

GS6384 Vault is for More than Engineers: Integrating AutoCAD Map 3D and ArcGIS with Vault

Stephen Brockwell

President, Brockwell IT Consulting

Lecture

In this class you will learn how to use Vault software in the context of AutoCAD Map 3D software, Esri's ArcGIS, Esri's ArcMap, and Esri's ArcCatalog GIS, with a simple plug-in developed with the Vault software API (application programming interface). We will demonstrate how to integrate ArcMap templates, SHP files, data connections, layers, and other GIS data sources with the Vault software to significantly improve the efficiency of the architecture, engineering, and infrastructure design process.

Key learning objectives

Learn how to store the templates, files, and data connections of ArcCatalog and ArcMap in Autodesk Vault

Learn how to configure Vault software security to better ensure clear distinctions between geographic information system (GIS) administrators and GIS end users

Learn how to use the data versioning features of Autodesk Vault to manage interim states of geographic information system projects

Learn how to publish DWG files, SHP files, and other files from AutoCAD Map 3D software and ESRI ArcMap to Vault

Workflow for Infrastructure Construction

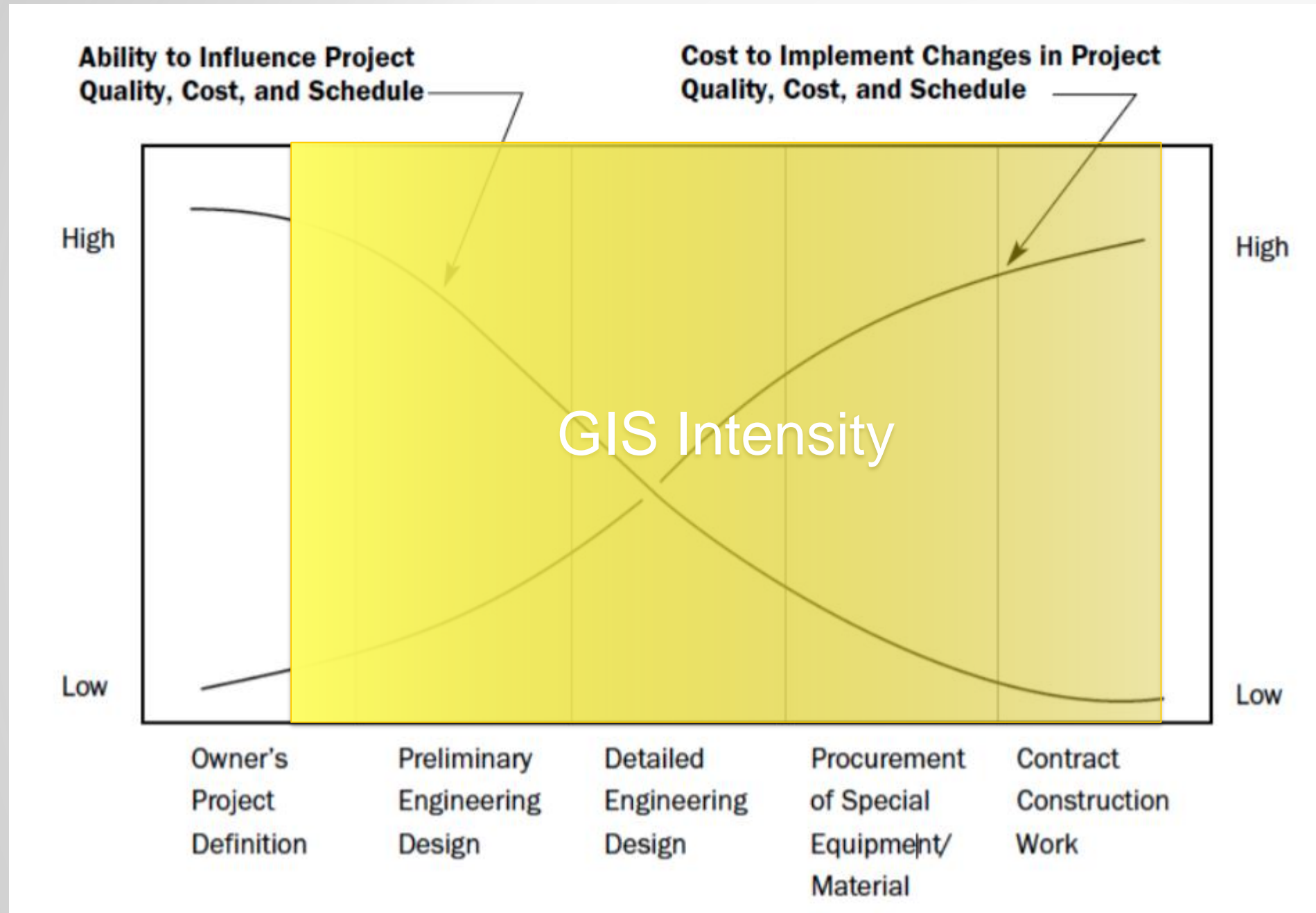


Year 1

Year 2

Year
3+

Where GIS plays a role



<http://commons.emich.edu/cgi/viewcontent.cgi?article=1937&context=theses>

“many engineers still do not know how to integrate CAD with the GIS software. They also do not know how to find GIS data or how to use these data”

Common Needs for GIS in Engineering

- Environmental impact assessment (EIA) based on latest, verified version of engineering drawings
- Easily access as-designed and as-constructed engineering drawings for GIS as-built mapping
- Consistent engineering and GIS data versioning
- Standards enforcement across disciplines

Scenario

- Oil & Gas pipelines
 - GIS corridor planning based on latest surveys
- Stakeholder engagement & exhibits
- Preparation of basemap materials for civil drawings
- EIA



Final Supplemental Environmental Impact Statement
Keystone XL Project

Executive Summary



Scenario

- Major transportation corridor development or reconstruction

1.2 Growth is Being Focused Along the Central Transit Corridor

To help the Region optimize available urban land, a key focus for new growth will be along the CTC. Through integration of land use and transportation planning, areas along the Corridor will be distinguished by an offering of enhanced transit and a greater mix of housing, jobs, retail and leisure choices all within close proximity.

At the heart of the CTC is the Region's planned rapid transit line. The line will be developed in two phases and will include 23 stations connecting the three cities. This integrated transportation corridor connects many key destinations throughout the region including places to live, work, play and shop. Along with improving access to existing places, the Corridor will become the focus for new medium and high density residential, retail and commercial development. Over time, this will lead to the creation of new and enhanced neighbourhoods, corridors and urban centres in each of the cities.



Scenario

■ Major transportation corridor development or reconstruction

The Many Places Along the Corridor

The CTC is comprised of many distinct places including opportunities to live, work, study, play, and shop. The pattern of distribution for each of these uses means that the Corridor will be experienced in many different ways depending upon where you live, the type of job you have and what you choose to do in your spare time.



Places to live along the Corridor



Concentration of employment areas along the Corridor

Living

The Corridor today contains a range of housing choices. High and medium density residential communities are located in Uptown Waterloo and Downtown Kitchener but are also clustered around the Universities, Block Line Road and Fairview Park Mall. Within Cambridge, much of the high and medium density can be found around the Preston, Can-Amara and Airside Stations. Though some housing variety exists along the RT line, a greater mix of housing options in close proximity to enhanced transit will be needed to encourage greater intensification along the Corridor.

