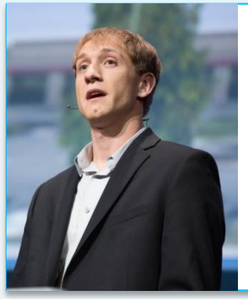
Where is 3D GIS TODAY?

Presenters

Atlanta Regional Commission 3D Workshop



Geoff Taylor

3D Solutions Engineer

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gtaylor@esri.com

Keith Cooke

State Government Account Executive

www.esri.com

kcooke#@esri.com

Adam Carnow

Local Government Account Executive

www.esri.com

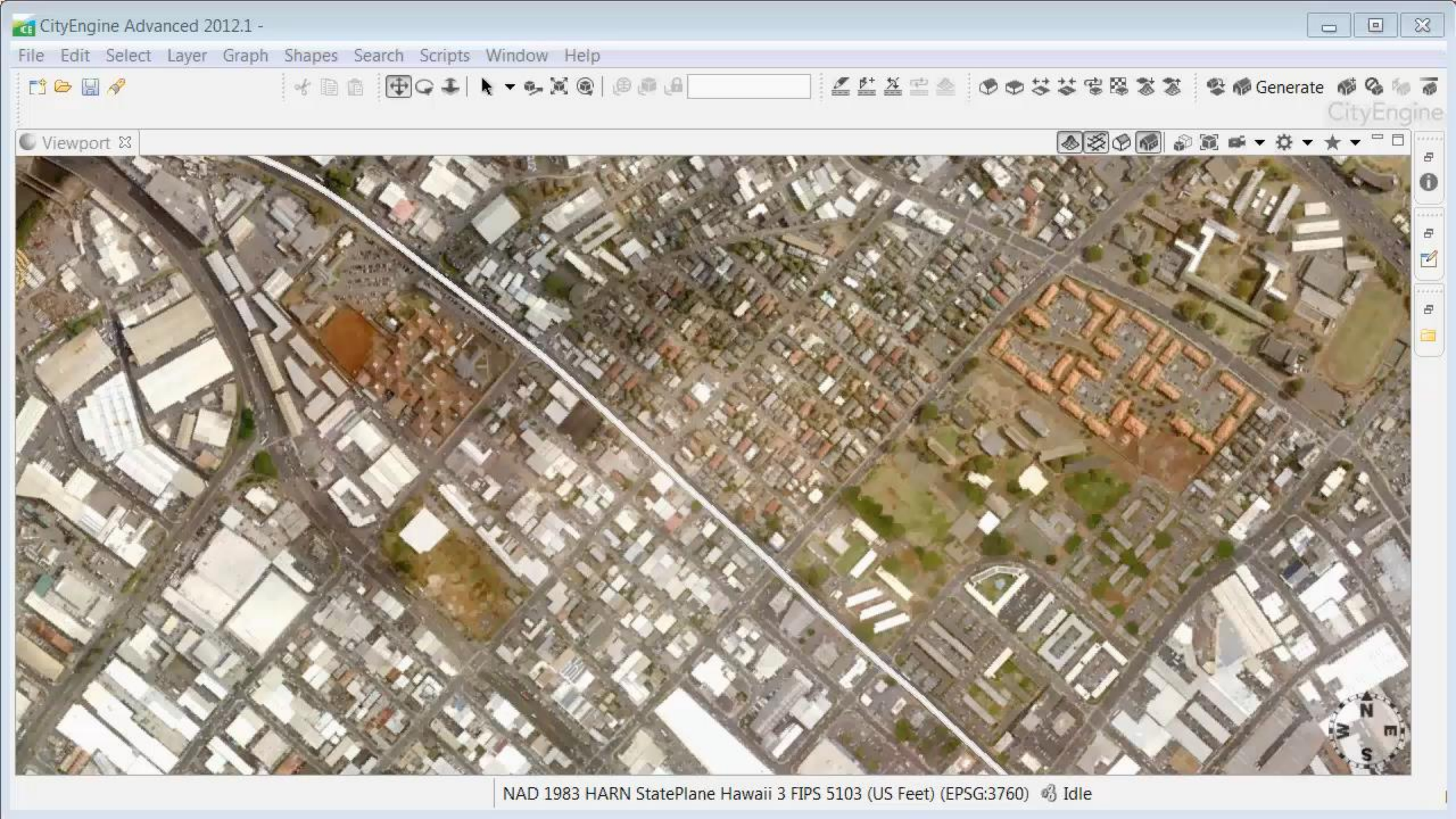
Acarnow@esri.com

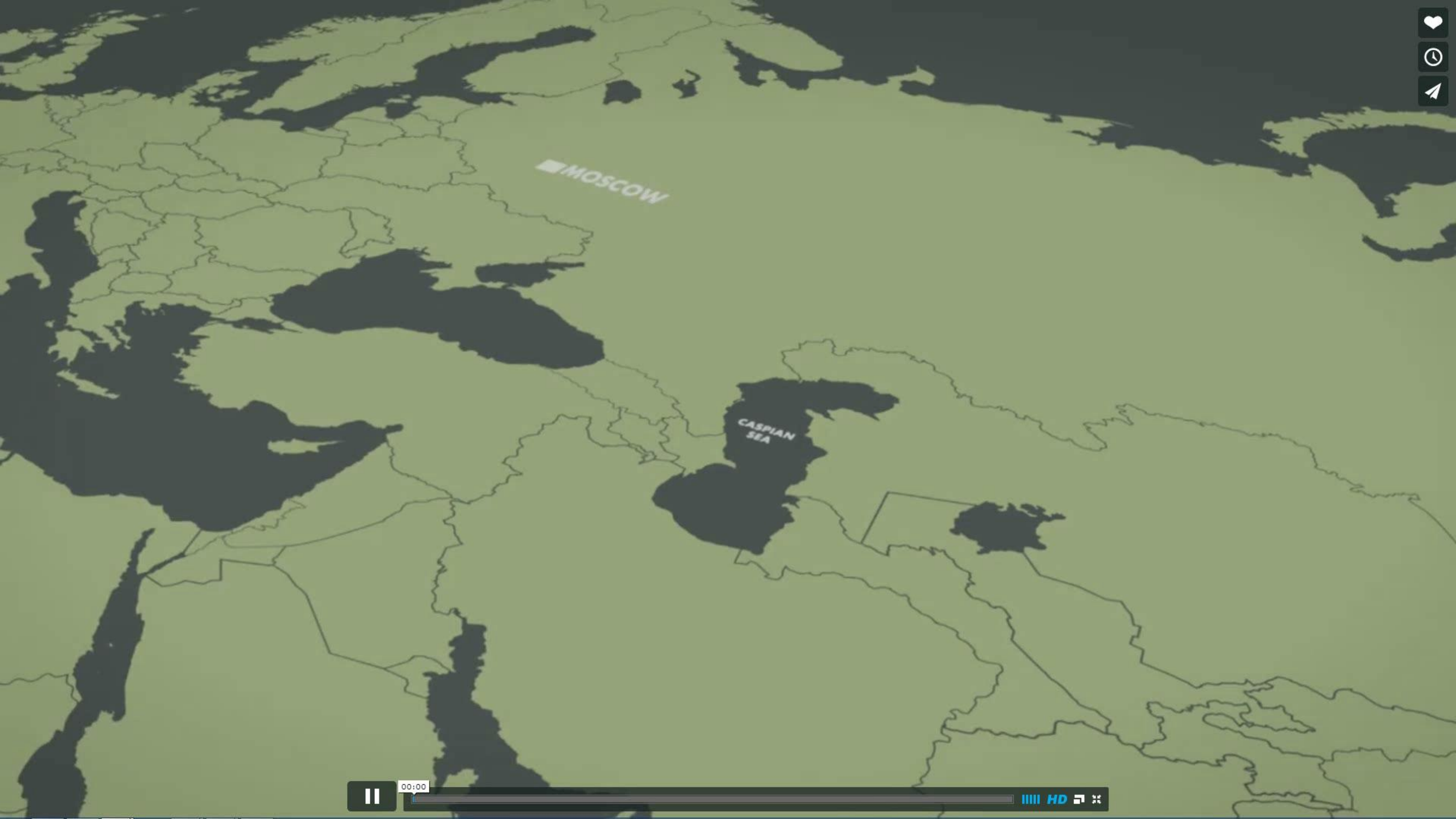

WELCOME
ROCHESTER
CENTER CITY
MASTER PLAN UPDATE

DC Height Study Massachusetts Ave

Layers

- Building Height
  - (•) Existing
  - ( ) Width + 20', 160' cap
  - ( ) Width + 20', no cap
  - ( ) Width + 25%
- Trees
- Comments


CityEngine Advanced 2012.1 -
File Edit Select Layer Graph Shapes Search Scripts Window Help
Generate
CityEngine
Viewport
N
E
S
W
NAD 1983 HARN StatePlane Hawaii 3 FIPS 5103 (US Feet) (EPSG:3760)
Idle


MOSCOW
CASPIAN SEA
00:00
HD

Low to Medium - Low Density Residential

0.5

NET 0.51-1.00

NET 1.01-1.50

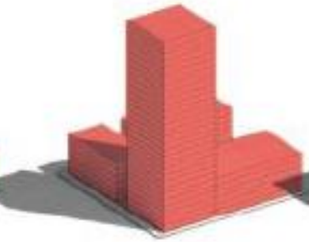
NET 1.51-2.00

Medium - High Density Residential, Mixed Use a

NET 2.01-3.00

NET 3.01-4.00

NET 4.01-6.00



NET 6.01-8.00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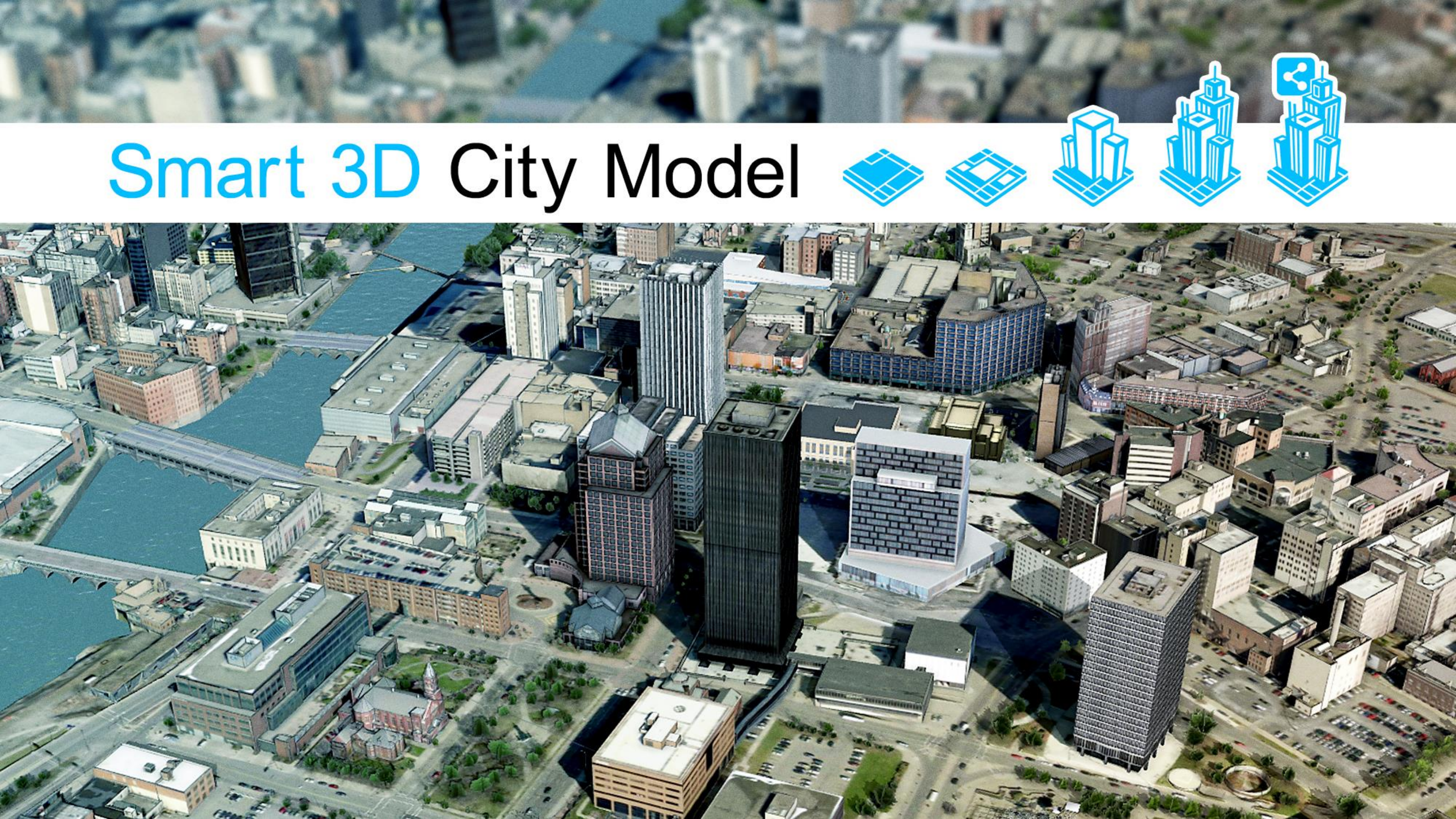
Smart 3D City Model



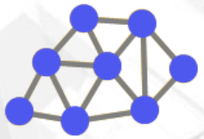
Top 3D GIS Use Cases

General Land Use

Economic Development

Zoning Regulations

First Responders (Pre-Incident)

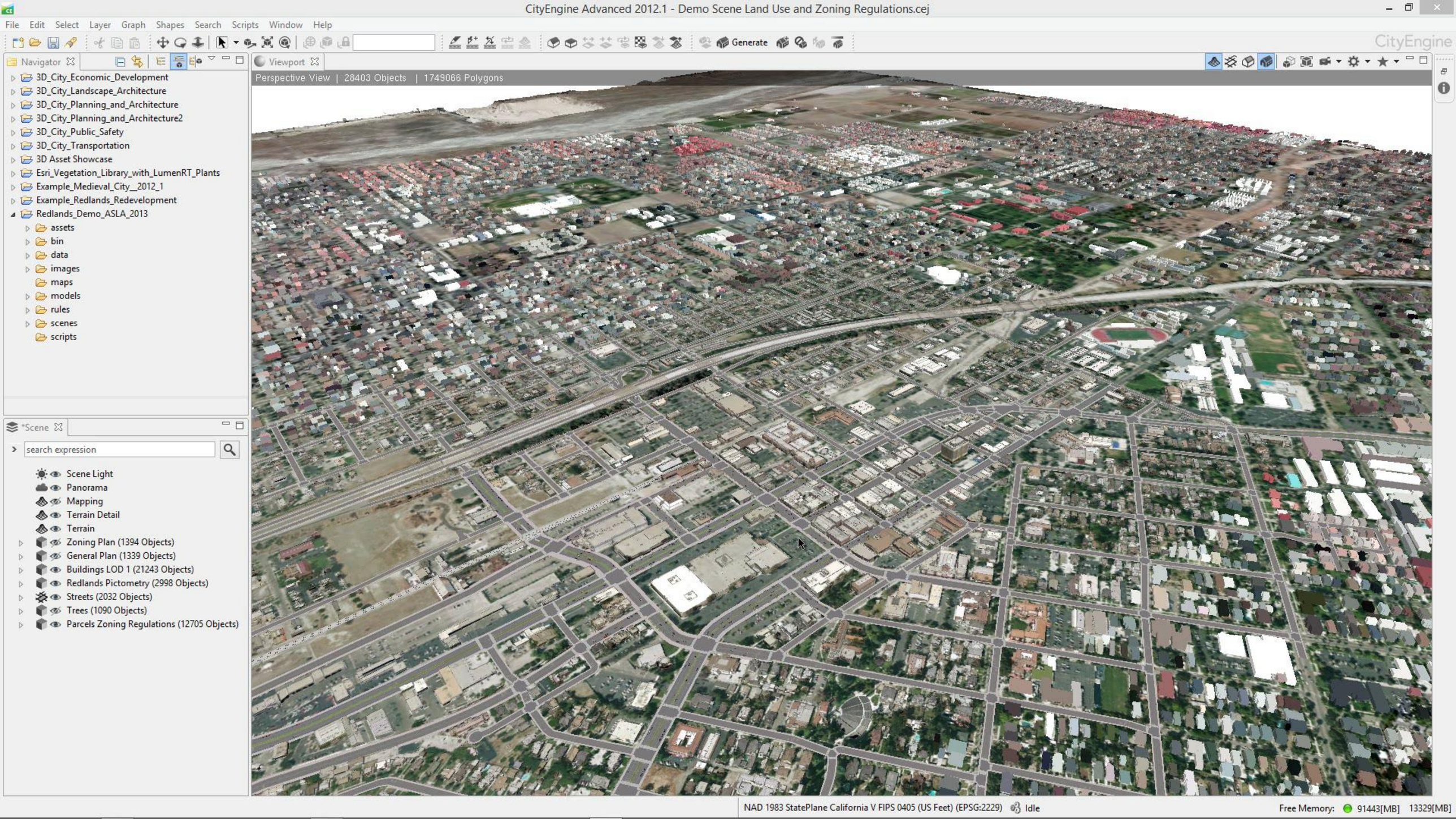


Underground

General Land Use


CityEngine Advanced 2012.1 - Demo Scene Land Use and Zoning Regulations.cej
File Edit Select Layer Graph Shapes Search Scripts Window Help
Generate
CityEngine
Navigator
3D_City_Economic_Development
3D_City_Landscape_Architecture
3D_City_Planning_and_Architecture
3D_City_Planning_and_Architecture2
3D_City_Public_Safety
3D_City_Transportation
3D Asset Showcase
Esri_Vegetation_Library_with_LumenRT_Plants
Example_Medieval_City__2012_1
Example_Redlands_Redevelopment
Redlands_Demo_ASLA_2013
assets
bin
data
images
maps
models
rules
scenes
scripts
Viewport
Perspective View | 8250 Objects | 4141379 Polygons
*Scene
search expression
Scene Light
Panorama
Mapping
Terrain Detail
Terrain
Zoning Plan (1394 Objects)
General Plan (1339 Objects)
Buildings LOD 1 (21243 Objects)
Redlands Pictometry (2998 Objects)
Streets (2032 Objects)
Trees (1090 Objects)
Building Footprints (23278 Objects)
Parcels General Land Use (19952 Objects)
Parcels General Zoning Regulations (10315 Ob
NAD 1983 StatePlane California V FIPS 0405 (US Feet) (EPSG:2229)
Idle
Free Memory: 95904[MB] 19[GB]

