EAST BAY MUNICIPAL UTILITY DISTRICT

WATER SYSTEM INSPECTOR I

STUDY GUIDE

Summer 2021

PART I

1. Basic Laws and Regulations

The Safe Drinking Water Act (SDWA) was passed in 1974. It was the first national law that authorized the government to establish national drinking water regulations. Although prior to its adoption, many states had laws and regulations regarding water treatment and quality, but on a national basis only water quality on interstate carriers, such as planes or trains was controlled. The impetus for adopting this law was the finding that certain chemicals that appeared to cause specific kinds of cancers, especially of the kidney and liver were found in some drinking waters. The SDWA dealt with both chemical and biological contamination, and defined monitoring programs that would be required of all public water supplies.

The United States Environmental Protection Agency (EPA) is responsible for administering the SDWA and does so through regulations that are administratively prepared and adopted after publication in the Federal Register. The first regulations, the National Primary Drinking Water Regulations (NPDWR) adopted in 1975, were known as Interim Regulations. They were revised in 1976, 1979, 1982 and 1983 as more information was accumulated and operating experiences obtained. In 1986, Congress passed amendments to the SDWA, and the EPA began adopting additional regulations defining the requirements under the amended SDWA.

One characteristic of all the regulations allows enforcement to be the responsibility of state governments. Thus, at the national level, Congress adopts the law and EPA is responsible for adopting the regulations detailing how the law is to be observed. At the state level there is a similar process: the legislature adopts a law consistent with the federal law, and the designated state agency adopts regulations for specific enforcement. Similar to other states, California has opted to enforce the federal law its own way. The State Water Resources Control Board has been charged with the responsibility of developing the regulations, consistent with both the federal regulations and state law. The regulations specify many details about who samples the water, for what, and how often. It is a violation of the regulations if not enough samples are collected and analyzed or if the water does not meet the defined quality standards.

Two terms are used to define quality: the Maximum Contaminant Limit Goal (MCLG), which is the non-enforceable ideal maximum concentration of undesirable substances in the water, and the Maximum Contaminant Limit (MCL), which is the enforceable upper limit of a particular substance. The MCL is the limit that all water agencies are required to meet. The regulations include MCLs for certain physical, inorganic chemical, organic chemical, and microbiological contaminants. If the actual concentration of the contaminant is less than the MCL, the water is considered to be in compliance and safe.

Physical factors: include radioactivity with specific MCLs for gross alpha particles, gross beta particles and radium. Even more important is turbidity, which is a measure of the particles present in the water and their effect on light transmission (clarity). Turbidity is usually measured and reported as NTU, turbidity units, and should be as low as possible, preferably under 0.1 NTU.

Inorganic chemicals: are chemical substances that do not contain either of the elements carbon or hydrogen. Most of them are called heavy metals. They are measured in weight per unit volume and usually reported as milligrams per liter (mg/L), or parts per million (ppm). These substances may be harmful to humans, depending on their concentration in the water. Included among the regulated inorganic contaminants are: arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, and silver.

Organic chemicals: are compounds containing carbon and hydrogen. They also are reported as mg/L. Because they may have an effect at even lower concentrations, they often are measured to levels of micrograms per liter (ug/L), or parts per billion. Dozens of organic chemicals are regulated; among them are such common pesticides as 2,4-D, endrin, lindane, and toxaphene.

Microbiological contaminants: are usually bacteria, but also include viruses and disease-producing protozoa. Microbiological contaminants are counted by complicated laboratory procedures. Coliform bacteria, a specific group of bacteria that live in the intestinal tract of humans and other warm-blooded animals and serve as the indicator of fecal contamination, may be present in feces, or sewage-contaminated water.

2. Water Quality Sampling

To determine if water is safe (will not cause disease to anyone drinking it), a sampling and testing program is required. This program may include sampling for all the contaminants for which MCLs have been established or may be more limited. But always included in the testing program are tests for coliform bacteria.

When a Water System Inspector (WSI) runs laboratory tests or collects samples for further analysis by laboratory personnel, s/he must follow basic safety procedures. For example, if going out to sample by car, obvious safe driving practices must be followed. Similarly, if sampling by boat, special boating safety practices should be followed; for example, wearing a life-preserver. It is desirable, though not always possible, to have Samplers work with a partner for safety reasons.

Containers used for water samples vary according to the purpose of the sampling, and are usually prepared by the laboratory for use in the field. For example, in collecting samples for bacteriological testing, either glass or plastic bottles may be used. Whether using glass or plastic, the bottle must be pre-sterilized as not to add any bacteria to the sample. The bottle usually contains a chemical that will destroy any remaining disinfectant. Therefore, the bottle should not be rinsed with the water being sampled. Glass bottles are often used to sample for inorganic chemicals. If the bottle doesn’t contain a chemical preservative to prevent the sample from changing during storage, the usual practice is to rinse the bottle with the water being collected. A specially prepared container must be used for organic samples, because very low concentrations are to be measured, and accidental contamination during sampling must be avoided. Under ordinary circumstances it is not acceptable to use an old coke bottle or pickle jar as a sample container.

Containers vary in size according to the purpose of the sampling. Containers for organic samples vary in size from 30 milliliters (mL) (approximately one ounce) to 4 liters (about a gallon). After following directions provided by the laboratory with respect to sample collection, rinsing the bottle, adding preservative, etc., most samples should be refrigerated, but not frozen, to keep the contaminants in the sample unchanged. Samples should be delivered to the laboratory as soon as possible, but certainly on the same day as the sample collection. If for some reason, it is impossible to deliver the sample(s) to the laboratory on the day of sampling, or if you are going to be late in getting to the laboratory, call the laboratory and ask for instructions as to how to proceed.

Time and temperature changes can change the sample, so these should be kept to a minimum. To keep samples cool, around 4° Celsius, an ice chest or picnic container with wet ice or frozen "blue ice" packages work well. It is not a good idea to use dry ice because it can freeze the sample.

The bottles provided by the laboratory will be accompanied by a sample analysis request slip. The WSI fills in the request slip completely, providing the necessary information about him/herself (the sampler) and the samples. Because the results may be used in court, or in some other regulatory procedure, it is important that the chain of custody form be used and filled out completely and correctly. The chain of custody is used to prove that the sample was always within the control of a responsible agent who appropriately received or collected the sample, and also properly delivered the sample to the laboratory. In the chain of custody, there may be no unaccounted-for time when the sample was not physically in the possession and control of an appropriate individual.

3. Water Quality Testing

Most testing activities are done in the laboratory by laboratory personnel. However, certain sample characteristics or constituents change so quickly after the sample is collected that the sample cannot be transported to the laboratory. This means the analysis must be made in the field, typically by the sample collector. This is called field testing, as opposed to laboratory testing. Whenever a WSI is performing a field test, it is essential that s/he have a complete understanding of the test being performed, and the safety features that must be observed. For example, if temperature is to be measured, care must be taken in handling the thermometer since the thermometer is made of glass and relatively fragile. Breaking the glass may produce dangerous fragments that can cut or stab the user, possibly releasing thermometer contents, usually mercury, a highly poisonous metal. The released mercury can be dangerous when handled or breathed as it easily changes to a gas.

