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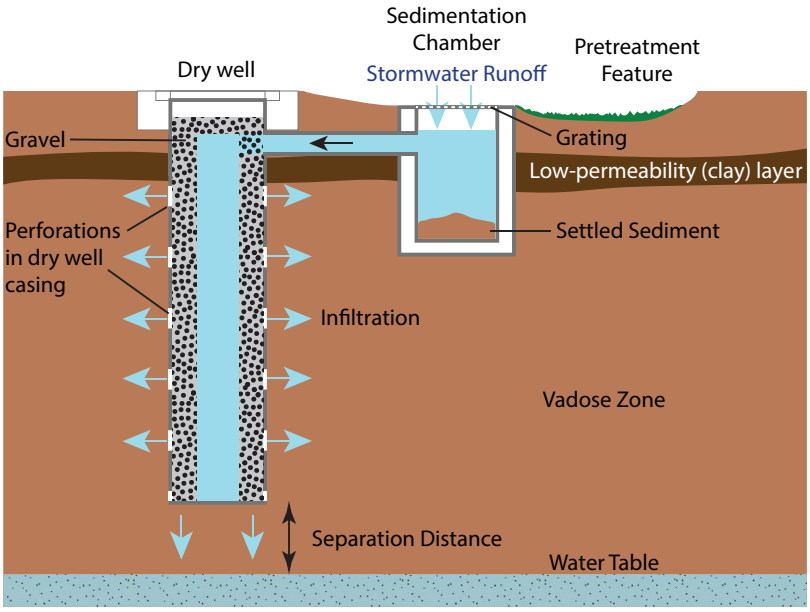
Factsheet

Dry wells for stormwater management

Wells used to drain stormwater and recharge groundwater supplies

What is a Dry Well?

A dry well is a well that is used to transmit surface water underground and is deeper than its width at the surface (see image, below). Most drywells are 30 to 70 feet deep and 3 feet wide at the surface. They are lined with perforated casings and can be filled with gravel or rock or left empty. Today, dry wells usually include some form of pretreatment to remove oil, particles, and associated contaminants, reducing the risk of clogging the wells and of transporting contaminants underground.



Typical dry well design with pretreatment features (not to scale). Arrows indicate the flow of stormwater through the dry well system and into the surrounding sediment and rock. Image Credit: E. Edwards and B. Mandler

Environmental and Human Benefits

Dry wells can be used to reduce the adverse effects of stormwater runoff on streams and rivers. Capturing urban stormwater prevents the runoff from entering streams and lakes where contaminants could cause pollution and erosion could damage aquatic habitats. Dry wells can also be used to return water to aquifers: a single dry well can transmit up to 5 acre-feet of water per year to underlying aquifers, equivalent to the water needs of about 10 households. This ability to recharge local groundwater supplies can help increase water resource security by mitigating the effects of drought or excessive groundwater extraction.

Quick Facts

Dry wells have been used around the world for decades. They are used in Australia, Europe (e.g. UK and France), Asia (e.g. Japan and India), and the US.

Dry wells are also known as soakaways, soakwells, and soak pits.

The majority of U.S. states oversee their own dry well programs; the rest are regulated directly by the EPA.

States with large dry well programs (number of dry wells in state):

- Washington: 100,000
- Arizona: 52,000
- Oregon: 46,000
- California: 35,000

Key words

Aquifer - coarse gravel or rock that contains and/or transmits groundwater.
PAH - polycyclic aromatic hydrocarbons, a group of carcinogenic molecules commonly formed by burning wood and other matter.
Water table - the depth underground below which rocks are saturated with (ground)water
Vadose zone - the area below the land surface but above the water table - this region conducts but is not saturated with water

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Risks to Groundwater Quality

Dry well use has been limited in some places by the concern that dry wells could contaminate groundwater, including drinking water, by reducing the distance contaminated stormwater must travel through sediment in order to reach groundwater. Surface soil and underground sediment remove contaminants by acting as a natural filter, but dry wells allow stormwater contaminants to bypass many underground layers. Groundwater contamination has occurred in the past when surface contaminant spills have entered dry wells, or when substances have been illegally dumped into open dry well. However, groundwater contamination is rare when dry wells are used as intended and when appropriate precautions are taken. Contamination risk can be reduced by using dry wells at sites where spills are unlikely or installing emergency shut-off valves to keep out contaminated water.

Dry wells can be a safe and effective way to manage stormwater and recharge groundwater as long as:

- The stormwater is not contaminated
- Appropriate pretreatment is used
- The dry wells are installed in suitable locations

A vegetated pretreatment feature (grassy swale) with dry well in center.
Image Credit: California Office of Environmental Health Hazard Assessment

References

For a complete listing of references, please visit the web version of this factsheet at www.americangeosciences.org/critical-issues/factsheet/dry-wells-stormwater-management

Avoiding Risks Associated with Dry Wells

Appropriate pretreatment design. Efficient pretreatment is the key to keeping contaminants out of groundwater. Vegetation helps to trap sediment and associated contaminants (see image, bottom-left). Sedimentation chambers further remove contaminants by allowing sediment to settle out of stormwater.

Safe dry well siting. Some states provide guidelines for where to install dry wells as part of their permitting process. These guidelines include minimum vertical separation distances between the dry well and groundwater, horizontal separation from municipal wells, the amount of pretreatment required, and appropriate land use surrounding a potential dry well. Typically, 10 feet of vertical separation is required between the dry well bottom and the water table, and a vadose zone of sand/gravel and clay is ideal for removing contaminants while still allowing aquifer recharge. Contaminant-rich areas, such as gas stations and many industrial sites, are often unsuitable for dry well installation.

Stormwater quality monitoring. For any new dry well installation, it is important to monitor the composition of stormwater entering the well over several years to identify potential risks to groundwater. Stormwater entering the well may be analyzed for common urban contaminants (metals, combustion by-products (PAHs), pesticides/herbicides, and volatile organics) and water soluble pollutants (e.g., nitrate and neonicitonoids).

More Resources

Environmental Protection Agency - Stormwater Drainage Wells: https://www.epa.gov/uic/stormwater-drainage-wells

Environmental Protection Agency - Class V Underground Injection Control Study: https://www.epa.gov/uic/class-v-underground-injection-control-study

American Geosciences Institute - Dry Well Usage Across the United States: www.americangeosciences.org/critical-issues/factsheet/dry-well-usage-us

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