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A survey of a sanitary sewer system with findings and recommendations

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Thesis

A SURVEY OF A SANITARY SEWER SYSTEM WITH FINDINGS AND RECOMMENDATIONS

by

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A

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At the time of the writers introduction to the problems of maintaining, coordinating and extending the sanitary sewer system at Hannibal, Mo., the problems presented were practically identical with those of any other small city whose incorporation dates back 60 to 75 years. By that I mean that generally speaking such cities will show the real old portions, which were the first to be built up, served by a nondescript sewer system--something which was a growth rather than a plan, while the newer portion will show modern and planned systems. Such a condition existed in this city at the time of this survey.

In the older portion of the city, which is now the business district, several cases were found where privately built sewer lines had been connected to and extended until private ownership was lost and the sewers became part of the city system.

On the other hand however, the city in the years of 1910-13 planned and built a 30" interceptor and outfall sewer from the Mississippi River on the east to the extreme southwest portion of the city to act as an interceptor for district sewers and to carry the sewage to the Mississippi River, its out fall. This sewer provided the outfall for the entire west portion of the city and many intervening districts and today carries the larger portion of the city sewage.

The period from 1913-1924 showed a substantial growth of the city and some expansion of its limits. These years which included the war period had also seen a general rise in living

conditions and standards. This betterment in living conditions plus a general increase in the financial status of the public, eventually brought about a demand for sanitary sewer service which was preceeded by this survey.

The object of the survey was:

1. To determine existing evils in the present system and make recommendations for their correction.

2. To create new sewer districts of the unsewered portions of the city and submit tenative estimates of quantities and costs.

The survey was conducted along the general lines of any sewer survey. The present sewer system being examined to determine if it satisfactorily served its own sewer districts, the trunk lines sewers being examined to see if their capacity would allow for further district connections and the unsewered districts examined and grouped into sewer districts and tenative estimates of cost prepared.

An examination of the existing sewer system was the first phase of the survey, it being the desire of the city to put the present system in good condition before proceeding with new districts. These findings can be stated in few words but much time and effort was put forth to gather data that would lead to definite conclusions and recommendations.

FINDINGS.

(a) The survey revealed that the main business district was being served by a privately built sewer which had been taken over by the city--and from time to time extended. The orginal sewer had been built at an elevation too high to serve even an ordinary basement and recently constructed buildings with eight and nine foot basements and subcellars were many feet below the sewer flow line. Nearly without exception pumps were being used in basements to lift basement water and sewage to the sewer level. This sewer was also inadequate as to size.

(b) It was found that the 30" sewer built in 1910-13 was ample not only to care for all sewage then empting into it, but also to accomodate several districts which had no sewer systems and which were to be sewered. The outfall of the sewer however, which had originally been built out into the Mississippi River was found to have been washed away so that the sewage was really empting into Bear Creek 200 yards west of the river bank. In hot weather when Bear Creek was dry this creek because of the disrupted outfall, became an open sewer and besides the health angle was accountable for obnoxious odors.

(c) The west part of the city was found to be served by an excellent sewer system, well planned and ample to take care of all future sewer requirements--but that nearly without exception all down spout and surface water was being allowed to run into it, which in wet weather overtaxed its capacity and

caused water to back up into cellars. It was also found that this district whose outfall was thru a 15" pipe emptied into a 12" sewer in an adjoining district. The supposition before the survey being that the sewers in this district were too small to accomodate the district.

(d) In the southwest portion of the city two lateral sewers were examined which were extremely sluggish and were causing much inconvenience to property owners and expense to the city. These were found to be small diameter pipes laid practically flat, and because of this and the length of the pipe laid on a ∓0.0 grade, there was insufficient velocity of sewage water to carry the solid matter and it was being deposited.

(e) The remainder of the sewer system was found to be serviceable but either taxed to capicity or overloaded during storm periods which tended to show that down spouts and surface drains were undoubtedly connected.

RECOMMENDATIONS

(a) In the case of the sewer serving the business district and known and designated as the Broadway sewer it was found that it would be impractical to use any part of the old sewer because of its shallow depth and uneconomical to attempt to salvage on account of the cost. Then too, some few users who were being served satisfactorily would not have to go to the expense of connecting to a new sewer if the old sewer was left in place. It was therefore recommended that an

entirely new line be built and designed to allow a minimum drop of 2 feet between the basement levels and the sewer invert. Under ordinary conditions serious consideration would have been given to recommending a double line of sewers, one on each side of the street and adjacent to the curbs as Broadway is a street 100 foot wide with 70 foot of paved roadway and with a street car track in the center. This paving however, was merely a two course brick pavement laid on the original macadam street, hence the cost of crosscutting it and relaying it was very nominal. Then too,this street was being considered as a new paving project so a single line was recommended to be built on the south side of the street. This sewer was designed and built in 1925.

