CHAPTER 1

GENERAL

1-1. Purpose and scope. This manual provides guidance in determining water requirements for Army mobilization installations and is applicable in selection and planning of supply systems. Other manuals in this series are:

EM 1110-3-161	Water Supply, Water Sources
EM 1110-3-162	Water Supply, Water Treatment
EM 1110-3-163	Water Supply, Water Storage
EM 1110-3-164	Water Supply, Water Distribution
EM 1110-3-166	Water Supply, Fire Protection

1-2. Definitions.

a. General definitions. The following definitions, relating to all water supplies, are established.

(1) Water works. All construction (structures, pipe, equipment) required for the collection, transportation, pumping, treatment, storage, and distribution of water.

(2) Supply works. Dams, impounding reservoirs, intake structures, pumping stations, wells, and other construction required for the development of a water supply source.

(3) Supply line. The pipeline from the supply source to the treatment works or distribution system.

(4) Treatment works. All basins, filters, buildings, and equipment for the conditioning of water to render it acceptable for a specific use.

(5) Distribution system. A system of pipes and appurtenances by which water is provided for domestic, industrial, and firefighting uses.

(6) Feeder mains. The principal pipelines of a distribution system.

(7) Distribution mains. The pipelines that constitute the distribution system except service lines.

(8) Service line. The pipeline extending from the distribution main to building served.

(9) Effective population. The resident personnel and dependents plus an allowance for nonresident personnel, derived by adding one-third of the population figure for nonresidents to the figure for residents.

$$\text{Effective Population} = \frac{\text{Nonresident Population}}{3} + \text{Resident Population}$$

(10) Backflow. The flow of any foreign liquids, gases, or other substances into the distributing pipelines of a potable supply of water from any source or sources not intended.

(11) Back-siphonage. The backing up, or siphoning, of a foreign liquid into a potable water system; this occurs when the potable water system, at any point or place, is at a pressure less than atmospheric, with an opening or break in the system, thereby drawing the foreign liquid toward the potable water.

(12) Capacity factor. The multiplier which is applied to the effective population figure to provide an allowance for reasonable population increase, variations in water demand, uncertainties as to actual water requirements, and for unusual peak demands whose magnitude cannot be accurately estimated in advance. The capacity factor varies inversely with the magnitude of the population in the water service area.

(13) Design population. The population figure obtained by multiplying the effective-population figure by the appropriate capacity factor.

$$\text{Design Population} = \text{Effective Population} \times \text{Capacity Factor}$$

(14) Required daily demand. The total daily water requirement. Its value is obtained by multiplying the design population by the appropriate per capita domestic water allowance and adding to this quantity any special industrial, aircraft-wash, irrigation, air-conditioning, or other demands. Other demands include the amount necessary to replenish in 48 hours the storage required for fire protection and normal operation. Where the supply is from wells, the quantity available in 48 hours of continuous operation of the wells will be used in calculating the total supply available for replenishing storage and maintaining fire and domestic demands and industrial requirements that cannot be curtailed.

(15) Peak domestic demand. For system design purposes, the peak domestic demand is considered to be the greater of:

(a) Maximum day demand, i.e., 2.5 times the required daily demand.

(b) The fire flow plus 50 percent of the required daily demand.

(16) Fire flow. The required number of gpm at a specified pressure at the site of the fire for a specified period of time.

(17) Fire demand. The required rate of flow of water in gpm during a specified fire period. Fire demand includes fire flow plus 50 percent of the required daily demand and, in addition, any industrial or other demand that cannot be reduced during a fire period. The residual pressure is specified for either the fire flow or essential industrial demand, whichever is higher. Fire demand must include flow required for automatic sprinkler and standpipe operation, as well as direct hydrant flow demand, when the sprinklers are served directly by the water supply system.

(18) Rated capacity. The rated capacity of a supply line, intake structure, treatment plant, or pumping unit is the amount of water which can be passed through the unit when it is operating under design conditions.

(19) Cross connection. Any physical connection which provides an opportunity for nonpotable water to contaminate potable water. Two types recognized are:

(a) A direct cross connection is a physical connection between a supervised, potable water supply and an unsupervised supply of unknown quality. An example of a direct cross connection is a piping system connecting a raw water supply, used for industrial fire fighting, to a municipal water system.

(b) An indirect cross connection is an arrangement whereby unsafe water, or other liquid, may be blown, siphoned, or otherwise diverted into a safe water system. Such arrangements include unprotected potable water inlets in tanks, toilets, and lavatories that can be submerged in unsafe water or other liquid. Under conditions of peak usage of potable water or potable water shutoff for repairs, unsafe water or other liquid may backflow directly or be back-siphoned through the inlet into the potable system. Indirect cross connections are often termed "backflow connections" or "back-siphonage connections." An example is a direct potable water connection to a sewage pump for intermittent use for flushing or priming.

(20) Elevated storage. That capacity or volume of a tank or reservoir above the minimum required hydraulic gradient. Elevated storage can be:

(a) Above natural grade - supported by a tower or pedestal where all storage is contained above ground except for water in feeder or supply pipes.

(b) At natural grade.

(c) Below natural grade.

(21) Ground storage. That capacity or volume of a tank or reservoir below the minimum required hydraulic gradient.

(22) Standpipe. A cylindrical tank whose height exceeds its diameter and is normally constructed of steel or reinforced concrete.

(23) Minimum required hydraulic gradient. That line (or plane) defining the minimum required residual pressures at given points during periods of peak demand.

