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Plans, estimates and specifications for a sewer system for the city of Plattsburg

Eldon E. Cook

William C. Perkins

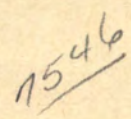
THESIS

FOR THE

Degree of Bachelor of Science

IN

CIVIL ENGINEERING.



SUBJECT :

"Plans, Estimates and Specifications for a Sewer System for the City of Plattsburg."

ELDON E. COOK.

WILLIAM C. PERKINS.

JUNE, '07.

PLANS,

SPECIFICATIONS AND

ESTIMATES

FOR A

SEWAGE SYSTEM

FOR

PLATTSBURG,

CLINTON CO., MISSOURI

BY

E.E.COOK W.C.PERKINS.

Introductory.

Plattsburg,Missouri is a thriving city of about two thousand population. It is situated in the heart of the most fertile Missouri land. Three railroads-

Atchison,Topeka and Santa Fe.

Chicago,Rock Island and Pacific

Quincy,Omaha and Kansas City

-give easy access to St. Joseph,thirty miles distant,Leavenworth forty miles,or Kansas City,forty-one miles;respectively.

The city is growing steadily and will in a few years be of such size that a sewage system will be necessary.

We therefore submit the following plans,specifications and estimates.

Since the city could not afford both Stone Sewers and Domestic Sewers or a combined Sewer System these plans will treat only of a Domestic Sewer System.

After a careful survey of the town and the adjacent streams it was decided to divide the system into two divisions, each division having a separate outlet,- the divisions to be known as Division I and Division II.

Division I includes the sewer on the central portion of (Main)First St. also the Broadway sewer and all sewers lying south. This division has its outlet in the southeastern portion of the town near a stream known as Horse Fork. This stream will serve to dilute and remove the sewage.

Division II includes the Locust St. sewer and all sewers north (except that portion on central Main St.).This division has its outlet in the central eastern portion of the twon near the above mentioned stream,-Horse Fork.

In designing the system it would have been less expensive to let the sewers follow the natural stream courses which would radiate from the central portion of the town.But owing to the increasing demands for sewage treatment and to other reasons of sanitation it was decided to design the system that whenever it becomes necessary the entire discharge of the two divisions can be concentrated at one point and there be subjected to treatment.

In making estimates the two divisions will be subdivided as follows:-

Division I

Boradway.

a East (of Fourth St.)

b West.

c Connection (on Fourth St.)

Clay Ave.

a East (of Walnut St.-Includes Central Main (First) Sewer)

b Highland Place

c West (of Walnut)

d Birch #I (Lateral.

Trunk Line.

a Walnut (South of Clay Ave.)

b Birch #2 and connection.(Lateral)

c Walnut to Elm.

d Elm (Lateral)

e Frost (Lateral)

f Elm to outlet.

Division #2.

Locust.

a East

b West

c Connection.

Maple

a West of Sixth St.

b Sixth St. and Osage St.(lateral)

c East

d Connection (on Third St.)

Seventh

a South

b North (including Railroad Ave.)

c Ingles.

Main.

a (North of Walnut St.)

Walnut.

a Prospect (west of Seventh St.)

b Seventh St. to fourth St.

c Fourth St. (lateral)

d Fourth St. to Main.

Trunk.

a Junction of Walnut and Main to outlet.

The quantity of sewage in any case depends to a large extent on the quantity of water consumed. The sewers must be designed to carry the maximum quantity which will flow at any time. To estimate this maximum quantity we will assume that the maximum rate of water consumption is fifty gallons per person per day. Also, it is assumed that in the wet season ground water will leak into the sewers at the rate of one and one-half gallons per foot per day.

In computing the number of persons served by the sewers an allowance of four families of five persons each has been made for the smaller blocks and an allowance of one family to the lot in the larger blocks which have large lots. This will give ample allowance for growth in population.

The following table gives the estimated maximum flow of sewage in the two divisions and the subdivisions:-

Data on Sewage Quantities.

Branch	NO Persons	Sewage in Gals.	Length of Branch	Gals Ground Water	Total Sewage in Gals.	Total Sewage Sin Cu.Ft.	Cu.Ft. in Minutes
Division I							
Broadway	250	12500	1770	2655	15155	2026	1.407
Clay Ave.	405	20250	5065	7597	27847	3723	2.585
Trunk Line	245	12250	5185	7777	63030	8426	5.851
Division II							
Locust	145	7250	2825	4237	11487	1536	1.066
Maple	205	10250	3810	5715	15965	2134	1.481
Seventh	105	5250	1960	2940	8190	1095	0.760
Main	30	1500	950	1425	2925	391	0.271
Walnut	180	9000	3600	5400	22590	3020	2.097
Trunk.	20	1000	1680	2520	56487	7552	5.244

By calculation a 4" sewer would serve for all laterals, but owing to danger from clogging it is thought that this would be too small. Therefore nothing less than a 6" pipe will be used.

For the two trunk lines 8" pipe will be used. This is done to allow for increase in the system, and to decrease the danger from accidents.

P R I C E L I S T.

