

# Service Life Comparison

[Minnesota Steel Culvert Pipe Service-Life Map Research](#)

## Galvanized 16 gage

## Aluminized 16 gage

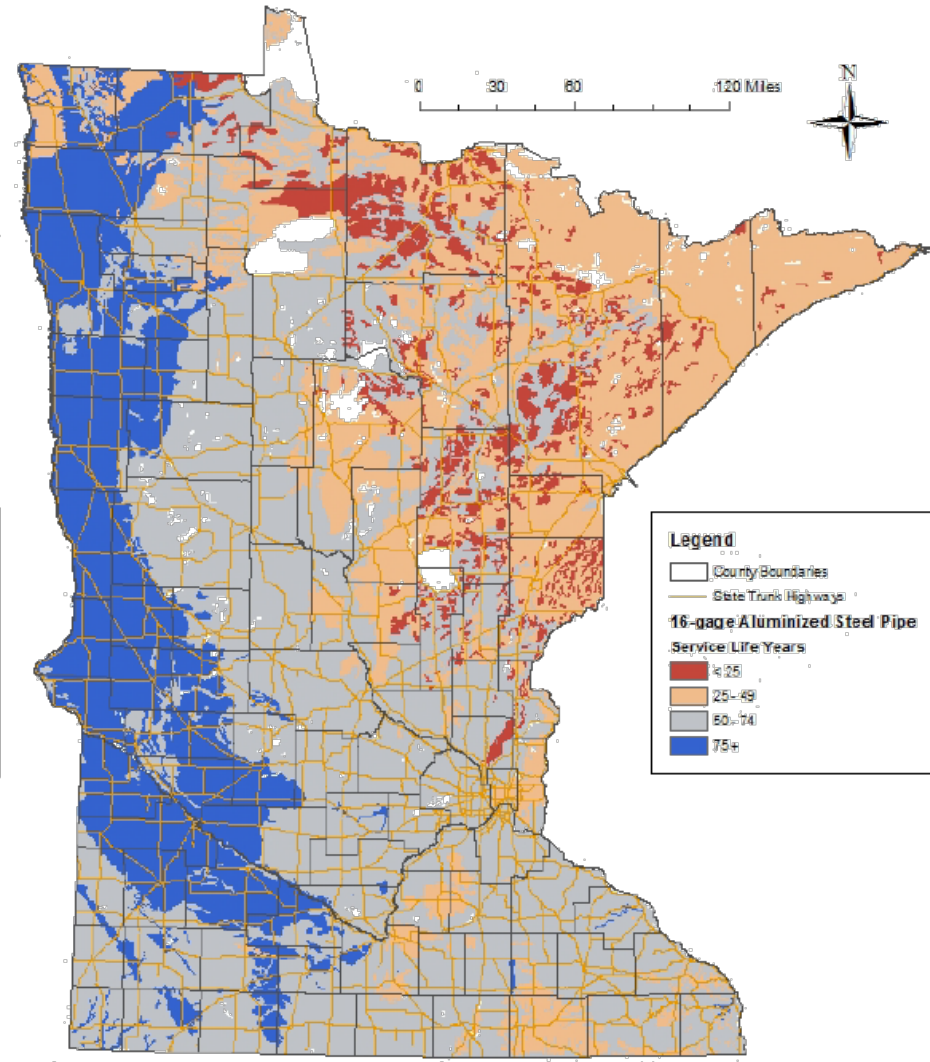
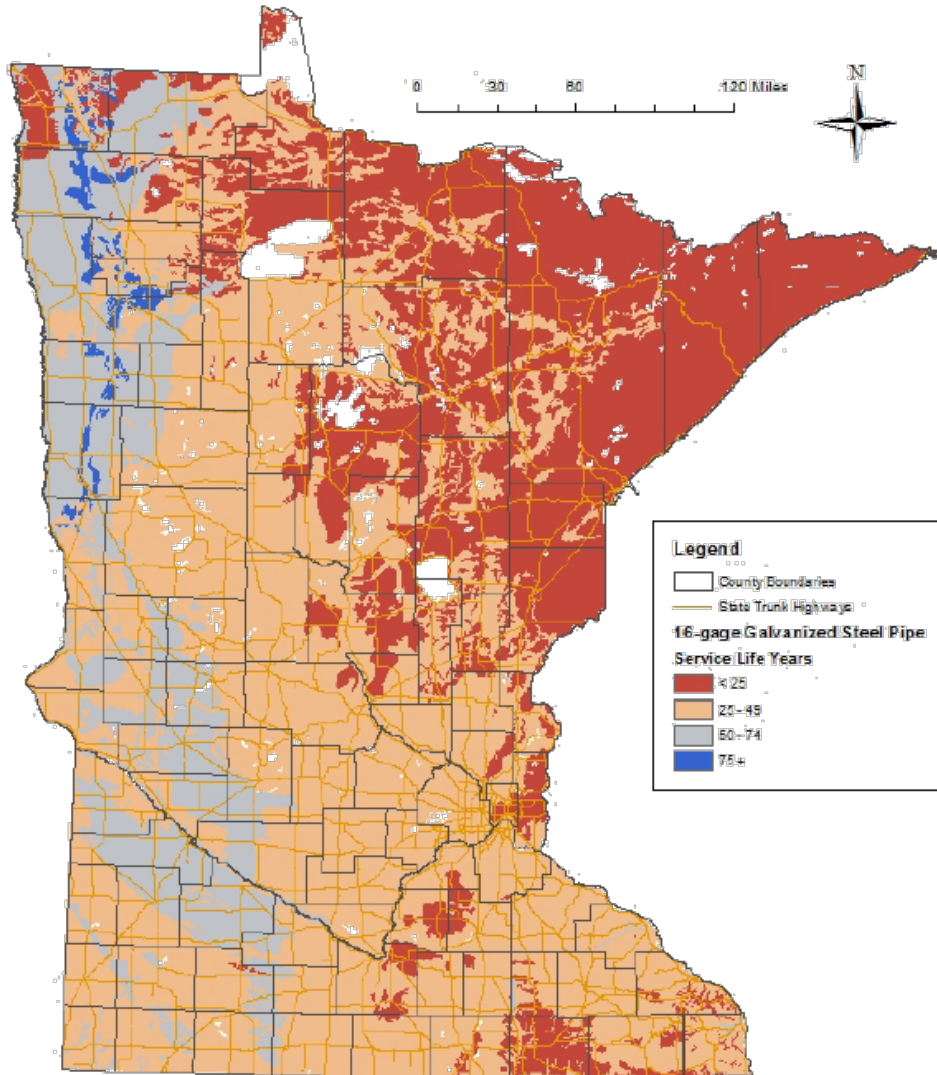


