ARC HYDRO TOOLS CONFIGURATION DOCUMENT #2

LOCAL PARAMETERS CONFIGURATION

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Arc Hydro Tools Configuration Document #2

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Local Parameters Configuration

1 Introduction

This document describes how to setup local parameters in Arc Hydro. A local parameter is a parameter computed for a local watershed, e.g. a watershed for which data (dem, etc.) is available in ArcMap.

2 Defining local parameters

The parameters available in Arc Hydro are defined in the XML associated to the map document under the node FrameworkConfig/HydroConfig/ProgParams/ApFunctions/ApFunction(WshParams). The function Compute Local Parameters reads this XML and displays the list of parameters in the Select Parameters window.

- Open a new ArcMap and save the map document.
- Select **Attribute Tools|Compute Local Parameters**.

The Select Parameters window is displayed. This form lists all the parameters that are defined in the XML and can be computed.

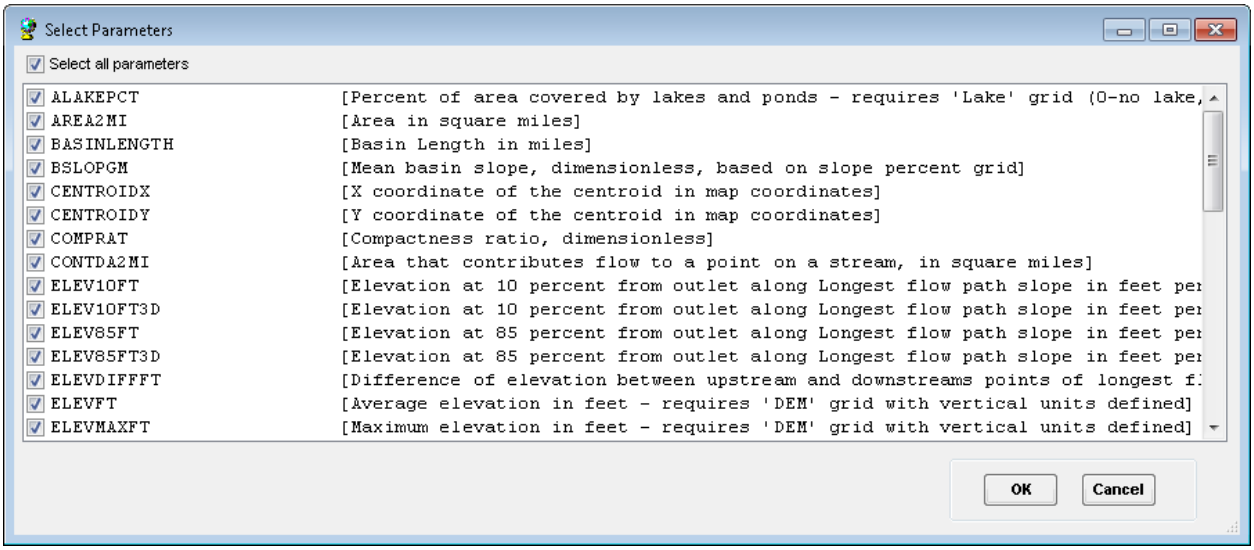


Figure 2-1 Select Parameters Window

- Click Cancel to close the form.

2.1 Name Definition

The parameter is defined with 4 types of "name": field name, tagname, field alias and description.

Name	Description
Name	Name of the field (if you look at the field in the layer properties window you see the name and the alias whereas if you open the table you see the alias).
TagName	Name used in the list of parameters in the Select Parameters window, as well as internally by the function.
Alias	Alias corresponding to the field name (what you see when you open the attribute table).
Desc	Description associated to the parameter in the Select Parameters window (if you maximize the window you see the description on the right).

- Select **ApUtilities|XML Manager**.

The XML Viewer displays the XML associated to the map document.

- Browse to the node FrameworkConfig/HydroConfig/ProgParams/ApFunctions/ApFunction(WshParams)/ApFields/

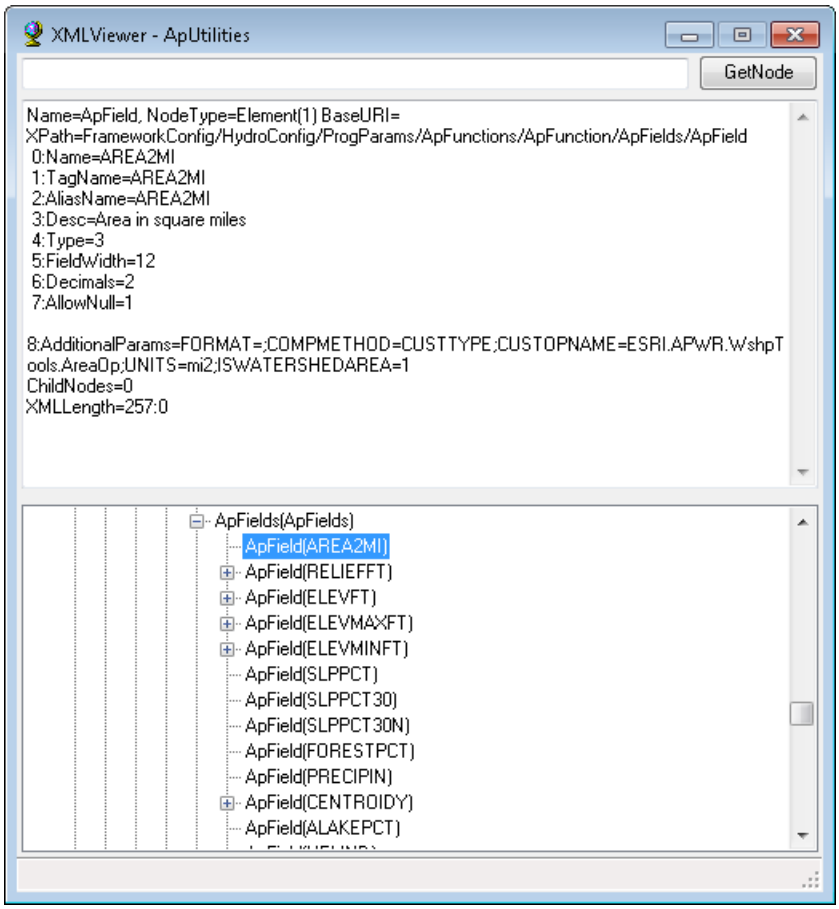


Figure 2-2 Browsing to ApFields Node

- Right-click ApField(ELEVFT) and select Copy.

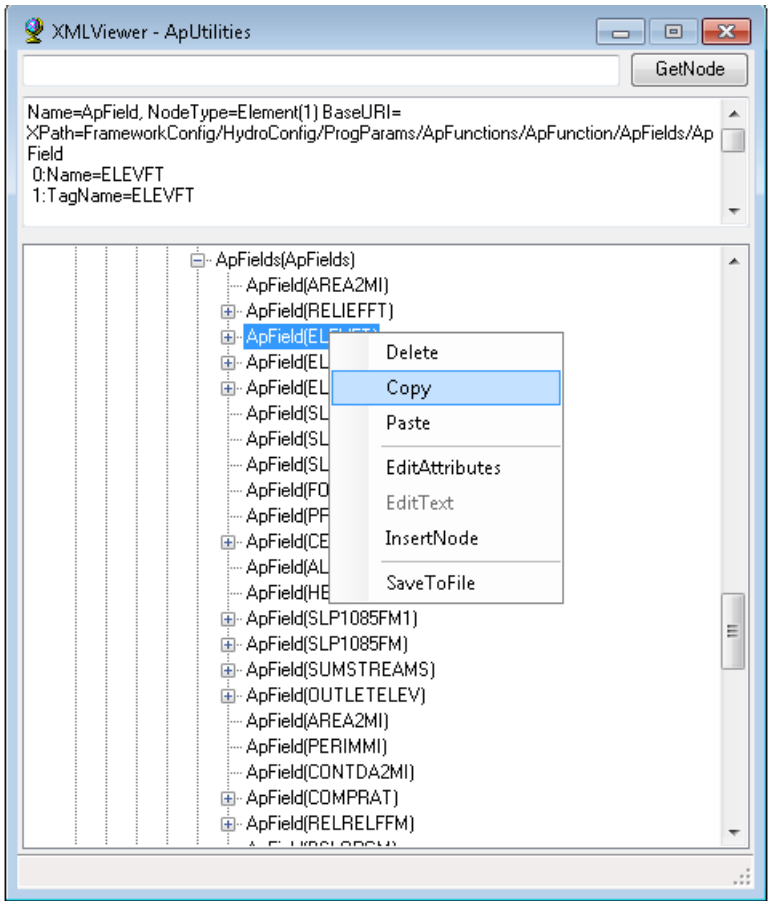


Figure 2-3 Copying ApField Node

- Right-click ApFields(ApFields) and select Paste.

The node ApField(ELEVFT) is added under the node ApField(WATERUSEPCT).

- Right-click the new node ApField(ELEVFT) and select EditAttributes.

The Attribute Editor window is displayed.

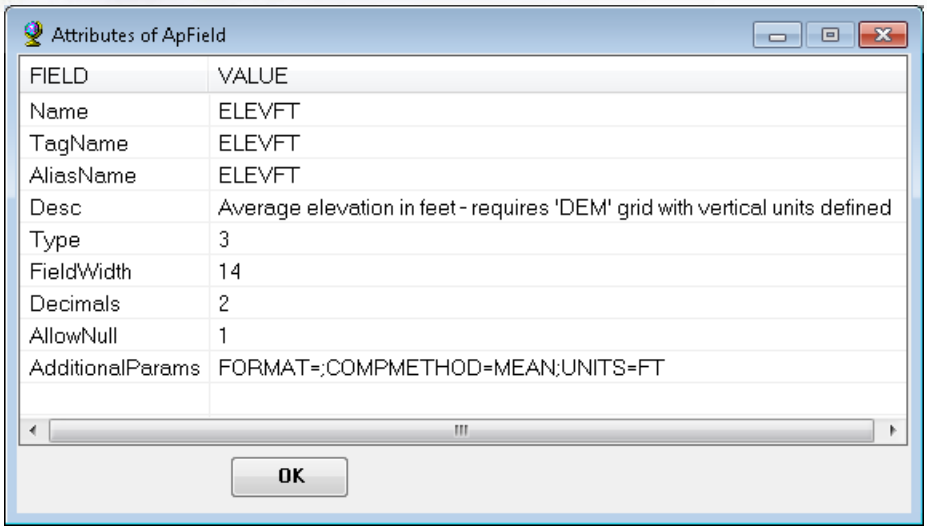
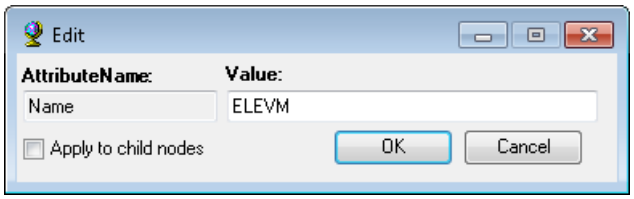


Figure 2-4 Attributes of ApField Node

- Right-click the Name record and select Edit. Enter ELEVM as value for name. Click OK



- Right-click the TagName record and select Edit. Enter ELEVMTAG as value for TagName. Click OK.
- Right-click the Alias record and select Edit. Enter ELEVM Alias as value for Alias. Click OK
- Right-click the Description record and select Edit. Enter “Average elevation in meters” as Description. Click OK
- Right-click the AdditionalParams record and select Edit. Replace “UNITS=FT” with “UNITS=M”. Click OK.

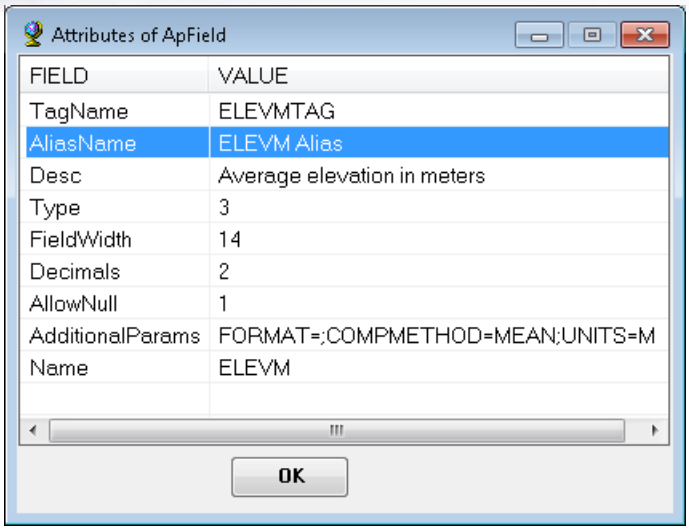


Figure 2-5 ELEVM ApField Attributes

- Click OK to close the Attribute Editor.
- Close the XML Viewer and save the map document.
- Add a raster (dem) and a polygon feature class that overlays the dem into the Table of Contents of ArcMap.
- Select one of the polygon features since the function Compute Local Parameters works with a selected set of drainage area features.
- Select **Attribute Tools|Compute Local Parameters**.

