Regional PEDESTRIAN PLAN

INDIANAPOLIS MPO

MPO

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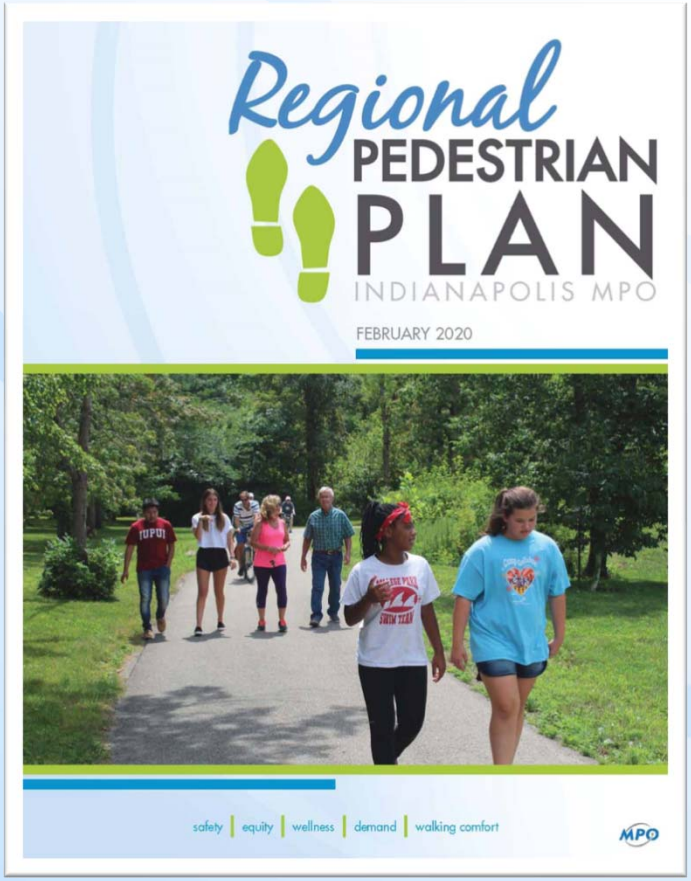
landscape architecture | community planning | urban design | visioning | strategic planning

GIS PRIORITIZATION METHODOLOGY TRAINING EXERCISE

MPO Regional Pedestrian Plan

- The MPO Regional Pedestrian Plan recognizes the importance of walking and planning for the pedestrian
- The Plan encourages the establishment of a connected pedestrian system that crosses county and municipality lines, providing the opportunity for continuous pedestrian activity throughout the MPA
- The Plan was adopted by the Transportation Policy Committee in February 2020.
- This GIS Prioritization Methodology Training Exercise was delayed due to COVID-19.



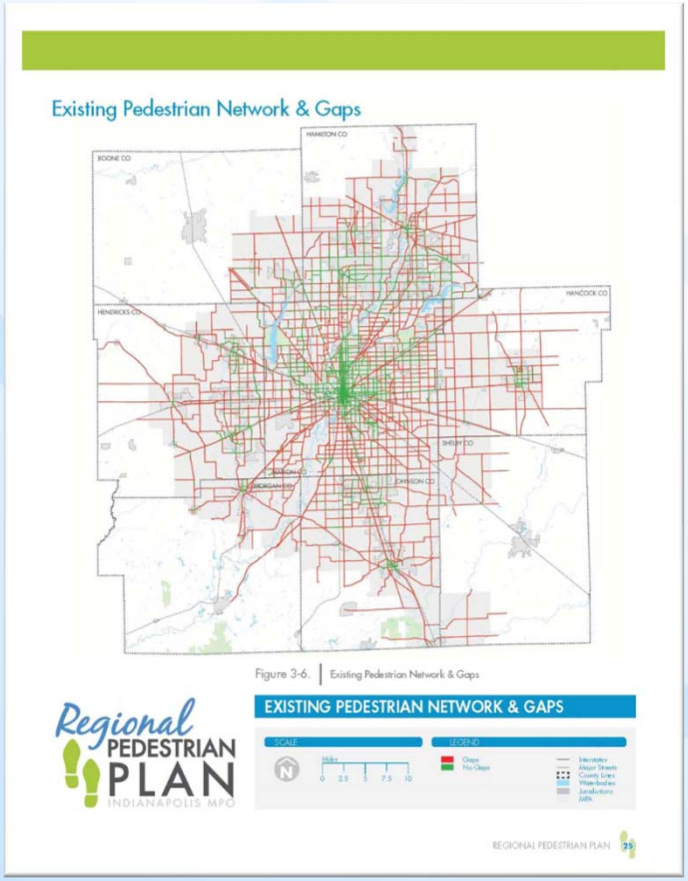
Why Prioritization?

- Limited funding and resources means it's impossible to meet every pedestrian need at once
- Prioritization is designed to provide decision makers with general recommendations on where to begin on improving upon and expanding the regional pedestrian network
- Regional priorities may not be the same as local priorities

Existing Pedestrian Network

- Streets were reviewed to identify existing and gap sidewalk networks in Central Indiana, based on community GIS files (if they existed) and manual aerial photography analysis
- Gaps identification only includes INDOT functional classifications 2-6 (excluding interstates and local roads)
- You can strengthen your own analysis by doing an inventory of your community's existing pedestrian network and adding existing sidewalks and gaps along local roads to the map

Please send any additional data to the MPO to include in the master regional database.



Priority Investment Areas Indices

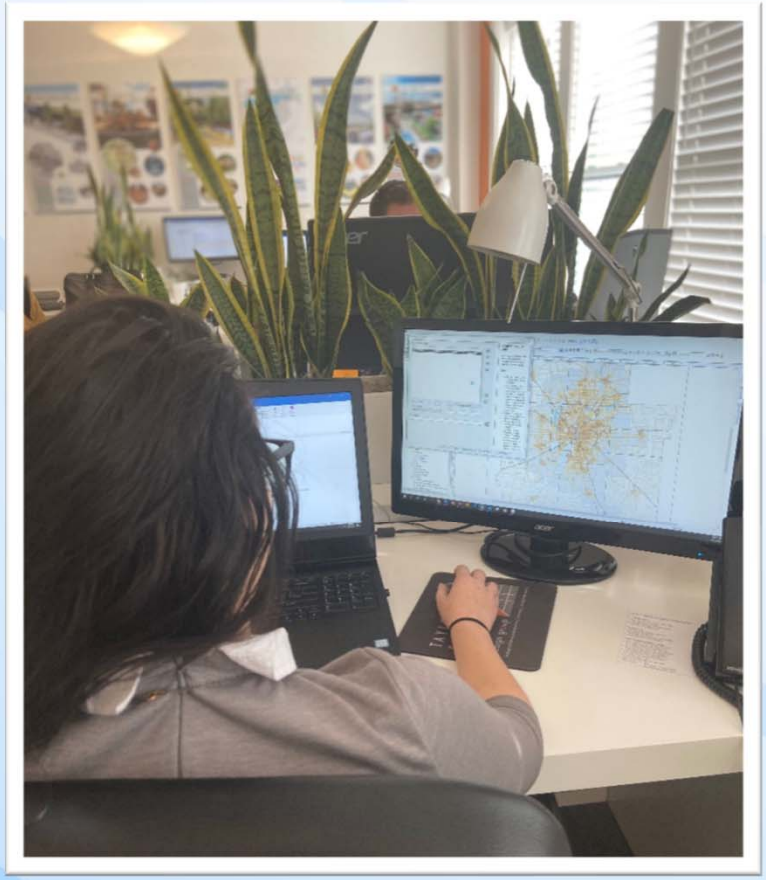
- A series of priority investment areas indices were established to rank areas of priority investment
- These indices were derived from the Plan goals and objectives and community planning efforts and vetted through public survey
- Priority investment areas indices include:

Composite Ranking Strategy

- A series of preliminary ranking strategies were used to weight the priority investment areas indices and inform the creation of a composite ranking strategy
- The composite ranking strategy provides communities with a map of gaps in the pedestrian network weighted and categorized into tiers to indicate priority
- The composite ranking strategy can also be modified into your own local scoring system if local priorities differ from regional ones

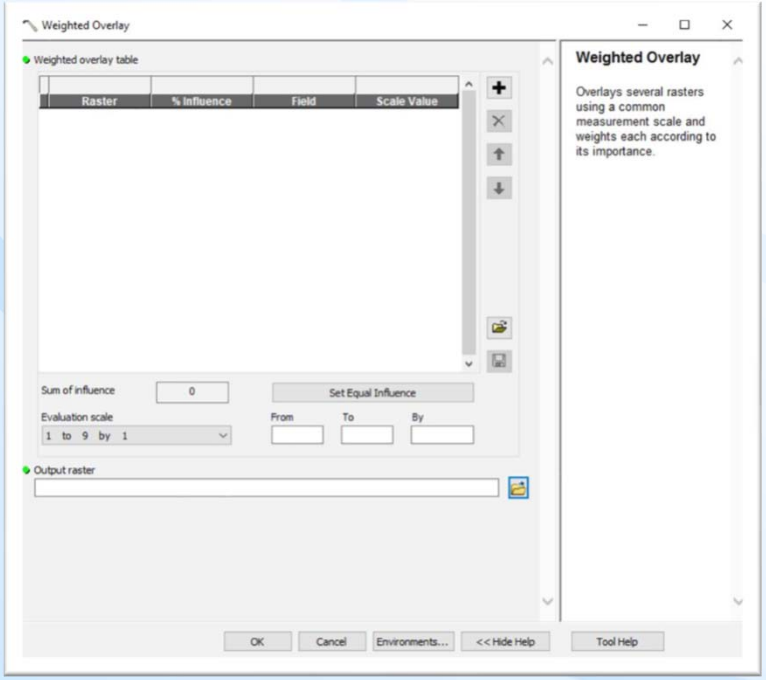
Training Overview

- The GIS prioritization methodology outlines the prioritization process used in the Regional Pedestrian Plan on a local scale
- Priority investment areas indices were mapped and weighted to establish rank
- Where these factors came together were the “hot spots” that indicate high priority



