

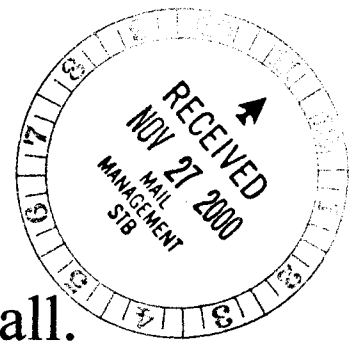
November 14, 2000

Office of the Secretary
Case Control Unit
STB Finance Docket No. 33407
Surface Transportation Board
1925 K Street NW
Washington, D.C. 20423-0001
Attn: Victoria Rutson

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NOV 27 2000

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The Mankato Flood Wall. Possible Implications of Hydrostatic Pressure and Vibration from Intensive Rail Traffic

Much has been said about the issues of vibration, noise and dirt upon the quality of life and property as related to the possible expansion of rail service through Mankato. There is an even more insidious and threatening concern to not only issues of environmental quality and property values but to life, health, and public welfare as well as private & public investment in the community. The flood wall which protects a significant component of the community's investment in commercial, residential, institutional and transportation land uses could potentially fail in its role should the D.M.&E proposal for upgrading the alignment through Mankato on what is known as Alternative M-3 be adopted.

Alternative M-3 has the potential to impact two flood control projects. The first at LeHillier Mn. is an earthen levee located immediately adjacent to the existing Union Pacific rail line, with the levee being on the river side of the rail line. The second impact would be felt on the concrete flood wall in "downtown" Mankato. This floodwall, designed by the Corps of Engineers in the 1980's is designed to contain without being overtopped a flood condition known as a 300-year flood-- that is to say, a

water level likelihood of one chance in three hundred (1:300). For the purposes of this document (see fig. 1), a "typical section" will be the depot site of floodwall section H-H. The typical elevation of 786.3ft at the top of the floodwall is the elevation of the wall at Main St.

This section of the floodwall is built on unconsolidated fill some seventy feet 70' above the bedrock but is not mounted or supported by piers or pilings. The fill material that supports the wall at the ground line on the inside or "city" side of the wall is mostly excavated soil, rock, debris and construction or demolition detritus that was excavated from buildings and basements from the pre-turn of the century era of construction in Mankato. This detritus is unconsolidated fill, which was placed along the riverbank to narrow the channel of the river at the point where the Minnesota River begins to swing to the north. Much of this backfilling effort was implemented to make way for the depot, railroad tracks and switching yards located there. In concert with this narrowing of the river the expanse of the "old Main St. Bridge spanning the river to North Mankato was foreshortened. No dynamic seismic and in-field dynamic soil tests have been conducted; there is no "real data" to determine the unconsolidated fill's true physical characteristics. The only data submitted to date has been based on "assumed" and static data for the site.¹

This untested fill, not just for the depot site but along the entire flood wall as it parallels the alignment of the railroad, has the very serious potential of failing as adequate structural support. It could also jeopardize either the integrity of the wall structure itself or the sub fill under

¹ HNTB Architects Engineers Planners report to Ray Gigear of the DM&E, October 12, 1999

and on either side of the sheet pilings driven down to the 748ft level below the wall. The materials are in all likelihood gravelly sands, gravel soil or sandy soils.

Materials such as these, under the stress of hyper saturation during flood conditions with the river at a one hundred year flood level creating a column of water some 30 feet high, would undergo extreme pressures which would exceed 2000psf. With the harmonic vibration of railroad cars numbering upwards to one hundred fifty units each loaded with 30+ tons of coal and pulled by as many as five 40 ton locomotives traveling at thirty five to forty five miles per hour every 45 minutes day an night the pressure acting upon the unconsolidated materials in concert with the harmonic vibration could create the scene for a terrible disaster. Such an event could terminate in the loss of not only huge investments in both public and private properties but could result in loss of life from inundation or from disease infiltrating into the service infrastructure of both sewer and water systems.

