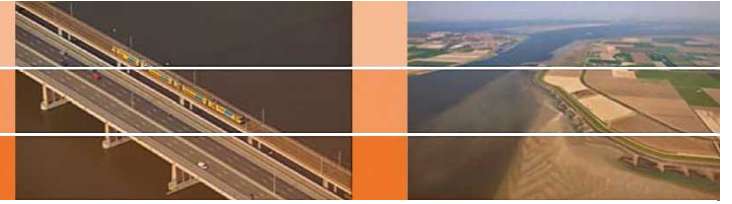




Werken met D-Geo Flow

Esther Rosenbrand
Vera van Beek

Inhoud



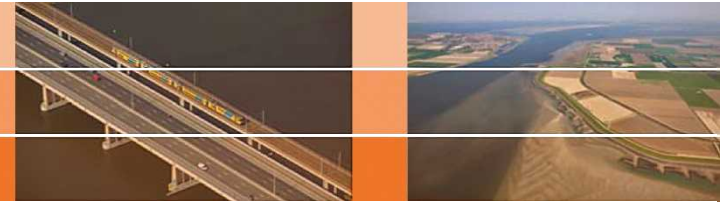
- Inleiding
- Wat kan wel, wat kan niet?
- Aandachtspunten en gevoeligheden
 - Meshing
 - MPicard
- Oefening
- Known issues

D-Geo Flow



- D-Geo Flow is een gezamenlijke ontwikkeling van RWS en Deltares
- D-Geo Flow wordt gereleased als een eerste versie (v1.0) en is een startpunt voor doorontwikkeling.
- D-Geo Flow wordt kosteloos verstrekt aan geïnteresseerde partijen na tekenen van het contract, wat recht geeft op:
 - Versie 1.0
 - Eerste lijn support
 - Eenmalige registratie per bedrijf, met meerdere installaties.
- Verdere verbeteringen via actieve gebruikers community en pilotprojecten
- In 2019 zal D-Geo Flow worden opgenomen in de ontwikkellijn van RWS/I&M

Inleiding

A screenshot of the Delta Shell software interface. The window title is "Project1 - Delta Shell". The interface includes a menu bar (File, Home, View), a toolbar, and a main workspace. The main workspace displays the "Start Page" for "Project1", which features a navigation menu (Home, Get started, Develop, Download, Manuals, Showcases, About Delta Shell) and a central text area titled "Delta Shell Free Software Community". A yellow arrow points from the "Project1" icon in the left-hand "Project" pane to the "Start Page" content. The "Properties" pane on the left shows details for "Project1", including its name, description, and creation/modification dates. The "Messages" pane at the bottom shows a list of system messages with timestamps. The "Toolbox" pane on the right contains folders for "Models", "Items", and "Scripts".

Project1 - Delta Shell

File Home View

Clipboard New Model

Project1

Start Page

Delta Shell Free Software Community

Delta Shell is a free integrated modeling environment with a focus to setup, configure, run and analyze results of the integrated environmental models used to simulate water, soil and the subsurface processes.

The software components available within Delta Shell are easy to reuse separately, or as a part of an integrated environment.

The software can run in a graphical user interface or a command-line mode.

Most of the components are developed using the C# programming language.

16.000+ joined the Deltares Open Source Community

Properties

Project

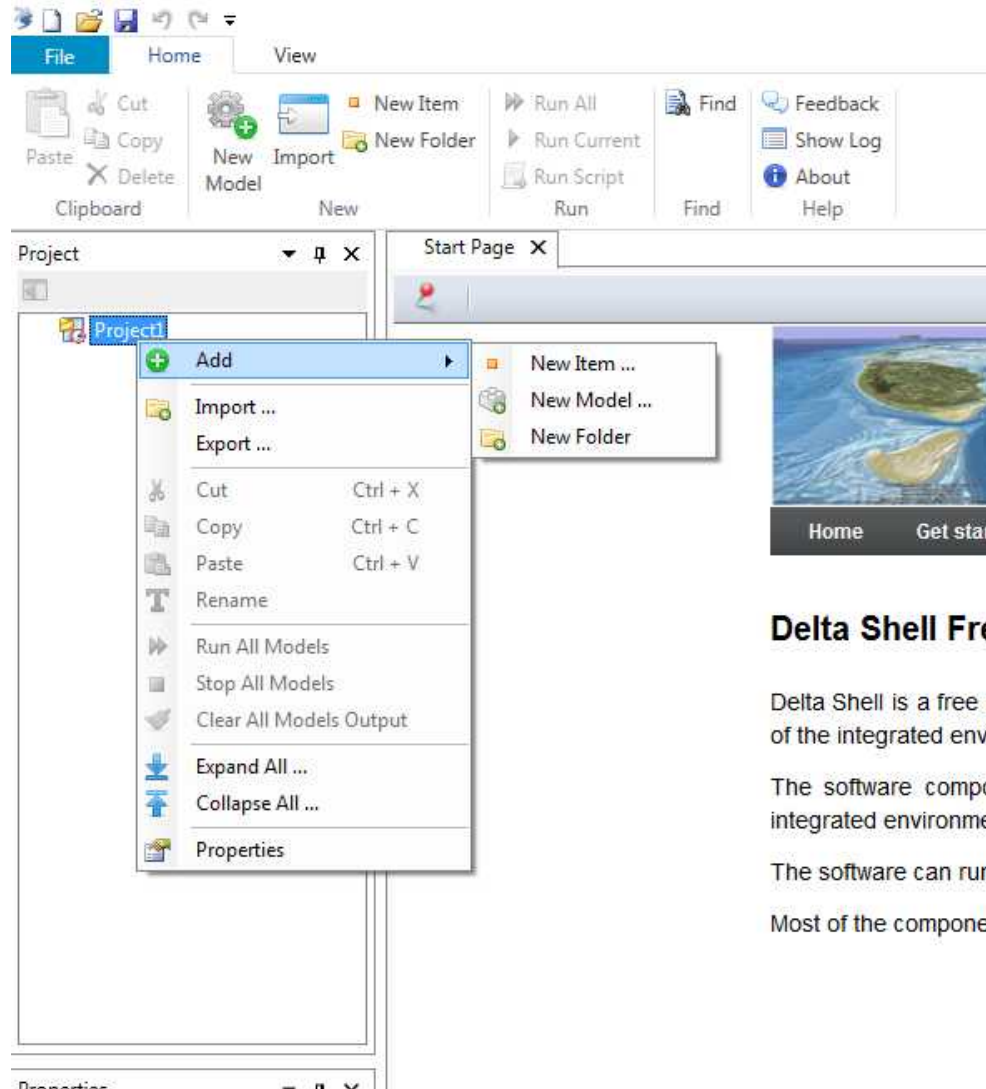
General	
Name	Project1
Description	
Project	
Created	
Changed	
Task count	0
Size	0

Messages

Message	Time
Adding welcome page ...	1/2/2018 10:23:06 AM
Main window created.	1/2/2018 10:23:06 AM
Hiding splash screen ...	1/2/2018 10:23:06 AM
Started in 4.03 sec ...	1/2/2018 10:23:06 AM
Project Project1 saved	1/2/2018 10:23:06 AM

Undo / Redo Chart Map Toolbox

Inleiding



Delta Shell Fre

Delta Shell is a free ii
of the integrated envi

The software compo
integrated environme

The software can run
Most of the componer

Inleiding



The screenshot shows the Delta Shell software interface. On the left is a 'Project' tree with folders for 'River_dike_tutorial', 'DgFlow_Models', 'Input', 'Materials', 'Boreholes', 'Boundary Conditions', 'Pipes', 'Grid', 'Output', and 'Pipe Results'. Below the project tree is a 'Properties' window for 'DgFlow model properties'. A yellow arrow points to the 'Time properties' section. The 'Time properties' section includes: Start time: 2017-03-10 00:00:00, End time: 2017-03-11 00:00:00, Time Steps: 2, Time step: 12:00:00. The 'Output properties' section includes: Output Step Interval: 1, Output time step: 12:00:00. The 'Settings' section includes: NDim: 2, Analysis: flow, MPicard: 500, Gravity: 9.81, EnLin: 1E-12, EnNonLin: 1E-06, Working Directory: C:\Users\vrossenbra\AppData\Local\Temp, File Name: DgTestXXX. The main window displays a 'Start Page' with a navigation bar (Home, Get started, Develop, Download, Manuals, Showcases, About Delta Shell) and a central text area titled 'Delta Shell Free Software Community'. The text describes Delta Shell as a free integrated modeling environment and mentions that 16,000+ people have joined the community. A 'Messages' window at the bottom shows three messages about selected objects of type 'DgFlowModelProperties'.

Inleiding



Properties

DgFlow model properties

Time properties	
Start time	2017-03-10 00:00:00
End time	2017-03-11 00:00:00
Time Steps	288
Time step	00:05:00

Output properties	
Output Step Interval	1
Output time step	00:05:00

Settings	
NDim	2
Analysis	flow
MPicard	1000
Gravity	10
ErrLin	1E-12
ErrNonLin	1E-06
Working Directory	C:\Users\rosenbra\AppData\Local\Temp\
File Name	DgTestXXX

Advanced Mode	
Advanced Mode	False

Inleiding

A screenshot of the DgFlow software interface. The top menu bar includes 'File', 'Home', and 'View'. Below it are various tool icons for file operations (Cut, Copy, Paste, Delete, New Item, Import, New Folder) and execution (Run All, Run Current, Run Script). The main 'Project' window shows a tree structure for 'River_dike_tutorial' with sub-items like 'DgFlow Model', 'Input', 'Materials', 'Water', 'Boreholes', 'Boundary Conditions', 'Pipes', 'Grid', 'Output', and 'Pipe Results'. A yellow arrow points from the 'Add new soil' button in the 'Materials' sub-tree to the 'Delta Shell' text block. The 'Properties' window at the bottom is empty. The 'Delta Shell' text block contains the following text:

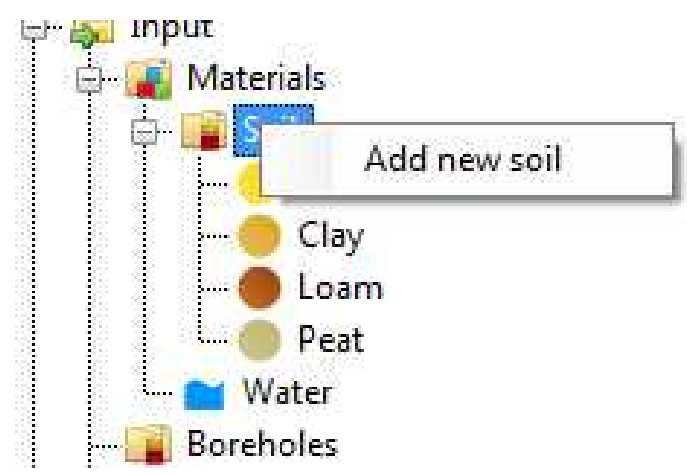
Delta Shell F

Delta Shell is a fr
of the integrated e

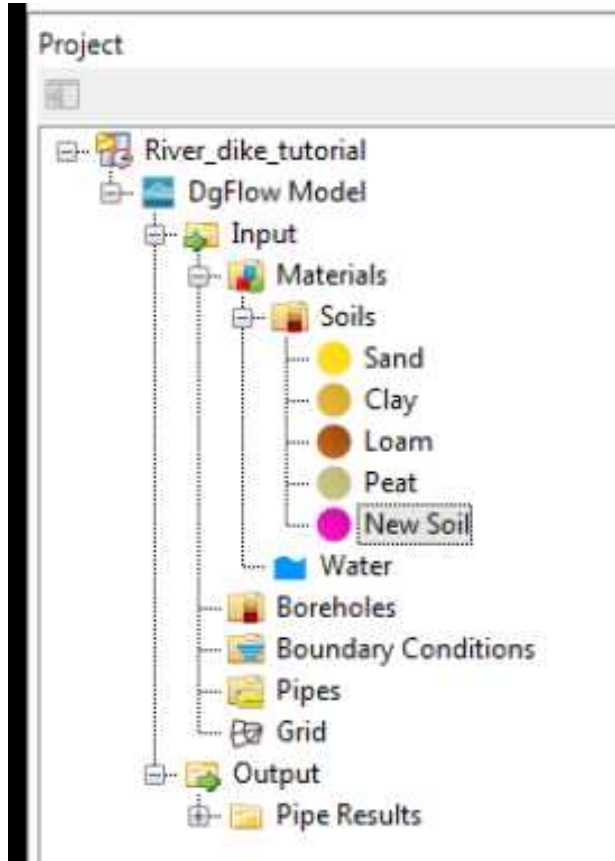
The software cor
integrated environ

The software can

Most of the comp



Inleiding



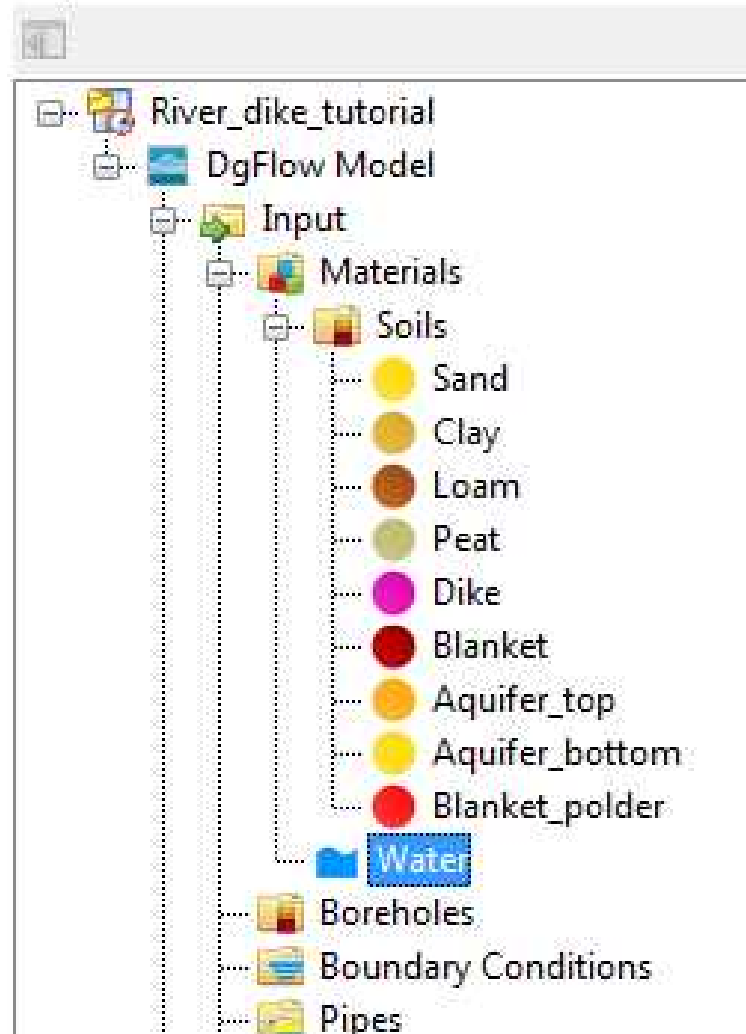
Properties: Soil Properties

General	
Name	New Soil
Color	213; 2; 165
Other	
Porosity, n [-]	0.36
Compressibility, α [m^2/N]	1E-07
Grain Particle Density, ρ^s [kg/m^3]	2650
Particle diameter, D_{70} [m]	0.0002
White's constant, η [-]	0.25
Bedding angle, θ [deg]	37
Permeability	
Hydraulic Conductivity, K_x [m/day]	7.5434976
Intrinsic permeability, k_x [m^2]	1.15700E-011
Hydraulic Conductivity, K_y [m/day]	7.5434976
Intrinsic permeability, k_y [m^2]	1.15700E-011
Fluid Density, ρ [N/m^3]	1000
Fluid Viscosity, μ [Ns/m^2]	0.0013

Inleiding



Project



Water Properties	
Name	Water
Compressibility, β [m^2/N]	5E-10
Density, ρ^l [kg/m^3]	1000
Viscosity, μ^l [Ns/m^2]	0.0013

Inleiding



The screenshot displays a software interface with a ribbon menu and a project tree. The ribbon menu includes tabs for File, Home, and View. The View tab is active, showing options such as New Item, New Folder, Run All, Run Current, and Run Script. The Project tree shows a hierarchy: River_dike_tutorial > DgFlow Model > Input > Materials > Boreholes. A context menu is open over the Boreholes folder, with options 'Add new borehole' and 'Create cross-section'.

Inleiding



Start Page | Borehole 1 X

Top level 0 m

Name Borehole 1

X position 0

Level -10 m

Aquifer_top

- Sand
- Clay
- Loam
- Peat
- Dike
- Blanket
- Aquifer_top
- Aquifer_bottom
- Blanket_polder

Sand(20.0 m)

Level -30 m

Zoom level

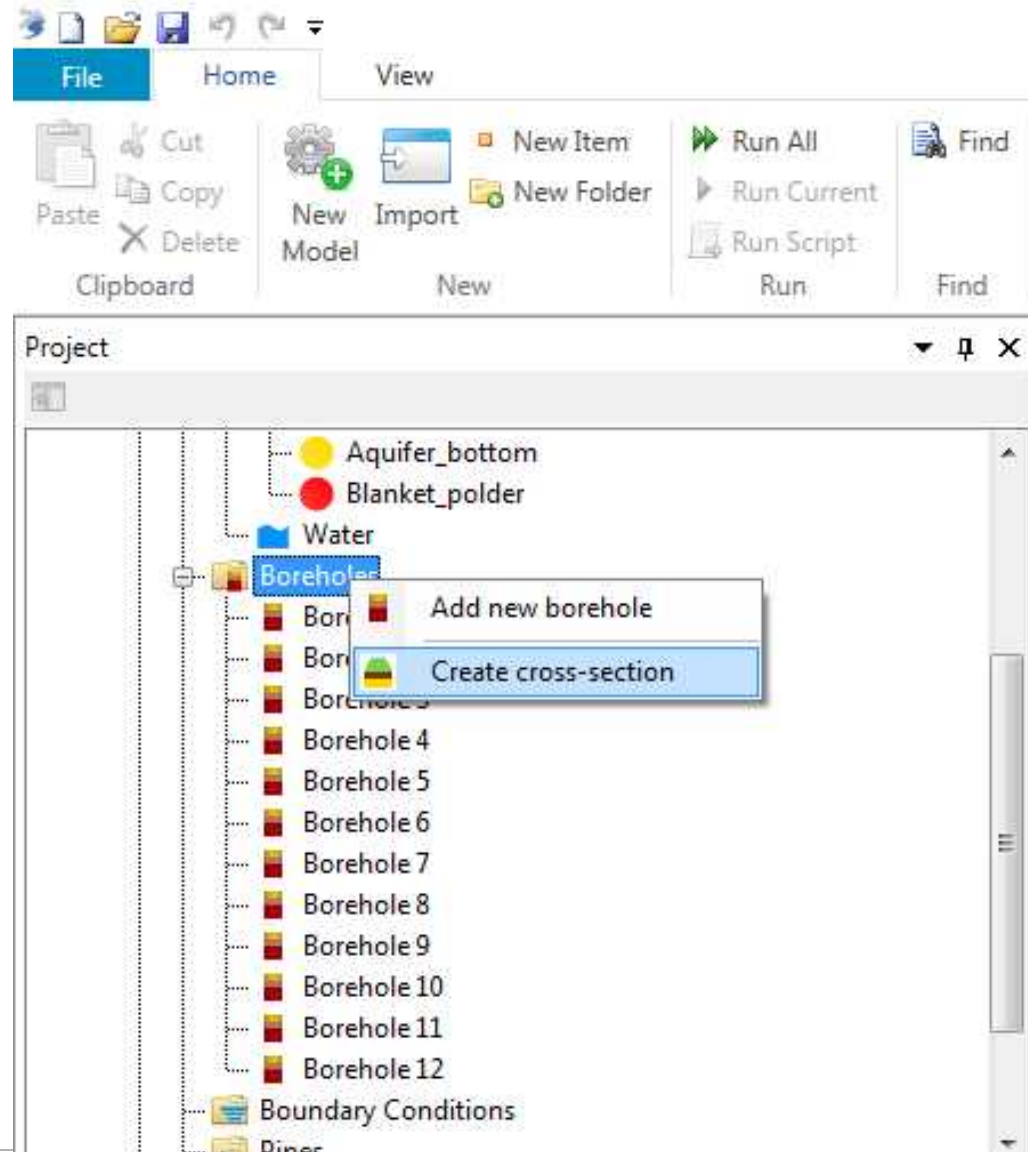
Maintain layer heights

Maintain layer depths

C

The image shows a software window titled 'Borehole 1'. It contains several input fields: 'Name' (Borehole 1), 'X position' (0), 'Top level' (0 m), and 'Level' (-10 m). A dropdown menu is open, showing a list of soil types: Sand, Clay, Loam, Peat, Dike, Blanket, Aquifer_top, Aquifer_bottom, and Blanket_polder. Below the dropdown, a vertical bar represents the borehole profile, with a yellow section labeled 'Sand(20.0 m)' extending from the -10 m level down to the -30 m level. At the bottom, there is a 'Zoom level' slider and two radio buttons: 'Maintain layer heights' (unselected) and 'Maintain layer depths' (selected). A small blue 'C' icon is visible in the bottom left corner of the window.

Inleiding



Inleiding



River_dike_tutorial - Delta Shell

File Home View Map

North Arrow Legend Scale Bar 15 Decorations

Zoom Previous Zoom Next Query Features Query Time Series

Map Coordinate System Export As Image

Show Profile Draw polygon - origin Cross-section tools

Grid Profile Edit

Project River_dike_tutorial DgFlow Model Input Materials Soils Dike Blanket Aquifer_top Aquifer_bottom Blanket_polder Water Boreholes Borehole 1 Borehole 2 Borehole 3 Borehole 4 Borehole 5 Borehole 6

Properties

m 2.5 5 7.5 10

Messages

Message	Time
Selected object of type: DgFlowModelProperties	1/2/2018 11:32:58 AM
Selected object of type: DgFlowProjectTreeItemProperties	1/2/2018 11:32:56 AM
Close view: DeltaShell.Digine.DgFlow.Gui.Menu.DgFlowBaseModelView	1/2/2018 11:32:54 AM

Messages Time Navigator

Inleiding



File Home View Map

North Arrow Legend 15 Scale Bar Decorations

Zoom Previous Zoom Next Query Features Tools

Map Coordinate System Export As Image Query Time Series Edit

Project

- River_dike_tutorial
 - DgFlow Model
 - Input
 - Materials
 - Boreholes
 - Boundary Cond
 - Pipes
 - Grid
 - Output
 - Pipe Results

River_dike_tutorial

- DgFlow Model
 - Input
 - Materials
 - Boreholes
 - Boundary Conditions
 - River_boundary
 - Head
 - Pipes
 - Grid
 - Output
 - Pipe Results

