Groundwater Contamination due to Landfill Leachate at Urali devachi and Validation with Argus One

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Abstract: Waste disposal facilities are mainly responsible for the gradual quality degradation of subsurface freshwater reservoirs. Million tonnes of solid waste generated per day is deposited at Urali Devachi Landfill site around 20 kms away from Pune. The solid wastes are disposed on the land fill surface, resulting in gradual quality degradation of subsurface fresh reservoirs due to land fill leachate. The main objective of this paper is to determine the ground water contamination risk due to potential leachate seepage beneath the municipal land fill at Urali Devachi Pune. Traditional Methods such as chemical analysis of groundwater, determining the concentrations of contaminants are used. The experimental results obtained showed the different parameters of leachate and the water samples causing the groundwater contamination in the area surrounding the landfill site.The chloride values are simulated using the Argus One Software in the aquifer . The simulated values showed resemblance with the observed values.

Index terms ; Solid waste, ground water contamination, landfill, leachate, Urali Devachi .

1. INTRODUCTION

Waste disposal has always been an important issue for human societies. Solid wastes are disposed on or below the land surface resulting in potential sources of groundwater contamination. As the natural environment can no longer digest the produced wastes, the development of solid waste management has contributed to their automated collection, treatment and disposal. One of the most common waste disposal methods is landfilling, a controlled method of disposing solid wastes on land with the dual purpose of eliminating public health and environmental hazards and minimizing nuisances without contaminating surface or subsurface water resources. However in many landfill sites because of lack of lining and precautions in the construction, the seepage of leachate is found. Leachate is defined as the polluted liquid emanating from the base of the landfill. The downward transfer of leachate contaminates groundwater resources, whereas the outward flow causes leachate springs at the periphery of the landfill that may affect surface water bodies. Hence, leachate seepage is a long-term phenomenon that must be prevented in order to protect natural water resources. In unlined landfills, the leachate continues to leach into the ground and may contaminate ground water. Many old landfills used a simple clay liner for controlling The Groundwater Contamination. Designs of landfill liner systems, detection and assessment of the extent of contaminants in groundwater and risk assessment for human health and environment are the three main relevant issues. Groundwater quality monitoring systems are the main link among them since they help to determine the likelihood, and severity of contamination problems. Pune city contains lots of commercial industries, Hospitals, hotels, residential buildings as well as high population which generate 0.14 kg of waste per capita/day. (Personal communication with PMC office Pune) The municipal solid waste is heterogeneous in nature and contains papers, Plastics, rags, metals, glass pieces, ashes and combustible materials. In addition to these it also contains other substances like scrap materials, dead animals, discarded chemicals, paints, hazardous waste generated from hospitals, industries and agricultural residues. The waste generated from biomedical waste, clinics, hospitals, nursing homes, pathological laboratories, blood banks and veterinary centers have also been disposed along with municipal solid waste at disposal site. This waste is hazardous to human being and environment.

1.1 *Study area*

Pune Muncipal corporation disposes its whole waste at the Urali Devachi Depot which is at 20 kms away from the city. About 3000 metric tonnes of solid waste from pune municipal area is disposed per day at Mantarwadi (Urali Devachi village). During the early period, MSW was conveniently disposed off at Mantarwadi disposal site in low lying areas with large open land space. The unscientific disposal of solid waste created lots of environmental problem in this area. It resulted into air pollution and ground water pollution problems. The Well water near to disposal site in UraliDevachi village is now not safe for domestic use (drinking, outdoor bathing, propagation of aquatic life, industrial cooling and for irrigation).About 43 ha of land has been allocated for solid waste disposal, of which 15 ha area is already land-filled and has been sealed-off permanently. The solid waste disposal site at UraliDevachi is being used since 1983. Various residential, industrial and agricultural establishments are situated around this disposal area. The present practice of solid waste disposal consist of biological decomposition of waste and landfilling. Extra molecular (EM) culture is applied over solid waste for decomposing the organic matter. However, due to the unsegregated waste, complete decomposition is not possible. Only 150 mt decomposed organic matter is segregated per day and collected from local farmers, to be used as manure, while the remaining solid waste is left as it is for landfilling. This solid waste disposal and management practice causes various environmental problems in Urali-Devachi village. 8 Wells are selected around this site for determining the groundwater contamination.

1.2 *Site Description*

The landfill is underlain by basalt and then natural soils.The hydraulic conductivity of soils is 1x 10-7 m/s. The soil texture contains alluvial deposits of sand, gravels, fine silts and clays. The thickness of this type of soil varies from 8 to 18 meters. The porosity of soil material is 0.25% .The soil texture of the remaining city is made of silicates, phyllosilicates and okenite group with basalts containing dykes and laterites The mean minimum temperature is about 12°C and mean maximum temperature is aboutv 39°C. The normal annual rainfall over the district varies from about 500 mm to 4500 mm.Pune City restrains to the Deccan volcanic province (DVP) of Cretaceous–Eocene age(Krishnan 1982; Fig. 2). Despite the fact that cavities, vesicles, flow contacts, lava pipes, and tunnels can build up principal porosity in the basalt (Pawar and Shaikh 1995), the flows in the study area are relatively less porous. Conversely, jointing and fracturing by way of interconnectivity have conveyed localized secondary porosity and permeability to form suitable groundwater reservoirs at places (Pawar et al. 2008). Furthermore, the cooling features such as columnar joints serve as hydrologic discontinuities, which in turn function as pathways for infiltration of rainwater .However, meager incidence of such primary openings in the exposed quarry sections nearby MSW site indicates low porosity and permeability to basaltic flows in the area. The studied dumping site is about 20 km SE of Pune, on Pune-Saswad road (Fig. 3). The study area around the dumpingsite (73◦55_ to 74◦00__ N and 18◦22_30__ to E 18◦30__) is situated at elevation ranging between 550 and 660 m a msl with the MSW site located on the eastern slopes of a small topographic high. Climate in the area is semi-arid with an average annual rainfall of 550 mm. The year 2006 experienced heavy rainfall (1266 mm; IMD 2007) much above the annual average of 550 mm. June to September is the period of rainy season with occasional heavy rainfall events. This leads to dispersion of leachates in the surrounding lowlying areas. A small natural stream, namely, Kala Odha, further carries the leachates downstream part of leachates derived from the municipal garbage gets naturally collected in a nearby small abandoned quarry and acts as another point source. The total area available for MSW dumping site is about 163 acre, and total study area under investigation is .Dug wells are the principle source of water supply for drinking and other purposes in the study area. Groundwater withdrawal is confined to vesicular, weathered, jointed, and fractured upper basaltic crust, which is overlain by thin soil cover. Depleting groundwater levels are common, the condition being further aggravated by frequent drought like situations. Average groundwater level during pre-monsoon is 5.7 m, whereas the water tables are fairly shallower during postmonsoon with an average depth of 2.7 m. The erratic nature of southwest monsoon is the controlling factor for groundwater fluctuations. The effect of leachate percolation is observed in many nearby dug wells in the form of brown tainted waters with unpleasant foul smell. The reddish brown soils rich in iron and ferric oxide content are present in higher regions of The study area (around the dumping site). These are medium textured silty soils. Moderately thick black soils rich in organic matter and humus content are observed in lower reaches. These are highly fertile and are under intensive irrigation. Sporadic patches of grayish soils are developed along the gentle slopes. These are rich in $CaCO_3$ and are described as calcareous soils.

