

Yemen Water User Association Study:

Findings and Recommendations for a Problem-Solving Approach

Bryan Bruns and Taha Taher

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Yemen Water User Association Study: Findings and Recommendations

Executive Summary

1. The study looked at experience, internationally and in Yemen, with various kinds of water user organizations (WUOs) including formally registered water user associations (WUAs); traditional institutions for managing spate irrigation, water user groups (WUGs) and other forms of water user organization. The study assessed ways to involve WUOs in integrated water resources management, and prepared findings and recommendations for development of more sustainable community water management in Yemen.

2. **FINDINGS.** Discussions with farmers, WUO leaders, and government officials, during field visits and workshops, along with analysis of reports, regulations, and other literature, confirm that WUOs can contribute to improving water management, and that changes in implementation approaches could help create more sustainable community water management in Yemen.

3. ***Some communities are strengthening local water management.*** The study paid particular attention to the need to improve groundwater governance to cope with rapid aquifer depletion. In some cases, communities have begun to regulate groundwater, for example by restricting well drilling. Protection of domestic water supplies is a priority that often motivates local initiatives.

4. ***WUOs can help improve project impacts.*** WUOs have initiated requests, mobilized resources, and taken part in planning and implementing projects for rural water supply and for surface irrigation. For groundwater irrigation, WUOs have facilitated provision of pipes and other subsidized irrigation equipment intended to reduce water consumption, and helped improve awareness that groundwater resources are limited and being depleted. However, aid to individual farmers for irrigation and aid to communities for rural water supply is not yet well-linked to creating community commitment to improve groundwater governance. In water supply and sanitation, WUOs, usually not formally registered, often play a central role in requesting, planning, and implementing projects, and then carry out operation and maintenance. Efforts are underway to further strengthen and systematize participatory approaches in rural water supply and sanitation projects.

5. ***Water user organizations are diverse.*** Traditional institutions for managing surface irrigation, from springs and spate flows in wadis (riverbeds), often continue to work relatively well, but can be disrupted by external intervention, especially if consultation is incomplete and designs are not compatible with traditional water rights. In groundwater projects, WUOs can be useful in implementation, but their longer-term sustainability seems questionable. WUO federations and representation in water management decisions at the sub-basin level and above are not yet well-developed.

6. ***Communities need better support for local water governance.*** Transfer of larger spate irrigation systems to WUOs seems problematic unless there is more consistent and effective support. Some WUOs are helping to collect monitoring data on wells for the National Water Resources Authority (NWRA), but lack feedback about the data and what it says about local aquifers. IN general, communities lack information and advice to support local analysis and action to improve water governance. Effective enforcement by the NWRA, local authorities, and other government agencies can

reinforce community efforts. However, current funding for NWRA is inadequate and unreliable, which impedes its ability to act as a regulator and to support local water management.

7. *Multiple regulatory frameworks.* Governance institutions, through which decisions are made, rules created and enforced, and disputes managed, include government agencies and laws as well as tribal, religious, customary and informal institutions. This legal pluralism means that multiple forums are available for dealing with disputes. The structure of formal water law includes a Water Law, its regulations, and relevant Cabinet Decrees. The NGO Law provides a basis under which WUAs are registered, through procedures supervised by the Ministry of Labor and Social Affairs. Formal WUAs register as voluntary associations, with members free to join or exit, and so lack authority to make and enforce rules.

8. *Lessons from international experience.* The sustainability of WUOs cannot be assumed. WUOs may quickly become inactive after project benefits are gone. Multi-level, “nested,” and polycentric organizational arrangements, in networks with many horizontal and vertical links, strengthen water governance. Internationally, examples of effective groundwater governance are scarce, but some cases suggest that it may be more feasible where water supplies can be augmented from recharge or other sources. Experience with integrated water resources management (IWRM) indicates the need to focus pragmatically on objectives that are technically and politically feasible.

9. *RECOMMENDATIONS.* The major recommendations from the study are to learn from community regulation of wells, develop WUOs through local problem-solving, fit organizational structure to activities, and link WUOs within networks of governance institutions.

10. *Learn from communities.* Local action to regulate groundwater, for example by restricting well drilling, demonstrates what is feasible and fits with local priorities. Such cases need to be better understood, and experience shared among communities, as part of a process of encouraging genuinely decentralized institutional development.

11. *Support local problem-solving.* Hydrological information and analysis should be made available to support a methodology of developing local water management through problem-solving in which communities:

- assess local conditions, using their knowledge, plus available data and expertise;
- analyze relevant scenarios, with and without changes in water governance;
- envision feasible pathways toward more sustainable local water management;
- agree on and implement actions to solve problems and move toward sustainability;
- further develop local water management, through a continuing process of solving problems and providing useful services to communities.

Support can include information, advice, facilitation (social mobilization), funding, delegation of authority, and consistent enforcement of regulations.

12. *Diversify approaches to organizing WUOs.* WUOs need to be able to take on diverse forms suited to local needs and circumstances. Sustainability depends on being able to survive using local resources, so WUOs need to be organized efficiently to deliver services that members want and are willing to contribute to. One useful option is a two-phase approach that allows more intensive organization during project implementation and simpler arrangements for post-project operation and maintenance. Working with women’s groups offers a way to make women’s participation more

effective and sustainable. Co-management should be developed to combine the strengths of government agencies, WUOs, and other local institutions in improving water management, particularly for crafting and enforcing local rules for water governance that fit community conditions and capabilities.

13. ***Weave networks for governance.*** WUOs need horizontal and vertical linkages, particularly with local councils for resources and enforcement, and to higher-level organizations for advice, funding, enforcement and other support. Federations should be developed from the bottom-up, with genuine representation in decisionmaking. Power, to make and enforce rules and collect fees, would make community water management more effective. Pragmatic steps to improve water governance at the local and sub-basin levels can help develop sustainable local water management.

14. ***Community water management can be developed by learning from and supporting local problem-solving to find pathways to sustainability, diversifying water user organization to fit local conditions, and weaving links with wider sub-basin, basin, and national water governance.***

Contents

Executive Summary	ii
1.0 INTRODUCTION	1
1.1 Background	2
1.2 Organization of the Report	3
2.0 FINDINGS	4
2.1 Some Communities Are Strengthening Local Water Management	4
2.1.1 <i>Local groundwater governance is incomplete</i>	4
2.1.2 <i>Some communities are strengthening regulation of wells</i>	5
2.1.3 <i>Protecting domestic water is a priority</i>	6
2.2 WUOs Can Help Improve Project Impacts	7
2.2.1 <i>Education is increasing awareness of depletion dangers</i>	7
2.2.2 <i>More income per drop is feasible</i>	7
2.2.3 <i>Aid is not tied to community water management</i>	9
2.2.4 <i>Water supply groups are managing O&M</i>	9
2.3 Water User Organizations Are Diverse	10
2.3.1 <i>Traditional irrigation governance is relatively resilient</i>	10
2.3.2 <i>There are several types of WUOs</i>	11
2.3.3 <i>Groundwater WUOs can be useful but do not seem sustainable</i>	11
2.3.4 <i>Basin and national representation of WUOs is not yet well-developed</i>	12
2.4 Communities Lack Support for Better Water Governance	12
2.4.1 <i>Irrigation management transfer is not yet working well</i>	12
2.4.2 <i>Groups monitoring wells lack feedback</i>	13
2.4.3 <i>Communities lack assistance in understanding local aquifers</i>	13
2.4.4 <i>Funding for NWRA is currently inadequate and unreliable</i>	14
2.5 Multiple Regulatory Frameworks Govern Water	15
2.5.1 <i>Local institutions play a major role in regulating land and water use</i>	15
2.5.2 <i>Well licensing has not succeeded</i>	17
2.5.3 <i>WUA can get legal status, with difficulty</i>	18
2.5.4 <i>WUOs lack legal authority</i>	19
2.6 Lessons from International Experience	19
2.5.1 <i>WUOs are hard to sustain</i>	19
2.5.2 <i>Nested organizations and networks improve governance</i>	20
2.5.3 <i>Governing groundwater is a difficult problem</i>	21
2.5.4 <i>IWRM needs to be pragmatic</i>	23
3.0 RECOMMENDATIONS	23
3.1 Learn from Communities	23
3.1.1 <i>Learn from local initiatives</i>	23
3.1.2 <i>Help communities learn from each other</i>	24
3.1.2 <i>Encourage local innovation</i>	25
3.2 Support Local Problem-solving	25
3.2.1 <i>Share information</i>	25
3.2.2 <i>Outsource data collection</i>	26
3.2.3 <i>Facilitate local planning and action</i>	26
3.2.4 <i>Monitor results</i>	27
3.3 Diversify Approaches to Organizing WUOs	28
3.3.1 <i>Develop WUOs that can sustain themselves with local resources</i>	28
3.3.2 <i>Use phased approaches</i>	30
3.3.3 <i>Work with women's groups</i>	31
3.3.4 <i>Develop co-management</i>	31
3.4 Weave Networks for Governance	33
3.5.1 <i>Create horizontal and vertical links</i>	33
3.5.2 <i>Federate WUOs from the bottom up</i>	33
3.5.3 <i>Empower communities to make and enforce rules</i>	34
3.5.4 <i>Include stakeholder representatives in sub-basin and basin governance</i>	35
4.0 CONCLUSIONS	36

References	41
APPENDICES	43
Appendix A: Hydrology	43
Appendix B: Groundwater Boom and Bust in Comparative Perspective	44
B.1 Rise and fall of groundwater socio-ecologies	44
B.2 Aquifer development and local cooperation	45
Appendix C: WUO Case Studies	50
C.1.0 Dhamar	50
<i>C.1.1 Wadi Al-Har.....</i>	<i>50</i>
<i>C.1.2 Wadi Akarem.....</i>	<i>50</i>
C.2.0 Taiz	51
<i>C.2.1 Mawia.....</i>	<i>51</i>
<i>C.2.2 CWMP.....</i>	<i>51</i>
C.3.0 Ibb	51
<i>C.3.1 Bani Garban WUO.....</i>	<i>51</i>
<i>C.3.2 Al-Gawaref WUO.....</i>	<i>52</i>
C.4.0 Amran	52
Appendix D: Water User Organizations Met During Fieldwork.....	53
Appendix E. Draft Terms of Reference for Case Studies of Local Initiatives in Water Governance	54
E.1 Introduction.....	54
E.2 Background.....	54
E.3 Tasks.....	55
E.4 Team	56
E.5 Duration and Financial Matters	56
Appendix F. Problem-Solving Processes for WUO Development	58
F.1 Introduction.....	58
F.2 Sequence of Activities	58
<i>F.2.1 Introductory Phase</i>	<i>58</i>
<i>F.2.2 Assessment Phase.....</i>	<i>58</i>
<i>F.2.3 Deliberation Phase.....</i>	<i>58</i>
<i>F.2.4 Implementation Phase</i>	<i>59</i>
<i>F.2.5 Review and Adaptation.....</i>	<i>59</i>
F.3 Facilitators	59
F.4 Reassessment for Existing WUOs.....	60
F.5 Recommendations for Pilot Activities	60
Appendix G. Participatory Water Resources Appraisal.....	61
G.1 Introduction.....	61
G.2 Methods.....	61
G.4 Community Research in Philosophy and Practice.....	62
G.3 Lessons from IPM, PRA and other sources	62
G.5 Recommendation	63
Appendix H. Summary of Results from November 1 Workshop.....	64

1.0 INTRODUCTION

15. This report presents findings and recommendations from an assessment of Water User Associations in Yemen.¹ Key objectives for the study were to:

- Compile international and Yemeni experience with water user groups, water user associations, and basin committees; and their interrelationship for achieving community water management,
- Propose an institutional structure and procedure to integrate WUAs in integrated water resources management (IWRM), and
- Provide a good proactive methodology for the formation, capacity building, and implementation support for sustainable WUAs involved in the irrigation and rural water supply and sanitation sectors in Yemen.²

16. The key question for the study can be framed as:

How to develop sustainable community water management?

17. It should be noted that much has already been done in Yemen concerning institutional structures for integrated water resources management, including WUOs. This is embodied in current laws, regulations, plans and other documents, as well as draft documents. This study has tried to understand current and proposed institutional structures, and look at how WUOs could more contribute to more effective and sustainable water governance within such a framework. Therefore, the second item might be better phrased as “propose ways of improving integration of WUOs in IWRM.”

18. *Terminology.* The study has looked at *water user organizations* (WUOs) in both the narrow sense of water user associations that are officially registered and have legal status such as formal WUAs established under the 2001 Law No. 1 on Nongovernment Organizations and Societies, and in the wider sense of the many ways in which water users may associate and organize, including customary irrigation roles and rules, informal groups, committees, water user groups (WUGs), associations of WUGs, legally registered associations, and federations (all of which would be included in the general meaning of WUOs).³

The word “*community*” is used in the sense of a local community, primarily at a village or district scale, with shared interests and social ties, while recognizing that such a “community” may include much conflict and contestation, multiple religious or tribal

¹ The authors wish to express their thanks to all those who provided information for the study. Statements in the report are the responsibility of the authors, and do not necessarily represent the views of any other organization. This version has been revised in response to comments, particularly those from workshops on August 4 and November 1, 2009 which discussed draft WUA study findings and recommendations.

² Detailed Terms of Reference had been drafted earlier in 2009, before the decision was made to arrange the study through the Groundwater and Soil Conservation Project (GSCP). During implementation of the study, activities have been prioritized and adjusted to respond to current conditions and time constraints for the study.

³ The preliminary draft report used the term WUA as a generic term for all kinds of water user organization. In this final report, WUO is used as the general term and WUA for legally registered associations, to avoid confusion with narrow legal definitions of WUAs. During July-August fieldwork and again in the November workshop it was clear that the scope of the study was intended to cover all forms of WUOs.

identities, a variety of strong and weak ties, trust and mistrust, and is usually heavily influenced by external linkages and broader political and economic processes.

In addition to the general meaning of sustainability in terms of being able to endure, and sustainable development that allows the current generation to meet its needs without compromising the ability of future generations to meet their needs, this study is concerned with institutional *sustainability* in the more technical sense of robustness; capacity to respond, adapt, and cope successfully with shocks and challenges, particularly increasing water scarcity.

1.1 Background

19. The need for the study was identified as part of a poverty and social impact analysis (PSIA) supported by the Government of Yemen, the World Bank, and German Technical Cooperation (GTZ) (Ward et al. 2007). The PSIA called for a more detailed study of the role that water user associations might play in improving water management. A recent study of economic incentives for reducing groundwater extraction in Yemen (Hellegers et al. 2008) concluded that there was very limited potential for economic incentives to affect groundwater use. It suggested that local collective action was one of the few feasible ways in which better groundwater management might be achieved. Similar views about the importance of local action to improve groundwater management have been expressed by other analysts (C. Ward 1998, 2009; Hamdi 2000; Handley 2000). The study is intended as a contribution towards implementation of the National Water Sector Strategy and Investment Plan (NWSSIP). The NWSSIP, created in 2004 and updated in 2009, discusses community water management, water user associations, participation, community involvement, and decentralization as important parts of integrated water resource management.

20. The study gathered information through a range of methods, including interviews and group discussions with stakeholders, case studies, and review of relevant literature and regulations. Field visits were carried out in the Governorates of Sana'a, Hadramaut, Ibb, Taiz, Hudaydah, and Amran in July and August 2009. Meetings were held with representatives of more than 24 WUOs, as listed in Appendix D. These WUOs had been supported by National Water Resources Authority (NWRA), Irrigation Improvement Project (IIP), Sana'a Basin Water Management Project (SBWMP), Groundwater and Soil Conservation Project (GSCP), General Authority for Rural Water Supply (GARWSP), and the Rural Water Supply and Sanitation Project (RWSSP). Discussions during fieldwork began by asking WUOs to explain what they had accomplished so far, what they hoped to accomplish, and what kind of support might help them. This was done primarily through group interviews and workshops that combined small breakout groups and plenary discussions. Participants were mostly WUO leaders, but also included ordinary farmers.

21. Individual and group interviews were also carried out with officials at NWRA headquarters and field offices, SBWMP, GSCP, GARWSP, RWSSP, Local Authority Head in Dhamar, Governor of Taiz, Executive Secretary General of Local Council (Taiz), Amran Basin Committee, Ministry of Water and Environment (MWE), Ministry of Agriculture and Irrigation (MAI), Women's Union (YWU), CARE representative at YWU, Tihama Development Authority (TDA), a university research institute (DAL), Dutch Embassy, German Technical Cooperation, and the Social Fund for Development (SFD) supported by the World Bank. The interviews thus covered a wide range of stakeholders in government agencies and communities. A workshop in August discussed initial findings.

22. The second phase of the study concentrated on analysis of relevant reports, regulations, articles, books, and other documents, and preparation of the draft report. The study drew on the international specialist's previous experience with WUOs, water rights, and participation in water governance internationally, as well as the national specialist's previous experience in other projects and other areas of Yemen, particularly the Community Water Management Project. For the third phase, the draft final report was discussed at a workshop on November 1, which included discussion of specific follow-up actions for implementation; and then revised in response to the comments and recommendations received. Results from the Workshop working groups are presented in Appendix H.

23. Yemen has an ancient heritage of carefully managing scarce water for domestic use and irrigation, including the physical infrastructure of terraces, canals, and dams, and the institutional software (and social capital) of leadership roles, water rights, and dispute resolution mechanisms and other institutions. This system, which evolved over centuries, has faced challenges in dealing with the new situations created by groundwater extraction with pumps and tubewells, dynamic national and international agricultural markets, growing population and other changes.

24. Table 1 shows minimum, maximum and average declines in groundwater, based on NWRA monitoring. Declines were particularly severe in Sana'a, Amran, and Sa'dah, but occurred in all basins. Appendix B provides further information on hydrology.

Table 1. Drop in Groundwater Levels 2006-2007

Basins	2006			2007		
	Min.	Max.	Av.	Min.	Max.	Av.
Sana'a	0.05	6.04	2.00	3.00	7.00	4.00
Marib	0.22	1.53	0.80	0.40	2.80	1.52
Tuban	0.31	1.76	1.03	0.12	2.30	1.08
Abyan	0.02	2.87	1.46	0.12	7.47	2.16
Taiz	0.05	4.80	1.65	0.30	4.80	1.60
Hadramaut	0.06	0.60	0.20	0.10	2.46	0.68
Wadi Surdud	0.05	2.79	0.50	1.70	4.40	0.54
Sa'dah	2.30	7.40	3.60	0.15	7.27	3.73
Amran	0.09	4.64	1.59	2.00	4.00	3.00

Source: Report on the Capacity Assessment of the National Water Resources Authority by the World Bank. August 20, 2008.

25. This study has sought to understand the regulatory frameworks for water governance, and to formulate recommendations consistent with developing effective and sustainable local water governance within a regulatory framework that includes both local customs and practices, and the formal laws and regulations of the national government.

1.2 Organization of the Report

26. This report examines the potential for development of water user organizations and more effective local water governance in Yemen, including lessons from international experience, implications of hydrology, forms of water user organization, regulatory frameworks, methods for developing water user associations, and the role of WUOs within the larger process of water resource management. Section Two presents the major findings concerning local initiatives to govern water, project impacts, sustainability of WUO development, community needs for support, regulatory frameworks, and lessons from international experience with WUOs, groundwater governance and IWRM. Much of what is discussed in Section Two may be unremarkable

for those familiar with water management issues in Yemen, but the discussion outlines situations and issues confirmed during interviews and literature review, as a basis for analysis and recommendations. Section Three presents four main recommendations and related actions for implementation. The final section summarizes conclusions and discusses timing and next steps to develop sustainable community water management. The first four appendices discuss hydrology of Yemen, comparative analysis of groundwater boom and bust, and WUOs visited during fieldwork. In response to the November workshop, appendices have been added with terms of reference for case studies of local water governance initiatives, problem-solving processes for WUO development, methods for participatory water resources appraisal and results from workshop discussions.

