Final Report
Mancos River Habitat and Diversion Project
Phase III

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Mancos Conservation District

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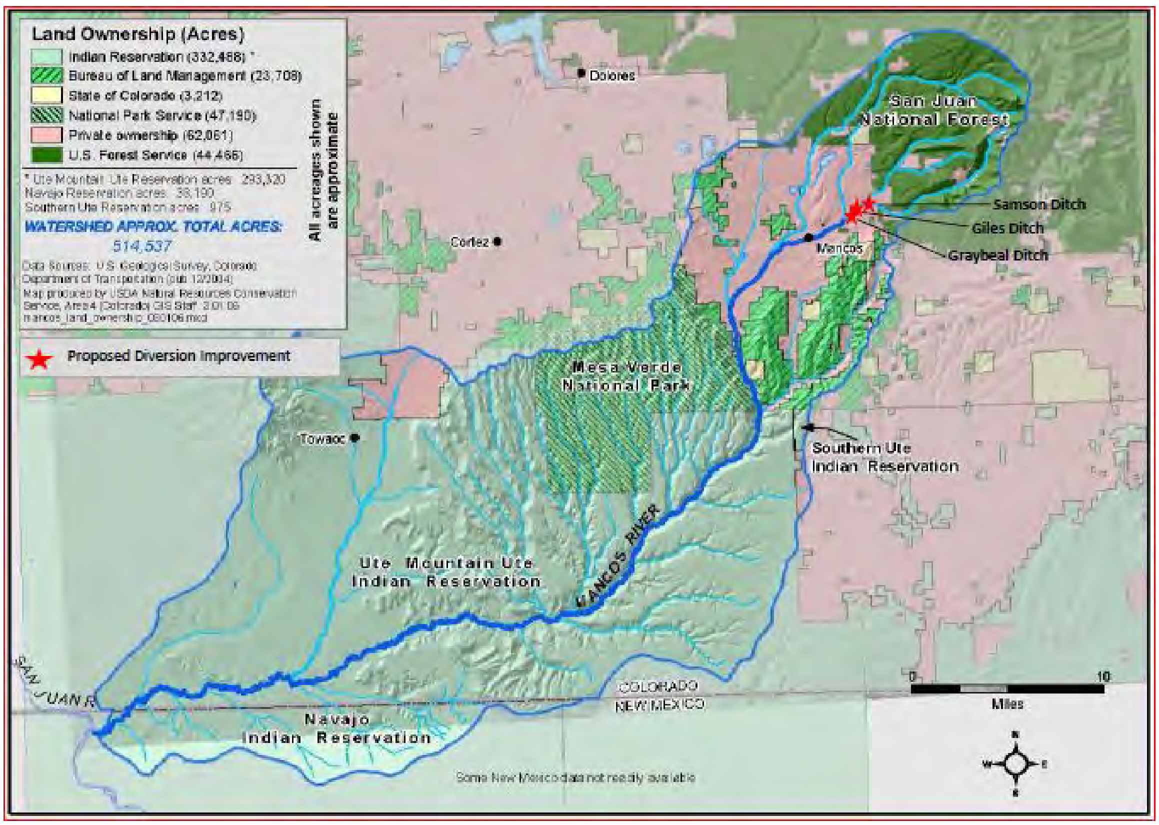
Introduction

The Mancos River Habitat and Diversion Project – Phase III is a multipurpose project building on and integrating the products of Phases I and II. Phase III will continue to implement the findings developed in the Mancos River Diversion Project- Phase I to improve the ecological and agricultural function of an additional 1.5-mile reach of the lower East Mancos River. In addition, Phase III will integrate existing data into an assessment of the resiliency of the Mancos River to support multiple values and uses, in light of a changing climate.

This multi-purpose project will complete two simultaneous efforts. One effort will physically improve the agricultural and ecological function of a 1.5-mile reach of the East Mancos River, by installing improved diversion structures at three irrigation ditch headings. The improved structures will save irrigators annual maintenance costs, while also allowing fish and sediment passage at higher flows, and promoting channel stability. The other effort will convene a collaborative process to integrate existing data into an assessment of the resiliency of the Mancos River in light of a changing climate. This stakeholder assessment will be useful to land owners and managers interested in where/how to invest resources to maintain/improve the value of the Mancos River for multiple uses into the future (Figure 1).

Figure 1 Mancos watershed and diversion locations.



Prior to approval of this WSRA grant support, many partners had already collaborated with and supported the Mancos Conservation District to lay the foundations for accomplishing these objectives. Among them are the Southwestern Water Conservation District, Mountain Studies Institute, Mesa Verde National Park, Trout Unlimited, the Ute Mountain Ute Tribe, the San Juan

National Forest, the Samson, Giles and Graybeal Ditches, MCD board members and staff, private landowners along the Mancos River (see Exhibit C for letters of support), and local volunteers. Objective 1 will implement designs produced with support from the Southwestern Water Conservation District under the Mancos Diversion Project grant to the Mancos Conservation District. Work on Objective 2 has already begun with a series of five Mancos River Restoration meetings facilitated by Mountain Studies Institute staff with Mancos Valley Watershed Group stakeholders between April and October 2015.

Goals and Objectives

The objectives of the Mancos River Habitat and Diversion Project – Phase III are:

1) To further the efforts begun in the Mancos River Habitat and Diversion Project – Phases I and II to decrease the time and costs incurred in diverting irrigation water at 3 irrigation diversions, while also improving channel function and fish passage on the reach of East Mancos River stretching from the West Fork upstream to just above the Middle Fork.

2) To complete the effort begun by the Mancos Conservation District, Mountain Studies Institute and the Mancos River Watershed Group in 2015 to integrate existing data into an assessment of the resilience of the Mancos River to continue to meet multiple uses and values in the face of changing climate conditions.

Tasks, Methods and Results

TASK 1 – Mancos River Resilience Assessment

In August 2016, the Mancos Conservation District contracted the Mountain Studies Institute to facilitate stakeholder driven development of Mancos River Resilience: A Watershed Health Report Draft 1 March 2018 (Appendix 2).

The purpose of this collaborative report is two-fold: 1) to compile the wealth of Mancos River data that currently exists into one usable reference for community members, and 2) assess the overall functional condition of the Mancos River and identify areas of needed data and information. Mancos River Resilience is intended to be helpful in addressing Mancos valley residents' concerns regarding where and how both effort and resources can be invested in order to maintain or improve the resilience and value of the Mancos River for agricultural, environmental, municipal, recreational and industrial uses into the future.

The Phase III grant allowed completion of "Draft 1." In 2018, Mancos Conservation District will make a concerted effort to further engage community members in reviewing, discussing and refining the document.

Methods/Activities

Through five meetings in 2015 (in April, May, July, September and October), local and regional stakeholders (including members of the Mancos Watershed Group, as well as new stakeholders) formed the Mancos River Restoration and Resilience Group to identify issues, interests, and resources. The group established a Dropbox site to house and share existing documents and data. The group agreed on a goal to compile information to address the questions "What do we know? What do we need to know?" This process and participation laid the foundation Mancos Conservation District's application for roundtable funding to support development of the Mancos River Resilience watershed report. Total in-kind contributions of time in the six months prior to the grant application were worth at least $8446.

On June 18, 2016, after receiving the Notice to Proceed from CWCB, the Mancos Conservation District (MCD) and Montezuma Land Conservancy co-hosted a workshop concerning Riparian Restoration and Livestock Management from 9 a.m. to noon. The event was open to the public and held on the Burk Ranch conservation easement located at the confluence of the Mancos River and County Road 39 (Figure 2). The workshop was led by: Marty Moses, Private Lands Wildlife Biologist, Natural Resource Conservation Service; Paul Morey, Wildlife Program Manager, Mesa Verde National Park; Stephen Monroe, Hydrologist, National Park Service/Southern Colorado Plateau Network; Chris Rasmussen, EcoMainstream Contracting; and Jack Burk, land owner. Thirty people attended this three hour workshop, which generated discussion and sharing of information regarding the current status of the riparian system along this reach of the Mancos River. Total in-kind contributions of time to the project were 90 hours.

Figure 2 Riparian Restoration and Livestock Management Workshop, Burk Ranch, June 2016.

In September and November 2016, Mountain Studies Institute (MSI) staff convened the Mancos River Resilience Project Steering Committee for two meetings, each from 10 AM- 12 PM at the Mancos Conservation District (MCD) Office, 604 Bauer Avenue, Mancos. Attendees included:

Gretchen Rank, MCD; Marcie Bidwell, MSI; Ann Oliver, Project Manager; Stephen Monroe, Hydrologist; Becca Samulski, FireWise Communities of Southwest Colorado; Celine Hawkins, The Nature Conservancy; Bob Becker, MCD Board; and Travis Custer, MCD Board. Topics discussed included the role of the steering committee, review of grant deliverables and October 2015 Science Meeting, the desired outcomes and agenda for the next Science Meeting, and the form, purpose, and resilience metrics for the "Resilience Report." The in-kind contribution of time toward the project totaled 16 hours. The group scheduled a science meeting for December 1, 2016 at the Mancos Grange.

On December 1, 2016 MSI and MCD convened the Mancos Restoration and Resilience Group (MRRG) meeting at the Mancos Valley Grange. The goals for the meeting were to share data on key resources not previously covered, and to develop metrics and measures for the basis of the resilience report. Nineteen partners participated in the full day (7.5 hour) meeting. The agenda included discussion of resources and information available for wildfire, agriculture, and fisheries, as well as presentations regarding current status of Mancos watershed resources and future plans from the San Juan National Forest and Town of Mancos. Presenters included Shauna Jensen, San Juan National Forest, Hydrologist; Becca Samulski, FireWise Communities of Southwest Colorado; Jim White, Aquatic Biologist, CPW; Travis Custer, District Conservation Technician, High Desert Conservation District; and Andrea Phillips, Mancos Town Administrator. Presentations can be accessed at https://www.dropbox.com/sh/gaml9nhrdzrar5x/AAAzPMQ2JCwRiMpeN_Fz_y3-a?dl=0.

The products of the December 1, 2016 workshop included these four presentations, a set of meeting notes (Appendix 1), and a refined Mancos River Assessment Metrics Table (Appendix 1). The MRRG decided to form subgroups to develop the indicators and metrics for the Resilience Report in more detail. The group refined the organization of the report to the following sections: Water Quality and Water Quantity, Agriculture, River Health, and Forest and Rangeland Health. Additionally, climate (as metrics) will be used as information to support these four topics/goals.

