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.

🔮 Select Parameters	
🔽 Select all parameters	
V ALAKEPCT	[Percent of area covered by lakes and ponds - requires 'Lake' grid (O-no lake,
📝 AREA2MI	[Area in square miles]
J BASINLENGTH	[Basin Length in miles]
SLOPGM	[Mean basin slope, dimensionless, based on slope percent grid]
CENTROIDX	[X coordinate of the centroid in map coordinates]
CENTROIDY	[Y coordinate of the centroid in map coordinates]
COMPRAT	[Compactness ratio, dimensionless]
CONTDA2MI	[Area that contributes flow to a point on a stream, in square miles]
V ELEV1OFT	[Elevation at 10 percent from outlet along Longest flow path slope in feet per
ELEV10FT3D	[Elevation at 10 percent from outlet along Longest flow path slope in feet per
📝 ELEV85FT	[Elevation at 85 percent from outlet along Longest flow path slope in feet per
📝 ELEV85FT3D	[Elevation at 85 percent from outlet along Longest flow path slope in feet per
ELEVDIFFFT	[Difference of elevation between upstream and downstreams points of longest f.
V ELEVFT	[Average elevation in feet - requires 'DEM' grid with vertical units defined]
V ELEVMAXFT	[Maximum elevation in feet - requires 'DEM' grid with vertical units defined] $ imes$
	OK Cancel

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.



🔮 XMLViewer - ApUtilities		
		GetNode
Name=ApField, NodeType=Element(1)Base XPath=FrameworkConfig/HydroConfig/Progl Field 0:Name=ELEVFT 1:TagName=ELEVFT	URI= Params/ApFunctions/ApFur	action/ApFields/Ap
	MI) FFT)	•
ApField(EL ApField(EL	Delete	
	Сору	
ApField(SL ApField(SL	Paste	
→ ApField(SL → ApField(FO → ApField(PF ⊕ ApField(CE	EditAttributes EditText InsertNode	
ApField(AL ApField(HE	SaveToFile	_
ApField(SLP10)	85FM1)	E
⊕ ApField(SLP10) ⊕ ApField(SLMS)	B5FM) (BEAMS)	
⊕ ApField(OUTLE	TELEV)	
ApField(AREA2	MI)	
Aphield(PERIM Aphield(CONTE	MIJ DA2MIT	
⊕ ApField(COMPF	RAT)	
Aprield(RELRE	LFFM)	-
		.::

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.





	VALUE .		
Name	ELEVFT		
TagName	ELEVFT		
AliasName	ELEVFT		
Desc	Average elevation in feet - requires 'DEM' grid with vertical units defined		
Туре	3		
FieldWidth	14		
Decimals	2		
AllowNull	1		
AdditionalParams	FORMAT=;COMPMETHOD=MEAN;UNITS=FT		
•			
ΟΚ			

Figure 2-4 Attributes of ApField Node

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

🔮 Edit		- • •
AttributeName:	Value:	
Name	ELEVM	
Apply to child nodes		OK Cancel

- 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]



🔮 Select Parameters	
Select all parameters	
V ELEV85FT3D	[Elevation at 85 percent from o 🔺
V ELEVDIFFFT	[Difference of elevation betwee
V ELEVFT	[Average elevation in feet - re
V ELEVMAXFT	[Maximum elevation in feet - re
V ELEVMINFT	[Minimum elevation in feet - re 🗏
ELEVMTAG	[Average elevation in meters]
V ELEVUP	[Elevation at the upstream end
V FORESTPCT	[Percent of area covered by for
V HELIND	[High Elevation Index - Percent
V LFPLENGTH	[Length of associated Longest F
V LFPLENGTH1	[Length of associated Longest F $\overline{}$
	OK Cancel

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.

🔮 Compute Local Parameters 🛛 🛛 💌			
Drainage Area	Watershed	•	
	<u>H</u> elp <u>C</u> ancel		

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

🔮 Compute Loca	l Parameters	×
Raw DEM	dem	•
<u></u> K	<u>H</u> elp <u>C</u> ancel	

• 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.



Ta	ble							□ ×
0	🖽 + 碧 + 唱 🚱 🖸 💩 🗙							
W	atershed							×
	Shape *	OID *	Shape_Length	Shape_Area	HydrolD	Name	ELEVFT	ELEVM Alias
Þ	Polygon	1	80	300	1	Name 1	≺Null≻	<null></null>
	Polygon	2	39520	38181100	3	Name 2	2126.960352	648.2659
I ← ← 1 → → I 🗐 🚍 (1 out of 2 Selected)								
Ŵ	/atershed							

• 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".

