Why you Should be Using Subsurface Utilities and How to Get There

Presented by:

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Bentley®
*Advancing* Infrastructure

Outline

- Why
  - Does your current design workflow fall short of a complete solution?
  - What problems does this cause?
  - Could you make the design and analysis process more efficient?
  - Are you using "Advanced H&H" products that you no longer need?
- How
  - Migrate legacy projects forward to SU
  - Check the results
  - Look at what CivilStorm gives you
  - Assess what you need other products for

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Subsurface Utilities

- Subsurface Utilities is the name we are using now
    - You may see it abbreviated to SU
    - At SELECTseries 3, there was Subsurface Utility Engineering (SUE)
    - SUE needed a separate licence
    - At SELECTseries 4, we added Subsurface Utilities Design and Analysis (SUDA)
    - SUE and SUDA are both in OpenRoads Designer – hence "SU"
    - No more SUE licence – it's part of the OpenRoads Designer licence
    - Encompasses StormCAD/CivilStorm/SewerCAD/SewerGEMS

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Two Verticals: Civil/Spatial and Water

Dirt / Space

Water
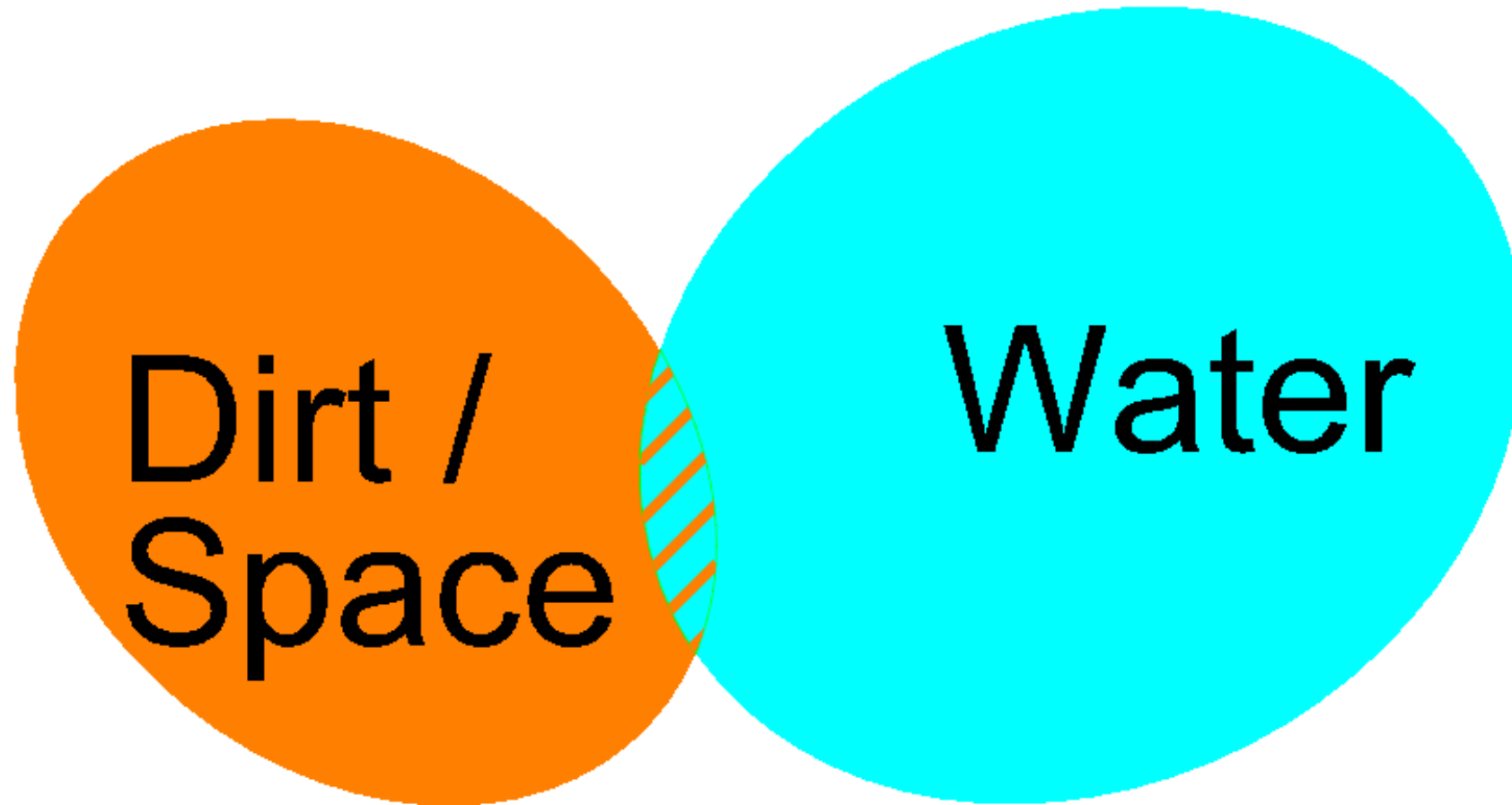
Older Civil Products with Drainage (InRoads, GEOPAK, MX)
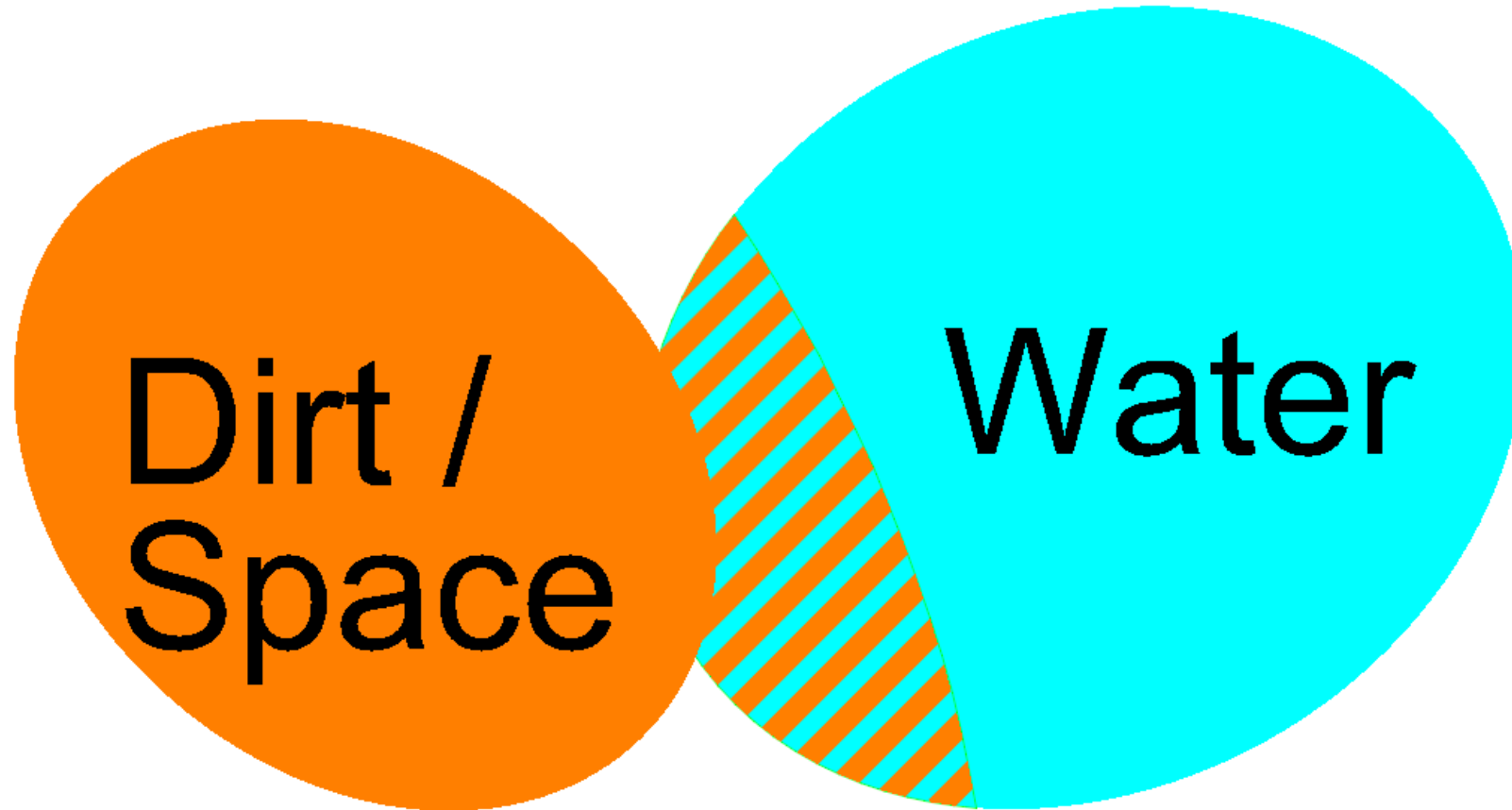
Older Civil Products with Drainage (InRoads, GEOPAK, MX)