Excavation and backfilling		@	$0.30	per cu. yd.
Glazed vitrified pipe,	6"	@	.08	
" " "	8"	@	.15	
T. & Y. Branches	6"	@	.25	
" " " "	8"	@	.65	
Curves			.30	
Increasers, 6" to 8"			.30	
Laying (hauling and cementing)	6"	@	.02	per lineal foot
" "	8"	@	.03	" " "
Manholes, 4 ft			16.00	$3.00 for each additional foot
Lampholes, for first 6 feet			6.00	.50 " "
Flushtanks, each			30.00	

Division	Branch		Sewer Pipe size	length	cost $	Excavation Backfilling cu.yds.	cost
		a East	6"	1770	159.30	1634	$490.20
	Broadway	b West	6"	1120	100.80	1236	370.80
		c Connection	6"	290	26.10	463	138.90
		Total	6"	3180	286.20	3333	999.90
		a East	6"	2000	180.00	2040	612.00
		b Highland	6"	600	54.00	519	155.70
I	Clay	c West	6"	1955	175.95	2332	699.60
		d Birch #1	6"	510	45.90	189	56.70
		Total	6"	5065	455.85	5080	1524.00
		a Walnut	8"	975	146.25	1483	444.90
		b Birch #2	6"	1190	107.10	583	174.90
		c Walnut to Elm	8"	360	54.00	320	96.00
	Trunk	d Elm (lateral)	6"	710	63.90	241	72.30
		e Frost "	6"	500	45.00	437	131.10
		f Elm to outlet	8"	1450	217.50	1404	421.20
		Total	6"	2400	216.00		
			8"	2785	417.75	4468	1340.40
	Division total-		6"	10645	958.05		
			8"	2785	417.75	12881	3864.30
		a East	6"	570	51.30	405	121.50
	Locust	b West	6"	1995	179.55	1096	328.80
		c Connection	6"	260	23.40	138	41.40
		Total	6"	2825	254.25	1639	491.70
		a West	6"	1930	173.70	1081	324.30

S U M M A R Y.

Cost of Division I	$6526.70
Cost of Division II	5628.95
Cost of System	12155.65

SPECIFICATIONS FOR SEWER

Definitions.

The word "Engineer" as used in these specifications refers to the engineer in charge of the work and also to his authorized agents.

The "party of the first part" is the City of Plattsburg,by and for whom the work herein described is being done,and the "party of the second part" is the person or persons contracting to do said work.

The word "sewer" in its general sense in these specifications refers to the sewer-barrel and to any bends,slants,branches,or other details joined to or forming a part thereof.

The word "appurtenance" refers to all manholes,flush tanks, lamp holes,inlets,and all other structures forming part of the sewerage system,but not included in the term sewer.

POSITION OF ENGINEER.

The engineer shall have the final decision on all matters of dispute involving the character of the work,the compensation to be made therefor,or any question arising under this contract. He shall,as representing the City of Plattsburg,have the option of making any changes in the line,grade,plan,form,position,dimensions or material of the work herein contemplated,either before or after the work is begun. All explanations or directions necessary for carrying out and completing satisfactorily the different descriptions of work contemplated and provided for under this contract will be given by said engineer.

DUTIES OF CONTRACTOR.

The contractor must perform the work contracted for strictly according to these specifications,and follow at all times,without

delay,all orders and instructions of the engineer in the prosecution and completion of the work and every part thereof,and constantly be on the ground or be represented by a duly qualified person to look after the work and receive instructions.

RESPONSIBILITY FOR INJURIES.

The contractor shall be responsible for all injuries to person and property inflicted during the prosecution of the work, and for all damages caused by the negligence of the contractor or any of his employees,and the city may at its discretion withhold the amount of such injury or damage from any estimate due the contractor,and the city shall not in any way be liable there for.

The contractor shall place sufficient lights on the work as directed by the engineer and shall keep them burning all night for the safety of the public.

GENERAL PROVISIONS.

The engineer shall make any change that he deems necessary in the details of these plans and if such change diminish the amount of work it shall not constitute a claim for damages by the contractor but any increase or decrease shall be paid for or deducted for strictly according to the contract price for such work.

The contractor shall begin transportation of material immediately upon and shall begin work within thirty days after signing the contract and shall employ a sufficient number of men, skilled in their various lines of work,to finish the work in the specified time. If at any time,in the judgment of the engineer, the contractor is using an insufficient number of men he may order the contractor to put more men on the work which the contractor must do.

If any person employed by the contractor on this work appears to be incompetent or disorderly he shall be discharged immediately on the requisition of the engineer and such person shall not be again employed on the work.

The contractor will be furnished a set of drawings, showing the details and dimensions necessary for carrying out the work, dimensions given in figures have precedence over the scale. A copy each of the plans and the specifications shall be kept constantly at the work by the contractor or his foreman. The plans of the sewers are to be interpreted in conjunction with and as a part of the specifications. No change shall be made in the plans without the written order or consent of the engineer.

The engineer will establish all alignments and grades and will properly mark same by suitable stakes. Should any of these stakes be moved or lost through the carelessness or negligence of the contractor or any of his employees, they shall be reset at the expense of the contractor.

METHOD OF PAYMENT.

The engineer, within the first five days of each month during construction, shall make an estimate of the work completed during the preceding month, according to these specifications, and eighty five per cent (85%) of the amount due beyond the reservation herein made will be paid to the contractor on or before the fifteenth day of each month for the work of the preceding month.

