

WHY ONLY SOME CONCEPTUAL SITE MODELS ARE USEFUL

A New Way to Look at the CSM Process

Battelle Bioremediation Symposium, Baltimore

April 18, 2019

Optimization as Critical Thinking

- Remediation rarely works as expected
- Success requires continuous learning



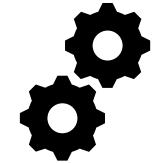
Optimization grows naturally from the CSM process

Critical Thinking about Critical Thinking

The Conceptual Site Model (CSM) is an iterative, 'living representation' of a site that summarizes and helps project teams visualize and understand available information.

USEPA "Effective Use of the Project Life Cycle Conceptual Site Model" EPA 542-F-11-011 (2011)

- A communication tool
- A process
- Sometimes, a diagram



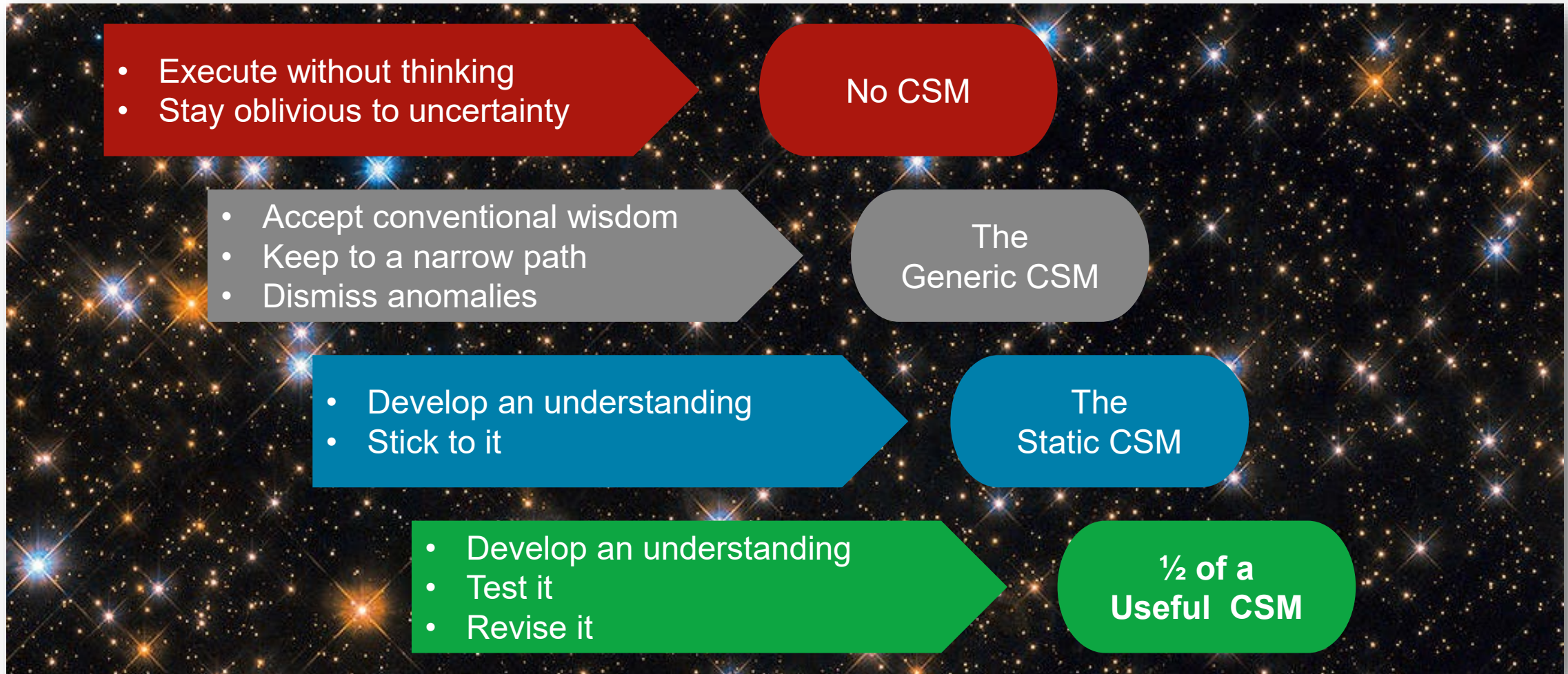
Like remediation itself, not all CSMs perform as hoped.

