A BRIEF STUDY ON INDIAN MUNICIPAL WATER TARIFF SYSTEMS

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Abstract

A regular and clean supply of water is one of the most important requirements of a household. Following this, its pricing has a significant impact on how and where households get their water from. This paper aims to analyse the water tariff schemes of major urban areas like Delhi, Jaipur and Kolkata. These cities follow different pricing mechanisms which seek to achieve various objectives such as efficiency, affordability, equity etc. The paper tries to provide an idea on how pricing structures are determined and what objectives are fulfilled with each modification to the structure. The differences and similarities in pricing structures of the three cities are discussed, while international case studies are provided as examples.

1. INTRODUCTION

1.1. Water As An Economic Good

The importance of water is becoming increasingly apparent over time and across the world. In most developing and developed countries, a sufficient and safe supply of water is considered every citizen's right (Shah, 2016). Its importance in and of itself is not lost upon anyone and hardly needs to be emphasized further. However, the importance of making this water adequately available to people requires due address. Before the emergence of the climate crisis, resulting from mass environmental destruction and the rapid depletion of natural resources, people's attitudes towards water usage were fairly lax. However, as elementary economics suggests, an increase in scarcity leads to an increase in price. This is precisely what would have happened to water supply in the absence of appropriate regulation. At the International Conference on Water and Environment in 1992, it was decided that water has an economic value and thus, should be treated as an economic good (GWP, 2017). This made it possible to put a price tag on water supply. In order to ensure that these prices are not exploitative, it was noted in the conference that water must first be seen as a human right and that access to it must be affordable. This responsibility of creating a fair, equitable and somewhat efficient pricing system falls upon government bodies. As per welfare economics, the traditional pricing mechanism which equates demand to supply would not be applicable in this situation because of water's status as a human right. In such a scenario, where a tradeoff must be made between equity and efficiency, a pricing system which aims to bring a balance between the two is the most desirable one. Various pricing systems are followed all over the world and each system deals with the equity-efficiency tradeoff differently. The aim of this study is to observe the pricing systems adopted by major urban government bodies in the country and analyse their effects on the end-users and/or the suppliers.

1.2. The Demand For Water

The demand for water comes from a very heterogeneous population for multiple uses. For example, farmers demand it for irrigation, industries for production or households and service providers for domestic use, and so on. The quality and quantity demanded by these people have significant differences. To make the analysis easier, we focus only on urban water pricing. This includes the water supply prices faced by households in urban dwellings. The rationale behind focusing on urban water pricing is pretty straightforward. A large part of the Indian population has migrated to urban areas in search of a livelihood which has not only led to an increase in urban population but has also led to the rapid development of towns into urban dwellings. Since most people live in these areas, it becomes very important to focus upon the fundamental requirement of these people, that is, a reliable water supply priced at an affordable rate.

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1.3. Pricing Structure

A pricing system typically has a tariff structure which is a set of procedural rules used to determine the conditions of service and monthly bills for water users in various categories or classes (Singh et al, 2005). A tariff structure is expected to fulfill certain objectives to ensure appropriate pricing. Before we discuss the objectives, it is important to understand the general functioning of a water distribution mechanism and the stakeholders involved in it.

In India, the responsibility of providing water rests with the states. The state governments are responsible for setting up and maintaining a water procurement, treatment and distribution framework. Today, many urban households have a metered connection to water, although this is not always true for the poor population. At times, the pipeline network does not reach poor or slum localities. The poor are then forced to source water through alternate means such as buying it from private sellers or pumping groundwater with personal pumps, which is illegal in most regions. We refer to the process of providing water to households through a government framework as the water distribution framework. The primary stakeholders that we identify in this framework are categorised into two groups: one, the general public, who are henceforth referred to as consumers and two, the government which acts as the supplier.

2. LITERATURE REVIEW

As a policymaker grapples with the issue of creating a water tariff, it must fulfill at least a few of the following objectives. These objectives are discussed in detail by Singh et al. (2005):

i. Cost Recovery: This requires that tariffs charged from the consumers should produce revenue equal to the financial cost of supply.

ii. Economic Efficiency: It requires that prices signal to the consumers the financial, environmental and other costs that their decisions to use water impose on the rest of the system and the economy.

iii. Equity: The water tariff treats similar consumers equally while those consumers in different situations are not treated the same. Users shall pay monthly water bills that are proportionate to the costs they impose on the utility by their water use.

iv. Affordability: Water, being basic a necessity for the maintenance of minimum health and hygiene standards, shall be provided to the poor at a price that they can afford through the system of subsidies.

v. Simplicity: A tariff design should be simple and easy to understand and implement. It should be acceptable to the public and politicians.

