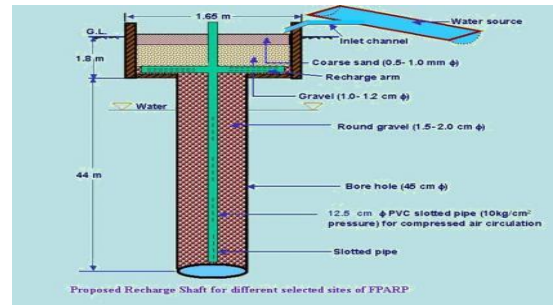
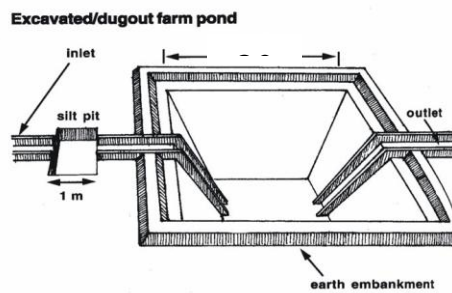




**CENTRAL GROUND WATER BOARD**  
MINISTRY OF WATER RESOURCES,  
RIVER DEVELOPMENT & GANGA REJUVENATION  
GOVERNMENT OF INDIA



**ARTIFICIAL RECHARGE TO GROUND WATER AND  
WATER CONSERVATION PLAN OF BAYANA  
BLOCK, DISTRICT BHARATPUR, RAJASTHAN**

Western Region, Jaipur  
January 2017

# ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN OF BAYANA BLOCK, DISTRICT BHARATPUR

## Plan at a Glance

1.	<b>Area of the Bayana Block</b>	<b>808.69 sq. km.</b>
2.	<b>Area identified for Artificial Recharge</b>	<b>676.31 sq km</b>
3.	<b>Dynamic Ground Water Resources (as on 31.03.2011)</b>	
	Net Ground Water Availability	<b>81.14 MCM</b>
	Annual Ground Water Draft	<b>79.63 MCM</b>
	Stage of Ground Water Development	<b>98.14%</b>
4.	<b>Volume of water to be harnessed</b>	<b>3.788 MCM</b>
	<b>Volume of water available for recharge through RS</b>	<b>2.555 MCM</b>
	<b>Volume of water available for recharge through PT</b>	<b>0.80 MCM</b>
5.	<b>Volume of unsaturated aquifer zone available for recharge</b>	<b>601.35 MCM</b>
6.	<b>Total number of structures to be proposed</b>	
	<b>Recharge structures</b>	<b>73 shafts in 45</b>
	Existing village pond with recharge shaft/ well	<b>Nos. of existing</b>
		<b>village ponds</b>
	Percolation Tanks	<b>04 Nos</b>
	Sprinkler Irrigation	<b>300 ha</b>
	<b>Expected Annual GW recharge</b>	<b>2.684 MCM</b>
	<b>Provision for supplemental irrigation, thus reducing GW withdrawal for irrigation</b>	<b>0.24</b>
	<b>Total recharge/ saving of ground water</b>	<b>2.924 MCM</b>
7.	<b>Estimated Cost</b>	<b>7.34 crore</b>
	Artificial Recharge Plan	5.25 crore
	Sprinkler Irrigation	1.50 crore
	Piezometer construction	0.24 crore
	Operation and maintenance	0.35 crore

# ARTIFICIAL RECHARGE TO GROUND WATER AND WATER CONSERVATION PLAN OF BAYANA BLOCK, DISTRICT BHARATPUR

## Introduction

The **Bayana Block, district Bharatpur** is one of the critical blocks of Rajasthan and provides favourable conditions for artificial recharge, with stage of ground water development of 98.14%. 676.31 sq. km. area is potential zone area and thus feasible for artificial recharge.

## Location of the block

The Bayana Block of Bharatpur District covering an area of 808.69 Sq. Km. falls in southern part of Bharatpur District and is located between North latitudes 27°48' & 28°13' and East longitudes 76°43' & 76°58'.

