

Federal GIS Conference

February 9–10, 2015 | Washington, DC



The Importance of Data Quality in your Enterprise

Heather Murnane & Sherry Fagin

Workshop Agenda

- **Importance of Data Quality**
- **What is ArcGIS Data Reviewer**
- **Automated Review**
- **Visual Review**
- **Managing Errors and Reporting Data Quality**
- **Summary/Resources**



Importance of Data Quality

Delivering high-quality data & products

Defining quality

A business perspective

Executive



Confidently make
decisions

Manager



Effective data
stewardship

User

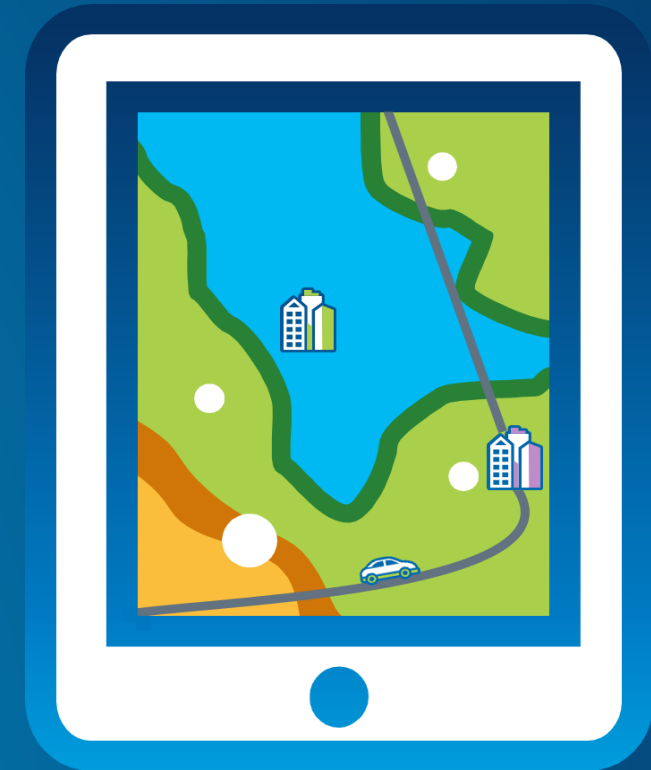


Confidence in
data

Defining Quality

A Technical Perspective

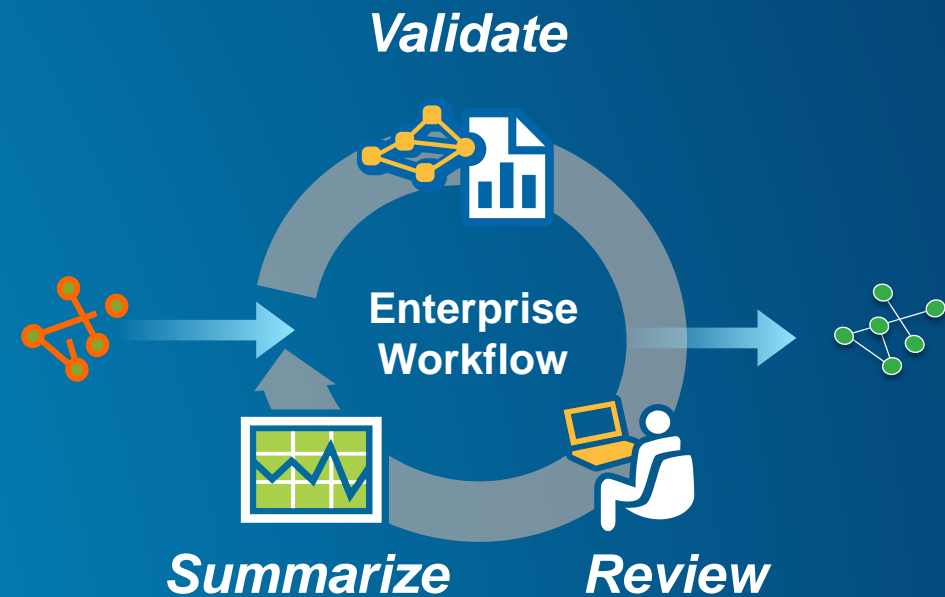
-  Spatial Accuracy
-  Thematic Accuracy
-  Completeness
-  Logical Consistency
-  Temporal Quality
-  Usability



What is ArcGIS Data Reviewer?

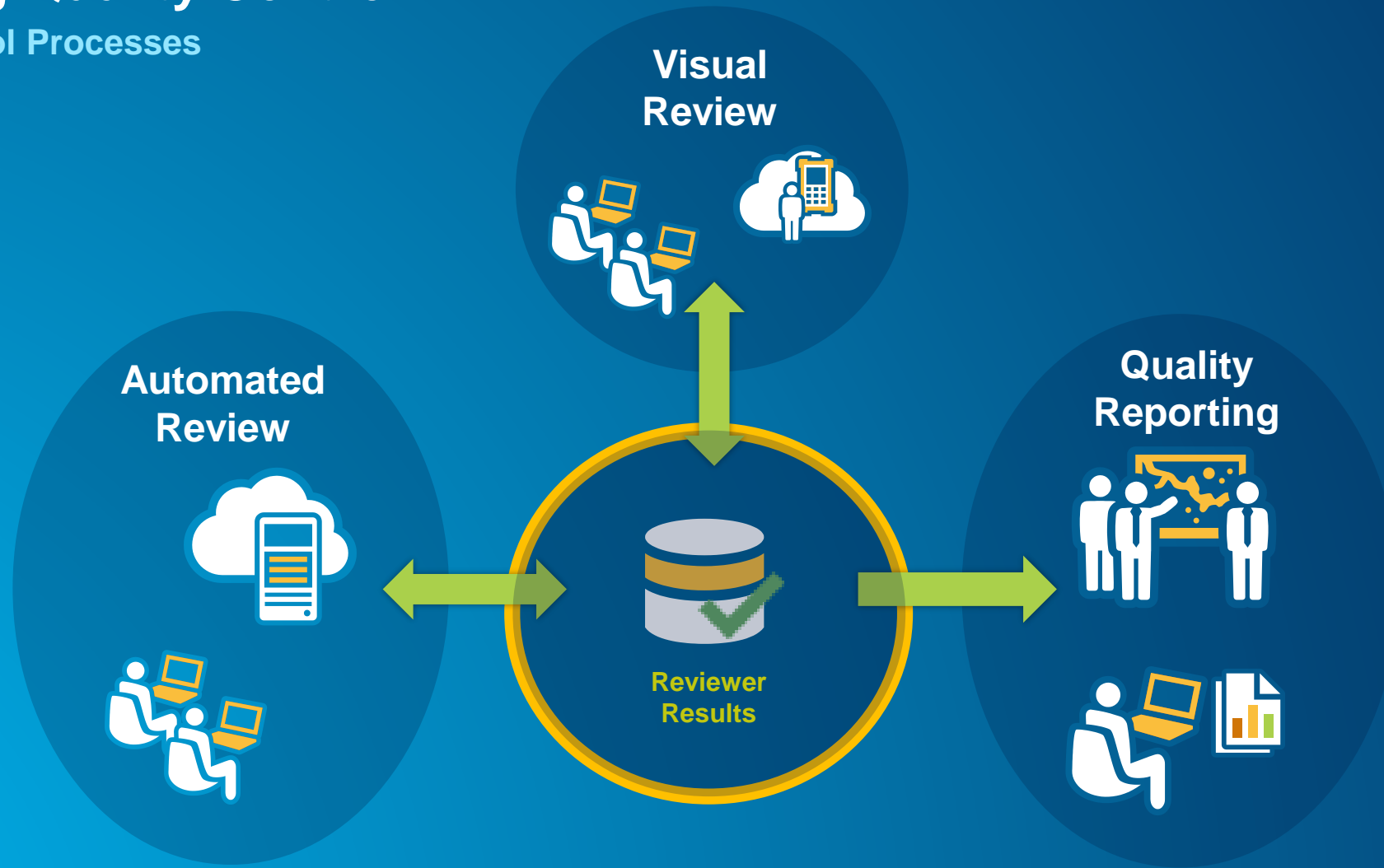
Data Quality Management for ArcGIS

- **Provides**
 - Rule-based validation
 - Interactive tools
 - Track errors
- **For individuals and enterprise**
 - Saves time/money
 - Less rework
- **For multiple domains**
 - Configurable
 - Extendable



Managing Quality Control

Quality Control Processes



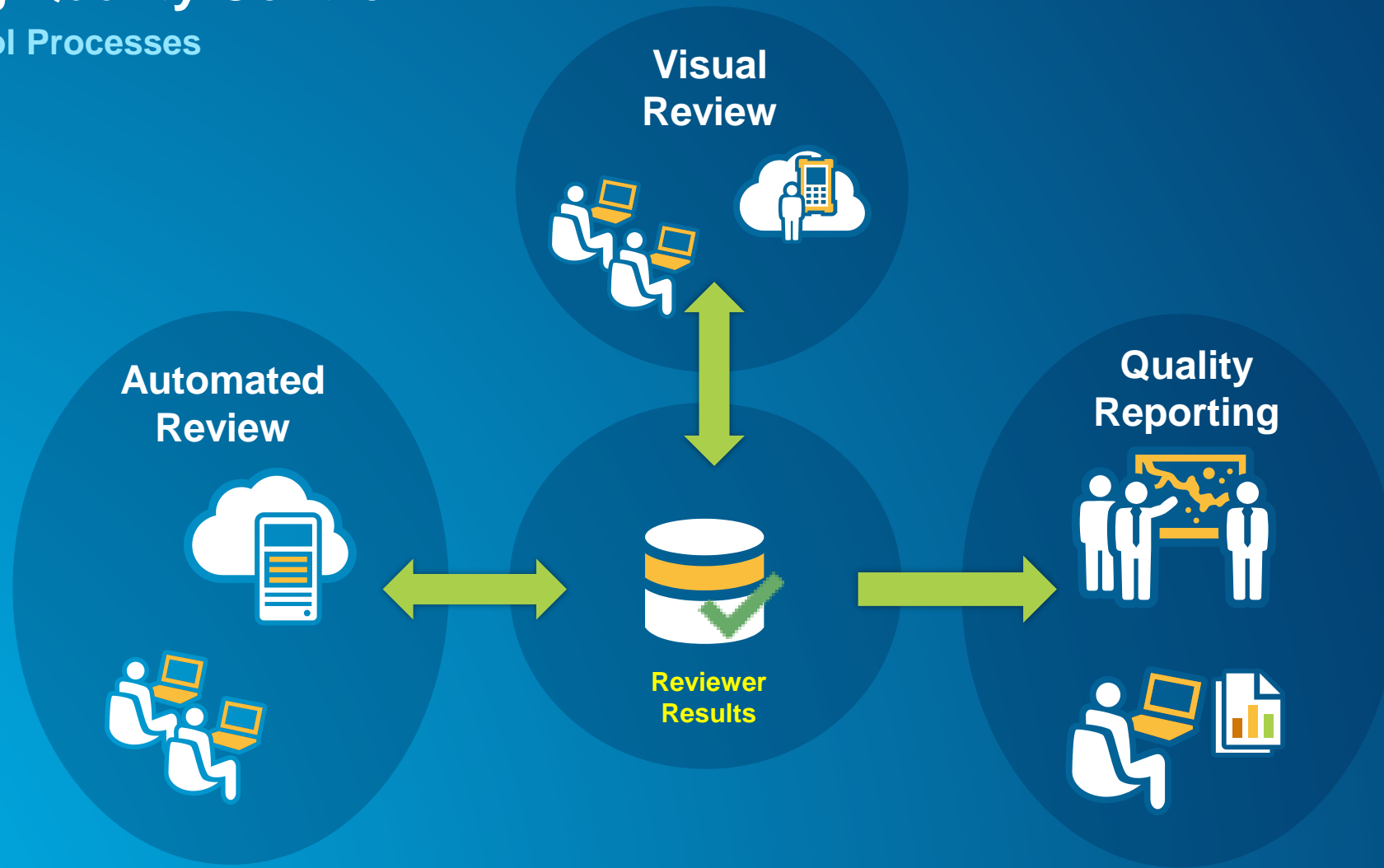


Automated Review

Streamlining data validation

Managing Quality Control

Quality Control Processes



Defining Quality

Sources of data quality requirements

Industry standards / Specifications



Subject matter experts



Training and experience



Quality assurance plans



Automating Data Validation

- Implementing quality requirements

- 40+ configurable checks

- Attribute

- Feature and table values

- Spatial

- Spatial relationships

- Feature integrity

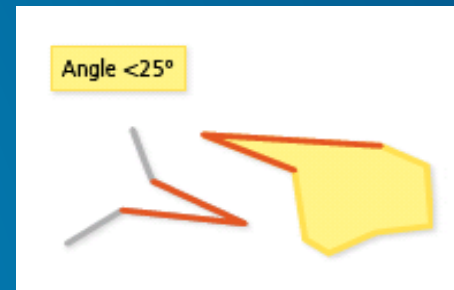
- Collection rules

- Metadata

- Completeness/Content

FEATURE CLASS 1	
7	25
8	18
9	18

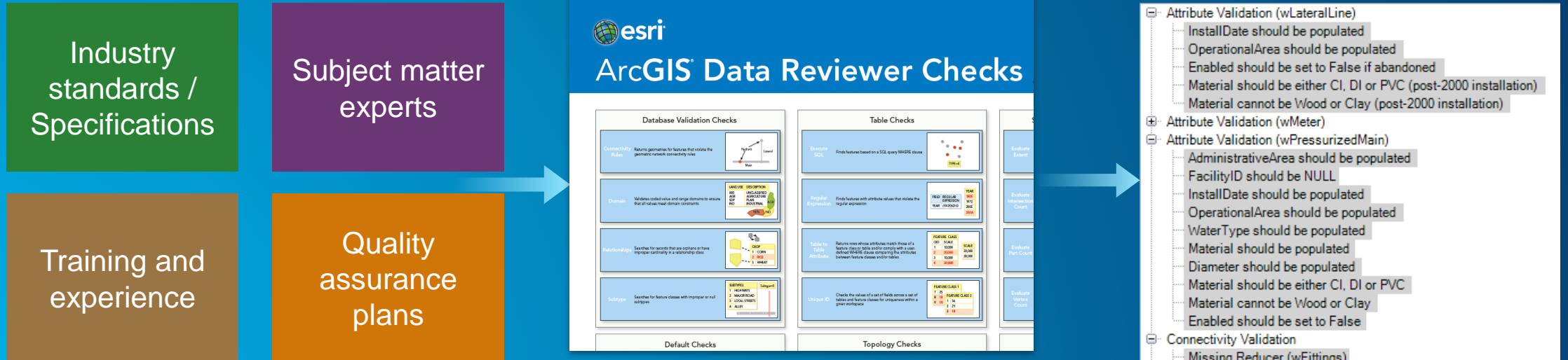
FEATURE CLASS 2	
1	36
2	21
3	18



Batch Validation

Implementing Cumulative Review

- Encapsulate quality rules
- Configured from 40+ automated checks
- Designed once and executed many times



