



**37<sup>TH</sup> INTERNATIONAL  
NO-DIG  
FLORENCE 2019**

**Fortezza da Basso • FLORENCE (Italy)**

**30<sup>th</sup> September • 2<sup>nd</sup> October 2019**

Considerations in planning successful trenchless utility installations  
Loui Thomsen, COWI A/S Denmark



- Uncover and reconcile needs
- Conceptual design
  - Authorities
  - Accessibility
  - Work areas
  - Traffic
  - Geotechnical conditions
  - Other subsoil utility's and structures
  - Method assessment
  - Risk assessment and in some cases an economic assessment
- Detailed design
- Stakeholder, cooperation
- SDG and planning of trenchless installations

# Uncover and reconcile demands

Before considering  
any of this:



You need to do this:



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# Considerations during the conceptual design process

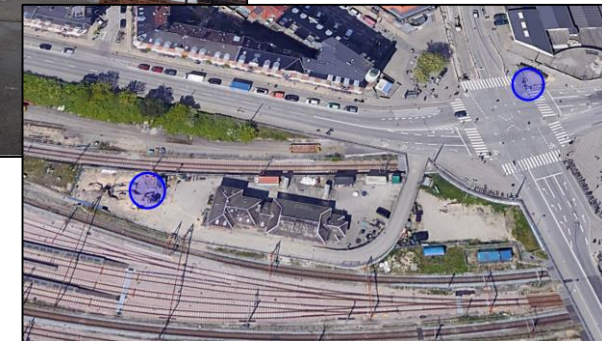
- Mapping of relevant authorities
- Assessment of accessibility
- Assessment of available work areas
- Assessment of measures to manage traffic
- Preliminary assessment of geotechnical conditions
- Detailed mapping of existing cables and pipelines
- Method assessment: HDD, MT, Auger, DP etc.
- Etc.
- Conceptual planning of vertical and horizontal alignment based on most reasonable available technologies.
- Risk assessment based on multiple possible methods/technologies
- In some cases an economic assessment based on reasonable methods is relevant.



Pipelines for cooling water under palace garden

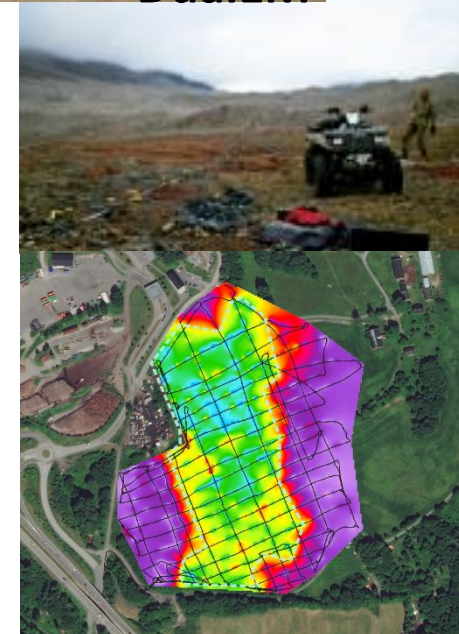
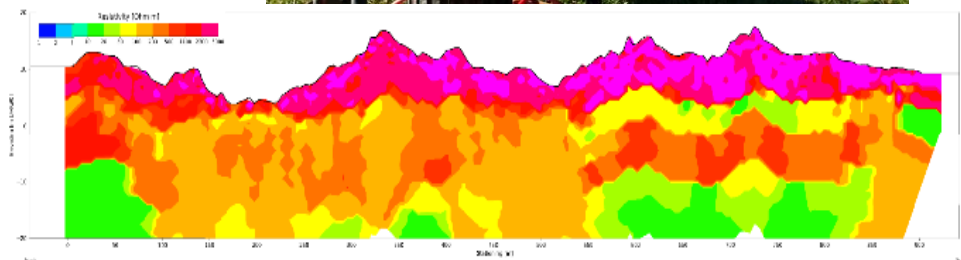
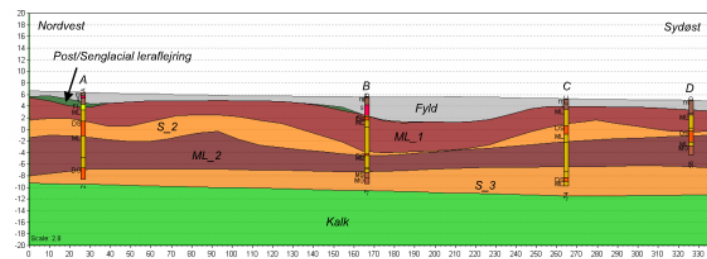