Figure 4.3: Service-life estimates for 16-gage galvanized steel pipe.

Figure 4.4: Service-life estimates for 16-gage aluminized steel pipe.

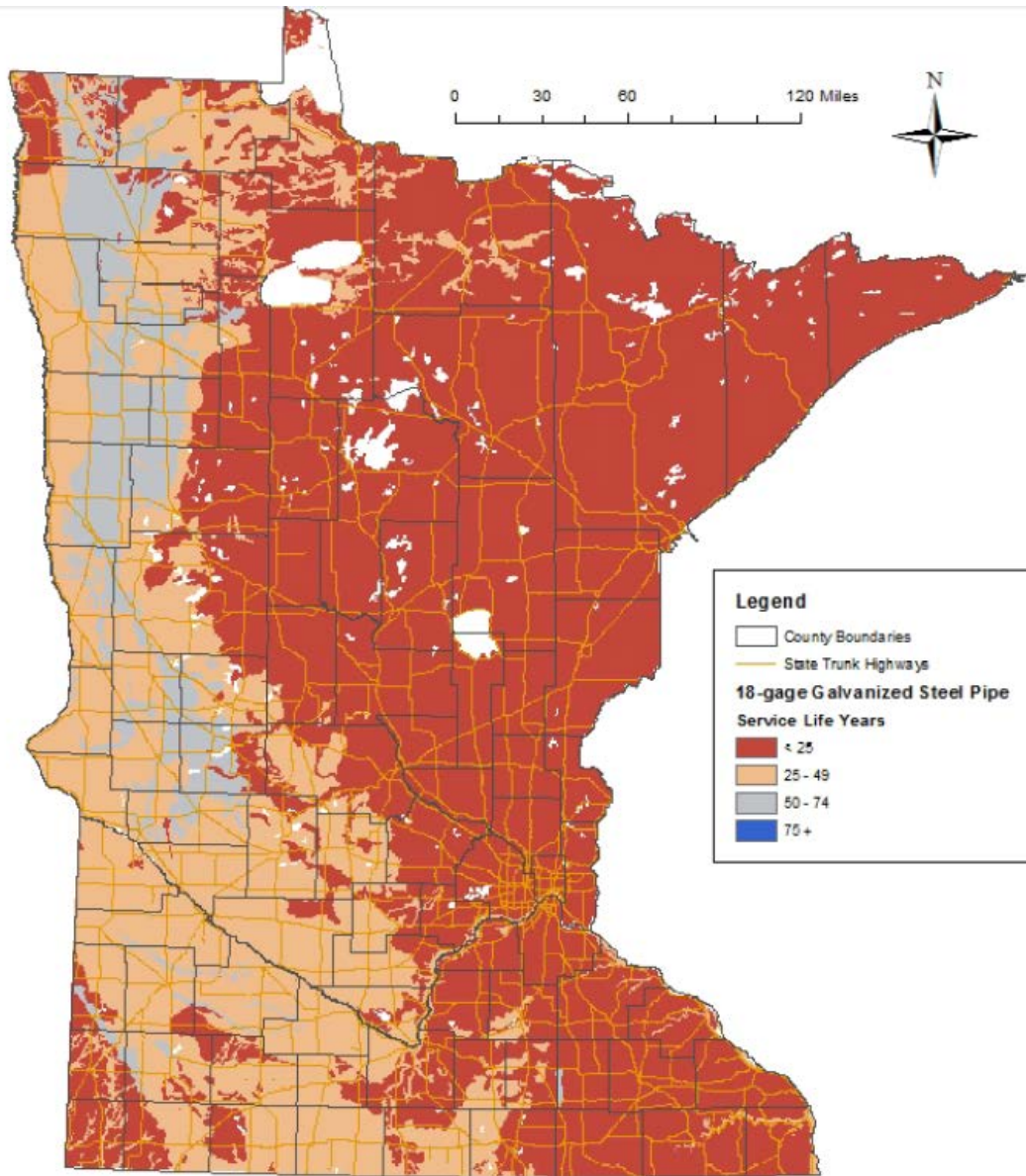


Figure C.1: Service-life estimates calculated using Caltrans 643 method for 18-gage galvanized steel pipe.

