

## Notes of the Plenary of IAH Commission on Managing Aquifer Recharge

### IGC7 Groundwater Vision 2030

Tues 18:45-19.45 in A.P. Shinde Symposium Hall, NASC Complex, New Delhi.

**Attendees** (33 from 6 countries): India 25 (W Bengal 5, UT 4, Odisha 3, Raj 3, Guj, Hary, J&K, Mah, MP, UP, national 4), Aust 2, Germany 2, UK 2, Korea, Sth Africa)

Yogita Dashora, Basant Maheshwari, Prahlad Swarnkar, Tapas Acharya, Cornelius Sandhu, Gopal Krishan, Alan Macdonald, Tushar Vidhyarthi, N R Behere, Sudarsan Sahu, Thomas Grischek, Vijay Pakhmode, Sami Uuah Bhat, R C Jain, Neha Rarh, Raghwendra B Shadilya, Navneet Sharma, Karen Villholth, S N Dwivedi, B C Joshi, Pravin Patil, SK Md. Equeenuddin, Munish Kumar Upadhyay, Arnab Majumdar, Badnish Rayzu Padkee, Niladri Naha, M K Garg, Sudhir Kr Srivastava, S P Sinha Ray, Anil Kumar, K G Bhartariya, David Polya, Peter Dillon (co-chair)

**Apologies:** Weiping Wang (co-chair), Enrique Fernandez Escalante (co-chair)

#### Agenda:

1. Welcome, Introductions and Objectives of Commission – Peter
2. Address by Dr D. Saha, Member CGWB representing MoWR –Dr Saha
3. Progress reports and plans of Working Groups (as reported by their leaders)
  1. MAR for Development – Yan Zheng Martin
  2. Global MAR Inventory – Catalin Stefan and Nienke Ansems
  3. Economics of MAR – Andrew Ross
  4. 60 years history of MAR – Peter Dillon and Pieter Stuyfzand
  5. Management of clogging– Russell Martin
  6. MAR to MARKET – Enrique Fernandez Escalante
  7. MAR and groundwater governance – Tim Parker
  8. MAR water quality guidance and regulations – Manuel Sapiano
4. ISMAR10 Madrid May 2019 – Invitation Enrique Fernandez
5. Process for bidding to hold ISMAR11.
6. Information Sharing
  1. GRIPP – Groundwater Solutions Initiative for Policy & Practice – Karen Villholth
  2. Bank Filtration Research Centre – Thomas Grischek and Cornelius Sandhu
  3. Checkdam recharge and economic performance Rajasthan (MARVI)- Yogita Dashora
  4. Status of web site and email list – Peter
  5. MAR and Fluoride Rajasthan project – Cranfield and NIH
  6. UTFI and PhD student looking for host university – Navneet Sharma
  7. UpScape – upscaling checkdams – Alan MacDonald
  8. BSMAR16 – San Diego, 5-7 March 2018
  9. Special Issues of Journals arising from ISMAR9
7. Suggestions for new activities – anyone
8. Volunteers to participate in existing and new activities – anyone
9. Close of Plenary (Next Plenary at next IAH Congress, South Korea, Sept 2018)

## Notes of meeting

### 1. Welcome, Introductions and Objectives of the Commission

Peter Dillon, co-chair IAH-MAR welcomed all to the meeting. He thanked conference organisers for making provision for this plenary, notably AGGS, with whom IAH shares many common objectives. All are welcome to attend and participate in commission activities regardless of whether a member of IAH. We hope each one gain benefits that may eventually lead to wanting to join IAH.

Objectives of Commission - Peter - as per our web site: <https://recharge.iah.org/>

- to promote the securing and expanding of water resources and improving water quality in ways that are appropriate, environmentally sustainable, technically viable, economic and socially desirable.
- to encourage research, development and adoption of improved practices for management of aquifer recharge
- to improve knowledge, skills and capabilities of practitioners, water resources managers and regulators.
- to facilitate international exchange of information between members (e.g. via a web page and an email list), by disseminating results of research and practical experience (e.g. via conferences and workshops), raising awareness of MAR among IAH members, related professions and the community, and its members undertaking projects and activities identified in plenaries as important.

