

# 3D Geological Modeling and Planning

Across the ArcGIS Platform

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**esri**

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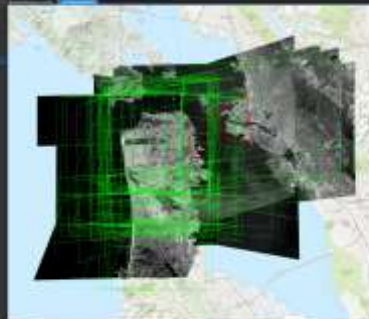
5/22/2019

**Safe Harbor Statement:** This presentation includes forward-looking roadmap and schedule information that may include dates, release numbers, or scope that could change without notice. Customers and partners are advised not to make business or purchasing decisions based on such forward-looking statements.

- ① 3D products and scene layers
- ② 3D geological modeling
- ③ Urban planning
- ④ Brief roadmap



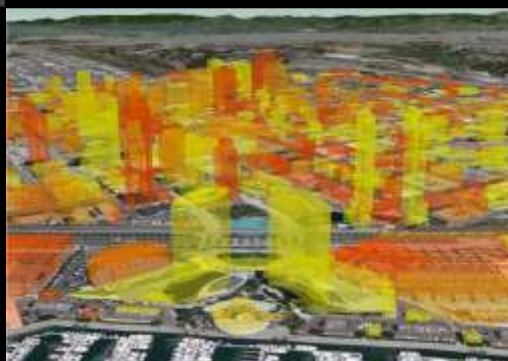
Lidar



Oblique  
photogrammetry



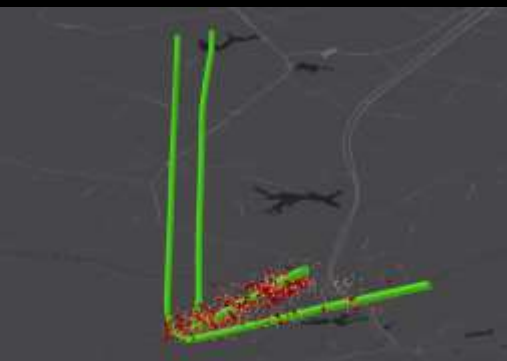
BIM



Indoor &  
subsurface  
scanning



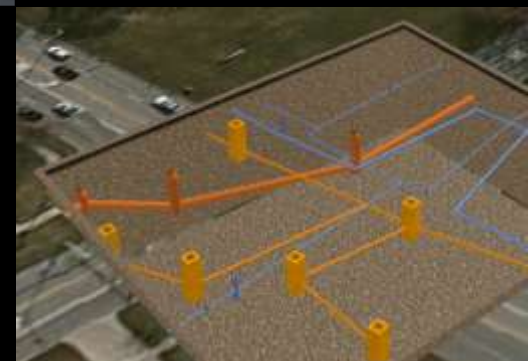
Real-time (4D)



IoT



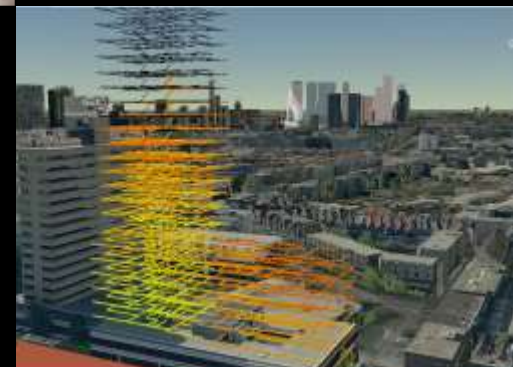
Textured Meshes




FMV



Spherical &  
panoramic  
imagery



UAV

A virtual reality environment featuring a cityscape with various buildings and a central circular plaza. A VR headset is visible in the upper left, and a hand controller is in the lower right. The scene is overlaid with a semi-transparent dark grey banner containing white text. The background shows a modern office interior with desks and chairs.

Data availability is driving  
demand for new experiences



Mobile

Immersive



Consumer-level Usability

3D is the common visual and analytical experience for GIS



Realtime

Deep & Smart



Visually compelling

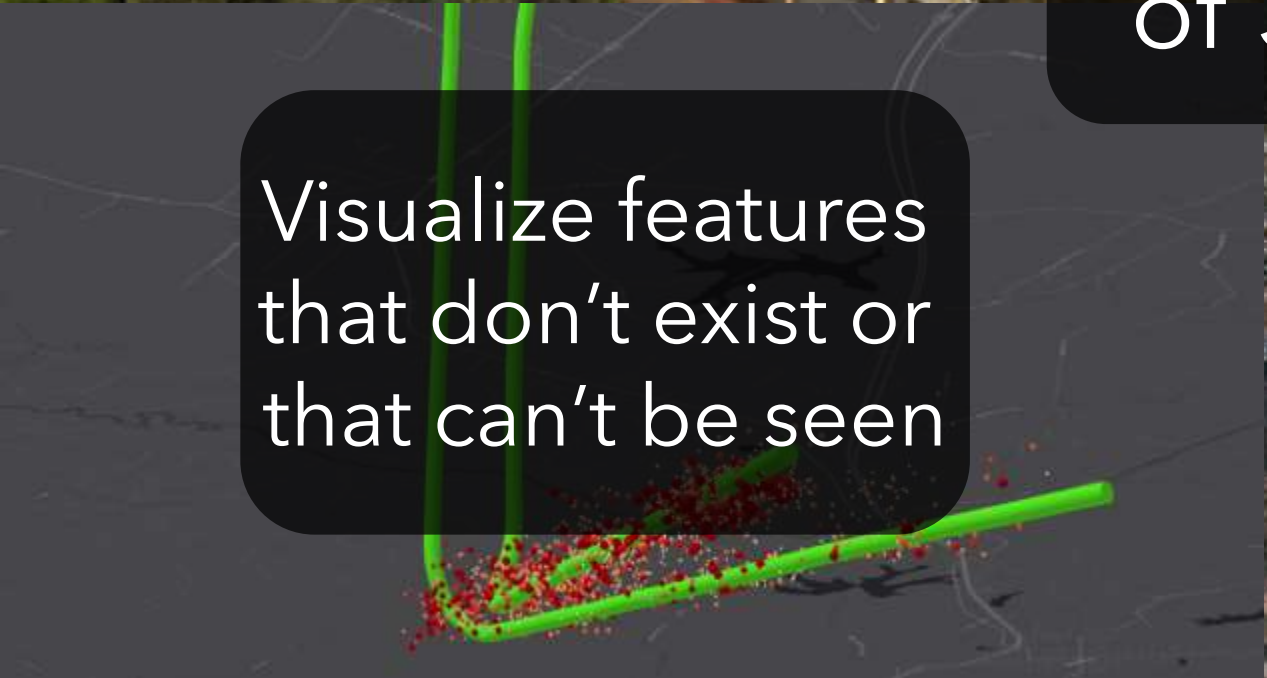


More accurate representation of the real world



Communicate with non-technical stakeholders

Value of 3D



Visualize features that don't exist or that can't be seen



Analyze behavior and aesthetics



# 3D Across ArcGIS

- GIS is 3D
- Web GIS services-based architecture
- New clients and experiences
- Workflow modernization
- Story-based solutions and products





