

THE ROLE OF GROUNDWATER AND CHALLENGES FOR ITS SUSTAINABLE UTILIZATION

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global **environmental** and **advisory** solutions

THE WATER BALANCING ACT

Supply

- Quantity (Natural Scarcity, Groundwater Depletion)
- Quality Degradation
- Cost of Options

Demand

- Increasing in all sectors
- Inefficient use

HOW TO RESTORE THE BALANCE?



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REALPOLITIK I

- Capacity diminishing
- Chronic lack of data on groundwater conditions and trends
- Water resource planners and managers do not trust our figures
- Legislation not being enacted or provisions enforced

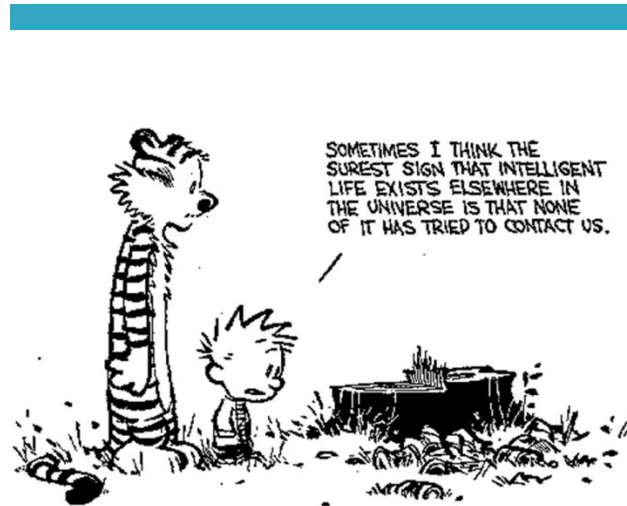
REALPOLITIK II

- Groundwater resource polluted through mining, agriculture and urban industrial activities
- Over-exploitation of groundwater by many individual users
- It may be public water now – but many still regard it as their own
- Limited institutional capacity of DWS

