Minutes of a regular Meeting of the City Council.
Austin, Texas, May 18th 1896.

Hon. Lewis Hancock, Mayor, presiding.

Roll called.

Present Aldermen, Bealy, Glass, Gooch, Haynes, Horton, Linn, Cowell, Rosengren, Schneider, Stumpf, and Zilker 11

Absent Aldermen Fischer, Glascock, Lawless, Nitschke, Platt, Redd, Robertson, Shelley, Taylor, Tobin, and Townsend. 11.

On motion of Alderman Linn the Council took a recess of five minutes.

Council called to order.

Aldermen Lawless, Platt, Shelley, Tobin and Townsend appeared and answered to their names.

Minutes Approved. — Alderman Schneider moved to dispense with the reading of the minutes and that they be approved as printed, which motion prevailed.

Pet. of Citizens of 3rd Ward for Work to be Done — The Mayor laid before the Council a petition of Citizens of the Third Ward, asking that work be done on Nueces Street, which was read and on motion, the petition was referred to Alderman Fischer.

Pet. of W. J. Reynolds to remove mud settlings from Lake — Petition of W. J. Reynolds for permission to remove from time to time the settlings of mud or clay from the bottom of the Lake, for manufacturing purposes. Read, and on motion referred to the Water & Light Commission.

Pet. of W. H. Firebaugh to lay water pipe in City Cemetery — By Alderman Platt. Petition of W. H. Firebaugh in regard to laying of pipe in the City Cemetery. Read, and on motion of Alderman Linn, referred to the Cemetery Committee.

Pet. of A. B. Nuckols to remove Picture Gallery to Cor. 7th & Neches St. — By Alderman Glass, Petition of A. B. Nuckles, for permission to remove Picture gallery to the vacant lot corner of Neches and Seventh Streets. Read, and on motion of Alderman Schneider, was referred to the Fire Committee.

Aldermen Redd and Robertson appeared in the Council Chamber and answered to their names.

Communication from City Engineer regarding bridge in S. Austin — A communication from the City Engineer in regard to bridge in South Austin was read, and on motion referred to the Street Committee.

Communication from W. & L. Commission — The Mayor laid before the Council the following communication from the Water & Light Commission, the reading of which was, on motion of Alderman Linn, dispensed with and the communication ordered published in full in the minutes:

Austin, Texas, May, 16th 1896.

Gentlemen of the City Council:

We respectfully present herewith for your consideration the report of Mr. Allen Hazen, Civil Engineer, who, at the request of the Water & Light Commission, visited Austin and carefully examined the City's water supply system:

Boston, May 5th 1896.

Hon. Lewis Hancock Mayor, of Austin, Texas:

Sir;

Report of Engineer [illegible] — In accordance with your request by telegram, I visited Austin March 2nd, remaining in your City from the 17th to the 20th inclusive, for the purpose of examining the water supply of your City, and determining the [illegible] of improving and extending it; and I submit herewith [illegible].

[illegible]

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pure water free from sediment; and second, to provide reservoir capacity, as a reserve against emergencies, and particularly to allow a more even and satisfactory operation of the pumping machinery.

Population and Supply Required.

The population of the City of Austin by the census of 1890 was 14,494. The City limits were, however, somewhat restricted, and the country immediately outside of the City limits contained a very considerable population, which required to be supplied with water. The population of Travis County, at the time was 36,307. The population which is or should be supplied with water from the public works in 1896 can be approximately estimated at 25,000, and this population is increasing very rapidly. Owing to the continued hot and dry weather during portions of the year, large quantities of water are required for sprinkling and irrigating purposes, and the consumption for this period of the year, and particularly the hourly consumption during that part of the day when most of the sprinkling is done, is very much greater than would be expected under other conditions. In addition, numerous public institutions, railroads, etc. are supplied, many of them having large quantities of water.

Water is sold at the present time almost without exception at a fixed price depending upon the fixtures used and is not measured by meters. Under these conditions no exact estimates can be made of the quantity of water which will be required, which will be largely dependent upon the use, or rather upon the waste, of water by various consumers. If meters should generally be introduced, the consumption would be reduced and kept within moderate limit.

At the present time the minimum meter rate is twelve dollars per annum. That is to say, if less water is used than amounts to twelve dollars, twelve dollars is nevertheless charged. As the fixture rate for small houses is considerably less than twelve dollars per annum, householders will obviously decline to introduce meters.

I would suggest that the City can afford to and should reduce the minimum meter rate to six dollars, and I believe that this reduction will largely overcome the present objection to the introduction of meters, and will thus be a material aid towards keeping the consumption of water within reasonable bounds.

City Water Works.

Within the past six years the City of Austin has constructed a masonry dam across the Colorado River about three miles above the centre of the City. This dam is 1150 feet long and sixty feet high above the

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The City Water Works were first put in operation on March 7th 1895.
The number of takers was at first small, but has been gradually and rapidly increasing, and no experience has yet been obtained as to the quantity of water required during the summer. The water previous to the time of my visit had been drawn direct from the Colorado River and was pumped by two pumps, each capable of lifting 4,000,000 gallons per day, operated by water power. The water was, and is, pumped directly into the mains, the rate of pumping being varied from minute to minute to meet the consumption and to hold as nearly as possible a constant pressure, there being no reservoir connected with the system.

A reservoir was contemplated in connection with this system, as will be mentioned below, but has not been constructed.

