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1961

Papers Concerning Logan Water Works; Proposals

Dean F. Peterson
Utah State University

Alvin A. Bishop
Utah State University

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PROPOSAL FOR
ENGINEERING SERVICES

WATER WELL DEVELOPMENT

We, A. Alvin Bishop and Dean F. Peterson, registered professional engineers in the State of Utah, do hereby propose to furnish engineering and supervision for four water production wells for the City of Logan.

We propose to prepare necessary plans, specifications and contract documents, prepare necessary filings, location surveys, inspect and supervise construction, and prepare final plans and report complete for the wells, equipment and housing; and to retain the services of a qualified groundwater geologist at our expense. The proposed fee shall be seven (7) percent of the total construction cost of the wells, pumps and housing; two percent of the estimated cost to be paid upon completion of plans, specifications and contract documents and execution of drilling contract; and the remainder upon completion of the work.

March 27, 1961
Date

ACCEPTED FOR LOGAN CITY

March 28, 1961
Date

BISHOP AND PETERSON

A. Alvin Bishop
Dean F. Peterson

Harold Spangil
Commissioner

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March 27, 1961
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BISHOP AND PETERSON

A. Alvin Bishop
Dean F. Peterson

Harold Stewart
Commissioner

Proposed Projects for Water Distribution System Improvements in Compliance with Master Water System Plan.

Project # 1

(a) Install booster pump station at Well # 3, 7N & 6 E	\$30,000.00 ✓	
(b) Install Throttling Valve & Chlorine Machine at reservoir	\$15,000.00 ✓	
(c) Complete Well # 1 including deep well pump	\$21,537.50 ✓	
(d) Complete Well # 2 including deep well pump	\$15,550.00 ✓	
(e) Complete well # 4 including deep well pump	\$14,000.00	
(f) Retention due well Contractor	<u>\$ 6,000.00</u>	
Total	\$102,087.50	\$102,087.50

Project # 2

(a) Install booster pump Station at Well # 2 2 E & Center	\$30,000.00	
(b) Install 16 inch water main from 10 N & 6 E So. to 2 N; Thence West to Canyon Rd. & Center St. (Well # 2); thence So. to 3 So. thence West to Main St.	¹²³²⁵⁰ <u>\$115,907.33</u>	
	\$145,907.33	\$247,994.83

Project # 3

(a) Install Booster pump station at well # 1.	\$30,000.00 ✓	
(b) Install 16" Water Main from 2 N & 6 E East to Crockett Ave; thence North to Well # 1 at Crockett Ave & Canyon Rd.	<u>\$41,225.03</u>	
	\$71,225.03	\$319,219.86

Project # 4

To complete the water distribution system to meet master plan req.

(a) Installation of 25,860' of 6" water mains	\$100,532.68	
(b) Installation of 16,160' of 8" water mains	\$ 81,707.06	
(c) Installation of 8,240' of 10" water mains	<u>\$ 52,199.89</u>	
	\$234,439.63	\$553,659.49

Future Reservoir & connecting lines on S E bench.

Reservoir 1,000,000 Gal	\$ 80,000.00	
5000' 16" main line @ 11.00 ft.	\$ 55,000.00	
5000' 24" main line @ 18.00 ft.	\$ 90,000.00	
Replace 20" Steel supply line in Canyon	<u>\$200,000.00</u>	
	\$425,000.00	\$978,659.49

PROPOSED BASIS FOR DESIGN OF
LOGAN CITY PIPE LINE REPLACEMENT

General Considerations

CONFIDENTIAL

Determination of the pipe to install at this time involves
a number of considerations. These are primarily:

- (1) The available **PROPOSED BASIS FOR DESIGN OF
LOGAN CITY PIPE LINE REPLACEMENT**
- (2) The estimated change in population of the city.
- (3) The size of replacement SUMMARY 24-inch and 36-inch
steel pipe sections now in operation.

From a consideration of possible population growth, physical conditions,
limiting available hydraulic head between the spring and the dam, and public
health standards; it is believed that the size of the pipe from the spring to
the dam should be 36-inch diameter and the remainder 24-inch. Because of the
construction difficulties involved, it is believed that the section from the
spring to the vicinity of the city dam should be permanent, centrifugal concrete
transite or cast iron pipe. For the remainder of the line, it is strongly
recommended that bids be taken for transite, centrifugal concrete, steel and
cast iron pipe and that the material be selected which gives the least equivalent
annual cost, considering the estimated serviceable lifetime of the material and
interest at the true cost to the city regardless of the first cost.

