Determining Sediment Impairment in New Mexico using Biologic and Geomorphic Sediment Thresholds

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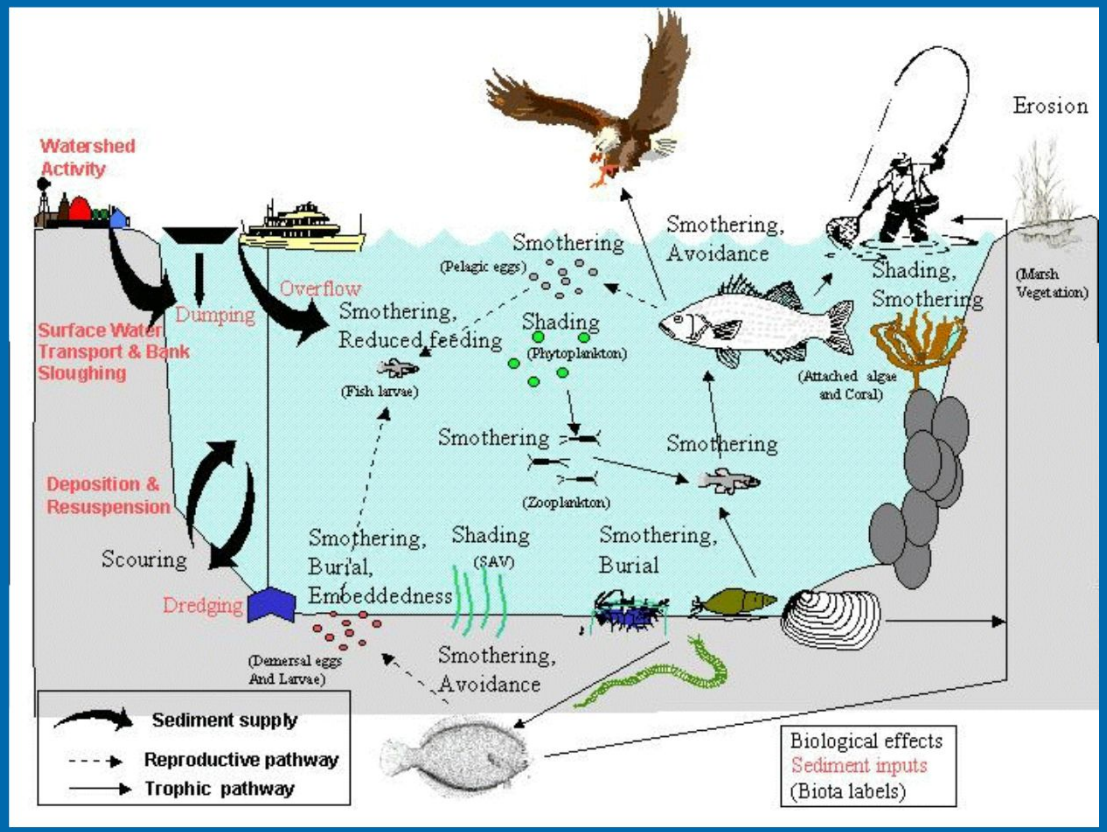
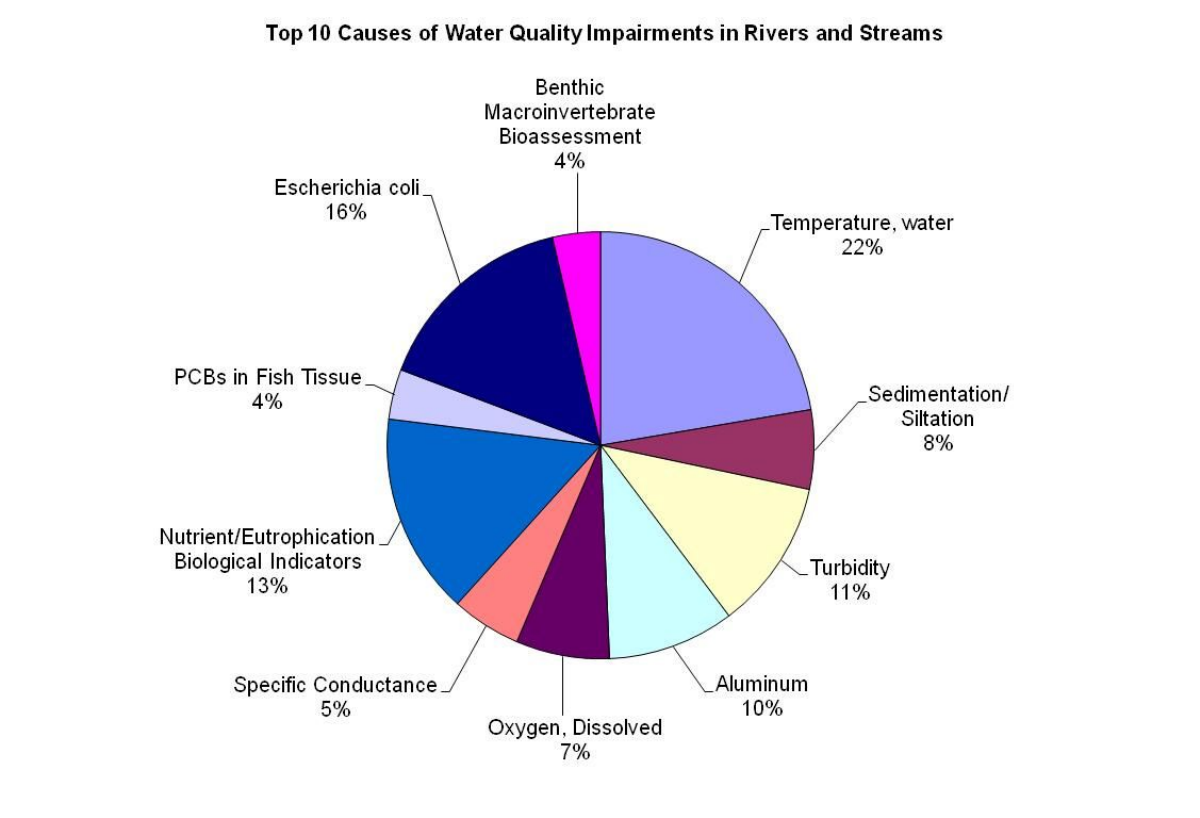
New Mexico Environment Department
Surface Water Quality Bureau

