Identifying Trends In Cast Iron Pipe Failure With GIS Maps Of Soil Environments

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ABSTRACT

This paper identifies relationships between recorded failure rates in Cast Iron water pipes and soil properties mapped in a Geographical Information System (GIS). Whilst external surface corrosion is known to be influenced by soil environment, the soil properties that govern this behaviour are debatable. The Ductile Iron Pipe Research Association (DIPRA) recommend a 10-point scoring system based on (but not limited to) soil properties such as resistivity, pH, sulphides and moisture content. Assuming that a similar corrosion mechanism occurs, this scoring system should also apply to soil environments that are corrosive to Cast Iron pipe. However, in order to apply this system to a pipe network, the relevant soil properties must be known. Whilst field measurements are possible on small projects, the number of measurements required to assess corrosive environments across an entire network is impractical. An effective alternative is to undertake regional soil mapping projects and represent the relevant soil environment properties in a GIS. This can then be used to identify potentially corrosive areas across an entire network. To validate this approach, Cast Iron pipe failure data (recorded by Yarra Valley Water in Melbourne, Victoria) has been related to soil environment data in a GIS. Average pipe failure rates are correlated with DIPRA scores for different soil environments present within the pipe network. Clear trends are observed, which suggest that mapping of DIPRA scores is a valuable asset management tool. Separate analyses also indicate relationships between soil environment properties and failure mode. A mappable soil corrosivity/reactivity matrix is proposed which combines DIPRA score with shrink-swell indices.