

# STATE OF THE ART IN OIL SANDS RECLAMATION REMTECH 2014 LEONARD LESKIW, P.AG.

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Summary and evaluation of existing work and future  
reclamation research priorities



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# Project Objectives

- Determine the “State of the Art” in oil sands and coal mining reclamation practices through a review of several selected reclamation research compilations/reports.
- The main objectives were to:
  - Categorise the research into thematic subject areas (research buckets), and to highlight future research priorities
  - Summarise differences/similarities and overall knowledge gaps noted within the literature
  - Highlight any learnings from coal mine reclamation
  - Bring together mining reclamation practitioners to evaluate and discuss the results
  - Create a summary report that includes the summarised state of the art, workshop findings and the path forward

# Ideal Reclamation – Where to set the bar?



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Stable, self-sustaining, locally common boreal forest equivalent to pre-disturbance communities, regardless of the end land use (e.g., forestry, recreation, wildlife and traditional use)



# Literature Review

Theme

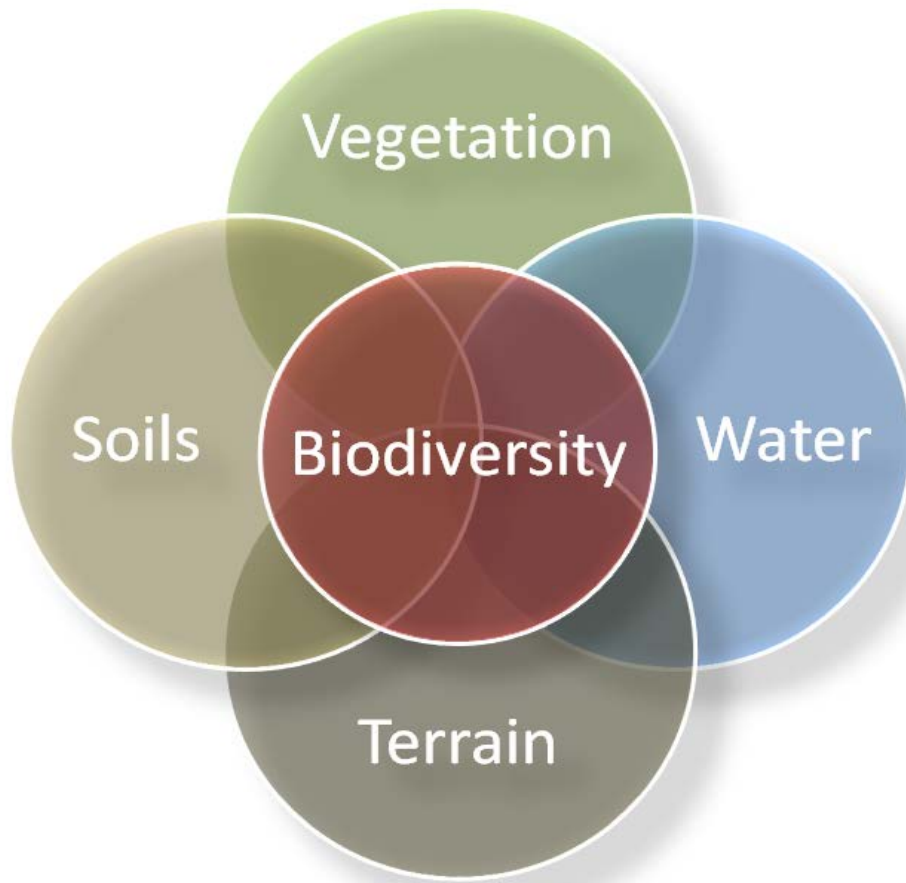
State

Gaps

Contribution

Take aways

# Thematic Subject Areas



# State of Reclamation - Terrain

## Research Buckets

- Landscape design
- Landscape modelling
- Terrain hydrology management
- Terrain stability
- Overburden reclamation
- Tailings sand reclamation
- Soft tailings reclamation

## Current State

- **The physical aspects are a success, hydrological aspects are progressing**
- Geomorphic approach
- Stable landforms are created on “dry” materials
- Capping unsuitable materials
- Tailings pond reclamation completed at pilot scale

