption in urban areas, along with dwindling water supplies, is a big concern. While India has around 17 per cent of the world's population, it only possesses about 4 per cent of the world's renewable freshwater resources and just 2.4 per cent of the world's geographical area. Growing water demand and the subsequent hunt for new water sources would inevitably come against natural restrictions in a country like India, which is densely populated and relatively

consistent. According to the 2011 Indian census, around 70 per cent of households have access to tap water, with 62 per cent having treated tap water. As a result, almost 40 per cent of urban residents do not have access to public water and must rely on alternate water sources. Furthermore, not all residences with public water have access to it within the premises. Only 49 per cent of homes have access to a piped water source on their property (Wankhade, 2015).

**Table 32: Sources of Water Supply for Selected Households**

Variable	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
<b>Distance from Premises</b>							
0-1m	34	10.7	36	14.7	16	18	86
1-2m	140	44	126	51.4	22	24.7	288
2-3m	143	45.1	67	27.3	38	42.7	248
3 and above m	0	0	16	6.5	13	14.6	29
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Sources of water</b>							
HSC	148	46.7	54	22.0	0	0.0	202
Own Borewell +HSC	0	0.0	24	9.8	78	87.6	102
HSC+Common Street Pipeline	154	48.6	153	62.4	0	0.0	307
HSC+Market Water	5	1.6	9	3.7	0	0.0	14
HSC+Borewell+ Market Water	0	0.0	0	0.0	11	12.4	11
HSC+Common Street Pipeline+ Market Water	10	3.2	5	2.0	0	0.0	15
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>

*Source: compiled from field survey, (2019).*

The sources of water supply for the respondents were identified from the table (32) The distance from the premises for getting water for the need of the respondent's details showed that for the low-income category 45.1 per cent were traveling 2-3m for getting water, 44 per cent had water resources within 1-2 m and 10.7 per cent had water resources within 0-1m, for middle-income category 51.4 per cent had water resources within 1-2m of their premises, 27.3 per cent were having water resources within 2-3km, 14.7 per cent had water resources form 0-1m and 6.5 per cent had water resources ranging from 3km and above and for the high-income category 42.7 per cent had water resources within 2-3m of the premises, 24.7 per cent had

water resources 1-2m of the premises, 18 per cent had water resources 0-1km of the premises and 14.6 per cent had water resources from 3 and above meters.

The source of water availability for the respondents showed for the low-income category 48.6 per cent used HSC service, the common street pipeline for their water consumption, 46.7 per cent used HSC for their water consumption, 3.2 per cent used HSC connection, common street pipeline, and market water for their water consumption and 1.6 per cent used HSC connection and market water to meet their water need. In the case of the middle-income category 62.4 per cent used HSC connection, common street pipeline, 22 per cent used HSC connection, 3.7 per cent used HSC and market water and 2 per cent used HSC, Common street pipeline, and market water. In the case of the high-income category, 87.6 per cent used HSC connection for water resources and 12.4 per cent used HSC, Borewell, and market water.

#### **a) Household Service Connection**

While 81 per cent of all families in India have access to 40 liters of water per day from some source, only 18 to 20 per cent of rural homes in India have piped water connections. This has resulted in a disparity in water supply and availability. According to the NitiAayog's Composite Water Management Index, 75 per cent of residences lack access to drinking water, while 84 per cent of rural households lack access to piped water. When water is delivered through pipes, it is not distributed evenly. Megacities like Delhi and Mumbai get more than the standard municipal water allocation of 150 liters per capita per day (LPCD), while the rest of the country gets 40-50 LPCD. The World Health Organization recommends 25 liters of water per person per day to fulfill basic hygiene and food needs. Extra available water is used for non-potable purposes such as mopping and cleaning, according to WHO estimates. The Jal Shakti ministry has been entrusted with developing a comprehensive and integrated approach to water issues, notably the supply of drinking water. It has already set an ambitious target of connecting every Indian home to piped water by 2024. The amount of water consumed for drinking is predicted to decrease as a result of this. Plugging leaks in piped water in metropolitan areas, on the other hand, would be a different challenge. It is estimated that around 40 per cent of piped water in India is lost owing to leakage.

**Table 33: Details of Respondent's Household Service Connection in Selected Households**

Variables	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
<b>Number of Pipelines</b>							
1 Pipe	300	94.6	235	95.9	25	28.1	560
2 Pipe	17	5.4	8	3.3	48	53.9	73
3 and above	0	0.0	2	0.8	16	18.0	18
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Frequency of Water Supply (HSC)</b>							
Daily	0	0.0	0	0.0	0	0.0	0
1-3 days ones	28	8.8	9	3.7	0	0.0	37
4-6 days ones	25	7.9	85	34.7	49	55.1	159
7-10 and ones	245	77.3	148	60.4	35	39.3	428
10 days and above	19	6.0	3	1.2	5	5.6	27
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Storage of WATER SUPPLY (HSC)</b>							
Sump	28	8.8	148	60.4	89	100.0	265
Container	280	88.3	88	35.9	0	0.0	368
Direct pipeline	9	2.8	9	3.7	0	0.0	18
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Tariff (HSC)</b>							
0-100	308	97.2	75	30.6	0	0.0	383
100-500	9	2.8	159	64.9	0	0.0	168
500 and above	0	0.0	11	4.5	89	100.0	100
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>
<b>Level of Water Supply (HSC)</b>							
Good	43	13.6	12	4.9	75	84.3	130
Moderate	157	49.5	163	66.5	8	9.0	328
Bad	117	36.9	70	28.6	6	6.7	193
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>

*Source: compiled from field survey, (2019).*

There was an inquiry made by the researcher on the number of pipelines available for them at their place and it is been presented in the table (33). From the table it can be identified that for low-income category respondents 94.6 per cent reported that they have 1 pipeline connection and 5.4 per cent said that they had 2 pipeline connections, for the middle-income category 95.9 per cent had one pipeline connection, 3.3 per cent had 2 pipeline connections and 0.8 per cent had 3 and above pipeline connection and for the high-income community, 53.9 per cent had 2 pipelines followed by 28.1 per cent had one pipeline connection and 18 per cent had 3 and above pipeline in their home.

Information on the frequency of water supply was studied in the research where it can be found that for all the respondents daily availability of water supply was not available, and for low-income category respondents 77.3 per cent received water 7-10 days once, 8.8 per cent received water between 1-3 days ones, 7.9 per cent received water on the interval 4-6 days once and 6 per cent received water from 10 days and above whereas for middle-income category respondents 60.4 per cent received water between 7-10 days once, 34.7 per cent received water from 4-6 days once, 3.7 per cent received water between the interval 1-3 days ones and 1.2 per cent received water from 10 days and above and for high-income category 55.1 per cent received water from 4-6 days ones, 39.3 per cent received water from 7 to 10 days ones and only 5.6 per cent received water from 10 days and above.

Details on the storage of water supply by the respondents showed that for the Low-income respondents 88.3 per cent stored water in the container, 8.8 per cent stored water in the ump and 2.8 per cent stored water in direct pipeline whereas for the middle-income category 60.4 per cent stored water in the sump, 35.9 per cent stored water in a container and 3.7 per cent stored water in direct pipeline whereas for high-income category 60.4 per cent stored water in the sump, 35.9 per cent stored water in a container and 9 per cent stored water in direct pipeline and for high-income category cent per cent stored water in the sump.

The tariff paid by the respondents for the water supply showed that for low-income category respondents 97.2 per cent paid tariff of about Rs.0 to Rs. 100 and 2.8 per cent paid tariff of about Rs.100- Rs. 500, whereas for middle-income category respondents 64.9 per cent paid a tariff of about Rs. 100 to Rs. 500, 30.6 per cent paid tariff about Rs. 0 to Rs. 100 and 4.5 per cent paid tariff about Rs. 50 and above and for high-income community cent per cent population paid /rs. 500 and above for their water supply.

Details on the level of water supply received by the respondents showed that for the low-income category 49.5 per cent stated that their water supply level was moderate, 36.9 per cent stated that their level of water supply was bad 13.6 per cent of respondents said their water supply was good, in case of middle-income category respondents 66.5 per cent felt that their water supply was moderate, 28.6 per cent felt their water supply was bad and 4.9 per cent felt water supply level to be good and for

high-income category respondents 84.3 per cent felt that the water supply level was good, 9 per cent stated that their level of water supply was moderate and 6.7 per cent felt that the water supply level was bad.

#### **b) Water Supply through Own Bore Well**

As we enter the second decade of the twenty-first century, the Indian economy and society confront significant problems in the water sector. The demands of a rapidly industrializing economy and urbanizing population come at a time when the capacity to replenish supplies is limited, water tables are falling, and water quality issues are rising. As we dig deeper for water, our groundwater gets contaminated with fluoride and arsenic. Effluents and sewage that have not been cleaned are still being dumped into our rivers and groundwater, contaminating both. Even though groundwater information is crucial for building a sustainable and equitable urban water supply, it is critically lacking in urban India. Increased per-capita consumption, greater ambient temperatures, decreasing river-intake dependability, demand-supply imbalances, and the low cost of water-wells are cited as important causes in people living in emerging cities throughout the world becoming more reliant on groundwater. (Kulkarni et al., 2015).

**Table 34: Details of Additional Water Supply through  
Own Bore Well in Selected Households**

Variables	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency
<b>Number of Borewells</b>							
1 BW	0	0.0	24	9.8	89	100.0	113
Not Applicable	317	100.0	221	90.2	0	0.0	538
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Frequency of Water Fetching (OBW)</b>							
Daily	0	0.0	20	8.2	75	84.3	95
2-5 days once	0	0.0	4	1.6	14	15.7	18
Not Applicable	317	100.0	221	90.2	0	0	538
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>
<b>Storage of Water Supply (OBW)</b>							
Sump	0	0.0	24	9.8	89	100	113
Container	0	0.0	0	0.0	0	0	0
Not Applicable	317	100.0	221	90.2	0	0	538
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>
<b>Level of Water Supply (OBW)</b>							
Good	0	0.0	0	0.0	14	15.7	14
Moderate	0	0.0	21	8.6	72	80.9	93
Bad	0	0.0	3	1.2	3	3.4	6
Not Applicable	317	100.0	221	90.2	0	0	538
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>

*Source: compiled from field survey, (2019).*

Several bore wells available for the respondents were examined by the respondents and from the table, it can be identified that for low-income category respondents no one had borne wells in their household whereas for the middle-income category 90.2 per cent were not applicable for the category and 9.8 per cent had one bore well and for high-income, cent per cent had borne well facility in their house.

The frequency of water fetching followed by the respondents showed that for the low-income category they did not have a frequency of water fetching for middle-income category 90.2 per cent are not applicable where 8.2 per cent were fetching water daily and 1.6 per cent were fetching water 2-5 days once and for high-income category 84.3 per cent were fetching water daily and 15.7 per cent were fetching water 2-5 days once.

The storage practice followed by the respondents was further studied in the cur laborers were for low-income category cent per cent were not applicable for this criteria whereas for middle-income category respondents 90.2 per cent were not applicable and 9.8 per cent were using sump for storage and high-income category cent per cent were using sump for water storage.

Information on the level of water supply available for the household details showed that for low-income category cent per cent were not applicable for this criteria whereas for middle-income category respondents 90.2 per cent were not applicable for this criterion where 8.6 per cent stated that their level of water supply was moderate and 1.2 per cent stated that their level of water supply was bad and for high-income category respondents 80.9 per cent stated that their level of water supply was moderate, 15.7 per cent felt that their level of water supply was good and 3.4 per cent stated that their level of water supply was bad.

### **c) Water Supply through Stand Post**

A public stand post, also known as a tap stand, distributes water to a large number of people from one or more faucets. Because it is used by so many people, it is frequently ignored, therefore the design and construction must be more robust than comparable domestic connections. A standing post is made up of a service connection to the supplying water pipeline, a supporting column or wall made of wood, brick, dry stone masonry, concrete, or another suitable material, and one or more 0.5 inches (1.25 cm) taps that protrude far enough from the column or wall to make filling the water containers easy. Globe or self-closing faucets are available. The water should have a residual pressure head of 10–30m at the stand post, and some stand posts include a regulating valve in the mains connection that can be controlled and locked to manage the maximum flow. A water meter might also be included. A drainage system under the taps, as well as a solid stone or concrete apron, deflect spilled water away from the taps, preventing muddy pools from forming. A fence may be necessary to keep cattle at bay. The location and style of a public stand post should be planned in close consultation with prospective users.

