



New Tools for Evaluating  
Alpine Sensitivity & Water Quality  
in the Upper Animas Watershed  
San Juan County, Colorado  
Revised Work Plan

Submitted by  
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## Executive Summary

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### **New Tools for Evaluating Alpine Sensitivity & Water Quality in the Upper Animas Watershed San Juan County, Colorado**

**Hydrological Unit Code:** 14080104

**Latitude & Longitude:** 37° 48' 43" N, 107° 39' 50" W

**Watershed:** Animas

**Identified Subwatershed Regions of Study:** Arrastra Gulch, Blair Gulch, Cunningham Gulch, Deer Park Cr.

#### **Environmental Setting/Problems**

San Juan County, CO (SJC) was at the center of the metal mining boom in the San Juan Mountains late in the 19<sup>th</sup> century. Although most mining activity ceased by the 1940s (some activity occurred as recently as the 1990s), the legacy of that activity lives on in colorful historical buildings as well as the effects of the metals in both surface and ground water through historical mining practices. These metals also occur in the water through natural processes. Metals in both surface and ground water can exceed EPA Clean Drinking Water Standards. In addition, the upper Animas watershed is experiencing pressure from recreational users and potential development. Identification and the mapping of sensitive areas would be a useful tool for resource management, preservation, and land use planning purposes. Since much of the private property in SJC takes the form of mining claims, often requests for development relate to these mining claims. However, reasonably accurate maps of these properties are non-existent. Such mapping will also aid in identifying public vs. private land for recreational users on the Alpine Loop (a scenic system of 4WD and other roads in the mountains north of Silverton). Currently, San Juan County officials must deal with protecting water quality and human health without the benefit of more accurate private property boundary maps, relevant scientific information or adequate tools.

#### **Major Goals**

The primary goal of this project is to take both existing and newly created data relating to water quality and to create an integrated user-friendly set of tools to be utilized by the San Juan County Board of County Commissioners (BOCC), Planning Commissioners and Assessor in making scientifically-based land use decisions—specifically as relates to effects on water quality and human health issues.

#### **Project Summary**

Although a great deal of water quality research has been done in the Animas watershed, the data collected has never been assembled into a package that is useful for land use planners. This project will focus on key areas in the Upper Animas Watershed to 1) review and re-organize relevant existing water quality data and information in order to identify human health risks relating to domestic and drinking water, 2) identify sensitive alpine areas including wetlands and 3) improve upon the accuracy of existing mining claim maps. From this information, an integrated package will be developed for use by the BOCC, Planning Commissioners, County Planner, Assessor, landowners and other agencies. Finally, County officials will be trained in the use of this information as an aid to making informed land use decisions.

**Funds Requested:** \$30,000

#### **Matching/Leveraged Funds**

Cash match is from GIS contractor, Computer Terrain Mapping of Boulder, CO who will subcontract with MSI for the identification of control points to facilitate the more accurate mapping of mining claims (\$5,000); from San Juan County (\$2000); and Fort Lewis College also for the purchase of ARCIMS server hardware and software (\$5000) In-kind match is in the form of office space (San Juan County, \$6500); proposal development and project planning by MSI staff (\$3500); lab analysis services from University of Colorado (\$2666); Dr. Mark Williams' salary for supervising the alpine sensitivity study (\$1400); and in Bill Simon's fee there is a \$2600 in-kind match.

**Cash Match:** \$12,000

**In-Kind Match:** \$16,666

## **PROPOSAL**

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### **Environmental Problem Description**

San Juan County, CO was at the center of the metal mining boom in the San Juan Mountains late in the 19<sup>th</sup> century. Although most mining activity ceased by the 1940s (some activity occurred as recently as the 1990s), the legacy of that activity lives on in colorful historical buildings as well as the effects of the metals in both surface and ground water through historical mining practices. These metals also occur in the water through natural processes. Metals in both surface and ground water can exceed EPA Clean Drinking Water Standards. In addition, the upper Animas watershed is experiencing pressure from recreational users and potential development. Little is known about what areas are most sensitive to these pressures, perturbations and the subsequent effects on water quality. Since much of the private property in SJC takes the form of mining claims, often requests for development relate to these mining claims. However, reasonably accurate maps of these properties are non-existent. Such mapping will also aid in identifying public vs. private land for recreational users on the Alpine Loop (a scenic system of 4WD and other roads in the mountains north of Silverton).

