



DETAILED PROJECT REPORT

Construction of Recharge Structures

under the sub-mission

Shallow Aquifer Management (SAM 2.0)

Submitted to: Palanpur Nagar Palika

Prepared by: Arid Communities and Technologies



Shallow Aquifer Management in AMRUT cities (SAM 2.0)

Supported by AMRUT 2.0

**Ministry of Housing and Urban Affairs
Government of India**

About the Project:

This Detailed Project Report (DPR) has been prepared under the Shallow Aquifer Management (SAM) 2 initiative to support urban groundwater sustainability through scientifically identified and context- specific recharge interventions. The report outlines the technical, financial, environmental, and implementation framework for the construction of recharge structures in selected locations within Palanpur..

The proposed interventions aim to enhance groundwater replenishment, improve water security, and promote sustainable urban water management practices. Site selection and design recommendations are based on hydrogeological assessments, field investigations, and stakeholder discussions.

About the DPR:

This DPR has been developed by the Arid Communities and Technologies as part of the SAM 2 programme, implemented by the National Institute of Urban Affairs (NIUA), and is submitted to the Palanpur Nagar Palika for review, approval, and implementation.

Disclaimer:

This report is based on available data, field assessments, and technical analyses conducted during the study period. The recommendations provided herein are intended to guide implementation and may require adaptation based on site-specific conditions during execution. NIUA and its technical partners shall not be held liable for any deviations arising during implementation without prior consultation.

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Source of Image :

<https://zeenews.india.com/gujarati/web-stories/gujarat/beautiful-waterfall-near-palanpur-in-banaskantha-paniyari-dhoddh-422454>

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DETAILED PROJECT REPORT

City: Palanpur, Gujarat

Palanpur is a district head quarter of Banaskantha district and the capital of former princely state of Palanpur. The town is situated in north – east direction at about 155 km from Ahmedabad and 135 km from Gandhinagar the state capital of Gujarat state. The town is created by hillocks in the close vicinity of Arvali Mountains. The town was once heavily fortified with seven gates providing the only means of thoroughfare and these are now in ruins. Of much more recent vintage are the other monuments that dot the town: the 'Keerti stumbh' or "victory tower" were erected in 1930s, as were the Jorawar palace and the Balaram palace. The well-known temple of Balaram Mahadev is situated about 20 km from Palanpur. The Jessore sloth-bear sanctuary, a reserve forest sprawling over 180 km² and home to several endangered species such as the Indian sloth-bear, leopard, wild boar and porcupine, lies about 45 km from the town. There is the famous Temple “Ambaji” which is 55 km from here. Earlier Palanpur was known as flower city because of scents available here. Palanpur is also well known in Gujarati literature with its shayars like Shunya Palanpuri, Agam Palanpuri, Shail Palanpuri. Famous Gujarati poet Chandrankant Bakshi also belongs to Palanpur.

The town is well connected with Air. The nearest airport is Ahmedabad. It is Rail linked with Ahmedabad, Mehsana and Delhi. The town is also well connected by road with important cities of Gujarat & Rajasthan. Many housing societies have been developed just near the out skirt of the town mainly on the Ahmedabad and Delhi national highway. The town being the headquarter of the Banaskantha District, the Collector office, district panchayat office and district police headquarters as well as ST depot etc. are located in the city. The city is centrally located in the district and is connected with all taluka headquarters. The city has full-fledged medical facilities with public and private hospitals and also is having an important commercial center. Thus the people from all surrounding areas visit the town for their administrative, commercial, social, educational and financial requirements.

Palanpur is located at 24.17° N 72.43° E. It has an average elevation of 209 meters (685 feet). The configuration of the town is having general slope towards north and west. The old town area drains in western and north direction. Storm water drains have been provided in the area near N.H. and drains through 1000 mm dia. R.C.C pipe lines into drain (nala) located in west, the drain (nala) crosses Palanpur – Deesa road and Railway tracks from Palanpur to Delhi.

The municipal boundary of Palanpur has expanded progressively due to rapid urbanization, commercial growth, transportation connectivity, and population increase. The urban area extends along the major transportation corridors connecting Ahmedabad, Deesa, Abu Road, and surrounding settlements. The city functions as an important regional center for administration, trade, education, and groundwater-dependent urban development in North Gujarat.

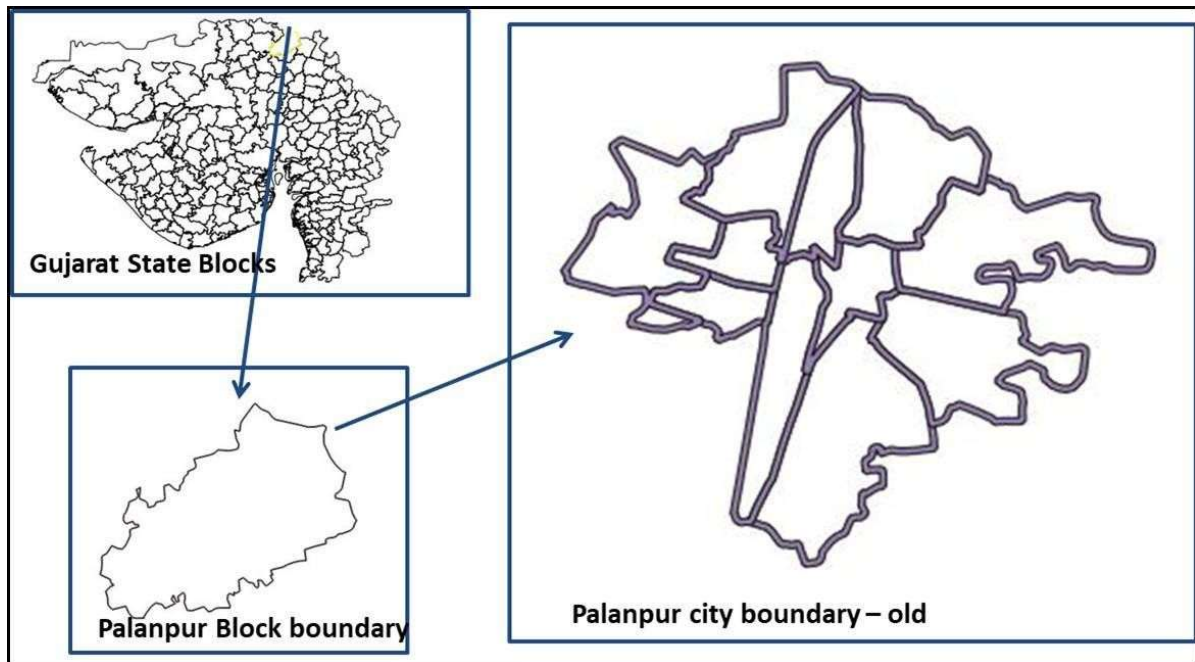


Fig.01 Location Map of Palanpur city

Groundwater Profile

Palanpur Water Supply Project was approved by Government of Gujarat during 1971. The source of supply was Dantiwada Reservoir. Later on the project was modified and approved by Government of Gujarat during 1977 based on tube wells drilled within city area. The yield of tube well is very poor. The quality of tube well water is also deteriorated and water has come to be un-potable in numbers of tube wells. However local body has pull on with increasing numbers of bores in the city area. At present, the water is being supplied through direct pumping in numbers of areas due to limited income of water. (Ref. secondary report)

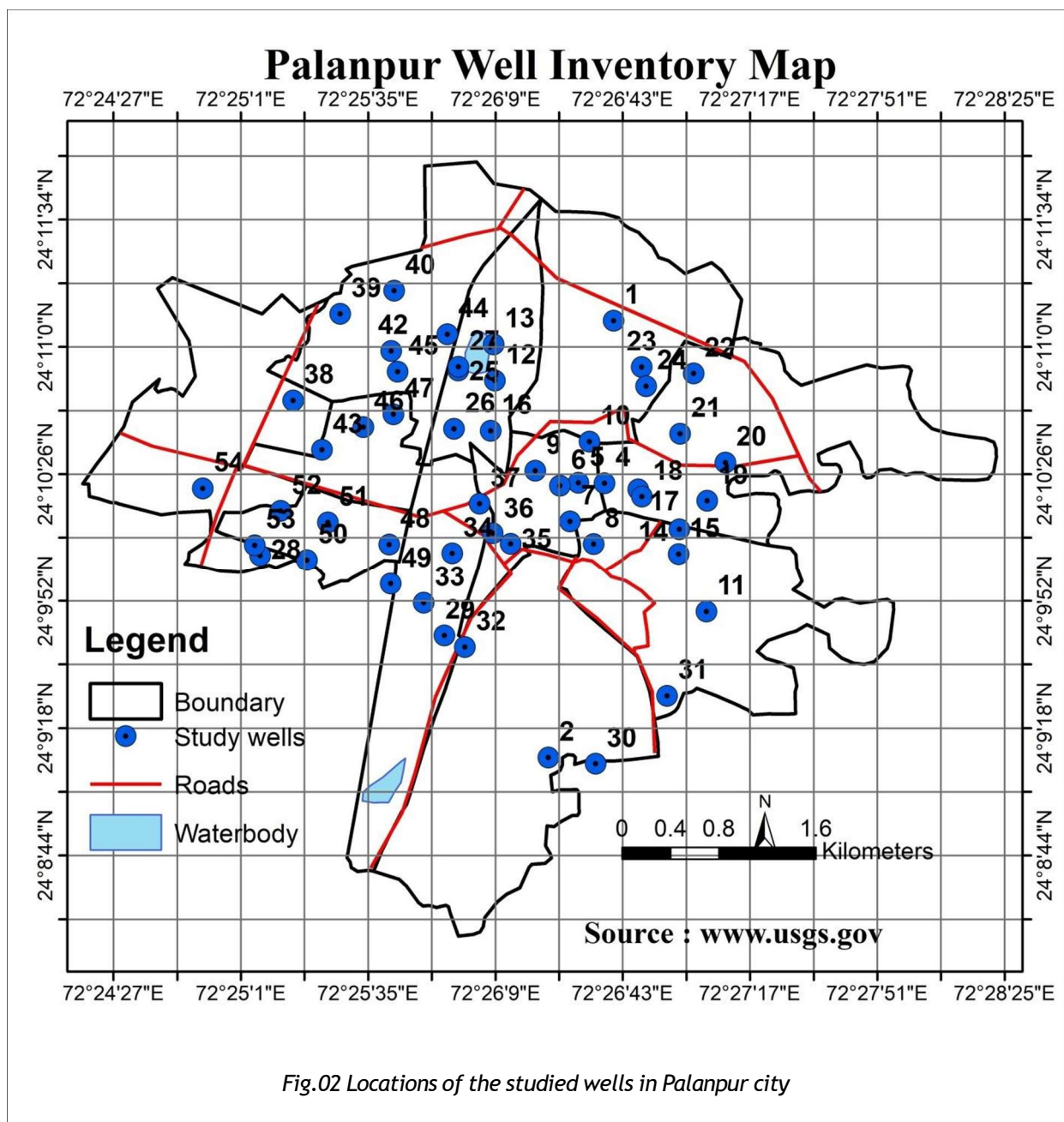
The well inventory is done as per the map (Figure 2) illustrates at the location of 54 study wells distributed across different parts of the city and surrounding urban area. The inventoried Borewells in the study area have total depths ranging from approximately 40 to 70 meters below ground level (mbgl), whereas the observed groundwater level varies between 30 and 50 meters below ground level.

The CGWB Dynamic Ground Water Resources Assessment Report (2024) indicates that Banaskantha district has one of the highest stages of groundwater extraction in Gujarat. The stage of groundwater extraction in the district is reported to be approximately 119.81%, which means the annual groundwater withdrawal exceeds the annual replenishable groundwater recharge. Such conditions classify the area under the “Over-Exploited” category.

According to the Aquifer Mapping and Management of Groundwater Resources management recommendations provided by the Central Ground Water Board (CGWB), there is limited scope for further groundwater development in major parts of the Banaskantha district, including Palanpur, due to excessive groundwater extraction and declining water levels. Therefore, urgent measures are required for augmentation, conservation, and sustainable management of groundwater resources. The CGWB

recommends the diversion of surplus monsoon runoff into ponds, percolation tanks, canal basins, and abandoned dug wells is suggested to enhance groundwater recharge and improve aquifer replenishment. The report further emphasizes the importance of rainwater

harvesting and artificial recharge structures for restoring groundwater storage in the alluvial terrain of the region. Community participation is considered essential for implementing large-scale artificial recharge and micro-irrigation programs effectively. These recommendations are particularly important for urban and semi-urban areas such as Palanpur, where increasing groundwater dependency and urban expansion continue to place stress on the aquifer system. (Ref. Aquifer Mapping and Management of Groundwater Resources – CGWB report for Banaskantha district)



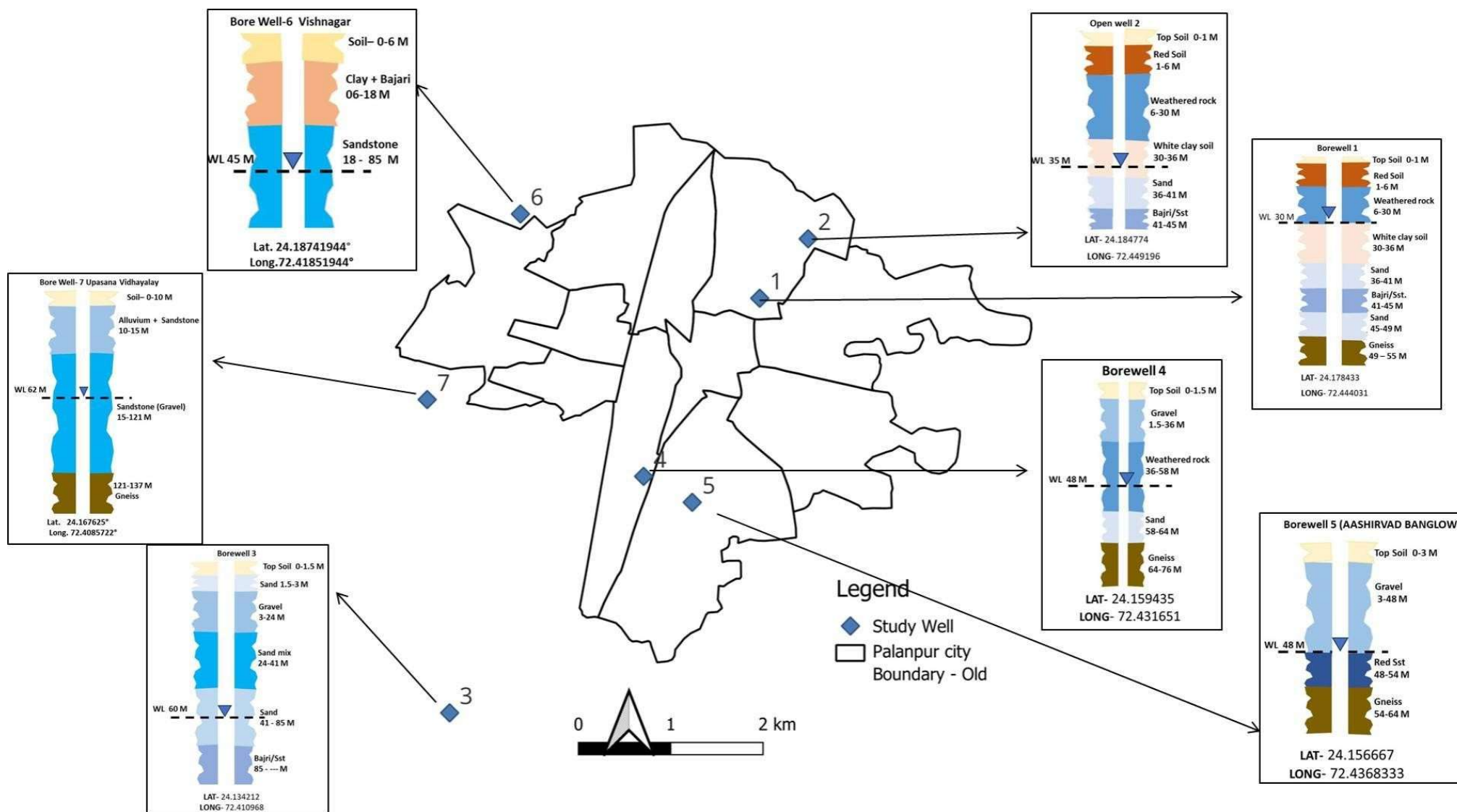


Fig.03 Lithological map of the studied wells in Palanpur city

PILOT DEMONSTRATIONS UNDER SAM 2.0

Under the Shallow Aquifer Management (SAM) 2.0 Project, the more than 22 sites were identified in Palanpur city, considering the various factors 10 sites are selected for the demonstration. The focus interventions to manage recharge of the shallow Aquifer, with emphasize on the issues related to the urban flood mitigation measures, and rejuvenate the existing groundwater resources are strategically incorporated into the site selection at various locations in the existing Municipal area and also the extended city locations. The figure 04 represents the Google Earth image of the sites selected for the demonstrations.

