Configuring Esri's Crime Reduction Statistics Solution

Part 4 of the *ArcGIS Solutions for Crime Reduction Operations* webinar series

Chris Delaney

Agenda

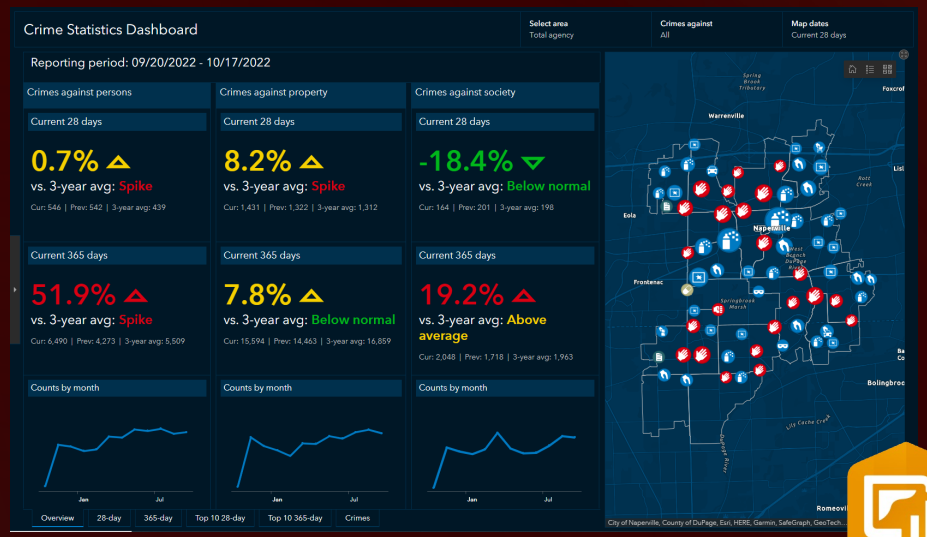
Configuring Crime Reduction Statistics Webinar

- Technical webinar- assumes knowledge of solution
- Solution Overview- What you get
- Setting up the Crime Statistics Dashboard
- Setting up the Calls For Service Statistics Dashboard
- Setting up reports

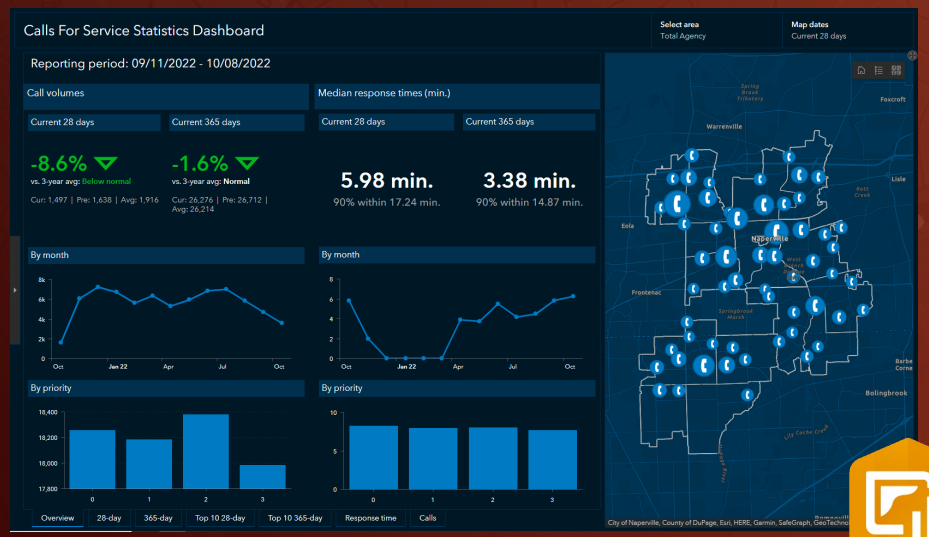
Best for users that have watched previous webinar or have already deployed solution

Crime Reduction Statistics

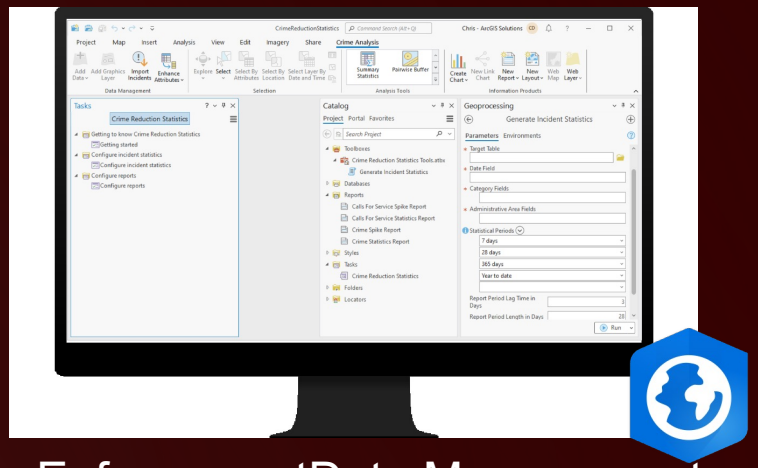
What You Get



Crime Statistics Dashboard

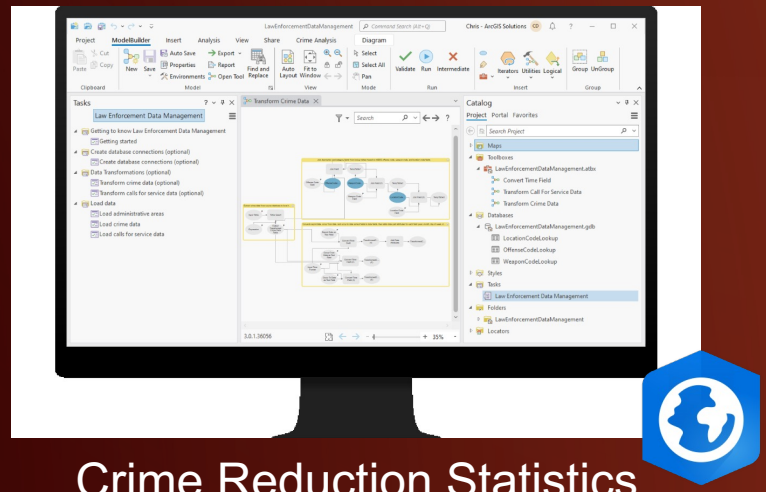


Calls For Service Statistics Dashboard



Law EnforcementData Management

Transform and load data



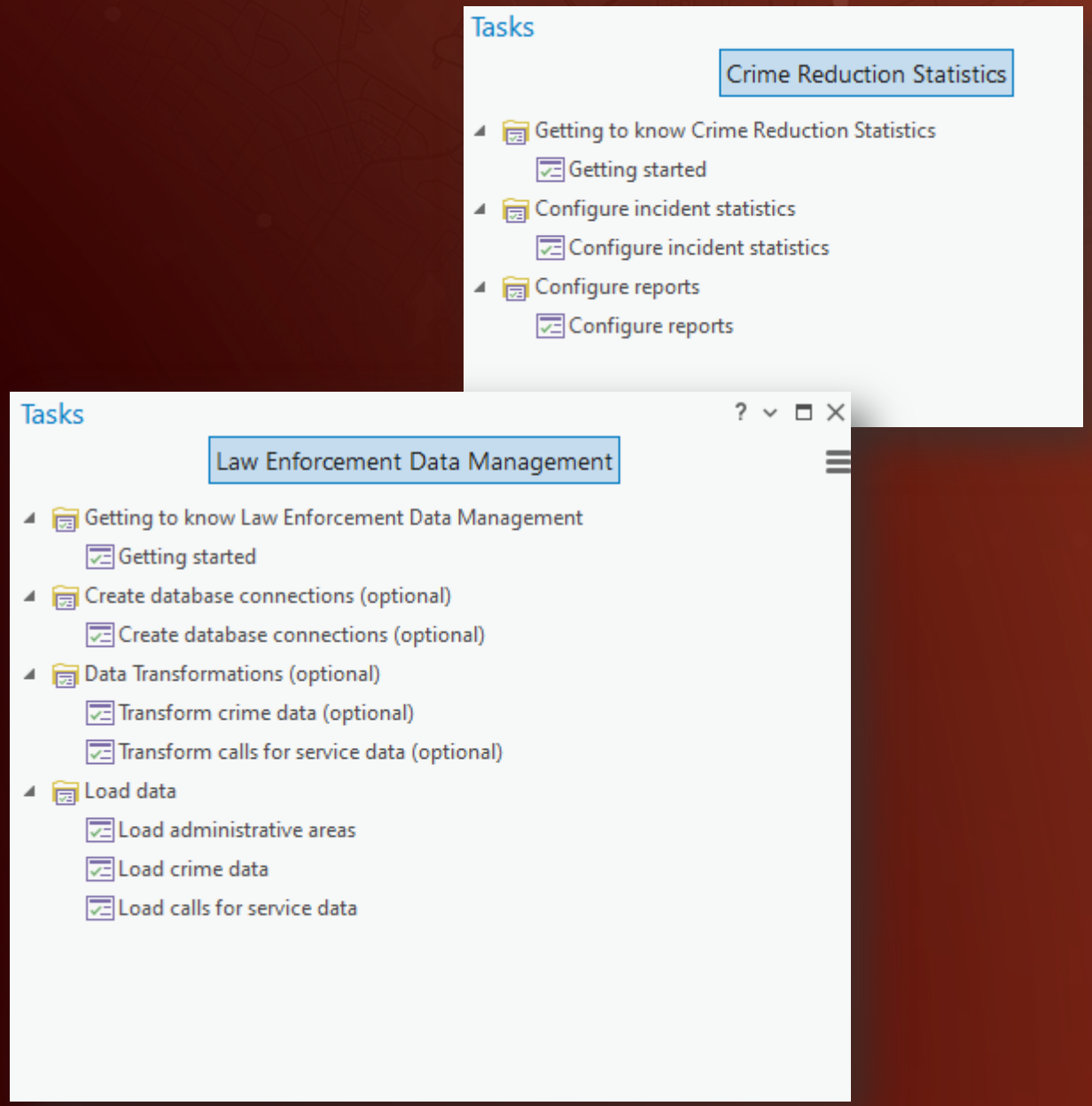
Crime Reduction Statistics

Calculate and publish stats

Tasks help you get set up

- **Law Enforcement Data Management** and **Crime Reduction Statistics** ArcGIS Pro projects have tasks to walk you through the steps of loading the data required for the solution

- Use of tasks is not required, but is recommended for initial configuration



Setting up the Crime Statistics Dashboard

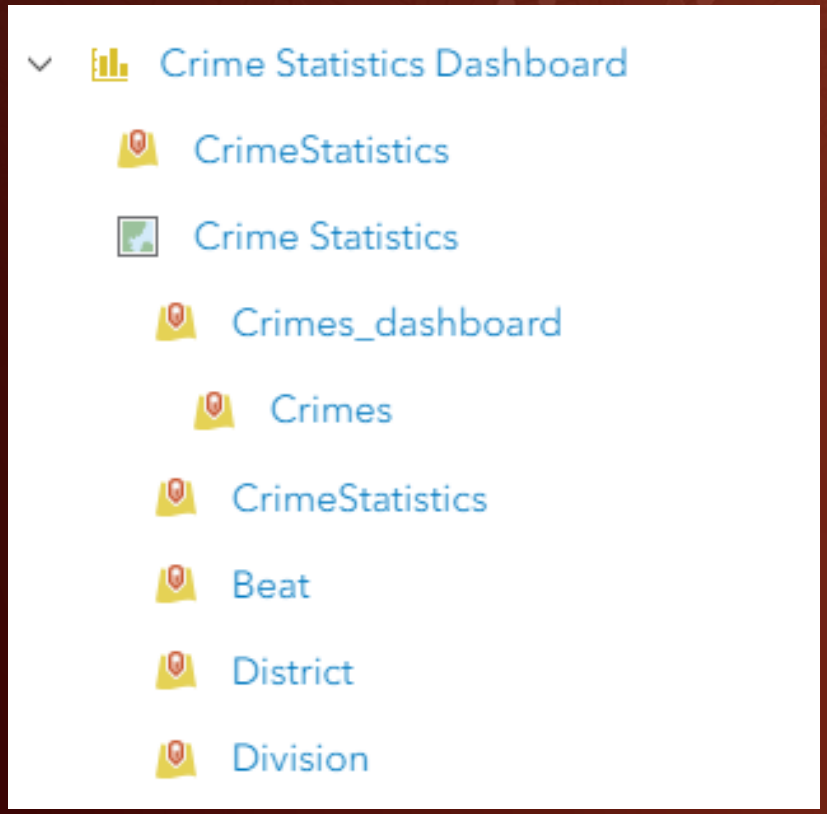
- Load administrative areas
- Set up crime data loading
- Set up crime statistics loading
- Dashboard configuration
- Troubleshooting

Crime Statistics Dashboard

- Displays statistics
  - By area (beat, district, division, all)
  - NIBRS crimes against, crime category, and description
  - 28 and 365-day periods
  - Percent change
  - Poisson z-score vs 3 year avg.
    - Presented in plain language
    - Detects spikes compared to recent history for each perioc
- Filter by any area or crime type
  - Map, charts, incident table
- Top 10 Lists
- Download to csv

