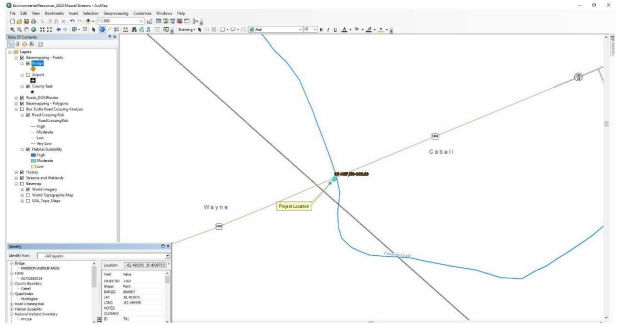
Automating NEPA Project Screening With Python

R. Carl DeMuth, PhD. RPA
Environmental Resources Specialist
NEPA and Permitting Section
Technical Support Division

Old Screening Process

- All files were locally stored on a thumb drive as part of an old ArcMap .mxd project.
- The process was entirely manual, with the screeners turning individual layers on and off to determine if they intersected with the project area.
- Screening maps and notes consisted of a word document with a screen capture, and notes on intersecting layer data.



12/2/2024

Madison Avenue Arch
S306-267-0.09 00
STBG-3267(002)DBC
Cabell County

No State Listed Species Found

Box Turtle High Road Crossing Risk and High Habitat Suitability

Huntington Quad

06A907

38.403975, -82.496956

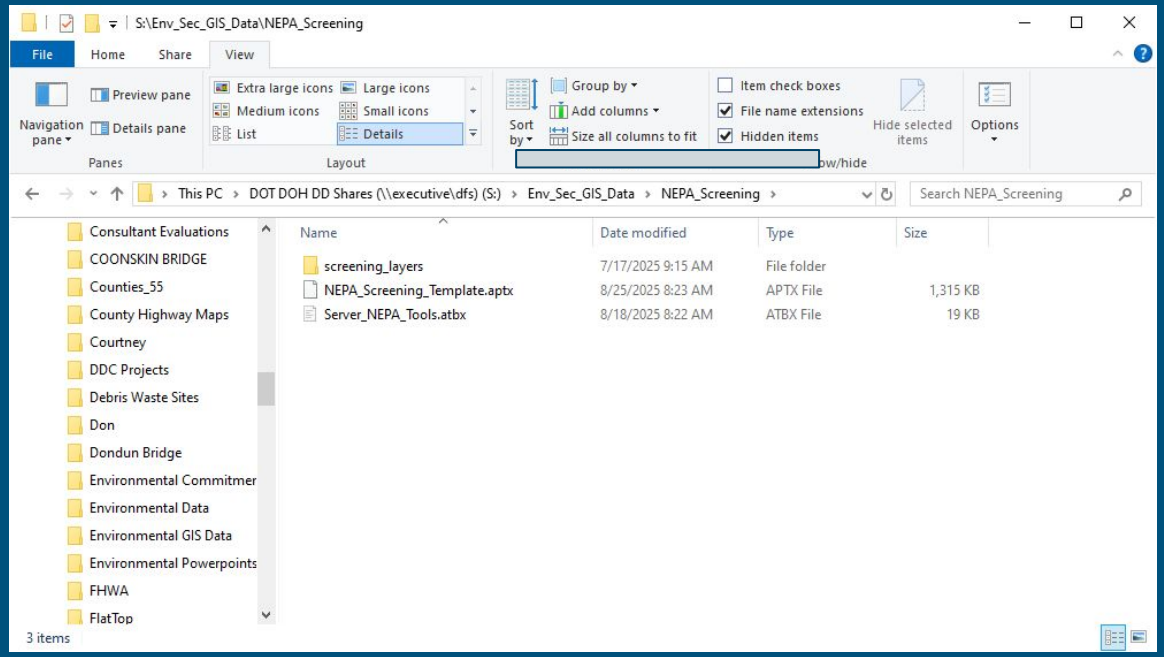
Goals of the screening tool

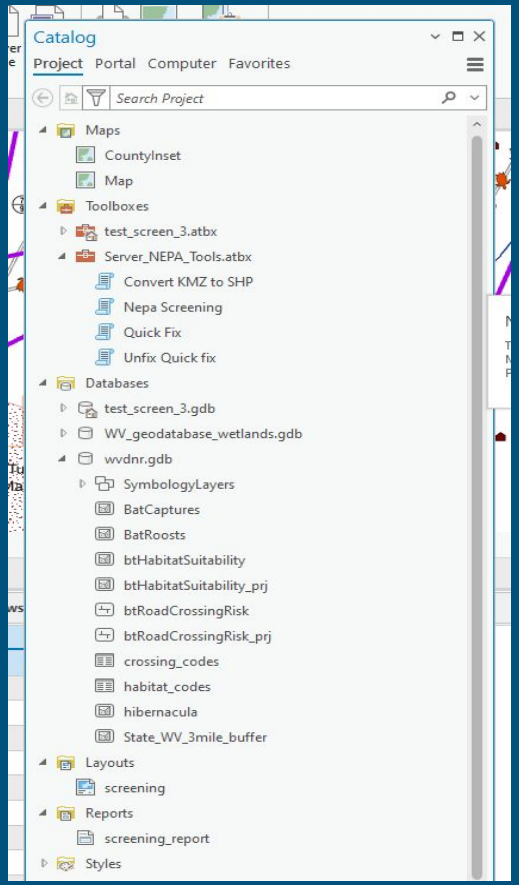
- Improve project screening time through scripted automation.
- Replace local GIS files with web layers from official sources (or mirrors) that should be updated with some regularity.
- Produce more traditional/professional map images for the CE reports.
- Reduce potential for human error.
    - Example: Lee Street Bridge Repair and the Kanawha River Trail Park

Requirements

- A “No Code” Solution
  - End users could not be expected to to use the python console.
  - This limited solutions to the default libraries included with ArcGIS Pro
- PDF Map and Textual Data output.