In the beginning... data

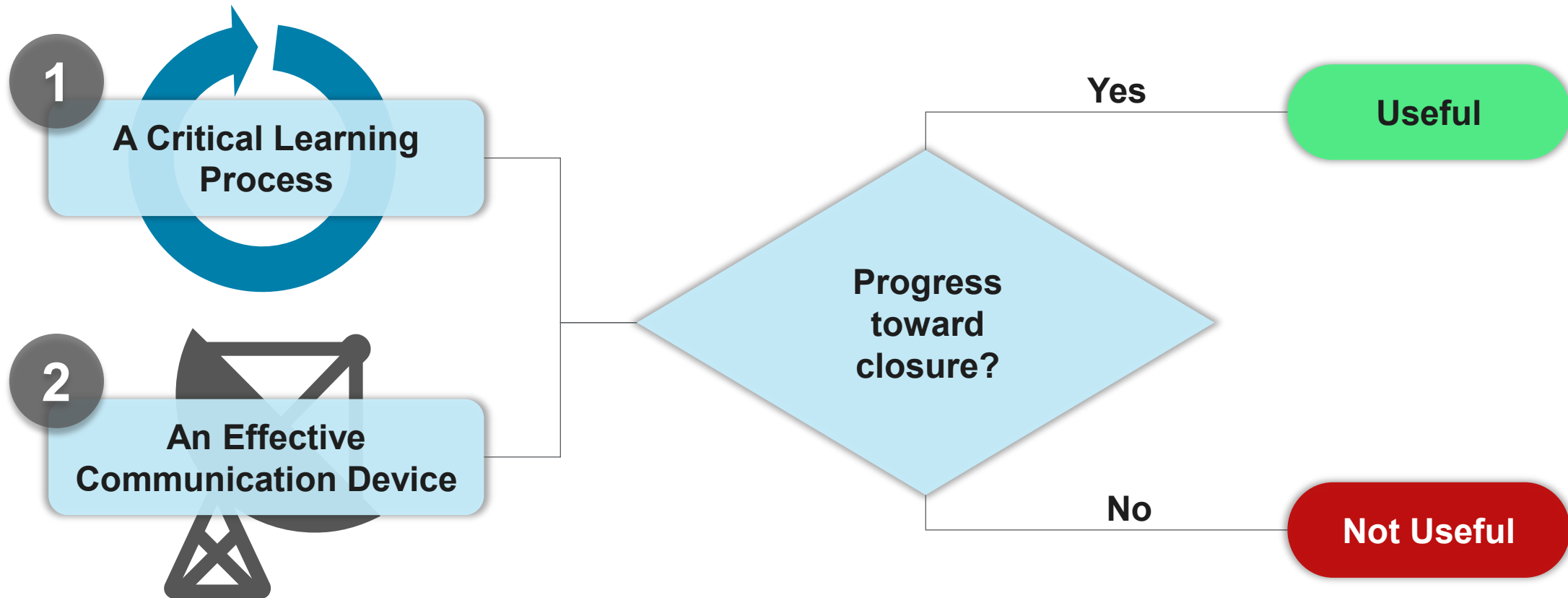


NASA Hubble Telescope Image (Messier 11)