SUSTAINABLE DEVELOPMENT

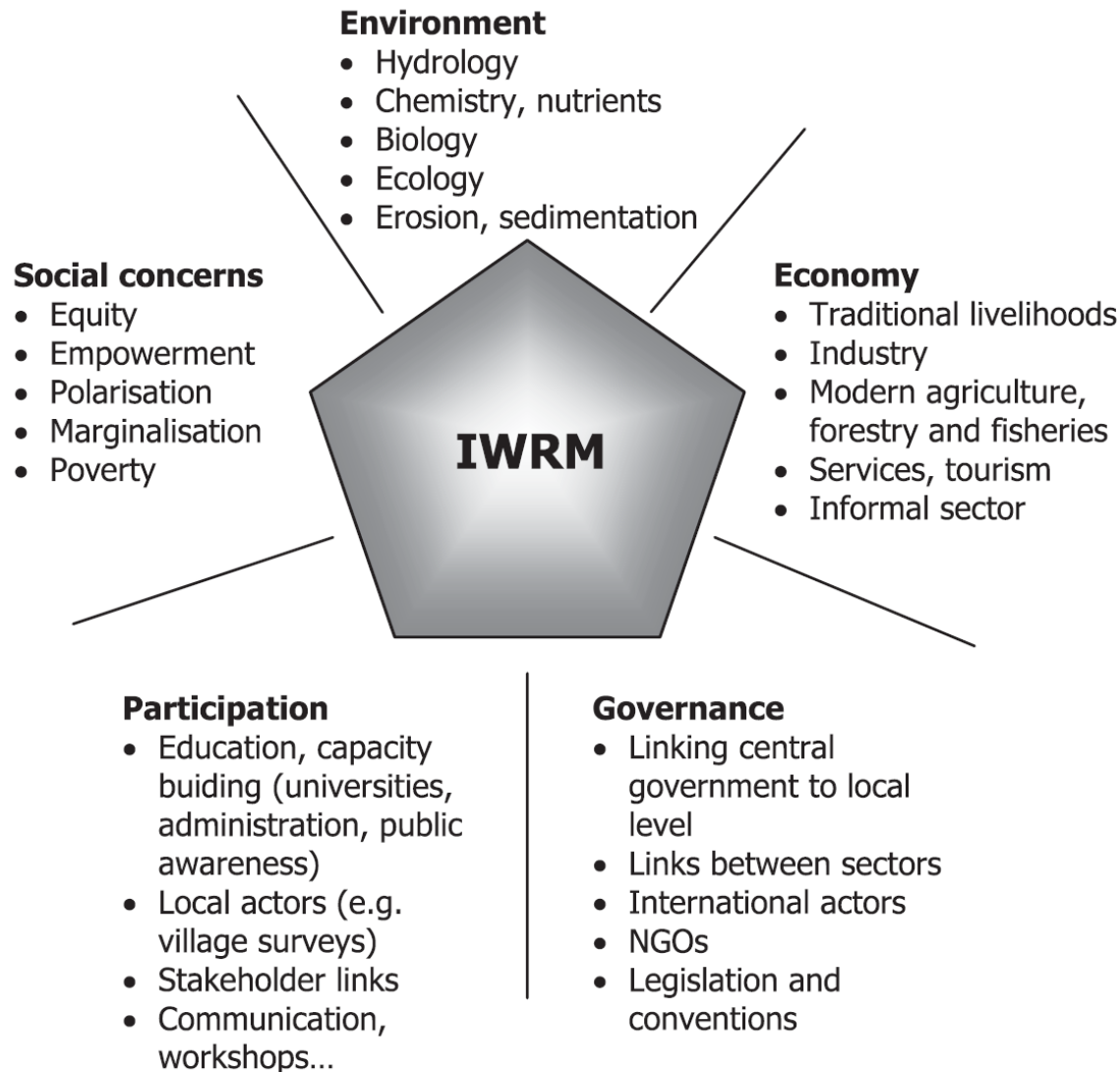


Translation of the principles of sustainable development and IWRM to reality in order to ensure sustainable groundwater management