# Terminology: Web Scenes, Scene Layers

## Web Scene

- Collection of layers, environment settings, slides, *animation*
- Essential for 3D apps on any platform or experience

## Scene Layer

- Scalable cache of graphics, styles, and attributes
- 3D Objects, Buildings, 3D Points, Integrated Meshes, Point clouds
- *Future: Transportation, 3D Lines, 3D Polygons*

## Mobile Scene Package (2019)

- Transportable, large 3D content packages
- Used for mobile and publishing workflows



Terrain



Mesh



Point Cloud



Objects



Features



Events

# Terminology: Scene Viewer, JavaScript API, Runtime 3D

## Scene Viewer

- Out of the box experience for using 3D in a web browser
- In ArcGIS Online and Enterprise (part of Portal)

## ArcGIS API for JavaScript

- 2D and 3D API for building custom apps and widgets that will work in a browser
- Scene Viewer is built with the ArcGIS API for JavaScript

## ArcGIS Runtime 3D

- Set of libraries for native application support for 3D and 2D
- ArcGIS Earth is built on the ArcGIS Runtime



Terrain



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Point Cloud



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Features



Events

# Enabling customers and partners through Open Standards

Open Software, Standards and Data enable organizational resiliency

- Ensure access to data
- Guarantee interoperability
- Enable innovation
- Encourage usage and adoption

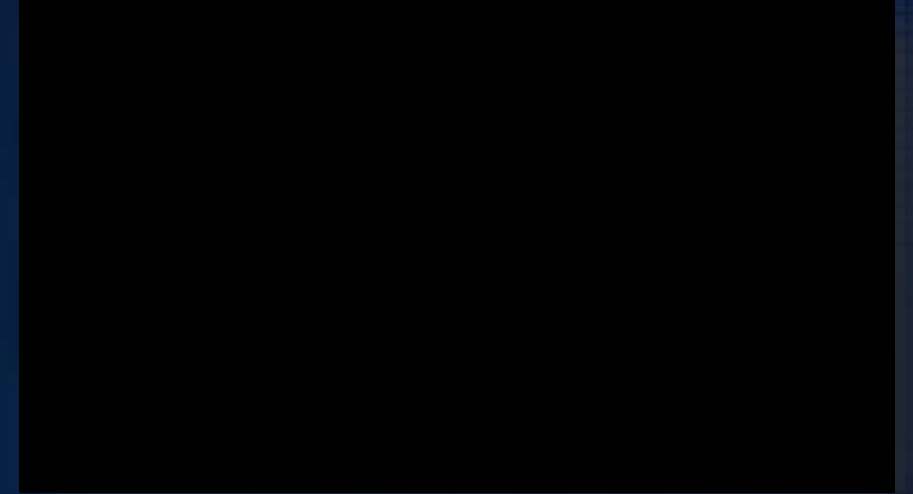


I3S	Scalable 3D scene content for visualization and distribution
LERC	Raster (imagery and elevation) compression technology for 2D and 2.5D
LEPCC	3D compression technology used for point clouds and other 3D rasterized data
GeoREST	Esri open REST APIs for access to any kind of GIS content and services

# 3<sup>rd</sup> party adoption of I3S

## Integrated mesh:

- Safe Software, VRICON, Pix4D, Nearmap, and Bentley sharing packages or services in I3S format
  - Melown created a full client/server stack that creates/consumes I3S
  - OGC Testbed project showed interop with I3S and Cesium
  - Supports Drone2Map
- 
- Expanding list of layer types and layer capability



# What's New

3D has seen huge advancements across the ArcGIS Platform in 2018

**BIM and AEC:** ArcGIS Pro's new capability to read Revit files, Autodesk InfraWorks' new Autodesk Connector for ArcGIS, integration of BIM 360 and ArcGIS Online and more

**Interactive tools:** Interactive visibility tools in ArcGIS Pro, ArcGIS Earth, and Esri CityEngine, 3D measurement tools in the ArcGIS API for JavaScript.

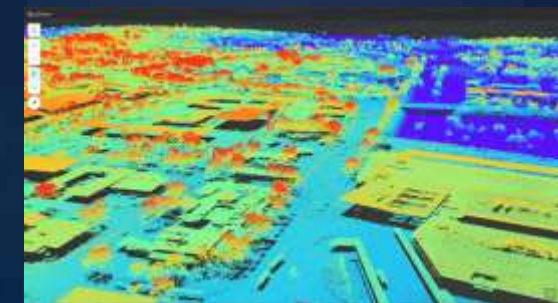
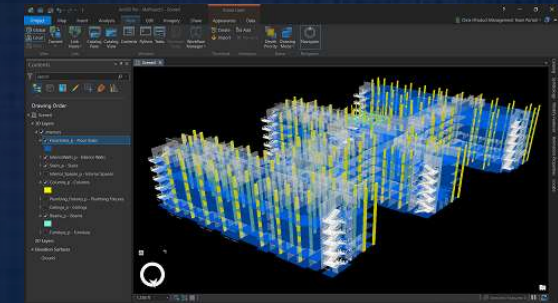
**Mobile:** Scene Viewer and the ArcGIS API for JavaScript 3D are now on mobile devices through the browser and ArcGIS Earth for Android has been released for early adopters.

**Underground capabilities:** New experiences for manipulating surfaces in ArcGIS Pro, underground navigation in the Scene Viewer, new slice exploratory tools, and Utility Network has been built for 3D utility information.

**Urban Planning:** The upcoming release of ArcGIS Urban announced, and further enhancements to Esri CityEngine's drawing tools and ability to utilize feature services from ArcGIS Online.

**I3S and 3D Content:** Many new content provider partners including Vricon, Nearmap, Orbit, and many others., new AIRBUS 3D ground elevation (best in class), LAZ and zLAS to I3S,

**AR, VR, and MR:** Two new VR templates for Unreal engine, for real-time visualizations and intuitive table-top experience in addition to partners delivering products for AR to our users, such as ArGIS Solutions and Meemim Inc.



# ArcGIS Pro

Enhancements to exploratory analysis and editing

Learn more: [youtu.be/rQkKIPFq2tg](https://youtu.be/rQkKIPFq2tg)

## Exploratory analysis tools

Line of sight, viewshed, view dome, and slice by plane or volume capability can be applied to visible scene layers.

**Future:** 3D Measurement, Flood, and Shadow

## 3D editing / modeling

Directly edit OBJ, DAE, multipatch features (geodatabase) and scene layers with new precision editing tools.

## 3D cartography

Improved geometric effects, new isometric viewport settings, and advanced cartographic options (e.g. military, scientific)

## Animation for static and dynamic story telling

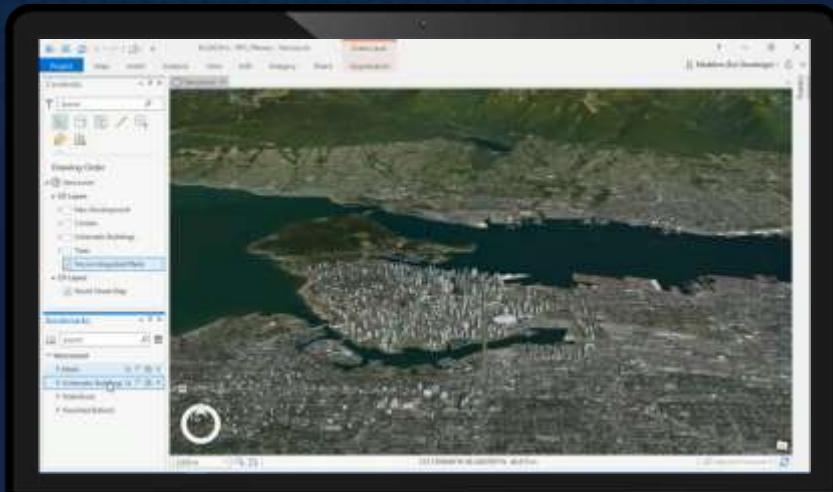
Create rich animations with 3D content and screen overlays for text and imagery content that can be configured with timing settings.