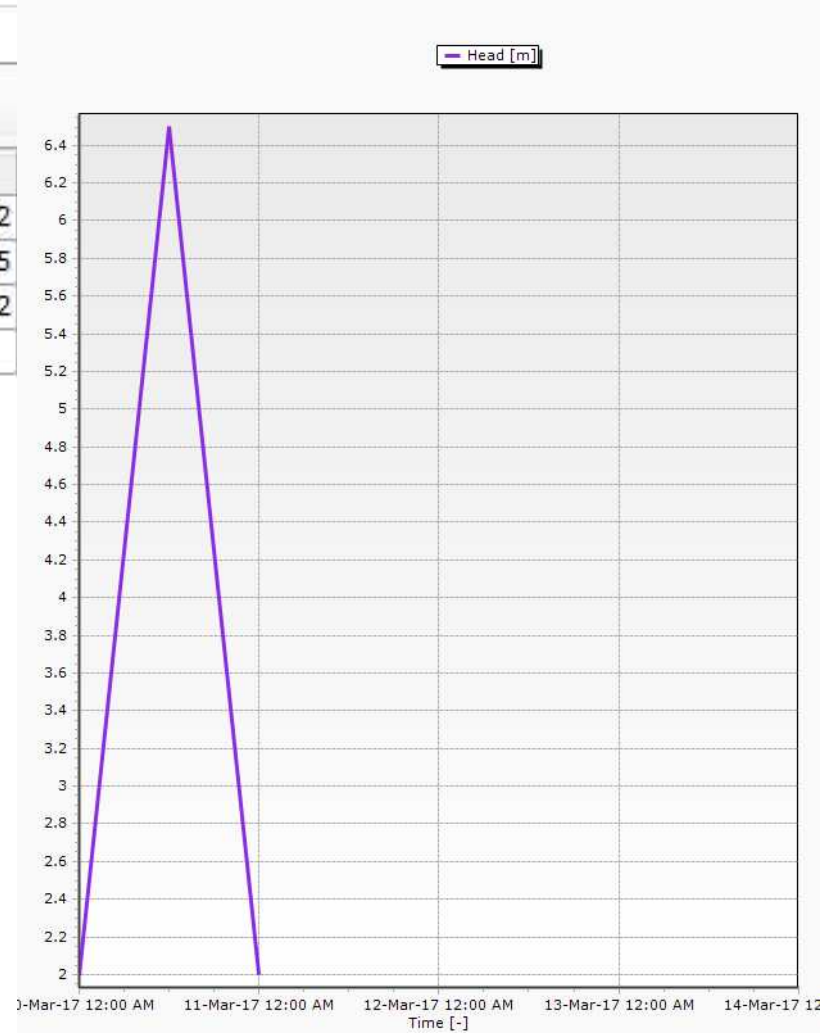
Inleiding



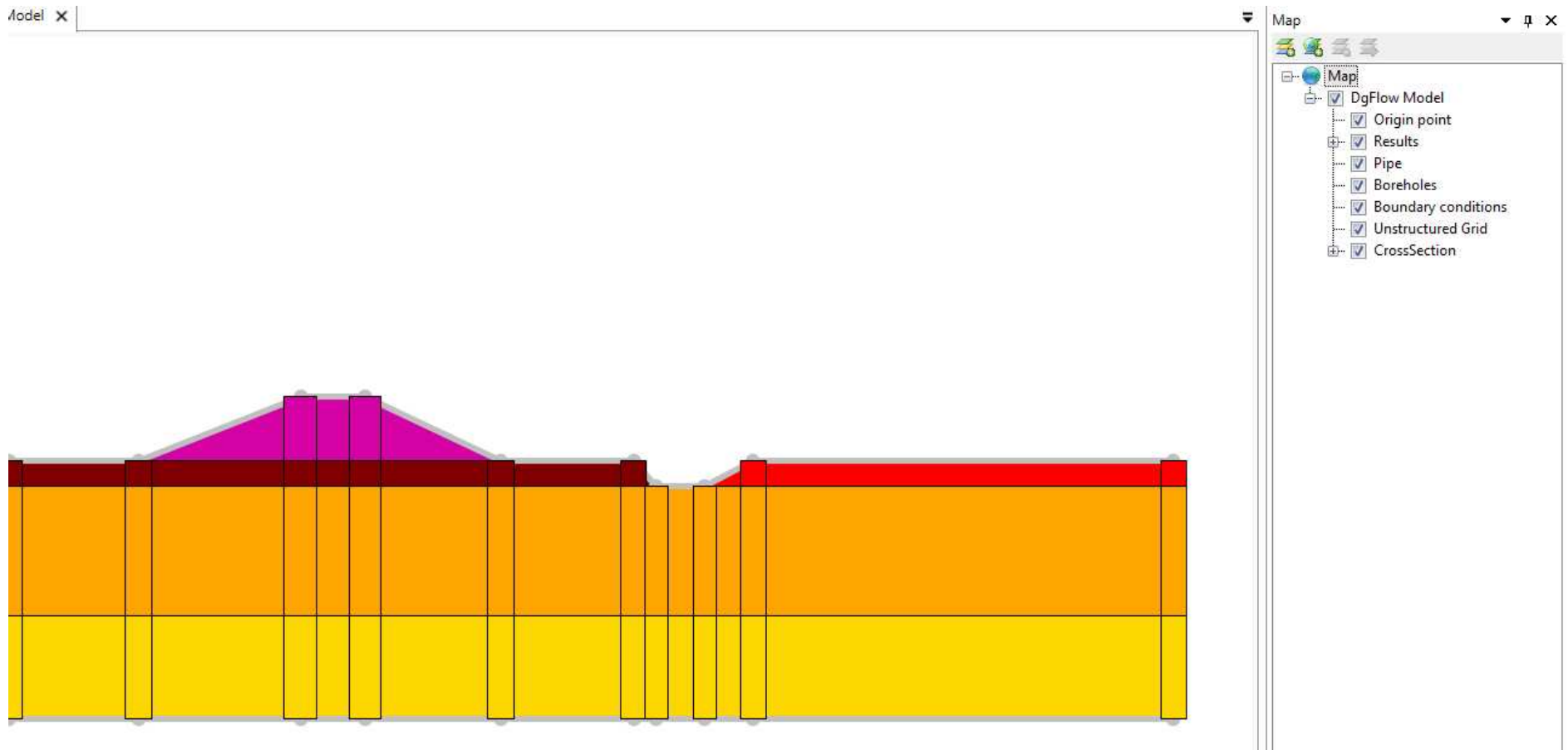
Start Page | DgFlow Model | Head X

Clipboard import | Csv import | Csv export

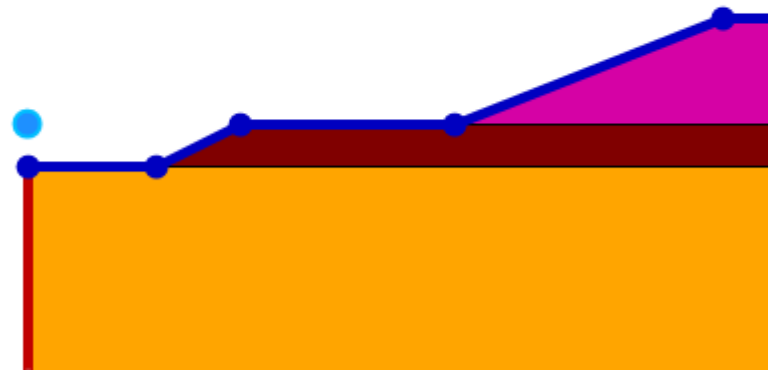
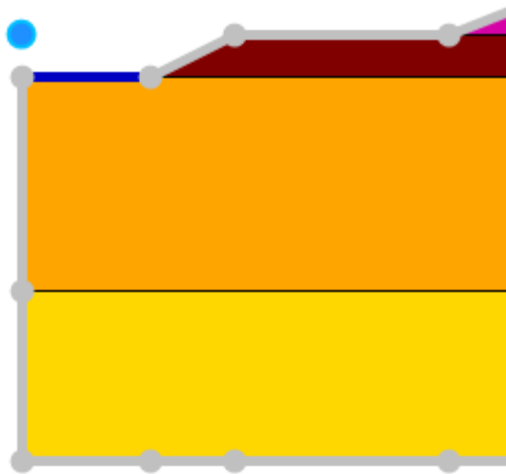
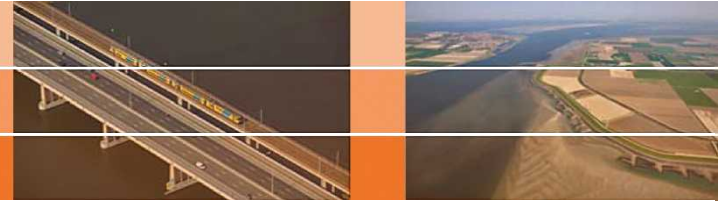
Time [-]	Head [m]
2017-03-10 00:00:00	2
2017-03-10 12:00:00	6.5
2017-03-11 00:00:00	2



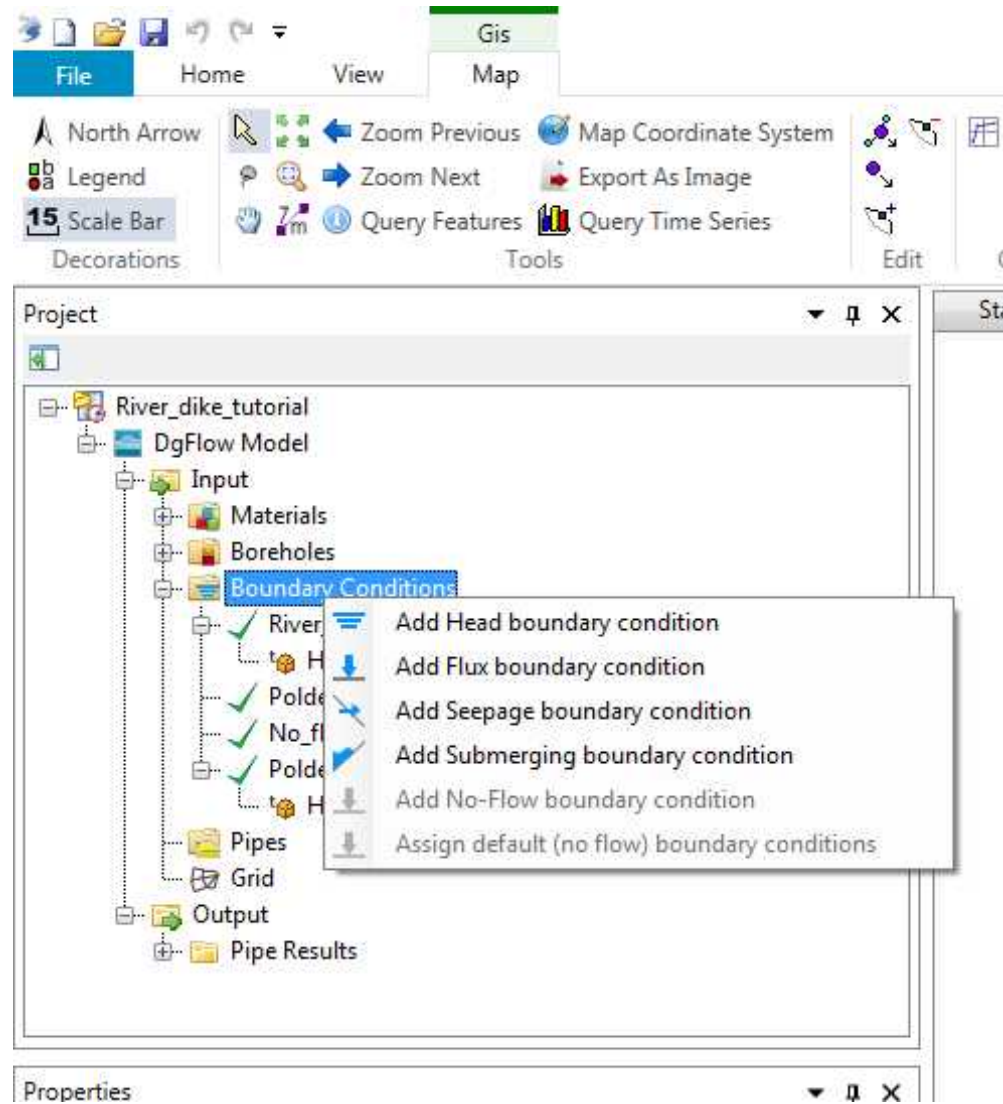
Inleiding



Inleiding



Inleiding



Inleiding



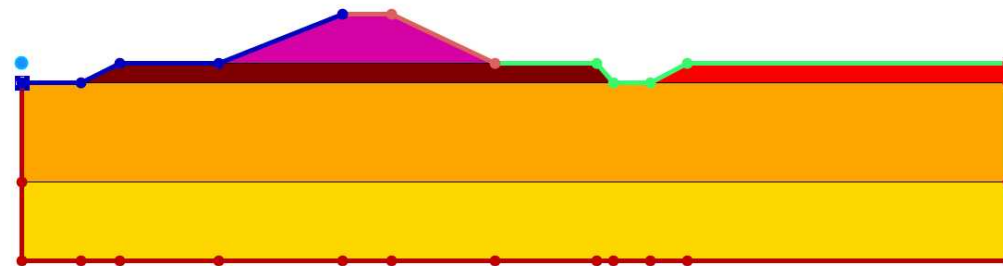
Tree view:

- River_boundary
 - Head
- Polder_side_seepage
 - No_flow
- Polder_level
 - Head
- Pipes
- Grid
- Output
- Pipe Results

