
FINAL REPORT

Order Number: G11PX02000

Proposal Title: GNIS Cultural Features Project for West Virginia

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Data Themes: *arenas and stadiums, auditoriums, cemeteries, city and town halls, convention and conference centers, courthouses, fire stations, post offices, libraries, museums, police stations , summits,* and *theaters*

EXECUTIVE SUMMARY

In collaboration with the U.S. Geologic Survey, the WV GIS Technical Center (WVGISTC) updated 2,740 structures and cultural features in the National Geographic Names Information System (GNIS) for the state of West Virginia. Included in this feature update were *cemeteries, city and town halls, auditoriums, arenas and stadiums, police stations, fire stations, post offices, libraries, museums, courthouses, summits, convention and conference centers,* and *theaters*. While comprehensive listings and attribute information existed for some features, others were limited in their extent. In addition to the use of any existing data information, federal, state and professional agencies were contacted when necessary in order to validate each feature. While the updated listings do include the most up-to-date data at the time of the study, it should be noted that cultural features continuously change in status and new features are added regularly. Therefore updating the GNIS is an ongoing process, requiring a periodic, but frequent maintenance process.

FEATURES

Each cultural feature required location information to be collected from a variety of sources. In all cases, more than one source was consulted to ensure accuracy and the inclusion of all available and relevant information. Each source was approved by the GNIS in Denver, CO.

Sources included various web sites, telephone interviews, local knowledge, and consulting federal and state agencies. In addition, data was validated using ortho-rectified aerial imagery via the 2003 and 2011 National Agriculture Imaging Program (NAIP).

Data was electronically submitted to the USGS GNIS office in Denver, Colorado via their online database system. Features were then verified by GNIS personnel and any concerns/questions addressed by the WVGISTC to ensure data accuracy. In addition the updated shapefile will be added to the West Virginia State GIS Data Clearinghouse as of July 2012.

DATA COLLECTION AND VALIDATION

Arenas and Stadiums

Data locations of stadiums and sports arenas were collected from the West Virginia Department of Commerce, www.thebaseballcube.com, www.arenamaps.com, and the Hospitality Junction website. There were no existing features in the GNIS database. There were 31 arenas and stadiums added to the GNIS representing all known features in the state.

Auditoriums and Concert Halls:

Defining the exact parameters for what is considered an auditorium or concert hall proved to be difficult. Ultimately, those spaces regularly used as public event spaces *and* with a capacity of over 300 people, were included in the update. There were 14 additions made to the 1 feature in existing GNIS data.

City and Town Halls:

County and Town Halls are defined as the primary location of municipal operations in the incorporated town or city. This is where county commissioners meet and mayor's offices are located. In the collection of data for city and town halls, web and Google Map searches were used in conjunction with www.yellowpages.com and individual city and town websites. While websites existed for larger and more significant cities and towns in West Virginia, many small towns have yet to create pages and were not listed

in the yellow pages and therefore could not be verified. Additional fieldwork and local knowledge will be required to identify these town and city halls. Included in the update, however, were all county seats, regardless of size, and other sizeable towns and cities within each county. For example, Lewisburg, the official county seat for Greenbrier County was included, as were Roncevert and Rupert because of their prominence in the county. The GNIS contained 41 town and city halls, to which 53 town and city halls were added. The WVGISTC did not possess a town and city hall shapefile and therefore one comprehensive shapefile was created that incorporated the GNIS data and new data.

Cemeteries:

The WVGISTC completed a cemeteries update in 2009 in which 347 cemeteries were added to the GNIS database. At the time of this update, inadequate information and imagery limited the number of cemeteries that could be verified. With the use of the West Virginia Cemetery Preservation Association, www.FindAGrave.com, and 2011 NAIP aerial imagery, the WVGISTC was able to include 944 additional features to the GNIS database. A new shapefile was created with all features, which will be added to the existing data and published on the WVGISTC data clearinghouse.

Convention and Conference Centers:

Convention and Conference Centers included in this update are meeting and exhibition spaces in the state with a capacity of 300 or above. In the collection of data for convention and conference centers, web and Google Map searches were used in collaboration with www.meetingsource.com, the WV Department of Commerce and the Southern West Virginia Convention and Visitor's Bureau. When possible, each feature was verified with its relative individual website. There were 23 convention and conference centers added to the GNIS. Prior to this no data existed either in the GNIS or at the WVGISTC. A new shapefile with each feature and attribute information was created.

