Best Practice Selection of Culvert Types
(Guidelines for Culvert Material Selection)

History

Roadway culvert material selection is normally based on cost effectiveness. In some cases, short term cost savings will over shadow long term culvert life expectancy. As a result, accelerated pipe deterioration will occur on culvert installations in areas where soil and water qualities promote rapid oxidation and perforation. The development of specialty coatings for metal culverts, enhancements in plastic pipe and availability of concrete pipes allows a wider selection of culvert materials providing improved performance in harsh environments.

Soil and water conditions of high conductivity generally accelerate culvert deterioration. It is the designer's responsibility to ensure that the products used are suitable for the site-specific environment. The following guidelines are provided to aid in the selection of culvert material types for use on departmental projects. The material types to be considered when using the guidelines are galvanized Corrugated Steel Pipe (C.S.P.), aluminum coated C.S.P., polymer coated C.S.P., plastic and concrete pipe.

Selection

The selection of culvert material is dependent on the following factors:

- Local experience
- Field testing of soil/water at culvert locations to determine pH and resistivity
- Determining life expectancies for culverts using Alberta Transportation (AT) Guidelines for Suitability Limits Charts
- Conducting a "Life Cycle" cost analysis for the various culvert material types such as

    - metal culverts (galvanized, aluminum and polymer coated)
    - plastic culverts
    - concrete culverts

It is very important that culvert selection be based on appropriate testing at the drainage location, economics, and long term culvert performance.

Guidelines

In 1997, the department developed guideline charts for culvert material suitability limits for various site conditions. These guidelines have been revised to include polymer coated CSP. The guidelines for suitability limits are intended to aid the designer in selecting suitable culvert materials for the site conditions. To use the selection guidelines choose the lower of the soil or water pH values, and the lower of the soil or water resistivity values.

Examples

Field pH and resistivity results are required for determining the culvert material type:

Example “A” - pH of 5.0 and a resistivity of 1000 ohm-cm (corrosive environment). The choice of culvert material in this zone would be Polymer Coated C.S.P., Plastic or Concrete pipe.

Example “B” - pH of 5.5 and a resistivity of 2500 ohm-cm. The choice of culvert material in this zone would be Aluminum Coat C.S.P., Polymer Coated C.S.P., Plastic, or Concrete pipe.

Example “C” – pH of 6.0 and a resistivity of 5500 ohm-cm. The choice of culvert material in this zone would be Standard Galvanized C.S.P.; specialty coatings are not required in this neutral environment.

All the above choices are based on the measured pH/resistivity point falling above the material type limitation line giving 50 years to perforation for metal culverts. The choice of material can vary; for examples “A” and “B” a standard galvanized culvert could be used with a provision for a future liner provided it is supported in the life cycle cost analysis.

Prepared By Joe Filice

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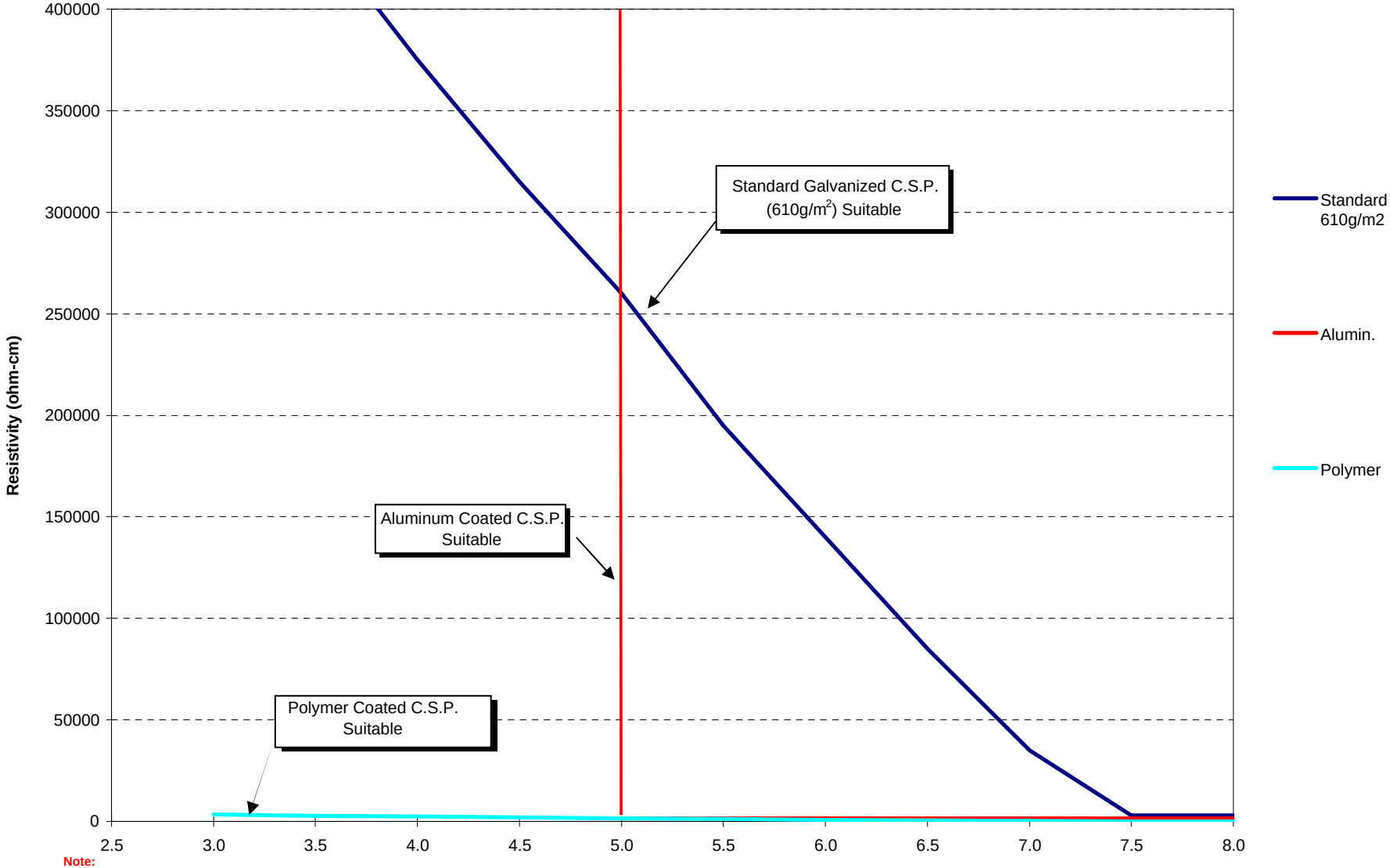
Chart 1