One would immediately notice that all five objectives cannot be fulfilled simultaneously mainly because they are conflicting in nature. For example, the objective of cost recovery would expect water to be priced at its marginal cost. However, the affordability objective indicates that water must be priced below its marginal cost for the poor. Achieving both of these objectives simultaneously hardly seems possible and opens up the idea of a tradeoff in achieving objectives. Most water pricing structures achieve one or two of these objectives and adjust prices in such a way that other objectives are partially achieved. The idea of water prices being below the marginal cost can be illustrated through an example of certain towns in Maharashtra. There, revenue per connection is ₹120 per year as opposed to expenditure per connection which is ₹1300 per year (Patwardhan, 1993). Thus, while there is a relief to the poorer sections of society and a certain degree of affordability, the prices fail to achieve cost recovery and economic efficiency for the state. The problem with such a pricing structure is that in the long run, as the government becomes unable to sustain the infrastructure, the quality and dissemination of water falls. This reduced quality and quantity of water will directly affect the consumers, who will face the brunt of a poorly designed price structure. As a result, it becomes imperative to analyse the water tariff structures that are currently operational.

3. TYPES OF TARIFF STRUCTURES

Two popular tariff structures are widely used around the world: the uniform pricing system and the volumetric pricing system. In the uniform pricing system, consumers pay a fixed charge to the supplier regardless of the amount of water consumed, and usually this fixed charge depends on factors such as the size of the property and acts as a form of water tax. In the volumetric pricing system, water is charged on the basis of the amount of water consumed per unit of consumption. Cities such as Kanpur, Indore, Surat and Madurai follow the uniform pricing system (Mathur et al, 2006). This kind of system is generally lauded for its simplicity but provides no incentive for the consumer to conserve water.

Within the volumetric pricing system, a fairly popular system of pricing is the Increasing Block Tariff (IBT) system. In this system, the rate per unit of water increases as the volume of consumption increases. Consumers face a low rate up to the first block of consumption and pay a higher price up to the limit of the second block, and so on until the highest block of consumption (Ricato, SSWMT). International financial and engineering consultants and water sector professionals working in developing

countries commonly presume that IBT structures are the most appropriate way to determine water users' monthly bills (Boland and Whittington, 1997) but this claim is contended in their paper.

After doing a review of the existing literature with regards to IBTs, and as argued by Whittington (1992), we agree that IBTs have several shortcomings, but they can be overcome. One of the main issues raised against IBTs is that of the construction of the first block and its pricing. If the initial block is too large and it is priced too low, the supplier may not be able to recover any of its costs. In fact, one of the prime features of an IBT is that it also has a concept of a lifeline block. The first block in an IBT system is referred to as the lifeline block. With the assumption that poor people consume less water than rich people, the lifeline block is priced at an extremely low rate or, at times, is made free of cost (Ricato, SSWMT). Since the rich pay more for water, they are expected to subsidise the usage of the poor. This cross-subsidy ensures that the poor are able to afford water at lower rates and the rich subsidise the water for them while ensuring cost recovery takes place. While this sounds viable in theory, a major problem with this stands in places where either the poor share meters or live in large families whose consumption is greater than the average household consumption. In such a scenario, the poor end up paying much more than the affluent simply because they fall in a higher block, despite their personal consumption being less than average (Singh et al, 2005).

However, these shortcomings can be overcome and the benefits that it provides can supersede the shortcomings. If meticulous surveys on people's demand, ability to pay and willingness to pay are done and the data is analysed appropriately, then the construction of this initial block should not be very difficult.

4. TARIFF STRUCTURES IN DIFFERENT CITIES OF INDIA

Most urban bodies use a combination of a uniform price and an IBT system, which is referred to as a two-part tariff system. The fixed part is usually levied in the form of connection fee, water cess or sewerage charge. The general trend in most cities has been a shift from a uniform price to a volumetric charge with some fixed part. Take the case of Chennai as an illustration. We see that until very recently, the Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), the water authority of the city, used to levy a fixed tariff irrespective of the quantum of water used (Vishwanath, 2019). However, now the city has moved towards an IBT system with a fixed portion which includes the sewerage charge ("Tariff', CMWSSB). Cities like Jaipur, Bangalore, Delhi, Hyderabad, Agra, Prayagraj, Pune and Mumbai also follow some form of the IBT system.