2 . MATERIALS AND METHODS

The Physicochemical analysis of water samples were done using different methods as follows:

The samples were collected in polyethylene bottles . having capacity of 1.2 litre. They have air tight Cover to protect the sample from leakage.The samples were

refrigerated before the laboratory tests.DO bottles were used for taking do based samples. DO was fixed using managanese sulphate and Potassium alkali iodide azide.The open well and tube well was pumped properly to ensure that the sample truly represent the groundwater sample.The following measurements were made.
(i) pH – Digital pH meter, AE 101 (Acme Electronics).
(ii) COD (chemical oxygen demand; mg/l) – ferrous ammonium sulphide titration methods. (iii) BOD (biochemical oxygen demand; mg/l) – modified Wrinkler method. (iv) TDS (total dissolved solids; mg/l) – quantitative analysis. (v) Total hardness (mg/l) – EDTA titrimetric method.
(vi) Chlorides (mg/l) – Mohr's titration (AgNO3).
vii)Dissolved Oxygen meter (digital)
viii) Conductivitymeter
ix)Turbidity by Nephelometer x) MPN (Most Probable Number) by using Autoclave, Biological Incubator
and pH meter

2.1 Groundwater *Well Location*

DW1 **DW2**
DW3 **DW4**
DW5 **BW1**
BW3 **BW2**

DW:DUG WELL BW =BORE WELL

Fig 2 .Groundwater wells around Urali Devachi Landfill Site

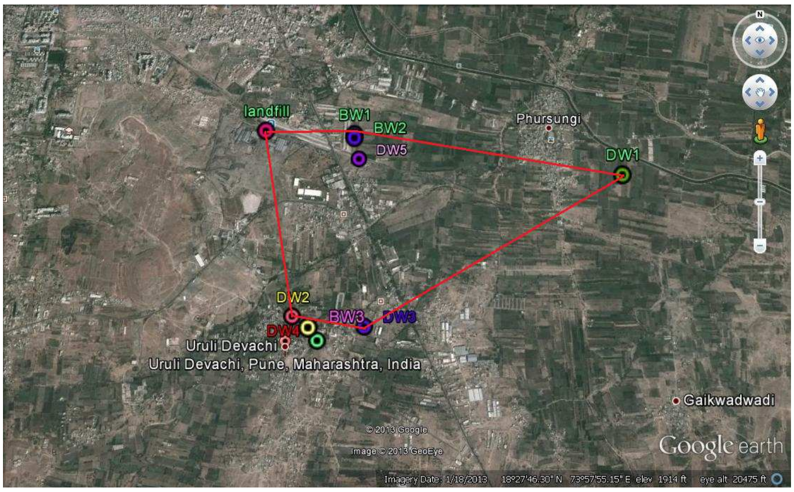


Fig 3. Map of the Urali Devachi Landfill

Fig 4 . a Solid waste site b Leachate sample

ΕTable 1. Details showing the GPS Co-ordinates and distances of wells from the site "

location	Latitude	Longitude	Distance between site and wells(km)
Solid waste landfill site	N18^{0} 28.163'	E 073^{0}57.3'	----------
DW1	N18^{0} 27.972'	073057.799' E	SITE: DW1 = 0.91 KM
DW2	N18^{0} 28.143'	E 073057.799'	SITE: DW2 = 1.37KM
DW3	N18^{0} 28.379'	E 073057.769'	SITE: DW3 = 1.67KM
DW4	N18^{0} 27.316'	E 073 0 548'	SITE: DW4 = 1.62KM
DW5	N18^{0} 28.159'	E 073057.728'	SITE: DW5 = 0.71KM
BW1	N18^{0} 28.159'	E 073057.728'	SITE: BW1 = 0.72 KM
BW2	N18^{0} 28.143'	E 073057.799'	SITE: BW2 = 0.79 KM
BW3	N18^{0} 27.316'	E 0730548'	SITE: BW3 = 1.63 KM

3. RESULT AND DISCUSSION

A Leachate Characteristics

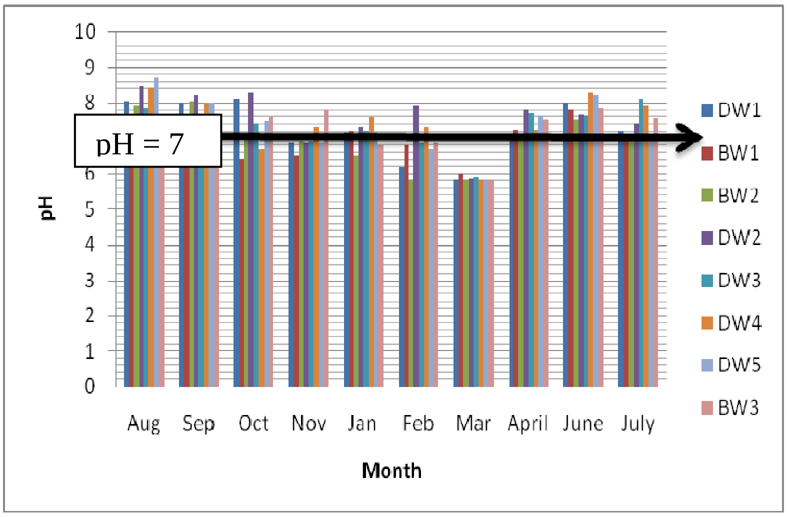
Month	pH	Conducticity (ms/cm)	Turbidity (mg/lit)	Total Hardness(mg/lit)	Chlorides (mg/lit)	TDS (mg/lit)	BOD (mg/lit)	COD (mg/lit)	DO (mg /lit)	MPN
Aug	8.05	64.7	25	666	805	1256	1340	376.36	0.8	17
Sep	8	20.2	18	855	856	1500	2450	568	1	19