2.0 FINDINGS

2.1 Some Communities Are Strengthening Local Water Management

2.1.1 Local groundwater governance is incomplete

27. In discussions during fieldwork, and in reviewing relevant literature, the need for more effective national or local institutions for governing groundwater was a persistent theme and point of concern. National legislation has been in place since the 1980s to require permits before installing or deepening wells. However, government efforts, through the formal institutions of bureaucracies and courts, have been relatively unsuccessful in stopping unauthorized, “random,” drilling and deepening of wells. The profitability of irrigated agriculture, particularly for high value crops such as qat and grapes, has driven rapid expansion of tubewells and pumps. As water tables are drawn down, the same forces are driving competitive deepening of pumps. In the absence of effective regulation, this seems likely to lead to deepening wells and draining aquifers until they are dry, or too expensive to tap, as has already occurred in some areas in Taiz and other governorates. Given rapid rates of aquifer depletion, the lack of capacity of institutions for governing groundwater poses the biggest single challenge for local water management.

28. Agriculture in Yemen has always relied on supplementing direct rainfall with water harvested from wider areas. As well as utilizing flows from springs and spate flows in wadis, farmers reshaped the landscape with terraces, bunds, and ditches to channel surface flows to fields, and sometimes excavated areas to enhance groundwater recharge. Traditional systems of rights governed access to land and water, encouraging investment and helping to prevent and resolve conflict. Traditional irrigated agriculture depended on collecting rainfall runoff from large areas to concentrate on irrigated plots. These runoff rights were separate from the land rights. While the owner had rights to grazing and other uses, they were not supposed to interfere with runoff. In the past, wells were dug by hand. However, the situation has been transformed by the availability of groundwater, extracted by pump and tubewell technologies. The advent of tubewells and pumps sometimes led to disputes, negotiation, and restructuring of land and water rights in order to expand irrigated agriculture.⁴

29. While many wells are owned privately, farmers may invest as partners to build a well, sharing costs and water. Such arrangements can provide some access for less

⁴⁴ See Lichtenthaler 2003 for a detailed discussion of such dynamics in the Sa’ dah Basin.

wealthy farmers. Rights to wells, including partnership arrangements, have been sufficiently secure to mobilize investments, including continuing investments to drill deeper and install larger pumps as groundwater levels have been drawn down. Similarly, local institutions provide enough certainty to enable farmers to mobilize substantial amounts of funding to build or improve spate irrigation systems, and for communities to mobilize investment for piped water supplies.

2.1.2 Some communities are strengthening regulation of wells

30. Despite the general picture of uncontrolled drilling and groundwater extraction, it became apparent during fieldwork that there were more than a few cases where communities have successfully joined together to regulate wells.⁵ Examples include the following:

- Stopping drilling, before it begins or even after drilling had started
- Closing wells that were judged to have dried up springs used for household water
- Reporting unauthorized drilling to NWRA, including some cases where NWRA was able to halt drilling. In some parts of Taiz and elsewhere, some cases of good cooperation between NWRA and communities in controlling unauthorized drilling have been developed.
- Stopping sales of water to outsiders, completely or except for household water supply. In some cases this has resulted from local initiatives. In Amran, the Deputy Governor for Environment and Water has taken the initiative to bring together local leaders to agree on and sign petitions to halt water sales for export.⁶ This part of a variety of pioneering activities that have been supported by GTZ to improve water management in the province.
- Consolidation of wells, e.g. replacing three wells with one. While this might occur just for private reasons, it may sometimes provide a way to make limitations on new wells or deepening wells more acceptable.
- Enforcing spacing restrictions or protection zones, particularly to protect domestic water supply sources. Restrictions include spacing new wells at least as far apart as the depth of an existing well, or in other cases a 500 meter spacing. A spacing of 500 meters can function as rule based on customary law and national law, accepted and enforced through local understanding and action even when national enforcement is not available or effective.⁷

⁵ Ward (2009) argues for strengthening local conflict resolution. Based on a variety of relevant articles, books, and reports, he cites many examples of how communities have used well spacing and other measures to try to control groundwater, sometimes successfully, as well as examples of how failure to control abstraction has dried up springs and wells, deprived downstream communities of water, worsened drinking water problems, and sometimes led to migration and abandonment of previously productive areas.

⁶ Restrictions on water export raise interesting issues in terms of implications for water rights, transferability between sectors, and availability of water to meet growing needs for urban and rural water supply, since water sales offer the most feasible and equitable means available for shifting water from agriculture to urban use. However, the main point here is to note that this is a type of regulation that in some cases has been effective in regulating well usage.

⁷ In a case discussed by Ward (2007:169-171) a village association protected their water supply system by buying and capping neighboring wells that might have interfered with their water source.

31. Appendix C provides additional information on several such cases. As explained, these usually involved a community consensus, agreement within the community, including support from traditional leaders and local councils. Enforcement depended on local social pressures, which sometimes included direct action or threats to forcibly stop violations, as well as more indirect social pressures. The existence of water user organizations, including educational activities and bringing people together, seems to have aided such action in some cases.

32. Thus, under various conditions, and using various approaches, local action to restrict well drilling has been initiated, and has worked. Not always, and not perfectly, but also showing that some forms of local water management are feasible. For example, even if the volume of water being exported by tankers is only a small percentage of total use, so that stopping export, in and of itself, may not have a major impact, effective implementation of such regulation provides an example and basis for further strengthening local water management.

33. Other restrictions were mentioned during discussions, but without specific examples of already being put into practice:

- Restricting the crops that can be grown, as a means of controlling water demand e.g. not allow cultivation of bananas, which are extremely water intensive, or forbidding expanding the area under qat.
- Limiting the hours of pump operation, or the times of year when crops are grown.
- Rather than simply saying to stop well drilling, a temporary moratorium on well installation and deepening could be declared, perhaps until new rules have been agreed to protect domestic water supplies and prevent harm to existing water users.

These are just a few additional examples of what might be done, if there were local consensus and support for such restrictions.

34. As is common on governance of common pool resources, local resource regulation often relies on a variety of locally designed rules, fitted to particular circumstances through local creativity and consensus (Elinor Ostrom 1990). It would be very useful to learn more about such cases in Yemen, how frequently such action occurs, what factors make it easier or harder, and what could be done to encourage it.

2.1.3 Protecting domestic water is a priority

35. Water for drinking is a priority, in traditional values and in national policy. This priority seems to be strongly reflected in local decisions about water management. Water for household use is often treated differently, with stronger regulation by communities, and more willingness to initiate and enforce restrictions. The quantities of water needed for domestic use are much smaller than those used in agriculture, while there is a stronger need for a reliable year-round supply. Even where water is withdrawn from the same “common pool” of underground water, this makes it important to distinguish between different needs. The differences in quantity, timing, reliability and priority may also open opportunities, particularly for using different sources to meet different needs.

36. Shared concerns for household water provide a unifying motive for collective action in some cases, especially where there are few alternative sources and where piped systems have been installed. The priority for drinking water will be more important as

water becomes scarcer and more valuable over time. The need to consider domestic water use as well as irrigation also indicates the limitations and even risks of a strategy that concentrates too narrowly on strengthening organization of irrigation water users. Irrigation is only one water use, and not the highest priority. Household water use often involves many households or the entire community sharing a water source.

2.2 WUOs Can Help Improve Project Impacts

37. In Yemen, local groups often play a central role in planning and implementing projects, including mobilizing substantial funding for their share of costs, for both water supply and for irrigation. This is one demonstration of the capacity for organizing that does exist. This constitutes an important resource, if projects have good arrangements for supporting community efforts and developing institutional capacity for operation and maintenance (Vermillion and Al-Shaybani 2004). Conversely, poorly designed projects, with inadequate consultation and excessive focus only on infrastructure can disrupt local social capital and lead to poor results.

2.2.1 Education is increasing awareness of depletion dangers

38. Visits to the water user groups supported by the Sana'a Basin Water Management Project, GSCP, and CWP consistently indicated that project activities are helping improve awareness of the dangers of depleting groundwater resources. Typically, farmers said that in the past they had believed that groundwater supplies were unlimited, but that they now understand that supplies are limited, are being rapidly drawn down, and could run out. The development of water user groups has provided an opportunity for education on this and other topics concerning water management, and potentially provides a basis for collective action. Even in Seiyun, where substantial underground storage means that current extraction rates might be continued for much longer than elsewhere, farmers said they now had a better understanding and were concerned to avoid the problems that have occurred elsewhere. The organization of water users has aided this change in awareness, providing a channel for communications.

39. Technical analysis suggests that many farmers may be providing more irrigation than necessary. Projects are providing training and extension to improve understanding. Water user groups have been involved in arranging participants for training, and they also provide a forum for sharing knowledge and skills gained from training. While this may be having an impact, and is supported by a strong rationale, it was hard to assess how much impact this was having. However, it shows another channel through which WUOs may affect project impacts by assisting training on more efficient irrigation practices.

2.2.2 More income per drop is feasible

40. Investment in improved irrigation equipment was contributing to increased farm-level irrigation efficiency. Water user groups often played a key role in planning and implementation, collecting names of interested farmers, and aiding implementation of training and installation of equipment.

41. Farmers are very interested in installing pipes to replace open channels, especially at the subsidized costs available from projects. For them, the main benefit seems to be less time required to irrigate, and, to a lesser extent, savings in energy costs. Reportedly, farmers are making this change in technology even without subsidies, for example

farmers growing qat outside the Sana'a Basin, in areas that are not eligible for subsidies. Plastic pipe is widely available, and comes from multiple sources. Projects may have advantages in terms of bulk purchasing price, quality control, and have helped to demonstrate the technologies in areas where it was unfamiliar. However, project provision has sometimes suffered from delays in delivery, and in many places demand now far exceeds available funds. Both government officials and farmers seemed to be thinking in terms of future provision of pipes through projects, with little consideration about whether or when this could shift to the private sector, particularly after the benefits had been demonstrated. Subsidies create a substantial financial burden for government, which becomes even heavier if arguments about fairness (which can be defined in various ways) result in subsidy levels being reduced. Highly subsidized approaches may tend to make farmers passively wait for government aid, and discourage private sector provision of improved irrigation technology. However, if provision of project subsidized pipes is substantially scaled up, then WUOs could certainly play a role in helping make implementation cheaper and faster than if projects had to work with farmers individually.

42. Sprinkler and drip irrigation systems are also being installed with project support in some places, and can generate further farm-level reductions in water use beyond those coming from pipes.⁸ There seems to be less farmer interest and enthusiasm regarding these technologies. It also appears that such specialized equipment is not available for ordinary retail sale outside of Sana'a. This seems to indicate that farmer adoption may well be dependent on project subsidies.⁹ This is somewhat surprising, since the high profitability and low water usage of qat means that in some cases qat is being irrigated with high cost water transported by tankers. Grapes, oranges and other fruits for which drip irrigation could be technically appropriate are also major, and profitable crops.

43. Detailed analysis of the economics of irrigation efficiency was outside the scope of this study. However, observation of market demand suggests that at present there is farmer demand for shifting from open channels to pipe conveyance, but not yet much demand for the additional savings that would come from sprinkler or drip delivery. Analysis suggests that costs for groundwater are currently a relatively small share of total costs, so that even substantial increases in the cost of water would not have much impact on the production of profitable and relatively water efficient crops such as qat and grapes (Hamdi 2000; Hellegers et al. 2008).¹⁰ This does imply that even at

⁸ The Study on Incentives to Reduce Groundwater Extraction in Yemen (Hellegers et al. 2008) offers economic analysis of why the benefits of increasing farm-level technical efficiency may be less helpful than expected for water management.. If a substantial portion of irrigation water returns to the aquifer, then it is not permanently "lost" to the basin, and may eventually be pumped and used by others. While in the short run for a single farmer, higher efficiency may reduce water use, in the longer run and for farmers in general, higher efficiency will increase profitability of irrigated crops and so increase demand for water, worsening the problem of groundwater depletion.

⁹ Lichtenberg notes that if perennial crops, such as fruit trees, have been accustomed to flood irrigation, they develop shallow roots accordingly, and may not be able to get enough water from drip irrigation.

¹⁰ This analysis also means that the incentives are similar for grapes, almonds, and other irrigated crops. The low water demand, high profitability, and other characteristics of qat do contribute to the severity and complexity of aquifer depletion problems, but even if qat cultivation stopped (which seems unlikely), the problems of groundwater over-extraction would still be largely the same.

substantially higher costs for water than at present, there will be technical options that could significantly increase farm-level water efficiency. WUOs could play a role in helping to demonstrate and expand application of such methods.

44. Increasing water productivity offers one of the tools for helping respond to increasing scarcity. WUOs seem to be playing a significant role in helping farmers to understand the opportunity, apply for aid and then install more efficient technologies that can help farmers earn more income per unit of water pumped from the ground.

2.2.3 Aid is not tied to community water management

45. Farmers accepting project equipment are required to sign an agreement that they will not expand their irrigated area. This is intended to ensure that increased efficiency would not lead to expansion and greater water withdrawal. Project staff in GSCP suggested that in most areas where they are working, all land is already under irrigated cultivation, so there is little or no scope for increasing area.

46. Under the current approach there does not seem to be a requirement or strong linkage to any collective commitment to help implement improved water governance. This may make project implementation easier, but seems to miss a major opportunity to use aid to advance not just individual water “savings,” but wider action to improve water governance. This concerns not just the specific issue of commitment in a contract, but also the extent to which the entire process of organizing farmers could contribute to the planning and implementation of measures to move towards more sustainable water management. Thus, this study confirms the conclusion in the November 2008 NWSSIP Update that “the challenge remains at the basin and local level to link water saving in agriculture with efforts to create the institutional basis for local water management.”

47. For rural water supply, similar issues seem to apply. Installation of infrastructure does not seem to be accompanied by strong efforts to ensure that water sources will be protected from harm. There are some cases where communities have acted to protect their domestic water source, and the Rural Water Supply Project has written supporting letters, but this is not part of a systematic process. Aid is not conditional on local agreement to restrict well drilling and deepening. The effectiveness of existing local water governance in regulating groundwater extraction does not seem to be a major criteria in deciding whether to provide aid. This also means that aid does not seem to adequately consider the role better local water management could play in determining the effective lifetime over which investments in wells and pumps could provide services.¹¹

2.2.4 Water supply groups are managing O&M

48. Various approaches have been used to support development of local groups for water and sanitation activities. These groups have helped initiate requests for assistance, participated in planning, mobilized community contributions in cash and kind, organized construction work, learned from training courses, and managed

¹¹ To the extent that government unconditionally assists in deepening wells for domestic supply or finding replacement sources, this creates a moral hazard situation, where other well owners and communities lack incentives to protect their current water sources, since they may not bear the cost of replacement. Realistically, the limited budget, delays, and uncertainty of aid weaken the moral hazard problem, nevertheless, it would be far better for aid to be given in ways that reinforce incentives for communities to protect their domestic water sources against harm from aquifer depletion.

operation and maintenance, including meter reading, billing, and repairs. While some are organized as formal WUAs, others have been able to handle O&M successfully without formal legal status. Formal ownership rights to infrastructure may lie with the local council, which provide support and help resolve problems with WUO performance. Registration as a formal WUA may offer some advantages in terms of banking, and formal accountability mechanisms through supervised elections, reporting, audits, etc., but also brings costs in terms of the time and effort to officially establish the group and annual requirements for reporting and fees. Experience does indicate that more thorough organizing processes have been more effective, in terms of project results and long-term performance. Changes are underway to institutionalize a more thorough approach to social mobilization in rural water supply projects and programs.¹²

49. The Social Fund for Development (SFD) supported by the World Bank has helped develop rural water supplies in some areas. SFD explicitly takes a two-phase approach to organization. During project implementation when there are more activities, there is more elaborate organization, in terms of numbers of people involved, committees, procedures, etc., while a simpler organization is designed to carry out O&M tasks. In general these groups have been able to work effectively, without requiring formal registration as an association.

50. Community participation is also central to the implementation of the Total Community Sanitation approach supported by SFD, in which communities have acted to end open defecation and ensure everyone has access to sanitary facilities. This “software-only” approach, based on improving awareness and local decision-making, has achieved much greater results, far faster, and at much less cost than traditional subsidy-driven approaches. This is a significant illustration of the potential of working to first develop community consensus about the need for change, and then harnessing local creativity to achieve results.

2.3 Water User Organizations Are Diverse

2.3.1 Traditional irrigation governance is relatively resilient

51. As mentioned earlier, Yemen has a long tradition of water management, including water rights systems in spring and spate irrigation systems to determine how water is distributed and the principles for resolving disputes if they do occur. In general, upstream users have first rights to water, to a sufficient amount to irrigate their fields, after which water goes to those further downstream. Traditional water rights are an integral part of local systems of land and water rights. Typically a parcel of irrigated land is attached to a larger area from which water is collected.

52. Government assistance has often been used to improve traditional irrigation systems, but has sometimes disrupted local institutional arrangements. Incomplete understanding and lack of participation can lead to inappropriate designs that may conflict with traditional rights. Traditional irrigation often relied on temporary dams, constructed of rocks and logs, which would wash out during high flows and then be rebuilt. Installation of permanent concrete dams can make it easier for those upstream to divert larger amounts of water, depriving those downstream of the water they have customarily received, leading to conflicts.

¹² A recent survey of user satisfaction with rural water supply services also found users relatively satisfied with WUA, particularly for projects using participatory, demand-driven approaches (Susmita Dasgupta et al. 2009).

2.3.2 *There are several types of WUOs*

53. Table 1 summarizes some of the different forms of WUOs, nonformal and formally registered; and in water supply and sanitation, surface water supply (from springs and spates), and groundwater. This shows that a range of forms exist, often related to history, local conditions, and the needs of different activities.

Table 1. A simple typology of WUOs

	Rural Water Supply and Sanitation	Irrigation (Surface and Groundwater)
Informal	Water supply groups and committees	Traditional irrigation institutions Ground-water user groups Irrigation user groups
Formal	Water User Associations Public utility corporations	Traditional irrigation organizations with legal recognition Water User Associations Water User Cooperatives WUA Councils in larger spate systems
Federations and other higher-level organization	Water Protection Associations? (as in Water Law amendment) Sub-basin Federations? Basin Federations National Union?	

2.3.3 *Groundwater WUOs can be useful but do not seem sustainable*

54. As discussed above, projects such as the Community Water Management Project, Sana'a Basin Water Management Project and the Groundwater and Soil Conservation Project show that projects can help establish water user groups and associations. These groups have helped inform farmers about project activities, raised awareness of the problems of groundwater depletion, organized requests for assistance, and helped the project in supplying equipment to reduce farm-level water losses. Some associations have been registered, enabling them to obtain legal status. CWMP also organized Women's WUAs, which have helped provide access to information, assisted women landowners in obtaining project assistance for their farms, and provided training about irrigation and domestic water use, and sanitation, as well as on sewing and other skills that could help women earn income. The primary motive for participation in groups formed by projects seems to be obtaining aid, particularly subsidized irrigation equipment such as pipes, sprinklers and drip irrigation equipment.

55. One point of discussion has been whether WUOs should be given offices. It is argued that this would help to reduce their costs. However, this does not seem well connected with analysis or long term plans concerning what services WUOs would provide to farmers and how they would sustain their funding.

56. Formal WUAs have significant operational expenses, for staff, utilities, and office rent. Some, such as the CWMP WUA visited in Hadramaut, have succeeded in obtaining

aid from other sources. However, this is difficult, and not a reliable source of funding. In the case of groundwater, in contrast to rural water supply or surface irrigation, there is no need for routine operation and maintenance activities for irrigation O&M, making it harder to sustain the organization. This makes it highly questionable how long such WUAs will be able to survive after the end of project assistance.

2.3.4 Basin and national representation of WUOs is not yet well-developed

57. The Amran Basin Committee includes a WUO representative. During the fieldwork, he attended the meeting of basin committee members, and spoke on behalf of WUOs. Such representation is not as systematically established elsewhere. The water law specifies that there will be an NGO representative on the basin committee, but does not explicitly state how WUOs would be involved in basin management.

58. The current initiative to establish a national level federation of water user associations raises several concerns. This seems to be a top-down rather than bottom-up initiative. It appears that many WUOs were not aware of the idea. It was publicized in the newspaper, satisfying basic formal legal requirements. However, it appears that organizing activities have primarily focused on irrigation WUOs in the Sana'a Basin area. There appears to have been little pro-active effort to spread news widely around the country. It also sounds as if it has concentrated on irrigation WUOs, without considering the involvement of rural water supply WUOs. The initiative seems to have started from above, in a centralized way, before federations or other forums joining WUOs at the local and basin level have been established. While there was some consultation with the National Water Resources Authority, the initiators have chosen to proceed even despite advice that a more gradual approach would be better. It is unclear how the union would relate to or work with NWRA and other organizations. Ideally, a national WUO union might play a useful role in representing WUAs in national decisionmaking. In practice, the effectiveness of a national union of WUAs is likely to depend on the extent to which it is able to become and be accepted as a legitimate and accountable representative for all WUOs.

