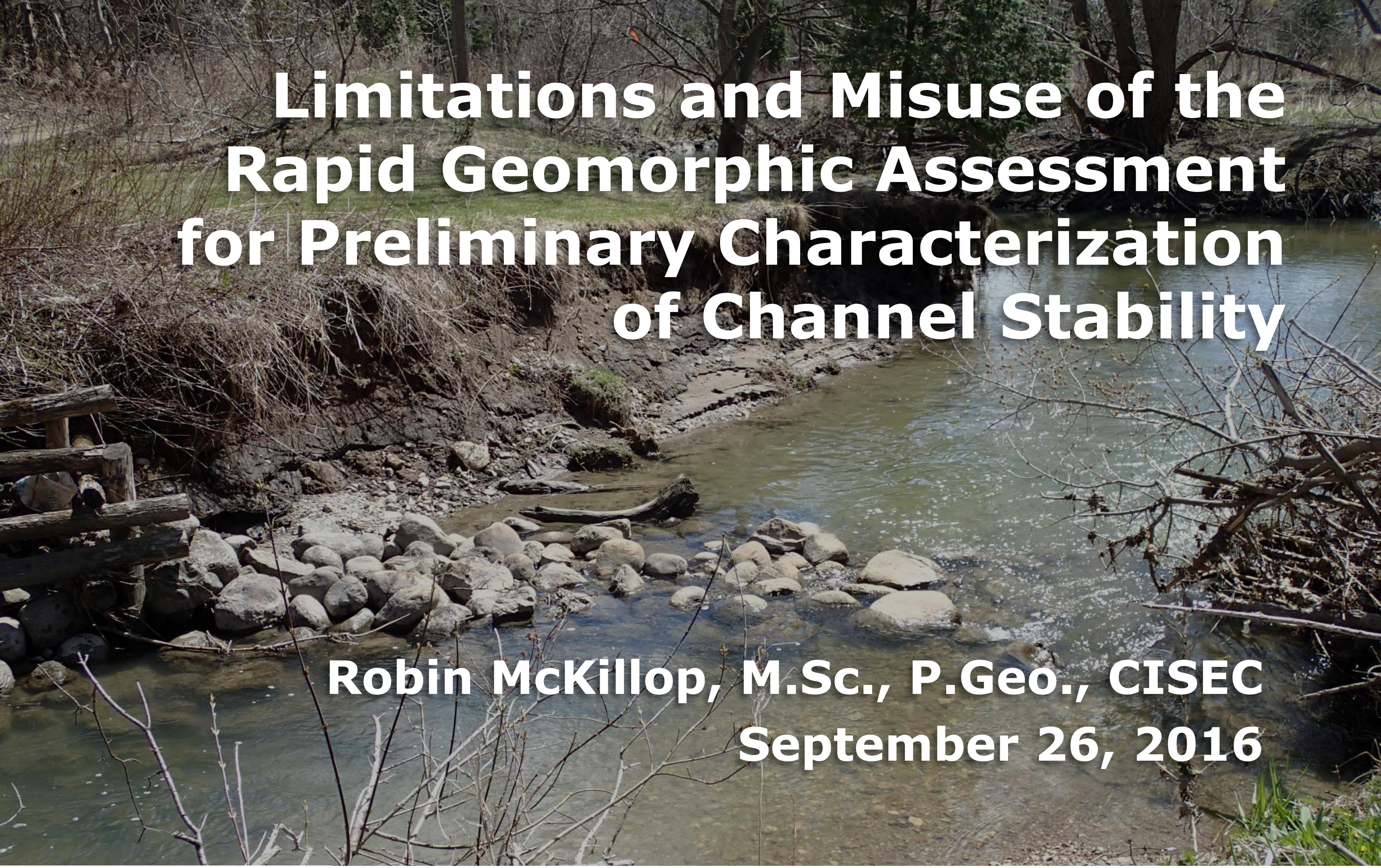

Limitations and Misuse of the Rapid Geomorphic Assessment for Preliminary Characterization of Channel Stability

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PALMER ENVIRONMENTAL CONSULTING GROUP INC.