# State of Reclamation - Water

## Research Buckets

- Surface water and ground water quality
- Soil pore-water quality
- Water quantity
- Establishment of functional wetlands
- Watershed reclamation

## Current State

- **Importance of holistic watershed functioning**
- **Wetland reclamation in early stages of implementation**
- Models to simulate water balance and transmission
- Soil capping configuration promotes infiltration
- Salt water discharge a concern



# State of Reclamation - Soil

## Research Buckets

- Soil salvage and material handling
- Stockpile management
- Direct placement
- Material balance
- Suitability/capability assessments
- Soil capping prescriptions
- Erosion control
- Creation of microsites
- Soil moisture regime mgt.
- Soil nutrient regime mgt.

## Current State

- **Coversoil types/depths developed for target upland moisture/nutrient regimes**
- Creation of microsites using mounding and woody debris
- Direct placement to stimulate soil biological processes and native species re-establishment
- Long-term stockpiling

# State of Reclamation - Vegetation

## Research Buckets

- Seed collection
- Coarse woody debris
- Agronomic cover crop establishment
- Revegetation
- Fertilization
- Plant water consumption
- Weed management
- Pest management

## Current State

- **Targets common local ecosite communities**
- Native seeds/cuttings collected locally
- Cover crops used to minimise erosion and improve structure
- Weeds and pests sprayed or manually pulled
- Fertilizer applied - effectiveness uncertain

