HYDERABAD LAKE ENVIRONMENT MANAGEMENT (HELM) SOFTWARE

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1. INTRODUCTION

Interventions in Urban Lakes are rapidly becoming increasingly important, and it is essential to examine the technical solutions; the socio-economic considerations and the economic viability and long term sustainability of the measures to be adopted.

To carry out all these tasks, a comprehensive knowledge of the hydrological, geological, socio-economic and historical data in required. This is normally available in fragmented form, and needs to be pieced together painstakingly or at great cost. Also, for sustainability, the data needs to be preserved in a standardized manner for the future.

Hyderabad Lake Environment Management Software **(HELM)** *Version 1.04* has been developed in-order to systematically organize all data related to lake and its environment. The first version 1.01 was essentially for storing all lake related technical data critical for planning and taking decisions on various lake improvement options as well as to monitor the performance of different interventions and update the information base for lakes which yet to be taken up for improvement. The new version, 1.04, offers provision for storing all technical data related to individual lakes - both static and dynamic and has sophisticated graphical features and reporting features. The version also incorporates limited GIS capabilities, and complete STP operations monitoring. The system also links with the accounting system to provide Contract management and accounting information. HELM is be a single integrated system that provides all data related to the lakes, their design, STP, Groundwater around the lake, and lake accounts and monitoring of different lake improvement interventions undertaken by HUDA.

The software has been developed on Access 2000 and has a number of features matching the requirements of the different disciplines involved with Lake Improvement and Management. The system has been deliberately kept in a distributed design mode; however; it can easily be adapted for centralized usage and for conversion of database to SQL Server or Oracle. With minor changes in the base GIS layers, the system is easily adaptable to any city or urban area in the sub-continent.

The software has data entry features and will enable all the data available in different offices to be standardized. The software has limited analytical tools. In order to carry out specialised analysis the software provides facilities for exporting the data in an ASCII format which is compatible with specialised application software. The software has also capabilities for integrating data generated by different automated water level/water quality equipments. Data export for modeling purposes is also integrated.

2. FEATURES OF HELM

The HELM software enables record by record entry. This allows the user to input data, review or update the individual lake information. However for monitoring water level, water quality, meterological data provision is made for entering data independently.

The software comes with built in security features. User levels can be clearly defined. Higher level users (database in-charge) have been provided with facilities for defining the user levels of lower level users. Data ownership and mandate for change is implemented.

In the fields provided with the combo box the user has to select from the list of alternatives instead of typing it. One can either type first few characters or select from the list. Entries other than the listed choices are not available for common users responsible for data entry or data editing.

The software offers facility for storing meteorological, water level and quality data as well generating hydrographs.

Major data Items
- Administrative location
- Geographical co-ordinate, elevation,
- Rainfall data

Graphics

- Graphical presentation of lake water levels
- Graphical presentation of lake water Quality
- Composite plot of the above
- Hydrograph with facility to zoom, scale, pan, and customize, read data from graph, print, export, etc.
- Composite hydrograph (Water level/rain fall, water quality)

3. PRIMARY VALIDATION

Reports

(Free format-reporting feature & customised reports :)
- Lake Information
- Lake details
- Lake Water quality
- Water level (tabular/ columnar)

Export
- Free format ASCII data

User Interface Administration and Security Features
- Three Login Levels with encrypted Password Control
- Super-user Password feature
- Data stored in separate Work-areas with complete Administrative Control
- Option of Creating multiple work-areas from one work-area (User controlled)
- Option of combining work areas selectively
- Option to customise data on the following :

- Administrative Set-up
- Basins
- WQ Parameters and Analysis Methods
- Sequence of WQ Parameters

Data Transfer
- Data Transfer in ASCII / MDB format

Forms and sub-forms
The HELM data entry software is made up of number of customized forms and sub-forms for establishing relationships, and to provide the users simple data entry screens. Related forms are linked together and can be invoked by the command buttons.

Three levels of forms have been designed.

Lake Static Information

Provides a layout for entering, editing or viewing the time independent General information one record at a time related to the details on well location, geology, geo-morphology and drainage system, DWLR installation details and associated Rain Gauge station.

Details

Provides a layout for entering, changing and viewing, data (one record) on well construction, designs, aquifer type, casing, screen and geophysical logging data.

Well design

Provides a layout for entering, editing and viewing (one record) of tube well designs including drilling mud, screen position, gravel pack, grout and seal.

Lake Water Quality

Provides a layout for entering, editing and viewing (single/ multiple records) of water quality analysis results. In this form the user can add number of records to one well as well as carry out entry of information for several wells. Customisation of water quality entry screens is an option made available. The form provides option for printing the water quality results of the

current record. The data can be validated here. There is option for the time series plot of the parameters.

Lake Water level:

Provides a layout for entering, editing and viewing time series (single & multiple wells) monitoring water levels. In this form the user can also view the water level hydrograph and print reports.

Calculator
On line calculator has been provided to convert the data from one unit to the different while working with HELM. To convert the value, enter the data in the respective field and click on the calculator button, while the cursor is still in the same field. Then highlight the unit in the calculator and click on transfer button.

