APPENDIX A: GENERAL DEFINITIONS

A.1 SUSCEPTIBILITY/SENSITIVITY DEFINITIONS

What is susceptibility?

The *intrinsic* sensitivity of a channel system to hydromodification as determined by the ratio of disturbing to resisting forces, proximity to thresholds of concern, probable rates of response and recovery, and potential for spatial propagation of impacts.

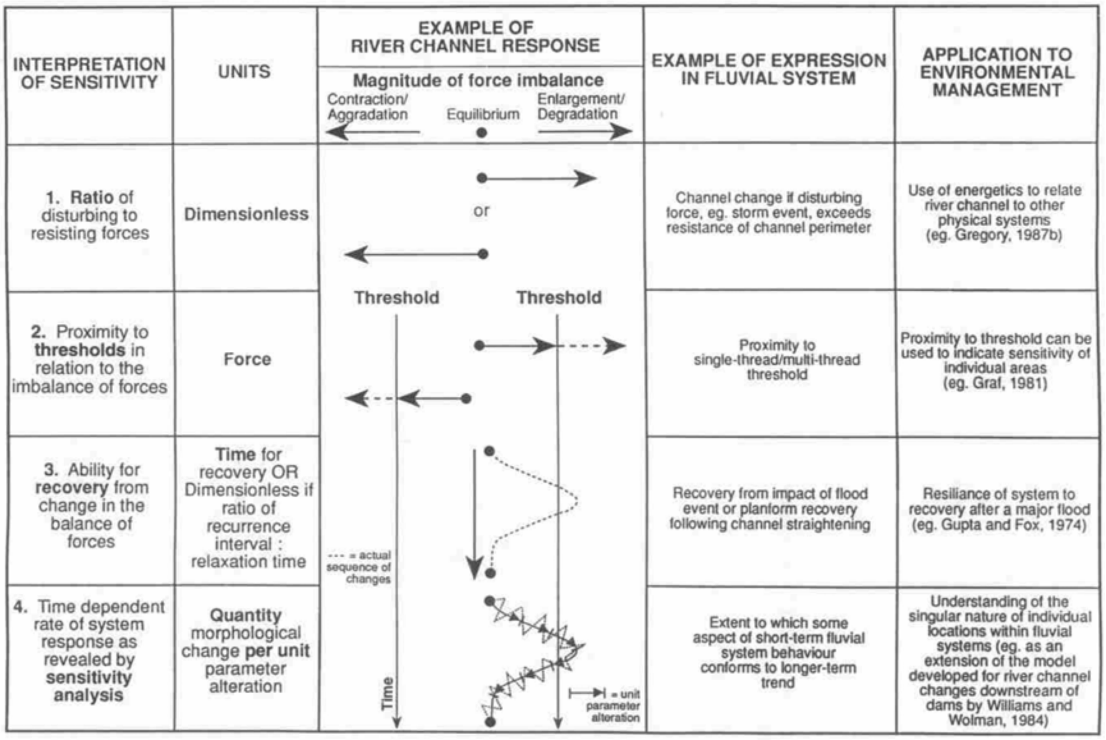
What is sensitivity?

Schumm defined *sensitivity* as:

“One aspect of (landform) singularity that must be treated separately is the sensitivity of landscape components... The reason for such variable response… is the existence of threshold conditions, which when exceeded produce a large change. In contrast, apparently similar landforms may show little or no response to a similar change. Thus, within a landscape composed of singular landforms there will be sensitive and insensitive landforms.” Schumm (1985, page 13)

“Sensitivity refers to the propensity of a system to respond to a minor external change. The changes occur at a threshold, which when exceeded produces a significant adjustment. If the system is sensitive and near a threshold it will respond to an external influence; but if it is not sensitive it may not respond.” Schumm (1991, page 78)

Downs and Gregory (1995) illustrated *sensitivity* as:



INTERPRETATION OF SENSITIVITY	UNITS	EXAMPLE OF RIVER CHANNEL RESPONSE Magnitude of force imbalance Contraction/ Aggradation — Equilibrium — Enlargement/ Degradation	EXAMPLE OF EXPRESSION IN FLUVIAL SYSTEM	APPLICATION TO ENVIRONMENTAL MANAGEMENT
1. **Ratio** of disturbing to resisting forces	**Dimensionless**	or	Channel change if disturbing force, eg. storm event, exceeds resistance of channel perimeter	Use of energetics to relate river channel to other physical systems (eg. Gregory, 1987b)
2. Proximity to **thresholds** in relation to the imbalance of forces	**Force**	Threshold / Threshold	Proximity to single-thread/multi-thread threshold	Proximity to threshold can be used to indicate sensitivity of individual areas (eg. Graf, 1981)
3. Ability for **recovery** from change in the balance of forces	**Time** for recovery OR Dimensionless if ratio of recurrence interval : relaxation time	--- = actual sequence of changes	Recovery from impact of flood event or planform recovery following channel straightening	Resiliance of system to recovery after a major flood (eg. Gupta and Fox, 1974)
4. Time dependent rate of system response as revealed by **sensitivity analysis**	**Quantity** morphological change **per unit** parameter alteration	Time; = unit parameter alteration	Extent to which some aspect of short-term fluvial system behaviour conforms to longer-term trend	Understanding of the singular nature of individual locations within fluvial systems (eg. as an extension of the model developed for river channel changes downstream of dams by Williams and Wolman, 1984)

Figure A.1: Interpretation of sensitivity from Downs and Gregory (1995)

We add to this, the potential spatial extent of impacts over a common engineering time scale of *ca*. 50 yrs. That is, some effects may propagate throughout drainage networks relatively quickly and result in headcutting, base-level lowering of tributaries, complex response, etc.

A.2 Braiding Definitions

- Broadest definition: multi-channel patterns (Leopold and Wolman 1957)
- Definition illustrations of sinuosity, braiding, and anabranching (Figure A.2), incision-driven CEM (Figure A.3), bank failure (Figures A.4a and A.4b)
- Flow separated by bars within a defined channel, where bars (Knighton 1998):
  - o may be inundated at higher flows, appearing as a single channel at/near 'bankfull'
  - o tend to be unvegetated, temporary, with little cohesion
- Characterized by repeated division and joining of channels (i.e., divergence and convergence of flow) resulting in high rates of fluvial activity relative to other rivers (Knighton 1998)

- Non-cohesive floodplains with braid-channel accretion as the main sediment accretion mechanism (Nanson and Croke 1992)

- Informed by the aforementioned definitions, we classify 'braided' channels for the purposes of this screening tool as:

  ➔ ***Multiple flow paths through over 50% of the reach length at low to moderate flows (see 35 – 65% 'degree of braiding', Figure A.2)***

  ➔ ***OR, if stakeholders are not concerned about 'anastomosing'/ 'anabranching' systems, augment above with: where paths are temporary and the result of dynamic, mostly unvegetated/non-cohesive bars***