Pipelines for cooling water under multiple Railway tracks in Copenhagen

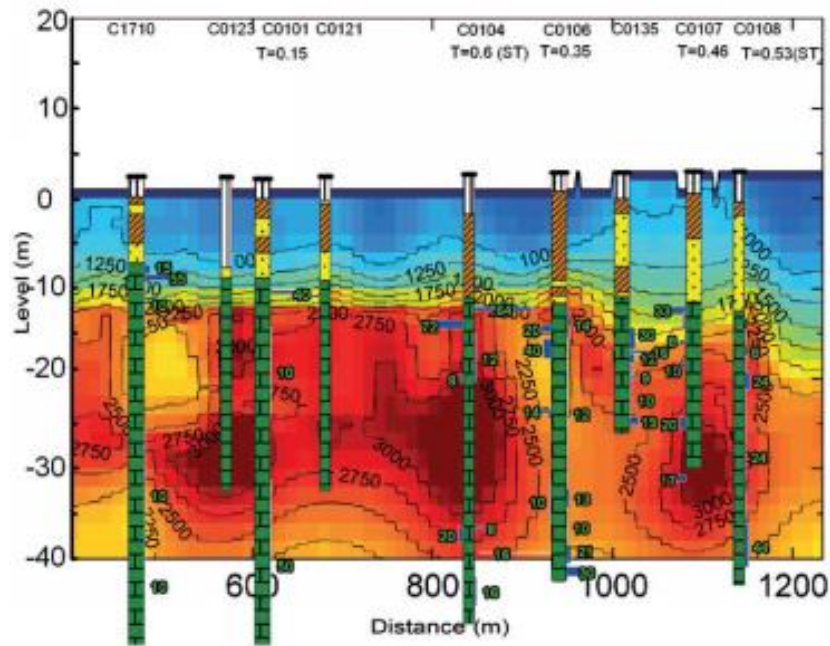


# Conceptual design - preliminary geologi

## Electrical Resistivity Tomography (ERT)/SVES and DualEM

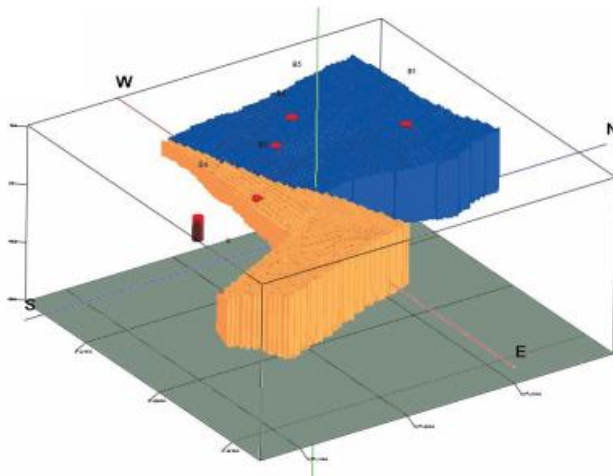


**Seismic Survey by Reflection Seismology - often combined with a multi beam investigation of the bathymetry when on water**