Oct	8.2	25.4	29	945	10000	125000	3750	13491	0.2	17
Nov	7.6	22.8	47	1053	1200	189400	1332	628	0.4	21

***B.* Chemical and Bacteriological characteristic of ground water.**

1.Ph

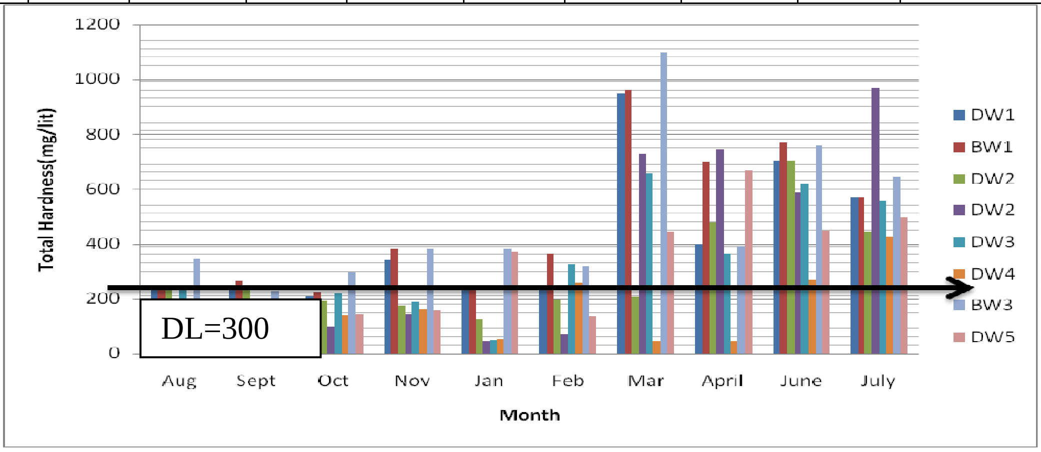
Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
Aug	8.04	8.44	7.85	8.4	7.56	6.98	7.89	7.56	
Sept	8	8.2	7.3	8	7.56	6.95	8.04	7.56	
Oct	8.1	8.3	7.4	6.7	7.6	6.4	6.98	7.6	7
Nov	6.9	6.9	6.93	7.3	7.8	6.5	6.92	7.8	
Jan	7.15	7.3	7.2	7.6	6.8	7.2	6.5	6.8	
Feb	6.2	7.9	6.86	7.3	6.9	6.8	5.83	6.9	
Mar	5.82	5.86	5.9	5.83	5.84	6	5.82	5.84	
April	7.1	7.8	7.7	7.25	7.51	7.24	7.07	7.51	
June	8	7.66	7.61	8.3	7.83	7.8	7.53	7.83	
July	7.2	7.42	8.1	7.92	7.55	7.1	7.05	7.55	



2) Total Hardness

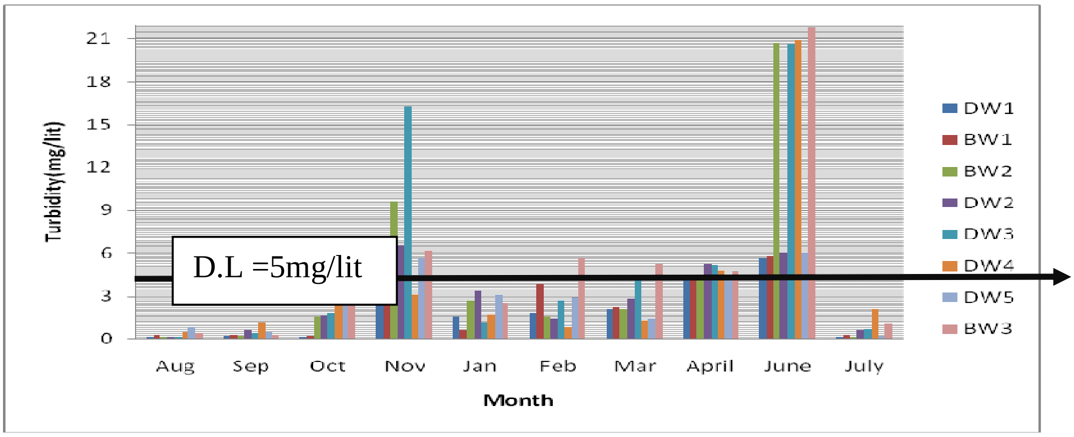
Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
	Total Hardness(mg/lit)								
Aug	244	94	230	162	135	250	240	345	
Sept	234	76	125	139	138	265	236	226	
Oct	210	98	220	138	143	225	190	298	
Nov	340	146	186	160	156	380	174	380	300

Jan	230	44	50	52.4	370	246	125	382	600
Feb	243	69	325	258	136	362	196	321	
Mar	948	728	656	43.2	446.4	960	205	1100	
April	399	743.2	361.2	46.2	667.8	701.4	478.8	390.6	
June	702.9	587.88	617.7	268.38	447.3	766.8	702.9	758.28	
July	567.6	968	554.4	426.8	497.2	572	444.4	642.4	



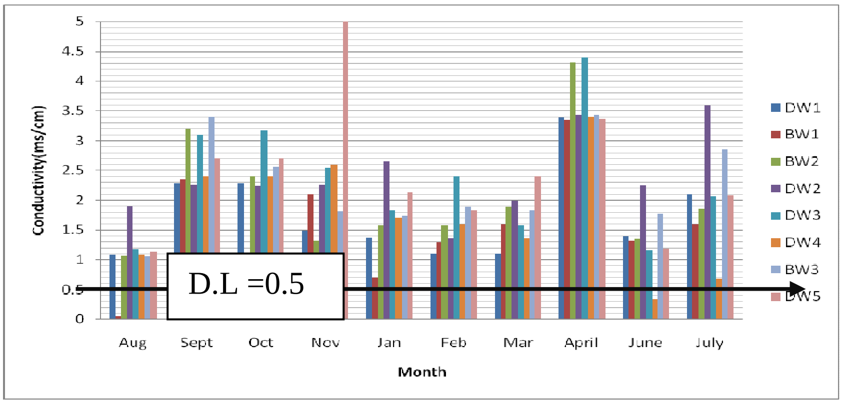
3) Turbidity

Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
	Turbidity(mg/lit)								
Aug	0.1	0.1	0.1	0.5	0.4	0.3	0.1	0.8	
Sept	0.2	0.6	0.4	1.2	0.3	0.3	0.2	0.5	
Oct	0.1	1.62	1.8	2.5	4.2	0.2	1.5	3.8	
Nov	6.6	6.5	16.3	3.1	6.2	5.5	9.6	5.7	
Jan	1.5	3.4	1.2	1.7	2.5	0.6	2.7	3.1	10
Feb	1.8	1.4	2.7	0.8	5.6	3.8	1.6	2.9	
Mar	2.1	2.8	4.2	1.3	5.3	2.2	2.1	1.4	
April	4.3	5.3	5.2	4.8	4.7	4.4	4.3	4.5	
June	5.6	6.1	6.8	20.9	21.8	5.8	20.7	6.1	
July	0.1	0.6	0.7	2.1	1.1	0.3	0.1	0.2	