### **Project Goals**

The overall goal of the project is to provide SJC officials scientifically-based tools for making smart growth decisions and to improve land use planning. This information will also benefit other land managers, such as the BLM, in carrying out their public land management responsibilities. These tools relate specifically to making decisions based on alpine sensitivity to perturbations, drinking water quality, and the potential effects of development and recreational use on water quality, e.g., where drinking water is likely to be unsafe, the effects of septic systems on hydrological flowpaths, the effects of roads and landscaping on the water supply or the effects of recreational use, etc. Currently, San Juan County officials and public land managers must deal with these issues without the benefit of relevant scientifically-based information and tools. “Water is a community asset that is critical to public health, economic stability, environmental quality, and quality of life. Sustainable communities protect their watersheds and conserve wetlands, flood plains, and other aquatic resources.”<sup>1</sup> Much water quality data exists, but it is not in a form that is useful to them. Three main components will be created to achieve this goal: 1) hydrogeomorphic identification of sensitive alpine areas to include wetlands, 2) mapping of existing and potential drinking and domestic water supplies and 3) more accurate mapping of mining claim properties. The outputs from these components will be combined in an integrated package (maps, tables, reports & GIS coverage) that will provide SJC officials scientifically-based tools to be used in making smart growth decisions. The areas identified for initial study by the San Juan Planning Commission are: Arrastra Gulch, Blair Gulch, Cunningham Gulch, and Deer Park Cr. (with Minni Gulch and Maggie Gulch also being mentioned as possibilities). Approximately 10 sq. kilometers will be studied in these areas.

### **Project Description**

#### **Background & Partners**

The Mountain Studies Institute (MSI), the submitting organization for this proposal, is a not-for-profit mountain research and education organization established in 2002 in Silverton, Colorado. In discussions with SJC officials it was agreed that MSI would seek funding for and coordinate a project that would be similar in focus to the alpine sensitivity study conducted in San Miguel County (SMC) in 1996-98. Initial thinking on the project was to build on the work done in SMC to enhance regional understanding of high alpine catchment areas. The SJC proposal is designed to fit the unique geologic and hydrologic characteristics of SJC utilizing a variety of EPA funds as well as BLM and other local matching funds. The SMC study was conducted by geographer Dr. Mark Williams (of University of Colorado and the Institute of Arctic and Alpine Research - INSTAAR) with EPA RGI grant support. Dr. Williams study focused primarily on identifying sensitive alpine regions to perturbations and the potential effects on water quality. Even though there are similarities in SJC and SMC, the SJC proposal will expand the scope of the SMC study to include domestic and drinking water quality, evaluation of riparian areas (including the rare iron fens located in SJC). These data will then be utilized to create hard-copy tools and assembled into a GIS for use by SJC officials. There is still some planning work to be done to locate specific areas of study, i.e., to identify sensitive alpine regions, priority areas for domestic/drinking water studies and riparian areas. Partner planning meetings will be scheduled as well as open public forums to seek public input into the project (see Task 1 below).

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<sup>1</sup> Smart Growth Strategies: Protecting Water Resources, Local Government Roles and Options for the Rocky Mountains and Northern Great Plains (December 2001), National Association of Counties.

Dr. Williams has agreed to conduct an alpine sensitivity study which will include wetlands mapping as a part of this proposal (see Task 2 below). MSI will also be collaborating with the Alpine Environmental Services, a contracting firm coordinating the efforts of the Animas River Stakeholders Group (ARSG), an organization that has been doing water quality studies in the Animas watershed since 1989. Utilizing existing historical and current data from the ARSG, Bill Simon, ASRG watershed coordinator and owner of Alpine Environmental Services (AES), will work on the component of the project that examines the quality of domestic and drinking water including mapping of 28 newly adopted TMDLs (Task 3 & 4 below). These data will also be utilized, where appropriate, to complement the water quality data being gathered by Dr. Williams in the alpine sensitivity study.