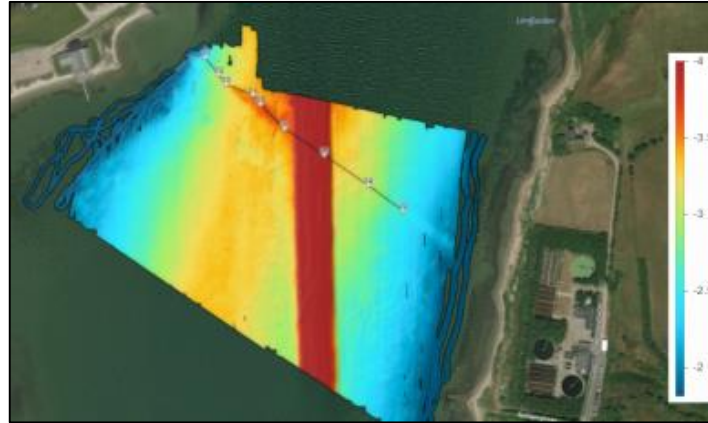


## Ground penetrating radar/GPR 2D/3D

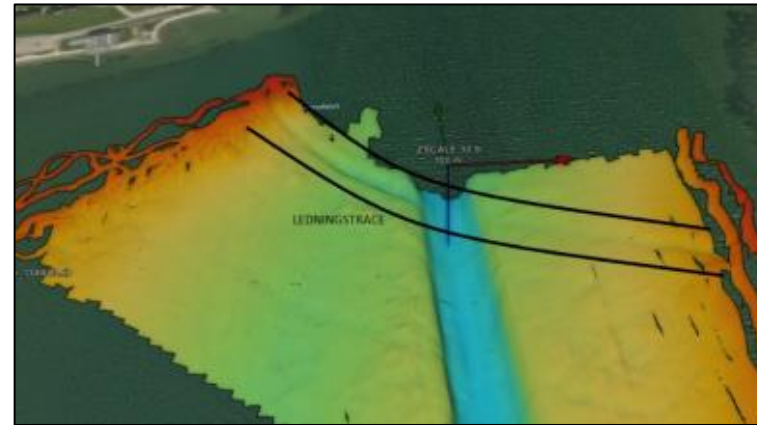
- A tool for screening the underground
- Can i.e. detect the following:
  - Mapping of soft soil vs. hard soil and transitions
  - Allowing approximate estimate of geological layers
  - Mapping of bedrock
  - Mapping of permafrost



# Conceptual design - mapping existing utilities and subsurface structures



- Historic data and national databases
- Seismic Survey
- Ground penetrating radar



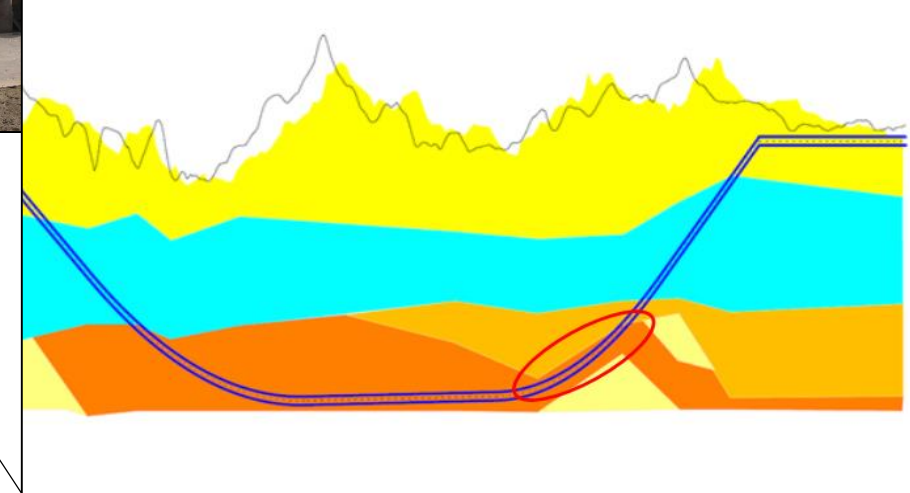
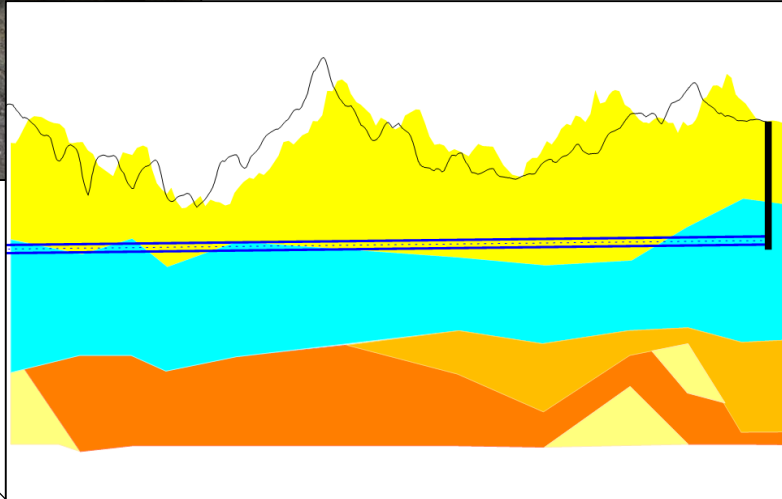
# Concept design – assessment of methods



