

Who can I contact to know more?

This is a pre-launch information bulletin on DHARMA. Implementation of the software will be taken up in a phased manner under the guidance of the **DHARMA Implementation Group**. All DRIP dams are expected to be incorporated into DHARMA before the completion of DRIP.

Further information on the Dam Rehabilitation and Improvement Project (DRIP) can be found at www.damsafety.in. A dedicated website for DHARMA 'dharma.damsafety.in.' will be launched in April 2016, once the design of the first version of the software is finalised.

In the meantime, the DHARMA development team can be contacted through the details provided below. We are particularly interested to hear from organisations and individuals who can assist with implementation of DHARMA through providing support to the **DHARMA Implementation Group**.

For further information please contact:

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DHARMA

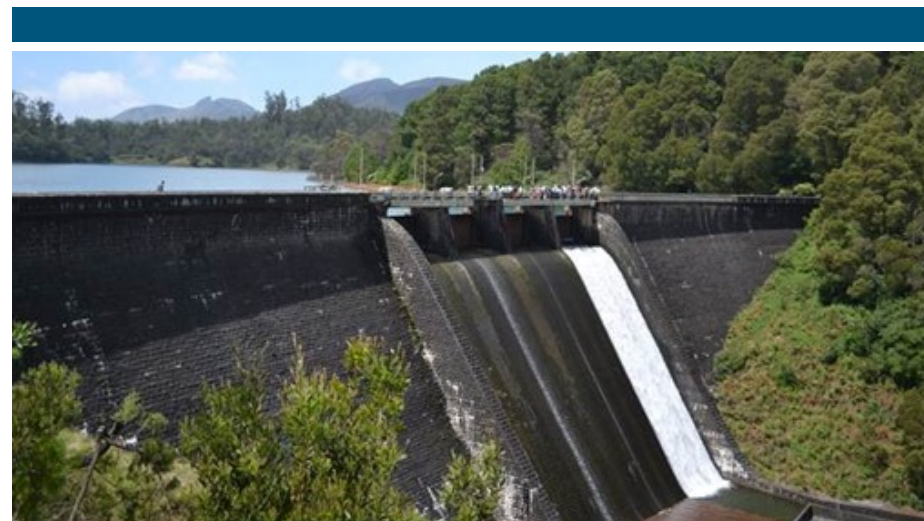


Information Bulletin No.1

Dam Health and Rehabilitation Monitoring Application

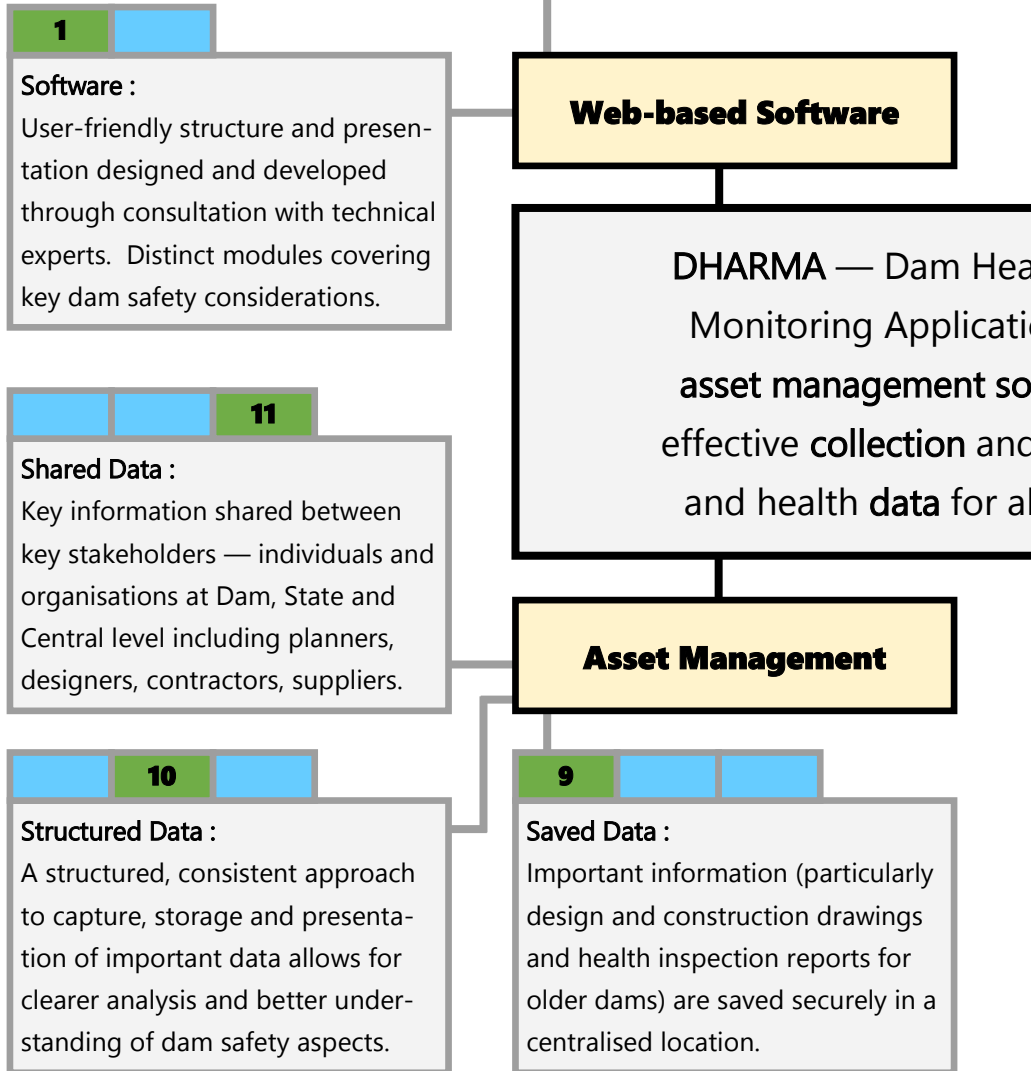


DHARMA



February 2016

What is DHARMA?



Component Summary Section

3. Image Pane :

For each asset component of the project shown in the 'tree', corresponding photos and drawings can be uploaded for presentation in this pane. For photos and drawings, arrows and a magnifying glass icon are provided for scrolling and closer viewing. For the 'Map' tab, a Google Map is displayed with the location of the selected node on either a map or satellite imagery.

4. Captions and Remarks :

Underneath the image pane, two boxes are provided. The upper 'Caption' box presents the description entered by the user for each photo, drawing or map. The lower 'Remarks' box is connected to the component 'node' and allows the user to explain the context of the node in the component tree. In the case of the example (Hirakud Dam in Orissa), it is explained that this is a composite dam with four sections and a node for each.

Project Asset Components Section

1. Components Tree :