Multiple Ways to Navigate Uncertainty



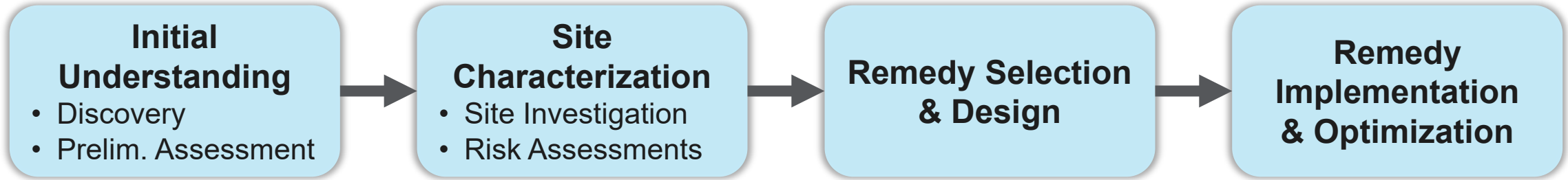
The Two Elements of Useful CSMs



Useful CSMs enable informed decision making... in every project stage

Projects evolve. So must CSMs.

The project life-cycle



Major role of CSM



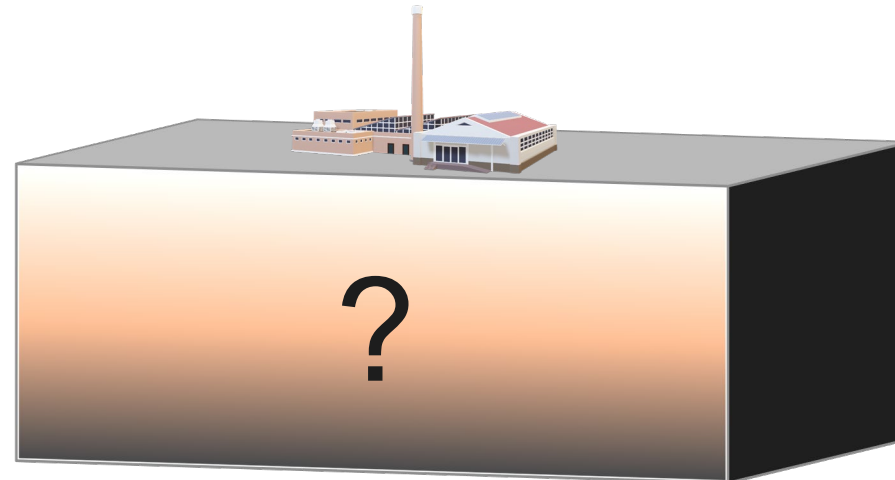
Stage 1: Initial Understanding

Frame Up the Issues

**Ask the
Fundamental
Questions**

- Sources
- Pathways
- Receptors

**Identify the Big
Unknowns**



FRAME



**Provide
Direction for
Future Work**

Still more questions than answers...

Stage 2: Site Characterization

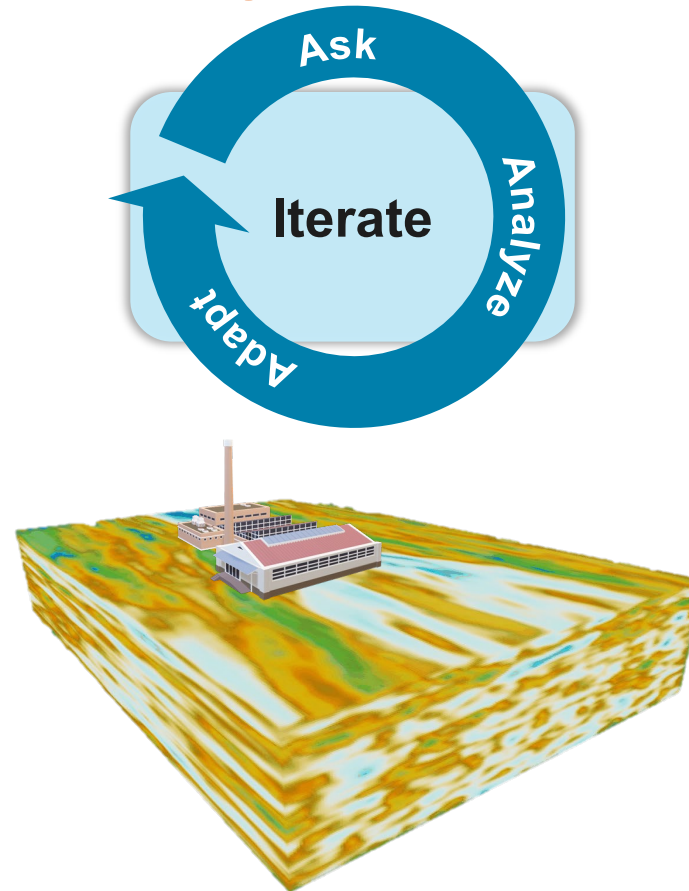
Bring definition to the site understanding

