

The Risk and Vulnerability Assessment of Delhi's Water Supply Shocks

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(As a part of Researching Reality Internship 2016, Centre for Civil Society)

Summary

This paper analyses the water supply shocks in Delhi and identifies the various possible hazards that can result in such shocks. Further it does a risk assessment of these hazards by developing a risk score matrix and by likelihood description. This is complemented by primary data analysis to understand the water supply problems in 3 areas across Delhi.

Water has been at the centre of political and socio-economic turmoil in recent times. With the ever-growing needs of a growing population, provision of water has become a quintessential policy issue. Water, which has been seen as an unalienable right and one of the basic needs for survival, has ceased to be an unlimited resource. In recent times, the exponential increase in demand for water and its rampant wastage has made it necessary to put a valuation to it.

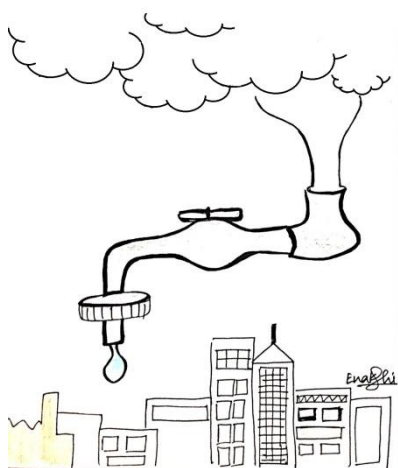
Hence we ask, what is the value of water in Delhi? Of late, that question has been answered by blatant water supply shocks due to human activities. The Munak Canal sabotage, ammonia contamination and similar detrimental hazards have

repeatedly paralyzed Delhi's Water Supply.

This necessitates a policy framework that analyzes risks and associated socio-economic vulnerabilities posed by such water supply disruptions. The paper is a step towards formulating this framework.

Background & Definitions

The present study evaluates the risk associated with water extraction, transportation and treatment on quantum of water supply. This study does not take into account the distributional aspect and the quality of water supplied. Risk assessment in water supply refers to evaluation of the potential risks that may be involved in the process. It is, here, calculated as the cross product of the likelihood of occurrence of a Hazard and the severity of its consequence. The distinction between hazard and risk needs to be understood so that attention and resources can be directed to actions based primarily on the level of risk, rather than just the existence of a hazard. Vulnerability is again a distinct concept from risk. Risk assessment examines the ability of different groups to resist the impact of hazard, once it has already taken place. In this context, it would imply how different groups respond and resist to water supply shock



Methodology

Hazard Identification

For the purposes of Hazard Identification, a comprehensive list of all the plausible hazards is made through reading case studies of water supply shocks across the world and brainstorming. After a careful study, relevant hazards are identified.

Risk Assessment

Risk is assessed qualitatively by gauging the likelihood of the occurrence of identified Hazards and attached severity of their consequences.

Likelihood Description

Likelihood in the context of the present research means the probability of occurrence of the hazard. The paper utilizes a qualitative assessment of grading likelihood under the five heads given below. In a qualitative assessment, likelihood may be calculated with the following parameters: -

- a. Historical Data
- b. Trend Analysis and Forecast
- c. Anecdotal evidence

Assessment I:

For the survey, a random sample of 50 RWA's from Central and South West districts of Delhi was taken.

Both these districts were affected because of the sabotage (DJB press release).

RWA's of both planned and unplanned colonies were chosen through methods of random sampling from telephone directory. All the RWAs interviewed had been registered with the government.

Following factors have proven to determine the vulnerability of localities in face of water cut:

Availability of boring in locality: Though 25 of the 40 localities that had access to borings depended on external water supply during water cut, average out of pocket payments of households were reported to be lower than of colonies without any access to groundwater.

This happened because demand of water for non-potable purposes was fetched by borings. Those who did not own one, shared from the neighbors.

The ease of getting water from DJB tankers

As noted earlier, the level of dependency on tankers vis-a-vis borings has been low. One reason has been the shortage of water while the relative ease of getting water from boring rather than tanker is also a factor. Few localities complained that they didn't get DJB tanker during the period even after repeatedly calling at the DJB emergency service number. They either had to call incur cost of calling private tanker or had to limit their water consumption. There were also examples where RWA president/secretary pointed out the help of sources like Zonal engineer

and MLA who helped them ease the process of procuring DJB water and also prioritize their locality when water supply was rationed. Furthermore, an RWA President based his case against not calling on tanker on an incident of murder in procuring water from tankers. There was an interesting case where price paid to DJB tanker was more than that charged by private tankers* The plying of both these DJB and private tankers is subject to a lot of transparency issue and has been under scrutiny. Since, tankers form an important contingency measure, the lack of transparency and susceptibility to political interests further increases the vulnerability of localities, especially for those lacking political power.

Unsustainability of contingency measure

From this analysis, it comes out very evidently that groundwater connection can prove to be a lot helpful even when there is a pipeline supply of water. But going beyond the immediate results, it is realized that such incentive is self-destructive. Once the access to groundwater is lost, no contingency measure will be left in case of any shock to supply system. Even in the present hazard, since the groundwater has depleted in many regions and is not fit for drinking, households were forced to buy drinking water even if they were not buying in normal scenario. And families who couldn't afford the cans had to suffer. The accelerated rate of depletion as identified earlier in risk assessment section means that the primary contingency measure is unsustainable.