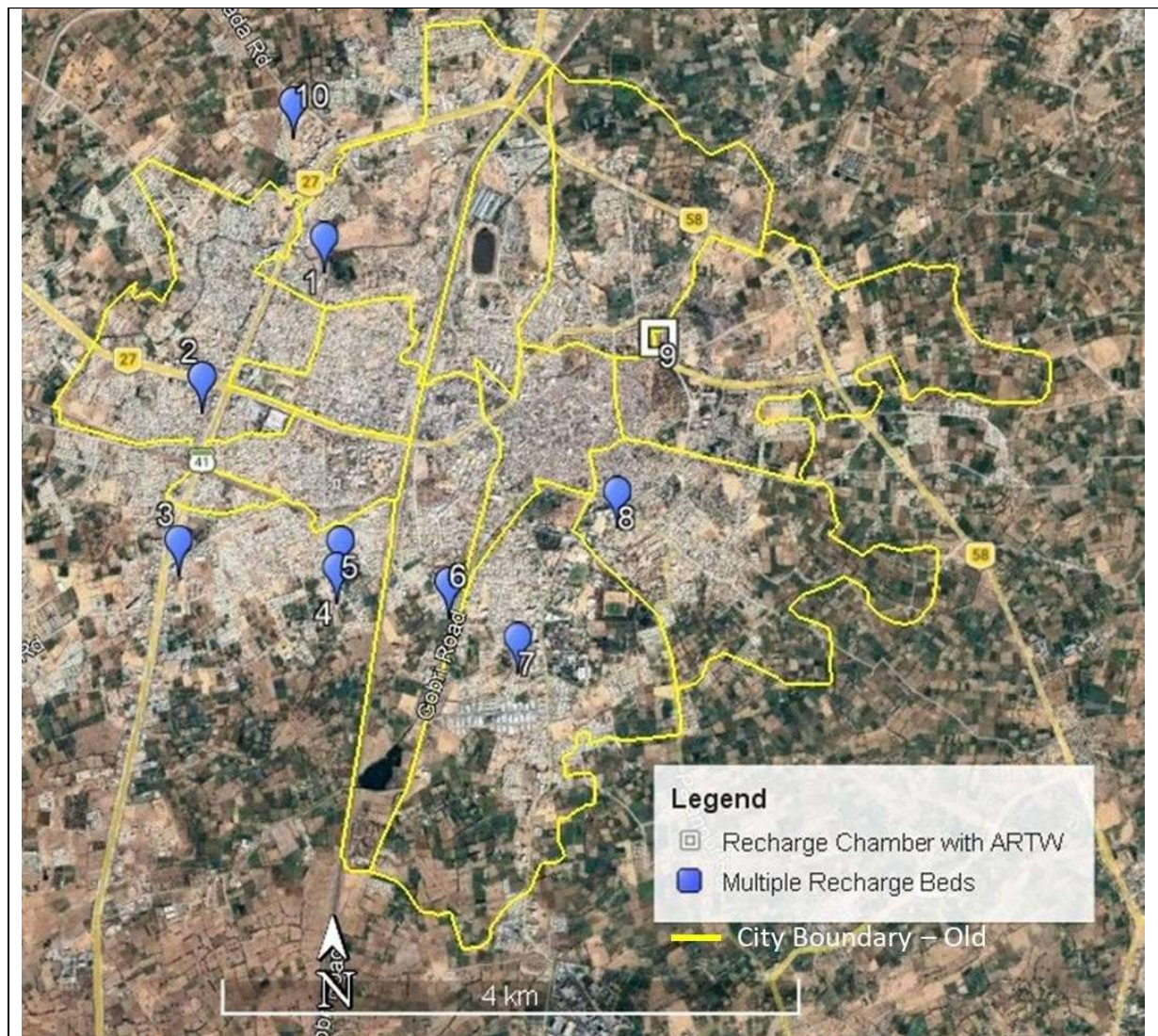


Fig. 04 Location Map of Proposed Interventions

Table 1: Strategic Framework for Shallow Aquifer Management in Palanpur City.

S. No.	Recharge Sites	Lat.	Long.	Main Issue	Strategic Intervention
1	New Aman Park, Opp. Hanuman Tekri Cross Road	24.1815°	72.423667°	The water inflow from the Southern direction of the society accumulates near the society wall at the proposed intervention. The accumulated storm water creates the flooding zone, resulting into the multiple challenges for the residents during the monsoon season. The proposed filter bed with ARTW intervention helps to mitigate the water logging, and recharge the shallow Aquifer.	Developing infrastructure with provision of utilization of storm water for aquifer recharge bypassing impermeable strata. Recharge Tubewell with large filter bed
2	SBI Society, Nr. Ahmedabad-Palanpur Highway	24.172833°	72.4153889°	The water inflow from the Southern direction of the SBI society accumulates on society road, and around the proposed intervention. That creates the water logging during the monsoon season, resulting the multiple issues for the residents.	Utilizing the urban facilities for the groundwater recharge and preventing the water logging issues. A large filter bed with ARTW intervention is proposed.
3	Ashirvad Bungalows	24.162694°	72.4138056°	The storm water inflow from northern direction accumulates at the backside of the settlement area; the accumulated water creates multiple health risks for the residents.	Urban flooding mitigation with the large recharge bed with ARTW to minimize the flooding issue, and utilizing the fresh water as the shallow Aquifer recharge.
4	VIP Society, Nr. Street No. 13	24.161°	72.4245556°	The storm water inflow from all direction accumulates near the main road, and internal road, the accumulated water results into the flooding zone, creating multiple issues including the health risks for the residents during the monsoon.	The filter chamber with ARTW is proposed to minimize issue, and converting the flooded water into the shallow Aquifer recharge.
5	Nr. Laxmipura Dairy	24.162639°	72.4248056°	The storm water inflow from northern direction near the Laxmipura Dairy that creates the flooding zone, resulting into the multiple health risks for the residents.	The Filter chamber with ARTW is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.

Table 1: Strategic Framework for Shallow Aquifer Management in Palanpur City. (Continue....)

S. No.	Recharge Sites	Lat.	Long.	Main Issue	Strategic Intervention
6	Karnawati School, Jagana-Gobri Road	24.160111°	72.4321667°	The storm water inflow from southern direction from open fields, settlement area and high-school road accumulates on the internal road, creating the flooding zone, resulting into the multiple risks for the residents	The Filter chamber with ARTW is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.
7	Surya Nagar, Nr. Banas dairy Road	24.156667°	72.4368333°	The storm water inflow from western direction from settlement area and road accumulates besides the colony, creating the water logging, resulting into the multiple risks for the residents	The Filter chamber with ARTW is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.
8	Baudeep Society, Opp BLPL Library	24.165694°	72.4435833°	The storm water inflow from northern direction from settlement area accumulates near the temple, creating the flooding zone, resulting into the multiple risks for the residents and visitors.	The large Filter bed with ARTW is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.
9	Mafatpura, Nr. Rampir Mandir	24.177417°	72.4463333°	The storm water inflow from all direction from settlement area accumulates near the existing Borewell, creating the flooding zone, resulting into the multiple risks for the residents.	The multiple Filter beds are proposed to minimize the flooding issue, and recharging the existing dried Borewell and also recharging the shallow Aquifer.

Section B :

1. Location 1 DPR – New Aman Park, opp. Hanuman Tekri Road

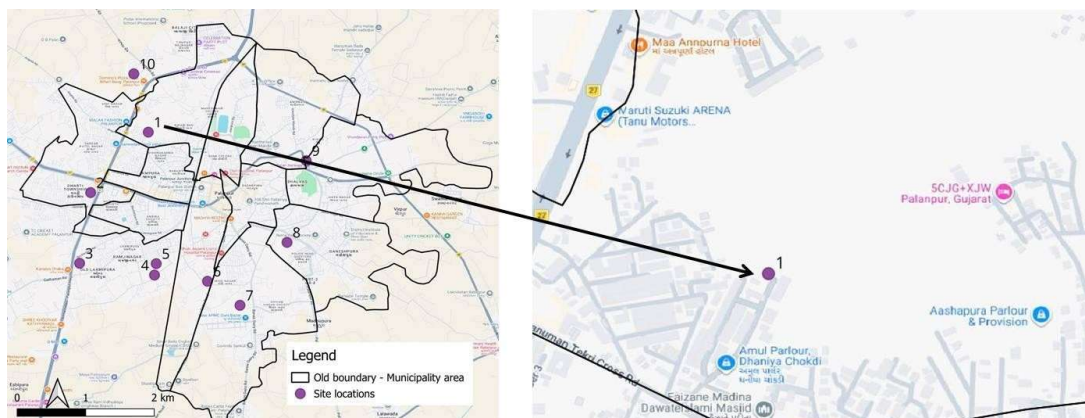


Fig. 1.1 Location Map of Site 1 – New Aman Park

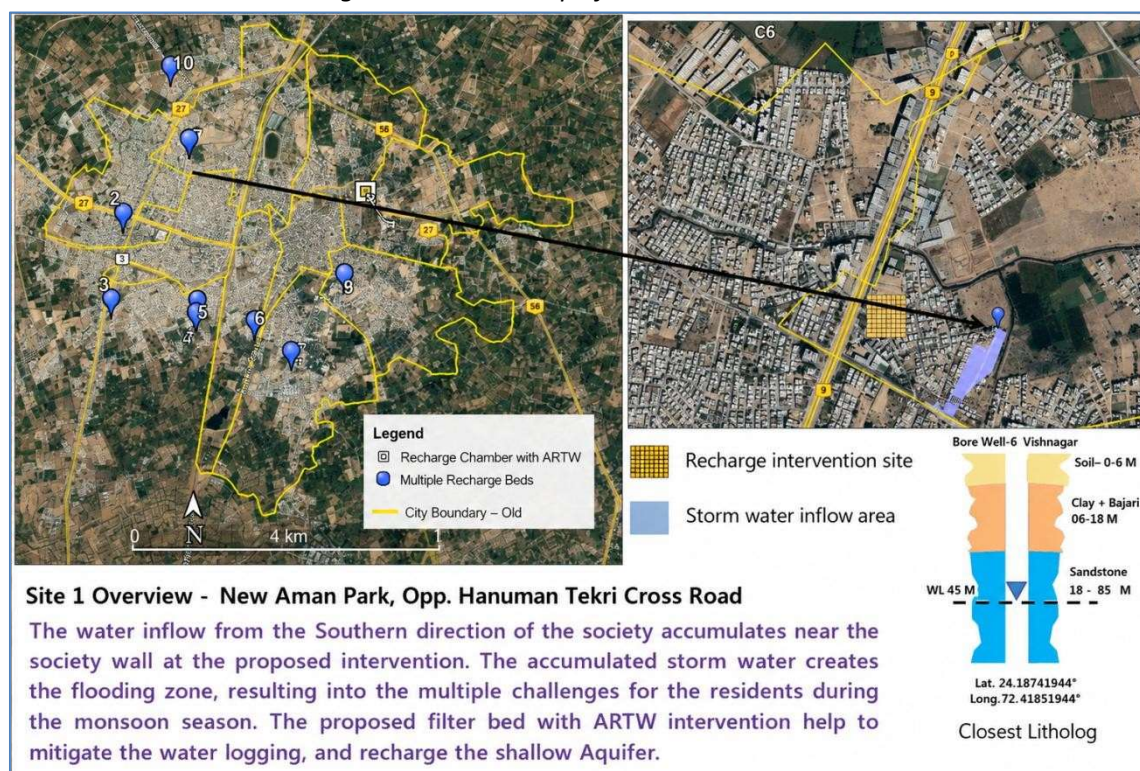


Fig. 1.2 Site Overview

Problem Description

The water inflow from the Southern direction of the society accumulates near the society wall at the proposed intervention. The accumulated storm water creates the flooding zone, resulting into the multiple challenges for the residents during the monsoon season. The proposed filter bed with ARTW intervention helps to mitigate the water logging, and recharge the shallow Aquifer.

Catchment area information	
Inflow Area	0.86 Ha
Water logging	0.10 Ha

Geohydrological Potential		
Lithology	0-6 M – Top soil 6-18 M – Clay + Bajri 18-85 M– Sst	<p>Bore Well-6 Vishnagar</p> <p>Soil– 0-6 M</p> <p>Clay + Bajari 06-18 M</p> <p>Sandstone 18 - 85 M</p> <p>WL 45 M</p> <p>Lat. 24.18741944° Long. 72.41851944°</p>
Water Level	45 M	
Water Quality	1304 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Clay + Bajri Layer 3 - Sst	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	New Aman Park Society, 24.181534° Lat. , 72.423767° Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer and another 1 layer
Technical Function	Collection of accumulated storm water near the society wall, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff through the settlement area, and direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	The freshwater usually runoff and creating water logging is captured through the filter bed and ARTW. The availability of excess fresh water makes the location ideal for capturing and utilizing storm water.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location 24.181534° Lat., 72.423767° Long.	New Aman Park Society,	Intercepts the water from the flood zone, filtering through the media
	Length	4 m	Intercepts storm water runoff
	Width	2 m	Provides adequate infiltration area

	Depth	4 m	Multi-stage treatment before recharge
Filtration System	Sand Layer	0.7 m thickness	Primary filtration of suspended solids
	HDPE Mesh	Layer separator	Prevents mixing of filtration layers
	Charcoal Layer	0.5 m thickness	Removal of odour and chemical impurities
	Gravel Layer	1.4 m thickness	Intermediate filtration and flow stabilization
	Boulder Layer	1.4 m thickness	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell			
Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	30 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
Well Casing Arrangement	Blind Pipe	10 M	Prevents recharge into the first layer
	Slotted Pipes	Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	4 x 2 x 4 M	SqM	18500	148000
ARTW	30 M	RM	2625	78750
			Grand Total	226750

Filter Bed – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	4	2	4	32	Cum
2	Providing and laying percolated paver block on the top of the filter media	4	2		8	Sqm.
3	Providing and Laying different material as filter media					
	Sand	4	2	0.7	5.6	Cum.
	Charcoal	4	2	0.5	4.0	Cum.

	Gravel	4	2	1.4	11.2	Cum.
	Boulder	4	2	1.4	11.2	Cum.

ARTW – Measurement Sheet

S. No.	Item	No.	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			30	30.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			30	30.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	20	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of RCC casing pipe and strainer pipes at the site of work as detailed below;						
	A) Supply of 300 mm dia RCC Plain pipes used in RCC Tube-wells.	1			10	10.00	RM
	B) Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			20	20.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			30	19.98	KG
7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.