## 3D object scene layer symbology

Smart mapping functionality to stylize 3D layers (similar to web scene viewer)

## Oblique imagery workflow

Orient view to the oblique image perspective and edit or measure in image space.



# Scene Viewer

Enhancements to search, navigation, and rendering

Learn more: [bit.ly/WSV2018-3](http://bit.ly/WSV2018-3)

Try it out: [arcg.is/yTSCe](http://arcg.is/yTSCe)

## Mobile Support

Users can open scenes directly in mobile browsers through an optimized UI for a light viewing experience on phones and tablets.

## Large point datasets

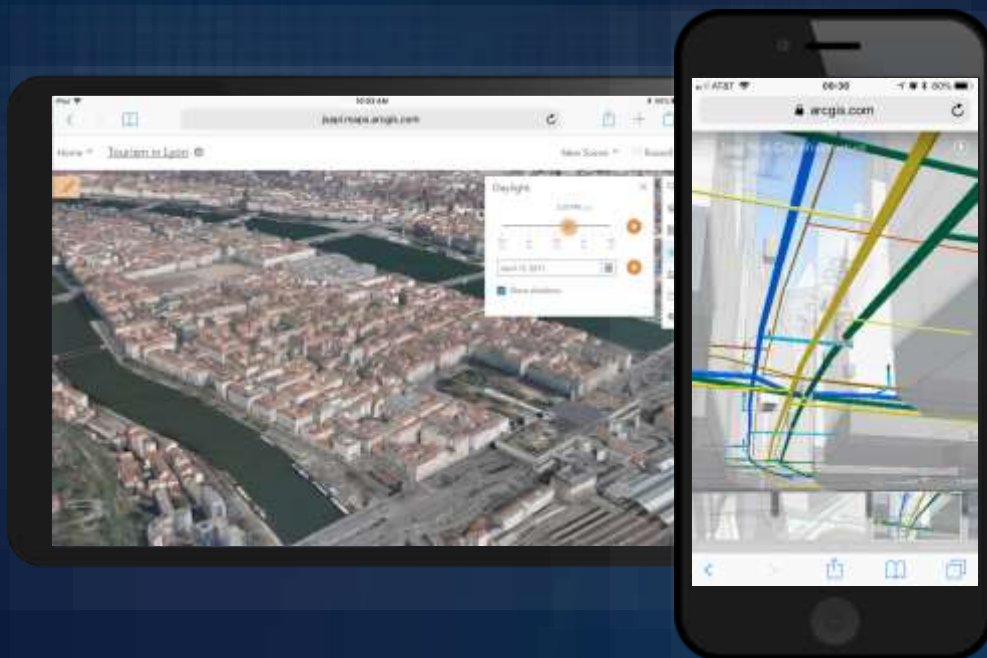
Point feature layers with thousands or even millions of points can be added to a scene.

## Edge rendering options

Configure the edges for 3D objects in the Scene Viewer with styles such as “sketch”.

## Underground navigation in Global Scenes

Users can set the ground transparency with a slider and enable underground navigation.



## Search for features in web scenes

Users can configure feature search in a scene and locate objects by attributed information.



## Gamepad and 3D Connexion SpaceMouse support

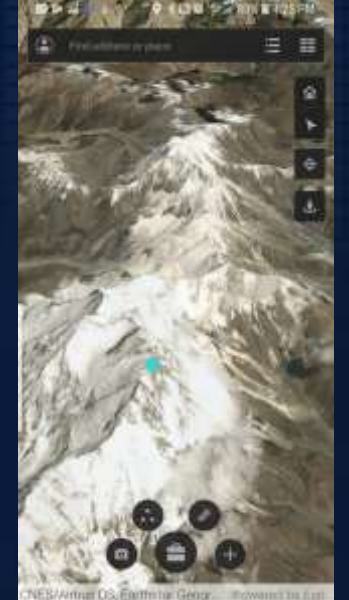
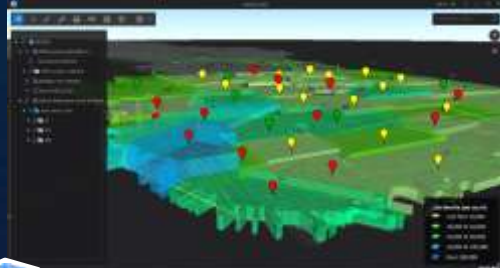
Navigate scenes with gamepad device or 3D Connexion SpaceMouse devices.







# Apps

3D Tools For The Field, Office, and Community



 ArcGIS Earth

 Drone2Map

 Web AppBuilder

ArcGIS  
Companion App

ArcGIS Earth  
mobile (alpha)

ArcGIS Earth

Easy-to-use 3D data exploration for Enterprise users

Drone2Map

Streamline the creation of professional imagery products from drones

Web Scene Viewer

View 3D maps in any standard web browser

Web AppBuilder

Build powerful 3D GIS apps without writing a single line of code

Story Maps

Combine 3D maps with narrative text, images, and multimedia content



# ArcGIS Indoors

Assemble, Manage, and Share Indoor Information



# ArcGIS Urban

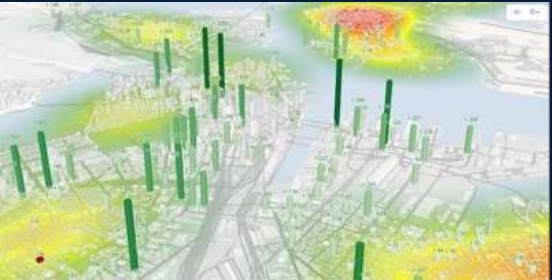
Orchestrate Urban Development and Planning Workflows



Track and Evaluate Projects



Create Planning Scenarios



Report and Engage

**Stakeholders**

- Government
- A/E/C
- Real Estate
- Citizens

# Esri CityEngine

Enhancements to drawing tools and exploratory analysis

Learn more: [bit.ly/CE20181](https://bit.ly/CE20181)

## Instant quantitative visibility assessments

Detailed statistics have been added to viewshed and view dome tools that quantify visibility qualities as inputs to assessment valuation models.

## Better drawing experience

New tools with snapping guides for drawing shapes of any form including arcs, circles, round corners, in addition to an offset edges and union tool.

## Web publishing of elevation data

Export a terrain layer as an elevation tile package (TPK, with LERC compression), that you can merge with Esri's world elevation surface.

