Summary Notes from Groundwater Data Workshop #2
Jan. 28 and 29, 2016

Introduction

The following are summary notes from a 1.5-day workshop on groundwater-surface water interactions and groundwater data under the Sustainable Groundwater Management Act (SGMA). This workshop was the second in a four-part workshop series convened by Stanford University's Water in the West program and the Gould Center for Conflict Resolution, in conjunction with California State University's Center for Collaborative Policy in order to understand the groundwater data-related challenges and opportunities that local, state and federal agencies are likely to face during the development of Groundwater Sustainability Plans (GSPs) under SGMA.

Held on January 28-29, the workshop was convened while the California Department of Water Resources was in the process of writing regulations for evaluating and implementing GSPs under SGMA. This workshop sought to inform that process, as well as to identify data-related challenges and opportunities during SGMA implementation.

The workshop was organized into two main topics, which were explored across five sessions. The first topic, groundwater-surface water interactions was explored in the following two sessions: 1) the legal, regulatory and environmental considerations in groundwater-surface water interactions, and 2) the tools and approaches for measuring and monitoring groundwater-surface water connectivity. The second topic explored groundwater data-related challenges and potential solutions under SGMA. This topic was explored in the remaining three sessions: 3) groundwater data needs and requirements under SGMA, 4) data sharing, coordination and transparency, and 4) potential solutions. Questions used to guide the discussion that followed each session can be found in the attached agenda. Please note that the summary notes are organized by themes under each topic and do not follow workshop sessions.

Day One: Groundwater-Surface Water (GW-SW) Interactions

Despite the physical connection between groundwater and surface water, the two resources are considered separate under California state law. This legal separation has hindered joint management of the resources and resulted in a dearth of data on the degree of groundwater-surface water (GW-SW) interactions in many areas of the state. While SGMA recognizes the need for joint management of groundwater and surface water resources, the legal requirements provide significant latitude in how they are implemented and the monitoring and management approaches undertaken to measure GW-SW interactions. Discussions on the first day of the workshop focused on the legal, regulatory and environmental considerations of GW-SW connectivity enacted in both California and other states and countries as well as the approaches and methods to measure them, in order to learn from these experiences.

1. **Clarify legal definitions under SGMA:** SGMA requires groundwater sustainability plans (GSPs) be developed to avoid, "[d]epletions to interconnected surface water..." and that GSPs include impacts on groundwater dependent ecosystems where applicable. However, neither of of these terms are defined under the legislation. Meeting participants generally agreed that there was a

need to clarify the legislative language pertaining to interconnected surface waters (ISW) and groundwater dependent ecosystems (GDEs) under SGMA. Meeting participants also indicated the need to define the term "baseline" in the legislation and how it would be interpreted in GSP evaluation.

Recommendations:
Define or clarify key terms used in SGMA, including:

a) Interconnected surface waters
b) Criteria that constitutes a "hydrologic connection between surface and groundwater bodies."
c) Groundwater dependent ecosystems
d) Baseline
e) Environmental users of groundwater
f) Surface water users

2. **Data:** Meeting participants identified two categories of data needs specific to GW-SW interactions: 1) Data to establish GW-SW connectivity, and 2) long-term monitoring data to assess impacts between interconnected waters and groundwater dependent ecosystems (GDEs).
    a. Data or assumptions to clarify GW–SW connectivity:
        i. The state or other agencies should provide data that state and local agencies can use to make a first assessment about whether an area has interconnected waters and/or GDEs.
        ii. In 2009, The Nature Conservancy performed a study mapping GDEs across California. They are currently working to update these data and develop an online tool that would enable these data to be accessed by all users and to be updated regularly.
        iii. TNC has also developed an approach to identify GDEs at the basin-scale.
        iv. The state could establish criteria or assumptions to clarify when GW-SW connectivity must be considered. For example, the state will assume that all GW-SW systems are interconnected unless proven otherwise.
    b. Long-term GW-SW monitoring data:
        i. There are three main approaches to monitoring GW-SW interactions: 1) local-scale field studies to understand connectivity in specific portions of the basin, 2) basin-scale field studies to understand basin hydrology more fully, and 3) modeling (analytical or numerical).
        ii. Basins with limited data/resources should start by establishing a robust water monitoring network that includes: groundwater levels, surface water and groundwater quality, surface water and groundwater temperatures, streamflow, and measurement or estimates of groundwater withdrawals.
        iii. Additional data for determining streamflow depletion from groundwater pumping, including basin geology; the hydraulic properties of aquifer and streambed; information on climate, vegetation, soils, topography and land use; surface water rights information; and reservoir operations.
        iv. Local, state and federal agencies should continue to fund and develop stream gauge networks.

