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3D sub-surface data visualization: Integration with InfraWorks and BIM360

Sanjay Kumar G R
Arcadis Consulting India Pvt. Ltd.

Learning Objectives

- Discover a 3D subsurface contaminant data visualization in Autodesk environment.
- Discover a conceptual site model and integration with InfraWorks.
- Learn about selection and optimization of remediation strategy for a contaminated site with the aid of an integrated 3D model.

Description

In the environmental industry, there is an ongoing need for analyzing and visualizing subsurface data such as soil and groundwater contamination in correlation with above-ground features to optimize the remediation design and thereby reduce the cost. An idea for a conceptual site model by integrating 3D contaminant plume with the InfraWorks tool has now been achieved to provide comprehensive understanding of a contaminated site. Also, the historical above-ground elements (roads, buildings, and tanks) were digitized using Civil 3D software and recreated using objects available within InfraWorks software. The integrated model was later published in BIM 360 software. A fly-through animated video was also developed in InfraWorks. With the help of Autodesk tools and environment, an idea has now become a reality as this is a powerful way to help client user experiences where physical and digital objects co-exist and interact in real time: clients can literally “see underground” on their sites.

Speaker(s)

Sanjay Kumar leads sub-surface data visualization group in environmental team. He has been responsible for developing this practice within the environment business line in India and building a team to work with different regions across globe. He has been working on identifying various platforms to better visualize the sub-surface data such as soil and groundwater to understand the extent of the contamination below the ground surface. Outside of work, he is a travel enthusiast and a motorcyclist.

Introduction – Need for sub-surface data visualization in 3D

There are wide varieties of pollutants affecting subsoil and groundwater, such as petroleum products, pesticides, metals, and other products. Extent of this contaminants in both soil and groundwater is investigated through collecting number samples at potential areas of concern across the site. Results obtained from these analyses will require a platform that enables users to interpret contamination levels and help in making better management decisions.

Many standalone software and tools are available in the market to visualize the contaminant extent beneath ground surface to understand the damage within a site. However, to build an integrated model that allows users to visualize the below ground scenarios in correlation with above ground elements has been a challenge to date. With aid of multiple platforms available within Autodesk environment, it has now enabled users to understand extent of contamination with respect to the above ground features to visualize and interpret data, and thereby arriving at a better remedial strategy.

Approach

A 3D sub-surface model was created in Earth Volumetric Studio (EVS) and was brought to Autodesk environment to integrate with above ground features. The integrated model was later published in BIM360 for a greater client experience.

Conceptual Site Model – Integration of sub-surface model with InfraWorks

As the site was identified to be contaminated due to historical events, it was important to bring historical footprints to the integrated model along with existing scenario. This was achieved by Civil3D through digitizing historical footprints such as buildings and storage tanks (*Figure A*), and later it was brought to InfraWorks.