Layer Properties		
General Source Selection Display Symbology Fields Image: Im	Definition Query Labels J	oins & Relates Time HTML Popup
Choose which fields will be visible Shape OID Shape_Length HydroID Name ELEVFT ELEVFT ELEVM Alias	 Appearance Alias Highlight Number Format Read-Only Field Details Data Type Name Precision Scale Allow NULL Values 	ELEVM Alias No Numeric No Double ELEVM 0 0 Ves
	ОК	Cancel Apply

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
Туре	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).

🔮 Attributes of ApFie	ld 🗖 🗖 💌
FIELD	VALUE
TagName	ELEVMTAG
AliasName	ELEVM Alias
Desc	Average elevation in meters
Туре	3
FieldWidth	14
Decimals	2
AllowNull	1
AdditionalParams	FORMAT=;COMPMETHOD=MEAN;UNITS=M
Name	ELEVM
•	4 III
	ОК

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	Optional.
	CentroidYOp	Parameter used with CENTROIDXY, CENTROIDY,
	PointXOp	OUTLETX, OUTLETY. Define the name of the projection
	PointYOp	file used for the X/Y coordinate. Defined as
		PROJECTIONFILENAME =Transverse_Mercator.prj. The
		file is located under the Archydro\bin directory.
SMOOTH	LFPathOp	SMOOTH=1: resulting 3D Longest Flow Path feature class
	LFPPathPreproOp	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.



LUOKUPTABLE	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.

🔮 Attributes of ApFie	ld 🗖 🖬 💌
FIELD	VALUE
Name	SLPPCT
TagName	SLPPCT
AliasName	SLPPCT
Desc	Average area slope in percent
Туре	3
FieldWidth	12
Decimals	3
AllowNull	1
AdditionalParams	FORMAT=;DATASET=WshSlope;APLAYER=WshSlope;COMPMETHOD=MEAN
	ОК



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).

🔮 XMLViewer - ApUtilities	- • •
	GetNode
Name=ApLayer, NodeType=Element(1) BaseURI= XPath=FrameworkConfig/HydroConfig/ProgParams/ApFunctions/ApFunction// ApLayers/ApLayer 0:Name=DEM 1:TagName=RawDEM 2:AliasName=RawDEM 3:Desc=Raw DEM 4:FeatureType=1 5:ShapeType=1 6:LayerType=1 7:TargetLocation= 8:TargetDataset= 9:ForInput=1	ApFields/ApField/
	×
ApFields(ApFields) ApField(AREA2MI) ApField(AREA2MI) ApField(RELIEFFT)	
	.::

🔮 Attributes of ApLa	yer 🗖 📼 💌
FIELD	VALUE
Name	DEM
TagName	RawDEM
AliasName	RawDEM
Desc	Raw DEM
FeatureType	1
ShapeType	1
LayerType	1
TargetLocation	
TargetDataset	
ForInput	1
•	II
	ОК

• 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:

🔮 Select Parameters	
Select all parameters	
ALAKEPCT	[Percent of area covered by lakes and ponds - requires 'Lake' grid (0-no lake, 1-lake)]
🔽 AREA2MI	[Area in square miles]
BASINLENGTH	[Basin Length in miles]
SLOPGM BSLOPGM	[Mean basin slope, dimensionless, based on slope percent grid]
CENTROIDX	[X coordinate of the centroid in map coordinates]
CENTROIDY	[Y coordinate of the centroid in map coordinates]
COMPRAT	[Compactness ratio, dimensionless]
CONTDA2 MI	[Area that contributes flow to a point on a stream, in square miles]
V ELEV10FT	[Elevation at 10 percent from outlet along Longest flow path slope in feet per miles, using DEM]
V ELEV10FT3D	[Elevation at 10 percent from outlet along Longest flow path slope in feet per miles, using 3D line]
V ELEV85FT	[Elevation at 85 percent from outlet along Longest flow path slope in feet per miles, using DEM]
V ELEV85FT3D	[Elevation at 85 percent from outlet along Longest flow path slope in feet per miles, using 3D line]
V ELEVDIFFFT	[Difference of elevation between upstream and downstreams points of longest flow path in feet]
V ELEVFT	[Average elevation in feet - requires 'DEM' grid with vertical units defined]
V ELEVMAXFT	[Maximum elevation in feet - requires 'DEM' grid with vertical units defined]
V ELEVMINFT	[Minimum elevation in feet - requires 'DEM' grid with vertical units defined]
V ELEVUP	[Elevation at the upstream end of the associated longest flow path]
FORESTPCT	[Percent of area covered by forest - requires 'Forest' grid (0-no forest, 1-forest)]
FILIND HELIND	[High Elevation Index - Percent of area with elevation > 1200 ft - requires 'HighElevation' grid (0-
V LFPLENGTH	[Length of associated Longest Flow Path in miles]
V LFPLENGTH1	[Length of associated Longest Flow Path in miles with computation of LFP]
V LUSE NLCD	[Percentages of Landuse based on NLCD (XML)]
V LUSE NLCD LOOKUP	[Percentages of Landuse based on NLCD (Lookup)]
MFPSLP1085FM	[Main flow path 10-85 slope in feet per mile]
V NHDPOINT	[NHDPoint features located within the drainage area]
OPENWATER	[Percentage of open water based on NLCD land use (11)]
V OUTLETELEV	[Elevation at outlet in Feet]
V OUTLETX	[X coordinate of the outlet in map coordinates]
V OUTLETY	[Y coordinate of the outlet in map coordinates]
V PERIMMI	[Perimeter in miles]
V PRECIP	[Mean annual precipitation at basin centroid in inches]
V PRECIPIN	[Mean annual precipitation in inches - requires 'Precipitation' grid with values in inches]
RELIEFFT	[Relief in feet - requires 'DEM' grid with vertical units defined]
RELRELFFM	[Relative relief in feet per mile]
SLP1085FM	[LFP 10-85 slope in feet per mile based on preprocessed data]
SLP1085FM1	[10-85 slope in feet per mile without preprocessed data]
SLPFM	[Longest flow path slope in feet per miles, using DEM]
SLPFM3D	[Longest flow path slope in feet per miles using 3D Line]
SLPPCT	[Average area slope in percent]
SLPPCT30	[Percent of area with slope greater than 30%]
SLPPCT3ON	[Percent of area with slope greater than 30% and facing North]
V STREAMVAR	[Streamflow variability index at the outlet]
V SUMSTREAMS	[Total stream length in miles]
VATERUSEPC T	[Water used at outlet in percent]
	OK Cancel



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



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



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

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

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Name	Definition	Layers	AdditionalParams
OUTLETELEV	Elevation at the outlet in feet.	Watershed Point	COMPMETHOD=CUSTTYPE;
		Raw DEM	CUSTOPNAME= ESRI.APWR.WshpTools.PointExtractOp;
			UNITS=FT;EXPRESSION=
OUTLETX	X coordinate of the outlet associated	Watershed Point Layer with DrainID	COMPMETHOD=CUSTTYPE;
	to the drainage area through DrainID	field	CUSTOPNAME= ESRI.APWR.WshpTools.PointXOp;
	in the projection file coordinates	Optional. Projection file stored in the	PROJECTIONFILENAME= Transverse_Mercator.prj
	system (or in projection of the point	ArcHydro\bin directory (e.g.	
	feature class if there is no projection	Transverse_Mercator.prj)	
	file).		
OUTLETY	Y coordinate of the outlet associated	Watershed Point Layer with DrainID	COMPMETHOD=CUSTTYPE;
	to the drainage area through DrainID	field	CUSTOPNAME= ESRI.APWR.WshpTools.PointYOp;
	in the projection file coordinates	Optional. Projection file stored in the	PROJECTIONFILENAME= Transverse_Mercator.prj
	system (or in projection of the point	ArcHydro\bin directory (e.g.	
	feature class if there is no projection	Transverse_Mercator.prj)	
	file).		
PERIMMI	Perimeter in miles.		COMPMETHOD=CUSTTYPE;
			CUSTOPNAME = ESRI.APWR.WshpTools.PerimeterOp;
DDECID	Management and the state of the state		UNITS=MI
PRECIP	Mean annual precipitation at basin	Centroid (output of related parameter	
DDECIDIN	Centroid in inches.	Centroida), PrecipitationGrid	COMPMETHOD MEAN
PRECIPIN	Mean precipitation in input grid unit.	Kainiali grid	COMPMETHOD=MEAN;
DELIGEET	Delief in feet (Difference between the	DewDEM	ADLAVED-DowDEM
KELIEFFI	maximum and the minimum	KawDEM	APLA I EK=KaWDEW;
	alevation)		UNITS_FT
DEL DEL EEM	Relative relief in feet per mile defined	PawDEM	COMPMETHOD-CUSTTVPE
KELKELITWI	as relief divided by perimeter	KawDEM	CUSTOPNAME-
	us feller divided by perilleter.		ESRI APWR WshnTools DerivedParamOn
			EOUATION=RELIEFFT/PERIMMI
SLP1085FM	10-85 slope in feet/mile using	RawDEM	COMPMETHOD=CUSTTYPE:
52110001101	preprocessed data.	Flow Direction grid:DrainageLine	CUSTOPNAME=
	r r	Longest Flow Path Adjoint Catchment	ESRI.APWR.WshpTools.LFPathPreproOp;
		Catchment; Adjoint Catchment	SMOOTH=1;
		Watershed Point	UNITS=FT/MI
		LongestFlowPath3D (output, optional)	
		Slp1085Point (output, optional)	

