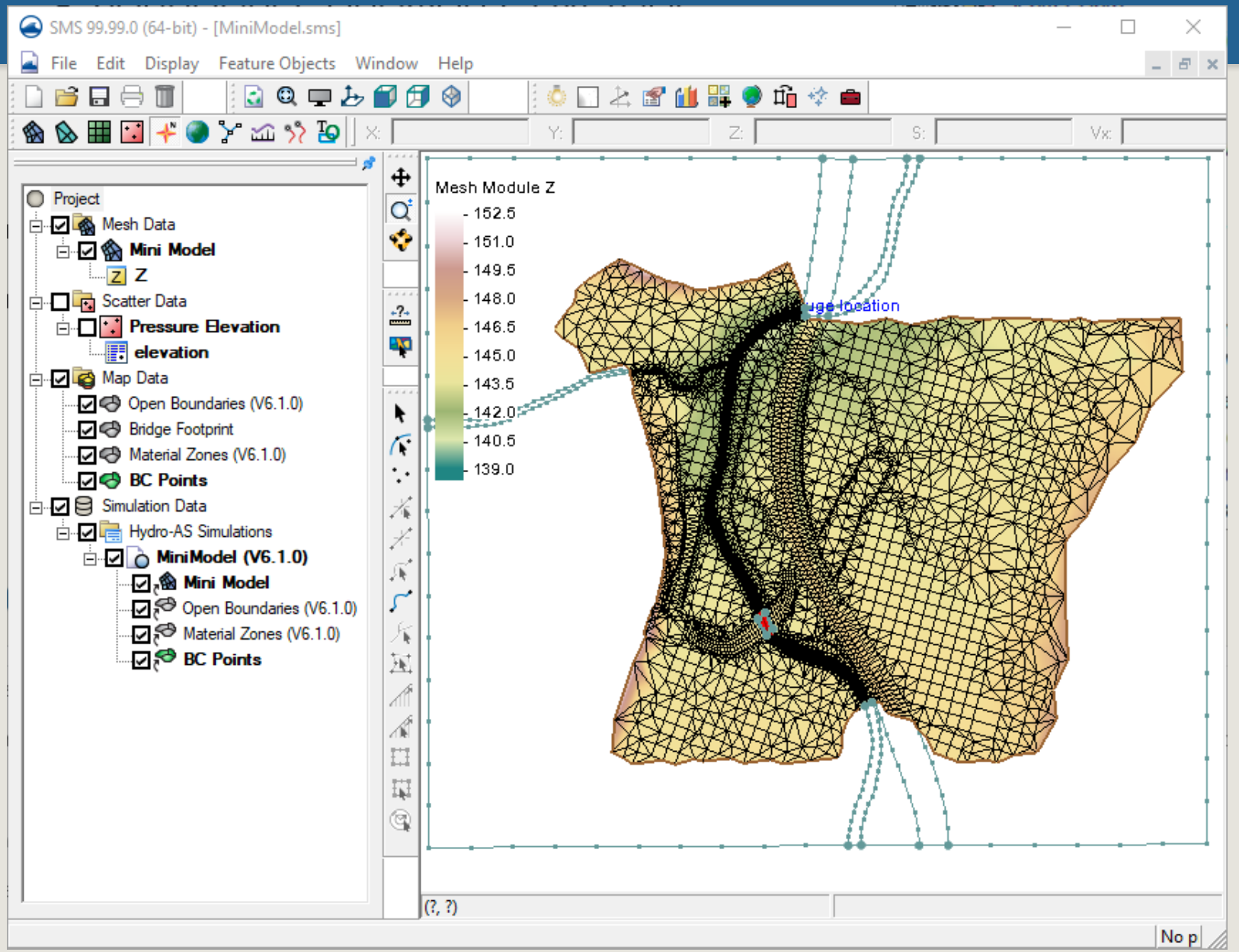
Simulation Based Modeling in HydroAS and SMS

September 24, 2024

2024 HydroAS User Meeting

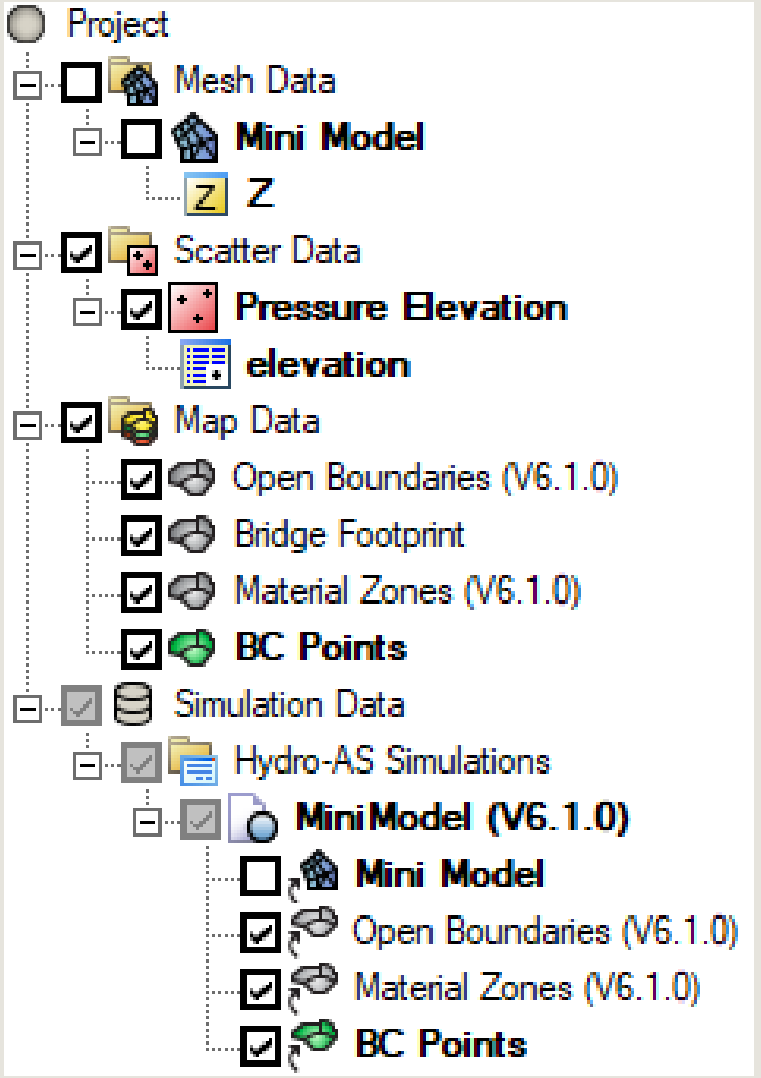
Outline

- Simulation Based Modeling
- Native File Support
- Simulation Management
- Custom Tools
- Updates on Mesh Generation



Simulation Based Modeling

- Component Based
  - Mesh
  - Boundary Condition Coverage
  - Materials Coverage
  - Simulation Entity
    - Model Parameters
- Reusable
- Flexibility