  - Requires both the use of map/layout and report making.
- There must be a way to interoperate with KMZ files.
  - These are deeply embedded in our current workflow.
    - Work with IPAC
    - Work with OpenRoads
    - Works with Google Earth (which is free).
    - Easy to share/upload (no zipping).
- Maintain data security for sensitive data layers.
  - Normally this would be an ideal candidate to deploy/develop for ArcGIS online.
  - BUT….Our MOA does not allow for that kind of data hosting. Fortunately, we were able to get permission to put it on a limited access folder on the S drive.

End Result





3 Prong solution consisting of a project template, a pair of geodatabases, and a toolbox all hosted on the S drive.

Why multiple scripts?

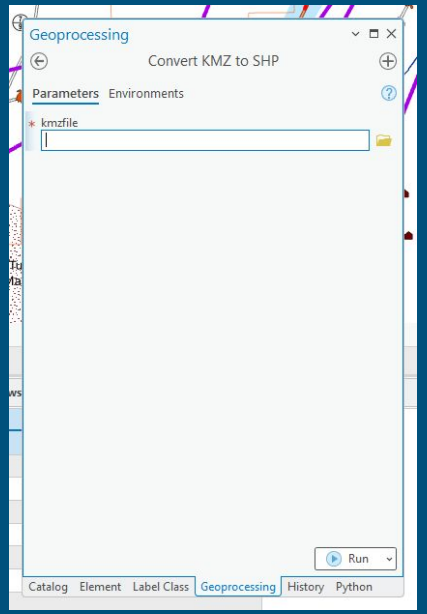
- ECZs are received as KMZ/KML files, but are extremely varied in nature.
- Conversions to ESRI features classes and/or shapefiles is not a universally smooth process.
- THIS is THE primary breaking point in the automated screening process.
- As such, three of the scripts are concerned with ECZ conversion and symbology.
  - Convert KMZ to SHP
  - Quick Fix - If the ECZ looks weird after conversion, script tries to change the symbology via definition query to select just one entry in the attribute table.
  - Unfix Quick Fix - Resets the ECZ for manual manipulation if quick fix doesn't resolve issue.
- If/When we move away from KML/KMZ we can still utilize the other script without making massive changes to it.

