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WILMINGTON,
N. C.

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Report No. 35

NATIONAL BOARD OF FIRE UNDERWRITERS

COMMITTEE ON

FIRE PREVENTION AND ENGINEERING STANDARDS

REPORT

ON THE

CITY OF WILMINGTON, N. C.

(Superseding Previous Reports)

The survey of the conditions in Wilmington, North Carolina was made in April and May, 1949 by Engineer J. H. Arnold and Assistant Engineers B. A. Hartley, R. M. Lewis and E. J. Walsh.

Acknowledgment is made of the valuable assistance rendered by the Hon. E. L. White, Mayor at the time of this survey; J. R. Benson, City Manager, the officials of the various city departments concerned, and others.

WILMINGTON, N. C.

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CITY IN GENERAL

A council-manager form of government was inaugurated in 1941. Hon. E. L. White was mayor at the time of this survey later succeeded by Hon. R. S. McClellan who is president of a council of five members. J. R. Benson is city manager.

Population is estimated at 50,000; a special 1946 United States census report showed 47,483. The city is an important railroad center and shipping port. Principal industries include petroleum products, creosoted lumber, cotton goods, and fertilizer. Transportation facilities are furnished by two railroads, interurban bus, air transport and coastwise shipping.

The city is 30 miles inland, on Cape Fear River, and covers 10.4 square miles, the majority of which is built upon. The city limits were extended in 1945. Elevations range from 3 to 65 feet. There are a few short, moderately steep grades close to the river front; others are uniformly slight. Of a total of 85 miles of streets, about 56 are paved. The paved streets are of a macadam or concrete base covered with asphalt. Unpaved streets are in poor condition even during dry weather. Streets in the congested value district are 66 feet in width, except for Water, Nutt and Market Streets which are 35, 48 and 99 feet wide. Bituminous coal is commonly used for manufacturing purposes and which together with manufactured gas fulfills domestic requirements.

The local U. S. Weather Bureau records show that high winds are infrequent. The climate is mild and cold periods are of short duration; long periods of hot, dry weather are moderate in number.

FIRE-FIGHTING FACILITIES

WATER SUPPLY

OWNERSHIP.—Municipal works, first built under private ownership in 1881, acquired by the city in 1908 and subsequently materially extended, cover all the built-on area of the city and supply about 3000 persons outside the city limits.

ORGANIZATION.—The water department is under the supervision of Superintendent of Water and Sewers, W. F. Evans, Jr., who is appointed by the city manager. The superintendent is a graduate engineer, has been in water works since 1934 and has been superintendent in Wilmington since 1945. He is assisted by 4 in the office, 14 at the pumping stations and 48 on maintenance and construction. Appointments are made by the superintendent with the approval of the city manager; long tenure has been the rule for responsible employees.

General and detailed maps of the distribution system are available in differing forms but have not been kept up to date. Weekly records of consumption, pressure and pumping station operation are filed but not properly posted or summarized. Valve and hydrant data is not complete. The superintendent submits a daily summary of maintenance work and weekly, monthly and annual reports to the city manager and council.

The main office is in city hall at Third and Princess Streets; pipe yard with meter and repair shop is at Anderson and Fanning Streets. Alarms of fire are received on a gong at the main pumping station. Superintendent and responsible employees have telephones at their homes. No regular attendance is made at fires; the superintendent or crew responds on call.

GENERAL OUTLINE OF SYSTEM.—Supply taken from the Cape Fear river above the dam at Kings Bluff, about 23 miles northwest of the city, is pumped, filtered and repumped directly to a single service system of distribution on which small elevated storage serves as an equalizer.

SUPPLY WORKS.—The northwest branch of the Cape Fear river, with a drainage area of over 5,000 square miles, furnishes an ample supply. The works comprise intakes, low-lift pumping equipment at 3 locations, filter plant, clear water storage and main pumping station.

Kings Bluff Pumping Station.—This station 23 miles northwest of the city, was placed in service in 1945 and forms the main source of supply. Equipment includes 3 Morris Machine Works centrifugal pumps, one rated at 5,000,000 gallons at 43 pounds, another rated at 7,500,000

gallons at 65 pounds, each direct-connected to a 250-hp. motor, and a 9,000,000-gallon at 82 pounds direct connected to a 12-cylinder 495 hp. gasoline engine. An overhead crane is provided for repairs. The 5,000,000- or 7,500,000-gallon pump is used depending on the consumption rate. The 9,000,000-gallon gasoline driven pump is held in reserve and is tested weekly for about 45 minutes.

Each pump takes suction from a common suction well which is fed by a canal of ample size extending 680 feet from the river. The level of the river is maintained at about elevation 15.0 by a dam; highest river stage elevation 28.0, occurred in 1947. Pumps in a pit 20 feet deep, with center at elevation 13.0, discharge to a 16-inch unvalved header with a rising connection to a 30-inch concrete conduit.

Power is supplied at 33,000 volts over 6.4 miles of aerial circuit on wood poles from a main circuit of the Tidewater Power Company connected by switches to two sources of power. Three 150-kva, 33,000/2,300-volt transformers are in a yard about 100 feet from the station arranged so that any transformer may be removed from service by switches. From the yard the power is carried in a single underground conduit to the station. Gasoline is stored in a 6000-gallon underground tank about 100 feet from the station; ordinarily about 2 days supply is on hand. In February 1947, 2 sleet storms 2 weeks apart caused interruption of electric and telephone service to the station for short periods.

The station is a small area, one-equals four-story brick building with concrete roof and floor, containing little combustible material. It is unexposed. Wiring is in conduit. No heating is provided. A small sump pump sufficient to handle only leakage is installed in the floor, elevation 8.29. The flood of 1947, came within 1 foot of window sills and 2 feet of the door sill at elevation 29.0 and 30.0 respectively. One CO_2 and one vaporizing liquid extinguishers, and 25 feet of garden hose with connection are provided inside the station and 100 feet of 1½-inch hose with a connection to the discharge header are outside. There is no response of fire apparatus. Two operators live nearby.

The raw water conduit is composed of 20.97 miles of 30-inch reinforced concrete pipe extending to Toomers Creek, of which 1.07 miles are on pile bents, and continuing 2.18 miles as the old 24-inch cast iron force main with flexible joints at stream crossings, to Hilton station. There are 5 valves in the line, one at Kings Bluff, one at Toomers Creek, two intermediate and one at Hilton pumping station.

Toomers Creek Pumping Station.—Formerly used as the main source of supply is now in reserve and tested infrequently. Equipment consists of two 4,000,000-gallon Morris centrifugal pumps, each direct connected to a 100-hp. 2200-volt motor. Suction is through a short 24-inch connection extending from 3 feet below low water in Toomers Creek, a cross-cut in a bend of the Cape Fear river. Discharge connects to the raw water conduit at the beginning of the 24-inch cast iron section.

A 2300-volt circuit extends from the transformers at Hilton pumping station and is of sufficient capacity to operate only one pump at a time. The pumps are in concrete pit with wood joisted roof on brick superstructure. No fire protection is provided. Manual operation is necessary by an engineer from the main pump station in event of use.

Hilton Pump Station. — Originally the main pumping station, this station has now been abandoned except for one 8,000,000-gallon low-lift pump, driven by a 12-cylinder, 180-hp. gasoline engine or a 125-hp. 2,200-volt motor; one 3,000,000-gallon high-lift Morris centrifugal pump rated at 86 pounds powered by a 150-hp. motor; and one 2,000,000-gallon high-lift Morris centrifugal pump rated at 86 pounds, driven by a 150-hp. motor. All motors are housed and heated to prevent corrosion, but no regular tests are made. The gasoline engine is tested monthly; the high lift pumps were last used in 1947.

The low lift pump takes suction from the Cape Fear river and discharges into the raw water conduit from Kings Bluff; a break between this point and the mixing chamber would interrupt all raw water supply. The high lift pumps take suction from the smaller clear water reservoir and discharge through a connection to the distribution system beyond the venturi meter.

Power is supplied from a bank of 2300-volt transformers, 200 feet away. Gasoline is supplied from a 500 gallon underground tank west of the building.

The station is a large area brick building with tin covered wood roof on steel trusses. Wiring is open; heat is by coal stove; there are no exposures. One CO_2 extinguisher is provided; no operator is in attendance; nearest fire station is one mile distant.

Filter Plant. — This plant located at the Sweeney pumping station and put in service in 1943, has 7 rapid sand filters each rated at 1,000,000 gallons. Each filter has a sedimentation basin attached which is supplied through a gated connection from a common flume. Raw water is received in a mixing chamber and passes through a floculation basin into the common flume; piping allows the floculation basin to be by-passed delivering raw water directly into the flume.

Filter operation usually has 5 units in service with 2 washing or in reserve; about 1 per cent of the total water filtered is required for washing. From the filters the water flows by gravity

through a 36-inch cast iron pipe, to two reservoirs, so arranged that either may be used while the other is out of service.

One reservoir, placed in service in 1943, holds 4,000,000 gallons at 15 feet depth; the second with full depth of 12 feet holds 900,000 gallons. Elevation of full line is 330 for both reservoirs; usual operation allows a drawdown of about 4 feet leaving an average minimum storage of 3,500,000 gallons. A 30-inch cast iron pipe connects the reservoirs, with a branch to the suction well of the pump station.

A Kohler 10-kva emergency generator is provided to supply lighting and floculation equipment. The filter plant is in the same building with the main high-lift pumps.

Sweeney Pumping Station. — The main high lift pumping station, built in 1943, located at 5th and Hilton Streets, supplies the city by continuous direct pumping. Equipment includes a 7,000,000-gallon centrifugal pump driven by either a 350-hp. motor, or a 12 cylinder 495-hp. Climax gasoline engine, a 4,000,000-gallon centrifugal direct connected to a Sterling 240-hp. gasoline engine, a series-pair, 5,000,000-gallon centrifugal direct connected to a 300-hp. motor; and a 3,000,000-gallon centrifugal direct connected to a 150-hp. motor. All pumps are Morris Machine Works make and rated at 86 pounds with centerline at elevation 38.0. A 12,000,000-gallon wash water pump direct connected to a 150-hp. motor is also provided, taking water from the suction well.