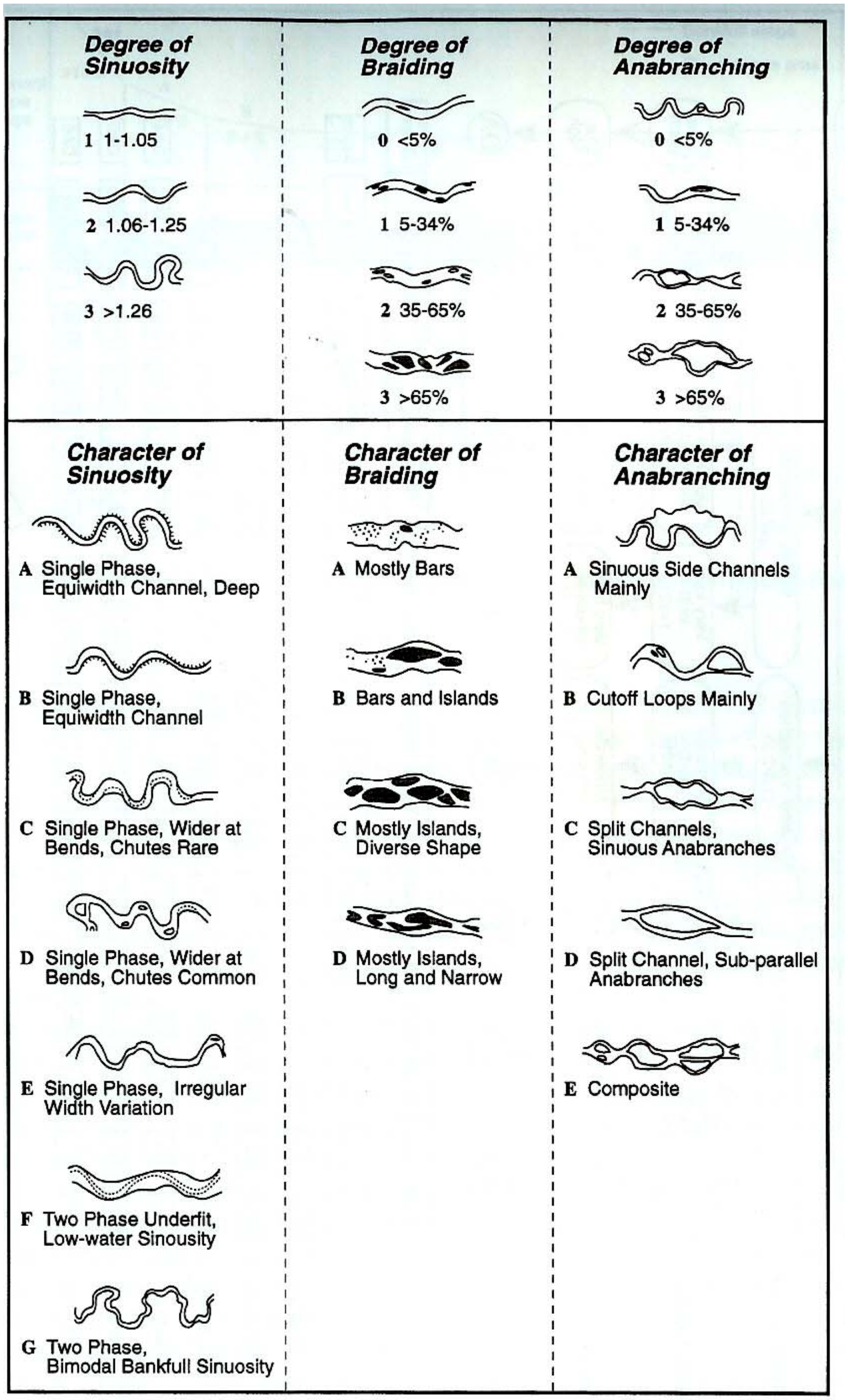
