

Sustainable Groundwater Management in California: A Framework and Implementation Roadmap

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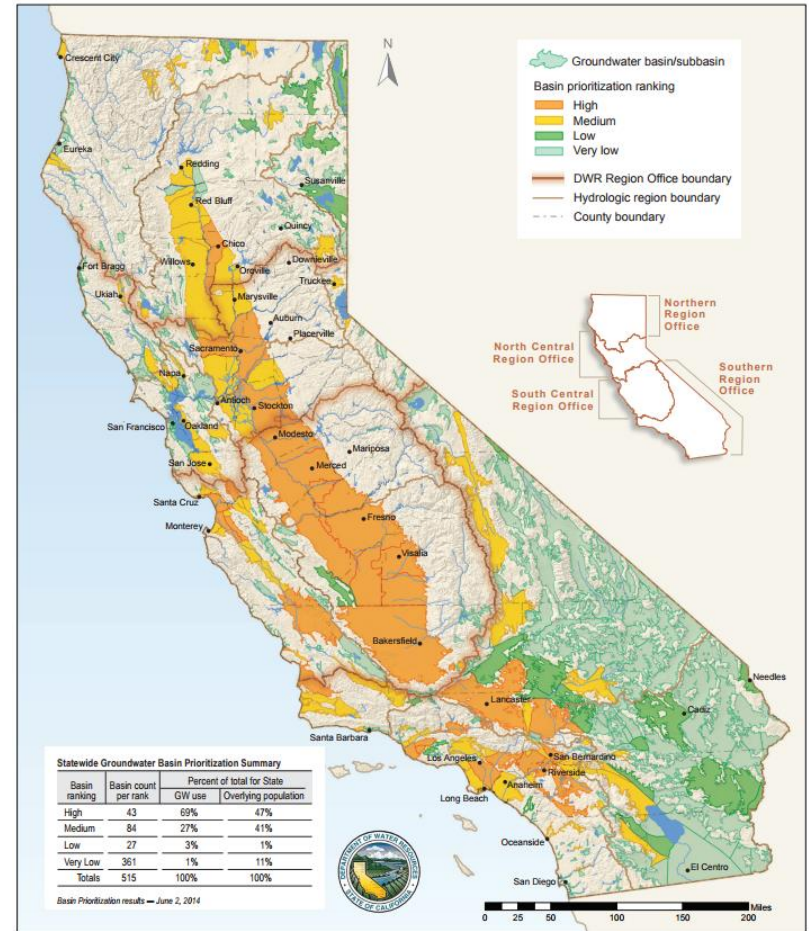
SGMA 101

Significant unreasonable and undesirable results

- (1) Depletion of groundwater levels
- (2) Reduction of groundwater storage
- (3) Land subsidence
- (4) Potentially adverse impacts on surface water use
- (5) Seawater intrusion
- (6) Degradation of water quality


SGMA

- Challenges local communities to form agencies & prepare plans
- Leaves the detail to local communities
- Is silent on governance arrangements, water rights, allocation arrangements, administrative structures, enforcement and accounting, etc.



The Roadmap and GSP Mock-up

1. Issue shares to all existing users
2. Make Annual volumetric allocations in proportion to shares held
3. Require users to hold a permit linked to a water account
4. Unambiguous Statutory Plan
5. Trusted, independent Basin Authority appointed by GSA
6. Watermaster as “CEO”
7. Guaranteed share registers with capacity to mortgage
8. Bank-like water accounts
9. Recharge project accounts
10. Protection for Domestic Users
11. Low-cost administrative systems



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Sharing Groundwater: A Robust Framework and Implementation Roadmap for Sustainable Groundwater Management in California

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SUMMARY
This working paper offers a framework and roadmap for development of a robust groundwater-sharing system consistent with California's Sustainable Groundwater Management Act, which requires communities in priority areas to prepare groundwater sustainability plans.

The proposed system draws on global experience. Robustness is its signature feature. Opportunities are maximized by a suite of robust local governance, allocation, and administrative arrangements. Additionally, the proposed system incentivizes innovation, stimulates investment, and facilitates low-cost adjustment to changes in groundwater demand.