- The Civil Drainage tools may have done enough hydraulics in the past, particularly for small projects, but they don't do enough now

- Now you need to consider climate change, larger storm events, attenuation, and low impact developments, in the design process

- You need to "Design for Exceedance" - because the capacity of the system will be exceeded

- What is the volume of flooding? How quickly will flooding occur? Do I need more attenuation? Where does the flood water go?

- You need more advanced drainage tools for this…

Advanced Drainage tools

- When InRoads, GEOPAK, MX drainage tools can't cope, at the moment you use more advanced drainage tools

- E.g. MIKE URBAN, MicroDrainage, SWMM etc.

- You've got a drainage system designed in your Civil product – how do you transfer it to the advanced drainage product? Copy it? Build it again from scratch?

- What happens when the Civil design changes?

- ☹ ☹ 😠 <> ☺

- Wouldn't it be easier just to use one piece of software?

OpenRoads & Subsurface Utilities: Expands the Scope

Dirt / Space

Water
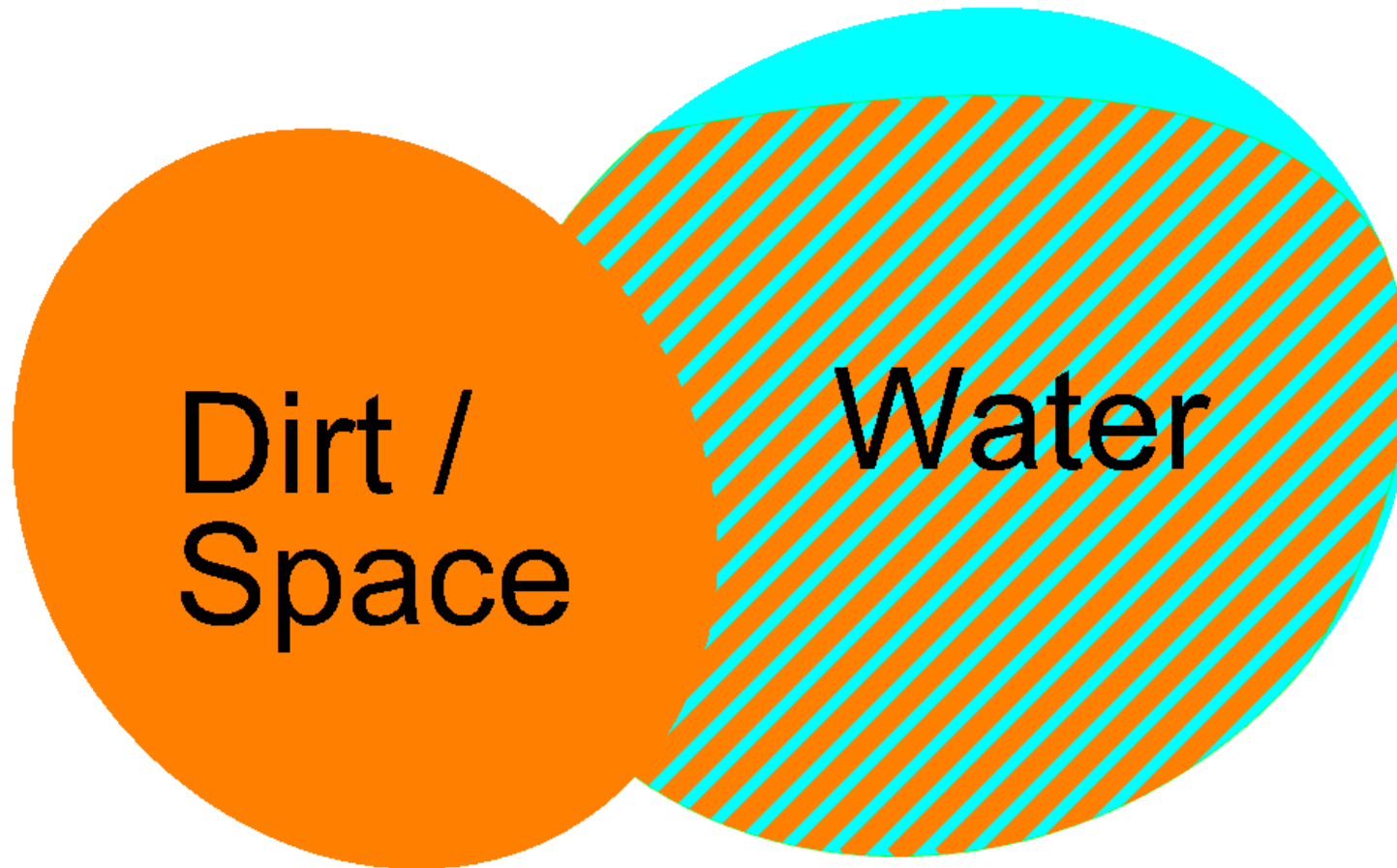
And uses proven Hydraulics Engines

OpenRoads & Subsurface Utilities: Expands the Scope

- You're not limited to peak flow hydraulics any more
- Use storm events – model changing rainfall intensity over time
- Then you can…
  - Produce runoff hydrographs (calculates a volume)
  - Model infiltration losses (reduces the volume)
  - Use time-varying analysis (routes the volume)
  - Design attenuation (stores the volume)
  - Find out where the system floods (excess volume)
- The key to all of this is to use CivilStorm functionality
- This could replace your current advanced drainage tools

Hydraulics!

- Haestad: A Hydraulic Jump in Capability!

WaterGEMS

WaterGEMS is a comprehensive yet easy-to-use decision-support tool for water professionals who design, plan, and operate water distribution systems.

VIEW

SewerGEMS

SewerGEMS streamlines the modeling process to give engineers more time to design, analyze, and operate sanitary or combined conveyance sewer systems.

VIEW

CivilStorm

CivilStorm provides an easy-to-use environment for engineers to analyze, design, and operate stormwater systems.

VIEW

WaterCAD

WaterCAD is an easy-to-use hydraulic modeling application for the analysis, design, and operation of water distribution systems.

VIEW

SewerCAD

Thousands of utilities and engineering firms around the world trust SewerCAD for sanitary sewer modeling and design to minimize capital investments.

