RECOMMENDATIONS FOR IMPROVING INFORMATION DOCUMENTATION FOR WATER SUPPLY IN NAVSARI

For Performance Assessment System In Gujarat

June 2012

Submitted to
CEPT University, Ahmedabad

Submitted By
Urban Management Centre

URBAN MANAGEMENT CENTRE

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The following team has been working on this project.

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This is phase one of the project analysis. More in depth analysis and improvements will be undertaken in coming months after consultations with Municipal staff.

Manvita Baradi
Director, UMC

List of Abbreviations

CENA	Capacity Enhancement & Need Assessment
CEPT	Centre for Environmental Planning & Technology
cu m	cubic metre
cusec	cubic metre per second
DC	District Collector
DoM	Directorate of Municipalities
DPR	Detailed Project Report
ESR	Elevated Service Reservoir
FIFO	First In First Out
GIS	Geographical Information System
GMFB	Gujarat Municipal Finance Board
GoG	Government of Gujarat
GoI	Government of India
HP	Horse Power
HR	Human Resources
HRS	Human Resource System
ICMA	International City/County Managers' Association
INR	Indian National Rupee
ISIP	Information System Improvement Plan
IT	Information Technology
JnNURM	Jawaharlal Nehru National Urban Renewal Mission
JSK	Jan Suvidha Kendra
Km	Kilometre
KPI	Key Performance Indicators
LIFO	Last In First Out
LPCD	Litres per capita per day
m	Metre
MIS	Management Information System
ML	Million Litres
MLD	Million Litres per Day
mm	Millimetre
NNP	Navsari Nagar Palika
NRW	Non Revenue Water
O&M	Operation & Maintenance
PAC	Ploy Aluminium Chloride
PAS	Performance Assessment System
PIP	Performance Improvement Plan
ppm	Parts per million
RC	Residual Chlorine
RCC	Reinforced Cement Concrete
SLB	Service Level Benchmarking

sq m	Square Metre
T&CD	Training & Capacity Development
TDS	Total Dissolved Solids
TOR	Terms of Reference
UDD	Urban Development Department
UIDSSMT	Urban Infrastructure Development Scheme for Small & Medium Towns
ULB	Urban Local Body
UMC	Urban Management Centre
WASMO	Water & Sanitation Management Organisation
WDS	Water Distribution Station
WSS	Water & Sanitation System
WTP	Water Treatment Plant

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i. Introduction to Performance Assessment System (PAS)

Access to water and sanitation services in urban India is widespread, but little is known about the quality and level of service, and coverage of the poor households. For new investments in the sector to be effective, it is important to assess the performance of the existing system and ensure its sustainability and reach for the poor and unserved.

Need for the PAS program:

- Aggregate statistics suggest good coverage of water and sanitation in urban areas in India, but little is known about the quality, level and financial sustainability of service
- Accurate information on access of urban poor households to water and sanitation is unavailable
- Lack of WSS (Water and Sanitation System) information leads to not only improper monitoring and management of the utility but also misallocation of resources
- Difficult to assess impact of past investments

PAS aims to measure and monitor the performance of the services, and thus improve the overall performance of service delivery system in urban areas reaching the unserved population. The project includes all ULBs in Gujarat and Maharashtra, and is to be implemented by CEPT University (CEPT). Urban Management Centre (UMC) is undertaking all programmatic activities in Gujarat.

ii. Aims and Objective of PAS Programme

Aim:

- To measure and monitor the performance of the services and hence improve the overall performance of service delivery system in urban areas ensuring equity, especially reaching out to the deprived and unserved populations.

The key **objectives** of the **five-year long PAS Programme** are**:**

- To review the quality of services in ULBs i.e. water supply, sewerage, solid waste management and storm water drainage
- To establish a database system in ULBs which can be used by decision makers of ULBs and others (State, Central Government)
- To document the good practices of ULBs and sharing them across cities
- To provide assistance in improving the system of ULB through Performance Improvement Plans (PIPs) and Information System Improvement Plans (ISIP)
- PIP includes technical and managerial aspects of basic services i.e. water supply, sewerage, solid waste management and storm water drainage along with advocacy at local as well at state level
- To compare the indicators of services across the cities for receiving overall picture of the state. This will be used by decision makers to identify priorities for the state government

iii. Benefits to ULB

- Database will help identify the gaps in existing system, especially in quantification of procurement, processing, coverage, delivery and supply. Besides, it would also identify gaps in cost recovery mechanism service-wise, identification of non revenue water, equity regarding all the services, etc.
- Appropriate and qualitative database enables factual reporting on reforms-related evaluation and compliance under Jawaharlal Nehru National Urban Renewal Mission (JnNURM) and Urban Infrastructure Development Scheme for Small & Medium Towns (UIDSSMT), Nirmal Gujarat, Garib Sammrudhi Yojana and other Central and state-sponsored special programs

- Analytical and comparative study of the service performance related to water supply, sanitation, solid waste management and storm water drainage will help in understanding the grey and critical service areas highlighting its inherent deficiencies that could lead to measures for its rectification and overall improvement. Innovative measures adopted for its improvement could serve as best practices worthy of replication by other ULBs

iv. Data collection for PAS Programme

The UMC team visited all 166 ULBs, spending time on field during the year 2009-10, and followed up with ULBs to get the required information for the year 2008-09. The process adopted to capture data on water and sanitation services is mentioned below:

i. Sensitisation meetings with chief officer and department heads through brief sharing of information on PAS program and objectives of field visit
ii. Discussion on questionnaire with chief officer and department heads
iii. Separate interaction with department officials and gathering of data/information
iv. Mapping on Google Earth – geo-specific data such as ward/zone/city boundaries, main water distribution lines, solid waste dumping site, locations of slums, water logging/flooding areas. etc.
v. Site visit to water sources, water treatment plant, solid waste dumping site, etc.
vi. Visit to slum settlements for an understanding on access to services to the slum dwellers
vii. Wrap up meeting with chief officer to summarize the extent of data available with ULB

After the first round of data collection, the UMC team compiled the data of all 166 ULBs and summarized the indicators values in tabulation form for each class. The indicator value of Navsari Municipality compared with the average of Class A Municipality and average of all ULBs of Gujarat against the national benchmark is mentioned in Table 1.

Table 1 Comparison of Navsari with Class A ULBs in Gujarat, all ULBs in Gujarat and SLB

S. No.	Indicator Name	Unit	Value for Navsari Municipality	Avg. of Class A ULBs (Gujarat)	Avg of all ULBs (Gujarat)	SLB values
1	Coverage of water supply connections	%	93	50	64	100
2	Per capita supply of water	Lpcd	108	71	77	135
3	Continuity of water supply	Hrs	6.51	2.1	1.5	24x7
4	Quality of water supplied	%	100	99	96	100
5	Cost recovery (O&M) in water supply services	%	34	39	43	100
6	Spatial variations in water supply coverage	Ratio	0.0	0.4	0.4	-
7	Spatial variations in per capita supply of water	Ratio	0.0	0	2	-
8	Coverage of water supply connections in 'slum settlements'	%	71	54	52	-
9	Extent of non revenue water	%	28	33	30	15
10	Efficiency in redressal of customer complaints	%	100	94	98	80
11	Percentage of recruited staff to sanctioned staff	%	53	51	53	-
12	Extent of functional metering of water connections	%	0	0.37	0.7	100
13	Unit electricity cost of production of water supply	INR/ KL	0.6	1	2	-
14	Efficiency in collection of water supply-related charges	%	75	53	49	90

(SLB – Service Level Benchmarks);

Indicators where Navsari performs better than Average of Class A cities and overall Average of ULBs in Gujarat

The above table shows that the performance of Navsari Municipality in water provision is significantly higher than state average and Class A average in most of the indicators.

v. Need for Diagnostic study

From the above comparison, it could be concluded that Navsari performs better in nearly all indicators when compared to class average or overall average of Gujarat state. However, despite high values of indicators, the service delivery on ground was found to be below satisfactory in many cases during the reconnaissance field surveys. Potential causes for the discrepancy between statistics and on-ground service delivery could be

- incorrect reporting
- faulty data recording practices
- use of obsolete water supply management practices
- faulty equipment being used for taking measurements

In the absence of cross checking data using back calculations with various associated indicators, data with low reliability is being used for planning and operations. This in turn could have resulted in multiplier effect and eventually led to large discrepancy between reported services and actual on-ground services reaching the consumers.

Apart from the above, many crucial measurement practices are missing in NNP. Some these issues have been identified below:

Preliminary issues identified based on reconnaissance survey in water supply information management of Navsari

1. Extent of bulk metering is poor with meters installed only at intake for water treatment plant (WTP). No bulk meters are installed at water distribution system (WDS) or individual meters at consumers' end are present. Hence no recordings of actual water delivered to consumers are available.
2. Losses between various stages of water supply system such as WTP-WDS and WDS-consumer, are unknown. Daily amount of water supplied from WTP is assumed to have reached the WDS and further to consumer.
3. NRW is estimated to be 28 percent roughly. No functional metering of water connections is present and hence NRW has never been calculated.
4. Pressure of water supply during supply hours was found varying spatially. Since no mechanism to measure pressure is in place, no remedial action is possible.
5. Water quality tests are not done as per standard procedures. However, infrequent and inadequate random spot testing is done occasionally.

This study aims to conduct a rapid assessment of information collection and reporting processes involved of water supply system in Navsari. Based on the findings of the assessment, this study would further recommend improvements in information documentation/ recording practices, which in turn would enable decision makers monitor and to plug the gaps in equitable service delivery.

vi. Methodology for Conducting Diagnostic Study of Water Supply System in Navsari

The UMC team met the chief officer and other departmental heads during several visits to Navsari Municipality . Officials from the departments of water supply, health & solid waste, property tax, sewerage and accounts were present during meetings.

Key performance indicator (KPI) values as per the service level benchmarking (SLB) derived from the SLB checklist were presented during the meeting.

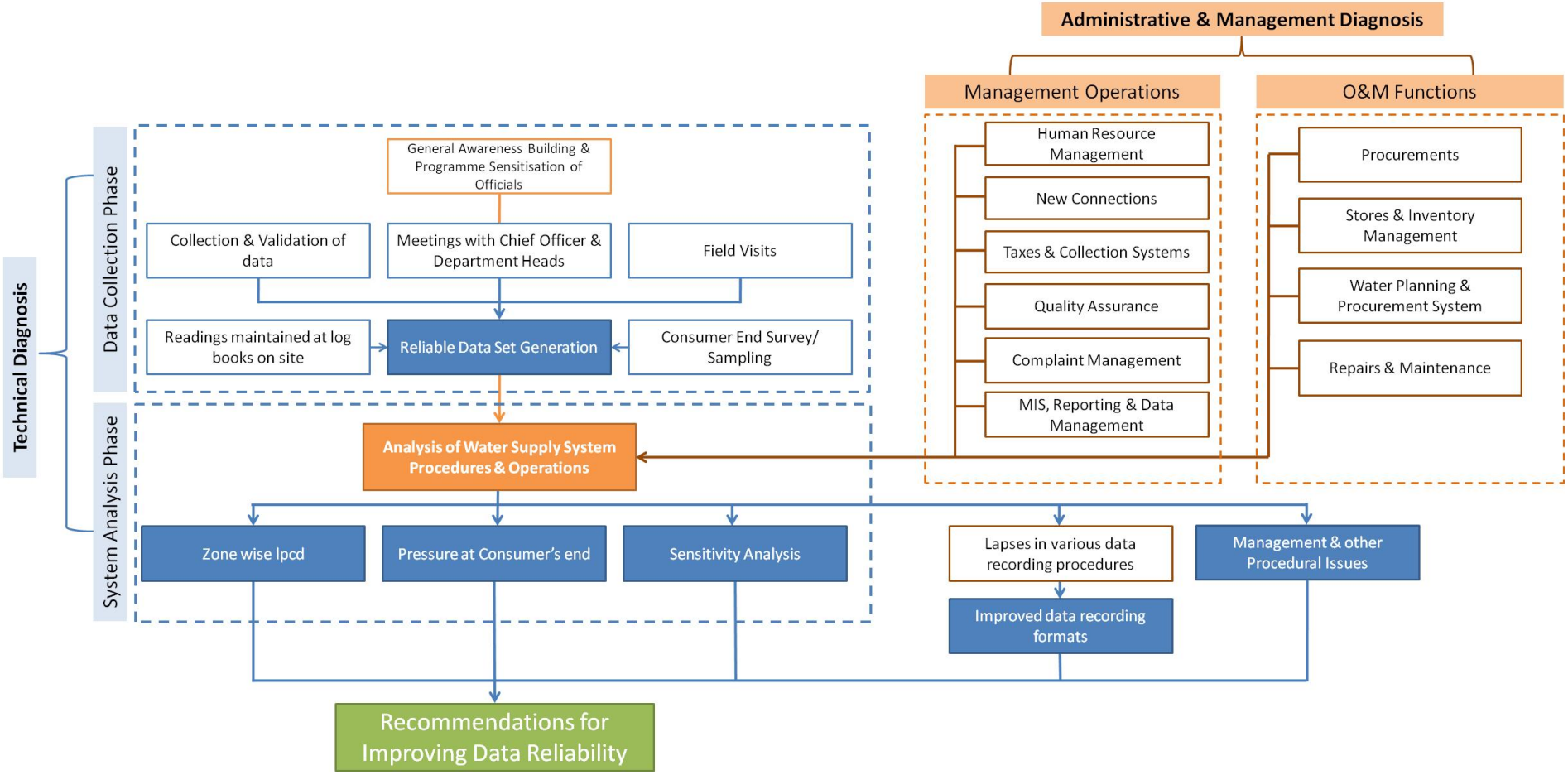
There were concerns regarding daily water supply of 98 litres per capita per day (lpcd) supplied by Navsari Municipality. The chief officer and the hydraulic engineer were of the opinion that this was lower than their estimate of provision. This, they opined, was due to a higher population considered for calculation of lpcd (260,609 persons instead of 180,000). Considering the population as indicated by the ULB then, the lpcd provision of Navsari was increased to 108 lpcd.

During this visit and further subsequent visits by the team, data collection was done with reconnaissance and field surveys. The methodology adopted for data collection and field visits has been detailed in the following section.

Methodology adopted for data collection, analysis and recommendations:
The water supply system of Navsari has been analysed from two perspectives
VOLUME I – technical diagnosis comprising of detailed engineering analysis through study of a) data collection phase, b) system analysis, and c) recommendations.
VOLUME II – management of water system comprising of management practices and HR issues

The chart below explains the above described methodology.

