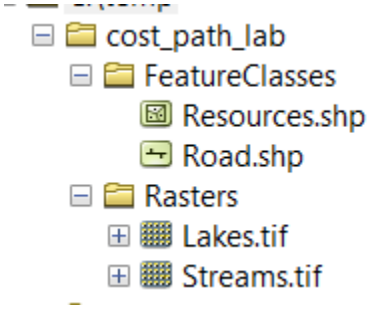
Lab#10: Optimal Path Across a Cost Surface

Download and unzip the file ***cost_path_lab_.zip*** from the website

http://dverbyla.net/nrm435/data/

The unzipped folder contains .tif rasters representing lakes and streams, and three polygons representing resources and a line theme representing an existing road.



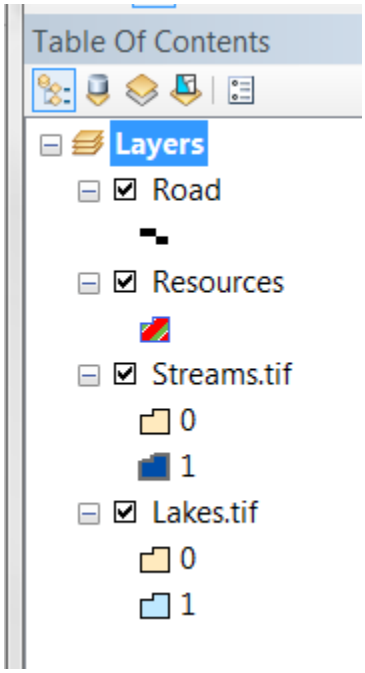
You job is to derive three potential new routes to the three resource polygons that will minimize travel cost.

What is the optimal path to travel from the existing road to each resource site, assuming the following costs:

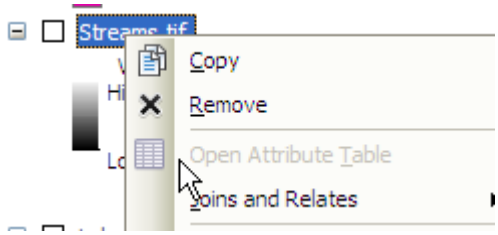
$ 1 per meter on land

$11 per meter to cross a stream

Lakes are barriers that cannot be crossed

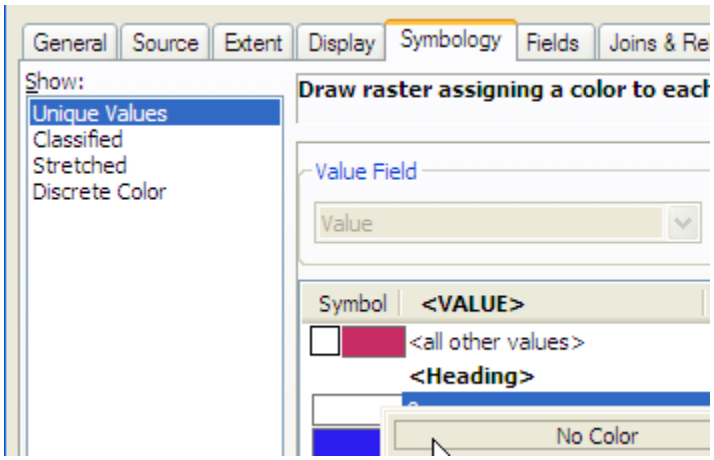


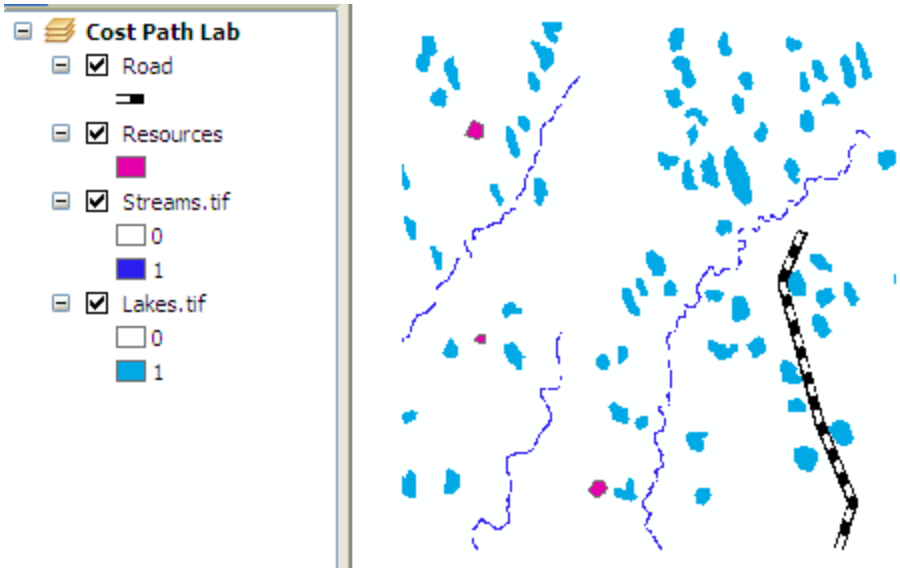
Although the tif rasters are integers, the raster attribute table may not have been built for them.



