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Milwaukee Metropolitan Sewerage District realizes the Benefits of Digital Twins

August 24, 2021

Introduction



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About MMSD

Regional government agency that provides water reclamation and flood management services for 1.1 million people in 28 communities in the Greater Milwaukee Area.

2 Water Reclamation Facilities locations

300+ Buildings & Structures

17,000+ Assets



Background

MMSD has traditionally used 2D drawings and technology for design, construction, and building management. Information was inconsistent, siloed, and difficult to access.

Current Problems

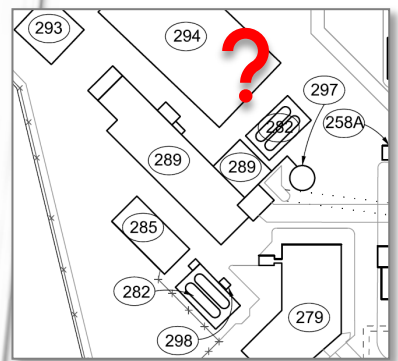
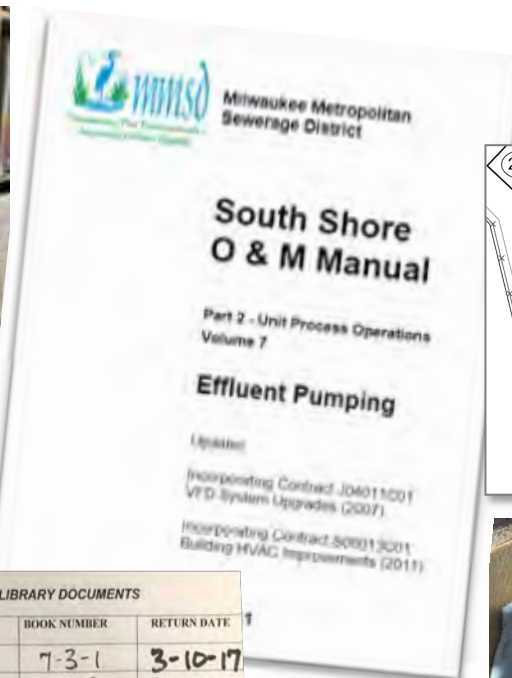
all systems

→ design phase, utility data consolidated starting @ planning phase

low need an overview of plant and which projects have occurred and were - background info (Rich Skocel)

- accessible, visual, usable,
- consolidation of drawings - master sets
- O&M (non-Capital) efforts that aren't documented
- technical manuals, specs, O&M manuals, Design - ^{electronic} document mgmt
- lacking detail & direction of CAD Standards
- ★ construction project close-out - accountability
- ★ Veolia - access to drawings - change & Sharepoint
- info sh be available - no + dependence on PEOPLE
- contractors - accuracy, completeness of drawings

All MS - unique IDs for all assets @ an early stage



SIGN OUT SHEET FOR LIBRARY DOCUMENTS

REMOVAL DATE	NAME	BOOK NUMBER	RETURN DATE
3-1-17	David Ennis	7-3-1	3-10-17
1-16-18	David Ennis	1999	1-25-18
5-23-18	Rick Mayer	557611.611112 Vol 5	
7-9-18	David Ennis	34-2	8-2-18
9-11-18	David Ennis	34-1	
7-2-20-18	Jim Ausprang	1692	
5-2-19	Ken Wojanowski	1797	
5-9-19	Blain Lopez	1653	5-9-19





BIM Vision Development

Building Information Modeling definition:

