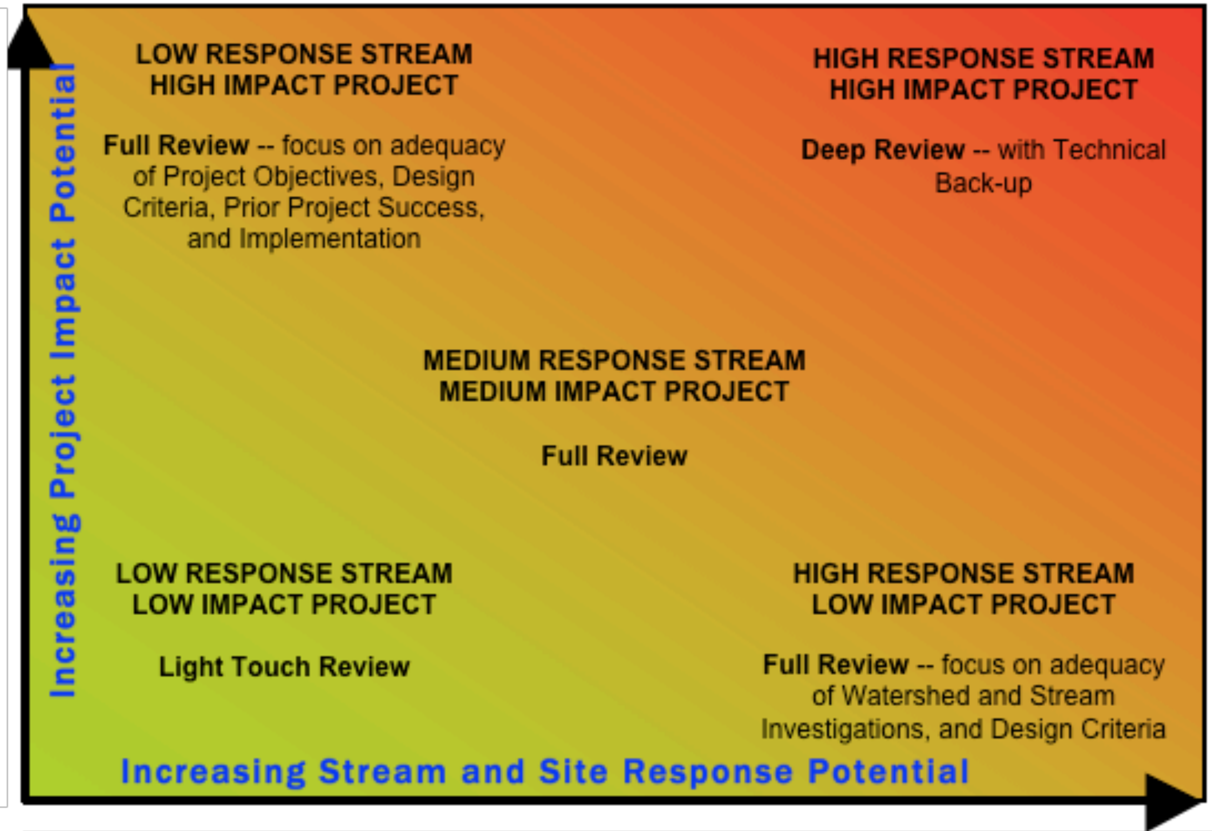
Project Screening Matrix

Scale of Disturbance (multiple of channel width)
1x — 3x — 5 - 7x — 10x — 20+

Planning Context
Coordinated Watershed Plan — Stand-alone Project

Artificial Bed and/or Bank Stabilization
Removed — Left in Place — Added (deformable) — Added (non-deformable)
Isolated Action — Multiple — Pervasive

Monitoring & Maintenance Plan
Adaptive Management — Monitoring only — None



Stream Sensitivity / Stream Type
Source (>10% slope) — Transport (3–10%) — Response (<3%)
Bedrock — Colluvial — Alluvial — Incised Channel / Alluvial Fan

Riparian Corridor
Continuous/Wide — Semi-continuous/Wide — Discontinuous/Narrow — Urbanized or Levee Confined

Bank Erosion Potential
Naturally Non-erodible — Erosion Resistant — Highly Erodible, or Revetted