4.   OPERATING "HELM"

Start-up
The pre-requisite skills for working with *HELM* is essentially, familiarity with hydro-geological, geophysical and water quality work along with basic computer skills. The software is user friendly and can be mastered easily by technical staff with adequate field exposure. The *HELM* operation can be initiated clicking the HELM 1.04 icon on the desktop (screen) of the computer or using the 'programs' folder in the task bar.
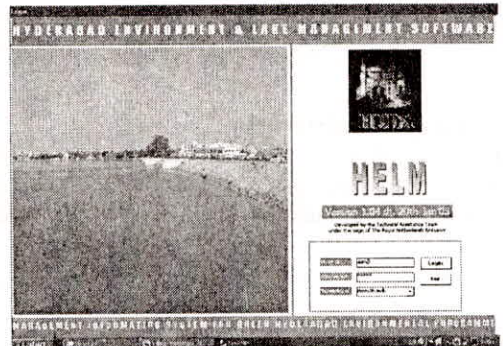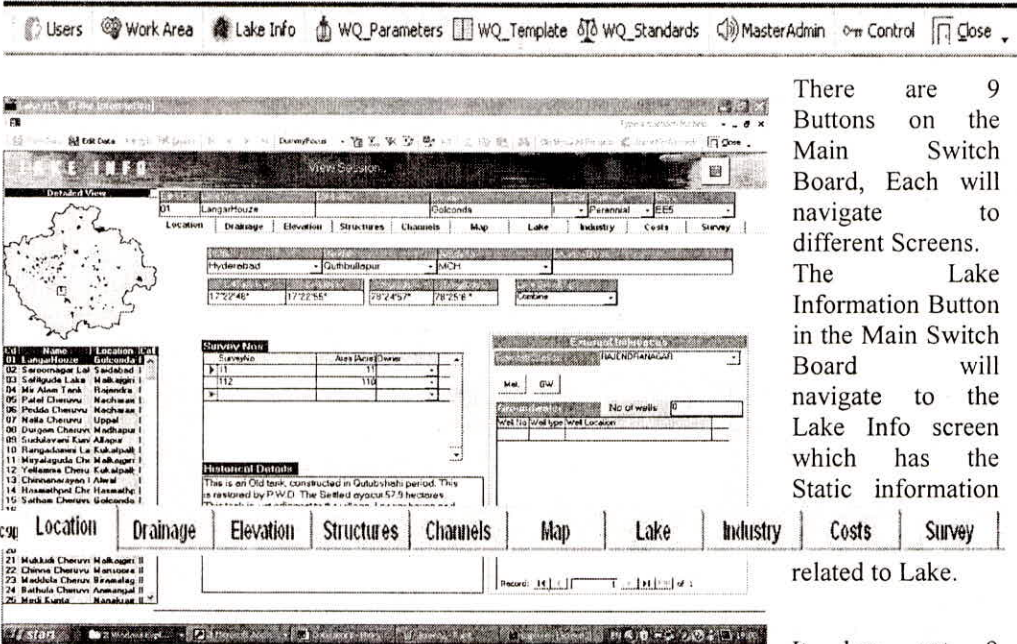

- The main switchboard appears. It has got 9 buttons

    - **Lake Information**

    - **STP Information**

    - **Met Data**

    - **Ground Water**

    - **Lake Levels**

    - **Lake Water Quality**

    - **Reports**

    - **Data Transfer**
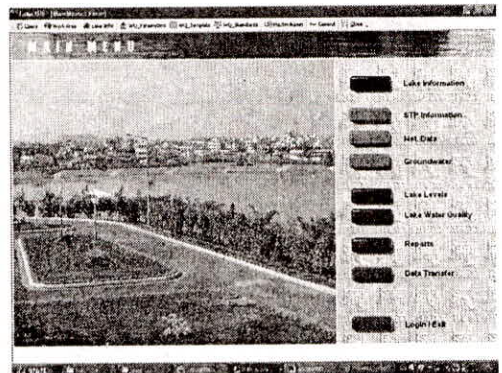
Toolbars are used very effectively in the system, as demonstrated below.

There are 9 Buttons on the Main Switch Board, Each will navigate to different Screens. The Lake Information Button in the Main Switch Board will navigate to the Lake Info screen which has the Static information related to Lake.

It has got 9 Buttons on the screen which will display different information of a Particular lake selected in the List box. The Buttons are :

- Location, Drainage, Elevation, Structures, Channels, Map, Lake, Industry, Costs, Survey

Elevation Tab

Full Tank Level

Type the full tank level of the lake in meters.