Digital, information-rich, 3D representation of a facility

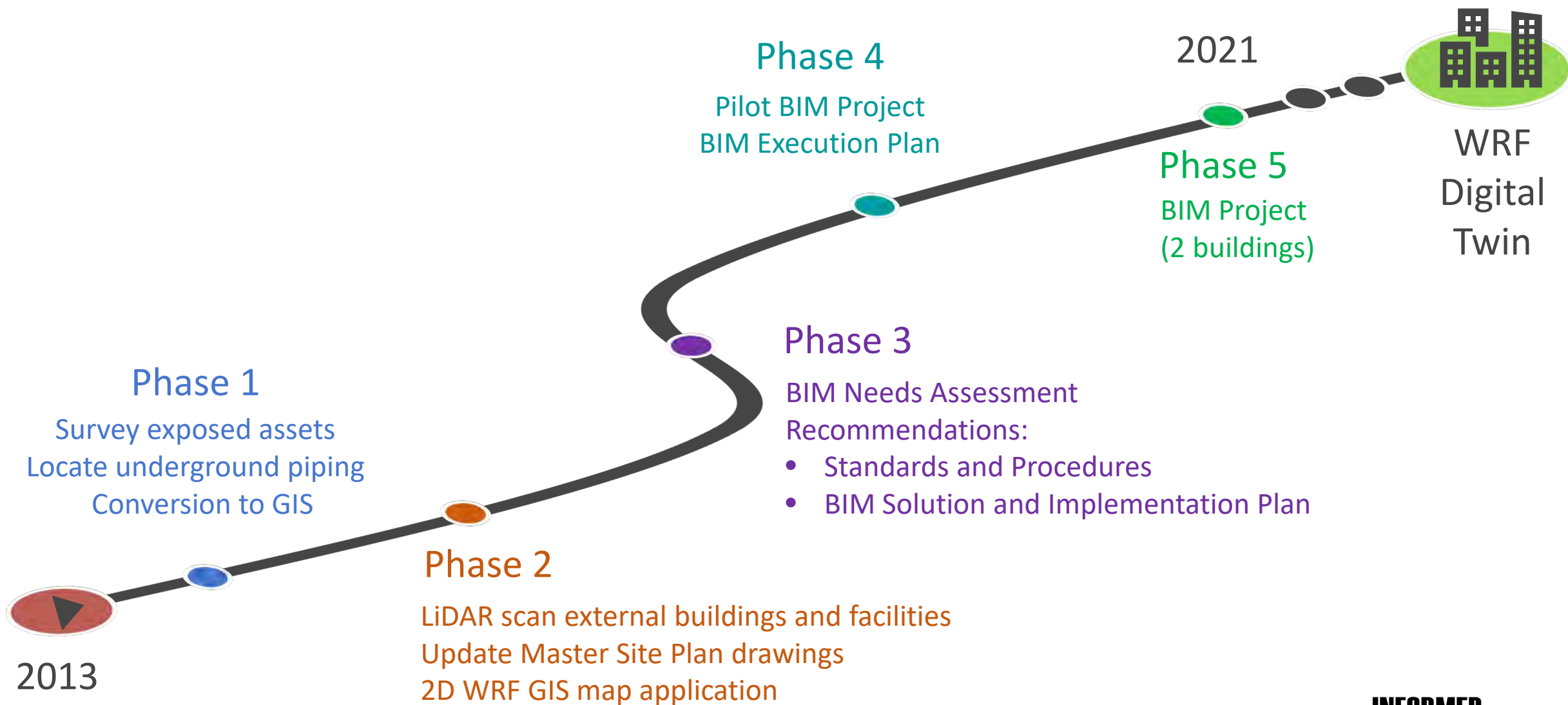
BIM ≠ SOFTWARE

Create a scalable and maintainable solution for sharing data that integrates with other systems

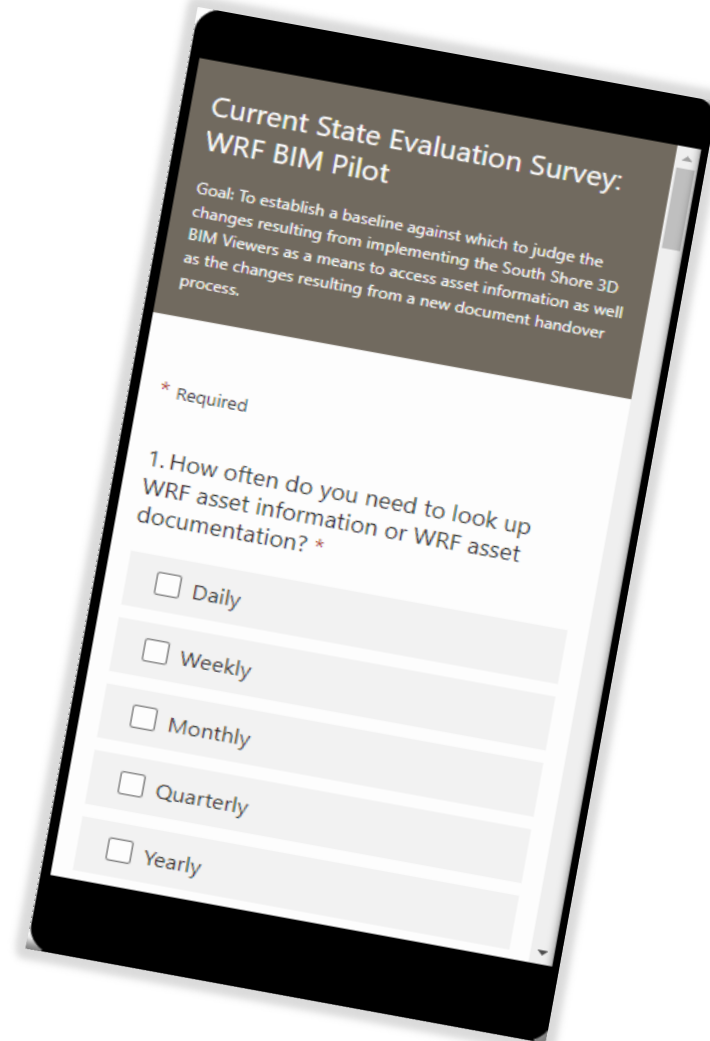
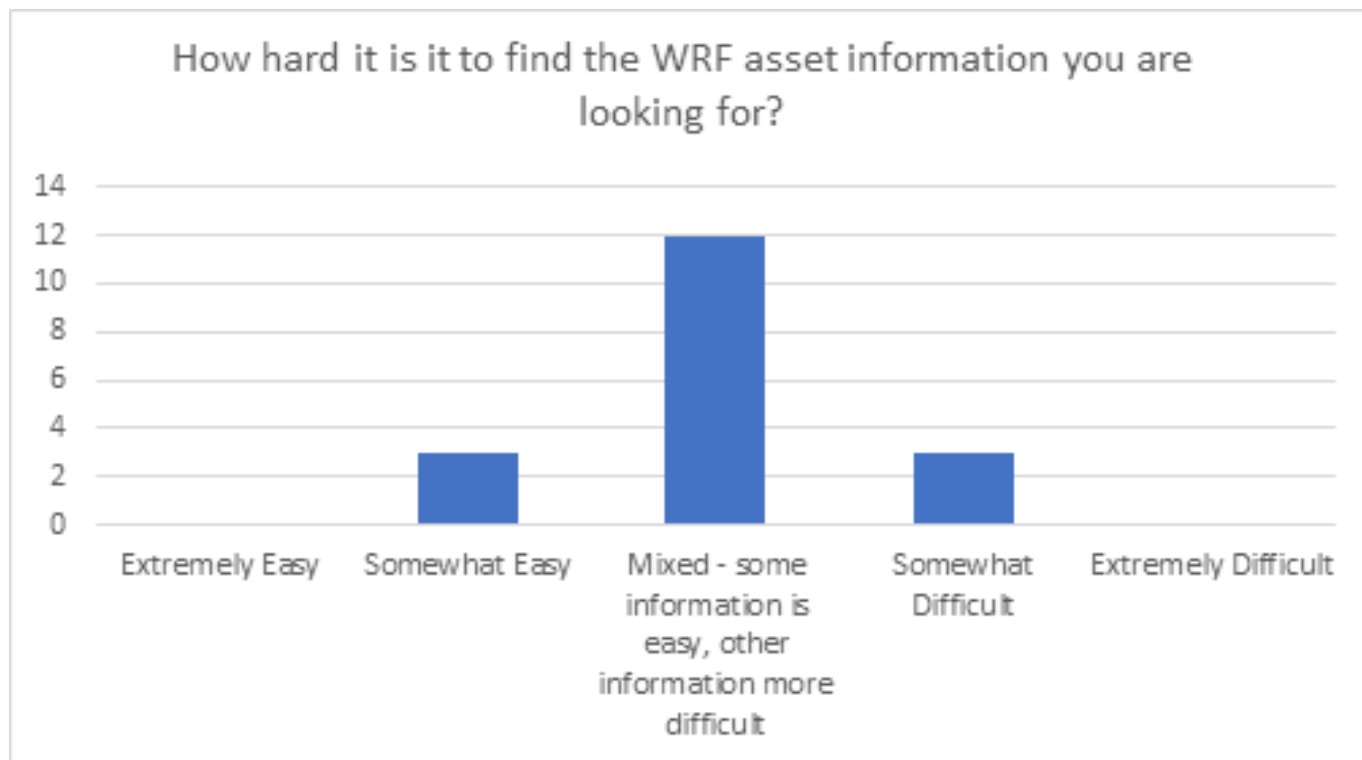
Water Reclamation Facility Goals:

