



Hanford Site Graded Approach to Vadose Zone Modeling: Current Status and Future Applications

Presented to: PA Community of Practice
12 December 2013

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Presentation Outline

- **Current Applications:**
 - 2011-50 document
 - Application to the River Corridor decision documents
 - Scoping of Performance Assessments

Presentation Outline (cont.)

- **Expected Future Applications:**
 - WMA C (and possibly IDF) PA and Related Analyses: tank residuals, past leaks, radionuclides and non-radionuclides
 - Central Plateau Deep Vadose Zone (200-DV-1 OU)
 - 200 East groundwater decisions (200-BP-5 and 200-PO-1 OUs): with potential impact for continuous sources from the CP possibly all the way to the Columbia River
 - Central Plateau decisions (200-WA-1 and 200-EA-1)
 - Updated Composite Analysis: scope will define radionuclides and non-radionuclides analysis

What is a Graded Approach

- Conservative simplification to rigorous site specifics.
- Conservative and relatively simple model of contaminant transport:
 - identifies waste sites that are unlikely to constitute a groundwater protection problem.
- Remaining waste sites, which could pose a greater risk to groundwater protection:
 - evaluated in a stepwise manner that matches the complexity and data needs of the assessment to the risk posed.
- The graded approach provides efficient, conservative, and rigorous evaluation of sites by allocating evaluation and characterization resources to those sites for which groundwater protection is a significant pathway:
 - site screening,
 - site assessment with preliminary remediation goals (PRGs), and
 - site assessment with site-specific modeling.

What the DOE/RL-2011-50 document provides

Provides **three key elements** that will be common to the use of fate & transport models on the Central Plateau:

1. **The regulatory basis for use of fate and transport models** for development of screening levels and preliminary remediation goals (PRGs) for contaminants of potential concern (COPCs)
2. **A graded approach (GA) for use of vadose flow and transport models** that provides for progressively increasing rigor appropriate to the potential risk from a waste site
3. **Model parameter values for use in the first steps of the GA** when applied to waste sites on the Central Plateau of the Hanford Site

What the DOE/RL-2011-50 document requires

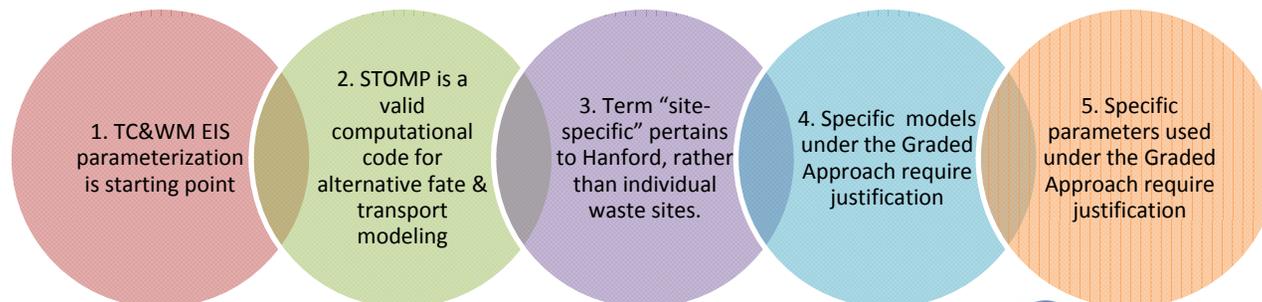
- Application of the Graded Approach
 - Specific applications will be in primary documents
 - Example: River Corridor RI/FS documents reference model package reports
- Model Input Parameters
 - Only provides an initial set, or “starting point,” for lower levels of the GA are provided
 - As work progresses to higher levels of the GA, greater specificity and justification will be necessary

Five Guiding Principles

- **Guiding Principle #1**

The Tank Closure & Waste Management Environmental Impact Statement Technical Guidance Document defines the initial values for model parameterization under the GA.