Figure 1 Methodology Chart for Technical Diagnosis of Water Supply System of Navsari



In accordance to the methodology outlined, UMC team conducted site visits followed by a step-wise analysis studying existing information recording systems and reporting practices. This was followed by analysis identifying issues in the current practices and followed by stage wise recommendations to improve the processes. A short summary of activities conducted at site have been listed below:

Major activities undertaken during visit and brief highlights of the subsequent follow-up actions

- Appraisal of the PAS program through a documentary film, explanation of the results obtained from the data collection undertaken by the previous team
- Visit to various water supply facilities and installations such as treatment plants, distribution stations, procurement point water sources of water within the city. Details were sought on the formats utilised, record keeping formats and mode of reporting and review
- Random sampling exercise specially undertaken for assessment of water availability at the consumer end. Residual chlorine, effective pressure, residual head and velocity also derived from the above sampling exercise
- Identification of water supply zone on the map, deriving the area of election wards, its density and applying these values to the area of influence under supply and deriving the approximate population being served
- Computation of water volume from the tank-level data maintained in the log book of Navsari Nagar Palika (NNP) water department
- Deriving zone-wise lpcd from the above computation of water quantity and population served under the zone
- Devising appropriate formats for required information under the program and also streamlining of the water supply operation and management. Some of the formats are:
  - Format for irrigation drawl (Table 3)
  - Format for depletion statement for the reservoir water budgeting (Refer Table 6)
  - Format for water volume computation at WTP (Table 16)
  - Format for drawing of ground water (Table 7)
  - Format for water quality checking at the consumer end (Table 11)
  - Format for asset management (Table 20)
- Special charts prepared for highlighting the indicator values, reliability scale and present practices, measures for improving the reliability scale (excel application based format)
- Status of various stages of water processes, the present practices, shortcomings, and required action for improvement

VOLUME I: OPERATIONAL ASPECTS OF WATER SUPPLY SYSTEM

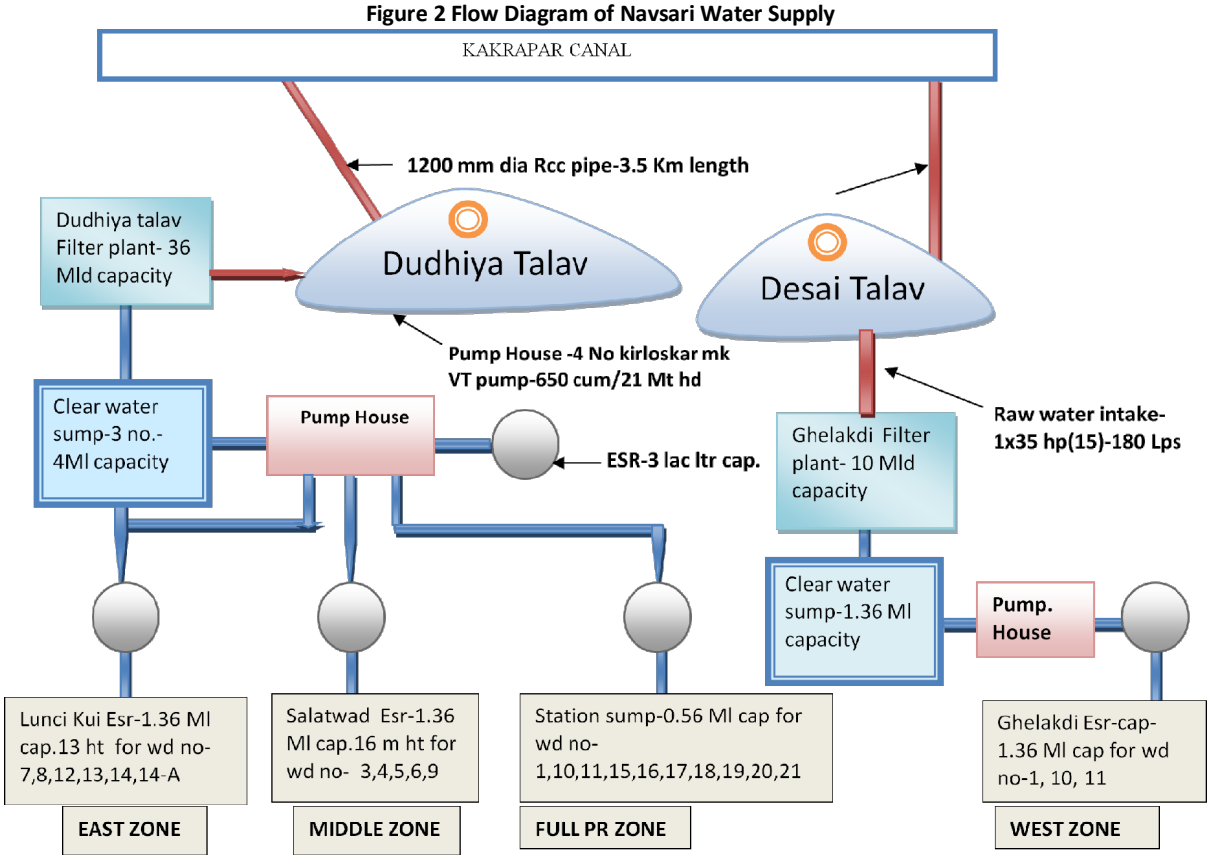
1. Water Supply Management

1.1. Prevailing Practices

Presently, water supply needs of the city are chiefly met by water from the Kakrapar dam's irrigation canal passing nearby. The canal water is drawn through the canal intake head works located near Vijalpore's city limit on the south-eastern side. Water meter, under the jurisdiction of Irrigation department is functional, and charges the ULB on monthly basis. The municipality draws water from the canal through 1200 mm RCC pipeline, about 3.5 km in length, and discharges into Dudhiya Lake- a rejuvenated lake by NNP. ULB draws about 20-22 MLD of water from this arrangement. This arrangement commenced form March 2000.

The following diagram describes the existing water supply management and distribution of Navsari

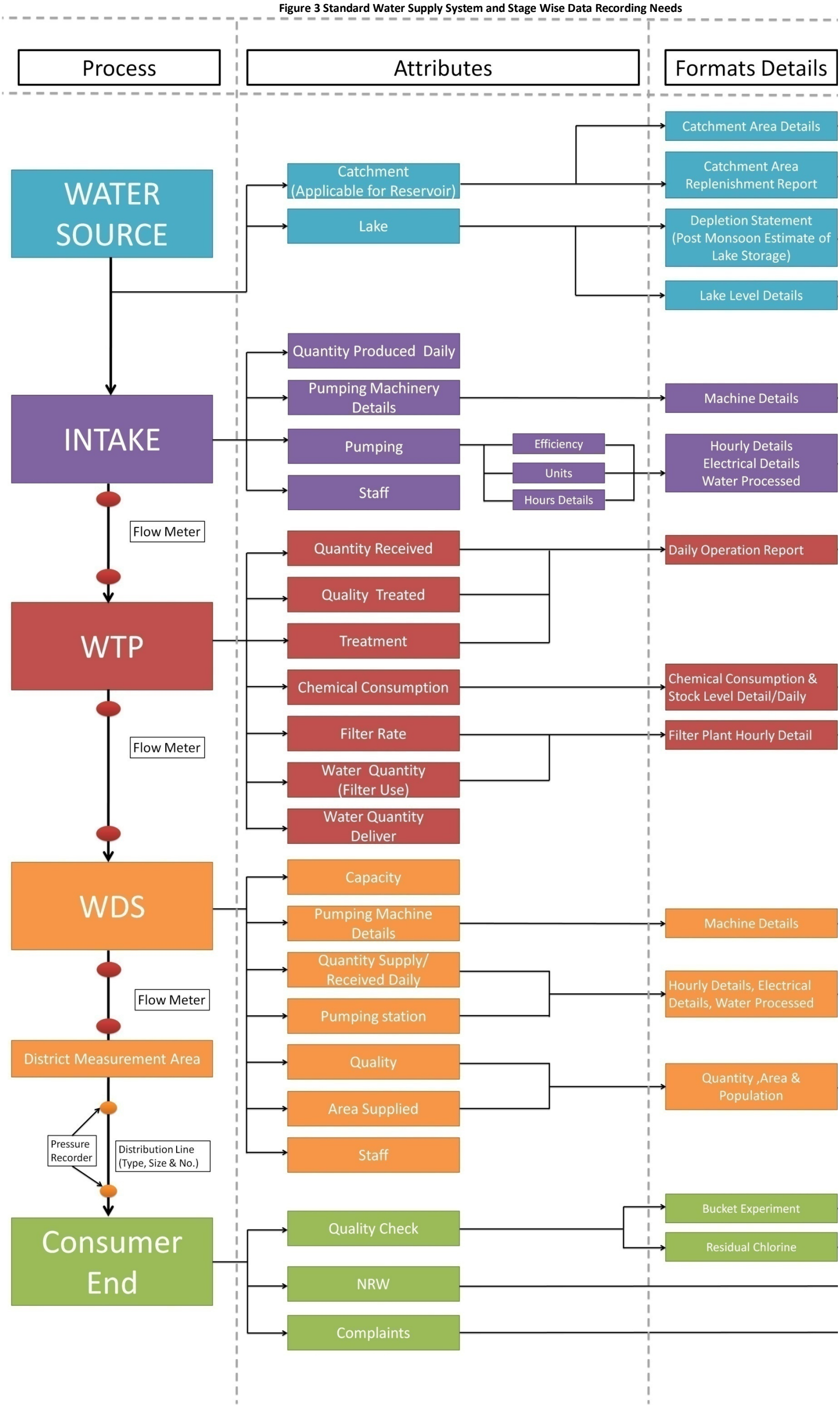
Figure 2 Flow Diagram of Navsari Water Supply



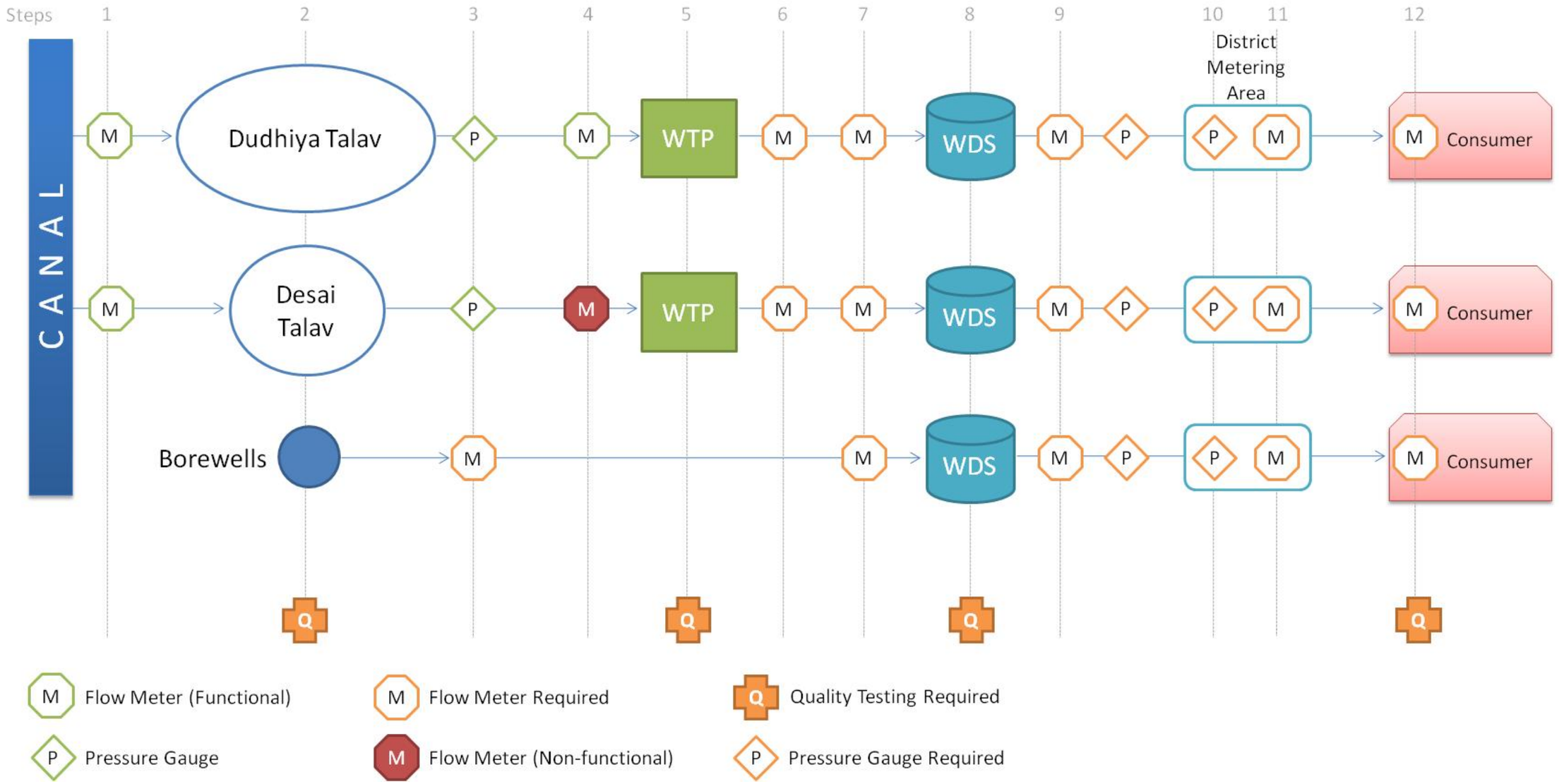
Dudhiya Lake feeds water to WTP with a capacity of 36 MLD. After treatment, the water is provided to consumers through four water distribution systems namely, Dudhiya head works, Silotwad ESR (elevated service reservoir), Lunci ESR and sump located near railway station. Similarly, water is also drawn from Kakrapar canal and collected in Desai talav which feeds the 10MLD WTP located in Ghelakdi area. Water from this WTP is supplied to consumers through overhead tank located in filter plant premises.

The diagram below shows a standard flowchart showing data recording requirements at various stages of water supply system.

Figure 3 Standard Water Supply System and Stage Wise Data Recording Needs



In Navsari, the existing water supply system has been indicated as below and analysed in the subsequent sections. In the diagram above, requirements of flow meter, pressure gauges and quality testing are shown.



1.2. Water Production

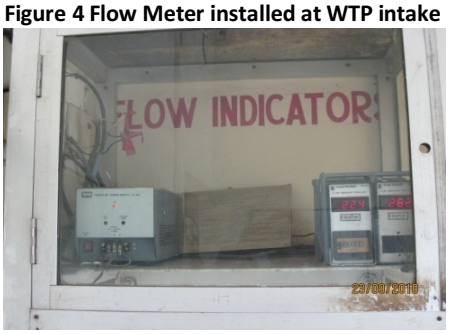
1.2.1. Water Drawl Management from Irrigation Canal

Navsari draws water from 3 sources

i. Kakrapar irrigation canal to Dudhiya Talav
ii. Kakrapar irrigation canal to Desai Talav
iii. Ground water through 6-8 borewells

NNP draws around 20-22 MLD water from the canal through intake head-works at canal and pumps water into Dudhiya Talav and Desai Talav. The irrigation department has installed a meter and charges NNP monthly for raw water based on the readings of the meter.

Figure 4 Flow Meter installed at WTP intake



Present Practice:

NNP maintains the records of the total monthly water quantity received from Kakrapar Canal based on the bill raised by the Irrigation Department. NNP has a well maintained record of the total water quantity received on monthly basis for the period March 2000 till September 2010. In addition to this, the following information is also documented either by Irrigation Department or NNP:

- Irrigation department maintains the drawl data on daily basis, and records at 0800 hrs in the log-book specially maintained for the said purpose1. (Refer Table 2)
- Lake level of Dudhiya talav is recorded on daily basis by NNP
- The records maintained by Irrigation Department in the register also get endorsed by the ULB officials on monthly basis.
- No details of the daily meter reading are provided by Irrigation Department to NNP.

Issues at NNP level:

- Although monthly record of quantity of water drawn is available (on the first and last day of the month), daily details are not utilised or reported to the ULB. Hence, variation in daily availability of water quantity is not known and hence consistency of water supply cannot be judged.
- Neither yearly water quantity received nor average monthly quantity is derived, and hence seasonal variations are not known.

Issues at Irrigation department level

- Details of the daily meter reading remain on the log-sheet of the irrigation department. It does not get communicated to the ULB at the month's end along with the bill raised.
- Thus, the ULB is unable to judge reliability of the canal as a perennial source.
- Any error in the meter is not reported to the ULB and quantity of water supplied is computed on daily average calculated by the irrigation department.

[1] From January 2004 to September 2005 the basis of the record was physical measurement of the water level over the weir or SWF (Standing Wave Flume) and since September 2005 the measurement was on the basis of ultra sonic flow meter reading.

- As daily water quantity received is not made available to the ULB, it is not possible to correlate the actual water quantity received against the rise and fall in the lake level, from where the water is drawn for treatment.

Figure 5 Existing Log Book at Drawl from Source (Irrigation Canal)

Recommendations

- ULB should make suitable arrangement for obtaining the daily meter data and deduce the actual water quantity made available, and maintain appropriate records of the same.
- Based on the average daily water consumption, and general availability of water quantity available from the canal, ULB should identify the approximate water demand, relate it with the lake level that ought to be maintained and place the demand accordingly.
- NNP should tabulate monthly, yearly and historic water quantity available from the canal. For this, UMC/ICMA-SA suggested NNP to modify their recording format (refer Table 3 for modified format).

The data recordings as per the recommendations made by UMC/ICMA-SA provide details related to the maximum, minimum and the average water quantity available from the canal for particular period during the year enabling decision making for placing the demand before the department.

Table 2 Existing Format used by Irrigation Department for Recording Water Supplied to NNP

MONTH/YEAR

Date	From	From	From	From	Average Cusec	Signature of Clerk/ Work Assistant
	0800 to 1400 hrs	1400 to 2000 hrs	2000 to 0200 hrs	0200 to 0800hrs		
1						
2						
3						
4						
5						
...						
...						
...						
31						
				TOTAL		

Source: Irrigation Department, Navsari

From the above format, information in column 'Average Cusec' is required by NNP. We recommend that NNP takes this information from Irrigation Department on a daily basis and record in the format suggested in Table 3.