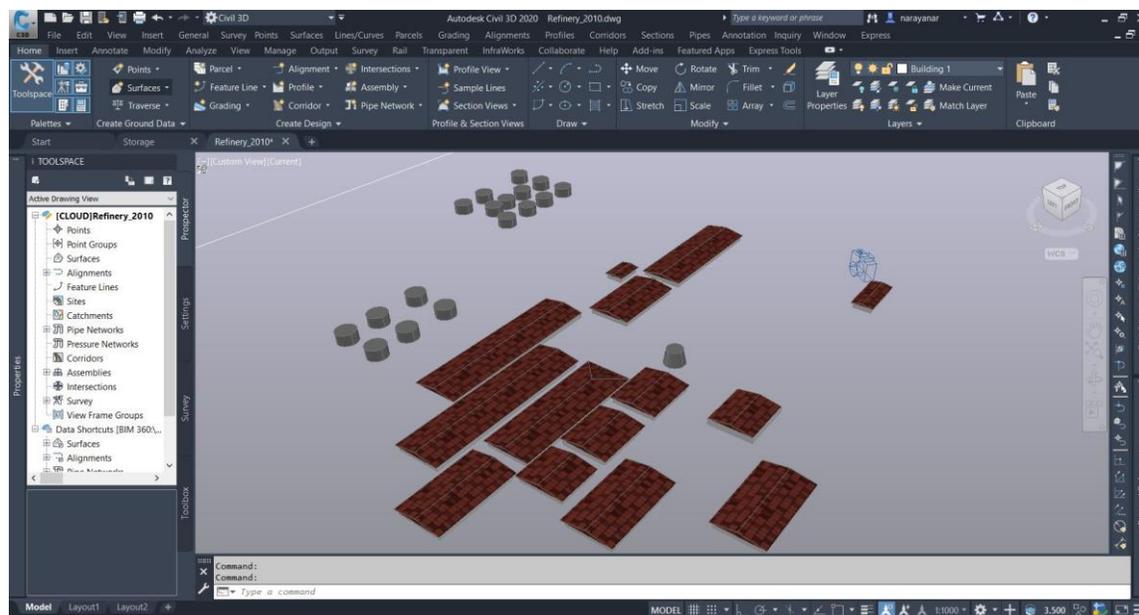


Figure A – Historical Footprint Created in Civil3D

A 3D contaminant model of Total Petroleum Hydrocarbons (TPH) was extracted out of EVS and georeferenced using Civil3D (Figure B and Figure C), and later it was brought to InfraWorks.