The new parameter is now visible in the Select Parameters window as:
ELEVMTAG [Average elevation in meters]
TagName [Description]

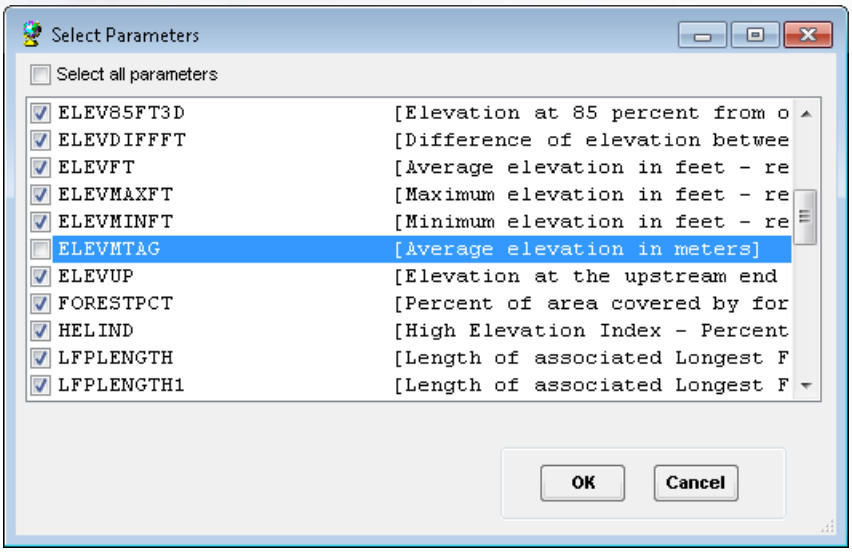
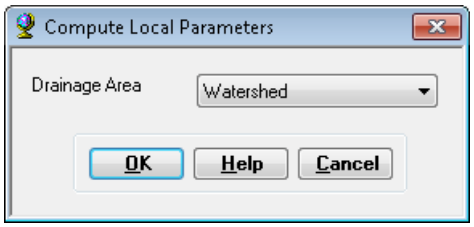
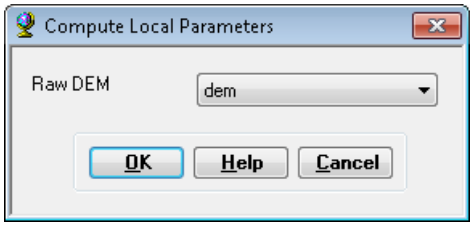


Figure 2-6 New configured Parameter in Select Parameters Window

- Uncheck Select All parameters. Select ELEVFT and ELEVMTAG. Click OK.
- Select the polygon feature class you just added as Drainage Area. This is the feature class for which parameters are computed. Click OK.

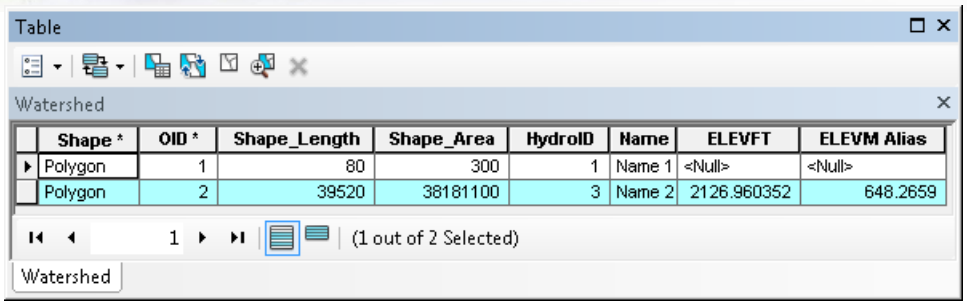


- Select the raster dem you just added as Raw DEM, which is used as input to compute the average elevation. Click OK.



- Open the attributes table of the drainage area feature class (e.g. Watershed).

The fields ELEVFT and ELEVM Alias (aliases set in the XML) have been added to the attributes table.



- Right-click the drainage area feature class (e.g. Watershed) in the Table of Contents of ArcMap and select Properties. Select the tab Fields.

The Properties window shows that a field called "ELEVM" (name) has been created. The alias for this field, that is visible when viewing the Attributes table, is "ELEVM Alias".

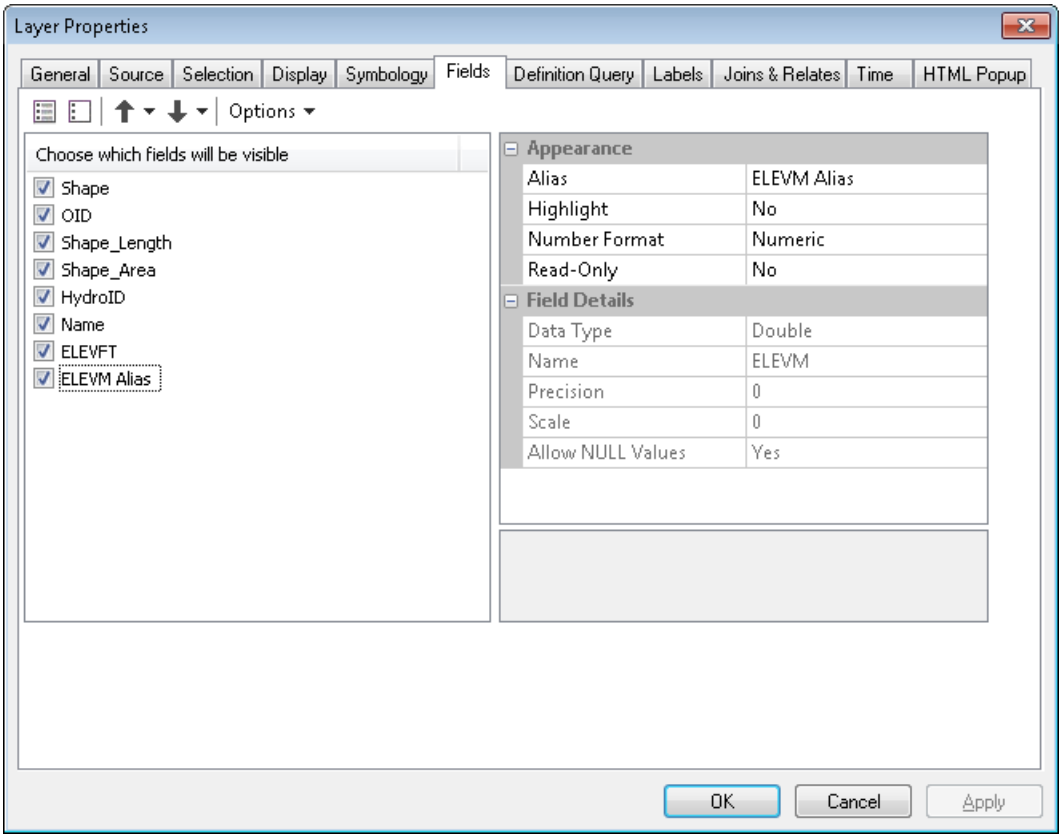
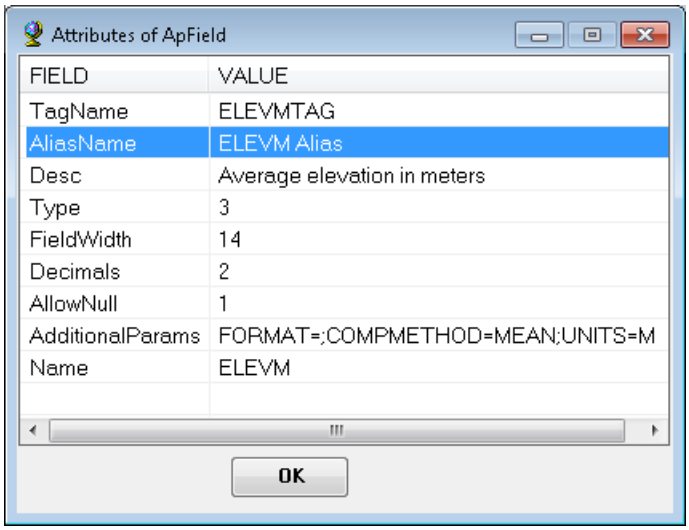


Figure 2-7 Layer Properties - Fields

2.2 Field definition

The XML allows also setting the type and width of the field, as well as the number of decimals for a numeric field. The XML also sets whether the field allows null values.

Name	Description
Type	The esriFieldType associated with this field node: • 0: Integer • 1: Long integer • 3: Double • 4: String • 5: Long integer • 6: OID • 7: Geometry • 8: BLOB
FieldWidth	Number. For a string, length of the field. For a number, maximum number of digits (number) allowed without counting the decimal separator.
Decimals	Maximum number of decimals allowed (=scale) for numbers. Ignored for string
AllowNull	Indicate whether the field allows null value or must always be populated. Usually set to 1 (Allow Null).



2.3 Computation Method Definition

The computation method and the parameter's units are defined in AdditionalParams.

AdditionalParams

Name	Description
COMPMETHOD	Computation method used to compute the local parameter. Available operations are: • MEAN: average value of input raster within the drainage area. • MAX: maximum value of input raster. • MIN: minimum value of input raster. • RANGE: (maximum-minimum) for input raster. • STD: standard deviation for input raster. • SUM: sum of raster values within the drainage area. • COUNT: number of cells within the drainage area. • FRACTION: ratio of cells with values 1. Input raster must be a grid with values 0 or 1 • PERCENT: percent of cells with values 1. Input raster must be a grid with values 0 or 1 • AREA: area covering the cells from input raster with a value of 1. Input raster must be a grid with values 0 or 1. • CUSTTYPE: custom operation (e.g. CentroidY)
CUSTOPNAME	Name of the custom operation used when COMPMETHOD=CUSTTYPE. e.g. CUSTOPNAME= ESRI.APWR.WshpTools.CentroidYOp Available custom operators: • AreaOp • BasinLengthOp • CentroidXOp • CentroidYOp • CopyFieldOp • DerivedParamOp • ElevDiff2DLineOp • GetMultiFeatureFieldOp • GPToolOp • LineLengthOp • LFPathOp • LFPathPreproOp • LineLengthOp • MainFlowPathOp • PerimeterOp • Point2DLineOp • Point3DLineOp • PointExtractOp • PointPolyExtractOp • PointXOp • PointYOp • RelLineLengthOp • Slope2DLineOp • Slope3DLineOp See section 3.2 for a detailed description of these operators.

Name	Description
UNITS	Units used for the parameter. Available values for standard parameters: • FT • FT2 • ACRE • MI • MI2 • M • M2 • HECTARE • KM • KM2 • FT/MI • M/KM
CONVERSION	Conversion expression that applies to the parameter: e.g. To convert slope in percent to slope dimensionless: CONVERSION=BSLPGM/100

Parameters required by custom functions can be defined as new AdditionalParams (e.g. PROJECTIONFILENAME for the Y-Coordinate of the Centroid). The custom operators retrieve these parameters as needed.

Name	Operator	Description
PROJECTIONFILENAME	CentroidXOp CentroidYOp PointXOp PointYOp	Optional. Parameter used with CENTROIDXY, CENTROIDY, OUTLETX, OUTLETY. Define the name of the projection file used for the X/Y coordinate. Defined as PROJECTIONFILENAME =Transverse_Mercator.prj. The file is located under the Archydro\bin directory.
SMOOTH	LFPathOp LFPPathPreproOp	SMOOTH=1: resulting 3D Longest Flow Path feature class is smoothed. SMOOTH=0: not smoothed
EXPRESSION	PointExtractOp	Value added to the resulting parameter. • EXPRESSION=1: add 1 to value after unit conversion. • EXPRESSION=-2: subtract 2 from value.
EQUATION	DerivedParamOp	EQUATION=@RELIEFFT@/@AREA2MI@ Where @ is the variable delimiter for the supporting parameters, defined in the WshParams>ParameterDelimiter node. This delimiter is optional and defaults to blank, i.e. the default expression is: EQUATION=RELIEFFT/AREA2MI The function is replacing the variable name with their value – the delimiter may be useful if several variables have similar name (e.g. ELEV, ELEVFT, etc.) to ensure that the replacement is correctly performed.

LOOKUPTABLE	GPToolOp	TagName of the ApField>ApLayers>ApLayer used to lookup the values of the classes of interest in the grid and of their (optional) associated field names in the attributes table of the GlobalWatershed/DrainageArea feature class. LOOKUPTABLE=NLCDLUTABLE
GPCOMMAND	GPToolOp	Command line used to run the geoprocessing tools. The input/output tables/feature classes are set using tagnames that are replaced on run time with the paths/names of the tagged tables/layers. GPCOMMAND=PercentByZone GlobalWatershed HydroID NLCDRaster VALUE LanduseCatTmp FlowDirGrid
RESULTFIELD	GPToolsOp	Name of the field storing the computed parameter in the first output table/layer parameter of the geoprocessing tool/model/script.
SOURCEFIELD	CopyFieldOp	Tag name of the source field the value is copied from.

2.4 Input/Output Layers Definition

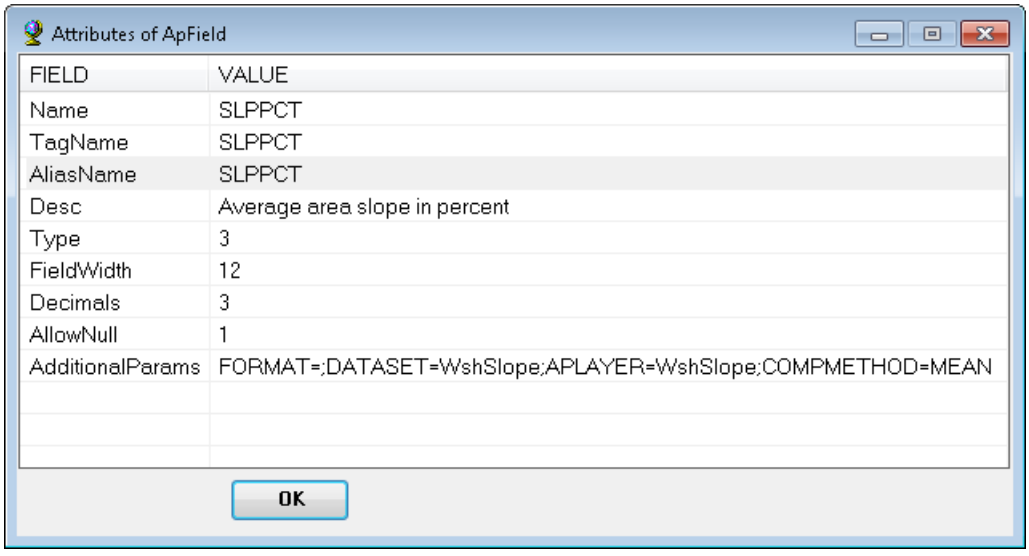
Standard parameters are computed by using an input raster that may be defined in 2 ways:

1. Using ApLayer
2. Using ApLayers

Custom parameters' inputs/outputs are always defined using the ApLayers method.

