# Deltares

enabling delta life


Deltares

# User meeting Embankment Suite

## April 19 2022

Raymond van der Meij

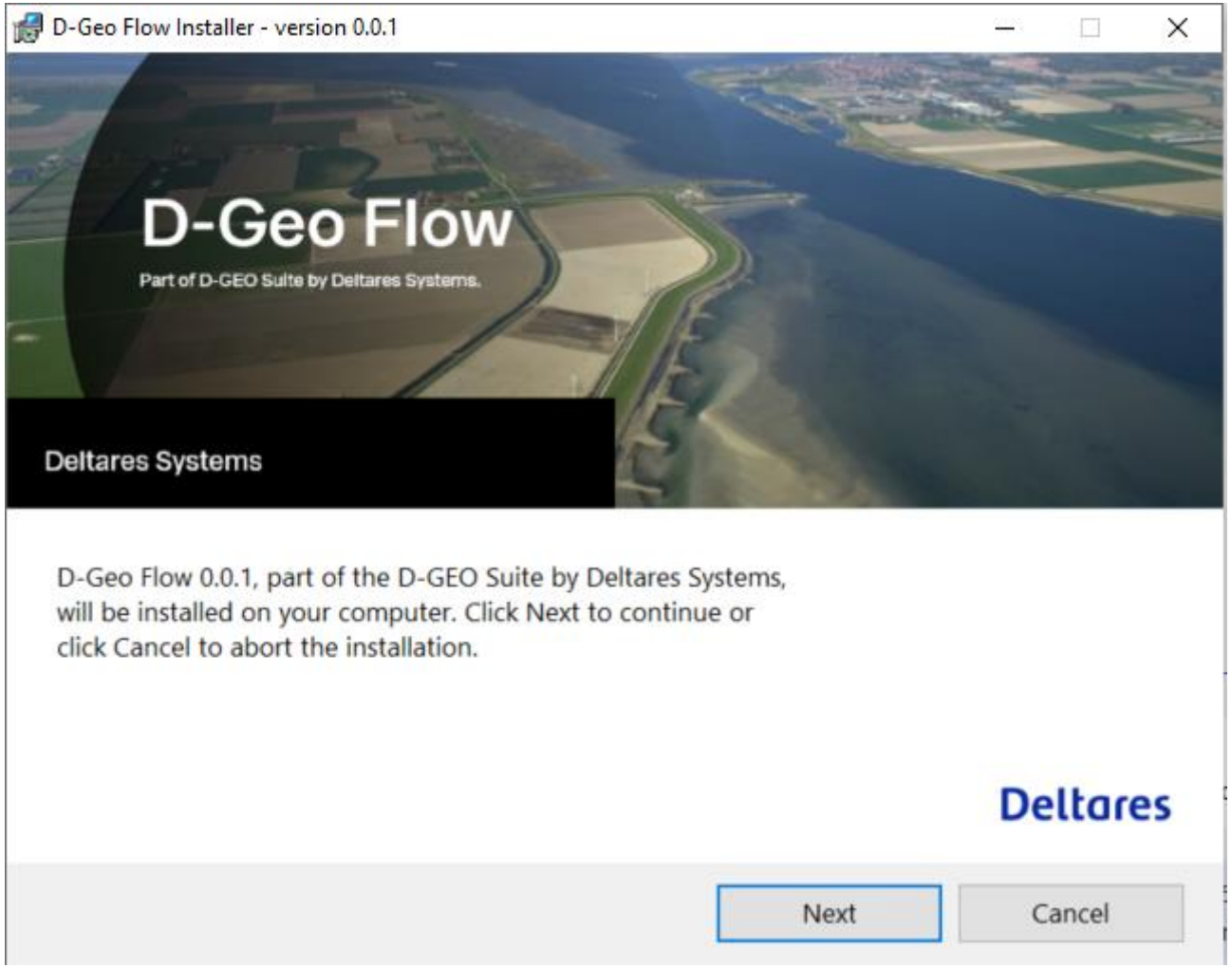
# Program

1) The new D-Geo Flow
    a) Install and explore the software
    b) Discuss further UI issues

Short break

2) Release of D-Stability
    a) Preview 2022.01
    b) Guidance on making Fragility curves
3) D-Settlement development plans

# D-Geo Flow

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# D-Geo Flow

The new Groundwater flow and Piping product

It will replace the prototype of D-Geo Flow

First release will be D-Geo Flow 2022.01 at the DSD

- D-GEO Suite user interface
- Kratos FEM kernel

The Kratos computational piping results are currently being tested.

Today, we will give you a first increment to give us feedback upon

# D-Geo Flow increment

What does this increment do?

It calculates the grondwater head, given two types of boundary condtions

- Closed boundary
- Fixed head
  → Water pressures can be okay in an aquifer
  → Water pressures will not be correct near the phreatic line
  → Future: seepage, flux, unsaturated flow, …

And gives you feedback in shadings

Berekening3.flox - D-Geo Flow

File Geometry Materials Water Calculate Results

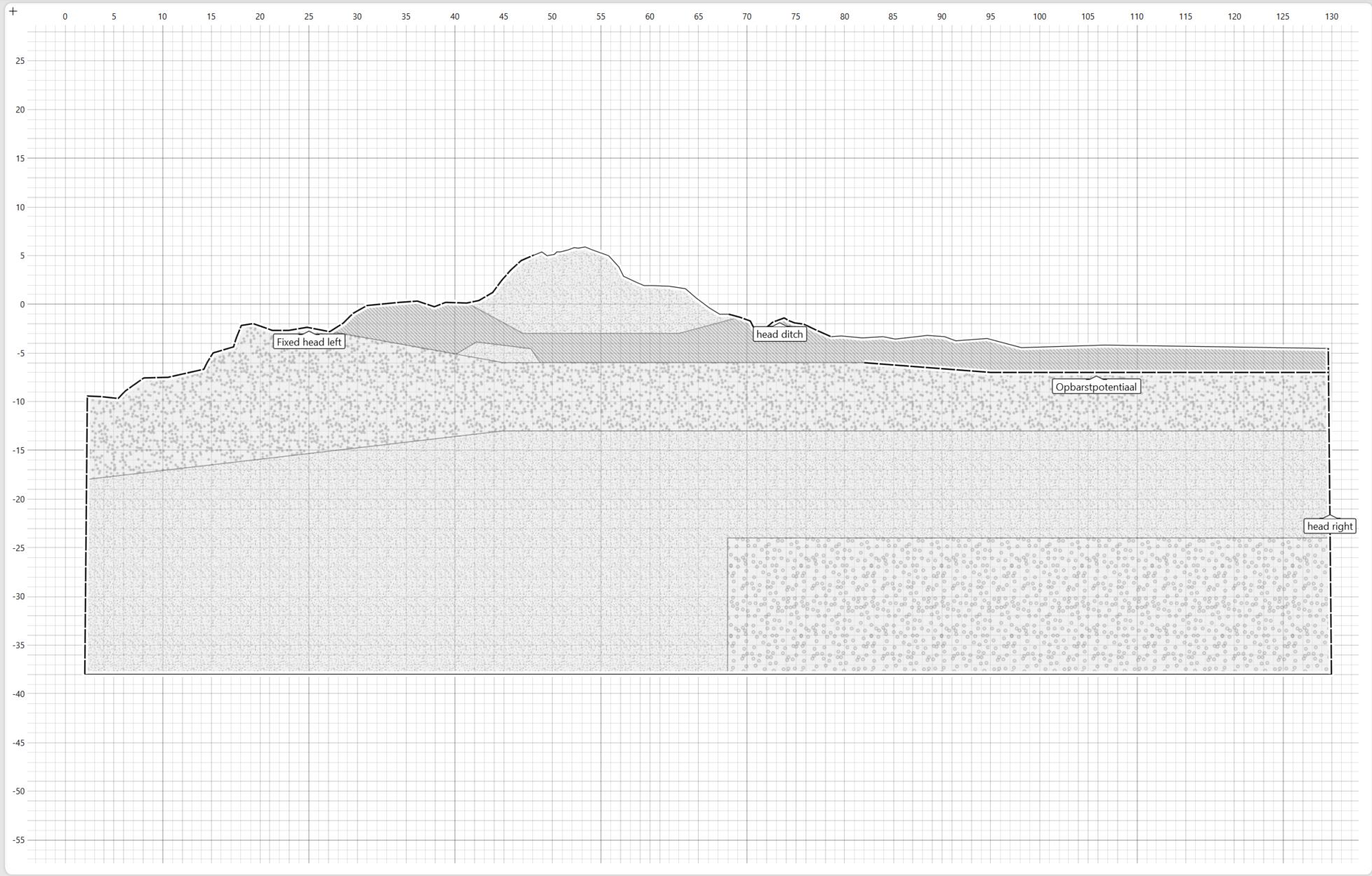
Select Pan Undo Redo Boundary

Scenarios and stages

Scenario 1

Stage 1

Calculation 1




No selection

No properties to show.