Another related component of this proposal stems from an identified need by SJC officials for more accurate mapping of private mining claims in key areas. When a request for development is received, if officials know (based on the use of the above described tools) that an area is potentially problematic because of potential threats to the water supply or because the water supply is hazardous to human health at that location, it is important for SJC officials and landowners to have access to reasonably accurate property maps that correlate to identified sensitive or non-potable areas.

The Bureau of Land Management (BLM) has recently agreed to a mapping project of private properties along the Alpine Loop, part of which extends into SJC. This mapping complements a larger mapping project, the San Juan Skyway Heritage Project, being conducted by the Office of Community Services at Fort Lewis College and partner counties along the San Juan Skyway. Their objective is to map private lands along the San Juan Skyway in order to identify properties with high resource values (biological, scenic, historic, etc.) at high risk of development. These sensitive properties will then be evaluated by local county planning commissions and boards of commissioners for management strategies that are acceptable to their individual communities.

This work also complements and extends the scope of work that has been successfully conducted by the Red Mountain Task Force on Red Mountain (RMTF) pass and surrounding areas. The Red Mountain Task Force has worked with property owners willing to sell their property at appraised value. To date, 3152 acres have been purchased by the Trust for Public Land and transferred to the Uncompahgre National Forest and Ouray County. An additional 2,500 acres are under options to purchase.

This mapping of the SJC portion of the Alpine Loop adds a key component to the SJC proposal, helping to tie water quality and alpine sensitivity data more precisely to private lands. The SJC method is discussed in more detail below (see Task 5 below).

Finally, the products from the above tasks will be integrated and made available to SJC officials and others along with instruction in the use of these tools. These data will also be assembled into a GIS to be made available through ArcIMS server technology that will allow access through a standard web browser (see Task 6 below).

To summarize: this proposal seeks to 1) identify alpine regions in the upper Animas that are sensitive to various perturbations (Task 2 below), 2) provide organized data relating to domestic and drinking water (Task 3 & 4 below), 3) create more accurate mapping of mining claims, especially in key development-prone areas (Task 5 below) and make these data available in hard copy (map plots, tables, explanations and final report) and GIS format via the world-wide web (Task 6 below).

### **Task 1: Planning**

As noted above, a strong coalition of partners (MSI, San Juan County, Alpine Environmental Services, University of Colorado - INSTAAR, Fort Lewis College - Office of Community Services, Red Mountain Task Force, BLM, et al.) has been assembled to accomplish the goals of this project. Partners have been working collaboratively over the past several months to develop this proposal, however, additional planning time is required to refine study priority areas and methodology among the partners.

**Objective 1:** During the grant period, MSI will coordinate and convene 3-5 meetings of the general public, project partners, and others to be determined.

**Completion of planning for this project:** Month 1

**Estimated Time:** 30

## **Task 2: Hydrogeomorphic Identification of Sensitive Alpine Regions**

This task will develop planning tools for high-elevation catchments in San Juan County (SJC). The evaluation will be based on the Hydrogeomorphic (HGM) approach recently outlined by the US Army Corps of Engineers in the Federal Register (Vol 61, No 160, August 16, 1996) and adapted by Williams et al. (Mtn Res and Devel, V 21, 71-78, 2001, see attachments) for San Miguel County. For each basin selected by SJC, landscape type will be mapped and assigned hydrogeomorphic attributes based on water quality and water isotope values. Please note that this proposal builds on previous efforts in nearby San Miguel County, for which M. Williams received an Environmental Achievement Award in 1999 from Region 8 of the EPA.

Dr. Williams (of INSTAAR) approach to landscape mapping is to draw polygons of landscape types on mapping material (e.g., topographic maps, aerial photos, etc) provided by SJC. The HGM attributes will be developed based in large part on water quality measurements associated with landscape type. These water quality measurements will provide information on sensitivity to perturbations such as:

- ?? Building construction
- ?? Septic tanks/leach fields
- ?? Road construction
- ?? Water development
- ?? Activities associated with mining

### **Goals**

The primary goal of this task is to provide information to SJC to identify and characterize high-elevation areas that are potentially sensitive to perturbations. Additional and complementary uses include information for protection of source-water and well-head protection areas. This information will aid SJC and other entities with developing land management strategies acceptable to SJC officials and citizens.