IAH-MAR aligns with Strategic Plan of UNESCO IHP-VIII (2014-2021) "WATER SECURITY: RESPONSES TO LOCAL, REGIONAL, AND GLOBAL CHALLENGES" Specifically:  
*Focal Area 2.2 - Addressing strategies for management of aquifers recharge*  
<http://en.unesco.org/themes/water-security/hydrology/ihp-viii-water-security>

### 2. Address by Dr Dipankar Saha, Member CGWB, representing MoWR

Dr Dipankar gave a talk showing the range and scale of some of the forthcoming MAR activities in India, under the artificial recharge master plan, and involve spending 25,000 crore Rp /yr (US\$4B/yr) for rainwater harvesting, conjunctive use, and unlined channel recharge including in interlinking rivers. A large volume of water is required. Of India's 6584 blocks (groundwater administrative areas), 1024 (16%) are overexploited – so aquifer storage space is plentiful but finding sources of water for recharge is the issue. There is much wastewater but groundwater quality needs to be cared for. A study in Krukshetra district (Haryana) showed that artificial recharge was not as efficient as improved irrigation practices, eg drippers and crop selection. Artificial recharge needs to be an integrated part of groundwater management.

### 3. Plans and actions of current working groups

The Commission forms groups to undertake specific tasks to address some of its objectives. These working groups are described on the IAH-MAR web site:  
<https://recharge.iah.org/working-groups> Working group leaders gave brief talks in a recent IAH-MAR Plenary session in Sept 25 in Dubrovnik at IAH Congress and Peter quickly summarised these:

1. *MAR for Sustainable Development – Yan Zheng*

Yan will oversee the development of a series of fact sheets (initially about 5) on a variety of successful MAR projects that have been in operation for preferably 15 years or more, and of different types in varied settings, covering developing and developed countries. She aims to develop a matrix of measures of success of MAR projects, to include in these fact sheet stories of success. These may be embedded in IGRAC MAR Portal on the web (see Global Inventory Working Group Report) and other formats with some or all linked with GRIPP.

**ACTION: Volunteers are sought to write site descriptions or provide information or existing papers on specific sites. Any volunteers to contact Yan. <https://recharge.iah.org/mar-for-sustainable-development>**

2. *Global MAR Inventory – Catalin Stefan with Nienke Ansems*

[IGRAC MAR Portal](https://recharge.iah.org/global-mar-portal) – The MAR Portal contains detailed information on 1200 Managed Aquifer Recharge sites around the world as well as regional MAR suitability maps. Outputs of the working group activities are uploaded and maintained here. It is intended to overlay the MAR layer on other thematic maps such as groundwater stress.

Catalin's powerpoint presentation is on the working group page :

<https://recharge.iah.org/global-mar-inventory>

Two papers are in preparation for the SWARM special issue.

**ACTION: If you have information on a MAR site that you would like included in the international set accessible at IGRAC's web site please visit the portal and complete a template of information and submit it.**

3. *Economics of MAR – Andrew Ross*

Andrew had reported that he intends to extend existing work on financial cost of MAR (1 article in prep for SWARM special issue) to less developed countries, and also to extend the work of the WG to cost effectiveness analysis of selected cases (comparing benefits and costs of MAR projects with alternative approaches to water supply, water security or water quality improvement). A summary of working group activities is at

<https://recharge.iah.org/economics-of-mar>

**ACTION: Volunteers are needed to provide economic information for MAR case studies that could be brought into the synthesis in this working group. Andrew is keen to have MAR sites from developing countries.**

4. *60 years history of MAR – Peter Dillon and Pieter Stuyfzand*

A global summary is in prep for review and publication in the Hydrogeology Journal as an open access paper supported by UNESCO as a contribution to IHP VIII. Further national/regional contributions will be uploaded at the IAH-MAR web site along with a web-link to the paper when published. Current annual volume of MAR exceeds 9 cu.km which is about 1% of total annual groundwater extraction but only 0.07% of natural recharge.

In India, only Gujarat has data on recharge structures to allow a reliable estimate of mean annual recharge volume and only 4 other states have information that enables this to be inferred. Considering the level of investment it is surprising that information has not been compiled for all other states. The five states have a volume (>3000Mm<sup>3</sup>) almost one third of the global total. A common element is a table of MAR annual volumes by decade since the mid 1960's: <https://recharge.iah.org/60-years-history-mar> However if historical data is

unavailable, current data on capacity of recharge structures in any state would be a useful step forward.