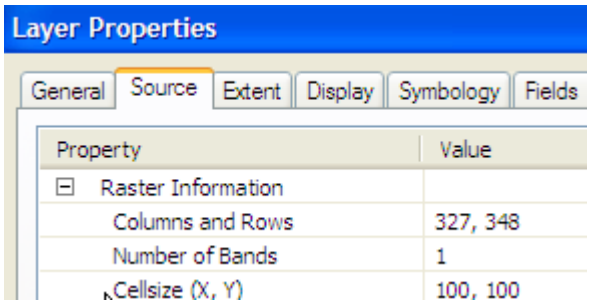
Run the ***Build Raster Attribute Table*** geoprocessing tool to build the raster attribute table for each raster.

Then change the symbology so each unique pixel value gets a different color, and pixels with zero get no color.





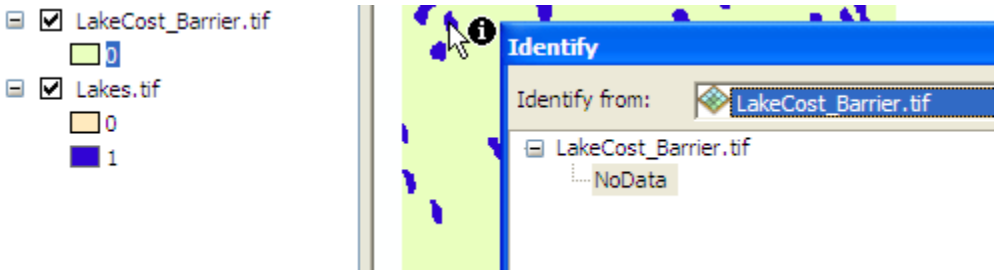
The rasters have 100m by 100m pixels:


Layer Properties
General
Source
Extent
Display
Symbology
Fields
Property
Value
Raster Information
Columns and Rows
327, 348
Number of Bands
1
Cellsize (X, Y)
100, 100

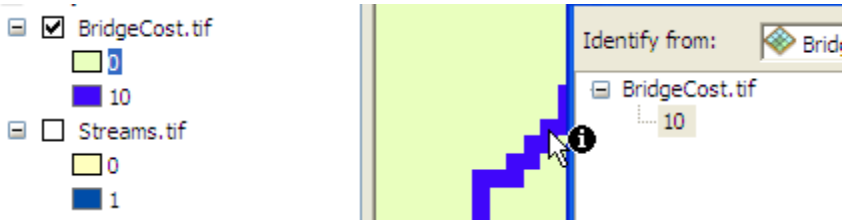
Step 1) Create a raster representing the travel costs to each pixel.

Lakes are ***barriers***, so a lake pixel cost is ***NoData***, while no-lake would have a lake cost of $0.

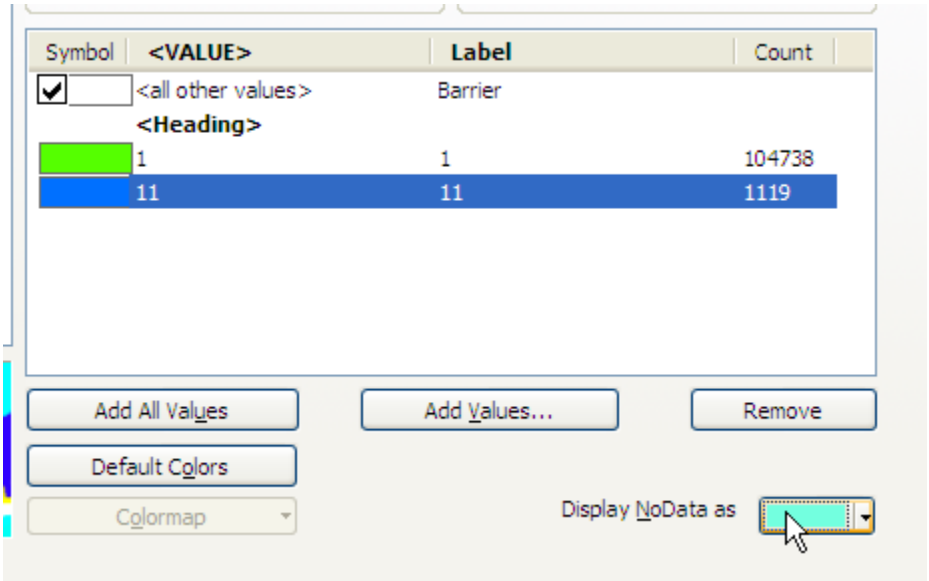
Use either the ***Con*** or ***Reclassify*** or ***Set Null*** tool to create this raster.