There are several other small springs in this immediate area. It is be-
lieved that with additional development of the Boggs Spring and by tapping in
other available springs, more than 50 second-foot could be developed at the
present intake, if necessary. It is assumed that the city will be able to
secure title to each of this water as they are used. In other circumstances, any
available yield from the seasonal variations of the spring. Available records
indicate that the maximum flow of the spring coincides with the period of maximum
demand by the city.

Population Statistics

Some basis for predicting the growth of Logan City is necessary in order
to estimate future water demands. For the purpose of studying past growth
characteristics, statistical data of the growth of several fish cities as well
as Logan, the growth of the State and Utah urban population, growth of the Utah
State Agricultural College and the growth of Logan primary and secondary school
populations. These curves are shown in Figs. 1 and 2 in which population is

PROPOSED BASIS FOR DESIGN OF
LOGAN CITY PIPE LINE REPLACEMENT

General Considerations

Determination of the proper size of pipe to install at this time involves a number of considerations. These are primarily:

- (1) The available water at the spring area.
- (2) The estimated future water demands of the city.
- (3) The time of replacement of the 20-inch and 24-inch steel pipe sections now in operation.
- (4) The necessity for positive pressure at all points on the line to avoid public health menace resulting from possible seepage of groundwater into the pipe.

Available Water Supply

The water was measured on April 16, 1949. The flow into the pipeline at the spring house was 13.48 second-feet (8,700,000 g.p.d.). Of this amount it is estimated that two to three c.f.s. is spilled back into the river at the existing weir house reducing the net amount entering the pipe to about 10.5 c.f.s. (6,800,000 g.p.d.) which is the maximum carrying capacity of the existing system in its present condition. At a point 50 feet downstream from the spring house, the flow was 9.20 second-feet. This flow increased to 10.37 second-feet before flowing out of the spring area. The total production of the fenced area was therefore 23.85 second-feet (15,400,000 g.p.d.)

Measurements of flow made May 6, 1949, gave a total production of 28.31 second-feet, (18,250,000 g.p.d.) which indicates a general increase resulting from Spring snow melt. The spring was measured by Logan City Engineer Roy Bullen on June 4, 1914, and a total production of 25.86 second-feet was noted.

There are several other small springs in this immediate area. It is believed that with additional development of the DeWitt Spring and by piping in other contiguous springs, more than 30 second-feet could be developed at the present intake, if necessary. It is assumed that the city will be able to acquire title to such of this water as they may need. No other measurements are available which show the seasonal variation of the spring. Reliable reports indicate that high-water flow of the spring coincides with the period of maximum demand by the city.

Population Estimates

Some means of predicting the growth of Logan City is necessary in order to estimate future water supply needs. For the purpose of studying past growth characteristics, studies were made of the growth of several Utah cities, as well as Logan; the growth of Utah total and Utah urban population; growth of the Utah State Agricultural College and the growth of Logan primary and secondary school population. These curves are shown in Figs. 1 and 2 in which population is

shown in percentage of the 1940 population. Most of these data for the cities and the state were taken from the U. S. Census. The 1948 Logan population (16,300) is based on an actual count by the Logan Planning Board and includes non-resident students. It is believed many such students are not included in the U. S. Census count. Estimates by the U. S. Census placed the 1945 (adjusted for service men) population of Utah at 647,000. The curves, Figs. 1 and 2, indicate that the growth of Logan City has closely paralleled the growth of the major cities of the state and the state as a whole.

Estimates of future population for a fairly large region may best be made by considering the possible industrial and agricultural development of the region. In 1940, it appeared that Utah had begun to approach the practical ultimate development of her resources and that further population increases would be at a low rate. With the advent of the steel industry during the war, and the development of plans for diverting Colorado River water into Bonneville Basin and the production of large quantities of electrical energy on the Colorado River, considerable expansion during the next half century is anticipated. The most comprehensive investigation of this possibility was made by the Federal Power Commission in 1945 ^{1/}. A long-range plan of power and agricultural development was considered. This study concluded that development of the agricultural and power resources would begin immediately and continue until about 1990, when they would be rather fully developed. Curves showing estimated population up to 1970 resulting from this development were computed. Three of these curves for Power Region I, with 1940 population as an index, are plotted in Fig. 3. Power Region I includes all Utah counties north of Juab, Sanpete, Wayne and San Juan Counties.