# State of Reclamation - Biodiversity

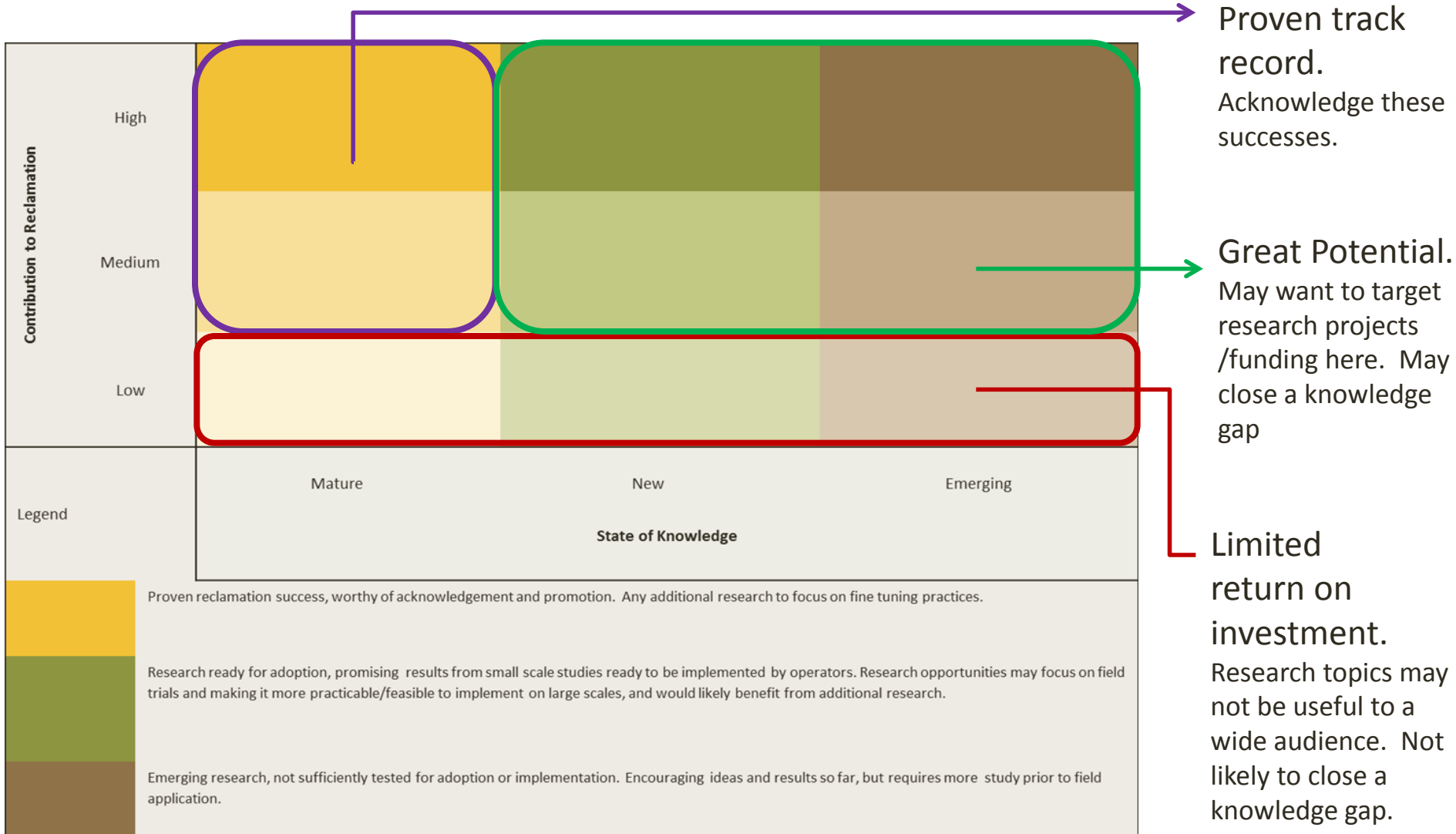
## Research Buckets

- Biodiversity monitoring
- Vegetation community diversity
- Wildlife habitat diversity
- Criteria of ecosystem performance
- Land conservation offsets
- Traditional ecological knowledge

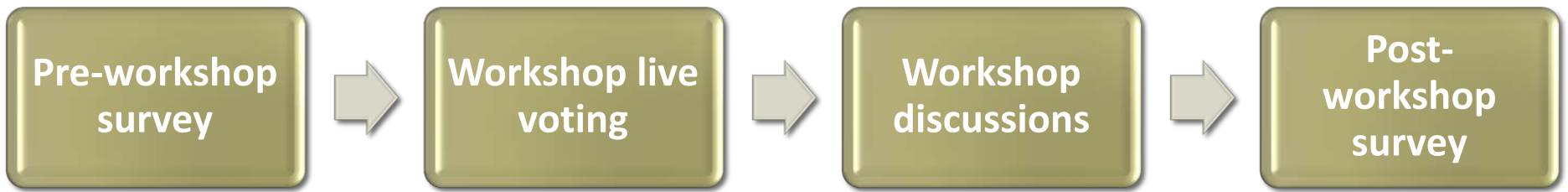
## Current State

- **Progress in designing wetlands vs. opportunistic establishment**
- Wildlife habitat not a direct focus, but target ecosites are expected to support a range of wildlife species

