APPRAISAL OF

WATERWORKS PROPERTY

OF

THE BEND WATER, LIGHT AND POWER CO.

BEND, OREGON

as of

October 1, 1924.

STEVENS & KOON
CONSULTING ENGINEERS

J. C. STEVENS
MEM. AM. SOC. C. E.
ASSOC. AM. INST. E. E.

R. E. KOON
MEM. AM. SOC C. E.
MEM. AM. W. W. ASSN.

SPALDING BUILDING
PORTLAND, OREGON

V-565

Letter of Transmittal

January 24, 1925.

Honorable Mayor & Common Council,

Bend, Oregon.

Gentlemen:

Following your instructions given under date of August 15, 1924, we have made an appraisal of the waterworks properties of the Bend Water, Light and Power Co. and beg to submit our report herewith.

Officials of the Company have permitted the examination of such records and information as are available at their office and have given aid in field surveys whenever requested to do so. Until quite recently the Company has not kept detailed construction records and the history of many of the pipe lines is uncertain. We believe, however, that the data appearing in the report are sufficiently accurate to substantiate the appraisal made. Wherever practicable the office records of the Company have been checked by field inspections and measurements.

The figures given in the report should be considered as applying to the value of the property as of October 1, 1924.

Respectfully submitted,

STEVENS & KOON

By R. E. Koon

INDEX AND

SUMMARY OF APPRAISAL

As of October 1, 1924.

Item Number	Page	Description	Reproduction Cost	Depreciation	Present Value
1	17	Real Estate and Rights-of-Way	$ 3,000	$ 400	$ 2,600
2	19	Water Rights	12,000	0	12,000
3	21	Filters, Pumping Plant, etc.	83,779	3,351	80,428
4	23	Emergency Pumping Plant	2,720	1,820	900
5	24	Gravity Supply to Filter	1,000	0	1,000
6	25	Reservoirs	5,792	5,398	394
7	28	Wood Pipe Lines	61,422	27,194	34,228
8	32	Arc Welded Steel Pipe Lines	2,799	80	2,719
9	33	Matheson Joint Steel Pipe Lines	12,547	1,346	11,201
10	34	Standard Weight Steel Pipe Lines	495	129	366
11	35	Casing or Boiler Tube Pipe Lines	17,568	2,129	15,439
12	37	Standard Weight Galv. Pipe Lines	5,985	1,676	4,309
13	38	Valves	3,326	549	2,777
14	38	Valve Boxes	605	120	485
15	39	Hydrants	3,935	918	3,017
16	41	Paving over Mains and Services	13,860	2,310	11,550
17	42	Rock Excavation	21,368	1,600	19,768
18	43	Mains in Business Dist.	750	105	645
19	44	Services	25,668	8,214	17,454
20	45	Meters & Housings	3,027	151	2,876
21	46	Tools and Operating Equip.	1,700	510	1,190
22	47	Maps and Plats	1,200	0	1,200
23	47	Stores and Supplies	*	*	*
24	48	Miscellaneous Structures	675	169	506
25	49	Engineering	14,996	2,653	12,343
26	50	General Costs During Construction	29,000	4,200	24,800
27	51	Business Development Cost	0	0	0
		Totals	$329,217	$65,022	$264,195
	52	Special Depreciation			5,000
		Value as of October 1, 1924,			$259,195

* Not included in inventory

GENERAL STATEMENT

This report is predicated upon facts obtained by a detailed examination of the water works property of the Bend Water, Light and Power Co. made between August 15 and November 15, 1924. Quantities and values are all as of October 1, 1924.

History of the Property

The City of Bend was incorporated in 1905. In the same year the building of a waterworks system was undertaken. It has always been privately owned, although the actual personnel of ownership has changed several times. Deschutes River has always been used as the source of water supply.

According to the most authentic information to be had,* the system as built in 1905 consisted of a pumping station, a small wooden water tower located in Block A, Bend, and approximately 9000 feet of distributing pipes. By the end of the year 1911 the distribution system had grown to a little more than 17,000 feet. There were about 130 services at this time. Subsequent to 1912 the Company has made yearly reports to Oregon State Commissions. While these reports probably are not closely accurate, they do indicate the rate of growth of the distribution system. Figures from such reports are given in Table I.

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* From Survey made by R. B. Gould under date August 31, 1911.