Recommendations:

a. The state should provide data or clarifying assumptions about GW-SW connectivity. For example, the state and/or other entities should provide datasets that show where there are interconnected waters and/or groundwater dependent ecosystems. Alternatively, the state could establish criteria or assumptions to clarify when GW-SW connectivity must be considered. For example, the state will assume that all GW-SW systems are interconnected unless proven otherwise.
b. The state should work with a broad range of stakeholders to develop clear criteria and/or BMPs for effective assessment and monitoring of interconnected surface water/groundwater systems and groundwater-dependent ecosystems. The state should require groundwater sustainability agencies (GSAs) to demonstrate that they have adequately considered these criteria for GSP development.
c. Local, state and federal agencies should continue to fund and develop stream gauge networks.
d. The state should provide technical assistance and data for the monitoring and modeling of interconnected surface water/groundwater systems, including: streamflow data, geology, climate, surface water rights information, reservoir operations, groundwater and surface water temperature data, maps of groundwater-dependent ecosystems, data on GW-SW connectivity, and land use changes.

3. **Measurable Objectives and Thresholds:** SGMA requires local agencies to develop measurable objectives (MOs) to achieve the sustainability goals within 20 years of GSP implementation. MOs must be developed for each undesirable result (UR) and must include a minimum quantitative threshold, the point below which URs are likely to occur.
    a. MOs and thresholds need to:
        i. Incorporate the interests of all water users, including environmental users.
        ii. Be conservative in areas where there is a high degree of uncertainty.
        iii. Be developed within a risk assessment framework to ensure prioritization of users most at risk.
    b. GDEs have experienced significant impacts from groundwater pumping during the most recent drought. The state should develop policies that incentivize the restoration of these systems.

    Recommendations:

    a. The state or other entities should provide guidance and/or examples of how environmental interests have been incorporated into management objectives in other states and countries.
    b. The state should develop policies that incentivize the restoration of GDEs in basins with interconnected waters. Incentives should focus on improving basin conditions beyond the degraded conditions present in many groundwater basin in January, 2015 resulting from the prolonged and ongoing drought affecting much of the western U.S.

4. **Hydrologic modelling**: Given the potential for long lag times between groundwater pumping and effects on surface water systems, many basins with interconnected water will need to develop a hydrologic model to better understand the spatial and temporal impacts of groundwater pumping on streamflows. While numerical models are necessary to understand the impacts of groundwater pumping across a basin, analytical models can be a useful first-order assessment of groundwater pumping impacts.

a. Many states (e.g. Michigan, some areas of Colorado) use an analytical model as a "screening" tool for the well permitting process.
b. A numerical model may be necessary when more information about the system is necessary, when a model will be used for planning purposes, or when the system is approaching critical thresholds.
c. Data on groundwater-surface interactions remain a large source of uncertainty in model development in California.

Recommendations:

- The state should develop guidance on the basin conditions that are likely to necessitate groundwater models for planning purposes. For example, basins with interconnected GW-SW need to develop a groundwater model capable of estimating the impacts of groundwater withdrawals on surface water flows.
- The state should work with a broad range of stakeholders to develop clear criteria and/or BMPs for effective modeling of interconnected surface water/groundwater systems and groundwater-dependent ecosystems.
- The state should develop more robust datasets of GW-SW connectivity in order to improve model confidence. Areas of GW-SW interaction remain a large source of model uncertainty.