Tank Bund Level

Tank Bed Level

Maximum Water Depth
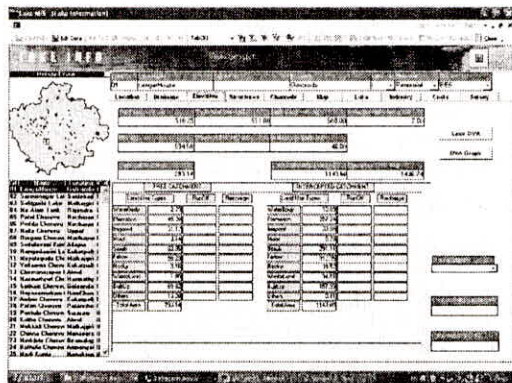
DVA Graph

DVA Graph

This button will navigate into
Lakes Depth-Volume-Area
Relationship Screen
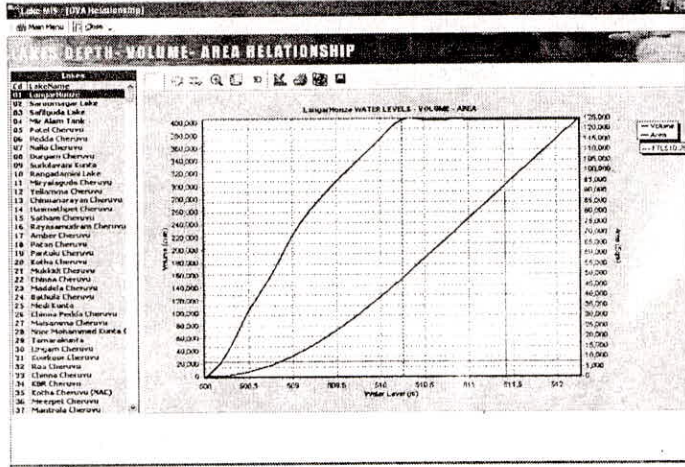
Structures Tab

STP Code
Click the Combo Box to choose the STP Code of the *Lake*.

Bund

Bund Length
Type the Length of bund (meters) of the Lake.

Bund Top Width
Type the top width of bund (meters) of the Lake.

Bund Height   (*The field will accept only numeric values.*)
Type the height of bund (meters) of the Lake.

Bund Side Slope U/s   (*The field will accept only numeric values.*)
Type the Side slope of the bund.

Bund Side Slope U/s   (*The field will accept only numeric values.*)
Type the Side slope of the bund.

Revetment Thickness   (*The field will accept only numeric values.*)

Type the thickness of the revetment.

Nature of the Bund

Type the nature of the bund in the Lake.

Status of the Bund

Type the status of the bund in the Lake.

Sluice

Provide the details of **Sluice,** Viz. No, Type of the Sluice, Location, its Sil Level , Ayacut Details and Status of the Sluice.

Weir

Provide the **Weir** Details. No, Type, Location, Status, Height in meters, Length in meters, Width in meters, Discharge in Cubic meters(Cum) and Remarks if any.

Channels

CNo

Type the Number for the Channel in the Lake.

Name

Type the Name of the Channel in the Lake.

Position

Type the position of channel in the Lake.

Length

Type the length of channel in the Lake.

(*The field will accept only numeric values.*)

Quality

 This button navigates to **Lake Water Quality** Screen.

Status

Type the status of channel of the Lake.

Map Tab
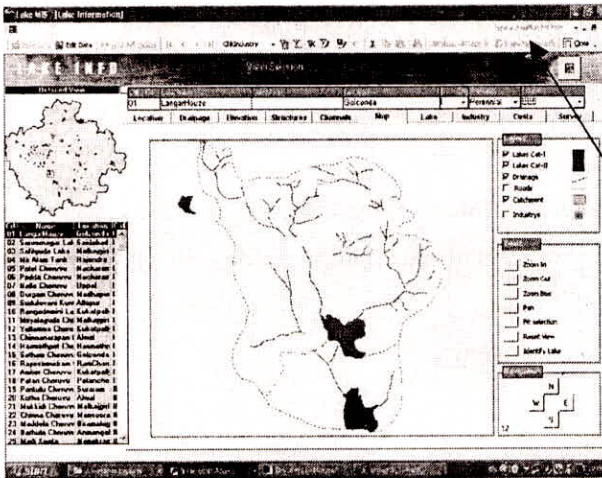
The map of the selected Lake with the surrounding lakes and its catchment, drainage, roads Industry's are visible here.

Layers

Check the Controls to select or deselect the features.

Tools

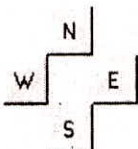**Zoom In:** To enlarge the Map

Zoom Out: To synchronize the Map.

Zoom Box: Selected Area on the map is enlarged.

Pan: To move the map.

Fit Selection: The selected lake in the map will be enlarged to the Map Size.

Reset View: To get back to Default View of the selected Lake in the List .

Identify Lake: To know the name of the selected Lake in the Map.

 These buttons help to navigate the map to different directions

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N – North, W – West, S – South, E - East.

Detailed View

Select the Check Box to true to enlarge the HUDA map which shows all the lakes with drainage, High Ways, Railway track & etc features.

Lake

The Lake screen shows the Lake Boundary in black color with dot format in the Map, Water Spread area in light blue color, Bund in green color, Streams in Dark blue and Red Points in the map indicate Cross Sections of different features of the Lake like inlets, outlets, Bund & etc cross sections in the map of a selected lake in the Lake list. When a feature in the Map is selected which is in red color, the image and the cross section of the respective feature is displayed as shown in the below screen.

The image and the cross section can be zoomed by double clicking them.