Courthouses:

Data for courthouses was gathered through West Virginia Courthouse Facilities Improvement Authority and local knowledge. While a shapefile already existed at the WVGISTC from 2002, many points were inaccurately located. These points were adjusted and edited in the GNIS. There were, however, 13 additions made to ensure all courthouses in the state were represented.

Libraries:

Data for the location of libraries was derived primarily from the Homeland Security Information Program (HSIP Freedom). There were 48 existing libraries in the GNIS database. The WVGISTC made 119 additions which were verified through the West Virginia Library Commission.

Museums:

The most comprehensive listing for museums in the state can be found at www.museumsofwv.com, (The West Virginia Association of Museums). This site was used in conjunction with web searches for individual features to gather attribute information for each museum. In many instances, the WV Association of Museums contained street addresses and telephone numbers for each museum which aided in the location of each feature. However, those without addresses or phone numbers could not be spatially verified and could not be included in the update. Another issue encountered with the website was duplicate entries with museums which may occupy the same buildings or in fact may be the same entity, but is known by two or more names. In these instances, phone interviews were used to verify the location of each feature. A third issue in the verification of museums was the parameters for what constituted a museum. The WV Association of Museums was liberal in their definitions including nearly every historical site in the state. Ultimately, the WVGISTC made the decision to include only those museums with significant collections relating to the history of the state of West Virginia *and* had appropriate location information.

Police and Fire Stations:

Data for Police and Fire Stations was gathered as a result of the West Virginia Office of GIS WV Broadband Mapping Program a collaborative effort between Office of GIS Coordination and the Division of Homeland Security and Emergency Management. In addition to this information, shapefiles dated 2007 (fire stations) and 2009 (police stations) from the Homeland Security Information Program (HSIP Freedom), were used in the verification of data. The GNIS did contain 559 fire station features, but there were no existing features for police stations. There were 4 additions and 3 edits for fire stations and 330 police station additions.

Post Offices:

Post Office features required no new entries. Only edits were made to existing GNIS information when required. Some coordinates for post offices were off by ½ mile or so and were adjusted to reflect the most up to date information as provided by the United States Postal Service and the 2011 shapefile created by HSIP Freedom. There were 56 edits made to existing GNIS post offices. It should be noted that in the near future, a number of West Virginia post offices are slated for closure and a detailed and complete update of post offices will be required.

Summits:

In verifying location information for summits, an algorithm was utilized in order to obtain the most accurate peak data. As a result, all 988 summits in the state of West Virginia were adjusted. In that this is a new process as well as the large number of features, the WVGISTC has requested guidance from the GNIS office in Denver, CO as to the proper update protocol. As of this report, changes have not been made to the online GNIS database. Please see Appendix D for detailed information about this process.

Theaters:

The parameters for what constituted a theater were problematic considering theaters encompass many types of buildings from historic performing arts spaces to modern movie complexes. Ultimately, after consulting the GNIS office in Denver, CO, the WVGISTC, made the decision to include only movie complexes. Theaters that are primarily utilized for the performing arts have been included in the auditoriums update. Web searches and movie ticket box offices, like www.boxofficemojo.com, were consulted in order to obtain location information.

Schools:

While not required by the GNIS in this update, there were edits made to schools in the database, primarily because it is incredibly important to update features as they change, rather than waiting until there are a significant number of edits to be made, which only further encumbers the process. In consulting the West Virginia Department of Education, the WVGISTC made 18 additions and 10 edits to the GNIS database for schools opened and closed in the state in just the last year and a half. The shapefile created by the WVGISTC when updating the GNIS in the fall of 2010 was modified to include each of these features.

PROJECT HIGHLIGHTS

1) **Goals**: The main goal of this project is to support an ongoing activity for the state of West Virginia by continuing updates to GNIS for cultural features complementary to the existing Homeland Security Infrastructure Program (HSIP). The focus of these cultural features updates was *arenas and stadiums, auditoriums, cemeteries, city and town halls, convention and conference centers, courthouses, fire stations, post offices, libraries, museums, police stations, summits,* and *theaters*.

2) **Deliverables**: Each cultural feature that was verified and included in this update was electronically submitted to the USGS Denver National Geospatial Operations Center (NGTOC) via the GNIS interactive form. Previous updates were submitted via a batch process, but given the accessibility to the official database, individual entries by WVGISTC employees was a more efficient method. In conjunction with and as a companion to the submitted data, an ESRI shape file containing all of the point features was created. For a summary table of edits made to the GNIS database please see Appendix A.