TABLE I

SHOWING GROWTH OF DISTRIBUTION SYSTEM

BEND, OREGON, WATERWORKS

Date	Source of Information See Below	Feet of Distributing Mains	Number of Services	Number of Fire Hydrants
1905	1	8700		
Aug. 1, 1911	1	17200		
Nov. 1, 1912	2	21900	130	
June 30, 1913	3	25200		
" " 1914	3	38000		17
" " 1915	3	44300	282	17
*Dec.31, 1916	4	95900	867	24
" 1917	4	102100	1041	39
" 1918	4	104400	1034	39
" 1919	4	114200	1250	49
" 1920	4	124900	1393	55
" 1921	4	124900	1357	60
" 1922	4	142700	1541	60
" 1923	4	162300	1749	62
Oct.31, 1924	5	180316#	2139	67

Sources of Information

1. Report of Robert B. Gould
2. Appraisal by Miller & McMeen
3. Report to Oregon Railroad Commission
4. Report to Oregon Public Service Commission
5. Appraisal by Stevens & Koon

* Large growth due to purchase of pipe systems constructed about 1911 and heretofore owned by other individuals or companies.

\# Includes 600 ft. of 8-inch pipe which is permanently out of use at Canal Headworks.

It is not to be inferred from Table I that the only yearly additions of new pipe are indicated by the increase in the total pipe in the system from year to year. Replacements of worn out or inadequate pipes were made; sometimes the old pipe was relaid and at other times it was discarded as unfit for further use, so that the total amount of new pipe added to the system from year to year was somewhat greater than the difference in quantities shown by the yearly reports.

Prior to 1916 water was secured by pumping from Deschutes River near the site of the present pumping plant. In 1916 a 14-inch wooden gravity supply main was put into service, taking water from the Central Oregon Canal at a point about two miles south of the City. An emergency pumping station was also built on Deschutes River near the Canal Intake. The gravity supply was maintained until early in 1924 when the present filtration and pumping plant was placed in service.

Until about 1919 the majority of the pipes 4-inches in diameter and larger were of wood. In 1919 the City began paving and the Company replaced a considerable part of their larger wooden mains with steel pipe. With one or two exceptions new wood pipes have not been laid since that date.

Description of Present System

Deschutes River furnishes the water now supplied to the City of Bend. It is taken from the forebay of the Power

Plant and flows by gravity through mixing tanks where coagulating chemicals are added, and through a battery of filters of the pressure type to a clear well below high service pumps. From the clear well low service pumps deliver the water to aerating tanks, where it is subjected to the action of air rising in small bubbles from the bottom of the tank. Air is supplied by a blower located in filter building. Water is taken from the aerating tanks and pumped directly into the City distribution system. Pressure in the system is maintained by pumps only. No reservoir is used for pressure and supply regulation.

The filters are in 10 units. They consist of metal tanks 8 feet in diameter and 20 feet long, each provided with a suitable bed of gravel and sand, necessary piping, valves and regulators. The filtration plant has a nominal capacity of 5,000,000 gallons per day. A diagrammatic sketch and photographs of the plant appear in the Appendix of this report (Exhibit No. 4). An emergency low service pump is maintained to supply water directly from the River to the filters in case water should not be available from the power plant forebay. Two small pumps which were in general service prior to 1916 are still maintained. An emergency supply under lower pressure might also be obtained from the Canal Intake which served the gravity supply in use from 1916 to 1924.

The distribution system (including supply pipes both in and out of service) consists of about 34 miles of

pipe and an inadequate number of valves and hydrants.* Pipe materials in use are: wire wound wood, arc welded steel, Matheson Joint Steel, standard black and galvanized steel, well casing and boiler tubes. Table II shows the proportion of each kind of pipe used.

TABLE II

SHOWING QUANTITIES OF PIPE IN DISTRIBUTION AND SUPPLY SYSTEM, CLASSIFIED AS TO KIND OF MATERIALS USED, BEND, OREGON, WATERWORKS AS OF OCTOBER 1, 1924.

Material	Total Quantity In Feet	Total Quantity In Miles	Percentage of Whole
Wire Wound Wood	100,858	19.10	55.9
Arc Welded Steel	1,375	.26	0.8
** Matheson Joint Steel	10,022	1.90	5.6
Standard Black Steel	718	.14	0.4
Casing and Boiler Tubes	38,249	7.25	21.2
Standard Galvanized Steel	29,094	5.50	16.1
Totals	180,316	34.15	100.0

* For details see Exhibit No. 2 in Appendix.
** Probably includes a small amount of casing.