Industry Information – including size and pollution status
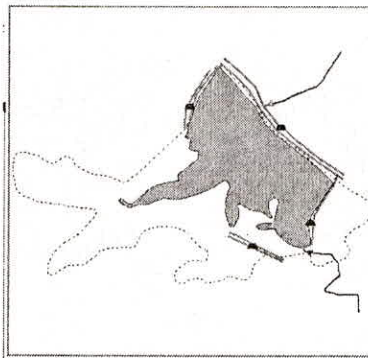
COSTS

Description

Administrative sanction date,

AmtApprovedAS

Technical sanction date,

AmtApprovedTS

Tenders Called date
AggredDate, Amount agreed
Cumulative Expenditure
Status
Activity
Sub activity

Survey
SurveyType
SurveyReference
DateFrom

DateTo
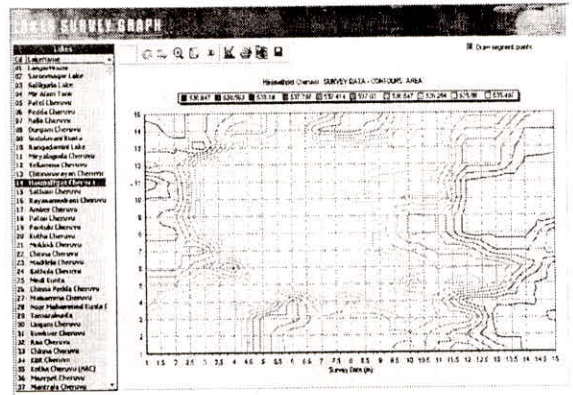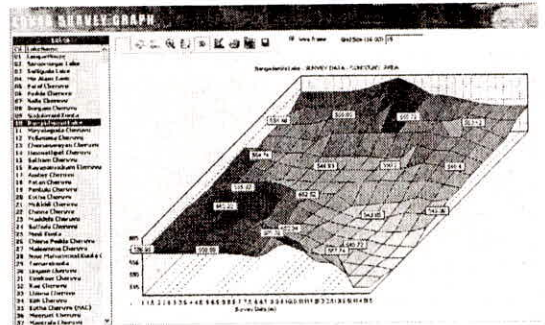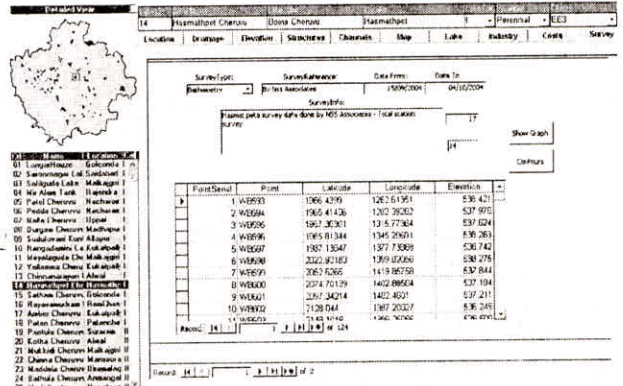SurveyInfo
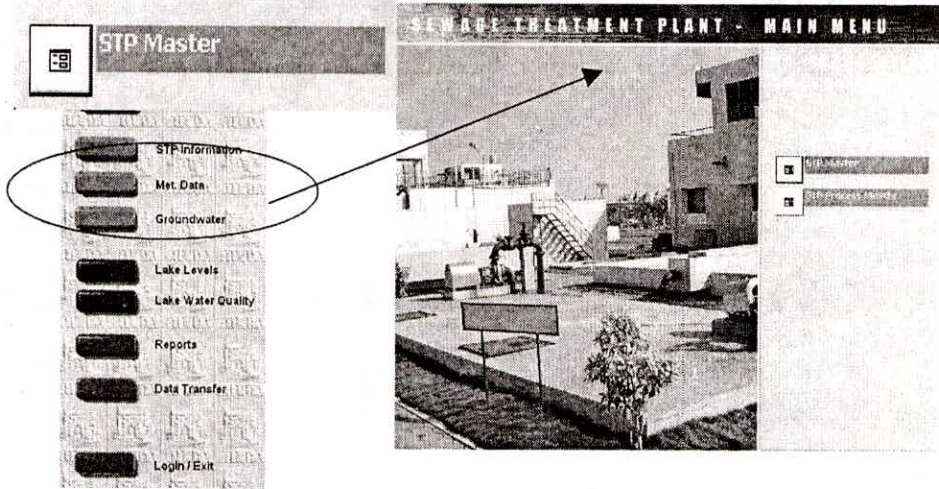
PointSerial
Point
Latitude
Longitude
Elevation

Show Graph
Will give you the profile of the Lake in 3D
view. You can view 'Wire frame' by click
the check box provided on top and also
change the 'Grid Size' .

Contours
Will generates the contours for surveyed
area.

STP Information

STP Master lets you the screen and it has the following tabs. First one is Equipment.

Equipment has two child tables named as "Equipment Master" which stores the Equipments available at STP, and the second one is "Equipment Usage" which stores the Usage of the equipment. User shall add Start and End fields only. The system will calculate the time duration.

In the bottom of the screen user can find some buttons like New Graph, Add to Graph…. etc and other buttons (see the picture).

New Graph: It will plot the equipment usage for selected equipment. User can add six graphs by clicking on "Add to Graph" button. It is useful to compare the performance of the equipments each other.