On March 7, Marcie Bidwell, Stephen Monroe, Gretchen Rank and Ann Oliver met to begin identifying and refining indicators for review by each subgroup. Marcie Bidwell and Ann Oliver continued this work at a meeting on March 9.

On September 13, 2017, the Mancos River Resilience Project Steering Committee reconvened to discuss a "strawman" version of the watershed health report and to agree on the report format. Attendees included Bob Becker, Travis Custer, Kevin Heiner, Gretchen Rank, Marcie Bidwell, Ann Oliver, Stephen Monroe, and Becca Samulski.

On November 14, 2017, Page Buono, MSI; Gretchen Rank, MCD; Stephen Monroe, Hydrologist and Rebecca Samulski met to review and discuss the draft watershed report card and to agree upon the schedule for moving forward. The group agreed that Page should compile and format the text that group members had compiled for each indicator into a draft of the watershed resilience report and circulate it for review. Appendix 2 present the results of that review and editing.

TASK 2 – Design Diversion Improvements

The Mancos Conservation District contracted Russell Klatt to prepare construction-ready design drawings for new diversion structures at the Graybeal, Giles and Samson Ditches (Appendix 3).

Methods/Activities

- Southwester Water Conservation District funded the Mancos Conservation District Mancos Diversion Project grant request in 2015.
- Mancos Conservation District contracted Russell Klatt in September 2015 to produce construction ready designs in AutoCAD for the Graybeal, Giles and Samson Ditches.
- Mancos Conservation District received and payed for the final designs in November 2015.

TASK 3 – Install Diversion Improvements

The Mancos Conservation District board joined Ditch owners and landowners in a tour of the Graybeal, Giles and Samson Ditch Diversions on the East Mancos River in 20The Mancos Conservation District contracted Problem Solvers, llc to install the diversion structures designed in Task 2 at the Graybeal, Giles and Samson Ditches on the East Mancos River. The diversions were all installed during the spring and summer of 2016. Figures 2 through 10 show each diversion before and after construction.

MCD staff conducted on-site inspections of each diversion between June 1 and June 23, 2016. NRCS completed the final inspection of the newly installed diversions on August 25. MCD staff completed As-Built surveys and drawings of each diversion from August 25-29, 2016. The time spent on these site surveys and inspections totals 79.5 hours of in-kind contribution to the project.

Method/Procedure

1. Purchase construction materials.
2. Hire local trucking company to transport materials from source to project site.
3. Provide construction staking and construction oversight.
4. Hire large track excavator to install structures.
5. Site clean-up (smooth grade disturbed areas and excavated materials).

TASK 4 – Administer, Coordinate, and Report Project

Mancos Conservation District coordinated the completion of Tasks 1-4 with partners and funders, as well as the fiscal administration of the grant. MCD also wrote and submitted two progress reports and this Final Report.

Method/Procedure

In July 2016, MCD contracted Ann Oliver to assist Gretchen Rank, District Manager, in managing this project. Ms. Oliver tracked and documented project progress, writing and circulating two progress report, dated April 1, 2017 and September 29, 2016. Ms. Oliver wrote this final report to document the methods, costs and outcomes of the project, including pre- and post-project photographs, and the products of each task. She contributed to planning the Task 1 stakeholder meetings in and attended most of those meetings. She provided support for match tracking and documentation, as needed.

MCD contracted MSI to complete Task 1 and Problem Solvers, llc to complete Task 3. Gretchen Rank managed and coordinated communications with the Graybeal, Giles and Samson Ditches, the MCD board, the NRCS and Problem Solvers, llc.

Mancos Conservation District submitted a total of three reimbursement requests, two Progress Reports, and this Final Report.

Obstacles Encountered

Mancos Conservation District did not encounter any significant obstacles to the successful completion of the project.

Proposed Versus Actual Budget

Table 1 shows the proposed project budget, with the cash match commitments and the committed and anticipated in-kind match. Upon completion of the project, the actual budget differs from the proposed budget in the actual amount of in-kind contributions toward completion of the Mancos River Resilience report. Completion of the report required a considerably larger in-kind contribution of staff time from the Mountain Studies Institute (with a value of at least $2200), as well as from many of the partners and stakeholders who participated in guiding, drafting and reviewing the document.

The Mancos Conservation District confirms that all match, both cash and in-kind, that was committed in the proposed budget was in fact contributed to the project.

Table 1 The Project Budget as proposed.

		CWCB Funds		Other Funding Cash		Other Funding In-Kind^			
Task	Description	Labor*	Materials and Equipment	MCD	NPS	MCD	MSI	NPS	Other Entities and Volunteers
1	Complete Mancos River Resilience Assessment	$ 10,430.00	$ -	$ -	$ 2,500.00	$ 848.00	$ 2,148.00	$ 877.00	$ 3,935.00
2	Design diversion structures.	$ -	$ -	$ 2,800.00	$ -	$ 500.00	$ -	$ -	$ 138.42
3	Install diversion structures.	$ 25,760.00	$ 14,910.00	$ 12,200.00	$ -		$ -	$ -	$ -
4	Administer, coordinate, manage and report on the project.	$ 7,900.00	$ -	$ 700.00	$ -	$ -	$ -	$ -	$ -
	TOTALS	**$ 44,090.00**	**$ 14,910.00**	**$ 15,700.00**	**$ 2,500.00**	**$ 1,348.00**	**$ 2,148.00**	**$ 877.00**	**$ 4,073.42**
	TOTAL MATCH				**$ 18,200.00**				**$ 8,446.42**
	TOTAL REQUEST		**$ 59,000.00**						

^In -Kind Contributions

Task	Description	Project Personnel:	MCD Board Members	MCD Manager	Total MCD In-Kind	Landowner Field Visits	MSI Staff and Resources	NPS Staff and Resources	Peter Stacey, UNM	Alison , Wild Utah Project	TU Staff and Volunteers	USFS	Colorado Extension	Professional Pro-bono (CR, ERO, ASO)	Ute Mountain Ute Staff	CNHP	DRMS	Total In-Kind (minimum)
		Rate:	$ 25.00	$ 20.00		$ 23.07	.	$ 23.07	800/day	$ 23.07	$ 23.07	$ 23.07	$ 23.07	Varied	$ 23.07	$ 23.07	$ 23.07	
1	Complete Mancos Watershed Resilience Assessment~		$ 688.00	$ 160.00	**$ 848.00**	$ -	**$ 2,148.00**	**$ 877.00**	**$ 400.00**	**$ 185.00**	**$ 81.00**	**$ 46.00**	**$ 46.00**	**$ 2,576.00**	**$ 358.00**	**$ 58.00**	**$ 185.00**	**$ 7,808.00**
2	Design diversion structures.		$ 500.00	$ -	**$ 500.00**	**$ 138.42**	$ -		$ -	$ -								**$ 638.42**
3	Install diversion structures.		$ -	$ -	$ -		$ -		$ -	$ -								$ -
4	Administer, coordinate, manage and report on the project.		$ -	$ -	$ -		$ -		$ -	$ -								$ -
	TOTALS		$ 1,188.00	$ 160.00	**$ 1,348.00**	**$ 138.42**	**$ 2,148.00**	**$ 877.00**	**$ 400.00**	**$ 185.00**	**$ 81.00**	**$ 46.00**	**$ 46.00**	**$ 2,576.00**	**$ 358.00**	**$ 58.00**	**$ 185.00**	**$ 8,446.42**

~ This row reflects in-kind contributions of professional time. Where the pay rate of a professional is not known, their time is valued at the Independent Sector Estimated Value of Volunteer Time ($23.07/hr). Time and mileage contributed to attend meetings are not included.

Figure 3 Graybeal Diversion BEFORE (May 31, 2015).

Figure 4 Graybeal Diversion AFTER (August 15, 2016).

Figure 5 Giles Diversion BEFORE (May 31, 2016).

Figure 6 Giles Diversion AFTER.

Figure 7 Samson Diversion BEFORE (May 31, 2016).

Figure 8 Samson Diversion AFTER (August 25, 2016).

Appendix 1

Notes from Mancos River Resilience Group Meeting
Mancos Valley Grange, December 1, 2016

Mancos Restoration and Resilience Group

December 1, 2016

Meeting Notes

Meeting Agenda

December 1, 2016 | Mancos Valley Grange | Mancos, Colorado

SESSION I	
8:30 – 8:45	**Introductions and Welcome**
8:45 – 9:15	**Review Purpose of Group and 2015 Meeting**
9:15 – 9:40	Gary Kennedy, Mancos Water Conservancy District - **MWCD Water Distribution and Activities**
9:40 – 10:05	Becca Samulski, Firewise or BLM – **Fire Management and Risk**
10:05 – 10:35	Shauna Jensen, San Juan National Forest - **Watershed Health and Hydrology**
10:35 – 10:45	**Break**
10:45 – 11:10	Jim White, Department of Natural Resources - **Fisheries and Aquatic Health**
11:10 – 11:35	Travis Custer, Mancos Conservation District and High Desert Conservation District - **Soil Health and Ranching/Farm Practices**
11:35 – 12:00	Colin Larrick, Ute Mountain Ute Tribe Environmental Department - **Water Quality and River Restoration**
	LUNCH!
SESSION II	
1:00 – 2:30	**Discussion of Direction of Report** - Identify Existing Information - Decide Metrics for Measuring Resilience - Identify Known Data Gaps
2:30 – 2:45	**Break**
2:45 – 3:15	**Process – Science Synthesis** - Sub-committee for Moving Report Forward - Who Will Contribute and Write Report? - Who Directs Final Report? - What Does the Report Look Like?
3:15 – 4:00	**Stakeholder Process – Proposed** - Meetings - Review

Wildfire in the Mancos Watershed – Becca Samulski, Firewise

Objective - Provide information about fire: risk = chance or probability a fire might start

Define the values that are at risk

- Water quality > increased erosion, hydrophobic soils, sedimentation
- Property

Values – Previous FireWise focus was on Wildland Urban Interface / expanded in recent years to watershed as whole (Forest Health).

Lower portion of Mancos watershed has higher risk for low frequency-high intensity fires.

Both Tres Rios and SJNF are in process of resource and asset assessment. Identify areas on landscape of net benefit (e.g. / net hazard (e.g. powerline). Data will be available in Spring and could be plugged into MRR report or added later.

Wildfire background – 1959 to recent show high probability in some part of watershed for high severity fire in near future (~10 years).

Impacts of mitigation and treatment – goal is restoration of natural fire regimes, using methods including thinning and other methods.