4) Conductivity

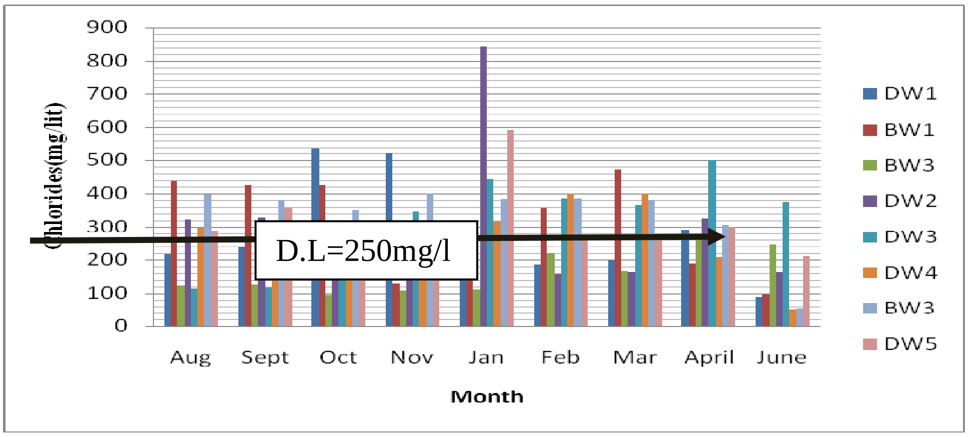
Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
	Conductivity(ms/cm)								
Aug	1.08	0.5	1.07	1.9	1.18	1.078	1.056	1.13	
Sept	2.28	2.35	3.2	2.26	3.1	2.4	3.4	2.7	
Oct	2.28	0.05	2.4	2.24	3.18	2.4	2.56	2.7	
Nov	1.49	2.1	1.32	2.26	2.54	2.6	1.82	5.24	
Jan	1.37	0.7	1.58	2.65	1.83	1.71	1.73	2.13	0.5-0.8 ms/cm
Feb	1.11	1.3	1.57	1.36	2.4	1.6	1.89	1.83	
Mar	1.1	1.6	1.89	2	1.57	1.36	1.83	2.4	
April	3.39	3.34	4.32	3.43	4.4	3.4	3.43	3.37	
June	1.39	1.32	1.35	2.25	1.16	0.34	1.77	1.19	
July	2.1	1.6	1.85	3.59	2.07	0.68	2.85	2.08	



5) Chlorides

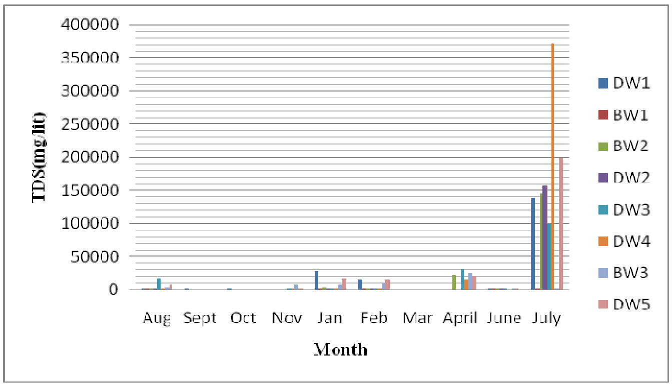
Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	

	Chlorides(mg/lit)								
Aug	216	223	115	298.2	288.6	437	123	396.3	
Sept	236	132.8	118.3	302.3	356	425	125	380.4	
Oct	432	230	220	290.2	290	426	95	350.2	
Nov	536	221	345	285.2	295	128	108	401.3	
Jan	242.2	842.23	442.36	317.4	592.3	145	112	382.38	250
Feb	185.2	156.3	385.2	399.3	268.3	356.23	221.3	385.2	
Mar	197.8	162.73	366.9	398.85	258.45	472.23	165.9	379.7	
April	292.45	432.65	500.75	208.31	300.45	188.28	263.39	304.46	
June	163.75	374.4	374.4	50.68	210.5	97.44	245.64	54.58	
July	29.78	276.51	115	298.2	288.6	437	123	396.3	



6) Total Dissolved Solids

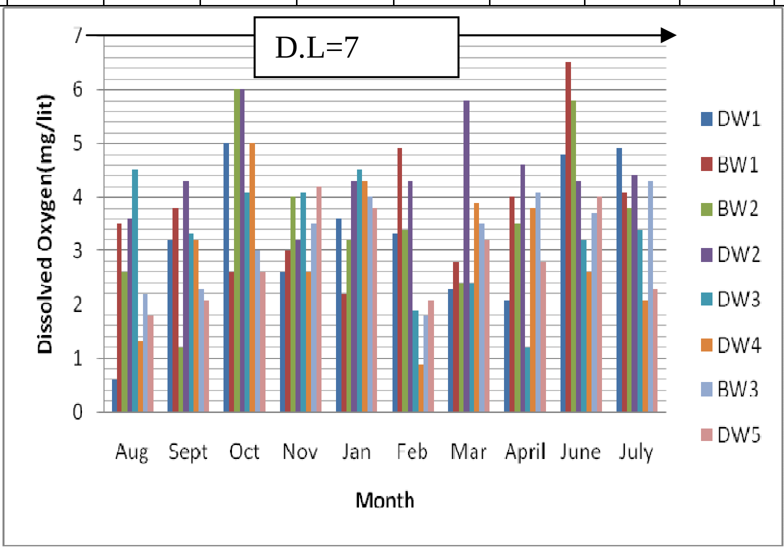
Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
	Total Dissolved Solids(mg/lit)								
Aug	2800	2820	1600	1400	16920	1250	3600	8200	
Sept	1235	125	136	49	132	48	38	215	
Oct	1189	145	128	38	42	92	69	48	
Nov	400	20	200	40	1400	1526	7586	1800	
Jan	28000	1250	3600	2820	1600	1400	8200	16920	250
Feb	15000	1525	3256	2896	1265	1358	8500	15269	
Mar	760	80	520	400	100	60	40	300	
April	380	20	23160	120	31440	14880	25840	20972	
June	1400	1000	2332	2460	1400	240	1600	1600	
July	138380	800	145600	157400	98260	371800	3000	198760	