Native File Support

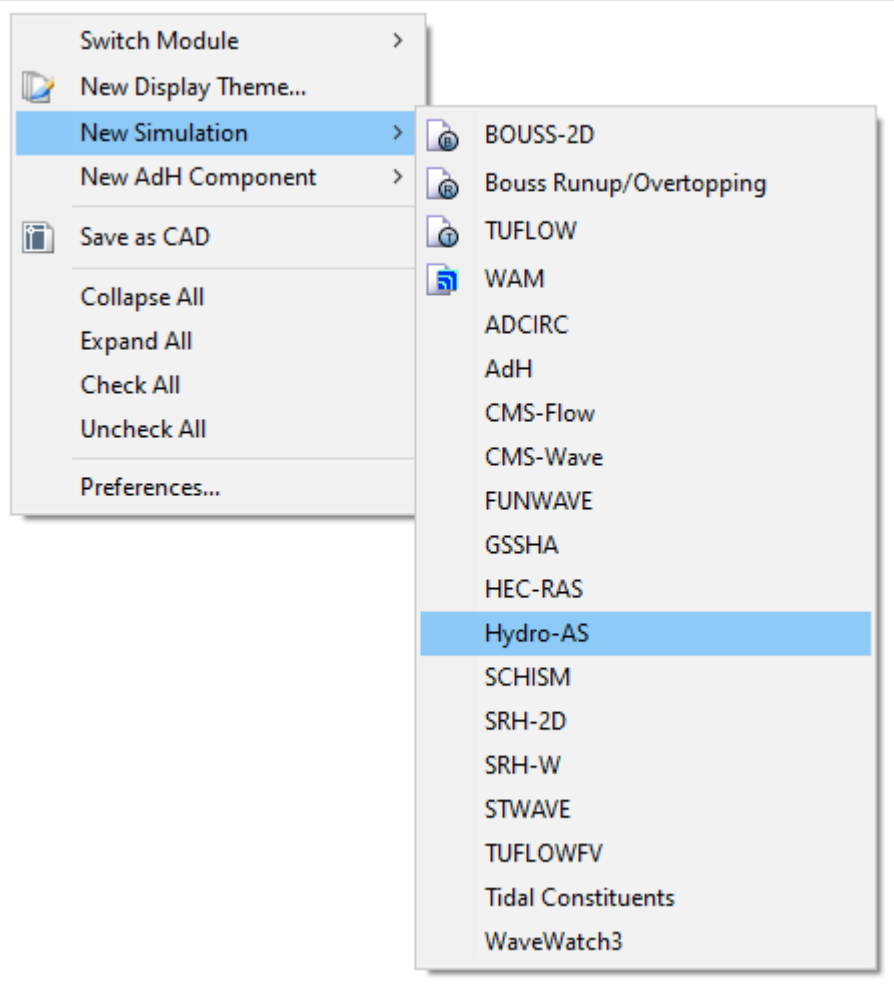
- .2dm File
  - Geometry
  - HydroAS Version
- Reading / Import
  - Simulation
  - Mesh
  - Line Boundaries
  - Point Boundaries
  - Material Polygons / List
- Writing / Export

```
BEGPARAMDEF
GM   "HydroAS V6.1.0"
SI   1
DY   0
TU   "sec"
TD   0   0
GP 1 "HydroAS" 1
.
.
.
ENDPARAMDEF
```

```
MESH2D
MESHNAME "Mini Model"
NUM_MATERIALS_PER_ELEM 1
E3T 1 20 21 1 4
E4Q 2 1 2 22 20 1
E4Q 3 3 23 22 2 1
E4Q 4 3 4 24 23 1
E4Q 5 5 25 24 4 1
.
.
.
ND 1 4298771.59 5506787.54 143.073
ND 2 4298772.08 5506787.75 142.97701
ND 3 4298772.57 5506787.97 142.75101
ND 4 4298773.02 5506788.25 142.701
ND 5 4298773.47 5506788.54 142.651
ND 6 4298773.92 5506788.83 142.629
.
.
.
NS 5351 5249 5142 5035 4924 4810 4676 4539 4411 -4288 1
NS 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 -19 2
```

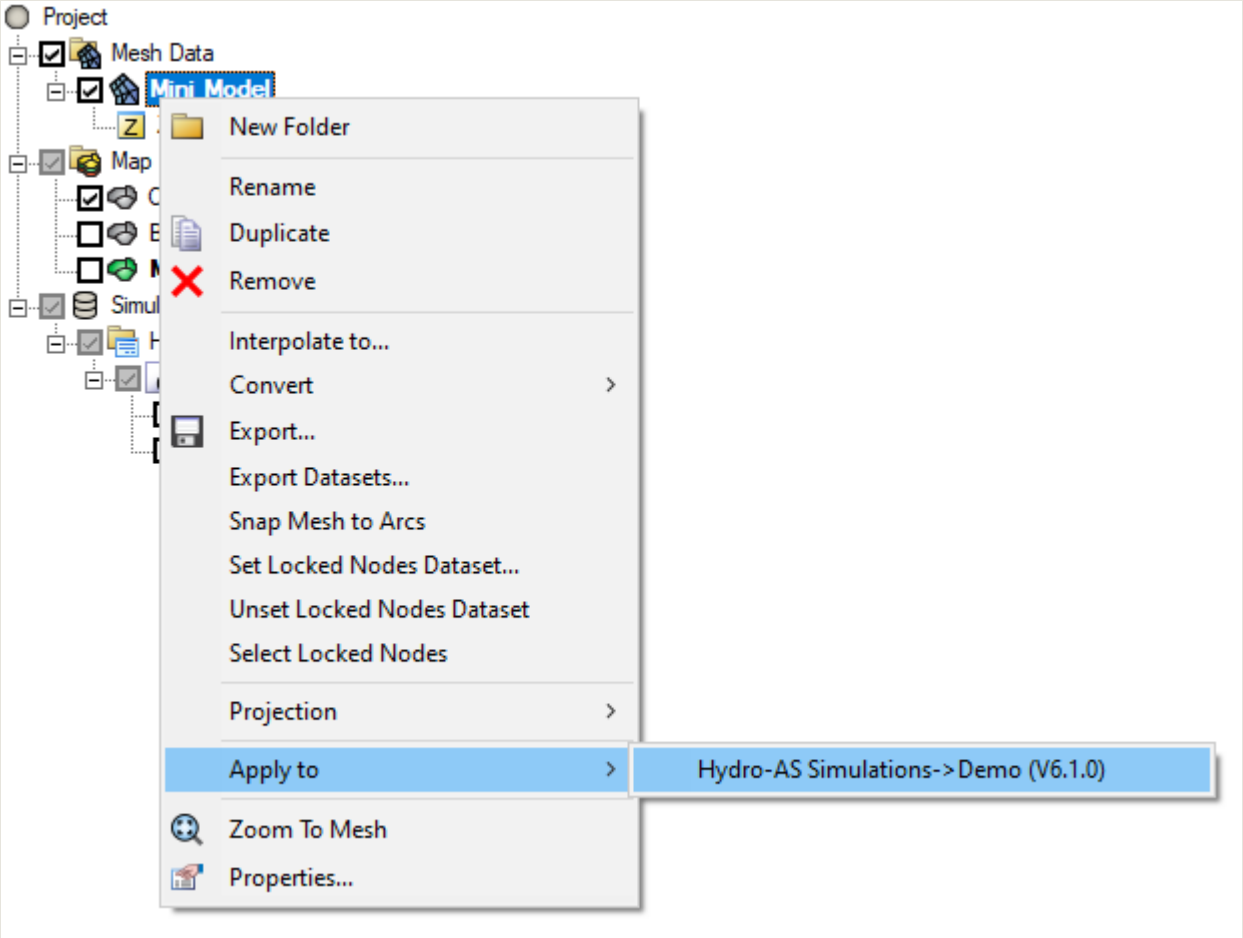
Simulation Creation

- Right click in Project Explorer
- Select “Template”
  - Determines HydroAS version
- Set simulation name