**Table 35: Details of Water Supply through Stand Post in Selected Households**

Variables	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency
<b>Number of Pipelines</b>							
1 Pipe	110	34.7	114	46.5	0	0	224
2 Pipe	59	18.6	44	18.0	0	0	103
3 and above	0	0.0	0	0.0	0	0	0
Not Applicable	148	46.7	87	35.5	89	100	324
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Frequency of Water Supply (SPWS)</b>							
Daily	150	47.3	156	63.7	0	0	306
2-5 days once	19	6.0	2	0.8	0	0	21
Not Applicable	148	46.7	87	35.5	89	100	324
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>
<b>Storage of Water Supply (SPWS)</b>							
Sump	0	0.0	6	2.4	0	0	6
Container	169	53.3	152	62.0	0	0	321
Not Applicable	148	46.7	87	35.5	89	100	324
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>
<b>Level of Water Supply (SPWS)</b>							
Good	9	2.8	10	4.1	0	0	19
Moderate	87	27.4	110	44.9	0	0	197
Bad	73	23.0	38	15.5	0	0	111
Not Applicable	148	46.7	87	35.5	89	100	324
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100.0</b>	<b>89</b>	<b>100.0</b>	<b>651</b>

*Source: Compiled from field survey (2019).*

The number of pipelines available for the respondent is one of the important criteria in finding out the usage of water and identifying if water is being sufficient for the respondents. For the selected respondents among the low-income category, 46.7 per cent were not applicable for this criteria whereas 34.7 per cent stated that they had one pipeline connection and 18.6 per cent had 2 pipelines at their households in case of middle-income category respondents 46.5 per cent had one pipeline connection, 35.5 per cent were not applicable for the study and 18 per cent had 2 pipeline connection and for the high-income category cent per cent were not applicable for the particular analysis.

The information on the frequency of water supply for the respondents showed that for the low-income category 47.3 per cent were receiving water daily, 46.7 per cent were not applicable for the study and 6 per cent received water 2-5 days once and for the middle-income category 63.7 per cent were receiving water daily,

35.5 per cent were not applicable for the study and 0.8 per cent were receiving water 2-5 days once.

The storage facility used by the sample respondents details figured out that for low-income category 53.3 per cent were storing their water in container and others were not applicable for the study, in case of middle-income category 62 per cent were using a container for storing their water, 35.5 per cent were not applicable for the study and 2.4 per cent were using sump for storing water and in case of high-income category, the sample respondents were not applicable for the particular analysis.

The level of water supply available for the respondents was examined and the result mentioned that for low-income category respondents 46.7 per cent were not applicable for the study 27.4 per cent of the households that their level of water supply was moderate, 23 per cent said that their level of water supply was bad and 2.8 per cent felt that their water supply level was good, in case of middle-income category 44.9 per cent said that their level of water supply was moderate, 35.5 per cent were not applicable for the particular analysis, 15.5 per cent said that their level of water supply was bad and 4.1 per cent reported that their level of water supply was good.

#### **d) Water supply through market water**

According to the World Health Organization, about 780 million people lack access to safe drinking water and almost 2.5 billion lack basic sanitation. In India, 62.3 per cent of households had access to clean drinking water in 1991, which increased to nearly 90 per cent in 2010, with 10 per cent still without access despite improved water delivery (World Health Organization households keeping up with current demand while also increasing supplies to meet future demand has become a major issue for city water delivery organizations. Various supply-side and demand-side factors, such as increased water scarcity due to depletion and degradation of water resources, unequal rainfall distribution due to climate change, a steep increase in water demand due to rapid urbanization, high-income elasticity of demand for water among the growing rich, low willingness to pay for poor-quality supply, and increased scarcity of budgetary resources, as well as other institutional and political factors. At the regional and local levels, there are additional site-specific difficulties that worsen the situation. Over-exploitation of groundwater by private water-tanker

owners, for example, has led to saltwater intrusion and deterioration of the quality of water collected for public supply in and around Chennai. As a result of these concerns, the government is compelled to pursue more costly options, such as large investments in pumping water from remote sources and requiring users to rely on informal water markets, especially in urban areas. The following factors might have a significant influence on the economy's social costs (Venkatachalam, 2015).

**Table 36: Details of the Respondents who Consume Water from Markets in Selected Households**

Variables	Low-Income Level		Middle-income Level		High-Income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency
<b>Frequency of Buying Water (MW)</b>							
Ones in a week	6	1.9	1	0.4	0	0.0	7
Twice a week	4	1.3	7	2.9	0	0.0	11
Two-week ones	3	0.9	4	1.6	7	7.9	14
Monthly ones	2	0.6	2	0.8	4	4.5	8
Not Applicable	302	95.3	231	94.3	78	87.6	611
Total	317	100.0	245	100.0	89	100.0	651
<b>The Amount for Market Water Supply (MW)</b>							
0-200	10	3.2	4	1.6	0	0.0	14
300-500	4	1.3	1	0.4	0	0.0	5
500-1000	1	0.3	3	1.2	2	2.2	6
1000 and above	0	0.0	6	2.4	9	10.1	15
Not Applicable	302	95.3	231	94.3	78	87.6	611
Total	317	100.0	245	100.0	89	100.0	651
<b>Packaged Drinking Water (Mw)</b>							
Can water	10	3.2	9	3.7	3	3.4	22
Lorry	5	1.6	5	2.0	8	9.0	18
Not Applicable	302	95.3	231	94.3	78	87.6	611
Total	317	100	245	100	89	100.0	651

*Source: compiled from field survey, (2019).*

The frequency of buying of water by the respondents varies for various income groups and also it is subject to change based on the respondents living style, family-style, and the place they are living. in the current study for the low-income category respondents, the frequency of buying water showed that 95.3 per cent were

not applicable, 1.9 per cent of the respondents bought water once a week, 1.3 per cent of them bought water twice in a week, 0.9 per cent bought water two weeks ones and 0.6 per cent got water monthly once whereas for middle-income category respondents 94.3 per cent were not applicable for the study, 2.9 per cent were buying water twice in a week, 1.6 per cent were buying water two weeks once, 0.8 per cent were buying water monthly once and 0.4 per cent were buying water in once in a week and for high-income category 87.6 per cent were not applicable for the study 7.9 per cent bought water two weeks once and 4.5 per cent bought water monthly once.

The amount of water spent by the respondents for buying water details showed that for the low-income category 95.3 per cent were not applicable, 3.2 per cent spent Rs.0-200 for purchasing of water, 1.3 per cent spent Rs. 300-500 and 0.3 per cent spent Rs.500-1000 for water and for middle-income category 94.3 per cent were not applicable for the study, 2.4 per cent spent Rs. 1000 and above for water, 1.6 per cent spent Rs.0-200 and 0.4 per cent spent Rs. 300-500 for purchasing of water and high-income category respondents 87.6 per cent were not applicable for the study, 10.1 per cent spent Rs.1000 and above and 2.2. per cent spent Rs.500-1000 for purchasing of water.

#### **4.3.2 Water fetching details**

##### **The Person who Bring Water from water supply Source**

The data about a person who brings water from the tap is collected and presented in the following table. Usually, women and children must fetch water for the household.

**Table 37: Details of Water Fetching from the Pipeline Water in Selected Area**

Variables	Low-Income Level		Middle-income Level		High-Income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency
<b>Person of Water Fetching</b>							
Male	58	18.3	20	8.2	0	0	78
Female	238	75.1	156	63.7	0	0	394
Children	21	6.6	58	23.7	0	0	79
Not Applicable	0	0.0	11	4.5	89	100	100
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Time for Water Fetching</b>							
01 to 02	278	87.7	148	60.4	0	0	426
02 to 05	25	7.9	52	21.2	0	0	77
5 and above	14	4.4	8	3.3	0	0	22
Not Applicable	0	0.0	37	15.1	89	100	126
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>

*Source: Compiled from field survey, (2019).*

The details on water fetching information namely on the person who fetches water in the house and time consumption for fetching of water were studied by the researcher and the finding is been presented in the table (37). The person who fetches water in the house detail shows that for low-income category 75.1 per cent of them are female in the house, 118.3 per cent of the male in the house fetches water and 6.6 per cent said their children fetch water for them. For the middle-income category, 63.7 per cent of females, 23.7 per cent of children, 8.2 per cent of males in the house are engaged in fetching water at the household and 4.5 per cent were not applicable for these criteria and in the case of high-income community cent per cent of the population were not applicable for the criteria.

The time consumption for fetching of water for the low-income category showed that 87.7 per cent of the respondents spent 01-02 hours for fetching of water, 7.9 per cent spent 02-05 hours for water fetching and 4.4 per cent spent 5hours and above for water fetching activity. In the case of the middle-income category 60.4 per cent spent 01-02 hours for water fetching, 21.2 per cent spent 02-05 hours, 15.1 per cent were not applicable and 3.3 per cent spent 5 and above hours for water fetching activity, and the high-income community cent per cent of them were not applicable for this criterion.

#### **4.3.3 Overhead Tanks**

The availability of overhead tanks in the selected respondent's household was studied to understand the consumption of water through the tanks by the researcher.

**Table 38: Details of Household Overhead Tanks in Selected Households**

Variable	Low-Income Level		Middle-income Level		High-Income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
<b>Over Head Tanks</b>							
NA	215	67.8	95	38.8	0	0.0	310
1 Tank	102	32.2	89	36.3	19	21.3	210
2 Tanks	0	0.0	55	22.4	59	66.3	114
3 and Above	0	0.0	6	2.4	11	12.4	17
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Capacity in Liters</b>							
NA	215	67.8	95	38.8	0	0.0	310
300-500	22	6.9	14	5.7	2	2.2	38
500-1500	78	24.6	55	22.4	21	23.6	154
1500-2000	2	0.6	65	26.5	16	18.0	83
2000-3000	0	0.0	16	6.5	38	42.7	54
3000 and Above	0	0.0	0	0.0	12	13.5	12
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Type of Motor</b>							
NA	215	67.8	95	38.8	0	0	310
Centrifugal Pumps	102	32.2	122	49.8	0	0	224
Submersible Pumps	0	0.0	24	9.8	0	0	24
Both	0	0.0	4	1.6	89	100	93
Others	0	0.0	0	0.0	0	0	0
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Frequency of using Motor</b>							
NA	215	67.8	95	38.8	0	0.0	310
Once in a Day	65	20.5	54	22.0	11	12.4	130
2-3times per day	37	11.7	66	26.9	29	32.6	132
2-3days Once	0	0.0	24	9.8	41	46.1	65
Once in the week	0	0.0	6	2.4	8	9.0	14
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Origin and Management Cost (per Annum)</b>							
NA	215	67.8	95	46.5	0	0.0	310
up to 1000	98	30.9	24	23.7	0	0.0	122
1000-5000	4	1.3	123	28.6	36	40.4	163
5000 and Above	0	0.0	3	1.2	53	59.6	56
<b>Total</b>	<b>317</b>	<b>100.0</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Frequency of maintenance</b>							
NA	215	67.8	95	38.8	0	0.0	310
Once in a Month	65	20.5	66	26.9	0	0.0	131
2-3Months once	37	11.7	54	22.0	0	0.0	91
6 Months Once	0	0.0	24	9.8	28	31.5	52
Once in the year	0	0.0	6	2.4	61	68.5	67
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Electricity Cost Increasing</b>							
NA	215	67.8	95	38.8	0	0	310
Yes	92	29.0	148	60.4	89	100	329
No	10	3.2	2	0.8	0	0	12
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>

*Source: Compiled from field survey, (2019).*

The result showed that in the case of low-income category respondents 67.8 per cent did not have any overhead tanks and 32.2 per cent had one tank at their house, whereas for middle-income category respondents 38.8 per cent did not have overhead tanks, 36.3 per cent had one tank and 22.4 per cent had 2 tanks where 2.4 per cent had 3 and above tanks in their houses and for the high-income category respondents 66.3 per cent had 2 tanks, 21.3 per cent had one tank and 12.4 per cent had 3 and above tanks. The result showed that in the case of the low-income majority did not have an over but in the case of the middle-income head tank category majority had either one or two tanks but in the case of the high-income category majority are found to have either 2 tanks or 3 and above tanks.