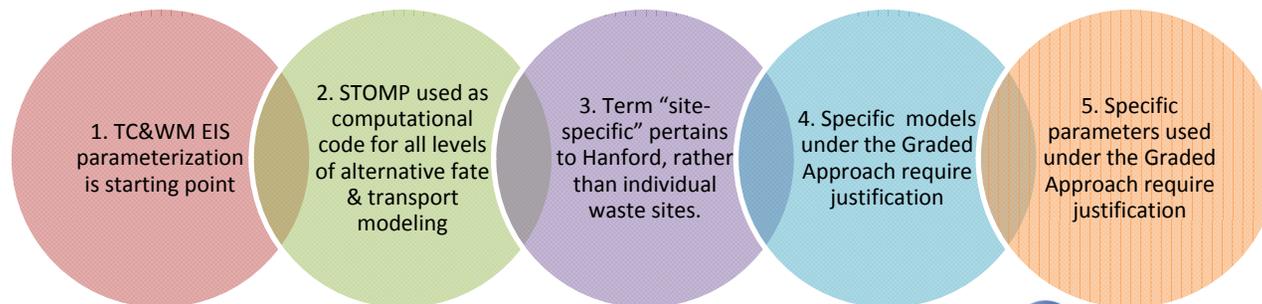
New information will always be used as the basis for any analysis



Five Guiding Principles

- **Guiding Principle #2**

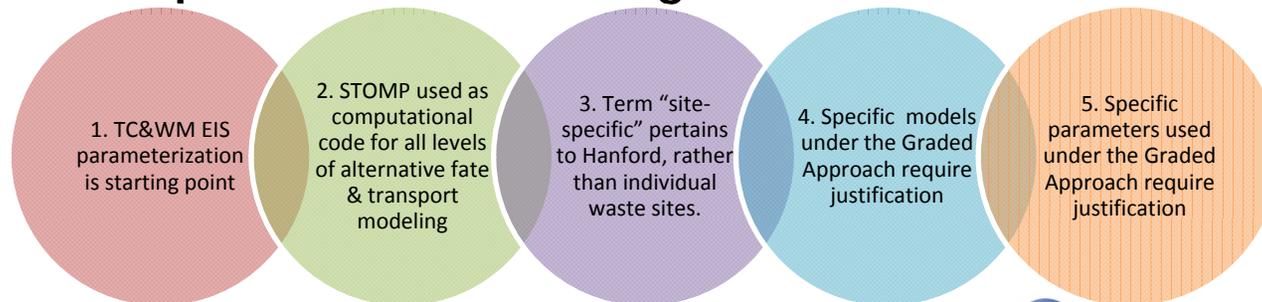
The STOMP code, a single code capable of simulating multiple levels of model rigor and sophistication, will be used for all levels of the GA.



Five Guiding Principles

- **Guiding Principle #3**

The term “site-specific data” as used in regulations pertaining to use of alternative fate and transport models, is understood to refer to data collected at the Hanford Site for analogous geologic media and characteristics as a starting point for model parameterization (rather than restricted to data collected within the boundaries of an individual waste site). However, where data are available from a specific waste site, these are to be used in preference to analogous data.



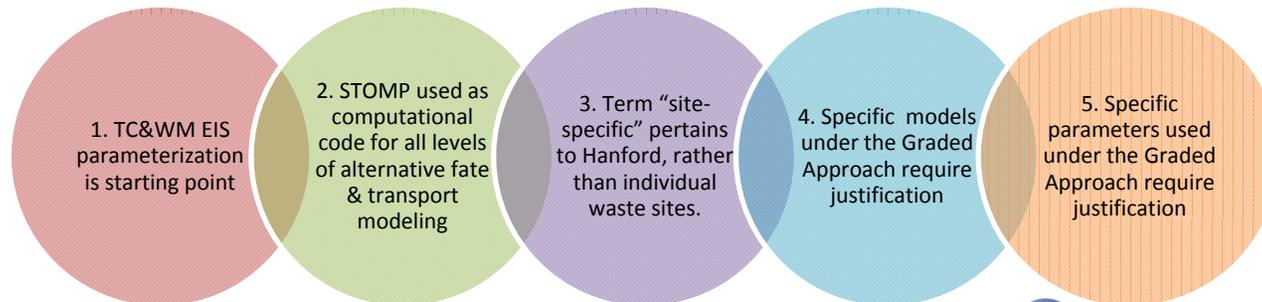
Five Guiding Principles

- **Guiding Principle #4**

The GA will provide justification for the uses of the STOMP code itself, but specific models implemented using the STOMP code require justification in application-specific documents.