High density housing Medium density housing Low density housing

Working

The Region of Waterloo is home to a great number of advanced high-technology manufacturing and industrial businesses. Office campuses for predominately technological firms are found in Waterloo. Downtown Kitchener houses financial and creative industries and Cambridge contains the largest portion of the region's manufacturing. While many of the smaller employment clusters are easily accessed by RT, the larger more built-out employment areas lack the necessary infrastructure to support employees wishing to walk, cycle or take transit to work.

Employment area

Source of Data: Region of Waterloo



Parks, open spaces, and community services along the Corridor

Playing

The Rapid Transit line will provide direct links to some of the region's parks and open spaces, including access to the Grand River Valley through Preston and Galt and the Dumfries Conservation Area, Riverside Park, Kitchener's Victoria Park and Waterloo Park. It will also facilitate greater access to community centres and recreational facilities located within the urban cores. However, the significant population increases that are expected for these areas will result in a greater demand for new facilities and parks and enhanced access to existing open spaces.

Parks/open spaces Recreational facility Community Centre



Places of learning along the Corridor

Learning

Nearly 80,000 students attend the region's three post-secondary institutions: the University of Waterloo, Wilfrid Laurier and Conestoga College. The University of Waterloo and Wilfrid Laurier have campuses at the north-end of the region that neighbour the RT at the R&T Park, University of Waterloo and Seagram Stations, along with additional satellite campuses in Kitchener and Cambridge. Conestoga College's main campus in Kitchener is situated away from the line and is currently accessed by local bus. A series of elementary and secondary schools are located near the RT including magnet schools which offer specialized programs or courses. Enhancing connections from home to school and from one school to another will be an important consideration as the student population grows and collaboration between institutions increases.

Public/Catholic school Post-secondary school Library



Places to shop and dine along the Corridor

Shopping

Three regional scale shopping malls are located along the Corridor: Conestoga Mall, Fairview Park Mall and the Cambridge Centre. Additional shopping districts are situated in Uptown Waterloo, Downtown Kitchener, Downtown Cambridge (former Galt City Centre), along Hespeler Road and in areas away from the Corridor such as in St. Jacobs and Hespeler Village. Over time, the Corridor has the potential to expand retail offerings to support growth.

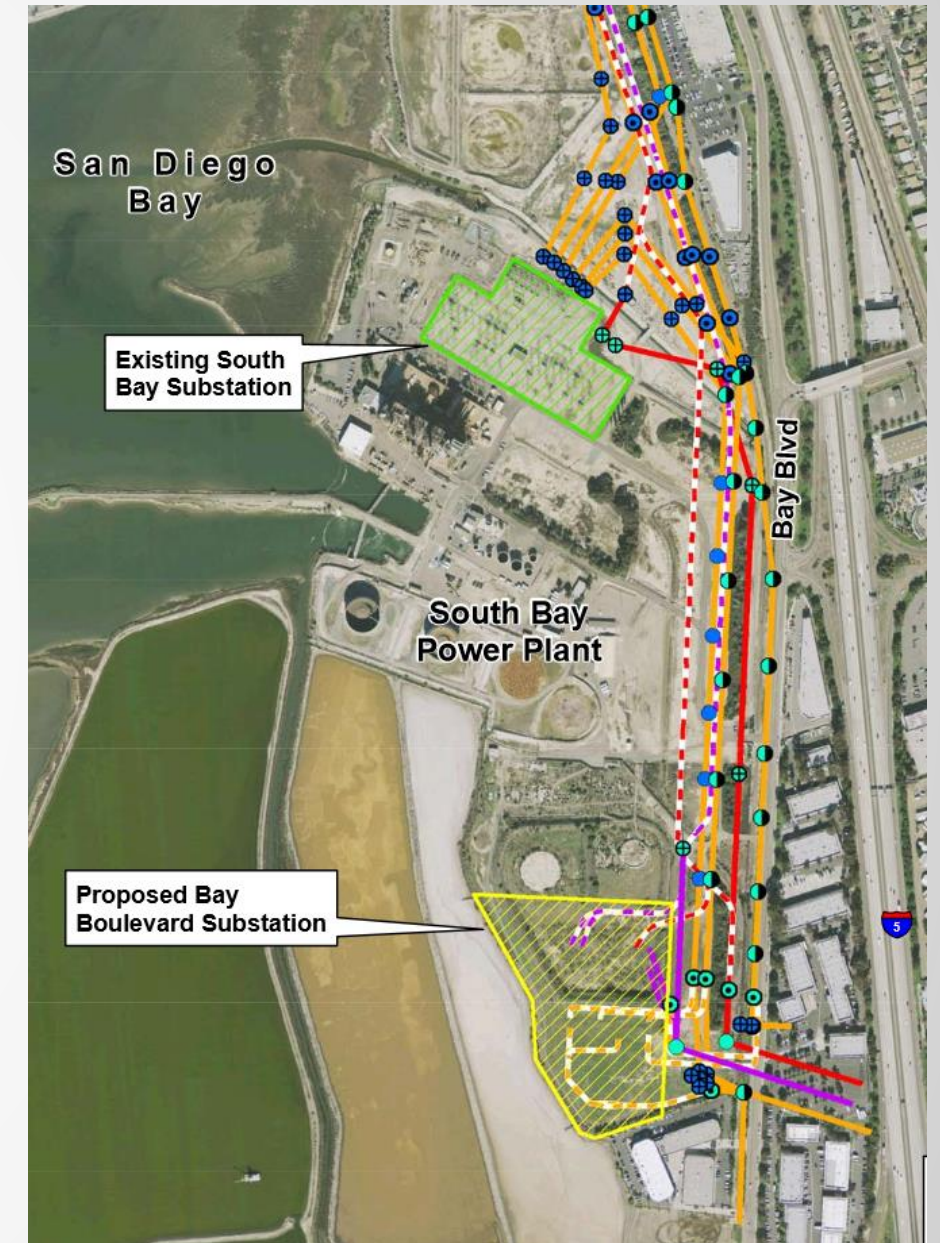
Retail/Commercial

Source of Data: Region of Waterloo

Scenario

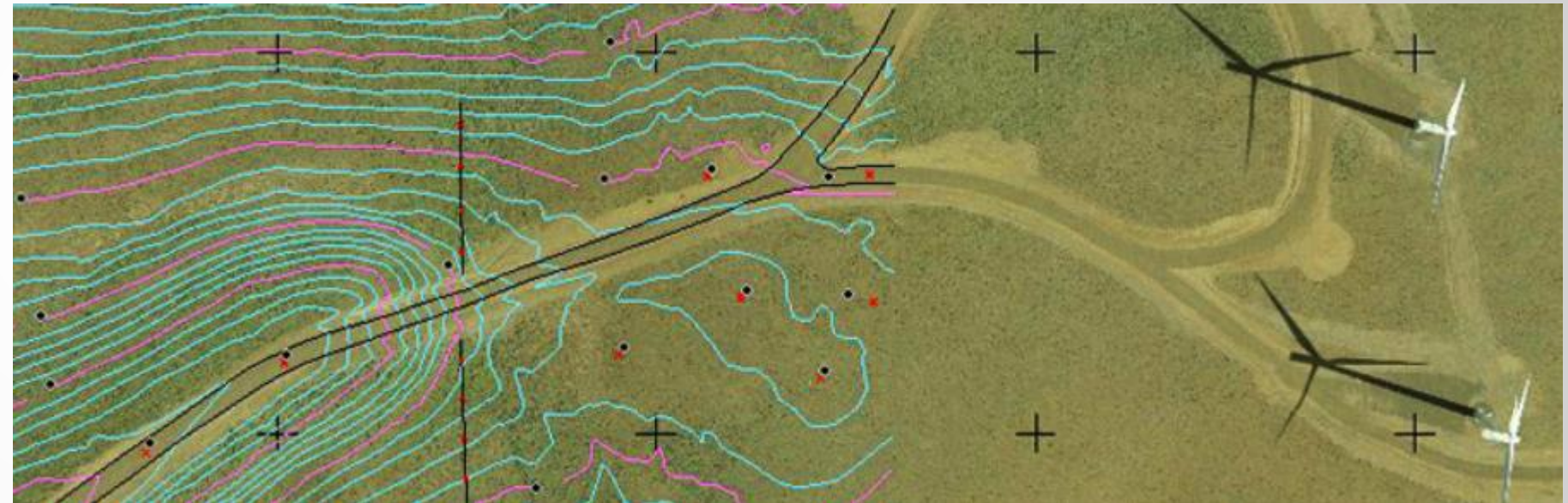
<http://www.cpuc.ca.gov/environment/info/dudek/sbsrp/SouthBaySub.htm>

