

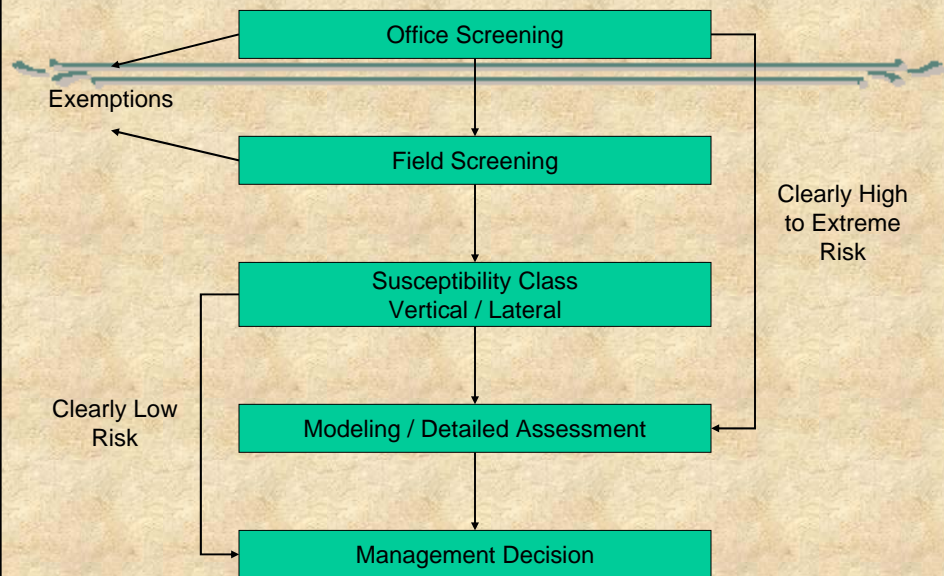
# Developing Tools for Hydromodification Management and Assessment Update - June 17, 2009



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## DECISION PROCESS



## Progress Since Last Meeting

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- Field testing of GIS/Landscape Analysis portion of screening tool
- Refinement of field-based portion of screening tool

## GIS/Landscape Analysis

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- Geomorphic landscape mapping validated reasonably well
- Divide out and analyze hydrologic landscape effects separately

# Landscape Mapping

		Increasing development impacts	Decreasing development impacts
Hydrology	% developed	Highly developed, high total impervious area (TIA)	Moderately developed, low TIA
	Development density	Concentrated development	Distributed development
	Degree of upstream stormwater retention	Minimal retention of stormwater run-off	Extensive retention of stormwater run-off
Sediment delivery	Upstream relative watershed sediment production	High relative sediment production	Low relative sediment production
	Relative watershed sediment production entering downstream of development	Low relative sediment production	High relative sediment production
	Degree of sediment transport blockage	High number of total upstream bridges and culverts and/or close upstream proximity of undersized bridges and culverts	Low number of total upstream bridges and culverts and/or distant upstream proximity of undersized bridges and culverts

# Potential Thresholds

Drivers		Description
Hydrology	% developed	<10 % total upstream area ( <b>Low</b> ); 10-50% total upstream area ( <b>Med</b> ); >50% total upstream area ( <b>High</b> )
	Development density	Distributed across the watershed ( <b>Low</b> ); Moderately concentrated ( <b>Med</b> ); Very concentrated ( <b>High</b> )
	Degree of stormwater retention and flow regulation	Few retention ponds and no upstream flow regulation ( <b>Low</b> ); Several retention ponds and/or some upstream flow regulation ( <b>Med</b> ); Many retention ponds and/or extensive upstream flow regulation ( <b>High</b> )
Sediment delivery	Upstream relative watershed sediment production	<1,000 t/km <sup>2</sup> /yr ( <b>Low</b> ); 1,000 – 3,000 t/km <sup>2</sup> /yr ( <b>Med</b> ); >3,000 t/km <sup>2</sup> /yr ( <b>High</b> )
	Relative watershed sediment production downstream of development	<1,000 t/km <sup>2</sup> /yr ( <b>Low</b> ); 1,000 – 3,000 t/km <sup>2</sup> /yr ( <b>Med</b> ); >3,000 t/km <sup>2</sup> /yr ( <b>High</b> )
	Degree of sediment transport blockage	<b>None</b> ; Few road crossings, no undersized culverts in close proximity ( <b>Low</b> ); Several crossings and no undersized culverts in close proximity, or few road crossings and an undersized culvert in close proximity ( <b>Med</b> ); Many road crossings and at least one undersized culvert in close proximity ( <b>High</b> )

## Focus of Field-based Assessment

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- Relationship of resistive forces to disturbing forces
- Proximity to geomorphic thresholds
- Relaxation time (potential response time)
- potential for creating feedback loops
- Spatial propagation down or upstream