All pumps take suction direct from a well with bottom elevation at 17.0; suctions are within 18 inches of the bottom. Discharge is to a loop, with a cross-connection in which the repair of a valve could put the station out of service. Plant operation uses the 3,000,000, 5,000,000, or 7,000,000 gallon pump, with discharge valve throttled to maintain 75 pounds pressure; 2 to 6 men are on three 8-hour shifts. An overhead crane is provided.

Electric power is supplied by the Tidewater Power Company over two 11,000-volt and a 2300-volt commercial circuits on wood poles to three 500 kva transformers from which a single overhead line carries 2300-volt power 200 feet to the main station. A 1750-gallon and a 500-gallon underground tank, with 1 days supply of gasoline, are close to the west side of the station.

The station is a large area, 2-story and basement brick building with concrete slab roof and floors. Oil storage is in drums in a room connecting with the pump room, considerable amounts of oil drippings are allowed to accumulate and a large accumulation of trash was also present at this inspection; there is indiscriminate paint storage in the workshop. There are no exposures. Wiring is in conduit. Heating is by unit heater. Two CO_2 extinguishers, 50 feet of 2½-inch hose with nozzle, and 50 feet of 1½-inch hose with nozzle are within station. There are 4 hydrants on the grounds. Nearest fire company is one mile distant.

Elevated Storage.—A 146,000 gallon elevated steel tank with overflow at elevation 189.0 is on the grounds but is too low to be in service. A check valve in a 10-inch connection to a 24-inch distribution main opens when the pressure drops below 65 pounds. A 2-inch by-pass is provided for filling.

A 500,000-gallon elevated steel tank being erected in 1949 at the northwest corner of 17th and Grace Streets at the time of this survey is connected to a 12-inch main of the distribution system. Overflow is at elevation 184.

CONSUMPTION. — The average daily consumption during 1948 was 5,050,000 gallons based on records of the Venturi meters at the pump station. The maximum day occurred on May 20, 1947 when 6,450,000 gallons were delivered. An examination of the venturi records show that cold weather causes consumption of near peak proportions, 6,200,000 gallons being delivered on January 16, 1948. Consumption ranges from a 2,000,000-gallon rate at night to as high as a 10,000,000-gallon rate during the day.

On April 27, 1949 there were 9,890 metered services, 586 unmetered services and 1261 inactive services. There are 32 unmetered fire connections 4 inch or larger.

PRESSURES. — Charts from a recording gauge at elevation 49 in the city hall, show average day and night pressures of 65 to 70 and 70 to 73 pounds respectively.

In May 1949, pressure readings at 17 hydrants well distributed over the system with normal operation at the pumping station showed a range from 51 to 84 pounds with average of 67 pounds. In the congested value district the average was 76 pounds with maximum of 84 and minimum of 70 pounds.

DISTRIBUTION SYSTEM. — As shown on the accompanying plan, two 24-inch mains extend south about 2400 feet from Sweeney pumping station to a 20-inch cross connection, from which a 12-inch and two 16-inch branches continue into the city, one of the latter passing directly through the congested value district. These three mains, with well spaced 12- and 10-inch cross connections and some 12-inch loops, form a complete system of arteries throughout the thickly built portions of the city. Minor distributors are largely 6-inch with moderate amount of 8-inch and small amount of 4-inch. Except for sparsely built outlying sections, the gridironing is good with an average length of 600 feet of 4- or 6-inch mains on long side of blocks between cross connections. There are 3.67

miles of dead end 4- and 6-inch pipe supplying hydrants.

In the congested value district, of a total of 15,000 feet of pipe, 18 per cent is 16-inch; 32 per cent 12 inch; 3 per cent 10-inch; 23 per cent 8-inch and 24 per cent is 6-inch.

PIPES.—See Table 1. All pipe is tar-coated or cement lined cast iron. The first pipes were laid in 1881; 47 per cent has been laid since 1926. Old pipe examined shows some tuberculation; flows from hydrants indicate some sediment. Pipes are laid with about 3 feet cover; there is no appreciable frost penetration. Except to a slight extent at railroad and creek crossings there are no exposed mains; no special provision is made for installation of pipe under railroads or on street bridges. Little trouble has been experienced with breaks in recent years.

Pipe is very largely Class 150 centrifugally spun cast iron purchased in the open market. It is inspected on receipt and tested to 150 pounds before back filling. No trouble is experienced from electrolysis.

TABLE 1.—PIPES AND VALVES IN THE DISTRIBUTION SYSTEM, MAY 1, 1949.

Diam., Inches	Length, Miles	Per Cent of Total	Net Increase Since 1926, Miles	Number of Gate Valves
4	5.11	6.3	.....	54
6	37.63	46.0	17.43	343
8	16.39	20.0	11.59	157
10	1.60	2.0	.....	21
12	14.91	18.2	5.51	135
16	4.64	5.7	2.34	21
20	0.08	.....	.....	2
24	1.42	1.8	1.42	7
Total...	81.78	100.0	38.29	740

GATE VALVES.—See Table 1. With few exceptions valves open to the right. A few 12-inch and all 16-inch and larger valves are geared and set in brick manholes; others are direct acting in the usual iron extension box. Most of those recently installed are Pratt and Cady or Mueller make; others are either of the Eddy or Chapman make with several of the older and larger ones of the Michigan type.

With few exceptions valves are located on property lines at street intersections. In the congested value district the average length of main that would be shut off in case of a single break is 660 feet, with a maximum of 2700 feet. In a representative residential district, the average was found to be 935 with a maximum of 2800 feet.

No regular inspections of valves are made. Of 34 valves inspected during this survey, one 4-inch valve was found with broken stem, one valve was paved over and could not be located, some valves leaked through stuffing boxes or were stiff. Two 16-inch valves in the congested value district are broken and either closed or with position not certain. These are to be replaced by new valves which are on order and their insertion under pressure is expected in the near future. Many valves are in doubtful condition due to a period of water salinity experienced for several years before the installation of the new pumping facilities.

The fire department is notified when valves affecting hydrant supply are operated.

HYDRANTS.—Of a total of 664 public hydrants in service May 1, 1949, 312 are Columbian, 262 Mueller, 37 Chapman, 29 Mathews, and the remaining 24 of the Holyoke, Eddy, Darling or M & H make; 77 per cent have one 4½-inch and two 2½-inch outlets; all others have two 2½-inch outlets. All but 7 have 6-inch branch connections to main and about 78 per cent of the total have valve in branch. Practically all have 4- or 4½-inch foot valves and 5¾ or 6-inch barrel. Locations are determined by the superintendent who refers questionable cases to the fire department.

Of 72 hydrants in and bordering on the congested value district, all have two 2½-inch outlets and 67 also have a 4½-inch outlet.

Hydrants are not regularly inspected. Those operated during this survey were found in good operative condition. Some trouble is experienced from the use of hydrants by street flushers and contractors.

In the congested value district the average area served by each hydrant is 49,000 square feet. In a representative residential district the average area served is 238,000 square feet.

FIRE FLOW TESTS.—See Table 2. The tests were made May 2, 1949, between 8 a.m. and 12:30 p.m. with an estimated consumption rate of 6,300,000 gallons a day. The 7,000,000 gallon electric pump was operated and slightly throttled for a pressure of 75 to 80 pounds at the station, which dropped several pounds during the tests. Allowance for this drop was made in computing the tabulated results. Tests 1 and 2 were made on either side of a closed valve and indicated increased quantities to be available when the valve is repaired.

CHANGES AND IMPROVEMENTS.—Since the last report of the National Board of Fire Underwriters in 1927 the primary source of supply has been moved to a point above the dam at

TABLE 2.—FIRE FLOW TESTS.

District, Number and Location of Group *	Elevation	Discharge, Gallons per Minute: Individual Hydrants			Discharge, Gallons per Minute: Total of Group	Pressure, Pounds: Hydrants Closed	Pressure, Pounds: Hydrants Open	Quantity, Gals. per Min. at 20 lbs.: Required	Quantity, Gals. per Min. at 20 lbs.: Available
CV 1. Nutt and Walnut Sts.	10	460	860	1120	2440	84	72	6500	6500†
CV 2. Front and Grace Sts.	25	390	700	1060	2150	74	60	6500	4900†
CV 3. Third and Princess Sts.	30	540	810		1350	70	65	6500	5200†
MM 4. Fourth and Brunswick Sts.	53	570	830		1400	67	61	3500	4300
Ind. 5. Greenfield West of Front St.	6	380	780		1160	78	71	4500	3600
Ind. 6. Wrightsville Ave. at A.C.L. R.R.	32	980			980	68	54	4000	1900
Ins. 7. Forest Hills and Colonial Drs.	15	1080			1080	75	49	3000	1600
Ins. 8. Thirteenth and Willard Sts.	25	380	530		910	66	50	3000	1600
Ins. 9. Thirteenth and Princess Sts.	20	500	530		1030	68	55	3500	2100
Res. 10. Eighth and Dock Sts.	58	490	570		1060	51	42	2500	2100
Res. 11. Eighth and Dawson Sts.	65	500	580		1080	52	41	2000	1900
Res. 12. Sunset Ave. and Harrison St.	21	560			560	67	60	1500	1600
Res. 13. Seventeenth and Ann Sts.	30	710	820		1530	68	54	2000	3000
Res. 14. Nineteenth and Market Sts.	26	1080			1080	67	55	2500	2300
Res. 15. Market and Brookwood Sts.	26	860			860	68	61	2500	2500
Res. 16. Market and Pauline Sts.	39	1040			1040	63	46	2000	1700
Res. 17. Oleander Dr. bet. Hawthorne and Live Oak Parkway	47	1160			1160	59	43	3000	1900

* Location of Groups Shown on Accompanying Map by Corresponding Numbers.
Districts indicated as follows:
CV-Congested Value MM-Minor Mercantile Ind.-Industrial Ins.-Institutional Res.-Residential
† For 10 lbs. residual pressure.