Guidelines for Suitability Limits for Metal Culverts (1.6mm thick) (based on 50 years to perforation)

Note: Chart does not apply for pH <3.0 or >8.0



Note:

1. **The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.**

2. **Plastic or Concrete pipe contact Manufacturer for limits**

Refer to Chart 1A for Resistivity <10,000 ohm-cm

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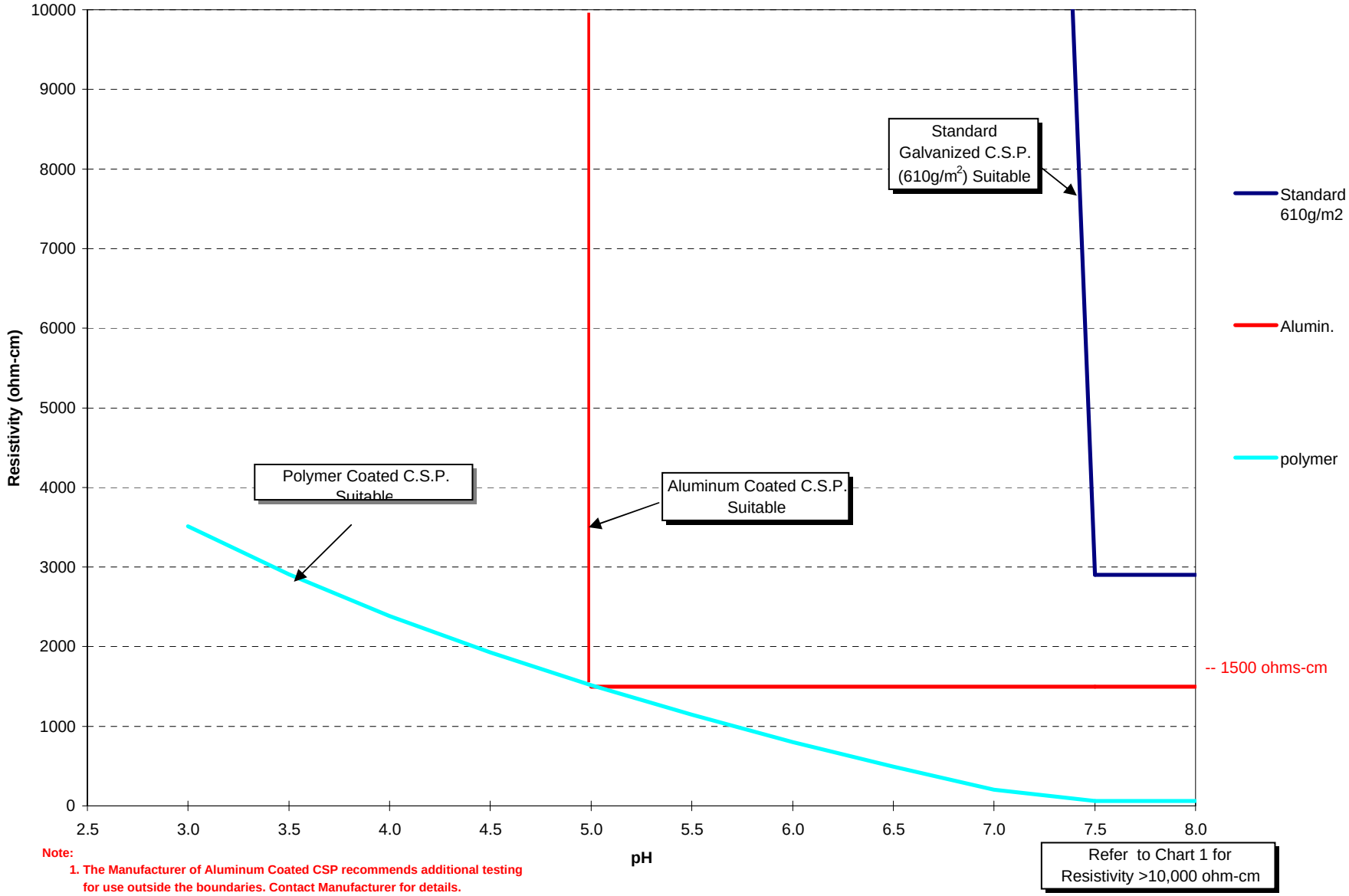
Chart 1A

Guidelines for Suitability Limits for Metal Culverts (1.6mm thick)
(based on 50 years to perforation)
Note: Chart does not apply for pH <3.0 or >8.0



Note:

1. **The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.**

2. **Plastic or Concrete pipe contact Manufacturer for limits.**

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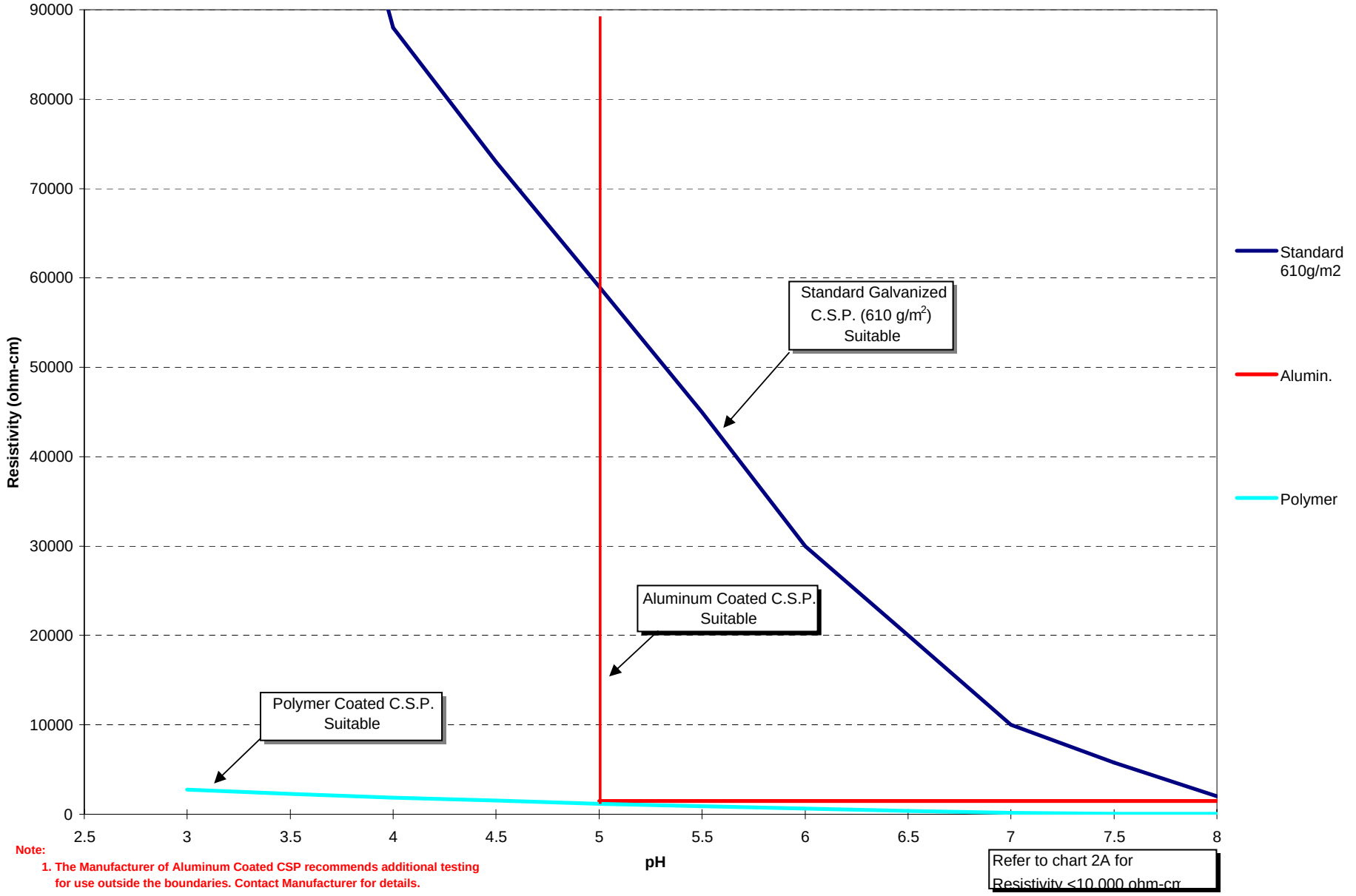
Chart 2

Guidelines for Suitability limits for Metal Culverts (2.0mm thick)
(based on 50 years to perforation)
Note: Chart does not apply for pH <3.0 or >8.0



Note:

1. **The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.**

2. **Plastic or Concrete pipe contact Manufacturer for limits.**

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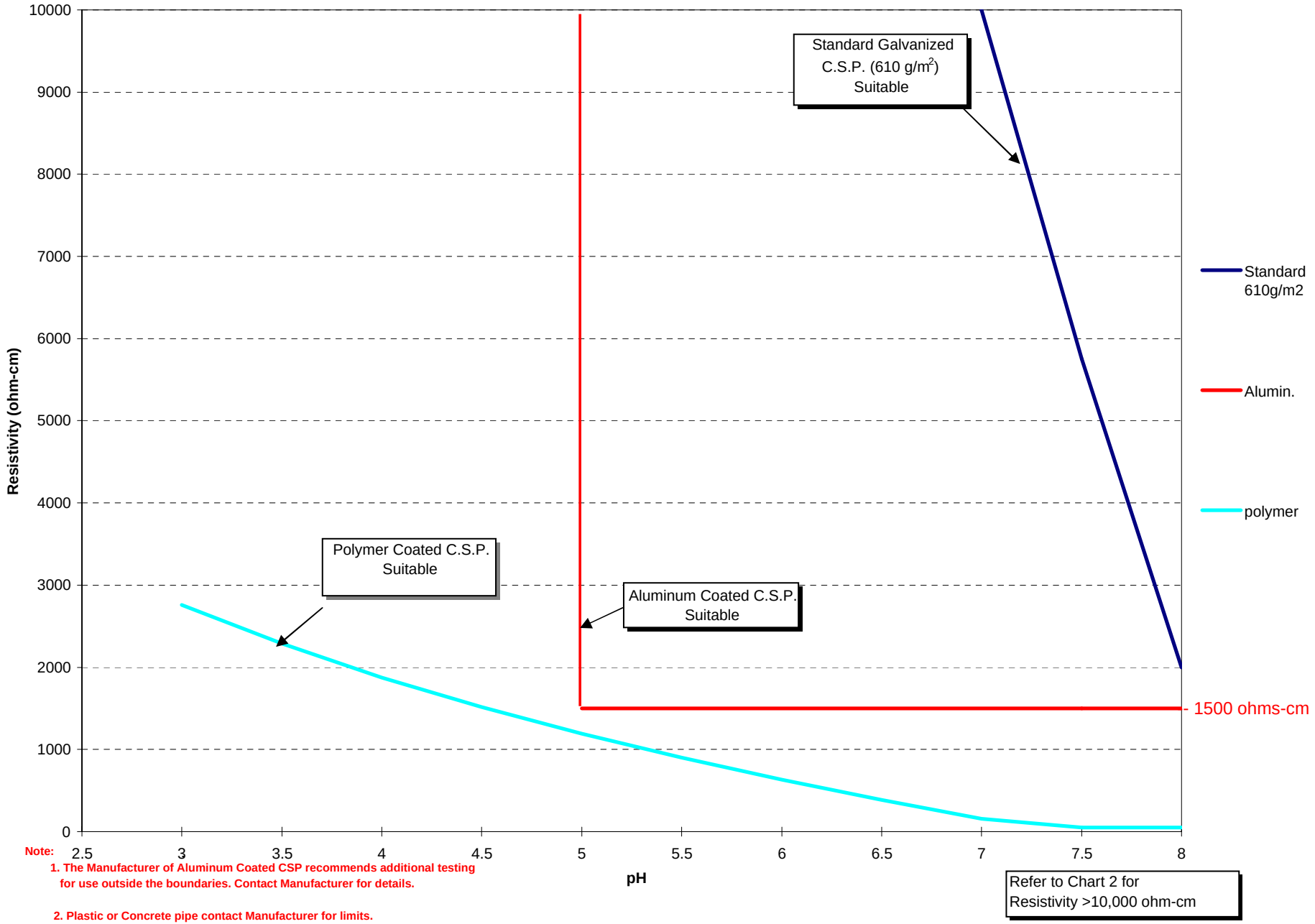
Chart 2A

Guidelines for Suitability limits for Metal Culverts (2.0mm thick) (based on 50 years to perforation)

Note: Chart does not apply for pH <3.0 or >8.0



Note:

1. The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.

2. Plastic or Concrete pipe contact Manufacturer for limits.

Refer to Chart 2 for Resistivity >10,000 ohm-cm

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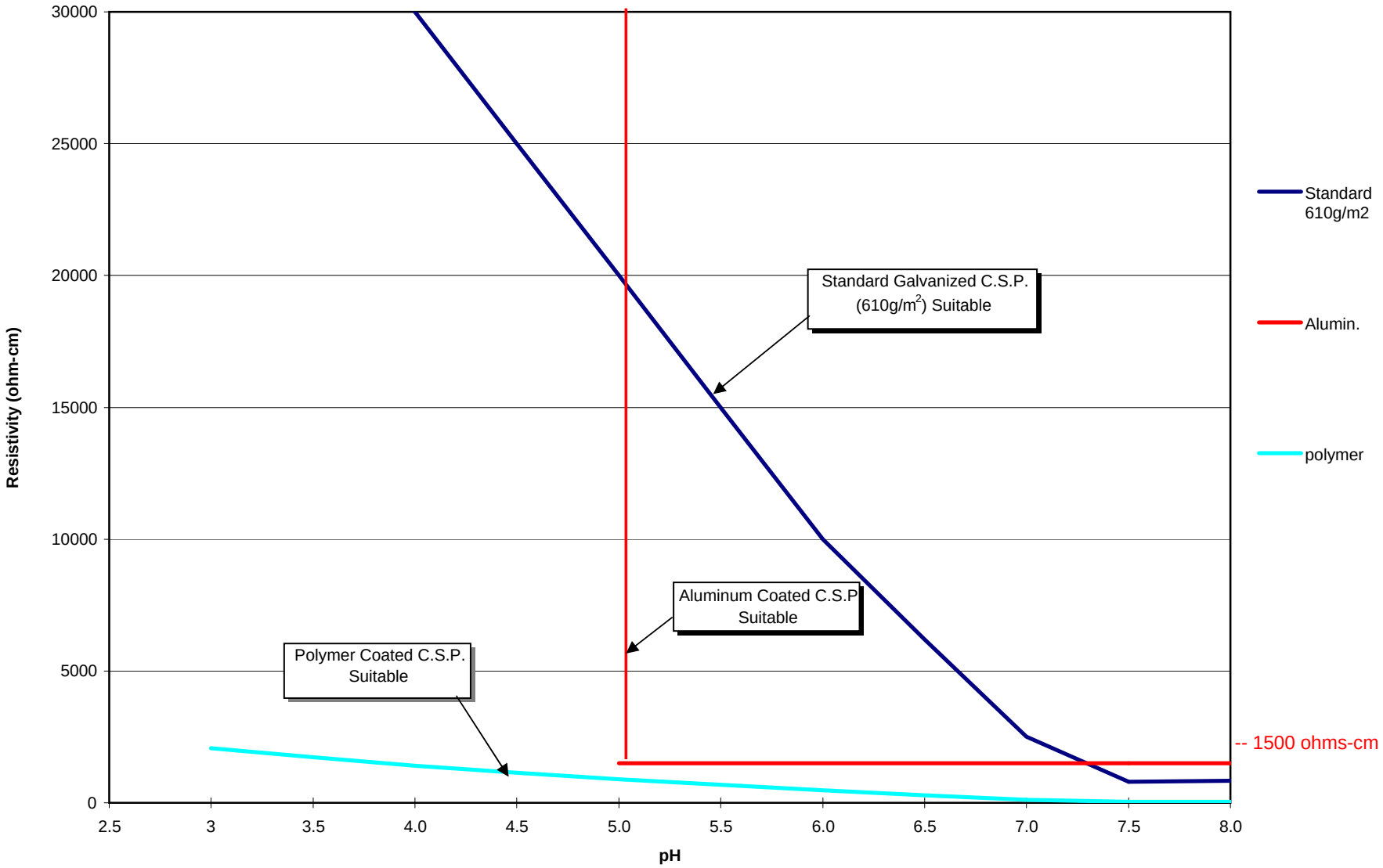
Chart 3