TABLE III

SHOWING QUANTITIES OF PIPE IN DISTRIBUTION AND SUPPLY SYSTEM, CLASSIFIED AS TO SIZE OF PIPE USED BEND, OREGON, WATERWORKS AS OF OCTOBER 1, 1924.

Nominal Pipe Size	Total Quantity In Feet	In Miles	Percentage of Whole
* 14-inch	11,854	2.24	6.6
12-inch	785	.15	.4
* 8-inch	14,144	2.68	7.9
6-inch	21,200	4.03	11.8
4-inch	69,496	13.16	38.5
3-inch	1,440	.27	.8
2-inch	33,993	6.43	18.8
1½-inch	336	.06	.2
1-1/4-inch	151	.03	.1
1-inch	5,049	.96	2.8
3/4-inch	19,885	3.76	11.0
1/2-inch	1,983	.38	1.1
Totals	180,316	34.15	100.0

During the past decade the growth of Bend has been very rapid. Development of the waterworks distributing system has not kept pace with growth in population, particularly as regards sizes of pipes to give adequate domestic and fire protection service. In proportion to

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* These items include some pipes that are out of service or of no value to the service, being 6005 feet of 14-inch wood pipe (see Line No. 129 on Exhibit No. 2) from the west end of Roosevelt St. southerly to old Canal Intake and 600 ft. of 8-inch wood pipe (not listed on Exhibit No. 2) from Deschutes River to Canal Intake which has been abandoned. If these pipes were eliminated from Table III, the percentage of 14-inch pipe would be 3.4 and that of 8-inch would be 7.8. All the percentages given for other sizes would be slightly increased.

population and improved property the City was better served in 1914 than in 1924. The average size of pipes in the distributing system is practically the same in 1924 as it was in 1914, whereas the population served is now four or five times that served in 1914.

A comparison is shown by Table IV. For purpose of this comparison the 6005 feet of 14-inch pipe and the 600 feet of 8-inch pipe mentioned in the note under Table III have in the preparation of Table IV been eliminated from the total mileage as given in Table III. The lengths and sizes of pipe serving the City in 1914 are taken from the Company's report to Oregon Railroad Commission as of June 30, 1915, and increased by the approximate amount of the pipe in the independent systems then operated by Steidl & Tweet and Henry Linster. The comparisons thus obtained are quite accurate.

TABLE IV

SHOWING A COMPARISON OF AVERAGE SIZE OF PIPES IN DISTRIBUTION SYSTEM IN 1914 AND 1924 BEND, OREGON, WATERWORKS

Nominal Size of Pipe	Approx. Area of Pipe in Sq. in.	Miles Pipe in 1914	Miles Pipe in 1924	Weighted Totals Pipe: Miles x Area in 1914	Weighted Totals Pipe: Miles x Area in 1924
14"	153.94	-	* .33	-	50.80
12"	113.10	-	.15	-	16.97
8"	50.26	.72	*3.35	36.19	168.37
6"	28.27	2.61	4.03	73.78	113.93
4"	12.57	6.84	13.16	85.98	165.42
3"	7.07	.23	.27	1.62	1.91
2"	3.14	1.80	6.43	5.65	20.19
1½"	1.767	.24	.06	.42	.11
1-1/4"	1.227	.06	.03	.07	.04
1"	.785	.32	.96	.25	.75
3/4"	.442	1.10	3.76	.49	1.66
1/2"	.196	.66	.38	.13	.07
Totals		14.58	32.91	204.58	540.22

Average Area of Pipes = 14.02 sq. ins. in 1914 and 16.72 sq. ins. in 1924.
Average Areas correspond to average diameters of 4-1/4 ins. in 1914 and 4-5/8 ins. in 1924.

It may be of interest to compare the average sizes of distribution system pipes used in Bend and a few other cities for which figures are available. Table V lists these comparisons.

*The 4100 feet (.78 mile) of 14-inch pipe (Line No. 130, Exhibit No. 2) on Sisemore St. and extending south to Roosevelt St. is here considered only the equal of an 8-inch pipe and is added to the mileage shown for this size pipe.

