Chapter 1

RATIONALE

Sustainable Groundwater Management and Conflict Resolution
A California-European Union Joint Workshop

24 & 25 June 2019

Aim:

Water UCI, an interdisciplinary center located in the School of Social Ecology at the University of California, Irvine, organized a 2-day joint California-European Union workshop on Sustainable Groundwater Management and Conflict Resolution in June 2019, sponsored by the Orange County Water District, the Water Replenishment District and the Irvine Ranch Water District, and with further assistance from the State Water Resources Control Board, California Department of Water Resources, and the USGS California Water Science Center.

By bringing practical examples from the European Union experience to California's groundwater stakeholders, the exchange of international experience can contribute to improved implementation of the Sustainable Groundwater Management Act (SGMA), and, more generally, California groundwater governance and management.

Groundwater, the most significant freshwater resource on Earth, is used in many locations in a non-sustainable way, over-drafted and increasingly polluted. Moreover, it is still rather neglected by some policy-makers and is frequently ignored by the public. Far from sight, far from mind! To revert the current trend of groundwater depletion and degradation, "good" groundwater governance is key for ensuring environmental protection and sustainable socio-economic development.

California adopted SGMA in September 2014. To implement SGMA, California's water regulators and managers face significant policy, governance and management challenges, including competition between various stakeholders (in agriculture, industry, and

mega cities), customs and habits acquired over the years, as well as water rights, to name a few.

The European Union has addressed, and continues to address, similar problems with the implementation of its Water Framework Directive, adopted in October 2000, and its follow-on Groundwater Directive, adopted in December 2006 (in European Union jargon, Daughter Directive).

Workshop Objectives:

- To describe case studies of European Union groundwater policy, governance, and management, especially related to implementation of the EU Water Framework Directive and the Groundwater Directive, and draw significant lessons for SGMA implementation.
- To identify possible conflicts in SGMA implementation, e.g. inter-basins conflicts and/or conflicts between stakeholders (public or private), conflicts at various geographic scales (local, regional or international), and explore techniques for their anticipation, prevention, and mitigation.
- To build on this effort as the first of a series of periodic workshops with future sessions centered on different groundwater issues.

Workshop Outcomes:

Online publication of the workshop's proceedings drafted as a practical reference tool for use by practitioners. The proceedings will gather the European Union case studies presented during the workshop, and summarize the resulting conclusions.

Invitees:

The workshop was composed of more than 30 participants, from State and Local Public Water institutions on the one hand, policy and decision-makers and local managers, e.g. Groundwater Sustainability Agencies (GSAs) managers, and, on the other hand, Private Stakeholders, e.g. farmers unions and urban users' associations.

Topics:

Five topics were identified for this workshop, corresponding to major challenges for both California's stakeholders in implementing SGMA, and European stakeholders in implementing the European Water Framework and Groundwater Directives. Each topic will be introduced by European case histories presented by a European specialist, followed by a comparative California-EU discussion to identify similarities, differences, and possible lessons. These topics and corresponding details are listed hereafter:

1) *Governance and management issues* -
   Models of decision-making; moving towards more local management, e.g. water agencies in France and GSAs in California; river basins as the basis of water

management; surface water and groundwater integrated management; EU river basin management plans vs GSPs.

Public information and awareness raising, stakeholder consultation, capacity-building.

Implementation issues related to the transposition of the EU directives into national legislatures; bridging science and policy; impact assessments and possible revision of existing water directives.

2) *Quantity issues* -
Reallocation schemes

Extractable volumes (limitation of withdrawals), permits for groundwater abstraction, databases and control, demand management and ways to reduce over-pumping, administrative authorizations vs water rights and withdrawals permits.

Contrast with performance metrics identified in SGMA.

3) *Quality issues of a technical and regulatory nature* -
Non-point source pollution

EU maximum admissible concentrations vs California maximum contaminant levels and their application in the field

4) *Conflicts 1: Typology of water disputes, groundwater at risk of use, conflict indicators* -
a. Urban vs agricultural settings
b. Inter-basins disputes (no overlap in France, while in California there are many cases of multiple GSAs in a single groundwater basin)
c. Groundwater rights in the EU and California
d. Groundwater and land-use, water quantity-quality nexus
e. Groundwater – surface water interactions/impacts/conflicts

5) *Conflicts 2: From conflict to cooperation, techniques of management and resolution of conflicts* -
a. Techniques for the anticipation, prevention and mitigation of conflicts
b. Examples of successful cases, to avoid court litigations, and lessons learned
c. Examples of failures and lessons learned
d. The value of data and public information in conflict avoidance and mitigation

Dates & Location:

Monday, 24 and Tuesday, 25 of June 2019

University of California, Irvine
Social & Behavioral Sciences Gateway, Room 1517

Chapter 2

ORGANIZATION & FORMAT

Organizing Committee

- Chair: Jean Fried, Professor and Project Scientist, Urban Planning and Public Policy, University of California, Irvine, USA
- David Feldman, Professor and Director, Water UCI, University of California, Irvine, USA
- Jacques Ganoulis, Professor and Special Secretary for Water, Ministry of Environment and Energy, Athens, Greece
- Adam Hutchinson, Recharge Planning Manager, Point person regarding SGMA compliance for OCWD and Basin 8-1, Orange County Water District, USA
- Léna Salamé, Lawyer, Conflict Management and Mediation Expert, Paris, France