In order to implement the above recommendations, following formats have been proposed:

S. No.	Title of the Format
1	Proposed Draft Format for Recording Daily Water Drawn from Kakrapar Canal
2	Proposed Draft Format for Recording Water Drawn from Kakrapar Canal since 2000

Table 3 Proposed Draft Format for Recording Daily Water Drawn from Kakrapar Canal

2004	January		February		March		Ap		November		December	
	Existing	Derived	Existing	Derived	Existing	Derived	Existing	l	Existing	Derived	Existing	Derived
Date	Av. Flow (cusec)	Water Drawl (ML)	Av. Flow (cusec)	Water Drawl (ML)	Av. Flow (cusec)	Water Drawl (ML)	Av. Flow (cusec)	r /l)	Av. Flow (cusec)	Water Drawl (ML)	Av. Flow (cusec)	Water Drawl (ML)
1												
2												
3												
4												
5												
6												
7												
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21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
TOTAL												

Table 4 Proposed Draft Format for Recording Water Drawn from Kakrapar Canal since 2000

STATEMENT SHOWING WATER DRAWN FROM KAKRAPARA CANAL BY NAVSARI NAGARPALIKA												
	YEARS											Monthly Avg
Months	2000	2001	……	……	……	……	……	……	……	……	……	
January												
February												
March												
April												
May												
June												
July												
August												
September												
October												
November												
December												
Total												
Average												

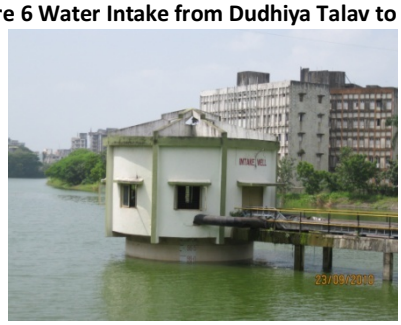
1.2.2. Intermediate Water Source Management – Lakes

An outstanding achievement of recent efforts in Water Supply management is the rejuvenation of the old Dudhiya Lake and converting it into a drinking water storage reservoir for the city.

The Dudhiya Lake was encroached upon by slum dwellers and also received grey water from its surroundings. The city's main supply was through underground sources, i.e. from 25-30 tubewells located in different parts of the city. The water had high TDS, forcing the people to make alternative arrangement to procure water for drinking and cooking purposes. Water quality crisis compelled the Nagar Palika to consider alternatives for mitigating the critical conditions caused by poor water quality. Encroachments on the lake were removed, the lake was cleaned and cleared of the debris, sewage and sullage, and the boundary was sealed with compound wall and wire fencing. Water procured from Kakrapar Dam is now stored in the lake.

Figure 6 Water Intake from Dudhiya Talav to WTP

Dudhiya lake



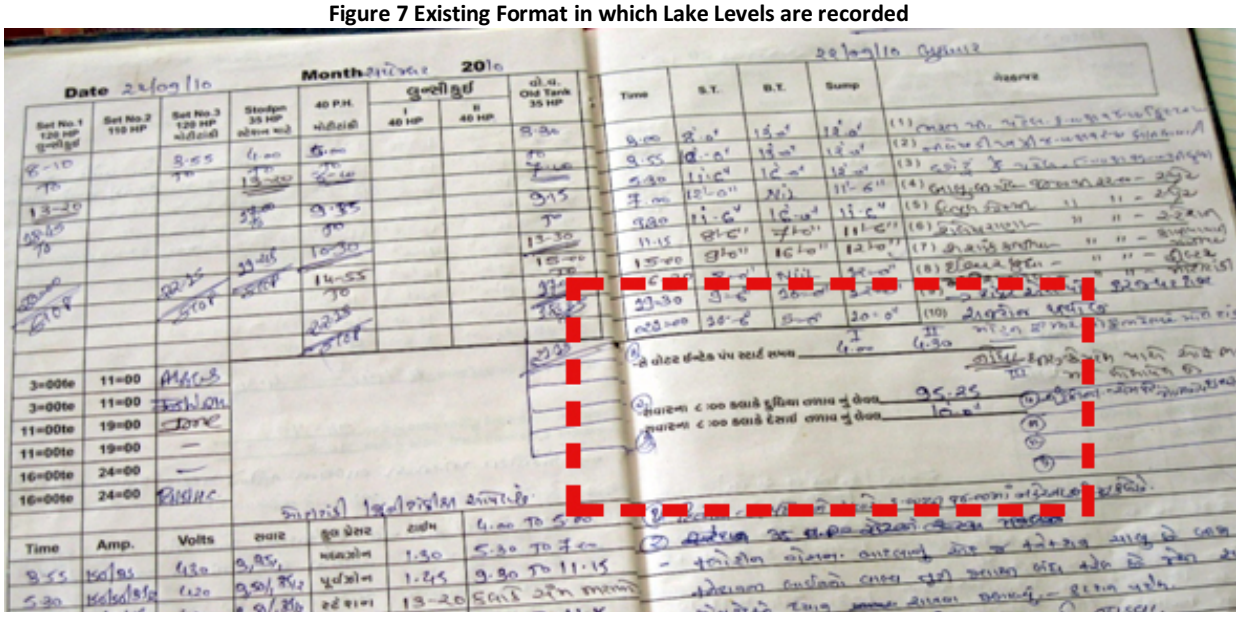
Intake tower at lake

Filtration plant

Current Process:

- Water is pumped from Dudhiya Talav (32 MLD capacity) into the WTP through the intake well.
- Likewise, water is pumped from Desai Talav into a WTP of 10 MLD capacity.
- The records for capturing information pertaining to water drawl from the lake is maintained on a daily basis, and enables the authority to monitor the filling of the lakes with canal water before placing demand for its release to the Irrigation Department.

Figure 7 Existing Format in which Lake Levels are recorded



Issues:

- Generally, there is a practice of recording the water quantity storage at various levels in other cities. In case of NNP there is no such information available.
- In the absence of appropriate stage wise documentation, it is difficult to assess water losses due to evaporation and absorption, and therefore, placing of actual demand (for water supply and for replenishing the lake) of water to Irrigation Department.

Recommendations:

- ULB should undertake detailed bathymetric surveys of the two lakes, and prepare contour maps of the lake bed.
- Based on the bathymetric survey, NNP should compute the water volume at every metre/ feet interval, and prepare a storage capacity chart for ready reference. A sample format for the same has been provided in Table 5.
- NNP should use appropriate formats for daily recording of the lake levels and preparation of depletion statement as shown in Table 6.

In order to implement the above recommendations, following formats have been proposed:

S. No.	Title of the Format
1	Proposed Draft format for recording Lake levels and indicating lake storage capacity
2	Proposed Draft format for preparing depletion statement of the lake

Table 5 Proposed Draft format for recording Lake levels and indicating lake storage capacity

Statement Monitoring Daily Levels of _____ Lake, Navsari		
S. No.	Lake Level (m)	Storage Capacity at respective levels (cu m)
1		
2		
3		
.....		
.....		
n		
Depletion Rates in Navsari: Summers = _____ , Monsoon = _____ , Winters = _____ .		

Table 6 Proposed Draft format for preparing depletion statement of the lake

Depletion Statement showing lake water levels and its storage capacity impact due to water consumption, losses and release from the canal												
Navsari Nagarpalika									Year:			
Month	Lake level at beginning of month (m)	Storage capacity at this level (ML)	Water drawn from the Lake during the month (ML)	Estimated Lake level after drawl (m)	Estimated Seasonal losses (ML)	Estimated level after the losses (m)	Actual level after the losses (m)	Actual storage at this level at end of month (ML)	Demand to be raised from canal for the month (ML)	Lake Level after addition of demanded water (m)	Storage capacity at end of month (ML)	Remarks
August												
September												
October												
November												
December												
January												
February												
March												
April												
May												
June												
July												

Benefits derived

- The storage capacity table (Table 5) would help in exact quantification of water quantity consumed by daily drawl as well as the evaporation and absorption losses occurring in the lake.
- It would also help in placing exact water demand and the lake level at which it needs to be provided.
- As mentioned in Table 6, the depletion statement would help in preparing the water budget for the whole year. It would also help in controlling and monitoring the drawl from the lake.

1.2.3. Water Supply from Tube Wells

Prior to surface water availability, the city's water supply was entirely dependent on ground water, utilising more than 30 bores. Due to declining water table and salinity intrusion along the coastal region of South Gujarat, Navsari was also severely affected by the rising TDS compelling the citizens to use water from alternative drinking water sources and prompting the ULB to resort to immediate measures for resolving the critical issue. This led to rejuvenation of the abandoned Dudhiya Lake, together with water treatment plant with sufficient capacity.

However, the Nagar Palika still utilises around 6-8 tubewells and draws water through pumping machinery and directly injects the water into the distribution network. These bores are:

Sagrawadi Borewell.	Sindhi Camp Borewell.	Islampura Khodiyar Borewell.
Mochiwad Borewell.	Tigra Borewell.	Ghelakdi Chikoowadi Borewell.
Alifnagar Borewell.	AWS Plot Borewell.	Dasera Tekri Borewell.
Kaliyawadi Borewell.	Khatriwad Borewell.	Juna Thana Borewell.
Tulsivan Borewell.		

Current Practice

The borewells act as an augmenting source of water. There is a pump room within which the main switch and other accessories are located and operated. NNP mainly utilises the bore water to feed the network prior to the regular supply. This helps in preventing the filtered water quantum from filling up the pipe lines, enabling immediate pressure increase. However, no documentation of quantity of water drawn from the borewells is maintained by NNP.

Yield from the bore well

Perhaps for the first time the yields from the borewells have been identified during the energy audit undertaken in 2009 and the machinery used was found to be inefficient.

Issues:

- The operation of these bore wells is not properly regulated, recorded or reported.
- Although NNP claims use of borewells for feeding network prior to supply from WDS, the normal operational period of these pumps is around 8-10 hours, more than the supply duration provided by the NNP from the regular network.
- No operational details are maintained at any borewell installation.
- There is unnecessary energy consumption due to inefficient pumping machinery.
- There is no regular inventory maintained pertaining for repairing or replacement of the pumps.

Recommendations:

- The operational details of borewells should to be maintained in appropriate formats as suggested in Table 7.
- The repairs undertaken and parts removed/ replaced should be properly recorded in an appropriate log register.
- Discharge from the borewell should be periodically observed and cross verified with the pumping hours to derive the borewell production on daily basis.

In order to implement the above recommendations, following formats have been proposed:

S. No.	Title of the Format
1	Proposed Draft Log Sheet for Recording Daily Operational Details of the Bore Wells using Meters
2	Proposed Draft Log Sheet for Recording Daily Operational Details of the Bore Wells using Pressure Differential (without Meters)

Table 7 Proposed Draft Log Sheet for Recording Daily Operational Details of the Bore Wells using Meters

Log Sheet for Recording Daily Operational Details of the Borewell at_____, Column Pipes:_____, HP:_____ using meters.											
Date	Start time	Close time	Total Supply Hours	Discharge Rate per hour	Total yield from the Borewell	Electricity Meter Reading at Start	Electricity Meter Reading at End	Total Units Consumed	Start Pressure	Closing Pressure	Remarks

Table 8 Proposed Draft Log Sheet for Recording Daily Operational Details of the Bore Wells using Pressure Differential (without Meters)

Statement showing details of approximate yield of water (based on pressure diferential) from Bores											
Nagar Palika									Year of observation		
S. No.	Bore pump running details	Bores no.									
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
1	Date of observation										
2	Location of bore										
3	Pressure at Point 1 (P1)										
4	Pressure at Point 2 (P2)										
5	Distance between P1 and P2										
6	Bores water level from Ground										
7	Depth of bore										
8	Approx. discharge rate of pump										
9	Hours of Bore pump operation										
10	Approximate yield from bore										
11	Other observation/Remarks										

Benefits:

- The above formats would help in deriving the borewell yield which could be undertaken periodically, and would help in maintaining the yield data with the time at which it is taken.
- It would also provide the details of the ground water levels of different bores. This information would prove to be very useful offsetting supply during significant variations at main source.
- The energy efficiency of each bore could be calculated using the energy consumption and volume of water processed.

1.3. Water Treatment Plant (WTP) Operation

Present Practice

NNP at present supplies water to the city from two of its plants located at Dudhiya Talav of 32 MLD capacity and Ghelakdi plant of 10 MLD capacity. However, the present operating quantity of these two plants is 20-22 MLD and 4-6 MLD, respectively. Water from Dudhiya Talav feeds the plant located nearby and Desai Talav feeds the Ghelakdi plant. Both these plants are of Rapid gravity sand filtration technique and were constructed in 2000 and 2006, respectively.

- The plants are operated on an average of 20-22 hours. PAC and alum is used as coagulant and Chlorine gas is used as disinfectant.
- Records of Chemical consumption and water testing are kept at the Dudhiya main plant.
- Other functional aspects of the WTP are not recorded and reported by the plant operators.
- Apart from water treatment, Dudhiya Talav WTP is also used to manage and monitor the city's water supply as it is connected to all other water distribution stations through telephone.
- Chlorine checking register is maintained by the line man to keep the data of residual chlorine checked in different parts of the city.
- The filter plant is being manned by a foreman who has gained experienced over long service tenure, and supported by shift operators and helpers.
- A chemist also assists in the water testing, and testing is carried out using the analysis kit supplied by WASMO.
- The hydraulic engineer who is in overall charge of the water works department of the Nagar Palika frequently visits the filter plant and checks the processes and other related functioning of the plant.

Issues:

- Only the intake of raw water is measured by the flow meter at Dudhiya Talav. No output measurements taken at the channel that discharges the treated water into the sump.
- Rate of flow meter and head loss meter on filter beds are either non-existent or non functional.
- The dosing of the chemical is done on an ad-hoc basis, without any pilot testing.
- The back wash water quantity is neither measured nor derived in the sludge removal operation.
- In absence of the head loss equipment, backwashing is done on ad-hoc basis.
- During the field visits, chlorine analyser was found to be non-functional.
- No recording formats for treatment process parameters are used.
- No measuring device is installed on the emerging channel of the filter plant, hence the total volume getting treated and collected in the clear water reservoir is not known.
- Present level measuring device at clear water reservoirs is inappropriate/ faulty and does not give the correct measurement readings.
- Detailed readings of pumps operation in pump house are not used to assess losses incurred in WTP. The same could be used to assess efficiency of pumps and calculate power consumption.
- At water distribution stations located at Silotwad, Lunci Kui, station sump, the staff is deployed (mostly valve men) to record tank level readings at the pre-defined time (the supply time). However, the level measurements are not precise and exact quantity delivered at ESRs is not known.