The division of a dam project into its component parts or 'nodes', each with corresponding icon, types and engineering features, provides the basis for the Project Portfolio module. There are presently 17 node categories — Reservoir; Dam; Dam Block / Reach; Gallery / Shaft; Drain; Spillway; Hydro-Mechanical; Energy Dissipation Structure; Intake / Outlet Structure; Water Conveyance Structure; Desilting Basin / Chamber; Surge Tank / Chamber; Powerhouse; Turbine / Pump; Access Road; Instrumentation; Flexi-Component.

2. Edit Tool :

The components tree is created and modified by the 'Dams Data Manager' using this edit tool. The 'data' button opens a new form into which information is added for display in the adjacent 'Image Pane'. Others allow components to be added, moved and deleted.

How does the Project Portfolio module work?

The screenshot displays the DHARMA Project Portfolio module. The interface includes a top navigation bar with 'Home', 'Modules', 'Analysis', 'Admin', and 'Help'. The main content area is divided into a left sidebar for project selection and a central area for project details. The sidebar lists various dam projects, including 'Hirakud Main Dam - Concrete and Earthfill Composite'. The central area shows a large image of the dam with a description. The right sidebar contains a 'Project Basket' and 'Your Notes' section.

1. Project Portfolio tree

2. Dam entry in the tree

3. Main image area

4. Image description

5. Sidebar

3

Data Types :
Text and values captured intelligently in standardised, responsive forms to ensure consistency of data. Photos, drawings and documents uploaded quickly and easily.

4

Static Data :
Salient and detailed static information for each dam project including name, location, original/as-built design, purpose and projected benefits, component parts.

Data Collection

5

Dynamic Data :
Regular updating of dynamic, time dependent data including current and previous stakeholders, dam health inspection results and associated rehabilitation needs/works.

Health and Rehabilitation
on — is a web-based
software to support the
management of asset
all large dams in India.

Data Management

6

Database :
All information managed in a comprehensive database, accessible to users with appropriate permissions. Linkage envisaged with other platforms including India-WRIS.

8

Report Generator :
Tool allowing users to generate reports in MS Word or PDF format. Standardised templates present data from software in consistent manner with option to edit further.