VIEW

StormCAD

StormCAD provides stormwater professionals with advanced tools to effectively deliver high-quality storm sewer design with lower capital investment.
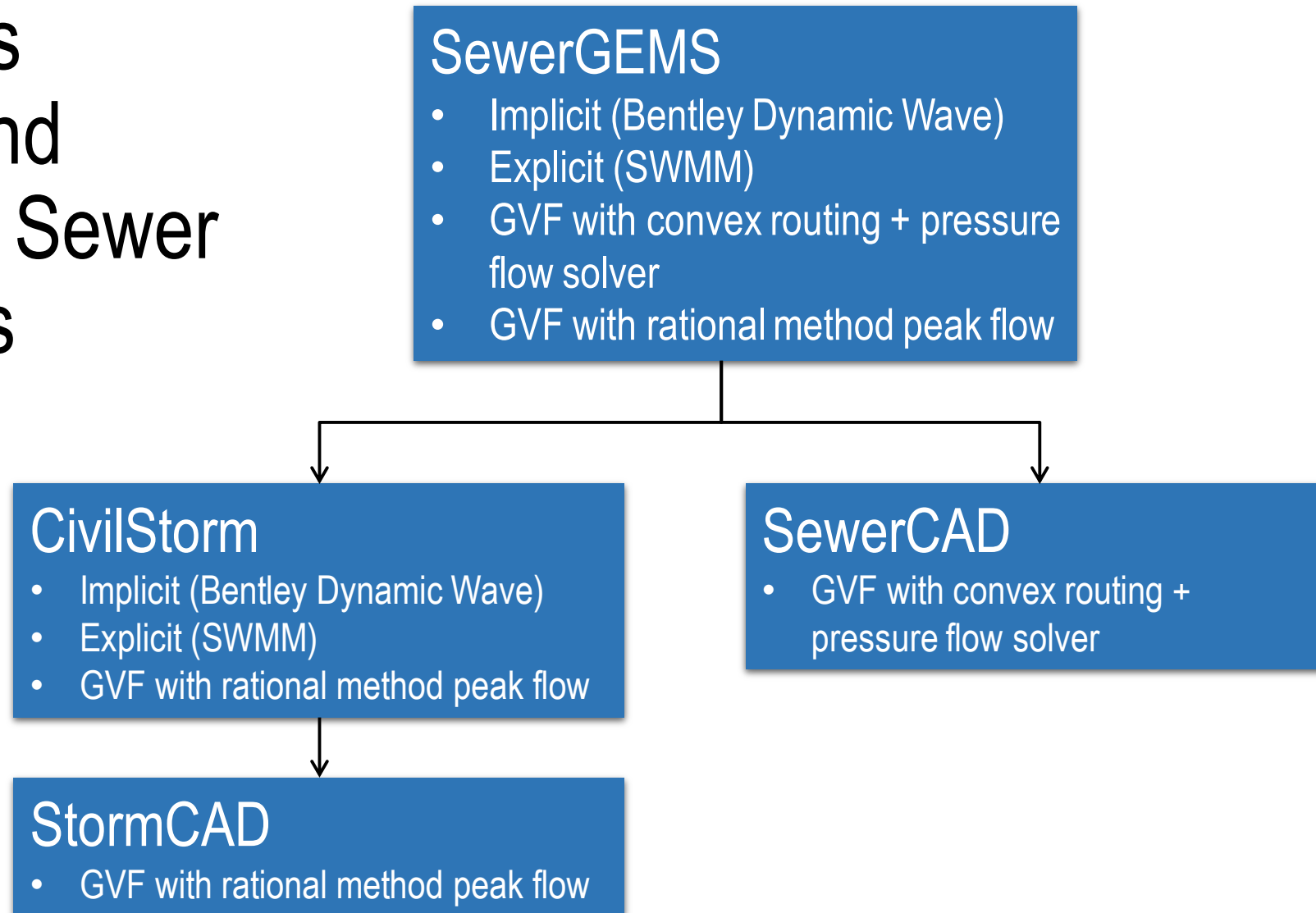
VIEW

PondPack

CulvertMaster

FlowMaster

Bentley's Storm and Sanitary Sewer Products

SewerGEMS

- Implicit (Bentley Dynamic Wave)
- Explicit (SWMM)
- GVF with convex routing + pressure flow solver
- GVF with rational method peak flow

CivilStorm

- Implicit (Bentley Dynamic Wave)
- Explicit (SWMM)
- GVF with rational method peak flow

SewerCAD

- GVF with convex routing + pressure flow solver

StormCAD

- GVF with rational method peak flow

GVF = Gradually Varied Flow

Haestad Hydrology & Hydraulics

Founded 1979, porting HEC-1, HEC-2 and TR-20 to PCs

- PondPack – 1987. Hydrology & detention pond analysis
- FlowMaster – 1991. Hydraulic calculator
- WaterCAD – 1995. Water distribution modeling
- StormCAD – 1995. Storm sewer analysis and design
- SewerCAD – 1999. Sanitary sewer analysis and design
- WaterGEMS – 2002. Water distribution modeling
- CivilStorm – 2003. Culvert hydraulics
- HAMMER – 2003. Hydraulic transient modeling
- SewerGEMS – 2004. Stormwater, sanitary sewer and combined sewer modeling.

CulvertMaster, PondPack and StormCAD are FEMA accepted

Hydrograph Methods

Unit hydrographs
    SCS
    RTK
    Generic
EPA-SWMM runoff
Modified rational
ILSAX
Time-Area Method

Low Impact Developments

- Bioretention
- Infiltration trenches
- Porous pavement
- Rain barrels
- Vegetative swales

How?

- Evaluate
  - Does SU meet your Needs? Yes.
  - Are there deltas/deviations? Inevitably.
    - Can you overcome them? Of course.
- Plan
  - For your designers
  - For your projects
  - For your standards
    - Hydraulics
    - Graphics
- Ensure
  - QC Tools
  - QA

- Implement
- Continuous Evaluation and Improvement

Evaluate - Hydraulic Compatibility

- If you use InRoads/GEOPAK/MX for Drainage:
    1. Import a project that you know
    2. Use a GVF Analysis scenario (doesn't change elevations or sizes)
    3. Review the calculation options
    4. Compute the scenario
    5. Check the results match

Evaluate - Importing

From InRoads

- You can get "Perfectly Preserved Symbology" IF your Legacy and OpenRoads settings meet conditions (same Naming, for example)