## Surface Water Availability

As per the studies carried out by Water Resources Department (WRD), Government of Rajasthan there is very little surplus water available for further development at 75% dependability. Based on the data made available from GWD, the surplus runoff available at 75% dependability level has been worked out for the zones as part of watershed within the block. The nature of aquifer (Alluvium/ Hard rock) is also considered while computing the number of Artificial Recharge structures feasible.

Accordingly about 3.788 MCM has been considered for recharge plan in the block. Optimum utilization of rainwater runoff depends on availability of land, feasible conditions, etc. Volume of Aquifer available for Artificial Recharge is given in **Table.1**

## Supply Side Management

### Feasible Artificial Recharge and Water Conservation Structures

About 0.035 mcm/year surplus has been considered for each recharge shaft and 0.2 mcm/year for percolation tank wherever feasible. The areas with shallow water level (<5m) have not been considered for construction of Artificial Recharge Structures

The number of Recharge Shaft is decided based on the number of suitable ponds available within the zone. If still some surplus remained unallocated, than few Percolation tanks are proposed at suitable locations. However, in some of the blocks entire available surplus cannot be utilized due to non availability of ponds for Recharge shaft or suitable location for Percolation tanks. Zone wise number of Recharge Structures proposed to be constructed is given in **Table 2**.

**Table 1: Volume of Aquifer available for artificial recharge**

District	Block	Area of Block (Sq.km.)	Potential area suitable for recharge (Sq.km.)	Type of Aquifer	Area feasible for artificial recharge (Sq km)	Sp Yield	Average DTW (mbgl) NOV 2013	Thickness of unsaturated zone 3 m below ground level (m)	Volume of sub surface storage space available for artificial recharge (MCM)
Bharatpur	Bayana	808.69	676.31	SR	509.11	0.12	12.54	9.54	582.83
				HR	167.2	0.02	8.54	5.54	18.53

**Table 2: Number of recharge structure**

ZoneCode	Sub_Basin	Type of Aquifer	Zone-Area (sq. km.)	Total Surplus (mcm)	Water Level >5m	Feasible RS_Prop	Feasible PT_Prop
Banganga_Banganga_012_RJ0601_AL	Banganga	SR	1.602	0.000	N	0	0
Banganga_Banganga_014_RJ0601_AL	Banganga	SR	3.317	0.000	N	0	0
Banganga_Banganga_017_RJ0601_AL	Banganga	SR	57.404	0.000	Y	0	0
Banganga_Banganga_025_RJ0601_AL	Banganga	SR	0.006	0.000	N	0	0
Gambhir_Gambhir_003_RJ0601_SR	Gambhir	SR	4.410	0.009	N	0	0
Gambhir_Gambhir_004_RJ0601_AL	Gambhir	SR	140.651	0.988	Y	5	3
Gambhir_Gambhir_006_RJ0601_AL	Gambhir	SR	184.459	0.823	Y	23	0
Gambhir_Gambhir_007_RJ0601_AL	Gambhir	SR	158.667	0.913	Y	15	1
Gambhir_Gambhir_011_RJ0601_SR	Gambhir	SR	100.829	0.000	N	0	0
Gambhir_Gambhir_011_RJ0601_SR	Gambhir	SR	0.000	1.055	Y	30	0
Gambhir_Gambhir_013_RJ0601_SR	Gambhir	SR	133.903	0.000	Y	0	0
Parbati_Parbati_005_RJ0601_SR	Parbati	SR	7.123	0.000	N	0	0
				<b>3.788</b>		<b>73</b>	<b>4</b>

## Recharge Shaft

It is proposed to construct Recharge Shaft in existing ponds. The selected ponds should be atleast 3m deep and shallow ponds will be deepened accordingly. It is proposed that the inlet for the Recharge Shaft should be atleast 1m above bed of pond so that the pond retains adequate water for use by villagers.

. The tentative location of villages for construction of recharge shaft/well in existing village pond and their cost estimates are shown in Fig 1 and Table 3.