Outline

- RGA 101
- Limitations
- Misuse
- Opportunities for Improvement

RGA 101

Rapid Geomorphic Assessment (RGA)

- Tool published by Ontario MOE (2003) for making preliminary evaluations of channel stability and sensitivity to an alteration in the sediment-flow regime
- Intended for urban/rural settings
- Implicit aim is for procedure to be relatively simple (“rapid”), such that non-specialists can apply it

The RGA field data collection form

FORM/ PROCESS (1)	GEOMORPHIC INDICATOR		PRESENT		FACTOR
	NO (2)	DESCRIPTION (3)	NO (4)	YES (5)	VALUE (6)
Evidence of Aggradation (AI)	1	Lobate bar			
	2	Coarse material in riffles embedded			
	3	Siltation in pools			
	4	Medial bars			
	5	Accretion on point bars			
	6	Poor longitudinal sorting of bed materials			
	7	Deposition in the overbank zone			
		SUM OF INDICES			
Evidence of Degradation (DI)	1	Exposed bridge footing(s)			
	2	Exposed sanitary/storm sewer/pipeline/etc.			
	3	Elevated stormsewer outfall(s)			
	4	Undermined gabion baskets/concrete aprons/etc.			
	5	Scour pools d/s of culverts/stormsewer outlets			
	6	Cut face on bar forms			
	7	Head cutting due to knick point migration			
	8	Terrace cut through older bar material			
	9	Suspended armor layer visible in bank			
	10	Channel worn into undisturbed overburden/bedrock			
		SUM OF INDICES			
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc.			
	2	Occurrence of large organic debris			
	3	Exposed tree roots			
	4	Basal scour on inside meander bends			
	5	Basal scour on both sides of channel through riffle			
	6	Gabion baskets/concrete walls/etc. out flanked			
	7	Length of basal scour > 50% through subject reach			
	8	Exposed length of previously buried pipe/cable/etc.			
	9	Fracture lines along top of bank			
	10	Exposed building foundation			
		SUM OF INDICES			
Evidence of Planimetric Form Adjustment (PI)	1	Formation of cute(s)			
	2	Single thread channel to multiple channel			
	3	Evolution of pool-riffle form to low bed relief form			
	4	Cutoff channel(s)			
	5	Formation of island(s)			
	6	Thalweg alignment out of phase meander form			
	7	Bar forms poorly formed/reworked/removed			
		SUM OF INDICES			
STABILITY INDEX (SI) = (AI + DI + WI + PI) / m					

Factor Value (e.g., AI) = # yes / # applicable

Stability Index (SI) = (AI + DI + WI + PI) / 4

Ontario MOE (2003)

Interpretation of the RGA Stability Index (SI) value

Increasing evidence of instability

Stability Index (SI) Value	Classification	Interpretation
$SI \leq 0.2$	In Regime	The channel morphology is within a range of variance for streams of similar hydrographic characteristics – evidence of instability is isolated or associated with normal river meander propagation processes
$0.21 \leq SI \leq 0.4$	Transitionally or Stressed	Channel morphology is within the range of variance for streams of similar hydrographic characteristics but the evidence of instability is frequent
$SI > 0.4$	In Adjustment	Channel morphology is not within the range of variance and evidence of instability is wide spread

Ontario MOE (2003)

Application & concerns

- Used extensively in southern Ontario, commonly *by* or *for* Conservation Authorities

- Inconsistent results may be contributing to mismanagement of stormwater and erosion control measures

- *May be contributing to bad reputation, expressed by some, of fluvial geomorphology in southern Ontario*

Inconsistent results

Reach	Other Assessor RGA Score	Other Assessor Dominant Mode of Adjustment				
Reach A	0.18	Widening				
Reach B	0.47	Planform				
Reach C	0.37	Widening, Planform				
Reach D	0.53	Widening				
Reach E	0.55	Planform				
Reach F	0.37	Planform				

Inconsistent results

Reach	Other Assessor RGA Score	Other Assessor Dominant Mode of Adjustment	PECG RGA Score			
Reach A	**0.18**	Widening	**0.47**			
Reach B	**0.47**	Planform	**0.35**			
Reach C	**0.37**	Widening, Planform	**0.44**			
Reach D	**0.53**	Widening	**0.46**			
Reach E	**0.55**	Planform	**0.40**			
Reach F	**0.37**	Planform	**0.52**			

Inconsistent results

Reach	Other Assessor RGA Score	Other Assessor Dominant Mode of Adjustment	PECG RGA Score	PECG Dominant Mode of Adjustment		
Reach A	0.18	**Widening**	0.47	**Degradation**		
Reach B	0.47	**Planform**	0.35	**Widening**		
Reach C	0.37	**Widening, Planform**	0.44	**Aggradation**		
Reach D	0.53	**Widening**	0.46	**Degradation**		
Reach E	0.55	**Planform**	0.40	**Degradation**		
Reach F	0.37	**Planform**	0.52	**Planform**		