Information on the liters of the overhead tanks that are available in the respondent's household was identified. As 67.8 per cent of the low-income category did not have any overhead tanks they were not considered for this criteria whereas 24.6 per cent of others said that they had over a tank with the capacity of 500-1500 liters, 6.9 per cent had an overhead tank with the capacity of 300-500 liters and 0.6 per cent had tanks with the capacity of 1500-2000 liters. For the middle-income category, 38.8 per cent did not have any overhead tanks so they are not considered for the particular criteria, and others 26.5 per cent tanks with the capacity of 1500-2000 liters, 22.4 per cent had tanks with the capacity of 500-1500 liters, 6.5 per cent had tanks with the capacity of 2000 to 3000 liters and 5.7 per cent had tanks with the capacity of 300-500 liters. For the high-income category respondents, 42.7 per cent had water tanks with the capacity of 2000-3000 liters, 23.6 per cent had tanks with the capacity of 500-1500 liters, 18 per cent had tanks with the capacity of 1500-2000, 13.5 per cent had water tanks with the storage capacity of 3000 and above liters and 2.2 per cent had water tanks with the storage of 300-500 liters.

The type of motor used for circulating the water supply to the overhead tanks was identified in the study and from the table (38) it can be verified that for the low-income category 67.8 per cent were not eligible for the particular aspect, whereas for other 32.2 per cent they used centrifugal pumps for water circulation, in case of middle-income category respondents 38.8 per cent were not considered for the study and others 49.8 per cent used centrifugal pumps, 9.8 per cent used submersible pumps and 1.6 per cent used both types of pumps and in case of high-income category cent

per cent of the population used both the centrifugal pumps and submersible pumps for their water circulation to tanks.

The Operation and Management cost they are needed to maintain the overhead tank information showed that for the low-income category 67.8 per cent were not taken for the criteria and the other 30.9 per cent spend up to Rs. 1000 for maintenance, in case of middle-income category 46.5 per cent are not considered for this aspect where 28.6 per cent spent Rs.1000-5000 for O and M cost per annum, 23.7 per cent spent up to Rs.1000 for O and M cost per annum and in case of high-income category, 59.6 per cent spend Rs. 5000 and above for the O and M cost per annum and 40.4 per cent spend Rs.1000 to Rs. 5000 for the O and M cost per annum.

The frequency of maintenance of the overhead tank details showed that 67.8 per cent are not considered in case of low-income category and other 20.5 per cent clean their tank once in a month and 11.7 per cent clean their tanks 2-3 months once, for middle-income category 38.8 per cent were not eligible for the criteria and others 26.9 per cent clean the tank once in a month, 22 per cent clean their tanks 2-3 month once, 9.8 per cent clean their tanks 6 months once and 2.4 per cent clean their tanks once in a year and case of high-income category 68.5 per cent clean their tanks once in a year and other 31.5 per cent clean their tanks 6 months once.

With using of overhead tanks whether the electricity charges have increased or not was examined by the researcher in the particular session and the result showed that for the low-income category 67.8 per cent were not eligible for the study and 29 per cent said yes and 3.2 per cent said no, in case of middle-income category 38.8 per cent were not eligible for the criteria 60.4 per cent said yes and 0.8 per cent said no and for high-income community cent per cent of the population reported yes for the electricity charge increasing with the use of overhead tanks.

## **4.4. Water Consumption**

### **4.4.1 Water Consumption in Selected Households**

Everyone in the globe, regardless of their development strategy, social and economic circumstances, has the right to appropriate quality and quantity of drinkable water to meet their fundamental requirements. The behavior of individuals to treat freshwater throughout their daily activities varies according to climatic circumstances, lifestyle, culture, technology, and economy. (Howard et al., 2003)

Water is used in houses for drinking, cooking, bathing, flushing toilets, washing clothing, and watering plants and lawns. According to WHO recommendations, "use of water in ordinary for all home purposes, including drinking water consumption, bathing, and food preparation" is defined as "the use of water in ordinary for all domestic purposes, including drinking water consumption, bathing, and food preparation" (Falkenmark et.al. 1989)

The association between water use, water usage behavior and attitudes, and water-related gadgets used in Indian households. The poll included about 90 residences of various sorts (single-family homes and flats on a university campus, as well as Jaipur city). Cluster analysis was used to go through the survey findings. The findings revealed that home type and size had a significant impact on per capita consumption. For single-family homes and flats, the average daily water use was 183 and 215 liters/person/day, respectively. In both single-family homes and flats, water used for bathing and toilets accounts for the majority of water use. Showers are not used by more than 40 per cent of the homes. Water usage per capita is inversely proportional to family size, particularly in single-family homes. Conclusion: The data on water use habits, as well as the qualitative and quantitative analysis, can be fed into a proposed domestic water efficiency tool (DoWET), which can generate optimal water-efficient composite strategies while taking into account a variety of sustainability indicators such as water-saving potential, cost, and associated energy consumption of water-saving devices and fixtures available in India (Sadar et al., 2016).

Having this background the researcher has tried to identify the association between LPCD and Water details of the selected respondents for which the researcher has used Chi-Square analysis.

**Table 39: Details of Association Between LPCD And Water usage in Selected Sample Respondents**

**Association between LPCD and Water Details (Chi-Square Analysis)**

<b>Variables</b>	<b>Calculated value</b>	<b>Df</b>	<b>P-value</b>	<b>S/NS</b>
Person of Water Fetching	16.272	6	.421	NS
Time	-27.479	6	<b>.012**</b>	<b>S</b>
Distance	-36.379	6	<b>.005**</b>	<b>S</b>
Family Size	56.231	6	<b>.000*</b>	<b>S</b>
Income	25.876	6	<b>.000*</b>	<b>S</b>
Source of Water	-36.236	6	<b>.008**</b>	<b>S</b>

*\*=Significant at 1 percent level, \*\*=Significant at 5 per cent level, NS= Not Significant*

The above table shows the Chi-square result of selected respondents regarding their association between LPCD and Water details. For water details, the researcher has used variables person of water fetching, time, distance, family size, income, and source of water. It can be identified from the table that variable family size and income are statistically significant at a 1 per cent level of significance indicating that there is a strong association between LPCD and these variables. As when several members of the family are high the family will need extra water to meet their requirements and when the respondents are having adequate income they will be able to spend a good amount on their water consumption. So both the family size and income of the respondents are associated with the water details of the respondents.

Variables such as time, distance, and source of water are associated with the LPCD of the respondents as these variables are statistically significant at a 5 per cent level of significance. When there is time constrain for the respondents in fetching water then the respondent has shown changes in their LPCD when the distance for getting water is high it has affected the LPCD of the respondents when the distance of water fetching is less the respondents are found to be having high LPCD and when the distance of water fetching is high the respondent is found to be having low LPCD and the course of water availability of the respondent is found to be associated with the

LPCD of the respondents when the respondent is having own water source other than the government supply then the respondent is found to be having higher LPCD whereas the respondent is not having any other water source then they are found to be using their water in limited condition showing the change in their LPCD. Variable “Person fetching of water” is not associated with LPCD either at 1 per cent level of significance or 5 per cent level of significance as the respondent has not shown any change in their LPCD with the member fetching water.

As a result of the study, variables such as time, distance, family size, wealth, and water source were shown to be connected with the respondents' LPCD.

According to the World Bank, water supplies in key Indian cities would run out by 2020, and half of China's 662 cities will have inadequate water supplies, with 110 towns experiencing acute water shortages. To reduce water usage and handle water shortage issues, governments have enacted restrictive measures. The inconsistency of water supply in many developing countries has been criticized, with governments and non-governmental organizations urging governments and NGOs to reduce water usage by increasing water conservation awareness and encouraging conservation behavior. Alitchkov et al., 1996; Fan et al., 2014.)

Seasonal and climatic variations are accompanied by three important variables that have a significant influence on residential water consumption rates, which are governed by household size, social and economic status. (Shankhwar and colleagues, 2015).

The general perception of water use among consumers is that their bills do not accurately represent their actual water consumption. However, this mismatch has gotten little attention, especially in cases including distinctive water-use patterns, water conservation strategies, and user socio-demographics. The data show that there are considerable links between perceived and actual water use. Participants have varied perspectives on certain water-use patterns. Participants tend to overestimate their indoor water use while underestimating their outdoor and kitchen water usage. Females and the elderly correctly estimate their water use, but individuals with a high level of education and wealth underestimate their actual water consumption. Individuals who can accurately estimate their water use have more water conservation knowledge and actions than those who underestimate their water consumption.

Multiple regression analysis is used to understand the relationship between LPCD and variables such as education of the respondents, occupation of respondents, type of family they were living in, number of members in their family, total distance for water collection, and sources of water and time spent for water collection. Firstly the correlation matrices were applied to understand and shortlist the number of variables influencing the per capita water consumption at the household level. The result of the multiple regression can be seen in the below table (40)

**Table 40: Multiple Regression**

**Table No: 1 Model Summary**

R	R Square	Adjusted R Square	Std. The error of the Estimate
.856	.733	.730	.368

**Table No: 2 ANOVA**

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	239.029	7	34.147	252.032	<b>.000</b>
Residual	87.118	643	.135		
Total	326.147	650			

**Table No: 3 Coefficients**

Variables	Standardized Coefficients	T	Sig.
Education	-.011	-.484	.000*
Occupation	-.074	-3.283	.629 <sup>NS</sup>
Age	.012	1.235	.689 <sup>NS</sup>
Income	-.312	-11.124	.000*
Family Size	-.302	-12.105	.000*
Type of Family	.204	9.309	.001*
Total Expenditure	-.342	-14.263	.000*
Total Distance for Water Collection	-.298	-12.325	.000*
Sources of Water	-.183	-7.649	.000*
Time Spent for Water Collection	-.239	-10.435	.000*

*Dependent Variable: LPCD; \* = Significant at 1 per cent level*

Regression analysis is used to identify the variables influencing the respondents in their LPCD. For the study, the researcher has considered variables like education, age, total expenditure occupation, type of family, number of members, total distance for water collection, sources of water, and time spent for water collection. From the above table, it is identified that variables such as education of the respondents, age of the respondents, type of family in which they were living, number of members in their family, total distance for water collection, total family expenditure sources of water, and time spent for water collection is statistically significant at 1 per cent level which indicates that these variables were found out to be influencing the respondents regarding their LPCD. All the above variables were found out to be influencing the respondent's LPCD, with an increase in the educational status of the respondents, age of the respondents, type of family in which they are living, number of members in the family, total family expenditure, total distance for water collection, sources of water and time spent for water collection increases the LPCD of the selected respondents. The 'R' squared value gives the goodness of fit of the model and the value being 0.706 which indicated that 73 per cent of the variation was influenced by the combined effect of all the independent variables. Multiple correlation coefficient (0.856) between LPCD and the set of independent variables shows a good amount of correlation and is found to be significant at 1 per cent level ( $p < 0.01$ ) as tested by the 'F' ratio value being 252.032

Through the study, the researcher has found that LPCD for the respondents is been influenced by the variables like education, age, type of family, number of members, total family expenditure, total distance for water collection, sources of water, and time spent for water collection.

#### **4.4.2. Seasonal Wise Variations of Water Usage**

The rate at which water is used varies from one day to the next. This is due to variations in everyday weather conditions, as well as the fact that the day is a holiday or a celebration day. As a result, the amount of water needed on a rainy day will be substantially less than on a dry and hot day.

Similarly, on a dust storm day, more water will be required for washing and cleaning the entire house, bathing, washing clothing, and other activities. In addition, on Sundays, water use is often higher than on other days of the week. Similarly, on some festival days, water consumption will be higher than on a usual day. The maximum daily demand of water per head or the maximum rate of demand of water is

typically recognized as 180 per cent of the annual average daily demand of water per head or the annual average rate of demand of water on the day of maximum water consumption (or the maximum day for the year).

