



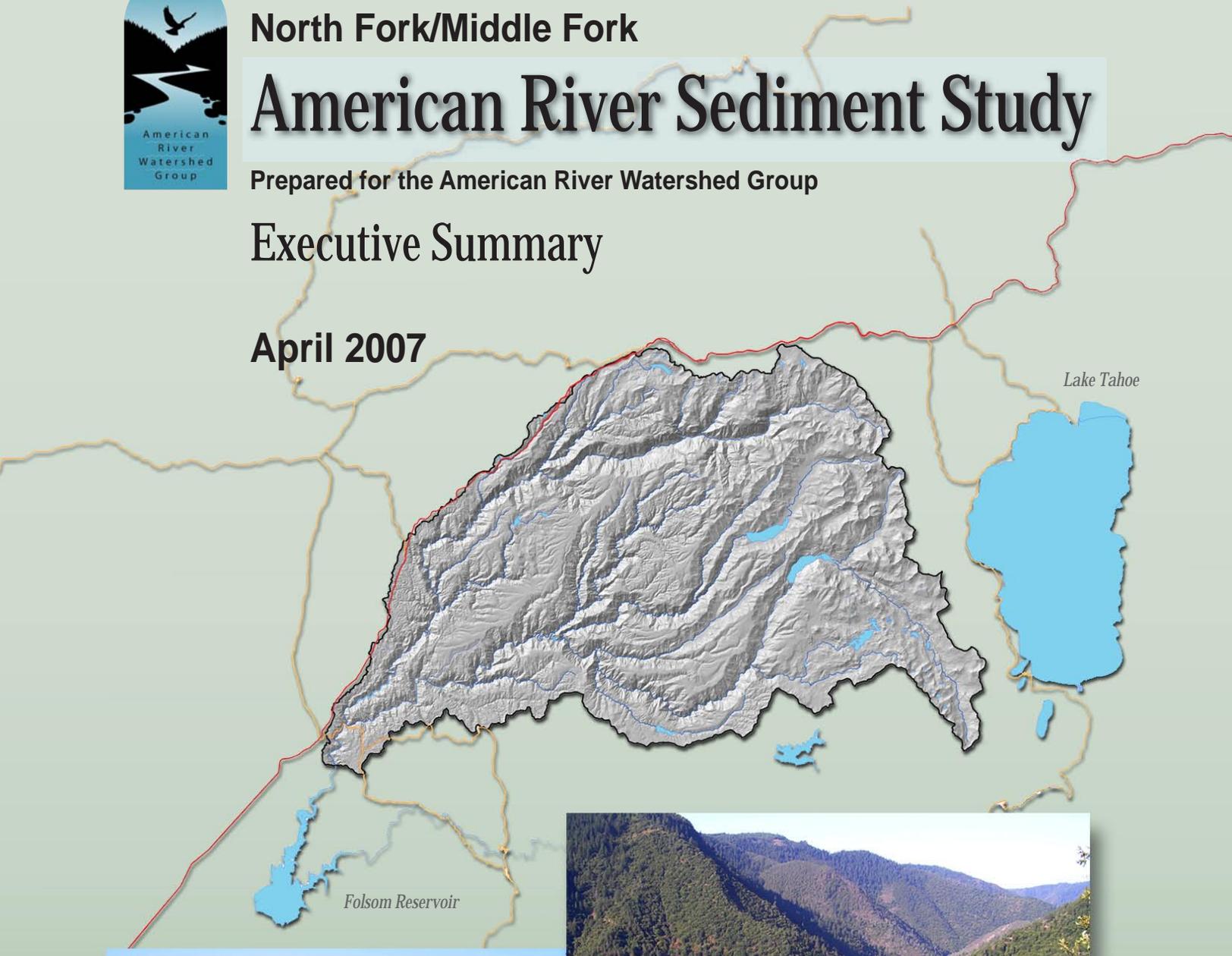
North Fork/Middle Fork

American River Sediment Study

Prepared for the American River Watershed Group

Executive Summary

April 2007



Lake Tahoe

Folsom Reservoir



Prepared by



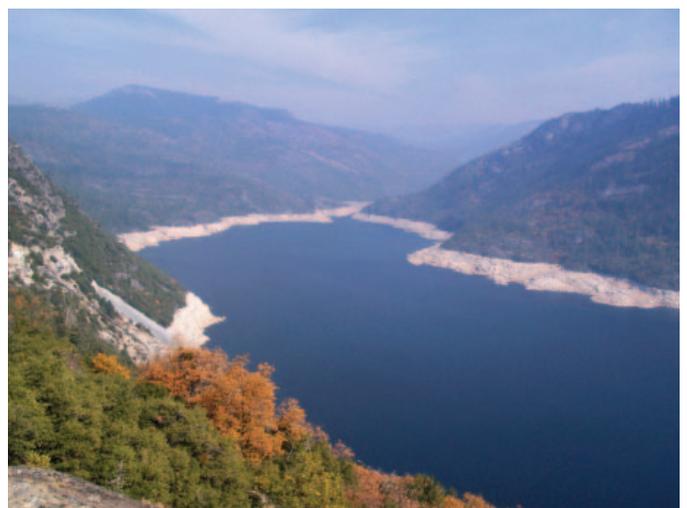
TETRA TECH EC, INC.



