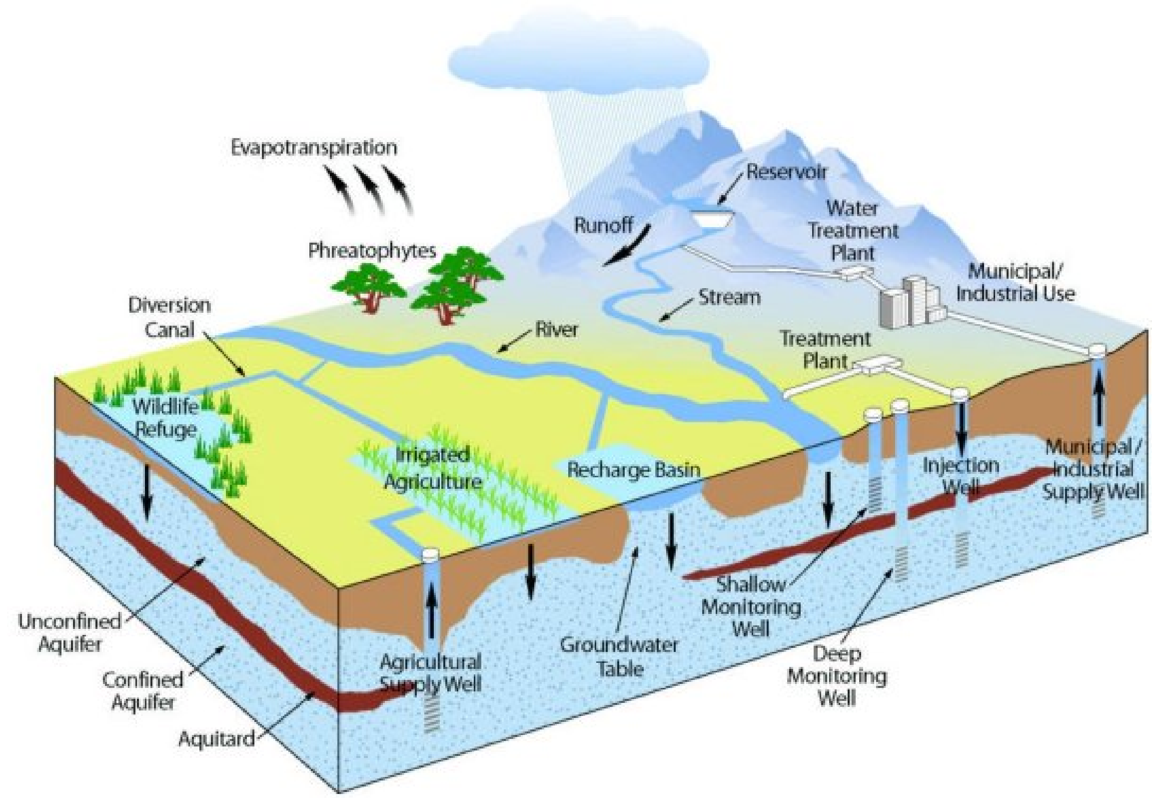
CALIFORNIA SUSTAINABLE GROUNDWATER MANAGEMENT

WHAT IS GROUNDWATER?

Groundwater is a component of the hydrologic cycle depicted by a light blue color in the block diagram below. It occurs beneath the earth's surface in pore spaces between the particles in sedimentary deposits or in rock openings, like fractures, caverns and mines.