Scenario 1 - Stage 1

mm cm dm m

136.57 m

# D-Geo Flow increment

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It calculates the grondwater head, given two types of boundary condtions

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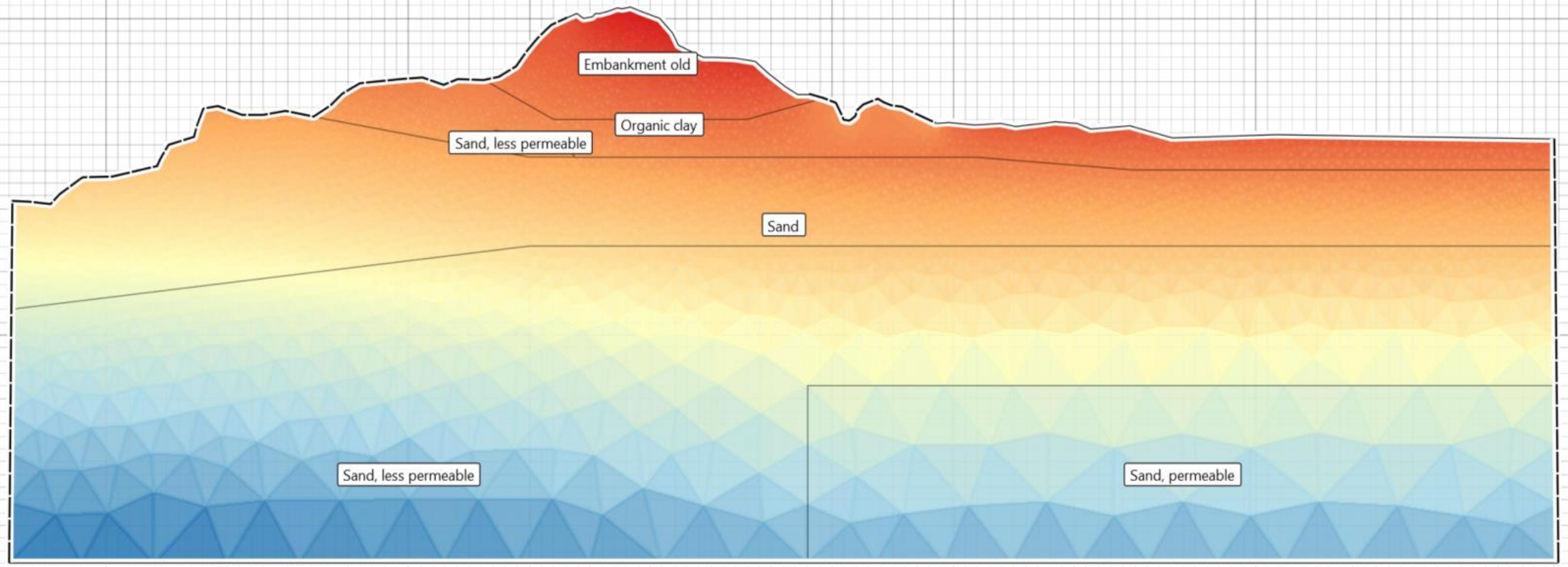
And gives you feedback in shadings


Embankment old
Organic clay
Sand, less permeable
Sand
Sand, less permeable
Sand, permeable

# D-Geo Flow increment

What will you notice?

D-Stability uses tabs as construction stages

- This will not work for a later time dependent groundwater flow product
- As it will not work for D-Settlement

Note the new definition of scenarios, stages and calculations.

# D-Geo Flow increment

What will you notice?

The software is released under “Pre-Release Software Licensing Agreement for testing of Pre-Release Software”

- It may not be used in projects
- It is only intended to provide feedback during development

# D-Geo Flow increment

What will you notice?

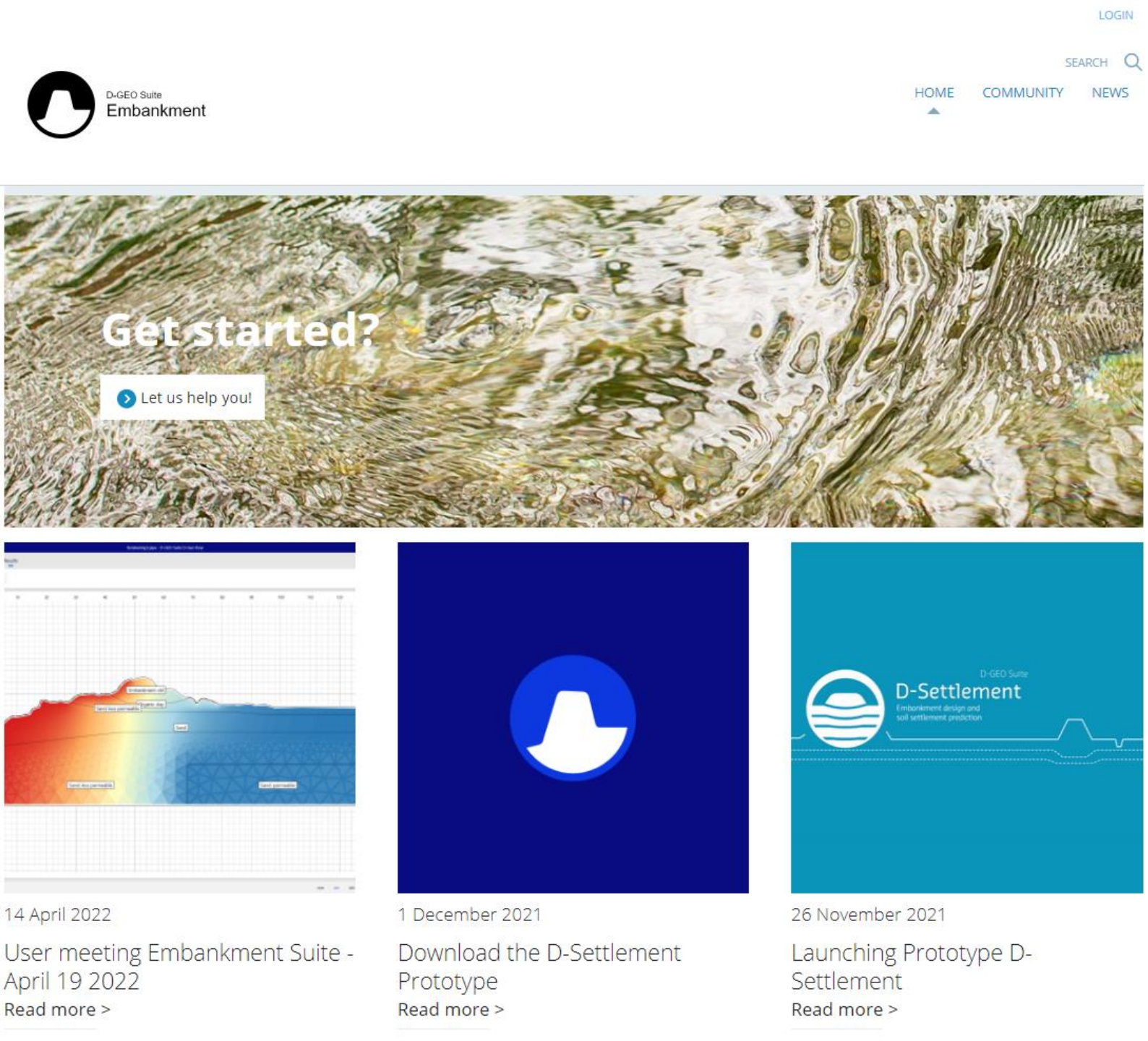
You cannot do a piping calculation yet

- On our next user meeting, we intend to deliver D-Geo Flow 2022.01 where you can calculate the length of a pipe
- After we look at with this increment, we'll discuss the further design of the piping product
- And we'll investigate which other features you need to replace the current prototype of D-Geo Flow

We'll discuss the design later this user meeting

# D-Geo Flow increment

https://oss.deltares.nl/web/embankment

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# D-Geo Flow increment

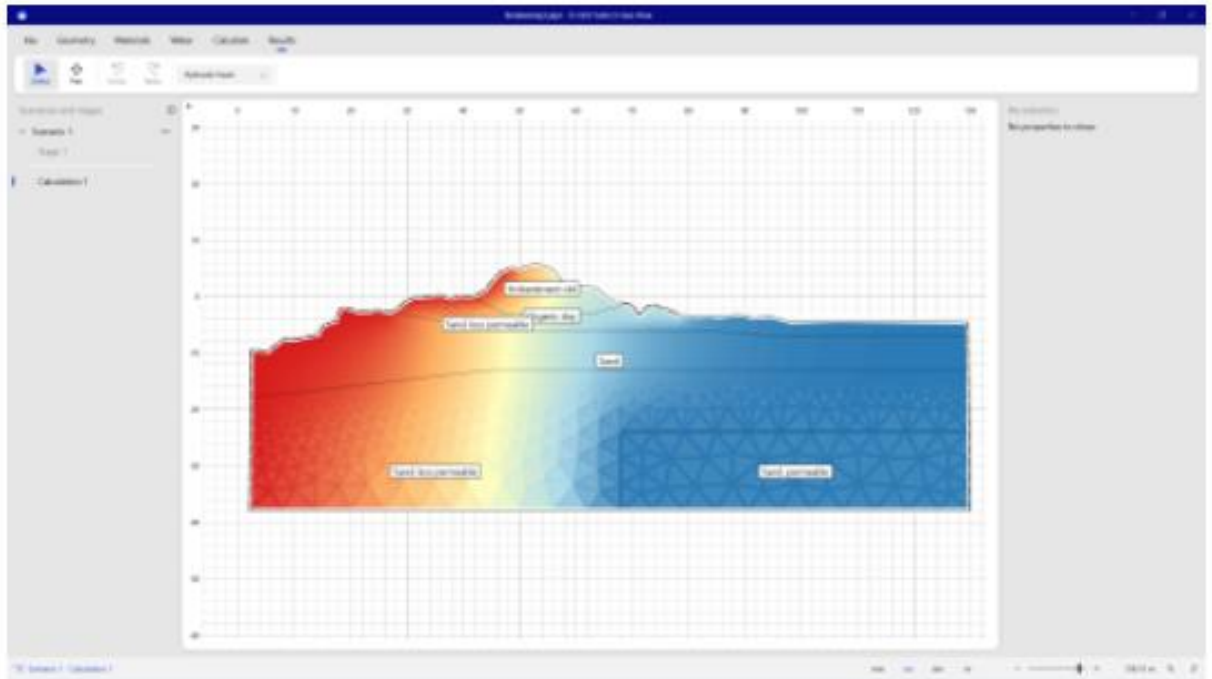
## User meeting Embankment Suite - April 19 2022