Two scenarios could occur at this point. The extreme pressure of the water column being exerted on the subsoil, in concert with the vibration could result in a condition known as liquefaction of soil materials. With the added DM&E railroad vibration, a mini seismic event could gradually occur deep underground. The water pressures and the vibration could cause the individual particles of sand and clay to liquefy or lose their cohesive structural character and become not unlike a slurry of mud which could result in what is commonly referred to by the Corps of Engineers as a "blowout!"

Such a "blowout" could weaken the subsoil and undermine the sheet pilings resulting in a loss of the structural integrity of the wall itself as the subsoil support is forced outward and upward along any zone of discontinuity. The explosive burst of water surging through the void it created would quickly flood the flood plain of much of "lower or downtown" Mankato. The extent of such flooding would be a function of the depth of the water in the river channel at the point of the "blowout" and the ability of emergency crews to intervene by quelling the water flow or the building of dikes to contain the flooding. (See Map 1)

Yet another possible effect of such a blow out would not only be the flooding created by its own column of hydrostatic pressure but the effect of the liquefaction of the soil and the concomitant loss of structure below the sheet pilings. The result of this could be a total loss of integrity of a section of the wall created by differential settling and the effect of the water pressure pushing the wall outward from the river. The resulting failure of a section of the wall would be unstoppable and of cataclysmic proportions to the community.

The second scenario could be a collapse of a section of the concrete wall itself without the undermining effects of a hydrostatic blowout. The vibration of the trains, in concert with the pumping action of the rails as traffic passes along them, could so weaken the wall's soils on the "inside" or city-side of the supporting embankment that, at the point of rotation for the wall, (see figure 1) which is only 8.62 feet below the ground line, a section of the wall could literally be forced "inward" or toward the city by the

hydrostatic pressure upon the wall while the base of the wall below the point of rotation would be forced “outward” or into the river. Were the structural integrity of a concrete section to be lost, a “wall” of water would literally surge into the city resulting in massive flooding along the river wall and levee back as far as Sibley Park and downstream to near the Mankato Stone Quarries at the base of Madison Avenue. (See Map 1)

In this scenario the continual pounding of the rail traffic within as little as 12.6ft of the wall and the harmonic vibrations of the wheels (which often have a flat spot which compounds the pounding) coupled with the weight of the locomotives, cars and loads could cause liquefaction of the soils permitting hyper saturation of the fill and a loss of integrity by the fill as support to the wall. This deterioration of integrity below the grade could go unnoticed during periods of heavy precipitation and long before an increase in the depth of the river channel. Continued heavy traffic along the railroad and a rising column of water could result in a sudden collapse of a section or sections of the wall. The results of that would be nothing short of catastrophic.

The City, the Corps of Engineers and the Surface Transportation Board must give serious consideration to the possible consequences of giving permit to the D.M.&E for its proposed rail corridor through Mankato. Serious testing of the wall, its support structures and the associated land uses adjacent to the wall must be accomplished before any further consideration is given to “Alternative M-3.” Test borings, In-Hole Vane Shear Testing, In-situ Electronic resistance strain gauges or extensimeters should be used to

measure the deflection response of the sub grade and subsoil during train passages of 35 to 50 miles per hour. These tests need to be conducted during wet periods of the year, especially during spring break up. These tests also need to be conducted at times when river levels are high and with heavily loaded trains operating on the track or tracks. For optimal consideration there should be two trains running simultaneously as it will not be unusual to find two heavily-loaded trains operating simultaneously on adjacent roadbeds of both the D.M.&E and the Union Pacific Rail Roads. Furthermore these tests should be conducted as long term studies rather than a "once over lightly" or by a "walk through" analysis in the fashion of the leadership of the D.M.&E.

