

Arc Hydro: Self and Esri Training Opportunities

Christa Campbell & Dean Djokic



Connecting with Esri Water Resources

Christa Campbell



Water Resources Team

Industry Solutions



Christa
Campbell



Mariah
Salazar

Business Development / Sales



Derek
Lorbiecki



James
Filloramo

Core Development



Steve
Kopp



Nawajish
Noman

Living Atlas



Caitlin
Scopel



Gonzalo
Espinoza

Professional Services



Dean
Djokic



Gina
O'Neil



Christine
Dartiguenave



Zichuan
Ye



Ezra Bosworth-
Ahmet



Paul
Burgess

Training
Services...

Conferences

Esri's hydro experts will be supporting several events this year with an exhibit and / or presentations.

- National Mitigation of Ecosystem Banking, May 2 - 6
- Association of State Floodplain Managers Conference, May 15 - 19
- AWRA Geospatial Water Technology Conference, May
- AWRA Annual Water Resources Conference, November 7 - 9

Connect with our team to ask questions and share your work.



Navigating Esri Web Sites

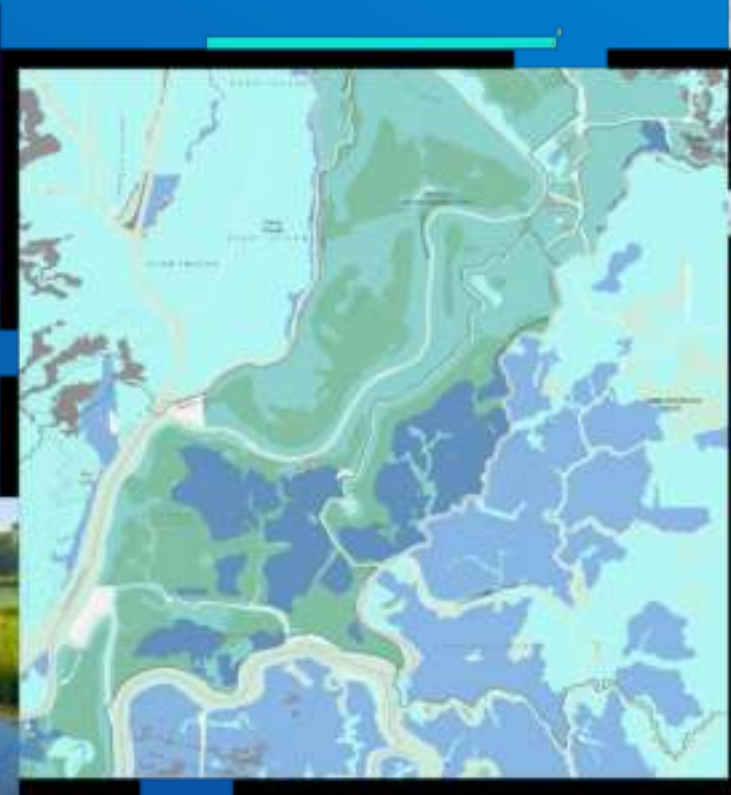
Finding information on Esri websites

- Water Resources
- Arc Hydro



Water Resources
web page

Arc Hydro
web page



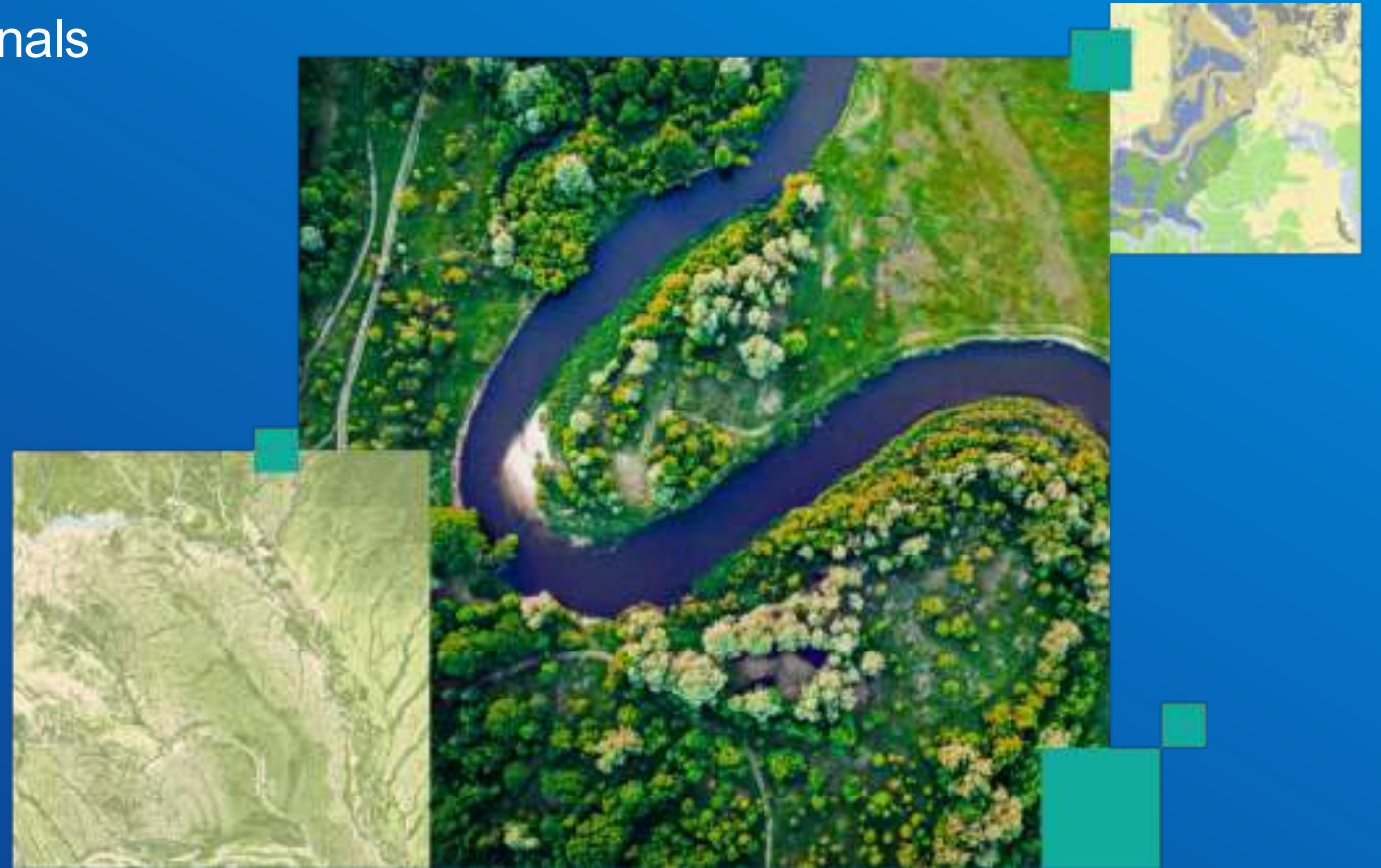
Esri Water Resources Community

Connecting with industry professionals

- Online Q&A
- Blogs
- Videos
- Technical documents



Water Resources
Community



Water Resources Office Hours (Virtual)

Esri's hydro experts host virtual office hours to discuss common water resources workflows and answer questions.

- April 21, 2022
- June 16, 2022
- August 18, 2022
- September 15, 2022

Join us to ask questions, contribute to the community, and vote on Office Hour topics.



