Development of an Empirical Range Management Model

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Topics for Discussion

- Refocus 'cost estimates' on weapons system life cycle empirical model

- View Range Management and Munitions Response as a portion of a larger systems life cycle

- Understand that Range Sustainability will result from a life cycle approach

- Example of model applied to GFPR

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Range Life Cycle

- A Life Cycle approach must include aspects of systems acquisition:
  - concept development and design
  - demonstration and validation
  - RDT&E
  - Manufacturing
  - Fielding
 - Decommissioning and disposal

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Life Cycle Approach

- Design out hazardous materials with performance neutral materials
- Design in features to reduce LC costs
  - Manufacturing (fewer solvents, oils)
  - Storage (reduce corrosion, leakage, duds)
 - Deployment (enable tracking)
  - D&D (enhance detection and removal)

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Life Cycle Approach

- **Manage irreconcilable issues**
  - ☐ Manage hazardous materials that have no substitute (more frequent EOD sweeps)
  - ☐ Have a plan to address deployment consequences (increase reliability of round)
  - ☐ Manage residual safety issues (fuze reliability, identification)

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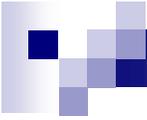
Empirical Model
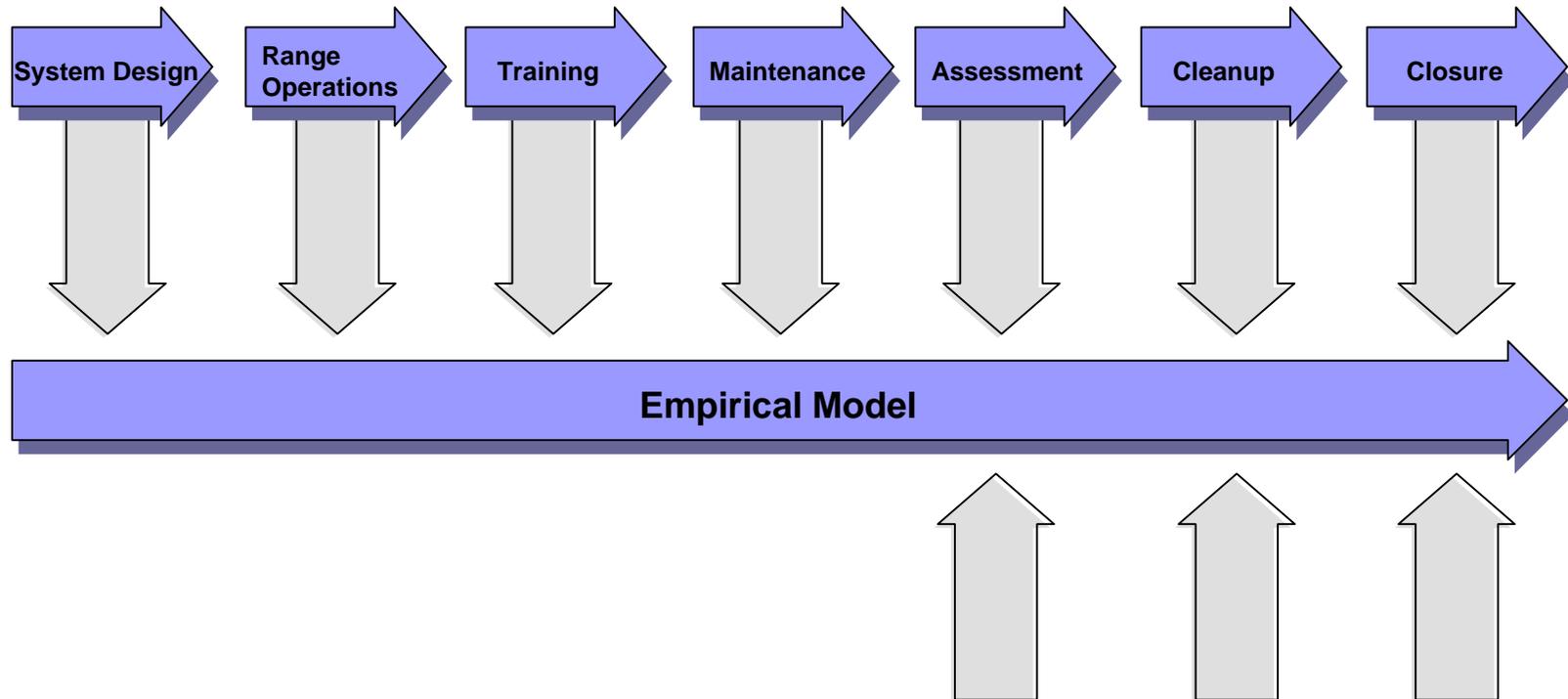
How Do You Make the Model Work?

