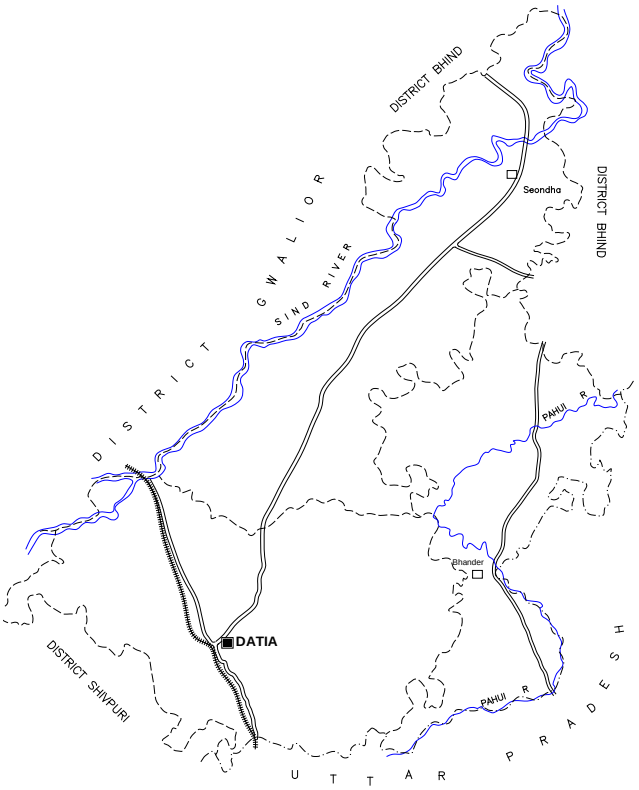
DISTRICT GROUND WATER INFORMATION BOOKLET

DATIA DISTRICT

MADHYA PRADESH



Ministry of Water Resources
Central Ground Water Board
North Central Region
Government of India
BHOPAL

July' 2009

DATIA DISTRICT AT A GLANCE

S.No.	Items	Statistics	
1.	**General Information**		
	i) Geographical area	2959 km^2	
	ii) Administrative Divisions (As on 2006) Number of Tehsil/Blocks Number of Panchayats/Villages	 3/3 281/583	
	iii) Population (Census 2001)	664159	
	iv) Average Annual Rainfall	793.8 mm	
2.	**Geomorphology**		
	1. Major Physiographic Units	i)Southern Hilly Region ii)North &Central Hilly Region iii)Cental Plain Region	
	2. Major Drainage	i) Sindh river &its tributaries ii) Pahuj & its tributaries	
3.	**Land Use (In Km^2)**		
	a) Forest area:	247.98	
	b) Net area sown:	2013.056	
	c) Cultivable area:	2485.31	
4.	**Major Soil Types**		
		Sandy clay loamy	
5.	**Area Under Principal Crops (June' 2006)**		
		792.84 Km^2	
6.	**Irrigation by Different Sources**		
		No.	**Area irrigated ($km^{2)}$**
	Dug wells	24679	685.08
	Tube wells/Bore wells	509	38.81
	Tanks/Ponds	2	5.74
	Canals	3	453.00
	Other Sources		18.84
	Net Irrigated Area		1201.47
	Gross Irrigated Area)		1220.34
7.	**Number 0f Ground Water Monitoring Wells of CGWB (As on 31.3.2007)**		
	Number of Dug Wells	7	
8	Predominant Geological Formations	Recent :Alluvium Gwalior series: Morar shale and Par quartzite Bundelkhand:Granites and granite gneisses	
9	**Hydrogeology**		
	Major Water Bearing Formation	Alluvium, Jointed and fractured granite sandstone and shale	