Discussion and Comments:

- What effect does beetle kill have on forest and on wildfire behavior?
  - Answer = recent studies have shown beetles do not increase risk of catastrophic wildfire.

USFS Activities in the Mancos Watershed – Shauna Jensen, San Juan National Forest

Portion of Mancos watershed managed by USFS is relatively small, but there is lots of activity on these lands.

Landscape scale initiatives on SJNF

- Aquatic Riparian and Wetland Assessment
  - Completed by SJNF in 2006.
  - Purpose of assessment was to describe, rate, and identify management needs.
  - Portions of the Mancos watershed had high levels of disturbance due to anthropogenic impacts.
- Watershed condition classification
  - Completed by SJNF in 2012.
  - One objective of condition classification is to prioritize watersheds for restoration.
  - East Fork of Mancos River (for water quality) and West Fork of Mancos River (for diversions affecting quantity) Mancos were rated at Risk; Chicken Creek rated as Impaired (for quantity re diversion, riparian,

roads and trails, soils, fire regime outside historic range of variability in Ponderosa, invasive species). Ongoing process done at forest level.

- Watershed Restoration Action Plan
  - Thinning in Ponderosa, prescribed burns, removal of invasives, ongoing analysis of grazing impacts
- Historic fire regimes based on frequency and severity
  - Fire Regime Condition Classes - significantly altered at lower elevations, moderate and mid-level and low in upper portion of watershed.
- Wildfire Risk Assessment
  - Tools for assessing and mitigating wildfire risk; working w Firewise
- Post Fire Risk Modeling
  - Use AGWA to model flood flows and total sediment (is necessary input data available?);
  - Firewise is working with UofA on AGWA model for Dolores, and may expand to entire SJNF, could include Mancos early on.
- Timber/Fuels activities
  - Thinning pine and oak, aspen coppice, prescribed burns; collaborative effort working w agencies and tribe.
  - Future management goals: increase target area, reduce costs, mimic natural fire regime.
- Range management activities
  - NEPA on all allotments, boundary changes, reduction in numbers, changes in livestock type, fencing, water developments, exclosures.
- Recreation/travel management
  - identify motorized routes, establish minimum road and trail system, eliminate unauthorized routes.
- USFS monitoring in the Mancos watershed
  - Timber, Fuels, Range, Watershed, Wildlife.
  - Data is available and can be requested.

Discussion and Comments:

- What is the extent of instream channel structures in watershed?
  - There are very few and none are major, mostly due to funding limitations.
- Is there a broadscale EA in works?
  - No.
- Are other groups using USFS data for watershed condition evaluations?
  - Yes, for example TNC's watershed assessment (beershed); and State 303d lists.

Status of Fisheries in the Mancos River – Jim White, Colorado Parks and Wildlife

Distribution

- Coldwater species upstream (reaches where water is 60F or less)

        - rainbow, brook and a few brown trout, perch, sculpin, (no cutthroat)
  - Warmwater species downstream
    - natives – roundtail chub, speckled dace, pikeminnow, flannelmouth and bluehead suckers (no white suckers). Natives are very mobile, moving as much as 20-30 miles;
    - Non-natives – sunfish, bass, minnows.
  - Hwy 160 is approximate cold/warm breakpoint. Shifting now or in future?

Abundance

- Overall density of fish in the Mancos River is very low for both cold and warm water species relative to other watersheds. Why?
- Low density is due to multiple limiting factors
  - Low flows or lack of flow at some times of year;
  - Fire effects (debris flows - sedimentation);
  - Limited habitat connectivity;
  - Haven't looked in detail at water quality, but most of these species are resilient to wide ranging water quality conditions.

Management goals

- Stocking, flannelmouth and bluehead sucker – issues hatchery fish don't have same instincts or behaviour as wild fish, potential for interbreeding w white sucker;
- Use of genetic characterization to support stocking and fish movement decisions.
- Barrier on UMUT 5-7 miles upstream from confluence w SJ. Prevents non-natives from moving upstream.
- Habitat improvement (flows);
- Stream reconnection (provision for movement to refugia during low flow periods);
- Protection (maintain the existing barrier on lower portion of river).

Soil Health and Ranching/Farm Practices Travis Custer, Mancos Conservation District and High Desert Conservation District

16,000 acres 35 diversions- pretty complicated for the size of the drainage in how water moves

1100 farms in Montezuma, 600 ac average, 97,000 acres of cropland in County. Mostly ranching and hay (60% in Montezuma County), plus growing number of small food production.

Hay production, cattle ranches, and smaller growing acreages. 15-20 acres are more common. Larger scale farms are also combining.

Soil heath and how it affects water quality and quantity- We are running into issues with the Colorado Water Compact, because we know understanding of watersheds and watershed health that we didn't have before.

Organic content of soils 2-5% on average across the County (obvious challenges with an average as soils vary). Annual croplands have reduced to 1% organic matter. The typical rotation/rest farming method used for alfalfa and pinto beans has affected the soil structure.

Four goals to maintain soil health

- Keep soil covered as much as possible (reduce erosion);
- Maintain living plants to fuel the factors of biology, structure and water holding capacity;
- Promote and maintain biodiversity in mimicking natural processes (crop rotations)
- Reduce disturbance (e.g. deep tillage);
- Incorporate livestock based on research showing beneficial role w appropriate management.

Challenges

- Increased runoff from poor soil structure. Place emphasis on importance of storing water in soil. Ability to do this is based on soil structure. Good structure allows infiltration (water and air) and supports bacteria and fungi – creating 'living filter';
- Sedimentation and nutrient pollution accompanying runoff. Increases in soil condition improves water quality and potentially runoff;
- Concerns that water conservation and efficiency measures will put water rights at risk
- Diversions are not necessarily measured (old systems or lacking), so hard to track improvements.
    - Can estimate from Crop ET, but hard to get a number
- Changes in practices take several years to see the payout for the investments. So the conversion is hard to show impact in short term.

We have a lot of old water rights and lack transboundary diversions in the watershed. There is fear that any change in the water rights system would weaken/threaten the security of their rights.

Improvements in Mancos Valley (or Montezuma County)

- Reduction in salinity loads due to BMPs (less flood irrigation);
- Trial technologies- dragging driplines (saves center pivot by 25-35%);
- Infiltration improvements;
- Looking for funding for improving larger ditches (efficiency);
- Lund Ditch as added telemetry to monitor their head gate remotely;

Measurable Outcomes

- Salinity projects
- Percent BMPs in the basin

Future Considerations

- What process and/or language will be helpful to how can agriculture participate in river health?
    - Can we forge partnerships between farmers/ranchers and instream flows?
- What are the changes in farming practices, crops, and acreages going to change in the future?
    - Small food crop acreages
    - Transitions of land to other uses
- What role can soil health have in absorbing carbon as a climate strategy?
    - Peter Donovan working with volunteers to monitor carbon levels and BMPs
- What other technologies are out there?
    - Biochar is challenging in alkaline soils, so may not be an option. Lack examples of broad application in
    - Combined methods- wood chips, biochar with manure, Elcelsoir mulch,
    - Management practices
- What monitoring would be worth installing to improve efficiency and precision of water usage?

Discussion and Comments:

- Is salt load delivered to SJ regularly measured?
    - Not currently.
- What are the challenges in monitoring water use in the Mancos Valley?
    - Difficulty in monitoring water use in Mancos is mostly due to large number of small ditches and high cost of gages/remote controls.
- Has there been talk of conservation group taking test water rights case to court to improve definition of understanding of law?
    - Not yet, but this would be helpful.
- To what extent is potential changes in flow (~-23% or more) due to drought or climate change being considered in ag community.
    - Leads to importance of language used to address climate in report.

Andrea Phillips – Mancos Town Administrator

The river is a key and vital resource for Mancos community, including part of the naming of the town. The administration also sees it as a neglected and missed opportunity in the past. They want to see it embraced as an asset. The Town also uses the river as a major drinking water source. Public works is working on bringing in improvements to the headgates for the Town water supply. Working on improving infrastructure, including settling ponds (control overflow) and piping.

Town of Mancos has a Comprehensive Plan (2011) including a vision for the town. It includes environmental sustainability, quality and affordable housing, infrastructure, and sustainable development to maintain the small town atmosphere of Mancos. The plan is available at: http://www.mancoscolorado.com/admindocs/2011CompPlan.pdf

The Board recognizes that in Mancos there is a mix of income levels, employment types, including many people that rely on the town for necessities as well as a component that consider it a bedroom community. It is very diverse in age, economics, politics, and demographics. The town is growing slowly, but positive growth. There is a mix of businesses here and also tie into businesses others. The Town is working to secure high speed internet- the lack of the infrastructure is holding the town back.

Emergency response planning, including drought, wildfire risk, serious winter storms, and climate change.

- The Town feels it has enough water 240 AC feet in Jackson Reservoir in addition to the river. Challenges are aging distribution lines and the water treatment plant. They just built a new water tank and also need to the old one.
- Thee water system serves approximately 500 accounts. They do have the ability to restrict watering and enforce water restrictions. They provide information to residents on xeriscaping. Increasing water rates has increased water conservation. It used to cost $10,000 for 28g/m. They lowered their base gallons to 7,000. People are paying for what they are using.
- The Town is a third tier water user, and has irrigation rights at Cottonwood Park, although they would like to better utilize it, improving efficiency.
- FEMA flood zone maps, show Chicken Creek and the Mancos River have many residences in the 100-year flood plain. They have a flood zone regulations.
- Concerns related to climate change are extreme winter storms, droughts and wildfires.

Development of the Mancos River Walk

- Working towards connecting Cottonwood Park with Boyle Park. Have 1 miles of soft surface path. Working on easements.
- Planning on improving Cottonwood Park, including intentional access points (rather than social trails). Finding issues with trash, social trails, and accessibility. The Town has a GoCO Grant in 2017 for improvements to trails and facilities at Cottonwood Park.

Afternoon Discussion Session

Report Objectives and Structure

What is the current health? Looking forward, what are the risks/vulnerability?

Use 'what do we value' as proxy for what are the risks/vulnerability (aka what are the problems?)

What proportion of watershed is public or private?

Who is this immediate group trying to serve? Who is the audience? There are enough tech reports available to drown us all. Suggest the audience be the community (see Ann's Yampa 2006 report).

Need to remember importance of engaging larger audience, particularly those who are not part of current group.

Suggestion - We want this report to read like a story.

- Convey to the readers why they should care.
- Engage the people who are using the water/support the agencies making the decisions.
- This is an informational/planning document. Remember to make sure it is accessible to community.