Methods for executing data validation

Execute data validation using

- ArcMap

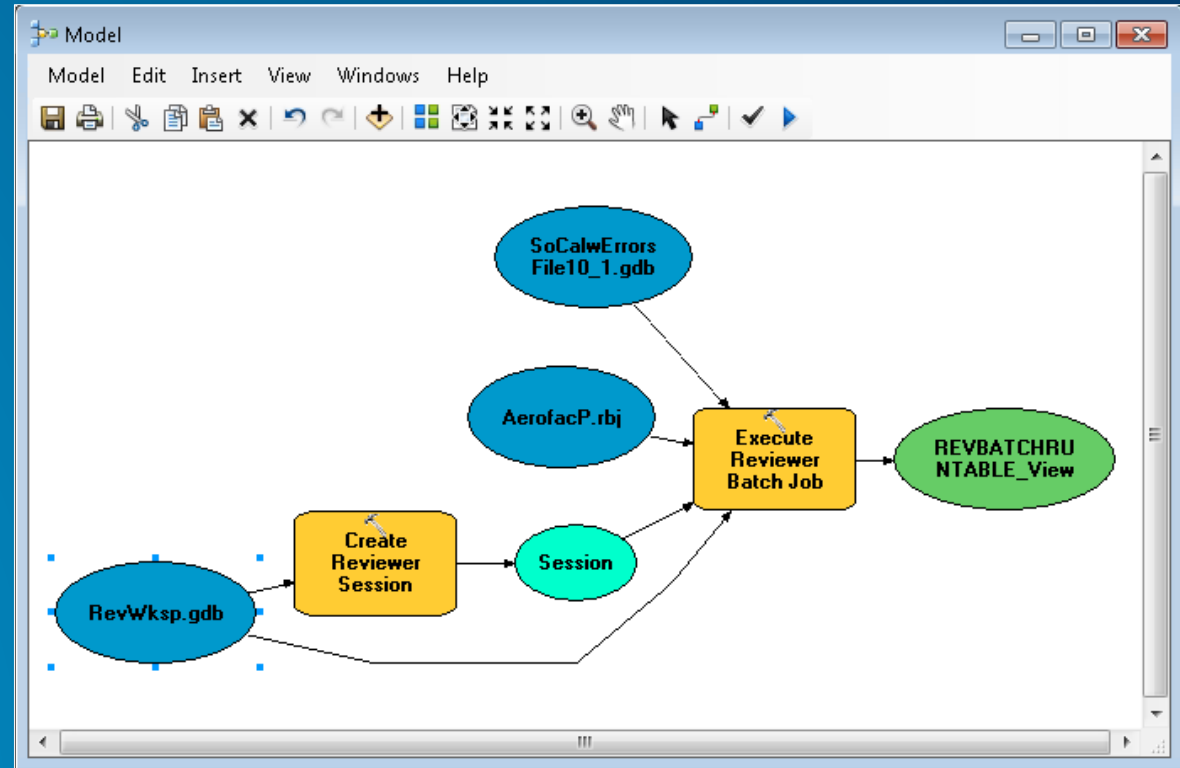
The screenshot displays the ArcMap Data Reviewer interface. The main map shows a network of pipes with several red and yellow review points. A 'Reviewer Batch Job Manager' dialog box is open, listing various checks such as 'Duplicate Geometry Check', 'Execute SQL Check', and 'Valency Check'. The 'Reviewer Table' at the bottom shows a table with columns for RECORDID, OBJECTID, SUBTYPE, REVIEWERCATEGORY, CATEGORY, REVIEWERCODE, SESSIONID, CHECKTITLE, ORIGINCHECK, and NOT. The table contains three rows of data for 'DIAMETER: Invalid domain value' and one row for 'SHAPE_Length < 5'.

RECORDID	OBJECTID	SUBTYPE	REVIEWERCATEGORY	CATEGORY	REVIEWERCODE	SESSIONID	CHECKTITLE	ORIGINCHECK	NOT
519	21		1	Feature Record	202	1	Domain Check	Domain Check	
520	23		1	Feature Record	202	1	Domain Check	Domain Check	
521	24		1	Feature Record	202	1	Domain Check	Domain Check	

Methods for executing data validation

Execute data validation using

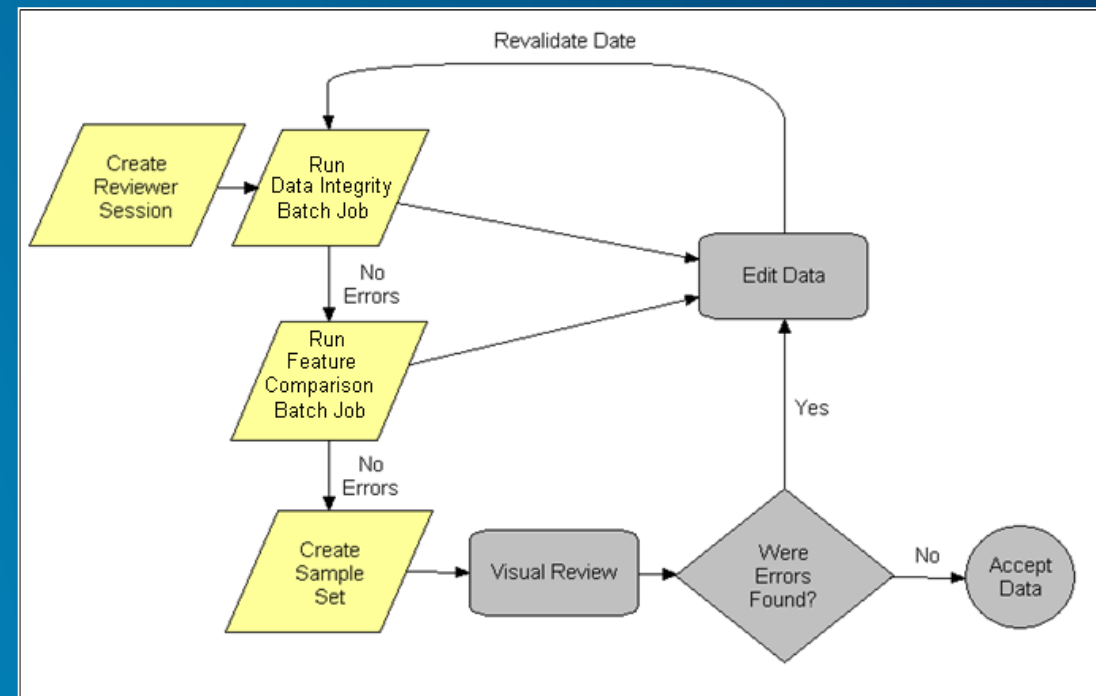
- ArcMap
- Model/Python script



Methods for executing data validation


Execute data validation using

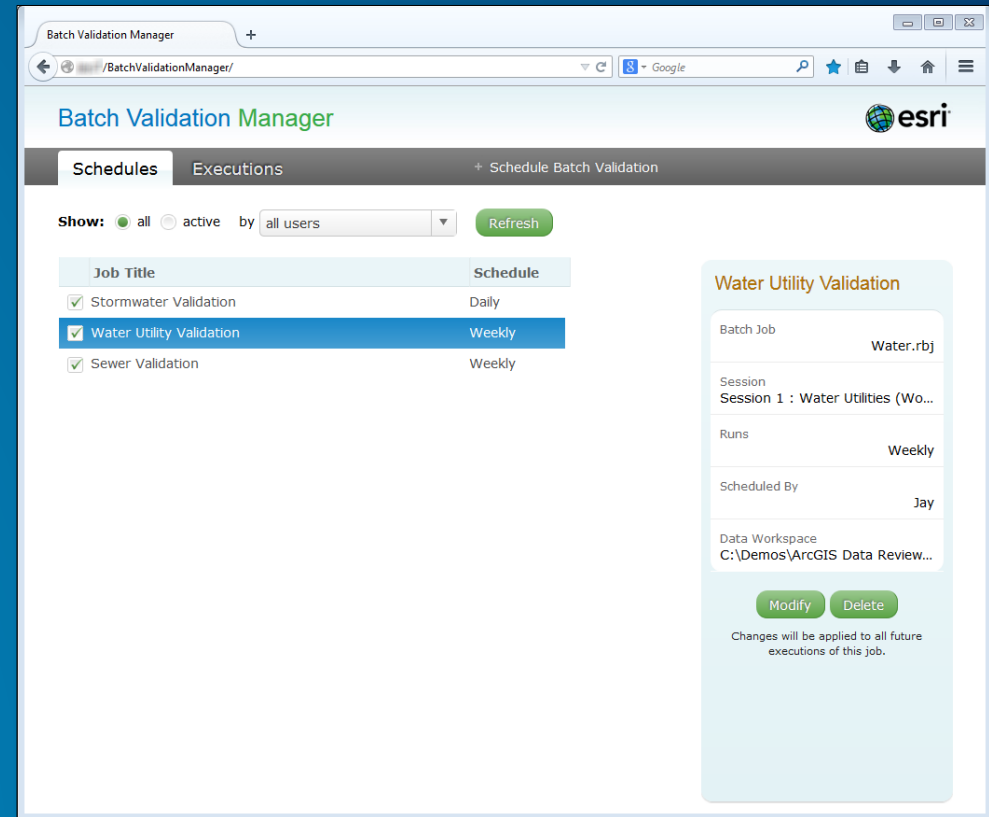
- ArcMap
- Model/Python script
- ArcGIS Workflow Manager



Methods for executing data validation

Execute data validation using

- ArcMap
- Model/Python script
- ArcGIS Workflow Manager
- ArcGIS for Server 



The screenshot shows the ArcGIS Batch Validation Manager web interface. The browser address bar shows the URL /BatchValidationManager/. The page title is "Batch Validation Manager" and the Esri logo is in the top right corner. The interface has two tabs: "Schedules" (selected) and "Executions". A "+ Schedule Batch Validation" link is visible. Below the tabs, there are filters: "Show: all active" (radio buttons), "by all users" (dropdown), and a "Refresh" button. A table lists validation jobs:

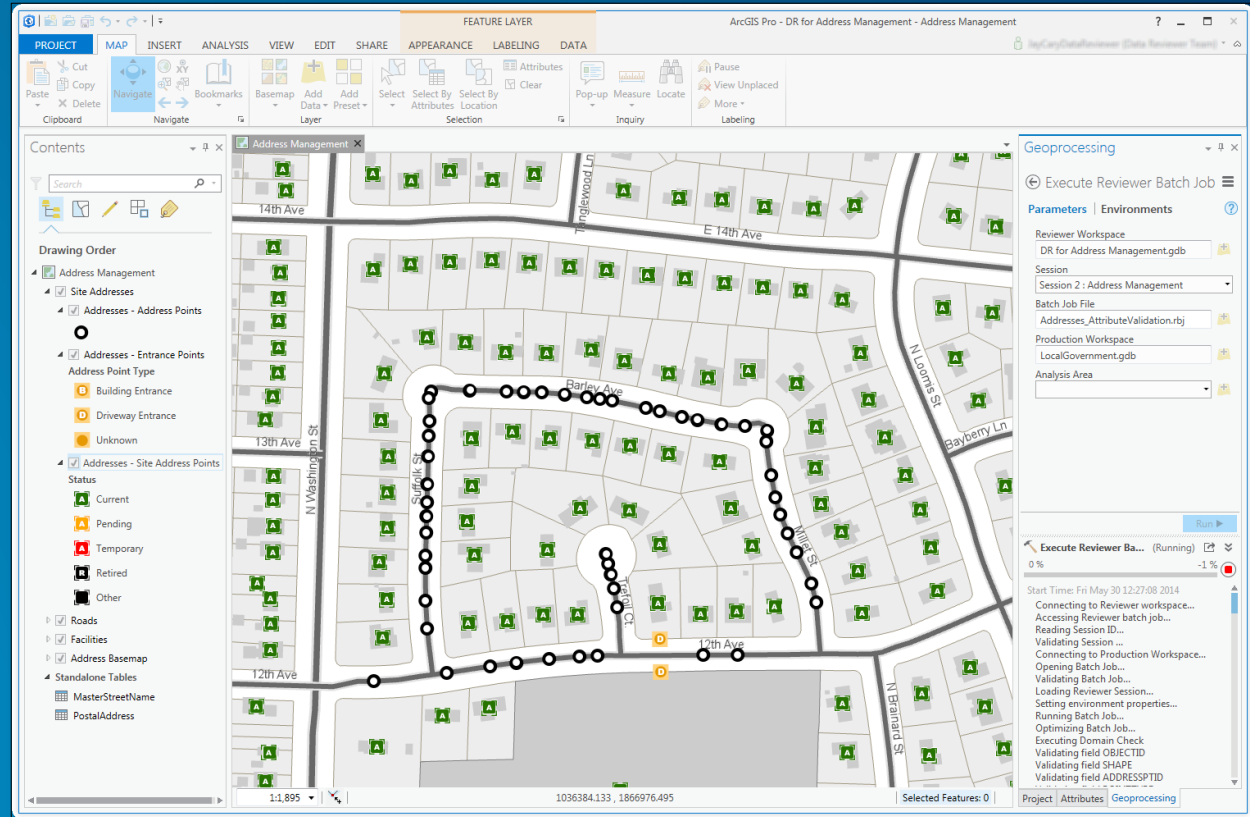
Job Title	Schedule
<input checked="" type="checkbox"/> Stormwater Validation	Daily
<input checked="" type="checkbox"/> Water Utility Validation	Weekly
<input checked="" type="checkbox"/> Sewer Validation	Weekly

