



City of Sacramento Dept of Utilities GIS Data Migration to the LGIM

Ryan Kirkham
Dara O'Beirne
Rong Liu

Points we'll cover

- General information about the city
- GIS at the Dept of Utilities and the city
- Our LGIM migration project
 - Data schema transformation
 - Migrating existing integrated systems to the new LGIM model
 - Project management: Keeping everything rolling on schedule

City of Sacramento

Population: ~ 486,000, Area: ~ 100.1 mi²

Utilities Department

- water, wastewater and drainage system
- has combined wastewater and drainage systems
- 1,596 miles of water transmission and distribution mains
- 1,666 miles of wastewater and drainage mains
- in the middle of a water meter installation program

Historical use of GIS at the Department of Utilities (2000-2016)

- Converted from AutoCAD 17 years ago
- Purpose was to support 1:200 paper map books used by Operations & Maintenance field crews
- Data model hasn't be updated or evaluated since the conversion
- No longer support the business needs and asset management requirements

GIS at the city and the Dept of Utilities

- Citywide GIS team is consolidated under IT
- 4 GIS positions are dedicated to Dept of Utilities
 - = 1 GIS supervisor + 3 GIS analysts
 - = 1 more GIS analyst added in 2017
- Enterprise GIS systems, separate transactional & publication SDEs, with simple model of gdb replication
- GIS integration with many business systems in the city
- Multiuser editing & versioning for Utilities data
- Directly integrated with Cityworks AMS 2014 and a custom Data Warehouse with GeoCortex based web maps

Data Migration (ETL)

- Review and document current model
- Research and design new model
- Build ETL process
- Test and refine process
- Run ETL and implement new model

Review Current Model

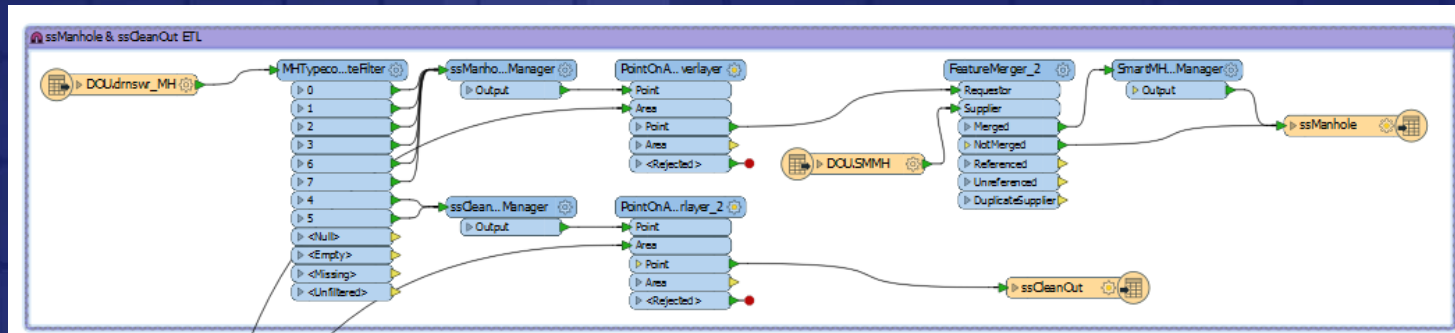
- Export schema using [X-ray for ArcCatalog](#)
- Document every field name, data type and its' accuracy
 - Identify fields used by 3rd party applications (Cityworks, etc.)
 - List all Domains and Subtypes used
 - Iterate over each field and document how much NULL, incomplete or non-standardized data within each field
- Work with engineers to get historical perspective on how and why data existed as it did
- Don't pass judgement, just look for perspective...or you'll lose your mind.

Design New Model

- Downloaded ESRI's LGIM as a starting template
- Met with members from all major groups in Utilities (O&M, Asset Management, Engineering, etc.)
 - Focus groups with SMEs in each group to understand needs.
 - Finding out what is missing is just as important as identifying what can be removed
 - Document EVERYTHING...more on that later
- Created a data mapping between old and new data
- Standardized values for most fields & domains
- Recategorized some fields into subtypes, and vice versa
 - This was done based on rules desired in Geometric Network

Build ETL Process

- Originally looked at using [Gizinta](#)
 - Free, but not quite what we were looking for
- Downloaded 60-day trial of [Safe FME Desktop](#)
 - Never used before, but had a working sewer/drainage model ready in less than 30-days
- Project success helped validate purchase