Esri Water
Meetup

Esri UC: Hydro Meeting (In person)

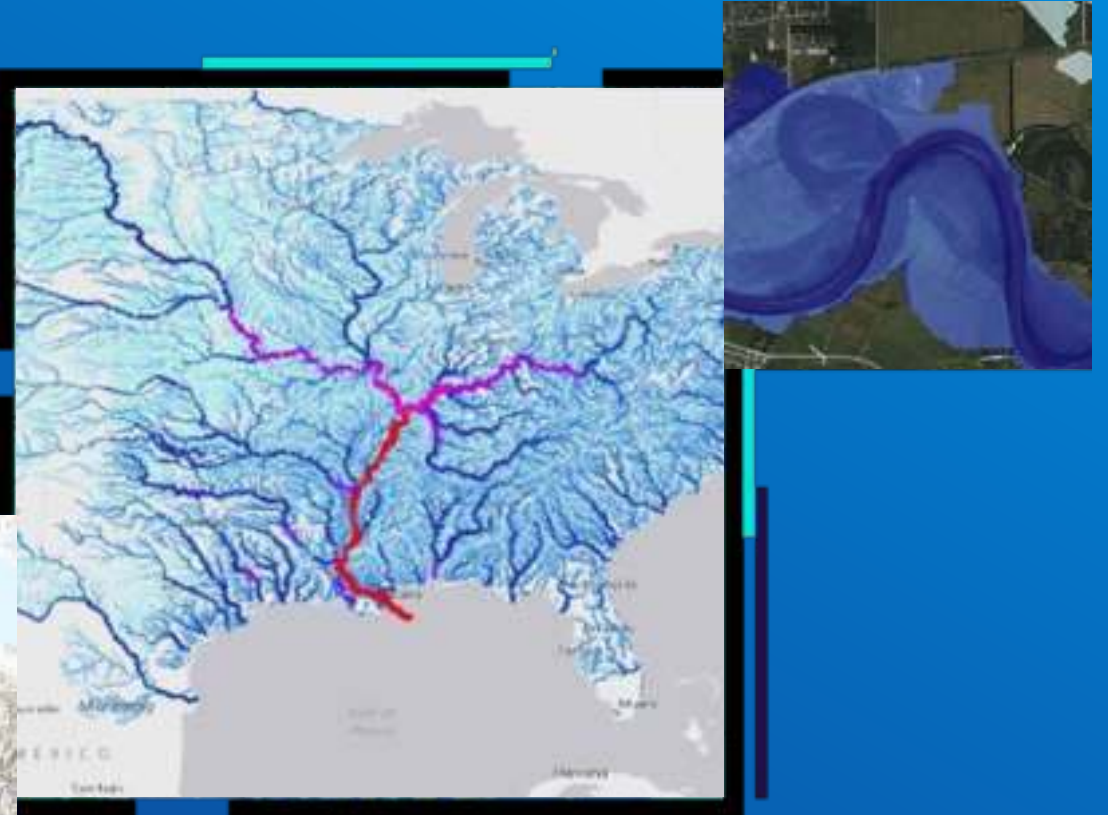
Save the Date – Sunday, July 10, 2022

Topics will include:

- Hydrology tools in Spatial Analyst
- Hillslope tools
- Hydro content in the Living Atlas...and more



Esri Water
Meetup



Stay Connected with Esri's Water Team



@EsriWater



Esri Water Resources



Esri Water Meetup



Esri Water eNewsletter

We're here to support your learning journey.

Whether you're brand-new to ArcGIS or a seasoned GIS professional who wants to master the latest technology, we have resources to help you achieve your goals.



Options for Individuals

Do you want to get started making maps and apps, apply advanced analysis tools, or automate your GIS workflow? We've got you covered with hundreds of options on these topics and dozens more.

[Learn More](#)



Options for Organizations

Your teams create products and services that give you a competitive advantage. Equip them with the GIS technology skills they need to achieve your strategic goals.

[Learn More](#)

Esri Training

Christa Campbell

Customized Training for You & Your Organization

Work with Esri training consultants to identify training needs

Build a training plan based on those needs

- Individual plans
- Team plans




E-Learning options

Training for Organizations



- Grow user skills, productivity, and confidence.
- Ensure sustainable GIS workflows and operations.
- Expand the use of ArcGIS maps and apps across your organization.
- Communicate the strategic impact of your GIS program and workforce.

