Exhibit A - Scope of Work

GRANTEE: Roaring Fork Conservancy
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PROJECT NAME: Crystal River Watershed – Assessment and Design of Restoration Projects

TOTAL PROJECT COST: $584,463
TOTAL GRANT AMOUNT: **$304,464**
MATCHING FUNDS: $279,999
CASH: $80,542. (Sources: CWCB Watershed Restoration Grant, Pitkin County Rivers Fund, West Divide Water Conservancy District, Roaring Fork Conservancy)
IN-KIND: $199,457 (Sources: White River National Forest, Rocky Mountain Research Station, Roaring Fork Conservancy including a Wyss Scholar)

INTRODUCTION AND BACKGROUND
The Crystal River was recently named one of *America's Most Endangered Rivers*. This project will apply a logical, scientifically-sound "watershed approach" to the prioritization and design of a series of restoration projects in the Crystal River Watershed which, when implemented, will enhance the ability to satisfy non-consumptive water needs that have not been met for years.

A series of assessments will be conducted to identify the sources of sediment loading and the geomorphic processes that are degrading water quality and damaging instream and riparian habitat in the Coal Basin sub-watershed and contributing to sedimentation issues in the Crystal River. This information will be supplemented with new stream flow, sediment, water quality, macroinvertebrate and meteorological data, and used to prioritize and design a series of site- and process-specific restoration projects for the Crystal River Watershed - with emphasis on Coal Basin and the Coal Creek/Crystal River confluence area.

Decommissioned mining road reclamation work will be conducted on 10 acres in Coal Basin. This pilot effort will also assess the cost-effectiveness and utility of using biochar, coupled with drainage improvements, to reduce the toxicity of surface runoff, improve the water and nutrient-holding capacity of soils, and enhance the growth of native vegetation.

OBJECTIVES:

1. Complete a series of land use and geomorphic assessments and obtain the information necessary to identify the primary natural and anthropogenic sources of sediment-loading in the Crystal River Watershed – with an emphasis on Coal Basin.
2. Design and prioritize a series of site- and process-specific mitigation projects to: (a) attenuate the Crystal River hydrograph, (b) contribute to the restoration of floodplain function at the Coal Creek/Crystal River confluence area, (c) improve overall riparian and instream habitat in Coal Basin and the Crystal River, and (d) reduce sediment and total iron delivery to the Crystal River from Coal Creek.
3. Establish a permanent stream gage and companion meteorological station in Coal Basin.
4. Obtain stream flow, meteorological data and sediment information for Coal Basin, and obtain water quality and macroinvertebrate data for both Coal Basin and the Crystal River to support the land use and geomorphic assessments and the design and prioritization of site- and process-specific mitigation projects, as well as to provide a baseline for measurement of overall project success.
5. Successfully reclaim and reduce sediment-loading from nearly 10 acres of the decommissioned road network in the former mining areas of Coal Basin.
6. Assess the cost-effectiveness and utility of using biochar in future large scale reclamation efforts in Coal Basin and other similar locations.
7. Promote and encourage implementation of other *Roaring Fork Watershed Plan* recommendations for meeting the Colorado Basin's consumptive and non-consumptive needs.

TASK #1 – Conduct a High-Level Crystal River Watershed Land Use and Geomorphic Assessment

Description of Task: Using NetMap (www.netmaptools.org), conduct a high-level assessment of the twenty-four 12-Level Hydrologic Units (HUs) in the Crystal River Watershed to obtain a better understanding of the existing natural conditions, human-induced changes to those conditions, and the dynamic geomorphic processes in the watershed. The relative contribution of Coal Basin (especially above the Coal Creek confluence with Dutch Creek) will be a priority in this assessment. The assessment will identify obvious sediment supply sources and processes affecting sediment supply and channel stability, as well as sources and causes of problems not intuitively obvious. This initial screening will eliminate stable, low-risk slopes, sub-watersheds and river reaches from further analysis. The assessment will determine the sub-watersheds and reaches to be included in subsequent targeted assessments (Task #2) and will guide future near-term projects in Coal Basin, as well as the Coal Creek/Crystal River confluence area.