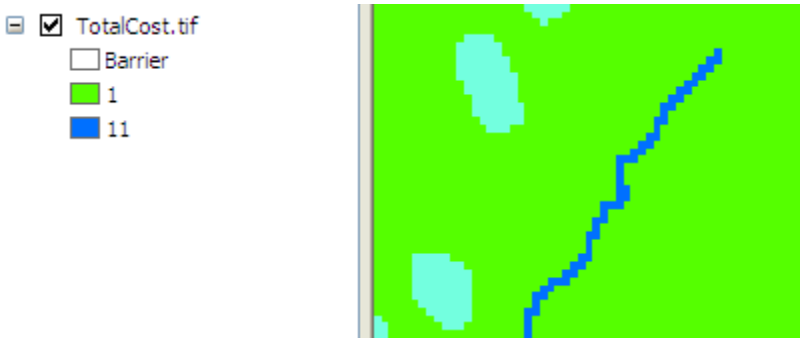


Repeat the process for bridge cost. The bridge cost for a stream pixel is $10, a non-stream pixel is $0.



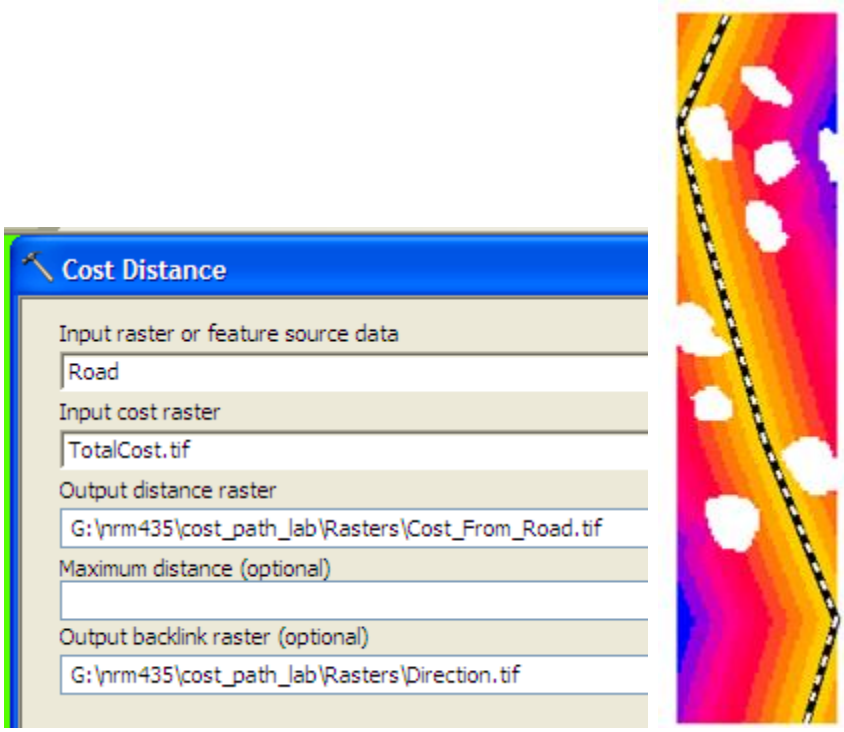
Without the lakes and streams constraints, it will cost you $1 per meter new road on land. So create a raster total cost for each cell by using the ***Raster Calculator.***



