

Mining, Groundwater Management and Water Monitoring Training 2017

Trainers:

Sustainability East Asia LLC & Groundwater Solutions LLC



SUSTAINABILITY
EAST ASIA LLC



Groundwater
Solutions

Introduction

Water is a shared resource requiring common understanding and joint management approaches, such that solutions cannot be the responsibility of any one company or sector. In Mongolia, the interception of water resources through mining activities is increasingly becoming an issue for decision makers, water users and planners, as well as for individual mines and the mining industry.

To establish common ground and improve understanding of water management among diverse stakeholders, the IFC, together with other co-sponsors, funded the “Mining and Groundwater Management in the South Gobi” training programme in Mongolia since 2013. Initial emphasis of the training was on integrating social and technical issues of water management and highlighting the role of broad stakeholder participation.

In the last three years, more than 1,000 people have participated in this training, with women making up about 50 percent of the participation base. Outside of the local communities, the representatives from the mining companies and government authorities were invited to the training.

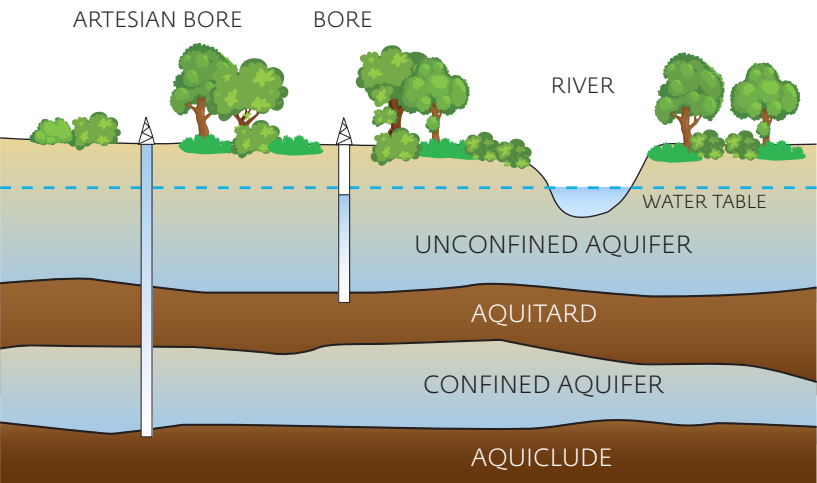
This booklet is developed to provide south Gobi community members with some general information to assist them to actively initiate and participate in groundwater management activities that are identified as key areas of knowledge gap by earlier studies¹.

¹IRIM 2014. Baseline community perceptions survey for IFC.

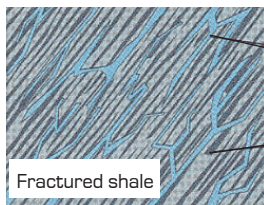


What are groundwater systems?

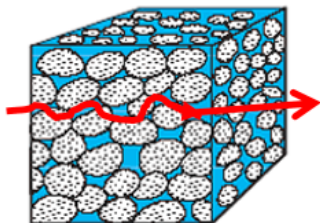
- Groundwater is not an underground lake or river. Groundwater is water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations.
- An underground layer of water bearing rock formations, rock fractures or unconsolidated materials called an aquifer. There are two types of aquifers: **Unconfined** (an aquifer in which there are no confining beds between the zone of saturation and the surface); and **Confined** (an aquifer that is overlain by a confining bed).
- **Aquitard** is a layer with low water permeability (for example clay) that separates the aquifers. If the aquitard overlies an aquifer, then the underneath aquifer becomes a confined aquifer.
- Groundwater which rises above the surface of the ground under its own pressure by way of a spring or when accessed by a bore is called **artesian**.
- **Groundwater recharge** is the downwards movement of water from the surface to the saturated zone. Recharge mostly originates from precipitation.



Groundwater systems



Water bearing rocks



Groundwater movement between water bearing materials

What is groundwater monitoring and why is it important?

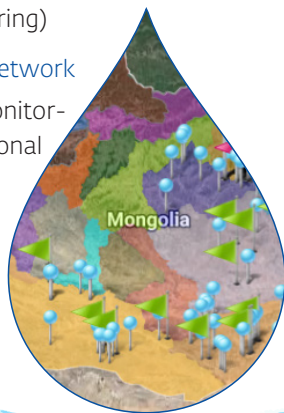
Groundwater monitoring helps to detect and monitor any changes to the quality and quantity of groundwater resources e.g. water contamination and aquifer depletion.