**Table 41: Season and Activity Wise Consumption of Water by Households (Liters)**

<b>Season/ Activity</b>	<b>HIG</b>	<b>MIG</b>	<b>LIG</b>	<b>Total</b>
<b>Summer</b>				
Toilet	112.8	106	82	<b>300.8</b>
Bathing	178.62	162	138	<b>478.62</b>
Clothes Washing	224.26	207.5	125	<b>556.76</b>
Utensils Cleaning	82	74	35.6	<b>191.6</b>
Drinking and Cooking	56.98	53	28	<b>137.98</b>
Watering Lawn	98	10	2	<b>110</b>
House Cleaning	35	29	16.8	<b>80.8</b>
Car Washing	22	15	7	<b>44</b>
Others	9.11	7	5.12	<b>21.23</b>
<b>Total</b>	<b>818.77</b>	<b>663.5</b>	<b>439.52</b>	<b>3660.95</b>
<b>Winter</b>				
Toilet	109	92	82	<b>283</b>
Bathing	162	145	139	<b>446</b>
Clothes Washing	207.32	185.6	137	<b>529.92</b>
Utensils Cleaning	89	62	31.58	<b>182.58</b>
Drinking and Cooking	45.67	67	19.8	<b>132.47</b>
Watering Lawn	72	5	1	<b>78</b>
House Cleaning	26.61	23.9	16.6	<b>67.11</b>
Car Washing	20.12	15	7	<b>42.12</b>
Others	6.52	4.4	3.5	<b>14.42</b>
<b>Total</b>	<b>738.24</b>	<b>599.9</b>	<b>437.48</b>	<b>1775.62</b>
<b>Average</b>				
Toilet	112.92	103.45	82	<b>298.37</b>
Bathing	171.32	152.36	136.18	<b>459.86</b>
Clothes Washing	225	194.14	137	<b>556.14</b>
Utensils Cleaning	51	70.65	36.23	<b>157.88</b>
Drinking and Cooking	54.96	45.69	24.64	<b>125.29</b>
Watering Lawn	58	6.75	0.98	<b>65.73</b>
House Cleaning	31.56	26.45	15.25	<b>73.26</b>
Car Washing	21	15	9	<b>45</b>
Others	7.98	6.32	4.78	<b>19.08</b>
<b>Total</b>	<b>733.74</b>	<b>620.81</b>	<b>446.06</b>	<b>1800.61</b>

Others activity may include watering the pots or watering streets in summers etc.

**Source: compiled from field survey, (2019).**

The above table shows the season-wise changes in water consumption among the selected households. It can be identified that for the high-income group they are found to be consuming more water for clothes washing (224.26 liters), bathing (178.62 liters) and for toilet (112.8 liters) during summer season whereas during winter season there are very small changes in their water consumption pattern as in case of cloth washing they were found to be consuming 225 liters, for bathing 171 liters and in case of toilet 112.8 liters water are been consumed. So it can be found from the table that for the high-income group majority of water consumption is been made for cloth washing, bathing, and toilet and there is no much difference in their consumption pattern during changes in the season.

Water consumption details of a middle-income group show that as like high-income group even the middle-income group is found to be consuming much water for cloth washing (207.5 liters), bathing (162 liters), and toilet (106 liters) during the summer season and in case of winter season again there are no much changes in their consumption pattern of water as they are found to be consuming 194.14 liters of water for clothes washing, 152.36 liters of water for bathing and 103.45 liters for toilet purpose. Thus it can be found through the study for the middle-income group there is a no bigger difference in their water consumption pattern and season variations.

Low-income group water consumption pattern shows that as like another group even they are found to be spending much of their water for bathing (138 liters), cloth washing (125 liters) and toilet (82 liters) for summer season whereas the same pattern is been followed even during the winter season as 137 liters of water is been spent on clothes washing, 136 liters of water is been spent on bathing and 82 per cent is been consumed for toilet purpose. So, it can be found that there are no changes in the water consumption made by the respondents and season variation.

Thus, through the study, it can be understood that there is no relationship between water consumption and changes in the season. All the income groups are found to be consuming much of their water source for cloth washing, bathing, and toilet.

#### 4.4.3 Preference of Water in Daily Usage

One of the most basic requirements for human life is access to domestic water sources. Life cannot exist for more than a few days without water, and a lack of adequate water supply will result in bad living conditions in the region. The ordinary household consumes a large amount of water. A bath may use up to 40 gallons of water, but a typical toilet flush uses about 5 gallons. For meal preparation and dishwashing, the washing machines use roughly 25 gallons every load, and the kitchen sink consumes about 20 gallons per day (Marni 2019). Watering lawns, flower beds, and vegetable gardens, as well as washing cars and filling pools, utilize a significant amount of our residential freshwater supply.

In the current study, the researcher has tried to identify the water preference made by the respondents in the selected area using the garret ranking technique. The result can be seen in the table (42).

**Table 42: Details of Preference of Water in Daily Usage**

Items	LIG		MIG		HIG	
	Score	Rank	Score	Rank	Score	Rank
Drinking	76.12	1	76.31	1	77.53	1
Cleaning of vessels	53.59	3	52.53	3	50.38	3
Bathing	40.70	5	39.64	6	38.08	6
Toilet	35.97	7	36.07	7	35.44	7
Cooking	55.29	2	55.13	2	52.06	2
Washing	44.03	4	44.95	4	49.29	4
Cleaning vehicles	40.70	5	39.64	6	38.08	6
Watering of garden	33.5	9	34.8	9	33.2	9
Cleaning House	34.5	8	35.6	8	34.1	8

*Source: Compiled from field survey, (2019).*

From the table (42), it can be identified that for low-income group, middle-income group and high-income group the first preference of their domestic water supply if for Rank I have been assigned for “Drinking” purpose for all the three income group, without drinking of water human life cannot sustain so this item has been given higher preference by the respondents, as per the WHO survey a normal

human must drink at least 3 liters of water per day so the respondents consider this item to be very important. “Cooking” purpose as all three groups has assigned “Rank I” for the preference. In everyday life, drinking has become an essential household activity and the water used for the process is relatively high as it includes water for washing and rinsing of cloth in the case of using a washing machine the consumption of water is high while compared to the traditional stone washing of cloth. Rank III has been given for the item “Cleaning of vessels”, without washing of vessels we will not be able to reuse the vessels again and for this reason, there is again a higher need of water for cleaning it even with so much modern technology development we follow the same old tradition of reusing vessels everyday one-time use plates, the tumbler is not that much preferred by the people. Whereas, the least rank has been given for items like Cleaning of vehicles, bathing, and toilet. Even though these items are necessary for regular activities but a higher preference is given for washing, drinking, and cleaning of vessels.

#### **4.4.4. Average Water Consumption**

Water availability per person is controlled by a country's population, and as India's population expands, water availability per capita is decreasing. In 2001 and 2011, the average annual per capita water availability was predicted to be 1816 cubic meters and 1545 cubic meters, respectively, and is expected to fall to 1486 cubic meters and 1367 cubic meters in 2021 and 2031, respectively. The benchmark for urban water supply, according to the Ministry of Housing and Urban Affairs, is 135 liters per capita per day (lpcd). For rural areas, the Jal Jeevan Mission has established a minimum service delivery of 55 lpcd, which can be extended to a higher level if necessary. According to a report by the National Commission for Integrated Water Resources Development (NCIWRD), irrigation accounted for 83.30 per cent of total water usage in 1997-98. Furthermore, according to the NCIWRD research, under the high-demand scenario, the proportion of water used for irrigation out of total water use is expected to reach 72.48 per cent by 2025. (Union Minister of State for Jal Shakti & Social Justice and Empowerment, 2020).

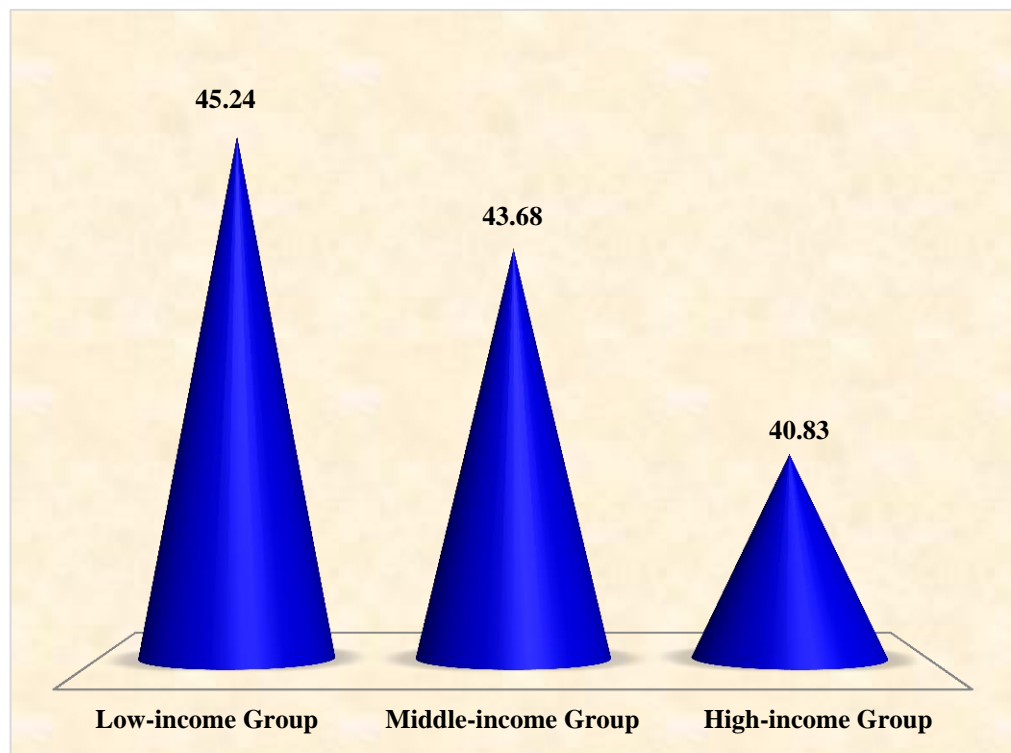
**Table 43: ANOVA Table (Between Variables) for Average Water Consumption by Different Income Groups in Selected Households**

Variables		Mean	SD	SE	F-value	Sig
Average Consumption of Water	Low-income Group	45.24	21.18	1.19	4.411	.013**
	Middle-income Group	43.68	10.01	1.06		
	High-income Group	40.83	13.84	.88		

*Source: compiled from field survey, (2019).*

*\*\*= Significant at 5 per cent level*

The above table (43) represents the relationship between the average consumption of water and income groups (low-income group, middle-income group, high-income group).



**Figure 9: Average Consumption of Water**

The mean value of the low-income group is 45.24, the middle-income group is 40.83 and the high-income group is 43.68. All these variables are significant at the 5 per cent level. Thus, from this, it can be incurred that there is a significant relationship between average water consumption of water and various income group in the selected area among the selected sample respondents.

#### **4.5. Water Quality**

##### **4.5.1 Quality of Corporation Water Supply (HSC)**

Water for drinking and cooking can come from any source and is intended for human consumption. It applies to all water intended for human consumption, whether treated or not. Water is safe if it is free of biological pollution (guinea worm, cholera, typhoid, etc.) and chemical contamination, according to the Bureau of Indian Standards' IS-10500 norm (excess fluoride, brackishness, iron, arsenic, nitrates, etc). (BIS) The British International Standard for Drinking Water (IS 10500:1991) was initially published in 1983 and was last revised in July 2010. (Additional Amendment No. 3) The standard was adopted by BIS with the following goals and objectives:

- Assessing the quality of water resources and
- determining the efficacy of water treatment and distribution by the relevant authorities.

According to the 2013 Uniform Drinking Water Quality Monitoring Protocol, qualitative testing for the presence of bacteriological contamination should be done twice a year: pre-monsoon (May-June) and post-monsoon (July-August). All samples that show contamination utilizing Field Testing Kits must be sent to the nearest authorized or government water quality testing laboratory for confirmation. The quality of urban water supplies is checked in water treatment plant labs. In addition, the health department is mostly responsible for water quality surveillance during outbreaks of water-borne illnesses. Privately operated testing laboratories have popped up alongside government testing facilities (Water Aid India, 2018).