Table 9 Existing Log Sheet Format for Flow Meter Reading at Dudhiya Head Works

Date **Month** **20__**

Set No. 1 120 HP	Set No. 2 110 HP	Set No. 3 120 HP	Stodpn 35 HP	40 P.H.	Lunci Kui I 40 HP	Lunci Kui II 40 HP	Old Tank 35 HP	Time	S.T.	B.T.	Sump	Absent

3-00te	11=00					
3-00te	11=00					
11-00te	19=00					
11-00te	19=00					
16-00te	24=00					
16-00te	24=00					
Time	Amp.	Volts	Morning	Full Pressure	Time	
				Middle Zone		
				East Zone		
				Station		
				Maneklal Rd Area		
				Full Pressure		
				Middle Zone		
				East Zone		
				Station		
				Maneklal Rd Area		

Water Intake Pump Start Time _____

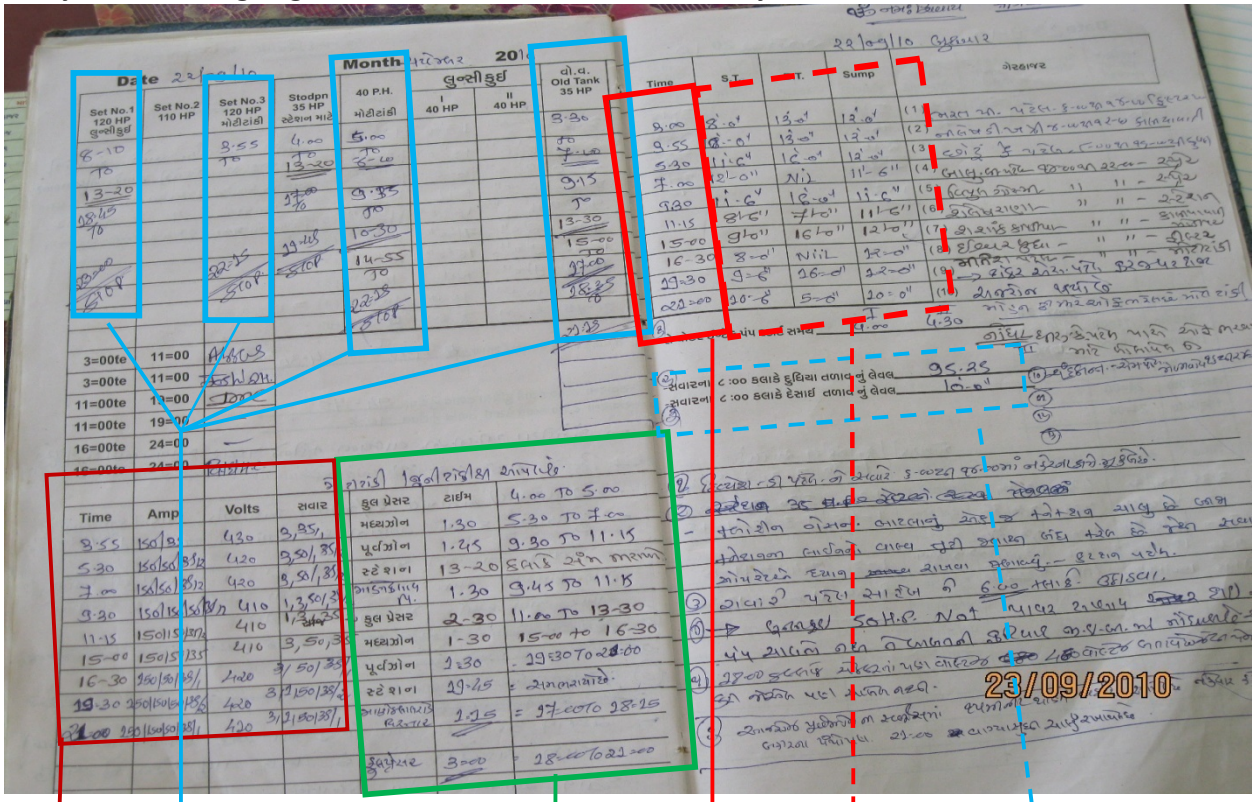
0800 hrs Dudhiya Talav Level _____

0800 hrs Desai Talav Level _____

At present, the following details are recorded in the existing log sheets

1. Pump start and shut timing
2. Duration of supply , start and shut timing of supply in various zones
3. Pump details like power, etc. are noted
4. Lake levels of both Dudhiya Talav and Desai Talav are noted

Analysis of Existing Log Book record maintained at Dudhiya Talav Head works



- Pumps start and shut times are recorded, but the total hrs and discharge during is not recorded and used for volume derivation

- Tank's water levels against the recorded time is noted, however further derivation of the water quantity and the pump discharge during that time is not derived.

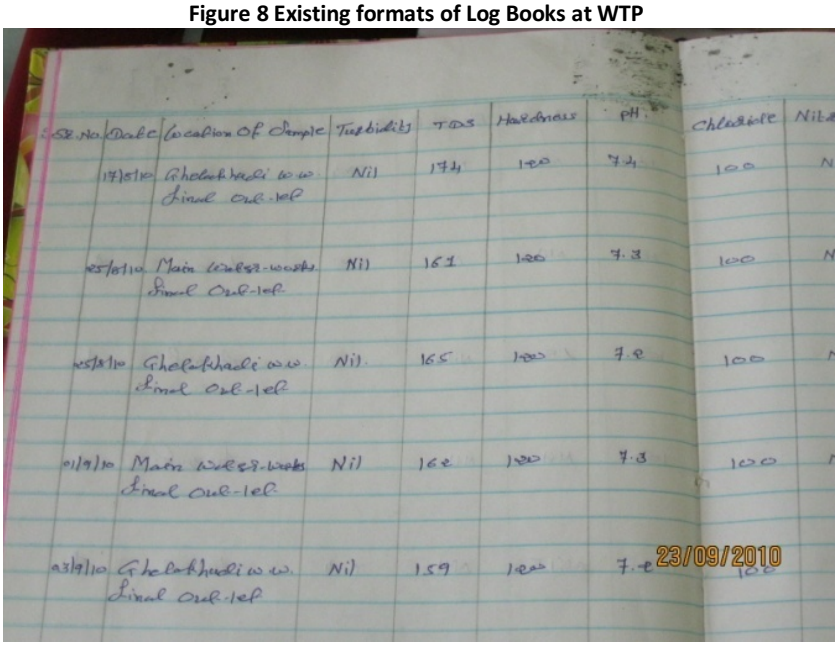
- Supply zone, its time duration, and the starting and shutting times are noted. However, the quantity of water supply is not derived

- Supply timings (closing and shutting) is noted. However, the water quantity supplied in a particular zone is not derived.

- Pump details related to ampere and volt is recorded at time intervals.
- Similarly no. of pumps operating a at periodic time intervals is also noted. However it's not further utilised for further derivation, nor reviewed for pump's performance.

- Lake levels of Dudhiya Talav and Desai Talav recorded daily.

Figure 8 Existing formats of Log Books at WTP



Recommendations:

As no format is maintained for recording the functional aspect of the treatment process, it is recommended that appropriate formats are maintained that enable recording of the several processes related to water treatment. The format for periodically reporting to the higher office is also suggested, as there is no practice of reporting at present.

In order to implement the above recommendations, following formats have been proposed:

S. No.	Title of the Format
1	Proposed Draft Format for Recording Water Treatment Plant Hourly Details
2	T3 – Proposed Draft Format for Documenting Details related to Treatment Process
3	Proposed Draft format for preparing General Report at Water Treatment Plant
4	Proposed Draft restructuring of details presently maintained by NNP

Table 10 Proposed Draft Format for Recording Water Treatment Plant Hourly Details

Filter plant - chemical consumption and stock details														
City:				Filter plant:						Year:	Month:			
S. No.	Date	Raw water quantity processed	Turbidity observed	Test dsg. Derived	Chemical stock B/F		Dsg applied		Chemical Consumed		Chemical stock C/F		Remark	Supervisor Sign
					Chlorine	alum/pac	Chlorine	alum/pac	Chlorine	Pac	Chlorine	alum/pac		
Total			Total											

Table 11 T3 – Proposed Draft Format for Documenting Details related to Treatment Process

		City:															Plant:		Year:		Month:				
		AM												PM											
Time		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	Total
S. No.	Details																									
1	Raw water in m^3/hr																									
2	Tank Sludging																									
	T1																									
	T2																									
3	Water consumed-ML																									
4	Filter Runing-m^3/hr																									
	F1																									
	F2																									
5	Filter head loss in metres																									
	F1																									
	F2																									
6	Filter wash																									
	F1																									
	F2																									
7	Water consumed-ML																									
8	Chemical parameter																									
	RC																									
	Ph																									
9	Filter water output in cum/hr																									
10	Clear water Reservoir Level																									
11	Power outages																									
				Supervisor					Deputy Engineer				Water works Engineer													

Table 12 Proposed Draft format for preparing General Report at Water Treatment Plant

Water treatment plant - General report

City:	Date:

I

Lake levels		
	Level	Storage
Lake 1		
Lake 1		
Lake 1		

II

Rainfall	
	Days/total
Location 1	
Location 2	
Location 3	

III

Water Quality		
Turbidity	TDS	Ph

IV

Raw water received – MLD	
Source -1	
Source -2	
Source -3	

V

Water supply position at WTP			
Water supply to WTP		cons. at WTP	supply from WTP
Wtp-1			
Wtp-2			

VI

Water supply in town from diff. plants		
WTP/Source	Area	Qty supply.

VII

Balance stock of chemicals		
Chemicals	Consumption	Balance Stock

VIII

Bulk water supply from sources/WTP		
Supply to	Qty suppl.	Payment recd

Water Works Engineer

Table 13 Proposed Draft restructuring of details presently maintained by NNP

Tank level details									Pumping and other details							
	Inflow fr. Talao	tank level	filter tank(ST)	Silotwad	Sump-	Lunci tank	Ghelkdi	Timings	Set-1 -120 hp	Set -2-110hp	Set-3-120hp B	40 hp B.tk	35-hp old tk			
	23/09/10	timings		tk(BT)	filter	level	tank level		Lunci kui		tk					
12:00:00 AM																
1:00:00 AM																
2:00:00 AM									8:10-13:20	3:55-22:15	4:00-13:20	5:00-8:00	3:30-7:00			
3:00:00 AM		3:00	2.13	3.96	3.66											
4:00:00 AM	1020	3:50	3.20	3.96	3.66											
5:00:00 AM	1020	5:30	3.20	4.88	3.66				18:45-23:00		17:00-19:45	9:35-10:30	9:15-13:30			
6:00:00 AM	1000	7:00	3.66		3.51											
7:00:00 AM	1000	9:30	3.35	4.88	3.51	6.5	4.88	7:30				14:55-22:15	15:00-17:00			
8:00:00 AM	1000	11:15	2.44	2.13	3.51	0	3.66	8:00								
9:00:00 AM	1000	15:00	2.74	4.88	3.66		2.44	8:30	**Time**	**Pump runn.**	**Volts**	**Pump no in op**	**supply to**	**Timings**		**supp.dur.**
10:00:00 AM	1000	16:30	2.74		3.66		0.00	9:00	3:55	150/35	430	3,35/1	full press. zone	4:00-5:00		1
11:00:00 AM	1000	19:30	3.05	4.88		6.5	4.88	14:30	5:30	150/50/35x2	420	3,50/1,35/2	Middle zone	5:30-7:00		1.3
12:00:00 PM	1000	20:45	2.74	1.52		1	1.22	16:00	7:00	150/50/35x2	420	3,50/1,35/2	East zone	9:30-11:15		1.45
1:00:00 PM	1000								9:30	150/150/50/35x2	410	1,3,50/1,35/2	Station area	sump fill. In 1 hr		
2:00:00 PM	1000								11:15	150/50/35x2	410	1,3,35/2	maneklal etc	9:45-11:15		1.3
3:00:00 PM	980								15:00	150/50/35x2	410	3,50,35	full press. zone	11:00-13:30		2.3
4:00:00 PM	980								16:30	150/50/35x1	420	3,50,35/1	Middle zone	15:00-16:30		1.3
5:00:00 PM	990								19:30	150/150/50/35x2	420	3,1,50,35/2	East zone	19:30-21:00		1.3
6:00:00 PM	990								21:00	150/150/50/35x1	420	3,1,50,35/1	Station area	sump fill		
7:00:00 PM	990												maneklal etc	17:00-18:15		1.15
8:00:00 PM	990												full press. zone	18:00-22:00		3
9:00:00 PM	996												full press. From	18:00-19:30		1.3
10:00:00 PM	996												stn			
11:00:00 PM	990															
11:30:00 AM																
Total in cumt	**19942**															

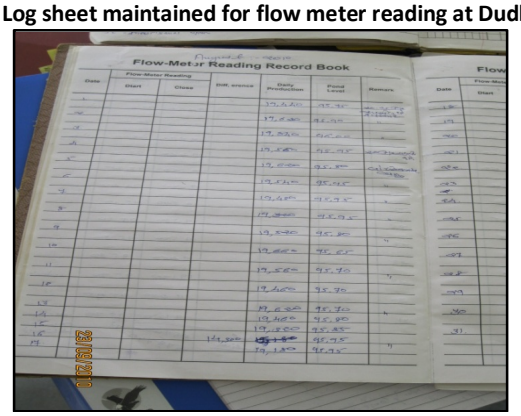
1.4. Water Distribution System

Water from WTP is pumped to a 0.3 ML capacity ESR located within the filter house premises, and outside the WTP compound such as ESR-Silotwad (1.36 ML), Lunci Kui (1.36 ML) and sump near Railway Station (0.56 ML). Lunci Kui ESR caters to the East Zone comprising ward no. 7,8,12,13,14,14-A, whereas Silotwad ESR caters to the Middle Zone comprising ward no. 3,4,5,6,9. The sump at station caters to the full pressure zone comprising of ward no. 1, 10, 11, 15, 16, 17, and 18. Similarly, Ghelakdi plant (drawing water from Desai Talav) caters to the western region of the city supplies around 4.0 MLD of water to the surrounding western region from the ESR of 1.36 ML capacity located within the filter premises at Ghelakdi. Refer Map 01

Present Distribution Management Practices

Presently, the Dudhiya Lake filter plant is the controlling centre for the city's water supply. Data regarding ESRs/Sump levels at starting & shut-off time, and area of supply are recorded and collated in the daily log books.

Figure 9 Existing Log sheet maintained for flow meter reading at Dudhiya Head Works



The operating staff at these WDS communicates the water levels of the tanks to the staff of the Dudhiya filter plant on phone every time the level is observed. Separate registers at these WDS are maintained along with the ones maintained at filter plant. The level is observed only when the supply is provided, i.e. the starting and closing time of the supply provided are recorded.

Issues

- There is no practice to derive water volume supplied using tank level records
- No drawings available pertaining to the sump and ESRs or actual dimensions of tanks/ ESRs are not available with the staff and hence, volumetric calculation based on tank levels was not possible.
- The levels of the tank are being recorded on fixed supply time basis (and not on hourly basis) and hence this record was found insufficient for deriving the functional parameters of pumping and the tank filling rate.
- Measuring equipment/methods for tank levels are unscientific[2]

[2] The Silotwad tank gauge consists of a rope with a knot used as a mark. This is brought along with the tank column which is roughly calibrated and the knot of the rope is read as a level and noted and communicated.

Similarly, at station sump, level markings on the column have faded and are not legible. The staff uses the steps of the staircase inside the tank as a 1 foot unit for counting and recording.

Measurements at sump located in the WTP are recorded using a wooden plank with faded markings. The OHT located in the Dudhiya Lake WTP is equipped with a level gauge. However, the gauge is calibrated in feet and half feet markings (without the inch markings) while metric system is the prevailing standard norm. These markings have been done using non-standard made up marker.

Exercise for deriving the Water Quantity supplied from WDS

As indicated in the issues, in the absence of data (both, statistical and spatial) regarding actual quantity of water supplied from the ESRs, an exercise was undertaken to estimate the actual quantity of water supplied.

Formula for calculation of water supplied from ESRs

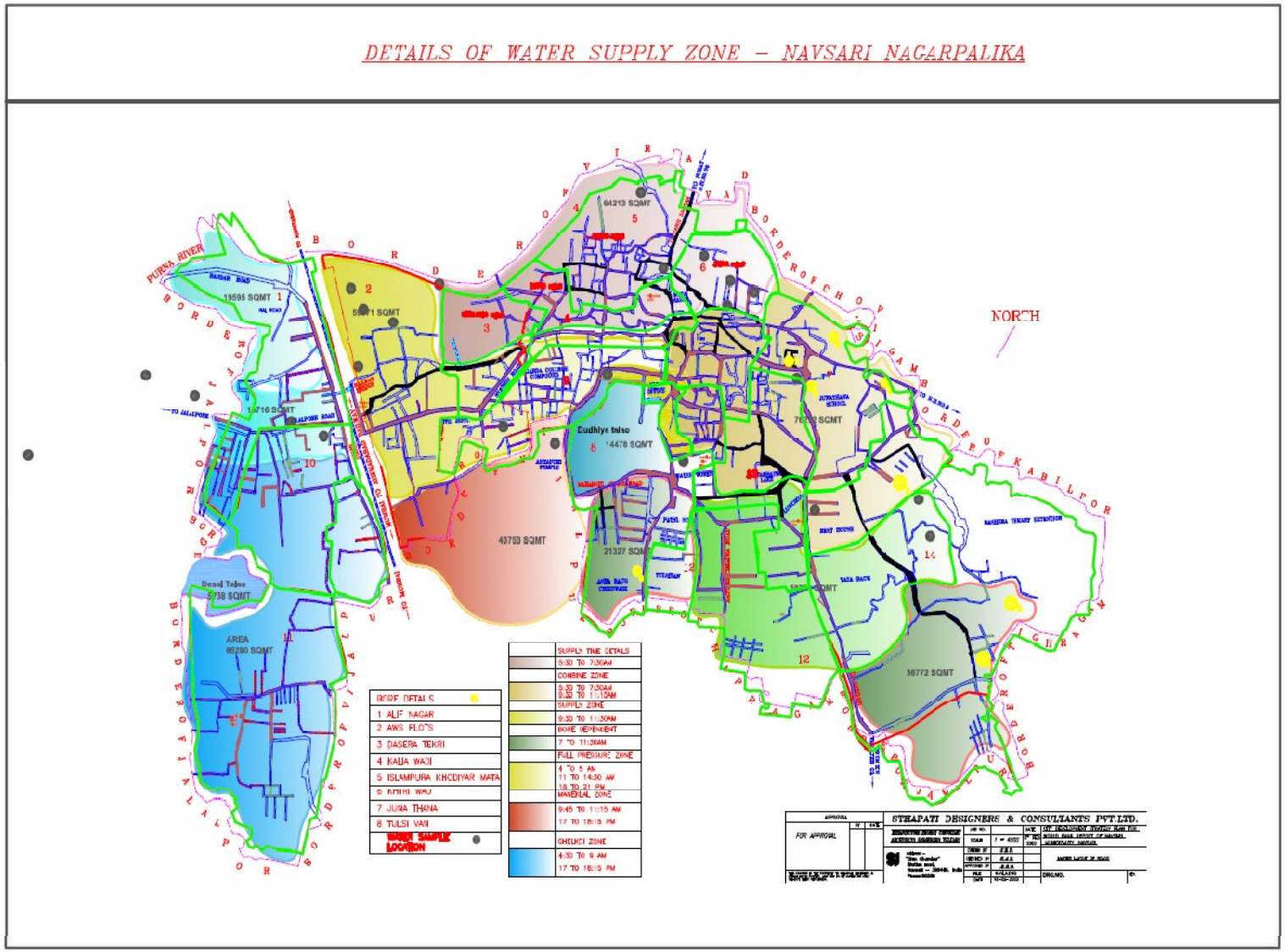
Volume of water supplied from ESR = *(difference in level of tank* x *volume per metre height of tank)* + *(pump discharge rate* x *time for which pump ran during supply)*

$$V = (L_2-L_1) \times H_v + D \times (T_2 - T_1)$$

where:

V = volume supplied during supply hours
L_1 = level of tank in metres at beginning of supply time
L_2 = level of tank in metres at end of supply time
H_v = volume of tank per metre of height
T_1 = starting time of supply in hours
T_2 = end time of supply in hours

Figure 10 Map showing Water Supply Zones and Distribution Network of Navsari



The format shown in Table 15 & Table 16 aims at capturing the main operational data of a WTP/WDS/Pumping Station. The main processes at WDS are as follows:

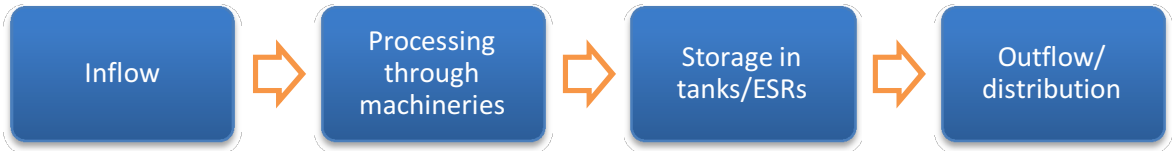


Figure 11 Level Gauge at ESR, Navsari

Recommendations

- Application of the recorded details for further derivation: The time at which the supply is provided to a particular zone, though routinely recorded, is complex to understand as each of the supply zones is provided the required water quantum through two or more tanks. Hence, the volume supplied from each tank for a particular zone becomes complicated. Further NRW can be calculated using the data collected.
- Recommendation of Simple Formats for Tank Level Recording: The measuring devices are not proper and should be replaced with standard products available in the market for the right measurement.
- New Formats: New simple formats designed for recording all necessary data as per the table below:

The following formats have been proposed:

S. No.	Title of the Format
1	Proposed Draft format for Distribution Pumping Details
2	Proposed Draft format for Valve Operation at Water Distribution Station
3	Proposed Draft format for supply volume computation from different WDS

Table 14 Proposed Draft format for Distribution Pumping Details

Navsari Nagarpalika Daily Log sheet record																							
Timings	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Filter sump	50/12		30/12		11		30/11		15/10				10	30/10 6"			30/10	45/8					
S.T old tk at filter	7/50/10 6"		30/10 6"		12		30/11		15/8				9	30/9			30/10	45/9					
Area supp	30/ Full Pressure zone						East zone/30		Full press zome/30				Middle zone/50			Full press.zone/30							
B.T (Silotwad tank)	13/50/13		30/16		nil		30/16	nil	15/7				16	30/nil			30/16	45/8					
Area supp	50/Full press. Zone		30/Middle				30/Combined Zone/15			11/Full press/30			Middle zone/30			Full press.zone/							
Lunci kui																							
Area supp					Society		30/East zone/15																
Stn sump																							
Area supp			Mafatlal/15																				
Ghelakdi																							
Area supp																							
Pumping machinerey operation																							
Set-1-120-Lunci						10/start					20/stop					start					stop		
Set-2-110-																							
set-3-120 silot	55/start																			15/stop			
set- 35 stn sump		start									20/stop				start						45/stop		
40 Hp for silotwad			start			stop	15/start	30/stop				55/start								15/stop			
Set-35 Old tank	30/start				stop		15/start				30/stop		start		stop	35/start			15/stop				

Table 15 Proposed Draft format for Valve Operation at Water Distribution Station

Tank level details and water computation							
Tank details			Tank level difference	Qty	Valve time	Area supplied	Remarks
Sr No	Time	Tank level					
1	0:00						
2	1:00						
3	2:00						
4	3:00						
5	4:00						
6	5:00						
7	6:00						
8	7:00						
9	8:00						
10	9:00						
11	10:00						
12	11:00						
13	12:00						
14	13:00						
15	14:00						
16	15:00						
17	16:00						
18	17:00						
19	18:00						
20	19:00						
21	20:00						
22	21:00						
23	22:00						
24	23:00						

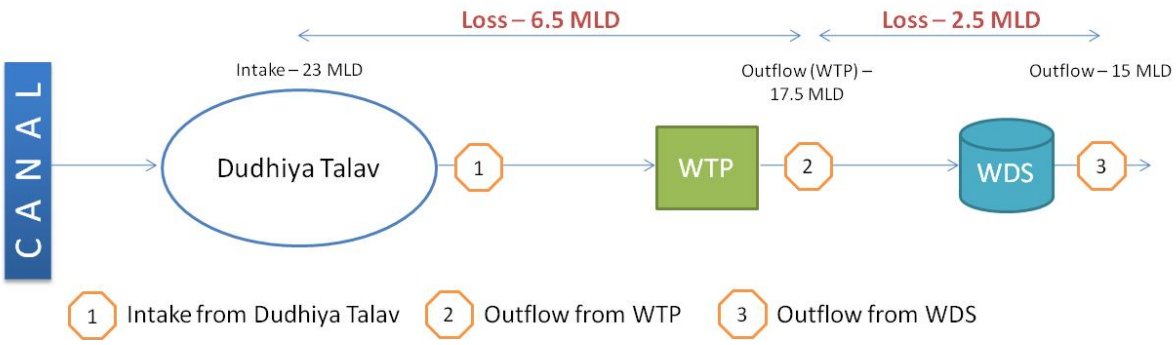
Table 16 Proposed Draft format for supply volume computation from different WDS

water volume computation from different water distribution station of NNP-21/9/2010																	
													Water supply to different zones				
Sr.No	time	period	tank	level at beg	level end	diff	in mt	vol/mt	vol process	pump vol	total vol	total qty	Full press	Middle	Stn sump	Direct	East zone
1	3.45-5.0	1.25	Small tk	10.5	10.5	0	0	82.2	0	217	271		604.398				
2	5.0-7.0	2	Small tk	10.5	12	1.5	0.4542	82.2	37.33524	217	397			2099.721			
3	9.30-11.0	1.5	Small tk	12	8	4	1.2112	82.2	99.56064	217	425					379.75	1893.117
4	11.0-13.50	1.5	Small tk	8	8	0	0	82.2	0	217	326		325.5				
5	18.0-20.0	2	Small tk	8	10	2	0.6056	82.2	49.78032	217	384		750.0837			271.25	
6	3.45-5.0	1.25	Big tank	13	16	3	0.9084	280	254.352	470	333	1802.70					
7	5.0-7.0	2	Big tank	16	7	9	2.7252	280	763.056	470	1703						
8	9.5-11.0	1.5	Big tank	16	7	9	2.7252	280	763.056	470	1468						
9	15-16.5	1.5	Big tank	16	7	9	2.7252	280	763.056	470	1468			1468.056			
10	18-19.5	1.5	Big tank	12	16	4	1.2112	280	339.136	470	366						
11	19.50-21.75	2.15	Big tank	8	16	8	2.4224	280	678.272	470	332	5337.26					
12	8.0-10	2	Lunci kui	6.5	0	6.5	6.5	226	1469	522	2513						
13	19.25-21	1.15	Lunci kui	6.5	0	6.5	6.5	226	1469	522	2069	4582.3					2069.3
14	4.45-5.45	1	Stn sump	22	20	2	0.6056	93.32	56.514592	280	337				336.5146		
15	5.45-7.30	1.75	Stn sump	20	10	10	3.028	93.32	282.57296	280	773				772.573		
16	7.30-9.15	1.75	Stn sump	10	4	6	1.8168	93.32	169.543776	280	660	1768.63			659.5438		
17	Direct supply to maneklal betweeen 9.45-11.15 & 17-18.15									213	586	585.75					
Total inflow into the Wtp as per the flow meter records= 19940 m3								Total water supply to the WDS from Dudhiya HW				14077	1679.982	3567.777	1768.631	651	3962.417
Total approximate flow into the Ghelkdi wtp=4000 m3								Approximate supply from Ghelkdi Hw				3400	Total from Dudhiya HW fed WDS				11630
Total flow into the wtp of NNP=23940 m3								Total water supply to the WDS from both HWs				17477					
% Loss occuring from WTP to WDS				26				Total water supply from WDS				14690					
% Loss occuring from WDS to WDS				16													

Critical observation:

- Total water production at both head works is approximately around 24 MLD, whereas the total output supply from WTPs is around 17.5 MLD resulting into a deficit or loss of around **27%** between intake and output from WTP.
- The supply provided from the WDS is around 15 MLD, resulting into a further loss of around **14.3%** between the WTP and WDS.
- Thus the cumulative loss between source intake and WDS is 8 MLD or **37.5%**.

Figure 12 Water Loss from Source till WDS



This needs to be confirmed after some detail measurements are undertaken by installing proper instruments, as well as minutely observing the functional and operational parameters of the delivery process.

1.5. Consumer End – Assessment of Quantity, Quality and Pressure

Distribution Network Coverage and Water Connections in NNP
As of March 31, 2010, Navsari Nagar Palika had around 28,390 total water connections. NNP also follows a standard practice of providing around 4 to 6 individual water connections to multi-household usage like flats and apartments. However, it collects the water charges as per the total number of families residing in the multi-household dwellings. In all there are around 45,788 such domestic chargeable families. In addition to these, there are 6,445 slum households with 3,965 water connections in the different slum areas of the city. The overall coverage of water distribution network is 61.52 percent with supply duration of 3 to 3.5 hours on an average.

NNP routinely checks the chlorine availability in the tap water at consumer end in different areas of the city and maintains the record of the samples inspected with the addresses and name of the household from where it is collected. Around 100 samples are collected on daily basis. However, the details of samples failing the test are not properly recorded, and there is no third party inspection carried out for residual chlorine.

There is no practice of assessing the water quantity availability at the consumer end or any pressure in the distribution network being routinely or randomly assessed.

Consumer End Survey to assess the Quantity, Quality and Pressure at Consumer's End
There is no practice of measuring the water quantity received at the consumer end. NNP claims to provide around 140 lpcd and more, this water quantity mainly relies on the supply assumed and not real measurements. Though this practice is commonly found lacking in almost all ULBs, it was decided to make a rapid and spot assessment of the water quantity received at the consumer end in different zones of the city. This would give the discrepancy between water supplied by NNP and water received by consumers.

This exercise was also considered under the context of the indicator definition of actual water availability at the consumer end that the program has recommended in the guidelines, as it would enable deriving the per capita supply as well as NRW computation.

Method applied:
In all, around 30 spots were identified in different supply zones, slum and non-slum areas of the city for random checking. Containers of 1 litre and 7 litres were selected for the measurement purpose. A stop watch from the mobile instrument was used for recording the time of filling of the container. Municipal staff deployed for the purpose assisted at the spot and area location and also in measurement.

Simultaneously, the connection length and diameter of connection was also recorded to derive the pressure at the point where the tapping was made. The roughness factor was assumed as 80, as the connections were old. The differential pressure principle of hydraulics was utilised for the pressure derivation.

Table 17 shows the observation of water quantity in lpcd, pressure in metres and RC details in ppm available at the consumer end. Though the supply duration is 3.25 hours on an average, the consumer connections except the multi household and the slum areas do not draw water during the available supply duration. In case of multi households or slum families deriving water from a common tap or shared connections, it was difficult to assess the number of families consuming the water from the observed connection. However, in case of multi households and as per the connections norms adopted by Nagar Palika of four families per connection, considering a family size of five, 20 people have been considered for the water usage. Whereas for the slum areas, where the connection is almost a shared

connection, it has been considered that 7 families comprising of 35 persons draw water per connection for the water usages.

Table 17 Consumer End Survey Data - Spot observation of discharge & pressure in different wards

Navsari spot observation of connection discharge and pressure in different city wards - 23-24 Sept 2010																		
Sr.No	Sample location	ward.Name/ No	container size in ltr	time taken to fill the sample	Supply duration	supply estimation						Length of pipe		Est press.	RC avail.	Remarks	Vel at end	Ress.hd
						lps	lpm	lph	App.supp	LPCD	Cumecs	in ft	In mt					
1	Anandbhavan	Jallalpur	1	28.87		0.0346	2.078	124.6969	405	81	3.46E-05	14	4.33	0.18	No cl			
	chawl				3.25					0								
2	Garurishnkr soc.	Jallalpur	1	10.36	3.25	0.0965	5.792	347.4903	1129	45	9.65E-05	16	4.95	1.38	No cl	shared cor	0.85	0.04
3	Khodiyar ngr	Jallalpur	1	25.96	3.25	0.0385	2.311	138.6749	451	90	3.85E-05	17	5.26	0.27	No cl		0.34	0.01
4	Jallalpur libr.	Jallalpur	1	39.97	3.25	0.025	1.501	90.06755	293	59	2.5E-05	18	5.57	0.13	No cl		0.22	0.00
5	ishwarngrslum	Jallalpur	1	4.45	3.25	0.2247	13.48	808.9888	2629	75	0.000225	10	3.10	4.21		shared cor	1.99	0.20
6	Purnes. Mahdev	Jallalpur	1	8.52	3.25	0.1174	7.042	422.5352	1373	39	0.000117	10	3.10	1.26			1.04	0.05
	East Zone									0								
8	Juna vandri molla		1	10.61	3.25	0.0943	5.655	339.3025	1103	221	9.43E-05	7	2.17	0.60	No cl		0.83	0.04
9	aerosteel	DGMohla	1	6.34	3.25	0.1577	9.464	567.8233	1845	369	0.000158	8	2.48	1.77	No cl		1.40	0.10
10	Juna		1	2.46	3.25	0.4065	24.39	1463.415	4756	951	0.000407	7	2.17	9.06	No cl		3.60	0.66
	thana/javeri									0				0.00				
11	Bhesat khada	Machiwad	1	4.8	3.25	0.2083	12.5	750	2438	70	0.000208	8	2.48	2.96		shared cor	1.84	0.17
12	Vorawad	Machiwad	1	3.71	3.25	0.2695	16.17	970.3504	3154	631	0.00027	10	3.10	5.90	1	shared cor	2.38	0.29
13	Mahavir so. It		1	13.99	3.25	0.0715	4.289	257.3267	836	167	7.15E-05	7	2.17	0.36			0.63	0.02
	bhata galli								0	0								
14	dasera tkriPH		1	7.29	3.25	0.1372	8.23	493.8272	1605	46	0.000137	5	1.55	0.88	0.1	shared cor	1.21	0.08
15	Ramji khtri chal		1	25.45	3.25	0.0393	2.358	141.4538	460	13	3.93E-05	12	3.72	0.20	0.8		0.35	0.01
16	Navyug soc.		1	3.42	3.25	0.2924	17.54	1052.632	3421	684	0.000292	25	7.74	16.66	1.5		2.59	0.34
17	same + pipelength		1	9.36	3.25	0.1068	6.41	384.6154	1250	250	0.000107	75	23.22	7.65	1.5		0.95	0.05
18	Filter plant-Dh		1	6.51	3.25	0.1536	9.217	552.9954	1797	359	0.000154	3	0.93	0.69			1.36	0.09
19	Santadevi rd																	
	Nr Kadambri apt		1	8.47	3.25	0.1181	7.084	425.0295	1381	69	0.000118	15	4.64	1.88	0.5	multi hhs	1.04	0.06
20	Shivdhara apt.		1	8.9	3.25	0.1124	6.742	404.4944	1315	66	0.000112	5	1.55	0.61		multi hhs	0.99	0.05
21	Sardar soc.		1	33.9	3.25	0.0295	1.77	106.1947	345	69	2.95E-05	7	2.17	0.07	0.8		0.26	0.00
22	Sardar soc.		1	13.14	3.25	0.0761	4.566	273.9726	890	178	7.61E-05	10	3.10	0.56			0.67	0.02
23	Sardar soc.		1	21.38	3.25	0.0468	2.806	168.3817	547	109	4.68E-05	7	2.17	0.16			0.41	0.01
24	Nagtalvdi		1	20.31	3.25	0.0492	2.954	177.2526	576	115	4.92E-05	5	1.55	0.13	0.8		0.44	0.01
	Middle zone									0								
25	Golwad Mhkali		1	7.48	3.25	0.1337	8.021	481.2834	1564	313	0.000134	7	2.17	1.15	1		1.18	0.07
26	Parsi agiari		1	1.45	3.25	0.6897	41.38	2482.759	8069	1614	0.00069	5	1.55	17.86	0.8		6.10	1.90
27	Kasi wad		1	4.74	3.25	0.211	12.66	759.4937	2468	494	0.000211	7	2.17	2.68	0.8		1.87	0.18
28	Golwad Mnrd		7	22.35	3.25	0.3132	18.79	1127.517	3664	733	0.000313	10	3.10	7.42	1.2		0.40	0.01
29	Golwad rnchd mndr		1	6.47	3.25	0.1546	9.274	556.4142	1808	362	0.000155	50	15.48	10.13	1.5		1.37	0.10
30	Ashangr/circle		1	8.91	3.25	0.1122	6.734	404.0404	1313	263	0.000112	15	4.64	1.72	1.2	multi hhs	0.99	0.05
31	salatwad tk		7	24.63	3.25	0.2842	17.05	1023.143	3325	665	0.000284	5	1.55	3.10	1.5		0.36	0.01

