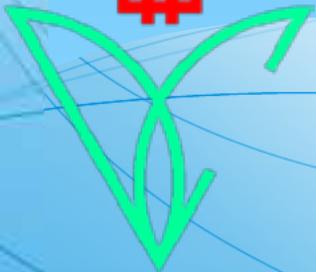


# 3-D GIS for Site Feasibility Study in Hong Kong Housing Authority

ESRI International User Conference 2013  
8-12 July 2013, San Diego, USA

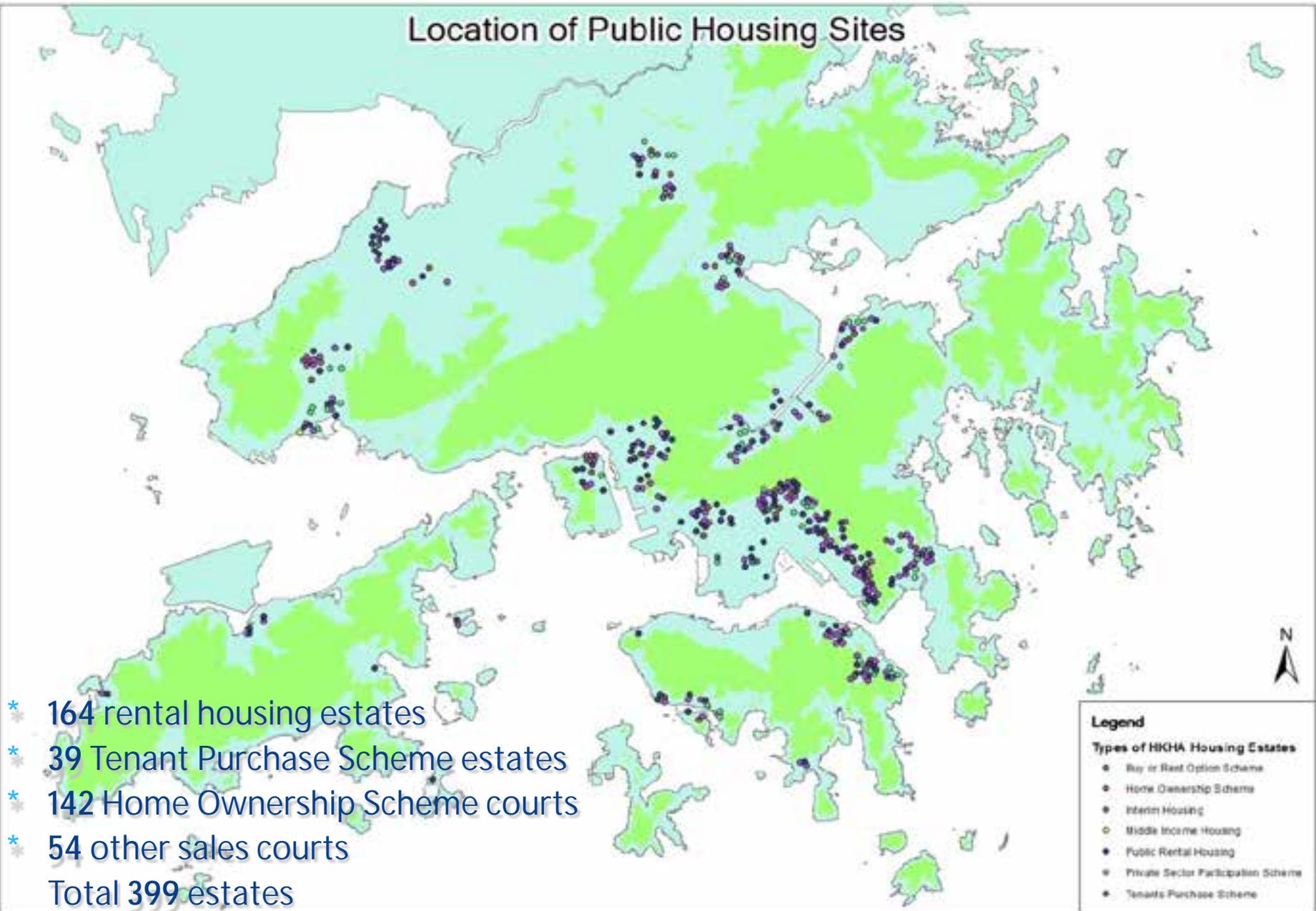
Winnie Shiu, Ricky Y.Y. Cheung  
Hong Kong Housing Authority



# Introduction of Hong Kong Housing Authority (HKHA)

- \* Formerly the Resettlement Department formed in 1953
- \* HKHA established in 1973
- \* Vision :
  - \* To help low-income families with housing need gain access to affordable housing.
- \* Mission :
  - \* To provide affordable quality housing, management, maintenance and other housing related services to meet the needs of our customers in a proactive and caring manner;
  - \* To ensure cost-effective and rational use of public resources in service delivery and allocation of housing assistance in an open and equitable manner;
  - \* To maintain a competent, dedicated and performance-oriented team

# Location of Public Housing Sites



- \* 164 rental housing estates
  - \* 39 Tenant Purchase Scheme estates
  - \* 142 Home Ownership Scheme courts
  - \* 54 other sales courts
- Total 399 estates**

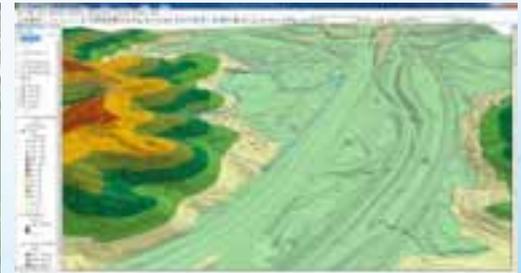
**Legend**

**Types of HKHA Housing Estates**

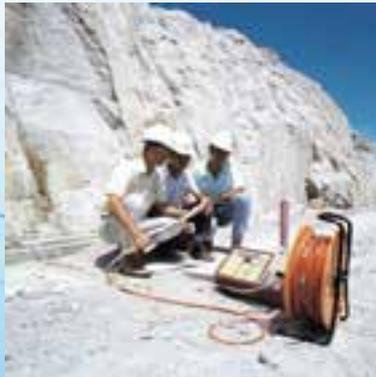
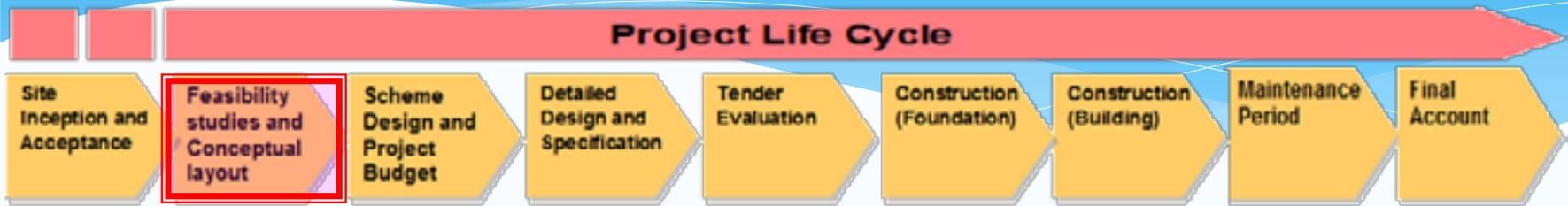
- Buy or Rent Option Scheme
- Home Ownership Scheme
- Intern Housing
- Middle Income Housing
- Public Rental Housing
- Private Sector Participation Scheme
- Tenants Purchase Scheme

# The Land Surveying Unit (LSU)

- \* Established in 1984
- \* Provides land & engineering surveying and GIS
- \* Feasibility study of potential sites, design, demolition, construction (foundation and building), maintenance, civil engineering works and tree management.



