Appendix 7

Water Quality

Contents

Water Quality

Theme Subcommittee Members

The Flood-MAR Water Quality Subcommittee consists of 2 co-chairs and 28 subcommittee members; subcommittee members are listed by name and affiliation below.

Position	Name	Affiliation
Co-Chair	Dr. Thomas Hartner	University of California (UC), Davis
Co-Chair	Scott Seyfried	State Water Resources Control Board (State Water Board)
Subcommittee Member	Jeffrey Albrecht	State Water Board
Subcommittee Member	Phillip Bachand	Bachand & Associates
Subcommittee Member	Carolyn Cantwell	State Water Board
Subcommittee Member	Jennifer Clary	Clean Water Action
Subcommittee Member	Helen Dahlke	UC Davis
Subcommittee Member	John Dickey	Southern Ag Coalitions/ILRP
Subcommittee Member	Sarah Fakhreddine	Environmental Defense Fund
Subcommittee Member	Scott Fendorf	Stanford Water in the West
Subcommittee Member	Andrew Fisher	UC Santa Cruz
Subcommittee Member	Rob Gailey	R.M. Gailey Consulting
Subcommittee Member	Charlotte Gallock	Kings River Conservation District
Subcommittee Member	Will Horwath	UC Davis
Subcommittee Member	Lisa Hunt	American Rivers
Subcommittee Member	Adam Hutchinson	Orange County Water District
Subcommittee Member	Matt Keeling	Central Coast Regional Water Quality Control Board
Subcommittee Member	Vicky Kretsinger	Luhdorff & Scalmanini
Subcommittee Member	Aysha Massell	American River Restoration
Subcommittee Member	Sue McConnell	State Water Board
Subcommittee Member	Mike Milczarek	GeoSystems Analysis
Subcommittee Member	Jean Moran	California State University, East Bay

Position	Name	Affiliation
Subcommittee Member	Tara Moran	Stanford Water in the West
Subcommittee Member	Nicholas Murphy	UC Davis
Subcommittee Member	Lisa Porta	Montgomery & Associates
Subcommittee Member	Nels Ruud	California Department of Pesticide Regulation
Subcommittee Member	Abhishek Singh	Intera Consulting
Subcommittee Member	Max Stevenson	Yolo County Flood Control & Water Conservation District
Subcommittee Member	Natalie Stork	State Water Board – Sustainable Groundwater Management Act (SGMA)
Subcommittee Member	Ate Visser	Lawrence Livermore National Laboratory

Engagement Process

The Water Quality theme co-chairs requested participation of water quality experts through their professional networks to assist with the objective of expanding statewide Flood-MAR implementation through understanding potential gaps in water quality issues. A diverse group of experts from universities, non-governmental organizations, private consulting firms, State and federal agencies, scientists, engineers, regulators, and irrigation districts participated in a one-day workshop in January 2019 and in follow-up email communications.

The subcommittee was asked to provide information to meet the following objectives:

- A comprehensive list of available research, data, and tools related to water quality, which, at a minimum, includes all current research, data, and tools that will be potentially helpful for project implementers.
- A comprehensive list of research, data, and tool needs/gaps specific to water quality.
- From the list of gaps, a prioritized list of up to 10 water quality research, data, and tools that are deemed essential to help implement Flood-MAR.

These experts provided input during a one-day workshop (workshop meeting notes are included in Attachment A, available by request to FloodMAR@water.ca.gov), which tackled six subtopics, with two short presentations introducing projects related to the subtopic. This was followed by a group discussion of key research, information, and data needs to inform local, regional, State, and federal entities of the need to increase the implementation of Flood-MAR projects statewide. The six subtopics discussed were:

1. Source water quality including sediment load.
2. Water quality issues associated with root zone in recharge area – agricultural landscapes.
3. Water quality issues related to management of the landscape/land use activities in urban recharge areas.

4. Role of the unsaturated zone: legacy loading and attenuation.
5. Reactions and attenuations in groundwater.
6. Policy and decision-making: Site selection and prioritization to achieve regional groundwater supply and water quality management goals.