Among the dynamic components underlying this sharing system is a share register that records ownership and transfers of ownership in a basin's available shares. These unit shares are fungible; each represents a proportional stake in access to the basin's groundwater resources. Volumetric allocations are made in proportion to the number of shares held during determined periods throughout the water year. These allocations are recorded in bank-like water accounts, affording account holders an efficient means to manage their resource but also ensuring that they cannot use more than is available. Unused water can be saved for later use. At the start of the transition to the new system, users are given an allocation buffer so that they have flexibility and time to adjust. Those who want to can make quick non-contestable trades at low cost.

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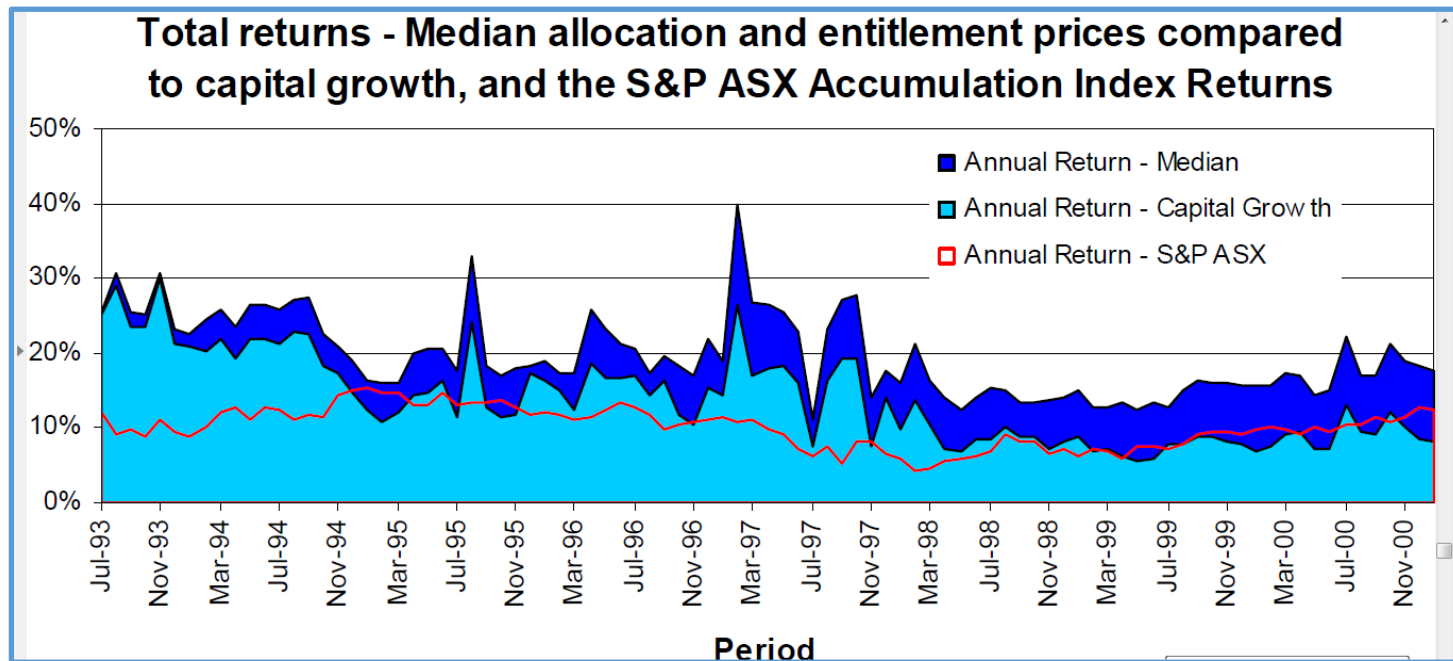
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Review
This working paper was reviewed by multiple experts inside and outside the Nicholas Institute for Environmental Policy Solutions. However, it has not undergone a formal review process as it is intended to present preliminary analysis, stimulate discussion, and inform debate on emerging issues. It may eventually be published in another form and its content revised.

• Google “Young McAteer groundwater” to read more

International insights

- If you focus on building robust administrative systems
- Markets will emerge naturally



Groundwater management is a sharing problem

The value of each water right is determined by the opportunities and risks associated with it.

The better the system, the greater a community will prosper.

First mover advantage is significant.