# Development Process of Public Housing Estates



# Technical Studies during Development Process

- \* Site Potential Study
- \* Architectural Feasibility Study
- \* Planning and Engineering Studies
- \* Site Formation Assessment
- \* Traffic Impact Assessment
- \* Drainage/Sewerage/Water Supply Impact Assessment
- \* Air Quality / Ventilation / Noise Impact Assessment
- \* Geotechnical Appraisal / Ground Investigation
- \* Visual Impact Assessment
- \* Tree Assessment

# Background



Carried out by Civil Engineering and  
Development Department (CEDD), HKSAR

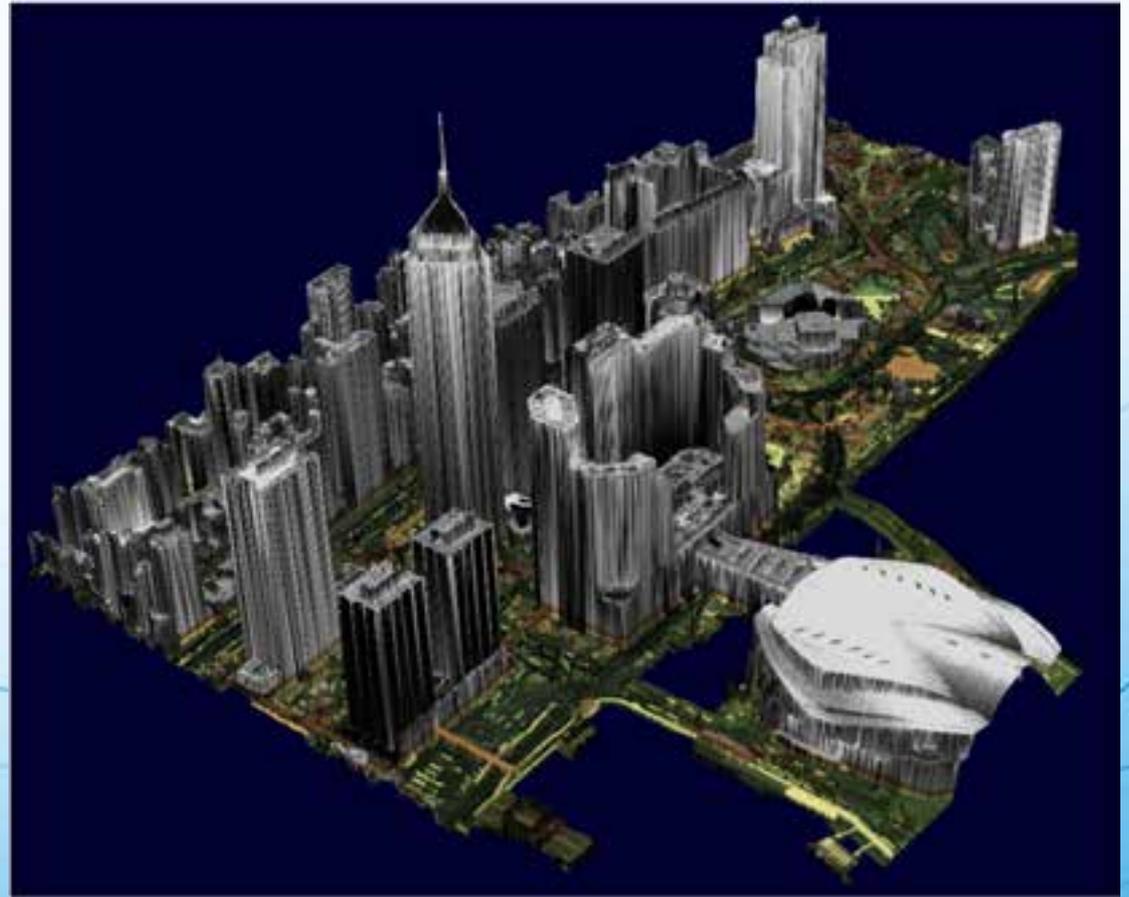
Data Capture:  
Nov 2010 – Jan 2011

Laser Wavelength  
(near infrared)

