National Radio Astronomy Observatory

VLA Electronics Memo No. 220

Cathodic Protection of the VLA 60mm Waveguide:

Natural Potentials versus Applied Potentials

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A corrosion survey of the underground waveguide at the VLA was conducted in May of 1980 and completed in March of 1981. At that time a recommendation was made by Pacific Corrosion Research, Inc. that a cathodic protection system should be installed. Due to the high current demand and the cost, it was unfeasible to consider the sacrificial anode so the impressed current system was installed.

Common criteria for protection of buried steel from corrosion required a minimum of -300 millivolt and an ideal of -800 millivolt potential relative to natural potential (steel-to-ground). The measured waveguide-to-soil natural potential ranged from -400 mv to -600 mv on the north and east arms. The measured west arm natural potential from A0 to A7 was in the range of -400 mv to -500 mv while the potential reading from W8 to W38 was in the range of -100 mv to -200 mv.

The consultant calculated that the total current required to give us minimum protection would be 288 amperes. This calculation was done on seventy-two observing stations, approximately 60km of 60mm underground waveguide, and the railroad track. The installed cathodic protection system consists of 11 air cooled rectifiers, 186 each 4" x 40" graphite anodes, and 35 each 4" x 4" x 56" sacrificial magnesium anodes. The magnesium anodes were used in areas, such as road crossings and some underground tanks, where active applied potential was not feasible.

The attached graphs show the measured applied potentials (AP) and measured natural potentials (NP) at each manhole on each arm. The graphs also show the minimum natural potential, minimum protected potential and the ideal protected potential. One set of graphs compare the 1980 natural versus the 1984 applied potentials. The second set compares the 1980 natural versus the 1990 applied potentials. A third set compares the 1990 applied potentials versus the 1992 natural potentials. In 1992 a break in the power cable between manholes E3 and E4 allowed us to take some natural potential readings after power had been down for 3 months.

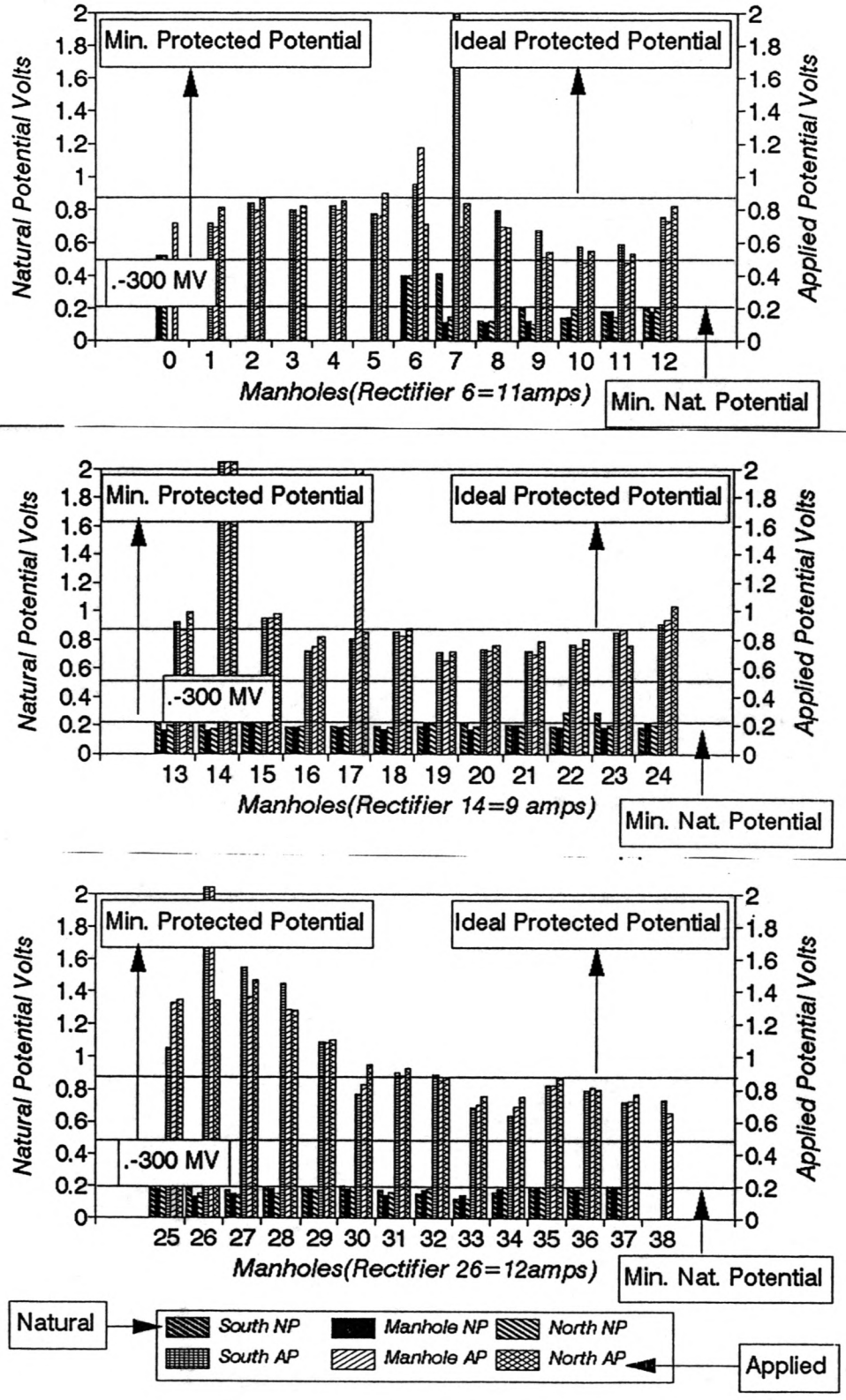
The natural potentials taken on the east arm between manholes E22 and E37 looked much better in 1992 than they did in the original 1980 survey. Comparing the 1984 applied potentials to the 1990 applied potentials, the 1990 graphs show some noticeable gain in the amount of protection on each arm. The amount of maintenance and watering that was done in the last two years may account for much of this increase. Although some areas didn't show much of an increase, it may be due to poor grounding on the waveguide. This is something we'll have to look at as time permits. According to the graphs from 1984, the waveguide had at least the minimum protection of -300 mv. The 1990 graphs show most of the underground waveguide has the ideal protection of -800 mv.