Any evaluation of the water delivery system's efficiency that ignores the quality of the water delivered is incomplete. According to the findings of the field survey, issues such as water quality, taste, and odor in the water supplied by the water

authority exist. As a result, data on public knowledge of water quality issues are examined and provided in Table (44).

**Table 44: Details about Quality of Urban Water Supply in Selected Households**

Variable	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	percentage	Frequency	percentage	Frequency	percentage	
<b>Water Quality</b>							
Good	24	7.57	23	9.39	16	17.98	63
Moderate	103	32.49	93	37.96	26	29.21	222
Bad	190	59.94	129	52.65	47	52.81	366
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Taste &amp; Smell</b>							
Good	102	32.18	12	4.90	4	4.49	118
Moderate	57	17.98	90	36.73	19	21.35	166
Bad	158	49.84	143	58.37	66	74.16	367
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>

*Source: Compiled from field survey, (2019).*

It is found from the table that the water quality for different income groups is different. In the case of low-income level, their water quality was either bad or moderate as it was reported by 59.94 per cent and 32.49 per cent respectively only 7.57 per cent stated that their water quality was good, the same is been reported by middle-income people about 90 per cent stated that their water quality was either bad or moderate and only 9.39 per cent enjoyed good quality of water. For the high-income level, 52.81 per cent had bad water quality, 29.21 per cent had moderate water quality and 17.98 per cent had a good quality of water. It can incur from the study that out of 651 respondents only 63 respondents enjoyed a good quality of water.

In the case of taste and smell, 49.84 per cent and 17.98 per cent of low-income levels had a bad and moderate taste and smell respectively and 32.18 per cent had good taste and smell in their water. For middle-income 58.37 per cent said their water was tasted and smelled bad, followed by 36.73 per cent whose taste and the smell was

moderate and 4.90 per cent water was having good taste and smell. For the high-income level, 74.16 per cent and 21.35 per cent stated that their water quality was either tasted and smelled bad or moderate only 4.49 per cent had good taste and smell in their water.

From the study, it is found that despite their income level the respondents felt that their water quality is bad and smelled bad and tasted bad.

#### **4.5.2. Measures Adopted to Purify the Drinking Water in Selected Households**

We don't need to remind you that having a water filter in every household is vital in a country where waterborne infections cause over 10,000 deaths each year. While higher authorities will do all possible to provide us with safe and clean drinking water, we must also take responsibility for ourselves. We must ensure that our homes and workplaces are equipped with an electric water purifier to have safe and clean water (Smith, 2019). Water purification is the process of eliminating undesirable chemical compounds, organic and inorganic materials, and biological contaminants from water. This procedure also includes distillation and deionization. Purification of water serves several functions, one of which is to provide safe drinking water. Purification of water also meets the needs for clean, consumable water in medical, pharmaceutical, chemical, and industrial applications. During the purification process, contaminants like suspended particles, parasites, bacteria, algae, viruses, and fungus are decreased. Water purification occurs on a large scale (for example, for a whole city) as well as on a local scale (for example, for individual homes) (Jordan K. Lanfair, 2018). The purifying processes employed by the respondents have been identified by the researcher and are included in the table (45).

**Table 45: Details of Measures Adopted to Purify the Drinking Water in Selected Households**

Variable	Low-income Level		Middle-income Level		High-income Level		Total
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	
<b>Purification Measures</b>							
Yes	72	22.71	107	43.67	89	100.0	268.0
No	245	77.29	138	56.33	0	0.0	383.0
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Type of Purification Measures</b>							
NA	245	77.29	138	56.33	0	33.7	383
Boiling	60	18.93	52	21.22	0	20.2	112
Manual Filtering	10	3.15	38	15.51	0	27	48
Using Machine	2	0.63	17	6.94	89	19.1	108
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Total Cost</b>							
NA	236	74.45	117	47.76	38	42.70	391
0-2000	18	5.68	38	15.51	12	13.48	68
2000-5000	51	16.09	59	24.08	25	28.09	135
5000 and above	12	3.79	31	12.65	14	15.73	57
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>O and M Cost</b>							
NA	116	36.59	50	20.41	8	8.99	174
0-1000	16	5.05	28	11.43	16	17.98	60
1000-2000	166	52.37	118	48.16	51	57.30	335
2000-3000	19	5.99	46	18.78	11	12.36	76
3000 and above	0	0.00	3	1.22	3	3.37	6
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>
<b>Electricity charges</b>							
NA	233	73.50	114	46.53	38	42.70	385
Yes	30	9.46	36	14.69	18	20.22	84
No	54	17.03	95	38.78	33	37.08	182
<b>Total</b>	<b>317</b>	<b>100</b>	<b>245</b>	<b>100</b>	<b>89</b>	<b>100</b>	<b>651</b>

*Source: compiled from field survey, (2019).*

The finding showed that among the selected respondents only 22.71 per cent of the low-income level group, 43.67 per cent of the middle-income group were following some kind of Purification measures. Whereas for high-income group cent per cent of the population was had Purification measures for their water utilization.

The type of Purification measure adopted by the respondents was analyzed under three main categories namely boiling, manual filtering, and using the machines. It can be identified from the study that among the selected respondents for low-

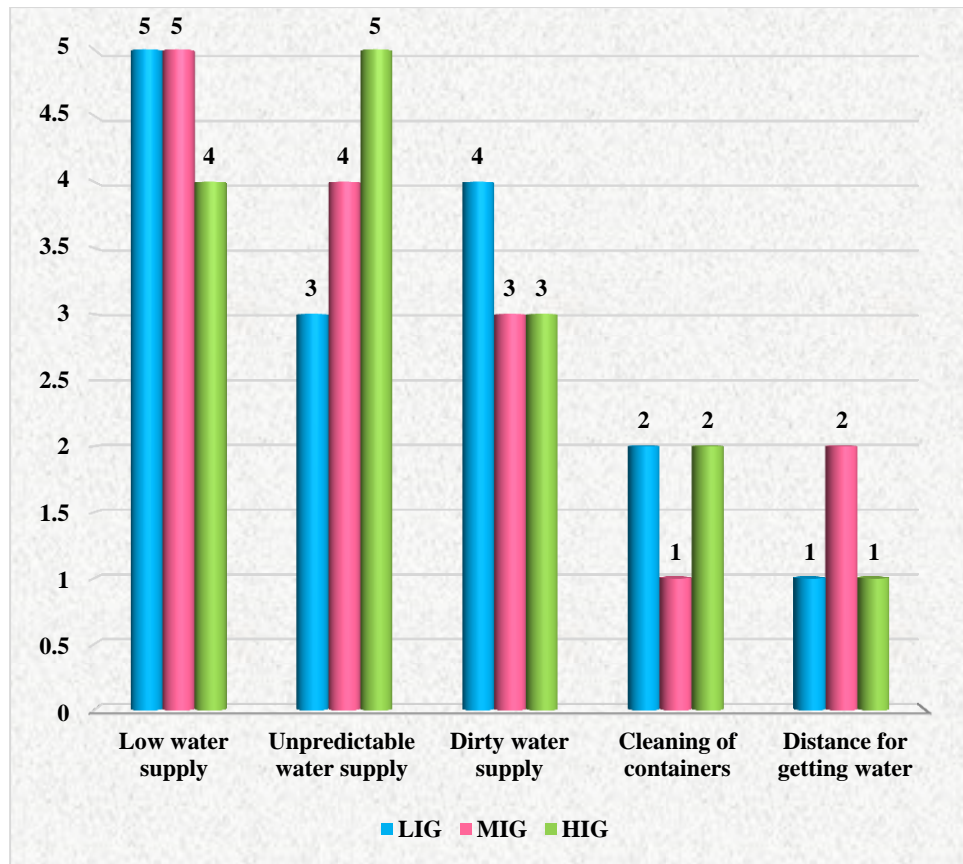
income and middle-income group the Purification measure adopted by them was boiling of water whereas in the case of the high-income group about 27 per cent preferred manual filtering method for their water utilization. In the case of using the machines for the Purification of water very least number is 0.63 per cent of low-income, 6.94 per cent of middle-income, and 19.1 per cent of high-income reported this category.

The total cost involved for the respondents in adopting their Purification measure was studied by the researcher and the study has found that most of the respondents were found to be spending about Rs. 2000 to Rs.5000 as among 651 respondents 135 of them mentioned this category of cost spending.

The Origin and Maintenance cost spent by the respondents showed that about 335 respondents were spending about Rs.1000 to Rs.2000 and about 174 members were not applicable for the study. Very minimum member of them is found to be spending 0-1000rs, 2000-3000rs and more than 3000rs. The electricity charges faced by the respondents for the Purification measures adopted by them showed that for 17.03 per cent of low-income group, 38.78 per cent of middle-income group and 37.08 per cent of the high-income group did not have much difference for the measures adopted by them, and only 84 respondents out of 651 said that they had a difference in their electricity charges for their Purification measures.

#### **4.5.3. Problems Faced by Respondents with their Urban Water Supply**

Every aspect of life needs the presence of water. Providing an adequate quantity of high-quality water is one of the most pressing concerns in developing countries like India. Water scarcity is a problem in nearly every sector of the economy, despite major government investment in the water business. The present rationale for the Sustainable Development Goal is that "Water for All" is a challenging issue in the country. According to a United Nations Resolution, "everyone has the right to sufficient, safe, acceptable, physically accessible, and affordable water for personal and family purposes" (2019). In the current study, the researcher has sought to identify the issues they have with their water supply, for which a garret score has been awarded.



**Figure 10: Problems Faced by Respondents with their Urban Water Supply**

Figure (10) highlights the problems of water supply in the selected households. For low-income communities top, three ranks have been assigned for the problems “Low Water Supply”, “Dirty water supply” and “High cost of secondary water source”. Whereas for Middle-income group the first three ranks been given to the issues “Low water supply”, “high cost of secondary water sources” and “Dirty water supply” and for High-income group the higher ranks has been assigned for concerns “High cost of secondary water source”, “Low water supply” and “Dirty water supply”. From this, it can be identified that for the selected respondents despite their income category they feel that the water they receive is low in quantity and quality and when they try to go for the next option of secondary water source they feel that the secondary water source price to be very high. The other ranks have been assigned for problems namely “Cleaning of containers” and “Distance for getting water”.

#### **4.5.4. Factors Influencing the Respondents to go for Secondary Water Source**

One of the most fundamental prerequisites for human health, development, and well-being is safe drinking water. Access to safe drinking water and a sanitary way of life is a worldwide challenge, but it is particularly acute in impoverished nations. Water scarcity currently exists in Addis Ababa, and it is predicted to worsen as a result of rising urbanization, higher individual water consumption as wages rise, and the effects of climate change. People are becoming more health-conscious, and they are drinking water with greater caution (Tilahun, 2020). In most industrialized and developing countries across the world, access to high-quality drinking water is a major concern. In poor nations, a lack of sufficient drinking water is also a big concern. Groundwater contamination, which is a severe hazard to the human population, is also a result of development initiatives. As a result, individuals use a variety of techniques to meet their drinking water demands, with a particular focus on their health. There are various reasons why someone may use bottled water as a supplemental source for something other than drinking. Health concerns, personal aesthetic preferences, and consumer skepticism of those responsible for the quality of public drinking water are just a few of the key reasons why some individuals think it is vital to use bottled water.

Increased sales of bottled water and home drinking water treatment systems demonstrate that the bottled water sector is becoming increasingly concerned (Delina and Dasinaa, 2016).

The current study employed factor analysis to investigate the underlying dimension among the numerous indicators of variables influencing respondents' decisions to use a supplementary water source. The low-income group's frequency of using secondary water sources was given a maximum score of 4 if it happened frequently and 0 if it didn't happen at all. Cronbach's alpha was calculated to determine the consistency of numerous indicators and was found to be 0.814, which was more than 0.7, suggesting that the indications were reliable.

To determine the appropriateness of applying factor analysis KMO and Bartlett's test measures were computed and the results are presented in the table (45).