# Concept design – assesment of methods



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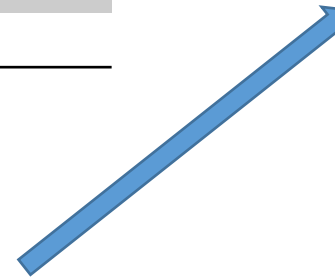


# Preliminary alignment and risk evaluation

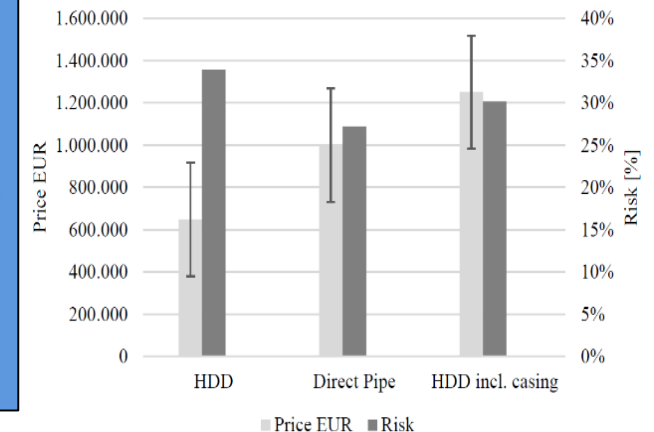
Riskmatrix		Likelihood		
		1: Low probability	2: Medium probability	3: High probability
Consequence	1: Low	1	2	3
	2: Medium	2	4	6
	3: High	3	6	9



ID	Description of risk	Type of risk	Likelihood	Consequence	Riskvalue
1	Geology	Rock and boulders in moraine deposits	3	3	9
2	Technical	Drill through existing buried cables	2	3	6
3	Geology	Drilling in soil layers with poor strength	1	1	1
4	Geology	Borehole collapses	1	3	3
5	Technical	Loosing mudpressure	2	2	4

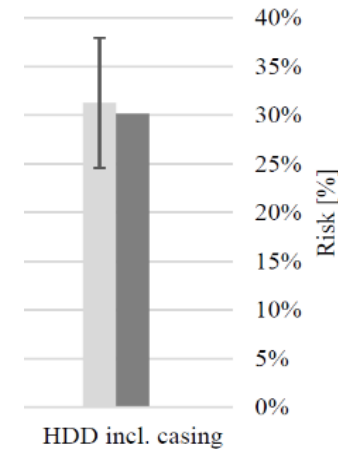
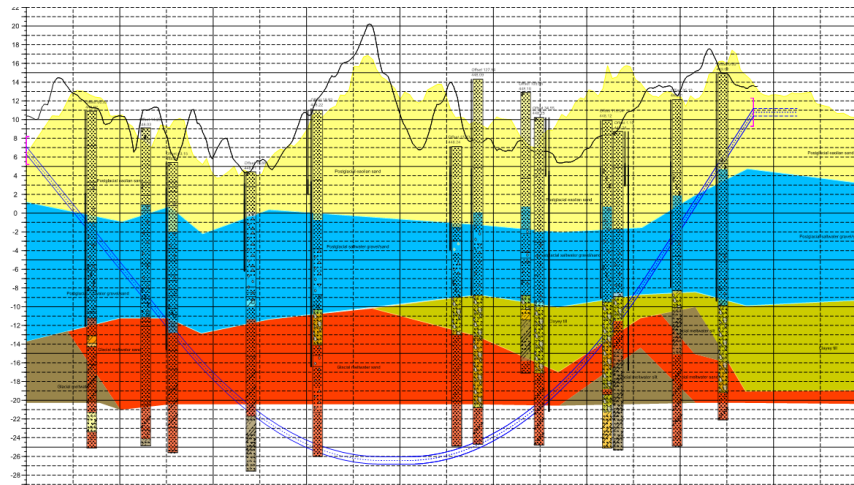


Riskvalue	Action
6-9	Requires immediate action
3-5	Requires rapid action
1-2	No immediate action required



# Detailed design considerations

- Detailed investigations and assessment of geotechnical conditions
- Detailed planning of alignment
- Detailed risk assessment based on detailed studies and the final chosen method of establishment.