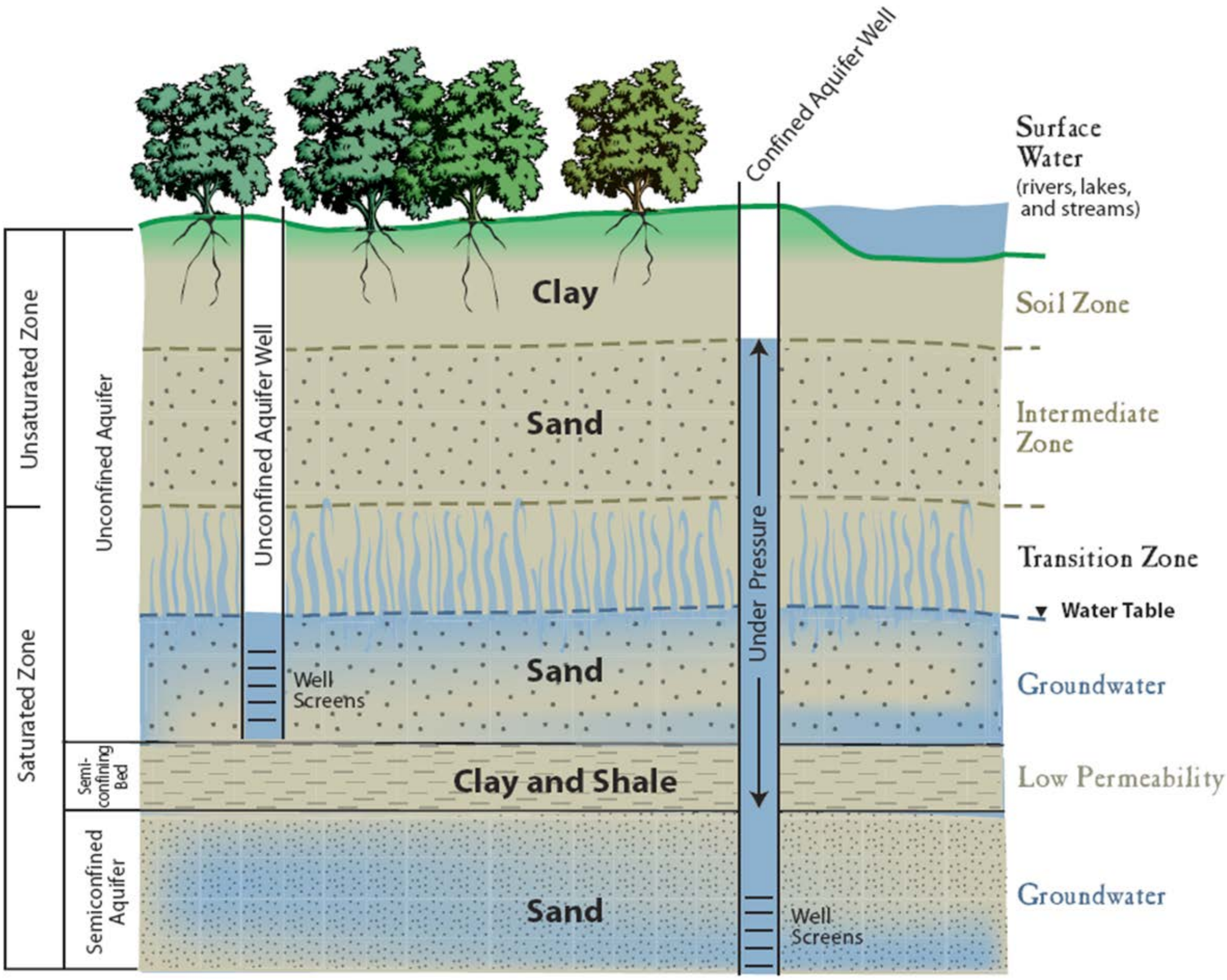
DWR, http://www.water.ca.gov/groundwater/groundwater_basics/index.cfm

SURFACE-GROUNDWATER CONNECTION, GROUNDWATER FLOW, AND WELLS

Precipitation either evaporates, is used by plants and animals, runs off the land to the ocean or infiltrates to become groundwater. Water percolates through soil beneath puddles, streams, lakes, canals and irrigated fields until it recharges groundwater. As shown on the figure above, percolation under recharge areas causes the groundwater surface to mound up and groundwater pushes outward to areas where the groundwater level is lower. Groundwater flows slowly, generally a few feet per year and usually less than 100 ft/yr. It flows slowly along the path of least resistance until it discharges to surface waters in wetlands, rivers and the ocean, a process that can take many, many thousands of years. Groundwater in transit to discharge areas can be captured by pumping wells that depress the water table around them, as shown above. This will affect the surface water that would otherwise have received the groundwater, and may deplete springs and reduce flow to streams. There are many pumping depressions that are below sea level and attract tidal saline waters from oceans and estuaries. Wells also provide access to monitor groundwater level and quality. Wells are rarely used to inject water (shown above) but this will become more common as more aquifers are managed as reservoirs for water storage and recovery.

AQUIFERS AND GEOLOGY

Aquifers are saturated geologic materials that yield water to wells. Gravity pushes groundwater over, around, under, and through the lattice of holes between particles. Sedimentary deposits from rivers form the most productive aquifers because they have gravel and sand particles with relatively large pore spaces for good water conductivity and storage. Clay and shale deposits have smaller particles and tiny pores that resist groundwater flow. Over millions of years, as rivers meander and sea level rises and falls, these different materials are commonly laid down in successively younger layers. An example below shows such a sand, clay, sand, clay sequence. Some clay and shale deposits are impermeable and confine water from flowing through them, even at high pressure. The well on the right taps a pressurized sand layer under the clay and shale deposit. Water rises in the well closer to the surface than the well on the left. There are many wells in the Central Valley that tap confined aquifers below clay layers, and water rises in them closer to the surface than in shallower wells. The water in the lower sand is under pressure because it is connected to recharge sources far away. There were many such pressurized wells in the Los Angeles basin area where water was trapped beneath tilted shale deposits and flowed up the wells to the surface. The water stored under pressure in those confined aquifers was tapped and depleted in a few decades.