Abstract

The North Fork/Middle Fork American River Sediment Study uses a coarse-filtered, geographic information system (GIS)-based, subwatershed relative potential risk screening model for soil erosion and sedimentation. It synthesizes relevant information using a map-based approach to support decision-making, and provides a spatial model that prioritizes the relative risk of erosion and sedimentation by subwatershed, regardless of land ownership. Watershed indicators are used to characterize potential erosion and sedimentation hazards. The knowledge-based modeling and risk-based prioritization achieves a consistent treatment of the individual subwatersheds that make up the watershed assessment area. The outcomes of the watershed modeling and prioritization process are used to prioritize and target management strategies (i.e., best management practices, disturbance minimization, and active restoration) for higher potential risk areas (relative to erosion and sedimentation under bare soil conditions) to enhance or maintain watershed health by minimizing potential sediment-related impacts to key

resources. The prioritization can also be used as a framework for the development and implementation of a watershed monitoring plan. The opportunities for watershed protection and restoration, with emphasis in priority category 1 and 2 subwatersheds (7th-level hydrologic unit code [HUC]), are voluntary in nature with no intended land owner mandates or land-use related regulations. For successful implementation of the management strategies and priorities, a coordinated and collaborative process (including education and outreach for information sharing) among stakeholders is needed. With existing gaps in knowledge or data, an adaptive resource management approach (using inventory, monitoring, research, and adjustment) is essential for the implementation of the subwatershed-based management strategies.





North Fork/Middle Fork **American River Sediment Study**

Preface

The California Department of Water Resources (DWR) supported the North Fork/Middle Fork American River Sediment Study with Proposition 50 (Chapter 7) funds dedicated for the California Bay-Delta Authority watershed grant program. This watershed assessment project was developed and proposed by the American River Watershed Group (ARWG). The study was performed under the DWR Contract No. 4600003570 between the California Department of Water Resources and Sierra College, who supported the ARWG by administering the project. Placer County Water Agency and Placer County Resource Conservation District representatives supported the effort as the project manager and facilitator, respectively.



This Executive Summary is designed to provide a quick glimpse of the North Fork/Middle Fork American River Sediment Study. It features only a brief overview of the watershed assessment approach, findings, and next steps. Detailed information can be found in the full final report available on CD through:

**Mal Toy, Director of Resource Development
Placer County Water Agency
144 Ferguson Road
Auburn, CA 95604
E-mail: mtoy@pcwa.net**

The full final report is organized as follows:

- Chapter 1 - Introduction
- Chapter 2 - Overview of Study Approach
- Chapter 3 - Watershed Characteristics and Processes
- Chapter 4 - Watershed Indicators, Modeling, and Prioritization
- Chapter 5 - Management Strategies and Priorities
- Chapter 6 - Monitoring Framework for Adaptive Management
- Chapter 7 - Opportunities and Next Steps
- Appendix A - Literature Cited
- Appendix B - GIS Data Sources and Gaps
- Appendix C - C-1: Site Photographs and C-2: Field Review Report
- Appendix D - Detailed GIS Methods, Spatial Analysis, and Modeling.

Maps are presented throughout the report at the end of the chapters.



The Approach

Watershed Characterization and Evaluation

The American River originates in the high Sierra Nevada west of Lake Tahoe, in the Tahoe and Eldorado National Forests. The North Fork/Middle Fork American River watershed study area begins at the upstream extent of Folsom Reservoir and encompasses approximately 625,500 acres (977 square miles). This study focuses on the North and Middle forks of the American River watershed and their respective subwatersheds.

The watershed characterization describes current landscape conditions and watershed processes related to soil erosion and sedimentation. To establish the relevant ecological context, the key topics covered for the watershed characterization include: (1) drainage basin/hydrologic units; (2) land ownership, land use, and population; (3) elevation and topography; (4) geology, geomorphology, and soils; (5) climate and surface water; (6) stream network and flow regimes; (7) channel morphology and water quality; (8) aquatic species and channel habitats; (9) road network and transportation; (10) water development and mining; and (11) erosion processes and sediment dynamics.

The watershed evaluation used two approaches to identify the potential sediment delivery risk to streams in the North Fork/Middle Fork American River watershed. First, specific indicators were used to assess the watershed condition and vulnerability. Second, watershed modeling was used to characterize the relative risk