Quality of the Colorado River Water.

The Colorado River has a drainage area of approximately 40,000 square miles above the dam. Upon this area, by the census of 1890, there was a population of about 90,000, or 2.25 people per square mile of water-shed; but of this number two thirds were resident upon the 10,000 square miles of watershed nearest to Austin, and the population of this part of the water shed was nearly three times as great per square mile as for the water-shed as a whole. The population is almost entirely rural and there are no considerable towns.

Rural populations, owing to the absence of sewerage systems, pollute water courses much less than urban populations, and in this case most of the population is so remote from the point where water is taken and is of such a character as to give no serious cause for anxiety as to its effect upon the healthfulness of the supply drawn from the river.

The river water is, however, always more or less turbid, and at times of high water the quantity of mud carried in suspension is considerable; and for this reason it is undesirable in its raw state for the purposes of municipal water supply. The river water is also somewhat hard, but in this respect it does not differ materially from all of the other waters which have been considered as possible sources of supply; and there is no way in which the City can get a water materially softer without incurring a heavy expense for a softening plant.

Spring in Power House

During the construction of the power house a large flow of water was encountered issuing from fissures in the limestone rock below the foundations. An outlet was provided for this flow through a 12 inch pipe built into the masonry floor and walls of the power-house. This water is almost entirely clear, having only a very slight milky turbidity which is so slight as to be unobjectionable. It is entirely free from the mud which makes the river water objectionable.

To utilize this water for the City supply, two Gould power pumps operated by a turbine, each capable of lifting 1,500,000 gallons per day or together 3,000,000 gallons per day, have been placed near the outlet of this spring, and connected with it, and these pumps were put in operation for the first time during the time of my visit in Austin.

[illegible] water been pumped [illegible] 3,000,000 gallons per day,

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of the capacity of the pumps. More recently, as I am informed, a centrifugal pump has been attached to the spring; and it has been found that by lowering the water to only a moderate extent water can be obtained at a rate of 6,000,000 gallons per day, in quantity in excess of the capacity of the 20-inch pipe from the pumping station to the City. It is stated that the flow of water from this spring is well maintained throughout the year, and can be depended upon at all times; and, if reasonable measures are taken to prevent waste, I believe that it can be depended upon to furnish an adequate supply of water for all proper purposes for a considerable time, although provision will be necessary for storing water during the night and giving it up again during those hours of the day when the consumption is heaviest.

I have caused chemical analyses to be made of this water and of the river water, the results of which are hereto appended, and I find that the water from the spring differs chemically from the river water in that it is entirely free from mud, and that it contains a much smaller quantity of organic matter, otherwise the waters are so nearly alike as not to indicate necessarily separate origins. I am not unable to determine whether the water from the spring has its origin in the water in the pond above the dam or not; nor do I consider at the present time that this has any very important bearing upon its suitability for public water supply. If it does have its origin in the water above the dam, it has either been filtered through gravel deposits or has passed through extensive cavities in the limestone rock in which a very complete deposition of mud has taken place. The water is thus physically fitted for the purpose of municipal supply, and, as stated above, the population upon the Colorado River above the intake is too slight to seriously pollute it, even if used in its raw state.

I therefore recommend for the present the continuance of the use of this source to its limit; but I strongly recommend at the same time the continuation of the City ordinance now in effect preventing the discharge of sewage matters into the river above the dam from steamboats or other sources, and I also strongly recommend that the water from the river and from the spring should be subjected to chemical analysis at regular intervals, preferably each month. Such a series of analyses will probably definitely settle the origin of the spring water.

The chemical composition of the water in the river will undoubtedly fluctuate widely at different seasons of the year. If the water of the spring shows corresponding fluctuations, it will demonstrate that it has its origin in the water of the river; while, if it has a constant composition independent of the changes in the river, an independent origin will be shown.

In this connection it should be stated that the Colorado River itself at times of low water is largely made up of water from underground sources coming in within a hundred miles or so above this dam; and, as the river was low at the time of my visit, and as this, [illegible]

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the spring water came from the river.
A check valve should be placed upon the 12 inch outlet of the spring to allow the water to flow out when there is an excess and to prevent the entrance of river water when the water of the river is above the outlet of the pipe, as occasionally happens.

Reservoir.