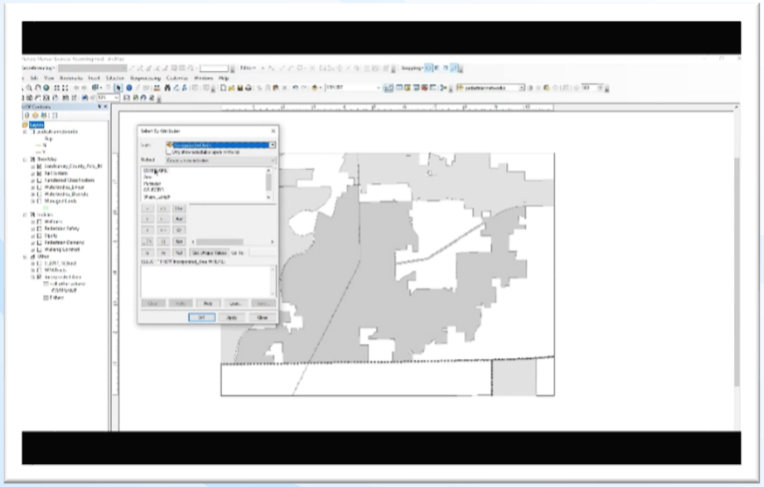
Data Processing

- ESRI ArcGIS 10.5.1and the Spatial Analyst Extension were used to identify areas of priority investment for pedestrian infrastructure
- The process was largely based on the prioritization approach used in the Marion County Walkways Plan, which used a series of ESRI ArcGIS toolboxes to execute batch commands



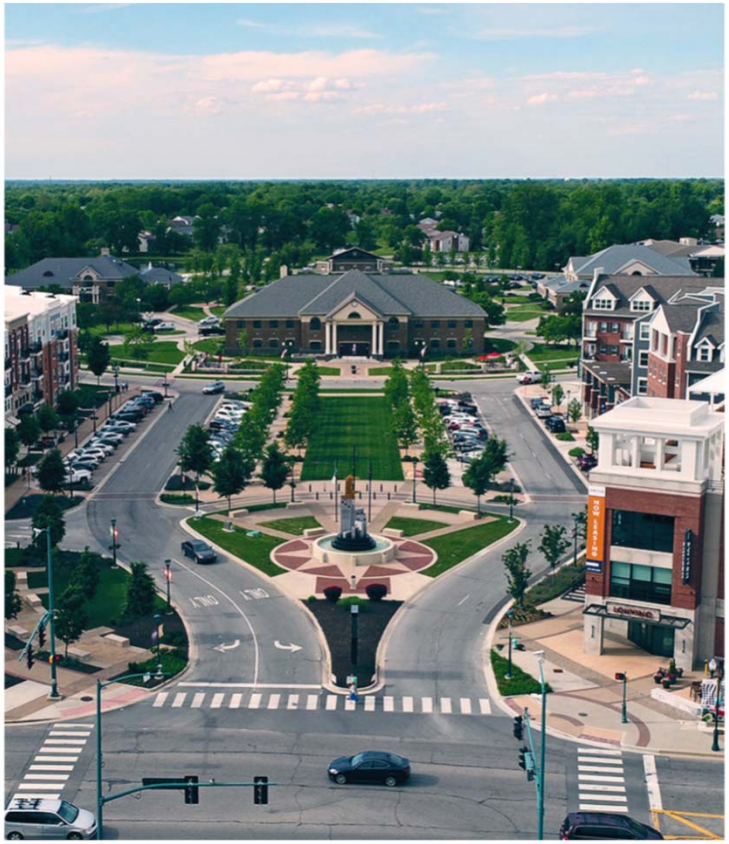
Training Videos

- A series of training videos were completed illustrating the prioritization process. These videos include:
  - Video 1: Prioritization Methodology/Select by Attributes
  - Video 2 : Density Analysis and Rasterization
  - Video 3: Reclassification and Weighted Overlay

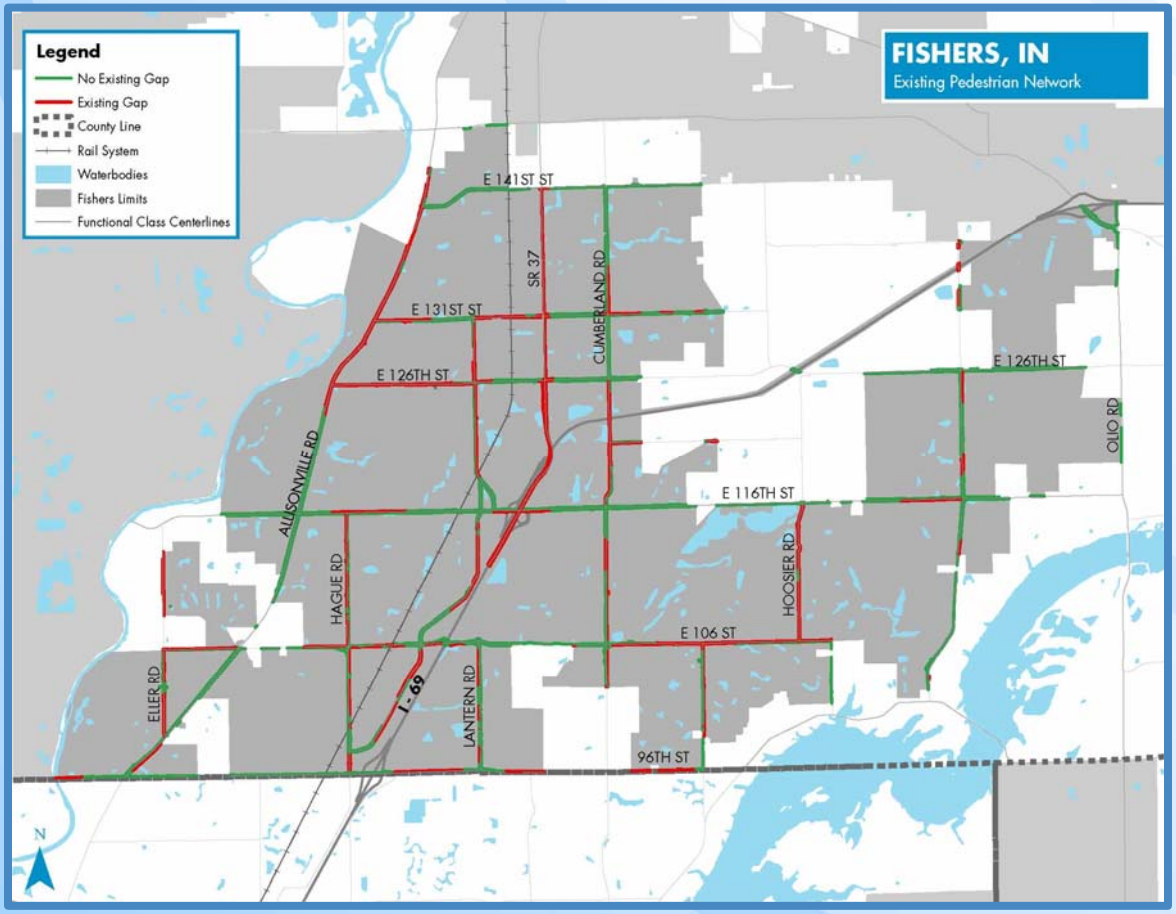


Training Exercise: Fishers, IN

- Fishers, IN was selected to illustrate how Central Indiana communities and local organizations can run similar analyses
- The study area includes additional areas outside of the jurisdictional limits of Fishers in order to eliminate holes and create a cohesive study zone.

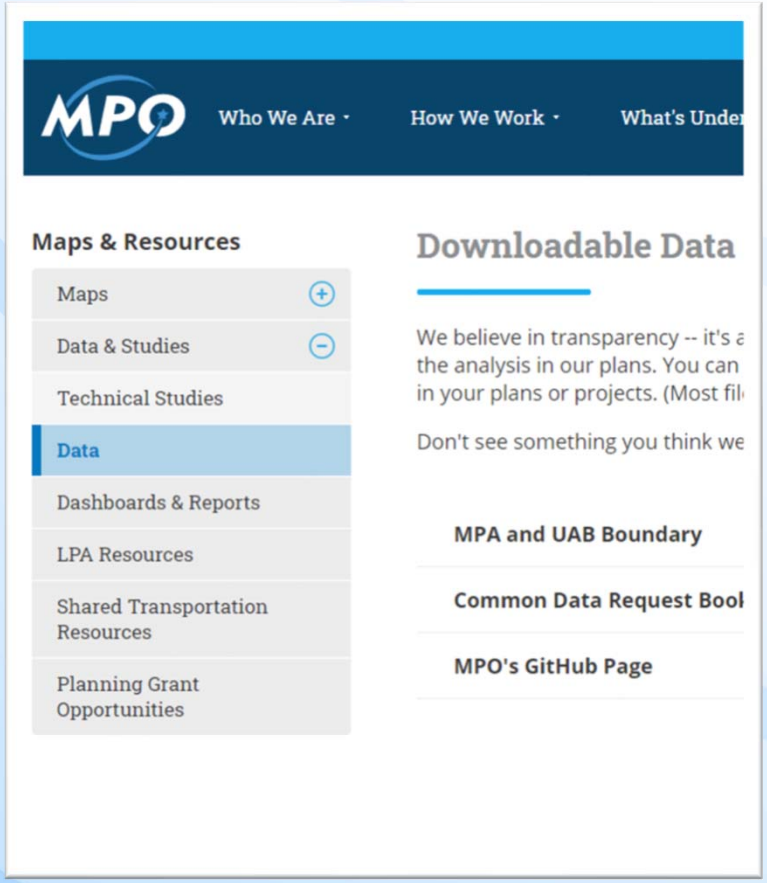


Existing Pedestrian Network & Gaps



Data Limitations

- For the purpose of this exercise, measures of priority investment were evaluated using data applicable to the entirety of the MPA
- Incomplete data sets where data was not present for one or more county were not included
- Participants are encouraged to explore data sets at the local level to adapt the prioritization process



Raw Data

- Pedestrian Safety
  - Pedestrian Non-Fatal/Non-Incapacitating Crashes 2012-2017
  - Existing Pedestrian Network
  - Lane Widths
- Equity
  - Youth Population
  - Senior Population
  - Minority Population
  - Household Poverty Levels
  - Zero-Car Households
- Wellness
  - Parks and Trails 2019
  - Hospitals
  - Pedestrian Fatal/Incapacitating Crashes 2012-2017
- Pedestrian Demand
  - Population Density
  - Employment Density
  - Educational Facilities
- Walking Comfort
  - County AADT (Annual Average Daily Traffic) 2018
  - Speed Limits
  - Functional Classifications 2018
  - Existing Pedestrian Infrastructure Network