- To improve decision making
- To increase efficient emergency response
- To support succession planning
- To determine the best solution that meets the functional requirements of major stakeholders and the project's objectives.

Timeline



Current State Evaluation



“The challenge with any asset management system is having it completely and accurately populated with data.

If even a small percentage of the data in a system is unreliable, then the other data (which may be correct) becomes unreliable in the mind of a user.”

Phase 4 - BIM Pilot Project

Effluent Pump Station

Size

- 2 Floors
- 11,500 sq ft

Complexity

- Mix of structures and equipment

Readiness

- 140 Assets identified

Use Case

- Planned Projects
- User Survey

Standards Development

- BIM Execution Plan



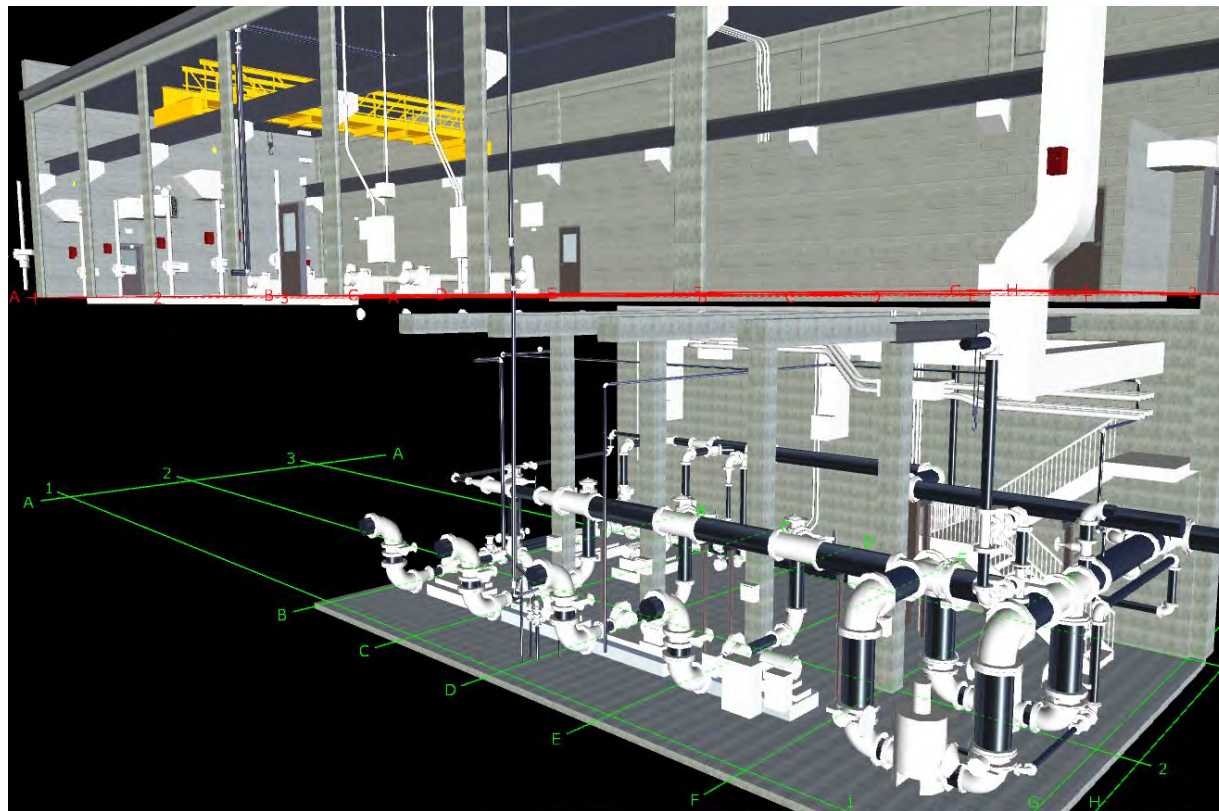
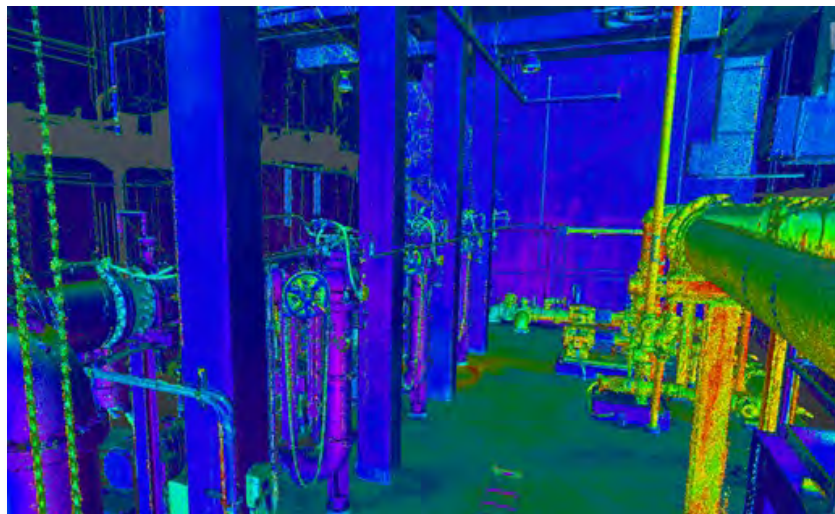
LiDAR Scanning

