THE ASHLAND COUNTY BUILDING INVENTORY PROJECT

BARRIERS TO ACQUIRING DIGITAL ASSESSMENT DATA IN WISCONSIN

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WISCONSIN
UNIVERSITY OF WISCONSIN–MADISON

Title Slide: The Ashland County Building Inventory Project

Today's objective is to discuss a project that is just wrapping up in the State Cartographer's Office, related to flood risk assessment and mitigation.

Ann Buschhaus is the GIS Researcher who carried out the project. Howard Veregin is project PI.

The study is based in northern Ashland County, and is an attempt to build a detailed building-by-building inventory of structure attributes relevant to flood modeling.

Our intent was to use a combination of data sources to develop this data, including building-level assessment data acquired annually by local assessors.

Unfortunately, obtaining assessment data for Wisconsin communities in a machine-readable format is more difficult than you might imagine.

The obstacles include technical and software issues, per-record fees, the data formats available, and restrictions on data redistribution.

We will address these issues in this presentation.

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WISCONSIN COASTAL MANAGEMENT PROGRAM

WISCONSIN DEPARTMENT OF ADMINISTRATION DOA.WI.GOV

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE

Slide 2: Funding

First, an acknowledgement to our sponsor: the WI Coastal Management Program, at the WI Dept of Administration, and NOAA.

PROJECT GOALS

Photo by Wolfgang Hasselmann on Unsplash

- Create building inventory
- Better flood mitigation plans
- Transferrable cost model
- Partner with WICDI project

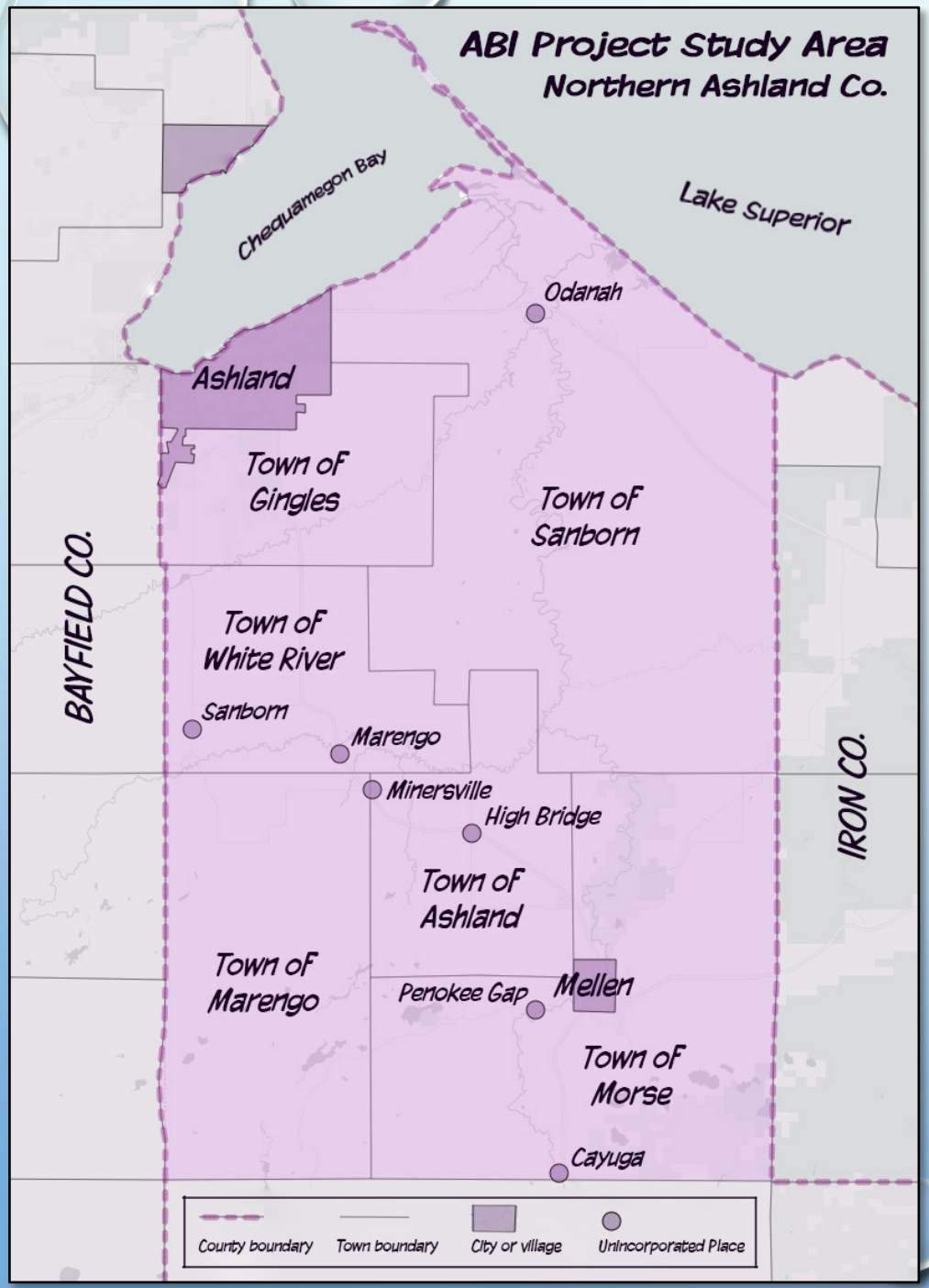
Slide 3: Project Goals

The goal of the project is to develop a detailed building inventory for northern Ashland county including the city of Ashland. The inventory will combine building footprints, parcel data, critical infrastructure points and local tax assessment records into a single GIS layer.

The rationale for creating this layer is to help local agencies develop better flood mitigation plans. These plans need to account for the effects of flood waters on buildings and the physical characteristics of these buildings. A detailed building inventory can be used with flood scenarios and in flood models to estimate the financial and human impacts of the flood. Without detailed building data, these estimates are necessarily much less precise.

Another important part of the project is that the methods and workflows we develop will be shared with local and state agencies responsible for flood risk assessment and planning. In particular, we are creating a cost model to allow the cost of dataset creation to be estimated in other coastal areas.

The project will also leverage the efforts of a concurrent NOAA Project of Special Merit – the WICDI project – which is looking at culvert data and is building a culvert mapping community of practice in the same region of the state.



STUDY AREA

Pre-flood planning

Flood-prone region

10,000+ buildings

Slide 4: Study Area

We all know that GIS data is useful **during and after** flood events – but we want to show that it is also useful **beforehand**, such as at the planning stage when communities are developing hazard mitigation plans. Work in other states shows how building inventories can be used to assess flood vulnerability and estimate flood damage and loss. Building inventories are an alternative to aggregated building data usually employed in hazard models – like the 2006 Hazus analysis described in the 2018 Ashland County Hazard Mitigation Plan.

Hazus can make use of a “user-defined facilities table” in place of more generalized regional averages derived from the US Census and other sources. The user-defined table allows specific information on building characteristics to be included in the Hazus model run. This has the potential to yield much better estimates of flood risk and damage.

The project focuses on northern Ashland county, an area that has experienced several devastating floods in recent years with significant impacts on infrastructure. We focus on the cities of Ashland and Mellen, and the Towns of Gingles, White River, Sanborn, Marengo, Ashland and Morse. This area had federal disasters declared in 2012, 2013, 2016 and 2018. As noted in the 2018 Ashland County Hazard Plan, “there is a very high probability of damage and losses due to flooding” in this area with potential vulnerabilities that include residential structures, businesses and “flooded public facilities and schools, many of which are the community’s shelters needed when individual housing is uninhabitable.” There are over 12,000 buildings in the study area.

CHALLENGES

Data integration

Local assessment

Errors & omissions

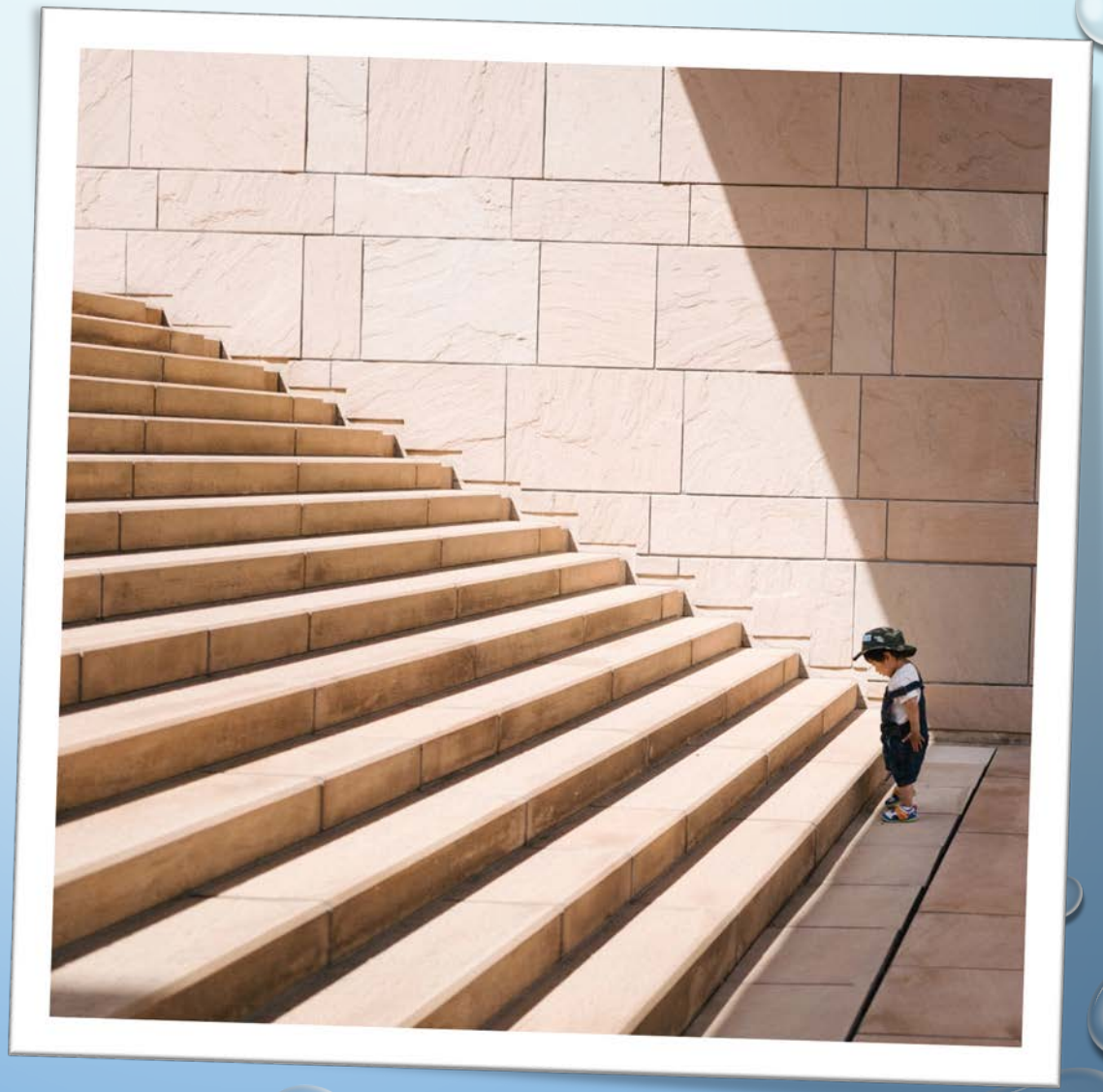


Photo by Jukan Tateisi on Unsplash

Slide 5: Challenges

One of the challenges with our project involves integrating the data for the inventory. We will need at least four sources of data:

1) building footprints;
2) data for improvements recorded at the tax parcel level
3) detailed local tax assessment data for the structures on each parcel
4) information on tax-exempt structures for which no assessment data exists

In Wisconsin, this even more of a challenge than some other states because tax assessment is conducted locally at the municipality level – city, village or town – not at the county level. There is no statewide or countywide aggregation of tax assessment records. Instead assessment data is managed by each assessor. The result is a multitude of software, formats and standards for assessment data across the state.