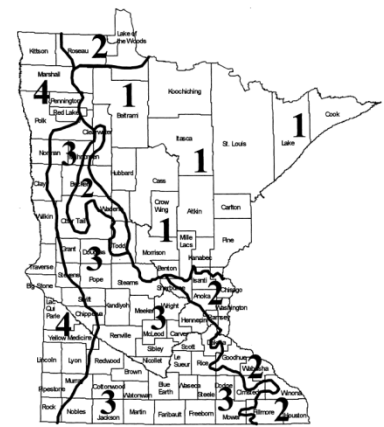
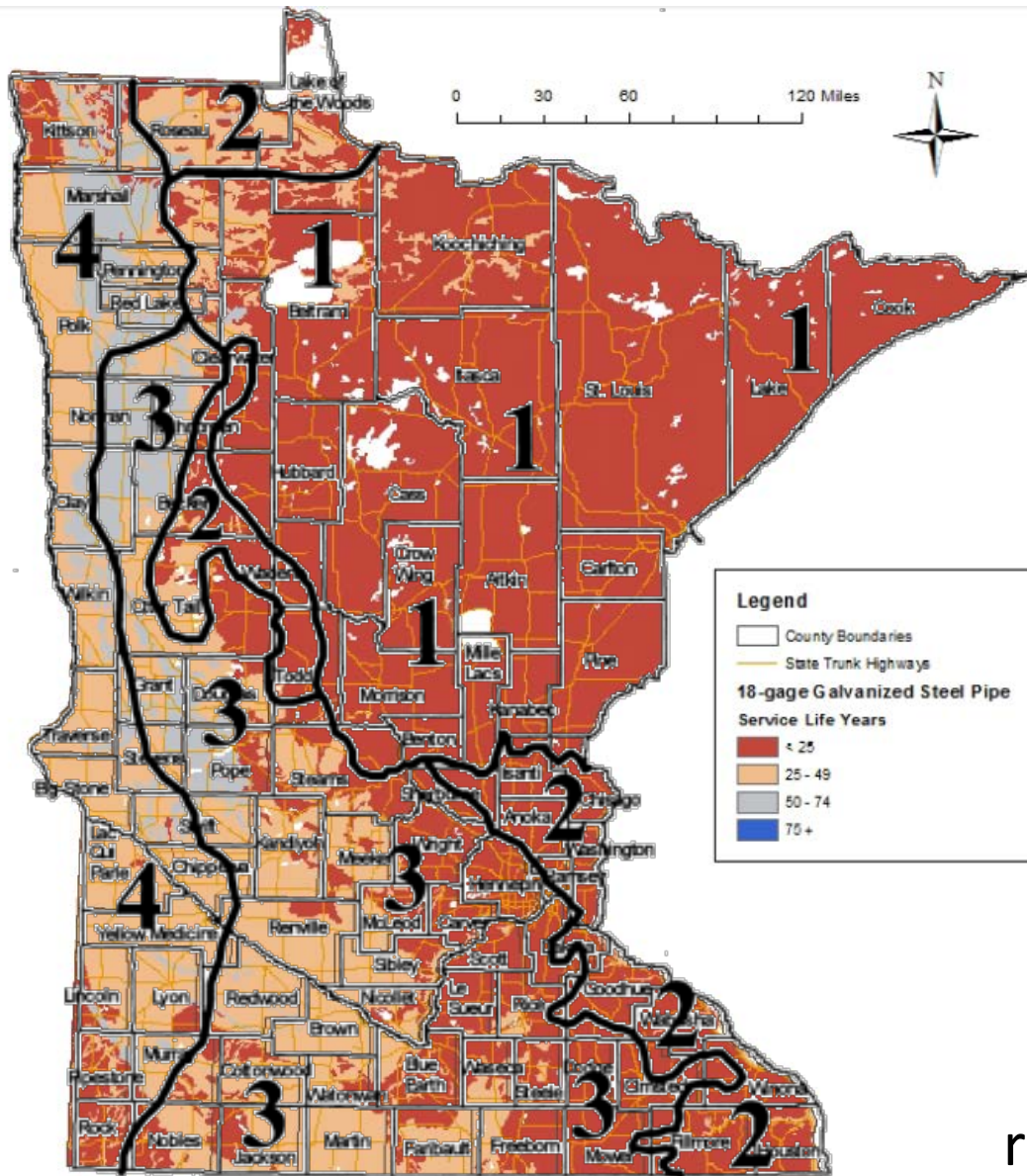


Figure 2.1 Four Soil Zones of Minnesota

1969 map above divides MN into 4 zones for steel pipe expected lifespan, based on 18 gage galvanized pipe

2015 map for 18 gage at left shows Blue area 75+ years and Red area less than 25 years.

Compare former guidance from the 1969 research recommendation with 2015 Service Life Map



1969 map MnDOT Drainage Manual shows 4 zones of expected service life for 18 gage steel pipes. Zone 1 is short life span and covers northeast MN.

[MnDOT Drainage Manual section 2.3](#)

[Serviceability of Corrugated Metal Culverts, Investigation No. 116, 1969](#)

2015 map at left shows Blue area 75+ years and Red area less than 25 years, based on Caltrans 643 Method for 18 gage steel pipe. pH and resistivity are factors.