5. **Technical and financial support:** California water law views and regulates surface water and groundwater as separate entities, contrary to scientific reality in many basins. SGMA for the first time requires the agencies managing groundwater to address the impacts of groundwater pumping on surface water users. Because groundwater and surface water connectivity was not necessarily a common consideration in local groundwater management previously, there are inadequate data in many groundwater basins pertaining to groundwater and surface water interactions. In many cases, there is no information on whether connectivity even exists. Meeting participants expressed concern about:
    a. The technical capacity of local agencies to identify the approaches or tools most appropriate for investigating groundwater-surface water interactions in their basin, as well as the financial and technical capacity to undertake the studies.
    b. Having the technical and financial means to develop groundwater monitoring networks that are adequate for understanding groundwater-surface water interactions, as well as for long-term monitoring of GDEs.
    c. The overall capacity of agencies to meet SGMA requirements by the required deadlines without substantial technical and financial assistance from the state or other agencies.

    Recommendations:

    d. The state or another entity should develop a "state-of-the science" handbook to guide local agencies on the range of approaches and tools available to measure GW-SW interactions.
    e. The state needs to develop consistent, long-term technical and financial assistance to support improved understanding of GW-SW connectivity at the state and local level.

6. **Case Studies**: Meeting participants discussed the legal, regulatory and data collection tools being used in other states and countries that could help to inform the development of regulations and BMPs for GW-SW interactions in California. While there are many examples of regions that manage GW-SW jointly, some examples that were discussed during the meeting, include:

a. *Colorado* – has a long history of managing groundwater and surface water jointly. In CO it is assumed that all groundwater is tributary to natural streams unless proven otherwise. As a result, all groundwater pumping in the state is assumed to result in injury to surface water rights holders and must have a "plan for augmentation" to replace the depleted stream water. By law, all wells that divert groundwater in Colorado must have a permit. The vast majority of groundwater wells in the state are also metered.
   For more details, see: *Citizen's Guide to Colorado Water Law.* (2004). Prepared by the Colorado Foundation for Water Education. Available at: http://www.colorado.edu/geography/class_homepages/geog_4501_s14/readings/CG-Law2004.pdf, and
   Guide to Colorado Well Permits, Water Rights, and Water Administration. (2012). State of Colorado Department of Natural Resources Division of Water Resources. Available at: http://water.state.co.us/dwripub/documents/wellpermitguide.pdf
b. *Michigan* – Groundwater and surface water are considered to be interconnected. All states and provinces who signed the Great Lakes Compact, agreed to prevent "adverse resource impact" from new withdrawals from the system. In Michigan, an adverse resource impact was defined as the ecological response of withdrawals on nearby streams and rivers. The water withdrawal assessment tool is the analytical model developed by the Michigan Department of Environmental Quality and the U.S. Geological Survey to estimate the likely impact of new surface or groundwater withdrawals on local riverine ecological health. The impacts of the withdrawals are divided into one of four categories (A – minimal impact: register well and pump to D – adverse resource impact: no pumping allowed) that dictate the management actions required for each registrant.
   For more details, see: H. Reeves, D.A. Hamilton, P.W. Seelbach, and A.J. Asher. (2009). *Ground-Water-Withdrawal Component of the Michigan Water-Withdrawal Screening Tool.* U.S. Geological Society Scientfic Investigations Report 2009-5003, Prepared in cooperation with the Michigan Department of Natural Resources. Available at: http://pubs.usgs.gov/sir/2009/5003/pdf/sir2009-5003_web.pdf
c. *Australia* – The National Water Commission of Australia has developed a GDE assessment framework. This framework provides tools or approaches for identifying, classifying and protecting GDEs based on the associated level of risk. It also provides approaches for data sparse regions.
   For more details, see: S. Richardson, E. Irvine, R. Froend, P. Boon, S. Barber, B. Bonneville. (2011). *Australian groundwater-dependent ecosystems toolbox part 1: assessment framewor*k. Available at: http://nwc.gov.au/__data/assets/pdf_file/0006/19905/GDE-toolbox-part-1.pdf

Recommendations:

a. The state or other entities should develop case studies to learn how other states and countries regulate and manage groundwater and surface water jointly and the tools and approaches used to meet legislative and regulatory requirements.