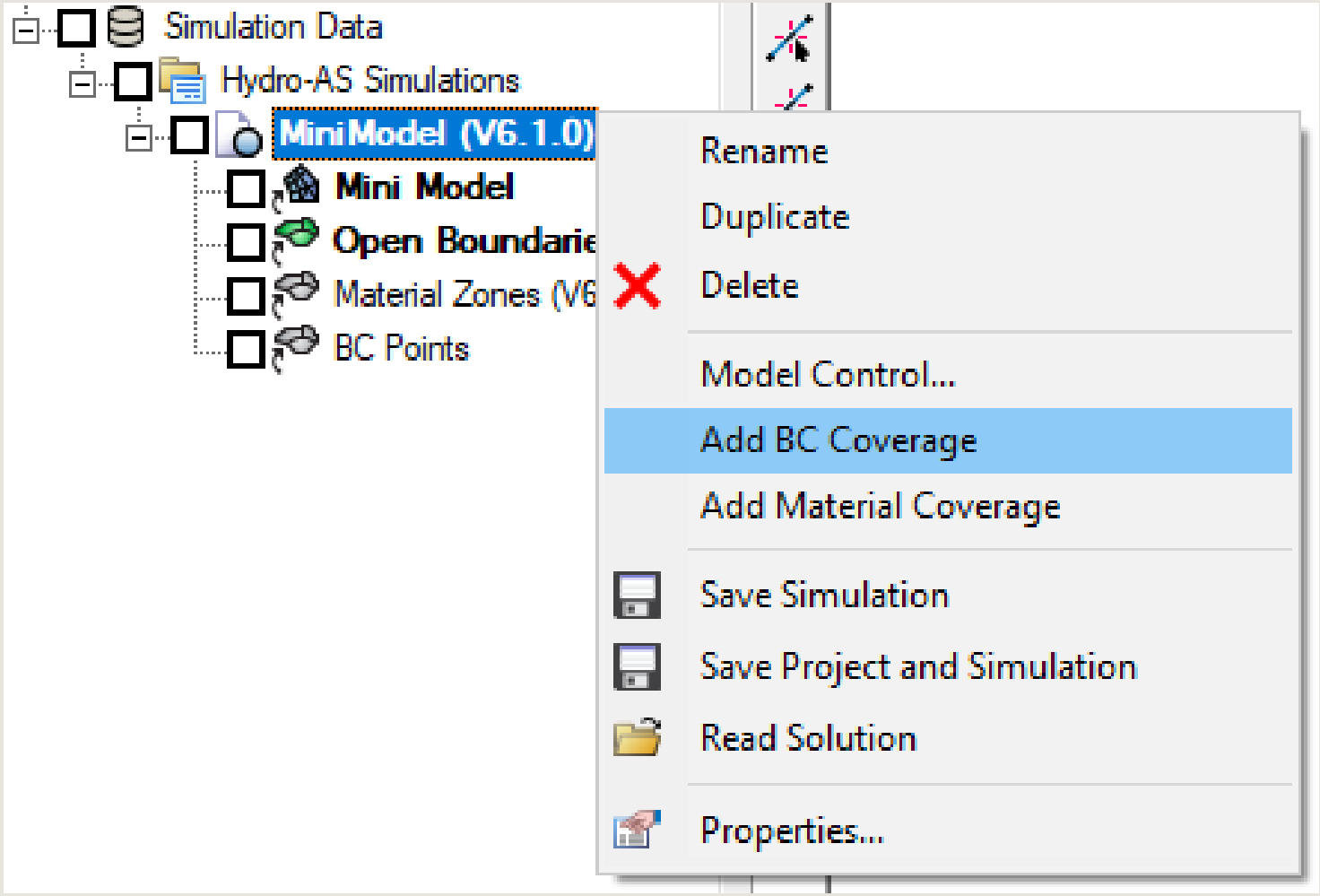
Simulation Management

- Apply Components
  - Drag / Drop
  - Right click - Apply
- Includes
  - Mesh
  - BC Coverage
  - Material Coverage