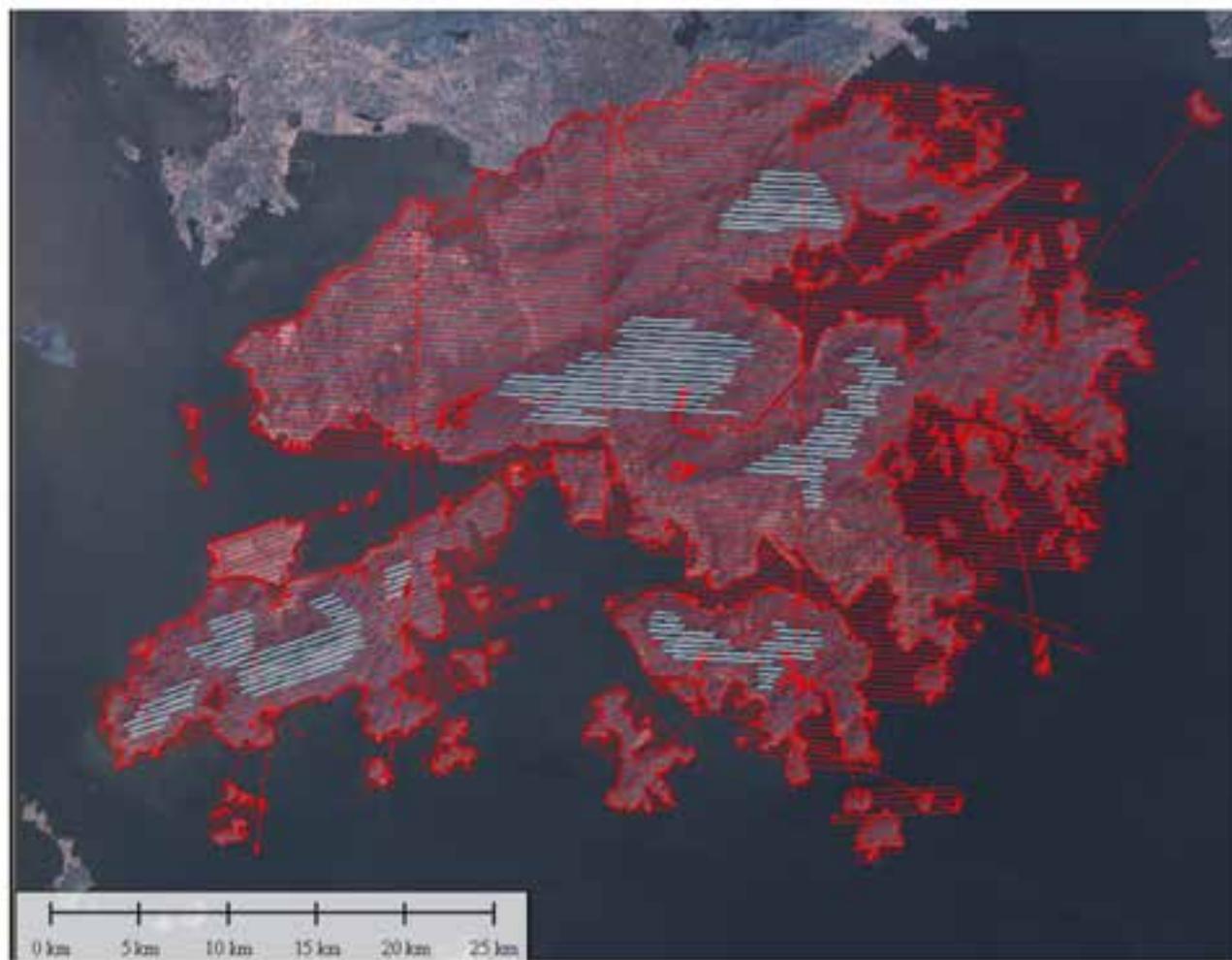
Average Point Spacing: 0.47m

Horizontal Accuracy: 0.20m

Vertical Accuracy: 0.10m



# Background



- Low level runs (3600 - 4700 feet ASL)
- High level runs (3900 - 5200 feet ASL)

# Usage of LiDAR in HKHA



## Previous Studies done by HKHA

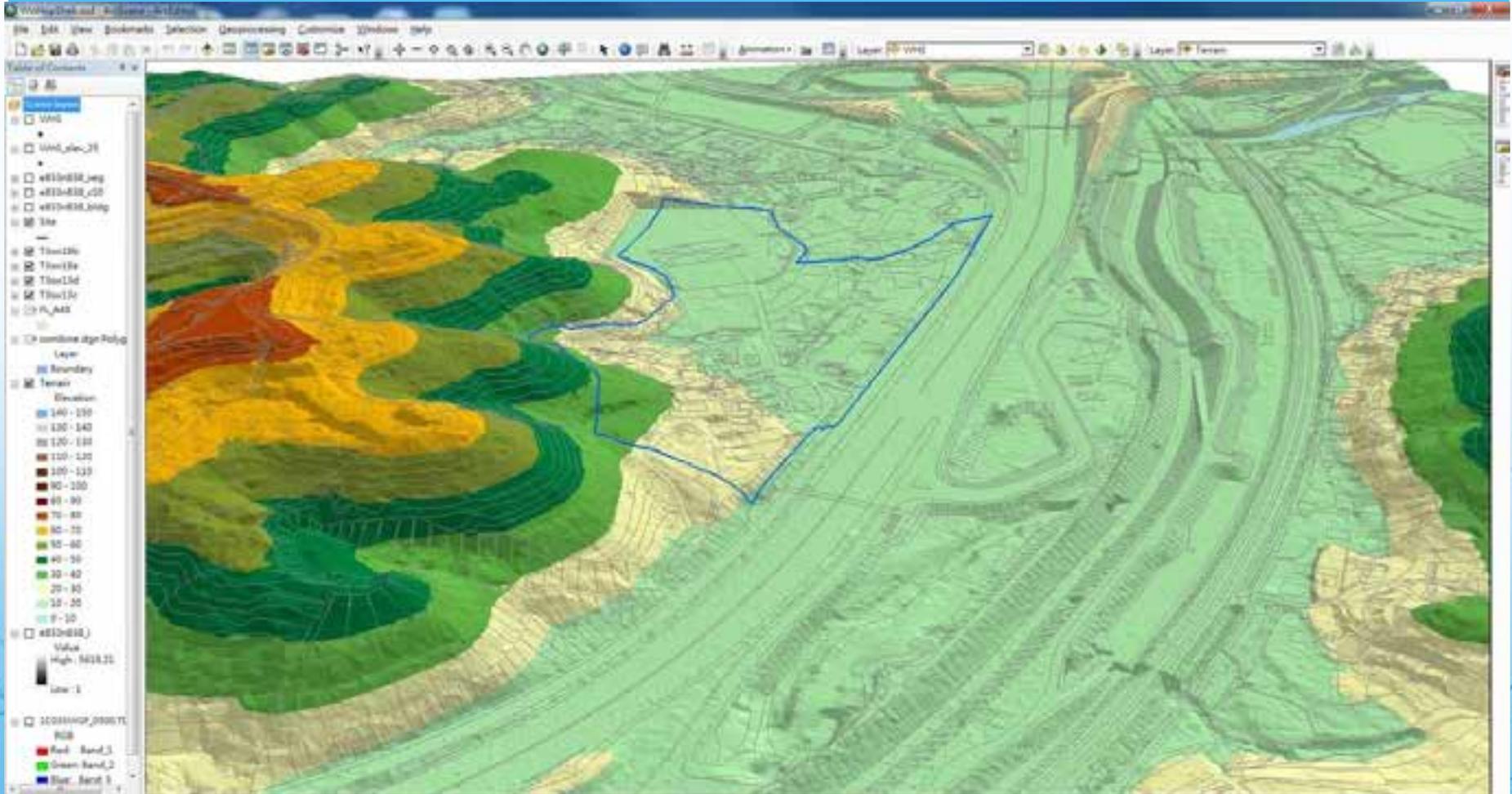
- \* Preliminary study of the terrain
- \* Checking clearance of structures
- \* Locate and measure the inaccessible berm on steep slope
- \* Flooding Simulation and Analysis
- \* Slope Steepness and Aspect Study
- \* Integration with Terrestrial Laser Scanning Survey
- \* Estimating number of trees on inaccessible slopes
- \* Preliminary study of the location and spread of reserved trees

# Applications



- Feasibility Study of Potential Sites
- Quick retrieval of  $x, y, z$  information, height clearance of overhanging object, & height of high-rise structures etc for use by A, CE and GE for prelim study
- Classify low, medium and high vegetation
- Provide a detailed and reliable digital elevation model for presentation purpose
- Cut Cross-Section, Calculate Cut and Fill & Gradient of Slope
- Flooding Simulation