2.4 Communities Lack Support for Better Water Governance

2.4.1 Irrigation management transfer is not yet working well

59. Government projects, such as the Tihamah Development Project site visited during the fieldwork, have built diversion structures and larger irrigation systems to use spate flows in several major wadis. These combine what were previously separate smaller irrigation systems along a river. Government had managed most of the major canals and structures, but is now trying to transfer management to water users, organized in an irrigation user council. In the Wadi Zabit system visited during the fieldwork, this was running into difficulties. The council was supposed to receive equipment to use for maintaining major works, but the equipment had not yet been transferred. The equipment transfer appeared to be entangled in bureaucratic complexities, and perhaps some lack of enthusiasm for transfer. This situation had persisted despite repeated attempts by the farmers to inform authorities and obtain help in completing the transfer. Farmers had mobilized their resources to hire equipment and carry out some maintenance, but much more needed to be done, which the equipment would make possible.

60. Cooperation was also made more difficult by unequal access to the benefits of improved works, which served only part of the command area. While some consultation occurred during design, it appeared that this may have been dominated by those with better knowledge and connections, particularly larger landowners in some areas, while many others were left out of the consultation process and largely left out of benefits from the scheme. The project had improved only part of the system, and those not included were unsatisfied. Some farmers had been much more involved in planning, and ended up receiving more of the benefits in terms of canal infrastructure and improved water supplies.

61. Council leaders were very concerned to improve the situation, but frustrated by the lack of response from government. There seemed to be conflicting views and information about the extent to which the government would continue to be involved in management, including who would operate the main canals taking water from the headworks. Some sources indicated that there were similar problems at other sites where irrigation management transfer was being attempted.¹³

2.4.2 Groups monitoring wells lack feedback

62. Some WUOs, particularly some formed with support from the CWMP, are helping to record data on wells, and send it in to NWRA. This is being done without any compensation from NWRA. However, it appears that the groups receive little feedback about how their information is reported and analyzed. This provided little encouragement for them to continue their efforts.

2.4.3 Communities lack assistance in understanding local aquifers

63. While farmers were becoming more aware of the dangers of aquifer depletion, this did not seem to be matched by much detailed understanding of when and where problems might become severe. There was often agreement on the principle of making current use more efficient, and the need to prevent increases exploitation. However, there seemed to be little or no specific thinking about what might be a sustainable outcome, and what might be transition paths to reach such a state. Figures for rates of groundwater decline, sometimes as much as 2, 4 or 6 meters a year, were discussed. However, maps showing groundwater levels or depletion rates were not usually available. The danger of aquifer depletion was accepted, but more detailed estimates of when and where it might occur did not seem to be available to WUOs and those working with them.

64. In Hadramaut, CWMP had previously established an informatics database of groundwater, that was not available before in the area. Such information related to well numbers, depths, discharge, water quality, and rainfall data, in a consolidated dataset. A projection of quantity of water used per year was estimated for the area. The monitoring data was submitted to NWRA, which planned to take this area as a model for understanding the groundwater behavior. This represents a useful process for consolidating data from multiple sources, but needs further action to make such data available to communities, in easily understood formats such as maps and diagrams.

¹³ These problems in Wadi Zabit, of partial rehabilitation, inequitable distribution, and equipment not transferred to the irrigation council, contrast with the very positive account of earlier PIM implementation by the Irrigation Improvement Project (Naji Abu-Hatim and Ahmed Shawky Mohamed 2009). As of the November 2009 workshop for the WUA study, no progress in resolving the issue seemed to have been made since the field visit in July,

GSCP has recently recruited a hydro-geologist consultant to take the lead in analyzing and disseminating information to WUOs and farmers, which could provide a good way to test and improve methods for sharing information that make it easily understandable and usable by community members.

65. In many places, there was interest in building water harvesting and recharge structures. However, this seemed to be part of a practical or opportunistic strategy, not part of any systematic analysis of the feasible impacts on local water balances. There seemed to be little differentiation, by farmers or government officials, between areas, such as the Sana'a Basin, where fossil groundwater is being mined, in contrast to other areas that have somewhat more potential for recharge. Some engineers were aware of and interested in the potential for recharge from treated urban wastewater (for some relevant analysis see Hamdi 2000). However, wastewater recharge did not seem to be receiving much priority as one of the tools available for dealing with water scarcity, at least in some specific areas. Similarly, diversion structures for spate irrigation in Tihamah were clearly helping to replenish groundwater, which was then pumped for irrigation. However, this understanding did not seem to have translated into much deliberate management of conjunctive use of surface and groundwater.

66. In part the lack of local groundwater assessment information may be due to the inherent complexity of aquifers and difficulty in understanding conditions underground. Lack of funds and shortage of expertise are also major constraints. Even if some relevant research has been done, NWRA limitations in terms of staff and budget may have made it hard to share. Nevertheless, the situation on the ground seemed to be one of lack of localized analysis and assessment of groundwater, which would have been useful as a basis for more detailed local assessment and decisions.

2.4.4 Funding for NWRA is currently inadequate and unreliable

67. Current funding for NWRA is very low compared to its responsibilities. Support for some staff is dependent on special funding from donors, which is for a limited duration of time. NWRA lacks adequate funding to monitor aquifers, carry out analysis, disseminate information, educate communities and other stakeholders (including other government agencies, both those working on water and those related to enforcement, such as police, security and courts), assess applications for well permits, check compliance with permits, pursue enforcement, or carry out other activities that could help communities develop effective local water management.

68. Upgrading NWRA and strengthening its staff capabilities and administration is a key dimension in enabling NWRA to effectively support WUOs and improve groundwater governance on a wider scale. In general, funding for NWRA is inadequate and unreliable, which greatly impedes its ability to function as a regulator, and makes it hard for NWRA to be an effective partner for communities in water management. Funding for a government agency will inevitably be subject to variations in budgets and priorities. Therefore, it would be unwise for WUOs to depend on such support as a primary source of funding. Nevertheless, a more effective NWRA working in a decentralized way, particularly at the sub-basin level and below, could contribute greatly to supporting the development of local water management.

69. NWRA's activities should reinforce local efforts to improve water governance, and be careful not to discourage or displace local efforts. Without adequate and reliable funding for NWRA, communities lack a supportive regulatory framework and lack a source of support and advice that could help them deal with the multiple sectors and

multiple scales of water conflicts. Even without strong support from NWRA there is much that communities could do, as discussed in this report. However much more could be accomplished if NWRA receives adequate and reliable funding, and thereby becomes better able to work in partnership with local water management.

2.5 Multiple Regulatory Frameworks Govern Water

2.5.1 *Local institutions play a major role in regulating land and water use*

70. The Water Law, promulgated in 2002 and amended in 2006, arranges formal legal authority for water regulation in Yemen. The National Water Sector Strategy and Investment Plan (NWSSIP), originally issued in 2006 and updated in 2008, sets out strategic directions and policies. A legal framework exists to regulate water, based on the water law, supplementary by-laws, regulations and decrees.¹⁴ Other relevant laws and regulations provide a basis for registering water user associations and cooperatives, and for decentralization of natural resources management to local authorities. However, the government's ability to implement and enforce the regulatory framework is relatively weak, due to limitations in budget, staff, and institutional capacity, part of a larger situation which can be characterized as one of "weak state, strong society." In many areas, disputes are primarily handled by tribal leaders or other local leaders, with little resort to state courts. In some cases communities initiate common rules and decrees to prevent water exports or irrigation for Qat and the authority mostly abides by those initiatives and support their implementation. At the local level in most rural areas, access to water and land is usually regulated through local institutions, largely based on traditional and Islamic legal principles.

71. Land rights regulate who is entitled to dig a well and what land may or may not be irrigated. In general, well owners feel able to pump as much water as they wish. Priority may be given to drinking water, in accordance with the "right of thirst." The extent to which owners have such a duty beyond those who would drink water right at the well is subject to different interpretations (Lichtenthäler 2003; C. Ward 2009). Local customs and Islamic law generally consider water in wells to be in a "receptacle" and thereby fully owned by the overlying landowner, who may use it as he wishes. In principle, owners should not use the resource in a way that would "harm" others, and community interests should be respected. Experience with groundwater use and depletion with deep aquifers and motorized pumps is relatively recent. While there are principles of access to drinking water, avoiding harm and balancing community and private interest, these have so far usually not had much impact on local groundwater governance.

72. In practice, well owners usually act as if they have a relatively unlimited right to take as much water as they want, and do with it as they please. This creates the classic conditions for a "tragedy of the commons" where individuals acting to maximize their personal benefits may collectively fail to protect and manage a resource, even though such collective action might make them all better off. However, research has shown that there are many cases where local communities can successfully manage shared resources (Elinor Ostrom 1990). Traditional spate irrigation systems in Yemen are one example of such sustainable local governance. Institutions take time to develop, need to

¹⁴ For comparative analysis of water laws in Middle Eastern and North African countries, see (Morill and Simas 2009), however this is based on the original 2002 law, and the analysis concentrates on legal frameworks, and not on administration and enforcement. For an introduction to the complexity of law and water governance in Yemen, see (Lichtenthäler 2003)

be appropriately designed, and depend on having sufficiently favorable conditions for local cooperation. The challenge facing Yemen is whether the growth of local water governance institutions can be encouraged and accelerated.

73. There are also differences between the constitution's assertion that water is state property, and civil law that recognizes property rights in water for well owners and others. It is worth noting that if the government becomes more assertive about controlling groundwater, based on the constitution's statement about water being state property, this could undermine the security of investment in groundwater. While this might discourage some well digging, insecurity about water rights would also weaken incentives of well owners to conserve water or agree to restrictions, and instead encourage taking as much water as possible as soon as possible, thereby worsening aquifer depletion.

74. In part, dispute resolution and other regulation through tribal institutions can be seen as a substitute where governance through formal law is weak, ineffective, or unavailable (Corstange 2008). In this view, two systems of social order are in competition. While many might prefer state law if it worked well, they may find tribal institutions more effective in practice. However, even where state institutions are relatively effective, they usually rely heavily on other forms of social order, particularly informal institutions, including general willingness to comply with social norms; social pressures against those who deviate; and conflict resolution directly between disputants or through mediators and other intermediaries. Depending on the circumstances, multiple regulatory systems, or multiple legal fields, may compete or complement each other, expanding the diversity of forums available for resolving disputes in ways which may help make them more accessible and effective. Where national laws are relatively compatible with local traditions, as in the case of surface irrigation where national law recognizes traditional rules, then the two systems may be mutually reinforcing. However, where national law lacks a foundation in local ideas and practices, then formal laws have much less influence, and governance of water and land occurs primarily through local institutions.

75. Legal pluralism can be seen as a problem, particularly for those who assume that state law is always necessary or sufficient to establish social order (see Lichtenthäler 2003). However, a deeper understanding of law and society makes clear that law and other social institutions usually complement each other. Laws are unlikely to be effective unless they are acceptable to and supported by individuals and institutions. The attempt to impose laws that are not understood or acceptable is a prime reason why laws in many countries may be ineffective. This is sometimes discussed in terms of the difference between "rule by law" and "rule of law" (Cooter 1997; 2000). Simply having a framework of formal law does not mean it will work, especially if it is largely based on ideas copied from elsewhere that may fit poorly with local ideas and conditions. Rule of law should mean not just having laws, but having laws that reflect and support local ideas of what is proper and just, so that law and other social institutions work together. The availability of other institutions for resolving conflicts, including local social pressures and the mediation of disputes by sheiks and other local leaders can be a resource for improving water governance, though one that becomes more difficult where such intermediaries are themselves major landowners, water users, and politically active. One thing that could be done is to try to ensure that formal laws and regulations are developed in ways that are largely consistent and compatible with local norms and ideas about justice, equity, due process and other considerations,

so that the multiple legal frameworks work together. Specifically for groundwater in Yemen, this would presumably mean giving much more serious and careful attention to the concepts such as right of thirst, preventing harm, and balancing community and private interests in property.

2.5.2 Well licensing has not succeeded

76. In discussions of groundwater management in Yemen, the problem is often framed in terms of drilling that is (in English translation) “random” or “haphazard,” which usually seems intended to mean that it is disorderly and unregulated. As discussed in the previous section, well drilling depends on rights to land, both for the site of the well and for the land to be irrigated. Land rights are strongly regulated through local laws, in ways that are generally consistent with the regulatory frameworks of *shariah* and of national law. Furthermore, well drilling is expensive and risky. This would encourage the person or group investing in the well to try to locate it where they think conditions will be most favorable. If part or all of the compensation for those actually drilling the well depends on a successful well, they will also have strong incentives to choose the site carefully, along with their logistical concerns for a site that is not too difficult for their vehicles to access. While local and national rules about well spacing are not completely effective, it does appear that in many cases those drilling wells are concerned about spacing. In summary, well drilling is not random or haphazard, instead it has an order that is regulated by land rights, traditional rights to agricultural land and run-off, well spacing and other local rules, as well as incentives to increase the chances of success, while avoiding getting too close to existing wells.

77. Many wells are unauthorized, both in the sense that they do not have the permits required by national law, and also in the sense that they are drilled without any permission or approval by communities or other local authorities. The ability of NWRA to process applications and enforce regulations concerning wells is limited by several factors, including NWRA’s own limitations in budget and capacity. Beyond NWRA’s own limitations, there are difficulties in enforcement, in preparing cases against violators, in getting prosecutors to file cases, in winning court verdicts, and in enforcing court decisions. These relate to the larger situation concerning the capacity of state authorities and the prevalence of dispute resolution through local institutions, as well as the limited priority given to water governance and how it may be overridden by other concerns. Farmers stand to lose their investments, profits, and land value if they cannot drill or deepen wells, so they have a strong stake in trying to evade punishment. This may be further complicated by perceptions that groundwater is an unlimited “sea,” lack of information about impacts on other users, the geological complexity of underground water, and, in some cases, suspicions that regulations are aimed to shifting water from rural areas to Sana’a or other towns.

78. At present, NWRA has no systematic procedure for consultation with those who might be affected. There are no formal requirements to notify those who might be affected by a well, e.g. by informing nearby landowners, posting notices in public places, making announcements at public gatherings, or making announcements using newspapers, radio or other media. There are no provisions for public hearings or other occasions to receive comments, beyond in those cases where district councils may be involved in recommending or opposing a well. The relative ineffectiveness of the legal system also means that those who feel a decision was made wrongly or that they are being harmed lack effective legal means for seeking redress.

79. Therefore, a variety of factors weaken the incentives to obtain permits, and limit the capacity of NWRA to issue and enforce permits, so that many wells are drilled or deepened without authorization. The problem is not “random” drilling, since drilling is done based on both local regulations related to land and water, and incentives of landowners and well drillers. It would be more accurate to say that drilling is unauthorized, not only due to lack of formal permits but also lack of authorization through any kind of local consultation and agreement.

80. Underlying the definition of the problem in terms of “random” drilling seems to be an assumption that it would be feasible to have all well drilling regulated by permits, and that if this occurred, then the problems could be solved. However, given the lack of institutional capacity, of NWRA specifically and the government more generally, it is highly questionable whether a permit system could achieve a high rate of compliance. Even if most well drilling complied with requirements for permits, the lack of information and the complexity of aquifer conditions make it likely that depletion problems would still occur. Given the number of wells already in place, even with no new wells there would still be severe problems with depletion, due to the lack of an effective regulatory framework for controlling the amounts withdrawn, and lack of effective ways to regulate cropping patterns and other factors influencing water demand. Operating a system of well permits and quantitatively defined water rights to groundwater is a challenging and problematic objective even in countries where water agencies have strong capabilities and substantial funding. For groundwater governance by both national agencies and communities, it may be more realistic to look for relatively simple rules, related to things that are easily observable such as well spacing, type of crop, and times when irrigation occurs, to govern groundwater through “rules not rights” (Steenbergen and Tushaar Shah 2003).¹⁵

2.5.3 WUA can get legal status, with difficulty

81. WUAs can be set up as associations under the NGO Law. This requires going through a specific set of procedures which are supervised by the Ministry of Social Affairs and Labor. It requires a minimum of forty people, application is made to the Ministry, notice is published in a newspaper, and an organizational meeting, supervised by the Ministry, is held to choose a board and approve a constitution. Based on this, officers are eligible to receive official identification cards confirming their position. This process takes at least several months, and may require traveling to the provincial or national capital to file documents or follow up on their processing. Once registered, the association has to fulfill requirements including filing annual reports. Some WUAs have been established as cooperatives under the Cooperatives Law, with similar but slightly different requirements.

82. At present, there does not seem to be any simpler procedure available that would allow registration just through filing the proper documents with a court or other local authority. Many WUAs have been registered under the existing procedures, so it is a feasible process, but one which can be relatively costly and time consuming.

¹⁵ From a theoretical perspective, rules, such as for well spacing or for upstream priority in spate systems, are also a form of water rights. However, Steenbergen and Shah are correct that much thinking about groundwater management has been dominated by unrealistic assumptions about the desirability and feasibility of water rights regulation through licenses and volumetric controls, and has neglected the potential for finding feasible solutions through relatively simple rules.

2.5.4 WUOs lack legal authority

83. WUA which are established as associations or cooperatives are arranged like voluntary organizations, in that members are free to join or withdraw as they please. Current legal arrangements do not seem to confer any formal authority on WUAs to make and enforce rules about water use, maintenance, fees and other matters over all users of the water resource, rather than just those who have joined the WUA. From a legal and managerial point of view this means that WUA lack authority to manage. Legal status may help them to make contracts and open bank accounts, but is not sufficient for them to make and enforce rules about water and water infrastructure. In practice, at least for surface water, local social relationships, and support from local authorities are usually sufficient to deal with most problems. However, there may be a greater need for WUOS to have formal legal authority in areas with a mixture of people from many areas, in dealing with powerful individuals who are not as susceptible to local social pressures, and dealing with groundwater which lacks well-established rules to limit abstraction and coordinate use among multiple users sharing the same resource.

2.6 Lessons from International Experience

2.5.1 WUOs are hard to sustain

84. Around the world, attempts to develop water user organizations (WUOs) have often been inspired by hopes of achieving the kind of local self-governance common in traditional irrigation systems, including traditional irrigation systems in Yemen. However, achieving such organization has often proved difficult in development projects. While WUO may not be that hard to start, having them succeed and survive is a much bigger challenge. International experience shows a variety of risks faced by efforts to organize WUOs.

- *Post-project failure.* It is often feasible for projects to set up WUOs and other kinds of organizations, and for them to be effective in helping achieve project objectives. Unfortunately, experience also shows that most such groups quickly become inactive or disappear with a few years of the end of the project. Groups dependent on project activities and resources rarely make a transition to mobilizing sufficient resources to sustain themselves. To be sustainable, groups need to be designed to survive under post-project conditions, usually with a different mix of activities and much more limited resources.
- *Paper organizations.* It is unfortunately too easy to hold a meeting, have leaders selected, a charter approved, and even obtain legal registration, ending up with an organization that exists on paper, but with little or no commitment and support from those who are supposed to be members. Where actual irrigation management is still organized using customary practices, this can result in a dualistic situation, creating a potential for conflict. It is usually much more effective to use and enhance existing local institutions wherever possible, rather than trying to create something completely new. A patient and thorough approach to institutional development is needed, avoiding the temptation to set overambitious targets, and instead focus on activities that organize collective action to yield meaningful benefits for members.
- *Puppet organizations.* Government agencies may also work with a set of leaders who serve the needs of the agency, with little accountability to or involvement of water users. While some tasks may get done, particularly for projects, lack of

membership involvement usually means that such organizations lack legitimacy and effectiveness, and quickly fade away if government patronage is interrupted.

- *Capture.* Organizations may be captured by a leader or small group who use the organization to serve their own interest. They may receive training, travel, stipends, and other benefits, without necessarily giving much to the community. If funding flows through the organization, corruption can be a problem. To reduce such risks, democratic procedures for choosing and removing leaders are important, as well as accountability mechanisms such as regular meetings, annual reports, open books.