Performance Chart of STP2
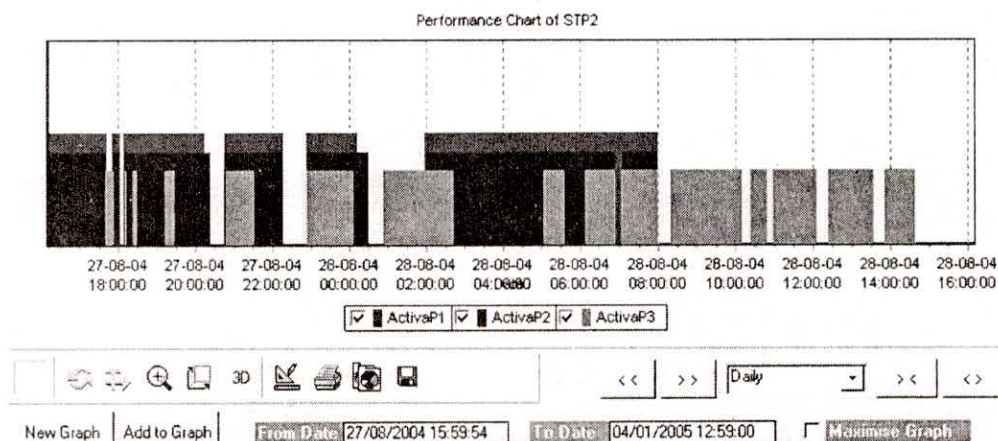
Default display of the graph is daily, i.e. one day; user can change the option by selecting the combo box. Combo box has Daily, Weekly, Half Month and Monthly options.

- Left extreme button (Moves Left) to combo box – moves the date in the graph to left side.
- Left button (Moves Right) to combo box – moves the date in the graph to right side.
- Right extreme button (Moves Out) to combo box – adds the date in the graph both sides.
- Right button (Moves In) to combo box – subtract the date in the graph both sides.

Consumption: Consumption tab lets you the following screen. User can enter the daily consumption of Alum, Chlorine and Diesel.

Plant_MSB: Plant Main Switch Board tab lets you the following screen. User can add the Main Switch Board data.

Met Data:
In this form user can store Rainfall, Maximum Temperature, Minimum Temperature, Evaporation, Wind and Humidity for each Meteorological Station. User can select Evaporation, Wind and Humidity check boxes whether the station records the listed parameters. Uncheck of the check box; disable the user to enter the data. Rainfall and Temperatures are default to all stations

Groundwater:
It will let the user to enter Ground Water Data collected from Wells nearer by the Lake.

It has the following fields, which gives the well information. No, Type, Latitude, Longitude, Height of Measuring Point, Depth, Location, Owner, Address and Distance from the Lake.

Ground Water form has two child forms, which accepts data for *Well Water Levels* and *Well Water Quality*. And has a button for viewing the graph for *Lake GW Levels*.

Well Water Levels: It has the fields of *Date*, *Total Depth* of the water, *Depth To Water-Below Ground Level*, *Reference Level*, *Water Level Elevation* for a well.

Date	Total D n	DTW- BGL	RL	WL-Elvn	▲
03/11/2004	30	6.03	545.2	539.17	
07/12/2004	30	6.24	545.2	538.96	
27/12/2004	30	6.38	545.2	538.82	
31/01/2005	30	6.49	545.2	538.71	
▶ 16/02/2005	30	12.67	545.2	532.53	
✳	0				▼

**Well Water Quality:** It has the fields of Date, TDS, pH at 30°C, Specific Conductivity at 25

μ Sie/cm, Carbonates (Co3)(ppm), Bicatbonates(Hco3)(ppm), Chlorine(ppm), Ferrous(ppm), Nitrates(No3) as N, Sulphates(So4)(ppm),Sodium (Na)(ppm), Potassium(K)(ppm), Calcium (Ca)(ppm), Magnesium (Mg)(ppm), Total Hardness as CaCo3.

Well Water Quality

	Date	TDS	PH at 30c	Sp cond at 25 C mse	CO3 (PPM)	HCO3 (PPM)	CL (PPM)	F (PPM)	NO3 as N	SO4 (PPM)	Na (PP
▶	10/10/2002	301	8	470	20	50	60	3	1	66	
	10/06/2003	230	8			40	30	1		40	
	10/10/2003	307	8	480		120	50	2	4	30	
✱											

Lake GW Levels graph: It has plots the water level of the lake and user can plot all wells water levels on graph and plot selected wells by clicking on the following buttons shown in the form. The right side button, which is marked on red circle is Exit from the form.

Plot All Wells   Plot Selected Wells
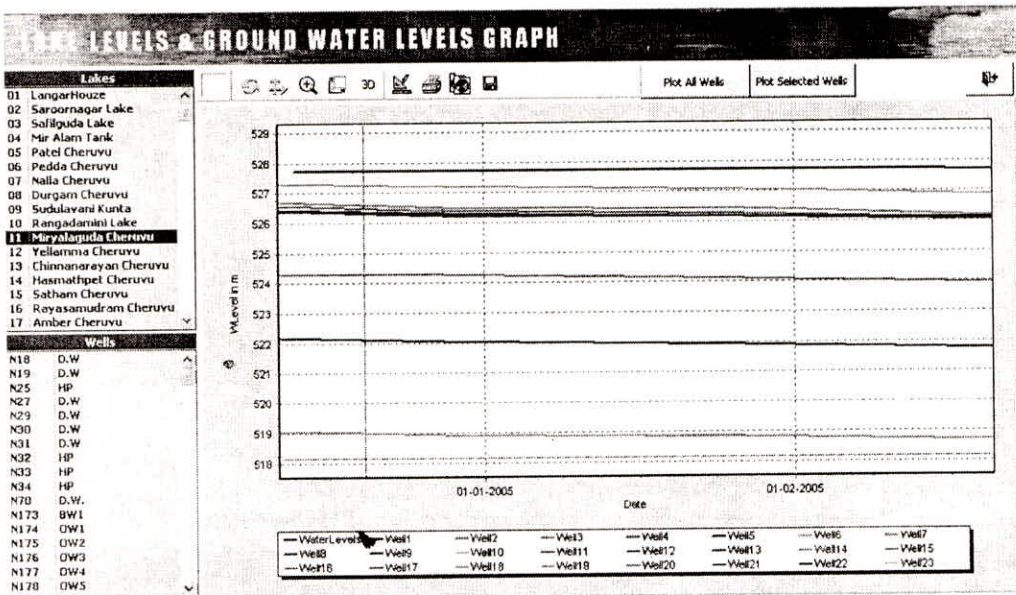
Lake Levels: It invokes the Lake Level form to store the daily lake water levels for individual lakes.