- Econometric models to create subset costs
- Use an Environmental Management System to bridge functional groups
  - Brings all issues (cost, violations) up to a common level, regardless of location in the life cycle
  - Validates decision making for cost expenditures at one portion of the life cycle bearing cost reduction in a later portion
  - Induces accountability, benefits long term management, and generates out-year funding and policy requirements

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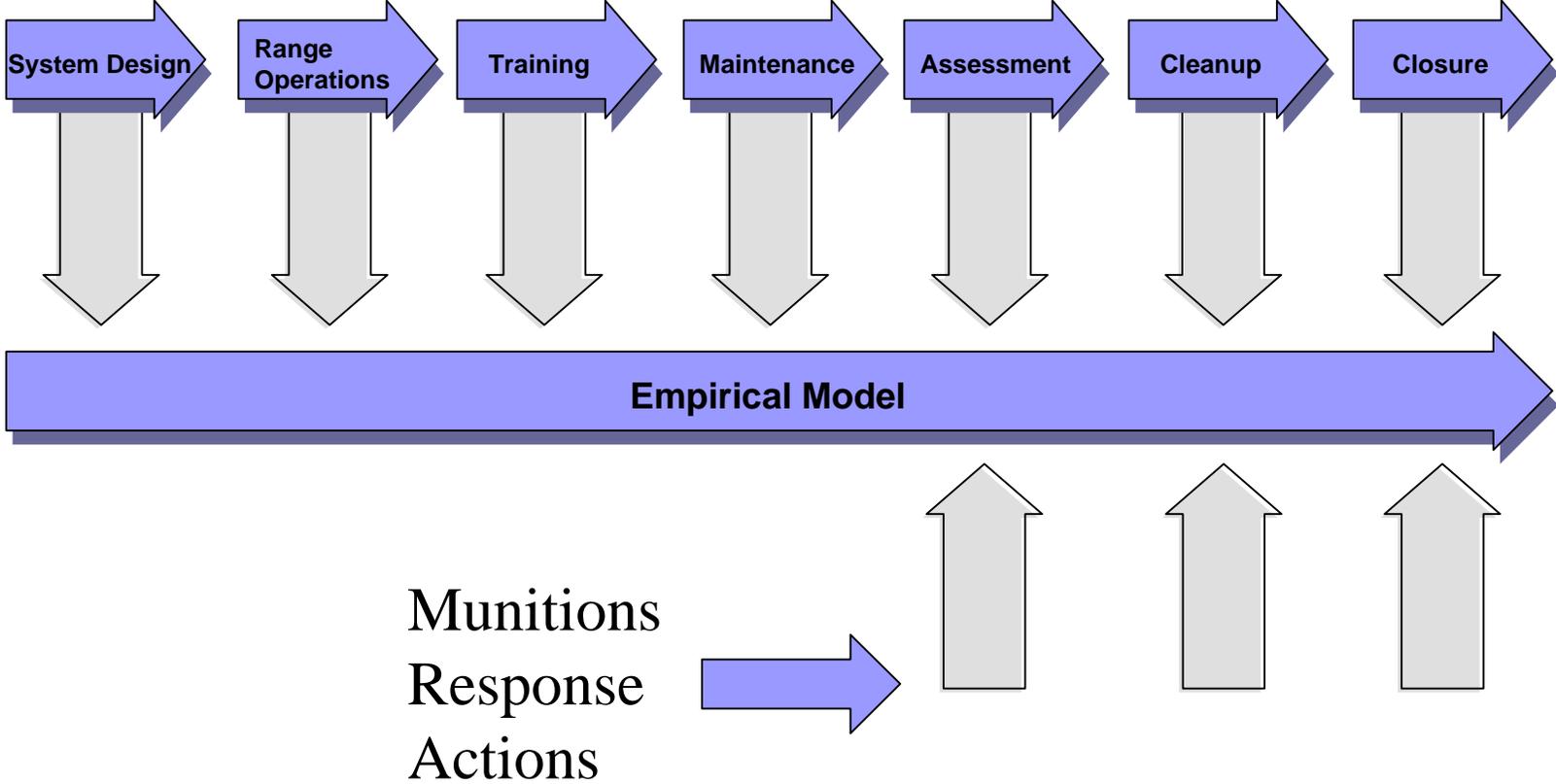
Empirical Model