Impacts of Excessive Sedimentation



Conceptual diagram (from USEPA 2006 – graphic courtesy of W. Munns, USEPA)

Causes of Stream/River Impairment in New Mexico



Previous Sedimentation Assessment Protocol (1998- 2010)

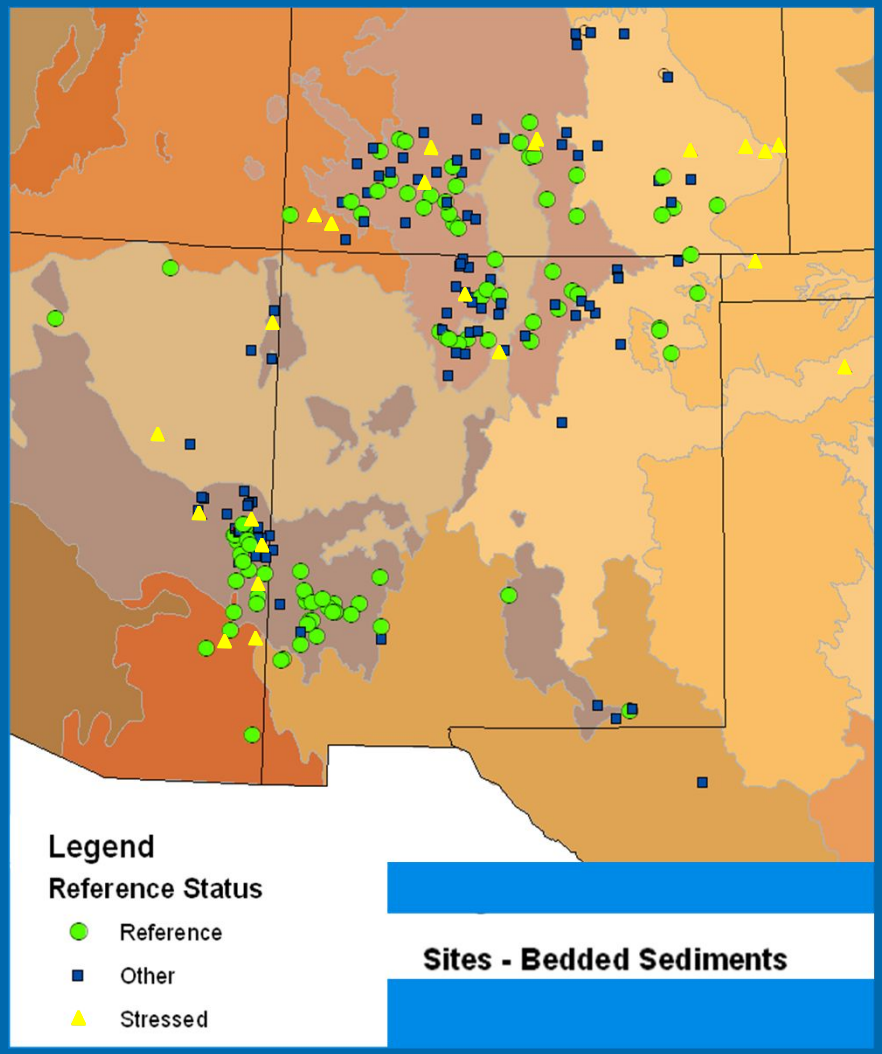
Physical \ Biological	Impaired (Non Support) RBP Index < 79% of ref M-SCI Score < 56.70	Non-impaired (Full Support) RBP Index > 84% of ref M-SCI Score > 56.70
Non-Support Percent Sand &Fines >28% increase over reference	Non-Support	Full Support
Full Support Percent Sand & Fines <27% increase* over reference	Full Support (Sedimentation); Non-Support (Unidentified Biological Impairment)	Full Support

* If percent sand and fines at study site <20, then Full Support

Sedimentation Workgroup and Goals

- Collaborative effort
- Primary goals
  - Utilize existing sediment and benthic macroinvertebrate data from New Mexico and surrounding states
  - Determine reference condition for sediment by class
  - Associate biological measures with sediment indicators
  - Determine potential quantitative sediment thresholds for New Mexico perennial streams that would be protective of our aquatic life uses
- Generally followed EPA's *Framework for Developing Suspended and Bedded Sediments (SABS) Water Quality Criteria (2006)*