Method/Procedure:

1. Compile and analyze existing GIS resource data. Review layers, resolution, attributes and determine adequacy and utility for informing Netmap products.
    a. 10m DEMS
    b. Stream Layers (USFS and counties)
    c. Geology Layers (State and USFS)
    d. Soils (NRCS and USFS)
    e. Roads (USFS, county, and state)
    f. Land Use (national, state, USFS)
    g. Climate
    h. Colorado landslide inventory
2. Determine and assign preliminary erosion rate factors to appropriate GIS layers based on literature review and field knowledge.
3. Conduct NetMap watershed assessment.
4. Review results, including field verification.
5. Conduct NetMap onsite training session.
6. Refine erosion rate factors as necessary.
7. Finalize NetMap watershed assessment.
8. Classify and rank (from high to low) selected attributes by 6^{th} code hydrologic units.

Deliverable: Grids of slope, erosion potential, and shallow landslides for the watershed. Erosion potential, debris flows, sediment delivery and sediment potential by stream reach for all streams in the watershed. Documentation of the relative erosion potential and sediment contribution of Coal Basin to the Crystal River Watershed and indication if the source is natural or human caused.

TASK #2 – Conduct a Targeted Land Use and Geomorphic Assessment of Coal Basin

Description of Task: Based on the results of the Netmap assessment for the Crystal River Watershed (Task #1), conduct a more detailed resource assessment for Coal Basin. This targeted assessment of land use impacts, geomorphic processes and sediment dynamics will elucidate important drivers of stream channel change and identify the primary natural and anthropogenic sediment sources in the watershed. The results of this targeted assessment will guide recommendations for specific restoration/reclamation actions throughout the Coal Creek watershed.

Method/Procedure:

1. Perform a landscape and river inventory and determine the variables (e.g., loss of stream buffers, floodplain encroachment, changes in riparian vegetation, excess sediment supply) influenced by existing conditions. Using broad assessment of channel condition (maps, aerial photos, and stream surveys), identify condition of channels, channel types, spatial linkage and relationship to land uses, and geomorphic setting. Reconnaissance and mapping using GPS/ data dictionary, simple measurements of slope/width, and photographs. Reconnaissance for selected streams in other portions of Crystal Watershed for comparative purposes. Determine the relationship between landslides and braiding/ channel instability in Coal Basin and other systems.
2. Establish and survey monitoring reaches within Coal Basin to document changes in channel form over time. Data collected at these reaches will be used in flow and sediment modeling effort (below). Identify areas in main subwatersheds (Main Stem Coal Creek, upper Coal Basin, Dutch Creek, and Bear Creek) to set up monitoring and "modeling" locations. Collect data on channel geometry, plan form, floodplain, riparian condition, channel sediment characteristics (size, lithology, imbrication, etc.). Collect periodic grab samples of Suspended Sediment Concentrations from these sites if needed. Add additional turbidity probes in 2014 and Aquarod as available.
3. Compile data necessary to rate level of resource management risk, including hillslope processes (including mass and surface erosion and roads), hydrologic processes (including an assessment of the potential for streamflow changes), and channel processes, including a general stability assessment (e.g., streambank erosion potential, aggradation, in-channel mining, etc.). This work will include an assessment of bedload transport processes, with specific protocols to be determined based on peak flow predictions from snowpack, site selection, and safety concerns. Using the suite of information from NetMap, landslide evaluations, road conditions, stream surveys (broad and finer scale), and modeling efforts, create an overall, quantitative story for what is occurring in Coal Basin. Data collected at monitoring locations are used to derive initial estimates of bedload transport. Should these be inconclusive, investigate ways of improving these estimates with measurements of coarse sediment transport.
4. Calculate total potential sediment supply and channel stability resource management risk and consequences (High/Medium/Low) of implementing or failing to implement mitigation measures. What is being translated through the system and ending up in Redstone? Can mining and associated land use impacts be separated from background sedimentation? With remediation, how much change in sediment (fine and coarse) can we expect?
5. Recommend site-specific mitigation measures and methodologies for monitoring for success (both channel and sediment load response). What is the expectation for the channel? Is there a stable state? What can be "fixed" and how? Are

Rosgen's artificial "fans" a reasonable possibility for reducing sediment loads? How does this system differ relative to the Trout Creek system where the fans have been constructed? How much braiding do we see in comparable channels in other nearby basins? How linked are landslides and braided channels?