A reservoir is an extremely desirable, in fact, almost a necessary adjunct of your system of water supply. The original projects contemplated the construction of a reservoir upon some one of the sites to the south or west of the river but the project has never been executed. The works were first designed by Mr. J. O. Frizell, who was afterwards succeeded by Mr. J. T. Fanning, of Minneapolis, both of them eminent engineers. The projects considered by both of them contemplated pumping the raw water to a reservoir to be formed by a dam across one of the valleys in the rugged limestone hills west of the river. A number of sites were proposed, but a basin near the upper end of Little Bee Creek and about 7000 feet from the power house was finally selected as being the best adapted to the purpose in hand. Plans and specifications were made for a reservoir to hold 100,000,000 gallons. Bids were received during the fall of 1895, the lowest bid being $47,635, based upon the engineer's estimate of quantities. In addition, a single pipe line from the power house to the reservoir, would cost about $30,000, and the land for the reservoir site would require to be obtained at a considerable expense.
This project was not carried out mainly on account of a lack of funds.
The chief use and value of a reservoir of this size was to allow the sediment to be deposited from the water before it was used. This sedimentation could only be made available by laying two lines of pipe to the reservoir so that all the water pumped should go directly to the reservoir, and all of the water drawn by the City should come from it and not from the pumps direct, a condition of things which obviously could not be realized with a single line of pipe. Even with a double pipe line the water from the reservoir would not be entirely clear, but would still retain the finer particles of suspended matters which in connection with the algae growths which would be sure to result in a reservoir of this size and construction, would often render the water disagreeable in taste, odor and appearance.
I consider it entirely unnecessary and undesirable that the City should continue to use the raw river water, and when a clear ground water is pumped, there is no mud to be removed by sedimentation, and the chief reason for a large reservoir is at once removed. Further, ground waters support algae growths much more freely than river waters.
At numerous places in New England open reservoirs were formerly used for ground waters, but objectionable tastes and odors have invariably resulted from the exposure of such waters to sunlight, and it has always been necessary to cover reservoirs for such waters to exclude the light. Roofs have been used successfully in many cases, but masonry coverings are more substantial and satisfactory. In Europe ground waters are invariably stored only in reservoirs from which light is excluded; and in the United States, particularly in recent years, many covered reservoirs have been constructed for such waters.
Pumping a pure spring water into an open reservoir with a capacity

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of 100,000,000 gallons would be almost certain to result in the prolific growth of organisms in the water, which afterwards by their death and decomposition would render the water offensive and objectionable.

In this connection it was called to my attention that at San Antonio a water of similar character was stored in an open reservoir without particularly objectionable results. To investigate this matter I visited the water works at San Antonio in company with ex-Mayor McDonald. The reservoir at San Antonio is very small in comparison with the consumption of water, and only a small part of the water ever goes to the reservoir.

Some algae growth was noticeable in the water at the time of my visit, and we were told that, particularly in summer, an excess of water is frequently pumped which overflows the reservoir and in a way flushes it out and carries off the organisms. Hard waters are less liable to algae growths than soft waters, but are not exempt; and the water at San Antonio is rather hard, although probably not much harder than the waters at Austin. With only a very small reservoir, and by overflowing the water in summer, the company has been able to get along with an open reservoir, but I do not regard it as a satisfactory procedure and do not advise its adoption at Austin.

Further, aside from the sedimentation, which is not required in the case of ground waters, there is no object in constructing a reservoir of the size proposed. While your water consumption cannot be predicated with certainty, it is quite safe to say that for many years at least you will have no variations in consumption between the different hours of the day which could not be fully taken care of by a reservoir holding three or four million gallons, and any expense incurred in constructing a larger reservoir than this at the present time is regarded as unnecessary.

For these reasons, and mainly because of the change in the character of the water pumped, I do not approve of the reservoir schemes formerly considered in connection with the use of the unfiltered water, but recommend instead the construction of a covered reservoir with a capacity of three or four million gallons. All the objects of a larger reservoir will be secured by a reservoir of this size, and with the light excluded the water will be maintained in as good condition as it is when it comes from the spring.

Sites for Covered Reservoirs.

Several sites are available for the construction of such a reservoir. A reservoir could be constructed directly west of the dam upon land owned by H. W. Stratton, to hold three or four million gallons, at a cost of about $25,000 with a roof, or about $30,000 with a masonry vaulting. A single line of pipe from the power house to it would be all that would be required. Such a reservoir could probably be constructed and connected ready for use at an expense of $50,000, exclusive of land damage. Another site which has much to commend it is upon a hill north of the City, and in a neighborhood which is being built up for residential purposes. Several points in this general neighborhood are available, and the limestone rock, or solid rock, affords a satisfactory foundation for a reservoir. The cost of constructing a reservoir in this locality would be no greater

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than at the site west of the dam; and although more pipe may be required to connect this reservoir with the system of pipes in the City, the lines would be through regions already containing some population and a population which is likely to increase, so that revenue can be expected from this extension, while nothing is to be expected from mains to the reservoirs west of the river.

In a recent letter you mentioned a site 7500 feet 11-½ degrees East by North of the end of the present 12-inch City main in front of the State Insane Asylum, where the elevation of the ground is about 269 feet above the top of the dam, ordinarily used as the datum for City work.

The water level in a reservoir constructed at this place would be about twenty-five feet lower than the water level in the reservoir proposed last year upon Little Bear Creek by Mr. Fanning; but as the reservoir is very much nearer the more elevated part of the City, the pressure maintained by the reservoir in these higher locations would be more constant and perhaps as great; for, owing to its nearness, it would maintain a pressure nearly equivalent to its static head plus or minus the slight friction in the pipes to it, according to the direction in which the water was flowing; while the reservoir on Little Bee Creek would only maintain the pressure due to its static head less the friction from the reservoir with the double pipe line, or the friction from the pumping station at least with a single pipe line to the localities mentioned; and, owing to the long distances and moderate sized pipes, it is not apparent that with ordinary conditions the pressure maintained by the Little Bee Creek reservoir would be greater than the pressure from a reservoir upon the site suggested to the north of the City.

All things considered, I consider this as a more satisfactory site for a reservoir than the west side of the river, and I recommend the construction of a covered reservoir at this point. In accordance with your request I shall have plans and specifications prepared for a reservoir on this site.

Necessary Pipe Connections.

It will be necessary to connect such a reservoir with your existing pipe system, which only extends at the present time as far as the State Insane Asylum. As you will see, the pipe connecting with a reservoir in this location will not necessarily carry a quantity of water equal to the consumption. The greater part of the water will be consumed in the City without ever going to the reservoir.