Inconsistent results

Reach	Other Assessor RGA Score	Other Assessor Dominant Mode of Adjustment	PECG RGA Score	PECG Dominant Mode of Adjustment	PECG Professional Interpretation	
Reach A	0.18	Widening	0.47	**Degradation**	**Widening**	
Reach B	0.47	Planform	0.35	**Widening**	**Stable to widening**	
Reach C	0.37	Widening, Planform	0.44	**Aggradation**	**Widening, Planform**	
Reach D	0.53	Widening	0.46	**Degradation**	**Widening, Degradation**	
Reach E	0.55	Planform	0.40	**Degradation**	**Degradation, Planform**	
Reach F	0.37	Planform	0.52	**Planform**	**Planform**	

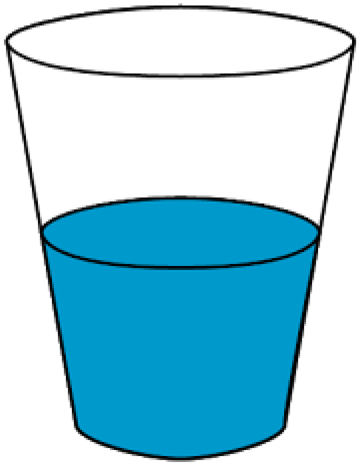
Inconsistent results

Reach	Other Assessor RGA Score	Other Assessor Dominant Mode of Adjustment	PECG RGA Score	PECG Dominant Mode of Adjustment	PECG Professional Interpretation	Higher RGA Score
Reach A	0.18	Widening	0.47	Degradation	Widening	**PECG**
Reach B	0.47	Planform	0.35	Widening	Stable to widening	**Other Assessor**
Reach C	0.37	Widening, Planform	0.44	Aggradation	Widening, Planform	**PECG**
Reach D	0.53	Widening	0.46	Degradation	Widening, Degradation	**Other Assessor**
Reach E	0.55	Planform	0.40	Degradation	Degradation, Planform	**Other Assessor**
Reach F	0.37	Planform	0.52	Planform	Planform	**PECG**

Objective

- Purpose of this talk is to heighten awareness of limitations and misuse of RGA, and foreshadow opportunities for improvement – **Step 1**

- **Step 2** – ideally completed in collaboration with the local geomorphology community – is to develop a more robust and defensible version



LIMITATIONS

Unsound statistics

Allowance for contradictory processes

Importance of calibration

Unsound statistics

- Inconsistent weighting (importance) of geomorphic indicators, <u>in case of N/A</u>

  ➔ inappropriate to compare reaches based on form/process indices (i.e., AI, DI, WI or PI)

FORM/ PROCESS (1)	GEOMORPHIC INDICATOR NO (2)	DESCRIPTION (3)	PRESENT NO (4)	YES (5)	FACTOR VALUE (6)
Evidence of Aggradation (AI)	1	Lobate bar			
	2	Coarse material in riffles embedded			
	3	Siltation in pools			
	4	Medial bars			
	5	Accretion on point bars			
	6	Poor longitudinal sorting of bed materials			
	7	Deposition in the overbank zone			
		SUM OF INDICES			
Evidence of Degradation (DI)	1	Exposed bridge footing(s)			
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	3	Elevated stormsewer outfall(s)			
	4	Undermined gabion baskets/concrete aprons/etc.			
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	6	Cut face on bar forms			
	7	Head cutting due to knick point migration			
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		SUM OF INDICES			
Evidence of Widening (WI)	1	Fallen/leaning trees/fence posts/etc.			
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	4	Basal scour on inside meander bends			
	5	Basal scour on both sides of channel through riffle			
	6	Gabion baskets/concrete walls/etc. out flanked			
	7	Length of basal scour > 50% through subject reach			
	8	Exposed length of previously buried pipe/cable/etc.			
	9	Fracture lines along top of bank			
	10	Exposed building foundation			
		SUM OF INDICES			
Evidence of Planimetric Form Adjustment (PI)	1	Formation of cute(s)			
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	4	Cutoff channel(s)			
	5	Formation of island(s)			
	6	Thalweg alignment out of phase meander form			
	7	Bar forms poorly formed/reworked/removed			
		SUM OF INDICES			
STABILITY INDEX (SI) = (AI + DI + WI + PI) / m					