2.4.1.1 With ApLayer (standard parameters only)

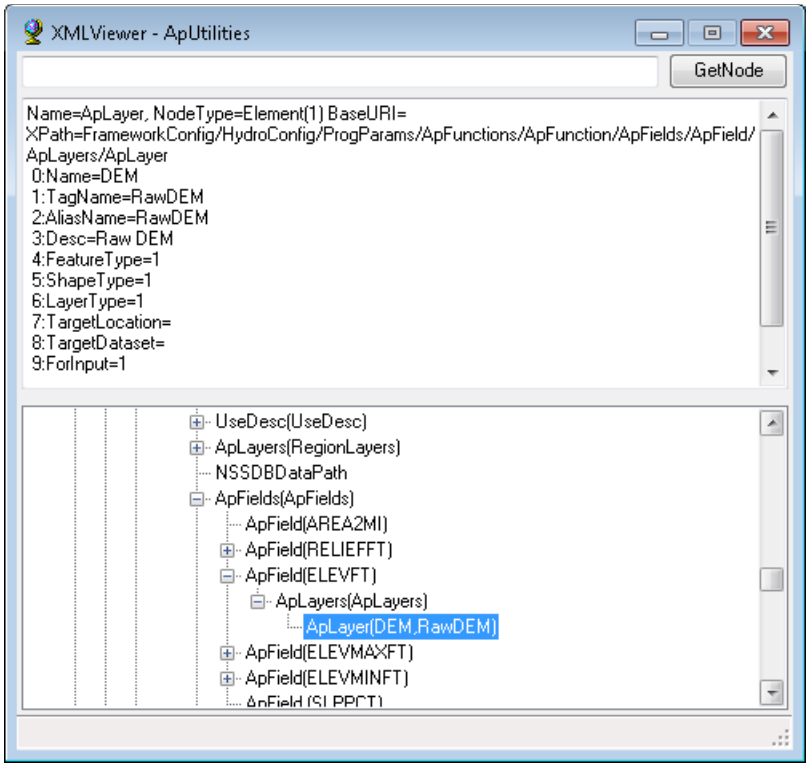
Standard parameters are the parameters defined with a standard operation method, i.e. not a custom operator. They are using one and only one input, a raster layer. This input may be defined with APLAYER= TagName within AdditionalParams.

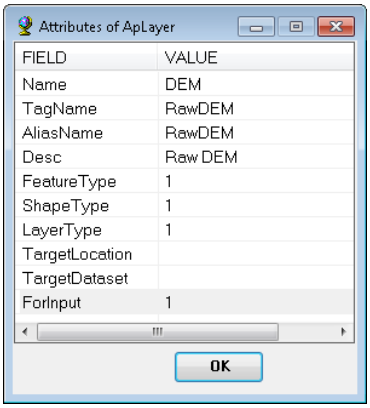


2.4.1.2 With ApLayers (standard and custom parameters)

- **Standard parameters (i.e. one raster input)**

For standard parameters, one ApLayer defining the input raster required by the function is configured. The figure below illustrates how to setup the RawDEM tag as input for the parameter ELEVFT (average elevation).





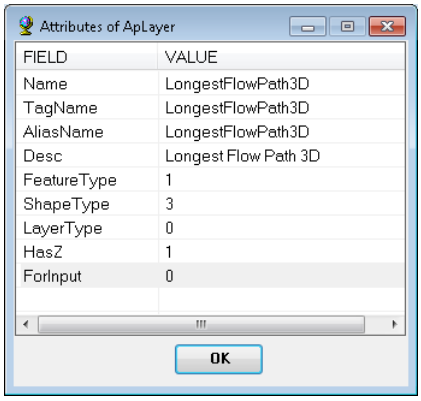
- **Custom parameters (none to multiple inputs/outputs)**

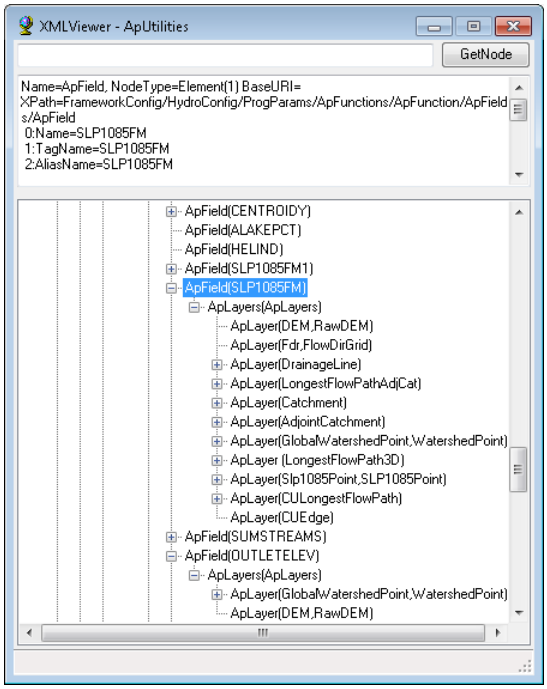
Custom parameters may require multiple input/output feature classes. Each feature class is defined as an ApLayer in the ApLayers collection associated to the parameters. Fields may also be defined for each layer. The parameter FoInput indicates whether the layer is a required input or an output layer that will be generated during the computation.

For example, when computing the parameter SLP1085FM (slope 10-85 in feet per mile using preprocessed data), 2 output feature classes are generated:

- LongestFlowPath3D, storing the output longest flow path feature.
- SLP1085Point, storing the output 10 and 85 points.

The parameter ForInput set to 0 indicates that the layer is an output layer that will be created if it does not already exist (ForInput set to 1 indicates an input layer, which is the default).



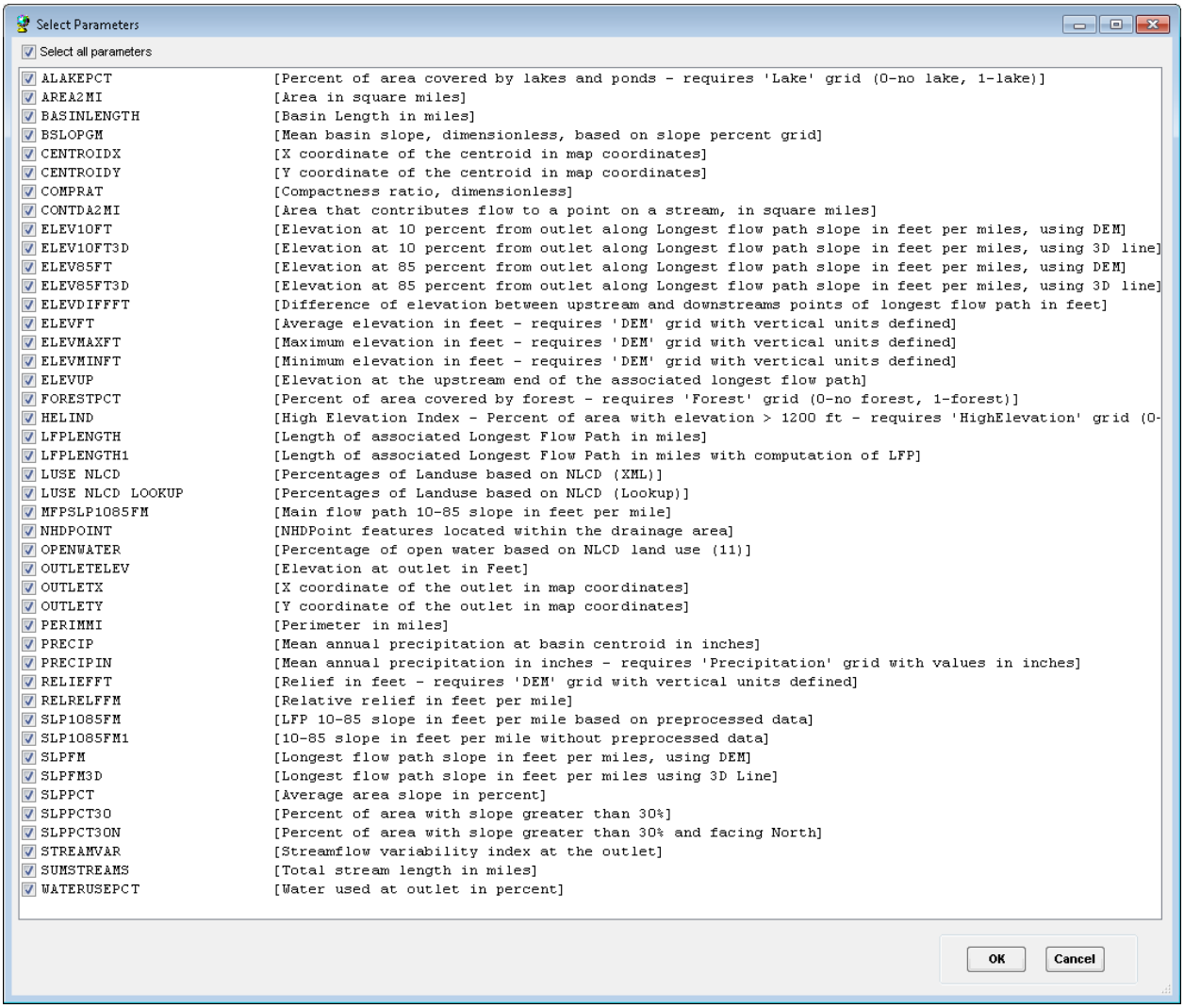


Name	Description
ForInput	Indicate whether the layer is an input or output layer.

3 Default local parameters in Arc Hydro

3.1 Parameters Description

The following parameters are available by default in Arc Hydro:



Name	Definition	Layers	AdditionalParams
ALAKEPCT	Area of lakes and ponds in percent.	LAKES grid with values: • 1 for lakes • 0 otherwise	APLAYER=WshLake; COMPMETHOD=PERCENT
AREA2MI	Area in square miles.		COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.AreaOp; UNITS=MI2
BASINLENGTH	Basin Length in miles.	Basin Length Grid Longest Flow Path 3D Basin Length Basin Length Point Global DEM Grid	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.BasinLengthOp; UNITS=MI; COSTGRIDPOWER=2
BSLOPGM	Mean basin slope, dimensionless, based on slope percent grid	Slope grid in percent	COMPMETHOD=MEAN; APLAYER=WshSlope; CONVERSION=BSLOPGM/100
CENTROIDX	X coordinate of the centroid in the projection file coordinates system (or in map coordinates if there is no projection file).	Centroid (output, optional) Optional. Projection file stored in the ArcHydro\bin directory (e.g. Transverse_Mercator.prj)	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.CentroidXOp; PROJECTIONFILENAME= Transverse_Mercator.prj
CENTROIDY	Y coordinate of the centroid in the projection file coordinates system (or in map coordinates if there is no projection file).	Centroid (output, optional) Optional. Projection file stored in the ArcHydro\bin directory (e.g. Transverse_Mercator.prj)	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.CentroidYOp; PROJECTIONFILENAME= Transverse_Mercator.prj
COMPRAT	Compactness ratio, dimensionless.	Layers required for parameters PERIMMI and CONTDA2MI, defined as supporting parameters as ApField of RelatedParams ApLayer.	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.DerivedParamOp; EQUATION=PERIMMI/2*(3.14159*CONTDA2MI)^0.5
CONTDA2MI	Area that contributes flow to a point on a stream, in square miles.	Contributing area grid	COMPMETHOD=AREA; APLAYER=WshContribarea; UNITS=MI2

Name	Definition	Layers	AdditionalParams
ELEV10FT	Elevation in feet at 10 percent from outlet along Longest Flow Path retrieved from DEM.	RawDEM Longest Flow Path	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.Point2DLineOp; POINT=0.1; UNITS=FT
ELEV10FT3D	Elevation in feet at 10 percent from outlet along Longest Flow Path 3D retrieved from 3D line.	Longest Flow Path 3D	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.Point3DLineOp; POINT=0.1; UNITS=FT
ELEV85FT	Elevation in feet at 85 percent from outlet along Longest Flow Path retrieved from DEM.	RawDEM Longest Flow Path	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.Point2DLineOp; POINT=0.85;UNITS=FT
ELEV85FT3D	Elevation in feet at 85 percent from outlet along Longest Flow Path 3D retrieved from 3D line.	Longest Flow Path 3D	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.Point3DLineOp; POINT=0.85; UNITS=FT
ELEVDIFFFT	Difference of elevation in feet between upstream and downstream end of longest flow path feature. Longest flow path feature must exist and is related to the Drainage Area through DrainID. Elevation is extracted from DEM.	Longest Flow Path with DrainID field RawDEM	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.ElevDiff2DLineOp; UNITS=FT
ELEVFT	Average elevation in feet.	RawDEM	COMPMETHOD=MEAN; APLAYER=RawDEM; UNITS=FT
ELEVMAXFT	Maximum elevation in feet.	RawDEM	COMPMETHOD=MAX; APLAYER=RawDEM; UNITS=FT
ELEVMINFT	Minimum elevation in feet.	RawDEM	COMPMETHOD=MIN; APLAYER=RawDEM; UNITS=FT
ELEVUP	Elevation at the upstream end of the longest flow path feature associated to the drainage area through DrainID. Value copied from the field ElevUp in Longest flow path.	Longest Flow Path with DrainID and ElevUp fields	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.CopyFieldOp; FIELDSOURCE=ElevUp