GIS Prioritization Methodology: Steps

1. Select by Attributes: Community
2. Clip
3. Select by Attributes: Functional Classifications
4. Normalization
5. Kernel Density
6. Line Density
7. Point Density
8. Polygon to Raster
9. Integer Raster
10. Reclassification
11. Weighted Overlay: Priority Investment Areas Indices
12. Weighted Overlay: Final Composite
13. Raster to Polygon
14. Intersect

VIDEO 1:

Prioritization Methodology/ Select by Attributes

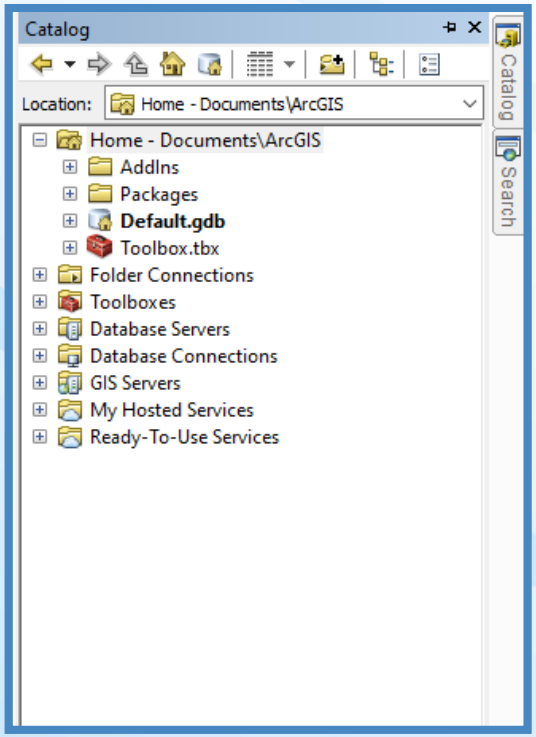
PRIORITIZATION: STEP 1

VIDEO 1

Create a File Geodatabase

- A file geodatabase must be created prior to proceeding with the prioritization process.

- Open ArcMap and click the Catalog window.
- Expand the file connections in the Catalog tree.
- Navigate to the folder where you want to create the file geodatabase. Right-click the folder, then click **New > File Geodatabase**.
- Once a file geodatabase has been created in the area you have selected, rename it by right-clicking on it and selecting **Rename**.



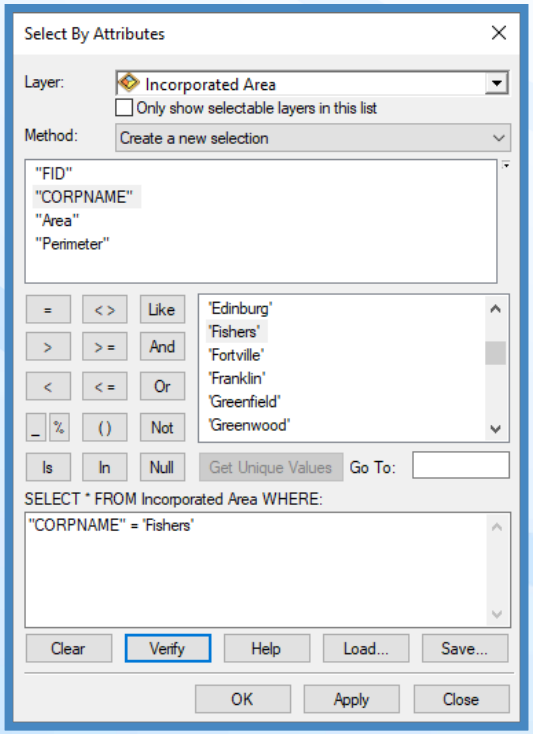
PRIORITIZATION: STEP 1

VIDEO 1

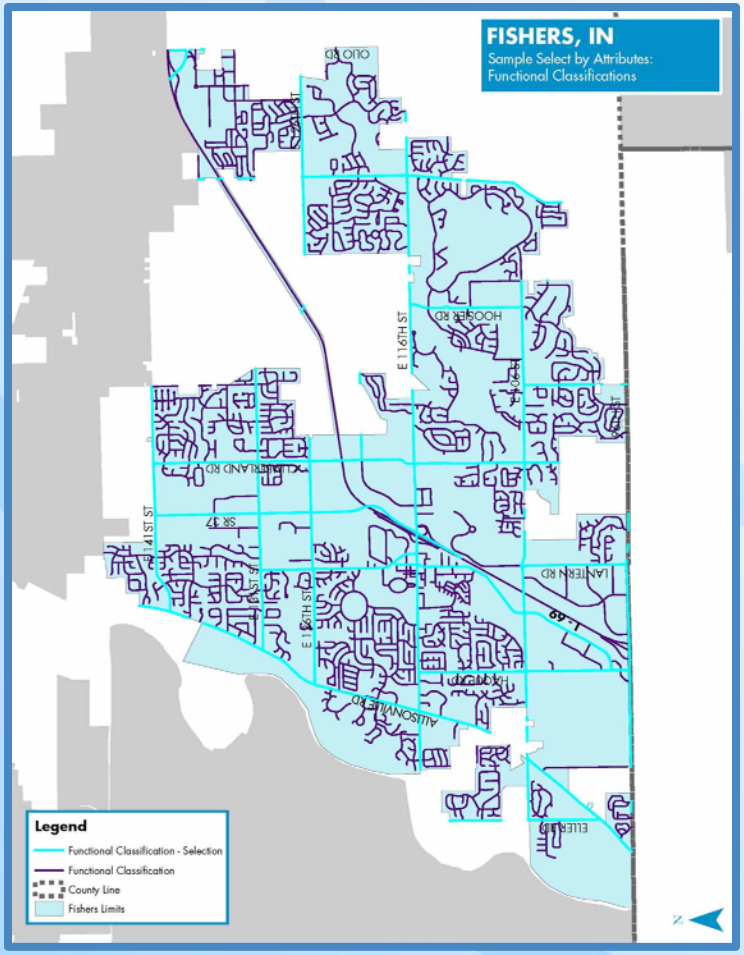
Select by Attributes: Community

- Separate your community from other incorporated areas in the MPA using the **Select by Attributes** tool.

- Click **Selection** > **Select by Attributes.**
  - In the Select by Attributes dialog box, choose the Incorporated Area layer.
  - Specify create a new selection as the selection **Method**.
  - Create a query using the expression building tools, selecting "CORPNAME" =
  - Click **Get Unique Values**. Select the name of your community from the list.
  - Click **Verify** to validate your query expression, then click **Okay**.
- Create a new layer for your community limits by right-clicking on the Incorporated Area layer in the Table of Contents. Click **Selection** > **Create Layer from Selected Features**.



Select by Attributes: Community

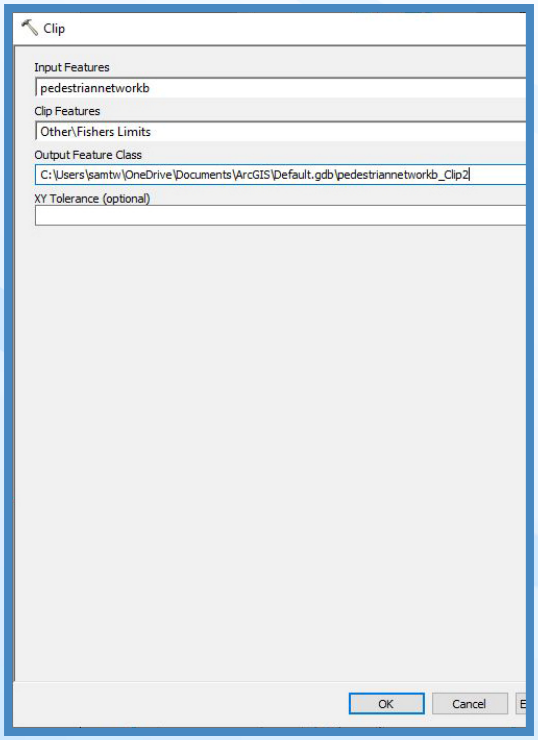


PRIORITIZATION: STEP 2

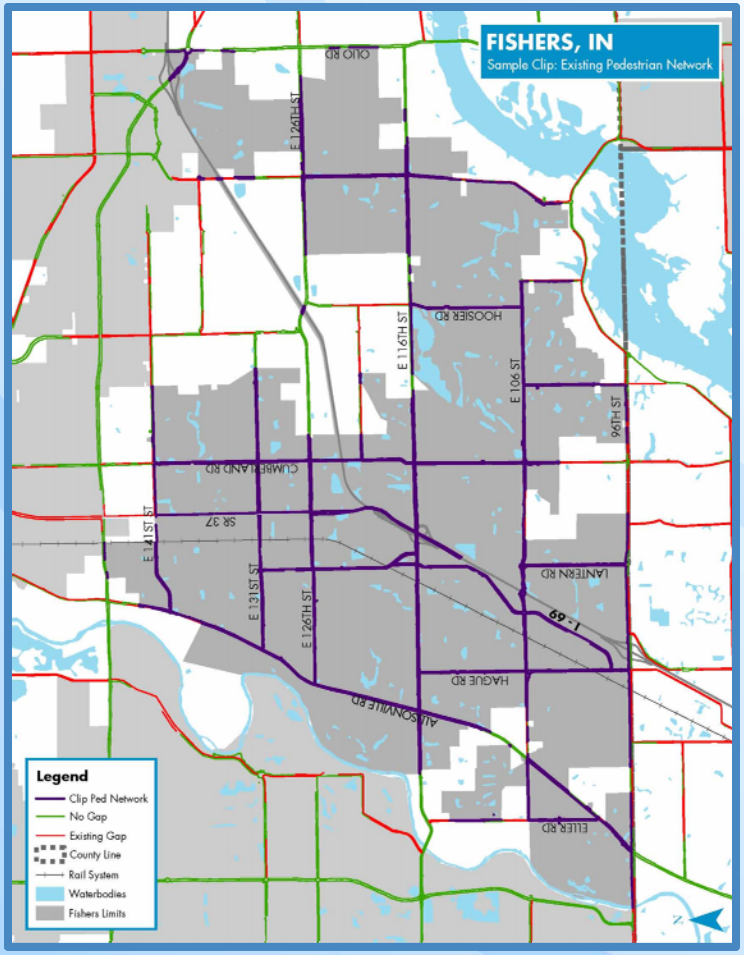
VIDEO 1
Clip

- **Clip** the Pedestrian Network, Gap Projects, Base Map and Index Measures layers to your community.