Unsound statistics

Not applicable to reach

Reach A

Evidence of Degradation (DI)		
	1	Exposed bridge footing(s)
	2	Exposed sanitary/storm sewer/pipeline/etc.
	3	Elevated stormsewer outfall(s)
	4	Undermined gabion baskets/concrete aprons/etc.
	5	Scour pools d/s of culverts/stormsewer outlets
	6	Cut face on bar forms
	7	Head cutting due to knick point migration
	8	Terrace cut through older bar material
	9	Suspended armor layer visible in bank
	10	Channel worn into undisturbed overburden/bedrock
		SUM OF INDICES

Reach B

Evidence of Degradation (DI)		
	~~1~~	~~Exposed bridge footing(s)~~
	~~2~~	~~Exposed sanitary/storm sewer/pipeline/etc.~~
	~~3~~	~~Elevated stormsewer outfall(s)~~
	~~4~~	~~Undermined gabion baskets/concrete aprons/etc.~~
	~~5~~	~~Scour pools d/s of culverts/stormsewer outlets~~
	6	Cut face on bar forms
	7	Head cutting due to knick point migration
	8	Terrace cut through older bar material
	9	Suspended armor layer visible in bank
	10	Channel worn into undisturbed overburden/bedrock
		SUM OF INDICES

10 of 10 possible geomorphic indicators applicable

Calculation of DI:
\# yes / 10 = x
4 / 10 = **0.40**

Only 5 of 10 possible geomorphic indicators applicable

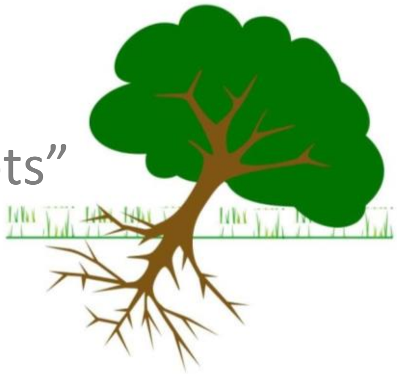
Calculation of DI:
\# yes / 5 = y
4 / 5 = **0.80**

Different denominators

Increased relative influence of remaining 5 indicators on DI

Unsound statistics

- Non-independence…
  - Presence of one influences probability of presence of another
  - Inefficient, and potentially masks true indicators of instability
- …at geomorphic indicator level
  - “Fallen/leaning trees” AND “Exposed tree roots”



- …at form/process level
  - Degradation counters aggradation
  - Planimetric form adjustment commonly triggered by one of other three processes

Unsound statistics

- Stability Index (SI) calculated as an *average* of the four form/process indices

- Information loss – mutes any extremes, which are most important

SI = (AI + DI + WI + PI) / 4

?!?

SI = (0.14 + 0.20 + 0.90 + 0.00) / 4 = 0.31

Virtually identical values, yet based on reaches with significantly different stabilities, dominant processes and management implications

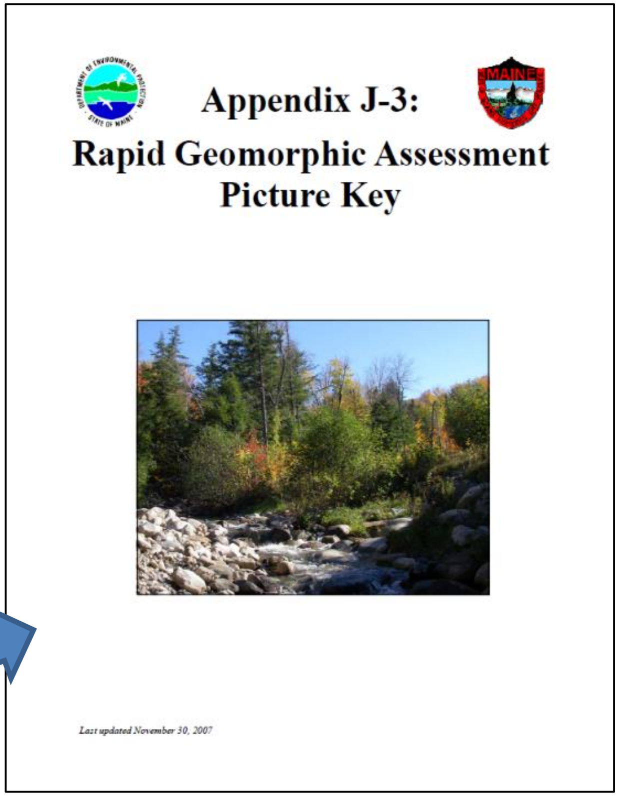
SI = (0.29 + 0.30 + 0.33 + 0.29) / 4 = 0.30