What is the organizational/business structure for current project and ongoing effort towards building/keeping group alive?

Long-term plan and funding options drive form and content of report.

Recreation was dropped out, but should we bring it back in?

- Probably not necessary.

Report could be a foundational piece that can branch to meet diverse needs.

Suggestion - Redefine as a foundational document/springboard that future communications to specific audiences can tier their information.

Measure what you value and value what you measure.

Focus on fundamental data

When doing trend analysis direct familiar and useful variables (e.g. use water balance to explain status and trend of water availability).

Topics & Goals

Water Quantity

- Identify what (if any) instream water rights are associated with sections of the river.

- Where are there existing protections for water in the stream? e.g. wilderness, instream…
- What water conservation practices should be implemented?
- Add storage to available water sources (reservoir or on landscape)

Agriculture

- Topic questions from Ann O.:
    - How many acres are in ag?
    - How many acres in different uses?
    - What is level of parcelization (size)?
    - What is the salt load delivered downstream?
- Identify how ag contributes to river health. Anecdotes/examples that can show this (e.g. water conservation practices implemented).
- Make the best use of a commons resource.
- Land use/Water use breakdown – from MCD?
- Agricultural lands play an important role in watershed health (not in opposition). Bringing agriculture to the table is a positive light is necessary to address water rights issued in CO.
- Economic importance.
- How resilient is the valley to flooding/drought?

River Health

- Change the form of questions from Yes or No to e.g. 'What is the extent and location of invasive weeds?'
- Add 'Riparian' to the 'River Health' section? Then Separate out Riparian and Aquatic.
- How does the Mancos fit into the 'Big Three'?
- Add sub-questions under Riparian and Aquatic that call out specific species of concern.
- What are we talking about when we say 'healthy'?
- Best fish metrics to use: 1) Presence/Absence, 2) Species Composition, 3) Demographics, 4) Density, 5) Distribution

Forest Health

- Consider change to Upland – Forest / Range / Urban. Or not.
- Promote forest health that promotes a healthy and functioning watershed.

Climate

- Focus on question, leave metrics to later.
- Start with fundamental data
- Trend analysis and projections – turn data to variables audience can relate to (e.g. water balance)
- NPS is resource for data / summaries.

Resiliency

- Fundamental resiliency question: What to What?

- Should we use Resistance and Resilience or go with Transition?
- Do we need to define Resilience?

Threats

- Frequency of extreme events / disturbance (drought, fire, floods, debris flows…)
- Invasive species
- Loss of instream flows
- Economic prosperity
- Vulnerability of ag to disturbance

Report Sub-committees

Water Quality and Quantity – Celine, Steve, Shauna, Gary

Agriculture – Travis, Jack, Bob, Joel

River Health – Ann, Celine, Steve, Duncan, Paul, Tova, Chris

Forest Health – Becca, Derek, Shauna

Climate – John, Duncan, Marcie, Steve, Tova

Report Time Frame

- Steering committee reconvene mid-January – revise matrix
- January/February - Sub-committees zero in on primary metrics.
- Content March 15
- April 1 first draft
- May 1 – final draft
- May - Review
- Final deadline = June

List of Attendees

Marcie Demmy Bidwell, Mountain Studies Institute, Climate Program manager

Derek Padilla, San Juan National Forest, District Ranger

Steve Monroe, Hydroecologist

Shauna Jensen, San Juan National Forest, Hydrologist

Becca Samulski, FireWise Communities of Southwest Colorado, forest health and wildfire protection

Shaun Bliss, NRCS Rangeland Management Specialist, private land owner assistance

Bob Decker, Mancos Conservation District, Water Commissioner

Josh Erwing, Mesa Verde National Park, Biologist

Jim White, Colorado Parks and Wildlife, Aquatic Biologist

Travis Custer, Mancos Conservation District, District Conservation Technician, soil health, water conservation

Tova Spector, Mesa Verde National Park, Plant Ecologist, riparian area, and springs

Jack Burk, Montezuma Land Conservancy, Mancos Conservation District, rancher, land owner

Duncan Rose, Trout Unlimited Dolores River Anglers, Upper Dolores fisheries assessment

John Gross, National Park Service Climate Change Response Program, climate adaptation

Celene Hawkins, The Nature Conservancy, Water Project Manager, agriculture efficiency

Paul Morey, Mesa Verde National Park, Wildlife Biologist, Mancos River restoration efforts

Gretchen Rank, Mancos Conservation District, District Manager

Garrett Hanks, Trout Unlimited Public Lands, Program Manager

Ann Oliver, Mancos Conservation District Project Manager for Phase III, consultant for water resources

Topic & Goals	**Question**	**Metric**	**Resources Available & Needed**	**Stakeholders & Experts**
Water Quality				
Ensure water quality sufficient to support water uses in the basin	• What is the state of water quality to support current or desired uses for water supply, recreation, aquatic life, and agriculture?	• Ute Mountain Ute Tribal Water Quality Standards for Designated Uses, Water Quality Control Commission standards for water quality classified uses	• Mancos Watershed Plan • Mancos Source Water Protection Plan • Water quality monitoring data- UMUT, NPS, CDPHE	MCD, CDPHE, NPS, UMUT
	• What water quality standards are not being met? Where?	• UMUT Water Quality Standards for Designated Uses, Water Quality Control Commission standards for water quality classified uses	Colorado Department of Public Health and Environment, NPS, UMUT	CDPHE, NPS, UMUT
Water Quantity				
Understand available water sources and patterns.	What is the range of timing when water is available? Where is water used and where is it available?	• Maximum annual discharge • Minimum annual discharge • Total annual discharge • Timing of streamflow • Timing of storage	Mancos River Basin Instream Flow Report	CDWR, USGS
Monitor and project water uses	Do we have enough water to support these water uses in the basin, now and by 2050? • Agriculture • Municipal • Recreational • Industrial • Environmental	• Frequency of calls on the river by use • Flow gaps for environmental needs • Water conservation	• Functional Assessment of the Mancos River Watershed • Mancos River Basin Instream Flow Report • CDWR Call and Diversion Records	CDWR, Southwest Basin Roundtable CWCB UMUT
		•	•	
		•	•	

Acronyms: *Colorado Department of Public Health and Environment-CDPHE, Ute Mountain Ute Tribe- UMUT, Mesa Verde National Park- NPS, Mancos Conservatation District- MCD, Colorado Water Conservation District- CWCB, Colorado Department of Water Resources- CDWR, Southwest Basin Roundtable- SWBR, United States Geological Society- USGS, United States Forest Service- USFS, Bureau of Land Management- BLM, Colorado State Forest Service- CSFS, Colorado Parks and Wildlife-CPW*

Agriculture	Question	Metric	Resources Available & Needed	Stakeholders & Experts
Maintain agriculture	• Do we have productive soils for desired crops? • Are our soils healthy and productive? • Are we losing soils to erosion? • Do we have sufficient crop yield? • Do we have sufficient lands available for desired agriculture?		Rapid Watershed Assessment	UMUT
Provide water through infrastructure	• Do we have the infrastructure and efficiency to support water delivery?	• Extent of gated pipe, high efficiency (e.g., sprinkler) on farm systems • Improved diversion structures • Improved (piped or lined) ditch systems • BMPs in basin		Natural Resources Conservation Service, Mancos Conservation District
Support sustainable level of grazing	• What is the extent of grazing in the basin? • What is the quality of the forage? • What is the condition of range?		**Modified Range Assessments**	
	•			
	•			

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River Health	Question	Metric	Resources Available & Needed	Stakeholders & Experts
Maintain healthy aquatic ecosystems	• Are aquatic ecosystems in the river healthy? • Do we have enough water for a fishery annually and seasonally?	• Abundance and diversity of aquatic macroinvertebrates • Spatial distribution of warm and cold water fish species • Species Composition • Extreme events, such as debris flows and droughts?	• Functional Assessment of the Mancos River Watershed • Mancos River Basin Instream Flow Report • Rapid Watershed Assessment • Mancos Watershed Plan • Colorado Parks and Wildlife, NPS, and UMUT monitoring and stocking data	Colorado Parks & Wildlife, NPS, UMUT

Maintain healthy riparian ecosystems	• What is the extent/trend of:
	  • invasive weeds and woody cover?
	  • connected wetland function?
	  • channel complexity?
	  • habitat and water flow for desired wildlife and bird species?
	  • desired flora and fauna in the watershed?
		• RSRA metrics
		• Sedimentation
		• Channel grading
		• Overbank flooding
		• Bank erosion
			• Functional Assessment of the Mancos River Watershed
			• Rapid Watershed Assessment
			• Instream Projects
				Colorado Parks & Wildlife, NPS, UMUT
				USFS Stream Surveys

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Forest Health	Question	Metric	Resources Available & Needed	Stakeholders & Experts
Maintain healthy forest to support a healthy river	• How healthy are our forests?	• Diversity of forest stands and age classes (species, composition)	• USFS, NPS, BLM management plans • Colorado State FS GIS	USFS, BLM, NPS, UMUT, CSFS
	• How susceptible are our forests to insects and disease now and in the future?	• Insect and disease infestation	• USFS Aerial Detection Survey • Colorado State CO WRAP	USFS, BLM, NPS, UMUT, CSFS
Reduce wildfire risk for communities and resources	• What is the wildfire risk in the community and our forests? Where are the values at risk? • Are we reducing risk to our communities?	• Percent acres burned (wildfire, Rx, ignitions) • Percent of WUI resistant to fire damage • History of fire incidence and extent • Critical fire risk • Areas of treatment and BMPs • Percent high risk of erosion & sediment	• Multiple GIS- burned areas, ignitions • USFS Aerial Detection Survey • Colorado State CO WRAP • USFS High Value Risk Assessment (in process) • Community Wildfire Protection Plans (CWPPs) • Erosion and Sedimentation Analysis	USFS, BLM, NPS, UMUT, SJNF
	•	•	•	
	•	•	•	

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Potential Other topics: Community Infrastructure, Economics, Community

Climate Metrics

Topic and Goals	**Question**	**Metric**	**Resources Available & Needed**	**Stakeholders & Experts**
Climate				
Temperature	What are the temperature trends?	• Maximum annual temperatures • Minimum annual temperatures • Seasonal max/min temperatures • Growing degree days • USDA Planting Zones • Frost free days • Heat Index • Phenology or spring indexes	NCDC, NOAA, SNOTEL	
Precipitation and streamflow	What are our precipitation trends?	• Annual precipitation totals • Seasonal precipitation totals • Drought Index • Water Balance • Phenology or spring indexes • Benchmark years	NCDC, NOAA, SNOTEL	
Extreme Events	What extreme events are happening in our region?	• Timing and magnitude of peak runoff • 100, 1000 year storm events	NCDC, NOAA, SNOTEL	
		•		
		•		