## Support for large datasets on the web

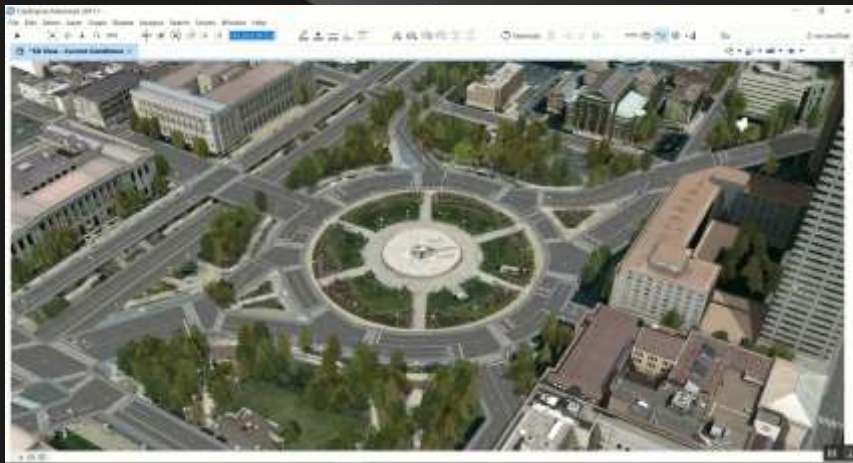
Synchronized editing with larger feature layer, allowing for cloud-based or collaborative editing workflows.

## Modeling on curved shapes

Introduction of the "insertAlongUV" operation for bending along polygon surfaces (e.g., guard railings, tunnels)

## Premium VR experience for urban planning reviews

Two new templates for Unreal engine, for real-time visualizations and intuitive table-top experience.

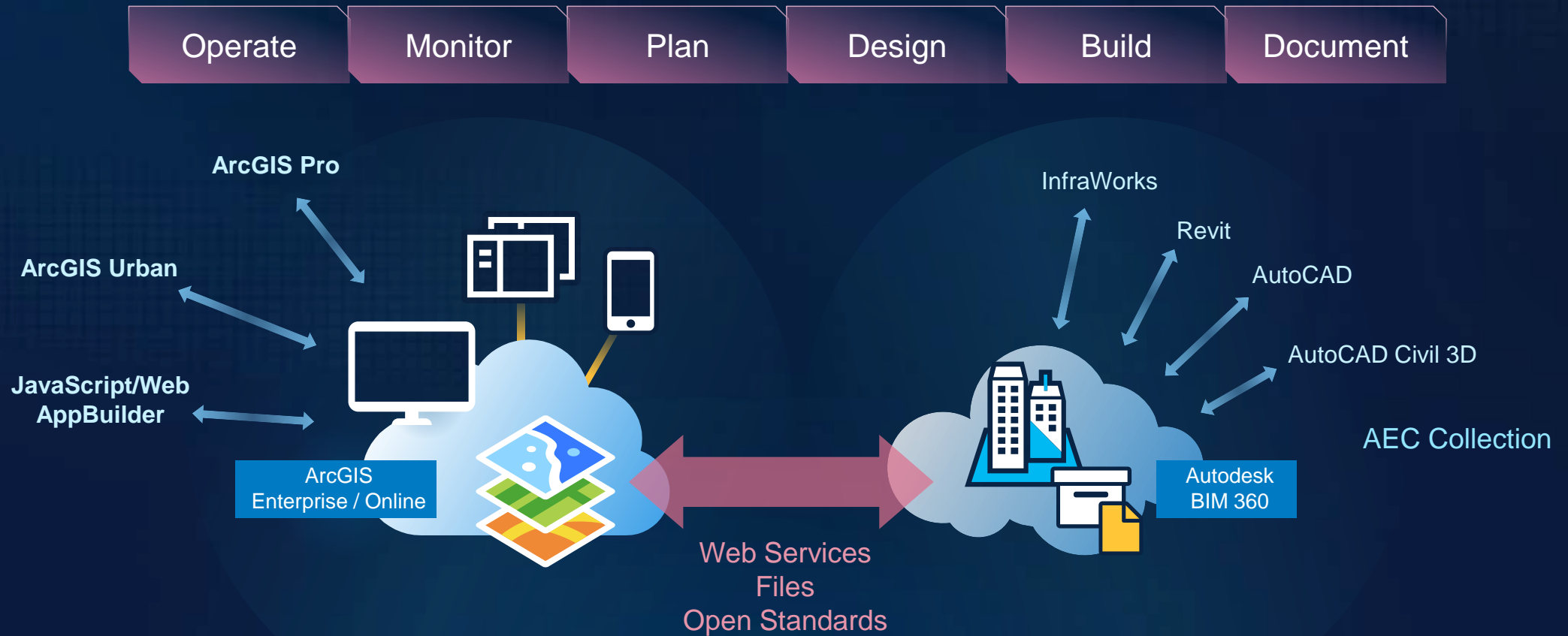


# Esri + Autodesk Integration

A complete enterprise GIS platform for A/E/C project delivery

Learn More: [esri.box.com/v/Project-Delivery-WhitePaper](http://esri.box.com/v/Project-Delivery-WhitePaper)

Webinar: [bit.ly/042018-ADSK-ESRI-WEBINAR](http://bit.ly/042018-ADSK-ESRI-WEBINAR)



# ArcGIS Earth

Enhancements to analysis and mobile

Learn more: [bit.ly/ArcGISEarth18](http://bit.ly/ArcGISEarth18)

Download directly from Google Play Store

## Browse 2D and 3D content from an Android device

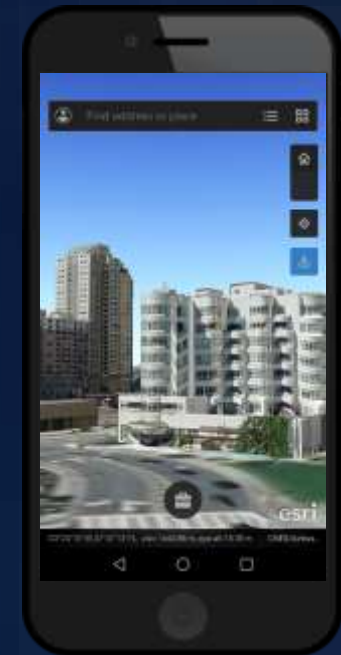
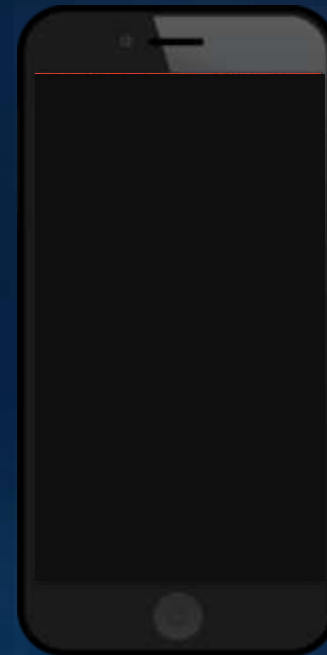
Users can connect to ArcGIS services or add local layer packages saved in local storage.

## Perform interactive 3D analysis and create simulations

Run a quick visibility assessment with your fingertips for line of sight and viewshed or simulate along a route.