Training for Individuals

 <h4>Instructor-Led Training</h4> <p>Master essential concepts, ArcGIS best practices, and recommended workflows in classes created and taught by Esri subject matter experts. Attend class at a training center or online.</p>	 <h4>Unlimited E-Learning Access</h4> <p>All customers who have a qualifying product with a current Esri maintenance subscription enjoy unlimited, organization-wide access to our large collection of self-paced e-learning.</p>	 <h4>Esri Technical Certification</h4> <p>Whether you're a GIS professional, an application developer, or an enterprise administrator, achieving an Esri technical certification can help you gain confidence, inspire trust, and stand out from the crowd.</p>
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Training

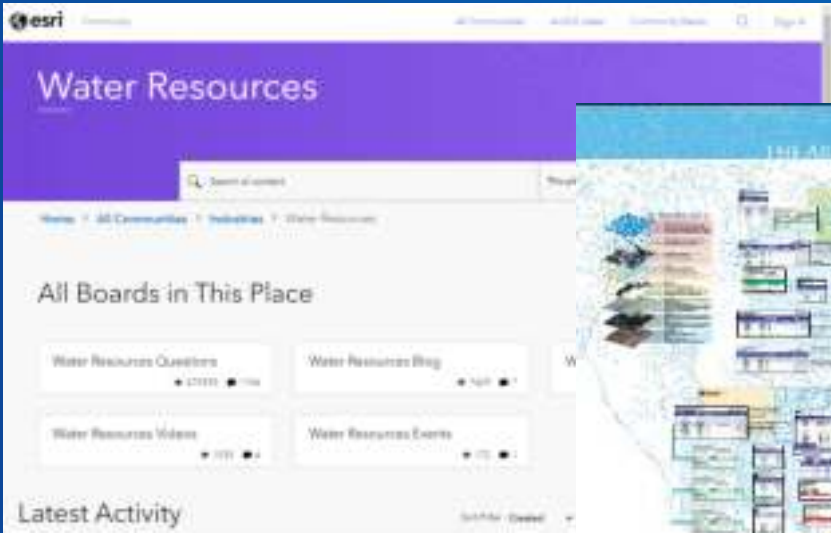
Arc Hydro: GIS for Water Resources Hydrologic, and Hydraulic Modeling with GIS

Dean Djokic



Arc Hydro: Vision

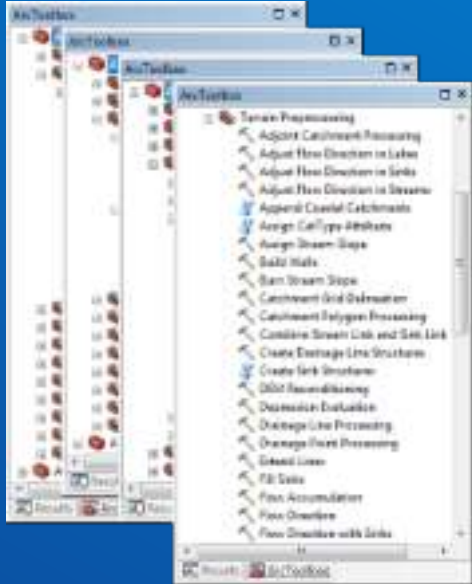
“Provide practical GIS framework for development of **integrated analytical systems** for water resources market.”



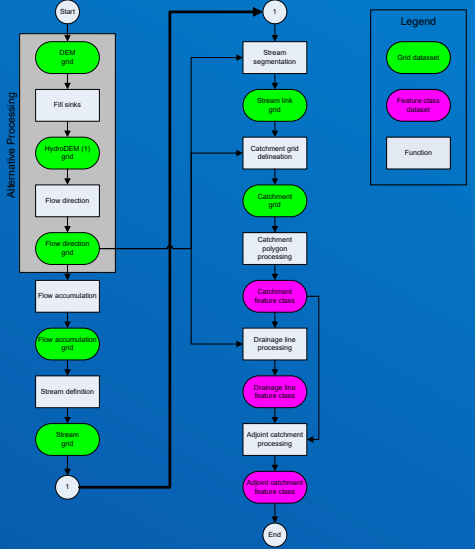
Community



Data Model



Tools



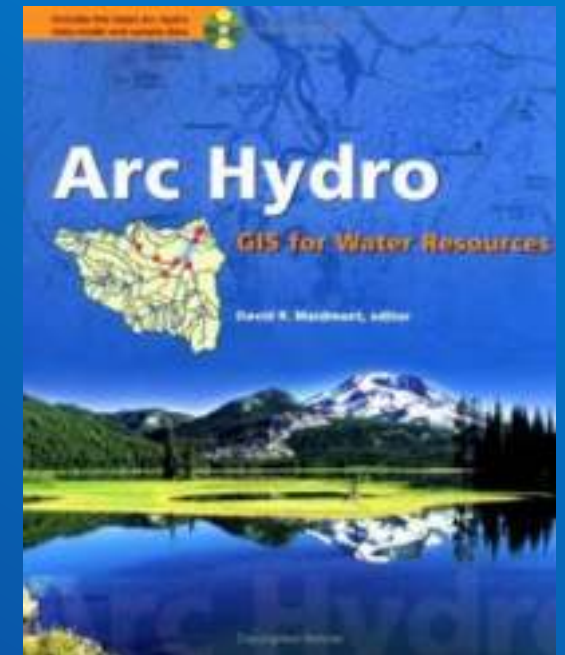
Workflows

Brief History

... and why it is important

1999 – 2002

- Project to demonstrate geodatabase capabilities in water resources.
- Worked with Dr. David Maidment at the University of Texas.
- Focused on the Arc Hydro Data Model.
- Released in 2002 as a data model, a toolset, and an Esri Press book (Arc Hydro).
 - Initial set of ~ 30 tools (8.3) developed by Esri (PS) as a complement to the data model.