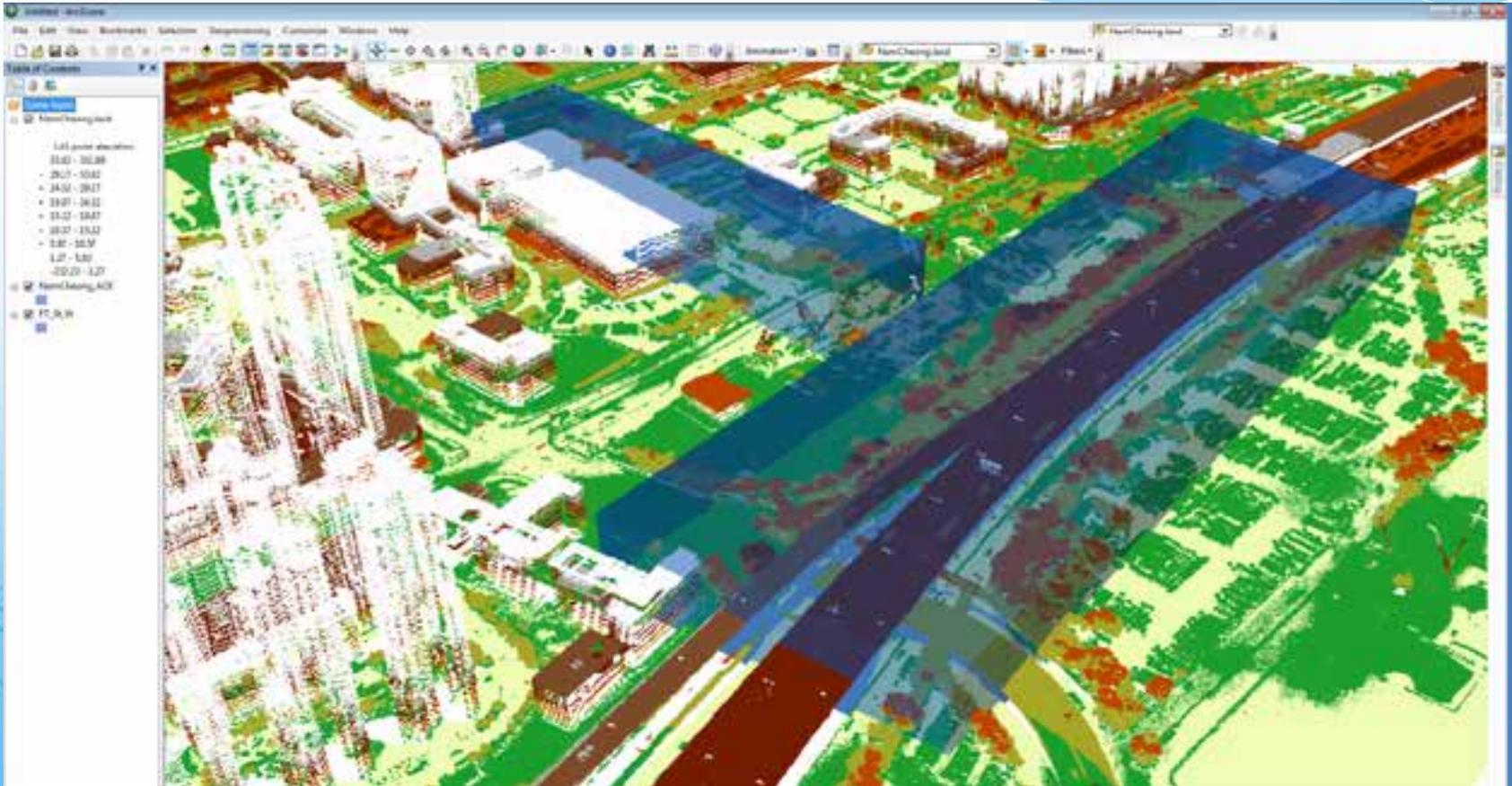
# Preliminary Study of the Terrain



# Checking Clearance of Structures

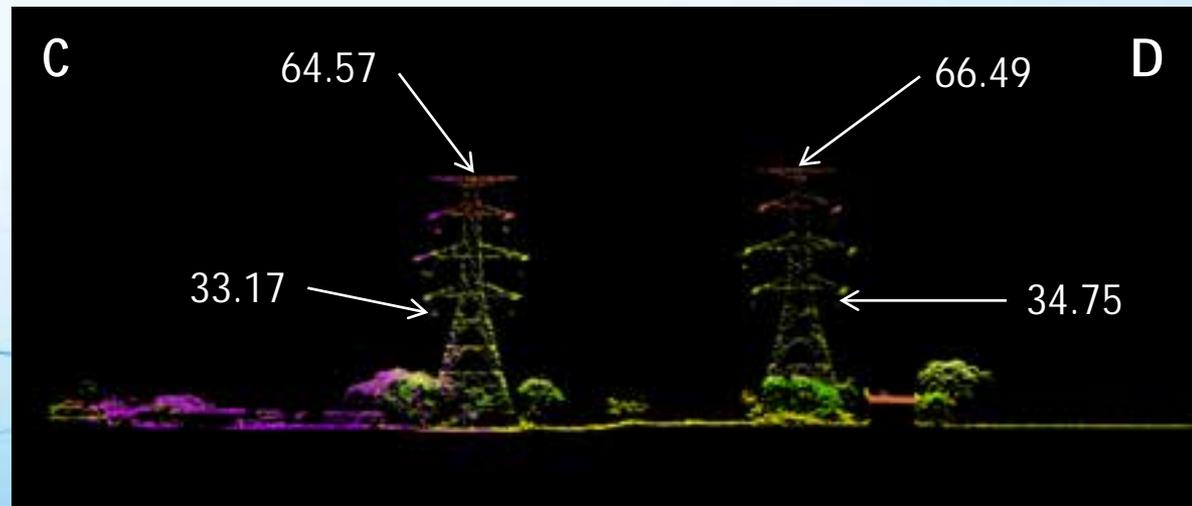
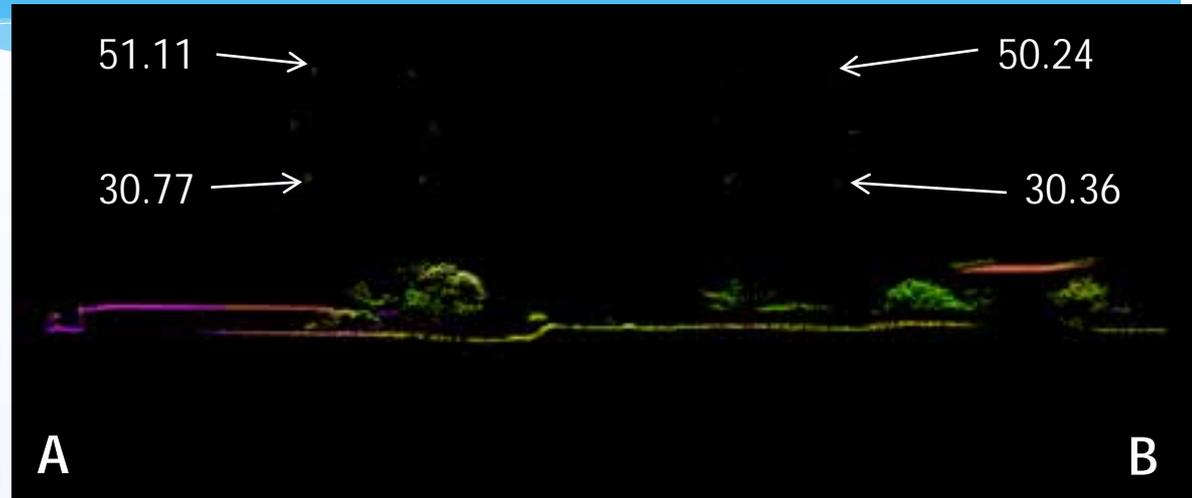
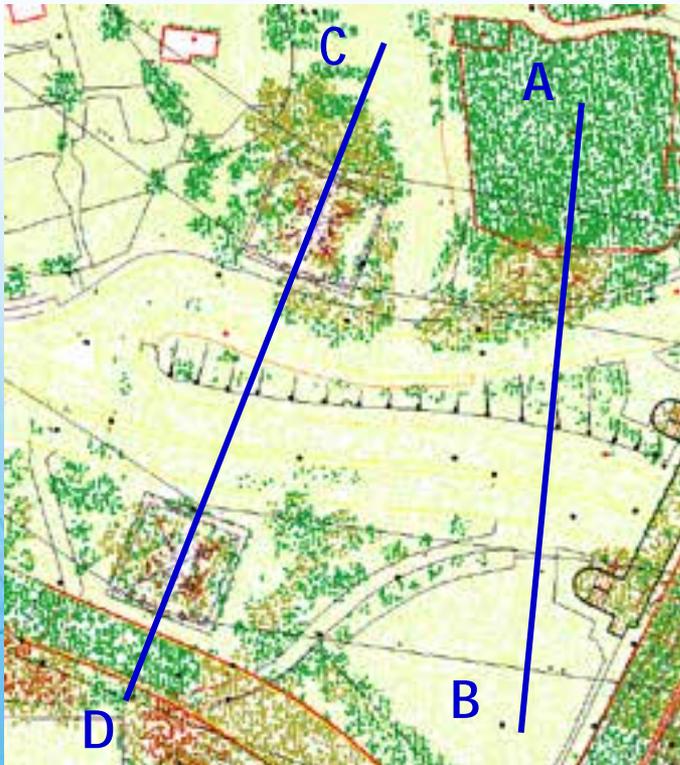