It has Date and Water level fields. It has two buttons, Graph and Digital Data. Graph will invokes the graphical view of the lake water level and Digital Data invokes the Digital Water Level Recorder form to store Water Levels from DWLR instrument.

Graph: Graph will give you the graphical view of the Water Level for selected Lake. It has few check boxes on left side of the form, which shows the Water Level, Points, Full Tank Level, Tank Bed Level, Rainfall and DWLR Data. User can change the dates by selecting the 'From' and 'To' Dates.
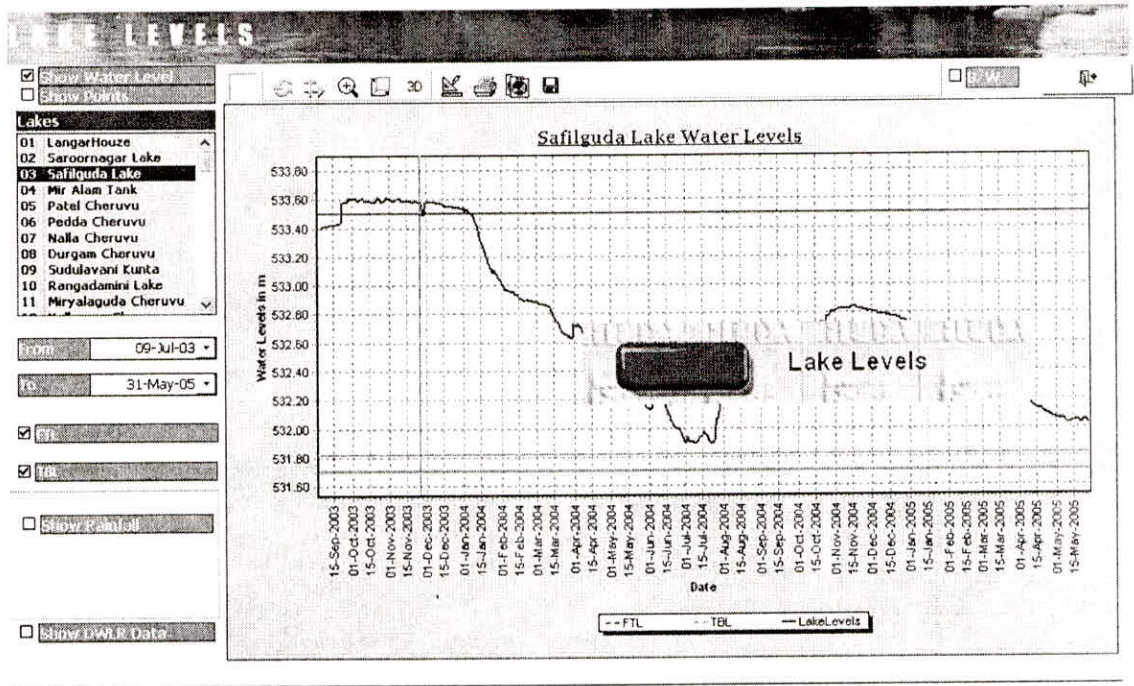
Digital Data: This button invokes the Digital Water Level Recorder Form; User can plot Rainfall on the graph. Digital data can be imported by Win-Situ software from the Palm PC and exported to a text file. The text file is to be imported by clicking a button, which is shown in red color circle on the form and then click on Proceed button to store the data in MDD database, which is shown in green circle.
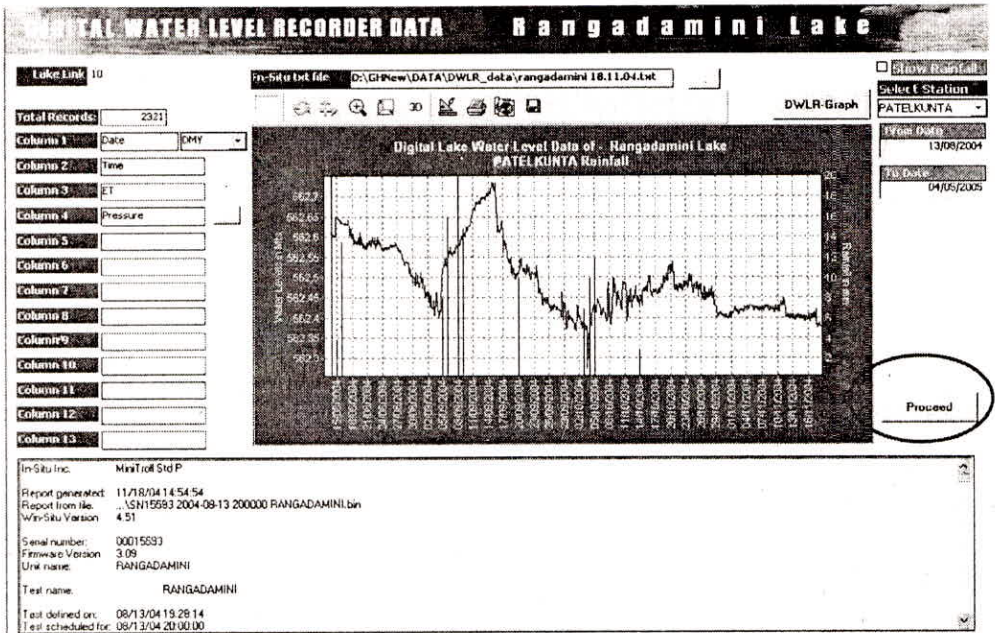
DWLR-Graph button will display the existing water levels on the graph. User can plot rainfall on the graph by clicking the check box of 'Show Rainfall' and Select the Station, if the rainfall is available on the DWLR data collected dates, it will shows the rainfall otherwise gives message that there is no rainfall during the dates. In such a case user can change the dates provided 'From Date' and 'To Date' on the form.

