An Approach to Mass Appraisal in Power BI

April 14, 2026

Agenda

- Overview of Tools
- Architecture
- Hands-on Demonstration
- Reflection
- Related Products

Mass Appraisal Activities

- Data Collection and Maintenance
  - Field Work, Pl
  - Sales
- Valuation
  - Model Configuration an
  - Mass Adjustment
- Measure Valuation Performance: Ratio Study

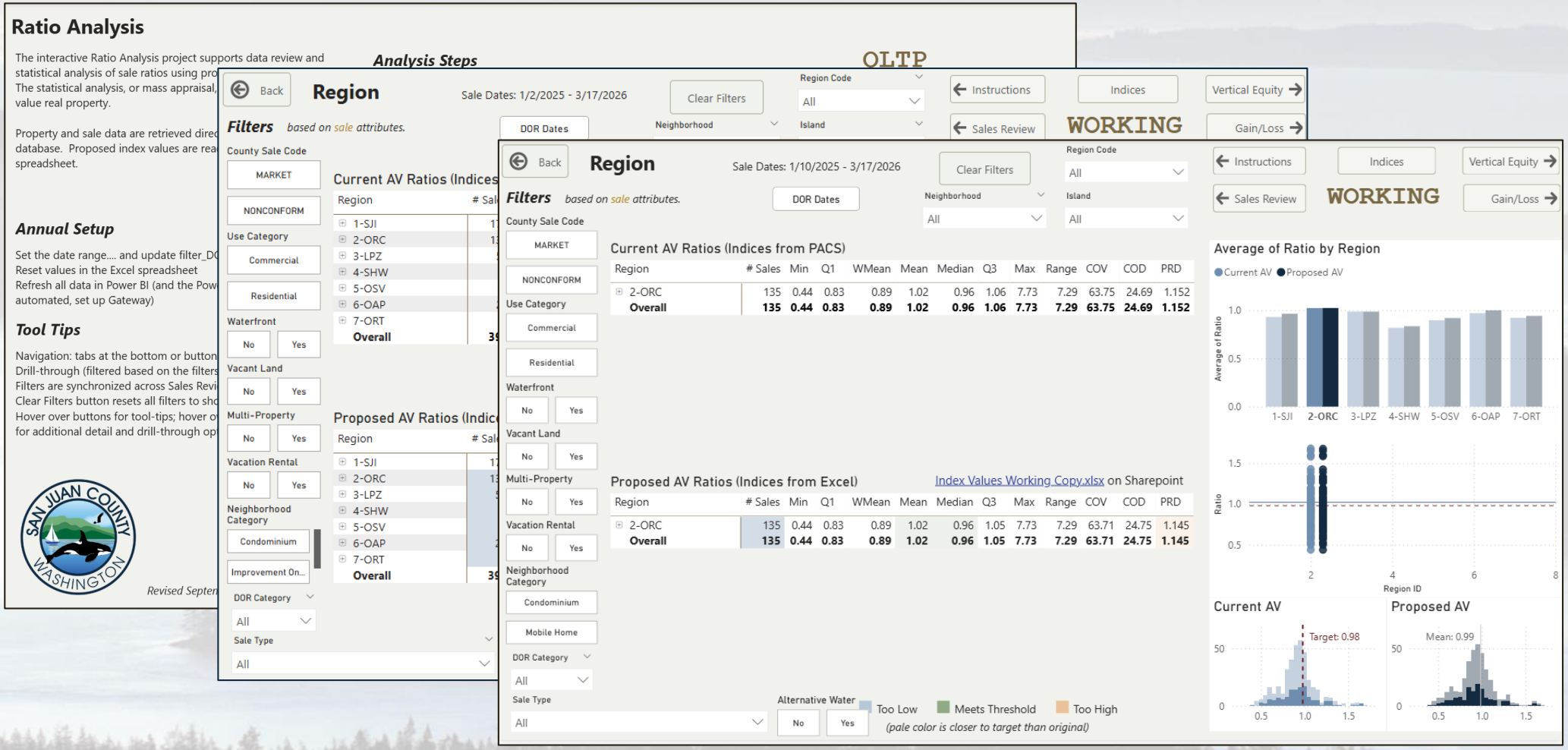
Identify records for research
- Highlight, filter
- Data

Iterative Calculations
- As-if Scenarios
- Slice by strata
- Compare against standards

Workflow

- Start of Season
  - Update sale date parameters
  - Refresh index spreadsheet
  - Sales review
- Repeat for as-if scenarios
  - Data refresh in Power BI
  - Review ratio statistics
  - Model refinement (PACS)
  - Set adjustment indices (Excel)
- Finalize
  - Enter adjustment indices (PACS Admin)
  - Recalc (PACS)
  - Data refresh in Power BI
  - Review Gain/Loss
  - Export Sales data

Tools 2025


Ratio Analysis
The interactive Ratio Analysis project supports data review and statistical analysis of sale ratios using pro
The statistical analysis, or mass appraisal, value real property.
Property and sale data are retrieved direc database. Proposed index values are rea spreadsheet.
Annual Setup
Set the date range..... and update filter_D Reset values in the Excel spreadsheet Refresh all data in Power BI (and the Pow automated, set up Gateway)
Tool Tips
Navigation: tabs at the bottom or button Drill-through (filtered based on the filters Filters are synchronized across Sales Revi Clear Filters button resets all filters to sh Hover over buttons for tool-tips; hover o for additional detail and drill-through op
SAN JUAN COUNTY WASHINGTON
Revised Septer
Analysis Steps
OLTP
Back
Region
Sale Dates: 1/2/2025 - 3/17/2026
Clear Filters
Region Code
All
Instructions
Indices
Vertical Equity
Filters
based on sale attributes.
DOR Dates
Neighborhood
Island
Sales Review
WORKING
Gain/Loss
County Sale Code
MARKET
NONCONFORM
Use Category
Commercial
Residential
Waterfront
No
Yes
Vacant Land
Multi-Property
Vacation Rental
Neighborhood Category
Condominium
Improvement On...
DOR Category
Sale Type
Current AV Ratios (Indices
Region
Sal
1-SJI
2-ORC
3-LPZ
4-SHW
5-OSV
6-OAP
7-ORT
Overall
Proposed AV Ratios (Indic
Back
Region
Sale Dates: 1/10/2025 - 3/17/2026
Clear Filters
Region Code
All
Instructions
Indices
Vertical Equity
Filters
based on sale attributes.
DOR Dates
Neighborhood
All
Island
All
Sales Review
WORKING
Gain/Loss
County Sale Code
MARKET
NONCONFORM
Use Category
Commercial
Residential
Waterfront
No
Yes
Vacant Land
Multi-Property
Vacation Rental
Neighborhood Category
Condominium
Mobile Home
DOR Category
All
Sale Type
All
Alternative Water
No
Yes
Current AV Ratios (Indices from PACS)
Region # Sales Min Q1 WMean Mean Median Q3 Max Range COV COD PRD
2-ORC 135 0.44 0.83 0.89 1.02 0.96 1.06 7.73 7.29 63.75 24.69 1.152
Overall 135 0.44 0.83 0.89 1.02 0.96 1.06 7.73 7.29 63.75 24.69 1.152
Proposed AV Ratios (Indices from Excel)
Index Values Working Copy.xlsx on Sharepoint
Region # Sales Min Q1 WMean Mean Median Q3 Max Range COV COD PRD
2-ORC 135 0.44 0.83 0.89 1.02 0.96 1.05 7.73 7.29 63.71 24.75 1.145
Overall 135 0.44 0.83 0.89 1.02 0.96 1.05 7.73 7.29 63.71 24.75 1.145
Too Low
Meets Threshold
Too High
(pale color is closer to target than original)
Average of Ratio by Region
Current AV
Proposed AV
Average of Ratio
1.0
0.5
0.0
1-SJI
2-ORC
3-LPZ
4-SHW
5-OSV
6-OAP
7-ORT
Ratio
1.5
1.0
0.5
2
4
6
8
Region ID
Current AV
Target: 0.98
50
0
0.5
1.0
1.5
Proposed AV
Mean: 0.99
50
0
0.5
1.0
1.5