Bed Scour Potential)
Boulder/clay bed (low) — Gravel/cobble bed (moderate) — Sand/silt bed (high)

Dominant Hydrologic Regime
Spring-fed — Snowmelt — Rain — Rain-on-Snow — Thunderstorm/Monsoon

PROJECT SCREENING MATRIX: A User's Guide

BACKGROUND

The *Project Screening Matrix* (Screening Matrix) is one of several tools that comprise the *River Restoration Assessment Tool Project* (RiverRAT) – a broad Federal effort to more efficiently and effectively evaluate stream management, engineering, and restoration proposals. By identifying the project impact and stream response potential associated with a proposed project, this screening tool helps reviewers characterize the relative risk to natural resources and stratify review time and intensity for various project types. The principle underlying the *Screening Matrix* is that stream projects should do no lasting harm to aquatic habitat on-site, upstream, or downstream, and that short- and long-term negative impacts will be avoided where possible, minimized to the greatest extent, and mitigated where necessary.

This User's Guide provides specific guidance on the *Screening Matrix*. For more detailed scientific background, please refer to the *Science* document that provides the foundation for the *RiverRAT* project (www.restorationreview.com).

EXPLANATION OF THE AXES

The *Screening Matrix* transitions from green in the lower left corner, indicating that a light project review may be sufficient, to red in the upper right corner indicating that a deep review of the project may be justified or necessary. The matrix indicates an appropriate level of design and review as a function of potential risk to natural resources - it does not mean that a project is either good or bad for habitat. For example, many restoration projects that provide great benefit to habitat and species may also plot in the red zone, due to the level of disturbance necessary to restore or connect valuable habitat.

The x-axis represents *stream response potential* – the inherent potential for the stream to exhibit morphologic response to disturbance. Disturbances may be natural, such as those caused by a flood or drought, or human caused, such as channelization or stream restoration work. The x-axis, therefore, uses attributes such as stream type, riparian vegetation, bed and bank materials, and flow regime, to assess overall response potential. Because these are inherent characteristics of a stream system, *risk to natural resources associated with stream response cannot be reduced unless the project is changed, or the site is relocated*. Additionally, because of the inherent stream sensitivity, long-term or persistent impacts are more likely to occur on higher response streams.

The y-axis represents *project impact potential*. Some disturbance is inevitable when performing management or restoration actions; therefore, this axis uses project disturbance indicators, such as project scale, watershed context, channel stabilization, and monitoring and maintenance activities, to assess overall impact potential of the project if implemented. Because the level of impact potential is related to the proposed action, *reducing risk to natural resources resulting from a project is often feasible through project redesign, implementation of Best Management Practices (BMPs), and adaptive management*.

Explanation of the Stream Response Potential Factors – X-axis

Stream Sensitivity / Stream Type

Source (slope >10%)		Transport (3—10%)		Response (<3%)
Bedrock	Colluvial		Alluvial	Incised Channel, Alluvial Fan

Channel response to disturbance can vary by channel type, and some simple classifications can help define possible sensitivity of channels. “Source” reaches are dominated by local sediment inputs from hill slopes; “Transport” reaches correspond to supply-limited channel types; and “Response” reaches correspond to transport-limited channel types (Montgomery & Buffington 1998). Consequently, the potential for morphologic response to a stream project is lowest in Source (colluvial & bedrock) reaches, intermediate in Transport (step-pool, cascade) reaches, and greatest in Response (plane-bed, pool-riffle, dune-riffle) reaches. Stream slope at the reach scale is often used as a surrogate for Source (>10%), Transport (>3% to <10%), and Response (<3%).

Response potential is relevant at the reach scale and should be evaluated in the context of an entire stream reach (similar slope and confinement). Reach breaks may include, but are not limited to, natural or artificial grade control, significant changes in channel slope, confluence with a significant tributary, changes in channel confinement, and/or changes in bed or bank materials.

If a stream is bedrock or colluvium dominated, then the remaining response factors of riparian corridor and bank and bed characteristics are generally not applicable. Alternatively, if the channel is on an alluvial fan, the site response potential will likely remain high even if the other risk factors are all rated low.