Convert ECZ to SHP Script

- Necessary due to functional limitations of ESRI's KML conversion tool.
  - Ie, ESRI's tool is not suitable for complex KMZs frequently output by software like open roads.

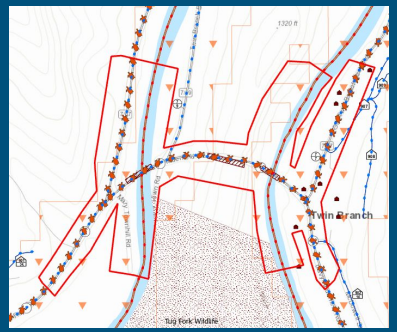
Primary Functions:

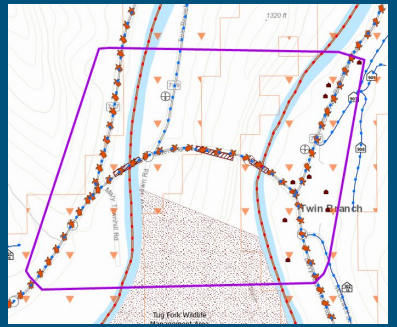
- Identify and isolate ECZ using OGR/GDAL
- Attempt to convert ECZ geometry to polygon
- Convert ECZ to shapefile
- Package shapefile into a zip archive
- Load ECZ Shapefile to map
- Remove KMZ layer from map
- Set symbology for newly loaded ECZ shapefile.



Geometry Conversion

- As the screening tool relies on intersecting geometriesd
- Attempted through various ogr library utilities such as polygonize, union, and force to polygon.
- Utilizing a ‘convex polygon’ can work as a fallback option, but is not always ideal.
- As a final fallback option, the ESRI KML to feature script is called and the resulting feature is converted to a shapefile.