Acknowledgement: James Guin, and Rey Serna measured the 1980 potentials. James Guin and John Leo Sanchez measured the 1984 potentials. James Guin and the cryogenic group measured the 1990 and 1992 potentials.

Reference: Corrosion Survey by Heaven Tso, Chief Engineer, Pacific Corrosion Research, Inc.

Applied Versus Natural Potential

West Arm 1980 natural and 1984 Applied



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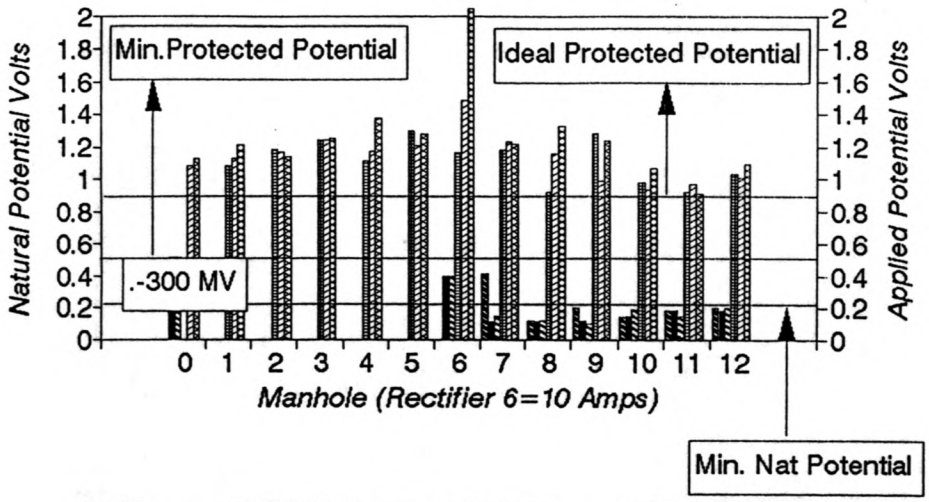
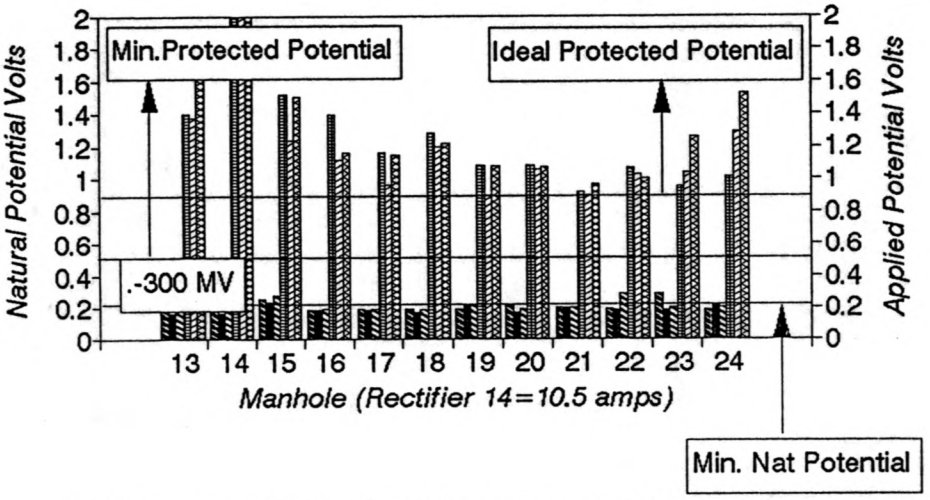
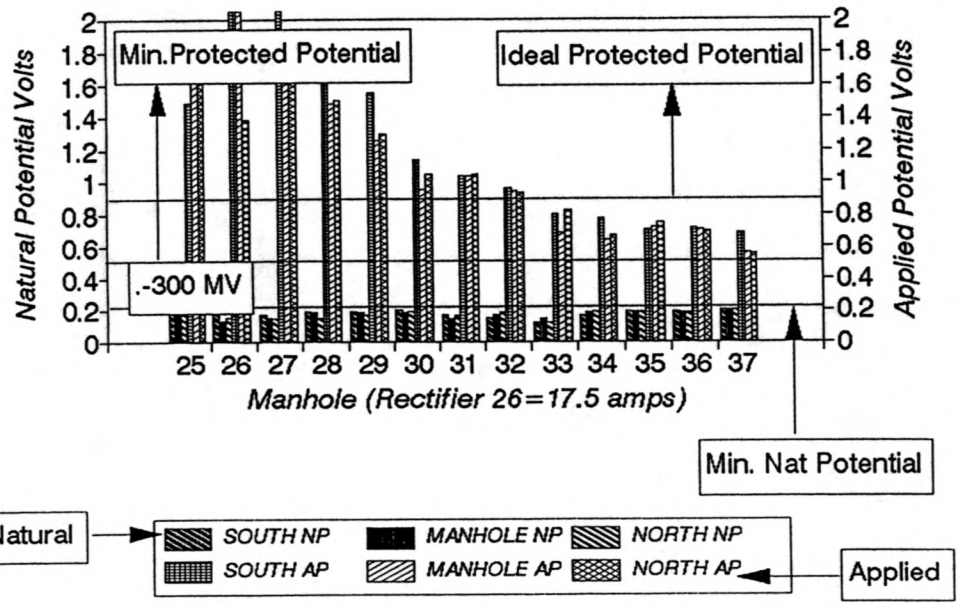
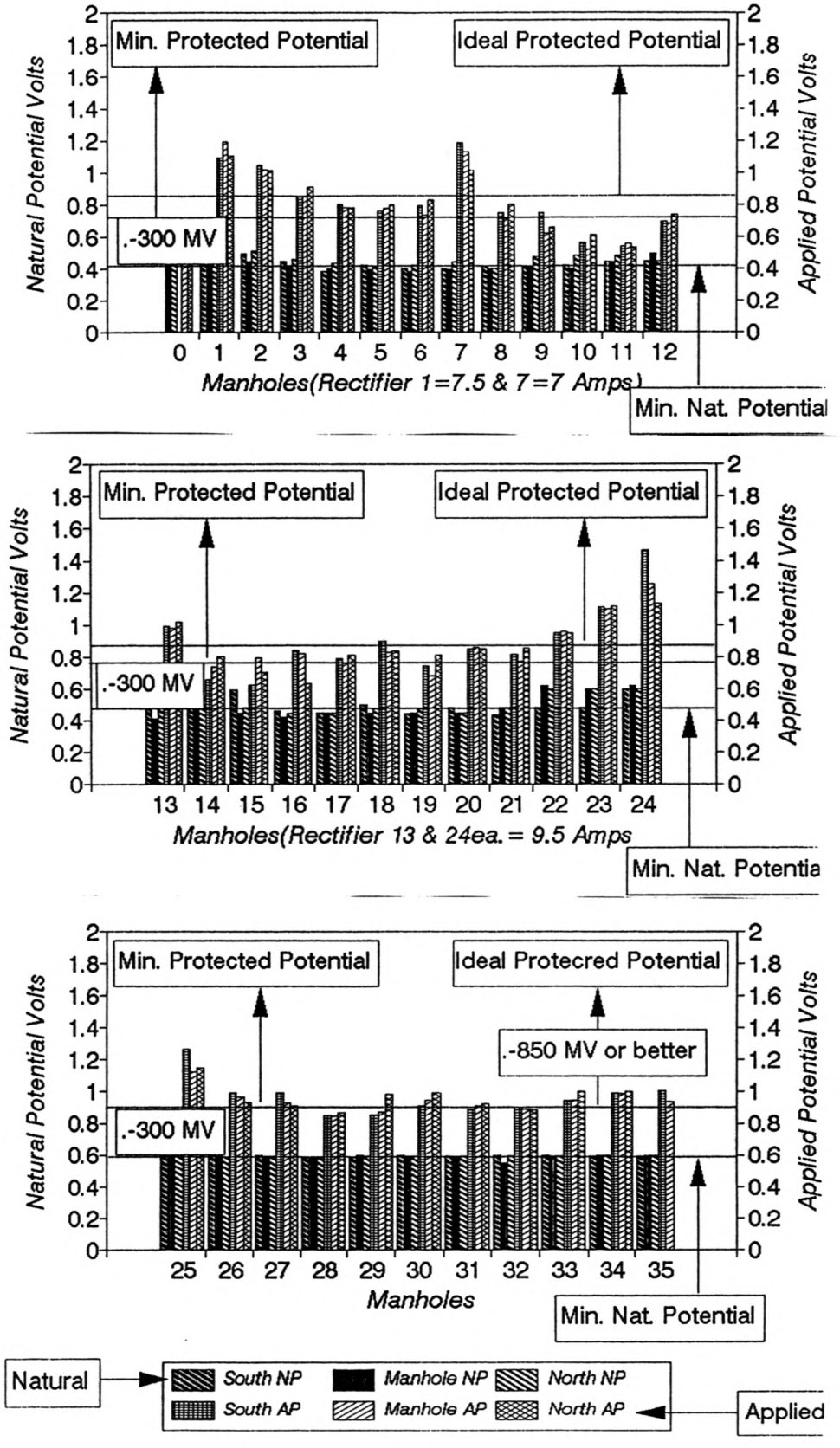






