MARYLAND GEOLOGICAL SURVEY

REPORT OF INVESTIGATIONS NO. 9

Kenneth N. Weaver, *Director*

CHEMICAL AND PHYSICAL CHARACTER OF MUNICIPAL WATER SUPPLIES IN MARYLAND

by

Jolly D. Thomas

and

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Prepared in cooperation with the Geological Survey

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Jolly D. Thomas and Sumner G. Heidel

ABSTRACT

The 65 largest public water supplies in Maryland deliver about 378 mgd (million gallons per day) of water to over 3 million people. More than 80 percent, or 2,444,000 of these people, who use about 320 mgd, are supplied by either the Baltimore Bureau of Water Supply or the Washington Suburban Sanitary Commission. Samples of raw and finished water from most facilities were analyzed by the Geological Survey.

Sixteen municipal supplies use surface water; 43 use ground water, and 6 use both surface and ground water. Surface water serves more than 89 percent of the population, although more individual communities obtain their supplies from ground water.

Twenty-two public supplies reportedly add fluoride to their water and 10 supplies have natural fluoridation of 0.4 ppm (part per million) or more. The treated water of most municipalities is soft or moderately hard, and only 7 facilities deliver finished water that is classified as hard water or very hard water.

INTRODUCTION

As a part of the cooperative water-resources program between the Maryland Geological Survey and the U. S. Geological Survey, an investigation was made of the chemical and physical quality of the 65 municipal water supplies that serve populations of over 1,000. The water-supply facilities are listed alphabetically in table 1. Each facility has been assigned a number that identifies the municipality on the location map (see figure 1). Figure 1 also shows the types of water sources used by these municipalities. This report is expected to be of value in the development and utilization of water supplies in Maryland.

The first section of this report briefly describes the major constituents in water, some properties of water, methods of determining these properties, and treatments of water supplies. Water of acceptable quality is available to all public supplies in Maryland, although some variations in character occur. Information is given on hardness of different supplies, according to the U.S. Geological Survey classification of hardness, and on the number of supplies delivering water with recommended concentrations of fluoride.

The second part of this report is a descriptive and analytical data inventory of these 65 water supplies, listing for each supply (a) population of the municipality; (b) the total population served; (c) the suburban areas or towns supplied by the facility; (d) the sources of supply; (e) the average

Table 1. Principal municipal water supplies in Maryland

(Identification number used on figure 1)

Aberdeen	1
Annapolis	2
Baltimore	3
Barton	4
Bel Air	5
Belcamp	6
Belvedere Heights	7
Berlin	8
Boonsboro	9
Bowie	10
Braddock Heights	11
Brunswick	12
Cambridge	13
Centreville	14
Chesapeake City	15
Chestertown	16
Crisfield	17
Cumberland	18
Delmar	19
Denton	20
Easton	21
Elkton	22
Emmitsburg	23
Federalsburg	24
Frederick	25
Frostburg	26
Glen Burnie	27
Greensboro	28
Hagerstown	29
Hancock	30
Havre de Grace	31
Hurlock	32
Jessup	33
Joppatowne	34
Kings Heights	35
La Plata	36
Leonardtown	37
Lexington Park	38
Lonaconing	39
Manchester	40
Maryland City	41
Middletown	42
Mount Airy	43
Mountain Lake Park	44
North East	45
Oakland	46
Ocean City	47
Oxford	48
Perryville	49
Pocomoke City	50
Princess Anne	51
Rock Hall	52
Rockville	53
St. Michaels	54
Salisbury	55
Severna Park	56
Snow Hill	57
Taneytown	58
Thurmont	59
Upper Marlboro	60
Waldorf	61
Walkersville	62
Washington Suburban Sanitary Commission	63
Westernport	64
Westminster	65

daily use; (f) the water treatment; (g) the rated capacity of each treatment plant; and (h) the raw-water and finished-water storage capacity. These data are intended to show conditions at the time of sample collection.

Estimates of population and water-use data are the most recent available. When no more recent estimates are reported, the populations listed are those given by the U. S. Bureau of the Census for 1960. Generally, the population served by each facility, the average daily use, the rated capacity of each treatment plant, and the finished water storage are listed as of January 1, 1963, as reported by the U. S. Public Health Service (1964). For some supplies, more recent data were available from the facility. Particular effort was made to obtain recent information on the communities and facilities that have grown and expanded greatly since 1960.

Acknowledgments

This report was prepared under the supervision of W. F. White, District Chief, U. S. Geological Survey, for publication by the Maryland Geological Survey, Dr. Kenneth N. Weaver, Director.

Water samples were analyzed in the U. S. Geological Survey laboratory in Washington, D. C. under the direction of Herman R. Feltz. The cover photograph was furnished by the Washington Suburban Sanitary Commission.

Method of Investigation

During 1966–67, personnel from the U.S. Geological Survey visited most municipalities whose water supply served a population estimated in 1963 to be 1,000 or more. For each facility, information was obtained on the population served, the source of water, the treatment, and the storage capacity. Water samples were collected for chemical analysis.

The number of water samples collected for analysis was limited to one from each raw supply and one from each finished supply, except for those supplies using multiple sources in significant amounts. When wells in the same aquifer were the source of supply, the sample was obtained from the well supplying most of the water. Samples from surface-water sources were collected from the stream at the impoundment, or from the plant's raw-water intake. Finished-water samples were collected at a tap in the plant or distribution system.

SOURCE OF PUBLIC WATER SUPPLIES

Forty-three public water supplies reported on herein use ground water, 16 use surface water, and 6 use a mixture of ground and surface water. At least one of the facilities using a mixture draws only a small percentage of its water from ground water; most of the water used by the Washington Suburban Sanitary Commission comes from surface-water sources and less than 2 percent comes from wells. Although more municipalities use ground water than surface water, more than 89 percent of the State's population is served from surface-water supplies.

Approximately 3 million people in the 65 municipalities use about 378 mgd. More than 80 percent, or 2,444,000 of these people, use about 320 mgd and are supplied by the Baltimore Bureau of Water Supply or by the Washington Suburban Sanitary Commission. Baltimore's water supply comes chiefly from Gunpowder Falls and the North Branch Patapsco River; a supplemental supply is available from the Susquehanna River. Most of the water provided by the Washington Suburban Sanitary Commission comes from the Potomac and Patuxent Rivers.

SUGGESTED QUALITY OF WATER STANDARDS

The quality of water of municipal supplies may be judged by comparison of their characteristics with the standards published by the U. S. Public Health Service (1962). These standards state: "The following chemical substances should not be present in a water supply in excess of the listed concentrations where other more suitable supplies are or can be made available." The concentrations in mg/l (milligrams per liter) are equivalent to ppm at or below the limits recommended.

Substance	Concentration in mg/l
Chloride (Cl)	250
Fluoride (F)	(See p. 10)
Iron (Fe)	0.3
Manganese (Mn)	.05
Nitrate (NO_3)	45
Sulfate (SO_4)	250
Total dissolved solids	500

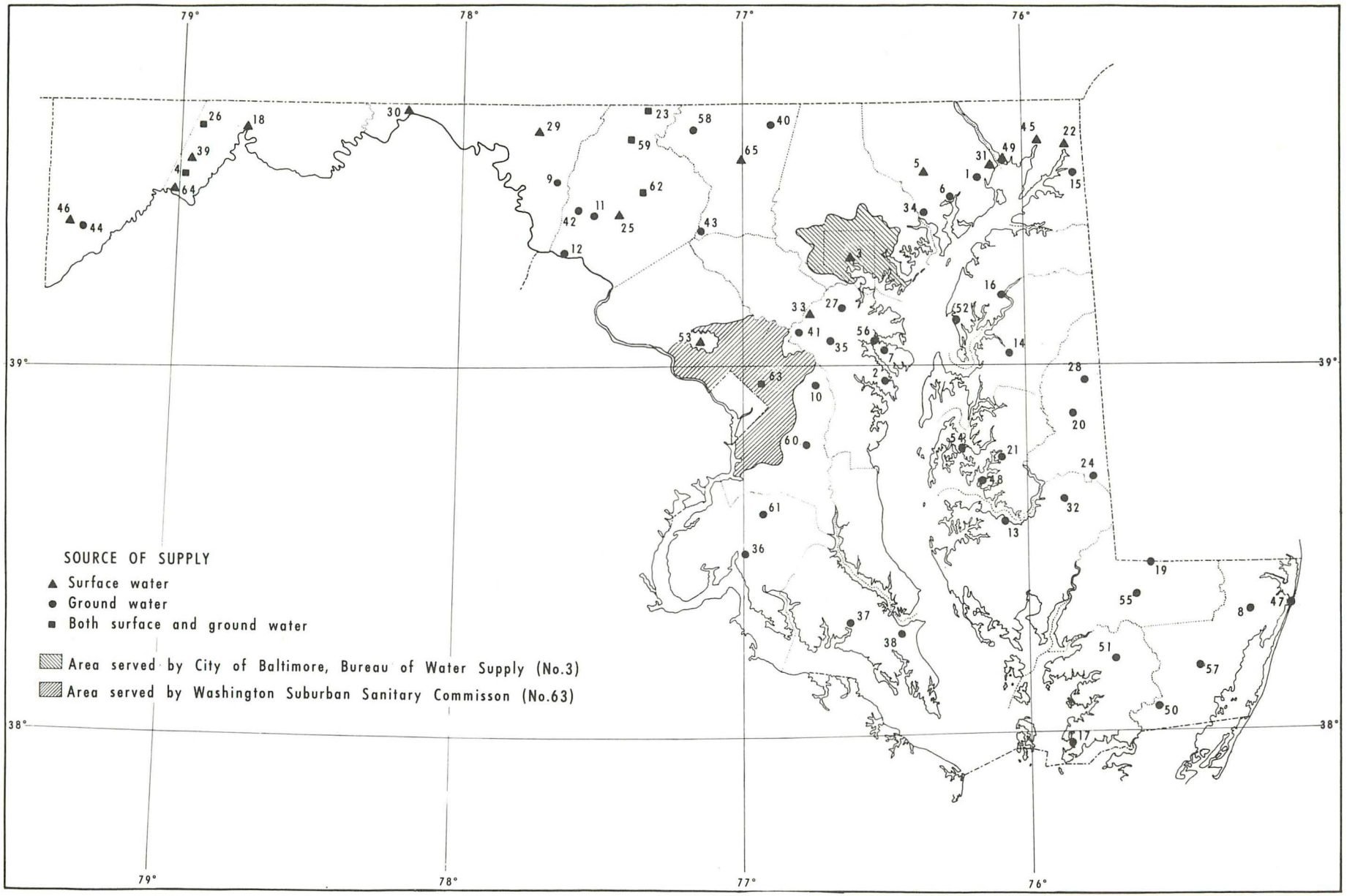

Figure 1. -- Sources of water for the 65 largest public water supplies in Maryland. See table 1 for identification of facilities.

COMPOSITION OF NATURAL WATERS

All natural waters contains dissolved mineral matter. Water in contact with soil or rock, even for only a few hours, will dissolve some mineral matter. The quantity of dissolved mineral matter in a natural water depends primarily on the type of rock or soil with which the water has been in contact and the length of time of contact. Ground water generally is more highly mineralized than surface runoff because it remains in contact with rock and soil for much longer periods. Most streams are fed by both surface runoff and ground water from springs or seeps. During dry periods, such streams reflect the chemical character of their underground sources, and generally are more highly mineralized than they are during periods of heavy rainfall. The dissolved-solids content in a river is frequently increased by drainage from mines or oil fields, by the addition of industrial or municipal wastes, or—in irrigated regions—by drainage from irrigated land.

The mineral constituents and physical properties of the raw and treated supplies in the table of analyses are those that affect the value of the water for most purposes. The analyses generally include determinations for silica, iron, manganese, calcium, magnesium, sodium, potassium, bicarbonate, carbonate, sulfate, chloride, fluoride, nitrate, phosphate, dissolved solids, hardness, specific conductance, pH, and color. The normal range of concentration of these constituents and the significance of the constituents and properties are discussed in the following paragraphs.

Mineral Constituents in Solution

The concentration of all mineral constituents listed in this report is expressed in ppm. A part per million is a unit weight of a constituent in a million unit weights of water.

Silica (SiO_2).—The concentration of silica in natural water generally ranges from 1 to 30 ppm, although as much as 100 ppm is fairly common. In low-pressure boilers, in the presence of calcium and magnesium, silica forms a scale that retards heat transfer; in high-pressure boilers, other elements in addition to calcium and magnesium may combine with silica to from a scale. Silica may be added to soft water to inhibit corrosion of iron pipes.

Iron (Fe).—Surface waters seldom contain as much as 1 ppm of dissolved iron, although some acid waters carry large quantities of iron in solution. Ground water may contain more than 50 ppm of iron. After exposure to air, most of the iron in ground water precipitates and causes turbidity; stains plumbing fixtures, laundry, and cooking utensils; and imparts objectionable tastes and colors to foods and drinks. More than 0.2 ppm is objectionable for most uses.

Manganese (Mn).—In natural waters, concentration of manganese is generally 0.20 ppm or less. However, ground water and acid mine water may contain more than 10 ppm. Bottom water of reservoirs may contain more than 150 ppm. During the spring or fall "turn over," this water may come to the surface and enter public supply intakes. More than 0.2 ppm of manganese precipitates upon oxidation. Manganese causes undesirable tastes, deposits on foods during cooking, stains plumbing fixtures and laundry, and fosters growths in reservoirs, filters, and distribution systems. More than 0.2 ppm is objectionable for most industrial use (Durfor and Becker, 1964).

Calcium (Ca) and magnesium (Mg).—A wide range of concentrations of both elements occur in natural water. Most water associated with granite or siliceous sands contains less than 10 ppm of calcium and contains less magnesium than calcium. Waters from areas where rocks are composed of dolomite and limestone may contain 30 to 100 ppm of calcium and 20 to 100 ppm of magnesium. Normal sea water contains about 400 ppm of calcium and 1,300 ppm of magnesium. Calcium and magnesium combine with bicarbonate, carbonate, sulfate, and silica to form heat-retarding, pipe-clogging scale in boilers and water systems. They also combine with ions of fatty acid in soaps to form insoluble products; the more calcium and magnesium, the more soap is needed to form suds.

Sodium (Na) and potassium (K).—These elements are found in all natural waters. Natural waters that contain only 3 or 4 ppm of sodium and potassium together are likely to contain about equal quantities of each. As the total quantity of these constituents increases, the proportion of sodium becomes much greater. Moderate quantities of sodium and potassium have little effect on the usefulness of the water for most purposes, but waters that carry more than 50 or 100 ppm of the two may require careful operation of steam boilers to prevent foaming.

Carbonate (CO_3) and bicarbonate (HCO_3).—Carbonate and bicarbonate are often reported as

alkalinity, which is expressed as an equivalent amount of calcium carbonate. Carbonate, as such, is present in relatively few natural waters. The concentration of bicarbonate is commonly less than 500 ppm in natural water, but it may exceed 1,000 ppm in water highly charged with carbon dioxide. Water having high alkalinity is undesirable in many industries.

Sulfate (SO_4).—Concentration of sulfate is usually less than 1,000 ppm in natural waters, except in streams and wells influenced by acid mine drainage. Sulfate in waters that contain much calcium and magnesium causes the formation of hard scale in steam boilers. Water containing about 500 ppm tastes bitter; water containing about 1,000 ppm may be cathartic (Durfor and Becker, 1964).

Chloride (Cl).—The concentration of chloride is commonly less than 10 ppm in humid regions; it may be as much as 19,000 ppm near the mouth of a tidal stream. In combination with sodium, large amounts of chloride give a salty taste to water. Large quantities of chloride increase the corrosiveness of water.