Properties

DgFlowBoundaryLineProperties_DisplayName

Boundary condition	No_flow
Geometry	POINT (0 -2)
Coordinates (X, Y, Z)	String[] Array



Inleiding



Head

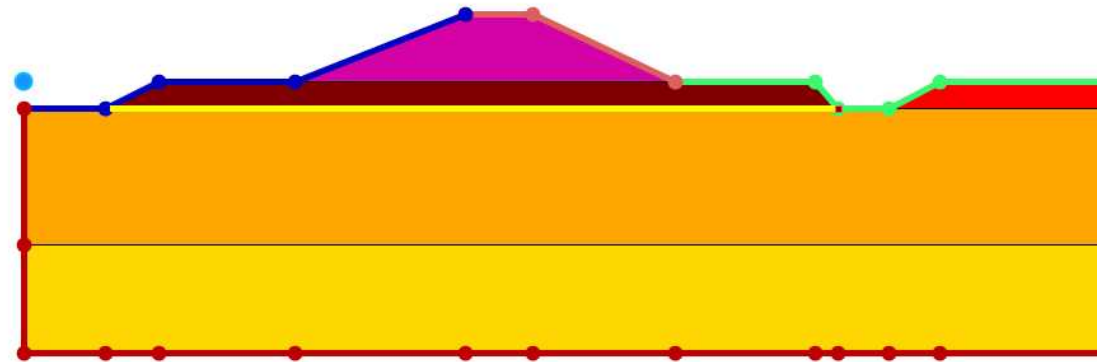
- Pipes
 - Pipe
- Grid
- Output
- Pipe Results

Properties

DgFlowPipeDataProperties_DisplayName

General	
Name	Pipe

Position	
Start: X	6
Exit: X	60
Y-Position	-2



Inleiding



Chart Operations Toolbox Undo / Redo

Properties

DgFlowProjectTreeItemProperties

20

↑ ×

'M

'M

'M

'M

'M

'M

PM

PM

PM

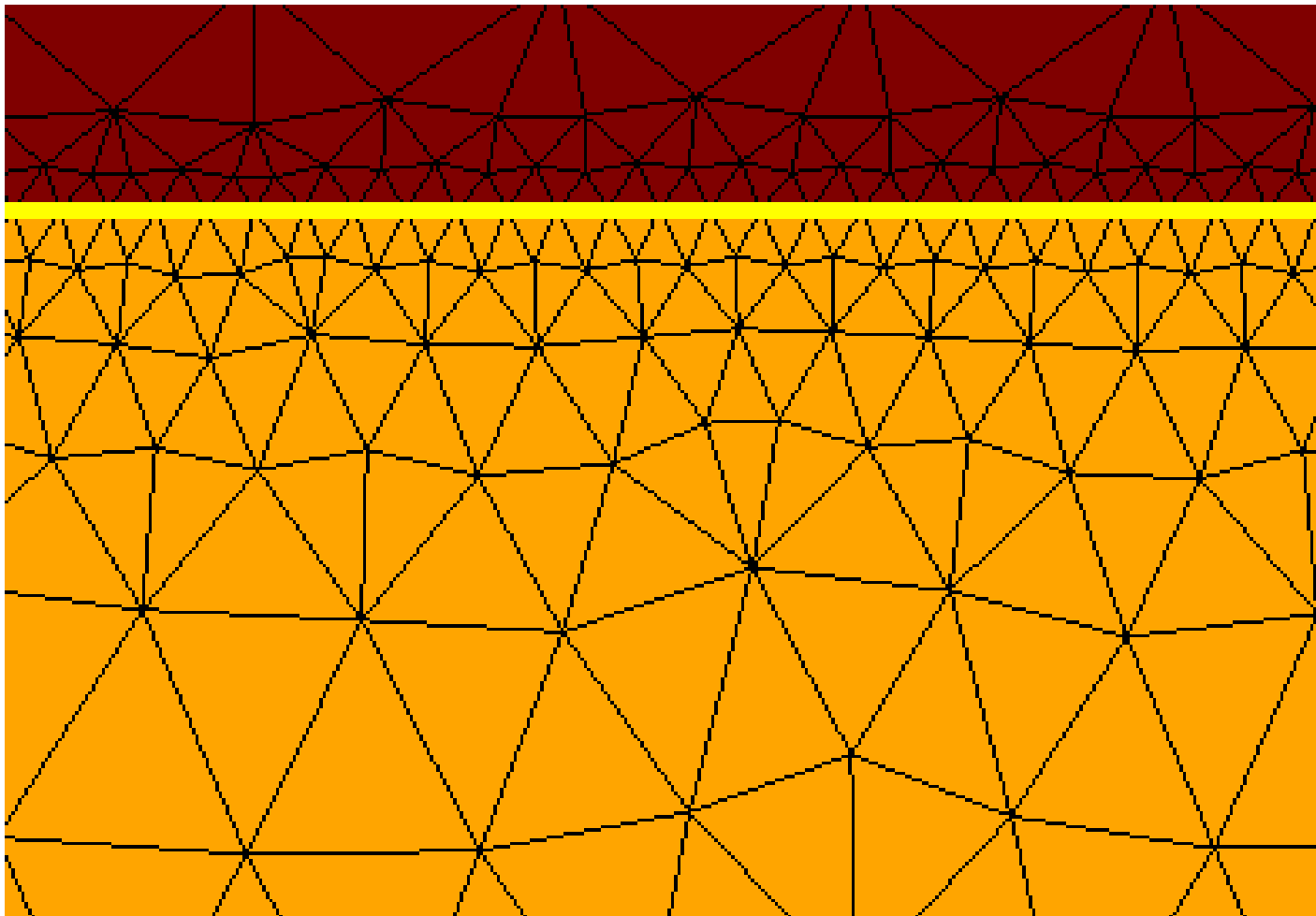
Mesh Data

Default Mesh Coarseness [m]	2.5
Pipe Coarseness [-]	6

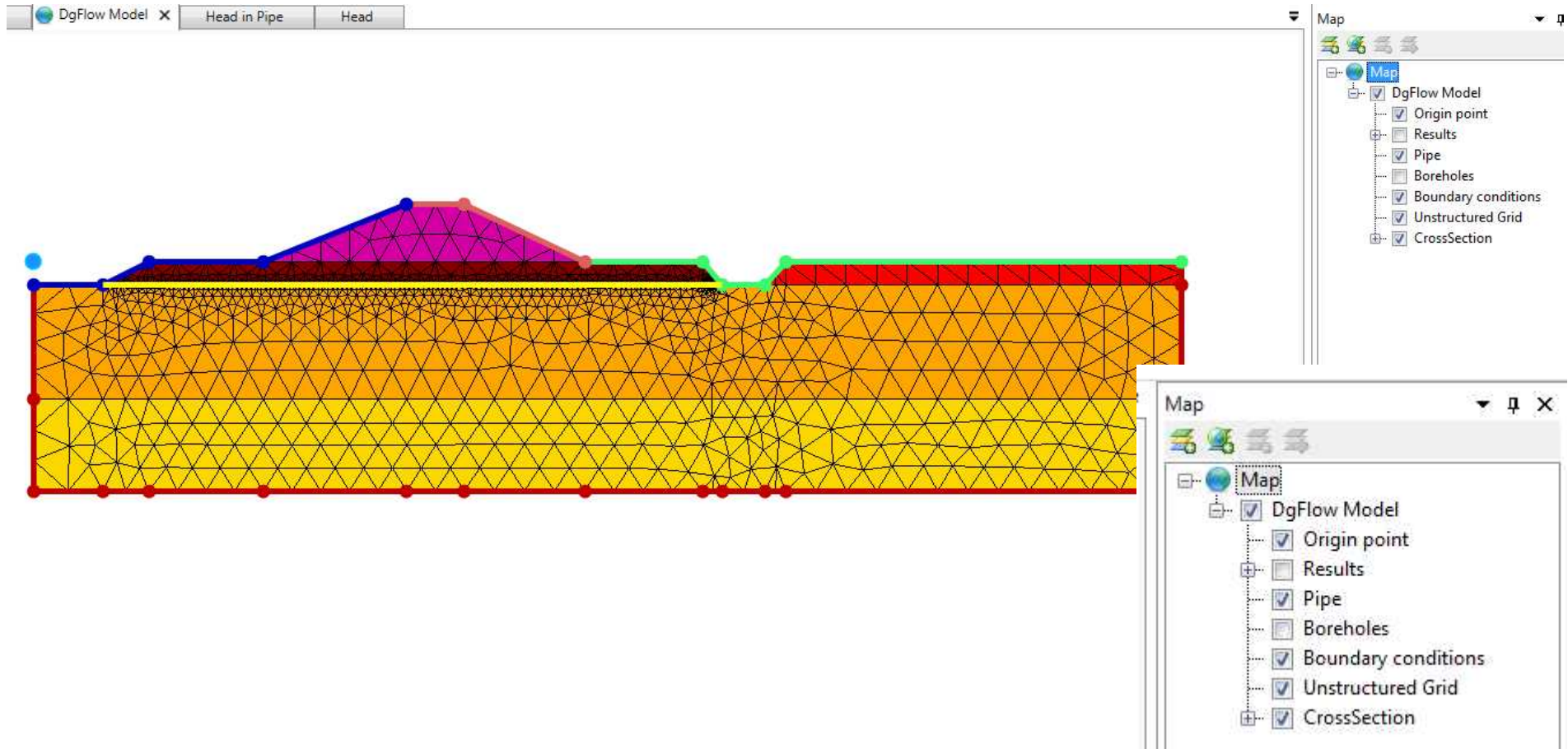
Mesh Parameters

Cell Count	0
Min Angle [deg]	0.00
Max Angle [deg]	0.00

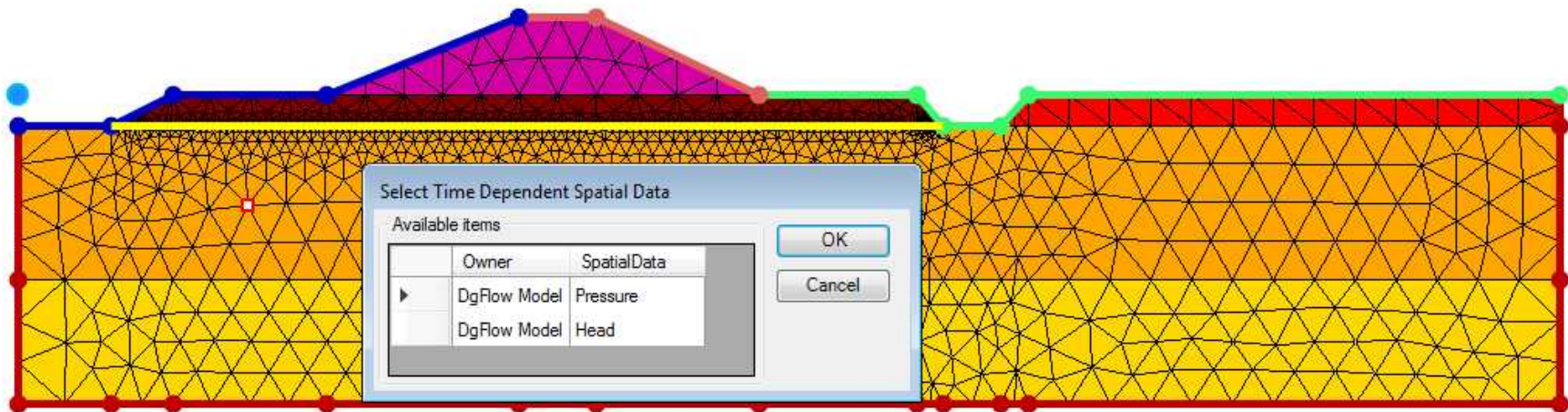
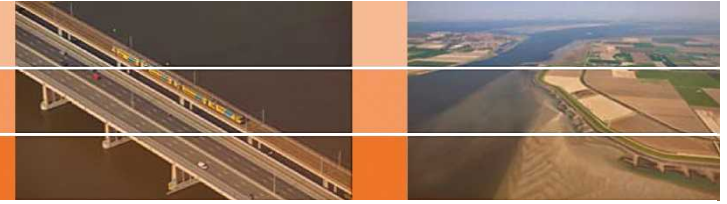
Inleiding