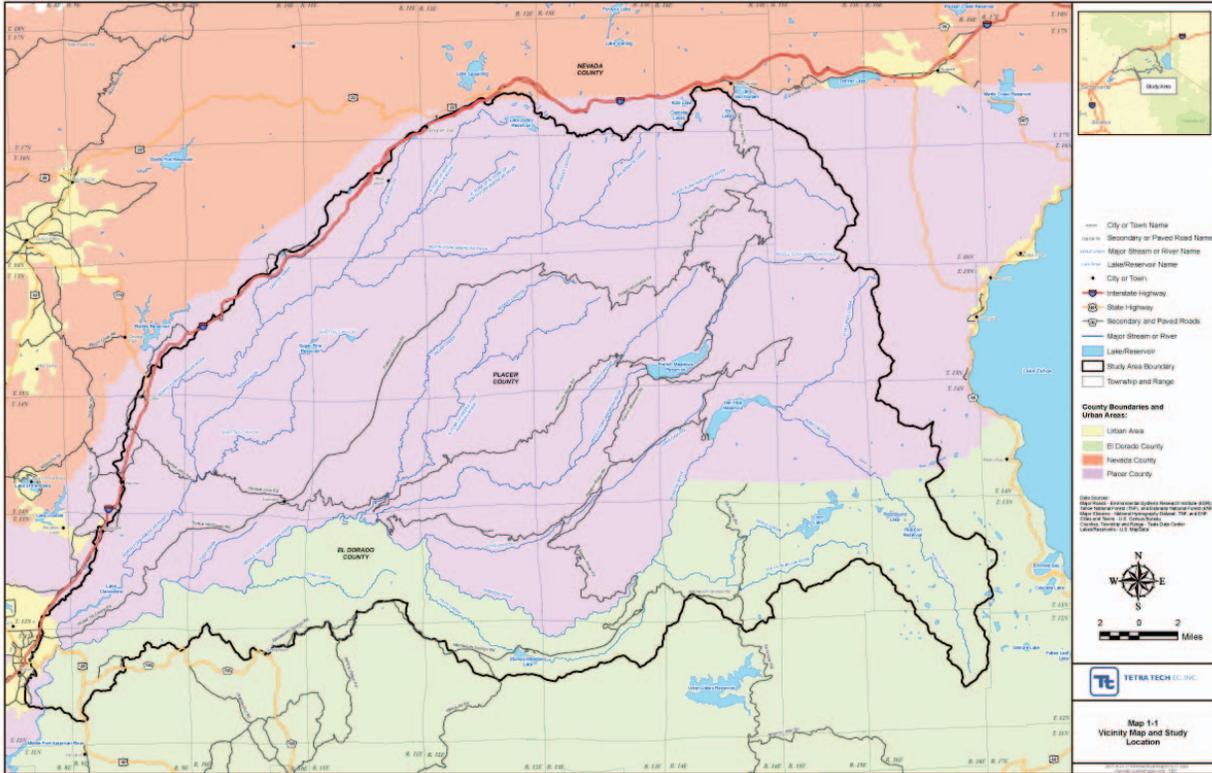
The North Fork/Middle Fork American River Sediment Study uses a coarse-filtered, GIS-based, subwatershed relative potential risk screening model for soil erosion and sedimentation. It synthesizes relevant information using a map-based approach to support decision-making, and provides a spatial model that prioritizes the relative risk of erosion and sedimentation by subwatershed.

for erosion and sedimentation and to develop a priority ranking. Land managers can use the prioritization to target, with limited financial resources, the highest potential risk areas where management practices could be implemented to optimally reduce potential adverse impacts on key resources (aquatic organisms and habitats, water and power infrastructure, and water quality).

Several GIS-based watershed indicators were developed to quantify the relative potential vulnerability of different subwatersheds to erosion and sedimentation. The watershed indicators fall into one of three categories: (A) surface erosion and mass wasting hazards, (B) road-stream interaction hazards, and (C) stream network and hydrologic hazards. The GIS-based data analysis and synthesis used the best available information for the North Fork/Middle Fork American River watershed.



North Fork/Middle Fork American River Sediment Study



Vicinity Map of North Fork/Middle Fork American River Watershed Assessment Area

Watershed Modeling and Prioritization

The relative risk for erosion and sedimentation was characterized based on inherent physical conditions (under bare soil conditions). The GIS-based watershed model and relative risk screen were used to facilitate multi-criteria decision making for strategic priority setting. The combined approach of prioritization and targeting can be used as a tool for sediment-related water quality management in the North Fork/Middle Fork American River watershed.

Seven GIS-based submodels were developed to address different potential watershed susceptibilities to erosion and sedimentation. The submodels were

designed to operate independently or be combined to produce an integrated priority ranking for 7th-level HUC subwatersheds. The seven submodels were grouped into three types: those that relate to hillslope sensitivity (i.e., precipitation sensitivity rating, erosion hazard rating, and mass wasting hazard or risk), those that involve road impacts (i.e., unpaved road density on hillslopes greater than 30 percent and unpaved roads within 100 meters of streams), and those that address stream sensitivity (i.e., overall stream density and source channel reach density).

