ITRC (Interstate Technology & Regulatory Council). 2023. Managed Aquifer Recharge Guidance MAR-1. Washington, D.C.: Interstate Technology & Regulatory Council, MAR Team. https://mar-1.itrcweb.org/.

Glossary

A

Adsorption
The mechanism whereby ions or compounds within a liquid or gas adhere to a solid surface upon contact.

Advanced treated water (ATW)
Wastewater that has been thoroughly treated by advanced treatment processes to reduce contaminant concentrations (including virus and pathogen reduction) to meet regulatory limits. This water often contains such low levels of impurities (for example, TDS) that it requires conditioning before it can be recharged.

Advection
The transport of solutes along with flowing groundwater.

Alkalinity
The acid neutralizing capacity of a solution.

Agricultural return flow
The portion of irrigation water that leaves the field, either as surface runoff or as infiltration to the water table.

Anisotropy
The dependence of a property on direction; for example, hydraulic conductivity is commonly different in the horizontal and vertical directions.

Aquifer storage and recovery (ASR)
A water resources management technique for storing water underground during wet periods and recovering that water at a later date, typically facilitated by ASR specific wells. These wells can be used for both the injection of source water and recovery of groundwater.

Aquifer storage transfer and recovery (ASTR)
An ASTR system uses separate injection wells and extraction wells allowing the injected water to migrate or transfer from the injection area prior to extraction occurring.

B

Base flow
The component of river or streamflow between storm flow peaks. Base flow is composed predominately of groundwater that discharges to the stream bed. Enhancing baseflow, particularly during low seasonal flow or during droughts, is a target for MAR.

Biofouling
The unwanted accumulation of microorganisms, plants, or algae on surfaces such as well screens that cause degradation of the surface's primary function.

C

Clay swelling
The tendency of some clays to increase in volume due to changes in water content or and/or salinity.

Confined aquifer
Aquifers that are bounded above and below by lower permeability confining units. Confined aquifers are pressurized, and therefore the water level in a well completed in a confined aquifer typically rises above the top of the aquifer.

D

Desorption
The opposite of adsorption; the release back into solution of a solute that formerly clung to a solid surface.

Dewatering
The pumping of groundwater to lower the water table below the base of an excavation. Dewatering is frequently used in construction projects and open-pit mining.

Disinfection by-products
Chemicals formed when organic and inorganic matter react during water treatment processes. An example is the formation of chloroform when chlorine reacts with organic matter in the water.

Dispersion
The dilution of a solute along the advancing edge of groundwater flow. Dispersion is caused by the variability in both pore-scale velocities and flow path distances due to the physical characteristics of flow in porous media.

E

Environmental justice
The fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies (USEPA 2023b)

F

Flood-managed aquifer recharge (Flood-MAR)
An integrated and voluntary resource management strategy that uses floodwater resulting from, or in anticipation of, rainfall or snow melt for MAR on agricultural lands and working landscapes, including but not limited to refuges, floodplains, and flood bypasses. (Flood-Managed Aquifer Recharge (Flood-MAR) (ca.gov))

H

Hydraulic conductivity
A measure of how easily water flows through the aquifer. Values of hydraulic conductivity typically range over orders of magnitude.

Hydrogeologic conceptual model
A hydrogeologic framework that forms one of the foundational pillars in planning and designing the MAR project. The hydrogeologic conceptual model typically consists of a report that provides the hydrogeologic setting (hydrostratigraphy), receiving aquifer physical characteristics (for example, depth to water, permeability, storage coefficient, degree of confinement), receiving groundwater quality, groundwater flow characteristics (directions, rates, volumes, variability), nearby public and private groundwater users, and groundwater/surface water connections.

Hydrogeologic feasibility
Feasibility of both recharging an aquifer and later recovering the recharged water.

I

Injection well
As used in this document, an injection well, also referred to as a recharge well, is a bored, drilled, or driven shaft or a dug hole where the depth is greater than the largest surface dimension used to directly supply water into the saturated zone or aquifer(s) for the purpose of recharge or replenishment.