TABLE V

SHOWING THE COMPARISON OF AVERAGE SIZE

OF PIPES IN WATERWORKS DISTRIBUTION SYSTEMS

City	Estimated Population	Average Diameter of Pipe in Inches	Comparison of Average Capacity Bend = 1
Portland	300,000	8½	3.38
Boise, Idaho	25,000	6-1/16	1.73
Yakima, Wash.	19,000	5-15/16	1.65
Corvallis, Ore.	8,000	5-5/8	1.47
The Dalles, Ore.	6,000	5-5/8	1.47
Raymond, Wash.	4,500	7-3/8	2.54
Bend	9,000	4-5/8	1.00

All of the cities listed in Table V have average sizes less than those which would conform strictly to the recommendations of the Board of Fire Underwriters.

This Table V is submitted as a matter of information in support of the theory that special depreciation due to obsolescense should apply to the whole distribution system at Bend. This matter will be further discussed later in the report.

GENERAL CONDITIONS AFFECTING THE

DEVELOPMENT OF WATERWORKS IN BEND

Until within the last few years Deschutes River has been quite satisfactory as a source of water supply. Of late years when developments for lumbering and irrigation enterprises have caused the water to become unsatisfactory for general city purposes, some consideration has been given to the securing of a water supply from a source other than the river. However, the large expense involved and diffi-

culties in securing water which had already been appropriated for other purposes appears to have discouraged the Company in securing a supply other than from the river. The extensive improvements recently made for purpose of filtering and treating the river water seem to indicate a definitely settled policy on the part of the Company to secure the permanent supply for the City from this source.

Prior to about 1915 when construction of the mills quite definitely attracted the center of population southward from the general business section, the distribution systems (there were three or four at this time) were extended as there was demand for service and without any definite knowledge that permanent improvement by building large mains was justified. Exploitation of real estate figured largely in the development of the early systems and even today water is being carried into new and undeveloped districts for the sole purpose of stimulating the sale of real estate. While these pipe extensions are not originally owned by the Water Company they are usually absorbed later and serve to extend the limits of poorly constructed and undersized pipe lines. In general such pipe lines as have been built in the promotion of real estate have been constructed as cheaply as possible and without regard for much else than to be able to show the prospective purchaser that city water was available. Under these conditions the appraiser has great difficulty in maintaining a judgment of value that will be fair to both the owner and the possible purchaser of the water

works property.

Existence of rock near the surface of the ground in all parts of the city has been the greatest cause of failure of the builders of pipe lines to observe rules of good construction. The lava rock which underlies the city is very costly to excavate, particularly in trenches. In general the depth of bury over the pipe lines is considerably shallower than is demanded for good construction, particularly in a climate that is sometimes extremely cold. The fair estimating of quantity and unit value to be used for rock removed in distribution system construction offers considerable chance of error in judgment by the appraiser.

and
Fundamental Assumptions on which Appraisal is based.

In recent years there has been much discussion relative to the assumptions which should be accepted as proper in arriving at a conclusion as to the fair value of an existing utility. Court decisions have been rendered touching on these points but they have not been in strict accord with each other. The appraiser is thus left to form many of his own conclusions without any firmly established precedent for guidance. One particular change in the assumptions of appraisers that has come about during and since the period of extreme high costs which prevailed during and immediately following the war has been in the method of determining a fair cost value to be placed upon the materials, labor and

equipment entering into the physical property. It is manifestly impossible to reproduce a property in the past or in the immediate present. All assumptions as to reproduction costs must be applied to some future time. Formerly it was customary in making valuations to use as base prices those prices which were a fair average of the prices prevailing during the immediately foregoing two- or five-year period. Eventually, when there has passed a considerable period of years unmarked by events which disrupt the commercial world, it may be that thus averaging prices for several years will again be a rational way to fix unit prices for appraisal purposes. Present day prices seem now to be the most reasonable and fair to use and they form the bases of cost of reproduction calculations in this report.

Without further explanation it may be stated that this appraisal is made with the following as fundamental assumptions:

1. That the property of a public utility has a value to the public equal to what it would cost the public to reproduce the property plus a fair and reasonable sum estimated to represent the commercial value of the business as a going concern, less a proper allowance for physical depreciation, all as of the date of appraisal.

2. That reproduction cost should take into consideration all elements of cost that would be met by the public or other organization in acquiring an equivalent property, assuming conditions as they are and as though no such utility

existed at the present time.

3. That the rational basis for estimating values is prices as they exist at the time of appraisal as nearly as may be determined, since it is impossible accurately to forecast prices as they may be at some future time when a transfer of ownership of the property may take place.