North Fork/Middle Fork American River Sediment Study

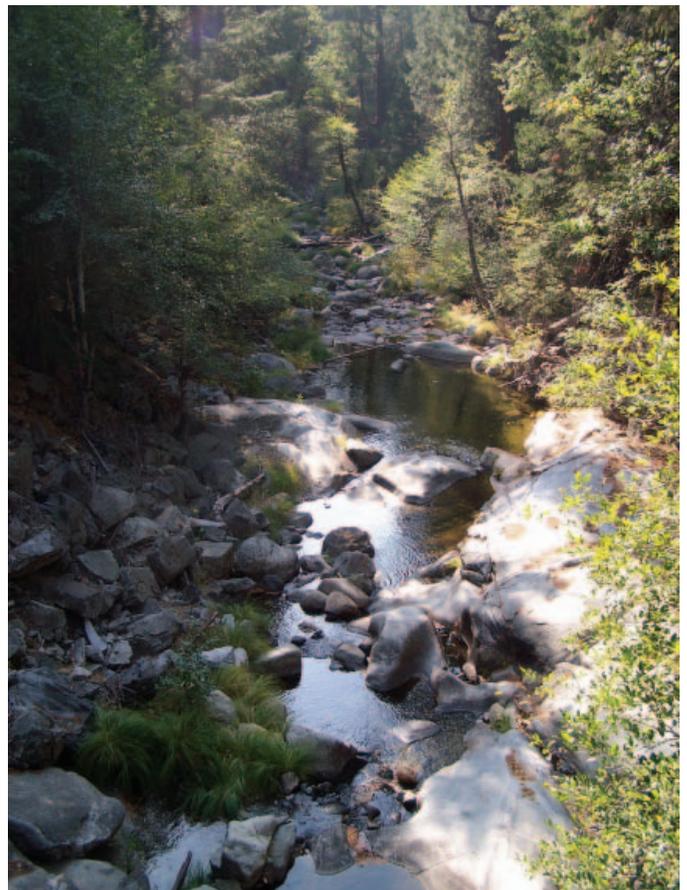


The submodels were integrated into one overall model that assesses the relative risk of sedimentation in subwatersheds across the North Fork/Middle Fork American River watershed. Two overall prioritization models were developed in parallel—one for the entire watershed assessment area and one for National Forest System lands only. For each overall prioritization model, the seven submodels were combined mathematically into three dimensionless, thematic indices: a hillslope sensitivity index, a road impact index, and a stream sensitivity index. The three separate thematic indices were combined during the priority ranking process to produce three priority categories (i.e., 1, 2, or 3). Priority categories were assigned to every 10-square-meter cell in the entire watershed assessment area. As the final step of the prioritization modeling process, the cell-based results were aggregated, regardless of land ownership or administration, for each 7th-level HUC subwatershed across the entire watershed assessment area. The ultimate goal of the ranking process is to prioritize subwatersheds and target management or enhancement practices.

The two parallel watershed prioritizations incorporate the best available data—data that cover the entire North Fork/Middle Fork American River watershed for one model, and finer-scaled data (where available) on National Forest System lands for the other model. Because these separate prioritization models are based on different datasets, they should not be directly compared. Instead, the overall prioritization of a subwatershed within a model is relative to other subwatersheds within that model.

Seven GIS-based submodels were developed to address different potential watershed susceptibilities. These were integrated into one overall model that assesses the relative risk for erosion and sedimentation.

When interpreting the subwatershed prioritization results, it is important to note that a priority category 1 or 2 ranking suggests a higher potential risk of erosion (under bare soil conditions) and a higher potential risk of sediment delivery relative to a priority category 3 ranking. The assignment of potential risk is based on broad subwatershed characteristics.





North Fork/Middle Fork **American River Sediment Study**

Consequently, only specific portions of a priority category 1 or 2 subwatershed may actually be high-risk sites. Similarly, priority category 3 subwatersheds, although generally low risk, may have localized high-risk sites. Localized surface erosion and sedimentation occurs even in priority category 3 subwatersheds. This approach

is useful for comparing and distinguishing between subwatersheds, but this assessment should not be used for site-specific or project-level interpretations. Rather it should be used as a guide to the types of potential hazard or risk factors to assess when conducting a site-specific evaluation.

Priorities and Management Strategies

The risk-based prioritization of 7th-level HUC subwatersheds and related priority categories (1, 2, or 3) was used to identify watershed enhancement opportunities. Management strategies for watershed enhancement are addressed from two perspectives—management measures (i.e., best management practices), which include general or specific approaches to control soil erosion or sediment sources, and management actions, which include watershed enhancement through

disturbance minimization and active restoration. Both strategies are keyed to the two highest subwatershed priority rankings—that is, priority category 1 and 2 subwatersheds. The basic assumption in formulating the management strategies is that land owners intend to be good stewards of their lands, and therefore many of the basic enhancement or maintenance approaches described here are suitable for land owners in priority category 3 subwatersheds as well.





Meeting Challenges through Collaboration

Resource and land managers in the North Fork/Middle Fork American River watershed face a number of strategic challenges, including: (1) management across a hierarchy of scales; (2) management across a diverse set of land-use types; and (3) management across a diverse set of public and private land ownerships.

By design, the “systems approach” for the North Fork/Middle Fork American River Sediment Study provides a framework for collaborative decision making for adaptive resource management (including monitoring and evaluation) and related watershed enhancement practices. Understanding the potential risks of erosion and sedimentation and the types of key resources that may be affected by sediment delivery allows the vulnerability of each subwatershed to be characterized without being site-specific with respect to land ownership. The watershed assessment methodology was designed specifically to meet the objectives of the current study. The knowledge-based modeling and risk-based prioritization approach used achieves a consistent treatment of the individual subwatersheds (90 7th-level HUC) that make up the watershed assessment area. At the same time, it explores the variability in these subwatersheds and ultimately highlights the areas where future efforts can focus to accomplish the greatest benefits with limited financial resources.

Data assembly focused on collecting base layers necessary to analyze potential erosion and sediment delivery to key resources. While compiling the GIS

data layers and other information, the ARWG Technical Advisory Committee (TAC) was consulted to ensure that the most representative data sources and best available information were included. The existing data were integrated into the watershed assessment with careful

The North Fork/Middle Fork American River Sediment Study met challenges by working collaboratively with the American River Watershed Group Technical Advisory Committee and other stakeholders. Through this approach, we included the most representative data sources and best available information, and created a framework for further collaboration and adaptive resource management.

review and documentation of potential differences in resolution, scale of capture, and extent between the different datasets from multiple sources. In the interest of using the best available information and appropriately managing data quality, a four-step procedure was used to compile and analyze the data.

GIS data layers were assembled from several agencies, organizations, and individuals that maintain watershed-specific data. In addition, existing data previously assembled by the USDA Forest Service and the ARWG were reviewed, and relevant data were incorporated into this study. In cases where more detailed data existed for some portions of the watershed assessment area, the more detailed GIS data layers were used. In



North Fork/Middle Fork American River Sediment Study

selected situations, new GIS data layers deemed critical to the outcome of the study were digitized.

Collaboration involves stakeholders in the decision-making process. A collaborative and iterative process was used for the

Although they typically take longer, collaborative processes commonly result in more effective outcomes, increased trust, reduced conflict, mutual learning, and new networks and institutions for sharing information and undertaking projects.

development and implementation of the North Fork/Middle Fork American River Sediment Study. Although they typically take longer, collaborative processes commonly result in more effective outcomes, increased trust, reduced conflict, mutual learning, and new networks and institutions for sharing information and undertaking projects. Additionally, collaboration allows for limited resources to be leveraged across groups to allow funding to be spent most effectively. The ongoing efforts of the ARWG and ARWG TAC are an example of a collaborative process at work.