Purpose of monitoring should be established before starting a monitoring. The following questions help to design effective water monitoring programme:

- Why? (Baseline study, water use impacts, address uncertainty)
- Where? (Catchment area, wells in potential impact zones etc.)
- What? (Water level or water quality)
- How? (What equipment to use)
- When? (Frequency, timing of the monitoring, for example before watering animals etc.)
- Who? (Who does the monitoring)

National groundwater monitoring network

Currently over 200 groundwater monitoring points are connected to the national groundwater monitoring network (groundwater.mn) for continuous water level monitoring and water quality for selected stations.



Groundwater Monitoring Equipment

Different monitoring equipment is needed depending on the objective. For example, identifying heavy metals through water chemistry analysis require special water sampling equipment and laboratory analysis.

Basic water quality or water level monitoring can be done using less complicated equipment such as mobile water quality tester or handmade dipper.



Water level dipper



Field water quality tester is useful for basic water quality tests in field situation.

Basic water quality parameters	Standard values (Drinking water standard MNS 900:2010)
TDS (ppm)	7
pH	6.5-8.5

A handmade water level dipper can be made using simple tools such as a tape measure and a handmade dipper made of a metal tube with one end closed.



Handmade water level dipper



Water level measurement by handmade dipper

When measuring water level:

- Always measure before watering animals
- Fill in the monitoring date
- Record the measured water level using a simple data recording sheet (see below table)
- Write any descriptive notes for example before watering, or if it rained since the last measurement data, etc.

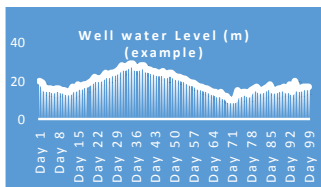
Water monitoring data recording sheet (example)

Date	Water level (m)	Note

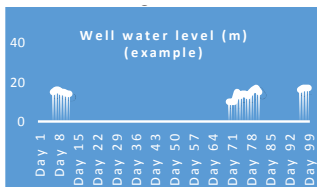
Water monitoring data analysis

Longer series of monitoring data is to reveal natural variations. It is crucial to keep the monitoring data and related records for future use.

Two different time series of monitoring data



*Longer term monitoring
will identify pattern*



*Short or missing data should
be used with care*



Participatory Water Monitoring (PWM)

Participatory monitoring is a process that engages diverse groups to collaboratively identify and solve problems through the process of data collection, analysis, and communication. This process is especially useful when there is a low level of trust in the reliability of monitoring results. Participatory water monitoring can help address the causes of potential conflict by:

- actively engaging stakeholders in the design and implementation of the monitoring program to identify their concerns,
- generating water monitoring data that is trusted by all stakeholders, and
- jointly developing solutions to mitigate or remedy any adverse impacts.

Community members can initiate and undertake Participatory water monitoring together with other stakeholders.

Basic steps of Participatory Water Monitoring (PWM)

1. **Identify stakeholders to participate** (Stakeholders to be identified depending on the monitoring objective);
2. **Develop PWM plan** (Identify and agree what needs to be done? Where to monitor? How to monitor? Who monitors? When? Cost estimate etc.);
3. **Implement the PWM Plan** (Implement the PWM according to the agreed plan); and
4. **Data analysis** (Convert the collected data into useful information. By doing this the PWM programme results will provide answers to the initial objective).

*IFC's Guide for Participatory Water Monitoring
(<http://www.caoombudsman.org/howwework/advisor/documents/watermoneng.pdf>)
can be used for comprehensive PWM programme.*

Well maintenance

Herder wells are the main sources of domestic water supply in the Gobi region of Mongolia. Regular maintenance of wells prevents well water quantity and quality deteriorating in longer term.

Type of maintenance	How it is done?	Benefits
Well cleaning	Remove solid i.e. mud, sand etc. materials from the well and deepen the well. It can be done by hand	Prevent reduction in water level and/or drain of well water
Well casing	Install concrete casing to protect well wall. Needs lifting machinery	Prevent well wall collapse and enhance well durability
Raise well collar	Elevate well collar from ground level by constructing wooden frame or placing concrete tubes	Prevent unwanted items and sand, mud and dirt to enter the well due surface run-off
Protecting well surroundings	Concrete well collar and areas around trough	Prevent soil contamination around well from livestock waste and surface run-off

Well maintenance planning



Assess the well condition



Plan what needs to be done



Collect necessary tools for efficient and safe work

Information source:

https://www.jircas.affrc.go.jp/english/manual/IIRCAS_Mongolia_technical_manual.pdf

Different types of well maintenance



Well cleaning for improved water recharge. Dry season with low groundwater recharge is suitable for well cleaning time.