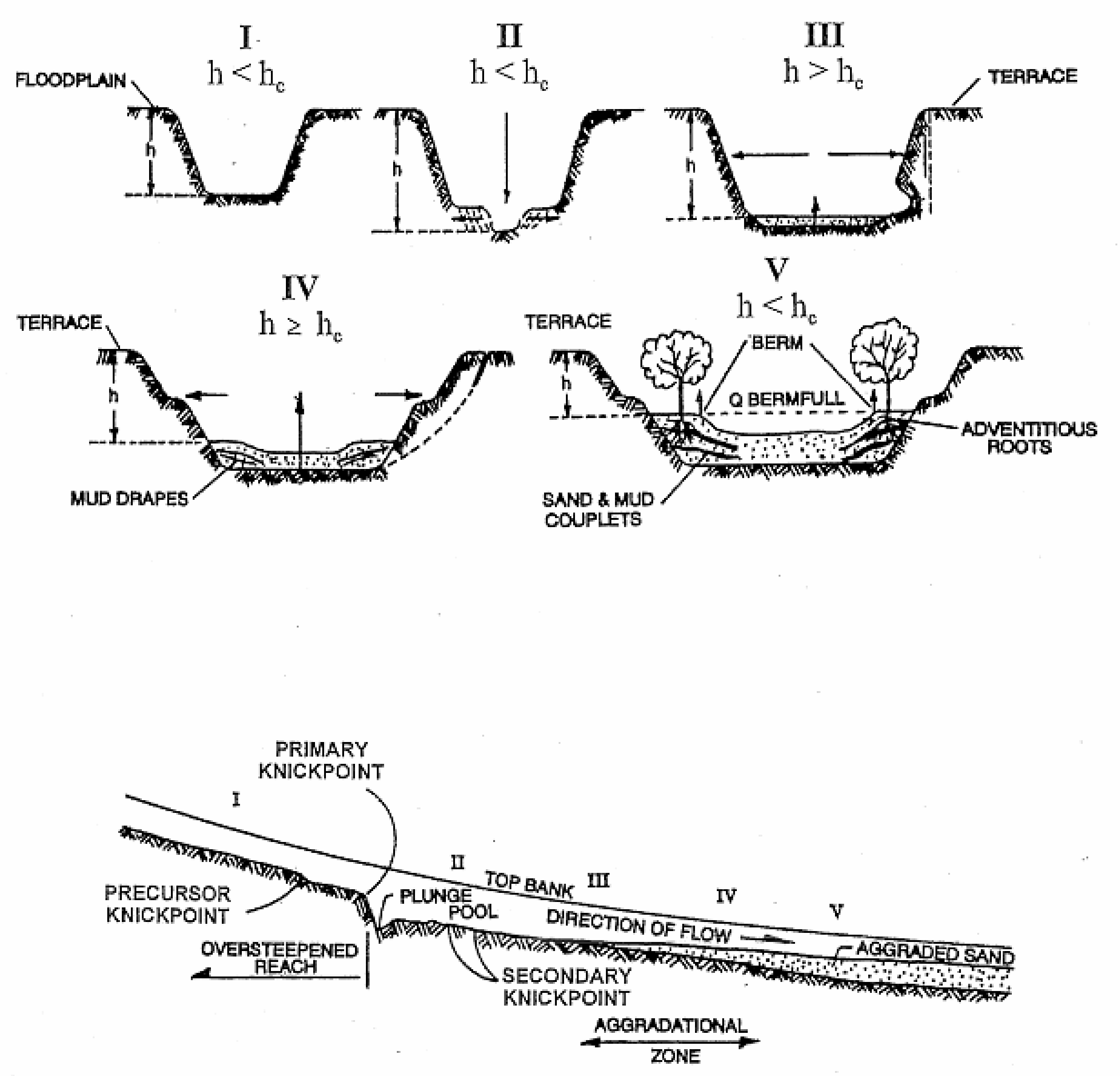