	Pre-monsoon depth to water level during 2006 **Post-monsoon** depth to water level during 2006 Long-term water level trend in 10 years (1997-2006)	8.34 to 27.12 mbgl 7.80 to 27.78 mbgl **Fall** 0.221-0.839 m/year (Pre-monsoon) 0.379 -0.959 m/year (Post-monsoon) **Rise** 0.054-0.251 m/year (Pre-monsoon) 0.007-0.027 (Post-monsoon)
10.	**Ground Water Exploration By CGWB (As on 31.3.2007)**	
	No of wells drilled (EW, OW, PZ, SH, Total)	14
	Depth Range	30-200 mbgl
	Discharge	1.920-21.25 lps
	Specific Capacity	6.50-172 **l/min/m**
	Transmissivity	16 m^2/day and 135 m^2/day .
11.	**Ground Water Quality**	
	Presence of Chemical constituents more than permissible limit (e.g. EC, F, As, Fe)	Nitrate
	Type of Water	Alkaline
12	**Dynamic Ground Water Resources 2004 (In MCM)**	
	Annual Replenishable Ground Water resources	418.28
	Net Annual Ground Water Draft	185.25
	Projected Demand for Domestic and Industrial uses up to 2025	18.92
	Stage of Ground Water Development	44 %
13	**Awareness and Training Activity**	
	Mass Awareness Programme Organised Number of Participant:	NIL
	Water Management Training Programme Number of Participant:	NIL
14	**Efforts of Artificial Recharge & Rainwater Harvesting**	
	Projects completed by CGWB	NIL
	Projects under technical guidance of CGWB	NIL
15	**Ground Water Control and Regulation**	
	Number of OE Blocks	NIL
	Number of Critical Blocks	NIL
	Number of Notified Blocks	NIL
16	**Major Groundwater Problems and Issues**	
		Depletion in groundwater level and rise of groundwater in canal command area

1.0 INTRODUCTION

Datia is the Smallest district of M.P. forming eastern part of Gwalior Commissionery. The district lies into a main body of land mostly on the Sindh -Paluj Doab and five enclaves (Basai,Kamra)surrounded by the portion of Shivpuri district and bordering Jhansi district of U.P. The main body of the district extends between the N-latitude 25^0, 28' and 26^0, 20' and E-Longitude 78^0, 10" and 78^0, 45'. The farthest enclaves extends in the South upto 25^0 3' N, near Talbahat. The district is bounded by Bhind and Gwalior (Main block) districts in the North, Shivpuri district of M.P and Jhansi district of U.P. in the south, Gwalior and Shivpuri (Main block) district in the west and Bhind district of M.P. & Jhansi district of U.P. in the East.(Plate I) . Datia, the district headquarters is the only town with sufficient urban activities and is connected with Gwalior & Jhansi by the Delhi-Bombay Main line of the Central Railway. It is also accessible by the roads from Gwalior, Jhansi, Bhander and Bhind.

The Datia district forms a part of Bundelkhand region covering an area of 2959 Sq.km The district is divided into three tehsils and three blocks of the same name i.e., Datia, Seondh and Bhander. The district is predominantly a rural district there are 4 towns and 583 villages. The district includes three tehsils and three blocks. The total population of the district of as per 2001 census is 664159 . The details of administrative units are given in Table -1.

Table-1: Administrative units of Datia District.(Census –2001**)**

S. N.	Tehsils	Blocks	Area in Sq. kms.	No. of village	No. of gram Panchayat	No.Janpad Panchavat	Population	Increase in 10 years in%	S.C. Population	S.T Population
1	Datia	Datia	1375	246	122	1	314556	22.97	78781	8655
2	Seondha	Seondha	926	197	91	1	209192	23.00	50983	999
3	Bhander	Bhander	654	140	68	1	140411	17.94	35667	1264
Total			2959	583	281	3	664159	21.82	165431	10918

The classification of the total area of the district reflects the extent of development of agricultural activities in the district and also represents the potential of cultivation of the area. The area under different land use and their percentage to the reported area of the district for the year 2006 is given in table -2.

Table-2: Land use pattern of Datia district.