Fluoride (F).—Concentrations of fluoride generally do not exceed 10 ppm in ground water or 1.0 ppm in surface water. Fluoride in drinking water reduces the incidence of tooth decay in children's teeth, but excessive concentrations produce objectionable dental fluorosis. The Public Health Service recommends the fluoride concentration between 0.7 and 1.2 mg/l as the optimum (see p. 10). Fluoride concentrations in Maryland's public water supplies are given in the section on fluoridation.

Nitrate (NO_3).—Concentrations of nitrate are commonly less than 1.0 ppm in surface water not subjected to pollution, but may be as much as 5.0 ppm. In ground water, the concentration may be as much as 1,000 ppm (Durfor and Becker, 1964). Water containing large amounts of nitrate is bitter tasting and may cause physiological distress. Methemoglobinemia in infants has been reported to result from nitrate concentrations higher than 45 ppm.

Phosphate (PO_4).—Phosphorus is an essential element in growth of plants and animals. The concentration of phosphate in natural water is generally less than a few parts per million and the small amounts normally present are not usually significant. Occurrence of higher concentrations may result from use of phosphate fertilizers or from discharge of sewage effluents. Phosphates are sometimes added in water treatment plants, but in rather small quantities.

Dissolved solids.—The reported quantity of dissolved solids—the residue after evaporation—consists mostly of the dissolved mineral constituents in the water. It may also contain some organic matter and water of crystallization. Surface water commonly contains less than 3,000 ppm, and in areas of high precipitation may contain only 25 or 30 ppm. Most ground water in Maryland contains less than 400 ppm. In some areas, where there are high chloride concentrations the dissolved-solids content may be as high as 7,500 ppm. More than 500 ppm is undesirable for drinking and many industrial uses, but water containing much higher concentrations is used for many purposes when a better supply is not available.

Properties and Characteristics of Water

Color.—Organic matter extracted from roots, leaves, or other organic substances may cause color in surface water. The extent to which water is colored by material in solution is commonly measured by comparison of a column of the water sample with a column of equal height of an arbitrary standard whose color is rated at 500. Color based on this standard is expressed in terms of units between 0 and 500 or more (Hem, 1959). Standards of the U. S. Public Health Service (1962) limit the color of potable water to 15 units. All raw-water supplies covered in this report had values of less than 9 units; all finished-water supplies had less than 8 units.

Hardness.—Hardness of water is a property caused principally by calcium and magnesium. Although other metals such as iron, manganese, and aluminum cause hardness in water, they are usually present in such small amounts that their effect on hardness is insignificant.

"Noncarbonate hardness is the difference between the hardness calculated from the total amount of calcium and magnesium in solution and the carbonate hardness. If the carbonate hardness (expressed as calcium carbonate) equals the amount of calcium and magnesium hardness (also expressed as calcium carbonate) there is no noncarbonate hardness. Noncarbonate hardness is about equal to the amount of hardness remaining after water is boiled. The scale formed at high temperatures by the evaporation of water containing noncarbonate hardness is tough, heat resistant, and difficult to remove." (Durfor and Becker, 1964.) Water supplies may be classified as soft, or

hard, but there is no absolute definition of these terms.

The U.S. Geological Survey uses the following classification:

Hardness range (ppm of calcium carbonate)	Hardness description
0–60	Soft
61–120	Moderately hard
121–180	Hard
More than 180	Very hard

On the basis of this classification, the analytical data in this report show that 3 facilities deliver very hard water, 4 facilities deliver hard water, 16 facilities deliver moderately hard water, and 40 facilities deliver soft water. The two largest public supplies, Baltimore and Washington Suburban Sanitary Commission, each deliver soft water from one treatment plant and moderately hard water from a second treatment plant.

Data on hardness are summarized in table 2.

Table 2. Number of people and supplies in Maryland using water in different ranges of hardness

Hardness as $CaCO_3$ (ppm)	Number and source of supplies				Population served	Average use (mgd)
	Ground	Surface	Mixed	Total		
<60	29	7.3	4.5	40.8	1,218,900[a]	145.46
61–120	10	6.7	.5	17.2	1,716,800[a]	228.20
121–180	3	1	—	4	59,400	4.08
>180	1	1	1	3	7,400	.44
Total	43	16	6	65	3,002,500	378.18

[a] Assuming population supplied by Baltimore and Washington Suburban Sanitary Commission from a source is proportionate to the amount of water used from that source.

pH.—Water that is neither acidic nor basic (alkaline) is called a neutral water and has a pH of 7.0. Values below 7 indicate acidic properties and values above 7 indicate alkalinity. The pH of water solutions can range from 0 to 14, but in most natural waters, it ranges from 5.0 to 8.0. By definition the pH value of a solution is the negative logarithm of the concentration of hydrogen ions (in gram equivalents per liter). However, the pH meters used to determine values in this report measured the activity of the hydrogen ions, as distinguished from the concentration.

Specific conductance.—Specific conductance is a conveniently determinable measure of the electrical conductivity of water. The dissolved solids in ppm is usually about 65 percent of the specific conductance in micromhos per centimeter at 25°C. The relationship is not constant from stream to stream or from well to well, but when it is established for a given source the conductance is of use in approximating the dissolved-solids content.

TREATMENT OF WATER

The type and method of water treatment used depend upon the quality of the water and usually also upon the quantity of water needed. In Maryland, treatment of ground water to remove iron is frequently necessary. On the other hand, most raw water in Maryland is relatively soft, and treatment to reduce hardness is less often necessary.

Comprehensive discussions of water treatment for public supplies are available in standard textbooks and other publications. The following brief discussion describes the different processes and chemicals commonly used in the treatment of supplies in Maryland.

Sedimentation

The term "sedimentation" usually refers to the process in which suspended matter is removed without the aid of an added coagulant. It may be carried out in lakes, ponds, reservoirs, or tanks. Sedimentation, when used as the first stage in the treatment process, is also called "presedimentation." Normally, sedimentation basins thus used remove a large percentage of suspended matter and prevent it from being carried along onto the filter beds. The size of the basin and the detention periods may vary greatly depending upon the amount of water being treated and the coarseness of the sediments.

Coagulation

The process of coagulation conditions the water for the removal of colloidal and other finely divided solid materials, such as clay, silt, organic color, algae, and bacteria not removed in the sedimentation basin.

Coagulation is accomplished in two steps. The first step, rapid or flash mixing, occurs as water enters the treatment plant. Under favorable conditions of pH, coagulant added during this period of agitation results in the formation of small gelatinous masses of loosely held particles called flocs. Suspended sediment adheres to or is entrapped in the flocs. In the second step, the minute particles combine to form larger masses which settle more rapidly. After coagulation, the water is kept for a length of time in a settling basin where most of the flocculated matter is removed.

Without these coagulants and the resultant flocs, the small particles, which are largely colloidal and could pass through the settling basins and the filter, would appear as turbidity and color in the water that reaches the consumer.

The most commonly used coagulating agent is aluminum sulfate, usually called alum. Other agents, such as ferric sulfate (Ferrisul or Ferrifloc), ferrous sulfate (copperas), ferric chloride, sodium aluminate, sodium silicate, and bentonite, are used less frequently. No public water supplies in Maryland report using iron compounds for coagulation. Alum, which gives best results in the pH range 5.5–6.8, reacts with bicarbonate and carbonate ions in the water to lower the pH and to increase the sulfate content (Nordell, 1961). Therefore, after coagulation, lime or soda ash may be added to raise the pH to prevent corrosion of the mains. The increase in sulfate content, however, is of only minor importance in industrial use.

Many waters require the addition of coagulant aids in the flocculating process. The most widely used aids are clays, activated silica, and polyelectrolytes. Use of activated silica as a coagulating aid is increasing in water treatment plants. Beside activated silica, clays and hydroxyethyl cellulose are used as coagulating aids because they improve coagulation by further promoting formation of rapidly settling flocs.

Factors such as temperature, pH, color, turbidity, mineral content of the water, mixing time, violence of agitation, presence of nuclei for the sediment to adhere to, and the type and dosage of chemicals influence the efficiency of coagulation and dosage of the coagulants. Good coagulation is obtained only within definite pH ranges, and in some waters pH adjustments are necessary. Length of time of mixing and temperature of the water affect coagulation and flocculation and consequently the dosage. The proper dosage of chemicals to obtain optimum coagulation is commonly determined by measuring the amount of coagulant necessary to obtain a good floc in a jar containing a sample of the water being treated. A more recent technique makes use of the fact that coagulation chemicals dissolved in water have a positive charge and suspended matter in water has a negative charge. The coagulant is added until a water sample is neither negative because of an excess of suspended sediment, nor positive because of an excess of coagulation chemicals (Durfor and Becker, 1964).

Disinfection

Disinfection agents used in public water supplies are chlorine, chlorine dioxide, chloramines, hypochlorites, or ozone.

Chlorine is the most widely used disinfectant and is a very strong oxidizing agent. It is available as liquified gas in cylinders and may be applied at any time during or after the treatment process.

Chlorine dioxide is made in solution by reacting chlorine with sodium chlorite. In addition to use as

a disinfectant, chlorine dioxide oxidizes organic matter that causes disagreeable tastes and odors.

Chloramines result from the reaction of chlorine and ammonia. Chloramines help maintain chlorine residuals.

Hypochlorites are used to replace liquified chlorine and are usually used in small water supplies where the complicated control devices required for chlorine would be a disadvantage.

Ozone is a powerful oxidizing agent and as such is active in oxidizing organic matter and killing bacteria.

Filtration

Suspended material is removed from water by filtration through a porous granular medium. The types of filters usually used are rapid sand, slow sand, and pressure filters.

The rapid sand filter is usually a rectangularly shaped compartment filled to desired depth with graded sand and gravel and equipped with a system of perforated pipes called underdrains. Rapid sand filtration is usually used only after coagulation or coagulation and settling. Advantages of rapid sand filtration are its rapid rate of filtering (as much as 50 times the rate of slow sand filtration), simplicity of cleaning by backwashing, and small space requirements as compared with slow sand filtration.

Slow sand filtration differs from rapid sand filtration in that no coagulant is used, and a growth of sediment and bacteria must be developed before efficient filtration can be effected. Slow sand filters are cleaned by removing and cleaning the top layer of sand. They are very effective in removing tastes and odors and can be operated with a minimum of attention. However, they lack adaptability to waters of changing characteristics and require much more space than rapid sand filters. If coagulation is required before filtration, rapid sand filtration is more economical than slow sand filtration.

Pressure filters are similar in construction to rapid sand filters except that they are contained in a steel pressure vessel. The backwash is similar to the operation of rapid sand filters. The advantage of pressure filters is that the pressure of water in the mains is not lost when the filter process takes place. One of the disadvantages of the pressure filters is the difficulty of applying chemicals.

Fluoridation

Studies have shown that fluoride in drinking water reduces the incidence of dental cavities. On the other hand excessive fluoride in drinking water results in dental fluorosis and mottled teeth. The Public Health Service, 1962 (p. 8), states, "When fluoride is naturally present in drinking water, the concentration should not average more than the appropriate upper control limit (0.8 to 1.7 ppm). Presence of fluoride in average concentrations greater than two times the optimum values shall constitute grounds for rejection of the supply." Concentrations recommended by the Public Health Service are given in table 3.

Of the 65 public water supplies covered in this report, 22 facilities which serve 2,761,000 people, fluoridate their water. The analyses in this report show an additional 10 communities with natural fluoride concentrations of 0.4 ppm or more in their finished water supplies. These communities are listed in table 4.

Table 3. Recommended fluoride concentrations in drinking water

Annual average of maximum daily air temperature (°F)	Recommended control limits—fluoride concentration in mg/l		
	Lower	Optimum	Upper
50.0–53.7	0.9	1.2	1.7
53.8–58.3	.8	1.1	1.5
58.4–63.8	.8	1.0	1.3
63.9–70.6	.7	.9	1.2
70.7–79.2	.7	.8	1.0
79.3–90.5	.6	.7	.8

Table 4. Municipalities served by naturally fluoridated water of 0.4 ppm or more

Municipality	Population served (estimated)	Fluoride (F) ppm in water delivered to user
Cambridge	16,000	1.2
Centreville	1,830	.6
Crisfield	5,300	2.2 to 4.0
Denton	2,500	1.4
Easton	7,500	.4
Greensboro	1,200	.7
La Plata	1,500	1.0
Lexington Park	7,500	.6
Oxford	1,000	1.9
St. Michaels	1,800	.4
Total	46,130	—

Iron and Manganese Removal

Surface-water supplies usually contain less iron and manganese than ground water unless polluted by mine drainage or other sources of iron-bearing compounds.

Removal of iron is usually accomplished by aeration and filtration. Table 5 lists the different proc-

Table 5. Processes of iron and manganese removal [a]

Treatment Processes	Oxidation Required	Character of Water
1. Aeration, sedimentation, sand filtration	Yes	Iron alone in absence of appreciable concentration of organic matter.
2. Aeration, contact oxidation, sedimentation, sand filtration	Yes	Iron and manganese loosely bound to organic matter, but no excessive carbon dioxide or organic acid content.
3. Aeration, contact filtration	Yes	Iron and manganese bound to organic matter, but no excessive organic acid content.
4. Contact filtration	Yes [b]	Iron and manganese bound to organic matter, but no excessive carbon dioxide or organic acid content.
5. Aeration, chlorination, sedimentation, sand filtration	Yes	Iron and manganese loosely bound to organic matter.
6. Aeration, lime treatment, sedimentation, sand filtration	Yes	Iron and manganese in combination with organic matter, and organic acids.
7. Aeration, coagulation, lime treatment, sedimentation, sand filtration	Yes	Colored, turbid, surface water containing iron and manganese combined with organic matter.
8. Cation-exchange softening	No	Well water devoid of oxygen, and containing less than about 1.5 to 2.0 ppm iron and manganese.
9. Lime treatment, sedimentation, sand filtration	No	Soft well water devoid of oxygen, containing iron as ferrous bicarbonate.

[a] "American Water Works Association, Water Quality and Treatment," second edition, 1950.
[b] But not by aeration.

esses for iron and manganese removal. The term "contact filtration" in this table refers to the use of coarse contact beds consisting of trays filled with coke, broken stone, or any coarse material that will provide a large contact surface. Small amounts of iron and manganese are favorably controlled by the use of commercial metaphosphates which have the property of preventing the precipitation of iron and manganese at temperatures lower than about 180°F (North Carolina Department of Water Resources, 1961).

Softening

The treatment of water to decrease the hardness —called softening—reduces the amounts of calcium and magnesium in the water. Municipal water supplies are usually softened by the cold lime-soda process, the sodium-cation exchange process, or the combination lime and sodium-cation exchange process.

Softening by the cold lime-soda process is accomplished by the addition of lime and soda ash to form insoluble precipitates of calcium and magnesium. The precipitated calcium carbonate and magnesium hydroxide are removed by filtration and sedimentation.

The cation-exchange process of softening is based on the exchange of calcium and magnesium for sodium. The exchange is achieved by using natural minerals called zeolites or by synthetic resins, which have the property of removing calcium and magnesium ions and replacing them with sodium ions. Regeneration of the exchanger material is accomplished by flushing with a concentrated solution of sodium chloride.

When a combination of both processes is used, lime is usually added first to reduce the carbonate hardness. After the precipitate has settled, the water is passed through the cation exchanger.

Taste and Odor Control

A good water supply should be free from tastes and odors. Undesirable tastes and odors usually come from two major sources, either from decaying vegetation, algae, and bacterial slime, or from sewage and industrial pollution.

Aeration is widely used as a preliminary step in taste and odor control. Other corrective measures include the use of coagulants, activated carbon, chlorination, chlorine dioxide, or ozone. Because of the complexity of the problem, no one type of treatment is adequate for removal of all tastes and odors.

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DESCRIPTIONS AND ANALYSES
OF
MUNICIPAL WATER SUPPLIES
IN
MARYLAND

ABERDEEN, HARFORD COUNTY

(Population, 12,000 Estimated 1966)

Ownership: Municipal. Population served: About 12,000 (1966).
Source: 5 wells.
Average daily use: 1,000,000 gpd.
Treatment: Soda ash, chlorination, sodium fluoride.
Rated capacity of treatment plant: 1,500,000 gpd.
Raw water storage: None.
Finished-water storage: 750,000 gal.