The Findings

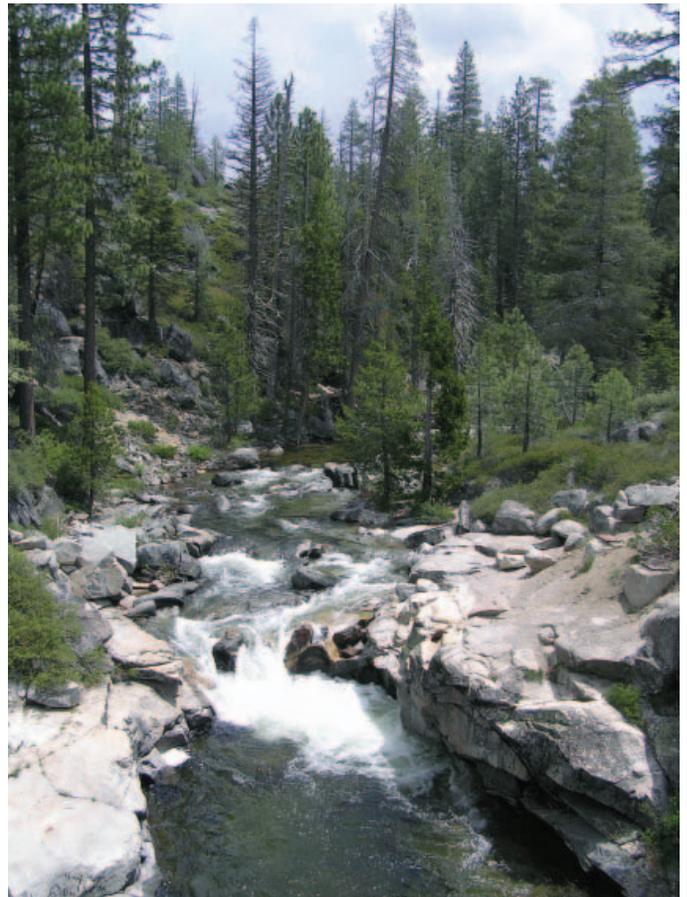
This North Fork/Middle Fork American River Sediment Study focuses primarily on GIS-based, watershed relative risk screening for potential soil erosion and sediment delivery at the 7th-level HUC subwatershed level. This approach is a reconnaissance-level analysis using watershed hazard indicators and not a detailed, fieldwork-based analysis of hillslope erosion and stream channel sedimentation. However, future adaptive management strategies (including inventory, monitoring, research, and plan adjustment) can be tiered off of this approach. In an overall phased process, this coarse-filtered, GIS-based study will allow the ARWG to continue progressing toward the ultimate goal, the implementation of a watershed management plan.

The results of this watershed assessment can be used to design and implement a monitoring and evaluation strategy, using geomorphic predictors to evaluate disturbance sensitivity and recovery potential, or conduct subwatershed-specific sediment studies to investigate sediment sources and yields. It can be used to examine sediment delivery and transport, and to develop and validate predictive or process-based models for soil erosion, runoff, and sediment delivery.

Major sediment sources identified in the North Fork/Middle Fork American River watershed relate to historical mining activities (“legacy” problem sites) and not

to watershed-scale accelerated erosion problems. Sediment-related water quality does not appear to be a major concern, except in localized areas.

The results of both the watershed indicators assessment and the watershed modeling prioritization reflect similar patterns. The prioritization results for





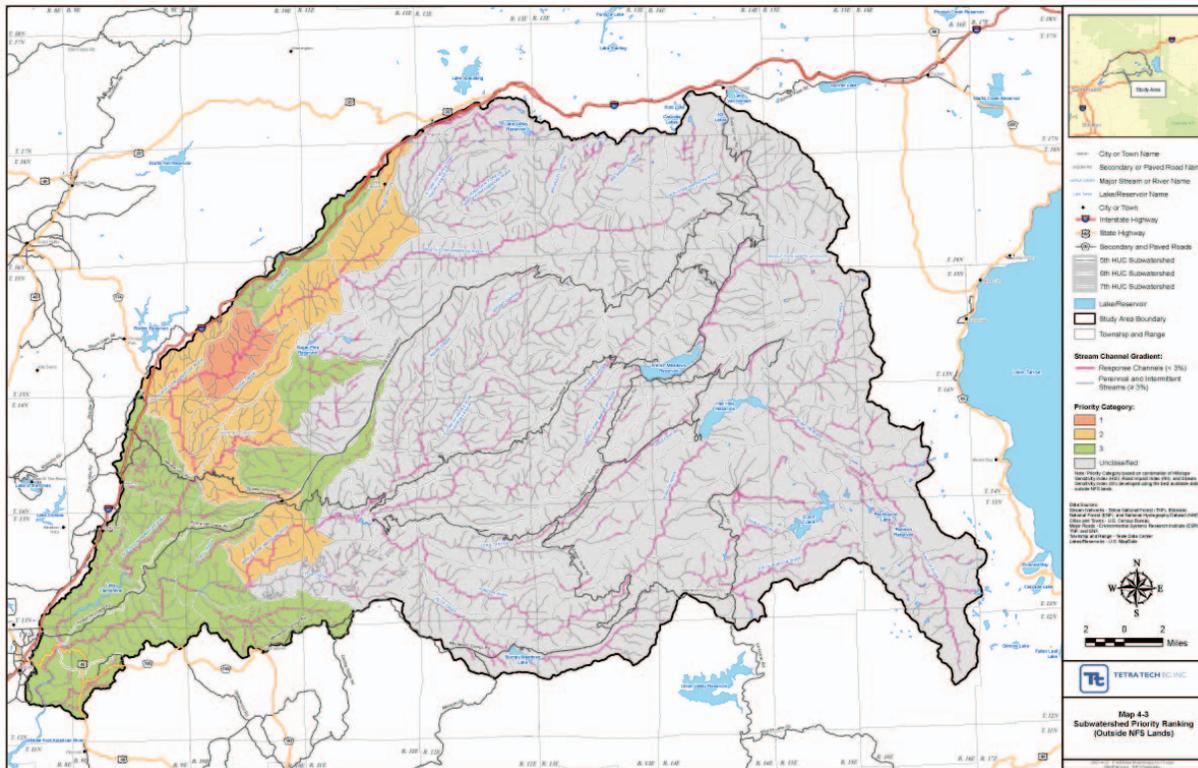
North Fork/Middle Fork American River Sediment Study