- Substation relocation
 - Community engagement
 - Site survey, engineering and mapping documentation
 - Iterative GIS documentation due to nature of planning, alternative consideration



Scenario

- Green energy new build
 - Line of sight impacts
 - Sound analysis
 - Wildlife impact
 - Site location alternatives



Why Integrated GIS & Engineering Documents

- **Cost & Profitability**
 - EAI alone typically < 1% of total construction budget
 - However, that 1% often exceeds hundreds of thousands of \$ on large-scale, long-term projects
 - Enforced standards and version control reduces project ramp-up
- **Liability**
 - Incorrect environmental assessments, if proven, can incur significant liability costs in the event of an unplanned event
- **Trust**
 - Knowing that all project documents are managed by the same process gives stakeholders confidence in the integrity and transparency of the larger process

Why Integrated GIS & Engineering Documents

- Expanding scope of impact assessment
 - Social aspects (such as impacts on employment, community interaction);
 - Risks (such as threats to native animals, water supplies);
 - Life cycle (such as the impacts at each stage of the project – design through to operation and closure); and
 - Energy (such as use of non-renewable energy sources, Greenhouse gas emissions)

Value Proposition

- Seamless workflow for GIS in engineering/construction business processes
- Access to latest engineering design information to minimize re-work
- Ability to easily share and version-control all project documents in a single system
 - Concerns about file management of massive scans
- Ability to enforce consistency for both engineering and GIS

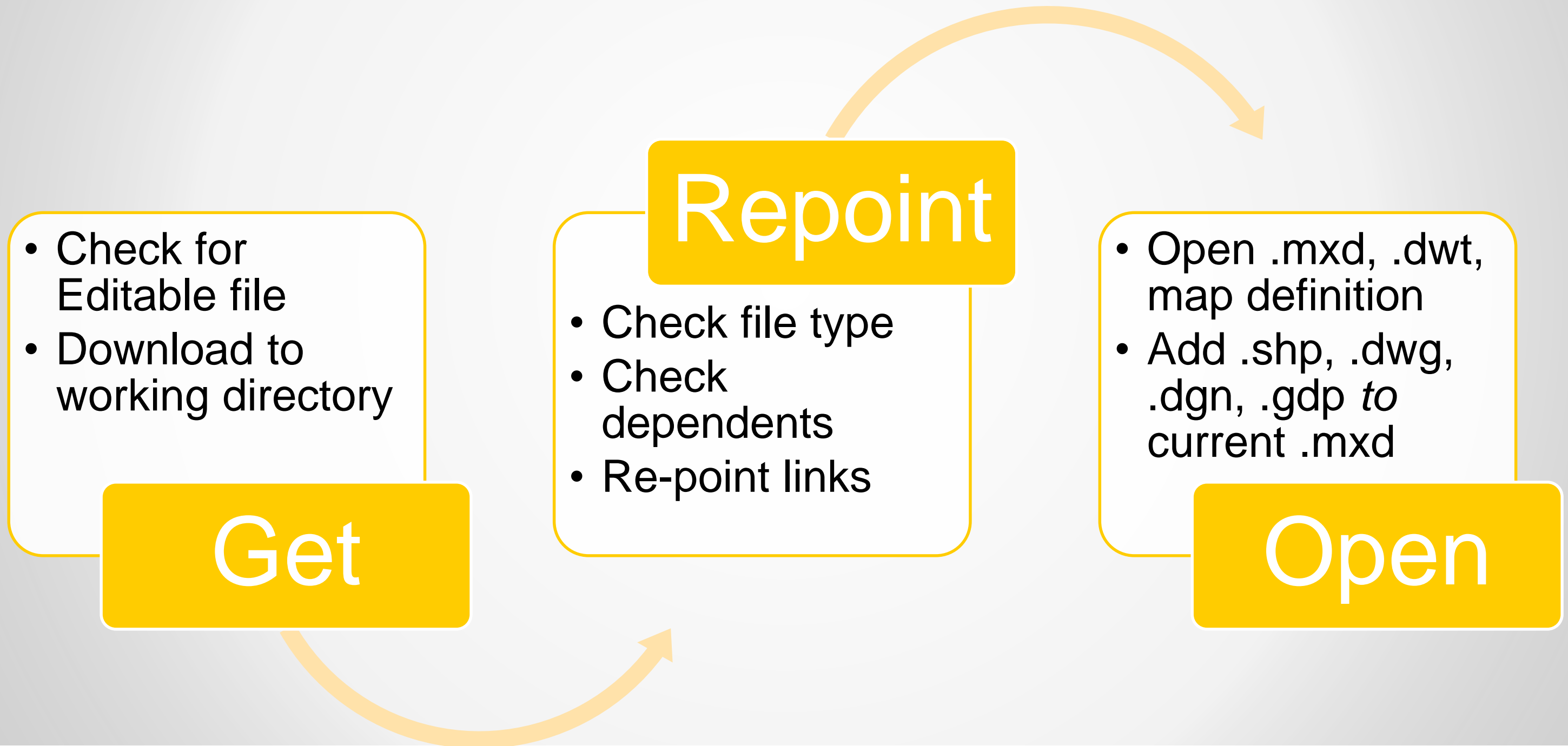
Proposal

- Use the Vault API to create simple plug-ins for AutoCAD Map and ESRI ArcMap/ArcCatalog that
 - Manages and clones standard template projects
 - Provides versioned documents on a project basis (GIS documents are versioned in a consistent fashion with engineering documents).
 - Allows similar metadata editing and search capability
 - Ensures document locking and integrity