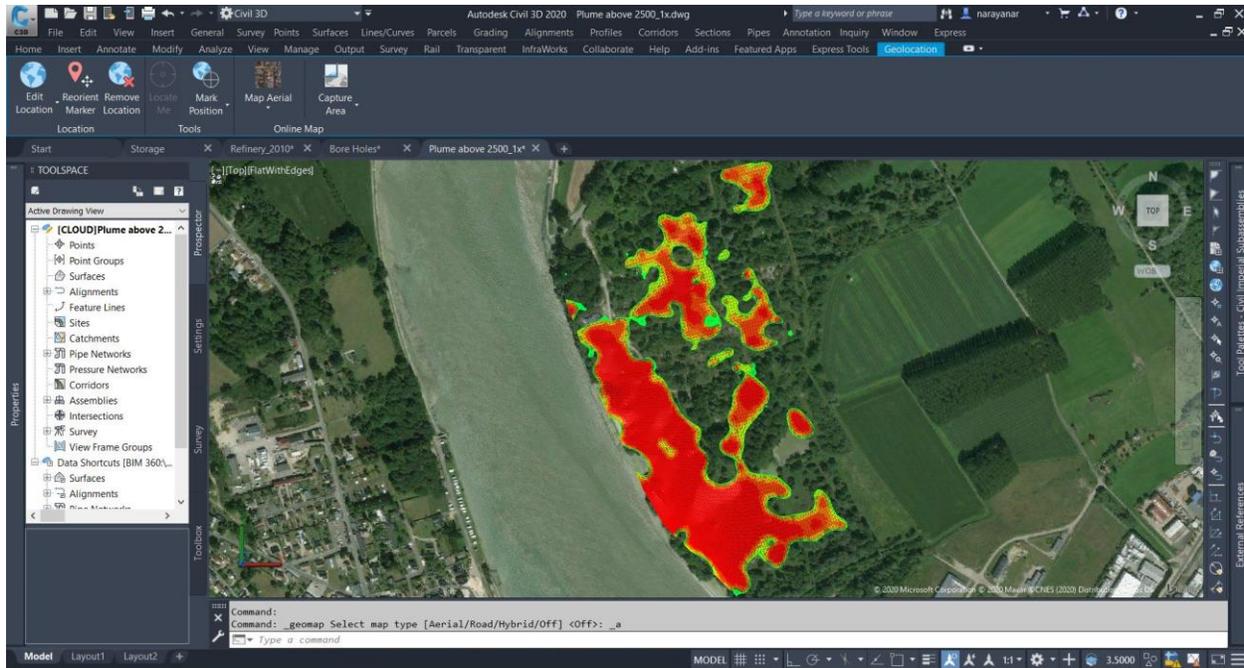


Figure B – 3D TPH Contaminant Plume Georeferencing in Civil 3D

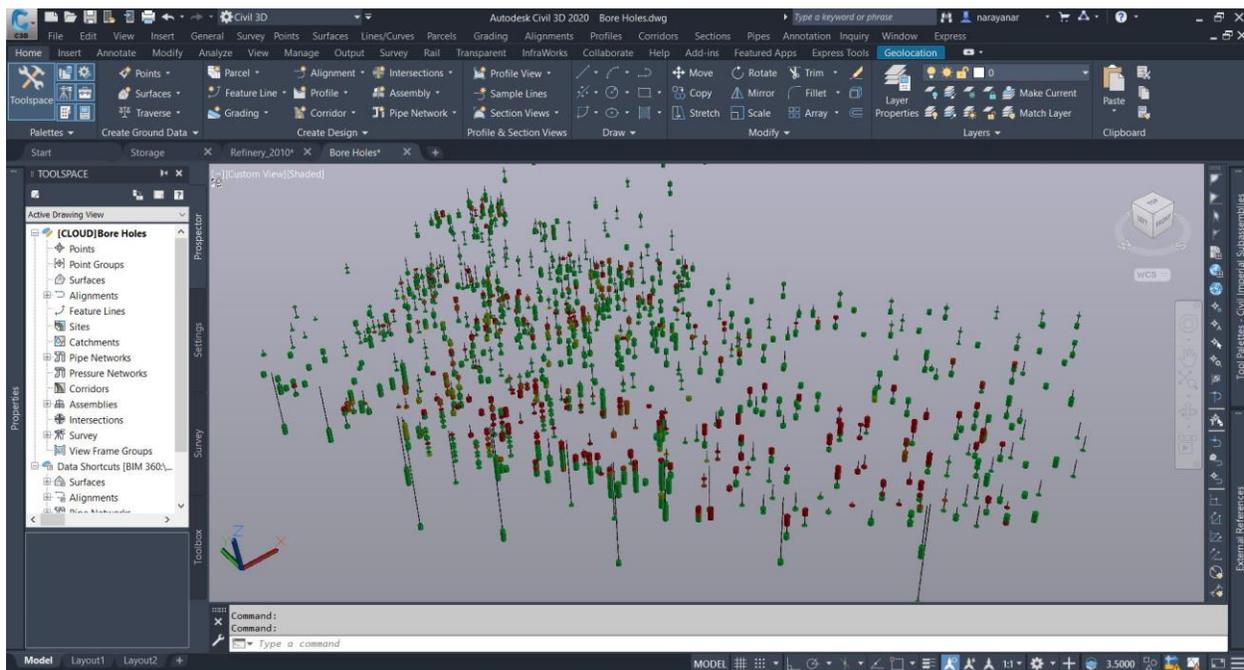


Figure C – 3D TPH Bore Holes Georeferencing in Civil 3D

Interpreted and georeferenced sub-surface objects were imported and integrated within InfraWorks software (*Figure D and Figure E*). It enabled environmental professionals and clients to conceptually analyze and visualize TPH concentration within a real-world context of built and natural assets and thereby enabling quick decision making for optimizing and designing the site clean-up strategies.