Quick Fix and Undo Quick Fix

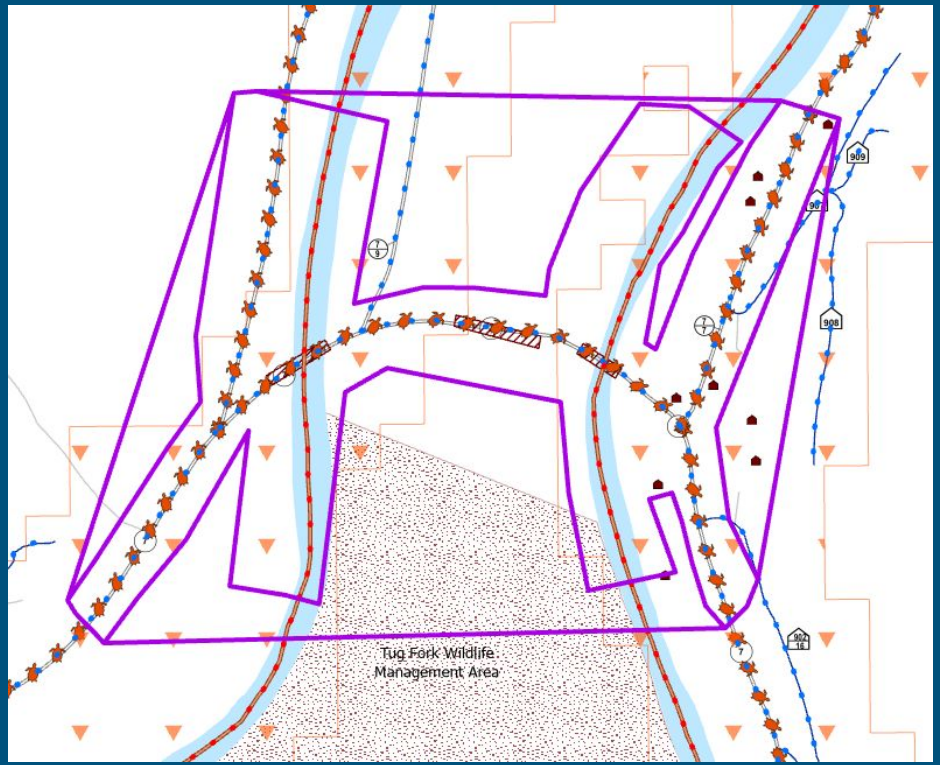
Quick Fix

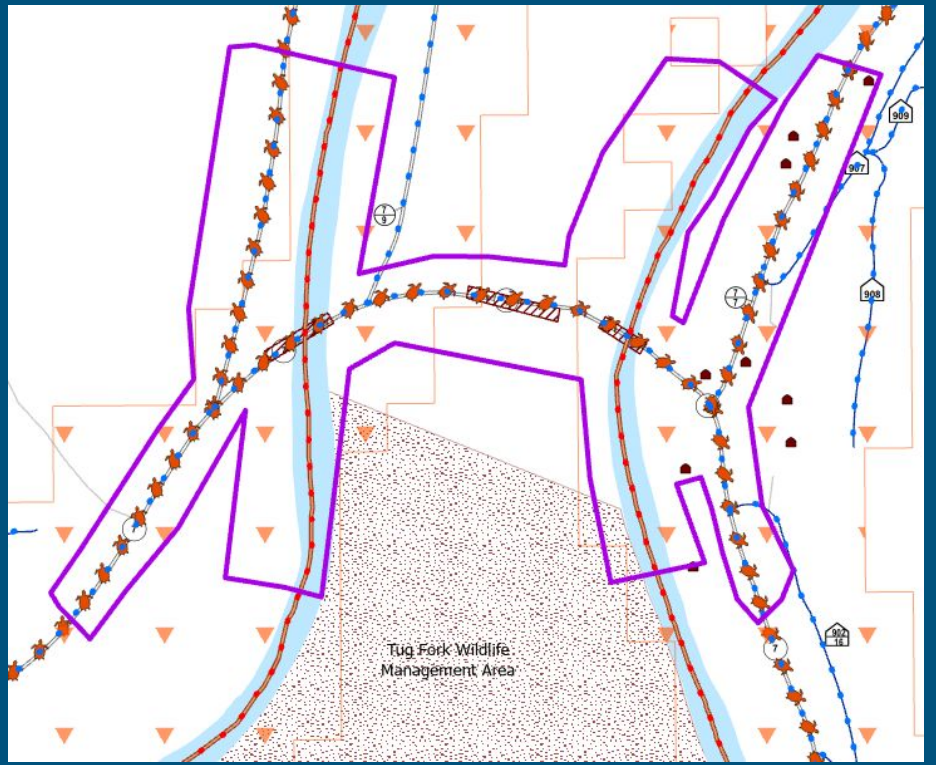
- For use when the ECZ appears incorrect after conversion.
- Uses a definition query to isolate and show only the first entry in the ECZ attribute table.

Undo Quick Fix

- For when Quick Fix does not work, and the ECZ symbology must be manually fixed.
- Undoes/resets the definition query set by Quick Fix.