- \* Checking clearance for bridge construction

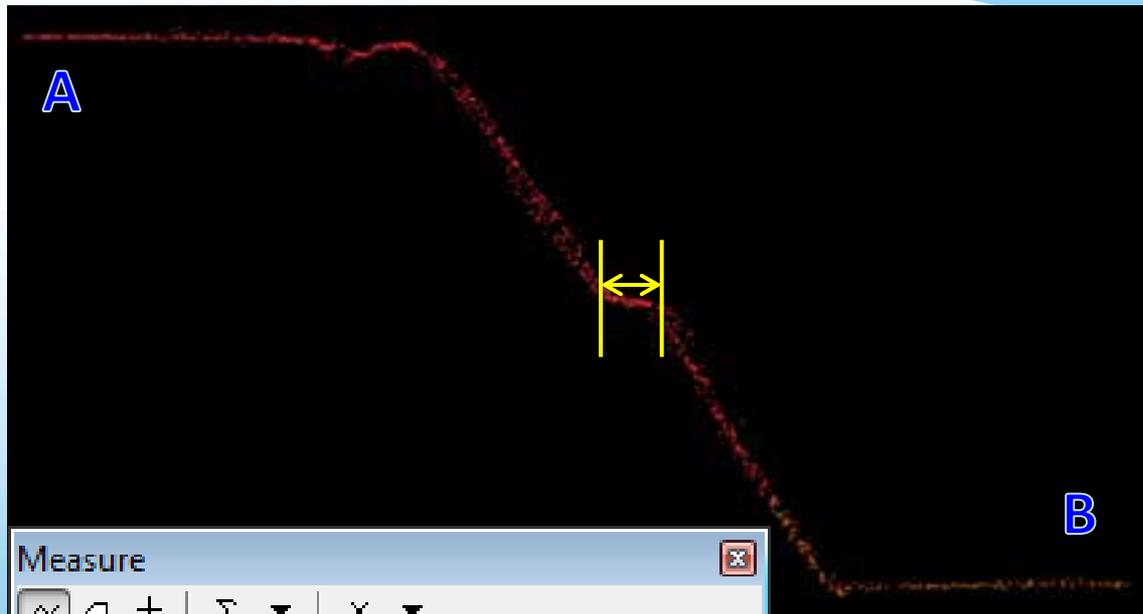


# Checking clearance of Structures

## Power Line and Tower Clearance Checking



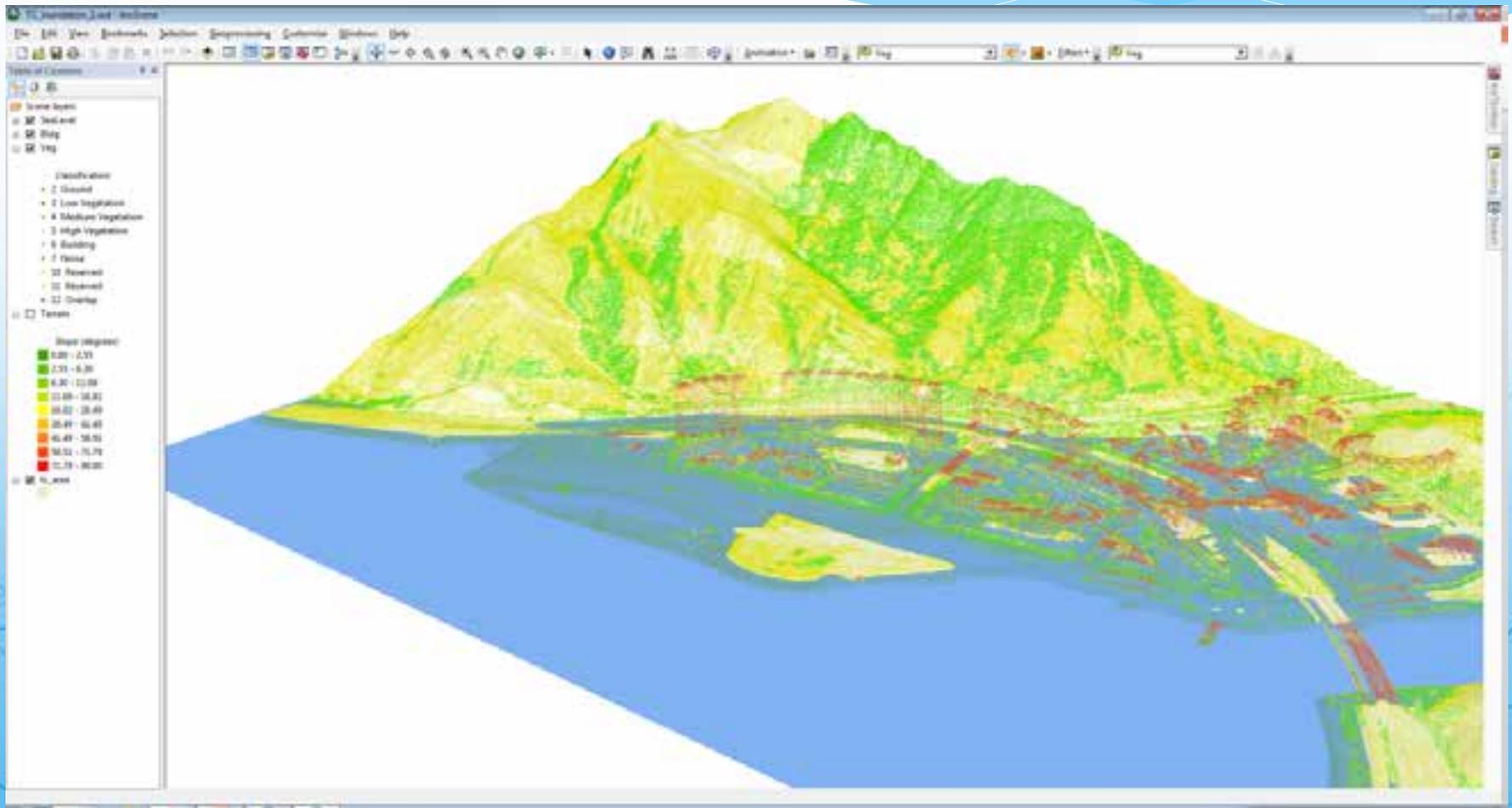
# Locate and Measure the Inaccessible Berm on Steep Slope