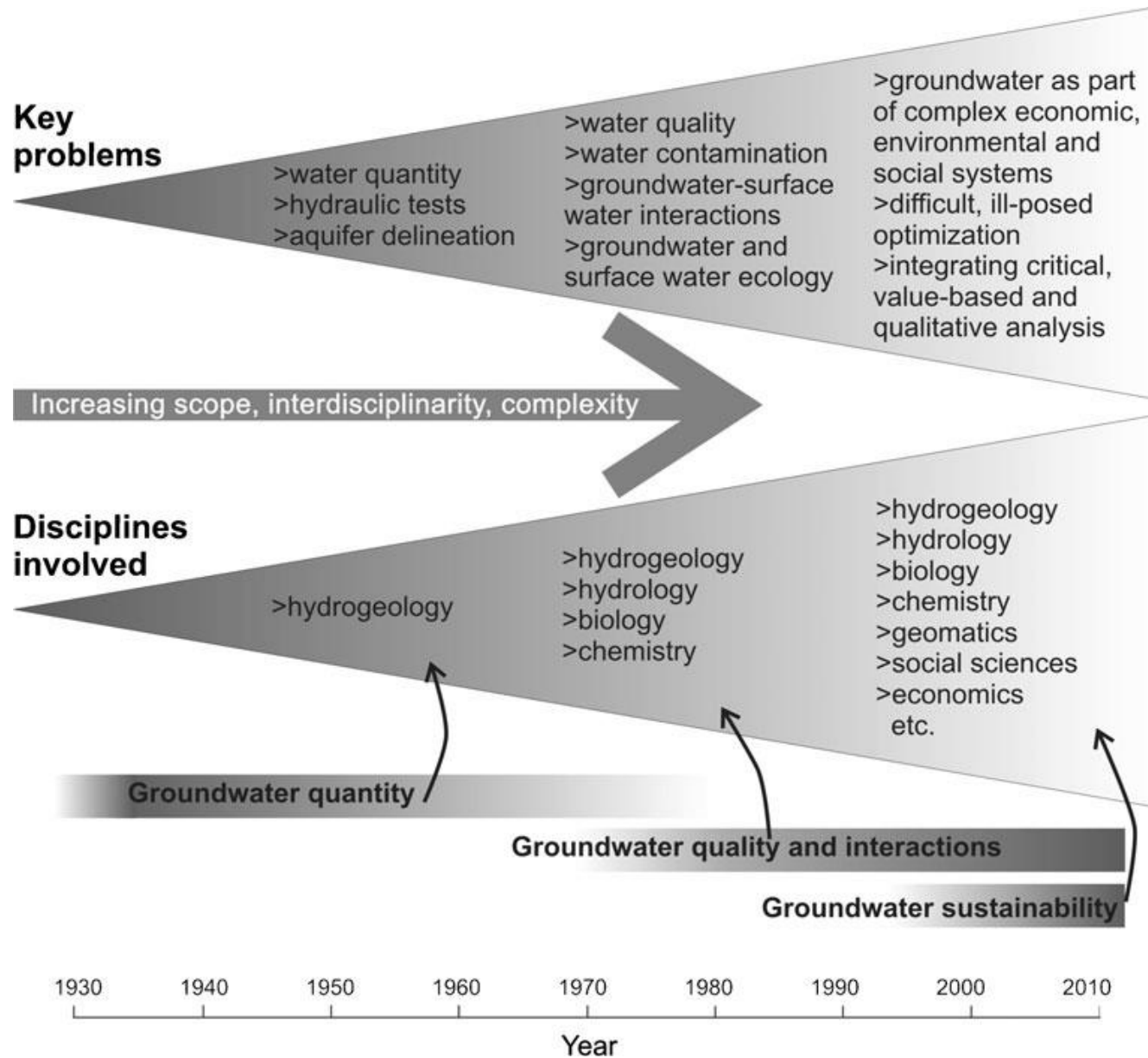


NO SIMPLE BLUE PRINT





VARIS, O., ENCKELL, K. & KESKINEN, M. 2014. Integrated water resources management: horizontal and vertical explorations and the 'water in all policies' approach. *International Journal of Water Resources Development*, 30, 433-444.



GLEESON, T. & CARDIFF, M. 2013. The return of groundwater quantity: a mega-scale and interdisciplinary “future of hydrogeology”? *Hydrogeology Journal*, 21, 1169-1171.

Water resources

National responsibility

NATIONAL WATER ACT

NATIONAL WATER ACT

(36 of 1998)

The **National Water Act** deals with the *water resource*. That is rivers, streams, dams, and ground water. It contains rules about the way that the **water resource** (surface and ground water) is protected, used, developed, conserved, managed and controlled in an integrated manner.

Water services

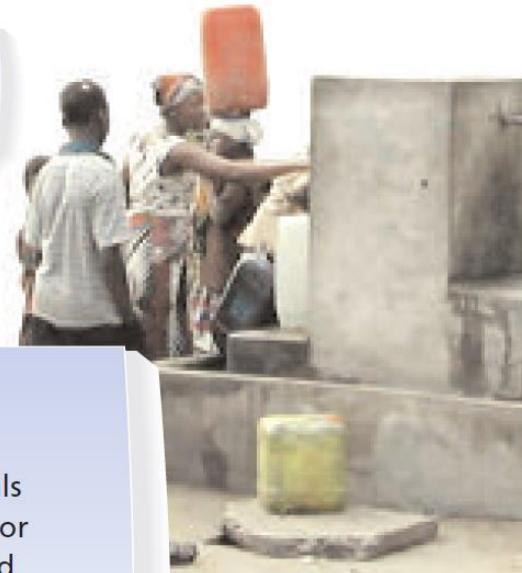
Local responsibility

WATER SERVICES ACT

WATER SERVICES ACT

(108 of 1997)

The **Water Services Act** deals mainly with **water services** or potable (drinkable) water and sanitation services supplied by municipalities to households and other municipal water users. It contains rules about how municipalities should provide water supply and sanitation services.



NATIONAL WATER ACT

- Fundamental principles
 - Sustainability
 - Equity
 - Efficiency
- Sustainability. Equity and efficiency recognise:
 - the basic human needs of present and future generations
 - the need to redress (correct) past discrimination
 - the need to protect water resources
 - the need to share water resources with other countries
 - the need to promote social and economic development through the use of water
 - the need to establish representative water management institutions
 - the need to ensure participation of stakeholders and users in decisions that affect them