What we are NOT suggesting

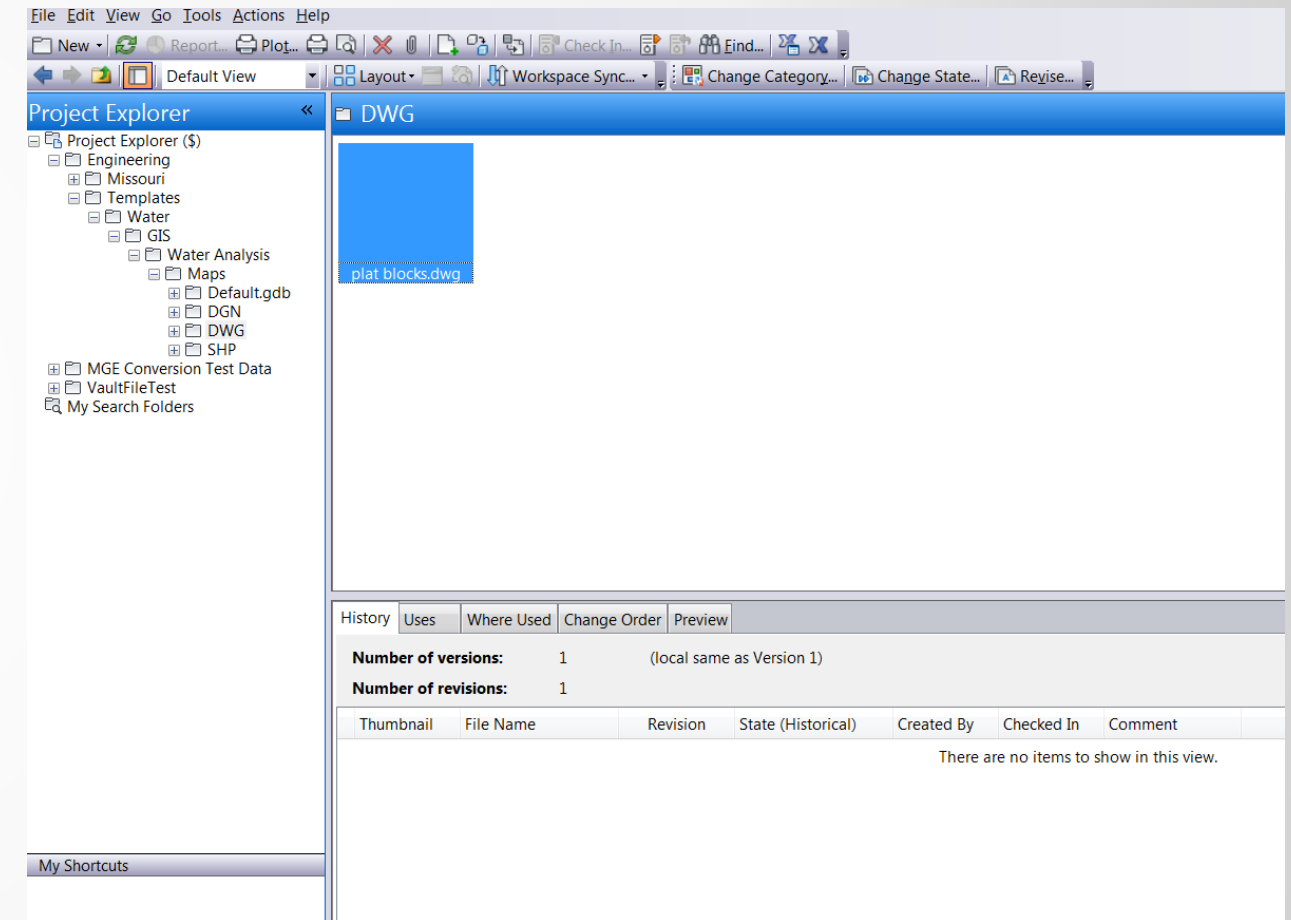
- Large scale as-built or as-designed GIS data in an enterprise GIS is NOT stored in Vault
- Standardized projects with *connections* to enterprise databases *are* stored in Vault
 - Easily pull in other engineering documents
 - Update map references accordingly

What happens in the ArcMap or AutoCAD Map client



Thoughts on Map

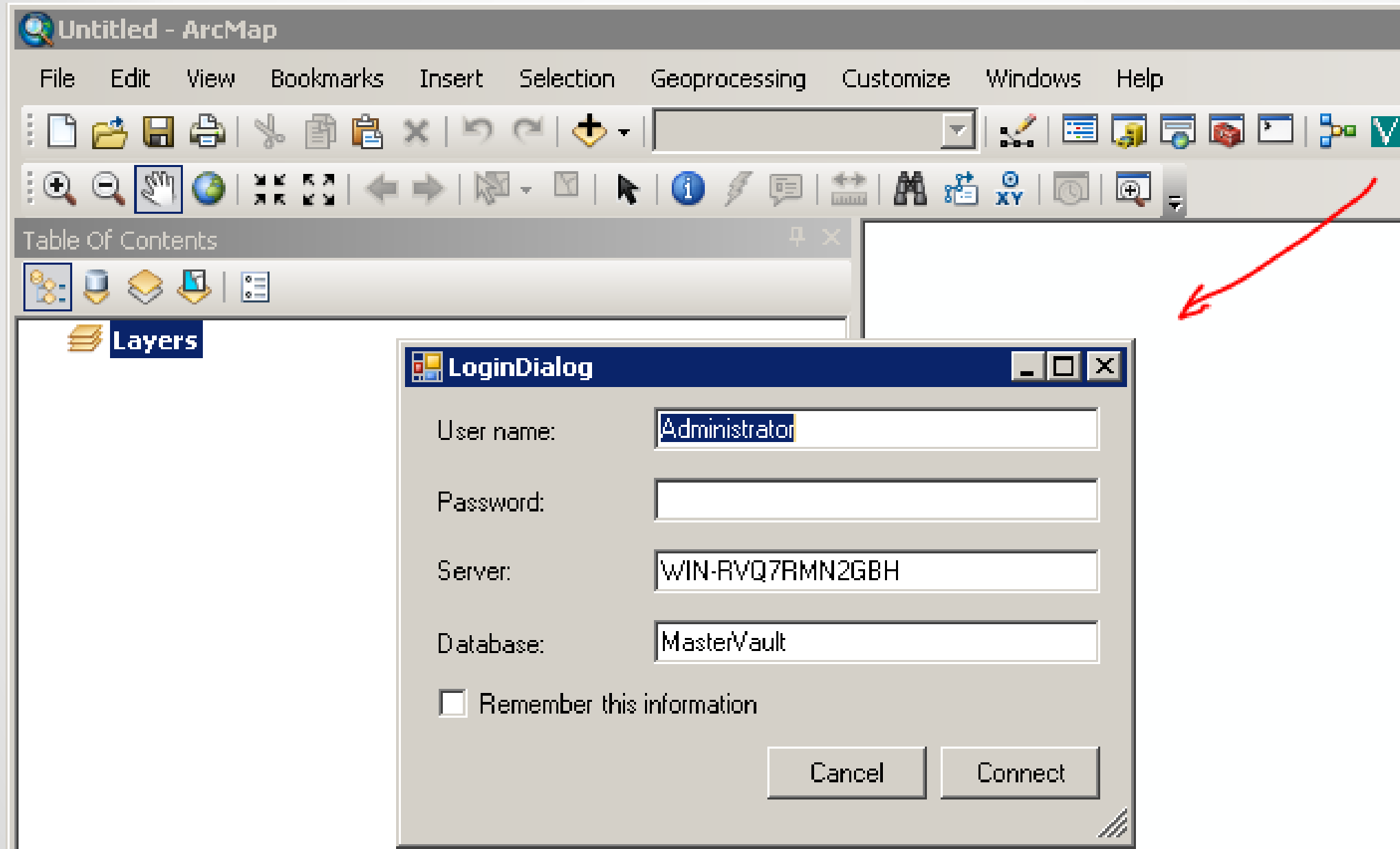
- Don't re-invent the wheel
 - Try to use existing Vault client for Map
 - Not sure if hooks are available to handle Vault client events.
 - Can check timestamps after load
- Perform identical logic (open tbdm, add referenced layer files)



