

# Technote<sup>205</sup>

NCSPA Technical Notes are prepared by the NCSPA Technical Advisory Committee to provide up-to-date technical information about drainage structures and their proper use and application. User comments or questions are welcome. ■ *Technical Notes are not intended for detailed design purposes.*

## Method of Water Testing for Appropriate Coating Selection of Corrugated Steel Pipe

### GENERAL

Corrugated Steel Pipe (CSP) has been used successfully for storm sewers and culverts since 1896. This success can be attributed to the fact that CSP is structurally strong and is an economical solution due to low material and installation costs. Corrugated steel pipe is available with a wide variety of protective coatings that have proven to meet the requirements of demanding environments. No matter the location or application, CSP has a coating to meet the needs of the situation. This provides the engineer or contractor an end result in optimum service life for the structure at the lowest cost. Service Life exceeding 100 years can be obtained using the proper coating, specific to location and application.

The National Corrugated Steel Pipe Association can provide guidelines for durability design when water and soil conditions are known. The "Service Life Selection Guide" can be found on the NCSPA website: [www.ncspa.org](http://www.ncspa.org)

### OVERVIEW

The water that flows through a culvert may contain dissolved salts and minerals. The amount of salt and type of salt can dramatically affect water quality and the long term durability of a culvert. Protective coatings on steel react differently in a variety of water conditions. Available coatings for CSP include Galvanized, Aluminized Type 2 and Polymer. The following tests using commercially available test strips will help the designer to identify existing water chemistry and through a process of elimination select culvert materials that are best suited to the existing environmental conditions to meet the Design Service Life (DSL) and economic requirements of a project.

### METHOD FOR WATER TESTING

#### TEST STRIPS

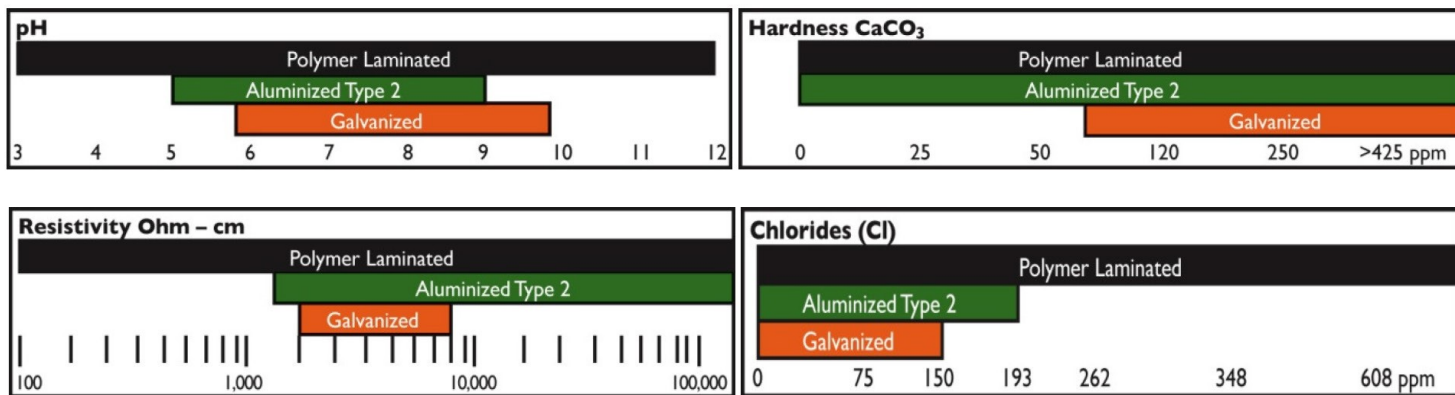
1. Total Hardness,
2. pH 4-9,
3. Chloride, Low Range 30-600
4. Resistivity test meter

#### METHOD

1. Collect a water sample from the test site in a small, clean plastic or glass container.
2. Remove a Total Hardness Strip from the package, dip the strip in the water sample for 1 second, wait for 15 seconds and then match the color with those on the package. If ppm reading is 50 or less, eliminate Galvanized from the selection process. If ppm reading is 120 or greater continue with all coating options.
3. Remove a pH strip from the package, dip the strip in the water sample for 1 second, wait for 15 seconds and then match the color with those on the package. If the reading is 5 or less eliminate Galvanized. If the reading is 4 or less eliminate Aluminized Type 2. If reading is 6 or greater continue with all remaining coating options.
4. Partially empty the container leaving water 1 to 2 cm deep. Remove a Chloride Titrator Strip from the package. Stand the strip in the water ensuring that the yellow string remains dry. Let stand until yellow string turns black. Remove the strip and note the upper level of the white peak. If the level is less than 4.2 consider all remaining coating options.

If the level is greater than 7.6 the EMSL for Polymer Laminated CSP may be less than 100 years.

- Use a water resistivity test meter to determine the resistance in ohm-cm. If resistance is less than 1500 eliminate Aluminized Type 2. If the resistance is less than 2000 or greater than 10,000 eliminate Galvanized. Figure 1 shows the reading levels associated with the appropriate CSP coatings.



#### Notes:

For readings beyond the range of test strips additional and alternate testing may be required to determine suitability of materials and estimated material service life. Tests reflect the conditions on the day of sample only. Wet weather and high flows will dilute the concentration of dissolved salts while hot dry weather will increase concentration. Future site development may change environmental conditions. Coating selection should reflect past performance of materials at the site and anticipated conditions into the future, for the entire DSL of the project.

These tests identify the most common elements found in waters that influence the durability of steel culverts. Other elements may exist locally. Other factors such as bed loads, slope, velocity, abrasion, foundation material, backfill material and freeze/thaw cycles, may affect overall performance of all pipe materials. Past experience and local knowledge should always be considered in material selection.

These tests were developed by the Corrugated Steel Pipe Institute as a tool to assist in the decision making process. It is the responsibility of the design professional to ensure that all factors are considered and to make the final coating selection.