Chemical analyses in parts per million

	Well 1	Finished water		Well 1	Finished water
Silica (SiO_2)	14	14	Phosphate (PO_4)	0.03	0.01
Iron (Fe)	.61	.02	Dissolved solids (residue at 180°C)	88	84
Manganese (Mn)	.03	.03	Hardness as $CaCO_3$:		
Calcium (Ca)	7.1	5.9	Total	30	25
Magnesium (Mg)	3.0	2.5	Noncarbonate	22	8
Sodium (Na)	8.5	12			
Potassium (K)	1.7	1.3			
Bicarbonate (HCO_3)	10	20	Specific conductance (micromhos at 25°C)	123	123
Carbonate (CO_3)	0	0	pH	5.8	7.1
Sulfate (SO_4)	4.8	5.6	Color	2	0
Chloride (Cl)	18	16	Temperature (°F)	--	--
Fluoride (F)	.2	.4	Date of collection	2/8/66	2/8/66
Nitrate (NO_3)	17	11			

ANNAPOLIS, ANNE ARUNDEL COUNTY

(Population, 23,385)

Ownership: Municipal. Population served: About 31,000 (1965).
Source: 4 wells, 242, 248, 250, and 345 feet deep.
Average daily use: 3,500,000 gpd.
Treatment: Lime, coagulation with alum, chlorination, aeration, fluoridation, sedimentation, filtration.
Rated capacity of treatment plant: 7,000,000 gpd.
Finished-water storage: 1 standpipe, 1,750,000 gal.; 2 elevated tanks, 500,000 gal. each; 1 clear well, 1,000,000 gal.; total storage, 3,750,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	12	7.8	Phosphate (PO_4)	0.07	0.09
Iron (Fe)	5.9	.05	Dissolved solids (residue at 180°C)	61	92
Manganese (Mn)	.14	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	9.5	23	Total	33	64
Magnesium (Mg)	2.3	1.6	Noncarbonate	12	27
Sodium (Na)	1.5	1.6			
Potassium (K)	2.0	1.6			
Bicarbonate (HCO_3)	26	46	Specific conductance (micromhos at 25°C)	86	143
Carbonate (CO_3)	0	0	pH	6.8	7.8
Sulfate (SO_4)	16	26	Color	3	0
Chloride (Cl)	1.8	4.4	Temperature (°F)	--	--
Fluoride (F)	.2	1.0	Date of collection	6/22/67	6/22/67
Nitrate (NO_3)	.0	.1			

BALTIMORE CITY

(Population, 939,024 Estimated 1965)

Ownership: Municipal. Population served: About 1,444,000 (estimated 1965), includes metropolitan area of Anne Arundel, Baltimore, and Howard Counties.

Source: Gunpowder Falls, impounded in Prettyboy and Loch Raven Reservoirs; North Branch Patapsco River, impounded in Liberty Reservoir; Susquehanna River, supplemental supply.

Average amount of water supplied during 1965: 224,000,000 gpd.

Treatment: Chlorination, coagulation with alum, sedimentation, rapid sand filtration, pH adjustment with lime; fluoridation with hydrofluosilicic acid to 1.0 part per million.

Rated capacity of treatment plants: Montebello (Gunpowder Falls) filtration plant, 240,000,000 gpd; Ashburton (North Branch Patapsco River) filtration plant, 120,000,000 gpd.

Raw-water storage: Prettyboy Reservoir, 20,000,000,000 gal.; Loch Raven Reservoir 23,000,000,000 gal.; Liberty Reservoir 43,000,000,000 gal.

Finished-water storage: 600,000,000 gal. in reservoirs and elevated storage tanks.

Remarks: Capacity of Conowingo Intake from Susquehanna River is 250,000,000 gpd., activated in January 1966; three 50,000,000-gpd. capacity pumps installed at Deer Creek Pumping Station.

Chemical analyses in parts per million a/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	1.6	2.0	Phosphate (PO_4)	0.03	0.02
Iron (Fe)	.04	.00	Dissolved solids (residue at 180°C)	56	79
Manganese (Mn)	.08	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	8.8	16	Total	37	55
Magnesium (Mg)	3.6	3.6	Noncarbonate	13	21
Sodium (Na)	5.5	5.4			
Potassium (K)	1.8	1.9			
Bicarbonate (HCO_3)	30	42	Specific conductance (micromhos at 25°C)	108	147
Carbonate (CO_3)	0	0	pH	7.0	7.2
Sulfate (SO_4)	10	12	Color	5	0
Chloride (Cl)	8.9	13	Temperature (°F)	--	--
Fluoride (F)	.1	1.0	Date of collection	8/18/67	8/18/67
Nitrate (NO_3)	4.6	4.5			

a/ Ashburton filtration plant.

BALTIMORE CITY (Continued)

Chemical analyses in parts per million b/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	3.2	2.7	Phosphate (PO_4)	0.00	0.01
Iron (Fe)	.02	.16	Dissolved solids (residue at 180°C)	82	97
Manganese (Mn)	.02	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	15	22	Total	60	77
Magnesium (Mg)	5.5	5.2	Noncarbonate	17	36
Sodium (Na)	4.8	5.3			
Potassium (K)	2.2	2.2			
Bicarbonate (HCO_3)	53	50	Specific conductance (micromhos at 25°C)	146	183
Carbonate (CO_3)	0	0	pH	7.4	7.2
Sulfate (SO_4)	11	17	Color	5	2
Chloride (Cl)	12	18	Temperature (°F)	--	--
Fluoride (F)	.1	1.0	Date of collection	8/18/67	8/18/67
Nitrate (NO_3)	2.5	2.5			

b/ Montebello filtration plant.

BARTON, ALLEGANY COUNTY

(POPULATION, 731)

Ownership: Municipal. Population served: About 1,400.
Source: Butcher Run and one 2-inch well. Use mostly surface water when available.
Average daily use: 90,000 gpd.
Treatment: Chlorination.
Raw water storage: 1,500,000 gal. reservoir, 700,000 gal. reservoir.
Finished-water storage: None except 1 to 1 1/4 mile of 8-inch line.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	5.0	5.0	Phosphate (PO_4)	0.00	0.00
Iron (Fe)	.07	.12	Dissolved solids (residue at 180°C)	117	348
Manganese (Mn)	.06	.06	Hardness as $CaCO_3$:		
Calcium (Ca)	26	74	Total	88	263
Magnesium (Mg)	5.6	19	Noncarbonate	36	50
Sodium (Na)	1.0	1.0			
Potassium (K)	2.0	3.7			
Bicarbonate (HCO_3)	64	260	Specific conductance (micromhos at 25°C)	188	494
Carbonate (CO_3)	0	0			
Sulfate (SO_4)	37	54	pH	7.0	7.7
Chloride (Cl)	1.9	1.6	Color	3	3
Fluoride (F)	.2	.3	Temperature (°F)	--	--
Nitrate (NO_3)	.4	2.8	Date of collection	6/24/66	6/24/66

BEL AIR, HARFORD COUNTY

(POPULATION, 4,300)

Ownership: American Water Works Service Co.; supplies surrounding areas of Harford County. Population served: About 8,000 (1966).
Source: Winters Run.
Average daily use: 550,000 gpd.
Treatment: Pre-chlorination, flocculation using alum and lime, filtration, post-chlorination, and fluoridation with hydrofluosilicic acid. Post pH adjustment.
Rated capacity of treatment plant: 1,250,000 gpd.
Raw-water storage: None except buildup behind retaining wall at stream.
Finished-water storage: Ground level (at plant) 260,000 gal.; elevated tank (in Bel Air) 250,000 gal.; elevated tank (Forest Hill) 250,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	13	12	Phosphate (PO_4)	0.03	0.03
Iron (Fe)	.12	.02	Dissolved solids (residue at 180°C)	56	74
Manganese (Mn)	.06	.02	Hardness as $CaCO_3$:		
Calcium (Ca)	6.4	12	Total	28	42
Magnesium (Mg)	2.8	2.8	Noncarbonate	8	22
Sodium (Na)	4.0	4.2			
Potassium (K)	1.2	1.3			
Bicarbonate (HCO_3)	23	25	Specific conductance (micromhos at 25°C)	85	118
Carbonate (CO_3)	0	0			
Sulfate (SO_4)	4.8	11	pH	6.6	7.1
Chloride (Cl)	6.2	9.0	Color	5	5
Fluoride (F)	.1	.9	Temperature (°F)	--	--
Nitrate (NO_3)	7.6	7.6	Date of collection	2/8/66	2/8/66

BELCAMP, HARFORD COUNTY

(Population, 225)

Ownership: Bata Shoe Co. Population served: About 3,400.
Source: 6 wells.
Average daily use: 144,000 gpd.
Treatment: Chlorination.
Finished-water storage: 98,000 gal., 102,000 gal., elevated tanks.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	9.0	9.0	Phosphate (PO_4)	0.03	0.00
Iron (Fe)	.07	.11	Dissolved solids (residue at 180°C)	47	62
Manganese (Mn)	.01	.01	Hardness as $CaCO_3$:		
Calcium (Ca)	2.5	4.4	Total	14	20
Magnesium (Mg)	1.9	2.2	Noncarbonate	10	15
Sodium (Na)	4.4	5.9			
Potassium (K)	1.0	1.1			
Bicarbonate (HCO_3)	5	7	Specific conductance (micromhos at 25°C)	58	88
Carbonate (CO_3)	0	0	pH	7.2	6.2
Sulfate (SO_4)	6.3	8.4	Color	2	4
Chloride (Cl)	8.1	12	Temperature (°F)	--	--
Fluoride (F)	.1	.1	Date of collection	6/14/66	6/14/66
Nitrate (NO_3)	4.8	4.9			

BELVEDERE HEIGHTS, ANNE ARUNDEL COUNTY

(Population, 1,700)

Ownership: Anne Arundel County. Population served: About 1,700.
Source: 2 wells: No. 1, 325 feet deep; No. 2, 332 feet deep.
Average daily use: 113,000 gpd. (1967)
Treatment: Aeration, lime, chlorination, fluoridation, settling basin, clear well, filtration.
Rated capacity of treatment plant: 172,000 gpd.
Raw-water storage: 24,300 gal. in settling basin and clear well.
Finished-water storage: 1 standpipe, 319,000 gal.
Remarks: The system serving Belvedere Heights is interconnected with that serving the smaller development of Pines-on-Severn, 2½ miles away.

Chemical analyses in parts per million [a]

	Well 1	Finished water		Well 1	Finished water
Silica (SiO_2)	--	--	Phosphate (PO_4)	--	--
Iron (Fe)	8.0	0.0	Dissolved solids (residue at 180°C)	60	96
Manganese (Mn)	--	--	Hardness as $CaCO_3$:		
Calcium (Ca)	--	--	Total	4.0	48
Magnesium (Mg)	--	--	Noncarbonate	--	--
Sodium (Na)	1.0	--			
Potassium (K)	--	--			
Bicarbonate (HCO_3)	21	33	Specific conductance (micromhos at 25°C)	--	--
Carbonate (CO_3)	--	--	pH	4.5	8.1
Sulfate (SO_4)	--	--	Color	5	3
Chloride (Cl)	3.8	.9	Temperature (°F)	--	--
Fluoride (F)	--	--	Date of collection	2/27/67	2/27/67
Nitrate (NO_3)	.06	--			

a/ Data from Maryland State Department of Health

BERLIN, WORCESTER COUNTY

(Population, 2,046)

Ownership: Municipal. Population served: About 2,500.
Source: 3 wells, 101, 105, and 115 feet deep.
Average daily use: 345,000 gpd.
Treatment: Chlorination, pH adjustment.
Rated capacity of treatment plant: 700,000 gpd.
Finished-water storage: 2 tanks, 135,000 gal., 200,000 gal.; total storage 335,000 gal.

Chemical analyses in parts per million

	Well 3	Finished water		Well 3	Finished water
Silica (SiO_2)	21	20	Phosphate (PO_4)	0.02	0.03
Iron (Fe)	.03	.20	Dissolved solids (residue at 180°C)	105	107
Manganese (Mn)	.01	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	7.9	7.6	Total	30	31
Magnesium (Mg)	2.6	2.9	Noncarbonate	15	15
Sodium (Na)	12	13			
Potassium (K)	1.6	1.6			
Bicarbonate (HCO_3)	19	20	Specific conductance (micromhos at 25°C)	132	139
Carbonate (CO_3)	0	0	pH	7.5	7.3
Sulfate (SO_4)	7.8	8.8	Color	3	0
Chloride (Cl)	14	16	Temperature (°F)	--	--
Fluoride (F)	.0	.0	Date of collection	6/27/67	6/27/67
Nitrate (NO_3)	20	19			

BOONSBORO, WASHINGTON COUNTY

(Population, 1,644)

Ownership: Municipal. Population served: About 4,000 (1966), including Keedysville.
Source: Springs.
Average daily use: 120,000 gpd.
Treatment: Chlorination.
Raw-water storage: 1,500,000 gal. reservoir, gravity to mains.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	9.5	9.8	Phosphate (PO_4)	0.03	0.05
Iron (Fe)	.03	.03	Dissolved solids (residue at 180°C)	253	250
Manganese (Mn)	.02	.03	Hardness as $CaCO_3$:		
Calcium (Ca)	74	73	Total	230	229
Magnesium (Mg)	11	11	Noncarbonate	34	32
Sodium (Na)	4.5	4.5			
Potassium (K)	2.0	2.1			
Bicarbonate (HCO_3)	240	240	Specific conductance (micromhos at 25°C)	449	446
Carbonate (CO_3)	0	0	pH	7.4	7.6
Sulfate (SO_4)	18	16	Color	5	0
Chloride (Cl)	10	12	Temperature (°F)	--	--
Fluoride (F)	.3	.3	Date of collection	3/3/66	3/3/66
Nitrate (NO_3)	12	12			

BOWIE, PRINCE GEORGES COUNTY

(Population, 28,000 Estimated 1967)

Ownership: Area Development Corp. - Subsidiary of Levitt & Sons Co. - Leased and operated by the City of Bowie. Population served: About 27,000 (1967)(includes Belair development).
Source: 5 wells.
Average daily use: 2,220,000 gpd (1967).
Treatment: Aeration, lime and alum chemical mixing, flocculation, clarification, filtration. Chlorination and fluoridation.
Rated capacity of treatment plant: 8,000,000 gpd.
Finished-water storage: Clear well, 150,000 gal., ground-level storage, 600,000 gal., 3,000,000 gal.; elevated storage, 600,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	9.9	8.3	Phosphate (PO_4)	0.01	0.03
Iron (Fe)	2.9	.02	Dissolved solids (residue at 180°C)	30	75
Manganese (Mn)	.08	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	1.9	18	Total	9	50
Magnesium (Mg)	1.1	1.1	Noncarbonate	7	22
Sodium (Na)	2.0	1.7			
Potassium (K)	1.4	1.5			
Bicarbonate (HCO_3)	3	34	Specific conductance (micromhos at 25°C)	38	117
Carbonate (CO_3)	0	0	pH	6.0	7.8
Sulfate (SO_4)	12	18	Color	0	0
Chloride (Cl)	1.7	4.9	Temperature (°F)	--	--
Fluoride (F)	.0	1.0	Date of collection	6/22/67	6/22/67
Nitrate (NO_3)	.3	.4			

BRADDOCK HEIGHTS, FREDERICK COUNTY

(Population, 600)