Equipment and Specifications

- Riegl VZ-400i
- RiSCAN PRO software
- TopoDOT, AutoCAD
- 120 Scan positions (interior and exterior)
- Survey grade accuracy to 1/8"



Modeling and QA/QC



Deliverables:

RCP, RCS, LAS files

RIEGL RiPANO panorama

System Integration



Assets		
MMSD Asset ID	Asset Description	Asset Status
117330	GATE, FLAP FINAL EFFLUENT PUMP #1 DISCHARGE	ACTIVE

Comments
9/25/18 TMM-UPDATED L3 ASSESSMENT INFO

Photo

	Assets	Commitments	Projects	Risks
Assets	17,671	175	35	416
R -- WATER RECLAMATION FACILITIES & BIOSOLIDS	17,671	175	35	416
IP -- INTERPLANT PIPELINE	541	14	1	9
JI -- JONES ISLAND WRF	10,555	103	22	304
SS -- SOUTH SHORE WRF	6,575	73	14	125
B -- BIOSOLIDS PROCESSING	1,956	33	3	34
L -- LIQUID TREATMENT	2,273	37	8	56
EF -- PLANT EFFLUENT	326	9	2	15
DIS -- DISINFECTION	132	3	1	7
EFF -- EFFLUENT PUMPING	80	2	1	6
PMP -- PUMPING	40	0	1	3
PMP01 -- EFFLUENT PUMPS #1	7	0	1	3
112269 -- GATE, PUMP STATION WET W...	1	0	0	1
112289 -- PUMP, FINAL EFFLUENT #1	1	0	0	2
112290 -- MOTOR, FINAL EFFLUENT PU...	1	0	0	1
117330 -- GATE, FLAP, EFFLUENT PUMP ...	1	0	0	0
118489 -- STARTER, SOFT, EFFLUENT P...	1	0	1	0
145785 -- GEAR BOX, EFFLUENT PUMP #1	1	0	0	0
146600 -- VFD, FINAL EFFLUENT PUMP #1	1	0	1	0