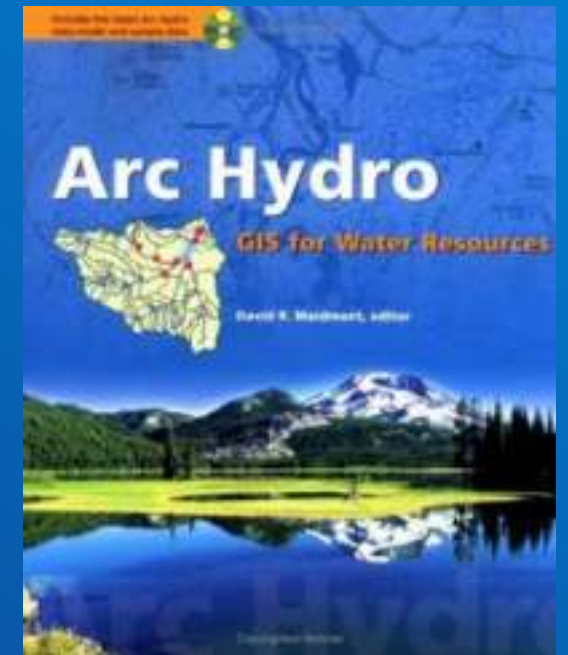


Brief History

... and why it is important

Since 2003:

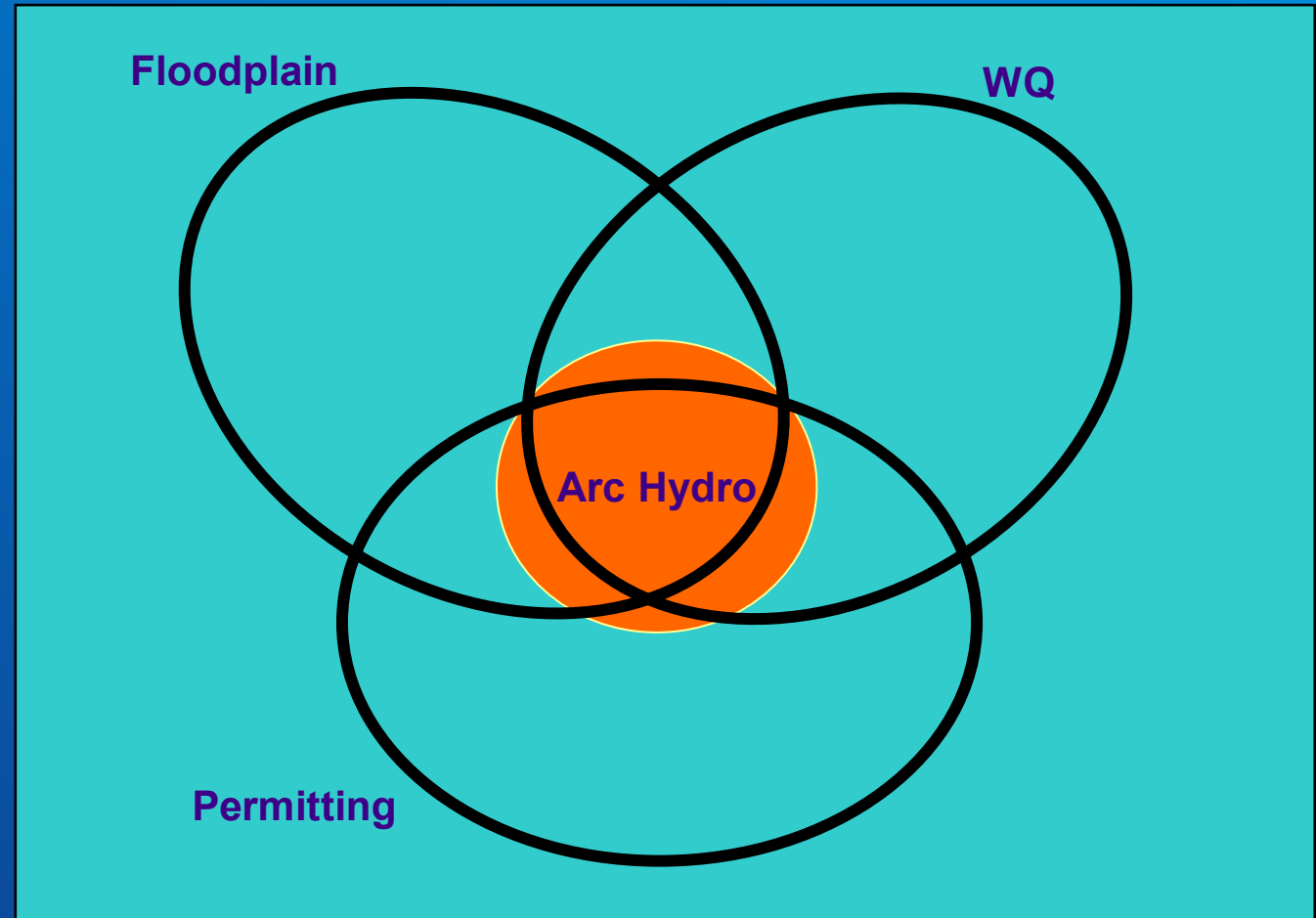
- Arc Hydro tool development through projects.
 - This added ~300+ tools over the years.
 - Development of specific workflows.
 - Minimal change to the core data model (besides Arc Hydro Groundwater).
- Training classes (managed as standard Esri training and are delivered by PS).
 - Started in 2004.
 - Over 1,600 customers reached through ~120 Arc Hydro and H&H classes delivered on 4 continents.
- Aquaveo does Arc Hydro groundwater training.



Brief History

... and why it is important

- Arc Hydro is not a “solution”.
- Building blocks to develop your specific solution.
- Designed to be extensible and flexible.