Elevating well collar or making secure cap to prevent well contamination from flooding or foreign objects falling into well.



Concreting around well limits water contamination through soil.

Well maintenance safety

Any well maintenance work should consider and mitigate potential safety risks such as falling into well or well wall collapse. Key safety tips for well maintenance work:

- Don not do if it is unsafe;
- Not recommended to work in too deep wells;
- Never work alone;
- Use safe ladder and/or safety harness;
- Place tools or equipment in safe distance from well opening to prevent them falling into well; and
- Use minimum PPE such as no slippery waterproof boots and hard hat.

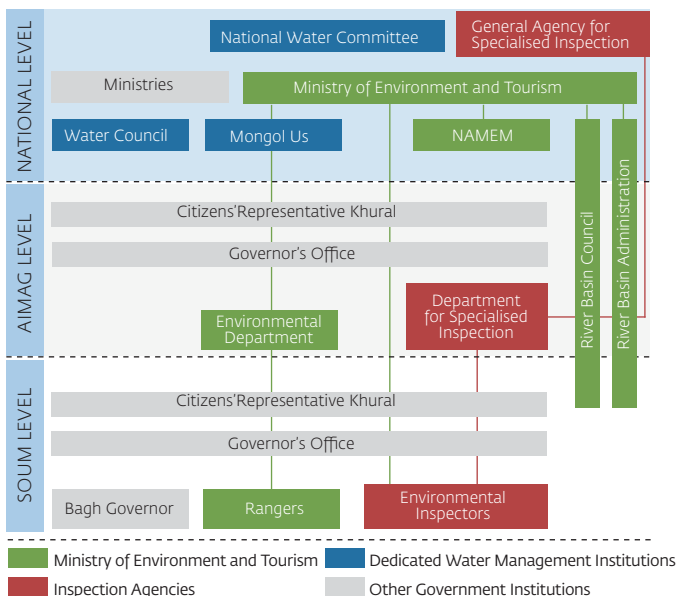
Information source:

https://www.jircas.affrc.go.jp/english/manual/IIRCAS_Mongolia_technical_manual.pdf



Water Management Institutions in Mongolia

- **The Ministry of Environment and Tourism** has overall responsibility of state wide water management in Mongolia.
- **The National Water Committee** coordinates inter-sectoral cooperation for water management and implementation of the National Water Action Plan.



Mongolia adopted the catchment based water management approach since 2012. The River Basin Administrations (RBA) are responsible for developing and implementing catchment based water management plan.

River Basins and River Basin Administrations (RBA) in Mongolia

The River basin is the catchment area of surface water and the groundwater resources underneath the ground surface. There are 29 River basins in Mongolia and each has an administration. RBA is responsible for development and implementation of the water management plan in the basin.



Some responsibilities of RBA:

- Provide coordination among local Governments, and multisectors to implement River Basin Water Management Plan
- Provide all levels of Governments and Citizens Representative Khurals with technical advice for water management
- Organise water census annually
- Host RBA water database and provide general public with water information

- Monitoring of water resources and water use in respective River basins; and
- Permitting of mining licences will be subject to RBA comments.

River Basin Council (RBC)

Each River Basin Administration will have River Basin Council (RBC). The RBC's roles include providing recommendations, monitoring, and stakeholder participation in development and implementation of river basin water management plan. RBC represents different stakeholders groups in river basin water management.

Composition of RBC:

- RBC consists of 31-45 members representing various stakeholder groups such as local administration, the environment department, professional inspection agency, NGOs, soum and district citizens, water users, scientists, researchers and professional organisations related to water issues.

Main responsibilities of RBC:

- Organise activities to get community input and provide feedback to the community on the river basin water management plan;
- Monitor implementation of the river basin water management plan;
- Request amendments to RBA in the water management plan;
- Appeal to the Ministry of Environment and Tourism to cancel water withdrawal assessment issued by RBA;

- Conduct socio-economic studies for sustainable water resource management; and
- Provide public awareness campaign on water resources management and sustainable water resource use.