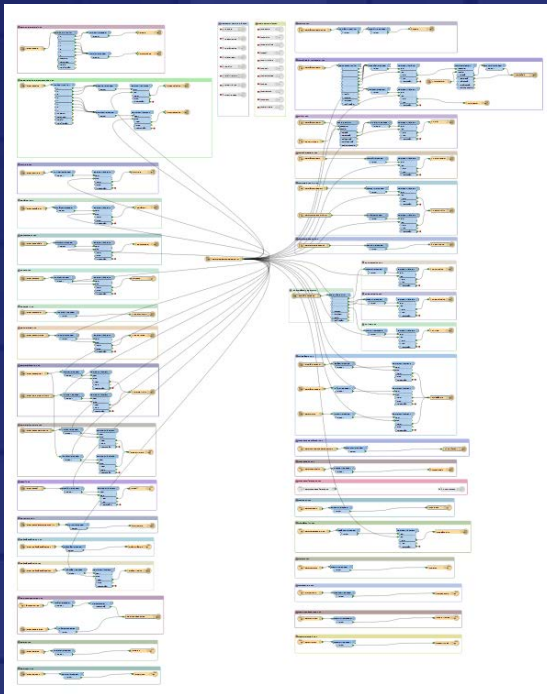


Test and Refine Process

- The first runs of the processes failed often because of bad or invalid data
 - Gave us a good list of things to fix before the final ETL
- First iteration of ETL complete ~10/2016
- Project broken into phases
 - Address current data for phase 1 and push any new data layer compilation or creation to phase 2 (Turnouts, Interties, Cathodic Protection, Pump Station details)

Implement New Model

- Final ETL ran on 3/28/2017 and converted 40 feature classes (763,122 features) into 37 feature classes (722,157 features) in 15 minutes.
 - Conversion data copied from fgdb into Oracle SDE



DOU.SewerStormwater

- DOU.ssCasing
- DOU.ssCleanOut
- DOU.ssControlValve
- DOU.ssDetentionBasin
- DOU.ssDischargePoint
- DOU.ssFacility
- DOU.ssFitting
- DOU.ssFloodgate
- DOU.ssFoodFacility
- DOU.ssInlet
- DOU.ssLateralLine
- DOU.ssLeveeEncroachment
- DOU.ssLeveePerformance
- DOU.ssLeveePoly
- DOU.ssMain
- DOU.ssManhole
- DOU.ssNetworkFacility
- DOU.ssNetworkStructure
- DOU.ssNotes
- DOU.ssOpenDrain
- DOU.ssPump
- DOU.ssScreens
- DOU.ssServiceConnection
- DOU.ssStructure
- DOU.ssSystemValve
- DOU.ssTap
- DOU.ssTestStation
- DOU.ssVault
- DOU.ssVirtualDrainline
- DOU.ssWaterwayPoly
- DOU.ssWell

