Excerpt from the 2005 Edition of NL 2218

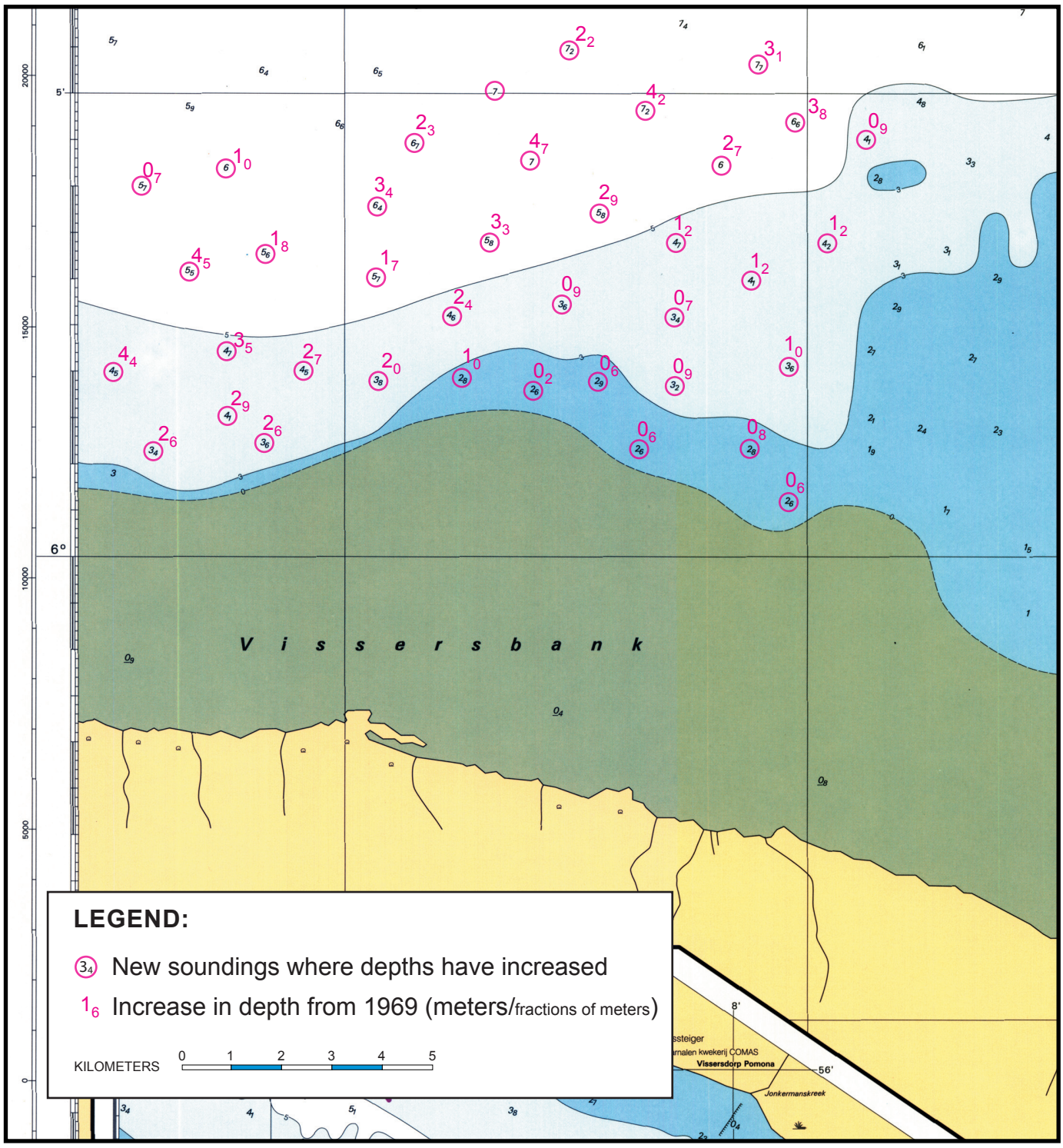


Figure 10

Attachment 1:

Differentiating Land Surfaces from Water Surfaces Using SPOT Imagery

The French satellite referred to as SPOT (Systeme Probatoire d'Observation de la Terre) operates as a passive imaging system. This means that it is dependent upon reflected electromagnetic radiation [EMR] from the sun, which is recorded by the system sensors for the purpose of generating an image. When EMR strikes matter, it may be transmitted, reflected, or absorbed in proportions that depend upon (1) the composition and physical properties of the medium, (2) the wavelength or frequency of the incident radiation, and (3) the angle at which the incident radiation strikes the surface.[1/] Therefore, the interrelationships between energy interactions, as a function of wavelength (λ), can be expressed in the following manner:

$$E1(l) = ET(l) + ER(l) + EA(l)$$

where: E1(l) = incident radiant energy
ET(l) = fraction of transmitted energy
ER(l) = fraction of reflected energy
EA(l) = fraction of absorbed energy