85. Lessons about how to reduce such risks lead to conclusions about the need for a thorough and participatory process for developing an organization, good arrangements for accountability to members, and matching organizational arrangements to the level of resources the WUO itself will be able to mobilize, e.g., in collecting fees in cash or kind from members, plus their contributions of labor and materials. Widespread understanding and participation need to be developed, often with outside facilitation and support. Local leaders need to be informed and involved, especially if reorganization or formalization may occur. At the same time opportunities should be created for new leaders to emerge. WUOs need to concentrate on activities that serve the interests of their members.

86. Social mobilization is the cornerstone of participatory approaches in rural development and poverty alleviation programs. It is a powerful instrument in decentralization policies and programs aimed at strengthening human and institutional resources development at local level. Social mobilization, if successful, has the potential to strengthen participation of rural poor in local decision-making, improve their access to social and production services and efficiency in the use of locally available financial resources, and enhance opportunities for asset-building by the beneficiaries. The particular methods to be used vary depending on project needs and community conditions. They typically involve some kind of facilitator role, either someone from the community who receives training and support to carry out this role, or someone from outside, recruited, training, and supported by an NGO, agency or other organization.

87. Building up trust between WUOs and local communities (transparency) is crucial for retaining community interest and support for the WUO to ensure its smooth progress. This requires that WUOs maintain transparency in financial, administrative, and technical activities and use of resources. Budget details and sources of funds can be displayed publicly at different places, in the WUO office area and in the community. Communications can be improved by involving more and more local people in various activities, and regular briefings to inform community leaders about ongoing activities and problems,

2.5.2 Nested organizations and networks improve governance

88. The structure of irrigation systems and river basins is usually nested, with smaller canals served by larger canals and larger basins encompassing smaller tributary basins. Organizations are likely to be more effective if they are arranged similarly in a nested structure with multiple levels, for example smaller water user groups combining into water user associations and WUOs federating at the levels of higher canals, and irrigation systems.

89. The structure and boundaries of water resources may cut across the boundaries of administrative jurisdictions such as cities, districts and provinces, posing a challenge for

water governance. Part of the answer often lies in finding ways in which those who share a water resource can combine their efforts, organizing according to hydraulic lines. The result can be what is called a polycentric system, with overlapping units, rather than a single center or hierarchical chain of command (Vincent Ostrom 1999). Polycentric system sometimes appear fragmented or redundant, but often gain advantages from the ability to work at multiple levels, and have multiple units available to respond to problems. Polycentric organization makes it possible to work through many different governance institutions, not only formal government jurisdictions at national, governorate and district levels, but also institutions concerned with a particular water resource or management problem, and tribal and religious institutions. Working with such institutions is likely to be a much more effective than trying to ignore or eliminate them and work only through new formal legal arrangements.

90. Networks of communication between those involved allow flows of information and discussion that can form the basis for learning, and for joint action in water management. This can draw on cooperation among a variety of government, community, civil society and private sector organizations. Successful management usually also requires strong support from local authorities such as mayors, district heads and governors, so it is not a matter of replacing or excluding existing jurisdictions such as districts, but of combining in ways that include those sharing a resources while also having support from local authorities. A pattern of polycentric, “network governance” contrasts with the top-down, hierarchical, command-and-control methods typical of much twentieth-century water resources development, especially construction of irrigation systems by centralized bureaucracies.¹⁶ Polycentric governance facilitates organization in “problemsheds,” among those affected by a common concern.

91. If looked at as a polycentric system, with multiple levels, then WUAs are not the “lowest building block” for IWRM, instead they are only one among many levels. WUOs are usually composed of multiple groups, such as water user groups related to projects. In the case of groundwater, a set of partners may share ownership of a well. Groups or partnerships in turn are composed of individuals, who are also part of households, tribes, and other affiliations. WUOs may be federated at multiple levels, for example on branch canals of an irrigation system, for the main canal, among multiple irrigation systems along a particular stream, or wadi, and within sub-basins and basins. Thus patterns of network governance weave multiple connections at multiple levels, rather than just a few “building blocks.” One implication is to avoid excessive focus on a top-down hierarchy, and to consider both hydraulic and administrative units. Nested organizations tend to be more effective than a single large organization would be. Network governance allows combining efforts from many sources to deal with problems.

2.5.3 Governing groundwater is a difficult problem

92. The world has few examples of successful groundwater governance, and many examples of failure and poor performance (T. Shah 2009). Groundwater is a common-pool good where one person’s use subtracts from what others can use, while excluding other users and monitoring or controlling their abstraction is difficult, This makes it easy for “tragedy of the commons” situations to occur, where if each individual user

¹⁶ For further discussion of network governance of water and other shared resources, see (Carlsson and Sandström 2008).

pursues only their own interest, everyone suffers from a much worse outcome than if they cooperated in managing the resource. The large number of wells, difficulty of monitoring, and strong economic incentives for groundwater use mean that even relatively powerful governments are often unable effectively control pumping. Aquifer depletion, “mining” deeper and deeper until pumping is no longer economically viable, is often the most likely outcome. Local level collective action also faces the problem of trying to ensure that everyone complies with the rules, but communities may be in a better position to detect violations.

93. One positive lesson from international experience is that groundwater management measures are more likely to be accepted by users if augmentation of supplies is combined with restrictions on abstraction, for example, bringing in new surface water supplies while enforcing tighter control on wells. In the case of Yemen, pipe and drip technologies that reduce water losses effectively provide more water (or lower costs), and so might be combined with restrictions on pump installation and use. Similarly, if in particular areas, water harvesting, spate flows, or treated wastewater can be used to recharge aquifers, this additional water might be combined with other management measures to control demand and shift towards more sustainable patterns of water use. Therefore, if action to control water demand is a requirement or criteria for getting aid that improves supply, this would integrate water resources development and management.

94. Southern California offers one interesting example of relatively effective groundwater governance, including aquifer recharge, reversal of seawater intrusion, and active management of aquifer storage as a reserve for dry periods (Blomquist 2006; 1992). Groundwater governance grew through a bottom-up polycentric process, formed by local water districts, water utilities and other large water users, with technical advice from state and national government. Court-approved settlements of water disputes provided the legal basis for enforceable agreements. Government agencies such as the U.S. Geological Survey helped provide information. Development of groundwater governance involved trial and error, failures and successes over a long period of time, impelled by pressing problems. Wholesale water management was largely in the hands of a relatively small number of formal organizations, substantial resources, and well-established rule of law, conditions which contrast with the challenges facing Yemen.

95. India and north China are other areas where groundwater use has boomed, and both have large numbers of relatively poor farmers. However, progress in establishing groundwater governance by the government has been difficult in both areas. Highly subsidized or free electric power for pumps in rural areas of India has made reform much more difficult and politicized. Some parts of India do have interesting examples of locally-driven activities for groundwater recharge, which has had substantial impacts, often initiated by religious or voluntary groups. Appendix B draws on research on groundwater governance in South Asia to analyze Yemen’s hydrology and potential implications for collective action. A major conclusion is that although collective action is often unlikely, there are conditions which can be conducive to collective action, sometimes to get more water or subsidies, but sometimes also to cooperate on recharging groundwater and local groundwater governance, particularly where sources of water for recharge are available, and aquifer characteristics mean that farmers can relatively quickly see and benefit from recharge.

96. Lessons from international experience with groundwater governance confirm that it poses a difficult challenge. However, establishment of effective aquifer governance may

be feasible under some circumstances; can sometimes develop bottom-up through local initiatives; is much more attractive if water demand management is accompanied by increased supply; and can benefit from government support for information and enforcement.

2.5.4 IWRM needs to be pragmatic

97. International experience with Integrated Water Resources Management (IWRM) is showing that simply understanding the integrated nature of water management and trying to make comprehensive plans on that basis is not enough to yield good results (Biswas 2004). IWRM has many interesting and important concepts, especially from a theoretical or academic perspective, but these may be subject to misunderstanding or hard to apply. Putting IWRM into practice can be uncertain and very difficult. Too much attention to comprehensive, holistic efforts may divert time and money away from more practical action to deliver results. Experience with and concerns about the limitations of IWRM, especially ambitious and unfocused versions of IWRM, has led to recommendations for “principled pragmatism”(World Bank 2004), “expediency” (Lankford et al. 2007) and “problem-solving” approaches (Bruns 2009) more closely fitted to particular priorities and changes that are politically feasible. In the case of Yemen, some particular priorities for an integrated approach would seem to include:

- Integrating regulation of domestic water supply and agricultural water to prioritize and protect sources for household water
- Conjunctive use of surface and groundwater, particularly in relation to recharging groundwater
- Integrating aid to augment water supply (e.g. through water saving or water harvesting) with developing local institutions to manage water demand
- Coordinating activities among those sharing a water resource at the sub-basin level such as an aquifer or a wadi.

3.0 RECOMMENDATIONS

3.1 Learn from Communities

3.1.1 Learn from local initiatives

98. Much more could be done to identify and learn from local initiatives to improve water governance, particularly for groundwater. In part this may be mainly a matter of shifting from an assumption that changes must be planned top-down to an approach that expects that local communities, with or without external support, will need to devise solutions that fit their specific conditions. Rather than a single rule, or uniform package of rules, the need is for a variety of rules adapted to particular priorities and constraints.

99. Local communities have a great deal of strength and experience in dealing with their local situation. In addition, they are encouraged to solve their own problems when they are given the opportunity and trust. Lessons from past experiences and projects show:

- Local communities can lead when they have the chance and can have the enthusiasm and willingness to work collectively,
- Communities possess great deal of experience and can provide logical solutions
- When there is no external intervention, WUOs are able to correct their mistakes and agree on the actions needed.

100. Much could be learned from further study of such cases, including

- learning what additional kinds of rules have been used,
- seeing which rules work best under which conditions,
- which rules are easier to start with,
- sequences that may work effectively to build on earlier progress, and
- which issues can primarily be handled locally and where government help may be most useful.
- It may also be possible to identify useful ideas that have been discussed some places, even if not yet implemented.

101. Case studies could document and analyze local initiatives, helping to spread awareness and understanding. Analysis by researchers can clarify what has worked and how it worked. More in-depth analysis would need interdisciplinary teams able to understand both the social and technical aspects of the situation. However, much important experience can be transmitted through simple stories about what has happened. As suggested during the workshop, dissemination of information about water distribution laws and traditional practices by different government agencies could help to expand awareness, among both officials and communities of useful examples of local water governance. Appendix E provides draft terms of reference for studies of local water governance initiatives.

3.1.2 Help communities learn from each other

102. A variety of measures can be taken to help communities learn from how others have acted to improve water governance. Exchange visits allow groups time to learn in detail from direct observation and discussion. Such visits work better when there is good selection of participants and hosts, emphasizing people who want to learn and willing to work to share what they learn. Farmer-to-farmer training can sometimes be very effective. Workshops can bring together representatives from many areas to share experience. Newspapers, television, radio and other media can spread information about interesting examples. Participants in the November 1 workshop recommended using study tours, advisory services and training by members of more successful societies.

103. Workshop participants also suggested improving documentation of laws and traditional practices. Some work on customs related to water is being done by GTZ-supported projects in Amran. Better documentation of traditional laws and local rules could provide a useful source of ideas.

One interesting example of traditional legal practices concerns agricultural courts, such as existed in the past in Lahaj.¹⁷ A three-person court appointed by the sultan could decide cases based on local custom. One of the workshop working groups suggested reviving agricultural courts. Such courts offer an example of how a formal legal system can recognize local custom, and provide specialized expertise in dealing with disputes over water and related matters.

¹⁷ See “Codification of Agricultural Customary Law in Lahj” at <http://www.spate-irrigation.org/librar/CodificationCustomaryLaw.htm> which contains many provisions related to the distribution of irrigation water and maintenance of canals.

3.1.2 *Encourage local innovation*

104. Decentralization and other policies can help to promote local innovation in devising ways to better manage aquifers and irrigation systems. In some cases this may be simply a matter of encouraging flexibility, rather than trying to impose or insist on a single solution. In other cases it may be important to provide specific forms of support.

105. Suggestions made during the workshop illustrate some of the diversity of different measures that might be employed. In addition to ideas already discussed in the report, these included:

- Stopping drilling of wells in areas where water level decline is more than 3-4 meters
- Closure of wells which are not spaced far enough from other wells
- Prohibited water export except for drinking water
- Installing water meters for water consumed for qat irrigation
- Regulating time periods for pumping
- Introducing and promoting crops with low water consumption, such as grapes, almond, and coffee

While there are many different possible rules, a key challenge is to develop rules that are appropriate and effective in particular situations.

3.2 **Support Local Problem-solving**

106. Support for community problem-solving to improve water governance should be an essential part of projects such as those providing subsidized irrigation equipment or other aid to irrigation. Similarly, rural water supply projects should pay attention to developing not just physical infrastructure and skills in O&M, but also developing the capacity to protect water sources and take part in improving water governance. If such activities are carried out by projects and programs, they should coordinate with and be guided by NWRA and local authorities, in accordance with their respective competencies. It would certainly be appropriate and consistent with NWRA's mandate to support such activities. This could be done through implementation directly by NWRA, or in cooperation with other agencies and organizations, including non-government organizations, charities, academic institutes, civic groups and community organizations.¹⁸ In Appendix H, the recommendations from Working Group 2 show a matrix that illustrates some of the activities that could be carried out by local groups and ways in which other organizations could support them.

3.2.1 *Share information*

107. Where communities are helping monitor wells, but not getting feedback, the first step would be to make sure that they have copies of the data, and receive reports that make use of it. This may help motivate them to continue monitoring, and help them to better understand the problems they face. More generally, much more could be done to make data and analysis available to communities, particularly through maps, charts, videos, or other formats that make it as accessible as possible.

¹⁸ Assigning a monopoly on WUA support to any single organization seems likely to complicate and restrict the development of local water management, so the emphasis in these recommendations is on encouraging support from multiple sources, with appropriate coordination.

3.2.2 *Outsource data collection*

108. Local communities may be able to collect information at much lower costs than NWRA. If budget is available, for example as part of gathering national statistics in rainfall, groundwater and other hydrological data, then in some cases data collection responsibilities could be outsourced to WUOs or others in the community, reducing costs and improving the continuity of data collection. If there are administrative obstacles to doing this, these should be identified and revised.

3.2.3 *Facilitate local planning and action*

109. This section outlines a methodology for participatory problem solving, which is further discussed in Appendix E, with more specific discussion of techniques for participatory water resources assessment in Appendix G.

110. *Assess aquifers.* Current educational activities for WUGs seem to be effective in raising alarms and improving understanding that aquifers are not unlimited and the potential threats to livelihoods. However, much less seems to have been done to identify what would be sustainable, and how to get there.

111. Many aquifers are complex. It is unlikely that sufficient resources will be available for detailed analysis by outside experts for each local aquifer. Therefore, the best or only option for many communities may be to engage in their own analysis, with suitable external support if available. Local people collectively have a wealth of knowledge, which can be compiled and analyzed. This includes information such as the history of how water levels have changed over time, the location and timing of drilling and deepening wells, springs that have dried up, and difficulties encountered while drilling and deepening wells. This analysis could also look at potential sources for recharge, and for enhancing recharge and conjunctively managing groundwater and surface water.¹⁹

112. Community research can be facilitated through NGOs, schools and other local organizations. Preparing maps, tables, and charts helps to synthesize data and analyze trends. This then provides a common basis of shared information for considering measures to change water use. Internationally, various forms of community research have turned out to be quite productive. These can also offer effective ways to combine local and scientific knowledge. Techniques from participatory rapid appraisal (PRA) and other sources can be applied to gather and analyze information from local people.

113. Outside analysis and advice can be used together with local research to better understand the factors affecting groundwater drawdown and the future prospects for aquifers. This provides a basis for better local understanding of the situation, problems, and what might be done to shift towards more sustainable water management.

114. *Consider scenarios.* The tables in Appendix B outline patterns of groundwater boom and bust, and the options that might be available for preventing aquifer collapse and establishing more sustainable patterns of water use. Participatory analysis of scenarios such as these can offer a useful framework for local planning. This would make it possible to contrast the likely result of current trends continuing with what might be sustainable patterns of water use that include increased recharge, reduced extraction and other changes.

115. *Envision sustainability.* Review of scenarios then provides a basis for trying to find pathways for shifting to more sustainable patterns of water use. Community visioning

¹⁹ For analysis and proposals for enhancing conjunctive management, using the example of Wadi Ahwar, see de Vries and Ghawana (2009).

techniques can gather a range of local leaders to share ideas and develop consensus principles, a preferred scenario, and then work on agreement about practical steps that can be taken to move toward sustainability.

116. *Agree on and implement actions.* The next step would be to agree on specific actions. As shown by the various examples above, these are likely to take the form of relatively simple rules that can be monitored and enforced locally. Agreement might be confirmed through signing a petition or other steps that are meaningful for participants. In some cases it may be crucial to confirm support from the district council and traditional leaders. Coordination with local security officials, NWRA, and others may help create supportive conditions. Announcements at community gatherings can help to make sure everyone understands the new rules. The most crucial times will probably be the first few cases where someone starts to act in violation of new rules.

117. *Continue to develop community water management.* Initial efforts provide a basis for further action, either building on success or trying to find ways to overcome obstacles. As discussed, the particular form of organization should be chosen to fit with the activities to be undertaken, and may change over time. Appendix E outlines procedures for a problem-solving process for WUO development. Appendix G provides more detailed description of methods for participatory water resources assessment.

3.2.4 Monitor results

118. The relative ease of setting up WUOs, poorly done but superficially existing on paper, together with the risks that WUOs become inactive, ineffective or do not achieve their intended objectives means that simply counting the number of WUOs “established” has little meaning as an indicator for monitoring project achievements. What is much more important is results, such as effective local action that restricts well drilling and deepening and makes other changes in groundwater and surface water use that reduce over-extraction, protect domestic water sources, and help communities adapt to increasing water scarcity.²⁰ Most of the results depend on local consensus and authority, in which WUOs are at most one of several participants.

119. Some relevant indicators of changes in local water management include establishment of local agreements concerning water governance (e.g. in meeting minutes or petitions); reports on enforcement actions, e.g., cases of stopping well drilling, closing wells and restricting their use, both local action and that done through the formal mechanisms of NWRA and the courts; works constructed for water harvesting and aquifer recharge (and the observed or estimated impacts); data on well drilling and deepening, authorized and unauthorized; water levels and flow rates for wells particularly domestic water supply sources (including springs where relevant); irrigated area and cropping patterns (from local sources or remote sensing) and indicators of changes in basin, sub-basin and local water balances (both from analysis of water table levels and other quantitative data and observable changes such as springs or wells drying up or being restored). Other changes, such as expansion of irrigation area or abandonment; and migration related to lack of domestic or irrigation water are also obviously relevant.

²⁰ For the new Water Sector Support Project (WSSP), these indicators would relate to Outcome 2 “Communities are empowered and enabled to manage their water resources at the local level” and Outcome 5 “Groundwater extractions from critical basins have been stabilized or reduced” (World Bank WSSP PAD 2009 pp 48-49).

120. For spate irrigation systems, equitable water distribution in accordance with customary water rights would be a key criteria, with indicators including both areas irrigated (according to reports and remote sensing), water user satisfaction, and the number and type of conflicts occurring over water distribution. Performance in implementing maintenance works would be particularly important in areas where WUOs and councils are taking over responsibilities for cleaning canals and making repairs. Management actions to enhance conjunctive use would be of interest, and thus could include some of the water governance indicators mentioned in the previous paragraph.

121. For rural water supply, standard performance indicators would be relevant, particularly full-time supply (or agreed service levels such as hours of service per day or per month), number and duration of service interruptions, and compliance with water quality standards, as well as system coverage and financial viability of O&M.

3.3 Diversify Approaches to Organizing WUOs

122. Existing methodologies seem relatively effective for facilitating the formation of WUOs and their involvement in implementing project activities, including training to build capacity. In both irrigation and rural water supply and sanitation, approaches have been developed for more thorough facilitation in helping develop local organizations, which could be expanded and systematically applied.

123. In the case of rural water supply, current approaches appear to lead to relatively sustainable organizations that can continue to carry out operation and maintenance activities. However, in irrigation there are much greater risks that organizations may not be sustainable after the end of special project support, and that current approaches may be too expensive and difficult to cover all affected area.