- Beginning with Wellness, expand the Measures Layer Group. Select the first layer in this group (No Gaps). Click **Geoprocessing** > **Clip**.
  - In the Clip dialog box, click the ***Input Features*** drop-down, and select the feature to be clipped.
  - Click the ***Clip Features*** drop-down, and select the feature used to clip the input features.
  - Set a name for the ***Output Feature Class***.
  - Click **Environments** > **Raster Analysis**. The environment settings are values that will be used by tools that honor the environment (our community). ***Cell Size*** stays as default, and ***Mask*** should use the community limits.
  - Click **Okay**.



Clip


FISHERS, IN
Sample Clip: Existing Pedestrian Network
OLIO RD
E 126TH ST
HOOSIER RD
E 116TH ST
E 106 ST
96TH ST
CUMBERLAND RD
SR 37
E 141 ST ST
E 131 ST ST
E 126TH ST
LANTERN RD
I- 69
HAGUE RD
ALLISONVILLE RD
ELLER RD
Legend
Clip Ped Network
No Gap
Existing Gap
County Line
Rail System
Waterbodies
Fishers Limits

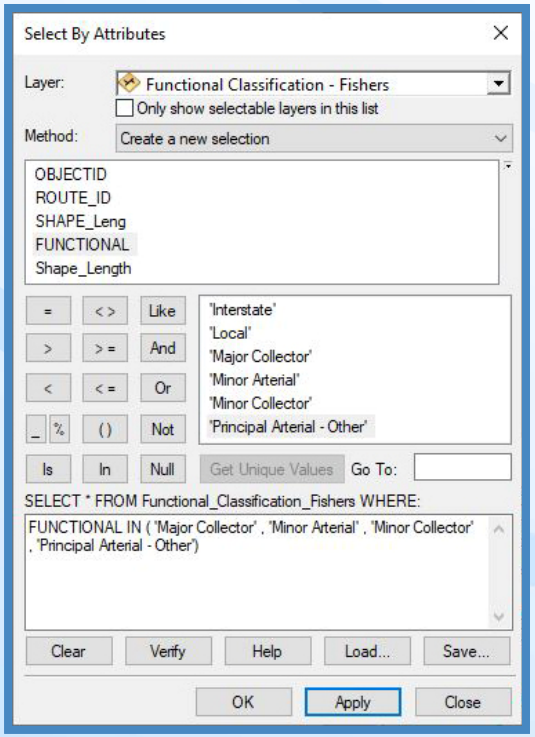
PRIORITIZATION: STEP 3

VIDEO 1

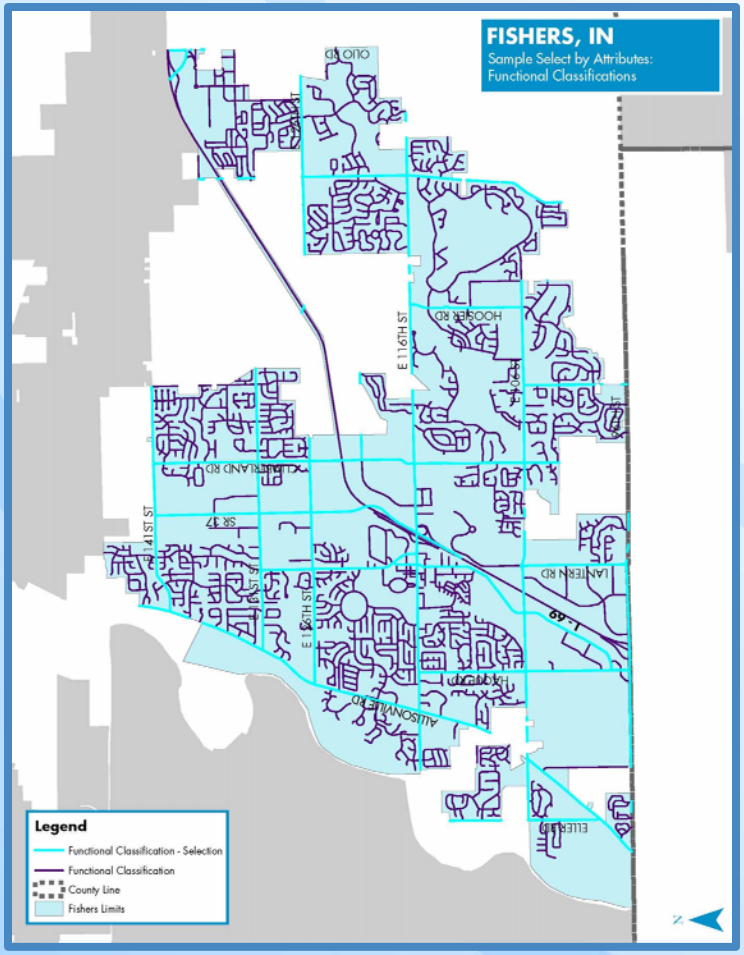
Select by Attributes: Functional Classifications

- Select only the road functional classifications you will be using in this analysis using the **Select by Attributes** tool.

- Click **Selection** > **Select by Attributes**.
  - In the Select by Attributes dialog box, choose the Incorporated Area layer.
  - Specify create a new selection as the selection **Method**.
  - Create a query using the expression building tools, selecting "FUNCTIONAL" =
  - Click **Get Unique Values**. Select major and minor arterial and collector roads from the list.
  - Click **Verify** to validate your query expression, then click **Okay**.
- Create a new layer for your community limits by right-clicking on the Incorporated Area layer in the Table of Contents. Click **Selection** > **Create Layer from Selected Features**.



Select by Attributes: Functional Classifications



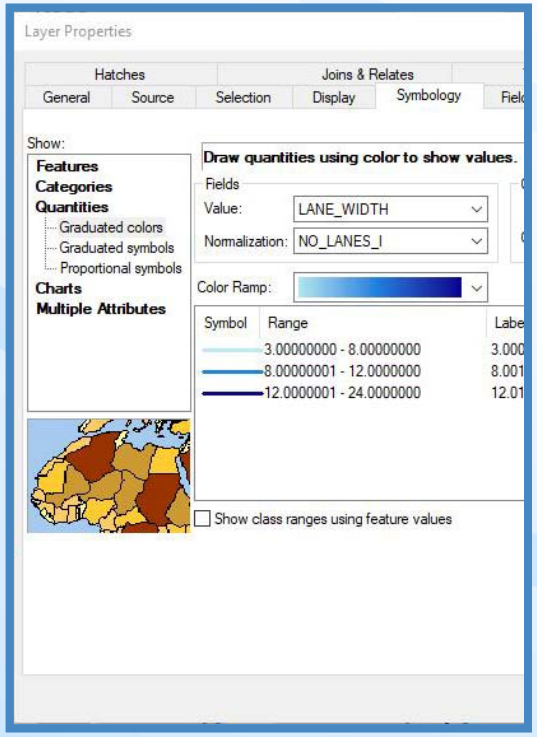
PRIORITIZATION: STEP 4

VIDEO 1

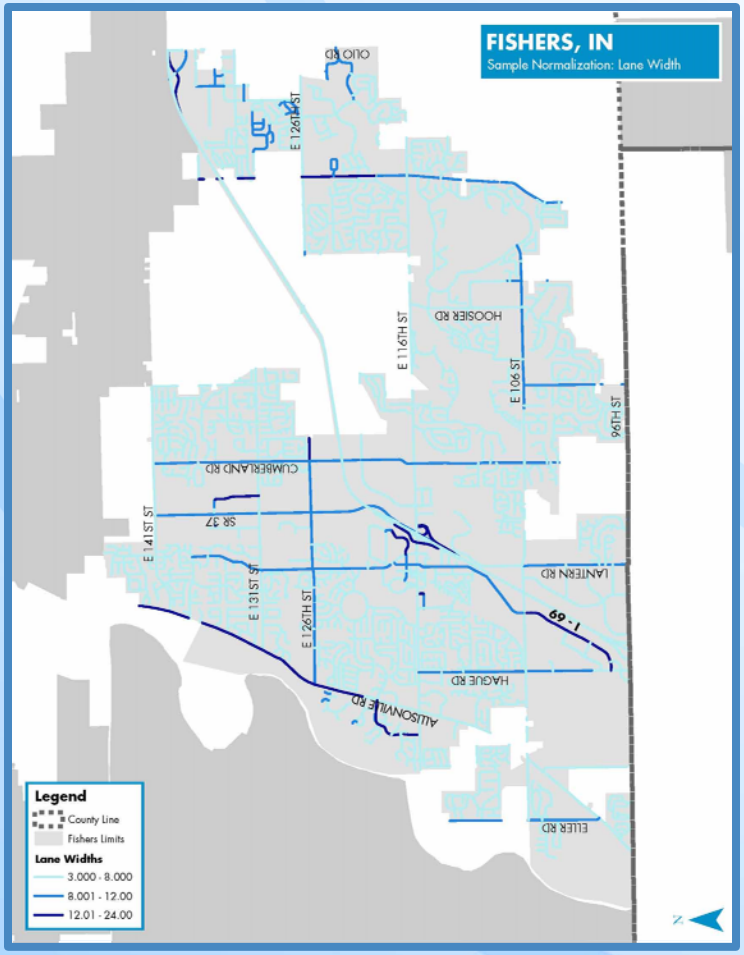
Normalization

- **Normalize** each of the clipped Index Measures layers by standardizing a field of measure (numerator) against a select value (denominator) to minimize differences, thereby transforming counts into ratios.

- Open the Layer Properties dialog box by right-clicking the layer in the table of contents and selecting **Properties**, or by double-clicking the layer name.
- Click **Symbology** > **Quantities** > **Graduated Colors** to display the quantitative values for a field in groups ordered into classes. All features within a class are drawn in the same color, and each class is assigned a graduated color from smallest to largest.
- In ***Fields***, select a measure to be used as the numerator from the ***Value*** drop down menu. Select a measure to be used as the denominator from the ***Normalization*** drop down menu.
- Classify numerical fields for graduated symbology under ***Classification***. Since this analysis uses a 3-tiered process, choose 3 classes, and click **Classify**. The Classification dialog box opens, where the ***Method*** should be selected as Natural Breaks.