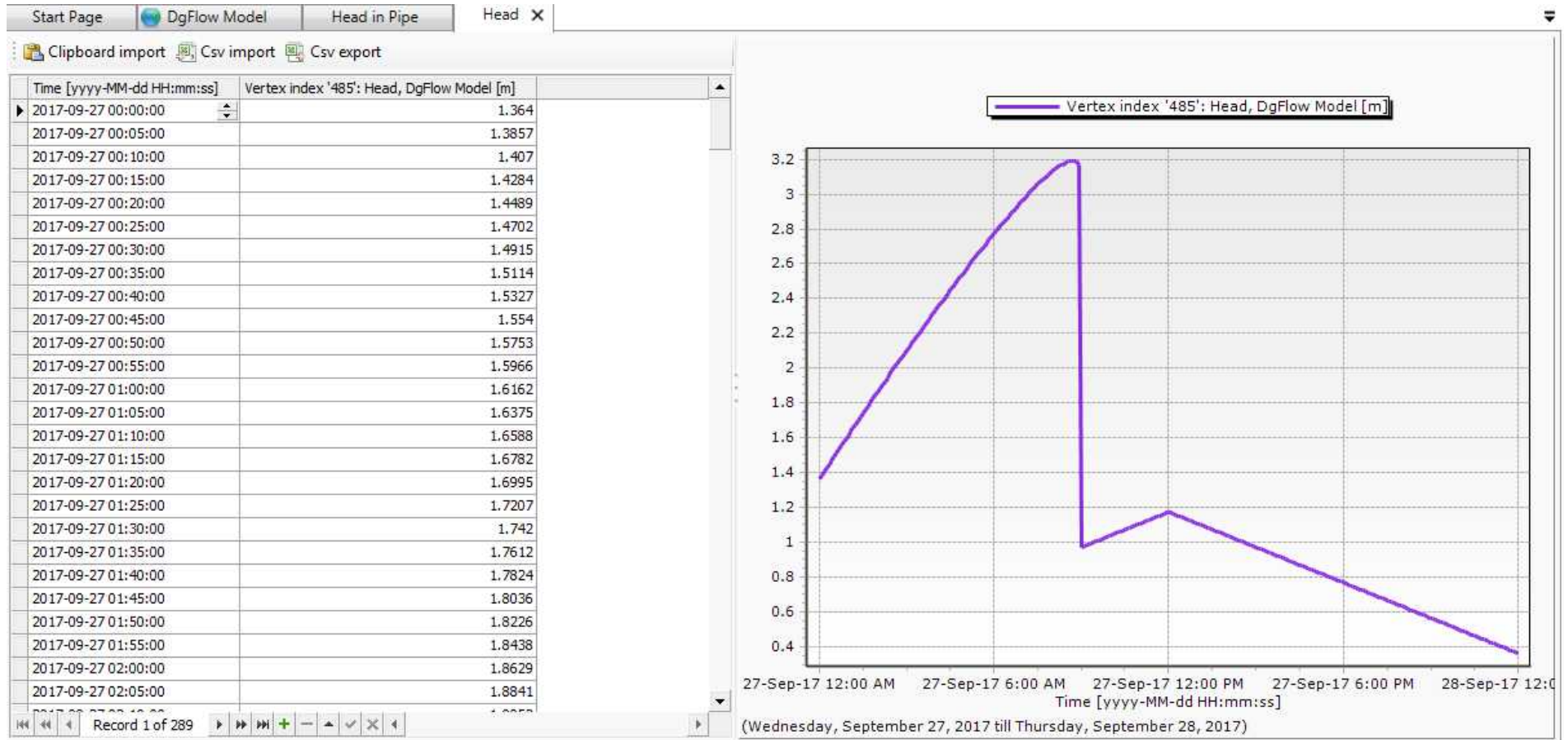
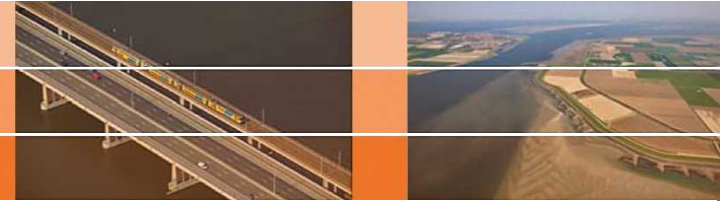
Inleiding