Both tools are simply run without any parameters

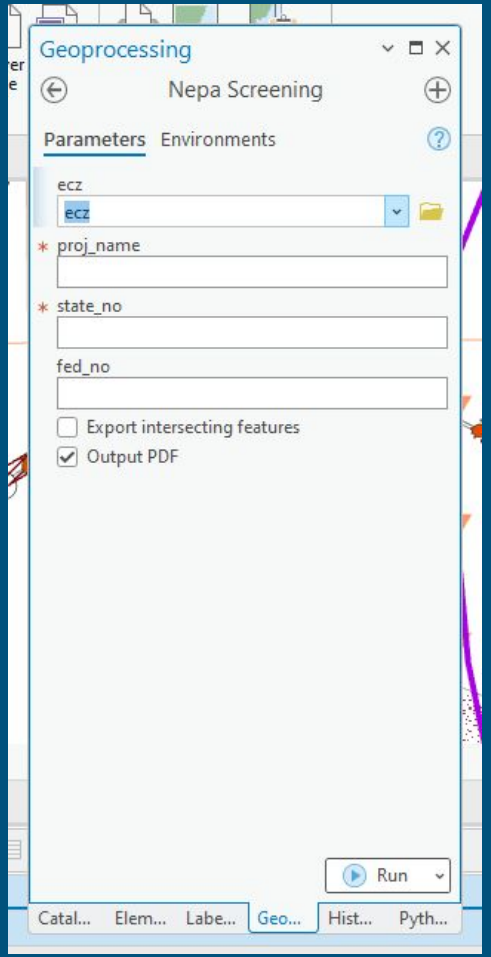

Tug Fork Wildlife
Management Area

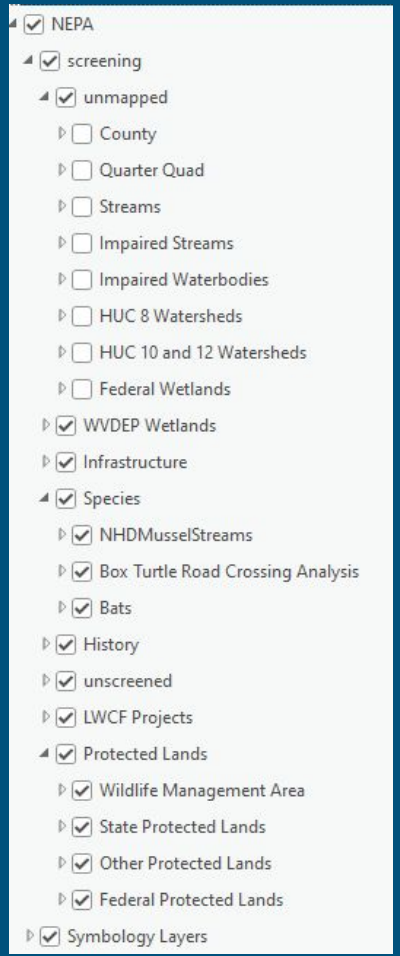

Tug Fork Wildlife
Management Area

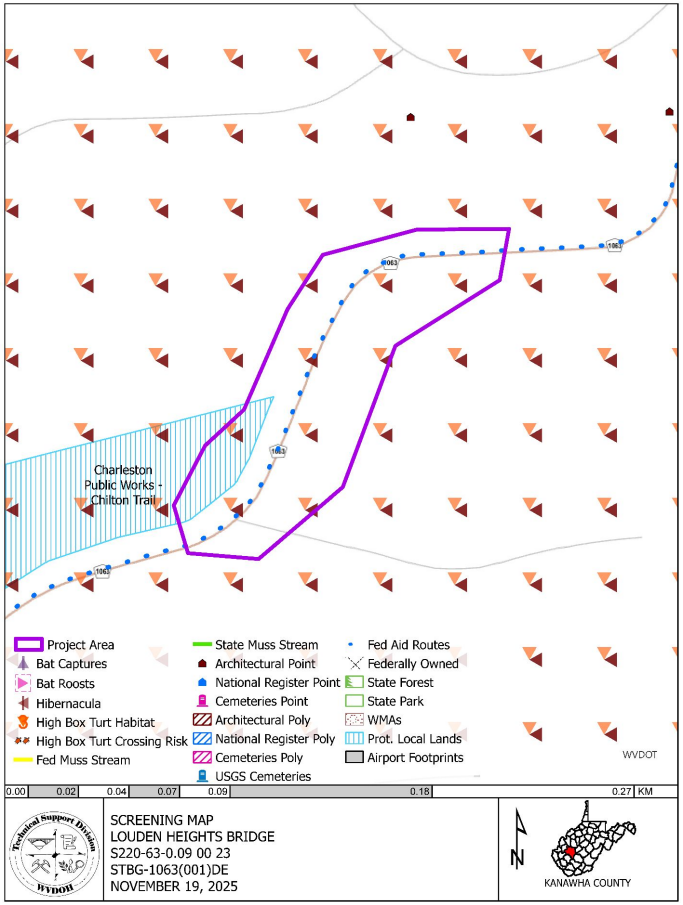
Nepa Screening

Script performs six primary duties:

- Screens for potential NEPA ‘red flags’ via through layer intersection.
- Sets the visibility of various layers based on pre and post analysis settings.
- Compiles and outputs a formatted string of this data as both a PDF and text file.
- Outputs our screening maps.
- Output cropped features if option is selected.
- Also currently outputs various status messages so that we can see where it breaks.







Louden Heights Bridge
State Project# S220-63-0.09 00 23
Federal Project# STBG-1063(001)DE
Kanawha County
District 1
Quarter Quad : YES - 1 :
    Charleston West
BARS Longitude: -81.6440469138025
BARS Latitude: 38.3344342233041
ECZ Center Longitude: -81.64387321607221 E
ECZ Center Latitude: 38.33460038369087 N
HUC 8 Watersheds : YES - 1 :
    Upper Kanawha
HUC 10 and 12 Watersheds : YES - 1 :
    Campbells Creek-Kanawha River / Rush Creek-Kanawha River
Fed Aid Routes : YES - 1 :
    2071063001900 / 3
High Box Turt Habitat : YES - 1
Hibernacula : YES - 2

objectid	species	buffermile	buffertype
182	myse	5.0	MYSE hibernacula outer-tier