Guidelines for Suitability Limits for CSP Culverts (2.8mm thick)
(based on 50 years to perforation)
note: Chart does not apply for pH <3.0 or >8.0



Note:

1. **The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.**

2. **Plastic or Concrete pipe contact Manufacturer for limits.**

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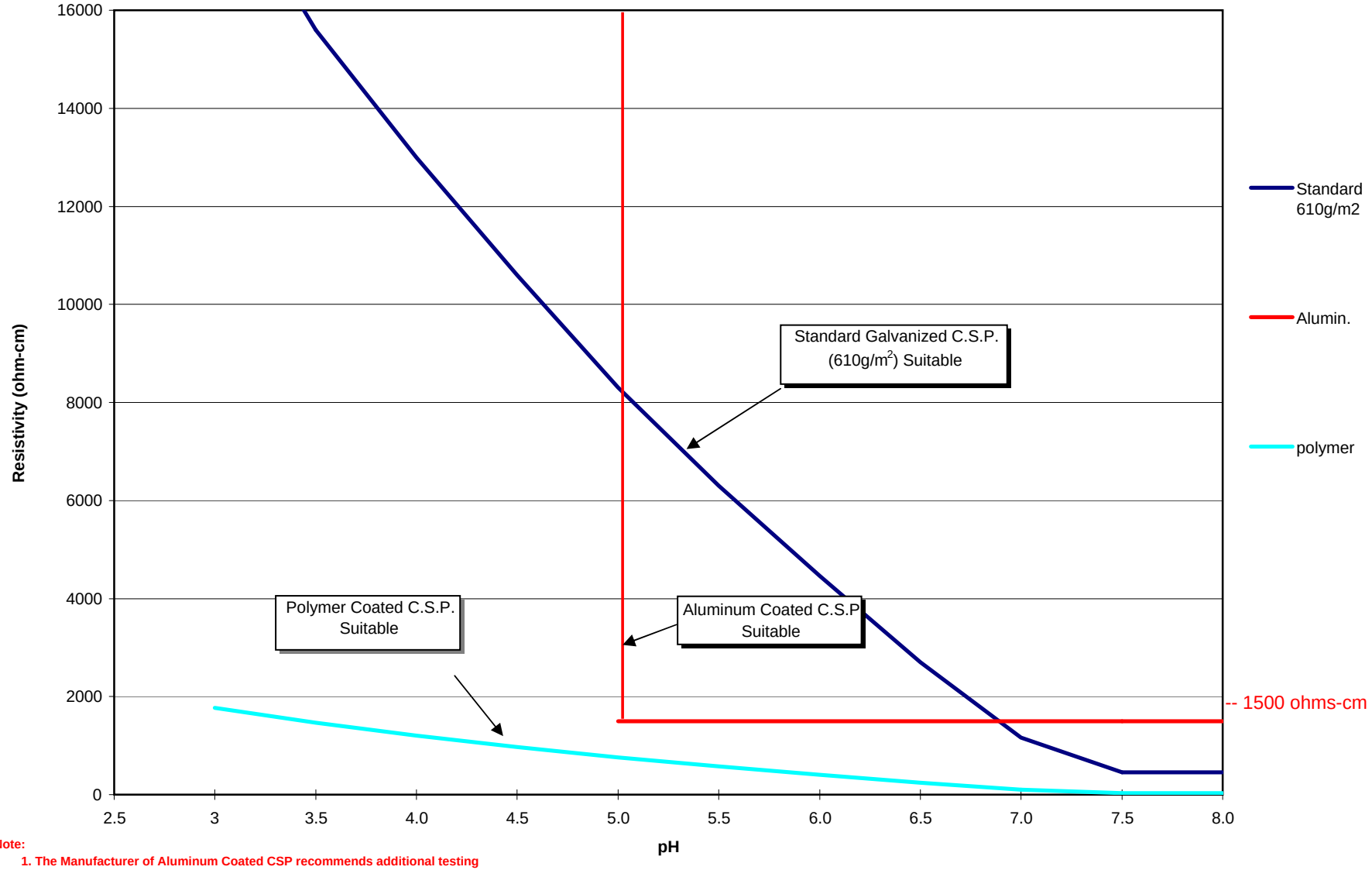
Chart 4

Guidelines for Suitability Limits for CSP Culverts (3.5mm thick)
(based on 50 years to perforation)
note: Chart does not apply for pH <3.0 or >8.0



Note:

1. **The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.**

2. **Plastic or Concrete pipe contact Manufacturer for limits.**

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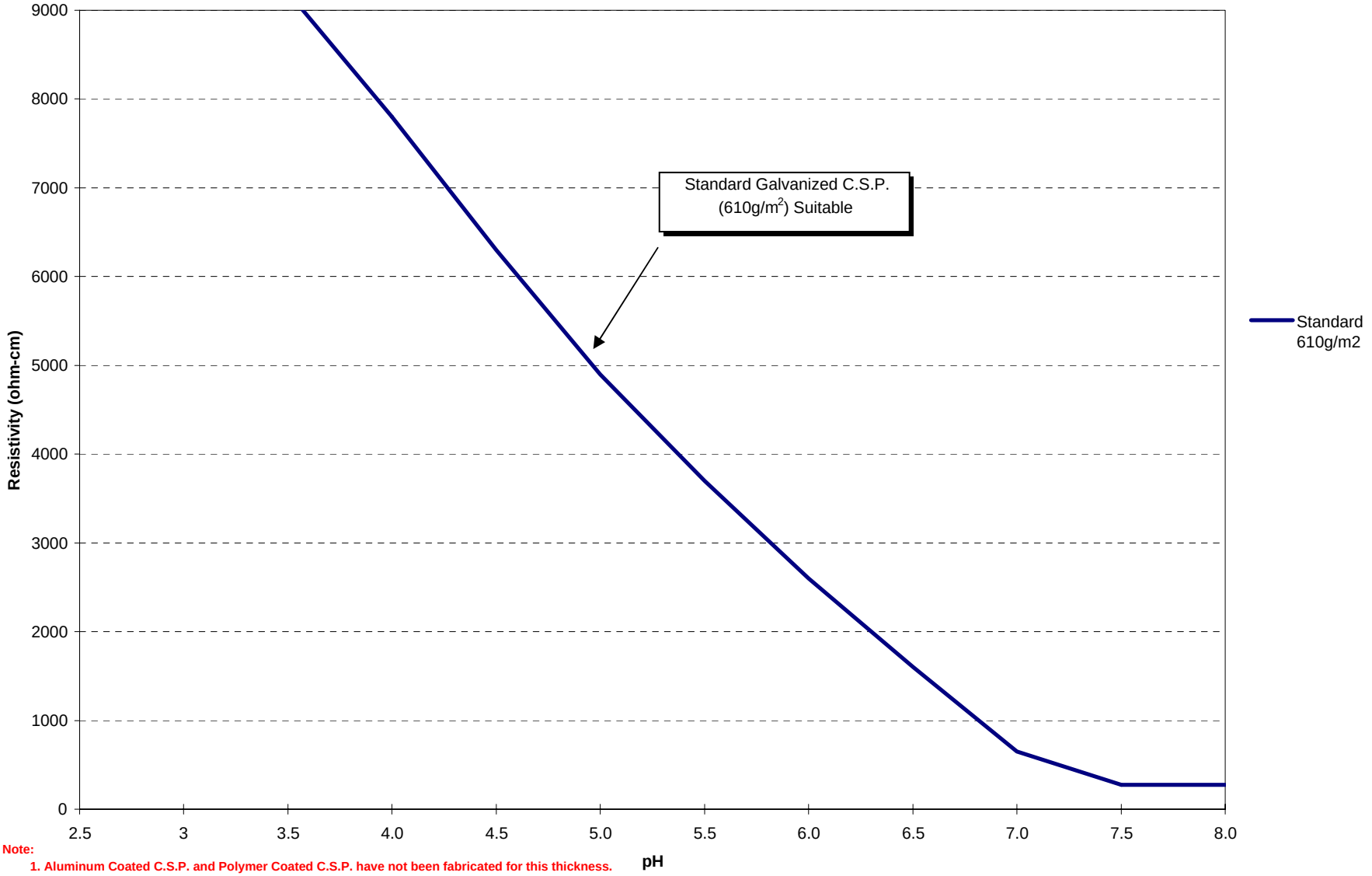
Chart 5

Guidelines for Suitability Limits for Metal Culverts (4.2mm thick)
Based on 50 years to perforation
Note: Chart does not apply for pH <3.0 or >8.0



Note:

1. **Aluminum Coated C.S.P. and Polymer Coated C.S.P. have not been fabricated for this thickness.**
2. **Plastic or Concrete pipe contact Manufacturer for limits.**