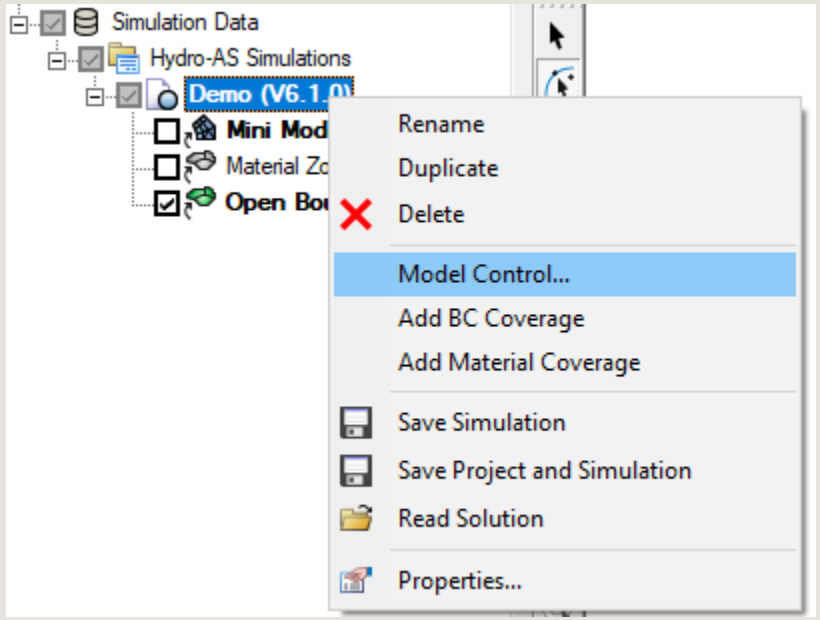
HydroAS Version Specification

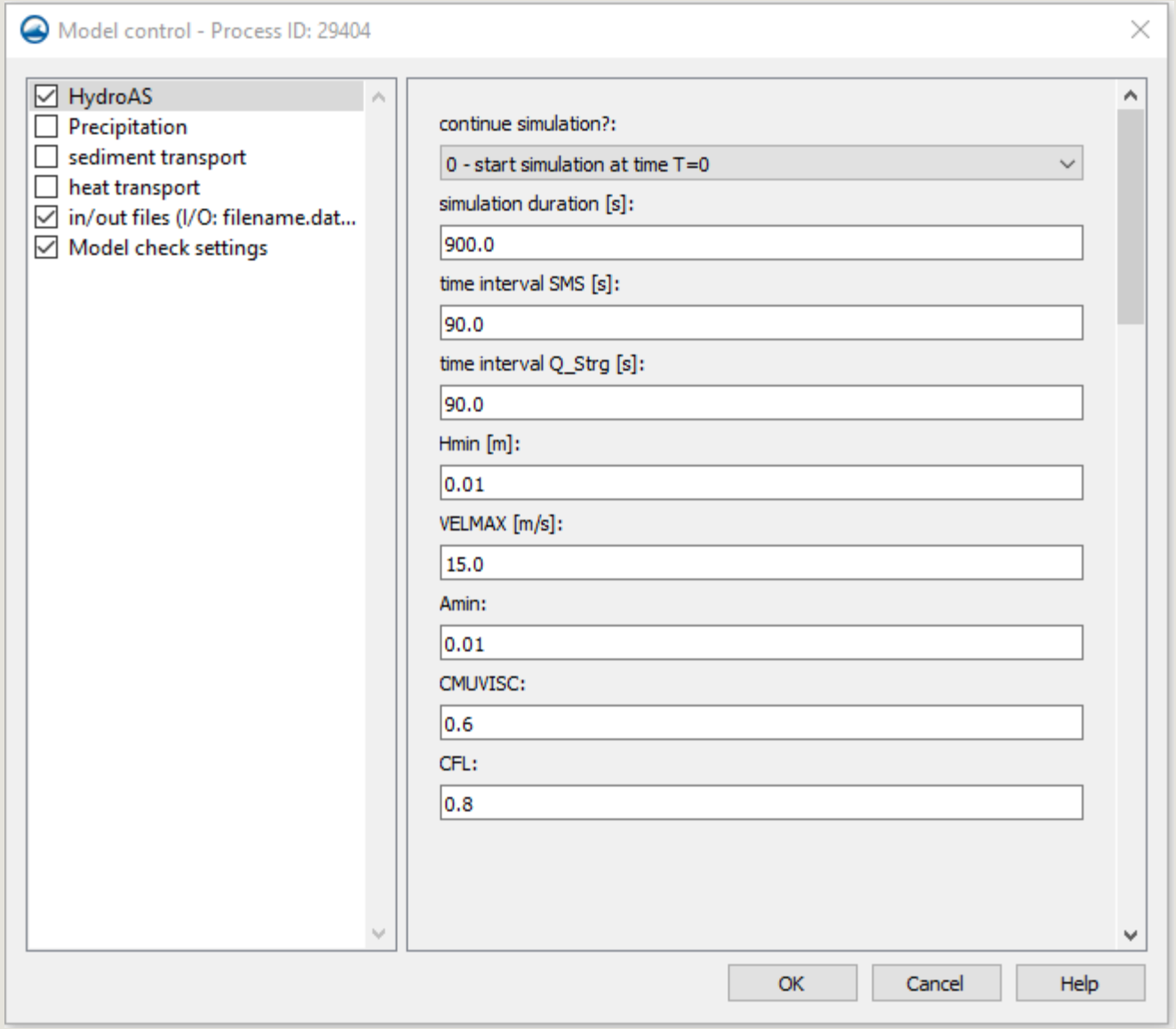
- Specified when:
  - Creating simulation
  - Creating coverage
  - Setting coverage type
- Copied when:
  - Copying simulation
  - Copying coverage
- Simulation Commands



Simulation Attributes (Model Control)