Integrating Revit Data into ArcGIS Pro

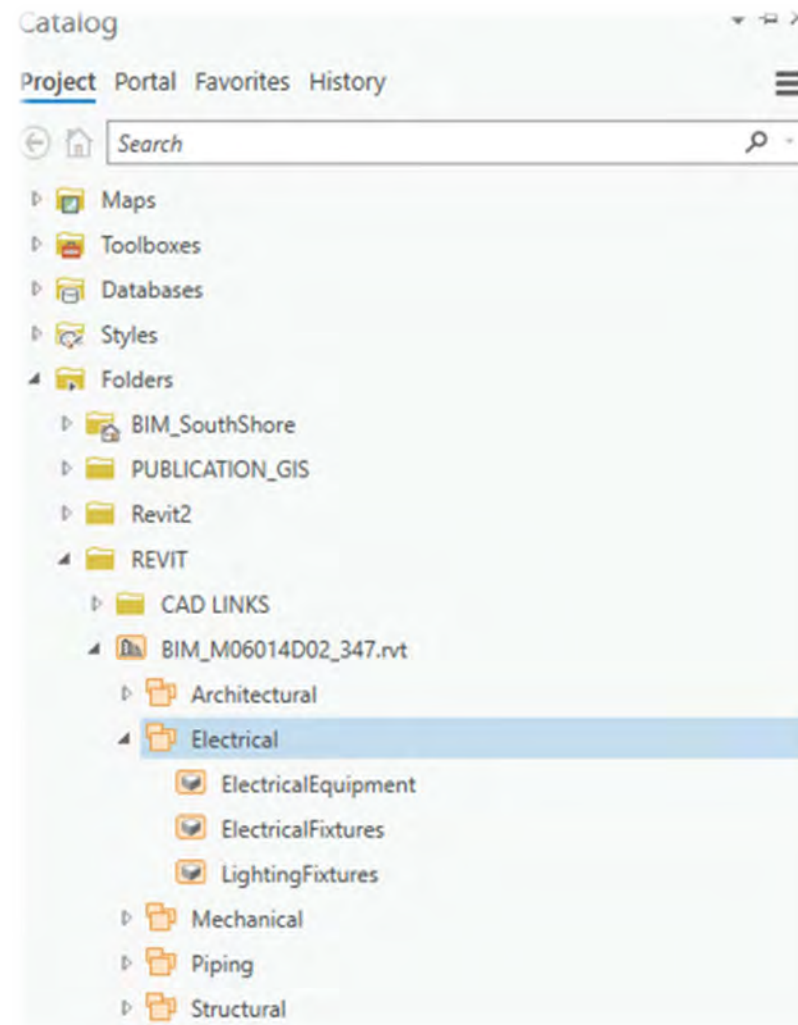
Options:

1. Convert Revit data into GIS data

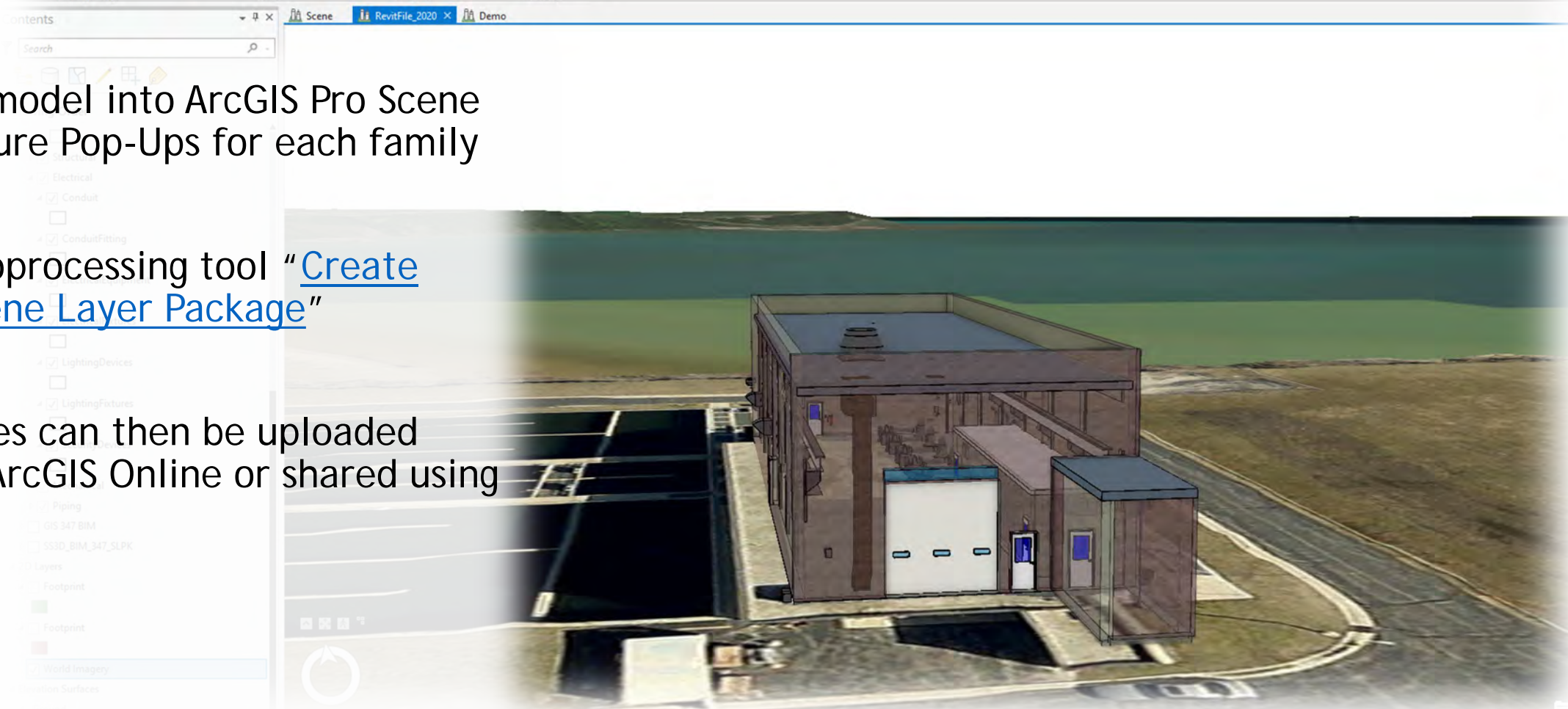
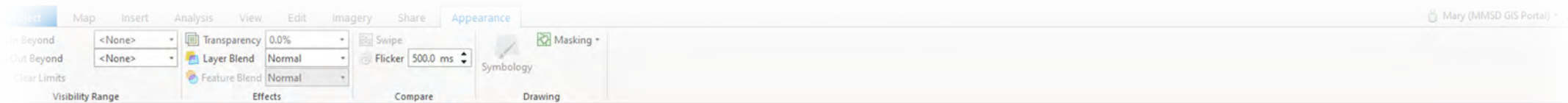
- Pros:
 - Data is editable
- Cons:
 - Some of the model's finer details are lost
 - More steps involved