In extending a population curve for Logan, it was considered that the population growth has closely followed that of the state and region as a whole. Using the estimated Power Region I urban population as an index, the predicted population curve is shown by Fig. 4. Beyond 1970, the curve is rather arbitrarily drawn, keeping in mind that resource development is anticipated to continue until at least 1990.

Future Water Requirements

In 1944, the maximum daily use of Logan City was 5,340,000 gallons with a daily average of 2,582,000 gallons. (The pipe line must, of course, be designed for the daily maximum.) It is estimated that the 1948 peak day required 6,000,000 gallons. Using the extended population curves for base population, the maximum daily use was 392 g.p.d. in 1944 and 370 g.p.d. in 1948. In 1944, only 1522 of 3133 private connections were metered. In 1948, there were approximately 3450 connections, of which all but about 250 were metered. These maximum daily demands appear to be in line with Utah municipal experience. It is felt that they might eventually be reduced to some extent, if necessary, to accommodate future growth. Estimated future maximum daily water demands are shown in Table 1.

^{1/} "Power Requirements Survey, State of Utah," Federal Power Commission, Bureau of Power, San Francisco Regional Office, 1946.

Table 1. Estimated future maximum daily water demands for Logan City

Year	Estimated Base Population	Estimated Water Needs @ 375 g.p.d.		Estimated Water Needs @ 300 g.p.d.		
		c.f.s.	m.g.d.	c.f.s.	m.g.d.	
1950	16,600 ✓	9.66	6.25	7.74 +8.94	4.98	16.68
1960	21,400 ✓	12.40 ✓	8.02	9.90 +10	6.42	19.90
1970	25,600 ✓	14.85	9.60	11.85 +10.5	7.68	22.35
1980	29,300 ✓	17.00	11.00	13.60 +11.2	8.80	24.80
1990	33,000	19.30 ✓	12.48	15.40 +12.0	9.90	27.40
2000	36,000	20.90	13.50	16.70 12.67	10.80	29.37 ✓
2010	38,000	22.00	14.25	17.65 13.00	11.40	
2020	40,000	23.20 ✓	15.00	18.55 13.33	12.00	

Size of Pipe

It is believed that the present installation should be consistent with an over-all plan for the ultimate development of the city. The city now has approximately 26,400 feet of pipe line, of which 16,330 feet is woodstave pipe to be replaced under this project. There will still be approximately 6,770 feet of 20-inch and 3300 feet of 24-inch steel pipe which has been installed at various times since 1931. In addition to being consistent with the ultimate development, the installation should provide adequate water through the present steel pipe to serve the city's needs until this pipe requires replacement because of physical deterioration.

The development is limited by the condition which requires that the head loss from the spring to the city dam not exceed about 10 feet. Several schemes for ultimate development, as follows, were studied:

- (1) 36-inch pipe to dam; remainder 24-inch. This will deliver about 23.5 second-feet to the reservoir.
- (2) 33-inch pipe to dam; remainder 24-inch. This will deliver about 23 second-feet.
- (3) 36-inch pipe to dam; remainder 27-inch. This will deliver about 31.5 second-feet.

Either scheme 1 or 2 would probably furnish the city with adequate water on the basis of growth predictions, until at least the year 2020. Scheme 1 is preferred to scheme 2 because under scheme 1 there will be some pressure in the

36-inch line, whereas under scheme 2 the 33-inch line would operate at practically no pressure and would, therefore, be more susceptible to ground-water infiltration and possible contamination. Further, 36-inch is standard size pipe, while 33-inch is special so that competition in bidding would probably not be as good for the 33-inch pipe.

Replacement of the 20^{and 24}-inch steel pipe, first laid 18 years ago, will probably take place about 1970. If population growth takes place about as anticipated, this line could be replaced with 24-inch pipe increasing the capacity of the system to 23 c.f.s. (15,500,000 m.g.d.). It is believed that this will take care of water needs for the next century, if growth occurs as now anticipated. If the lower portion of the present steel pipe is replaced with pipe greater than 24-inch, there is danger that the pressure in the remaining 24-inch pipe will be reduced below that desirable from a public health point of view. This factor has been considered in the location of the pipe, so that high points in the line are minimized.