Generally speaking, the WSI should be aware that the containers used in sampling and the materials used in analysis may be dangerous when not handled appropriately. If concentrated acid or alkali is used as a preservative, care must be exercised to avoid the serious burns these materials can produce. One should also have an awareness of the cost of materials and equipment and not abuse them.

A common field test is measuring temperature. Thermometers may be calibrated in either degrees Fahrenheit, F° (the American scale in which water freezes at 32° and boils at 212°), or degrees Celsius, C° (the metric scale, used over most of the world, with water freezing at 0° and boiling at 100°).

Another field test may be for pH (the hydrogen ion concentration, a measure of the acidity or alkalinity of the sample). A neutral pH is 7. The pH of most raw water usually falls below 7, making it more acidic, while finished water as delivered to the customer is usually between 8 and 9, more alkaline, which is less irritating and less corrosive. Usually pH is measured with a pH meter, which must be calibrated by the laboratory. Most pH meters are sensitive to temperature and have a temperature correction. If temperature correction is done by hand, the temperature must be measured first.

Conductivity, the ability of the water to conduct electricity, is measured with a conductivity meter that also requires a temperature correction. Conductivity is used to give approximate information on the amount of solids dissolved in water; the higher the conductivity, the more solids that are dissolved (these solids are called the total dissolved solids, or TDS).

Another common field test is measuring chlorine residual. Chlorine is the disinfectant commonly used to kill bacteria in the water, and its measurement is essential in determining whether the disinfection process is, or has been, adequate. Unlike testing for pH and conductivity, the field test for chlorine residual is a chemical one, rather than by a specialized meter. In this test, appropriate reagents are added to the sample to produce a colored product. This color is compared to the color on a color chart or standard, and the concentration of chlorine is read off the chart. This is called a colorimetric test.

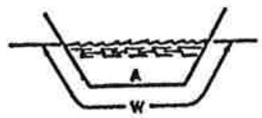
4. Water Treatment Fundamentals

The purpose of water treatment is to produce a product that is safe, wholesome, and attractive to use or drink. The first consideration is safety, that the water and its contents not produce disease. Disease may be caused by infectious agents such as bacteria or viruses or by chemical agents which may be toxic or carcinogenic. Thus, if any of these agents are present in the untreated water, they must be killed or removed. Agents of disease, or potential disease that have been identified, all have an MCL specified in the primary regulations. This MCL serves not only as the indicator of safety, but also of when treatment is required, or even the kind of treatment that might be needed.

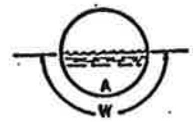
There also are secondary regulations that help define non-health related characteristics that may be important to a consumer's acceptance of the water, such as taste and odor, color, temperature, etc.

Conventional water treatment (complete treatment) includes the following steps: coagulation, sedimentation, filtration, and disinfection. These will be described in terms of both the process and the goal of the process. An important characteristic of the raw water to be treated is its turbidity. Turbidity affects the appearance of the water (in a case of extremely high turbidity, the water may look and feel muddy). Turbidity also indicates the effectiveness of the treatment processes, and the success of disinfection since suspended particles tend to protect bacteria in the water from the disinfectant. Thus, removal of turbidity is essential to adequate treatment. This is achieved by adding one or more chemicals, called coagulants, such as alum or iron sulfate, which produce an insoluble (solid) product. This solid product is heavier than water and can settle out, carrying with it all or most of the particles of turbidity. The coagulation process includes adding the coagulant chemical, mixing it thoroughly with the water, and then letting the particles "grow" in size (flocculation). When the floc has formed and is of optimum size and strength, the flow rate of the water is decreased and the heavy particles are allowed to settle. This step is called sedimentation or settling. The next step is filtration in which the settled water is passed through a sand filter, where the rest of the particles are removed. The sedimentation process significantly reduces the amount of solids that get carried on to the sand in the filter, thereby increasing the efficiency of the filtration process. When the sand in the filter accumulates too many solids (the "dirt" that was being removed), the process is stopped and the filter is washed by reversing the flow of water for a brief time. The dirty water may be discharged to waste or to reclamation.

The water leaving the filter is clear and sparkling but may still have some undesirable bacteria in it. To get rid of the unwanted bacteria, the water is disinfected with a chemical-killing agent that is particularly effective against bacteria in water. The agent most commonly used for disinfection is chlorine. Chlorine may be obtained as a pure liquid in pressurized tanks, or as a solid or liquid, such as the type used as a household bleach - only stronger. Chlorine kills the bacteria and makes the water safe to drink, although there may be taste or odor associated with the presence of chlorine. This taste or odor may lead to consumer complaints. To minimize the taste and odor concerns and the production of undesirable disinfection by-products, a process modification called chloramination may be used. Here, instead of using straight chlorine, chlorine is mixed with ammonia to produce the disinfectant chloramine. Chloramine is not as strong a disinfectant as chlorine, but lasts longer and achieves the same kind of killing of the

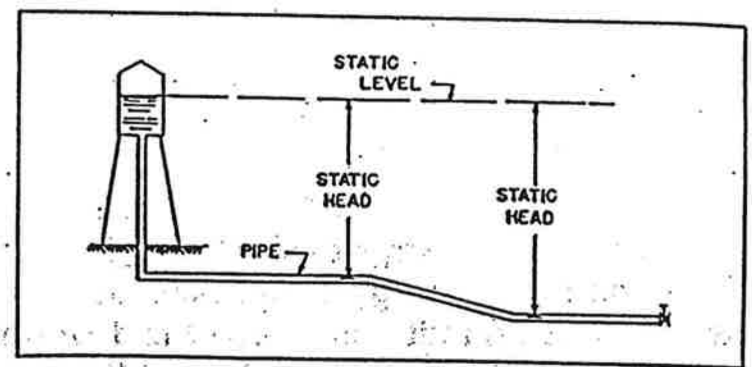


OPEN CHANNEL

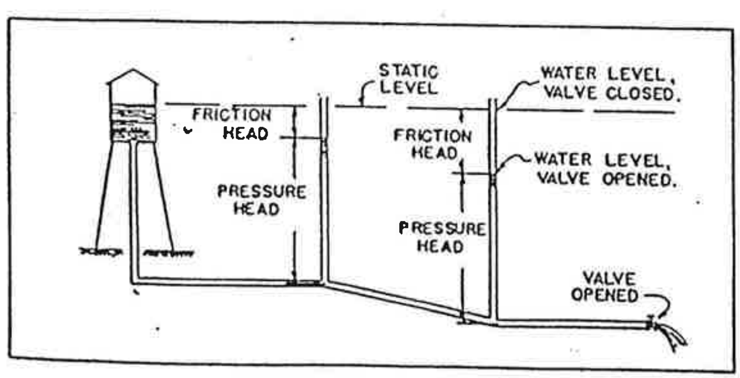


CIRCULAR CONDUIT

A = Area



STATIC HEAD



PRESSURE HEAD

bacteria without as many taste and odor complaints. When only chlorine is used as the disinfectant, it is called free chlorine. Together, free and combined chlorine make up the total chlorine. Because chlorine is measured some time after it is added, it is called residual chlorine, which is the chlorine remaining (residual) after some time.