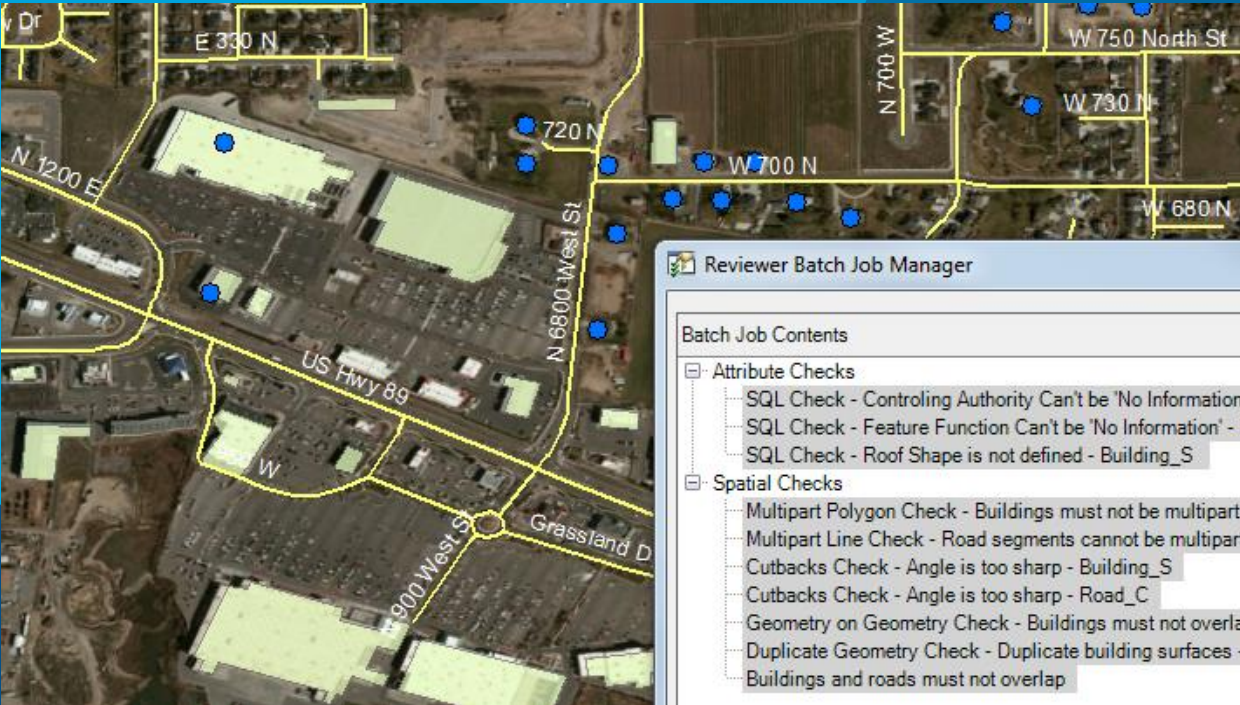
On the right side, a detailed view for "Water Utility Validation" is shown. It includes fields for "Batch Job" (Water.rbj), "Session" (Session 1 : Water Utilities (Wo...)), "Runs" (Weekly), "Scheduled By" (Jay), and "Data Workspace" (C:\Demos\ArcGIS Data Review...). There are "Modify" and "Delete" buttons at the bottom of this panel. A note states: "Changes will be applied to all future executions of this job."

Methods for executing data validation

Execute data validation using

- ArcMap
- Model/Python script
- ArcGIS Workflow Manager
- ArcGIS for Server
- ArcGIS Pro

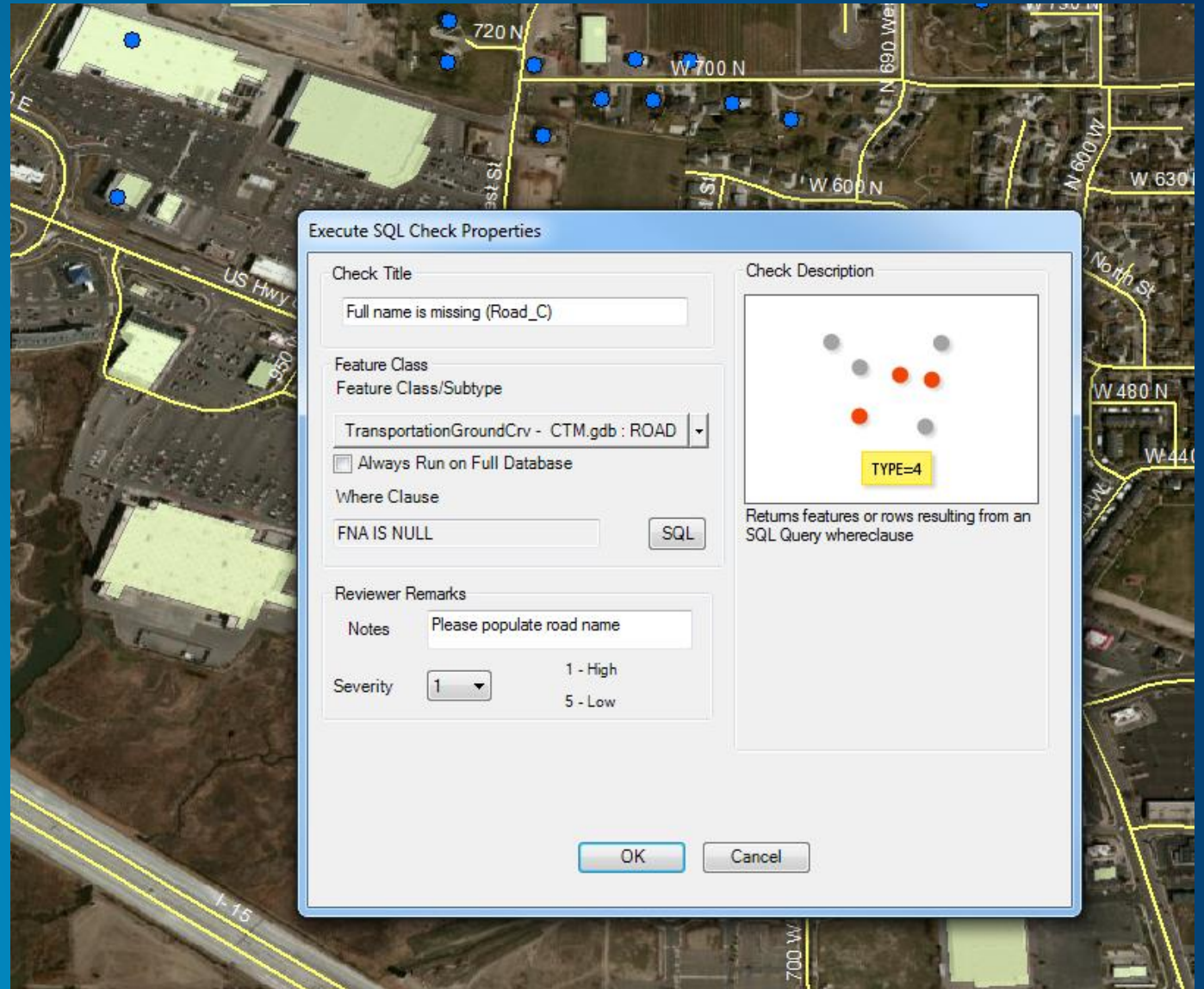




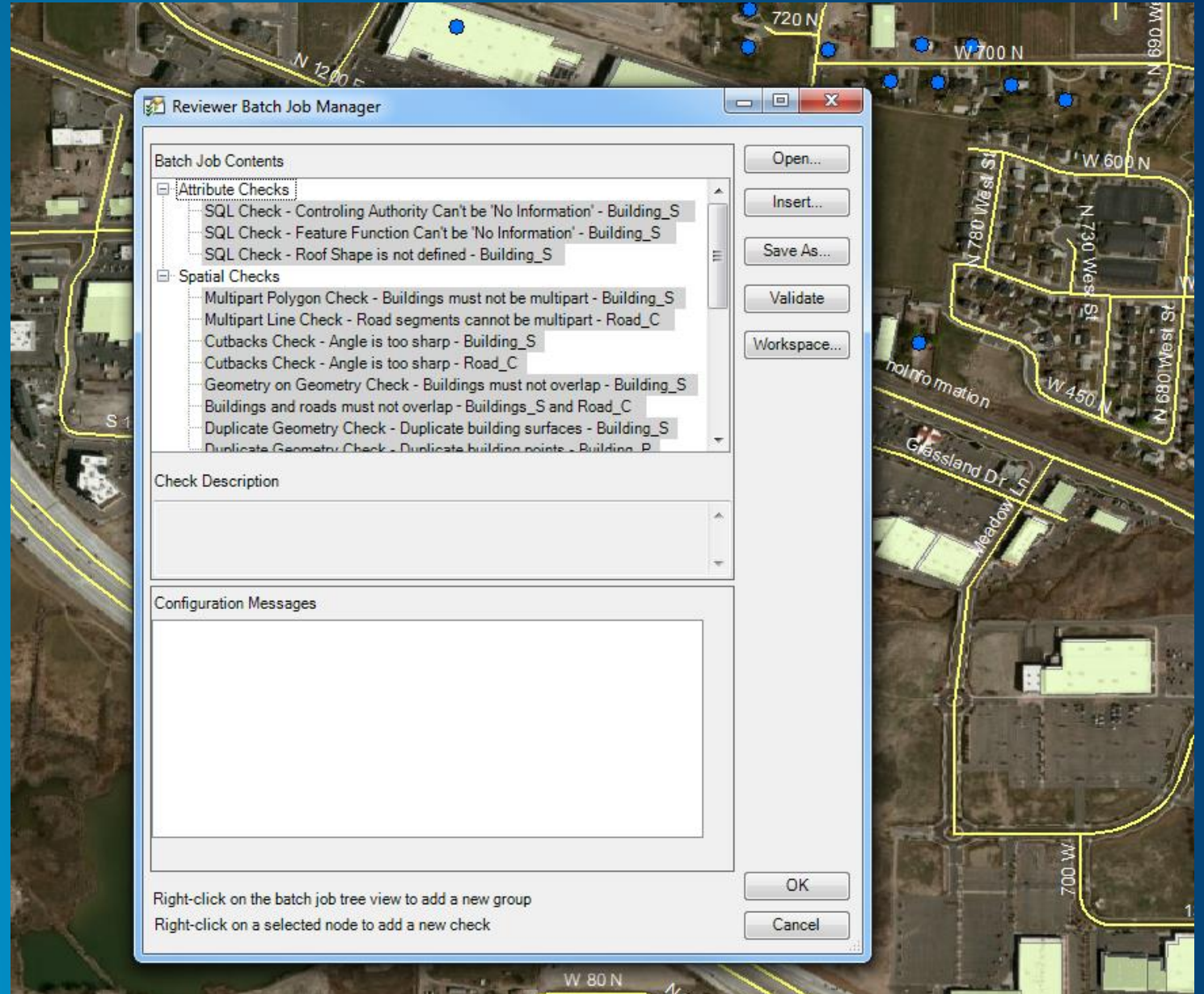
Authoring Data Quality Rules & Executing Batch Jobs

Sherry Fagin

Single Automated Check



Configure a Batch Job



Execute a Batch Job in ArcGIS Pro

The screenshot displays the ArcGIS Pro Geoprocessing interface for the 'Execute Reviewer Batch Job' tool. The tool's parameters are configured as follows:

- Reviewer Workspace:** ReviewerWorkspace.gdb
- Session:** Session 13 : Batch Review
- Batch Job File:** C:\Demo\FedGIS\DataReviewer\CTM_WORL
- Production Workspace:** CTM.gdb
- Analysis Area:** (Empty)