DOU.WaterDistribution

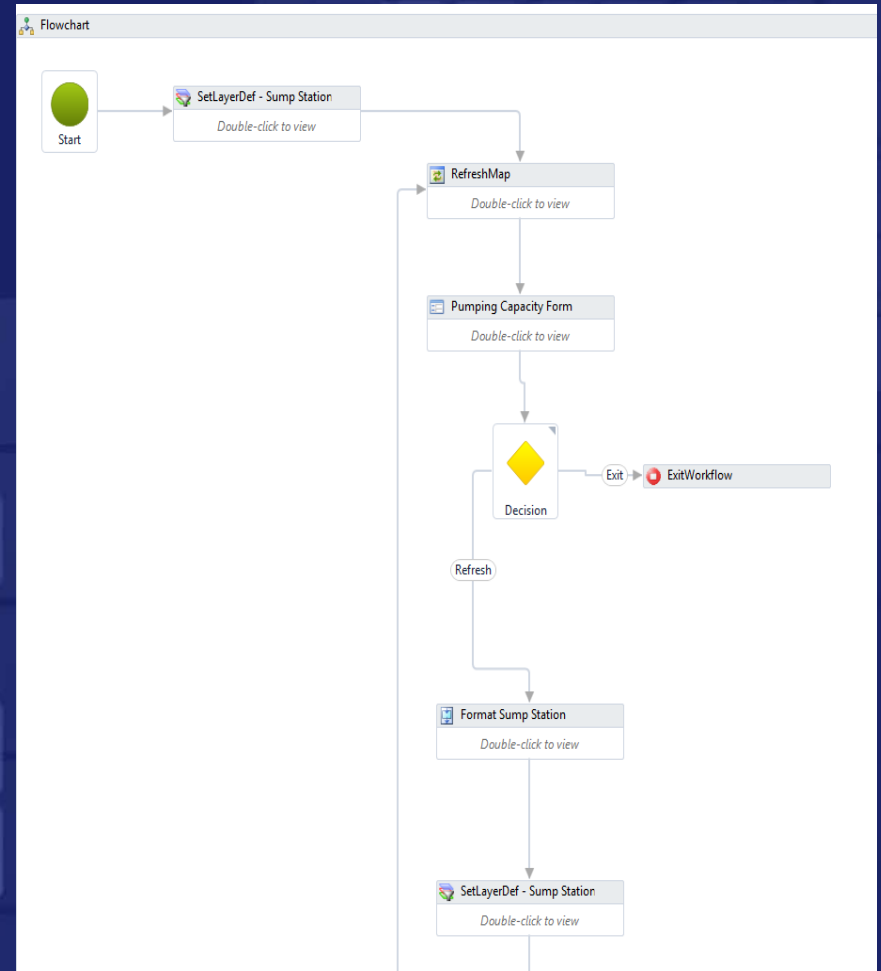
- DOU.wAbandonedMain
- DOU.wAbandonedValve
- DOU.wAccessPoint
- DOU.wCasing
- DOU.wConstructionLine
- DOU.wControlValve
- DOU.wCurbStopValve
- DOU.wElevationPt
- DOU.wFacility
- DOU.wFitting
- DOU.wHydrant
- DOU.wLateralLine
- DOU.wMain
- DOU.wMultiServiceConnection
- DOU.wNetworkFacility
- DOU.wNetworkStructure
- DOU.wNotes
- DOU.wOperationalArea
- DOU.wPressureZone
- DOU.wPump
- DOU.wSamplingStation
- DOU.wServiceConnection
- DOU.wServices
- DOU.wStructure
- DOU.wSystemValve
- DOU.wTestStation
- DOU.wWell

“Integration” with Department Wide Applications

- Department of Utilities Enterprise Applications Integration (EAI)
- Existing Geocortex apps and workflows
- Cityworks work order management system