Day Two: Groundwater Data in the SGMA Context: Data Needs, Challenges and Potential Solutions

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The amount of data and information that agencies have about their groundwater basins varies widely across the state. Some agencies have very sophisticated groundwater monitoring networks, basin

characterization, and groundwater models, while others have very little information about their basin and limited groundwater monitoring networks. During SGMA implementation It is important for the state and others to recognize these constraints and support agencies as they begin to manage their basin's with the data available to them. Many basins will require guidance on how to best utilize those data to formulate initial GSPs and to inform the design and implementation of monitoring strategies moving forward.

GSAs are also likely to face additional data-related challenges resulting from the legislative requirement to coordinate data and methodologies necessary for sustainable groundwater management at the basin-scale. Achieving the coordination requirements of SGMA will require GSAs within a groundwater basin to work collaboratively to develop a single sustainability goal for the basin along with the groundwater monitoring network and shared data management platform to achieve that goal. Doing so will require many agencies that have not worked together, or in some cases have had adversarial relationships, to come together to collectively make decisions for sustainable groundwater management. This portion of the workshop focused on data-related challenges that local and state agencies are likely to face during SGMA implementation, and potential solutions to address them.

1. **Data adequacy**
    a. Data in many groundwater basins are inadequate for decision-making purposes at present. Meeting participants cited a variety of reasons for data inadequacy, including:
        i. A lack of data.
        ii. Missing or highly uncertain data.
        iii. Poor quality data quality and/or inadequate reporting information (i.e. lacking date, sampling information, etc.) or metadata.
        iv. Data are not available or coordinated at the scale necessary for sustainable groundwater management.
        v. Data are inconsistent (e.g, inadequate or inconsistent spatial and/or temporal coverage, inconsistent data collection and reporting protocols).
        vi. The data collected are not the data needed for decision-making purposes.
        vii. Data from state and federal agencies may be difficult to locate, lack consistency in formatting or methodologies between agencies, be housed in many different locations, and have sporadic coverage (spatial or temporal).
        viii. The decisions being made are complex, politically-charged decisions that would be difficult to make even with perfect data.
    b. Key themes discussed by meeting participants include:
        i. Many basins will require guidance on how to best utilize those data to formulate initial GSPs and to inform the design and implementation of monitoring strategies moving forward.
        ii. The collection of long-term, consistent datasets should be prioritized.
        iii. Local agencies need technical and financial assistance to develop the datasets necessary for sustainable groundwater management.
        iv. State agencies are short-staffed and do not have consistent funding for data-related projects.
        v. There is need for clear data standards and protocols across agencies.

vi. Agencies need to leverage existing data. GSAs should work collaboratively to develop a common data sharing platform within each basin that integrates existing datasets. Doing so may help to develop agreement around basin characterization, basin management objectives, and the development of a groundwater monitoring network that is consistent across the entire basin.
vii. There is a need to differentiate between data collection standards and protocols necessary for basin characterization, and management actions.
    1. The state should provide guidance to ensure clear and consistent data collection standards and protocols for basin characterization. Common data standards will facilitate data sharing and ensure that basins are evaluated in a consistent manor.
    2. Flexibility and local control should be reflected in the management actions undertaken within basins to meet sustainability goals or specified management actions.
viii. State and local agencies should be strategic when making the decision to acquire data. This means:
    1. Prioritizing data collection and basin studies in areas where the level of uncertainty hinders management decisions.
    2. Data should be acquired with specific management goals and objectives in mind.

Recommendations:

c. The development of comprehensive basin-wide groundwater monitoring networks in all high- and medium-priority basins should be prioritized.
d. The state should provide additional funding to support the development of groundwater monitoring networks in disadvantaged communities.
e. The state should develop clear data standards and protocols to ensure that data can be readily integrated and require GSAs to follow them.
f. The state needs to develop consistent, long-term technical and financial assistance to support sustainable groundwater management.

2. Data from state and federal agencies

a. Local agencies use a variety of data from state and federal agencies, including: water quality data, groundwater level data, geology, climate data, and stream gauge data.
b. Remote sensing data presents a significant opportunity for the development of regional- and state-scale datasets pertinent for sustainable water management.