5. Fundamental Hydraulics

Hydraulics is the study of fluids in rest and in motion. It deals with water flowing through pipes, channels and pumps, and the ways of measuring quantities in a given time.

Head is the amount of energy possessed by a quantity of water at its given location. The quantity often used is 1 pound so that the energy is given as foot pounds per pound (ft. x lb. / pound), which simplifies to feet.

Elevation is the vertical distance from some base level (sea level is often used) and the water level under consideration. Water that is 10 feet above the base level being used has an elevation (static) head of 10 feet.

Pressure head often is expressed as pounds per square inch (psi). That is, the pounds of pressure on each square inch of surface.

Velocity is the rate of movement (speed) and velocity head relates to the force of gravity on a mass (usually one pound) of water. Velocity head is written as equal to $v^2/2g$ (velocity squared divided by twice the force of gravity).

The relationship between the volume of water flowing per unit time, the velocity of the moving water, and the size of the pipe or channel through which it flows is given by the equation $Q=AV$ where Q is the rate of flow or volume of water (usually as cubic feet/sec or cfs), A is the cross sectional area through which the water is flowing (usually as square feet), and V is the average velocity (usually expressed in feet/sec). When water moves through a channel or pipe, there is a loss of head, called head loss. This is due to such factors as friction between the water and the pipe or channel wall, loss because of pipe joints or bends, and increasing resistance to the movement of water through the filter. Filter head loss is an essential measurement in the operation of water filters because when the head loss approaches a fixed level, it is time to take the filter out of service and backwash it.

In pumping water, it is necessary to know the total head (including elevation, pressure, velocity, and friction) in order to calculate the energy required (usually as horsepower or water horsepower) to make the water move through the system. In open channels, pressure is not a factor determining flow rate but the slope of the water (that is, the drop in water elevation per linear distance, usually given as the drop in feet per thousand feet) is the key factor. This slope is also called the hydraulic gradient. Friction is also a factor in open channel flow.

6. Working in the Distribution System

A WSI deals with problems associated with the distribution system, the reservoir and pipe system, that brings water from treatment plants to consumers. Even when a very high grade water with adequate pressure leaves the plant, it may not arrive at the consumer’s tap in the same condition for a variety of reasons. A few examples include: main breaks, growth of undesirable organisms in the water, cross connections (when the water line gets connected to an unrelated system, particularly important if the other system is contaminated), or other disturbances that occur in the miles of underground pipe or above surface reservoirs.

Reservoirs are storage tanks ranging in size from tens of thousands of gallons to tens of millions of gallons. In these reservoirs, the treated water is held, usually at a high enough elevation so that flow to the consumer's taps can be by gravity, rather than by pumping. As the water level in the reservoir falls, more water is pumped into it from the treatment plant. Reservoirs are covered water storage basins covered to protect the treated water from people and animals. Despite the protection given to such reservoirs, foreign objects, dirt and dust, can enter the basin and alter the quality of stored water.

In order to evaluate the quality of water in the entire distribution system, it would be necessary to sample all the water in it. Of course, this is not done; instead, representative samples are regularly collected and analyzed for the previously discussed contaminants. These samples will be from the different reservoirs, pressure zones, and from special sampling taps spread throughout the distribution system. Great care must be used in sampling to insure that nothing foreign to the water gets added while the sample is being collected. It is important that the sample contain only the water in the system. For bacteriological samples, the sample bottle must be kept sterile with no contamination from fingers, hands, or environment can be introduced. In sampling from reservoirs, great care also must be used to make sure that the operation is conducted safely. It may be necessary to go out on the reservoir in a boat, so all boat safety precautions must be taken. If any work is done in confined spaces, special safety rules must be followed. Sampling from taps is considerably easier, but sample contamination must always be avoided.

Occasionally, it is found that undesirable bacteria have multiplied in a reservoir and that the count of coliform bacteria has reached an unacceptably high level, or there may be special problems associated with tastes and/or odors in the water. Usually in these instances, a high-quality water was pumped into the reservoir but something has subsequently happened to it. This may require special treatment of the reservoir, usually with a disinfecting material that will kill bacteria. Sodium or calcium hypochlorite is used for this purpose and is distributed throughout the water in the reservoir from a boat. This material must be handled carefully and should be spread uniformly over the reservoir surface, in an amount calculated to give enough for a good kill.

Similarly, it may be found that a distribution main has become contaminated and needs to be treated. Such contamination is more commonly associated with main breaks, or accidents in which a main or a hydrant is damaged and dirt and contaminants get into the pipe and water. Treatment will be with hypochlorite, or chlorine gas, usually enough to give a concentration of 50 ppm of chlorine. Because killing bacteria is a function of the concentration of the disinfectant and the amount of time it stays in the water, exposure times of up to one day may be required. During that holding time, the reservoir or line must be taken out of service so customers do not receive the highly chlorinated water. After the appropriate holding time, the water needs to be dechlorinated before it can be served to consumers. Dechlorination can be done by letting the water stand until the chlorine breaks down, adding a non-toxic chemical to reduce the chlorine, or filtering the water through a column filled with activated carbon that will remove the chlorine from the water. Often the treated water that still contains a high chlorine residual will be flushed to waste through a convenient nearby sewer.

If water in the mains does not flow constantly, it may become stagnant and encourage the growth of undesirable organisms. This is especially a problem in so-called dead ends (ends of the pipe through which there is little flow). This kind of growth tends to be responsible for many taste and odor complaints. It is dealt with by having a flushing program, in which a hydrant near the pipe end is opened, and the water allowed to run to waste. Although main flushing is considered integral to maintaining a distribution system in good order, in times of drought, the quantity of water can be so limited that it should not be "wasted" by main flushing. This can make special problems for proper operation of the water system.

A key function of the WSI is to deal with consumer complaints. Consumers who use water from a public water system correctly believe that the water should come to them at a reasonable pressure and be free from taste and odor. The water should be safe, but one can't taste bacteria or know whether or not undesirable chemicals are present. This tends to make consumers even more responsive to the problems of which they can be aware without laboratory testing or other sophisticated procedures. Taste and odor complaints tend to be the most common consumer complaints, and even in a high quality water system like East Bay Municipal Utility District, there are many such complaints. Since the District undertook to maintain a disinfection residual throughout the distribution system, a very common complaint is about the taste and odor of chlorine.