124. Yemen has experience with a variety of different forms of water user organizations. Different forms can be adapted to different needs. As suggested earlier, the goal should be to avoid unnecessary overhead and develop the minimum, not maximum, level of organization to fit the tasks to be accomplished. Findings from the study suggest that it will be important to support not a single model for WUOs, but a range of forms of water user organization, including various kinds of groups, associations and federations, fitted to diverse conditions and activities in different areas. Sustainable organizations will need to rely on local resources, which often means that the appropriate way to organize during projects may be different from what may work best during a particular project.

3.3.1 Develop WUOs that can sustain themselves with local resources

125. Current WUO development has been stimulated by the benefits available from projects, particularly subsidies for capital investment costs of building and improving major infrastructure. However, perpetual dependence on government patronage is not a viable strategy for sustainable WUOs.

- Contracting WUOs to help implement project activities can be useful, and provides benefits for local employment. However, projects and programs have limited duration. Contracting WUOs to implement project activities also brings risks that WUOs are primarily seen as contractors and instruments for

implementation, and not as representatives of communities and forums for local problem-solving.²¹

- Offices and paid staff may be useful for some activities, but create costs that may be difficult to pay in the future.
- Joint purchasing, for example of agricultural inputs, or joint marketing of products can help to save money or increase earnings for members, but also creates risks of losses and conflicts, and can be highly dependent on market conditions and on the skills of those handling purchasing and marketing.
- Access to subsidized inputs, e.g. through government programs, can bring benefits, but also may result in delays and disappointment, as well as vulnerability to politicized manipulation.
- Similar issues apply to using other subsidized inputs and inducements for WUO development, such as tractors or low interest loans. While they sometimes work in the short term, they create dependency and a perception that the organization is mainly a means for getting things from the government.

126. In simple terms, sustainable WUOs need to be able to rely on local resources. This does not rule out obtaining additional assistance from outside, but this should be a supplement, not the primary basis for WUO survival. If WUOs must rely primarily on local resources for their continuing activities, this means concentrating on things that local people want and are willing to contribute to. It means avoiding unnecessary overhead for paid staff, offices, and vehicles.

127. It may be reasonable to require organization of some kind of a WUO as a condition for requesting or receiving project assistance. However, having a formal WUA should not be required, since this may be more elaborate than necessary and could make sustainability more difficult.

128. WUOs involved in rural water supply seem to provide examples of relatively lean efficient organizations. However, they have the advantage of a regular source of income from water fees, and routine maintenance tasks that are obviously essential to assuring reliable supplies. A variety of changes have been made to strengthen capacity to facilitate group formation in rural water supply and sanitation.

129. For surface irrigation, the activities needed from WUOs are typically less demanding and more sporadic. This may make it appropriate to rely more on voluntary work, and temporary or part-time workers. Government bureaucracies and other formal organizations with many routine tasks and regular budgets are unlikely to provide good models for how to organize. More can be learned from the patterns of roles involved in traditional irrigation management, which can function effectively with low overhead costs. For federations providing services to larger areas, there may be more need and potential for having enough staff and resources, at least on a seasonal basis, to manage gates and carry out maintenance requiring heavy equipment.

130. For groundwater governance, establishing a basis for obtaining resources and sustaining activities seems even more difficult. For the groundwater itself, it is not clear that there is a specific worthwhile service that the organization could provide. In some cases, the organization might provide other services, such as agricultural inputs, or

²¹ Conceptually, the proper role of WUAs is as project “owner” helping to ensure successful results. In some cases, WUAs may be able to handle multiple roles without major conflicts, while in other cases, particularly in larger, more expensive projects, incentives for leaders and members may be distorted and results compromised.

another existing organization might also take on responsibilities. However, as mentioned above, reliance on outside resources creates a dependence on subsidies, and vulnerability to any interruption or manipulation of subsidies. Rather than creating a separate specialized organization, it may sometimes be more efficient and effective to make use of existing local institutions, including local councils, as forums for creating agreements and arranging enforcement, particularly concerning wells.

131. Regulating a resource, such as groundwater, is a very different task from delivering services, and may require a different form of organization, one that can develop local consensus and organize enforcement for all resource users. If this falls within the jurisdiction of a local government unit, such as an aquifer or watershed mainly located within the territory of a single village or district, then that may be the logical way to organize. In other cases, it may be essential to build a coalition for action that has support from all the relevant authorities, at a scale that covers the resource, for example in a sub-basin or wadi. This is discussed further below in the subsection on empowering local water management.

132. Approaches to supporting the development of local organizations need to be diversified to fit particular conditions. For demand-driven projects, self-organization by communities should be the main emphasis, though some efforts may be needed to help ensure inclusiveness and accountability. In some cases, for example where there are serious conflicts, heterogeneous mixtures of people from different areas, and suspicions due to past events or fears about the future, then a large amount of effort may need to be devoted to building understanding and trust, with support from academics or other knowledgeable advisers, specialized teams for community mobilization, and a patient, lengthy process. The problem-solving process discussed in the previous section provides one illustration, particularly in relation to areas with severe aquifer depletion problems. The November 1 workshop discussions noted the need to promote willingness and awareness concerning developing WUAs that could sustain themselves with local resources. The methods for developing WUOs, and for developing community water management more generally, need to be fitted the actual circumstances.

3.3.2 Use phased approaches

133. One useful example of a flexible approach to water user organization comes from the two-phase approach used in the Social Fund for Development (SFD) project supported by the World Bank. During project implementation when there is a substantial amount of work to be carried out, local organization may be relatively elaborate, with many people, committees and subcommittees involved. However, for continuing operation and maintenance, this is adjusted to work through a simpler organization, avoiding unnecessary costs and increasing the prospects for sustainability. In the case of spate irrigation, this may just continue with traditional management arrangements. For facilities with pumps, pipes, tanks and other facilities that require more maintenance, a suitable committee is set up and those responsible for O&M receive training.

134. In most cases, water user groups may be sufficient for project activities, with no necessity for forming a legally registered WUA. Therefore it is important to avoid establishing unnecessary requirements or targets that projects establish formal WUAs. Where there is a strong need for legal status and good basis for sustainable funding, then it would be helpful for projects to provide appropriate support, under the guidance of and in coordination with NWRA, Ministry of Labor, and district government. Projects

might begin by working with existing water user groups or helping new ones to organize, followed by informal associations composed of WUGs. In some cases a next step might be to form a legally registered WUA, while in others post-project responsibilities might be handled by a simpler, streamlined organization or arranged through suitable arrangements with local government and other local institutions. Thus, the goal is not to develop WUAs as a goal in itself, but instead to find help farmers organize in ways that fit their needs at different times.

3.3.3 Work with women's groups

135. Women's groups can play a crucial role in helping women learn and be involved in improving water management in households and communities. Development of water-specific women's WUOs, as in CWMP, would be an option. Such groups, for example at a district level, can provide support to women in local communities. However, based on discussions with the Yemen Women's Union, it looks like it would be much more efficient, effective, and sustainable to work with more general purpose women's groups, at multiple levels. Activities would include training on household water management (including sanitation), inclusion of women landowners in programs for improving irrigated agriculture, and involvement in community decision-making concerning water management. This deserves specific funding as part of programs in the sector.

136. The Yemen Women's Union and its associated organizations at the governorate, district, and village level could play a crucial role in the effective implementation of these activities. Social mobilization programs to support development of WUGs and WUOs should have staff and budget for pro-active work with women and women's groups, to promote inclusive participation, including communications, gender analysis, training, and other activities. In WUOs, arrangements for leadership and decisionmaking should ensure the women are well-informed (e.g., about project planning), able to voice their views, and involved in making decisions. The specific ways to do this need to be adapted to what will be feasible and effective under local conditions.

3.3.4 Develop co-management

137. Customary water rights and patterns of organizing surface irrigation seem to have held up relatively well. However, attempts to transfer larger irrigation systems to local management have run into more problems, including uncertainty about the future roles of government and communities.

138. In such schemes, given the amount of capital involved in construction, and limitations in local financial capacity, it is probably unrealistic to expect government to withdraw completely from all roles. Therefore, it may be helpful to see the future situation as one of co-management, rather than simple "transfer." Government and water user communities will both continue to be involved. Most likely, communities will continue to seek government aid for repairs and improvements, particularly larger works. Government may be able to provide some aid, but likely much less than water users might prefer. Amidst this potential confusion and contestation, the need is to find ways to more effectively organize collective action, including cooperation among farmers and between farmers and the government.

139. Similarly, for water supply and sanitation, government subsidies may continue to be important for capital costs, as well as technical assistance for planning and for monitoring water quality. Rather than assuming the goal would be to minimize or

eliminate government roles, the objective should be to find the best mix of public, community, and private activities.

140. The principle of cost sharing seems to be well established, and is reinforced by the shortage of funding compared to needs, both for irrigation and for rural water supply. There can be tensions, negotiations, and conflicts over cost sharing, especially as problems occur during implementation.²² This can be seen as a natural, political process. In theory, “consistency” in cost-sharing might be thought to be desirable; however in practice this may turn into an excuse to lowering costs, a lowest common-denominator approach or aid arbitrage, that weakens the impact of outside investment for inducing local investment. There are differences in the scale of investment, wealth of local communities, availability of local resources, and availability of financing, as well as differences in policies and budgets for both national and international funding, all of which would make it difficult or impossible, and not necessarily advisable to be “consistent” on cost-sharing percentages. Overemphasis on consistency could be unfair to poorer communities, either shutting them out or allowing other places to take most of the benefits of external aid. At the same time, overemphasis on consistency or “equality” in cost sharing would also forfeit opportunities to mobilize more local resources for those places and investments with more capacity for cost-sharing.

141. Changes during implementation reopen issues of cost-sharing, in ways that are hard to predict and that make excessive strictness problematic. In practice, transparency about budget constraints can do much to encourage local resource mobilization, as can clear policies, including giving priority to those who offer to share more of the costs. One recommendation to reduce problems with promises not being fulfilled is to divide investments into phases, with each side contributing during each phase, and only proceeding after promises have been fulfilled (Vermillion and Al-Shaybani 2004).

142. Government policy in the NWSSIP explicitly states co-management as a goal. Fieldwork and analysis for this study suggest that local governance may be able to play an important role, at least in some cases. However, external support will also be crucial in some matters, including those requiring large lumpy investments or high levels of technical expertise. Workshop participants recommended involving all the related authorities with water user organizations. More generally, the question is how to best link the various different organizations providing services related to water, in order to cope with the most important interrelationships in the water resource system.

143. As should be clear from the discussion so far in this paper, WUOs can play a valuable role in providing services, such as O&M and assisting project implementation. However, regulating water resources is a different type of task, which requires that all water users comply with rules. Therefore is more likely to succeed if consultation, consensus-building, and implementation involve as many stakeholders as possible, including local authorities and traditional leaders. WUOs for water supply, or surface irrigation, or groundwater irrigation, are ways of organizing some of the users, but need to be woven into a wider network in order to establish effective local water management.

²² The report by Douglas Vermillion and Al-Shaybani (2004) describe several cases, showing the capacity of communities to initiate projects and mobilize local resources, attempts to renegotiate cost-sharing as unexpected problems occur during implementation, and how poorly designed interventions with little local consultation can undermine local cooperation and lead to poor results.

3.4 Weave Networks for Governance

3.5.1 *Create horizontal and vertical links*

144. National policy in the NWSSIP discusses WUOs as the lowest level “building blocks” for IWRM. Vertical linkages can be important for WUOs, but horizontal linkages with local government and traditional leaders are even more important. Thus the need is not to establish a single vertical hierarchy, but instead to combine multiple horizontal and vertical linkages. It may be important for WUOs to have vertical linkages not just to basin committees and NWRA, but also to other agencies. Horizontal linkages may also be important at the basin and national levels, for example to coordinate between agricultural and domestic water use. Therefore an appropriate analogy is weaving with horizontal and vertical threads, which gain strength from a network of multiple linkages.²³ Such patterns have been analyzed in terms of “network governance.” This provides a way to draw on the capabilities of many different stakeholders,²⁴ combining their actions in various ways in response to different types and scales of common interests.

145. Accordingly, the study recommendation concerning institutional structure or “architecture” is to look beyond a single hierarchy, and instead work on combining horizontal and vertical linkages at multiple levels to help develop network governance. This should primarily build up from the bottom, based on local initiatives aimed at solving specific problems, and federate up from there to provide representation at higher levels of decision-making.

3.5.2 *Federate WUOs from the bottom up*

146. Federations of water user organizations can play a valuable role in allowing efficient communication and decisionmaking. The usual approach to developing federations is to work from the bottom up. Within irrigation systems this leads to multiple levels, for example with federations at the branch canal and main system level. If there are multiple weirs along a stream that need to coordinate water management, then some form of federation at that level would be important, and this also may apply to larger sub-basins and basins.

147. A similar approach to developing nested organizations, building up from the bottom, can be applied to aquifer governance, including use for domestic water supply as well as agriculture. Villages or parts of villages may share an aquifer or set of aquifers. In some cases these are highly localized, with little connection. In other cases, users may share a large aquifer, drawing on the same pool of underground water, so that each is affected by the actions of others. Where users are connected by sharing the same resource, it may be crucial to have a higher level of organization that can encompass the relevant aquifer, or at least the most closely connected portions, with

²³ In theoretical terms, this emphasizes “bridging” social capital, building links across groups, which complements “bonding” social capital of trust and cooperation within groups.

²⁴ It should be noted that drillers, the owners and operators of well-drilling equipment, are important stakeholders. If the goal is to have them accept and comply with restrictions on well drilling, while accepting that some deepening and replacement of wells may be inevitable, then consulting them on their views, educating them about the problems, and involving them in finding solutions that they feel would be tolerable and legitimate is more likely to succeed, in contrast to the evasion and conflict likely to result from a purely adversarial or narrowly enforcement-oriented approach.

multiple levels if necessary. However, it is important to identify what tasks may be appropriate for each level, following a subsidiarity principle to keep things as simple as possible consistent with carrying out essential activities.

148. Collective action may also be important for management of surface catchment areas. Traditionally these have often been organized through the customary rights or different villages and tribes. Cooperation to improve water harvesting and aquifer recharge will need to take account of these rights, as well as ensuring cooperation among those sharing an irrigation system or an aquifer.

149. Since lower level WUOs and federations at the subbasin and basin level have not yet been well-developed, the effort to develop a national WUO union seems premature, and at risk of ending up incomplete, confused, unrepresentative, and ineffective. A wiser approach would be to take more time, patiently federating up from local areas to subbasins and basins, democratically deciding whether and what form of national level organization might be useful, ensuring that representatives are chosen in a way that is accepted as transparent and legitimate, and ensuring that the union is accountable to and serves the interests of all WUOs.

150. Participants in the November 1 workshop suggested it could be useful to establish coordination councils at the district level, with selected representatives from water user organizations. They also suggested having coordination councils at the the basin or provincial level, with equal representation of WUOs. As discussed in the previous section, it would be important to link such organizational development to practical problem-solving. It is helpful to be able to organize at multiple scales, including higher level federations, so that the scale of organization can fit the scale of the priority problems.

151. Organizations federated in terms of irrigation systems, aquifers, and catchments may be combined in various ways depending on circumstances. Agreement about joining forces, creating consensus, and cooperating efficiently are likely to be more important than theoretical concerns about hydraulic and administrative boundaries.

3.5.3 Empower communities to make and enforce rules

152. For rules to be effective, there need to be ways to deal with those who violate them. This may come through local social pressures, formal legal punishments, or a combination of these and other sanctions. WUAs are currently organized as cooperatives, where members have a voluntary choice of whether to join or withdraw. However, this fits poorly with the situation in a piped water network, irrigation system, or aquifer where many people share a common resource. In such cases, there is a need to be able to make and enforce rules that will apply to all users, not just to those who voluntarily agree to comply. Accompanying such authority is responsibility to ensure that decisions are made in a responsible way.

153. The theoretical answer is that organizations such as WUO should have legal authority to make and enforce rules. In traditional systems, this authority may derive from traditional leaders. However, where traditional authority is less effective, for example where there are people from many different groups, other methods are necessary. The recommendation would be to change legislation so that WUOs and other local water management organizations have adequate legal authority. In the short run, the practical solution is more likely to come from drawing on the authority of local government and traditional leaders, and perhaps also specific authority delegated from

NWRA. This may mean WUOs and other local water management organizations have less autonomy, but at least provides a way to function.

154. The Ministry of Social Affairs and Labor regulates and supports the formal establishment of WUAs. This requires compliance with specific procedures regarding public notice and holding meetings. This enables WUAs to obtain legal status. Based on the information provided during the study, this seems to work relatively well and does not seem to constitute a major constraint or bottleneck to the process of WUA development. In other countries the registration process is often much simpler, for example just filing the correct documents with the authorized government office, and does not involve extensive supervision. Such simpler registration procedures can still provide redress, through courts and administrative procedures, if there are errors or improper actions in registration. Thus, it would be helpful to make it simpler for WUAs to obtain legal status.

155. The Water Law does provide for NWRA to delegate authority, and this should be applied to support decentralization and development of local water management. This could include delegation of specific authority to basin and sub-basin level organizations, to provinces and districts, and to specialized organizations including WUOs. Local groups could be involved in processing applications for well drilling, ensuring that wells are not drilled or deepened without authorization, checking compliance with any conditions for well usage, and responding to complaints that water abstraction from wells may be harming others. If more such issues can be handled at the local level, this would help avoid overloading NWRA's capacity. In some cases this might be just a matter of confirming and improving awareness of what can already be done according to law, for example in commenting on applications for well drilling or reporting possible violations, while other cases may require explicit delegation of authority to district councils, sub-basin organizations or other organizations.

156. Water governance could work better through a special purpose organization, with some specialized governmental powers for making and enforcing rules and requiring contributions from members. This could be done by something that is seen as a form of WUO. For groundwater, where users take water from their own wells, it would have to concentrate on a regulatory role, quite different from the service delivery role of WUOs in water supply or surface irrigation. Trying to carry out local rule-making and enforcement through a top-down structure covering a broad area, such as NWRA or basin committees, seems unlikely to gain sufficient user support and unlikely to be focused enough to work effectively. Instead the need is for a way to enable bottom-up or polycentric formation of specialized units with specific governance powers. There could be ways such an entity could be established under the current regulatory framework, e.g. through delegation of powers, from NWRA or transferring some power over groundwater governance from local councils to a specialized organization or sub-unit for local water management. The amended Water Law also provides for local water protection associations, which might provide an alternative organizational vehicle for such governance. Legal mechanisms need to be available through which communities are legally empowered with authority for local water management.

3.5.4 Include stakeholder representatives in sub-basin and basin governance

157. Basin governance is much more likely to be effective if users feel they have been consulted during decisionmaking. In some cases, such as in Amran, WUOs are already represented on basin committees. However, this is not yet a standard approach. Thus

ensuring that WUOs are represented on basin committees should be a high priority. In principle, and in the long run, the best way to do this is if users choose their own representatives through federations. However, if federations are not yet present, then pragmatic alternatives may be appropriate, such as convening forums of WUOs and asking them to choose representatives. Conversely, if representative are not chosen by users, and instead appointed from the outside, they are much less likely to be seen as genuine representatives, and much less likely to be effective. There seems to have been relatively little work on smaller subunits within basins, even though this is where community management is more likely to play a major role, and so this would be a key priority for moving ahead to develop community water management.

4.0 CONCLUSIONS

158. This study has drawn on information from Yemen and other countries to look at the role water user organizations might play in improving water management. Given the difficulty in changing the economic incentives driving demand for water and limitations in government regulatory capacity, local collective action is seen as a necessary and potentially feasible part of solutions to the problem of groundwater overdraft. Well-focused government support, especially in relation to information and enforcement, can help make such local action effective.

159. International experience reveals risks that often lead to water user associations not being sustainable. Hasty formation, overemphasis of formalizing legal status, and overdevelopment based on dependence on outside aid imperil WUO effectiveness and sustainability. A thorough, inclusive approach to social mobilization can help reduce risks, especially if activities focus on providing meaningful benefits for participants. The study's analysis of current approaches in Yemen suggests WUOs in Yemen are unlikely to be sustainable unless approaches are adjusted to better fit with the institutional feasibility of collective action, i.e. the kinds of actions communities are capable of initiating and continuing using their own resources, along with realistically available and sustainable levels of external support.