The primary data source for this evaluation will be mapping of landscape types in high elevation areas of SJC. The mapping program will be supplemented with measurements of water quality and water isotopes as detailed below. Other available data that may become available from complementary or prior research activities in and near SJC, will be included in the analysis, as outlined in Tasks 3, 4, and 5.

The sensitivity analysis will be conducted for three components. [1] Landscape Types. For each landscape type that is mapped, Dr. Williams will provide attribute information based on the HGM approach. In turn, this attribute data will be based on process-level information for each landscape type. [2] Sensitive Portions of Individual Watersheds. Dr. Williams will identify specific portions of individual watersheds that appear to be the most sensitive to perturbations. [3] Whole-basin Analysis. For each of the identified watersheds, Dr. Williams will provide a sensitivity analysis of the basin as a whole. This sensitivity analysis will be based on more than the sum of the component analytical tools, such as the inventory of landscape types and HGM attributes.

### **Objective 1: Landscape Mapping**

The purposes of landscape mapping for SJC are to:

- (i) provide an areal inventory of alpine landscape types for SJC, (ii) provide HGM attribute information associated with landscape type, (iii) provide the location of landscape types in each basin, and (iv) provide a scientific foundation on which to evaluate sensitivity of individual basins to perturbation.

The higher the resolution of the base map, the higher the resolution of the mapping.

The process of landscape mapping will be as follows:

- ?? Inventory basins as determined by SJC.
- ?? Draw polygons of landscape types from site visits in each of the basins on mapping materials provided by SJC, including topographic maps and aerial photos.

- ?? Landscape types are defined in Inyan and Williams, 2001. These landscape types were developed for neighboring San Miguel County and hence should be appropriate for SJC, including talus, tundra, forest, riparian, wetland and exposed bedrock areas.

**Completion:** Month 1-2

**Estimated Time:** see budget section

**Objective 2: Wetlands Identification**

Special attention will be devoted to identifying and mapping wetland areas. Alpine areas have unique wetland attributes, including alpine fens and ice bogs. Wetland areas will be identified using the same criteria as Science Applications International Corporation (SAIC) used for wetland mapping in nearby San Miguel County and adapted by Inyan and Williams (2001). Thus, the mapping efforts will be compatible with EPA efforts to map wetland areas in San Miguel County. First, Dr. Williams will choose sub-basins to be mapped and wetland parameters to be used, then map wetlands, streams and open water as polygons. Finally, this mapping will be ground-truthed.

**Completion:** Month 1-2

**Estimated Time:** see budget section

**Objective 3: Water Quality and Water Isotope Measurements**

Water samples will be collected bi-weekly to monthly from approx June 1 through Aug 15 at three to five sites along the primary drainage identified by SJC. At least one water sample will be collected from each of the remaining drainages of interest. At least one water sample will be collected from each landscape type, with special emphasis placed on tundra, talus, meadow, and riparian areas. All water quality samples will be analyzed for the following parameters: pH, specific conductance, acid neutralizing capacity (ANC) or alkalinity using the Gran titration method (here assumed to equal bicarbonate), ammonium, Ca, Mg, Na, K, Cl, NO<sub>3</sub>, SO<sub>4</sub>, and PO<sub>4</sub>. A subset of samples will also be analyzed for total nitrogen (TN), dissolved organic nitrogen (DON), particulate nitrogen (PN), total phosphorus (TP), and total organic phosphorus (TOP). Locations of sampling sites will be marked on maps and coded for reference. Water quality data will be presented in hardcopy and digital formats. ARSG water quality data will be used to complement and expand upon water quality conditions within these sub-basin units. Dr. Williams will separate the stream flow into its baseflow or "pre-event water" and rain and snowpack runoff waters or "event water" using mixing models as conducted in previous work in nearby San Miguel County. Quality Assurance/Quality Control (QAPP) management plan for this project will follow guidelines established by the EPA for previous RGI grants received by M. Williams to conduct research on water quality in the San Juan Mountains of Colorado.