The price bid for sewers or drains shall include furnishing all material and labor for excavating, constructing sewer or drain shoring, back filling and restoring street surface to original condition.

Branches shall be paid for by the piece at the price bid which shall include cost of furnishing and fitting necessary plugs for said branches.

The price bid for flush tanks,catch basins,inlets,man holes and lamp holes shall include the tanks,catch basins,inlets,manholes and lamp holes complete as shown in plans and specifications and shall include excavation,back filling and all appurtenances.

Manholes and lampholes shall be paid for on a basis of a depth of eight feet,with an additional amount for each foot by which the depth exceeds eight feet.

All iron work shall be paid for by the pound except that no payment for ironwork as such will be made for the heads,steps and other devices of manholes and other appurtenances.

The price bid for timber in foundations shall include furnishing and setting of the same.

On the completion of the work the engineer shall proceed to make final estimates and measurements of the same and shall certify the same to the city who shall,except for causes herein specified, pay to the contractor on or before the fifteenth day after completion of said contract all money which shall be found due him.

MEASUREMENTS.

Measurements of sewers and drains shall be made from the center of the uppermost flush tank or manhole on each line to the center of the manhole at its junction with a main or lateral,including all branches,manholes or other appurtenances along the line. The depth by which the sewer prices will be graded will be measured from the surface of the ground to the under side of the sewer pipe or masonry or the timber platforms. Measurements of connections shall be made from the bell end of the branch to the upper end of the connection pipe.

The depth of flushtanks,manholes,and lamp holes shall be measured from the invert of pipe sewers to the top of the iron head.

IMPERFECT WORK.

When any work or material is found to be imperfect,whether passed upon or not by the inspector,the said work shall be taken up and replaced by new work at any time prior to final acceptance, the contractor to be allowed nothing extra for such replacement.

UNNECESSARY DELAYS.

In case of any unnecessary delay,in the opinion of the engineer,he may notify the contractor in writing to that effect.If the contractor should not within one week thereafter,take such measures as will,in the judgment of the engineer,insure the satisfactory completion of the work,the engineer may then under authority from the city,notify the contractor to discontinue all work under this contract and it is hereby agreed that the contractor will immediately respect such notice and cease work. The engineer shall then have the power to continue the work by contract or otherwise,and to purchase material for the completion of the same,-the expense of labor and materials to be paid for by the city from such money as may be due or may become due to the contractor;and in case such expense is less than the sum payable under this contract if the same had been completed by the contractor,he shall receive the difference and if such expense is greater the contractor shall pay the amount of such excess.

EXTRA WORK.

If any extra work should need to be done the contractor shall do such work under the direction of the engineer and shall receive therefor the actual cost of labor and material used plus 10% for superintendance and use of tools,but he shall not be entitled to payment for extra work unless ordered in writing by the engineer to do the same as such. No claim for extra work will be allowed unless made before the payment of the next following monthly estimate.

MATERIALS.

Sewer Pipe :-

All pipes and specials unless otherwise specified shall be of the best quality,salt glazed,vitrified clay sewer-pipe of the hub-and-spigot pattern;both body and bell shall be of standard thickness. Each hub shall be of sufficient diameter to receive,to its full depth,the spigot end of the next pipe,or special without any chipping whatever of either,and must leave a space of not less than 1/2 inch all around for the cement mortar joint;it shall also have a depth of at least two inches greater than the thickness of the pipe on which it is molded. Straight and curved pipe shall be furnished in three foot lengths. Branches may be in two foot lengths. All pipe shall be sound and well burned,well glazed and smooth on the inside and free from broken blisters,lumps,and flakes. No pipe having unbroken blisters more than 1/4 inches high shall be used. Pipes or specials having fire checks or any other cracks extending through the thickness shall be rejected.

No pipe designed to be straight shall deviate materially from a straight line:nor shall there be a variation of more than 1/2 inch between any two diameters of a pipe.

No pipe shall be used which has a piece broken from the bell end if the fracture extends into the body of the pipe;nor which has a piece broken from the spigot end greater than one inch in depth or more than three inches long. Any pipe or special which betrays a want of thorough vitrification or fusion,or the use of improper materials in its manufacture shall be rejected.

Drain Pipe:- Pipe for subdrains shall be composed of the best quality of drain-tile of circular cross-section in two foot lengths. They shall be hard-burned and without cracks or any considerable deviation from their designed shape,size,or cross-section.

Brick:- For all brick work none but the best of sound,hard burned, perfect-shaped bricks shall be used. After being thoroughly dried and immersed in water for twenty-four hours they shall not absorb more than ten percent by weight of water.

Masonry:- All stone used shall be of sound and durable quality,free from cracks and having bedding planes approximately parallel. No stone shall be less than four inches thick,seven inches wide and one foot long.

Iron;- All iron castings shall be made from a superior quality of gray iron,remelted in the cupola or air furnace and shall possess a tensile strength of not less than 20,000 pounds per square inch. All castings shall conform to the shape and dimensions shown upon the drawings and shall be clean and perfect without blow-or sand-holes or defects of any kind. No plugging of holes will be allowed. The castings are to be thoroughly cleaned of all lumps and subjected to careful hammer tests,after which they are to be dipped in a bath of coal-tar pitch heated to at least two hundred degrees Fahrenheit.