A 'Run' button is visible at the bottom right of the parameter section. Below the parameters, the execution log shows a successful completion of the job:

```
✓ Execute Reviewer Batch Job
Start Time: Wed Feb 11 11:29:50 2015
Connecting to Reviewer workspace...
Accessing Reviewer batch job...
Reading Session ID...
Validating Session ...
Connecting to Production
Workspace...
Opening Batch Job...
Validating Batch Job...
Loading Reviewer Session...
```

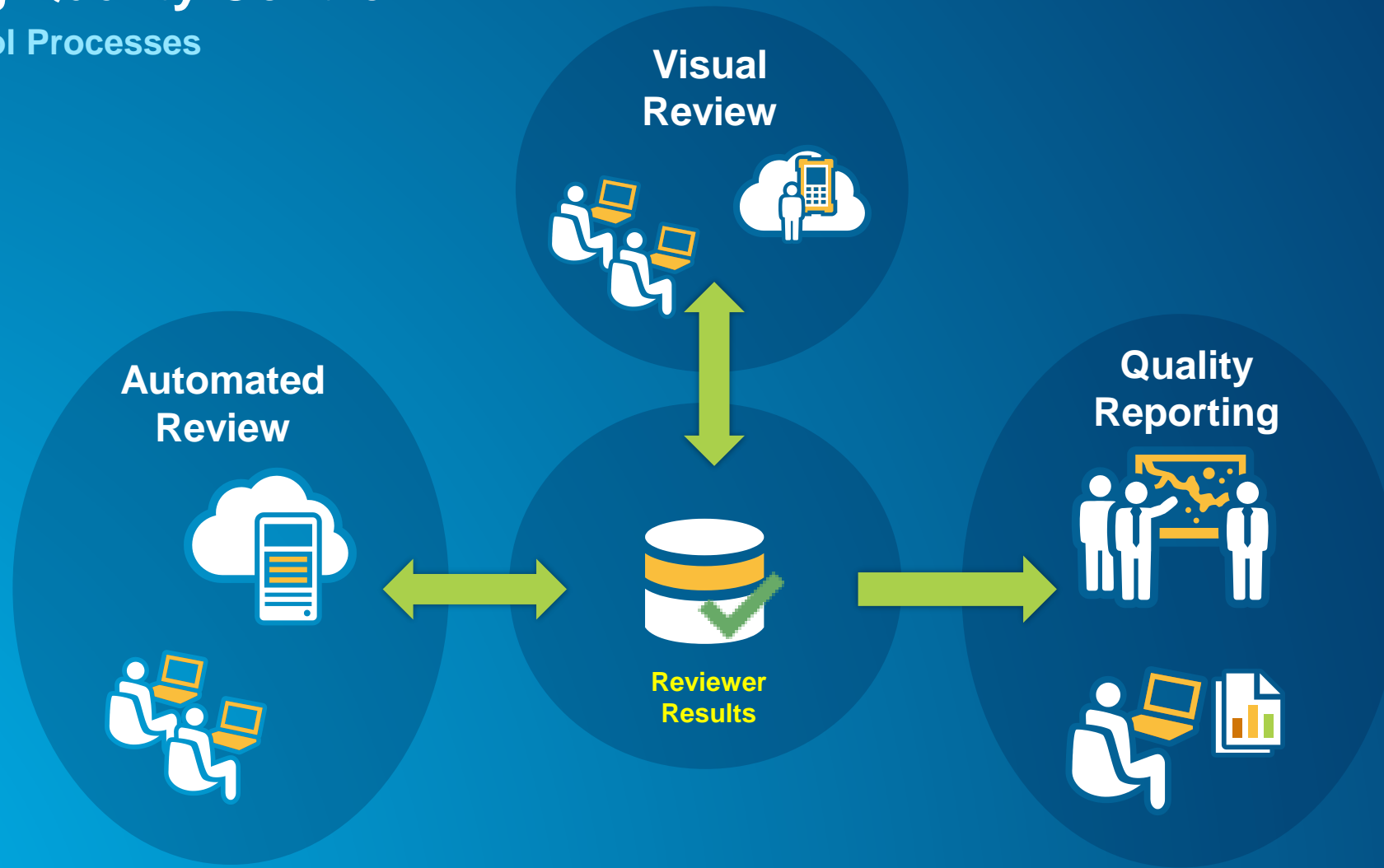


Visual Review

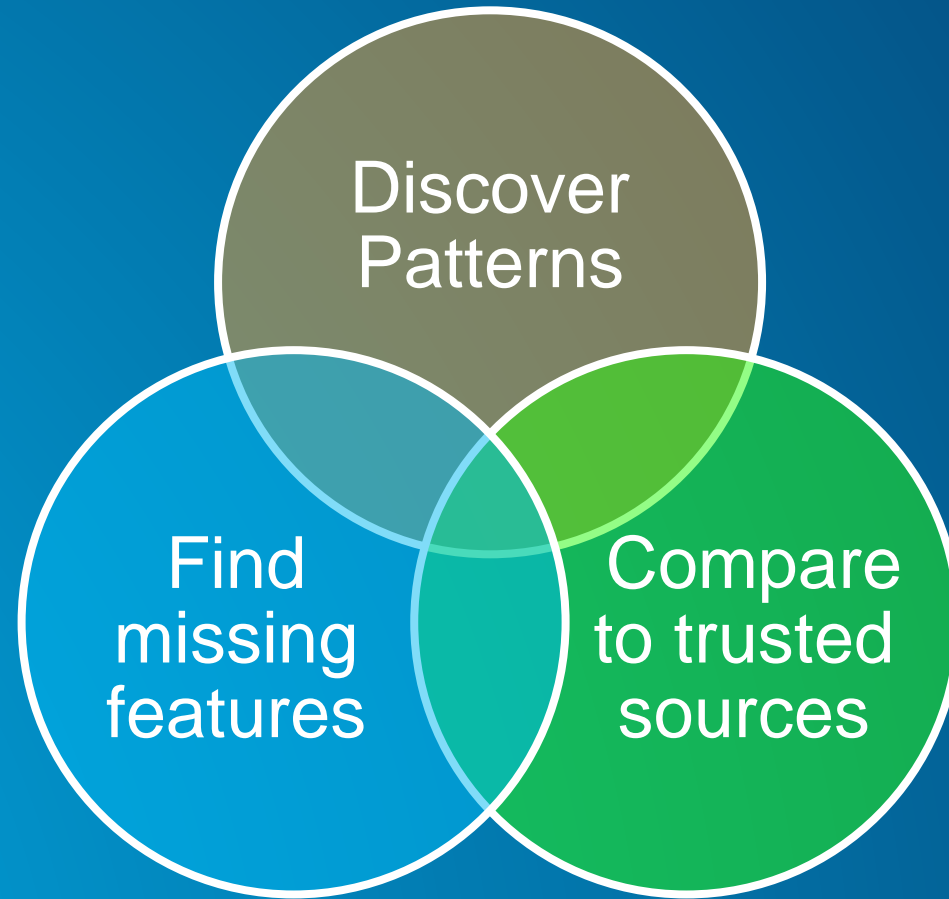
Discovering patterns & missing elements

Managing Quality Control

Quality Control Processes



Value of Performing Visual Review

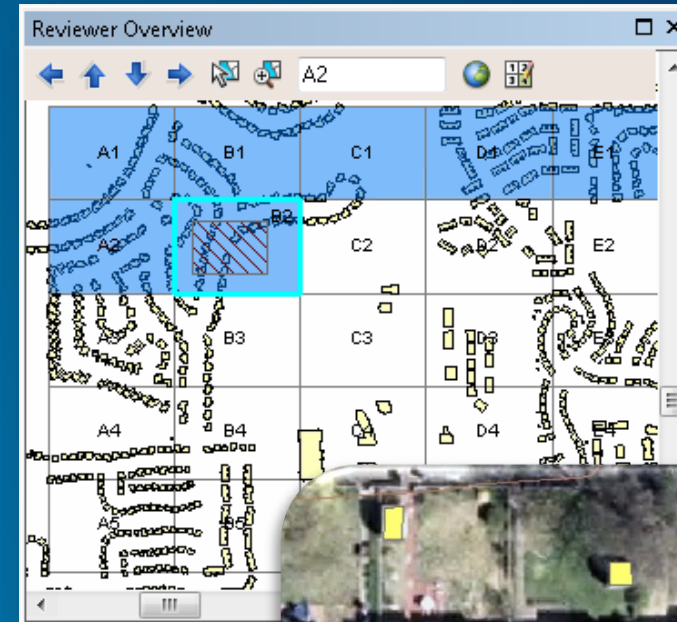


Visual Review

Leveraging ArcGIS for Desktop

Tools supporting

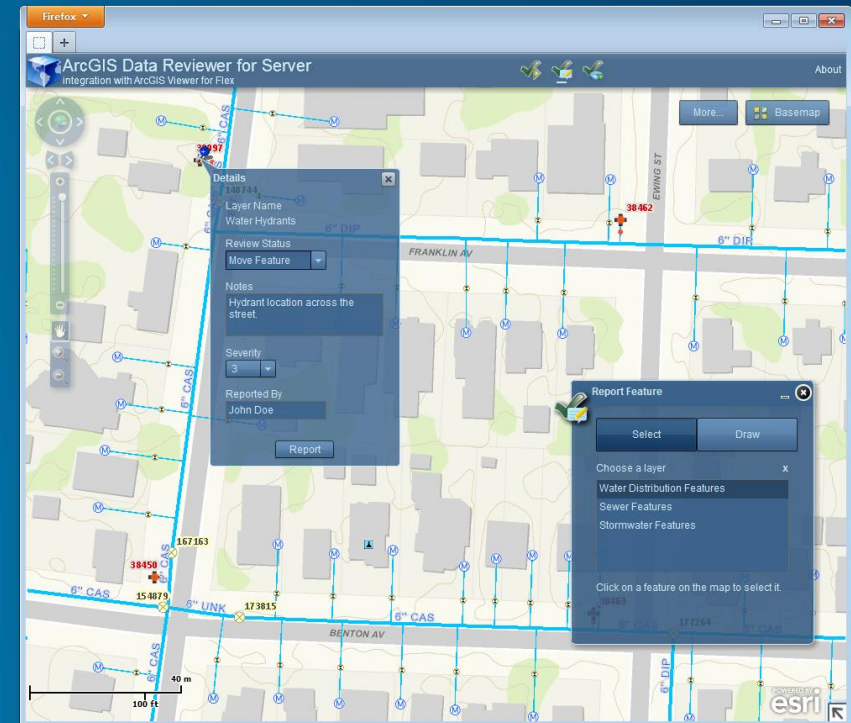
- Selecting/browsing features
- Redlining missing features
- Flagging features in error
- Assessing positional accuracy
- Comparing geodatabase versions
- Generating random samples

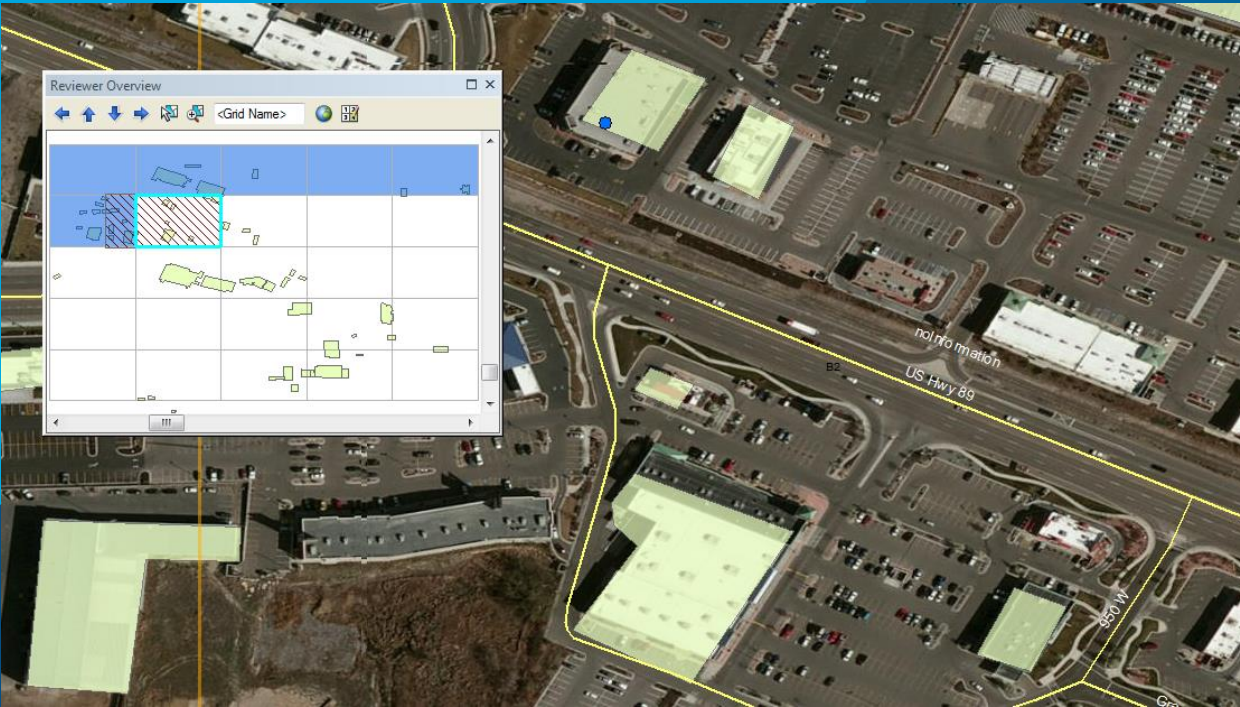


Visual Review

Leveraging ArcGIS for Server

- Extending quality control workflows into other communities
 - QC review across ArcGIS platform
 - Simple to use tools for error identification
 - Manual QC workflow “automation”





Performing Visual Review

Sherry Fagin

Report Feature Widget

Federal Civilian Mapping – QC with Web AppBuilder for ArcGIS

Report Feature [Close]

Select | Draw

Choose a layer: StructureSurfaces

Click on a feature on the map to select it.