The reservoir will take the excess of water when more water is pumped than is used, and the water will flow back from the reservoir to the City when the consumption exceeds the quantity pumped. With this in view it is probable that a 16-inch pipe would answer very well for the present requirements, but if the consumption increases, as it is likely to do a larger pipe will be required at an early date to always maintain an adequate pressure in the City during those hours in the summer when the consumption is greatest. The 20-inch pipe costs only about eighty cents less per foot than the 16-inch pipe. I recommend that the pipe from the present system to the reservoir be 20 inches in diameter.

[illegible] connections to be made at the present time, upon [illegible]

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a 12-inch line. In order to make a suitable connection it will be necessary to add another line, probably of 16-inch pipe from Nineteenth Street to the 20-inch line to the reservoir. This line should go through the streets where it will do the most good to your system as a whole, perhaps through Lampasas and Duval Streets, and connect in Hyde Park with the line to the reservoir. The 16-inch pipe and 12-inch pipe together will have a carrying capacity equivalent to the 20-inch pipe beyond. From Pecan Street to Nineteenth Street you already have one 16-inch two 6-inch and two 8-inch pipes, which together are equal in capacity to the 16-inch and 12-inch pipes from Nineteenth Street to Hyde Park, and to the 20-inch pipe from the pumping station to the heart of the City and from the Insane Asylum to the reservoir. The capacity of this part of the system will, of course, be gradually increased as additional pipes are placed in this part of the City connecting the cross lines. The 12-inch pipe in Nineteenth Street will collect water from the various lines of pipe on one side of it and distribute to those on the other side.

It may be possible to do without the additional line of 16-inch pipe for a short time, particularly as that part of the City most influenced in pressure by the heavy friction in the single line of 12-inch pipe is the lower portion, where less harm would be done by a considerable falling off in pressure.

The arrangement, however, with only the single line of 12-inch pipe will at best be but a temporary expedient, and the other line will require to be added at an early date.

Additional Water Supply.

While I consider that the Spring in the Power House in connection with a suitable reservoir will yield all the water required to meet the legitimate demands for a number of years, I am not confident that it can be depended upon as a permanent supply to meet the ultimate requirements of the City, and I regard it as desirable that the matter of additional supply should be kept constantly in mind with a view of taking advantage of the unusual opportunities for securing a pure water in the neighborhood of Austin.

While in your City the full capacity of the Spring in the Power House was not known, and some misgivings were felt as to its quantity and quality; and although, as I have shown, later developements have shown these misgivings to have been unfounded, I examined carefully the possibilities of securing additional supply, and I shall review briefly the more important possible methods of supply which have been considered.

Springs above the Dam.

It is reported that there are very large springs in the river above the dam; but on account of the difficulty of locating and controlling their flow beneath so great a depth of water as now covers them, I have not considered this source at length

Wells above the Dam.

It has been suggested that wells might be sunk into the porous materials above the dam to secure a water having its origin in the water of the river, but which would be thoroughly purified by natural processes in passing through the gravel in the bed of the river. The shore of the river above the dam is rocky, with limestone and affords no [illegible]

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but I have not considered this matter at length, both because of the difficulty of securing and controlling a water supply beneath such a depth of water, and because the scouring action upon the surface of the gravel usually present in river beds is lacking, owing to the still water back of the dam, and there is every reason to believe that even if such a bed of gravel should have a good filtering power at first, it would gradually become clogged with the sediment from the river water, and the yield of the water would after a time become unsatisfactory.

Artesian Wells near the Dam.

Artesian wells have been used at a number of points in the neighborhood of Austin, and water flows at a much higher level than the water in the dam. There is every reason to believe that a considerable quantity of water could be secured from an artesian well sunk near the power house. Judging from the other wells in the neighborhood, the best results would be secured from a well from fifteen to eighteen hundred feet deep, and the cost of which would be about $5000. The water so secured would probably contain a larger quantity of mineral matter and would be less desirable for the purpose of municipal supply than the other waters considered in this report, although this cannot be absolutely determined without making the experiment and it is possible that an auxiliary supply might be obtained in this way to advantage

Spring in the Power House.

This spring has been mentioned at length above. Pumps are now connected to pump 3,000,000 gallons a day of this water, or substancially the quantity which was flowing to waste before the pumping commenced. Tests have shown that a larger quantity can be obtained by pumping the water at a lower elevation, and an additional supply can be developed either by putting in a centrifugal pump to lift the water to the 4,000,000 gallon pumps which are now placed too high to pump from the spring, or these pumps, or one of them, may be lowered so that it will be possible to pump from the spring.

Wells in the Gravel below the Dam.

The gravel deposits immediately below the dam rest at a slight depth upon the limestone rock, and there is not a sufficient depth of material to promise a good yield of ground water.

Spring half a mile below the Dam.

There is a considerable spring upon the northeast side of the river half a mile, more or less, below the dam, but this spring is stated to go dry in the summer, and its use would involve an auxilliary pumping plant; and if such a plant is to be established, much better locations are available.

Filtration of the River Water.

The water of the Colorado is capable of being purified by filtration. A suitable and convenient site for filters could be found just south of the power house. Water could be taken to the filters through one of the steel penstocks provided for driving water for manufacturing mills, and the water could be filtered and delivered at a sufficient elevation to be pumped.