Recommendations:

a. Public data from local, state and federal agencies necessary for sustainable water management (water quality and quantity data, and biological data) should be collated into a main data portal or clearinghouse that can be accessed readily from any location.
b. State and federal agencies should provide or work with other entities to support or develop the following datasets: reservoir operations, climate, soil, land use, geology, stream gauge, water quality, water level information, water

temperature, information about interconnected surface water/groundwater systems, surface water rights information, surface water diversions, maps of groundwater dependent ecosystems, future water availability, and population projections.

c. The state should provide local agencies with technical assistance for the development of: water budgets, sustainable yield, recharge area mapping, estimation of groundwater extraction, estimation of recharge potential.
d. The state should form an advisory board composed of technical experts, consultants, and other representative stakeholder to advise on the technologies to support and to pilot different methods of data acquisition. Doing so would remove some of the risk associated with individual agencies investing in specific technologies.

3. Data coordination, sharing and transparency

a. Meeting participants expressed a variety of concerns related to data coordination. Some of these concerns were practical concerns relating to the need for common data standards and protocols, which are listed in Section 1. on Data Adequacy. (e.g., inconsistencies in data formatting or data collection protocols).
b. Other concerns focused on cultural barriers to data sharing and the need for improved communication by the state and local agencies about the value of data, and data sharing. Discussion topics included:
    i. The need to clearly communicate with agencies, landowners and other stakeholders:
        1. The ways that SGMA can help to protect their interests.
        2. The value of open, transparent data for individual protection, a means of establishing rights, and more effective, efficient management.
        3. To address security and regulatory concerns and how they have been overcome in other states and jurisdictions.
c. Additional data coordination topics included:
    i. The importance of governance structures and the institutional design of GSAs in meeting the GSP coordination requirements under SGMA.
    ii. The need to develop a common data sharing and reporting platform.
    iii. Ways for the state and local agencies to incentivize data sharing, including:
        1. Communicating of the benefits of data-sharing (i.e. establishing water usage, transparency of actions, reducing uncertainty, clarifying or reducing the need for assumptions, improved management outcomes, etc.)
        2. Studies on the economic, social and management benefits of data-sharing,
        3. Making additional funds or grants available to individuals or agencies who share data.
    iv. Data reporting sites need to be as simple as possible. Data need to be easy to input and should be designed with checks to ensure data quality and consistency.
    v. The need to coordinate data with land use and well permitting agencies.

vi. The need to work on improving data coordination at all levels, within state agencies, between state agencies (e.g. land use, in-stream flow data, etc.), and between local, state and federal agencies.
vii. The state should develop a task force or advisory council to help collate data between agencies into a common data sharing platform.

Recommendations:

a. The state should develop a develop a common data sharing and reporting platform that integrates with state and federal water data and require GSAs to use it. The data reporting site should have a simple, intuitive user interface with integrated data quality checks.
b. The state should continue to fund facilitation services during GSA and GSP development. The state should look for additional ways to incentivize collaboration during SGMA implementation.
c. The state should develop a task force or advisory council to help collate data between agencies into a common data sharing platform.

4. Data Uncertainty

a. There is uncertainty underlying data collection and groundwater basin characterizations. GSAs need to develop GSPs that account for uncertainties in data, as well as uncertainty in future conditions.
b. Areas or basins with less data and/or higher uncertainty may need to adopt more conservative management actions.
c. Data should be collected under a risk assessment framework that prioritizes data collection for the most vulnerable or highest risk communities.
d. GSAs will need to work with other local agencies and local stakeholders to communicate the uncertainties in basin characterization, data, data estimates, and management projections, and the effect that uncertainty has on management actions. In many cases, recognition and understanding of data uncertainty will drive data acquisition to reduce uncertainty, and may incentivize data sharing.
e. GSAs need to work with other local agencies and local stakeholders to jointly develop contingency plans and management actions that can be enacted during times of extreme stress.
f. Adaptive management will play in important role in ensuring that GSAs are: 1) setting MOs and thresholds that reflect the level of uncertainty in the basin characterization or data, 2) revising MOs and thresholds to reflect new data and information about the basin, 3) modifying monitoring programs, models, and management actions to reflect new data or information, and 4) adopting staged management actions that can be undertaken to ensure thresholds are not exceeded even during periods of stress.