Details [Close]

Layer Name
StructureSurfaces

Review Status
Delete Feature

Notes
building demolished

Severity
2

Reported By
SF

Report

The screenshot shows a web application interface for reporting features on a map. The main map area displays an aerial view of a residential area with yellow outlines around buildings. A blue dot is visible on the map. Two dialog boxes are overlaid on the map. The 'Report Feature' dialog box is in the foreground, showing a 'Select' tab and a 'Draw' tab. The 'Select' tab is active, and it contains a dropdown menu for 'StructureSurfaces' and a text input field for 'Reported By' with the value 'SF'. The 'Details' dialog box is in the background, showing the 'Layer Name' as 'StructureSurfaces', the 'Review Status' as 'Delete Feature', the 'Notes' as 'building demolished', and the 'Severity' as '2'. A 'Report' button is located at the bottom of the 'Details' dialog box.

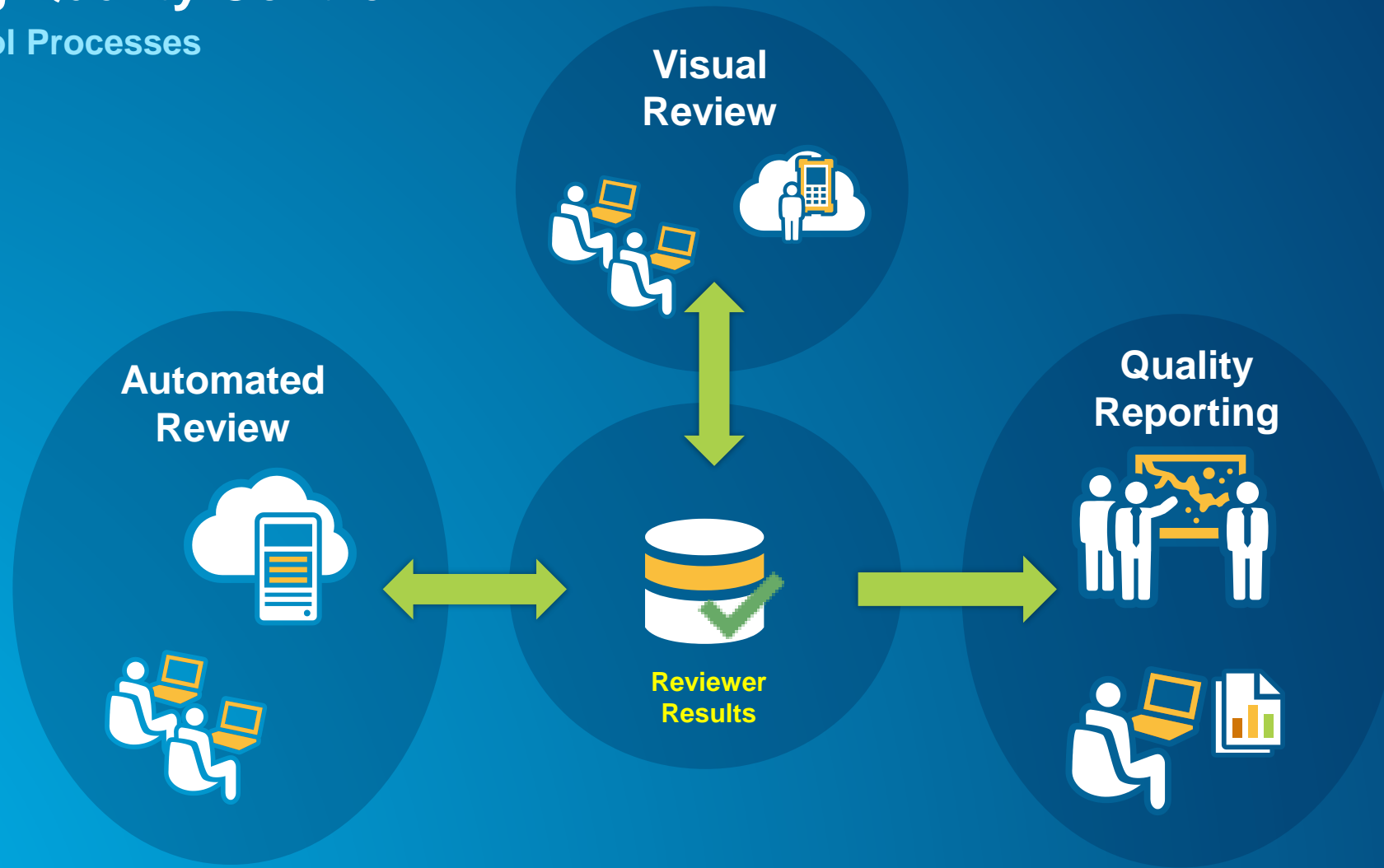


Managing and Reporting Quality Results

Communicating data quality

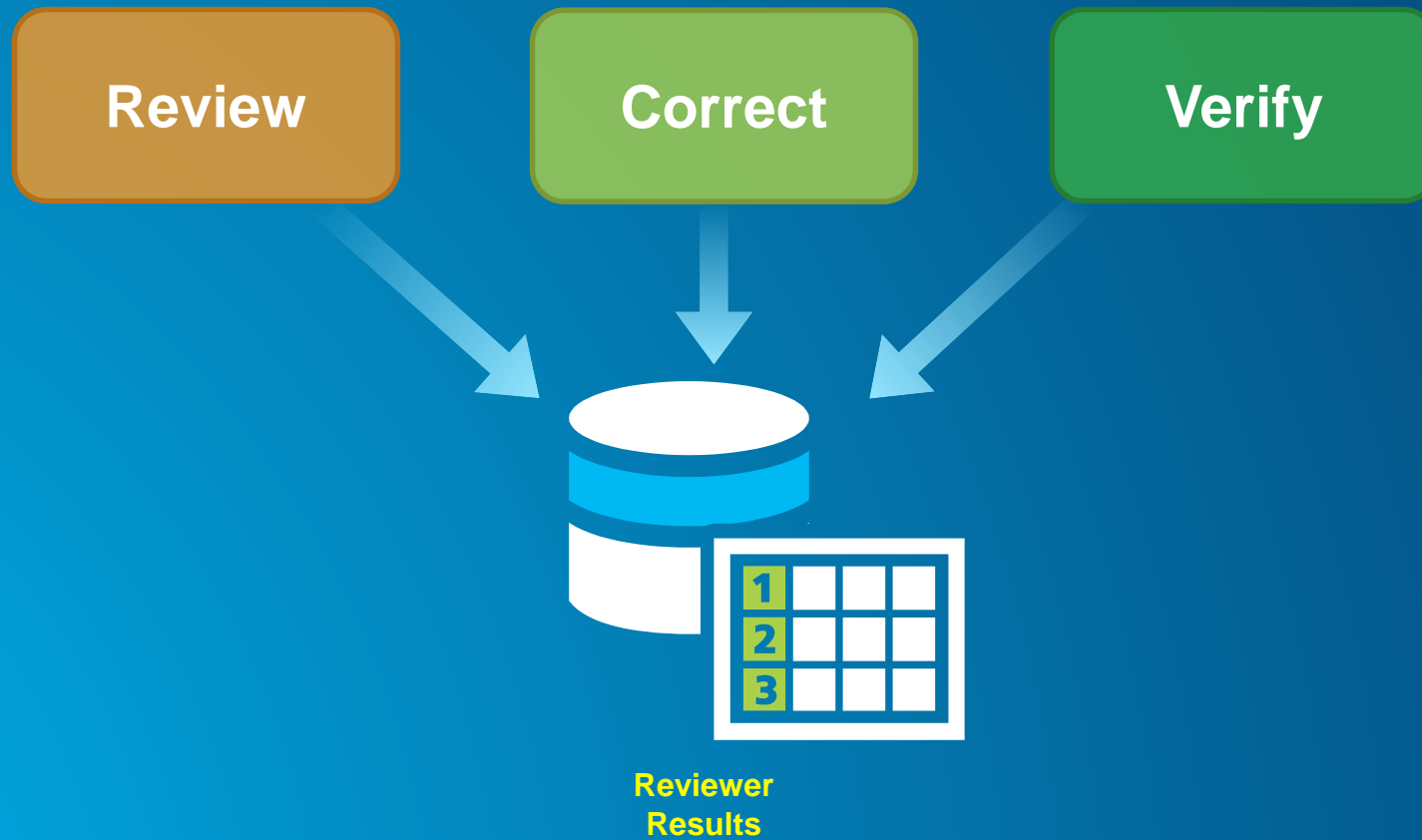
Managing Quality Control

Quality Control Processes



Managing Quality Control

- QC lifecycle management



Data Quality Reporting

ArcGIS for Desktop

- Automated reporting of quality control results
- Available Reports
 - Automated Check (Origin Table, Subtype, Check Group)
 - Total Record Count
 - Sampling

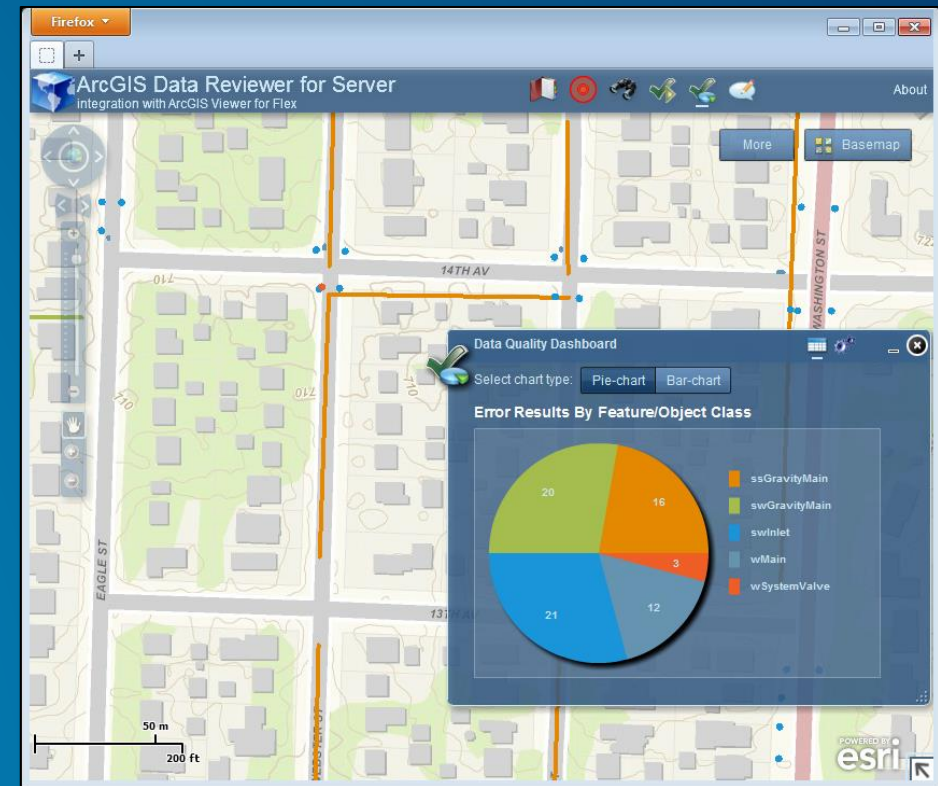
Date/Time	Origin Table	Subtype	Total Records	Confidence Level	Margin of Error	Sampling Number	Acceptable Error Percentage	Acceptable Error	Number of Errors	Pass/Fail	QC Complete
7/4/2010 11:05:59 AM											
	AtlasMap		153	98%	3%	0	2%	0	0	Pass	Yes
						0			0		
	wControlValve		302	98%	3%	9	2%	1	1	Pass	Yes
		AirRelease				2			0		
		BackflowControl				4			0		
		BlowOff				3			1		
	wFitting		297	98%	3%	9	2%	1	2	Fail	Yes
		Reducer				7			0		
		Tap				2			2		
	wLateralLine		18690	98%	3%	544	2%	17	9	Pass	Yes
		Hydrant Lateral				50			0		
		Service Lateral				493			8		
		Service Lateral To Meter				1			1		

