Upper Elk River
Sediment Total Maximum Daily Load

Elk River Forum
November 16, 2013
Eureka, CA

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Water Resource Control Engineer
Planning Unit
North Coast Regional Water Quality Control Board
Presentation Overview

- Water Quality Standards and Scope of TMDL
- Status of Upper Elk Sediment TMDL
- Watershed Overview
- Details of Upper Elk Technical TMDL to address management-related hillslope and instream sediment loading
- TMDL Implementation Strategy
Water Quality Standards

- Beneficial Uses
- Water quality objectives to protect uses
- Antidegradation to maintain and protect existing uses and high quality water
- Program of implementation

TMDL

- Comprehensive Analysis
- Improved program of implementation and monitoring
## Water Quality Objectives

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suspended Material</strong></td>
<td>Waters shall not contain suspended material in concentrations that cause nuisance or adversely affect beneficial uses.</td>
</tr>
<tr>
<td><strong>Settleable Material</strong></td>
<td>Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.</td>
</tr>
<tr>
<td><strong>Suspended Sediment Load</strong></td>
<td>The suspended sediment load and suspended sediment discharge rate of surface water shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.</td>
</tr>
<tr>
<td><strong>Turbidity</strong></td>
<td>Turbidity shall not be increased more than 20 percent above naturally occurring background levels. Allowable zones of dilution within which higher percentages can be tolerated may be defined for specific discharges upon the issuance of discharge permits or waiver thereof.</td>
</tr>
</tbody>
</table>
Nuisance (Defined in CWC § 13050)

Anything which meets all of the following requirements:

(1) Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property.

(2) Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.

(3) Occurs during, or as a result of, the treatment or disposal of waste.
Elk River TMDL

Comprehensive Peer Reviewed Assessment:

- Identifies impaired reaches (Geographic scope)
- Characterizes the water quality impairments (Problem Statement)
- Quantifies the magnitude and timing of sediment discharges to Elk River (Sediment Source Analysis)
- Develops measures of progress toward attainment of water quality standards (Numeric Targets)
- Describes the sediment loading capacity of the river to ensure water quality standards are met (TMDL, Loading Capacity, MOS)

Implementation and Monitoring Being Developed

- Develops a watershed recovery and TMDL attainment strategy (Program of Implementation)
- Describes monitoring and adaptive management
Elk River Watershed

58.3 square miles

- North Fork Elk River (22.5 mi²)
- South Fork Elk River (19.5 mi²)
- Lower Elk River (10.4 mi²)
- Martin Slough (5.9 mi²)
Elk River Geologic Terrains
Elk River
Waterbody Delineations
Fine Sediment Impairments

• Deposition of settleable material impacts beneficial uses and causes flooding
  – Altered channel and floodplain morphology
  – Diminished streamflow conveyance capacity
  – Diminished pool size
  – Reduced substrate grain size
  – Cross-sectional areas continue to decrease
• Elevated turbidity and suspended sediment concentrations impact fisheries, water supplies
• Loss of property uses (access, structures, water systems)
Comparison with Historic Conditions

USGS gaged Upper Mainstem Elk (1958-1967)
PL reoccupied site beginning in 1998

1965-2003 = 35% reduction in bankfull cross-sectional area
Nuisance Flooding Conditions

(California Water Code section 13050)

11/16/2013

Photo by N Sievert, 2003

Photo part of RWB files, 2003
Cumulative Effects

Photo by N. Sievert, 2005

Photo by A. White, 2008

11/16/2013
Background on Elk

- High levels of harvesting, roading
- Violations of FPRs/BP
- Stressing storms
- Channel filling, degradation of water supplies, flooding
- 303(d) listed
- Need for coordinated and comprehensive evaluation of harvesting impacts, flooding, and recovery and monitoring strategy
Current RWB Implementation Program in Upper Elk