Normalization



VIDEO 2:

Density Analysis and Rasterization

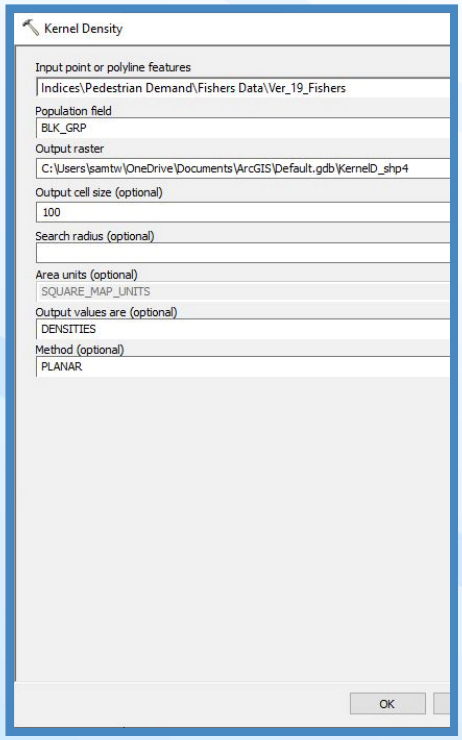
PRIORITIZATION: STEP 5

VIDEO 2

Density: Kernel Density

- Convert Index Measures layers into rasters using the **Kernel Density** function to fit a smoothly tapered surface to each point or polyline.

- For **Kernel Density**:
  - In the Kernel Density dialog box, click the ***Input Point or Polyline Features*** drop-down, and select the point or polyline feature for which to calculate density.
  - Set a name for the ***Output Raster***.
  - Set the ***Output Cell Size*** for the output raster dataset as 100.
  - Set the ***Search Radius*** within which to calculate density as 1,000.
  - Set the ***Area Units*** for output density values as Square_Map_Units.
  - Click **Environments** > **Raster Analysis**. ***Cell Size*** stays as default, and ***Mask*** should use the clipped functional classification.
  - Click **Okay**.



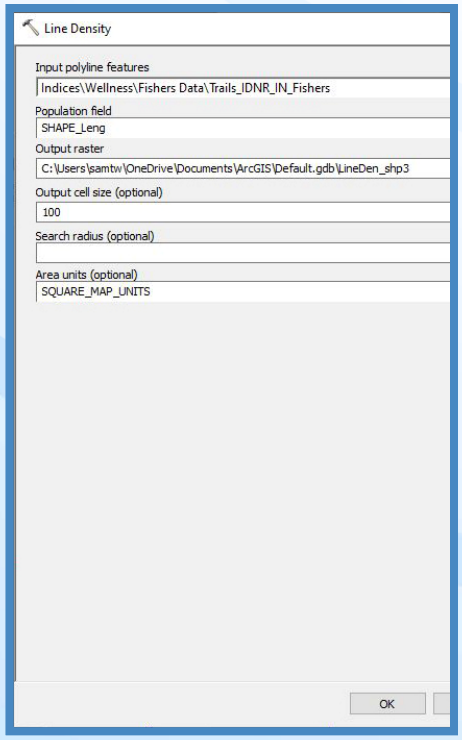
PRIORITIZATION: STEP 6

VIDEO 2

Density: Line Density

- Convert Index Measures layers into rasters from polyline features that fall within a defined radius around each cell using the **Line Density** function.

- For **Line Density:**
  - In the Line Density dialog box, click the ***Input Polyline Features*** drop-down, and select the polyline feature for which to calculate density.
  - Set a name for the ***Output Raster***.
  - Set the ***Output Cell Size*** for the output raster dataset as 100.
  - Set the ***Search Radius*** within which to calculate density as 1,000.
  - Set the ***Area Units*** for output density values as Square_Map_Units.
  - Click **Environments** > **Raster Analysis**. ***Cell Size*** stays as default, and ***Mask*** should use the clipped functional classification.
  - Click **Okay**.



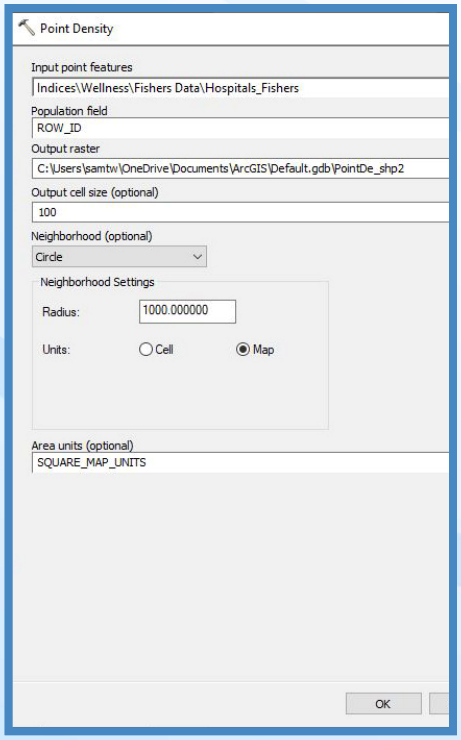
PRIORITIZATION: STEP 7

VIDEO 2

Density: Point Density

- Convert Index Measures layers into rasters from point features that fall within a neighborhood around each cell using the **Point Density** function.

- For **Point Density**:
  - In the Point Density dialog box, click the ***Input Point Features*** drop-down, and select the point feature for which to calculate density.
  - Set a name for the ***Output Raster***.
  - Set the ***Output Cell Size*** for the output raster dataset as 100.
  - Set the Neighborhood to dictate the shape of the area around each cell to calculate the density value. Set the ***Neighborhood Class*** as Circle, with a ***Radius*** of 1,000 and ***Map Units***.
  - Set the ***Area Units*** for output density values as Square_Map_Units.
  - Click **Environments** > **Raster Analysis**. ***Cell Size*** stays as default, and ***Mask*** should use the clipped functional classification.
  - Click **Okay**.



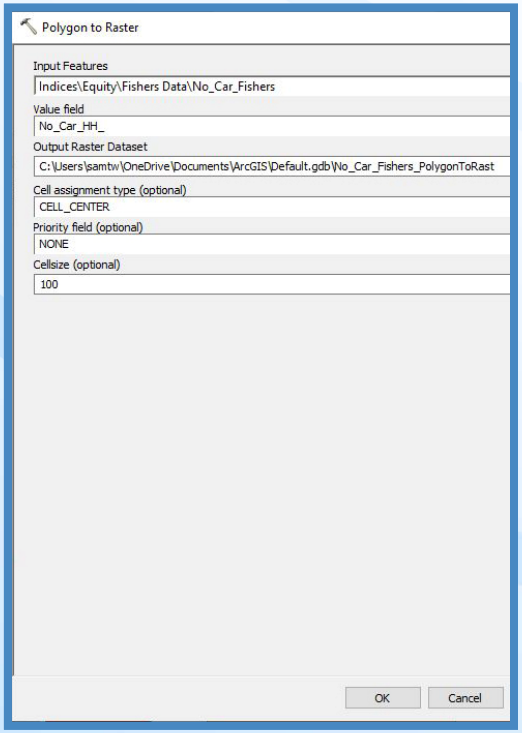
PRIORITIZATION: STEP 8

VIDEO 2

Density: Polygon to Raster

- Convert Index Measures layers into rasters using the **Polygon to Raster** function.

- Click **ArcToolbox > Conversion Tools > To Raster > Polygon to Raster.**
  - In the Polygon to Raster dialog box, click the ***Input Features*** drop-down and select the polygon input features dataset to be converted to a raster.
  - Set the ***Value Field*** to assign values to the output raster from the input feature's attribute table.
  - Set a name for the ***Output Raster***.
  - Set the ***Output Cell Size*** for the output raster dataset as 100.
  - Click **Environments > Raster Analysis**. ***Cell Size*** stays as default, and ***Mask*** should use the clipped functional classification.
  - Click **Okay**.