Brief History

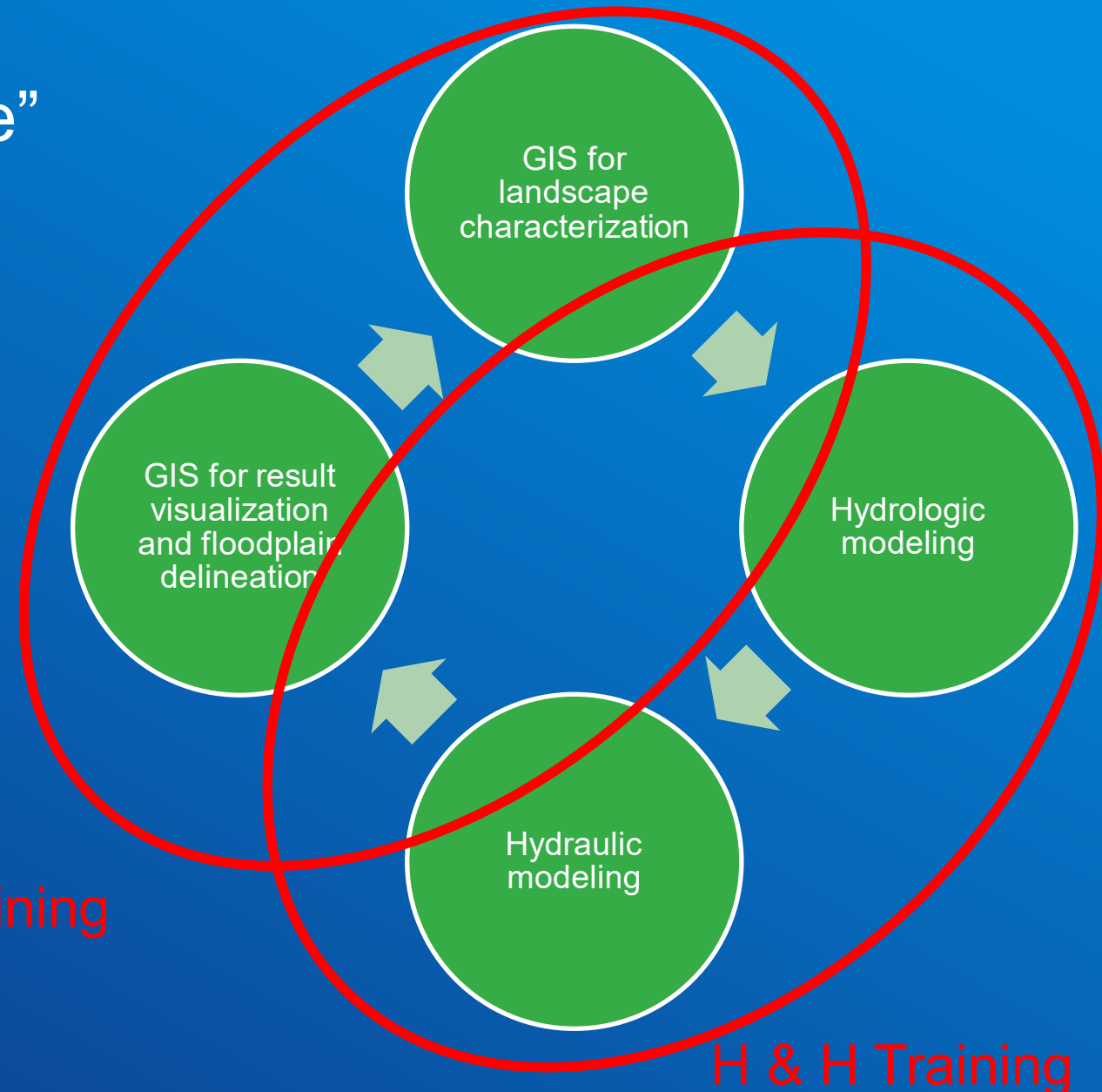
... and why it is important

- Three “pillars” of Arc Hydro:
 - Geodatabase model and use of core capabilities
 - Workflows (data processing):
 - General ArcGIS
 - Specific “Arc Hydro”
 - Analysis:
 - GIS:
 - Vector
 - Raster
 - “Hydro”:
 - Within GIS
 - H&H modeling



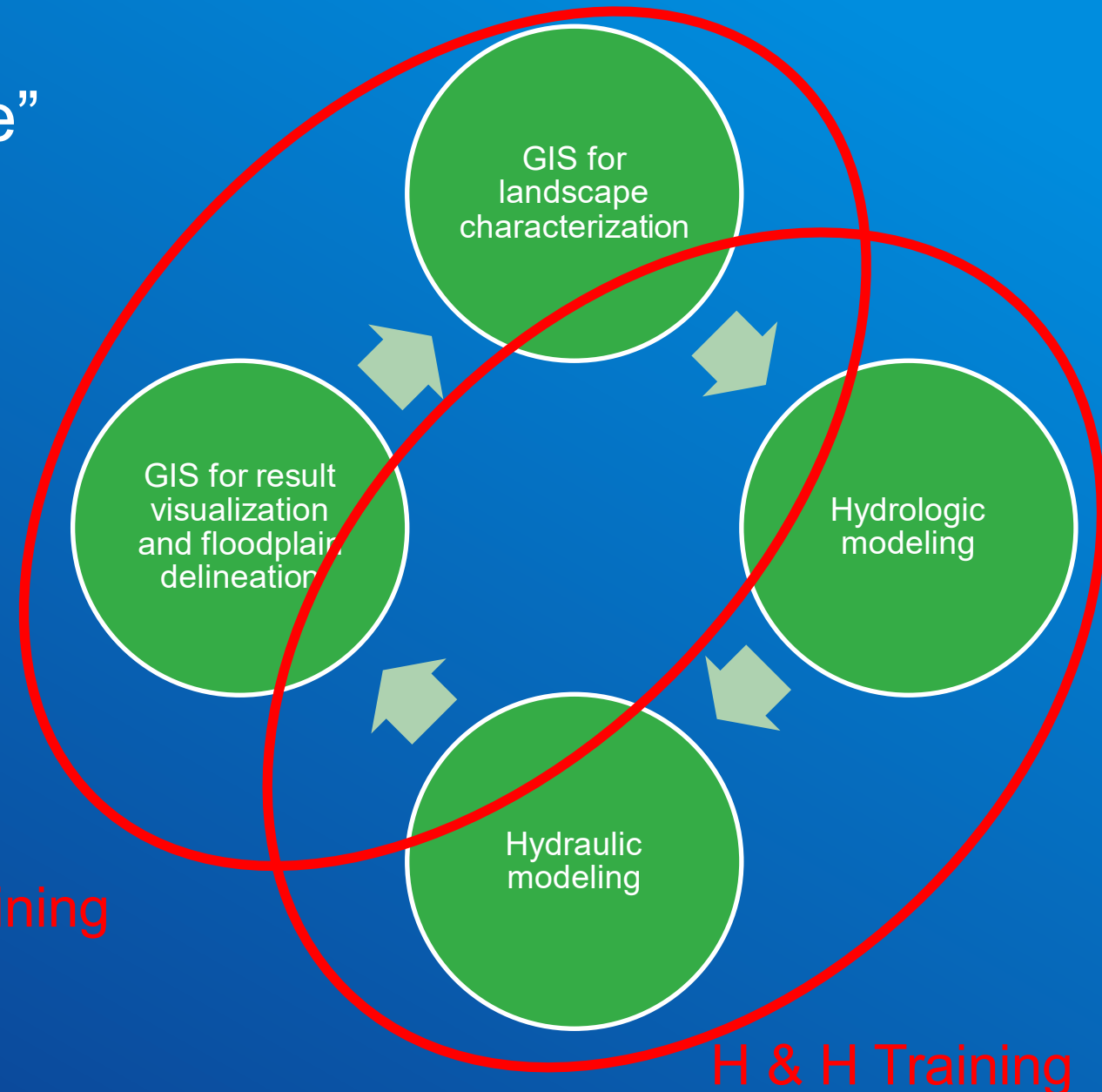
GIS for Hydro Modeling “Cycle”