Critical observation:

The locations around the ESR receive good water quantity (with pressure around 1.5-2.0 metre pressure, whereas the distant areas are deprived of adequate water quantity as well as the pressure. These are the areas at S. No 8-12 and 25-31 as they are located near the Silotwad tank and Lunci Kui tank. The pressure, especially in the area at point no 25-31 (Golwad area) is high as it is a low lying area and close to Silotwad ESR. It also receives excess water quantity as compared to other parts of the city.

Residual chlorine was detected in most of the areas, except the ones that are also fed by bore waters and the Municipal water, which recorded nil RC. The last two columns also show the velocity at the tap end and the residual pressure at that point.

Benefits:

Mere discharge observation at the consumer end would enable derivation of critically important hydraulic parameters of the pipeline network like diameter, length, roughness factor, head losses, velocity and residual heads. This important information available with the supervisor would allow him/ her to appropriately monitor the network for equitable water quantity, quality and pressure. It would also assist him/ her in taking remedial measures for any of the occurring deficiencies, besides assisting in preparing planning proposals for network replacement and augmentation with due justification.

Periodic random observation in different water supply zones and at specific locations where the size and length of the connection as well its roughness coefficient is initially observed and pre-derived, is taken up for observation at decided interval. This would help in defining the hydraulic parameters in more scientific manner with better reliability. The observed data could also be appropriately linked to GIS.

A summary of present status of data, current practices adopted by NNP for data recording, gaps in the current formats for recording, need for new formats and a brief of new formats is provided in the table below. The table summarizes the analysis from source to consumer end.

Table 18 Information Recording System for Water Supply - Current Practices, Gaps and Need for New Formats

Water supply						
	Present status	**Present practice**	**Formats & Gaps**	**New formats**	**Other Actions**	**Why needed**
Water Procurement: Surface source and ground water	• Water drawn from surface source of Kakrapar canal (70% of total supply) • 30% source-ground water tubewells • Water received in Dudhiya Talav & Ghelakdi Talav through pipeline from Kakrapar canal.	• Monthly record of the water drawn available based on monthly bill of irrigation dept. • Assessment of water quantity drawn from ground source not done by ULB • No storage capacity of the lake available • No assessment of water loss towards evaporation and absorption done	• Manual records on monthly basis presently maintained for surface water-daily details missing • Records of lake storage capacity not available. Hence, water depletion statement not maintained • No quantity derived for actual losses encountered in the lake • Formats for ground water drawl records not maintained.	• Appropriate format for daily drawl from irrigation canal to be designed. • Preparation of storage capacity chart for the lake. • Annual water depletion statement inclusive of monthly drawl and program schedule for obtaining water from the irrigation canal. • Formats for the water qty. drawn from the bores	• Contour survey of the lake for identifying the storage capacity. • Meters to be installed on each bore or periodic survey of the water availability from the bores	• Quantification of actual water production. - For assessment of actual water qty drawn on daily basis from surface and ground water sources.
Drawl from the lake into the water treatment plant	• Water drawn from the lake through intake well.	• Pumping machinery installed at intake well. • Flow meter records the hourly data of the pumped water at water treatment plant. • Pressure details of the pumping system not observed or recorded.	• Flow meter data is recorded in register on hourly basis but recorded separately. • Pressure details of the pumping mains from intake well not observed & maintained.	• Inclusive format providing easy reading of water pumped and processed. • Format for one time periodic recording of pressure (pump head), corresponding discharge and the duty point and the pump efficiency.	• Pressure gauges to be installed on the delivery mains emerging from the intake.	• Quantification of actual water quantity for processing, pump's functional head point, discharge, and efficiency. • For head loss assessment and the roughness co.eff (C-value) of delivery mains.
Water processing at WTP	• Water head works comprising mainly of water drawn from the Intake wells through pumps run on steam engines were in existence since 1927. ESR constructed then is still in use. • Increased salinity of ground water compelled NNP to switch over to canal based surface source and treatment facilities. • At Dudhiya talav Head works Treatment plant of 36 MLD capacity presently treats approximately 20-24 MLD • Ghelakdi plant of 10MLD capacity presently treats around 4-6 MLD.	• Chemical analysis of the raw water done at the Dudhiya Talav WTP. • Chlorine/chemical consumption records maintained. • Chlorination through panels done, but requires standard and good quality product. • No laboratory testing for dosing of alum or PAC carried out for actual consumption requirement. • Rate of flow and head loss assessment for the filter beds not done due to lack of functioning of the existing equipments. • Filter outflow channel measurement not done. Hence outflow qty not assessed. • No suitable arrangement exists for the third party inspection of the water quality at consumer end.	• Water testing records maintained on daily basis. • Residual chlorine records at consumer ends maintained daily • Clear water levels recorded but not on hourly basis. • Pumping log register maintained but not in appropriate format & on hourly basis. • Volume of water for inflow and outflow in the clear water reservoir (through pumping) not derived. • Operational data of the filter plant is not maintained in any type of formats. • WTP component details (measurements) & clear water reservoir size details not maintained and volume not known.	• Appropriate formats for deriving the operational data of the WTP will be designed. • Format for asset management comprising the installation details will be designed. • Formats for recording the levels of the CWR on hourly basis for data of inflow and outflow shall be designed. • Format for pumping operation on hourly basis, with power consumption, ampere and voltmeter readings shall be designed. • Formats for chemical analysis & bacteriological analysis to be improved.	• Installation of rate of flow meters & head loss meters on the filter beds. • Installation of channel flow meter. • Installation of level gauge at the clear water reservoir. • Installation of flow meters and pressure gauges on the delivery mains emerging from the pumping machinery. • Third party inspection of the water sample checking.	• For assessment of actual water qty processed and its quality check. - Assessment of head loss over filter bed for timely bed washing for optimum water qty procurement. - Assessment of water qty flowing out of the filter house into CWR. - Assessment of the pump discharge and the inflow from the filter house. - Assessment of pumped water qty.
At consumer end	•Water supplied to the areas of the city for duration of around 3.5 hrs, divided into morning, afternoon/evening supply. •Consumer end supply assumed to be around 120 lpcd.	•Water assumed to be supplied to the consumer. •No assessment carried out on random and periodic basis. •Consumer end complaints are normally attended related to poor quantity or no pressure, or improper timings.	•There is no record kept for the consumer end quantity, pressure received. •No record for the supply duration available at consumer end is maintained. •Attention of the department is drawn for poor pressure and quantity and quality only through consumer complaints that get promptly addressed	• Appropriate formats for the random but periodical checking of the consumer end water and pressure receipt.	• To undertake random checking of the water received at consumer end for different areas of the zones. • Checking would also enable knowing about quantity, pressure availability and also the RC availability at consumer end.	• To assess the water received at the consumer end. - For lpcd derivation. • To assess the pressure and quality available at consumer end. - For consumer end pressure assessment. • For assessment of NRW

2. Required actions by Navsari Nagar Palika

The recommendations made in the preceding chapters for overall improvement of Information system as well as Performance need to be followed up with appropriate action supported by the policy decision of the competent authority.

The details of the follow up actions which need to be undertaken are listed below.

1. Surveys

Type of Survey	Description
General Surveys	
Survey 01: for Assessing Water Connections and Households Served	Undertake detailed survey every four years identifying HHs in the ULB area for identifying the number of direct service water connections.
Regular Periodic Surveys	
Survey 02: Consumer End Survey	To be undertaken for assessment of water quantity, quality received and pressure available at the consumer end in different areas of each zone.
Survey 03: Duration of supply survey	Undertake Periodic survey for assessment of supply duration in different areas of each zone for period of 7 days, and average of the values for deriving the average supply duration of the zone. Aggregate of all values of different zones and derive the city average for all zones.
Survey 04: NRW Survey	Periodic survey for the assessment of transmission losses through water audit.
Survey 05: Water Demand Assessment for Floating Population	Periodic survey of the hotel occupancy rate for floating population assessment.
Survey 06: Survey for Status of Water Supply in Slums	Periodic survey to be carried out for assessment of water supply to the slum areas receiving < 70 litres/day.
Survey 07: Survey for Bulk Production of Water	As measuring equipment (except the flow meters at Dudhiya Talav) are absent, periodic sample survey to be carried out for assessing the production flows at bulk production points.

2. Installations

Type of Installation	Location of Installation
Level Gauges	At all sumps and ESRs
Calibrated Level Measurement Equipment	On clear water channels emerging from the water treatment plants
Level Sensors (Automatic Reading & Recording Type)	At various locations.
Flow meters (electromagnetic- full bore type)	On all pumping mains and emerging lines from ESRs
Flow Meters	On important sub zones for assessment of water quantity supplied

3. Periodic Assessment

Assessment	Description
Daily Assessment using Proposed Formats	Water quantity received from the irrigation canal
	Pumped from the talav intakes
	Supply from the filter plants
	Pumping hours and their corresponding discharge
	Water volume computation from the ESR
	Valve operation and areas supplied
	Water samples quality checks- daily and monthly aggregate of samples passed and failed
	Total complaints pertaining to water supply received, type and ward wise, and its redressal within specified time limit.
Annual Assessment using Proposed Formats	Total ward-wise, type-wise, use-wise water connections given in slum and non slum areas
	Annual water quantity procured, processed and supplied
	Annual expenditure incurred related to major heads of water supply
	Annual water network coverage in area and km
	Annual water complaints received, resolved
	Annual water demand and collection
	Annual cost of water and income of water per m^3
	Annual water quantity provided to different bulk consumers (metered ones)

4. Policy level decisions

- Metering policy for the bulk level consumers, non domestic and commercial, institutional premises, industrial consumers.
- Decisions for NRW reductions activities.
- Decision for sale of water through tankers providing potable water to the bulk users.
- Decision for implementing measures suggested under energy audit proposal.
- Decisions for providing logistic support for the meter provision/repairs/replacement and checking.
- Providing arrangements for receiving complaints through drop boxes, e-mails, web sites and telephone- registering and recording as well as creating other ward collection centres for receiving.
- Policy decisions for publicising the annual budget as well as the Performance level annual report before the public.
- Auditing of the annual financial statement through the third party audit.

VOLUME II: ULB SYSTEMS – WATER WORKS DEPARTMENT

1. Human Resource System

Human Resource Systems (HRS) are prescribed manners of performing repetitive tasks in an organisation. Soundly designed and well-implemented systems enhance performances, ensure quality with consistency and provides for transparency. When appropriately linked to the responsibilities and authorities, systems provide for appropriate decentralisation/delegation and empowerment. A critical examination of systems at appropriate interval is required to ensure that the systems are updated and in tune with changes in the organisational ways of functioning and its environment.

In the absence of a formal system, informally developed practices take place. The main characteristics of the ULB systems in general and NNP in specific are a mix of prescribed systems and informal practices. There has never been a full-fledged system study in NNP. There are no existing manuals and this report aims to provide a rapid bird's eye view of the existing systems and practices with key suggestions for performance improvement.

HRS is one of the key systems in an organisation as they deal with intangible assets, the performance drivers in a ULB. HRS is a conglomerate of prescription of dealing with human resources, right from entry within the NNP to her/his retirement.

Existing Institutional Structure and Administrative Set Up

- A total of 30 positions are sanctioned in water supply department of which 50 percent are vacant. The sanction was given by the government in 1956 and has not been revised after that.
- There were no sanctions for the new recruitment/ promotion on the vacant positions. The existing staff is given the additional responsibility of the vacant positions[3].
- Most of the field staff members including pump operators, key men and plumbers are time scale employees[4] and some of them are working on contractual basis. The table below summarizes the total HR strengths of the department.

Table 19 Status of Staffing at NNP w.r.t. Sanctioned Positions

S. No.	Details	Number of Staff
1	Total number of sanctioned positions by government	30
2	Total number of staff on board against the government sanctioned positions	14
3	Total number of time scale employees	48
4	Total number of contractual workers	13

"These issues make HR systems in NNP counter-productive and outdated. If this is the case in all ULBs then this becomes a key policy issue for GOG/UDD".

- Reporting Relationship- Hydraulic Engineer is the head of Water Works department. He reports to the Chief Officer. Below Hydraulic Engineer, there is horizontal structure of reporting. The Water works foreman, inspectors and line inspectors- all report to hydraulic engineer. This is a good feature of NNP that all the team members have been working for a fairly long term and know each other and work well with each other. The team working and

[3] Example – The Hydraulic Engineer of the Water Works department is having two additional charges of municipal engineer and drainage engineer. Water Works inspector was transferred to the drainage department two years ago.
[4] Time scale employees are those whose remuneration is frozen without any retirement benefits.

easy camaraderie is despite the counter-productive systems and must be attributed to characteristics of its human resources.

- Governance- There is functional committee named as 'Water Works Committee' comprising of six elected representatives and headed by the Chairperson. The committee approves the request/ orders/ payments of the department. The committee has financial sanctioning power upto INR. 2500/-, beyond which, it requires the approval/ratification of standing Committee and general board of NNP.

Recruitment and Remuneration

- NNP sends recruitment request to the Director of Municipalities (DoM) on vacant positions every year through the District Collector (DC). Only 7 positions out to 156 proposed were sanctioned by the DoM, despite prior approval from DC.
- NNP sent requests for promotions to DoM but approvals are pending.
- Increments are based on government rules based on pre-fixed criteria and not linked to performance. The only cases of additional increments reported were due to GoG norms of providing extra increment for family planning operation.
- Approval for permanent status to time scale employees us pending in some case for time scale employees working for more than two decades.
- The permanent staff's salary structure is as per the Fifth Pay Commission and would be revised as per the Sixth Pay Commission upon approval from DOM.
- The empanelled contractors provide the contractual workers as per requirements. Agreements are done and labour contractors are selected through bidding process.