14 April 2022

This user meeting, we have three agenda points

1. The new D-Geo Flow
    a. Install and explore the software
    b. Discuss further UI issues
2. Release of D-Stability
    a. Preview 2022.01
    b. Tutorial making Fragility curves
3. D-Settlement development plans

The increment of D-Geo Flow can be downloaded from this link




**Raymond van der Meij**

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# D-Geo Flow increment

Three walk throughs

- A file with multiple scenario's (future)
- A realistic current calculation
- From scratch

- Install

**Watch and play along, the chat is open for feedback.**

**Raise your and to break in.**

# D-Geo Flow piping design

First design sketches

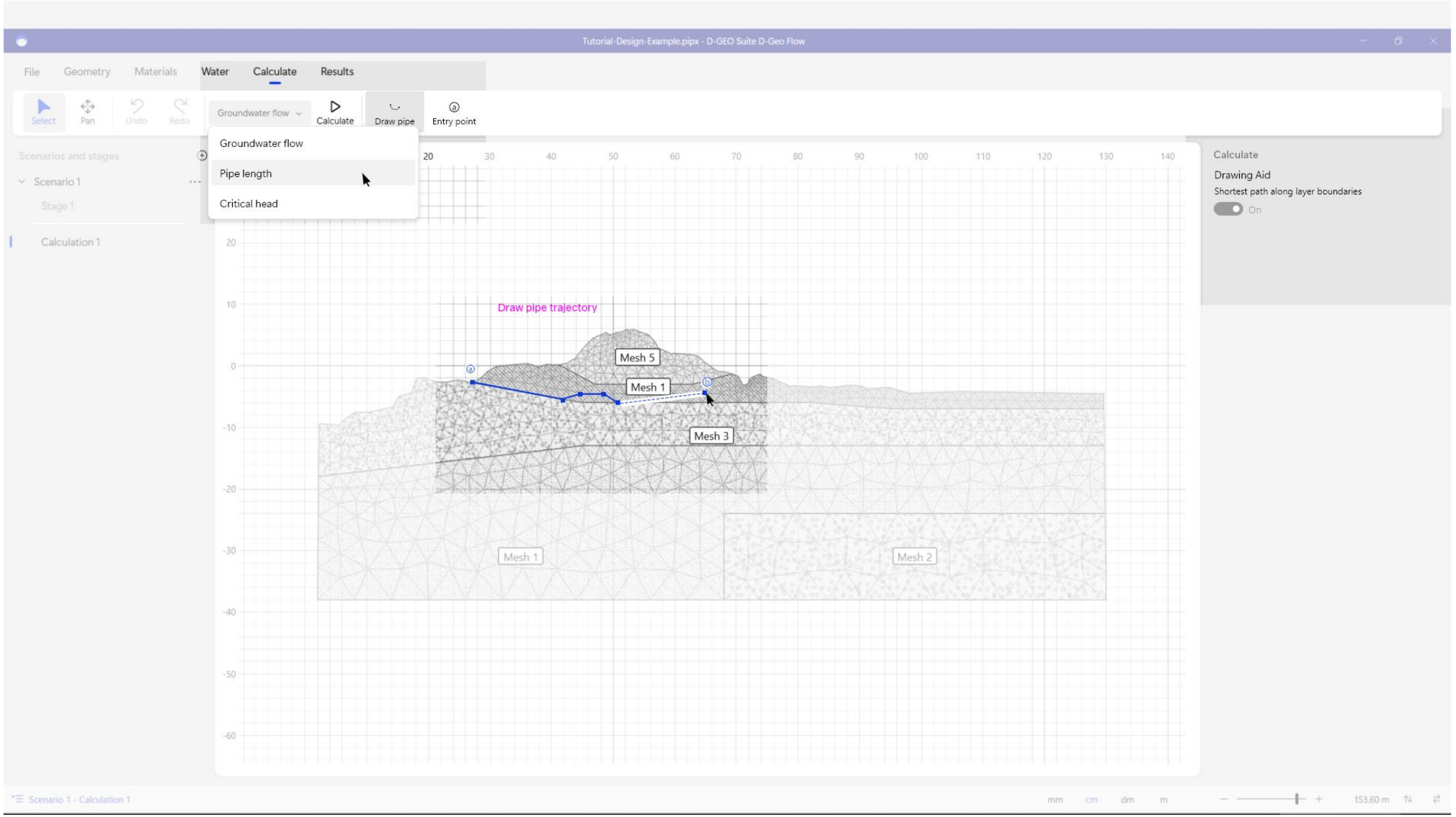
Please provide feedback.

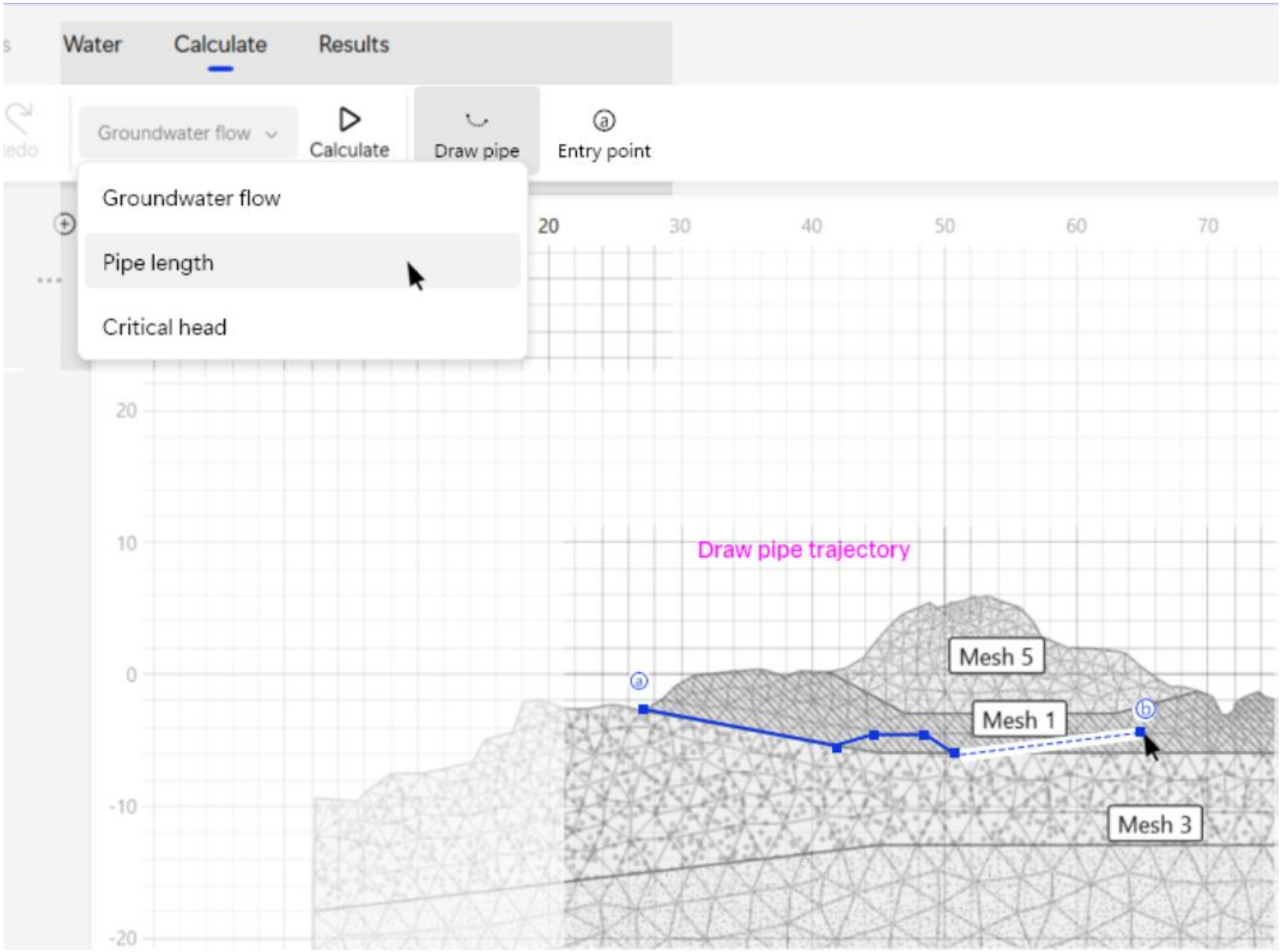
Is this all you need to replace the current prototype?