DWR, http://www.water.ca.gov/groundwater/groundwater_basics/index.cfm

GROUNDWATER QUALITY

The quality of available groundwater often varies with the layers from which it is drawn. Some aquifer layers yield high quality water while others contain salts or undesirable elements like arsenic. Placement of well intake zones and seals between layers should be carefully considered. As an aquifer becomes depleted, the zones of highest water quality become increasingly valuable and the risks of contamination from poor quality zones are greater. Wells that penetrate layers of different water quality are a recognized problem in California basins because they create pathways for cross contamination, and can bleed useful pressure from confined layers.

SUBTERRANIAN STREAMS - SCIENTIFICALLY SPEAKING

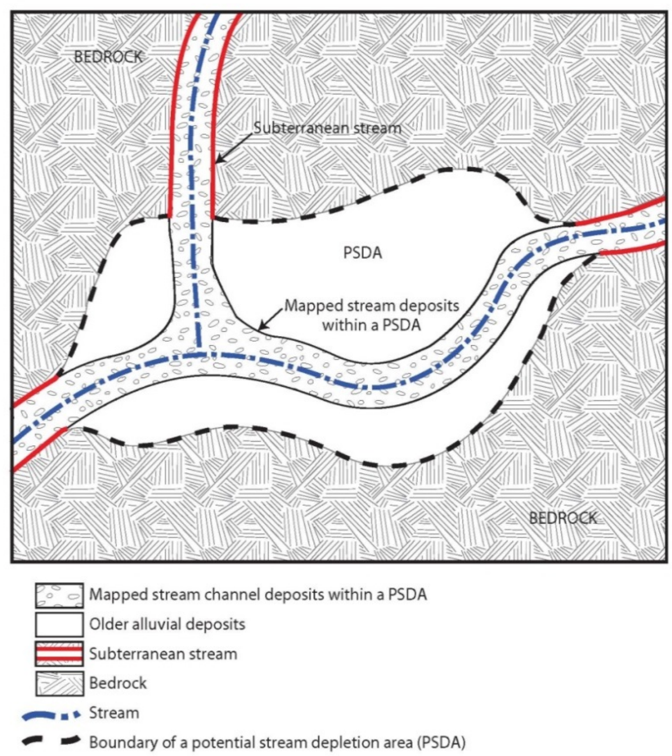
The State Water Resources Control Board (SWRCB) has permitting authority over "subterranean streams flowing in known and definite channels". This is an important issue for water managers adjacent to active streams. In alluvial channels along streams, extracting groundwater from wells is regulated just like a direct taking of surface flow. In this setting, groundwater is flowing through river-laid deposits and is moving parallel with the stream water as one body of water. It is supporting the level in the stream. Distinguishing if water from a well is from a subterranean stream can be vague and contentious. Below is an example of guidance for delineating a Potential Streamflow Depletion Area in one jurisdiction.

Scientifically speaking, other geologic circumstances could meet the definition of the SWRCB's subterranean stream authority.

Two natural subterranean passages that host stream-like flow are lava tubes and limestone caverns. These subterranean conduits can supply voluminous flows to large springs. They are present in California but are very rare and are of only local consequence for water managers.

Clear examples of fossil stream channels occur in the Sierra foohills where ancient vigorous streams were buried by mudflows that hardened into rock. The coarse gravel in the fossil channel is a preferred pathway for groundwater flow, which is measurably greater than elsewhere in the vicinity, and is confined to within discernable banks.

FIGURE 2



SCHEMATIC MAP SHOWING RELATIONSHIP BETWEEN SUBTERRANEAN STREAMS, POTENTIAL STREAM DEPLETION AREAS AND MAPPED STREAM CHANNEL DEPOSITS

From Stetson Engineers, Technical Memorandum Approach to Delineate Subterranean Streams and Determine Potential Streamflow Depletion Areas, Feb 28, 2008.