3) **Challenges**: Cultural data from a variety of sources with varying quality presents several challenges in terms of long term maintenance as well as source validation and access to specific structures.
    a) Updating information about features may involve site-specific challenges based upon the practicality of field work and updates at the local level. The result is that not all areas statewide will receive the same attention or frequency of updates.

    b) Comprehensive data listings are difficult to come by. While we were successful in obtaining statewide data for *police stations, libraries*, and *fire stations* from the WV Division of Homeland Security and Emergency Management, similar spatial databases for *auditoriums, town halls*, and *arenas* did not yet exist beyond the yellow pages and online telephone and business directories. In addition, even when provided with datasets such as a statewide listings of post offices and fire stations, verification was complicated and time-consuming, given there were well over 500 features in each dataset.

c) Identifying structures only through aerial imagery depends on the accuracy of feature identification. Discrepancies between data sets complicate this process further.

4) **Future Directions**: This project, and similar future federal-state-local collaborations, will help greatly in maintaining the GNIS so that it more accurately reflects the current status and location of cultural features. Such activities may also stimulate more frequent and creative use of GNIS resources. Further work is needed to locate additional validated sources as well as improve the quality of other cultural features in the state. Some future recommendations are:

   a) **Field Work:** Field work is a highly effective tool for spatial verification, and is often necessary and preferred, but it must be used judiciously to avoid exceeding time lines and project budgets.
   b) **High Resolution Imagery:** While the NAIP aerial imagery is 1 meter resolution, imagery of higher quality and varying views (top-down, birds-eye, etc.), increasingly becoming available, will always be helpful. For example, new oblique imagery for the state is becoming available that will aid in verifying features like cemeteries, that normally would be indiscernible. See Appendix C for more information regarding the aerial imagery verification process.
   c) **Web Validation:** The use of local knowledge has the ability to be one of the most valuable assets in obtaining the most accurate location information for features in the GNIS. In that every part of the state cannot be surveyed by the WVGISTC's limited staff, connections via social and professional networks have the ability to yield a greater amount of local knowledge. To facilitate the local knowledge identification and verification process, the WVGISTC suggests the use of a web verification program (created by WVGISTC) wherein an interactive mapping application is used to encourage and receive input from county, state and federal partners, who in most cases are more familiar with their local features than staff members. Once feedback is received, the WVGISTC will verify the information and begin the GNIS submission process.

APPENDIX A: UPDATES SUMMARY

Feature	Additions	Edited	Total Edits
Cemeteries	944	0	**944**
City and Town Halls	53	0	**53**
Auditoriums	14	0	**14**
Arenas and Stadiums	31	0	**31**
Police Stations	330	0	**330**
Fire Stations	4	3	**7**
Post Offices	0	56	**56**
Libraries	119	0	**119**
Museums	43	0	**43**
Courthouses	13	42	**55**
Summits	988	0	
Schools	18	10	**28**
Conventions and Conference Centers	23	0	**23**
Theaters	49	0	**49**
TOTAL:			**2740**

APPENDIX B: UPDATES SUMMARY

GNIS Specification and Qualifications (Fields and Definitions provided by USGS)

There is certain attribute information required by the GNIS when submitting data to the database system. These same fields were also included in the shapefile in order to facilitate a greater clarity when using the data. In updating the GNIS database for these features, fields containing bibliographic sources were required. New additions which coincided with these updates were made to the GNIS database by official personnel in order to properly identify where the information was obtained. The following are source additions made by the GNIS specifically for this project:

feature_id	the current GNIS ID, if it exists
class	feature class (lower case), a separate document listing the possible feature types is also available
name	feature name (as shown, no abbreviations allowed) If you are making a name historical, append (historical) to the end of the name. For example, if Smith School is no longer a school, edit the name to now read, Smith School (historical) and add the *Historical* designation in the designation field.
originator	two-digit code, in caps (usually the state [WV] or [US] if it's national.
ref_type	type: map (M), text (T), dataset (D), web (W), interview (I). It is possible to add new codes if necessary.
ref_code	the number of the reference
ref_detail	might be the year of the map's publication or when you accessed a web site
county_name	name of the county in which the primary point falls, other counties are listed in order of areal extent.
state_alpha	the postal abbreviation for the state
lat_dec	Latitude coordinate of the feature in decimal degrees.
lon_dec	Longitude coordinate of the feature in decimal degrees.
description	free text field to enter elevation or location information beyond just the coordinates, for example. If the feature has an address, it should be added here unless there are other designated GNIS fields for addresses.
quad_name	name of the quadrangle in which the primary point falls.