Respectfully submitted

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November 14, 2000

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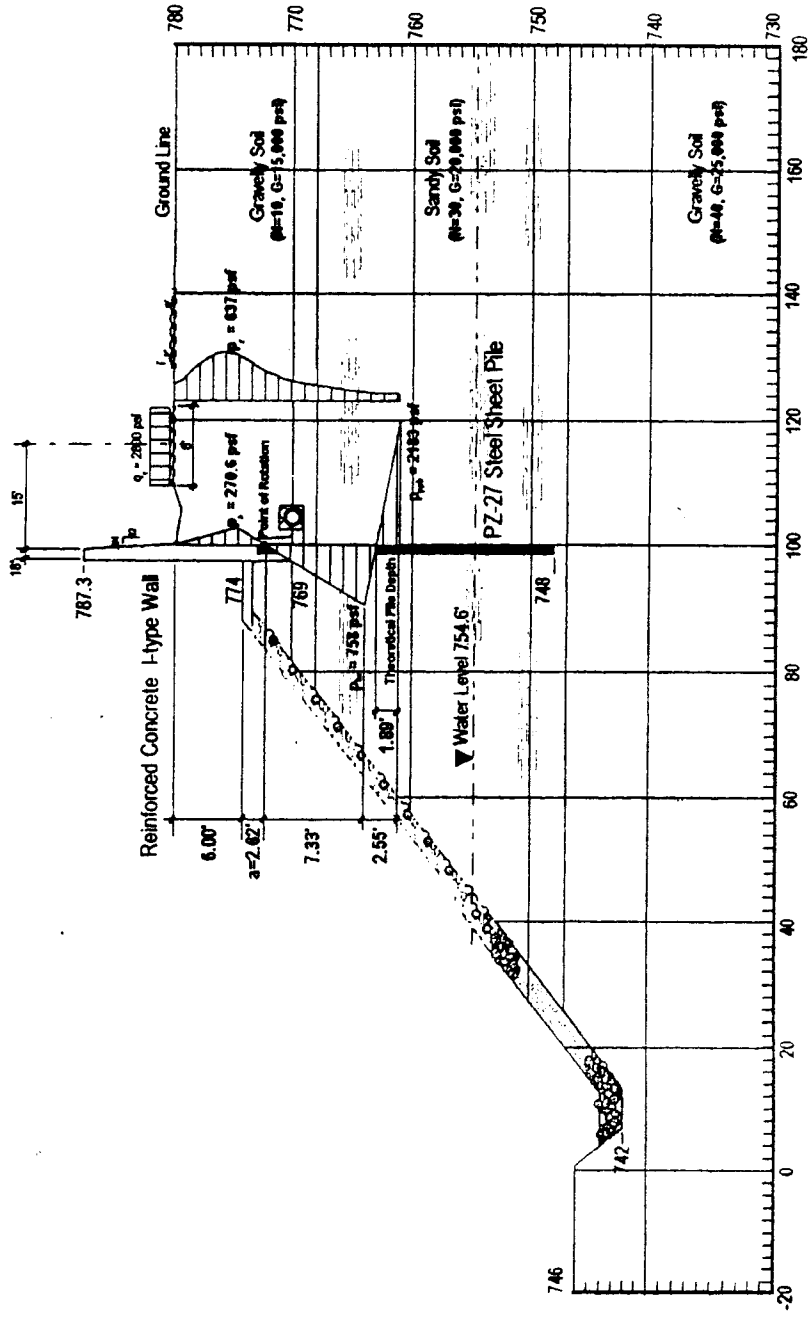
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Subject: City of Mankato
Assessment of DM&E Trains
Ground Borne Vibration Attenuation

Oct 10, 1999
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File: P110502.mcd

I. Cantilever I-Wall in Granular Soil - Active, Passive Pressures + Train Loading



Floodwall at Section H-H at Depot (Station 86+50)

