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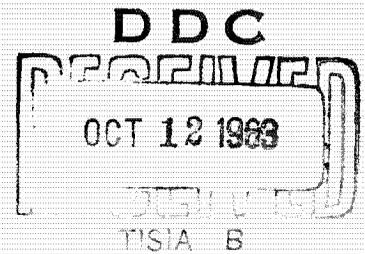
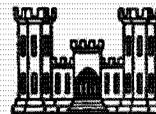
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ENGINEERING AND DESIGN

WATER SUPPLY
FOR
SPECIAL PROJECTS



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WATER SUPPLY FOR SPECIAL PROJECTS
Army and Air Force

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ENGINEERING AND DESIGN
WATER SUPPLY FOR SPECIAL PROJECTS
Army and Air Force

1. **PURPOSE.** This manual prescribes the total quantities of water required for domestic purposes and for fire protection at various small military projects. It prescribes the duration and rates of flow required for fire-hydrant hose streams. It establishes criteria concerning the treatment of water, pumping, pneumatic pressure systems, and the locating of fire hydrants.

2. **SCOPE.** The manual will be used by all elements of the Corps of Engineers performing military construction and by those elements of the Air Force planning military construction.

3. **REFERENCES.**

- a. EM 1110-345-165 Plumbing (Engineering Manual for Military Construction, Part V, Chapter 4)
- b. EM 1110-345-22 Water Supply—General Considerations (AFM 88-10, Chap. 1)
- c. EM 1110-345-221 Water Sources (AFM 88-10, Chap. 2)
- d. EM 1110-345-222 Water Treatment (AFM 88-10, Chap. 3)
- e. EM 1110-345-223 Water Storage (AFM 88-10, Chap. 4)
- f. EM 1110-345-224 Water—Distribution Systems (AFM 88-10, Chap. 5)
- g. EM 1110-345-228 Water Supply for Fire Protection (AFM 88-10, Chap. 6)

4. **GENERAL.** Many special projects and tactical sites have special water requirements that are not covered by the Engineer Manuals referenced hereinbefore. This manual covers water-supply requirements for some of these sites; requirements for those not mentioned will be covered by special instructions from the Chief of Engineers.

5. **DOMESTIC WATER REQUIREMENTS.** All stations with populations of 500 or more will be designed on the basis of a demand of 150 gallons per capita per day with the capacity factor applied. Where the population is less than 500, capacity factor will also be applied and the following demands will govern:

a. *Antiaircraft Tactical Sites, Including Family Housing.* Average demand will be 150 gallons per capita per day. Peak demand will be determined according to fixture units (see EM 1110-345-165) plus 52 gallons per minute to any one of the underground structures. Residual pressures will be not less than 30 pounds per square inch at the emergency shower fixtures and not less than 20 pounds per square inch at other fixtures.

b. *Air Control and Warning Stations.* Average demand will be 150 gallons per capita per day. Minimum pressure in the distribution system will be 30 pounds per square inch. Where sufficient supply at required pressure is not available from an existing dependable source, a pneumatic pressure system will be necessary supplemented by a ground storage tank and pump equipment. (See EM 1110-345-165.)

c. *Reserve Centers.* Demand will be based on fixture units. (See EM 1110-345-165.)

d. *Use of Existing Facilities.* Expansion of existing facilities that have proved

adequate will not be undertaken solely to comply with these criteria. Where an increased authorized population can be accommodated by existing facilities, these facilities will not be expanded. If the increased population will require expansion of existing facilities or if existing inadequate and unsuitable facilities are to be replaced, the capacity factor will be applied.

6. FIRE PROTECTION. Where required, the normal fire flow will be 500 gallons per minute.

a. *Antiaircraft Tactical Sites.* Fire protection will not be provided by the water system.

b. *Family Housing at Tactical Sites.* Fire hydrants and a system capable of delivering a sustained flow of 500 gallons per minute for 1 hour at a residual pressure of not less than 45 pounds per square inch at the most remote hydrant will be provided. Hydrants will be so located that no family unit entrance is more than 200 feet from the hydrant. Where local fire departments are not readily available, each hydrant will be provided with a mill-type hose house equipped with 300 feet of 2½-inch C.R.L. fire hose, a 7/8-inch Underwriters-type nozzle, and spanner and hydrant wrenches in each hose house. Where ground storage is required, the fire pump will be electrically driven with a remotely located manual starting station in each hose house and an automatic starting switch that will start the pump upon drop in line pressure well below the pressure that would exist at maximum domestic water demand. The pump will not be equipped for automatic stopping except upon complete consumption of reservoir water.

For projects involving more than 20 family-housing units, specific requests for waivers will be submitted to the Chief of Engineers, attention ENGMI, outlining circumstances and alternate fire-protection means contemplated.