S.No.	Type	Area in km^2
1	Forest	247.98
2	Not available for agriculture	362.04
3	Other non agricultural land	73.82
4	Agricultural land	2485.31
5	Fallow land	112.85
6	Total sown area	2013.056
7	Double crop area	323.26

1.1 Physiographiy and Drainage

The general level of the country is about 198 metres but the variations range from about 152 to 335 metres above the Mean Sea Level. The District can be studied under two physiographic divisions, viz. the Lower Extension of Bundelkhand Plateau and the Gangetic Plain, In Fact, the second division is also an imperfect fringe of the Gangetic alluvial-belt. The whole district is uniformly sloping towards the north-east but the mounds and hillocks of otherwise concealed granite are also marked intermittently on the plain.

Physiographically the district can be divided in to three parts.

1. Southern Hilly Region
2. North & Central Hilly Region
3. North & Central Plain Region

The main body of the district is drained by the two important rivers, viz, the Sind and Pahuj. The Sind flows along the western boundary for a considerable distance, whereas the Pahuj touches the eastern boundary only for about a kilometre and a half . Thus the drainage of the district is divided into these two rivers. The water divide line runs through the district from south-west to north-east. East of the water divide line the tributary streams flow towards the north-east while those in the west flow in a north-westerly direction and join Sind. Beyond the district boundary in the north, Pahuj, the eastern river, joins the Sind which itself joins the Yamuna. Thus the whole district falls in the Ganga basin. The character of the rivers is seasonal. Most of the streams and the span of the river-beds dry up in the winter and summer seasons. The run off in the rainy season is very large. The water potential has not been assessed so far.

1.2 IRRIGATION

The area is irrigated by tube wells, dug wells and tanks. The area irrigated by dug wells 56 %, tube wells 3 % and canal is 37 %. Thus, ground water is the main source of irrigation in the area.

1.3 CGWB ACTIVITES

Systematic hydrogeological survey was carried by the Shri M.L.Parmar ,Scinentist ‘B’,Central Ground Water Board during field season programme 1987-1988. District Ground water management studies have been carried out by Sh, Seraj Khan, Asstt. Hydrogeologist, Central Ground Water Board during field season programme 2001-02. Depostis wells of CGWB were drilled by direct rotary method in the area of the district.

While four exploratory wells, under contractual drilling programme of CGWB, were drilled by down to the hammer method in granitic terrain..

2.0 RAINFALL & CLIMATE

The climate of Datia district is characterized by a hot summer and general dryness except rainfall during the southwest monsoon season. The year can be divided in to four seasons. The cold season, December to February is followed by hot season. from March to about first week of June is the summer season. May is the hottest month of the year with temperature of 42.1^{0}C. The minimum during the January is 7.1 ^{0}C .

The southwest monsoon starts from middle of June and lasts till end of September. October and middle of November constitute the post monsoon or retreating monsoon season. The normal annual rainfall of Datia district is 793.8 m/hr. About 90.4 % of annual rainfall is received during monsoon season. Only 9.6 % of annual rainfall takes place between October to May.

The humidity comes down lowest in April. It varies between 26 % and 83 % at different time in different seasons. The wind velocity is high during the monsoon period as compared to pre and post monsoon. The wind velocity is highest in June around 11.3 km/hr and lowest is 3.1 km/hr in November. The average normal annual wind velocity of Datia district is 6.8 km/hr.

3.0 GEOMORPHOLOGY AND SOIL

The southern part around Datia town lies in the granite area and forms a somewhat barren and rocky tract. The tract lies above 213 metres and the prominent hills lie to the south-east and west of Datia. The hill near Gharwa is 308 metres, Udnu-Ki-toria 326 metres and Baroni hill 317 metres. The tract is gradually covered by the alluvium and the hard masses reappear only across the Sind on its north-western side. North-west of Seondha and the left bank of the Sind, a low range of sandstone hill overlook the river and extends up to its north-eastern bend in the District.