Allowance for contradictory processes

- **Aggradation** and **degradation** refer to opposite changes in a channel, yet their concurrence is plausible according to the RGA
  - Site- vs. reach-scale observations
- Certain observations (indicators) should trump others
- Also need to consider timescale – historic vs. present

Calibration of interpretations

- Subjectivity
- Presence vs. dominance
- Inconsistent recording of indicators inhibits reliable comparisons, whether in space or time
- Critical to calibrate to reference keys (e.g., Maine Picture Key) and colleagues


Appendix J-3:
Rapid Geomorphic Assessment
Picture Key

Last updated November 30, 2007

Maine Department of Environmental Protection (2007)

MISUSE

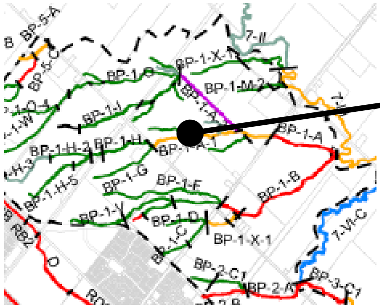
Inappropriate watercourse application

Unclear representation of planimetric form adjustment

Over-assignment of indicators

Inappropriate watercourse application

- Small (swale) headwater drainage features

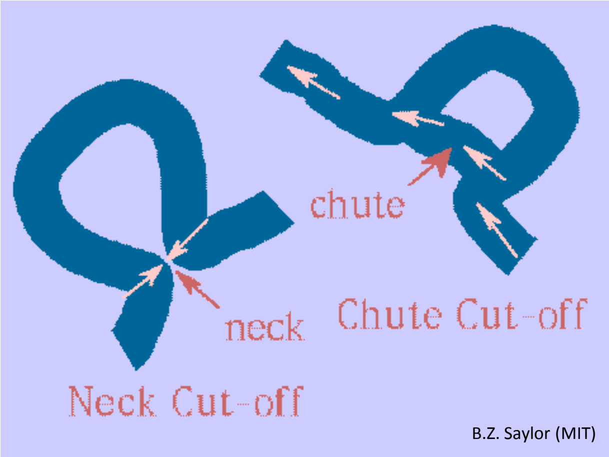


Inappropriate watercourse application

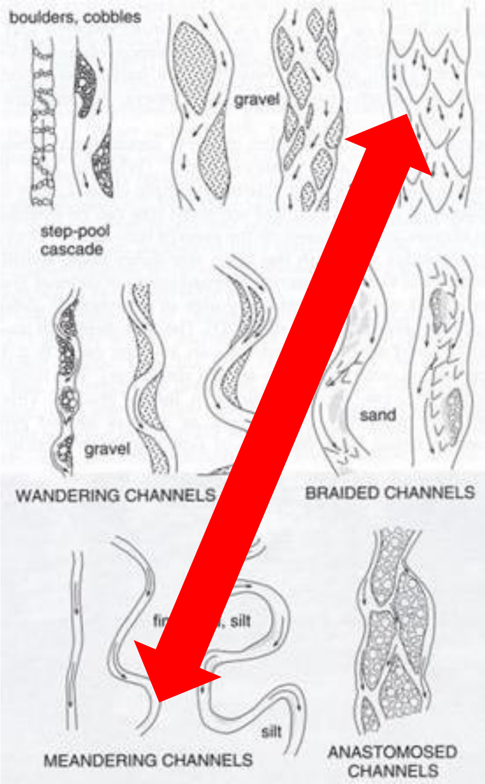
- Small (swale) headwater drainage features
- Bedrock channels
- Alluvial fans & braided streams
- Chronically beaver-dammed streams
- *Natural (pristine) channels?*

Unclear Representation of Planimetric Form Adjustment

- Geomorphic indicators of Planimetric Form Adjustment mix indicators of morphologic instability and dynamic equilibrium
  - e.g., “Formation of chute(s)” and “Cutoff channel(s)”



vs.