4. That the straight line method of estimating physical depreciation is as accurate as any other method when applied to a property where assumptions as to useful life are necessarily somewhat arbitrary and particularly where the element of obsolescence is always so threatening as it is in a community which has developed as rapidly as Bend.

The so called straight line method of calculating depreciation assumes that the total depreciation bears the same proportional relation to value new that the age of the unit bears to its estimated life.

5. That obsolescence or insufficiency to provide adequate service is reason for special depreciation of a unit or indeed a whole property.

Actual Cost of Utility not Affecting Present Value

It is not the intention in these pages which precede the actual statements of appraised value, to enter upon an expanded discussion of the theory of appraisals in general, but rather to try to make plain those matters in this report which may be difficult to grasp without some explanation.

When first considered it may seem unfair to the Utility Company or to the Public, depending upon the viewpoint of the critic, that actual cost of the property to the owners is not necessarily the present reproduction value as herein determined. Such a feeling may come about on consideration of an item on which an exceptionally heavy expense has been borne by the Utility, due to construction under adverse conditions, mistaken judgment, or faulty plans, as, for instance, construction work the Company was required to perform during the prevalence of the extreme high prices in war years. On the other hand, it may seem unjust to appreciate the structural value of a unit by reason of certain exterior conditions that have come about without direct expense to the Utility Company, as, for example, paving over mains and services.

In considering this phase of the problem the second of the fundamental assumptions named above should be well understood, since such an assumption is recognized by experts and the courts as the proper basis for fixing the present value of a property.

The past cost of a unit may be of interest to the and to the engineer insofar as the details of such light upon the ease or difficulty of con- under conditions that would be met in the hypo- reproduction of the unit as is required by logical to the principles outlined in the assumptions to the appraiser by review of historical cost may

develop in consideration of the probable cost of excavation for water mains or structures where it is impractical to make a detailed analysis of the varying soil conditions.

The only material use made of data relative to construction as shown by the Company's records, is in the matter of the building of the filtration plant as it exists today. This plant was built so recently that actual construction cost is believed to represent the fairest estimate of the probable cost of reproduction new. The Company's records of cost of the filter plant have been studied and to a great extent are allowed in this appraisal as the reproduction cost. No further use has been made of the Company's records of cost other than to serve as a check on a few individual items.

Depreciation

Physical depreciation of a property begins when the property is exposed to wearing elements or is put into use. In addition to physical depreciation there may also occur a depreciation due to the fact that a unit under consideration may have ceased to be useful on account of its insufficiency to render the service required. In more unusual instances, particularly in the case of machinery, such depreciation may occur to a unit while it is functioning properly, performing all the service required, but so inefficiently as compared to a more suitable machine as to make its longer continuance as a unit of the plant a source of waste in the cost of oper-

ation. Such depreciation is covered by the general term "obsolescence" which in its strictest sense is usually only partial as referred to the worth of materials, since there may be a considerable salvage value or indeed under other circumstances and conditions the unit may again become useful and function in such way as to restore its true physical value.

Details of Appraisal

No. 3 Having outlined the fundamental theories which are applied in this appraisal, the present value of the waterworks property of The Bend Water, Light & Power Co. is found to be as shown in detail on the following pages.

ITEM 2

WATER RIGHTS

No water rights on Deschutes River have yet been adjudicated by the State. Until completion of such adjudication it can only be assumed that the water right claims of The Bend Water, Light & Power Co. are valid and any valuation made must be construed as subject to the effect of the final adjudications and recognition of the Company's right to the use of sufficient water for the domestic supply of the City of Bend.

The final award may be for a greater or less amount than 10 cubic feet per second, but from evidence at hand it appears that such an amount can reasonably be claimed as a right established by filings, actual use, and probable early future requirements of the City.

The fair market value of such a water right is best evidenced by the cost of purchasing a like quantity of water, having title equal or superior in priority from owners whose status of rights is as well established as is that of this Company. Information from sources believed to be reliable indicates that bona fide offers to sell such quantities of water have been made from time to time and that actual sales and transfers have been made in this vicinity at prices ranging from $800 to $1600 per second-foot. A value of $1200 per second-foot has therefore been placed on

10 second-feet of water from Deschutes River at or above Bend, having a priority of about 1905.