Applied Versus Natural Potential

North Arm 1980 Natural and Applied 1984



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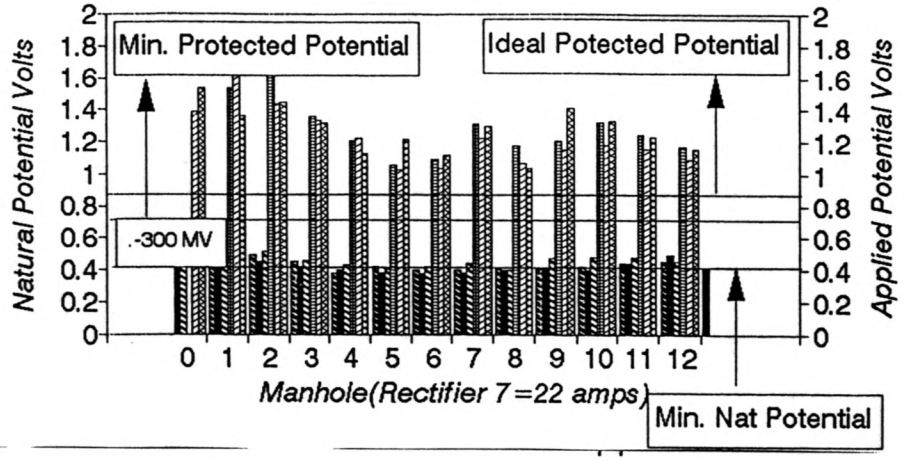