Figure A.2: Illustration of sinuosity, braiding, and anabranching (from Brice (1960, 1964))



h_c = critical bank height for mass failure

Figure A.3: Incision-driven CEM after Schumm *et al.* (1984); figure adapted from Watson *et al*. (2002)

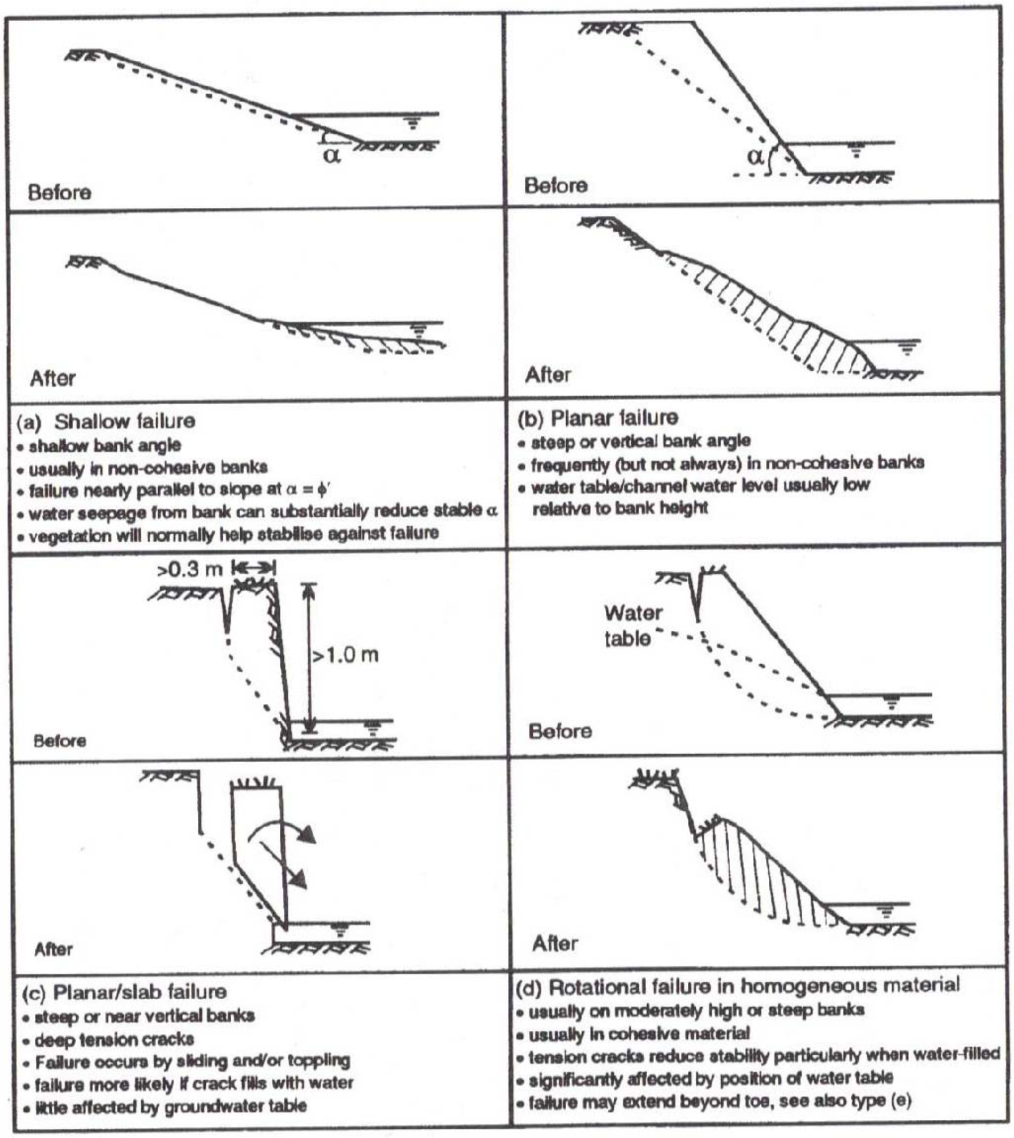


Figure A.4a: Bank-failure illustrations (a through d) after Hey *et al.* (1991); figure adapted from Lawler *et al.* (1997)