Assessment II: Data collection at household level

Three different kinds of localities were visited and a sample of 20 people were interviewed in each. Localities: Kautilya Apartments, Dwarka, Sector 14; Malkaganj; Bharat Vihar, Dwarka

Observations

- If water is being provided by tankers which is done once or twice a week, people become habitual of consuming less amount of water. In case of Jat agitation, the provision of water tankers in Bharat Vihar to delayed by a day or two at maximum. Though some had to buy drinking water cans from outside, there was not much of problem faced by the community.
- In case water is solely provided by water supply, people face a lot of problem when water supply is cut off.
- However, living in a society reduces the vulnerability as collective action helps. In most societies, there also exist society level borings which though used to water gardens are used when water supply is cut off.
- Living around neighbors with boring also reduces vulnerability as non-drinking water is obtained free of monetary cost.
- In case boring is used additionally, people prefer to use DJB's water to drink. In case of water supply cut, the only cost involved is related to procuring drinking water, that too when RO is not put and ground water cannot be used at all.

Likelihood Index for Risk Matrix

- i) Point Risk (A point risk reflects the risk posed by abrupt and

unpredictable events that last for a short duration but may endure larger and long term damage.)

- ii) Continuous Risk (There also exist persistent risks that persevere through time. These

include risks posed by Climate Change, Mining, and Excessive Groundwater Extraction. In this case we may take into account the rate of damage caused by the given hazards.)

Risk Matrix Score

RISK SCORE	Low	Average	High	Very High	Extreme
Highly likely	11	16	20	23	25
Likely	7	12	17	21	24
Somewhat Likely	4	8	13	18	22
Unlikely	2	5	9	14	19
Highly Unlikely	1	3	6	10	15

Risk Table

Hazard	Type	Likelihood	Severity	Risk Quotient
Earthquake				
	Low Intensity <3.5	Highly Likely	Low	11
	Medium Intensity 3.5-4.5	Likely	Average	12
	High Intensity 5.5<	Somewhat Likely	High - Very High	13-18
Flood	Major- Water levels above 205m	Unlikely	High	9
Climate Change				
	Reduced river flow	Persistent and constant rate of decline - somewhat likely	High	13
	Reduced Groundwater	Persistent and Increasing rate	Very High	21

	recharge	- likely		
	Disappearing water bodies	Persistent, Irreversible and Increasing rate - Highly Likely	Average	16
Contamination	Ammonia	Highly likely	Very high	23
	Heavy metals	Likely	High	17
	Eutrophication	Somewhat likely	Average	8
	Organic contamination	Somewhat likely	Average	8
Mining	Floodplain and riverbed	Persistent and Constant rate	High	17
Accidents				
	Drawing water tragedy	Somewhat likely	average	8
	Chlorine leakage	Somewhat likely	average	8
	fire	Highly unlikely	Very high	10
Power cut	WTPs, Tube wells	Likely	High	17
Non-water related acts of violence	Deliberate Sabotage	Somewhat Likely	High-Very High	13-18
Water Development Disputes				
	International water development disputes	Highly Unlikely	Extreme	15
	Intra-national water development disputes	Unlikely	High-Very High	9-14
Adverse change in inter-state water sharing agreements				
	Inter-state Yamuna-water sharing	Highly Unlikely	Extreme	15
	International	Highly Unlikely	Extreme	15

	sharing of Indus river basin			
	Inter-state sharing of Ravi-Beas river	Highly Unlikely	Extreme	15
	Inter-state Ganga water sharing	Highly Unlikely	Extreme	15

APPENDIX

Severity Index for Risk Matrix

Extent of shortage in water supply	Severity of Risk
Major part of water cut for 30 days or more	Extreme
Minor part of water cut for 30 days or more; Major part of water cut for five days or more	Very High
Minor part of water cut for 15 days or more; Major part of water cut for 1 days or more	High
Minor part of water cut for 7 days or more; Major of water cut for or more	Average
1-5% of water cut	Low

Level	Description
Highly Unlikely	Probability or Past frequency below 2% in a given time period
Unlikely	Probability or Past frequency between 2-10% in a given time period
Somewhat Likely	Probability or Past frequency between 10-25% in a given time period
Likely	Probability or Past frequency between 30%-50% in a given time period
Highly Likely	Probability or Past frequency above 50% in a given time period

Rate of Damage/ Damage	Likelihood of Risk
Persistent, Irreversible and Increasing Rate of Damage	Highly Likely
Persistent, Reversible and Increasing Rate of Damage/Irreversible and Constant Rate of Damage	Likely
Persistent, Reversible and Constant Rate of Damage/ Irreversible but Decreasing Rate of Damage	Somewhat Likely

Persistent and Reversible but Decreasing rate of Damage	Unlikely
Reversible and Decreasing Rate of Damage	Highly Unlikely

Observations for vulnerability assessment of RWA

Colony Profile	Total Number	Number of colonies dependent on external water sources during water cut	Percentage of colonies dependent on external water sources during water cut
Number of colonies with provision of DJB water pipeline for households	41	27	65%
Number of colonies with only individual borings for at least of the households	23	17	N/A
Number of colonies with only community borings for households	3	1	N/A
Number of colonies with both individual and community borings for households	6	4	N/A
Number of colonies without any access to groundwater	8	5	N/A
Number of colonies without provision of DJB water pipeline for households	9	2	22%
Number of colonies with only individual borings for at least some of the households	4	1	N/A
Number of colonies with only community borings for households	2	1	N/A
Number of colonies with both individual and community borings for households	2	0	N/A
Number of colonies with no access to groundwater	0	N/A	N/A
Total number of colonies surveyed	50	29	58%