THE NATIONAL WATER ACT AND GROUNDWATER

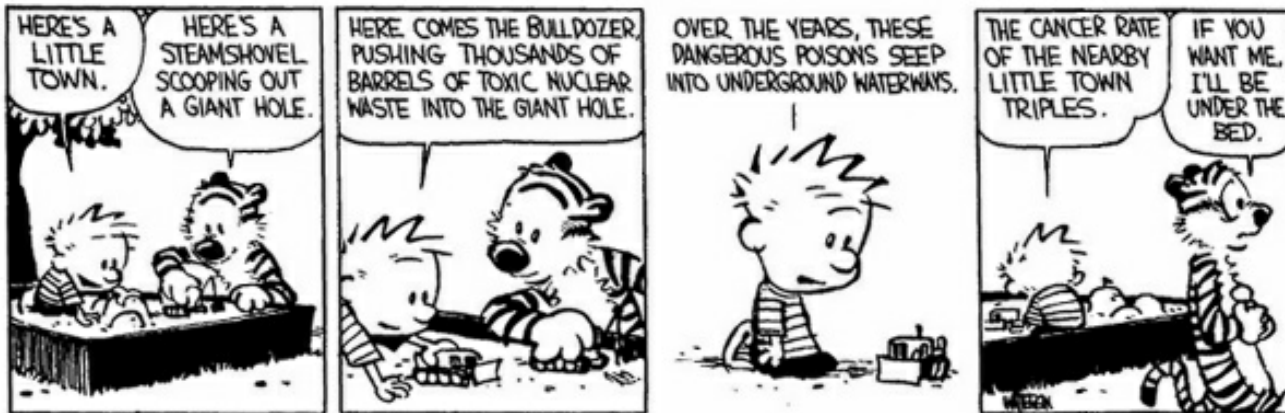
- Groundwater is referred to only once in the National Water Act, and that is in the definition as a “**significant water resource**”
- This is because all water resources should be treated the same under the key guiding principle underpinning the whole Act, namely that all water, wherever it occurs in the hydrological cycle, is a resource common to all, requiring national control, with government as the public trustee

(Water Act News- February 2004)

Why **FIT IN** when you were
Born to **STAND OUT!**

- Dr. Seuss

SO WHERE DOES GROUNDWATER FIT OR NOT?



GROUNDWATER AND SURFACE WATER

- Intimately linked:
 - Aquifer discharge to surface water bodies or recharge from them
- There are differences:
 - River systems are flow-dominated
 - Aquifers are characterised by large storage (stocks) and much lower flux (flow rates)

FOSTER, S. & AIT-KADI, M. 2012. Integrated Water Resources Management (IWRM): How does groundwater fit in? Hydrogeology Journal, 20, 415-418.

IMPLICATIONS

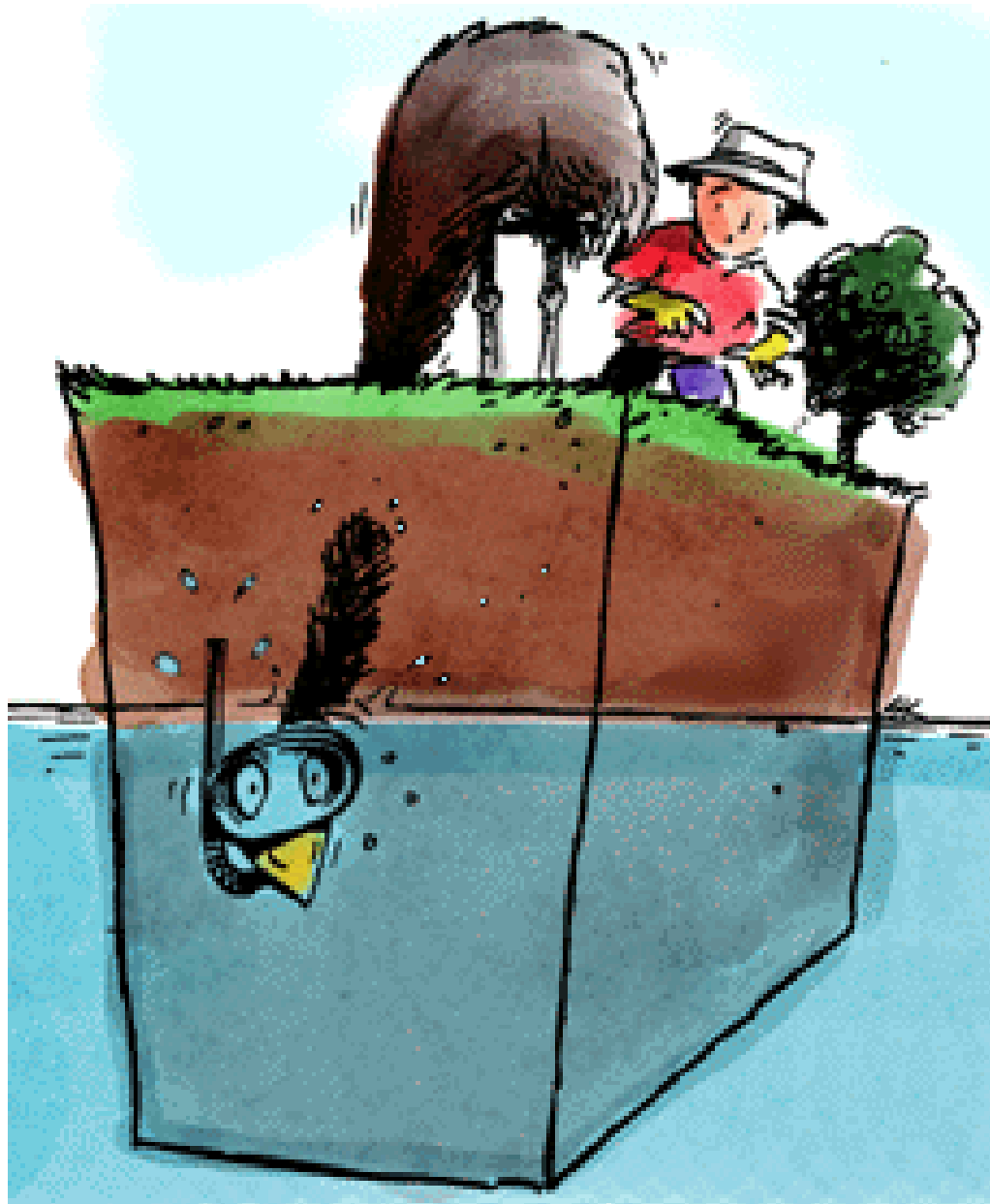
- Upstream-downstream considerations neither predominate nor are necessarily fixed
- The storage buffer makes it is easier to accommodate uncertainty in management decision-making and the cost of applying the ‘precautionary principle’
- Management and protection actions, of necessity, must cover a wide scale range