Lake Water Quality: This button invokes the Lake Water Quality form.

In this form User can store the Polluting Status and details of Polluting Sources of the Lake. The form has four buttons Viz. Customise Water Quality Parameters, Digital Data, Water Quality and Sediment Quality. Lets go to the detailed description for the buttons.

Customise Water Quality Parameters: Here user can select the parameters from Optional Parameters to Selected Parameters by clicking on right and left buttons and then change the order of the parameters in Selected Parameters by clicking up and down arrows and then go for Water Quality button to enter the Water Quality data.

Digital Data: Digital data can invokes the Digital Water Quality Data form, to import the

Digital Data logger.

To import the In-Situ file Click the button, provided on right side of the "In-Situ txt file" text box and open the required text file.

In-Situ txt file

Proceed: It will stores the data from selected text file to MDD database.

Water Quality: This form will let you to enter the Water Quality Data for different Sampling point Locations of different lakes. User can add a new sampling point location by clicking on *"Add New"* button and then to save the record by clicking on *Save* button.

Lab Ref	Time	Date	Temperatu	pH	Turbidity	EC	TDS	TH	Alk	Nitrate-N	Nitrate-	PO4	DO	
	12:00:00	10/01/2004		7.0	210.00			.00	420.00	.00				
0	12:00:00	08/11/2004	25.5	7.8	400.00	1408	918				.60	2.64	95.50	1.7
Ramky	19:00:00	23/11/2004	23.0	8.3		1	636							1.4
Ramky	01:00:00	24/11/2004	16.4	8.3		1	774							2.2
Ramky	07:00:00	24/11/2004	21.9	8.5		1	626							1.6
	12:00:00	24/11/2004		9.5										
Ramky	13:00:00	24/11/2004	26.7	8.6		1	488							1.2
Ramky	19:00:00	24/11/2004	22.9	8.2		1	712							1.5
Ramky	01:00:00	25/11/2004	16.2	8.4		1	512							2.0
Ramky	07:00:00	25/11/2004	22.9	8.3		1	650							1.4
0	12:00:00	25/11/2004		7.9										.7
Ramky	13:00:00	25/11/2004	27.2	7.7		1	468							1.6
*	12:00:00													

Graph: This button will give graphical view of the Water Quality of selected sampling points for a single parameter. User can plot the water levels of the lake and Rainfall on the graph.