Name	Definition	Layers	AdditionalParams
FORESTPCT	Percentage of area of type forest.	FOREST grid with values: • 1 for forest landuse • 0 otherwise	COMPMETHOD=PERCENT; APLAYER=WshForest
HELIND	High elevation index.	High elevation grid: • 1 if elev > high elevation • 0 otherwise	COMPMETHOD=PERCENT; APLAYER=WshHelind
LFPLENGTH	Length of longest flow path in miles. Longest flow path feature already exists and is related to Drainage Area through DrainID.	Longest flow path feature class with DrainID field	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.RelLineLengthOp; UNITS=MI
Name	**Definition**	**Layers**	**AdditionalParams**
LFPLENGTH1	Length of longest flow path in miles. Longest flow path feature does not already exist and is computed on the fly.	Longest flow path feature class with DrainID field Layers required to compute SLP1085FM, defined as supporting parameter as ApField of RelatedParams ApLayer.	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.RelLineLengthOp; UNITS=MI
LUSE NLCD	Percentages of Landuse based on NLCD (XML).	NLCD Raster Flow Direction Grid LanduseCatTmp (output table) DerivedParams: List of fields to compute.	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.GPToolOp; GPCOMMAND=PercentByZone GlobalWatershed HydroID NLCDRaster VALUE LanduseCatTmp FlowDirGrid
LUSENLCD LOOKUP	Percentages of Landuse based on NLCD (Lookup)	NLCD Raster Flow Direction Grid LanduseCatTmp (output table) NLCD Lookup Table	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.GPToolOp; GPCOMMAND=PercentByZone GlobalWatershed HydroID NLCDRaster VALUE LanduseCatTmp FlowDirGrid; LOOKUPTABLE=NLCDLUTABLE

Name	Definition	Layers	AdditionalParams
MFPSLP1085FM	Main flow path 10-85 slope in feet per mile.	RawDEM Flow Direction Grid Flow Accumulation Grid Watershed Point Drainage Line Catchment MainFlowPath3D (output) SLP1085MFPPoint (output)	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.MainFlowPathOp; UNITS=FT/MI; SMOOTH=1; CELLTHRESHOLD=450
NHDPOINT	NHDPoint features located within the drainage area.	NHDPoint NHDPoint_DA (output)	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.GetMultiFeatureFieldOp
OPENWATER	Percentage of open water based on NLCD land use (11)	NLCD Raster Flow Direction Grid LanduseCatTmp (output table)	COMPMETHOD=CUSTTYPE;CUSTOPNAME=ESRI.APWR.WshpTools.GPToolOp; GPCOMMAND=PercentByZone GlobalWatershed HydroID NLCDRaster VALUE LanduseCatTmp FlowDirGrid; RESULTFIELD=VALUE_11

Name	Definition	Layers	AdditionalParams
OUTLETELEV	Elevation at the outlet in feet.	Watershed Point Raw DEM	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.PointExtractOp; UNITS=FT;EXPRESSION=
OUTLETX	X coordinate of the outlet associated to the drainage area through DrainID in the projection file coordinates system (or in projection of the point feature class if there is no projection file).	Watershed Point Layer with DrainID field Optional. Projection file stored in the ArcHydro\bin directory (e.g. Transverse_Mercator.prj)	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.PointXOp; PROJECTIONFILENAME= Transverse_Mercator.prj
OUTLETY	Y coordinate of the outlet associated to the drainage area through DrainID in the projection file coordinates system (or in projection of the point feature class if there is no projection file).	Watershed Point Layer with DrainID field Optional. Projection file stored in the ArcHydro\bin directory (e.g. Transverse_Mercator.prj)	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.PointYOp; PROJECTIONFILENAME= Transverse_Mercator.prj
PERIMMI	Perimeter in miles.		COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.PerimeterOp; UNITS=MI
PRECIP	Mean annual precipitation at basin centroid in inches.	Centroid (output of related parameter CentroidX), PrecipitationGrid	
PRECIPIN	Mean precipitation in input grid unit.	Rainfall grid	COMPMETHOD=MEAN; APLAYER=WshPrecip
RELIEFFT	Relief in feet (Difference between the maximum and the minimum elevation).	RawDEM	APLAYER=RawDEM; COMPMETHOD=RANGE; UNITS=FT
RELRELFFM	Relative relief in feet per mile, defined as relief divided by perimeter.	RawDEM	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.DerivedParamOp; EQUATION=RELIEFFT/PERIMMI
SLP1085FM	10-85 slope in feet/mile using preprocessed data.	RawDEM Flow Direction grid;DrainageLine Longest Flow Path Adjoint Catchment Catchment; Adjoint Catchment Watershed Point LongestFlowPath3D (output, optional) Slp1085Point (output, optional)	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.LFPathPreproOp; SMOOTH=1; UNITS=FT/MI

Name	Definition	Layers	AdditionalParams
SLP1085FM1	10-85 slope in feet/mile.	RawDEM Flow Direction grid DrainageLine LongestFlowPath3D (output, optional) Slp1085Point (output, optional)	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.LFPathOp; SMOOTH=1; UNITS=FT/MI
SLPFM	Longest flow path slope based on line and DEM. Longest flow path feature already exists and is related to the Drainage Area through DrainID	LongestFlowPath3D RawDEM	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.Slope2DLineOp; UNITS=FT/MI
SLPFM3D	Longest flow path slope in feet per miles using 3D Line.	Longest FlowPath3D	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.Slope3DLineOp; DOWNSTREAMPOINT=0; UPSTREAMPOINT=1; UNITS=FT/MI
SLPPCT	Average slope in percent.	Slope grid in percent	COMPMETHOD=MEAN; APLAYER=WshSlope
SLPPCT30	Percentage of slopes greater than or equal to 30%.	Slope30 grid	COMPMETHOD=PERCENT; APLAYER=WshSlopeGE30
SLPPCT30N	Percentage of slopes facing North and greater than or equal to 30%.	Slope30N grid	COMPMETHOD=PERCENT; APLAYER=WshSlopeGE30N
STREAMVAR	Streamflow variability index at the outlet.	Watershed Point Variability Index grid	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.PointExtractOp
SUMSTREAMS	Total stream length in mile.	Stream layer	COMPMETHOD=CUSTTYPE; CUSTOPNAME= ESRI.APWR.WshpTools.LineLengthOp; UNITS=MI
WATERUSEPCT	Water used at outlet in percent.	WatershedPoint WaterUsePercent Grid	COMPMETHOD=CUSTTYPE; CUSTOPNAME=ESRI.APWR.WshpTools.PointExtractOp

3.2 Default custom operators

AreaOp

This operator converts the area of each selected drainage area feature into the specified unit. If no units are set, the unit of the Drainage Area feature class is used.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.AreaOp;
UNITS=MI2

Available units are:

- KM2
- M2
- HECTARE
- MI2
- FT2
- ACRE

BasinLengthOp

This operator computes the basin length in the specified unit. The Basin Length is defined as the cost path line from the inlet point to the outlet point of a basin traveling through a cost surface that has minimum values toward the center and maximum values at the boundary. Unlike longest flow path, this function does not use the flow direction for the cost path. It uses the geometry to travel through the approximated centroid of the basin.
The cost grid used is a power of the inverse of the Euclidian distance from the boundary (i.e. the cost decreases when the distances from the boundaries increase). The impact of this cost grid may be increased by taking a positive power of this grid (i.e. using cost grid ^2 instead of cost grid). The power defaults to 2 and may be modified in the XML by editing the parameter COSTGRIDPOWER

COMPMETHOD=CUSTTYPE;
CUSTOPNAME=ESRI.APWR.WshpTools.BasinLengthOp;
UNITS=MI;
COSTGRIDPOWER=2

Input layers

- Basin Length Grid
- Longest Flow Path 3D

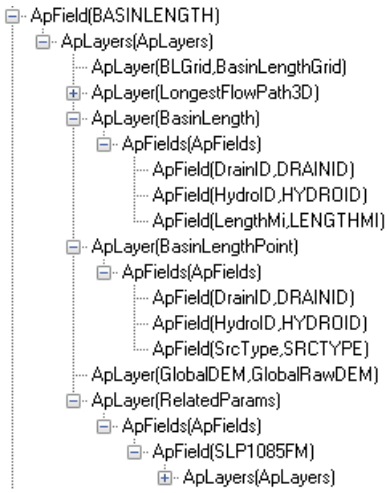
Output layers (optional)

- BasinLength (output, optional)

- BasinLengthPoint (output, optional)

Available units are:

- KM
- M
- MI
- FT



CentroidXOp

This operator computes the X coordinate of the centroid of the input drainage area in the coordinates of the specified input projection file. If no projection file is specified, the X coordinate is provided in the coordinates system of the map.

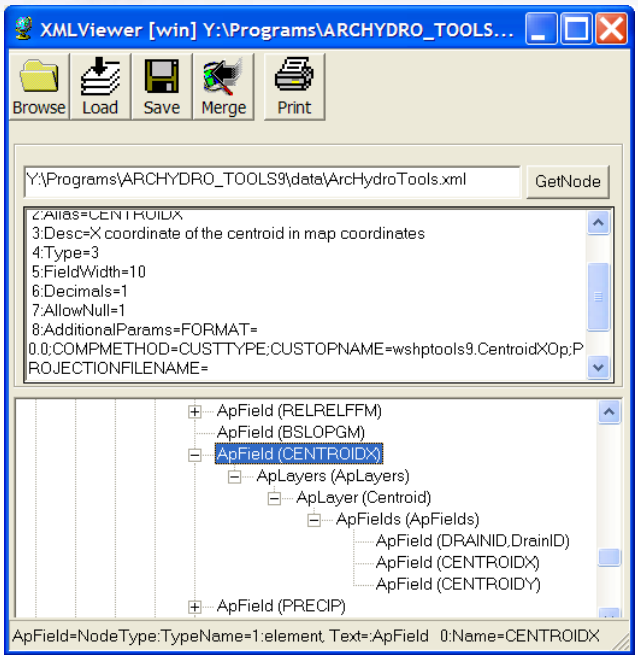
COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.CentroidXOp;
PROJECTIONFILENAME= Transverse_Mercator.prj

Where Transverse_Mercator.prj is stored in the \ArcHydro\bin directory.This parameter is optional and may also be specified as a full path the projection file.

If an output Centroid feature class is specified in the XML for the CENTROIDY parameter, the centroid point will be stored with the following attributes (provided that the corresponding fields are also specified):

- DrainID: HydroID of the corresponding drainage area.
- CentroidX: X coordinate of the Centroid.
- CentroidY: Y coordinate of the Centroid.

The output layer needs to have the tag name Centroid.



Note
If the node corresponding to the Centroid layer is deleted, the X-coordinate is computed but the corresponding Centroid point is not stored.

The parameter ForInput is set to 0 indicating that Centroid is an output layer.

CentroidYOp

This operator computes the Y coordinate of the centroid of the input drainage area in the coordinates of the specified input projection file. If no projection file is specified, the Y coordinate is provided in the coordinates system of the map.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.CentroidYOp;
PROJECTIONFILENAME= Transverse_Mercator.prj

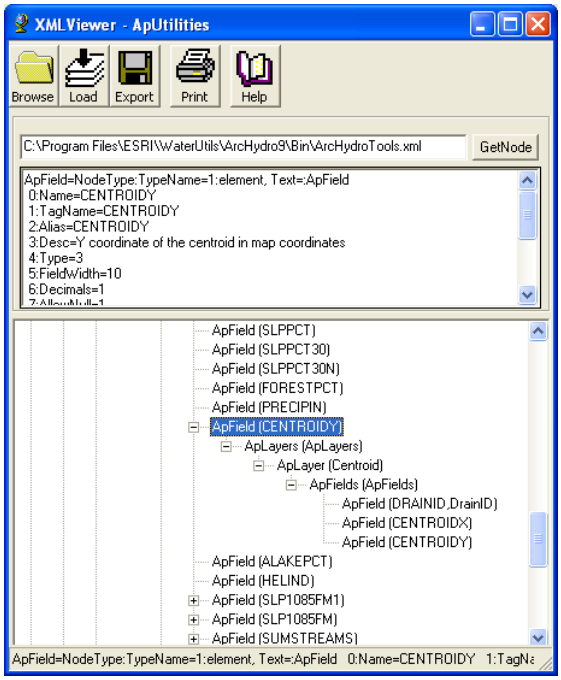
Where Transverse_Mercator.prj is stored in the \ArcHydro\bin directory.This parameter is optional and may also be specified as a full path the projection file.

If an output Centroid feature class is specified in the XML for the CENTROIDY parameter, the centroid point will be stored with the following attributes (provided that the corresponding fields are also specified):

- DrainID: HydroID of the corresponding drainage area.
- CentroidX: X coordinate of the Centroid.

- CentroidY: Y coordinate of the Centroid.

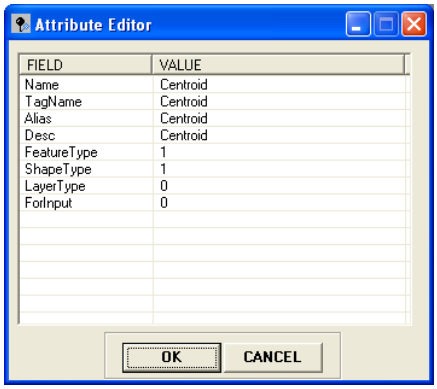
The output layer needs to have the tag name Centroid.



Note

If the node corresponding to the Centroid layer is deleted, the Y-coordinate is computed but the corresponding Centroid point is not stored.