## Collect and share information in the field

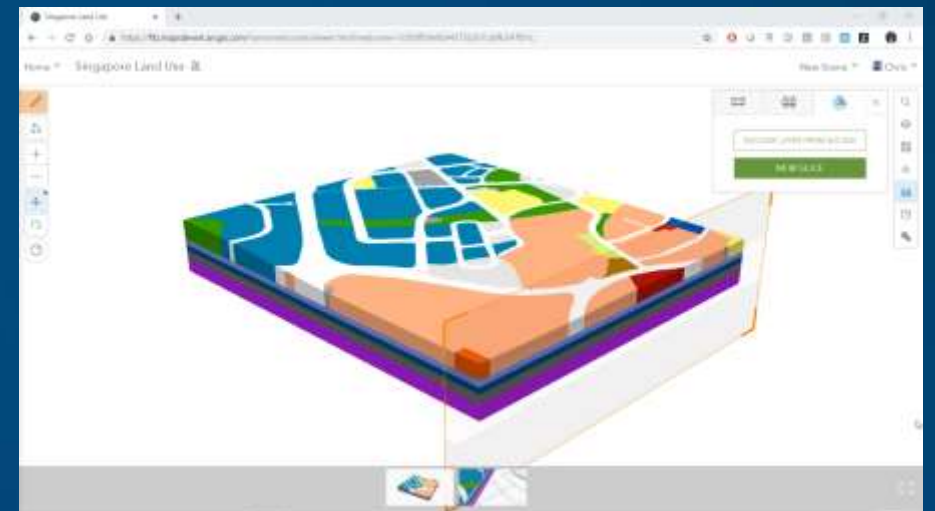
The tour feature was introduced to help users collect and share information with photos in album.



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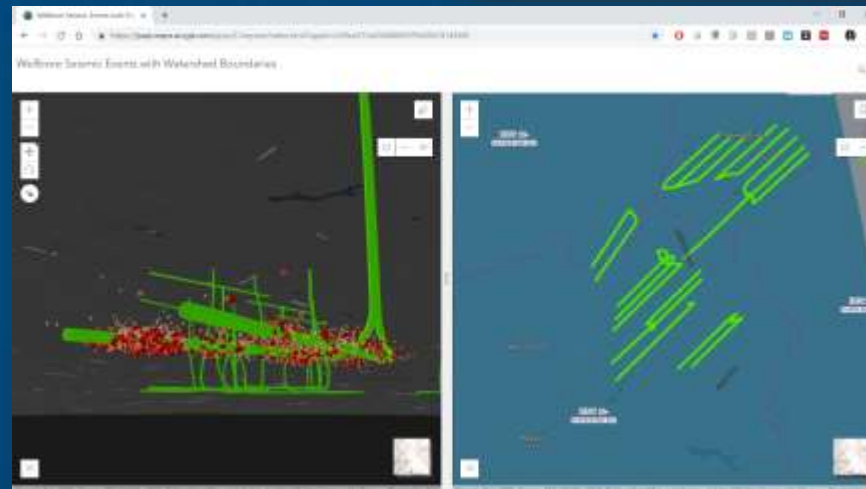
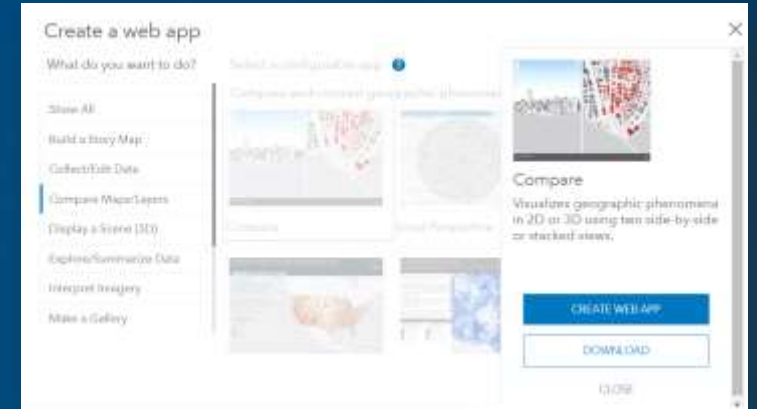
# Interactive slice tools in ArcGIS Pro and Scene Viewer

- In 2017, initial push for game-like, interactive analysis tools to explore 3D content
- Slice tool released in Pro opened up possibilities to explore complex subsurface information interactively
- Extended to the Scene Viewer in December 2018



# 2D/3D web app comparison template

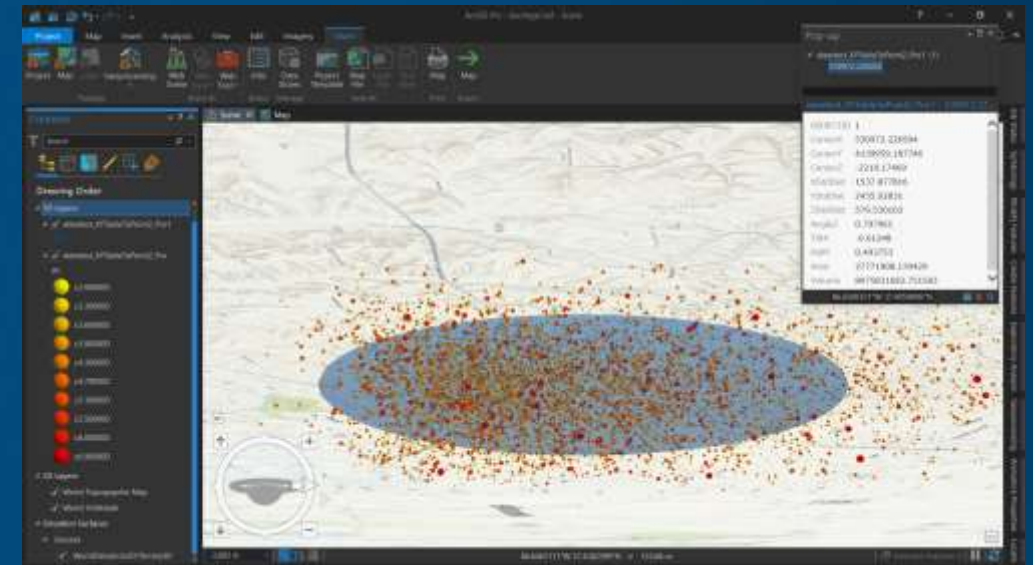
- Configurable App template
- Compare 2D and 3D
- Measure, change basemaps
- In ArcGIS Online
- In ArcGIS Enterprise 10.7





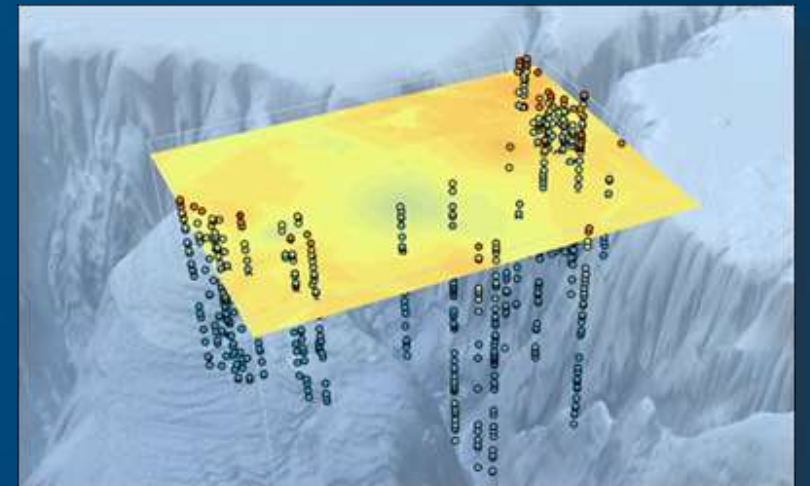
# Measuring Geographic Distribution toolkit (ArcGIS Pro)