Vault API Requirements

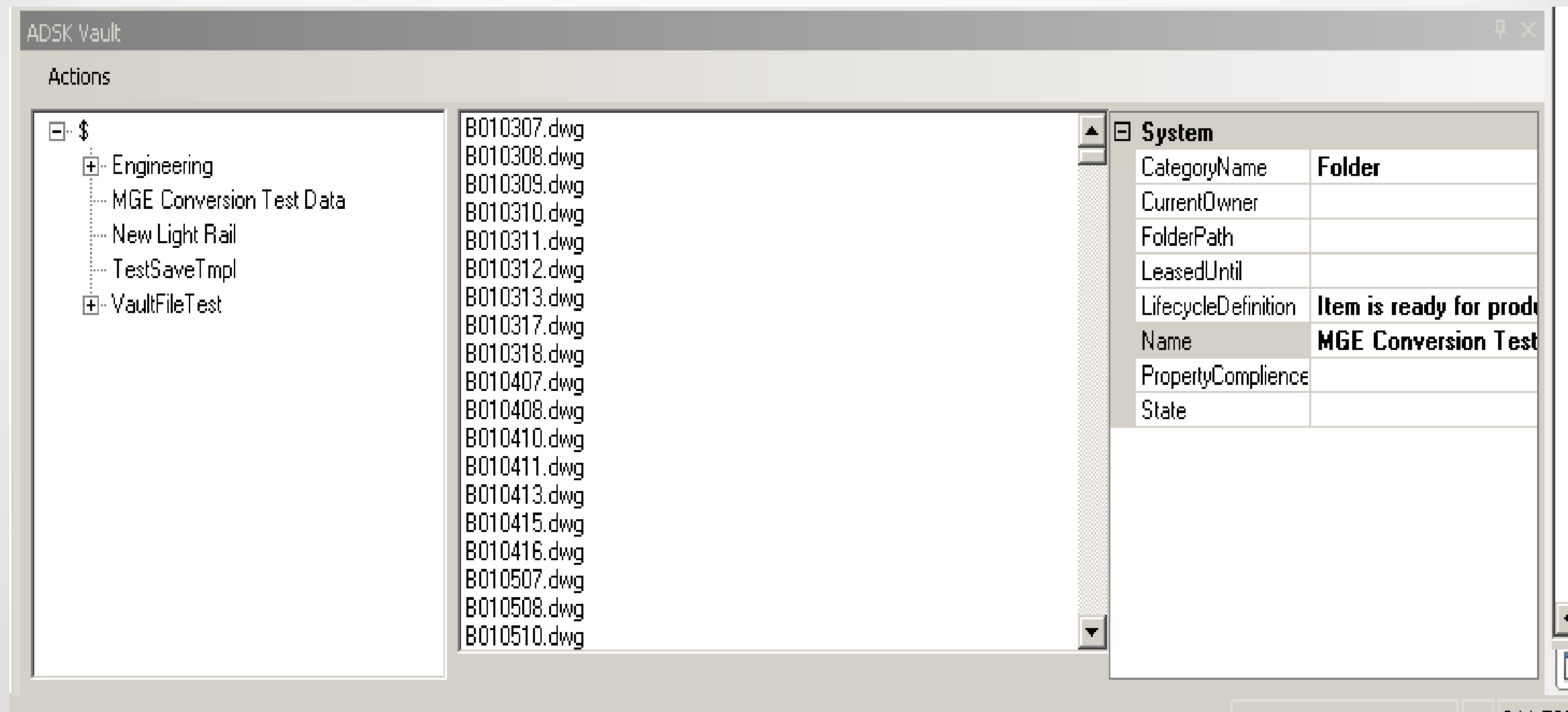
- Simple use of standard Vault APIs
 - C# .NET
 - Vault web services (Autodesk.Connectivity.WebServices)
 - Vault extensibility tools (Autodesk.Connectivity.Explorer.ExtensibilityTools)

ArcMap Scenarios



Vault browser dockable window

- Folders, files and Properties (folder or file)



Preview

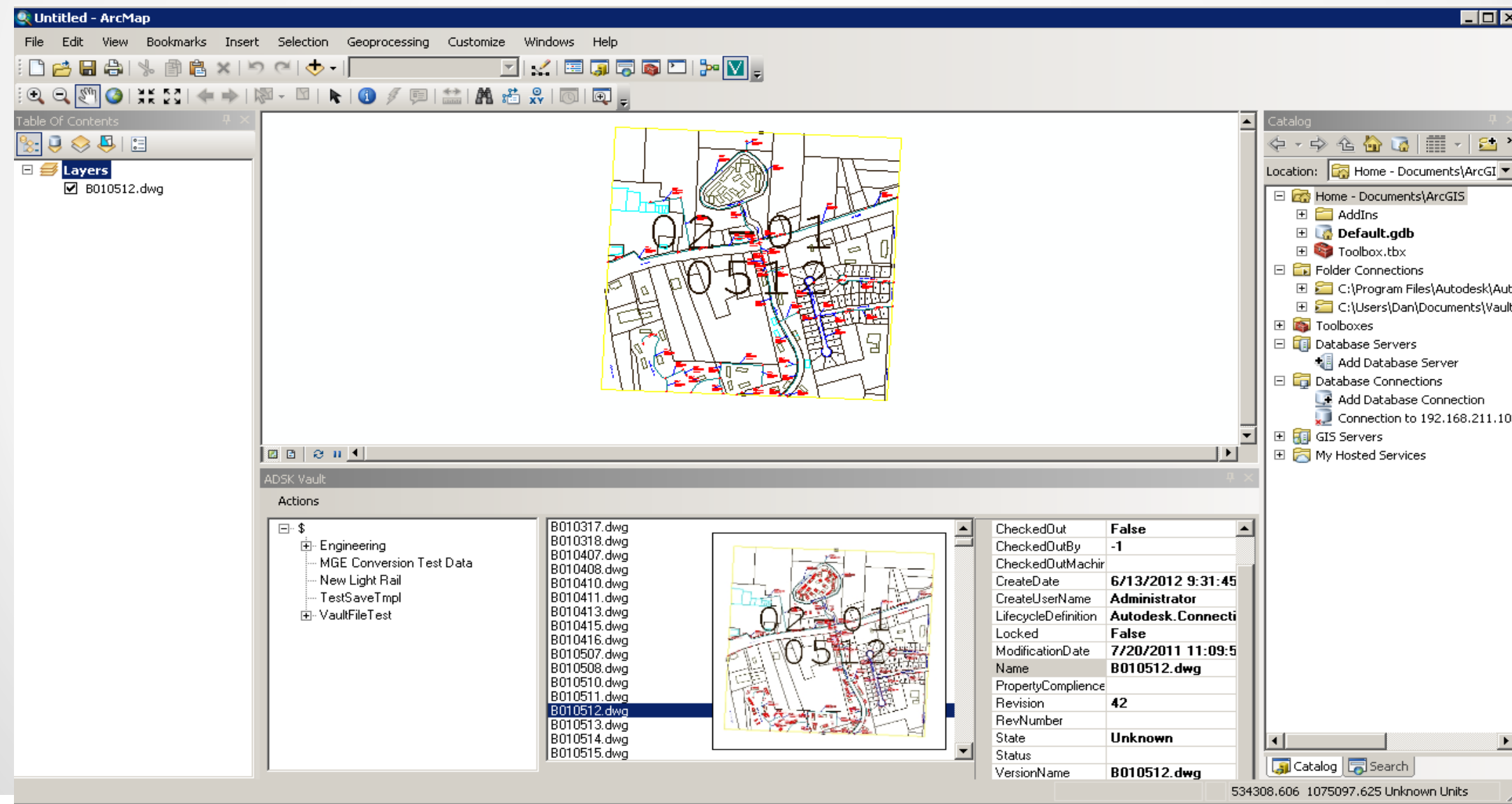
- Single-click on a .gdb folder, SHP folder or DWG file will display its preview if any in the vault.

