DEPARTMENT OF THE INTERIOR
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DISSOLVED SOLIDS, HARDNESS, AND ORTHOPHOSPHATE OF SURFACE - WATER RUNOFF IN THE SUWANNEE RIVER WATER MANAGEMENT DISTRICT, FLORIDA

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EXPLANATION

Introduction

This atlas consists of three maps that show the general distribution of dissolved solids, hardness, and orthophosphate in the streams and lakes within the Suwannee River Water Management District. The atlas was prepared in cooperation with the Water Management District to provide pertinent water-quality information relating to the objectives of the Florida State Water Resources Act of 1972. Under the provisions of this act, the Water Management District is required to establish a regional water-use plan, issue permits for water-use and water-resources related construction, and authorize the export of water. The data presented on these maps will be useful to those concerned with water management and use, in assessing regional water quality, and in establishing a base for comparison with future quality data.

The ranges of concentration shown on the maps represent maximum concentrations in surface water during the sampling period, January 1965-September 1970. Concentrations are plotted at the sampling sites and are the major criteria for determining the extent of concentration ranges. In some cases the drainage basin boundaries are used in defining concentration range boundaries because the quantity and quality of surface runoff is characteristic of the environment of the basin and may be entirely different from the runoff of adjacent basins. Within drainage basins, individual streams and local drainage divides define concentration boundaries. Some areas, although adjacent to each other in the same basin, have entirely different concentration ranges. For example, an area containing dissolved-solids concentrations in the 0-25 mg/l (milligrams per litre) range may be adjacent to an area in which concentrations exceed 100 mg/l, as in the southeast part of Jefferson County. Concentration boundaries in these areas were selected by extending each range about halfway between the two sampling sites, as opposed to grading an intermediate range between them without supporting data. As the data are sparse in many areas, regional concentration patterns are generalized and local variations may be expected to exist.

Dissolved Solids

The dissolved-solids concentration, a general indicator of water quality, includes all material in water that is in solution (Pl. 1). Sources of dissolved solids include the atmosphere, the land surface, and the soil and rock below the land surface. Although dissolved-solids concentration in rainfall is low, generally less than 30 mg/l, when water flows overland or through the ground to streams the concentration increases as small amounts of soil and rock are dissolved. Domestic, industrial, and agricultural by-products and wastes may increase the concentration of dissolved solids in a specific stream.

Concentrations of dissolved solids in water in a stream usually are greatest under low- or base-flow conditions, that is, after or during periods of little or no rainfall. Water entering streams under these conditions is chiefly ground water which has had contact with subsurface rock and soil. The range in dissolved-solids concentrations at a specific site is greatest in areas where rainfall is infrequent, scattered, and intense.

The National Academy of Sciences and National Academy of Engineering (1973) do not include a recommendation for dissolved solids in drinking water. The table that follows, based on data presented by McKee and Wolf (1963), shows the dissolved-solids concentrations below which the water should not interfere with the indicated uses:

Domestic water supply	1,000 mg/l
Irrigation	700 mg/l
Stock watering	2,500 mg/l
Fresh-water fish and aquatic life	2,000 mg/l

Hardness

Hardness is reported as $CaCO_3$ and in most waters is attributable to calcium and magnesium ions (Pl. 2). Water is classified (Durfor and Becker, 1962) with respect to hardness as follows:

Hardness (mg/l as $CaCO_3$)	
0- 60	soft
61-120	moderately hard
121-180	hard
more than 180	very hard

Sources of hardness in water are rocks and soil, industrial wastes, and irrigation drainage.

High concentrations of hardness inhibit the lathering ability of soap, cause formation of scale in boilers and hot-water heaters, toughen vegetables cooked in the water, and render the water unsuitable for many industrial practices.

The National Academy of Sciences and National Academy of Engineering (1973) do not recommend any specific limit for hardness. McKee and Wolf (1963) list the following limits of hardness tolerable or desirable for some industrial practices:

Cooling	50 mg/l
Pulp and paper making, fine paper pulp	10-250 mg/l
Food processing, general	100 mg/l
Steel manufacturing	50 mg/l
Textile manufacturing	0- 50 mg/l

Orthophosphate

Dissolved orthophosphate is the sum of phosphate ions in solution and includes the three ionized products of phosphoric acid, $H_2PO_4^{-1}$, HPO_4^{-2}, and PO_4^{-3}, reported as milligrams per litre PO_4 (Pl. 3). Orthophosphate concentrations serve as an index of total soluble phosphorus which is used to assess the nutrient load in water.

Sources of phosphate include agricultural, industrial, urban and sewage-treatment-plant wastes, drainage from natural phosphatic terranes, mine drainage, rural runoff, and precipitation. Excessive dissolved phosphates cause: (1) reduced efficiency in water-treatment softening, (2) overabundant growth of algae and other aquatic plants, resulting in undesirable tastes and odors and increased treatment costs, and (3) a high oxygen demand (related to item 2), resulting in reductions of dissolved oxygen in lakes or streams. The effects of (2) and (3) above are most serious where water is impounded. For that reason the Federal Water Pollution Control Administration (1968) suggests that the concentration of total phosphorus should not exceed 0.05 mg/l where streams enter lakes or reservoirs.

Selected References

Durfor, C. N., and Becker, Edith, 1962, Public water supplies of the 100 largest cities in the United States: U.S. Geol. Survey Water-Supply Paper 1812.

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McKee, J. E., and Wolf, H. W., 1963, Water quality criteria: State Water Quality Control Board, pub. 3A, Sacramento, Calif., 548 p.

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