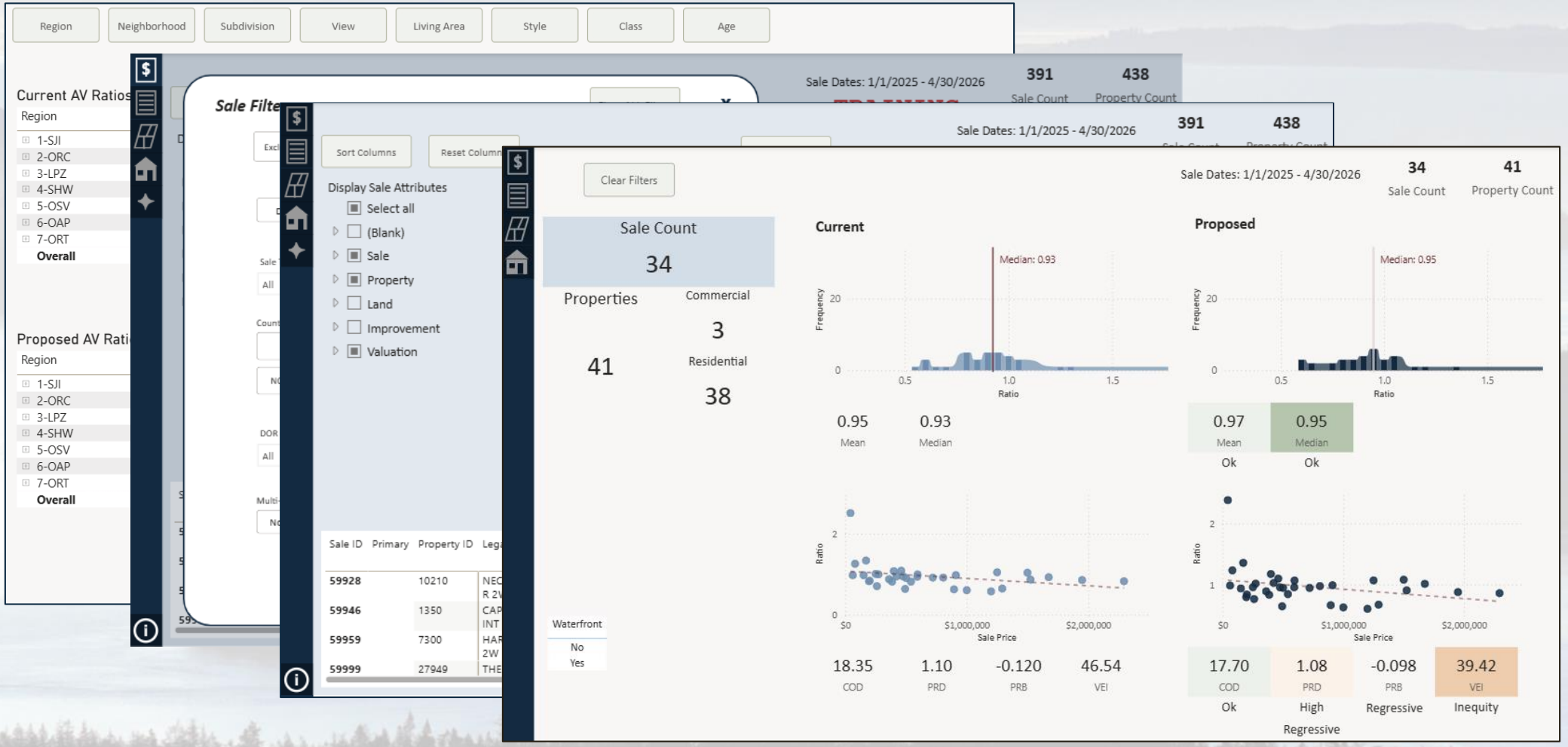
Tools 2025

Proposed as-if index values in Excel (SharePoint)

Code	Neighborhood	Land Index	Land Index Modifier	Ignore Inherited Land Modifie	Improvement Index	Improvement Index Modifier	Ignore Inherited Improvement Modifier	Property Coun	Analysis Status
11011	Friday Harbor- Area -General	105	0		145	0		292	
11012	Friday Harbor-Area -Waterfront	126	0		157	0		116	
11013	Friday Harbor- Area -Condo	105	0		116	0		129	
11014	Friday Harbor- Area -Imp Only	100	0		105	0		10	
11015	Friday Harbor- Area -Land Trust	100	0		100	0		45	
11016	Friday Harbor- Area -Comm	100	0		120	0		22	
11017	Friday Harbor- Area -Comm Condo	100	0		100	0			not active
11021	Friday Harbor Core	105	0		132	0		586	
11022	Friday Harbor-Pear Point-Waterfront	105	0		149	0		123	
11023	Friday Harbor-Low Q Condo	105	0		110	0		104	
11024	Friday Harbor - Harbor Ridge Mobile Home Park	100	0		20	0		73	
11031	Friday Harbor Terra Bella	105	0		151	0		15	
11033	Friday Harbor-Cannery Village	100	0		173	0		38	
11034	Friday Harbor-Imp Only Hangars	100	0		100	0		67	
11041	Friday Harbor-Hillview Terrace	105	0		143	0		146	
11043	Friday Harbor-Marina Slips	100	0		100	0		78	

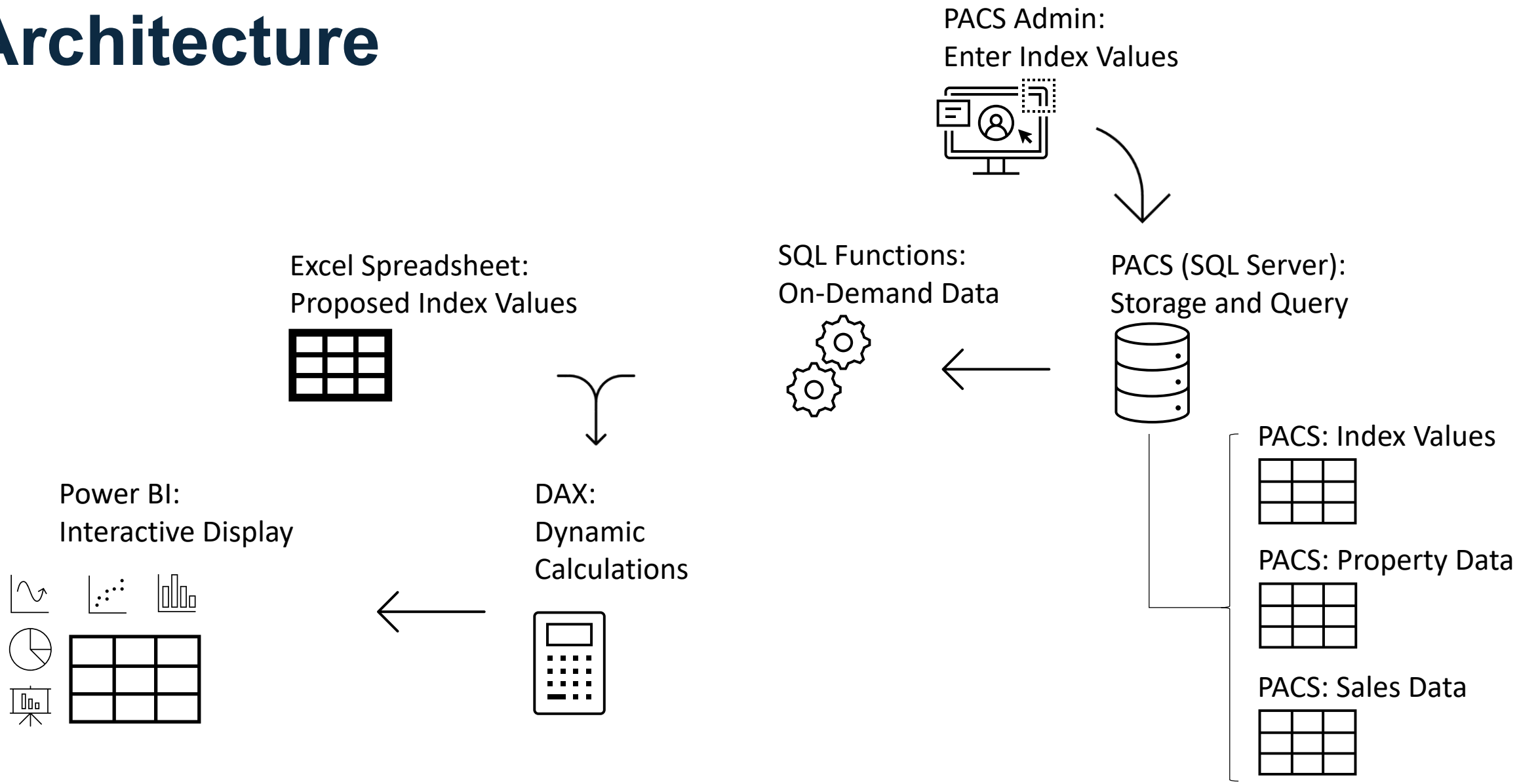
README | County | Region | District | **Neighborhood** | Abstract,Subdivision | ...