- Standard ArcGIS Pro GP tools
- Enabled to work with 3D points
- Standard Deviation Ellipse
- Generates a 3D multipatch
  - Share this to the web as a Scene Layer
- Note: Requires xyz to be in the same units



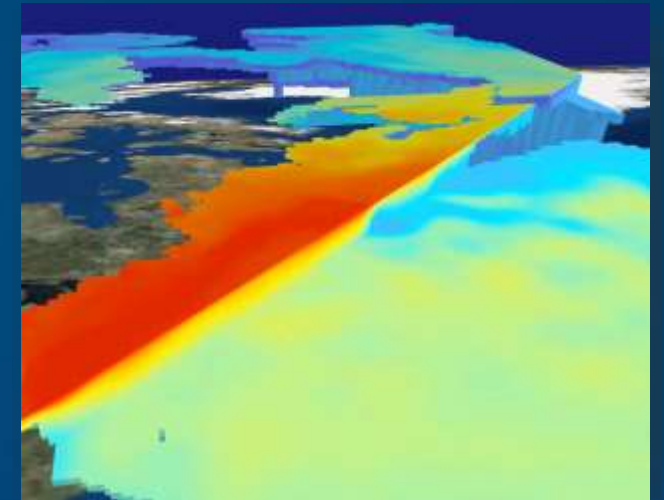
## 3D Empirical Bayesian Kriging (new in Pro 2.3)

- Highly accurate method for interpolation between points
  - Use on up to 300M points (PointZ or PointM)
  - Anisotropic – accounts for variation in change rate from XY to Z
  - Does not currently support barriers (faults)
  - Primarily useful for atmospheric & oceanic data
- Extract multiple products
  - Contours
  - Raster surfaces
  - 3D points
- New ArcGIS Learn Lesson
- Future: Export Voxel Scene Layer



## Voxel Scene Layer (*Planned for Q4 2019*)

- New I3S scene layer for irregularly gridded scientific or volumetric content
  - Initial experience will support a new NetCDF import workflow
  - Billions of cells
  - Multi-LOD
  - Optional interpolation
  - Will support a new slicing capability with interpolated surface
  - Face transparency
- Initial version
  - May have a vertical probe capability with table output
  - Will be desktop (ArcGIS Pro) only
  - May support GP processing of raster slices

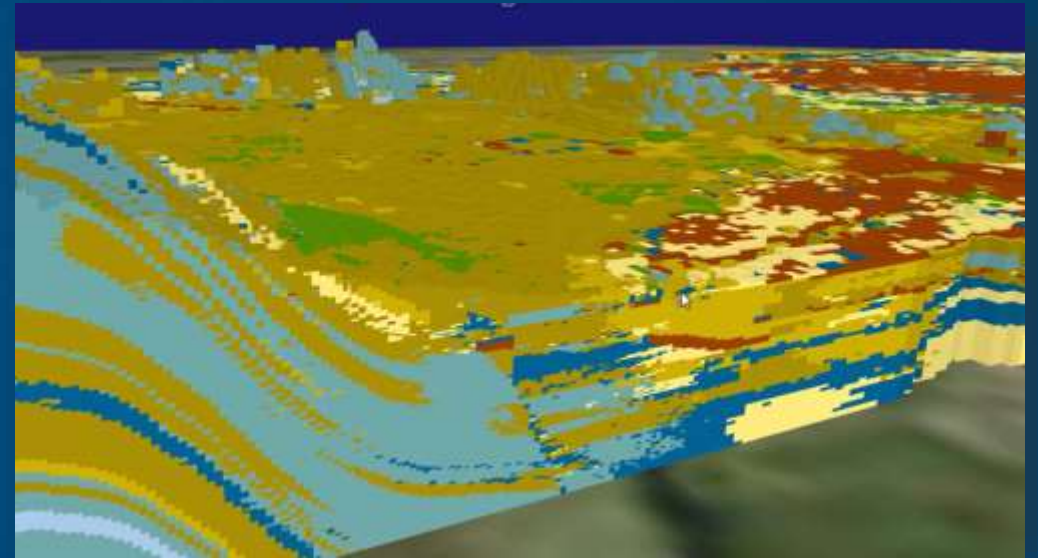


## Demonstration Links

- **British Geological Survey:**
- [Cross Sections](#)
- [Thurrock](#)
- [Boreholes](#)
- **Voxel Model Dutch TNO: <http://arcg.is/2nK4Syn>**
- **3D-Model Lower Saxony (Germany), Geotektonischer Atlas 3D (GTA3D): <https://arcg.is/j9a9i>**

## Voxel Scene Layer *(future plans)*

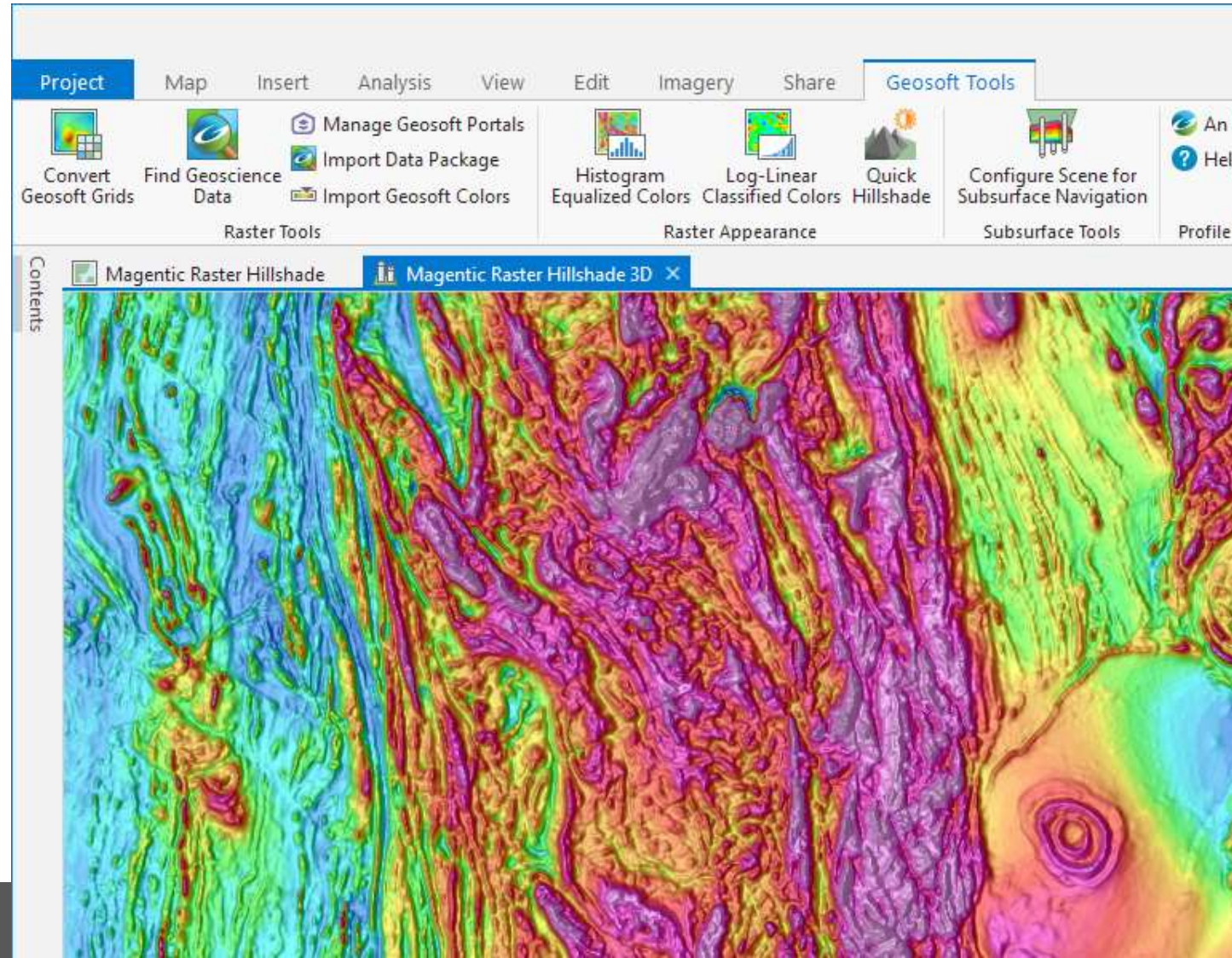
- Web experience
  - Explore Voxel Scene Layer in the Scene Viewer with other layers
- Virtual boreholes
  - Linear feature services
- Additional data sources
  - 3D points
  - GP input
- Volume measurement/intersect workflows