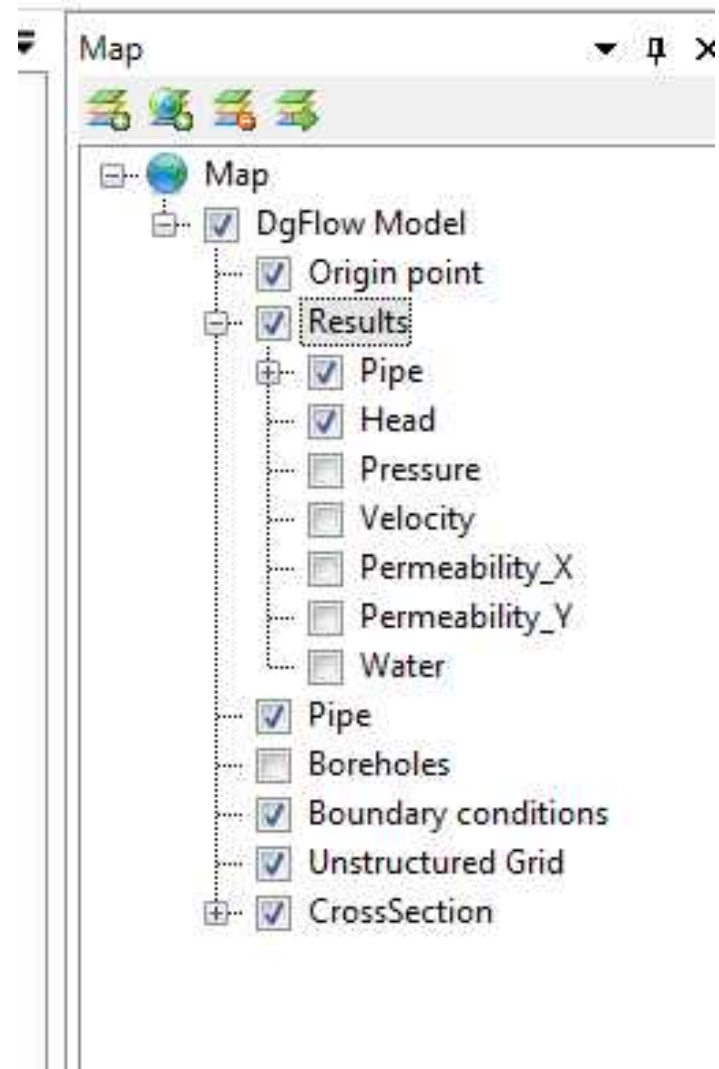
Inleiding



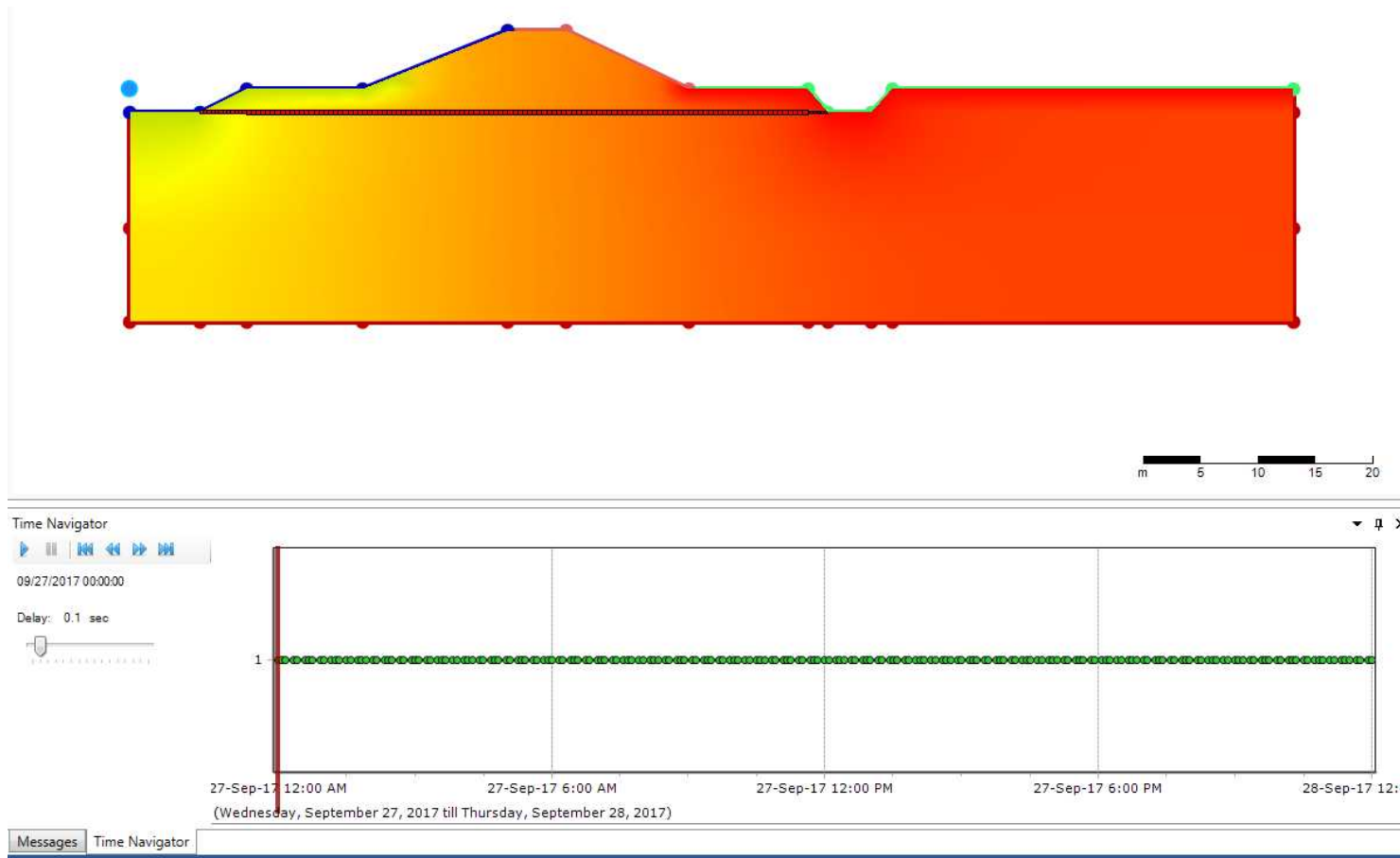
Inleiding



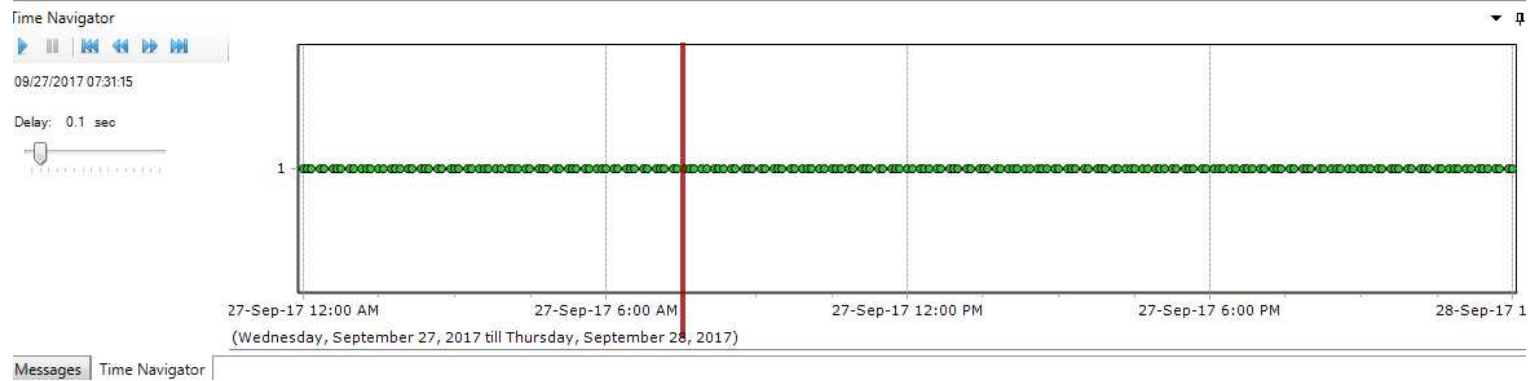
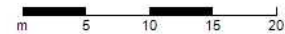
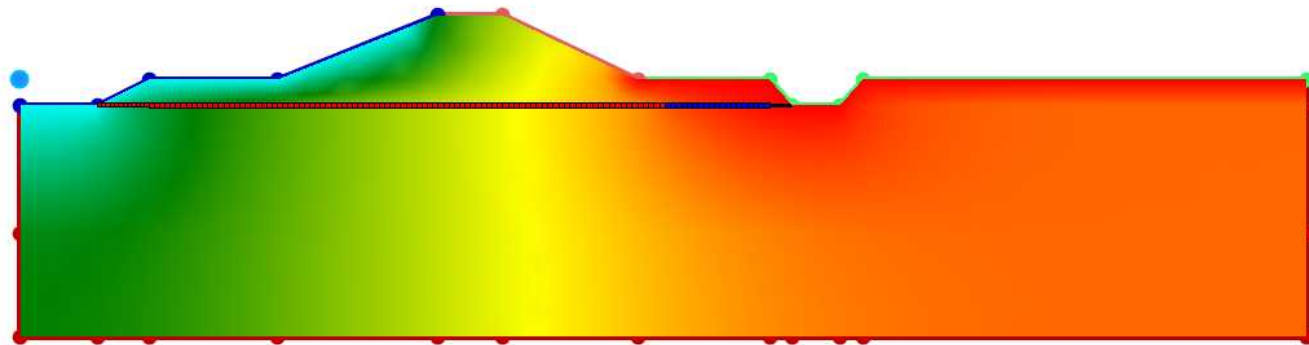
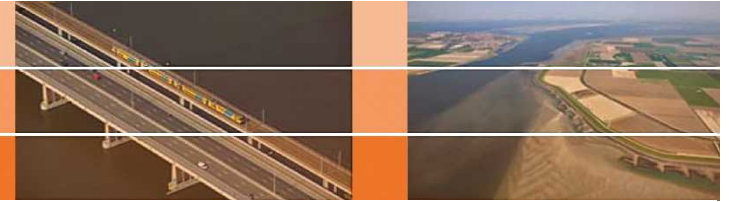
Inleiding



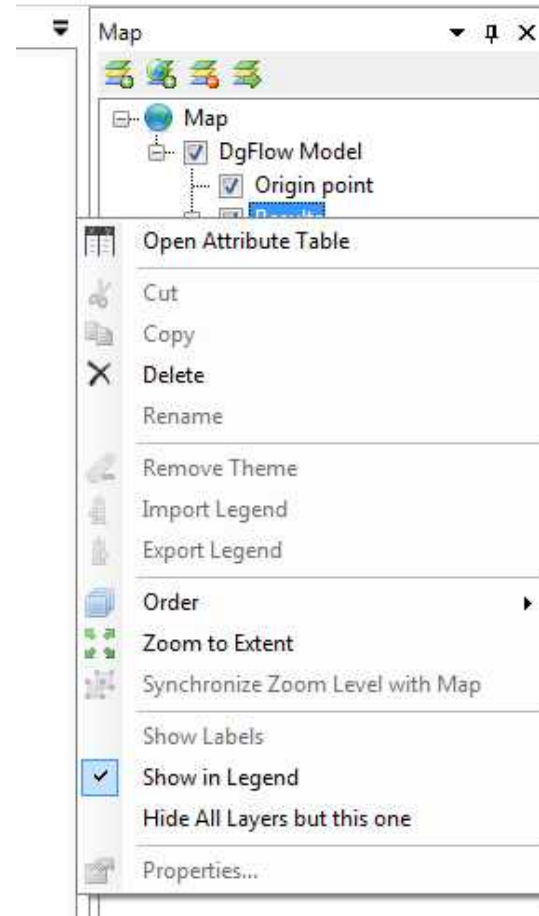
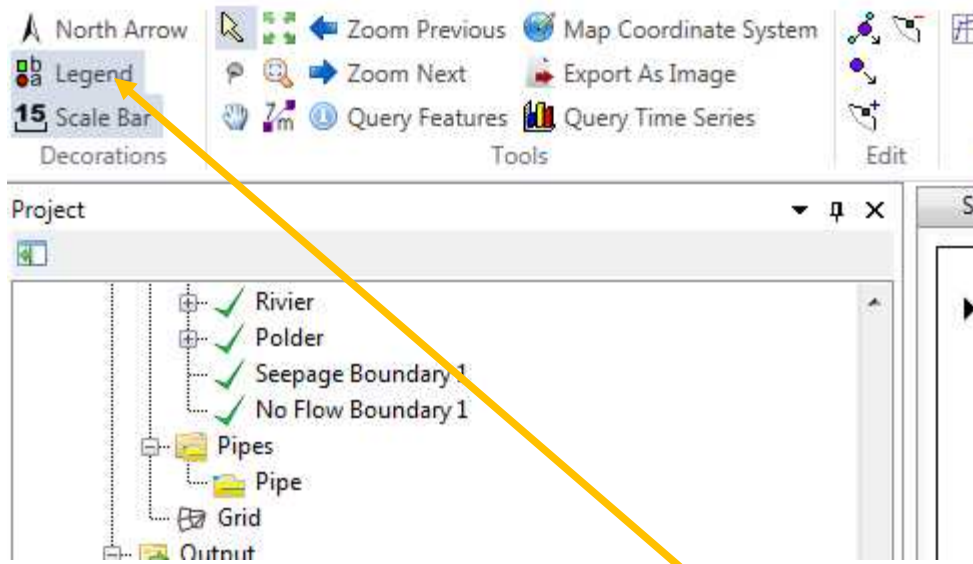
Inleiding



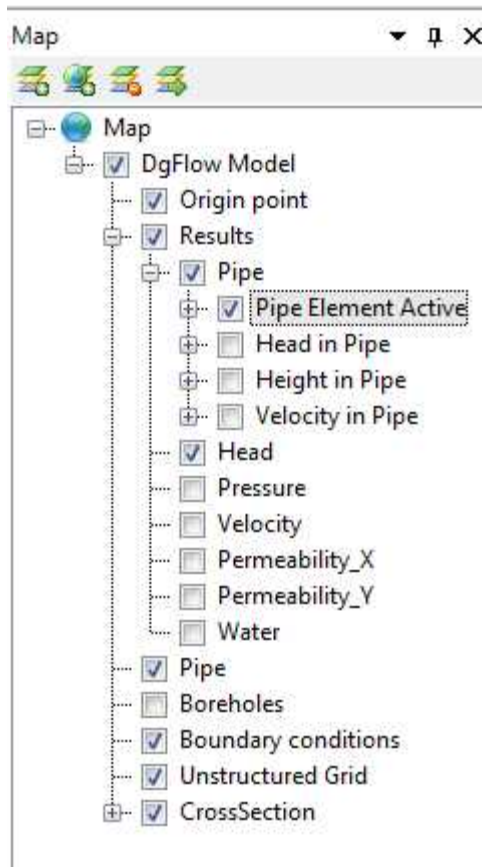
Inleiding



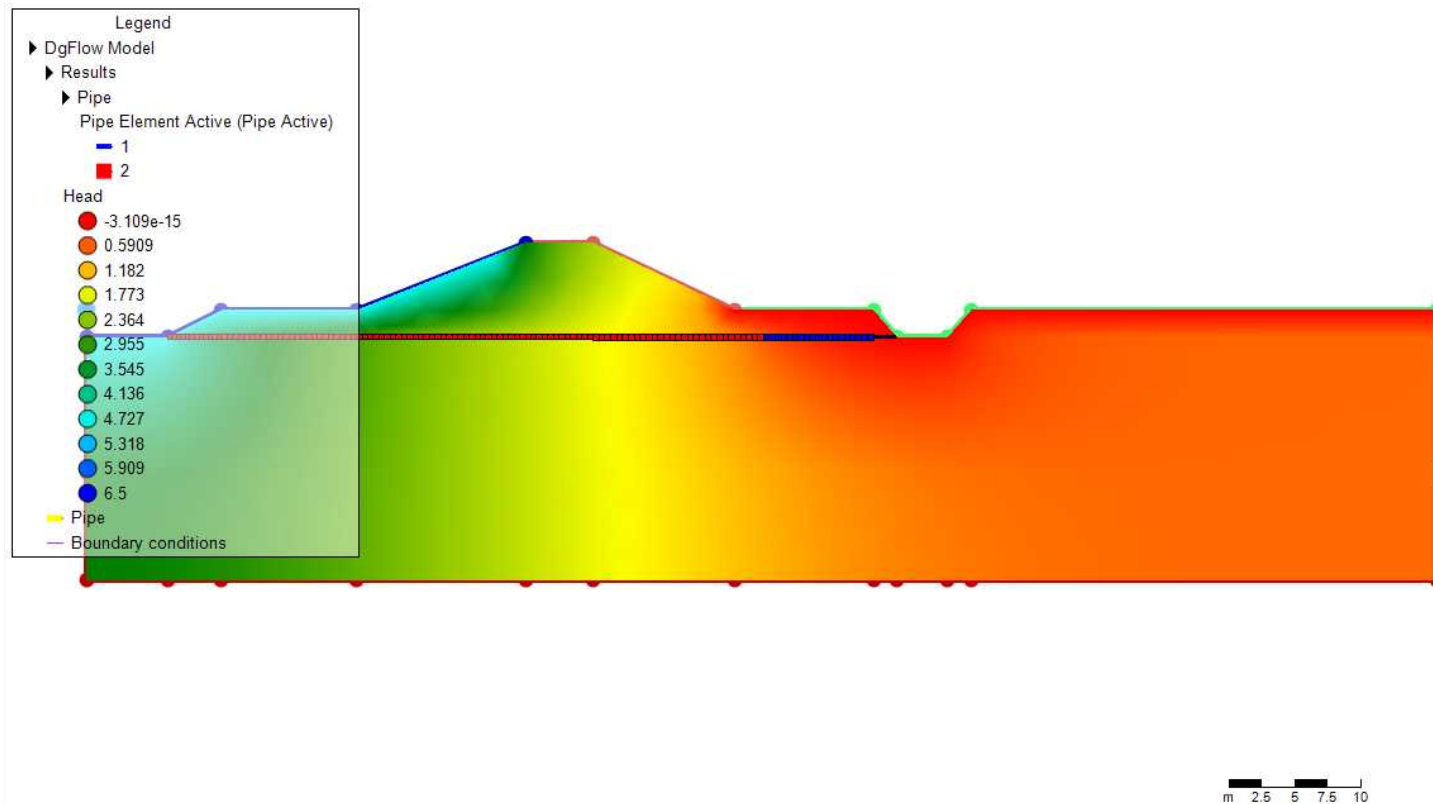
Inleiding



Inleiding



Inleiding



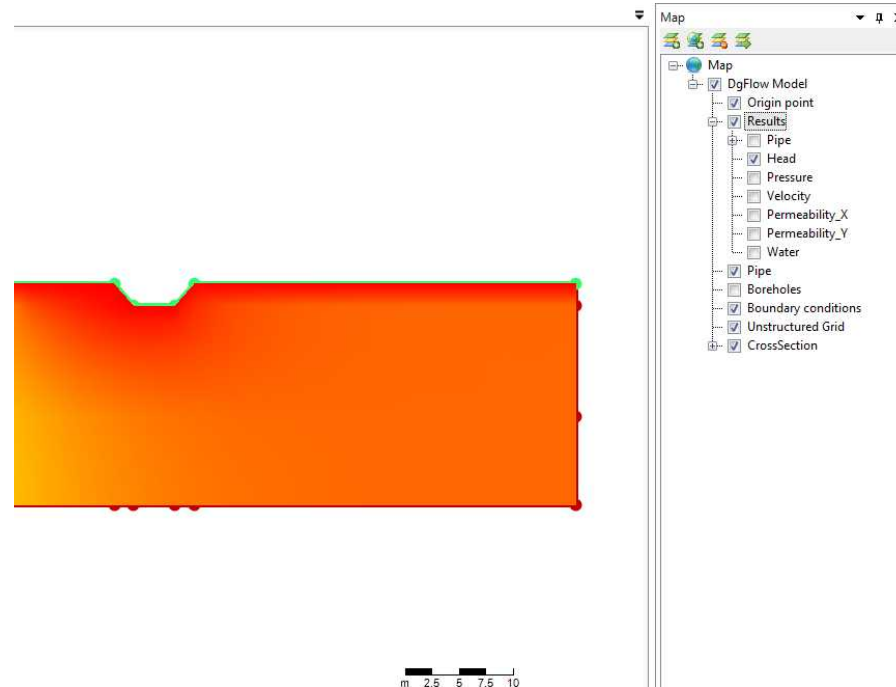
Inleiding



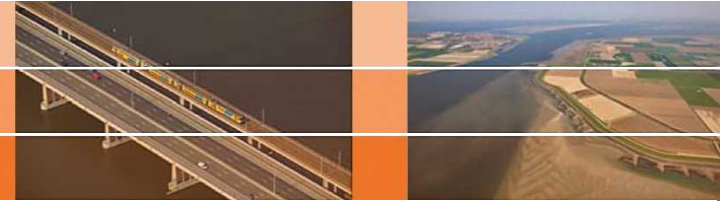
Map

Map

- DgFlow Model
 - Origin point
 - Results
 - Pipe
 - Head
 - Pressure
 - Velocity
 - Permeability_X
 - Permeability_Y
 - Water
- Pipe
- Boreholes
- Boundary conditions
- Unstructured Grid
- CrossSection