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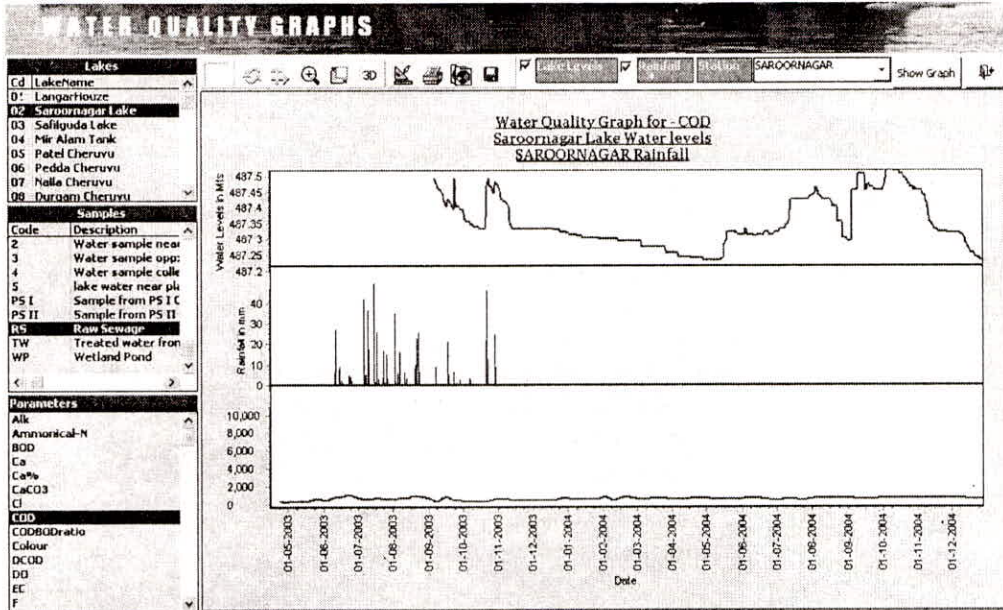
STP WQ Graph: This graph displays three parameters (user definable) for two separate locations on a single graph. This is an extremely useful tool.
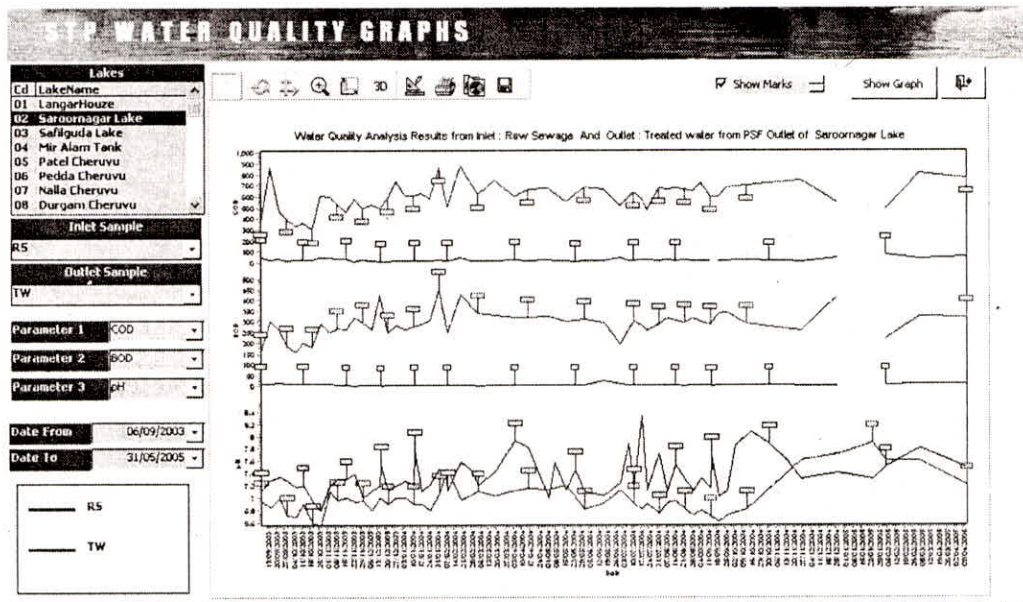
Graphs for Parameters: Here user can select seven parameters in two locations to plot on graph to compare as described above.

Sediment Quality: This form will let you to enter the Sediment Quality Data for different Sampling point Locations of different lakes. User can add a new sampling point location by clicking on *"Add New"* button and then to save the record by clicking on *Save* button.

Graph: This button will give graphical view of the Sediment Quality of selected sampling points for a single parameter.

Reports: Reports button let the user to take the reports for required lakes. The form will give the options to select different reports as per the Jurisdiction.

List of Lakes: Gives the list of the lakes under Jurisdiction.

Lake Catchment Nature: Gives the Catchment details (free and intercepted)

Individual Lake Reports:

Individual Lake reports have the options:

Lake Inventory Report: Gives the inventory details for selected lakes.

Lake Level Report: Gives the Water Levels report for selected lakes.

Ground Water Report: Gives the Ground Water Levels report.

Industrys Report: Gives the Industrys surrounded by the lake.

Water Quality Report: Gives the Water Quality report.

Water Quality – Parameter wise: Gives the Water Quality report for parameter wise.

STP Reports: Gives the STP reports.

> **Equipment Usage:** Gives the Equipment usage.
>
> **Daily Consumption:** Gives the Daily Consumption report.
>
> **Cumulative Consumption:** Gives the Cumulative consumption of item.

Meteorological Reports: Gives the Meteorological report for selected Met Station.

Selected Lakes Water Quality(Fixed Parameters): Gives the Water Quality report.

Data Transfer

Data Transfer: This button let the user to transfer the data from one place to another by Import and Export the data.

Export: Export will export the data into a new MDB file. User can select the lakes from the list box, and tick the check box to export the Lake Water Levels and Water Quality by selecting the Dates,

Surfer Data Export: Exports the Lake Well Data to a new MDB file.

Import: Imports data from an existing MDB (where the file exported some where else).

Import Lake Features (Images): ------ to be described------

PLC Data Import: Import the STP's PLC Data for Safilguda lake only.

Wrap Up

We observe that HELM can be useful for a variety of reasons. It serves as

   a)   a Planning tool – with comprehensive, detailed and validated information

   b)   a Monitoring tool : Time series of water levels, quality, flows and STP performance

   c)   a decision making tool – with analysis options and GIS views

   d)   a central repository – with comprehensive import and export features

The possibility of deploying the software in either of server or stand-alone configurations lends a lot of flexibility – both in terms of LAN / WAN topology and user skill sets.