The screenshot displays the Autodesk Vault application window. On the left, a tree view shows the folder structure: Engineering, MGE Conversion Test Data, New Light Rail, TestSaveTmp, and VaultFileTest. The file B010512.dwg is selected in the file list. The central pane shows a preview of the selected DWG file, which is a technical drawing of a building layout with various annotations and dimensions. On the right, a properties table provides details about the selected file.

CheckedOut	False
CheckedOutBy	-1
CheckedOutMachir	
CreateDate	6/13/2012 9:31:45
CreateUserName	Administrator
LifecycleDefinition	Autodesk.Connecti
Locked	False
ModificationDate	7/20/2011 11:09:5
Name	B010512.dwg
PropertyCompliance	
Revision	42
RevNumber	
State	Unknown
Status	
VersionName	B010512.dwg
VersionNumber	1

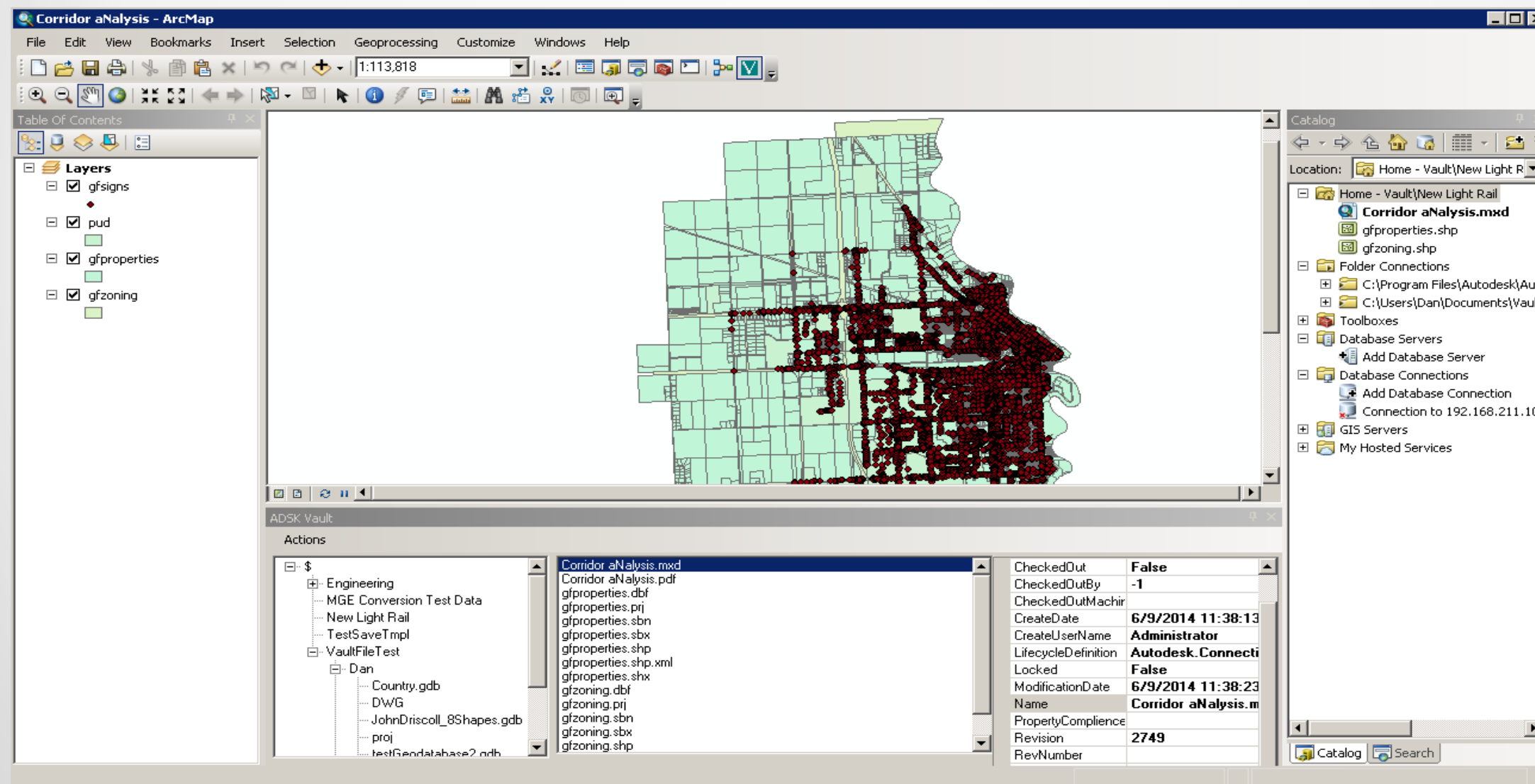
Downloading data (I)

- Automatic data loading into ArcMap on double-click (.gdb SHP, .mdx or DWG). Example for a DWG file:



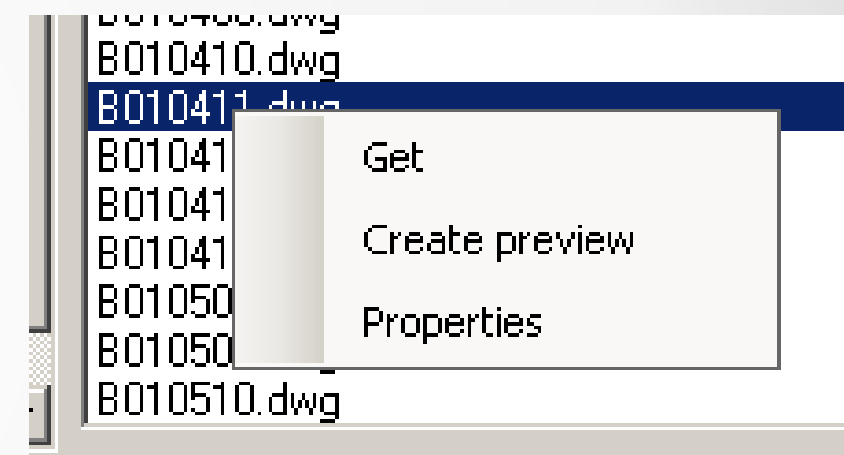
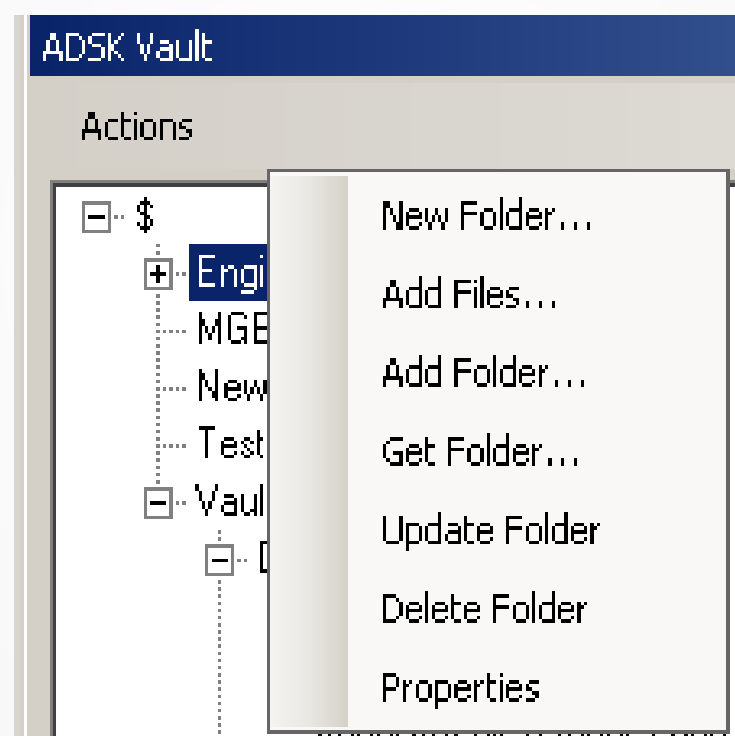
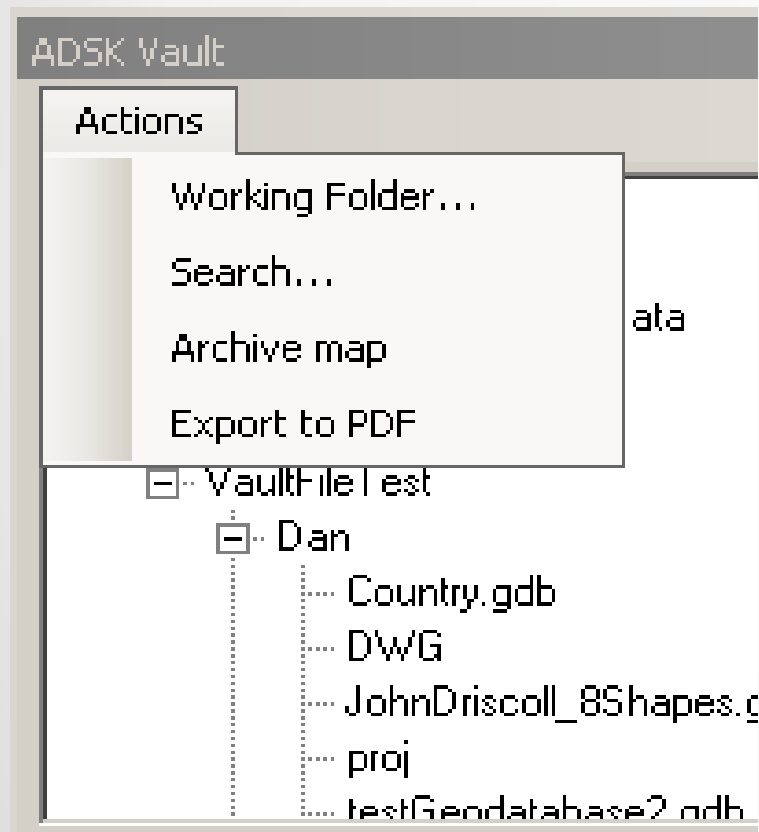
Downloading data (II)

- Load a ArcGis .mxd project, example:



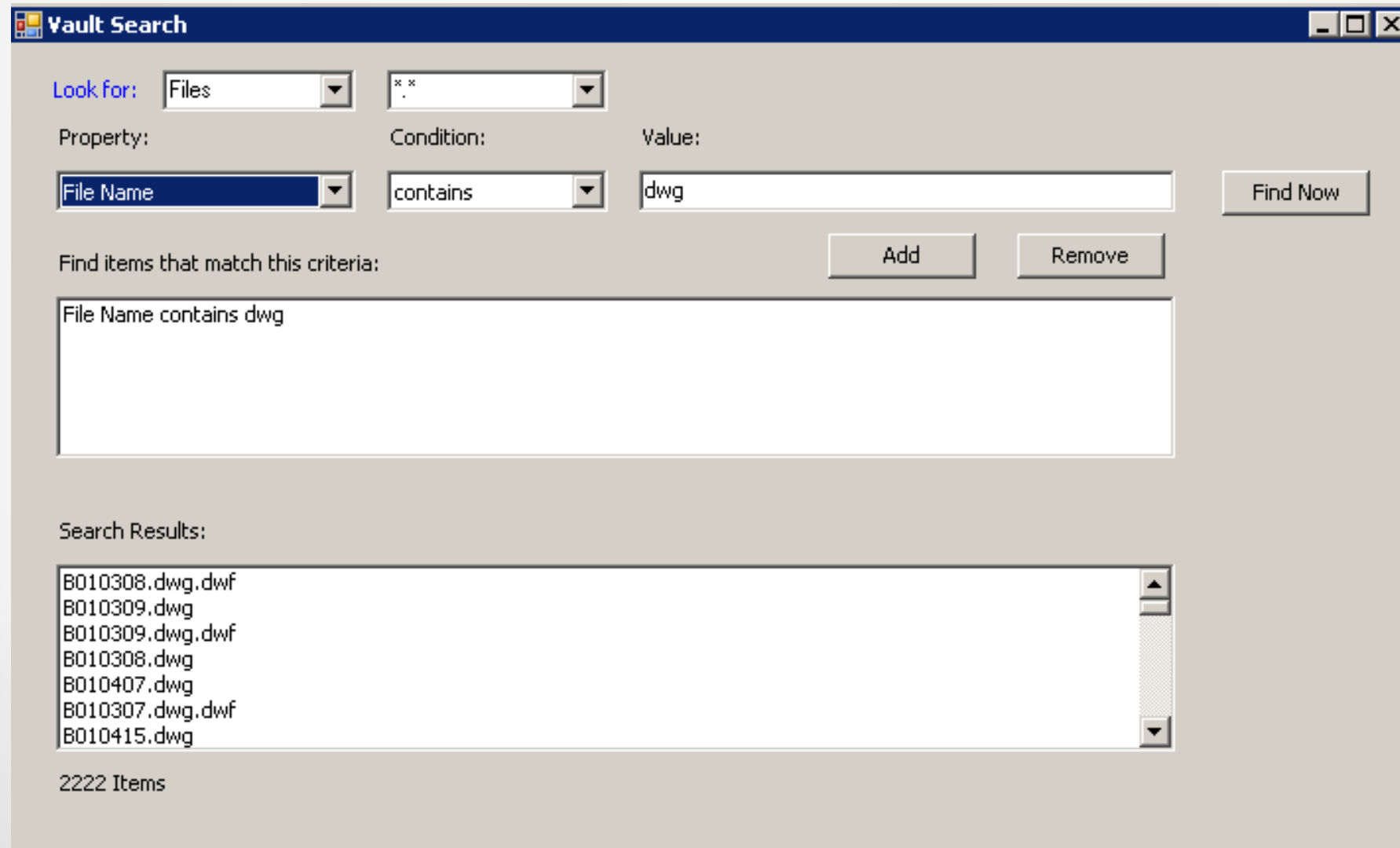
Options

- General options, context menus on folder and files
- Example: automatic archiving the current map



Search

- Search the vault using filters on properties
- Selected files can be uploaded automatically



The screenshot shows the 'Vault Search' dialog box. At the top, there is a 'Look for:' section with a dropdown menu set to 'Files' and a text box containing 'xx.'. Below this, there are three columns: 'Property:', 'Condition:', and 'Value:'. The 'Property:' column has a dropdown menu set to 'File Name'. The 'Condition:' column has a dropdown menu set to 'contains'. The 'Value:' column has a text box containing 'dwg'. To the right of these columns is a 'Find Now' button. Below the search criteria, there is a section labeled 'Find items that match this criteria:' with 'Add' and 'Remove' buttons. A text box below this section contains the text 'File Name contains dwg'. At the bottom, there is a 'Search Results:' section with a list box containing the following files: B010308.dwg.dwf, B010309.dwg, B010309.dwg.dwf, B010308.dwg, B010407.dwg, B010307.dwg.dwf, and B010415.dwg. Below the list box, it says '2222 Items'.