The height of the scarp on its south-eastern face is 30 to 01 metres. These hills join the Gwalior range in the west and slope towards the north, where also the rocks beneath the alluvium disappear. Among these hills there are three peaks which rise above 244 metres, the highest of 263 metres being in south. Seondha hill on the northern bank of the Sind, opposite the village is over 183 metres. The plateau area is either bare or stony on steep slopes or is covered with reddish soil or black cotton soil.

Most of the central and northern parts of the the District lie in the Sindh-Pahuj Doab which forms the southern margin of the Gangetic valley.

The central part of the District is from 183 to 213 metres above the Mean Sea Level whereas the northern part and the area south-east of Maithana (Bhander tahsil) lie below 183 metres.

Although dotted with hillocks and low mounds of granite the valley is flat, uniformly and gently sloping towards the north-east, and formed mostly of the river alluvium. Other types of soil are also met with near the mounds and on the upper reaches. Deeper alluvial deposits occur along the major rivers ad streams of the District.

The alluvial soil is loamy and fertile. Admixture of sand, in varying proportions and of various sizes of grains produces a number of soil types. Due to location factor also, some sub-types are added. The soil in the low-lying flats with poor drainage is usually saline. It is generally brown in colour. The alkaline soil is grey, sticky on wetting and hard on drying acquiring a cloddy structure. Growth of crops or flora is difficult at places where undulating Kankar layer often comes up on the surface in any soil region. Due to alternate leaching and capillary rise of moisture the subordinate layer of calcium carbonate is also undesirable.

The alluvial tract is marked by the gullies along the major rivers and their tributary streams caused by the water-action on the loose soil. The banks of the deep streams and their upper reaches in the alluvial tracts are experiencing the rill-erosion which is the early stage of gully-formation.

To some extent it is a natural process but is accelerated because of the removal of the natural flora, uncontrolled grazing, careless ploughing and unplanned management of field drainage, Gullies have developed in the alluvium all along the Sind, the Mahuar and the Parron. The nala-banks are also cut up around Imalia, Bauhara, and Badora

4.0 GROUND WATER SCENARIO

Aquifer systems

The district is underlain by granite, sandstone, shale and alluvial formation and occurrence of ground water in different formation varied with the rock type (Plate II). About 70% of area is occupied by alluvium the extending from Indergarh to Secondha, (South to North) and Goreghat to Pandokhar (West to East). The thickness of alluvium varies between 20-60 m. It is the most extensive aquifer system in the district. Two or even more aquifer system comprising of fine to medium to coarse-grained sand are encountered. The top phreatic aquifer ranges in thickness of 3 to 10 m and encounter of 4 to 30 mbgl.

The phreatic aquifer mostly comprises of clay, fine sand with silt and at places coarse sand. The most productive aquifer is encountered between 40-50 mbgl existing

under semi confined to confined condition under the thick clay. The aquifer consist of coarse sand yields 10 to 30 lps.

Ground water in granite occurs in joints, fractured planes and mostly in weathered zone under water table condition. The occurrence of ground water is controlled by degree of weathered size and interconnectivity of joints, which varies from place to place.

Dug wells and tube wells sustain discharge of 2-10 lps depending on degree of weathering and fracturing. Sandstone of Gwalior system with limited extent in northern part of the district is hard with thin bedding plane.

Ground water occurs mostly in unconfined condition, but at places in semi confined conditions. The yield potential in this formation ranges between 2 to 10 lps. The transmissviity in the granite area is 16 m^2/day and 135 m^2/day .

Ground Water Movement

The water table contain map of the district shows that all stream the Sindh and Pahuj are effluent in nature. The quartz reef and granite out crops at places act as ground water barrier. The water table elevation varies between 156-190m amsl in northern and central parts 190 to 220 m amsl in the southern part of the district.

The hydraulic gradient in the North eastern side is 6 to 8 m/Km and 10 to 25m/km in southern part of the district. Northern and North eastern part of the district flow direction is generally NE and SW and NW in southern part. The area showing gentle hydraulic gradient indicates higher permeability in north and north eastern, North western part of the district. While the area of steeper hydraulic shows low permeability in south and south western part of the district.