**Objective 4: Sensitivity Analysis**

The primary objective of the mapping and water quality measurements is to derive sensitivity maps for use in planning decisions. Sensitivity criteria will be developed in cooperation with the San Juan County Planning Department and through public forums. Initial results will be presented at a public forum hosted by the Planning Department. At that time, the public will be invited to comment on overarching themes for determining sensitivity criteria. A second public meeting will be held to present the results of the sensitivity analysis and mapping and to obtain public feedback on whether the sensitivity analysis is acceptable, in need of revision, or other action.

In nearby San Miguel County, sensitivity analysis was based on the public's desire to maintain high-elevation areas in a pristine condition. Two water quality variables were then used: (a) alkalinity (or buffering capacity) concentrations less than 50 ueq/L, and/or (b) nitrate concentrations greater than 8 ueq/L. Nitrate concentrations in surface waters are generally near or below detection limits of 0.5 ueq/L in pristine ecosystems. The reason for the low nitrate concentrations in surface waters is because terrestrial ecosystems are generally N-limited. This is why farmers add ammonium-nitrate and other fertilizers. Perturbations such as road construction, buildings, grazing, septic systems, and related activities short-circuit the nitrogen cycle through changes in hydrologic pathways and soil disturbance, resulting in increased output of nitrate to aquatic systems. The amount of nitrate in streams and rivers thus provides an index of the amount of current perturbation in the system and how that area may respond to future perturbations.

Residents of San Juan County will decide the rationale for determining sensitivity criteria. Most likely, residents of SJC will have a different overarching theme than nearby San Miguel County. Water quality and isotopic data will then be used in conjunction with the landscape mapping to develop sensitivity criteria and map sensitive areas. An important component of this sensitivity mapping is the incorporation of existing information on trace metal content and other water quality data (see Tasks 3, 4, and 5).

**Completion:** Month 1-2

**Estimated Time:** see budget section

### **Task 3: Mapping of Drinking & Domestic Water Quality**

Much of San Juan County, and the sites with the highest potential for future development, lie within the San Juan Caldera, a volcanic feature that is enriched with metals. These metals have entered both surface and ground water through natural processes and historical mining practices. Metals in both surface and ground water do exceed EPA Clean Drinking Water Standards in certain areas and these needs to be identified clearly. San Juan County and the San Juan Planning Commission have recognized a need to provide the public with available information concerning drinking water quality of streams, springs, and underground sources (wells). The Animas River Stakeholders Group (ARSG) and participating entities have been sampling water quality throughout the basin since 1989. This information currently resides in several databases with different formats. Well and surface water sampling has continued in several locations within the basin. Alpine Environmental Services proposes to collect and validate these data and produce a format with site location maps that will specifically relate to drinking and domestic use water standards. The information will then be made available for easy use by planners and landowners.

**Goal:** Provide recent and historical human health-related water quality data and information in a user-friendly format for planning and development purposes.

**Objective 1:** Create a format, with attached site location map, of water well data.

(Probably about 10 to 12 sites only – includes monitoring wells)

Subtask 1: Gather data and load into a format of health related parameters.

Subtask 2: Map all data points

**Completion:** Month 4

**Objective 2:** Create a format, with attached site location map, of water quality data of springs and seeps.

Subtask 3: Gather data and load into a format of health related parameters.

Subtask 4: Map all data points

**Completion:** Month 5

**Objective 3:** Create a format, with attached site location map, of surface water quality data.

Subtask 5: Gather data and load into a format of health related parameters

Subtask 6: Map all data points

**Completion:** Month 6

**Objective 4:** Create a format, with attached site location map, of draining mine water quality data.

Subtask 7: Gather data and load into a format of health related parameters

Subtask 8: Map all data points

**Completion:** Month 7

**Objective 5:** Create a format recommended by Mark Williams and insert all existing nutrient related water quality data for the Animas Watershed.