- **GIS** is used for landscape characterization and model parametrization.
- **Hydrology and Hydraulics** (H&H) is used for determination of flows, depths and velocities.
- **GIS** is used for result postprocessing and visualization.
- GIS and H&H modeling are closely connected as one impacts the other



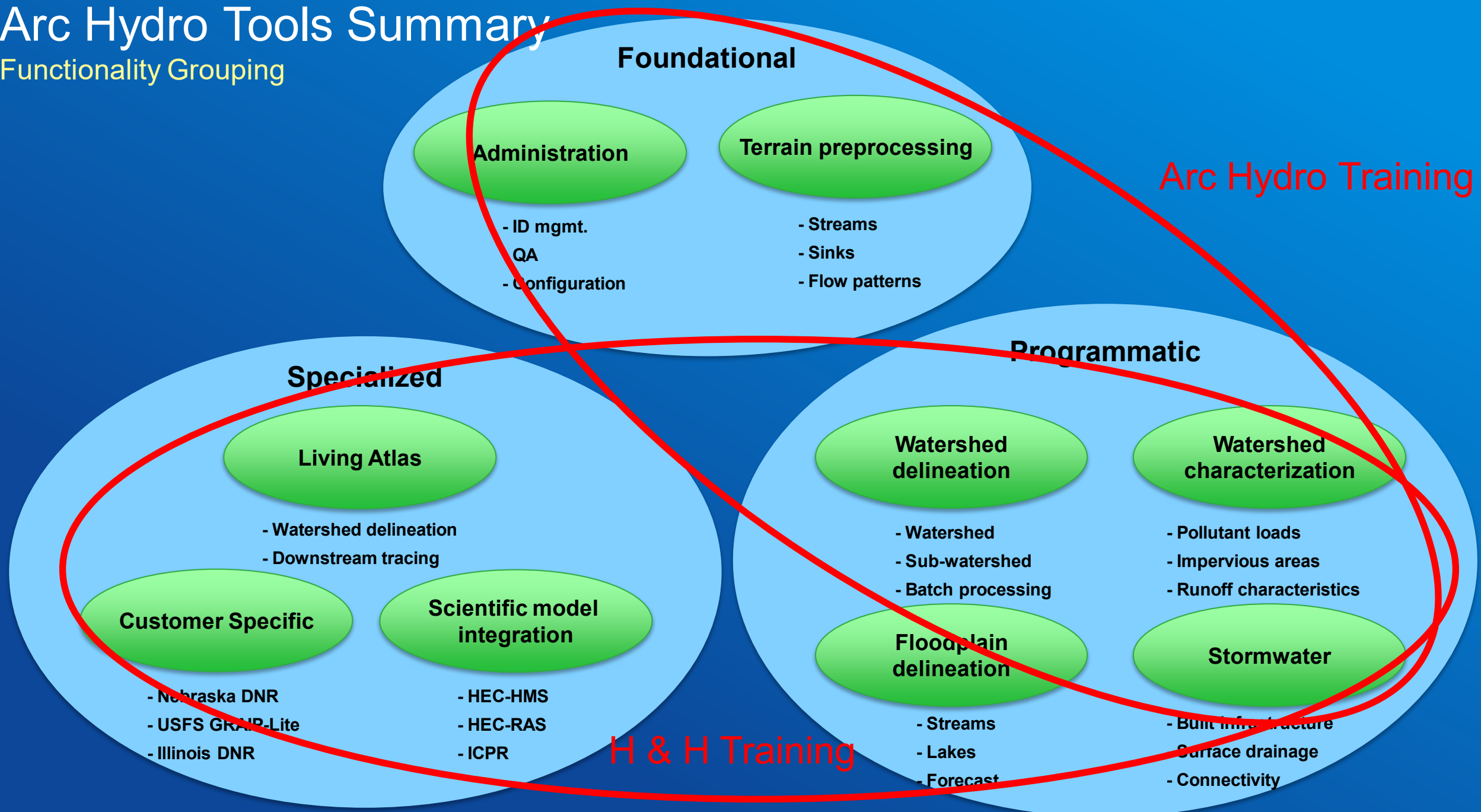
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Arc Hydro Tools Summary

Functionality Grouping



Arc Hydro Training

H & H Training

The screenshot shows the Esri Academy website interface. At the top, the Esri logo is on the left, and navigation links for Products, Industries, Support & Services, News, and About are on the right. Below this is a dark navigation bar with 'Esri Academy' on the left and 'About', 'Catalog', 'Certification', 'My Academy', and 'Help' on the right. Underneath, a secondary navigation bar includes 'Course Catalog', 'Courses by Schedule', 'Courses by Location', 'New and Retired Training', and 'Learning Plans'. The main content area features a blue header with the text 'Explore Our Courses'. Below this is a search bar containing the text 'Hydro', with a search icon and a clear button. Under the search bar, there is a 'Browse by Topic' section with a grid of nine topic cards, each with an icon and a label: 'Getting Started', 'ArcGIS Products', 'Data Management', 'Mapping', 'Spatial Analysis & Data Science', 'Field Operations', 'Scripting & Development', 'Imagery & Remote Sensing', and '3D Visualization & Analytics'.