Church (1992), modified from Schumm (1985)

- Strong dependency on other processes (e.g., aggradation)

Over-assignment of indicators

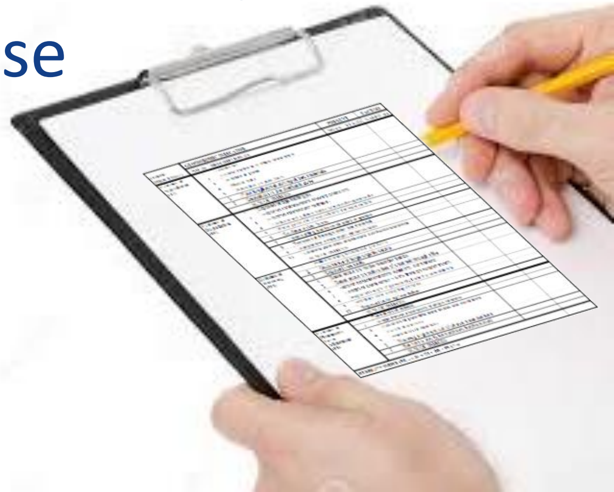
- Checklist format commonly leads to over-assignment of indicators of instability
  - What if the RGA logged indicators of *stability*?

- Reach-scale vs. site-scale
- Particularly problematic for assessors untrained and/or inexperienced in fluvial geomorphology

OPPORTUNITIES FOR IMPROVEMENT

Application of existing MOE (2003) RGA method

- Field training and calibration
- More diligent reference to picture keys
- Avoidance of comparisons based on SI alone
- Temporal comparisons through repeat assessment preferred
- Regulatory acceptance to justify stability conditions that depart from those indicated by the RGA



Application of other, modified or new RGA method

- Allowance for **weighting** of different indicators
- Accommodation of **severity** of indicators
- New, modified or removed indicators
- Vermont Agency of Natural Resources (2004) RGA protocol?...

Vermont RGA

Field data sheets for "confined streams"

VT RAPID GEOMORPHIC ASSESSMENT ----- CONFINED STREAMS

For narrowly and semi-confined valley types (confinement ratio < 4)

Stream Name: ______________________ Segment I.D: ______________
Location: ______________________ Date: ______________
______________________ Town: ______________
Observers: ______________________ Elevation: ______________ ft.
Organization /Agency: ______________________ Weather: ______________
Reference Stream Type ______________ ☐ Modified Rain Storm within past 7 days: Y / N
(If bedrock controlled gorge, alluvial fan, or naturally braided system see Handbook Protocols)