The prominent ground water divide coincide with the surface water divide in the area which is indicated by diverse of the flow. The major ground water divide/ surface water divide runs NE- SW probably along the quartz reef.

Water levels

Ground water levels form a very important parameter of the ground water system, as these are its physical reflection. The groundwater balance expresses itself in the change in water levels; hence a continuous record is important and useful. CGWB has 07 National Hydrograph Monitoring Wells in Datia district.

Pre-monsoon (May 2006)

The water level is shallow in the central part of the district. Deeper water level over 10 to 20 mbgl is recorded is south western in granitic terrain around Datia and northern in the alluvial tract along the Sindh river and north east along the Pahaj river Plate (III). During May 2006, pre-monsoon the depth to water level in the district ranges between 8.34 to 27.12 mbgl .

Post-monsoon (November 2006)

The behaviour of post monsoon water level represents the same as pre-monsoon water level Plate (IV).. During post-monsoon period of, November 2006, the water levels vary from 7.80 to 27.78 mbgl.

Decadal Average Water Level (May 1995-2006)

There are 7 no of national hydrograph monitoring wells of CGWB falling in the district,. Visualizing trend analysis of all NHMW, it is observed that, the water level trends, are almost falling in all over the district This is the average of water levels for the last 10 years. This gives a more realistic picture as the water level of any particular year depends on rainfall and draft and may vary widely.

The long-term water level trend shows declining of 0.221-0.839 and 0.379 -0.959 m/yr during pre –monsoon and post -monsoon respectively which are quite significant. The long-term water level trend shows rising of 0.054-0.251 and 0.007-0.027 m/yr during pre –monsoon and post -monsoon respectively in the command canal area in the north central part of the district.

4.2 Ground Water Resources

The Net annual ground water available in the Datia district is 418.28 **MCM** and draft from all uses is 185.25**MCM**, Net ground water available for future irrigation use is **22.458 MCM.** The Net annual ground water available in the Datia district and draft from all uses for block is shown in Plate-V and table 3. The ground water resource development, in the area, has reached up to 44.0 % categorizing as safe.

Table 3.0 Ground Water Resources & Stage of Development

Block	Command/ non-Command/ Total	Net Annual Ground water Availability	Existing Gross Groundwater Draft for All uses	Allocation for domestic & industrial requirement supply upto next 25 years	Stage of Groundwater Development (%)
			(In MCM)		
Seondha	Command	36.18	18.66	0.87	52
	Non-Command	133.22	14.61	7.48	11
Bhander	Command	18.26	0.94	0.53	5
	Non-Command	75.47	18.95	3.42	25
Datia	Command	7.98	.59	0.08	7
	Non-Command	147.17	131.50	6.53	89
Total		**418.28**	**185.25**	**8.92**	**44**

4.3 Ground Water Quality

The groundwater samples are being collected form each monitoring wells during the month of May every year. The quality of ground water in district is being described by the analysis of groundwater samples from 7 ground water monitoring wells. The analysis of water samples for year 2006 indicate that the pH values of all water samples varies between 7.63 to 8.10 showing alkaline nature of water in the district.

The electrical conductivity (EC) values were found in the range of 530 and 2222 µs/cm at 25^0C. The highest EC value exceeding BIS limit (1000 µs/cm at 25^0C) was

found in Datia town (2222 µs/cm at 25^0C). The concentration of No_3^- ranges between 6-187 mg/l was reported in Datia town (187 mg/l).

The higher concentration of No_3^- may be due to localized pollution. The study of analyzed data shows that this district does not have any problem of fluoride since all the wells have fluoride less than 1.5 mg/l permissible limits. No arsenic content was detected in the groundwater. Ground water quality in the district is generally good for drinking except one well of Datia town.