There are other data challenges as well, including: 1) incomplete assessment records including missing attribute data; 2) spatial errors and lack of attribution in building footprint datasets; and 3) missing data for critical infrastructure points like police stations, fire stations, hospitals and government offices, which are tax-exempt and therefore not part of the tax assessment process.

BUILDING FOOTPRINTS

Photo by Amir Saboury on Unsplash

Lack of attribute data

Building “blobs”

Parallax

LiDAR tools?

Slide 6: Data Sources

A few more words about our data sources.

Many Wisconsin counties have a building footprint layer – you can download these on the GeoData@Wisconsin data portal. Many of these are derived from air photos.

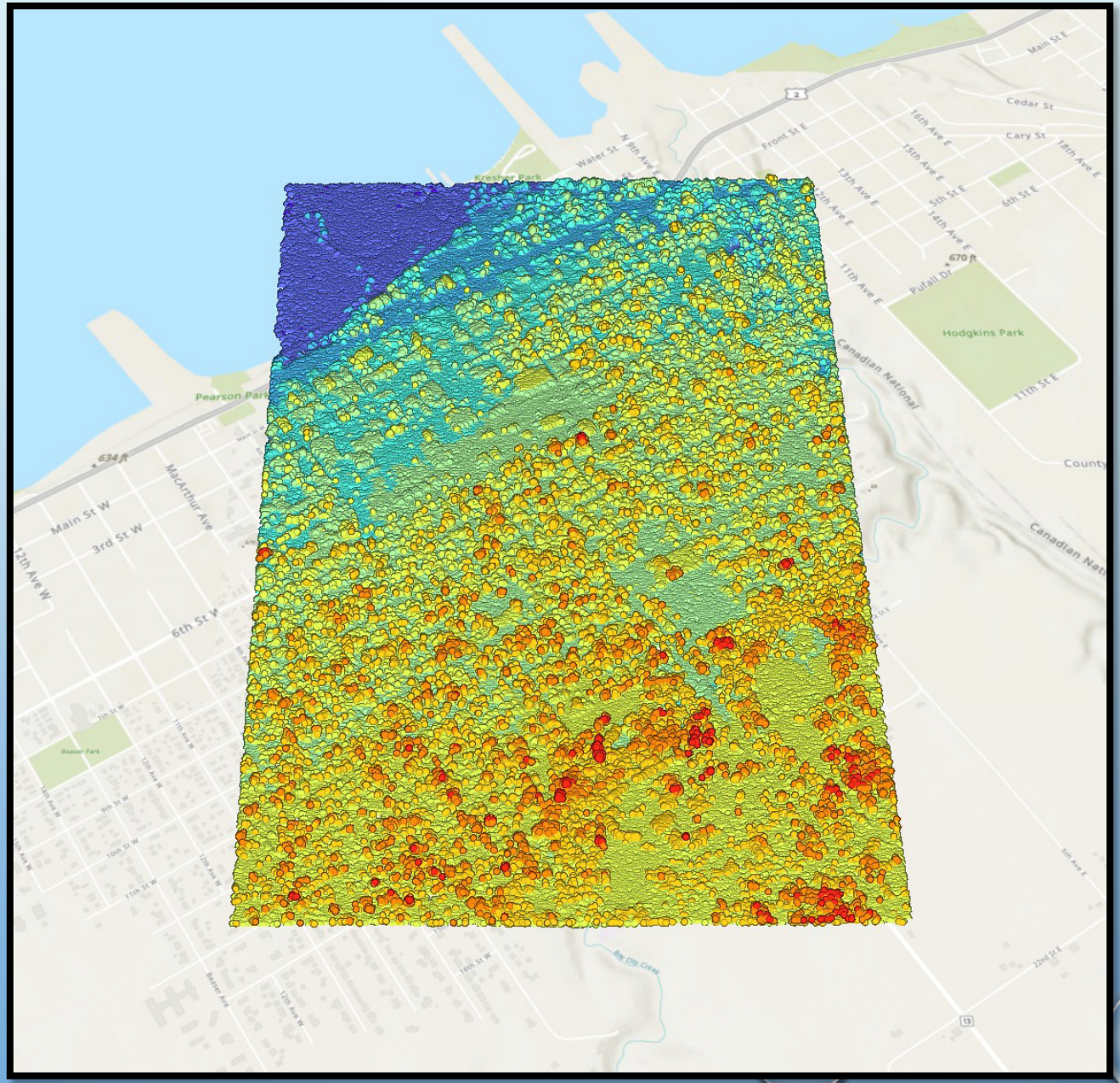
But these datasets have some problems:

- Lack of attribute data as a whole and lack of consistency in attributes from county to county.
- Building “blobs” i.e., connected buildings not split along parcel lines.
- Parallax distortion on air photos, causing buildings to lurch across property lines.

These errors and omissions need to be corrected, which can be costly and time-consuming. We can use parcel boundaries to do this, but this can cause slivers to be produced, which must then be cleaned up based on rules and visual inspection.

Building extraction from Lidar is an alternative to using these pre-made layers. We conducted a pilot study to assess how well this would work.

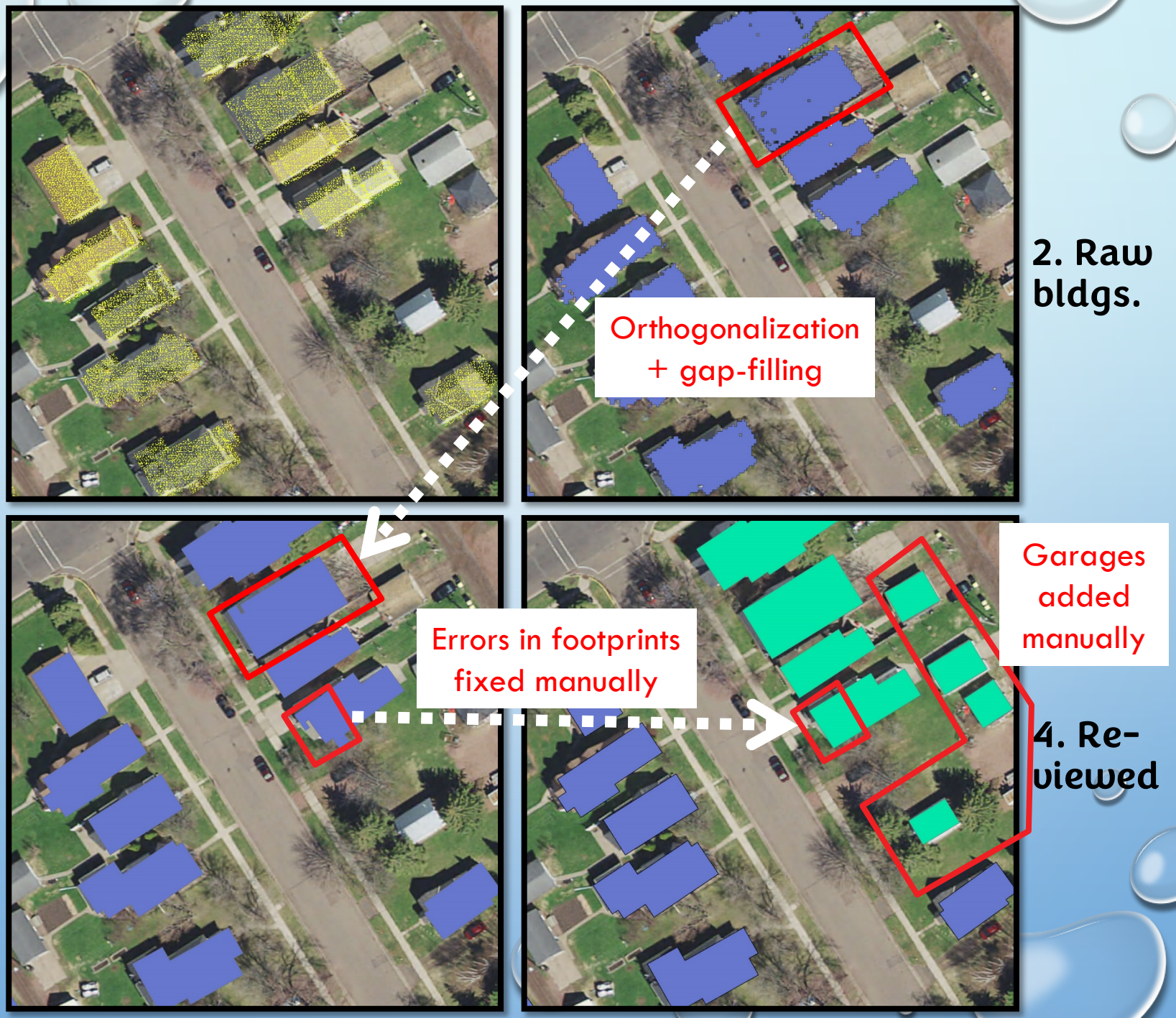
LIDAR PILOT PROJECT



Slide 7: Lidar Pilot Project

In fact, original plan was to use newly acquired LiDAR data (ca. 2019 acquisition) to extract all buildings. However, the release of the data was significantly delayed and the LiDAR data that was available at start of study was out-of-date. So, we did a pilot study using LiDAR later in the project (using pre-release LiDAR data) and used pre-made building footprints for our study.

We did a pilot LiDAR project to test the feasibility of using LiDAR data for footprint extraction. We focused on a small portion of the study area, used latest LiDAR classified point cloud data. We used available Esri tools and tutorials.


1. Bldg Points
2. Raw bldgs.
Orthogonalization + gap-filling
3. Re-fined
Errors in footprints fixed manually
Garages added manually
4. Re-viewed

Slide 8: Lidar Processing

The process is straightforward, but:

- It takes time. The approach is iterative, requiring clean-up after each step.
- The classified point cloud misclassifies a lot of points; garages frequently missed.
- Straightness/orthogonality constraints must be applied to get good-looking footprints. This removes jaggies and donut-holes. Tools available to do this. But, these can cause problems with non-rectangular buildings.
- Attributes are lacking except for basic info such as footprint square footage.

The slide graphic shows some examples of semi-automated but mostly manual steps that must be employed to generate good building footprints from LiDAR.

There are more sophisticated tools available that operate on the raw (unclassified) point cloud that might avoid some of these problems. We did not test these.

Overall, LiDAR is orders of magnitude more time-consuming than using an existing footprint layer if available. This is true even though existing building footprint data invariably need cleanup and attribute creation to make them usable.

Another option would be to use Open Street Map building polys as a starting point and clean up from there.

PARCEL DATA

Statewide parcels

Valuation data

Class of property

Photo by Michael Tuszynski on Unsplash

Slide 9: Parcel Data

For our study we also used parcel-level attributes from the statewide parcel dataset. Now in its eighth year, under the direction of the Wisconsin Department of Administration, the SCO has been responsible for integrating county parcel and tax roll data to produce the statewide parcel dataset.

One role of parcel data is to split building polygons for buildings that connect to each other. Parcels also allow us to assign a tax ID from each parcel to the buildings on that parcel, to join to assessment data.

Parcels are also a source of valuation data and property class data – even though these attributes should also be available in assessment data. Valuation relates to assessed value and fair market value – which may be used as surrogates for replacement cost, which is what is really needed for disaster assessment.

Integrating parcels into building footprints is a time-consuming step due to ambiguity in relationships between parcels and buildings. For example, slivers of buildings frequently fall into neighboring parcels – rules must be developed to eliminate TRUE slivers. Some building polygons need manual evaluation to determine correct parcel-pairing (for buildings crossing parcel boundaries).

There are also anomalies – such as parcels with > $0 assessed improvements value but no building. And vice versa.

This process is one of the most time-consuming in the cost-model.