**ACTION: Volunteers who can write state summaries for India are needed. Please contact Peter if you can help.**

5. *Monograph on clogging and its management – Russell Martin*

The first monograph is available (see <https://recharge.iah.org/working-groups/clogging-and-its-management>). The second volume underway is underway and more contributions are needed. The aim is to complete this for ISMAR10 – Madrid May 2019

- New material - seeking papers on
  - Low cost low tech applications to reduce/manage clogging
  - MAR clogging indicators
  - standardization of investigation methods
  - case studies on management of clogging during MAR
- Synthesis of clogging papers from previous ISMAR proceedings may also be.

**ACTION: Papers or reports on management of clogging are invited in 2018 for consideration for inclusion in Volume 2. Please contact Russell if you wish to contribute, or are aware of relevant open access material: [rmartin@wga.com.au](mailto:rmartin@wga.com.au)**

6. *MAR to MARket – Enrique Fernández Escalante*

Many examples of MAR including Peruvian example of flood water detention and infiltration are posted on: <https://recharge.iah.org/mar-to-market>

7. *MAR and Groundwater Governance – Tim Parker*

Tim led the working group that produced ‘A Call to Action for Groundwater Management’ based on workshops at ISMAR9, and communicated broadly through IAH and GRIPP.

<https://recharge.iah.org/call-to-action-on-groundwater-management>

8. *MAR water quality guidance and regulations – Manuel Sapiano*

At the IAH-MAR Plenary in Dubrovnik 25 Sept 2017 a water quality guidance and regulations working group was established to assemble examples from around the world

<https://recharge.iah.org/mar-regulations> and to give critical review of the assembled material.

**ACTION: Anyone aware of national or state regulations regarding MAR and water quality for health and environment protection please provide a copy or send the link to Manuel or Peter.**

4. **ISMAR10, Madrid May 2019 – Invitation - Enrique Fernández (PPT)**

This is the leading global symposium on Managed Aquifer Recharge and Enrique has issued a warm invitation to ISMAR10 in Madrid in May 2019. A call for papers will be coming in 2018.

5. **Process for bidding to hold ISMAR11**

Peter advised that anyone wishing to form a team to host ISMAR11 in 2022 should contact him to advise of their interest and to receive details on information requirements of proposals that would need to be received by December 2018. All proposals would be examined by a panel comprising IAH, UNESCO and ASCE (the partners to the series). India ran a very strong bid to hold ISMAR10 in Delhi, but with three recent ISMARs in Asia, and

none in Europe since 2005, Madrid was successful. ISMAR11 would therefore be a different story.

## 6. Information Sharing

### 1. GRIPP – Groundwater Solutions Initiative for Policy & Practice – Karen Villholth

Karen gave an overview of the objectives (towards improved groundwater management, including MAR), development of the program and current membership and outcomes of several recent projects including MARVI. These were detailed on a handout that she distributed. Karen invited all who wish to participate to speak with her. The GRIPP web site is: [www.iwmi.cgiar.org/issues/groundwater/gripp/](http://www.iwmi.cgiar.org/issues/groundwater/gripp/)

### 2. Bank Filtration Centre, Roorkee – Thomas Grischek and Cornelius Sandhu

Thomas described the River Bank Infiltration Centre, a joint activity of University of Applied Sciences Dresden and National Institute of Hydrology, Roorkee. [www2.htw-dresden.de](http://www2.htw-dresden.de) Bank filtration provides natural treatment to the poor quality water in rivers to make it safe for drinking after only chlorination. The Centre is submitting a proposal for EU to further advance the work of this Centre and allow expansion of riverbank filtration to 5% of municipal water supplies in India. Anyone interested to know more please contact Thomas or Cornelius. Cornelius handed out a questionnaire which will be used to illustrate the extent of current understanding, acceptance of, and opportunities for river bank filtration.

### 3. Checkdam recharge and economic performance Rajasthan (MARVI)- Yogita Dashora

Yogita Dashora, who submitted her PhD thesis at MPUAT, Udaipur, on 8 December 2017 briefly described her PhD research on evaluating the hydraulic and economic performance of four checkdams in Rajasthan over a period of 3 years. She has published a paper on the methodology that relies on farmers to take daily measurements of water levels (using a gaugeboard) and rainfall <https://doi.org/10.1007/s40899-017-0185-5>. Further results on the effectiveness of desilting by hand and machine scraping, and local- and catchment-wide economics are in progress. This work was part of the MARVI (Managed Aquifer Recharge and Village-level Intervention, led by Basant Maheshwari, Western Sydney Uni, Australia. <https://www.westernsydney.edu.au/marvi> and <https://www.researchgate.net/publication/318460578> MARVI - Managing Groundwater Use and Sustaining Aquifer Recharge through Village-level Interventions

### 4. Status of web site and email list – Peter

The IAH-MAR web site <https://recharge.iah.org> is a source of information on MAR that is freely accessible to all. The Commission's email list can also be joined from this site. No more than about one email a month would be sent to inform on upcoming conferences, new publications and other items of specific interest on MAR.