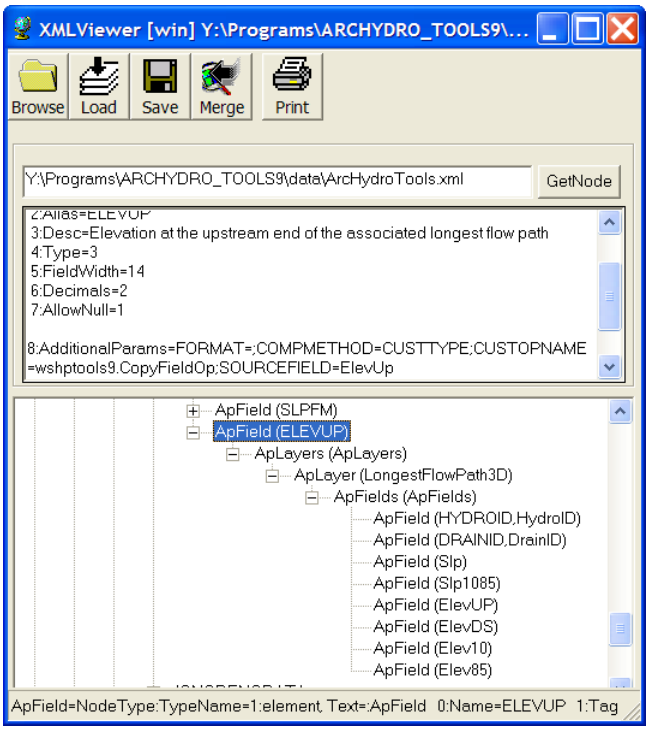
The parameter ForInput is set to 0 indicating that Centroid is an output layer.



CopyFieldOp

This operator copies the value from a field in a layer related through DrainID to the Drainage Area of interest. The source field is defined using SOURCEFIELD in the AdditionalParams, and must also be listed as an ApField of the source layer.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.CopyFieldOp;
SOURCEFIELD=ElevUp



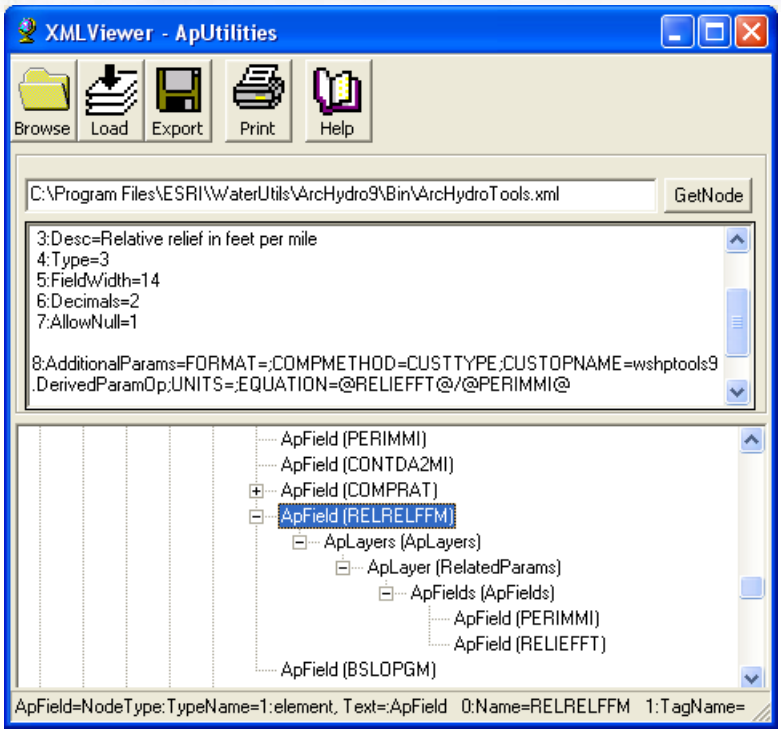
DerivedParamOp

This operator computes a parameter as an expression of other parameters. The supporting parameters and expression need to be defined in the XML with the following structure:

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.DerivedParamOp;
EQUATION=@param1@*10+@param2@/5..., where @ is the parameter delimiter, defined under the node Apfunction(WshParams>ParameterDelimiter). Default value is blank.

The function is replacing the parameter with their value – the delimiter is useful to ensure that the replacements are correctly performed when the parameters have similar names.

The supporting parameters are defined as ApField of the ApLayer tagged “RelatedParams” in the following way:



ElevDiff2DLineOp

This operator computes the difference of values for the input grid between the upstream and the downstream ends of the input line feature. The line feature is related to the Drainage Area through its DrainID. The operator requires as input a line feature class with DrainID and a grid. The tagnames of the line feature class and of the grid do not matter, as the function is looking for a line feature class and a grid.

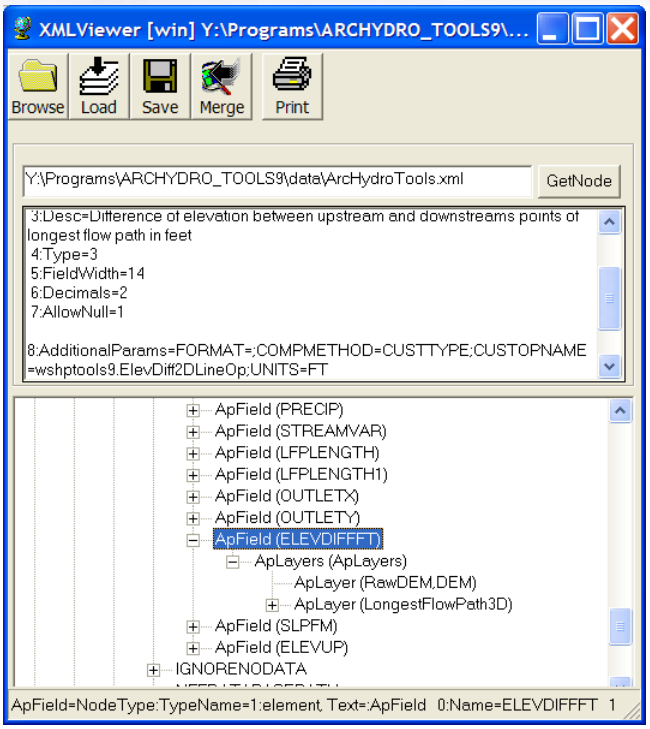
COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.ElevDiff2DLineOp;
UNITS=FT

Input layers

- Line feature class
- DEM

Available units are:

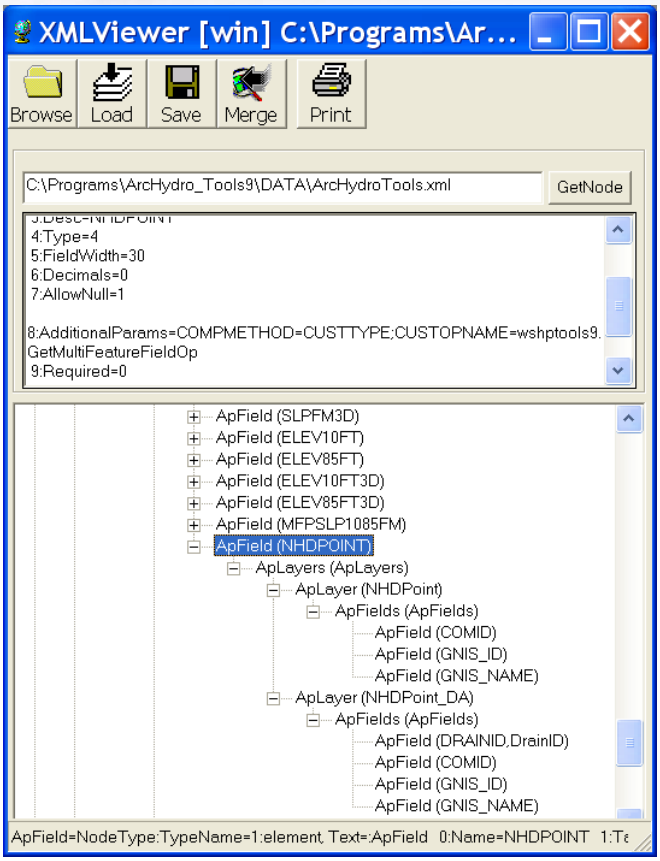
- KM
- M
- MI
- FT



GetMultiFeatureFieldOp

This operator allows retrieving the values from one to many features from an input feature class that intersect the drainage area. The user has the option to save the intersecting features into a new output feature class or to save the records of intersect (without the geometry) into a new output table. It requires as input a feature class and as output a feature class of the same geometry type (and HasZ, HasM attributes) as the input layer or a table, depending on the way the related data should be stored (features or records).
Field Tags required: HydroID in source Drainage Area feature class, DrainID in outptut table/feature class.
Note that the attribute “Required” should be set to 0 for the ApField defined with this operator so that the field does not get created in the attributes table of the Drainage Area feature class.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.GetMultiFeatureFieldOp;
UNITS=MI



GpToolOp

This operator connects to an existing geoprocessing tool, model or script. The operator will retrieve the parameter from the first output generated by the geoprocessing tool/script/model – this output may be a table or a layer. It must contain the HydroID field storing the HydroID of the associated watershed as well as the values of the computed parameters. They are 3 ways to configure this operator:

- Method 1 – 1 parameter defined in XML using RESULTFIELD additional parameter.
- Method 2 – Multiple parameters defined explicitly in the XML configuration using ApLayer(DerivedParams)>ApFields>Field
- Method 3 – Multiple parameters defined using a Lookup table with a Value and an optional FieldName field.

In each case, the configuration must contain the following elements:
COMPMETHOD=CUSTTYPE;
CUSTOPNAME=ESRI.APWR.WshpTools.GPToolOp;

GPCOMMAND=command line used to run the geoprocessing tool/model/script using TagName for the input/output tables and layers. The function will replace the TagName on the fly with the correct tables/layers.

Each TagName must have an associated ApLayer defined under ApField>ApLayers.

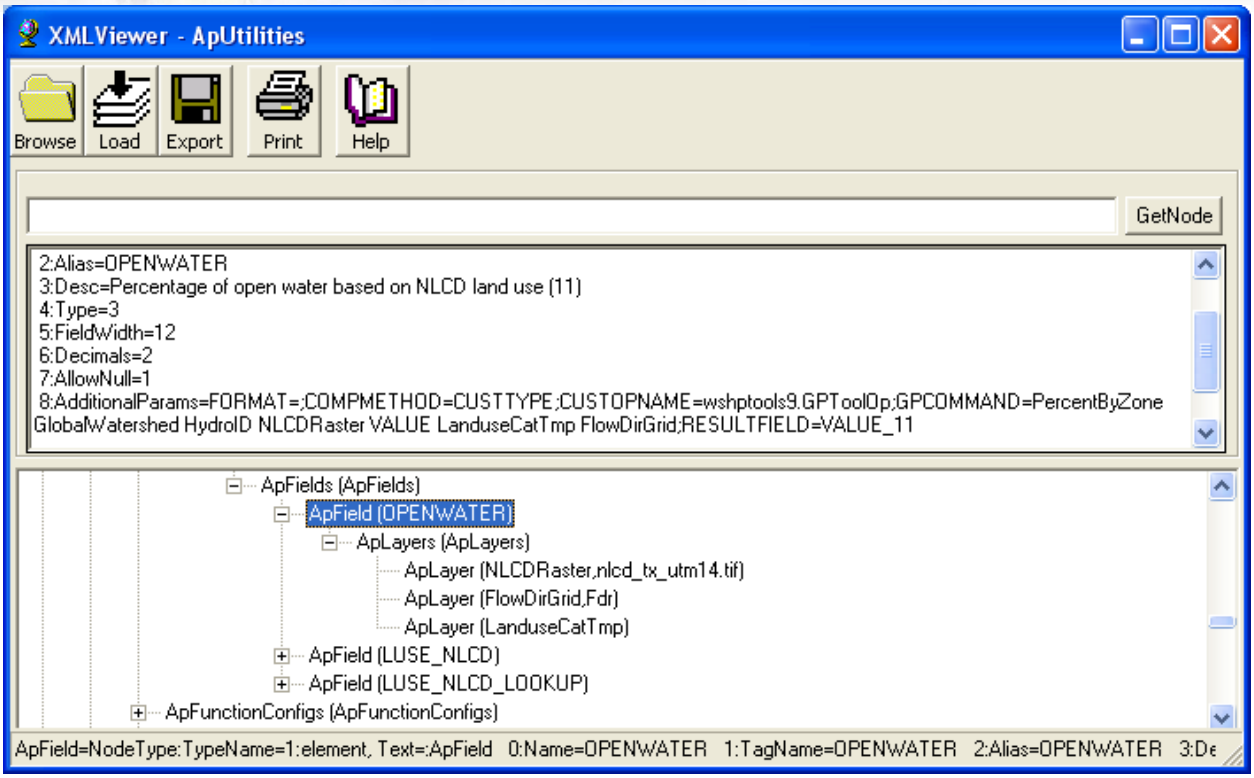
Additional Parameters Definition

Method 1 – Single Parameter	Method 2 – Multiple Parameters defined in XML	Method 3 – Multiple Parameters defined using Lookup Table
COMPMETHOD=CUSTTYPE;		
CUSTOPNAME= ESRI.APWR.WshpTools.GPToolOp;		
GPCOMMAND=command line used to run the geoprocessing tool/model/script using TagName for the input/output tables and layers. The function will replace the TagName on the fly with the correct tables/layers. If the geoprocessing tool requires the GlobalWatershed or DrainageArea as input, either of the tags can be used in the GPCOMMAND – it will be replaced depending on the calling function (local/global) with the Drainage Area or the Global Watershed feature class as appropriate.		
RESULTFIELD= Name of the field in the first output generated by the tool storing the computed parameter. The parameters will be stored in the field named after the ApField		
		LOOKUPTABLE=TagName of the ApLayer used as Lookup table. This ApLayer must have the ApField tagged VALUEFIELD and may have the ApField tagged FIELDNAME defining.