TAX ASSESSMENT DATA

Square footage (building, not footprint)

Outbuildings

Property/ occupancy type

Height above grade/basement

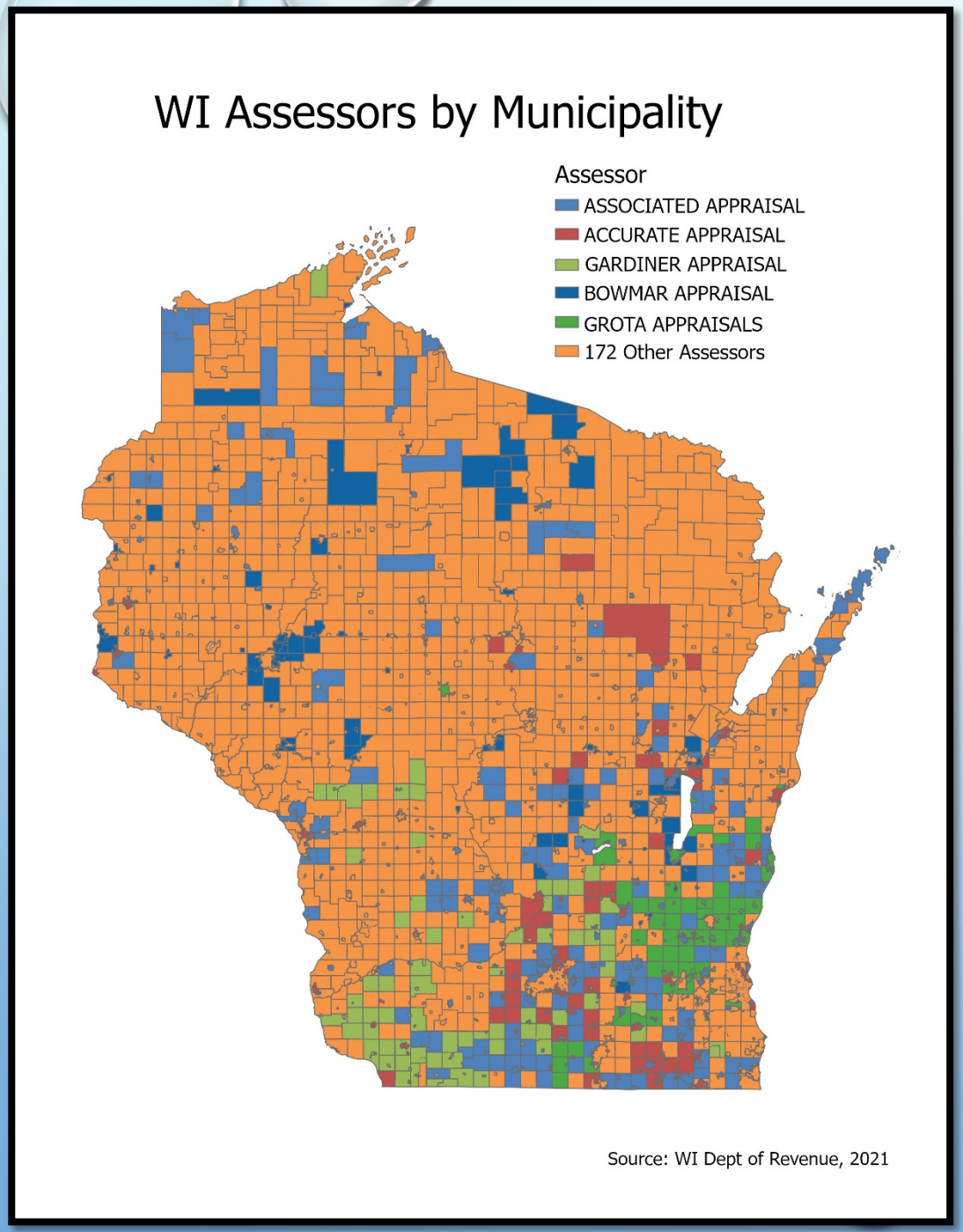
Photo by Vincent Ledvina on Unsplash

Slide 10: Tax Assessment Data

The next step in our plan was to add building-specific information to the footprints with added parcel attributes. This was to be obtained from assessment data. Assessment data keys on parcel ID, and now we have a parcel ID attached to each building. The first processing step for assessment data is to create a record for each building with attributes from the assessment database.

The primary attributes of importance for flood risk assessment to be collected from tax assessment data include:

- square footage of the main building any outbuildings such as garages and sheds (important for estimating replacement value)
- property or occupancy type (residential, commercial, industrial, or even finder definitions), important for replacement value
- the height of the building off the ground/presence of basement (how likely is the first floor to flood?)
- valuation (same as parcels) although it is really replacement cost (not assessed value) that is of interest



ASSESSORS

Municipality is official data steward

Assessor maintains electronic data

Municipality receives data request

Assessor responds to request

Slide 11: Assessors

Things did not go as planned. Why? This is a complex topic -- we spent a great deal of time on this as shown in our cost model.

Let’s start out by remembering that in Wisconsin, assessment is conducted locally. Every city, village or town may hire a different assessor to conduct the assessment process.

This map shows the assessors in Wisconsin based on Dept of Revenue data. Associated is the largest single commercial assessor company in the state, in terms of number of municipalities.

For our area, we have Associated (City of Ashland, Town of Gingles), Bowmar (City of Mellon) and the rest are some other assessor. Note that the orange color also includes city assessors, which some municipalities have.

Each assessor is responsible for discharging the municipality’s duty to maintain electronic assessment records. The municipality is the official steward of the data. They delegate that responsibility to their assessor.

When there is a data request, it is the municipality that receives the request (e.g., city clerk). They hand the request off to the assessor, who has the data on their computers.

How does this play out in reality? There are a few different scenarios.

SCENARIO A

2021 Property Records for Town of Gingles, Ashland County

June 14, 2021

Tax key number: [redacted]

Property address: [redacted]

Traffic / water / sanitary: Light / Well water / Septic

Legal description: [redacted]

Summary of Assessment	
Land	$20,200
Improvements	$195,300
Total value	$215,500

Land

Qty	Land Use	Width	Depth	Square Feet	Acres	Water Frontage	Tax Class	Special Tax Program	Assess Value
1	Residential			87,120	2.000	None	Residential		$16,000
1	Prime pasture			479,160	11.000	None	Undeveloped		$4,200

Residential Building

Year built:	2001	Full basement:	1,400 SF
Year remodeled:		Crawl space:	
Stories:	2 Story	Rec room (rating):	
Style:	Modern Two Story	Fin bsmt living area:	
Use:	Single family	First floor:	1,472 SF
Exterior wall:	Alum/vinyl	Second floor:	1,560 SF
Masonry adjust:		Third floor:	
Roof type:	Asphalt Shingles	Finished attic:	
Heating:	Gas, hot water	Unfinished attic:	
Cooling:	A/C (same ducts)	Unfinished area:	
Bedrooms:	3	Open porch	180 SF
Family rooms:		Patio	624 SF
Baths:	3 full, 1 half	Garage	572 SF
Other rooms:		Deck	264 SF
Whirl / hot tubs:			
Add'l plumb fixt:			
Masonry FPs:			
Metal FPs:			
Gas only FPs:		Grade:	C
Bsmt garage:		Condition:	Average
Shed dormers:		Energy adjustment:	No
Gable/hip dorm:		Percent complete:	100%

Total living area is 3,032 SF; building assessed value is $189,300

Slide 12: Scenario A

In scenario A, the assessor delivers a bunch of PDFs for the properties of interest.

Per the Wiredata case some years ago, PDF format satisfies the electronic records requirement.

There is a cost – perhaps $30/hr or whatever the assessor thinks is reasonable for their time.

There are no restrictions on redistributing the PDFs or any data you can extract from them.

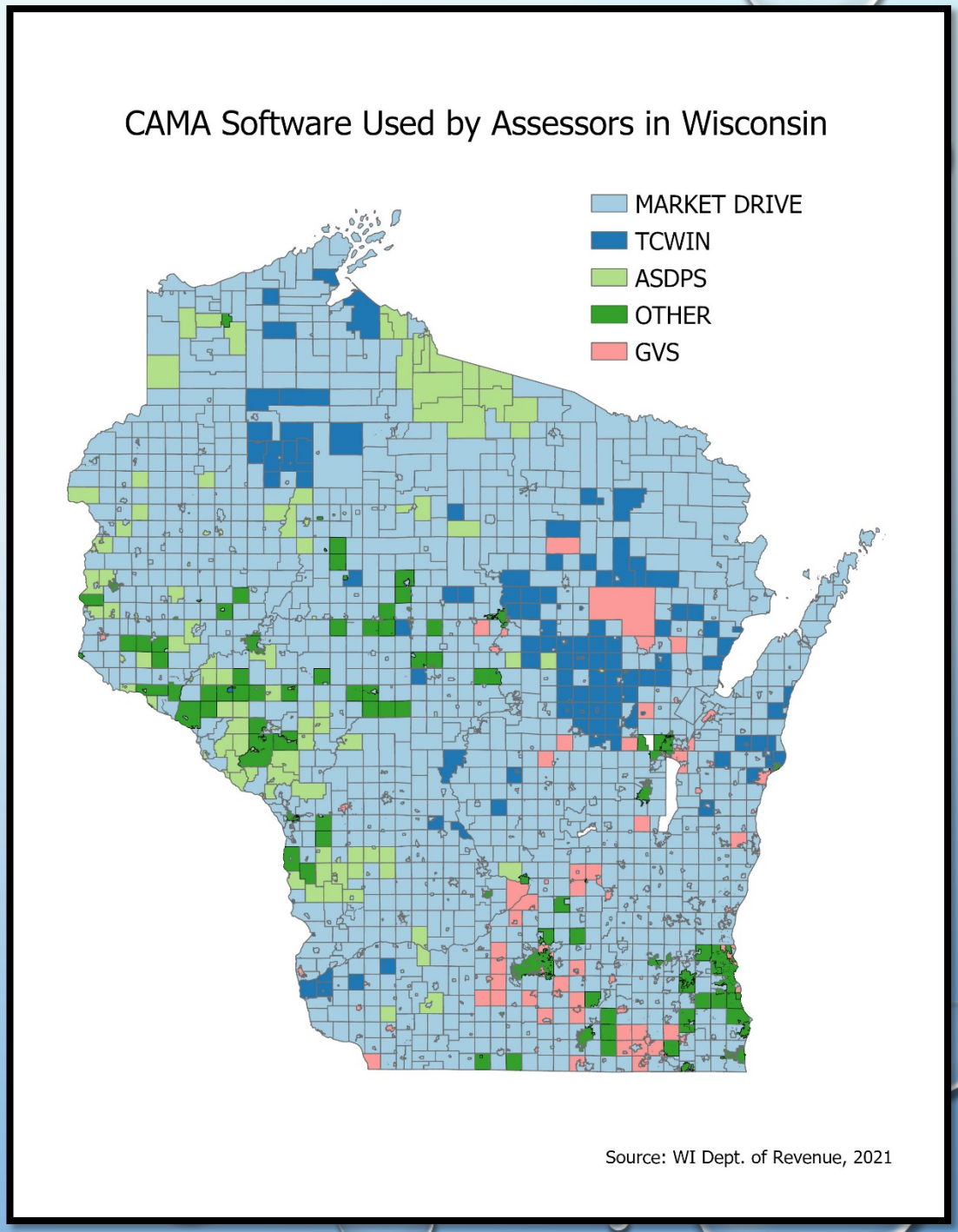
The problem is extracting data in a digital format that is actually usable, e.g., in GIS. This may sound simple but is not necessarily so.

There’s another caveat and that is that Scenario A is based on the assumption that the assessor is using Market Drive CAMA software (Computer Assisted Mass Appraisal)

CAMA SOFTWARE

Approx 80% of Wisconsin municipalities use Market Drive

Scenario B:
What if they use something else?



Slide 13: CAMA

Market Drive is used by 80% of Wisconsin’s municipalities, as shown on this map.

All of the municipalities in our area except Town of Sanborn use Market Drive.