GROUNDWATER BASINS

Groundwater basins and sub-basins in California are areas underlain by alluvial aquifers. The California Department of Water Resources (DWR) has identified 515 groundwater basins and sub-basins throughout the State, shown below. These basins and subbasins are legally distinct groundwater areas that are the basic planning units of Sustainable Groundwater Management Act (SGMA). Maps and descriptions of all the basins are listed in DWR Bulletin 118 or at the following link:

California Groundwater Basins

California Groundwater Basins and Subbasins

Source: Department of Water Resources, CWP 2013

DWR, Bulletin 118, http://www.water.ca.gov/groundwater/bulletin118/gwbasins.cfm

Basins are of variable depth, and may reach many hundreds to thousands of feet below the surface. Their surface boundaries are defined in part by rivers, drainage divides and bedrock outcrops. In DWR's on-going basin boundary modification process, the emphasis appears to be to conform basin and subbasin boundaries to political boundaries where it would appear to better facilitate groundwater management under the SGMA discussed below.

GROUNDWATER SUSTAINABILITY PLANNING IN CALIFORNIA

California law requires groundwater basins to be managed in a sustainable manner. The text of the **Sustainable Groundwater Management Act (SGMA)** can be accessed at the link:

SGMA Text

SGMA clearly defines sustainable management and how it will be implemented.

SGMA Definitions

"Sustainable Groundwater Management" is the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results.

"Undesirable results" mean any of the following effects caused by groundwater conditions occurring throughout the basin:

1. Chronic lowering of groundwater levels, but excluding reductions in groundwater levels during a drought if they are offset by increases in groundwater levels during other periods;
2. Significant and unreasonable reductions in groundwater storage;
3. Significant and unreasonable seawater intrusion;
4. Significant and unreasonable degradation of water quality;
5. Significant and unreasonable land subsidence; and
6. Surface water depletions that have significant and unreasonable adverse impacts on beneficial uses.

Groundwater Sustainability Agencies (GSA) will be formed by public entities in each basin (or sub-basin) to coordinate the management. The agencies will have powers to levy and collect fees to develop and support sustainable management and enforce a **Groundwater Sustainability Plan (GSP).**

The timing of agency formation and plan development is determined by a combination of basin priorities established by the **Department of Water Resources (DWR)** and deadlines specified in SGMA**.** For example, GSAs in medium- and high-priority basins and subbasins must be established by June 30, 2017. In addition, in January 2016, DWR designated 21 basins and subbasins as "Critically Overdrafted Basins." Basins or subbasins that are designated as critically overdrafted must adopt a GSP by January 30, 2020; all other basins or subbasin have until January 31, 2022.

Critically Overdrafted Basins
Basin Priority

The State Water Resources Control Board (SWRCB) may designate "probationary basins" if no GSA has been formed by the June 30, 2017, deadline or no timely GSP has been developed for a basin or subbasin. The SWRCB staff has made it clear that they will focus on the sixth Undesirable Result (defined above) if a river or stream is affected by groundwater extractions, and will establish and enforce pumping curtailments if needed to meet the SWRCB-developed GSP objectives.

Below are links to official resources about SGMA and its implementation:

Sustainable Groundwater Management

The Water Education Foundation has published a Handbook to Understanding and Implementing the Law:

SGMA Handbook

FOUNDATIONS OF SGMA – LEGALLY SPEAKING

SGMA Section 10720.5 states that "Nothing in SGMA modifies rights or priorities to use or store groundwater consistent with Section 2 of Article X of the California Constitution, except that in basins designated medium- or high-priority basins by DWR, no extraction of groundwater between January 1, 2015, and the date of adoption of a groundwater sustainability plan pursuant to this part, whichever is sooner, may be used as evidence of, or to establish or defend against, any claim of prescription." While the "except" clause has significant groundwater law implications, the existing law pertaining to groundwater rights and priorities among pumpers and the Article X Section 2 requirement that all water be used in a reasonable and beneficial manner remains unchanged. Therefore, each pumper should consult with a water attorney to assist in a determination of the pumper's groundwater rights and the pumper's relative priority among all pumpers within the pumper's basin or subbasin.

In addition, knowing your groundwater rights is one thing, proving your rights is something very different but essential. For example, if you are subject to a groundwater adjudication, you will have only six months to report to the court the quantity of groundwater you extracted from the basin or subbasin and the method of measurement used **for each of the previous 10 years preceding** the filing of the adjudication complaint, (California Code of Civil Procedure Section 842(a)(2)). A discussion of how you prove and report your groundwater extractions is beyond the scope of this summary. Other related issues include how you could preserve and protect your groundwater extraction rights in those years in which you have reduced your groundwater pumping because you are able to use surface water instead.

While most people are focusing on the machinations and details of SGMA, you must understand that SGMA has an existing foundation consisting of groundwater hydrology, DWR-designated basins and subbasins, groundwater law, and your own need to prove your groundwater extractions based upon recognized methodologies. Ninety percent of an iceberg is underwater. SGMA is like the top ten percent you can see. The other ninety percent is what sank the Titanic.

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