- Otherwise you get "Default" structures, and you can apply feature definitions
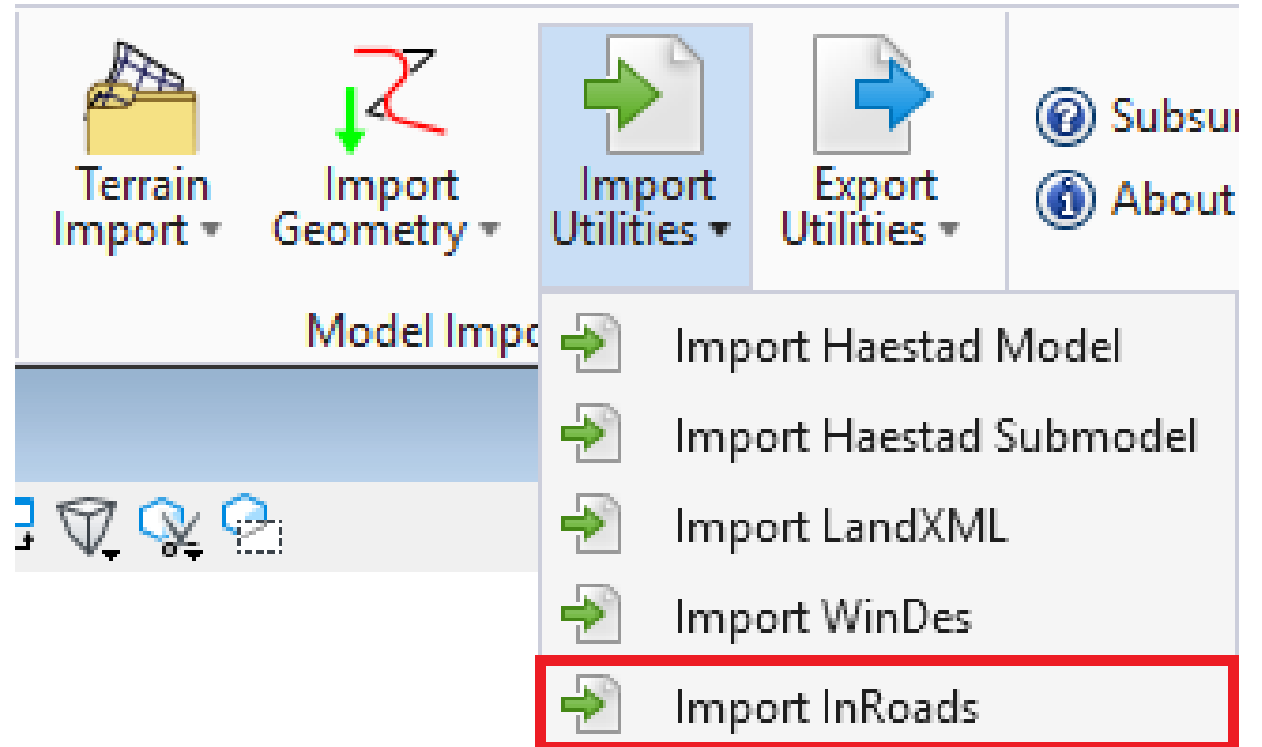
Evaluate - Importing

From GEOPAK/MX

- Both write a .SWS file

- MX writes a .XML file

- C3D writes a .XML file
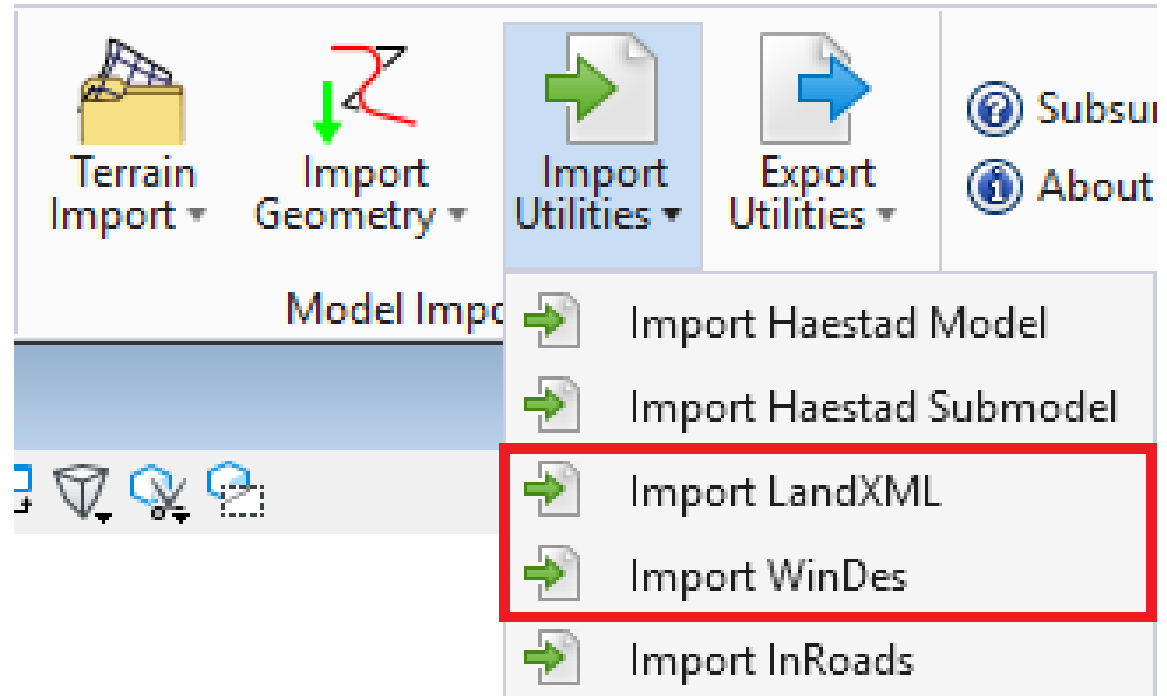
Evaluate - Importing