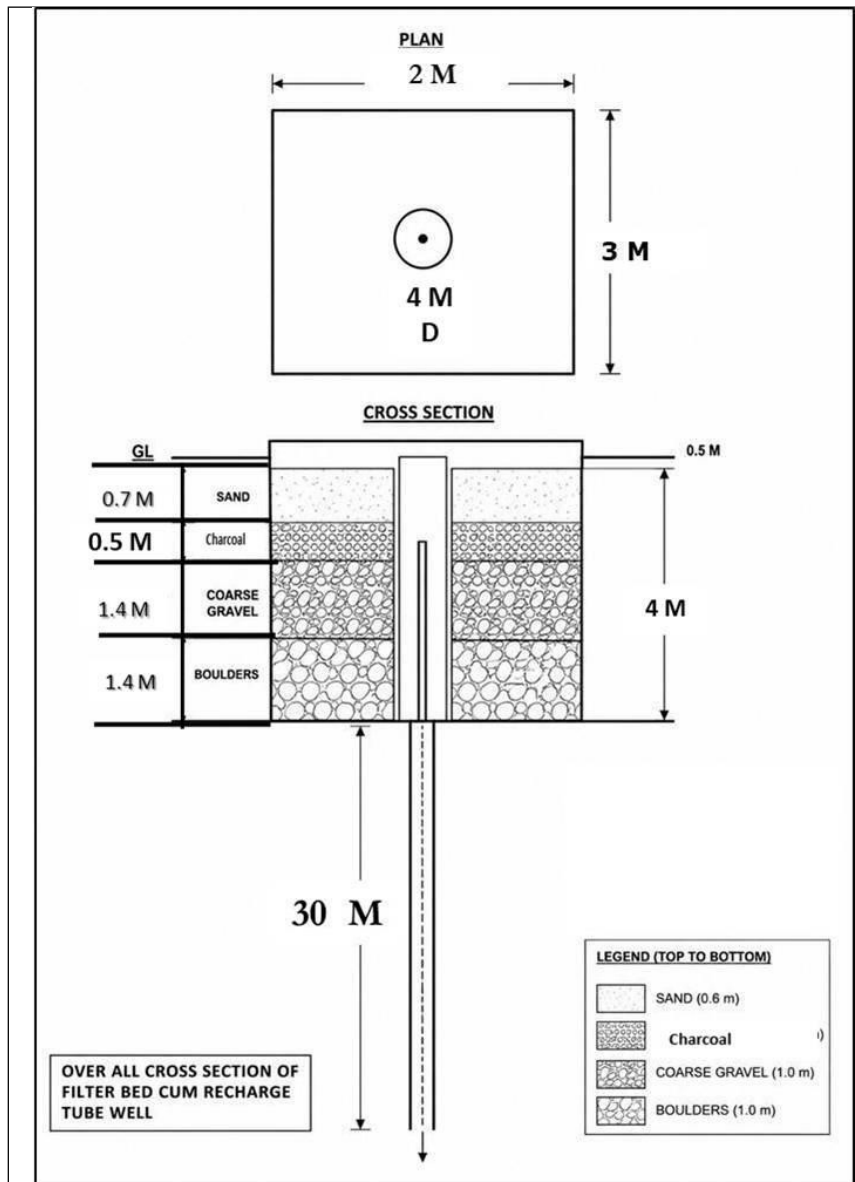


Fig. 1.3 Proposed design for Filter bed and ARTW

2. Location 2 DPR – SBI Society, Nr. Highway

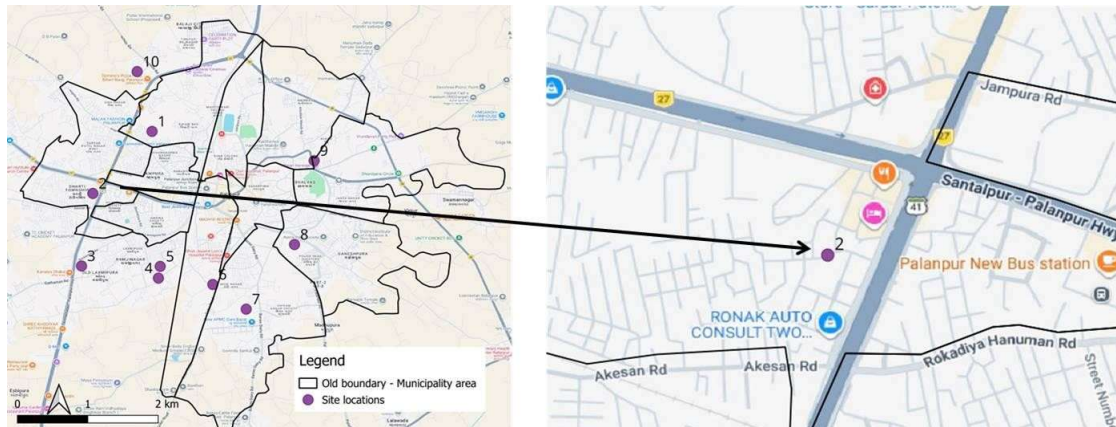


Fig. 2.1 Location Map of Site 2 – SBI Society

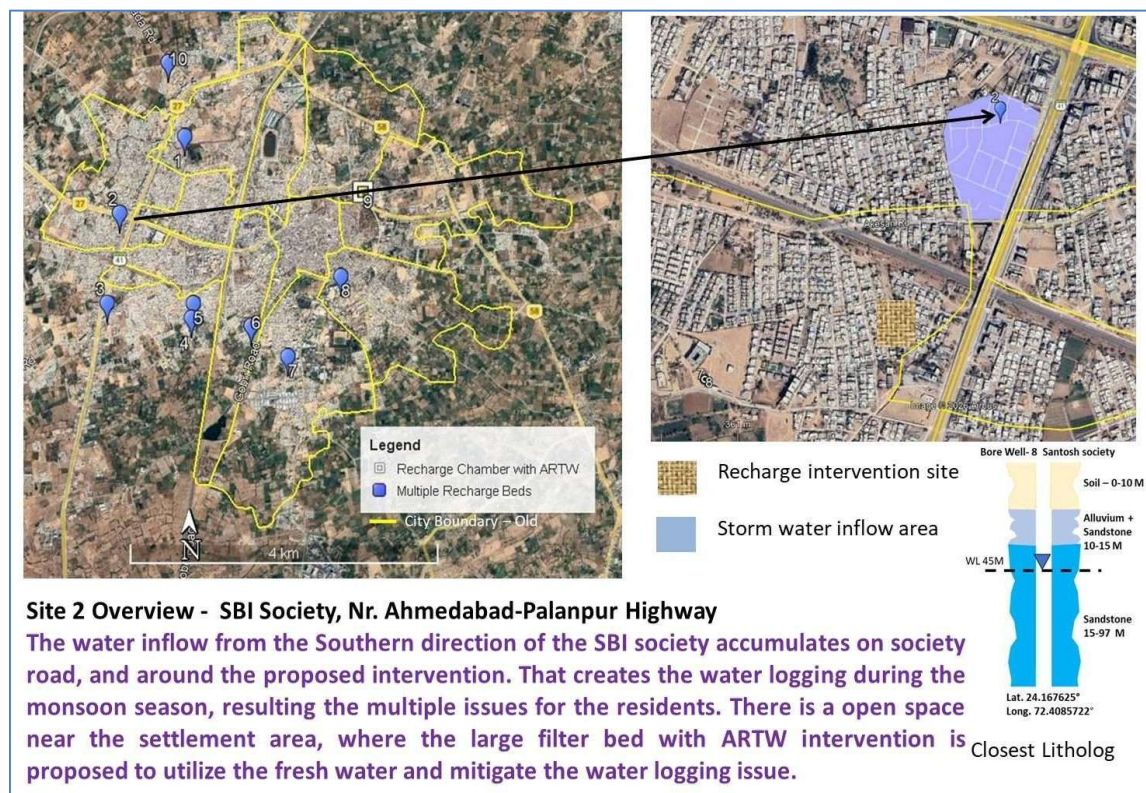


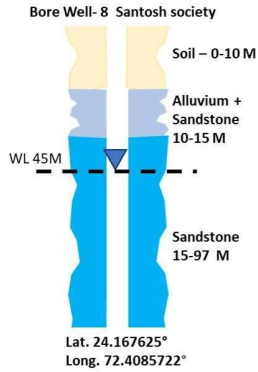
Fig. 2.2 Site Overview

Problem Description

The water inflow from the Southern direction of the SBI society accumulates on society road, and around the proposed intervention. That creates the water logging during the monsoon season, resulting the multiple issues for the residents. **Utilizing the urban facilities** for the groundwater recharge and preventing the water logging issues. **A large filter bed with ARTW** intervention is proposed.

Catchment area information

Inflow Area	4.59 Ha
Water logging area	0.57 Ha

Geohydrological Potential		
Lithology	0-10 M – Top soil 10-15 M – Alluvium+ Sst. 15-97 M– Sst.	
Water Level	45 M	
Water Quality	1920 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Alluvium+ Sst. Layer 3 - Sst	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	SBI Society, Nr. Ahmedabad-Palanpur Highway, 24.172833° Lat. , 72.4153889° Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer and another 1 layer
Technical Function	Collection of accumulated storm water near the road, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff through the settlement area, and direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	The site is feasible for Utilizing the urban facilities for the groundwater recharge and preventing the water logging issues. A large filter bed with ARTW intervention is proposed.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location	SBI Society	Intercepts the water from the flood zone, filtering through the media
	Length	6 m	Intercepts storm water runoff
	Width	6 m	Provides adequate infiltration
	Depth	4 m	Multi-stage recharge treatment
Filtration System	Sand Layer	0.7 m	Primary filtration of suspended solids
	Charcoal Layer	0.5 m	Removal of odour and chemical impurities
	Gravel Layer	1.4 m	Intermediate filtration and flow stabilization
	Boulder Layer	1.4 m	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell			
Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	45 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
Well Casing Arrangement	Blind Pipe	10 M	Prevents recharge into the first layer
	Slotted Pipes	35 M Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	6 x 6 x 4 M	SqM	18500	666000
ARTW	45 M	RM	2625	118125
			Grand Total	784125

Filter Bed – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	6	6	4	144	Cum
2	Providing and laying percolated paver block on the top of the filter media	6	6		36	Sqm.
3	Providing and Laying different material as filter media					
	Sand	6	6	0.7	25.2	Cum.
	Charcoal	6	6	0.5	18.0	Cum.
	Gravel	6	6	1.4	50.4	Cum.
	Boulder	6	6	1.4	50.4	Cum.

ARTW – Measurement Sheet							
S. No.	Item	No.	Length (M)	Width (M)	Height/ Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			45	45.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			45	45.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	35	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of RCC casing pipe and strainer pipes at the site of work as detailed below;						
	A) Supply of 300 mm dia RCC Plain pipes used in RCC Tube-wells.	1			10	10.00	RM
	B) Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			35	35.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			45	29.97	KG
7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.

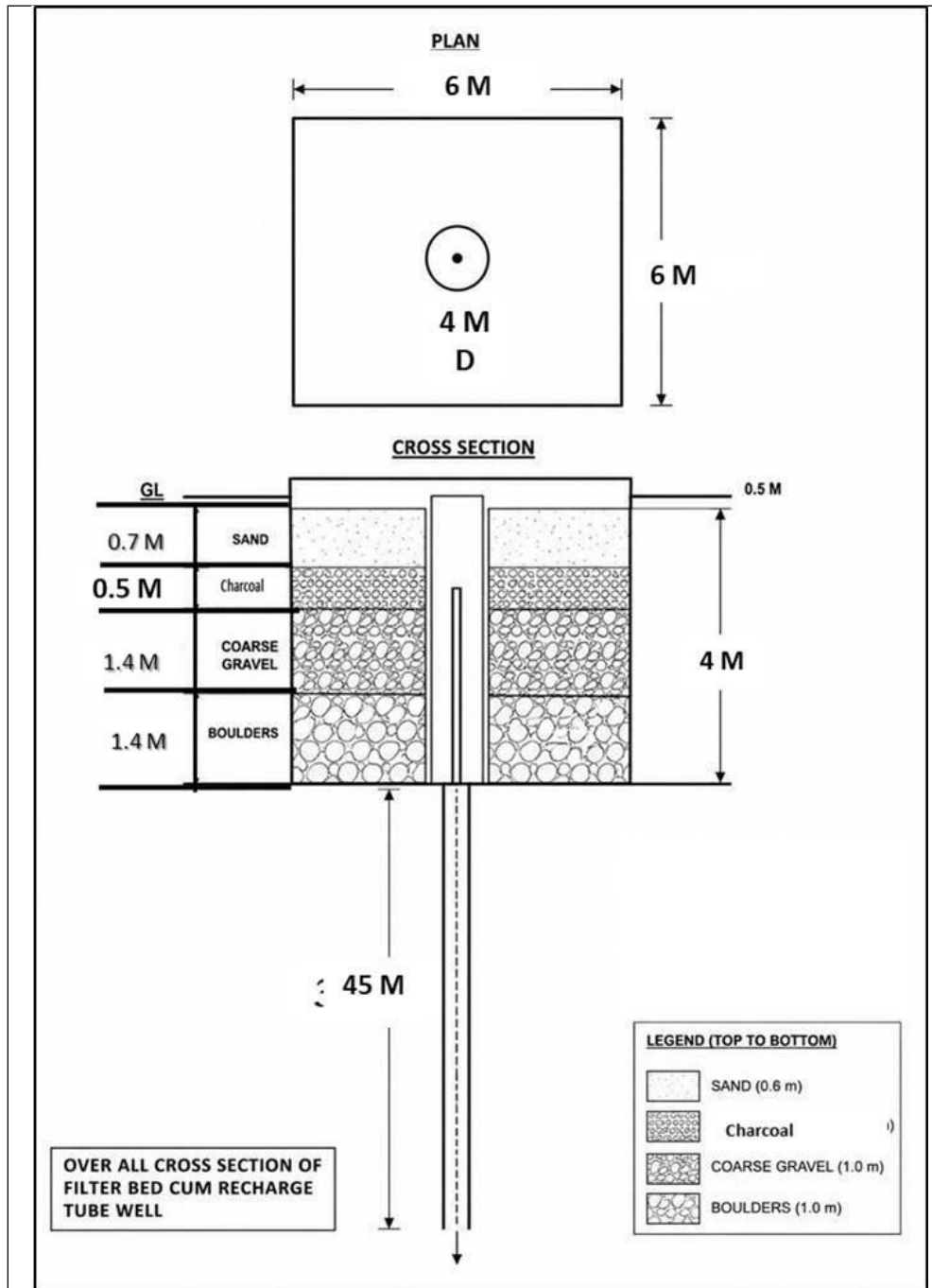


Fig.2.3 Proposed Designs for Filter Bed and ARTW

Location 3 – DPR 3 Ashirvad Bungalows

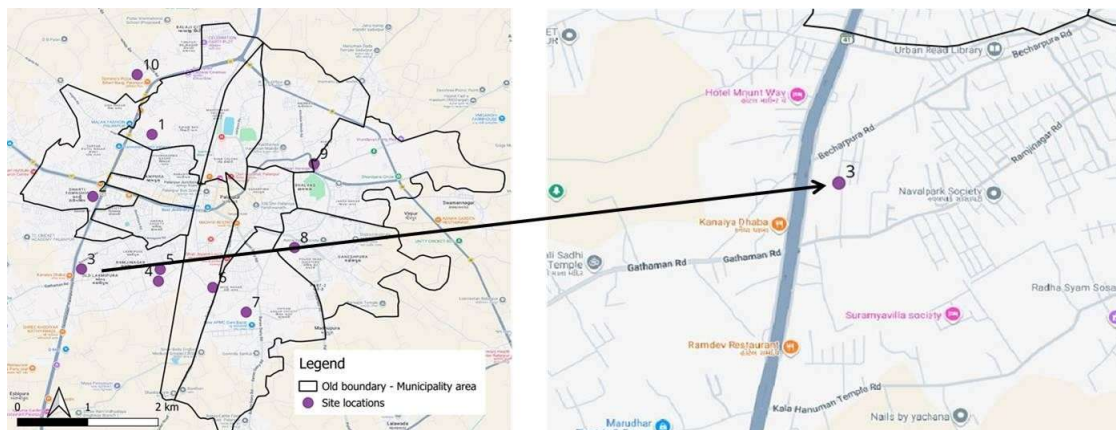


Fig. 3.1 Location Map of Site 3 - Ashirvad Bungalows

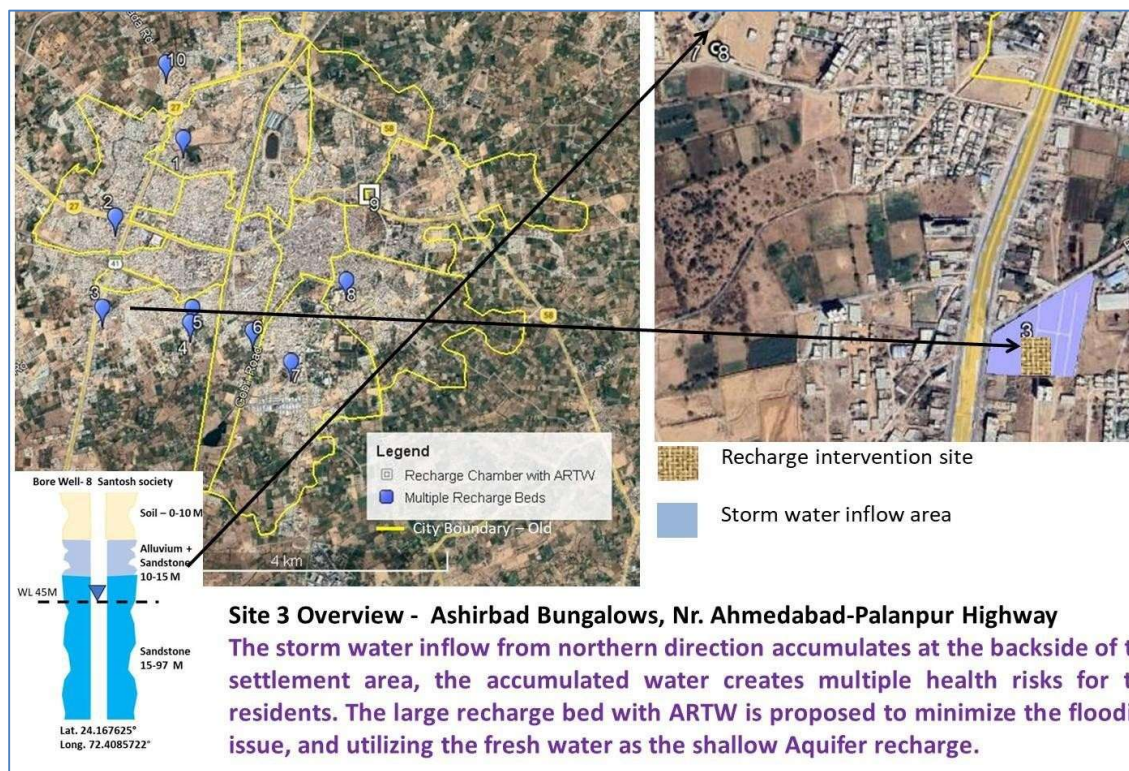


Fig. 3.2 Site Overview

Problem Description

The storm water inflow from northern direction accumulates at the backside of the settlement area; the accumulated water creates multiple health risks for the residents. **Urban flooding mitigation with the large recharge bed with ARTW** to minimize the flooding issue, and utilizing the fresh water as the shallow Aquifer recharge.