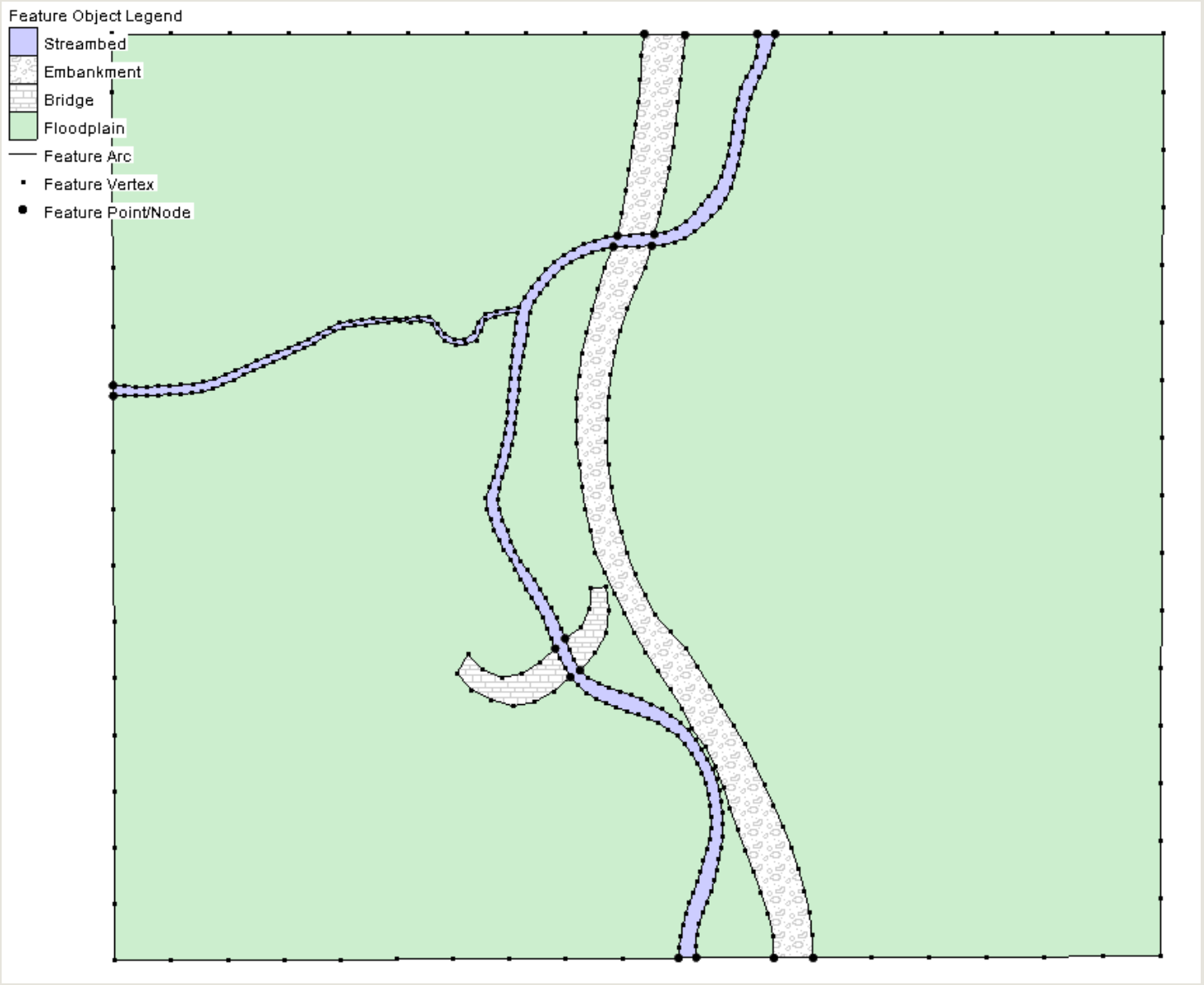
- Access with right click





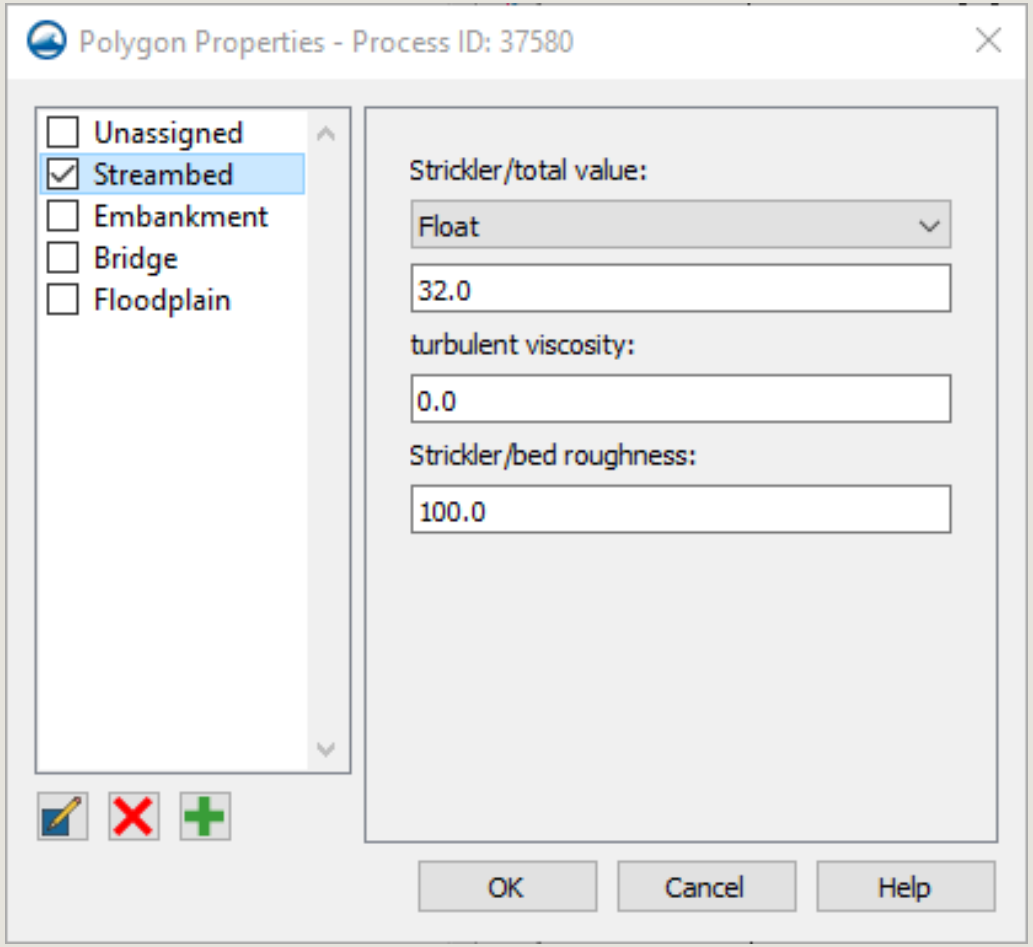
HydroAS Material Coverage

- Version Specific
- Material List / Attributes
- Display Options
- Applied to Simulation
  - Assigned to elements