Define



Define Site Conditions

- Nature & Extent
- Fate and Transport
- Risk



Demystify

- Bring clarity
- Inspire confidence
- Build consensus

Good CSMs get projects unstuck

Stage 3: Remedy Selection & Design

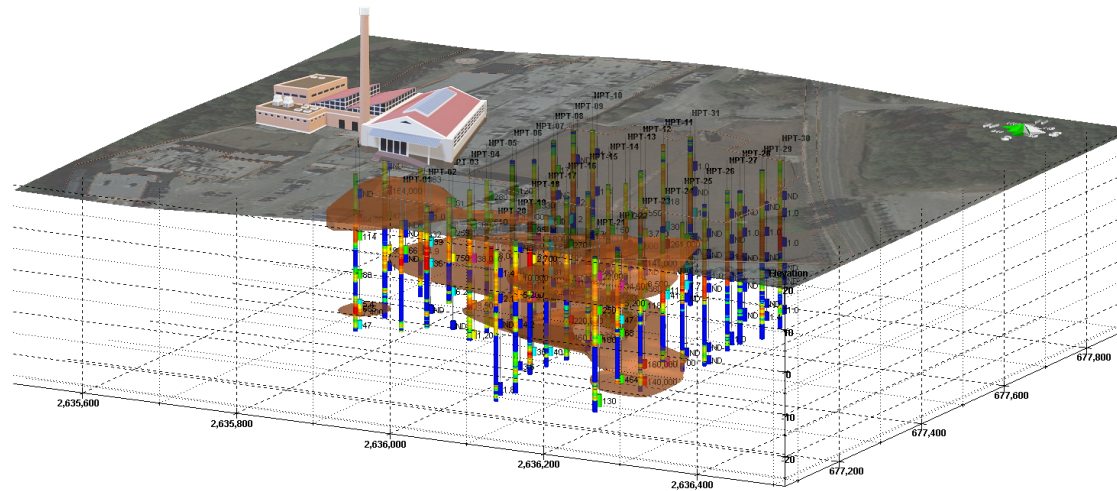
Refine the details that control success



Fill in the details

- Mass storage
- Mass flux
- Treatability

Identify soft spots



Define Success

Your CSM is your basis of design

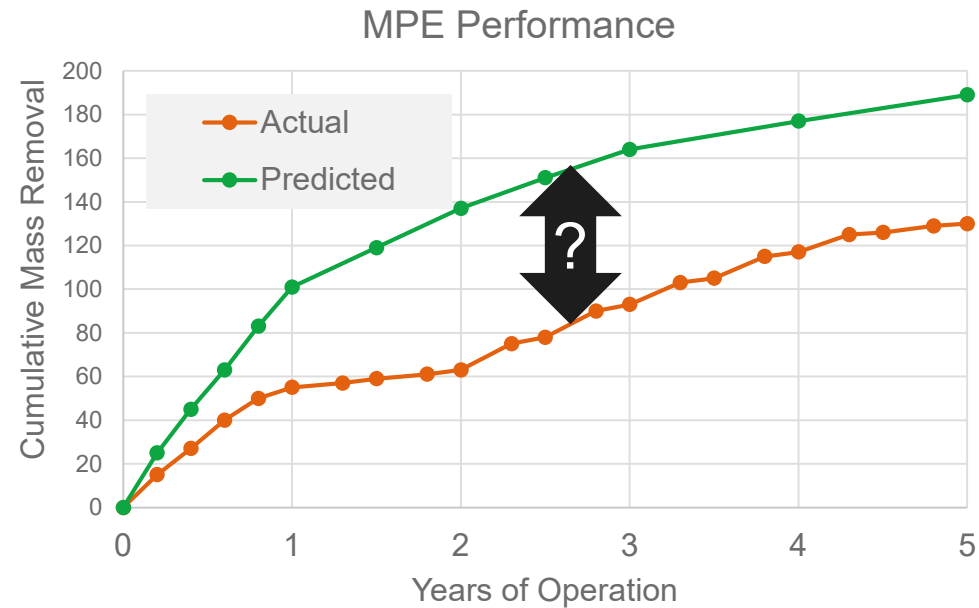
Stage 4: Implementation & Optimization

Let performance data challenge your assumptions



Question the data

Ask why?