- Inventory, prioritize, treat & monitor existing sediment sources
- Avoid creation of new sediment sources; limit overall areas of landuse disturbance as a means of controlling harvest-related landslides and peakflow increases from canopy removal
- Monitor landslide occurrence and instream sediment loads
Upper Elk River Source Analysis

- Timing and magnitude of natural and management-related hillslope sediment sources
- Sub-basin analyses based on site specific data
- Reference and managed study sub-basins for generalized loadings where no site specific data available
Upper Elk River Source Analysis

Data sources:

• Humboldt Redwood Company
• Pacific Lumber Company
• Green Diamond Resource Company
• Bureau of Land Management
• Pacific Watershed Associates
• Stillwater Sciences
• North Coast Regional Water Board
• Redwood Sciences Laboratory
• California Geologic Survey
• Salmon Forever
• Humboldt State University
# Upper Elk Source Analysis: Natural

<table>
<thead>
<tr>
<th>Sediment Source</th>
<th>Data Sources Relied Upon / Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Creep</td>
<td>Literature</td>
</tr>
<tr>
<td>Bank Erosion</td>
<td>Field surveys; natural drainage density estimate</td>
</tr>
<tr>
<td>Small Streambank Landslides</td>
<td>Field surveys; natural drainage density estimate</td>
</tr>
<tr>
<td>Shallow Hillslope Landslides</td>
<td>Areas not harvested in past 15 years</td>
</tr>
<tr>
<td>Deep seated Landslides</td>
<td>CGS mapped active features; Palco WA rates</td>
</tr>
</tbody>
</table>
### Upper Elk Natural Sources Summary

<table>
<thead>
<tr>
<th>Natural Sediment Source Category</th>
<th>Annual Average Sediment Loading (yd$^3$/mi$^2$/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Creep</td>
<td>0.4</td>
</tr>
<tr>
<td>Bank Erosion</td>
<td>8.9</td>
</tr>
<tr>
<td>Small Streambank Landslides</td>
<td>26.1</td>
</tr>
<tr>
<td>Shallow Hillslope Landslides</td>
<td>30.1</td>
</tr>
<tr>
<td>Deep seated Landslides</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>68.4</td>
</tr>
</tbody>
</table>

11/16/2013
# Upper Elk Source Analysis: Management

<table>
<thead>
<tr>
<th>Sediment Source</th>
<th>Data Sources Relied Upon / Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Order Channel Incision</td>
<td>Field-based estimates of managed and natural drainage density; assumed 75% occurred in 1950’s and 5% in each subsequent decade</td>
</tr>
<tr>
<td>Management-Related Soil Creep</td>
<td>Soil creep to management-induce channel network</td>
</tr>
<tr>
<td>Management-Related Bank Erosion</td>
<td>Field surveys in managed study sub-basins; managed drainage density estimate; subtracted natural loading</td>
</tr>
<tr>
<td>Management-Related Open Slope Shallow Landslides</td>
<td>Sub-basin specific landslide inventory data from Palco WA and 2005 ROWD; non-road-related slides, includes some skid-related slides</td>
</tr>
<tr>
<td>Road-related Landslides</td>
<td>Sub-basin specific landslide inventory data from Palco WA and 2005 ROWD</td>
</tr>
</tbody>
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## Upper Elk Source Analysis: Management

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<tr>
<th>Sediment Source</th>
<th>Data Sources Relied Upon / Approach</th>
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</thead>
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<tr>
<td>Management-Related Streamside Landslides</td>
<td>Field surveys in managed sub-basins in Freshwater Creek; applied to natural drainage density estimate assuming bank erosion captured features in management-induced network; subtracted natural loading</td>
</tr>
<tr>
<td>Management-Related Discharge Sites</td>
<td>Sub-basin specific site inventories from Palco WA, HRC CAO reports, GDRC WDR reports, BLM reports</td>
</tr>
<tr>
<td>Post-Treatment Discharge Sites</td>
<td>Compiled monitoring results from BLM, HRC, and GDRC from sites treated in Elk River.</td>
</tr>
<tr>
<td>Skid Trails</td>
<td>Compiled findings from Elk River skid-related inventories on BLM and HRC lands to estimate loading from skid sites not included in Management Discharge Site inventories</td>
</tr>
<tr>
<td>Road surface erosion</td>
<td>Sub-basin road densities &amp; surface condition based on Palco and HRC WA and ROWD; unit loading based upon Palco ROWD</td>
</tr>
<tr>
<td>Harvest surface erosion</td>
<td>Estimated harvest history in clear-cut equivalents based upon CDF, Palco WA, and Palco ROWD; unit loading based upon Palco WA</td>
</tr>
</tbody>
</table>
TMDL to Attain WQ Standards