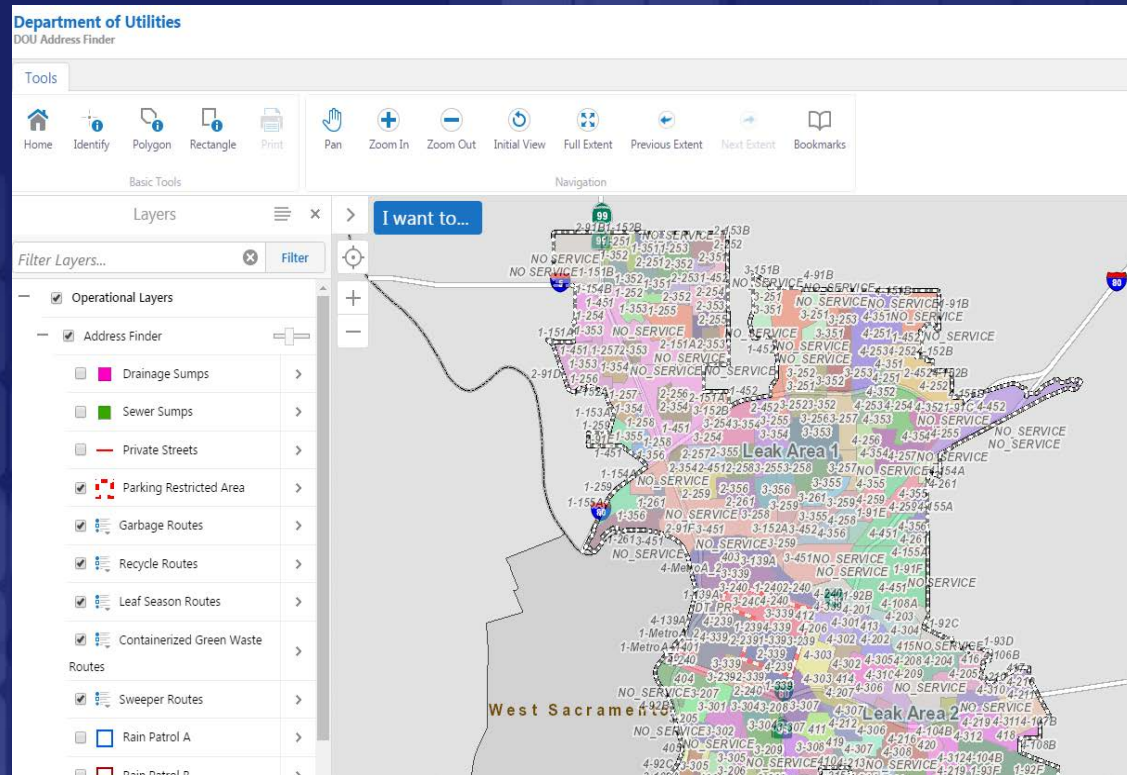
EAI

- Solution designed by consultant years ago.
- Used custom built workflows.
- Reverse engineer workflows to meet new schema
- Coordinate, plan, meet and test test test.



Geocortex Apps

- 4 Applications in production
- Silverlight to HTML5 capabilities
- Modified schema and tools



Cityworks Integration

- Update and maintain work order history with new schema.
 - Required fields (FacilityID and Location)
- Worked with consultant on tight timeline (1 month to implement)
- Lessons learned:
 - Start planning early and get stakeholders involved as early as you can.
 - Test your implementation.
- Published services required less configuration

Project Management

- Aggressive timeline with limited resources:
 - Started: Nov 18th 2016
 - Completed: March 24th 2017
- Coordination between several teams:
 - Utilities GIS
 - Citywide GIS infrastructure
 - IT server, security and DBA
 - Cityworks admin + consultants
 - Data warehouse support team

Keep things rolling

- Get a (powerful) project sponsor!
 - Keep the sponsor updated with progress and milestones
 - Supply the sponsor with facts and justification when asking for funding and resource allocation
 - Ask for help directly when needed
- Clearly define expectation and project goals:
 1. Transform the existing GIS model to align with LGIM
 2. Migrate existing systems integrated with GIS (Cityworks and data warehouse) to the new GIS model

- A project plan with clear roles and responsibilities

DOU GIS Data Model Migration Project
Project Plan & Status
Updated: 3/17/2017

Project Summary:

The DOU GIS data model has not been updated since its migration from AutoCAD in 2000. The old data model was designed for supporting paper map book production and no longer satisfies the departments growing needs for asset management, systems integration, and easier access to data. This project is to migrate the DOU GIS data model to align with the industry standard Local Government Information Model (LGIM), and enhance it to support our department's business objectives. This project builds the GIS foundation and is crucial for further deployment of tools and services.

Project Goal:

1. Transform the existing GIS model to align with LGIM
2. Migrate existing systems integrated with GIS (Cityworks and EAI) to the new GIS model

Project Champion: Brian McKee

Project Manager: Rong Liu

Project Complete: March 24, 2017

Project Major Components:

	Rong Liu	Coordinate with section leads on timeline and deliverables to ensure project success
GIS	Rong Liu	<ol style="list-style-type: none"> 1. Lead GIS section, allocate resources to ensure GIS tasks are completed on time 2. Primary on GIS servers allocation to host the new GIS model 3. Secondary on Cityworks map services migration, recreate Cityworks data views and map services 4. Secondary on EAI map services migration, help to recreate the map services for EAI
	Ryan Kirkham	<ol style="list-style-type: none"> 1. Lead data model transformation, design and develop processes to transform current GIS data to the new model – critical for the overall project 2. Secondary on Cityworks map services and EAI map services migration
	Dara O'Beirne	<ol style="list-style-type: none"> 1. Lead GIS map services migration, recreate data views and map services for EAI and Cityworks 2. Primary on GeoCortex applications (EAI maps) migration 3. Secondary on data model transformation
CW	Sheri Adams	<ol style="list-style-type: none"> 1. Lead Cityworks system integration, select and manage consultants to integrate Cityworks with the new GIS model 2. Coordinate user acceptance test for Cityworks
	Charley Wang	<ol style="list-style-type: none"> 1. Cityworks integration support 2. Reporting support
EAI	Charles Lei	<ol style="list-style-type: none"> 1. Lead EAI integration with the new GIS model, plan and allocate resources needed 2. Coordinate user acceptance test for EAI
	Joe Jamilosa + Jim Cotton	<ol style="list-style-type: none"> 1. Primary on ETL process migrating EAI to use the new GIS model