Development of Empirical Model for Munitions Response Action

- Guaranteed Fixed Price Remediation process drives requirements for cost models for upside and downside risks, costs, schedule, long term liability

- Current process focused on cost-plus contracting

- Need a process to estimate costs with high confidence

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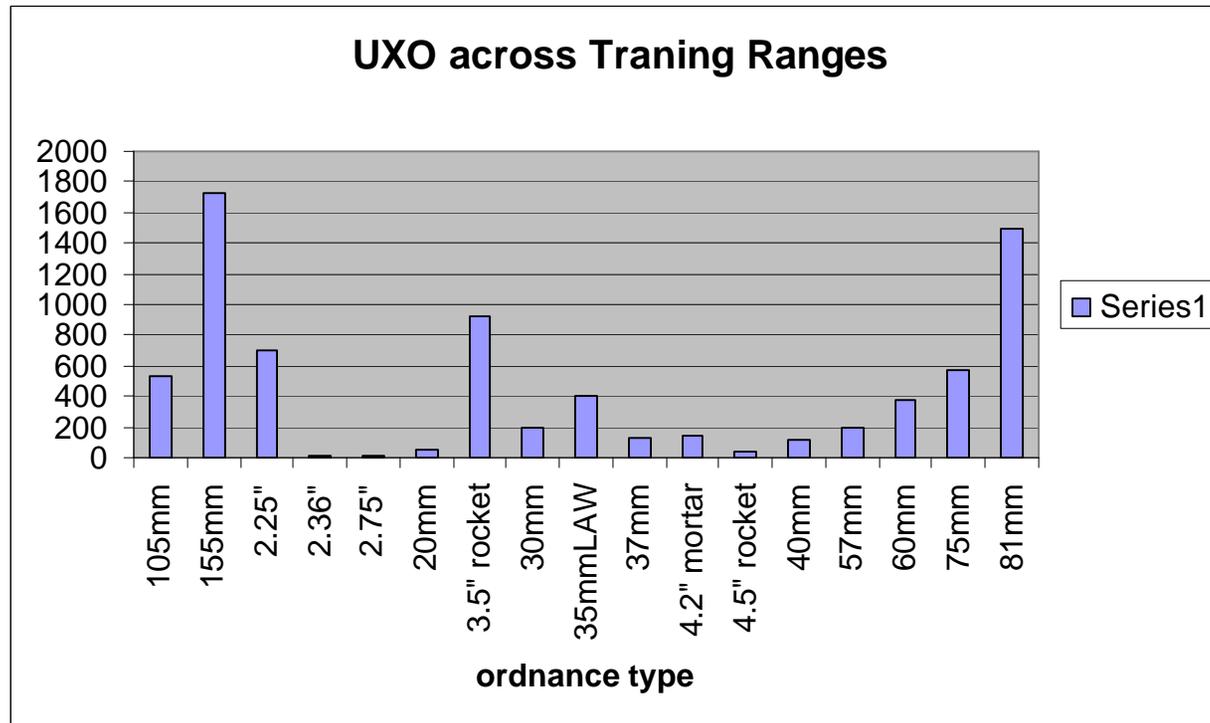
Why Does It Cost So Much?