Ownership: Braddock Heights Water Co. Population served: About 1,400.
Source: 4 wells and 3 springs.
Average daily use: 42,000 gpd.
Treatment: Chlorination.
Finished water storage: 350,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	21	21	Phosphate (PO_4)	0.12	0.16
Iron (Fe)	.02	.02	Dissolved solids (residue at 180°C)	119	102
Manganese (Mn)	.00	.02	Hardness as $CaCO_3$:		
Calcium (Ca)	20	13	Total	85	64
Magnesium (Mg)	8.5	7.6	Noncarbonate	17	22
Sodium (Na)	5.0	5.4			
Potassium (K)	.3	.5			
Bicarbonate (HCO_3)	84	52	Specific conductance (micromhos at 25°C)	190	156
Carbonate (CO_3)	0	0	pH	8.0	7.7
Sulfate (SO_4)	9.6	9.2	Color	0	2
Chloride (Cl)	8.0	14	Temperature (°F)	--	--
Fluoride (F)	.0	.2	Date of collection	8/9/67	8/9/67
Nitrate (NO_3)	3.9	6.6			

BRUNSWICK, FREDERICK COUNTY

(Population, 3,555)

Ownership: Municipal. Population served: About 4,500 (1967).
Source: 3 springs in Virginia, 1 spring in Maryland.
Average daily use: 200,000 gpd.
Treatment: Chlorination.
Rated capacity of treatment plants: (Va.) 115,000 gpd., (Md.) 225,000 gpd.
Finished-water storage: 1 tank 250,000 gal.; reservoir 3,000,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	12	15	Phosphate (PO_4)	0.38	0.07
Iron (Fe)	1.5	1.2	Dissolved solids (residue at 180°C)	85	103
Manganese (Mn)	.14	.12	Hardness as $CaCO_3$:		
Calcium (Ca)	20	24	Total	79	91
Magnesium (Mg)	6.9	7.5	Noncarbonate	0	4
Sodium (Na)	1.8	2.7			
Potassium (K)	1.0	1.0			
Bicarbonate (HCO_3)	99	107	Specific conductance (micromhos at 25°C)	157	184
Carbonate (CO_3)	0	0	pH	8.0	8.2
Sulfate (SO_4)	2.4	2.4	Color	0	3
Chloride (Cl)	.7	5.1	Temperature (°F)	66	66
Fluoride (F)	.2	.1	Date of collection	6/29/67	6/29/67
Nitrate (NO_3)	.0	.3			

CAMBRIDGE, DORCHESTER COUNTY

(Population, 12,239)

Ownership: Municipal. Population served: About 16,000 (1965).
Source: 9 wells, about 370 to 500 feet deep; 1 well,(Dor-Ce 3) 977 feet deep.
Average daily use: Average plant output in fiscal year 1967: 420,000 gpd. Dor-Ce 3,and 2,510,000 gpd. 8 other wells.
Treatment: Chlorination, aeration, pH adjustment at individual wells.
Rated capacity of wells: 6,900,000 gpd.
Finished-water storage: 1,000,000 gal., ground storage; 500,000 gal., surface storage; 582,000 gal. in 5 elevated tanks; total storage 2,082,000 gal.

Chemical analyses in parts per million

	Well No. Dor-Ce 3	Well No. Dor-Ce 78		Well No. Dor-Ce 3	Well No. Dor-Ce 78
Silica (SiO_2)	11	22	Phosphate (PO_4)	--	--
Iron (Fe)	.02	.06	Dissolved solids (residue at 180°C)	248	456
Manganese (Mn)	.01	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	.0	5.4	Total	4	32
Magnesium (Mg)	1.0	4.6	Noncarbonate	0	0
Sodium (Na)	93	168			
Potassium (K)	4.4	8.0			
Bicarbonate (HCO_3)	245	408	Specific conductance (micromhos at 25°C)	397	719
Carbonate (CO_3)	0	16	pH	7.9	8.6
Sulfate (SO_4)	9.6	18	Color	--	3
Chloride (Cl)	2.2	10	Temperature (°F)	--	63
Fluoride (F)	1.1	1.0	Date of collection	4/2/65	11/3/65
Nitrate (NO_3)	.0	.5			

CAMBRIDGE, DORCHESTER COUNTY (Continued)

Chemical analyses in parts per million

	Well No. Dor-Ce 2	Finished water		Well No. Dor-Ce 2	Finished water
Silica (SiO_2)	20	29	Phosphate (PO_4)	0.32	0.24
Iron (Fe)	.04	.04	Dissolved solids (residue at 180°C)	475	477
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	5.3	5.3	Total	28	28
Magnesium (Mg)	3.5	3.5	Noncarbonate	0	0
Sodium (Na)	174	174			
Potassium (K)	8.3	8.3			
Bicarbonate (HCO_3)	442	454	Specific conductance (micromhos at 25°C)	760	763
Carbonate (CO_3)	20	14	pH	8.7	8.5
Sulfate (SO_4)	12	12	Color	2	3
Chloride (Cl)	6.7	7.5	Temperature (°F)	64	--
Fluoride (F)	1.2	1.2	Date of collection	8/2/67	8/2/67
Nitrate (NO_3)	.1	.3			

CENTREVILLE, QUEEN ANNES COUNTY

(Population, 1,863)

Ownership: Municipal. Population served: About 1,830.
Source: 2 wells, 530 and 480 feet deep.
Average daily use: 290,000 gpd.
Treatment: Chlorination.
Finished-water storage: 70,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	16	16	Phosphate (PO_4)	0.06	0.09
Iron (Fe)	.28	.24	Dissolved solids (residue at 180°C)	166	164
Manganese (Mn)	.01	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	29	29	Total	113	112
Magnesium (Mg)	9.7	9.6	Noncarbonate	0	0
Sodium (Na)	16	14			
Potassium (K)	13	13			
Bicarbonate (HCO_3)	184	174	Specific conductance (micromhos at 25°C)	300	299
Carbonate (CO_3)	0	4	pH	7.9	8.4
Sulfate (SO_4)	6.0	5.8	Color	3	3
Chloride (Cl)	1.0	4.0	Temperature (°F)	--	--
Fluoride (F)	.6	.6	Date of collection	12/1/66	12/1/66
Nitrate (NO_3)	1.9	.2			

CHESAPEAKE CITY, CECIL COUNTY

(Population, 1,104)

Ownership: Municipal. Population served: 1,055.
Source: 2 wells, 226 and 163 feet deep.
Average daily use: 75,000 gpd.
Treatment: Chlorination, softening, iron removal, pH adjustment, zeolite pressure filtration.
Finished-water storage: 75,000 gal., elevated tank.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	7.3	11	Phosphate (PO_4)	0.00	0.13
Iron (Fe)	23	.07	Dissolved solids		
Manganese (Mn)	.18	.00	(residue at 180°C)	50	215
Calcium (Ca)	8.5	.0	Hardness as $CaCO_3$:		
Magnesium (Mg)	2.7	.0	Total	32	0
Sodium (Na)	2.8	85	Noncarbonate	22	0
Potassium (K)	1.5	.0			
Bicarbonate (HCO_3)	13	190	Specific conductance		
Carbonate (CO_3)	0	2	(micromhos at 25°C)	91	350
Sulfate (SO_4)	22	24	pH	6.2	8.3
Chloride (Cl)	3.7	3.3	Color	1	--
Fluoride (F)	.0	.2	Temperature (°F)	--	--
Nitrate (NO_3)	.2	.0	Date of collection	2/8/66	2/8/66

CHESTERTOWN, KENT COUNTY

(Population, 3,602)

Ownership: Chestertown Utilities Commission. Population served: About 3,800.
Source: 6 wells.
Average plant output for 1965: 600,000 gpd.
Treatment: Aeration, lime, chlorination, fluoridation.
Rated capacity of treatment plant: 2,160,000 gpd.
Finished-water storage: 570,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	12	12	Phosphate (PO_4)	0.01	0.00
Iron (Fe)	.03	.04	Dissolved solids		
Manganese (Mn)	.02	.02	(residue at 180°C)	202	203
Calcium (Ca)	22	28	Hardness as $CaCO_3$:		
Magnesium (Mg)	4.4	4.4	Total	72	87
Sodium (Na)	24	22	Noncarbonate	49	50
Potassium (K)	2.9	2.7			
Bicarbonate (HCO_3)	28	45	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	299	312
Sulfate (SO_4)	5.2	6.0	pH	6.5	7.6
Chloride (Cl)	56	53	Color	1	2
Fluoride (F)	.0	.8	Temperature (°F)	--	--
Nitrate (NO_3)	22	21	Date of collection	2/23/66	2/23/66

CRISFIELD, SOMERSET COUNTY

(Population, 3,540)

Ownership: Municipal. Estimated population served: 5,300.
Source: 4 wells, No. 1, 994 feet deep; No. 3, 1,076 feet deep; No. 4, 1,146 feet deep; No. 5, 1,110 feet deep.
Average daily use: 530,000 gpd.
Treatment: None.
Finished water storage: 150,000 gal.

Chemical analyses in parts per million [a]

	Well 1	Well 3		Well 1	Well 3
Silica (SiO_2)	11	11	Phosphate (PO_4)	--	--
Iron (Fe)	.0	.0	Dissolved solids (residue at 180°C)	1,208	796
Manganese (Mn)	.0	.0	Hardness as $CaCO_3$:		
Calcium (Ca)	1.9	.4	Total	6.4	2.6
Magnesium (Mg)	1.3	.4	Noncarbonate	0	0
Sodium (Na)	460	264			
Potassium (K)	--	--			
Bicarbonate (HCO_3)	830	560	Specific conductance (micromhos at 25°C)	--	--
Carbonate (CO_3)	76	57	pH	--	8.5
Sulfate (SO_4)	58	49	Color	5	5
Chloride (Cl)	121	23	Temperature (°F)	--	--
Fluoride (F)	4.0	2.2	Date of collection	9/6/66	9/6/66
Nitrate (NO_3)	.04	.06			

a/ Data from Maryland State Department of Health

CRISFIELD, SOMERSET COUNTY (Continued)

Chemical analyses in parts per million [a]

	Well 4	Well 5		Well 4	Well 5
Silica (SiO_2)	12	11	Phosphate (PO_4)	--	--
Iron (Fe)	.10	.0	Dissolved solids (residue at 180°C)	806	934
Manganese (Mn)	.0	.0	Hardness as $CaCO_3$:		
Calcium (Ca)	.4	1.6	Total	2.6	7.4
Magnesium (Mg)	.4	.7	Noncarbonate	0	0
Sodium (Na)	288	308			
Potassium (K)	--	--			
Bicarbonate (HCO_3)	530	620	Specific conductance (micromhos at 25°C)	--	--
Carbonate (CO_3)	64	62	pH	8.6	8.5
Sulfate (SO_4)	50	50	Color	5	5
Chloride (Cl)	59	82	Temperature (°F)	--	--
Fluoride (F)	2.3	2.7	Date of collection	9/6/66	9/6/66
Nitrate (NO_3)	.06	.06			

a/ Data from Maryland State Department of Health

CUMBERLAND, ALLEGANY COUNTY

(Population, 33,415)

Ownership: Evitts Creek Water Co. Population served: About 47,500.
Source: Evitts Creek, impounded in two lakes in Pennsylvania, Koon Lake and Lake Gordon.
Average daily use: 12,000,000 gpd.
Treatment: Chlorination, ammonia gas, chemical alum-lime coagulation, sedimentation, filtration, activated carbon.
Rated capacity of treatment plant: 18,000,000 gpd.
Raw-water storage: Koon Lake 2,330,941,000 gal., Lake Gordon 1,300,000,000 gal.; total raw-water storage 3.6 billion gal.
Finished-water storage: Ridgedale Reservoir 7,500,000 gal., Fort Hill Reservoir 3,500,000 gal., 3 tanks 100,000 gal. each, 1 tank 200,000 gal., 1 tank 500,000 gal.; total finished-water storage 12,000,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	1.1	2.5	Phosphate (PO_4)	0.00	0.00
Iron (Fe)	.07	.03	Dissolved solids (residue at 180°C)	79	106
Manganese (Mn)	.02	.02	Hardness as $CaCO_3$:		
Calcium (Ca)	20	24	Total	65	77
Magnesium (Mg)	3.5	4.0	Noncarbonate	20	24
Sodium (Na)	1.5	1.6			
Potassium (K)	1.5	1.4			
Bicarbonate (HCO_3)	54	64	Specific conductance (micromhos at 25°C)	137	165
Carbonate (CO_3)	0	0	pH	7.2	7.6
Sulfate (SO_4)	18	20	Color	5	5
Chloride (Cl)	2.7	4.3	Temperature (°F)	--	--
Fluoride (F)	.1	.1	Date of collection	6/23/66	6/23/66
Nitrate (NO_3)	.2	1.3			

DELMAR, WICOMICO COUNTY

(Population, 1,291)

Ownership: Municipal. Population served: About 2,500.
Source: 2 wells, 126 and 135 feet deep.
Average daily use: 347,000 gpd (in 1964).
Treatment: Chlorination.
Finished-water storage: 93,000 gal.

Chemical analyses in parts per million [a]

	Well 2	Well 3	Tap		Well 2	Well 3	Tap
Silica (SiO_2)	27	24	--	Phosphate (PO_4)	--	--	--
Iron (Fe)	.60	.80	0.30	Dissolved solids (residue at 180°C)	86	78	102
Manganese (Mn)	.06	.08	--	Hardness as $CaCO_3$:			
Calcium (Ca)	6.1	6.3	--	Total	21	21	--
Magnesium (Mg)	1.7	1.6	--	Noncarbonate	7	7	--
Sodium (Na)	9.5	9.0	--				
Potassium (K)	--	--	--				
Bicarbonate (HCO_3)	17	17	17	Specific conductance (micromhos at 25°C)	--	--	--
Carbonate (CO_3)	.0	.0	0	pH	6.0	6.1	6.1
Sulfate (SO_4)	7.9	10	--	Color	3	3	3
Chloride (Cl)	23	19	--	Temperature (°F)	--	--	--
Fluoride (F)	.2	.1	--	Date of collection	6/27/67	6/27/67	12/5/66
Nitrate (NO_3)	2.8	3.4	--				

a/ Analyses by Maryland State Department of Health

DENTON, CAROLINE COUNTY
(Population, 1,938)

Ownership: Municipal. Population served: About 2,500.
Source: 2 wells, 400 and 402 feet deep.
Average daily use: 270,000 gpd.
Treatment: None.
Finished-water storage: 100,000 gal.

Chemical analyses in parts per million

	Well Care-Dd 2	Tap		Well Care-Dd 2	Tap
Silica (SiO_2)	23	28	Phosphate (PO_4)	--	0.56
Iron (Fe)	.04	.04	Dissolved solids (residue at 180°C)	517	533
Manganese (Mn)	.0	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	4.4	5.0	Total	26	26
Magnesium (Mg)	3.6	3.3	Noncarbonate	0	0
Sodium (Na)	190	189			
Potassium (K)	8	7.4			
Bicarbonate (HCO_3)	512	480	Specific conductance (micromhos at 25°C)	809	819
Carbonate (CO_3)	18	32	pH	8.5	8.9
Sulfate (SO_4)	7.4	8.0	Color	--	2
Chloride (Cl)	3.5	2.7	Temperature (°F)	63.5	--
Fluoride (F)	1.6	1.4	Date of collection	11/24/53	11/30/66
Nitrate (NO_3)	.7	.7			

EASTON, TALBOT COUNTY
(Population, 6,337)

Ownership: Municipal. Population served: About 7,500.
Source: 5 wells (Tal-Ce 1-3, 5, 50), 1012, 110, 1025, 1148, and 630 feet deep.
Average daily use: 700,000 gpd.
Treatment: Chlorination.
Finished-water storage: Standpipe, 87,500 gal., 2 elevated tanks, 1,250,000 gal.; total storage, 1,337,500 gal.