Wrought iron must be tough,ductile and of a uniform quality, free from crystalline structure,cinders,flaws,or cracks. It must have an ultimate strength in tension of at least fifty thousand pounds per square inch. Iron which has been burnt in the forge will be rejected. Each wrought iron piece furnished must correspond in all respects to dimensions specified.

Sand:- All sand must be clean and free from all loam,clay,or vegetable matter. It shall not be exceedingly fine nor exceedingly coarse.

Cement:- All cement used shall be Portland cement of a brand equally as good as the Atlas and shall,when tested neat in briquettes (American Society of Civil Engineers Standard) show a tensile strength of at least four hundred pounds after one day in air and six days in water. The cement mixed neat shall develop,

initial set in not less than thirty minutes and final set in not less than one hour after mixing.

The engineer shall be allowed to test all cement and notice of its receipt by the contractor must be made to the engineer at least forty eight hours before its use in the work. Any cement not satisfactory to the engineer shall be at once removed from the work.

Packing:- Packing must consist of flax, jute, oakum, or hemp clean and with long fibres loosely twisted into strands.

Timber:- All timber used in platforms, cradles or foundations shall be of spruce or timber equally as good, straight, sound, free from sap, shakes, worm holes, large, loose, or decayed knots or other imperfections which may impair its strength or durability. Piles shall be of sound, straight, live timber, of lengths specified by the engineer. They shall be not less than six inches in diameter at the smaller end and the bark shall be removed in all cases.

Concrete:- All concrete shall be one part by bulk Portland cement, three parts sand and six parts broken stone or gravel. The cement shall be measured compact as received and the broken stone be measured for every batch of concrete mixed. The gravel or broken stone must be of such a size as to pass through a two inch ring. In mixing the cement and sand shall be thoroughly mixed dry until the whole is of an even, uniform color, when sufficient water shall be added to form a thick paste. The stone which has previously been thoroughly wet shall then be added and the whole quickly mixed until every stone is coated with mortar, water being gradually added if necessary, to obtain a better consistency. Concrete must not be mixed in quantities greater than required for immediate use, and any which has begun to set shall not be retempered or used in any way. Concrete shall be deposited in layers not to exceed ten inches in thickness and each layer rammed till water flushes to the surface.

When fresh concrete is to be placed in contact with that already set all loose stone or concrete not thoroughly compacted shall be removed from the surface of the latter, which shall be washed clean and thoroughly wet. When the concrete is in place all walking or working on it must be prevented until it is firmly set.

Such forms and centres as may be necessary for placing the concrete shall be furnished by the contractor without extra charge. These forms shall not be withdrawn until the concrete is set to the satisfaction of the engineer. No concrete shall be made or used in freezing weather, without the permission of the engineer, whose instructions for such use shall be followed.

EXCAVATION.

Classification of Materials:- All material excavated shall be classified as either earth or rock. No material shall be classified as rock which cannot be removed more cheaply by drilling and blasting than by picking, except that any boulders measuring one half cubic yard or more shall be so classified.

Excavation of Trench:- The trench shall be excavated to the depth necessary for laying the sewer or sub-drain at the grade given by the engineer. It shall be one foot wider at the bottom than the outside diameter of the pipe without any undercutting of the banks. Where, in the opinion of the engineer, the original earth is sufficiently solid for the foundation of the work the contractor shall excavate the bottom of the trench to conform to the outside of the sewer pipe and the bottom of the trench under each bell shall be hollowed out so as to permit of making the joint. In case a trench be excavated at any place, except at joints, below the proper grade it shall be refilled to grade with sand well rammed and without extra compensation.

The material excavated shall be laid compactly on the side of the trench so as to interfere as little as possible with travel. The engineer shall have the right to limit the amount of trench which shall be excavated in advance of the completed sewer,and also the amount of trench left unfilled.

Pumping and Bailing:- The contractor shall furnish all necessary machinery to pump,bail,or otherwise remove any water which may accumulate in the trenches and shall keep them clear of water while foundations are being constructed or the sewer laid. In no case shall water be allowed to run through the sewer until cement is satisfactorily hardened. The disposal of water after removed shall be satisfactory to the engineer.

Shoring and Sheating.:- Whenever necessary, the sides of the trench shall be braced and rendered secure and sheathed to the satisfaction of the engineer;such sheathing and bracing to be left in the trench until it is refilled,all such bracing and sheathing being done at the contractors expense. Sheathing left in permanently by the order of the engineer and only such shall be paid for at the price bid. When left in the trench sheathing shall be cut off at about a foot below the surface. The contractor shall,at his own expense,shore up and otherwise protect any buildings which may,in the opinion of the engineer,be endangered by the work.

Railway Crossings:- When any railways are to be crossed specific directions as to time and manner of doing this work will be given by the engineer and the contractor shall conform to such directions. He shall be allowed for material furnished and made part of permanent construction,so far as it may be additional to that indicated on the plan,but all other work shall be done at his own cost.