6. Additional analysis and reporting.
7. Report preparation.

Deliverables: A map, table and narrative summary identifying the severity of land use changes, departure from reference conditions, long- versus short-term potential impacts associated with these changes, sources and causes of impairment, and the consequences of continued impairment to beneficial uses. Results of modeling of sediment loads in each of the watersheds, verified using coarse sediment sampling protocols. Summary of site- and process-specific recommendations for mitigation of causes of impairment in each of the watersheds, and recommendations for monitoring for success of mitigation measures.

TASK #3 – Collect Stream Flow and Meteorological Data and Conduct Sediment Sampling in Coal Basin

Description of Task: Establish a permanent stream gage and companion meteorological station in Coal Basin to collect the basic hydrologic/meteorologic information necessary to support the design of site- and process-specific mitigation measures and to determine the effectiveness of restoration efforts in the Coal Creek watershed. Conduct in-stream sediment sampling in Coal Basin to support the Task #2 assessment.

Method/Procedure:

1. Evaluate and select one of the three alternative stream discharge gaging locations near the bottom of Coal Basin recommended in *Site Recommendations for Stream Discharge Gaging on Top Tier Priority Reaches in the Roaring Fork Watershed*.
2. Obtain supporting infrastructure for a year-round, real-time streamflow measurement gage and turbidity/total suspended solids (TSS) sensor. Obtain companion meteorological gaging equipment for the station.
3. Install and set-up the gaging station in Coal Creek at the location selected under #1 above.
4. Operate and maintain (O&M) the gaging station on an ongoing basis. The O&M schedule will include monthly site visits for data collection, any necessary cleaning, sensor calibration, and/or troubleshooting. Calibration of the suspended sediment and turbidity probe will include collection and analysis of suspended load sediment samples. Barrel samples will be collected for subsurface sediment analysis. Calibration of the pressure transducer will include collection of discharge data and creation

of a stage/discharge rating curve. The relatively unstable nature of the streambed may require frequent discharge data collection and ongoing modification of the stage/discharge rating curve. (Costs associated with twelve (12) months of O&M and laboratory analysis are included in this project).

5. Collect and analyze sediment size distribution data at eight (8) locations across Coal Basin and on the Crystal River during baseflow conditions.
6. Collect Wolman pebble counts to characterize the channel surface at sites determined to be safe for wading. Coordinate with the collection of macroinvertebrate data (Task #4).

Deliverables: An installed and calibrated water quality, water quantity and meteorological gaging station and initial data obtained from same, and from in-stream sediment sampling.

TASK #4 – Conduct Water Quality and Macroinvertebrate Sampling in Coal Basin and the Crystal River

Description of Task: Collect and analyze water quality and macroinvertebrate data in Coal Basin and the Crystal River.

Method/Procedure:

1. Collect and analyze macroinvertebrates at eleven (11) locations across Coal Basin six (6) and on the Crystal River five (5).
2. Collect quarterly water quality samples at the mouth of Coal Creek and at two (2) sites on the Crystal River (above and below the confluence with Coal Creek).

Deliverable: Annual report summarizing water quality and macroinvertebrate data and trends.

TASK #5 – Conduct a Road Reclamation Pilot Project in Coal Basin

Description of Task: Reclaim some of the highest sediment-producing portions of the decommissioned road network in the former mining areas of Coal Basin and assess the cost-effectiveness and utility of using biochar in this type of reclamation effort.