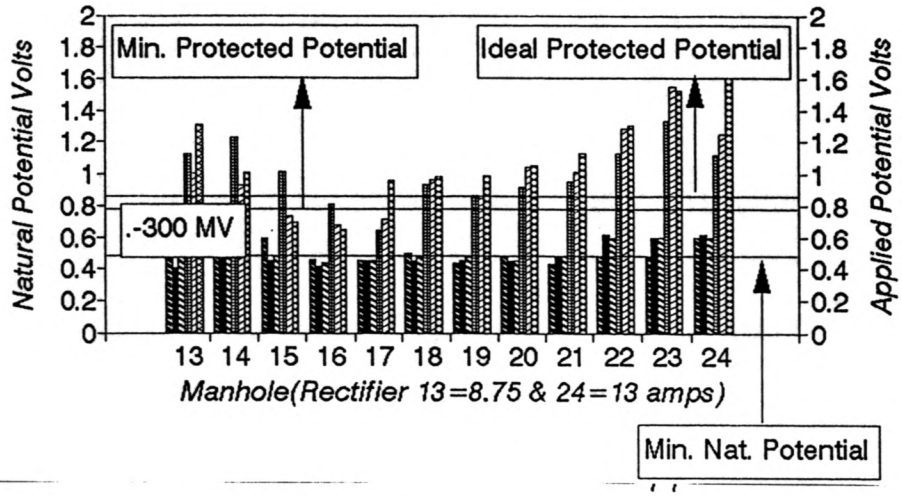

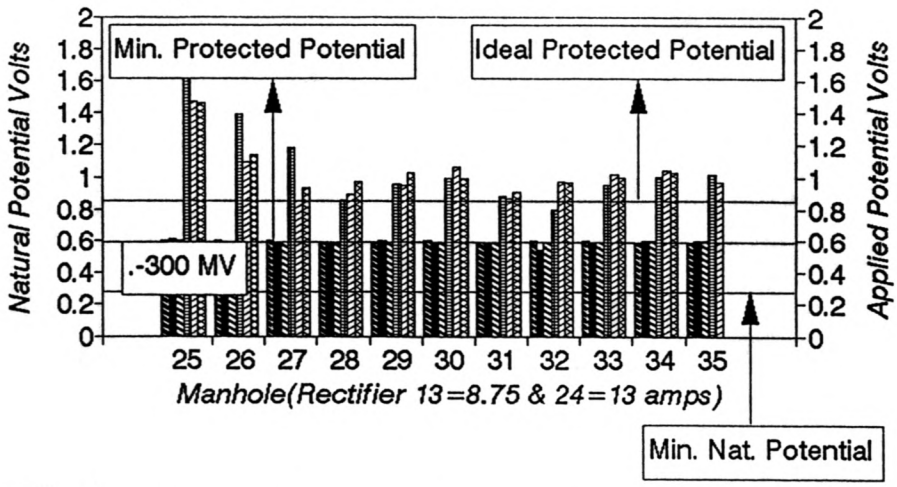

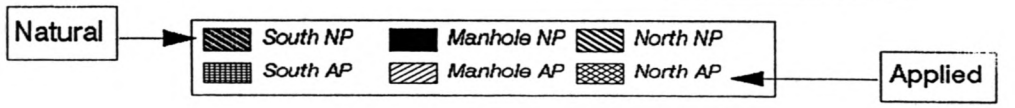

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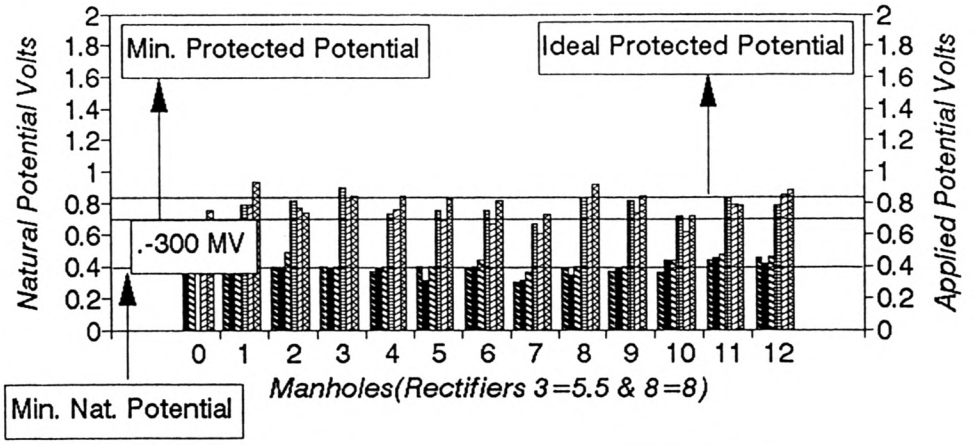