Instructor-Led Training

Instructor Led: Two “Hydro” Options

Viewing: **2 Results** [Clear Search](#)

Course Title	Duration	Price
INSTRUCTOR-LED Arc Hydro: GIS for Water Resources	3 Days (24 Hours)	\$2,460
INSTRUCTOR-LED Hydrologic and Hydraulic Analyses Using ArcGIS	2 Days (16 Hours)	\$1,640

The image shows a search results interface with two course cards. Each card includes a 'Clear Search' link, a course title, duration, price, and icons for sharing, favoriting, and adding to a cart. The background of the cards features a topographic map pattern.

Arc Hydro: GIS for Water Resources

Instructor-Led

Arc Hydro: GIS for Water Resources

by Esri Professional Services

Contact Us



Duration: 3 Days (24 Hours)

Cost: \$2,460

Arc Hydro: GIS for Water Resources – Data Model

- Arc Hydro data model

- Core feature classes, properties, and relationships
- HydroID as the unique identifier and primary key in all relationships
- Managing HydroID

- Extending Arc Hydro data model

- Adding properties to existing Arc Hydro feature classes
- Adding additional feature classes to Arc Hydro projects and data model
- Managing HydroID for new feature classes
- Using existing relationships with new data model elements
- Adding GRIDs and TINs to the Arc Hydro model and project

Arc Hydro: GIS for Water Resources - Tools

- Core Arc Hydro tools

- Tools managing Arc Hydro core properties
- **HydroID editor extension and management tools**
- Creating Arc Hydro feature classes through tools
- Terrain processing and basic network tracing
- Combining raster, vector, and network datasets into an integrated data environment

- Advanced Arc Hydro functionality

- Local and global watershed delineation
- Watershed characteristics extraction
- Time series management tools
- Advanced network/attribute tracing
- **Controlling tools' operations through XML**
- **Controlling data structures through XML**

Arc Hydro: GIS for Water Resources - Implementations

- Arc Hydro in action

- Loading time series data via WEB into Arc Hydro
- Manipulating NEXRAD data
- Mass-balance analyses
- Watershed delineation and characterization

- Extending Arc Hydro tools

- Developing custom functionality within Arc Hydro tools
- Developing custom functionality on top of Arc Hydro tools
- Arc Hydro tools programming framework
- **Control XML**

Arc Hydro: GIS for Water Resources – Model Integration

- Integration of external models into Arc Hydro
 - Principles of generic data exchange
 - XML as a vehicle for data exchange and exchange control
 - Building custom exporter
 - Building custom importer

Hydrologic and Hydraulic Analyses Using ArcGIS

Instructor-Led

Hydrologic and Hydraulic Analyses Using ArcGIS

by Esri Professional Services

Contact Us



Duration: 2 Days (16 Hours)

Cost: \$1,640

Hydrologic and Hydraulic Analyses Using ArcGIS

- What is ArcGIS?
 - Basic principles of GIS
 - Using GIS for water resources analyses
 - Data structures, tools, and techniques
- Data sources for H&H analyses
 - Terrain data, water features, precipitation, land use, soils, flows, curve numbers, and roughness (NED and NHDPlus HR, lidar, WBD, NHD, Nexrad, STATSGO, SURRGO)
 - What to expect and what not to expect
 - International data

Hydrologic and Hydraulic Analyses Using ArcGIS

- Terrain representation for H&H analyses
 - Esri vector (TIN) and grid structures
 - Precision vs. generality
 - Size considerations
 - Managing large TIN and Esri Grid datasets
- USGS StreamStats
 - National regression equations for high and low flow estimation
 - Developing a StreamStats database
 - Watershed delineation and characterization
 - Running NSS
 - Desktop implementation of NSS

Hydrologic and Hydraulic Analyses Using ArcGIS

- HEC-GeoHMS

- ArcGIS preprocessor for HEC-HMS
- DEM preprocessing
- Building a GeoHMS project
- Extracting basin characteristics
- HMS parameter computations
- HMS schema generation
- Exporting data to HMS

- HEC-GeoRAS

- ArcGIS pre- and post-processor for HEC-RAS
- Terrain preparation—developing consistent terrain representation from multiple data sources
- Building a GeoRAS project—required and optional data
- Developing RAS-required information
- Exporting data to RAS

Hydrologic and Hydraulic Analyses Using ArcGIS

- Running HEC-HMS and HEC-RAS

- Considerations when building an integrated HMS-RAS model
- Supplementing HMS and RAS with additional required data
- **Running HMS and RAS**
- Post-processing HMS results (time series)
- Post-processing RAS results—floodplain delineation

- Putting it all together

- GIS support for floodplain mapping, real-time operations, and emergency management
- Using ModelBuilder™ to automate processes

Custom IL Classes (Both AH and H&H)

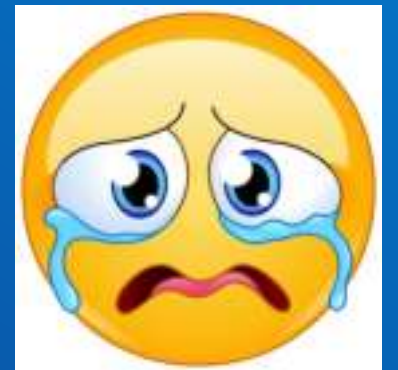
- Usually developed for a specific organization.
- Two general types:
 - None or slight “tweaks” to class structure:
 - Focus on specific topics (or omission of others).
 - Using local data.
 - Adding an additional day for class summary and future directions
 - Full customization. This then transitions from a “class” to a “workshop” format.
 - Built around specific client requirements.
 - Not a “class” but a tech transfer engagement (different contract mechanism).