Suggested Objectives & Goals

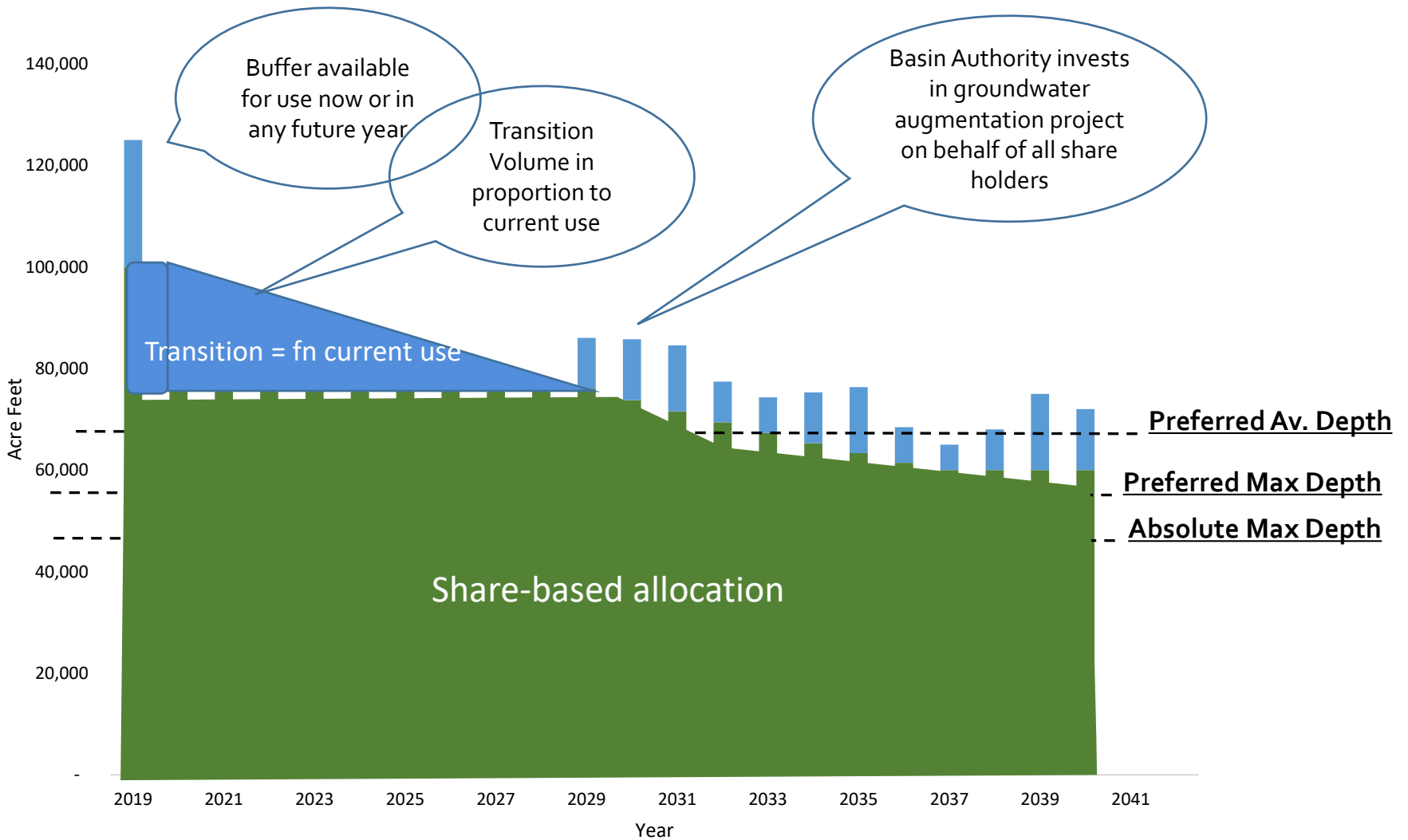
Six objectives:

1. **Avoid SGMA's 6 undesirable groundwater results**
2. Maximize local profits → Economically efficient groundwater use, investment, and SGMA compliance
3. Encourage and reward water conservation
4. Facilitate continuous adjustment as conditions change
5. Provide fair and equitable access for domestic purposes
6. Maintain local control

One Sustainability Goal

- Groundwater use is in balance and free of 6 undesirable results by 2042 (at the latest)