- Bi-weekly project touch base meetings to keep major tasks & milestones on schedule

#	Tasks	Lead	State Date	Target End Date	Actual Complete	Progress
1	Design and build new GIS servers	Rong	10/9/16	12/15/16	12/8/16	100%
2	Design and develop new GIS data model	Ryan	7/15/16	12/20/16	12/13/16	100%
3	Post RFP for choosing <u>Cityworks</u> consultant firm	Mohit	11/14/16	11/28/16	11/23/16	100%
4	Milestone: New GIS model is ready in Dev GIS	--	7/15/16	12/31/16	12/13/16	100%
5	Migrate <u>Hawkley's</u> report to EAI data source	Charley	12/2/16	2/28/16	3/15/17	100%

#	Tasks	Lead	State Date	Target End Date	Actual Complete	Progress
6	Select <u>Cityworks</u> consultant firm					
7	Develop/unit test ETL change					
8	Recreate <u>Cityworks</u> data view					
9	Recreate GIS map services and					
10	EAI user acceptance test (HD)					
11	<u>Cityworks</u> consultant firm start					
12	Work with Rebecca & Elizabeth and Re <u>Inspection</u> maps work					
13	Migrate other DOU and Citywide map services to use the new GIS model (<u>DFirm</u> , <u>DOU Address Finder</u> , <u>Spill Notification</u> , etc)	Ryan + Dara	1/23/17	2/28/17	3/16/17	100%
14	Test existing GIS tools/extensions with the new model	Ryan	1/2/17	2/28/17	3/10/17	100%
15	Milestone: Complete <u>Cityworks</u> Integration discovery and test	<u>Sheri+EEC</u>	1/23/17	2/28/17	3/17/17	100%
16	Milestone: Complete EAI integration test	Charles	1/1/17	2/28/17	3/16/17	100%
17	Create go-live check lists for GIS	Dara	3/1/17	3/15/17	3/14/17	100%
18	EAI Unit and system testing, user acceptance testing	Charles	3/1/17	3/15/17	3/16/17	100%
19	<u>Cityworks</u> unit and system testing, user acceptance testing	Sheri, Charley	3/1/17	3/17/17	3/17/17	100%
20	Review and adjustment, confirm go-live plan	All	3/1/17	3/17/17	3/17/17	100%
21	Milestone: New GIS data model go-live	Rong	--	3/24/17		
22	Production EAI Integration Complete	Charles		3/24/17		
23	Production <u>Cityworks</u> Integration Complete	<u>Sheri+EEC</u>		3/24/17		