Subtask 9: Gather all data and load into a format of nutrient related parameters

**Completion:** Month 8

**Estimated Time:** See Budget Section

**Equipment Needs:** existing equipment will be utilized

### **Task 4: Provide map and tables of the State of Colorado water quality 303 (d) list of non-compliant streams and parameters**

**Objective:** Create a strip map of streams with the 28 newly adopted Total Maximum Daily Loads (TMDL's), the points where compliance is to be met, and accompanying tables of the TMDL for each parameter for each segments.

Subtask 1: Use a base map to develop a strip map of non-compliant streams.

Subtask 2: Associate tables of non-compliant parameters and their TMDL's to the respective stream segment map.

**Estimated Time:** See Budget Section

**Completion:** Month 8

### **Task 5: More Accurate Mapping of Private Mining Claims**

SJC officials currently utilize outdated maps with a high degree of inaccuracy to identify mining claim properties. The information gathered from tasks 2 & 3 above (alpine sensitivity identification and mapping of drinking and

domestic water sources) will be enhanced by the development of more accurate maps of private property—much of which is in the form of mining claims. These maps will help locate areas presenting human health problems and sensitive areas within the context of the private property in question. The accurate mapping of mining claims is rife with problems since most mining claim groups are tied to datum points that are not necessarily geo-referenced to any coordinate systems commonly in use today. Short of extensive and extremely time consuming field surveys, techniques do exist for improving accuracy through the use of a mapping technique known as “rubber sheeting”. The BLM, in conjunction with the OCS, has recently agreed to fund a mapping project of the Alpine Loop region, part of which extends into San Juan County. This mapping work will be accomplished by a GIS contractor Computer Terrain Mapping (CTM) of Boulder, CO. CTM will subcontract with MSI to identify control points in areas identified as critical by county planners. MSI will work with CDOT, BLM, SJC Surveyor and the SJC Assessor to identify existing control points.

**Goal:** The goal of this task is to provide SJC BOCC and planners more accurate maps of private property and mining claims to help orient data from tasks 2 & 3, providing an integrated package for making informed land use decisions.

**Objective 1:** Identify control points in key areas and georeference them to UTM, coordinate system.

**Objective 2:** Utilizing control points, “rubber sheet” existing maps to create digital GIS maps (compatible with other electronic deliverables) as well as print versions.

**Completion:** Month 2-4

### **Task 6: Assembling data into hard copy & GIS format**

Once the field data have been collected, existing water data is organized and formatted, and mapping of mining claims is completed from the tasks above, they will all be incorporated into an integrated package for SJC officials. This package will include map plots, tables, explanations and a final report in hard copy. In addition, this information will be assembled into a GIS. This work will be accomplished by a GIS contractor (to be decided) and the Mountain Studies Institute. As a part of this proposal funds are also being donated by Fort Lewis College to provide MSI with ArcIMS server capability. Once GIS applications are completed they will be served on the ArcIMS server which will make the coverages available to anyone with a standard web browser. This capability will also be used to publish other projects that MSI coordinates and facilitates in the future within the whole region as well as to publish existing orphaned data within the region.

**Objective 1:** MSI and Alpine Environmental Services will inventory and select an appropriate base map(s) and attributes for the development of a multilayered GIS. The objective is to provide resource, usefulness and cost information for the initial project planning sessions of all potentially usable base maps and attributes for GIS development, and to determine where additional data needs to be collected. Tasks include assembling and evaluating available maps and attributes from several agencies including San Juan County, Bureau of Reclamation, US Forest Service, BLM, USGS, and ARSG.

**Objective 2:** Assemble all data into an integrated GIS.

**Objective 3:** Make this integrated GIS coverage available on the web through ArcIMS technology.

**Estimated Time:** See Budget Section

**Completion:** Months 4-8

**Equipment Needs:** ArcIMS server and software

### **Outputs & Progress Reports**

The following outputs will be created for the following watershed areas, as identified by the San Juan County Planning Commission:

**Task 1 Outputs** – Project Partner and Public Forum Meeting Coordination, development and dissemination of proposal products into user-friendly tools. 3-5 public forums and project partner meetings, and production of varied watershed maps is planned.