Graph 1[2/] illustrates a wide range of surfaces and how they reflect various portions of the Electromagnetic Spectrum [EMS]. Note that water exhibits its highest reflectivity in the shortest part (0.4μ) of the visible spectrum, and that virtually no reflection occurs beyond the longest wavelengths of visible light (0.7μ). This means that in the SPOT frequency range of Band 3, Near Infrared with wavelengths of 0.79μ – 0.89μ are absorbed by water.

Graph 2[3/] illustrates the percent of transmittance (the amount of energy that passes through an object, such as light passing through glass) that occurs at various wavelengths of the EMS in various types of water. Note that there is no transmittance of energy beyond the visible part (0.7μ) of the EMS. These two graphs clearly illustrate that virtually all EMR in the wavelengths of SPOT Band 3 are absorbed by water.

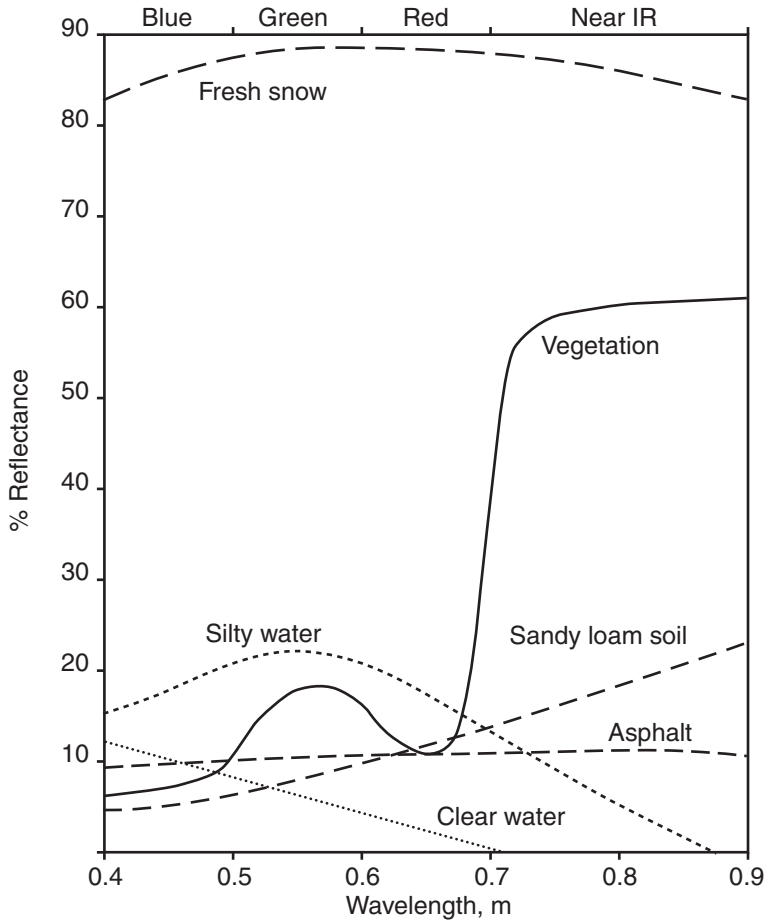
Detection of objects using Band 3 of SPOT is dependent upon the return of EMR in the 0.79μ – 0.89μ range. Since virtually no EMR in Band 3 wavelengths is returned from the water surfaces to the SPOT sensor, any object covered by water (even less than an inch) would be masked by the water's absorption of EMR in these wavelengths. On the other hand, any land surfaces protruding above the water would be readily visible, as land surfaces not covered by water will reflect large amounts of EMR in the Band 3 wavelengths (see Graph 1). Sandy loam soil and vegetation both produce their highest reflectance in the near IR portion of the EMS.

[1/] Avery, Thomas Eugene, 1992. *Fundamentals of Remote Sensing and Airphoto Interpretation*, 5th ed. p. 8. New York: Macmillan Publishing Co.

[2/] Avery, p. 42.

[3/] Slater, Philip N., 1975. *Manual of Remote Sensing*, v 1. p. 279. Falls Church, VA, American Society of Photogammetry.

Graph 1



Graph 2