Kings Bluff. Hilton and Toomer's Creek stations have been placed in reserve. A net increase of 24,000,000 gallons has been made in low lift pump capacity. A filtration plant of seven 1,000,000-gallon units, an increase of 2,500,000 gallons in clear water storage and a net increase of 11,500,000 gallons in high lift pump capacity has been provided. The distribution system has been strengthened by the installation of a 24-inch main from the pumping station and a number of 12-inch mains. A 500,000 gallon elevated tank is under construction.

CONCLUSIONS.—The superintendent is capable, but suitable assistance is not provided to maintain adequate records and plans and attend to details of operation.

Ample supply is available from the river with low-lift pumps of adequate capacity. The single cast-iron raw water main between Hilton station and sedimentation basins and the poorly gated discharge line from the high-lift pumping station might cause serious interruption of service if repairs are necessary. The high-lift capacity is mainly adequate in reserve. The unreliable feature of single power line from transformer yard to the high-lift station is only partly offset by the gasoline equipment.

Filter capacity and clear water storage are adequate; equipment is in good condition except for that in Toomers Creek station which must be assumed unreliable because of infrequent tests and maintenance. Main low-lift and high-lift pump stations are of fireproof construction; the reserve stations are of combustible material and lacking fire protection.

Pressures are well maintained and are adequate for automatic sprinkler equipment. Fire flow tests indicate that the mains can deliver adequate quantities to the congested value district and generally fair to good quantities to other districts.

The system of main arteries and secondary feeders is of good capacity and well looped and cross connected. The system is closely gridironed; 4-inch pipe is small in amount, dead ends are infrequent and the interior condition of the pipes is only fair.

Valve spacing is somewhat wide; no inspections are made and valves are in questionable condition with some known to be broken and closed.

Hydrant spacing is good in the congested value district but wide in other areas. Hydrants are of satisfactory size and in good condition but systematic inspections are infrequent.

FIRE DEPARTMENT

ORGANIZATION.—The fire department, full-paid since 1897 and on a two-platoon basis since 1919, is under general supervision of the Board of Commissioners and City Manager J. R. Benson. It serves a population of about 20,000 outside the city limits under a stipulated minimum fee. The chief is the executive and administrative head and is responsible for its discipline and efficiency. Chief J. L. Croom, age 65, has been a member of the department for 42 years and was appointed to his present position in 1937. First and Second Assistant Chiefs J. A. West, age 52, and F. A. Tatum, age 49, have been in the department for 28 and 29 years and were appointed to their present positions in 1939 and 1948 respectively.

The total membership of 82 includes 3 chief officers, 9 captains, 5 lieutenants, and 65 privates including the master mechanic and fire prevention inspector who are captains, and the fire alarm superintendent, the secretary and the 2 chief's drivers who are privates.

During the 5 fiscal years ending June 30, 1948 fire department expenses averaged $187,815 annually; for the last fiscal year it was $217,709, a per capita expense of $4.35 based on a population of 50,000. During the same 5-year period a total of $14,992 was spent for new equipment.

Civil Service regulations adopted by State law to be administered by a 5-man municipal civil service board provide for the appointment of new members, promotion of all officers subject to the approval of the chief, written rules and regulations for the department, and for the administration of all disciplinary measures subject to appeal to the Superior Court of the County. Appointments are made by Council on recommendation of the chief from 3 names submitted for each position by the civil service commission; candidates are required to qualify by standard I.Q. tests on the high school - college level and by a physical examination with good height and weigh limitations and age limits of 21 to 35 years. Appointees serve a probationary period of 6 months; promotions are made by the council on recommendation of a board composed of the chief and 4 firemen after consideration is given to seniority, service and ability, but no written examinations are given. Medical examinations are given annually to all members.

The pension fund is supported by 2 per cent salary deductions and by payment of all fines imposed for disciplinary reasons. It provides pension for disability, for retirement at age 55 or after twenty years service by action of the board and for optional retirement after 25 consecutive years of service; death benefits for dependent beneficiaries are provided. No maximum age limit is set for retirement. The state workmen's compensation fund and optional hospitalization provide compensation for injury; salaries are continued until retirement for disability or recovery. One company member is 65 years of age.

Companies. — Five pumper, a pumper-ladder, an aerial ladder, and a fireboat companies are in service in 6 stations. Each station has a captain and a lieutenant assigned; assistant chiefs are assigned to headquarters platoons and respond with the pumper-ladder. The department is divided into two platoons working 11 and 13 hours and changing weekly; members are allowed 2 weeks annual vacation, one shift off per week, 8 holidays per year, 3 days absence per 15-year service period for family sickness or death, and 1 day per month sick leave accumulative to 120 days at full pay and 120 days at ½-pay. No substitutes are provided for vacation or sick leave. Off-shift members are required to attend fires when sirens, located in three sections of the city, are sounded; this has been necessary three times in the past year when all but 3, 7 and 9 men respectively responded. Under present operating conditions an average of 7 men are on days off, 3 men are on vacation and sick leave is equivalent to one man absent at all times. Only two men are on duty with the aerial ladder and for three shifts each week with the fireboat. At times it is necessary to put Pumper 1 out of service in order to maintain a minimum of three men in other pumper companies.

All buildings in the congested value district are within 3000 feet of headquarters which houses a pumper, a pumper-ladder, and an aerial ladder companies; another pumper company is within ¾ mile and a third within a mile of this district. Distribution in other parts of the city is fair to poor; the pumper-ladder company, due to its headquarters location, has runs of up to 3 miles to the southeastern and southern parts of the city where delays may be occasioned by railroads at grade.

APPARATUS AND EQUIPMENT.—Pumpers.—See Table 3. Four 750-gallon American-La France pumpers purchased in 1917, 1927, 1928 and 1942 and one 600-gallon Mack pumper purchased in 1937 are in service. The three older pumpers have been rebuilt with reconditioned engines and rotary gear pumps, pneumatic tires, and a windshield installed. Those purchased in 1927 and 1928 continue to operate with 2-wheel brakes. The other two pumpers are equipped with centrifugal pumps. Each pumper carries 1000 feet of 2½-, 200 feet of 1½-, and 200 or 250 feet of ¾-inch hose, a 24- or 28-foot extension and a 12-foot roof ladders and two lengths of 4½-inch hard suction. There is no suitable reserve apparatus.

The three older pumpers were tested at draft to determine their condition and the proficiency of their operators. The pumpers delivered rated capacity at reasonable speeds but slippage was

high in pressure gear. Operators were good, showing familiarity with operation of apparatus and testing procedure. Annual service tests as recommended by the National Board of Fire Underwriters are in use and records are kept; results of tests conducted during this survey agreed with records of the last test.

TABLE 3.—FIRE COMPANIES—LOCATION AND EQUIPMENT.

Company	Location	Platoon Assignment	Apparatus Type
Pump. 1*hv*	Headquarters: Fourth St., near Dock St.	6	600-gal. Pumper*
Pump. 2*hv*	Fifth and Castle Streets	5	750-gal. Pumper
Pump. 3*hv*	Fourth and Campbell Streets	5	750-gal. Pumper
Pump. 5	Dock and Seventeenth Streets	5	750-gal. Pumper
Pump. 6	Willard & Third Streets	5	750-gal. Pumper*
Fireboat	Foot of Grace Street	3	Fireboat
Pumper-Ladder 1	Headquarters	6	750-gal. Pump.-Lad.*
Ladder 1*hv*	Headquarters	2	75-ft. quick-raising aerial

*Equipped with Portable Turret Pipe.
hv Company located in or near High Value District.

Fire Boat.—The fireboat "Atlantic III", to replace "Atlantic II", is a wooden hull, built in 1943 and acquired by the city in 1948, with a length of 64 feet 11 inches, a beam of 14 feet 6 inches and a draft of 4 feet. It is powered by an 8-cylinder diesel engine of 230 horsepower at 1500 r.p.m. and, under favorable conditions of wind, tide and warmed-up engine, can make a speed of 12 miles per hour. Two Mack pumping units, each consisting of a 6-cylinder 200 horsepower gasoline engine driven 1250-gallon per minute centrifugal pump, take suction through individual sea chests and discharge into 6-inch welded gated pipes delivering water to two turret nozzles on steel framework towers, one forward above the pilot house and one above the after deck; two pairs of 2½-inch gated outlets on each side of the engine housing are fed by 4-inch pipes connected to the 6-inch pipe. Valves and piping are so arranged that either unit may discharge through either turret but the gated outlets are supplied only from the line leading to the after turret. The boat is to be equipped with 3-way radio on the police department frequency.

The units were tested during this survey and delivered full capacity at 150 pounds pressure within 80 per cent of the peak speed of the engines.

Ladder Trucks.—See Table 3. A 1939 American-LaFrance pumper-ladder is equipped with a 750-gallon centrifugal pump and carries 45- and 30-foot extensions, 14- 16- and 18-foot straight and 12- and 16-foot roof ladders; all ladders were being scraped and refinished during the period of this survey. A 1915 American-LaFrance 75-foot quick-raising aerial ladder truck, completely rebuilt in 1939 by the manufacturer, is in service and carries, in addition to the aerial, a 45-foot extension and 8 other ladders including 1 roof and two pompiers.

Chief's Car—Other Vehicles—Fuel.—The chief is provided with a 1949 model 4-door sedan equipped with 3-way radio; automobiles are not furnished for the assistant chiefs. A ½-ton pickup truck is supplied for use by the master mechanic.

An auxiliary unit consisting of a Chrysler gasoline engine driven 500-gallon Hale OCD centrifugal pump mounted on a commercial truck chassis is kept at Station 5 and another at Station 6 for answering calls outside the city limits where heavier city apparatus would be unable to go. They are equipped with 1000 or 750 feet of 2½-, 200 feet of 1½-, and 200 feet of ¾-inch hose, one or two 10-foot lengths of 4½-inch hard suction hose, a portable gasoline engine driven 65-gallon centrifugal pump, an extension and a roof ladder and other minor equipment.