Recommendations:

a. The state or other entities should develop best management practices (BMPs) for communicating uncertainty to stakeholders and the public.
b. The state or other entities should develop BMPs that incorporate adaptive management practices into sustainable groundwater management.

5. **Measurable objectives and thresholds:**
    a. Agencies need to establish quantitative thresholds for all six URs under SGMA. Agencies will require data and monitoring networks that can provide relative change in URs over time.
    b. Quantitative thresholds should be science-based and incorporate environmental protections.
    c. MOs and thresholds should be updated as information about the basin improves or if a basin is not showing progress toward its sustainability goal.
    d. MOs and threshold should be coordinated across basins to ensure that they will collectively meet a basin's sustainability goal.
    e. Agencies with multiple URs may need to prioritize data collection and management actions to address the most pressing URs first.
    f. Basins with multiple URs will likely need a groundwater model to simultaneously assess the interactions between URs.
    g. Decisions on how to prioritize URs will need to undertaken in an open, transparent, and inclusive forum.
    h. GSAs will need to ensure that the quantitative thresholds developed for each UR do not conflict with other state and federal standards.

6. **Hydrologic models under SGMA**
    a. The types of hydrologic models that agencies develop will depend on numerous criteria including: model objectives, the amount of data available, and the availability of technical and financial resources. Developing material to guide these decisions would be useful.
    b. Hydrologic models are likely to be important for agencies to meet the 50-year planning and implementation horizon required under SGMA.
    c. While many basins currently use models for water resources planning, other basins lack basic data and information about their basin. As a result, it may not be useful or feasible to require all basins to develop a numerical model.
    d. Many other states use analytical models as a first-step in groundwater basin planning. Then develop a numerical model when, and if necessary. This may be a good approach under SGMA.
    e. In some cases, developing a "scoping" model with limited data can be useful in identifying and prioritizing areas for additional data acquisition and/or monitoring.
    f. Basins lacking a basic monitoring network should begin to develop it as soon as possible. These data will ultimately serve as the basis for groundwater model development and maintenance.

    <u>Recommendations:</u>
    g. The state or another entity should provide guidance on the applications of different models and the data requirements to support them.
    h. The state should provide and/or support the development of datasets necessary for model development (see Section 2. Data under GW-SW interactions).

7. **Property rights:** SGMA does not have the legislative authority to change people's water rights. As a result, agencies may face legal challenges when making decisions about groundwater pumping reductions in their basin. GSAs will need to work with locals to

develop GSPs and management action that will collectively meet sustainability goals and are palatable for all groundwater users. In many cases this will mean:

a. Finding supplemental water to offset pumping reductions.
b. Developing policies and building infrastructure to recharge additional water during periods of excess.
c. Developing mutually agreeable pumping reduction strategies that include incentives for water conservation and repurchasing. These could include:
    i. Funding or subsidies for irrigation efficiency.
    ii. Developing programs to pay farmers to fallow or retire land, change crop type or change management practices.
    iii. Incentivizing water transfers and other transactions between users.
d. Pumping reductions may be incentivized through water markets or other market mechanisms like tiered water prices. In all cases, establishing more certainty in water rights and better data are necessary to ensure effective, sustainable water markets.

<u>Recommendations:</u>

a. A review of past groundwater management agreements to determine how property rights have been managed in adjudicated basins may provide insights for basins seeking to reduce groundwater pumping without violating property rights.
b. The state should develop a mechanism to make GSPs "binding" and provide more certainty to pumping volumes for individual pumpers.

8. **Incentives and potential solutions:** Meeting participants discussed the need for incentives and other mechanisms to motivate data sharing and coordination between agencies. Key themes focused around:
    a. Collaboration:
        i. Meeting participants agreed on the importance of developing robust and collaborative governance structures during GSA formation. The state should continue to fund facilitation services during GSA formation, as well as during GSP development.
        ii. The state should look for ways additional ways to incentivize collaboration during SGMA implementation.
        iii. The state should create opportunities for GSAs to come together and share information and experience both in electronic forums, but also in face-to-face meetings.
    b. Communication:
        i. The state and local agencies need to develop effective communication strategies to ensure that that agencies, landowners and other stakeholders:
            1. Understand the role that uncertainty plays in management decisions.
            2. The ways that SGMA can help to protect their interests.
            3. The value of open, transparent data for individual protection, a means of establishing rights, and more effective, efficient management.