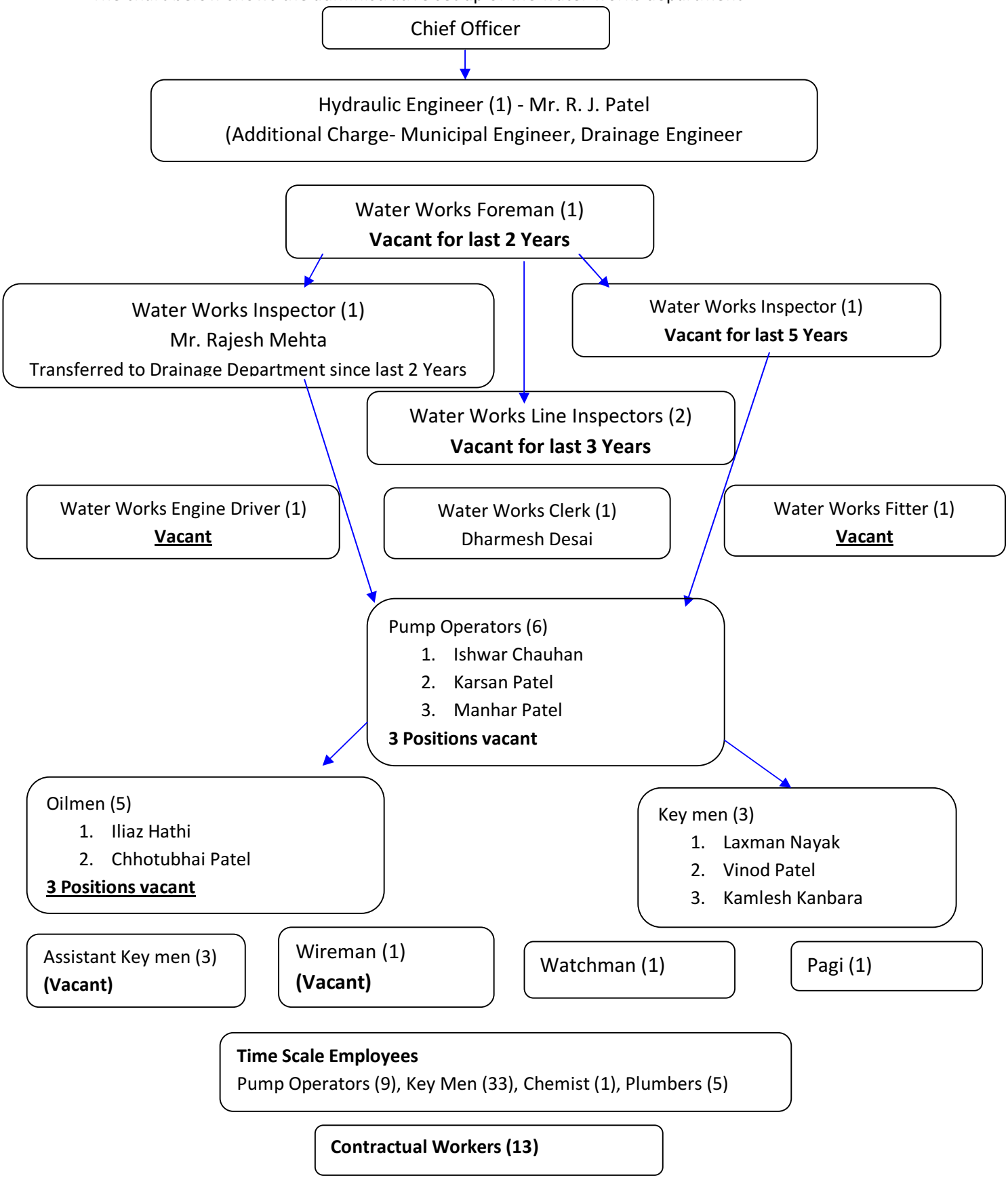
Training and Development

No Training and Capacity Building of is done at any level. There is no mechanism for the induction training of the new employees and refresher training of old employees and training a new person is through unstructured on-the-job learning. No efforts/ plans have been made by government or municipality to impart training to employees.

Key Issues:

- No recruitment and hence large number of vacant positions
- Sanctioned positions were approved as per requirements in 1956 which are not applicable today
- In the absence of relevant staff, unstructured and informal reporting system across various levels and peers
- No performance measurement and monitoring of individual staff. Also, increments and salary independent of performance
- Long administrative and bureaucratic delays in approvals and implementation
- No training and capacity building of staff to keep up with new technology and practices

The chart below shows the administrative set up of the water works department



Recommendations

1. **Implementing 74th amendment in its spirit – Urban sector HR Policy:** Second Administrative Commission in its report on the Decentralisation has commented on the sorry state of affairs of HR in ULBs. Outdated HR norms, curbing of ULB's authority by the state government go against the spirit of 74th amendment and such a situation is not sustainable in the long term. There is an urgent and important need for formulating HR policies of ULBs at GoG/ UDD level. Preserving the autonomy of ULBs and making them a vibrant structure of the local democracy should be the fundamental aim of such a policy.
2. **Right Sizing – The Need of the Hour:** The sanctioned positions in the department were estimated in 1956, after which no assessment on human resource requirements was carried out. Thus, sanctioning itself is outdated. Actual staffing is even lower than outdated sanctioned posts aggravating the truncated organisational structure of department. On the other hand the work quantum has increased with increase in population, complexity and physical growth of the city. Right sizing is required urgently and an important issue as current gap in the Water Works Department is not tenable.
3. **Designing the organisational Structure:** Organisational structure of the department needs overhauling by developing detailed Terms of Reference (TOR) for each position, job specifications, recruitment procedures and clear reporting relationship. This should be done based on HR assessment based on the existing and future work load
4. **Investment in Human Resource – Training and Development:** Reasons such as a) advancement in water technologies in recent times, b) improved operation & maintenance practices, c) targets of Government of India (GoI) of water availability and quality and d) nil past investment in training and capacity building; all argue for a strong system of training and capacity development.

Capacity Enhancement Nas Needs Assesssment (CENA) Report 2006-07 undertaken by Urban Management Centre for the Givernment of Gujarat funded by the World Bank, suggested comprehensive T&CD efforts to augment the urban capacity of Gujarat. A proper central platform needs to be carved out at the State Government level from existing Training Institutions.

2. Procurement of Materials and Equipments

Procurement of raw material, equipments, spares and services is an important function of NNP and the systems comprise purchase management, contract management and payment administration. Mostly, Annual Rate Contracts are employed for procurements and occasionally local immediate shopping is done for urgent needs.

Annual Rate Contract

The procurement of materials and equipment is mainly done through the annual rate contracting. The systems and practices followed for procurement are highlighted in subsequent paragraphs.

Requirements and Approvals

- The administrative staff, in consultation with the Hydraulic Engineer starts the process of yearly rate contract in the month of August-September every year, taking three to four months for finalisation in the month of November-December.
- Department prepares the list and annual estimated requirement of items to be procured from the vendors and are classified under 26 major classes.
- The list is approved by the Hydraulic Engineer and then the chief officer every year. Once it gets approval from the Chief Officer, it is sent to the Water Works Committee and after that to the general board for the final approval.

Advertisement and Tendering

- After the approval from the general board, the advertisement is published in the newspapers by the information department. The interested firms collect the copy of the tenders from the department by paying tender fees as per the government rule.
- The received tenders are opened in front of the members of the Water Works committee. The president and a senior member of the committee sign on the tenders.
- The summary report consisting of number of tenders received, name of the bidders, etc. is prepared. The comparative statement of the bids is also prepared and sent to the committee for approval. Tenders, with lowest bids are considered for the agreements.

Agreements and Work Orders

- The firms with lowest bids are invited to sign the agreement for duration of one year.
- Work orders are issued to the selected parties based on the requirements of the materials. The firms supply the materials within seven to ten days of issue of work orders.
- The materials are supplied at the department stores and bill for the same is raised by the firm.

Bill Payment

- The water works inspector and the foreman check the bill forward it for approval of department head, chief officer, auditor and the president. Post all the approvals, accounts department releases the payment in two to three weeks. Contractors make numerous visits to various departments and accounts department for getting their payments.

Local Immediate Small Shopping

For any urgent requirements, the water works inspector/ foreman can purchase the materials with prior information to the Hydraulic Engineer and not exceeding INR 500/-. Such immediate purchasing is then approved by the chief officer and the committee.

Key Issues:

- Water committee involved in day to day operational decisions
- Very low limit for Chief Officer to spend under local immediate shopping
- Administrative and bureaucratic delays in release of payments by NNP to contractors

Recommendations

On the whole, the procurement system is sound. The key suggestions here include

i. **Formulating appropriate roles of Executive wing and elected wing--Providing adequate functional autonomy to the executive wing-** The functional committee of Elected Representatives acts as decision makers in operational decisions. It is argued that the role of Water Committee should be focused on providing governance and oversight management only and should not include operational decision making, operational approvals, approvals for bill payments etc.

ii. **Rationalisation -Delegation of Financial powers-** The power of Chief Officer to spend up to INR 500 only seems ridiculously low in keeping with the quantum, complexities and width of services provided by NNP. It is suggested that the general board within its constitution delegate appropriate financial powers to all levels.

iii. **Creation of Chinese walls- payment handling to be done by neutral department-**Contractors making rounds to various departments in order to collect their cheques is a common sight in NNP. A better practice is to ensure that contractors get paid without any contacts with accounts or any functional department.

3. Water Supply Asset Management

Importance
Normally various details pertaining to water supply assets ought to be maintained, so that during future requirements and planning the existing details could be easily accessible and available. These details are frequently required for day to day evaluation of the operation and processes.

Present status
However, the required care and diligence for its regular maintenance and upkeep is found lacking in most of the ULBs and Municipal Corporations. NNP is no exception to this state of affairs. During the water supply status study, the prime requirement was to identify the components dimensions for required evaluation, but no drawings of the installations were found to be properly maintained. Nor were the ground level details of various installations available, hence whatever evaluation that has been attempted is based on certain assumptions which need to be verified. Some of the details were however obtained by referring to the DPRs prepared by NNP through the Consultant hired for specific project.

Recommendations
- NNP may undertake special survey for the physical measurement of various installations for identifying its correct dimensions.
- The L/Section of various trunk mains, both rising and gravity mains, should be prepared after undertaking level survey.
- Special survey ought to be carried out to identify the water storage capacities of the two lakes by physical level survey (latest technology could be well used to carry out these surveys even if the lakes are in filled conditions).
- Special contours prepared from the lake survey and area identification at vertical metre or half meter interval computed for deriving the volume between the two intervals, and storage capacity chart prepared.
- Several installations, pumping machinery details, its suction and delivery pipe size, suction length, bottom and top levels should be checked and clearly noted along with proper sketch drawn to the scale.

Benefits
The asset register would provide the details of various installations with ease.
It would assist in arriving at right decision promptly.
It would also help in avoiding unnecessary checking of the dimension sizes.

Table 20 Component details of various installation under ULB

Component details of various installation under ULB																	
City:			Nagarpalika:			Department:						Month			Year		
Sr.No	Installation	Components	Incoming piping det			Bore well details						Pumping details					
		Bore/Well/Sump/ESR/P.stn/others	Type	Length	Free flow p	Size	depth	G/w depth	No of col. Pipe	Gr RL	Feeding to	No of pumps	Type of pumps	Pump hd	pump dis in lps/lph	Yr of inst.	motor type and
Sump details							ESR details						Remarks				
shape	size	water depth	structure	yr of const.	RL-Top/Botto	in/out pipe size	capacity	size	Ht	Water depth	RL-Top/Botto	in/out pipe size					
As on date:				Supervisor					Deputy Engineer				Water Works Engineer				

4. Stores and Inventory Management

Stores and inventory system deals with receipt of material/equipment/spares, record keeping, stores management and issue of the material including ensuring appropriate inventories.

Physical Infrastructure

There are two stores located at Dudhiya Talav WTP out of which one is used for storage of fitting items/ materials and the other for electronic equipment. Both the stores are managed by two store keepers who are time scale employees.

Figure 13 Stock of materials at store department

Record Keeping and Issuing Materials

Store keepers maintain the stock registers for all the items. When needed, the concerned person informs the store keeper of the requirements and sends field staff for collection of the required materials. The store keeper records the materials delivered in the stock register.

Receiving New Materials

In case of the requirements of new materials, the storekeepers prepare the list and obtain approval of the water works inspector. They then send the request to the department for procurement. It takes minimum ten days to get the ordered materials form the vendors. There is no proper system for putting demand to the department; it is done on ad hoc basis.

Issues:

- Despite sufficient space, materials/ spare parts/ items are not arranged systematically
- Raising demand for procurement of new materials is done on an ad hoc basis and should be streamlined

Recommendations

i. **Scientific Inventory Management**- NNP needs to implement inventory control measures (minimum ordering quantity, reordering levels, selective control analysis like ABC, VED,HML etc.) in order to improve the stores and purchase performance. At present these are fixed on ad-hoc levels and not based on consumption pattern.

ii. **Scientific stores management-** Store management systems (issuing rules like FIFO _First In First Out, LIFO-last In First Out), appropriate codification of all material, material handling and layout, etc. need to be redesigned and implemented.

5. Water Planning and Procurement System

Planning

There is a yearly planning system for total water requirements of the city. This is mainly updating last year's planned requirement with ad hoc additions. The city estimates the yearly water requirement base on a) city population, b) buildings and businesses, and c) leakages and wastages at various stages of water supply. However, none of the above information is authentic or validated through a survey or by any department. Hence, the estimated demand is an unscientific rough estimate.

The demand is then sent to Irrigation Department, GoG which ultimately decides supply of surface water based on its available data on rainfall, reservoir levels and estimated requirements of uptown farmers. The remaining gap, usually 20 percent of demand, is met by NNP through withdrawal of ground water. While groundwater exploitation is cheaper, it suffers from higher TDS due to past overexploitation and salinity intrusion of salt water into aquifers. Long-term strategic planning for the water requirements and procurement is absent.

Procurement of Surface Water

- The demand is largely met by water drawn from the Kakrapar irrigation canal and Irrigation Department charges the ULB on a monthly basis using a functional water meter installed at the intake.
- The department maintains the records of the total monthly water quantity received from the irrigation department. It has maintained the record of the total water quantity received on monthly basis since March 2000.

Issues

- Demand calculation is not done using validated data and hence has no scientific basis
- No wastage/leakage is measured and hence severely impacts any planning undertaken to improve service delivery
- Rain water harvesting has not been seriously planned by NNP yet

Recommendations

- NNP needs to do strategic planning for meeting long term needs of the city and ensure sustenance
- Apart from Irrigation Department, NNP should also measure water quantity purchased using appropriate instruments

6. New Water Connections

Procedure

- Application forms for new water connections are available at Jan Suvidha Kendra (JSK). The application form contains all formats to be filled and specifies day wise process to be done.
- The JSK verifies application form and sends it to the hydraulic engineer of water works department for further action.
- After the necessary verification by the department, the applicant is informed to deposit the charges which include deposit amount, new connection charges and road rearing charges within a week. The entire process takes maximum seven days after the application.
- Once the applicant deposits the amount, the new connection is provided to the applicant. The information about the new connection is then sent to the tax department and JSK.

Charges

- The general board passed a resolution in 2005 for fixing the charges for new water and drainage connections. The resolution specifies all the charges related to new connection including application form fee, deposit amount, new connection charges for house hold & commercial properties, plumber charges etc.
- As reported, the water works department earns, an average, INR 1 to 1.2 million from the charges of new water connection

Legalising Illegal connections

- The resolution of general board also specifies the charges for legalising illegal connections. All charges fixed for the new connection are doubled to legalise illegal connection.
- It has been reported that the proportion of the illegal connections is very minimal due to positive approach from elected representatives.

Issues

- New water and drainage connections charges have not been revised since 2005
- No cross subsidisation model has been explored to make water and drainage connections accessible to all

Recommendations

- The costing of new connections should be rationalised considering the current cost norms
- Cross subsidisation should also explored improve equitable service delivery along with innovative schemes such as distribution of connection charges across a few months (included in the bill) to ease the one-time payment burden for economically weaker sections

7. Tax Design and Collection System

Existing Tax Structure

The tax department is responsible for collection of following taxes, fees and penalties. The types of taxes and revenues collected comprise:

i. Property tax
ii. Water tax
iii. Drainage tax
iv. Education tax - to be handed over to the state government
v. Vehicle tax - lifetime tax to be paid once
vi. Show tax
vii. Notice fees - late payment charges on any tax, penalty do not increase in proportion to delays in payment.

The current water tax structure exists since 1998. The table below highlights the prevailing water tax rates for different types of residences and activities.