Catchment area information

Inflow Area	1.9 Ha
Water logging area	0.1 Ha

Geohydrological Potential		
Lithology	0-10 M – Top soil 10-15 M – Alluvium+ Sst. 15-97 M– Sst.	<p>Bore Well-8 Santosh society</p> <p>Soil – 0-10 M</p> <p>Alluvium + Sandstone 10-15 M</p> <p>WL 45M</p> <p>Sandstone 15-97 M</p> <p>Lat. 24.167625° Long. 72.4085722°</p>
Water Level	45 M	
Water Quality	1920 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Alluvium+ Sst. Layer 3 - Sst	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	Ashirvad Bungalows, 24.172833° Lat., 72.4153889° Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer and another 1 layer
Technical Function	Collection of accumulated storm water from the open ground, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff through the settlement area, and open fields direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	The site is feasible for Urban flooding mitigation with the large filter/recharge bed with ARTW to minimize the flooding issue, and utilizing the fresh water as the shallow Aquifer recharge.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location 24.172833° Lat., 72.4153889° Long.	Ashirvad Bungalows	Intercepts the water from the flood zone, filtering through the media
	Length	6 m	Intercepts storm water runoff in settlement area
	Width	6 m	Provides adequate infiltration area
	Depth	4 m	Multi-stage treatment before recharge

Filtration System	Sand Layer	0.7 m	Primary filtration of suspended solids
	Charcoal Layer	0.5 m	Removal of odour and chemical impurities
	Gravel Layer	1.4 m	Intermediate filtration and flow stabilization
	Boulder Layer	1.4 m	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell			
Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	45 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
Well Casing Arrangement	Blind Pipe	10 M	Prevents recharge into the first layer
	Slotted Pipes	35 M Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	6 x 6 x 4 M	SqM	18500	666000
ARTW	45 M	RM	2625	118125
Cleaning of nearby existing Borewell	Compressor blow and site clearance	No	20000	20000
			Grand Total	804125

Filter Bed – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	6	6	4	144	Cum
2	Providing and laying percolated paver block on the top of the filter media	6	6		36	Sqm.

3	Providing and Laying different material as filter media					
	Sand	6	6	0.7	25.2	Cum.
	Charcoal	6	6	0.5	18.0	Cum.
	Gravel	6	6	1.4	50.4	Cum.
	Boulder	6	6	1.4	50.4	Cum.

ARTW – Measurement Sheet							
S. No.	Item	No.	Length (M)	Width (M)	Height/ Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			45	45.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			45	45.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	35	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of RCC casing pipe and strainer pipes at the site of work as detailed below;						
	A) Supply of 300 mm dia RCC Plain pipes used in RCC Tube-wells.	1			10	10.00	RM
	B) Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			35	35.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			45	29.97	KG

7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.
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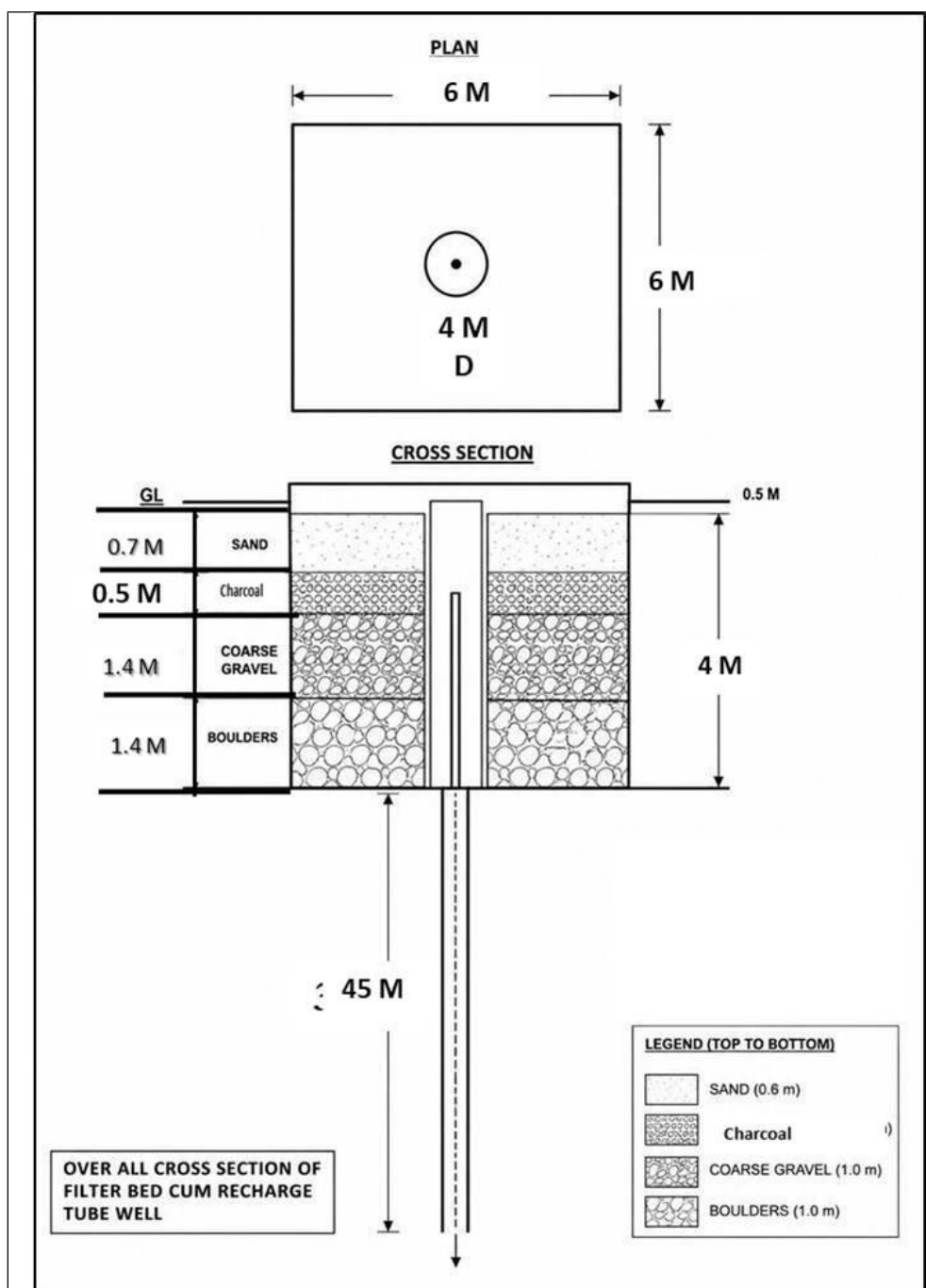


Fig. 3.3 Proposed Designs for Filter Bed and ARTW

4. Location 4 DPR – VIP Society, Nr. Street No. 13

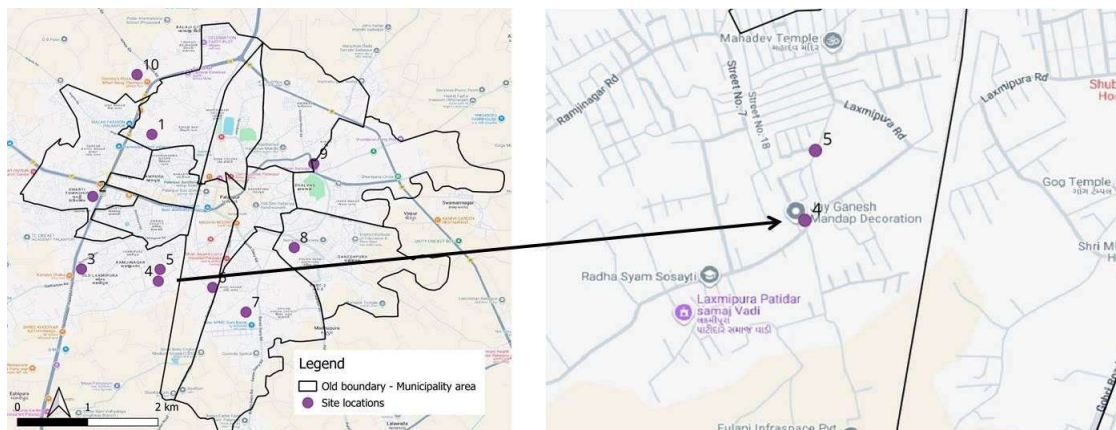


Fig. 4.1 Location Map of Site 4 – VIP Society

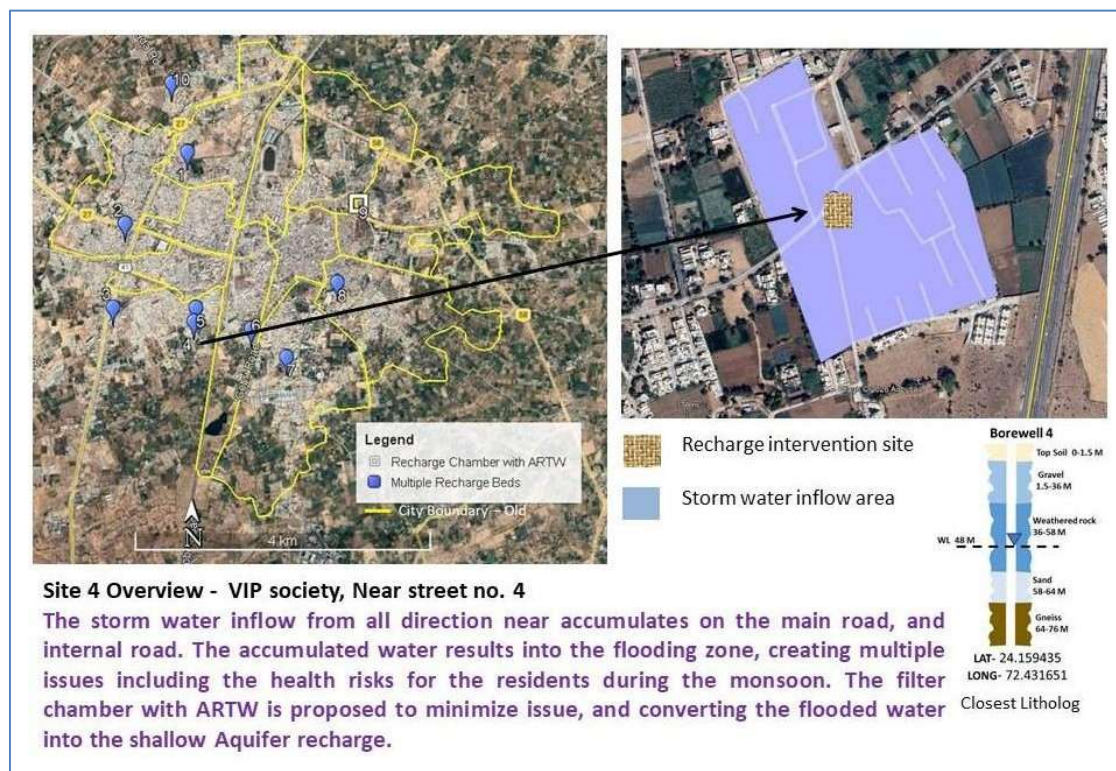


Fig. 4.2 Site Overview

Problem Description

The storm water inflow from northern direction accumulates at the backside of the settlement area; the accumulated water creates multiple health risks for the residents. **Urban flooding mitigation with the large recharge bed with ARTW** to minimize the flooding issue, and utilizing the fresh water as the shallow Aquifer recharge.

Catchment area information

Inflow Area	7 Ha
Water logging area	0.3 Ha

Geohydrological Potential		
Lithology	0-1.5 M – Top soil 1.5-36 M – Gravel 36-58 M– Weathered Rock	<p>Borewell 4</p> <p>Top Soil 0-1.5 M</p> <p>Gravel 1.5-36 M</p> <p>Weathered rock 36-58 M</p> <p>Sand 58-64 M</p> <p>Gneiss 64-76 M</p> <p>WL 48 M</p> <p>LAT- 24.159435 LONG- 72.431651</p>
Water Level	48 M	
Water Quality	3584 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Gravel Layer 3 - Weathered Rock	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	VIP Society, Nr. Street No. 13, 24.161° Lat., 72.4245556°Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer and another 1 layer
Technical Function	Collection of accumulated storm water from the open ground, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff through the settlement area, and open fields direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	Considering the large inflow area, flooding zone, and intervention space availability. The site is feasible for The filter chamber with ARTW to minimize issue, and shallow Aquifer recharge.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location 24.161° Lat., 72.4245556°Long.	VIP Society, Nr. Street No. 13	Intercepts the water from the flood zone, and filtering
	Length	3 m	Intercepts storm water runoff in settlement area
	Width	3 m	Provides adequate infiltration area'
	Depth	4 m	Multi-stage recharge treatment

Filtration System	Sand Layer	0.7 m	Primary filtration of suspended solids
	Charcoal Layer	0.5 m	Removal of odour and chemical impurities
	Gravel Layer	1.4 m	Intermediate filtration and flow stabilization
	Boulder Layer	1.4 m	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell			
Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	45 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
Well Casing Arrangement	Blind Pipe	10 M	Prevents recharge into the first layer
	Slotted Pipes	35 M Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Filter Bed – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	3	3	4	36	Cum
2	Providing and laying percolated paver block on the top of the filter media	3	3		9	Sqm.
3	Providing and Laying different material as filter media					
	Sand	3	3	0.7	6.3	Cum.
	Charcoal	3	3	0.5	4.5	Cum.
	Gravel	3	3	1.4	12.6	Cum.
	Boulder	3	3	1.4	12.6	Cum.

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	3x 3 x 4 M	SqM	18500	166500
ARTW	45 M	RM	2625	118125
			Grand Total	284625

ARTW – Measurement Sheet							
S. No.	Item	No.	Length (M)	Width (M)	Height/ Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			45	45.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			45	45.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	35	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of RCC casing pipe and strainer pipes at the site of work as detailed below;						
	A) Supply of 300 mm dia RCC Plain pipes used in RCC Tube-wells.	1			10	10.00	RM
	B) Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			35	35.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			45	29.97	KG
7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.