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Appendix 2

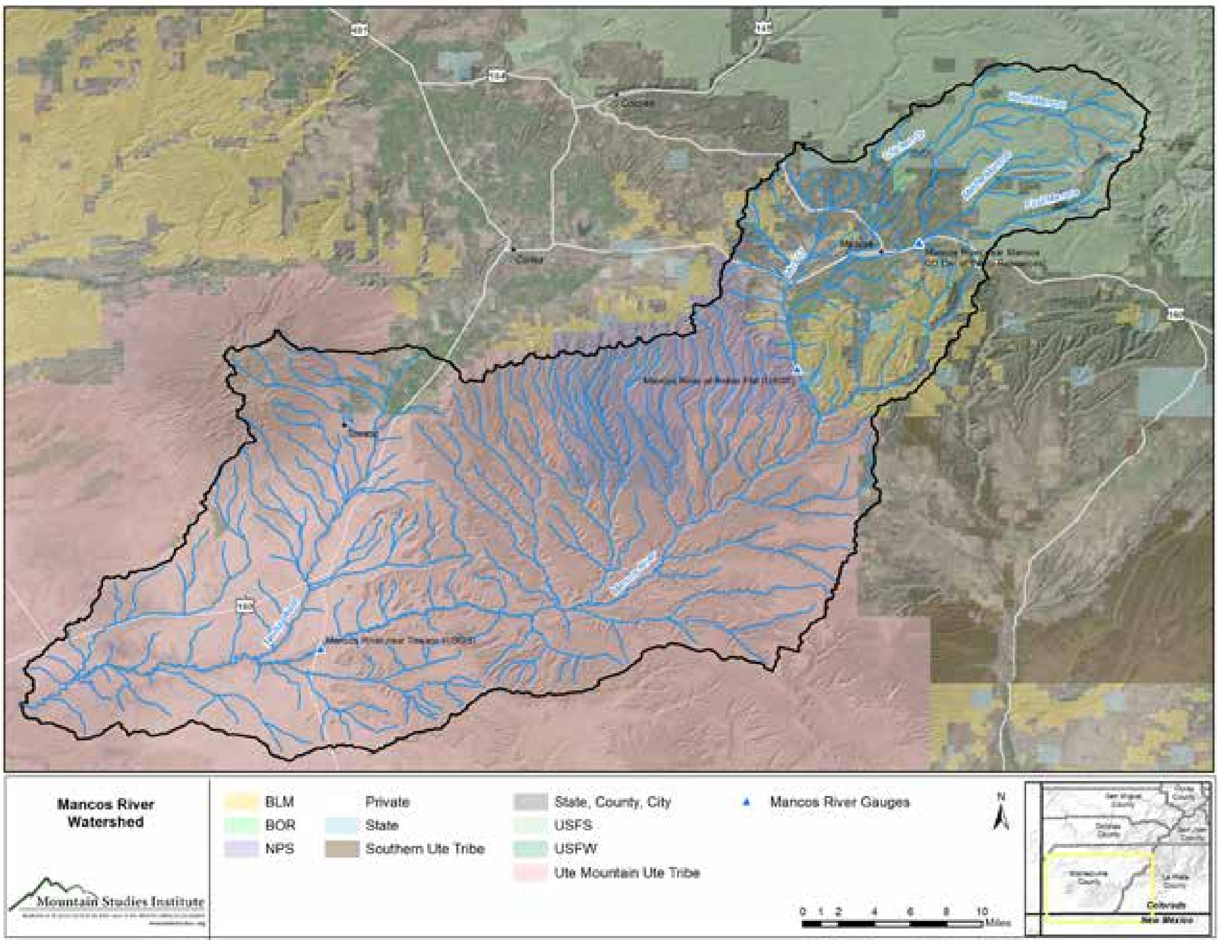
Mancos River Resilience: A Watershed Health Report, Draft 1 March 2018

MANCOS RIVER RESILIENCE

A Watershed Health Report

February 2018

DRAFT I



Editor: Page Buono
Maps: Scott Roberts

Authors:
Paul Morey
Stephen Monroe
Ann Oliver
Tova Spector
Travis Custer
Rebecca Samulski
Gretchen Rank
Marcie Bidewell

The goal of this report card is to synthesize existing data about the health of the Mancos River Watershed and identify data gaps that can help to inform future management and restoration efforts

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SUMMARY OF FINDINGS

The Mancos River Resilience Report is a snapshot of the health of the Mancos River Watershed. Perhaps most importantly, the report highlights gaps in our understanding of the River and identifies research opportunities that could help us to better understand river health as it relates to ecological, economic, and community values.

Of note, authors of this report found that water quality and quantity data is collected intermittently and that data sets are often incompatible; that opportunities for increased efficiency and better production could be gained through better understanding soil quality in the Mancos River Valley; that our understanding of post-fire impacts on ecosystem near the river is limited; and that while we can identify reaches where the river is not in attainment of relevant standards, the reasons why are rarely understood.

Further, authors of the report and engaged stakeholders identified a prominent and demanding need for information about growth and changing uses of land and water availability to support planning for the Mancos River Valley's future.

Like much of Colorado, Mancos has experienced, and likely will continue to experience the effects of drought, population growth, and increasing demand on local water resources. While there is no clear answer or path forward, the need to better understand changing demographics and address an over-allocated resource remain critical to the success and resilience of communities and ecosystems in the Mancos Watershed.

Some of these gaps are already being addressed with plans for research in 2018:

> The RiverWatch water quality monitoring program will resume at six sites on the Mancos River in 2018.
>
> An investigation to identify and quantify sources of metal loading in the East Mancos River will begin in 2018.

We hope this report inspires further questions and curiosity, innovative thinking about how to reconcile unique forms of data collection, and cross-table conversations about how to work collectively for the health and resilience of the Mancos River Watershed.

INTRODUCTION

The Mancos River Reselience Report is a collaborative effort of the Mancos River Restoration and Resilience Group (MRR), a working group of stakeholders with a shared desire to understand the current state of the Mancos River. Together, we aim to identify opportunities for restoration, conservation, and building resilience in the watershed.

In 2016, the Mancos Conservation District received a grant from the Southwest Basin Roundtable and the Colorado Water Conservation Board to develop this Mancos River Resilience Report by gathering existing data, summarizing the current state of the river, and identifying information needs.

The Mancos River originates in the La Plata Mountains at nearly 13,000 feet and flows southwest through the Mancos Valley and Mancos Canyon before joining the San Juan River in northwestern New Mexico at nearly 4,000 feet. This 116-mile long river flows through public and private lands, through Mesa Verde National Park, and both the Ute mountain Ute Reservation and Navajo Nation.

The watershed is divided into two main parts: an upper watershed of approximately 200 miles that includes the Mancos Valley and surrounding mountains, and a lower area that begins at the confluence of Weber Creek and drains the mesa and desert lowland country of Mesa Verde National Park , the Ute Mountain Ute Tribal Lands, and surrounding areas. Three reservoirs-- Jackson Lake, Bauer Lake, and Weber Reservoir--store Mancos River water for irrigation, hydroelectric generation, recreation and municipal water supply.

From the 2011 Mancos Watershed Plan: “The Town of Mancos is a small, rural community historically inseperable from agriculture in a semi-arid climate that is dependent upon irrigation and hard work. The community also recognizes that the character of the valley is changing and that it must deal with an increasing population less involved with agriculture. The National Park Service recognizes the imortant role that the Mancos river provides to fish and wildlife and has taken steps to protect this value. The Ute Mountain Ute utilize the Mancos for farming and also recognize the role the Mancos River has in providing habitat to native fish and wildflife that depend on healthy riparian habitat”.

BACKGROUND & APPROACH

The Mancos Conservation District and MRR partners have supported the completion of several different reports that have assessed the condition of the Mancos River Watershed and identified management priorities over the years. These include:

- **Mancos Watershed Plan (Mancos Valley Watershed Group 2011)**
  : The goals of the Mancos Valley Watershed Group (MVWG) were:
  a) Improve fishing, primarily from the confluence of the East Mancos River with the West Mancos River downstream;
  b) Reduce the loading of dissolved copper from the East Mancos river either through reductions at the sources, increasing assimilative capacity, or through dilution;
  c) Work with irrigators/irrigation companies and landowners along the Mancos River to restore the functioning capacities of the river system;
  d) Work with irrigators to rebuild diversion systems that are in need of constant maintenance and that have major impacts on river functioning capacities of the river system;
  e) Work with irrigators to rebuild diversion systems that are in need of constant maintenance and that have major impacts on river functions;
  f) Improve the riparian ecosystem and thus the functioning capacity of the river;
  g) Improve the in-stream flows throughout the summer months through the town of Mancos and downstream when irrigation tends to dewater the river.

- **Mancos Source Water Protection Plan**
  : this report was completed by the Colorado Rural Water Association to provide the Mancos River community with information and a plan to help ensure the availability of long-term, high-quality clean drinking water sources in the watershed. Objectives of the plan:
  a) create an awareness of the community's drinking water sources and the potential risks to water quality within the watershed;
  b) encourage education and voluntary solutions to alleviate pollution risks;
  c) promote management practices to protect and enhance drinking water supply;
  d) provide for a comprehensive action plan in case of an emergency threat or disruption to the communities water supply

- **the Mancos River Basin In-Stream Flow Report: Preliminary Evaluation of Flow Restoration Options (Beatie and Smith 2011)**
  : conducted preliminary water rights and hydrologic analyses of the Mancos River, outlined potential tools for protecting or restoring flows and recommended the following: 1) examine potential for new instream flow appropriations, 2) examine potential for instream flow ac quisitions, 3) continue efficiencies projects, and 4) consider other projects (eradication of non-native phreatophytes, stream channel modifications, etc.) as appropriate.

BACKGROUND & APPROACH

CONTINUED

- **Mancos River Watershed Diversions (Lanci 2009)**
  : the Mancos River Watershed Diversions (Lanci 2009) report includes maps, photographs and descriptions of diversion structures throughout the watershed. All three of the diversions to be addressed in this project were mapped and described in this report.