### 5. MAR and Fluoride Rajasthan project

Peter advised a new project was announced on the web in Nov 2017 by Cranfield University, UK and NIH, India on Impact of rainwater harvesting in India on groundwater quality with specific reference to fluoride and micropollutants ; [www.gtr.rcuk.ac.uk](http://www.gtr.rcuk.ac.uk)

6. *UTFI and intending PhD student looking for host university and supervisor – Navneet Sharma*  
Navneet is looking for a PhD supervisor for his research related to the Underground Taming of Floods for Irrigation project, where he has been monitoring recharge of stream water diverted to infiltration basins that contain filters and wells to recharge a confined aquifer. He has a special interest in clogging and its management. Any enquiries to Navneet : [navneetsharma.mit@gmail.com](mailto:navneetsharma.mit@gmail.com)

7. *UPSCAPE – upscaling checkdams in catchments – Alan MacDonald*

Alan informed there is a project “UPSCAPE: Upscaling Catchment Processes in Peninsular India” (April 2016-March 2019) led by Indian Institute of Science Bangalore and Centre for Ecology and Hydrology, UK, that is intended to assess cumulative effects of multiple check dams in a catchment. <http://www.iukwc.org/upscape-upscaling-catchment-processes-peninsular-india> “The project seeks to address the key scientific challenge of representing local, small-scale influences at larger scales. Focussing on the large inter-state Cauvery River basin, and using observations from established experimental catchments in both rural and urban settings, the project will explore how changes in land-use, land-cover, irrigation practices and small-scale water management interventions locally affect hydrological processes. It will then develop novel upscaling methods to represent the improved process-understanding in models at the larger sub-basin (Kabini, ~10,000km<sup>2</sup>) and basin (Cauvery, ~80,000km<sup>2</sup>) scales.

8. *BSMAR16 – San Diego, California, USA, 5-7 March 2018*

The title of this Biennial Symposium on MAR is “*Recharge to the Rescue - Managed Aquifer Recharge as a Water Management Tool*”. Abstracts closed 1 November 2017. Will be an excellent symposium in an area where water security is attracting attention and large scale investment. <https://www.grac.org/events/99/>

9. *Special Issues of Journals arising from ISMAR9*

2 special issues of journals have arisen from ISMAR9 Mexico City, June 2016.

1. on the theme: *Water quality considerations for MAR systems* a special issue of MDPI J Water was edited by Pieter Stuyfzand and Neils Hartog. This has 18 papers now published with Open Access. [http://www.mdpi.com/journal/water/special\\_issues/ARS](http://www.mdpi.com/journal/water/special_issues/ARS)

2. on the theme: *MAR in Integrated Water Resources Management*, Springer Journal of Sustainable Water Resources Management is publishing a special issue edited by Peter Dillon, Paul Pavelic, Weiping Wang and Adriana Palma Nava. About 18 will be published, 11 have been accepted including 5 so far published online.

<https://link.springer.com/journal/40899/onlineFirst/page/1>

## 7. Suggestions for new activities

Karen Villholth requested if there was anyone willing to prepare information on “Nature based solutions” Thomas Grischek responded he was willing to do this on Bank Filtration as this was a great example of a natural solution to improving water quality for drinking water supplies. **Action: Karen and Thomas to discuss.**

## 8. Volunteers to participate in existing and new activities

Peter advised that anyone interested in contributing to one or more working group activities could see the IAH-MAR web site <https://recharge.iah.org> and contact the working group leaders whose email addresses are listed there.

## **9. Close of Plenary**

Peter thanked Dr Saha for his address, and thanked all for attendance, and remarked that the commission is fortunate to have dynamic working group leaders and inspiring leaders of programs and centres that help continual innovation and knowledge dissemination to facilitate wise and effective use of MAR.

Next Plenaries of the Commission will be at BSMAR16, San Diego, March 2018 and at next IAH Congress, South Korea, Sept 2018. The session was closed and delegates proceeded to the IGC7 conference dinner.

..PD 29 Dec 2017