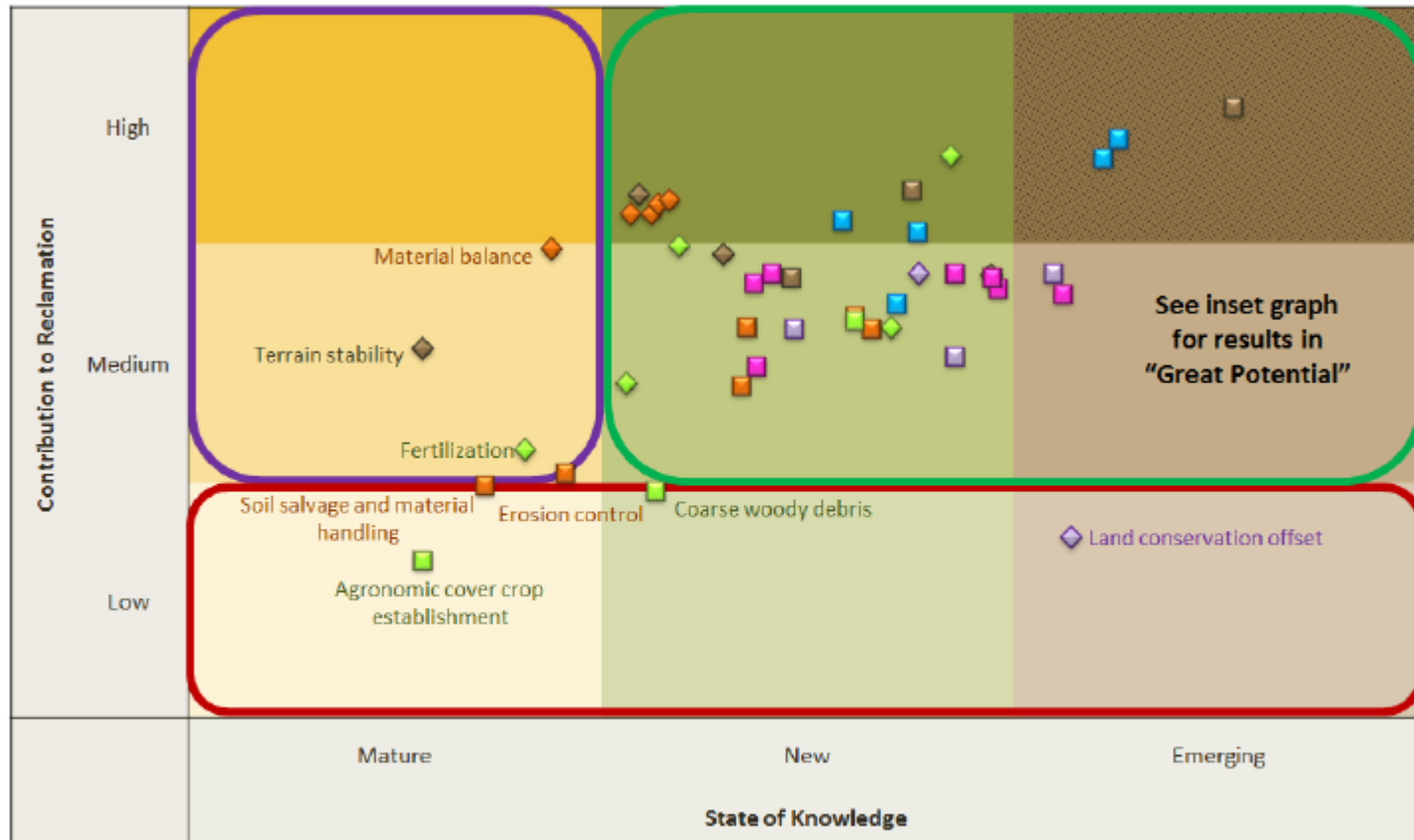
# The Evaluation Matrix



# Evaluation Results

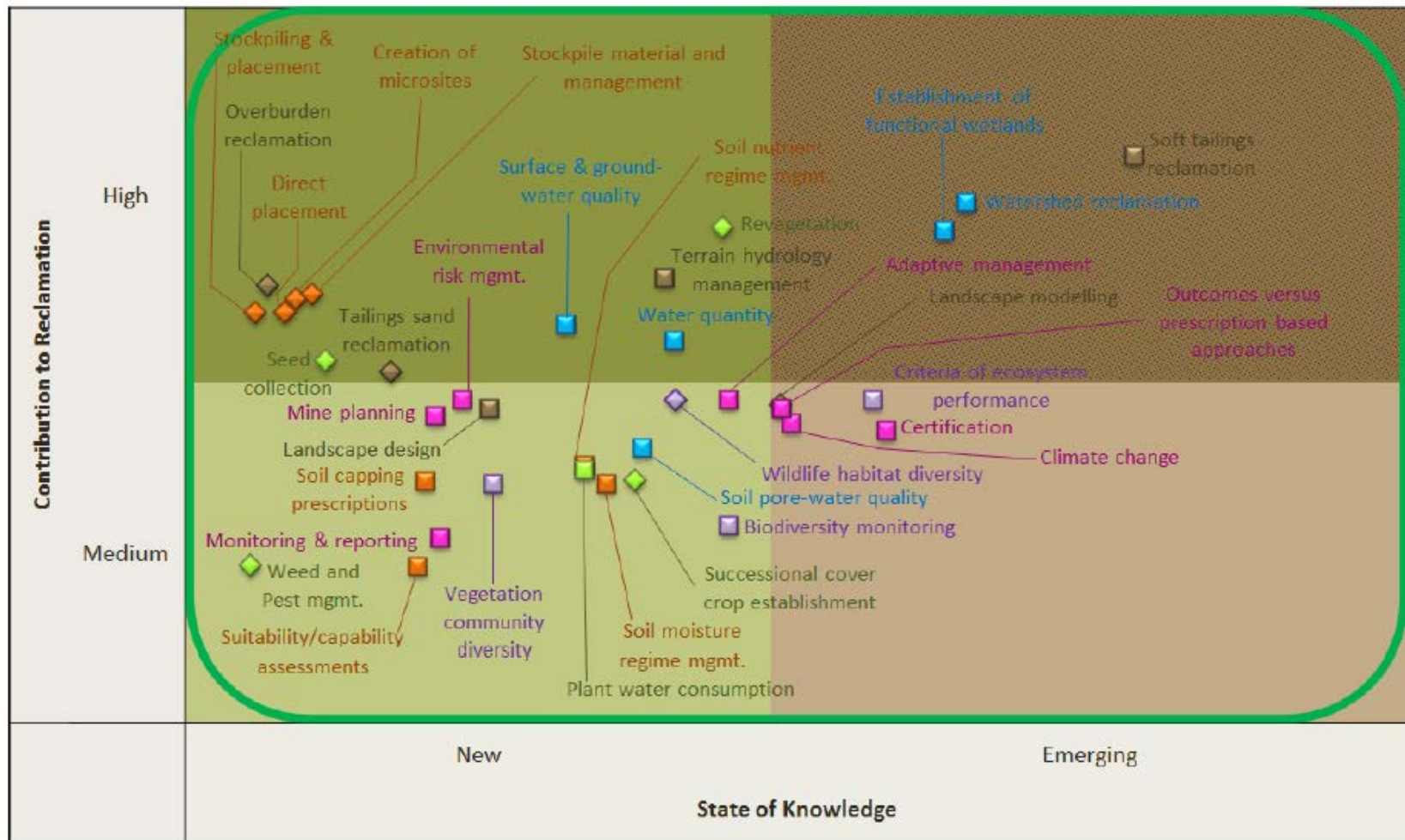


# Evaluation Results



- Legend:**
- ◆ Terrain Buckets
  - ◆ Vegetation Buckets
  - Great Potential
  - Highest Potential
  - ◆ Water Buckets
  - ◆ Biodiversity Buckets
  - Proven Track Record
  - ◆ Workshop results
  - ◆ Soil Buckets
  - ◆ Global Buckets
  - Limited Return
  - ◆ Survey Results

# Evaluation Results – Greatest potential



- Legend:**
- Terrain Buckets
  - Vegetation Buckets
  - Water Buckets
  - Biodiversity Buckets
  - Soil Buckets
  - Global Buckets
  - Great Potential
  - Highest Potential
  - ◇ Workshop results
  - Survey Results

# Key Research Focus: Watershed reclamation

## Gaps to Close

- Watershed scale
- Mechanisms to shed water
- Geomorphic approach
- Water table management and fluctuation
- Climate change effects
- Drawdown effects on natural drainage
- Transport pathways of constituents
- Subsidence of reclaimed surfaces

## Research Focus

- **Synthesis, knowledge transfer, and implementation**
- Leach characteristics of different materials
- Rates of transport and sink
- Water quality mgt. techniques
- Test landforms that shed water in a predictable way
- Robust soil and vegetation prescriptions



# Key Research Focus: Establishment of functional wetlands

## Gaps to Close

- Establishment/survival of diverse aquatic and salt tolerant communities
- Loading of wetlands from uplands
- Impact of process components
- Duration of monitoring before target is achieved

## Research Focus

- **Monitor integrated constructed landforms**
- Wetland revegetation
- Water table dynamics
- Cover thickness requirements to maintain pore water quality
- Standard methods for quantifying constituents
- Landform configuration strategies to mitigate migration of salts and naphthenic acids

# Key Research Focus: Soft tailings reclamation

## Gaps to Close

- Predicting possible water quality issues
- Water table dynamics
- Subsidence of reclaimed surfaces

## Research Focus

- **Implementation at operational scales**
- Validation of conceptual models
- Robust soil and vegetation pres.
- Geochemical leach characteristics of different materials (salts and metals)
- Include hydrogeology of prescriptions and allocation of water to vegetation, infiltration, runoff, discharge, etc.