Site Specific Analyses vs Sitewide:

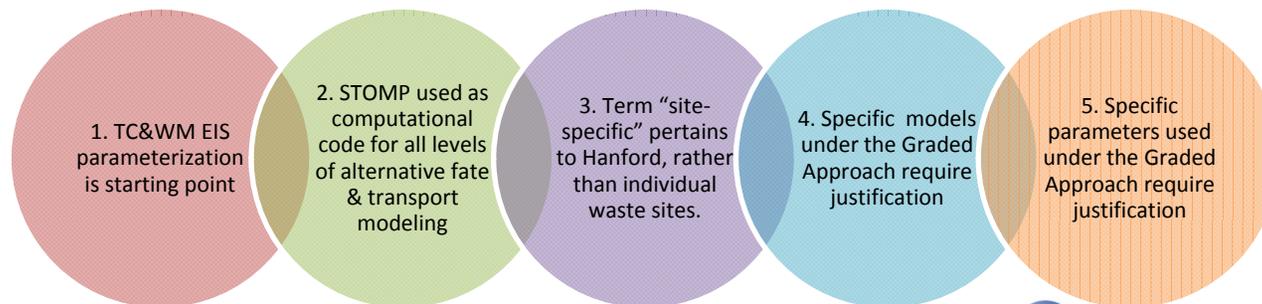
- Graded approach concept is the same
- Application can have different assumptions (simple to complex)



Five Guiding Principles

- **Guiding Principle #5**

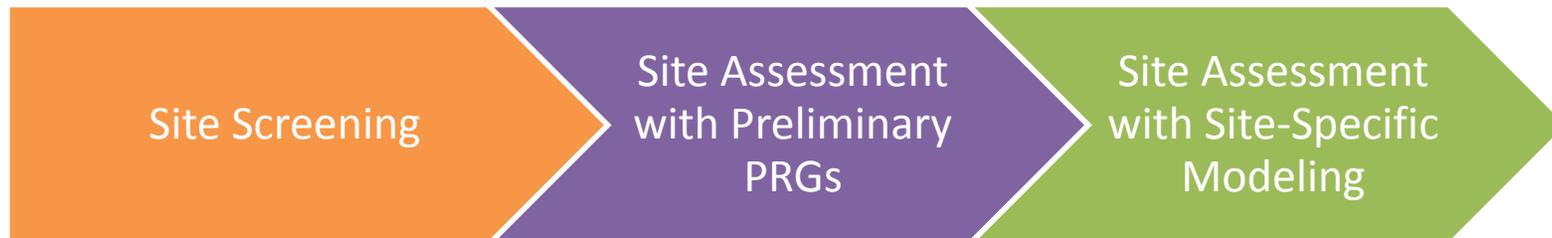
The GA defines a general methodology, but justification of specifics for a given application of the GA is to be presented in other application-specific documents (e.g., Performance Assessments, Model Package Reports).



Regulatory Basis for Code Use

- Answers to these questions:
 - What is the regulatory basis for using models?
 - What methods or models are most appropriate for assessing potential impacts to groundwater from vadose zone contaminants at the Hanford Site?
 - How are appropriate models determined?
 - What regulatory requirements and technical rationale are associated with the selection of appropriate models?
 - What regulatory requirements and technical rationale are associated with the use of an appropriate model for risk-based applications (e.g., risk characterization)?
 - What is necessary to demonstrate compliance with these requirements and expectations, and the acceptability of a method?