- If the results don't match, review the calculation options again – there is probably a setting that you need to change
- These settings can be set up as defaults in your SU DGNLib
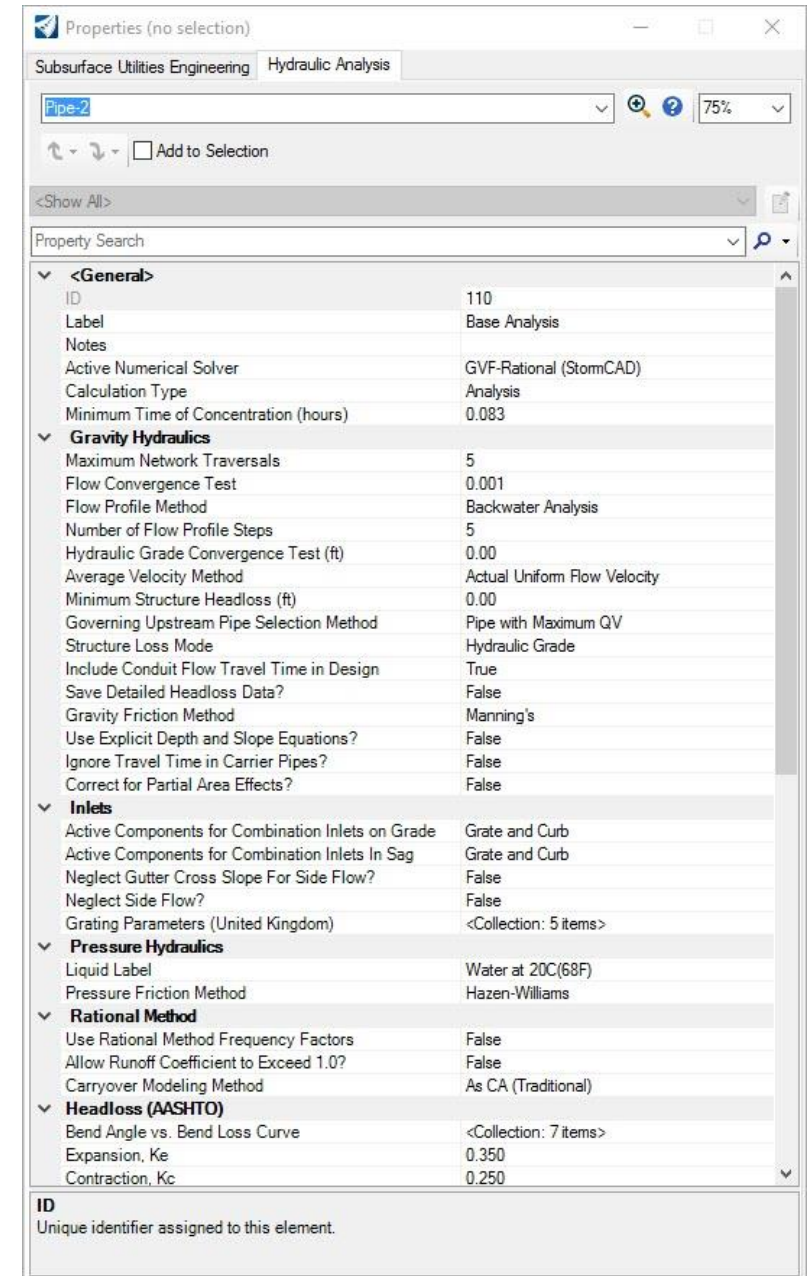
Evaluate - Importing

From Haestad

- If you have a StormCAD / SewerCAD / CivilStorm / SewerGEMS project

- All the settings and calculation options from it will be imported
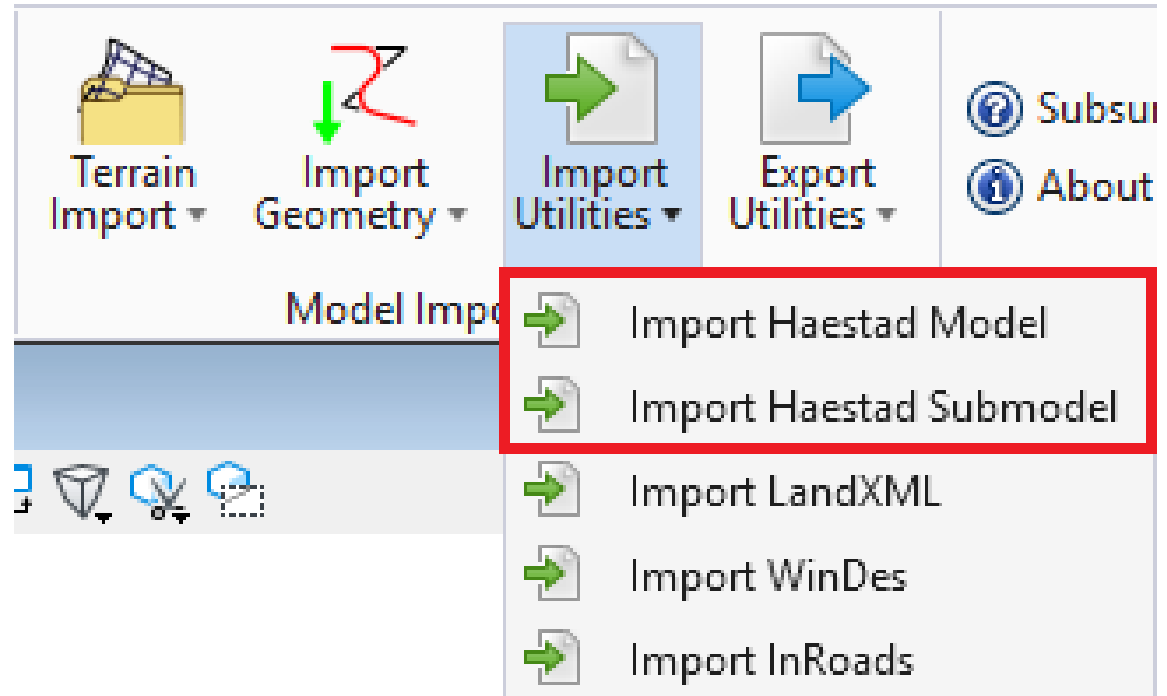
Evaluate - Importing