**Table 3: Tentative locations of village for village pond with recharge shaft**

S.No.	Village	Long	Lat	Watershed	No of Shafts	Unit cost (Rs in lac)	Total cost (Rs in lac)
1	Khatnawali	77.261	27.007	Gambhir_Gambhir_004_RJ0601_AL	1	5.0	5.0
2	Nayagaon Kalan	77.244	26.999	Gambhir_Gambhir_004_RJ0601_AL	1	5.0	5.0
3	Dehgawan	77.272	26.989	Gambhir_Gambhir_004_RJ0601_AL	1	5.0	5.0
4	Agawali	77.337	27.004	Gambhir_Gambhir_004_RJ0601_AL	1	5.0	5.0
5	Milakpur	77.391	27.011	Gambhir_Gambhir_004_RJ0601_AL	1	5.0	5.0
6	Bayana (M)	77.281	26.924	Gambhir_Gambhir_006_RJ0601_AL	1	5.0	5.0
7	Bayana (M)	77.283	26.906	Gambhir_Gambhir_006_RJ0601_AL	1	5.0	5.0
8	Bayana (M)	77.297	26.905	Gambhir_Gambhir_006_RJ0601_AL	1	5.0	5.0
9	Bayana (M)	77.295	26.903	Gambhir_Gambhir_006_RJ0601_AL	1	5.0	5.0
10	Nagla Chheetariya	77.287	26.974	Gambhir_Gambhir_006_RJ0601_AL	1	5.0	5.0
11	Bhagori	77.263	26.984	Gambhir_Gambhir_006_RJ0601_AL	2	5.0	10.0
12	Sikandara	77.255	26.868	Gambhir_Gambhir_006_RJ0601_AL	2	5.0	10.0
13	Mahloni	77.236	26.933	Gambhir_Gambhir_006_RJ0601_AL	3	5.0	15.0
14	Dhurairi	77.243	26.839	Gambhir_Gambhir_006_RJ0601_AL	3	5.0	15.0
15	Bhagori	77.250	26.971	Gambhir_Gambhir_006_RJ0601_AL	4	5.0	20.0
16	Bayana (M)	77.289	26.934	Gambhir_Gambhir_006_RJ0601_AL	4	5.0	20.0
17	Kair	77.114	26.909	Gambhir_Gambhir_007_RJ0601_AL	1	5.0	5.0
18	Khan Khera	77.136	26.907	Gambhir_Gambhir_007_RJ0601_AL	1	5.0	5.0
19	Bagren	77.197	26.896	Gambhir_Gambhir_007_RJ0601_AL	1	5.0	5.0
20	Mahrawar	77.184	26.881	Gambhir_Gambhir_007_RJ0601_AL	1	5.0	5.0
21	Madanpur	77.170	26.854	Gambhir_Gambhir_007_RJ0601_AL	3	5.0	15.0
22	Bagren	77.172	26.907	Gambhir_Gambhir_007_RJ0601_AL	4	5.0	20.0
23	Bhaja Moroli	77.102	26.892	Gambhir_Gambhir_007_RJ0601_AL	4	5.0	20.0
24	Kot	77.376	26.779	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
25	Kot	77.369	26.772	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
26	Kot	77.377	26.766	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
27	Kot	77.376	26.756	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
28	Jaisora	77.404	26.758	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
29	Jaisora	77.408	26.761	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
30	Kani	77.411	26.779	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0

31	Baisora	77.421	26.755	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
32	Baisora	77.428	26.755	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
33	Samantgarh	77.450	26.752	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
34	Chak Samantgarh	77.447	26.745	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
35	Baisora	77.437	26.731	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
36	Singhrawali	77.386	26.730	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
37	Singhrawali	77.387	26.724	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
38	Bajna	77.433	26.817	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
39	Bajna	77.436	26.803	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
40	Kani	77.415	26.789	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
41	Kani	77.408	26.787	Gambhir_Gambhir_011_RJ0601_SR	1	5.0	5.0
42	Kani	77.423	26.795	Gambhir_Gambhir_011_RJ0601_SR	3	5.0	15.0
43	Samantgarh	77.434	26.763	Gambhir_Gambhir_011_RJ0601_SR	3	5.0	15.0
44	Baisora	77.438	26.750	Gambhir_Gambhir_011_RJ0601_SR	3	5.0	15.0
45	Samantgarh	77.454	26.765	Gambhir_Gambhir_011_RJ0601_SR	3	5.0	15.0
				<b>Total</b>	<b>73</b>		<b>365</b>