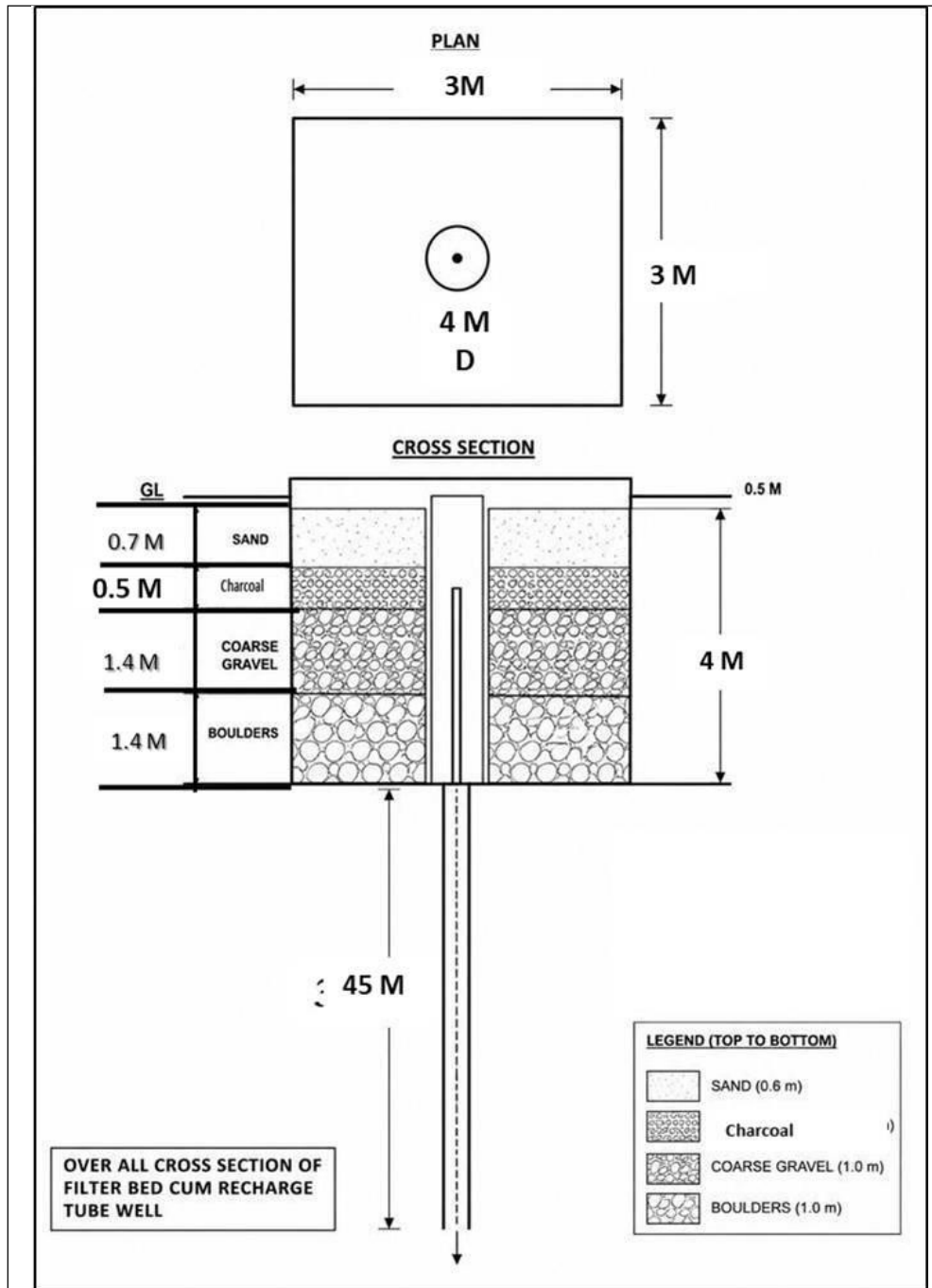


Fig. 4.3 Proposed Designs for Filter Bed and ARTW

5. Location 5 DPR – Nr. Laxmipura Dairy

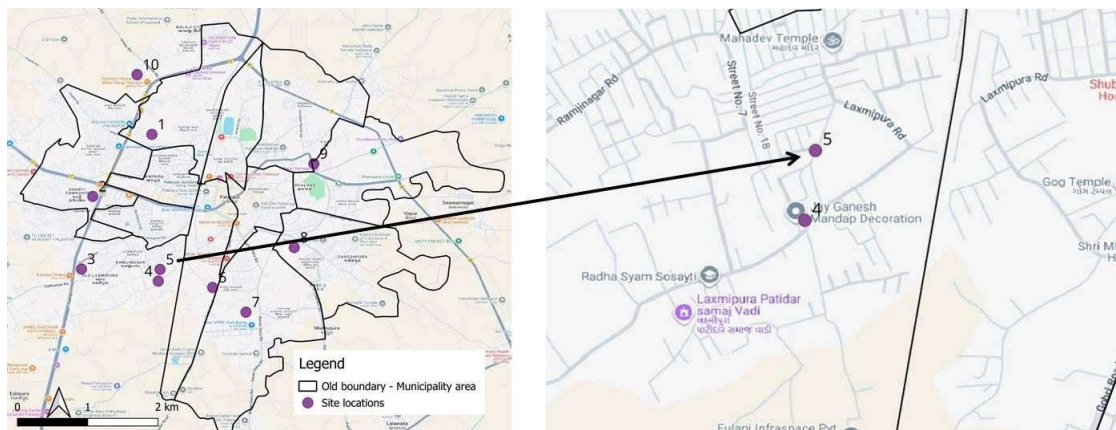


Fig. 5.1 Location Map of Site 5 Nr. Laxmipura Dairy

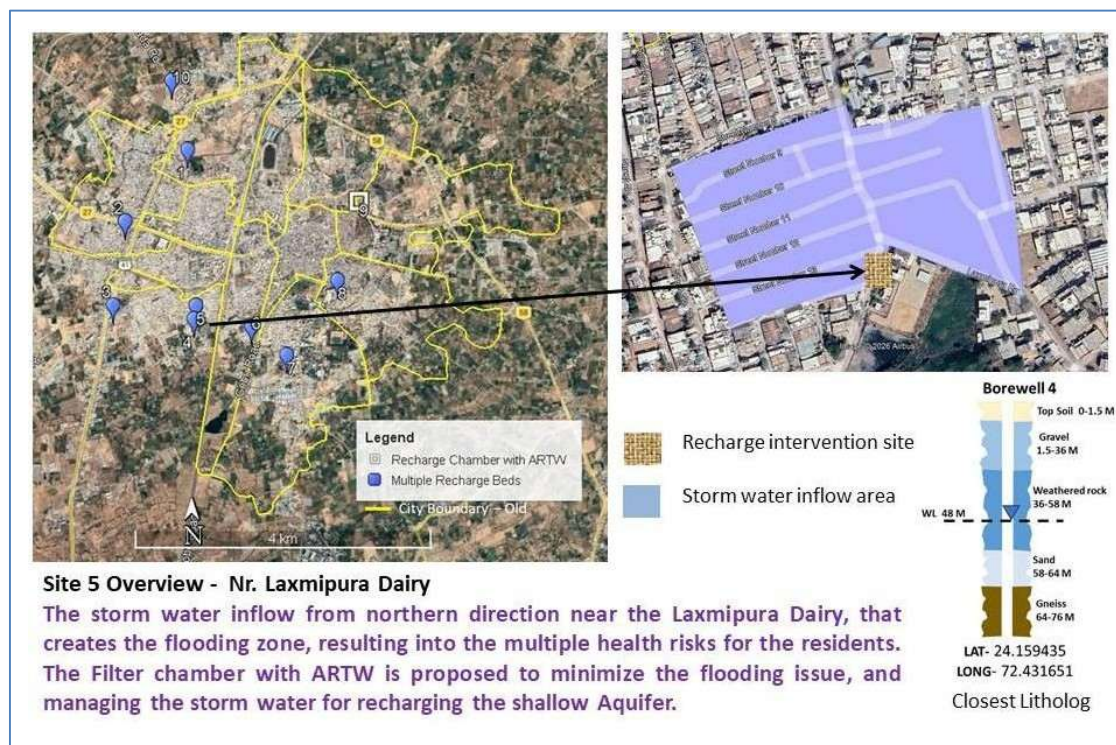


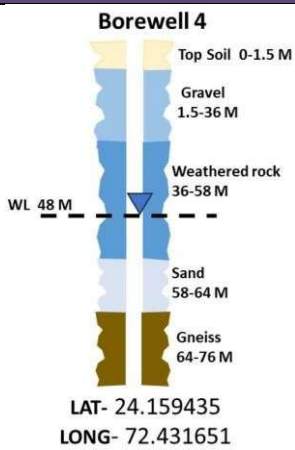
Fig. 5.2 Site Overview

Problem Description

The storm water inflow from northern direction near the Laxmipura Dairy that creates the flooding zone, resulting into the multiple health risks for the residents. **The Filter chamber with ARTW** is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.

Catchment area information

Inflow Area	4.48 Ha
Water logging area	0.2 Ha

Geohydrological Potential		
Lithology	0-1.5 M – Top soil 1.5-36 M – Gravel 36-58 M– Weathered Rock	 <p>Borewell 4</p> <p>Top Soil 0-1.5 M</p> <p>Gravel 1.5-36 M</p> <p>Weathered rock 36-58 M</p> <p>Sand 58-64 M</p> <p>Gneiss 64-76 M</p> <p>WL 48 M</p> <p>LAT- 24.159435 LONG- 72.431651</p>
Water Level	48 M	
Water Quality	3584 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Gravel Layer 3 - Weathered Rock	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	Nr. Laxmipura Dairy 24.162639°Lat., 72.4248056° Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer and another 1 layer
Technical Function	Collection of accumulated storm water from the settlement area, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff through the settlement area, and open fields direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	Site is convenient, to intercept the inflow storm water having availability for the intervention space. The Filter chamber with ARTW is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location 24.161° Lat., 72.4245556°Long.	VIP Society, Nr. Street No. 13	Intercepts the water from the flood zone, and filtering
	Length	3 m	Intercepts storm water runoff in settlement area
	Width	3 m	Provides adequate infiltration area'
	Depth	3 m	Multi-stage recharge treatment
Filtration	Sand Layer	0.6 m	Primary filtration of suspended

System			solids
	Charcoal Layer	0.4 m	Removal of odour and chemical impurities
	Gravel Layer	1 m	Intermediate filtration and flow stabilization
	Boulder Layer	1 m	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell			
Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	45 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
Well Casing Arrangement	Blind Pipe	10 M	Prevents recharge into the first layer
	Slotted Pipes	35 M Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Filter Bed – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	3	3	3	27	Cum
2	Providing and laying percolated paver block on the top of the filter media	3	3		9	Sqm.
3	Providing and Laying different material as filter media					
	Sand	3	3	0.6	5.4	Cum.
	Charcoal	3	3	0.4	3.6	Cum.
	Gravel	3	3	1.0	9.0	Cum.
	Boulder	3	3	1.0	9.0	Cum.

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	3x 3 x 3 M	SqM	12500	105000
ARTW	45 M	RM	2625	118125
			Grand Total	217500

ARTW – Measurement Sheet							
S. No.	Item	No.	Length (M)	Width (M)	Height/ Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			40	40.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			40	40.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	40	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of strainer pipes at the site of work as detailed below;						
	Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			40	40.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			40	26.64	KG
7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.