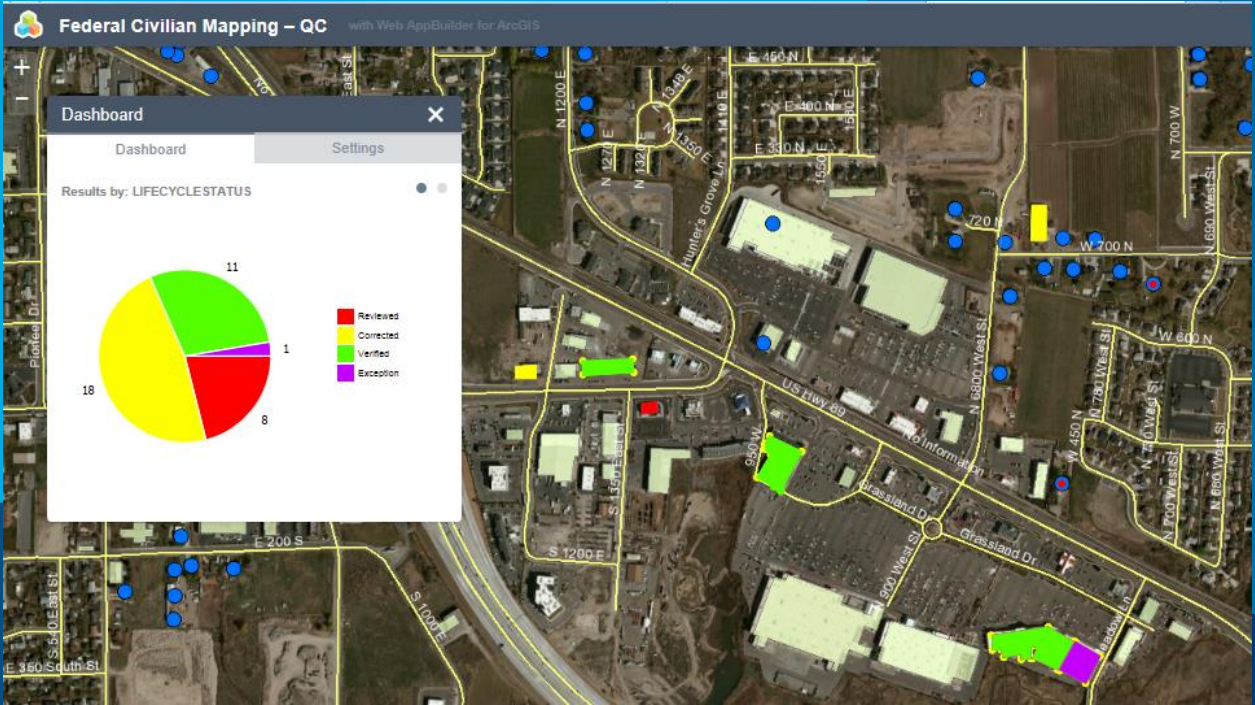
Data Quality Reporting

ArcGIS for Server

Dashboard

- Enabling transparency in data quality
- Better decision making by communicating data quality across stakeholders
- Open quality reporting
- Shared across ArcGIS system
- Tools and methods to communicate quality





Reporting Data Quality

Sherry Fagin

Correct and Verify

Reviewer Table

General

Phase ▾

Phase : (10 items)

Phase : (1 items)

Status	Source	Source Subtype	ID	Check Title	Check Notes	Severity	Description	Created On	Corrected On	Correction Notes	Verified On	Verification Notes
Resolved	StructureSrf	BUILDING_S	830	Geometry on Geometry Check - Buildings must not	Remove overlap	2	Polygon intersects polygon	Monday, February 09, 2015 3:25:28 PM	Wednesday, February 11, 2015 11:33:34 AM	Per Guidance	<Null>	<Null>

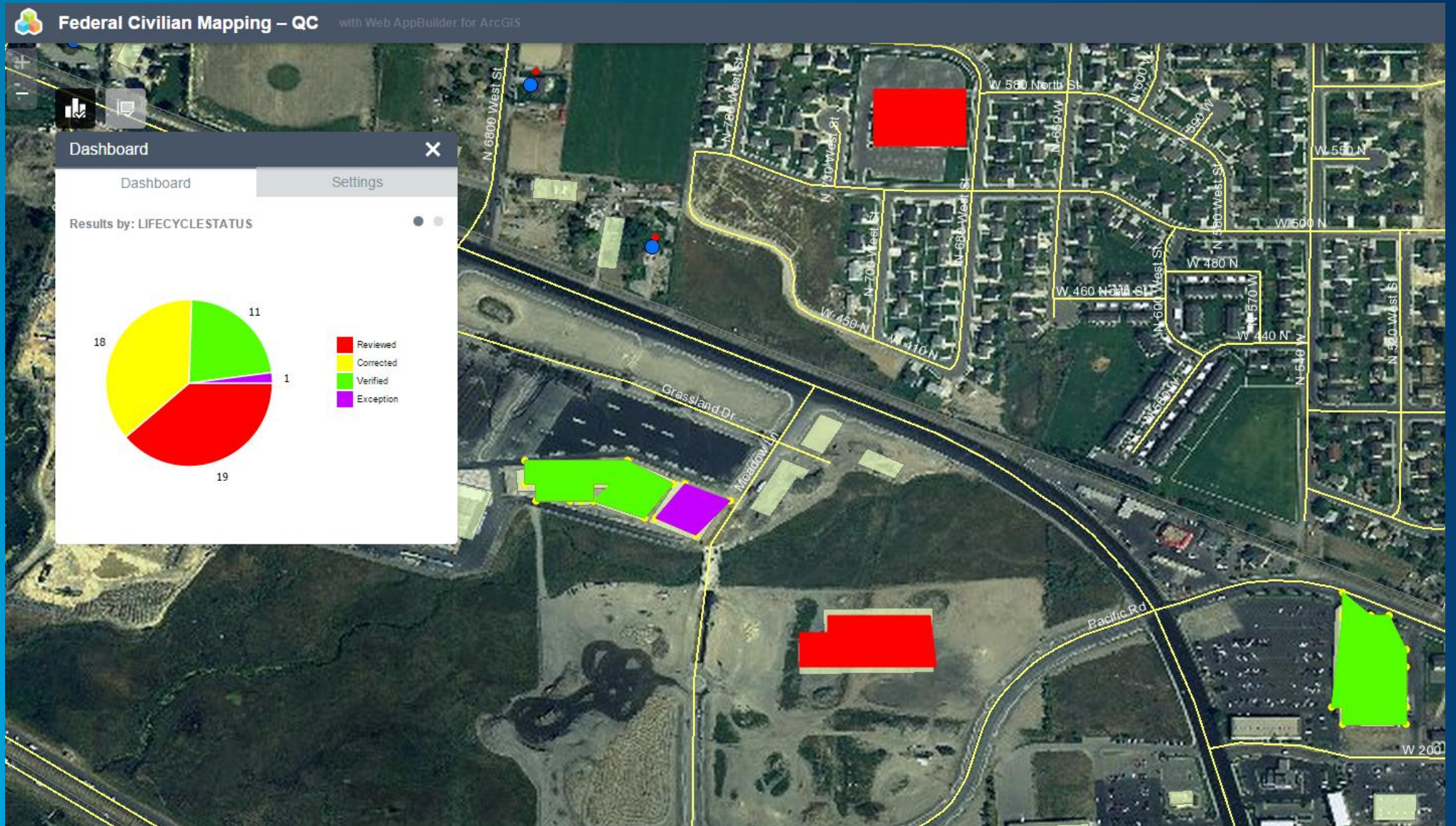
Phase : (1 items)

Status	Source	Source Subtype	ID	Check Title	Check Notes	Severity	Description	Created On	Corrected On	Correction Notes	Verified On	Verification Notes
Acceptable	StructureSrf	BUILDING_S	237	Geometry on Geometry Check - Buildings must not	Remove overlap	2	Polygon intersects polygon	Monday, February 09, 2015 3:25:28 PM	Monday, February 09, 2015 3:37:51 PM	Per Guidance	Monday, February 09, 2015 3:38:22 PM	looks good

Excel Reporting

Automated Check Report By Origin Table										
Report generated on 2/10/2015 7:42 AM										
Reviewer Workspace Location: C:\Demo\FedGIS\Top10\FedGIS_Top10_Final\ReviewerWorkspaceTop10.gdb										
Session(s): Session 8 : QC Tech										
Batch Job Name	Date/Time	Origin Table	Check Type	Check Title	Severity	Records Validated	Total Results	Total Percent Accuracy	Distinct Results	Distinct Percent Accuracy
C:\Users\Documents\CTM_FedGIS_Checks_v1.1.rbj						1455	40	97.25%	24	98.35%
	2/10/2015 12:38:17 PM									
		StructurePnt				60	4	93.33%	4	93.33%
			Duplicate Geometry Check							
				Duplicate Geometry Check - Duplicate building points - Building_P	3	30	4	86.67%		
			Invalid Geometry Check							
				Invalid Geometry Check (StructurePnt)	5	30	0	100.00%		
		StructureSrf				495	36	92.73%	20	95.96%
			Cutbacks Check							
				Cutbacks Check - Angle is too sharp - Building_S	2	55	0	100.00%		
			Duplicate Geometry Check							
				Duplicate Geometry Check - Duplicate building surfaces - Building_S	2	55	8	85.45%		
			Execute SQL Check							
				SQL Check - Controlling Authority Can't be 'No Information' - Building_S	2	55	4	92.73%		
				SQL Check - Feature Function Can't be 'No Information' - Building_S	1	55	1	98.18%		
				SQL Check - Roof Shape is not defined - Building_S	2	55	4	92.73%		

Dashboard Reporting



Case Study

Air Combat Command



Headquarters Air Combat Command

Geospatial Enterprise Data Quality



Richard Olivieri
ACC/A7Z
10 February 2015

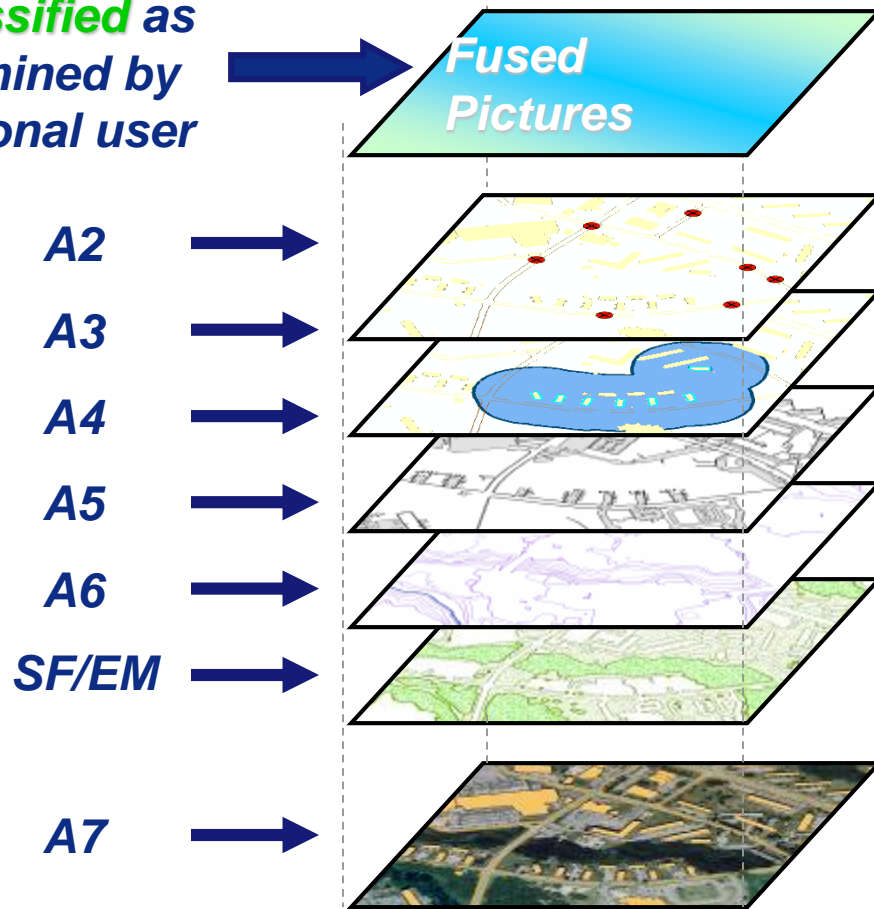
This Briefing is:
UNCLASSIFIED



Common Installation Picture (CIP) and Mission Data Layers (MDL)

Classified or unclassified as determined by functional user

Functional data stewards
MDS
CIP



Functional communities generate fused installation pictures with CIP and select MDL in functional IT solutions