Graded Approach



Graded Approach

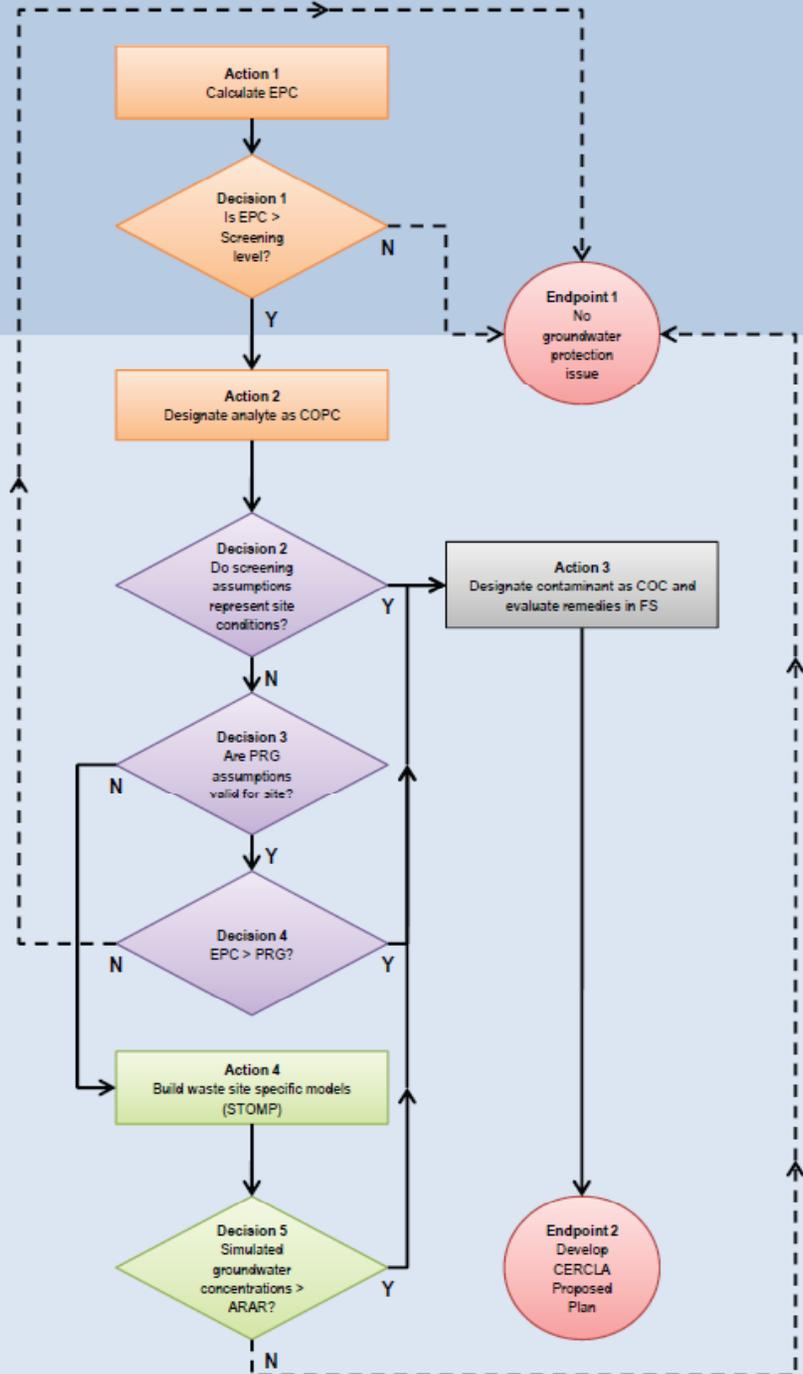


Baseline Risk Assessment

- EPC:**
 - 95% UCL on mean concentration by waste site
 - Use ProUCL Version 4 or other tool
- Screening Levels – largest of:**
 - Background
 - PQL
 - Simulated screening level (STOMP) using conservative values (recharges rates, vertical permeability, K_v , nature and extent of contamination)

Remedial Investigation / Feasibility Study

- Screening level assumptions:**
 - Source location and geometry
 - Source mass and release/depletion rates
 - Distance to water table
 - Recharge rate
 - Fate and transport assumptions
- PRG development assumptions:**
 - Applicable across a wide range of site conditions
 - Using representative values (recharge rates, vertical permeability, K_v) with conservative estimate of nature and extent of contamination
 - Assumptions are documented and are checked each time PRGs are applied
- Waste site specific models:**
 - Conservative estimate of nature and extent of contamination
 - Evaluate different scenarios and possible configurations based on available data
 - Evaluate conditions for a long time
 - Sensitivity analysis
- Contaminants specific to the ARARs:**
 - MCLs, state groundwater cleanup levels (WAC 173-340-720), other drinking water standards, and ambient water quality standards
 - Transport time > 10 half-lives (for radionuclides)



Model Parameterization for the Central Plateau

- Starting Point: Tank Closure & Waste Management EIS Technical Guidance Document – new information will always be used
- Augmented by: Numerous site-specific studies and characterization efforts at the Hanford Site
- Supported by: Site-specific modeling where required
- Updated technical basis document would be helpful with regulatory approval

Model Parameters:

