PARSONS

# Integration of Design Factors into Post-Construction Ecological Restoration QA/QC

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# Agenda

- Restoration is a multi-decade process
- Communication
- Information handoffs
- Typical Challenges
- Vegetation as condition indicators
- Conclusions

# Ecological restoration vs. a lawn

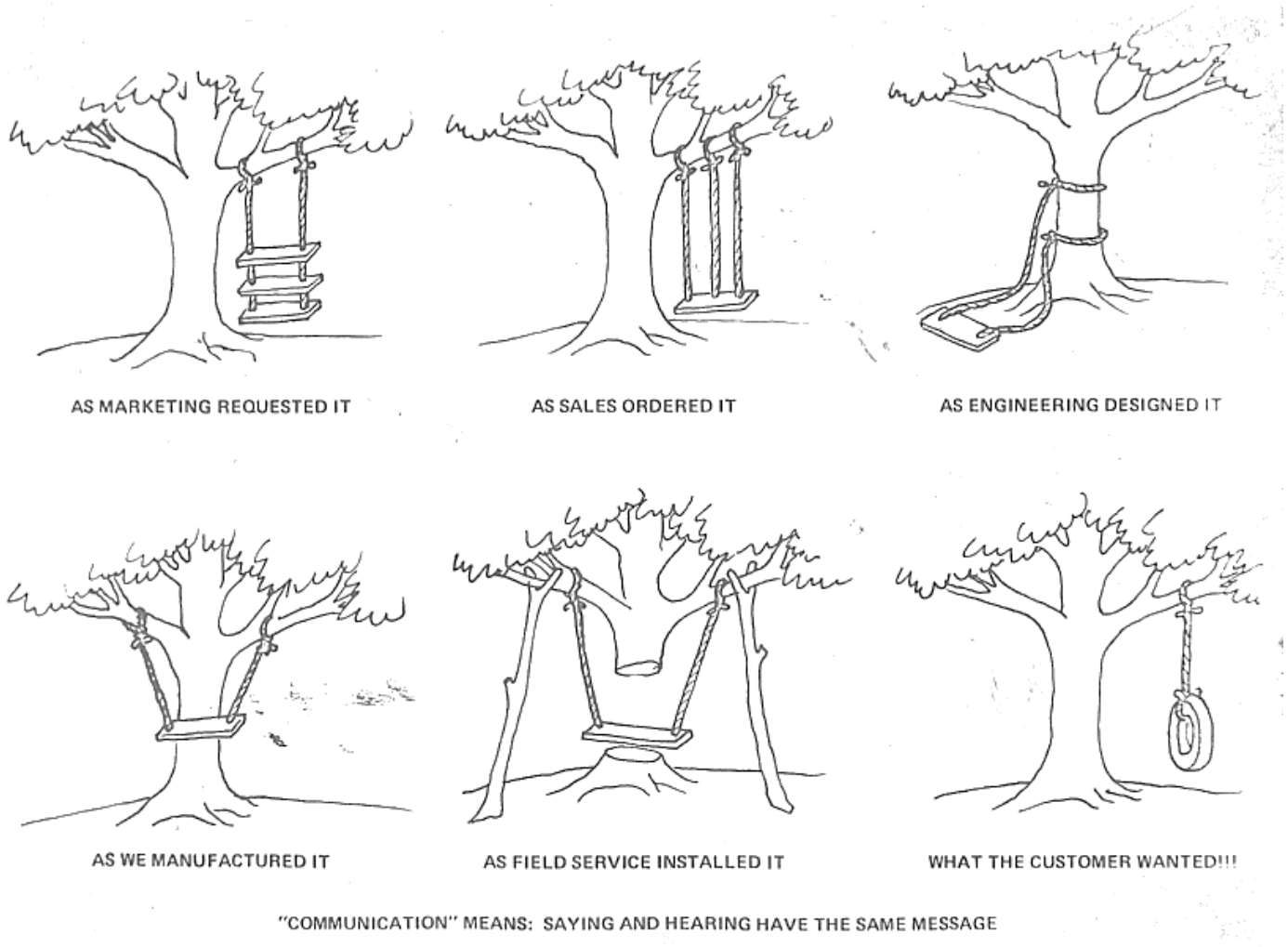
- Complexity
  - Numerous different plants and planting environments
- Evolution
  - The initial planting is just the beginning
  - Trees take decades to establish and create their own environment
- Maintenance and monitoring is not just mowing
  - Easy to get off-track during site evolution
- Multi-disciplinary staff necessary
  - Communication is critical
  - Knowledge is lost with personnel and team changes