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by the 4,000,000 pumps. The cost of the construction and operation of such a plant would be considerable, but this expense would be partially balanced by the convenience of having the source of supply close to the present pumping machinery.

Limit to the Capacity of the Force Main.

I will now call your attention to a point which equally affects each of the above mentioned projects, namely, the limit of the capacity of the force main. Mr. Canning in his report recommended the construction of two force mains from the power house to the City, one a 24-inch main down Nineteenth Street, and one a 16-inch main following the line of the Railroad.

The line following the Railroad was first laid, but 20-inch pipe was used instead of 16. The Nineteenth Street line has not yet been laid.

The present 20-inch line, 16,800 feet long to Congress Street, where it joins the main lines running north and south, cannot be depended upon to carry water at a rate above 5,000,000 gallons per day of twenty four hours and it is obviously useless to secure a greater supply than this without at the same time giving increased carrying capacity from the pumping station to the City. The spring at the power house is already supplying the greater part of the water which can be carried through this force main, and it seems probable that water can be secured from the same source fully up to the limit of the capacity of the pipe.

If a supply of water could be secured nearer to the central part of the City where the principal consumption occurs, it would be possible to largely increase the supply without involving the expenditure necessary for additional force mains. Two projects have been considered for accomplishing this purpose.

Tubular Wells on North side of River near Railroad Bridge.

A series of tubular wells can be sunk in the gravel deposit between the low water bank of the river and the high water bank, and these wells can be connected with suitable iron collecting mains which would take the water to a pumping station to be located at a convenient point near the high bank of the river not far from the Railroad. In order to secure a sufficient supply it will be necessary to place the pumps not higher than ten feet above extreme low water in the river and to protect them by a masonry structure extending above high water. The pumps could best be operated by electricity with power obtained from your power station.

Springs on South side of the River.

On the south side of the river a little to the west of the center of the City and from 7500 to 3000 feet from the river is located a series of four springs which yield a very large quantity of extremely pure water. During the various limitations at the time of my visit at Austin I was unable to measure accurately the flow from these springs, but it is [illegible]

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floor and operated by electricity furnished from power present power house.
The walls would require to be carried up above high water, and an outlet for surplus water from the springs would have to be provided which could be partially closed if necessary in times of flood. The water would be carried through a force main extending in nearly a direct line about 7000 feet to Pecan Street, or 8500 feet to Congress Street, where it would join the net work of pipes which would carry the water to all parts of the City and to the reservoir.
The bed of the river is favorable for the location of a pipe line across it, and no serious engineering difficulties would be encountered.
This project would deliver into the center of the City just where it is wanted any quantity of water for which pumping capacity is provided of the greatest purity and without involving any extensive additions to your pipe system. I have had the water from these springs examined by Professor Harper, of the University of Texas, and by Mr. Harry W. Clarke, of the Lawrence Experiment Station of the Massachusetts State Board of Health, and have been unable to learn any quality in it which will be objectionable in a public water supply, except the hardness, which is not materially different from the other waters considered.
Springs of this size, issuing from fissures in limestone rock, are in reality underground streams, and may have passed for long distances through clean fissures in which there is no straining or filtering effect corresponding to that which has invariably taken place in water issuing from springs in sand or gravel formations. For this reason it is important in considering the use of such springs in densely populated regions to investigate with the greatest care the original source of the water and to ascertain that it is not and cannot be polluted by cesspools or other sources of filth at any point upon its route. The country back of the springs in question, however, consists of a broken limestone formation upon which there is scarcely any population at all, and upon which no population is to be expected; and under these conditions, and in view of the great purity of the water shown by the analyses, I do not consider that there is any reason whatever to question the wholesomeness of the water for municipal supply. I consider these springs from the fine purity of the water and from their nearness to the central part of the City, and in every way except the convenience of pumping, as the most desirable source of supply. The installation of another pumping station with electrical pumping machinery will involve a considerable expense both in construction and operation, and may in part offset the natural advantages of this source of supply.
In view of the increased capacity found in the springs in the present power house, there is no immediate necessity for deciding among the various projects mentioned, and I therefore make no recommendation as to them.
I would, however, strongly urge that some competent person should be instructed to keep track of the flow of these springs and, if possible, to measure occasionally the flow of them. The springs should be visited at least once a month, and the observations should be systematically carried on till times of minimum flow. Occasional measurements of the water from these springs over time to time would be of great value.

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The data thus secured will cost the City but little and may be of great value at some later time.

Conclusions.

In conclusion, I recommend the utilization of the present source of supply to its full extent, and the construction of a covered reservoir north of the City with suitable pipe lines leading to it, and the supply so obtained is apparently adequate to meet the requirements of the City for the present. At the same time a record should be kept of the quality of the water obtained, and of the other possible sources of supply which may be required to be considered at a later date. Plans and specifications of the reservoir will be sent as soon as completed.

In conclusion I wish to express my appreciation of the attention and assistance received from the Members of the Water and Light Commission; Mr. Maddox, Superintendent of Water Works; Mr. Oliphant, Secretary; from ex-Mayor McDonald, from Professor Harper, of the State University, and numerous other citizens who did everything in their power to aid me in securing necessary information.

Respectfully submitted,
Allen Hazen.
For Noyes & Hazen,
Consulting Engineers.

Appendix.