Cost of Reproduction	$12,000
Depreciation	None
Present Value Item No. 2	12,000

[illegible] item. This arrangement has been made in the appraisal because nearly all of the [illegible] within the [illegible] kept and [illegible] no appreciable change in any of the [illegible] taken place. [illegible] of cost [illegible]

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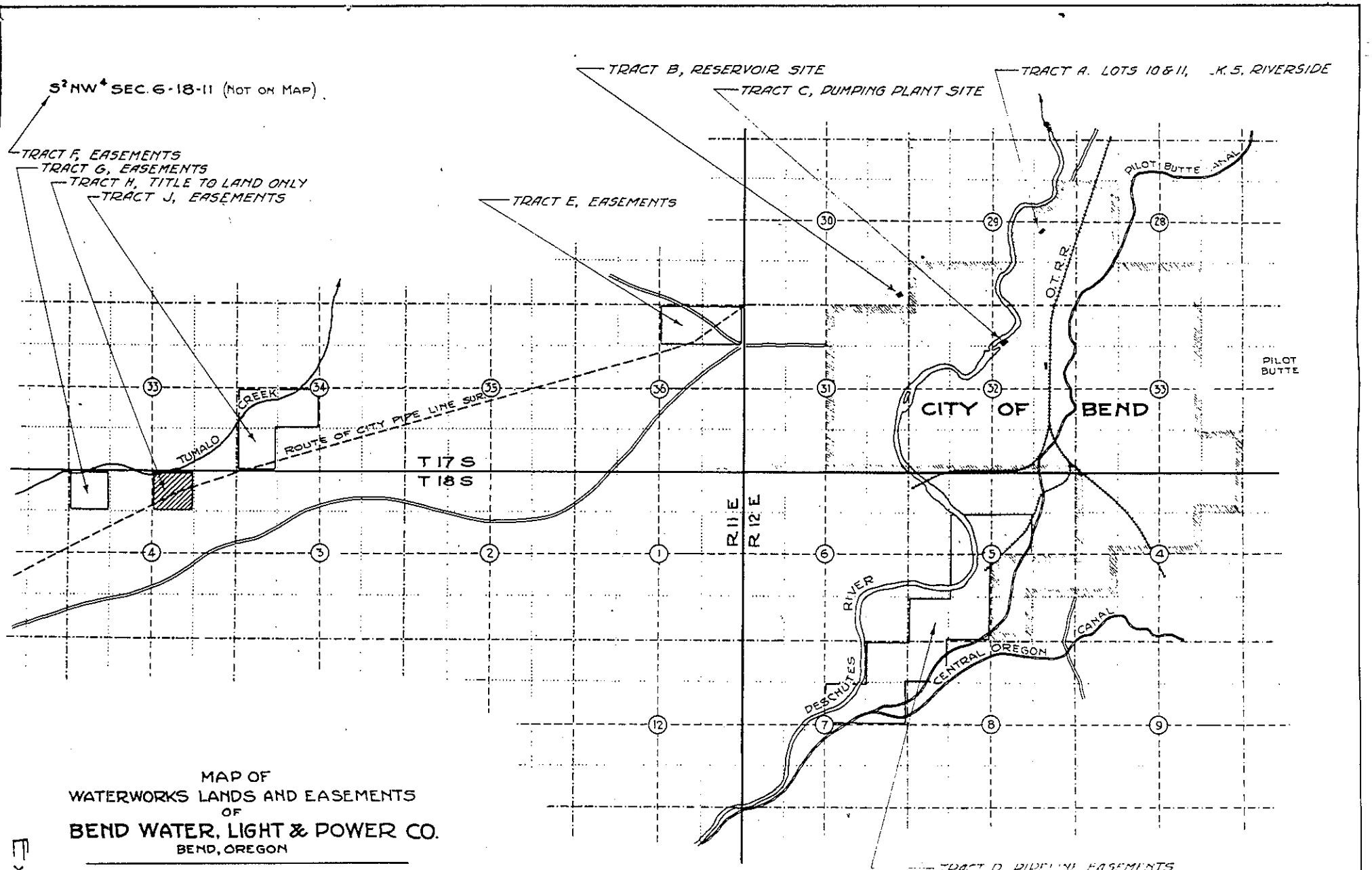

MAP OF
WATERWORKS LANDS AND EASEMENTS
OF
BEND WATER, LIGHT & POWER CO.
BEND, OREGON

TO ACCOMPANY APPRAISAL REPORT
BY
STEVENS & KOON, CONSULTING ENGINEERS
PORTLAND
DEC 1924

Exh. No. 3.
565-270