- **Technology Costs**
  - ☐ Digital Geophysics has reduced present and future costs
- **Analytical Costs—more than just sample costs**
  - ☐ Explosive constituent analyses and fate and transport issues still being debated
- **We don't know where to look for OE**
  - ☐ Incomplete legacy/historical data
  - ☐ Munition types used/number shot
  - ☐ Distribution/density/depth
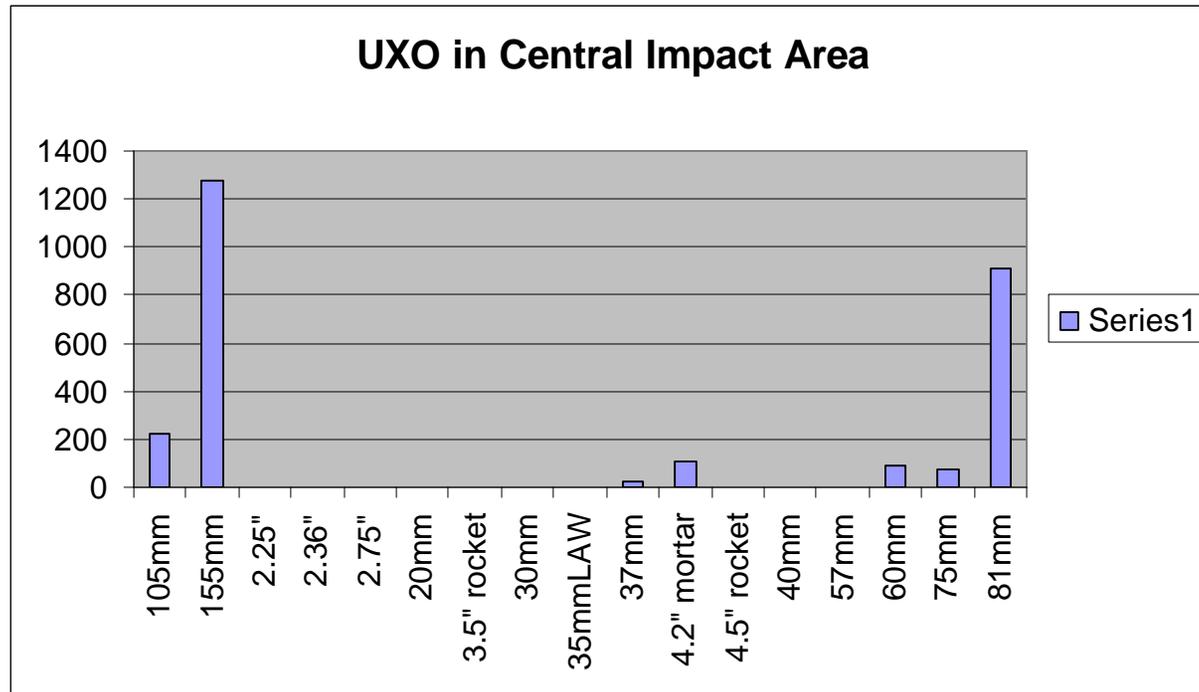
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Uninformed Range Assessment