Chemical Analyses by Professor Harper.
Chemical Analyses by Mr. Harry W. Clarke.
Population upon the water-shed of the Colorado River above Austin.
Population of towns upon water shed.

Analyses of Samples of Water by Prof. H. W. Harper, University of Texas
Samples collected March 14th, 1896.
Parts in 100.000.

	Spring in Power House	Spring on Beach half mile below Power House.	Large Spring on South side of River (Walsh Spring)	River Water from Pump in Power House.
Total Solids,	29.80	28.00		29.60
Temporary Hardness,	7.20	8.306	5.000	6.613
Permanent Hardness,	3.44	3.790	4.408	5.053
Total Hardness,	10.64	12.096	9.408	11.666
Chlorin,	2.828	1.262	2.222	2.929
Nitrogen, as nitrates,	0.0125	0.1000	0.0667	0.0080
H S	None	None	None	None
Sulphides,	None	None	None	None
Sulphites	None	None	None	None

The similarity of results of the water from the spring in the power house and the river water from [illegible] and power house is suggestive of a relation [illegible] between the sources of the two waters. This feature presents peculiar interest as [illegible] results differ very widely from the analyses made of these two waters during the spring of 1895, and this [illegible] has not been [illegible] for the [illegible].

This feature is worthy of further study.

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Respectfully,
(Signed) H. W. Harper.

Chemical Analyses of Water from Austin, Texas, by Mr. Harry W. Clarke, Chemist in Charge of the Lawrence Experiment Station of the Massachusetts State Board of Health.

Samples collected March 21st 1896; examined March 30th 1896.

Parts in 100,000.

	River Water from Pump in Power House.	Spring in Power House.	Spring on South Side of River (Stern Spring.)
Turbidity,	Decided	Very slight	None
Sediment,	Decided	Very slight	Very slight
Color,	0.31	0.10	0.04
Total solids,	28.95	26.55	33.00
Free Ammonia,	0.0108	0.0007	0.0
Albuminoid Ammonia	0.0117	0.0018	0.0018
Chlorine,	2.8300	2.9800	3.3800
Nitrogen as nitrates,	0.0370	0.0780	0.1760
Nitrogen as nitrites,	0.0008	0.0004	0.0002
Oxygen consumed,	0.1400	0.0600	0.0300
Hardness,	14.	13.	18.

(Signed) Harry W. Clarke.

Memorandum in Regard to Analyses.

The river water is a moderately hard water, very much harder than the New England supplies, slightly harder than the water of the Great Lakes, used by Chicago, Cleveland, Detroit and many other Cities; but softer than the waters of many of the Cities in the Central States.

No very great amount of pollution is indicated by the analyses.

The water from the spring in the power house resembles very closely the river water in its general chemical composition. It is nearly free from the turbidity and sediment of the river, and contains a very much smaller quantity of organic matter.

The spring on the south side of the river as far as examined are of extremely pure water, almost entirely free from organic matter.

Mr. Clarke's analyses indicates that the water from the south side springs is a little harder than the river water.

It cannot be concluded, however, from a single set of analyses that this is necessarily the case throughout the year. As a rule, river waters are softer in spring and harder in fall; while water from springs with deep origins differs but little with the different seasons of the year; and it would therefore be unsafe to conclude that the springs for the whole year are harder than the river water until analyses have been made extending over the various seasons of the year.

Population on Water-Shed of Colorado River above Austin
Drainage area 40,000 square miles.

	Population in Counties.	Population on Water-Shed. (Approximate.)
Travis,	24	24
Bastrop,	4049	3486

Hazens report

	Population of County	Proportion on water-shed (Approximate)
Borden,	777	777
Brown,	11,471	11,471
Burnet,	10,747	5,373
Callahan,	5,145	2,728
Coleman	6,711	6,711
Concho	1,065	1,065
Crockett,	194	38
Dawson,	29	29
Eastland,	10,373	1,037
Ector,	277	277
Edwards,	1,970	246
Gaines	68	68
Gillespie,	7,056	7,056
Glasscock,	208	208
Hays,	11,357	1,400
Howard,	1,710	1,710
Irion,	870	870
Kerr,	4,467	446
Kimble,	2,243	2,243
Lampasas,	7,584	1,896.
Llano,	6,777	6,777
Martin,	264	264
Mason,	5,180	5,180
McCulloch,	3,217	3,217
Menard,	1,215	1,215
Midland,	1,033	1,033
Mills,	5,493	4,119
Mitchell,	2,059	2,059
Nolan,	1,573	787
Runnels,	3,193	3,193
San Saba,	6,641	6,641
Schleicher,	155	155
Sterry,	1,415	875
Sutton,	658	329
Taylor,	6,957	1,493
Tom Green,	5,152	5,152
Winkler,	18	5
Total.	174,956	89,890

Population of Towns near the Water-Shed of the Colorado River above Austin, Census of 1890.

	Population.	Distance from Austin Miles.
Marble Falls,	584	40
Burnet,	1,454	45
Fredericksburg,	1,537,	65
Llano,	1,208,	66

Hazens report

	Population.	Distance from Austin Miles.
San Saba,	697	86
Mason,	1,275	95
Brady,	560	110
Brownwood,	2176	170
Junction City,	449	175
Menardsville,	185	126
Santa Anna,	468	135
Coleman,	906	145
Paint Rock,	373	150
Ballinger,	1,417	165
San Angelo,	2,615	177
Sherwood,	264	190
Sweetwater,	614	215
Colorado City,	1,587	235
Big Spring,	1,158	260
Midland,	277	280
Total.	20,937	

The distances are the distances from Austin in a straight line. I have no map sufficiently accurate to determine the distances as the water flows, which is usually used in such cases. Judging from experience in other cases, the distances by the courses of the streams would be on an average nearly twice as great as the distances in straight lines.