A WSI responding to a complaint call must be polite and courteous and consider that the consumer has a legitimate reason for complaining. Investigating the complaint involves talking with the customer and trying to identify the kind and source of the problem. Are many homes affected or is it just one home? Has there been a problem at the treatment plant, or any change in the way of operating the plant, etc.? This type of questioning and investigation is directed at separating the cause: is it the problem of the water company, or does the problem arise from the consumer's plumbing system which is not the company's responsibility. Even if the problem belongs entirely to the customer, the WSI should provide as much help and information as possible.

Aside from the most common complaints of taste and odor, other quality-oriented complaints stem from such things as colored water (this is more common in water systems that use water from wells which often have high concentrations of iron and manganese coloring the water reddish brown or black), dirty water (water with particles in it, such as sand or other "dirt", rust, or generally unaesthetic appearance), or milky water (usually due to air in the water as a result of a household plumbing problem with air getting into the lines and giving a milky appearance that disappears when a glass of water is held a few moments).

In addition to quality complaints, the common consumer complaint is about the lack of or loss of water pressure. There are many reasons for a drop of water pressure, some being the responsibility of the water company, and others due to plumbing defects in the home. In the distribution system there may be serious drops in pressure because of a broken main, a fire hydrant that is hit by a motor vehicle, or other accidental problems. A fire nearby, with large water use can also produce a temporary pressure drop. Within the home a drop may be associated with problems of a malfunctioning pressure regulator or the house valve. Corroded plumbing or serious leaks can produce the pressure drop. Irrespective of the cause for a pressure drop, in the system or in the home, there is always the danger of a cross connection, in which undesirable or unsafe materials get "sucked into" the water line, and at least for a time, contaminated water may be in the water lines.

7. Working on Raw Water Reservoir

The typically closed or covered reservoirs mentioned earlier were reservoirs in a distribution system containing fully treated and disinfected water. The District also has raw water reservoirs that store water before it has been treated. These reservoirs are large, open bodies of water, and could well be described as lakes. Because they are open to the air, they are subject to environmental effects from rain, wind, sun, etc. The water can become "dirty" or contaminated from natural causes or the activities of man and animals. In working on raw water reservoirs, because of their size and relative isolation, observing safety practices is essential. Most of the sampling will be done from a boat, so boat safety is critical. The WSI must wear a life vest and be a qualified boat operator. Smoking is dangerous in a small boat with a gasoline engine and is forbidden. Smoking, in addition to being bad for one's health, could also lead to sample contamination.

There are various kinds of samples and sampling done on raw water reservoirs. First is getting general information about the lake: using a special instrument, a profile of the lake can be obtained. This means that at various locations the water is sampled and analyzed, from the surface to the bottom, while the changes that occur with depth are recorded. Measurements commonly are made for temperature, pH, the amount of oxygen in the water (dissolved oxygen), and the oxidation-reduction potential (ORP, which is a measure of electron transfer, or the oxygen capacity of the water).

Another important type of sample is one for the algae growing in the water. These algae, taken together, are called plankton. They may affect the water by producing tastes and odors or may create operating difficulties in the filtration system. The analysis has to be made in the laboratory where the individual algae are identified and counted using a microscope.

Samples also may be collected for chemical analyses to be made in the laboratory. Sampling procedures and containers are the same as those used for sampling on distribution system reservoirs except that samples may be collected at different water depths to make possible the evaluation of the effect of depth on water quality. Chemical analyses include tests for inorganic chemicals, particularly those for which MCLs have been established, especially metals and other minerals. Special samples for organic chemicals also may be collected. It is important to note that the quality of the treated water depends in large measure on the quality of the raw water; therefore, sampling and analysis of raw water reservoirs is an important part of any water quality evaluation.

8. Total Coliform Rule

The Total Coliform Rule adopted in 1989, specifies a Maximum Contaminant Limit Goal (MCLG) of zero coliform bacteria and an MCL based on the absence of coliform bacteria in most (95%) samples analyzed per month. The number of coliform bacteria need not be measured, only whether any are present (although the District does, in fact, make a count of them). The District has prepared a monitoring (sampling) plan, approved by the California State Water Resources Control Board, that specifies where and how often samples are to be collected in the distribution system. The number of samples collected and analyzed per month is based on the population served. For the District, with service to about 1.3 million people, the monthly number of samples is about 350. If coliform bacteria are found in less than 5% of the monthly samples, the District is in compliance, meeting the standard.

Whenever a sample gives a positive result, even though the total number of positives is within the 5% limit, repeat samples must be taken to check out the positive. One repeat sample must come from the same tap and others must be collected upstream and downstream from that tap. If any of these samples is positive, follow-up procedures, including notifying the State Water Resources Control Board, must be followed. Of course, simply collecting and analyzing more samples does not correct a problem if one does exist. The utility must look at overall operations to be sure that everything is in order. For example, the use of the disinfectant chlorine is essential to keeping a bacteriologically pure water in the system, so the residual amount of chlorine has to be checked to insure an adequate amount present. Cleaning a main by flushing may be necessary, or a main may require both chlorination and flushing. Similarly, the problem may have its origin in one of the distribution system reservoirs, in which case the reservoir may require chlorination.

What is a zone gate?

Because of the varying topography of the EBMUD service area, it is necessary to pump water to reservoirs at higher elevations in order to supply homes below the reservoirs by gravity (see schematic of zones). The pressure of the water supplied to these homes is determined by how much lower in elevation the home is than the reservoir. For every 100 feet of difference in elevation the water pressure will increase by 43.3 pounds per square inch (psi). This means that when homes are much lower than the reservoirs, the pressure will be too high. To control the water pressure at homes and keep the pressure within a range of 40 to 130 psi, the District establishes elevation zones in its distribution system. To separate the higher from the lower pressure zones, distribution mains crossing from higher to lower pressure areas have a valve that is always kept closed under normal conditions. This valve (or gate) is called a zone gate and is designated on maps by the closed gate symbol with the zone designations on either side of the closed gate. A zone gate is the same as any other gate valve except that zone gates separate pressure zones.