Tools 2026 – Work in Progress

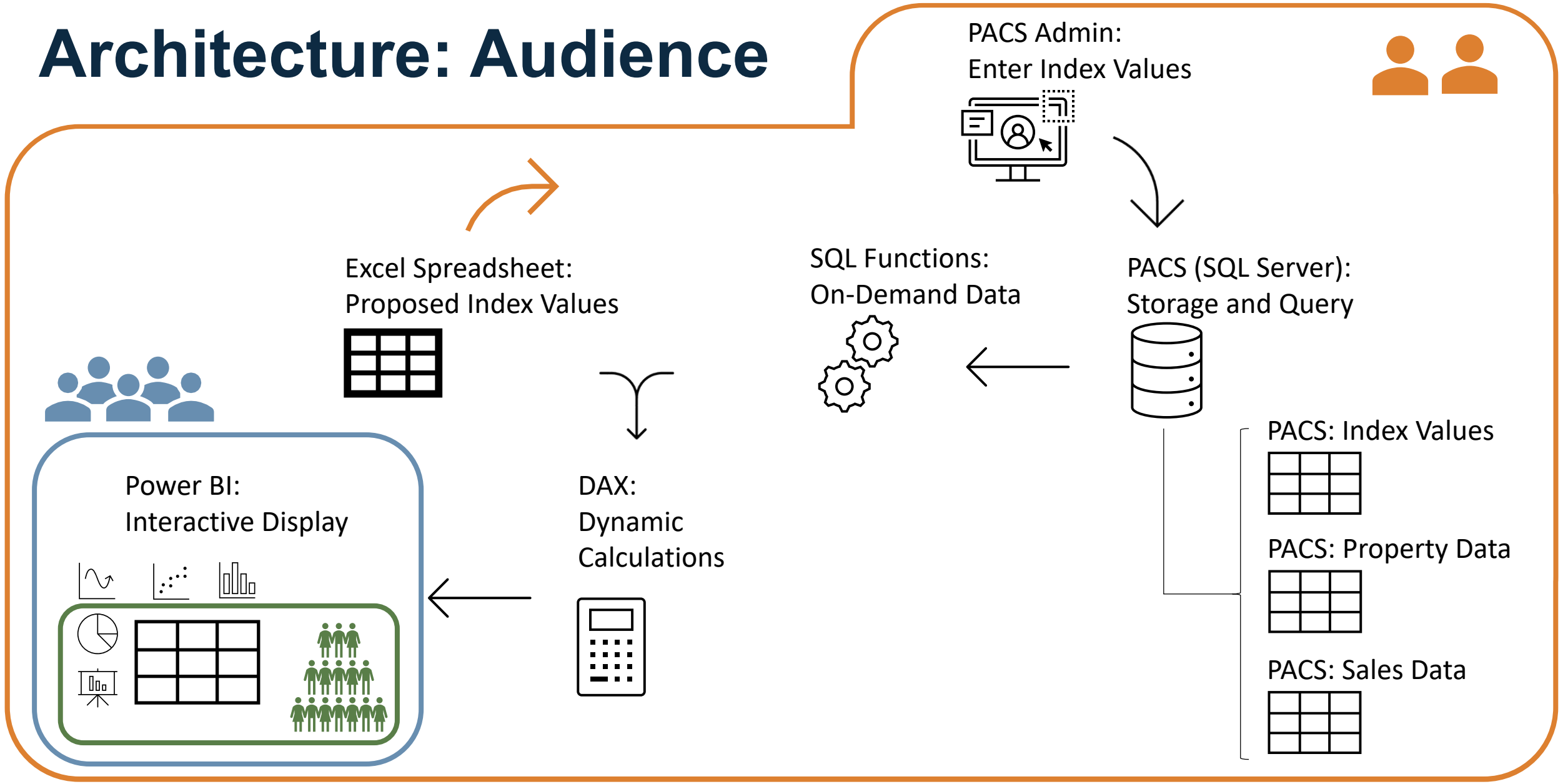


Live Demo!

Architecture



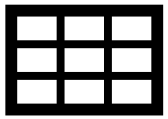
Architecture: Audience



Architecture: Details

PACS Admin:
Enter Index Values

Excel Spreadsheet:
Proposed Index Values



SQL Functions:
On-Demand Data

PACS (SQL Server):
Storage and Query

PACS: Index Values

PACS: Property Data

PACS: Sales Data

Power BI:
Interactive Display

DAX:
Dynamic
Calculations

Data Needs: Calculations

- Ratio
  - Assessed Value
    - Land Value
    - Improvement Value
  - Sale Price
- Identifiers
  - Strata for mass adjustments
  - Categories that align with the valuation model

Data Needs: Exploration and Explanation

What data should be displayed?

- Property data: value, attributes
- Sale data: attributes, properties
- Mass adjustment index values

Data Queries: Property Data

Function: SanJuan_SalesProperties(@startDate,@endDate)

- 1:1
  - Property, property values
  - PACS-computed rollup info
- Pivot
  - Property group codes
  - Land characteristics
- Filter – choose one
  - Land characteristics
  - Improvements
  - Primary property
- Aggregate – exist, sum, string_agg
  - Improvement records
  - Events
- Annotate
  - Interpret codes
  - Sort order
  - Format

Data Queries: Property Data

```
SELECT * FROM SanJuan_SalesProperties('01-01-2025','04-30-2026')
```

	1:1	generalize	1:1	format	pivot, choose	annotate	exists	filter, agg	
	property_profile		property_val		land_detail_characteristics		event	event	
Property ID	Living Area	Living Area Category	Island (Map ID)	Island	View	View Order	Parcel Maint	Event Type(s)	…
1248		No Improvement	LOPEZ ISLAND	Lopez Island	GMV	1	No		…
15308	1,632	1,500-1,999 sq ft	SAN JUAN ISLAND	San Juan Island	NO VIEW	18	No		…
2446	0	None	DECATUR ISLAND	Decatur Island	FTV	16	Yes	BLM, SPLIT	…
2446	0	None	DECATUR ISLAND	Decatur Island	FTV	16	Yes	BLM, SPLIT	…
3133	1,158	1,000-1,499 sq ft	ORCAS ISLAND	Orcas Island	ATV	13	No		…
8840	3,273	3,000 sq ft or more	ORCAS ISLAND	Orcas Island	AMV+	3	Yes	BLA	…

Data Queries: Sales Data

Function: SanJuan_SalesSummary(@startDate,@endDate)

- 1:1
  - Price, state | county codes
- Filter – choose one
  - Neighborhood, region
  - Primary use code
- Aggregate – sum, string_agg
  - Values, land size, living area
  - Flags (set if any, set if all)
- Annotate
  - Living area category
  - Plot X
  - (Mis-)match coding
  - Sort order
  - Color coding

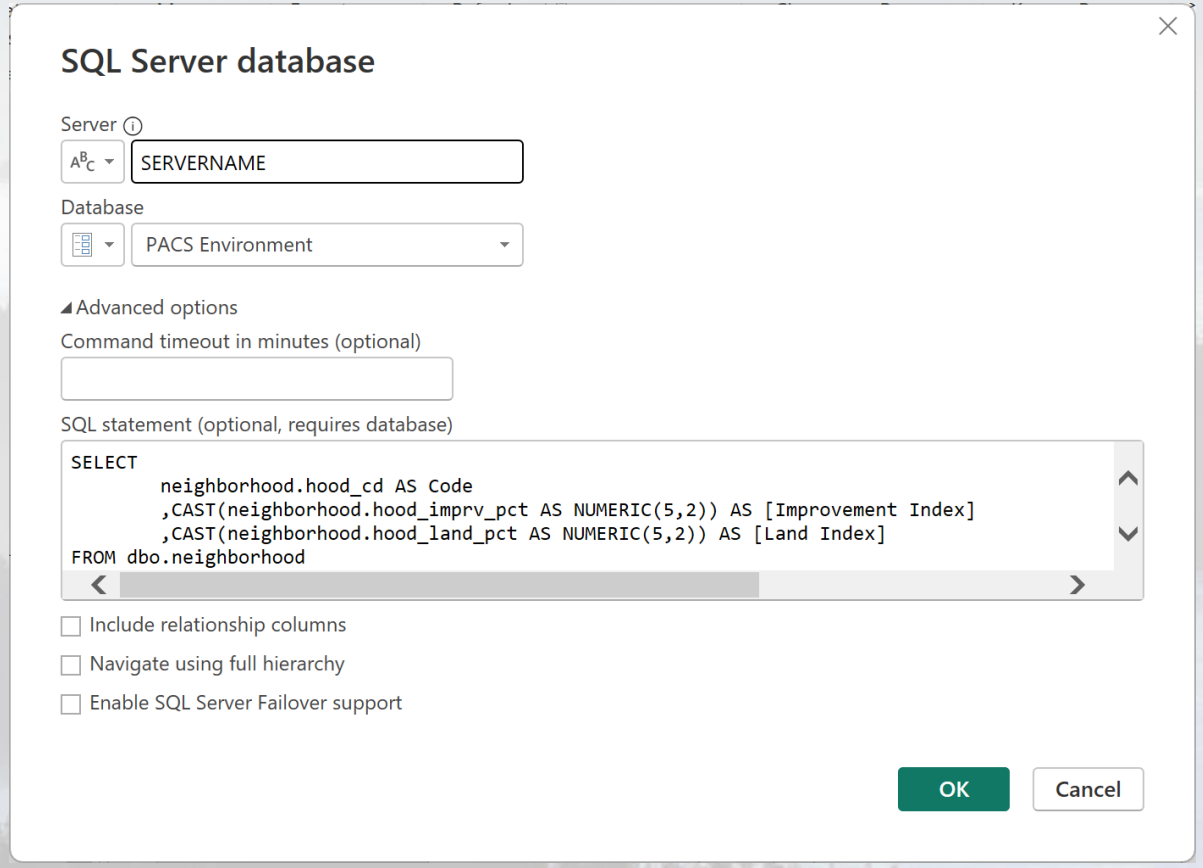
Data Queries: Sales Data

```
SELECT * FROM SanJuan_SalesSummary('01-01-2025','04-30-2026')
```