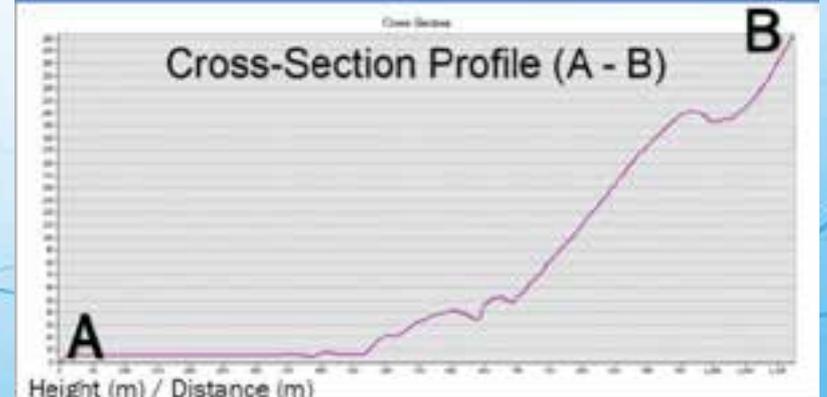
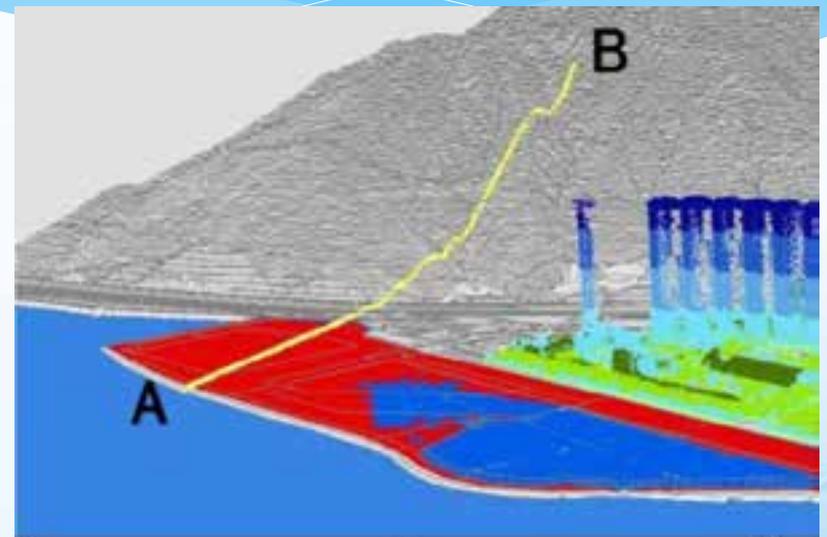
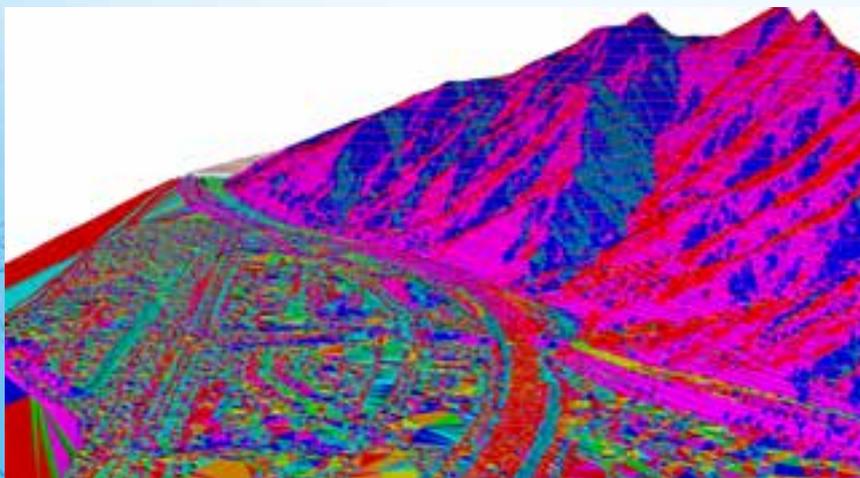
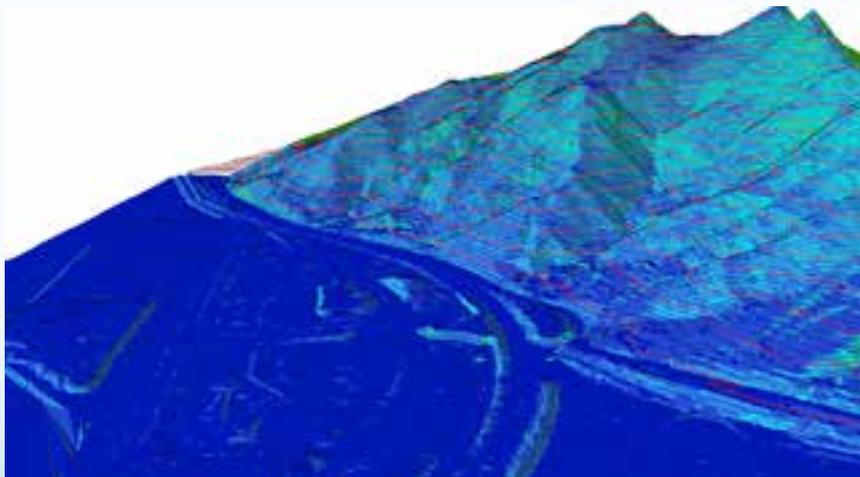
Measure