The authors would like to discuss the tariff structures of Delhi, Jaipur and Kolkata in detail primarily because of the innovations that the policymakers have brought into the pricing mechanisms and whether these innovations are better than traditional pricing structures.

4.1. Delhi

In Delhi, most of the water supply and pricing activities fall under the jurisdiction of the Delhi Jal Board (DJB). Up until 2014, the city had a basic two-part tariff system which had a fixed rate and a volumetric charge. The volumetric charge in this structure followed an IBT system. However, a large part of the population did not have meters and thus had to get water from illegitimate sources. This was because of the inability of the government to supply water to these regions and the subsequent birth of the 'water mafia'. These were private suppliers who held a regional monopoly on water supply. As a result of this, the people without meters, who were mostly the poor, ended up paying more for water. To address this problem, the Delhi Jal Board altered their pricing mechanism and marketed it as a 'free water scheme'. The alterations were:

1) A subsidy was provided on the initial block (lifeline block) such that any domestic consumption within the 20,000 litre limit would get a 'zero-bill'.

2) The tariffs of the higher blocks were increased by 20%. If consumption exceeds the 20,000 litre limit, then the appropriate rate would be applicable to the entire amount of water consumed, and not the differential.

3) For example, if your water consumption is 25,000 litres per month, the bill will be calculated as: 25 x ₹21.97[1] = ₹549.25

A key requirement of availing the benefit of this subsidy was to have a government-approved water meter. This led to a considerable increase in the number of water connections and significantly reduced the presence of the 'water mafia' in the city. Now most of the households who shifted from an unmetered water supply to a metered water supply are likely to have benefitted as they faced lower prices and could avail the subsidy if their consumption was sufficiently low. This indicates the fulfilment of both objectives of affordability and equity because the poor, who are assumed to consume less water, now get water at an affordable rate through the means of subsidy. More-

[1] *The water charges are per kilo liter (1kl = 1,000l). "Water", Delhi Jal Board http://delhijalboard.nic.in/content/water-0*

over, the existence of different prices for different consumers ensures that equity is maintained.

We will analyse the cost recovery of the new (introduced in 2015) and old (introduced prior to 2015) pricing structures. The calculation of expenditure includes the cost of water supplied and the sewerage charges as both of those constitute the production costs. Sewerage costs have not seen a significant change and have been progressively increasing in each year by a marginal amount. Using data from Table A and Table B in the appendix, the revenue and expenditure data for both time periods are compiled to track their efficiency. The years 2013-2014 and 2014-2015 are omitted due to ambiguity over the government's resignation and the subsequent modification of their water scheme from the next term when they were re-elected in 2015.

***Table 1**: Before modification (₹ lakhs)*

Year	Revenue Collected	Total Expenditure	Revenue - Expenditure
2010-2011	92531.62	160807	-68275.38
2011-2012	120247.97	156104	-35856.03
2012-2013	151926.49	171737	-191810.51
Total	364706.08	488648	-295341.92

Source: Compiled by authors from official Delhi Jal Board figures.

***Table 2**: After modifications to the price structures (₹ lakhs)*

Year	Revenue Collected	Total Expenditure	Revenue - Expenditure
2015-2016	161583.50	172393	-10809.5
2016-2017	178220.00	138465	+39755
2017-2018	171981.00	173000	-1019
Total	511784.5	483858	+27926.5

Source: Compiled by authors from official Delhi Jal Board figures.

From the two tables, it is clear that the Delhi government water tariff scheme has somewhat been able to reduce the difference between its revenue and expenditure and hence sustain the water subsidy. The price hike in higher blocks has led to the recovery of costs to an extent greater than ever before.

In reference to the scheme's funding, as per the budget documents of the Delhi government, it has spent approximately ₹1400 crores to actualise the price structure (Budget NCT, 2015-16). Subtracting that from the total balance at the end of 2018, we get a deficit of ₹1120.755 crores, which is roughly 40% of the revenue deficit in the previous term with no subsidy. This decrease in the revenue deficit is significant primarily because a section of the population pays virtually no money for their water consumption but the DJB is still able to recover costs better than the previous pricing structure.