7

Tables and Graphs :
Tool allowing users to view, customise or create tables and graphs summarising key data and metadata. Options to export to MS Excel/ other software for further analysis.

Why is DHARMA needed?

There are about **4,900 large dams** in India and about 300 are under construction. In addition, there are several thousands smaller dams. All of these dams are vital for ensuring the water security of the country in a sustainable manner and regulating water during the rainy season to prevent floods.

However, today many of these dams are facing various **structural deficiencies** as well as shortcomings in the **operation and monitoring** facilities. There are also inadequacies in complying with the current **design standards** and philosophy. These conditions affect the safety of the structures and pose **risks to life and properties** of people downstream of dam.

The Dam Health and Rehabilitation Monitoring Application (DHARMA) has been designed and developed to **enhance the capacity** of individuals and organisations throughout India to manage their dam assets scientifically and professionally so as to **sustain advantages** of dams (irrigation and water supply, flood control, hydropower etc) and **prevent disasters**. DHARMA will address **four main challenges**, listed and described below :

1. Bring stakeholders together

There are many stakeholders involved in any dam project, including dam owners, operators, consultants, contractors and suppliers. Often, in the decades following commissioning, the details of these stakeholders can be misplaced thus denying access to valuable **information, insights and skills**.

⇒ DHARMA will ensure that details of all stakeholders are **recorded and maintained**. Such details may pertain to individuals as well as organisational entities associated with dam planning and design, construction, operation and maintenance, and rehabilitation.

DHARMA Page Structure

1. Top Menu Bar :

The menu bar allows the user to navigate between the main features of the software and includes an explanation of the current page and link to account settings.

2. Project Basket and Your Notes :

This right hand panel allows users to navigate between the dam projects in their basket (those assigned to the Licensee and within their specific authorisation level).

3. Your Notes :

This feature allows users to record either general or project specific notes and reminders.

4. Toolbar Section :

As with those elements described above, the Toolbar remains visible throughout the software. It includes editing and saving options and context-based help.

Project Features Form

5. Information Tabs :

Tabs are used throughout DHARMA to intelligently gather information by categorising information appropriately and maximising use of the available space. In the case of Project Features, the number of tabs is dependent on the purposes selected in the first 'General' tab — for a project with all nine purposes, nine tabs are provided to capture the benefits for each.

6. Boxes and Fields :

For each tab, information is further categorised within boxes. For example, in the case of the 'General' tab, the 28 fields are presented in four boxes labelled 'Name', 'Type', 'Agency' and 'History'. The fields are designed to enable as much data to be captured as consistently as possible through check-boxes and dropdown lists whilst also leaving flexibility for additional information and comments to be added.

How does the Project Features module work?

The screenshot displays the 'Project Features' module in the DHARMA system. The interface includes a top navigation bar with 'Home', 'Modules', 'Admin', and 'Help'. A sidebar on the left contains 'Project Features', 'Location', 'Benefits', and 'F'. The main content area is divided into several sections:

- 1** (Callout 1): A search bar at the top left of the main content area.
- 2** (Callout 2): A 'Project Basket' section showing a search for 'Hirakud' and a list of results including 'OR10HH0003' and 'Hirakud Reservoir'.
- 3** (Callout 3): A 'Your Notes' section with tabs for 'General' and 'Project', and a 'Last Updated' date of '12/02/2016'.
- 4** (Callout 4): A 'Remarks' field at the bottom right of the form.
- 5** (Callout 5): A 'General' tab in the sidebar.
- 6** (Callout 6): A 'Project Purpose' section with checkboxes for 'Irrigation', 'Water Supply', 'Flood Control', 'Hydropower', 'Industrial', 'Fish Production', 'Navigation', 'Tourism', and 'Other Benefits'.

The form also includes fields for 'Type', 'Multi-State Project?', 'Project Category', 'Y/N', 'Current Status', 'Start of Construction', 'First Impoundment', 'Project Commissioned', 'Project Decommissioned', and 'Remarks'.

2. Ensure completeness of information

Today, local and State authorities maintain limited information concerning their dam assets. This gap in information not only affects routine operation and maintenance but also decisions on **policy, budgeting and rehabilitation**.

- ⇒ DHARMA will enable gathering and updating of dam asset information in a **centralised and structured** manner so as to overcome limitations of multiplicity of agencies, wide geographical spread, voluminous data, varied terminologies and units, unknown and mismatched time reference and inconsistent formats.

3. Assess soundness of dam health

Well established procedures exist for periodical dam health assessment through routine inspections and detailed investigations wherever required. However, dam asset information in its current form and format often does not show the **time dependent variations** in dam health condition.