- From Excel, Access, ESRI, and pretty much everything else: use ModelBuilder
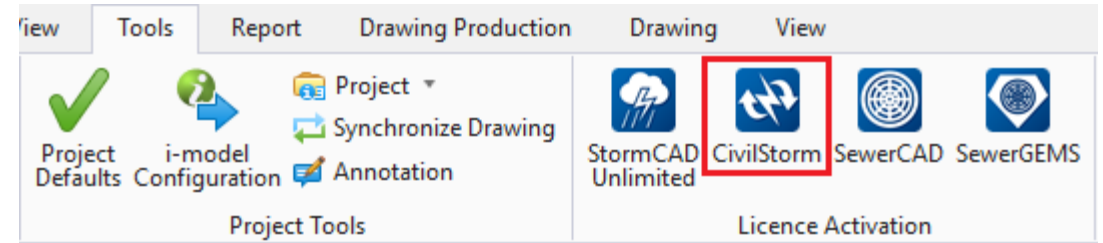 - Plenty of training available
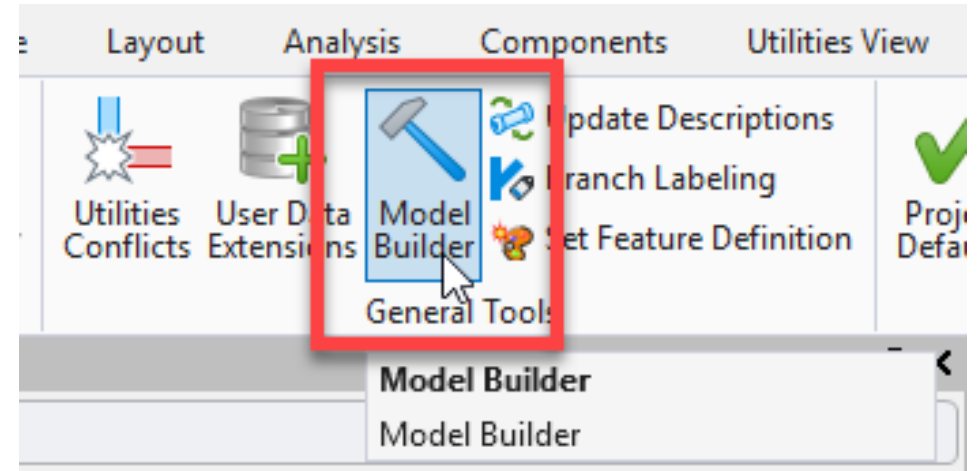
Evaluate - Hydraulic Compatibility

- Now you have a SU project, and you are happy that the results either:
  - Match the legacy product
  - Are better than the legacy product
- What next?
- Evaluate how SU compares with your current Advanced Drainage Tool
  1. CivilStorm should give you equivalent H&H functionality
  2. All the data is in one place
  3. Can be managed in ProjectWise
  4. Can be viewed in Navigator
  5. Can be a BIM solution

Evaluate – Advanced Hydraulic Compatibility

1. Activate CivilStorm
2. Create a new scenario for a dynamic wave analysis
3. Set up alternatives for rainfall and hydrology
4. Set up the Calculation options
5. Compute
6. Export to SWMM

SWMM

SWMM

- Written by the EPA, in the USA

- Its freeware

- Its probably the best known dynamic hydrology-hydraulic water quality simulation model for urban storm drainage in the world

- CivilStorm uses it

- MIKE URBAN uses it

- Other products use it

- That's why you might not need them any more

Evaluate - Exporting

- For any Advanced Drainage Tool that does not read SWMM data, use ModelBuilder

- Choose a format that suits the Advanced Drainage Tool in question
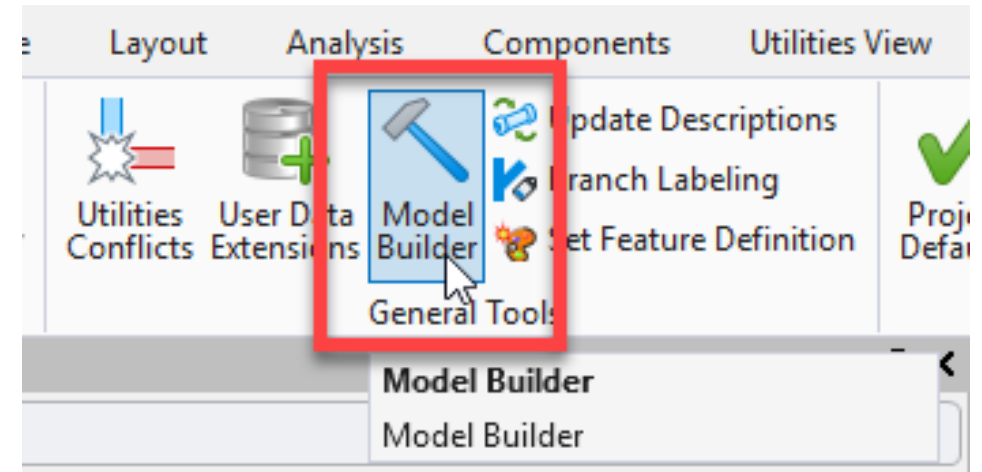
Evaluate – Advanced Hydraulic Compatibility

- CivilStorm highlights:
    1. Uses the same SWMM engine as other products
    2. Bentley extends it, to make it more internationally relevant
    3. Lots of ways to create runoff hydrographs
    4. Lots of ways to model losses
    5. Profiles show results over time (e.g. HGL)
    6. Analytic Symbology varies over time
    7. Design and analyse attenuation, such as ponds
    8. Find out where flooding occurs, and where it goes (one-dimensional)
- What's left, that you use your Advanced Drainage Tool for?
    - Two-dimensional flooding? We are looking at that