Indicative Basin Groundwater Allocation Plan



A Mock-Up Water Account

Date	Action or event	Debit	Credit	Balance
1 Oct 2019	Opening balance			0.00
1 Oct 2019	Start-up buffer		+83.33	+83.33
1 Oct 2019	Share allocation 10,000 shares at one acre-inch per share		+833.33	+916.66
15 Oct 2019	Net use—estimated using satellite imagery and land parcel area	-10		+906.66
30 Oct 2019	Net use—estimated using satellite imagery and land parcel area	-15		+891.66
5 Oct 2019	Within-zone allocation transfer to M.D. and S.M. Jones	-50		+841.66
20 Nov 2019	Metered use taken for industrial water use purposes on land parcel (six acre-feet with 50% return following treatment in septic system)	-3		+838.66
25 Nov 2019	Purchase from D. Smith (Zone 2) 30 acre-feet at 0.8 per acre-foot		+24	+862.66
28 Dec 2019	Transfer to J.J. Esau	-70		+792.66
30 Mar 2020	Aquifer recharge using water sourced from the state water project		+100	+892.66
~				~
30 Sept 2020	Closing balance at the closure of the 2019/20 water year			+892.66
End of year	Amount to be carried forward to the next water year with 10% adjustment for losses	-89.3		+803.36

GSP Structure

Plan Rules

(Very hard to change,
Needs DWR approval)

Appendices

(Can be adapted by GSA as
knowledge improves and
careful community
consultation.)

Website

(Kept current
by
Watermaster)

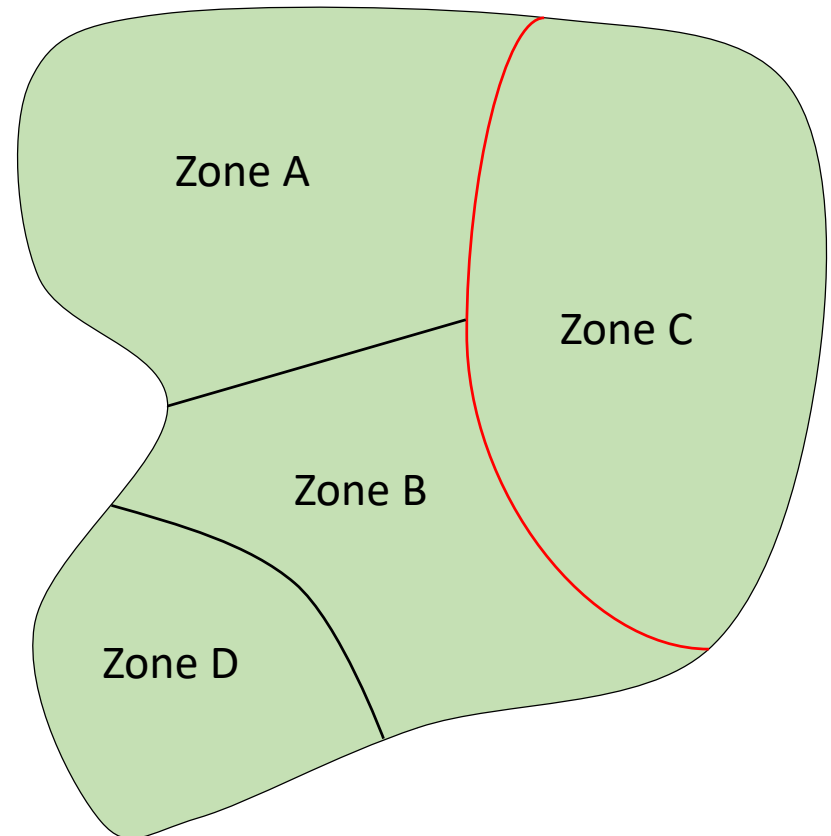
Transferring Allocations

Exchange rates and a maximum annual transfer volume are established for transfers between each zone

Zone	To A	To B	To C	To D
From A	1	0.8	0	0.6
From B	0.8	1	0	0.8
From C	0	0	1	0
From D	0.5	0.8	0	1

Notes:

- (1) Exchange rates determined via groundwater modeling and knowledge of hydraulic conditions
- (2) No more than 10% of allocations to a zone may be transferred out without a formal review of its impact.
- (3) No transfers of shares between zones allowed