Components

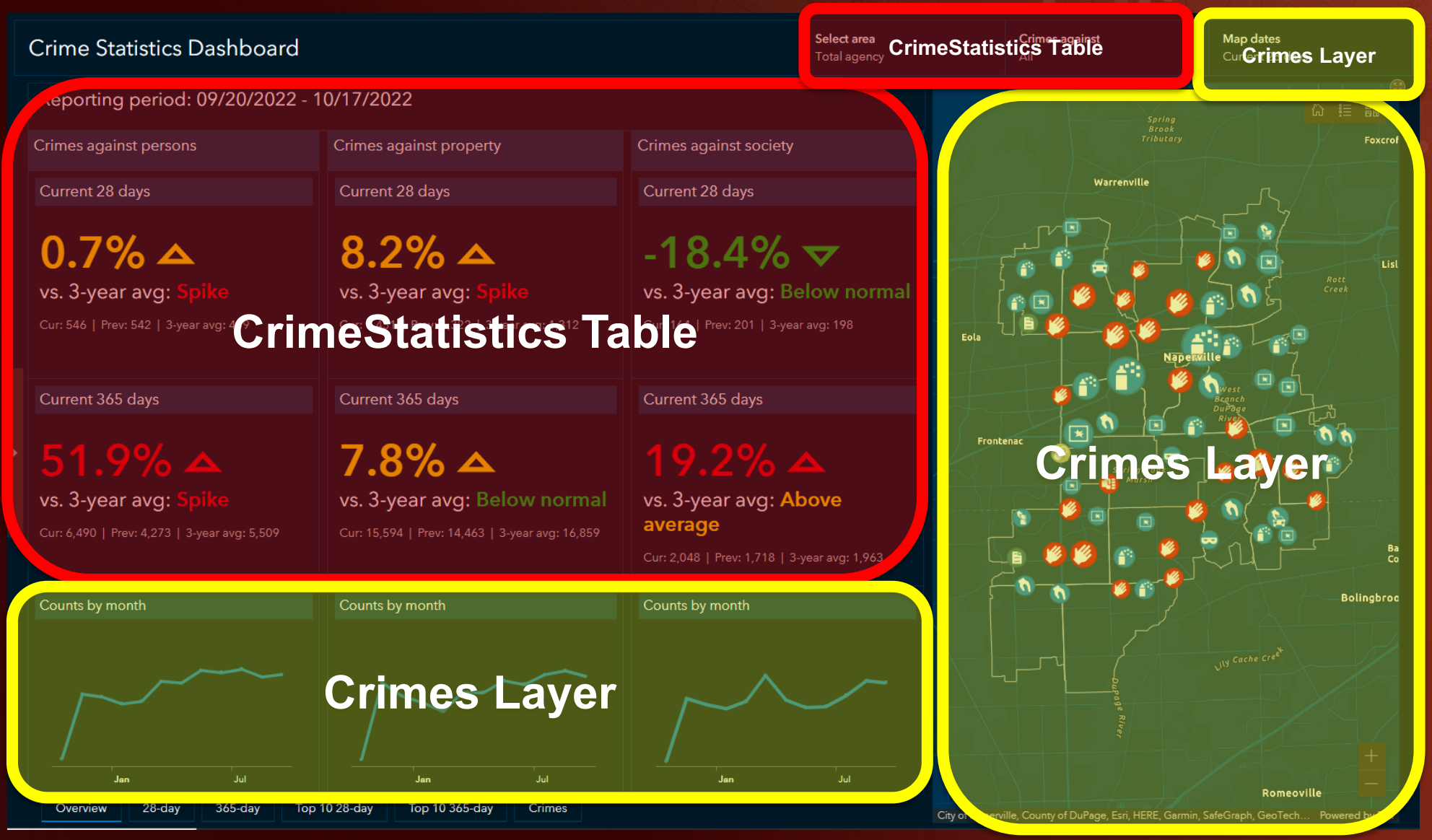
- Web Map (Crime Statistics)
- 5 feature layers
  - Crimes_dashboard view
    - 365-day filter on Crimes layer
  - CrimeStatistics table
  - Administrative Areas
    - Beat
    - District
    - Division



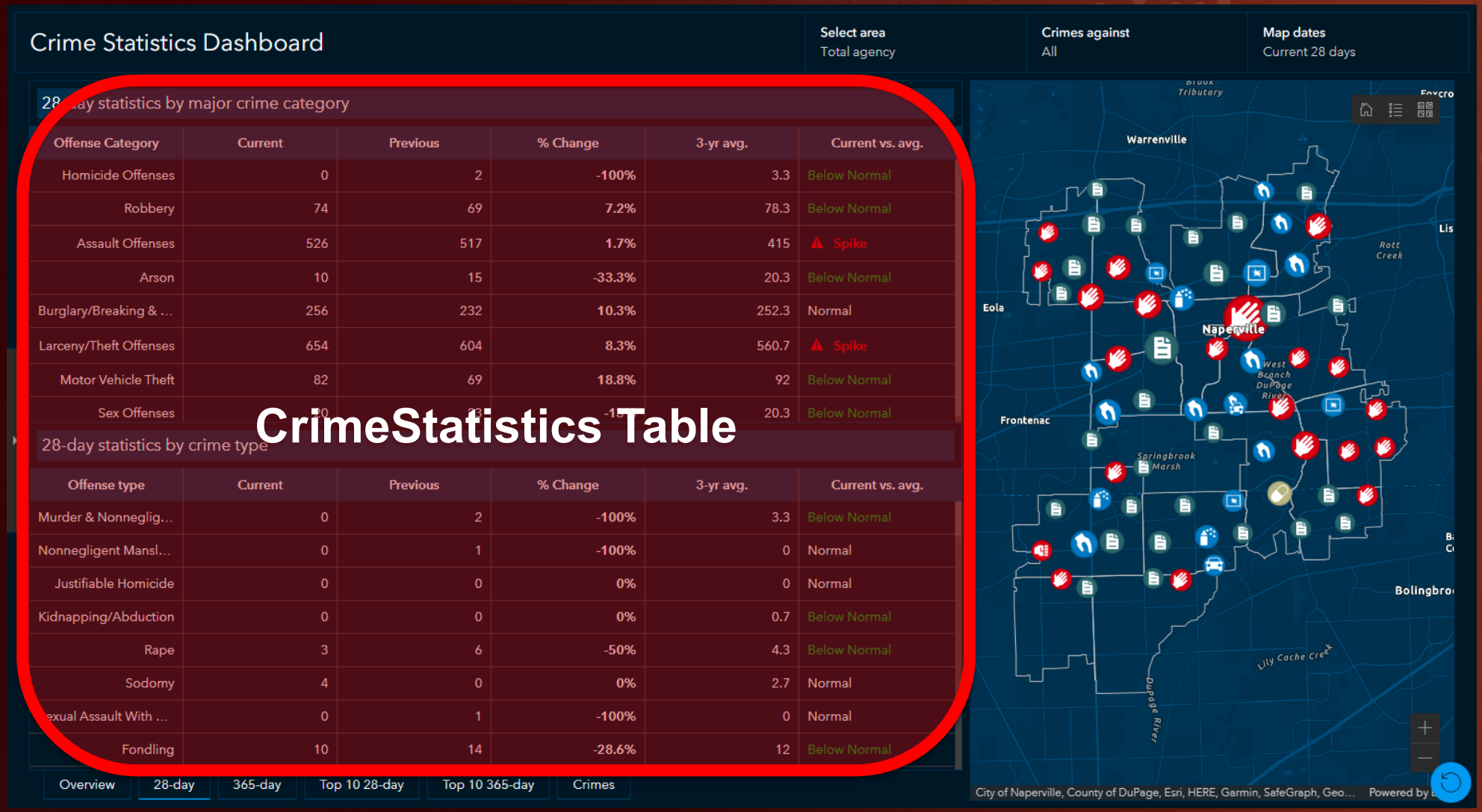
Key Concepts

- Stats are pre-calculated stored in separate table
- Loading stats and loading crimes are TWO SEPARATE PROCESSES
- Crimes layer and CrimeStatistics table work together to create interactivity on dashboard

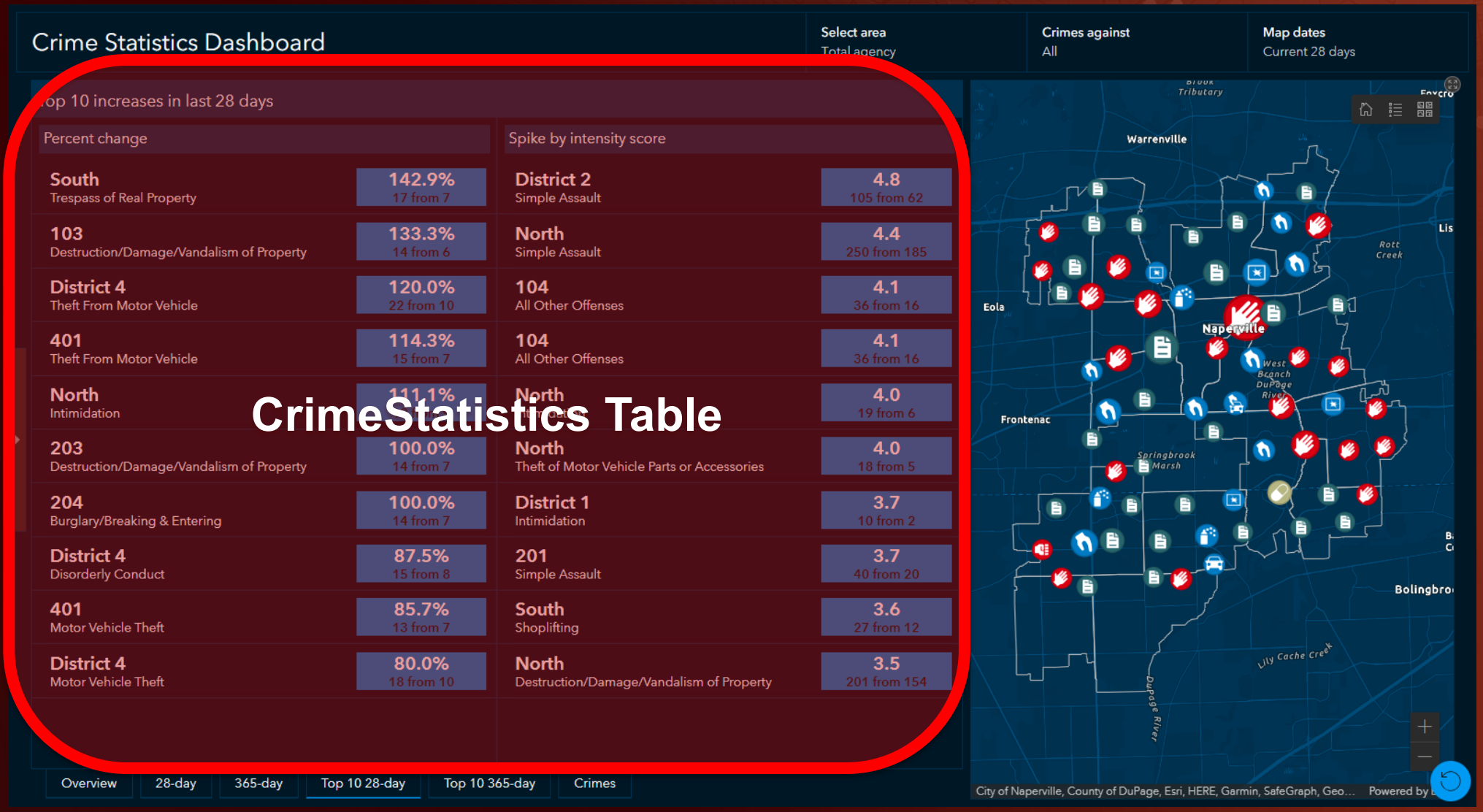
Crime Statistics Dashboard- Overview tab



Crime Statistics Dashboard- 28-day and 365-day tabs

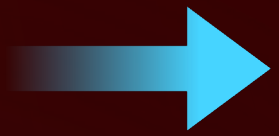


Crime Statistics Dashboard- Top 10 28-day and 365 day tabs



Crime Statistics Dashboard- Crimes tab

Loading Data In Crime Statistics Dashboard



Law Enforcement
Data Management

Records
Management
System (RMS)

Crime Statistics
Dashboard

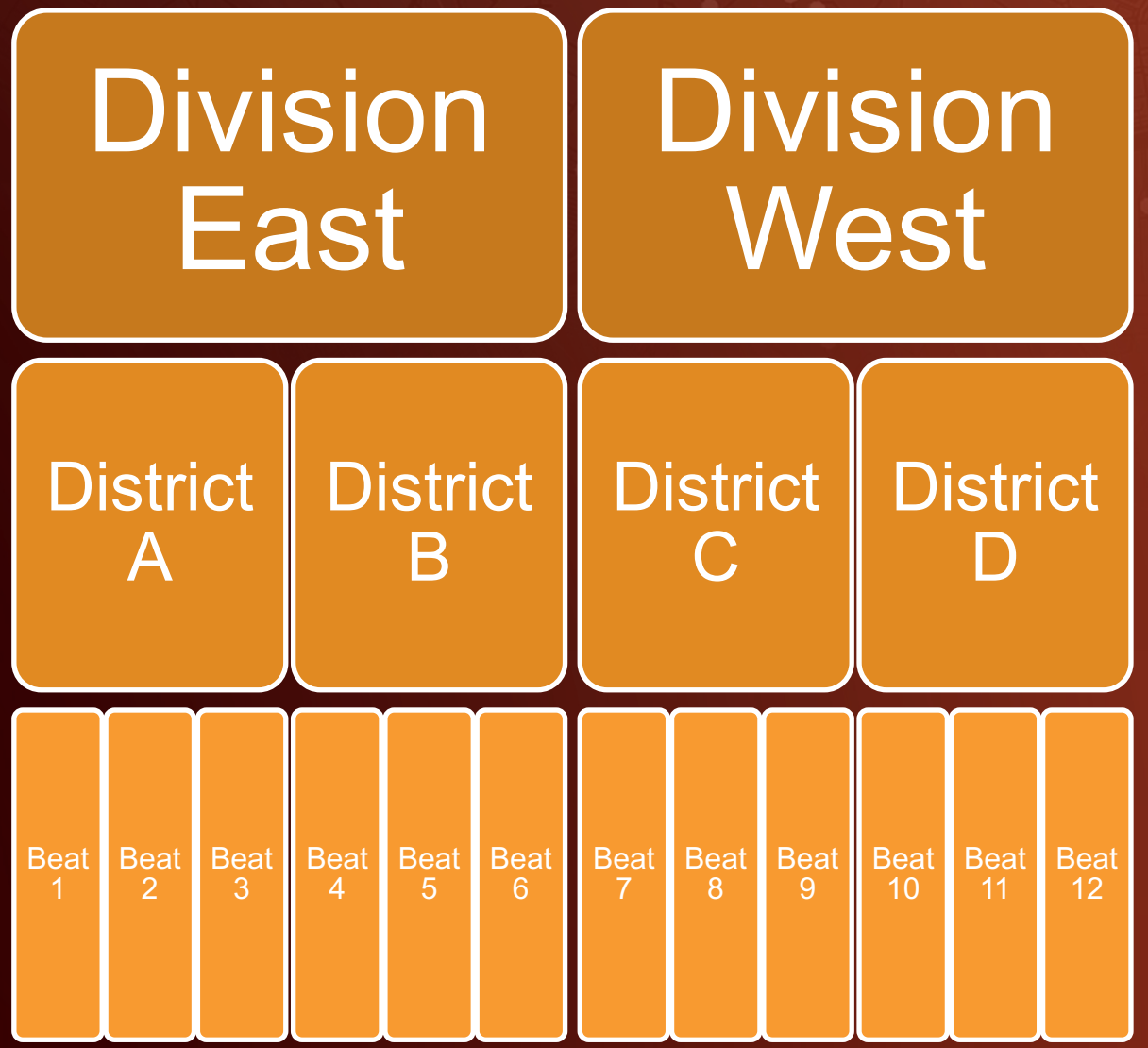
ArcGIS Online
ArcGIS Enterprise

Setting up the Crime Statistics Dashboard

- **Load administrative areas**
- Set up crime data loading
- Set up crime statistics loading
- Dashboard configuration
- Troubleshooting