**Task 2 Outputs** – Maps outlining landscape type polygons with HGM attributes, water quality/quantity data, plus in-depth report detailing problems areas, criteria for making smart management decisions for SJC officials

**Task 3 Outputs** - Table, site location map, explanation and limitations for the three objectives outlined

**Task 4 Outputs** - a strip map of streams with approximately 9 of the 28 newly adopted Total Daily Maximum Loads (TMDL's), the points where compliance is to be met, and accompanying tables of the TMDL for each parameter for each segment.

**Task 5 Outputs:** GIS Map coverage of mining claim properties in upper Animas watershed georeferenced based on identified control points

**Task 6 Outputs** - Integrated GIS coverage incorporating data from above stated tasks, map plots and web-enabled GIS application

## Mountain Studies Institute – Revised Work Plan - RGI Grant Project

A 5-page progress report will be submitted by December 15, 2003. It will include field data collection completed, the status of domestic water quality data organization, progress on GIS mapping and any adjustments to completion dates. A 20-page draft final report will be completed March 1, with a final report to SJC, project partners and the EPA by April 15. The final report will summarize all work completed, analysis, conclusions and recommendations to SJC.

### Milestones

July 16	Initial Planning Meeting, Silverton
July 23	Planning Meeting II, Silverton
Aug 1	Begin field work
July 29	End field work/Planning Meeting III
Oct 15	Turn in field maps to GIS contractor
Nov 31	Complete mapping of mining claims
Nov 1	End sample analysis
Dec 15	Submit 5-page progress report
Jan 15	Conference call to discuss progress report
February 15	Complete Integrated GIS application
March 1	20-page draft final report to San Juan County
March 15	Receive comments from San Juan County
April 1	Meet with San Juan County officials
April 15	Final report to San Juan County, project partners & EPA

### Budget

Cash match has been supplied by San Juan County Commissioners (\$1000), San Juan County Planning Commission (\$1000), Fort Lewis College (\$5000) and Computer Terrain Mapping, Boulder, CO (\$5000).

Task	In-Kind Match	Cash Match	RGI Funds	Total
<b>Task 1 - Planning &amp; Coordinating</b>				
Planning & Coordination (see Project Coordinator below)				
<b>Task 2 - Alpine Basin Sensitivity Analysis</b>				
Salary & Fringes				
Mark Williams (Task supervision)	1400			1400
Kim Raby 1 semester RA			7767	7767
Kim Raby Summer salary (107 hrs. @ \$15/hr.)			1600	1600
Kim Raby 1 semester tuition remission			2500	2500
Bill Simon wetlands identification (65 hrs)	1300		3250	4550
Travel (& August lodging)			900	900
Other Costs				
Supplies			1000	1000
Isotopic Analysis			1333	1333
Water Sample Analysis	2666			2666
<b>Task 3 &amp; 4 - Drinking Water Quality Analysis/TMDL M&amp;M</b>				
Bill Simon ( est.65 hrs @ \$70/hr.)	1300		3250	4550
<b>Task 5 - Geospatial Mapping of Mining Claims</b>				
GPS control points identification		5000		5000
<b>Task 6 - Creating Integrated GIS</b>				
GIS Creation (est. 125hrs. @ \$20/hr.)		500	3000	3500
Map Plots		500		500
GIS Interns Interns (est. 100hrs. @ \$10/hr.)			1000	1000
Other Costs				
ArcIMS Server Hardware		4000		4000
ArcIMS Server Software		2000		2000
<b>MSI Personnel</b>				
Project Coordinator (est. 150 hrs.@ \$20/hr.)			3000	3000
Data/GIS Coordinator (see Task 6)				
Interns (see task 6)				
Fringe (20%)			1400	1400
<b>MSI Office Space (Silverton &amp; Fort Lewis College)</b>	6500			6500
<b>MSI Proposal Development</b>	3500			3500
<b>Total</b>	<b>16666</b>	<b>12000</b>	<b>30000</b>	<b>58666</b>