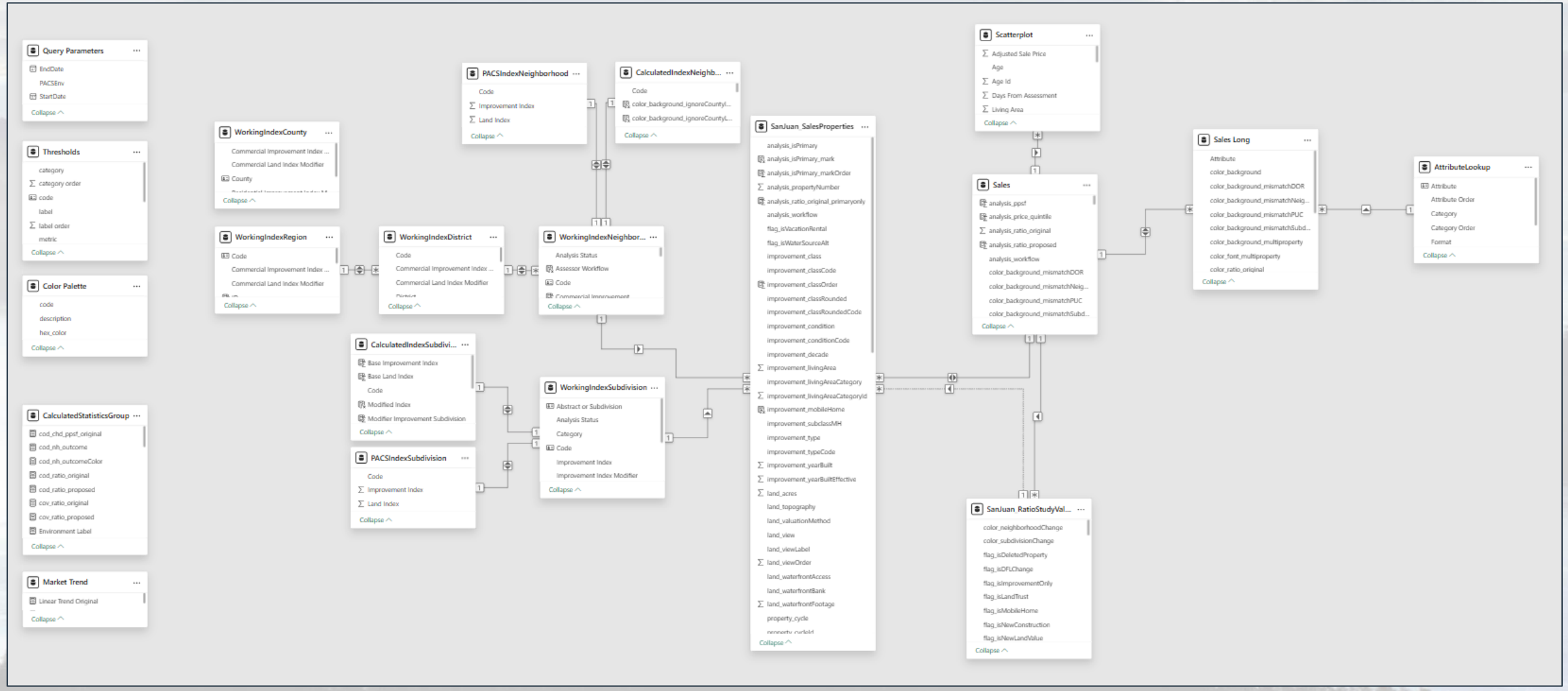
	1:1	1:1	generalize	aggregate	choose	aggregate	choose	annotate	rollup	calculate	annotate	annotate	
	sale	sale											
Sale	Sale Date	Sale Code	Ratio Study	Property Count	Primary Property	Property List	NH	NH Plot X	Multi NH Highlight	Ratio	Ratio Highlight	Ratio Label	...
61095	4/9/2025	REJECTED	Excluded	1	10689	10689	21031	61				OK	...
61099	4/9/2025	MARKET	Ratio Study	1	7189	7189	11022	8		0.96		OK	...
61115	4/11/2025	MARKET	Ratio Study	1	20729	20729	14011	33		0.86		OK	...
61212	4/17/2025	NONCONFORM	Ratio Study	1	3179	3179	23026	81		1.00		OK	...
61275	4/26/2025	NONCONFORM	Ratio Study	2	12826	12826, 12829	21081	68		1.26		OK	...
62288	7/31/2025	MARKET	Ratio Study	4	19194	19193,19197, 19194, 19178	14032	37	#b4c7d8	1.03		OK	...
62699	8/29/2025	MARKET	Ratio Study	1	4614	4614	22021	76		2.75	#ffd1d1	Review	...

Data Queries: Index Values

- SQL query
- Import into Power BI



Data Organization



Where logic resides… evolves over time

SQL Server (PACS, T-SQL)

- Easy to version
- Explicit code statements
- Heavyweight

Power BI (DAX, configuration)

- Binary file (plus DAX editor)
- Configuration in the UI
- Flexible and dynamic

Hands-On!

Demonstration: Hands-on

Software	Power BI desktop Excel
Files	Power BI Project (.pbix) Demo Data (.xlsx) T-SQL Query (.sql)
Knowledge	Ratio statistics Computer scripts

Take-ways

- Impression of the interface
- DAX formula examples
- Visualization examples

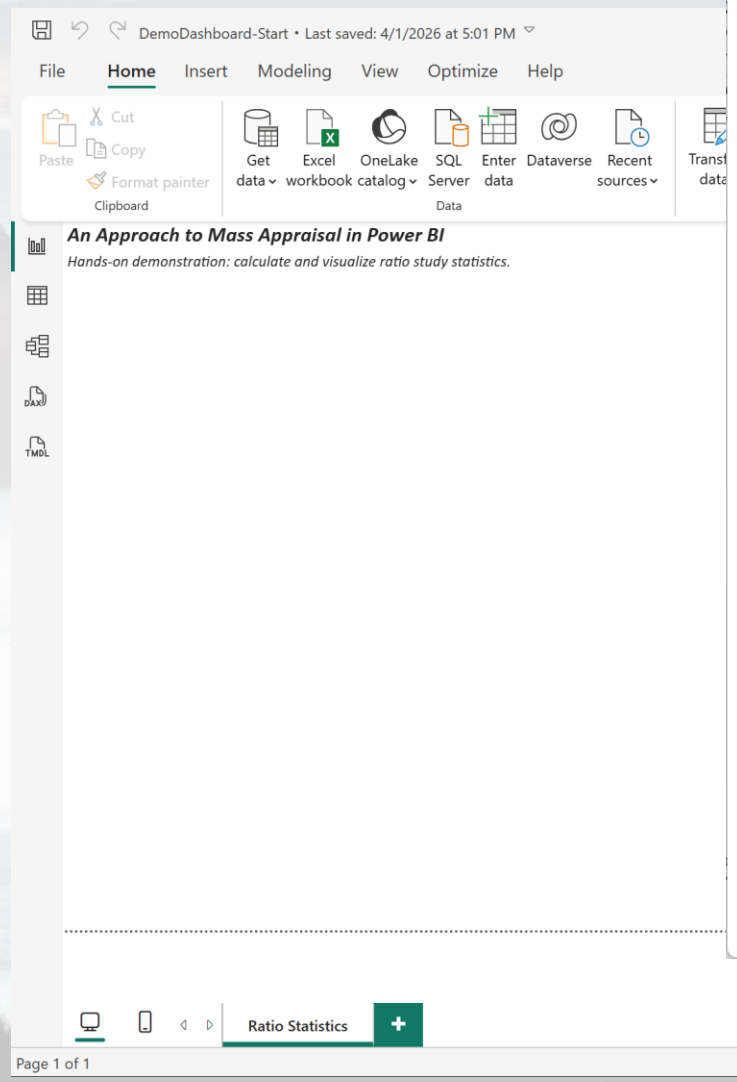
Example for Educational Purposes Only

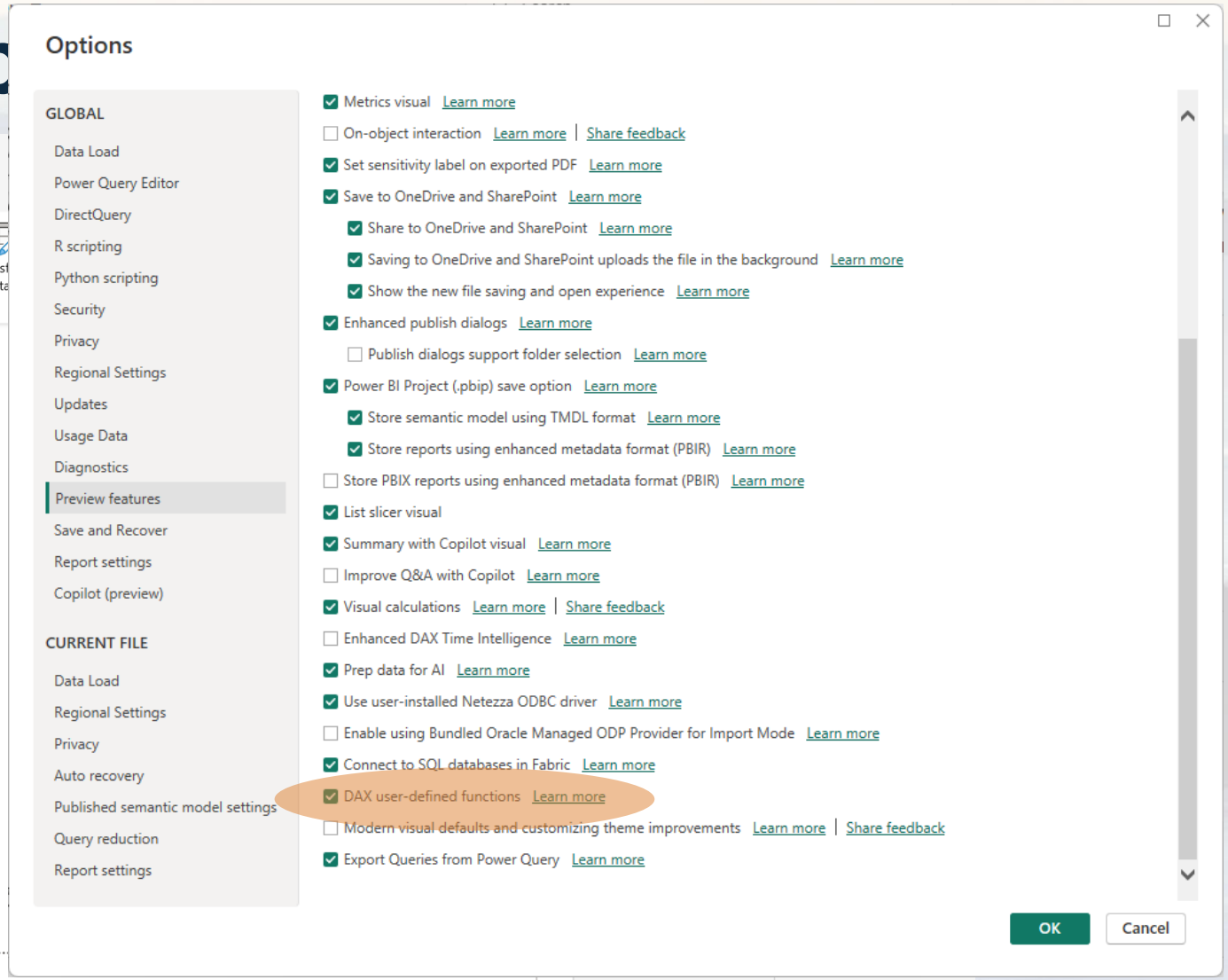
Demonstration File Download

https://www.sanjuancountywa.gov/DocumentCenter/View/34895/PACSUC2026_DemoPowerBI

- DemoDashboard.pbix — Power BI project file pre-loaded with sample data
- DemoSales.xlsx — Excel spreadsheet with sample data
- SimpleSalesQuery.sql — T-SQL query to fetch minimal data