If 36-inch pipe is used from the spring to the dam and the remainder of the woodstave replaced with 24-inch, the resulting flow will be 19 second-feet. This flow appears to be adequate until the year 1985. It is fairly certain that the 10,000 feet of 20-inch and 24-inch pipe now in service will not last beyond this date.

In view of the above considerations, we recommend that the diameter of the pipe from the spring to city dam be 36-inch pipe and from there to the present steel pipe 24-inch.

Materials

Because of the difficult construction, we recommend that the pipe from the spring to the dam be "permanent" and, therefore, be either centrifugal concrete transite or cast iron. Below the dam, we recommend that bids be let on the basis of steel, transite, concrete or cast iron and that the material be selected which gives the least annual cost, considering the estimated lifetime of the material and the rate of interest which the city must pay on its bonds.

Signed:

STOCK, BISHOP, PETERSON

by _____

APPROVED:

Logan City

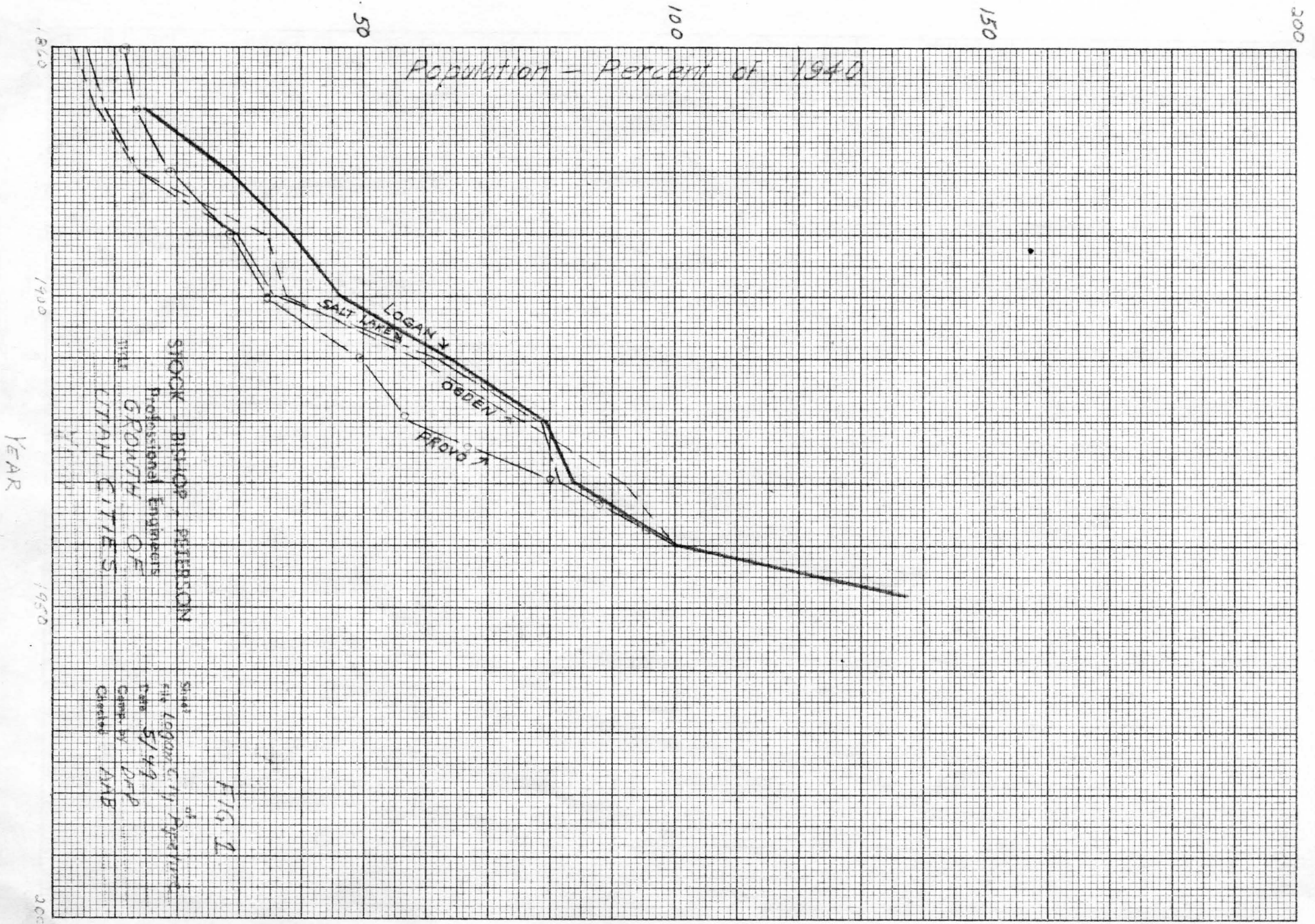


FIG. 2

State of Utah
 the Logan City Apartment
 Plan 5/49
 Camp by DWP
 Grand Ave

SHOCK BISHOP, STEERSON
 Professional Engineers
 THE GROWTH OF
 UTAH CITIES

YEAR

2000

1950

1900

1850

50

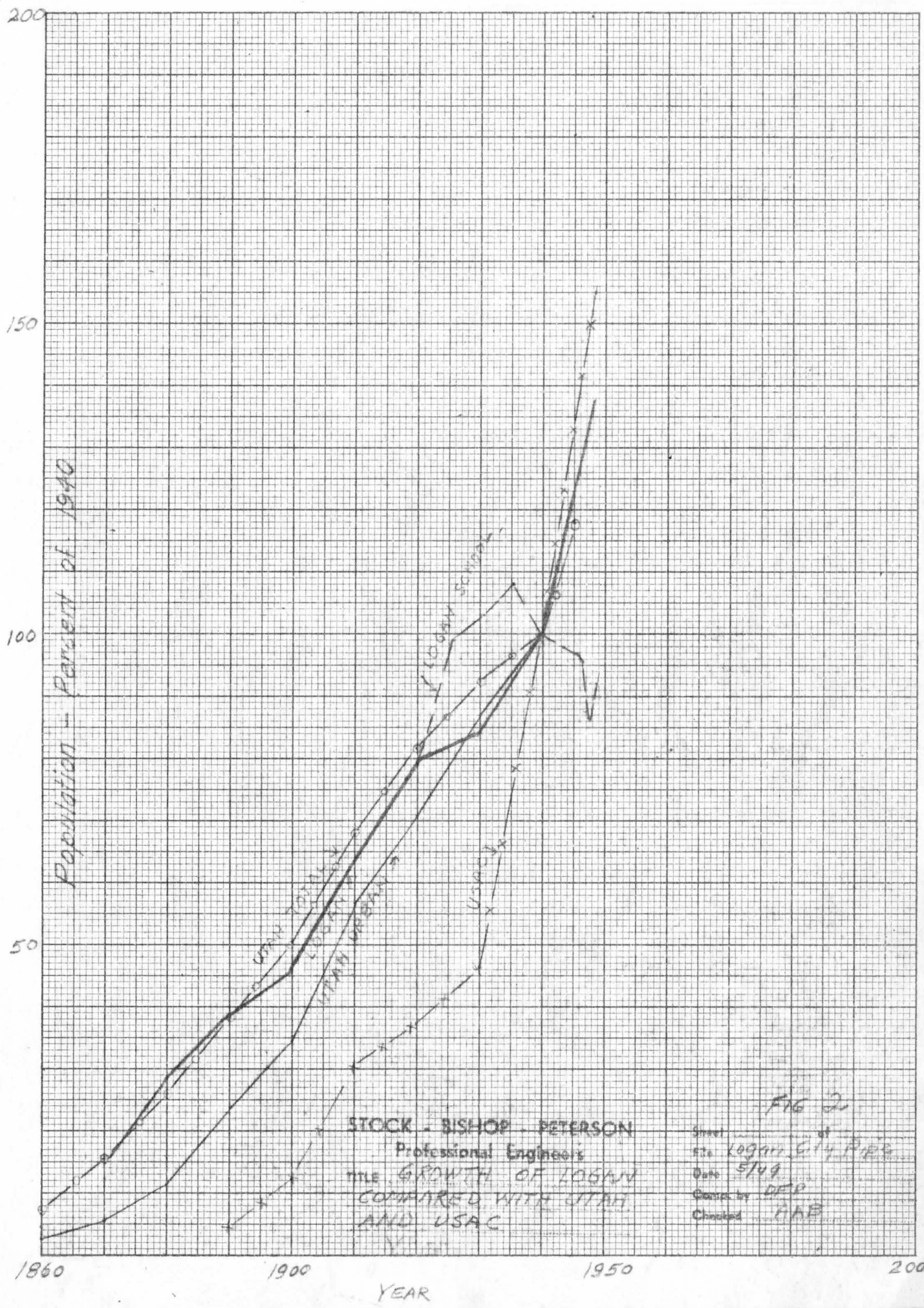
100

150

200

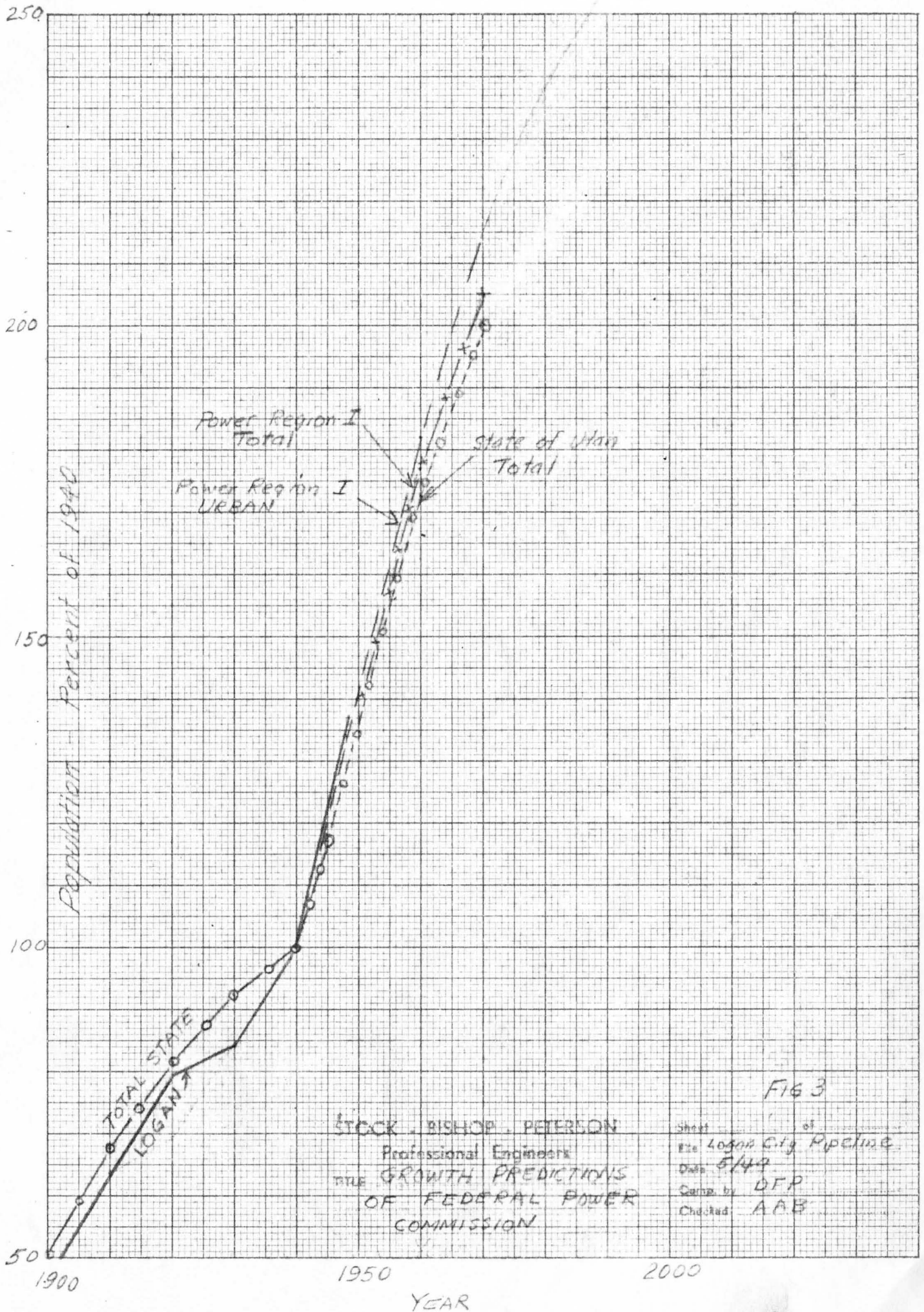
NO. 323-11 10 X 10 to the half inch, 2 1/2 times expanded.
 MADE IN U.S.A.
 Engraving, 7 X 10 in.

KENNEL & ESSER CO.