Photo source: <http://govi-altai.nature.gov.mn/subInformation/3/content/194>

Refer to the following links for more information on Water management Institutions and issues in Mongolia, particularly in the Southern Gobi region:

Ministry of Environment and Tourism: <http://www.mne.mn/>

Division for RBA: <http://www.riverbasin.mn/>

National Water Committee: <http://www.water.mn/>

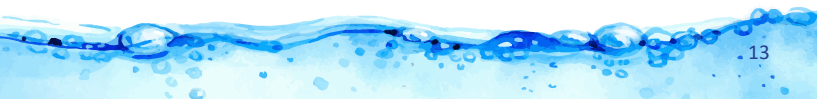
Galba-Uush-Dolood Gobi RBA: <http://galba.gobiwater.mn/>

Altain Uvur Gobi RBA: <http://altai.gobiwater.mn/>

Umar Gobi RBA: <http://gobi.gobiwater.mn/>

RBC procedure: <http://www.legalinfo.mn/annex/details/5898?lawid=9257>

Demand in the Desert: [Mongolia's water-energy-mining nexus. https://www.adb.org/sites/default/files/publication/42820/demand-desert.pdf](https://www.adb.org/sites/default/files/publication/42820/demand-desert.pdf)





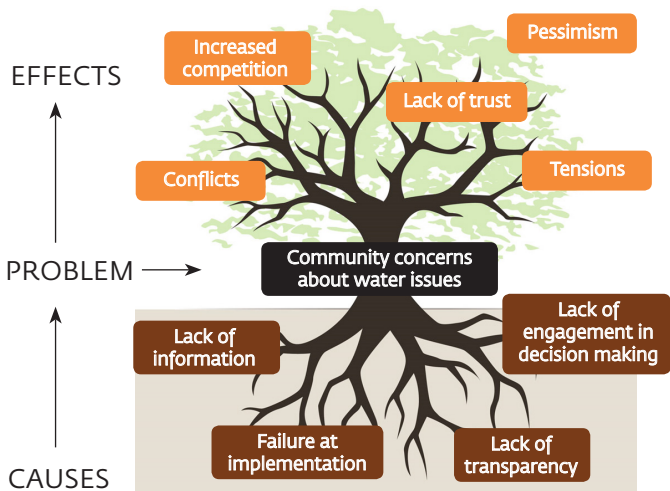
Mine and Water Use

- Mine is water intensive and most mines operate in water scarce regions.
- Mineral processing does not require good quality of water allowing it to use lower quality of water such as brackish or recycled water
- The use of water by mining projects can lead to negative perceptions in communities due to lack of transparent information about mining water use, consultation and uncertainties surrounding mining water use impacts on local water resources. It is increasingly becoming a source of conflict between mining and community around the world.
- Transparent and effective stakeholder engagement by mining companies helps to solve the issue.



There is no exception for Mongolia. Community perceptions towards mining industry water use are very negative in the south Gobi. Lack of transparency and inadequate engagement by mining industry seems the root causes.

Causes and Effects of Conflict Surrounding Mine Water Use



Findings of Community perceptions survey¹ about water issues in South Gobi

- Lack of information available to the herders, for example: about water quantity.
- Low level of trust in information provided by mining companies, for example: regarding the effects on water from mining activities
- Herders/communities have a number of concerns, for example: common views exist that mine is water intensive so that it will negatively impact on pastureland overtime.

¹IRIM 2014. Baseline community perceptions survey for IFC.

Ongoing initiatives to address challenges for sustainable water management in the Southern Gobi region

Voluntary Code of Practice (VCP) for Mineral Industry Water Management

VCP was developed with the overall goal of improving water management and stakeholder engagement practices in early 2016 as a result of the South Gobi Water and Mining Industry Roundtable project facilitated by IFC.

VCP Mission

We acknowledge that access to water is a basic human right and voluntarily commit to the responsible, legally compliant, and sustainable use of water. We will be efficient in our use of water, transparent in our monitoring, maintain water quality and will provide broad participation in our water management activities.

VCP Vision

We will be responsible companies and build trust by working together to relieve water stress, support the development of sustainable communities and bring benefits to Mongolia.