Current State of the IL Classes

- Open enrollment classes have not been held in the last two years.
 - COVID.
 - Class structure is not agreeable for distance learning mode (focus on discussions and examples developed in the class).
 - Transition from ArcMap to ArcGIS Pro.
- Custom/client classes continue to be held.
 - Easier to deliver around predefined focal areas.
 - Less discussion (that is part of class planning) and more hands-on
 - Specific technology.
- Aquaveo class on Arc Hydro Groundwater:
 - “GIS-Based Modeling & Data Management using AHGW”
 - April 5-8, 2022

Current State of the IL Classes

- Transition from ArcMap to Pro exercises.
 - Arc Hydro – reached “baseline critical functionality” match with ArcMap version with Arc Hydro release for Pro 2.8 (September 2021).
 - Big item: Trace Network vs. Geometric Network
 - H&H – deprecation of HEC-GeoHMS and HEC-GeoRAS (no ArcGIS Pro version).
 - Transition of selected H&H tools into Arc Hydro.
 - Inclusion of additional exercises based on new tools (WIM, rational method, floodplain delineation using HAND, ...).
- Change in class structure to be more agreeable with distance learning mode (focus on using the tools and less on discussion).
- Q3 target for open enrollment (remote option)





Self Training

ArcGIS Foundation

- Back to the three “pillars” of Arc Hydro:
- MANY free (and at cost) resources through Esri and other entities (e.g.):
 - Pro:
 - Getting started with ArcGIS Pro (5.5 hours)
 - Going Pro: ArcGIS Pro Essentials for ArcMap Users (1 hour)
 - Gdb:
 - Getting started with the Geodatabase (3.5 hours)
 - Getting started with data management (1.5 hours)
 - Projections:
 - Basics of Map Projections (3 hours)
 - Introduction to coordinate systems (2.5 hours)



ArcGIS Foundation

- MANY free (and at cost) resources through Esri and other entities (e.g.):
 - Analysis:
 - Getting started with geoprocessing (1.5 hours)
 - ArcGIS Pro: Analysis and Geoprocessing Essentials (1 hour)
 - Deriving raster for terrain analysis using ArcGIS (2.75 hours)
 - Terrain analysis using ArcGIS Pro (2.75 hours)
 - Introduction to surface modeling using ArcGIS (3.5 hours)
- Work with your training consultant to develop a “learning plan” matching your skills and needs.



Arc Hydro: Getting Started

- Learning about Arc Hydro: Resources and Documentation
 - https://go.esri.com/AH_Resources
- Getting Started with Arc Hydro
 - https://go.esri.com/AH_Getting_Started



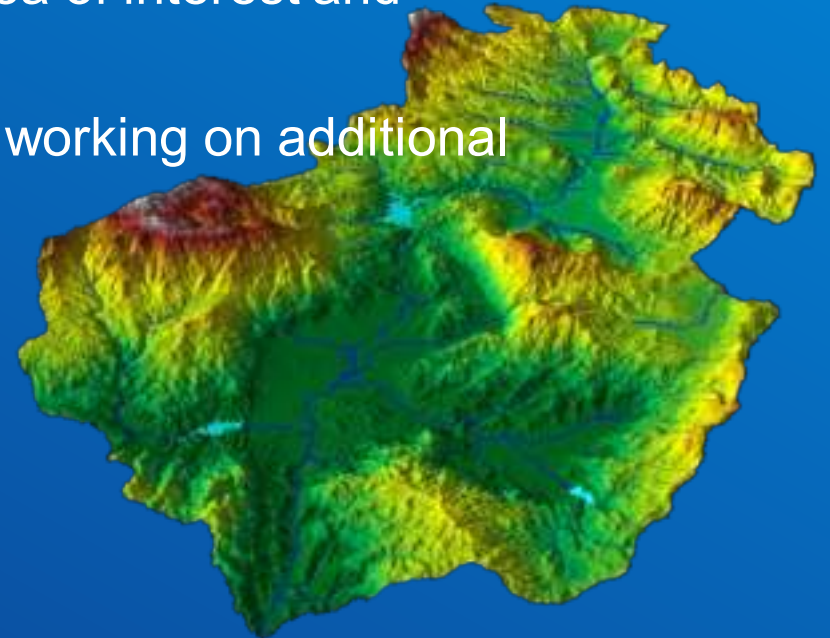
Arc Hydro: Your First “Project”

- Download and install the (correct) Arc Hydro tools. Follow instructions in “Downloading and Installing Arc Hydro Tools” document.
- Read “Arc Hydro: Project Development Best Practices” document – **this is required reading**. Follow the recommendations closely, specially as you are getting into Arc Hydro.
 - Once you learn its ropes, feel free to diverge from the recommendations (but be ready for “surprises”).
- Define the initial Arc Hydro implementation domain that you want to use first. Start simple and with something that is already well documented (review the “Arc Hydro Resources” document for a list of existing documents).



Arc Hydro: Your First “Project”

- Define spatial area of interest and collect data to use in Arc Hydro processing and analysis. Start with something small in extent and with low data requirements.
- Review any existing documentation pertinent to your domain of interest.
- Start using Arc Hydro tools in the context of your selected area of interest and implementation domain.
- Complete your first Arc Hydro (simple) project and then start working on additional capabilities by building on your first project.
 - Incremental addition.



Arc Hydro: New Materials

- Documentation:
 - Hillslope analysis (Q1).
 - HAND processing (Q2).
- Learn lessons:
 - Wetland Identification Model (Q2).
 - Floodplain delineation (Q3).
 - Watershed delineation and characterization (Q3).
 - Terrain processing (hydro-conditioning) (Q3/Q4).