- **As part of the Mancos River Watershed Diversions report, a functional Assess ment of the Mancos River Watershed was conducted in the Mancos Valley and adjacent areas (Stacey 2007):**
  :the report included field assessments of 17 reaches through-out the Mancos Watershed. One additional reach on Ute Mountain Ute Tribal (UMUT) lands was also assessed by the Tribe. At each reach, 38 parameters were rated using the Rapid Stream Riparian Assessment Protocol to characterize the reach's Water Quality, Hydrogeomorphology, Fish/Aquatic Habitat, Riparian Vegetation, and Terrestrial Wildlife Habitat. These ratings were then combined to provide an overall score of the functional condition of that reach. Several of these reaches were resurveyed in 2013-2014 and referenced in this report.

- **MCD's 2017-2019 Long Range Plan**
  :This watershed health report builds on historic efforts to advance community and watershed land managers understanding of the local watershed, share and promote science, support planning efforts, and identify data gaps and management opportunities.

WATER QUALITY

QUESTION:

Does the river's water quality support current or desired use needs?

Authors: Stephen Monroe, Ann Oliver, Scott Roberts, Marcie Bidwell

WHAT WE KNOW

The availability of clean water resources is essential to agricultural and domestic water users, as well as to aquatic and riparian ecosystems. The Mancos River and its tributaries are used primarily to support agriculture, aquatic life, and domestic water supply, as well as some recreation. In order to be in attainment of agriculture and aquatic life use standards, segments must meet criteria set by the Colorado Water Quantity Control Division and UMUT.

AGRICULTURAL USE: Colorado and New Mexico define safe as water suitable for crop irrigation and for livestock drinking water. Safe water requires certain levels of metals, forms of nitrogen (specifically nitrate/nitrite), and three radionuclides (radioactive materials) for these uses.

AQUATIC LIFE USE: Both the State of Colorado and UMUT consider a stream segment or lake safe for aquatic life and plant species if it currently supports, or is capable of supporting, aquatic life. The State considers a stream or lake capable of supporting aquatic life if the physical habitat, water levels, and water quality do not limit aquatic life (species or populations), while the UMUT considers them safe for aquatic life if they are free from levels of pollutants that can impair plants, animals, or ecological integrity.

In order to protect the most water quality sensitive animals and plants in streams and lakes, both the State and UMUT identify safe levels of physical parameters, such as Dissolved Oxygen and temperature, and a wide range of pollutants including metals and organic pollutants. [See CO Reg 31 & UMUT Approved Standards for specific criteria].

Water quality monitoring usually includes pH, temperature, bacteria, turbidity, nutrients, major ions and trace elements. Some agencies have also collected data for pesticides, waste water indicators and pharmaceuticals.

WATER QUALITY TERMS

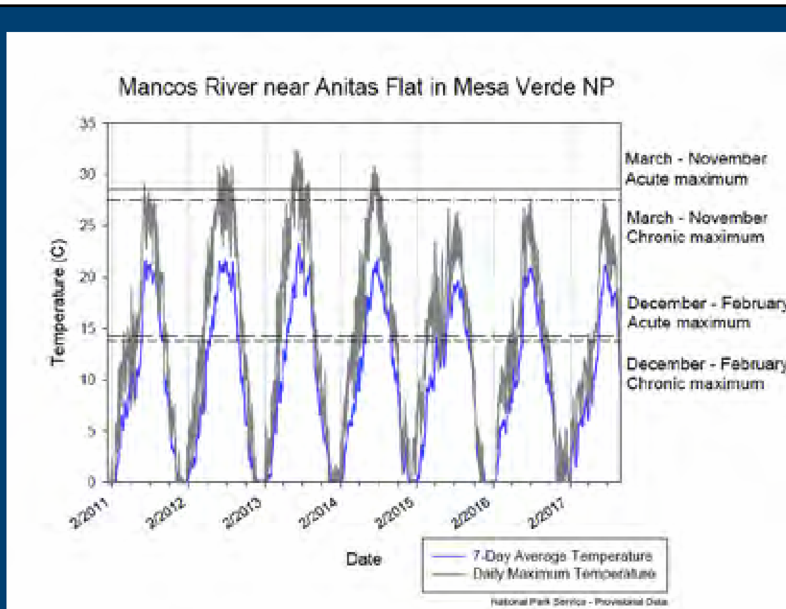
WATER TEMPERATURE varies as rivers flow from mountains to lower elevations and during the changing seasons each year. The temperature of rivers is influenced by the source of the water (e.g. snowmelt, spring flow, reservoir release), the quantity of water in the stream, and by the condition of the surrounding riparian areas. Water temperature is an important factor in determining habitat suitability. **Changes in temperature, like persistent warming, can have a negative affect on many species.** Colorado's daily maximum water temperature criteria says the highest two-hour average water temperature recorded during a 24-hour period should not be exceeded more than once every three years. Mancos River water temperatures recorded in the Park were greater than the State's Warm Water Tier 2 March-November standard of 28.6C during summer months in 2012-2014.

WATER QUALITY (CONTINUED)

SALINITY OR DISSOLVED SOLIDS (TDS) is an issue in streams throughout the Colorado River Basin. The Mancos Valley is the type locality for the Mancos Shale, a well-known natural source of major ions (salts), nitrate, selenium, and uranium. Excess salinity can limit the beneficial uses of water, particularly for agricultural and drinking water uses. The Colorado River Basin Salinity Control Act was enacted in 1974 for the purpose of protecting and improving the quality of water in the river basin. As part of Act, the U.S. Department of Agriculture Natural Resource Conservation Service's Environmental Quality Incentive's Program (EQIP) provides cost-share assistance to landowners in the Colorado River basin, including all sub-basins of the Southwest Basin, who install salinity control measures.

TRACE ELEMENTS (e.g. chromium, copper, iron, manganese, magnesium, molybdenum, selenium, zinc, etc.) are constituents that occur in very small amounts (usually less than 1 to 10 parts per million) and are necessary for the growth, development, and health of most living organisms. Whereas the shortage of trace elements in the body may result in stunted growth or even death, their presence in higher amounts can also be harmful. Activities or sources that could contribute to elevated metals and/or water quality exceedances include historic and current mining, oil and gas development activities, coal-fired power plants and waste incinerators, the underlying geology and the upstream wastewater discharges. Selenium is a trace element of particular concern throughout much of the Colorado River basin, with elevated levels occurring in some places due to irrigation practices and development. Natural background levels are high and associated with particular soil types and geological features, such as Mancos Shale.

WATER TEMPERATURE



WATER QUALITY (CONTINUED)

SNAPSHOT

East Mancos: Dissolved oxygen has been identified as a Clean Water Act (CWA) impairment and manganese and lead have been designated by the State for monitor and evaluation (M&E).

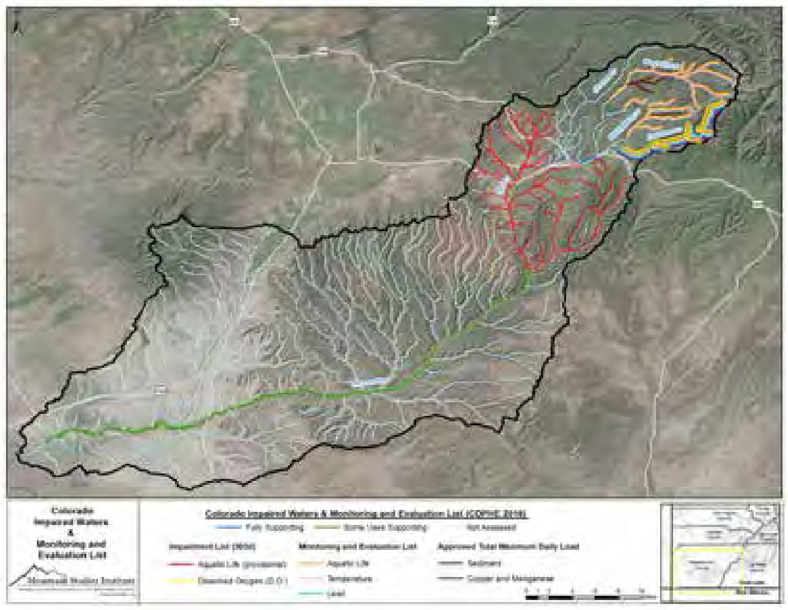
Mancos River & Tributaries above Highway 160, excluding the East Fork:
The State determined the high levels of dissolved oxygen in this section of the river are an impairment of the CWA so copper, lead and temperature were designated for M & E.

Mancos River from HWY 160 to the boundary of UMUT lands and the mainstem of Weber Canyon from source Mancos River:
Aquatic life impairment

NPS data (2010-2016): research indicates exceedances of water quality standards for water temperature, E. coli, arsenic, manganese, and sulfate.

The UMUT boundary to San Juan River: UMUT data (2011-2012) indicated exceedances of established water quality standards for total suspended solids and associated copper, selenium, phosphorus, aluminum, and iron.

The Colorado 2016 Integrated Water Quality Monitoring and Assessment Report **report identified the following water quality impairments for the Mancos River:**



WHAT WE WANT TO KNOW

Water quality monitoring in the Mancos River Watershed is ongoing, with both planned and existing efforts listed below.

1) The NPS and UMUT have ongoing water quality monitoring programs on the Mancos River.
2) The RiverWatch water quality monitoring program lapsed in 2009, however sample collection will resume at six sites on the Mancos River in 2018.
3) An investigation to identify and quantify sources of metal loading in the East Mancos River will begin in 2018.

RIVER HEALTH: macroinvertebrates

QUESTION:

What is the health of the macroinvertebrate communities in the river?

Author: Ann Oliver, Stephen Monroe, Marcie Bidwell, Scott Roberts

WHAT WE KNOW

Data for assessing macroinvertebrate health comes from a 2011 study conducted by the Mancos Watershed Group at eleven locations in the Mancos Watershed. Additionally, macroinvertebrates are monitored by the UMUT once per year on a rotating basis among basins in the watershed and once per year at two sites on the Mancos river by the NPS.

In the fall of 2010, the Colorado Department for Public Health and Environment developed an index known as the Multi-Metric Index (MMI) which identifies thresholds for "attainment" and "impairment". The Rapid Stream Riparian Assessment (RSRA) has been used to assess the river's aquatic habitat. The RSRA includes a set of field indicators designed to evaluate aquatic habitat.

The Colorado 2016 integrated Water Quality Monitoring and Assessment Report summarizes water quality and river health conditions in Colorado. The report lists provisional aquatic life impairment for two reaches of the Mancos River (see the map on the next page). The provisional listing of aquatic life impairment means the cause of impairment was not identified and the determination was based on MMI scores of benthic macroinvertebrate samples collected in 2011 or earlier by CDPHE and NPS.