- ⇒ DHARMA will ensure **prompt capturing** of inspection and investigation data directly by the 'Dam Health Engineers' and provide tools for **correct analysis and interpretation** of this timeline data.

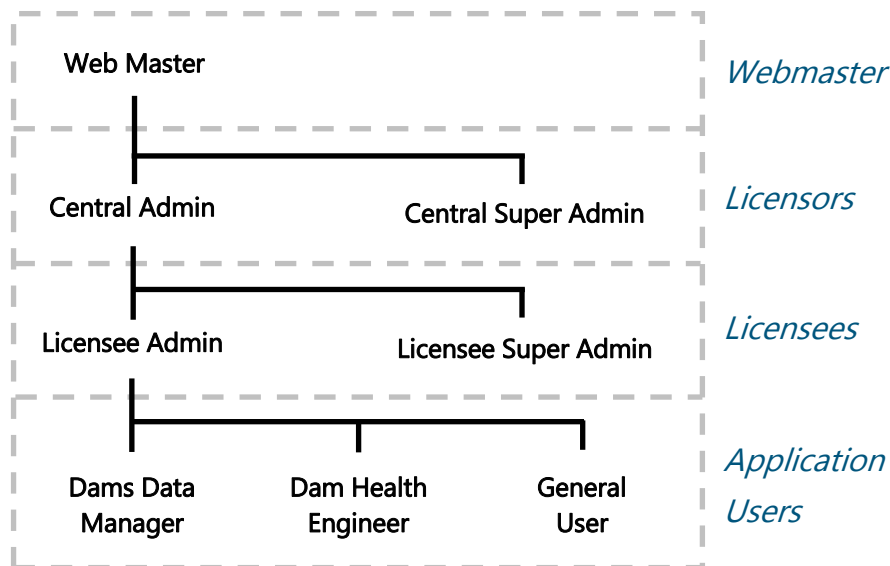
4. Effectively manage asset inventory

Effective asset management can only be achieved with engagement of key **stakeholders**, completeness of **information** and access to appropriate **tools** — a requirement which is not being met for most of dams in India.

- ⇒ DHARMA will provide a **complete data collection and management platform** for assimilation of varied information for every dam component across all dam projects, also thereby benefiting from the insights and learning curves of a wider stakeholder spectrum.

Who can use DHARMA?

DHARMA has been designed for individuals and organisations at **Dam, State and Central level**. Owing to the large number of dams, several thousand individuals are expected to use the software; they will be assigned to seven main user roles across three tiers, as presented below:



The highest tier '**Licensors**' includes the 'Central Admin' and 'Central Super Admin' roles — these are based in the Central Dam Safety Organisation (in Central Water Commission) and are responsible for administrative control and distribution of the DHARMA software. One of the responsibilities of the 'Licensors' is to grant licenses to the second '**Licensees**' tier which includes the 'Licensee Admin' and 'Licensee Super Admin' roles. These are typically members of Central or State dam owning organisations (eg. State Water Resources Departments). Licensees, in turn, can add three types of '**Application Users**' namely 'Dams Data Manager', 'Dam Health Engineer' and 'General User' who are responsible for managing and updating the data in DHARMA.

What is the status of DHARMA?

DHARMA is being developed as part of the institutional strengthening component of the **Dam Rehabilitation and Improvement Project (DRIP)** — a six year programme being undertaken by the Central Water Commission with loan assistance from the World Bank. The project started in April 2012 and is due to complete in 2018.

To date, extensive development has been undertaken to establish the key features of the software including the site architecture, page design, user roles and authorisation matrix, data standardisation and unit customisation. Two modules have been developed and are currently under testing (**Project Features** and **Project Portfolio**, presented overleaf). In the coming months, further modules (**Stakeholders**, **Asset Health**, and **Asset Rehabilitation**) and analytical tools (**Tables**, **Graphs** and **Report Generator**) will also be completed. As presented below, it is expected that a first complete version of DHARMA will be ready in April 2016. A **DHARMA Implementation Group (DIG)** consisting of members from Central Water Commission and representatives from select DRIP Implementing Agencies will undertake the alpha-testing prior to launch of the first release of the software (expected in June 2016).

February 2016	Completion of design and development for Project Features and Project Portfolio modules.
April 2016	Completion of design and development for complete first version of DHARMA software.
June 2016	Launch of DHARMA software following two-month testing period with DHARMA Implementation Group
Beyond June 2016	Implementation of DHARMA among DRIP Implementing Agencies, followed by extension to other Indian States