## Susceptibility Ratings

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- Separate ratings for vertical vs. lateral susceptibility
  - ✓ Low, medium, high, very high
- Simple to apply observable field metrics
- Combinations of scores of vertical and lateral point to specific models and or management responses

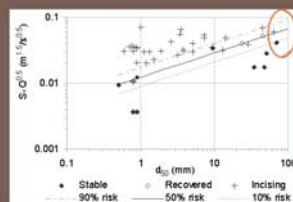
## Low Susceptibility

- Low ratio of disturbing forces to resisting forces
- Far from geomorphic thresholds of concern (based on explicit quantification of probability if feasible- < 1% probability of exceedence)
- Relatively rapid relaxation time
- Low potential for positive feedbacks, nonlinear response, sensitivity to initial conditions
- Very limited or no spatial propagation

## Vertical (Bed) Susceptibility

- Dominant bed material
- Amount of armoring
- Grade control
  - ✓ Presence
  - ✓ Proximity and spacing
  - ✓ integrity

Vertical supplement (b) – probability of incision

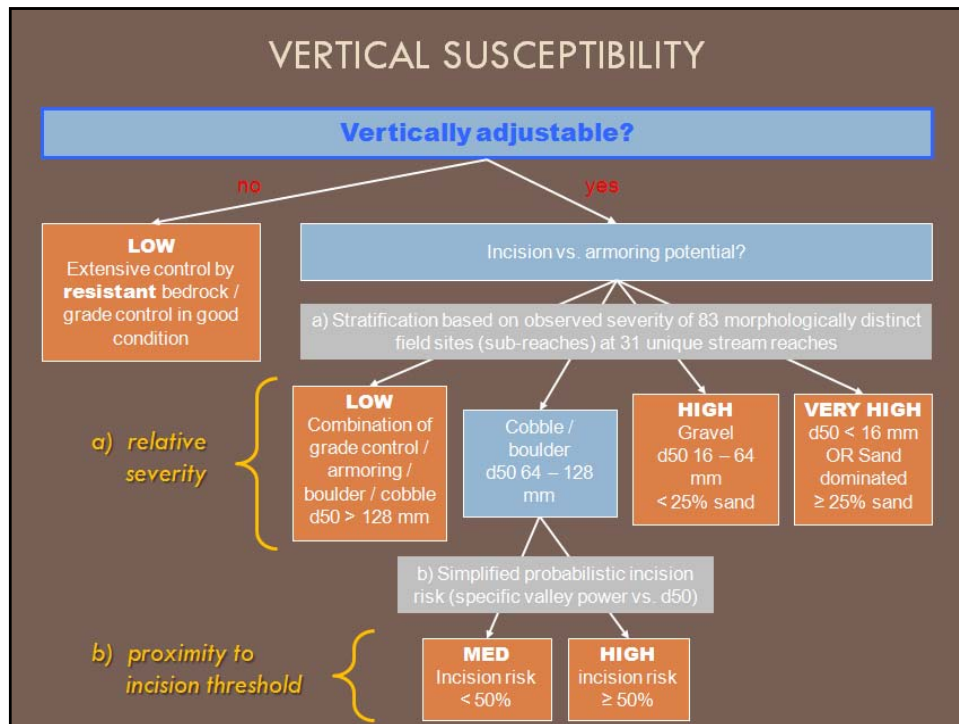


For unconfined / non-bedrock cobble / boulder systems  $d_{50}$  64 – 128 mm

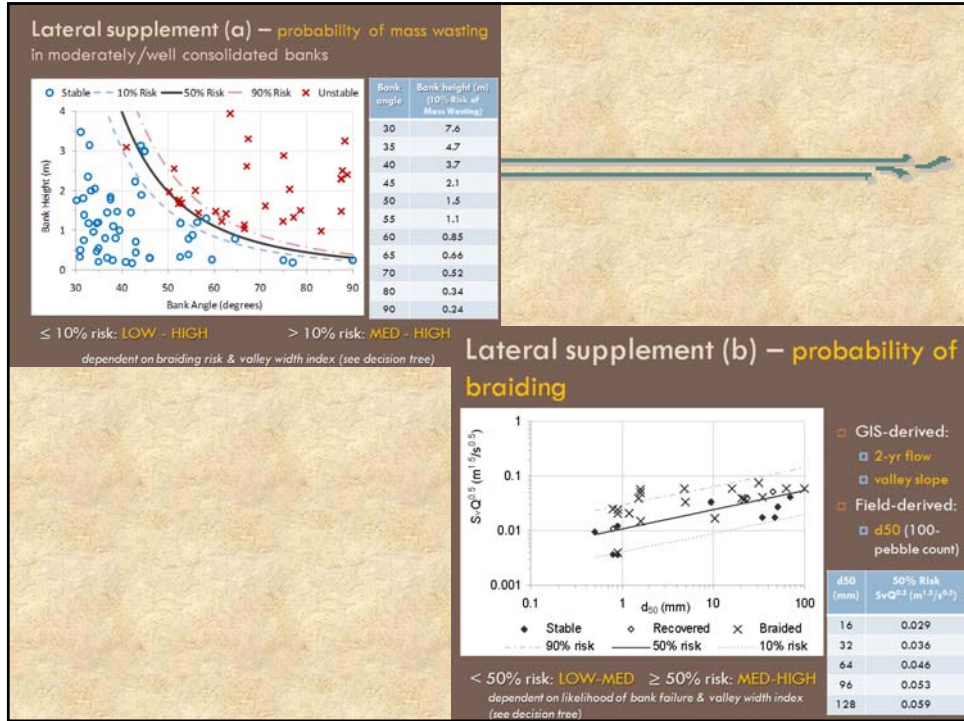
Potential valley power vs. armoring potential  
 < 50% risk: MED  
 ≥ 50% risk: HIGH