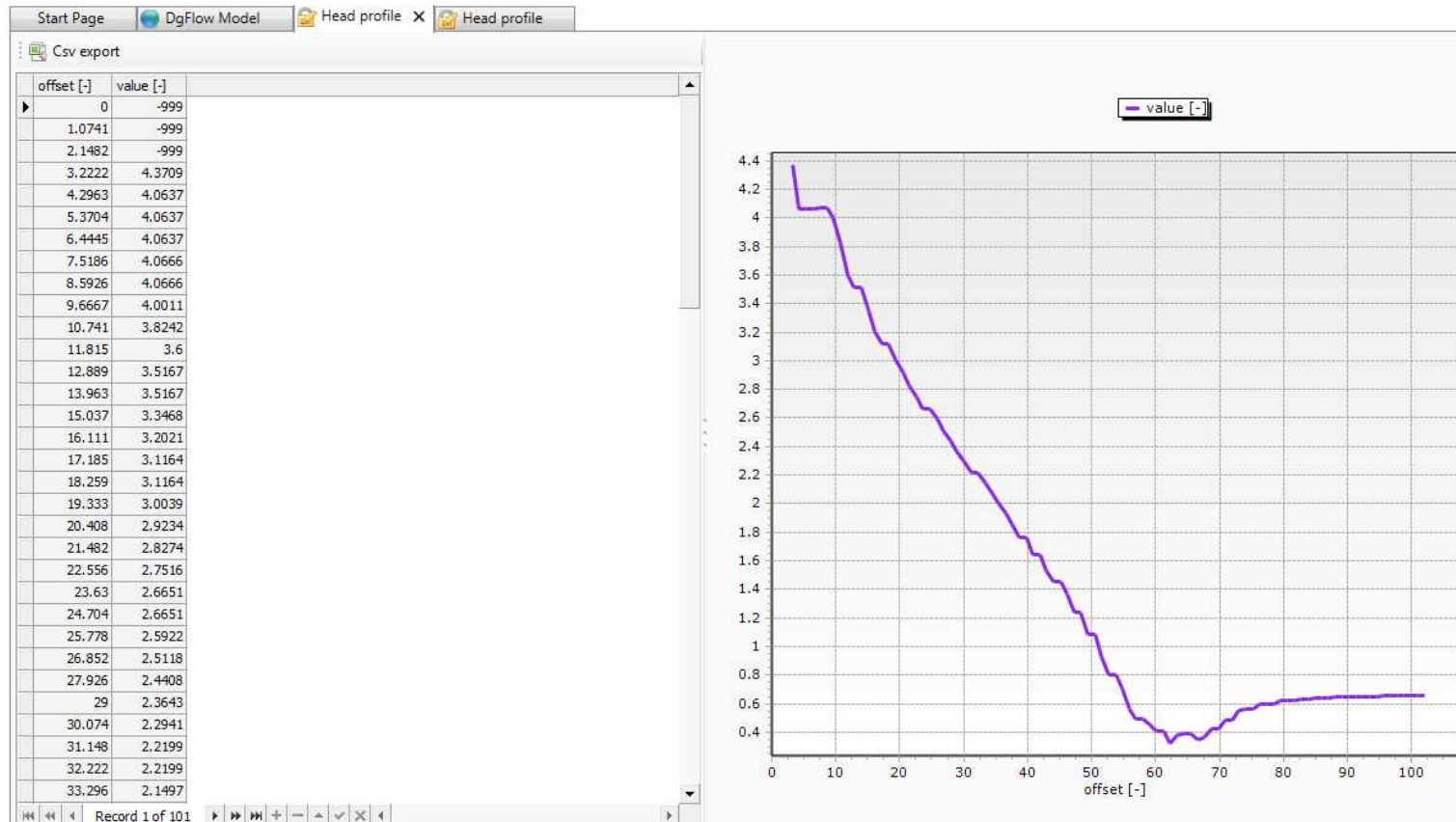


Inleiding

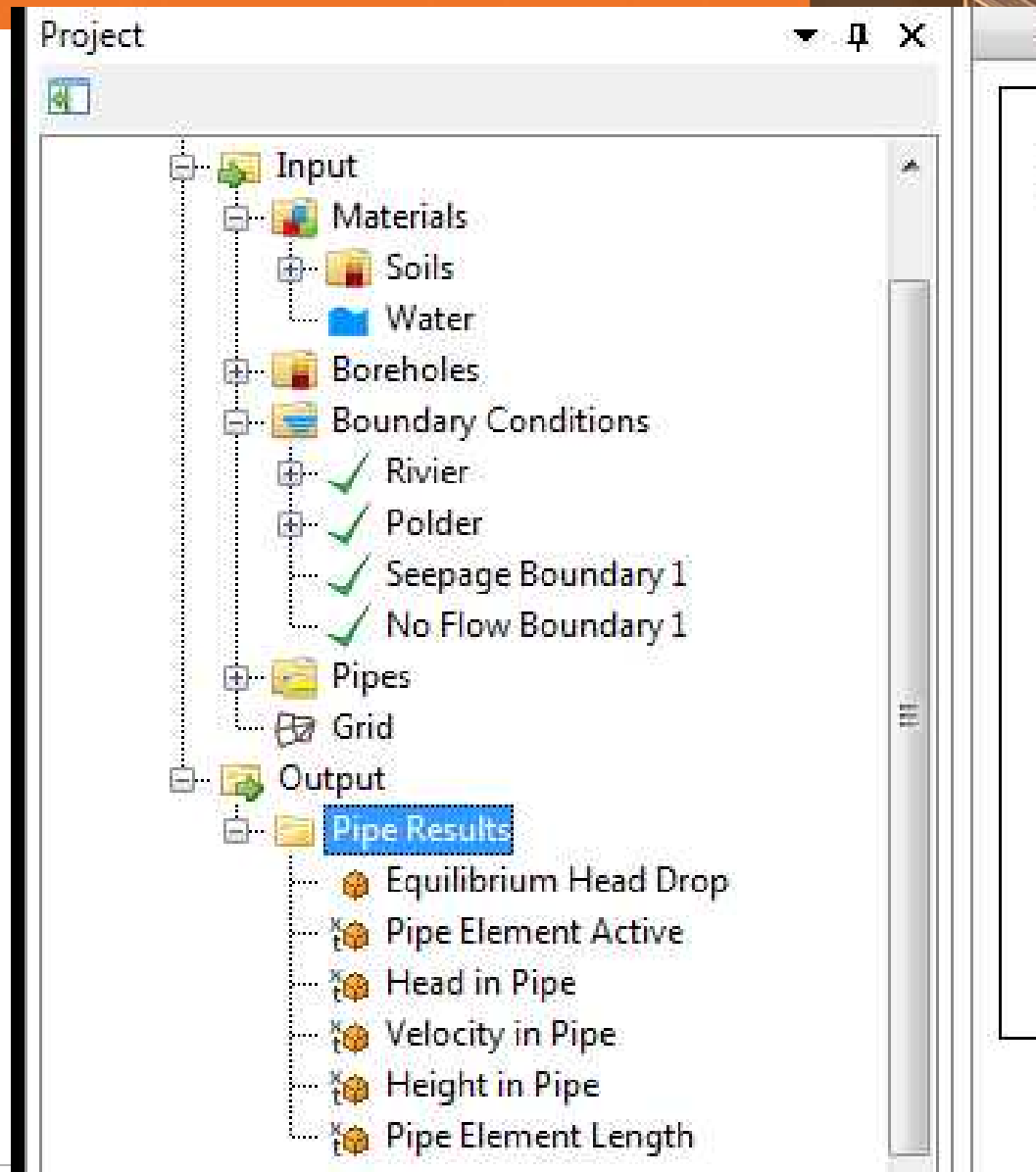


The screenshot displays the DgFlow Model software interface. At the top, there is a menu bar with 'File', 'Home', 'View', and 'Map'. Below it is a ribbon with various tool icons. A yellow arrow points from the 'Show Profile' icon in the ribbon to a 2D cross-section diagram of a pipe. The diagram shows a pipe with a trapezoidal cross-section, colored with a gradient from blue at the top to red at the bottom. To the right of this diagram is a larger, more detailed 2D cross-section of a pipe, also showing a similar color gradient. On the left side of the interface, there is a 'Project' tree view with a hierarchy: Rivier, Polder, Seepage Boundary 1, No Flow Boundary 1, Pipes (containing Pipe and Grid), Output, and Pipe Results (containing Equilibrium Head Drop, Pipe Element Active, Head in Pipe, Velocity in Pipe, Height in Pipe, and Pipe Element Length). Below the Project tree is a 'Properties' panel. In the center of the interface, there is a large 'Show Profile' button with a grid icon. To the right of the button is a large, detailed 2D cross-section of a pipe, colored with a gradient from blue at the top to red at the bottom.