160. Groundwater governance is a particularly hard problem, in which international experience primarily shows the lack of success in establishing control over groundwater extraction. Intervention has been somewhat more effective when provision of additional supplies was combined with regulation. In some parts of South Asia, recharge from rainwater harvesting has had major impacts, arising primarily through local initiatives.

The study offers four major recommendations, for developing sustainable local water management:

1. Learn from local initiatives and successes in water governance and help communities learn from each other
2. Share information with communities and facilitate problem-solving process in which they analyze their situation and find pathways to sustainability
3. Diversify organizations to fit activities, through diverse WUGs, WUOs, and federations fitted to specific needs and objectives of activities, using a variety of options to customize organizational arrangements to particular circumstances, and adjusting them as conditions change over time.
4. Weave networks for governance, strengthening horizontal linkages between WUOs and local government and traditional leaders for effective local water governance, including support for enforcement and financing, and vertical

linkages at district, governorate, sub-basin, basin and national scales to address wider coordination and cooperation, including technical advice, delegation of enforcement authority, and sharing of ideas and experience.

161. **Learn from Communities.** Yemen faces serious challenges with current and future depletion of aquifers. The government has relatively little capacity to impose rules through external enforcement. There is also limited potential to shift the economic incentives driving groundwater exploitation. Therefore, local action by communities, with appropriate support, offers a way of addressing some problems.

162. Fortunately there are interesting examples of communities beginning to take action. A key priority should be to learn from these experiences, which can help show what sorts of changes are feasible, and what impact they may have. Successful implementation of some changes, such as greater control on well drilling, can build capacity for further steps. Building on the experiences and successes of the local communities, with some fine-tuning, would help improve water governance, and ease clashes between communities and governmental institutions,

163. Outsiders can play a valuable role in helping communities learn from experience elsewhere. Exchange visits, workshops and other forums can help to share ideas. Case studies help others to understand what has and has not worked. More generally, a recognition that solutions need to be customized to fit local conditions, rather than implementing standardized external advice, can help to legitimate and encourage local innovation. Key tasks would include:

- Identifying interesting examples of local initiatives
- Organizing workshops and exchange visits to share experience among communities
- Case studies by interdisciplinary teams to document and analyze processes and impacts of local water management initiatives

164. **Support Local Problem-Solving.** The main method recommended for development and sustainability of local collective action in water governance, including development of WUOS, is through procedures that concentrate on solving practical problems facing local communities. This builds capacity in meaningful ways.

165. A strategic initial intervention is to improve information and understanding. Feeding back currently available information is a first step.

166. Information, advice, and facilitation can support problem solving processes, which can include:

- Assessing local conditions, based on local knowledge and available technical data and analysis
- Considering future scenarios, without and with changes in local water governance
- Envisioning pathways to more sustainable water management, through practical, feasible steps
- Agree on and implement specific actions
- Continue to develop local water management, learning from and building on local experience

167. At present, subsidies are given to farmers without requiring any commitment to collective action to improve water governance. If projects do continue to provide

subsidies for pipes, sprinklers, and drip irrigation equipment, then these should be tied not just to individual commitments to reduce water use by not expanding water use, but also to collective commitments to cooperate in improving local water management. For this to be meaningful and effective it would require not just adding a statement to contracts about commitment to support rules about groundwater use, but also an effective process of local problem-solving that builds consensus and capacity through effective actions.

168. ***Diversify Organizations to Fit Activities.*** Experience, internationally and in Yemen, shows that the sustainability of water user organizations organized by projects in a top-down way is highly problematic. Organizations that depend on a continuing flow of outside subsidies are unlikely to survive. Instead organizations need to be able to rely primarily on local funding, as currently occurs with WUOs operating and maintaining water supply systems.

169. Reliance on local resources means focusing carefully on those activities that farmers want and are willing to contribute to. Some strategic subsidies might help start up organization, particularly facilitating initial discussions. External support may provide useful aid for specific things, especially some kinds of capital costs. However, routine costs should come from routine local funding. Among other things, this may mean relying on voluntary work where feasible, keeping costs low, and only incurring the costs of formal registration where absolutely necessary.

170. A phased approach, such as that used by SFD, can allow for more extensive organization during intensive project activities, and simpler arrangements post-project, and it may be possible to do both without requiring formal legal status. Rather than assuming that organizations have to maintain the same level of staff, costs, and activities in perpetuity after the project, the extent of organization can be planned and adjusted dynamically to fit needs. A diverse range of options should be used to develop WUOs fitted to particular times and conditions.

171. ***Weave Networks for Governance.*** The most important linkages for success in local water governance do not concern guidance from above, but support and cooperation from other important actors in local governance, including local councils, traditional authorities, and local government officials. The institutional architecture therefore needs to combine horizontal and vertical connections, crossing multiple sectors and organizations, and weaving a network of governance. Representation of users at higher levels is unlikely to be effective unless developed from the bottom-up, enabling people to choose their own representatives, and to hold them accountable.

172. Water resources management needs to concentrate pragmatically on objectives that are technically, economically, and socially feasible, rather than drowning in the complexity of all the possible integrated relationships that may exist. For aquifers, this may often mean concentrating on integrating surface and groundwater use, particularly the potential for recharge and trying to find better pathways to a sustainable pattern of use. For integration across sectors, this usually means finding ways to protect drinking water, while also responding to other needs. Such focused objectives may help to build coalitions of WUOs supporting efforts they see as feasible and worthwhile.

173. ***What First, What Needs More Time?*** Some of the activities for implementing recommendations could be done relatively quickly and directly, while others would take longer. The following discussion does not cover all the specific recommendations, but highlights some as examples of differences in timing that might be required for implementation. This is just a first set of suggestions, which needs further review,

analysis and prioritization by those with a deeper knowledge of water sector organizations, institutions, and of implementation constraints and capacities.

174. Recommendations that might be implemented relatively quickly could include:

- Making irrigation equipment subsidies conditional on commitment to community water management,
- Arranging workshops and exchange visits to collect and share experience with local water management initiatives, and
- Feeding back well monitoring data and analysis to communities.

175. Some other recommendations would be relatively straightforward to implement, or are even already being implemented in some places, but might take a bit more time and discussion to put in place, including:

- Using a two-phase approach for project-related development of WUOs,
- Emphasizing development of horizontal linkages at multiple levels for weaving network governance, and
- Working with women's groups to strengthen women's participation in community water management.

176. By contrast, some other activities may require somewhat more time to assure sufficient resources, learn which approaches work best, and develop institutional capacity to implement:, such as:

- Recruiting interdisciplinary teams of researchers to examine local case studies in depth, and in comparative context. Data collection and analysis can be expedited by using participatory rural appraisal and similar methods, and by using secondary data, including remote sensing (satellite and air photos). Nevertheless, this takes some time and specialized skills, particularly if the goal is to extract useful lessons that might be applied elsewhere if conditions are suitable.
- Supporting community research to analyze aquifer information, which needs a combination of technical and social skills, and a willingness to move away from conventional expert-driven approaches. This could be done relatively quickly, but would require some boldness and flexibility. Especially in the initial phase it could benefit from involvement of NGOs, universities, civic groups, under arrangements that allow them substantial flexibility to innovate and learn from experience.
- Carrying out community visioning activities, for which a variety of methods are available, but more experience is needed on how these could be applied to exploring paths toward sustainable water management. Simple approaches can easily be incorporated in the problem-solving approach discussed above, but some pilot testing would be useful for more elaborate techniques, particularly those that involve adapting international ideas to diverse conditions in different parts of Yemen.
- Developing effective co-management arrangements for larger spate irrigation systems with responsibilities turned over to WUOs and irrigation councils. Some issues appear to require higher-level decisions that could overcome bureaucratic obstacles that currently impede implementation. Government and community responsibilities need to be clarified, including assuring longer-term maintenance and capital investment in ways that encourage preventive maintenance.

177. Several other recommendations are desirable in principle, but may depend on suitable conditions, including:

- Increasing the legal authority of WUOs and other local organizations involved in water governance to charge fees and to make and enforce regulations. If this is accomplished in the short run, it could be very helpful, but if not, when it will be important to concentrate on practical approaches such as using the authority of district councils and delegating authority from NWRA for sub-basin and local level water governance.
- Developing a national level union or other body representative of and appropriately autonomous and accountable to member organizations. The foundations for this would be much more solid if federations are developed in a more bottom-up approach, starting first for particular irrigation systems and for groundwater at village or subdistrict level, in a nested way related to the structure of local wadis and aquifers, building up to the sub-basin and basin level. As discussed, the emphasis should be on having genuine and accountable representatives, forging agreement to take action on specific issues, and strengthening organizations by learning from doing.

178. This report has sought to offer ideas that can contribute to the broader vision of water governance in Yemen and to a more specific vision of WUOs and sustainable local water management. It has emphasized the importance of recognizing local initiatives, as shown in current examples and as can be encouraged with suitable support in the future. In terms of priority, and potential impact on developing sustainable local water management, the most important recommendation would be to support local problem-solving, with technical information and advice, and assistance in a process of assessing aquifers and other water resources, considering alternative scenarios, envisioning feasible paths to more sustainable futures, and putting those ideas into practice.²⁵ This requires a process of learning by doing, and so should be given ample time and patience, enabling local communities to monitor, evaluate and adjust their activities, with suitable external support.

179. Community water management can be developed by learning from and supporting local problem-solving to find pathways to sustainability, diversifying organizations to fit local conditions, and weaving links between communities and wider sub-basin, basin, and national water governance.

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APPENDICES

Appendix A: Hydrology

Yemen is an arid country. Its water resources are at risk, since abstraction is higher than recharge, which depends on rainfall that ranges from 50 mm - 800 mm /year averaging to 200 mm / year . The renewable water resources are 2500Mm³/Year while the water uses is 3400Mm³/year with a deficit of 900 Mm³/year. Agriculture consumes 90% of the groundwater resources.

Figure A.1 shows rainfall levels in Yemen. Rainfall levels are somewhat higher in the highlands, where most of the population is concentrated. Much rainfall evaporates without being used, while runoff and underground flows concentrate in wadis. Yemen has no permanent streams, so traditional irrigation systems relied on springs and spate flows. Up until a few decades ago, water use was sustainable, in the sense that it was limited by the available rainfall, ephemeral flows in springs and streams, and hand dug wells in shallow aquifers.

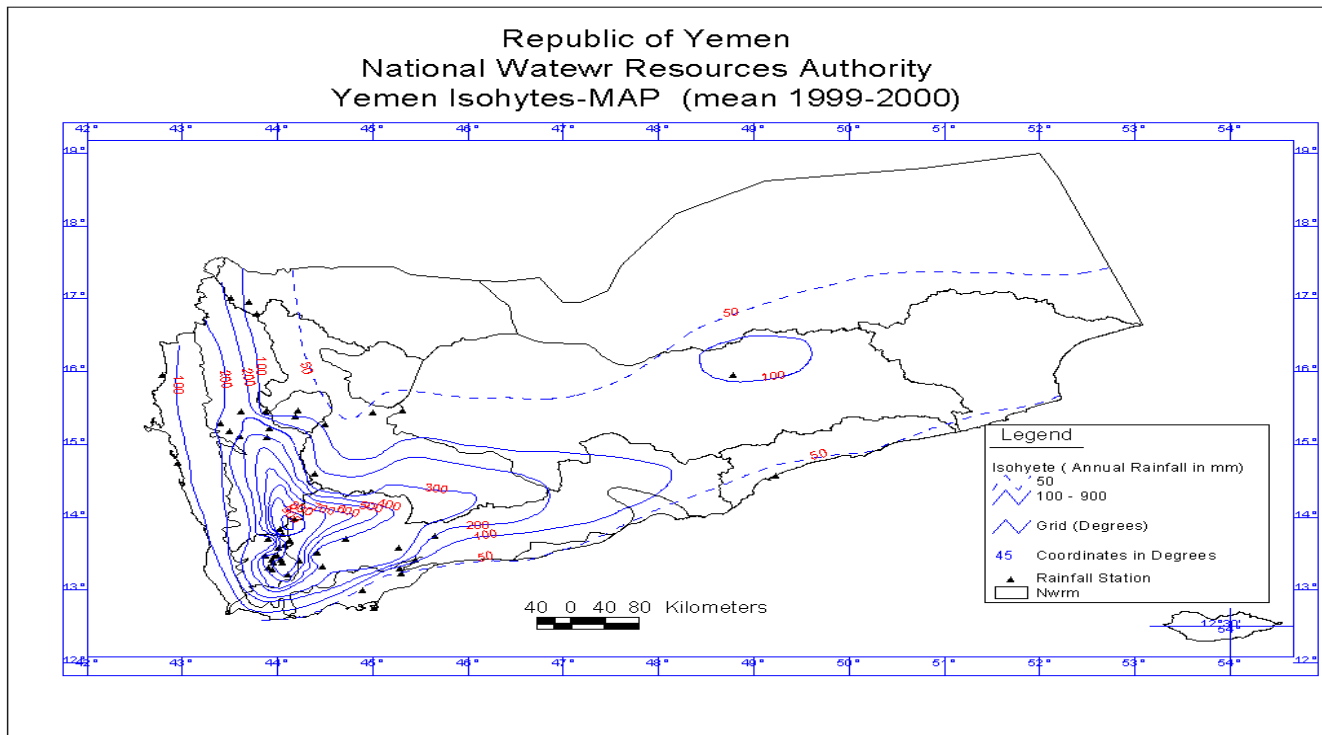


Figure 1

Appendix B: Groundwater Boom and Bust in Comparative Perspective

B.1 Rise and fall of groundwater socio-ecologies

Yemen has experienced a boom in groundwater use, and now faces a bust. Some aquifers have already been depleted, for example in parts of Taiz; others are being rapidly drawn down, often at rates of several meters per year, some as much as six meters a year or more. This raises urgent questions about what might be done to slow rates of depletion and find more sustainable patterns of water use. Figure B.1. illustrates the rates of depletion.

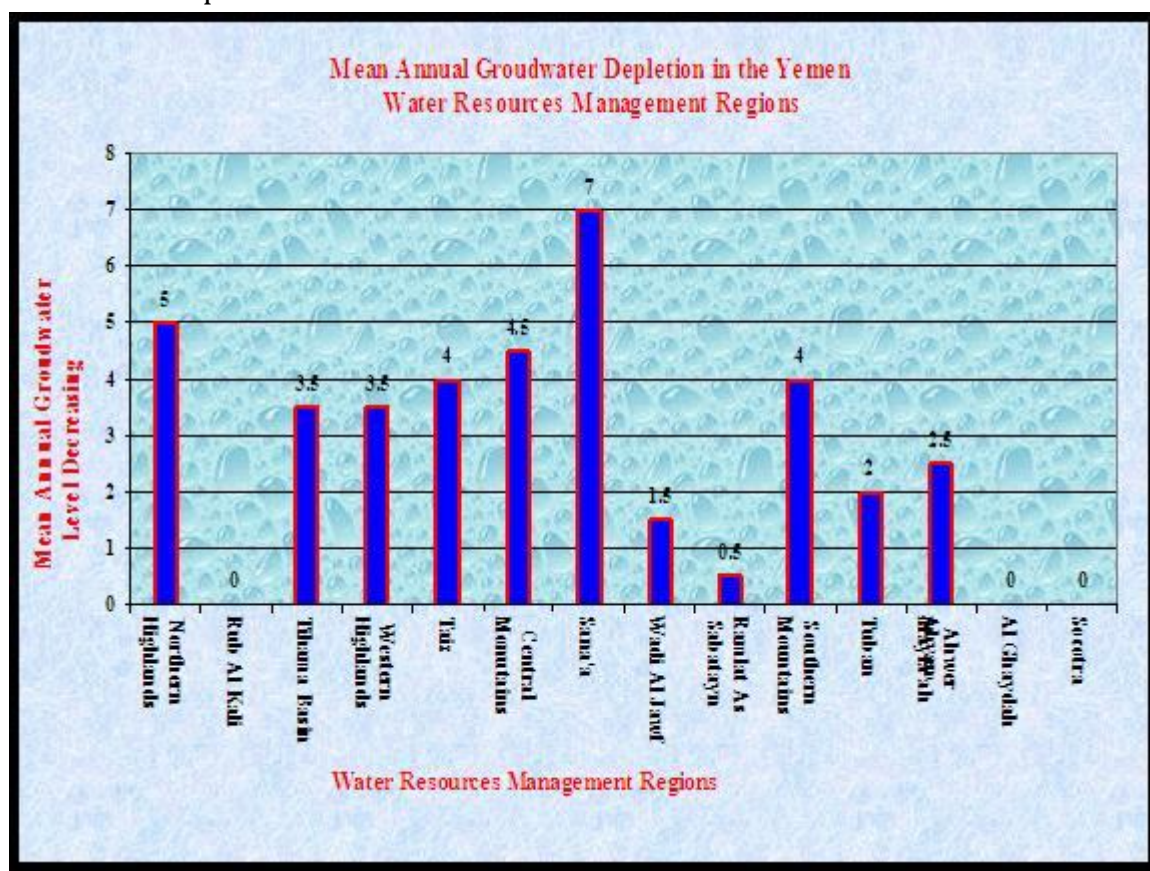


Table B.1 is based on a synthesis of studies in South Asia by Tushar Shah (2009) and colleagues, examining areas that also face major challenges in groundwater governance. The table analyzes patterns of groundwater development from initial introduction of tubewells through agrarian boom to early stages of overexploitation to decline of a groundwater socio-ecology, and applies it to Yemen. Much of this framework seems highly applicable to Yemen, concerning the past, the present, and what may happen in the future. The challenge is then how to best manage this process, in a context where the main decisions about extracting water are dispersed among thousands of water users, and government has very limited capacity to regulate.

Table B.1. Rise and fall of groundwater socio-ecologies

	Stage 1	Stage 2	Stage 3	Stage 4
Stages	Rise of tubewells	Groundwater-based agrarian boom	Early stages of groundwater overdraft	Decline of groundwater socio-ecology with immiserising impacts
Examples	<i>Yemen in 1980s</i>	<i>Hadramaut, Dhamar</i>	<i>Sana'a-Amran</i>	<i>Taiz, Sa'dah</i>
Characteristics	Subsistence agriculture and concentrated rural poverty; traditional water lifting devices,, <i>water harvesting, traditional spate irrigation systems</i>	Skewed ownership of wells; access to pump irrigation prized; rise of 'exchange' institutions in irrigation service; Rapid growth of agrarian income and employment	Crop diversification and falling water tables; The groundwater-based 'bubble economy' continues booming but tensions surface as pumping costs soar and private and social costs of groundwater use diverge	The 'bubble' bursts; agrarian growth slows leading to migration and pauperization. Water quality becomes a serious issue; the 'smart' make a planned transition; the poor suffer decline.
Interventions	Targeted subsidy on pump capital; public tube well programs; electricity <i>diesel</i> subsidies, and flat tariff to stimulate tube well irrigation by the poor	Subsidies and credit continue for WEMs. Donors augment resources for pump capital formation; NGOs promote small farmer irrigation as a livelihood program.	Subsidies, credit, donor and NGO support continue apace; laws are made but not enforced. WEM owners emerge as a powerful vote bank that politicians cannot ignore.	Policy support to WEMs reluctantly ebbs as NGOs, donors adopt a conservation posture. Regulations begin to get enforced but with pre-election relaxations; ameliorative action starts but demand-management remains neglected

Adapted from Shah 2008: 124. *Added or changed text is in italics.*

B.2 Aquifer development and local cooperation

Table B.2 adapts work of Shah (2009) and colleagues to look at ways of responding to different aquifer conditions. Water is much more scarce in Yemen, and geology, geography and social institutions are substantially different. Nevertheless, considering how this might apply in the context of Yemen may help identify where conditions are more favorable for local collective action, and options that might be feasible for responding to aquifer conditions.