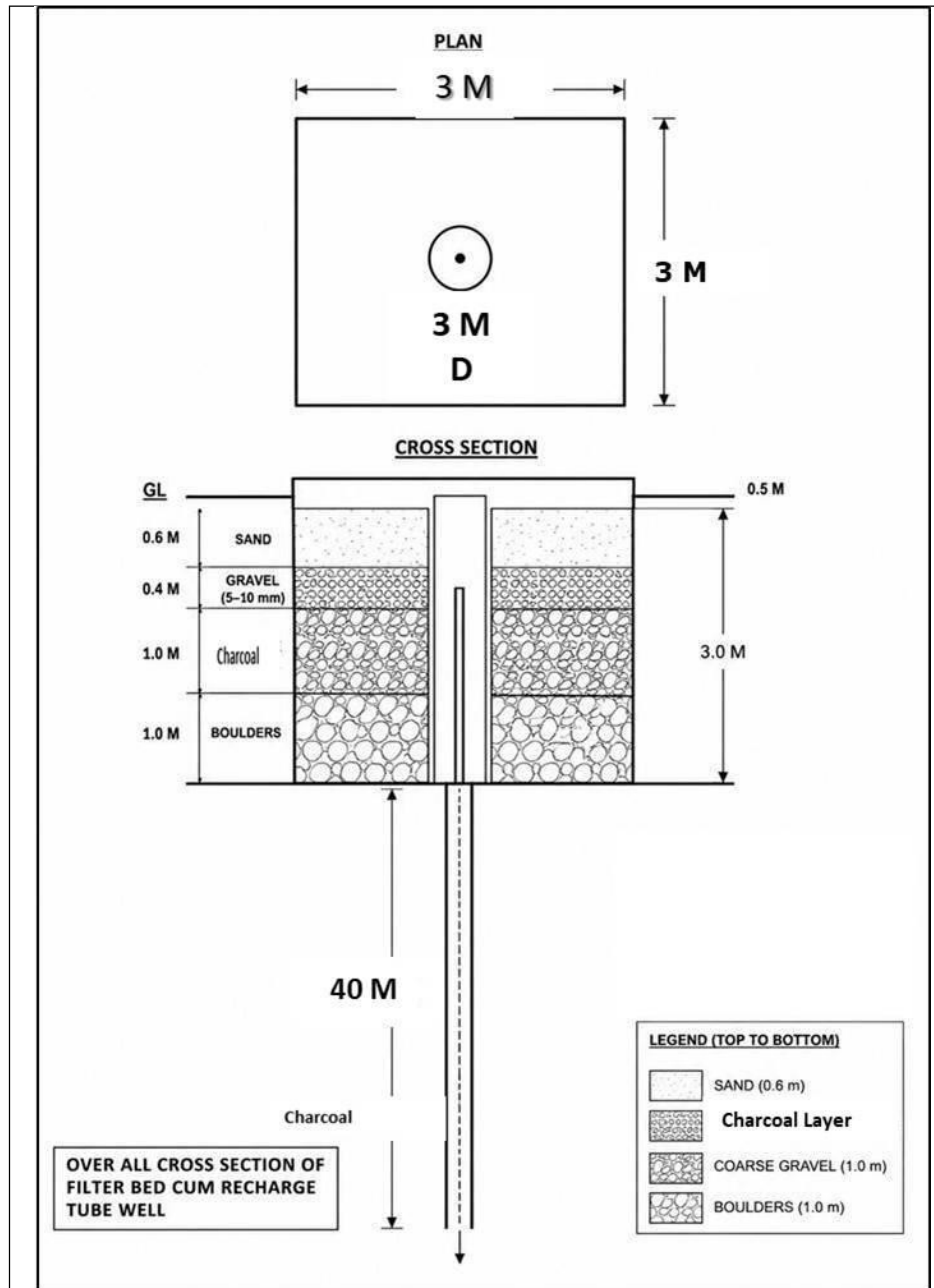


Fig. 5.3 Proposed Designs for Filter Bed and ARTW

6. Location 6 DPR – Karnawati School, Jagana-Gobri Road

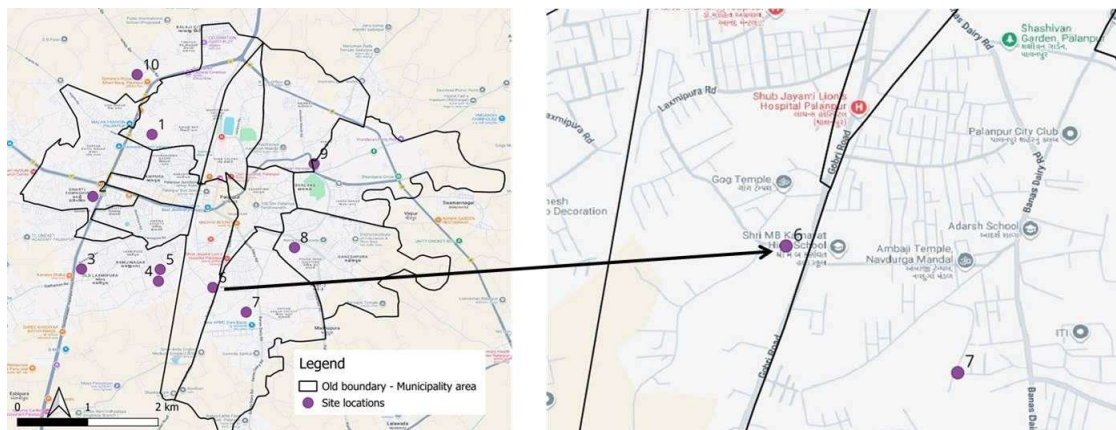


Fig. 6.1 Location Map of Site 6 Karnawati School, Jagana-Gobri Road

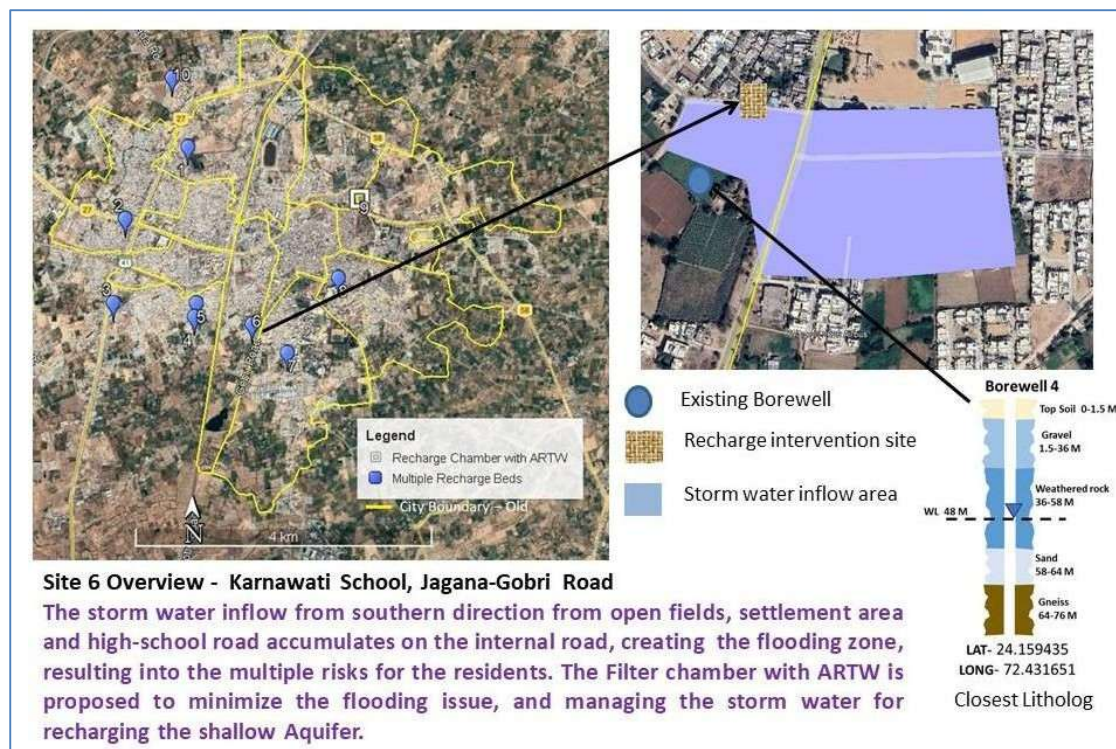


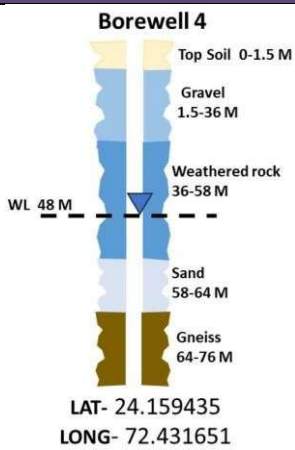
Fig. 6.2 Site Overview

Problem Description

The storm water inflow from southern direction from open fields, settlement area and high-school road accumulates on the internal road, creating the flooding zone, resulting into the multiple risks for the residents. **The Filter chamber with ARTW** is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.

Catchment area information

Inflow Area	5.6 Ha
Water logging area	0.2 Ha

Geohydrological Potential		
Lithology	0-1.5 M – Top soil 1.5-36 M – Gravel 36-58 M– Weathered Rock	 <p>Borewell 4</p> <p>Top Soil 0-1.5 M</p> <p>Gravel 1.5-36 M</p> <p>Weathered rock 36-58 M</p> <p>Sand 58-64 M</p> <p>Gneiss 64-76 M</p> <p>WL 48 M</p> <p>LAT- 24.159435 LONG- 72.431651</p>
Water Level	48 M	
Water Quality	3584 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Gravel Layer 3 - Weathered Rock	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	Karnawati School, Jagana-Gobri Road, 24.160111° Lat., 72.4321667° Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer and another 1 layer
Technical Function	Collection of accumulated storm water from the settlement area, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff through the settlement area, and open fields direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	Due to the availability of intervention space and flooding zone factors. The Filter chamber with ARTW is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location 24.160111° Lat., 72.4321667° Long.	Karnawati School, Jagana-Gobri Rd.	Intercepts the water from the flood zone, filtering through the media
	Length	3 m	Intercepts storm water runoff in settlement area
	Width	3 m	Provides adequate infiltration area'
	Depth	3 m	Multi-stage treatment before recharge

Filtration System	Sand Layer	1 m thickness	Primary filtration of suspended solids
	HDPE Mesh	Layer separator	Prevents mixing of filtration layers
	Charcoal Layer	0.6 m thickness	Removal of odour and chemical impurities
	Gravel Layer	0.4 m thickness	Intermediate filtration and flow stabilization
	Boulder Layer	1 m thickness	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell			
Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	40 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
	Slotted Pipes	40 m Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Filter Bed – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	3	3	3	27	Cum
2	Providing and laying percolated paver block on the top of the filter media	3	3		9	Sqm.
3	Providing and Laying different material as filter media					
	Sand	3	3	0.6	5.4	Cum.
	Charcoal	3	3	0.4	3.6	Cum.
	Gravel	3	3	1.0	9.0	Cum.
	Boulder	3	3	1.0	9.0	Cum.

ARTW – Measurement Sheet							
S. No.	Item	No.	Length (M)	Width (M)	Height/ Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			40	40.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			40	40.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	40	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of strainer pipes at the site of work as detailed below;						
	Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			40	40.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			40	26.64	KG
7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	3x 3 x 3 M	SqM	12500	105000
ARTW	45 M	RM	2625	118125
			Grand Total	217500

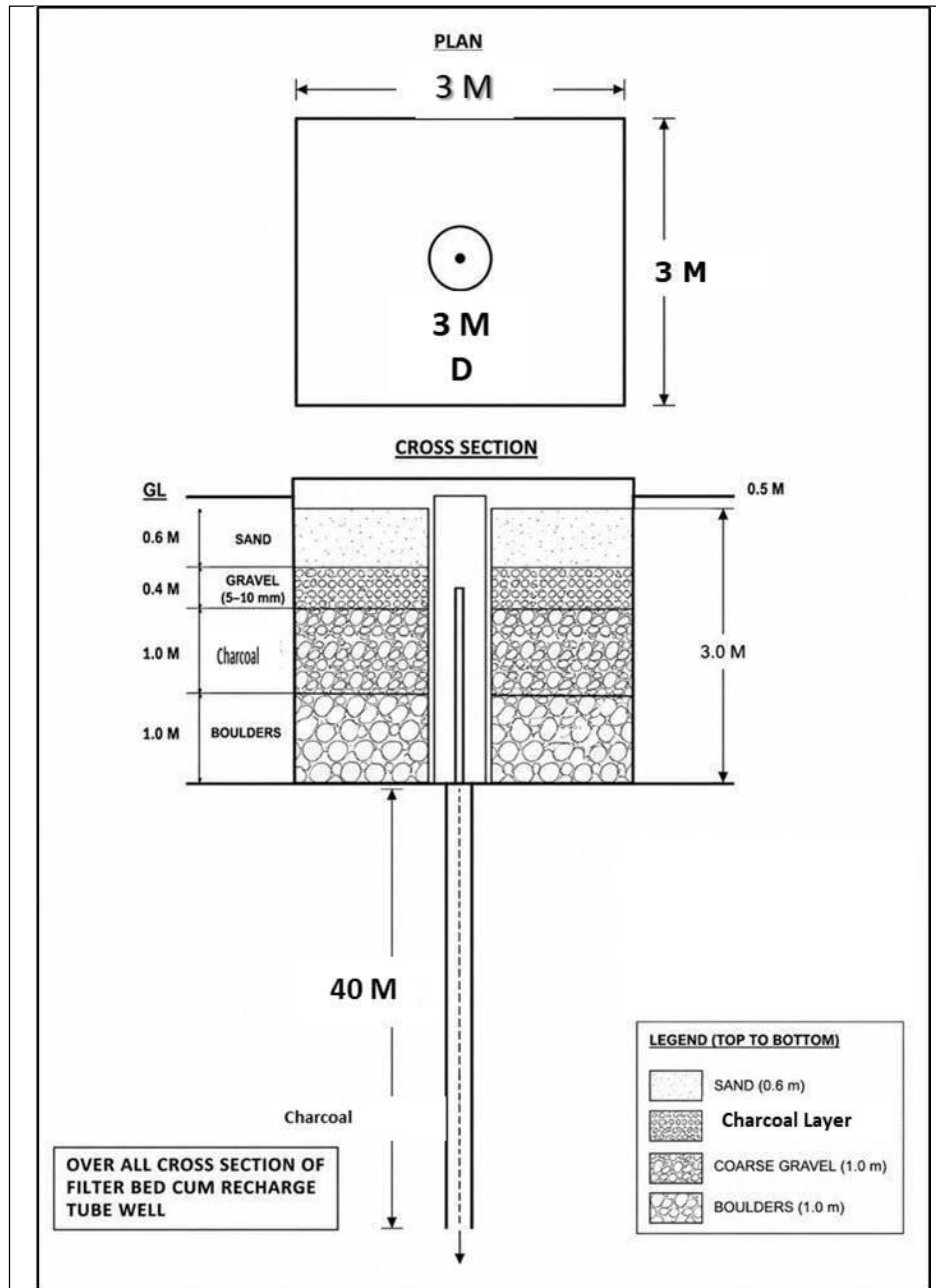


Fig. 6.3 Proposed Designs for Filter Bed and ARTW

7. Location7 DPR – Surya Nagar, Nr. Banas dairy Road

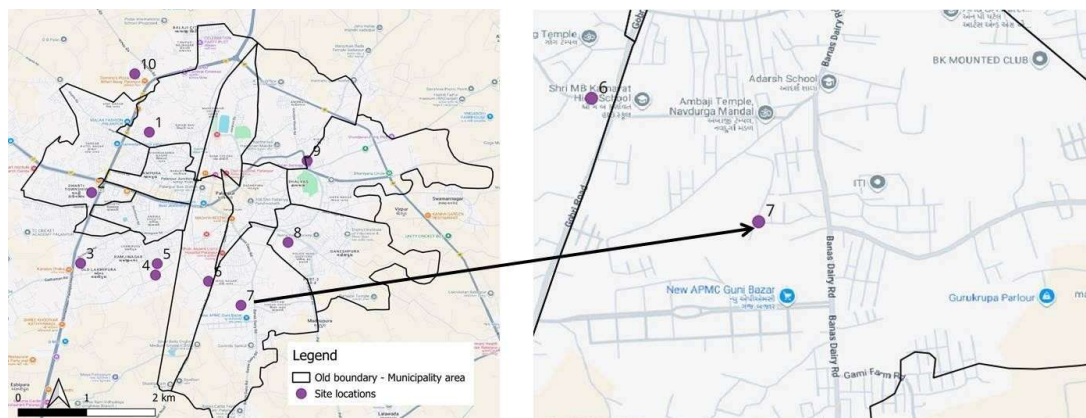


Fig. 7.1 Location Map of Site 7 – Surya Nagar

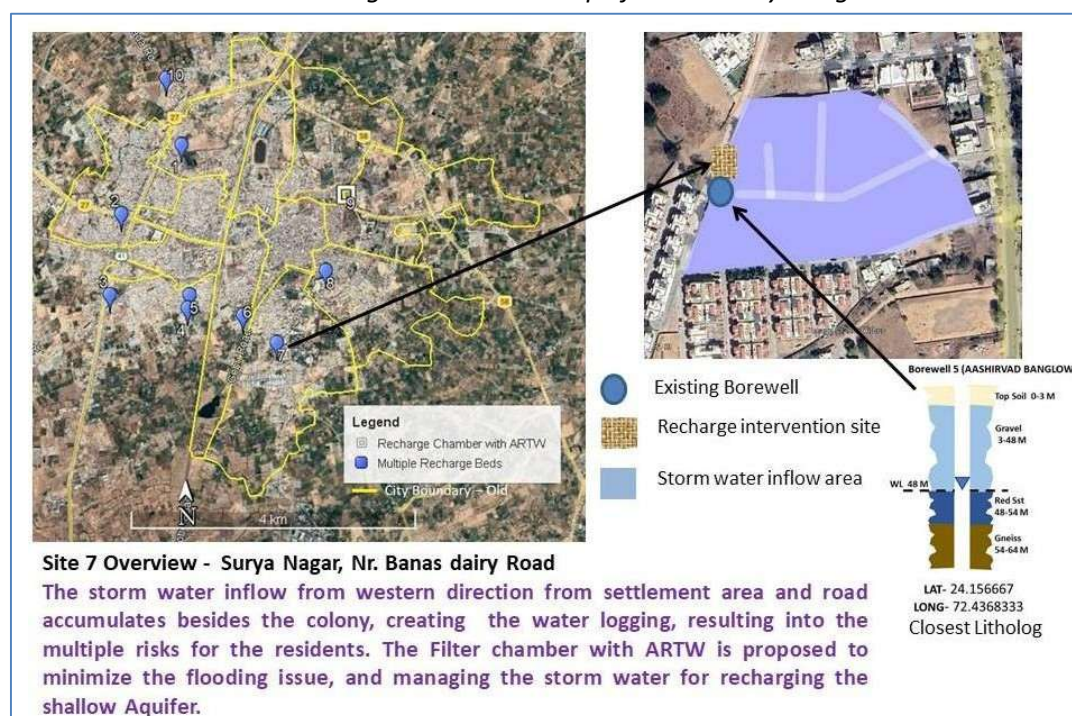


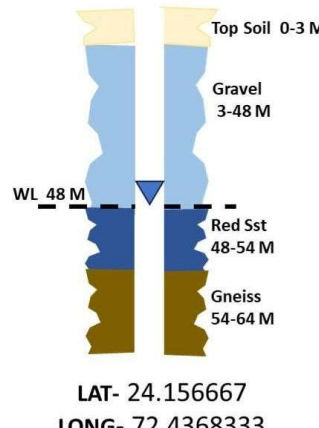
Fig. 7.2 Site Overview

Problem Description

The storm water inflow from western direction from settlement area and road accumulates besides the colony, creating the water logging, resulting into the multiple risks for the residents. **The Filter chamber with ARTW** is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.

Catchment area information

Inflow Area	1.86 Ha
Water logging	0.10 Ha

Geohydrological Potential		
Lithology	0-3M – Top soil 3-48 M - Gravel 48 -54 M - Red Sst 54-64 M - Gneiss	 <p>Top Soil 0-3 M Gravel 3-48 M Red Sst 48-54 M Gneiss 54-64 M WL 48 M LAT- 24.156667 LONG- 72.4368333</p>
Water Level	45 M	
Water Quality	2176 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Gravel	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	Surya Nagar, Nr. Banas dairy Road, 24.156667°Lat., 72.4368333°Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer Layer
Technical Function	Collection of accumulated storm water besides the society, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff through the settlement area, and direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	The freshwater usually runoff and creating water logging is captured through the filter bed and ARTW. The availability of excess fresh water makes the location ideal for capturing and utilizing storm water.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location 24.156667°Lat., 72.4368333°Long	Surya Nagar, Nr. Banas dairy Road,	Intercepts the water from the flood zone, filtering through the media
	Length	3 m	Intercepts storm water runoff
	Width	3 m	Provides adequate infiltration area
	Depth	4 m	Multi-stage recharge treatment

Filtration System	Sand Layer	0.7 m	Primary filtration of suspended solids
	Charcoal Layer	0.5 m	Removal of odour and chemical impurities
	Gravel Layer	1.4 m	Intermediate filtration and flow stabilization
	Boulder Layer	1.4 m	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell

Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	30 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
Well Casing Arrangement	Slotted Pipes	30 M Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Estimated Cost of the Intervention

Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	3 x 3 x 4 M	SqM	18500	166500
ARTW	30 M	RM	2625	78750
			Grand Total	245250

Filter Bed – Measurement Sheet

S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	3	3	4	36.0	Cum
2	Providing and laying percolated paver block on the top of the filter media	3	3		9.0	Sqm.
3	Providing and Laying different material as filter media					
	Sand	3	3	0.7	6.3	Cum.
	Charcoal	3	3	0.5	4.5	Cum.

	Gravel	3	3	1.4	12.6	Cum.
	Boulder	3	3	1.4	12.6	Cum.

ARTW – Measurement Sheet							
S. No.	Item	No.	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			30	30.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			30	30.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	30	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of strainer pipes at the site of work as detailed below;						
	Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			30	20.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			30	19.98	KG
7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.