Advisers

- Erik Ekdahl, Deputy Director, Division of Water Rights, State Water Resources Control Board, Sacramento, USA
- Eric Reichard, Director, California Water Science Center, U.S. Geological Survey, San Diego, USA

Workshop Chairs

- David Feldman, Professor and Director, Water UCI, University of California, Irvine, USA
- Mike Markus, General Manager, Orange County Water District, USA
- Robb Whitaker, General Manager, Water Replenishment District of Southern California

European Union (EU) experts

- Jacques Ganoulis, Professor and Special Secretary for Water, Ministry of Environment and Energy, Athens, Greece
- Johannes Grath, Head of Unit Groundwater, Environment Agency Austria, Vienna, Austria
- Marcel Kuper, Senior Researcher at the French Agricultural Research Centre for International Development (CIRAD, Montpellier, France) and Visiting Professor at the Institut Agronomique et Vétérinaire Hassan II (IAV, Rabat, Morocco).
- Olivier Petit, Associate Professor in Economics, University of Artois, Arras, France
- Léna Salamé, Lawyer, Conflict Management and Mediation Specialist
- Elena Lopez-Gunn, Director ICATALIST, Madrid, Spain

California Contributors

- Taryn Ravazzini, Deputy Director, California Department of Water Resources, Sacramento, California, USA
- Craig Altare, GSP Review Section Chief, California Department of Water Resources, Sacramento, California, USA
- Steven Springhorn, Technical Assistance Chief, California Department of Water Resources, Sacramento, California, USA

Guest Speaker at Lunch on Monday, June 24th, 2019

- Paul Weghorst, Executive Director of Water Policy, Irvine Ranch Water District, California

Guest Speaker at Dinner on Monday, June 24th, 2019

- Joaquin Esquivel, Chair, State Water Resources Control Board, Sacramento, California

Workshop Facilitators

The purpose of the facilitator is to create a bridge between the EU experience and what is happening in California by developing a set of questions ahead of time and facilitating a discussion with the audience, assisting in the guidance of the discussions and, if possible, taking part in the finalization of the conclusions and drafting of the proceedings. Each facilitator will receive a copy of what each EU expert will share and develop questions to prime the audience for the discussion.

- Erik Ekdahl, Deputy Director, Division of Water Rights, State Water Resources Control Board, Sacramento, California, USA
- David Feldman, Professor and Director, Water UCI, University of California, Irvine, USA
- Jean Fried, Professor and Project Scientist, Urban Planning and Public Policy, University of California, Irvine, USA
- Jacques Ganoulis, Professor and Special Secretary for Water, Ministry of Environment and Energy, Athens, Greece
- Ted Johnson, Chief Hydrogeologist, Water Replenishment District of Southern California, Lakewood, California, USA
- Eric Reichard, Director, USGS California Water Center, San Diego, California, USA

Workshop discussion topics:

1) *Governance and management issues*
   EU expert: Jacques Ganoulis
   Facilitator: Ted Johnson

Models of decision-making; moving towards more local management: for instance, water agencies in France and GSAs in California; river basins as the basis of water management; surface water and groundwater integrated management; river basin management plans vs GSPs.

Public information and awareness raising, stakeholder consultation, capacity-building.

Implementation issues related to the transposition of the EU directives into the national legislatures; bridging science and policy; impact assessments and possible revision of existing water directives

2) Quantity issues

EU Experts : Olivier Petit & Marcel Kuper

Facilitator: Eric Reichard

Reallocation schemes

Extractable volumes (limitation of withdrawals), permits for groundwater abstraction, databases and control, demand management and ways to reduce over-pumping, administrative authorizations vs water rights and withdrawals permits.

Contrast with performance metrics identified in SGMA.

3) Quality issues of a technical and regulatory nature

EU Expert : Johannes Grath

Facilitator : Erik Ekdahl

Non-point source pollution

EU maximum admissible concentrations vs California maximum contaminant levels and their application in the field

4) Conflicts 1: Typology of water disputes
, groundwater at risk of use, conflict indicators

EU Expert: Elena Lopez-Gunn

Facilitator: David Feldman

a. Urban vs agricultural settings

b. Inter-basins disputes (no overlap in France, while in California there are many cases of multiple GSAs in a single groundwater basin)

c. Groundwater rights in the EU and California

d. Groundwater and land-use, water quantity-quality nexus

e. Groundwater – surface water interactions/impacts/conflicts

5) Conflicts 2: From conflict to cooperation, techniques of management and resolution of conflicts

EU Expert : Léna Salamé

Facilitators : Jean Fried and Jacques Ganoulis

a. Techniques for the anticipation, prevention and mitigation of conflicts

b. Examples of successful cases, to avoid court litigations, and lessons learned

c. Examples of failures and lessons learned

d. The value of data and public information in conflict avoidance and mitigation

Format

Monday, June 24th, 2019:

The morning will start with a presentation of the objectives, format, and expected output of the workshop. It will be followed by the presentation of California's Sustainable Groundwater Management Act (SGMA), its implementation challenges, and existing solutions.