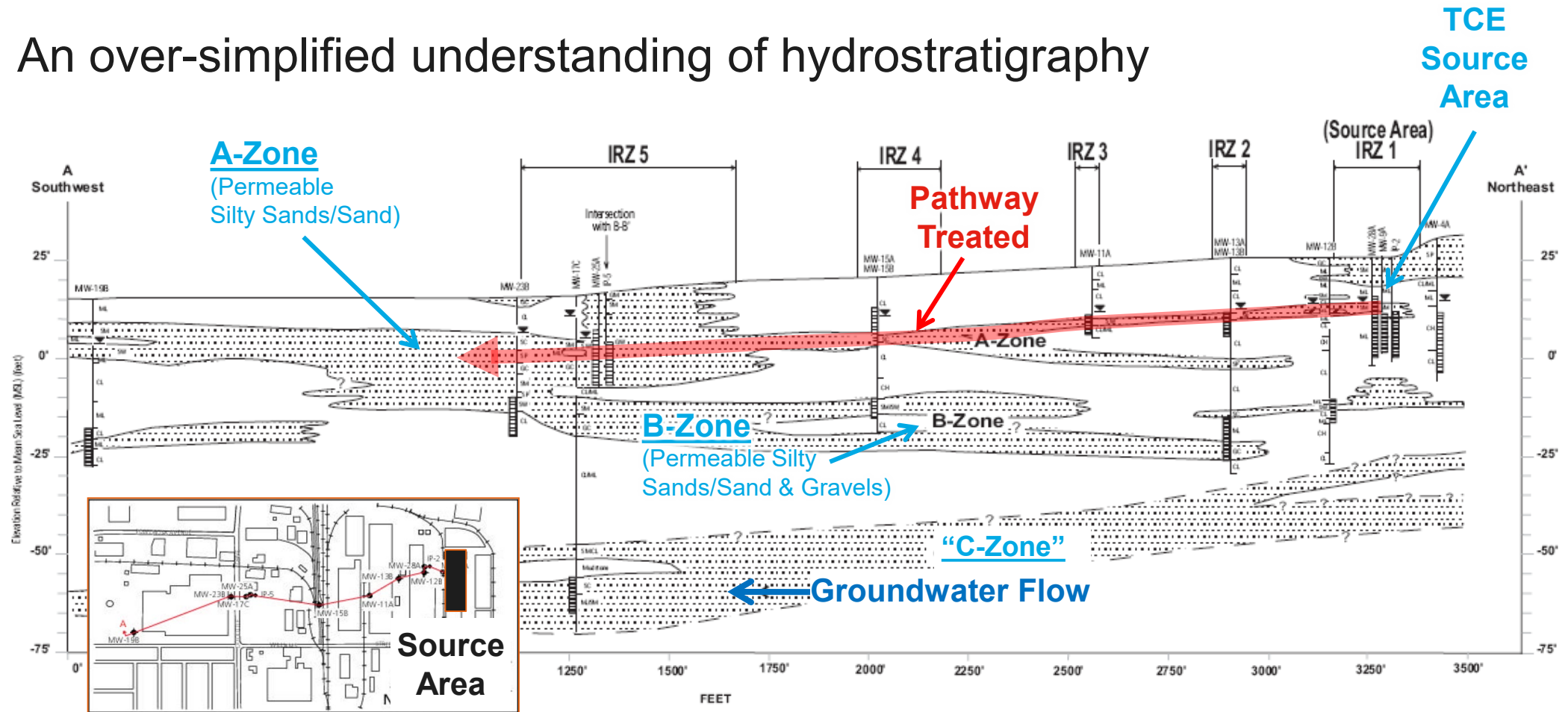


Revisit CSM assumptions