Zoning Regulations


CityEngine Advanced 2012.1 - Demo Scene Land Use and Zoning Regulations.cej
File Edit Select Layer Graph Shapes Search Scripts Window Help
Generate
CityEngine
Navigator
3D_City_Economic_Development
3D_City_Landscape_Architecture
3D_City_Planning_and_Architecture
3D_City_Planning_and_Architecture2
3D_City_Public_Safety
3D_City_Transportation
3D Asset Showcase
Esri_Vegetation_Library_with_LumenRT_Plants
Example_Medieval_City__2012_1
Example_Redlands_Redevelopment
Redlands_Demo_ASLA_2013
assets
bin
data
images
maps
models
rules
scenes
scripts
Viewport
Perspective View | 28403 Objects | 1749066 Polygons
*Scene
search expression
Scene Light
Panorama
Mapping
Terrain Detail
Terrain
Zoning Plan (1394 Objects)
General Plan (1339 Objects)
Buildings LOD 1 (21243 Objects)
Redlands Pictometry (2998 Objects)
Streets (2032 Objects)
Trees (1090 Objects)
Parcels Zoning Regulations (12705 Objects)
NAD 1983 StatePlane California V FIPS 0405 (US Feet) (EPSG:2229)
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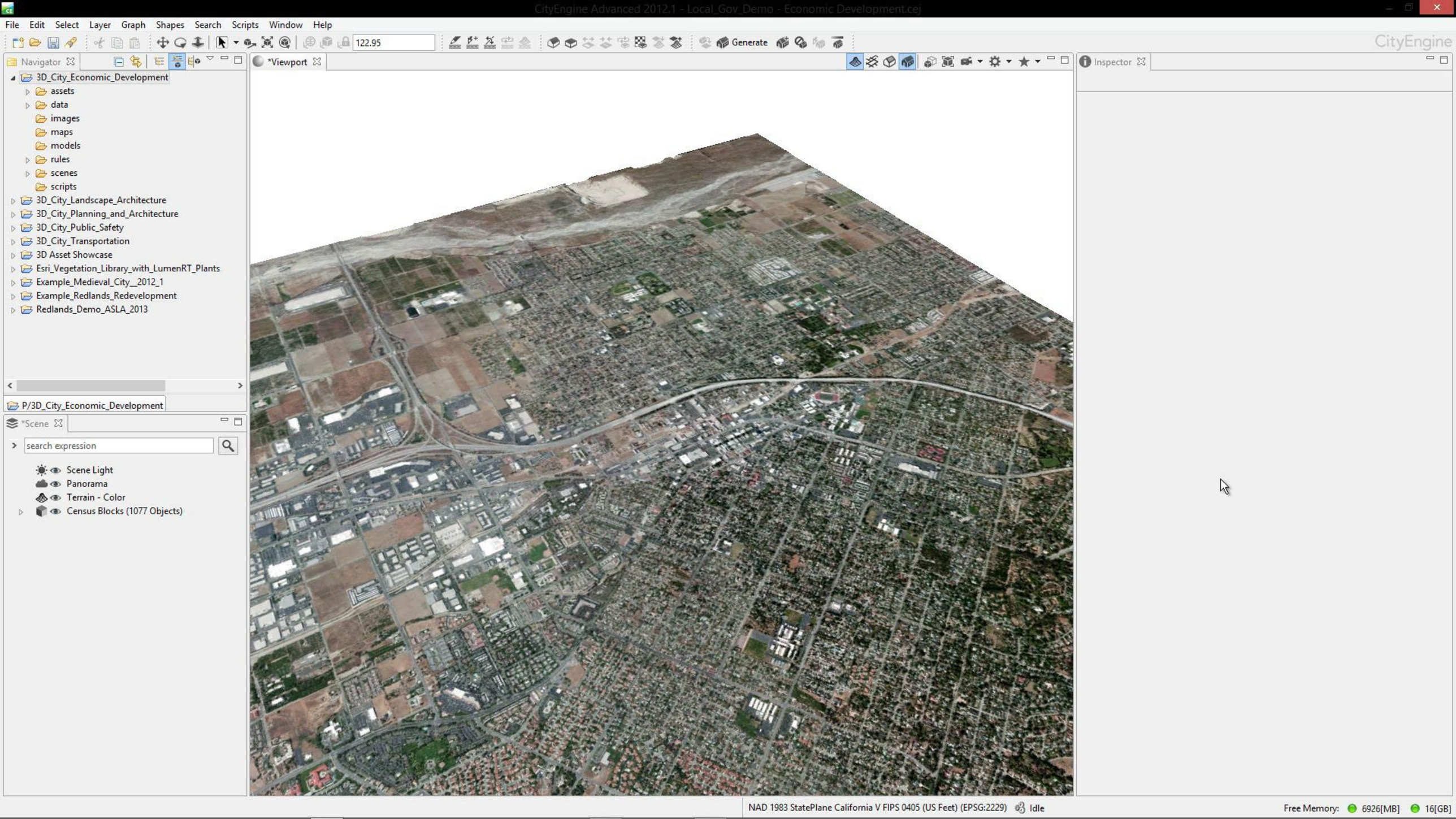
Economic Development


CityEngine Advanced 2012.1 - Local_Gov_Demo - Economic Development.cej
File Edit Select Layer Graph Shapes Search Scripts Window Help
122.95
Generate
CityEngine
Navigator
3D_City_Economic_Development
assets
data
images
maps
models
rules
scenes
scripts
3D_City_Landscape_Architecture
3D_City_Planning_and_Architecture
3D_City_Public_Safety
3D_City_Transportation
3D Asset Showcase
Esri_Vegetation_Library_with_LumenRT_Plants
Example_Medieval_City__2012_1
Example_Redlands_Redevelopment
Redlands_Demo_ASLA_2013
P/3D_City_Economic_Development
*Viewport
Inspector
*Scene
search expression
Scene Light
Panorama
Terrain - Color
Census Blocks (1077 Objects)
NAD 1983 StatePlane California V FIPS 0405 (US Feet) (EPSG:2229)
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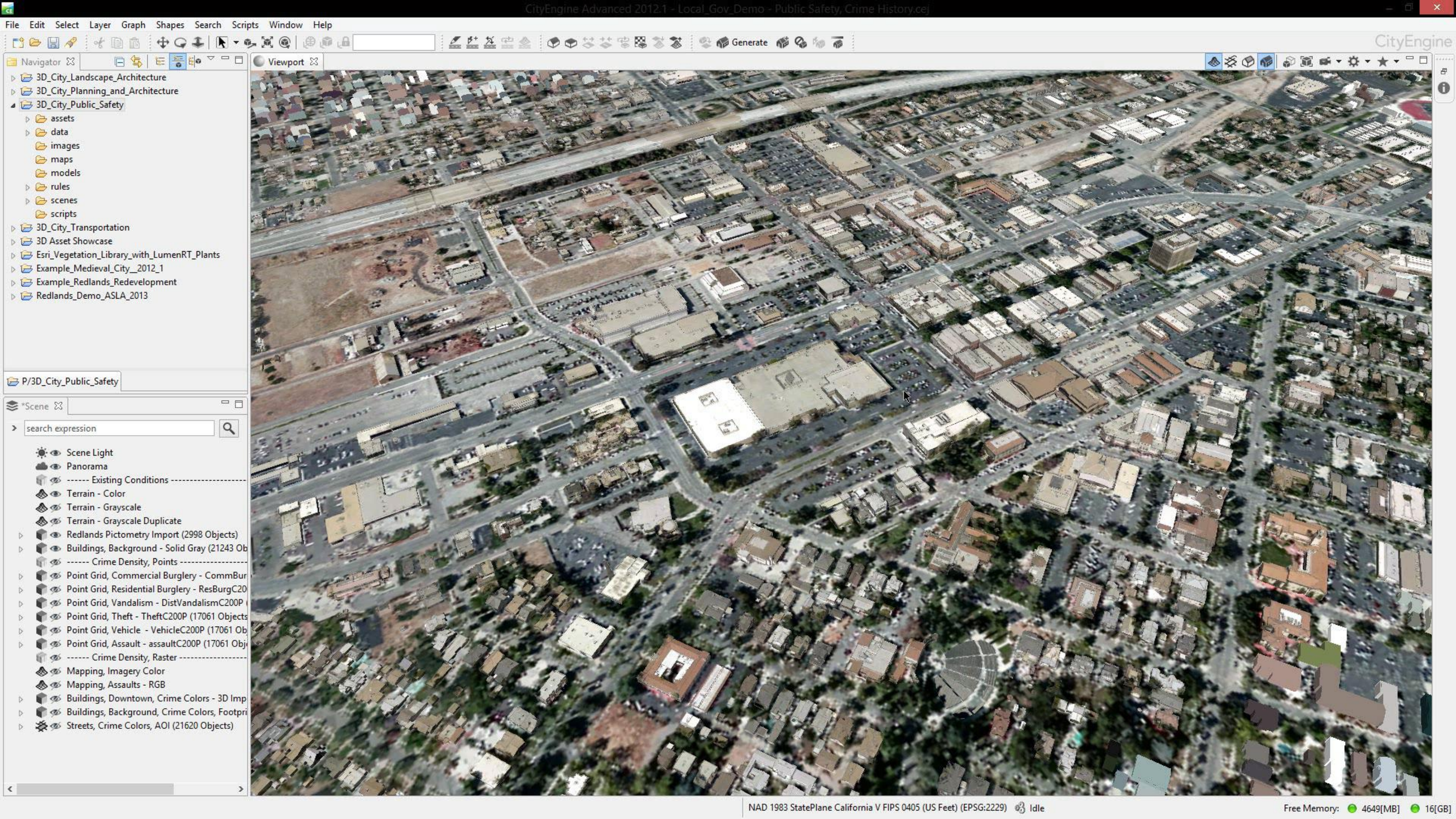
Free Memory: 6926[MB] 16[GB]

First Responders (Pre-Incident)


CityEngine Advanced 2012.1 - Local_Gov_Demo - Public Safety, Crime History.cej
File Edit Select Layer Graph Shapes Search Scripts Window Help
Generate
CityEngine
Navigator
3D_City_Landscape_Architecture
3D_City_Planning_and_Architecture
3D_City_Public_Safety
assets
data
images
maps
models
rules
scenes
scripts
3D_City_Transportation
3D Asset Showcase
Esri_Vegetation_Library_with_LumenRT_Plants
Example_Medieval_City__2012_1
Example_Redlands_Redevelopment
Redlands_Demo_ASLA_2013
P/3D_City_Public_Safety
*Scene
search expression
Scene Light
Panorama
------ Existing Conditions ----------
Terrain - Color
Terrain - Grayscale
Terrain - Grayscale Duplicate
Redlands Pictometry Import (2998 Objects)
Buildings, Background - Solid Gray (21243 Ob
------ Crime Density, Points ----------
Point Grid, Commercial Burglery - CommBur
Point Grid, Residential Burglery - ResBurgC20
Point Grid, Vandalism - DistVandalismC200P
Point Grid, Theft - TheftC200P (17061 Objects
Point Grid, Vehicle - VehicleC200P (17061 Ob
Point Grid, Assault - assaultC200P (17061 Obj
------ Crime Density, Raster ----------
Mapping, Imagery Color
Mapping, Assaults - RGB
Buildings, Downtown, Crime Colors - 3D Imp
Buildings, Background, Crime Colors, Footpri
Streets, Crime Colors, AOI (21620 Objects)
Viewport
NAD 1983 StatePlane California V FIPS 0405 (US Feet) (EPSG:2229)
Idle
Free Memory: 4649[MB] 16[GB]

Underground Visualization (Utilities)

Subsurface infrastructure Rotterdam

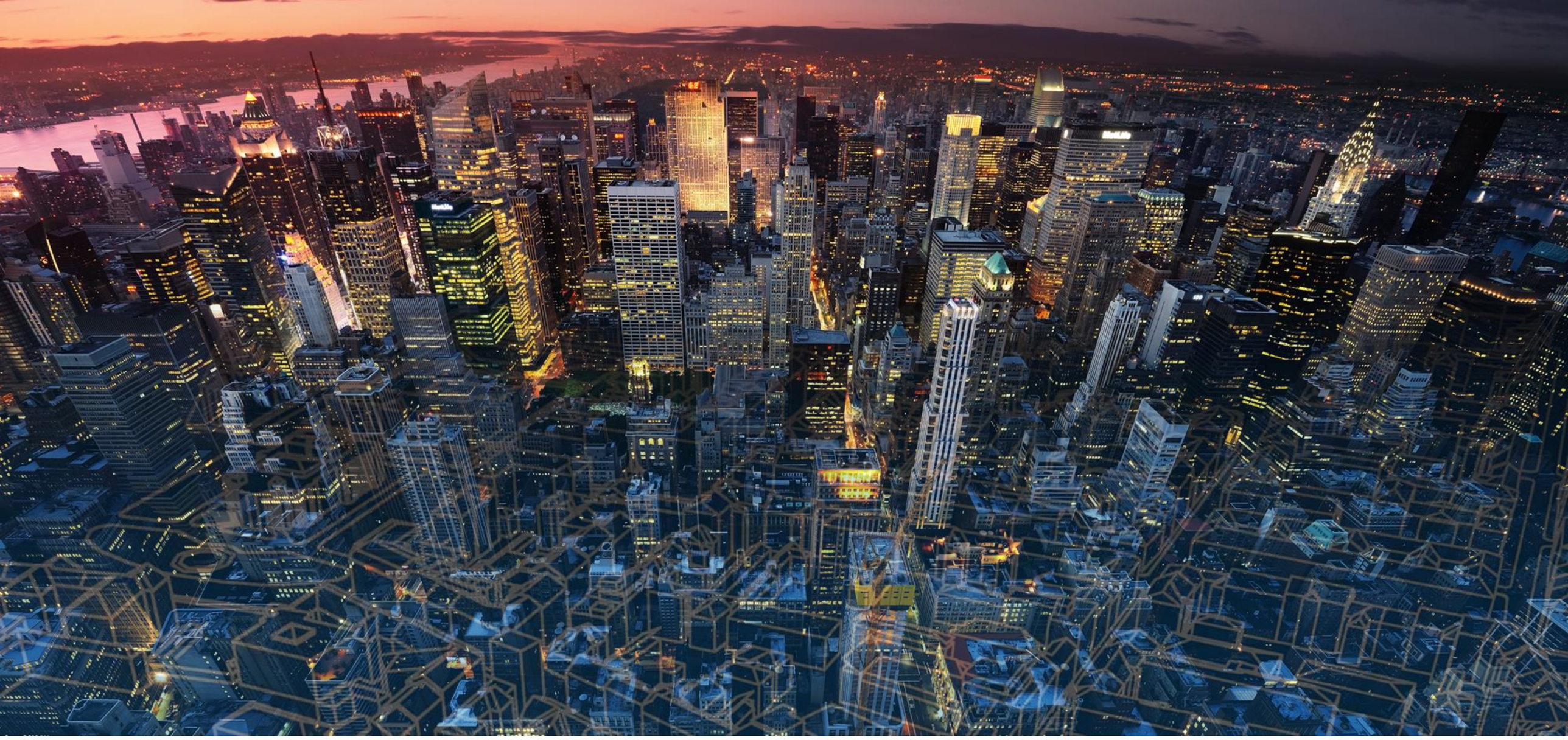
Downloading: 9% (1.46 of 16.44 MB) Details

Take Your GIS to a NEW DIMENSION

What is NEXT?

Creating a Smart 3D City Model From Start to Finish

esri

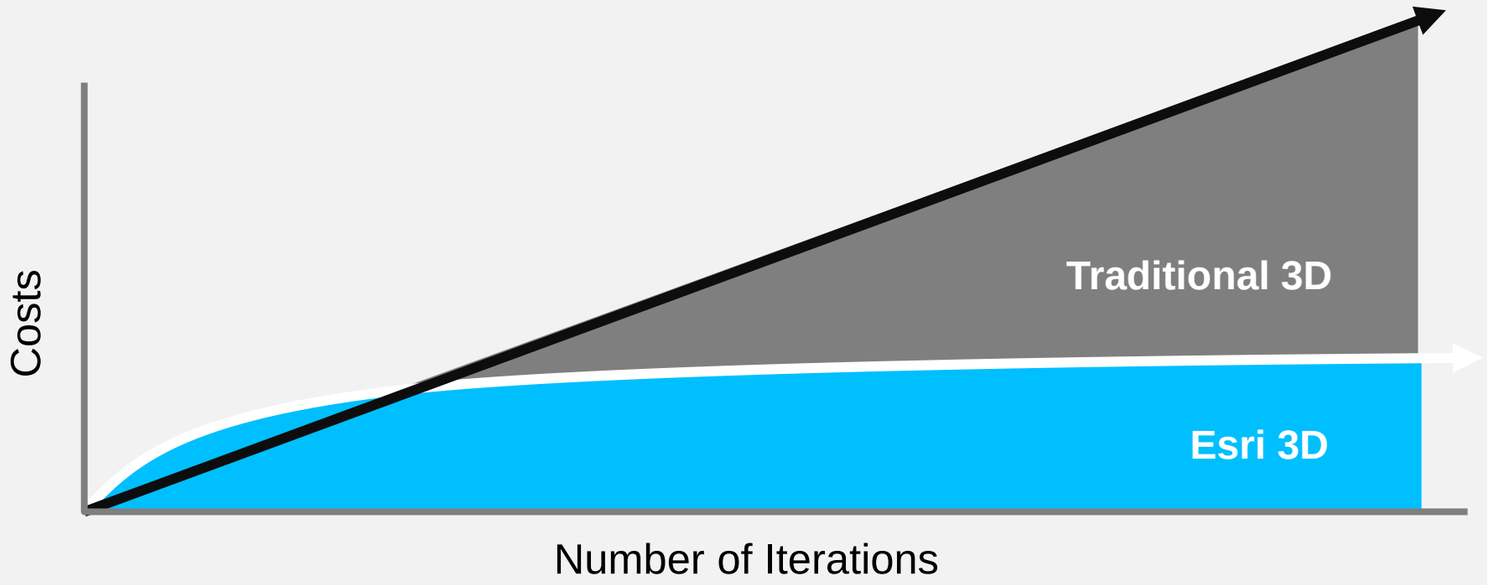


Challenges

3d was not easy

Procedural Modeling Saves Time and Costs

Supporting a Rules Based Generation of Alternatives



Why Procedural Modeling?

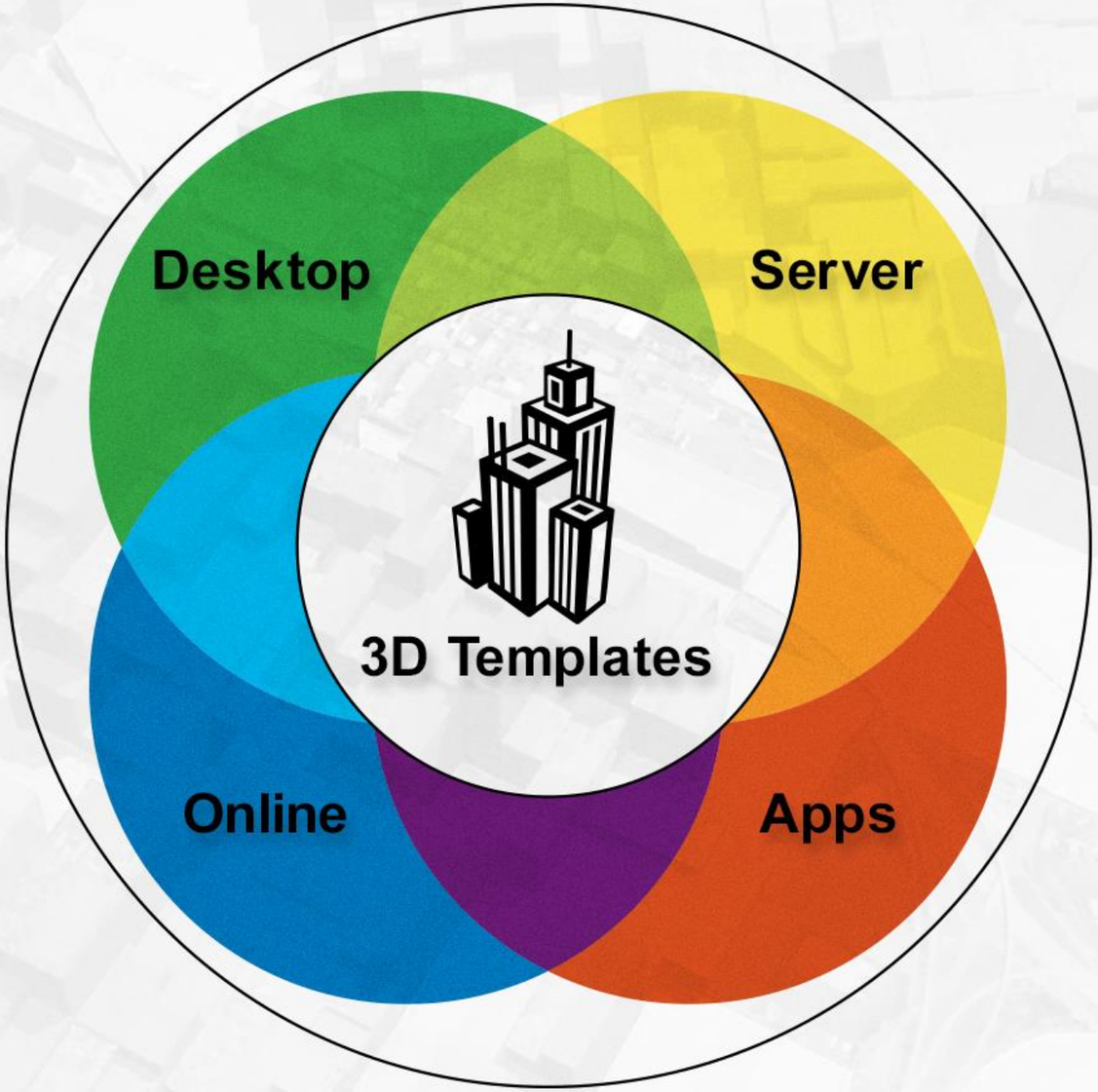
Rule-Based Modeling

3D Across the Platform

CityEngine

3D Analyst

ArcGIS Pro



3D Services

Web Scenes

3D Basemaps

3D Runtime

Creating a Smart 3D City Model

From Start to Finish

Esri CityEngine | 3D Model

www.esri.com/software/cityengine

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Esri CityEngine

Transform 2D GIS data into smart 3D city models.

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"Turning Zoning laws with CityEngine into vivid three dimensional visualizations, is drastically changing the way we understand and plan our sustainable future environments."

Niels Lehmann, Urban Synergy Group

Watch the Video: Build Smart 3D Cities

Build Flexible Scenarios Faster

Compare and analyze building proposals from every angle. See how they fit into your city's overall vision for the future.