Line measurement (Planar)  
Length: 0.798529 Meters

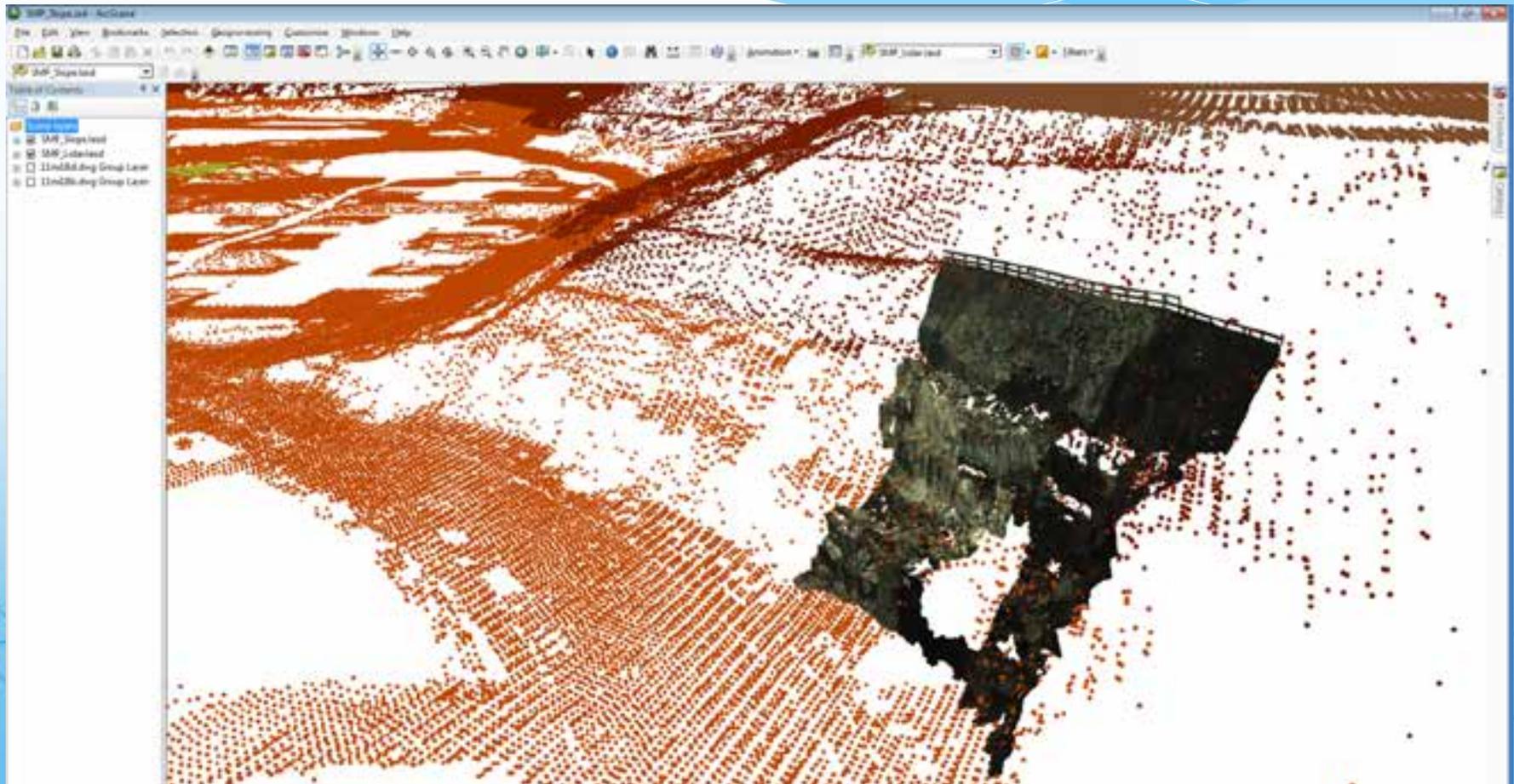
# Flooding Simulation and Analysis



# Slope Steepness and Aspect Study



# Integration with Terrestrial Laser Scanning Survey



# Estimating Number of Trees on Inaccessible Slopes

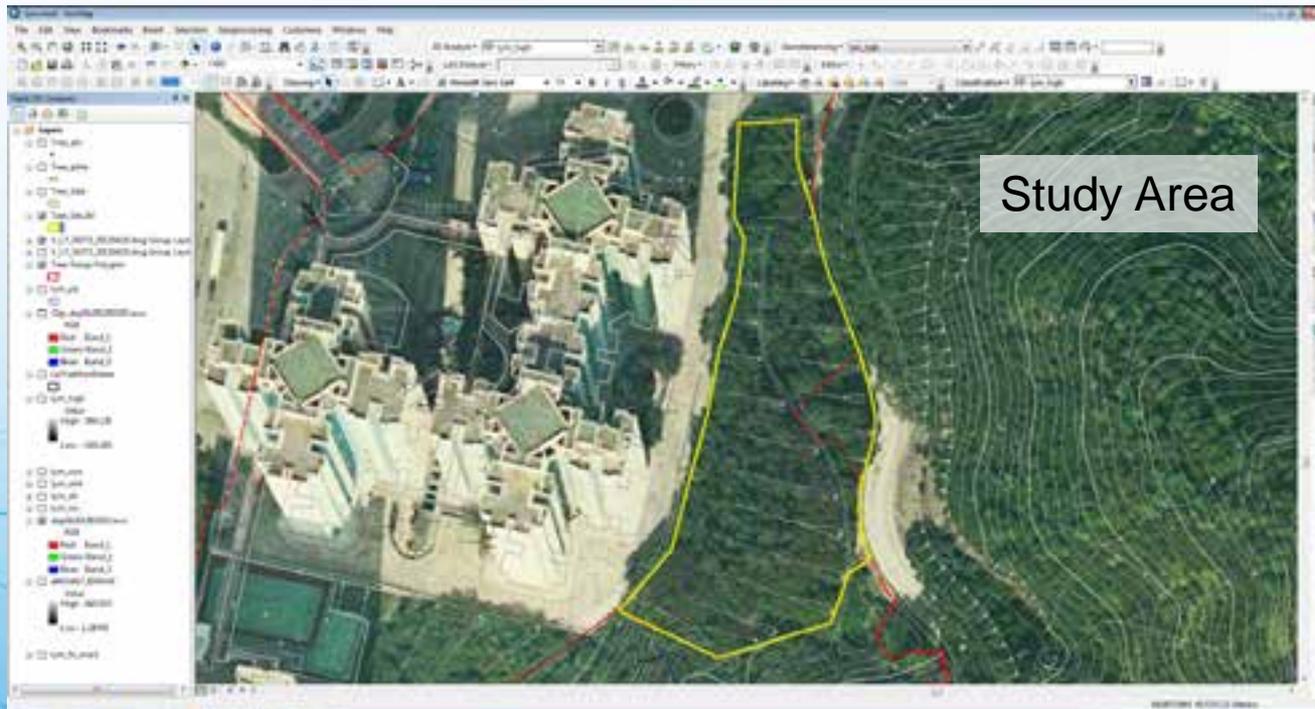


- \* Study Area:

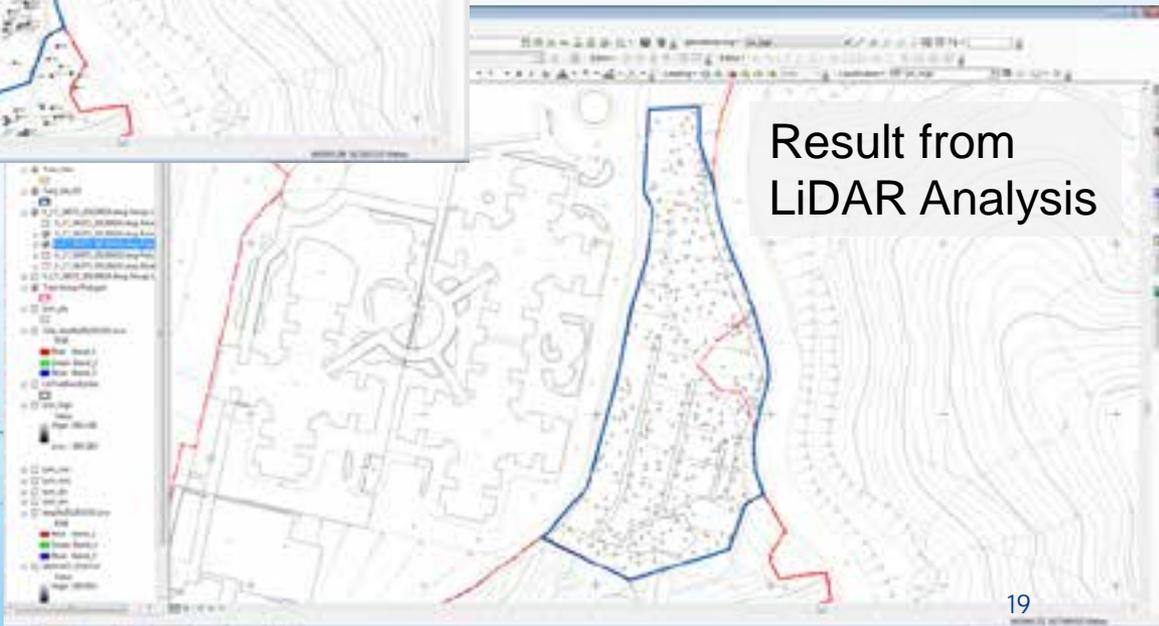
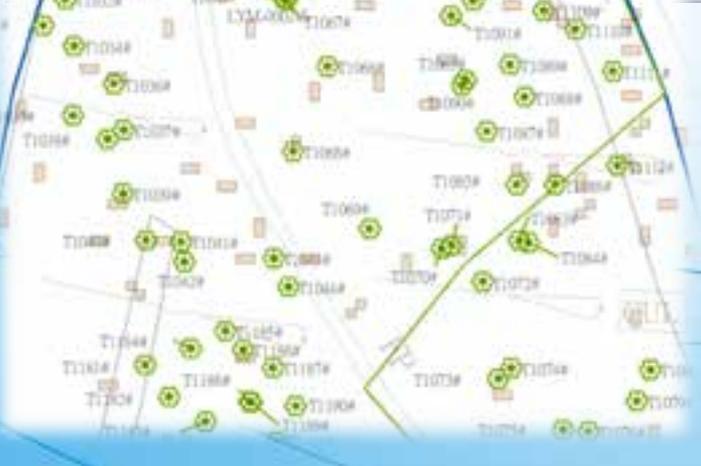
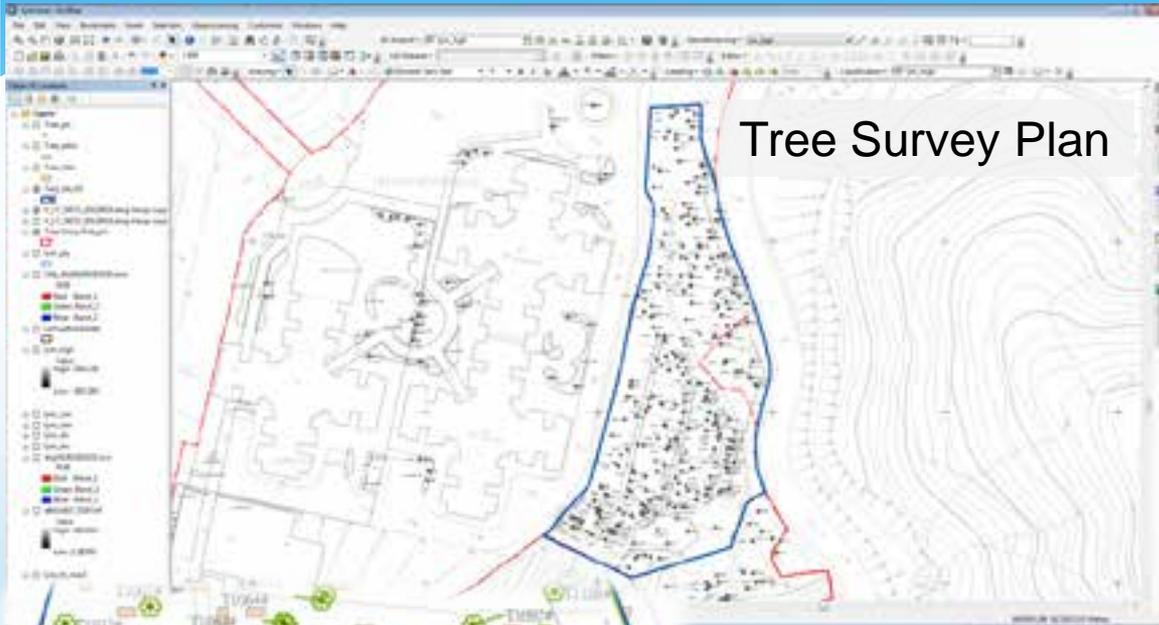
- \* Portion of slope in Lei Yue Mun Estate

- \* Number of Trees:

- \* Tree Survey on Field: 289
- \* LiDAR: 294



# Estimating number of trees on inaccessible slopes



# Estimating number of trees on inaccessible slopes



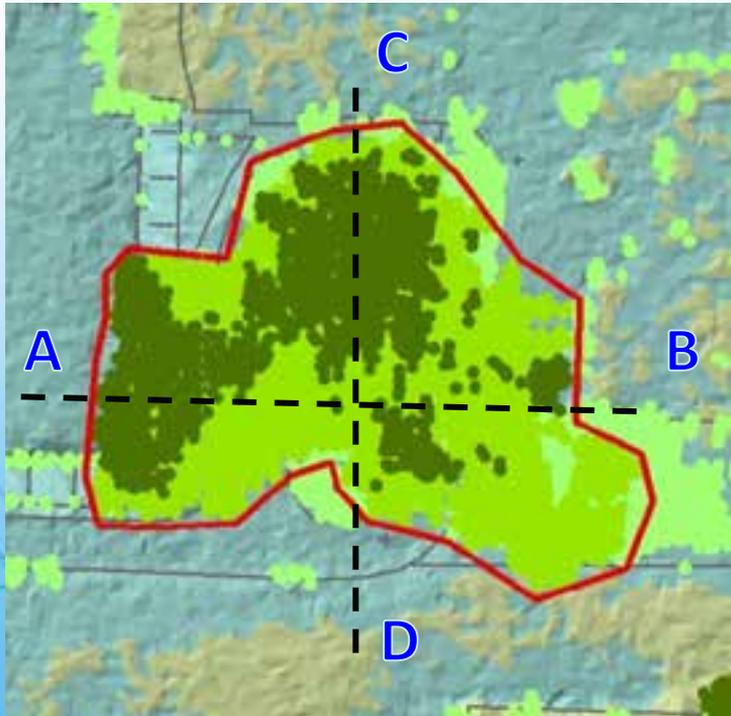
## \* Process

- \* Inverse the raster DSM from LiDAR
- \* Create "Sink" by using "Hydrology" tools inside "Spatial Analysis Tools" to find out the potential canopy
- \* Using "Con" inside Spatial Analysis Tools, extract the "sink" values to a new layer and convert to Features

# Preliminary Study of the Location and Spread of Reserved Trees



## Tree Height and Spread Clearance Checking with Design Structure



Cross Section Profile



Red Circle: Tree Spread identified from LiDAR Data

# Conclusions



## \* Pros

- \* Extract survey information of inaccessible area
- \* LiDAR collects both geometric and classified data useful for spatial analysis
- \* Facilitate the feasibility study of public housing sites and related infrastructure

## \* Cons

- \* Relatively time consuming for processing raw data
- \* Time lapse between date of data acquisition and date available

**THANK YOU**