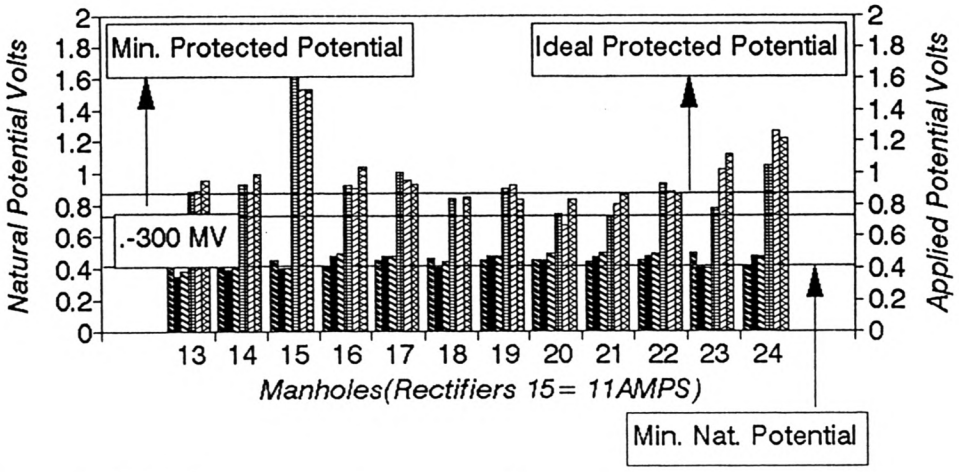

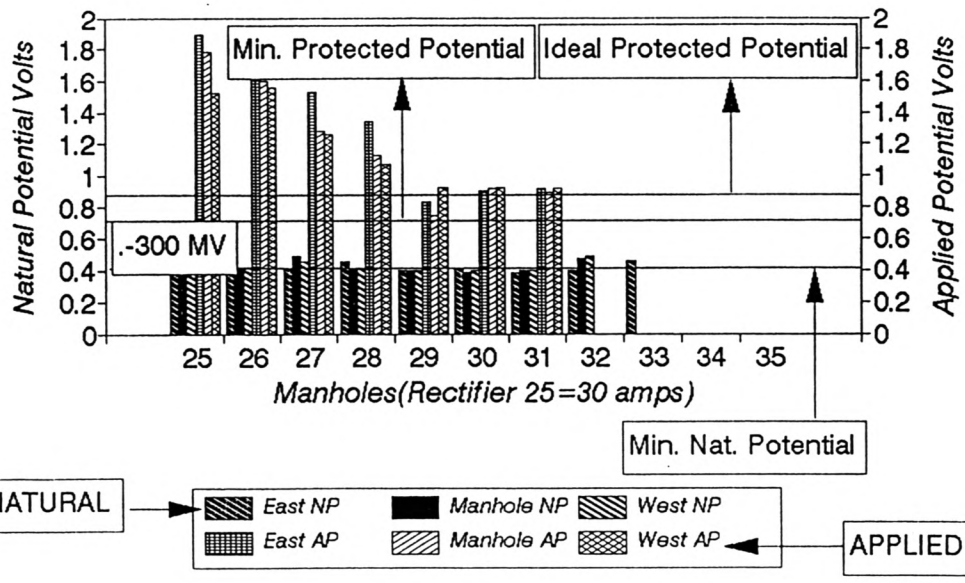

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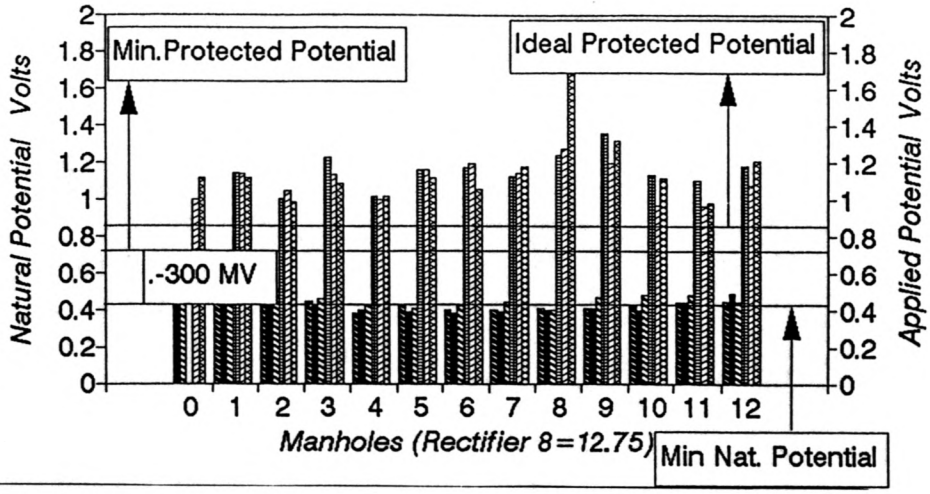