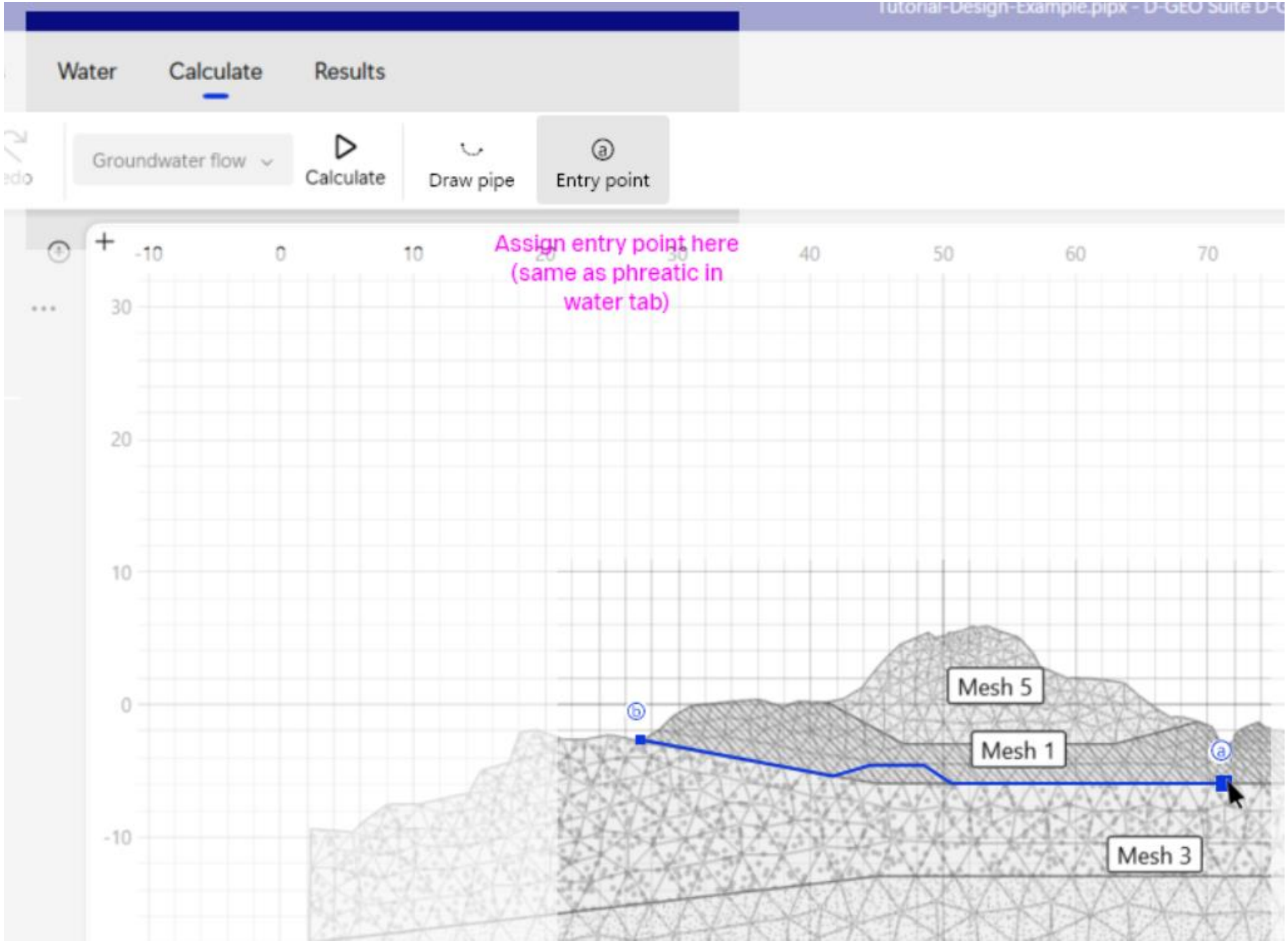
Plan: allow for three analysis types

- Calculate groundwater flow (as demonstrated)
- Calculate pipe length.
- Calculate critical head.

# D-Geo Flow piping design




Water
Calculate
Results
Groundwater flow
Calculate
Draw pipe
Entry point
Groundwater flow
Pipe length
Critical head
20
30
40
50
60
70
20
10
0
-10
-20
Draw pipe trajectory
Mesh 5
Mesh 1
Mesh 3
a
b


Water
Calculate
Results
Groundwater flow
Calculate
Draw pipe
Entry point
Assign entry point here
(same as phreatic in
water tab)
-10
0
10
20
30
40
50
60
70
30
20
10
0
-10
Mesh 5
Mesh 1
Mesh 3

Tutorial-Design-Example.pipx - D-GEO Suite D-Geo Flow

File | Geometry | Materials | Water | Calculate | Results

Select | Pan | Undo | Redo | Groundwater flow | Calculate | Draw pipe | Entry point

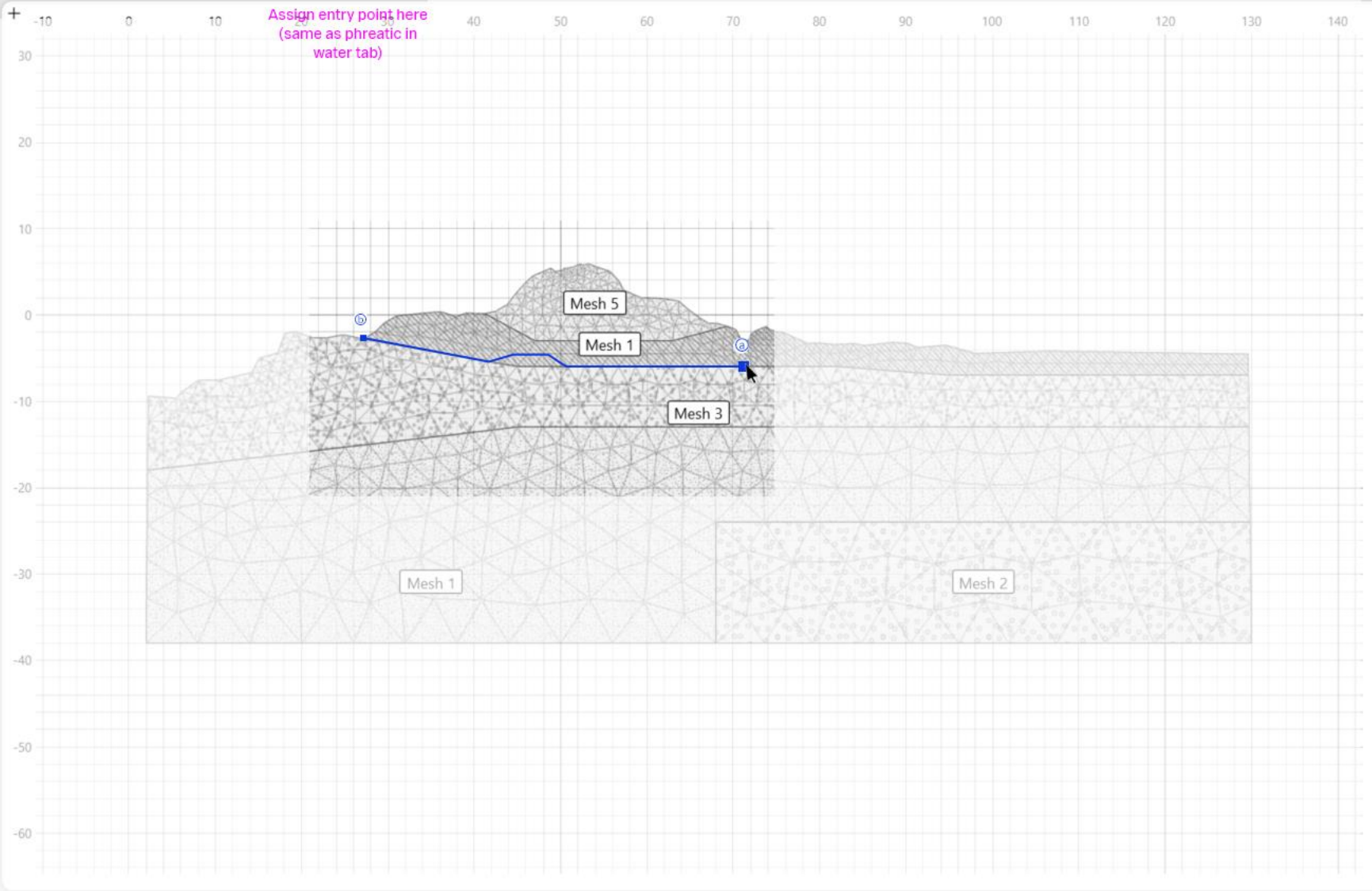
Scenarios and stages

Scenario 1

Stage 1

Calculation 1

Assign entry point here (same as phreatic in water tab)