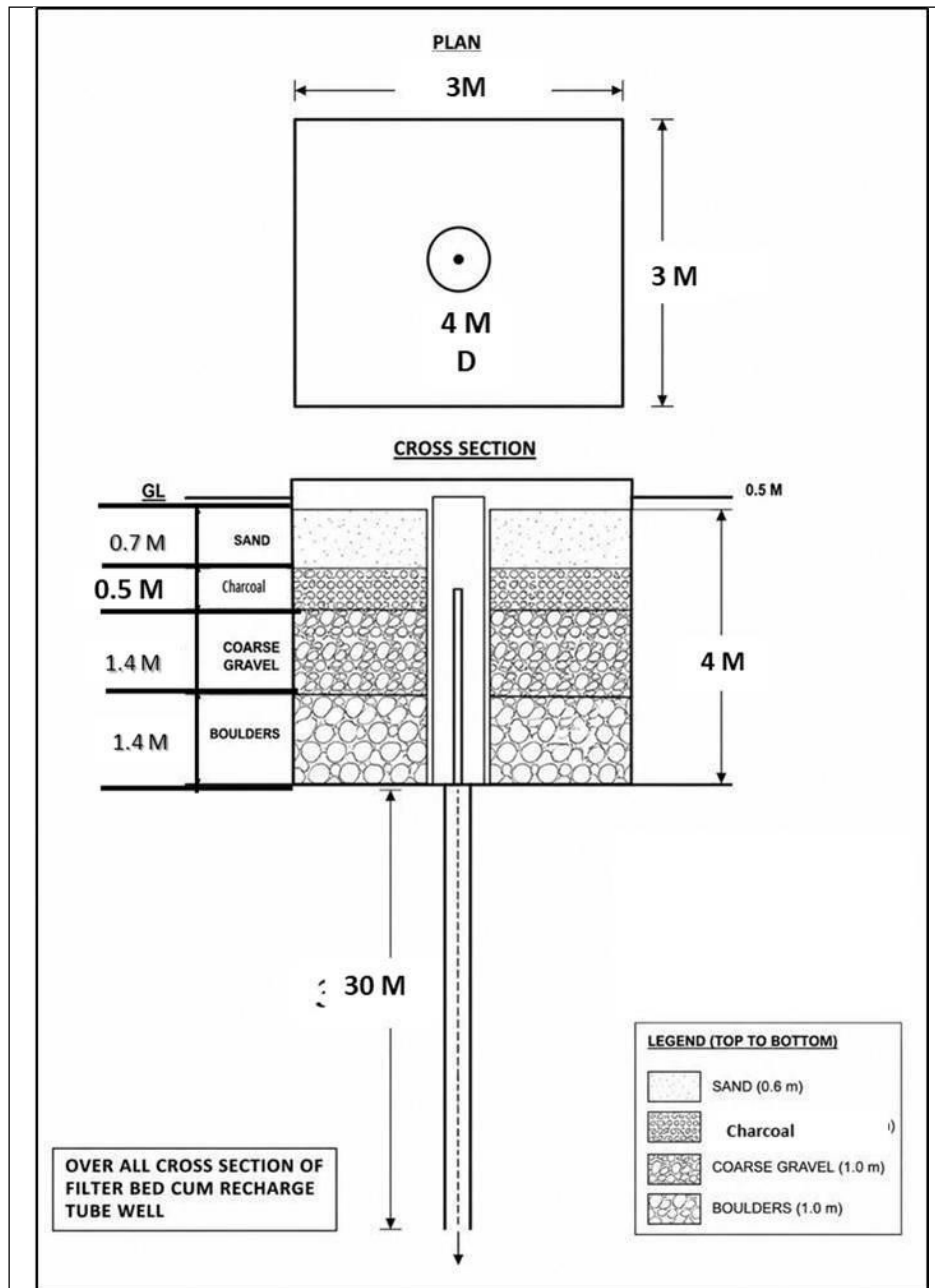


Fig. 7.3 Proposed Designs for Filter Bed and ARTW

8. Location 8 DPR – Baudeep Society, Opp BLPL Library

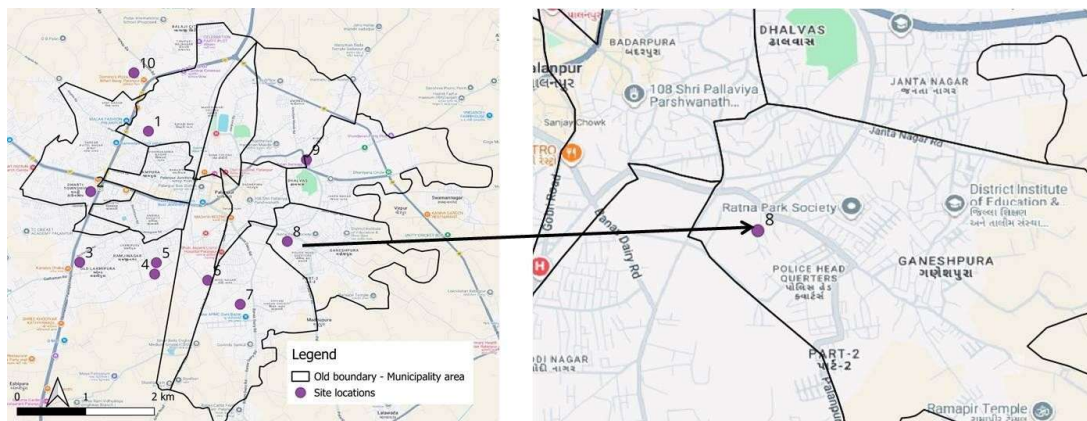


Fig. 8.1 Location Map of Site 8 Baudeep Society, Opp BLPL Library

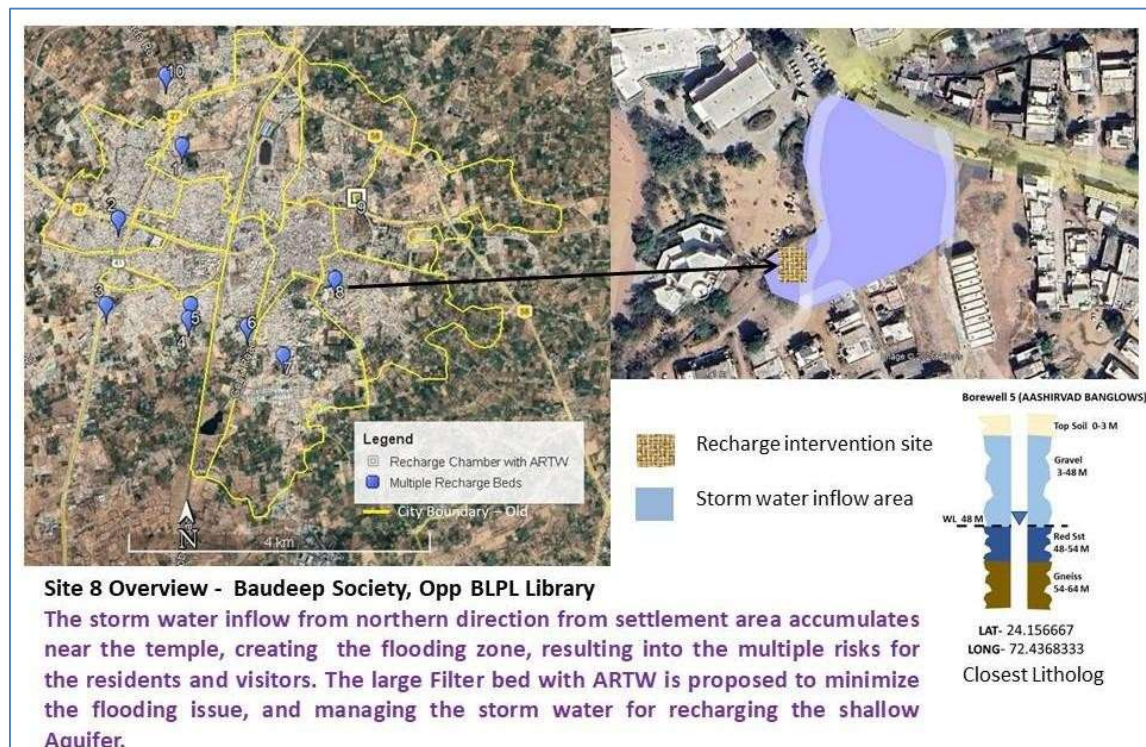


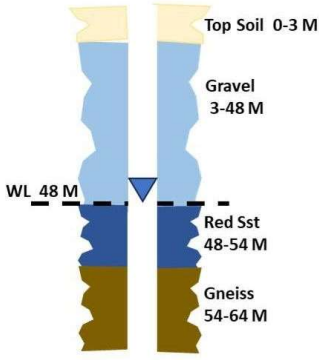
Fig. 8.2 Site Overview

Problem Description

The storm water inflow from northern direction from settlement area accumulates near the temple, creating the flooding zone, resulting into the multiple risks for the residents and visitors. **The large Filter bed with ARTW** is proposed to minimize the flooding issue, and managing the storm water for recharging the shallow Aquifer.

Catchment area information

Inflow Area	0.61 Ha
Water logging	0.10 Ha

Geohydrological Potential		
Lithology	0-3M – Top soil 3-48 M - Gravel 48 -54 M - Red Sst 54-64 M - Gneiss	 <p>LAT- 24.156667 LONG- 72.4368333</p>
Water Level	45 M	
Water Quality	2176 ppm TDS	
Targeted Aquifer for recharge	Layer2 - Gravel	

Proposed Intervention design : Filter Bed and ARTW	
Type of Structure	Filter Bed and ARTW
Existing Status	The fresh water loss due to overflow runoff
Location	Baudeep Society, Opp BLPL Library, 24.165694° Lat., 72.4435833° Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer Layer
Technical Function	Collection of accumulated storm water besides the society, filtration through filter bed, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff nr. The temple side, and direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	The freshwater usually runoff and creating water logging is captured through the filter bed and ARTW. The availability of excess fresh water makes the location ideal for capturing and utilizing storm water.

Design Specifications of Proposed Storm water Filter bed			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Filter bed with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location	Surya Nagar, Nr. Banas dairy Road, .	Intercepts the water from water logging area near the temple side, filtering through the media
	Length	6 m	Intercepts storm water runoff and water logging zone
	Width	6 m	Provides adequate infiltration area
	Depth	4 m	Multi-stage treatment before recharge

Filtration System	Sand Layer	0.5 m	Primary filtration of suspended solids
	Charcoal Layer	0.7 m	Removal of odour and chemical impurities
	Gravel Layer	1.4 m	Intermediate filtration and flow stabilization
	Boulder Layer	1.4 m	High permeability base directing water to recharge wells

Design Specifications of Proposed Artificial Recharge Tubewell			
Component	Parameter	Specification	Purpose / Function
ARTW	Diameter	1 m	Allows sufficient recharge capacity
	Depth	30 m	Facilitates vertical recharge into Shallow and the deeper aquifer zones
Well Casing Arrangement	Slotted Pipes	30 M Alternate slotted	Prevents entry of surface contaminants and recharges into the targeted layers
Hydraulic Function	Inflow Source	Water logging zone	Utilizes accumulated storm water
	Recharge Mechanism	Multi-layer filtration and vertical percolation in slotted casing	Enhances groundwater recharge

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Filter Bed	6 x 6 x 4 M	SqM	18500	666000
ARTW	30 M	RM	2625	78750
			Grand Total	744750

Filter Bed – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	6	6	4	144	Cum
2	Providing and laying percolated paver block on the top of the filter media	6	6		36	Sqm.
3	Providing and Laying different material as filter media					
	Sand	6	6	0.5	18.0	Cum.
	Charcoal	6	6	0.7	25.2	Cum.
	Gravel	6	6	1.4	50.4	Cum.
	Boulder	6	6	1.4	50.4	Cum.

ARTW – Measurement Sheet							
S. No.	Item	No.	Length (M)	Width (M)	Height/ Depth (M)	Total Qty.	Unit
1	Drilling of 250 mm dia pilot bore hole in all type of strata by mud flush direct rotary rig from 0.00 M to specified depth.	1			30	30.00	RM
2	Reaming of 250 mm dia bore hole to following size of bore including Assembling, jointing, clamping, lowering RCC, housing, casing, strainer pipes and other assembly items with black crush metal packing and clay packing etc. Completing 600 mm dia bore hole from Specified depth.	1			30	30.00	RM
3	Providing selected black crush metal of 10 mm to 20 mm mix size.	3.14	0.45	0.15	30	1.35	Cum.
4	Air compressor 400 CFM / 100 PSI upto specify depth.	1				1.00	Job
5	Providing and supplying of strainer pipes at the site of work as detailed below;						
	Supply of 300 mm dia RCC Strainer pipes used in RCC Tube-wells.	1			30	20.00	RM
6	Providing and supplying suitable size of bore plug, RCC pipe clamp, Nut-Bolts and Bottom Lowering Plate.	0.666			30	19.98	KG
7	Providing MS Clamp made from MS plate with three holes on either side with nuts & bolts of Std. make and suitable size.	1				1.00	No.