If the municipality is NOT using Market Drive the situation is different. The information you need may be less available. PDFs may not be an option. The situation varies case-by-case.

```
      </Land>
      <Buildings>
        <MobileHome>
          <Description>1960 generic, aluminum/vinyl
exterior</Description>
          <Quantity>1</Quantity>
          <TaxClass>Residential</TaxClass>
          <MarketValue>$3,000</MarketValue>
          <AssessedValue>$3,000</AssessedValue>
          <Model>A</Model>
          <YearBuilt>1960</YearBuilt>
          <EffectiveYearBuilt>1960</EffectiveYearBuilt>
          <ExteriorWall>Aluminum/vinyl</ExteriorWall>
          <FoundationType></FoundationType>
          <SkirtType>Metal or vinyl</SkirtType>
          <HeatType>Heat only</HeatType>
          <FireplaceType>None</FireplaceType>
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          <Bedrooms></Bedrooms>
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SCENARIO C

Product request

Legal obligations

Cost

Redistribution

Format

Slide 14: Scenario C

In scenario C, we want usable digital data, not PDFs. Again, we are assuming Market Drive.

This is a fundamentally different request. It is no longer a request for public data. It has become a request for a PRODUCT.

The assessor must send their data to Market Drive to process, but the assessor is under no obligation to do so. IF they send it to Market Drive, Market Drive charges for the data, between 10 and 50 centes per record.

The format is digital but will be XML, which needs to be translated into something usable.

And there are redistribution restrictions. (Note that through her efforts, Ann has been able to negotiate the possibility of a subset of attributes from the assessment record being able to be redistributed and shared publicly.)

Other issues: It is one-time snapshot, not a service, you are buying. And, you must buy the entire municipality. Also, Market Drive could decline to process the request.

Remember that Market Drive sells their data en masse to the real estate market at a higher cost for custom areas in usable formats. This quickly adds up for a small project like ours that wants data from a large area.

In short, acquiring usable assessment data for studies like this one – or for any purpose – will require more resources than this project could bring to bear.

TAX-EXEMPT & OTHER DATA

Photo by Andrew Seaman on Unsplash

Original goal: Augment assessment data with tax-exempt info from public data sources

Modified goal: Use public data sources for as much building-specific data as we could find

Slide 15: Tax-Exempt and Other Data

Our final data source relates to tax-exempt properties -- those where we have no assessment data (by definition). This includes facilities like schools, police stations, churches and other exempt properties.

Our original plan was to use assessment data for ALL buildings (residential, commercial, etc.) EXCEPT tax-exempt as these would not be in the assessment data.

BUT without assessment data, we used these sources (as best we could) to provide information on occupancy type for ALL non-residential buildings, NOT just for tax-exempt. In other words, we tried to substitute other sources in place of assessment data. In our case we used three free, public (non-commercial) sources of BUILDING-based datasets:

Open Street Map

IRS Tax Exempt Organizations List, which we geocoded (unless a PO Box)

HIFLD data – National foundation-level geospatial data within the open public domain. Used only the publicly-releasable HIFLD data.

There's also something called the National Structures Inventory from US Army Corps of Engineers. The NSI uses CoreLogic data that has a somewhat restrictive use agreement. However, the data is available to Federal, State, Local, Tribal, and Territorial Mission Partners who have a signed Data Use Agreement with HIFLD. Unfortunately, NSI is "paused".

We pulled what we could from these sources to get structure information at a deeper level than what the parcel dataset would tell us (e.g., commercial, industrial, etc.). We were able to get some information on structure type (e.g., gas station, car wash) in some cases but not all.

Along with assessment data problems, this is one of the most disappointing parts of the study. There is a very little converge out there about building-specific information that is publicly usable, which points even further to the importance of assessor data if we could get it.

RESULTS: DATA LAYER

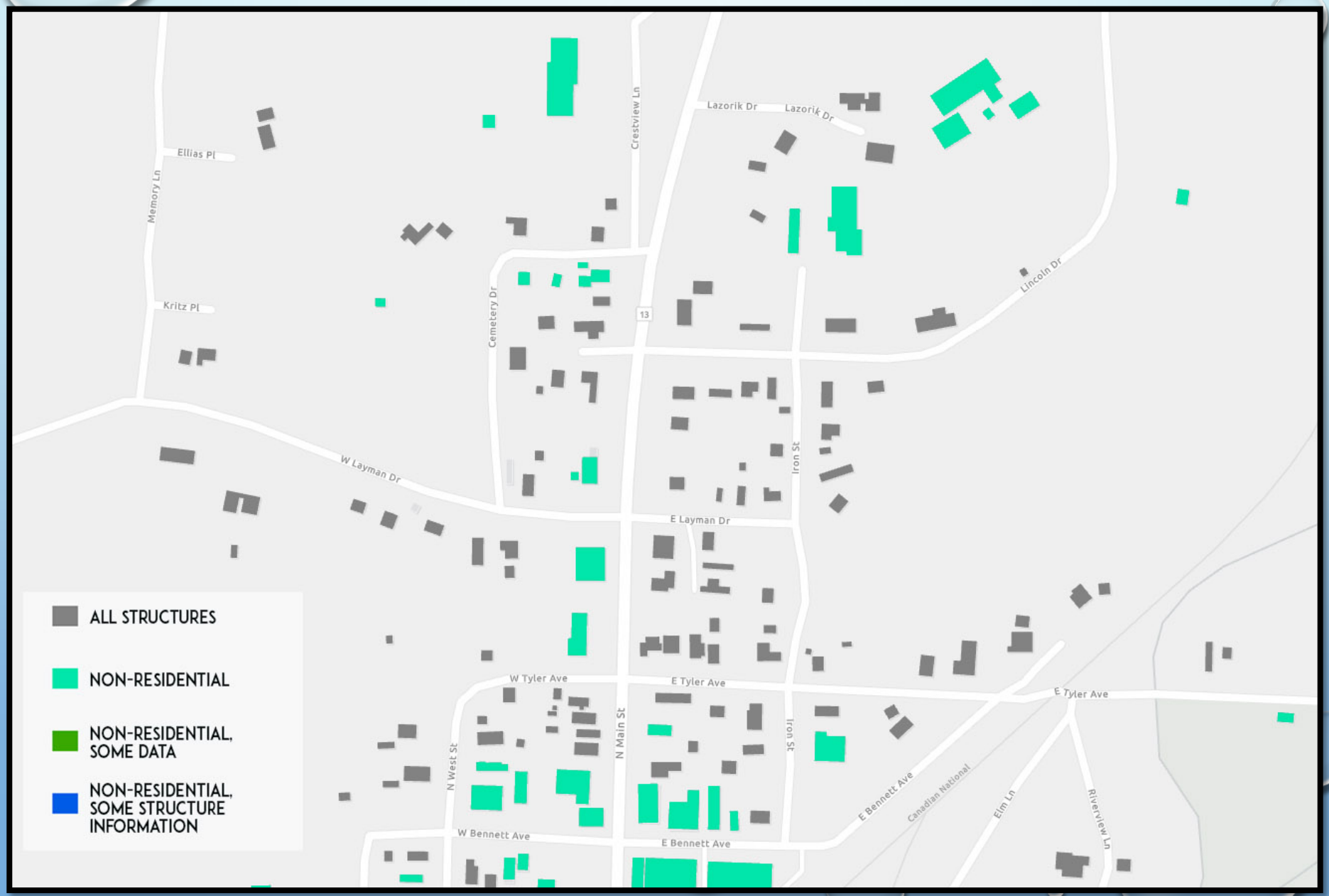
Slide 16: Results: Data Layer

Here’s what we produced.

This example is in City of Mellen (part of the study area).

The gray polygons are buildings (cleaned) from Ashland County Building Layer.

RESULTS: DATA LAYER

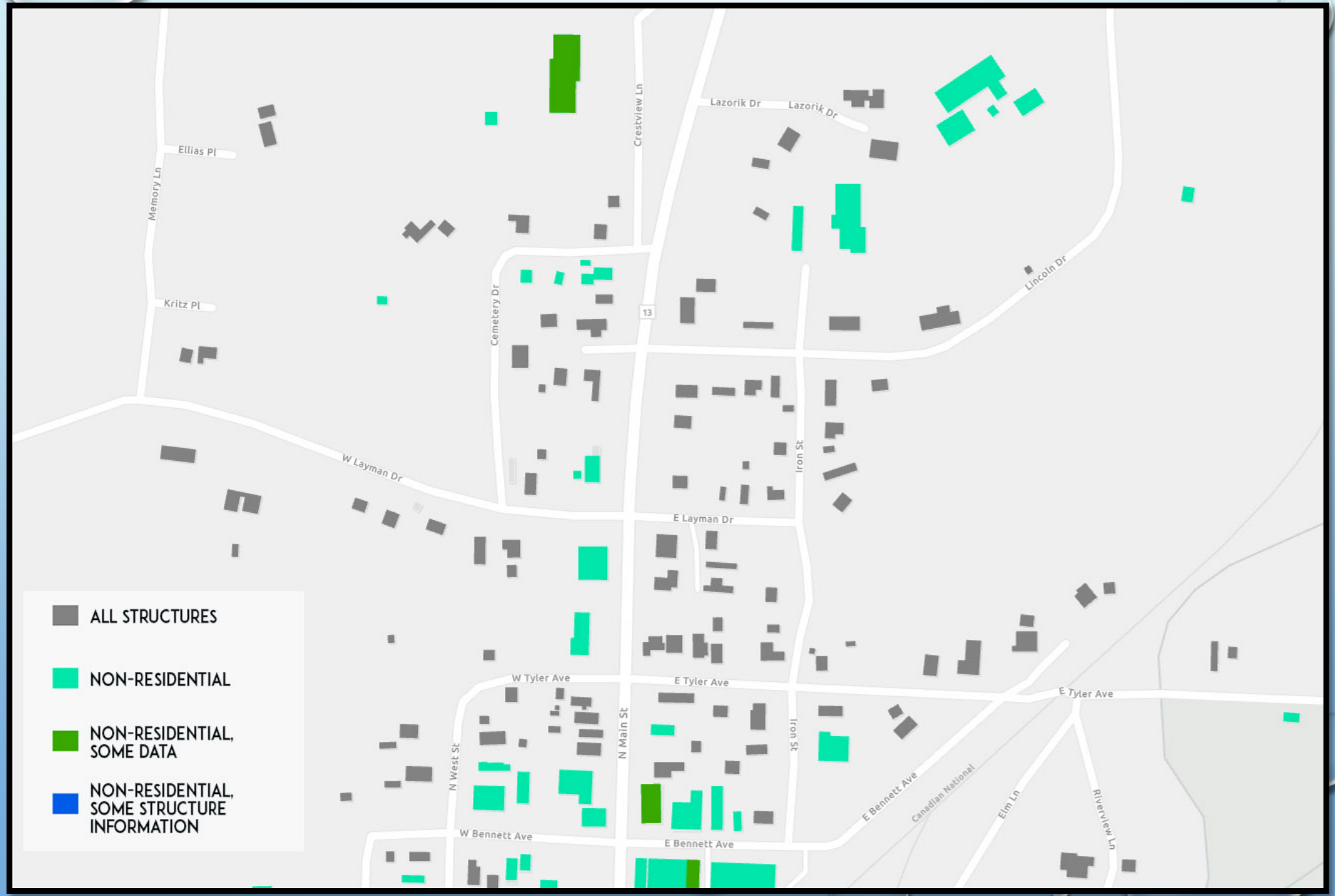


Slide 17: Results: Data Layer

Teal colored buildings are non-residential buildings, based on Class of Property from statewide parcels dataset.

Commercial, industrial, institutional, etc.

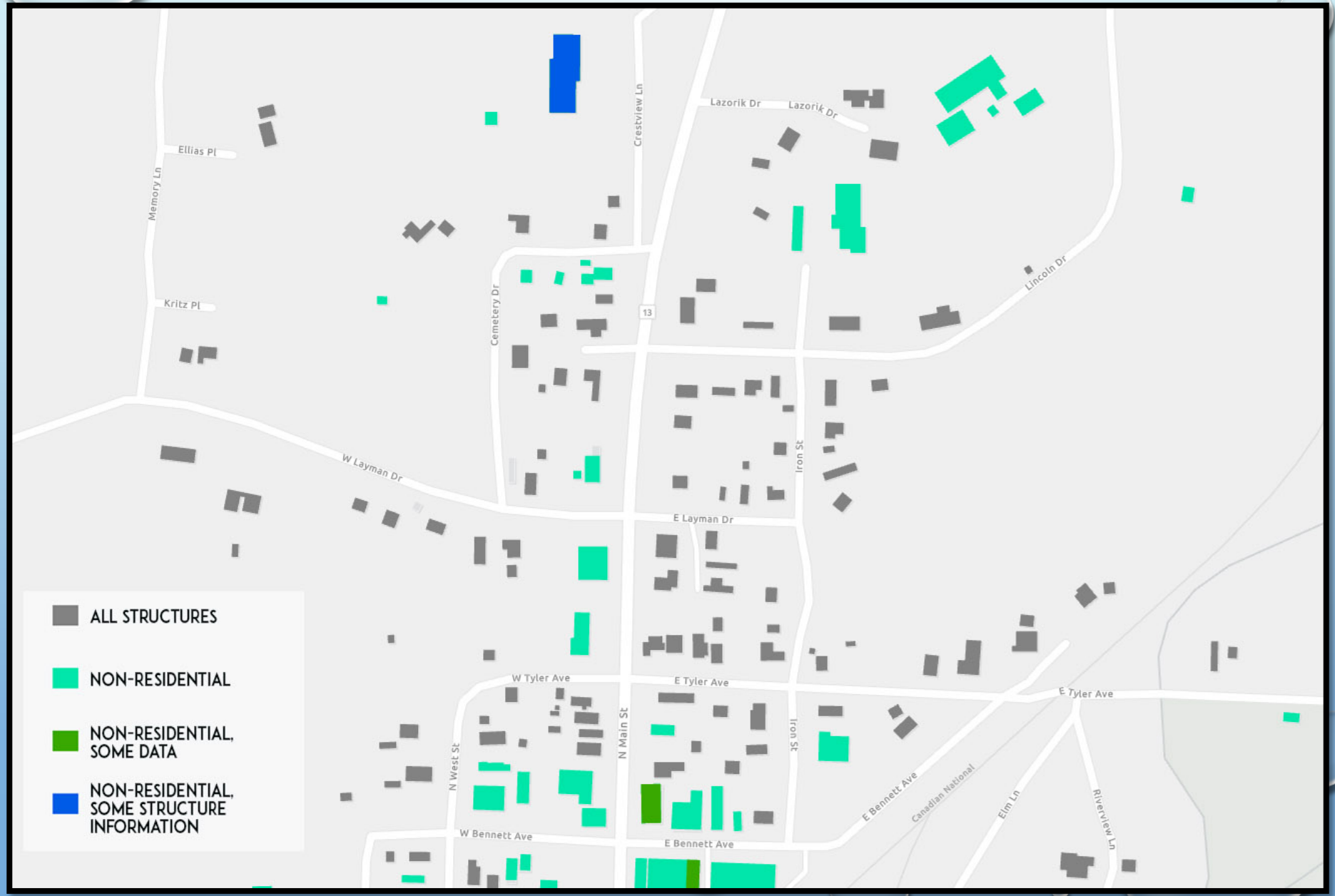
RESULTS: DATA LAYER



Slide 18: Results: Data Layer

Dark green polygons are buildings for which we were able to find some data from our secondary data sources: OSM, IRS, HIFLD.

RESULTS: DATA LAYER



Slide 19: Results: Data Layer

The blue building (one example here) is a case where we were able to find some information on the kind of structure (in this case, apartment).

Overall, the data is very sparse.

RESULTS: ATTRIBUTES

ABI_V2 - <Null>

Building Height	705
Number of Stories	<Null>
Facility Site Code	<Null>
Last Update Date	<Null>
Last Editor	<Null>
RuleID	8
BUILDINGCLASS	8
ST_PROV	<Null>
COUNTRY	<Null>
DATASOURCENAME	<Null>
EDITCOMMENTS	<Null>
SOURCEFEATUREID	<Null>
Accuracy	<Null>
PublishedDate	<Null>
ContributorViz	<Null>
LicensedViz	<Null>
ContributorUID	<Null>
FeatureUID	<Null>
DeliveryUID	<Null>
Severity	<Null>
RuleID_1	8
ParcelID	201007832000
Municipality	City of Ashland
Buildings within 10Ft	1
Buildings within 30Ft	2
Buildings within 100Ft	1254
SqFt	9796.942516
Principal_Structure	1
created_user	<Null>
created_date	<Null>
last_edited_user	GISTECH
last_edited_date	8/16/2019 12:40:38 PM
CityPropertyStatus	<Null>
BuildingName	<Null>
Campus	<Null>
Alias	<Null>
Type	<Null>
Classification	Recreation

Attributes from County Buildings Layer

Slide 20: results: Attributes

Here are some quick screenshots of the attributes for each building polygon.

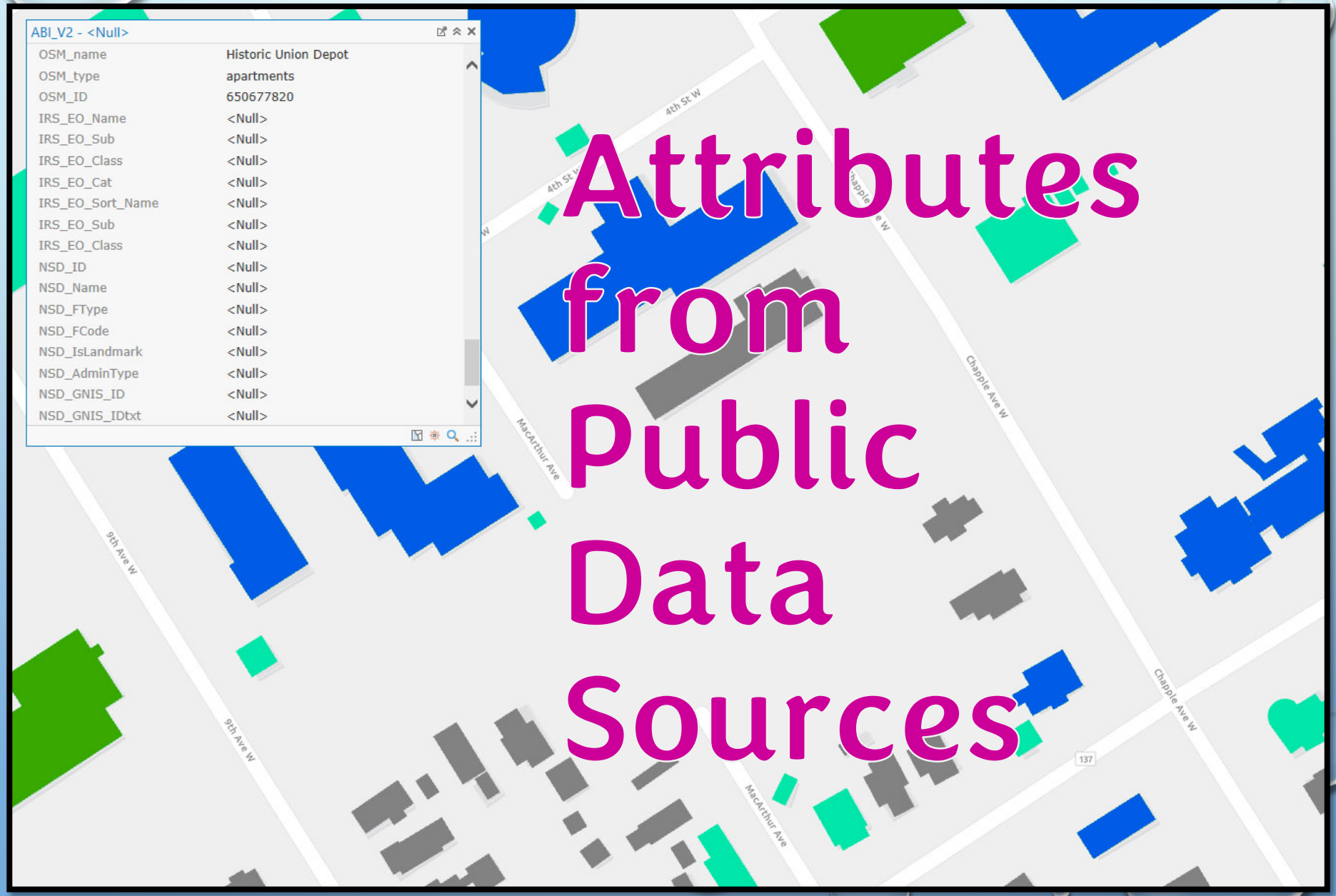
RESULTS: ATTRIBUTES

ABI_V2 - <Null>

Tax Parcel ID	201-00783-2020
Parcel Date	3/7/2019