Calculate

Line Mesh label

Mesh A

Element size

1 m

Minimum element size is 0.05m

Start erosion process

x coordinate

72 m

L1

This is an example of a note

Material: Sand

Fill

Permeability horz: 1.157E-07 : vert: 2.314E-07 m/s

$d_{70}$

1.00E-04 [-]

Define d70 per layer

Layer small

Material: Sand with clay

Fill

This is an example of a longer note

Permeability horz: 1.157E-07 : vert: 2.314E-07 m/s

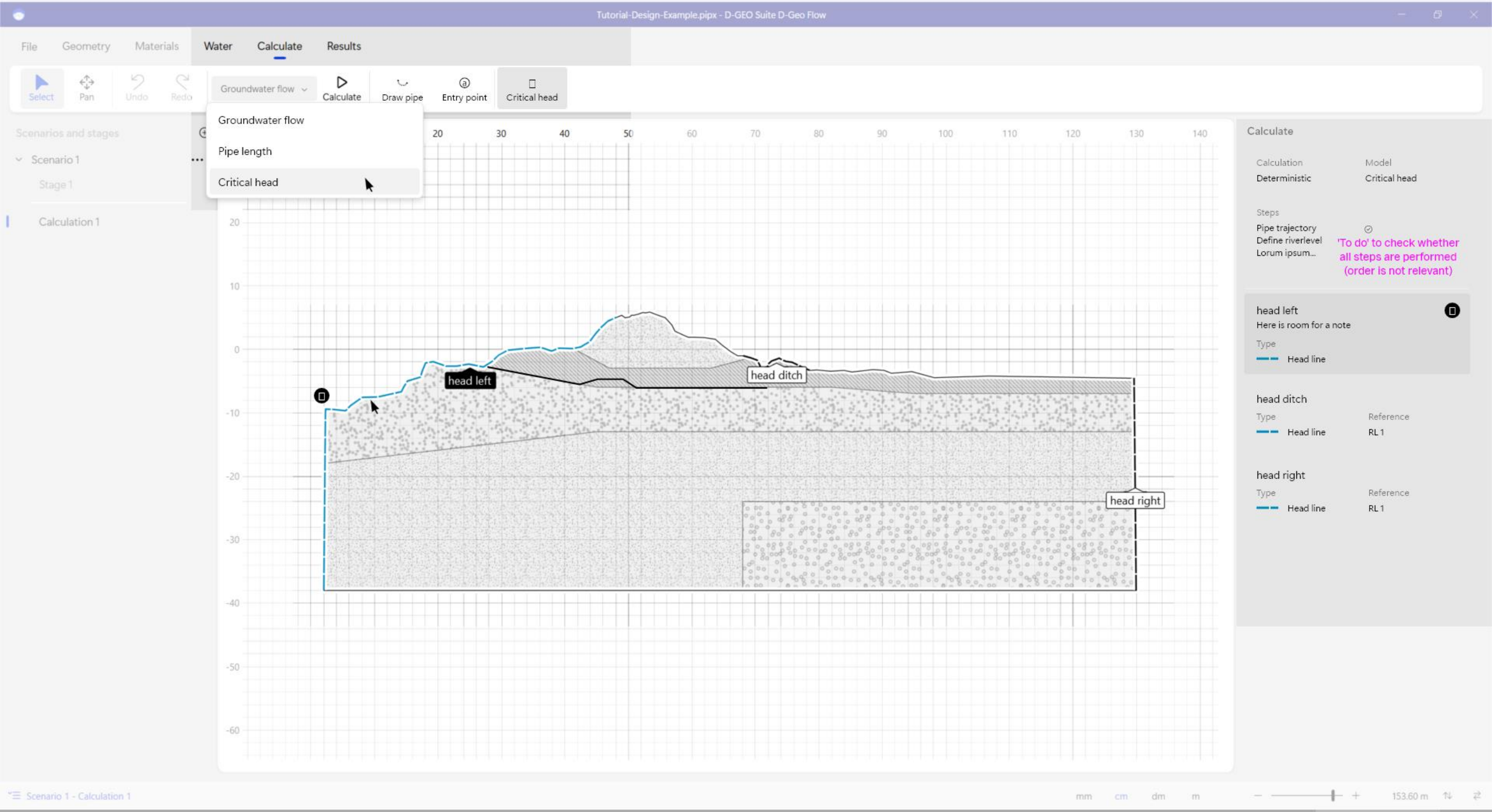
$d_{70}$

1.00E-04 [-]

Scenario 1 - Calculation 1

mm | cm | dm | m

153.60 m


Tutorial-Design-Example.pipx - D-GEO Suite D-Geo Flow
File
Geometry
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Calculate
Draw pipe
Entry point
Critical head
Groundwater flow
Pipe length
Critical head
Scenarios and stages
Scenario 1
Stage 1
Calculation 1
head left
head ditch
head right
Calculate
Calculation
Deterministic
Model
Critical head
Steps
Pipe trajectory
Define riverlevel
Lorum ipsum...
'To do' to check whether all steps are performed (order is not relevant)
head left
Here is room for a note
Type
Head line
head ditch
Type
Head line
Reference
RL 1
head right
Type
Head line
Reference
RL 1
Scenario 1 - Calculation 1
mm
cm
dm
m
153.60 m

Tutorial-Design-Example.pipx - D-GEO Suite D-Geo Flow

File Geometry Materials Water Calculate Results

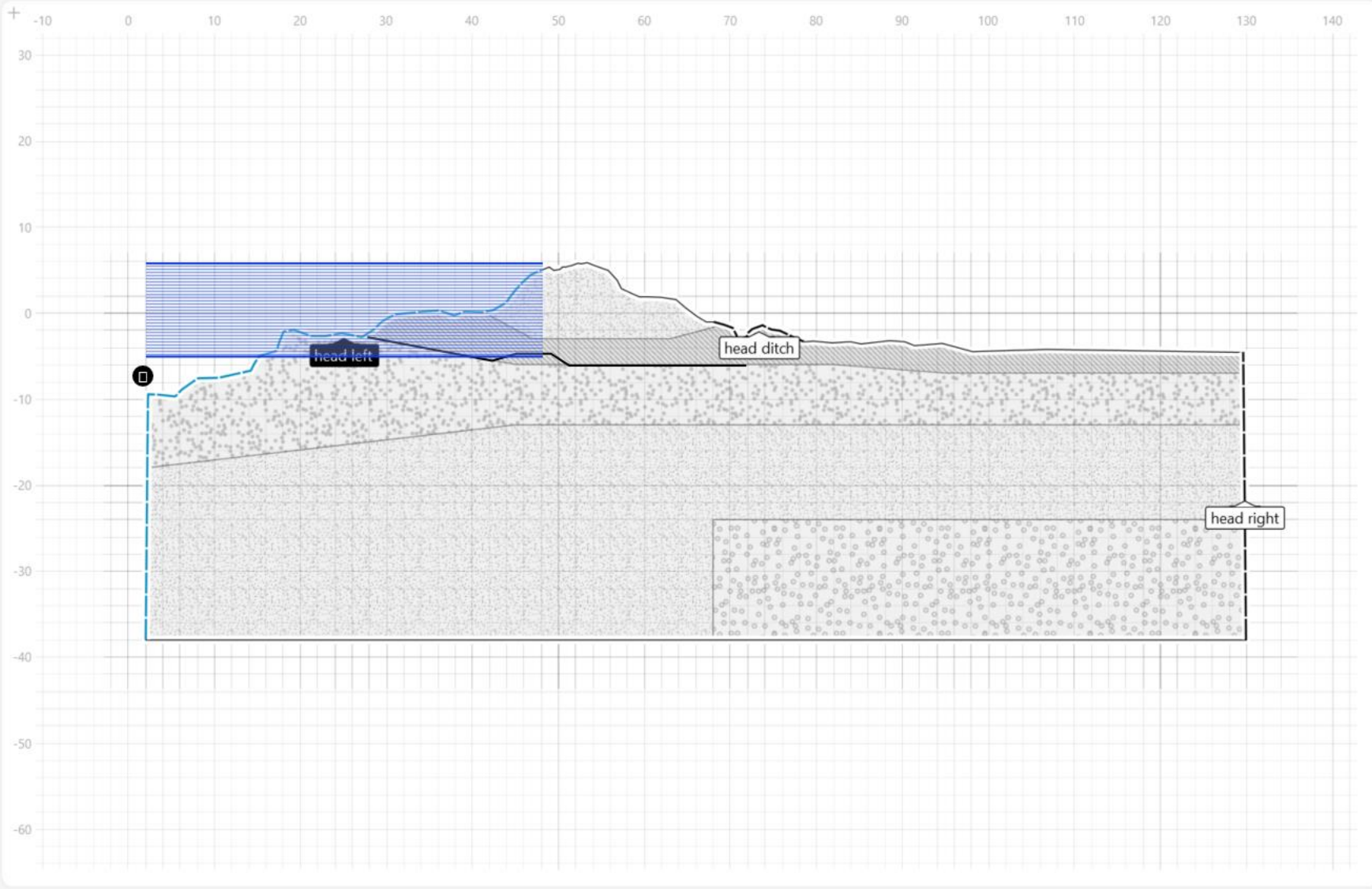
Select Pan Undo Redo Groundwater flow Calculate Draw pipe Entry point Critical head

Scenarios and stages

Scenario 1

Stage 1

Calculation 1




Calculate

Calculation
Deterministic

Model
Critical head

Steps
Pipe trajectory
Define riverlevel
Lorum ipsum...