At All street crossings and other points as may be directed by the engineer the trenches shall be securely bridged to prevent any

serious interruption of travel. The cost of all such work must be included in the regular price bid for the sewer.

The contractor shall at his own expense provide for all water-courses and drains interrupted by the work, and replace them in as good condition as he found them.

Rock Trenches:- When the excavation for a sewer or drain is made through rock the trench shall be excavated at least four inches deeper than the grade of the outside bottom of the pipe and re-filled to grade with sand or loam thoroughly rammed. When rock is encountered in the trench it shall be stripped of earth and the engineer notified and given proper time to measure the same before blasting. All rock removed which has not been measured by the engineer will not be classified as rock excavation. Measurements for rock excavation will be limited to six inches on each side of the sewer, and side slopes of one horizontal to ten vertical. In all cases of blasting the blast shall be covered with heavy timbers chained together. No blasting shall be done within forty feet of the finished sewer, and the end of the finished sewer shall be stopped with plank or earth during each blast.

CONSTRUCTION.

Foundations:- When timber or pile foundations are necessary, in the opinion of the engineer special designs will be furnished the contractor who shall place such foundations in position satisfactory to the engineer. If cradles or platforms are laid directly upon the ground this must be graded even and smooth to receive them. If cap or sills are used the spaces between them and under the planking must be filled with earth well rammed.

Where piles are used they shall be driven to refusal. After driving, the piles must be sawed off truly at the proper elevation for receiving the caps, which shall be fastened to them with one inch drift bolts driven into holes bored with a seven-eighths

inch bit.

Concrete or masonry foundations shall be constructed where ordered according to the specifications for "concrete" and "stone masonry".

Stone and Brick Masonry:- All masonry shall be laid with mortar composed of one part by bulk of Portland Cement and two parts of sand mixed as specified for concrete mortar. No mortar shall be retempered or used in any way after it has partially set.

All stone shall be laid on their natural beds,breaking joints at least six inches and with one header for every three stretchers. No stone once bedded shall be lifted by spalling,but any spalls used must be embedded in the mortar before setting the stone. Each stone shall be floated to place in a full bed of mortar and every joint thoroughly filled with the same. No dressing of stone upon the wall will be allowed.

For brick masonry in manholes,flush tanks,etc. half bricks may be used not to exceed one fourth of the whole number of bricks. Unless the engineer direct otherwise each brick shall be throughly wetted just before being laid. It shall be laid with full joints of mortar and in no case must mortar be slushed in afterwards. Where pipe connections enter a manhole or flush tank "bull's eyes" shall be constructed by laying rowlock courses of brick around them,the cost of such construction being included in the regular price bid for the appurtenance. All brick work shall be thoroughly bonded,adjacent courses breaking joints at least one sixth of the exposed length of the brick.

Laying Pipe Sewers:- All pipe not meeting the specifications for sewer pipe shall be rejected and either destroyed or removed from the work except that pipe that may be suitable for sub-drains may be used for that purpose.

No pipe shall be laid except in the presence of the engineer or his authorized representative,and the engineer may order the removal of any pipe so laid. No sewers shall be laid within ten feet of the excavating or forty feet of the blasting.

The pipe shall be so laid in the trenches that after completion the sewer invert shall conform accurately to the grade and alignment fixed by the engineer. All adjustment to line and grade of pipe laid directly on the bottom must be done by scraping away or filling in earth under the body of the pipe,and not by blocking up. Before laying, the interior of the bell shall be carefully wiped clean and the annular space shall be free from dirt,stones,or water. A narrow gasket or packing dipped in cement grount,shall be calked into each joint,after which cement mortar shall be introduced therein. The gasket shall be of a thickness sufficient to bring the bottom of the pipe to the same level. Special care must be taken to properly fill with the mortar the annular space at the bottom and sides as well as the top of the joints. The cement shall be compacted in the annular space by a calking tool or by the fingers and a neat finish shall be given the joint by application of mortar to the face of the hub so as to form a bevelled surface from the exterior of the hub to the exterior of the spigot all around. All water must be kept out of the bell hole during laying or else such bell hole must be completely filled with concrete for which no extra compensation will be allowed. The interior of the joint shall be wiped clean by a wad made of a sack filled with hay,large enough to tightly fill the pipe and attached to a cord,and which shall be kept at all times in the sewer and pulled ahead past each joint as soon as it is cemented. The mortar used shall be composed of neat cement wet to a thick paste.

As soon as the cementing of a joint is completed the bellhole under the hub must be carefully and compactly filled with sand or loam. Refilling shall also be made with material,free from stones, carried half way up the sides of the pipe and compacted with a proper tamping tool. The trench shall be filled to two feet above the top of the pipe with material containing no stone larger than two inches in any dimension.

At such places as will be directed by the engineer,branches will be inserted in the sewer for future connections. Each branch thus inserted shall be closed by a thin vitrified stoneware plug which shall be so cemented in as to prevent any water entering the sewer through such branches. The entire cost of such covers shall be included in the price bid for branches. Where directed by the engineer deep cut connections shall be constructed as shown upon the plans.

Before leaving the work at any time the end of the sewer shall be securely closed by a tight fitting plug.