Plan - for your Designers

- Train the New Scopes
  - OpenRoads Fundamentals
  - Subsurface Utilities
    - Operational Training (What to click)
      - Subsurface Utilities Fundamentals
    - Deeper Training
      - "What Happens when you..."
    - QC Tools and Techniques
    - Implementation and Standards
- Training as a Process
  - Connect Advisor, Help, Communities
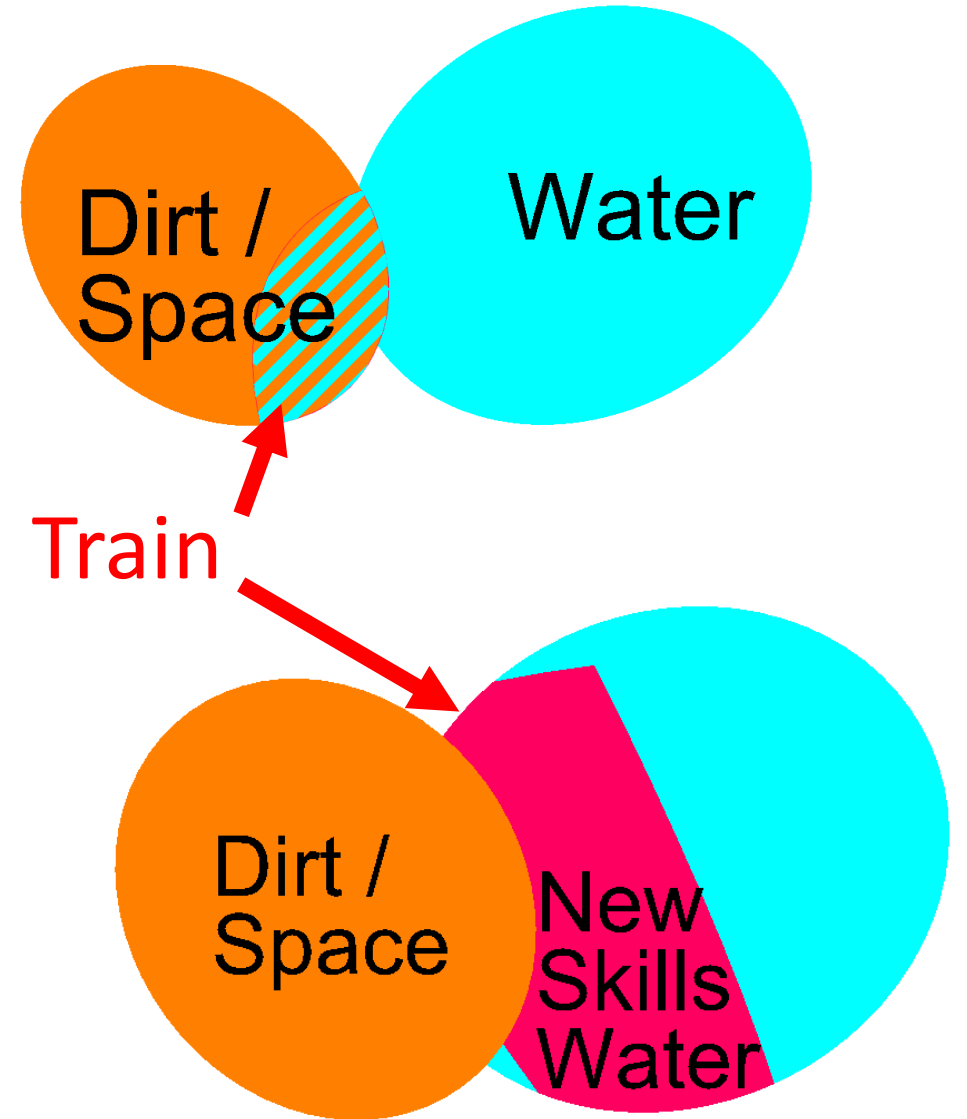
Plan - Standards / Workspace

A well-managed workspace facilitates conforming to standards, ease of use, and quality

- Hydraulics

- Graphics

You can base SU standards on a DGNLib that ships with the software

Make a copy of it, and adjust to suit

Plan - Workspace Setup

- Hydraulics and Utility Structures' Feature Definitions & Symbology is, for the most part,
  - encapsulated into SU-specific files
  - Consistent with OpenRoads Methodology (dgnlibs, etc.)
- "Standard" OpenRoads Setup is still required (terrain, geometry, etc.)
- *Meeting Subsurface Utility Standards and Streamlining Design*
  - This is your primary source for SU-specific Standards setup
  - Nominate a single person, and give them the time they need to work on this
  - It will be worth it, because you'll ensure that standards are followed

Plan - Workspace Setup Training

- OpenRoads Workspace Training & Documentation
  - [OpenRoads Designer Workspace Setup Learning Path](#)

- Subsurface Utilities Training & Documentation
  - [4 Subsurface Utility Design and Analysis Learning Path](#)
    - *Meeting Subsurface Utility Standards and Streamlining Design* training

Plan - Project

- Once you have:

1. Satisfied yourself that you can design and analyse your storm drainage system using StormCAD and CivilStorm functionality

2. Trained your designers

3. Set up your Workspace/Workset

- You are nearly there. Think about a suitable project to use

Plan – Project

- Are drawings needed?
  - OpenRoads Designer Update 2 includes annotation / drawing / sheeting functionality
  - For SU, annotation for profiles isn't ready yet, but
  - You can use Engineering Profiles to create a drawing with tabular annotation
  - Projected profiles – coming soon
- Are reports needed?
  - FlexTables can be customized to suit most reporting needs
  - Can be exported to Excel or XML, and formatted with a style sheet

Plan – Project

- ## What about BIM?
  - You can use User Data Extensions (UDX) to store any data you want to
  - Not just text – can be enumerated, Boolean, date/time, formula
  - UDX fields appear in properties / FlexTables etc just like any other field
- ## Use UDX to add value for your client

Why you Should be Using Subsurface Utilities and How to Get There

Thank You