Table B.2 Institutional Responses to Aquifer Development

Institutional response situation	Aquifer Characteristic	Impact of aquifer development on typical user	Pump irrigation markets	Example	Ease of political mobilization of farmers	Scope for local aquifer governance
1. Atomistic individualism	High storage: high recharge resources	Insignificant	Efficient, deep and broad WEM ownership, major source of neither power nor profit	<i>Alluvial canal commands in some wadis, e.g. Tihama?</i>	Low	Nil
2. Collusive opportunism	High storage; no or limited recharge resources	Sharply rising marginal cost of groundwater	Highly monopolistic; fairly deep and broad; resource-poor elbowed out of pump economy	<i>Rada'a, Dhamar, Sana'a-Amran Basin, Wadi Hadramaut</i>	High for energy subsidies and surface water imports	Low or nil
3. Rivalrous gaming	Hard-rock aquifer with low aquifer storage; some <u>recharge resources</u>	Rising marginal cost and declining share in limited water	Highly monopolistic, thin and shallow, poor have limited access, on adverse terms	<i>Taiz and Ibb?</i>	High for energy subsidies and recharge resources	Scope for functional aquifer community
4. Cooperative gaming	Alluvial with confining layer, or humid hardrock environment with low storage; some recharge resources	Sharply rising marginal cost and declining share in limited water	Monopolistic; moderate in depth and breadth; access to groundwater more equitable	<i>Taiz</i>	High for energy subsidies and recharge resources	High; functional aquifer community
5. Exit	Fragile	Sharp	Absent or	<i>Rada'a</i>	Low	Nil

	aquifers prone to rapid quality deterioration	deterioration of water quality	insignificant			
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Adapted from Shah 2008: 154. *Added text in italics.* Emphasis added

Yemen lacks high levels of rainfall, so *atomistic individualism*, where farmers could handle water individually and not collectively, is not a sustainable strategy in Yemen. Low rainfall means that the potential for high recharge is, at best, limited to some alluvial aquifers in wadis and valleys in mountainous areas. Even in such locations, which may have lots of water for short periods of time, aquifer storage capacity is limited. Therefore, as groundwater extraction increases, farmers are affected by what other farmers do. The limited size of the area involved, and availability of irrigation works, may create the potential for collective action for recharge. This may be more difficult, the larger the area and the greater the number of people involved. Thus, as groundwater usage grows, atomistic individualism is difficult. Instead, as discussed below, the choice may be between rivalrous gaming or cooperative gaming.

If there is high storage, but little water available for recharge, then the result may be *collusive opportunism*, with each farmer seeking to extract as much as possible. Any water saved by a particular user benefits others, so incentives for restraint are weak. This sets the stage for pumping races with competitive deepening of wells and increasingly powerful pumps. Farmers may join together to lobby for energy subsidies or water imports, but have little other reason to work together in groundwater governance. Rising costs for wells and for pumping mean that over time, access to water may become increasingly difficult, with the poor suffering first. In Yemen, shared ownership of wells provides a mechanism through which poorer farmers may gain some access to water even if they cannot afford one by themselves. However, financial constraints may still affect the ability to continue investing in deeper wells and bigger pumps. In the absence of effective regulation, from government, community, or individual rights, the situation easily turns into a tragedy of the commons. This seems to be the path along which much of Yemen is likely to proceed until aquifers are depleted, unless there are major changes in groundwater governance.

Much of the Sana'a Basin and Wadi Hadramaut would seem to fit the conditions for collusive opportunism, except for those areas where recharge resources might be available, from sources such as wadis, return flows from irrigation infiltration, and wastewater. The fossil groundwater is irreplaceable, and so is being "mined." Like oil or minerals, there is a fixed quantity, the only question is when and how it might be used. In such a context, farmers may well be inclined to organize to defend their access to water, and to obtain subsidies and defend them. This includes explicit subsidies, such as low diesel prices, and the implicit subsidy created by prohibitions on import of qat and other crops. Such subsidies maintain or increase the demand for irrigation water. Subsidized irrigation technologies, such as the pipes, sprinklers, drip emitters and other irrigation technologies, may have an immediate impact of reducing losses. However, by making irrigation more efficient and more profitable, they ultimately increase the demand for irrigation, increasing depletion as it becomes economic to drill even deeper and lift water higher (Hellegers et al. 2008).

In a case such as this, development of WUOs may strengthen the influence of those interested in continuing current patterns of over-exploitation, reinforcing the system,

unless WUO development is closely linked to establishment of effective regulatory arrangements. Water user organizations do at least provide a channel for communications.²⁶ If increases in efficiency reduce extraction, then they might prolong the life of the aquifer, which seems to be the primary strategy being pursued at present by the government and international organizations supporting its efforts. However, even if individual farmers increase their efficiency, reduce water use, and so comply with agreements to not expand use, others may expand their use, especially if higher efficiency reduces the cost of pumping. If there are no resources for recharge, then the fossil aquifer will be depleted sooner or later. If so, then “sustainability” could mean having to shift back to the kinds of rainfed agriculture and grazing that prevailed before the advent of tubewells and pumps, far less productive and profitable, and only able to support a much smaller number of people.

Rivalrous gaming occurs where limited aquifer storage makes users interdependent, as available supplies can be used up relatively quickly. This rapidly creates the conditions for pumping races, where water goes to those who can take water more quickly and drill deeper wells. Water scarcity may also drive farmers to shift towards more water efficient crops. Experience in India suggests that farmers in such conditions may be likely to mobilize to obtain and protect subsidies, as well as for development of surface water sources, including those which could be used to recharge aquifers. In some cases, however, farmers facing these physical conditions may shift to a pattern of cooperative gaming.

A strategy of *cooperative gaming* may develop sometimes, in aquifers with limited storage, as farmers, individually and as groups, act to recharge groundwater. In India, this occurred where farmers could clearly see the benefits from recharge. This sometimes occurred in hardrock areas where hydrogeologists had concluded that aquifer storage capacity was too small to be worth recharging (Shah 2009:174). However, ironically, limited aquifer capacity may have also meant that farmers saw relatively quick responses in higher well levels, and so were encouraged to continue and expand recharge activities. This grew through mass movements promoted by farmers, religious leaders, scientists, NGOs and others, reviving traditions of local water management. Confined aquifers with limited storage could also create the potential for cooperative gaming.

The question for Yemen is under what conditions such “cooperative gaming” might be likely, and what might be done to encourage it. For storage, this could be a matter of identifying those aquifers that have some storage capacity, where recharge is likely to stay at accessible depths. For alluvial aquifers, this could include those with an impermeable layer that could help retain recharge. Conversely, conditions would seem to be much less favorable in deep alluvial aquifers or in aquifers, such as limestone, where recharge water would be unlikely to stay accessible. Shah says that in some of the Indian cases where collective action for recharge developed, farmers had already been active in enlarging wells and adding lateral bores to increase flows in aquifers with limited storage and permeability, which also helped make recharge more effective.

²⁶ The Poverty and Social Impact Assessment of Groundwater in Mexico (World Bank 2009) concluded that lack of organizations that could act as communication channels between government and groundwater users was a major obstacle to improving groundwater governance.

Given the complexity of aquifer conditions in some parts of Yemen, and limited information available, decisions about feasible strategies may have to be based on local analysis and trial and error, depending on whether local water users see any response to recharge. Availability of recharge could depend on rainfall, water harvesting, wadi, wastewater or other sources. In the Sana'a Basin, it is clear that shallower aquifers are being recharged from irrigation and wastewater, as well as wadis (Hamdi 2000). Once fossil groundwater is used up, these would be the available sustainable sources. Recharge could involve relatively localized management, rather than requiring basin wide coordination. Rainfall and water harvesting could play a more significant role in areas where rainfall is higher. It should be noted that even in large aquifers, such as the Sana'a Basin, where aquifers are relatively homogenous and well understood, the local impacts of depletion will vary, depending on the depth of different water bearing formations and other factors. So some places will experience shortage sooner than others, and have different options available for responding.

Exit from groundwater irrigation may end being the only choice for many. Shah (2008) discusses families who observed groundwater trends and invested in educating their children, so that as adults they could get jobs outside of agriculture. During the study fieldwork, there seemed to be little evidence of water users having given much consideration to what they might do if water was no longer available. Here, as with other options, there is a need to move beyond an "alarmist" strategy concentrated on making people aware that aquifers are not unlimited and they ought to reduce their water use, and move towards an active search for ways to deal with increasing scarcity.

Comparative analysis of how hydrology affects cooperation in groundwater governance, based on South Asian experience, makes clear that there may be many cases where users are unlikely to cooperate to manage groundwater. In some cases, they may have little reason, and little likelihood of cooperating in relation to water abstraction, but might join together to lobby for government aid, e.g., for getting more water or subsidized inputs. However, where there are resources available for recharge, and a relatively limited aquifer in which recharge would have apparent impacts, substantial cooperation may be much more feasible. This suggests attention to both the potential for increasing aquifer recharge, e.g., from spate flows or treated wastewater, and how the aquifer would respond. Exit, sooner or later, from groundwater irrigation also needs to be considered as an important option.

Appendix C: WUO Case Studies

The following case studies are models for the success of WUOs and local communities. They represent the potentiality that they are able to deal with water scarcity and initiate some roles and ideas to cope with water scarcity. The design of these case studies was started during the field visit where we heard excellent stories and realized that it is important to document them. Several areas were suggested and the following table lists the sites:

Governorates	Site
Dhamar	1-Wadi Al Har
	2- Wadi Akram
Taiz,	1- Mawia WUOs
	2- CWMP
Ibb	1- Bani Garban WUO
	2- Al-Gurf WUO
Amran	Several WUGs

C.1.0 Dhamar

C.1.1 Wadi Al-Har

The area is located in Anss district. The main character of the area is the water scarcity and the qat plantations. People are aware of the problem since drilling of wells is costing a lot of money. In addition is the failure of finding groundwater. People are striving very hard to collect water for drinking and for household use. This is in addition to the need to irrigate the qat plantations which are the main income source. They agree (verbally) amongst them that there is no objection against anybody drilling a deep well for agriculture as long as the well will supply drinking water to the nearby communities. They suggested that the priority is for drinking as long as the owner is able to drill a well and bear the relevant costs. Most wells are drilled without licensing.

In the past before 1982, the area was cultivating vegetables and other crops that are irrigated from springs. After the earthquake, most of the springs fade away and the area faced water shortages. Several shallow wells and two deep (failed) were drilled to overcome the water shortages and irrigate the vegetables. However this has cost the farmers more money which was not covering the input costs of the vegetables. Therefore, they have changed to cultivate qat which earns a lot of money. They know that qat takes a lot of water, but they have no choice since it is the main source of income.

C.1.2 Wadi Akarem

This wadi is shared by two influential Sheiks. One of them is leading Bani Umar and the other one Abo Yabes. Both have rights to the Wadi Akarem and tried to drill deep wells to irrigate their qat plantations. Disputes concerned who should drill wells (more than 150m deep) in the wadi. To prevent any conflict, the two tycoons agreed verbally that no deep wells be drilled in the main wadi. Such agreement have been adopted by farmers and become a doctrine. The agreement added that deep well can be drilled at the outskirts of the main wadi and can be used for qat plantation as well as for water

supply. The agreement also allows farmers to drill shallow wells in the main wadi (30-50m). Farmers are happy about this agreement since it settles the dispute which might result in unrest in the area. Farmers are depending on qat as the main source of income and don't want to shift to other crops unless they would provide the same income.

C.2.0 Taiz

C.2.1 Mawia

Mawia district is an important area for qat cultivation in Taiz. Wells became dry in some parts of the area, which resulted in outmigration by farmers, exporting the experience of qat plantation to nearby areas of Taiz such as Warazan causing the same water problem.

Other farmers in the area tried to drill more wells and deepen their own wells, in order to overcome the water scarcity problem and increase water productivity to cover the increased expansion of qat plantations. The farmers approached NWRA to obtain licenses. NWRA suggested that licenses will be provided if farmers are organized into WUOs served by the representative wells. Farmers agreed to that suggestions and organized themselves to about 26 WUOs. Most of the board of members of these WUOs are headed by the well owners who influence the decisions in the board. The WUOs tried to make arrangements related to water distributions and conservations such as:

If the area under the WUO has several wells and there is a need to increase well productivity, it suggests the well to be deepened and used by the beneficiaries under the WUO. If the water is not enough to cover the requirements of the farmers, the WUO may deepen or drill a new well. This means that water distribution amongst farmers will be scheduled and allocations will be set accordingly with cost of 1500-2000YR/hr. Some WUOs are paying back $\frac{1}{4}$ the harvest to the WUO (well owner!). Some farmers argue that such system may affect the productivity of qat plantations since they will not receive enough water.

Suhail-AlGranee WUO has prevented the plantation of new qat trees and introduced mango trees (500 trees) so that in the long run there will be another alternative for qat

WUOs are striving to obtain modern irrigation systems to reduce the water use in the qat plantation. This means that farmers realize the water problem but they can not replace qat with another crop due to the high income they gain from qat.

C.2.2 CWMP

The well WUO organized in Al-Kalaiba by the Community Water Management project has initiated a monitoring system to control random drilling. It succeeded with NWRA and the local authorities to prevent 21 attempts at unauthorized drilling in the WUO area. The WUO has also taken the readings for the monitoring wells, such as water levels, discharge, EC and pH as well as the rain gauge readings. It has records for the past one and half year submitted to GSCP and NWRA for analysis.

C.3.0 Ibb

C.3.1 Bani Garban WUO

Bani Garban is located in Al-Kafr district. RWSSP has handed the water supply project to the WUO in 2003 when it started working. In the same site where the water supply well is located, there is an agricultural well drilled in an earlier time.

The idea came from NWRA during the starting period of the project to make the wadi as a protection zone to preserve the water and use it only for the water supply project. So NWRA established the protection zone aiming at preventing drilling of new agricultural wells. The community was very happy about the protection zone and worked very hard to implement the decision of NWRA.

The dilemma started in the beginning of 2009 where NWRA provide a license to drill a well in the protection zone to irrigate qat, which contradicts the earlier decision of NWRA to make the area as a protection zone. The community is striving very hard not allow any new drilling and has several letters supporting them from the minister of MWE, the parliament, RWSSP and other authorities. They even had support from the president.

C.3.2 Al-Gawaref WUO

This project was handed over to the WUO by RWSSP in 2006. The WUO has obtained a similar protection zone decision from NWRA resembling Bani Garban WUO. However this association has failed to prevent new drilling and a new well was drilled in the protection zone area with license from NWRA. Both areas suffer from water shortages and the communities completely agreed to prevent any use of the water for irrigating qat.

C.4.0 Amran

Several WUGs in Amran basin have been established in the past few years by GSCP with the help of GTZ. The WUGs have started working towards the conservation of the depleted aquifers. The communities felt that they have to do something against the misuse of groundwater.

Wa'alah WUG had been established in 2006. There were about 15 wells working day and night to supply water to tankers for transport to other areas for drinking and qat irrigation. The community realized that water levels in their wells were getting lower and lower which caused them either to invest in drilling new wells or deepening their recent wells. They got together and discussed the situation and realized that the transport of water outside the area is the main reason for the drop of the water levels in the wells. They agreed to prevent any well from selling water to tankers and prevent tankers to transport water outside the area. So they made a petition (Markoum) signed by every well owner and sheik, to establish a new regulation. This was approved by the local authority. The fine of 50,000YR is to be paid to the local authority as a penalty for the breaking of Al-Markoum. The community agreed with the Sheiks, who the violators belong to, to report the violators to their Sheiks to make the necessary judgment against them, and to prevent them from coming back to transport water outside the area. This agreement has prevented any conflicts between the different tribes in the area.

The community got very involved in implementing Al-Markoum. The result is that no more tankers are coming to the area for qat irrigation. They have agreed also to not stop small tankers who supply water for drinking. The outcome is that the water levels stabilized in the area and no significant drop was seen.

Other WUGs in Amran basin have agreed on the same Markoum regulations such as Bait Sarhan and AlHarmaly WUG, Al Ma'akhad WUG, and Qa'a Al Shams WUG.

Appendix D: Water User Organizations Met During Fieldwork

Table D.1 List of WUAs and WUGs visited

#	WUO	male/female	location	Affiliation	Type
1	Al-Gaith	m	Shibam/ Hadramouth	CWMP	GW
2	Eastern Tareb	m/f	Tareb/ Hadramouth	Private	WS
3	Upper Qa'a Jahran	m	Dhamar	CWMP	GW
4	Al-Hyat	f	Taiz	CWMP	GW
5	Al-Kalaiba	m	Taiz	CWMP	GW
6	Al-Senah Cooperative	m/f	Taiz	Private	WS
7	Al-Yousiffy	m/f	Zabid/ Hodidah	IIP	IR
8	Al-Rawdha Gerbah	m/f	Zabid/ Hodidah	IIP	IR
9	Ibbry	m/f	Zabid/ Hodidah	IIP	IR
10	Al-Mansoury	m/f	Zabid/ Hodidah	IIP	IR
11	Al-Bary	m/f	Zabid/ Hodidah	IIP	IR
12	Irrigation Council	m/f	Zabid/ Hodidah	IIP	IR
13	Al-Maghras	m/f	Zabid/ Hodidah	private	WS
14	Wadi Gahef	m/f	Zabid/ Hodidah	GSCP	IR
15	Al-Mahal	m/f	Al-Mansouriah/ Hodidah	GARWSP	WS
16	Yemen Women Union	f	HQ Sana'a	-	NGO
17	WUAs Union	m/f	HQ Sana'a	MWE	GW
18	AlWidian- AlSwaida'a	m/f	Mawia/ Taiz	NWRA	GW
19	Akamaat Al-Masjed	m/f	Mawia/ Taiz	NWRA	GW
20	Khozam	m/f	Mawia/ Taiz	NWRA	GW
21	Suhail-Al Garane'e	m/f	Mawia/ Taiz	NWRA	GW
22	Bani Garban	m/f	Al Kafr/ Ibb	RWSSP	WS
23	Al-Gawaref	m/f	Al Kafr/ Ibb	RWSSP	WS
24	Bait Saran Al Harmaly WUG	m/f	Qa'a Al Bone/ Amran	GSCP	GW
25	Wa'ala WUG	m/f	Riadah/ Amran	GSCP	GW
26	Al Ma'akhad	m/f	Amran/ Amran	GSCP	GW
27	Qa'a Al Shams	m/f	Qa'a Alshams/ Amran	GSCP	GW

Appendix E. Draft Terms of Reference for Case Studies of Local Initiatives in Water Governance

E.1 Introduction

These terms of reference have been prepared as a basis for contracting qualified persons or institutions to document and analyze a case of collective action by users of one or more shared water resources (aquifer, spring, wadi, etc.) to improve local water management, through developing agreements and carrying out changes in water resources governance. The focus is on activities at the local scale of villages or groups of villages, and similar-sized catchments and aquifers.

E.2 Background

The study on WUOs in Yemen has found that there are many interesting cases of local initiatives by communities to improve water governance, particularly for the important challenges involved in responding to rapid drawdown and depletion of groundwater.

It would be useful to have a better understanding of what aids or impedes such local initiatives; their performance in improving the efficiency, equity and sustainability of water resources management; and how government can encourage such activities as part of improving integrated basin water resources management in accordance with principles of participation, subsidiarity, and democracy. Better information on such cases would be particularly useful for helping other communities to consider what they might do to improve water governance. Documentation and analysis of such cases can help to identify good sites for exchange visits, workshops and other farmer-to-farmer training.

Examples of interesting initiatives in local water governance for study would include, but are not limited to the following:

- Restoring a spring, which had stopped flowing after a well was installed nearby, and which flowed again after the well was closed
- Community action to establish and/or enforce well spacing restrictions or a protection zone to safeguard a well supplying domestic water supply
- Revitalizing water harvesting, including associated rights regarding land use and collection of rainfall run-off, as a coordinated effort by a community
- Collective action to increase aquifer recharge, e.g. through construction of infiltration structures, terracing and other land management measures, changes in management of spate flows, changes in cropping patterns, etc.
- Controlling water abstraction from aquifers through agreeing to and implementing limitations on type of crop (i.e. prohibiting particular crops), area irrigated, crop schedules, or other limitations on irrigated agriculture; and/or through clarifying how principles such as avoiding harm, balancing private and public interests, and prioritizing needs for drinking water can be applied to the governance of groundwater.
- Responding to well failure by improving sharing of water from existing wells, in ways that promote equity in access, efficiency in capital and operational costs, and efficiency in water use
- Cooperating with the National Water Resources Authority in preventing drilling of unauthorized wells, e.g. by warning potential violators, reporting

violations, assisting in collection of information for prosecution of violators, contributing information for use in considering applications, etc.