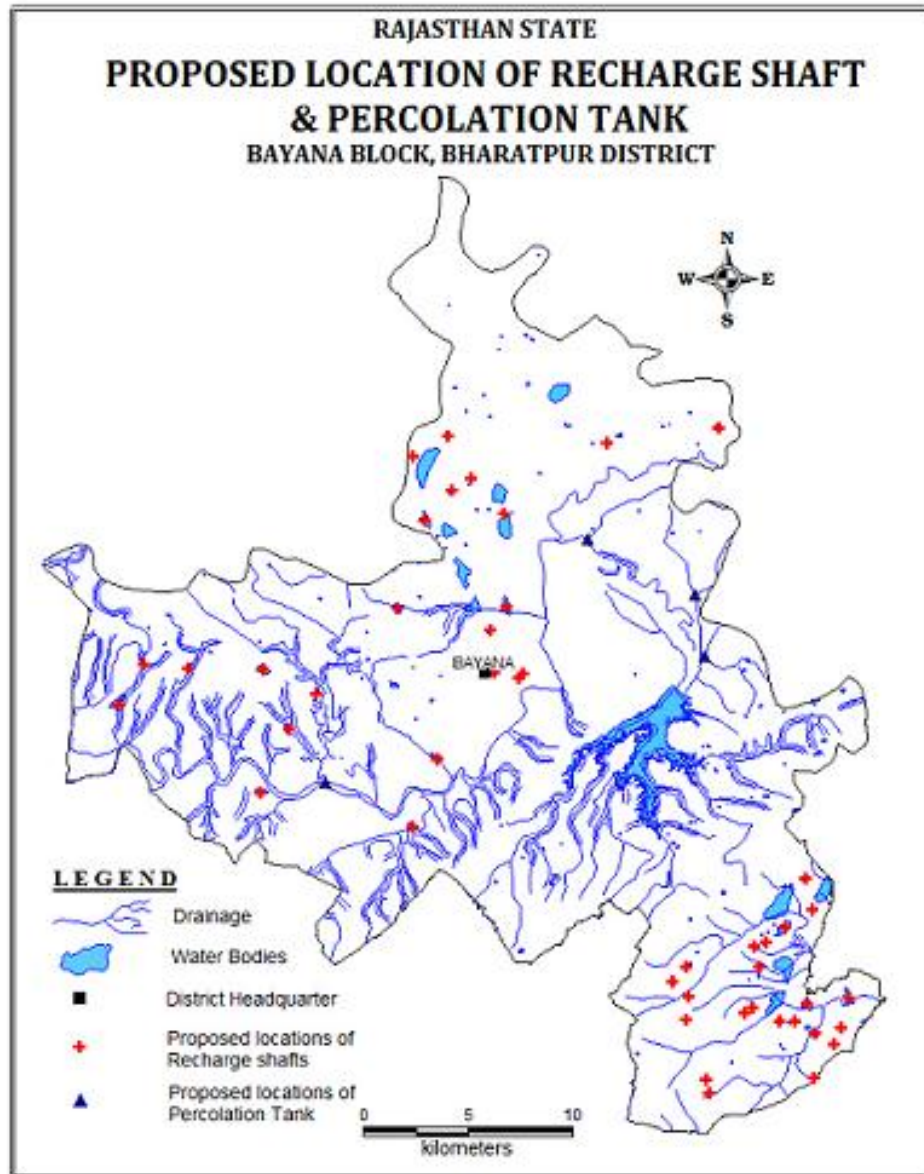
## Percolation Tank

The tentative location of villages for construction of percolation tank and their cost estimates are shown in Fig 1 and Table 4