A ¾-ton truck is kept in reserve at headquarters for special call; it is loaded with 1-ton of foam powder, 200 feet of 2½-inch hose, 4 foam generators and nozzles, and two asbestos suits. A ½-ton pickup truck is stored at headquarters for use when called for; it is equipped with three 50-gallon drums of water, a 65-gallon pump belt-driven from the engine, 150 feet of ¾-inch hose, a 24-foot extension and a 12-foot roof ladder.

Gasoline is stored in an underground tank at headquarters where all apparatus must refuel. Refueling at fires is done from 5-gallon cans transported by the master mechanic in his truck. The fireboat is refueled directly from a tank truck. A good grade of fuel is used.

Hose. — All 2½-inch hose is double-jacketed cotton rubber-lined. It is purchased under the usual manufacturers' guarantees and all sections are tested to 200 pounds pressure. Annual tests of 200 pounds are made by attaching to a pumper; each operator tests his own hose. Unserviceable hose is given to other city departments or otherwise disposed of. New hose is put into service as soon as delivered. A total of 16,050 feet of 2½-inch hose is in service of which 50 per cent is over 7 years old and 60 per cent over 5 years old. Hose in apparatus bodies is changed about twice a year unless used. All hose

is dried on wooden ramps in a frame hose house at headquarters; each station maintains 1000 feet of spare hose rolled and stacked.

Couplings are of the usual screw type; the outside diameter of male thread is 3¼-inches with 6 threads per inch. The 2½-inch outlet on hydrants is 3 13/64 inches with 6 threads per inch on which the female coupling of the hose is a loose fit. National Standard dimensions are 3 1/16 inches outside diameter with 7½ threads per inch.

Appliances.—Distribution of minor equipment is fairly uniform but some important appliances are lacking in whole or in part. Powerful stream appliances consist of an aerial ladder pipe fed by siamesed 2½-inch lines, 3 portable turrets, 2 distributing nozzles and 2 cellar pipes. Emergency equipment includes 12 gas masks of which one has a cracked lens and several show lack of proper maintenance, 2 self-contained breathing apparatus, 1 fresh air mask, and 1 smoke ejector. An outboard motor powered boat on Greenfield Lake equipped with an inhalator, life preservers and life jackets is manned by firemen from Station 6 when called by the lifeguard on duty in the swimming season. Salvage appliances consist of 2 or 3 salvage covers for each company, a few mops, 2 squeegees and brooms; 2 portable gasoline engine driven centrifugal pumps are kept on the reserve hose wagons in Stations 5 and 6. First-aid kits are incomplete in the few cases where they are provided.

Repairs. — All repairs to apparatus are made by the master mechanic, Captain D. E. Millinor, assisted by C. C. Jordan and such firemen as are available. Departmental facilities are very poor; a small frame shop is provided in the rear of headquarters but the only power tools provided are a small bench grinder, a small electric drill, and an air compressor; most of the hand tools are privately owned. A small supply of minor parts such as gaskets and spark plugs is maintained but all other parts must be ordered from the manufacturer; it is reported that prompt service is given. Three rectifiers for recharging batteries are distributed as necessary by the mechanic; batteries are checked weekly.

Fire Stations. — Six buildings built between 1907 and 1942 of ordinary construction are in use as fire stations; all are two stories in height. Headquarters station is drafty, overcrowded, and without adequate facilities for modern fire department service. The fire boat station is in poor condition and of inadequate size to house the required men for the new fire boat; other stations are of ample size to house two pieces of apparatus but are single door stations. Housekeeping was poor in Stations 2 and 4. Lights are controlled automatically in all stations. Heating facilities consist of pot stoves on the apparatus floor in 5 stations; Station 6 is heated by steam. Hose drying facilities are provided at headquarters only. The drill tower, the hose house, the mechanic's shop and fire alarm headquarters are in separate buildings in the rear of headquarters and the congestion restricts the drill facilities.

OPERATION.—Discipline. — The law creating the Municipal Civil Service Commission states that they shall establish rules and regulations relating to the conduct and standard of service of the employees of the department and that such rules shall be printed and made available for public inspection and for use of such employees. Rules and regulations compiled and submitted to the Civil Service Commission by the chief in 1946 were never adopted. Discipline is based on rules and regulations for all city employees insofar as they apply, supplemented by typewritten orders issued at various times by the chief. Discipline is informal and lax. Disciplinary action is administered by the chief subject to the approval of the city manager and civil service commission and subject to appeal to the Superior Court of the County. Records of disciplinary action are kept by the secretary in the personnel folders; they show four cases of suspension and fine since January, 1948.

Training and Instruction.—A 7-story concrete and brick drill tower is located in the rear of headquarters; it is inaccessible on one side due to fire alarm headquarters and barely accessible on another side due to a wall around the adjoining property; very little water can be discharged during drills due to repeated complaints from adjacent property owners. During the summer months combined company drills are held under the supervision of the captains assigned to headquarters on their respective shifts, each shift of each company receiving about three hours of drill every three weeks. Basic standard evolutions are used consisting of use of pompier ladders and life belts with elementary hose and ladder work using groups of 4 to 6 or more men. Companies are not trained as individual or combined units and training is not given in modern fire ground operations because of the restricted facilities. Station exercises are held sporadically at the discretion of the company officers. New men are assigned to headquarters companies for training. Some men in the department have received good first-aid training but their ability has not been used to train others. Pump operators are trained by the master mechanic and secretary during annual hose and pumper tests. Special Interest Bulletins issued by the National Board of Fire Underwriters are received by the department but are not distributed to the stations for company use.

Response to Alarms.—The pumper-ladder and the aerial ladder companies and either Pumper

Company 2 or 3 respond to alarms in the congested value district. Two pumper companies, whose longest ladder is a 24-foot extension, or a pumper and the pumper-ladder companies respond to alarms in residential areas. The pumper-ladder and a pumper companies respond to manufacturing districts; the pumper-ladder, a pumper and the aerial ladder companies respond to schools; and the pumper-ladder, 2 pumper and the aerial ladder companies respond to hospitals. Telephone alarm response for building fires is identical with box alarm response for the same location. Arrangements are made for response of additional apparatus or men and also for moving in.

Grade crossings in the southern part of the city would seriously obstruct response. Many overhead power lines and overhanging business signs in and adjoining the congested value district interfere with the raising of ladders. Unpaved streets may delay apparatus somewhat in very wet or very dry weather.

The department responds outside the city limits, serving an additional population of 20,000, with one pumper company, provided that there are no fires within the city limits and that someone will guarantee the minimum fee charged.

Fire Methods.—Fire department records show that, for the fiscal year 1947-1948, booster pumps were used 232 times, chemical extinguishers were used at 27 fires, fifty-nine 2½-inch and twenty 1½-inch hose lines were laid, and large pumps were used at one large lumber yard fire. Unless fire is visible when apparatus arrives, the first company takes in its booster line and the second company lays a 2½-inch hose line from the hydrant to the fire. Hydrant hose gates are placed on the unused 2½-inch outlet. Shut-off nozzles with 1- to 1¼-inch tips are used. Some fog and spray nozzles are provided but their use is restricted. Good use is made of the heavy stream appliances provided. Salvage operations are very limited due to the lack of equipment and men. Seriously inadequate manpower restricts company fire ground operations to single stream activities or a delay until other companies arrive.

At a large hotel fire in January, 1949, good use was made of all types of apparatus and equipment, especially heavy stream appliances, in restricting its spread through unprotected and seriously exposed openings. Some small fires were started in exposed office buildings but were quickly extinguished. The removal of defective walls was well accomplished. Almost 100 per cent response resulted from the recall of off-shift members.

Building Inspections.—The fire prevention inspector, Captain C. S. Bullard, inspects all schools, hospitals and public buildings regularly and other establishments at random at an approximate rate of 20 per day. No records of inspections made or defects noted are kept and information gathered is not used for instruction purposes. Fire department members do not make any official inspections.

SUMMARY OF APPARATUS

	In Service	In Reserve
Pumpers:		
750-gallon	*5	0
600-gallon	1	0
Hose Wagons with 500 gal. OCD Pump	0	2
Ladder Trucks:		
Aerial	1	0
Pumper-Ladder	1	0
Fire Boat	1	0
Foam Wagon	0	1
Chief's Automobile	1	0
Fuel and Supply Wagon	1	1
Fire Alarm Truck	2	0
Hose, 1½-inch	2400′	0
Hose, 2½-inch	16,050′	0
Hose, ¾-inch for Booster	1950′	0
Ladders, Total Length	491′	0
Ladders, Short, on Pumpers, etc.	214′	114′
Portable Extinguishers	23	5
Water Tanks	6	3
Gas Masks, Type N	12	0
Self-contained Breathing Apparatus	2	0
Fresh Air Mask	1	0
Salvage Covers	18	10
Portable Turrets	3	0
Deluge Set	1	0
Siamese Connections	2	0
Ladder Pipe	1	0
Cellar Pipes	2	0
Distributing Nozzles	2	0

* Including Pumper-Ladder combination.

Report and Records.—Records are kept by a fireman who serves as secretary at headquarters; they are mainly complete. Company officers maintain a company journal showing all activities. Individual personnel folders, a time record book, a card file consisting of a report submitted by the senior officer at each fire for each building involved, a card file of the daily report from each station and a record of hose tests are maintained. Annual and monthly reports are submitted to the city manager.

IMPROVEMENTS.—Since the 1927 report of the National Board of Fire Underwriters 4 officers and 31 men have been added, 3 pumper and 1 pumper-ladder companies have been formed and two stations have been built. Three pumpers, a pumper-ladder and a new fire boat have been purchased and the aerial-ladder has been rebuilt.