- Assume worst case variety of munition types
- Assume entire range has UXO
- Assume worst case depth of penetration
- Assume worst case percentage of UXO
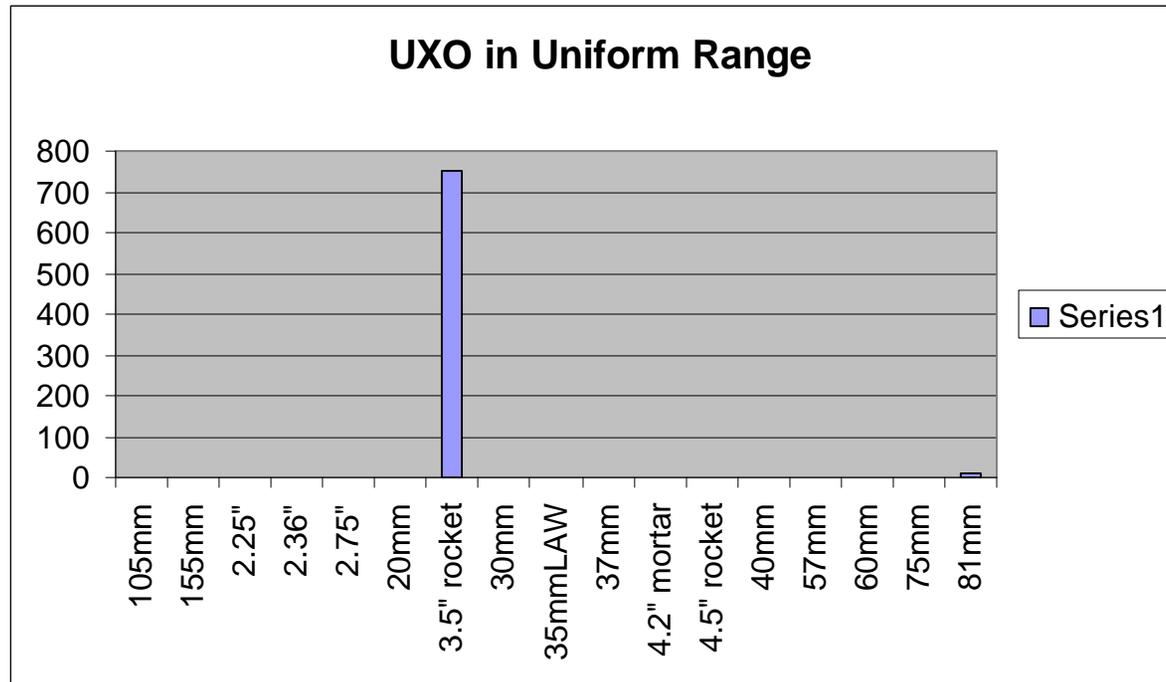- Assume worst case contamination
- Assume worst case EOD risk

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UXO By Type All Ranges

UXO across Traning Ranges

UXO in Impact Area

UXO in Central Impact Area

Range Specific UXO

UXO in Uniform Range

800
700
600
500
400
300
200
100
0

■ Series1

105mm | 155mm | 2.25" | 2.36" | 2.75" | 20mm | 3.5" rocket | 30mm | 35mmLAW | 37mm | 4.2" mortar | 4.5" rocket | 40mm | 57mm | 60mm | 75mm | 81mm

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Firing Fans

Narrowed Footprint

Depth Penetration

GIS Tool Predicts (2.1m)

Actual Discoveries

Cross-Section of Test Plot #1

US Army Engineering Waterways Experiment Station (WES) Equation Estimation (5.6m) of Maximum Depth