'To do' to check whether all steps are performed (order is not relevant)

Critical head

head left
Here is room for a note

Type
Head line

River level range

Maximum
6 m

Step size
0.10 m

Refinement
0.02 m

Minimum
-5.1 m

Result Sellmeijer
2 m

Scenario 1 - Calculation 1

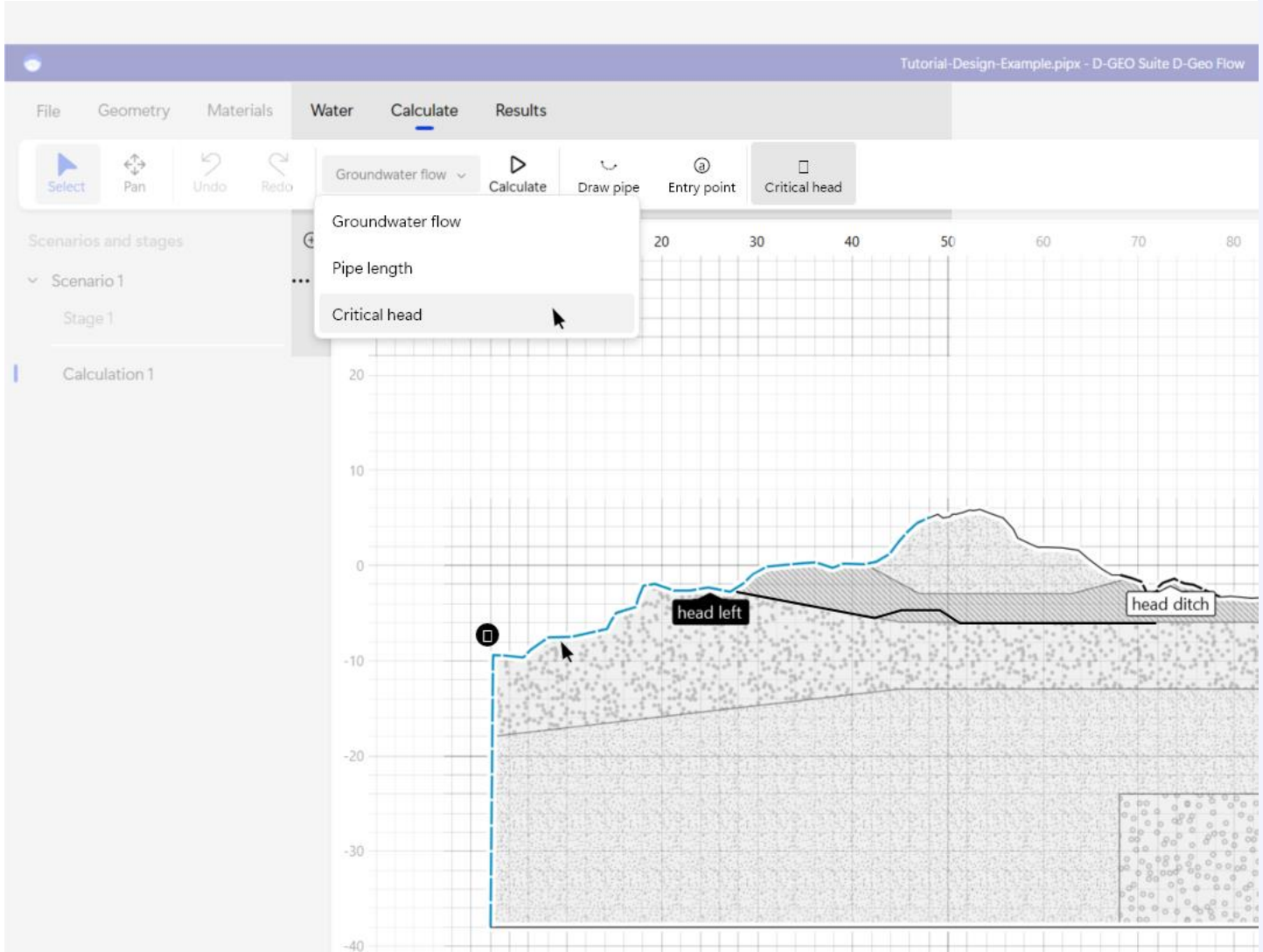
mm cm dm m

153.60 m

# D-Geo Flow 2022

Is this what you need to replace the prototype?

- What features do you need to reach the level of the prototype?
- What features do you need next?
  - Probabilistics
  - Virtually extend boundaries
  - Correct for uplift potential
  - …
- What features does D-Geo Flow need for Stability?
  - Determine phreatic line
  - Flux boundary (inflow)
  - Unsaturated flow
  - …



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# Release D-Stability 2022.01

- It’s not there yet. Will be on our download portal in a few weeks.
  - How would you like to be informed?

- Significantly improved the stability of Uplift-Van
- Improved look and feel of the GUI
  - Windows 11
  - Consistency with D-Geo Flow

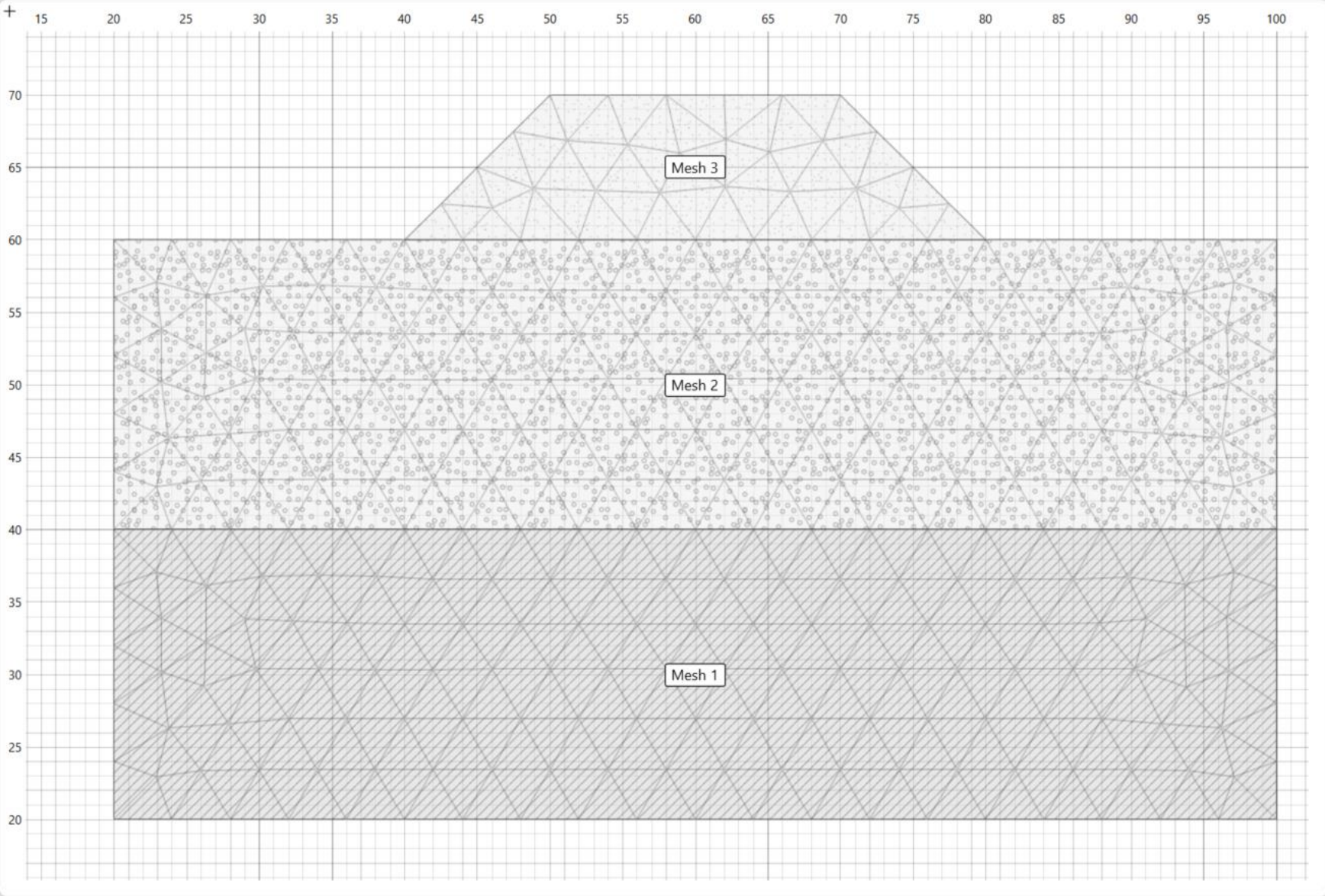
Tutorial.pipx - D-GEO Suite D-Geo Flow

File Geometry Materials Water Calculate Results

Select Pan Undo Redo Groundwater flow Calculate

Scenarios and stages

- Scenario 1
  - Stage 1
  - Stage 3
  - Stage 2
  - Calculation 1
  - Calculation 3
  - Calculation 2
- Scenario 2
  - Stage 1
  - Stage 3
  - Stage 2
  - Calculation 1
  - Calculation 3
  - Calculation 2
- Scenario 3