Loading Administrative Areas

1. Review the administrative area structure of your agency
2. Solution supports up to three levels (smallest to largest)
    1. Beat
    2. District- use if you only have one
    3. Division
3. For each layer, the values in the field with the same name must match identically the values in the equivalent field of the Crimes and CallsForService layers
    1. Example- values in Beat field in Beat layer MUST match values in Beat field of Crimes layer AND Beat field of CallsForService layer
4. Only need to load once
5. Source data should be zipped shapefile or field geodatabase feature class
6. Follow task and use Append tool for each layer



Updating naming conventions

If your area naming conventions are different (Precincts instead of Districts, PSAs instead of Beats), and you want to change an area name, update the following:

1. **Layer item page**
   - Update layer item alias on Overview tab
   - Update field alias on Data tab, fields view

2. **Crime Statistics and Calls For Service Statistics Web Maps**
   - Update pop-up in Crimes/Calls For Service layer
   - Update name of layer (for example, change Beat to PSA)

3. **Crimes and CallsForService layer item pages**
   - Update field alias on Data tab, fields view

Setting up the Crime Statistics Dashboard

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- **Set up crime data loading**
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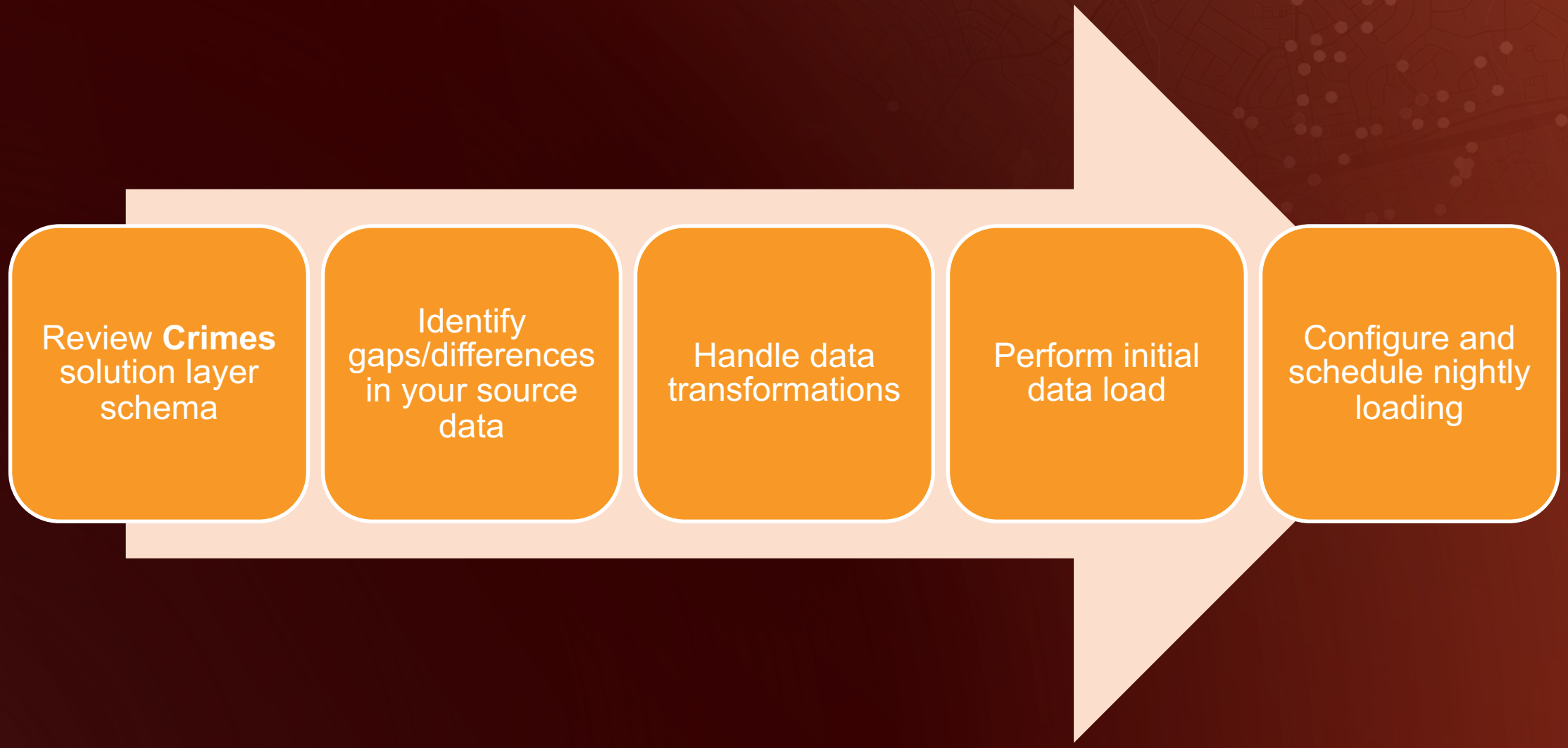
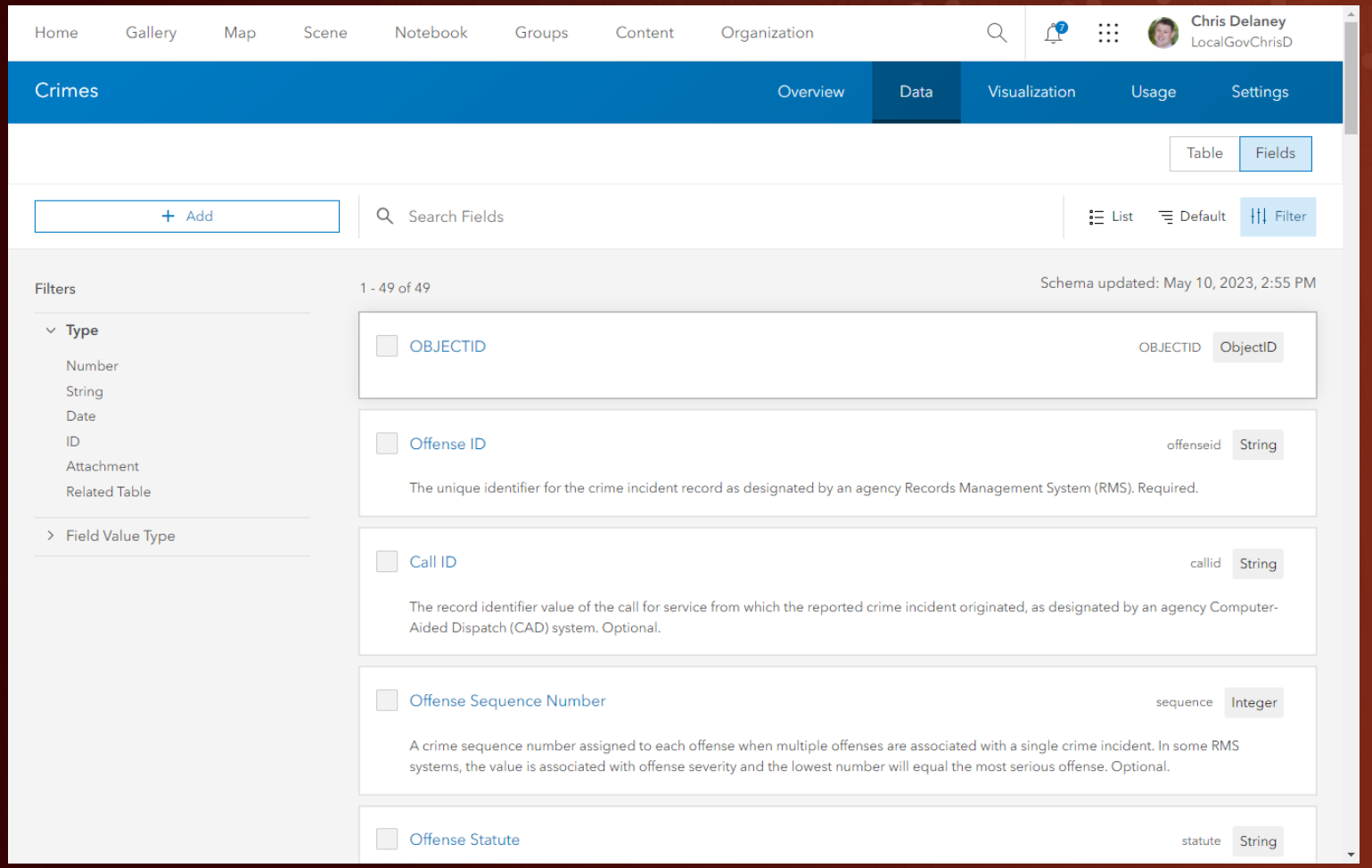
Loading Crime Data



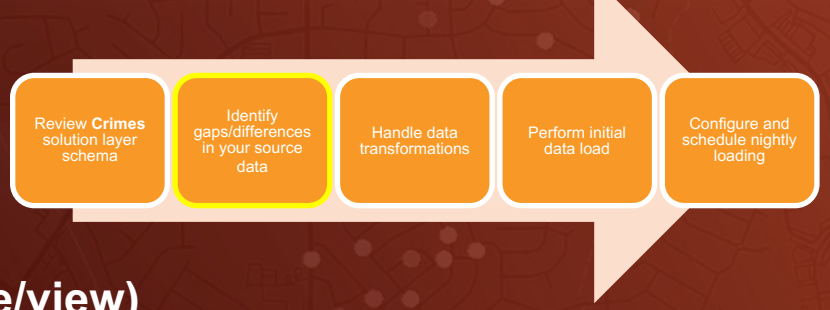
Review the **Crimes** solution layer schema

- Go to Crimes layer item page->Data tab->Fields
  - Review each field description and type

- 3 Date fields-report, occur from, occur to
  - DATE type- need date and time.
  - Report year, month, downum, hour are INTEGER
- 5 NIBRS offense fields- code, description, category, crimes against, and group
- 3 NIBRS location fields- code, description, category
- 3 NIBRS weapon fields- code, dscription, category
- X and Y Fields are DOUBLES



Identify gaps/differences in your source data



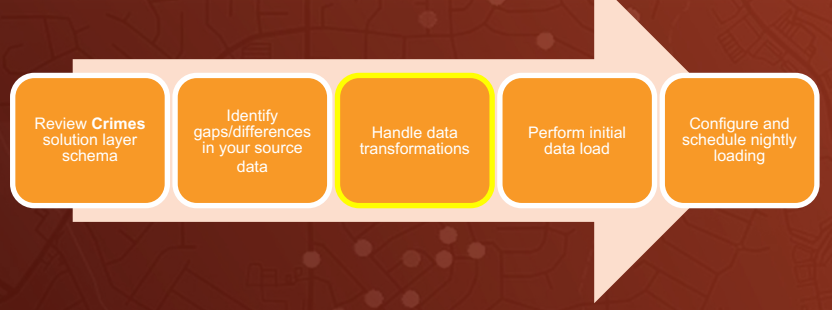
- **How will I extract my source data? Extract or database connection (table/view)**
- **Are dates and times in a single field or separate?**
- **Do my field types match what is required by the solution layer?**

- **Do I have NIBRS values, if so which?**
  - Do my NIBRS values match federal NIBRS values or are they state-specific?

- **Which administrative area values do I need and which do I have?**
  - Are they accurate?

- **Do I have XY coordinates or just addresses?**
  - What % of incidents are not mapping?
  - IF XY coordinates, are they in the correct field type (DOUBLE)
  - If addresses, are they single field or multi-field? Do you have an address locator?

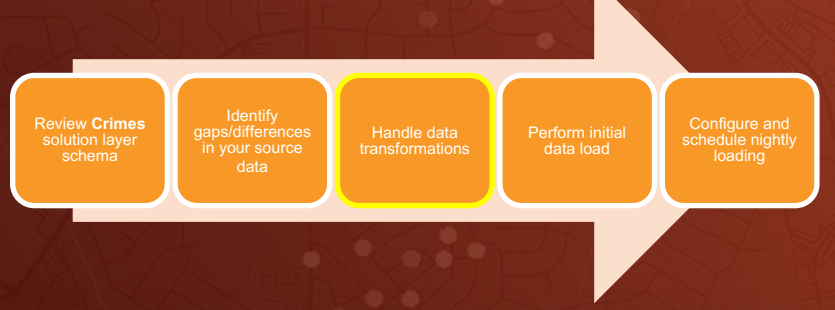
Data Transformation Best Practice



Use a database table/view:

1. Perform all translations within database in a view
2. Re-name all fields to match field names in **Crimes** solution layer
3. Ensure all field types match the associated field type for target field in **Crimes** solution layer
4. For initial load of data, have 365 days worth of records from report date

Data Transformation Lookup Tables



Law Enforcement Data Management project includes lookup tables you can import for:

-Adding NIBRS offense fields based on code

-Adding NIBRS weapon and location descriptions based on code

-Adding location and weapon categories (to simplify charts and filtering)

deLookup

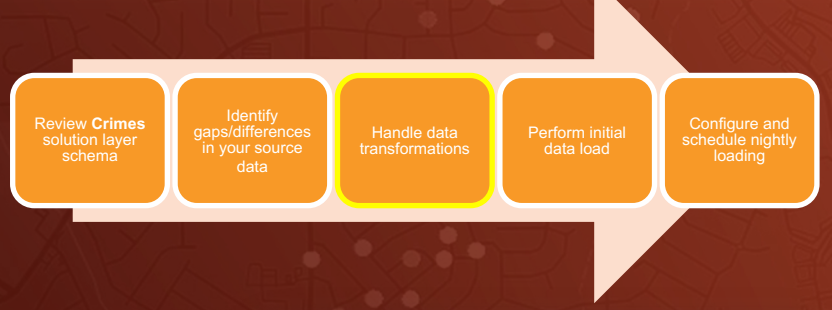
Calculate | Selection: Select By Attributes | Switch | Clear | Delete | Copy | Rows: Insert