MDL are functionally specific map layers

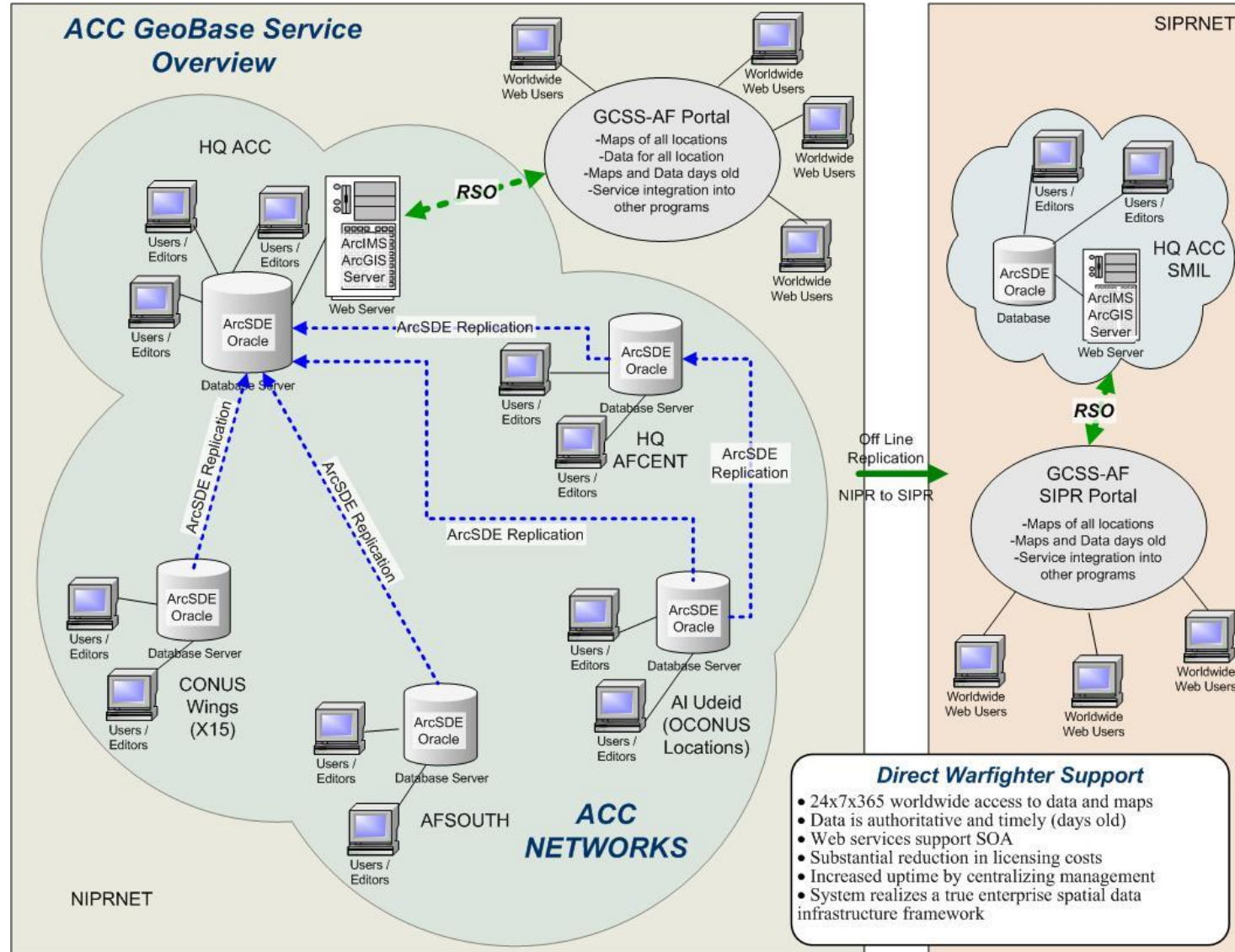
MDL are stored, where possible, with the CIP and are shared on a need-to-know basis as determined by functional data steward

The **CIP** is the common base map

The **CIP** is maintained by CE and shared widely across the base LAN



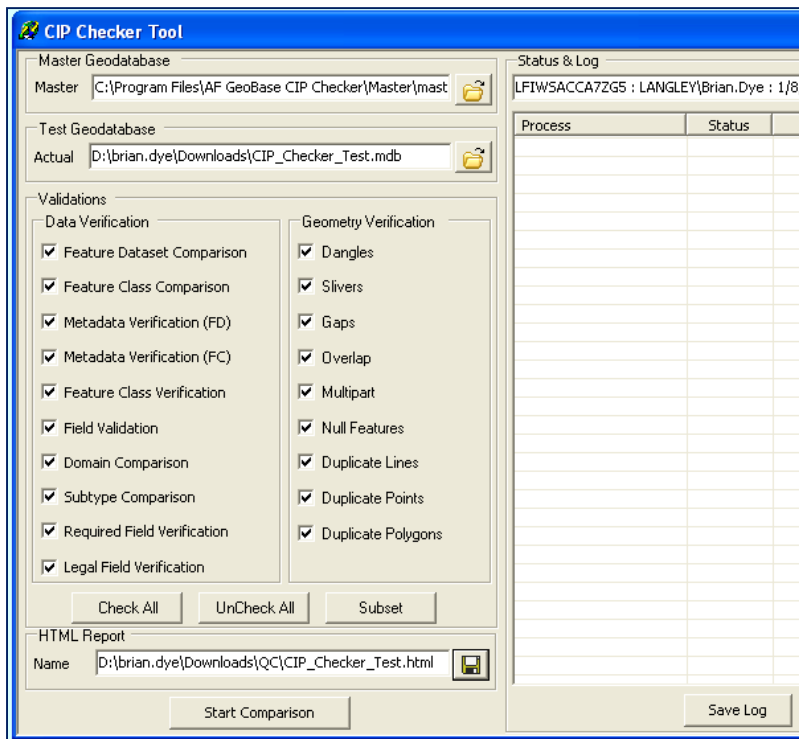
ACC GeoBase Architecture





History

- Lengthy manual process
- We created CIP Checker because Data Reviewer was bundled with PLTS and did not meet requirements
- CIP Checker was great but it became outdated for GeoBase requirements



General Information

Geodatabase Compliance

Test Geodatabase	Compliance
UTHMAN_12NOV07_WGS84_UTM35N_CIP.MDB	97%

Geodatabase Scores Summary

Test Performed	Maximum Score	Achieved Score	Compliance
Feature Dataset Comparison	140	140	100%
Feature Class Comparison	410	410	100%
Metadata Verification (FC)	820	820	100%
Metadata Verification (FD)	260	0	0%
Subtype Comparison	410	410	100%
Field Validation	410	410	100%
Legal Field Verification	820	660	80%
Required Field Verification	900	900	100%
Required Field Percent Complete	6919	6919	100%
Geometry Verification	820	820	100%
Feature Class Verification	410	410	100%

Geodatabase Input/Output Information

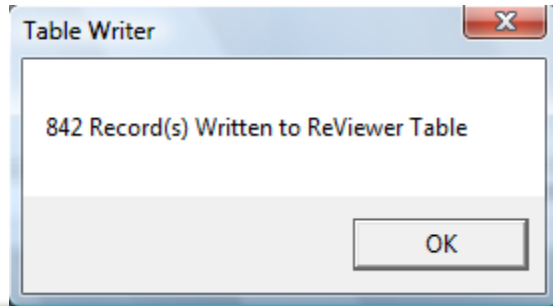
Database	Location
Master	C:\delete\CIP_CHECKER_TEST\Feature_Extraction_CIP_CHECKER.mdb
Testing	C:\ET_Working\Uthman_EG\Vector\uthman_12nov07_wgs84_utm35n_CIP.mdb

Test Geodatabase Description (SR - Spatial Reference)**



Today

- Utilize Data Reviewer for QA/QC.
- Checks run monthly on each base
- Data quality reports online



Automated Check Report By Origin Table

Report generated on 1/14/2015 1:44 PM by 1400195435E
 Reviewer Workspace Location: D:\Users\Lisa.Wilson\Documents\GeoMetrix\HQV_DataReviewer\HQV_GeoMetrix_6_gdb
 Session(s): Session 27 : QSEU_01142015

Batch Job Name	Date/Time	Origin Table	Check Type	Check Title	Records Validated	Total Results	Total Percent Accuracy	Distinct Results	Distinct Percent Accuracy
			Domain Check						
				Domains	0	0	#NUM!		
			Execute SQL Check						
				GeoLoc	0	0	#NUM!		
				INSTL	0	0	#NUM!		
				Owner	0	0	#NUM!		
				RPSUID	0	0	#NUM!		
				SiteID	0	0	#NUM!		
				WAC_INNR	0	0	#NUM!		
			Invalid Geometry Check						
				InvGeom	0	0	#NUM!		
		Bridge			24	2	91.67%	2	91.67%
			Domain Check						
				Domains	2	0	100.00%		
			Execute SQL Check						
				GeoLoc	2	0	100.00%		
				INSTL	2	0	100.00%		
				Lat	2	0	100.00%		
				Lon	2	0	100.00%		
				MGRS	2	0	100.00%		
				Owner	2	0	100.00%		
				RPSUID	2	0	100.00%		
				RPUID	2	2	0.00%		
				SiteID	2	0	100.00%		
				WAC_INNR	2	0	100.00%		
			Invalid Geometry Check						
				InvGeom	2	0	100.00%		
		Building			7716	39	99.49%	24	99.69%
			Domain Check						
				Domains	643	0	100.00%		
			Execute SQL Check						
				GeoLoc	643	8	98.76%		
				INSTL	643	1	99.84%		
				Lat	643	0	100.00%		
				Lon	643	0	100.00%		
				MGRS	643	3	99.53%		
				Owner	643	2	99.69%		
				RPSUID	643	1	99.84%		
				RPUID	643	18	97.20%		
				SiteID	643	3	99.53%		
				WAC_INNR	643	3	99.53%		
			Invalid Geometry Check						
				InvGeom	643	0	100.00%		

Automated Check Report By Origin Table

Report generated on 1/14/2015 1:38 PM by 1400195435E
 Location: D:\Users\Lisa.Wilson\Documents\GeoMetrix\HQV_DataReviewer\HQV_GeoMetrix_6_gdb
 Session(s): Session 26 : MUHJ_01142015

Check Type	Check Title	Records Validated	Total Results	Total Percent Accuracy	Distinct Results	Distinct Percent Accuracy
	InvGeom	17	0	100.00%		
		4608	3615	21.55%	512	88.89%
Domain Check						
	Domains	512	0	100.00%		
Execute SQL Check						
	GeoLoc	512	512	0.00%		
	INSTL	512	512	0.00%		
	Owner	512	512	0.00%		
	RPSUID	512	512	0.00%		
	SiteID	512	512	0.00%		
	TBD	512	512	0.00%		
	WAC_INNR	512	512	0.00%		
Invalid Geometry Check						
	InvGeom	512	31	93.95%		
Domain Check						
	Domains	1700	530	68.82%	170	90.00%
Execute SQL Check						
	Domains	170	0	100.00%		
Execute SQL Check						
	GeoLoc	170	170	0.00%		
	INSTL	170	4	97.65%		
	Owner	170	4	97.65%		
	RPSUID	170	4	97.65%		
	RPUID	170	170	0.00%		
	SiteID	170	4	97.65%		
	TBD	170	170	0.00%		
	WAC_INNR	170	4	97.65%		
Invalid Geometry Check						
	InvGeom	170	0	100.00%		
Domain Check						
	Domains	36	12	66.67%	3	91.67%
Execute SQL Check						
	Domains	3	0	100.00%		
Execute SQL Check						
	A_UOM	3	0	100.00%		
	GeoLoc	3	3	0.00%		
	INSTL	3	0	100.00%		
	Lat	3	3	0.00%		
	Lon	3	3	0.00%		
	MGRS	3	3	0.00%		
	Owner	3	0	100.00%		
	RPSUID	3	0	100.00%		



GIS Data ReViewer

- **Key Checks to use on all Feature Classes in your Database:**
 - **Invalid Geometry**
 - **Duplicate Geometry**
 - **Domain**
 - **Polygon Overlap (for obvious features like buildings and parking lots)**





Mission Impact

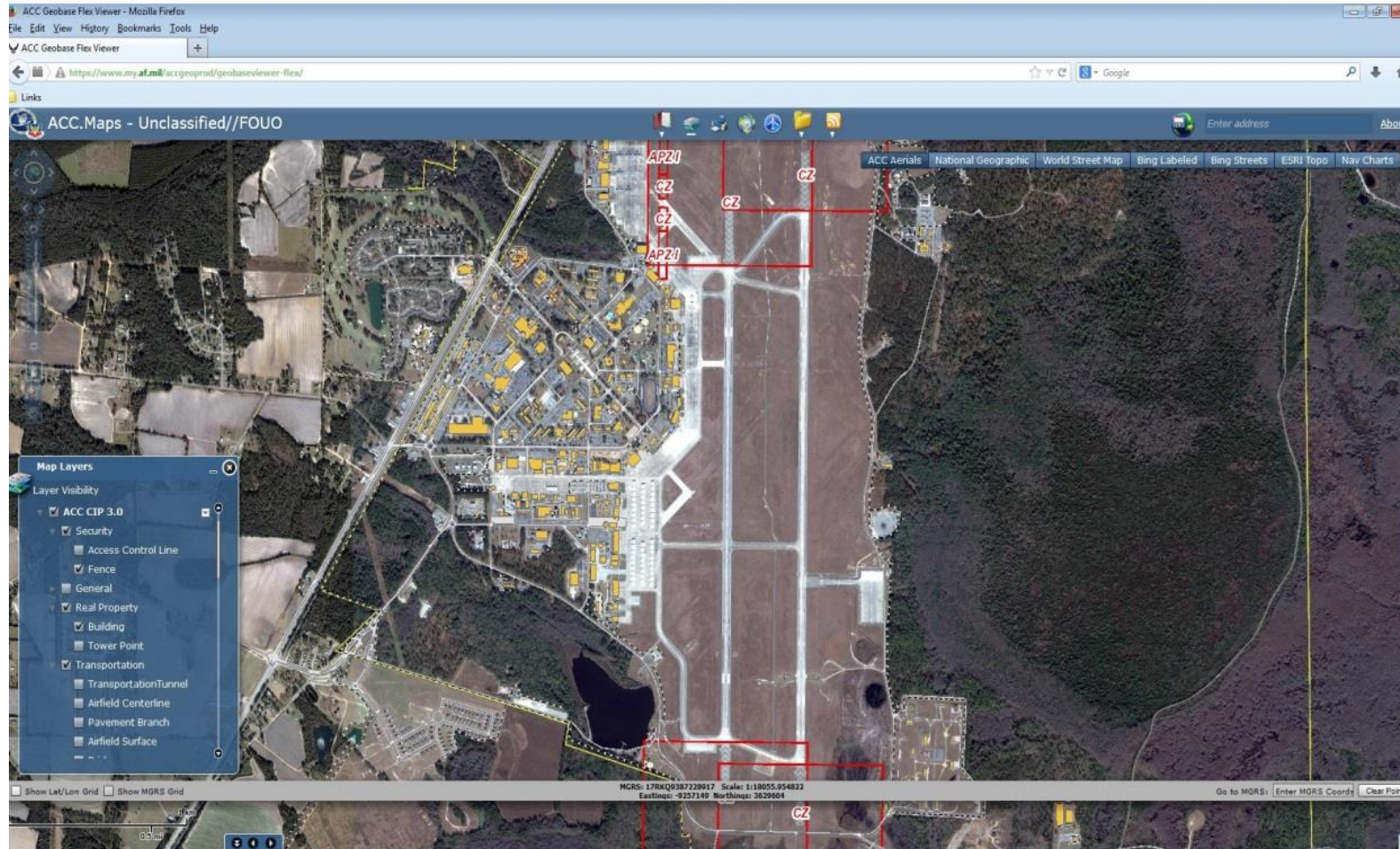
- Improve quality of (and trust in) data
- Helps other Air Force programs capitalize on the data
- Reduce manpower required to manage the data
- Improve utilization of webtools
- Standard schema CRUCIAL for Enterprise GIS