For projects involving 20 units or less, the Division Engineer is authorized to approve deviations from these criteria to the extent that fire protection will be provided where local circumstances or cost limitations dictate.

Where future expansion is contemplated that will result in more than a total of 20 units, provision will be made for ultimate installation of fire protection prescribed above.

c. *Air Control and Warning Stations.* Fire-flow requirement will be 500 g.p.m. for a 2-hour period with a minimum residual pressure of 10 pounds per square inch at the fire hydrants. This will require the use of a mobile fire pumper capable of discharging 500 g.p.m. at a pressure of 90 pounds per square inch (based upon two standard fire streams each of which will be conveyed through 300 feet of 2½-inch rubber-lined cotton fire hose). Where ground storage is required and an adequate supply of electricity is available, a stationary dual-powered fire pump will provide the fire flow at a residual pressure of 90 pounds per square inch at the fire hydrants under fire-flow conditions. Where an adequately assured source of electricity is not available, a suitable gasoline-engine-driven pump will be used. Hydrants will be at least 25 feet and preferably 50 feet away from a building and so located that each building may be reached with 300 feet of fire hose. Water supply for fire protection of gate houses and other buildings located at a distance from the main group will not be required, unless readily available.

d. *Reserve Centers.* Consideration will be given to the size of the structure, the type of construction, and the exposure hazard that it creates to or receives from nearby buildings. In making this determination the information furnished in the Engineer Manuals hereinbefore referenced will be taken into consideration for guidance. Where the reserve centers are to be built in communities served by municipal or private water systems and fire-fighting forces, fire-flow requirements will be as given in table I.

Table I. Fire-Flow Requirements for Reserve Centers in Communities Served by Municipal or Private Water Systems and Fire-Fighting Forces.

Size of center No. of men	Fire Flow (g.p.m.)	
	Noncombustible construction	Combustible construction
100	750	1000
200	750	1000
400	1000	1500
600 and over	1500	2000

The flows in table I will be available for 2 hours at a residual pressure of 10 pounds per square inch at the fire hydrants and will be considered as minimum requirements. However, when the cost of providing the flows indicated would exceed available funds, a reduction of 20 percent in the required rates of flow may be allowed. Such cases will be submitted to the Chief of Engineers, ATTN: ENGEU, for disposition.

7. **WATER SOURCES.** Available public or private water-supply systems will be used as sources of water supply wherever feasible. In the absence of such a source, adequate water source and supply facilities will be constructed in accordance with criteria established in EM 1110-345-221. If no adequate source of water is economically available at the site, water may be hauled in.

8. **WATER TREATMENT.** Usually only chlorination will be required. If other treatment is found necessary, it will be provided in accordance with criteria in EM 1110-345-222. Water-treatment units will not be provided in duplicate. However, more than one unit may be provided where necessary to produce the required daily demands. Such cases will be limited to electrodialysis, zeolite-type softeners, and ion exchange units except when used in the two-step demineralization process. An exception to the above policy of not providing duplicate water-treatment facilities will be made where the sole source of water is obtained by the conversion of sea water. In this event sufficient salt-water-treatment units for producing potable water will be provided so that the required daily water demand can be maintained when one or more units are out of service for maintenance or repair.

9. **WATER STORAGE.** Storage will usually be required for water for fire-protection purposes. Ground storage will be provided unless it is determined by the using service that elevated storage will not interfere with operation of technical equipment.

a. Antiaircraft Tactical Sites. Where peak domestic demand at adequate pressure is not available, a pneumatic pressure system supplemented by a ground-storage tank with a minimum gross capacity of 3,500 gallons, pumping equipment, and appurtenances as required by site conditions will be installed. An elevated wood storage tank on wood tower, or a wood, steel, or concrete tank on high ground, if economically justified, may be installed in lieu of a pressure system. The capacity of the pneumatic pressure tank will be not less than the discharge from the pump in 3 minutes. (See EM 1110-345-165.) The capacity of the storage tank will be at least equal to the water requirement for one day.

b. Family Housing at Tactical Sites. Storage capacity as determined by criteria in EM 1110-345-223 will be provided for the fire protection required by paragraph 6b herein before.

c. Air Control and Warning Stations. Storage capacity as determined by criteria in EM 1110-345-223 will be provided for the fire protection required by paragraph 6c.

10. WATER-DISTRIBUTION SYSTEMS. Water-distribution systems will be designed in accordance with criteria in EM 1110-345-224. Pipe sizes will be based on domestic flow at antiaircraft tactical sites, and on combined domestic and fire flows at all other sites.

FOR THE CHIEF OF ENGINEERS:

C. H. DUNN,
*Colonel, Corps of Engineers,
Executive.*