Stream sensitivity also includes the potential for disturbance to propagate upstream and/or downstream. An example of upstream disturbance propagation is erosion of the channel bed, creation of a headcut, and the migration of this nick point; this process is commonly initiated when artificial grade controls, such as culverts, are removed. This erosion process sets off a series of feedback mechanisms that can cause sedimentation downstream, channel widening, loss of base flows, and other related impacts. This response is highly influenced by stream type; headcuts are unlikely to migrate upstream through a high gradient, colluvial reach, but may migrate many miles up a lower gradient, alluvial response reach.

Riparian Corridor

Continuous/Wide	Semi-continuous/Wide	Discontinuous/Narrow	Urbanized/ Levee Confined

In steep streams, narrow riparian corridors provide important functions, but large riparian corridors are generally associated with lower gradient, unconfined stream systems. The capacity of the stream to absorb disturbances without harm to habitat and species, often referred to as resilience, generally increases with the width of the riparian corridor; however, the probability that the stream may be adversely affected increases when the riparian corridor is narrow or discontinuous. Riparian vegetation both reduces velocity and increases soil strength. The risk to resource associated with morphologic response is greatest in urban and levee-confined streams that lack the space necessary to respond to disturbances.

Bank Erosion Potential

Naturally Non-erodible | Erosion Resistant | Highly Erodible or Revetted

Bank erosion and lateral channel migration rates are lower in channels with naturally non-erodible bank materials, such as rock or highly cohesive clay, and banks that are reinforced with vegetation. Conversely, erosion and migration rates are higher in channels with banks that are highly erodible, either due to natural conditions or because of vegetation removal or management practices. Channels with artificially revetted banks (riprap) are also classed as having a high response potential because a flood event may cause failure of the revetment, leading to rapid rates of channel change – the presence of a revetment indicates an inherently erodible bank.

Bed Scour Potential

Boulder / Clay | Cobble | Gravel | Silt | Sand

Channels with erodible bed material such as sand will respond to disturbance more rapidly and to a greater degree than those with less erodible material. Coarse sediment, particularly immobile material such as boulders, creates streams with much lower scour risk. Artificial grade control structures may indicate vertical instability, though these are often unnecessarily applied. Thus streams with grade controls are classed as having high morphologic response potential. Grade control structures can fail during large flood events causing rapid incision and channel instability, with impacts propagating both upstream and downstream.

Dominant Hydrologic Regime

Spring-fed | Snowmelt | Rain | Rain-on-Snow | Thunderstorm/Monsoon

Flow characteristics are a function of climate and watershed hydrology and determine the frequency and degree of hydrologic disturbance, which affect the relative channel stability and potential for stream response. For example, spring-fed stream systems have low flow variability and hence are highly stable and predictable. In contrast, convective thunderstorm-driven hydrology results in streams with high variability and more frequent high flows and thus they are often disturbed and destabilized.

Stream reaches that are transitional in their hydrologic regime should be evaluated for changes in hydrologic regime over time due to climate change. For example, if a stream reach is located 500-feet in elevation above the current snow level, it is possible that this reach will become a rain-on-snow dominated system in the future. Streams with co-dominant or bimodal hydrologic regimes should be evaluated at the higher response potential of the two regimes; for instance, if a basin experiences both snowmelt and convective thunderstorms, then the dominant regime should be considered the convective thunderstorm.

Coastal California and coastal southern Oregon streams may be dominated by ENSO climate cycles, repeating in approximately five year intervals. In this hydrologic regime it is El Nino phase of the cycle that dominates sediment transport and drives major channel changes.

EXPLANATION OF THE PROJECT IMPACT POTENTIAL FACTORS – Y-AXIS

Scale of Disturbance (multiple of channel width)

1x	3x	5 – 7x	10x	20+

The project impact potential factor is intended to capture potential effects to stream habitat by scaling the project extent to the channel. For instance, if the primary disturbance of a channel management action is within the channel and is 75 feet in length in a channel that is 150 feet wide, then the disturbance index would be 0.5; however, if the channel is only 15 feet wide, then the disturbance index would be 5. The potential for impacts is higher for smaller streams because more habitat units, which are also scaled to channel width, would be affected.