Assemble Datasets



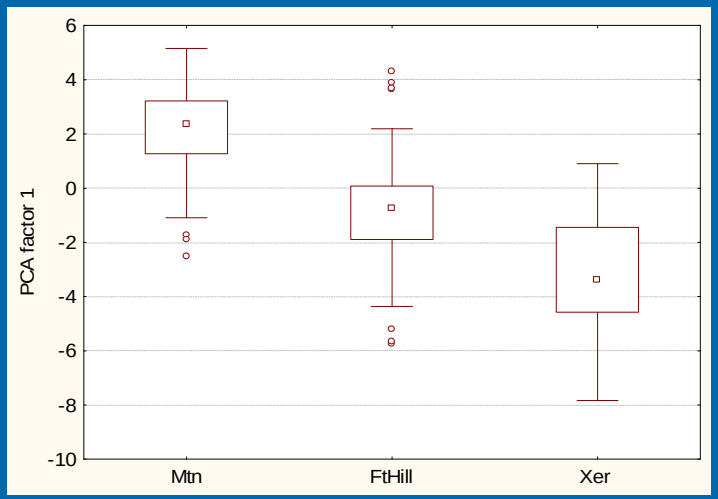
- 229 sites

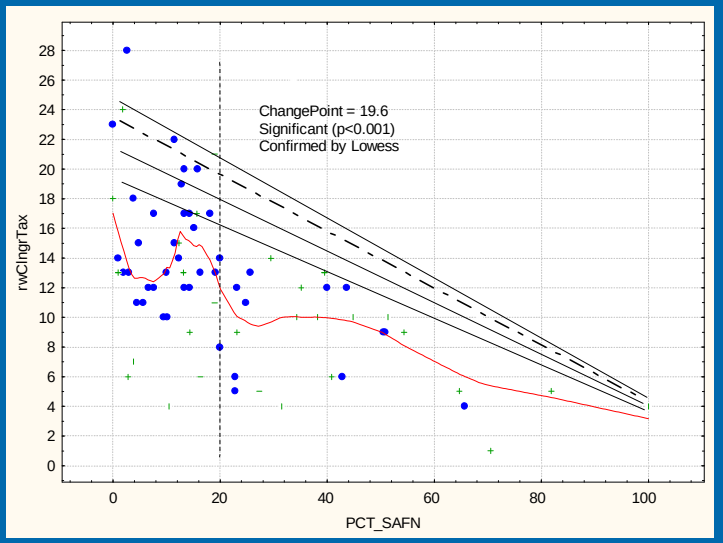
- EMAP West
- EMAP Wadeable Streams Assessment
- EMAP Arizona Streams
- EMAP New Mexico
- EMAP Colorado Streams
- GIS Data

Analysis of Sediment Indicators and Biological Measures

- Establish reference sites: 99 of 229 sites

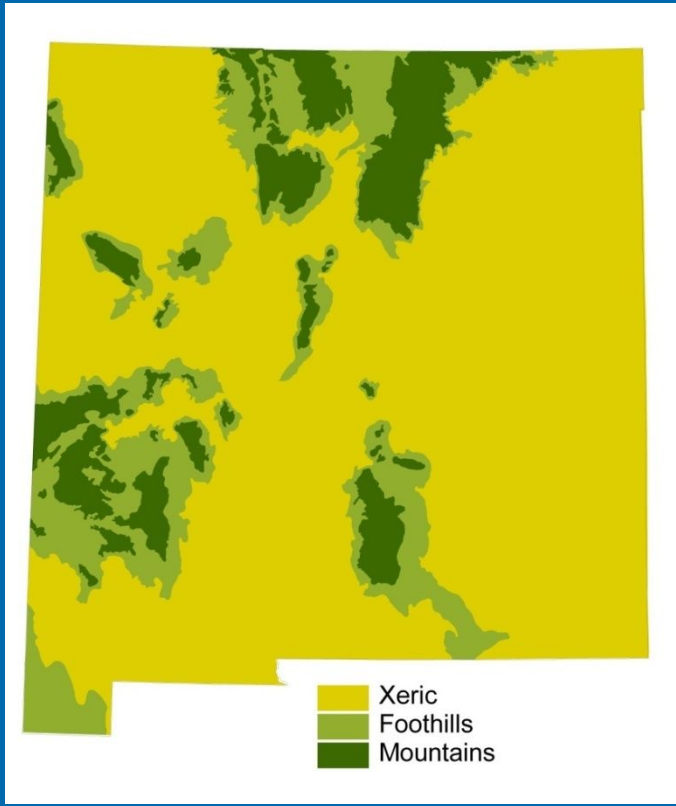
- Classify sites: Principal components analysis of environmental variables used to group Level IV ecoregions





- Describe stressor-response relationships: Reference distributions, quantile regression, and change-point analysis used to explore biological response to bedded sediment conditions

New Mexico Sediment Site Classes



Site Class	Definition
Mountains	Ecoregions 21 and 23, ***except*** *21d, 23a, 23b and 23e*
Foothills	Ecoregions 21d, 22a, 22b, 22f, 23a, 23b, 23e and 79
Xeric	Ecoregions 20, 22, 24, 25, and 26, ***except*** *22a, 22b, 22f*

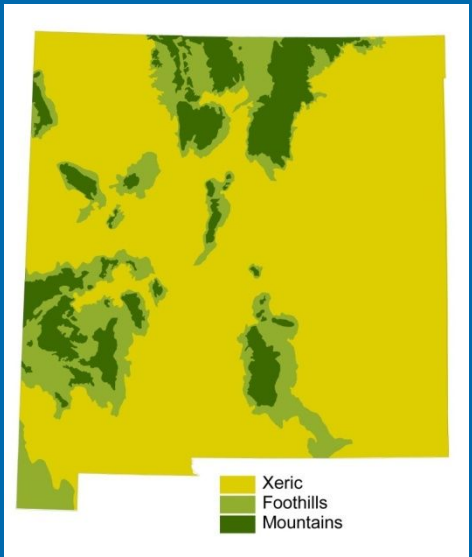
Sediment Thresholds by Site Class

% sand & fines: The percentage of systematically selected streambed substrate particles that are **≤2.0 mm** in diameter.