FOSTER, S. & AIT-KADI, M. 2012. Integrated Water Resources Management (IWRM): How does groundwater fit in? Hydrogeology Journal, 20, 415-418.

DIFFICULTIES AND UNCERTAINTIES

- Groundwater cannot be readily observed
- Groundwater may occur in large, and complex aquifer systems
- Aquifers have high spatial variability of its characteristics





THE SITUATION

“The human influence on the global hydrological cycle is now the dominant force behind changes in water resources across the world and in regulating the resilience of the Earth”

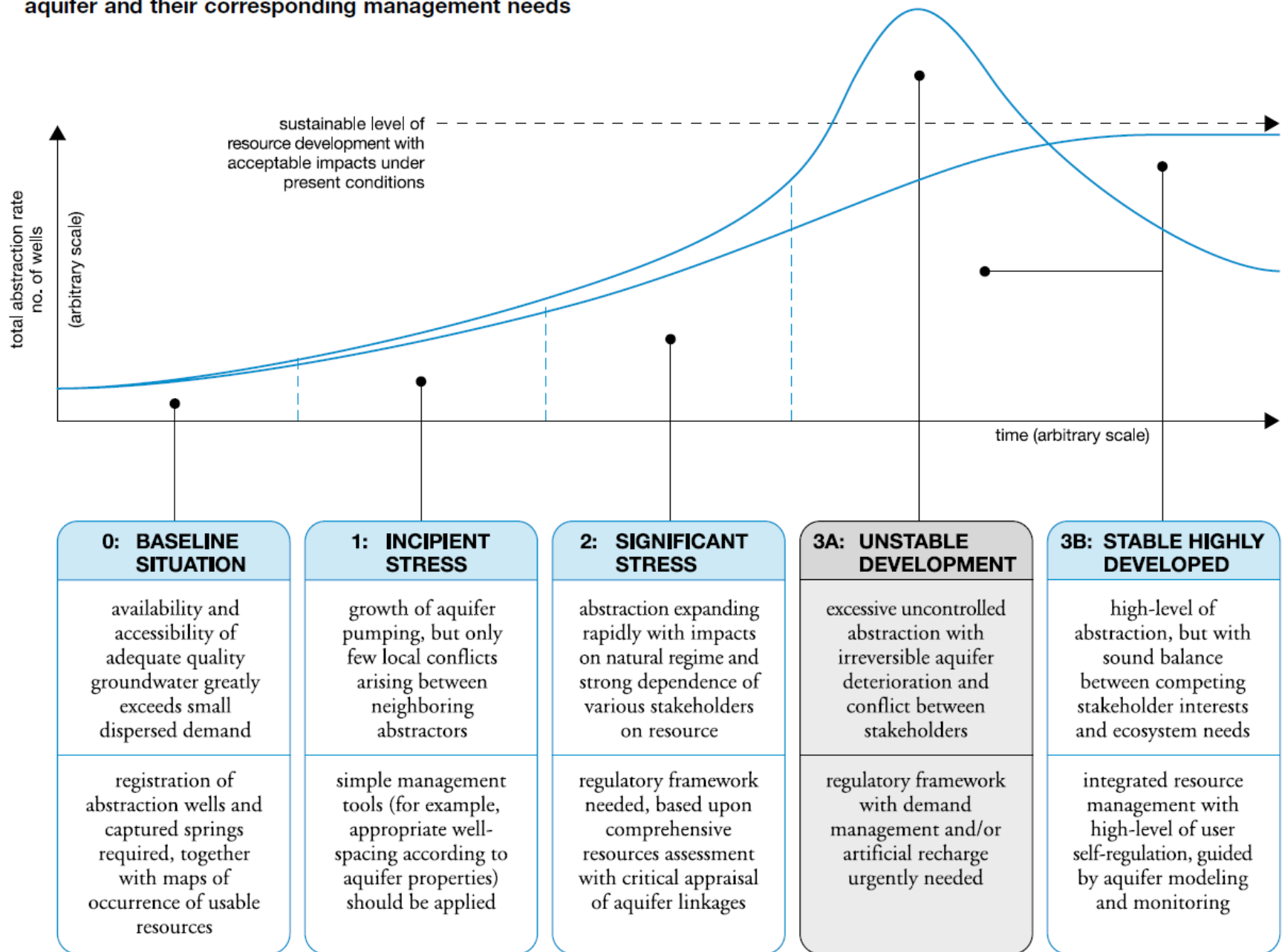
ROCKSTRÖM, J., FALKENMARK, M., ALLAN, T., FOLKE, C., GORDON, L., JÄGERSKOG, A., KUMMU, M., LANNERSTAD, M., MEYBECK, M., MOLDEN, D., POSTEL, S., SAVENIJE, H., SVEDIN, U., TURTON, A. & VARIS, O. 2014. The unfolding water drama in the Anthropocene: towards a resilience based perspective on water for global sustainability. Ecohydrology.

DISCLAIMER

“Water resources cannot be developed without altering the natural environment; thus, one should not define basin yields, either as safe or sustainable, without carefully explaining the assumptions that have been made about the acceptable effects of groundwater development on the environment.”

ALLEY, W. M. & LEAKE, S. A. 2004. The Journey from Safe Yield to Sustainability. *Ground Water*, 42, 12-16.

Figure 3: Stages of groundwater resource development in a major aquifer and their corresponding management needs



CONCLUSION

GROUNDWATER SUSTAINABILITY

- Concept (not definition)
 - Water conservation
 - protection of the water quantity and quality
 - Long term implications
 - best done through framing the hydrologic implications of various alternative development strategies
 - Uniqueness