$d_{50}$ (mm)	50% Risk $S_v Q_b^3$ ( $m^3/s^3$ )
64	0.057
96	0.066
128	0.074

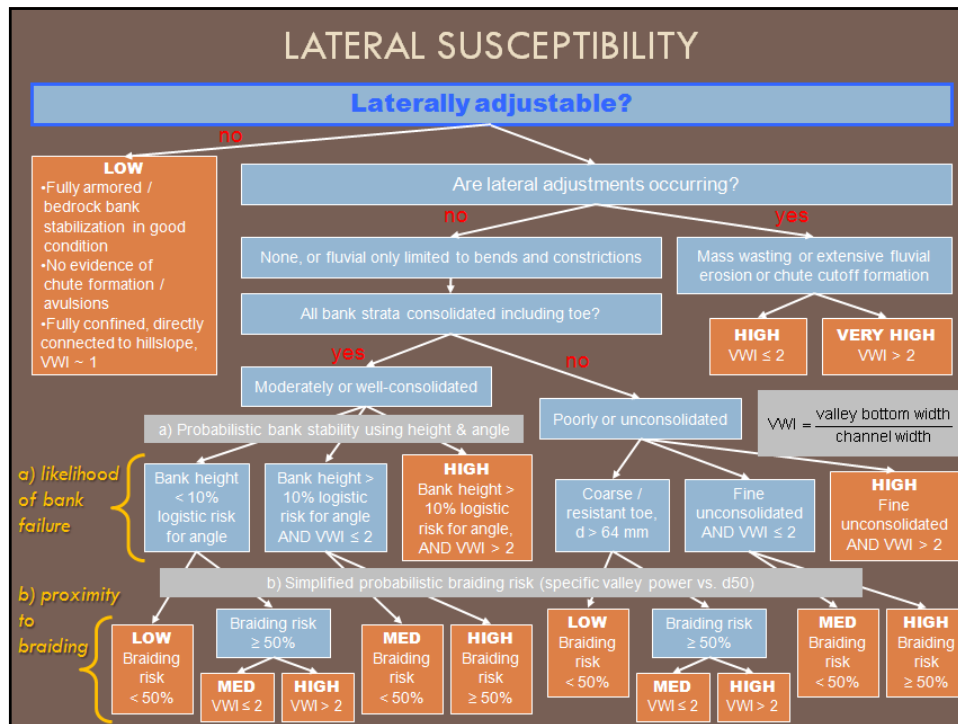
- GIS-derived: 2-yr flow & valley slope
- Field-derived:  $d_{50}$  (100-pebble count)



- ## Lateral (Bank) Susceptibility
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- Bank cutting
  - Toe material
  - Consolidation of bank material
  - Stratification of bank material
  - Proximity to braiding threshold



- ## Geomorphic Thresholds / Responses – Examples
- Planform pattern shifts
    - ✓ Single thread to braided
  - Incision past critical bank height
    - ✓ CEM stage
  - Enlargement - incision, widening
  - Sand dominated vs. gravel+ transition
  - Armoring potential



*a) likelihood of bank failure*

*b) proximity to braiding*

- ## Downstream Analysis Domain (downstream)
- One reach beyond the first hard point
  - Tidal backwater / lentic waterbody
  - Accumulation of 50% additional drainage area
  - Major confluence or stormdrain input
  - 20 times bankfull width or 200 m

## Next Steps

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- Continued refinement of tools
- Field testing late July 2009
  - ✓ Participation by county staff & contractors
- Revisions → beta version fall 2009