Topics 1, 2 and 3 will then be introduced by an EU expert on EU issues and examples during 20-30 min, followed by a general discussion involving all participants, focused on the comparative analysis of both the California experience and the EU experience, along the themes listed in each topic.

A guest speaker will speak during the lunch

A formal dinner, with a guest speaker, will take place in the evening.

Tuesday, June 25th, 2019:

The morning will start with topic 4, introduced by the 20-30 min presentation by an EU expert of EU examples illustrating the typology of water disputes, conflict indicators and groundwater at risk, along the themes listed above, followed by a comparative discussion involving all participants.

This will be followed by topic 5 starting with a Role Play presented and directed by an EU expert, to show the participants the significance of trust and communication in the management of conflicts and cooperation processes, completed by a debriefing outlining the key aspects of successful cooperation processes.

After the presentation of EU cases by the EU expert, a general discussion will follow, focusing on California experience and the differences and similarities between the EU and California

During the afternoon, the key conclusions of the workshop, e.g. the identification of the remaining challenges and the key guidelines to facilitate the implementation of SGMA will be presented by Erik Ekdahl and Jacques Ganoulis and discussed for finalization and adoption. The final conclusion of the workshop and a vision for the future will be presented by Jean Fried.

The workshop will end at 05:00pm.

Chapter 3

Sustainable Groundwater Management and Conflict Resolution
A California-European Union Joint Workshop

24 & 25 June 2019
University of California, Irvine
Social & Behavioral Sciences Gateway
Room 1517

PROGRAM

Monday 24th June 2019

08:00am-09:00am: Registration

09:00am-09:15am: Welcome by Mike Markus (General Manager, Orange County Water District, California), Robb Whitaker (General Manager, Water Replenishment District of Southern California) and David Feldman (Professor and Director, Water UCI, University of California, Irvine), Co-Chairs of the Workshop

09:15am-09:45am: Presentation of the objectives, format and expected output of the workshop, by Jean Fried (Professor and Project Scientist, Urban Planning and Public Policy, University of California, Irvine), Chair of the Organizing Committee

09:45am-10:45am: California's SGMA implementation: general issues, challenges and solutions, by Taryn Ravazzini, (Deputy Director, Department of Water Resources), Craig Altare, (GSP Review Section Chief, Department of Water Resources), Steven Springhorn, (Technical Assistance Section Chief, Department of Water Resources)

10:45am-11:00am: Refreshment break

11:00am-12:30pm: Topic 1: Governance and management issues
EU Contributor: Jacques Ganoulis (Professor and Special Secretary for Water, Ministry of Environment and Energy, Athens, Greece)
Facilitator: Ted Johnson (Chief Hydrogeologist, Water Replenishment District of Southern California)

12:30pm-02:00pm: Lunch
Guest Speaker: Paul Weghorst (Executive Director of Water Policy, Irvine Ranch Water District, California) on "Groundwater Banking in Kern County Using Local Governance and Conflict Avoidance"

02:00pm-03:30pm: Topic 2: Quantity issues
EU Contributors: Olivier Petit (Associate Professor in Economics, University of Artois, Arras, France) and Marcel Kuper (Senior Researcher at Cirad, Montpellier, France, and Visiting Professor at IAV Hassan II, Rabat, Morocco)
Facilitator: Eric G. Reichard (Director, California Water Science Center, U.S. Geological Survey San Diego, California)

03:30pm-03:45pm: Refreshment break

03:45pm-05:15pm: Topic 3: Quality issues of a technical and regulatory nature,
EU Contributor: Johannes Grath (Head of Unit Groundwater, Environment Agency Austria, Vienna, Austria)
Facilitator: Erik Ekdahl (Deputy Director, Division of Water Rights, State Water Resources Control Board, Sacramento, California)

05:15pm-06:15pm: Free time for the participants and drafting of topics 1, 2 and 3 key conclusions by the workshop task force

06h15pm: Dinner at University Club 801 E. Peltason Dr. University of California, Irvine
Keynote Speaker: Joaquin Esquivel, (Chair, State Water Resources Control Board, Sacramento, California)

Tuesday 25th June 2019

09:00am-10:30am: Topic 4: Conflicts 1: Typology of water disputes, groundwater at risk, conflict indicators
EU Contributor: Elena Lopez-Gunn (Director, ICATALIST, Madrid, Spain)
Facilitator: David Feldman (Professor and Director, Water UCI, University of California, Irvine)

10:30am-10:45am: Refreshment break
*10:45am-01:*30pm: Topic 5: Conflicts 2: From conflict to cooperation, techniques of management and resolution of conflicts
EU Contributor: Léna Salamé (Lawyer, Conflict Management and Mediation Specialist, Paris, France)
Facilitators: Jean Fried and Jacques Ganoulis

10:45am-12:00pm Role Play and Debriefing
12:00pm-12:30pm Presentation of EU cases
12:30pm-01:30pm General discussion