The chemical quality of groundwater is an important factor to be considered in evaluating its suitability for irrigation purpose. The parameters such as EC, Sodium Absorption Ratio (SAR), percent sodium (% Na) and Residual Sodium Carbonate (RSC) are used to classify the water quality for irrigation purpose. US Salinity Laboratory suggested a diagram of classifying waters for irrigation purposes in 1954. The plot of US Salinity Laboratory diagram suggested that except are observed under C_2-S_1 class (medium salinity and low sodium) which means that these waters can be used for all type of crops on soils of low to high permeability and C_3-S_1 (high salinity and low sodium) class. How ever ground water in the district in generally safe for irrigation but proper drainage system is required where EC is more than 1500 µs/cm at 25^0C

4.4 Status of Ground Water Development

In Datia district, except Datia, Bhander Seonda and ,Indergarh, rest of the areas falls under rural. Ground water is main source of water except Datia town where water is supplied for drinking purpose from a small tank and Ramsagar Dam. The drinking water supply in the district by Municipal Corporation and Panchayat in the rural areas is met through the borewell and tube wells. All though, all the block of Datia distt.

Area categorized as ‘Safe’ but it can be seen that the development of ground water increasing every year. The number ground water structures and accordingly area irrigated by ground water has increased.

The fact that, the construction of wells for irrigation purpose has increased in the recent past without much consideration of well spacing .This causes adverse impact on ground water regime in some localized areas. The development of ground water can be noticed by visualizing long term water level trend as observed declining trend in non-command area and rising trend in command area.

5.0 GROUND WATER RELATED ISSUES & MANAGEMENT STRATEGY

The number of ground water structure are distributed dividing balance resources in equally for dugwell and tubewells and taking consideration of 100% development of net ground water availability in each block (Plate VI.).It is felt that the over exploitation, indiscriminate development of groundwater and irrigation practices have led to many groundwater related problems particularly in non command areas where as in command areas rise of water level is recorded . So there is need proper management of groundwater resources. To achieve 100% development of net ground water availability in each block, the number of ground water structures can be increased.

5.1 Water Conservation & Artificial Recharge

It is observed in non command areas of Datia block, depletion water level is quite with stage of development of 89%. To remedy the ill effects, the following steps are required to be taken for effective groundwater management in this area.

Thus, to maintain the ground water regime in equilibrium condition, there is need to conserve the ground through artificial means. There are many ways to adopt this practice but the structure which are feasible in Datia distt are outlined below: -

1. Contour bunding
2. Gully plugs
3. Sheek dam
4. Percolation tanks
5. Recharge shafts
6. Sub surface dykes.

Broadly the area for artificial recharge has been divided into two categories i.e. alluvial area where ground water has been over developed and granitic terrain where the developed is reaching to the critical level.

Granitic Terrain

The area lies South and East of the Datia district (Plate VII). The granites are weathered down to depth of 12-18 mbgl. Using GIS, four layers, namely lithology, geomorphology, slope (3.5%) and lineaments are superimposed to identified the site for percolation tanks. The results obtained are categorized into three categories i.e. according to suitability of the site i.e. suitable 1,2,3. These sites are located on plate no and table 4

Table 4 Prominent sites under I suitability

Village	Toposheet	Lithology	Geomorphology	Slope
Sijor-Khuriya	54k/6	granite	pediment	0-1
Kanthariya	54k/6	granite	pediment	0-1
Imalya	54k/10	granite	pediment	1-3
Kasuali	54k/10	granite	pediment	0-3
Malera	54k/6	granite	pediment	0-1
Jhadia	54k/6	granite	pediment	1-3

It is observed that gully plugs and contour bunds may be constructed on the upper reaches stream identified for percolation tanks. Some sites identified for percolation tanks do not provide sufficient spread area for them. .In that location, stream are of 5-6 m width- 3-6 m in depth hence, a series of small check dam in the stream course may full fill the objective of conservation of ground water. The farmers use bunds in Datia block (54k/10) for storing the water in their fields till September to October. These bunds are normaly 3 – 5 m high and often retains water till September. It is observed that clay beds prevent percolation of water to the unsaturated zone in weather granite. Hence, recharge shaft in this area may be proved good structures for artificial recharge of ground water.