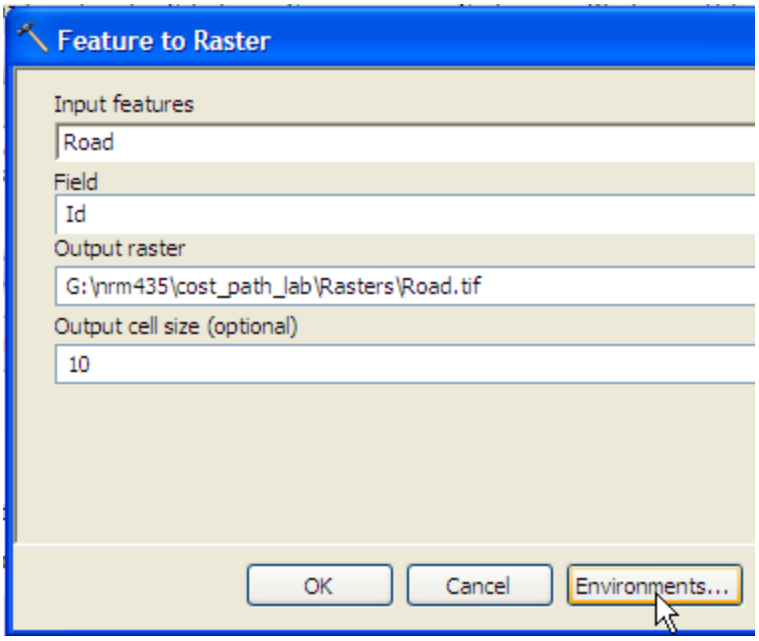


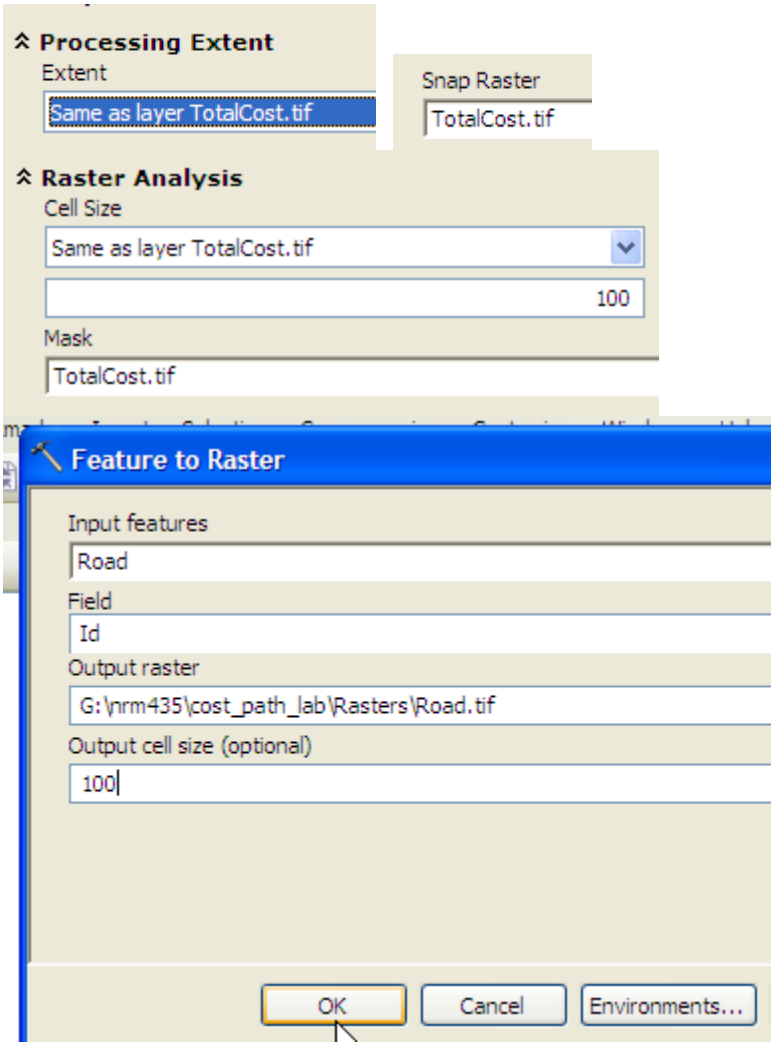
Step 2) Create a raster of minimum travel cost to each resource.

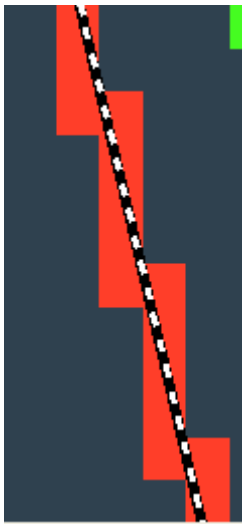
The ***Cost Distance*** tool will determine the minimum total cost from the road, given an input of cost for each pixel.

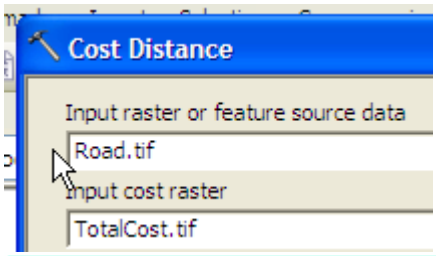


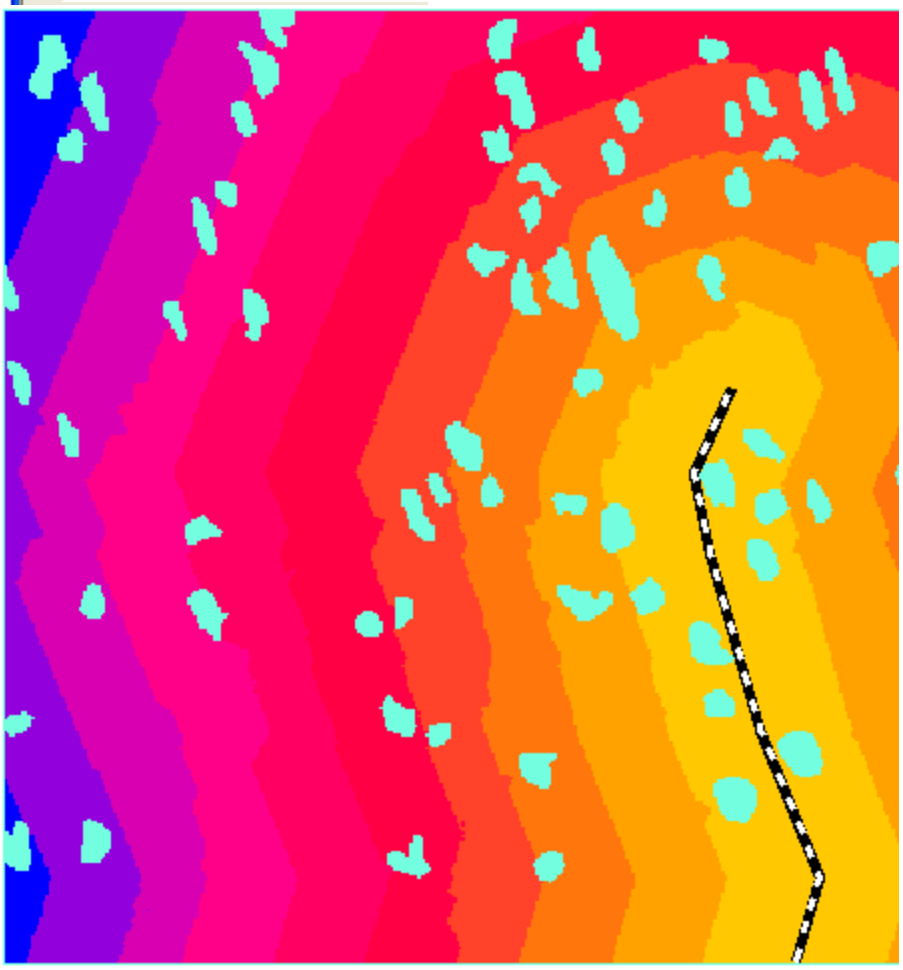
This would result in a raster with the extent of the road…we want the distance raster for the entire area…so convert your road to a raster matching the cost surface raster in extent and cellsize.