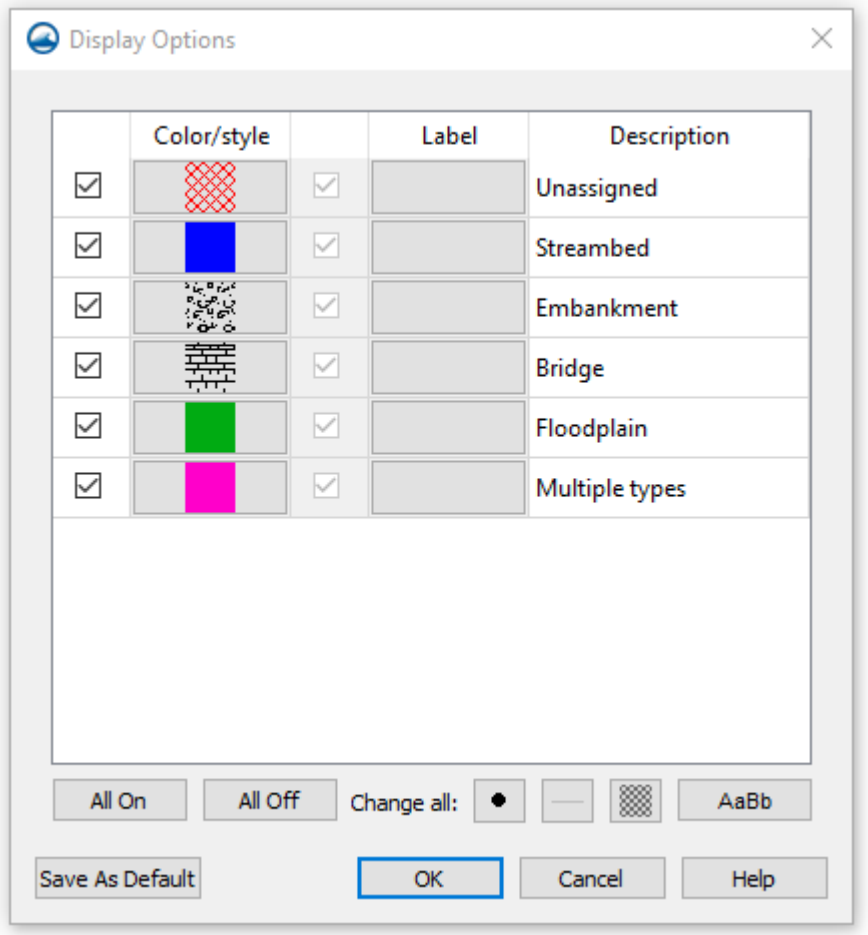
HydroAS Material List

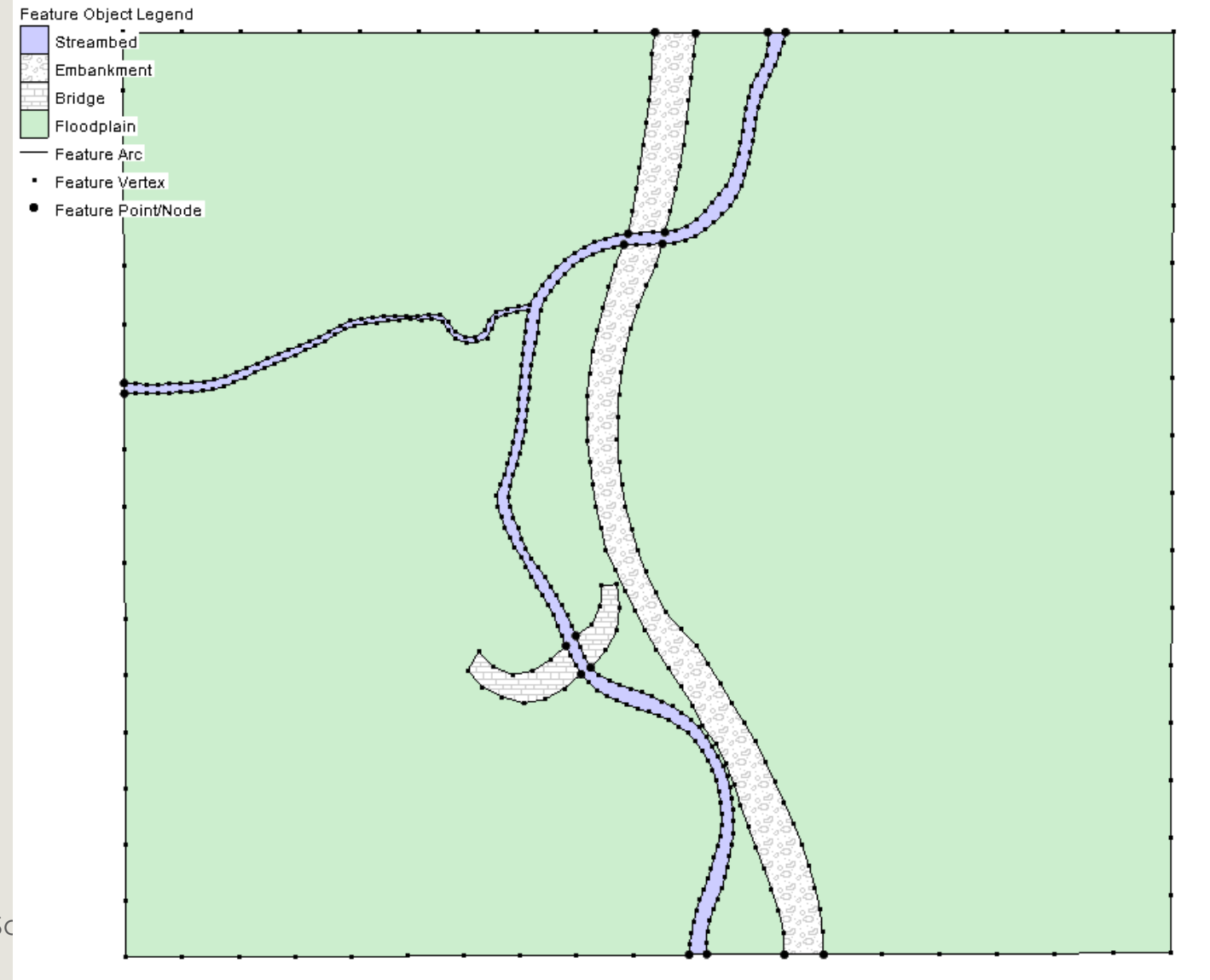
- Add / Delete materials
- Specify names
- Attributes
  - Strickler /total value
    - Constant
    - Depth Varied
  - Viscosity
  - Strickler /bed roughness
- Assign material type to polygon(s)



HydroAS Material Display Attributes

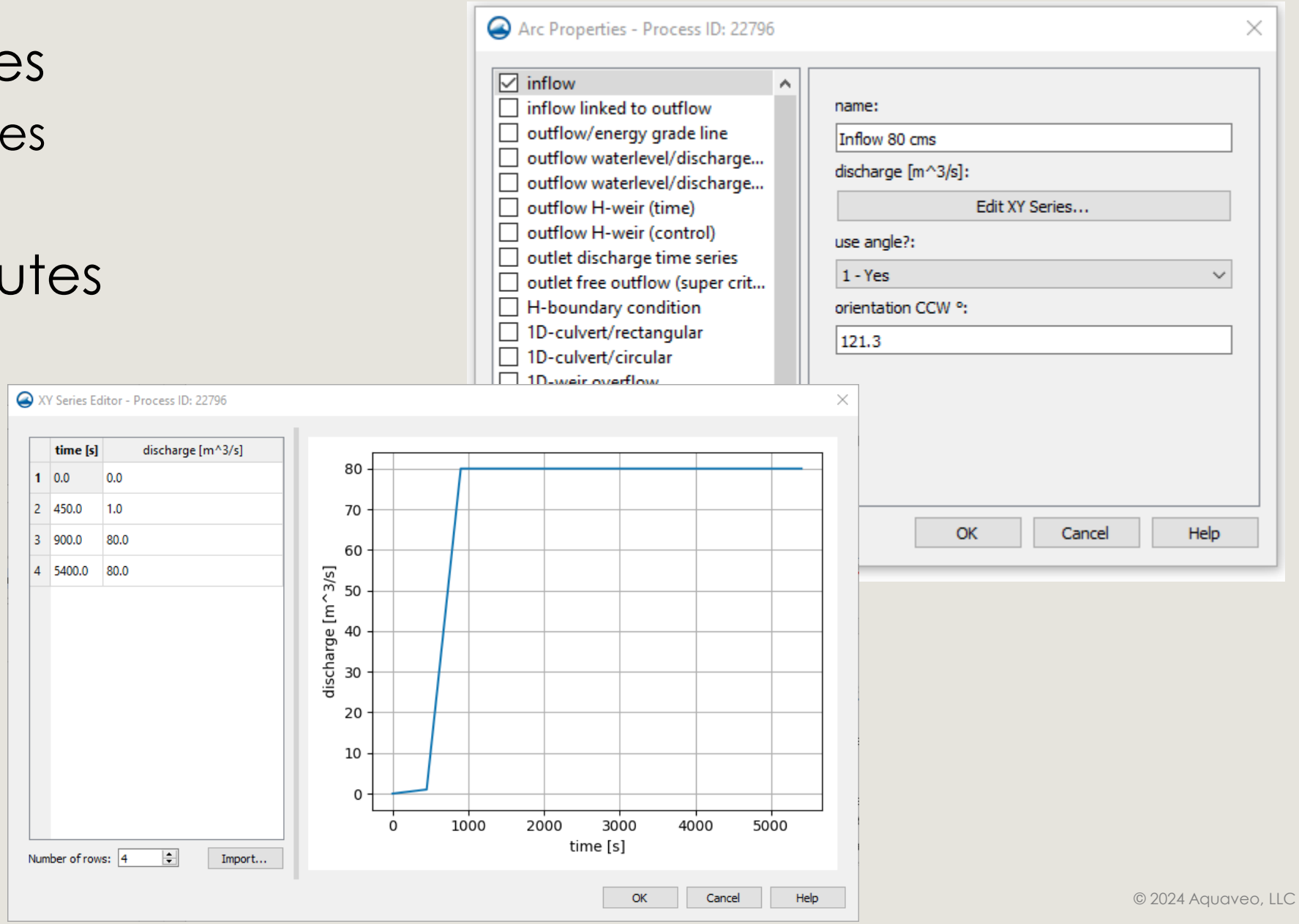
- Color / Style / Label for each material in the list