TDS values are out of range

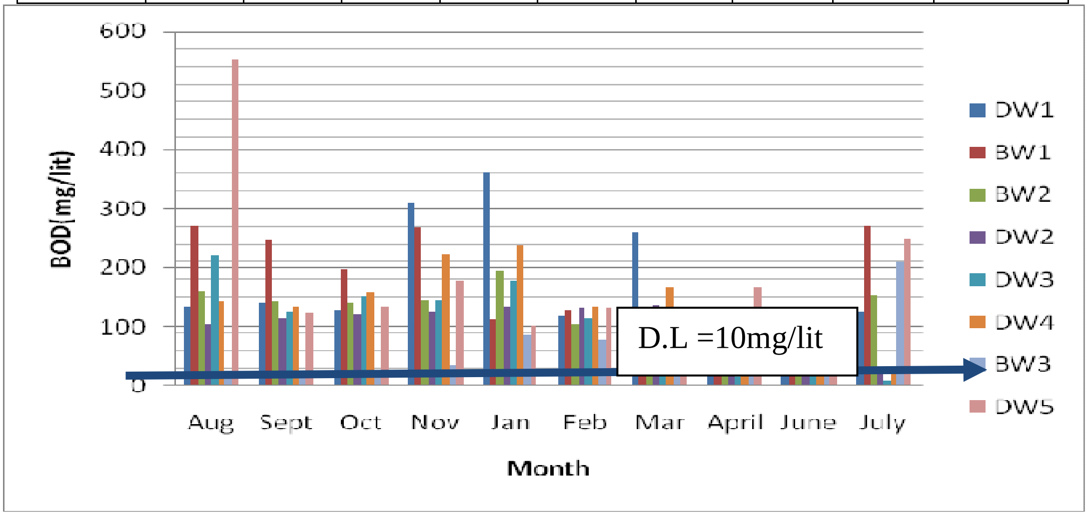
7) Dissolved Oxygen

Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
	Dissolved Oxygen(mg/lit)								
Aug	0.6	3.5	2.6	3.6	4.5	1.3	2.2	1.8	
Sept	3.2	3.8	1.2	4.3	3.3	3.2	2.3	2.1	
Oct	5	2.6	6	6	4.1	5	3	2.6	
Nov	2.6	3	4	3.2	4.1	2.6	3.5	4.2	
Jan	3.6	2.2	3.2	4.3	4.5	4.3	4	3.8	7
Feb	3.3	4.9	3.4	4.3	1.9	0.9	1.8	2.1	
Mar	2.3	2.8	2.4	5.8	2.4	3.9	3.5	3.2	
April	2.1	4	3.5	4.6	1.2	3.8	4.1	2.8	
June	4.8	6.5	5.8	4.3	3.2	2.6	3.7	4	
July	4.9	4.1	3.8	4.4	3.4	2.1	4.3	2.3	



8) BOD

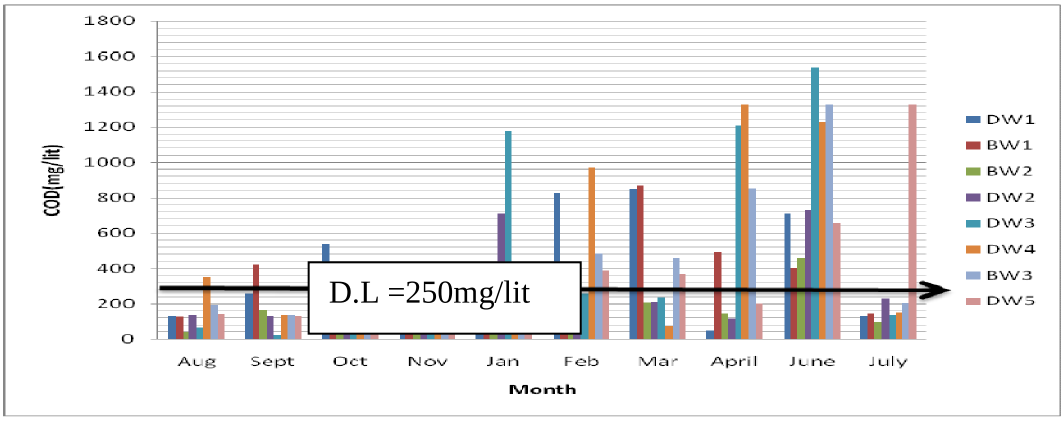
Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
	BOD(mg/lit)								
Aug	136	270	160	105	220	142	26	552	
Sept	141	246	143	115	125	135	18	123	
Oct	128	197	140	122	150	158	22	136	
Nov	310	268	145	126	145	223	35	178	10
Jan	361	112	195	135	178	239	85	102	
Feb	118	128	104	131	114	135	78	132	
Mar	259	134	109	138	124	165	95	124	
April	52	20	65	24	15	36	41	165	
June	113	45	88	75	24	66	34	72	
July	125	270	155	20	10	30	209.8	249.6	



9) COD

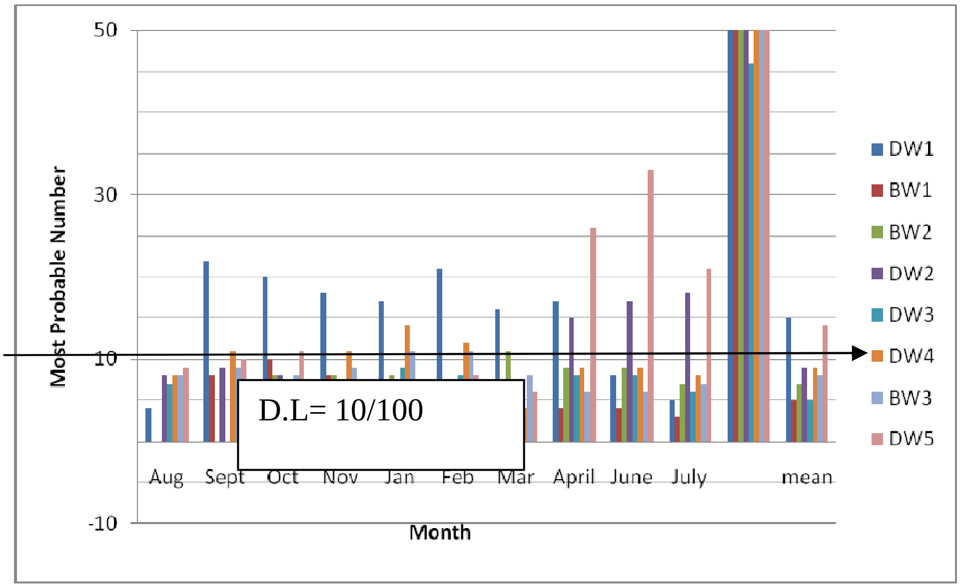
Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3	
	COD(mg/lit)								
Aug	133	127	39	135	65	349	190	142	
Sept	256	421	165	133	23	135	138	132	
Oct	536	426	349	190	127	39	35	46	