Feature to Raster
Input features
Road
Field
Id
Output raster
G:\nrm435\cost_path_lab\Rasters\Road.tif
Output cell size (optional)
10
OK
Cancel
Environments...

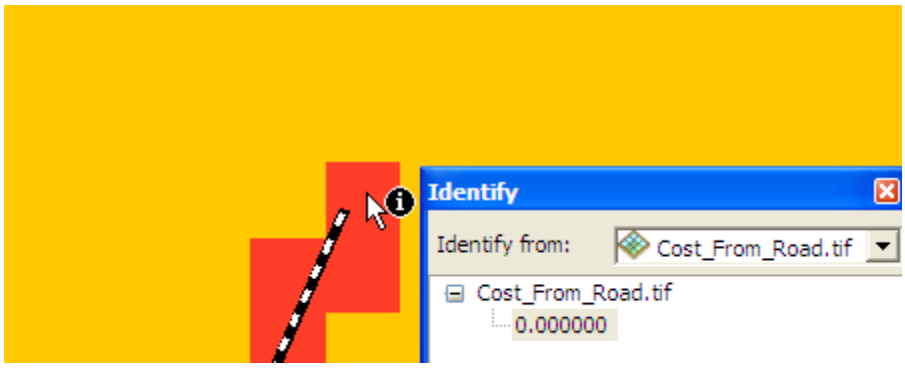

Processing Extent
Extent
Same as layer TotalCost.tif
Snap Raster
TotalCost.tif
Raster Analysis
Cell Size
Same as layer TotalCost.tif
100
Mask
TotalCost.tif
Feature to Raster
Input features
Road
Field
Id
Output raster
G:\nrm435\cost_path_lab\Rasters\Road.tif
Output cell size (optional)
100
OK
Cancel
Environments...