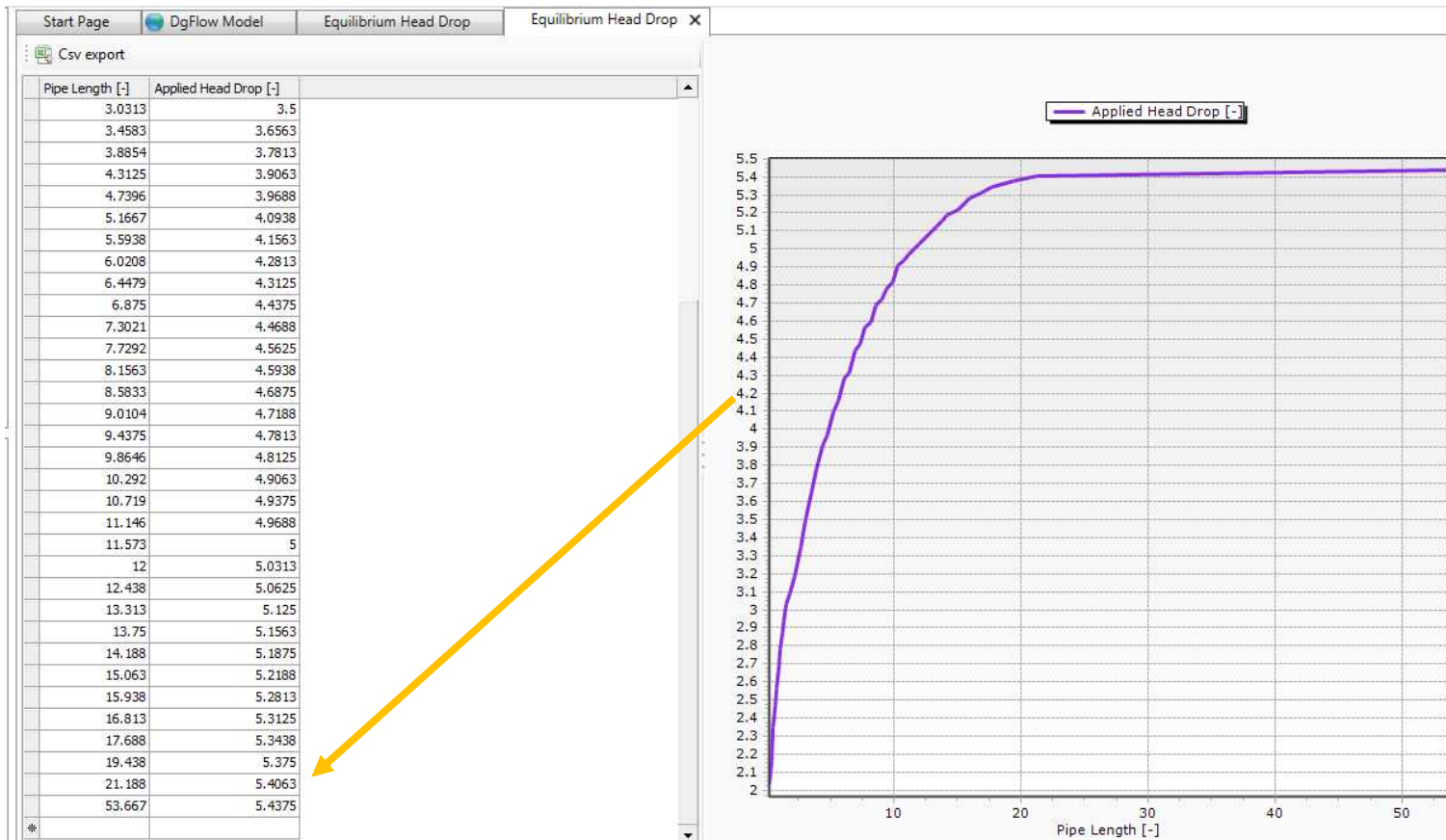
Inleiding



Inleiding



Inleiding



Aandachtspunten en gevoeligheden

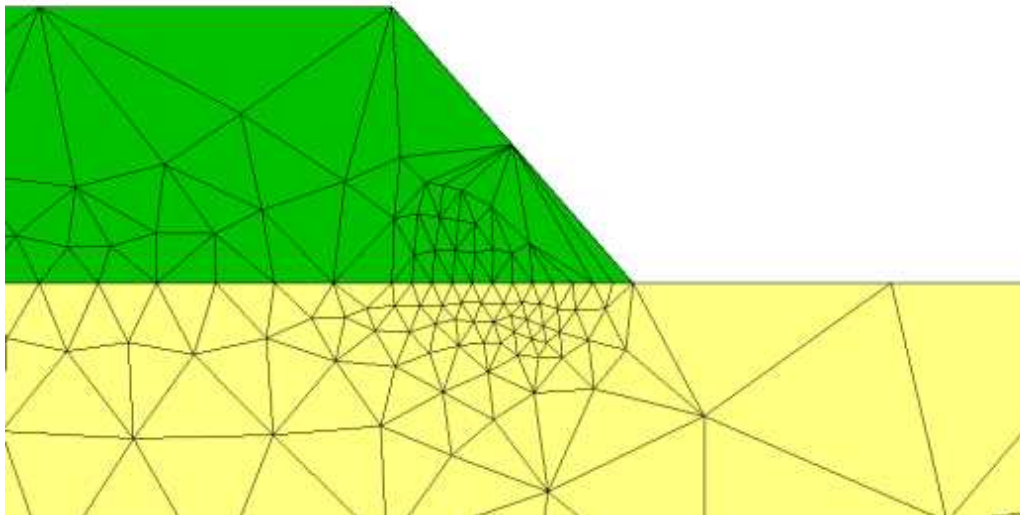
- **Dit is een eerste versie**
- Invoer met gebruik van de punt, niet komma voor decimalen
 - 0.02 *niet* 0,03
- Als er meerdere projecten open staan wordt alleen het actieve project opgeslagen door de save functie
- Bij het selecteren van lijnen voor randvoorwaarden zijn nodes niet automatisch mee geselecteerd, die moet je dus apart nog een randvoorwaarde geven.

Aandachtspunten en gevoeligheden

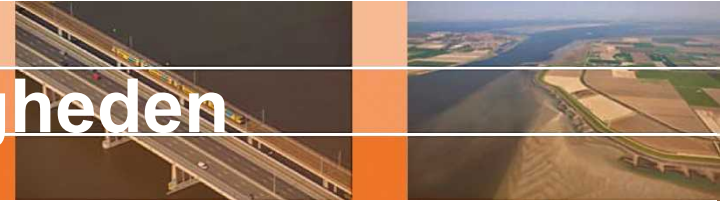


- **Mesh**

- Resultaten zijn afhankelijk van de meshverfijning
- Bij grote verfijning om pipe krijg je slecht gevormde elementen.



Aandachtspunten en gevoeligheden

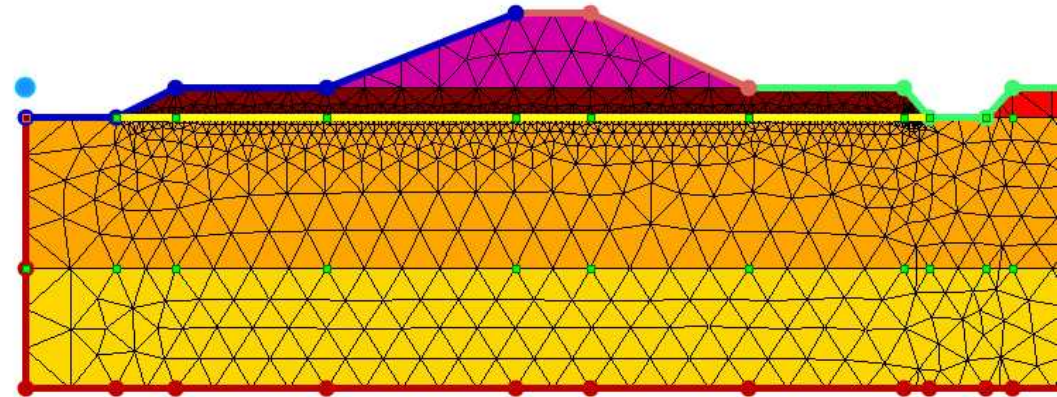


Tree view showing variables:

- Equilibrium Head Drop
- Pipe Element Active
- Head in Pipe
- Velocity in Pipe
- Height in Pipe
- Pipe Element Length

Properties: DgFlowGeometryProperties

Geometry Properties	
Assigned Soil	Aquifer_boven
Colour of the soil	Orange
Polygon Mesh Coarseness [m]	0



Properties: DgFlowGeometryProperties

Geometry Properties	
Assigned Soil	Aquifer_boven
Colour of the soil	Orange
Polygon Mesh Coarseness [m]	0

Aandachtspunten en gevoeligheden

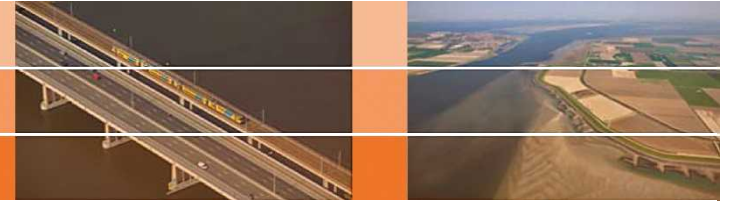
- **MPicard**
- Pipe hoogte wordt bepaald met een nauwkeurigheid van

$$\Delta a_{pipe} = \frac{100 * D70}{MPicard}$$

Dus een hogere MPicard leidt tot een hogere nauwkeurigheid maar ook langere rekentijden.

Bij een onnauwkeurigere pipe hoogte wordt het criterium overschat wat leidt tot een lager kritiek verval. Dit is onnodig conservatief.

Wat kan wel, wat kan niet



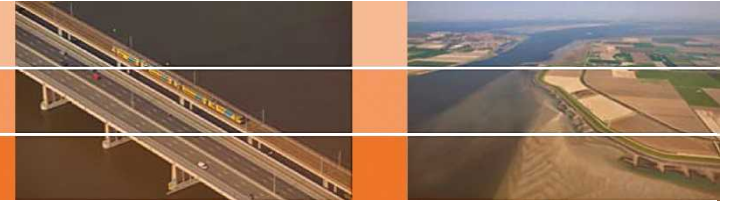
- Range waarin rekenregel geldig is van 63-500 mu; dat geldt ook voor D-Geo Flow.
- Grondopbouw door boreholes, niet polygons
- Dezelfde grondlaag mag niet op twee diepten voorkomen, dus zandlaag die gescheiden wordt door kleilaag moet boven en onder klei verschillende namen hebben.
- Een grondlaag mag niet onderbroken worden, dus blanket aan linkerzijde van sloot krijgt een andere naam dan blanket rechterzijde.

Transiente berekening



- **Aandachtspunten tijdsafhankelijk rekenen**
- Pipe groei met 1 element per tijdsstap
- Sterkere mesh afhankelijkheid
- Momenteel erg lange rekentijden en onbetrouwbare resultaten bij te lage mesh verfijning en/of te grote tijdsstappen.
- Nog niet aangeraden

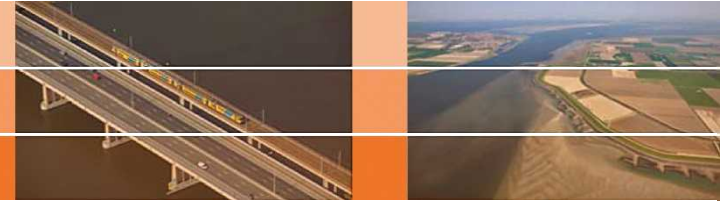
Oefening



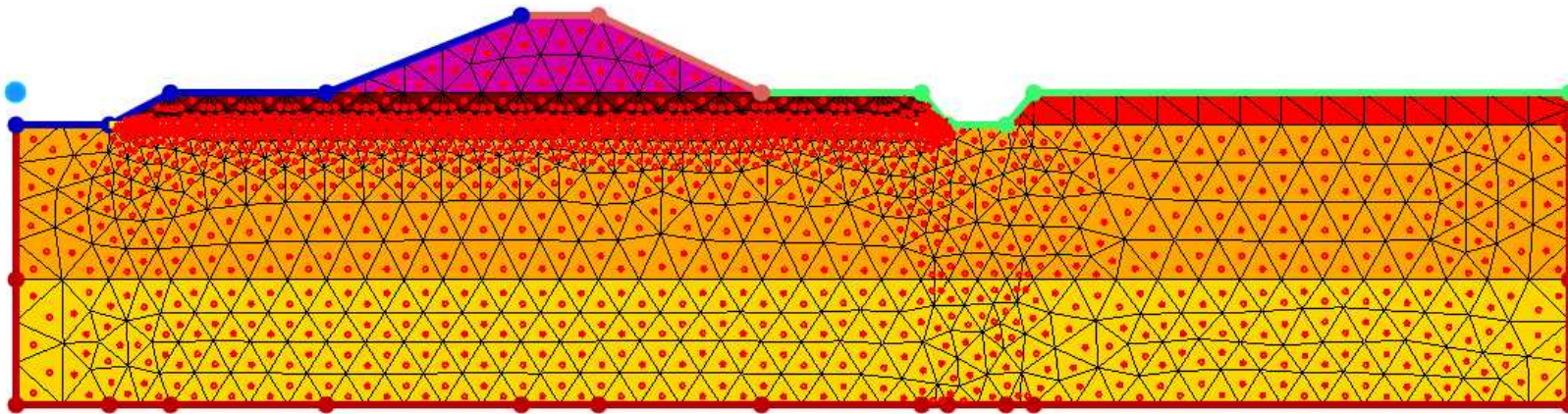
Tutorial River dike in cursusmateriaal

- Let op: dit voorbeeld is slechts ter illustratie van het werken met D-Geo flow, in het voorbeeld is het contact tussen de rivier en het zandpakket erg klein wat in werkelijkheid vaak niet het geval zal zijn. Bij een diepere insnijding van de rivier in het zandpakket moet dit wel meegenomen worden.

Known Issues



- **Visualisatie stroomsnelheid**
Geen vectoren die stroomsnelheid weergeven



Slide 45

ER3

still an issue

Esther Rosenbrand; 02-Jan-18