Tax Roll Year	2020
Primary Owner Name	SCOTT H WARREN
Secondary Owner Name	ANITA L WARREN
Full Mailing Address	24715 GARDEN LAKE RD, CABLE, WI 54821
Full Physical Address	419 CHAPPLE AVE UNIT 102
Address Number Prefix	<Null>
Address Number	419
Address Number Suffix	<Null>
Prefix	<Null>
Street Name	CHAPPLE
Street Type	AVENUE
Suffix	<Null>
Landmark Name	<Null>
Unit Type	UNIT
Unit ID	102
Place Name	CITY OF ASHLAND
Zip Code	<Null>
Zip Code Plus 4	<Null>
State	WI
School District	ASHLAND SCHOOL DISTRICT
School District Number	0170
Total Assessed Value	185000
Assessed Value of Land	16000
Assessed Value of Improvements	169000
Assessed Value of MFL/FCL Land	<Null>
Estimated Fair Market Value	205400
Net Property Tax	4764.15
Gross Property Tax	4764.15
Class of Property	1
Auxiliary Class of Property	<Null>
Assessed Acres	0
Deeded Acres	<Null>
GIS Acres	<Null>
County Name	ASHLAND

Attributes from Statewide Parcel Layer

RESULTS: ATTRIBUTES



RESULTS: SOME STATS

Category	Total	Percent of total
All buildings	12,368	100%
Non-residential buildings	2,941	23.8%
Approx. number that are tax exempt or pay no property taxes	*1,256*	*10.2%*
Non-residential buildings, some data from public sources	683	5.5%
Approx. number that are tax exempt or pay no property taxes	*290*	*2.3%*
Non-res bldgs, some structure info from public sources	382	3.1%
Approx. number that are tax exempt or pay no property taxes	*191*	*1.5%*

Slide 23: Results: Some Stats

The key takeaways from this table are:

Non-residential buildings make up almost a quarter of all buildings in the area.

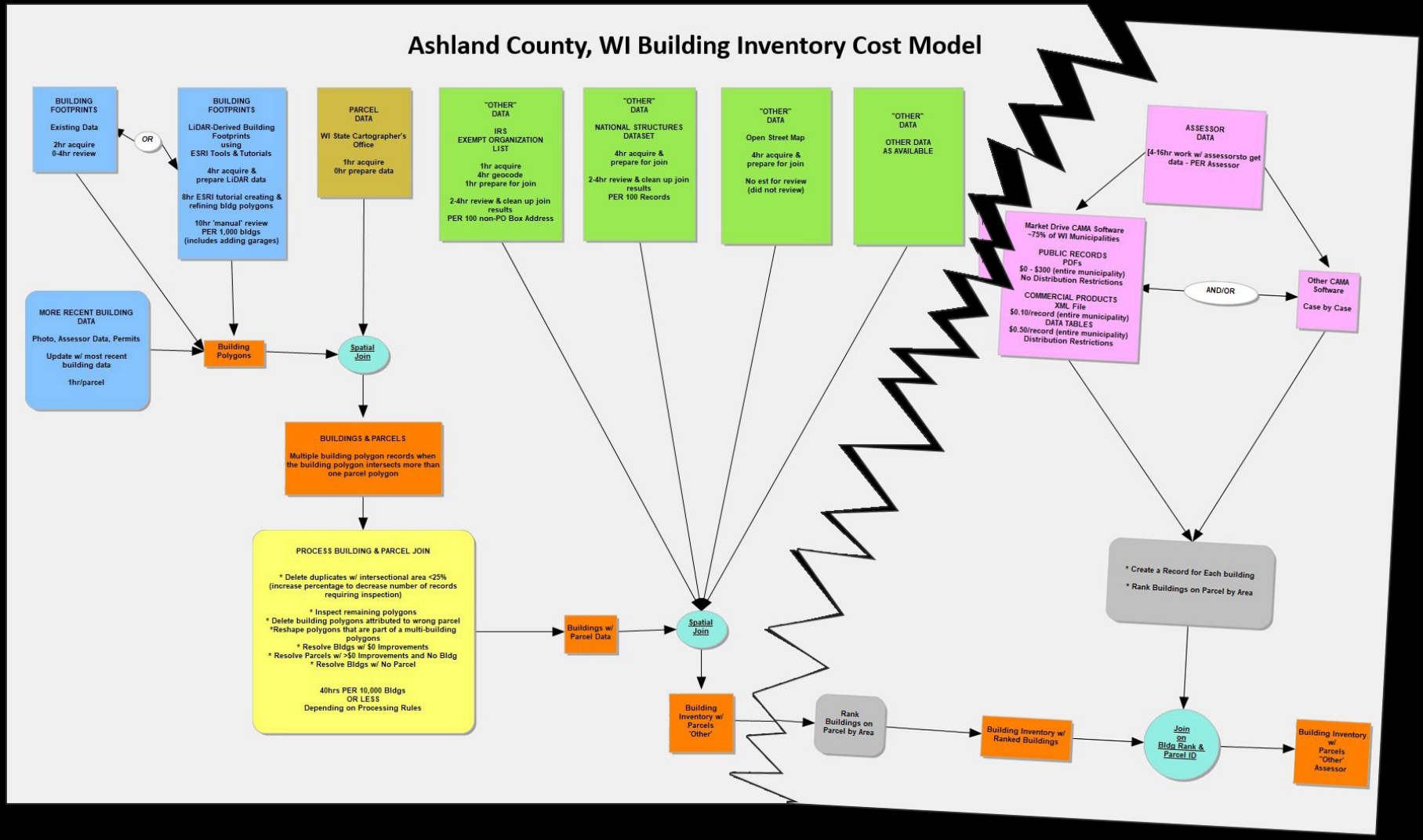
Many do not have assessment data, as they are exempt or otherwise do not pay property taxes.

Most non-residential buildings do not have data from public data sources.

Using other sources (public data) does cut down on the number of buildings with no information at all. But it does not completely close the gap (there are still buildings for which there is no data in public sources AND some of these buildings would not be in assessment data even if we could get it.)

Also the information we can get from the public sources is not really the info we need. The information does not say all that much about the building itself. In other words, it is NOT a substitute for assessment data.

COST MODEL


Ashland County, WI Building Inventory Cost Model
BUILDING FOOTPRINTS
Existing Data
2hr acquire
0-4hr review
OR
BUILDING FOOTPRINTS
LiDAR-Derived Building Footprints using ESRI Tools & Tutorials
4hr acquire & prepare LiDAR data
8hr ESRI tutorial creating & refining bldg polygons
10hr 'manual' review PER 1,000 bldgs (includes adding garages)
PARCEL DATA
WI State Cartographer's Office
1hr acquire
0hr prepare data
"OTHER" DATA
IRS EXEMPT ORGANIZATION LIST
1hr acquire
4hr geocode
1hr prepare for join
2-4hr review & clean up join results
PER 100 non-PO Box Address
"OTHER" DATA
NATIONAL STRUCTURES DATASET
4hr acquire & prepare for join
2-4hr review & clean up join results
PER 100 Records
"OTHER" DATA
Open Street Map
4hr acquire & prepare for join
No est for review (did not review)
"OTHER" DATA
OTHER DATA AS AVAILABLE
ASSESSOR DATA
[4-16hr work w/ assessorsto get data - PER Assessor
Market Drive CAMA Software ~75% of WI Municipalities
PUBLIC RECORDS PDFs