Chemical analyses in parts per million

	Well Tal-Ce 2	Well Tal-Ce 3		Well Tal-Ce 2	Well Tal-Ce 3
Silica (SiO_2)	56	14	Phosphate (PO_4)	--	--
Iron (Fe)	.03	.06	Dissolved solids (residue at 180°C)	260	241
Manganese (Mn)	--	--	Hardness as $CaCO_3$:		
Calcium (Ca)	36	4.8	Total	152	17
Magnesium (Mg)	15	1.2	Noncarbonate	0	0
Sodium (Na)	27	81			
Potassium (K)	5.9	1.8			
Bicarbonate (HCO_3)	242	210	Specific conductance (micromhos at 25°C)	394	377
Carbonate (CO_3)	0	0	pH	7.5	8.2
Sulfate (SO_4)	6.9	15	Color	--	5
Chloride (Cl)	2.8	2.5	Temperature (°F)	59	75
Fluoride (F)	.5	.9	Date of collection	10/7/48	3/18/49
Nitrate (NO_3)	.3	1.8			

EASTON, TALBOT COUNTY (Continued)

Chemical analyses in parts per million

	Well Tal-Ce 5	Finished water		Well Tal-Ce 5	Finished water
Silica (SiO_2)	9.5	57	Phosphate (PO_4)	--	0.05
Iron (Fe)	.38	.05	Dissolved solids (residue at 180°C)	111	254
Manganese (Mn)	--	.01	Hardness as $CaCO_3$:		
Calcium (Ca)	2.4	35	Total	14	141
Magnesium (Mg)	2.0	13	Noncarbonate	0	0
Sodium (Na)	30	26			
Potassium (K)	2.2	6.2			
Bicarbonate (HCO_3)	80	219	Specific conductance (micromhos at 25°C)	168	369
Carbonate (CO_3)	0	9	pH	7.5	8.5
Sulfate (SO_4)	15	5.8	Color	15	2
Chloride (Cl)	2.5	5.1	Temperature (°F)	78	--
Fluoride (F)	.2	.4	Date of collection	3/11/49	8/2/67
Nitrate (NO_3)	1.6	.0			

ELKTON, CECIL COUNTY

(Population, 5,989)

Ownership: Municipal. Population served: About 7,500 (1966).
Source: Big Elk Creek.
Average daily use: 1,200,000 gpd in 1965.
Treatment: Alum for coagulation, lime to regulate pH, filtration, and chlorination.
Rated capacity of treatment plant: 1,500,000 gpd.
Raw-water storage: 10,000,000 gal.
Finished-water storage: 2,500,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	12	11	Phosphate (PO_4)	0.00	0.02
Iron (Fe)	.15	.00	Dissolved solids (residue at 180°C)	61	106
Manganese (Mn)	.04	.02	Hardness as $CaCO_3$:		
Calcium (Ca)	7.2	19	Total	28	60
Magnesium (Mg)	2.3	3.0	Noncarbonate	10	31
Sodium (Na)	6.4	7.1			
Potassium (K)	1.8	1.9			
Bicarbonate (HCO_3)	21	36	Specific conductance (micromhos at 25°C)	100	174
Carbonate (CO_3)	0	0	pH	6.4	7.5
Sulfate (SO_4)	8.2	21	Color	3	2
Chloride (Cl)	9.4	14	Temperature (°F)	--	--
Fluoride (F)	.1	.0	Date of collection	2/8/66	2/8/66
Nitrate (NO_3)	5.6	7.5			

EMMITSBURG, FREDERICK COUNTY

(Population, 1,369)

Ownership: Municipal. Population served: About 4,000 (1966).
Source: Wells, springs, and reservoirs filled from Turkey Creek.
Average daily use: 350,000 gpd.
Treatment: Chlorination and filtration.
Rated capacity of treatment plant: 530,000 gpd.
Raw-water storage: 30,000,000 gal.
Finished-water storage: 500,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	9.4	10	Phosphate (PO_4)	0.00	0.03
Iron (Fe)	.09	.09	Dissolved solids		
Manganese (Mn)	.02	.01	(residue at 180°C)	49	45
Calcium (Ca)	4.7	5.9	Hardness as $CaCO_3$:		
Magnesium (Mg)	2.8	2.6	Total	24	26
Sodium (Na)	1.9	1.8	Noncarbonate	20	16
Potassium (K)	.5	.3			
Bicarbonate (HCO_3)	4	12	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	70	65
Sulfate (SO_4)	9.2	8.6	pH	5.6	6.6
Chloride (Cl)	10	7.1	Color	4	4
Fluoride (F)	.1	.1	Temperature (°F)	--	--
Nitrate (NO_3)	1.0	1.5	Date of collection	3/1/66	3/1/66

FEDERALSBURG, CAROLINE COUNTY

(Population, 2,060)

Ownership: Municipal. Population served: About 3,000.
Source: 4 wells.
Average daily use: 313,000 gpd.
Treatment: Chlorination.
Finished-water storage: 150,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	11	10	Phosphate (PO_4)	0.00	0.01
Iron (Fe)	.40	.02	Dissolved solids		
Manganese (Mn)	.01	.01	(residue at 180°C)	52	55
Calcium (Ca)	3.5	3.0	Hardness as $CaCO_3$:		
Magnesium (Mg)	1.8	2.0	Total	16	16
Sodium (Na)	7.5	7.6	Noncarbonate	12	11
Potassium (K)	2.0	1.9			
Bicarbonate (HCO_3)	5	6	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	82	87
Sulfate (SO_4)	3.0	5.0	pH	5.9	6.9
Chloride (Cl)	7.5	7.6	Color	3	2
Fluoride (F)	.0	.0	Temperature (°F)	--	--
Nitrate (NO_3)	20	19	Date of collection	12/1/66	12/1/66

FREDERICK, FREDERICK COUNTY

(Population, 21,744)

Ownership: Municipal. Population served: About 25,000 (1967).
Source: Linganore Creek, Tuscarora Creek, Fishing Creek, and Monocacy River.
Average daily use (1967): 3,560,000 gpd.
Treatment: Tuscarora Creek, chlorination at intake, further treatment after water enters Fishing Creek water lines; Fishing Creek, chlorination, ammonia; Monocacy River and Linganore Creek, alum, lime, chlorination, fluoridation, carbon.
Rated capacity of treatment plant: Linganore, 4,000,000 gpd.; Monocacy, 2,000,000 gpd.
Raw-water storage: Fishing Creek, 90,000,000 gal.
Finished-water storage: Linganore Creek, 125,000 gal. (clear well); Monocacy River, 150,000 gal. (clear well); 2 elevated tanks, 1,000,000 gal. each.

Chemical analyses in parts per million a/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	4.7	4.2	Phosphate (PO_4)	0.01	0.01
Iron (Fe)	.15	.02	Dissolved solids (residue at 180°C)	79	111
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	17	26	Total	62	84
Magnesium (Mg)	4.6	4.6	Noncarbonate	8	29
Sodium (Na)	3.0	3.6			
Potassium (K)	1.8	2.0			
Bicarbonate (HCO_3)	65	68	Specific conductance (micromhos at 25°C)	133	198
Carbonate (CO_3)	0	0	pH	7.1	7.7
Sulfate (SO_4)	7.4	23	Color	4	0
Chloride (Cl)	5.2	8.1	Temperature (°F)	37	--
Fluoride (F)	.1	.9	Date of collection	11/21/66	11/21/66
Nitrate (NO_3)	4.7	5.2			

a/ Linganore Creek filtration plant

FREDERICK, FREDERICK COUNTY (Continued)

Chemical analyses in parts per million b/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	0.3	3.2	Phosphate (PO_4)	0.16	0.16
Iron (Fe)	.08	c/ .01	Dissolved solids (residue at 180°C)	130	162
Manganese (Mn)	.00	c/ .00	Hardness as $CaCO_3$:		
Calcium (Ca)	29	38	Total	99	122
Magnesium (Mg)	6.3	6.5	Noncarbonate	13	45
Sodium (Na)	6.6	6.6			
Potassium (K)	3.6	2.4			
Bicarbonate (HCO_3)	100	94	Specific conductance (micromhos at 25°C)	237	280
Carbonate (CO_3)	2	0	pH	8.3	7.0
Sulfate (SO_4)	18	37	Color	5	1
Chloride (Cl)	8.3	13	Temperature (°F)	--	--
Fluoride (F)	.2	.9	Date of collection	11/21/66	11/21/66
Nitrate (NO_3)	4.9	4.6			

b/ Monocacy River filtration plant

c/ In solution when analyzed

FROSTBURG, ALLEGANY COUNTY

(Population, 6,722)

Ownership: Municipal. Population served: About 11,000.
Source: Savage River, Piney Run, springs, and wells.
Average daily use: 460,000 gpd.
Treatment: Coagulation, sedimentation, filtration, chlorination, pH adjustment.
Rated capacity of treatment plant: 1,000,000 gpd.
Raw-water storage: 60,000,000 gal. (1965).
Finished-water storage: 7,000,000 gal. (1965).

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	5.1	4.7	Phosphate (PO_4)	0.02	0.01
Iron (Fe)	.54	.17	Dissolved solids		
Manganese (Mn)	.02	.02	(residue at 180°C)	65	88
Calcium (Ca)	11	17	Hardness as $CaCO_3$:		
Magnesium (Mg)	1.9	1.9	Total	36	51
Sodium (Na)	4.4	4.4	Noncarbonate	9	29
Potassium (K)	.8	.8			
Bicarbonate (HCO_3)	33	27	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	94	133
Sulfate (SO_4)	5.6	21	pH	6.8	7.2
Chloride (Cl)	9.4	12	Color	7	2
Fluoride (F)	.1	.1	Temperature (°F)	--	--
Nitrate (NO_3)	.3	.8	Date of collection	6/20/66	6/20/66

GLEN BURNIE, ANNE ARUNDEL COUNTY

(Population, 15,000)

Ownership: Anne Arundel County. Total population served: About 55,000.
Source: 18 wells supplying water to 3 separate treatment plants.
Average daily plant production (1964): Dorsey Rd., 2,190,000 gpd.; Sawmill Branch, 1,270,000 gpd. and Harundale, 1,300,000 gpd.
Treatment: Aeration, pH adjustment, chlorination, fluoridation at all plants; sedimentation and filtration at Dorsey Rd.
Rated capacity of treatment plants: Dorsey Rd., 5,000,000 gpd., Sawmill Branch, 2,000,000 gpd; Harundale, 2,000,000 gpd.
Raw-water storage: 170,000 gal., Dorsey Rd.
Finished-water storage: 5,859,000 gal. in surface storage, elevated tanks, and standpipes.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	9.6	11	Phosphate (PO_4)	0.01	0.02
Iron (Fe)	.05	.2	Dissolved solids		
Manganese (Mn)	.03	.04	(residue at 180°C)	26	53
Calcium (Ca)	2.3	15	Hardness as $CaCO_3$:		
Magnesium (Mg)	1.0	.6	Total	10	40
Sodium (Na)	2.1	1.4	Noncarbonate	8	11
Potassium (K)	1.2	.9			
Bicarbonate (HCO_3)	2	36	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	39	88
Sulfate (SO_4)	4.8	6.2	pH	6.2	7.6
Chloride (Cl)	3.2	2.7	Color	3	3
Fluoride (F)	.1	1.0	Temperature (°F)	--	--
Nitrate (NO_3)	6.5	2.2	Date of collection	7/31/67	7/31/67

a/ Dorsey Rd. plant

GLEN BURNIE, ANNE ARUNDEL COUNTY Continued)

Chemical analyses in parts per million b/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	8.0	8.5	Phosphate (PO_4)	0.00	0.00
Iron (Fe)	.05	.02	Dissolved solids (residue at 180°C)	27	39
Manganese (Mn)	.01	.01	Hardness as $CaCO_3$:		
Calcium (Ca)	1.9	6.6	Total	8	20
Magnesium (Mg)	.8	.7	Noncarbonate	7	7
Sodium (Na)	1.9	2.1			
Potassium (K)	.8	.8			
Bicarbonate (HCO_3)	2	16	Specific conductance (micromhos at 25°C)	31	55
Carbonate (CO_3)	0	0	pH	6.2	6.7
Sulfate (SO_4)	.2	.0	Color	2	2
Chloride (Cl)	3.0	3.3	Temperature (°F)	--	--
Fluoride (F)	--	.7	Date of collection	7/31/67	7/31/67
Nitrate (NO_3)	8.2	7.2			

b/ Harundale plant

GLEN BURNIE, ANNE ARUNDEL COUNTY (Continued)

Chemical analyses in parts per million c/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	10	9.1	Phosphate (PO_4)	0.01	0.00
Iron (Fe)	.04	.08	Dissolved solids (residue at 180°C)	47	72
Manganese (Mn)	.02	.02	Hardness as $CaCO_3$:		
Calcium (Ca)	3.9	11	Total	17	34
Magnesium (Mg)	1.8	1.6	Noncarbonate	15	15
Sodium (Na)	5.0	4.5			
Potassium (K)	1.6	1.3			
Bicarbonate (HCO_3)	3	24	Specific conductance (micromhos at 25°C)	72	103
Carbonate (CO_3)	0	0	pH	6.4	7.2
Sulfate (SO_4)	4.8	4.0	Color	3	2
Chloride (Cl)	8.8	9.4	Temperature (°F)	--	--
Fluoride (F)	.1	1.0	Date of collection	7/31/67	7/31/67
Nitrate (NO_3)	13	9.5			

c/ Sawmill Branch Plant

GREENSBORO, CAROLINE COUNTY

(Population, 1,160)

Ownership: Municipal. Population served: About 1,200.
Source: 2 wells, each 275 feet deep.
Treatment: None.
Average daily use: 100,000 gpd.
Finished-water storage: 50,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	52		Phosphate (PO_4)	0.07	
Iron (Fe)	.02		Dissolved solids (residue at 180°C)	306	
Manganese (Mn)	.00		Hardness as $CaCO_3$:		
Calcium (Ca)	10		Total	47	
Magnesium (Mg)	5.2		Noncarbonate	0	
Sodium (Na)	82				
Potassium (K)	5.2				
Bicarbonate (HCO_3)	263		Specific conductance (micromhos at 25°C)	431	
Carbonate (CO_3)	6		pH	8.4	
Sulfate (SO_4)	1.6		Color	3	
Chloride (Cl)	1.5		Temperature (°F)	--	
Fluoride (F)	.7		Date of collection	11/30/66	
Nitrate (NO_3)	.7				

HAGERSTOWN, WASHINGTON COUNTY

(Population, 36,660)

Ownership: Municipal; also supplies Williamsport, Funkstown, Security, and neighboring communities.
Population served: About 57,000.
Source: Potomac River and mountain springs.
Average daily use: 6,930,000 gpd.
Treatment: Chlorination, filtration, sedimentation, alum, pH adjustment, fluoridation.
Rated capacity of treatment plant: 13,000,000 gpd.
Raw-water storage: 120,000,000 gal. reservoir, mountain supply.
Finished-water storage: 11,500,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	2.4	2.7	Phosphate (PO_4)	0.03	0.02
Iron (Fe)	.07	.16	Dissolved solids (residue at 180°C)	159	146
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	33	31	Total	105	100
Magnesium (Mg)	5.4	5.3	Noncarbonate	46	41
Sodium (Na)	8.8	8.7			
Potassium (K)	4.8	1.9			
Bicarbonate (HCO_3)	72	72	Specific conductance (micromhos at 25°C)	271	251
Carbonate (CO_3)	0	0	pH	7.1	7.4
Sulfate (SO_4)	43	41	Color	0	3
Chloride (Cl)	17	16	Temperature (°F)	--	--
Fluoride (F)	--	.8	Date of collection	11/21/66	11/21/66
Nitrate (NO_3)	.1	.2			

HANCOCK, WASHINGTON COUNTY

(Population, 2,004)