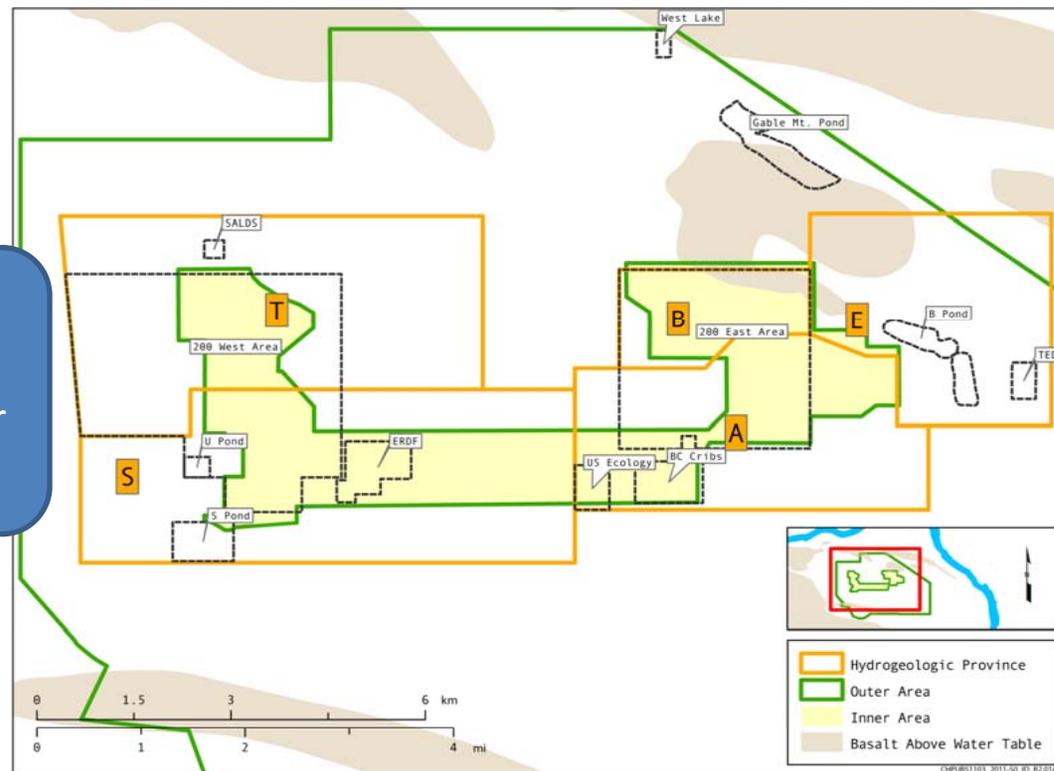
Model domain and boundary conditions

- Model domain and boundary conditions are identified in the graded approach as a site-specific (or site-wide) feature that will be identified in the application of the graded approach for decision documents.
- It is noted that consideration must be given to ensure that the boundary conditions are selected so as to not artificially affect the rate of contaminant transport.

Model Parameters: Geologic Setting

- Provides representative hydrostratigraphic profiles for 200 East and 200 West Areas

Location of Hanford Site
Central Plateau Geographic
Areas Represented by Similar
Hydrostratigraphic Columns