(b) The 30" trunk line sewer known as the Collier Street sewer was found to be partially filled with sand and gravel--due to the fact that surface water had been allowed to enter the sanitary system in a number of districts, and had washed it down to this sewer. It was recommended that this sewer be cleaned in designated portions where the accumulation was the worst. It was also recommended that the outfall of this 30" sewer, which had been washed away, be replaced and extended into the Mississippi River and a substantial concrete bulkhead be built to prevent future washing.

(c) An ordinance restraining property owners from running

down spouts into the sewer which was on the ordinance book but not enforced was called to the attention of the people by newspaper advertisement and 30 days notice given for all property owners to disconnect downspouts which were connected to the sewers. After 30 days a house to house canvass of inspection was made to see that this ordinance was complied with.

The street department was also instructed and immediately began taking all surface drain connections out of the sanitary sewer. As Hannibal has no storm sewer system, this necessitated in many places changes in pavement grades and the building of numerous new surface drains and small storm sewers. The removal was however eventually accomplished.

At the outfall end of the sewer where the sewer was bottlenecked by having a 15" pipe flow into a 12" sewer, an additional overflow line of 12" pipe paralleling the one in place was recommended.

The entire system was then cleaned of sand and gravel with the result that later when tests were run at hours of peak load it showed the sewer to not run more than 50% capacity and all flooding of basements ended.

(d) In the southwest portion of the city, the two lateral sewers which had always given trouble were remedied by the installation of flush tanks timed for 6 hour discharge. The head created by this discharge cleared these laterals perfectly and no more trouble was had.

(e) The remainder of the system was helped generally by the removal of down spouts and surface drains. It was recommended that several additional man holes for clean out purposes be built in long stretches of line where none existed. It was also recommended that the system be given a general cleaning by flushing out with a fire hose and sand and gravel being removed at each man hole.

NEW DISTRICTS

That portion of the City of Hannibal that was unsewered at the time of this survey was an area which lies south of Bear Creek and is known as the south side. It comprises quite a large area and is quite rugged, with high hills and large valleys. The general fall of the land is toward Bear Creek, however, the east portion also drains toward the Mississippi River.

Because of the topography of the land the grouping of this unsewered portion of the city into a number of separate sewer districts was seemingly the only adequate plan. Since the natural drain was toward Bear Creek, the natural solution was the building of a trunk line sewer along the south Bank of Bear Creek with separate submains extending south to care for each district. This plan would have called for the construction of approximatly 8100 feet of intercepting sewer varying in size from 12 to 21 inches and would have cost

quite an appreciable amount of money.

Further examination showed however, that there was a large intervening territory in between the east and west ends of this interceptor sewer which was very rugged and not built up. In view of this fact and also that the 30" Collier Street sewer laid on the north side of Bear Creek and was of ample size to accomodate the west portion of this unsewered district, and also that the east portion of this unsewered district abutted on the Mississippi river, which furnished an outfall, it was decided that the expense of the interceptor sewer was not warranted. It was, therefore decided to divide this section into 3 Main districts according to topography.

This matter of creating sewer districts preliminiary to the building of sewers was necessitated by the fact that all sewers built were to be paid for by tax bills issued against all property within the designated sewer district. By this method, which is provided for under the laws of the State of Missouri, the total cost of the sewer system within the sewer district is divided by the total area in square feet of the sewer district, streets and alleys excepted, and the price per square foot arrived at. This figure multiplied by the area in square feet of any lot or parcel of land gives the assessment against any lot or parcel of land.

The three sewer districts created were designated as the south side sewer, the Ely street sewer and the Elza Addition sewer.

The Ely Street sewer district was comparatively small comprising approximately 567,000 square feet of assessable area. It presented no complications in design at all. As stated before, this district lies south of Bear Creek and the 30" Collier street sewer lies on the North side of Bear Creek. It so happened that the Collier street sewer was particularly deep at a point opposite the place chosen for the outfall of the Ely street sewer and a gravity flow was obtained into the Collier street sewer, the crossing being under the bed of the creek.

The Elza Addition sewer district was comprised of an approximate assessable area of 2,066,000 square feet. It presented no problems in design except for the outfall of the sewer. This district also lies south of Bear Creek and the natural outfall for the district was to empty the sewage into the 30" Collier street sewer, which was on the North side of Bear Creek, but was too high for a gravity flow from this district. It was found that the sewage from this district could be collected at a point on the south side of Bear Creek and at a level approximately 2 feet lower than the invert of the 30" Collier street sewer. It was suggested that the most economical way of handling from there was by pumping thru a short force main to the north side of Bear Creek and then flow by gravity into the 30" Collier street sewer. This recommendation was later substantiated by a consulting engineer who made a more detailed survey.

The south side sewer district was the largest of the 3 reported on. It compris d an assessable area of approximately 5,855,000 square feet. It also lies south of Bear Creek but since it extended west from the Mississippi River it was logical to build a separate outfall sewer to the river rather than try to connect up to the 30" Collier street sewer.

There were several points in connection with the general design of the sewer system in this district that were unusual. The topography and street layout was such that a duplication of sewer lines was frequently necessary, since in several locations the low side of the street was so much lower than the high side that it was impractical to serve both sides with the same sewer and was found to be more economical to build additional lines to serve the low side of the street.