Ownership: Municipal. Population served: About 2,000.
Source: Little Tonoloway Creek; emergency supply from Potomac River.
Average daily use: 230,000 gpd.
Treatment: Chlorination, alum, sedimentation, filtration.
Finished-water storage: 500,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	4.0	4.0	Phosphate (PO_4)	0.00	0.00
Iron (Fe)	.20	.02	Dissolved solids		
Manganese (Mn)	.05	.00	(residue at 180°C)	--	267
Calcium (Ca)	62	63	Hardness as $CaCO_3$:		
Magnesium (Mg)	15	15	Total	216	219
Sodium (Na)	5.7	5.6	Noncarbonate	52	58
Potassium (K)	1.7	1.8			
Bicarbonate (HCO_3)	200	196	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	442	440
Sulfate (SO_4)	57	56	pH	7.5	8.0
Chloride (Cl)	11	13	Color	3	3
Fluoride (F)	.2	.2	Temperature (°F)	--	--
Nitrate (NO_3)	1.0	2.1	Date of collection	6/20/66	6/20/66

HAVRE DE GRACE, HARFORD COUNTY

(Population, 8,510)

Municipal. Population served: About 10,500.
Source: Susquehanna River.
Average daily use: 950,000 gpd. (1965).
Treatment: Pre-chlorination, coagulation, flocculation, sedimentation, filtration, post-chlorination, pH adjustment.
Rated capacity of treatment plant: 2,250,000 gpd.
Finished-water storage: Open concrete reservoir, capacity 3,000,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	4.6	4.0	Phosphate (PO_4)	0.02	0.03
Iron (Fe)	1.1	.08	Dissolved solids		
Manganese (Mn)	.23	.17	(residue at 180°C)	138	207
Calcium (Ca)	23	24	Hardness as $CaCO_3$:		
Magnesium (Mg)	7.1	6.6	Total	86	86
Sodium (Na)	7.9	34	Noncarbonate	60	26
Potassium (K)	1.4	1.5			
Bicarbonate (HCO_3)	32	74	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	230	343
Sulfate (SO_4)	62	80	pH	6.5	7.7
Chloride (Cl)	9.5	13	Color	8	2
Fluoride (F)	.2	.2	Temperature (°F)	--	--
Nitrate (NO_3)	3.7	3.5	Date of collection	2/8/66	2/8/66

HURLOCK, DORCHESTER COUNTY

(Population, 1,035)

Ownership: Municipal. Population served: 1,035.
Source: Wells
Average daily use: 70,000 gpd.
Treatment: None.
Finished-water storage: 80,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)		17	Phosphate (PO_4)		0.11
Iron (Fe)		.02	Dissolved solids (residue at 180°C)		86
Manganese (Mn)		.02	Hardness as $CaCO_3$:		
Calcium (Ca)		7.4	Total		26
Magnesium (Mg)		1.8	Noncarbonate		21
Sodium (Na)		7.7			
Potassium (K)		2.3			
Bicarbonate (HCO_3)		7	Specific conductance (micromhos at 25°C)		110
Carbonate (CO_3)		0	pH		7.0
Sulfate (SO_4)		1.8	Color		0
Chloride (Cl)		7.6	Temperature (°F)		--
Fluoride (F)		.0	Date of collection		12/1/66
Nitrate (NO_3)		32			

JESSUP, ANNE ARUNDEL COUNTY

(Population 4,500)

Ownership: State of Maryland. Population served: About 5,000; water furnished to 5 institutions and about 200 families.
Source: Dorsey Run, Little Patuxent River.
Average daily use: 1,000,000 gpd.
Treatment: Rapid sand filtration, soda ash, alum, chlorination.
Rated capacity of treatment plant: 1,000,000 gpd.
Raw-water storage: 2,000,000 gal. at dam; 2,000,000 gal. at reservoir.
Finished-water storage: 1,200,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	10	9.4	Phosphate (PO_4)	0.20	0.09
Iron (Fe)	.52	.83	Dissolved solids (residue at 180°C)	74	112
Manganese (Mn)	.15	.18	Hardness as $CaCO_3$:		
Calcium (Ca)	9.2	9.7	Total	36	38
Magnesium (Mg)	3.2	3.3	Noncarbonate	8	0
Sodium (Na)	7.1	19			
Potassium (K)	1.8	1.8			
Bicarbonate (HCO_3)	34	53	Specific conductance (micromhos at 25°C)	114	167
Carbonate (CO_3)	0	0	pH	7.3	7.7
Sulfate (SO_4)	8.0	13	Color	2	8
Chloride (Cl)	11	18	Temperature (°F)	--	--
Fluoride (F)	.2	.2	Date of collection	8/2/67	8/2/67
Nitrate (NO_3)	2.7	2.0			

JOPPA TOWNE, HARFORD COUNTY

(Population, 5,138 Estimated 1967)

Ownership: Panitz & Co., Inc. Population served: 5,138 (1967).
Source: 3 wells, 110 to 120 feet deep.
Average daily use: 320,000 gpd.
Treatment: Aeration, chlorination, fluoridation, (started after June 1966), softening.
Rated capacity of treatment plant: 2,500,000 gpd.
Raw-water storage: None
Finished-water storage: 100,000 gal. ground storage; 100,000 gal. elevated storage.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	7.8	7.4	Phosphate (PO_4)	0.01	0.02
Iron (Fe)	.00	.02	Dissolved solids (residue at 180°C)	--	--
Manganese (Mn)	.02	.01	Hardness as $CaCO_3$:		
Calcium (Ca)	1.0	.8	Total	4	4
Magnesium (Mg)	.4	.4	Noncarbonate	0	0
Sodium (Na)	2.5	16			
Potassium (K)	7	.5			
Bicarbonate (HCO_3)	5	39	Specific conductance (micromhos at 25°C)	22	76
Carbonate (CO_3)	0	0			
Sulfate (SO_4)	.8	.3	pH	6.8	7.9
Chloride (Cl)	3.2	4.2	Color	--	--
Fluoride (F)	.0	.0	Temperature (°F)	--	--
Nitrate (NO_3)	1.0	.6	Date of collection	6/14/66	6/14/66

KINGS HEIGHTS, ANNE ARUNDEL COUNTY

(Population, 900 Estimated 1967)

Ownership: Anne Arundel County. Population served: About 2,000, including areas outside the development.
Source: 4 wells: No. 2, 164 feet deep; No. 3, 462 feet deep; No. 4, 748 feet deep; No. 5, 875 feet deep.
Average daily use: 277,000 gpd. (1967)
Treatment: Aeration, lime, chlorination, fluoridation, settling, clear well, pressure filter.
Rated capacity of treatment plant: 1,440,000 gpd.
Raw-water storage: 153,000 gal. in clear well.
Finished-water storage: 1 standpipe, 339,000 gal.

Chemical analyses in parts per million [a]

	Well 2	Finished water		Well 2	Finished water
Silica (SiO_2)	16	--	Phosphate (PO_4)	--	--
Iron (Fe)	.0	0.1	Dissolved solids (residue at 180°C)	50	62
Manganese (Mn)	.9	--			
Calcium (Ca)	2.0	--	Hardness as $CaCO_3$:		
Magnesium (Mg)	0	--	Total	13	22
Sodium (Na)	3.0	1.0	Noncarbonate	--	--
Potassium (K)	--	--			
Bicarbonate (HCO_3)	3.2	34	Specific conductance (micromhos at 25°C)	--	--
Carbonate (CO_3)	0	--			
Sulfate (SO_4)	.6	--	pH	5.2	8.7
Chloride (Cl)	9.5	3.5	Color	<3	<3
Fluoride (F)	0	--	Temperature (°F)	--	--
Nitrate (NO_3)	.3	0.18	Date of collection	9/29/68	9/7/66

a/ Data from Maryland State Department of Health

LA PLATA, CHARLES COUNTY

(Population, 1,500 Estimated 1967)

Municipal. Population served: About 1,500.
Source: 3 wells.
Average daily water use: 150,000 gpd.
Treatment: Chlorination and pH adjustment.
Rated capacity of operating wells: 475,000 gpd. in 1967.
Finished-water storage: Tank No. 1, 75,000 gal.; tank No. 2, 300,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	36	35	Phosphate (PO_4)	2.0	2.2
Iron (Fe)	.26	.23	Dissolved solids (residue at 180°C)	--	--
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	1.4	1.4	Total	6	6
Magnesium (Mg)	.6	.6	Noncarbonate	0	0
Sodium (Na)	120	83			
Potassium (K)	5.4	5.4			
Bicarbonate (HCO_3)	237	204	Specific conductance (micromhos at 25°C)	528	366
Carbonate (CO_3)	32	6	pH	9.2	8.5
Sulfate (SO_4)	12	11	Color	--	--
Chloride (Cl)	12	3.0	Temperature (°F)	--	--
Fluoride (F)	1.0	.9	Date of collection	6/10/66	6/10/66
Nitrate (NO_3)	.2	.1			

LEONARDTOWN, ST. MARYS COUNTY

(Population, 1,281)

Ownership: Municipal. Population served: About 2,500.
Source: Well.
Average daily use: 180,000 gpd (Estimated 1967).
Treatment: Chlorination.
Finished-water storage: 100,000 gal.

Chemical analyses in parts per million

	Raw water a/	Finished water		Raw water a/	Finished water
Silica (SiO_2)	8.7	10	Phosphate (PO_4)	--	0.14
Iron (Fe)	.0	.04	Dissolved solids (residue at 180°C)	124	137
Manganese (Mn)	.0	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	4.7	4.4	Total	17	16
Magnesium (Mg)	1.2	1.1	Noncarbonate	0	0
Sodium (Na)	--	42			
Potassium (K)	--	6.6			
Bicarbonate (HCO_3)	122	124	Specific conductance (micromhos at 25°C)	--	221
Carbonate (CO_3)	--	0	pH	8.2	8.2
Sulfate (SO_4)	7.9	8.8	Color	3	0
Chloride (Cl)	3.5	1.3	Temperature (°F)	--	--
Fluoride (F)	.1	.2	Date of collection	12/16/64	8/2/67
Nitrate (NO_3)	--	.2			

a/ Analysis by Maryland State Department of Health

LEXINGTON PARK, ST. MARYS COUNTY

(Population, 7,039)

Ownership: Patuxent Water Co. Population served: About 7,500.
Source: Wells.
Average daily use: 200,000 gpd (Estimated 1967).
Treatment: Chlorination.
Finished-water storage: 100,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	11	11	Phosphate (PO_4)	0.14	0.03
Iron (Fe)	.09	.03	Dissolved solids (residue at 180°C)	219	228
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	2.3	2.4	Total	9	9
Magnesium (Mg)	.9	.9	Noncarbonate	0	0
Sodium (Na)	81	81			
Potassium (K)	7.4	7.4			
Bicarbonate (HCO_3)	217	207	Specific conductance (micromhos at 25°C)	359	345
Carbonate (CO_3)	0	5	pH	8.0	8.4
Sulfate (SO_4)	11	6.6	Color	4	4
Chloride (Cl)	2.0	3.6	Temperature (°F)	--	--
Fluoride (F)	--	.6	Date of collection	6/10/66	6/10/66
Nitrate (NO_3)	.0	.0			

LONACONING, ALLEGANY COUNTY

(Population, 2,077)

Ownership: Lonaconing Water Co. Population served: About 4,000.
Source: 3 springs, Elklick Run, Jackson Run, and Koontz Run.
Average daily use: 240,000 gpd (Estimated).
Treatment: Chlorination.
Raw-water storage: 15,000,000 gal. (3 reservoirs).

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	5.0	4.0	Phosphate (PO_4)	0.00	0.01
Iron (Fe)	.01	.24	Dissolved solids (residue at 180°C)	42	37
Manganese (Mn)	.01	.03	Hardness as $CaCO_3$:		
Calcium (Ca)	5.9	7.2	Total	22	24
Magnesium (Mg)	1.7	1.6	Noncarbonate	6	6
Sodium (Na)	.8	1.3			
Potassium (K)	1.1	.8			
Bicarbonate (HCO_3)	19	23	Specific conductance (micromhos at 25°C)	54	56
Carbonate (CO_3)	0	0	pH	6.9	7.2
Sulfate (SO_4)	8.2	7.2	Color	3	3
Chloride (Cl)	1.0	2.0	Temperature (°F)	--	--
Fluoride (F)	.2	.1	Date of collection	6/24/66	6/24/66
Nitrate (NO_3)	.0	.4			

MANCHESTER, CARROLL COUNTY

(Population, 1,108)

Ownership: Municipal. Population served: About 1,200.
Source: Springs and wells.
Average daily use: 90,000 gpd.
Treatment: Chlorination.
Raw-water storage: 80,000 gal.
Finished-water storage: 150,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	8.3	8.2	Phosphate (PO_4)	0.01	0.01
Iron (Fe)	.01	.01	Dissolved solids (residue at 180°C)	--	--
Manganese (Mn)	.01	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	7.1	7.3	Total	33	33
Magnesium (Mg)	3.7	3.7	Noncarbonate	23	23
Sodium (Na)	5.6	4.8			
Potassium (K)	2.0	1.6			
Bicarbonate (HCO_3)	12	13	Specific conductance (micromhos at 25°C)	109	107
Carbonate (CO_3)	0	0	pH	7.3	7.1
Sulfate (SO_4)	1.4	1.4	Color	--	--
Chloride (Cl)	8.8	8.1	Temperature (°F)	--	--
Fluoride (F)	.0	.0	Date of collection	6/14/66	6/14/66
Nitrate (NO_3)	28	28			

MARYLAND CITY, ANNE ARUNDEL COUNTY

(Population, 1,000)

Ownership: Anne Arundel Co. Population served: About 1,100.
Source: 3 wells: No. 1, 124 feet deep; No. 2, 166 feet deep; No. 3, 108 feet deep.
Average daily use: 180,000 gpd (1964).
Treatment: Alkali feed for pH adjustment, chlorination, fluoridation.
Rated capacity of treatment plant: 1,080,000 gpd.
Finished-water storage: Elevated storage, 100,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	7.2	7.9	Phosphate (PO_4)	0.00	0.00
Iron (Fe)	.04	.03	Dissolved solids (residue at 180°C)	34	92
Manganese (Mn)	.02	.01	Hardness as $CaCO_3$:		
Calcium (Ca)	2.0	3.5	Total	12	13
Magnesium (Mg)	1.6	1.0	Noncarbonate	10	0
Sodium (Na)	2.7	26			
Potassium (K)	2.2	1.2			
Bicarbonate (HCO_3)	2	67	Specific conductance (micromhos at 25°C)	49	140
Carbonate (CO_3)	0	0	pH	6.3	7.7
Sulfate (SO_4)	3.2	2.4	Color	0	0
Chloride (Cl)	4.9	6.5	Temperature (°F)	--	--
Fluoride (F)	--	.7	Date of collection	7/31/67	7/31/67
Nitrate (NO_3)	9.2	5.4			

MIDDLETOWN, FREDERICK COUNTY

(Population, 1,036)

Ownership: Municipal. Population served: About 1,300 (1966).
Source: Wells and mountain springs.
Average daily use: 235,000 gpd. (estimated 1965).
Treatment: Chlorination.
Raw-water storage: About 1,750,000 gal.
Finished-water storage: None.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	13	13	Phosphate (PO_4)	0.02	0.01
Iron (Fe)	.10	.31	Dissolved solids (residue at 180°C)	41	46
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	5.1	6.7	Total	23	24
Magnesium (Mg)	2.6	1.8	Noncarbonate	4	6
Sodium (Na)	2.0	2.1			
Potassium (K)	.6	.5			
Bicarbonate (HCO_3)	23	22	Specific conductance (micromhos at 25°C)	58	65
Carbonate (CO_3)	0	0	pH	6.6	6.7
Sulfate (SO_4)	6.1	5.2	Color	--	7
Chloride (Cl)	2.0	2.2	Temperature (°F)	--	--
Fluoride (F)	.1	.1	Date of collection	3/3/66	3/3/66
Nitrate (NO_3)	.3	.5			

MOUNT AIRY, CARROLL COUNTY

(Population, 1,352)