DemoDashboard.pb





Data Source

Option 1:

- Excel: DemoSales.xlsx
- Pre-loaded in DemoDashboard.pbix

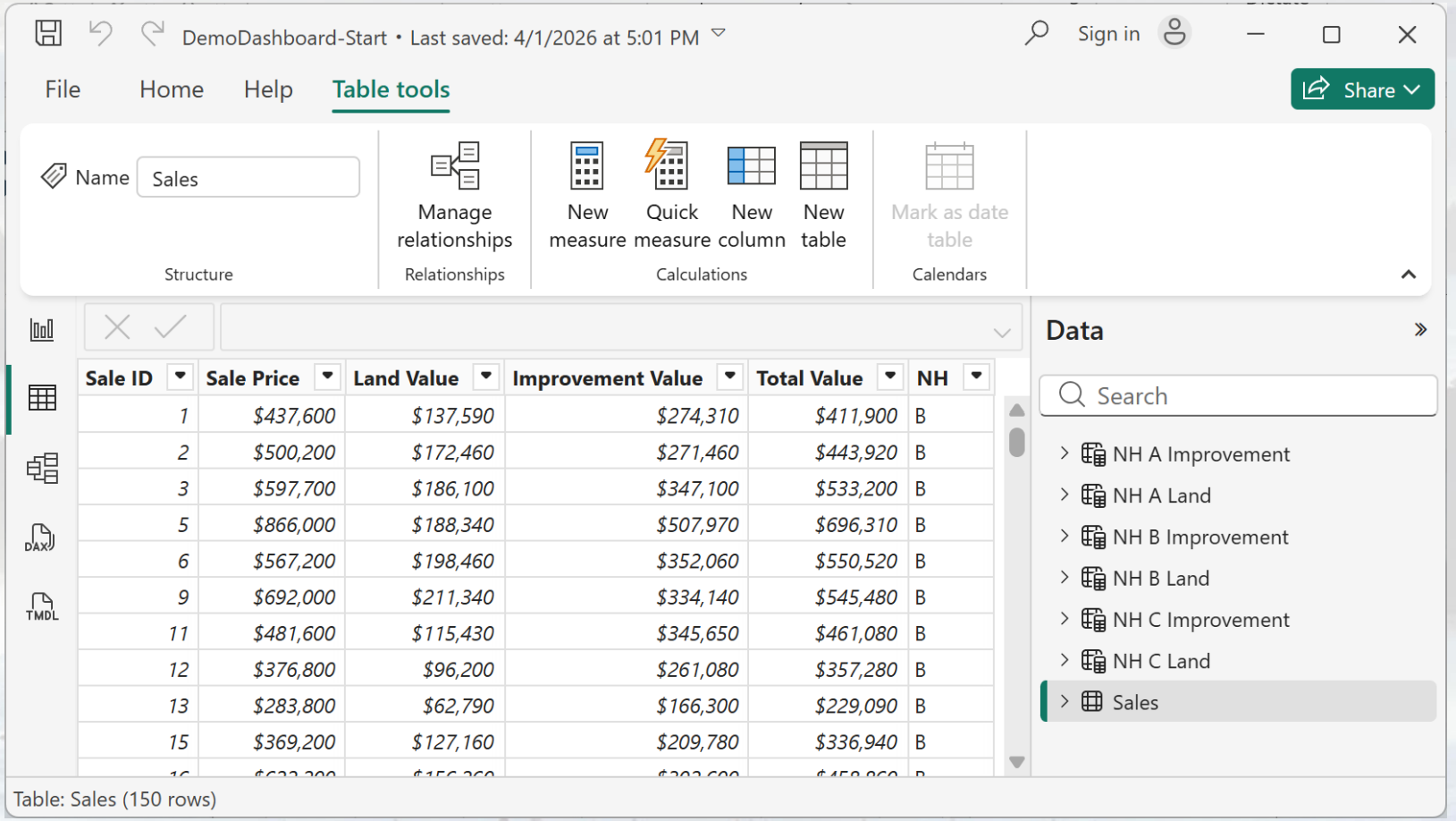
Option 2:

- SQL Query (PACS)
- Import

Demo assumptions:

- *arm's length transactions*
- *only residential real property*
- *sold on the assessment date*

Data Source: Schema



Sale ID	Sale Price	Land Value	Improvement Value	Total Value	NH
1	$437,600	$137,590	$274,310	$411,900	B
2	$500,200	$172,460	$271,460	$443,920	B
3	$597,700	$186,100	$347,100	$533,200	B
5	$866,000	$188,340	$507,970	$696,310	B
6	$567,200	$198,460	$352,060	$550,520	B
9	$692,000	$211,340	$334,140	$545,480	B
11	$481,600	$115,430	$345,650	$461,080	B
12	$376,800	$96,200	$261,080	$357,280	B
13	$283,800	$62,790	$166,300	$229,090	B
15	$369,200	$127,160	$209,780	$336,940	B

DAX Examples

New column

```
Ratio = Sales[Total Value]/Sales[Sale Price]
```

```
Histogram Bin = ROUND(FLOOR(Sales[Ratio],0.05),2)
```

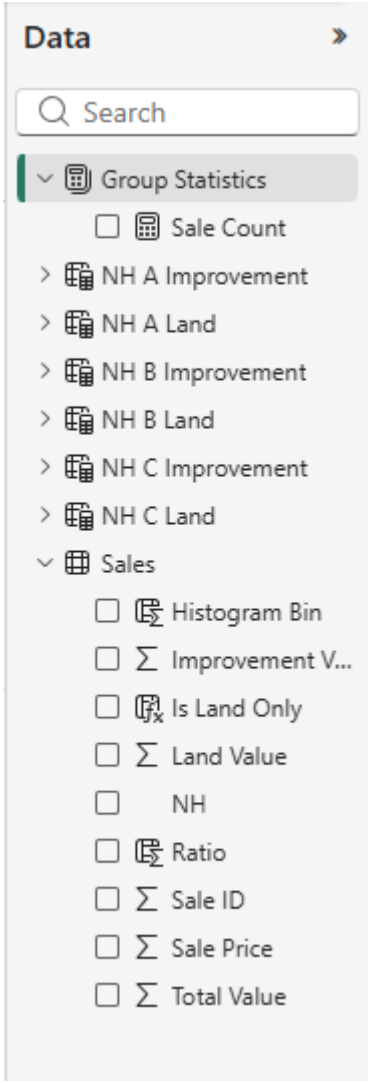
```
Is Land Only = IF(Sales[Improvement Value]=0,
        "Vacant","Improved")
```