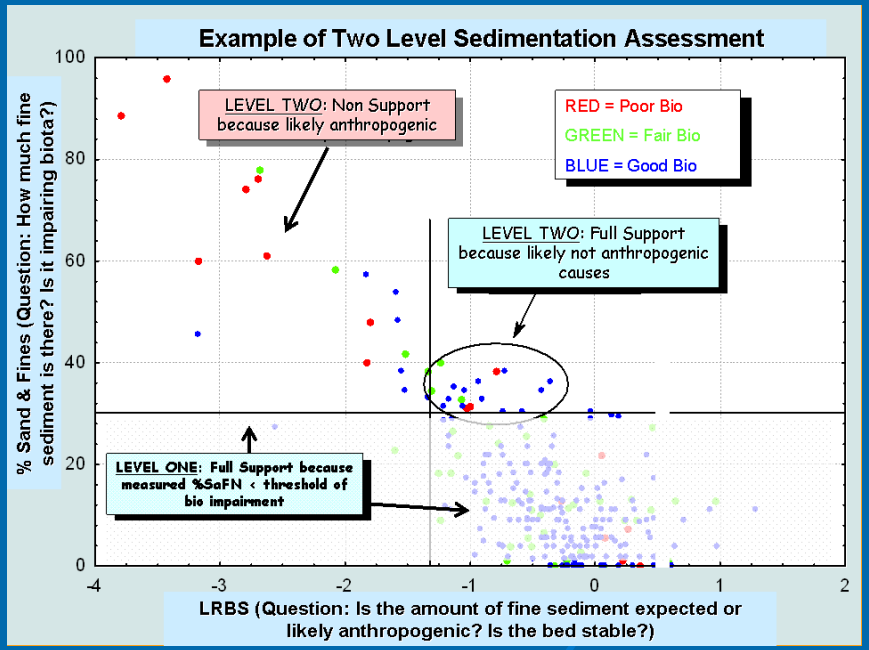
Relative Bed Stability (LRBS_NOR): The median **observed** particle size in a stream reach compared to the critical particle size **expected** to be mobilized during a bankfull event (Peck et. al 2006). Calculated from channel dimensions, roughness factors, and shear stresses (Kaufmann et al. 2008), without bedrock.

Site Class	% sand & fines	LRBS_NOR units
Mountains	< 20	> -1.1
Foothills	< 37	> -1.3
Xeric	< 74	> -2.5

Revised Sedimentation Assessment Protocol (2012 -)



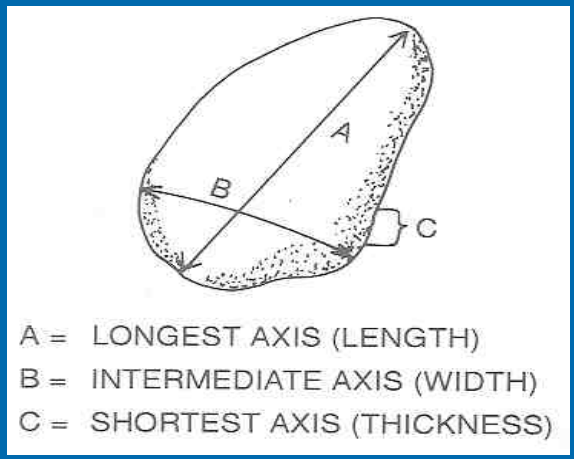
The first level considers the simpler indicator of biological impairment, and then refines the assessment with the second indicator of geomorphic impairment as needed when the first level threshold is exceeded.