Ownership: Municipal. Population served: About 1,200.
Source: 4 wells.
Average daily use: 140,000 gpd.
Treatment: Chlorination.
Finished-water storage: 1 elevated tank, 200,000 gal.; 1 elevated tank, 75,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	8.5	8.6	Phosphate (PO_4)	0.02	0.00
Iron (Fe)	.08	.00	Dissolved solids (residue at 180°C)	55	65
Manganese (Mn)	.00	.02	Hardness as $CaCO_3$:		
Calcium (Ca)	8.8	9.9	Total	30	32
Magnesium (Mg)	1.9	1.7	Noncarbonate	14	16
Sodium (Na)	2.6	2.8			
Potassium (K)	.5	.5			
Bicarbonate (HCO_3)	20	20	Specific conductance (micromhos at 25°C)	81	89
Carbonate (CO_3)	0	0	pH	6.5	6.7
Sulfate (SO_4)	1.8	2.8	Color	5	1
Chloride (Cl)	4.8	4.1	Temperature (°F)	--	--
Fluoride (F)	.1	.0	Date of collection	3/1/66	3/1/66
Nitrate (NO_3)	13	15			

MOUNTAIN LAKE PARK, GARRETT COUNTY
(Population, 1,700 Estimated 1967)

Ownership: Municipal. Population served: About 1,700 (1967).
Source: Several springs.
Average daily use: 95,000 gpd (Estimated 1960).
Treatment: Chlorination.
Finished-water storage: 80,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)		7.8	Phosphate (PO_4)		0.02
Iron (Fe)		.21	Dissolved solids (residue at 180°C)		60
Manganese (Mn)		.53	Hardness as $CaCO_3$:		
Calcium (Ca)		17	Total		49
Magnesium (Mg)		1.5	Noncarbonate		3
Sodium (Na)		1.0			
Potassium (K)		.4			
Bicarbonate (HCO_3)		56	Specific conductance (micromhos at 25°C)		107
Carbonate (CO_3)		0	pH		7.4
Sulfate (SO_4)		5.2	Color		0
Chloride (Cl)		1.7	Temperature (°F)		66
Fluoride (F)		.2	Date of collection		6/28/67
Nitrate (NO_3)		.8			

NORTH EAST, CECIL COUNTY
(Population, 1,628)

Ownership: Municipal. Population served: About 1,700.
Source: Northeast River.
Average daily use: 110,000 gpd.
Treatment: Chlorination, alum, fluoridation, rapid sand filtration, sedimentation.
Rated capacity of treatment plant: 300,000 gpd.
Finished-water storage: 160,000 gal. distribution storage.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	13	11	Phosphate (PO_4)	0.05	0.03
Iron (Fe)	.42	.01	Dissolved solids (residue at 180°C)	78	145
Manganese (Mn)	.02	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	7.4	7.3	Total	37	37
Magnesium (Mg)	4.5	4.5	Noncarbonate	8	0
Sodium (Na)	7.3	33			
Potassium (K)	2.2	1.9			
Bicarbonate (HCO_3)	36	82	Specific conductance (micromhos at 25°C)	117	232
Carbonate (CO_3)	0	0	pH	7.7	8.2
Sulfate (SO_4)	12	29	Color	4	3
Chloride (Cl)	7.1	8.6	Temperature (°F)	--	--
Fluoride (F)	.1	.7	Date of collection	11/30/66	11/30/66
Nitrate (NO_3)	3.6	3.8			

OAKLAND, GARRETT COUNTY

(Population, 1,977)

Ownership: Municipal. Population served: About 2,200.
Source: Youghiogheny River.
Average daily use: 250,000 gpd.
Treatment: Coagulation, activated carbon, sedimentation, pH adjustment, filtration, chlorination, fluoridation.
Rated capacity of treatment plant: 500,000 gpd.
Finished-water storage: 700,000 gal. distribution storage.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	5.0	4.0	Phosphate (PO_4)	0.00	0.37
Iron (Fe)	.02	.07	Dissolved solids (residue at 180°C)	99	133
Manganese (Mn)	.15	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	14	25	Total	49	75
Magnesium (Mg)	3.4	3.0	Noncarbonate	49	63
Sodium (Na)	2.0	10			
Potassium (K)	1.4	1.6			
Bicarbonate (HCO_3)	0	15	Specific conductance (micromhos at 25°C)	161	217
Carbonate (CO_3)	0	0	pH	4.3	7.1
Sulfate (SO_4)	59	78	Color	3	2
Chloride (Cl)	2.3	3.6	Temperature (°F)	--	--
Fluoride (F)	.2	.9	Date of collection	6/24/66	6/24/66
Nitrate (NO_3)	.0	.9			

OCEAN CITY, WORCESTER COUNTY

(Population, 1,500 Estimated 1967)

Ownership: Municipal. Population served: About 50,000 during summer.
Source: 8 wells; sampled well No. 3 at 15th St.
Average daily use: 1,100,000 gpd (1967). During July and August, 3,000,000 gpd.
Treatment: Chlorination, filtration for removal of iron and manganese, caustic soda, softening.
Rated capacity of treatment plant: 310,000 gpd. at Worcester St. plant; 2,300,000 gpd. at 15th St. plant; 2,200,000 gpd. at 44th St. plant.
Finished-water storage: 4 tanks, 1,500,000 gal. ea. 3 tanks, 450,000 gal. ea. 1 tank 150,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	24	24	Phosphate (PO_4)	0.24	0.84
Iron (Fe)	2.0	.05	Dissolved solids (residue at 180°C)	269	274
Manganese (Mn)	.03	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	34	18	Total	135	71
Magnesium (Mg)	12	6.2	Noncarbonate	0	0
Sodium (Na)	39	67			
Potassium (K)	9.1	6.8			
Bicarbonate (HCO_3)	203	182	Specific conductance (micromhos at 25°C)	439	437
Carbonate (CO_3)	1	9	pH	8.3	8.6
Sulfate (SO_4)	.2	.2	Color	5	2
Chloride (Cl)	44	42	Temperature (°F)	--	--
Fluoride (F)	.1	.2	Date of collection	6/27/67	6/27/67
Nitrate (NO_3)	.3	.1			

OXFORD, TALBOT COUNTY

(Population, 852)

Ownership: Municipal. Population served: About 1,000.
Source: 2 wells, 639 and 577 feet deep.
Average daily use: 100,000 gpd. (Estimated 1967).
Treatment: Chlorination.
Finished-water storage: 100,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	17	17	Phosphate (PO_4)	0.09	0.08
Iron (Fe)	.06	.07	Dissolved solids (residue at 180°C)	411	410
Manganese (Mn)	.01	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	5.0	4.8	Total	23	23
Magnesium (Mg)	2.5	2.5	Noncarbonate	0	0
Sodium (Na)	150	150			
Potassium (K)	9.1	9.1			
Bicarbonate (HCO_3)	340	330	Specific conductance (micromhos at 25°C)	682	680
Carbonate (CO_3)	10	14	pH	8.6	8.7
Sulfate (SO_4)	12	12	Color	3	2
Chloride (Cl)	40	41	Temperature (°F)	69	--
Fluoride (F)	2.1	1.9	Date of collection	8/2/67	8/2/67
Nitrate (NO_3)	.3	.0			

PERRYVILLE, CECIL COUNTY

(Population, 674)

Ownership: Municipal. Population served: About 1,330 (1965).
Source: Mill Creek.
Average daily use: 180,000 gpd.
Treatment: Chlorination, pH adjustment, filtration.
Rated capacity of treatment plant: 360,000 gpd.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	13	12	Phosphate (PO_4)	0.01	0.00
Iron (Fe)	.25	.24	Dissolved solids (residue at 180°C)	50	62
Manganese (Mn)	.00	.01	Hardness as $CaCO_3$:		
Calcium (Ca)	5.4	6.2	Total	25	28
Magnesium (Mg)	2.8	3.0	Noncarbonate	9	9
Sodium (Na)	4.9	5.6			
Potassium (K)	1.0	1.0			
Bicarbonate (HCO_3)	20	23	Specific conductance (micromhos at 25°C)	79	88
Carbonate (CO_3)	0	0	pH	7.5	7.5
Sulfate (SO_4)	8.4	7.6	Color	3	4
Chloride (Cl)	7.0	9.0	Temperature (°F)	--	--
Fluoride (F)	.2	.3	Date of collection	11/30/66	11/30/66
Nitrate (NO_3)	2.2	2.2			

POCOMOKE CITY, WORCESTER COUNTY

(Population, 3,329)

Ownership: Municipal. Population served: About 3,250.
Source: 2 wells.
Average daily use: 300,000 gpd.
Treatment: Chlorination, filtration.
Rated capacity of treatment plant: 1,500,000 gpd.
Finished-water storage: 1 elevated tank, 300,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	25	24	Phosphate (PO_4)	0.16	0.21
Iron (Fe)	.86	1.3	Dissolved solids (residue at 180°C)	201	198
Manganese (Mn)	.04	.01	Hardness as $CaCO_3$:		
Calcium (Ca)	30	30	Total	101	107
Magnesium (Mg)	6.2	7.7	Noncarbonate	0	0
Sodium (Na)	28	28			
Potassium (K)	3.6	3.6			
Bicarbonate (HCO_3)	141	140	Specific conductance (micromhos at 25°C)	328	328
Carbonate (CO_3)	0	0	pH	7.5	7.3
Sulfate (SO_4)	4.2	5.6	Color	6	5
Chloride (Cl)	32	32	Temperature (°F)	60	--
Fluoride (F)	.2	.2	Date of collection	10/19/66	10/19/66
Nitrate (NO_3)	.3	.2			

PRINCESS ANNE, SOMERSET COUNTY

(Population, 1,351)

Ownership: Municipal. Population served: About 1,400.
Source: 4 wells, sampled No. 1 well.
Average daily use: 250,000 gpd.
Treatment: Chlorination, filtration, alkali feed for pH adjustment.
Rated capacity of treatment plant: 1,400,000 gpd.
Finished-water storage: 100,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	11	11	Phosphate (PO_4)	1.1	1.2
Iron (Fe)	.08	.30	Dissolved solids (residue at 180°C)	416	419
Manganese (Mn)	.04	.08	Hardness as $CaCO_3$:		
Calcium (Ca)	6.9	8.2	Total	48	42
Magnesium (Mg)	7.5	5.3	Noncarbonate	0	0
Sodium (Na)	144	144			
Potassium (K)	7.3	7.5			
Bicarbonate (HCO_3)	359	357	Specific conductance (micromhos at 25°C)	695	695
Carbonate (CO_3)	0	0	pH	8.0	8.2
Sulfate (SO_4)	8.2	8.4	Color	38	17
Chloride (Cl)	46	48	Temperature (°F)	62	--
Fluoride (F)	.4	.3	Date of collection	10/19/66	10/19/66
Nitrate (NO_3)	.9	.4			

ROCK HALL, KENT COUNTY

(Population, 1,073)

Ownership: Municipal. Population served: About 1,100.
Source: 3 wells.
Average daily use: 110,000 gpd.
Treatment: Lime, chlorination, fluoridation, filtration, sedimentation.
Rated capacity of treatment plant: 300,000 gpd.
Raw-water storage: 75,000 gal.
Finished-water storage: 75,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	10	10	Phosphate (PO_4)	0.51	0.06
Iron (Fe)	5.7	.07	Dissolved solids (residue at 180°C)	112	150
Manganese (Mn)	.04	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	3.7	20	Total	16	58
Magnesium (Mg)	1.6	1.8	Noncarbonate	0	0
Sodium (Na)	36	35			
Potassium (K)	3.0	3.0			
Bicarbonate (HCO_3)	98	131	Specific conductance (micromhos at 25°C)	193	267
Carbonate (CO_3)	0	0	pH	8.0	8.3
Sulfate (SO_4)	7.6	7.8	Color	3	0
Chloride (Cl)	8.3	18	Temperature (°F)	--	--
Fluoride (F)	.3	.3	Date of collection	8/7/67	8/7/67
Nitrate (NO_3)	.0	.0			

ROCKVILLE, MONTGOMERY COUNTY

(Population, 47,000 Estimated 1967)

Ownership: Municipal. Population served: About 47,000 (1967).
Source: Potomac River.
Average daily use: 2,980,000 gpd. (1965).
Treatment: Pre-chlorination, lime, alum, fluoridation, post-chlorination.
Rated capacity of treatment plant: 4,000,000 gpd.
Finished-water storage: 7,000,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	0.3	1.0	Phosphate (PO_4)	0.14	0.02
Iron (Fe)	.13	.03	Dissolved solids (residue at 180°C)	153	184
Manganese (Mn)	.07	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	31	39	Total	110	131
Magnesium (Mg)	7.9	8.0	Noncarbonate	34	59
Sodium (Na)	7.4	8.0			
Potassium (K)	2.1	2.0			
Bicarbonate (HCO_3)	93	88	Specific conductance (micromhos at 25°C)	253	297
Carbonate (CO_3)	0	0	pH	8.1	8.2
Sulfate (SO_4)	35	51	Color	5	0
Chloride (Cl)	11	16	Temperature (°F)	--	--
Fluoride (F)	.1	1.0	Date of collection	6/22/67	6/22/67
Nitrate (NO_3)	2.2	.2			

ST. MICHAELS, TALBOT COUNTY

(Population, 1,484)

Ownership: Municipal. Population served: About 1,800.
Source: 2 wells.
Average daily use: 190,000 gpd.
Treatment: Chlorination.
Finished-water storage: 150,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	12	12	Phosphate (PO_4)	0.08	0.08
Iron (Fe)	.08	.05	Dissolved solids (residue at 180°C)	304	304
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	12	13	Total	62	64
Magnesium (Mg)	7.6	7.5	Noncarbonate	0	0
Sodium (Na)	88	87			
Potassium (K)	15	14			
Bicarbonate (HCO_3)	220	228	Specific conductance (micromhos at 25°C)	536	541
Carbonate (CO_3)	6	2	pH	8.5	8.3
Sulfate (SO_4)	8.4	8.4	Color	0	0
Chloride (Cl)	48	51	Temperature (°F)	63	--
Fluoride (F)	.5	.4	Date of collection	8/2/67	8/2/67
Nitrate (NO_3)	.5	.2			

SALISBURY, WICOMICO COUNTY

(Population, 26,000 Estimated 1967)

Ownership: Municipal. Population served: About 19,000 (1967).
Source: 14 wells.
Average daily use: 2,405,000 gpd. (in 1964).
Treatment: Ammonia, chlorination, lime, hydrofluosilicic acid, aeration, settling basin.
Rated capacity of treatment plant: 8,000,000 gpd.
Finished-water storage: 3 elevated tanks, 200,000, 300,000, and 500,000 gal.; 1 standpipe 85,000 gal.; underground reservoir at plant, 500,000 gal.