183	myse	5.0	MYSE hibernacula outer-tier

Architectural Point (1 mile buffer) : YES - 282
National Register Point (1 mile buffer) : YES - 20 :
    84000782 / Chesapeake & Ohio Depot | 84000411 / Stoneleigh |
    02000253 / Smith-Giltinan House | 84000390 / Barnes-Wellford House |
    84000393 / Bird Haven | 84000395 / Bougemont Complex | 84000396 / Briarwood |
    84000397 / Chilton
    84000400 / Cox-Parks House | 84000401 / Crawford-Gardner House | 84000404 / Dalgain |
    84000405 / Danner-Fletcher House |
    84000407 / Gilliland
    84000409 / McAndrews-Gallaher House | 84000413 / Thomas-McJunkin-Love House |
    79002585 / MacFarland House | 74002008 / Sunrise | 94000720 / United Carbon Building |
    15000841 / Charles A. Haviland's Summers House
Cemeteries Point (1 mile buffer) : YES - 4 :
    46-KA-384 / None | 46-KA-385 / None | 46-KA-387 / None | 46-KA-386 / Unknown
Architectural Poly (1 mile buffer) : YES - 3
National Register Poly (1 mile buffer) : YES - 4 :
    84003607 / Grosscup Road Historic District |
    06000166 / Downtown Charleston Historic District |
    78002800 / East End Historic District | 14001060 / None
USGS Cemeteries (1 mile buffer) : YES - 2 :
    Adkins Cemetery | Saint Matthews Church Cemetery
Protected Local Lands : YES - 1 :
    Charleston Public Works - Chilton Trail / City of Charleston