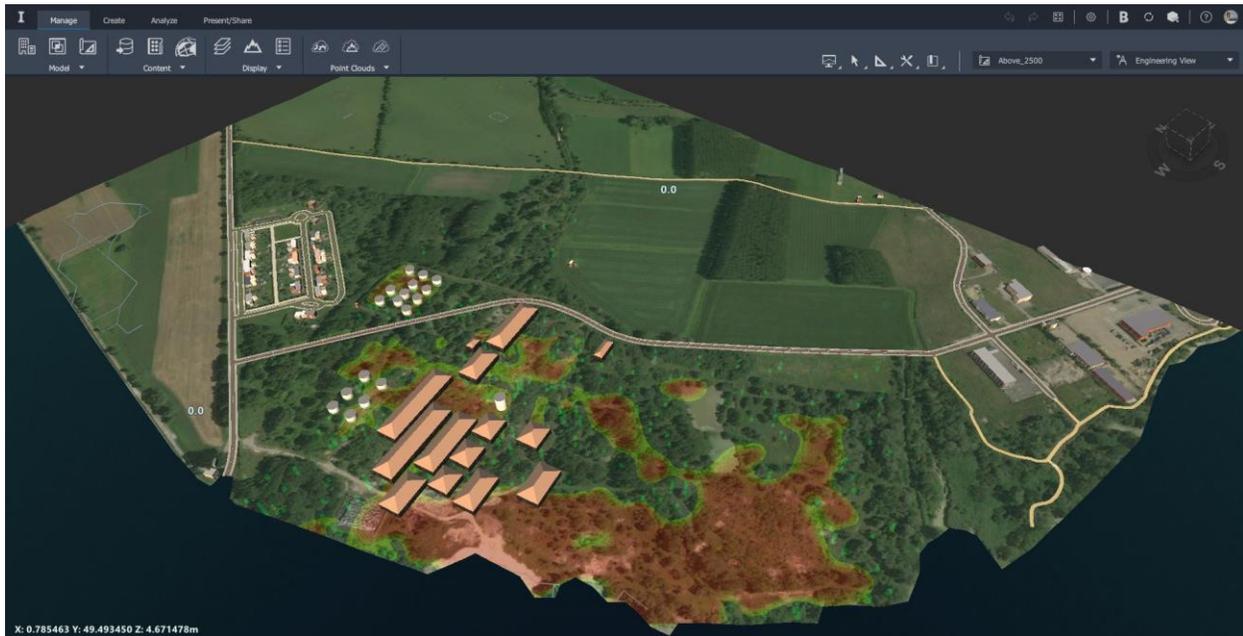


Figure D – 3D Sub-surface model in InfraWorks along with historical footprint of aboveground elements

