



Topographic Mapping for Environmental Assessment

Introduction

The location, extent, and historical change in the nature of hazardous waste sites is of great importance to the Environmental Protection Agency, and can be documented through the creation of topographic maps. The National Exposure Research Laboratory in Las Vegas (NERL-LV) is the Agency's center for mapping and related remote sensing technologies. Topographic (elevation) maps are simple, effective, and graphic tools for recording the quantitative and qualitative characteristics of hazardous waste sites. These maps are most often created from aerial photographs and, since national archives of coverage date back more than fifty years, maps can be created that reflect historical site conditions.

Technique

A typical topographic mapping project begins with a request from an RPM to the NERL-LV's Environmental Photographic Interpretation Center (EPIC). The EPIC provides a cost estimate and arranges for all necessary geodetic surveys, aerial photographic overflights, and map production. No permission is needed for a flyover, so aerial photography is of particular value in situations where uncooperative owners deny intrusive sampling. A specially calibrated aerial camera is used to ensure accurate photography for later use in the map production process. Once the film is developed and converted into digital format, it is processed within a digital photogrammetric environment. This allows the creation of digital elevation models and the subsequent production of contour maps. The map may be generated as hard-copy, or in digital form for later use with Geographic Information Systems (GIS). The same aerial photographs can be interpreted to assess the remediation actions at the site.

Scope

In addition to basic positional information about ground elevation and locations of objects, maps can serve as the base for a targeted sampling grid, or for recording specialized information such as land disposal activity, population distribution, geologic fractures, vegetation communities, wetlands delineation, and land use. When compared with historical aerial photographs, these maps can provide both qualitative and quantitative

information on changes in volume and elevation (e.g., last year there was a mound three times larger than the present one; or, between 1988 and 1990, there were 100,000 cubic yards of material placed in the landfill). Topographic information is entered into ARC/INFO (EPA's GIS software) for future referral. The information on these maps can provide answers to critical environmental questions such as the probable sources of contamination and the ultimate destiny of discharges.

Advantaged and Limitations

Topographic mapping is a mature technology that is expanding to meet the needs of the environmental community. Advances in computer technology and optical sciences have enhanced remote sensing capabilities over the years - and continue to do so.

Advantages

- Legally defensible data
- Permanent historical record
- Digital or analog format
- Geographic relationships are clearly demonstrated
- Quantitative measurements can be made

Limitations

- Seasonal and weather restrictions
- Complexity of technology

Future Plans

Remote sensing and mapping technologies continue to develop and hold great promise for practical environmental usage. The basic topographic mapping process is being augmented by a series of related monitoring techniques that will provide new thematic mapping products. Among these are: the use of orthoimagery (imagery corrected to map-quality standards); land use/land cover mapping from satellite data; and the development of various digital products in a geographic Information Systems format. The increased need for accurate information will continue to drive remote sensing and topographic mapping growth in the 1990's and beyond.

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References

U.S. Environmental Protection Agency. 1984. Photogrammetric Mapping Program for Hazardous Waste Sites. An NERL-LV publication. Remote Sensing and Interpretation, Lillesand, T.M., and R.W. Kiefer, John Wiley and Sons, 1994, especially Chapter 5. Elements of Photogrammetry, Wolf, P.R., McGraw-Hill, 1983.

The Environmental Photographic Interpretation Center (EPIC) is a field station of the Landscape Ecology Branch (LEB), Environmental Sciences Division - Las Vegas (ESD-LV), National Exposure Research Laboratory (NERL), Office of Research and Development (ORD).

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