7th-level HUC subwatersheds outside of National Forest System lands (with less than 75 percent on National Forest System lands) and within National Forest System lands (with at least 75 percent on National Forest System lands) are presented below. The 7th-level HUC subwatersheds are nested under both the 6th-level and 5th-level HUC subwatersheds on the maps. If

several top-priority 7th-level HUC subwatersheds occur in a 6th-level HUC subwatershed, then a strategic program might consider further investigations of potential erosion and sedimentation throughout the entire 6th-level HUC subwatershed. The 6th-level HUC subwatersheds that include at least one top-priority 7th-level HUC subwatershed are listed below.

1. For the prioritization model covering non-National Forest System lands:

- North Fork American River-Indian Creek



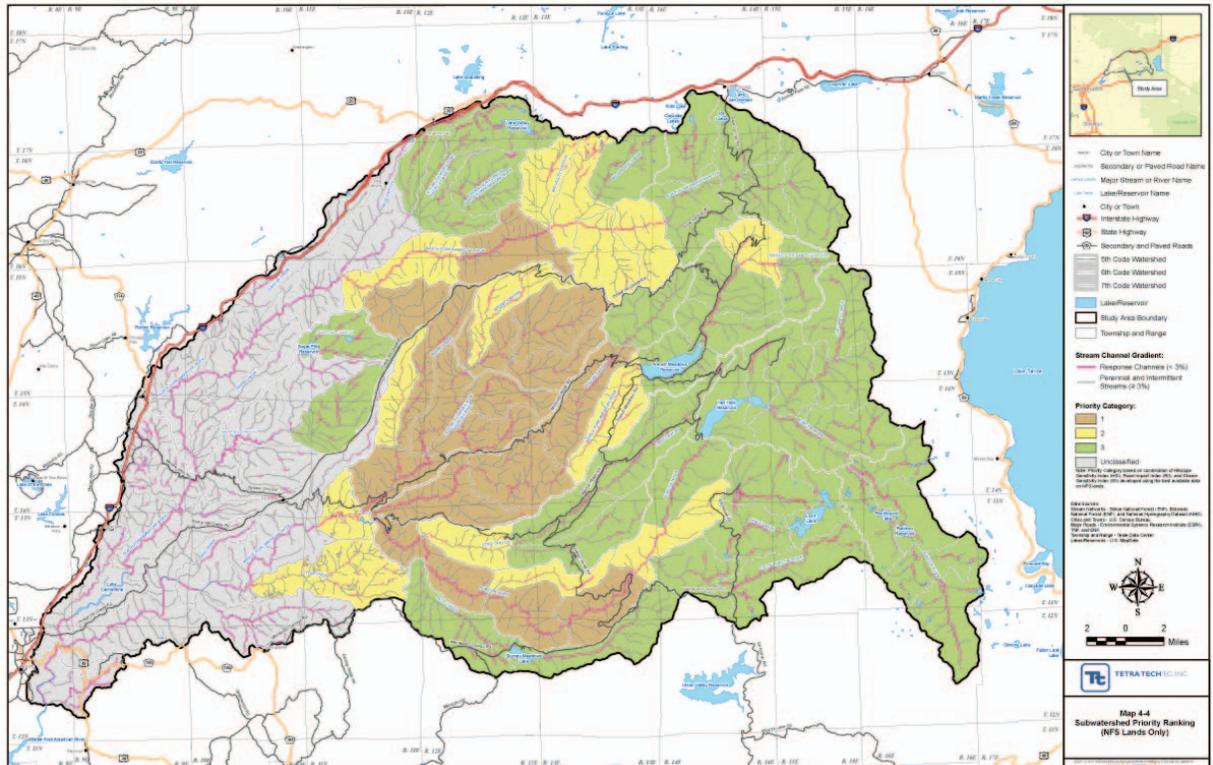
Subwatershed Priority Ranking for Non-National Forest System Lands

North Fork/Middle Fork American River Sediment Study



2. For the prioritization model covering National Forest System lands:

- Middle Fork American River-Duncan Canyon
- Lower Rubicon River
- Lower North Fork Middle Fork American
- Upper North Fork Middle Fork American
- North Fork American River-Mumford Bar



Subwatershed Priority Ranking for National Forest System Lands

The selection of the higher-priority 7th-level HUC subwatersheds within each of these 6th-level HUC subwatersheds is based on the inherent susceptibility of these areas to erosion and sedimentation processes, coupled with relatively dense road systems, many of which were likely created during mining, logging, and other historical land use activities. In the watershed indicators assessment, each of these 6th-level HUC subwatersheds appeared more susceptible to the surface erosion and mass wasting, road-stream interaction, and stream network and hydrologic hazards.