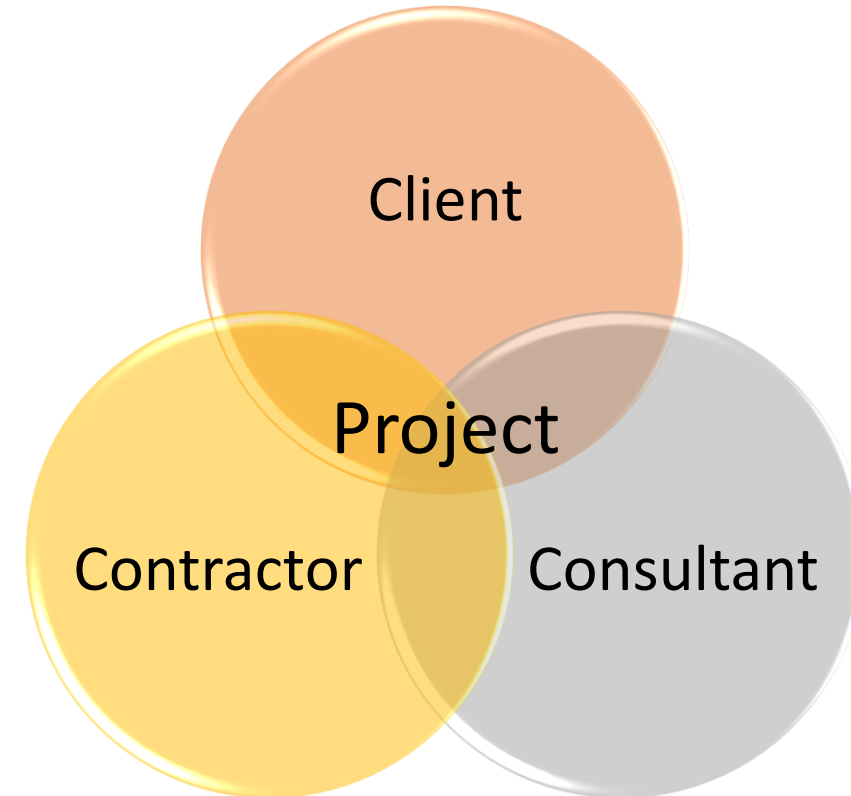
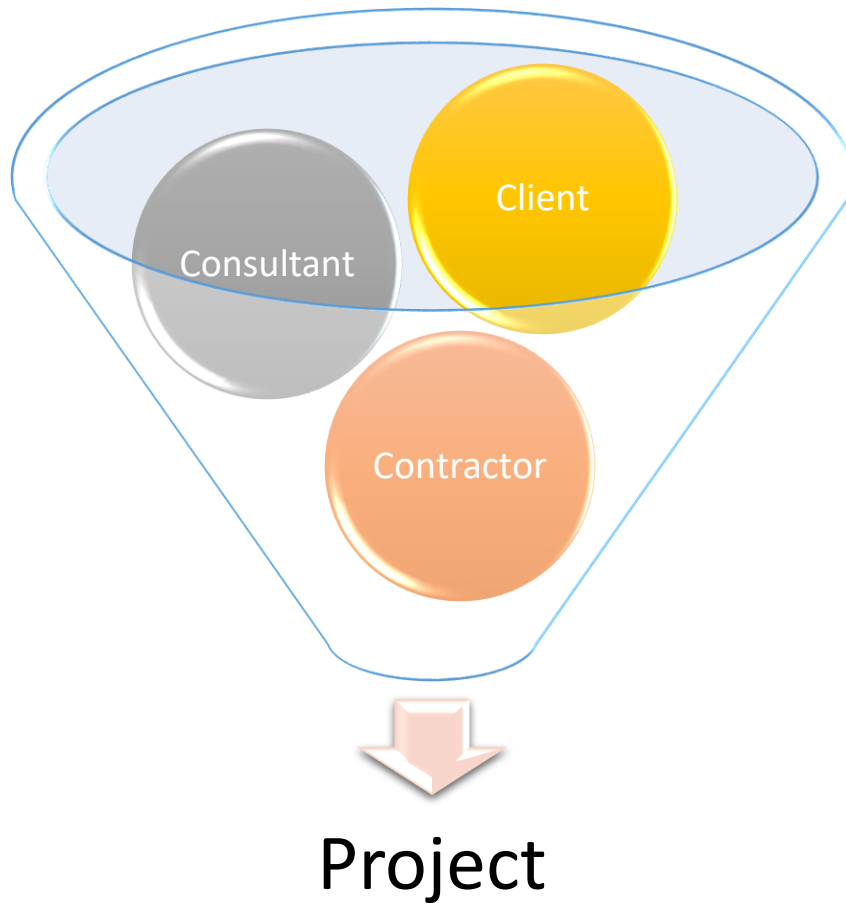