\[ \text{TMDL} = \text{Loading Capacity} = \text{Natural Background} + \text{Waste Load Allocation} + \text{Load Allocation} + \text{Margin of Safety} \]
Results

\[
\frac{\text{SSL}_{\text{Objective}}}{\text{SSL}_{\text{Background}}} \times 100 = \% \text{ Natural SSL to attain turbidity objective}
\]

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004</td>
<td>123%</td>
</tr>
<tr>
<td>2005</td>
<td>126%</td>
</tr>
<tr>
<td>2006</td>
<td>115%</td>
</tr>
<tr>
<td>2007</td>
<td>132%</td>
</tr>
<tr>
<td>Mean</td>
<td>124%</td>
</tr>
</tbody>
</table>

Loading Capacity = 120% of Natural loading, with a Margin of Safety
TMDL  = Loading Capacity

= \sum (\text{Natural Background} + \text{Waste Load Allocation} + \text{Load Allocation} + \text{MOS})

= (0 \text{ WLA}) + \text{Load Allocations} + \text{MOS}

= 1.2 \times \text{Natural Background}

= 1.2 \times (68 \text{ yd}^3/\text{mi}^2/\text{yr})

= 82 \text{ yd}^3/\text{mi}^2/\text{yr}
Load Allocation  = Loading Capacity – Natural Background

= 82 yd$^3$/mi$^2$/yr - 68 yd$^3$/mi$^2$/yr

= 14 yd$^3$/mi$^2$/yr

= Upslope Loading - Instream Loading
<table>
<thead>
<tr>
<th>Management-Related Sediment Source Category</th>
<th>Allocation (yd³/mi²/yr)</th>
<th>2004-2011 Loading (yd³/mi²/yr)</th>
<th>Percent Reduction from 2011 Loading</th>
<th>Schedule to Achieve Allocations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Management-Related Upslope Sediment Loading</td>
<td>14</td>
<td>417</td>
<td>97%</td>
<td>20 years</td>
</tr>
</tbody>
</table>
Instream Loading = (Volume management-related deposits) ÷ (upstream area) ÷ (10 year time frame for restoration)

<table>
<thead>
<tr>
<th>Reach description (downstream to upstream)</th>
<th>Estimated Volume Stored within Reach (yd$^3$)</th>
<th>Upstream drainage area (mi$^2$)</th>
<th>Volume per Unit Area (yd$^3$/mi$^2$)</th>
<th>Instream Loading (yd$^3$/mi$^2$/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Mainstem: Shaw Gulch to confluence</td>
<td>260,000</td>
<td>45</td>
<td>5,777</td>
<td>578</td>
</tr>
<tr>
<td>Lower North Fork: confluence to Browns Gulch</td>
<td>280,000</td>
<td>22</td>
<td>12,727</td>
<td>1,273</td>
</tr>
<tr>
<td>Lower South Fork: confluence to Toms Gulch</td>
<td>100,000</td>
<td>19</td>
<td>5,263</td>
<td>526</td>
</tr>
<tr>
<td><strong>Total Middle Reach</strong></td>
<td><strong>640,000</strong></td>
<td><strong>45</strong></td>
<td><strong>14,222</strong></td>
<td><strong>1,422</strong></td>
</tr>
</tbody>
</table>
**Targets:** Translate Allocations and Objectives to Inform Implementation and Compliance