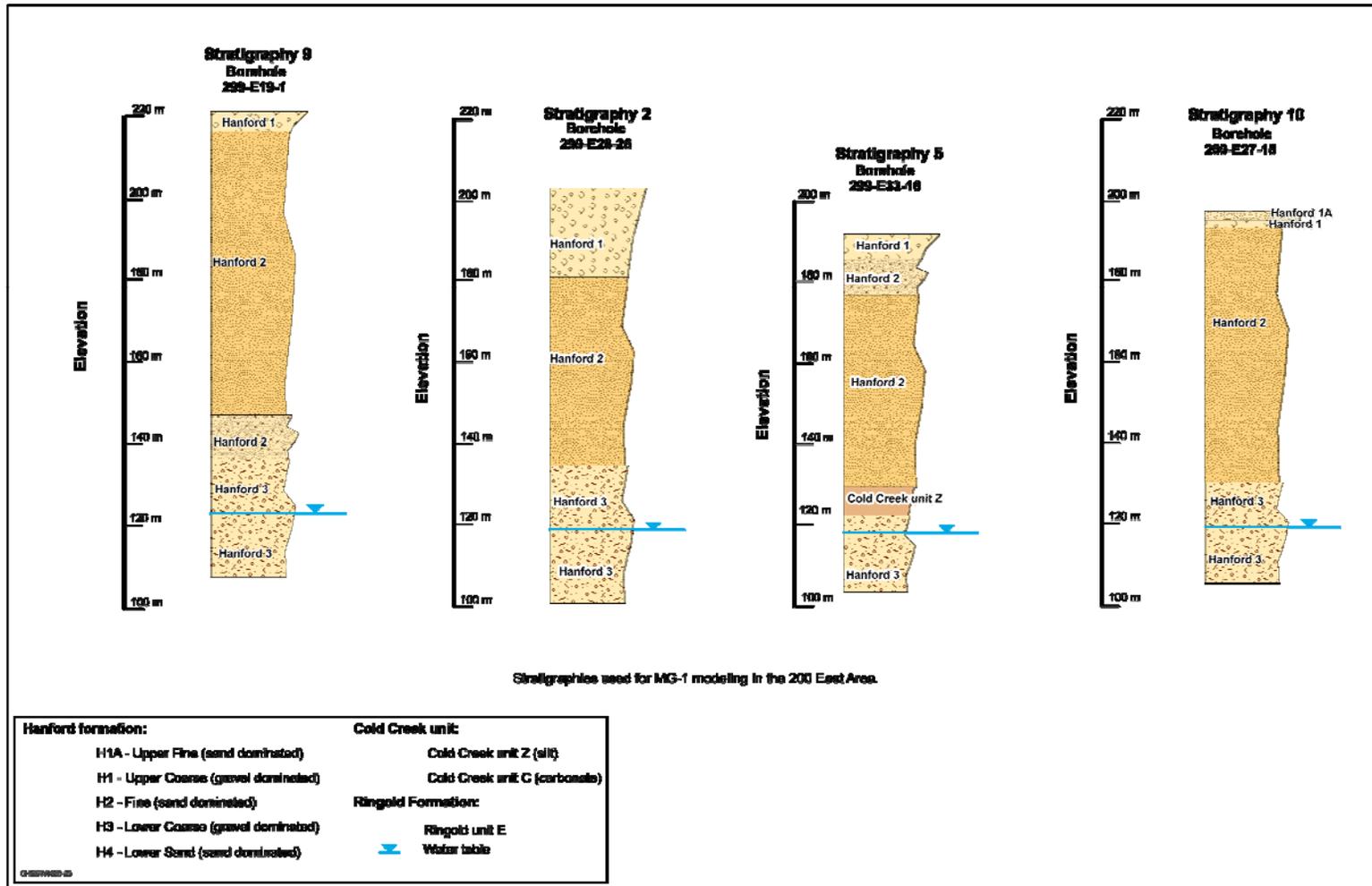


Model Parameters: Geologic Setting

- Example of a representative hydrostratigraphic profiles for geographic area "A"

Depth (ft)	Elevation (ft)	Geologic Unit	Description	Hydraulic Property Type	Soil Type	K _v Zone
Template 200A-x for Surface Disposal Sites (e.g., Ponds)						
0	690	Surface	N/A	N/A	N/A	N/A
15	675	Eolian	Sand and silt	S	Hss	HI
30	660	Hanford Gravel	Slightly silty pebbly very coarse to coarse sand	SG1	Hg	II
233	457	South 200 East Sand	Slightly silty medium to coarse sand to coarse to fine sand	S	Hfs	II
295	395	Hanford Gravel	Pebbly very coarse to coarse sand to medium to fine pebble	SG1	Hg	II
305	385	Ringold Unit E	Silty sandy medium to fine pebble to sandy very coarse to fine pebble	SG2	Rg	II
305	385	Water Table	N/A	N/A	N/A	N/A

Model Parameters: Geologic Setting



Graded Approach Principles for Future Applications

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Summary

- DOE/RL-2011-50 provides approach for using models in a graded approach to calculate PRGs
- GA includes three key elements:
 - **Regulatory Basis for using STOMP**; demonstration that the STOMP code meets the Washington State requirements for an alternative fate and transport model*
 - **Graded Approach to Calculate Protection Levels**; applies appropriate model rigor commensurate to risk and uncertainty for a given site
 - **Preliminary Model Parameterization**; a starting point for modeling Central Plateau sites at first level of graded approach