Math Facts

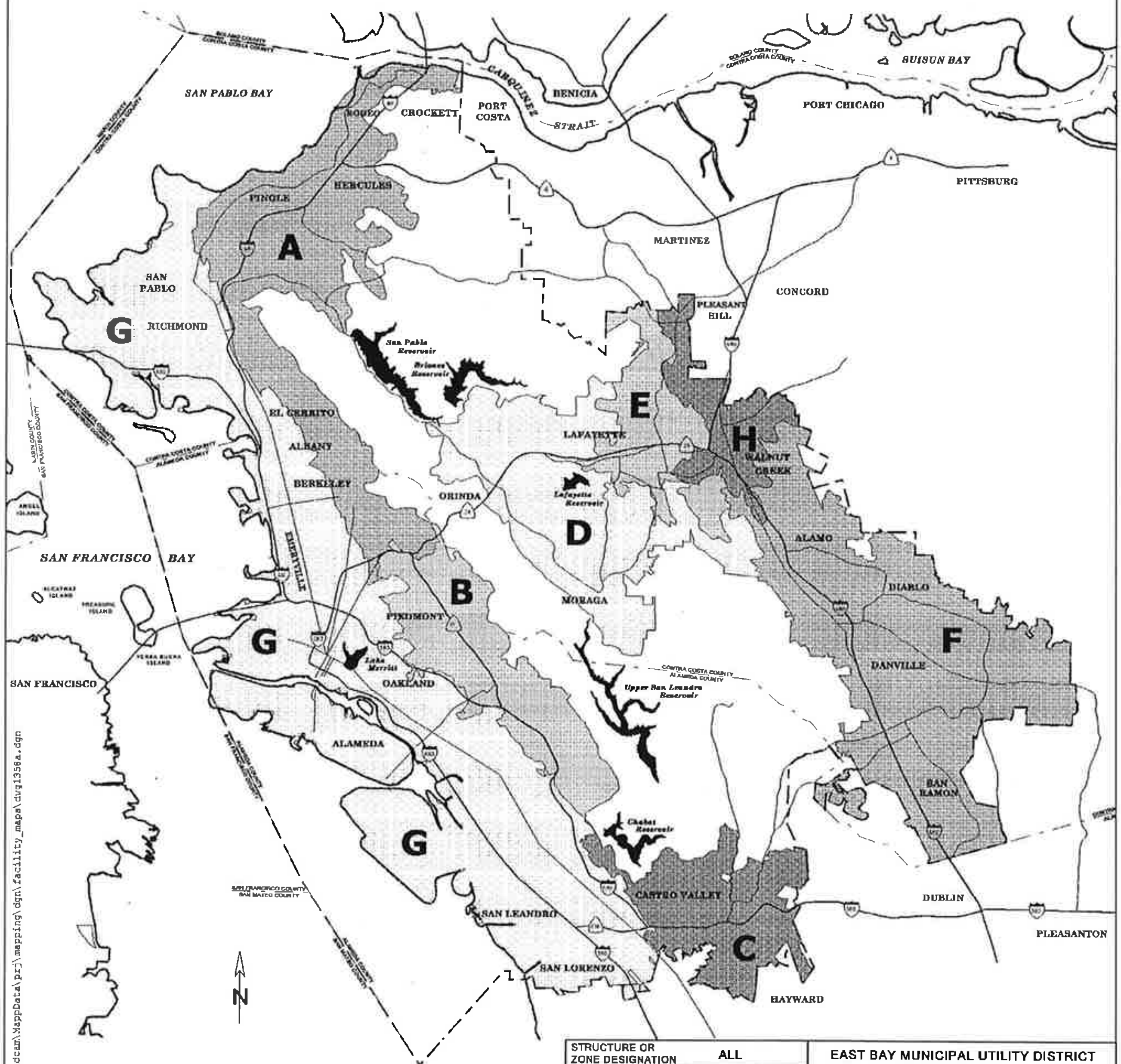
volume is: $V = \pi r^2 h$, and can be expressed in ft^3

area is: $A = \pi r^2$, and can be expressed in ft^2

$\pi = 3.14$ r = radius = diameter/2 h = height

1 gallon of water weighs 8.34 pounds
1 cubic foot (ft^3) of water contains 7.48 gallons

AREAS AND ASSIGNED DESIGNATIONS
WITHIN THE
ULTIMATE SERVICE AREA



STRUCTURE OR ZONE DESIGNATION	ALL	EAST BAY MUNICIPAL UTILITY DISTRICT OAKLAND, CALIFORNIA	
SCALE	NONE		
DATE	APR 23, 2003	PRESSURE ZONE AREAS	1358-A

I. PURPOSE

To establish permanent designations for areas, corresponding pressure zones and associated distribution facilities within the District's Ultimate Service Boundary (USB).

II. APPLICATION

References to pressure zones and distribution facilities made in connection with mapping, computations, correspondence, design, drafting, filing, etc., should be in conformance with this practice. Pressure zone designations will be assigned by the Water Distribution Planning Division (WDPD). Distribution facility designations will consist of the appropriate pressure zone designation plus a structure code assigned by Engineering Records per ESP 120.1.

III. DESIGNATIONS FOR AREAS

The ultimate service area of the District is divided into eight principle geographic areas as shown on Drawing 1358-A. Their locations and assigned designations are as follows:

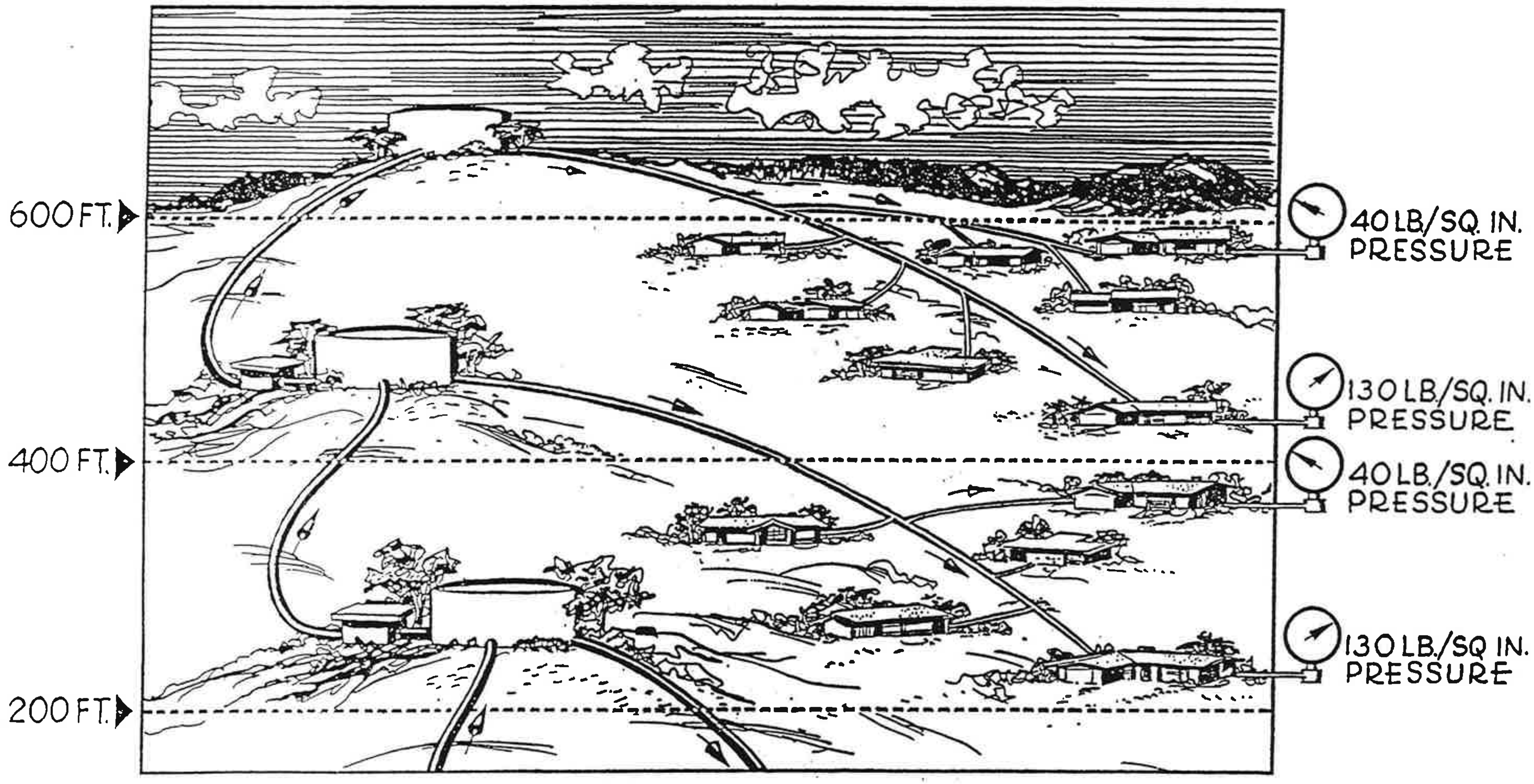
Area Location	Area Designation
Areas supplied by pumping:	
Berryman, Road 24, and Maloney zones and above	A
39th Avenue zone and above	B
Bayview zones and above	C
Bryant zone and above	D
Colorados zone and above	E
Danville zone and above	F
Areas supplied by gravity:	
West of hills	G
East of hills	H