Enter data

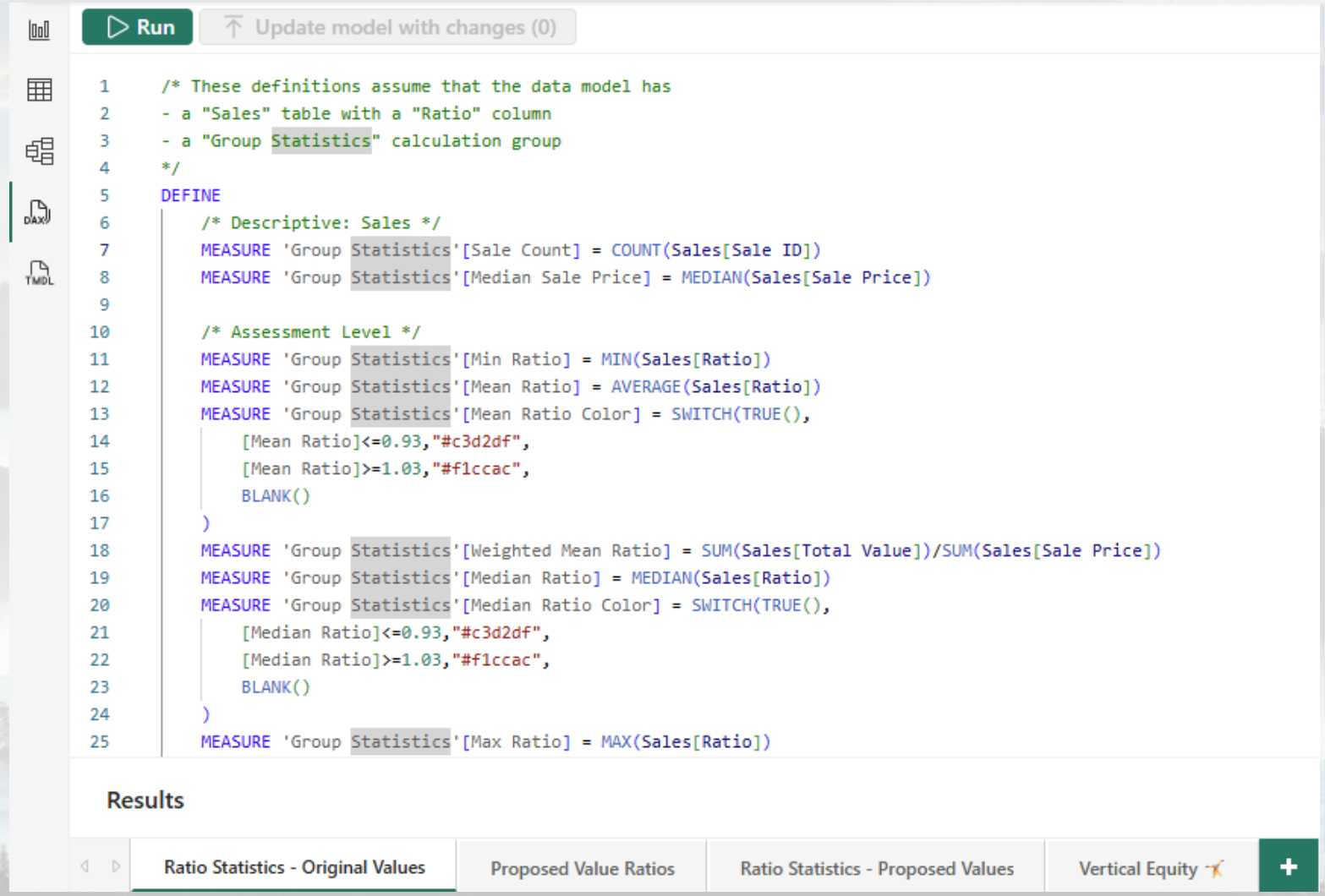
```
Measure group “Group Statistics”
Sale Count = COUNT(Sales[Sale ID])
```

New measure

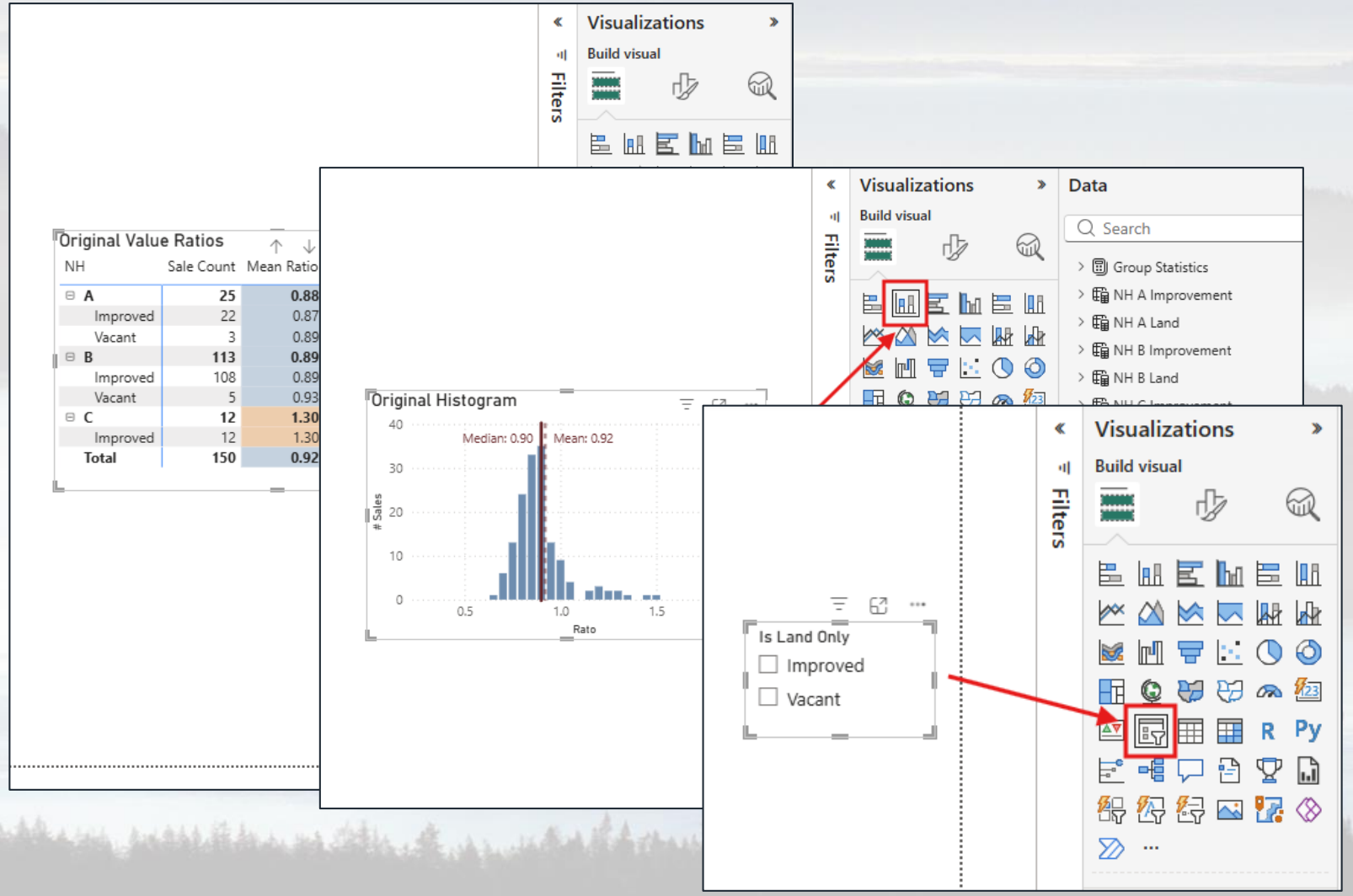
```
Delete from model “Column1”
```



DAX Query Editor



Visualizations



Optional Enhancements:

- Matrix: Conditional color coding
- Barchart: Add trend lines
- Slicer: Filter for vacant land
- Sort: 1=Vacant, 2=Improved

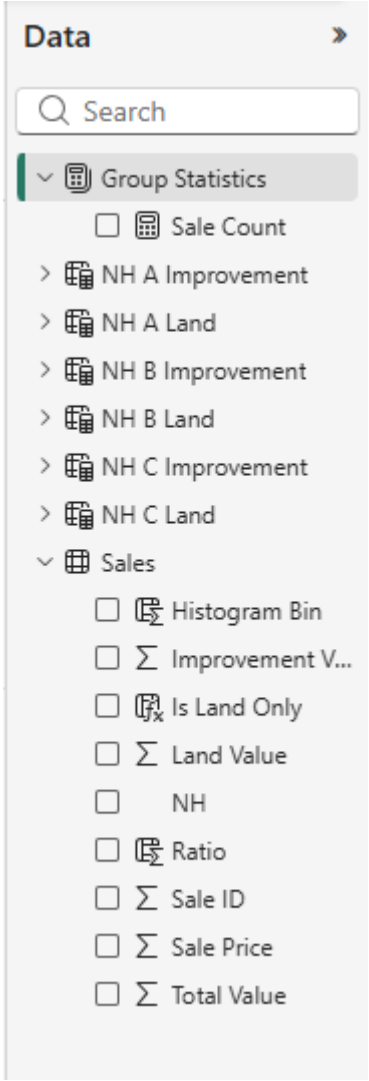
DAX Examples

New table

```
Proposed Histogram = GENERATESERIES(0.25,1.8,0.05)
```

New measure

```
Bin Count Proposed =
    VAR _proposed_values = ProposedAssessedValue()
    VAR _this_bin = MIN('Proposed Histogram'[Value])
    VAR _filtered = FILTER(_proposed_values,
      ABS([histogram bin] - _this_bin)<0.025)
    VAR _count = COUNTROWS(_filtered)
    RETURN IF(_count>0,_count,0)
```



DAX Query Editor

New measure

Run | Update model with changes (1)

```
DEFINE
    MEASURE 'Group Statistics'[VEI] =
        RETURN _result

    MEASURE 'Group Statistics'[VEI Proposed] =
        VAR _proposed_ratios = SELECTCOLUMNS(
            ProposedAssessedValue(),
            "ratio", [ratio],
            "sale price", [sale price]
        )

        VAR _break1 = PERCENTILEX.INC(_proposed_ratios,[sale price],0.2)
        VAR _break2 = PERCENTILEX.INC(_proposed_ratios,[sale price],0.4)
        VAR _break3 = PERCENTILEX.INC(_proposed_ratios,[sale price],0.6)
        VAR _break4 = PERCENTILEX.INC(_proposed_ratios,[sale price],0.8)

        VAR _quintile1_ratios = FILTER(
            SELECTCOLUMNS(
                _proposed_ratios, "ratio", [ratio],
                "is_quintile", IF([sale price] <= _break1, 1, 0)
            ),
            [is_quintile] = 1
        )
        VAR _qmr1 = AVERAGEX(_quintile1_ratios,[ratio])

        VAR _quintile2_ratios = FILTER(
            SELECTCOLUMNS(
                _proposed_ratios, "ratio", [ratio],
```

Results

Ratio Statistics - Original Values | Proposed Value Ratios | Ratio Statistics - Proposed Values | Vertical Equity

Demo Dashboard

An Approach to Mass Appraisal in Power BI

Hands-on demonstration: calculate and visualize ratio study statistics.