Severity of condition

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.1 Channel Degradation (Incision) (Degradation)	☐ Little evidence of localized slope increase or nickpoints.	☐ Minor localized slope increase or nickpoints.	☐ Sharp change in slope, head cuts present, and/or tributaries rejuvenating.	☐ Sharp change in slope and / or multiple head cuts present. Tributaries rejuvenating.
• Exposed till or fresh substrate in the stream bed and exposed infrastructure (bridge footings). • New terraces or recently abandoned flood prone areas.	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Where channel slope < 4% Entrenchment ratio > 1.4 Where channel slope ≥ 4% Entrenchment ratio > 1.2	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Where channel slope < 4% Entrenchment ratio > 1.4 Where channel slope ≥ 4% Entrenchment ratio > 1.2	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Where channel slope < 4% Entrenchment ratio > 1.4 Where channel slope ≥ 4% Entrenchment ratio > 1.2	☐ Incision ratio ≥ 2.0 **and** Where channel slope < 4% Entrenchment ratio ≤ 1.4 Where channel slope ≥ 4% Entrenchment ratio ≤ 1.2
• Headcuts, or nickpoints significantly steepened segment and comprised of smaller bed material than typical steps. • Freshly eroded vertical banks.	☐ Step-pool systems have full complement of expected bed features, steps complete with coarser sediment (≥ D80).	☐ Step-pool systems have full complement of expected bed features, steps mostly complete.	☐ Step-pool systems with incomplete (eroded) steps, dominated by runs.	☐ Step-pool bed features eroded and replaced by plane bed features.
• Alluvial sediments that are imbricated (stacked like dominoes) high in the bank.	☐ No significant human-caused change in channel confinement.	☐ Only minor human-caused change in channel confinement.	☐ Significant human-caused change in channel confinement but no change in valley type.	☐ Human caused change in valley type.
• Tributary rejuvenation, observed through the presence of nickpoints at or upstream of the mouth of a tributary. • Depositional features with steep faces, usually occurring on the downstream end.	☐ No evidence of historic / present channel straightening, dredging, and/or channel avulsions.	☐ Evidence of minor historic dredging and/or channel avulsion.	☐ Evidence of significant historic channel straightening, dredging, or gravel mining, and/or channel avulsions.	☐ Extensive historic channel straightening, commercial gravel mining, and/or recent channel avulsions.
Stream Type Departure ☐ **Type of STD:** ________	☐ No known flow alterations (i.e., increases in flow and/or decreases in sediment supply).	☐ Some increase in flow and/or minor reduction of sediment load.	☐ Major historic flow alterations, greater flows and/or reduction of sediment load.	☐ Major existing flow alterations, greater flows and/or reduction of sediment load.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.2 Channel Aggradation (Aggradation) • Shallow pool depths.	☐ Step-pool systems have full complement of expected bed features, complete steps and deep pools.	☐ Step-pool systems with full complement of bed features. Pools filling with fine sediment and may be only slightly deeper and wider than runs.	☐ Step-pool systems with incomplete steps, dominated by runs. Pools filling with fine sediment and may be absent with runs prevailing.	☐ Step-pool bed features are filled with sediment and stream appears as a plane bed.
• Abundant sediment deposition on side bars and unvegetated mid-channel bars and extensive sediment deposition at obstructions, channel constrictions. Islands may be present	☐ Minor side or delta bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel, side or diagonal bars present. Minor depositional features typically less than bankfull stage in height.	☐ Multiple unvegetated mid-channel, side or diagonal bars present. Sediment buildup at constrictions leading to steep riffles and/or flood chutes.	☐ Multiple unvegetated mid-channel, side or diagonal bars or islands present, splitting or braiding flows even under low flow conditions.
• Most of the channel bed is exposed during typical low flow periods.	☐ No apparent increase in gravel / sand substrates (pebble count).	☐ Some increase in small gravel / sand substrates that may comprise over 50% of the sediments.	☐ Large increase in gravel / sand substrates that may comprise over 70% of the sediments.	☐ Homogenous gravel/sand substrates may comprise over 90% of the sediments. Fine sediment feels soft underfoot.
• Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel.	☐ Low width/depth ratio ≤ 20 for channel slopes < 4% ≤ 12 for channel slopes ≥ 4%	☐ Low to moderate W/d ratio > 20 ≤ 30 for slopes < 4% > 12 ≤ 20 for slopes ≥ 4%	☐ Moderate to high W/d ratio > 30 ≤ 40 for slopes < 4% > 20 ≤ 30 for slopes ≥ 4%	☐ High width/depth ratio > 40 for channel slopes < 4% > 30 for channel slopes ≥ 4%
	☐ No known flow alterations (i.e., decrease in flow and/or increase in sediment supply).	☐ Minor reduction in flow and / or increase in sediment load. Flood-related sediment working through reach, seen as enlarged bars.	☐ Major historic flow alterations, reduction in flows and / or increase in sediment load.	☐ Major existing flow alterations, extreme reduction in flows and / or increase in sediment load.
Stream Type Departure ☐ **Type of STD:** ________	☐ No human-made constrictions causing upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive upstrm / dwnstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Adjustment Process	Condition Category: Reference	Good	Fair	Poor
7.3 Widening Channel (Widening)	☐ Low width/depth ratio ≤ 20 for channel slopes < 4% ≤ 10 for channel slopes ≥ 4%	☐ Low to moderate W/d ratio > 20 ≤ 30 for slopes < 4% > 10 ≤ 12 for slopes ≥ 4%	☐ Moderate to high W/d ratio > 30 ≤ 40 for slopes < 4% > 12 ≤ 20 for slopes ≥ 4%	☐ High width/depth ratio > 40 for channel slopes < 4% > 20 for channel slopes ≥ 4%