CONCLUSIONS.—Provisions for fire department expansion have not kept pace with the growth of the city and response is made outside the city limits. The new fireboat should prove valuable in fighting waterfront fires. There is need for additional pumper and ladder service with an additional pumper company so located as to overcome possible obstruction to response to the south caused by the railroad; greater utility could be made of the pumper-ladder if relocated with Pumper 5. Provisions for appointments are fair but confusion exists regarding requirements for promotion. The number of officers and company strength is seriously deficient, at times making it necessary to place a piece of apparatus out of service in order to maintain a minimum of three men in other pumper companies and two men on the aerial ladder and fireboat. The absence of individual transportation for assistant chiefs restricts their service. Headquarters is congested and deficient in many appointments considered necessary for modern fire service, and the fireboat station is of inadequate size for required personnel of the new fireboat. The training program is restricted by the location of the drill ground where there is not sufficient room to allow for modern fire ground activities. The absence of modern rules and regulations as provided for in the State Act has resulted in informal and loose discipline. Repair facilities are inadequate and there is a deficiency in reserve pumping capacity. Fire methods are generally good with the apparatus provided although wetting agents, fog nozzles and salvage appliances are not sufficiently provided and methods are further restricted by the lack of proper building inspections and discussion by company members. Records are fair.

FIRE ALARM SYSTEM

ORGANIZATION.—The fire alarm system is under the same general supervision as the fire department and is maintained by City Electrician D. F. Sandlin, Jr. who was appointed to his present position in 1946 and also maintains the police signaling system, the traffic control system and supervises electrical installations. He has 3 assistants and may obtain help from personnel of the fire department or public utilities.

Fire alarm headquarters is in a 1-story, 2-room fireproof building in the rear of fire department headquarters. It is protected by wired glass windows from a moderate exposure of an adjacent hose ramp in a frame shed. The battery room and the operating room are completely cut-off. Except for regular visits by the superintendent, the building is unattended. The transmitter for the police department radio system is in one corner of the operating room. An automatic direct gas fired unit heater has been installed to prevent dampness.

EQUIPMENT. — At Headquarters. — Gamewell equipment of automatic type installed in 1938 consists of a cross-connecting rack, a 12-circuit protector cabinet, a 12-circuit operating board, a rectifier cabinet, and a 12-circuit repeater. The switchboard has operating, supervisory and testing facilities but when the system was installed the ammeter was put in series with the rectifier instead of the line and consequently no amperage readings may be taken when operating on the battery alone; jacks are provided for connecting a punch register to each circuit but are not used; no facilities are provided for communication over circuits.

Operating current is provided by individual circuit rectifiers with batteries floating. Two high-low rate charging rectifiers are provided, one for each 6 circuits; these, in addition to the rectifier of the unused circuit, may be used as spare rectifiers. Batteries are composed of 12 to 19 cells mounted on glass rods on porcelain insulators on an iron pipe rack; all cells have been installed since 1947. A gasoline engine driven 2500-watt generator provides an alternate power supply, and is started as soon as weather reports warn of an impending storm. The power supply to the fire alarm system and to the radio transmitter are from separate sets of public utility transformers and may be used interchangeably.

Apparatus at Fire Stations and Elsewhere. — Each station has a punch register and take-up reel, a large gong and automatic light switch, facilities for vocal communication with all fire stations, and a telephone; fire headquarters has the telephone switchboard, a punch register and take-up reel with a defective time stamp, a 4-plate manual transmitter which is seldom used, a large and a small gong and an automatic light switch. Electrically operated sirens for recall of off-shift members are located at headquarters and Stations 5 and 6. A gong is located at the chief's and first assistant chief's homes, Tidewater Power Company, water department pumping station and police headquarters in city hall; voice amplification facilities are installed at police headquarters.

Boxes. — Total number, 195, of Gamewell or Horni makes; 2 are inaccessible to the public, 6 are connected to a sprinkler system, and 2 are auxiliarized with 15 and 5 stations respectively. Five are non-interfering, non-succession and the remainder are of succession type; doors are of quick-action or key under glass guard type; glass is not replaced in the latter when broken. Two boxes are on pedestals with an underground lead-in from the nearest pole and the remainder are mounted on poles or on walls of buildings. All boxes and works are grounded. No indicating lights are in use. Red and white bands are provided and are repainted every 2 years. Twenty boxes were tested during this survey; three did

not operate properly but were adjusted and retested before completion of the survey. Boxes are timed to transmit at a speed of 1.3 to 1.6 with an average of 1.5 seconds between blows. No regular tests are made of boxes.

Box distribution is fair, but some streets are without boxes for long distances; it is estimated that 1 additional box is needed in the congested value district and about 150 additional boxes elsewhere; relocation of some existing boxes would reduce this number.

Circuits. — Ten box and one alarm normally-closed all-metallic circuits are in use; the voice amplification system is on a separate multiple station circuit designed for two-way transmission. One box circuit enters the chief's and assistant chief's homes. Seven box circuits are without recording instruments in a fire station and eight box circuits serve areas in excess of that considered reasonable for 20 properly placed boxes. All circuits are overhead, some wires of which has been bunched or laced, mounted on joint poles above communication and below power lines. Circuits enter fire headquarters underground from an adjoining pole then go underground to fire alarm headquarters; all other stations and buildings are entered aerially.

Overhead wire is approximately 50 per cent of No. 12 copper welded steel with triple braided insulation in newer installations and 50 per cent of No. 10 medium hard drawn copper with triple braided insulation. Box leads are No. 12 and 14 rubber covered twisted pair in iron pipe with weatherproof head; insulating joints have recently been removed but will be replaced as soon as insulators can be procured. All boxes are grounded with No. 8 ground wire.

Protection at headquarters consists of a 3-ampere telephone type fuse, an inert gas lightning arrester, and a ½-ampere sneak fuse on each side of the circuits. Batteries are protected on the rack by 3-ampere cartridge fuses. The junction point between overhead and underground outside of fire headquarters is protected by an inert gas lightning arrester and a 7-ampere fuse. Stations 4 and 5 are protected by lightning arresters only and no protection is furnished other locations. Voice amplification units are protected by 3-ampere fuses.

Telephone Service. — A private telephone switchboard, owned and maintained by the Southern Bell Telephone Company, is in the watch room at fire headquarters; it has an extension to each fire station and to the chief's office and is attended by a fireman; there have been times when it was unattended between the response of headquarters apparatus and the moving in of other companies. Three trunks, numbered progressively, extend from the public automatic exchange the last of which is reserved for incoming calls only.

OPERATION. — The city electrician and his assistants devote part of their time to the fire alarm system; two pick-up trucks are provided for their use. Circuit readings are taken daily and records are kept. Batteries are recharged regularly but are tested only when trouble is evident. Boxes are tested when installed, damaged or moved. Test blows are sent out weekly if no alarm has been received. Maps of circuit and box locations are kept.

Four rounds of box alarms are automatically transmitted over the system. Telephone alarms are received at fire headquarters and all companies are notified by the vocal alarm; they are not confirmed over the fire alarm system.

During the fiscal year ending June 30, 1948, there were 387 telephone, 158 box, and 26 verbal alarms of which 82 were false; 147 were for other than building fires.

CONCLUSIONS.—The fire alarm system was greatly improved by the installation of new headquarters equipment in 1938 but insufficient space has been provided for the expansion necessary to adequately protect areas added by the extension of the city limits. Several features of unreliability are still present; the complete dependence upon aerial circuits means added maintenance due to accidents, the weather, trees or routine changing of public utility-owned poles; lack of adequate protection at fire stations, although protection is good elsewhere, adds to the unreliability, and the absence of regular box tests reduces their assurance of operation. Telephone facilities are mainly adequate but the reserved line is improperly located in the sequence and improperly listed in the telephone directory; an operator is not always in attendance.

FIRE DEPARTMENT AUXILIARIES

FIRE MARSHAL.—By State law the chief of the fire department must investigate all fires within three days of their occurrence and submit a written statement concerning all facts of the fire to the State Insurance Commissioner at Raleigh. At present, a monthly report is forwarded and such statistics are filed at the Commissioner's office. W. P. Hodges is the State Insurance Commissioner; Sherwood Brockwell is State Fire Marshal. Deputies of the Insurance Commissioner investigate fires upon report of the chief as to suspicious origin. Authority is granted to take testimony and summon witnesses and the commissioner is required to furnish testimony for the prosecuting attorney upon request. Fires of an incendiary nature have been negligible in recent years.

POLICE DEPARTMENT. — The police department is under the direction of Chief H. Hayes and has a total complement of 73 men. Automotive equipment consists of 9 automobiles and 5 motorcycles. All police vehicles, the fire chief's car and the fireboat are equipped with 3-way FM radio; the transmitting equipment is in fire alarm headquarters and the microphone at police headquarters in city hall. The police signaling system is maintained by the city electrician and consists of 10 call boxes equipped with telephone.

Box alarms are received by a gong and a vocal alarm is installed at the watch desk. A police car responds and fire lines are set up. Some unauthorized construction is reported by police to the building inspector.

TELEPHONE SERVICE. — The Southern Bell Telephone and Telegraph Company serves about 15,700 subscribers on from 1- to 8-party lines through one exchange in a 2-story and basement fireproof building; wired glass windows protect against slight exposures. Inside protection is furnished by foam and carbon-dioxide extinguishers. All wires in the congested value district are underground. The exchange is connected to the fire department switchboard at headquarters by three trunk lines, one of which is for incoming calls only. Known emergency calls are supervised and records are kept for a short period.

PUBLIC SERVICE CORPORATION.—The Tidewater Power Company receives all box alarms on a gong and an emergency truck responds. Four taps followed by the box number is a signal for the power in that area to be cut off.

PRIVATE FIRE PROTECTION. — Thirty-two business establishments have private fire protection consisting of automatic sprinklers, hydrants and hose, standpipes, water tanks, or reservoirs of 1000- to 75,000-gallon capacity with fire pumps of 500- to 1000-gallons per minute. The Atlantic Coast Line Railroad maintains a private fire brigade consisting of a chief and 2 companies of 5 men each who man the private fire hydrants and assist the municipal department on arrival; regular drills are held.