Nov	163	349	200	127	39	135	142	65	
Jan	302	232	112.3	710.4	1177.6	132.3	152	78	250
Feb	826	369	265	325	256	969.2	485	389	
Mar	848	869.2	205	212	236	72.08	456	365	
April	47.52	495	142.56	118.8	1207.8	1326.6	851.4	198	
June	710.4	403.2	456	729.6	1536	1228.8	1323	652.8	
July	131.92	142.8	93.12	228.48	134.64	149	201.76	1326	



10) Most Probable Number(MPN)

Month	GROUNDWATER SAMPLES								Drinking water standards as per BIS	
	DW1	DW2	DW3	DW4	DW5	BW1	BW2	BW3		
	MPN									
Aug	4	nil	nil	8	7	8	8	9		
Sept	22	8	nil	9	nil	11	9	10		
Oct	20	10	8	8	nil	nil	8	11		10
Nov	18	8	8	nil	nil	11	9	7		
Jan	17	3	8	7	9	14	11	4		
Feb	21	7	7	6	8	12	11	8		
Mar	16	7	11	4	nil	4	8	6		
April	17	4	9	15	8	9	6	26		
June	8	4	9	17	8	9	6	33		
July	5	3	7	18	6	8	7	21		



4 . GEOGRAPHICAL INFORMATION SYSTEM ARGUS ONE

Argus ONE is a model-independent geographical information system (GIS) for numerical modelling. As in other GIS systems, the various types of geospatial information are stored and viewed in coverages or B layers,^ which the user may view and interact with on screen. Argus ONE is a program to create finite-element meshes or finite-difference grids in a graphical, easy way. It has a set of utilities that allows one to import digitized maps, extract domain outlines from them and automatically generate grids or meshes on the domains. It is also possible to associate different variables to the mesh or grid as a whole or to particular elements or nodes, such as values for boundary or initial conditions, concentrations, etc. Mesh and grid layers, which are also available, are used to automatically create meshes and grids onto which a discrete realization of the B real^ continuous world, described in the geospatial layers, is synthesized. Information is synthesized by using mathematical, logical and spatial functions to define relations between layers. These relations form a conceptual model that represents the relations between geospatial entities as they are articulated by the underlying concepts of the model being used. Plug-in support allows one to automate the use of all mentioned Argus ONE components. Argus' plug-in extension (PIE) technology enables a two way communication between external programs and Argus ONE. One of the groundwater flow and transport models that can be used in combination with Argus ONE, using the PIE technology, is the Princeton Transport Code (PTC) model .

4.1 *Groundwater flow model PTC*

The PTC is a three-dimensional groundwater flow and contaminant transport simulator that can use both finite element and finite-difference discretization. The maximum number of elements that it can create and process is 2,000. PTC is written in FORTRAN 77; thus, it can be easily applied in combination with Argus ONE in an easy to use Windows environment PTC uses the following system of partial differential equations to represent groundwater flow described by hydraulic head h,

$$\frac{\partial}{\partial x}(k_x \frac{\partial x}{\partial x}) + \frac{\partial}{\partial y}(k_y \frac{\partial y}{\partial y}) + \frac{\partial}{\partial z}(k_z \frac{\partial z}{\partial z}) + w = \mu_s \frac{\partial h}{\partial t} \quad (1)$$

$$h(x, y, z, 0) = h_0(x, y, z)$$

$$h|_{B1} = f(x, y, z, t)|_{B1}$$

$$k \frac{\partial h(x, y, z, t)}{\partial n}\Big|_{B2} = q(x, y, z, t)\Big|_{B2}$$

where k_x, k_y, k_z are hydraulic conductivity along the x,

y, and z -axis (LT^{-1}); h is the hydraulic head (L); W is a volumetric flux per unit volume and

represents sources and/or sinks of water (T^{-1}); μ_s is the specific storage (L^1);

nd t is time (T); h_0 is initial hydraulic head *z,t*) | 1 the t ry; *z,t*) | is

the second boundary. Equation(1) describes groundwater flow under non-equilibrium conditions in a heterogeneous and anisotropic medium, provided the principal axes of hydraulic conductivity are aligned with the coordinate directions. Analytical solutions of (1) are rarely possible except for very simple systems; therefore numerical methods must be employed to obtain approximate solutions as is the use of the popular finite-difference method based on discretization of points in time and space.

4.1.1 *Groundwater contaminant transport model*

Simulation of ground-water flow is performed by the numerical solution of both ground-water flow and solute-transport equations. The partial differential equation describing the 3D transport of dissolved solutes in the groundwater can be written as follows:

$$\frac{\partial(\theta C^k)}{\partial t} = \frac{\partial}{\partial x_i}\left(\theta D_{ij}\frac{\partial C^k}{\partial x_j}\right) - \frac{\partial}{\partial x_i}(\theta v_i C^k) + q_s C_s^k + \sum R_n \quad (2)$$

Where θ is porosity of the subsurface medium, dimensionless; C^k is the concentration of contaminants dissolved in groundwater of species *k*, (ML^{-3}); *t* is time, (T); $x_{i,\ j}$ is distance along the respective Cartesian coordinate axis,(L); *Dij* is hydrodynamic dispersion coefficient tensor, (L^2T^{-1}); v_i is seepage or linear pore water velocity, (LT^{-1}); it is related to the specific discharge or Darcy flux through the relationship,

$v_i = q_i / \theta$; q_s is volumetric flow rate per unit volume of aquifer representing fluid sources (positive) and sinks (negative), (T^{-1}); C_s^k is concentration of the source or sink

flux for species k, (ML^{-3}); $\sum Rn$ is chemical reaction term, ($ML^{-3}T^{-1}$).