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Quarter Quad : YES - 1 :
    Charleston West
BARS Longitude: -81.6440469138025
BARS Latitude: 38.3344342233041
ECZ Center Longitude: -81.64387321607221 E
ECZ Center Latitude: 38.33460038369087 N
Bridge : YES - 1

brnum	barsid	locname	featint	feattype	yrblt	lenft	historic
20-NO2/80-000.09	20A909	LOUDEN HEIGHTS BRIDGE	FORK OF PORTERS HOLLOW	5-Waterway	1924	181.1	NOT DETERM

Streams : NO
Impaired Streams : NO
Impaired Waterbodies : NO
HUC 8 Watersheds : YES - 1 :
    Upper Kanawha
HUC 10 and 12 Watersheds : YES - 1 :
    Campbells Creek-Kanawha River / Rush Creek-Kanawha River
Federal Wetlands : NO
WVDEP Wetlands : NO
Comm Nav Streams : NO
Fed Aid Routes : YES - 1 :
    2071063001900 / 3
Airport Footprints : NO
state mussels : NO
endangered mussels : NO
endangered mussels quarter mile : NO
endangered mussels half mile : NO
High Box Turt Habitat : YES - 1
High Box Turt Crossing Risk : NO
Hibernacula : YES - 2

objectid	species	buffermile	buffertype
182	myse	5.0	MYSE hibernacula outer-tier
183	myse	5.0	MYSE hibernacula outer-tier

Bat Roosts : NO
Bat Captures : NO
Architectural Point (Intersecting) : NO
Architectural Point (1 mile buffer) : YES - 282
National Register Point (Intersecting) : NO
National Register Point (1 mile buffer) : YES - 20 :
    84000782 / Chesapeake & Ohio Depot | 84000411 / Stoneleigh |
    02000253 / Smith-Giltinan House | 84000390 / Barnes-Wellford House |
    84000393 / Bird Haven | 84000395 / Bougemont Complex | 84000396 / Briarwood |
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Cemeteries Poly (Intersecting) : NO
Cemeteries Poly (1 mile buffer): NO
USGS Cemeteries (Intersecting) : NO
USGS Cemeteries (1 mile buffer) : YES - 2 :
    Adkins Cemetery | Saint Matthews Church Cemetery
LWCF Projects (Intersecting) : NO
LWCF Projects (1 mile buffer): NO
Wildlife Management Area : NO
State Wildlife Sanctuary : NO
State Wildlife Center : NO
State Park : NO
State Forest : NO
State Nature Area : NO
Protected Local Lands : YES - 1 :
    Charleston Public Works - Chilton Trail / City of Charleston
TNC Nature Preserves : NO
Private Protected Lands : NO
Easements : NO
USFWS : NO
USACE : NO
FS Admin Limit : NO
  FS Owned: NO
NPS Admin Limit : NO
    NPS Owned: NO

Problems/Limitations

- ECZ/Project area NEEDS to be represented by a polygon shapefile.
  - The KMZ conversion script attempts to account for lines/point files - however conversion is often an imperfect process.
  - We are still frequently sent line files.
- Non-local data sources subject to technical problems.
- Manual review still required in some instances. (ie, Land Water Conservation Fund).
- These scripts are not backwards compatible with ArcMap. (And there are no plans to implement this compatibility.)

Potential Improvements

- Branding
  - NEPA and Permitting will be moving to Engineering in January when Technical Support is Dissolved.
  - Should have probably used the WVDOH shield from the start.
- Improving the report formatting
- Add in critical habitat files
- Improve ECZ/KMZ conversion.
  - This will ultimately require the use of additional libraries and potentially more advanced
- Addition of a pre screening script for evaluating multiple potential projects.
  - This may be a whole new project

Questions?

Contact

R Carl DeMuth

I'm in the directory as Robert DeMuth

Email: robert.c.demuth@wv.gov

Interests: EVERYTHING! Seriously just reach out. (ex. current side project: sub $200 tilt compensated RTK-GPS)