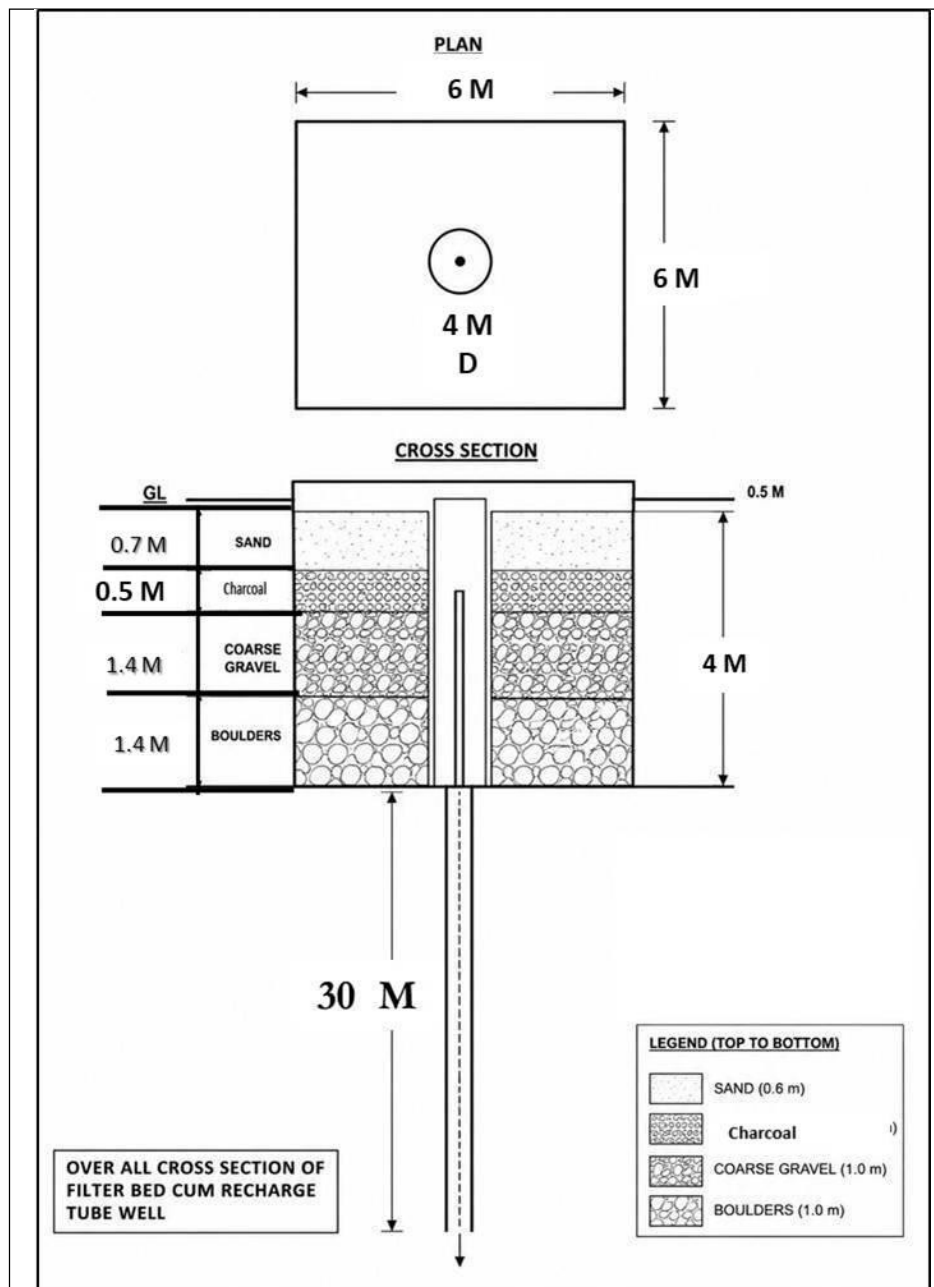


Fig. 8.3 Proposed Designs for Filter Bed and ARTW

9. Location 9 DPR – Mafatpura, Nr. Rampir Mandir

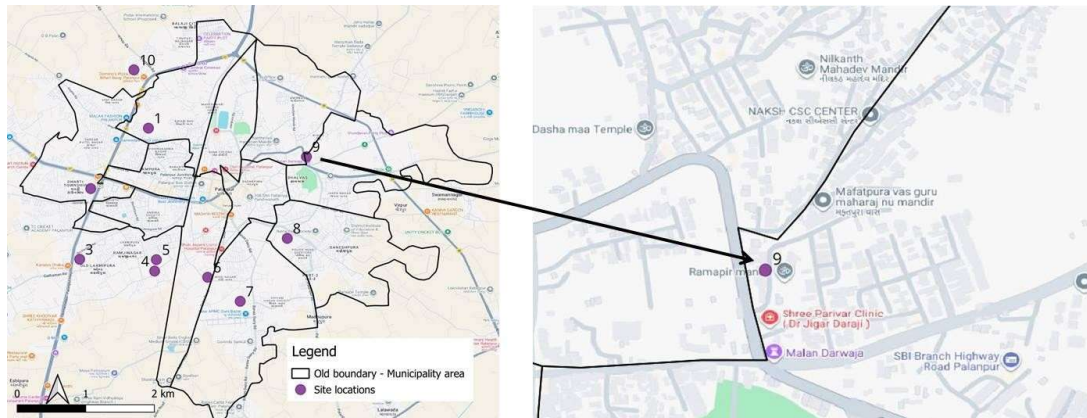


Fig. 9.1 Location Map of Site 9 Mafatpura

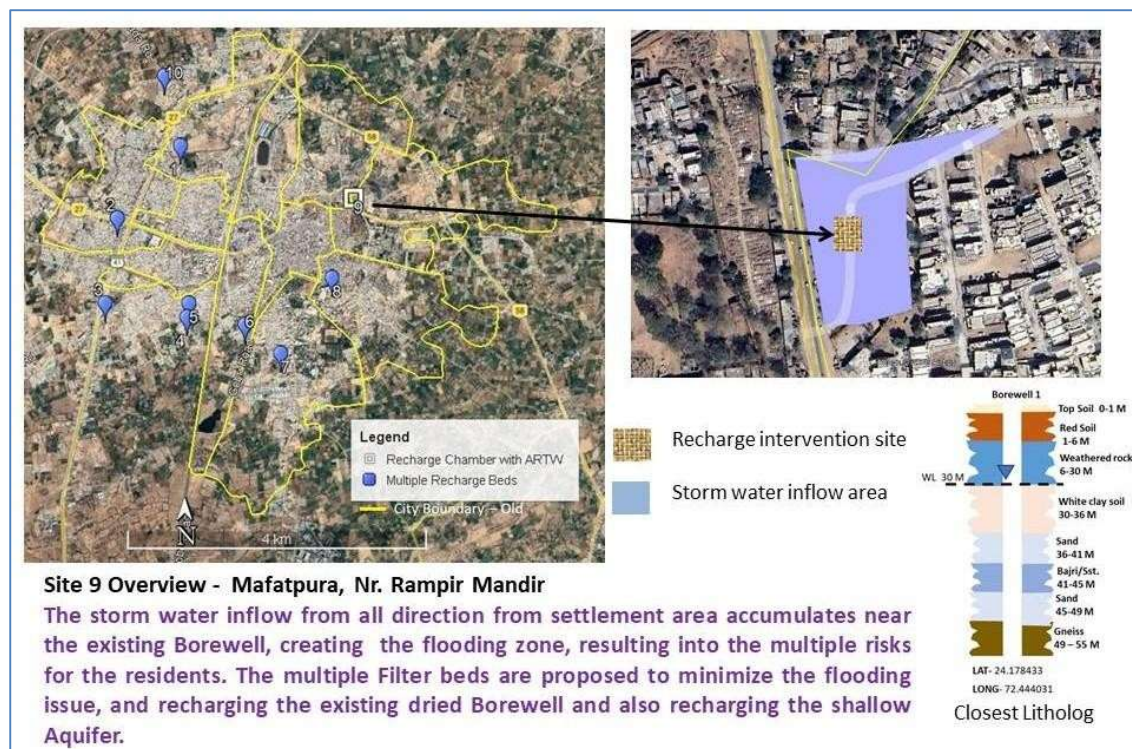
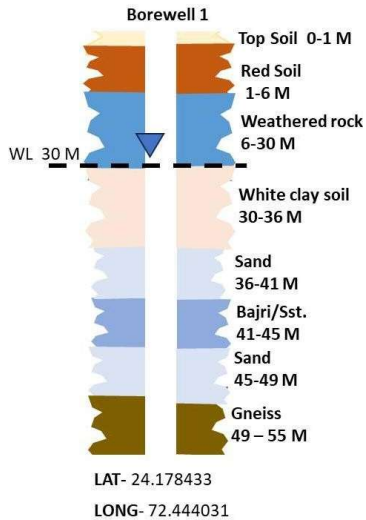


Fig. 9.2 Site Overview

Problem Description

The storm water inflow from all direction from settlement area accumulates near the existing Borewell, creating the flooding zone, resulting into the multiple risks for the residents. The **multiple Filter beds** are proposed to minimize the flooding issue, and recharging the existing dried Borewell and also recharging the shallow Aquifer.

Catchment area information	
Inflow Area	0.81Ha
Water logging	0.10 Ha

Geohydrological Potential		
Lithology	0-1M – Top soil 1- 6 M – Red Soil 6 - 30 M – Weathered Rock 30 -36 M – White clay soil 36-41 Sand 41-45 Bajri + Sst. 45-49 Sand 49-55 Gneiss	 <p>Borewell 1</p> <p>Top Soil 0-1 M</p> <p>Red Soil 1-6 M</p> <p>Weathered rock 6-30 M</p> <p>White clay soil 30-36 M</p> <p>Sand 36-41 M</p> <p>Bajri/Sst. 41-45 M</p> <p>Sand 45-49 M</p> <p>Gneiss 49-55 M</p> <p>WL 30 M</p> <p>LAT- 24.178433</p> <p>LONG- 72.444031</p>
Water Level	30 M	
Water Quality	1344 ppm TDS	
Targeted Aquifer for recharge	Layer2 – Red Soil	

Proposed Intervention design : Multiple Recharge Pits	
Type of Structure	Recharge Pits
Existing Status	The fresh water loss due to overflow runoff
Location	Mafatpura, Nr. Rampir Mandir, 24.177417° Lt., 72.4463333° Long.
Objective	Utilization of storm water inflow for groundwater recharge in Shallow Aquifer Layer
Technical Function	Collection of accumulated storm water from the flooding zone, filtration through filter media, and conveyance of filtered water into shallow Aquifer recharge
Rationale for Intervention	Intercepts storm water runoff at the multiple locations on the road, and direct into the Shallow Aquifer layer after the filtration.
Benefits	Reduced fresh water loss, improved storm water management, enhanced groundwater recharge
Justification for Structure Selection	The site is feasible to recharge the Shallow Aquifer, through the existing dried-up Borewell.

Design Specifications of Proposed Storm water Recharge Pits			
Component	Parameter	Specification	Purpose / Function
General Layout	Intervention Type	Recharge Pits with filter media	To reduce waterlogging while enhancing groundwater recharge into the Shallow Aquifer
	Location 24.177417° Lt., 72.4463333° Lng.	Mafatpura, Nr. Rampir Mandir,	Intercepts the water from water logging area from the settlement and road side, through multiple filter beds, filtering through the media for groundwater recharge
	Length	3 m	Intercepts storm water runoff and water logging zone
	Width	3 m	Provides adequate infiltration area
	Depth	3 m	Multi-stage recharge treatment
Filtration System	Sand Layer	1 m thickness	Primary filtration of suspended solids
	HDPE Mesh	Layer separator	Prevents mixing of filtration layers
	Charcoal Layer	0.6 m thickness	Removal of odour and chemical impurities
	Gravel Layer	0.4 m thickness	Intermediate filtration and flow stabilization
	Boulder Layer	1 m thickness	High permeability base directing water to recharge wells

Estimated Cost of the Intervention				
Intervention	Component	Unit	Unit Cost INR	Total INR
Recharge Pits	3 x 3 x 3 M (4 No.s)	Sq M	12,500	4,50,000

Recharge Pits – Measurement Sheet						
S. No.	Item	Length (M)	Width (M)	Height/Depth (M)	Total Qty.	Unit
1	Excavation for percolation bed in all types of soil	3	3	3	27.0	Cum
2	Providing and laying percolated paver block on the top of the filter media	3	3		9.0	Sqm.
3	Providing and Laying different material as filter media					
	Sand	3	3	0.4	3.6	Cum.
	Charcoal	3	3	0.6	5.4	Cum.
	Gravel	3	3	1	9.0	Cum.
	Boulder	3	3	1	9.0	Cum.

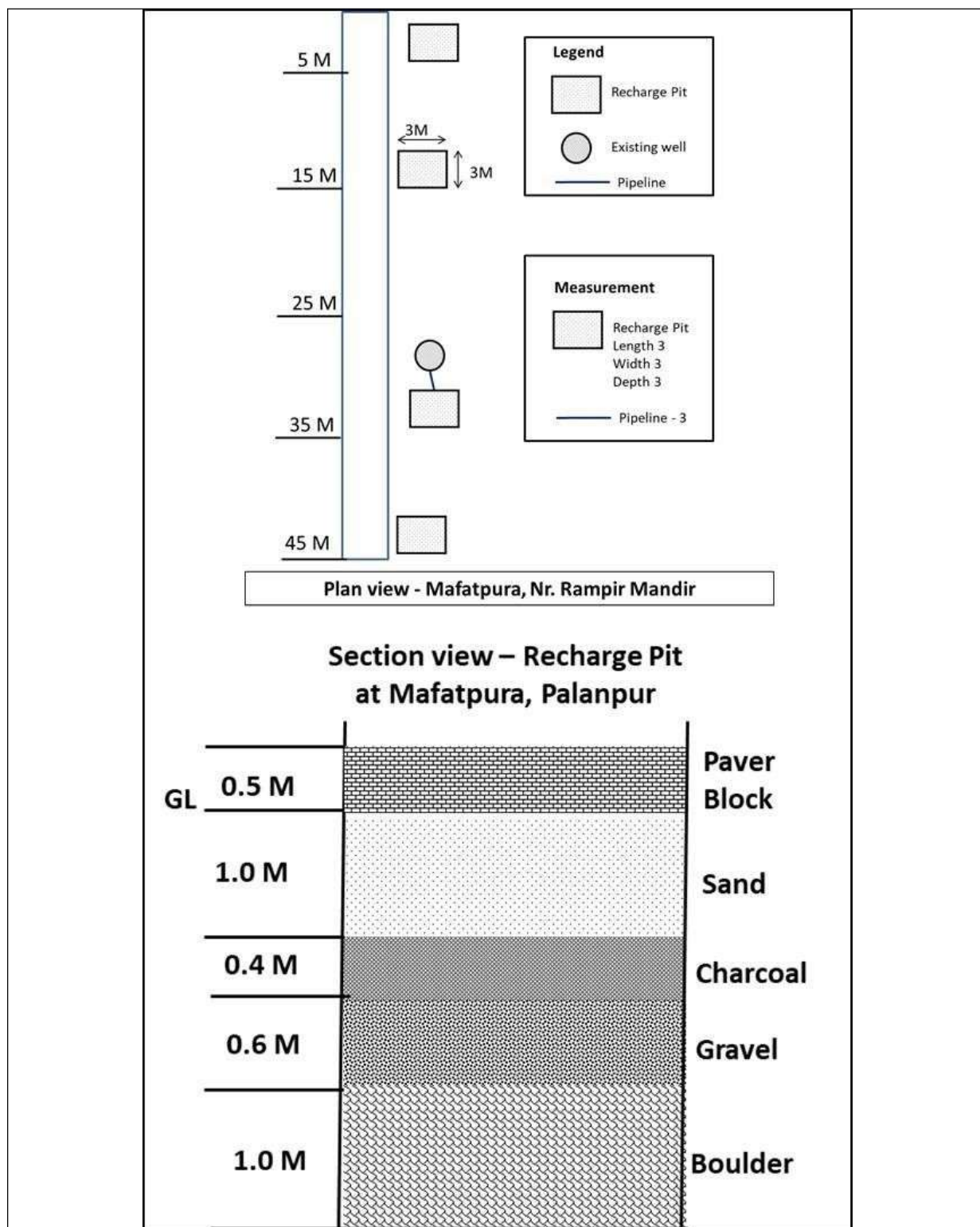


Fig. 9.3 Proposed Designs for Filter Beds

Annexure A : Site wise estimated coast with Intervention dimension (Summary Sheet)

S. No.	Site Name & Intervention	Lat.	Long.	Components	Dimensions in M (l * w * d)	Unit	Unit Cost	Qty	Estimated Cost INR
1	New Aman Park, Opp. Hanuman Tekri Cross Road	24.1815°	72.4236667°	Filter Bed	4 M length x 2 M Width x 4 M depth	SQM	18500	8	148000
				ARTW	30 M Depth	RM	2625	30	78750
2	SBI Society, Nr. Ahmedabad-Palanpur Highway	24.172833°	72.4153889°	Filter Bed	6 M length x6 M Width x 4 M depth	SQM	18500	36	666000
				ARTW	45 M Depth	RM	2625	45	118125
3	Ashirbad Bungalows, Nr. Ahmedabad-Palanpur Highway	24.162694°	72.4138056°	Filter Bed	6 M length x6 M Width x 4 M depth	SQM	18500	36	666000
				ARTW	45 M Depth	RM	2625	45	118125
				Cleaning of existing nearby Borewell		No.	20000	1	20000
4	VIP Society, Nr. Street No. 13	24.161°	72.4245556°	Filter Chamber	3 M x 3 M x 4 M Depth	SQM	18500	9	166500
				ARTW	45 M Depth	RM	2625	45	118125
5	Laxmipura Dairy	24.162639°	72.4248056°	ARTW	40 M Depth	RM	2625	40	105000
				Filter Chamber	3 M x 3 M x 3 M Depth	SQM	12500	9	112500
6	Kanawati School, Jagana-Gobri Road	24.160111°	72.4321667°	Filter Chamber	3 M x 3 M x 3M	SQM	12500	9	112500
				ARTW (40M Depth)	40 M Depth	RM	2625	40	105000

Table 2: Site wise estimated coast with Intervention dimension continued

S. No.	Site Name & Intervention	Lat.	Long.	Components	Dimensions in M (l * w * d)	Unit	Unit Cost	Qty	Estimated Cost INR
7	Surya Nagar, Nr. Banas dairy Road	24.156667°	72.4368333°	Filter Chamber	3 M x 3 M x 4 M Depth	SQM	18500	9	166500
				ARTW (30M Depth)	30 M Depth	RM	2625	30	78750
8	Baudeep Society, Opp BLPL Library	24.165694°	72.4435833°	Filter Bed	6 M length x6 M Width x 4 M depth	SQM	18500	36	666000
				ARTW (30 M Depth)	30 M Depth	RM	2625	30	78750
9	Mafatpura, Nr. Rampir Mandir	24.177417°	72.4463333°	Recharge Bed	3 M x 3 M x 3 M	SQM	12500	9	112500
				Recharge Bed	3 M x 3 M x 3 M	SQM	12500	9	112500
				Recharge Bed	3 M x 3 M x 3 M	SQM	12500	9	112500
				Recharge Bed	3 M x 3 M x 3 M	SQM	12500	9	112500
Subtotal of All Sites									39,74,625
	GST	GST with respect to the cost of all sites (1-9) @ 18%							7,15,432
	Contingency @ 1%								46,900
	Operation and Maintenance	Lump sum O&M for two years							2,20,000
	IEC sign board as per sample given in agreement	IEC sign board at 9 sites							45,000
Total									50,01,957