IV. DESIGNATIONS FOR PRESSURE ZONES

Pressure zones will be designated in the following manner:

		1	2	3	4	
Example (1):	Pressure Zone	B	2	A		(39th Avenue)
Example (2):	Pressure Zone	B	2	A	a	(Highland Regulator)
Example (3):	Pressure Zone	F	7	F	3	(Derby, portion in SCC Region 7B)

SCHEMATIC DRAWING OF TYPICAL ZONING LIFTS



EAST BAY MUNICIPAL UTILITY DISTRICT

ENGINEERING STANDARD PRACTICE

ESP	251.1
EFFECTIVE	31 JAN 89
SUPERCEDES	15 NOV 79

SUBJECT:

PIPE DESIGNATIONS FOR 100 FT/IN DISTRIBUTION AND SERVICE MAP

PURPOSE

The size, kind, lining, coating, and year of pipe installation are presented on the 100 ft. per inch Distribution and Service Maps with the designation scheme described here.

PIPE SIZE

Main size will be shown to the nearest whole inch of net inside diameter.

KIND, LINING AND COATING

LETTER CODE	KIND	LINING	COATING
A	Asbestos Cement	M - Mortar or Cement	M - Mortar or Cement
C	Cast Iron	B - Insulating Material: Epoxy, Asphaltic, Coal Tar, etc.	B - Insulating Material
D	Ductile Iron	U - Unlined	BM - Insulating Material with Mortar Overcoat
K	Copper		MB - Mortar with Insulating Overcoat
N	Non-metallic, plastic, etc.		PE - Polyethylene Coating
W	Wrought Iron		PP - Polypropylene Coating
L	Reinforced Concrete Cylinder		TW - Tape wrapped
R	Reinforced Concrete Non-Cylinder		
S	Steel		
T	Pretensioned Concrete Cylinder		
P	Prestressed Concrete Cylinder		

The pipeline description will then be expressed in a one, two, three or four letter code. The first position will invariably indicate the kind of pipe. If the pipe is bare, this will be the only position used. The second position will describe the lining. Again, if there is no coating, there would be only two positions. The third and fourth positions will describe the coating and/or an overcoat when used.

YEAR OF INSTALLATION

The year of installation will be indicated with the last two digits from the year.

PIPE DESIGNATION

A standard grouping of these designations will be used throughout. The first element in the group will be size expressed in numerals; the second element will be the one, two, three or four position letter code describing kind, lining and coating; and the third element will be the year of installation, again in numerals.

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EXAMPLES

6A53	6" I.D. Asbestos Cement installed in 1953
8C36	8" I.D. Cast Iron bare pipe installed in 1936
12CM28	12" I.D. Cast Iron mortar lined but no coating installed in 1928
16SUM08	16" I.D. Steel Pipe unlined but mortar coated installed in 1908
24SMB56	24" I.D. Steel Pipe mortar lined and coal-tar enamel coating installed in 1956
53SMM52	53" I.D. Steel Pipe mortar lined and coated installed in 1952
60T63	60" I.D. Pretensioned concrete cylinder pipe installed in 1963
36SMBM62	36" I.D. Steel Pipe mortar lined and coated first with an insulating coating followed by a mortar overcoat installed in 1962
16SMPP78	16" I.D. Steel Pipe mortar lined and polypropylene coated installed in 1978

C. W. WAY
Chief Engineer

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ENGINEERING STANDARD PRACTICE

ESP	251.2
EFFECTIVE	30 APR 64
SUPERSEDES	29 NOV 62

SUBJECT:

DISTRIBUTION AND SERVICE MAPS

PIPE AND FITTING SYMBOLS

Air Valve on Main (Show Size)

Blowoff at end of Main (Show Size if over 2")

Blowoff on Main (Show Size)

Blowoff and Pumping Tee (Show Size)

Cathodic Protection Station

Change in Size, Kind or Installation Date of Pipe

Check Valve

Culvert for Pipe (All types)

Electrolysis Test Station

Encasement around pipe

Extension replacing extension where Front Foot Charge still applies

Extension With Front Foot Charge

Flow Meters - All Types

Gates and Cocks on Main

Butterfly Valve on Main

Hydrant

Insulation Joint

Manhole (On Large Lines)

Pressure Zone Designation (See ESP 480.1)