Two Level Field Survey

•LEVEL ONE: Simple substrate characterization (percent of bedded sediment < 2.0 mm in diameter) to determine potential biological impairment based on the site class

Intermediate axis measured at 0, 25, 50, 75, and 100% of wetted width at 21 transects (105 total count)



Two Level Field Survey

If the % sand & fines threshold is exceeded, then complete …

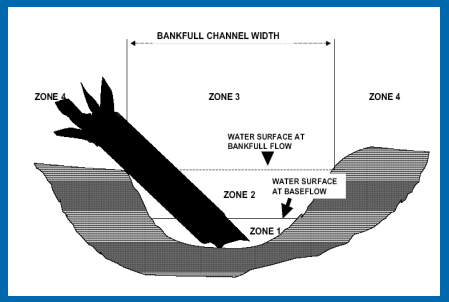
•<u>LEVEL TWO</u>: Modified Environmental Monitoring and Assessment Program (EMAP) survey to calculate LRBS_NOR

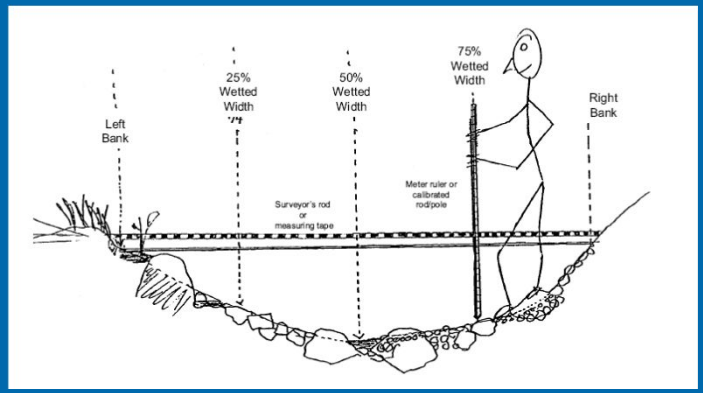
Cross sectional profile (5 transects)

Thalweg depths (100 or 150 measurements depending on stream width)

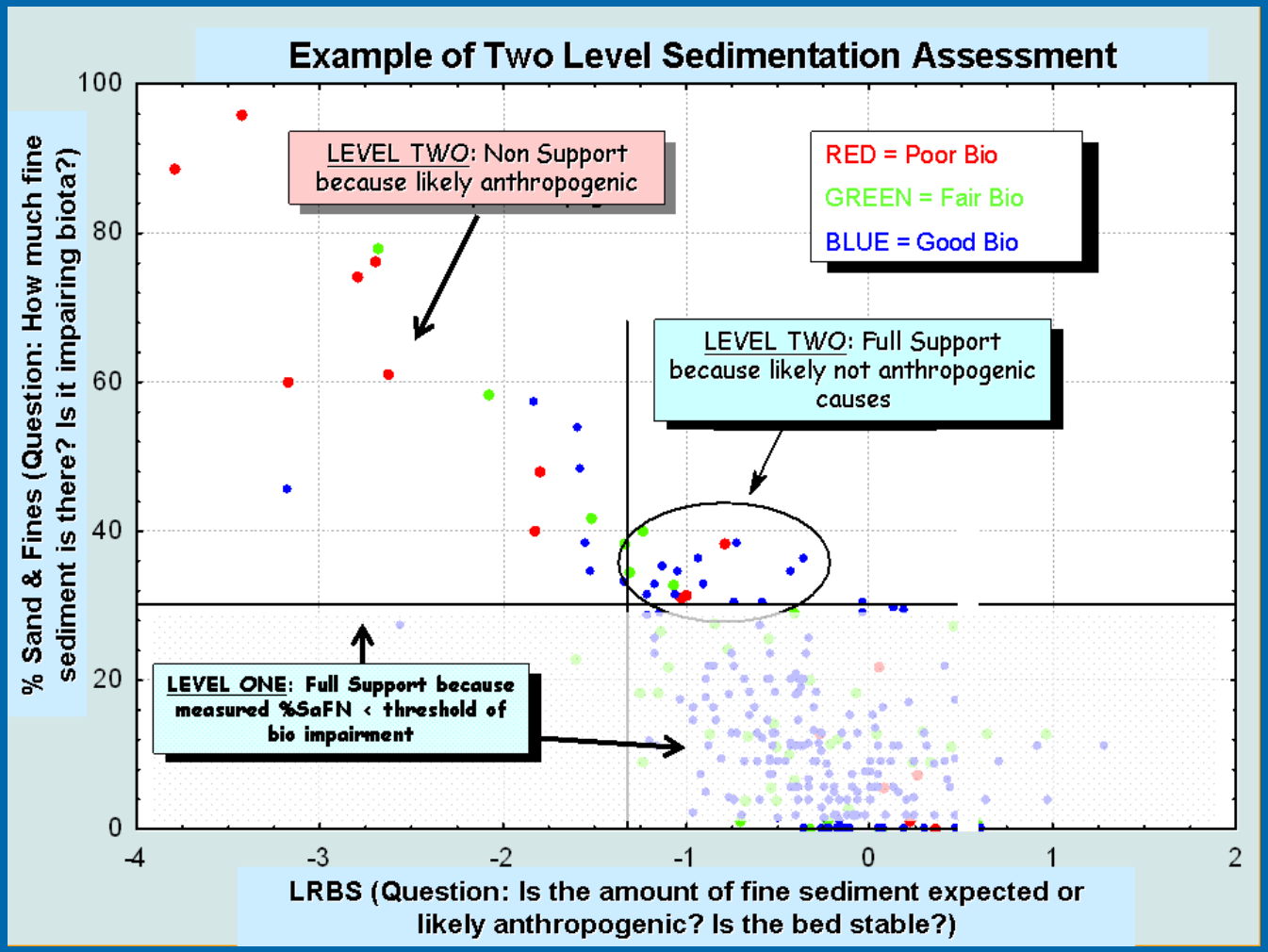
Large wood debris visual estimate (between 5 transects, 5 categories from 0% “Absent “ to > 75% “Dense”)