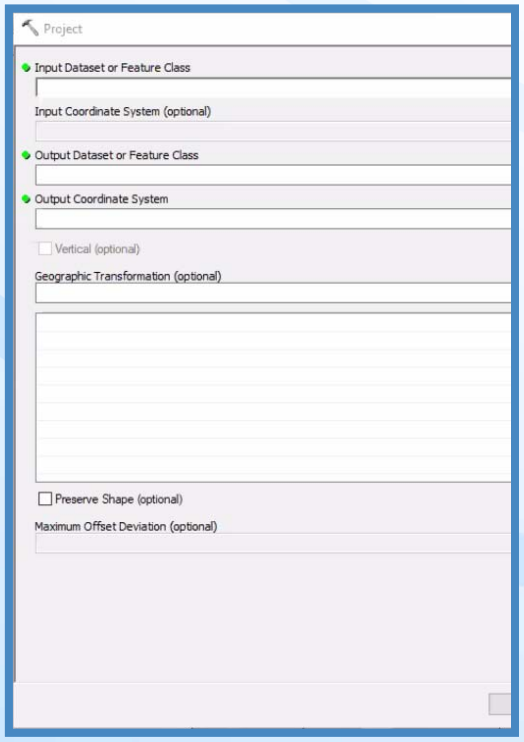
TROUBLEHSOOTING

VIDEO 2

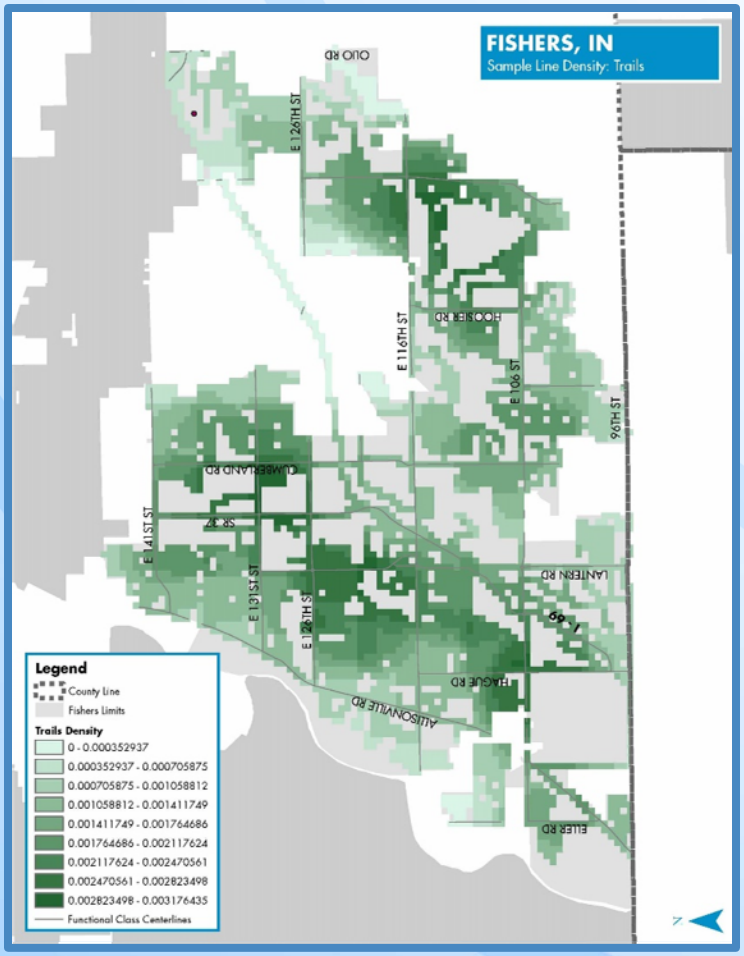
Troubleshooting: Project

- If the density tool does not generate an output in ArcMap, ensure that the projection of the data is in a projected coordinate system (PCS), not a geographic coordinate system (GCS).

- Open the Layer Properties dialog box by right-clicking the layer in the table of contents and selecting **Properties**, or by double-clicking the layer name.
- Click **Source>Geographic Coordinate System**. If the coordinate system is GCS, continue with projection conversion.
- Click **ArcToolbox>Data Management Tools>Projections and Transformations>Project.**
  - For ***Input Dataset***, select the feature class to be projected from one coordinate system to another.
  - Set a name for the ***Output Dataset***.
  - For ***Output Coordinate System***, select Projected Coordinate System>UTM>NAD 1983 UTM Zone 16N.
  - Click **Okay**. The new layer is now ready for raster conversion.



Density Analysis or Polygon to Raster



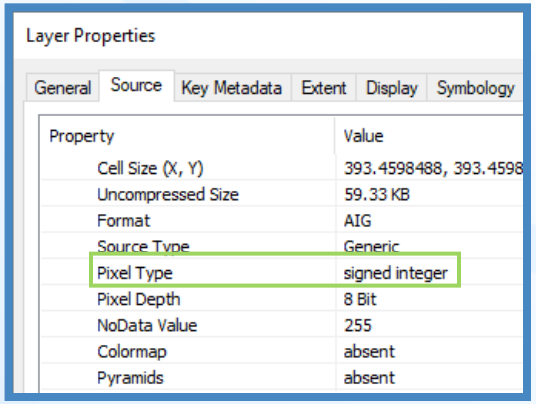
PRIORITIZATION: STEP 9

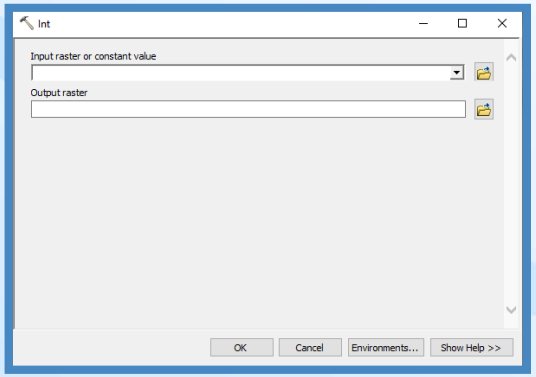
VIDEO 2

Integer Raster

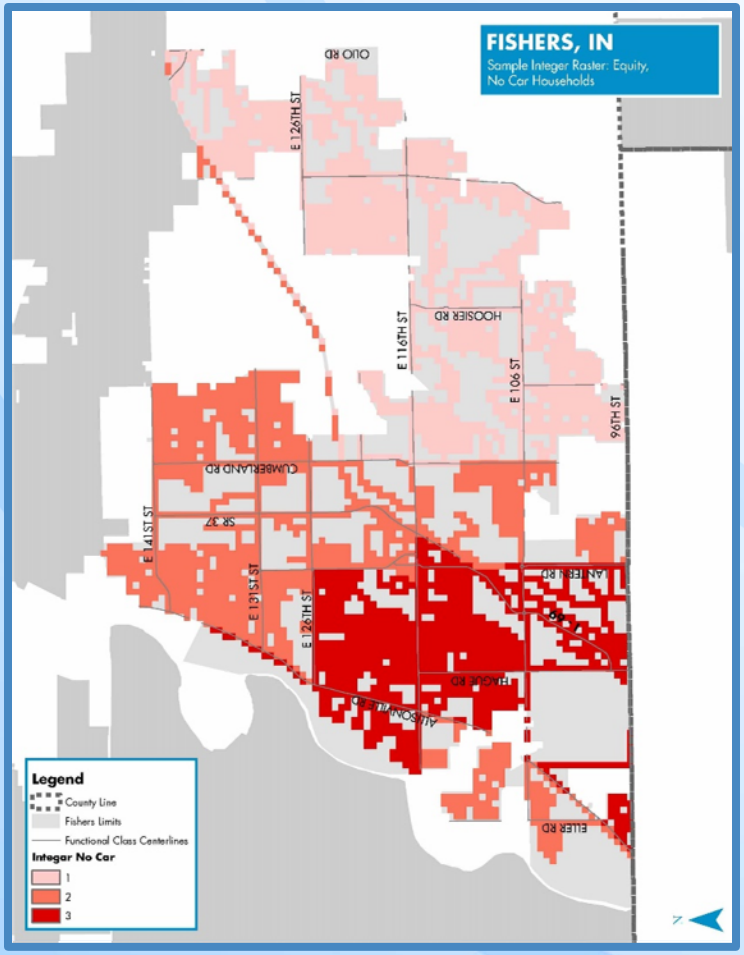
- Convert all rasters to signed integer format. Open the *Layer Properties* dialog box of each rasterized layer by right-clicking the layer in the table of contents and selecting **Properties**, or by double-clicking the layer name. Click **Source** > **Data Source** > **Pixel Type**. If the pixel type is signed integer, proceed to Reclassification.

- Click **ArcToolbox** > **Spatial Analyst Tools** > **Math** > **Trigonometric** > **Int**.
  - For *Input Raster*, select the raster to convert from a floating type raster to an integer type raster.
  - Set a name for the *Output Raster*.
  - Click **Environments** > **Raster Analysis**. *Cell Size* stays as default, and *Mask* should use the clipped functional classification.
  - Click **Okay**.





Integer Raster



VIDEO 3:

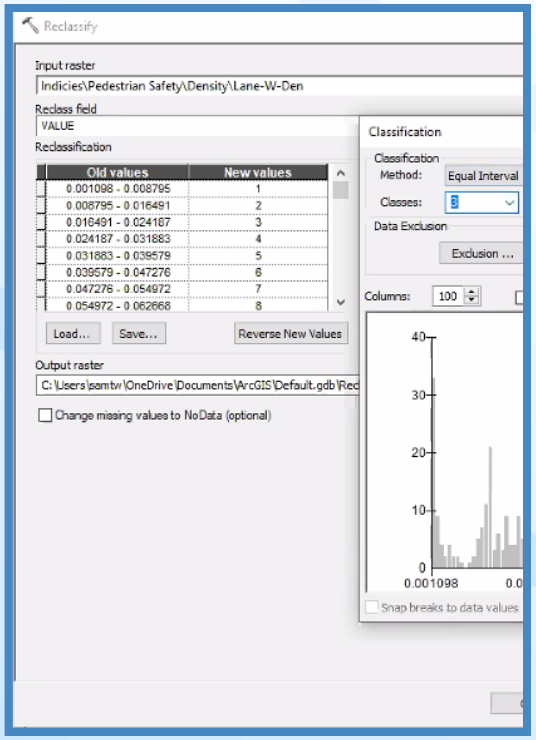
Reclassification and Weighted Overlay

PRIORITIZATION: STEP 10

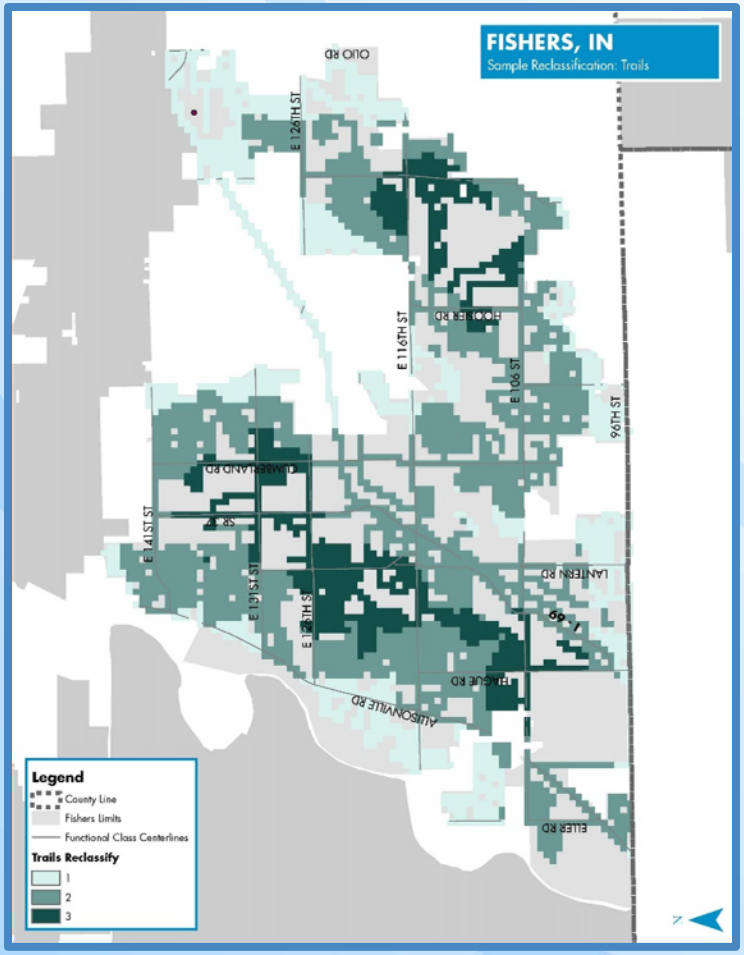
VIDEO 3
Reclassification

- Once each of the rasterized Index Measures layers is in signed integer raster format, they must be **Reclassified** into a common scale.