Following the meeting, these experts provided feedback solicited through review of the meeting minutes and draft prioritization of the top 10 gaps identified by the theme co-chairs. The experts also answered the request for input into a common worksheet with priority research topics and priorities.

Available Research, Data, and Tools

The meeting notes (Attachment A, available by request to FloodMAR@water.ca.gov) provide a list of available research, data, and tools by subject for each of the six topics discussed during the brainstorming session. This information has not been included in the research, data, and tool (RDT) template that is similar to the other themes because of the time required to format the data and because no additional value would be gained. Note that this is not a comprehensive list of existing information and is meant to be a foundation for researchers to build upon existing information when developing sources of information to explore gaps in research, data, and tools.

Research Needs and Gaps

The meeting notes (Attachment A, available by request to FloodMAR@water.ca.gov) provide a list of gaps in research, data, and tools by subject for each of the six topics discussed during the brainstorming session. This information has not been included in the RDT template that is similar to the other themes because of the time required to format the data and because no additional value would be gained.

Prioritization Process

Information and ideas produced during the workshop were used to develop the prioritization of the gaps by organizing the information into a worksheet identifying the information requested from the RDT form and providing it to the subcommittee for individual ranking. The co-chairs prioritized their top 10 gaps, with more emphasis requested for the top three priorities based on their expertise of what was needed to broadly implement Flood-MAR activities statewide. An emphasis was placed on identifying the top three priorities to inform discussions at the third Flood-MAR Research Advisory Committee meeting and relationships among the other top three priorities from other themes.

Listed below are four action ranks, followed by the top three priorities.

1. Research, guidance, and decision-making tool to address water quality issues related to Flood-MAR.

A multi-criteria decision analysis matrix decision tool that includes weighting values for several important to critical factors related to water quality concerns for Flood-MAR projects, this tool will allow users to conduct a site-specific suitability analysis of their location for Flood-MAR. The tool also could be used to evaluate potential sites on a statewide scale. Researching and developing this guidance and decision-making tool encompasses most points raised by the Water Quality Subcommittee, as summarized in Action Ranks 1A, 1B, 1C, and 1D.

1A. Assess influence of surface water source and conveyance system management on water quality and provide guidance.

Increased understanding of water quality impacts associated with different water sources (streams with and without reservoirs, various watershed characteristics, stormwater runoff) and conveyance systems (e.g., algicide accumulation in canals, turbidity increases with different conveyance systems based on soil type). Cost benefit of turbidity management (pre-treatment?) versus recharge benefit. Understanding when increased turbidity can be advantageous as a filtering mechanism. Should large areas be "sacrificed" to handle more turbid first flush flows to enable more focused recharge of less turbid flows? Are there (agricultural) landscapes and (perhaps existing) practices (e.g., plowing) that would benefit or not be

harmed by recharging turbid waters? What limitations must be observed because of turbidity impacts on a conveyance system?

1B. Develop guidance on management of landscapes used for recharge.

Increase understanding to support development of strategies for managing urban and agricultural landscapes, crop selection, recharge practices, nutrient and pesticide management (ag landscape), and toxic substances (spreading out vs focusing in). Potential advantages for focused recharge in areas with suitable soils.

1C. Perform research to develop efficient approaches to integrated root zone water quality and soil health assessment.

Integrated assessment of interactions among different contaminants in the flooded root zone, including a variety of source water quality. This must include a better understanding of the relationship between healthy soils (carbon sequestration) and recharge water quality (denitrification).

1D. Develop increased understanding of and tools to address geochemical interactions under Flood-MAR.

Tools and increased understanding of how to deal with areas with unknown geochemical consequences. Better understanding of potential trade-offs between generation and mobilization of uranium, arsenic, manganese (infinite sources) and denitrification, and geochemical evolution of the vadose zone, groundwater, and affected wells and streams.

2. Compile all existing knowledge identified by Water Quality Subcommittee members in workshop or by writing, organizing and making available.