ArcGIS for Desktop - Adva ×

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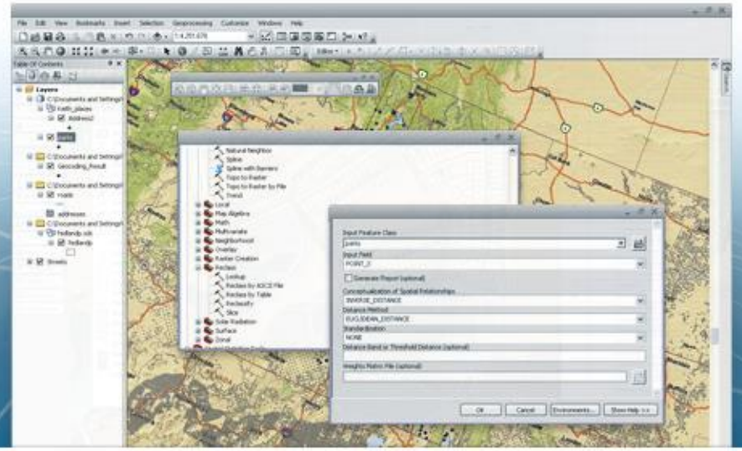
Answer Questions and Examine Relationships

Unlock the power of advanced spatial analytics

Take a Look



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Minimum Data Requirements

Orthoimagery

(Imagery to Drape on Terrain)

Digital Elevation Model (DEM)

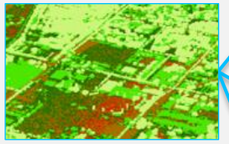
(Low Quality Terrain)

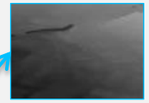
Recommended Data

Orthoimagery

(Imagery to Drape on Terrain)

LiDAR

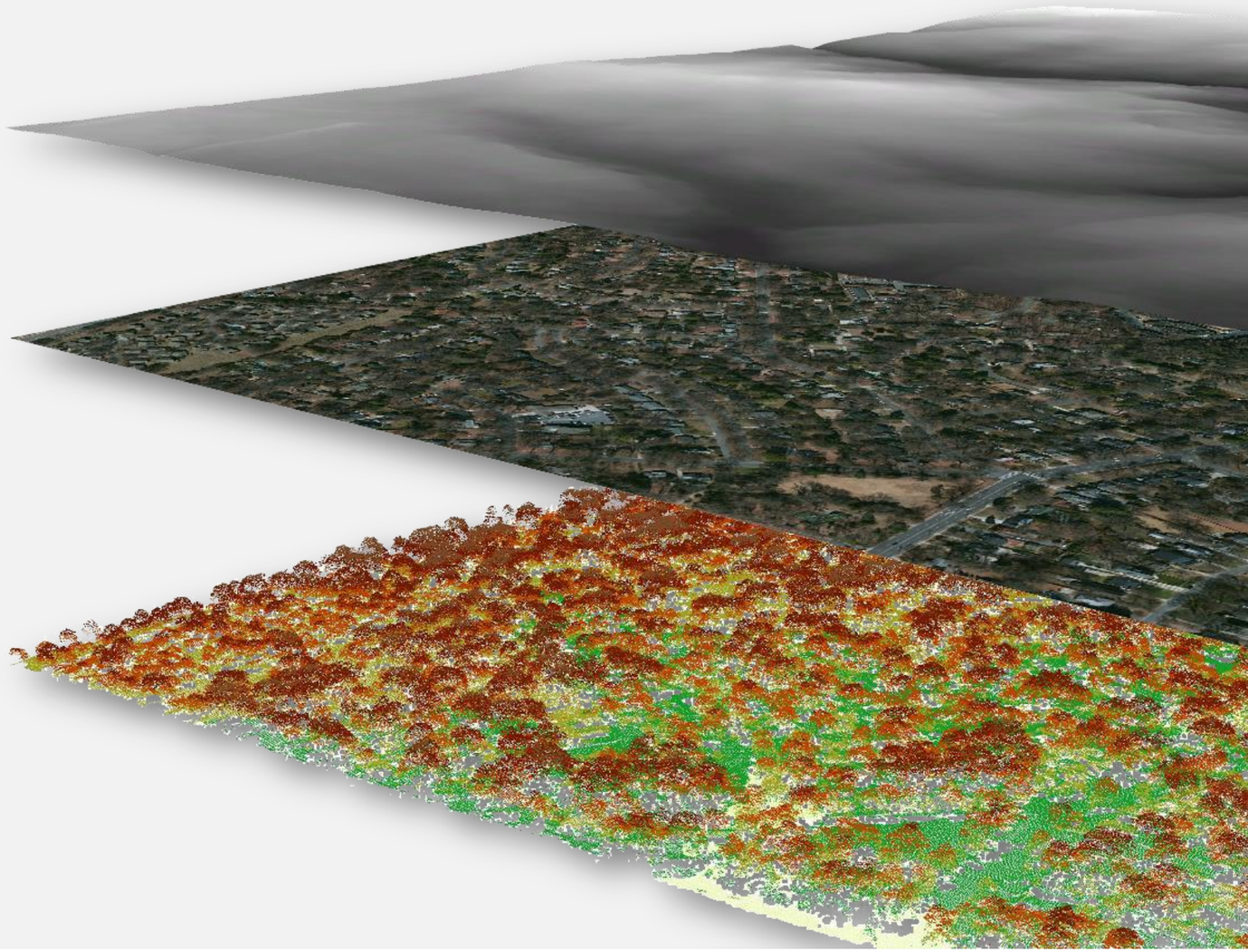




DTM
(Digital Terrain Model)

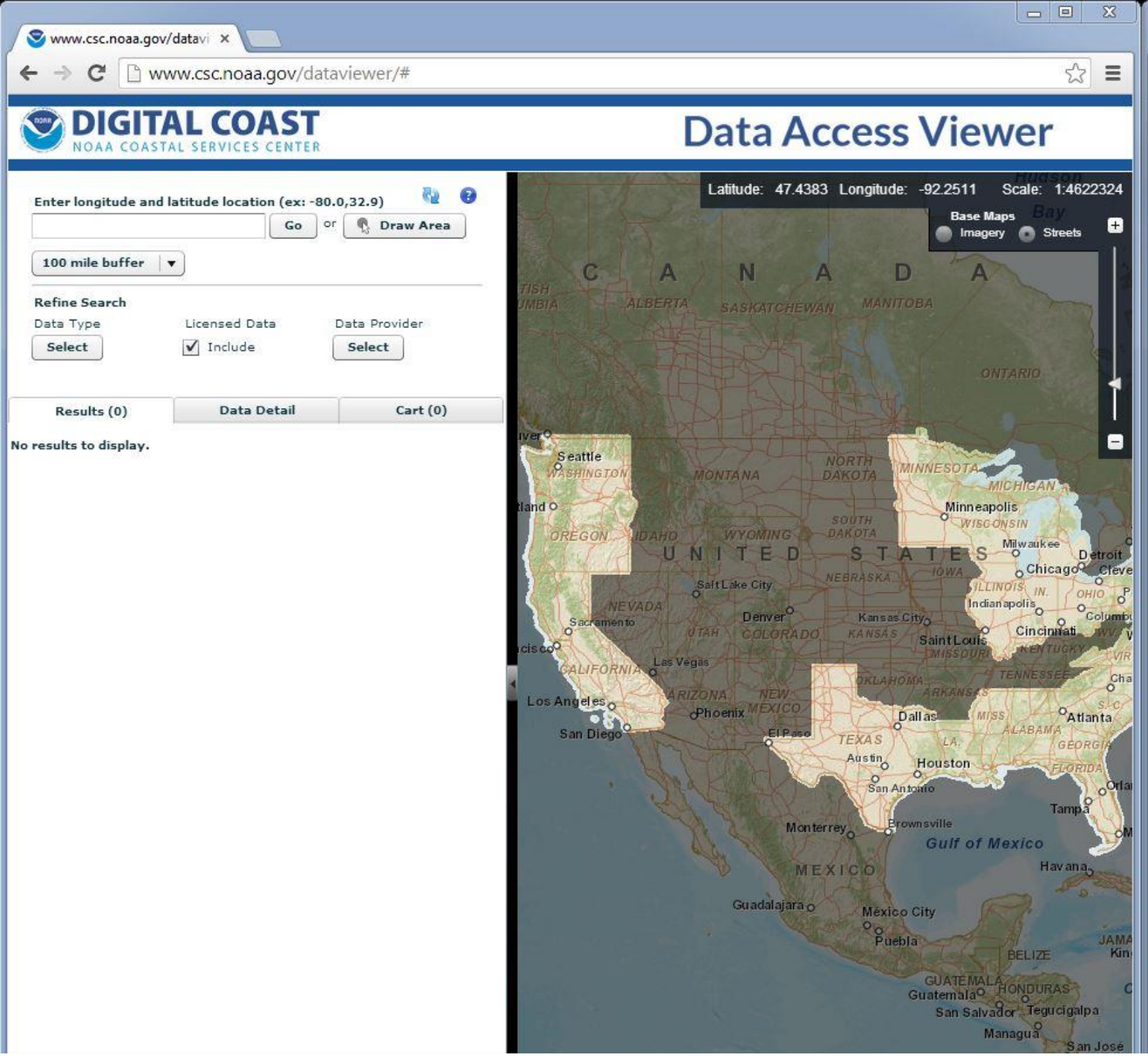
DSM
(Digital Surface Model)

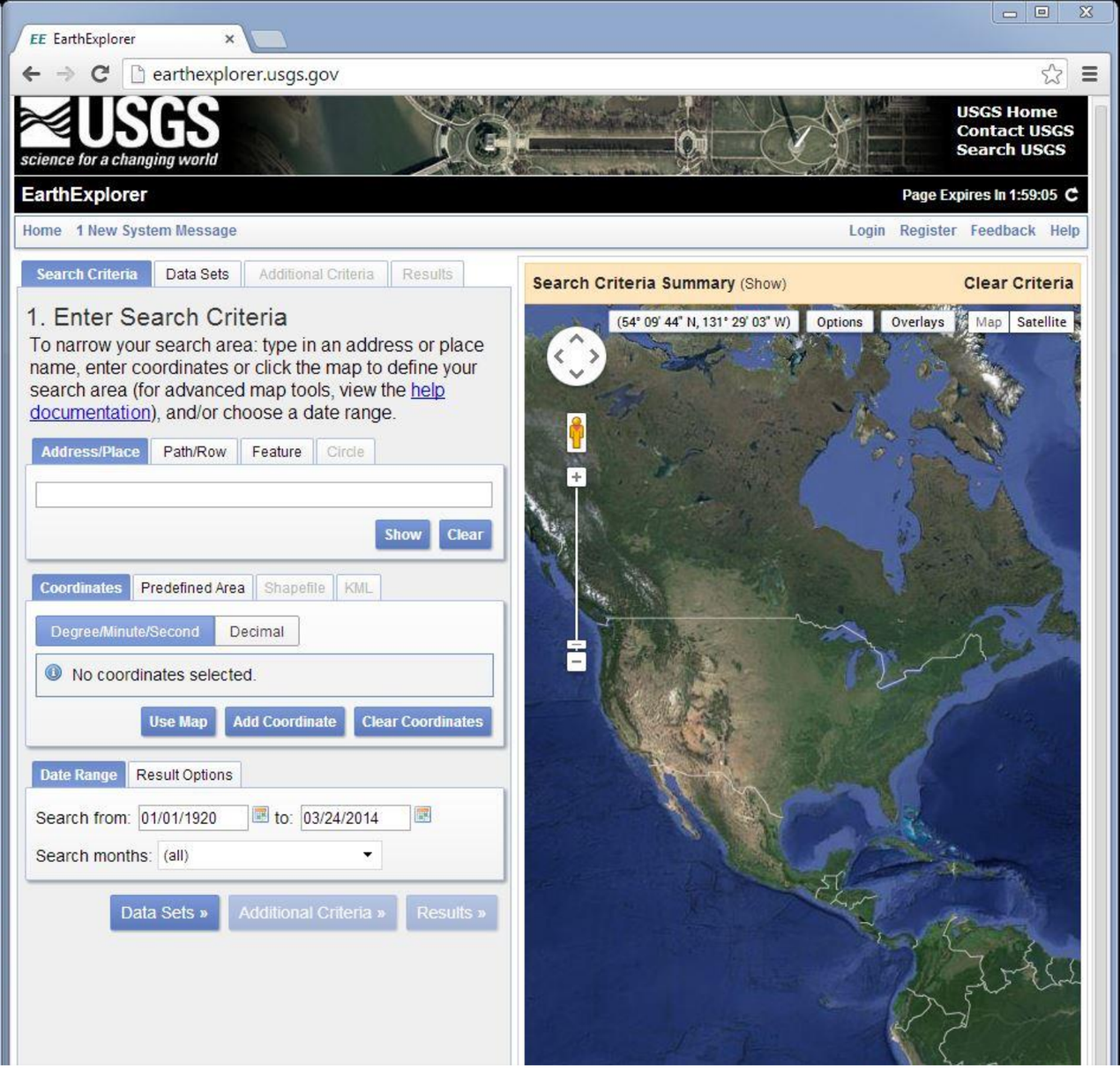
nDSM
(Normalized Digital Surface Model)



3D City Model Data Requirements

Imagery & LiDAR





3D City Model Data Requirements

Imagery & LiDAR

Minimum Data Requirements

Building Footprint Data
City Data
County Data
Consultant

Vegetation Data
City Data
County Data
Consultant

Recommended Data

Building Footprint Data
City Data
County Data
Consultant

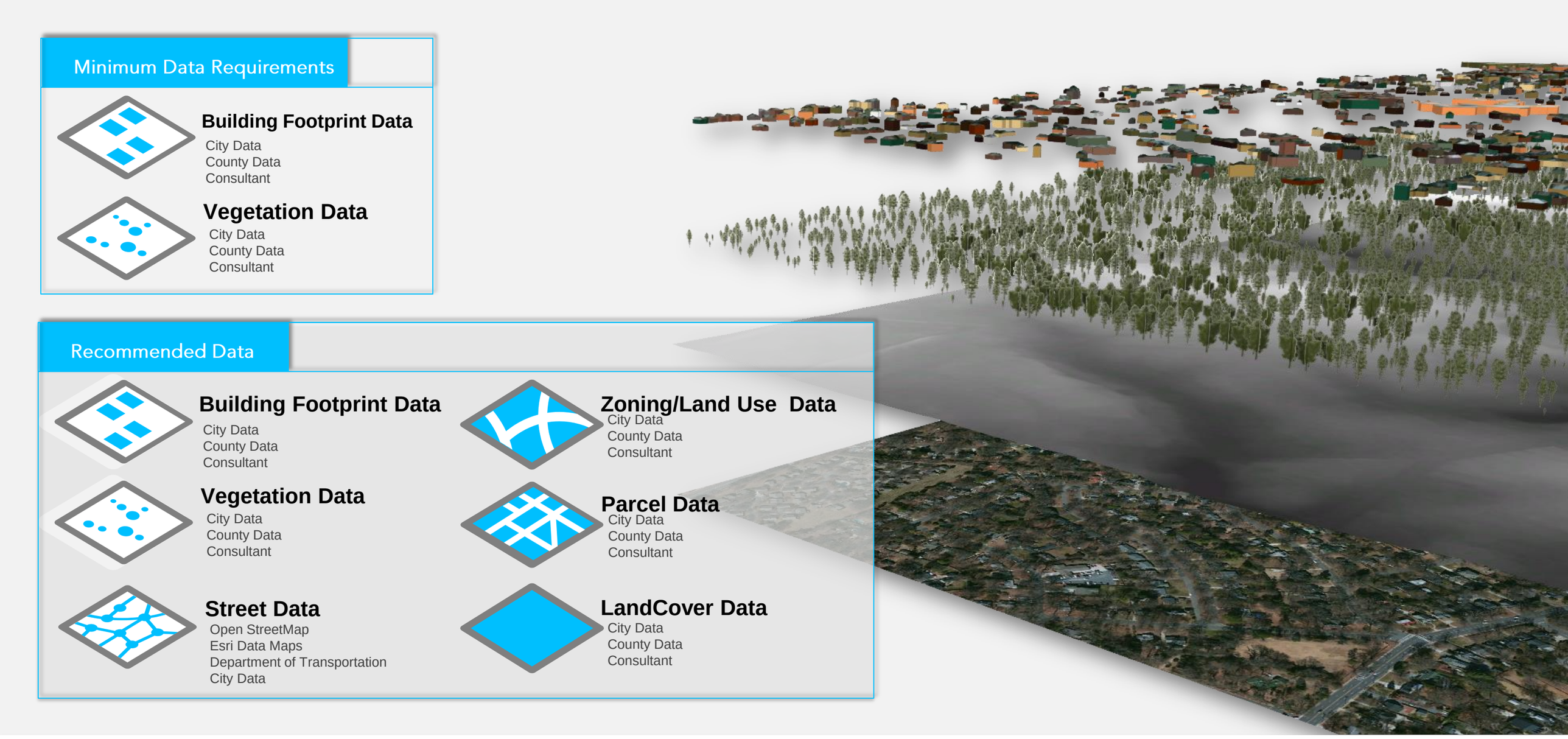
Vegetation Data
City Data
County Data
Consultant

Street Data
Open StreetMap
Esri Data Maps
Department of Transportation
City Data

Zoning/Land Use Data
City Data
County Data
Consultant

Parcel Data
City Data
County Data
Consultant

LandCover Data
City Data
County Data
Consultant



3D City Model Data Requirements

Vector Data

Error: No Data Available!

What if I don’t have Data?

PCI GEOMATICS

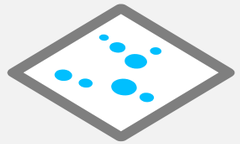
DTM
(Digital Terrain Model)
Terrain for 3D Model

DSM
(Digital Surface Model)
Height Information For 2D Geometries

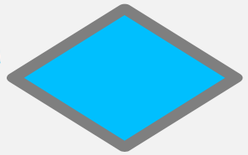
Orthoimagery
(Imagery)
Imagery to drape onto Terrain

OVERWATCH

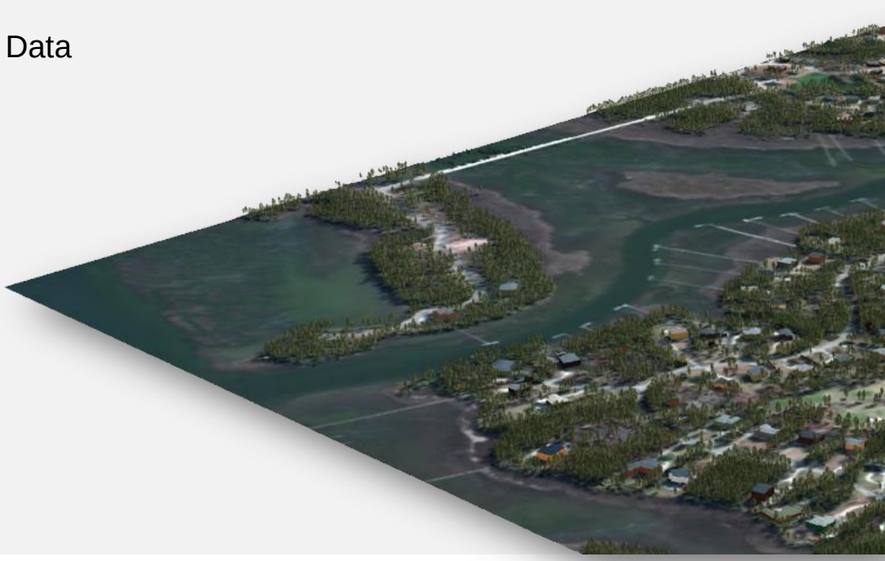
Building Footprint Data



Vegetation Data

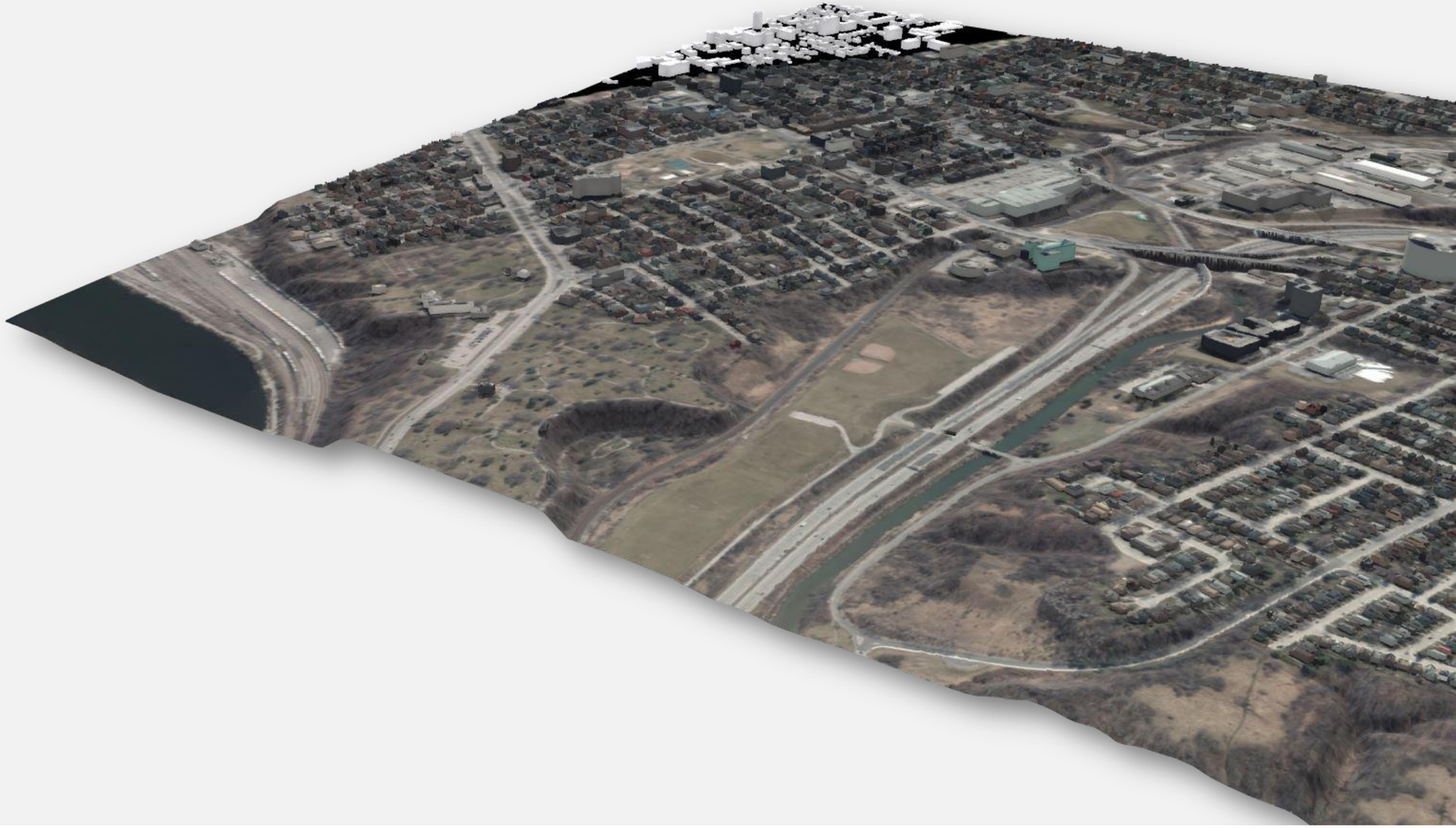


LandCover Data



What if I don’t have Data?