- Click **ArcToolbox > Spatial Analyst Tools > Reclass > Reclassify.**
  - For ***Input Raster***, select the raster to reclassify.
  - For ***Reclass Field***, select the field denoting the values that will be reclassified. In most cases, this field will be Value.
  - Click **Classify**.
  - For ***Classification Method***, select Equal Interval.
  - For ***Classes***, select 3 for the 3 tiers of prioritization we are determining in this analysis.
  - Click **Environments > Raster Analysis**. ***Cell Size*** stays as default, and ***Mask*** should use the clipped functional classification.
  - Click **Okay**.



Reclassification



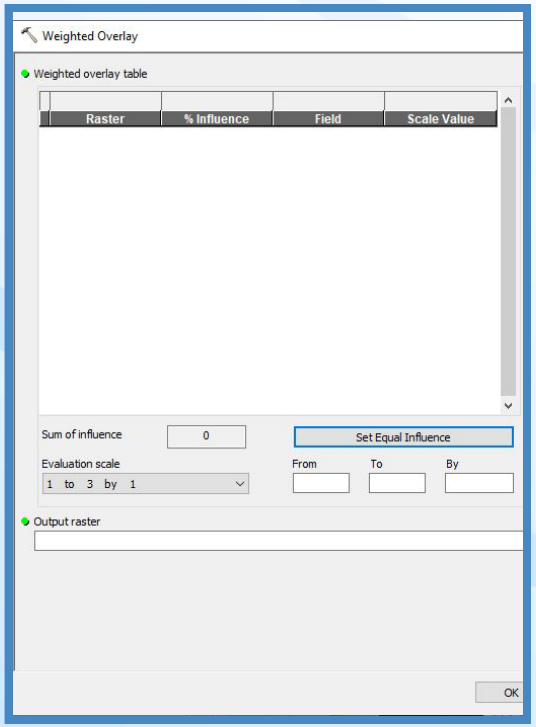
PRIORITIZATION: STEP 11

VIDEO 3

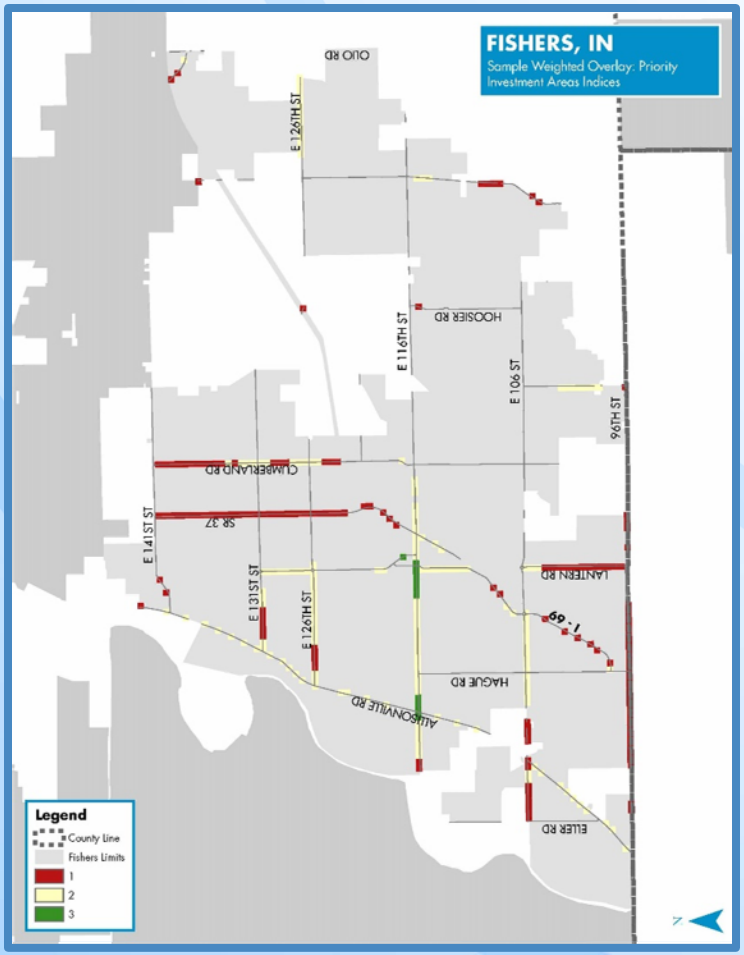
Weighted Overlay: Indices

- In order to create heat maps for each of the five indices, the **Weighted Overlay** tool must be used to establish "hot spot" priority areas.

- Click **Arc Toolbox** > **Spatial Analyst Tools** > **Overlay** > **Weighted Overlay.**
  - In the Weighted Overlay dialog box, click + to select the reclassified Index Measures rasters for each measure within a single index to specify the input criteria rasters to be weighted.
  - Click **Set Equal Influence** to balance the percent influence of the input rasters equally and sum them to 100.
  - Set the *Evaluation Scale* to 1 to 3 by 1.
  - If the *Scale Values* in the *Weighted Overlay Table* aren't automatically updated, manually change them from 1 to 3.
  - Set a name for the *Output Raster*.
  - Click **Okay**.



Weighted Overlay: Indices



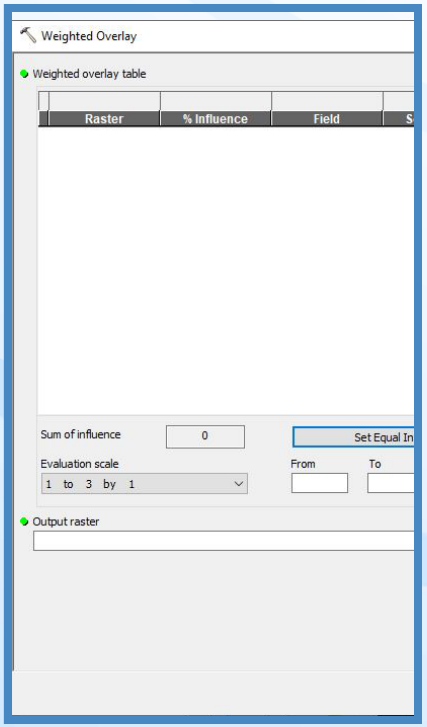
PRIORITIZATION: STEP 12

VIDEO 3

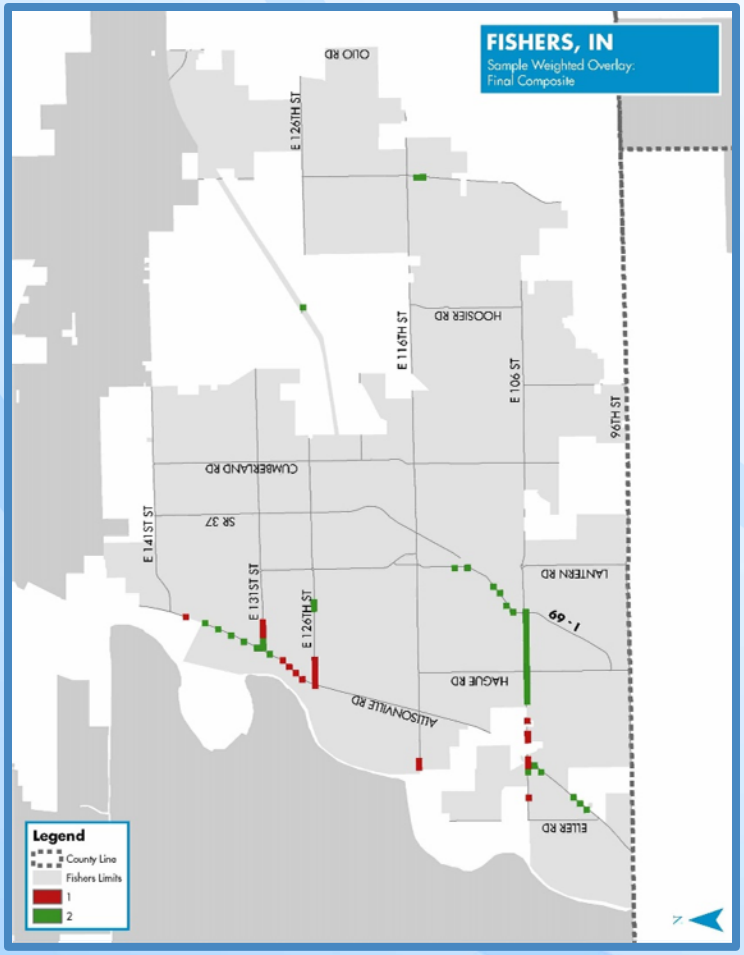
Weighted Overlay: Final Composite

- Create the Final Composite raster for your community using the **Weighted Overlay** tool. At this time, you will need to establish a ranking strategy for the five indices, or use the final composite ranking strategy.

- Click Arc Toolbox > Spatial Analyst Tools > Overlay > Weighted Overlay.
  - In the Weighted Overlay dialog box, click + to select the reclassified Index Measures rasters for each measure within a single index to specify the input criteria rasters to be weighted.
  - Set ***% Influence*** for each of the five index heat maps. For example, 20% Pedestrian Safety, 20% Equity, 20% Wellness, 20% Pedestrian Demand and 20% Walking Comfort. The sum of influences must equal 100.
  - Set the ***Evaluation Scale*** to 1 to 3 by 1.
  - If the ***Scale Values*** in the ***Weighted Overlay Table*** aren't automatically updated, manually change them from 1 to 3.
  - Set a name for the ***Output Raster***.
  - Click **Okay**.