2. Use Revit model as is

- Pros:
 - Fast Simple, straight-forward process
- Cons:
 - Data is not editable

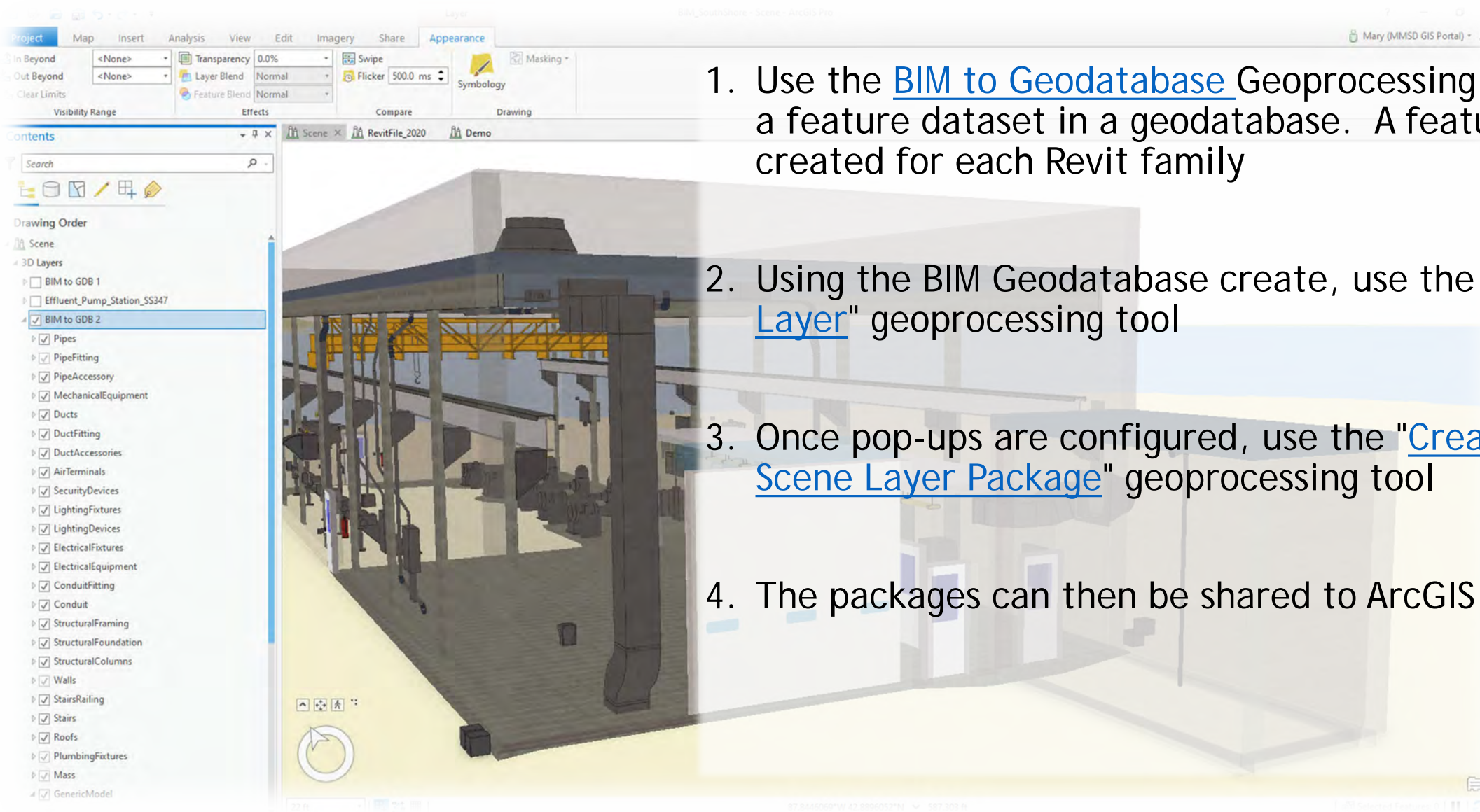


Use Revit Model in ArcGIS Pro As-Is



1. Pull Revit model into ArcGIS Pro Scene and configure Pop-Ups for each family
2. Run the Geoprocessing tool "[Create Building Scene Layer Package](#)"
3. The packages can then be uploaded directly to ArcGIS Online or shared using ArcGIS Pro.

Revit Model Converted to GIS Data



1. Use the [BIM to Geodatabase](#) Geoprocessing tool to create a feature dataset in a geodatabase. A feature class is created for each Revit family
2. Using the BIM Geodatabase create, use the "[Make Building Layer](#)" geoprocessing tool
3. Once pop-ups are configured, use the "[Create Building Scene Layer Package](#)" geoprocessing tool
4. The packages can then be shared to ArcGIS Online.