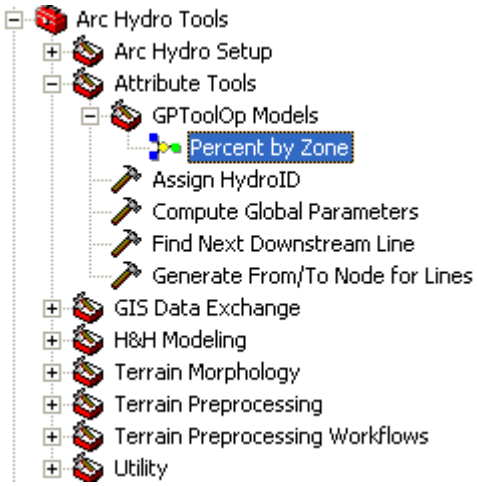
Examples

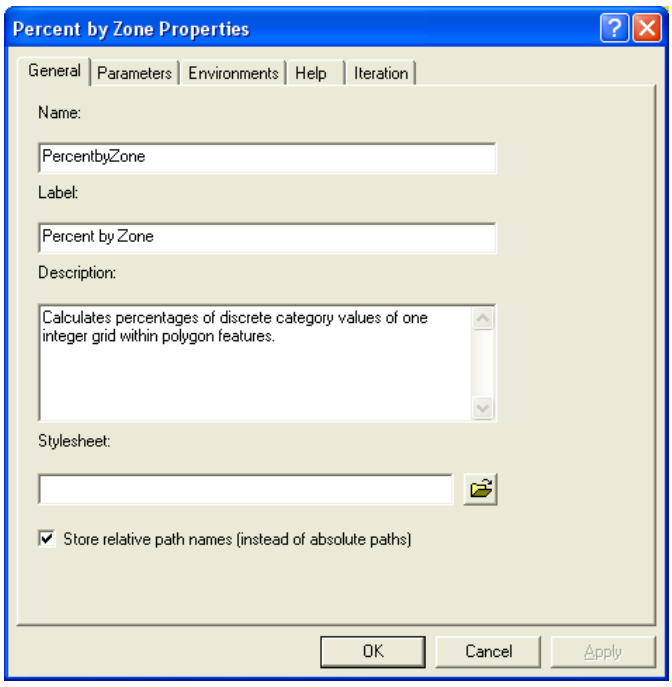
Method 1 – Single parameter defined using RESULTFIELD additional parameters

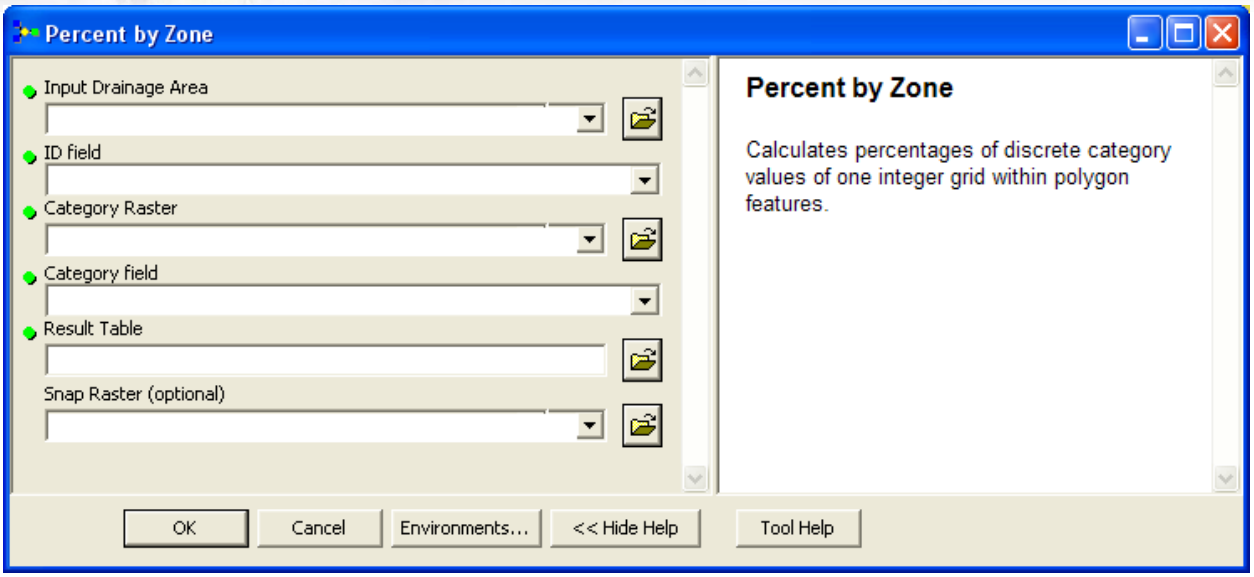
The ApField OPENWATER is defined as the percentage of landuse that is Open Water (i.e. has a value of 11 in the input NLCD raster). The AdditionalParams RESULTFIELD is set to VALUE_11, i.e. the function will retrieve the value from the field VALUE_11 in the output LanduseCatTmp table to populate the field OPENWATER in the attributes table of GlobalWatershed/DrainageArea. If RESULTFIELD is not set, the function will look for fields named using the ApField name, then alias, tagname and description. The function will display a warning if no field meeting on the criteria above is found in the first output of the tool.

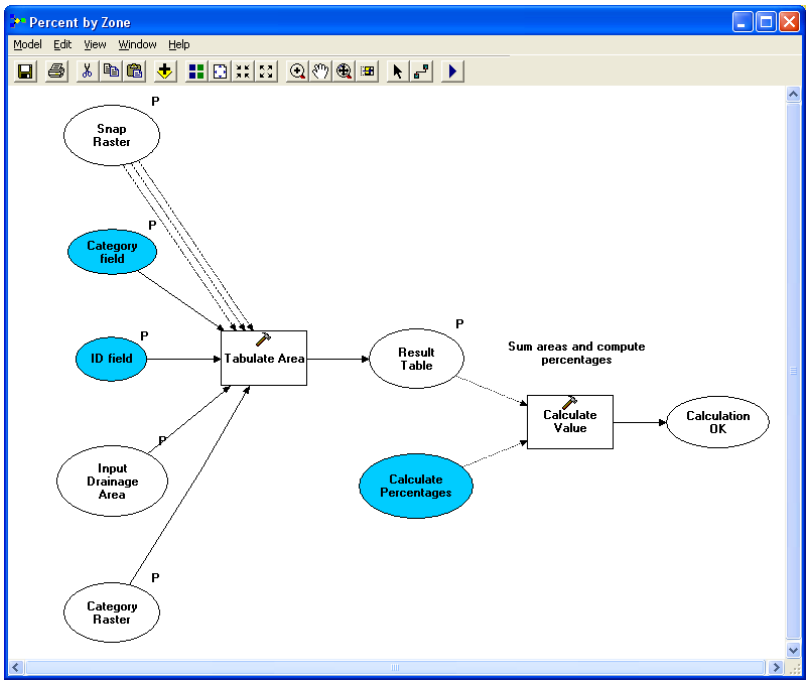


The geoprocessing script used called in this example is called PercentByZone:







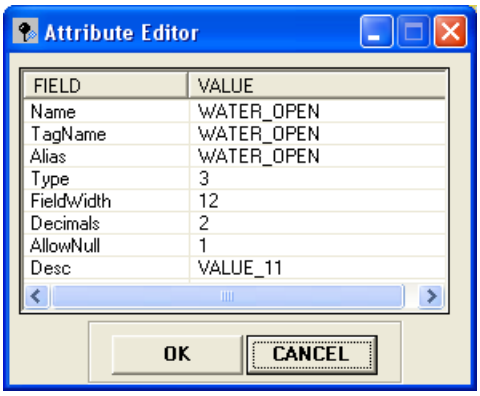


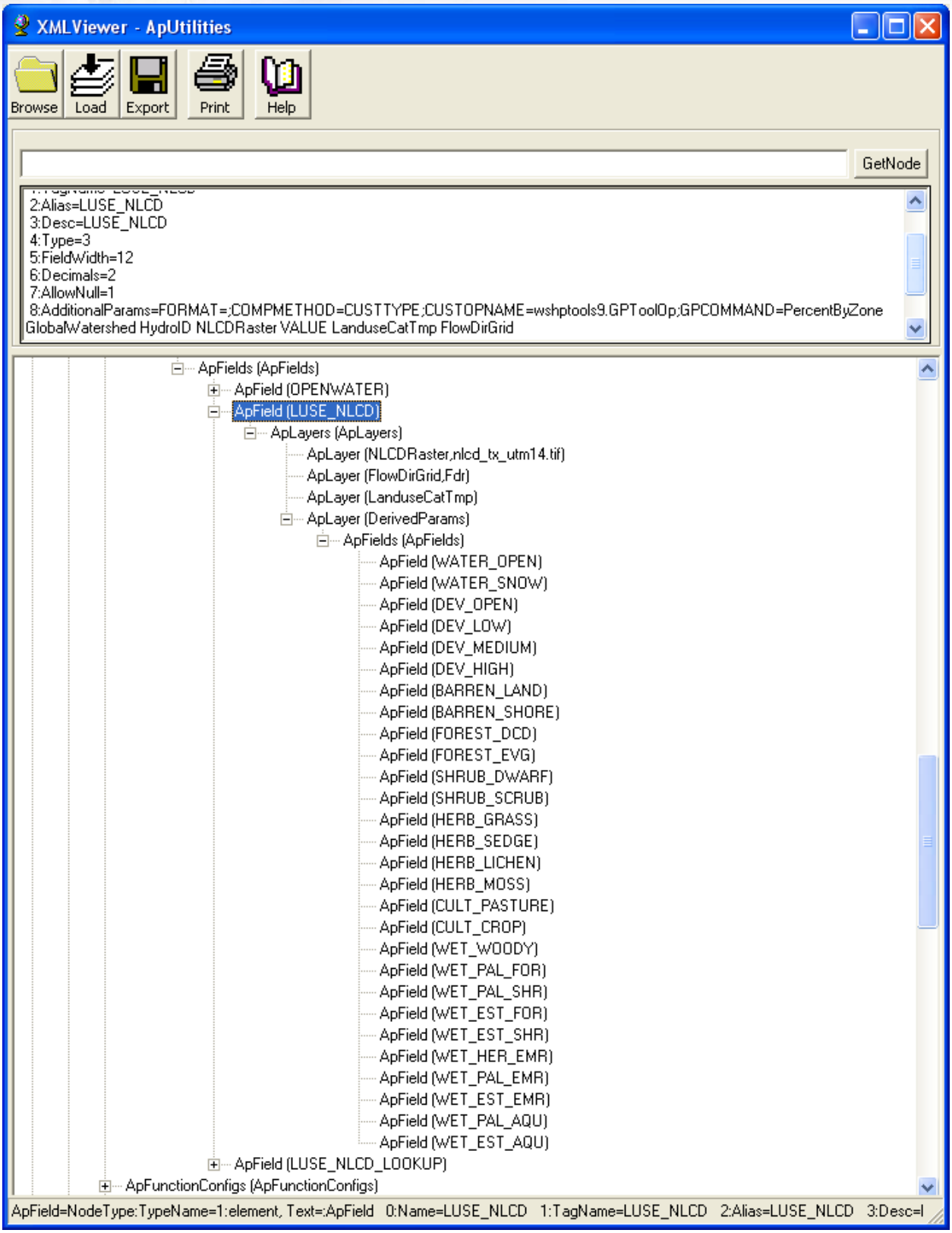
The Result Table output is the first (and only) output parameter and contains the computed parameters as well as the HydroID field of the input GlobalWatershed/DrainageArea feature being processed.

Method 2 – XML Definition

The ApField LUSE_NLCD is used to populate the NLCD landuse fields with the percentage of each landuse. Each landuse that needs to be stored is defined as one ApField under ApField>ApLayers>ApLayer(**DerivedParams**)>ApFields.

The Desc attribute in the ApField is set to the name of the field storing the corresponding value in the first output of the geoprocessing tool/script/model. In the example below, the WATER_OPEN attribute is populated by looking up the value from the field VALUE_11 in the resulting LanduseCatTmp table.