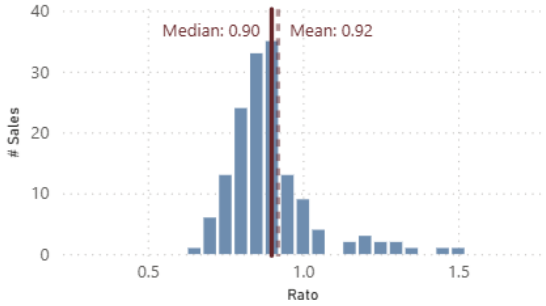
Is Land Only

- ☐ Vacant
- ☐ Improved

Original Value Ratios

NH	Sale Count	Mean Ratio	Median Ratio	VEI
⊟ **A**	**25**	**0.88**	**0.87**	**7.53**
Vacant	3	0.89	0.92	8.71
Improved	22	0.87	0.87	12.44
⊟ **B**	**113**	**0.89**	**0.89**	**7.17**
Vacant	5	0.93	0.94	12.61
Improved	108	0.89	0.89	5.77
⊟ **C**	**12**	**1.30**	**1.28**	**14.12**
Improved	12	1.30	1.28	14.12
Total	**150**	**0.92**	**0.90**	**11.47**

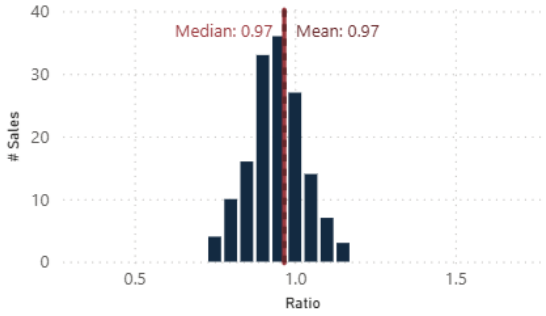
Original Histogram



Proposed Value Ratios

NH	Sale Count	Mean Ratio	Median Ratio	VEI
⊟ **A**	**25**	**0.97**	**0.97**	**7.60**
Vacant	3	0.94	0.96	8.71
Improved	22	0.98	0.97	12.42
⊟ **B**	**113**	**0.96**	**0.97**	**6.40**
Vacant	5	0.98	0.99	12.61
Improved	108	0.96	0.97	5.70
⊟ **C**	**12**	**0.99**	**0.96**	**14.25**
Improved	12	0.99	0.96	14.25
Total	**150**	**0.97**	**0.97**	**6.04**

Histogram of Ratio Values



Proposed Index Values

Neighborhood A

Land: 105

Improvement: 115

Neighborhood B

Land: 105

Improvement: 110

Neighborhood C

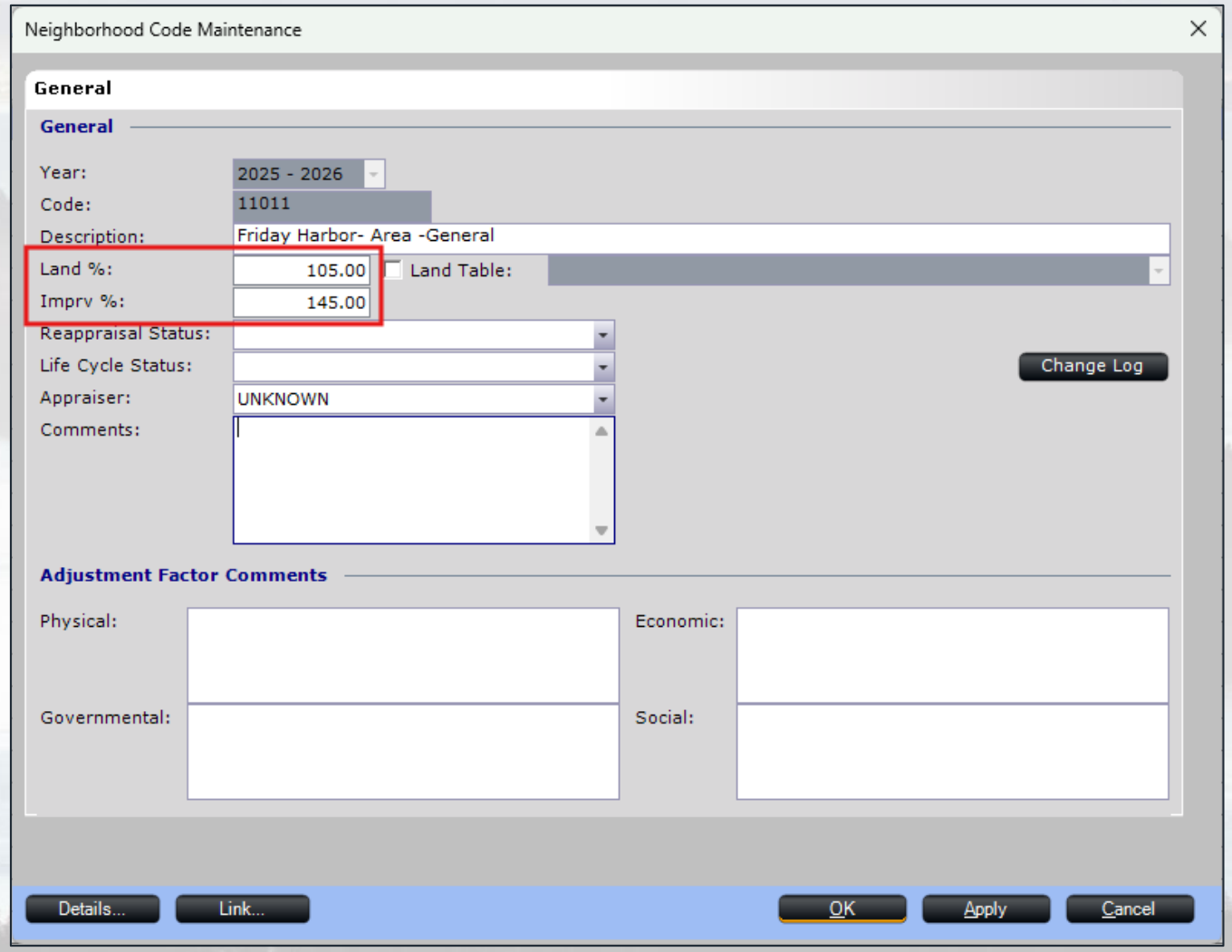
Land: 100

Improvement: 70

Clear

Example for Educational Purposes Only

Set Index Adjustments



- Store index values in PACS Admin
- Recalc property values in PACS

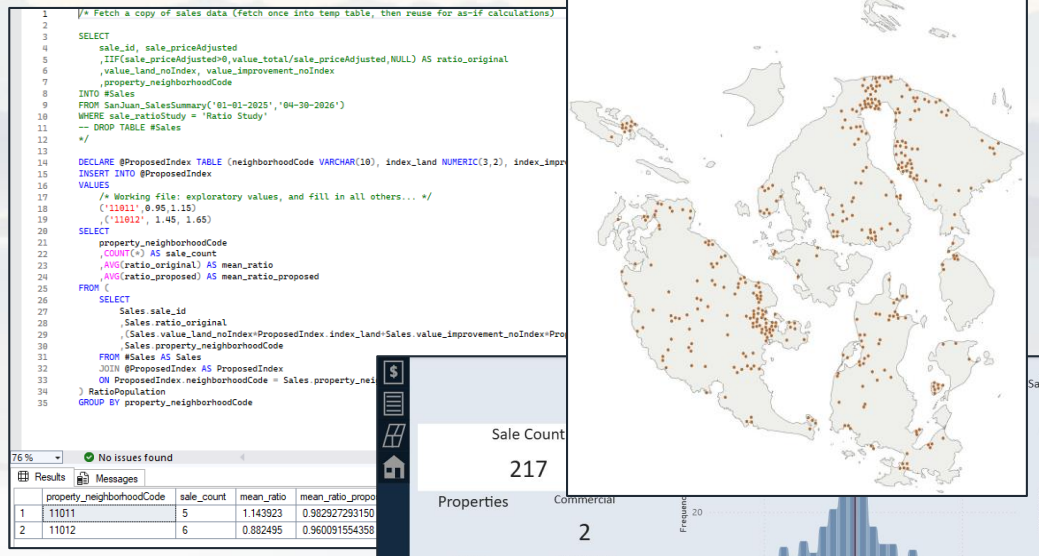
Reflection

Reflection

- Organic evolution, phases of analysis
- Multi-property sales
- Maintenance
- Automate data refresh (or use parameters)
- Persistent static (snapshot) reports

The “Right” Tool?

- You have access (install permission, license, etc.)
- You will use it
- Sustainable (usability, reuse, maintenance, integration, etc.)