**Table 46: Factors Influencing the Respondents to Go for  
Secondary Water Source  
Cronbach's Alpha = .813**

**Table No: 1 KMO and Bartlett's Test Measures**

<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</b>		.797
<b>Bartlett's Test of Sphericity</b>	<b>Approx. Chi-Square</b>	4927.559
	<b>Df</b>	36
	<b>Sig.</b>	.000

**Table No: 2 Factor Loadings for Choice for Secondary Water Source**

<b>Inhibitors</b>	<b>Components</b>		
	<b>1</b>	<b>2</b>	<b>3</b>
Quality of water		.808	
Quantity of water	.890		
Speed of water supply	.917		
Distance for getting public water			.980
Time spend getting water	.866		
To meet the daily requirement	.822		
Inadequacy of water supply	.905		
The unpredicted water supply of public water	.901		
No one is available for fetching water		.811	
Eigen values	4.707	1.509	1.051
Percentage of variance	52.305	16.770	11.677
Cumulative percentage	52.305	69.075	80.752

*Extraction Method: Principal Component Analysis.  
Rotation Method: Varimax with Kaiser Normalization  
Rotation converged in 3 iterations.  
Source: compiled from field survey, (2019).*

The KMO statistics was 0.797 signifying higher than acceptable adequacy of sampling. A value close to one indicates the patterns of correlation as relatively compact. Bartlett's test of sphericity was also found to be significant at a 1 per cent level providing evidence of the presence of a relationship between the variables to apply factor analysis.

Table (46) enlist the Eigenvalues their relative explanatory powers and the factor loadings for 9 components identified within the data set. The Eigenvalue greater than one was considered for inclusion in the analysis. The above results indicated that the Eigenvalue for the first three factors alone was greater than one indicating that these factors alone were appropriate for inclusion in the analysis. These factors taken together accounted for 52.305 per cent of the variance. For the sample respondents, factor 1 has significant loading on 6 dimensions namely “Quality of Water”, “Speed of water supply”, “time spend for getting water”, “To meet the daily requirement”, “Inadequacy of water supply” and “Unpredicted water supply of public water”. Factor 2 has significant loadings on two dimensions namely “Quality of water” and “No one available for fetching of water” these variables explains about 16 per cent of the variance in the factors and Factor 3 has significant loading on 1 dimension which is “Distance for getting public water”, this explains about 11 per cent of the variance in the factors.

#### **4.5.5 Incidence of Waterborne Disease Faced by the Selected Urban Households**

Providing safe drinking water is a big concern in most developing countries. It is crucial to have access to basic amenities such as clean water and good sanitation. Approximately 7000 million people in Asia and the Pacific region, particularly in rural areas, lack access to safe drinking water. Around 70 per cent of Pakistan's population depends on groundwater, and the rapid rate of removal is causing the water table to decrease. Sewage and industrial effluents, surface run-off, and a variety of human activities alter the physical (color, taste, and smell) and chemical characteristics of water. . Cholera, typhoid fever, malaria, amoebiasis, and dysentery are all waterborne infections that can be caused by contaminated or polluted water. Each year, more than 5 million people die throughout the world as a result of water-related ailments. Disease and death are caused by a lack of suitable and clean water supply and sanitation facilities in underdeveloped countries. Each year, 250 million people are infected with waterborne illnesses, with 10–20 million people dying as a result. According to statistics, diarrhea kills approximately 4 billion children under the age of five in developing countries each year, and around 250,000 children under the age of five die from diarrhea each year. As a result of frequent waterborne diseases, the cost of medical services has increased, and rural communities have become more disadvantaged (Malik et al., 2012).

With this background, the researcher tried to examine the factors determining the treatment of cost for water-borne diseases among the selected respondents for this the researcher has implied multiple regression. The result of it can be seen in the table (47).

**Table 47: Multiple Regression for Treatment Cost of Waterborne Disease Faced by the Selected Urban Households**

**Table No: 1 Model Summary**

<b>R</b>	<b>R Square</b>	<b>Adjusted R Square</b>	<b>Std. The error of the estimate</b>
0.728	0.512	0.497	0.23489

<b>Model</b>	<b>Sum of Squares</b>	<b>Df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Regression	11.642	6	1.976	35.543	0
Residual	16.253	298	0.045		
Total	27.865	354			

**Table No: 3 Coefficients**

<b>Variables</b>	<b>Standardized Coefficients</b>	<b>T</b>	<b>Sig.</b>
Medical Expenditure	.267	4.432	.000*
Total Expenditure	.259	5.876	.000*
Affected Person Men	-.029	-1.512	.109 <sup>NS</sup>
Affected Person Women	.345	5.457	.000*
Affected Person Children	.278	4.439	.000*
Water Bone Disease Viral	.178	3.983	.002*
Water Bone Disease Bacterial	.189	3.183	.002*
Water-related Diseases	.226	4.236	.001*

*Dependent Variable: Treatment Cost for Water Bone Diseases*

\* = Significant at 1 per cent level, \*\* = Significant at 5 per cent level, <sup>NS</sup> = Not Significant

Source: compiled from field survey, (2019).

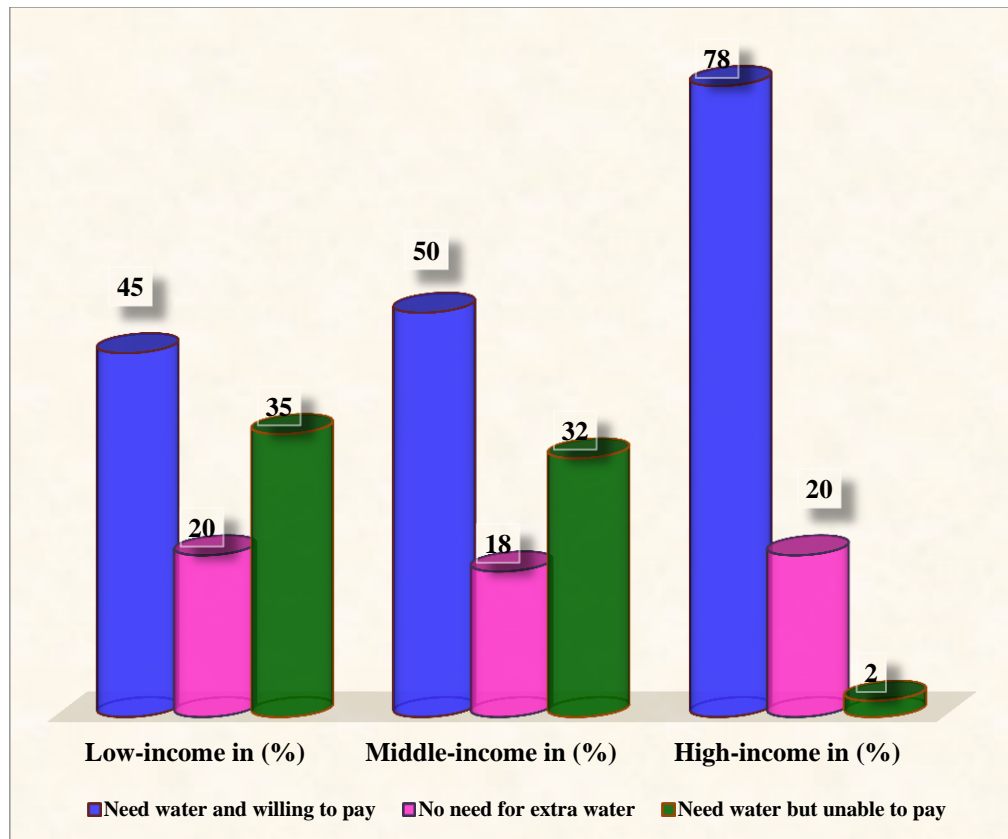
The dependent variable taken by the researcher for the multiple regression analysis was treatment cost for water bone diseases faced by the respondents for which the independent variables were medical expenditure, total expenditure, affected

person, water bone disease, and other water-related. From the table, it can be identified that factors such as medical expenditure, total expenditure, affected person, water bone disease, and other water-related diseases are statistically significant at 1 per cent level which indicates that these variables were found to be influencing the respondents regarding their waterborne disease treatment. All the above variables were found to be influencing the respondent's waterborne disease treatment. The 'R' squared value gives the goodness of fit of the model and the value being 0.512 which indicated that 51 per cent of the variation was influenced by the combined effect of all the independent variables. Multiple correlation coefficient (0.728) between LPCD and the set of independent variables shows a good amount of correlation and is found to be significant at 1 per cent level ( $p < 0.01$ ) as tested by the 'F' ratio value being 35.543

Through the study, the researcher has found that treatment cost for waterborne disease for the respondents is been influenced by the variables like medical expenditure, total expenditure, affected person men, affected person women, affected person children, water bone disease viral, water bone disease bacterial and other water-related diseases like skin allergy, hair fall, etc

#### **4.6. Willingness to Pay for Improved Urban Water Services in Coimbatore Corporation**

Willingness to pay is a word used in economics to describe how much a consumer is willing to pay for a water supply. It's a concept that's been tested in a variety of research initiatives throughout the world, and it's shown that people in impoverished countries are happy to pay for water. The cost of establishing a city's public water service has been proved to be equal to the revenues from water purchases. This is a crucial result for water planners in emerging countries, where urbanization is rapidly spreading and water demand is outpacing current infrastructure. As a result, local governments now have to repay the expenditures of local infrastructure development. Indeed, according to a World Health Organization study of the International Decade of Drinking Water and Sanitation (the 1980s), budget constraints were the single most serious hindrance to the Decade's goals being realized. CWTP is in charge of setting suitable water costs for consumers, enabling the formulation of water policies with the certainty of cost recovery.



**Figure 11: Willingness to Pay for Improved Water Supply among the Selected Households**

The above Figure (11) shows the willingness to pay for improved water supply among the selected households. It can be identified from the study among the selected groups for low-income group 45 per cent have stated that they need water and they are willing to pay for improved water supply followed by 35 per cent who stated that they need water but they are unable to pay for it and 20 per cent said that they no need extra water for their consumption. In the case of a middle-income group 50 per cent said that they need water and they are willing to pay for improved water supply, 32 per cent said that they need water but are unable to pay for it and 18 per cent said that they no need extra water. Whereas, for the high-income group, 80 per cent said that they need water and they are willing to pay for it and 20 per cent said that they do not need extra water and only 02 per cent said that they need water but they are unable to pay for improved water supply.

In the current study, the probit model was applied to identify the relationship between the variables selected for the study and the willingness to pay for improved

urban water sources by the respondents. The result can be seen in the table below. For the study variables like LPCD, the total distance for water collection, sources of water, time spent for water collection, and the family size is considered to be the key determinants of willingness to pay for improved water supply among the selected respondent group.

**Table 48: Probit Analysis for Willingness to Pay for Improved Water Supply among the Selected Households**

Variables	Co-efficient	Standard Error	P-value
LPCD	-0.594	-0.078	0.007*
Total Distance for Water Collection	1.265	0.489	0.001**
Sources of Water	4.012	0.236	0.689 <sup>NS</sup>
Time Spent for Water Collection	1.612	0.075	0.415 <sup>NS</sup>
Family Size	0.658	0.521	0.000**
Income	1.652	0.487	0.011**
Constant	1.365	0.458	0.001
Number of Observations	651		
Log-Likelihood	58.2178		
Pseudo R <sup>2</sup>	0.785		
Chi-Square	42.356*		

Dependent variable: **willingness -to pay**

The willingness to pay for the water represents the dependent variable (Y). The Probit model was estimated to find out the variables that influence the willingness to pay for water among urban households is related to the following variables.

Y = Willingness to pay (Willing to pay = 1, 0 otherwise)

X1 = LPCD

X2 = Sources of water

X 3= Time spent for water collection

X4 = Family size

X5 = Income

X6 = Family size,

The model produced a good fit for the data because the chi-square value is statistically significant ( $p < 0.01$ ) and the pseudo adjusted co-efficient of determination reveals that the included variables explained 78.5 per cent of the variations in the values of willingness to pay probability. The variables that show statistical significance are LPCD, Total distance for water collection, family size, and income. The significance and the positive relationship between the variables and willingness to pay by the respondent can be identified through the probit model.