Crimes Against Categ...	Offense Category	Offense Code *	Offense Description	Offense Group
Crimes Against Persons	Homicide Offenses	09A	Murder & Nonnegligе...	Group A
Crimes Against Persons	Homicide Offenses	09B	Negligent Manslaught...	Group A
Crimes Against Persons	Kidnapping/Abduction	100	Kidnapping/Abduction	Group A
Crimes Against Persons	Sex Offenses	11A	Rape	Group A
Crimes Against Persons	Sex Offenses	11B	Sodomy	Group A
Crimes Against Persons	Sex Offenses	11C	Sexual Assault With A...	Group A
Crimes Against Persons	Sex Offenses	11D	Fondling	Group A
Crimes Against Persons	Sex Offenses	36A	Incest	Group A
Crimes Against Persons	Sex Offenses	36B	Statutory Rape	Group A

Location Code *	Location Type	Location Category
02	Bank/Savings and Loan	Commercial
03	Bar/Nightclub	Commercial
05	Commercial/Office Buil...	Commercial
07	Convenience Store	Commercial
08	Department/Discount...	Commercial
09	Drug Store/Doctor's O...	Commercial
12	Grocery/Supermarket	Commercial
14	Hotel/Motel/Etc.	Commercial
17	Liquor Store	Commercial
19	Rental Storage Facility	Commercial
21	Restaurant	Commercial
23	Service/Gas Station	Commercial
24	Specialty Store	Commercial
38	Amusement Park	Commercial
39	Arena/ Stadium/Fairgr...	Commercial
40	ATM Separate from Bank	Commercial
41	Auto Dealership New/...	Commercial
44	Daycare Facility	Commercial
55	Shopping Mall	Commercial
58	Cyberspace	Cyberspace
45	Dock/ Wharf/Freight/...	Other
46	Farm Facility	Other
48	Industrial Site	Other
25	Other/Unknown	Other

Weapon Type	Weapon Category	Weapon Code *
Firearm	Firearm	11
Handgun	Firearm	12
Rifle	Firearm	13
Shotgun	Firearm	14
Other Firearm	Firearm	15
Knife/Cutting Instrum...	Knife	20
Blunt Object	Blunt Object	30
Motor Vehicle/Vessel	Motor Vehicle	35
Personal Weapons	Personal Weapons	40

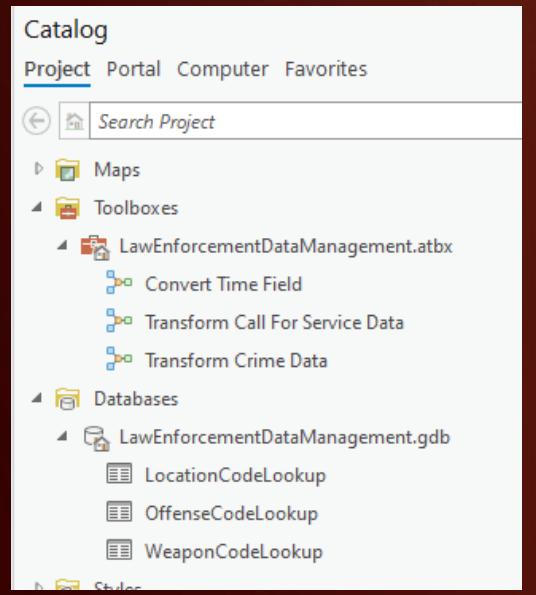
Data Transformation- Extracts

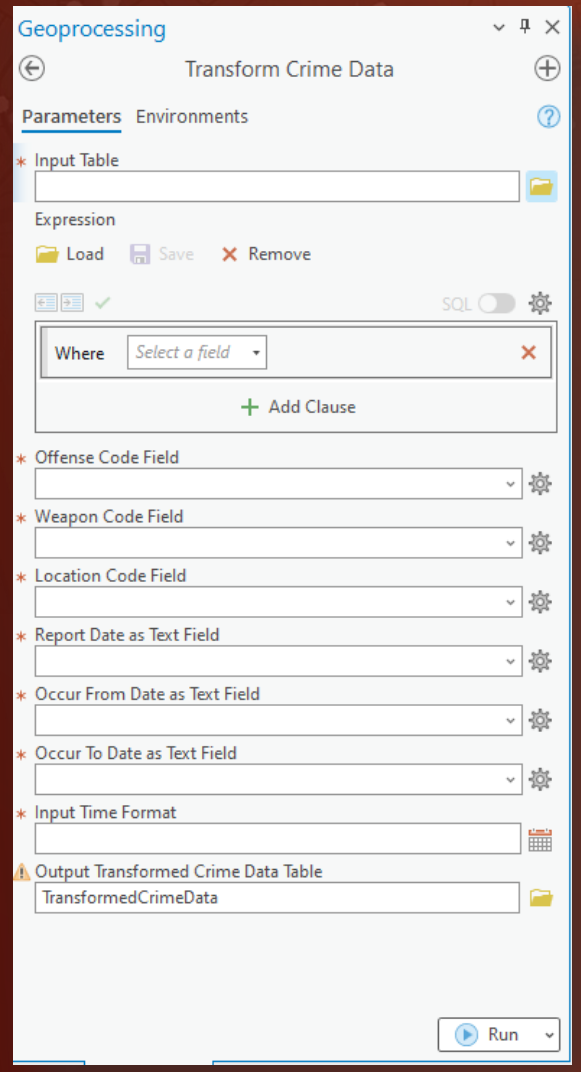


If data source is extract, edit the **Transform Crime Data** model in toolbox of **Law Enforcement Data Management** project to create your own custom data transformation model based on your needs

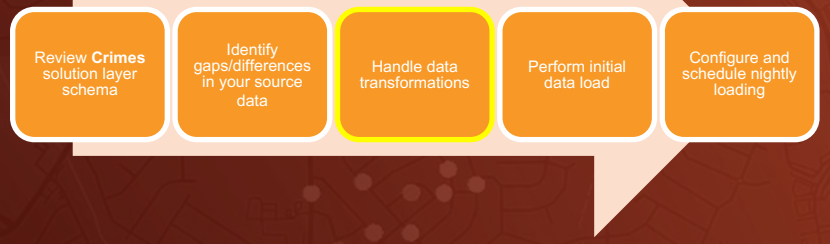
By default the model:

- Adds NIBRS fields based on offense code
- Adding NIBRS weapon and location descriptions based on code
- Adjusts date fields from string to date
- Adds date part fields for report date
- Creates output data table



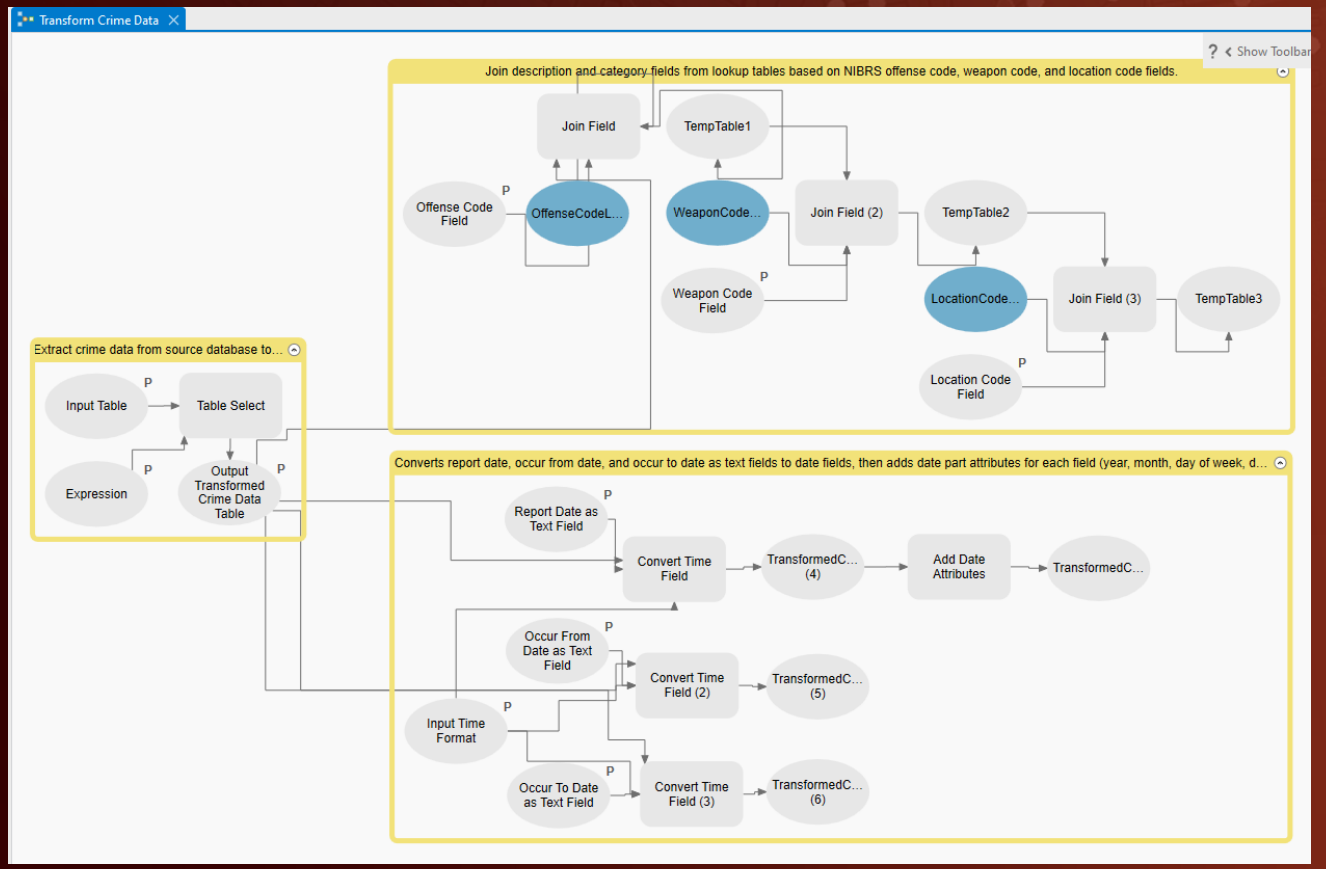


Handling Data Transformation

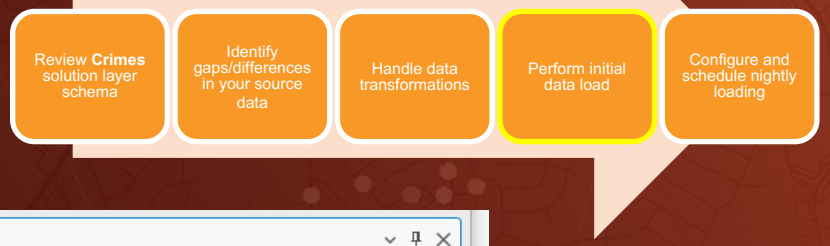


After you modify the model to fit your data transformation needs, schedule it to run nightly

- Needs to run before Update Features With Incident Records tool
  - Allow sufficient time in between for model to complete
  - Test length before scheduling
- Example model includes parameters, but you can hard-code your inputs
- Examples of transformations you may need to add to model:
  - Combine date and time into a single field
  - Trim leading or trailing spaces from values in a field
  - Transform XY string fields to doubles
  - Replace string 'NULL' with valid ArcGIS <Null>
  - Spatial join of beat/district/division value

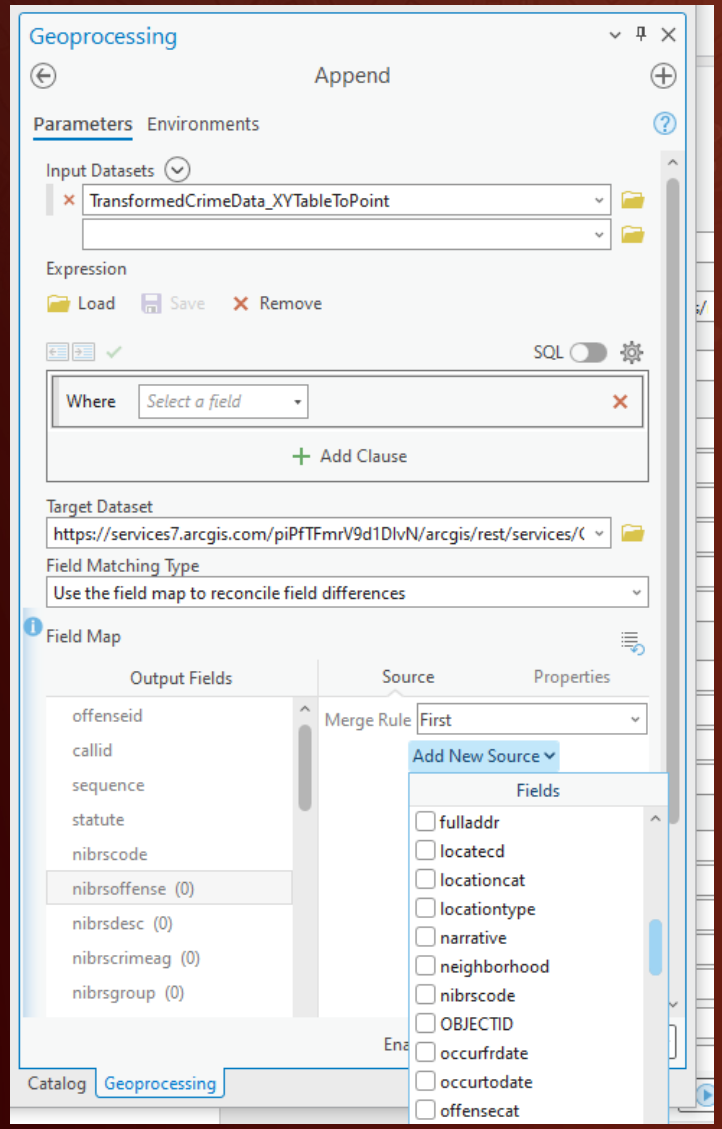


Perform Initial Data Load

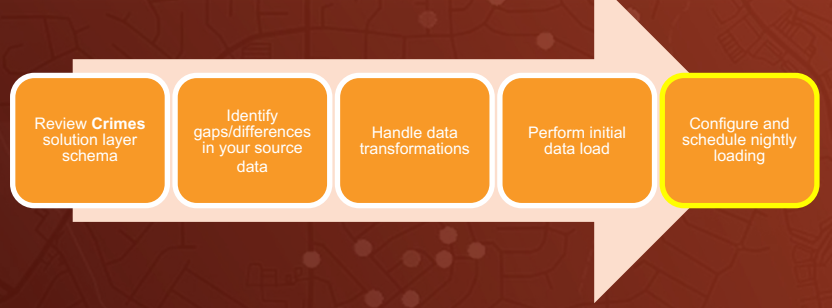


Initial data load should be 365 days worth of records into **Crimes** solution layer

1. In ArcGIS Pro, If source data is a database table/view, create a new database connection and add to new map. If extract, add extract to map.
2. Run Geocode Addresses OR XY Table to Point tool on your transformed data table to create a layer.
3. Run Append tool- better performance for larger datasets
   - Input Dataset = Transformed dataset
   - Target Dataset = Crimes solution layer
   - Field Matching Type = Use the field map to reconcile field differences

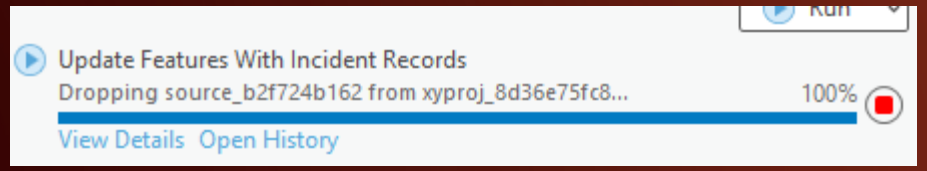


Configure and schedule nightly loading



Configure **Update Features with Incident Records** tool

- The tool submits records in batches, so it takes longer to work
- It may appear to have stopped, but don't panic- it is working!
- To validate- open the item page of the target solution layer, go to data tab and view number of records in layer. Refresh periodically- you'll know its working because the number of records increases.