Alluvial area

The alluvial terrain is flat with very poor drainage density where feasibility of percolation tanks is almost remote. In this area where phreatic aquifer has gone dried up and the clay bed do not allow to percolated the water in deeper, recharge

6.0 RECOMMENDATION

On the prevailing hydrogeological and data gathered ,the following recommendations are made for the development of ground water in Datia Distt**.** Which are shown in plate –VI

1- The present ground water development in command area is 23% and in non command area is 44% with annual development rate of 3.3%. It is likely that dynamic resources may be fully utilised in both command and non command area.

2- The stage of development in Datia block is 89% in the non-command area falling under granitic terrain. Hence the ground water may be augmented artificially as outlined in sec 5.1

3- An area of about 540 sq, km. has been demarcated as over developed during course of ground water management studies by CGWB in 2000-01, where no further ground water development may be taken up. In this area ground water may be augmented artificially as outlined in sec 5.1

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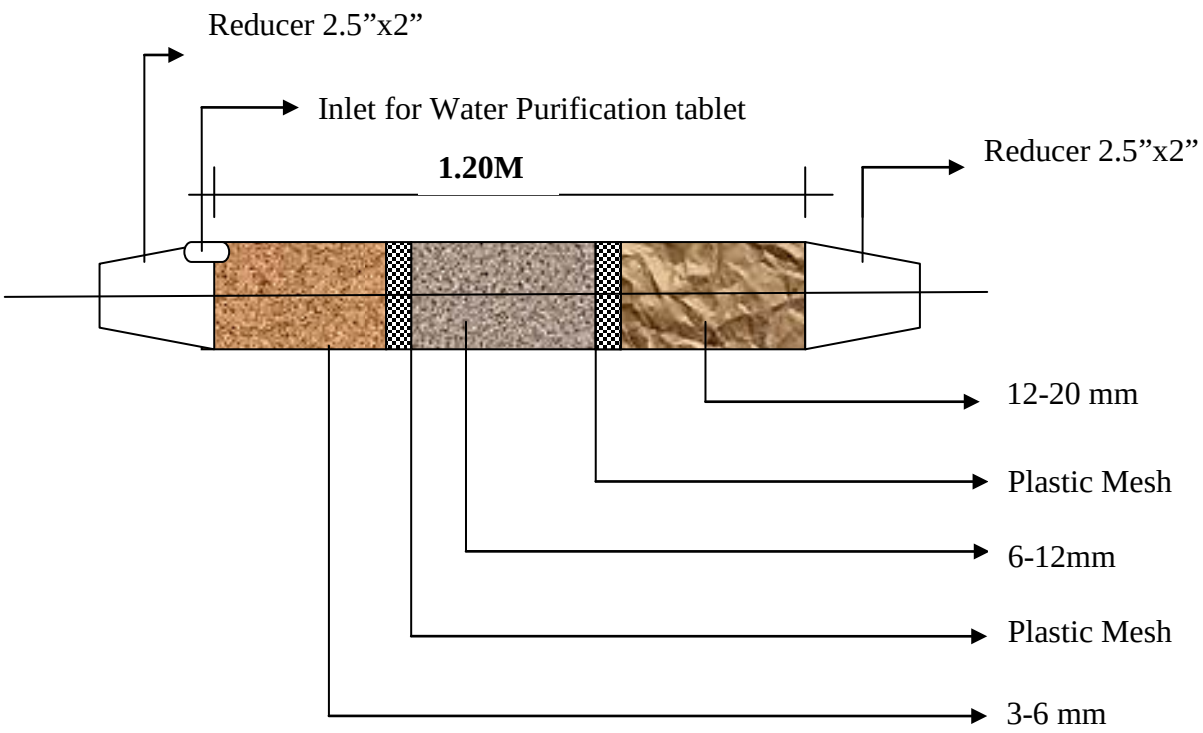

SCHEMATIC DIAGRAM OF DEWAS FILTER