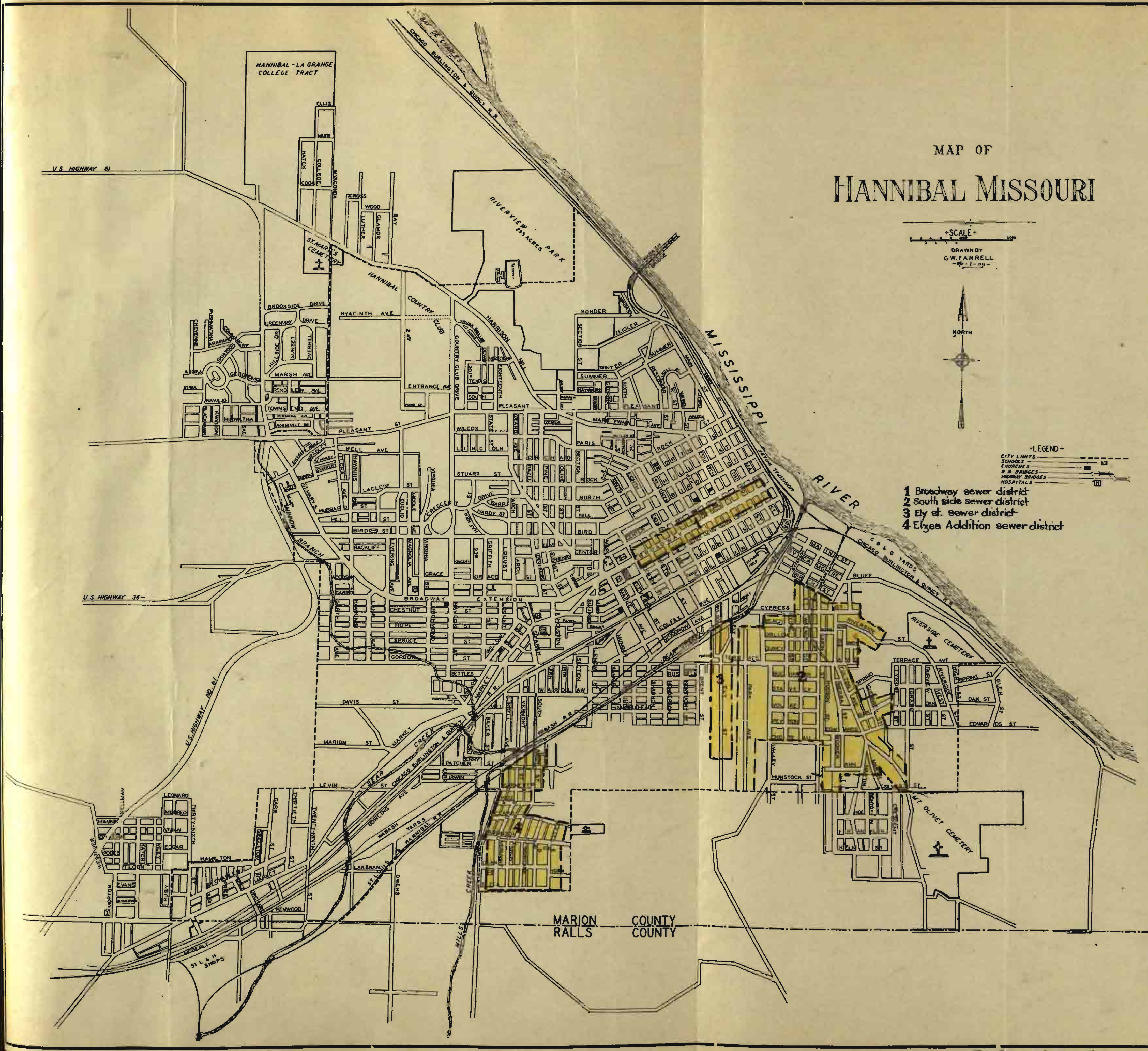
New paving on another street raised the question of the relative economy of a single sewer with a tunnel under the pavement for each connection, and of a double sewer with no interference with the paving. It was recommended that the double line be built, a line in the parking on each side of the street. In the writers opinion the final cost to property owners would be less since with this construction there would be shorter sewer connections and no pavement repairs.

Tax bill payment for public improvements at the best usually runs up the cost of any project as most contractors are forced to discount these bills substantially in order to

sell them. It is an especially expensive way of building sewers. Within a sewer district all property good and bad is assessed equally pro rata--and all good property bears the brunt of paying for bad property assessed and which the contractors is liable to get in lieu of payment.

Tenative estimates were offered on each of these 3 districts as set out here, but in making these up, as high as 15% additional had to be added to care for bad property and tax bill discount.

The larger of these 3 districts as reported on here, namely the south side district, was built in 1926-27. The Ely street sewer and the Elza Addition sewer have never been built.



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