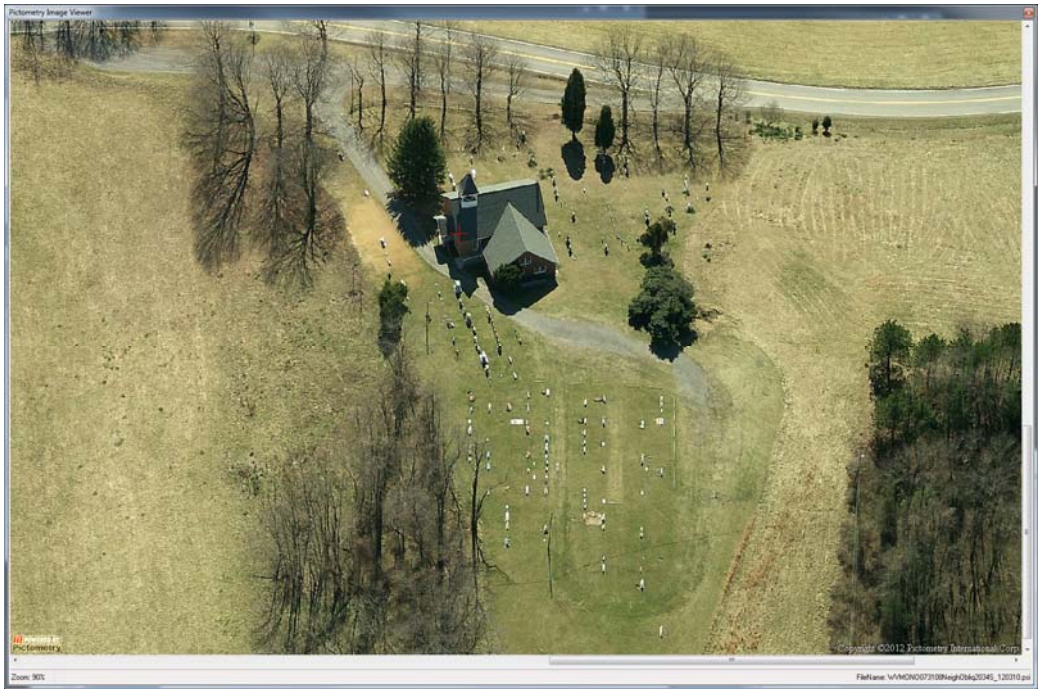
APPENDIX C: AERIAL IMAGERY

While some features are identifiable due to their roof line, shape and surrounding features, others require detailed and extensive investigation of aerial imagery. Higher resolution imagery reveals additional idiosyncrasies that are often indiscernible in the lower resolution counterpart. Smaller cemeteries and buildings are sometimes lost in the lower resolution images. The WVGISTC has used the most detailed imagery available (2011 NAIP ortho-rectified imagery and Best Leaf Off Imagery) to verify features for this update. However, available in the coming months is high resolution oblique imagery which could yield even greater and more accurate results.

The following are images of a cemetery in Monongalia County that illustrates the possibilities in identifying features with use of this new imagery:

Current 2011 NAIP ortho-rectified imagery proved to be the most beneficial in identifying locations for GNIS feature updates. While it is 1 meter resolution, there were still uncertainties in terms of visually locating smaller features such as cemeteries.

Forthcoming *High Resolution Imagery* allows the user to identify features, such as cemetery monuments, that may be otherwise indiscernible in lower resolution imagery, increasing accuracy in the validation process.



Forthcoming *High Resolution Oblique Imagery* further increases accuracy by allowing the user to identify smaller features that may be otherwise indiscernible in even the highest resolution ortho-rectified imagery.

APPENDIX D: SUMMITS UPDATE PROCESS

Prepared by: Tyler R. Wylie, Kevin Kuhn

Goal:

The goal of this project was to update the GNIS summit elevations for West Virginia using current data. The need for this project arose from discrepancies between GNIS summit data and USGS NED 1/9th arc-second derived 10' contours; the summit location did not always fall within the expected contour interval. This project ensured that all GNIS summit locations correspond to the actual summit location of the USGS elevation data, while preserving both the GNIS elevation value and USGS NED elevation value.