Issuing Shares

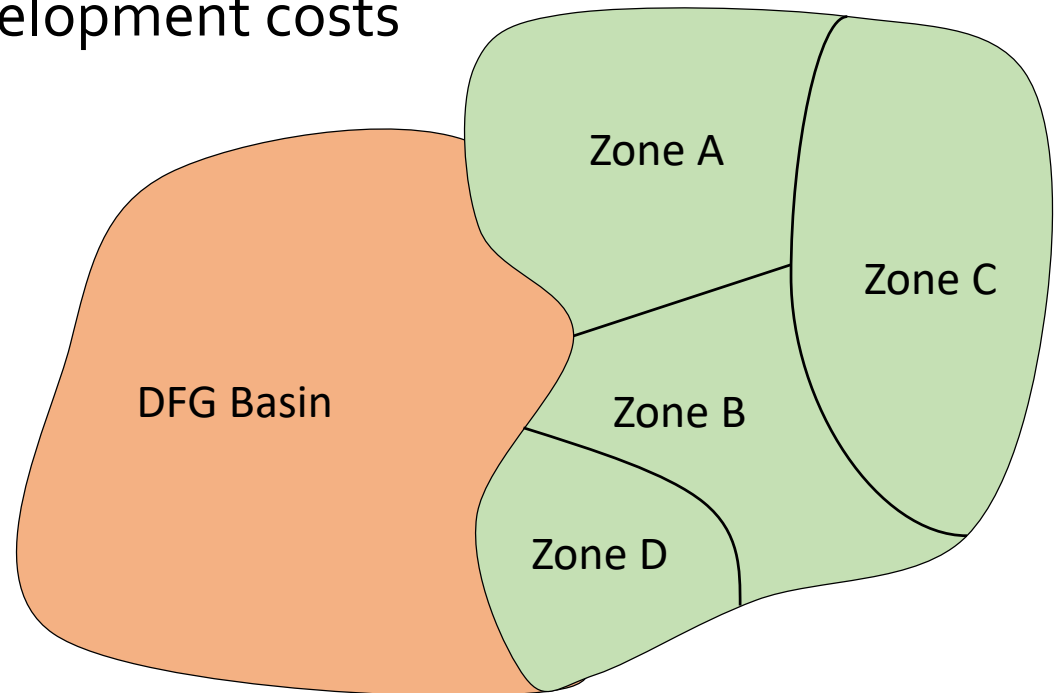
Requires careful engagement and consultation

1. Determining eligibility criteria
2. Design the share allocation database
3. Assemble and validate the database
4. **Develop and finalize the allocation formula
(Advised by an independent panel or person)**
5. Build share register and, where appropriate, record financial interests
6. Confirm accuracy of share register

Managing relationships between GSAs

Coordination Agreement established between ABC Basin GSA and DFG Basin GSA agrees to develop individual plans base on

- Balance by common date
- Common adjustment pathway
- To share common development costs



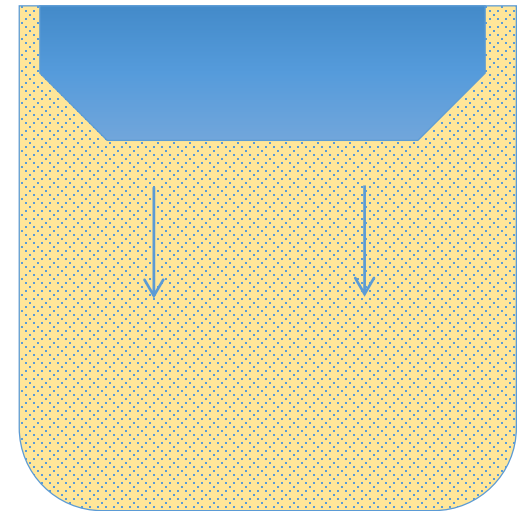
A Recharge Project

Scenario: An irrigation district constructs a recharge project.

Question: To whom does the volume belong?

Answer:

1. The Recharge Project is designated a “project” and volume is credited to Irrigation District’s Water Account.



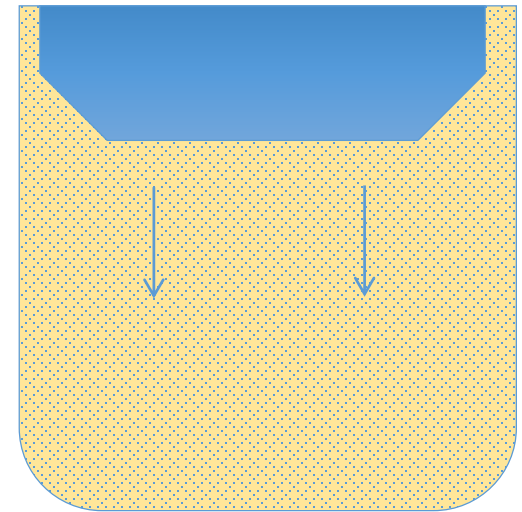
A Seeping Canal

Scenario: A canal is seeping water into the aquifer

Question: To whom does the volume of seeping water belong?