OUTSIDE AID.—No substantial outside aid can be expected within a reasonable length of time.

STRUCTURAL CONDITIONS AND HAZARDS

BUILDING DEPARTMENT

ORGANIZATION AND CONTROL. — The office of Building Inspector was created in 1905. City ordinances prescribe that the building inspector shall be appointed by the city manager with the approval of the council. The department is under the direct supervision of the city manager. Powers and duties are prescribed by the laws of the State of North Carolina and the ordinances of the city. State laws require the building inspector working in conjunction with the State Insurance Commissioner to enforce the State building code.

E. J. Hale is the present building inspector. He was appointed to the office by the city manager in March, 1948. W. P. Hodges is the State Insurance Commissioner.

A permit is required before any building operations may be started in the city. All applications for building permits are required to be accompanied by plans and specifications where the building inspector deems the type of construction requires them. For every building valued at $10,000 or more, with the exception of dwellings, a complete set of plans must be furnished the State Insurance Commissioner.

The building inspector is required to inspect all new construction with the frequency of inspections depending upon the character of the buildings under construction. Only part time is devoted to inspections of old and new buildings since office work requires considerable time. Recommendations on unsafe conditions are reported to the city council by a committee composed of the mayor, city engineer, chief of the fire department, and the building inspector with any condemnation action taken by council. Police aid in the reporting of unauthorized construction.

Applications and permits are filed in a steel cabinet at city hall; index cards, kept according to owner and address, are filed for reference. Monthly reports are submitted to the city manager and the U. S. Department of Labor. The report to city manager includes information as to number of permits, estimated value, fees, and notices on condemned buildings.

LAWS AND REGULATIONS.—The North Carolina State Building Code, adopted in 1936, classifies buildings as to occupancy and type of construction. Limitations on heights are good, but no restriction is placed on frame residential construction. Allowable areas are liberal for heavy timber and ordinary construction. All windows above the first floor in certain occupancies are required to be protected with approved fire shutters or wired glass. Protection to vertical and horiontal openings is good. No frame construction is allowed in the

fire limits, except for temporary structures approved by the building inspector. Fire walls are 4 inches deficient in thickness. Ample provisions on chimney construction are provided. Fireproof construction requirements are good. Provisions for sprinkler installation are incomplete, but standpipes are required in buildings over 55 feet in height. Parapets must extend at least 18 inches above the roof and be properly coped. Buildings found by the inspector to be in a dilapidated condition or to be a serious life or fire hazard must either be condemned or repaired by the owner under the provisions of the code.

An act pertaining to fire protection in hotels and buildings of like occupancy, effective September 1947, contains a 3 year compliance period and requires a manual fire alarm system in all hotels or buildings of like occupancy and watchman service for any hotel over 2 stories in height. Hotels of other than fireproof construction and more than 3 stories in height must be provided with an automatic sprinkler system. An approved automatic detection system may be used in place of the required sprinkler system with the approval of the insurance commissioner. Interior stairways must be enclosed when used as exits. Fire extinguishers must be provided on each floor and decorations must be approved by the chief of the fire department.

The municipal code, placed in effect in December 1946, requires a permit from the building inspector for the installation of oil burning equipment. Such installation must conform to the standards set by the National Board of Fire Underwriters. No limitations are prescribed for heights or areas. Automatic sprinkler systems are required in basements of occupancies used for the manufacture and sale of flammable liquids within the fire limits. Parapets are required on all brick and stone buildings, but no definite thickness or height above roof is mentioned. Frame construction is prohibited within the fire limits. All stores, shops, and mills within the fire limits must have their windows protected by fire shutters or wired glass. Dumb-waiters must be enclosed and lined with fireproof material. An ordinance passed in 1935 provides that all wooden shingles within the city must be replaced by 1950 with a fire-resistive material.

As shown on the accompanying map, the fire limits are of a sufficient extent to adequately cover the congested value district with the exception of the southeast corner of the district. A second fire limit embraces a small mercantile district and extends about 3 blocks in length and 2 half blocks in width.

An earnest effort is being made by the building inspector to enforce the building laws. Some frame construction was noted to have been erected recently within the fire limits with the approval of the city council. Enforcement of the act concerning fire protection in hotels and apartments has been greatly emphasized. Permits for the installation of oil burning equipment although required, have not been issued and no inspections are made on such installations.

LOCAL CONDITIONS. — The congested value district consists of 25 blocks or part blocks containing 15 buildings of fireproof, 281 of ordinary and 34 of frame construction, exclusive of sheds and additions.

Fireproof construction covers 9 per cent of the built upon area and consists of bank, hotel, office, and garage occupancy. The highest is an 11-story office building of 10,200 square feet in area. A 9-story sprinklered hotel is of 9,400 square feet area; 5 other buildings are 6 to 8 stories in height. Three railroad office buildings, communicating through bridges with an extensive area of ordinary construction, form a total area of 33,700 square feet; the 3-story custom house covers 23,000 square feet. Four buildings have windows protected and floor openings are protected in four cases; 8 have inside standpipes with hose.

Ordinary construction occupies 77 per cent of the area built upon. Only 21 buildings exceed 3 stories in height, 17 being 4 and four 5 stories in height. Ten buildings are of excessive area, the largest being the several sections of a 1-story sprinklered warehouse, varying from 13,700 to 22,000 square feet, having a total fire area of 115,600 square feet due to unprotected communications with adjoining sprinklered cotton sheds of frame construction. Two garages, both 1-story in height, have areas of 23,000 and 19,200 square feet. Unprotected and poorly protected communications form many of the large areas. Vertical openings, including those of 2-story buildings, are protected in 14 cases and exposed windows in 50 cases. Communications are protected in 5 and partly protected in 8 cases.

Frame construction covers 14 per cent of the area built upon. Three buildings are of excessive area. The largest is a 1-story shed of 27,000 square feet. Cotton warehouse sheds with unprotected communications provide a total fire area of 60,400 square feet. These adjoin with the 1-story warehouse of ordinary construction. A 2-story tobacco warehouse divided into sections by fire walls is provided with open sprinklers over windows. Wooden shingle roofs in the congested value district are negligible.

CONCLUSIONS.—The building inspector and State Insurance Commissioner have adequate authority to administer and enforce the building laws. State laws are generally good, but incomplete or liberal in some important features restricting the spread of fire. The municipal code is generally inadequate. The fire limits do not adequately protect the congested value district especially in the southeast section. Enforcement is fairly good, but inadequate with respect to the

installation of oil burning equipment. The recent small amount of new construction in the city has enabled the building inspector to concentrate on reinspections of the more serious conditions. Structural conditions remain fire resistively weak with very little increase in fireproof construction erected in the congested value district. Good records are kept.

FIRE PREVENTION

ORGANIZATION AND CONTROL. — The chief of the fire department is empowered by ordinances to issue permits and enforce provisions regulating explosives and flammables and is required, at frequent intervals, to inspect buildings and premises within the city to see that they are kept clear of combustible material. Powers and duties of the chief of the fire department have been delegated to a fire inspector appointed by the city manager.

J. L. Croome is chief of the fire department; Captain C. S. Bullard, a member of the fire department under civil service regulations was installed as fire inspector in June, 1943.

City ordinance requires a permit to be obtained from the fire chief for the storage of explosives and flammable liquids in excess of limited quantities, but none are issued. Storage tank installation for flammable liquids must be approved by the city council. The building inspector issues permits for dry cleaning establishments, but none are issued for the installation of oil burning equipment.

There is no systematic method of inspection of hazardous occupancies. The fire inspector makes inspections upon receipt of a request or complaint; otherwise he continuously inspects establishments throughout the city. It is reported that quarterly inspections are made of the congested value district. Members of the fire department do not make fire prevention inspections. The chief of the fire department is required to make recommendations to the city council whenever an unsafe condition or a serious fire hazard exists.

Reports of inspections are not made with the exception of conditions existing in hotels and apartments which are forwarded to the city manager. Records of applications, permits, and inspections are not kept.

LAWS AND REGULATIONS. — The state laws require that ashes be placed in non-combustible receptacles; oily rags and waste must be placed in covered metal vessels and removed from buildings daily. Motion picture booths must be approved by the state insurance commissioner. The storage and handling of flammable liquids and dry cleaning operations are governed by rules and regulations.

Municipal ordinances require quantities of gasoline, benzine, or naphtha exceeding 1 gallon be stored in properly arranged underground tanks or safety cans in an isolated section. Requirements for the storage of kerosene are fairly good. All public garages must be of fireproof construction and also private garages, if within the fire limits. Buildings used for dry cleaning purposes must be of non-combustible material with fireproof floors; no steam boiler, furnace or electric motor is permitted in the washing, drying, or distilling rooms. Sufficient ventilating ducts with sparkless exhaust fans must be provided and smoking and the carrying of matches is prohibited. A permit is required for gunpowder in quantities exceeding 3 pounds and storage is restricted to 50 pounds. The discharge of fireworks, other than public displays having the approval of the council, is prohibited. Hay, cotton, or hemp in bales or in bulk for the purpose of baling, are prohibited in frame buildings; buildings used for this type of storage must have slate or metal covered roofs and standard protection to wall openings. Coal, lime, lumber, shingles, or any other combustible material must be safeguarded against fire. Ashes may not be placed in any wooden receptacle or on any wooden floor.

LOCAL CONDITIONS.—No explosives were found in the congested value district and none are manufactured or stored in the city. Hardware stores carry moderate amounts of fixed ammunition. A small amount of ammonium nitrate in bulk was found stored in a frame warehouse of an isolated fertilizer manufacturer. Private fire protection was negligible. A large terminal warehouse on the north edge of the congested value district was used exclusively for the storage and packaging of sodium nitrate. It was equipped with an automatic sprinkler and fire alarm system.

Gasoline at garages and service stations is stored in well arranged underground tanks; an adjoining paint spray booth in one garage was separated from cutting and welding operations by a wooden door. Lacquers and thinners were stored outside of booth on a wooden table. Paint and hardware stores carry most stocks in small containers; oil storage is in drums equipped with pumps.