**Table 4: Tentative locations of village for Percolation Tanks**

S. No.	Village	Longitude	Latitude	Micro Watershed	Unit Cost (Rs. In lacs)
1	Soopa	77.380	26.939	Gambhir_Gambhir_004_RJ0601_AL	40
2	Purabai Khera	77.328	26.963	Gambhir_Gambhir_004_RJ0601_AL	40
3	Mahmadpura	77.385	26.912	Gambhir_Gambhir_004_RJ0601_AL	40
4	Peelloopura	77.202	26.858	Gambhir_Gambhir_007_RJ0601_AL	40
				<b>Total</b>	<b>160</b>

**Fig: 1: Tentative location of Recharge Shaft and Percolation Tank**



## Demand Side Management

### Efficient Irrigation:

In Flood/ furrow irrigation method more than 50% of applied water is wasted through seepage to deeper levels, local inundation causes loss through evaporation and it leaches out the nutrients from the plants. While through drip and sprinkler irrigation method, wastage through irrigation losses could be minimized. Ground water usage can be minimized drastically by using HDPE pipes. Initially the scheme can be proposed to be started in 300 ha area, which is worst affected showing deepest water level and declining trends. The area is to be finalized based on land holdings, willingness of farmers and No Objection certificate from the land owner.

### Impact Assessment and Monitoring

Assessment of impact of the artificial recharge schemes implemented is essential to assess the efficacy of structures constructed. It helps in identification of cost-effective recharge mechanisms for optimal recharge into the ground water system. It also helps to make necessary modifications in site selection, design and construction of structures in future.

It is proposed to construct 40 piezometers, at suitable locations for monitoring of water levels, in the vicinity of proposed recharge structure.

### Revival, Repair of Water Bodies

The existing ponds and tanks with time loose their storage capacity as well as the natural ground water recharge through these water bodies has also become negligible due to siltation and encroachment by farmers for agriculture purposes. There are several such villages where ponds/ tanks are in dilapidated condition. These existing village tanks, which are normally silted and damaged, can be modified to serve as recharge structure in case these are suitably located to serve as percolation tanks. Through desilting, coupled with providing proper waste weir, the village tanks can be converted into recharge structure.

### Financial Outlay of the Plan

The total estimated cost of the Plan is Rs. 7.34 cr. The tentative cost estimates of the various activities of the Plan are shown in Table 5 & 6. The unit rates are as followed by the Govt. of Rajasthan (BSR).

**Table 5: Cost of the recharge structures**

Cost Recharge Shaft Rs in crs (Unit cost Rs 0.05 cr for alluvium and Rs 0.026 cr for hard rock)	Cost of Percolation Tank in Rs in crs (Unit cost Rs 0.4 cr)	Cost of Sprinkler irrigation in Rs (Unit cost 0.005 cr/ha)
Soft rock – 3.65	1.60	1.50



**Table 6: Tentative cost of different activities**

Feasible Artificial Recharge & Water Conservation structures/ activities	Tentative Design	Quantity (in nos. or area in ha)	Rainwater harvested (mcm ) or No. of sprinklers (/ha)	Tentative unit cost (in Rs lakh)	Total tentative cost (in Rs lakh)	Expected Annual GW recharge/ conservation (mcm) @ 0.8 mcm/structure
<b>Recharge Structures/ Activities</b>						
Recharge shaft within the pond /tanks	Alluvium – Depth 80m, Dia: 10-12” with filter pit	73	2.555	5	365	2.044
	Hard rock: Depth –60m, Dia 10-12”with filter pit	-	-	-	-	-
Percolation tanks (3 fillings)	200m*200m*1.5 m	4	0.80	40	160	0.64
Water Conservation Measures	Sprinkler Irrigation	300 ha	25	0.5/ha	150	0.24
		<b>Total</b>			<b>675</b>	<b>2.924</b>
<b>Impact assessment &amp; Monitoring</b>						
Piezometer	50 – 80 m	40		0.6	24	
<i>Impact assessment will be carried out by implementing agency</i>						
O & M - 5% of total cost of the scheme					34.95	
<b>TOTAL</b>					<b>733.95</b>	<b>2.924</b>

*Note: Type, number and cost of structure may vary according to site after ground verification*