(continued on the next page)

What are macroinvertebrates? And why does their health matter?

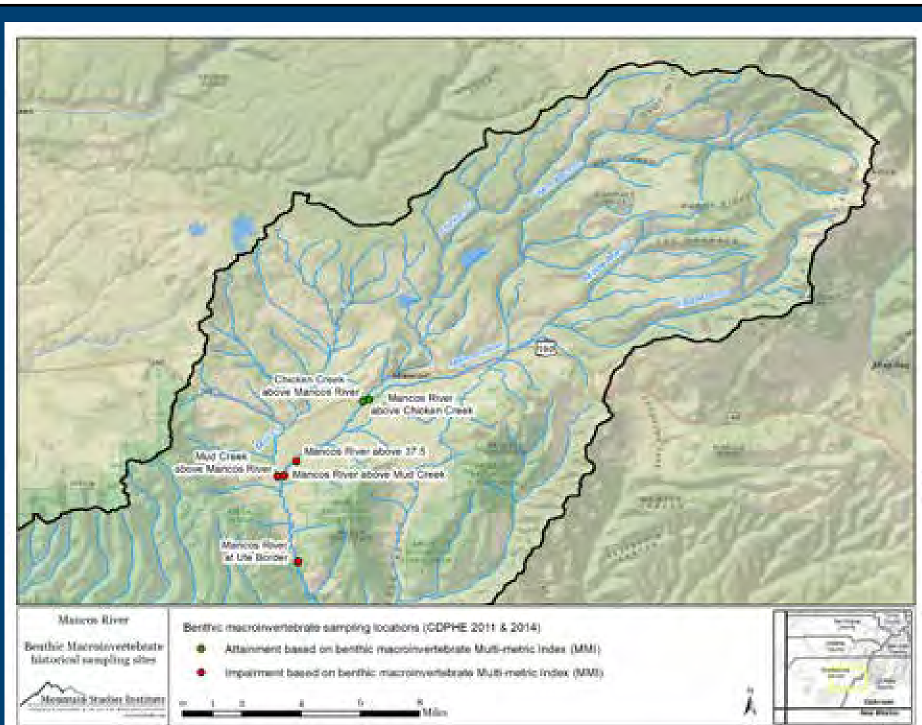
Due to their sensitivity to change, macroinvertebrates are a bellwether for ecologic integrity in aquatic ecosystems. Total abundance, taxa richness, and diversity of macroinvertebrates help researchers and resource managers identify areas of concern with respect to water quality and broader ecosystem health.

Macroinvertebrates are sensitive to changes in water quality (such as pH, turbidity, and temperature). Many factors, such as urbanization, wildfire, mining, or agriculture can affect these watershed characteristics, and the use of the multi metric index helps us to detect changes in macroinvertebrate communities resulting from these activities.

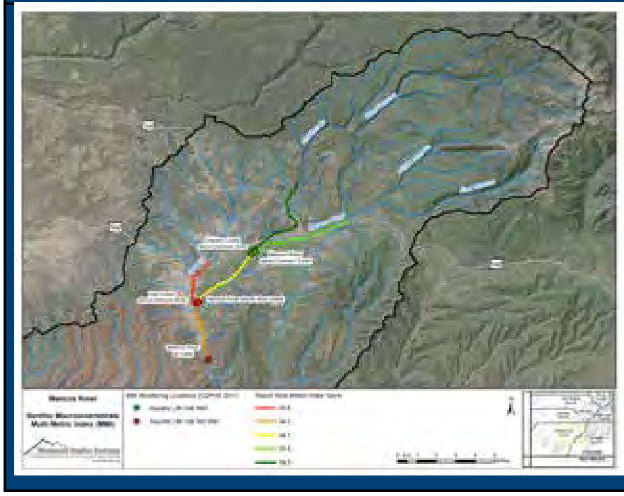
SNAPSHOT

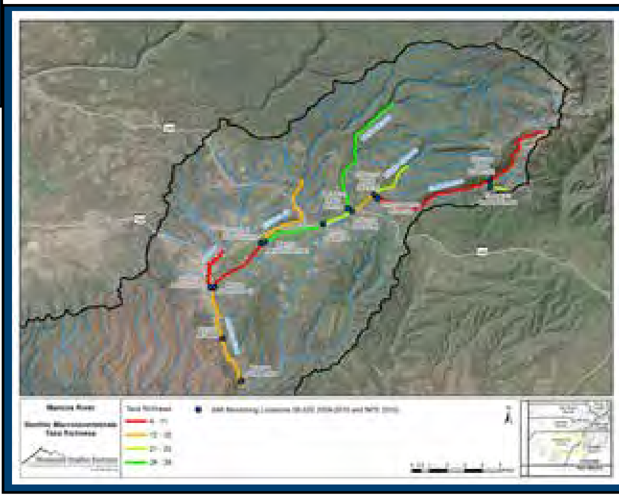
MMI analysis has not been completed for all samples collected by UMUT and NPS. However, data collected by both show a consistent downstream decreasing trend in species richness, abundance. Large volumes of sediment deposited in the river by floods following the Weber Fire negatively impacted aquatic habitat and likely further depleted the macroinvertebrate community in the lower reaches of the River.

The RSRA survey conducted in 2007, 2012 and 2013 show that of the 17 reaches assessed, the Aquatic Habitat mean score was high (4-5) at sites upstream from the Town of Mancos and decreased significantly at sites further downstream. These scores suggest that there are opportunities for improving the aquatic habitat along much of the Mancos river and its tributaries. The primary reason for poor aquatic habitat conditions at the downstream sites is abundance of fine-grained sediments and absence of woody debris, a critical component of macroinvertebrate habit. Macroinvertebrates prefer coarse sediment for breeding and refuge. Woody debris provides refuge and shade, maintaining cooler water temperatures. Some taxa are sensitive to high concentrations of metals or other water quality constituents. Large quantities of fine sediments can change the suitability of substrate for some macroinvertebrate taxa.



RIVER HEALTH: macroinvertebrates (CONTINUED)





WHAT WE WANT TO KNOW

Data documenting benthic macroinvertebrate communities and habitat in the Mancos River is sparse and much of it is outdated. Reaches where MMI impairments have been identified (on the previous page), should be priorities for future monitoring efforts.

OUTSTANDING QUESTIONS:

1) How can communication and data-sharing between agencies be improved?
2) Why are benthic macroinvertebrate communities in some reaches designated as impaired?

OPPORTUNITIES:

1) Co-locate benthic macroinveterbate monitoring network at the new River Watch sites with other sampling programs.
2) Ensure all available data are included in future CDPHE analysis.

RIVER HEALTH: fish

QUESTION:

Where do we have native fish and non-native/invasive fish?

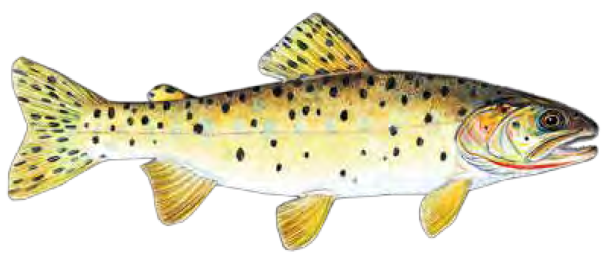
Author: Ann Oliver

WHY DO FISH MATTER?

The persistent presence of fish is a useful indicator of the health of the aquatic habitat a river supports. The presence of fish suggests (yet does not prove) that a stream has enough flow at the right times to form and rework the channel into aquatic habitats that help sustain fish and the food they eat.

Habitat for fish include: pools, runs, riffles, hiding habitat and holding habitat, as well as gravel beds where fish can lay their eggs. The presence of fish also suggests that while contaminants may be present, they are not routinely present at levels high enough to cause those fish to die, or die out over time. Cutthroat and brook trout are particularly senstive to poor water quality, especially contamination by metals.

The presence of fish may also suggest that they are able to move upstream and down-stream, uninhibited through a particular reach.



CUTTHROAT TROUT, no longer in the Mancos Watershed

WHAT WE KNOW

A basic measure of fishery health in a stream reach is whether or not fish are present. However, this presence/absence metric does not tell us why a particular species live in one reach and not another, or *why* they are absent.

For instance, rainbow trout or roundtail chub might be present in a given reach because they have been stocked or reintroduced, rather than because they are reproducing on their own. Similarly, if brook trout are not present in a reach, there may be multiple explanations.

A measure of fish presence merely offers a snapshot in time and does not necessarily indicate persistence over a period of time.

RIVER HEALTH: fish (CONTINUED)

SNAPSHOT

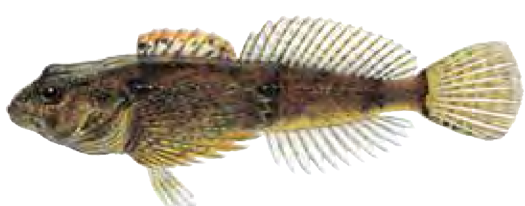
As with most watersheds on the west slope of the Colorado River, several kinds of warm and coldwater fish live in reaches of the Mancos River. Coldwater fish include the native mottled sculpin as well as several non-native species of game trout, including brook trout, rainbow trout, and brown trout. No native Colorado River Cutthroat Trout remain in the watershed. Yellow perch have been stocked in Jackson Reservoir.

In some warmer reaches, native fish include bluehead sucker, flannelmouth sucker, roundtail chub, and speckled dace. Non-native fish present in some warmer reaches include green sunfish, fathead minnow, largemouth bass, and catfish.

The Mancos River is special amongst most west slope rivers because it has not been invaded by the white sucker, which causes problems when it hybridizes with the native flannelmouth sucker.

While coldwater trout species and native warmwater species can be found throughout much of the watershed, the CPW and UMUT have found that overall fish abundance is very low. In the most recent sampling conducted (YEAR), approximately 6lb/acre of trout were sampled in the West Mancos, compared to an average density of 40lb/acre on the West Slope. Warmwater fish in the Mancos River were sampled at less than 50 native species/mile. In contrast, it is not uncommon to sample 1000 native fish/mile in nearby McKelmo Creek.