Procedure:

This project involved creating a process that extracts elevation summit data from the WVSAMB / USGS DEM and assigns it to the related GNIS summit. This required creating a method of quality assurance of elevation, GNIS name, and horizontal point location. The USGS 7.5 minute quad was established as the working data unit due to the fact that both the elevation and GNIS data sets use the USGS quad index grid system. A script was written in Python that automated most of the project tasks performed in ArcGIS 10.

Generate summits: The first phase was to identify summit point locations using an analytical query on the new elevation data. This phase was broken into several tasks. The individual elevation quads were mathematically inverted, creating a negative value elevation raster. This step allowed the use of a hydrological model 'sink' to be identified, which is the location of all elevation peaks (referred to 'generated summits'. This phase resulted in only horizontal locations of all peaks. The generated summit points were then intersected with the original elevation data to assign the DEM elevation value. Due to the nature of the data, many additional summits were identified than previously identified by the GNIS data, therefore a second phase was used to narrow the point locations to those surrounding previously identified GNIS summits.

Focus generated summits: The second phase of the process was to utilize existing GNIS summits as a template to reduce the number of generated summit points. This was done by creating a 1000' buffer around existing GNIS points, and selecting all points that are within that buffer. The selected points were subset from the generated summits and further processed, the remaining points were not used.

Assign GNIS summit: The GNIS summit IDs were then assigned the best generated summit ID. If more than one generated summit was present, selection of the generated summit ID was based

upon the horizontal location, closest to elevation summit, and maximum elevation value. If multiple locations of equal elevation were present, the ID was assigned manually during the QC. The resulting file could be joined by elevation summit ID to GNIS attributes. This meant points were never actually moved, rather the GNIS attributes were assigned to the new location (this preserved the horizontal location).

Quality Assurance: The third phase in the process performed a quality check of all automatically referenced points and addressed any GNIS summit not assigned a generated summit ID. Comments were then recorded regarding any information believed to be valuable for further efforts as a feature level metadata record.

Comments:

Figure A

Figure A is an example of a GNIS summit that was manually referenced to one of two generated summits that show the same elevation in feet (RED lettering). By referencing this GNIS point to one of the elevation IDs (GREEN lettering), the GNIS point is being pulled off of the topographic 'X'. The elevation in feet for the generated summits is different from the topographic elevation displayed as well. Therefore: "Spot elev. 1488**."** and "Moved off topo 'X/triangle'**. "** would be recorded in the "comments" section of the attribute table.

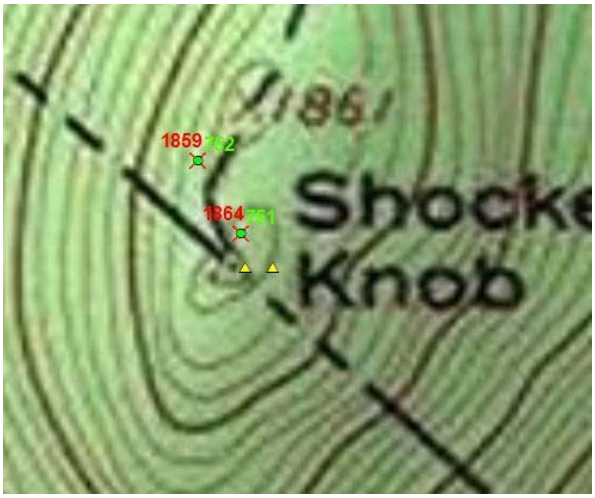


Figure B

Figure B demonstrates a situation where there were separately named GNIS points located for the same summit. In this specific case, the area shows the WV-VA border, so one point is referenced to VA while other point WV. In this situation the "comments" would read "Coincident with Shockeys Knob, VA". Similar situations also occurred with in-state points. In this situation the Feature ID # of the coincident point is written in parentheses following the name. The comments for Figure B would also give respect to the spot elevation to the North with comment: "Spot elev. 1861". Comments were also made for any GNIS points that were moved more than 300 feet from their original location. ("Moved over 300' ").

Comments:

OK: Most points were located adjacent to or directly on a spot elevation mark "X".

Spot elev. '*number*': recorded the elevation listed on the USGS Topographic map.

State Location: The GNIS data was extracted by query from the GNIS website. This resulted in two errors in the data. Points that were attributed to be in WV, but located outside the state boundary and points attributed outside of WV but located within the state boundary.