4. To address the security and regulatory concerns and how they have been overcome in other states and jurisdictions.

Establishing effective communication with local stakeholders may incentivize data sharing and acquisition.

c. Environmental:
    i. Environmental interests and users are often not represented in management decisions. The state and other entities should:
        1. Support the development of datasets on groundwater dependent ecosystems and interconnected waters.
        2. Ensure access to environmental and biological datasets necessary for sustainable water management.
        3. Create incentives for agencies who incorporate environmental use or users into measurable objectives and management actions.
        4. Develop policies or incentives for agencies to exceed the 2015 baseline established under SGMA.
d. Data and data sharing:
    i. The state or other entities should perform a study to understand barriers to data sharing.
    ii. The state or other entities should develop BMPs for database development and maintenance and require agencies to follow them.
    iii. Local and state agencies need to develop incentives for well owners to register their wells, provide well locations and provide information about the amount of pumping. Examples and case studies of how and where this has been done would be useful.
    iv. Develop an advisory board to provide the state with information on data issues from a breadth of stakeholders, academics, consultants, managers, industry experts, other agencies and NGOs. This group could:
        1. Provide guidance on data necessary for decision-making purposes at a variety of levels, as well as on technologies useful for data acquisition.
        2. Make recommendations and guidance on the development of a common data management platform.
        3. Pilot projects to demonstrate the value of shared, transparent data.
        4. Develop case studies to see how other agencies, states and countries have handled data and data sharing issues, and make recommendations based on these findings.
        5. Have an outreach arm to help communicate the value of data to stakeholders and the public.
e. Technical and Financial Support
    i. The state needs to provide consistent, long-term technical and financial assistance to support data coordination and sharing.
    ii. The state should provide additional support (financial, technical and training) to disadvantaged communities to support data collection and sharing.

GROUNDWATER DATA IN THE SGMA CONTEXT:
Identifying Groundwater Data Needs, Challenges, and Potential Solutions
January 28-29, 2016

Location: Stanford Faculty Club, 439 Lagunita Drive, Stanford CA 94305 (Red Lounge)
Contact: Athena Serapio, 650-724-7609, athena3@stanford.edu

Workshop Goals and Objectives:

1. To exchange information and promote open discussion regarding groundwater data needs in order to support development of regulations and best management practices under the Sustainable Groundwater Management Act, and to support local agencies during the development of groundwater sustainability plans.

2. To identify the major data-related issues or challenges state and local agencies are likely to face during SGMA implementation and potential solutions to address these challenges.

3. To build relationships between meeting participants to coordinate efforts around SGMA implementation.

Possible Workshop Outputs:

1. A report or white paper providing background information, major themes, and recommendations captured during workshop discussion.

2. One or more academic publications focusing on groundwater data challenges and potential solutions identified in the groundwater data workshop series, as well as in the groundwater data survey.

Meeting Details:
When: January 28 and 29, 2016
Where: Stanford Faculty Club, 439 Lagunita Drive, Stanford CA 94305 (Red Lounge)
Hotel: Stanford Guest House, 2575 Sand Hill Road, Menlo Park, CA 94025

Attendees:
The workshop will be attended by a group of approximately 35 representatives of government agencies, groundwater consultants, groundwater managers, NGOs, foundations, research institutions, and facilitators focused on the successful implementation of the Sustainable Groundwater Management Act.

Conference Hosts and Sponsors:

- Stanford University's Water in the West Program
- Stanford Law School's Gould Center for Conflict Resolution
- California State University Sacramento's Center for Collaborative Policy

AGENDA

Day 1: January 28, 2016

11:00am Lunch at the Stanford Faculty Club

12:00pm **Welcome & Meeting Overview, Introductions**

Tara Moran, Program Lead, Sustainable Groundwater, Water in the West

Marci DuPraw, Managing Senior Facilitator and Mediator, California State University, Sacramento

12:15pm **Session 1: Legal, regulatory and environmental considerations of groundwater-surface water interactions**
Moderator: Leon Szeptycki, Executive Director, Water in the West