Mission Impact Examples

Web Map Viewer and Services





Mission Impact Examples

Expeditionary Airfield Management and Planning Tool

The screenshot displays the Air Force ExAMP (Expeditionary Airfield Management and Planning) web application interface. The main map shows an aerial view of an airfield with various data layers overlaid, including airfield violations, obstructions, and infrastructure. The interface includes a navigation menu at the top with options like Home, Tools, Bookmarks, Map Manager, Export, and Share. A search bar and a dropdown menu for 'Installations' are located in the top right corner. The left sidebar contains a 'Map Layers' panel with a tree view of data layers, including 'Temporary Markup', 'ExAMP', 'AOT', 'CIP Data', 'NGA Data TERPs Obstructions', 'Airfield Data', and 'AirfieldSurfaceArea-Runway'. The current Area of Interest (AOI) is set to 'Bagram'. The bottom of the map shows a scale bar (0 to 0.4 miles) and coordinate information: 'Decimal Degrees - Lon (X): 69.24628 Lat (Y): 34.95834'.



Visualizing Data Reviewer Results

Mike Cannon

USAF ACC GeoBase



Data Reviewer

ESRI Data Reviewer Reports

- Used to perform Quality Checks against Geo-Spatial data
- Determine valid and invalid geometries
- Batch multiple checks
- Users can create custom attribution checks
 - Checks based on defined standards
- Provides detail information on Data

Automated Check Report By Origin Table

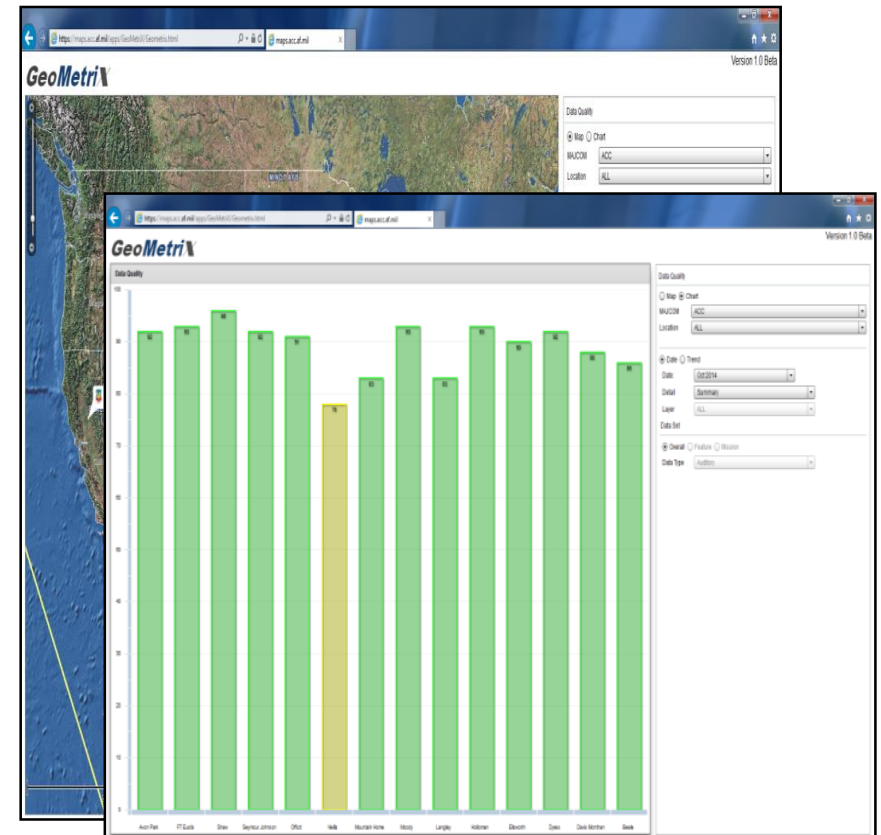
Report generated on 10/20/2014 1:09 PM by 1400195435E
Reviewer Workspace Location: D:\Users\Lisa.Wilson\Documents\GeoMetrix\HQV_DataReviewer\HQV_GeoMetrix.gdb
Session(s): Session 48 : BAEY_10202014

Batch Job Name	Date/Time	Origin Table	Check Type	Check Title	Records Validated	Total Results	Total Percent Accuracy	Distinct Results	Distinct Percent Accuracy
D:\Users\Lisa.Wilson\Documents\GeoMetrix\Batch_Checks_3_9\CIP_Metrics Batch Files\CIP_Chr	10/20/2014 3:31:25 PM	GIO AccessControl_L	Domain Check		303322	45377	85.04%	31554	89.60%
			Domain Check		3170	633	80.03%	317	90.00%
			Execute SQL Check						
			GeoLoc		317	0	100.00%		
			INSTL		317	0	100.00%		
			Owner		317	0	100.00%		
			RPSUID		317	0	100.00%		
			RPUID		317	317	0.00%		
			SiteID		317	0	100.00%		
			TBD		317	316	0.32%		
			WAC_INNR		317	0	100.00%		
			Invalid Geometry Check						
			InGeom		317	0	100.00%		
			GIO AirfieldSurface		276	100	63.77%	23	91.67%
			Domain Check						
			Domain Check		23	0	100.00%		
			Execute SQL Check						
			GeoLoc		23	23	0.00%		
			INSTL		23	0	100.00%		
			Lat		23	23	0.00%		
			Lon		23	23	0.00%		
			MGRS		23	23	0.00%		
			Owner		23	0	100.00%		
			RPSUID		23	0	100.00%		
			RPUID		23	8	65.22%		
			SiteID		23	0	100.00%		
			WAC_INNR		23	0	100.00%		
			Invalid Geometry Check						
			InGeom		23	0	100.00%		



GeoMetriX – Measure, Analyze, Act

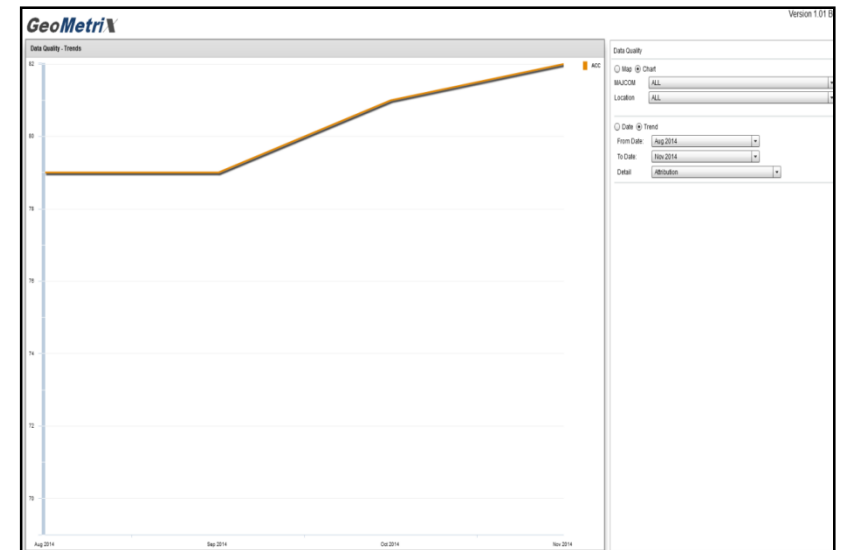
- **GeoMetriX takes generated reports from ESRI Data Reviewer Reports and provides a visual interface that provides a summarized view of Data Quality.**
 - Visualize Data Reviewer reports
 - High level view of data quality
 - MAJCOM Summary
 - Base/Wing Summary
 - Drill down details
 - Geometry, Attribution, Domain and Custom Checks
 - View Trends over time
 - Promotes awareness of data quality
 - Helps identify areas for improvement





The Results – Data Quality Improves

- **Since GeoMetriX has been implemented at USAF ACC GeoBase data quality has improved.**
 - **Streamline processing of Data Reviewer Results**
 - **Better visualization and transparent reporting**
 - **Clear Definition on what needs to be improved/corrected**
 - **Leadership at both Wing and MAJCOM can see the same picture**





GeoMetriX Demo

Demo



Questions?

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Michael Cannon

ACC Geospatial Information Office

ACC/A7ZG

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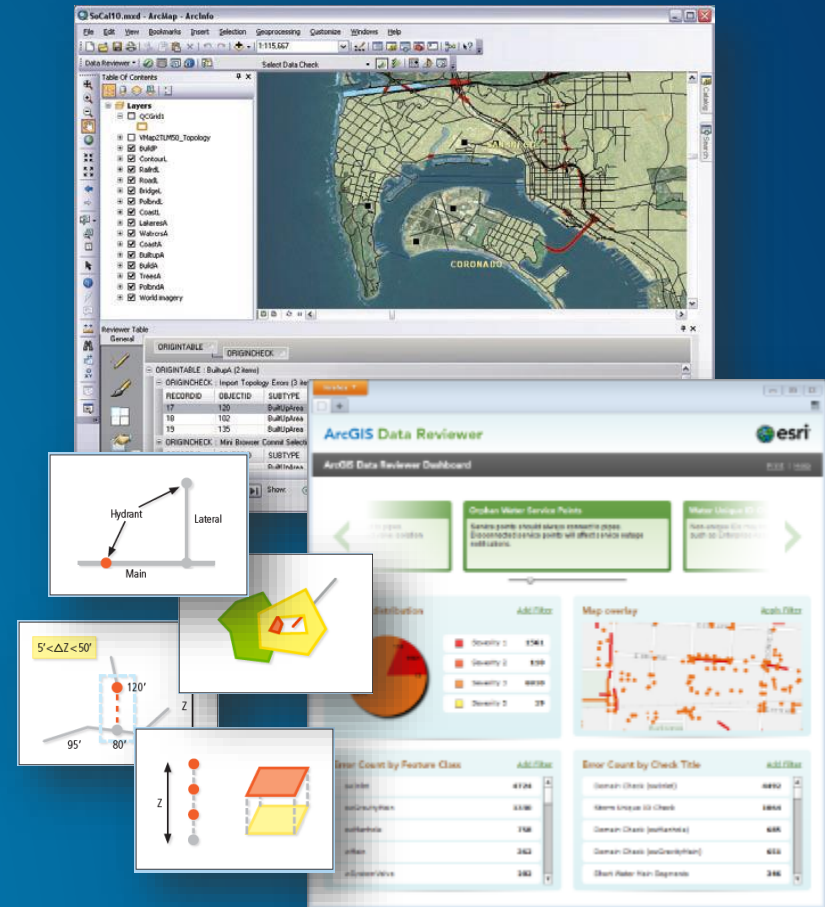
Michael.Cannon.11.ctr@us.af.mil

DSN 574-4184

Comm 757-764-4184

Workshop Review

- Importance of data quality
- Components of data quality
- Forms of data quality control
 - Automated review
 - Visual/Manual review
- ArcGIS Data Reviewer
 - Automated validation
 - Visual QC tools
 - Reporting
 - Error lifecycle management



Resources

Product page

- <http://www.esri.com/software/arcgis/extensions/arcgis-data-reviewer>

Resource Center

- <http://resources.arcgis.com/en/communities/data-reviewer/>

Training

- www.esri.com/training

Questions & comments

- datareviewer@esri.com

The screenshot shows the ArcGIS Resources website for Data Reviewer. The page features a navigation bar with links for Home, Communities, Help, Blog, Forums, and Videos. A search bar is located on the right side of the navigation bar. The main content area is titled "Data Reviewer" and includes a "Communities" section with a description: "Automate, simplify, and improve data quality control management across multiple platforms - desktop, server, mobile, and online." Below this is a "Visual Review" section with a description: "Data Reviewer enables the systematic assessment of your data and provides a number of tools such as creating a sample set and recording missing features to efficiently perform visual review." A "Read more..." link is provided. To the right of the "Visual Review" section is a "Quick Links" section with sub-sections for Desktop (Install guide, Help: 10.3 | 10.2 | 10.1 | 10 | 9.3 | 9.3), Server (Concepts | Install guide), and Server APIs (Flex | JavaScript | REST | Download). Below the "Quick Links" section is a "Resources" section with links for Data Reviewer Checks poster, Forum | Blog | White papers, Support, Training, and Ideas. At the bottom of the page is a "Gallery" section with a "More Gallery posts" link. The gallery contains five thumbnails: "Data Reviewer for Tax Parcels", "Data Reviewer for Basemaps", "Data Reviewer for Addresses", "Data Reviewer for Water Utilities", and "Data Reviewer for ArcGIS Pro Tutorial".

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