4.2 Jaipur

If we take the case of Jaipur, we find similarities in its tariff structure with that of Delhi, with some minor differences. Although the effect of the scheme in terms of cost recovery and consumer benefit has been significantly different, mostly because of the finer details of the scheme. The water supply authority of Jaipur, the Public Health Engineering Department (PHED) made interesting changes to their tariff systems.

In 2017, the PHED decided that the water tariff would be revised upward each year by 10%. Due to this, the average water bill for each household went up from ₹ 435 to ₹ 550. The PHED claimed that the increase was necessary to secure loans from the bank for water projects (Pink City Post, 2017). This made an existing problem of defaulting even worse. The PHED had been seeing an increase in the number of defaulters for the past six years and the amount of unpaid bills had reached ₹68,56,503. The only measure that was taken against the defaulters was to cut their connection but that proved to be futile as it did not ensure cost recovery (Sharma, 2018).

Till 2019, the tariff system in the city was two-part, i.e. it had a fixed rate and a volumetric charge. The fixed rate was calculated on the basis of the average consumption of each household for the past six months. The system was incredibly complex with charges varying according to service lines and the level of consumption. There also existed a flat charge for unmetered households (Water Tariff, PHED).

In 2019, the city introduced a 'free water' scheme similar to the scheme we assessed in Delhi. The differences being:

1. The lifeline block included consumption upto 15,000 litres, which meant that urban households consuming under 15,000 litres do not have to pay any volumetric charge.

2. Households in rural areas would be supplied up to 40 litres of water per capita per day free of charge.

Similar to the requirement in Delhi, this tariff would be applicable to only those households that have a metered connection of water. However, unlike Delhi, this requirement did not lead to an increase in the number of metered households, primarily because of the exemptions made for non-metered households. The water charge for

non-metered areas, which was earlier fixed at ₹ 240, was now made free of cost. As per data from the PHED (up to August 2019) there are about 1,91,689 consumers in Jaipur who don't have a metered connection. There are about 21,866 flat rate connections in the city. If the average water bill for a metered household in 2019 was ₹127 inclusive of all charges, then that bill amount changes to ₹ 25.96 after the change in the price structure, which is a dramatic reduction, to say the least (Jain, 2019).

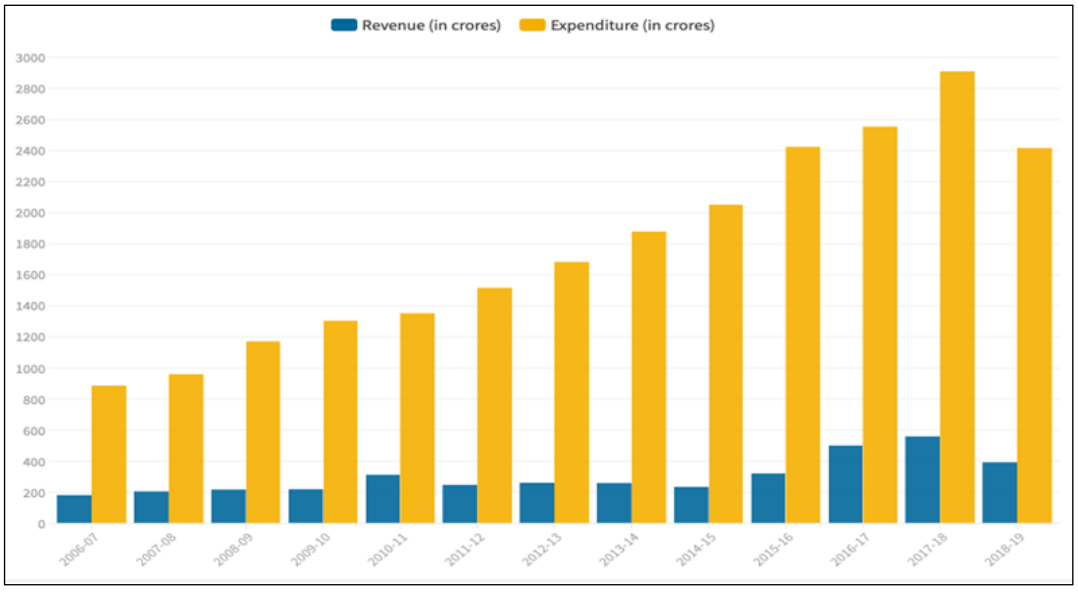
The PHED already has a disappointing track record with respect to cost recovery up till 2018. By introducing a lifeline block, reducing fixed charges and exempting flat rate charges, the PHED has blocked a significant source of its income which is more than likely to affect cost recovery. The IBT system, along with the introduction of a free lifeline block, has the potential to change water pricing and delivery. However, different circumstances in each region and the effect of parallel price structures must be accounted for in order to get the desired results, something Jaipur may not have done properly. There are 45,257 consumers but only 27,859 functional meters. This indicates that the government has no means to track water consumption of roughly 38.4% of the consumers. This is worrying because without the means to track the water consumption of these consumers, the PHED has no means to prepare itself for capacity, leakages and unlawful use. Moreover, this price structure does not achieve economic efficiency as the consumers are not made aware of the costs incurred in supplying water via the prices.