Calculate

L 1

| Material | Fill |
|---|---|
| Clay, deep | |
| Mesh label | Element size |
| Mesh 1 | 4 m |

L 2

| Material | Fill |
|---|---|
| Clay with silt | |
| Mesh label | Element size |
| Mesh 2 | 4 m |

L 3

| Material | Fill |
|---|---|
| Embankment new | |
| Mesh label | Element size |
| Mesh 3 | 4 m |

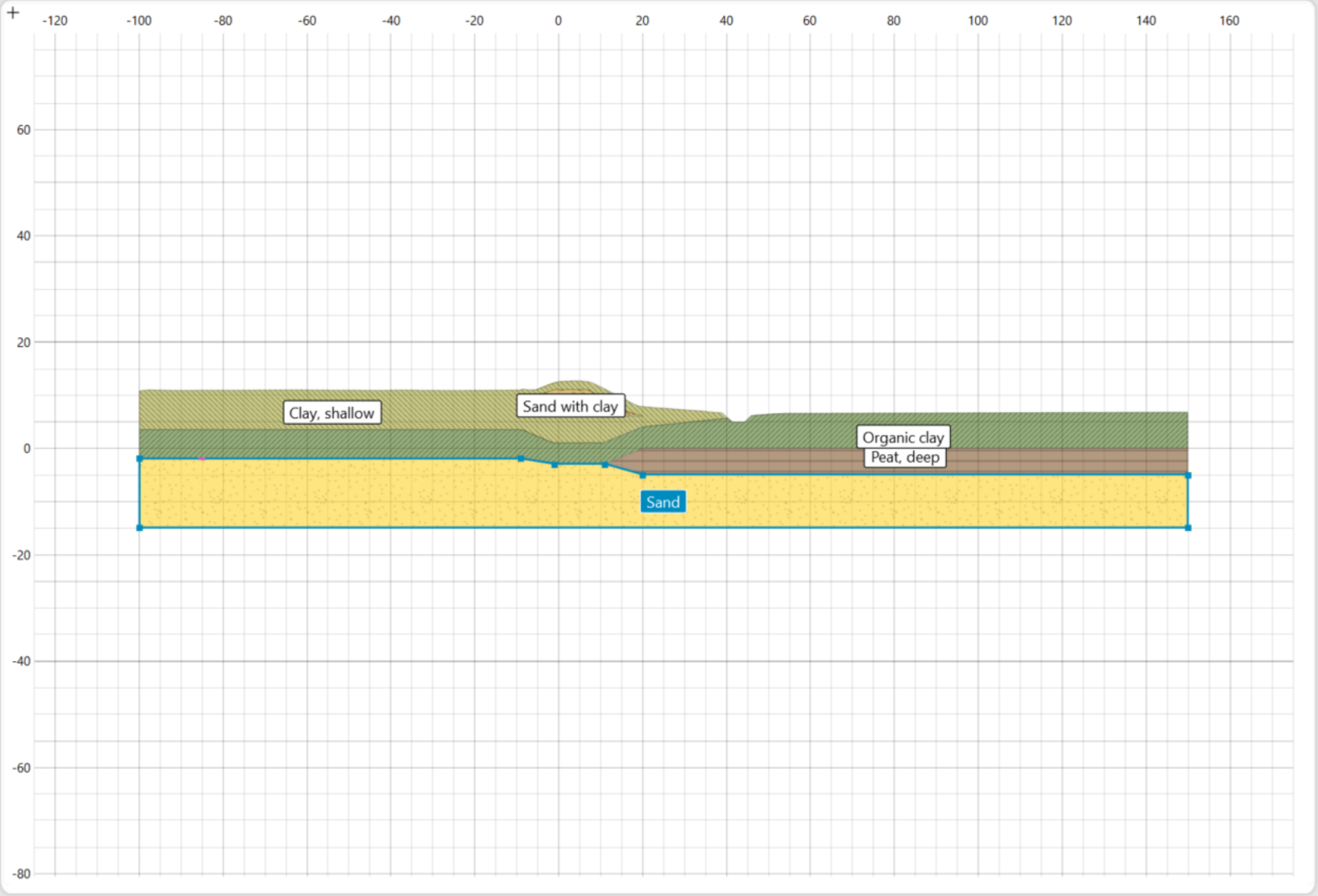
Scenario 1 - Calculation 1

mm cm dm m 88.24 m

Tutorial.stix - D-Stability

File Geometry Materials Water State Loads Reinforcements Calculate Results

Select Pan Undo Redo Materials Correlate Profile Screenshot




Material

Label: Sand

Fill

Notes

Code: Sand

Probabilistic variables: On

Above phreatic level

Shear strength model: Mohr-Coulomb (drained)

| | Deterministic | Use as stochastic | Mean | Standard deviation | Design | | Correlation |
|---|---|---|---|---|---|---|---|
| Unit weight | 18 | | | | | kN/m³ | |
| Cohesion (c) | 0 | Off | 1 | 0 | 1 | kN/m² | Off |
| Frictional angle (φ) | 30 | Off | 1 | 0 | 1 | deg | |
| Dilatancy angle (ψ) | 0 | Off | 1 | 0 | 1 | deg | Off |

Below phreatic level

Shear strength model: Same as above

Unit weight: 20 kN/m³

Daily conditions | High Water | High Water Spencer | High Water Design values | High Water Probabilistic | Improvement | Large improvement | Probability large improvement

mm cm dm m 300.00 m

# Release D-Stability 2022.01

Let’s have a quick look!

# Guidance on making fragility curves

https://oss.deltares.nl/web/embankment/home

You can find guidance on how to make a fragility curve for a probabilistic alanysis

- How to deal with Uplift scenario's
- Choosing the representative slip plane
- How to deal with overtopping

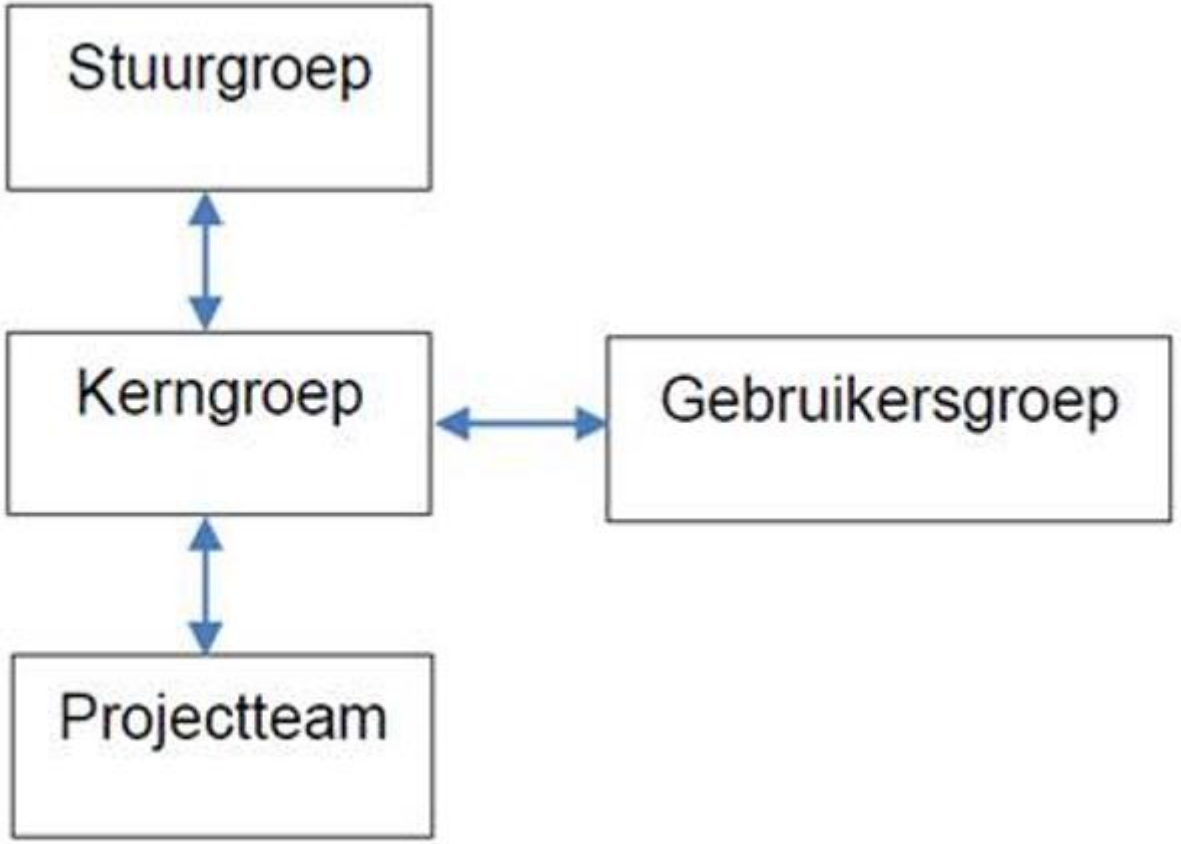
# Embankment Suite development plans

What?