EFFLUENT PUMP STATION

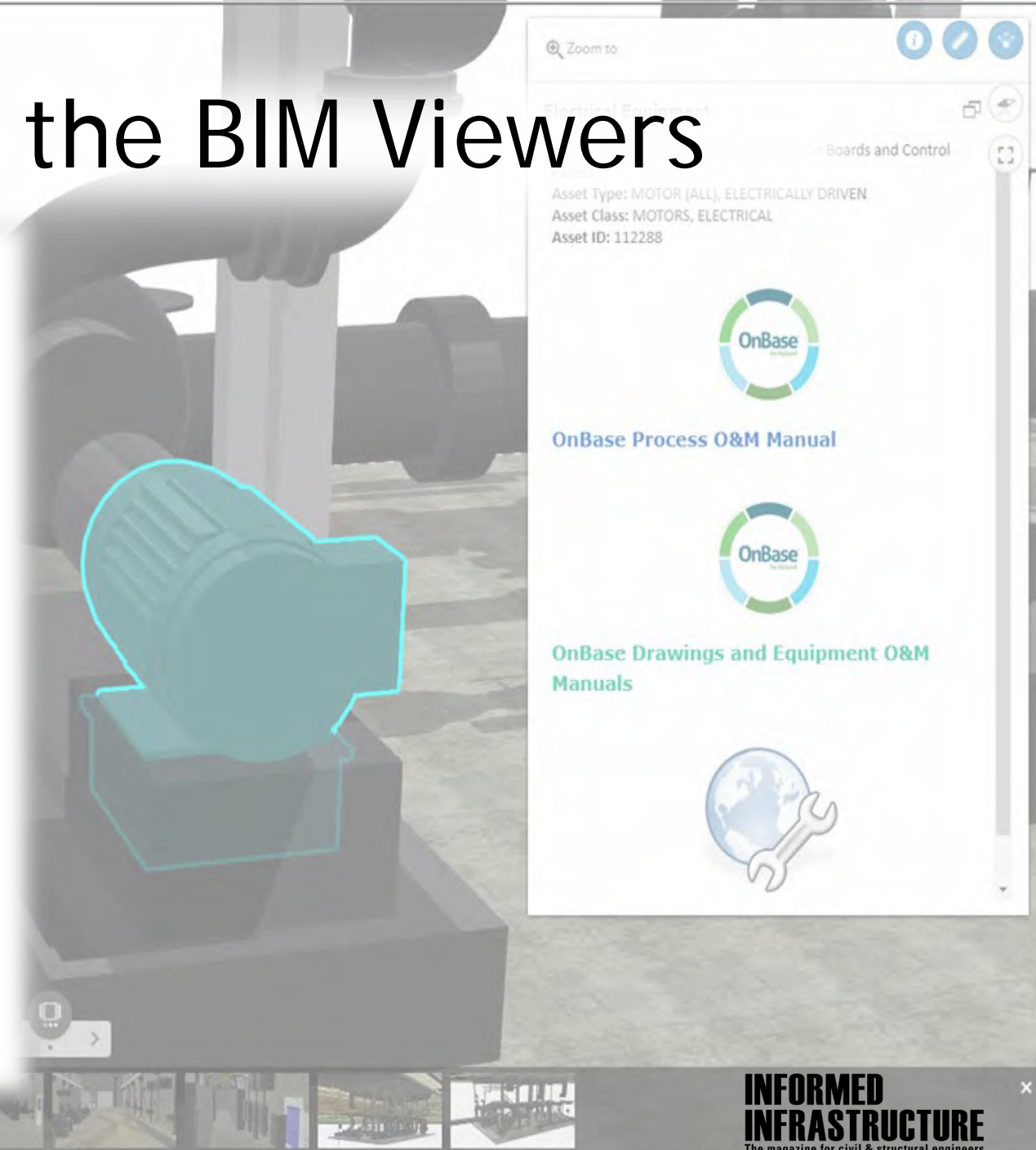
Demonstration

-87.845 42.889 Degrees elev 178.96 Meters eye alt 193.50 Meters



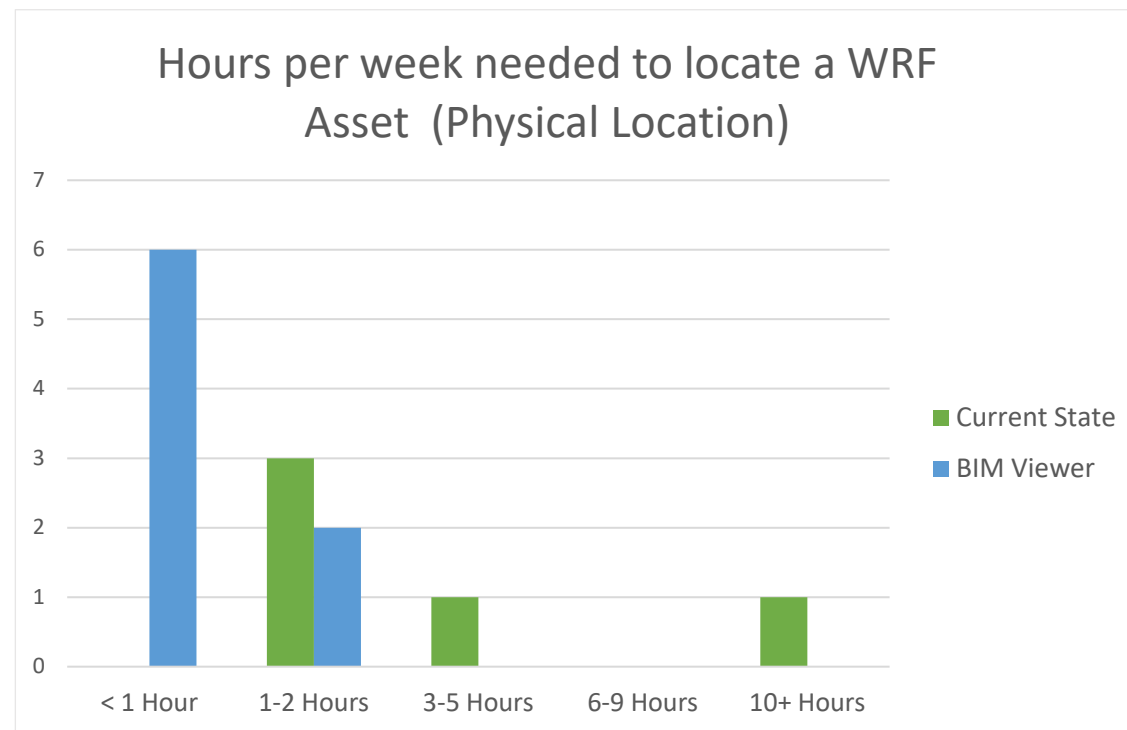
Future Goals for the BIM Viewers

- [Build filters](#) for features within the model
- Add searching capabilities
- Linkage to more applicable documents
- Establish a concrete workflow for BIM updates
- View photos from linked scan positions
- Ability to add comments/mark-ups to model view
- Include underground utilities at WRFs



User Training, 3D Viewer Survey & Pilot Evaluation Results

- ✓ Improved efficiency
- ✓ Better accuracy
- ✓ Find and visualize assets
- ✓ Easier access to related information
- ✓ Enhanced communication



“It was easy and simple, found the information I was looking for in a couple of mouse clicks, it was extremely helpful.”

“These are excellent tools. As more buildings are added and as I get more familiar with navigation, it will only become more useful.”



Lessons Learned

BIM Execution Plan

- Set minimum threshold, Level of Detail, units of measurement
- Verify list of assets and prepare a reconciled Asset Inventory

Scanning

- Scan setups > equipment density settings
- Capture a lot of photos - look for blind spots

Modeling

- Custom Revit object families – Revit standard object library
- Quality control checks and communication

Viewer Application

- Focus on navigation tools and add bookmarks
- Limitations of cell service and Wi-Fi inside buildings



BIM Pilot Conclusion