• Active undermining of bank vegetation on both sides of the channel; many unstable bank overhangs that have little vegetation holding soils together. • Erosion on both right and left banks.	☐ Little to no scour and erosion at the base of both banks. Negligible bank overhangs, fracture lines at top of banks, leaning trees or freshly exposed tree roots.	☐ Minimal to moderate scour and erosion at the base of both banks. Some overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Moderate to high scour and erosion at the base of both banks. Many bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.	☐ Continuous and laterally extensive scour and erosion at the base of both banks. Continuous bank overhangs, fracture lines at top of banks, leaning trees and freshly exposed tree roots.
• Recently exposed tree roots (fresh roots are 'green' and do not break easily, older roots are brittle and will break easily in your hand). • Fracture lines at the top of the bank that appear as cracks parallel to the river.	☐ Incision Ratio ≥ 1.0 < 1.2 **and** Where channel slope < 4% Entrenchment ratio > 1.4 Where channel slope ≥ 4% Entrenchment ratio > 1.2	☐ Incision Ratio ≥ 1.2 < 1.4 **and** Where channel slope < 4% Entrenchment ratio > 1.4 Where channel slope ≥ 4% Entrenchment ratio > 1.2	☐ Incision Ratio ≥ 1.4 < 2.0 **and** Where channel slope < 4% Entrenchment ratio > 1.4 Where channel slope ≥ 4% Entrenchment ratio > 1.2	☐ Incision ratio ≥ 2.0 **and** Where channel slope < 4% Entrenchment ratio ≤ 1.4 Where channel slope ≥ 4% Entrenchment ratio ≤ 1.2
• Evidence of landslides and mass failures. • Mid-channel bars and side bars may be present.	☐ Minor side or delta bars present. Depositional features typically less than half bankfull stage in height.	☐ Single to multiple mid-channel or side bars present. Minor depositional features typically less than half bankfull stage in height.	☐ Multiple unvegetated mid-channel or side bars present. Major sediment buildup at the head of constrictions leading to steep riffles and/or flood chutes.	☐ Multiple unvegetated mid-channel, side or diagonal bars or islands present, splitting or braiding flows even under low flow conditions.
• Urbanization and stormwater outfalls leading to higher rate and duration of runoff and channel enlargement.	☐ No known channel and / or flow alterations (i.e., increase in flow and/or change in sediment supply).	☐ Minor increase in watershed input of flows and/or sediment. Episodic (flood) discharges resulting in short-term enlargement.	☐ Major channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).	☐ Major and extensive channel and/or flow alterations, increase in flows and/or change in sediment load (increase or decrease).
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7.4 Change in Planform (Planform) • Flood chutes present.	☐ Low bank erosion on outside bends, little or no change in sinuosity within the reach.	☐ Low to moderate lateral bank erosion on outside bends, may include minor change in sinuosity within the reach.	☐ Moderate to high lateral bank erosion on most outside bends, may include moderate change in reach sinuosity.	☐ Extensive lateral bank erosion on most outside bends, may include major change in sinuosity within the reach.
• Channel avulsions evident or impending. • Change or loss in bed form structure, sometimes resulting in a mix of plane bed and step-pool forms.	☐ Little or no evidence sediment buildup, only minor delta or side bars typically less than half bankfull stage in height.	☐ Single to multiple unvegetated mid-channel, delta, or side bars. Some potential for channel avulsion.	☐ Multiple unvegetated mid-channel, delta, or side bars, typically greater than bankfull stage in height. Evidence of channel avulsions and/or islands.	☐ Multiple and major mid-channel, delta, and/or side bars. Evidence of recent channel avulsions, multiple thread channels, and islands.
• Island formation and/or multiple thread channels.	☐ No human-caused alteration of channel planform and / or the width of the floodprone area.	☐ Minor to moderate alteration of channel planform and/or width of the floodprone area resulting from floodplain encroachment, channel straightening, or dredging.	☐ Major alteration of channel planform and/or width of the floodprone area resulting from historic encroachment, dredging, or channel straightening.	☐ Major alteration of channel planform and the width of the floodprone area resulting from recent and extensive encroachment, dredging, and/or channel straightening.
	☐ Human-made constrictions causing only negligible upstream deposition.	☐ Human-made constrictions smaller than floodprone width, causing minor to moderate upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than floodprone width, causing major upstrm / dwnstrm deposition.	☐ Human-made constrictions significantly smaller than bankfull width, causing extensive major upstrm / dwnstrm deposition and flow bifurcation.
Score: **Historic** ☐	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

Acknowledgment of 'history'

7.5 Channel Adjustment Scores – Stream Condition – Channel Evolution Stage

Condition / Departure	Reference / N/S	Good / Minor	Fair / Major	Poor / Extreme	STD*	Historic	Condition Rating: (Total Score / 80)	Channel Evolution Stage:
Degradation								
Aggradation								
Widening							7.6 Stream Condition:	
Planform								
Sub-totals:					Total Score:			

*STD = Stream Type Departure where existing stream type is no longer the same as the reference stream type.

Channel Adjustment Processes: ______________________

7.7 Stream Sensitivity: Very Low / Low / Moderate / High / Very High / Extreme

* Channel Condition "default" to poor – significant flood damage (not able to get accurate channel data) Y/N ;
* Channel Condition default to poor - Due to channel alterations from work in channel after flood: Y/N
* Stream Sensitivity "default" to poor – significant flood damage (not able to get accurate channel data) Y/N ;
* Stream Sensitivity "default" to poor Due to channel alterations from work in channel after flood: Y/N

Professional judgment (P.Geo. or P.Eng.) remains essential to validate and interpret results, especially where there are stormwater management or erosion control implications

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