Creating Data

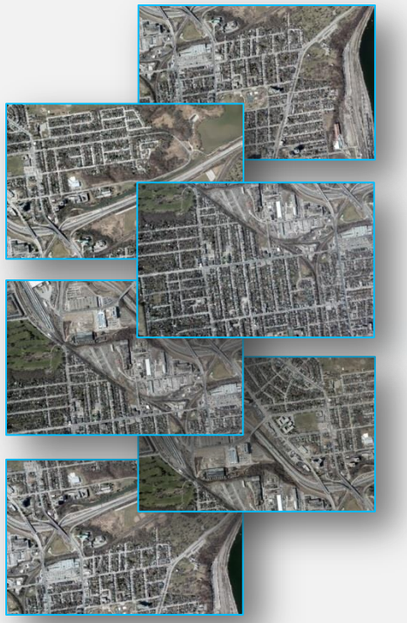


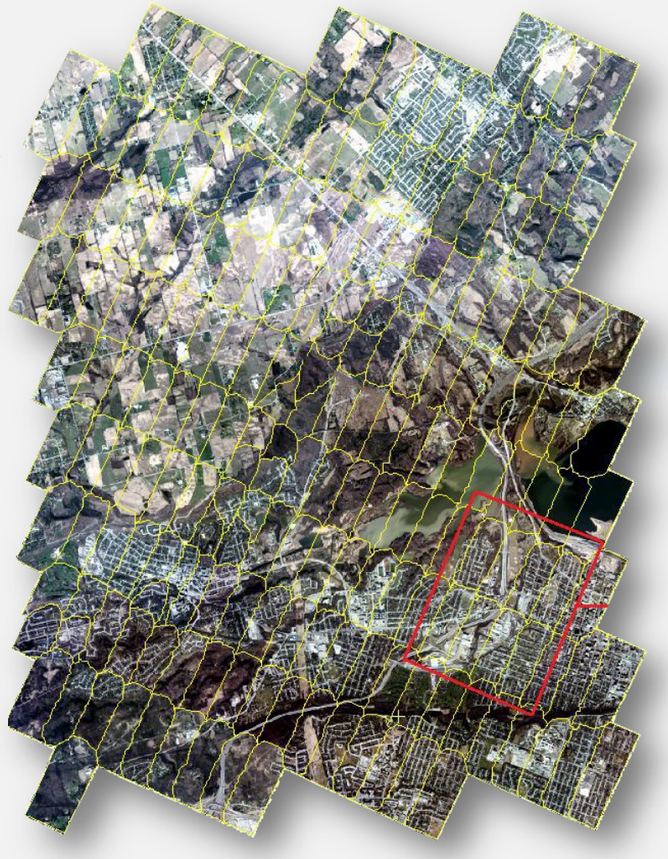
PCI Geomatics

Creating Ortho, DEM, & DSM from
Aerial & Satellite Imagery

Satellite with Stereo Pair

Aerial Imagery





PCI Geomatics

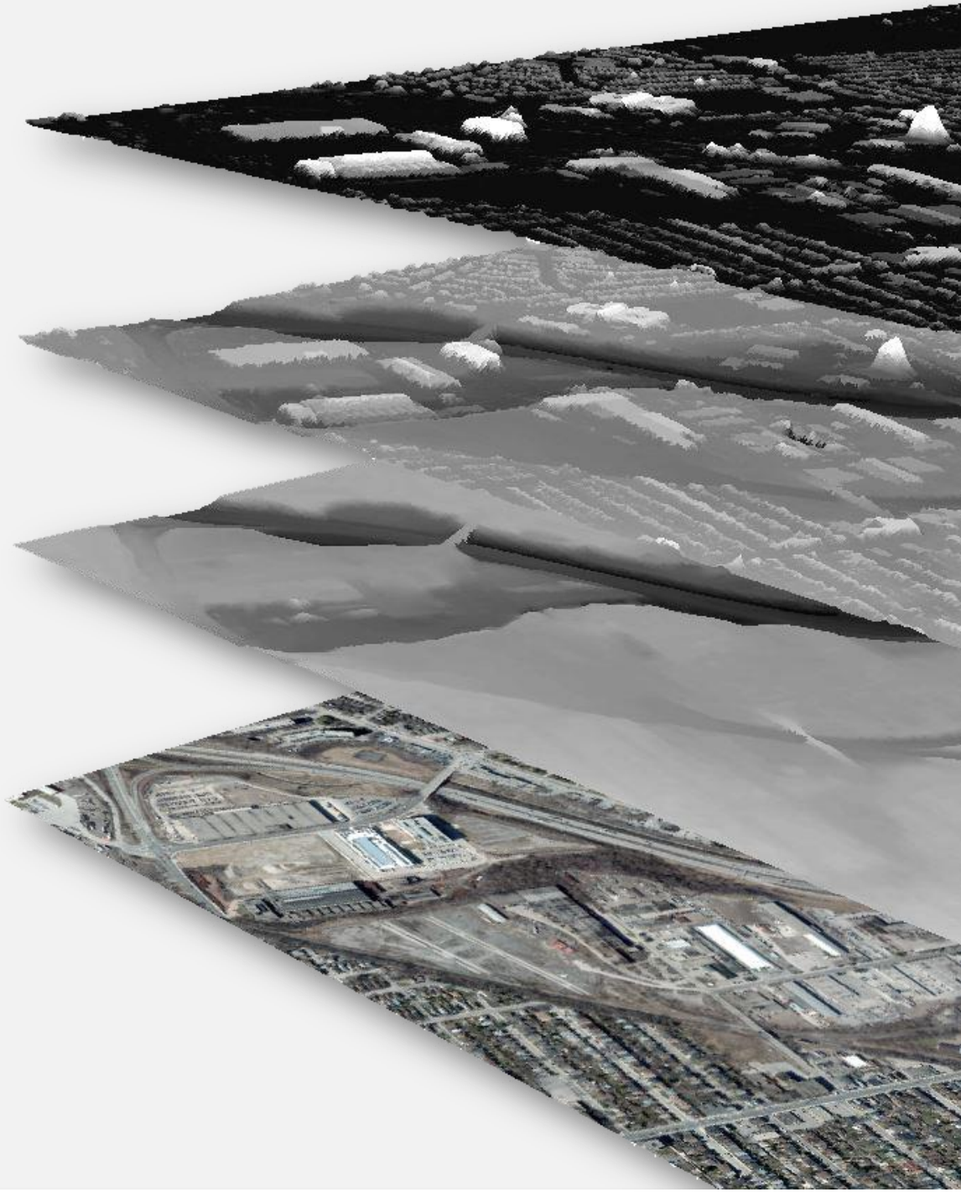
Creating Ortho, DTM, & DSM from Aerial & Satellite Imagery

Normalized Digital Surface Model (nDSM)
For determining heights of Buildings & Vegetation

Digital Surface Model (DSM)
Surface Height above Sea Level

Digital Elevation Model (DEM)
Used as the 3D Model Terrain.

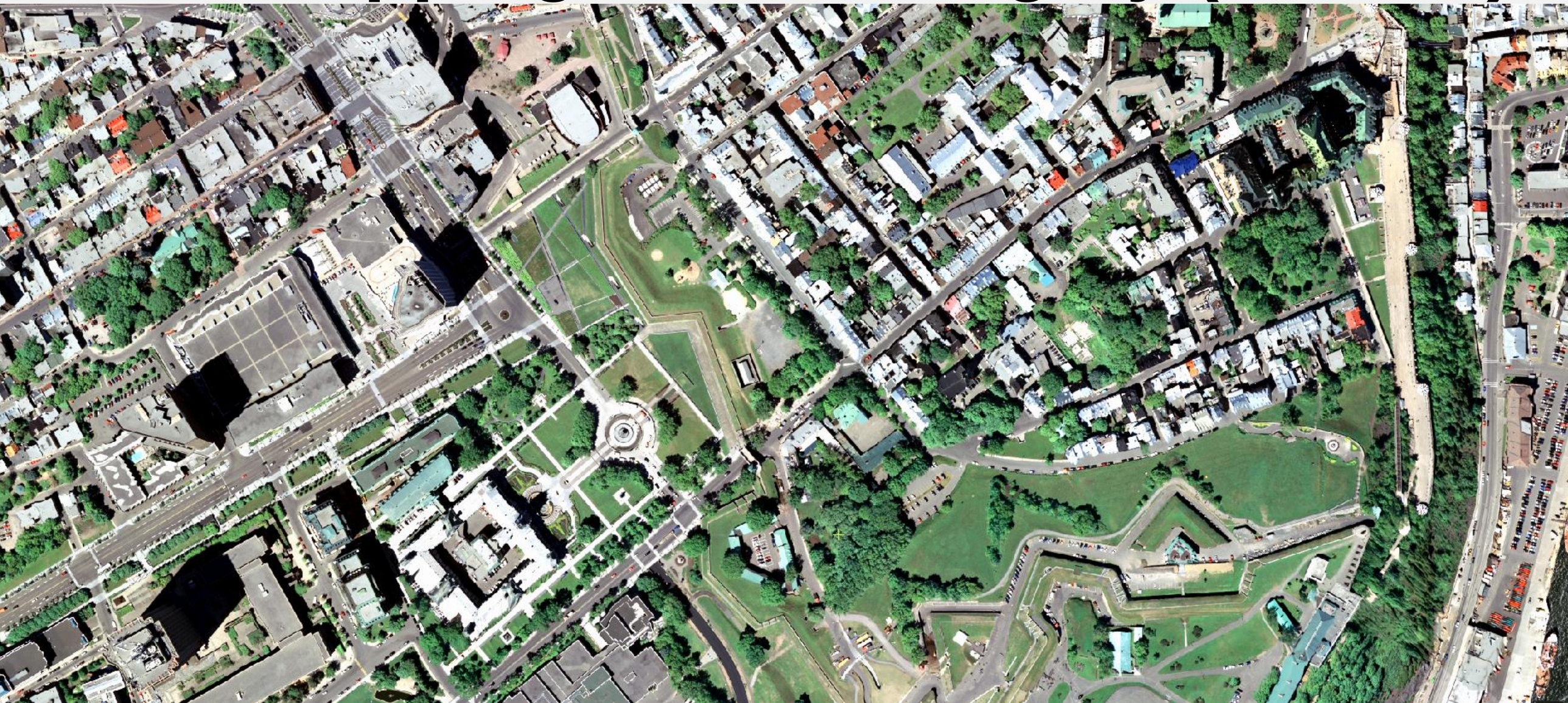
Ortho-Mosaic
Ortho Imagery for draping on terrain



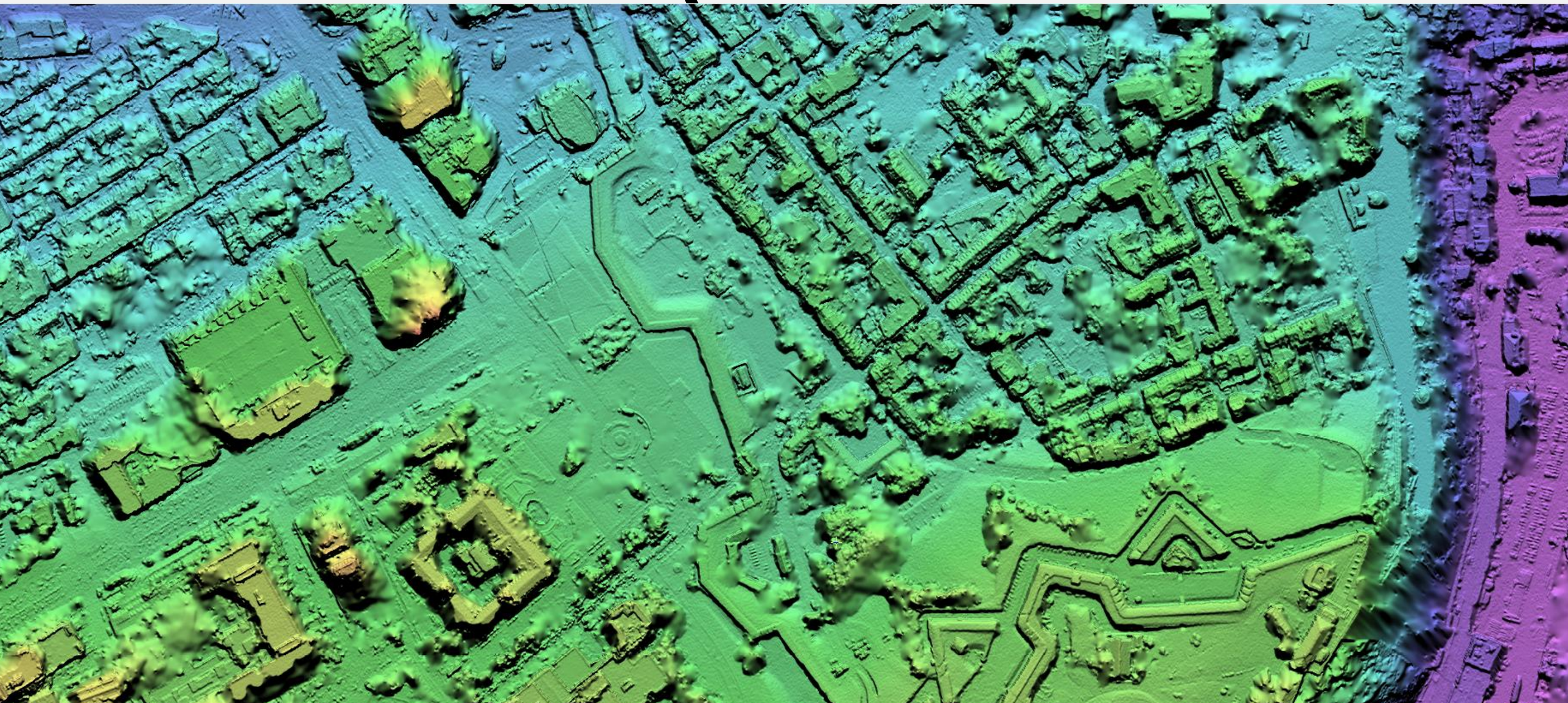
PCI Geomatics

Creating Ortho, DTM, & DSM from Aerial & Satellite Imagery

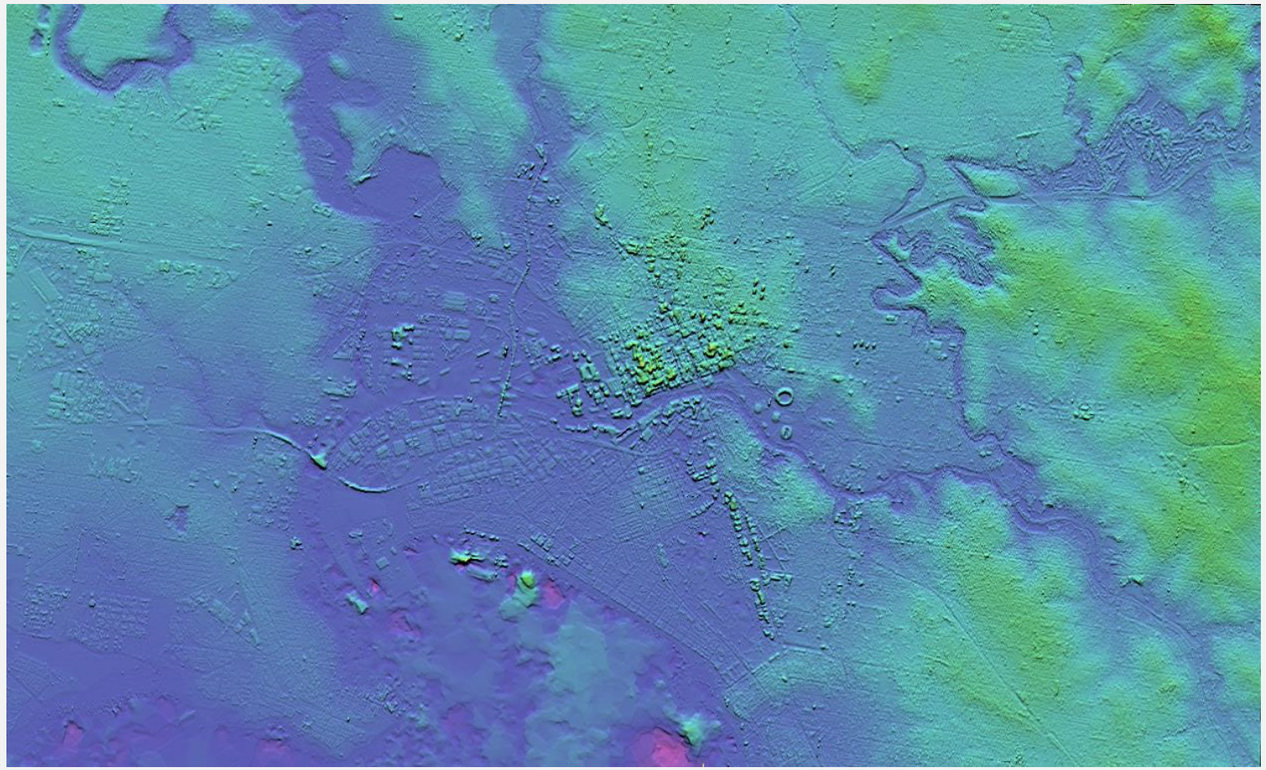
Overlapping Stereo Imagery (15 cms)