[Minnesota Steel Culvert Pipe Service-Life Map](#)

Compare 1969 recommendation with 2015 Service Life Map (18 gage Galvanized)

Figure C.1: Service-life estimates calculated using Caltrans 643 method for 18-gage galvanized steel pipe. **Figure 2.1. Four Soil Zones of Minnesota**

# Service Life Comparison 16 gage with 1969 map overlay

## Galvanized 16 gage

## Aluminized 16 gage

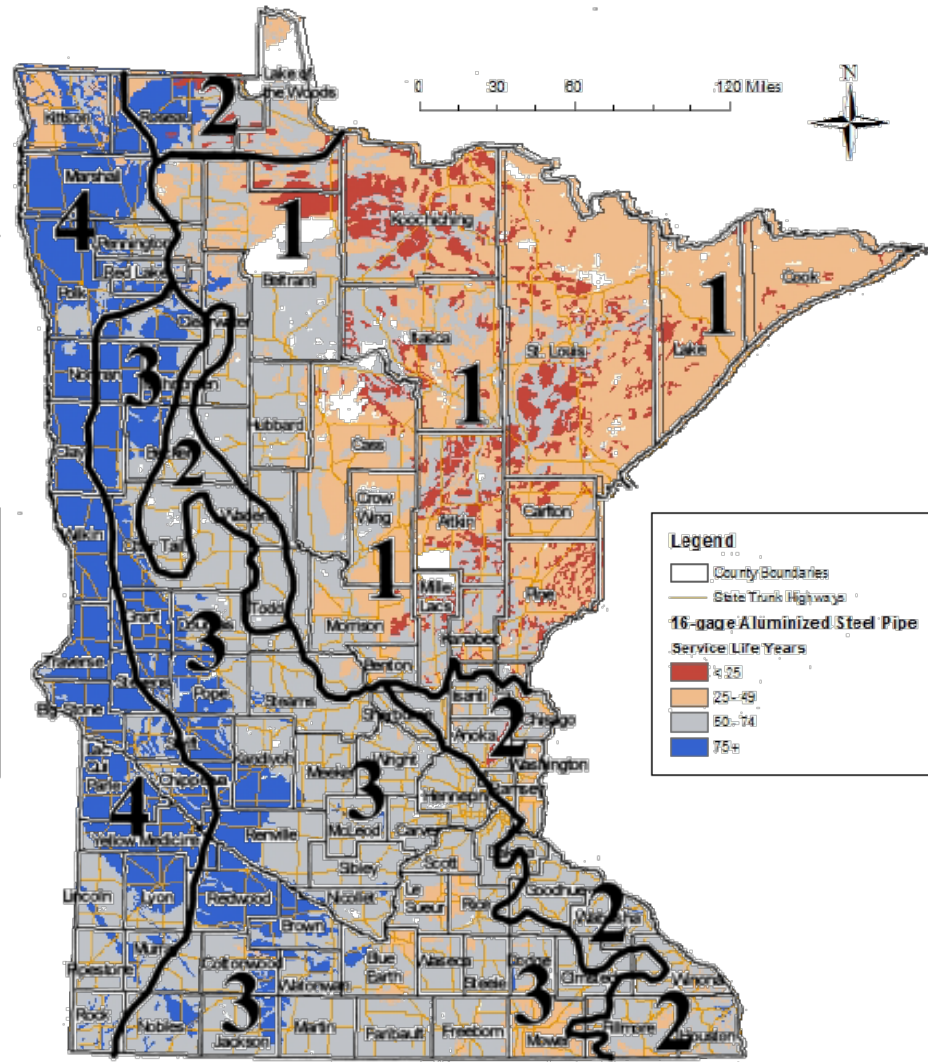
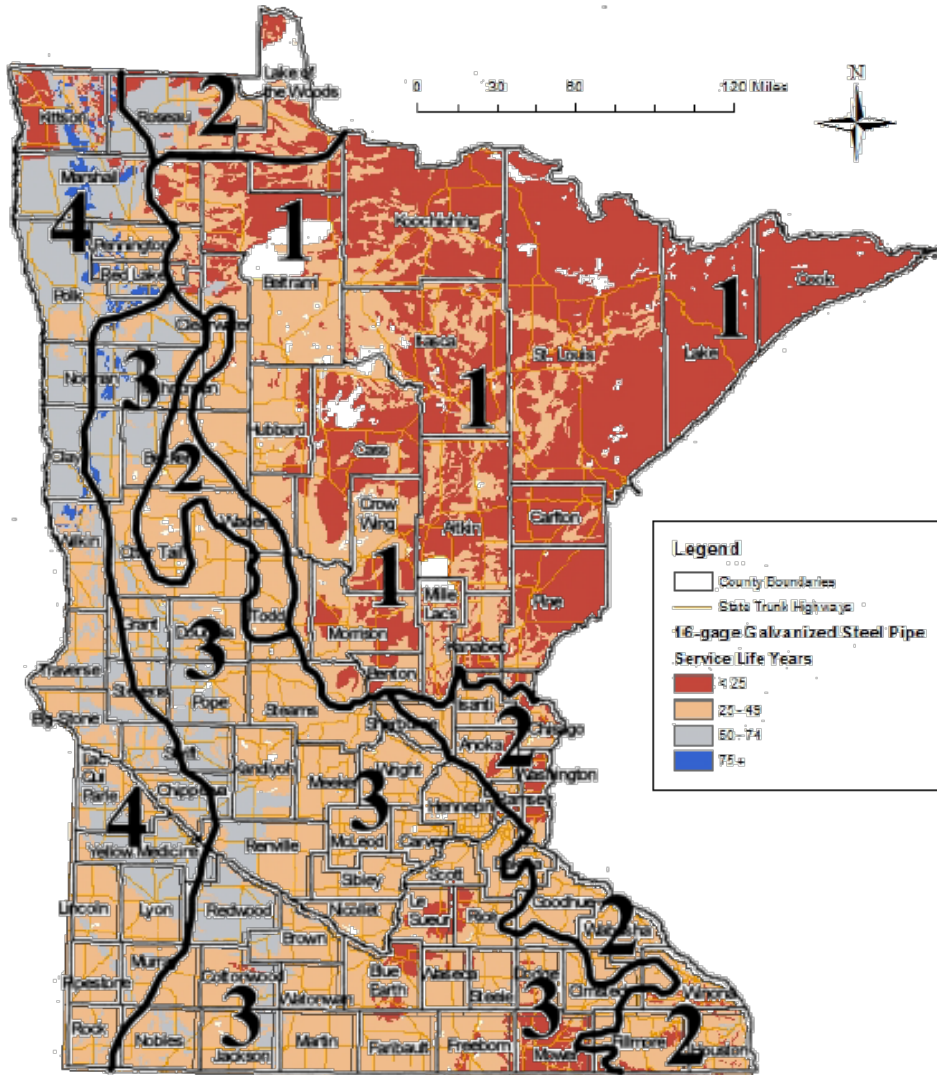