HydroAS Boundary Condition Coverage

- Arc attributes
  - Type - values
  - Name
- Node attributes



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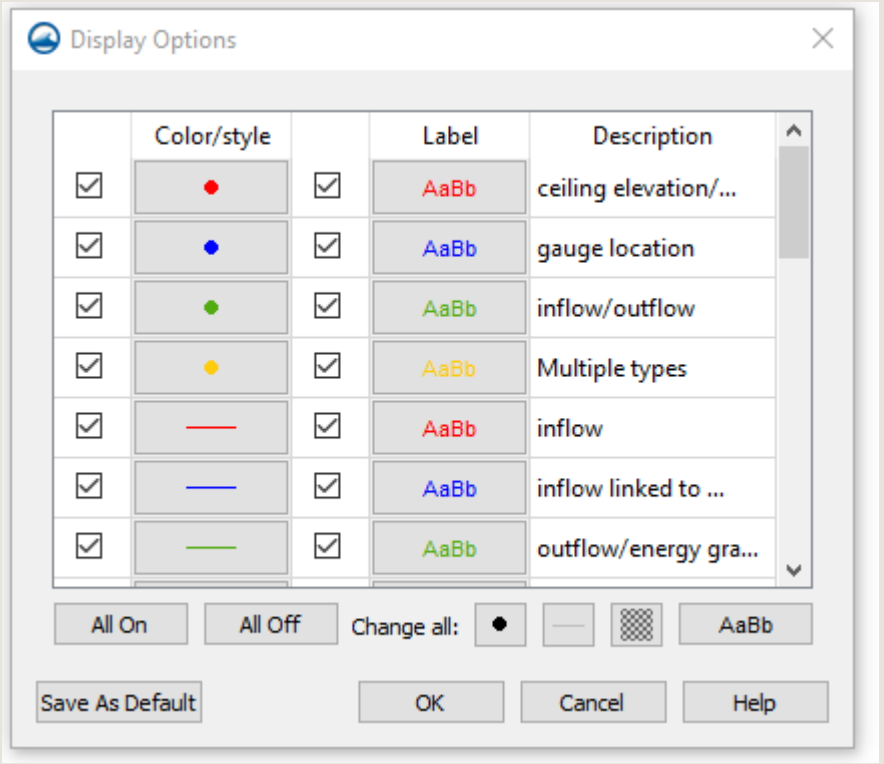
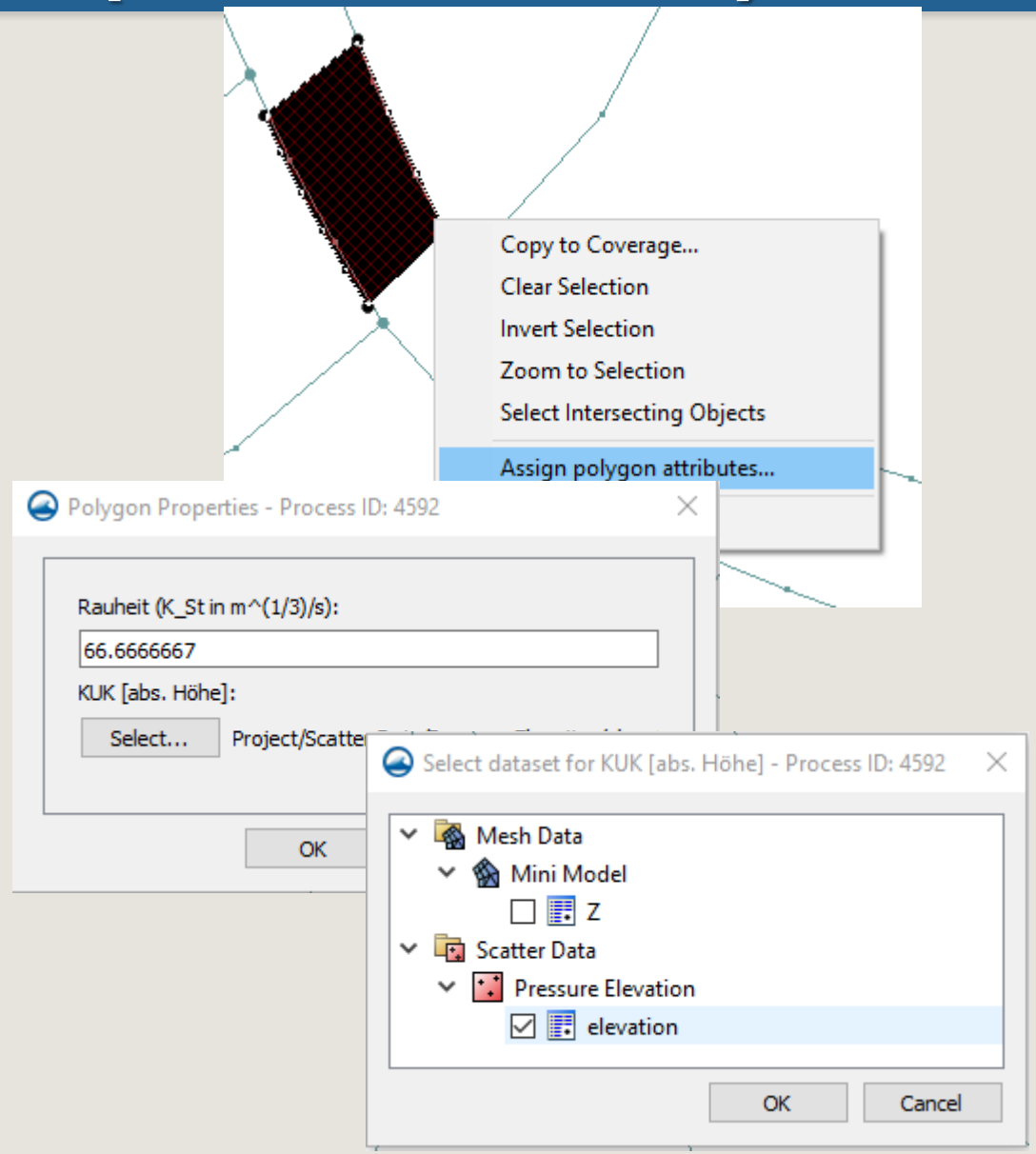
HydroAS Boundary Condition Display Attributes

- Color / Style / Font for each boundary condition type (nodes and lines).