Laying Sub-drains:- Sub-drains shall be laid when directed by the Engineer in sub-trenches excavated of the dimensions and depth necessary to lay the pipe at the grade given by the engineer. This sub-trench shall be filled with clean broken stone or gravel, up to the drain invert;This broken stone compacted so that there may be no future settlement. On this the drain-pipe shall be laid accurately to grade. The pipes shall be separated by a space about one fourth inch.

The space between the pipes and the sides of the sub-trench shall be then filled with broken stone or gravel,compacted,which material shall be placed to a depth of six inches above the pipe. Where directed by the engineer this stone filling shall be covered by plank,to be paid for as "timber in foundations." If any earth or other material shall fall into the sub-trench while the stone filling is proceeding,such material and the adjacent stone-fill-

ing shall be removed and clean stone be put in its place.

Where directed by the engineer branches shall be inserted in the drain for future connections. These shall be closed as specified for sewer branches.

Appurtenances:- Manholes, lamp holes, flush tanks, inlets, and other appurtenances shall be built where the engineer may direct, and in all respects in accordance with the plans, except that manholes with a greater depth than twelve feet shall have walls one foot thick below that depth. Great care shall be taken to make the channels in manholes and lamp holes conform accurately to the sewer grade as given by the engineer. In the case of pipe sewers, split pipe shall be used for the inverts to these channels where possible. Where a curve in the channel prevents this the channel shall be formed of brick set on edge, in Portland cement mortar and lined with mortar one fourth inch thick. The inverts shall be semi-circular and of the diameter of the pipes connected, or if the pipes be of different diameters the channel shall taper uniformly from one size to the other.

Flush-tanks and inlets shall be plastered on the outside with one inch of mortar; and on the inside shall be given three coats of thin, neat Portland cement grout applied with a brush, each coat being allowed to set before the next is added.

All manholes and flush-tanks shall be fitted with steps similar to those shown in the plans and spaced eighteen inches apart vertically. All tops or other fittings shall be set during the construction or on the completion of each appurtenance.

Such appurtenance shall be constructed as soon as possible after it is reached in the construction.

BACK FILLING AND CLEANING UP.

Back-filling:- In back filling sewer trenches loose, fine earth, free from stones shall be used up to a point two feet above the sewer and shall be thoroughly compacted in sixteen inch layers

by hand ramming,there being two rammers to each shoveller.Rammers for this purpose shall weigh from four to six pounds each and shall have not to exceed ten square inches of face. The remainder of the trench shall contain not more than one third broken stone and no piece of this shall weight more than fifty pounds.

The filling of the trenches above the level of two feet above the sewer shall be filled loosely by hand up to the surface,or when directed by the engineer the filling shall be rammed in ten inches layers. Hand ramming shall be paid for at the price bid. All back-filling shall be done by hand and in no case shall a scraper or plow be used.

Street Surface. In all streets the surfaces of the trenches shall be filled without needless delay and with the same material as that which was removed from the surface in excavating the trench. The street surface shall be left in every respect,in as good condition as it was before excavation and shall be subject to the approval of the engineer.

Cleaning Up:- As soon as the trenches have been refilled and the street surface restored,all refuse of any kind deposited by the contractor on the street shall be removed and said streets left in all respects as they were before excavation began. All surplus earth left after refilling the trenches shall be removed at the contractor's expense.

FINAL INSPECTION.

Upon notification by the contractor of the completion of the work herein contracted for the engineer will carefully inspect all sewers,appurtenances,and other work performed by the contractor.

In each stretch of sewer designed to be straight, light shall be visible from one end to the other. Any broken or cracked pipe shall be replaced with sound ones. Any deposits,cement,or packing found

in the sewer shall be removed and the sewer bore left clean and smooth throughout its entire length. There shall be no appreciable leakage in the sewer. The under drains shall discharge water freely. All appurtenances shall be of specified size, shape and form, of a neat appearance and their tops set accurately to grade.

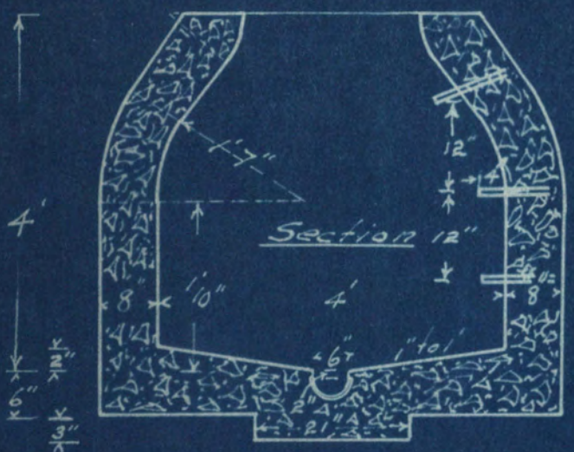
In general the work shall comply with these specifications and if found not to do so in any respect shall be brought to the proper condition at the contractor's expense.

Index.