The outcomes of the watershed prioritization process can be used to target management strategies (i.e., best management practices, disturbance minimization, and active restoration) to areas with higher potential risk of erosion and sedimentation (under bare soil conditions). The results can also be used as a framework for the development and implementation of a watershed monitoring and adaptive management plan. An adaptive management approach is a key element of any ecosystem-based



North Fork/Middle Fork American River Sediment Study

strategy. In adaptive management, monitoring is integrated with management for a continuous feedback and adjustment loop to improve management actions. If monitoring is integrated with management, adequately designed, and effectively implemented (with clear goals and specific

objectives), it will allow us to evaluate how well the management actions meet their objectives and what actions to take to modify management practices to achieve desired outcomes. Adaptive management is essential when there are gaps in critical knowledge or data.

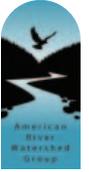
Assumptions and Limitations

This study is a coarse-filter analysis of potential erosion hazard and sedimentation risk (under bare soil conditions) based on the best available spatial data for all or large portions of the North Fork/Middle Fork American River watershed. The watershed prioritization presented takes into account broader subwatershed characteristics and does not incorporate site-specific erosion and sedimentation hazards. By design, the coarse-filter analysis presented can be used to prioritize additional, more focused studies. The current analysis is not intended and is

not sufficiently site-specific to serve as the basis for regulatory compliance. This watershed assessment does not address the effects of land use or management activities. It is not a detailed, fieldwork-based analysis of hillslope erosion and stream channel sedimentation. The current prioritization models are based on the best available information both on and off National Forest System lands. Caution should be used before making any direct comparisons between the subwatersheds priority rankings developed using separate data sources.



This approach is a reconnaissance-level analysis and should not be used for site-specific or project-level interpretations. Rather, it should be used as a guide to the types of potential hazard or risk factors to assess when conducting a site-specific evaluation.



The Next Steps

Management opportunities and possible next steps that can be considered and potentially implemented in the North Fork/Middle Fork American River watershed are presented here. The opportunities for watershed enhancement, adaptive management and monitoring, and information needs are based on the key findings of this watershed assessment. The goal of the recommendations is to identify watershed enhancement opportunities and management practices that could contribute towards maintaining watershed functions and minimizing the accelerated

delivery of sediment to key resources. These recommendations can serve as the starting point of a phased action plan (4 to 12 years) for watershed management, and strategically guide efforts to obtain the necessary multi-source funding to implement programs based on priorities.

The goal of the recommendations is to identify watershed enhancement opportunities and management practices that could contribute towards maintaining watershed functions and minimizing the accelerated delivery of sediment to key resources.

Priority Watersheds and Targeted Management

1. Seek voluntary implementation of management measures in priority category 1 and 2 subwatersheds for reduced soil erosion and sediment delivery.

Subwatersheds identified as priority category 1 and 2 have the highest potential risk of effects to key resources from increased erosion and sedimentation; thus, the management measures (general or specific approaches) are targeted for these subwatersheds.

2. Promote an integrated and collaborative process for voluntary implementation of management measures to protect beneficial uses and values.

The ARWG can promote a coordinated and collaborative process to engage watershed residents and stakeholders in the voluntary implementation of the management measures identified in this watershed assessment. In addition, the ARWG can conduct systematic and progressive education and outreach campaigns to engage residents and stakeholders in understanding the watershed's generally high water and aquatic habitat quality.



North Fork/Middle Fork **American River Sediment Study**

Watershed Protection and Restoration

1. Adopt and implement voluntary management actions for watershed protection and restoration.

The watershed protection and restoration strategies also are targeted for the priority category 1 and 2 subwatersheds. These watershed enhancement opportunities are addressed by two strategies: protection by disturbance minimization and active restoration.

2. Promote a coordinated and collaborative process for implementation of the proposed management actions

for watershed protection and restoration.

The voluntary implementation of management actions identified to maintain natural watershed functions (disturbance minimization) and to enhance watershed functions (active restoration) would be most effective through a coordinated and collaborative process by watershed residents and stakeholders guided by the ARWG. Successful implementation of the management strategies includes collaboration, education, and outreach.

Monitoring and Evaluation for Adaptive Management

The ARWG can work to develop a monitoring network with federal, state, and regional programs. In addition, citizen monitoring can be a useful component of the monitoring framework. The ARWG can work towards implementing a collaborative monitoring and evaluation process for adaptive management. For the best results, the elements of adaptive resource management—monitoring, evaluation, and adjustment—can be designed to increase the probability of achieving desired outcomes for watershed enhancement.

Monitoring Framework:

1. Develop and implement a monitoring program of appropriate intensity and with

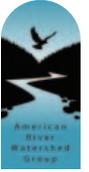
appropriate diagnostic features to address critical questions and meet the objectives of knowledge-based decision support.