0m

0m

1m

2m

3m

4m

5m

15m

Lift #1

Lift #2

Lift #3

Lift #4

Lift #5

Excavation of 4th and 5th lifts not required for test plot 1 as no anomalies detected in lift #3
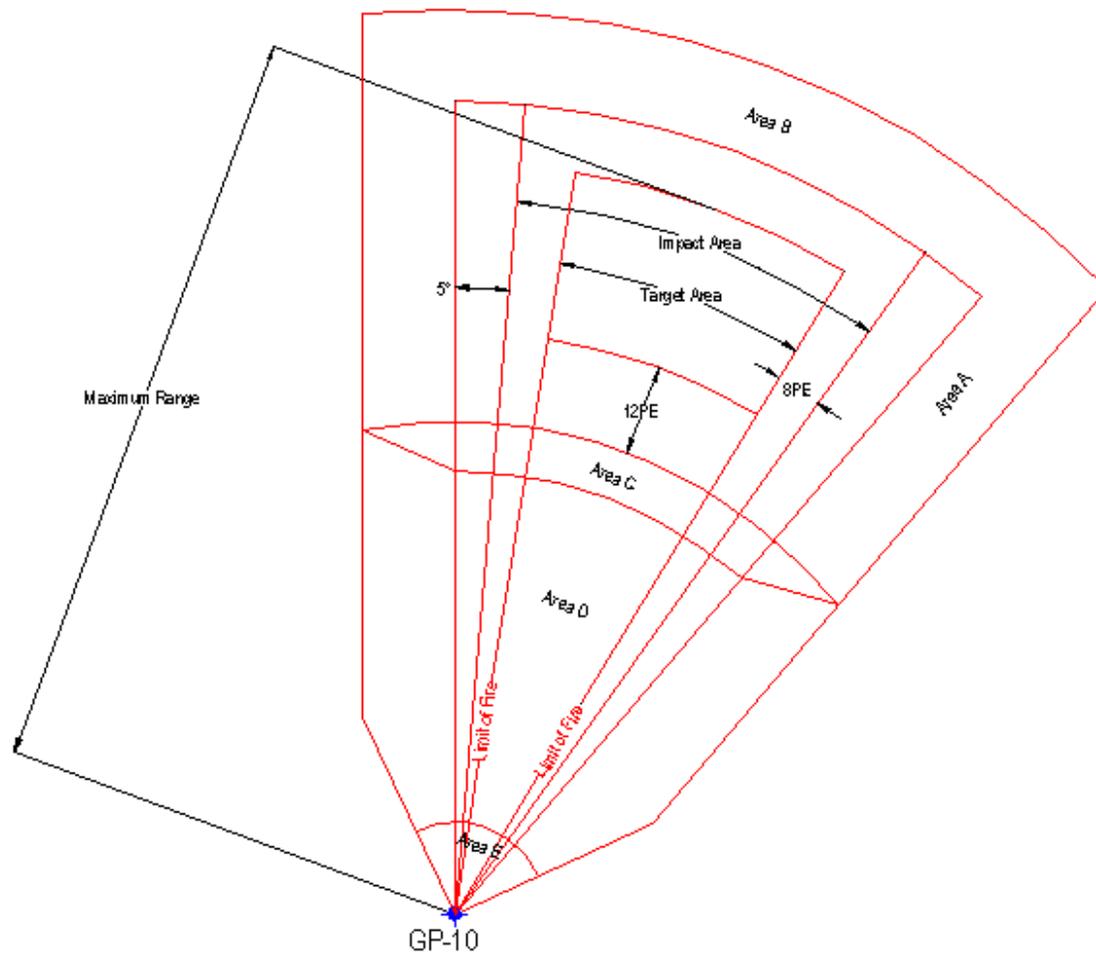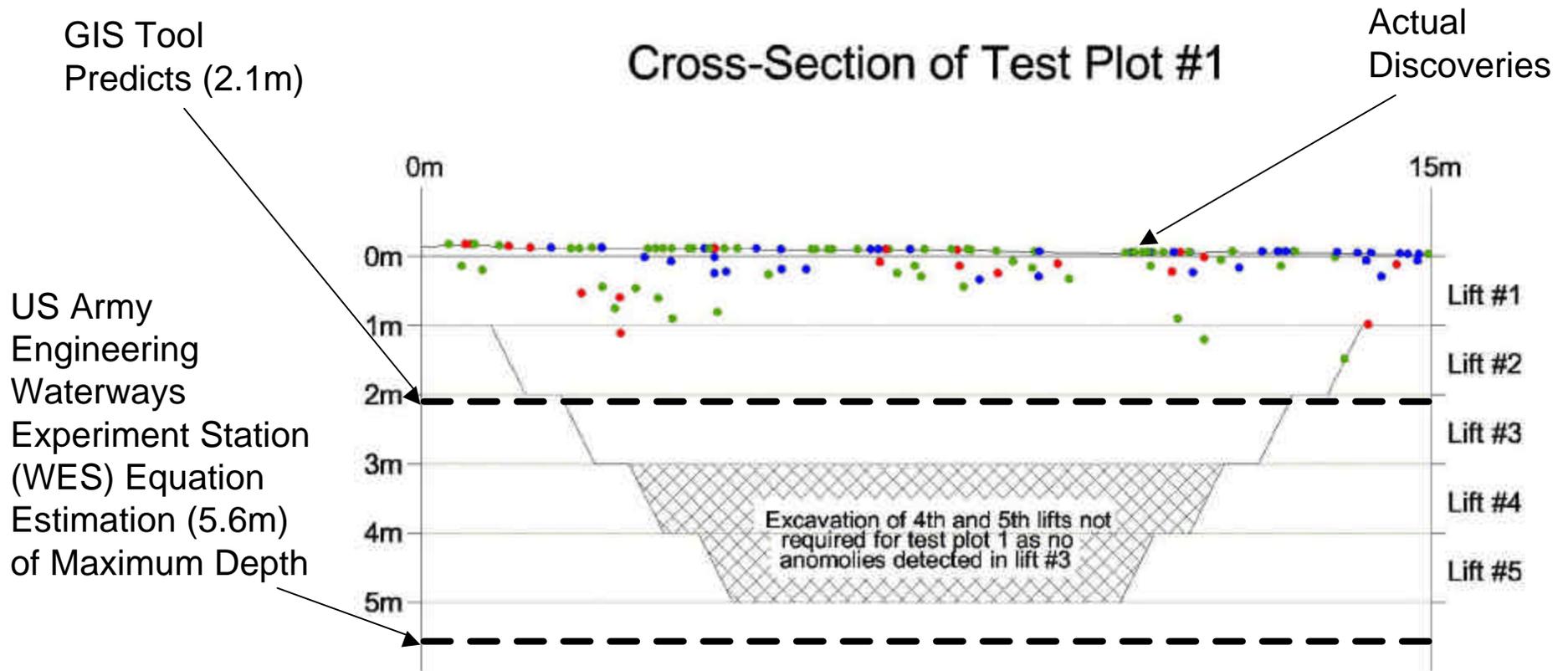
LEGEND
- UXO (22 Discovered)
- UXORM (63 Discovered)
- Debris (38 Discovered)

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Contamination from UXO

- Source terms difficult to estimate
- Contamination sources from low order rounds, high order detonation, contaminated ordnance fragments
- Use comprehensive ordnance database to generate complete chemical fingerprint of each munition type

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Informed Range Assessment

- Assume entire range has UXO
  - Target area is only a small percentage of firing fan
- Assume worst case variety of munition types
  - Most ranges have a few munition types
- Assume worst case percentage of UXO
  - Dud rate varies over time
- Assume worst case depth of penetration
  - Model and empirical data show shallow penetration
- Assume worst case contamination
  - Understand chemical constituents in ordnance
- Assume worst case EOD risk
  - Make risk decisions based on ordnance used
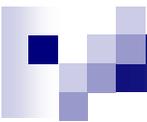
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Tetra Tech's Approach for Initial Assessment

- Use existing geospatial data (ITAMS)
- Input legacy FP, TP, range ops data (Archive Search Report data)
- Input ordnance, weapons systems used
- Factor in site geometry, topography
- Reduce the footprint
- Run chemical assessment

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