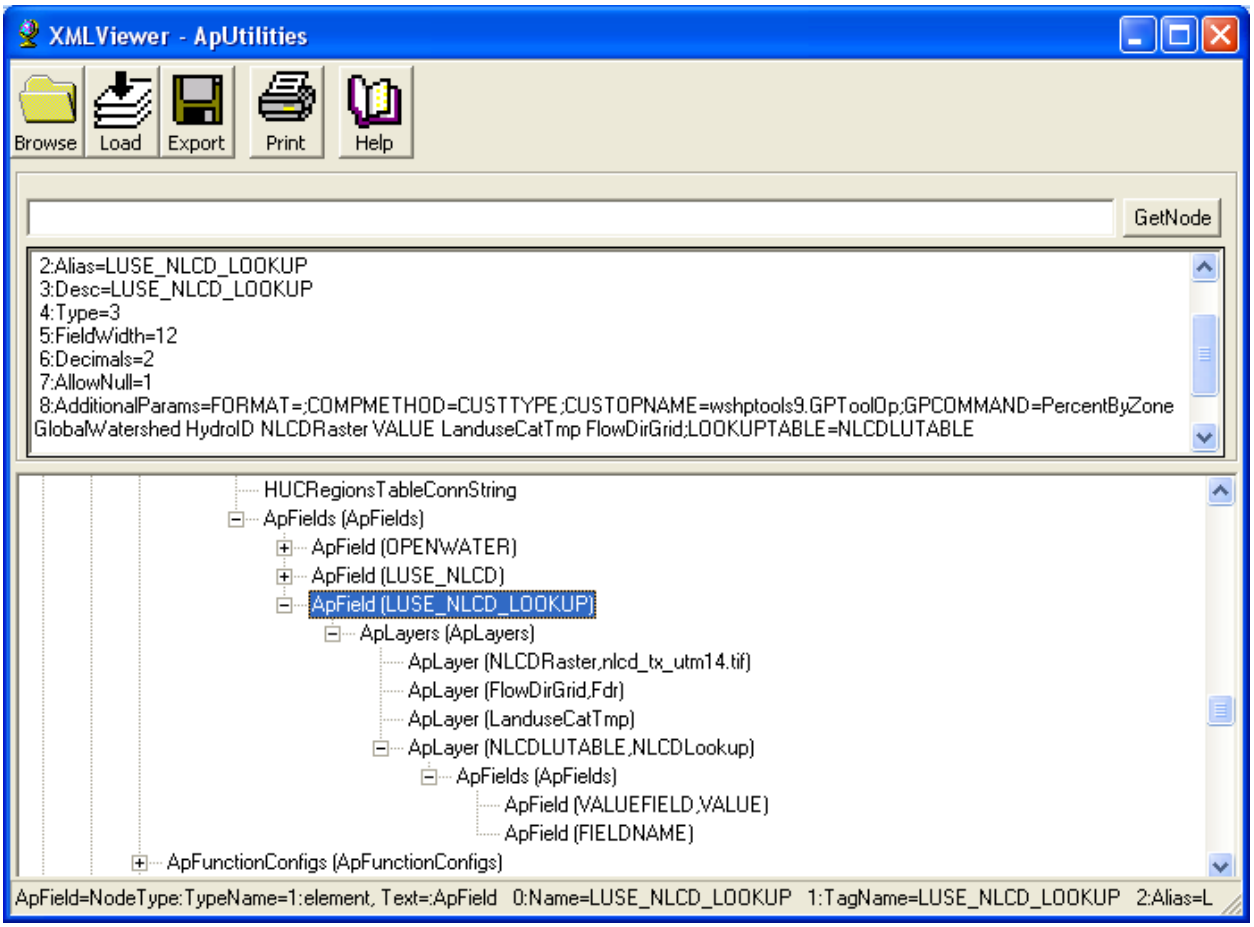

XMLViewer - ApUtilities
Browse
Load
Export
Print
Help
GetNode
2:Alias=LUSE_NLCD
3:Desc=LUSE_NLCD
4:Type=3
5:FieldWidth=12
6:Decimals=2
7:AllowNull=1
8:AdditionalParams=FORMAT=;COMPMETHOD=CUSTTYPE;CUSTOPNAME=wshptools9.GPToolOp;GPCOMMAND=PercentByZone
GlobalWatershed HydroID NLCDRaster VALUE LanduseCatTmp FlowDirGrid
ApFields (ApFields)
ApField (OPENWATER)
ApField (LUSE_NLCD)
ApLayers (ApLayers)
ApLayer (NLCDRaster,nlcd_tx_utm14.tif)
ApLayer (FlowDirGrid,Fdr)
ApLayer (LanduseCatTmp)
ApLayer (DerivedParams)
ApFields (ApFields)
ApField (WATER_OPEN)
ApField (WATER_SNOW)
ApField (DEV_OPEN)
ApField (DEV_LOW)
ApField (DEV_MEDIUM)
ApField (DEV_HIGH)
ApField (BARREN_LAND)
ApField (BARREN_SHORE)
ApField (FOREST_DCD)
ApField (FOREST_EVG)
ApField (SHRUB_DWARF)
ApField (SHRUB_SCRUB)
ApField (HERB_GRASS)
ApField (HERB_SEDGE)
ApField (HERB_LICHEN)
ApField (HERB_MOSS)
ApField (CULT_PASTURE)
ApField (CULT_CROP)
ApField (WET_WOODY)
ApField (WET_PAL_FOR)
ApField (WET_PAL_SHR)
ApField (WET_EST_FOR)
ApField (WET_EST_SHR)
ApField (WET_HER_EMR)
ApField (WET_PAL_EMR)
ApField (WET_EST_EMR)
ApField (WET_PAL_AQU)
ApField (WET_EST_AQU)
ApField (LUSE_NLCD_LOOKUP)
ApFunctionConfigs (ApFunctionConfigs)
ApField=NodeType:TypeName=1:element, Text=:ApField 0:Name=LUSE_NLCD 1:TagName=LUSE_NLCD 2:Alias=LUSE_NLCD 3:Desc=I

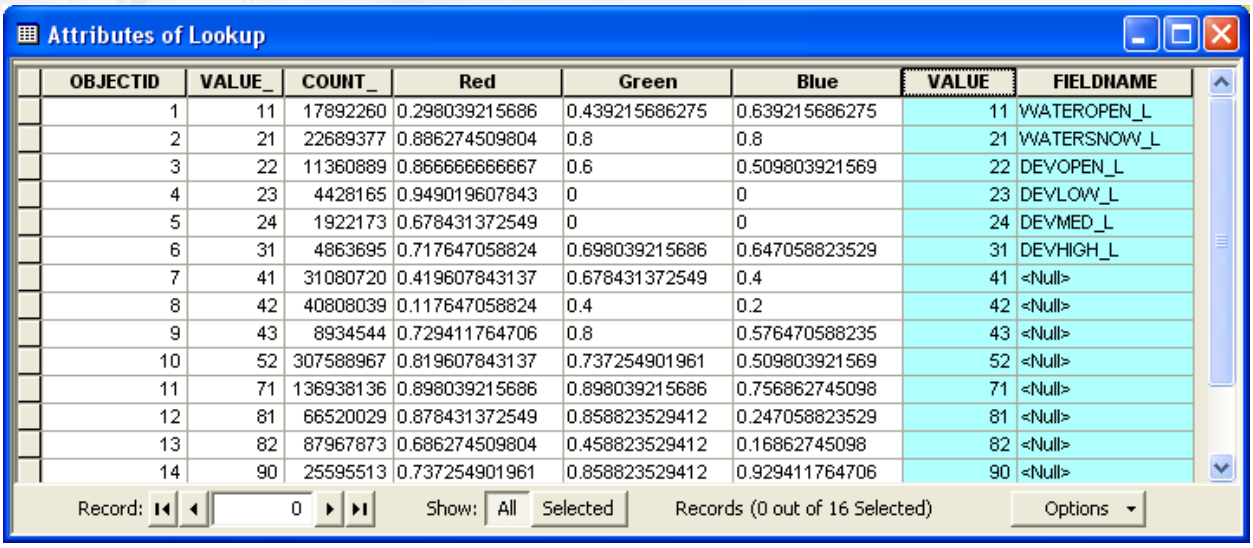
Only the landuse types defined as ApField will be stored in the attributes table of the GlobalWatershed/Drainage Area feature class.

Method 3 – Lookup table (with and without FieldName)

The ApField LUSE_NLCD_LOOKUP allows computing the percentages of NLCD landuses defined in the Lookup table NLCDLookup. The additional parameter LOOKUPTABLE=NLCDLUTABLE indicates that the ApLayer tagged NLCDLUTABLE should be used as lookup table. This ApLayer must have a field defining the values – this field is tagged VALUEFIELD and is named VALUE in the example below. The function will look in the first output of the geoprocessing tool for the fields names VALUE_XX, where XX are the values listed in the VALUE field in the lookup table.

The ApField(FIELDNAME) is an optional field – if not configured or available, the function will store the computed parameters in fields named VALUE_XX. If ApField(FIELDNAME) is configured and populated, the function will store the parameters in fields named after fieldnames in the lookup table.





Attributes of Lookup

OBJECTID	VALUE_	COUNT_	Red	Green	Blue	VALUE	FIELDNAME
1	11	17892260	0.298039215686	0.439215686275	0.639215686275	11	WATEROPEN_L
2	21	22689377	0.886274509804	0.8	0.8	21	WATERSNOW_L
3	22	11360889	0.866666666667	0.6	0.509803921569	22	DEVOPEN_L
4	23	4428165	0.949019607843	0	0	23	DEVLOW_L
5	24	1922173	0.678431372549	0	0	24	DEVMED_L
6	31	4863695	0.717647058824	0.698039215686	0.647058823529	31	DEVHIGH_L
7	41	31080720	0.419607843137	0.678431372549	0.4	41	<Null>
8	42	40808039	0.117647058824	0.4	0.2	42	<Null>
9	43	8934544	0.729411764706	0.8	0.576470588235	43	<Null>
10	52	307588967	0.819607843137	0.737254901961	0.509803921569	52	<Null>
11	71	136938136	0.898039215686	0.898039215686	0.756862745098	71	<Null>
12	81	66520029	0.878431372549	0.858823529412	0.247058823529	81	<Null>
13	82	87967873	0.686274509804	0.458823529412	0.16862745098	82	<Null>
14	90	25595513	0.737254901961	0.858823529412	0.929411764706	90	<Null>

Record: 0 Show: All Selected Records (0 out of 16 Selected) Options

If FIELDNAME exists and is populated, only the VALUEs with a corresponding FIELDNAME will be stored in the attributes table of the GlobalWatershed/DrainageArea in fields named after the FIELDNAME. The type and length of these fields is set using the properties of the parent ApField.

LFPathOp

This operator computes the 10-85 slope in the specified units, and generate the associated longest flow path and 10-85 points.

It requires as input the following layers:

- RawDEM
- Flow Direction grid
- DrainageLine

2 output layers are generated if they are specified in the XML:

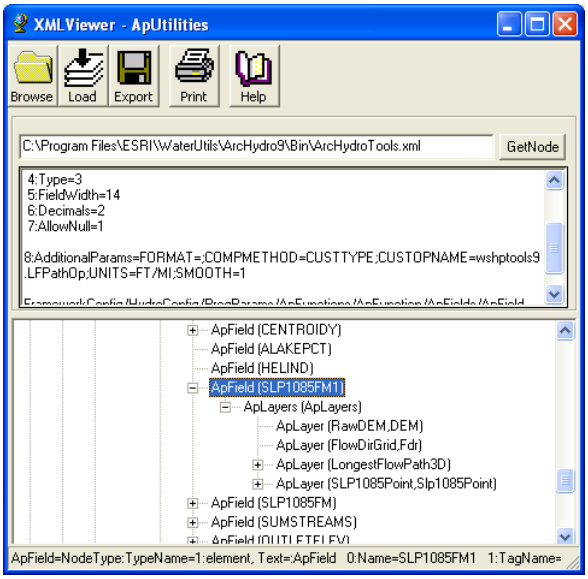
- LongestFlowPath3D (output, optional)
  - DrainID
  - Slp1085
  - Slp
  - ElevUP
  - ElevDS
  - Elev10
  - Elev85

- Slp1085Point (output, optional)
  - Name
  - DrainID
  - Elev

The LongestFlowPath3D feature is smoothed if the SMOOTH parameter is set to any value (e.g. SMOOTH=1) except 0. The smoothing does not occur only if SMOOTH=0.

Available Units

- FT/MI
- M/KM



LFPathPreproOp

This operator computes the 10-85 slope in the specified unit, and generate the associated longest flow path and 10-85 points using preprocessed data to speed up the process. In works like the previous operator but requires additional input layers.

Input layers

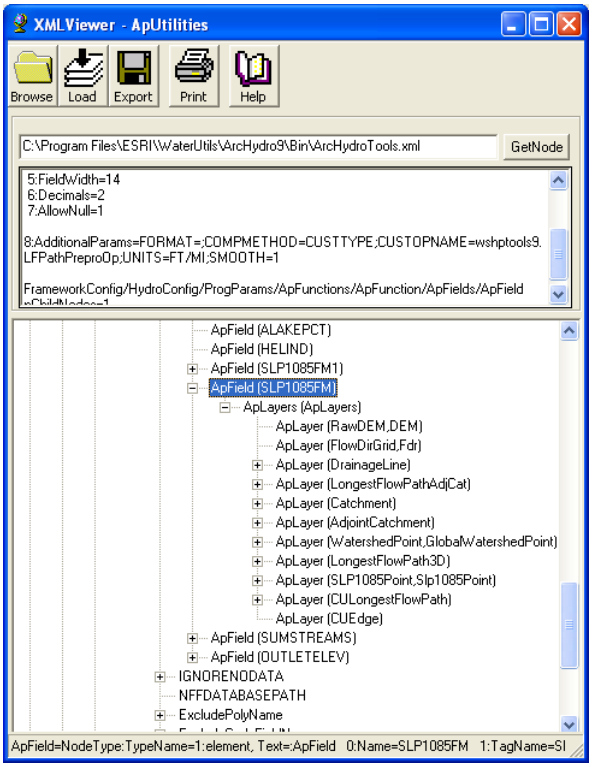
- RawDEM
- Flow Direction grid
- DrainageLine
- Longest Flow Path Adjoint Catchment
- Catchment
- Adjoint Catchment
- Watershed Point

Output layers (optional)

- LongestFlowPath3D (output, optional)
- Slp1085Point (output, optional)

Available Units

- FT/MI
- M/KM



Note
The layers CULongestFlowPath and CUEdge are not required to compute the local 10-85 slope. They are used to compute the global parameter.