Evaluation and Adjustment Process:

1. Decide on the specific indicators to measure and how to measure them to detect changes;

2. Establish the criteria to determine when an indicator is within the desired condition range and what to do when it is outside that range; and

3. Adopt integrative procedures for the feedback and adjustment loop for continuous improvement in management practices.



Filling Critical Data or Knowledge Gaps

Inventory and Monitoring Needs:

- 1. Field verify the source (e.g., streams) and analysis (e.g., mass wasting hazard) GIS data layers used in the North Fork/Middle Fork American River Sediment Study. In particular, focus on the data layers that were used to evaluate watershed hazard (erosion and sedimentation potential).**
- 2. Assemble the Tahoe National Forest and Eldorado National Forest stream habitat inventories into a consistent database that represents attributes such as physiographic positions, stream types, channel gradients, instream habitat structures and conditions, sediment regimes, and the amounts of subwatershed disturbance. Identify and integrate other stream inventory data that may exist in the watershed.**
- 3. Coordinate with the California Department of Conservation Office of Mining Reclamation to inventory abandoned and active mine sites in the North Fork/Middle Fork American River watershed to identify areas that are contributing sediment to streams. Review the existing reports on mine site water quality impacts and assemble their sediment evaluations into the inventory. Evaluate hydraulic mining debris in the North and Middle Forks of the American River to determine if any sites are appropriate for stream bank or other restoration actions to prevent excessive sedimentation.**
- 4. Coordinate with the Tahoe National Forest and Eldorado National Forest (and their roads analysis programs) to inventory road locations, types (including all-terrain vehicle trails and historic roads), characteristics (including cross-drain spacing, slope position, cut-fill amounts, and road gradients), uses (including season and volume), and maintenance levels. Identify sources of erosion and sediment delivery both on and off of National Forest System lands, and inventory road-stream connectivity, including near stream roads and road-stream crossings.**
- 5. Monitor erosion rates, sediment routing, and biological responses, stratified by land-use practices, in selected subwatersheds of the North Fork/Middle Fork American River watershed. Monitor runoff, sediment-related water quality, and biological responses. A distributed monitoring network could be implemented to identify the level of disturbance by land-use practices. Monitoring data could be used to help establish cumulative watershed effects of land management practices.**



North Fork/Middle Fork **American River Sediment Study**

6. Perform mass wasting and landslide inventories and assess their stream channel sediment contributions.

Opportunities for Further Research:

- 1. Evaluate the relationship of mass wasting to Cenozoic volcanic deposits. Develop a more-detailed geologic mapping of these volcanic formations (including mapping the contact between the Mehrten and Valley Springs formations). Evaluate Cenozoic volcanic formations with respect to slope stability to develop a more refined conceptual model of slope instability.**
- 2. Research the geologic fault lines, joint angle orientations, and other geologic types (e.g., serpentine) that may affect mass wasting in the North Fork/Middle Fork American River watershed. Inventory mass wasting to determine the relationship between mass**

wasting type, bedrock or geological material, soils, slope angle, local surface and subsurface drainage characteristics, and disturbance.

- 3. Complete a mass wasting study to evaluate the relationships between landslides, landslide movement, and precipitation amounts and intensities. Conduct watershed-specific hydrometeorological studies to gain a basic understanding of the hydrologic condition and processes. Evaluate the relationship between the hydrologic regime, subbasin morphometry, and the rates of erosion, sediment transport (both hillslope and inchannel), and sediment deposition.**
- 4. Use Light-Imaging Detection and Ranging (LiDAR) to map erosion sources and mass wasting areas. Study could be focused on investigating the cause-effect relationships between land-use practices and sedimentation, and between sedimentation and biotic responses.**
- 5. Examine road effects on geomorphological and hydrological processes on a watershed scale.**





Acknowledgments

Many thanks to the individuals and agencies that contributed funding, time, and technical expertise to the collaborative process that produced the North Fork/Middle Fork American River Sediment Study.

Special thanks to:

California Bay-Delta Authority (funding source)

California Department of Water Resources (funding source)

American River Watershed Group (ARWG, watershed grant leadership)

ARWG Technical Advisory Committee (technical oversight)

Sierra College (project administration)

Placer County Water Agency (project management)

Placer County Resource Conservation District (project sponsor and facilitator)

We are pleased to acknowledge the support, insights, and comments of the following participants (in alphabetical order by last name) in the ARWG Technical Advisory Committee:

Kevin Cornwell (California State University, Sacramento)

Tim Dabney (USDA Forest Service, Georgetown Ranger District)

Marie Davis (Placer County Water Agency)

Doug Ferrier (Forest Slopes Management)

Vern Finney (Natural Resources Conservation Service)

Rich Gresham (Placer County Resource Conservation District)

Mary Grimm (USDA Forest Service, American River Ranger District)

Cliff Heitz (Natural Resources Conservation Service)

Mike Hunerlach (USDI Geological Survey, Water Resources Division)

Rich Johnson (USDA Forest Service, American River Ranger District)

Carol Kennedy (USDA Forest Service, Tahoe National Forest)

John Lane (Teichert Aggregates)

(Continued)



North Fork/Middle Fork **American River Sediment Study**

Stefan Lorenzato (California Department of Water Resources)

Christine Mai (USDA Forest Service, Eldorado National Forest)

Katie Maloney (Placer County Resource Conservation District)

Eric Nichol (California Department of Water Resources)

Kevin Roberts (Sierra Pacific Industries)

Sandra Scott (Sierra College)

Dan Teater (USDA Forest Service, American River Ranger District)

Bill Templin (American River Watershed Group)

Mal Toy (Placer County Water Agency)

Matt Triggs (USDA Forest Service, American River Ranger District)

Jann Williams (USDA Forest Service, Eldorado National Forest)

Dan Wermiel (CALFED Bay-Delta Program)

Tetra Tech EC, Inc. completed the North Fork/Middle Fork American River Sediment Study and prepared the final report. The ARWG Technical Advisory Committee supported and facilitated this study for its successful development and implementation. We would like to express our gratitude to other individuals not listed here that have contributed through their immensely helpful suggestions, criticisms, and data/information exchanges.



North Fork/Middle Fork American River Sediment Study

Executive Summary