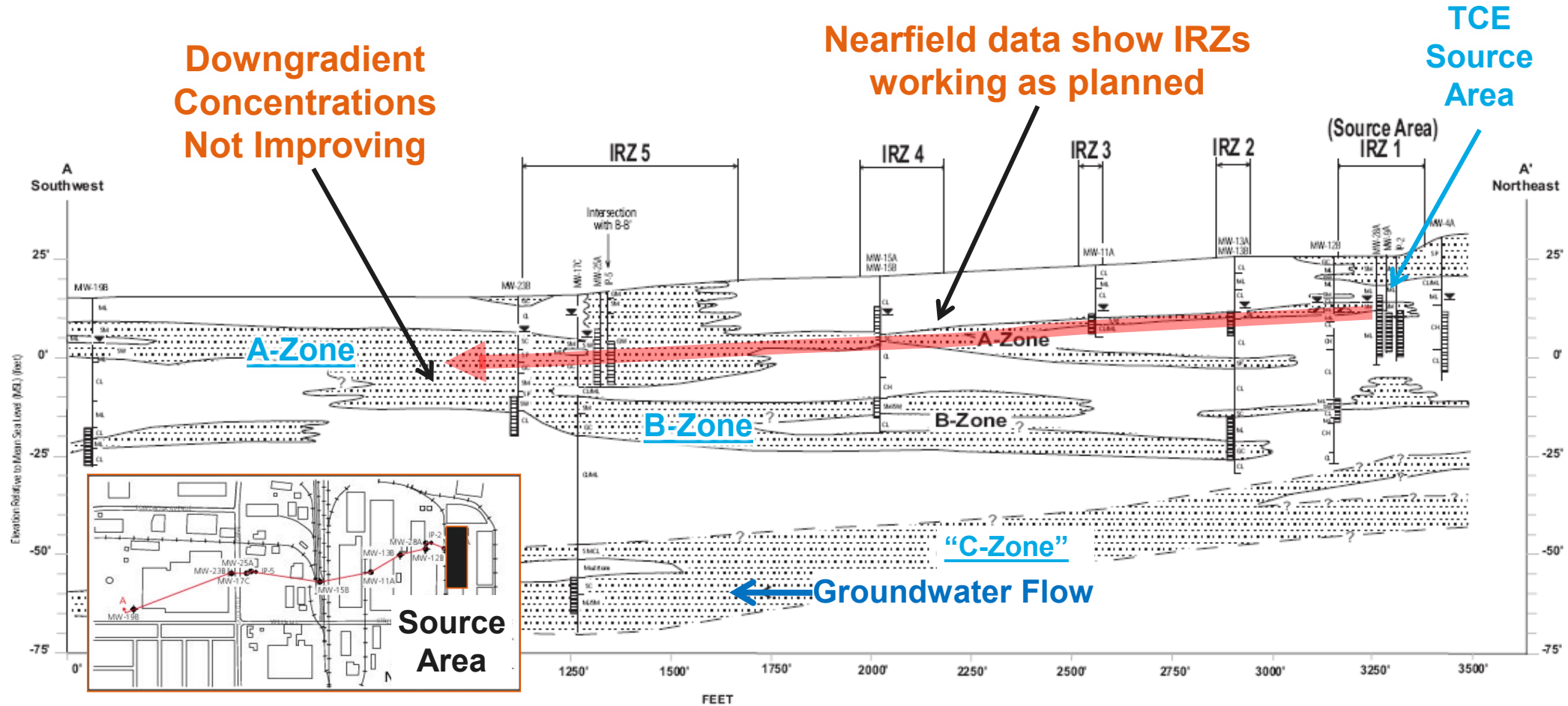
Be willing to be wrong.