Compile all existing knowledge of research, data, and tools into an easily accessible database, using https://groundwaterexchange.org as a platform. A fairly exhaustive list of sources is obtained from subcommittee members and compiled by California Department of Water Resources (DWR) staff or a student assistant.

3. Statewide site mapping and ranking.

Develop a database of the most promising sites throughout the state for Flood-MAR opportunities.

4. Provide policy guidance.

Compile all existing regulatory and policy instrument relevant to Flood-MAR; initiate process to clarify areas of ambivalent policy directions, including a clearer understanding of how the State Water Board will view potential temporary degradation of water quality associated with Flood-MAR, on application of the antidegradation policy; and develop new policies as needed.

Top Three Research, Data, and Tools Actions

The top three research, data, and tools actions, presented below, include an action, detailed description and connection to Flood-MAR, implementation strategy, and rough cost estimate of the identified actions.

Priority 1

Action: Develop a web-based platform to allow public access to a compilation of all existing knowledge identified by the Water Quality Subcommittee.

Description and Connection to Flood-MAR: Compile all existing knowledge of research, data, guidance, and tools into an easily accessible database or web-based platform.

Draft Strategy for Implementation:

Product: Multi-criteria matrix decision-making tool, guidance documents, factsheets, research library, and data and information system.

Lead: Academia.

Partners: Academia, DWR–SGMA, State Water Board, County planners, groundwater sustainable agencies (GSAs), consultants, integrated regional water management (IRWM), farmers, Regional Water Quality Control Board (RWQCB), other State of California agencies, flood control agencies, federal agencies (National Marine Fisheries Service (NMFS), U.S. Army Corps of Engineers (USACE), others).

Estimated Timeline: 1 to 2 years

Cost Estimate: $1–$2 million

Priority 2

Action: Develop better knowledge of water quality issues (sources, conveyance, land use and land use history, naturally occurring contaminants) related to Flood-MAR design and implementation.

Description and Connection to Flood-MAR:
Implement research initiative to increase understanding of and develop tools to assess water quality impacts associated with different water sources (streams with and without reservoirs, various watershed characteristics, stormwater runoff, turbidity) and conveyance systems (e.g., algicide accumulation in canals, turbidity increases with different conveyance systems based on soil type); potential land characteristics (land use, soils, land management practices, site grading) that enable receiving land to handle Flood-MAR for appropriate water quality (turbidity, pathogens, chemicals); cost-benefit analyses of various practices; water quality issues related to past and current land practices in the recharge area including crop selection, past and current nutrient and pesticide management (ag landscape), toxic substances (urban stormwater landscape); potential water quality impacts to the vadose zone and receiving aquifer from legacy contaminants and naturally occurring contaminants; understanding of the relationship between healthy soils (carbon sequestration) and recharge water quality (e.g., denitrification); methods to assess areas that lack water quality and geochemistry data; better understanding of potential trade-offs between generation and mobilization of uranium, arsenic, manganese, and denitrification, geochemical evolution of the vadose zone and groundwater, and affected wells and streams; clarification of antidegradation policy within Flood-MAR context.

Draft Strategy for Implementation:

Product: Curated online knowledge resources library.

Lead: Academia.

Partners: Academia, DWR–SGMA, State Water Board, County planners, GSAs, consultants, IRWM, farmers, RWQCB, other State of California agencies, flood control agencies, federal agencies (NMFS, USACE, Others)

Estimated Timeline: 10 years

Cost Estimate: $20 million

Priority 3

Action: Develop guidance and multi-criteria decision-making tools to address water quality issues in Flood-MAR projects.

Description and Connection to Flood-MAR: Develop guidance and a multi-criteria decision analysis matrix decision tool that includes weighting values for several important-to-critical factors related to water quality concerns for Flood-MAR projects. The tool should allow users to conduct a site-specific suitability analysis of their location for Flood-MAR. The tool also could be used to evaluate potential sites on a statewide scale.

Draft Strategy for Implementation:

Product:

Lead: DWR

Partners:

Estimated Timeline: 2 years

Cost Estimate: $1 million