Ion exchange
Sorption process in which ions of like charge are exchanged between a solid and a solution surrounding the solid.

L

Liquefaction
When saturated, loosely packed soil near the ground surface liquefies and loses all strength during an earthquake. Liquefaction often results in major structural damage.

M

Managed aquifer recharge (MAR)
The purposeful recharge of water to aquifers for subsequent recovery or for environmental benefit (Dillon et al. 2009).

P

Phreatophyte
Plant with a deep root system that taps the water table aquifer.

Produced water
Oil wells produce both oil and water; this water is commonly known as produced water. Produced water is typically very saline and contains both suspended and dissolved hydrocarbons.

R

Receiving aquifer
Aquifer into which source water is applied. An aquifer can be a porous medium such as sand and gravel, fractured hard rock such as granite, karst, or a combination.

Receiving aquifer lithology and mineralogy
The general physical and chemical characteristics of the solid materials that make up the aquifer matrix. For example, a quartz (mineral) sandstone (lithologic) aquifer.

Recharge front
The interface where source water comes into contact with native groundwater.

Recharge technology
Method used to introduce source waters into an aquifer. Technology can range from relatively passive methods such as farm-flood infiltration to more intensive methods such as injection wells.

Reclaimed water
As used in this document, the term “reclaimed water” has the same meaning as “recycled water.”

Recycled water
Treated wastewater that is reused for a new purpose, such as irrigation, potable water supply, and groundwater supply, among others. Sources of wastewater include but are not limited to municipal, industrial, and agricultural wastewater.

Redox
Redox reactions are chemical reactions that involve the transfer of electrons between two species, where oxidation is the loss of electrons and reduction is the gain of electrons.

Residence time
Length of time recharged water resides in an aquifer before it is extracted. Residence times can be mandated by regulatory agencies to ensure pathogens and other contaminants are filtered from the recharged source water prior to being removed from the subsurface and served as drinking water.

S

Saturation Index
A measure indicating the tendency of water to dissolve or precipitate a particular mineral.

Seismicity
The occurrence or frequency of earthquakes in a region.

Soil aquifer treatment
The filtration of wastewater through the soil matrix to remove wastewater contaminants through physical, chemical, and biological processes.

Source water
Source water intended for use as recharge. This can range from transient sources such as captured available flood flows to more consistent sources such as treated water originating from a wastewater treatment plant. Source water availability and quality are key components in the design and implementation of MAR projects. Source water quality can be highly variable and may require treatment or design constraints to improve water quality prior to use in recharge.

Specific storage
A parameter that quantifies the change in aquifer storage due to compressibility effects of both the water and the aquifer matrix.

Specific yield
The fraction of the total aquifer volume that can be either drained of water or refilled with water. The upper bound on the specific yield is the total porosity of the aquifer, but the specific yield is typically less than the porosity because capillary pressure effects prevent the complete replacement of one fluid in aquifer pore space with a different fluid.

Storm flow
The peak in discharge from a river or basin that is seen after a precipitation event. Storm flow is composed predominately of runoff with some through flow. The water associated with storm flow may contribute to flooding and may be more than demand and thus potentially available for MAR.

Stormwater
Stormwater runoff is generated from rain and snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground (USEPA 2023b).

T

Tracer study
Aquifer studies that are performed to understand groundwater flow pathways and residence times. Tracers can include naturally occurring chemicals and introduced substances such dyes, salts, and isotopes. These are often performed when injecting treated wastewater.

U

Unconfined aquifer
An aquifer whose upper water surface (water table) is at atmospheric pressure and is able to receive direct infiltration/recharge from precipitation or surface water.

V

Vadose zone
The unsaturated to intermittently saturated zone between the ground surface and the water table.

W

Water banking
The purposeful recharge of surface water or treated water with the intent to recover a portion of the water later by the parties that performed the recharge.

Water supply resilience
The ability to recover from disruptive events such as droughts and floods and adapt to future uncertainty.