01:30pm-02:30pm: Lunch and drafting of topics 4 and 5 key conclusions by the workshop task force

02:30pm-04:30pm: Presentation of the key conclusions, general discussion and adoption of the conclusions, by Jacques Ganoulis and Erik Ekdahl

04:30pm-05:00pm: Final Conclusion of the Workshop and Perspective for the Future, by Jean Fried, Chair of the Organizing Committee

05:00pm: End of Workshop

Chapter 4

Introduction

Workshop Presentation

Jean Fried
Chair of the Organizing Committee

A warm welcome to all, with my very special greetings to our colleagues from Europe who did not hesitate to cross an ocean and a continent to share their experience with us. They are bringing their knowledge and experience, but I am sure that they will also learn from California groundwater governance and management experience during this workshop, which we plan to be the first of a series of yearly workshops, entitled "**California Groundwater Policy, Governance and Management, the Relevance of International Experience**".

Why a California-EU workshop?

For 20 years I have been an expert-consultant and an advisor at the European Commission, the executive body of the European Union in Brussels. I chaired the task force that drafted the first EU groundwater directive of 1980, directed the survey and mapping of

the EU aquifers and, as Secretary General of the 1991 Ministerial Seminar in the Hague, Netherlands, started the preparation of the second groundwater directive of 2006.

Having introduced my EU experience in my course on groundwater policy and governance at UCI, within Water UCI, I noticed the interest of my students. I was also inspired by the article of Richard Thomas, published in January 2009 in the Pace Environmental Law Review and entitled: "The European Directive on the Protection of Groundwater: A Model for the United States". And I decided to share this experience with David Feldman and Mike Markus, and this is how the idea of the workshop was born and took shape.

The Paradox of Groundwater

Groundwater presents an incredible paradox: it is the most significant freshwater resource in the world, yet it is often non-sustainably used, over-drafted and polluted, and, furthermore, it is ignored by policy-makers and the public.

Groundwater is a most important freshwater resource: non-saline groundwater represents about 30% of all freshwater while usable surface water, like rivers and lakes, represents 0.4% of all freshwater, the rest being ice and glaciers.

For the US, groundwater constitutes an estimated 90% of all freshwater, but less than 27% of the used freshwater.

Groundwater use is increasing worldwide, and it must face many threats, such as over-abstraction and pollution, with degrading recharge areas, due to deforestation and desertification and the increase of areas with impermeable surfaces.

Yet legislation and management concerning groundwater are nearly absent. Compared to surface water, there are few legal and institutional tools designed to specifically manage groundwater resources. Lack of scientific and technical knowledge about groundwater, on the one hand, weak institutional structures and the absence of legal frameworks involving groundwater, on the other hand, are major challenges, and the 'out-of-sight, out-of-mind' nature of groundwater adds a dimension of complexity to understanding groundwater characteristics.

This means that it is critically needed now to have a groundwater policy, supported by groundwater governance and implemented through groundwater sustainable management, in an **Integrated Approach,** which means that surface water and groundwater should be managed as a whole paying equal attention to both quantity and quality aspects, that all interaction with soil and atmosphere should be duly taken into account and that water management policies should be integrated within the wider environmental framework as well as with other policies dealing with human activities such as agriculture, industry, energy, transport and tourism.

I am pleased to underline that both California on this side of the world and the European Union on the other side of the world are thoroughly working towards sustainable groundwater policy, governance and management according to the following timeline:

In 1980 the European Union adopted its first Groundwater Directive dealing with quality (in the EU jargon, a directive is a law: once adopted, it must be transposed into each Member State legislation according to its institutional rules), then in 2000 it adopted the Water Framework Directive to manage all its water resources and, in 2006, completed it by adopting a new Groundwater Directive replacing the 1980 directive and dealing with both quality and quantity.

In 2014, the passage of the Sustainable Groundwater Management Act (SGMA) set California on a fundamentally new course on how it manages groundwater.

Europe as an entity has had more than thirty years of water and groundwater legislative experience, notwithstanding the specific legislation and regulations of each Member State, hence as California existing agencies, new Groundwater Sustainability Agencies (GSAs), and regulators grapple with how to comply with SGMA, it should be instructive to consider the European experience.

Aim of the workshop

- To gather case studies of European Union groundwater policy, governance, and management, analyze their relevance to SGMA implementation issues and draw significant lessons for California.
- To more specifically learn about conflicting situations in the management of groundwater in the EU and draw parallels in the implementation of SGMA, especially in terms of possible resolution methods
- To establish useful and lasting contacts between the participants (attendees, facilitators, EU contributors, organizing team)
- To show the interest of such international workshops for California water and groundwater stakeholders of various denominations, through the reactions of the participants and agree on the need to organize such events yearly
- To identify themes and topics for the next workshop

One important aim for all of us whose professional life has been dedicated to groundwater in all its aspects is how to give groundwater the scientific, political, economic, social and ecological significance it deserves for the well-being of humanity, or, in short, **how to increase the visibility of the invisible**.

Outcome of the workshop

The outcome of this workshop will be the online publication of its proceedings, downloaded to the Water UCI website.