• Keep an itemized task list for GIS

City of SACRAMENTO Department of Utilities		DOUGIS								
Updated 4/19/2017		New GIS Data Model Migration Plan - GIS Task Details				GIS Team				
#	Sequence	Main Task	Subtask	Lead	Start	Target Complete	Actual Complete	Progress		
2	1	Create draft model	Secure fundline for FME	Rong			07/14/16	100%		
3			Create draft model and draft FME process	Ryan	05/01/16	9/1/16	09/01/16	100%		
4	1	Discuss Citywide GIS Architecture	Discuss pro/cons with Dan McCoy on setting up a new database	all	09/19/16	9/20/16	09/20/16	100%		
5	2	Get feedback on data model	Setup workshops	Ryan	09/26/16	10/31/16	10/31/16	100%		
6				Document feedback for the draft data model	Ryan	09/26/16	11/20/16	11/20/16	100%	
7	2	Build new DOU database servers	Secure funding for new SDE servers, identify server specs	Rong	09/20/16	10/14/16	10/28/16	100%		
8				Send server request form to Jim Berg	Rong	10/28/16	11/1/16	11/01/16	100%	
9				Transaction server (ELSDETR01) ready	Peggy	11/01/16	11/14/16	11/15/16	100%	
10				Vijay to install Oracle on ELSDETR01	Vijay	11/15/16	11/23/16	11/23/16	100%	
11				Rong to install SDE on ELSDETR01	Rong	11/23/16	11/30/16	11/28/16	100%	
12				Create DOU data owner, users, and roles	Vijay	11/28/16	11/30/16	11/30/16	100%	
13				Publication server (ELSDPUB01) ready	Peggy	11/01/16	11/30/16	11/28/16	100%	
14				Vijay to install Oracle on ELSDPUB01	Vijay	12/01/16	12/9/16	12/06/16	100%	
15				Rong to install SDE on ELSDPUB01	Rong	12/12/16	12/13/16	12/07/16	100%	
16				Create DOU data owner, users, and roles	Vijay	12/13/16	12/16/16	12/12/16	100%	
17	3	Create db-links	Document all db-links needed on PUB01 (for Cityworks and EAI apps)	Rong	12/02/16	12/13/16	12/13/16	100%		
18				Remind Peggy to install MS SQL ODBC driver on PUB01	Rong	12/12/16	12/15/26	12/15/26	100%	
19				Ask Vijay to create db-links on PUB01 (from Cityworks PRD, PUB02, etc) as soon as PUB01 is done	Rong	12/13/16	12/16/16	12/16/16	100%	
33	6 (New)	(new discovery and requirement as of 12/19/2016)	Build windows server(s)	Chad Kramer		12/21/16	1/6/17	12/29/16	100%	
34			Install ArcGIS Server 10.3.1 with Web Adapter	Dara(Rong)		01/06/17	1/10/17	01/05/17	100%	
35			Configure ArcGIS server	Dara(Rong)		01/03/17	1/10/17	01/06/17	100%	
36	6	Connect ArcGIS Server to new SDEs	Install Oracle Client on new ArcGIS server	Dara		12/12/16	12/16/16	01/06/17	100%	
37				Register new SDEs as datastores to the AGS server	Dara		12/12/16	12/16/16	01/06/17	100%
38	6	Document existing -> New model	Update existing model to new model crosswalk spreadsheet	Auturo		12/02/16	12/30/16	12/29/16	100%	
39				Review spreadsheet and release to use	all		01/05/17	1/20/17	1/20/17	100%
40	Milestone	New GIS model is ready in GIS					12/30/16	12/13/16	100%	
41	7	Build GIS for Cityworks	Build all SDE views needed by Cityworks & document tech details	Rong->Ryan		01/03/17	1/13/2017	01/19/17	100%	
42				Verify Cityworks required fields list (EEC sent in April 2016)	Ryan+Dara		01/03/17	1/13/2017	01/12/17	100%
43				Create all map services for Cityworks	Dara		01/03/17	1/13/2017	01/20/17	100%
44	8	Create GeoCortex maps for EAI	Build new SDE views needed by EAI (use ArcCatalog method instead of SDE cmd line)	Dara		12/13/16	1/31/17	01/20/17	100%	
45				Create new EAI map service	Dara		12/13/16	2/28/17	01/20/17	100%
46				Verify and modify EAI workflows	Dara		12/13/16	2/28/2017	01/20/17	100%
47				Re-build EAI map viewers in HTML5	Dara		12/13/16	2/28/2017	01/20/17	100%
48			Remove existing data replication, delete LGIM data on new SDEs	Ryan+Dara		01/16/17	1/20/17	01/19/17	100%	
49		Adjustment: LGIM Data Schema	Modify LGIM, re-process the data, load into ELSDETR01	Ryan+Dara		01/16/17	1/20/17	01/19/17	100%	

- Evaluate project risks, have plan B (and plan C); Resolve challenges along the way

Some unforeseen challenges we resolved:

- Needed new ArcGIS servers
- Changed Cityworks project manager – a major stakeholder in the project
- Delayed Cityworks consultant starting time
- Strict field mapping requirement for LegacyID and Location fields in Cityworks
- Last-minute server security requirement

Final Implementation

- Utilities GIS LGIM data model go-live: March 24th, 2017
 - ArcSDE 10.4.1 with AGS 10.3.1
 - Separate transaction and publication SDEs, with simple model gdb replications
 - Implemented 28 SDE views to support Cityworks
 - Customized workflows for GeoCortex with HTML5 viewer
- Cityworks migration go-live: March 24, 2017
- EAI (data warehouse) migration go-live: March 30th 2017

Benefits of the LGIM Migration

- Customized LGIM that meets our business needs
- Captured asset attributes that had no place to be stored before
- Streamlined and simplified processes for building web apps:
 - Have already developed Web AppBuilder maps on portal for internal uses
 - Able to utilize out of box solutions more efficiently
- More effectively integrate with other systems in the future

Questions?

Contact Information

- Ryan Kirkham
rkirkham@cityofsacramento.org
- Dara O'Beirne
dobeirne@cityofsacramento.org
- Rong Liu:
rliu@cityofsacramento.org