Optimizing by Challenging the CSM

- IRZ remedy implemented on basis of “vintage” CSM
- An over-simplified understanding of hydrostratigraphy

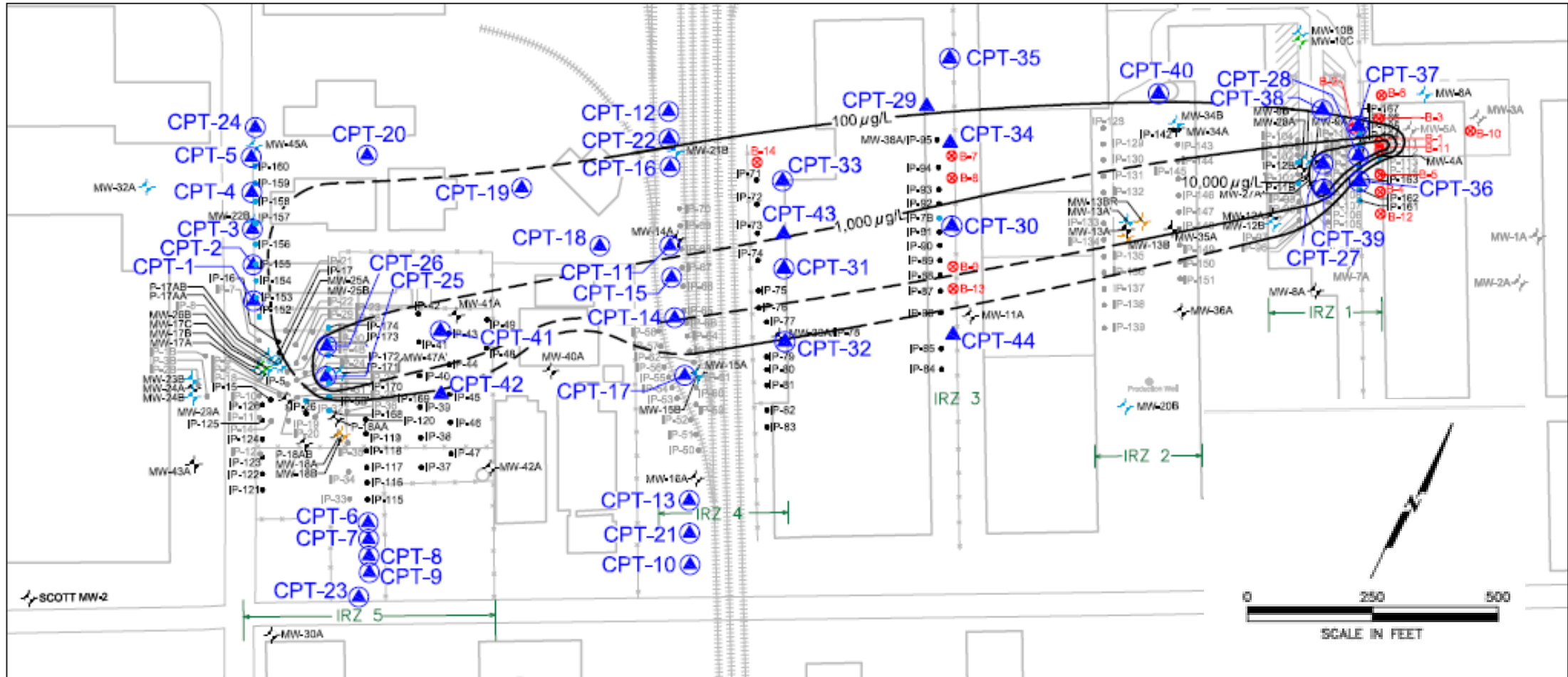


Years Pass... Remedy Underperforms



Asking why is just the first step.

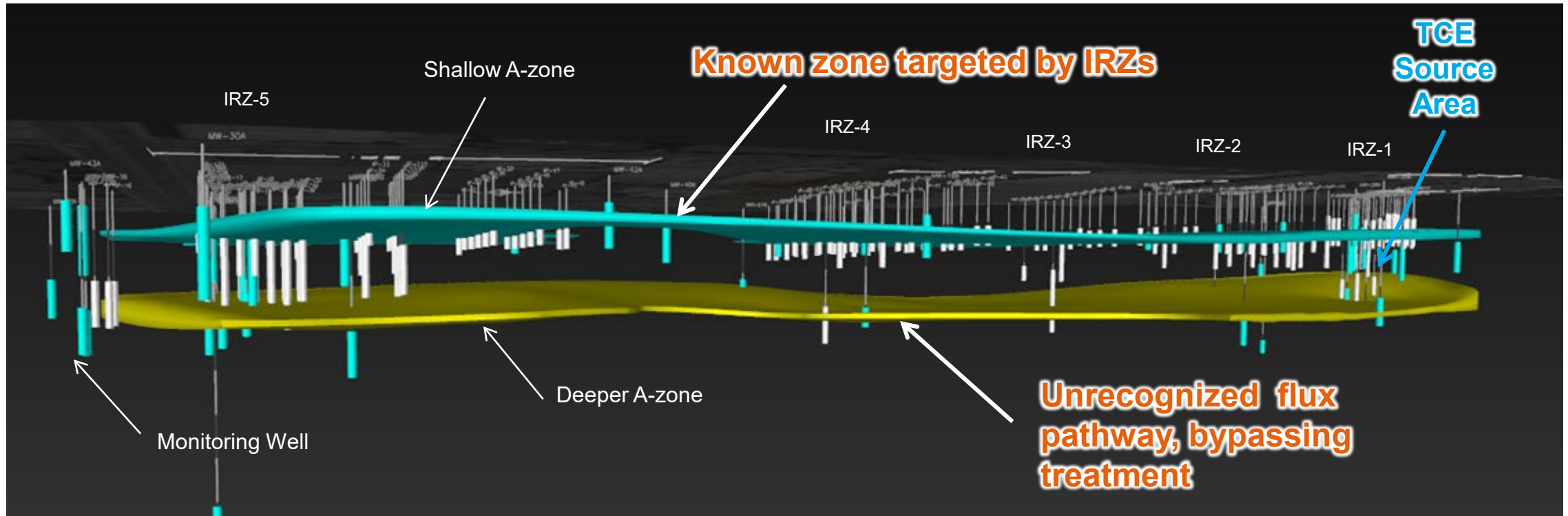
Refining the CSM



High Resolution Site Characterization (HRSC) 

Map Flux Pathways

A new CSM emerges...



... and the remedial program gets back on track

The Useful CSM

Is Not:

Any one tool.
Any one diagram.
Any one approach.
Any one thing.

Is:



Professionals, working through problems...



... telling the site story, however best told.

Thank you!



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