In this model, the MT3D, a modular three-dimensional finite-difference groundwater solute transport model based on dispersion approach, coded by [11] was applied to solve the solute-transport equation. The model is based on the assumption that changes in the concentration field do not significantly affect the flow field. This allows the user to construct, calibrate and validate a flow model independently. The calculated hydraulic heads and various flow terms from the current

4.1.2 *Simulation of chloride contaminationin the aquifer*

The aquifer system model covered an area 1.468861 SqKm. The model simulated One aquifer layer with a grid spacing ranging from 100 m X 100m.There are 22 rows and 11 columns.There are total 217 cells in the model . A transient model was constructed using the measured values of chloride concentrations The simulation time is divided into a steady state period and a transient period. . The transient period from Aug 2012 to July 2013 was divided into annual stress period for which pumping rates were defined. The stress period consists of the no of days in the monthThere are total 10 stress periods for which the simulation is run. The constructed numerical model was calibrated using measured chloride concentrations from the area under study. The top elevation of the aquifer is set to be 31.792 and bottom elevation s set to zeroThe aquifer has been considered to be a uniform unconfined aquifer unit with hydraulic conductivity of 0.0005m/sec, which is widespread throughout the study area with a thickness of 32m .The porosity of the aquifer is 0.25 .Storage coefficient was assumed to be 1e-5.The initial contaminant concentration in the aquifer is assumed to be 150 mg/lit .The observation well data was available from the month Aug 2012 – July 2013. In the Month of dec and May the data was not available , so those months are ignored during the simulation. The domain consists of the leachate pond location and Dug well s DW1,DW2,DW3,DW4 and DW5 . The Top and bottom elevation, pumping rate and concentrations are feeded I n the respective well data for the 10 months.The model was calibrated for many runs using different Hydraulic conductivities and data obtained from previous work done in this area

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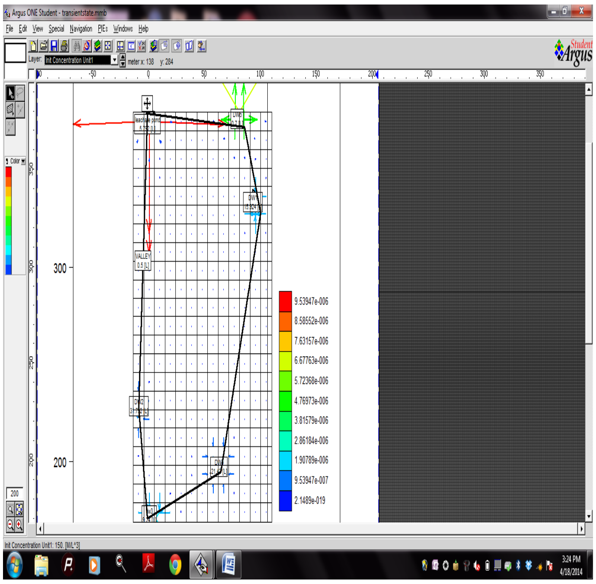
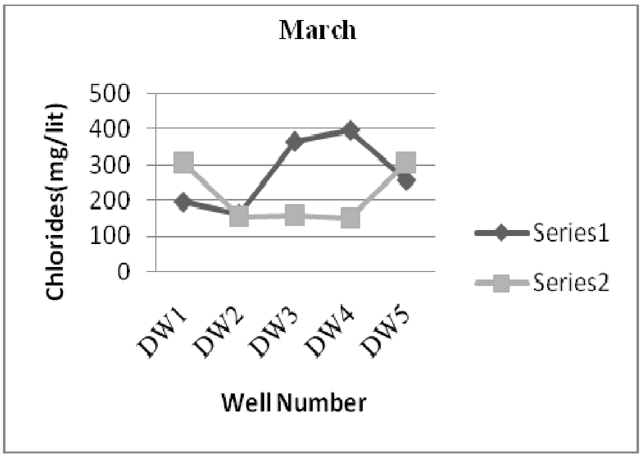
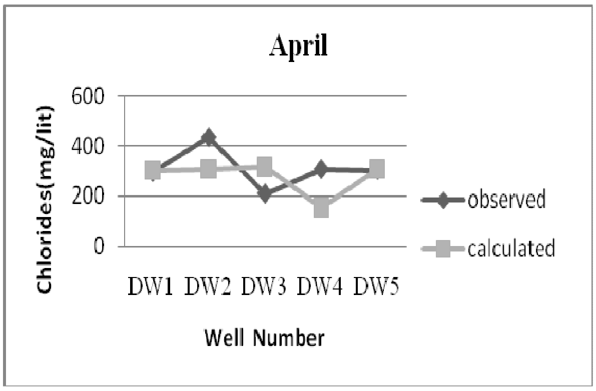
5. RESULTS AND DISCUSSION

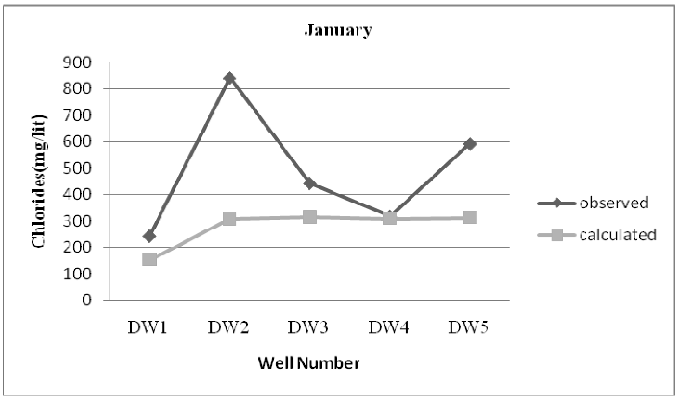
The postprocessing charts show the colour diagram of the chloride concentrations in the wells . The colour code with values indicate the range of chloride contamination For every month, the values are displayed and the chloride contamination is seen in all wells. The velocity vector diagram clearly indicate the range of contamination reaching the wells. The colour diagram shows the presence of leachate in the aquifer and wells.