The proceedings will gather the invited European Union and California presentations, the California examples proposed by participants during the discussions, the analysis of the notes taken during the discussions and the conclusions, drafted by a working group comprised of the facilitators and organizers. The proceedings should present conflict management challenges and practical guidelines for their resolution, and recommendations for GSAs and their GSPs, especially if our European Union guests discuss River Basin Districts and their River Basin Management Plans.

Negotiations are under way to have the proceedings published as a book.

How will the workshop operate?

The workshop is conceived as **interactive** and will entail discussions between the participants, the guest contributors and the organizers:

- Each session will deal with a chosen topic relevant to the implementation of SGMA (Sustainable Groundwater Management Act) and will be introduced by **an expert from the European Union (EU)** presenting a case history from the EU experience. This presentation will be followed by a general discussion between the participants, coordinated and stimulated by a **facilitator** leading the discussion and watching the discussion time allowance. We figured out 30mn per presentation followed by 1 hour of discussion, i.e. 6 to 10 questions in the average.
- We expect that participants bring their own issues and interrogations concerning the corresponding theme and, especially, the possible conflicts they are facing in the implementation of SGMA, their solutions, if any, and, more generally, the management of their own groundwater.
- The last session, corresponding to Topic 5, will be a practical exercise to apply the participants' capacity to negotiate, by acting in the simulation of a real case, in the format of a **conflict resolution Role-Play**.
- Two student assistants will take notes during the discussions, which will then be analyzed and integrated in the proceedings of the workshop.
- All participants should have received the program with the names of contributors, both from EU and California, and facilitators

Thank you!

Chapter 5

California's SGMA implementation: general issues, challenges and solutions

Taryn Ravazzini, (Deputy Director, Department of Water Resources), Craig Altare, (GSP Review Section Chief, Department of Water Resources), Steven Springhorn, (Technical Assistance Section Chief, Department of Water Resources)

See Power Point presentation

Chapter 6

Topic 1: Governance and management issues

EU Contributor: Jacques Ganoulis (Professor and Special Secretary for Water, Ministry of Environment and Energy, Athens, Greece)
Facilitator: Ted Johnson (Chief Hydrogeologist, Water Replenishment District of Southern California)

See Power Point Presentation

Chapter 7

Lunch presentation

Paul Weghorst (Executive Director of Water Policy, Irvine Ranch Water District, California)

"**Groundwater Banking in Kern County Using Local Governance and Conflict Avoidance**"

See Power Point Presentation

Chapter 8

Topic 2: Quantity issues

EU Contributors: Olivier Petit (Associate Professor in Economics, University of Artois, Arras, France) and Marcel Kuper (Senior Researcher at Cirad, Montpellier, France, and Visiting Professor at IAV Hassan II, Rabat, Morocco)
Facilitator: Eric G. Reichard (Director, California Water Science Center, U.S. Geological Survey San Diego, California)

See two Power Point Presentations

Managing Groundwater Quantity Issues in Europe, the Case of France Olivier Petit

9Managing Groundwater links between California and Morocco Marcel Kuper

Chapter 9

Topic 3: Quality issues of a technical and regulatory nature,

EU Contributor: Johannes Grath (Head of Unit Groundwater, Environment Agency Austria, Vienna, Austria)
Facilitator: Erik Ekdahl (Deputy Director, Division of Water Rights, State Water Resources Control Board, Sacramento, California)

See Power Point Presentation

Text by Johannes Grath, Christoph Leitner, Andreas Scheidleder
Environment Agency Austria, Unit Groundwater

European water policy - legal framework and objectives

The legal framework for the protection and use of waters in Europe is laid down in the EU Water Framework Directive (WFD, Directive 2000/60/EC). This directive was jointly drafted and adopted by the European institutions and the member states of the European Union. Provisions in several other policy fields, including agriculture, chemicals and rural development, interact and complement efforts under the WFD.

Within the framework created by the WFD, the EU member states are responsible for transposing the WFD into water legislation at national level. The member states are also fully responsible for implementing the directive. The WFD is supplemented by the so-called EU Groundwater Directive (GWD, 2006/118/EC) and the Directive on Environmental Quality Standards for Priority Substances in Surface Water (2008/105/EC). These two directives fill regulatory gaps which had been left open for later discussion when the WFD was developed.

The WFD defines the objective that all waters must gradually achieve 'good status' by 2015, or, in exceptional cases, by 2021 or 2027. It follows the principles of integrated water resources management and obliges, for example, management on the basis of river basin districts, compliance with the polluter pays principle and public participation in water management planning.

In addition to these two directives, there are other so-called 'sectoral directives' at the EU level, which are also highly relevant for water protection. Examples can be given here:

- Nitrates Directive (Directive 91/676/EEC)
- Waste Water Directive (Directive 91/271/EEC)
- Regulation on the placing of plant protection products on the market (Regulation (EC) No 1107/2009)
- Framework Directive on Pesticides (Directive 2009/128/EC)
- Biocide Regulation (Regulation (EU) No 528/2012)
- Industrial Emissions Directive (Directive 2010/75/EU)
- Sewage Sludge Directive (Directive 86/278/EEC)
- …..