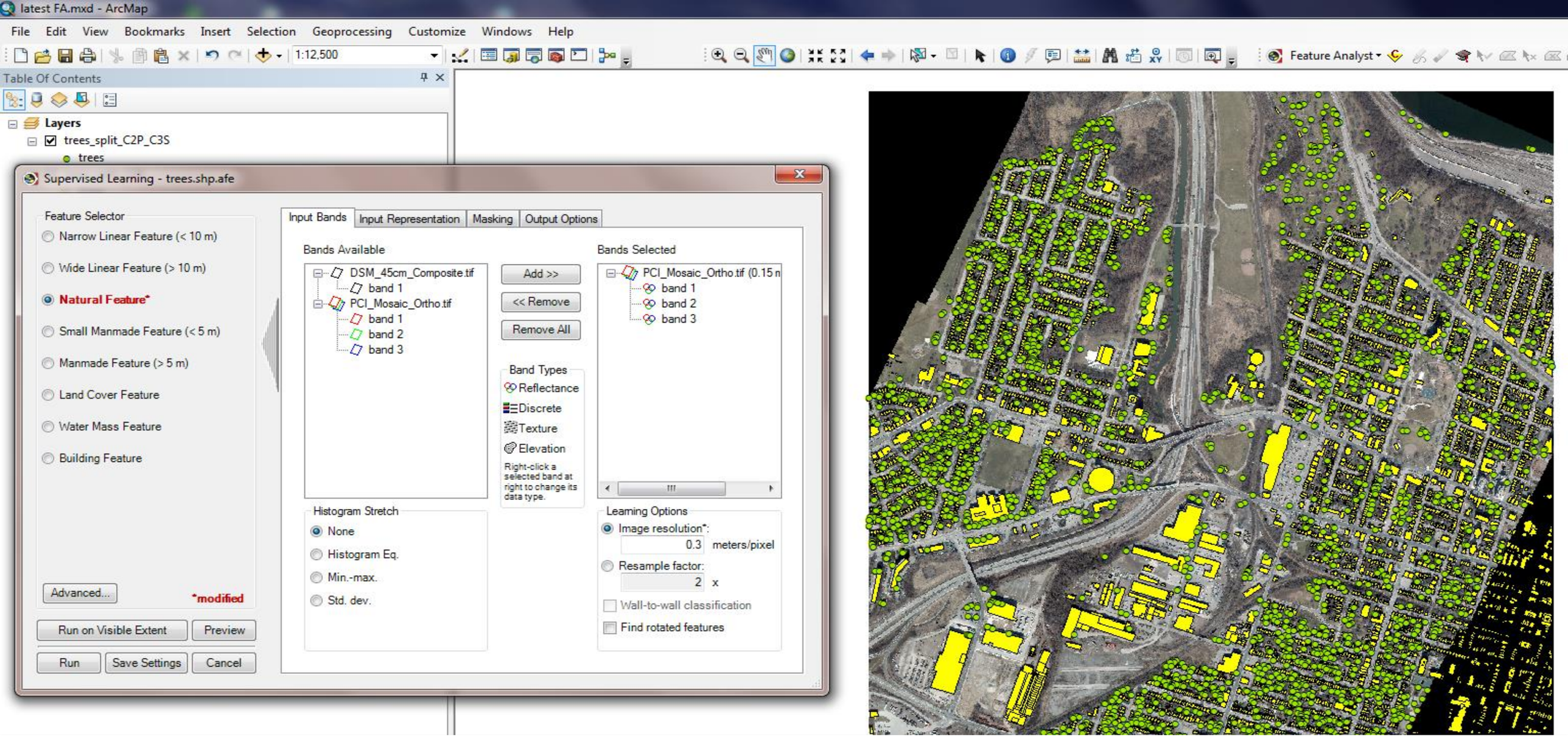


DSM Results (45 cms from



DSM Results (1 m from Satellite)

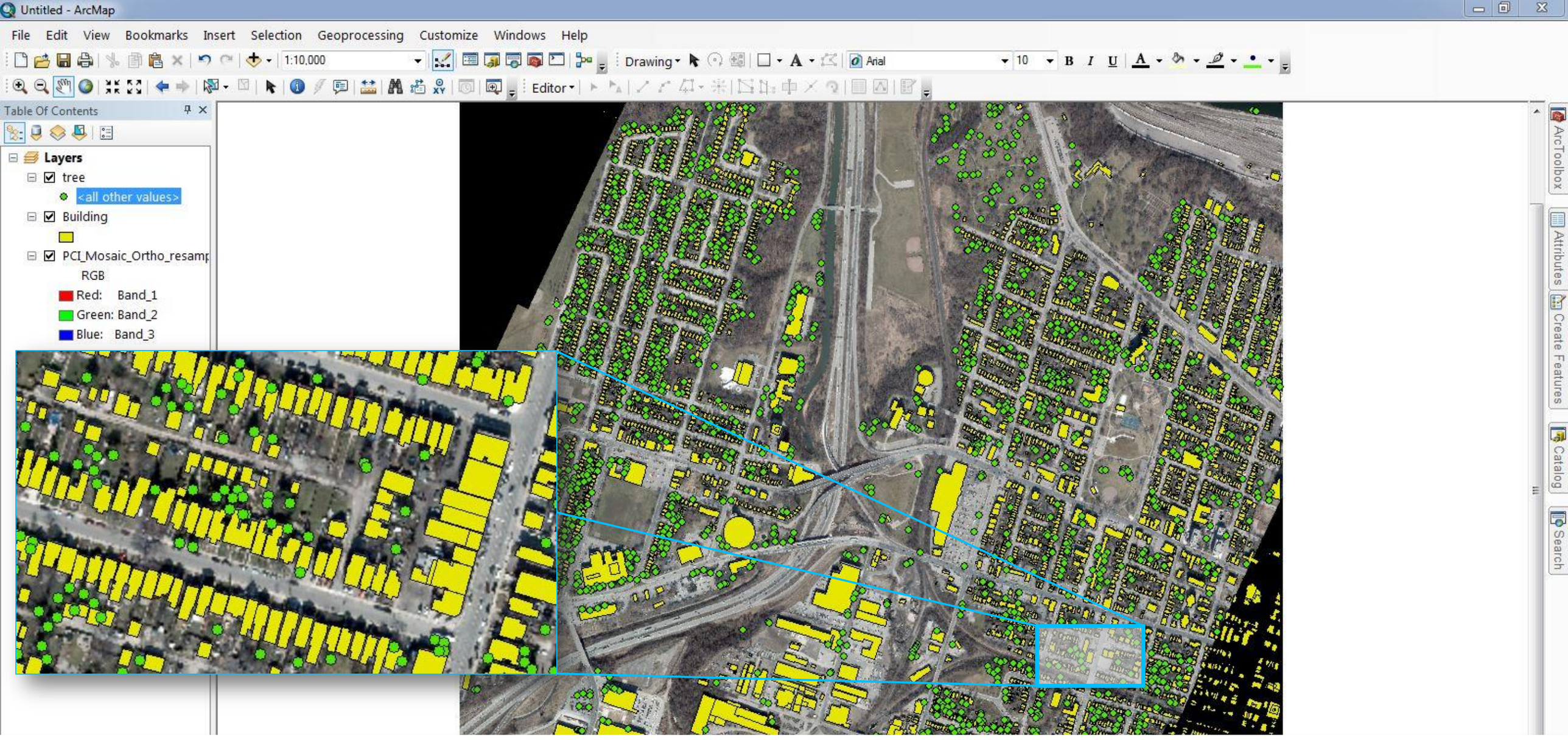




OVERWATCH

Overwatch

Extracting Features from Imagery



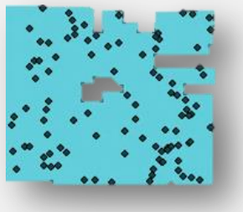
OVERWATCH

Overwatch

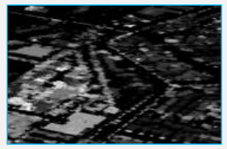
Extracting Features from Imagery

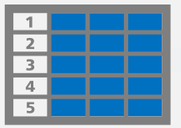
Adding Height Data to Features

Process for adding height information to building footprints & vegetation



NDSM





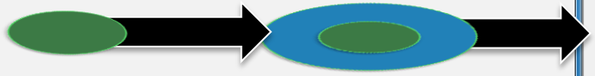
Building Footprint

Create Random Points

Add Surface Information

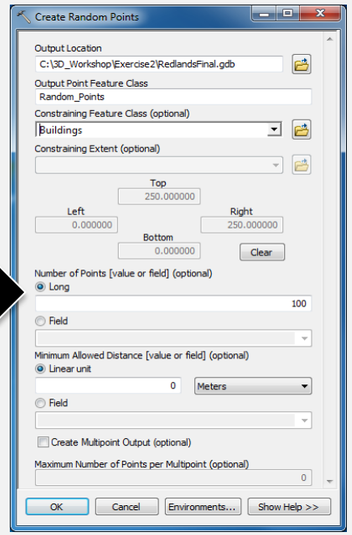
Run Summary Statistics

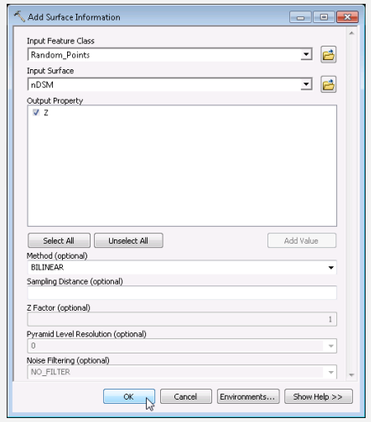
Join Data

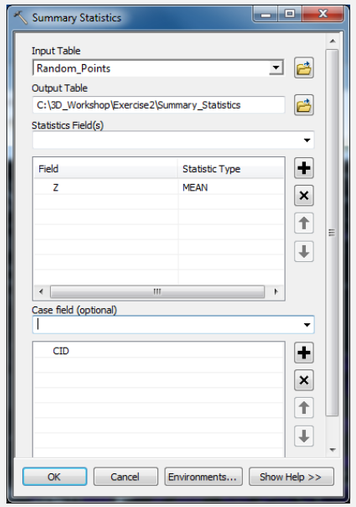


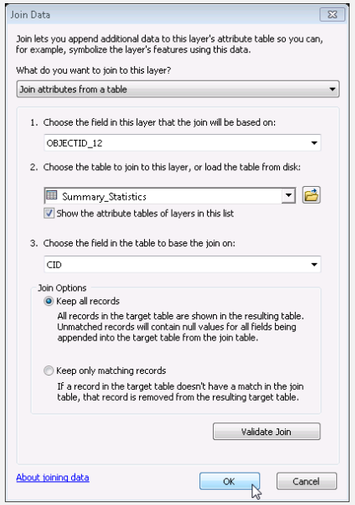
Vegetation Point Data

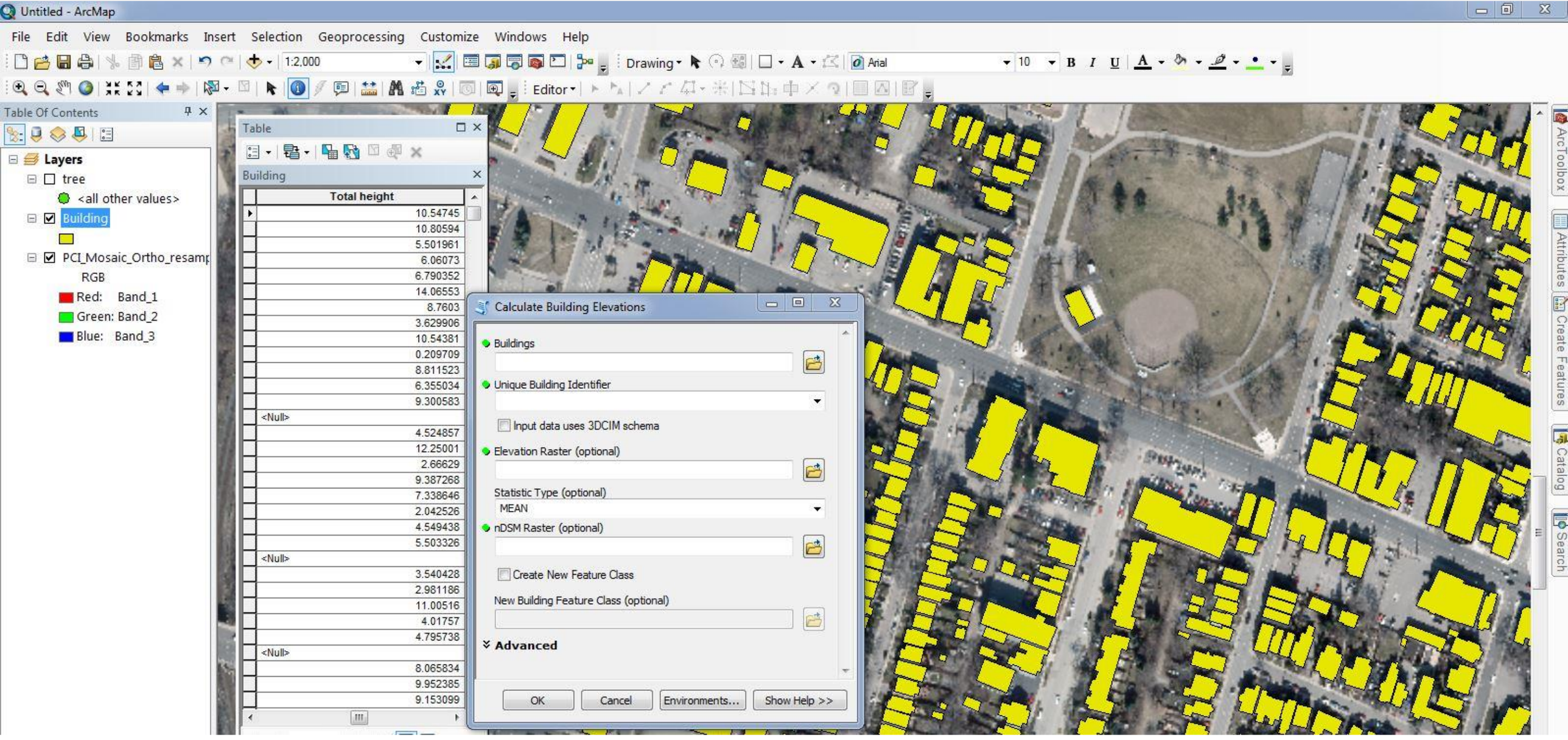
2.5m Buffer







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RGB
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Green: Band_2
Blue: Band_3
Table
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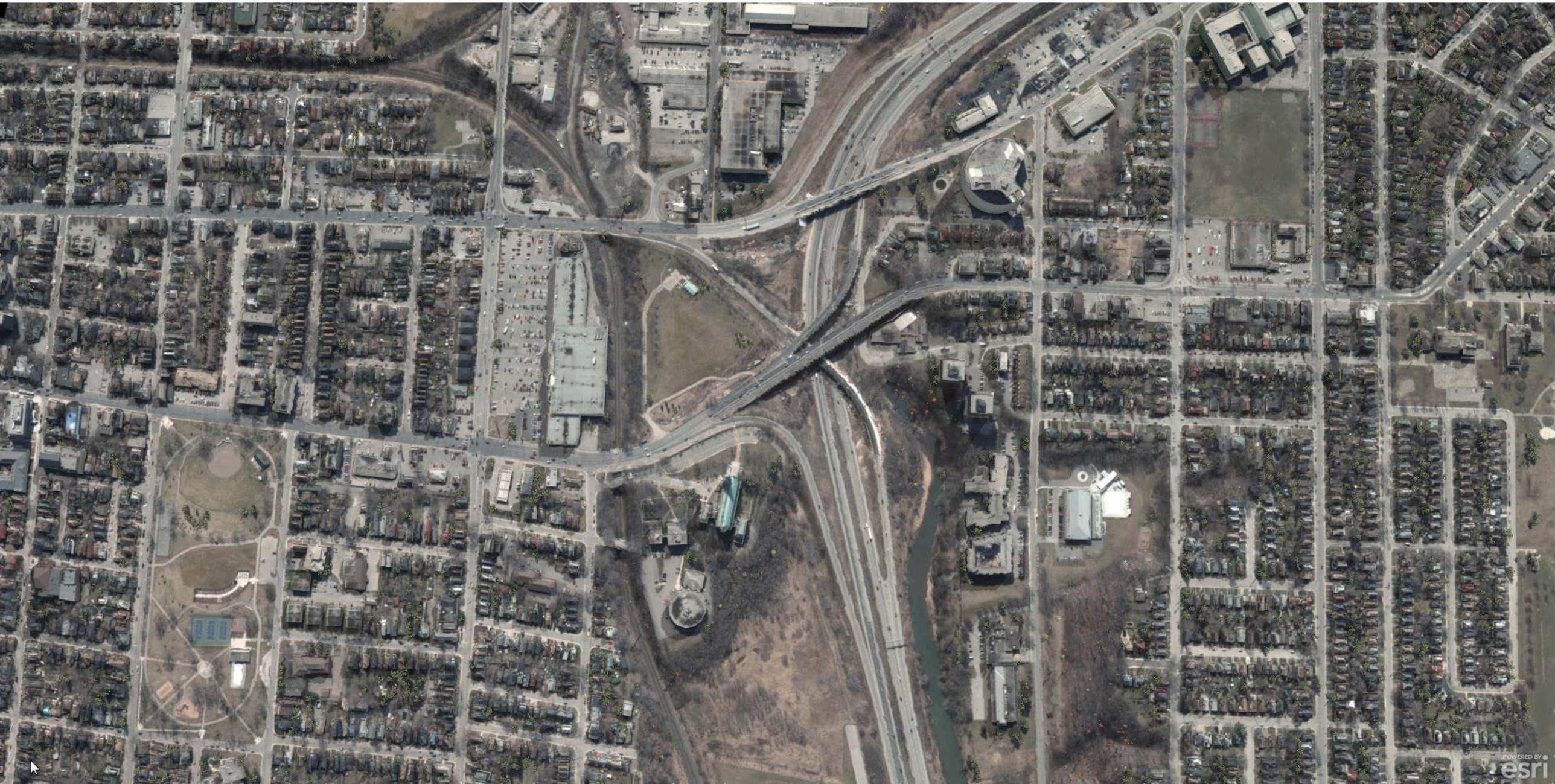
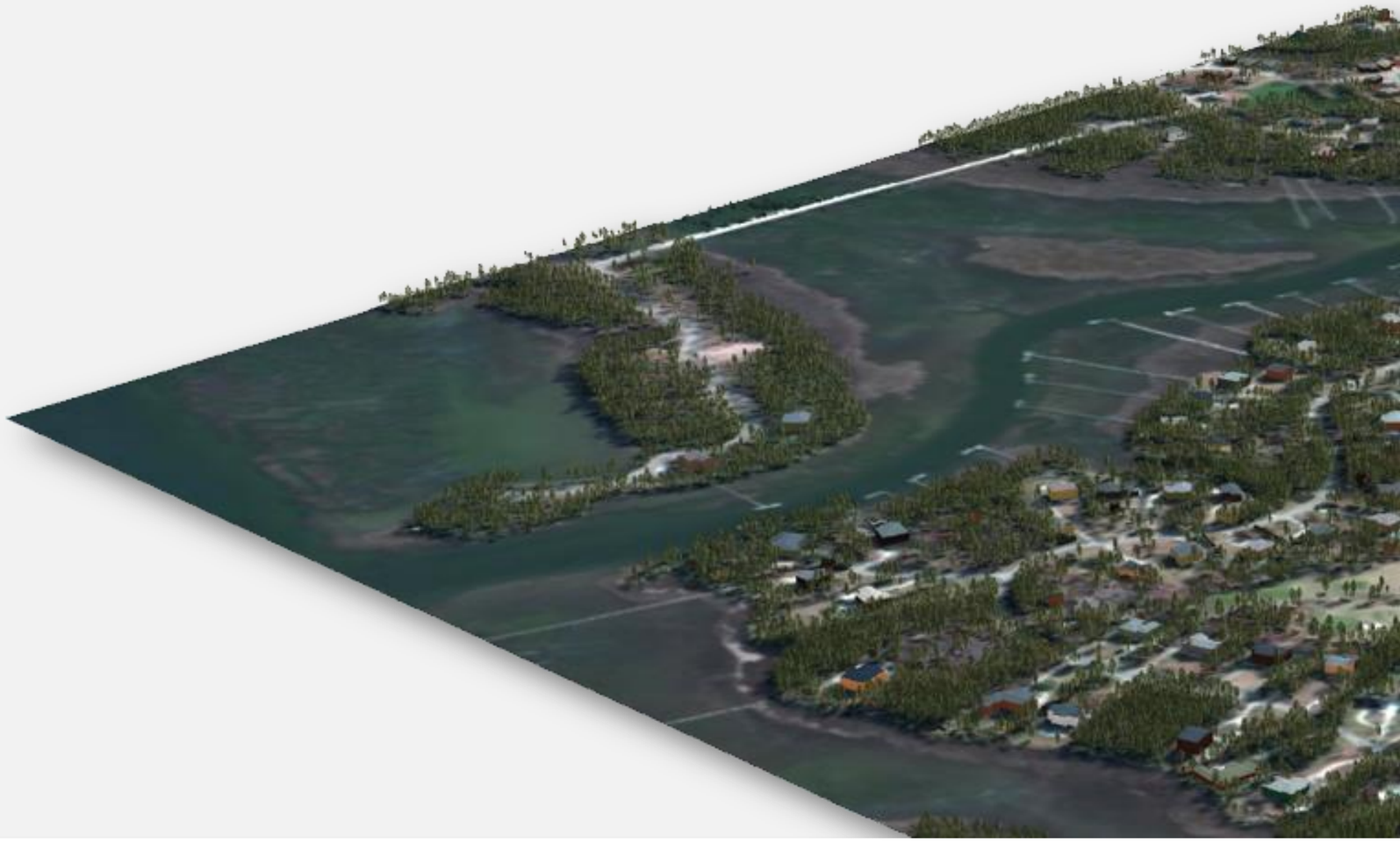
Buildings
Unique Building Identifier
Input data uses 3DCIM schema
Elevation Raster (optional)
Statistic Type (optional)
MEAN
nDSM Raster (optional)
Create New Feature Class
New Building Feature Class (optional)
Advanced
OK
Cancel
Environments...
Show Help >>
ArcToolbox
Attributes
Create Features
Catalog
Search