	Sale ID	Sale Price	Land Value	Improvement Value	Total Value	Assessor Neighborhood
2	1	$ 496,000.00	$ 170,900.00	$ 350,220.00	$ 521,120.00	B
3	2	$ 620,000.00	$ 208,400.00	$ 379,190.00	$ 587,590.00	B
4	3	$ 507,000.00	$ 120,490.00	$ 360,150.00	$ 480,640.00	B
5	4	$ 953,000.00	$ 442,760.00	$ 344,610.00	$ 787,370.00	C
6	5	$ 552,000.00	$ 141,400.00	$ 355,070.00	$ 496,470.00	B
7	6	$ 703,000.00	$ 163,170.00	$ 410,230.00	$ 573,400.00	B
8	7	$ 1,296,000.00	$ 402,300.00	$ 525,270.00	$ 927,570.00	C
9	8	$ 799,000.00	$ 162,600.00	$ 437,060.00	$ 599,660.00	A
10	9	$ 784,000.00	$ 209,160.00	$ 406,000.00	$ 615,160.00	B
11	10	$ 397,000.00	$ 46,650.00	$ 310,970.00	$ 357,620.00	A
12	11	$ 686,000.00	$ 153,950.00	$ 415,590.00	$ 569,540.00	B
13	12	$ 305,000.00	$ 88,290.00	$ 264,540.00	$ 352,830.00	B
14	13	$ 661,000.00	$ 168,310.00	$ 392,570.00	$ 560,880.00	B

Assessor Neighborho	Land Index	Improvement Inc
A	1.16	1.02
B	1.18	1.05
C	1.10	1.35

Row Labels	Average of Sale Price	Median Sale Price	Mean Ratio	Mean Ratio Proposed
A	$562,960	$577,000	0.907	0.973
B	$480,142	$481,000	0.880	0.960
C	$949,500	$995,000	0.774	0.968
Grand Total	**$531,493**	**$499,000**	**0.876**	**0.963**

Resources

- Jason Davidson's Effective Dashboards (YouTube)
- Greg Deckler's DAX for Humans (YouTube, book)
- Adam Saxton and Patrick LeBlanc's Guy in a Cube (YouTube)
- SQLBI's Filter and Row Contexts explained visually

- Microsoft's Field Parameters … among other docs

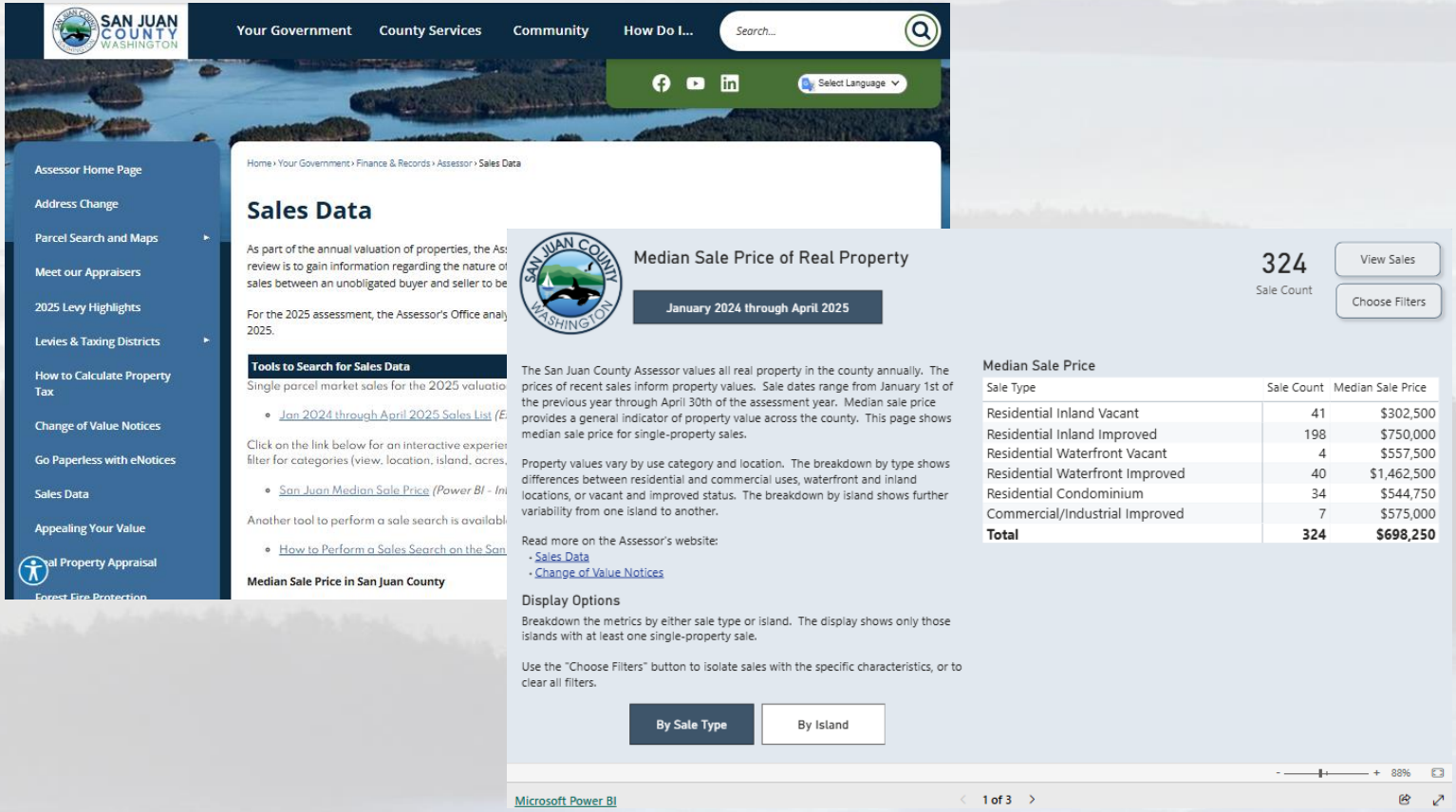
- Fabric Community (Microsoft contributors)
- StackOverflow (community contributors)

Related Products

Sales Data

Sales Data Website

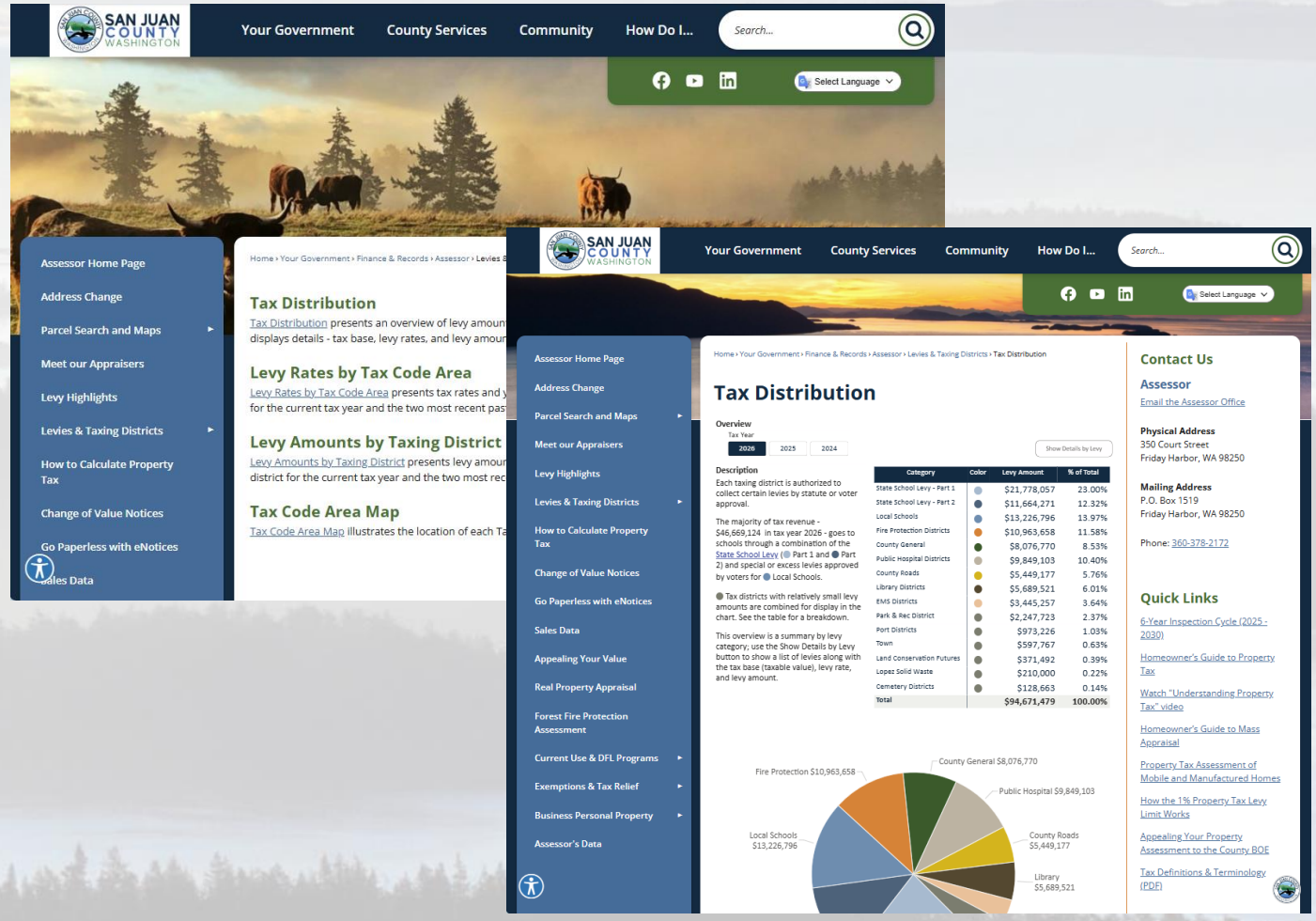
- Download Excel spreadsheet
- Interactive Power BI display
- Embedded tables with median sale price



Levy Data

[Levies and Taxing Districts Website]

with interactive displays of tax distributions and levy data



Thank You!

Megen Brittell | Statistical Analyst

San Juan County Assessor's Office

PO Box 1519 | Friday Harbor, WA 98250-1519

360-378-2172 | megenb@sanjuancountywa.gov

Public Hours: 10:00am-4:00pm, Monday – Thursday