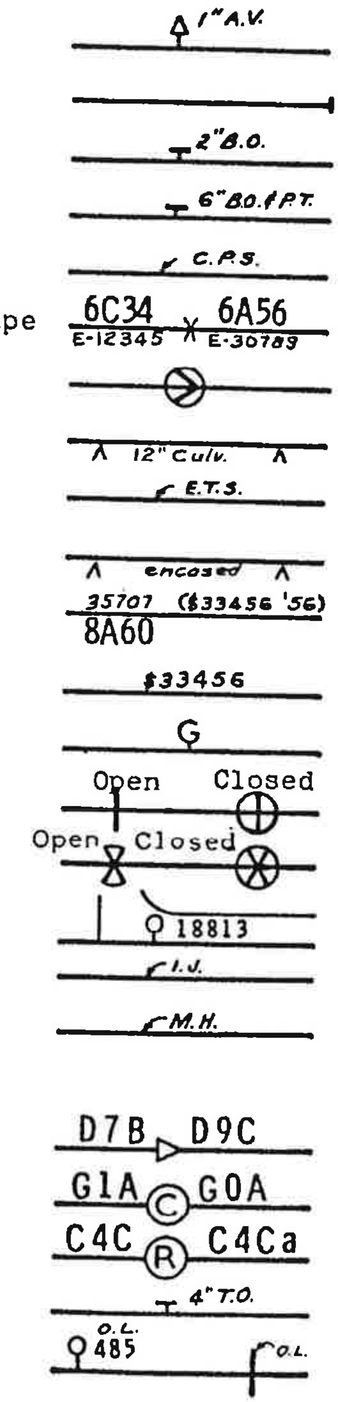
Pumping Plant

Rate Control Station

Regulator

Turnout (Show Size)

Valves Opening Left (Hydrant & Main Line Valves)

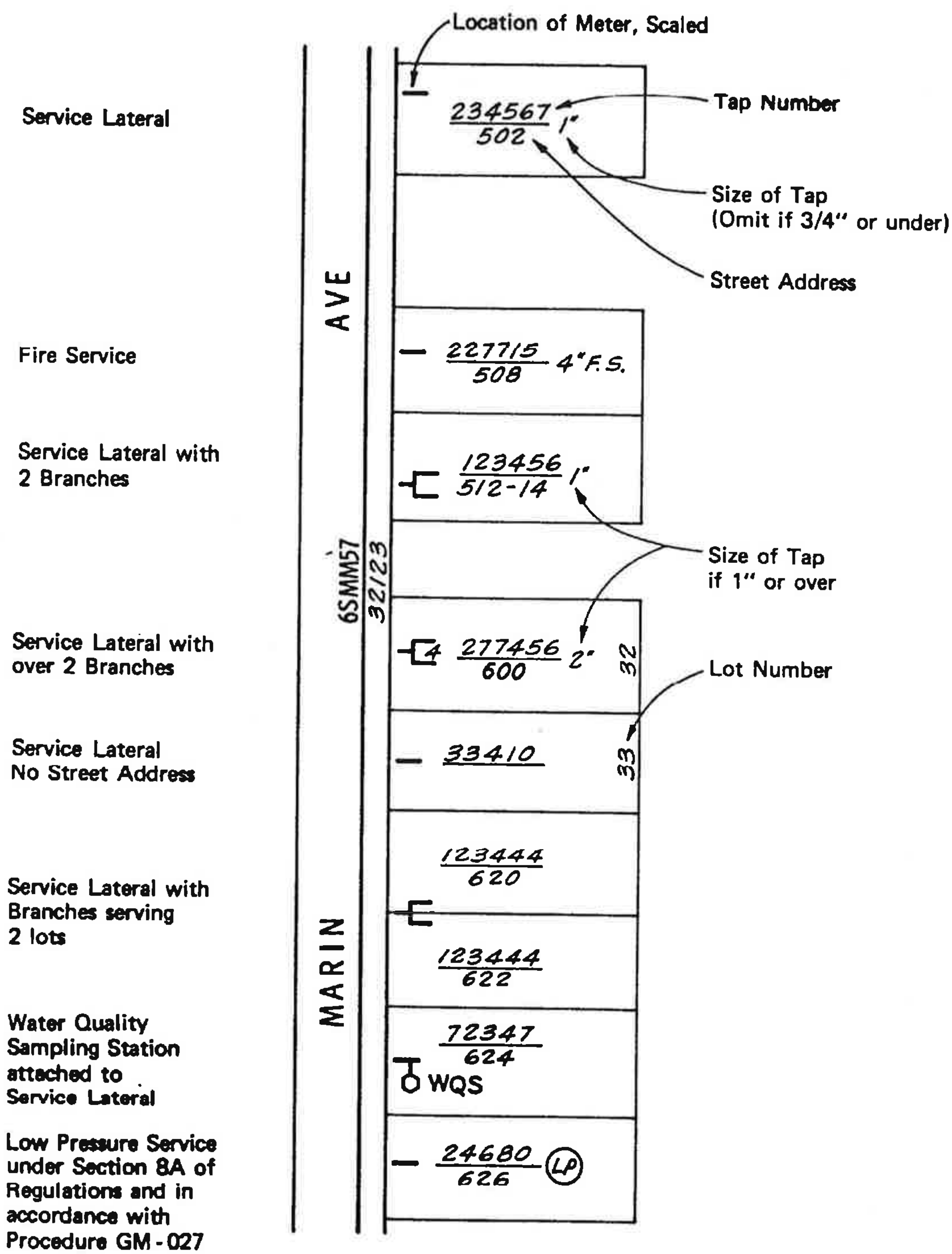


ENGINEERING STANDARD PRACTICE

ESP	251.3
EFFECTIVE	15 FEB 80
SUPERSEDES	8 JUN 70

SUBJECT:

DISTRIBUTION AND SERVICE MAP
SERVICE SYMBOLS



Chief Engineer

ENGINEERING STANDARD PRACTICE	ESP	251.4
SUBJECT: **DISTRIBUTION AND SERVICE MAP SYMBOLS, TAPS TO MULTIPLE MAINS**	EFFECTIVE	05 AUG 98
	SUPERCEDES	30 APR 89

PURPOSE

To provide a means to indicate the main to which a service tap is connected when more than one main exists in a street.

APPLICATION

This information is needed:

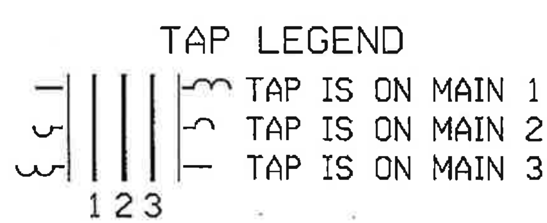
1. when studying loadings on pressure zones and making comparisons with various geographic areas described by other agencies, it is necessary to know with certainty which services relate to individual pressure zones;

2. when planning to shut down a portion of the distribution system, it is necessary to know which services will be affected; and

3. to calculate charges for water service as these are determined by the pressure zone in which the service connection is located.

Whenever it becomes necessary to include this information on a map sheet, the symbols below should be used. The Tap Legend should be placed in the lower margin of the map and each individual tap should display the proper tap symbol to indicate from which main it is tapped. If the dual main situation is eliminated, the tap symbols should be corrected and the Tap Legend removed from that map.

Loops in the tap symbols below indicate the number of mains jumped by the tap lateral and the straight bar indicates a service tap on the closest main.



ONLY THOSE MAPS ON WHICH THIS LEGEND APPEARS IDENTIFY THE MAIN TAPPED.