Slope





Two Level Impairment Determination



Upper Rio Grande Examples
2012 Integrated List

Foothills sediment class
(% sand & fines <37%, LRBS > -1.3)

Site	Level IV Ecoregion	Site Class	% sand & fines	LEVEL ONE Sediment Assessment	LRBS_ NOR units	LEVEL TWO Sediment Assessment
Rio Fernando de Taos abv Rio Pueblo de Taos	22f	Foothills	68.8%	Non Support	-2.20	***Non Support***
Rio Pueblo de Taos blw Taos WWTP channel	22f	Foothills	49%	Non Support	-1.15	***Full Support***
Cordova Creek above Costilla Creek	21d	Foothills	27.6%	***Full Support***	--	--

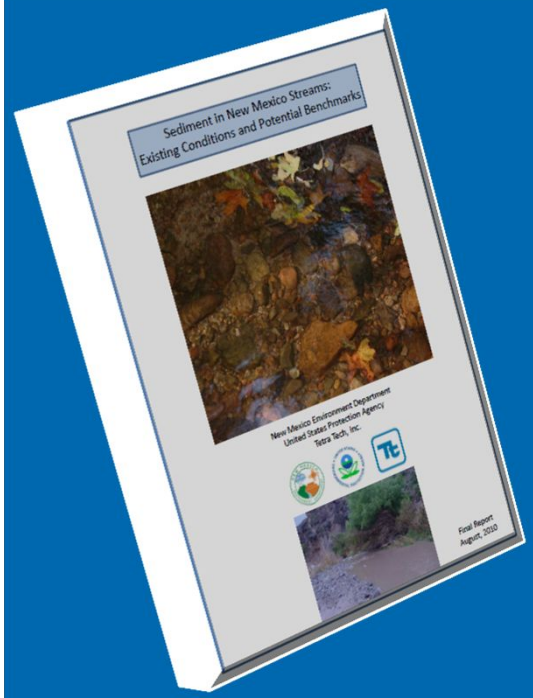
Summary and Conclusion

Primary goals of Sedimentation Workgroup were met.

Streamlined field survey and revised assessment protocol has increased efficiency and confidence in sedimentation assessments.

- No longer necessary to identify and survey individually-determined reference site(s) each survey year in order to assess for sedimentation
- No longer necessary to collect benthic macroinvertebrate data at each site in order to assess for sedimentation
- NMED is now able to assess additional stream types, especially foothills, with greater confidence

Additional Information



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New Mexico Assessment Protocols
http://www.nmenv.state.nm.us/swqb/protocols/

SWQB Physical Habitat Field Protocols
http://www.nmenv.state.nm.us/swqb/SOP/

New Mexico SWQB Sedimentation Threshold Development Website (contains 100+ page Jessup et. al report)
http://www.nmenv.state.nm.us/swqb/Sedimentation/

*** Look for upcoming article by Jessup et. al.***