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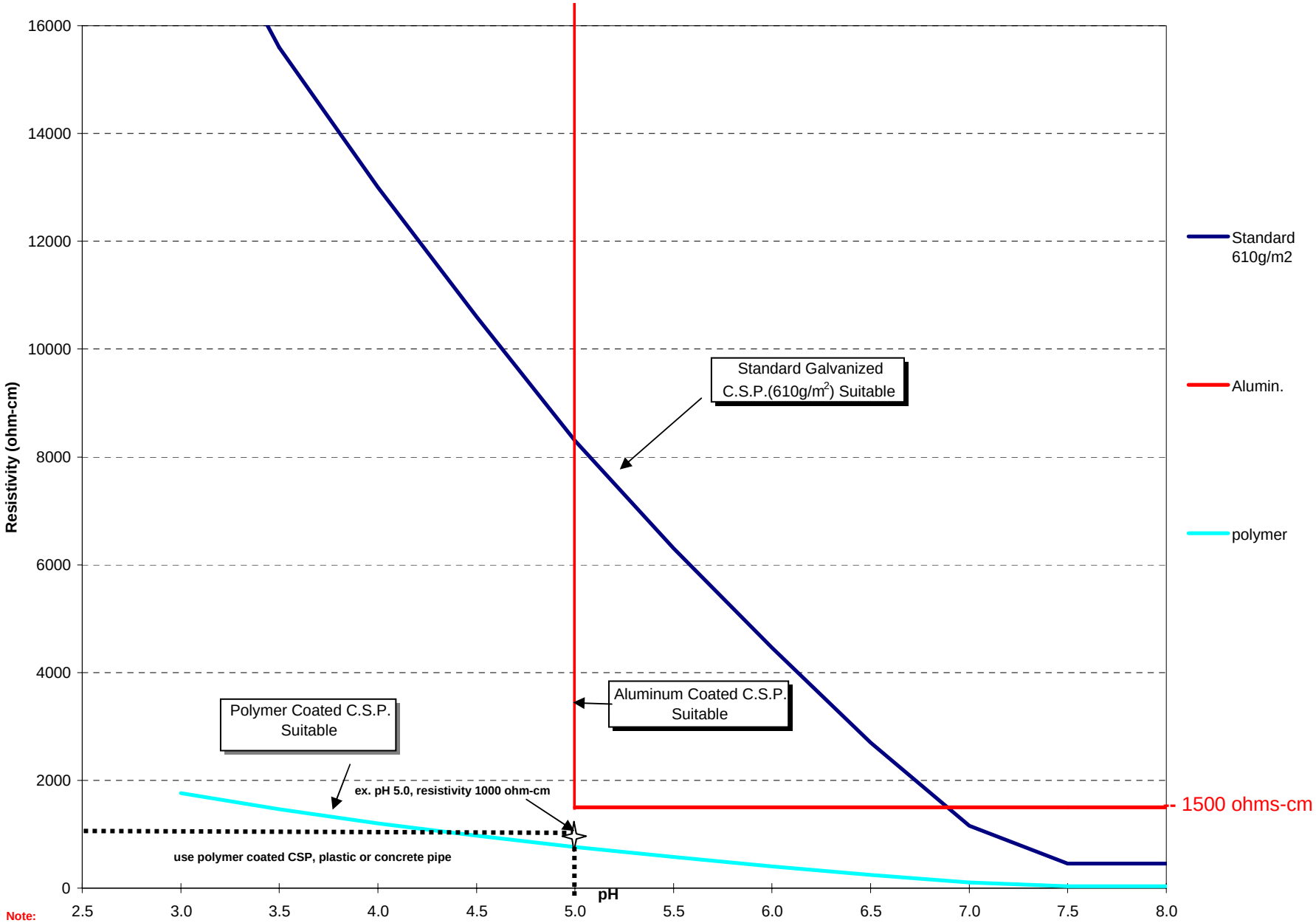
Chart 4

Example A

Guidelines for Suitability Limits for Metal Culverts (3.5mm thick)
Based on 50 years to perforation
Note: Chart does not apply for pH<3.0 or >8.0



Note:

1. The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.

2. Plastic or Concrete pipe contact Manufacturer for limits.

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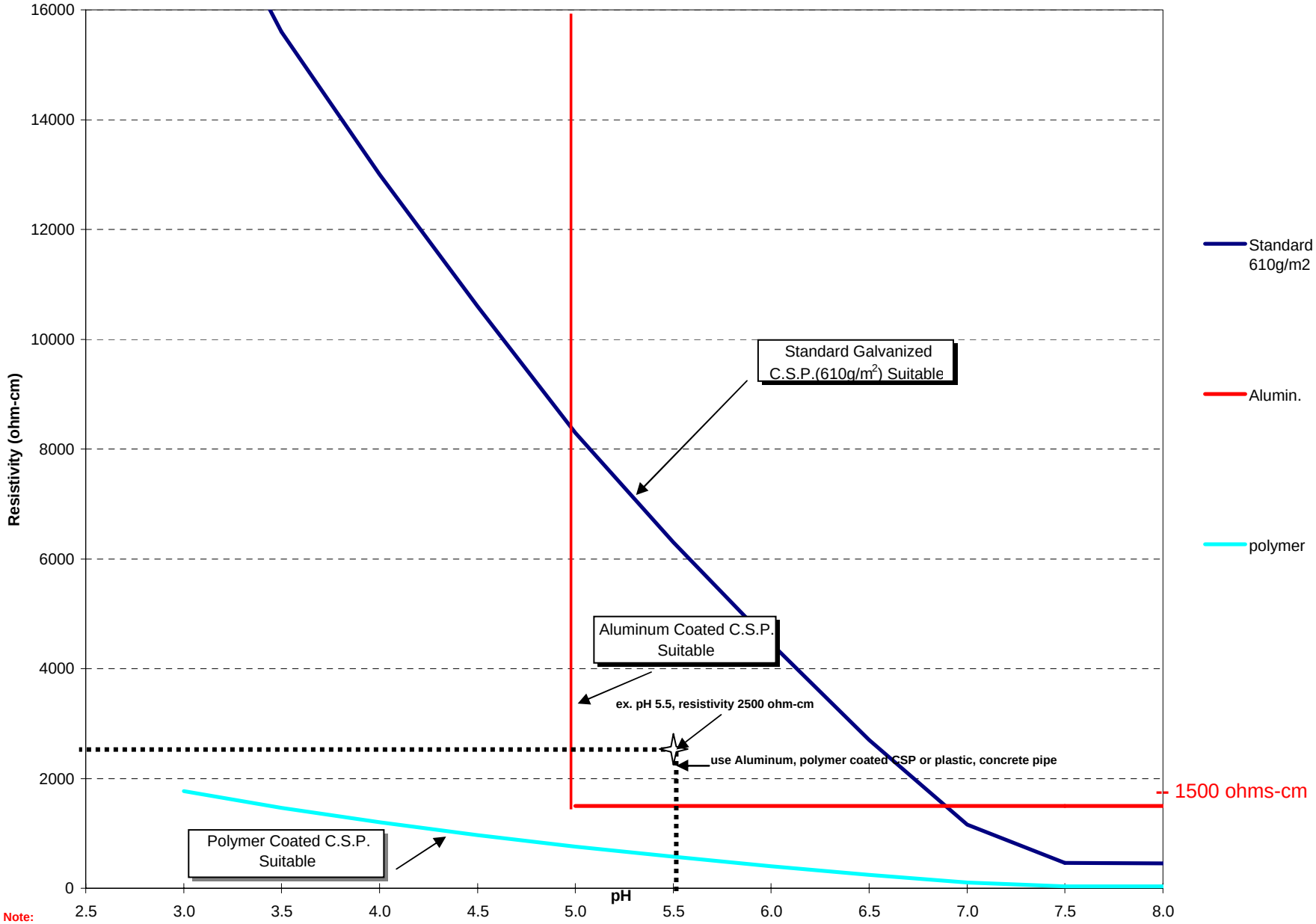
Chart 4