As per the progress report released by the PHED, huge gaps have been observed between the revenue and expenditure of the department over the years. In the financial year 2018-19, the expenditure was as high as ₹2,412.98 while the department generated a revenue of only ₹390.07 crores which is only 16.1654% of the expenditure. A similar trend was seen in the past few financial years. The only source of revenue generation for the department has been billing (ibid). The revenue and expenditure trend can be summarised in Figure 1.

4.3. Kolkata

The case of Kolkata is interesting for many reasons. Firstly, the city has a rich source of water from the river Hooghly and has liberal access to groundwater as well. Despite an abundance of water, the supply and pricing system of water in Kolkata is in shambles. The municipal authority, Kolkata Municipal Corporation (KMC), has been unable to recover costs and monitor supply across its command area. Due to bad planning and rampant criminal activities, the water-rich city is now becoming water-stressed. Prior to 2003, a 'nominal water fee' was charged for domestic use along with the property tax paid quarterly by the residents. This form of flat rate was discontinued by the government and at present, domestic water supply is not billed in the city. For any new connection, a household has to pay a fixed charge which includes a meter charge and road restoration fees. This can cost a consumer somewhere between ₹1500 and ₹6000 based on the size of the meter. A household is also liable to pay rent for the meter which varies between ₹100 to ₹1100 per month, depending on the size of the meter. Clearly, these prices are much higher than those found in any other city. These prices are close to indicating the actual value of water. So, one can conclude that having such prices may indicate economic efficiency. However, due to high prices, most households pump their own groundwater despite having a piped connection (Basu, 2015). This has led to a sharp decline in the groundwater tables and a

***Figure 1**: Revenue versus Expenditure of the PHED Department, Rajasthan*



Source: The Wire, "Rajasthan: Gehlot's Free Water Scheme Benefits Neither Consumers Nor The Exchequer", 2019

steep rise in arsenic levels in the water.

Public taps in Kolkata are not billed and hence are responsible for a significant portion of water wastage and revenue loss for the KMC. The pricing structure in Kolkata fails to fulfil the objective of not just cost recovery, but also that of simplicity. Users in the city have been divided into 49 categories for levying in connection fees and these include stables, cooling plants, flushing purposes in the market areas, firefighting, medical practitioners, film actors and painters, owners of newspapers, estate agents, racehorse jockey, persons engaged in the profession of loading and unloading and others (Mathur, 2006). Efforts have been made by the authorities to simplify this system and increase the coverage of piped connections. For example in 2002, 85% of the population was served by a piped connection but by 2015, this figure jumped to 94%. Although it is an increase, the increase is not significant enough. The provision of free water through public taps ensures that water is available even to the poorest in the city, but studies have shown that most people are ready to pay money and even higher prices for water (Majmudar et al, 2009). In such a situation, the water authority of Kolkata must adequately charge at least a nominal fee for water and ensure a steady revenue flow.

5. INTERNATIONAL PRACTICES

Most developed and developing countries have experimented with different forms of pricing structures to suitably price water to ensure availability while also indicating the true economic cost of providing water to households. We will briefly look at the tariff structures of Australia and Guinea.