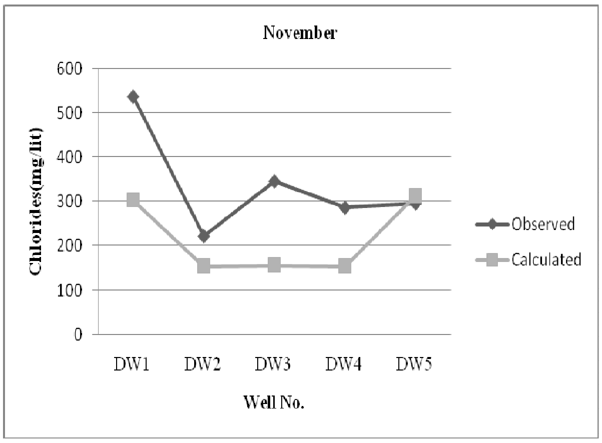
5.1 *Comparison Graphs for observed and simulated values*

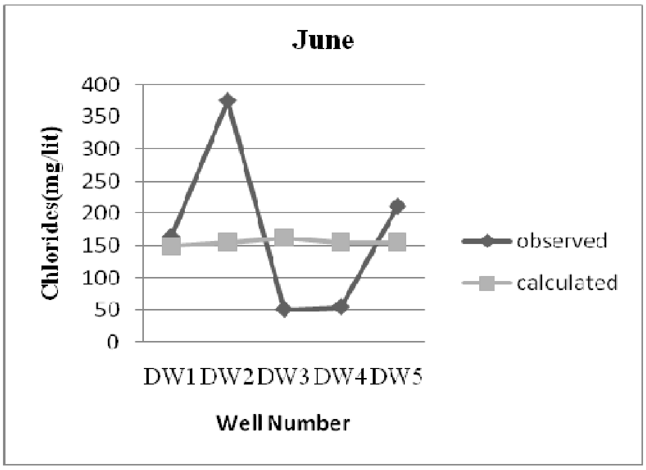


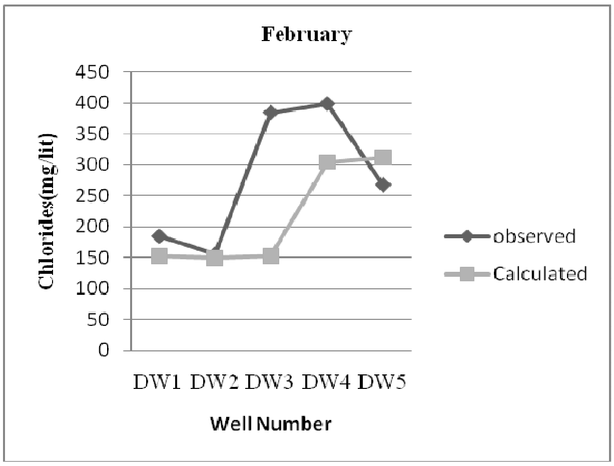

March
Chlorides(mg/lit)
500
400
300
200
100
0
DW1
DW2
DW3
DW4
DW5
Well Number
Series1
Series2

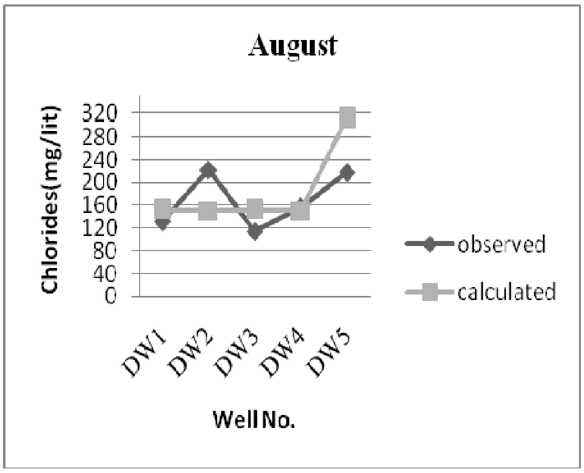

April
Chlorides(mg/lit)
600
400
200
0
DW1 DW2 DW3 DW4 DW5
Well Number
observed
calculated

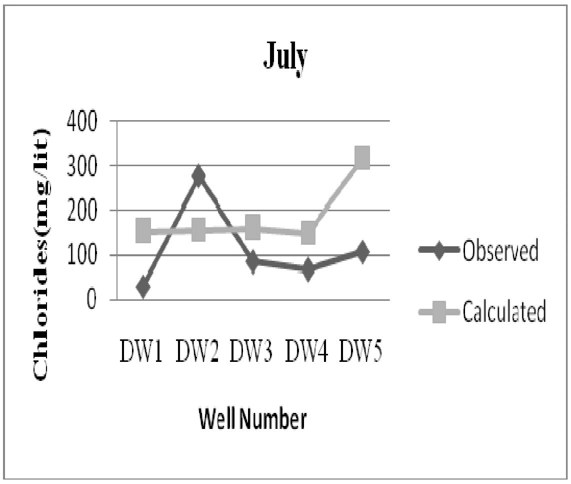

January
Chlorides(mg/lit)
900
800
700
600
500
400
300
200
100
0
DW1
DW2
DW3
DW4
DW5
Well Number
observed
calculated


November
Chlorides(mg/lit)
600
500
400
300
200
100
0
DW1
DW2
DW3
DW4
DW5
Well No.
Observed
Calculated


June
Chlorides(mg/lit)
400
350
300
250
200
150
100
50
0
DW1 DW2 DW3 DW4 DW5
Well Number
observed
calculated


February
Chlorides(mg/lit)
450
400
350
300
250
200
150
100
50
0
DW1 DW2 DW3 DW4 DW5
Well Number
observed
Calculated





6. CONCLUSION

The results showed that the the leachate sample is highly turbid because of the excessive impurities suspended particles in water. It has higher values of BOD and COD Which indicates presence of organic and inorganic compounds .the chlorides and hardness levels are also high which indicates presence of salts in leachate sample. The Ph values are within limits. The dissolved oxygen levels are Very low in leachate sample because of the high amount of organic matter .The coliform group (MPN) is high in number in the leachate sample because of the biodegradable matter in it. The other well water sample indicates higher BOD and COD values because of the contamination caused due to the leachate from the site in these wells .They also have higher dissolved solids and MPN values indicating the contamination. Groundwater model has become a commonly used tool for hydrogeologists to perform various tasks. The rapid increase of computing power of PCs and availability of user friendly modeling systems has made it possible to simulate large scale regional groundwater systems The USGS modular 3D finite difference groundwater flow model (MODFLOW) and Modular 3D Finite Difference Mass Transport Model (MT3D) software were used to simulate groundwater flow and contaminant transport modeling The contaminant source was attributed to leachate from Urali Devachi Landfill contaminating groundwater and eventually wells .It was found that groundwater flow is most sensitive to the changes in the hydraulic conductivity and to a lesser extent to changes in infiltration and leachate infiltration flow. The model calibration was performed with field data of the measured chloride plume. From the comparison graphs , it is seen that the measured chloride values and simulated chloride values are almost same , some values differ due to the limitation of the software to represent the actual hydrogeological Conditions in the aquifer which is not possible.

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