# Restoration is a multi-decade process

"Cover crops" needed for decades to establish a forest

Early ecological functions are important
- may differ from long-term goal

# Handoffs are communication opportunities



# Key elements in handoffs

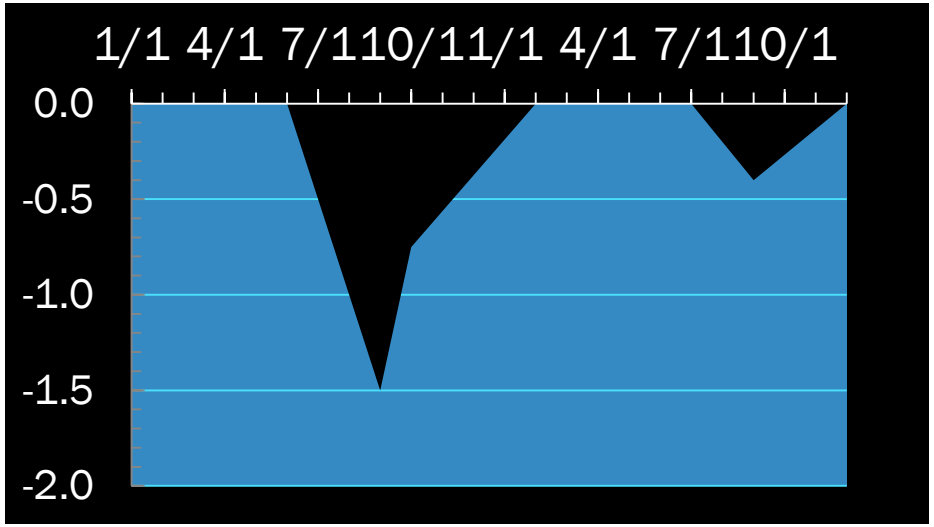
- Geometry
  - Site designed to work when constructed
  - Natural processes can change topography over time
- Soils
  - Construction specifications are focused on initial gradation and properties
  - USDA/wetland soil taxonomy requires *in situ* weathering over time
- Hydrology
  - Design analyses are focused on flooding and erosion control
  - Site evolution changes soil and vegetation retention of moisture
- Vegetation
  - Initial establishment to prevent erosion
  - Vegetation will evolve for years, decades, and centuries

# Available Design & Construction Information

- Remedial Design Report
  - Goals and objectives
  - Analyses
  - Drawings
  - Specifications
  - Stormwater/Erosion Control
- Construction Completion Reports
  - As-built geometries
  - Design changes
  - Material submittals
  - Daily field reports with photos
  - Regulatory acceptance

Document filing & retention is under-appreciated

# Handoffs  from design to post-construction




# Soil is important

Erosion, water retention, pH, etc.

# Hydrology is important

Is it working as expected?

# If you don’t know where you are…..

## You probably won’t get there

- Vertical datum
  - Site specific
  - Local
  - National Geodetic Survey: NGVD29 vs. NAVD88
    - NGS datum conversion program: https://www.ngs.noaa.gov/TOOLS/Vertcon/vertcon.html
- Horizontal coordinates
  - Site specific
  - Local
  - State plane
  - Latitude/Longitude
  - Linear stationing (highways, railroads, rivers, pipelines)
- Units
  - Metric, US, Imperial

# Surprises

5 years of design and construction and nobody ever mentioned “carp”

# Design seed mixes to help identify actual site conditions

- Plants sensitive to:
  - Water
  - Soils
  - Nutrients
  - Light
- Include indicator plants to ID micro-variations:
  - Hydrology
  - Salinity
  - pH
  - Well-drained soil
  - Poorly-drained soil
- Increases bio-diversity
- Identify trends in QA/QC data
  - Define adaptive management opportunities

# Vegetation as indicator example

Year 1: *Alisma subcordatum*

Salinity < 1 ppt

Year 2: *Typha latifolia*

1 ppt < Salinity < 7 ppt

Utility work over winter

Likely re-directed salt seep

# Concluding remarks

- Site restoration includes long-term restoration
  - Duration and multi-discipline requires communication focus
- Design needs to set up post-construction monitoring and QA/QC
- Design and construction documentation is valuable
  - Hand off to post-construction team
- Vegetation is “free” site instrumentation
  - Incorporate indicator species in design
- Site variations and evolution require adaptive management