The above-mentioned directives have in their objectives either a direct relation to the protection of water bodies or the protection of the environment in general against various sources of pollution and are therefore to be seen as complementary to the WFD and the GWD.

Environmental objectives for groundwater

The WFD takes regard to the fact that groundwater represents an important link of the hydrological cycle for the maintenance of wetlands and river flows, acting as a buffer through dry periods. In other words, it provides the base flow (i.e. the water which feeds rivers all year round) for surface water systems, many of which are used for water supply and recreation. The effect of human activity on groundwater quality will eventually also impact on the quality of associated aquatic ecosystems and directly dependent terrestrial ecosystems if so called natural attenuation reactions such as biodegradation in the subsurface are not sufficient to contain the contaminants (Quevauviller, 2008).

The risks to human health which may arise when groundwater is used for drinking water abstraction and other legitimate human uses are elements of the assessment of chemical status of groundwater. Moreover, saltwater intrusion into groundwater has to be taken into account in this assessment.

The elements mentioned above are subject to the status assessment procedure for groundwater and have to be considered when assessing the risk of failing good status of groundwater bodies and setting threshold values. These threshold values are environmental quality standards for groundwater in WFD terminology.

Groundwater bodies

The environmental objectives of the WFD must be applied to so-called water bodies. The application of the term 'body of groundwater' must be understood in the context of the hierarchy of relevant definitions provided under Article 2 of the WFD, wherein

- 'groundwater' means all water that is below the surface of the ground in the saturated zone and in direct contact with the ground or subsoil; and
- 'aquifer' means a subsurface layer or layers of rock or other geological strata of sufficient and permeability to allow either a significant flow of groundwater or the abstraction of significant quantities of groundwater; and
- 'body of groundwater' means a distinct volume of groundwater within an aquifer or aquifers;

Management plans and results

According to the EU Water Framework Directive, the competent authority for each river basin district has to prepare a management plan. They have to review, update and make the plans available for public review every six years. The content and structure of these plans is laid down in the WFD and include programmes of measures, which are the main instruments used to implement the directive, and need to protect and restore water resources in order to reach the good status objective. The competent authorities have to report the information to the European Commission (EC), following guidance which was developed by the Commission and the member states to ensure that the reported data can be assessed. The first reporting was scheduled for March 2010 and the second one for March 2016.

The plans are published by the member states themselves and, following a review and assessment by the EC, are summarized for Europe. The EC published the summary of the second cycle management plans on 26 February 2019. In addition, the European Environment Agency (EEA) published an EU-wide analysis of water status in 2018, based on the same reported data.

The main results for groundwater - summarized in brief

The EEA report shows that by 2015, the deadline for achieving good status, the competent authorities managed to reach good chemical status in 74% of EU groundwater bodies. For quantitative status, the rate of success was higher at 89% of groundwater bodies.

The main anthropogenic pressures related to chemical status and exerted on groundwater were diffuse sources of pollution. As much as 35% of overall groundwater body area – out of a total groundwater body area of 4.3 mil km² in the EU – were affected.

The following diffuse sources of pollution were reported: agriculture, wastewater discharges not connected to a sewerage network, mining, urban runoff and other. The EEA assessment showed that agriculture is by far the main pressure as it is relevant for 29 % of groundwater body area across the EU.

Nitrates are the pollutants that most commonly cause poor chemical status. They are the predominant groundwater pollutant throughout the EU. 24 out of 28 EU member states reported that nitrate causes poor chemical status within their territory, and the substance leads to failure to achieve good status in 18 % of groundwater body area.

It is the responsibility of member states to take all necessary measures to achieve good status for all waters and to prevent any further deterioration. In the area of EU regional funding, the distribution of funds is partly linked to the implementation of water management measures in accordance with the WFD.

Provisions of the Groundwater Directive

The Groundwater Directive (GWD 2006/118/EC) complements the WFD and sets the following requirements, obliging member states to

- set groundwater threshold values (quality standards)
- perform trend assessments for pollutant concentration
- take measures to reverse statistically and environmentally significant upward trends in pollutant concentrations
- take measures to prevent or limit inputs of pollutants into groundwater
- comply with the criteria for good chemical status (EU-wide standards for nitrates and pesticides and threshold values established by the member states)

EU-wide standards are set in GWD, Annex I for:

- nitrates at 50 mg/l
- active substances in pesticides, including their relevant metabolites, degradation and reaction products[(1)], at 0.1 µg/l for individual substances and 0.5 µg/l for total pesticides[(2)]

[(1)] 'Pesticides' means plant protection products and biocidal products as defined in Article 2 of Directive 91/414/EEC and in Article 2 of Directive 98/8/EC, respectively.

[(2)] 'Total' means the sum of all individual pesticides detected and quantified in the monitoring procedure, including their relevant metabolites, degradation and reaction products.

In case the characterization of groundwater bodies and the risk assessment show that there is risk of failing to achieve good status, the member state concerned has to set further groundwater quality standards , which are called 'threshold values'. GWD Annex II comprises a non-exhaustive list of pollutants which member states need to consider when setting threshold values. If more stringent limits on the concentration of nitrates or pesticides are required to protect e.g. associated aquatic ecosystems or groundwater dependent terrestrial ecosystems, or to allow for other legitimate human uses, then the member state has to set respective threshold values for these pollutants.