H & L Corns recommend adoption of Hazens report

The commission, after a careful consideration of Mr. Hazen's report and of the condition and needs of the City, both at the time of Mr. Hazen's visit here and since then, respectfully recommend that the recommendations of said report be adopted, by

First, Increasing the pumping capacity in connection with the spring in the lower house so as to pump at least 5,000,000 gallons of spring water per day.

Second, The construction of a covered reservoir to contain from three to five million gallons at a point north of town and to connect same with the 12-inch main terminating at the Lunatic Asylum.

H & L Corns recommend purchase of 15 acres of land for reservoir purposes on Geo Hancock estate

We beg leave to report that we have visited all the points suggested north of town and find one on land belonging to the estate of the late John Hancock, about 8500 feet N. 11½ degrees E. from the end of the said 12-inch main. The ground at this point is about 70 feet above the top of the dam and is in every way admirably adapted for the construction of a reservoir, and for [illegible] water with our pipes by way of the Lunatic road. The estate according to proposition will sell the City [illegible] at this point for $50. per acre, this price [illegible]

We therefore recommend that the City purchase said fifteen acres of land according to said proposition, and herewith submit an ordinance appropriating $750 for that purpose.

It has been often suggested that now that the City has plenty of spring water there is no need of a reservoir. This is not the case, for the following reasons: As stated by Mr. Hazen, the capacity of the 20-inch main from the power house to the City is about 5,000,000 gallons per day of twenty four hours; that is, it can supply 5,000,000 gallons if the consumption is steady and constant at the rate of 208000 gallons per hour night and day for each of the twenty four hours. But very little water is used at night, and comparatively little during the morning hours. The greatest consumption of water, especially in summer, is from 3 to 9 P.M. when it will probably amount to four or five hundred thousand gallons per hour. The main from the power house bring capable of delivering only 208,000 per hour, it is clear there will be a defective service unless the deficiency is supplied in some other way. This the proposed reservoir north of the City does. The pumps working night and day if necessary, can fill the reservoir, and when the time of heavy consumption comes it will be answered by the pumps supplying water from one direction and the reservoir supplying an equal or greater amount from another direction.

Respectfully submitted,
W.H. Sobin,
P.J. Lawless,
J.P. Schneider,
Lewis Hancock.
Water and Light Commission.

Police Committee's report on City Marshal's report for April

Alderman Powell, for the committee on police, to whom was referred the report of the City Marshal for the month of April presented their report, stating that the reports had been examined and found correct.

The report of the committee was received, adopted and ordered filed.

Resolution authorizing Washington Hose Co No 1 to change Hose Cart at their own expense

The Mayor laid before the Council a resolution authorizing Washington Hose Company No 1 to change the present Hose Cart now in their possession to a Hose Wagon, at their own expense, with a favorable report thereon from the Board of Fire Commissioners.

The resolution was adopted.

Unfinished Business.

Ord. Appropriating $95.00 to rebuild bridge across Blunn Branch in South Austin

The Mayor laid before the Council an ordinance appropriating the sum of $95.00 to repair Bridge across Blunns Branch in South Austin, with the report of the street committee.

The ordinance was passed under suspension of the rules by the following vote:

Yeas Aldermen Beaty, Glass, Gorth, Haynes, Lawless, Linn, Platt, Powell, Rosenbaum, Rosenquest, Schneider, Shelley, Stumpf, Sobin, Townsend and Wilson. 11

Nays None.

Report from committee

Aldermen Taylor entered the Council Chamber and answered to his name.

Alderman Sobin, for the Water and Light Commission, presented a report from the Superintendent of Waterworks, which was read and ordered filed.

Ord. fixing minimum rates read 2nd time

The Mayor laid before the Council, on its second reading, an ordinance fixing minimum rates for Water & Light meters. The ordinance was read a second time.

Alderman Haynes moved to suspend the rules and place the ordinance on its third reading.

Alderman Linn moved that the ordinance be laid on the table. Lost by the following vote:

Yeas Aldermen Beaty, Glass, Linn, Platt, Roberdeau, Stumpf & Taylor. 7

Nays Aldermen South, Haynes, Horton, Lawless, Powell, Redd, Rosengren, Schneider, Shelley, Tobin, Townsend and Zilker. 12.

The vote was then taken on the motion of Alderman Haynes to suspend the rules and place the ordinance on its third reading and was lost by the following vote:

Yeas Aldermen South, Haynes, Horton, Lawless, Powell, Rosengren, Schneider, Shelley, Tobin, Townsend and Zilker. 11

Nays Aldermen Beaty, Glass, Linn, Platt, Redd, Roberdeau, Stumpf, and Taylor. 8.

Resolution of Fin. Com.tee

The Mayor laid before the Council the following resolution, offered by the Finance Committee:

Be it resolved by the City Council of the City of Austin, That the Assessor and Collector of Taxes of the City of Austin be required to execute a bond in the sum of $5000, payable to the Mayor of said City, conditioned that he will pay over to the Treasurer of the School Board of the City, all moneys collected by him belonging to the School fund of said City.