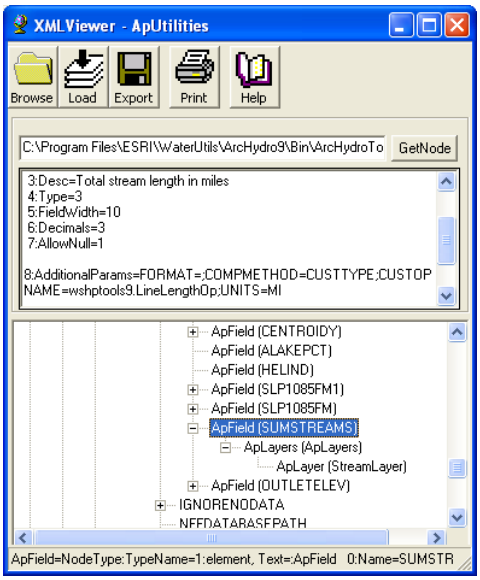
LineLengthOp

This operator computes the total length of all lines or partial lines from the specified input line layer that are within a drainage area and converts it into the specified unit. It requires as input a line feature class (e.g. Streamlayer). The tagname of the line feature class does not matter, as the function is looking only for a line feature class.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.LineLengthOp;
UNITS=MI

Available units are:

- KM
- M
- MI
- FT



MainFlowPathOp

This operator generates the 3D main flow path associated to the drainage area and calculates its 10-85 slope in the specified unit. The resulting line will be smoothed so that elevations along the line decrease in the digitized direction is the parameter SMOOTH is set to 1. The CELLTHRESHOLD parameter defines the location on the stream (flow accumulation value in number of cells) from where the main flow path will be extended to the boundary

COMPMETHOD=CUSTTYPE;
CUSTOPNAME=ESRI.APWR.WshpTools.MainFlowPathOp;
UNITS=FT/MI;
SMOOTH=1;
CELLTHRESHOLD=450

Input layers

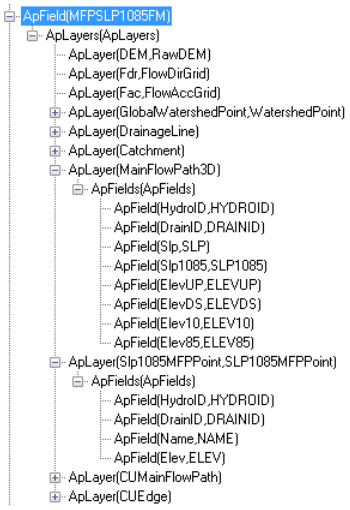
- RawDEM
- Flow Direction grid
- Flow Accumulation grid
- Watershed Point
- DrainageLine
- Catchment
- Adjoint Catchment

Output layers (optional)

- MainFlowPath3D (output, optional)
- Slp1085MFPPoint (output, optional)

Available Units

- FT/MI
- M/KM



PerimeterOp

This operator computes the perimeter of the drainage in the specified unit.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.PerimeterOp;
UNITS=MI

Available units are:

- KM
- M
- MI
- FT

Point2DLineOp

This operator extracts the elevation from an input DEM at the specified location along the line associated to the drainage area through the DrainID/HydroID relationship. The location of the point is specified using the parameter POINT that is defined as the ratio along the line length starting from the from node of the line in the digitized direction.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME=ESRI.APWR.WshpTools.Point2DLineOp;

POINT=0.1;
UNITS=FT

Input layers

- Line feature class
- DEM

Available units are:

- KM
- M
- MI
- FT

Point3DLineOp

This operator extracts the elevation from a 3D line at the specified location along the line associated to the drainage area through the DrainID/HydroID relationship. The location of the point is specified using the parameter POINT that is defined as the ratio along the line length starting from the from node of the line in the digitized direction.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME=ESRI.APWR.WshpTools.Point3DLineOp;
POINT=0.1;
UNITS=FT

Input layers

- 3D Line feature class

Available units are:

- KM
- M
- MI
- FT

PointExtractOp

This operator extract the value of a raster at a point linked to the input drainage area through the DrainID/HydroID relationship. The HydroID of the drainage area is stored in the DrainID of the related point. This operator may be used for example to compute the elevation at the outlet of the watershed (parameter OUTLETELEV).

This function requires 2 inputs:

1. raster layer storing the value to retrieve

2. point feature class with the DrainID field.

Any tag name can be used to setup these layers as the function is looking for a raster and point feature class, not for specific tag names.

Note
If there is more than one point related to the input drainage area through the DrainID/HydroID, the first point found is used.

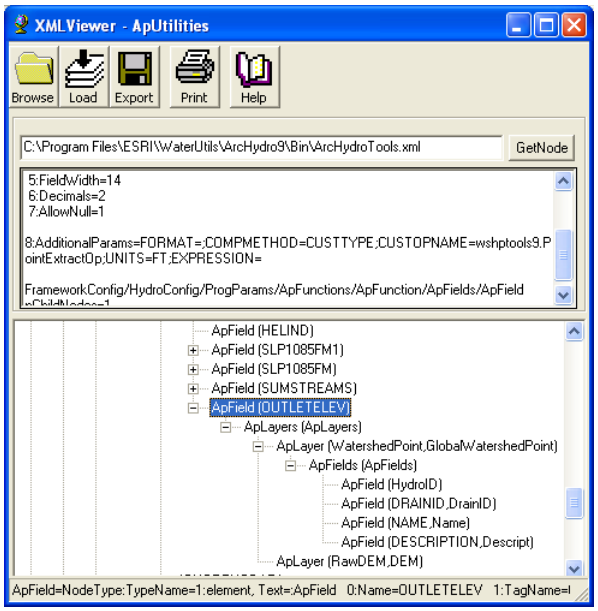
The operator retrieves the value at the first point found and performs a unit conversion if a unit has been specified in AdditionalParams.

The Expression attributes allows adding a value to the parameter computed after unit conversion:

- EXPRESSION=1: add 1 to the converted value
- EXPRESSION=-2: subtract 2 from the converted value

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.PointExtractOp;
UNITS=FT;
EXPRESSION=

The 2 input layers are set as ApLayer belonging to the ApLayers collection associated to the parameter. The point feature class contains the ApField (belonging to ApFields) DrainID.

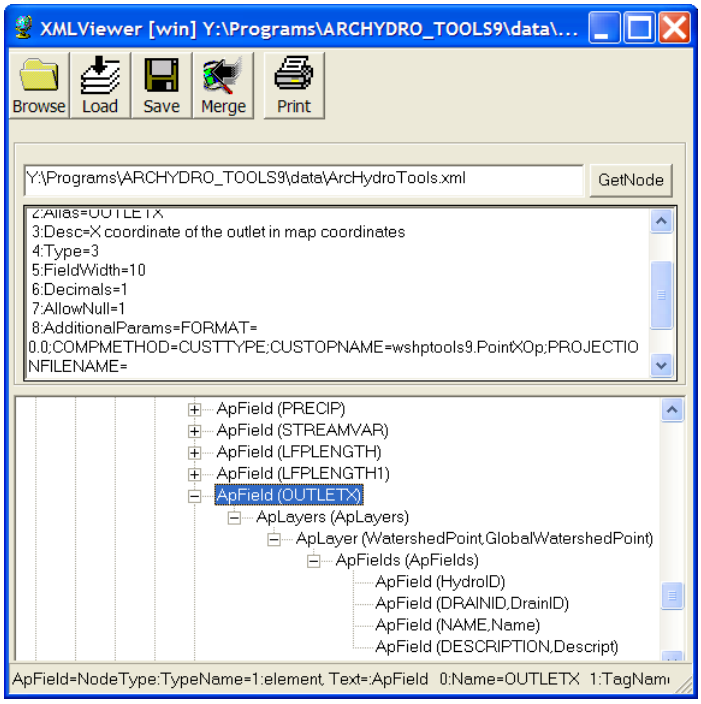


PointXOp

This operator computes the X coordinate of the point associated to the drainage area through the DrainID in the coordinates of the specified input projection file. If no projection file is specified, the X coordinate is provided in the coordinates system of the point feature class

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.PointXOp;
PROJECTIONFILENAME= Transverse_Mercator.prj

Where Transverse_Mercator.prj is stored in the \ArcHydro\bin directory.This parameter is optional and may also be specified as a full path the projection file.

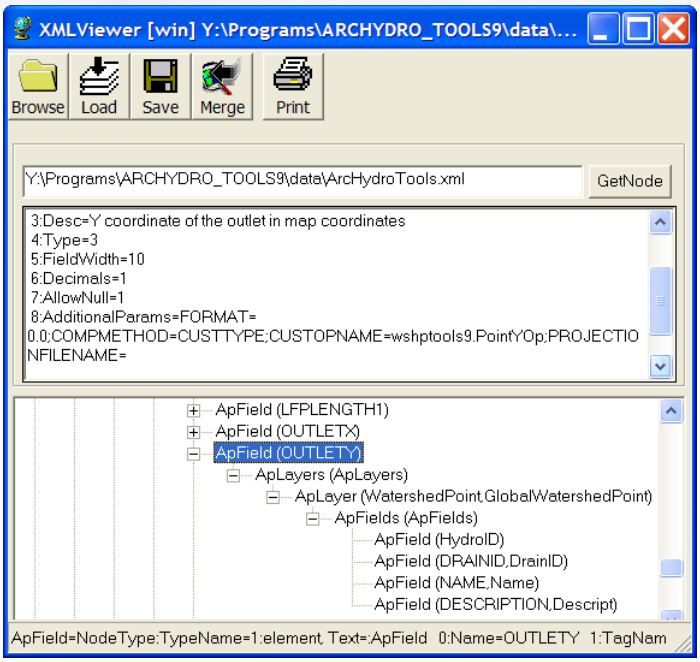


PointYOp

This operator computes the Y coordinate of the point associated to the drainage area through the DrainID in the coordinates of the specified input projection file. If no projection file is specified, the Y coordinate is provided in the coordinates system of the point feature class

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.PointYOp;
PROJECTIONFILENAME= Transverse_Mercator.prj

Where Transverse_Mercator.prj is stored in the \ArcHydro\bin directory.This parameter is optional and may also be specified as a full path the projection file.



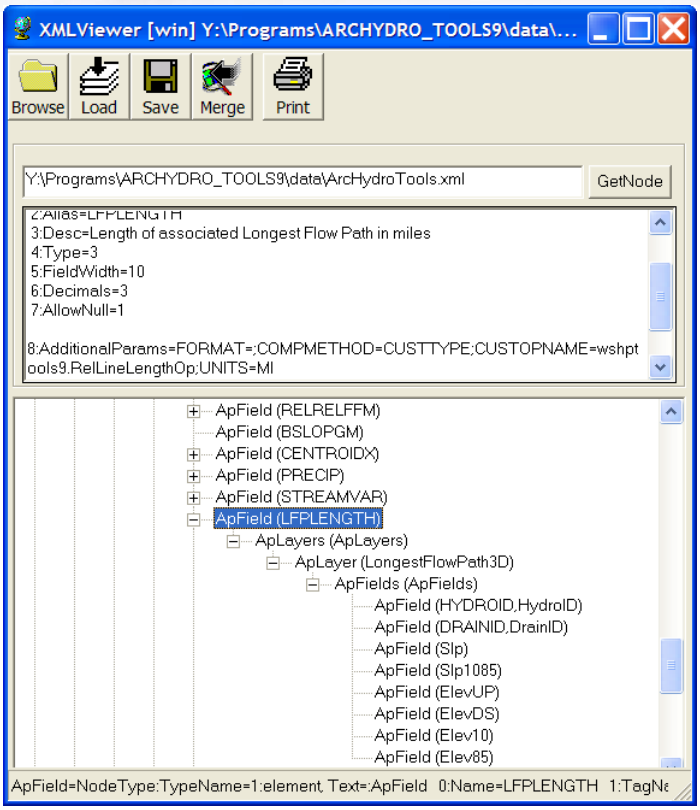
RelLineLengthOp

This operator computes the total length of the line feature related to the drainage area through the DrainID and converts it into the specified unit. It requires as input a line feature class (e.g. Streamlayer). The tagname of the line feature class does not matter, as the function is looking only for a line feature class with a DrainID field.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.RelLineLengthOp;
UNITS=MI

Available units are:

- KM
- M
- MI
- FT



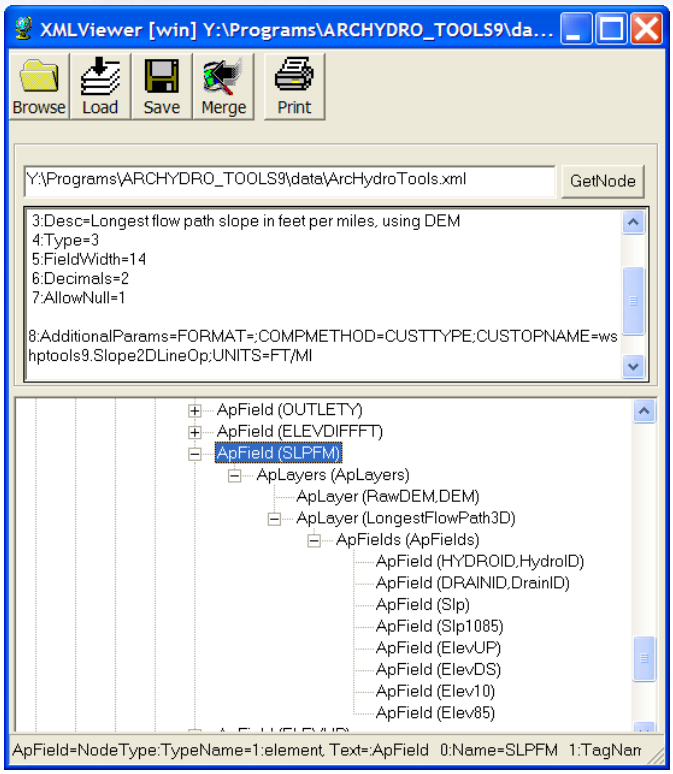
Slope2DLineOp

This operator computes the slope of the line feature related to the drainage area through the DrainID using elevation extracted from the input DEM and converts it into the specified unit. It requires as input a line feature class and a DEM grid. The tagname of the line feature class and of the DEM grid do not matter, as the function is looking only for a line feature class with a DrainID field and a grid.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME= ESRI.APWR.WshpTools.Slope2DLineOp;
UNITS=FT/MI

Available Units

- FT/MI
- M/KM



Slope3DLineOp

This operator computes the slope between the specified points of the line feature related to the drainage area through the DrainID using elevation extracted from the input 3D Line. It converts the slope into the specified unit. It requires as input a line feature class. The tagname of the line feature class does not matter, as the function is looking only for a line feature class with a DrainID field. The location of the upstream and downstean ponts are specified as a ratio of the line length. 0 indicates the from node or dowmstream end of the line in the digitized direction and 1 the to node or upstream end of the line in the digitized direction.

COMPMETHOD=CUSTTYPE;
CUSTOPNAME=ESRI.APWR.WshpTools.Slope3DLineOp;
DOWNSTREAMPOINT=0;
UPSTREAMPOINT=1;
UNITS=FT/MI

Available Units

- FT/MI
- M/KM