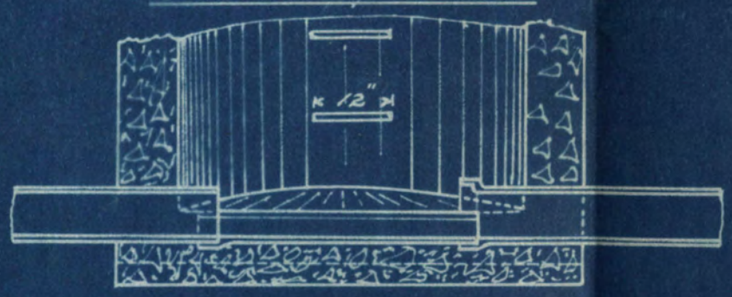
STANDARD
FOUR-FOOT MANHOLE.

Scale:- 1" = 2'

Plan



Section
on line of Sewer.



Note:- Estimated cost of
4' manhole = $16.00
Each additional foot = $3.00

STANDARD PLANS
FOR
SEWER SYSTEM
FOR
PLATTSBURG MO.

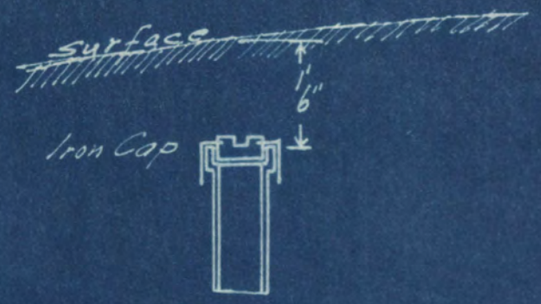
M.S.M. Rolla. Mo.

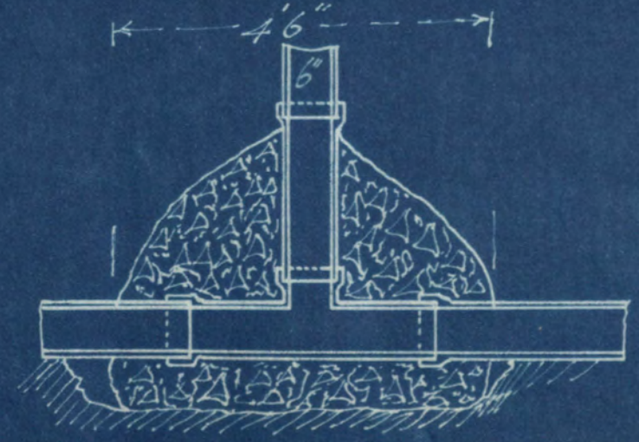
C.E. Class '07.
E.E. Cook.
W.C. Perkins.

STANDARD
LAMP-HOLE.

Scale:- 1" = 2"

Note:- Estimated cost of 6 ft. lamp hole is $6.00 and $0.50 extra for each additional foot.





WEST CLAY AVENUE

OAK ST. SEWER

WILBER ST.

BIRCH AVE.

WALNUT STREET

ELEV 1000 990 980 970 960

CLAY AVE.

ALLEY ST.

WALNUT

FROST ST.

STREET

ELM ST.

MAIN ST.

1.0% 0.5% 0.5% 0.5%

CLAY AVE.

ALLEY ST.

FROST ST.

WALNUT

STREET

ELM ST.

MAIN ST.

1.0% 1.0% 1.0% 1.0%

CLAY AVE.

WEST ALLEY

FROST ST.

BIRCH AVENUE

WALNUT ST.

1.0% 0.5% 5.2% 1.19% 1.0% 2.1%

To Outlet

CLAY AVE.

SEVENTH

WEST ALLEY

WEST ALLEY

1.0%

PROFILES OF SEWER SYSTEM FOR PLATTSBURG, MO.

Domestic Sewers.

Division No. 1 Sheet No. 1.

E. E. Cook

W. C. Perkins.

○ Lamphole
⊗ Manhole
◎ Flushtank

PUBLISHED BY KEUFFEL & ESSER Co. NEW YORK

Distances in 100 feet Stations

WEST BROADWAY

WEST BROADWAY SEWER

2.5 % 0.5 %

CLAY AVE. SEWER

BROADWAY and CLAY

EAST BROADWAY SEWER

MAIN STREET

1.124 % 1.124 %

EAST CLAY AVE SEWER

MAIN STREET SEWER

0.75 % 0.75 % 1.43 %

ELM STREET SEWER.

FROST STREET SEWER

3.25 % 2.67 % 1 %

ELEV. 1000 990 980

PUBLISHED BY KEUFFEL & ESSER Co NEW YORK.

STANDARD "CROSS SECTION

PROFILES OF SEWER SYSTEM FOR PLATTSBURG, MO.

Domestic Sewers.

Division No. 1 Sheet No. 2

○ Lamphole
⊗ Manhole
◎ Flushtank

E.E. Cook
W.C. Perkins

PROSPECT ADDITION

SOUTH STREET

Q.O.&G. R.R.

MAIN ST.

NORTH ALLEY

WALNUT STREET

SIXTH ST.

SEWER

ELEV.

1010

1000

990

980

970

960

950

940

930

920

1.94%

1.4%

2.9%

WALNUT STREET

MAIN ST.

3.68%

1.0%

3.0%

1.84%

CEDAR ST.

OSAGE ST.

EAST ST.

BLUFF ST.

MAPLE ST.

LOCUST ST.

2.0%

1.55%

Outlet

WALNUT ST.

FOURTH ST.

3.0%

PROFILES OF SEWER SYSTEM FOR PLATTSBURG, MO.