Provisions of the Nitrate Directive

Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources requires member states to monitor surface water and groundwater and to designate nitrate vulnerable zones. Member states have to establish a code of good agricultural practice to be applied in their whole territory on a voluntary basis. Moreover, member states must adopt compulsory action programmes in nitrate vulnerable zones.

Below, the contents of the codes of good agricultural practice and the action programmes according to the provisions of the Nitrate Directive are listed:

Establishment of codes of good agricultural practice to be implemented by farmers on a voluntary basis
Codes should include:

- measures limiting the periods when nitrogen fertilizers can be applied on land in order to target application to periods when crops require nitrogen and prevent nutrient losses to waters;
- measures limiting the conditions for fertilizer application (on steeply sloping ground, frozen or snow covered ground, near water courses, etc.) to prevent nitrate losses from leaching and run-off;
- requirement for a minimum storage capacity for livestock manure; and
- crop rotations, soil winter cover, and catch crops to prevent nitrate leaching and run-off during wet seasons.

Establishment of action programmes to be implemented by farmers within nitrate vulnerable zones on a compulsory basis
These programmes must include:

- measures already included in Codes of Good Agricultural Practice, which become mandatory in nitrate vulnerable zones; and
- other measures, such as limitation of fertilizer application (mineral and organic), taking into account crop needs, all nitrogen inputs and soil nitrogen supply, maximum amount of livestock manure to be applied (corresponding to 170 kg nitrogen/hectare/year) (EC, 2019).

Common Agricultural Policy (CAP)

The European Court of Auditors (ECA) found in 2014 that the need for the further integration of water management concerns into other policy areas, such as agriculture, has been clearly expressed by the European Commission, the EEA, the Council of the European Union and the Water Directors of the EU member states. The integration of EU water policy objectives into the CAP is an important goal, not least with regard to Article 11 of the Treaty on the Functioning of the European Union, which states that 'environmental protection requirements must be integrated into the definition and implementation of the Union policies and activities, in particular with a view to promoting sustainable development.'

Cross-compliance is a mechanism that ties direct payments to farmers (and a number of rural development payments) to compliance with a series of rules relating to the environment, food safety, animal and plant health and animal welfare and to maintaining agricultural land in good agricultural and environmental condition (GAEC).

These rules are set out in 18 statutory management requirements (SMRs) and 15 GAEC standards. Non-compliance with these standards and requirements can lead to a reduction in CAP payments to the farmer (ECA, 2014).

Several other cross-compliance requirements have an indirect impact on water protection. For instance, the SMRs on the conservation of wild birds and natural habitats and the GAEC standards on minimum soil cover or protection of landscape features also positively affect water resources.

Member States can implement the water policy partly using funds from other policies. For instance, measures defined in the river basin management plans can in some cases be financed through the CAP.

Outlook

During the workshop, examples for Europe and for Austria will be provided to further illustrate the approaches applied.

Literature

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Water Framework Directive (WFD; Directive 2000/60/EC): Directive of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. OJ No L 327, 22.12.2000 as amended

Chapter 10

Keynote presentation

Joaquin Esquivel

- Chair, State Water Resources Control Board, Sacramento, California

See power point presentation

Chapter 11

Topic 4: Conflicts 1: Typology of water disputes, groundwater at risk, conflict indicators

EU Contributor: Elena Lopez-Gunn (Director, ICATALIST, Madrid, Spain)
Facilitator: David Feldman (Professor and Director, Water UCI, University of California, Irvine)

See Power Point Presentation

Chapter 12

Commission Activities Working Group Groundwater

Elisa Vargas Amelin (European Commission Officer in charge of Groundwater)
Was not present but sent the ppt to illustrate Elena Lopez-Gunn's presentation

See the Power Point

Chapter 13

Topic 5: Conflicts 2: From conflict to cooperation, techniques of management and resolution of conflicts

EU Contributor: Léna Salamé (Lawyer, Conflict Management and Mediation Specialist, Paris, France)
Facilitators: Jean Fried and Jacques Ganoulis

See Power Point Presentation

Chapter 14

Conclusions

Erik Ekdahl & Jacques Ganoulis

General Findings

- "The 28th Member State: Similarities between California Groundwater Management and the European Water Framework Directive (WFD)"
    - Overall, more similarities than differences, particularly with management goals and overall regulatory pressures
    - Whereas the WFD explicitly integrates surface water and groundwater quality and quantity, California's waters are distributed between different statutory authorities and agencies (e.g., water quantity through SGMA, water quality through the Water Boards' existing authorities under the Porter Cologne Water Quality Control Act)
    - Convergent evolution of groundwater quality and quantity public policy
- Governance – can be varied, but should be based on sound science
    - Govern as informed by science, don't let governance inform the science
    - But also, government is responsible for leading, funding, and shepherding critical science (and related infrastructure)
- Increase at the local level the social capital involving stakeholders and water value
- Conflict is inherent – how you deal with that conflict is critical to success
    - What happens when avoidance delays that conflict?
    - Choice of who – who do you conflict with first?