VCP Members



Voluntary Code of Practice: Minerals Industry and Water Management

1. Act transparently and with accountability					
2. Comply with national law and international standards		3. Engage proactively and inclusively		4. Effective water resource management and conservation	
2.1 Comply with Mongolian law, catchment governance requirements (RBAs RBCs) and international standards on water management		3.1 Develop participatory monitoring programs for communities adjacent or near to exploration and mining activities		4.1 Maintain a water monitoring program that respects local customs and monitoring reports will include information on water levels and water quality in wells	
2.2 Support Government of Mongolia in developing and implementing its legal and regulatory framework for water resources management		3.2 Organize community discussions and information sharing, including the results of any monitoring programs		4.2 Optimize water efficiency and conservation at mine site operations and minimize water waste	
2.3 Incorporate good international industry practice for mine-water management in business operations		3.3 Support public education and awareness raising through communications materials in a format that is accessible to the given audience		4.3 Identify, monitor and manage high value biodiversity assets that are dependent on water to ensure their safeguard	
1.1 Publicly report water risks, management activities and performance using recognized metrics		1.2 Organize project site visits for communities and vice-versa		1.3 Develop a community grievance mechanism and ensure it is accessible for communities	
5. Create positive impacts		6. Support local water infrastructure and services		6.1 Rehabilitate or improve impacted water resource infrastructure in pastureland to pre-project status	
5.1 Support impacted local communities to maintain or improve access to water resources		5.2 Support local communities to improve traditional ways of protecting wells		5.3 Support access to water for livestock in times of stress	
6.2 Engage community members to improve water management practices in pastureland themselves		6.3 Support community projects to develop sustainable water supplies in areas of impact			
				4.4 Maintain a site water balance to report annually on key metrics pertaining to water performance and that is used to inform long term mine planning and closure plans	

Reports by VCP Signatories

The VCP Signatories will report the following metrics about their water use to make information transparent to the public:

- Extracted water for mine use
- Quantity of used water
- Quantity of recycled and discharged water
- Mine water quality
- Water levels of mine boreholes and herder wells around mine site
- Water quality around mine site and local drinking water quality

Community's inputs to and cooperation with VCP signatories

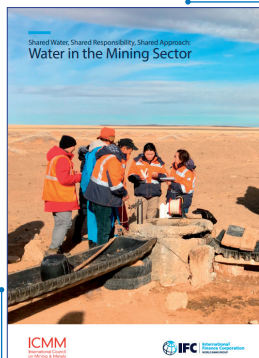
Local communities can engage in and contribute to implement VCP with VCP signatories through following ways:

- Request the VCP signatories to report their water use information transparently;
- Request the VCP signatories to share information on their water monitoring, such as water level and water quality;
- Make a complaint about water related issues to the companies;
- Actively engage in Participatory Water Monitoring program by the VCP signatories; and
- Visit nearby mine site to see mine water use and management.



Challenges in Sustainable Water Management in Mongolia

- Lack of rigorous systematic regional hydrogeological study
- Increased water demand and use in relation to development of mining industry
- Uncertainty around water use impacts on shallow aquifers due to lack of detailed study and long term monitoring data
- Lack of adequate regulatory coordination and impact assessment
- Lack of stakeholder cooperation
- Potential negative impacts on water resources from climate change.



Requirements for water management

- Shared water; shared responsibility; shared approach
- Collaboration among all stakeholders
- Transparent information sharing and inclusive cooperation

For more information about collaborative approaches to water management developed by IFC, please visit at https://www.ifc.org/wps/wcm/connect/ee079cb5-222c-4fe7-8844-8210ac77f0dc/170321_ICMM-IFC_shared-water-shared-responsibility+FINAL+FINAL+FINAL.pdf?MOD=AJPERES



Definitions of some hydrogeological terms:

Terms	Definition
Hydrogeology	Hydrogeology (<i>hydro-</i> meaning water, and <i>-geology</i> meaning the study of the Earth) is the area of geology that deals with the distribution and movement of groundwater in the soil and rocks of the Earth's crust (commonly in aquifers).
Groundwater	Groundwater is water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations.
Aquifer	An aquifer is a saturated permeable geological unit that can store and transmit large volumes of water under a hydraulic gradient. An aquifer is able to supply water to wells.
Groundwater deposit	The area of aquifer that can yield usable quantity of water.
Aquitard	An aquitard is a layer of low permeability that can store groundwater and transmit it slowly from one aquifer to another.
Confined Aquifer	It is an aquifer that is confined between two aquitards does not transmit water in considerable amounts or it is impermeable.
Unconfined Aquifer	This aquifer is open to receive water from the surface and whose water table surface is free to fluctuate up and down depending on recharge and discharge rates.
Artesian water	Groundwater which rises above the surface of the ground under its own pressure by way of a spring or when accessed by a bore.
Hydraulic Conductivity	The hydraulic conductivity is the rate of water movement through a porous material or fractures.

Reference: MNS 3382:82

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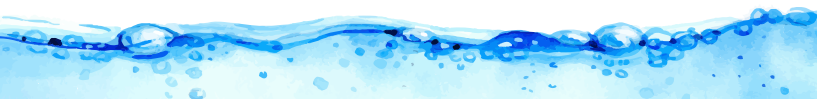
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