Method/Procedure:

1. Route drainage and place boulders and wood for grade control in strategic locations over a 10.88 acre reclamation area (pre-selected using the USFS analysis of Connected Disturbed Areas (CDAs) in Coal Basin). Create sediment traps (using waddles, silt fencing, logs, and geotextile fabric) in depositional areas, with berms constructed on contour and energy dissipaters throughout the project area. Construct alluvial fans in strategic locations.
2. Procure biochar and local landfill compost and haul to site.
3. Amend soils in portions of the area to be reclaimed by incorporating a mix of biochar and compost obtained from locally-available sources of supply. Treat other portions of the area targeted for reclamation with compost tea.
4. Conduct site revegetation using USFS-supplied native tree and seed stock.
5. Fence portions of the reclaimed areas to prevent cattle-grazing.
6. Conduct soil testing in the project area to determine the efficacy of the biochar/compost mix. Four monitoring events will occur, two each summer for two years. On-site measurements of vegetation cover (%) and soil moisture (%) will be made – for "before" and "after" comparisons.

Deliverables: Road restoration and an assessment of the effectiveness of several restoration techniques which can be applied on a broader scale in Coal Basin and other locations.

TASK #6 – Manage Project; Education & Outreach

Description of Task: Manage the overall project, including preparation of CWCB reports. Conduct public education and outreach related to the project.

Method/Procedure: Coordinate and oversee implementation of the overall project (including the work of all partners and subcontractors), ensure fiscal accountability and prepare and submit invoices. Conduct public education and outreach related to the project (e.g., site visits for stakeholders and interested members of the public, articles on specific restoration initiatives, etc.). Prepare and deliver progress reports to CWCB every six (6) months. Prepare and deliver a final report to CWCB at the conclusion of the project.

Deliverables: Progress reports describing the completion or partial completion of Task #1 - #5, including a description of any major issues and any corrective action taken to address the issues.

Final report summarizing the project and documenting how the project was completed – to include all products, data and information developed as a result of CWCB funding (in hard copy and electronic format).

TASK NUMBER	CATEGORY	DETAILS	COST PER HOUR	HOURS	OTHER RATES	TOTAL COST	WSRA REQUEST	MATCH (in-kind and cash)
TASK #1 – Conduct a High-Level Crystal River Watershed Land Use and Geomorphic Assessment								
	PERSONEL COSTS	1. Compile and analyze existing GIS resource data.	40	40		1,600	0	1,600
			48.75	16		780	0	780
			65	40		2,600	0	2,600
		2. Determine and assign preliminary erosion rates factors to appropriate GIS layers.	40	50		2,000	0	2,000
			48.75	8		390	0	390
			55	8		440	0	440
			62.5	10		625	0	625
		3. Conduct NetMap watershed assessment	75	575		43,125	43,125	0
		4. Review results, including field verification	40	40		1,600	0	1,600
			62.5	24		1,500	1,500	0
			40	60		2,400	0	2,400
		5. Conduct NetMap onsite training session	75	83		6,225	6,225	0
			65	8		520	520	0
			40	16		640	0	640
			48.75	16		780	0	780
			55	8		440	0	440
			62.5	18		1,125	1,125	0
			40	8		320	0	320

		6.Refine erosion rate factors as necessary.	40	40		1,600	0	1,600
			62.5	10		625	625	0
		7. Finalize NetMap watershed assessment.	75	45		3,375	3,375	0
		8. Classify and rank selected attributes by 6th code hydrologic units.	75	30		2,250	2,250	0
			40	20		800	0	800
			48.75	16		780	0	780
			62.5	20		1,250	1,250	0
TASK 1 SUB-TOTAL						77,790	59,995	17,795

TASK NUMBER	CATEGORY	DETAILS	COST PER HOUR	HOURS	OTHER RATES	TOTAL COST	WSRA REQUEST	MATCH (in-kind and cash)
TASK #2 – Conduct a Targeted Land Use and Geomorphic Assessment of Coal Basin								
	PERSONEL COSTS	1. Perform a landscape and river inventory and determine the variables influenced by existing land use and geomorphic setting.	62.5	800		50,000.00	37,500.00	12,500.00
			48.75	80		3,900.00	0.00	3,900.00
			17.5	112		1,960.00	0.00	1,960.00
		2. Establish and survey monitoring reaches within Coal Basin to document changes in channel form over time.	62.5	520		32,500.00	24,375.00	8,125.00
			48.75	80		3,900.00	0.00	3,900.00
			17.5	112		1,960.00	0.00	1,960.00
		3. Compile data necessary to rate level of resource management risk, including hillslope, hydrologic, and channel processes.	62.5	1400		87,500.00	65,625.00	21,875.00
			40	40		1,600.00	0.00	1,600.00
		4. Calculate total potential sediment supply and channel stability resource management risk and consequences of implementing or failing to implement mitigation measures.	62.5	200		12,500.00	9,375.00	3,125.00
			40	46		1,840.00	0.00	1,840.00