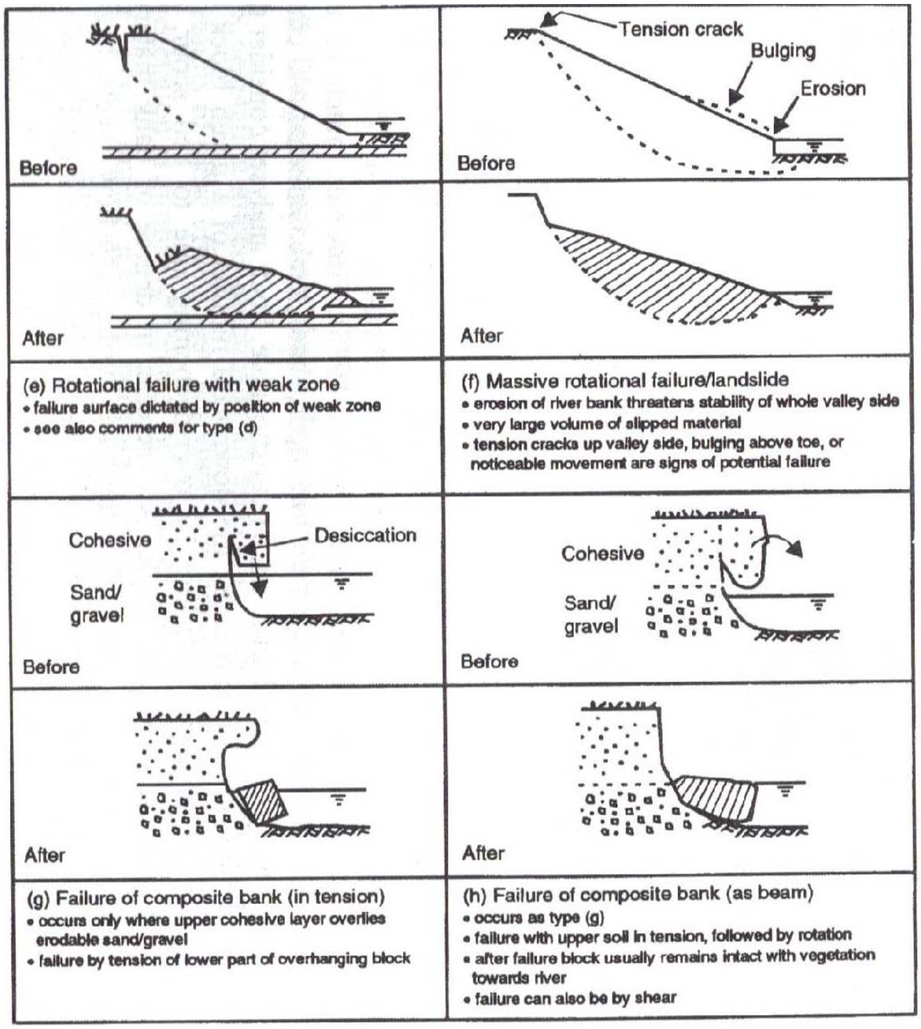


Figure A.4b: Bank-failure illustrations (e through h) after Hey *et al.* (1991); figure adapted from Lawler *et al.* (1997)

A.3 PEBBLE COUNT INSTRUCTIONS

Sampling with a frame – Excerpt from Bunte and Abt, 2001b:

“A tape measure is stretched from bank to bank. The sampling frame is placed onto the stream bottom so that one of the corners aligns with even-spaced marks on the tape, e.g., every three feet or one meter. Grid points derived by the elastic bands are used to visually define the particle to be selected. If the flow is deep and fast, and vision is blurred, looking at the grid intersection can help identify the particle to be included in the sample. If, for example, the grid intersection is between two cobbles, the operator knows that a small interstitial particle should be selected, but neither of the cobbles.

If flow is too deep or too fast to see the particle under the grid intersection, the particle to be included in the sample has to be identified by touch. A pointed index finger is placed in a corner of the grid intersection, and vertically lowered onto the sediment surface. The grid intersection serves as a guide for the position of the finger as it is lowered to the bed surface. Using the grid intersection as a reference point as opposed to the tip of the boot helps the operator select a particle more representatively because the operator works in a more comfortable posture when bending down to the sampling frame as opposed to bending down to the tip of the boot. The elastic bands in the sampling frame do not hinder the removal of a particle from the streambed. Particles are collected from under all four grid points, measured with a template, and placed back approximately into the same position from which they were taken. The frame is then moved to the next position along the tape. For many coarse gravel-bed rivers, a 30-cm grid within a 60 by 60 cm frame placed at 1 m, or 3 feet increments along the tape will be adequate. The sampling frame can be used on both sides of a transect. Individual transects should be 3 - 4 m apart to avoid overlap between sampled areas.”

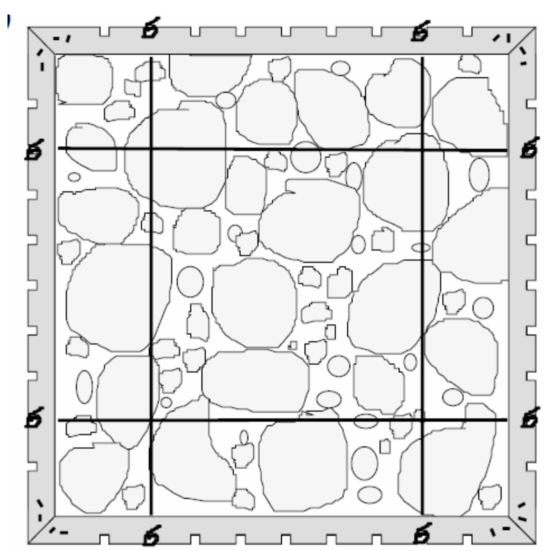


Figure A.5: Pebble Count Sampling Frame and Instructions from Bunte and Abt (2001b)