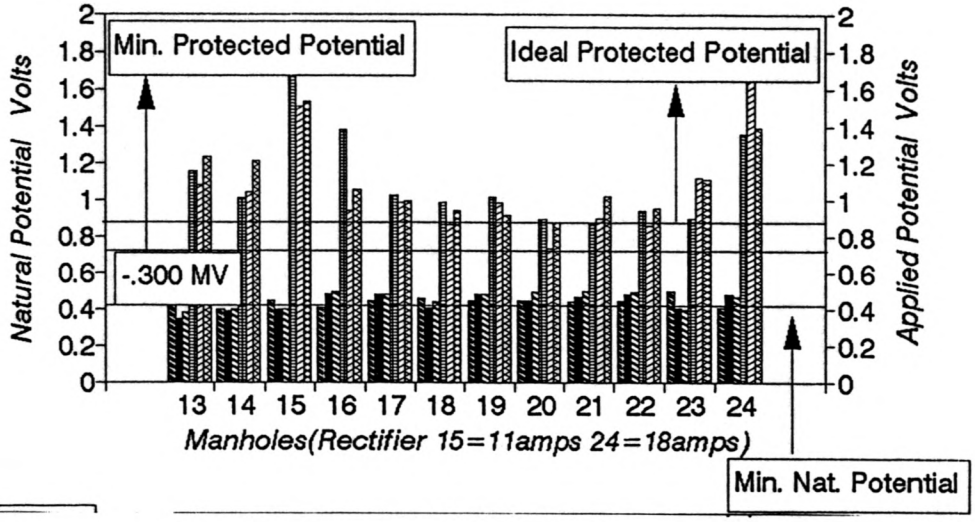

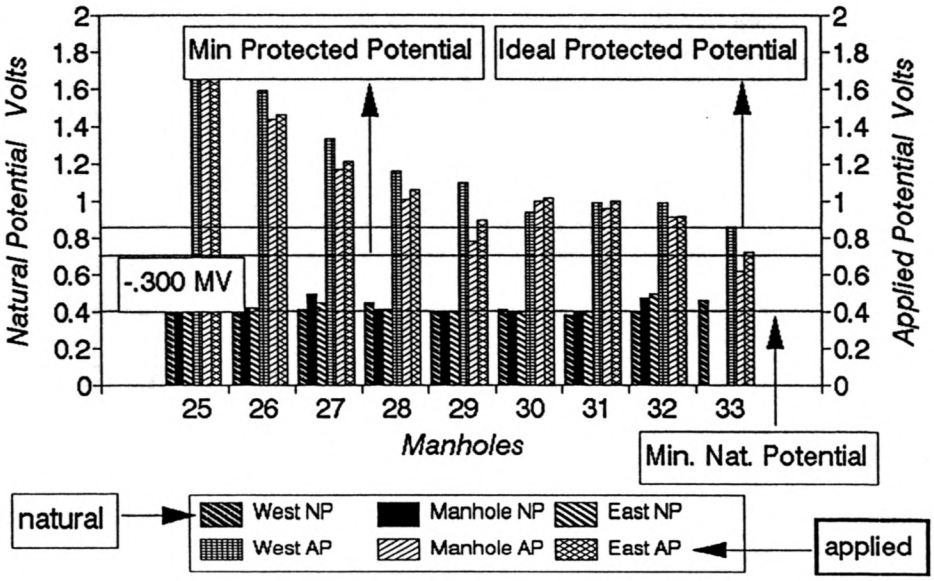

APPLIED VERSUS NATURAL POTENTIAL

EAST ARM 1990 APPLIED AND 1992 NATURAL