In a case study published by the World Bank Oxford University Press, we observe the case of the Hunter District Water Board. The Hunter District Water Board supplies water to Newcastle, the second-largest city in New South Wales. In the 1970s, the board had proposed the construction of a new dam to ensure capacity for rising demand but was short on finances. In 1982, the board reformed its tariff structure and ensured a reduction in demand and a simultaneous increase in revenue.

Prior to this reform, users had to pay a flat charge on the basis of the value of their property, for a base or free allowance of water. The free allowance was generous, with the result that the cost to most consumers at the marginal unit of water consumed was zero. Consumers who exceeded the base allowance paid a volumetric charge. The reform introduced a two-part tariff structure, similar to the ones observed in Delhi and Jaipur but without the lifeline block. This reform modified the base charge such that it was still based on land value but simultaneously reflected that it only existed to cover the fixed costs of the board. There was a phased change to the tariff structure and it led to dramatic impacts. This pricing reform based on the principles of consumption-based pricing, full cost recovery and the removal of cross-subsidies was successful as it led to many similar reforms by urban authorities in the country (Ariel, 2000).

In a move similar to Delhi and Jaipur, Guinea has adopted a lifeline block within its IBT system and has made the consumers falling under this block free of payment. The water authority is a private commercial operator. Subsequent block rates were increased in a phased manner so that the higher paying consumers could subsidize the consumption of those falling in the lifeline block. This has ensured the fulfilment of affordability and equity. External credit was sought to sustain the phased increase of tariffs to ensure cost recovery at a future date which has worked out well for Guinea (Mathur et al, 2006). The pricing structure also seems to be fairly simple to understand and hence, fulfils the objective of simplicity as well.

6. CONCLUSION

As we get closer to a climate crisis, it is expected that a large part of the population will lose its access to clean water very soon. In this context of scarcity and urgency, it becomes very important for municipal bodies to get water tariffs right which will not only ensure availability of water but also make sure that the prices encourage conservation of water. From the brief analysis we have conducted above, we are of the belief that the water tariff system of Delhi has by far been able to produce desirable results. However, no empirical study has been conducted to substantiate these claims. The authors are currently working on this issue to gather evidence via a primary survey to evaluate the benefits of the water tariff structure of Delhi. The primary research aims to look into the various aspects of consumer behaviour and public reaction to pricing policies of essential commodities.

Such innovations in tariff structures are essential especially for cities like Kolkata which have an abundance of water, but poor management systems. These innovations encourage households to install a water meter in order to benefit from a subsidy. This decreases the households' dependence on illegitimate sources of water and helps the authorities to keep track of the water consumption patterns. This can ensure that there is no reckless use of water and can help in ensuring that groundwater tables do not get depleted.

APPENDIX

Table A: Expenditure incurred on water supply and sewerage programmes in Delhi during 2007-2018

(₹ Crore)

S. No.	Details	Water Supply	Sewerage	Total
1.	**Approved Outlay (2007-2012)**	**4361.50**	**3132.50**	**7494.00**
2.	Fund Released			
	a. 2007-08	962.01	383.96	1345.97
	b. 2008-09	1015.17	441.73	1456.90
	c. 2009-10	1080.35	568.55	1648.90
	d. 2010-11	1080.14	527.93	1608.07
	e. 2011-12	1033.02	528.02	1561.04
	Total (a+b+c+d+e)	**5179.69**	**2450.19**	**7620.88**
3.	**Approved Outlay (2012-17)**	**6087**	**4913**	**11000**
4.	Fund Released			
	a. 2012-13	964.97	752.40	1717.37
	b. 2013-14	796.77	753.23	1550.00
	c. 2014-15	854.50	934.50	1789.00
	d. 2015-16	646.50	1077.43	1723.93
	e. 2016-17	850.15	534.50	1384.65
	Total (a+b+c+d+e)	**4112.89**	**4052.06**	**8164.95**
5	**Revised Outlay 2017-18**	1023.00	813.50	1890.00
6	Fund Released 2017-18	999.50	730.50	1730.00

Source: Economic Survey of Delhi 2018-19 | Planning Department |

Table B: Revenue Collection of Delhi Jal Board

Year	Revenue Collection(rupees in lakh)
2009-2010	64936.05
2010-2011	92531.62
2011-2012	120247.97
2012-2013	151926.49
2013-2014	143715.33
2014-2015	121993.29
2015-2016	161583.50
2016-2017	178220.00
2017-18	171981.00

Source: Delhi Jal Board Website, Revenue Department

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