		5. Recommend site-specific mitigation measures and methodologies for monitoring for success.	62.5	300		18,750.00	14,062.50	4,687.50
			55	16		880.00	0.00	880.00
			40	32		1,280.00	0.00	1,280.00
			40	20		800.00	0.00	800.00
		6. Additional analysis and reporting.	62.5	260		16,250.00	12,187.50	4,062.50
		7. Report preparation.	100	70		7,000.00	7,000.00	0.00
TASK 2 SUB-TOTAL						242,620.00	170,125.00	72,495.00

TASK NUMBER	CATEGORY	DETAILS	COST PER HOUR	HOURS	OTHER RATES	TOTAL COST	WSRA REQUEST	MATCH (in-kind and cash)
TASK #3 – Collect Stream Flow and Meteorological Data and Conduct Sediment Sampling in Coal Basin								
	PERSONEL COSTS	Hydrologist (installation of stream gage)	60	25		1,500.00	1,500.00	0.00
		Hydrologist(annual operation and maintenance of stream gage)	60	70		4,200.00	4,200.00	0.00
		Suspended sediment sample processing and sampler maintenance	62.5	128		8,000.00	8,000.00	0.00
		Coarse sample processing	62.5	48		3,000.00	3,000.00	0.00
	EQUIPMENT	Streamflow gage with sensors (itemized list available)				8,519.80	7,810.00	710.00
		ISCO water sampler and data loggers				11,058.40	0.00	11,058.40
		Equipment Shipping				300.00	0.00	300.00
TASK 3 SUB-TOTAL						36,578.20	24,510.00	12,068.40

TASK NUMBER	CATEGORY	DETAILS	COST PER HOUR	HOURS	OTHER RATES	TOTAL COST	WSRA REQUEST	MATCH (in-kind and cash)
TASK #4 – Conduct Water Quality and Macroinvertebrate Sampling in Coal Basin and the Crystal River (2 years)								
	PERSONEL COSTS	Macroinvertebrate data collection (11 sites)	40	96		3,840.00	0.00	3,840.00
		Macroinvertebrate sorting, identification, analysis, interpretation, and reporting	65	128		8,320.00	0.00	8,320.00
		Water Quality data collection (4 sites/quarterly)	60	128		7,680.00	0.00	7,680.00
		Water Quality data analysis and interpretation	78	185		14,430.00	4,744.00	9,686.00
		River Watch support and lab analysis (4 sites/quarterly)			$46/site	1,472.00	0.00	1,472.00
	MILEAGE	WQ and macroinvertebrate sampling			1540 miles @.555 per mile	854.70	0	854.70
	SUPPLIES and SHIPPING	WQ sampling			$6/site	192.00	0.00	192.00
TASK 4 SUB-TOTAL						36,788.70	4,744.00	32,044.70