Point in '*state'*: Points located outside of the West Virginia state boundary.

Point listed in '*VA*': Several points were attributed in the 'State_Alpha' field as "VA", but location is within WV boundaries.

Coincident point: Many points were located adjacent to other GNIS Summits points and were therefore co-located.

Feature Type: It was noted that there were several GNIS summits that were not true summit locations. These features are generally shown as other features on the USGS Topographic map. For example, "Brushy Hill" is not located on a mountain summit, rather on the side of a mountain. Several of these locations were therefore not updated.

Data Results:
Source WV GNIS Summits : n= 988
(where "STATE_ALPH" = 'WV')
WV Summits: n=992

(988 + 4 = 992) 4 points listed as points stated as VA points, but fall within WV.
982 points in WV (10 points outside)

APPENDIX E: SUMMITS: ELEVATION SUMMIT SCRIPT

```
# ---------------------------------------------------------------------------
# summits_1.py
# Created on: 2011-09-21 12:01:30.00000
#   (generated by ArcGIS/ModelBuilder)
# Usage: summits_1 <FlowDir__Raster_> <Output_raster__2_> <Name> <NEG__RASTER_>
# Description:
# ---------------------------------------------------------------------------

# Set the necessary product code
# import arcinfo


# Import arcpy module
import arcpy

# Check out any necessary licenses
arcpy.CheckOutExtension("spatial")

# Load required toolboxes
arcpy.ImportToolbox("Model Functions")

# Script arguments
FlowDir__Raster_ = arcpy.GetParameterAsText(0)
if FlowDir__Raster_ == '#' or not FlowDir__Raster_:
    FlowDir__Raster_ = "D:\\gis_data\\temp\\FlowDir_Time1" # provide a default value if unspecified

Output_raster__2_ = arcpy.GetParameterAsText(1)
if Output_raster__2_ == '#' or not Output_raster__2_:
    Output_raster__2_ = "D:\\gis_data\\temp\\Sink_FlowDir2" # provide a default value if unspecified

Name = arcpy.GetParameterAsText(2)
if Name == '#' or not Name:
    Name = "masontown_wv" # provide a default value if unspecified

NEG__RASTER_ = arcpy.GetParameterAsText(3)

# Local variables:
Output_drop_raster = NEG__RASTER_
Delete_succeeded = Output_drop_raster
Output_data_element__2_ = Output_raster__2_
RasterT_Sink_Fl3_shp = Output_data_element__2_
RasterT_Sink_Fl3_FeatureToPo_shp = RasterT_Sink_Fl3_shp
Extract_RasterT2_shp = RasterT_Sink_Fl3_FeatureToPo_shp
Output_data_element = FlowDir__Raster_
Input_raster_or_constant_value_2 = "-1"
DEMs = "D:\\gis_data\\GNIS\\Summits\\DEMs"
Any_value = ""
RASTER = "D:\\gis_data\\GNIS\\Summits\\DEMs\\RASTER"
```

```
# Process: Iterate Datasets
arcpy.IterateDatasets_mb(DEMs, "*.tif", "RASTER", "NOT_RECURSIVE")

# Process: Times
arcpy.gp.Times_sa(RASTER, Input_raster_or_constant_value_2, NEG__RASTER_)

# Process: Flow Direction
arcpy.gp.FlowDirection_sa(NEG__RASTER_, FlowDir__Raster_, "NORMAL", Output_drop_raster)

# Process: Rename
arcpy.Rename_management(FlowDir__Raster_, Output_data_element, "")

# Process: Sink
arcpy.gp.Sink_sa(Output_data_element, Output_raster__2_)

# Process: Rename (2)
arcpy.Rename_management(Output_raster__2_, Output_data_element__2_, "")

# Process: Raster to Polygon
arcpy.RasterToPolygon_conversion(Output_data_element__2_, RasterT_Sink_Fl3_shp, "SIMPLIFY",
"VALUE")

# Process: Feature To Point
arcpy.FeatureToPoint_management(RasterT_Sink_Fl3_shp, RasterT_Sink_Fl3_FeatureToPo_shp,
"INSIDE")

# Process: Extract Values to Points
arcpy.gp.ExtractValuesToPoints_sa(RasterT_Sink_Fl3_FeatureToPo_shp, RASTER,
Extract_RasterT2_shp, "NONE", "VALUE_ONLY")

# Process: Delete
arcpy.Delete_management(Output_drop_raster, "")
```