 - each hydrologic system and development situation is unique and requires an analysis adjusted to the nature of the water issues faced, including the social , environmental, economic and legal constraints that must be taken into account

CONCLUSION

REVIEW, EVALUATION AND OPTIMISATION OF THE WATER RESOURCES MONITORING GROUNDWATER

- The regular collection, analysis and dissemination of data and information are fundamental for any programme of groundwater management that wants to influence policy, decision makers and public opinion.
- Lack of information and lack of access to information are the two issues widely identified by experts and stakeholders as constraining the development of effective strategies and policies for managing groundwater.

NGS, 2016

THANK YOU

GWD 2017

Change • Challenge • Opportunity

15th Biennial Ground Water Division Conference
14 to 18 October 2017
Spier Wine Estate, Stellenbosch, South Africa



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GUIDING PRINCIPLES FOR IWRM

- **Dublin Principles**

- Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment
- Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels
- Women play a central part in the provision, management and safeguarding of water
- Water has an economic value in all its competing uses and should be recognized as an economic good

- **Rio, Local Agenda 21**

- Ensure the integrated management and development of water resources
- Assess water quality, supply and demand
- Protect water resource quality and aquatic ecosystems
- Improve drinking water supply and sanitation
- Ensure sustainable water supply and use for cities
- Manage water resources for sustainable food production and development
- Assess the impact of climate change on water resources