- Hillslope Targets
  - Address factors influencing sediment source categories
  - Provide basis for conditions in future permits
  - Progress informed by monitoring program
- Instream Targets to support beneficial uses and prevention of nuisance
  - COLD, SPAWN, MIGR, MUN
  - Bankfull conveyance capacity
  - Progress informed by monitoring program
<table>
<thead>
<tr>
<th>Management-Related Sediment Source Category</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headward Incision in Low Order Channels</td>
<td>Zero increase in existing drainage network</td>
</tr>
<tr>
<td>Bank Erosion and Streamside Landslides</td>
<td>Decreasing trend in length of unstable channel</td>
</tr>
<tr>
<td></td>
<td>Harvest-related peak flow increases in Class II and III watercourse catchment areas do not exceed 10% in 10 years</td>
</tr>
<tr>
<td></td>
<td>All road segments are hydrologically disconnected from watercourses</td>
</tr>
<tr>
<td>Open Slope Shallow Landslides</td>
<td>Decrease in management-related open-slope landslide delivery in conformance with load allocation</td>
</tr>
<tr>
<td>Management-Related Sediment Source Category</td>
<td>Target</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Road Related Landslides</td>
<td>Improving trend in stability of roads in conformance with load allocation</td>
</tr>
<tr>
<td>Deep Seated Landslides</td>
<td>Zero increase in discharge from deep seated landslide due to management-related activities</td>
</tr>
<tr>
<td>Road Surface Erosion</td>
<td>Decrease road surface erosion to load allocation</td>
</tr>
<tr>
<td>Management Discharge Sites and Skid Trails</td>
<td>No new management discharge sites created</td>
</tr>
<tr>
<td></td>
<td>Treatment of all controllable management discharge sites</td>
</tr>
<tr>
<td>Watershed Indicator</td>
<td>Targets</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Riparian Areas</td>
<td>Improving trend in quality of riparian stands capable of providing: 1)</td>
</tr>
<tr>
<td></td>
<td>delivery of wood and complexity to the channel for sediment metering,</td>
</tr>
<tr>
<td></td>
<td>stabilization, and to provide habitat elements, 2) slope stability to</td>
</tr>
<tr>
<td></td>
<td>minimize sediment delivery associated with landslide features, and 3)</td>
</tr>
<tr>
<td></td>
<td>ground cover to ensure sediment control.</td>
</tr>
<tr>
<td>Cumulative Watershed</td>
<td>The maximum timber harvest rate is ~1.5% of a Class I subbasin area and</td>
</tr>
<tr>
<td>Effects</td>
<td>~1.5% of ownership.</td>
</tr>
</tbody>
</table>
Program of Implementation

• Revise Waste Discharge Requirements (WDRs) to conform with load allocations
• Control strategy to attain hillslope load allocations for all management-related sediment sources
• Identify and implement feasible recovery actions to remediate instream deposits
• Target for cumulative watershed effects ties voluntary remediation of instream deposits to hillslope activities
Adaptive Implementation for 20-Year Recovery Conceptual Model

Plan and permit instream deposit recovery actions

Implement instream deposit recovery actions

Open slope landslides; road-related landslides

Management discharge sites and their treatments; road surface erosion; harvest surface erosion

Bank erosion and streamside landslides

Percent Attainment of Load Allocations

Annual Timber Harvest Rate

0.0% 0.5% 1.0% 1.5% 2.0% 3% 5% 41% 76% 94% 95% 96% 97% 98% 100%
External Scientific Peer Review of Upper Elk River TMDL Staff Report

• Cal/EPA coordinates Peer Review Program through the University of California
• Four reviewers with expertise in fisheries, water quality, hydrology and geomorphology, and slope stability
• Technical TMDL submitted in March 4, 2013; comments received April 26, 2013
• Reviewers evaluated if the assertions, findings, and conclusions were based upon sound scientific knowledge, methods, and practices
Peer reviewer comments