# Geosoft Add-In for ArcGIS Pro

A free, interoperability add-in for users of Geosoft rasters

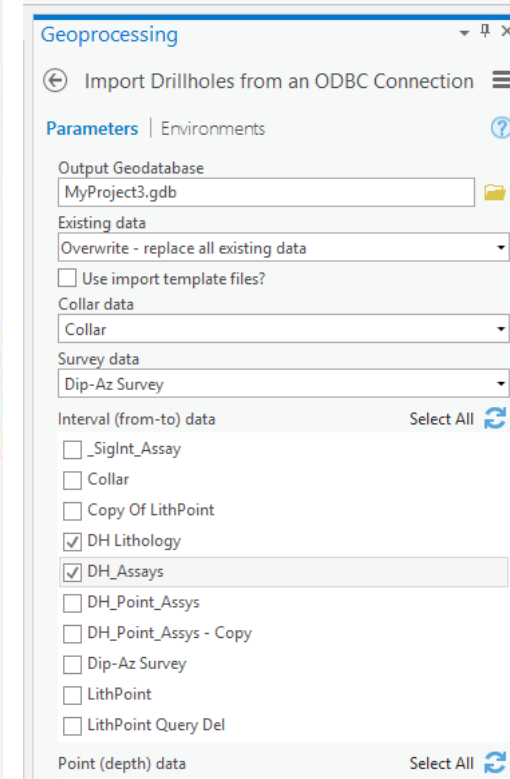
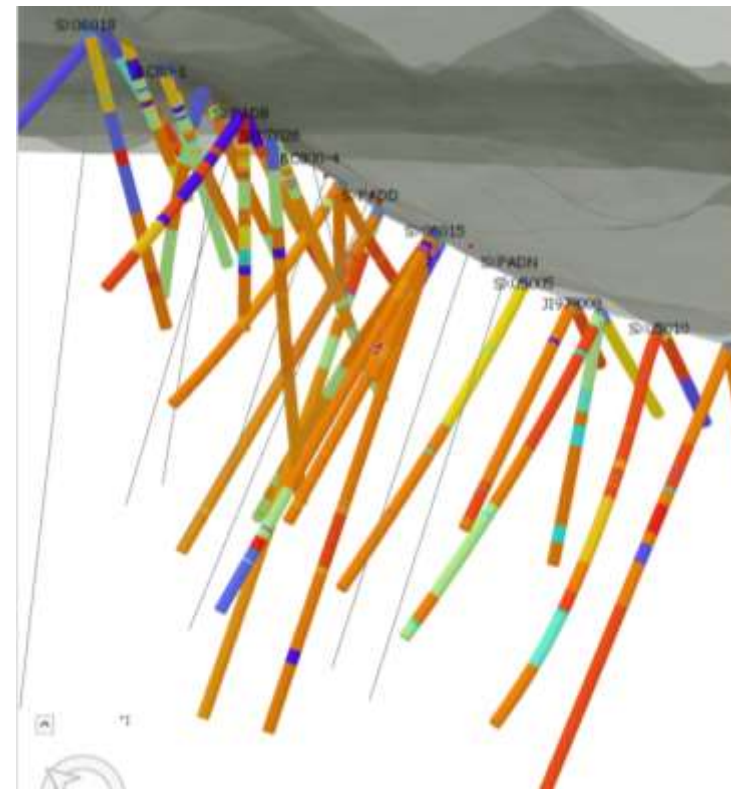
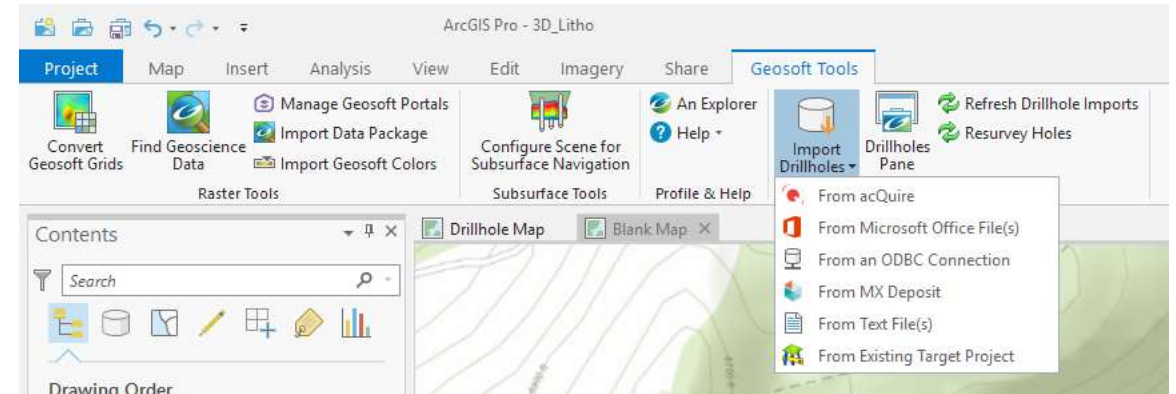
- View and convert Geosoft grids to Esri rasters
- Apply quick symbology and shading presets
- Import section rasters without georeferencing
- Find free geoscience data



# Geosoft Target Pro

A drillhole extension for ArcGIS Pro

- Imports several mining drillhole storage formats
- Converts raw drillhole data into 3D features for use in ArcGIS
- Instant refresh to update drillhole features when drilling data has changed
- 2D & 3D symbology options that visualize downhole attributes (lithology, alteration, geochemistry)