Jeanette Howard, Associate Director of Science in California, The Nature Conservancy
Topic: Sustainable Groundwater Management and Groundwater-Dependent Ecosystems: Approach and Best Practices (15 mins)

Rebecca Nelson, Non-Resident Fellow, Stanford Woods Institute for the Environment and Senior Lecturer, Melbourne Law School, University of Melbourne
Topic: Groundwater, Rivers and Ecosystems: Regulatory and Policy Approaches to Making Links (15 mins)

Kevin Rein, Deputy State Engineer, Colorado Department of Water Resources
Topic: Colorado Ground Water Management: Integrating Ground Water and Surface Water Administration (15 mins)

1:15pm **Discussion (60 mins)** (Facilitated by Leon Szeptycki, Executive Director, Water in the West)

Potential Discussion Topics:
- How will significant and unreasonable impacts on beneficial uses of surface water be defined under SGMA?
- Will SGMA be adequate to protect groundwater-dependent ecosystems?
- What are the legal and regulatory requirements for surface water and groundwater connectivity in other western states? What lessons can we draw for California that might inform our approach?

2:15pm **Break**

2:30pm **Session 2**: **Approaches and methods for measuring and monitoring groundwater-surface water interactions**
Moderator: Marci DuPraw, Managing Senior Facilitator and Mediator, California State University, Sacramento

Paul Barlow, Hydrologist, U.S. Geological Survey, Office of Groundwater
Topic: Field and Modeling Approaches for Assessing and Managing Streamflow Depletion by Wells (15 mins)

Howard Reeves, Research Hydrologist, U.S. Geological Survey, Ohio Water Science Center
Topic: Streamflow Depletion by Pumping Wells and the Michigan Water-Withdrawal Assessment Process (15 mins)

Marcus Trotta, Hydrogeologist, Sonoma County Water Agency
Topic: Application of Groundwater-Surface water Interaction Monitoring in Sonoma County (15 mins)

3:30pm **Discussion (75 mins)** (Facilitated by Marci DuPraw, Managing Senior Facilitator and Mediator, California State University, Sacramento)

Potential Discussion Topics:

- What data are necessary to determine interconnected surface waters and/or groundwater-dependent ecosystems?
- What should be included in regulations and best management practices for surface water-groundwater interactions given the array of local conditions?

4:45pm **Wrap up and adjourn**
Janet Martinez, Director, Gould Center for Conflict Resolution

5:15pm **Shuttle** to the dinner location at MacArthur Park, 27 University Avenue, Palo Alto

5:30pm **Reception**

6:00pm **Dinner**

8:00pm **Shuttle** pick up at MacArthur Park - drop off at the Tressidor Union parking lot & Stanford Guest House

Day 2: January 29, 2016

8:00am **Breakfast**

8:30am **Welcome & Meeting Overview for the Day, Introductions**

Tara Moran, Program Lead, Sustainable Groundwater, Water in the West

Marci DuPraw, Managing Senior Facilitator and Mediator, California State University, Sacramento

8:45am **Session 3**: **Data Requirements under SGMA and Regulatory Update**

Dan McManus, Supervising Engineering Geologist, California Department of Water Resources (20 mins)

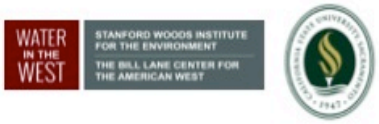
9:10am **Questions and Comments (20 mins**) (Facilitated by Marci DuPraw, Managing Senior Facilitator and Mediator, California State University, Sacramento)

9:30am **Break**

9:50am **Session 4**: **Data Needs for Sustainable Groundwater Management**
Moderator: Marci DuPraw, Managing Senior Facilitator and Mediator, California State University, Sacramento

Tara Moran, Program Lead, Sustainable Groundwater, Water in the West
Topic: Groundwater Data Needs and Adequacy in California (15 mins)

Juliet Christian-Smith, California Climate Scientist, Union of Concerned Scientists
Topic: Setting Measurable Objectives for Effective Groundwater Management (Title TBD) (15 mins)



Groundwater Workshop Series - Data
January 28 & 29, 2016
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