PCI Geomatica & Overwatch Feature Analyst to Esri CityEngine



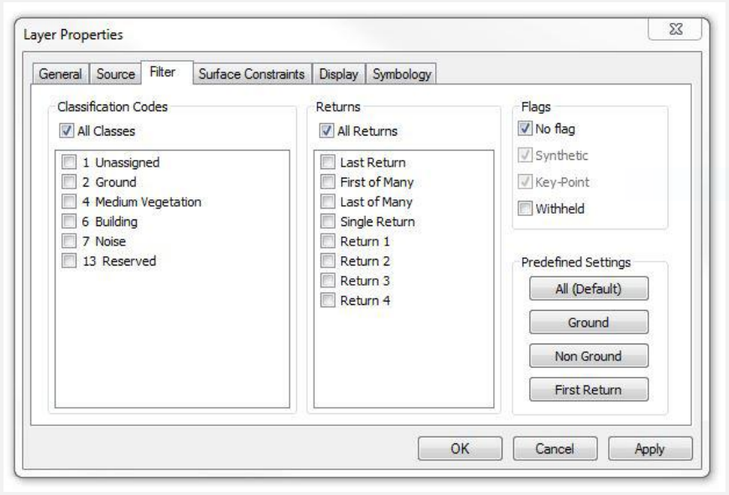


Esri

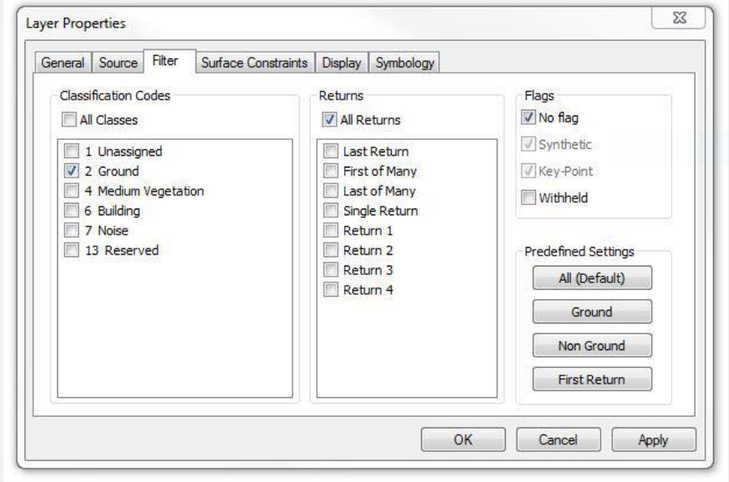
Extracting Features from LiDAR

Extracting Terrain & Surface Models from LiDAR

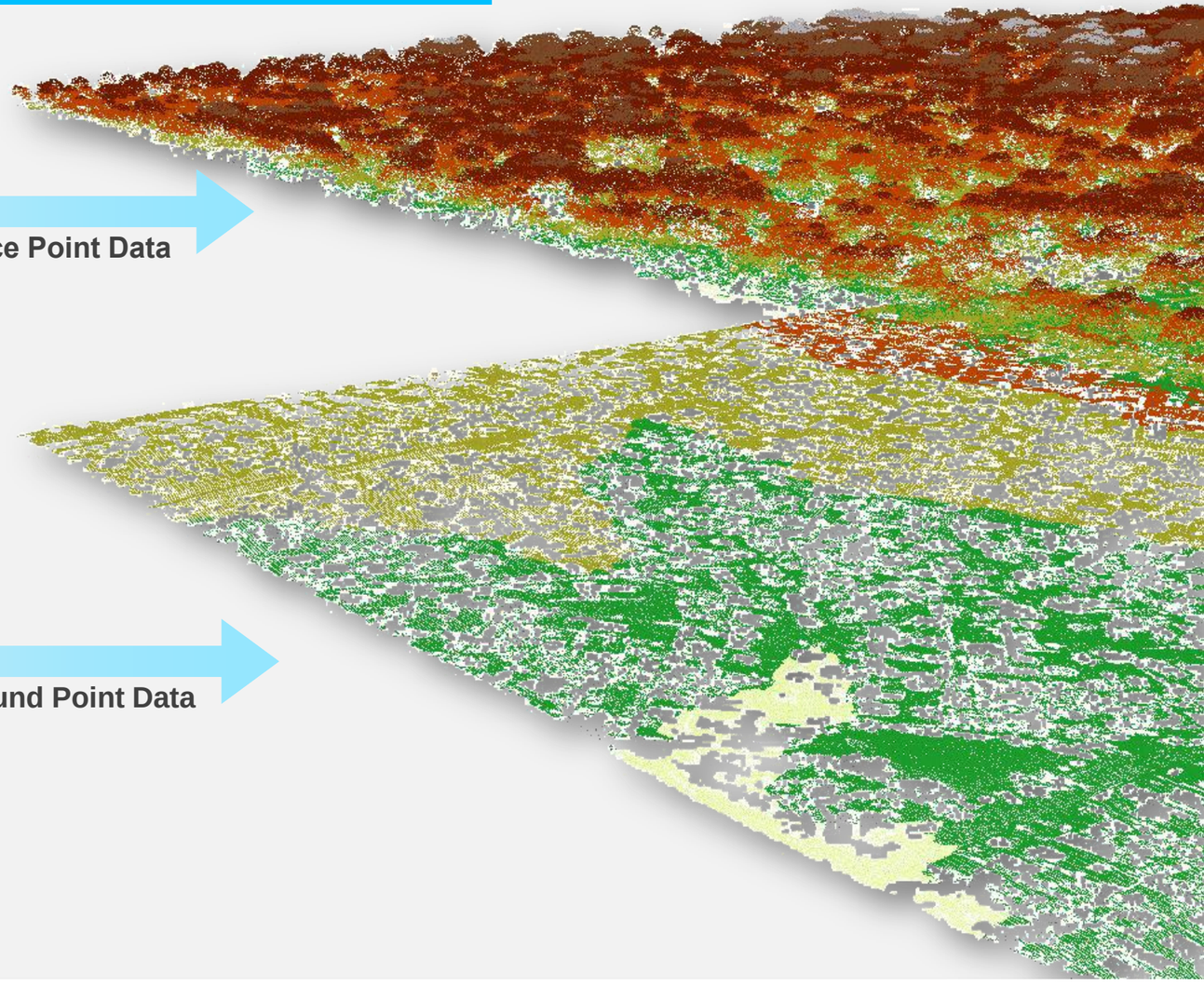
In the Esri .las format



Select “All Returns” for Surface Point Data



Select Ground Returns for Ground Point Data



Esri

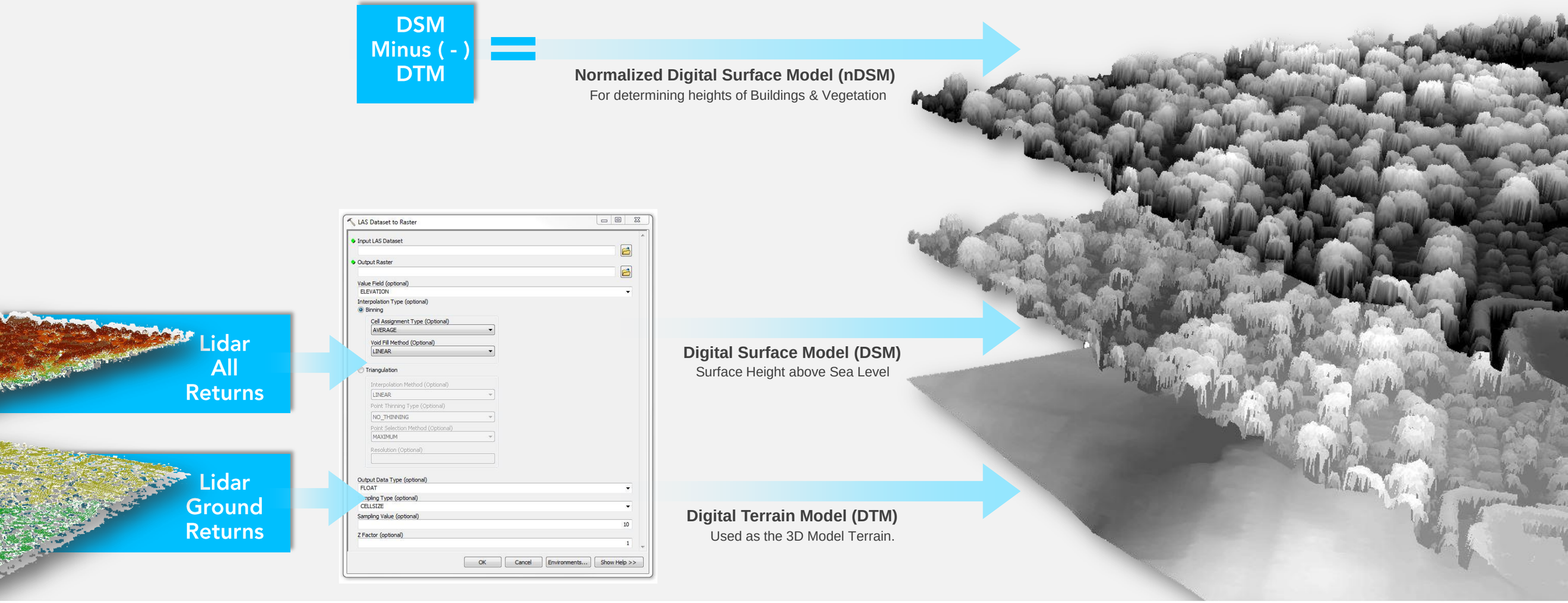
Extracting Features from LiDAR
(Terrain, Digital Surface Model)

Extracting Terrain & Surface Models from LiDAR

In the Esri .las format

DSM Minus (-) DTM

Normalized Digital Surface Model (nDSM)
For determining heights of Buildings & Vegetation



Lidar All Returns

Lidar Ground Returns

Digital Surface Model (DSM)
Surface Height above Sea Level

Digital Terrain Model (DTM)
Used as the 3D Model Terrain.

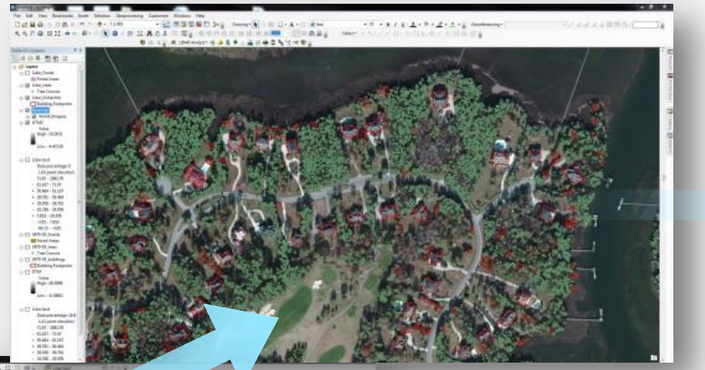
Esri

Extracting Features from LiDAR
(Terrain, Digital Surface Model)

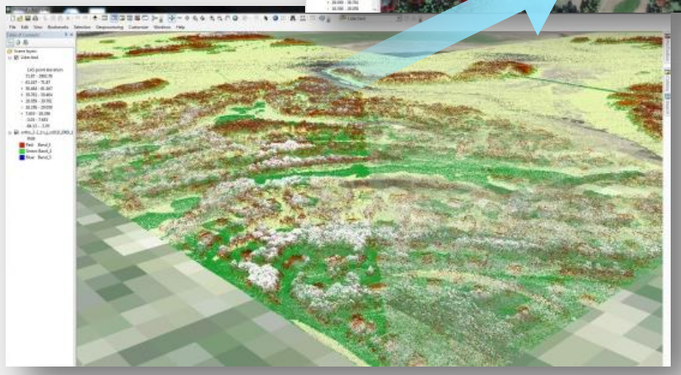
Extracting Features with LiDAR Analyst

Process of extracting building footprints and Vegetation Data directly from LiDAR

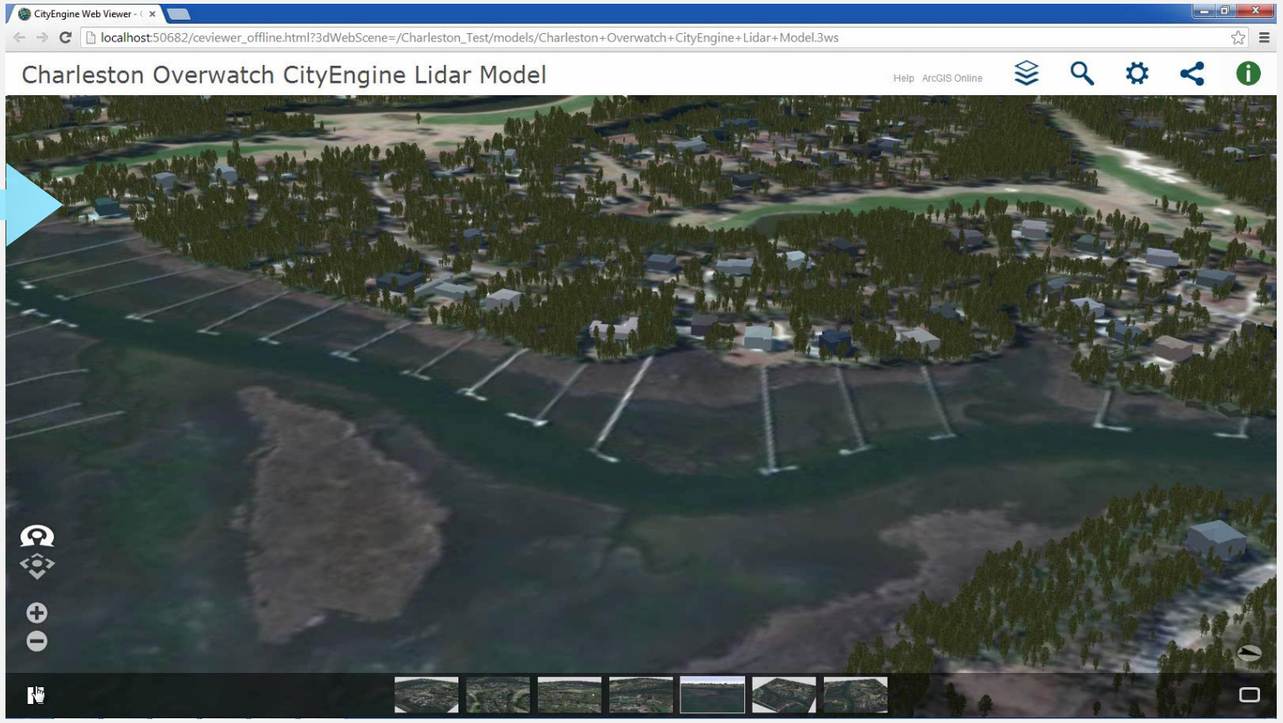
ArcGIS Desktop & Overwatch LiDAR Analyst