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# Cooperation amogs stakeholders and Knowledge



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# Risk assesment and Sustainable Development Goals, SDG's

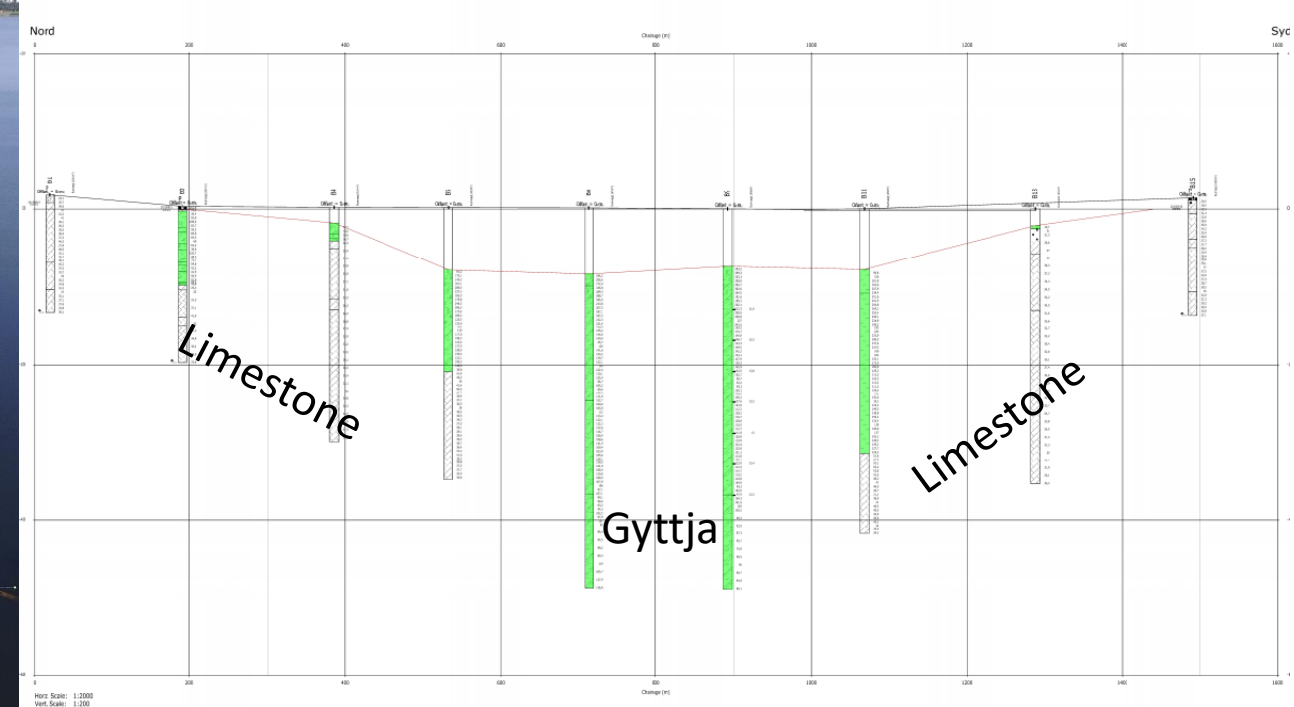


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# SOME TIMES OTHER METHODS MUST BE CONSIDERED



15

30th Sept  
Loui Thomsen LTMO@COWI.COM



Mariagerfjord  
Vand a/s



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- Reconcile demands and best case wishes, the two are often mixed
- Conduct trenchless ground investigations before conducting geotechnical boreholes. The risk of redundant boreholes or worse poorly placed boreholes is reduced significantly..
- Evaluate the possibilities and consequences of the methods and actual alignments carefully and critically. **Trenching og Trenchless. No projects are with out risks but in many cases risks can be reduced if they are known and adressed.**
- Re-reconcile demands while considering the risks and challenges in any given project.

# Thank you for listening

- Name: Loui Thomsen
- Education: Aalborg University department of civil engineering
- Mail: LTMU@COWI.COM
- COWI, Aalborg, Denmark
- Membership: NoDig Infra (Danish Society of trenchless technology)



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