Table 21 New Tax Structure as per Government Resolution from Urban Development and Housing Department, GoG

Type of residence/activity	Prevailing rates	Expected revision as per GoG directives for minimum rates (INR/yr)
Zupada	INR 120/-	For all residential INR 600/-
Till 25 sq.m. carpet area	INR 180/- for residential 300 for non residential activities	Commercial (Less than 400 sq. ft.) INR 600/-
More than 25 sq.m. carpet area	INR 360/- for residential INR 600/- for non residential	Commercial Hotel, Lodge, Restaurant, Guest House, Hospitals, Small Factories (No Water Usage), INR 1000/-
Water tax outside boundary of Municipality	INR 1,000/- for residential, INR 2,000/- for non residential	Industrial including ice factories, mineral water, manufacturing, service station, party plots etc. INR 2250/-
For business activities of jewellers and diamond factories	INR 600/- (for less than 10 workers)	
Hotel, service station, beauty parlour, restaurants, bakery, theatre, sweet shops, laboratory, washing laundry, dairy	INR 2,000/-	
Banks, insurance, diamond factories with more than 10 workers, party plots, halls etc.	INR 4,000/-	

Proposed Revision of Tax Structure

- The ULB has received government resolution from Urban Development and Housing Department, GoG to revise the current water tax structure. The new tax structure as per the GR is also highlighted in the table above.
- The ULB will revise its current water tax structure as per GoG directives. This new tax structure will be implemented soon after the approval from ULB general board.

Collection System and Procedure

- *Tax collection system* - The ULB has sound tax collection system and procedure. The ULB has been using one printed bill for the collection of all taxes. Tax is collected as per the administrative wards. There are total 14 such administrative wards and the ward wise tax collection arrangement is made.

- *Tax collection drive* - The tax collection drive starts in September every year with personal delivery of tax bills to each property over a period of two months. There are total 58,000 registered properties. By December the first call to pay is given and by March the second and last call to pay after which penalty is imposed.
- The rapport of the tax clerks and public at large is fairly good and personal follow up may be resorted to at times to collect the tax. The tax drive, timeliness, personal rapports are strong aspects of the tax collection system.
- *Tax collection efficiency* - All taxes are structured as per guidelines of GoG/GMFB and have to be adopted by board resolution prior to any changes. In 2009-10 the total of all above collected was INR 59.1 million while billed was INR 74.1 million, with collection efficiency of about 80%. The collection efficiency is showing declining trend from high of 93% in 2006 and 2007 to 80% at present.
- At one time the highest collection was of 99.37% and NNP has been awarded for high tax collection. The reasons provided for declining trends are economic recession, closure of several industrial units in the city, etc. but lack of political will to sustain highest collections has also been observed.

Penalties

- The penalty imposed is not significant (except on delayed payment of education tax) and the penalty does not increase in proportion to delays
- While there are penalties, there are no incentives for early payments. In fact there is no provision of receiving early payments as it creates accounting difficulties. With significant NRI population, provision of early payments has potential of increasing collections/ advances. Thus there is a need for rationalisation of incentives and penalties.
- The last recourse of disconnecting the water is rarely resorted due to lack of political will.

Exemption and Subsidy

Defence service personnel, ex-service men and the widows of soldiers are exempted from paying the taxes. The GoG has also issued directives to the ULB for the same. The current tax structure is opined to be less sensitive to the bottom of the pyramid, i.e. the poorest of poor.

Issues

- In cases of non payment, the penalties are not substantial enough to make people pay on time or recover the losses due to non payment.
- No incentives are given to public for early payments
- Tax revision is due and resolution is yet to be implemented

Recommendations

The tax structuring and collection system needs to be modified through:

i. Rationalisation of penalties to ensure penalties in proportion to the length of delay in payment
ii. Introduction of incentives for early birds in view of significant NRI population
iii. Rationalisation of subsidies for bottom of the pyramid people in consultation and with approval of GMBF/GoG
iv. Aging analysis of old debts and special drives for collections

8. Complaint Management

Complaint Management through Jan Suvidha Kendra

- Jan Suvidha Kendra (JSK) is a computer-based mechanism set up by ULB for availing civic services, issuing various certificates and registering complaints. Forms for general complaints are available free of cost at JSK.
- The list of complaints is pre-printed and the complainant can either tick-mark his/her complaint on the printed form or register complaints over phone using the helpline created by JSK.
- JSK forwards the complaint to the respective department for further action. As reported, complaints concerning the water works department are resolved within 24 hours.

Alternate Mechanisms

- The department's administrative staff also registers complaints directly over phone. The information is then passed to the respective field staff.
- The current practice also includes direct phone calls by complainants to the water works inspector, plumber and other field staff regarding complaints. Complaints which are registered and resolved by the staff are not documented anywhere.

Issues

- Direct complaints given to field staff and/or inspector are addressed but not recorded or documented
- The complaints database is not utilised for any further analysis or used for appropriate scheduling of repairs and maintenance of frequent trouble spots

Recommendations

i. Proper Documentation and Record Keeping - Effective system for documentation needs to be established at all levels for complaint management.
ii. Data Analysis - The proper analysis of complaints registered and complaints resolved should be done at regular intervals in order to understand the effectiveness of the system.
iii. Feedback Mechanism - Jan Suvidha Kendra should send the monthly/ fortnightly feedbacks to the department on number of complaints, nature of complaints, average response time, etc. Senior officials of the department should provide regular feedback to the staff.

9. Quality Assurance

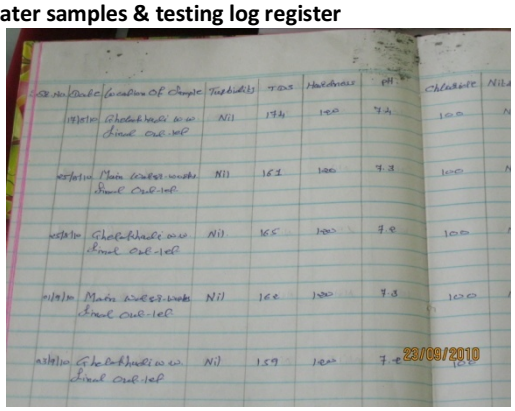
There are two WTPs to filter the surface raw water received from Kakrapar irrigation canal. The details of both plants are as under.

S. No.	Name of the Plant	Capacity	Water supply to which zones
1	Dudhiya Talav Treatment Plant	36 MLD	East zone, middle zone and full PR zones
2	Ghelakdi Treatment Plant	10 MLD	West zone

Testing at Plant Level

- The laboratory for water testing is located at Dudhiya Talav WTP for chemical analysis (PH, TDS, Nitrate, turbidity, chloride, hardness and fluoride). These tests are conducted five to six times in a month at the WTP. The chemist maintains the register and records the test results. The sample of the register is shown in Figure 14. The senior officials are regularly briefed about the test results.

Figure 14 Testing kit used for testing water samples & testing log register



- Testing kits are provided by the WASMO. The accuracy of the results conducted using these testing kits is 70 to 80% as indicated in WASMO testing manual. The bacteriological tests are not carried out.

Testing at Consumer End

- The residual chlorine (RC) test is conducted at consumer end every day by the field staff. Daily 70 to 80 samples are collected for RC tests. Samples are mostly collected from stand posts. Samples are collected from the each zone to ensure the representation from each zone. Test results are recorded in the register and also are conveyed to the department head. If RC test samples fail in particular area, the field staff is informed about the same and asked to check for leakages.

Monitoring

- Quality is assured through following measures.
  - Most complaints are addressed within 24 hours.
  - Daily route checking by the water works inspector as per the schedule of water supply
  - One foreman to monitor the activities of 40 key men at filed level.

Issues

- Bacteriological tests are not carried out at WTP
- Random sampling at consumer end is done without defining appropriate test intervals, locations and number of samples in a scientific manner, leaving a possibility of missing out certain pockets in the city

Recommendations

i. **Scheduling -** Scheduling will help in defining the test intervals and number of tests to be conducted periodically which is lacking presently.
ii. **Testing by Accredited Laboratory** - The required tests should be carried out by accredited/ public health laboratory on regular intervals for chemical and bacteriological analysis especially in view of low accuracy levels of WASMO kits used daily. The bacteriological analysis of raw water should also be conducted at regular intervals.
iii. **Proper sampling at consumer end -** Samples should also be collected from household taps ensuring proportionate representation including slum households.
iv. **Client satisfaction survey -** ULB can conduct client satisfaction survey at regular interval to know the satisfaction level for different services of the department.

10. MIS, Reporting and Data Management

Issues in Current Practices

While majority of decisions gets taken and business of the ULB goes on, it is without the benefit of structured Management Information System or any systematic databases. Most of the time, data by and large

- Is not compiled
- Is not accurate
- Is not in the form required
- Is replaced by estimates and guesstimates
- Not broken down to analyse performances at unit/micro level
- Does not get aggregated
- Does not get reported
- Is not stored systematically. As a result information retrieval not only becomes difficult but also time and effort consuming.
- There is no link between the projects executed and ongoing operations, information of new projects, renovations and details of upgradation are lost in transit. As a result, there are almost no current drawings, specifications, performance analysis, data base etc. information at unit levels or aggregate levels available readily or at a place or updated.
- Significant quality assurance systems do not note down exceptions and thus are unable to indentify proactively required actions.

Recommendations

i. **Strong IT Platform -** NNP needs a strong IT platform with appropriate hardware, software and connectivity to ensure appropriate database updating and retrieval as needed. The data base may comprise citizen data base, property data base, services-wise asset database etc. with appropriate built-in safety and security.
ii. **Performance Monitoring Oriented Climate Building -** At present, the recording, reporting, aggregation, analysis and monitoring based on accurate data is either non-existent or very weak. Building of performance-oriented climate will require systematic multipronged approach, empowering policies and roles of elected and executive wings, adequate institutional structuring, strong IT driven MIS and Monitoring, significant capacity building and training and technical leadership.

11. Repairs and Maintenance

The repairs and maintenance include the system for repairs, mechanism for break down, planned and preventive maintenance.

Internal Repairs and Maintenance and Repair

- Line break down maintenance is done by the internal staff of the department. Total 12 staff members have been given the responsibility of line break down maintenance under the supervision of water works inspector. The break down and leakage maintenance are also taken care of by the same internal staff.
- The machine maintenance is done by the department staff on weekly basis.
- Four electricians are responsible for the maintenance of electrical equipment.

External Maintenance

- An annual maintenance contract has been made with three contractors for the external maintenance. The external maintenance mainly includes motor rewinding, valve maintenance, etc. A total of INR 150,000 to INR 200,000 is, on an average, spent for carrying out external maintenance.

Issues

- No preventive and planned maintenance works undertaken
- In the absence of required technical staff, delays in rectifying any faults or complains occur

Recommendations

- Preventive and planned maintenance - ULB should have the system for the preventive maintenance

Summary of Conclusions & Recommendations

S. No.		System	Impacting on Performance Indicators	Actions To Be Taken	Time Frame (ST/MT/LT)[5]
1	Systems Affecting Overall Institutional Capacity	HR System	NA	HR Policy and rationalisation study and implementation	MT
2		Procurement of Materials and Equipments System	NA	Scientific procurement study and implementation	ST
3		Stores and Inventory Management System	NA	Inventory control and stores management study	ST
4		MIS, Reporting and Data Management System	NA	ULB wide ERP with requisite hardware and software with connectivity study and implementation	MT
5	Systems Affecting Performance Indicators	Water Planning and Procurement System	- per capita supply of water - extent of non revenue water - extent of metering of water supply connections - continuity of water supply - quality of water supply	1. Strategic planning system for water to be designed and implemented 2. Yearly planning system for water to be fine-tuned and implemented 3. Intake water to be measured.	ST ST ST
6		New Water Connection System	- coverage of water supply connections	Costing for new connections, penalty for illegal connections etc. to be rationalised	ST
7		Tax Design and Collection System	- extent of metering of water supply connections - cost recovery in water supply services - collection efficiency of water supply related charges	1. Rationalisation of tax system including various levies, fees and penalties including incentives for early collections 2. Analysis and actions on old and aging debts	ST ST
8		Complaint Management System	- efficiency of redressal of complaints	Implement record keeping, analysis and feedback system	ST
9		Quality Assurance System	- quality of water supply	Design and implement sound system of quality assurance system including QIS (Quality Information System) at consumer end and in the in-house laboratory testing supplemented by periodic double check up by external	ST

[5] ST – Short Term; MT – Medium Term; LT – Long Term.

				reputed laboratories.	
10		Maintenance and Repair System	- per capita supply of water - extent of non revenue water iv- continuity of water supply - quality of water supply - efficiency of redressal of complaints	Introduce system of preventive and planned maintenance system.	ST

The broad Terms of Reference (TOR) for additional various studies as indicated in the actions for improving institutional capacity have been outlined below:

- HR Policy and rationalisation study- This study should have components of manpower rationalisation and right sizing, policies of managing HR (including recruitment, remuneration, promotions, transfers, retirement, termination, incentives etc.). The study also should study the model Urban Act of GOI, the State Act (which is not yet passed, ULB byelaws (not yet approved by GMFB, extent of centralisation/decentralisation envisaged under the constitution (as per amendment 74 and model Act of GOI) and the one granted in the state Act/as per prevailing practice, Extent of distribution of authorities and responsibilities between the Elected wing and executive wing of the ULB, state cadre management issues etc. and come out with a holistic empowering HR policy and rational manpower for the ULB considering the present and future workload expected over next five years.

- Scientific Procurement Management Study and implementation- This study should consider and revise as appropriate, present role division and tasks done by elected wing and executive wing in procurement bill passing and develop smoother and faster procurement system and procedure along with formats of all forms. The study should also recommend type of procurement approaches (ad hoc purchase, short term tender notice, long term contracts) along with criteria of shot listing and selecting vendors including negotiation procedures. The study also should suggest standard contract formats with general and special conditions and clauses for various types of purchases. The study should specify roles of various functionaries in executive wing and also of elected wing including authorities and responsibilities break up at various stages.

- Inventory Control and Stores Management- The study should develop standard codification and classification for all items, accounting codes for various departments/users cost definitions as per the model account code prevailing though not yet fully implemented); Carry out all relevant analysis of inventory control (E.g. ABC, VED, FMS, HML etc.) and develop minimum and safe inventory standards for all A level items and store issue policy (E.g. FIFO, LIFO etc.). The study also should recommend scientific layout and material handling equipments as per the needs.

- ULB wide ERP- ULB as a socio-economic entity needs a holistic management package which should include ULB wide computerisation and IT platform along with requisite hardware, software and connectivity. There are many ERP systems and brand available and the ULB should identify suitable platform and vendor to outsource such development and implementation.

- Strategic Planning for Water procurement – Water as a key resource requires adequate long term planning for the city survival and growth. All sources of surface water, ground water along with their ownership should be identified and estimated need of the water should be forecasted based on projected population growth. The cost of water also should be estimated (as it is the major raw material used in the ULB). Area wide planning for water distribution, metering, leakages estimation, rationalisation of water charges/fees/taxes etc. all should be part of such a study. Standards of water supply, quality of water etc. should be defined by the study. The study should suggest system and procedures for strategic planning and yearly planning along with formats, responsibilities and timeframe. The study also should develop M&E plan for monitoring such planning outcomes.

- Tax collection and design system- Current water cost recovery and taxation structure needs significant revision if ULB has to survive as a sustainable socio-economic entity. For majority of the costs/taxes GMBF do establish minimum standards. The general board of the ULB in theory is empowered to charge appropriately while observing these minimum standards. The cost structure along with taxes, user based charges, cross subsidisation if any among various user sectors (E.g. industry, trade and commerce, religious, social, household, government and parastatals etc.), penalty for reconnections, late payments etc. should be developed. The role of GMBF and the ULB in fixing such taxes, fees etc. should be defined appropriately. Cross subsidisation should be quantified totally and transparently. The various trade-offs should be proposed for decision by the general board of the ULB.

- Complaint management system- while the complaint management system is sound it needs cumulative performance analysis to fine-tune it to respond optimally. This framework is recommended to be done in-house.

- Quality Assurance System- Quality assurance standards are defined by the MOUD, PWD Public Health manual, international standards and WHO standards of potable water quality. The study should develop comprehensive standards which the ULB should follow based on all above along with test protocols, frequencies, acceptance and rejection standards, analysis protocol and secondary external testing as appropriate with specifications (type, nature, frequency etc.). The study should develop a full-fledged quality reporting system which is missing at present.

- Maintenance and repair system- The ULB at resent follows only break down maintenance approach. The study here should develop preventive maintenance schedules for all major machines and equipments including cleaning, oiling, overhauling schedules based on manufacturer's specifications, age of machines/equipments and engineering judgments. Appropriate spare part policy also should be suggested by the study.

Focus and Limitation of the system study

A ULB is affected by policies, Acts, Rules and Regulation and prevailing extent of decentralisation practiced in the state. This study looks at water supply department only within the Navsari Municipality. This focus and limitation of the study are highlighted in the following model.

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