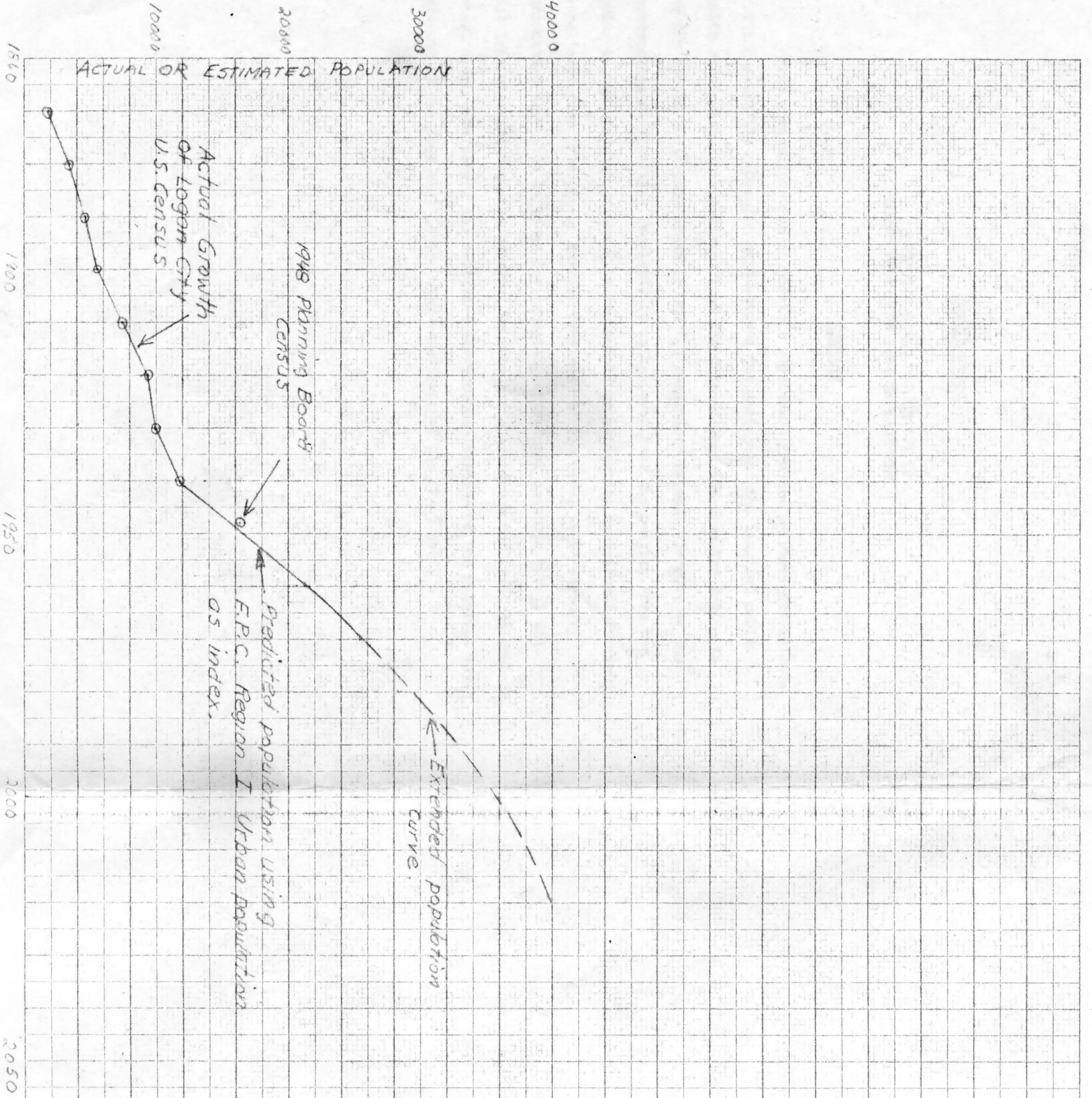
STOCK - BISHOP - PETERSON
 Professional Engineers
 THE GROWTH OF LOGAN
 COMPARED WITH UTAH
 AND USAC

FIG 2
 Sheet _____ of _____
 Site Logan City Pipe
 Date 5/49
 Checked by DEP
 Checked LAR



STOCK, BISHOP, PETERSON
Professional Engineers
THE GROWTH PREDICTIONS
OF FEDERAL POWER
COMMISSION

FIG 3
Sheet _____ of _____
Re Logan City Pipeline
Date 5/49
Scale by DFP
Checked ABE



STOCK - CHAMP - PETERSON
Professional Engineers
THE PREDICTED POPULATION STUDY
LOGAN CITY

Checked by AAB

FIG 4
Logan City Pipe

PROPOSED BASIS FOR DESIGN
LOGAN CITY PIPE LINE REPLACEMENT

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^{Power Region I,}
curves are plotted, with 1940 population as an index, in Fig. 3. Power Region I

^{1/} "Power Requirements Survey, State of Utah" Federal Power Commission, Bureau of Power, San Francisco Regional Office, 1946.