Chemical analyses in parts per million

	Well 2	Finished water		Well 2	Finished water
Silica (SiO_2)	20	19	Phosphate (PO_4)	0.00	0.04
Iron (Fe)	.22	.42	Dissolved solids (residue at 180°C)	87	87
Manganese (Mn)	.08	.03	Hardness as $CaCO_3$:		
Calcium (Ca)	6.4	8.4	Total	25	29
Magnesium (Mg)	2.2	1.8	Noncarbonate	10	12
Sodium (Na)	8.8	8.1			
Potassium (K)	2.2	1.7			
Bicarbonate (HCO_3)	18	20	Specific conductance (micromhos at 25°C)	109	109
Carbonate (CO_3)	0	0	pH	6.8	7.3
Sulfate (SO_4)	4.8	6.4	Color	1	5
Chloride (Cl)	12	10	Temperature (°F)	--	--
Fluoride (F)	.1	.7	Date of collection	6/27/67	6/27/67
Nitrate (NO_3)	12	13			

SALISBURY, WICOMICO COUNTY (Continued)

Chemical analyses in parts per million

	Well 11	Well 14		Well 11	Well 14
Silica (SiO_2)	19	20	Phosphate (PO_4)	0.09	0.00
Iron (Fe)	.22	.00	Dissolved solids		
Manganese (Mn)	.00	.02	(residue at 180°C)	62	80
Calcium (Ca)	4.5	5.2	Hardness as $CaCO_3$:		
Magnesium (Mg)	.5	1.6	Total	13	20
Sodium (Na)	6.8	8.5	Noncarbonate	8	11
Potassium (K)	1.7	2.5			
Bicarbonate (HCO_3)	6	10	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	74	100
Sulfate (SO_4)	3.6	7.8	pH	6.3	5.9
Chloride (Cl)	5.6	7.1	Color	5	0
Fluoride (F)	.1	.0	Temperature (°F)	58	58
Nitrate (NO_3)	11	18	Date of collection	11/29/62	2/7/63

SEVERNA PARK, ANNE ARUNDEL COUNTY

(Population, 3,728)

Ownership: Anne Arundel County. Population served: About 5,560.
Source: 2 wells, 150 and 185 feet deep.
Average daily use: 320,000 gpd.
Treatment: Lime, chlorination, fluoridation, alum, aeration, sedimentation, filtration.
Rated capacity of treatment plant: 1,100,000 gpd.
Finished-water storage: 11,500 gal.; elevated standpipe, 306,000 gal.
Remarks: The area adjacent to that served by the Severna Park treatment plant supply is served by the Severndale water treatment plant. The Severndale plant has a rated capacity of 2,500,000 gpd., and obtains water from the same formation as Severna Park. Average plant production in 1964 for Severndale and Severna Park, 430,000 gpd.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	10	9.7	Phosphate (PO_4)	0.00	0.00
Iron (Fe)	1.2	.62	Dissolved solids		
Manganese (Mn)	.01	.02	(residue at 180°C)	31	44
Calcium (Ca)	.7	11	Hardness as $CaCO_3$:		
Magnesium (Mg)	.3	.4	Total	3	29
Sodium (Na)	1.1	1.3	Noncarbonate	3	16
Potassium (K)	.5	.5			
Bicarbonate (HCO_3)	0	16	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	72	72
Sulfate (SO_4)	14	14	pH	3.9	6.8
Chloride (Cl)	1.6	2.2	Color	2	2
Fluoride (F)	.1	.7	Temperature (°F)	--	--
Nitrate (NO_3)	.0	.0	Date of collection	7/31/67	7/31/67

SNOW HILL, WORCESTER COUNTY

(Population, 2,311)

Ownership: Municipal. Population served: About 2,300.
Source: 2 wells.
Average daily use: 250,000 gpd.
Treatment: Chlorination, fluoridation.
Rated capacity of treatment plant: 1,300,000 gpd.
Finished-water storage: 40,000 gal.

Chemical analyses in parts per million [a]

	Well 3	Well 4		Well 3	Well 4
Silica (SiO_2)	14	15	Phosphate (PO_4)	--	--
Iron (Fe)	.10	.10	Dissolved solids (residue at 180°C)	360	342
Manganese (Mn)	.0	.0	Hardness as $CaCO_3$:		
Calcium (Ca)	42	16	Total	124	65
Magnesium (Mg)	7.3	7.1	Noncarbonate	0	0
Sodium (Na)	98	100			
Potassium (K)	--	--			
Bicarbonate (HCO_3)	278	284	Specific conductance (micromhos at 25°C)	--	--
Carbonate (CO_3)	0	0	pH	8.1	8.2
Sulfate (SO_4)	1.2	.0	Color	5	5
Chloride (Cl)	56	47	Temperature (°F)	--	--
Fluoride (F)	.3	.4	Date of collection	12/13/67	12/13/67
Nitrate (NO_3)	.04	.04			

a/ Analyzed by Maryland State Department of Health, on finished water.

TANEYTOWN, CARROLL COUNTY

(Population, 1,519)

Ownership: Municipal. Population served: About 3,500 (1966).
Source: 10 wells.
Average daily use: 325,000 gpd.
Treatment: Chlorination, soda ash.
Finished-water storage: Elevated tanks, 100,000, 150,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	21	21	Phosphate (PO_4)	0.05	0.03
Iron (Fe)	.01	.00	Dissolved solids (residue at 180°C)	228	239
Manganese (Mn)	.01	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	48	34	Total	174	178
Magnesium (Mg)	13	23	Noncarbonate	6	1
Sodium (Na)	16	21			
Potassium (K)	.8	.8			
Bicarbonate (HCO_3)	206	216	Specific conductance (micromhos at 25°C)	394	425
Carbonate (CO_3)	0	0	pH	7.5	8.2
Sulfate (SO_4)	5.6	6.4	Color	5	3
Chloride (Cl)	22	22	Temperature (°F)	--	--
Fluoride (F)	.2	.2	Date of collection	3/3/66	3/3/66
Nitrate (NO_3)	3.3	4.3			

THURMONT, FREDERICK COUNTY

(Population, 1,998)

Ownership: Municipal. Population served: About 2,200.
Source: High Run and 2 wells.
Average daily use: 225,000 gpd.
Treatment: Chlorination.
Finished-water storage: 1,800,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	4.6	4.7	Phosphate (PO_4)	0.01	0.01
Iron (Fe)	.08	.72	Dissolved solids (residue at 180°C)	18	22
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	1.8	1.9	Total	8	8
Magnesium (Mg)	.9	.9	Noncarbonate	6	7
Sodium (Na)	.6	.9			
Potassium (K)	.9	.9			
Bicarbonate (HCO_3)	3	1	Specific conductance (micromhos at 25°C)	27	33
Carbonate (CO_3)	0	0	pH	6.3	6.5
Sulfate (SO_4)	6.7	5.5	Color	--	--
Chloride (Cl)	1.2	3.9	Temperature (°F)	--	--
Fluoride (F)	.1	.1	Date of collection	3/1/66	3/1/66
Nitrate (NO_3)	.1	.4			

UPPER MARLBORO, PRINCE GEORGES COUNTY

(Population, 673)

Ownership: Municipal. Population served: About 1,400 (1967).
Source: 2 wells.
Average daily use: 70,000 gpd.
Treatment: Chlorination
Finished-water storage: 100,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	24	25	Phosphate (PO_4)	0.13	0.20
Iron (Fe)	.30	.34	Dissolved solids (residue at 180°C)	225	237
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	60	60	Total	171	172
Magnesium (Mg)	5.2	5.4	Noncarbonate	16	16
Sodium (Na)	2.3	4.6			
Potassium (K)	2.7	2.7			
Bicarbonate (HCO_3)	182	184	Specific conductance (micromhos at 25°C)	329	334
Carbonate (CO_3)	4	3	pH	8.5	8.4
Sulfate (SO_4)	16	17	Color	--	--
Chloride (Cl)	1.9	4.9	Temperature (°F)	--	--
Fluoride (F)	.3	.3	Date of collection	6/10/66	6/10/66
Nitrate (NO_3)	.1	.1			

WALDORF, CHARLES COUNTY

(Population, 2,000 Estimated 1965)

Ownership: Charles County Sanitary District, Inc. Population served: About 2,000 in 1966.
Source: 2 wells.
Average daily use: 102,000 gpd. (1965).
Treatment: Chlorination.
Rated capacity of treatment plant: None; 500 gpm pump on each well.
Finished-water storage: 200,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	10	10	Phosphate (PO_4)	0.05	0.05
Iron (Fe)	.00	.04	Dissolved solids (residue at 180°C)	191	195
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	28	28	Total	109	110
Magnesium (Mg)	9.4	9.6	Noncarbonate	0	0
Sodium (Na)	11	12			
Potassium (K)	13	11			
Bicarbonate (HCO_3)	171	163	Specific conductance (micromhos at 25°C)	268	273
Carbonate (CO_3)	0	0	pH	8.2	7.9
Sulfate (SO_4)	8.7	8.9	Color	--	--
Chloride (Cl)	.6	1.9	Temperature (°F)	--	--
Fluoride (F)	.3	.3	Date of collection	6/10/66	6/10/66
Nitrate (NO_3)	.1	.0			

WALKERSVILLE, FREDERICK COUNTY

(Population, 1,300 Estimated 1966)

Ownership: Municipal. Population served: About 1,550.
Source: Reservoir and 2 wells.
Average daily use: 130,000 gpd. (1965)
Treatment: Filtration, chlorination.
Rated capacity of treatment plant: 130,000 gpd.
Raw-water storage: 2,000,000 gal. (Estimated).
Finished-water storage: Tank, 300,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	4.5	4.9	Phosphate (PO_4)	0.03	0.04
Iron (Fe)	.33	.02	Dissolved solids (residue at 180°C)	42	46
Manganese (Mn)	.04	.02	Hardness as $CaCO_3$:		
Calcium (Ca)	5.6	5.3	Total	23	23
Magnesium (Mg)	2.2	2.4	Noncarbonate	9	12
Sodium (Na)	4.7	4.8			
Potassium (K)	1.3	1.3			
Bicarbonate (HCO_3)	17	13	Specific conductance (micromhos at 25°C)	79	82
Carbonate (CO_3)	0	0	pH	6.7	6.5
Sulfate (SO_4)	9.4	9.6	Color	2	3
Chloride (Cl)	4.8	7.6	Temperature (°F)	--	--
Fluoride (F)	.1	.1	Date of collection	3/1/66	3/1/66
Nitrate (NO_3)	5.5	5.3			

WASHINGTON SUBURBAN SANITARY COMMISSION
(PRINCE GEORGES AND MONTGOMERY COUNTIES)

Ownership: The Washington Suburban Sanitary Commission, a public body incorporated by the Maryland General Assembly in 1918, serves a metropolitan area that includes most of Montgomery and Prince Georges Counties. It supplies water to: Beltsville, Berwyn Heights, Bethesda, Bladensburg, Brentwood, Capitol Heights, Cheverly, Chevy Chase, College Park, Colmar Manor, Cottage City, District Heights, East Riverdale, Edmonston, Fairmount Heights, Forest Heights, Gaithersburg, Greenbelt, Hyattsville, Kensington, Landover Hills, Lanham, Laurel, Maryland Park, Morningside, Mount Rainier, Riverdale, Riverdale Heights, Seabrook, Seat Pleasant, Silver Spring, Somerset, Suitland, Takoma Park, University Park, Wheaton, Woodside, and other communities. Total population served: About 1,000,000 in 1967.

Source: Potomac River, Patuxent River, and 3 wells.

Average daily use: 95.3 mgd. during 1967; 1.4 mgd. from wells and the remainder from Potomac and Patuxent Rivers.

Treatment: Coagulation (alum), chlorination, filtration, corrosion control (lime), fluoridation, dechlorination (sodium bisulfite).

Rated capacity of treatment plant: 70,000,000 gpd. Potomac River filtration plant; 65,000,000 gpd. Patuxent River filtration plant; 2,250,000 gpd., 3 wells in Prince Georges County.

Raw-water storage: Triadelphia Reservoir on the Patuxent River at Brighton, 7,000,000,000 gal.; T. Howard Duckett (formerly Rocky Gorge) Reservoir on the Patuxent River near Laurel, 6,400,000,000 gal.

Finished-water storage: Reservoirs, standpipes, elevated tanks, totalling 40 structures and 119,000,000 gal.

Remarks: Third stage construction of the Potomac Plant, scheduled during the next two years will increase its nominal production capacity from 70,000,000 gpd. to 160,000,000 gpd.

Chemical analyses in parts per million a/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	2.7	3.3	Phosphate (PO_4)	0.05	0.01
Iron (Fe)	.13	.03	Dissolved solids (residue at 180°C)	44	68
Manganese (Mn)	.00	.00	Hardness as $CaCO_3$:		
Calcium (Ca)	6.0	14	Total	24	44
Magnesium (Mg)	2.1	2.2	Noncarbonate	6	17
Sodium (Na)	3.5	3.8			
Potassium (K)	1.9	1.8			
Bicarbonate (HCO_3)	22	33	Specific conductance (micromhos at 25°C)	74	119
Carbonate (CO_3)	0	0	pH	7.2	7.6
Sulfate (SO_4)	6.6	8.6	Color	3	2
Chloride (Cl)	5.0	10	Temperature (°F)	--	--
Fluoride (F)	.1	.8	Date of collection	8/21/67	8/21/67
Nitrate (NO_3)	1.7	1.5			

a/ Patuxent River

WASHINGTON SUBURBAN SANITARY COMMISSION (Continued)

Chemical analyses in parts per million b/

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	2.5	2.7	Phosphate (PO_4)	0.07	0.04
Iron (Fe)	.23	.02	Dissolved solids		
Manganese (Mn)	.00	.00	(residue at 180°C)	146	177
Calcium (Ca)	28	35	Hardness as $CaCO_3$:		
Magnesium (Mg)	7.6	7.5	Total	102	119
Sodium (Na)	8.6	8.5	Noncarbonate	31	61
Potassium (K)	2.8	2.9			
Bicarbonate (HCO_3)	86	70	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	256	300
Sulfate (SO_4)	34	54	pH	7.5	8.0
Chloride (Cl)	13	18	Color	2	2
Fluoride (F)	.1	.8	Temperature (°F)	--	--
Nitrate (NO_3)	2.2	1.4	Date of collection	8/21/67	8/21/67

b/ Potomac River

WESTERNPORT, ALLEGANY COUNTY

(Population, 3,559)

Ownership: Municipal. Population served: About 3,900.
Source: Savage River.
Average daily use: 475,000 gpd.
Treatment: Chlorination, coagulation, pH adjustment, sedimentation, filtration.
Rated capacity of treatment plant: 1,000,000 gpd.
Raw-water storage: Savage Reservoir has 6,500,000,000 gal. capacity.
Finished-water storage: 750,000 gal. reservoir; tanks, 10,000, 590,000 gal., and 32,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	4.9	5.4	Phosphate (PO_4)	0.00	0.00
Iron (Fe)	.14	.06	Dissolved solids		
Manganese (Mn)	.12	.00	(residue at 180°C)	41	51
Calcium (Ca)	6.3	5.1	Hardness as $CaCO_3$:		
Magnesium (Mg)	1.2	1.7	Total	20	20
Sodium (Na)	1.9	8.4	Noncarbonate	10	3
Potassium (K)	1.0	.9			
Bicarbonate (HCO_3)	12	21	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	60	84
Sulfate (SO_4)	11	15	pH	6.9	7.0
Chloride (Cl)	3.0	4.0	Color	3	5
Fluoride (F)	.1	.1	Temperature (°F)	--	--
Nitrate (NO_3)	1.1	.2	Date of collection	6/24/66	6/24/66

WESTMINSTER, CARROLL COUNTY

(Population, 6,123)

Ownership: Maryland Water Works Co. Population served: About 10,000.
Source: Cranberry Run primarily, and West Branch of North Branch Patapsco River.
Average daily use: 900,000 gpd.
Treatment: Chlorination, alum, lime, fluoridation, copper sulfate.
Rated capacity of treatment plant: 1,750,000 gpd.
Raw-water storage: 213,000,000 gal. reservoir.
Finished-water storage: 1,400,000 gal.

Chemical analyses in parts per million

	Raw water	Finished water		Raw water	Finished water
Silica (SiO_2)	7.3	6.8	Phosphate (PO_4)	0.03	0.02
Iron (Fe)	.16	.00	Dissolved solids		
Manganese (Mn)	.06	.05	(residue at 180°C)	95	120
Calcium (Ca)	16	23	Hardness as $CaCO_3$:		
Magnesium (Mg)	3.6	3.7	Total	54	72
Sodium (Na)	3.7	5.0	Noncarbonate	28	42
Potassium (K)	1.8	2.0			
Bicarbonate (HCO_3)	33	38	Specific conductance		
Carbonate (CO_3)	0	0	(micromhos at 25°C)	145	193
Sulfate (SO_4)	12	23	pH	6.9	7.6
Chloride (Cl)	10	12	Color	5	5
Fluoride (F)	.1	1.2	Temperature (°F)	--	--
Nitrate (NO_3)	12	15	Date of collection	3/3/66	3/3/66