Dimensions

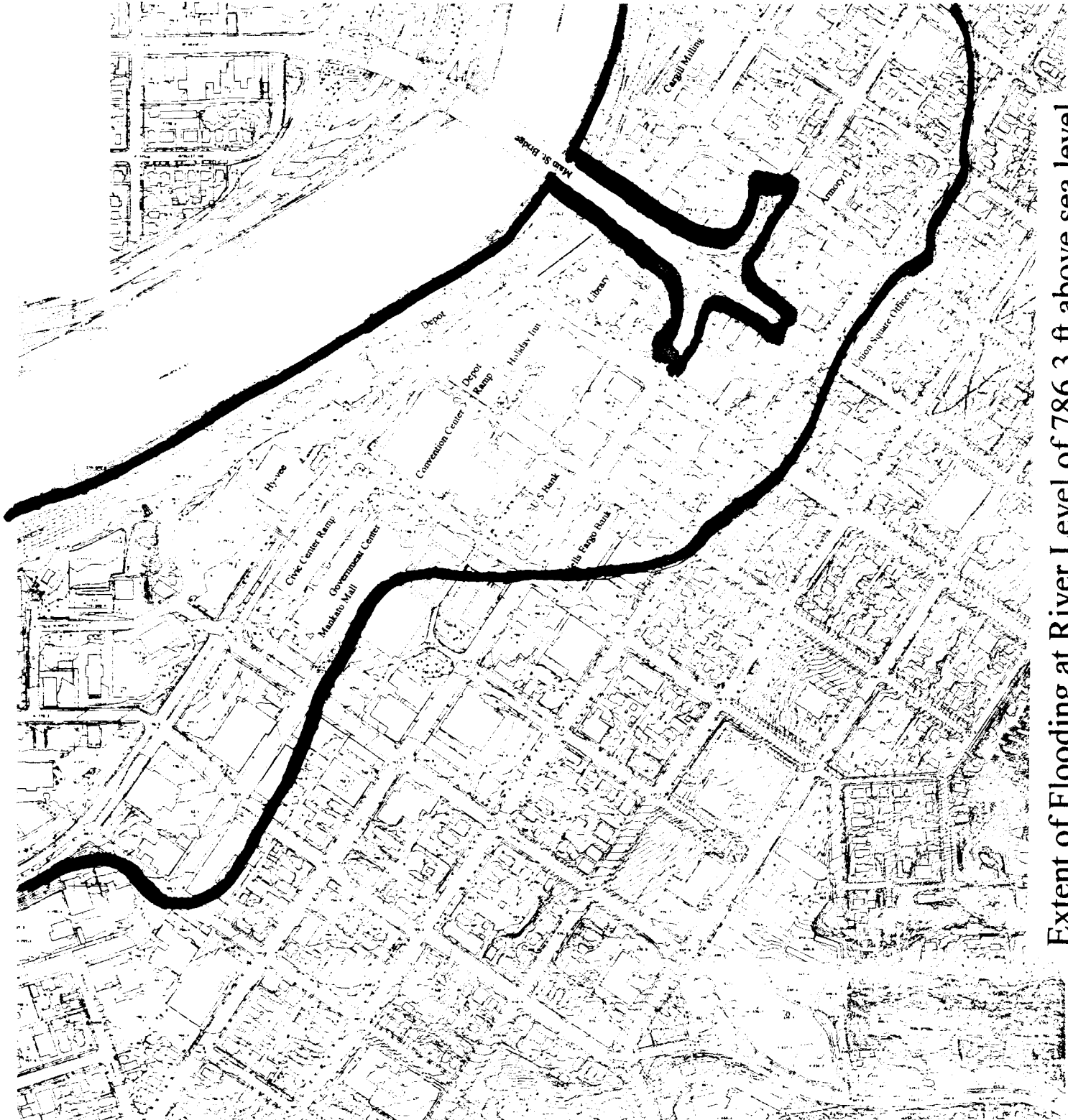
$$H_t = 32 \quad H = 6$$

Soil Constants: Assume Water Table Below 754'