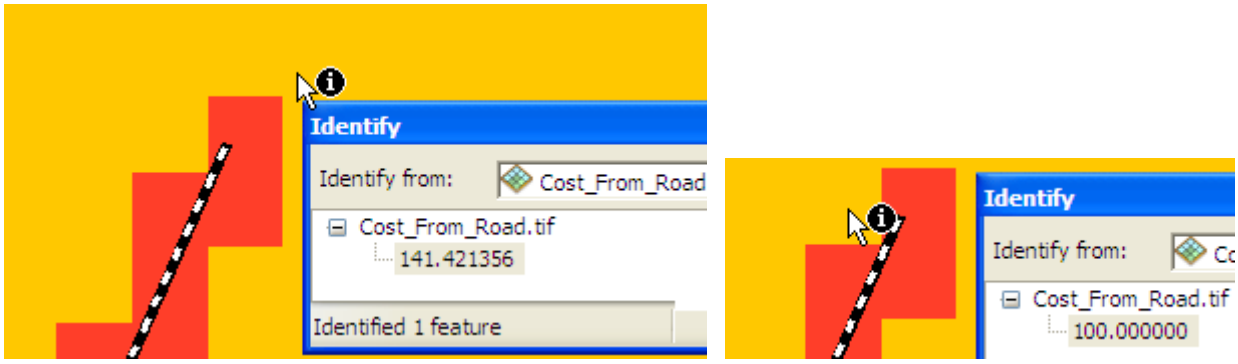




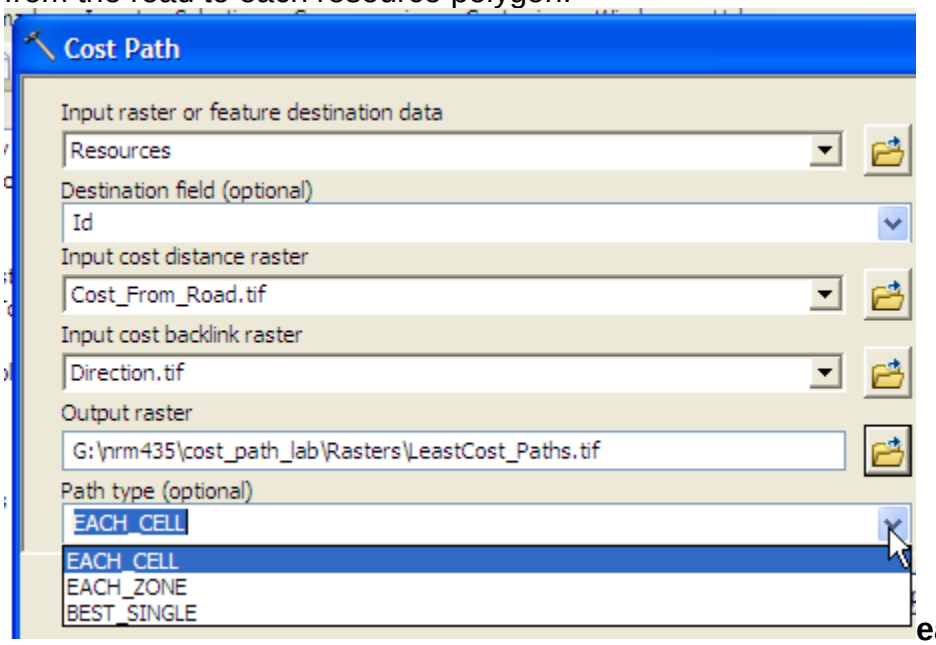


Use the identify tool to see if the output is reasonable….notice that the tool multiplies the cost per meter times the distance across each cell, including the diagonal distance if that is the minimum travel cost.



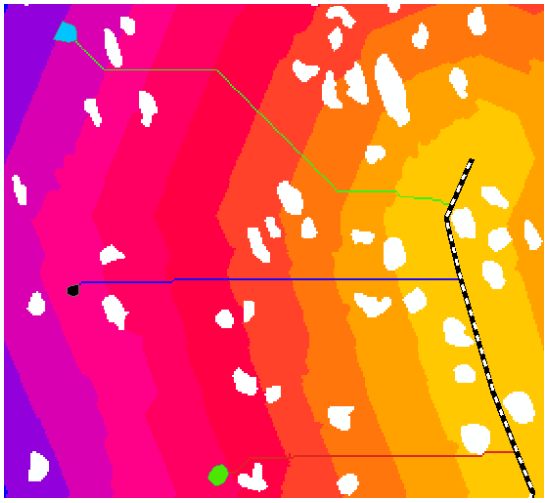


Step 4) Determine the least-cost path from the road to each resource.
Now that you have raster themes representing the minimum cost and direction from every pixel to the road, you can use the ***Cost Path*** tool to determine the least-cost path from the road to each resource polygon.



each zone for each resource polygon

Each zone will generate an optimal path for each resource (154,155,156)

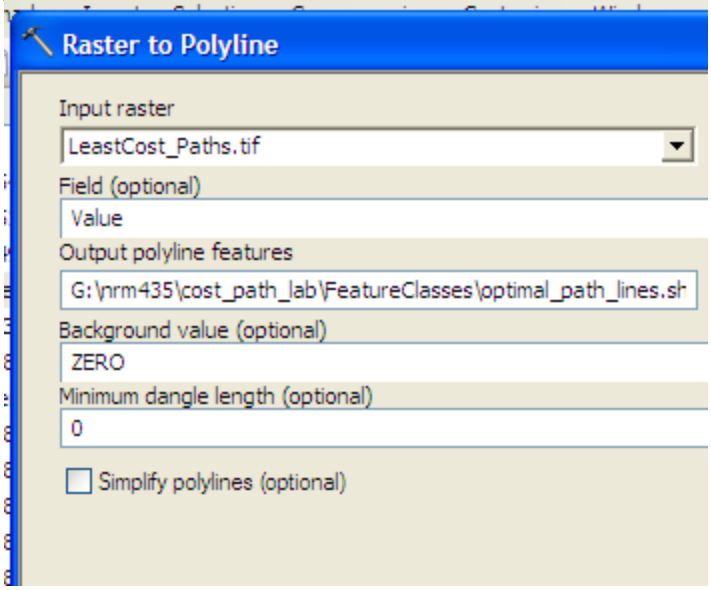


The raster attribute table also contains the total travel cost for each of the three paths:

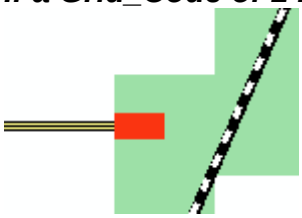
CostPaths

Value	Count	PATHCOST	STARTROW	STARTCOL
1	3	$0.00	0	0
3	203	$21,672.79	206	54
4	199	$25,793.59	74	52
5	146	$16,925.47	306	134