Figure 4.3: Service-life estimates for 16-gage galvanized steel pipe  
Figure 2.1 Four Soil Zones of Minnesota

Figure 4.4: Service-life estimates for 16-gage aluminized steel pipe  
Figure 2.1 Four Soil Zones of Minnesota

### 2.3 PIPE DURABILITY

The Department is presently doing a statewide condition survey of centerline culverts. It is planned to correlate the results of the survey with information regarding soil and water properties including pH and resistivity measurements to develop a revised policy regarding the use of metal culverts. Until that study is completed the usage criteria for prefabricated corrugated galvanized steel culverts that was previously in the Drainage Manual will remain in effect and are given in Table 2.1 and Figure 2.1. Structural plate culverts although normally having heavier galvanizing and a greater metal thickness than prefabricated culverts are still vulnerable to corrosive attack in an aggressive environment. Therefore, usage criteria for structural plate culverts is included in Table 2.1.

# MnDOT Drainage Manual

## Section 2.3 Pipe Durability

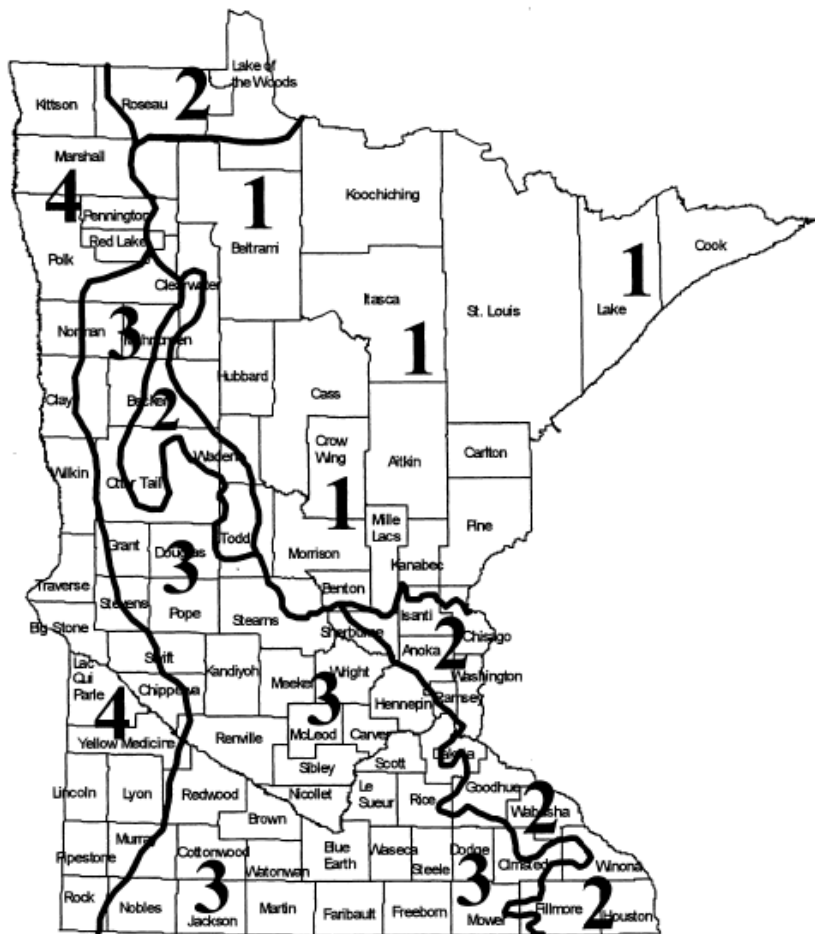


Figure 2.1 Four Soil Zones of Minnesota

Table 2.1 Drainage Condition at Culvert Location

Zone <sup>4</sup>	Water <sup>1</sup>	Prefabricated Corrugated Galvanized Steel Culvert	Structural Plate Culvert
1	Dry	Yes	Yes
	Wet	No	Yes <sup>3</sup>
2	Dry	Yes	Yes
	Wet	Yes, if not acid <sup>2</sup>	Yes <sup>3</sup>
3	Dry	Yes	Yes
	Wet	No	Yes <sup>3</sup>
4	Dry	Yes	Yes
	Wet	Yes	Yes

- <sup>1</sup> Dry refers to structures that drain out after rainfall or snow melt and Wet is when there is standing or flowing water practically the entire year.
- <sup>2</sup> District Soils Engineers should make pH determinations of samples from drainage area of the proposed culvert.
- <sup>3</sup> Provided the location is not in a swamp or that the soil or water does not have a pH of 6.5 or less. The District Soil Engineer should take samples from the drainage area for pH determination.
- <sup>4</sup> The Zones referred to in the Table 2.1 criteria for selecting prefabricated and structural plate culverts are shown in Figure 2.1.

# 1969 research defined the 4 map zones

“the State is subdivided into four soil zones which generally coincide with the Great Soil Groups and generally indicate the acidity of the soil”

## Serviceability of Corrugated Metal Culverts, Investigation No. 116, 1969

Similar surveys made by other state highway departments and manufacturers have indicated that soil characteristics which are a portion of the environmental conditions had a major influence on service life of corrugated metal culverts. The one soil characteristic most generally indicated as having an influence on service life is soil pH. Therefore, the State is subdivided into four soil zones which generally coincide with the Great Soil Groups <sup>(1)</sup> and generally indicate the acidity of the soil (Figure 1). The soils in zone 1 are the podsol which are strongly acid soils. In soil zone 2 are the gray-brown podsol which are acid soils. Soil zone 3 has a slightly acid surface and a neutral to alkaline subsoils. The soils are called prairie soils. The soils in zone 4 are the chernozem soils which are alkaline. Findings and recommendations for use of corrugated metal culverts are given for each soil zone.