Potential Options:

1. The Canal is designated a “project” and seeping volume is credited to the Water Account of the canal owner (e.g. Irrigation District)
2. Seeping water is considered “natural recharge” and is distributed among all shareholders



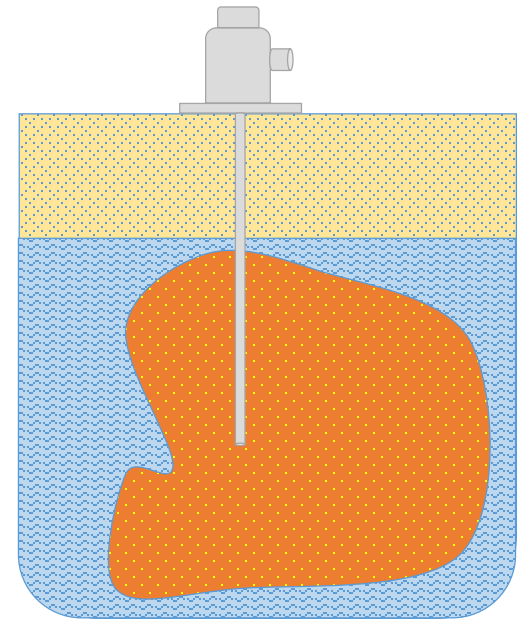
Managing a Toxic Plume

Scenario: A toxic plume is located in an area of the aquifer.

Question: How do you manage the plume?

Answer:

1. New conditions are attached to Use Permits for wells overlying the plume to control pumping rates.
2. Volumetric allocations per share are still made and can be transferred to other locations.



Preventing Cones of Depression

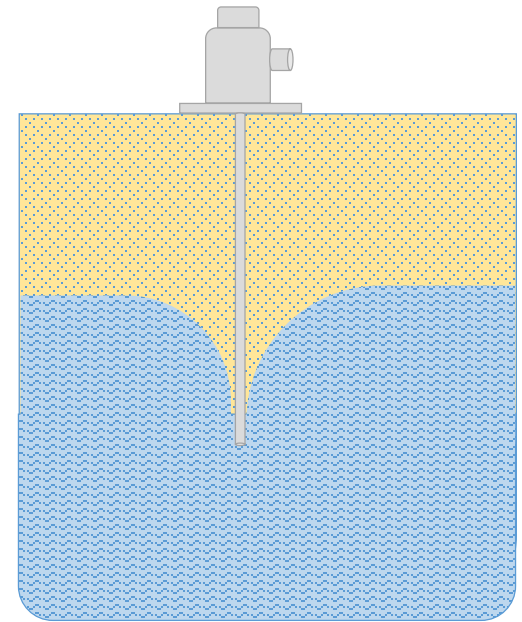
Scenario: Pumping at a high rate may produce a cone of depression causing other wells to fail.

Question: How do you manage the cone of depression?

Answer:

Groundwater Use Permits may contain:

1. Maximum pumping rate
2. Total annual &/or seasonal extraction limits.



Accessing Water

Scenario: Account holder wants to access water.

Question: How does one acquire water allocations?

Potential Options:

1. Hold shares and wait for next allocation
2. Organize a transfer
3. Invest in a recharge project

Date	Action or event	Debit	Credit	Balance
1 Oct 2019	Shares in ABC Basin allocated 0.25 af/share; Water Account holder owns 100 shares		+25	+25
15 Oct 2019	California Irrigation District Transfers 100 af from recharge project to local landowner's Water Account		+100	+125
30 Oct 2019	Water Account holder purchases 20 af from local account holder in same zone		+20	+145

Mortgaging Shares

Scenario: A shareholder wants to acquire a loan.

Question: How does the shareholder mortgage their shares as security for the loan?

Answer:

The shareholder authorizes the Webmaster to record a mortgage.

Transfer of a mortgaged share is subject to all the conditions in the mortgage have been met.