On motion of Alderman South the resolution was adopted.

Ord Appropriating $100 to pay claim of T. J. White reported adversely by Charity Com. which was adopted

The Mayor laid before the Council an ordinance appropriating the sum of $100 to pay the claim of T. J. White, with the report of the Charity committee recommending that the ordinance do not pass.

The report of the committee was adopted by the following vote:

Yeas Aldermen South, Haynes, Horton, Lawless, Linn, Powell, Redd, Roberdeau, Schneider, Stumpf, Taylor, Tobin and Townsend. 13.

Nays Aldermen Beaty, Glass, Platt, Rosengren and Zilker 5.

On motion of Alderman Powell, Superintendent Maddox was excused from further attendance at this session of the Council.

Resolution of Ald. Haynes regarding recent trouble of Electric Light system

Alderman Haynes offered the following resolution, which was read, and on motion was referred to the Water & Light Commission:

Austin, Texas, May 18th 1896.

Whereas, For some time past, the tower lights of the City have at times been very inferior, many of the lamps scarcely showing any light whatever, and

Whereas, Sunday's storm has at the tower house have caused many of the City's lamps to be entirely without light for several weeks, causing an great deal of comment and serious misgivings as to [illegible]

equipped and operated with safety to the works and to the satisfaction of the people; therefore be it

Resolved, That the Water & Light commission be and are hereby instructed, in connection with the Electrical Engineer in charge of the works, to carefully examine all the electrical appliances at the power house as to their usefulness and capacity and to note fully if any part of the machinery is improperly adjusted, overloaded or is inadequate to the work required, and what may be necessary to at once remedy any defects and what parts of the equipments of the City should have duplicates of, to prevent in future such serious delays, and what if anything, will render this costly plant safe from injury in the event of electrical storms; be it further

Resolved, That if necessary to further an intelligent examination and report to this Council on above important points the service of an expert electrical Engineer - other than now employed by the City - is required, the Water & Light Commission be, and are hereby authorized to employ such expert, and that he be requested also to make suggestions as to the number and qualifications of men necessary to operate the plant in a thorough, business-like, safe and up to date manner, and that the Water & Light commission make report of their action in the matter at as early date as practicable.

H. L. Haynes.

Ord. appropriating $75 00/100 to add new doors to Colorado Fire Co's Hall.

By Alderman Stumpf, An ordinance appropriating the sum of $75. for the purpose of adding necessary doors to Colorado Fire Hall.

The ordinance was read first time, and on motion of Alderman Powell the rules were suspended and the ordinance placed upon its second reading by the following vote:

Yeas Aldermen Beaty, Glass, Goeth, Haynes, Horton, Lawless, Linn, Platt, Powell, Redd, Roberdeau, Rosengren, Schneider, Shelley, Stumpf, Tobin, Townsend and Zilker, 18

Nays Alderman Taylor.

The ordinance having been read, Alderman Powell moved to amend by inserting $15. instead of $75. Lost.

Alderman Schneider moved to amend by adding, "and that the work be done under the supervision of the Fire Committee and the City Engineer." Adopted.

The Ordinance, as amended, was then passed, under suspension of the rules, by the following vote:

Yeas Aldermen Beaty, Glass, Goeth, Haynes, Horton, Lawless, Linn, Platt, Powell, Redd, Roberdeau, Rosengren, Schneider, Shelley, Stumpf, Taylor, Tobin, Townsend and Zilker 19.

Nays None.

Ord. appropriating $68.15 to pay for Lumber used for Bell Tower for So. Austin Fire Co.

By Alderman Redd, An ordinance appropriating the sum of $68.15 to pay for lumber used for bell tower for South Austin Fire Company

Read and referred to the Fire Committee.

Ord. appropriating $200.00 to build a coffer dam in Colorado River below the bridge.

By Alderman Glass, An ordinance appropriating the sum of $200. to build a coffer dam in river below the bridge.

On motion the ordinance was referred to the Committee on [illegible]

Resolution that [illegible] water main [illegible]

By Alderman Zilker, Resolution that all the water [illegible] from [illegible] water main leading to the drill grounds be laid to [illegible]

be laid on E 1st St. on Drive

East First street on the drive in the South Ward.
A motion to refer the resolution to the Water & Light Commission was lost.
On motion of Alderman Glass the resolution was adopted by the following vote:
Yeas Aldermen Beaty, Glass, Haynes, Platt, Redd, Rosengren, Shelley, Stumpf, Townsend and Zilker, 10
Nays Aldermen Booth, Lawless, Linn, Powell, Roberdeau, Schneider, Taylor and Tobin. 8.

Ord. Appropriating $750. to purchase 15 acres of land for reservoir site.

The Mayor laid before the Council an ordinance offered by the Water & Light Commission, appropriating the sum of $750. to purchase a site for a reservoir; read first time and laid over until the next meeting of the Council.
Alderman Tobin offered the following resolution, which was read and on motion was referred to the ordinance committee and the City Attorney:

Resolution instructing City Electrician to remove all obstructions to the Electric wires

Be it resolved by the City Council of the City of Austin,
That it is hereby made the duty of the City Electrician to remove all obstructions to the electric wires of the City caused by branches of trees extending over the streets or sidewalks of the City of Austin.
On motion of Alderman Tobin the Council adjourned.

Jno. E. Johnson
City Clerk.