LiDAR

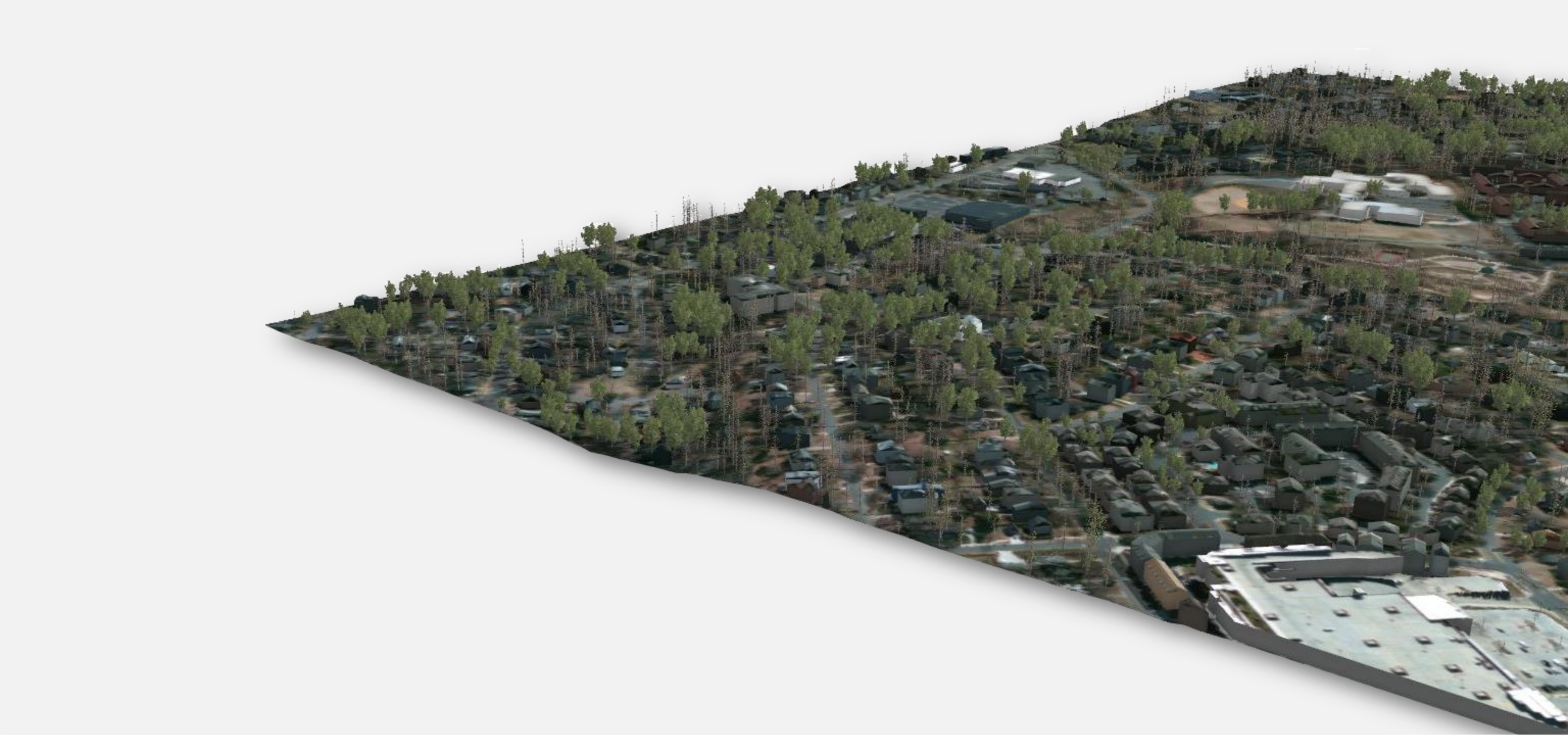


Rule Packages



OVERWATCH

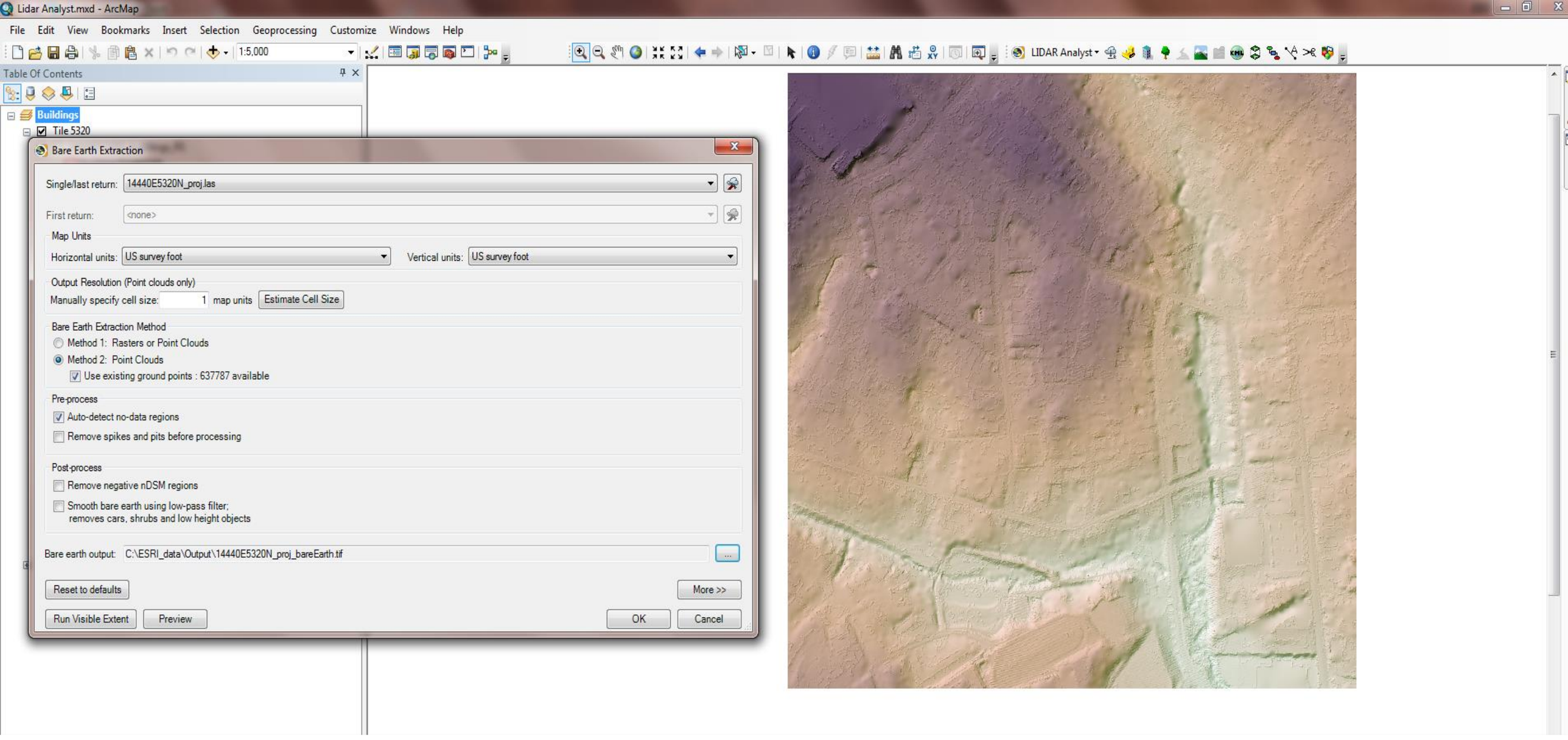
LiDAR Analyst | Overwatch



OVERWATCH

Overwatch

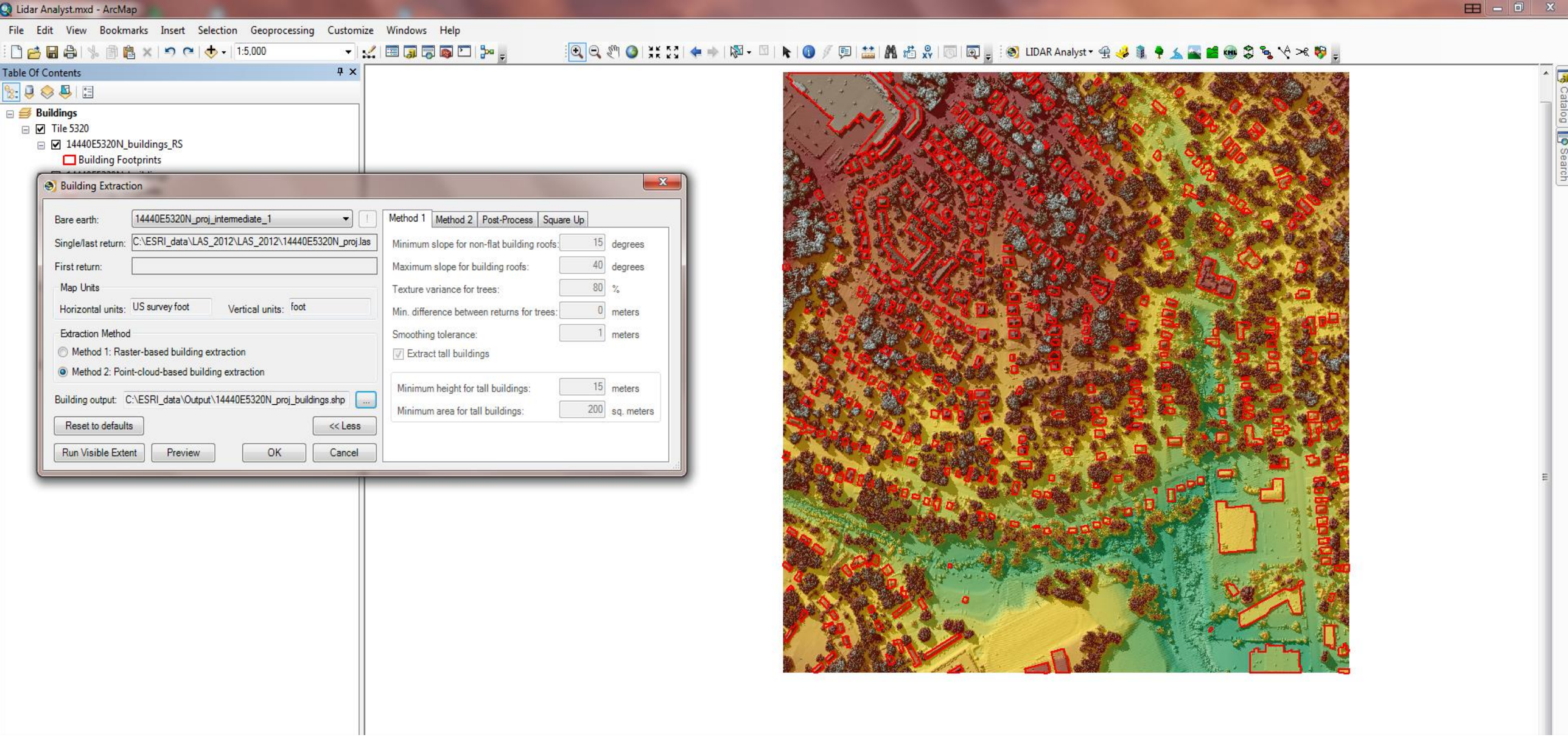
From LiDAR to 3D



OVERWATCH

LiDAR Analyst

Overwatch



OVERWATCH

LiDAR Analyst

Overwatch

Building Extractions.mxd - ArcMap

File Edit View Bookmarks Insert Selection Geoprocessing Customize Windows Help

1:6,000

LIDAR Analyst

Table Of Contents

Buildings

Tile 5320

Tree Extraction

Bare earth: 14440E5320N_proj_intermediate_1

Single/last return: C:\ESRI_data\LAS_2012\LAS_2012\14440E5320N_proj.las

First return:

Buildings: <none>

Map Units

Horizontal units: US survey foot Vertical units: foot

Extraction Method

Method 1: Fixed window search (better for dense forests)

Method 2: Variable window search (better at getting accurate crown widths)

Predominant tree/forest type: Mixed

Minimum tree height: 3 meters

Typical tree height: 40 meters

Minimum size of a forest: 600 sq. meters

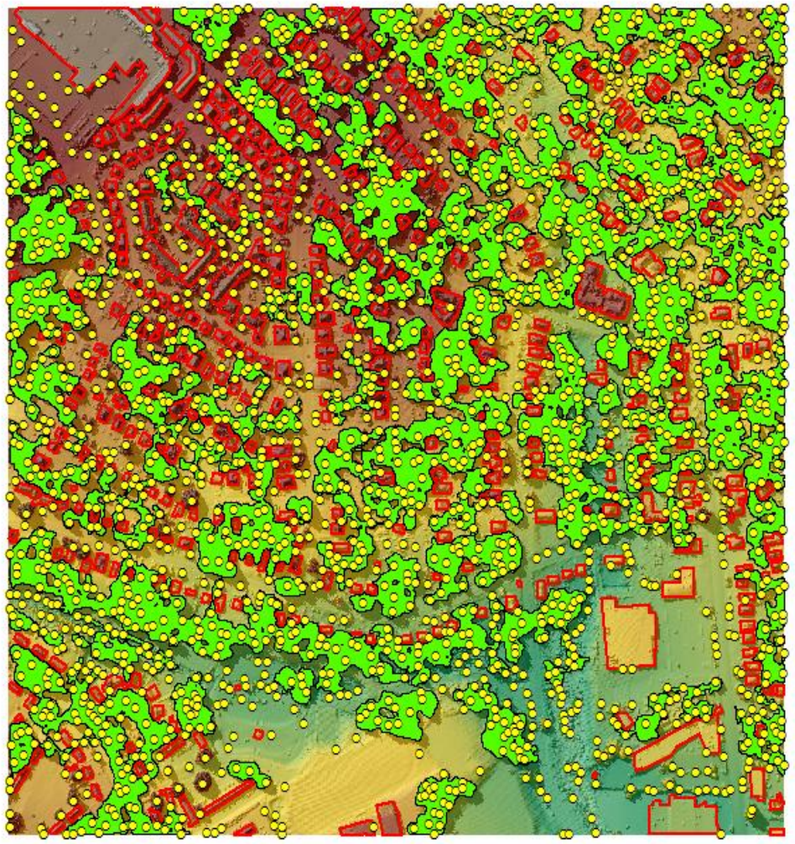
Output Files

Tree points: C:\ESRI_data\Output\14440E5320N_proj_trees.shp

Forest areas: C:\ESRI_data\Output\14440E5320N_proj_forests.shp

Reset to defaults

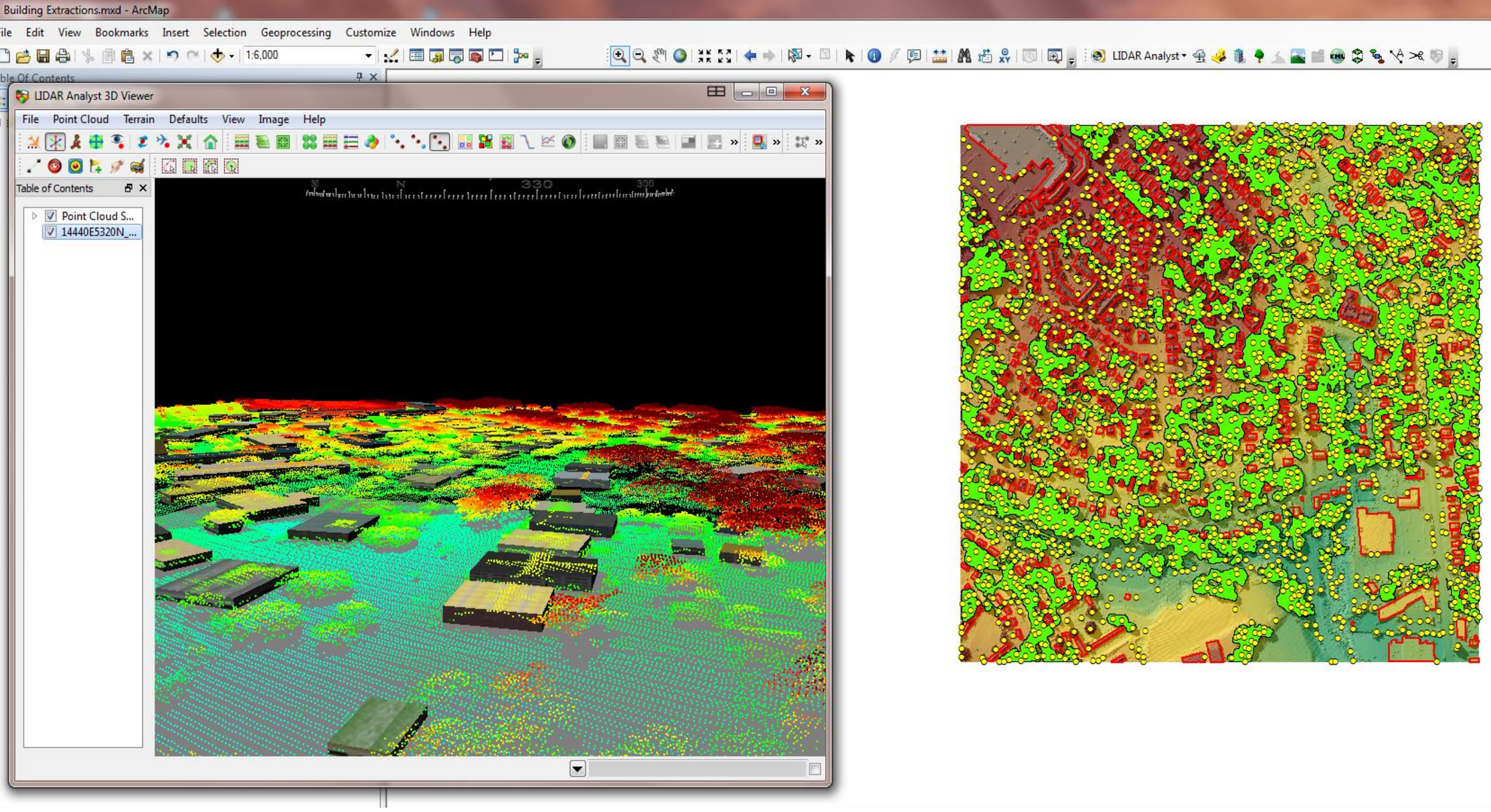
Run Visible Extent Preview OK Cancel



OVERWATCH

LiDAR Analyst

Overwatch



LiDAR Analyst

Overwatch

Extracting Features with LiDAR Analyst

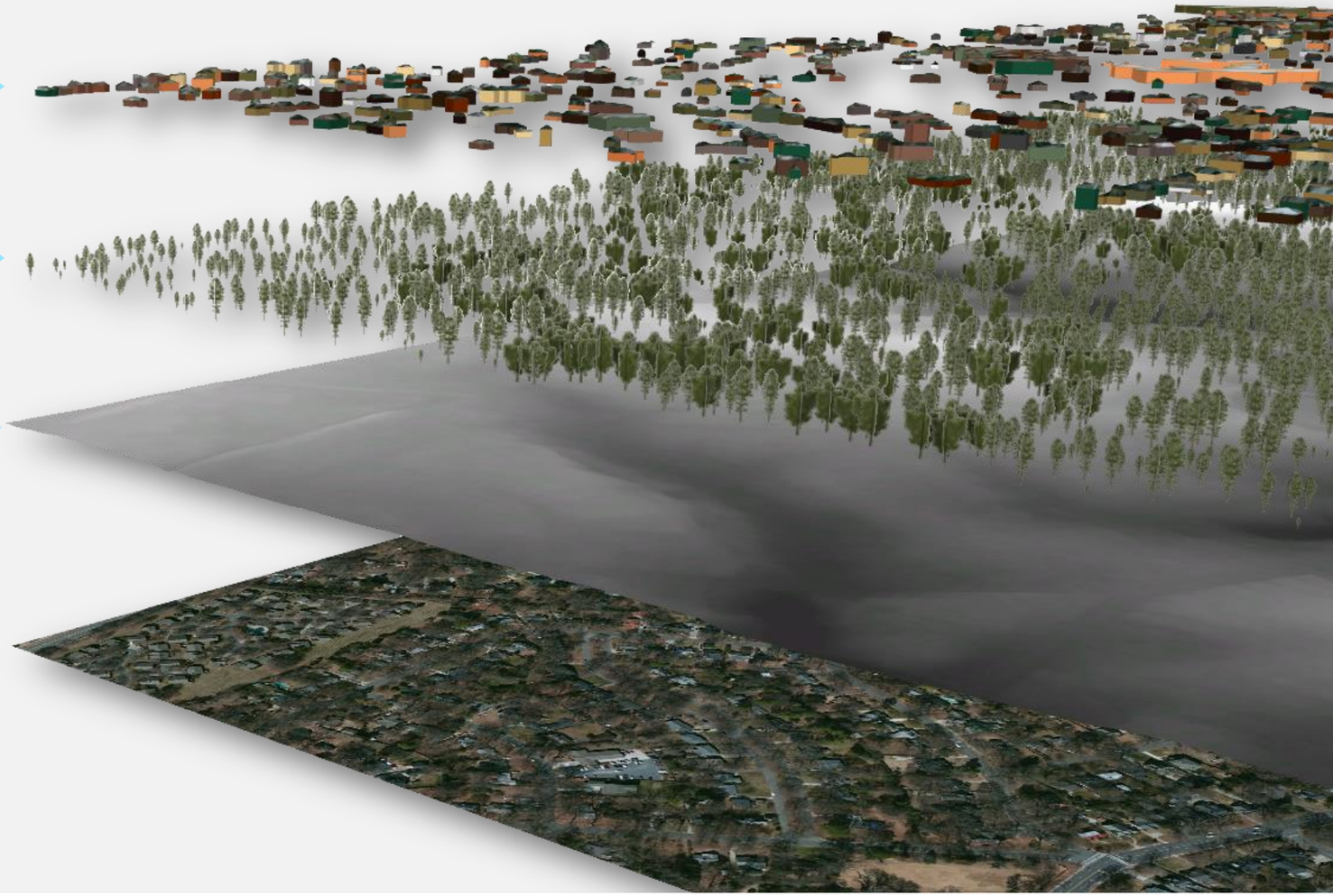
Process of extracting building footprints and Vegetation Data directly from LiDAR

OVERWATCH LIDAR ANALYST

Building Footprints with Height
Extract Building Footprints with Height Data

Vegetation Data
Extract Vegetation Point and Height Data

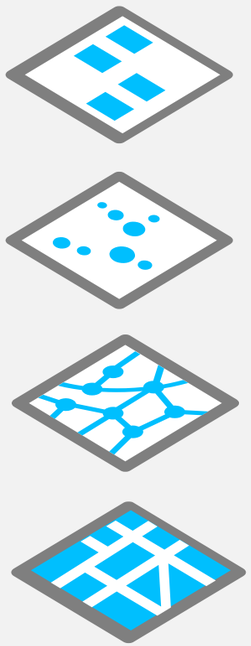
Bare Earth Raster
Digital Elevation Model



Overwatch Lidar Analyst to Esri CityEngine

CityEngine Compatible Geospatial Data Formats

Vector Data



- 3D City Information Model — Recommended Format
- File Geodatabase (.gdb)
- Shapefile (.shp)

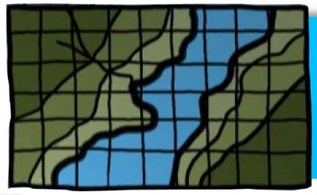
Imagery

Orthoimagery

(Imagery to Drape on Terrain)

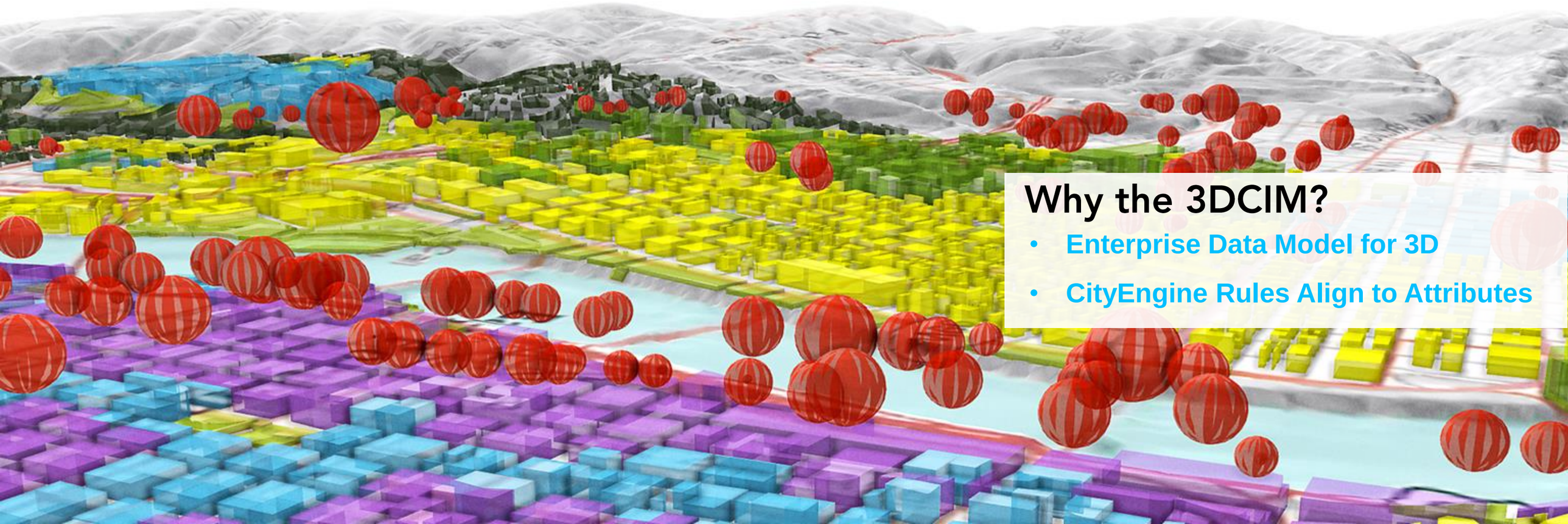
DEM or DTM

(Elevation Model)



- GeoTIFF (.tif) — Required Format

3D City Information Model



Why the 3DCIM?

- Enterprise Data Model for 3D
- CityEngine Rules Align to Attributes

Esri is on GitHub!

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esri-leaflet
JavaScript

A lightweight set of tools for working with ArcGIS services with Leaflet.

115 ★ 185

terraformer
JavaScript

A geometric toolkit for dealing with geometry, geography, formats, and building geo databases

44 ★ 141

arcgis-viewer-flex
ActionScript

Source code for ArcGIS Viewer for Flex - a great application framework for web applications.

120 ★ 121

gis-tools-for-hadoop
Python

The GIS Tools for Hadoop are a collection of GIS tools for spatial analysis of big data.

39 ★ 78

geometry-api-java
Java

The Esri Geometry API for Java enables developers to write custom applications for analysis of spatial data. This API is used in the Esri GIS Tools for Hadoop and other 3rd-party data processing solutions.