MARILYN L. MILLER
Director of Engineering and Construction

ENGINEERING STANDARD PRACTICE

ESP	251.5
EFFECTIVE	30 APR 64
SUPERSEDES	29 NOV 62

SUBJECT: 100' SCALE DISTRIBUTION AND SERVICE MAP
LINES & SYMBOLS

PIPELINES

Water Tunnels

Raw Water Lines

Water Mains 12" and over

Water Mains 6" to 10"

Water Mains 4" and under

Overflow Drain Lines

OTHERS

Ultimate EBMUD Service Boundary

County Boundary Line

City Boundary Line

(Outside) EBMUD Boundary Line (Present Service Limits)

(Outside) EBMUD Property Line

(......Street Property Lines & Paths
(......Tract Lines
(......Railroad R/W Lines
(......Shorelines & Canal R/W
(......Freeway R/W Lines

(......Named Undedicated Streets (Public by Use)
(......Tract Line (Overlapping Ownership)

(......Freeway Structure Lines
(......Lot Line
(......Section Line
(......Ownership Line
(......Underline for Service (Tap) Number

(......EBMUD R/W Lines
(......Edge of Paving

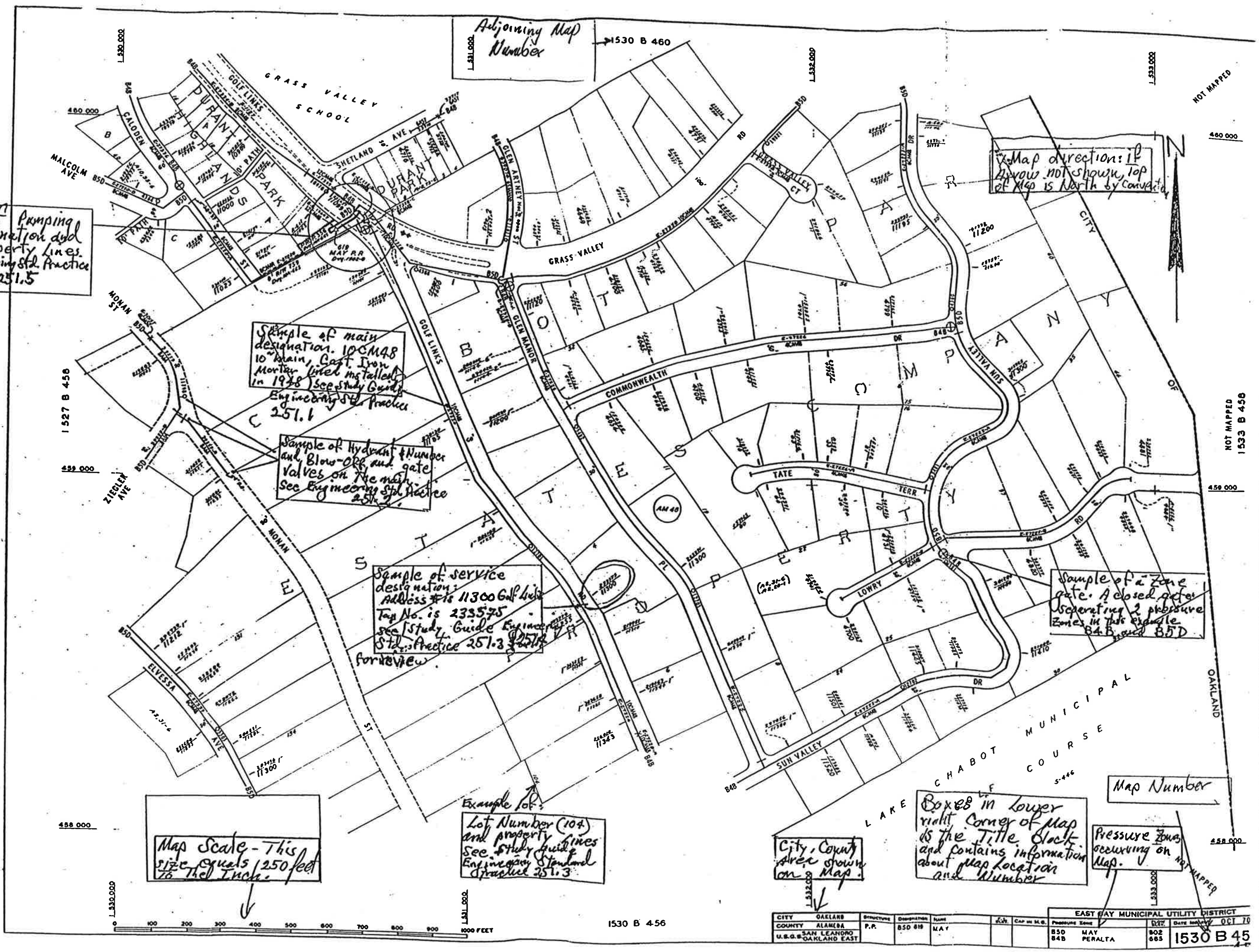
Railroad Track

Mapping Control Point

Junction between differently named portions of the same street

Fence Line

FORM E 104



Adjoining Map Number
1530 B 460
Sample of Pumping Plant designation and District Property Lines. see Engineering Std. Practice 251.2 and 251.5
Sample of main designation. 10CM48 10" main, Cast Iron Mortar lined installed in 1948) See Study Guide Engineering Std. Practice 251.1
Sample of Hydrant & Number and Blow-Off and gate valves on the main. See Engineering Std. Practice 251.2.
Sample of service designation: Address # is 11300 Golf Links Tap No. is 233575 see Study Guide Engineering Std. Practice 251.3 for review.
Map direction: If Arrow not shown, Top of Map is North by convention
Sample of a Zone gate. A closed gate separating 2 pressure zones in this example B4B and B5D
Map Scale - This size equals 250 feet to the Inch.
Example of: Lot Number (104) and property lines See Study Guide Engineering Standard Practice 251.3
City, County area shown on Map.
Boxes in Lower right Corner of map is the Title Block and contains information about map Location and Number
Map Number
Pressure Zones occurring on Map.
GRASS VALLEY SCHOOL
GOLF LINKS
SHETLAND AVE
DURANT HIGHLANDS
DURANT PARK
CALODEN
MALCOLM AVE
MONAN ST
ZIEGLER AVE
GLEN ARTNEY
GRASS VALLEY
GLEN MANOR
COMMONWEALTH
TATE TERR
LOWRY
SUN VALLEY DR
GRASS VALLEY CT
ELVESSA AVE
MONAN ST
LAKE CHABOT MUNICIPAL GOLF COURSE
CITY OF OAKLAND
NOT MAPPED
1527 B 458
1533 B 458
1530 B 456
1000 FEET
EAST BAY MUNICIPAL UTILITY DISTRICT
CITY OAKLAND
COUNTY ALAMEDA
U.S.G.S. SAN LEANDRO OAKLAND EAST
B5D MAY
B4B PERALTA
OCT 70
1530 B 45