

Mapping Impervious Surfaces with High Resolution QuickBird Satellite Data: Application to Stormwater Management

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Mapping impervious areas (e.g. parking lots, roads, buildings) is critical to stormwater management because impervious surfaces reduce infiltration of surface water into the soil, thereby increasing runoff which can carry harmful pollutants into streams and lakes. For the City of South Burlington, accurate impervious surface maps are required for the implementation of a new stormwater utility where each land use category (residential, industrial, commercial and other land uses) is taxed relative to the amount a parcel contributes to stormwater runoff based on its impervious cover. The recent availability of high spatial resolution (2.44m) QuickBird satellite data provided an opportunity to assess the utility of this data for impervious surface area mapping.

Storm Water Management

In November 1999, the EPA issued the Phase II Stormwater Rules for metropolitan areas of less than 100,000 people. To comply with these new rules, this project was developed to assist the City of South Burlington, VT in its effort to develop a stormwater utility. A critical need in any program to implement successful water/stormwater management policies is the ability to identify impervious surfaces that are widely recognized to impact urban water quality.

The recent availability of commercial high spatial resolution satellite imagery offers improved land cover characterization, capability to monitor environmental change over time, digital processing capability, and data that are compatible with Geographic Information System technologies. Although satellite data have proven too coarse to track impervious cover in the past, this project utilized recently available high spatial resolution QuickBird satellite data to map impervious cover for South Burlington. A multi-step classification was employed using NIR and red band ratio to differentiate vegetated and non-vegetated surfaces combined with stratification of water, wetlands, and agricultural areas. As a result of this pilot study, our satellite-derived impervious data product was adopted by the South Burlington as the basis for its stormwater utility. These data will also serve as a baseline from which periodic updates can be performed so that the City of South Burlington can monitor land cover changes as the community grows.



Figure 1. Natural color, panchromatic, and color infrared composite images from Digital Globe's QuickBird satellite

Recent Applications Using High Resolution Satellite Imagery

- Stormwater Management
- Urban Planning
- Land Use/Land Cover Mapping
- Monitoring Development/Change



Figure 2. Impervious area map for stormwater management in South Burlington, VT derived from QuickBird satellite imagery.

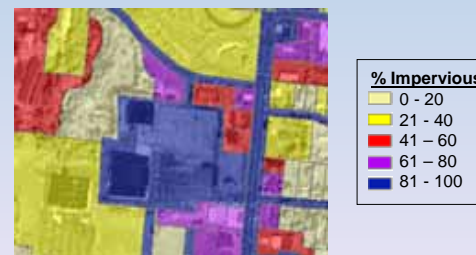


Figure 3. Percent impervious surface area summarized by town parcel for South Burlington.

Impervious Area for South Burlington

- 0 - 10%
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 50
- 51 - 60
- 61 - 70
- 71 - 80
- 81 - 90
- 91 - 100

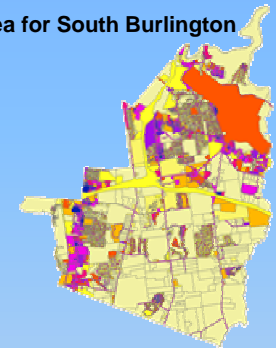


Figure 4. Impervious area (%) is summarized for each parcel in the City of South Burlington. The large orange area is Burlington International Airport.



Figure 5. QuickBird satellite imagery can also be used to monitor land use change over time. New housing development at Butler Farms in South Burlington is evident in the QuickBird satellite data acquired in 2003 that was not present in the 1999 DOQ.