30 ★ 73

koop
JavaScript

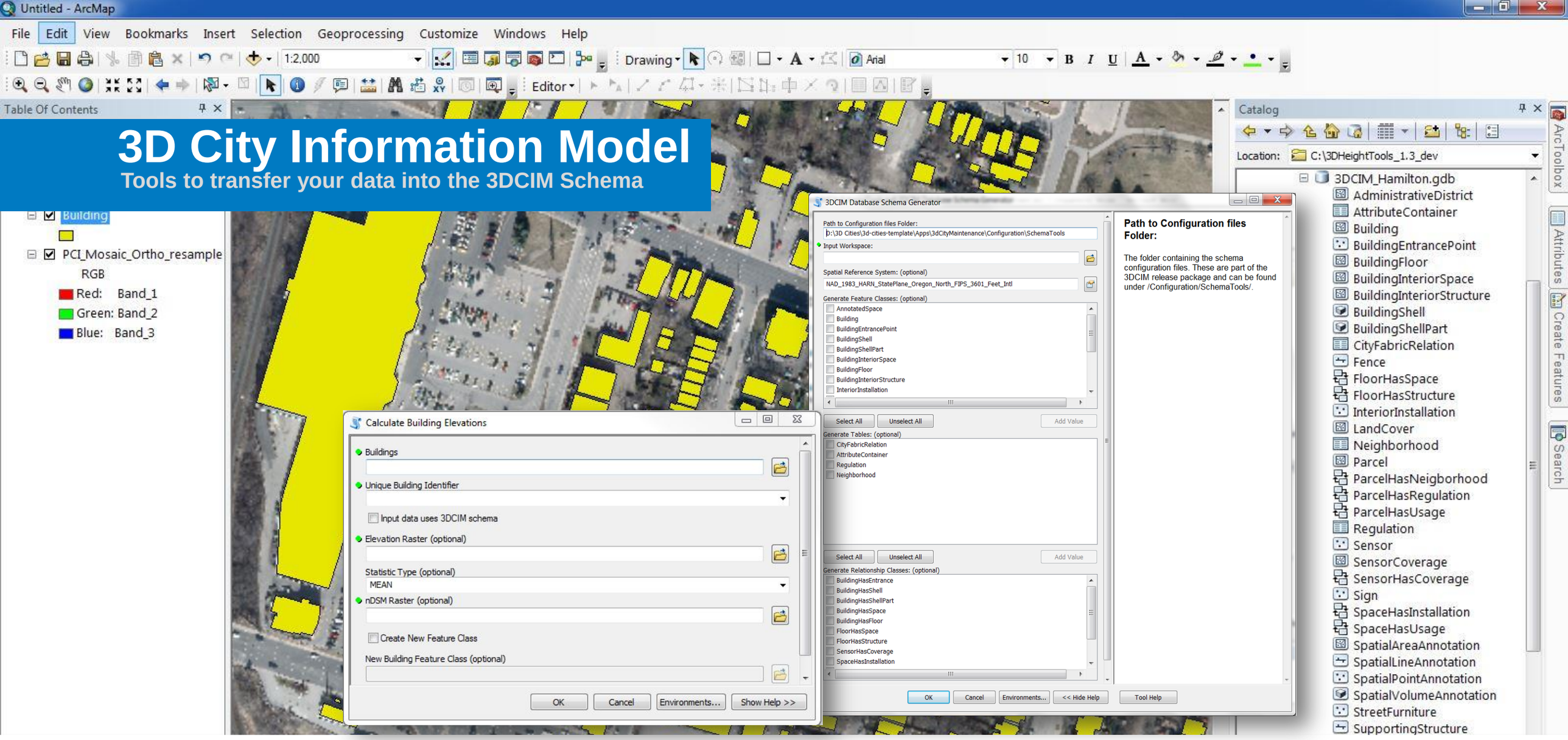
Expose GeoJSON services as Feature Services

14 ★ 66

bootstrap-map-js

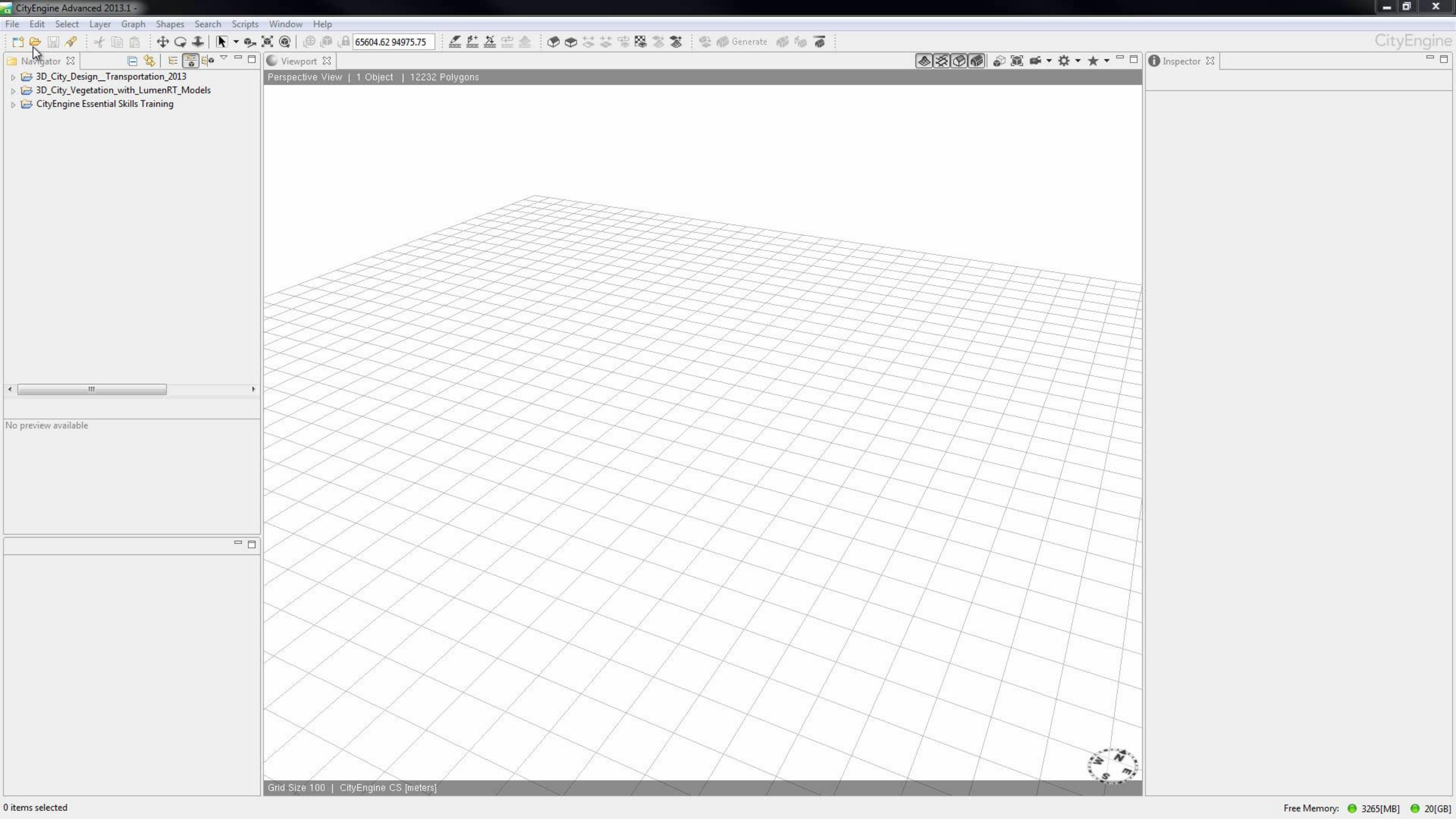
3D City Information Model

Tools to transfer your data into the 3DCIM Schema



Esri

3D City Information Model (3DCIM)


CityEngine Advanced 2013.1 -
File Edit Select Layer Graph Shapes Search Scripts Window Help
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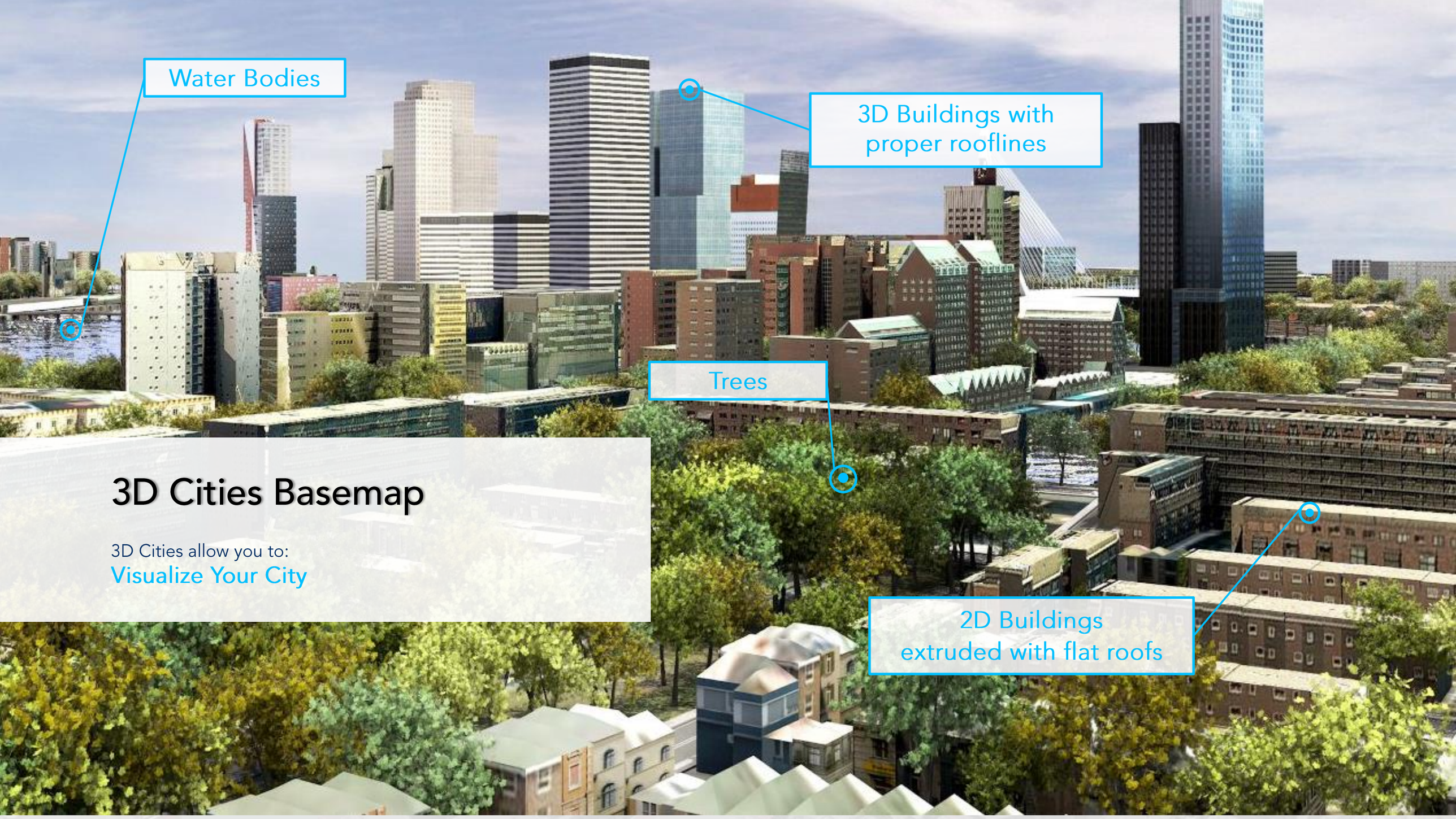
CityEngine
Navigator
3D_City_Design__Transportation_2013
3D_City_Vegetation_with_LumenRT_Models
CityEngine Essential Skills Training
No preview available
Viewport
Perspective View | 1 Object | 12232 Polygons
Grid Size 100 | CityEngine CS [meters]
Inspector
0 items selected
Free Memory: 3265[MB] 20[GB]

3D Basemaps

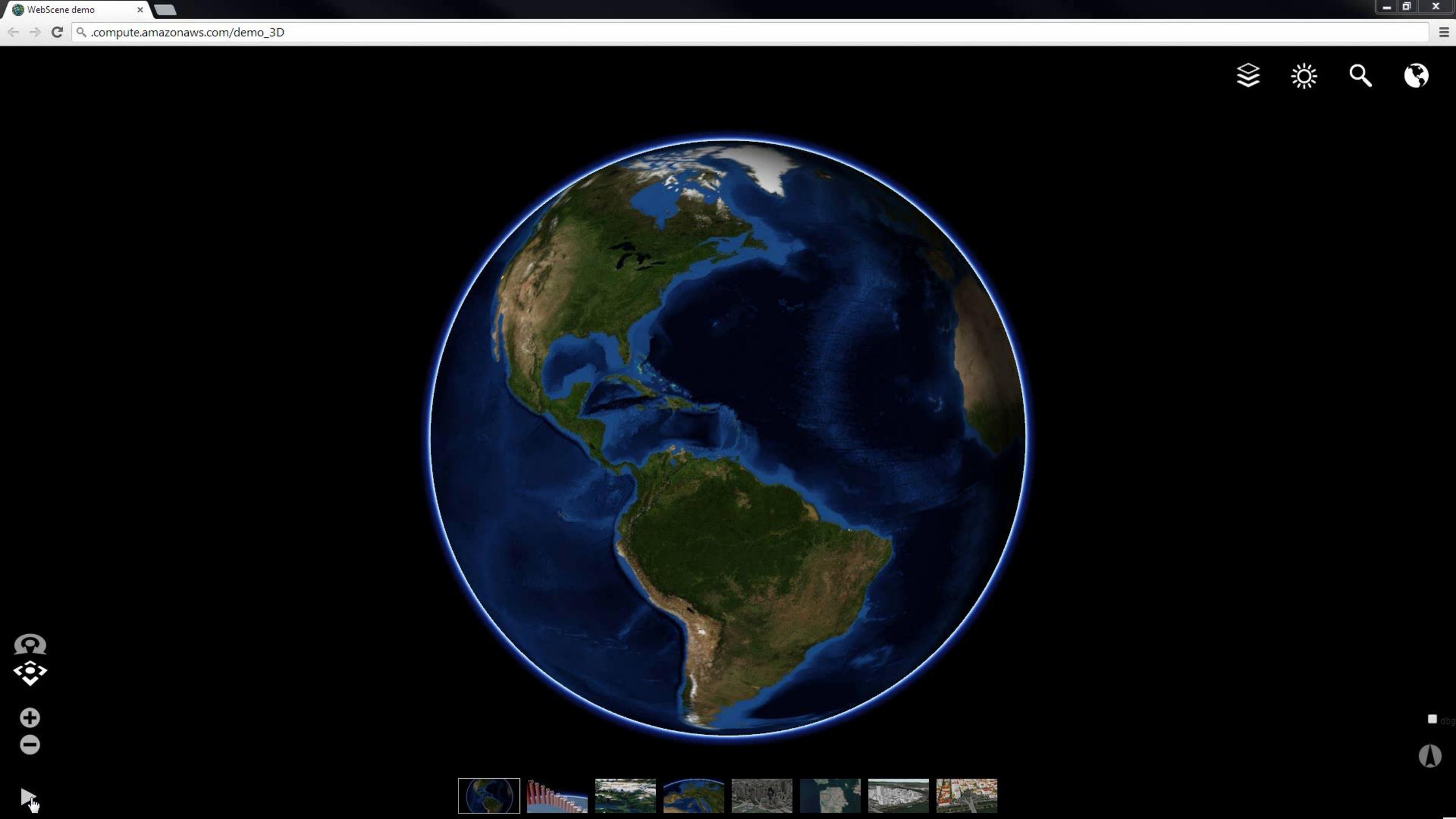
3D content and 3D basemaps preview



3D Cities Basemap

3D Cities allow you to:

Visualize Your City

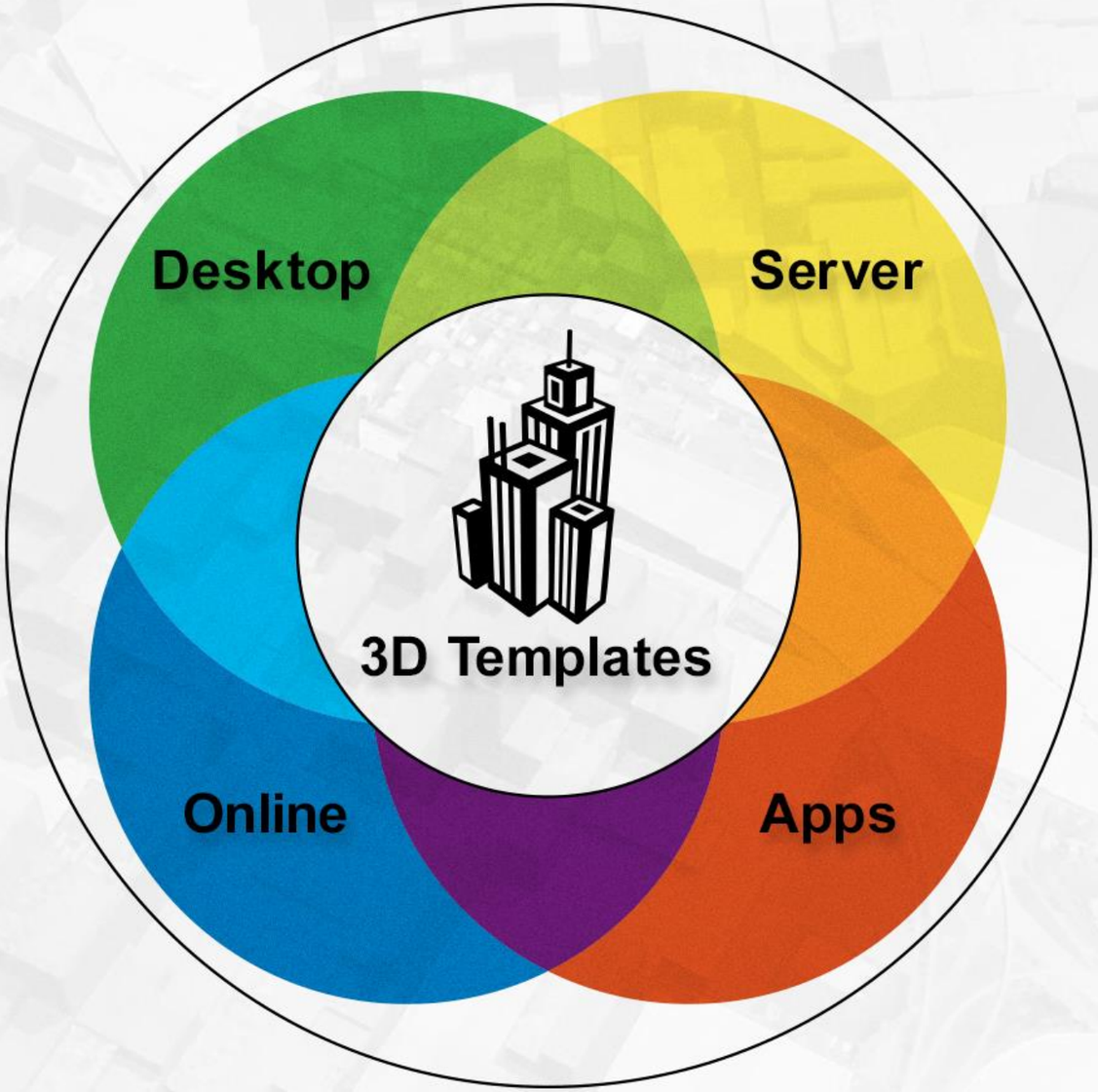

WebScene demo
.compute.amazonaws.com/demo_3D

3D Across the Platform

CityEngine

3D Analyst

ArcGIS Pro



3D Services

Web Scenes

3D Basemaps

3D Runtime

3D City: Levels of Detail

Level of Detail	1	2	3	4
Definition:	**3D Extrusion**	**3D Extrusion with Roof Form or Building Shell**	**High Detail 3D Building Models**	**Interior Spaces and Floors**
Data Required:				
Building Footprints	# of Stories or Total Height & or Usage	# of Stories or Total Height or Usage & if available Roof Height	3D Building Shell with Fine details (Textured or Untextured)	3D Building Shell Interior Spaces (CAD or BIM)
Streets	Street Centerlines	Street Centerlines with Width attributed	Detailed Streets (CAD)	Street Furniture, Stop Lights, Signage, Infrastructure lines (GIS/CAD)

Esri's 3D Solutions | for 3D Cities

3D City Modeling Process & Options

Data Assessment

Use Existing Data

Acquire Data

Initial 3D City Model

Do It Yourself

Contract Work Out

3D City Maintenance

Do It Yourself

Contract Work Out

Professional Service Offerings

3D Jump Start	3D City Development
In Person 3D City Training	**Esri Models the City for You**

Esri’s 3D Solutions | for 3D Cities

PLW modelworks

Bergmann associates
architects // engineers // planners

CRITIGEN

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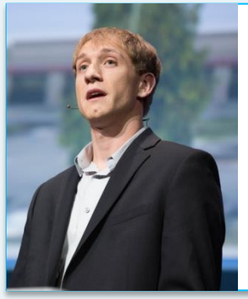
Thank You

3D Cities

Thank You

Atlanta Regional Commission 3D Workshop



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