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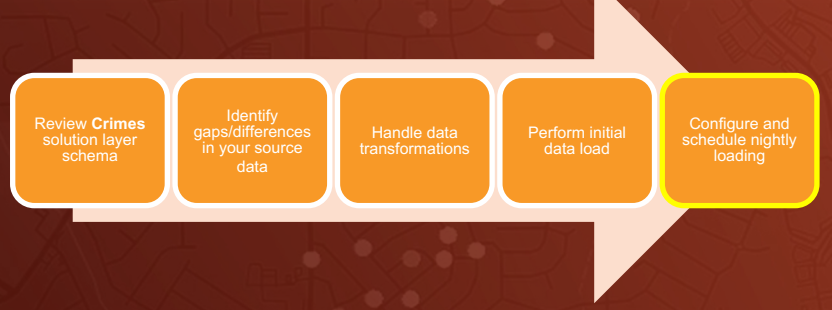


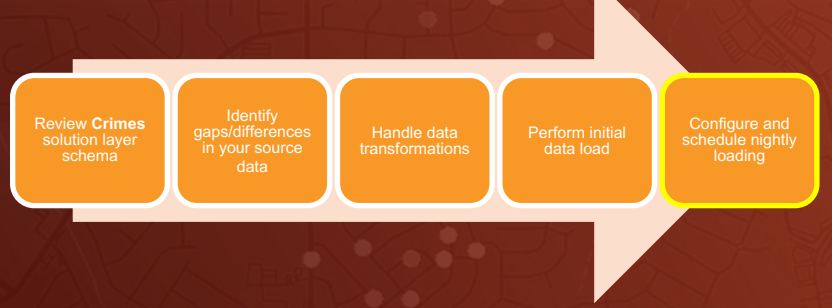
Schedule **Update Features with Incident Records** tool:

- Once you successfully manually run the tool, click down arrow next to Run button, then click Schedule
- Name your scheduled task and set time for task to run
- In Windows, open the **Task Scheduler** app
  - Set task to run even when logged off, provide credentials

NOTES:

- Administrative access to machine will be required to store credentials and run scheduled tasks
- This can be run on a local desktop or a server- Machine just needs ArcGIS Pro licensed and installed
- Recommend to use Single Use license rather than named user, as named user licenses have a time out period of a few months which will eventually cause task to fail

Input data source best practices



Try to keep overall number of records in view small to ensure performance of Update Features With Incident Records tool.

If you are using an extract:

- Use one extract for both processes (uploading crimes and calculating statistics)
  - Should have 4 years of data (1460 days)
  - Transform it (if needed- may require a model scheduled)
- When running Update Features With Incident Records, apply a filter on input data source to reduce records processed
  - Last 7 or 28 days by report date?

If you are using a database table/view:

- If you have a “last modified” date value, filter the view to only records modified in last 7 days
- If no “last modified” date is available, filter the view last 28 days of records from report date or your discretion
- Try to keep overall number of records in view small to ensure performance of Update Features With Incident Records tool.

Setting up the Crime Statistics Dashboard

- Load administrative areas
- Set up crime data loading
- **Set up crime statistics loading**
- Dashboard configuration
- Troubleshooting

Best Practices for Generate Incident Statistics tool

Input data requirements

- Recommended: 4 years of crime data (1460 days worth)
  - Why? Z-score calculates average of 3 previous periods
  - Calculating 3-year average for a 365 day period requires 1460 days worth' of data

Using non-standard time periods

The CrimeStatistics and CallsForServiceStatistics tables support the following periods by default:

- 7-Day, 28-Day, YTD, 365-Day

The Generate Incident Statistics tool additionally supports the following alternative periods:

- 14-Day, 56-Day, MTD

- For each alternative period you want to calculate, add corresponding fields (see example) to CrimeStatistics and/or CallsForServiceStatistics hosted tables:

Example-To use calculations for a 14-day period, add:

- curcnt_14days
- prevcnt_14days
- perc_14days
- pz_14days
- pzave_14days
- pzper1_14days
- pzper2_14days
- pzper3_14days

Setting up the Crime Statistics Dashboard

- Load administrative areas
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- Set up crime statistics loading
- **Dashboard configuration**
- Troubleshooting

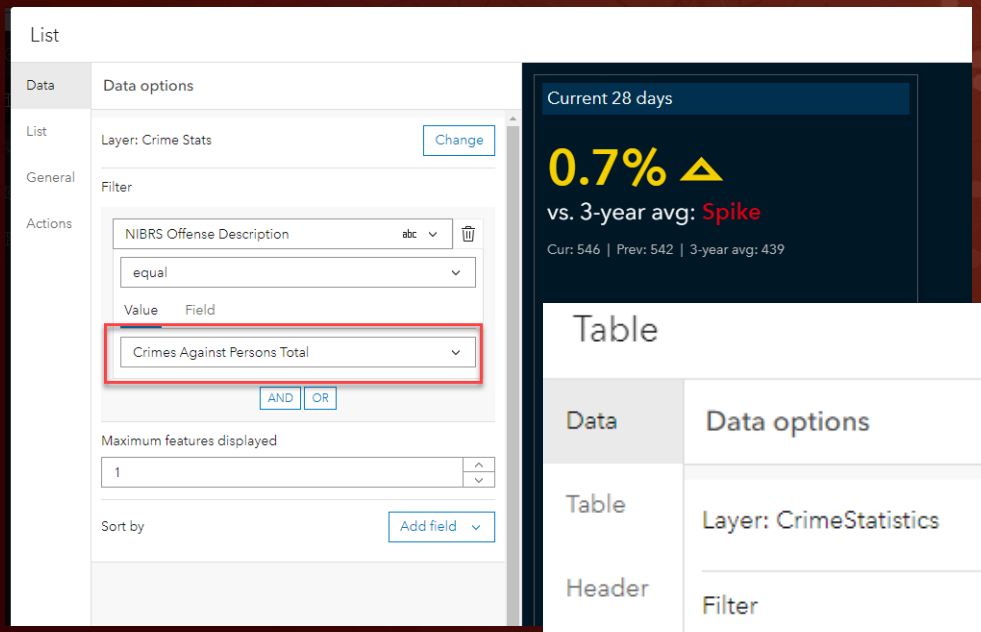
Match element filters to your agency values

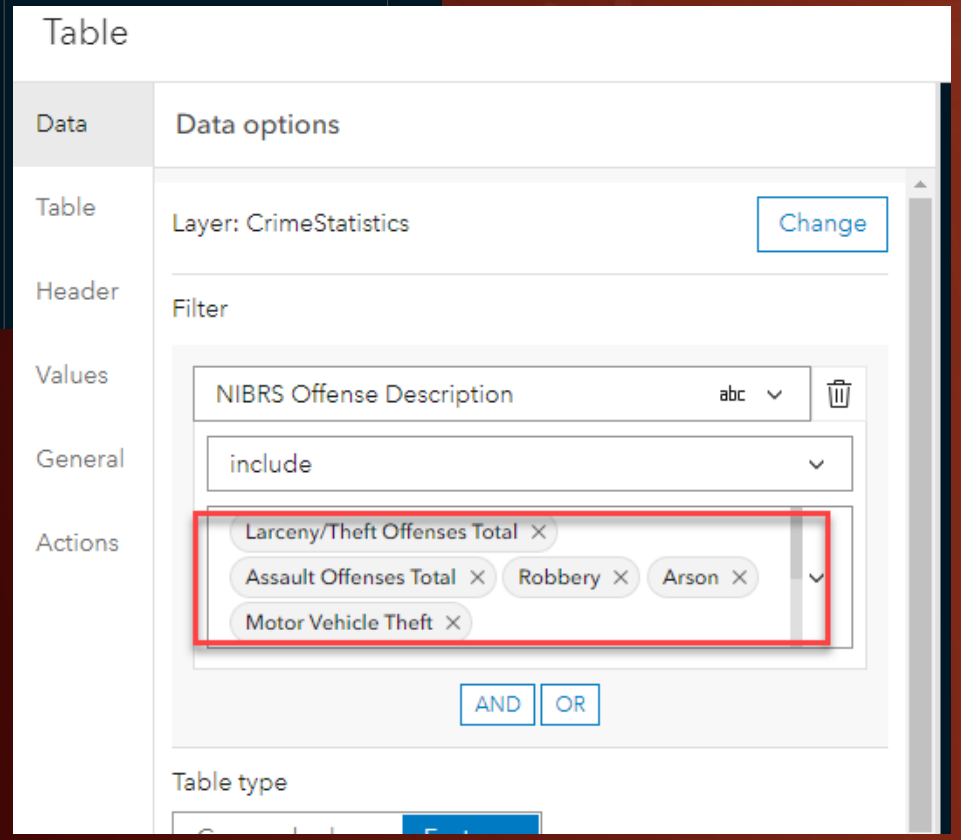
Why:

- Default filtered values do not correspond to your data values

Where:

- Persons/Property/Society 28 and 365 day stat elements on Overview tab
- Major crimes 28 and 365 day tables





Fix:

- Open each element
- Change filtered values to reflect the values in your data
  - Elements on overview tab should correspond to crimes against totals
  - Major crime totals should correspond to the total values for each of the part 1 crime categories (or whichever categories you prioritize)

Add values and color to pie charts

Why:

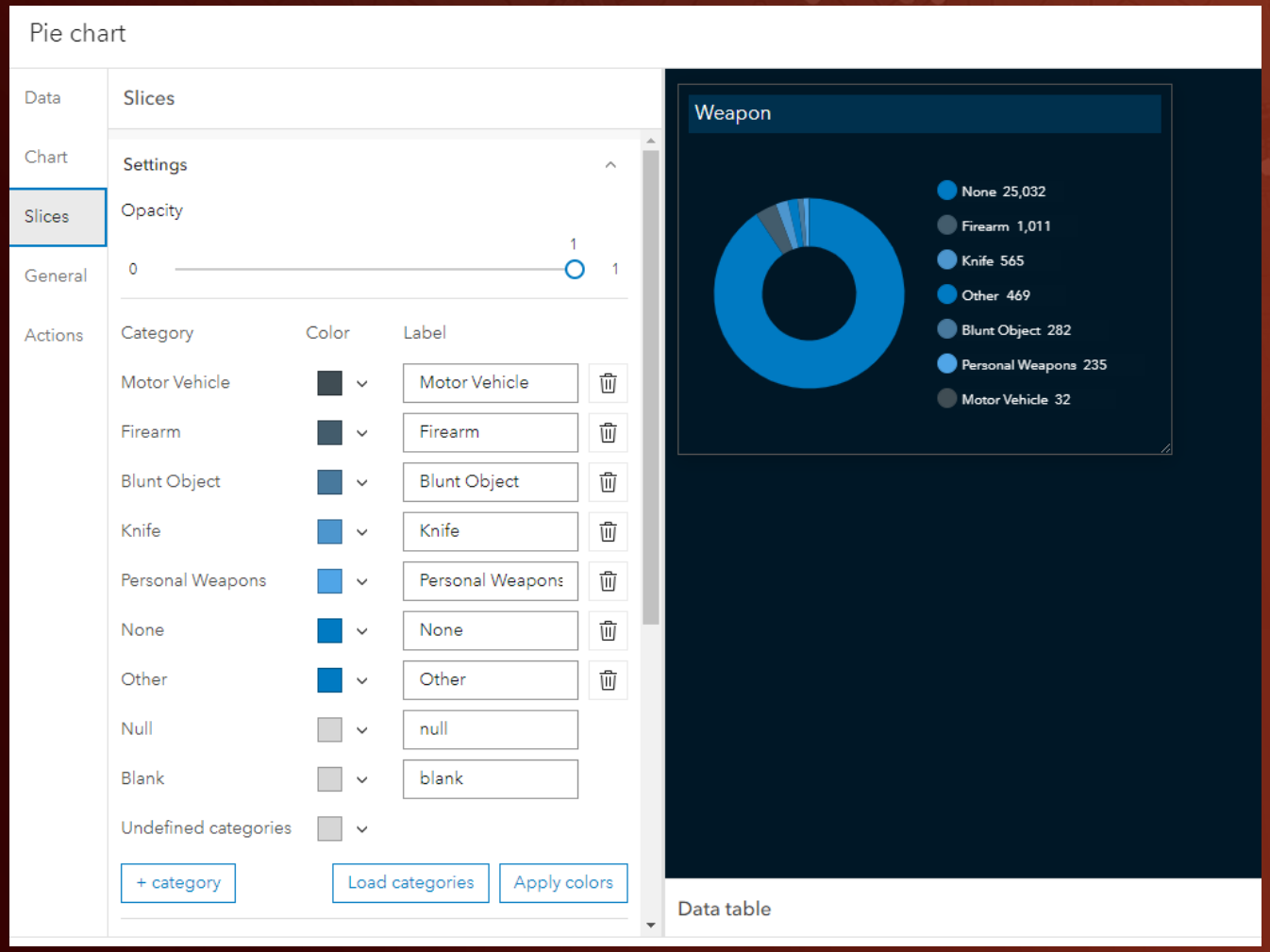
- Default categories do not correspond to your data

Where:

- Pie charts on Crimes tab

Fix:

- Open chart element
- On Slices layer, delete existing categories and click Load categories
- Click Apply colors and choose blue scale- adjust as necessary



Configure symbology

Why:

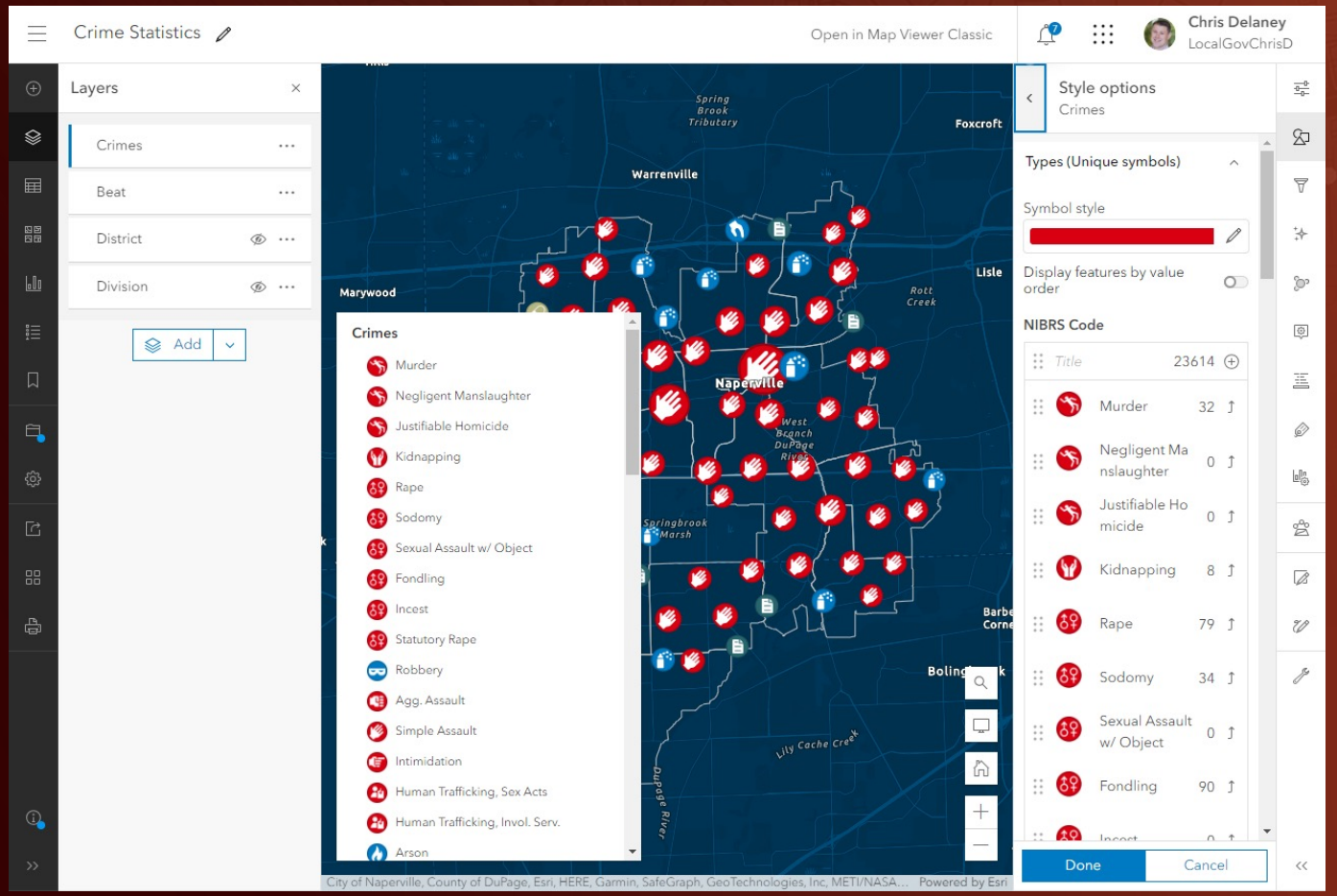
- If your data does not correspond to standard NIBRS codes, symbology will not appear correctly. Crimes layer symbology is pre-set to NIBRS codes- if you have valid NIBRS code values, symbology appears automatically

Where:

- Crime Statistics Web Map- Crimes layer

Fix:

- Must be an admin of your portal
- Create a new group called ‘web styles’
- Search ArcGIS Online for ‘NIBRS web style layer’ and add to group
- At top of the site, click Organization, and click Settings.
- Scroll to web styles section- click the box under 2D web style group and choose the group you created.
- The NIBRS vector symbols will now appear in map viewer in the vector symbols category.



Remove unused fields from pop-up

Why:

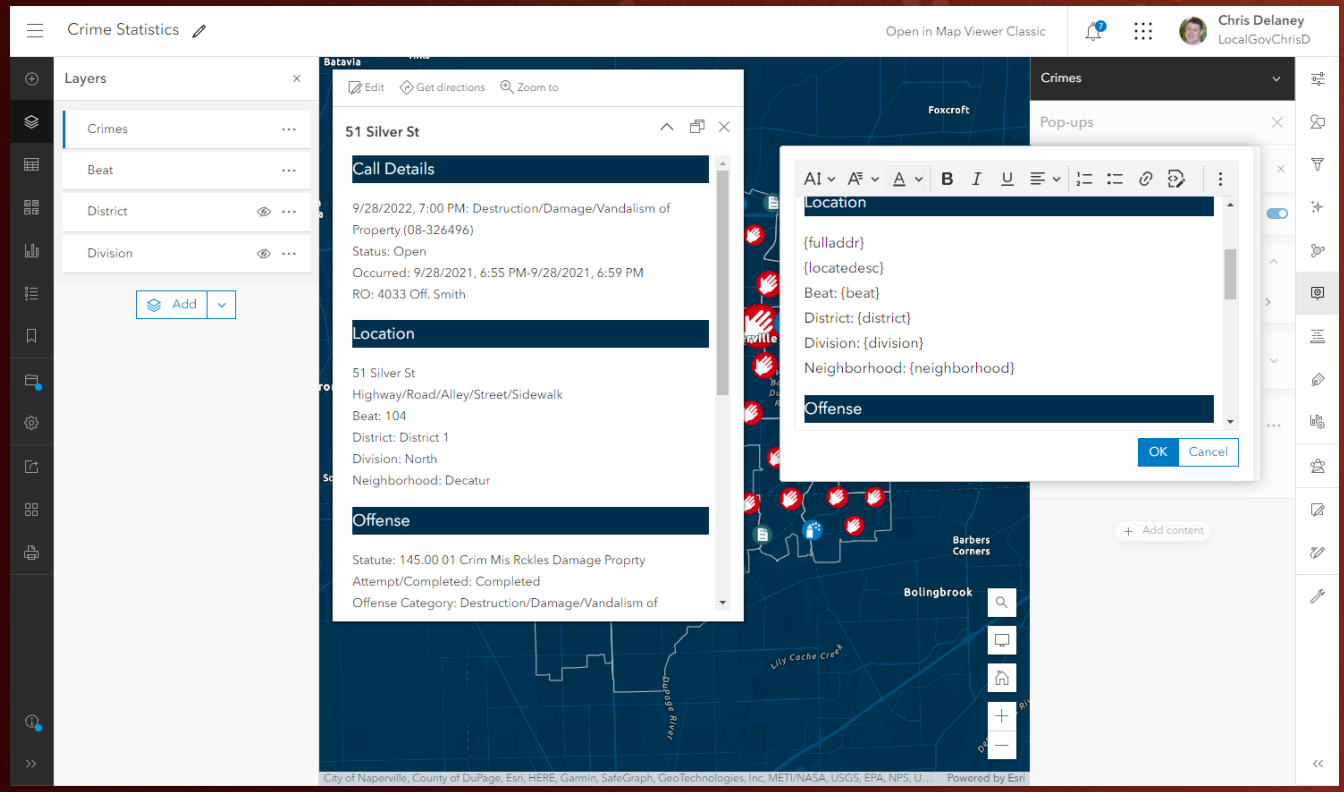
- Your organization may have elected not to populate data in all solution layer fields.

Where:

- Crime Statistics Web Map- Crimes layer

Fix:

- Open Crime Statistics web map
- Click Crimes layer, then click Pop-up
- Click edit text
- Remove unused fields and click OK.



Substituting Time Periods

Why:

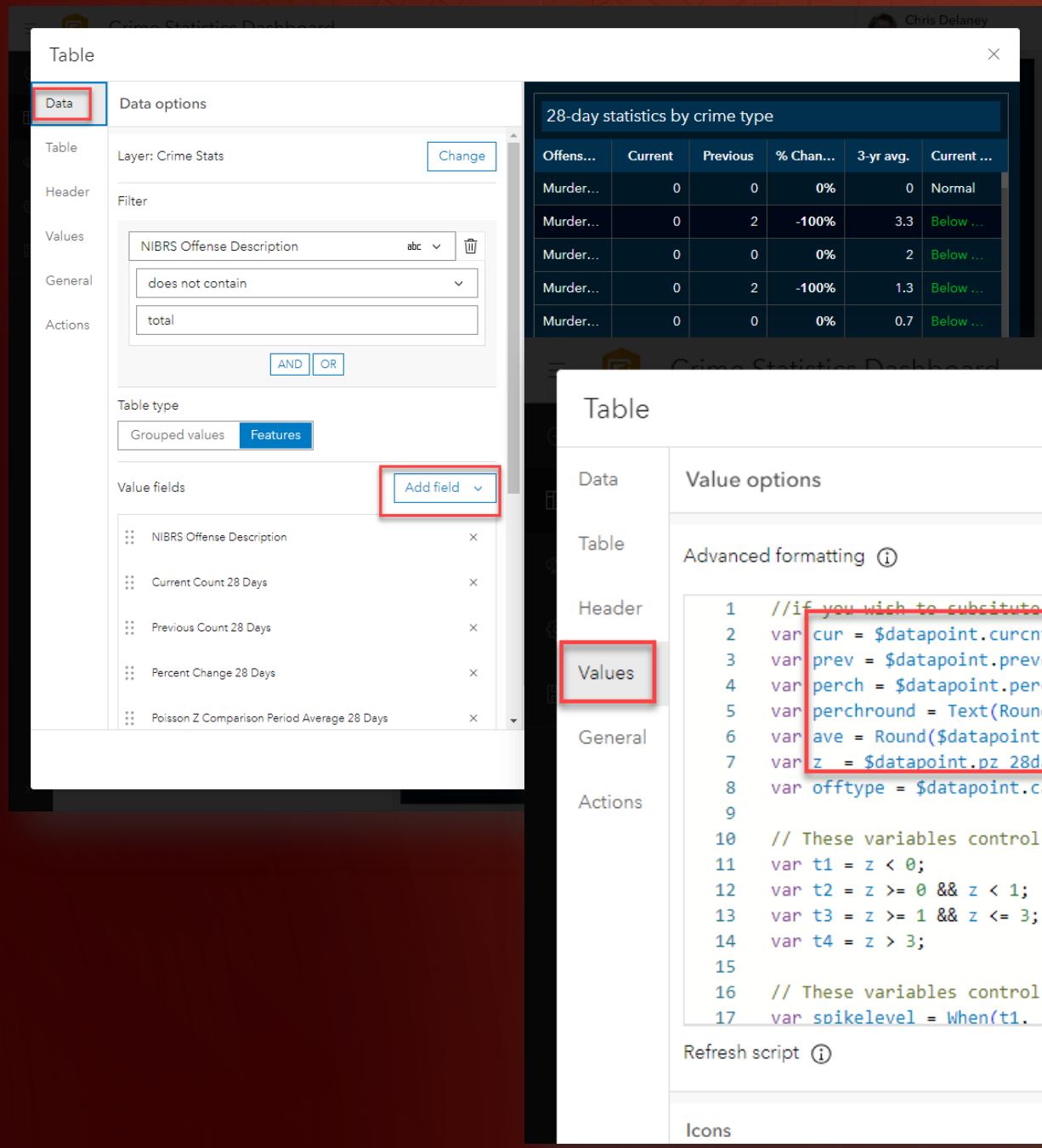
- Your organization may prefer to have different time periods displayed on dashboard than 28-day and 365-day

Where:

- Crime Statistics Dashboard

Fix:

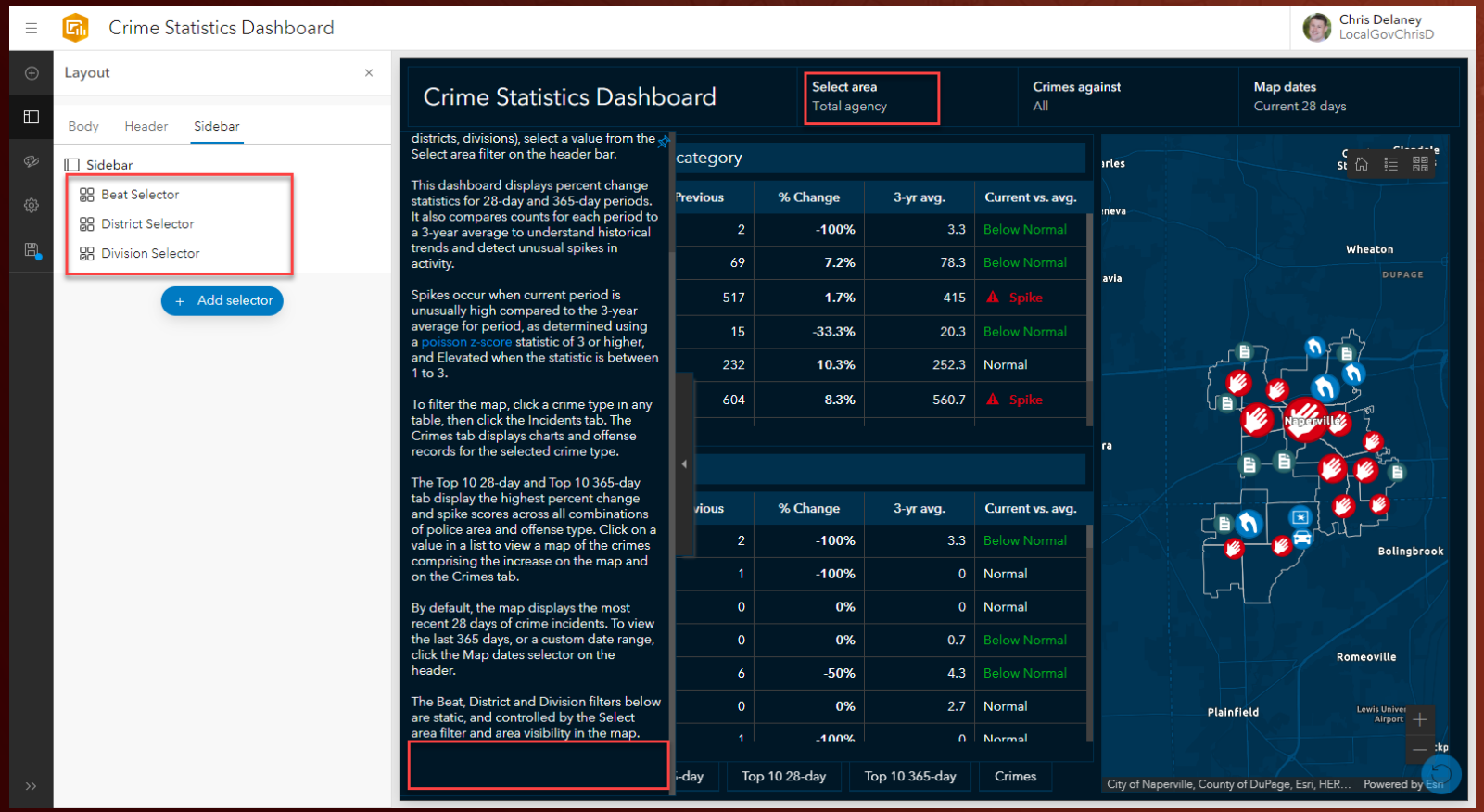
- Overview tab- repoint variable displayed in each element list
- Tables- Add new fields to table- data tab, modify arcade and swap variables in advanced formatting on values tab
- Top 10 lists- Update variables displayed in list.