(24) Uniformity coefficient. The ratio of the grain size of gravel or filter material for 40 percent retention to the grain size of gravel or filter material for 90 percent retention as measured by sieve analyses.

b. Ground water supply definitions. The meanings of several terms used in relation to wells and ground waters are shown in figure 1-1.

(1) Specific capacity. The specific capacity of a well is its yield per foot of drawdown and is commonly expressed as gpm per foot of drawdown.

(2) Aquifer. A porous, water-bearing geologic formation. The term is generally restricted to formations capable of yielding an appreciable supply of water.

(3) Confined aquifer. An aquifer that is surrounded by geologic formations of less permeable or impermeable material. An artesian well is one that taps a "confined aquifer."

(4) Unconfined aquifer. An aquifer whose upper limit is at atmospheric pressure. Unconfined aquifers are sometimes termed "water table" aquifers and are recharged principally by vertical percolation.

(5) Permeability coefficient. Permeability is a measure of the capacity of a porous formation for transmitting water. The standard permeability coefficient is the rate of flow of water at 60 degrees F., in gpd, through a cross section of 1 square foot, under a hydraulic gradient of unity.

(6) Transmissibility coefficient. The rate of flow in gpd through an aquifer's vertical section, whose height is the thickness of the aquifer and whose width is 1 foot, under a hydraulic gradient of unity, is the transmissibility coefficient. The transmissibility coefficient is, therefore, the product of the "standard permeability coefficient" and the aquifer thickness.

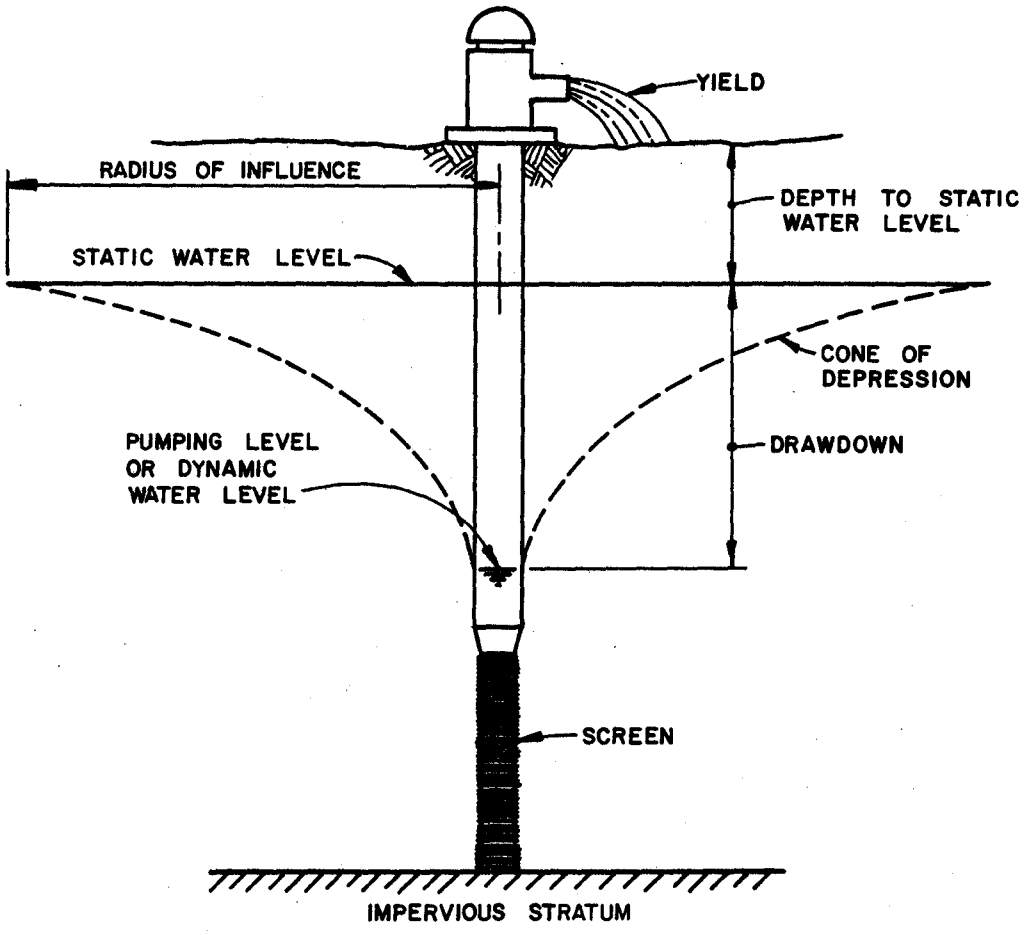

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FIGURE 1-1. DIAGRAMMATIC SECTION OF A WELL

(7) Vertical line shaft turbine pump. A vertical line shaft turbine pump is a centrifugal pump, usually having from one to 20 stages, used in wells. The pump is located at or near the pumping level of water in the well, but is driven by an electric motor or internal combustion engine on the ground surface. Power is transmitted from the motor to the pump by a vertical drive shaft.

(8) Submersible turbine pump. A submersible turbine pump is a centrifugal turbine pump driven by an electric motor which can operate when submerged in water. The motor is usually located directly below the pump intake in the same housing as the pump. Electric cables run from the ground surface down to the electric motor.

1-3. Environmental considerations. In general, the local and state environmental protection laws of the subject area will be applicable to the construction and operation of the mobilization facility. Agencies of these governing organizations should be contacted before construction begins to insure compliance with all applicable laws. For information on environmental policies, objectives, and guidelines, refer to AR 200-1.