Continuation of the same workflows within silos of departments and databases (the status quo) is not an option for MMSD's Water Reclamation Facilities.

BIM has already become the standard tool to conduct business in construction and is rapidly transforming AEC operation lifecycles as more organizations migrate to a Digital Twin.

Implementing and applying BIM to assets and facilities will allow MMSD to utilize its current investment in technology and database systems.

The Digital Twin is more productive, efficient, and provides more accurate deliverables and project outcomes, ultimately saving the organization labor and costs.

Digital Twin Resources

[Website:](#)

GIS creates digital twins of the natural and built environments and enables integration of digital twins.



Digital Twin Resources

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Integrate the worlds of location intelligence to help you plan, design, build, and operate better

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Digital Twin Resources

[StoryMap:](#)

Most utilities already have a strong foundation for digital twins in the form of their GIS.



A Foundation for Digital Twins in Water

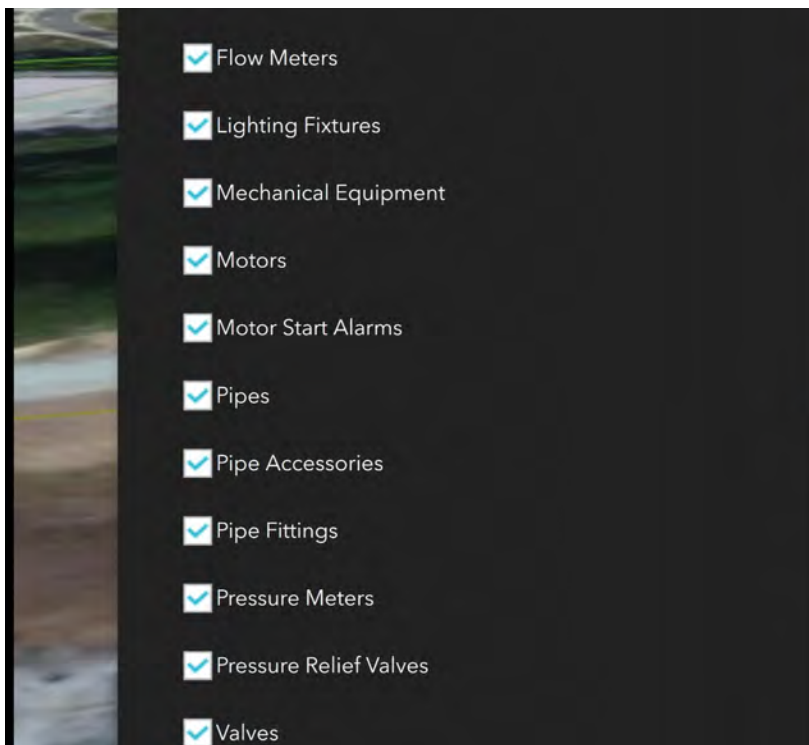
How the ArcGIS System supports Intelligent Utilities

Esri Global Water Practice

Digital Twin Resources

Case Study:

Gwinnett County operations staff locate and monitor assets within a rich 3D, spatially accurate environment.



Esri Water Team Contacts

Esri's water team supports water, wastewater, and stormwater utilities, irrigation districts and water resources organizations.

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