Topic Findings and Areas for Future Study and Collaboration

1. Governance:
    a. Hydro-Governance and Water Problems
        i. Hydro-governance may lead to good solutions (if effective)
        ii. Problems can generate good hydro-governance
            1. What does "good" mean – and maybe a better way to say that "problems can generate good governance" is instead to say "problems can generate good policy integration"?
            2. Power dynamics and inequality are key considerations and will influence the needed approach and outcome.
    b. There are different models of hydro-governance, each with benefits/drawbacks, and with increasing social capital costs:
        i. Authoritarian
        ii. Democratic
        iii. Participatory

c. Does the model of governance that's used relate to the makeup of the basin (geology, stakeholders)?
d. Concept of Polycentricity – there are multiple layers of governance, both for EU and CA – can we do a comparison of the different regulatory entities, and policies, and how they stack up in each? Is there more or less regulation in EU vs CA?
e. EU vs SGMA Comparisons
    i. EU WDF starts from the fundamental approach of IWRM – SGMA will result in similar outcomes for groundwater
        1. Both strongly encourage policy integration
    ii. Fitness Checks – Assessment of effectiveness/benefits; SGMA has similar mechanisms to WDF built in
    iii. Include Sectorial Policies – recommendation (stakeholder input from different economic sectors)
f. Questions on what "good" means in terms of governance and outcomes *see a.ii.1*
g. How do you bridge gaps between science and policy – do we need new institutions? Here's where we should compare the EU institutions to CA/US – idea of polycentricity/multiple layers of governance *see d.*
h. Future Study and Collaboration:
    i. Case studies comparing GSA governance styles, successes, and failures relative to EU responsible agencies and local implementation
    ii. Which conflict do you address first?
        1. And, you can't get governance you want until you admit conflict is inherent
    iii. What about non-government related water decisions – things like mutual water companies, private water markets, private water distributors?
    iv. What is governance… vs what is policy – and is there such thing as "adaptive governance"?

2. Quantity:
    a. Local measurement actions are varied, with varying levels of success in achieving good status; variances are based on local member state laws and regulations, water rights, and use.
    b. Maintenance of ecological functions is a key element of EU – how does CA or SGMA work?
    c. There are significant differences in property rights between EU member states and California – deep dive on those differences will be helpful and interesting

d. Make the invisible visible meaning giving groundwater its real significance (how? Politically, education, communication…)
e. Sectorial economies – how do different stakeholders, and their related economies, affect the approach to managing quantity
f. Bioremediation
g. Clear delineation of boundaries, and how those delineations affect management goals
h. How has EU reprioritized sectorial economics to prevent permanent loss?
i. Questions on quantity monitoring – refer to similar questions under quality
j. How will climate change affect – track climate change effects (both groundwater levels, and as well as resulting policy implications)
k. Future Study and Collaboration: Deeper dive into the EU member state control measures, incentives

3. Quality:
    a. The WFD and California's water quality management mechanisms share similar goals, but implementation (e.g., permitting methods) seem very different
    b. Monitoring systems (and philosophies) are different, even though both entities (EU and CA) share similar goals and objectives
    c. Intercalibration – EU has directives(?) and requirements on intercalibration related to data management (same standards, etc.) – what are SGMAs, and how do they compare?
    d. Future Study and Collaboration:
        i. Deep dive into monitoring and reporting programs:
            1. How are they funded?
            2. Program design
            3. How do the member states, regions, or responsible parties develop the policies and laws needed to produce a robust water quality/quantity management program
        ii. Source Water Protection
        iii. Case study on permitting compare an EU wastewater treatment facility vs CA: number of permits, taxes, fees for each
        iv. CECs
        v. Analytical Comparison (results, and methods) – transparency (1755), data systems and interfaces

4. Conflict Resolution
    a. Trust is key, is difficult to build, very easy to break, when broken almost impossible to rebuild

b. When dealing with a conflict, deal with communication, perceptions, and emotions
    i. Listen and be listened to
    ii. Don't deduce actions from your perception and vice versa
    iii. Reason and be open to reason
c. There are a number of conflict resolution tools – preserve relationships and can be mutually acceptable, quick, cost effective, and win-win
d. Future Study and Collaboration:
    i. Application of dispute resolution tools, how to apply them to local GSA/GSPs (or other conflicts in CA)

5. Other

a. Future study and collaboration:
    i. Economic analysis and cost recovery principles
    ii. Recycled water and conjunctive Use
    iii. Exploration of member state water rights (e.g. ESP and CA)
    iv. Drought indicators (color coding)
    v. Anti-degradation: EU vs. CA
    vi. Equality and equity – overarching, but look at specifically
    vii. Public participation – also overarching, but make sure to integrate into any potential deep dive in the future
    viii. Natural infrastructure
    ix. Rollout/transition – public perception, transition management, and behavioral sciences (how do you bring the public along to an environmental goal, or vice versa?).
    x. Understand Failures, as well as successes
    xi. Data systems, data transparency?

List of Attendees

See power point presentation

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