• Sound scientific basis for:
  – Water quality impairments
  – Reference subbasin in natural loading estimates
  – Management-related loading estimates
  – Loading Capacity
  – Load allocation strategy for hillslope and instream loading
  – Hillslope targets
  – LIDAR DEM and landslide hazard modeling and mapping strategy
  – Adaptive implementation

• Suggested greater detail on:
  – Instream conditions, provide individual cross section data
  – Implementation and monitoring plans

• Concerns/Recommendations:
  – Lower harvest rate may be needed to attain allocations
  – Channel conveyance target may not reflect unimpaired conditions
  – Habitat enhancement actions may be warranted for salmonids
Upper Elk River WDR Development

**Objective:** Update and consolidate the regulatory structure in place for timber operations and associated activities (including restoration) in the Upper Elk River watershed to be consistent with the load allocations and targets presented in the Upper Elk River TMDL.

**Desired Outcome:** Adopt, by single action of the Regional Water Board, the Upper Elk TMDL and TMDL implementation plan through a watershed WDR for all timberlands within the Upper Elk, including BLM, Green Diamond, HRC and non-industrial timberlandowners.
TMDL & WDR Next Steps

• Coming months
  – Continue stakeholder outreach
  – Describe and resolve key technical issues
  – Continue to refine scope and content of WDR

• Spring 2014
  – Release Public Review Drafts of TMDL Staff Report, WDR, and Adopting Resolution
  – Workshop

• Summer 2014
  – Receive and respond to public comments
  – Revise drafts

• Winter 2014/2015
  – Adopting hearing for proposed TMDL Staff Report, WDR, and Adopting Resolution
Instream Deposits: Elk River Recovery Assessment

• TMDL and WDR: appropriate tools for new activities, source control
• Stored material remains an enormous water quality problem
• Restoration is necessary to remedy channel storage
• 2004 RWB Resolution:  
  – Restoration actions need to be based upon a scientifically defensible feasibility study  
  – Need for lead entity for funding and permitting
• Restoration actions need to be scientifically-based, have a high likelihood of success, and avoid unintended consequences.
• Elk River Recovery Assessment is the tool to identify restoration actions to ameliorate pre-HRC problem
Elk River Recovery Assessment

• Over a 18.5 mile reach (top of Middle Reach Elk River downstream to Humboldt Bay):
  – Document existing channel morphology and sediment conditions
  – Develop, calibrate, and validate hydrodynamic and sediment transport model
• Assess the system trajectory:
  – Existing sediment loads,
  – Reduced sediment loads,
  – A suite of broad recovery actions and reduced sediment loads
• Prioritize a suite of direct recovery actions
• Develop scientifically defensible, peer reviewed restoration plan to recover beneficial uses and abate nuisance flooding conditions in middle reach of Elk River.
Project Team

• CalTrout
• Northern Hydrology and Engineering
• Stillwater Sciences

Current Project Partners

• Humboldt Redwood Company
• State of California Coastal Conservancy
• Redwood Community Action Agency
• Bureau of Land Management
• Salmon Forever
• Elk River residents
Elk River Recovery Assessment: Funding

- Recovery Assessment exceeds funding typically awarded through planning grants
- Water Code Section 13443 allows RWB to apply to State Board Cleanup and Abatement Account (CAA) to assist in responding to a water quality problem posing public health threat
- 2009-2010 HRC paid $330,000 into CAA as a result of civil liability penalties accrued by Pacific Lumber Company
- 2013 State Board approved $475,030 from CAA for Recovery Assessment
- Cost shares from Coastal Conservancy, HRC, and RCAA
- Contract request package currently under review
Staff Contacts

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Track Elk River TMDL development, and download documents for review and comment:

http://www.waterboards.ca.gov/northcoast/programs/tmdl/elk

Sign-up for announcements pertaining to Elk TMDL:

http://www.waterboards.ca.gov/resources/email_subscriptions/reg1_subscribe.shtml