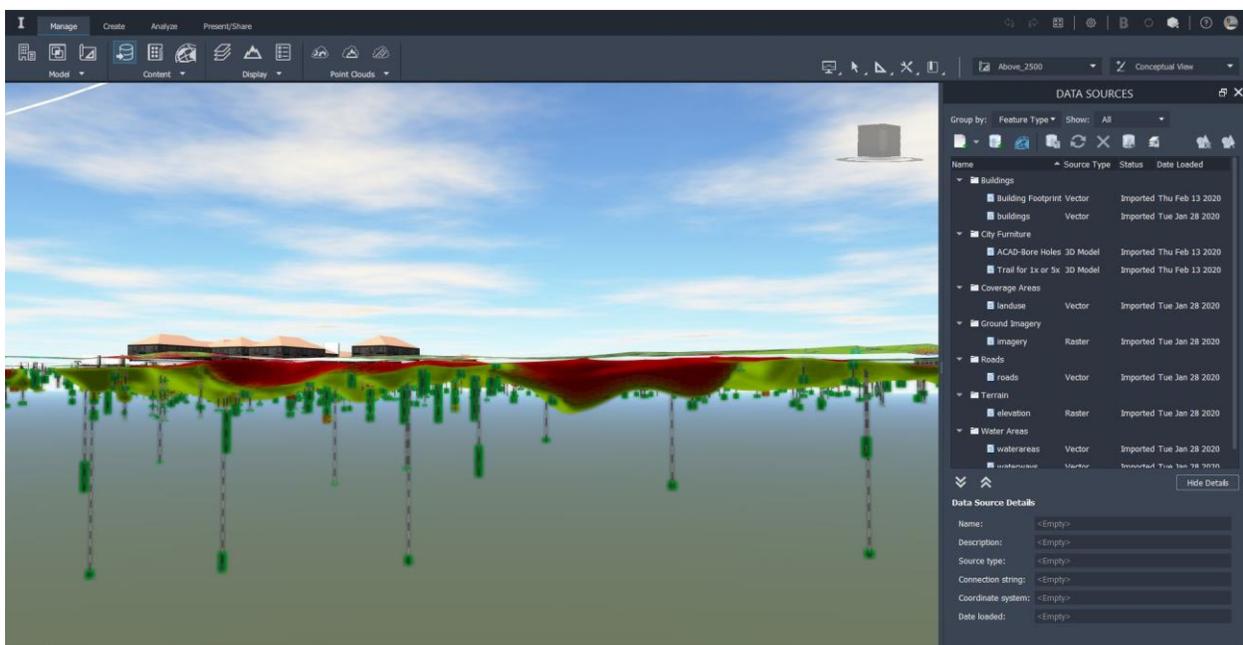


Figure E – 3D TPH Plume in InfraWorks

To have an integrated model published in a centralized location, 3D conceptual model from InfraWorks was published in BIM360 which enabled better user experience for the client (Figure F).

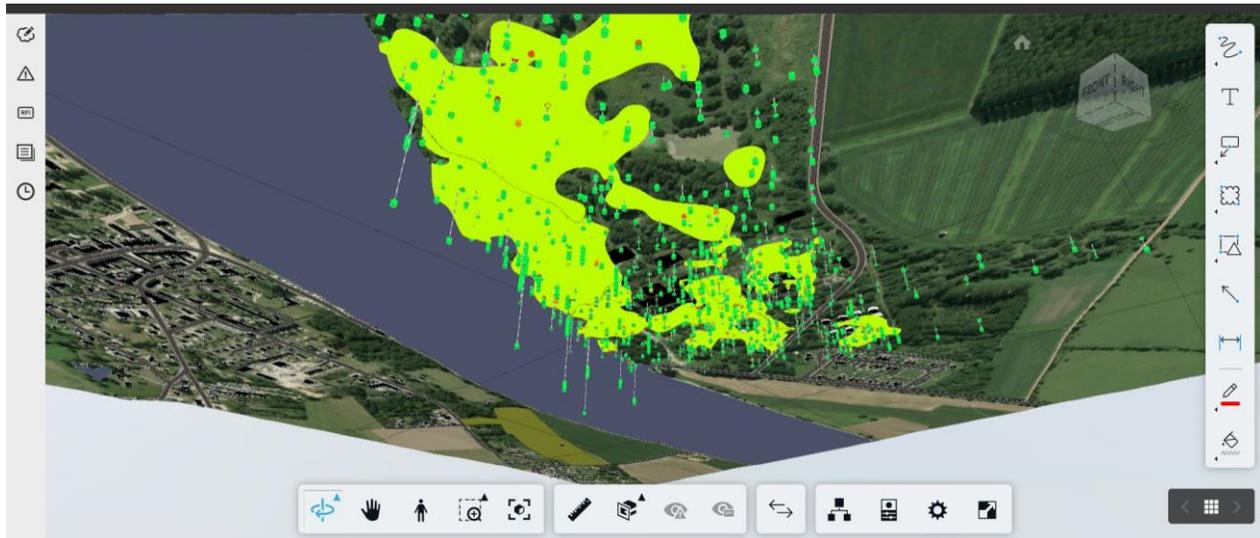


Figure F – 3D Conceptual Site Model Published in BIM360

An Opportunity for ‘BIM for Environment’

Considering the planned updates to this model, an opportunity for “BIM for Environment” can now be established. This can include further integrating the model with geology interpretations, and embedding the model with all the relevant data such as contaminant concentration, mass, and volume. This can also be further upgraded to calculate the cost for remediation of a contaminated site.

Conclusion

Without sufficient sub-surface data visualization options, users risk exposing themselves to unforeseen obstacles during active remediation and thereby increasing the cost. By utilizing powerful tools available within Autodesk environment, user can now achieve comprehensive visualization by establishing centralized visualization platform which will give users more context into sub-surface conditions, allowing them to make vital management decisions that affect operations.