How area filtering works

Area Selector is based on **statarea** field in **CrimeStatistics** table

- All unique values across all three area layers PLUS an *All area (total jurisdiction)
- Area Selector filters:
  - All stat tables
  - Top 10 lists
  - Elements on overview tab
  - HIDDEN beat, district, division selectors on sidebar
- Hidden selectors in turn filter map, counts by month charts, and all elements on Crimes tab



Setting up the Crime Statistics Dashboard

- Load administrative areas
- Set up crime data loading
- Set up crime statistics loading
- Dashboard configuration
- **Troubleshooting**

General troubleshooting

- In ArcGIS Pro, are you logged into the portal you deployed solution to?
  - Does your named user have rights to publish data?
  - Do you have access to the solution layers?
- Do you have network access to your source data?
  - Database connection to source database or network drive location of extract
- Do you administrative rights to your computer?
  - To store credentials and run scheduled tasks when logged off

Common data loading errors

- **Field type mismatches**
  - Example: In solution layer, X is DOUBLE type, in source data is STRING type
  - Example: CSV extract has ‘NULL’ in a DATE field- in a CSV this is not null it is a text string and thus invalid!
- **Field value is longer than allowed in field**
  - Watch out for trailing and leading spaces- especially in fields with short length, like Zip
- **Missing records**
  - Update Features tool does will not publish a record in the following conditions:
    - Null XY or Address values, unmatched addresses, Field Type mismatch, field value too long, duplicate unique id in same upload batch, bad date, no unique ID

Troubleshooting data loading

- **Update Features With Incident Records seems hung**
  - With large datasets, tool will appear stuck- to check that it is still working, go to Crimes layer item in your portal, click Data tab, note number of records in the layer, then click refresh. As long as the data is incrementing, the tool is working and will complete as intended.

- **Avoid using Update Features With Incident Records for initial data load if working with a large dataset**
  - Tool works in batches of 5000 records at a time, and can experience failures due to network timeouts (400 errors) if loading very large datasets
  - Append is optimized for this type of work, as it zips up the data first, then sends it.

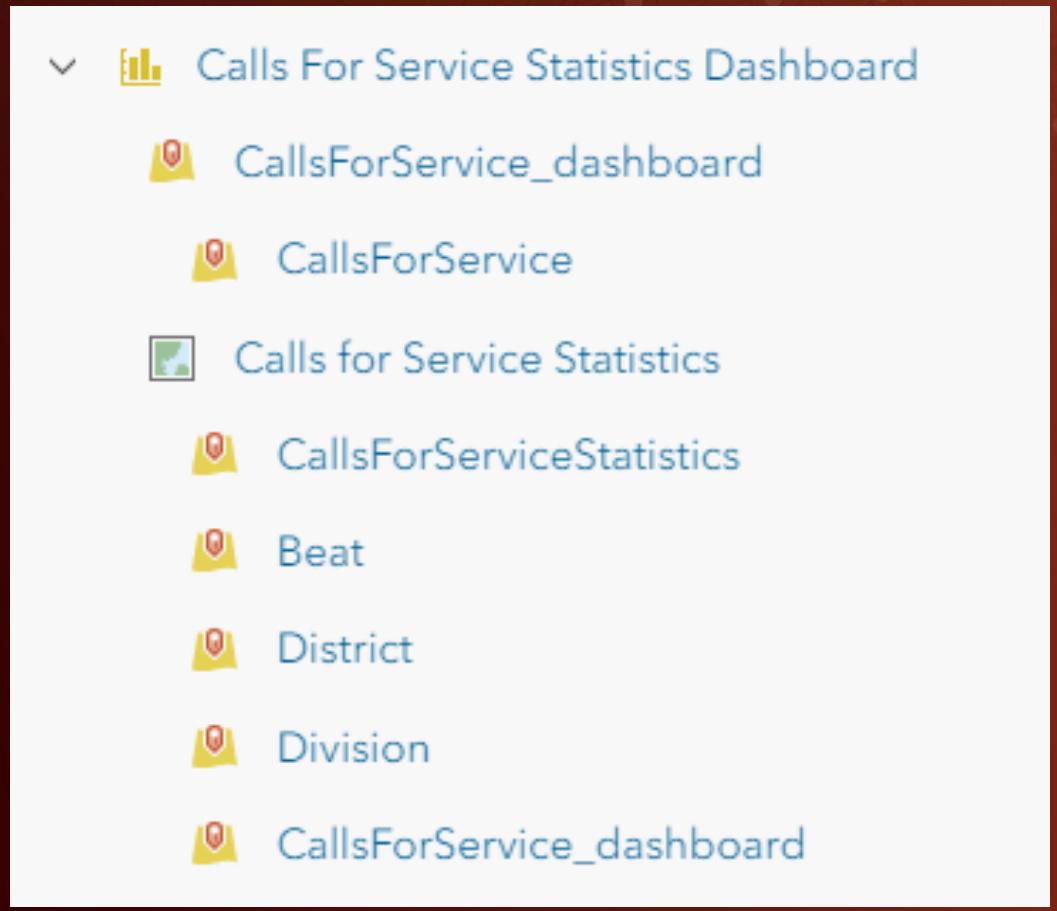
Setting up the Calls For Service Dashboard

Calls for Service Statistics Dashboard

- Same statistics as Crime Statistics Dashboard, plus:
- Median response time and each component period (time to dispatch, etc.)
- Follow same set up process- when complete you should have:
  - 1 scheduled task for loading data to CallsForService layer
  - 1 scheduled task for loading data to CallsForService Statistics layer

Calls For Service Statistics Dashboard Components

- Web Map (Calls for Service Statistics)
- 5 feature layers
  - CallsForService_dashboard view
    - Filters for only last 365 days
  - CallsForServiceStatistics table
  - Beat
  - District
  - Division



Special considerations for Calls For Service Statistics Dashboard

1. All of the date fields (Call Date, Dispatch Date, Enroute Date, Arrival Date Clear Date)- should have datetime values in them

2. All of the “time” fields (Time to Dispatch, Queue Time, Travel Time, Time on Call, Total Response Time) are DOUBLE field type and should reflect the interval between two times in decimal minutes
   - For example- Time To Dispatch should measure the interval of time between Call Date and Dispatch Date in decimal minutes

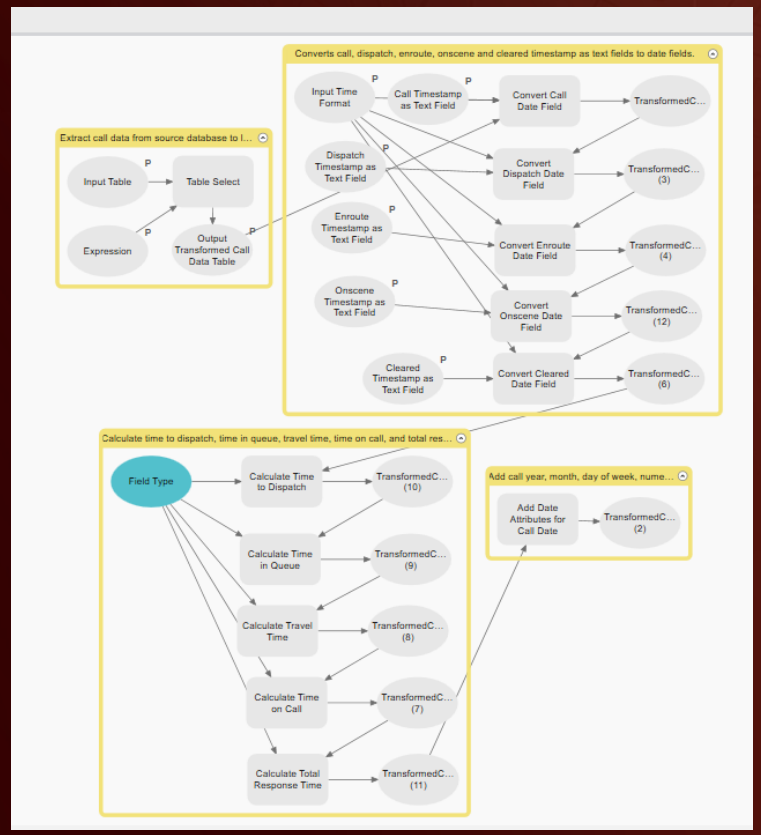
3. Any response times displayed are being calculated BY THE DASHBOARD, not by the Generate Incident Statistics tool

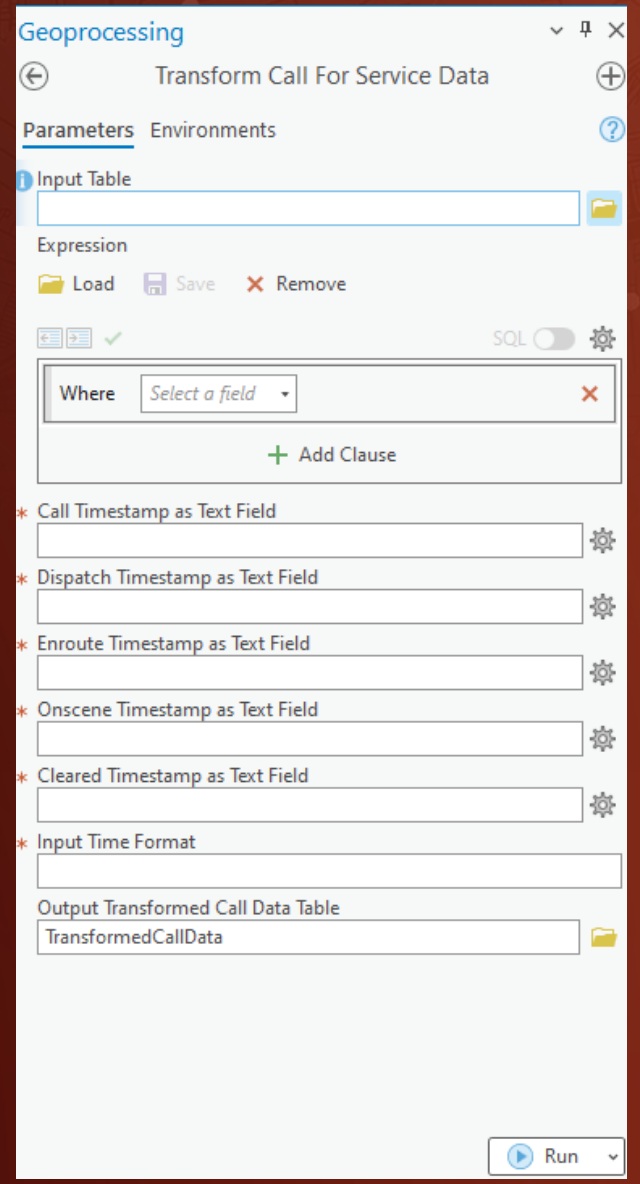
4. If you cannot obtain these values, remove all response time elements from the dashboard.

Data Transformations for Calls For Service

Law Enforcement Data Management ArcGIS Pro project includes Transform Calls For Service data model, which performs the following:

- Converts date in string type to date type
  - Call Date, Dispatch Date, Enroute Date, Arrival Date, Clear Date
- Calculates response time interval fields in decimal minutes
  - Time to Dispatch, Queue Time, Travel Time, Time on Call, Total Response Time





Setting up reports

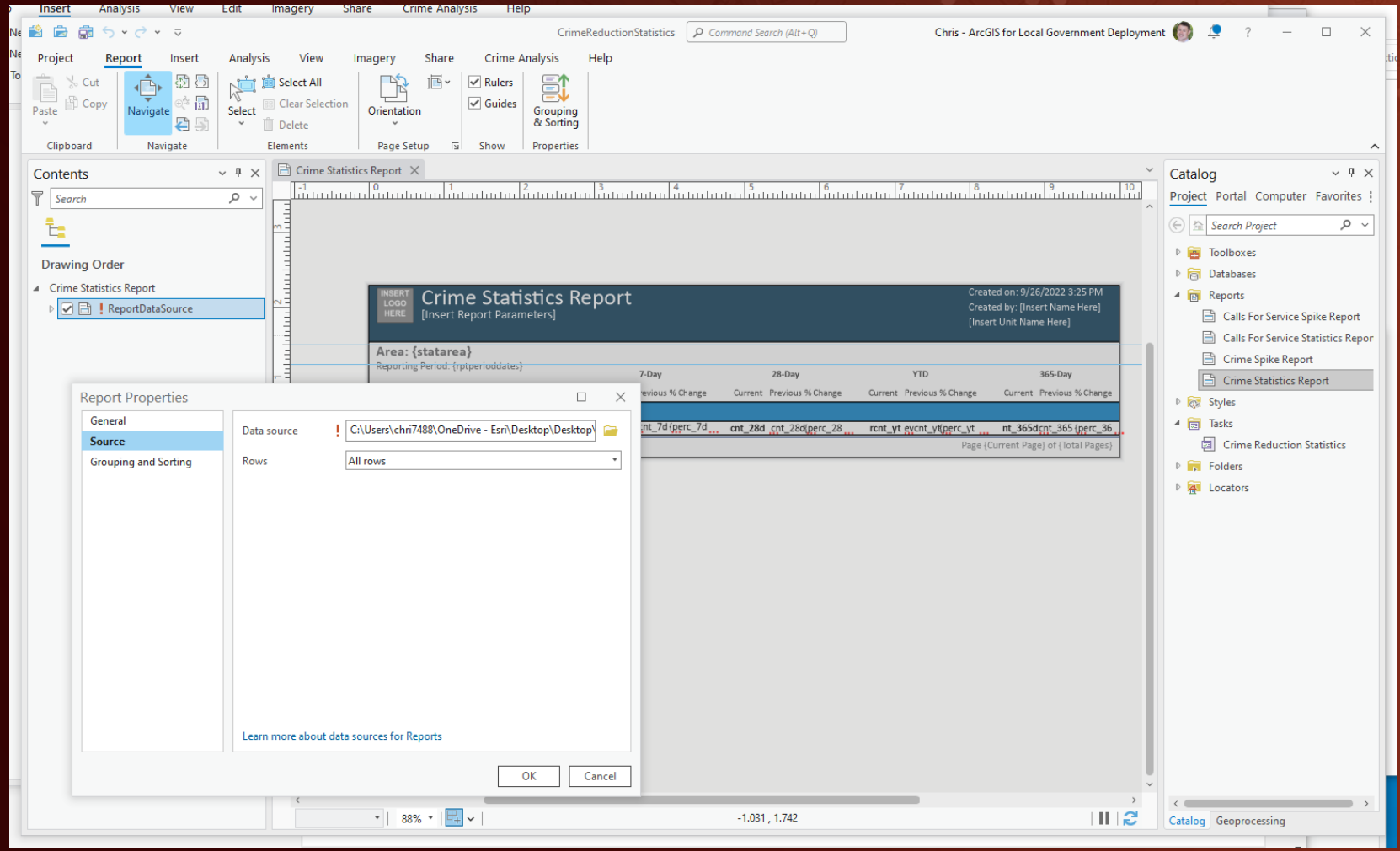
Reports

Crime Reduction Statistics ArcGIS Pro project comes with four reports that can be used to generate hardcopy statistical reports