$$\gamma = 110$$

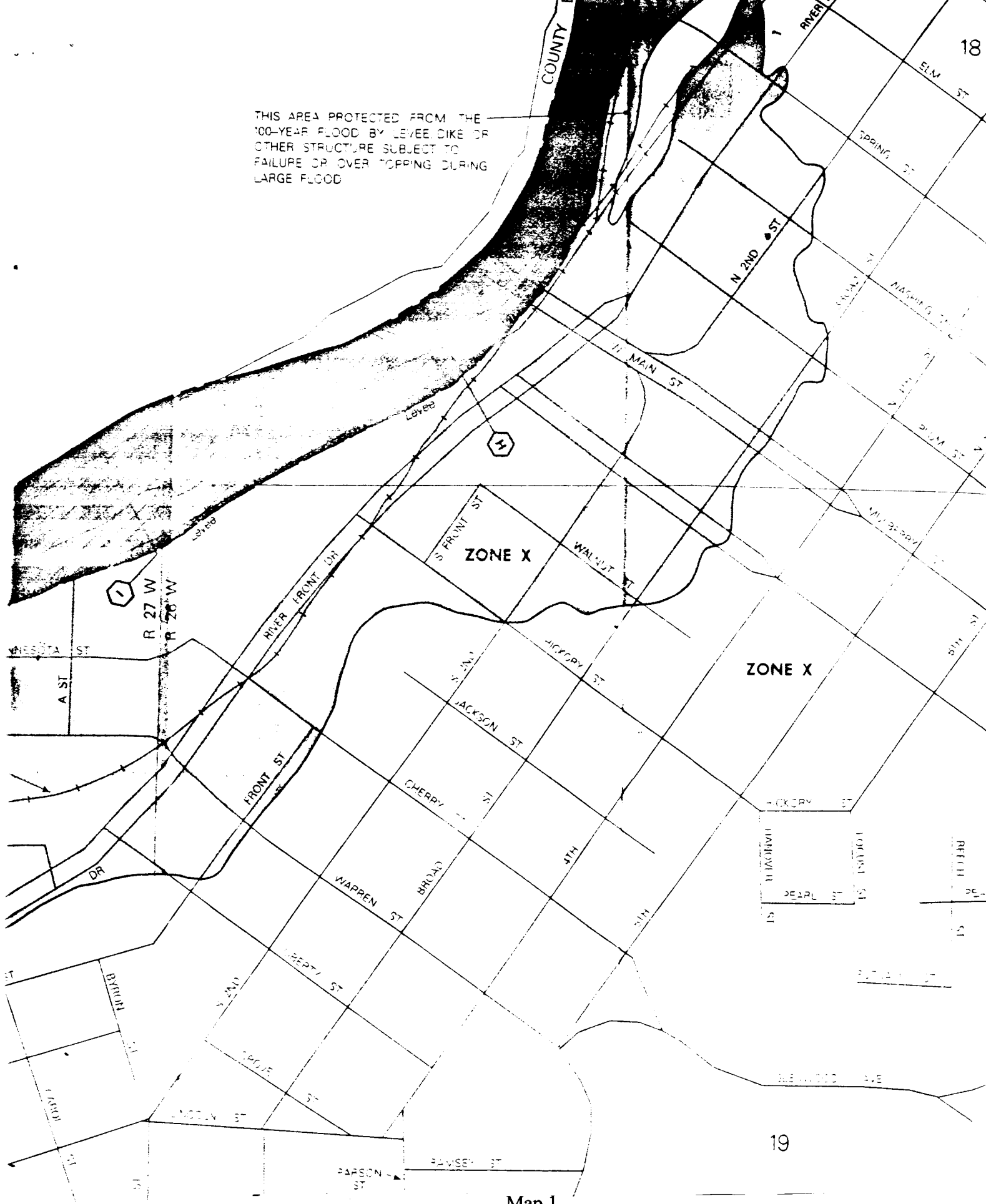
$$\gamma_w = 121$$

Figure 1



Extent of Flooding at River Level of 786.3 ft above sea level.

Source: Federal Emergency Management Adm.



Map 1
Flood Insurance Rate Map, City of Mankato, MN., Federal Emergency Management Agency, Nov. 20, 2000