Domestic Sewers.

Division No II Sheet No 3.

○ Lamphole

⊗ Manhole

◎ Flushtank

E.E. Cook.
W.C. Perkins.

PROFILES OF SEWER SYSTEM FOR PLATTSBURG, MO.

Domestic Sewers.

Division No II. Sheet No 4.

○ Lamphole
⊗ Manhole
◎ Flushtank

E.E. Cook
W.C. Perkins

STANDARD "C" CROSS SECTION

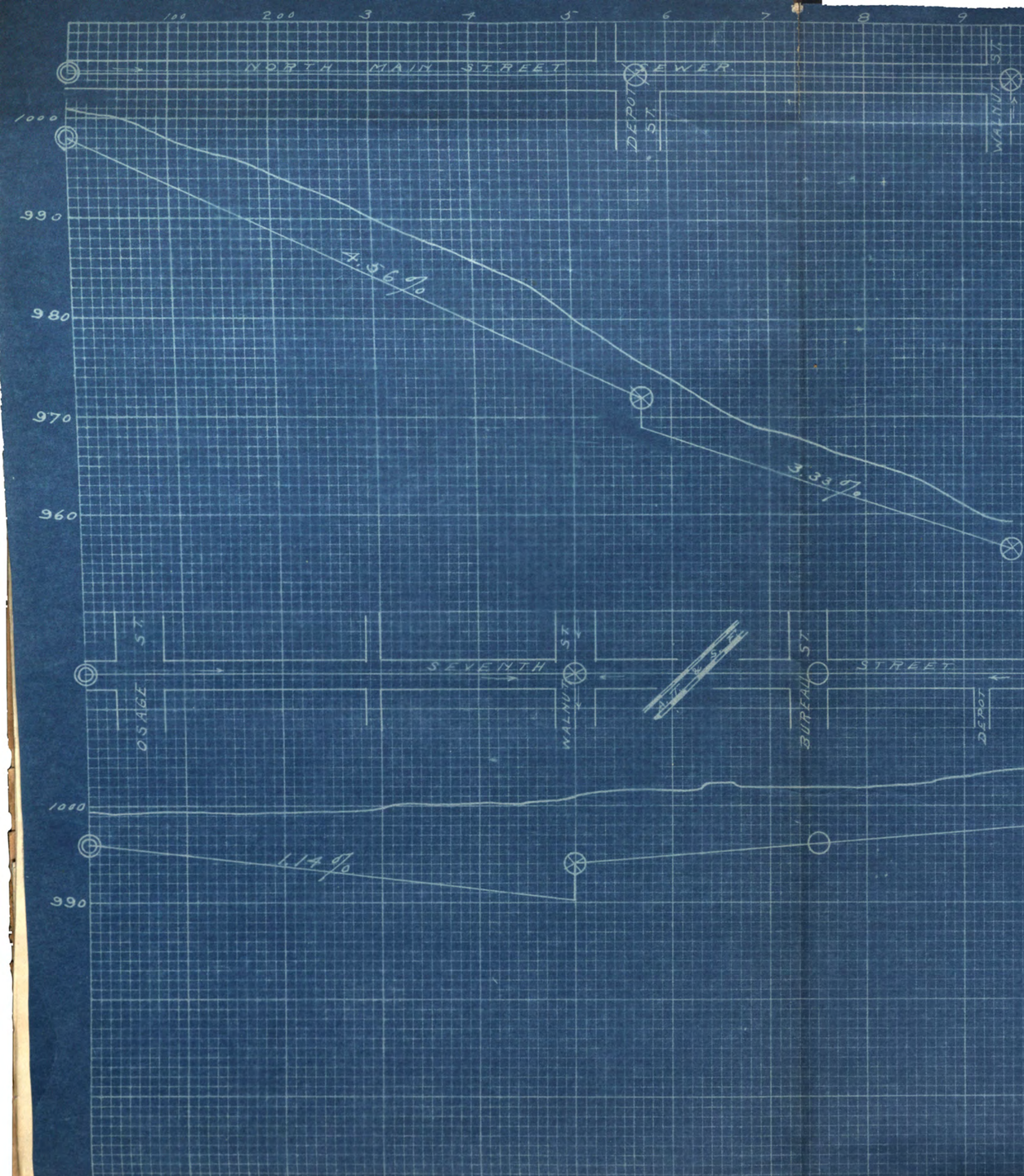
PROFILES OF SEWER SYSTEM FOR PLATTSBURG, MO.

Domestic Sewers

Division No. II. Sheet No. 5.

○ Lamphole
⊗ Manhole
◎ Flushtank

E.E. Cook
W.C. Perkins



MAP OF PLATTSBURG CLINTON - CO., MO.

SHOWING

SEWER SYSTEM

○ Lamp-hole.
⊗ Manhole
◎ Flushtank
Scale:- 1" = 200'
— 6" pipe
— 8" pipe

Missouri School of Mines
Rolla, Mo.
C.E. class '07.
E.E. Cook.
W.C. Perkins.

N

Sec. 14 Sec. 13
Sec. 23 Sec. 24

T. — 55 — N.

Sec. 23 Sec. 24

R. — 32 — W.