- Revitalizing or revising traditional rights to spate flows in response to changes in cropping patterns, infrastructure improvements, changes in water availability, or to improve conjunctive management of surface water and groundwater
- Community action to support changes in sharecropping arrangements that will encourage more efficient water use, increased aquifer recharge, soil conservation, and other improvements in watershed management, e.g. through adjustments in cost sharing between owners and tenants
- Other relevant collective action, such as community action to diversify income sources before or after aquifer depletion reduces income from irrigated agriculture

E.3 Tasks

1. Identify a suitable case, either in a brief proposal or through consultation with the sponsoring organization after the contract has been arranged.
2. Gather information using appropriate methods, including review of relevant literature, interviews with stakeholders, participatory rapid appraisal methods, collection and analysis of secondary data, and remote sensing imagery.
3. Analyze processes and factors, physical and social, that affected the initiative, particularly those relevant to other communities that might want to undertake similar efforts and assess implications for how government could encourage such activities.
4. Prepare draft versions of a two-page brief, report and short video (as specified below under outputs) presenting the main accomplishments and lessons from the case.
5. Present these to the community and to the sponsoring organization, obtain their comments, and prepare revised final versions, (including a record of comments on the draft and responses to the comments).

Outputs:

1. A case study **brief**, no more than two pages long, presenting the case in clear and interesting language, including the following:
 - Simple clear language suitable for helping people in other communities to understand the case
 - Initial one paragraph summary
 - Explanation of:
 - what was done;
 - how it was done;
 - how problems were overcome;
 - problems, limitations, and opportunities for further improvement; and
 - conclusions on several major lessons from the case
 - at least one graphic per page (e.g., flow charts and other diagrams, map of water resources features involved, etc.).
2. A **report** presenting a description and analysis of the case in terms of both social aspects (institutions, organizations, governance, etc.) and physical (water resources, geology, etc.).

- This should include the processes used to develop agreements (consensus, voting, petitions, etc.), changes in rules or in the interpretation and application of rules, (including customary institutions and relevant national laws and regulations), leadership, enforcement, and mobilization of necessary resources.
 - Actual and potential impacts on the equity, efficiency, and sustainability of water resources and of stakeholder livelihoods should be assessed. Actual and potential impacts on local basin water balances (stocks and flows) should be assessed, to the extent feasible using available data.
 - The length of the main report should be between 4,000 to 5,000 words, not counting additional material in appendices.
3. A short **video** presenting the main activities, accomplishments and lessons, suitable for presentation in low resolution mpg format (i.e., amateur/YouTube-style), 1-5 minutes in length, including local poetry and/or music, with narrative and dialogue by community members accompanying video showing the situation and what was done (re-enactments are acceptable, but should be labeled as such in credits at the end of the video).

E.4 Team

The primary basis for selection will be the qualifications of the proposed team members, as shown by curriculum vitae, and supporting information including letters of recommendation and examples of previous work.

The team leader may have a background in social science/community development, or engineering/natural science, and must have demonstrated skills in interdisciplinary research and in managing research related to resource use in rural areas.

The team should include people with the following qualifications (one person may satisfy more than one requirement):

- Social science or community development: Master's degree in sociology, anthropology or other appropriate field, or both: a) having published reports or articles on relevant topics and having least five years of relevant professional experience concerning community development and local social institutions in Yemen.
- Engineering, geology, hydrogeology or other relevant environmental expertise, with either a Master's degree or higher, or both: a) having published reports or articles on relevant topics and b) having at least five years relevant professional experience related to rural water resources.
- At least one community member who will act as a co-researcher and co-author. This could be a traditional irrigation watermaster, water supply system manager or operator, farmer using groundwater, local teacher or other suitable person from the community
- Gender diversity: At least one woman researcher with a good understanding of rural society in Yemen

E.5 Duration and Financial Matters

The level of effort expected would be 20-40 workdays per researcher, and a total of 100-200 workdays for the study. Compensation will be determined according to standard procedures including previous experience. Completion within 3 months of contract signature is desirable, and the study must be completed within six months of contract signing.

Compensation will be based on an agreed budget including time-based payment for researchers, and reimbursement for other expenses, for lump sum amounts or at specified rates up to maximum amounts. Payment will be in three tranches: an initial advance of 30%, a second payment of 30% on delivery of the three draft outputs, and a third and final payment of 40% on delivery of all three revised final outputs.

Appendix F. Problem-Solving Processes for WUO Development

F.1 Introduction

This appendix discusses the activities for a problem-solving process of WUO development. This is intended as a basis for beginning pilot activities to apply this approach. The emphasis would be on supporting local stakeholders to take the leading role in assessing their situation and deciding what to do, with outsiders acting as facilitators and sources of specialized information. The next section discusses the sequence of activities, which can be roughly divided into five phases: introduction, assessment, deliberation, implementation, and review and adaptation. The following section discusses options for who would act as facilitators. The potential for applying a similar approach to reassessment of existing WUAs is briefly discussed, followed by recommendations for pilot implementation.

F.2 Sequence of Activities

F.2.1 Introductory Phase

Work with a community needs to start with initial familiarization, to learn about the people and their situation. This can occur through visits and informal discussion, as well as more formal presentations to explain the proposed process to support local problem solving. This would include meeting, informally or formally, with local authorities and other leaders, and with the various members of the community, both in terms of different locations and the range of different water uses. This should result in a good understanding by community members of what might be done, and a decision about whether to proceed, as well as an identification of people who show an interest and could participate in and lead various activities.

F.2.2 Assessment Phase

Fact-finding and analysis is crucial to provide a basis for deliberation and decisions. A broad range of techniques are available to support participatory collection and analysis of information, as described in more detail in Appendix G. These include transects, sketch mapping, charts and physical models. The time required will depend on the number of people, size of the area and complexity of problems. Depending on local schedules and logistics, activities may need to be organized in shorter half-day sessions or a more intensive two or three-day workshops. This phase would include identifying and obtaining any relevant secondary data, but would primarily rely on local knowledge and information that can be gathered by community members. At the end of this phase there should be a clear idea about current trends, likely outcomes if those trends continue, and initial ideas about alternative more desirable scenarios.

F.2.3 Deliberation Phase

Community visioning techniques can provide an effective way to gather a representative range of stakeholders, review the current situation, envision future scenarios and build consensus about what to do. Typically this may involve a process extending over two or three days. Based on the information from the assessment phase, it should be possible to develop a small number of scenarios, for example three or four alternative scenarios projecting what may happen if current trends continue

unchanged, what could happen if various threats or risks turn out to make things even worse, and what might be achieved with good cooperation and careful management of water resources. Discussion about these scenarios and criteria for evaluating them can help to build common understand about the substance of the issues and the values that people would like to protect and enhance. To encourage objectivity and development consensus, it is useful to develop criteria before developing the scenarios. Discussion can work on finding practical ways to move towards more desirable scenarios, in terms of sustainability, equity, income and other criteria. This can be part of a larger process of consensus-building, which may require repeated deliberation and negotiation in order to reach agreement and receive support at multiple levels.

F.2.4 Implementation Phase

Having the WUO carry out activities that can be accomplished with its own resources, with little or not external support, is crucial to developing sustainable community water governance. This may include new or revised rules for matters such as well digging and deepening, use of domestic water supply sources, construction or revitalization of water harvesting, and other activities. These are likely to include some of the kinds of activities that were done in the case studies of local initiatives in water governance. For some activities, support from local authorities or NWRA may be very important, but the main focus should be on what communities can do themselves.

F.2.5 Review and Adaptation

Continuing to learn from experience and make suitable adjustments contributes to a continuous process of management. This can be supported by periodically taking time to evaluate what has been accomplished and what else might need to be done, for example once every six months or every year.

Figure F.1 Flow Chart

Introduction
Assessment
Deliberation
Implementation
Review and Adaptation

F.3 Facilitators

International experience suggests that a variety of different people may be able carry out roles to facilitate development of water user organizations, including young graduates, government field staff, and people recruited from local communities.

- Recruiting local people benefits from their knowledge, but may be difficult if they are too young or too strongly associated with particular groups within the community, in which case outsiders may be more effective.

- Recruiting recent graduates benefits from their energy and knowledge, but often means there is high turnover as they seek more permanent employment.
- Government field staff have lots of relevant knowledge and skills, but may be accustomed to more top-down ways of working, and superficial target-oriented implementation, threatening the quality of work that can be done.
- NGOs may have dedicated staff, with a good knowledge of and skills for participatory work, but lack technical expertise and the NGO may have its own agendas.

In the context of Yemen, it is not yet clear which approaches may be most suitable. Experience from the Social Fund and similar projects should provide one source of useful lessons. One possibility would be to try various kinds of facilitators during pilot phase activities.

F.4 Reassessment for Existing WUOs

As discussed earlier, WUAs have been developed by several different projects in ways that seem unlikely to be sustainable unless substantial changes are made, to reduce costs and increase benefits to local communities. The process discussed above could be applied in these cases, working with WUA leadership and members while trying to also ensure that all other relevant stakeholders are involved in the process. As noted during the November 1 workshop, in some cases it may be important to consider whether new elections are needed to ensure leadership the genuinely represents beneficiaries. The process of reassessment would need to carefully consider what additional benefits WUOs may be able to provide, as well as ways to minimize the cost of providing services.

F.5 Recommendations for Pilot Activities

The logical next step would be to carry out pilot activities in several sites, covering a range of geographic and social conditions, applying the participatory problem-solving process discussed above. This would probably require six months or a year, which would then provide a basis for a wider program. This could be arranged in ways similar to the social mobilization teams in previous projects, or perhaps through a research institute, NGO or other organization with suitable skills in facilitating community-level planning and implementation.

Appendix G. Participatory Water Resources Appraisal

G.1 Introduction

Much scope exists to make use of available information to better understand aquifers and other local water resources. The appendix describes methods that could be used by communities and those working with them to improve water governance. The emphasis is on simple low-cost methods that allow water users themselves to work with and understand relevant information, avoiding more complicated methods that would raise costs and depend on specialized equipment and expertise. The goal is to begin with low-cost activities that could be applied and expanded quickly.

G.2 Methods

Transects

Transects involve following a line along the landscape, e.g. from the lowest point to highest. These could be chosen to cross relevant types of water use such as for fields and homes, including sources for domestic water. Sketches can be prepared showing the different water users, as they related to elevation and other characteristics.

Calendars

Seasonal calendars can show the annual cycle of various activities related to water. This helps identify when water scarcity occurs, in relation to the progress of the dry season, irrigation needs, and other factors.

Timelines

Timelines covering the past few decades can show the occurrence of droughts and floods, changes in agriculture, road improvements, and other factors that affect the supply of and demand for water. This may help improve awareness of longer-term trends, and how people have adapted to changing conditions.

Maps

Sketch maps can be a very effective tool for allowing people to present their own understanding of the landscape and waterscape, concentrating on the features that are most important to them. This would include the locations of water sources, including wells and springs that may have been used in the past but have now dried up. The relative depth of wells and frequency of well deepening can be shown with numbers. Symbols and colors can be used for various forms of information, such as the different types of wells, areas under different kinds of crops and irrigation, and severity of problems. Among other things, maps can help show where water is being used and where aquifers are being depleted, in a way that encourages discussion and understanding of the situation and what might be done.

Charts

Where people are helping to monitor wells, this information can be plotted on charts, to show variations in levels. This can help to reveal and analyze long term trends in underground water levels, seasonal changes, and shorter changes from drawdown during pumping and subsequent recovery. This may help people to understand the interconnections between different wells, how one well may harm others, and the severity of aquifer depletion. Having local people involved in actually doing the analysis,

plotting values on graphs, would help make it meaningful for them, so that they feel they understand, and have a better basis for making decisions, for example in establishing protection zones around water supply sources.

Physical models

Another interesting technique to support participatory land use planning is to construct three dimensional models. These can be done on the ground outdoors, using soil, rocks and other available materials. Alternatively, if topographic maps are available these can be used to cut cardboard following contour lines (e.g. using tracing paper, such as that used for engineering design or sewing patterns), and then assembling these into a physical model. A simple model on the ground may be faster and sufficient in working with community members who share a knowledge of the local area, while a topographic model may be particularly useful in working with outside agencies which have other map-based information. Among other things, physical models could be useful in looking at the areas covered by different kinds of irrigation and water harvesting, and the potential for increasing recharge.

Other tools

The preceding paragraphs outlined a few particularly relevant tools that could be used for participatory water resources analysis. There are many more, and many of these are described in websites, sourcebooks, and other publications on participatory rapid appraisal. This could include methods such as having people draw pictures, tell stories, role playing and improvisational theater. In the context of Yemen's culture and traditions some analysts have noted the potential role for poetry (Lichtenthäler 2003). In further stages these techniques could be integrated with more technical approaches, such as participatory geographic information systems. However, the emphasis here is on simple, low-cost methods that could be easily implemented and replicated by communities, which would not be constrained by the availability of specialized equipment or high levels of expertise, and instead could have substantial impact without requiring large investment and prolonged data collection and analysis, and instead assisting communities in taking action to improve local water management, and following through with a process of learning and adaptive management.

G.4 Community Research in Philosophy and Practice

The approach recommended here can be seen as a form of community research or community science, related to methods such as action research. These are usually based on philosophies of recognizing and enhancing the capability of people to understand and act on their own situation. Depending on the situation, such local science may ignore, challenge, or be integrated with conventional scientific research. A major reason for using such approaches is that outside ideas may only have a lasting impact if they become part of local culture and governance, changing how communities perceive and manage shared resources. This may involve not just new rules for governance, but changes in how people think about and talk about their environment, a different kind of "environmentality" (Agrawal 2005).

G.3 Lessons from IPM, PRA and other sources

Appraisal can draw on ideas from participatory rural appraisal (PRA) and similar techniques, which have proven highly effective at gathering relatively good quality information quickly, in ways that are interesting and useful for local people. Several

relevant methods, such as transects, seasonal calendars, and timelines are discussed below. One lesson from PRA is that it is not enough to just generate lots of interesting information, but crucial to make use of the information, in deciding on and carrying out meaningful improvements that will affect the lives of those involved. This makes it important to focus on factors that are at least partially under the control of those involved, e.g. what can local people do to change water resources management. If there is not an explicit focus on this, then there is a risk that the exercise turns into a wish list for government subsidies, creating expectations that are likely to be disappointed, and even being detrimental by discouraging local initiative and self-reliance. It will be important to keep asking what the community itself could do, and the limitations, uncertainties, and risks of government actions.

PRA has often concentrated on local knowledge. While communities in Yemen have centuries of experience managing surface water, and using shallow wells, groundwater in deeper aquifers is a new and relatively unknown resource. Therefore, if outside information can be made available it may be quite useful, e.g. about different geological formations and their capacity to store and transmit water. In this sense there are resemblances to work in Integrated Pest Management (IPM) which sought to build local knowledge and action, combining scientific and local knowledge about pest species, life cycles, and factors which would affect different management strategies. One example of such integration of local and outside knowledge would be to collect samples of different kinds of local rocks, including those extracted during well drilling, and link this to more general geological analysis of conditions underground, including relating local understanding of different characteristics such as color and hardness to geological classifications related to origins, chemistry and structure.

G.5 Recommendation

Given the severity and widespread occurrence of water problems, the availability of local knowledge, and the limitations in data, expertise, equipment, funding and institutional capacity available from outside agencies and projects, there could be considerable potential to develop participatory water resources appraisal. This would help communities to analyze their situation, make decisions about what they can do, and learn from the results in order to further improve water governance. There are a wide variety of techniques available, from participatory rapid appraisal and other sources, including transects, sketch maps, seasonal calendars, timelines for local history, and physical models which can be tried out as part of pilot activities and combined into a toolkit of methods for PWRA.

Appendix H. Summary of Results from November 1 Workshop

Working Group 1

Recommendation No. 1: Learn from Communities

- **Spate Irrigation:**
 - Distribution takes place according to water quantity (volume)
 - Distribution in the past top – down
 - Re-establish agricultural courts
- **Awareness Raising on Water Distribution Laws and Traditional Practices**
 - Documentation of Laws and Traditional Practices
 - Mobilization of government different apparatus to carry out the awareness process
 - Encourage local innovations
- **Activate the Water Law**
 - Stop random wells drilling, influence and control by local authorities
 - Stop drilling wells with water level decline is more than 3 – 4 meters
 - Participation of local community in monitoring random drilling
 - Immediate stopping of wells drilling in case of absence of optimal distance
 - Prohibit transfer (export) from a location to another location except for drinking. Societies should intervene by force of law
 - Install water meters for water consumed for Qat irrigation
 - Community participation in water monitoring
 - Activate and develop role of Water and Environment Center (WEC) of Sana'a University. WEC to become a specialized training center for water management, modern irrigation techniques and other activities
 - Regulation of pumping process among farmers and specification of time period for pumping process
 - Introduction of scarce water tolerant crops, that consume little water, that match the environment and motivate corresponding research
 - Introduction of low water consumption crops and gradual exclusion of crops that consume large quantities of water
 - Farmers are recommended not to cultivate on the ground directly, they must rely on central nurseries or reduced nurseries set up by the farmer himself or society
 - Provide nurseries materials by government support
 - Support local community to plant cash crops except Qat

YEMEN WUA STUDY

- Prohibit import of raisins, almond, coffee and similar products
- Encourage Yemeni farmers to remove Qat plant and replace it by coffee, almond plants and provide them with modern irrigation networks
- Find a marketing mechanism to protect farmers

Working Group 2

Recommendation No. 2: Support Local Problem-Solving

Actions/Implementation Steps and Responsibilities	Time	Resources	Comments
Access to data: rainfall, water level, water quality	Throughout the year (during season) Quarterly Annually	Own + government + external (donors)	Water societies, NWRA, current projects
Involve communities in information collection and analysis <ul style="list-style-type: none"> - Training and qualification of societies members on collection of above mentioned information and participation in its analysis process - Develop maps or models 	Throughout the year	Own + government + external (donors)	Water societies, NWRA, current projects
Facilitate planning Assessment of water basins Diverse studies Wells inventory and water quality study	Every 5 years	Own + government + external (donors)	NWRA
Specify a vision for sustainability Provide financial resources Membership fees Returns from activities or services	Monthly, annually When providing services	Own/self from members and beneficiaries	
Support societies	Continuous	Own + government + external (donors)	Community participation Local councils International organizations

Actions/Implementation Steps and Responsibilities	Time	Resources	Comments
<p>Water basin sustainability through:</p> <ul style="list-style-type: none"> - Create employment opportunities other than agriculture - Introduce modern irrigation techniques - Introduce low water consuming crops with high economic return - Rain water harvesting techniques - Capacity building for societies members 	<p>Continuous</p>	<p>Members (community) Government</p>	<p>Responsible authority MEW, MAI</p> <p><i>MEW: Ministry of Water and Environment</i> <i>MAI: Ministry of Agriculture and Irrigation</i></p>
<p>Stop investment in water side</p>			

Working Group 3

Recommendation No. 3: Fit Organizations to Activities

3.1 Develop WUAs that can sustain themselves with local resources

Activities:

- Create willingness and awareness
- Start self-financing by 10% up to ten years

3.2 Use phased approaches

- Tours/visits, advisory services and training by members of successful societies to failed/unsuccessful societies
- Tours/visits of failed/unsuccessful societies to successful societies

Financing through the societies from start till reaching 100% for a period of five years

3.3 Work with women's groups to improve water management

- Establish women groups for water users under the framework of the society

3.4 Develop sustainable co-management for water users organizations based on local resources

- Involve all related authorities with water users societies
- Formation of organizational structures for geographic adjacent areas

Working Group 4

Recommendation No. 4: Weave Network Governance

- Re-consider/revise naming
- Re-consider formation of societies and groupings so as to really represent the beneficiaries
- Establish coordination council on district level with selected coordinators from societies
- Establish coordination council on basins level or provinces with equal representation of water users societies
- Reinforce and support the societies for decision making

Reinforcing and support consist of three pillars:

- **Legislative:** Find legislation and legal framework regulating societies activity that are suitable for society characteristics
- **Technical:** Organization and implementation of technical courses to support sound management, development of plans and development of district level database
- **Logistic:**
 - Support establishment of societies
 - Commitment of local authority to support the societies to carry out their tasks
 - Support societies to find self resources to guarantee sustainability
- Involve related authorities in good governance

Recommendations:

Coordination among all authorities/parties active in the water field to develop the unified version of the basic system of water cooperative societies and water users.

Government and community participation in decision making	Community
MWE, NWRA	
Basin committee	Basin WUA
Hydraulic/area committee	Links
Other societies, local councils, civil society organizations	Water users societies