#### **4.7. Water Conservation**

According to folklore, the planet cooled and had warm waters around 3.7 billion years ago. These heated water sources were the birthplace of the earliest single-celled animals. As a result, water was important in the origin of life. Water comprises 70 per cent of the earth's surface, and up to 70 per cent of the human body is made up of water. Many plants and animals have evolved to flourish in non-saline settings, even though there are millions of marine species today. Human civilization arose along the banks of rivers. It was straightforward for early people to live in the fertile river basins because the food was easy to grow and transportation was simple. Agriculture presently consumes 70 per cent of all available freshwater. The remaining 30 per cent is shared between industry and personal use. However, due to a variety of human-caused factors, this valuable resource has become limited. 2014 (UNESCO) Freshwater accounts for only 3 per cent of the total amount of water available. More than 60 per cent of this drinking water, however, is locked in ice caps and glaciers. As a result, we must utilize water responsibly as people. We have, on the other hand, do the exact opposite thus far. Water is used extensively in agriculture and industry. Furthermore, we have neglected to keep our water bodies clean. Industrial effluents and sewage are discharged directly into rivers. Cities are built on top of dry ponds and lakes. As a result, we don't have a place to store water when it rains. As a result, we not only have flash floods regularly, but the precipitation also ends up in the sea, where it is squandered.

We recklessly exploit riverbeds' fertile soil, resulting in flooding in both urban and rural areas. As a result, we humans are mostly responsible for reducing aquatic bodies' ability to hold water. In modern cities, we live in concrete jungles with little to no vegetation. The roots of trees are crucial for groundwater retention. Plants also

produce oxygen while absorbing CO<sub>2</sub>. As a result, they contribute significantly to the reduction of global warming. Less warming slows the melting of glaciers and ice sheets, safeguarding the world's largest supply of fresh water. Floods and storms are natural occurrences, yet the water that flows into the seas is replenished by nature. However, people have a long history of destroying forests for a variety of reasons, including agriculture, industrialization, and human settlements.

A finite resource, clean and fresh water is a finite resource. With all of the devastating droughts that are sweeping the globe, freshwater is quickly becoming one of our most important resources. Water is required for the survival of every people on the globe. Many of us would develop ill and maybe die if it weren't for it. Water conservation means making careful and reasonable use of our water resources. We must learn how to keep our limited supply of water clean and free of pollution because everyone depends on it for a living. Keeping our water supply clean and pure will ensure that future generations will have access to safe drinking water. However, people have a long history of destroying forests for a variety of reasons, including agriculture, industrialization, and human settlements.

Water conservation means preventing environmental pollution. This involves the deployment of measures including waste reduction, water pollution mitigation, and better water management. The population must conserve the water it has now to assure a sufficient supply in the future. The most important step in finding solutions to water and environmental conservation challenges is for people's attitudes and actions to change, including our own. (Singh and Kumari) (2016)

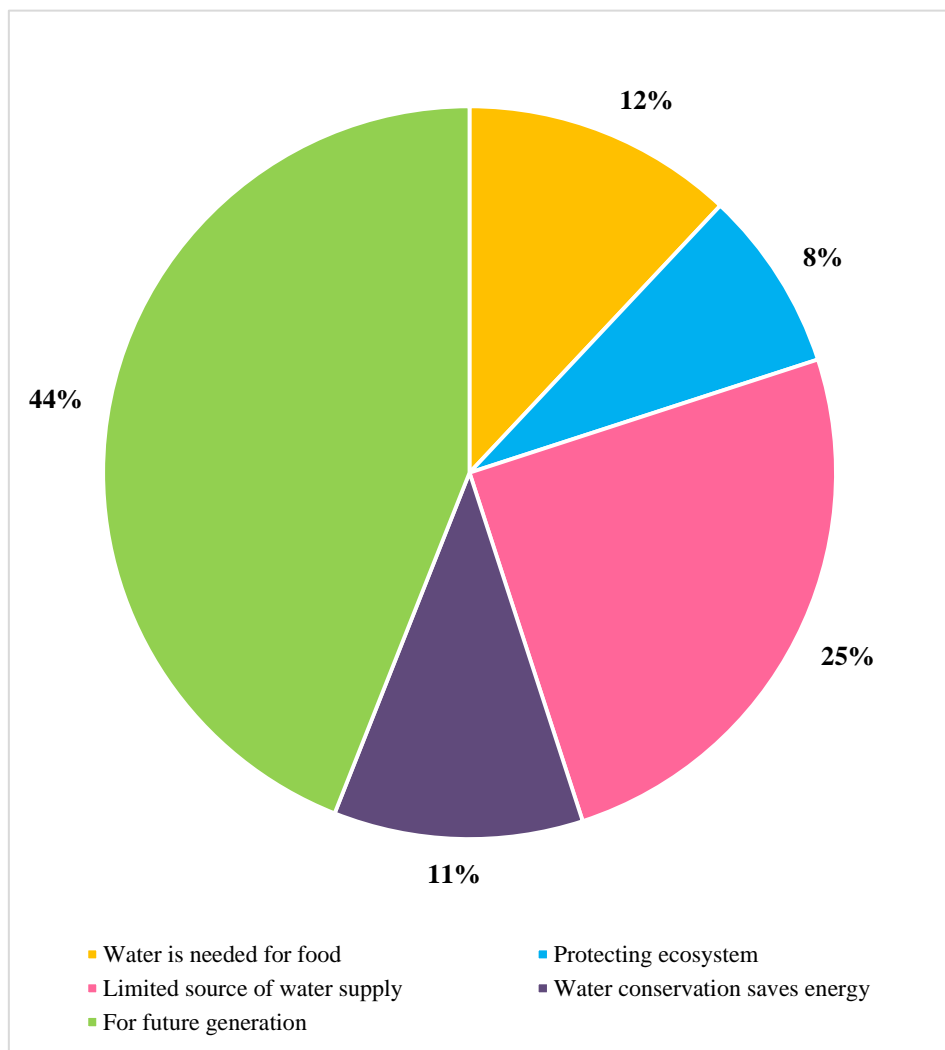
Based on this context, the researcher attempted to determine the respondents' understanding of water conservation. The study's findings are detailed further down.

#### **4.7.1 Opinion of the Selected Households about Water Conservation**

The sample participants were asked about the importance of water conservation in the district. Around 75 per cent of respondents said water conservation is a very significant issue in the area, 10 per cent said it is an important issue, 3 per cent said it is not a very important issue, and 2 per cent said it is not at all. While 10 per cent of the respondents stated that they have no opinion on water conservation or its importance in the district.

Even though a significant majority of the population believes that water conservation is necessary for the district, there is still a group of individuals who have no opinion on the subject or do not believe that water conservation is a pressing issue in the district.

The 85 per cent who said water conservation is vital for the district were questioned further to find out why they believe water conservation is necessary. The outcome is shown in the table below.



**Figure 12: Opinion of the Selected Households about Water Conservation**

From the given Figure (12) it can be incurred that about 44 per cent of the respondents feel that water conservation is needed to provide adequate water for future generations, it was followed by 25 per cent of people who opined that water conservation is needed in the district as the district is suffering from a limited source

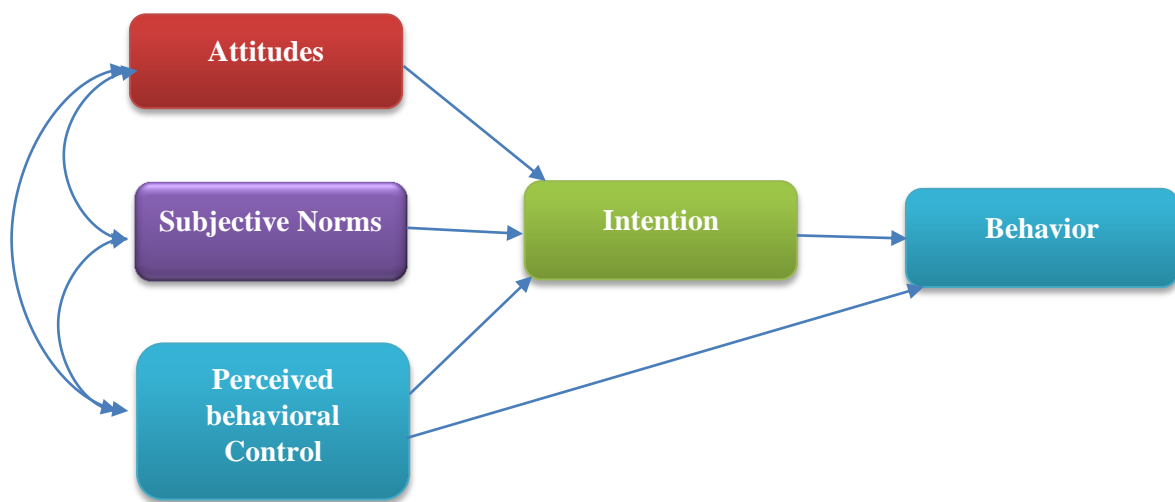
of water supply, 12 per cent said that water is needed for growing food as it is the main source for agriculture growth, 11 per cent mentioned that through water conservation we can save energy and 08 per cent said that by conserving water we are protecting our ecosystem.

#### **4.7.2. Water-Saving Behaviour**

Many major river systems are suffering insufficient water flow, and most of the world is now under water stress. Water management that serves the growing human demand for water while also safeguarding vulnerable ecosystems is critical in this circumstance. Although solving this problem would include the use of new water sources and increased productivity of existing water resources, demand management is also seen as a critical component of future water security. Substitute and augment supplies, such as new water supply projects and locating additional water sources, frequently come at a high cost and take a long time to accomplish. Water conservation, on the other hand, can be adopted fast and does not need significant infrastructure expenditure. Water-saving behaviour (WSB) is critical for long-term economic and social growth in cities, and it is aided by increased water-saving awareness. Understanding the elements that contribute to WSB might help with water demand management and public awareness initiatives. The effect of subjective attitude perceived behavioural control, and subjective norms on behavioural intention and final behaviour are investigated using the theory of planned behaviour.

The theory of planned behaviour, one of the most extensively used and well-supported social psychology theories of behavioural decision-making, places a strong emphasis on attitudes. Intentions, which represent a motive or goal to engage in an activity, are the most immediate predictors of conduct, according to the theory of planned behaviour. Attitudes (positive or negative evaluations of the behaviour), subjective norms (perceptions of social support for the behaviour from important others), and perceived behavioural control (perception of the extent to which the behaviour is under volitional control) are all factors that influence intentions. As indicated in Figure (13), the three key factors of behavioural consciousness are subjective attitude, perceived behavioural control, and subjective norms.

The psychological judgement of given conduct is referred to as subjective attitude. In this study, a person's water-saving attitude refers to their beliefs about water resource conservation and protection, such as their perspectives on the current state of water resources and the environment, the value of water resources, and public awareness and education activities related to water resource protection. The notion of an individual's capacity to do a given activity is referred to as perceived behavioural control. The impression of the sample homes' water-saving abilities is referred to as water-saving behavioural control in this study. The directing impact of residents' social environment on their behavioural intention is referred to as subjective norms.



**Figure 13: Flowchart for the Planned Behaviour Model**

Based on the field investigation, this study added a fourth element, water-saving expectation, to predict behavioral intentions using the theory of planned behavior. As a result, a questionnaire was used to collect data on 17 items relating to water-saving attitudes, water-saving expectations, perceived behavioral control, subjective norms, and WSB). The overall situation in terms of the number of respondents to the questionnaire. Among the water-saving attitudes indicator variables, one is related to water resource cognition.

### **Factors Influencing High-Income People towards Water-Saving Behavior**

Factor analysis was used in the current study to examine the underlying dimension among the various indicators of factors influencing the respondents regarding water-saving behaviour for high income. The frequency of choosing water-

saving behaviour had a maximum score of 4 if the occurrence was frequent and zero if the occurrence was not present. Cranach's alpha was computed to check the consistency of various indicators and was estimated to be 0.901, which was greater than 0.7 indicating the reliability of the indicators. To determine the appropriateness of applying factor analysis KMO and Bartlett's test measures were computed and the results are presented in the table (49)

The factors about the decision of respondents regarding water saving behavior. Were identified by the respondents and these factors were taken for factor analysis. The result of the same can be seen in the following.