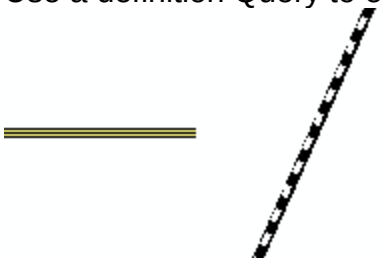
Step 5) Convert your raster paths to a line shapefile and compute the length of each path in meters. Use the ***Raster to Polyline*** tool…



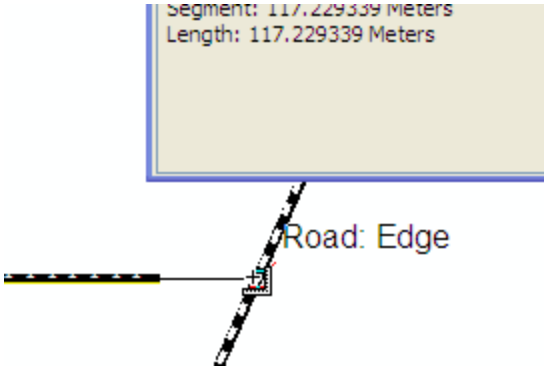
If a Grid_Code of 1 is the pixel touching the existing road.



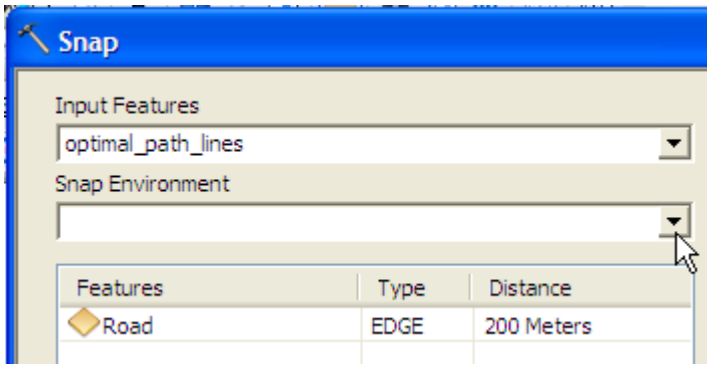
Use a definition Query to eliminate the lines with grid code of 1.



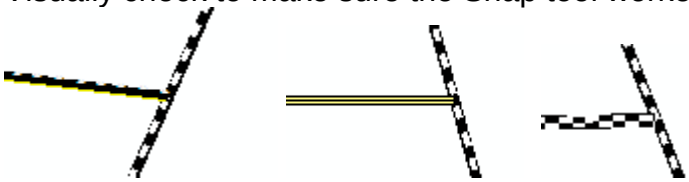
Use the measure tool to determine the distance from each line to the existing road.



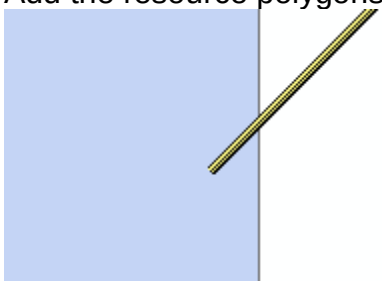
Then use the ***Snap*** tool to snap the lines to the existing road.



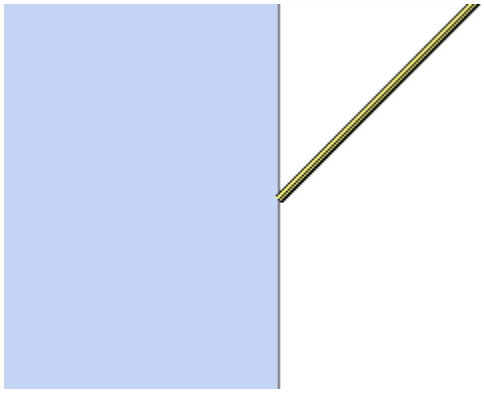
Visually check to make sure the Snap tool worked with your three lines.



Add the resource polygons to your data frame.



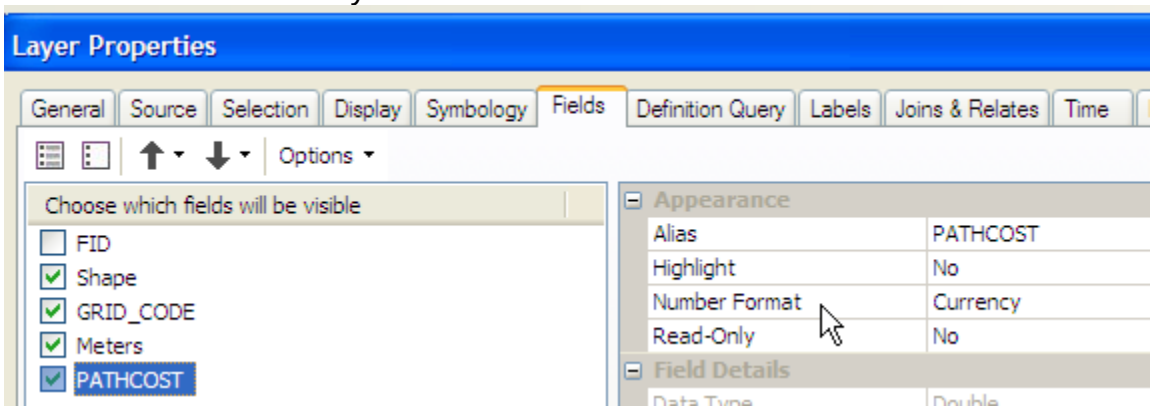
The lines are inside your resource polygons. So use the ***Erase*** tool to fix this.