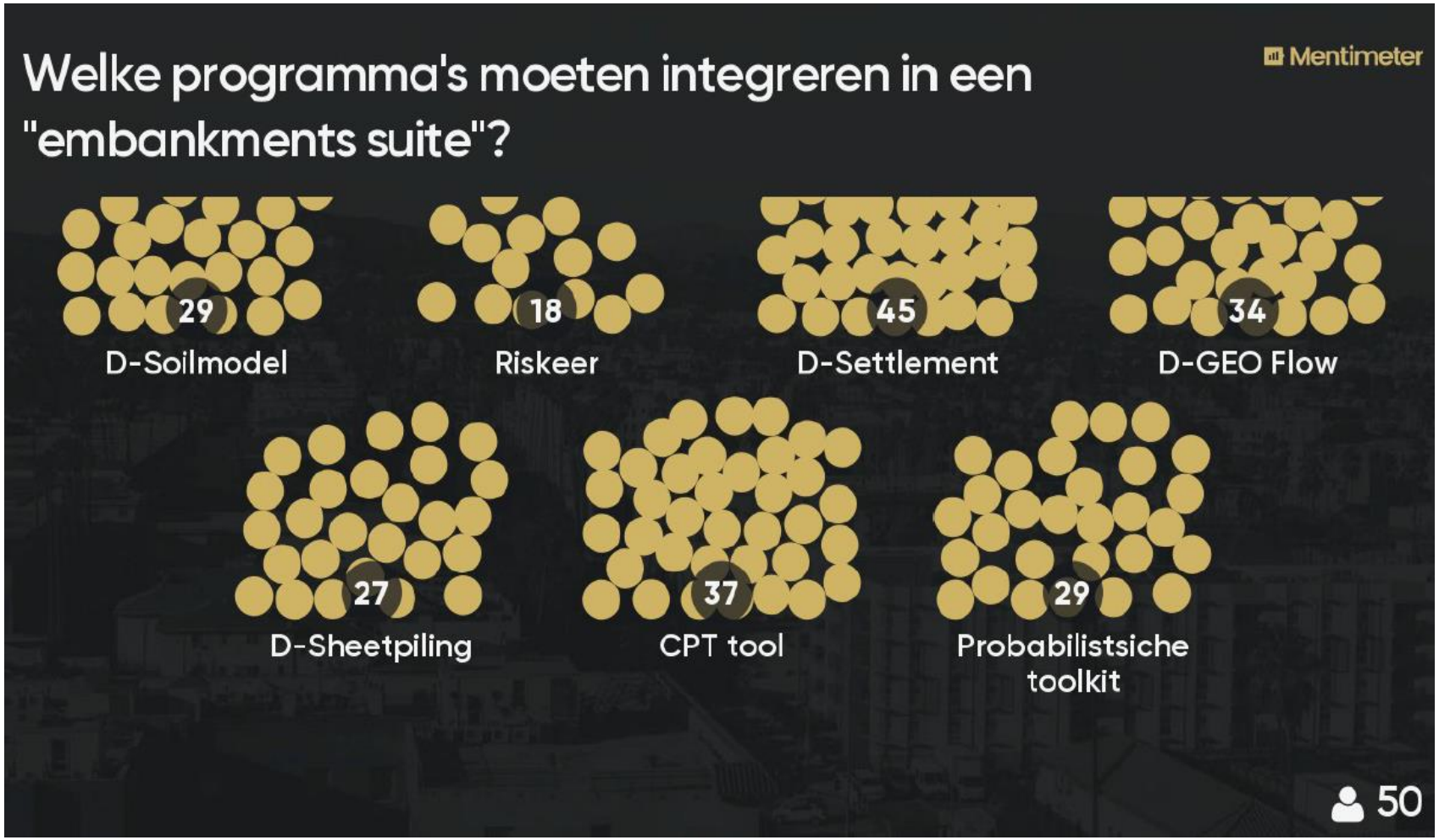
- HWBP, WVL, Deltares

How?

Development



# Embankment Suite development plans: enquête 2017



# Embankment Suite development plans: enquete 2017

# Embankment Suite development plans: enquête 2020

# Embankment Suite development plans: enquête 2020

# Embankment Suite development plans: enquête 2020

# Embankment Suite development plans: enquête 2020

# Embankment Suite development plans

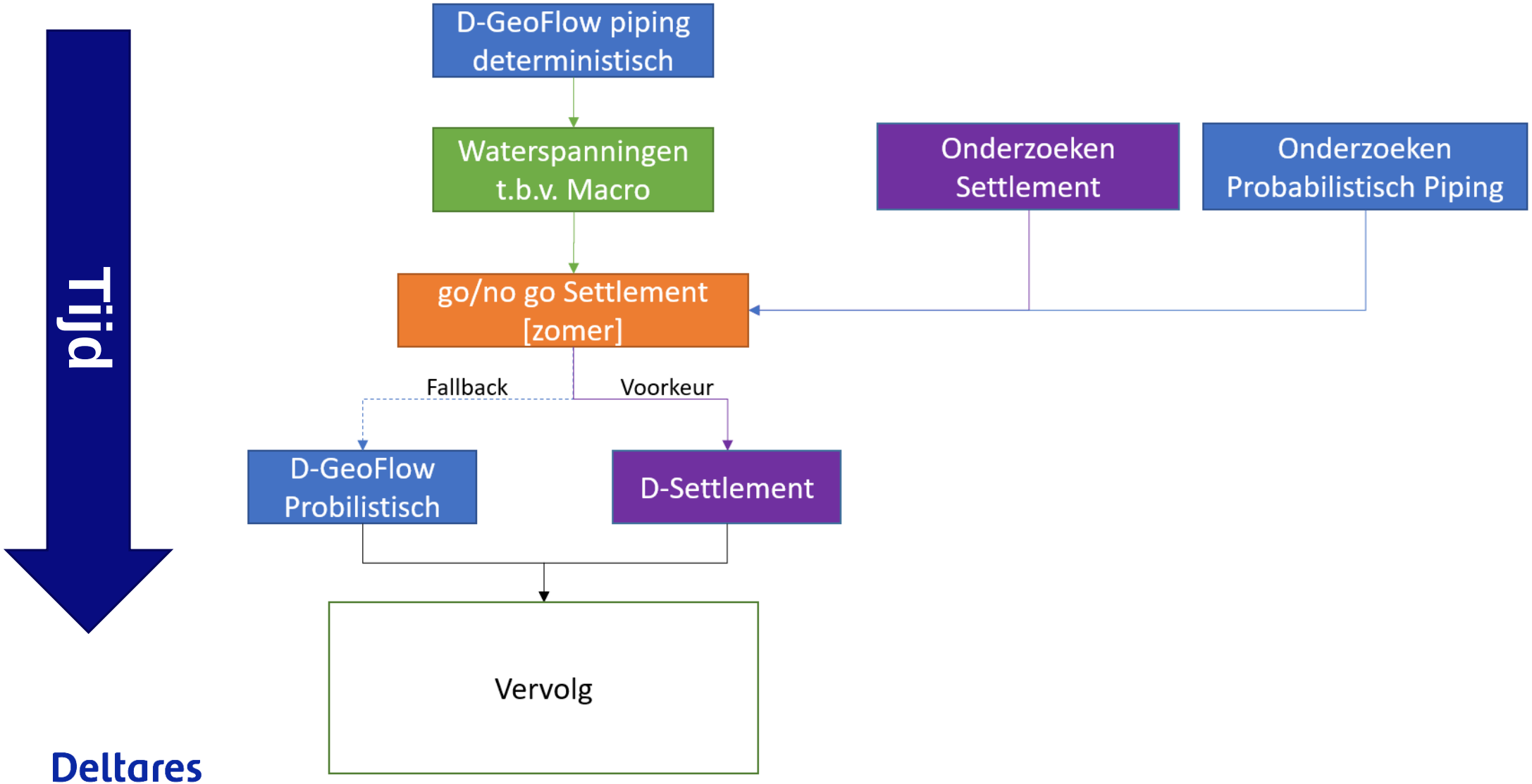
The steering committe have recently given direction for the rest of this year

The Embankment Suite must enable the engineer to design and construct an embankment

- Predict deformations of a cross section
- Predict excess pore pressures for stability

We will build upon the D-Settlement prototype

# Embankment Suite development plans



# D-Settlement 2023.01 tbv uitvoeringsstabiliteit

Continue from the prototype, focus on “uitvoeringsstabiliteit”

On an entire geometry:

- Vertical deformations ABC/BJE
- Spread the loads using the FEM engine
- No horizontal deformations yet (infinite stiffness, no “failure”, like the old D-Settlement)

Exchange excess pore pressures and deformed geometry between Stability and Settlement

Go/ no go: can the Kratos engine perform this analysis.

- Is the 2D stability of Kratos as good as the 1D stability of Kratos?
- Do the users agree with the assumptions and restrictions?

Investigation has started. We will keep you informed.

**First thoughts? Questions**?

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# Contact


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