Motion picture booths are of non-combustible construction, equipped with automatic shutters over observation and projection openings, and provided with fair ventilation. Storage of film was in approved containers; rewinding machines were enclosed and extinguishers were amply provided.

Four dry cleaning establishments were inspected. Poor conditions prevailed at some of the smaller establishments. One establishment within the congested value district had no sepa-

ration between boiler and cleaning room, an open system of piping, and other deficiencies which severely exposed the adjoining buildings.

Two large wholesale oil storages are located within the city limits and others are located just outside. Storages are generally well distributed and isolated and provide no exposure to the district.

Wooden boxes and other combustible rubbish were found in the rear of buildings and areaways.

CONCLUSIONS.—Laws contain many good features relating to the storage and handling of flammable liquids, but are lacking in covering other equally hazardous materials and occupancies. The duties and responsibilities of the fire inspector have become so intermingled with those of the building inspector that control over the issuance of permits and inspection of certain installations has been neglected. Inspections are superficial due to the large number that the fire inspector is required to make without assistance of the members of the fire department. A number of hazardous conditions exist which can only be corrected by the adoption and rigid enforcement of a modern fire prevention ordinance. Records and reports are incomplete; systematic filing system is badly needed.

ELECTRICITY

ORGANIZATION AND CONTROL. — The office of City Electrician was established by ordinance in 1941. He is appointed by the city manager for an indefinite term and has general supervision and control over inside and outside wiring and the maintenance of the fire and police alarm systems. The city electrician is required to make inspections of all new electrical installations and all existing installations.

D. F. Sandlin, Jr., an experienced electrician, was appointed city electrician in 1946. He has three assistants who perform maintenance and office work.

Permits are required for installation or alteration of any electric wiring, device, or appliance. All contractors and electricians must be licensed by the State and county. Two inspections are required by city ordinance on all new work and such inspections are reported to be made. Before power may be turned on, a certificate of approval must be issued by the city electrician to the lighting company. Permit cards are the only records available and filed at the city electrician's office. Cooperation with other departments is good.

The State law of 1905 prescribes the National Electrical Code as the standard for wiring of all buildings. An ordinance enacted in December, 1941 adopts the National Electrical Code with some modification as the municipal standard for all electrical installations.

INSIDE WIRING. — Inspection of new wiring indicates that it is fairly well installed and complies substantially with code requirements. Old wiring, in many cases, is in fair to poor condition due mainly to unapproved additions, faulty maintenance, and abuse.

OUTSIDE WIRING. — The Tide Water Power Company supplies current for lighting and power. Two 110,000- and two 33,000-volt lines terminate outside the city limits at Eagle Island; this net is reduced to three 33,000- and five 11,000-volt lines which in turn supply a power station at the foot of Castle Street. Distribution within the city is either direct at 11,000 volts in two aerial cable circuits which cover the congested value district or reduced to 4160 volts and then stepped down by transformers to 220-110 volts for local consumption. The majority of local transformers are mounted on poles; two are located in basements. A steam generating plant with a capacity of 10,000 kva located at the power station is held in reserve for emergency use.

Some wires have triple-braided weatherproof insulation in only fair condition. Pole lines are substantially constructed and mainly well provided with protective arrangements. Overhead wire obstructions are serious in certain sections of the congested value district, but present only a moderate hazard to fire department operations in other parts of the city. All wires are overhead except those of the telephone company which are underground in the congested value district and in most of the city. The street railway system has been abandoned.

No damage from electrolysis has been reported. Periodic tests are made by telephone company.

CONCLUSIONS.—State and municipal electrical laws are adequate. Supervision over interior wiring is invested in the city electrician who has other duties. A fairly good class of new work is being obtained; there is no systematic reinspection of old work, although some bad conditions have been alleviated through cooperation of other departments. All wires in the congested value district are overhead with the exception of telephone lines. Congestion of overhead wires in some locations would hamper fire department operations. Electrolysis is negligible; tests are made by the telephone company. Records are incomplete.

CONFLAGRATION HAZARD

CONGESTED VALUE DISTRICT.—Beginning at the foot of Orange Street; Orange, Front, Dock, Second, Market, Third, Chestnut, Second,

Grace Street, a line 180 feet east of and parallel to Front, the Atlantic Coast Line railroad and the river to the place of beginning.

The district is in the west central portion of the city, on the east bank of the Cape Fear River, extending 8 blocks or 3140 feet north and south and is 2 to 4 blocks wide; it includes 25 blocks or part blocks and covers 70.3 acres; 33 per cent of the total area is in streets and 64 per cent of the block area is built upon. Values range from high to low; the higher values being fairly well distributed in mercantile and office buildings, mainly along Front Street, with a few high values to the extreme north. The streets parallel to the water front are practically level or have moderate grades, but those running east from the river have a fairly steep grade up to Front Street. Streets are paved and in good condition. Exposures from surrounding residential and minor mercantile districts are moderate.

Most blocks are of moderate area with the exception of some small blocks along the water front and are generally cut by alleys with open areas in the interiors. Some blocks are compactly built, but 36 per cent of the total block area is vacant. Market Street, at the south end of the district, which separates three of the less important blocks, is 99 feet wide; other streets vary from 28 to 66 feet in width.

Fireproof construction covers 9 per cent of the built-on area and is scattered throughout the central and northern portions of the district. Exposed windows and vertical openings are mainly unprotected in these buildings and hence they are of only local value as fire stops. Frame construction, found in the majority of the blocks, covers 14 per cent of the built-on area and where located contributes materially to the general hazard.

Ordinary construction is notably lacking in fire resistive features. Heights are generally low, but 24 per cent of area covered by this class is in excessive areas. Unprotected vertical openings are the rule. Some walls are in a deteriorated condition and most party and fire walls are of insufficient thickness. The predominance of mutually exposing buildings of this inferior construction creates a high potential hazard.

Occupancies of excessive area and of a hazardous nature in the northern portion of district which might be considered conflagration breeders are equipped with automatic sprinklers and other private fire protection and should only form local hazards. However, other similar occupancies are devoid of such protection and constitute an exposure to adjoining buildings. The water supply is mainly adequate, but the fire department is seriously undermanned and only fairly well trained and equipped. High winds are infrequent. Severe individual or group fires are probable and in a few sections of the district these might spread to adjoining blocks, but no fire involving a considerable portion of the district is probable.

Since the last survey a substantial part of the block bounded by Chestnut, Front, Princess and Water Streets has burned out so that conflagration conditions are no longer considered above normal for the district.

OTHER DISTRICTS. — Two minor mercantile districts, one along Fourth Avenue between Red Cross and Nixon Streets, the other on Castle Street between Fifth Avenue and Tenth Street consist of buildings of ordinary construction interspersed with frame. Heights are low, areas are small, and accessibility is good. The water supply is adequate and spreading fires should be confined to the group of origin.

To the north and south of the congested value district along the river front are a number of railroad warehouses, lumber mills, and other diversified occupancies. The prevailing construction is ordinary and frame, but some buildings are provided with private fire protection. Severe individual fires are probable, but the water supply is adequate and with assistance from the fireboat, the conflagration hazard is slight. Manufacturing plants are located throughout the city in isolated sections. While single fires may occur, the probability of a conflagration is slight.

Residential districts consist mainly of 2- and 3-story detached frame dwellings. Dwellings are closely grouped in the center of the city. In the southern portion of the city, wooden shingle roofs and frame construction of the poorest type result in severe hazard, however the water supply is adequate and such fires should be confined to local areas.

CONCLUSIONS. — In the congested value district, the predominating ordinary construction is seriously deficient in fire-resistive features. A large proportion of this type of construction is in excessive areas including some of hazardous occupancy. Fire proof construction is scattered throughout the district and forms only local fire stops. The fire department is undermanned and only fairly well equipped, but the water supply is mainly adequate. Furthermore, street widths are generally good and many hazardous occupancies of excessive area are provided with automatic sprinklers and other private protection. Serious individual and group fires are probable, but these fires should not involve a considerable portion of the district. In minor mercantile districts deteriorated and weak construction makes for severe individual or group fires, however with the small areas, low heights and good accessibility fires should be confined to the group of origin. In the manufacturing and warehouse districts, buildings are well isolated, except along

the water front, where the availability of the fireboat reduces the conflagration hazard. In the southern section of the city, the hazard in residential districts is substantially increased by the congestion of dwellings, poor construction, and wooden shingle roofs which is offset by the adequate water supply so that fires should be confined to the building or group of origin.

RECOMMENDATIONS

Recommendations marked with a star (★) are deemed of most importance and their early adoption is urged.

WATER SUPPLY

1. That the superintendent be furnished a qualified assistant to devote his entire time to water department maintenance and operations.

2. That records be brought up-to-date and regularly maintained as follows:

a. A comprehensive map of pumping station and supply works.

b. Large scale sectional maps showing details of piping, special fittings, connections and necessary location measurements.

c. Complete details as to make, type, size and location of all gate valves and hydrants in convenient form for field and office use.

d. Comprehensive and detailed information of consumption and operation, regularly posted in convenient form for ready reference.

★3. That the raw water main from Hilton station be duplicated so that a single break will not completely interrupt supply.

4. That regular tests be made at Hilton and Toomers Creek station and equipment be maintained in good operative condition.

5. That additional valves be provided in the discharge piping at the Sweeney pumping station so that the repair of a single valve will not seriously reduce supply from this station.

6. That the distribution system be strengthened by installing the mains shown in red on the accompanying map and that the following be adopted as the standard minimum sizes of mains used for hydrant supply for all future construction.

a. In mercantile and manufacturing districts, 8- and 12-inch; the former to be used only where it completes a good gridiron and the latter for long lines not cross-connected.

b. In residential districts 8-inch; 6-inch to be used only where it completes a good gridiron, and in no case in blocks exceeding 600 feet in length.

7. That a definite plan be adopted by which all 4-inch mains used to supply hydrants will be replaced within a reasonable time and dead ends eliminated wherever practicable.