If the primary disturbance is in the floodplain, such as a levee set-back project, then the disturbance can be indexed to floodplain width instead of channel width. If the levee is set back, creating a 100-foot wide floodplain, and the length of the project is 1,000 feet, the index would be 10. The greater the extent of floodplain disturbance associated with project implementation, the greater likelihood of impact to natural resources.

Planning Context

Incorporated in Watershed Plan	Stand-alone Project

All stream management and restoration projects should be developed within a watershed framework; this is especially important when identifying the underlying cause of the problem. This risk factor uses watershed plans as a surrogate for project prioritization and context; it is assumed that if the project is specifically identified as part of a larger plan that some level of technical analysis has been performed to justify the need and appropriateness of the proposed project.

Artificial Bed and/or Bank Stabilization

Removed	Left in Place	Added (deformable)	Added (non-deformable)
Isolated Action		Multiple	Pervasive

Projects that constrain (1) stream processes, (2) morphologic adjustment, or (3) channel/floodplain sediment exchange are generally riskier than projects that either remove existing constraints or leave them undisturbed. Hence, the potential risk to resources associated with channel stabilization measures is lower for temporary, deformable structures than for permanent, rigid ones.

Deformable structures are designed to provide short-term stability (5 to 10-years) before degrading, thus allowing for vegetative reestablishment. Construction material may include large wood, soil lifts, brush mattresses, and other forms of bioengineering using live materials. Non-deformable structures are generally designed to last longer (50+ years) and are composed of non-degradable materials such as rock and synthetic geotextiles.

As the level of artificial channel stabilization increases within a stream reach, the more significant the impacts on aquatic species and habitat. For instance, if a rigid bank stabilization project is an isolated action, it will likely have a lesser effect on habitat than a pervasive project action that cumulatively affects 50% of the stream reach. A single project may be considered as a stand alone or in the context of cumulative impacts of other associated projects, in which case, it may represent a greater impact potential.

Monitoring & Maintenance Plan

Adaptive Management	Monitoring only	None

All projects have some level of habitat impact, hence monitoring is required to determine the extent of the impacts along with the anticipated benefits. While monitoring will detect changes and help to identify problems, adaptive management will allow for correction of these problems.

For higher impact potential projects, or new project types, an adaptive management plan can help to significantly reduce the overall risk to resources in the long-term and facilitate improved future projects.

SHORT VS. LONG-TERM IMPACTS AND ASSOCIATED MONITORING

The left hand side of the *Screening Matrix* represents low stream response potential; hence minimizing direct impacts during construction to reduce short-term impacts may be the greatest concern. Because the stream has a low response potential, focus is placed on good project design, minimization of construction impacts, and Best Management Practices.

The right hand side of the *Screening Matrix* represents high stream response potential; hence while minimization of construction impacts is important, it is the longer-term processes that may result in on-going impacts to the stream system. Because of the high stream response potential, emphasis is placed on the adequacy of the monitoring and adaptive management plan.

USING THE SCREENING MATRIX TO SCREEN PROJECT PROPOSALS

Once the impact and response factors have been assessed, screening factors can be combined and analyzed in at least three different ways:

1. Assume that all screening factors are critical to avoid resource harm. In this case, the overall risk category is defined by the highest screening factor on each of the X- and Y-axes. A good example of this precautionary principle is a stream on an alluvial fan, which would always receive a high rating for stream response potential.

2. Consider none of the screening factors to be individually critical to the resource. In this case, the overall risk category is defined by the average of the screening factors on each of the X- and Y-axes -- there is a balance among factors.

3. Deem some of the screening factors to be more important than others with no single factor dominating. In this case, the overall risk category is defined by weighting the screening factors on each of the X- and Y-axes.

There is no ‘cook book’ solution to deciding how to select the overall risk category, as each project and stream presents different challenges and risks. What is required is consistent critical thinking and transparent, evidence-based decision-making. The level of risk to natural resources is often reduced when more data are available, or if there is more familiarity of the site by the reviewer.

There is no correlation between project rating and habitat benefits – the screening matrix is used simply to determine the level and intensity of project design, review, and monitoring.

REFERENCE CITED:

Montgomery. D. R., and J. M. Buffington. 1998. Channel processes, classification, and response. *In* R. J. Naiman and R. E. Bilby (eds.), River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer, New York, NY.