TASK NUMBER	CATEGORY	DETAILS	COST PER HOUR	HOURS	OTHER RATES	TOTAL COST	WSRA REQUEST	MATCH (in-kind and cash)
TASK #5 – Conduct a Road Reclamation Pilot Project in Coal Basin								
	PERSONEL COSTS	Project Planning/on-site project supervision	50	752		37,600.00	0.00	37,600.00
		Soil Monitoring	40	96		3,840.00	240.00	3,600.00
			40	16		640.00	0.00	640.00
			30	16		480.00	480.00	0.00
			50	16		800.00	800.00	0.00
		Vegetation Monitoring	43.75	32		1,400.00	0.00	1,400.00
		Tree Planting			500/ac for 3 ac	1,500.00	1,500.00	0.00
		Trackhoe Operator	50	80		4,000.00	0.00	4,000.00
		D-5 Bulldozer Operator	50	120		6,000.00	0.00	6,000.00
		Dump Truck Operator	50	160		8,000.00	0.00	8,000.00
		Fence Building			750/acre for 5 ac	3,750.00	0.00	3,750.00
	EQUIPMENT /SUPPLIES	Trackhoe 315 with thumb Time			2 wks @ 2876.90 /wk	5,753.80	0.00	5,753.80
		D-5 Bulldozer Time			2 for 1.5 wks @2,500 /wk	7,500.00	0.00	7,500.00
		Dump Truck			2 for 2wks@ 1600/wk	6,400.00	0.00	6,400.00
		Compost Cost				7,885.20	0.00	7,885.20

		Compost Haul			62 miles round trip	7,927.50	0.00	7,927.50
		Blending				3,150.00	0.00	3,150.00
		Biochar Cost				6,916.00	0.00	6,916.00
		Biochar Haul to South Canyon			269 miles	3,000.00	0.00	3,000.00
		Spruce Trees			200 trees @ 8 each	1,600.00	0.00	1,600.00
		Grass Seed				250.00	0.00	250.00
		Fencing Supplies			800/acre for 5 ac	4,000.00	0.00	4,000.00
		Weed Treatment (horseback spraying and mechanized boom type application)			100/acre for 40 ac	4,000.00	2,000.00	2,000.00
		Soil Moisture Monitoring Station (itemized list available)				5,230.00	0.00	5,230.00
		Misc supplies				63.53	0.00	63.53
TASK 5 SUB-TOTAL						131,686.03	5,020.00	126,666.03

TASK NUMBER	CATEGORY	DETAILS	COST PER HOUR	HOURS	OTHER RATES	TOTAL COST	WSRA REQUEST	MATCH (in-kind and cash)
TASK #6 – Manage Project; Education and Outreach								
	PERSONEL COSTS	Education and Outreach, Workshop	75	160		12,000.00		12,000.00
		Coordinate and oversee implementation of the overall project, ensure fiscal accountability and prepare and submit invoices.	75	400		30,000.00	23,070.00	6,930.00
		Prepare and deliver progress reports to CWCB every 6 months. Prepare and deliver a final report to CWCB at the conclusion of the project.	100	170		17,000.00	17,000.00	0.00
TASK 6 SUB-TOTAL						59,000.00	40,070.00	18,930.00
TOTALS						**584,463**	**304,464**	**279,999**

Timeline

TASK	Fall 2012	Winter 2012-2013	Spring 2013	Summer 2013	Fall 2013	Winter 2013-2014	Spring 2014	Summer 2014	Fall 2014	Winter 2014-2015	Spring 2015	Summer 2015	Fall 2015	Winter 2015-2016	Spring 2016	Summer 2016	Fall 2016	Winter 2016-2017
Task 1			NeMap Assessment		Calibration and Verification		Level I Assess-ment Draft Report	Level I Assess-ment Final Report										
Task 2				Field Work		Analysis		Field Work	Analysis			Field Work	Analysis and Project Design					Targeted Assess-ment Final Report
Task 3			Gage Installat-ion	Flow and Precipitation Monitoring				Flow and Precipitation Monitoring (if needed and additional funding is found)										
Task 4	Macro Data Collection and Quarterly Monitorin g	Quarterly Monitoring		Macro Report Quarterly Monitorin g	Quarterly Monitor-ing	WQ Interim Report (Quarterly Monitorin g)	Quarterly Monitoring											
Task 5	10 acre project implemen tation		Soil Monitor-ing	Weed Treatment Fencing and Soil and Veg Monitor-ing	Soil and Veg Monitor-ing	Draft report	Soil Monitoring			Final Pilot Project report	Soil Monitoring (if needed and additional funding is found)							
Task 6					6-month CWCB report		6-month CWCB report		6-month CWCB report		6-month CWCB report		6-month CWCB report		6-month CWCB report			CWCB Final Report