$0 - $300 (entire municipality)
No Distribution Restrictions
COMMERCIAL PRODUCTS XML File
$0.10/record (entire municipality)
DATA TABLES
$0.50/record (entire municipality)
Distribution Restrictions
AND/OR
Other CAMA Software
Case by Case
MORE RECENT BUILDING DATA
Photo, Assessor Data, Permits
Update w/ most recent building data
1hr/parcel
Building Polygons
Spatial Join
BUILDINGS & PARCELS
Multiple building polygon records when the building polygon intersects more than one parcel polygon
PROCESS BUILDING & PARCEL JOIN
* Delete duplicates w/ intersectional area <25% (increase percentage to decrease number of records requiring inspection)
* Inspect remaining polygons
* Delete building polygons attributed to wrong parcel
*Reshape polygons that are part of a multi-building polygons
* Resolve Bldgs w/ $0 Improvements
* Resolve Parcels w/ >$0 Improvements and No Bldg
* Resolve Bldgs w/ No Parcel
40hrs PER 10,000 Bldgs OR LESS
Depending on Processing Rules
Buildings w/ Parcel Data
Spatial Join
Building Inventory w/ Parcels 'Other'
Rank Buildings on Parcel by Area
Building Inventory w/ Ranked Buildings
* Create a Record for Each building
* Rank Buildings on Parcel by Area
Join on Bldg Rank & Parcel ID
Building Inventory w/ Parcels 'Other' Assessor

Slide 24: Cost Model

One of our other deliverables is a cost model. Our goal is to provide others with a sense of the effort involved in such an analysis, so that effort can be allocated correctly.

We tracked the cost (in terms of labor hours) at a very fine level for this study:

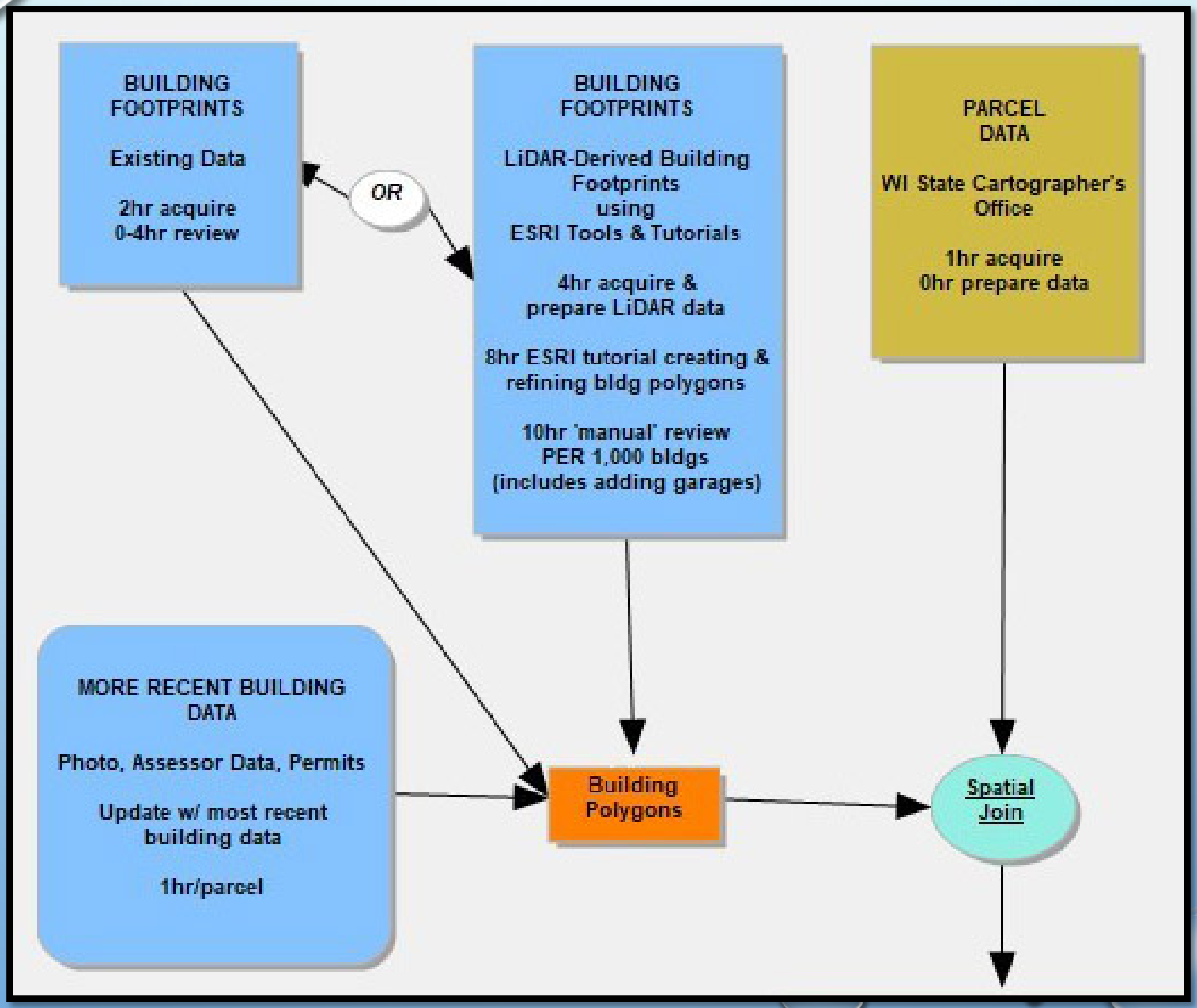
- Meetings/admin/planning
- Processing building footprints
- Lidar extraction of footprints
- Acquiring assessor data
- Data integration
- Etc.

The diagram on the slide shows our cost model, integrated within a workflow diagram.

- Data sources are along the top.
- Processes and products are below.
- Color coding: BLUE is bldg. footprints; BROWN = parcels; GREEN = other data; PINK = assessment data; YELLOW = footprint/parcel processing integration task

One note: we invested a large amount of time in the assessment data issue, even though we were unable to use it. (As shown above!)

COST MODEL


BUILDING FOOTPRINTS
Existing Data
2hr acquire
0-4hr review
OR
BUILDING FOOTPRINTS
LiDAR-Derived Building Footprints using ESRI Tools & Tutorials
4hr acquire & prepare LiDAR data
8hr ESRI tutorial creating & refining bldg polygons
10hr 'manual' review PER 1,000 bldgs (includes adding garages)
PARCEL DATA
WI State Cartographer's Office
1hr acquire
0hr prepare data
MORE RECENT BUILDING DATA
Photo, Assessor Data, Permits
Update w/ most recent building data
1hr/parcel
Building Polygons
Spatial Join

Slide 25: Cost Model

Here we have zoomed in on one part of the workflow/cost model, related to building footprints.

There are two options: Using existing footprints or extraction from LiDAR

As an example, the LiDAR extraction includes manual review at 10 hrs per 1000 buildings.

Users can use the workflow and cost model to estimate how much it would cost to do something similar.

COST MODEL

Example: Sheboygan County, WI – **85,000 BUILDINGS – EXISTING BUILDING FOOTPRINTS**		
Category	Task	Hours
Building Footprints Existing Dataset GeoData@WI Sheboygan_Buildings_2014	Acquire	2
	Review (dataset has <10 attributes)	1