Weighted Overlay: Final Composite



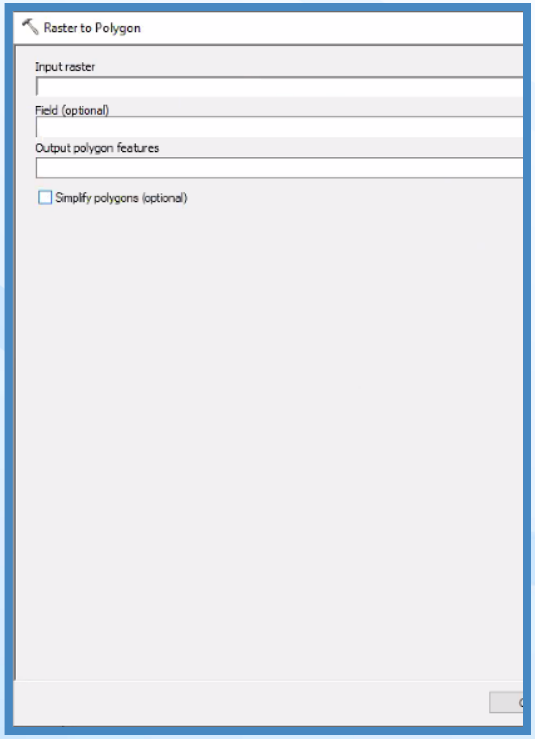
PRIORITIZATION: STEP 13

VIDEO 3

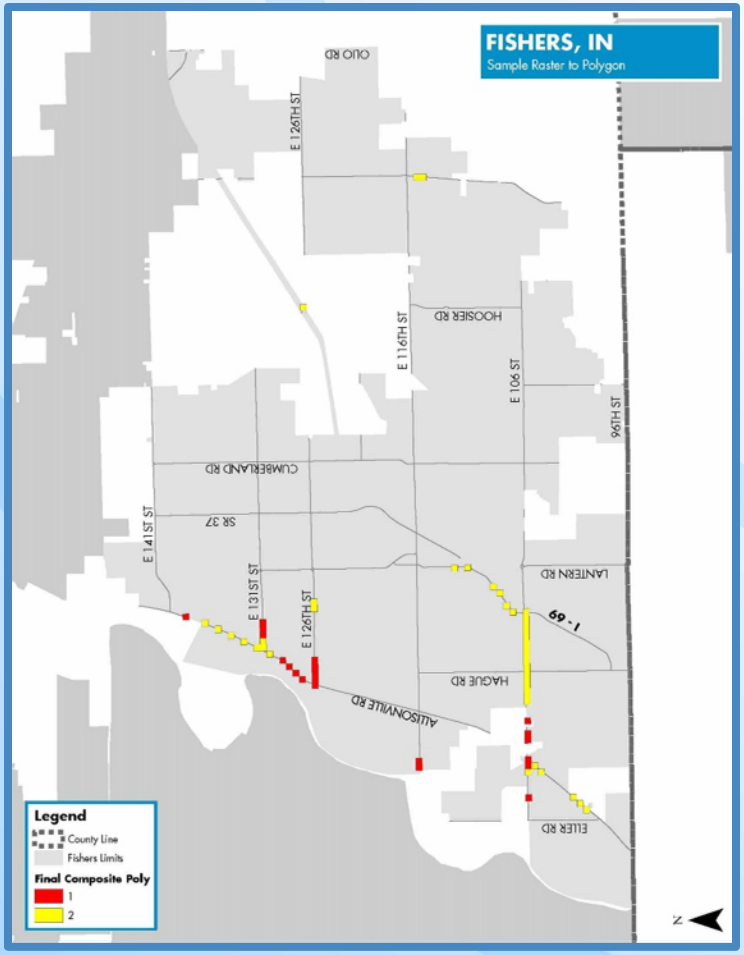
Raster to Polygon

- Convert the Final Composite raster from **Raster to Polygon** in order to cross-reference and categorize the existing pedestrian network and determine where gaps fall in the tier system.

- Click **ArcToolbox > Conversion Tools > From Raster > Raster to Polygon** in order to convert the raster dataset into polygon features.
  - Select the Final Composite raster as the *Input Raster.*
  - Set the *Field* as Value to assign values from cells in the input raster to the polygons in the output dataset.
  - Set a name for the *Output Polygon Features*.
  - Uncheck *Simplify Polygons.*
  - Click **Environments > Raster Analysis**. *Cell Size* stays as default, and *Mask* should use the clipped functional classification.
  - Click **Okay**.



Raster to Polygon



PRIORITIZATION: STEP 14

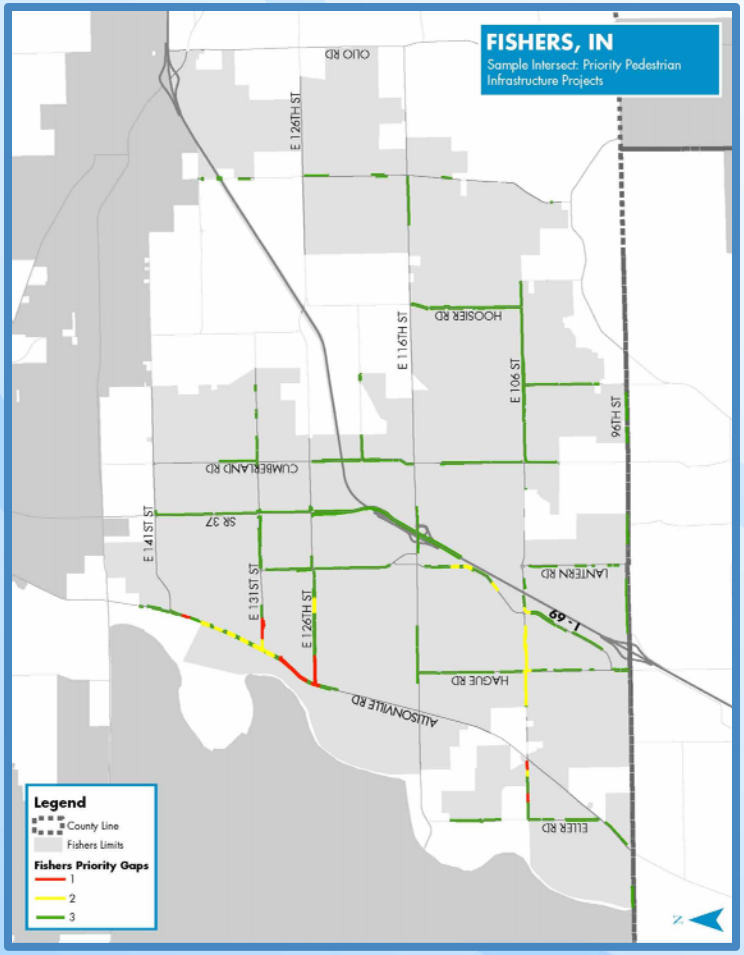
VIDEO 3

Intersect

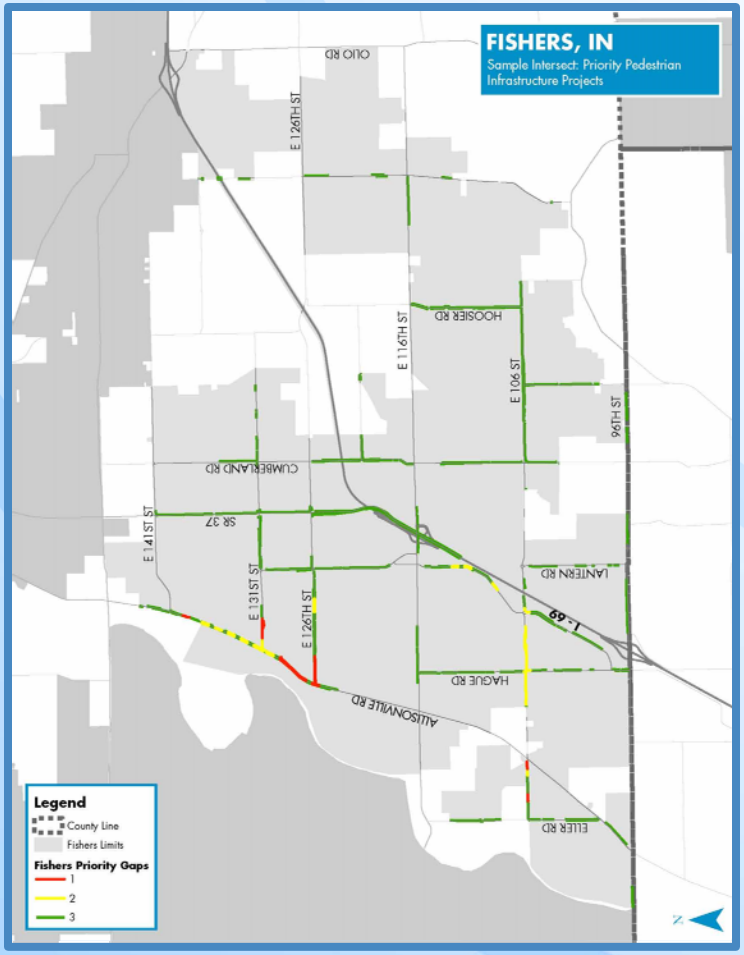
- **Intersect** the Final Composite polygon layer with the clipped Gap Projects layer to determine pedestrian infrastructure prioritization for your community.

- Click **Geoprocessing** > **Intersect**.
  - Select the final composite layer and the clipped Gap Projects layer as ***Input Features.***
  - Set a name for the ***Output Feature Class***.
  - Set ***JointAttributes*** as All.
  - Set the ***Output Type*** as Line.
  - Click **Environments** > **Raster Analysis**. ***Cell Size*** stays as default, and ***Mask*** should use the clipped community limits, NOT the clipped functional classification. This is very important to change, or the command will not process.
  - Click **Okay**. Open the Layer Properties dialog box by right-clicking the layer in the table of contents and selecting **Properties**, or by double-clicking the layer name.
  - Click **Symbology** > **Categories** > **Unique Values.**
  - Change the ***Value Field*** to GRIDCODE. Click **Add All Values.**

Sample Intersect



Priority Pedestrian Infrastructure Projects



For more information on the plan:

https://www.indympo.org/whats-completed/regional-plans/bike-pedestrian-plans

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Regional PEDESTRIAN PLAN

INDIANAPOLIS MPO

MPO

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landscape architecture | community planning | urban design | visioning | strategic planning

GIS PRIORITIZATION METHODOLOGY TRAINING EXERCISE