**Table 49: Factor Influencing for Water-Saving Behavior for High-Income Respondents**

**Cranach's Alpha Value: .901**

<b>KMO and Bartlett's Test Measures</b>		
<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</b>		.623
<b>Bartlett's Test of Sphericity</b>	<b>Approx. Chi-Square</b>	26088.579
	<b>Df</b>	136
	<b>Sig.</b>	.000

The KMO statistics was 0.623 signifying higher than acceptable adequacy of sampling. A value close to one indicates the patterns of correlation as relatively compact. Bartlett's test of sphericity was also found to be significant at a 1 per cent level providing evidence of the presence of a relationship between the variables to apply factor analysis.

Table below enlist the Eigenvalues their relative explanatory powers and the factor loadings for 9 components identified within the data set.

**Table 50: Factor Loadings for Water-Saving Behavior for High-Income Respondents**

Factors	Inhibitors	Components			
		1	2	3	4
Water-Saving Attitudes	Environmental Awareness		.926		
	Scarcity Awareness	.842			
	Water resource Value	.910			
	Effect of cognition	.853			
	Responsibility cognition				.944
	Individual water-saving attitudes		.939		
	Attitude towards participating in water-saving activities	.823			
Water-Saving Expectations	Saving time and man-days	.913			
	Water shortage	.870			
	Cost expectations	.893			
	Water fee expectations	.898			
Perceived behavioural control	Family water-saving perceptions		.968		
	Family water saving capacity	.853			
Subjective norms	Social water-saving expectations	.926			
	Public water-saving expectations			.943	
	Social opinion expectations	.882			
Water-saving practices	Investment in water-saving technologies and tools	.820			
Eigenvalues		10.895	1.789	1.182	1.066
Percentage of variance		64.091	10.525	6.952	6.269
Cumulative percentage		64.091	74.616	81.568	87.836

Extraction Method: Principal Component Analysis.  
 Rotation Method: Varimax with Kaiser Normalization,  
 Rotation converged in 4 iterations.  
 Source: Estimation based on Field Survey

The Eigenvalue greater than one was considered for inclusion in the analysis. The above results indicated that the Eigenvalue for the first three factors alone was greater than one indicating that these factors alone were appropriate for inclusion in the analysis. These factors taken together accounted for 64 per cent of the variance. In the current study for the sample respondents Factor 1 has significant

loadings on 12 dimensions namely “Scarcity awareness”, “Water resources value”, “Effect of cognition”, “Attitude towards participating in water-saving activities”, “Saving time and man-days”, “Water shortage”, “Cost expectations”, “Water fee expectations”, “Family water saving capacity”, “Social water-saving expectations”, “Social opinion expectations”, “Investment in water-saving technologies and tools”. Factor 2 has significant loadings on “Environmental Awareness”, “Individual water-saving attitudes”, “Family water-saving perceptions” and Factor 3 has significant loadings on one dimension namely “Public water-saving expectations” and Factor 4 has significant loadings on one dimension “Responsibility cognition”.

Thus, through the factor analysis for the high-income group factor 1 has significant loadings in explaining the water-saving behavior among them. As they are from high-income backgrounds, they are willing to provide a significant concentration in providing income for their water-saving decision. Thus, income influences the water-saving behavior of the respondents.

### **Factors Influencing Middle-Income People towards Water-Saving Behavior**

Factor analysis was used in the current study to examine the underlying dimension among the various indicators of factors influencing the respondents regarding water-saving behavior for middle income. The frequency of choosing water-saving behavior had a maximum score of 4 if the occurrence was frequent and zero if the occurrence was not present. Cronach’s alpha was computed to check the consistency of various indicators and was estimated to be 0.827, which was greater than 0.7 indicating the reliability of the indicators. To determine the appropriateness of applying factor analysis KMO and Bartlett’s test measures were computed and the results are presented in the table (51).

The factors about the decision of middle-income respondents regarding water saving behavior<sup>0</sup>. Were identified by the respondents and these factors were taken for factor analysis. The result of the same can be seen in the following.

**Table 51: Factor Influencing for Water-Saving Behavior for Middle-Income Respondents**

**Cranach's Alpha Value: .827**

<b>KMO and Bartlett's Test Measures</b>		
<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</b>		<b>.855</b>
<b>Bartlett's-Test of Sphericity</b>	<b>Approx. Chi-Square</b>	<b>21825.475</b>
	<b>Df</b>	<b>136</b>
	<b>Sig.</b>	<b>.000</b>

The KMO statistics was 0.855 signifying higher than acceptable adequacy of sampling. A value close to one indicates the patterns of correlation as relatively compact. Bartlett's test of sphericity was also found to be significant at a 1 per cent level providing evidence of the presence of a relationship between the variables to apply factor analysis.

Table below enlist the Eigenvalues their relative explanatory powers and the factor loadings for 9 components identified within the data set.

**Table 52: Factor Loadings for Water-Saving Behavior for  
Middle-Income Respondents**

Factors	Inhibitors	Components			
		1	2	3	4
Water-Saving Attitudes	Environmental Awareness			.891	
	Scarcity Awareness	.890			
	Water resource Value	.903			
	Effect of cognition	.863			
	Responsibility cognition				.986
	Individual water-saving attitudes			.921	
	Attitude towards participating in water-saving activities	.891			
Water-Saving Expectations	Saving time and man-days	.903			
	Water shortage	.869			
	Cost expectations		.960		
	Water fee expectations		.949		
Perceived behavioral control	Family water-saving perceptions			.848	
	Family water saving capacity	.907			
Subjective norms	Social water-saving expectations	.916			
	Public water-saving expectations		.974		
	Social opinion expectations	.808			
Water-saving practices	Investment in water-saving technologies and tools	.779			
Eigenvalues		9.163	2.863	1.634	1.022
Percentage of variance		53.900	16.842	9.611	6.012
Cumulative percentage		53.900	70.742	80.353	86.365

Extraction Method: Principal Component Analysis.  
 Rotation Method: Varimax with Kaiser Normalization,  
 Rotation converged in 4 iterations.  
 Source: Estimation based on Field Survey

The Eigenvalue greater than one was considered for inclusion in the analysis. The above results indicated that the Eigenvalue for the first three factors alone was greater than one indicating that these factors alone were appropriate for inclusion in the analysis. These factors taken together accounted for 53 per cent of the variance. In

the current study for the sample respondents, Factor 1 has significant loadings on “Scarcity awareness”, “Water resources value”, “Effect of cognition”, “Attitude towards participating in water-saving activities”, “Saving time and man-days”, “Water shortage”, “Family water saving capacity”, “Social water-saving expectations”, “Social opinion expectations”, “Investment in water-saving technologies and tools”. Factor 2 has significant loadings on “Public water-saving expectations” “Cost expectations” and “Water fee expectations”. Factor 3 has significant loadings on “Environmental Awareness”, “Individual water-saving attitudes” and “Family water-saving perceptions”. Factor 4 has significant loadings on “Responsibility cognition”.

Thus, through the factor analysis, it can be identified that factor 1 has a significant impact on the water-saving behavior of the selected middle-income respondents. Unlike high-income, middle-income respondents are willing to provide income for saving behavior but due to income constrain they are not able to spend much on the saving behavior. Thus through the study, it can be identified that water saving is been influenced by the income of the respondents.

### **Factors Influencing Low-Income People towards Water-Saving Behavior**

Factor analysis was used in the current study to examine the underlying dimension among the various indicators of factors influencing the respondents regarding water-saving behavior for low-income. The frequency of choosing water-saving behavior had a maximum score of 4 if the occurrence was frequent and zero if the occurrence was not present. Cranach’s alpha was computed to check the consistency of various indicators and was estimated to be 0.812, which was greater than 0.7 indicating the reliability of the indicators. To determine the appropriateness of applying factor analysis KMO and Bartlett’s test measures were computed and the results are presented in the table (53)

The factors about the decision of middle-income respondents regarding water saving behavior<sup>0</sup>. Were identified by the respondents and these factors were taken for factor analysis. The result of the same can be seen in the following.

**Table 53: Factor Influencing for Water-Saving Behavior for  
Low-Income Respondents  
Cranach's Alpha Value: .812**

<b>KMO and Bartlett's Test Measures</b>		
<b>Kaiser-Meyer-Olin Measure of Sampling Adequacy.</b>		<b>.808</b>
<b>Bartlett's Test of Sphericity</b>	<b>Approx. Chi-Square</b>	<b>1259.624</b>
	<b>Df</b>	<b>136</b>
	<b>Sig.</b>	<b>.000</b>

The KMO statistics was 0.855 signifying higher than acceptable adequacy of sampling. A value close to one indicates the patterns of correlation as relatively compact. Bartlett's test of sphericity was also found to be significant at a 1 per cent level providing evidence of the presence of a relationship between the variables to apply factor analysis.

Table below enlist the Eigenvalues their relative explanatory powers and the factor loadings for 17 components identified within the data set.

**Table 54: Factor Loadings for Water-Saving Behavior for  
Low-Income Respondents**

Factors	Inhibitors	Components			
		1	2	3	4
Water-Saving Attitudes	Environmental Awareness	.865			
	Scarcity Awareness			.884	
	Water resource Value		.788		
	Effect of cognition		.878		
	Responsibility cognition	.858			
	Individual water-saving attitudes	.909			
	Attitude towards participating in water-saving activities	.834			
Water-Saving Expectations	Saving time and man-days	.871			
	Water shortage				.700
	Cost expectations	.801			
	Water fee expectations		.917		
Perceived behavioral control	Family water-saving perceptions	.918			
	Family water saving capacity				.843
Subjective norms	Social water-saving expectations	.910			
	Public water-saving expectations			.892	
	Social opinion expectations	.848			
Water-saving practices	Investment in water-saving technologies and tools		.915		
	Eigen values	8.942	2.274	1.453	1.237
	Percentage of variance	52.602	13.375	8.549	7.278
	Cumulative per centage	52.602	65.976	74.526	81.803

**Extraction Method: Principal Component Analysis.**

**Rotation Method: Varimax with Kaiser Normalization,**

**Rotation converged in 4 iterations.**

**Source: Estimation based on Field Survey**

The Eigenvalue greater than one was considered for inclusion in the analysis. The above results indicated that the Eigenvalue for the first three factors alone was greater than one indicating that these factors alone were appropriate for inclusion in the analysis. These factors taken together accounted for 52 per cent of the variance. In the current study for the sample respondents, Factor 1 has significant loadings on “Environmental Awareness”, “Responsibility cognition”, “Individual

water-saving attitudes”, “Attitude towards participating in water-saving activities”, “Saving time and man-days”, “Cost expectations”, “Family water-saving perceptions”, “Social water-saving expectations” and “Social opinion expectations”. Factor 2 has significant loadings on “Water resource Value”, “Effect of cognition”, “Water fee expectations” and “Investment in water-saving technologies and tools”. Factor 3 has significant loadings on “Scarcity Awareness” and “Public water-saving expectations”. Factor 4 has significant loadings on “Water shortage” and “Family water saving capacity”. Thus, it can be identified through the factor analysis that factor 1 has a significant impact on the water-saving behavior of the low-income group respondents.

Using the theory of planned behavior, the researcher analyzes the influence of subjective attitude, perceived behavioral control, and subjective norms on behavioral intention and final behavior with WSB. Moreover, a comparative study of the high, middle, and lower-income groups is also carried out to examine the behavioral differences. Overall, it shows that,

- (1) Awareness of WSB is high in High and Middle-income groups but it is found to be low in the Low-income group
- (2) water-saving expectations and subjective norms and perceived behavioral control have positive effects in all income groups;
- (3) Water-saving practice was highly adopted by High income and middle-income groups Low-income group is not much interested in investment in water-saving technology.

It can be understood from the study that even though the low-income households wish to adopt a saving pattern due to their income constraint they are not able to spend much on water savings. Thus, income influences the water-saving behaviour of the respondents.

Determining the behaviour of the domestic water consumers can facilitate a more proactive approach to water demand management, and serves as the foundation of the development of any intervention strategies that seek to bring about sustained and substantial reductions in domestic water consumption. The most cogent is that water-saving plans should be based on quantitative restrictions and voluntary actions promoted by information campaigns focusing on increasing the environmental

awareness of the households. This creates prospects for further demand analysis and forecasting. So that policymakers will be able to define focus group other factors that could shape an effective water demand policy. Overall water-saving behaviour like rainwater harvesting and utilization are powerful instruments for successfully coping with challenges of care water resources and are the indispensable starting basis for the realization of integrated water resource management and sustainable urban development.