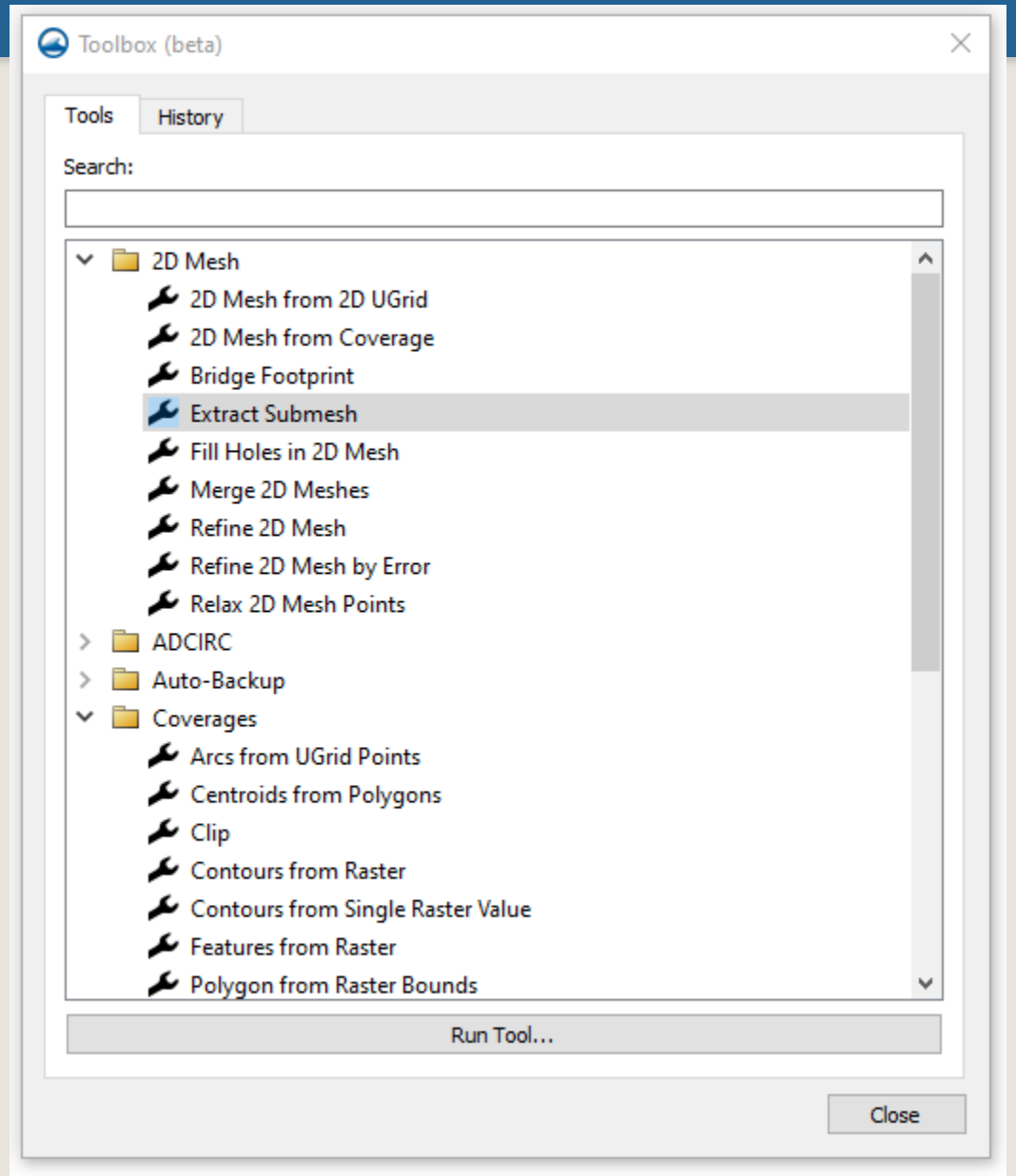
Custom Tool Development – Pressure (KUK, Druckabfluss)

- Custom options
  - Coverage with Attributes
  - Tools in the Toolbox
- Pressure Zone Points
- Not version specific
- Stand alone python library
- Creates Boundary Condition coverage when “applied”
- Modular
  - Example of user specific tools



Mesh Editing

- Mesh Editing
  - Extract Submesh
  - Merge 2D Meshes
- Decoupled from the boundary conditions for flexibility and speed.

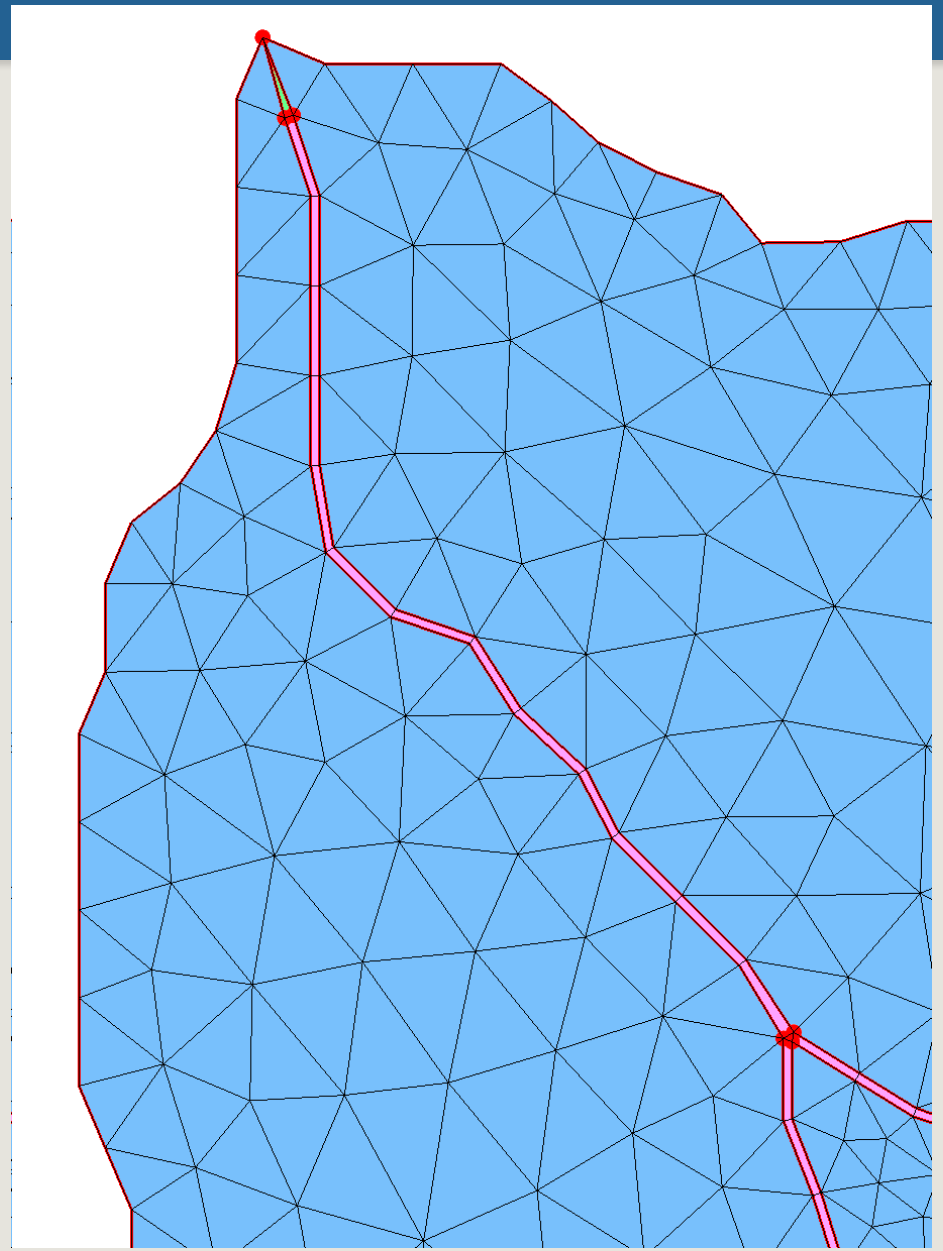


Mesh Generation Enhancement

- Networks to polygons
- Channel patches
  - # of cells across
  - Size and bias
  - Auto-redistribution
- Confluences / Intersections
- Merge with floodplains

Resulting Grid / Mesh

- Mesh Generation
  - Domain field
  - Flood plains / Basin
  - “Auto patch”
- Mesh Characteristics
  - Matches features
  - Minimal interaction
  - May require manual cleanup
    - Not necessarily a bad thing



Conclusion

- Simulation based modeling:
  - Separates geometry from mesh.
  - Allows reuse of components
- New interface allows for future customization

- Questions…

- Information - info@aquaveo.com