Parcel Data WI State Cartographer's Office	Acquire	1
Building Footprint & Parcel Data	Spatial Join	1
	Process Building & Parcel Join (85,000 Bldgs)	340 OR LESS (possibly 50% less)*
Other Data – IRS Exempt Organization List	Acquire	1
	Geocode	4
	Review Join Results (574 Non-PO Box Addresses)	16
Other Data – National Structures Dataset	Acquire & prepare for join	4
	Review & clean up join results (216 points)	4 - 8
Other Data – Open Street Map	Acquire & prepare for join	4
Assessor Data	None	NA
TOTAL		Approx. 380 (10 wks) (possibly 200 (5 wks))

*Processing of parcel join can be reduced if building polygons are simply assigned to the parcel of greatest intersection and the dissection of multi-building polygons is automated. This would introduce more error which could cost time later.

Update of building polygons with more recent building data from photos, assessor data, or permits not included.

Slide 26: Cost Model

We can then use this information to estimate project costs for other areas.

Here’s an example for all of Sheboygan County using existing building footprint data.

In this example, the highest cost component is the footprint/parcel integration process at as much as 340 hours.

None of our examples show costs for assessment data.

OTHER USES

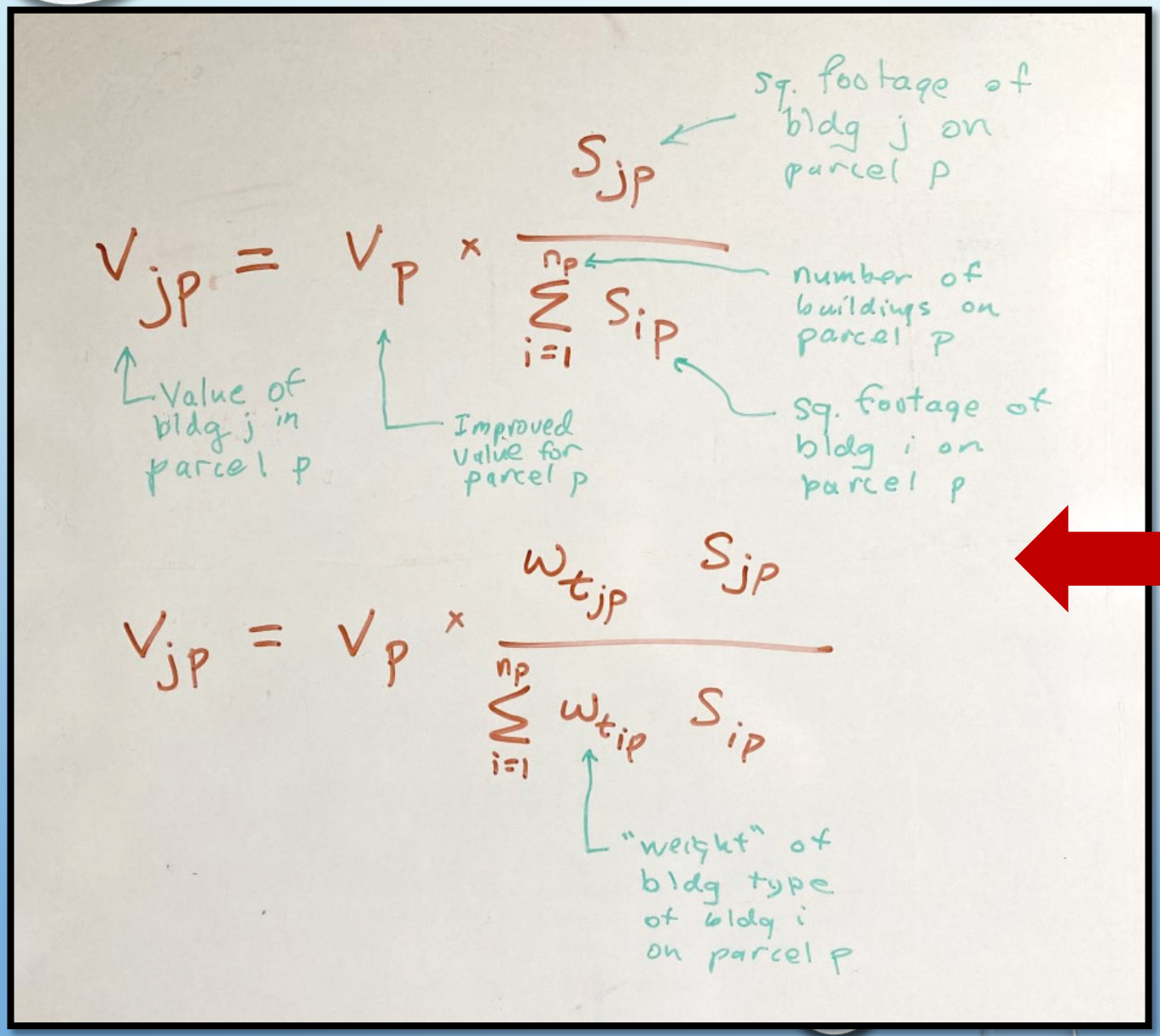
- Zoning & permitting enforcement (County Gov't)
- Contesting tax increases (County Gov't)
- Exposing tax inconsistencies (County Gov't)
- Social services (County Gov't)
- Damage Estimates (County Gov't; State agencies; RPCs; Researchers)
- Planning (County Gov't; State agencies; RPCs)
- First responder structure-specific information (County Gov't; State agencies; RPCs)
- Baseline data for socio-economic analyses (County Gov't; Researchers)
- Insurance – value, condition, location, elevation (County Gov't; State agencies; RPCs; Researchers)
- Social vulnerability – building characteristics & condition, value, location (Researchers)

Slide 27: Other Uses

It’s not just projects like ours (flood modeling) that could benefit from assessment data.

Our outreach to stakeholders showed a LOT of interest in assessor data.

SOLUTIONS?



LiDAR?

Out-buildings

Allocation model

Oblique photos

Slide 28: Solutions?

In the absence of assessor data, what are some solutions?

Some ideas.

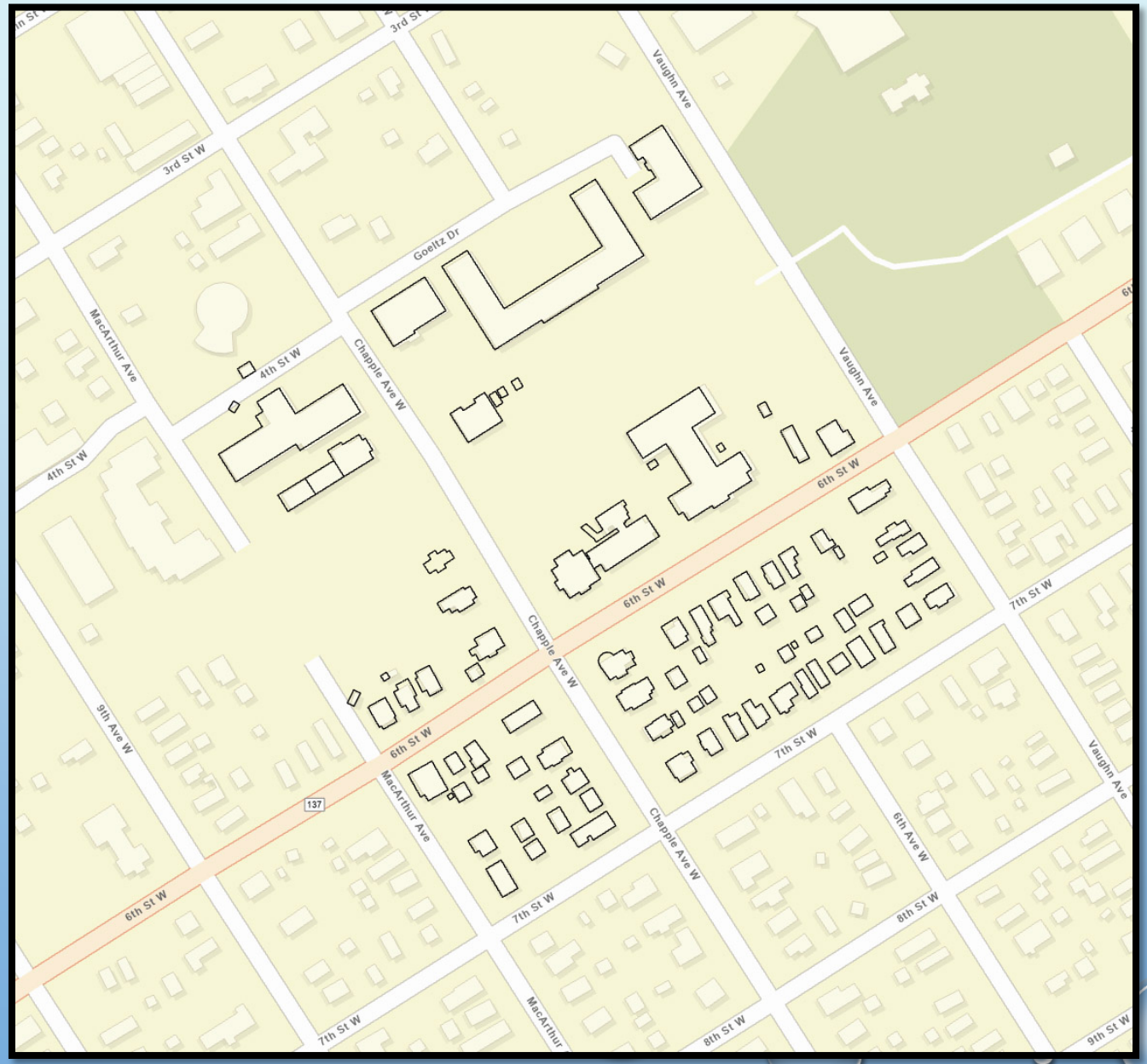
Can we derive building square footage from Lidar-derived building heights coupled with square footage from footprints?

Identify outbuildings based on square footage? Might work differently in urban areas versus on farms.

Allocation model to split assessed value amongst bldgs. Use class of property to assign weights to different types of bldgs.

Height of first floor …. Oblique photos (street view)?

WHAT COULD BE...

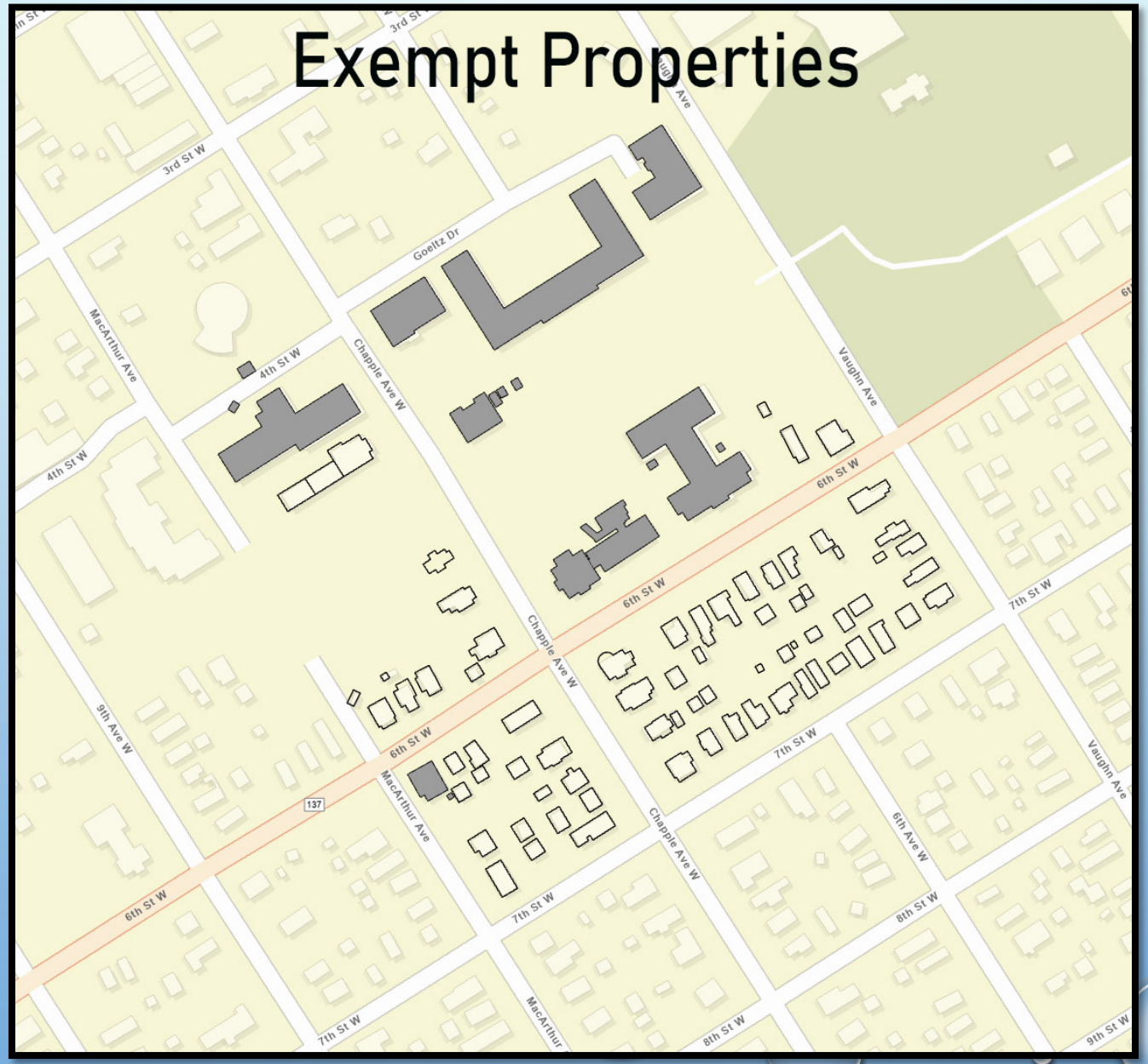


Slide 29: What Could Be…

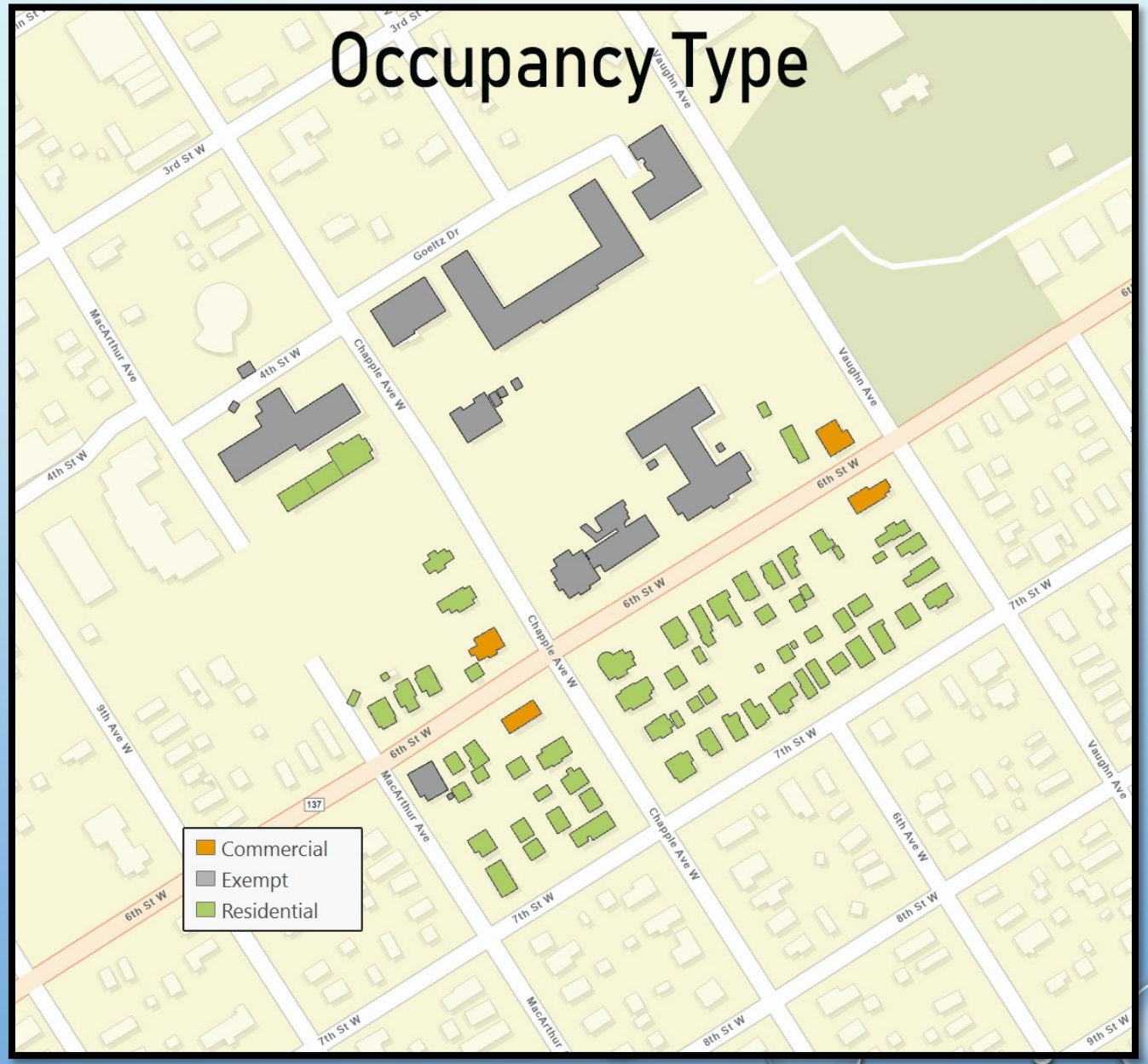
If we had assessor data, here's a slideshow of what sorts of attributes we could have.

Ann created this by manually entering data from PDFs for a small area.

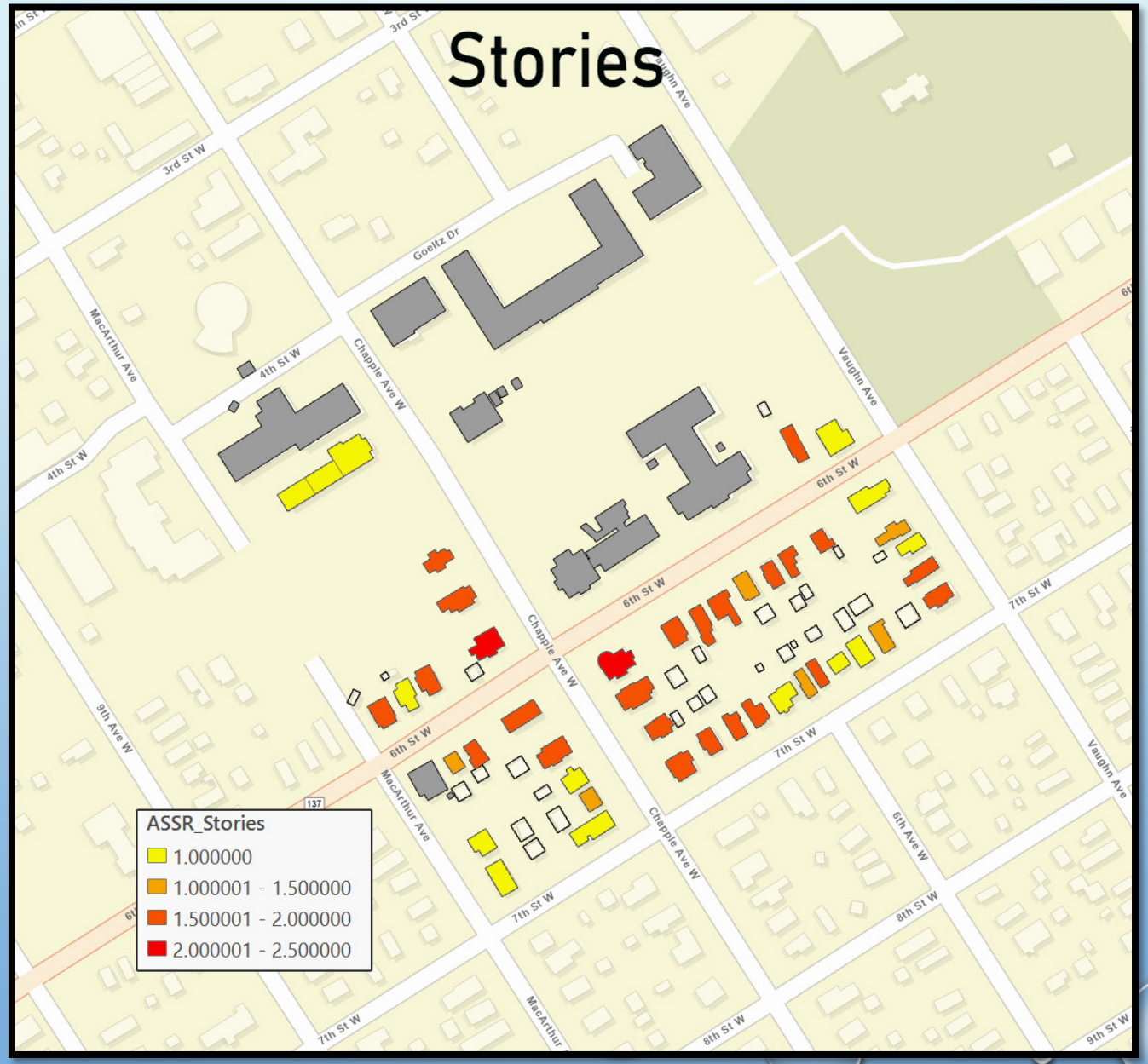
WHAT COULD BE...



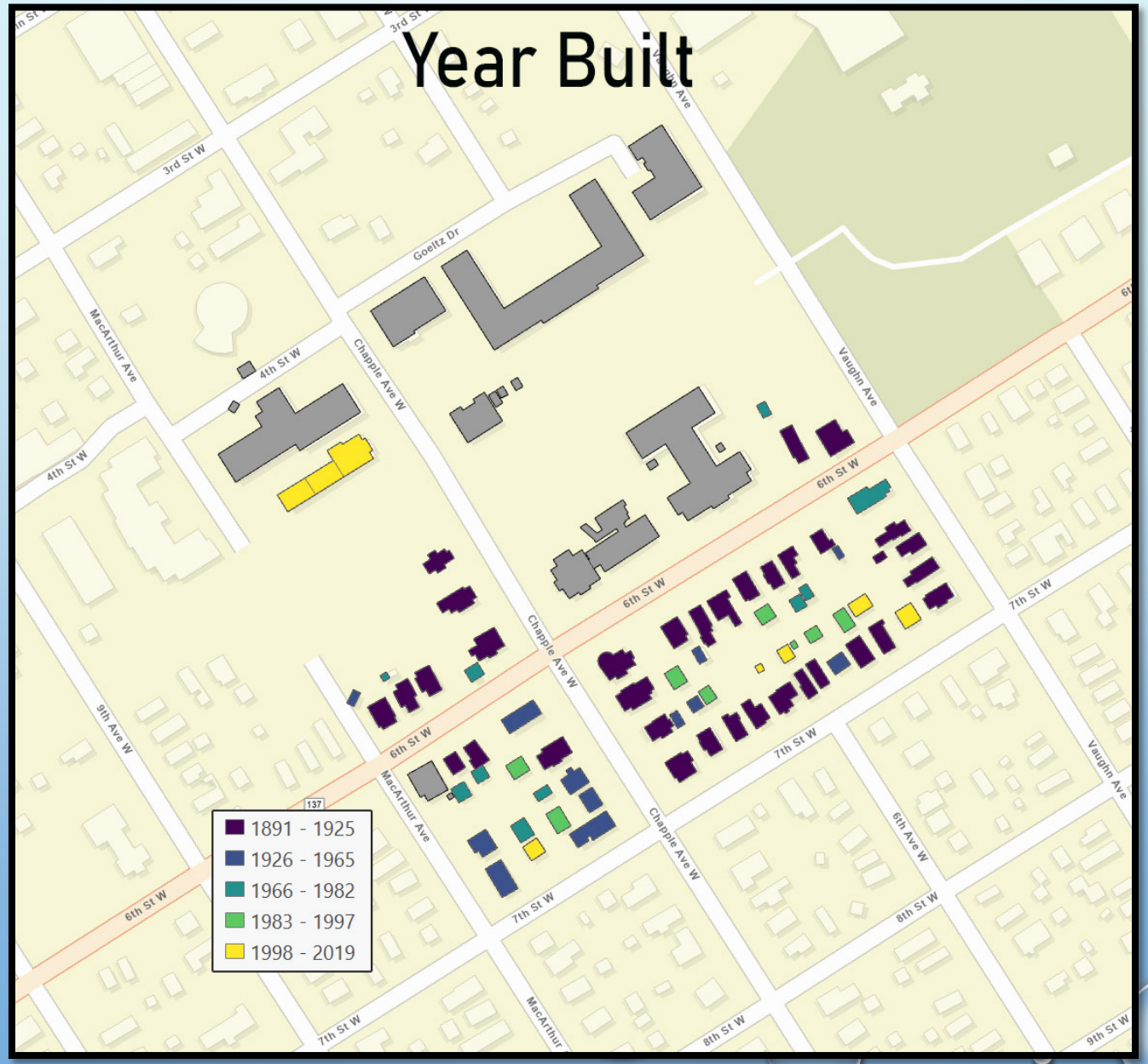
WHAT COULD BE...



WHAT COULD BE...



WHAT COULD BE...



WHAT COULD BE...

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