Procedure

Soil Assessment for Installation of Ductile Iron Pipes without Sleeving

1. Overview

1.1. At a glance

What

This document describes the process for assessing the suitability of soil for installation of new generations of ductile iron pipes without loose polyethylene sleeving.

1.2. Scope

Who

- Sydney Water personnel.
- Contractors, consultants, suppliers, project managers and water servicing coordinators.

1.3. Objective

Why

In accordance with the latest Australia Standard for ductile iron pipes and fittings, AS/NZS 2280:2014, new generations of ductile iron pipes have been introduced into the Australian market. The pipes feature either a thermally sprayed metallic zinc or zinc-aluminium alloy with polymeric topcoat coating system These protective coating systems are effective in most of soils around Australia without loose polyethylene sleeving. However, **it is important to assess the soils prior to installation to ensure the expected service life of 100 years is achieved**.

Notes:

1. For extremely aggressive soils, the pipes can be coated with polyurethane or an extruded high-density polyethylene coating to totally isolate the ductile iron from the environment.
2. Previously, ductile iron pipes were typically supplied in Australia with a bituminous coating system but no zinc. This coating system require additional loose polyethylene sleeving to warrant adequate performance against external corrosion, regardless of the soil condition.

2. Soil corrosivity assessment

The soil corrosivity of where the ductile iron pipes are to be buried requires assessment prior to the installation. This is to identify any areas with highly corrosive soil that may not be suitable for installation of ductile iron pipes without sleeving.

For newly developed (greenfield) areas, the soil property information is often available from the Land and Soil Capability or geotechnical assessment that has been in carried out within the area. Where they are not readily available, such as in brownfield areas, a soil corrosivity assessment needs to be carried out to characterise the soil properties.

2.1. Soil parameters

Three critical parameters are required for assessing the soil corrosivity on metallic pipes. These properties are:

1. Soil resistivity (or soil conductivity);
2. Soil pH level; and
3. Chlorides concentration.

Note: Soil resistivity value (ohm.cm) may be calculated from soil conductivity (S/m) using the following conversion formula.

$$Resistivity\ (in\ ohm.cm) = \frac{1}{Conductivity} \times \frac{1}{100}\ (in\ S/m)$$

It is also important to assess if the pipeline route contains any of the followings;

1. Acid sulphate soil;
2. Contamination and waste from mining, processing, or manufacturing industries such as refuse, ash, slag, liquid manure, dairy waste; and
3. Stray currents from industrial plants or equipment using direct current electricity such as cathodically protected structures and electric trains/trams.

2.2. Acceptable test methods

Parameters	AS test methods	CSIRO test methods	Other test methods
Resistivity	AS 1289.4.4.1	-	Wenner 4-point method conducted in situ along pipe route. ASTM G57
Conductivity	-	3A1 EC of 1:5 soil/water extract	-
pH	AS 1289.4.3.1	4A1 pH of 1:5 soil/water suspension	-
Chlorides	-	5A1 Chloride – 1:5 soil/water extract, potentiometric titration	-

Note: only one test method for every parameter is required for each soil sample

2.3. Recommended testing frequency

Where testing outside Land and Soil Capability or geotechnical assessment is required, carry out soil testing at every 100 metres along the pipeline route. The soil sample or measurement shall be obtained from the approximate depth of the pipeline invert.

Additional testing is required in locations of waterways, wetlands, polluted soils or when the soil conditions are variable.

2.4. Acceptable testing organisation

Only test results produced by a NATA accredited testing organisation are acceptable.

The combined results should be reviewed by the pipe supplier, who then may issue a certificate indicating level of suitability and expected design life..

3. Soil condition criteria

The following table describes the acceptable soil properties for installation of ductile iron pipes without using loose polyethylene sleeving according to the external coating types.

	Ductile iron pipes external coating systems		
Parameters	200g/m^2 Zn coating	400g/m^2 Zn-Al coating	800µm PU coating or 1800µm extruded PE coating
Resistivity	≥2500 ohm.cm	≥500 ohm.cm	No limit
pH	≥6	≥5	No limit
Chlorides	≤5000 ppm	≤50,000 ppm	No limit
Acid sulphate soil	Not allowed	Not allowed	Allowed
Contaminated soil	Not allowed	Not allowed	Allowed
Stray currents potential	Not allowed	Not allowed	Allowed

Notes:

1. Refer to Section 2.1 in the previous page for definition of contaminated soil.
2. Ductile iron pipes with bituminous coatings continue to require loose polyethylene sleeving to warrant adequate performance against external corrosion, regardless of the soil condition.

4. Submissions

The Contractor who is installing the ductile iron pipes shall submit the following documentations to the Project Manager or Water Servicing Coordinator (WSC) in case of Developer Works.

1. A product Technical Data Sheet relating to the proposed product and specifying the composition of the external corrosion protection system.

2. A current product certification for the proposed product stating compliance to AS/NZS 2280:2014.
3. The test results of the soil parameters specified in Section 2 along with the information of the test locations. An excerpt of the relevant Land and Soil Capability or geotechnical report is also acceptable.
4. The supplier's recommendation and certification of design life considering the soil characterisation.

The Project Manager or WSC shall review the submissions and provide acceptance or rejection of the proposal to install ductile iron pipes without loose polyethylene sleeving based on the criteria set in this document.