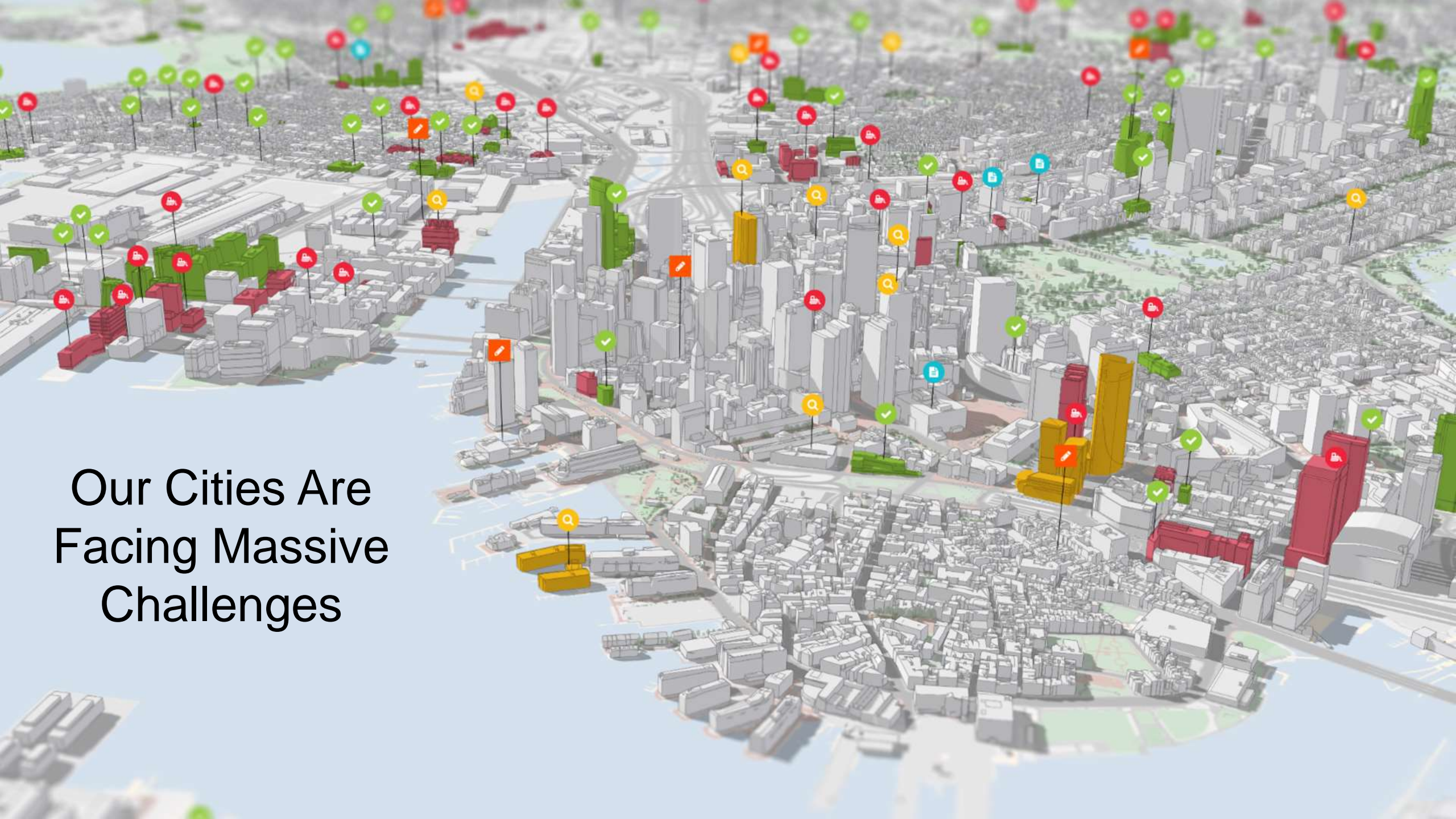
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An aerial, grayscale 3D architectural rendering of a city, likely New York City, showing a significant portion of the urban area submerged in blue water. The water level is high, reaching the lower floors of many buildings and completely inundating the surrounding lowlands and industrial areas. The city's dense grid of buildings is visible, with some taller skyscrapers standing prominently above the water. The image illustrates the impact of sea level rise on coastal urban centers.

Our Cities Are  
Facing Massive  
Challenges

Our Cities Are  
Facing Massive  
Challenges





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**Citizens**

**Real Estate**

**A rchitecture  
E ngineering  
C onstruction**

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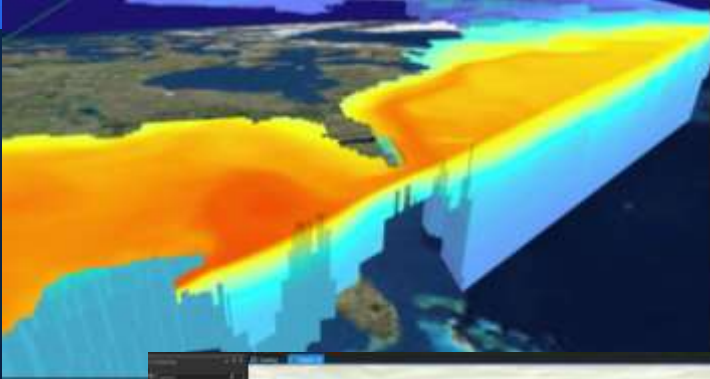
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2D

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- ① 3D products and scene layers
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# What's coming next for 3D at Esri



## New capabilities

- Building scene layer
- Slicing tool in the web
- MultiLOD symbols
- 3D Empirical Bayesian Kriging workflow
- 3D SD ellipse GP tool
- KML refresh rate (Earth)
- Point clouds in Runtime
- 2D/3D template
- Utility line solution
- Flood solution
- I3S spec update

## Near-term

- ArcGIS Urban
- gITF symbols
- SSAO & better lighting in Pro
- Cut & Fill tools (Pro)
- Profile Viewing (Pro)
- Earth Mobile
- Voxel desktop UX
- Mobile Scene Packages
- CGCS2000
- Water effects

## Mid-Long term

- ArcGIS for Revit
- Voxel web experience
- Transportation scene layer
- More interactive tools across ArcGIS
- 3D integration with IoT systems
- 'Blue dot' IPS location in 2D & 3D



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# RESOURCES

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## Esri CityEngine

Learn more: [bit.ly/CE20181](https://bit.ly/CE20181)

## VR & AR

Learn more: [youtu.be/ASIVJmlGNc8](https://youtu.be/ASIVJmlGNc8)



# RESOURCES

Continued

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Webinar: [bit.ly/042018-ADSK-ESRI-WEBINAR](https://bit.ly/042018-ADSK-ESRI-WEBINAR)

## ArcGIS Hub

Learn more: [youtu.be/KsSjpNmbsbE](https://youtu.be/KsSjpNmbsbE)

## ArcGIS Indoors

Learn more: [youtu.be/tZouNROhHeE](https://youtu.be/tZouNROhHeE)

## ArcGIS Urban

Learn more: [directionsmag.com/webinar/7802](https://directionsmag.com/webinar/7802)