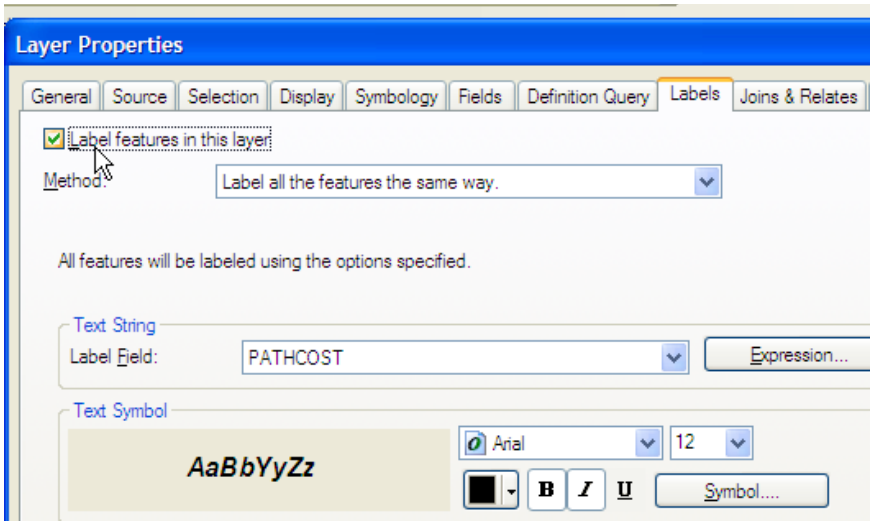
Compute the length of each least-cost path in meters.

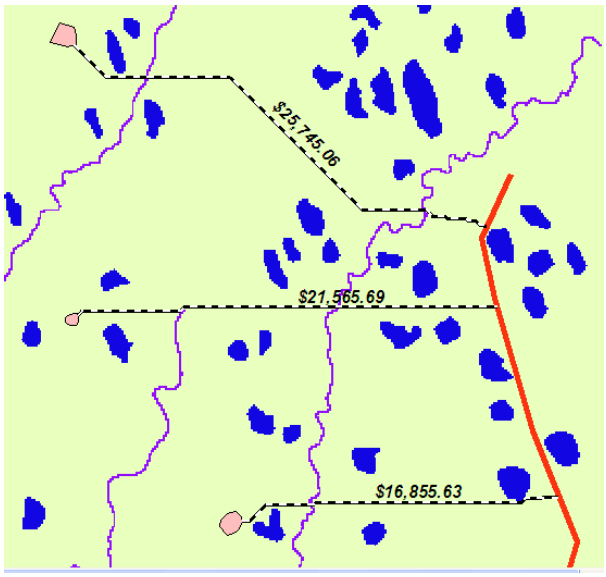
Use the ***Join Field tool*** to transfer the cost of each path from your raster to your lines.

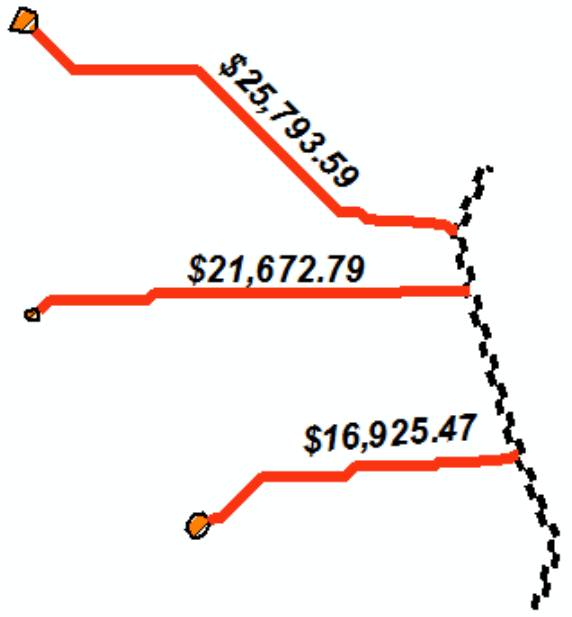
You can label each line using the pathcost field…first specify that for this field the display nuber format as Currency



Then specify the field and font for your labels.


Layer Properties
General
Source
Selection
Display
Symbology
Fields
Definition Query
Labels
Joins & Relates
Label features in this layer
Method:
Label all the features the same way.
All features will be labeled using the options specified.
Text String
Label Field:
PATHCOST
Expression...
Text Symbol
AaBbYyZz
Arial
12
B
I
U
Symbol....


$25,745.06
$21,565.69
$16,855.63


$25,793.59
$21,672.79
$16,925.47