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Table 1. Estimated Future Maximum Daily Water Demands For Logan City

Year	Estimated Base Population	Estimated Water Needs @ 375 g.p.d.		Estimated Water Needs @ 300 g.p.d.	
		c.f.s.	m.g.d.	c.f.s.	m.g.d.
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1970	25,600	14.85	9.60	11.85	7.68
1980	29,300	17.00	11.00	13.60	8.80
1990	33,000	19.30	12.48	15.40	9.90
2000	36,000	20.90	13.50	16.70	10.80
2010	38,000	22.00	14.25	17.65	11.40
2020	40,000	23.20	15.00	18.55	12.00

Size of Pipe

It is believed that the present installation should be consistent with an over-all plan for the ultimate development of the city. The city now has approximately 26,400 feet of pipe line, of which 16,330 feet is woodstave pipe to be replaced under this project. There will still be approximately 6,770 feet of 20-inch and 3300 feet of 24-inch steel pipe which has been installed at various times since 1931. In addition to being consistent with the ultimate development, the installation should provide adequate water through the present steel pipe to serve the city's needs until this pipe requires replacement because of physical deterioration.

The development is limited by the condition which requires that the head loss from the spring to the city dam not exceed about 10 feet. Several schemes for ultimate development, as follows, were studied:

- (1) 36-inch pipe to dam; remainder 24-inch. This will deliver about 23.5 second-feet to the reservoir.
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Either of schemes 1 or 2 would probably furnish the city, ^(with adequate water) on the basis of growth predictions, until at least the year 2020. Scheme 1 is preferred to scheme

2 because under ^(scheme) 1 there will be some pressure in the 36-inch line, whereas under ^(scheme) 2 the 33-inch line would operate at practically no pressure and would therefore be more susceptible to ground-water infiltration and ^(possible) contamination. Further, 36-inch is standard size pipe, while 33-inch is special so that competition in bidding would probably not be as good for the 33-inch pipe.

Replacement of the 20-inch steel pipe, first laid 18 years ago, will probably take place about 1970. If population growth takes place about as anticipated, this

line could be replaced with ^(pipe) 24-inch (increasing the capacity of the system to 23 c.f.s.

It is believed that this will take care of anticipated water
(15,500,000 m.g.d.). ~~If growth has been greater than anticipated, (see Table 1) and a~~
needs for the next century, if growth occurs as now anticipated.
~~foreseeable need for more than 23 c.f.s. of water exists, the steel pipe can be re-~~

If the lower portion of ^(the present) steel pipe is replaced with pipe greater than 24-inch,

There is danger that the pressure in the remaining 24-inch pipe
ced at that time with 30-inch pipe instead of 24-inch pipe as now anticipated, which
will be reduced below that desirable from a public health point of view.
could furnish an ultimate flow of 29 c.f.s. (18,750,000 m.g.d.).

This factor has been considered in the location of the pipe, so that high
points in the line are minimized.

If 36-inch pipe is used from the spring to the dam and the remainder of the
woodstave replaced with 24-inch, the resulting flow will be 19 second-feet. This flow

appears to ~~should~~ be adequate until the year 1985. It is fairly certain that the ~~approximately~~ 10,000 feet of

~~and 24-inch~~ 20-inch steel pipe ~~will not last this long.~~ beyond this date.
~~now in service~~

In view of the above considerations, we recommend that the diameter of the
pipe from the spring to City Dam be 36-inch pipe and from there to the present steel
pipe 24-inch.

Materials

Because of the difficult construction, we recommend that the pipe from the
spring to the dam be "permanent" and, therefore, be either centrifugal concrete ^{transite} or
castiron. Below the dam, we recommend that bids be let on the basis of steel, ^{transite,}
concrete or castiron and that the material ^{be selected} which gives the least annual cost,
considering the estimated lifetime of the material and the rate of interest which the
city must pay on its bonds, ~~be selected.~~

Signed
Stock, Bishop, Peterson
by _____

APPROVED:

Logan City