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Name	Definition	Layers	AdditionalParams
SLP1085FM1	10-85 slope in feet/mile.	RawDEM	COMPMETHOD=CUSTTYPE;
		Flow Direction grid	CUSTOPNAME= ESRI.APWR.WshpTools.LFPathOp;
		DrainageLine	SMOOTH=1;
		LongestFlowPath3D (output, optional)	UNITS=FT/MI
		Slp1085Point (output, optional)	
SLPFM	Longest flow path slope based on	LongestFlowPath3D	COMPMETHOD=CUSTTYPE;
	line and DEM. Longest flow path	RawDEM	CUSTOPNAME=
	feature already exists and is related		ESRI.APWR.WshpTools.Slope2DLineOp;
	to the Drainage Area through		UNITS=FT/MI
	DrainID		
SLPFM3D	Longest flow path slope in feet per	Longest FlowPath3D	COMPMETHOD=CUSTTYPE;
	miles using 3D Line.		CUSTOPNAME=ESRI.APWR.WshpTools.Slope3DLineO
			p;
			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	Slope30 grid	COMPMETHOD=PERCENT;
	equal to 30%.		APLAYER=WshSlopeGE30
SLPPCT30N	Percentage of slopes facing North	Slope30N grid	COMPMETHOD=PERCENT;
	and greater than or equal to 30%.		APLAYER=WshSlopeGE30N
STREAMVAR	Streamflow variability index at the	Watershed Point	COMPMETHOD=CUSTTYPE;
	outlet.	Variability Index grid	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	COMPMETHOD=CUSTTYPE;
		WaterUsePercent Grid	CUSTOPNAME=ESRI.APWR.WshpTools.PointExtractOp

Missing?

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)

Arc Hydro Configuration Doc. #2

Local Parameters Configuration



Available units are:

- KM
- M
- MI
- FT

- ApField(BASINLENGTH) ApLayers(ApLayers) --- ApLayer(BLGrid,BasinLengthGrid) ▲ ApLayer(LongestFlowPath3D) ApLayer(BasinLength) 🚊 ApFields(ApFields) ApField(DrainID, DRAINID) ApField(HydroID,HYDROID) --- ApField(LengthMi,LENGTHMI) ApLayer(BasinLengthPoint) . apFields(ApFields) - ApField(DrainID,DRAINID) ApField(HydroID,HYDROID) ApField(SrcType,SRCTYPE) ApLayer(GlobalDEM,GlobalRawDEM) - ApLayer(RelatedParams) - ApField(SLP1085FM) ApLayers(ApLayers)

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.

P	Attribute	Editor	
	FIELD		VALUE
٩	Name		Centroid
I	TagName		Centroid
A	Alias		Centroid
	Desc		Centroid
F	FeatureType		1
9	ShapeType		1
L	.ayerType		0
F	ForInput		0
			i i i i i i i i i i i i i i i i i i i
			OK CANCEL



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	Method 3 – Multiple Parameters			
	defined in XML	defined using Lookup Table			
	COMPMETHOD=CUSTTYPE;				
CUSTO	PNAME= ESRI.APWR.WshpTools.GP	ToolOp;			
GPCOMMAND=command line used t	to run the geoprocessing tool/model/scrip	pt using TagName for the input/output			
tables and layers. The function will rep	place the TagName on the fly with the co	orrect tables/layers. If the			
geoprocessing tool requires the Global	Watershed or DrainageArea as input, ei	ither of the tags can be used in the			
GPCOMMAND – it will be replaced of	lepending on the calling function (local/	global) with the Drainage Area or the			
Global Watershed feature class as appr	Global Watershed feature class as appropriate.				
RESULTFIELD= Name of the field	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:

	Percent by Zone Properties	? 🔀
	General Parameters Environments Help Iteration	
	Name:	
	PercenthuZone	
🖻 🚳 Arc Hydro Tools		
🗄 💩 Arc Hydro Setup	Percent by Zone	
🖻 🔕 Attribute Tools	Description:	
	Calculates percentages of discrete category values of one	
Percent by Zone		
Assign HydroiD	· · · · · · · · · · · · · · · · · · ·	
Find Next Downstream Line	Stylesheet:	
Generate From/To Node for Lines		
🕀 💩 GIS Data Exchange		
🕀 🔕 H&H Modeling	✓ Store relative path names (instead of absolute paths)	
🕀 🥸 Terrain Morphology		
Terrain Preprocessing		
Terrain Preprocessing Workflows	OK Cancel	Apply
🛨 🚫 Utility		

- Contraction	(as) as		
Percent by Zone			
 Input Drainage Area 	· · · · · · · · · · · · · · · · · · ·	Percent b	y Zone
• ID field		Calculates p values of one	ercentages of discrete category e integer grid within polygon
 Category Raster 	 -	features.	
Category field Pecult Table	•		
Spap Dacter (optional)	🗃		
onap Kaster (optional)			



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.

🐕 Attribute Edito	r 📃 🗖 🔀					
	VALUE					
Name	WATER OPEN					
TagName	WATER OPEN					
Alias	WATER_OPEN					
Туре	3					
FieldWidth	12					
Decimals	2					
Desc	VALUE 11					
<						
OK CANCEL						

Local Parameters Configuration 🔮 XMLViewer - ApUtilities Export Print Browse Load 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 (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) Description Configs (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.



I 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></null>	
	8	42	40808039	0.117647058824	0.4	0.2	42	<null></null>	
	9	43	8934544	0.729411764706	0.8	0.576470588235	43	<null></null>	
	10	52	307588967	0.819607843137	0.737254901961	0.509803921569	52	<null></null>	
	11	71	136938136	0.898039215686	0.898039215686	0.756862745098	71	<null></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></null>	~
	Record: III 0 III 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

Local Parameters Configuration

- 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; Local Parameters Configuration

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.

XMLViewer [win] Y:\Programs\ARCHYDRO_TOOLS9\data\	
Browse Load Save Merge Print	
Y:\Programs\ARCHYDR0_T00LS9\data\ArcHydroTools.xml	GetNode
2/Allas=UTLE IX 3/Desc=X coordinate of the outlet in map coordinates 4/Type=3 5/FieldWidth=10 6/Decimals=1 7/AllowNull=1 8/AdditionalParams=FORMAT= 0.0/COMPMETHOD=CUSTTYPE;CUSTOPNAME=wshptools9.PointXOp;PROJECTIO NFILENAME=	
ApField (PRECIP) ApField (STREAMVAR) ApField (LFPLENGTH) ApField (LFPLENGTH1) ApField (UTLETX) ApLayers (ApLayers) ApLayer (WatershedPoint GlobalWatershedPoint) ApField (HydroID) ApField (DPANID_DrainID) ApField (NAME,Name) ApField (DESCRIPTION,Descript)	
ApField=NodeType:TypeName=1:element,Text=:ApField_0:Name=OUTLETX_1:TagNam	

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.

XMLViewer [win] Y:\Programs\ARCHYDRO_TOOLS9\data\... 8 Browse Load Save Merge Print Y:\Programs\ARCHYDR0_T00LS9\data\ArcHydroTools.xml GetNode 3:Desc=Y coordinate of the outlet in map coordinates ^ 4:Type=3 5:FieldWidth=10 6:Decimals=1 7:AllowNull=1 8:AdditionalParams=FORMAT= 0.0;COMPMETHOD=CUSTTYPE;CUSTOPNAME=wshptools9.PointYOp;PROJECTIO VFILENAME= ¥ + ApField (LFPLENGTH1) ~ ApField (OUTLETX) ÷ ApField (OUTLETY) - ApLayers (ApLayers) - ApLayer (WatershedPoint GlobalWatershedPoint) ApFields (ApFields) ApField (HydroID) ApField (DRAINID, DrainID) ApField (NAME,Name) ApField (DESCRIPTION, Descript) ApField=NodeType:TypeName=1:element,Text=:ApField_0:Name=OUTLETY_1:TagNam

Local Parameters Configuration

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 downstream 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