Vault Search

Look for: Files xx.

Property: File Name Condition: contains Value: dwg Find Now

Find items that match this criteria: Add Remove

File Name contains dwg

Search Results:

- B010308.dwg.dwf
- B010309.dwg
- B010309.dwg.dwf
- B010308.dwg
- B010407.dwg
- B010307.dwg.dwf
- B010415.dwg

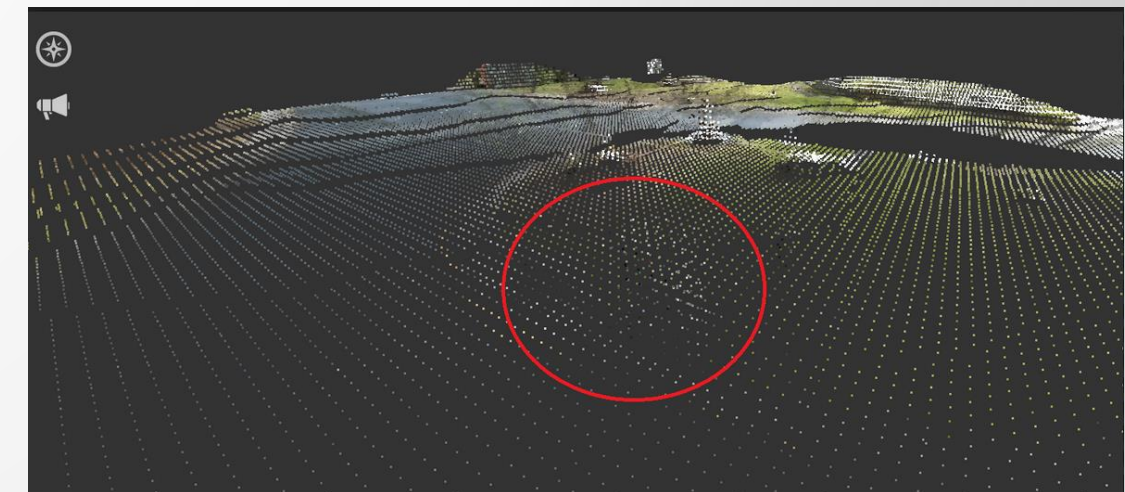
2222 Items

Work remaining

- Reliably re-point *all* files within the reference system for AutoCAD Map and ArcMap
 - This is already handled by Vault for xref files
 - Depends on standards
- Add detailed version history to ArcGIS browser

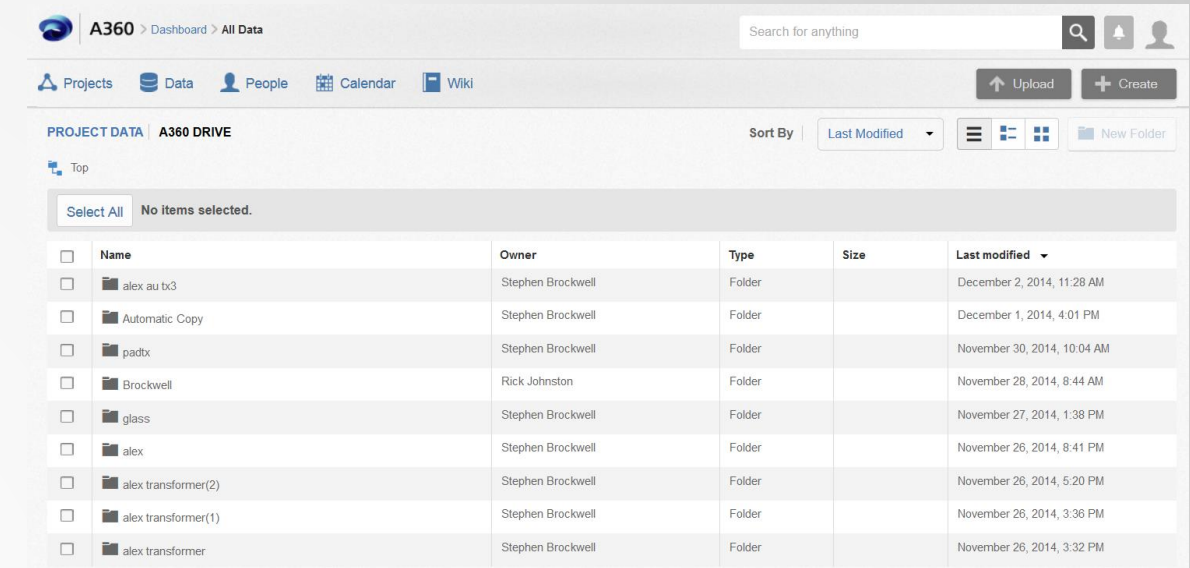
Concerns for the future

- Cloud computing and data management
 - ESRI ArcGIS Web Services
 - Autodesk 360
- 3D visualization with Infraworks & ArcScene
- Model integration
 - Autogeneration of Infraworks models (or model references & styles that are configured but not imported)
 - Autodesk BIM 360 Glue
- Massive data sets & reality capture



Concerns for the future

- Cloud computing and data management
 - ESRI ArcGIS Web Services
 - Autodesk 360
- 3D visualization with Infraworks & ArcScene
- Model integration
 - Autogeneration of Infraworks & Navisworks models (or model references & styles that are configured but not imported)
 - Autodesk BIM 360 Glue
- Massive data sets & reality capture



The screenshot shows the Autodesk 360 web interface. At the top, there's a navigation bar with 'A360 > Dashboard > All Data' and a search bar. Below this are tabs for 'Projects', 'Data', 'People', 'Calendar', and 'Wiki'. The main content area is titled 'PROJECT DATA | A360 DRIVE' and shows a table of files. The table has columns for 'Name', 'Owner', 'Type', 'Size', and 'Last modified'. The files listed are folders named 'alex au tx3', 'Automatic Copy', 'padtx', 'Brockwell', 'glass', 'alex', 'alex transformer(2)', 'alex transformer(1)', and 'alex transformer'.

	Name	Owner	Type	Size	Last modified
<input type="checkbox"/>	alex au tx3	Stephen Brockwell	Folder		December 2, 2014, 11:28 AM
<input type="checkbox"/>	Automatic Copy	Stephen Brockwell	Folder		December 1, 2014, 4:01 PM
<input type="checkbox"/>	padtx	Stephen Brockwell	Folder		November 30, 2014, 10:04 AM
<input type="checkbox"/>	Brockwell	Rick Johnston	Folder		November 28, 2014, 8:44 AM
<input type="checkbox"/>	glass	Stephen Brockwell	Folder		November 27, 2014, 1:38 PM
<input type="checkbox"/>	alex	Stephen Brockwell	Folder		November 26, 2014, 8:41 PM
<input type="checkbox"/>	alex transformer(2)	Stephen Brockwell	Folder		November 26, 2014, 5:20 PM
<input type="checkbox"/>	alex transformer(1)	Stephen Brockwell	Folder		November 26, 2014, 3:36 PM
<input type="checkbox"/>	alex transformer	Stephen Brockwell	Folder		November 26, 2014, 3:32 PM



Video Demonstration