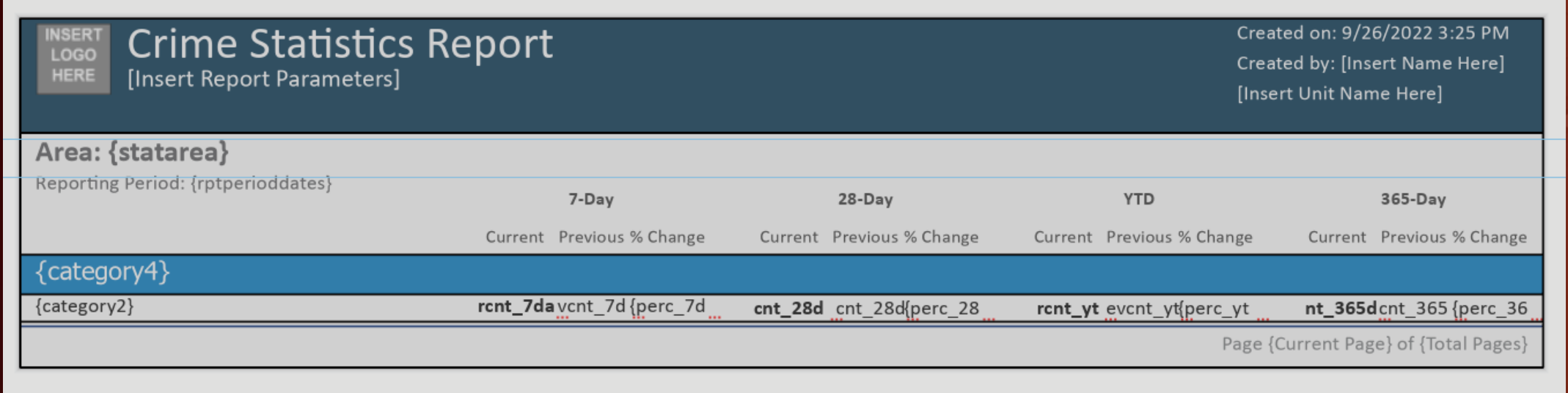
Setting up reports

Reports come pre-configured but need to be connected to either the CrimeStatistics or CallsForServiceStatistics table

1. Open report
2. Double-click ReportDataSource
3. Click source tab, then update Data source to point at solution table
4. Optionally use rows drop-down to filter for subset of records



Setting up reports



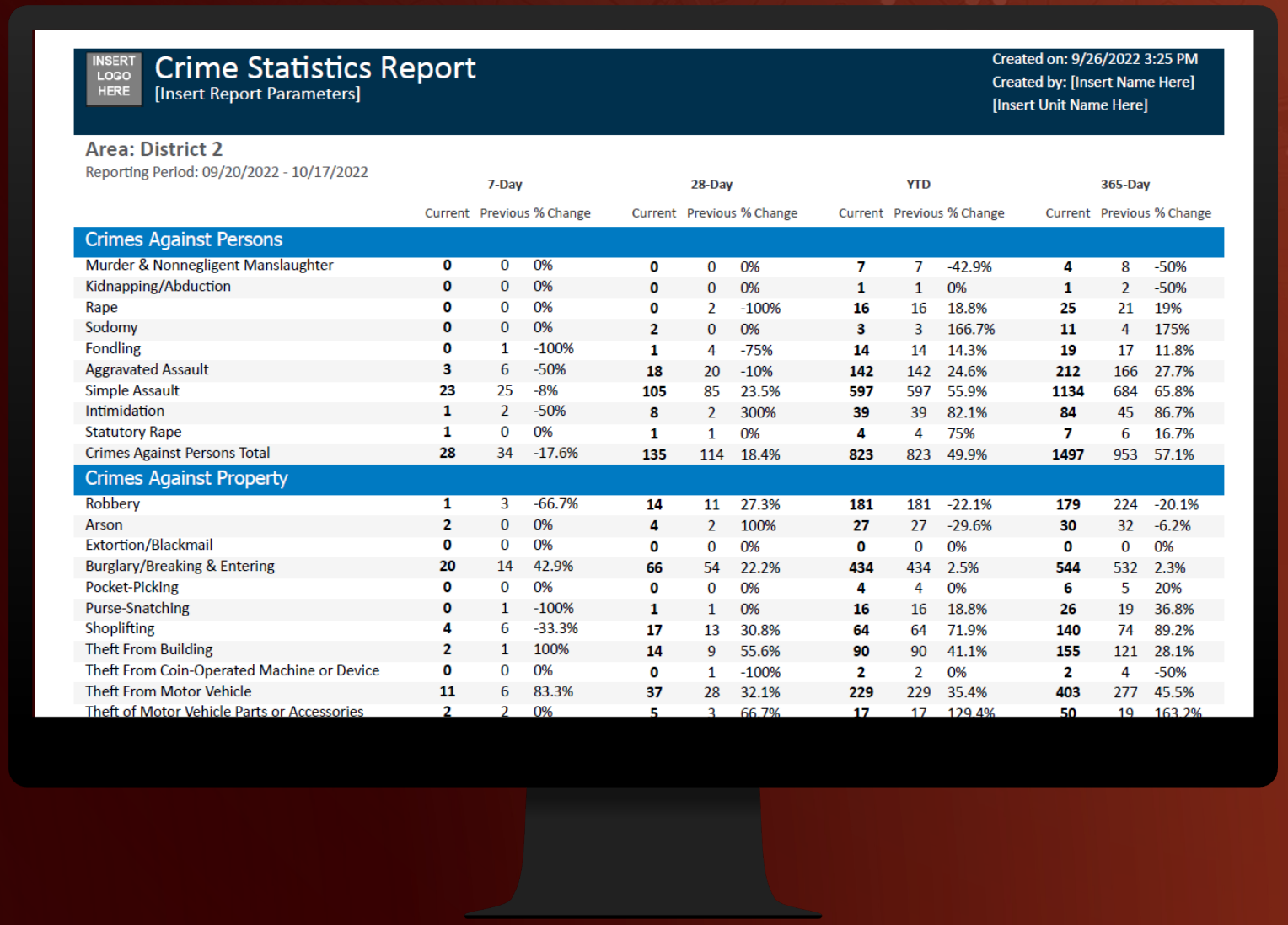
- Reports by default display 7-Day, 28-Day, YTD, and 365- day periods
- Separate reports for percent change and spikes
- Crime data is aggregated by crimes against category by default and for each administrative area
  - Field name {category4} is the crimes against category
  - Field name {category2} is the nibrs description
    - If you configured Generate Incident Statistics tool from smallest to largest (nibrscode, description, category, crimes against, group)

Setting up reports

Exporting to PDF will generate a report for each administrative area as well as overall.

To schedule report, run Export Report to PDF tool and create a scheduled task

- Tool can also be filtered to control which areas and crimes are exported.



INSERT LOGO HERE

Crime Statistics Report

[Insert Report Parameters]

Created on: 9/26/2022 3:25 PM
Created by: [Insert Name Here]
[Insert Unit Name Here]

Area: District 2

Reporting Period: 09/20/2022 - 10/17/2022

	7-Day			28-Day			YTD			365-Day		
	Current	Previous	% Change	Current	Previous	% Change	Current	Previous	% Change	Current	Previous	% Change
Crimes Against Persons												
Murder & Nonnegligent Manslaughter	0	0	0%	0	0	0%	7	7	-42.9%	4	8	-50%
Kidnapping/Abduction	0	0	0%	0	0	0%	1	1	0%	1	2	-50%
Rape	0	0	0%	0	2	-100%	16	16	18.8%	25	21	19%
Sodomy	0	0	0%	2	0	0%	3	3	166.7%	11	4	175%
Fondling	0	1	-100%	1	4	-75%	14	14	14.3%	19	17	11.8%
Aggravated Assault	3	6	-50%	18	20	-10%	142	142	24.6%	212	166	27.7%
Simple Assault	23	25	-8%	105	85	23.5%	597	597	55.9%	1134	684	65.8%
Intimidation	1	2	-50%	8	2	300%	39	39	82.1%	84	45	86.7%
Statutory Rape	1	0	0%	1	1	0%	4	4	75%	7	6	16.7%
Crimes Against Persons Total	28	34	-17.6%	135	114	18.4%	823	823	49.9%	1497	953	57.1%
Crimes Against Property												
Robbery	1	3	-66.7%	14	11	27.3%	181	181	-22.1%	179	224	-20.1%
Arson	2	0	0%	4	2	100%	27	27	-29.6%	30	32	-6.2%
Extortion/Blackmail	0	0	0%	0	0	0%	0	0	0%	0	0	0%
Burglary/Breaking & Entering	20	14	42.9%	66	54	22.2%	434	434	2.5%	544	532	2.3%
Pocket-Picking	0	0	0%	0	0	0%	4	4	0%	6	5	20%
Purse-Snatching	0	1	-100%	1	1	0%	16	16	18.8%	26	19	36.8%
Shoplifting	4	6	-33.3%	17	13	30.8%	64	64	71.9%	140	74	89.2%
Theft From Building	2	1	100%	14	9	55.6%	90	90	41.1%	155	121	28.1%
Theft From Coin-Operated Machine or Device	0	0	0%	0	1	-100%	2	2	0%	2	4	-50%
Theft From Motor Vehicle	11	6	83.3%	37	28	32.1%	229	229	35.4%	403	277	45.5%
Theft of Motor Vehicle Parts or Accessories	2	2	0%	5	3	66.7%	17	17	129.4%	50	19	163.2%

Wrap-up

Regular monitoring and maintenance

When configuration is complete, you should have the following scheduled tasks:

1. Loading and updating new records into Crimes layer
2. Generating Crimes Statistics and overwriting CrimeStatistics table
3. Loading and updating new records into CallsForService layer
4. Generating Crimes Statistics and overwriting CallsForServiceStatistics table

In addition, you may have additional scheduled tasks for:

1. Data transformation of source crime data
2. Data transformation of source calls for service data
3. Creation of 1 or more crime or calls for service report

Example scheduled task timings with data extract

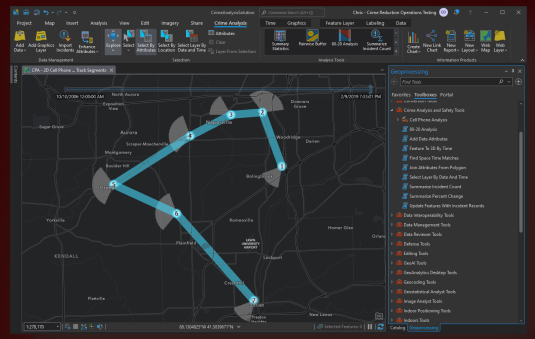
- Amount of time necessary for scheduled tools to complete will vary by volume of data processed
- Allow sufficient gaps in time between processes to allow tools to complete

Crime Reduction Solutions

An ArcGIS system for improving community safety with place-based science

- ✓ Evidence-based
- ✓ Problem-oriented
- ✓ Data-driven

Crime Analysis

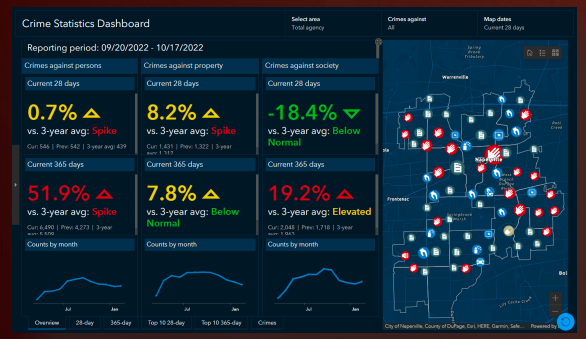


Empower analysts with a focused experience and analysis tools for operations and investigations

Daily Activity Dashboard

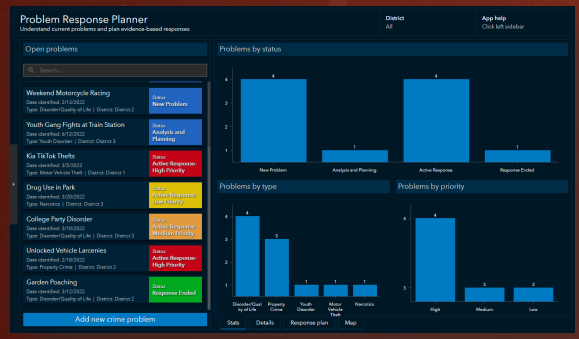
Visualize crime and call hot spots to improve daily decision support

Crime Reduction Statistics



Update CompStat with modern statistical analysis to identify problems and trends

Crime Problem Management



Plan, manage, and evaluate evidence-based responses to crime and disorder problems

…An integrated continuum of capabilities with flexible deployment patterns…

Need example data to play with?

https://links.esri.com/crsdata

Read the help documentation & deploy:

https://links.esri.com/CrimeReductionStatisticsGallery

Archived Webinars

ArcGIS Solutions for Crime Reduction Operations

esri.com/pswebinars

Contact Us

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