8. That the distribution system be equipped with a sufficient number of gate valves so located that no single case of accident, breakage or repair to the pipe system, will necessitate the shutting from service a length of pipe greater than 500 feet in important districts, or 800 feet in other sections.

9. That all valves be inspected yearly and large valves more frequently and where defects are noted repairs be made as soon as possible and that records of inspections, operation, repairs and condition be regularly filed.

★10. That additional hydrants be installed in residential districts so that there shall be one hydrant at each street intersection and the necessary intermediate hydrants so that the average areas served per hydrant will not exceed 110,000 square feet.

FIRE DEPARTMENT

11. That sufficient company officers be appointed to provide one on duty at all times with each company.

★12. That sufficient men be appointed at once to provide a minimum of four men in all land companies and five men in the fireboat company on duty at all times.

13. That the department membership be further increased as soon as practicable so that the least number on duty at any time including vacation and sick leaves will be 7 men in Pumper Companies 1, 2, and 3 and the aerial ladder company, 5 men in all other pumper companies and 8 men in the pumper-ladder company.

14. That all promotions be made as required by the Municipal Civil Service Regulations after comprehensive wrtten competitive examinations.

15. That retirement from active duty be made compulsory for all company personnel upon reaching the age of 62 years.

16. That the following changes and additions be made:

a. A pumper company be established in a new station to be built in the vicinity of Colonial Drive and Wrightsville Avenue.

b. The pumper ladder company now at headquarters be installed with Pumper Company 5 after suitable remodeling to provide for rapid response of apparatus.

c. Another pumper company equipped with a pumper of at least 750 gallons capacity be installed at headquarters.

d. A new headquarters station be provided.

e. A new fire station of sufficient size to house the men required for the fireboat be provided.

17. That pumper companies serving residential areas be equipped with 3-sectional metal extension ladders at least 35 feet long in addition to their present ladders.

18. That a program be instituted for replacement of old apparatus; the best of the old apparatus to be put in good condition and held in reserve.

19. That the following equipment be furnished where not already provided:

a. To each pumper: A burst-hose jacket, siamese connection, rubber gloves, rope, nozzles of combination spray type, 2 Type N gas masks, 2 electric hand lights, and first-aid kit.

b. To each ladder truck: 2 electric hand lights, 1 hydraulic auto jack, 1 cellar pipe, 1 portable electric generator with 3 portable floodlights, 4 Type N gas masks, 4 self-contained breathing apparatus, hand and power saws, portable acetylene cutting outfit, 4 waterproof covers, 2 hatchets, sprinkler heads and sprinkler stoppers, chamois, sponges, squeegees, roofing paper and nails.

20. That suitable refueling and hose drying facilities be provided at all stations.

21. That adequate repair facilities including power tools and a supply of major and minor spare parts be provided.

22. That printed rules and regulations be compiled and issued as required by law and that they be rigidly enforced.

★23. That a complete training building and tower be provided on grounds of ample area for combined operation of pumper and ladder companies when using loaded hose streams under simulated fire ground conditions.

★24. That the training program be expanded to include all fire-ground operations under competent supervision and that officers' and company schools be organized and held weekly in all subjects bearing on fire department activities.

25. That all company members be required to make regular inspection of buildings in their respective districts making sketches and using all information obtained for discussion at company schools.

26. That response to alarms in residential districts consist of 2 pumpers with adequate ladder equipment or 2 pumpers and a ladder truck.

FIRE ALARM SYSTEM

27. That consideration be given to the establishment of a new fire alarm headquarters in a properly cut-off fireproof section of the recommended fire headquarters building, so arranged as to reduce as far as possible all liability of interruption of service and to provide for any possible future expansion.

★28. That the telephone switchboard be moved to fire alarm headquarters and sufficient operators provided so that one will be on duty at all times.

29. That telephone alarms be confirmed over the fire alarm telegraph system after first notifying the department of the exact location of the fire over the vocal-alarm system.

★30. That circuits be placed underground wherever ducts containing signaling circuits only are available.

31. That circuits be protected where entering fire stations or other buildings by an approved lightning arrester.

32. That additional circuits be provided so that not over 20 properly spaced boxes will be on a circuit except that on circuits that are entirely underground 30 boxes are allowed on a circuit.

★33. That additional boxes be installed so that a box will be visible from and within 500 feet of all buildings in high value districts and within 800 feet of buildings in other sections.

34. That special lights be provided over boxes in high value districts to indicate their location at night.

35. That boxes be tested and circuits examined monthly, circuits tested twice daily for current strength, voltage, grounds and continuity, batteries tested weekly and records be kept of all tests and troubles.

36. That at least two telephone lines from the public exchange be reserved for fire calls only and be properly listed in the telephone directory.

BUILDING DEPARTMENT

★37. That the municipal building code be revised to conform with the modern standards for construction and fire prevention as given in the current edition of the National Building Code recommended by the National Board of Fire Underwriters and that its provisions be rigidly enforced.

38. That the fire limits be extended on the southeastern boundary to properly protect the congested value district.

FIRE PREVENTION

★39. That a complete code of modern regulations covering all hazardous materials, processes and occupancies be adopted by ordinance and the chief of the fire department be held solely responsible for its rigid enforcement. It is recommended that the Suggested Fire Prevention Ordinance promulgated by the National Board of Fire Underwriters be used as a guide in framing new regulations.

ELECTRICITY

40. That a complete reinspection of old wiring be made, defects corrected, and old wiring subsequently reinspected at suitable intervals.

41. That all overhead wiring in closely-built sections be placed underground.

★42. That a complete system of records be installed as required by the existing city ordinance.

CONFLAGRATION HAZARD

★43. That owners of defectively-constructed buildings which involve serious life haard or are so located as to form conflagration breeders be required to protect floor, party wall and exposed window openings.

★44. That automatic sprinkler equipment, be required in all buildings which by reason of their size, construction, or occupancy, involve serious life hazard or might act as conflagration breeders.

GENERAL SUMMARY

City in General.—Population about 50,000. Railroad center and shipping port. Surface rolling with slight grades, except close to river front. Streets mainly paved or surfaced and in fair condition; unpaved streets in poor condition. High winds infrequent; winter temperatures mild.

Water Supply.—Municipal works; records poor. Ample source of supply. Low-lift pumping capacity satisfactory; high-lift pumping capacity slightly inadequate in reserve. Unreliable features in raw water line to filter plant and discharge piping of high-lift station. Principal stations fireproof. Consumption moderate. Pressures good. Main arteries and secondary feeders generally complete and of good capacity; gridiron of small mains good. Gate valves widely spaced and in questionable condition. Hydrants of good size; widely spaced in residential areas.

Fire Department.—Full paid on a 2-platoon basis. Appointment under Civil Service; promotion under recommendations of chief. Suitable pension requirements. Pumper company distribution fair. Ladder company distribution poor. Companies seriously undermanned; insufficient officers. Apparatus mainly in good condition but repair facilities poor. Salvage equipment limited to waterproof covers; heavy stream appliances adequate; insufficient minor equipment supplied. Discipline informal and lax. Drills and training inadequate. Fire methods limited in effectiveness by undermanned companies, inadequate training and insufficient equipment. No building inspections by company members. Records good.

Fire Alarm System.—Automatic system; inadequate maintenance force. Headquarters in fireproof building. Operator at fire headquarters, responds with companies. Box distribution fair; boxes mainly of good type but not regularly tested. Two circuits to all fire stations but most box circuits do not enter a station. Circuits aerial; mostly overloaded. Circuit protection provided at only two of the six fire stations; good elsewhere. Tests and records inadequate. Telephone alarms not confirmed over fire alarm system.

Fire Department Auxiliaries.—State fire marshal investigates incendiary fires. Police and public service corporation assist fire department at fires; police cooperate with building department. Telephone service fairly well distributed and much used for sending alarms. Some private fire protection but no outside aid available.

Summary of Fire Fighting Facilities.—Water supply works adequate with some unreliable features; quantities for fire protection mainly adequate. Fire department only fairly well-equipped and seriously undermanned. Fire alarm system of proper type but somewhat unreliable.

Building Department.—State laws generally good; municipal laws inadequate. Fire limits insufficient. Enforcement fairly good. Structural conditions still remain fire resistively weak. Good records.

Fire Prevention.—Laws contain many good features, but are inadequate in covering some important hazards. Control not exercised over permits. Inspection and enforcement by fire department poor. Local conditions only fair. Records confused and neglected.

Electricity.—Good State and local laws. Municipal supervision competent. New work fairly good; some old work in poor condition. Moderate obstructions from overhead wires. Electrolysis negligible; tests made by telephone company. Records poor.

Conflagration Hazard.—In the congested value district, predominating ordinary construction is deficient in fire resistive features with a large amount in excessive areas. Scattered fireproof construction good only as local fire stops. Serious fires probable but with fair fire fighting facilities those should be confined to block of origin. Individual and group fires probable in minor mercantile districts. Availability of fireboat reduces the probability of serious fires on the river front. Wooden shingle roofs, congestion and poor construction results in a severe hazard in some residential districts which is substantially mitigated by the adequate water supply.

October, 1949.

TANK
ELEV. 184
(UNDER CONSTRUCTION)

SWEENEY
PUMP. STA., FILTER
PLANT & RESERVOIR

HILTON P.S.

FROM TOOMERS CREEK &
KINGS BLUFF
PUMP. STAS.

CITY LIMITS

CAPE FEAR RIVER

KEY

Congested Value District
Fire Limits

WATER SUPPLY

Mains 8 inches and larger in diameter
Mains 6 inches in diameter
Mains 4 inches in diameter
Mains recommended
Fire flow tests designated by numbers 1 2

FIRE DEPARTMENT

Present companies shown in black
Recommended companies shown in red
Companies designated by symbols
⊗ Pumper-Ladder (FB) Fire boat
Y Pumper L Aerial ladder

Scale of Feet
1000 2000 3000 4000 5000
MILE