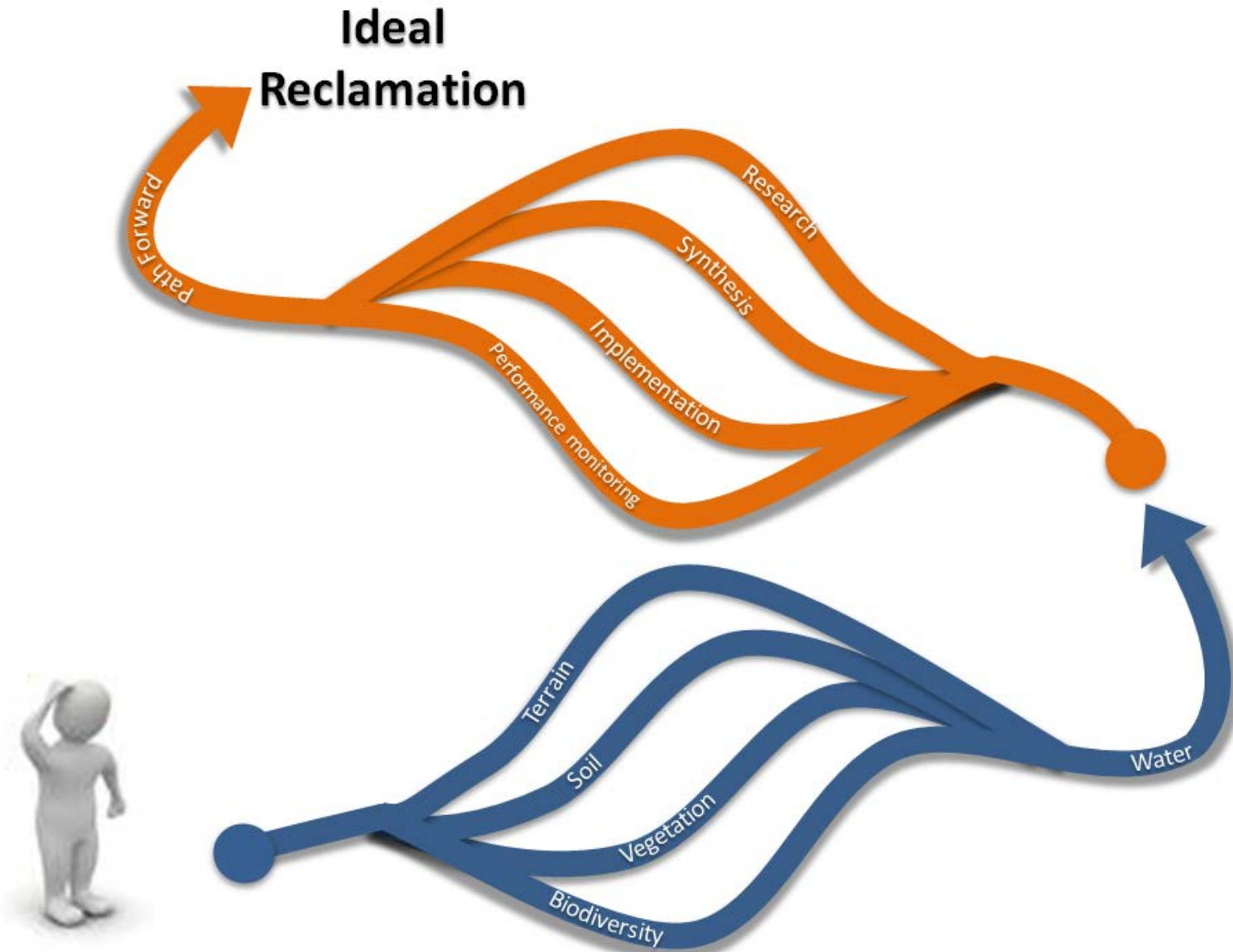
# Conclusions

**Watershed  
Reclamation**

**Functional  
Wetlands**

**Soft Tailings**

# Conclusions – The path forward



# Acknowledgements

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