Example B

Guidelines for Suitability Limits for Metal Culverts (3.5mm thick)
Based on 50 years to perforation
Note: Chart does not apply for pH<3.0 or >8.0



Note:

1. **The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.**

2. **Plastic or Concrete pipe contact Manufacturer for limits**

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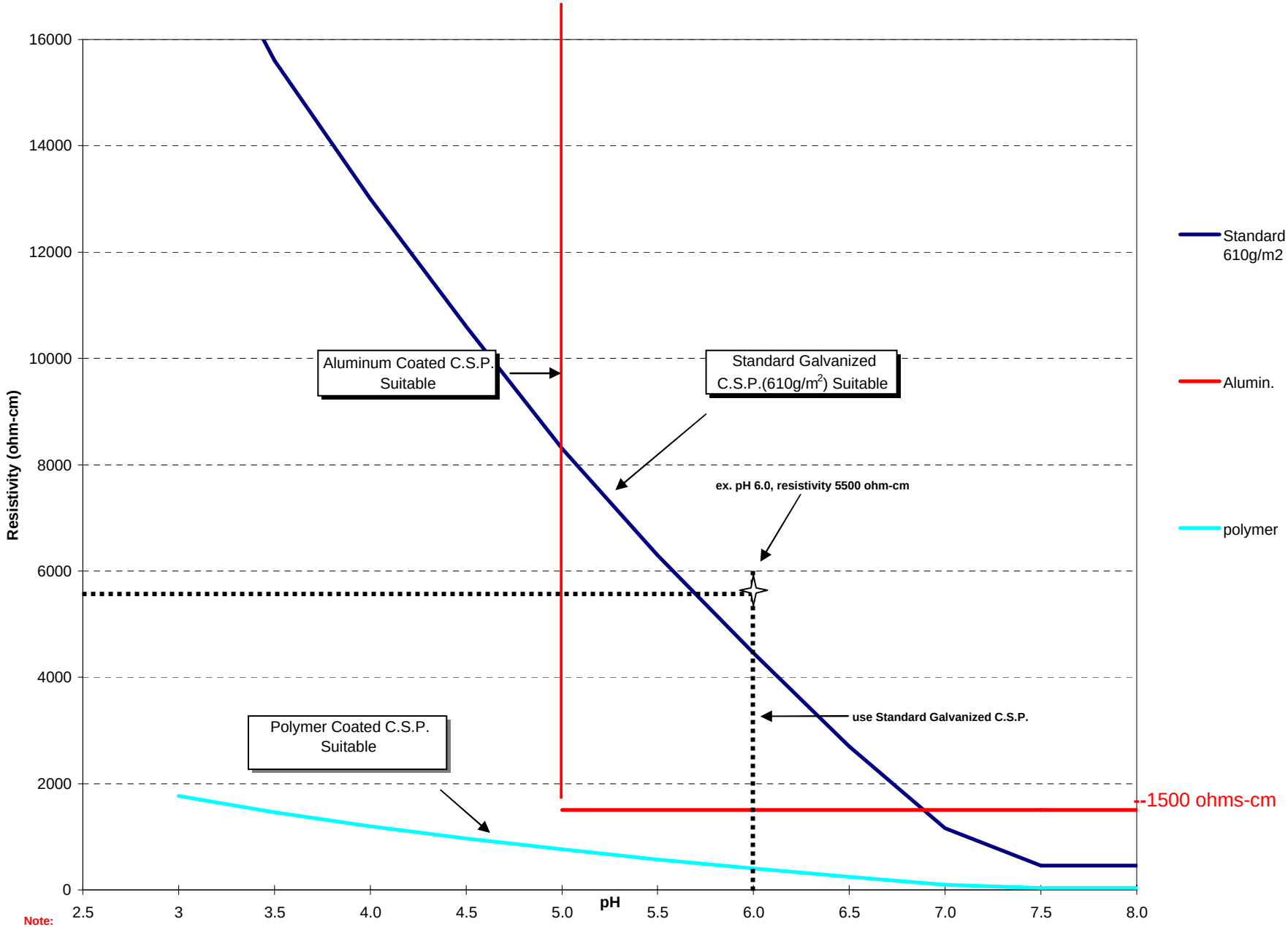
Chart 4

Example C

Guidelines for Suitability Limits for Metal Culverts (3.5mm thick)
Based on 50 years to perforation
Note: Chart does not apply for pH<3.0 or >8.0



Note:

1. **The Manufacturer of Aluminum Coated CSP recommends additional testing for use outside the boundaries. Contact Manufacturer for details.**

2. **Plastic or Concrete pipe contact Manufacturer for limits.**