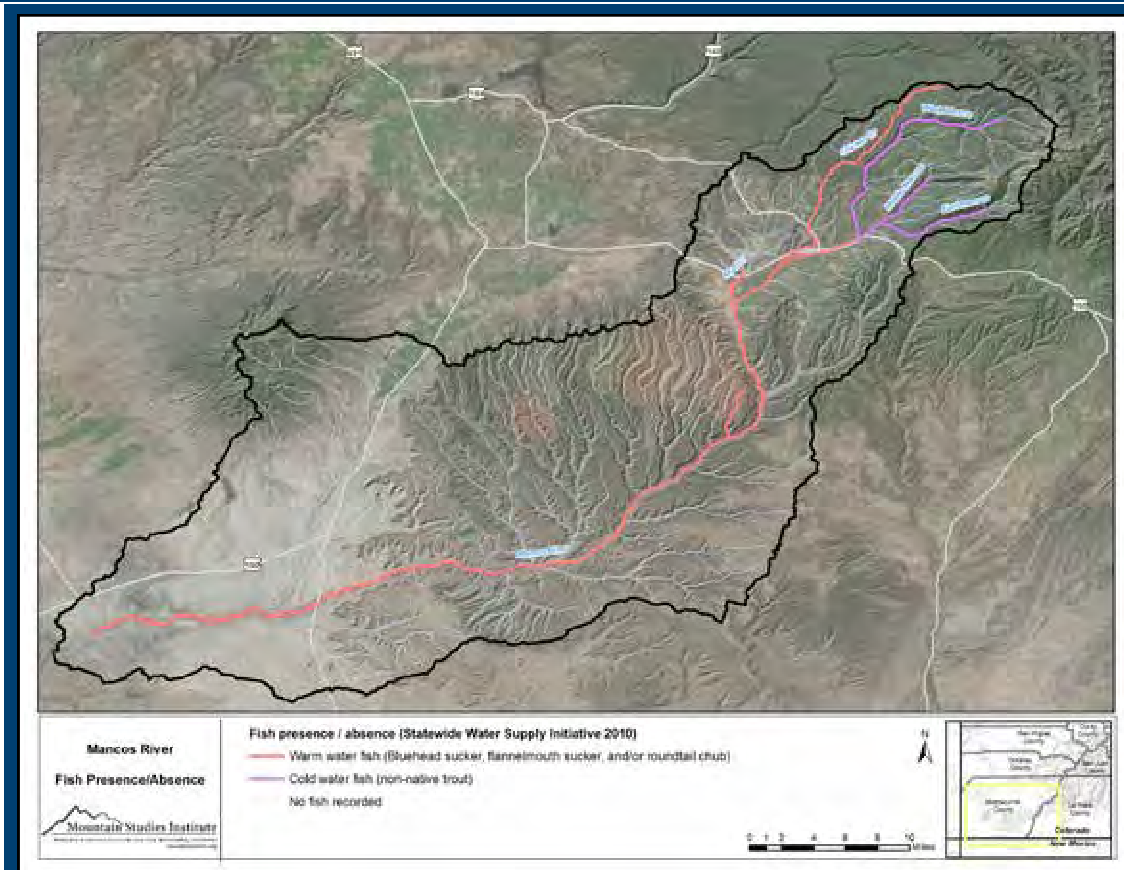
Most species of fish require a specific range of flow regimes (amount or timing of water in a river) and water temperatures. Significant changes in either of these can have negative effects on fish populations. Sections of the Mancos River have been dry during drought or low flow years, and available data shows stream temperatures sometimes exceed critical limits in summer months during the same years.



MOTTLED SCULPIN, native to the Mancos Watershed

BROOK TROUT, non-native in the Mancos Watershed

RIVER HEALTH: fish (CONTINUED)



WHAT WE WANT TO KNOW

1) What is the estimated abundance of each species in the sampled reaches? How and why has abundance been changing over time?

2) What is the age structure of species in sampled reaches? How has the age structure changed over time?

3) Where and how frequently does fish stocking occur? What are the goals?

4) What are the most productive reaches in the Mancos Watershed for native fish? For game trout?

RIVER HEALTH: riparian ecosystem

QUESTION:

How healthy is the riparian system within the watershed?

Author: Ann Oliver, Stephen Monroe

WHAT WE KNOW

The Mancos River can support lush vegetation on and near the surface. Just as the river is critical to the plant life on its banks, the riverside plants are critical to river health. These plants, especially shrubs and trees, benefit the channel and adjacent landowners by protecting river banks from erosion, filtering and absorbing pollutants,slowing runoff to the river, and providing food and cover for wildlife and livestock.

Native shrubs and trees that grow along the Mancos River include cottonwood, boxelder, dogwood, hawthorn, buffalo berry, skunkbush sumac, and the ubiquitous coyote willow, among others. Invasive, non-native plants such as Russian olive, tamarisk, and Siberian elm, as well as Russian knapweed and Canada thistle, also grow along the Mancos River and nearby uplands. These non-native species can outcompete native plants for space and water, and can even change soil chemistry and increase fire risk.

(continued on next page)

Whenever you walk or drive along a section of the Mancos River, study the river's banks. Is there a dense overstory and understory of native trees, shrubs and plants to hold the river banks, shade the channel and provide habitat for wildlife? If not, what are your guesses as to why not? Are the plants you see mostly native to the valley or are they non-native and invasive?

SNAPSHOT

Several different methods have been used to assess the health of the riverside (riparian) vegetation along the Mancos River. The primary two are the Rapid Stream Riparian Assessment (RSRA) and the Watershed Condition Classification (WCC) methodology.

The RSRA has been used to assess (in 2016) and, in a few cases, reassess (2012 & 2013) 18 reaches located throughout the Mancos Watershed. Many of theses reaches flow through private lands where landowners have graciously allowed this monitoring to occur. The RSRA protocol employs 23 total field indicators to rank the following five functional components of the stream-riparian system:

1) Water quality
2) Stream channel and floodplain morphology
3) Aquatic habitat
4) Riparian vegetation structure and composition, including the occurrence and dominance of non-native species
5) Terrestial widlife habitat

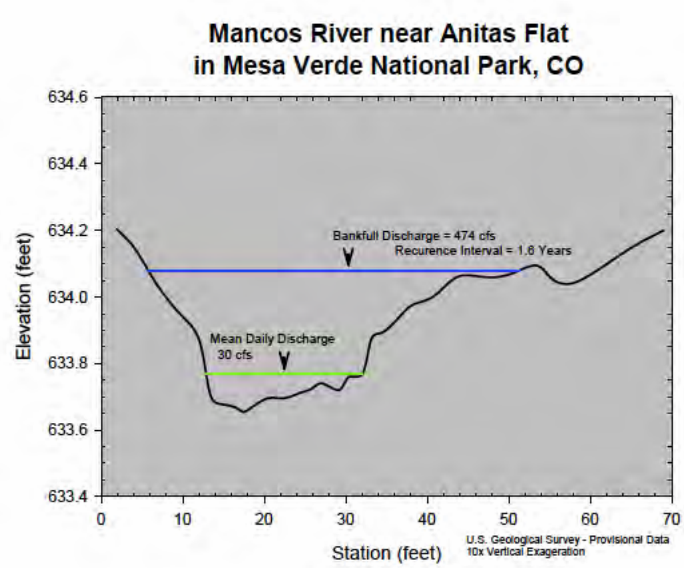
Within each category, between two and seven indicators are evaluated to reflect the functional condition of the stream ecosystem. Field counts allow assignment of scores to each variable, ranging from “1” (completely non-functional) to “5” (what would be expected in a system not impacted by human activites).

The WCC was completed in 2012 and used to assess riparian condition on San Juan National Forest Lands within the Mancos Watershed, but the Forest Service used this method to characterize the health and condition of National Forest lands in over 15,000 watersheds across the country. Forest Service managers used the classification to prioritize watersheds for restoration.

RIVER HEALTH: riparian ecosystem (CONTINUED)

In addition, topographic surveys of the stream channel have been completed by the USGS and NPS for the purposes of estimating the magnitude of flows in the river and studying the river channel and floodplain. These surveys can be used to evaluate 'bankfull' discharge. Bankfull discharge is important to consider because it is generally thoguht to be the most effective flow for moving sediment, forming, changing, or removing channel features such as bars, bends and meanders, and recharing shallow groundawater aquifers that provide water necessary to riparian pldant species.

To estimate the frequency and duration of bankfull flows we used survey and streamflow gage data collected by the USGS on the Mancos River near Anitas Flat in Mesa Verde National Park. The agency surveyed the stream channel in 2014, shortly after a large flood occurred in the river. Bankfull discharge at this site is approximately 475 cfs, with a recurrence interval of 1.6 years. Annual peak flows in the river were greater than 475 cfs in the eight year period the USGS maintained the streamflow gage on the mnacos River at Anitas Flat (203-2015). Most of these floods were of short duration (1 day or less) and occurred as a result of summer monsoon tunderstorms. However, 2005 was a very wet year and river flows were near or above bankfull many days in April through June that year.



SNAPSHOT:

In the headwaters of the Mancos Watershed, the WCC indicated that the Riparian Wetland Vegetation indicator (one of the Aquatic Biological indicators) ranked the West Mancos River, Middle Mancos, and the Upper Mancos Valley of the Mancos River as “good” but Chicken Creek as “bad”. Based on the overall rankings of these watersheds, the Dolores District has already developed and begun implementing a plan to improve the condition of the Chicken Creek watershed.

Scores from the RSRA suggest that there are opportunities for improving the riparian vegetation structure and cover along much of the Mancos River and its tributaties. According to Dr. Peter Stacey, who conducted most of the RSRA surveys, potential reasons for scores below a 5 in riparian vegetation structure and cover include past clearing, levee construction, and heavy past use of these riverside areas by both livestock and wildlife (Stacey 2007). Continuous heavy browsing on trees and shrubs can diminish their growth and the cover they provide. Sometimes browsing keeps young plants from becoming shrubs or trees at all.

The Mancos River is the only perennial river within Mesa Verde National Park. Livestock grazing occurred along the Mancos River in the park until 1997, when grazing tenancy agreements expired. Park staff worked until 2004 to fence out livestock successfully and plant native seed. A riparian tree inventory conducted in the Park in 2016 shows that riparian trees are recovering from grazing impacts with successful recruitment of Narrowleaf cottonwood (*Populus angustifolia*). More than 85 percent of the riparian trees mapped (over 16,000) were less than three meters tall, showing evidence of abundant and recent recruitment.

RIVER HEALTH: riparian ecosystem (CONTINUED)

Mesa Verde National Park undertook a woody invasive species control project along the river within the park in 1999, with follow-up treatment in 2002 and 2016. This project has been highly successful, allowing native willows, cottonwoods, buffaloberry and fragrant sumac to once again dominate the riparian corridor within the Park.

However, non-native, herbaceous plants continue to persist and in some areas dominate the riparian understory. These include Russian knapweed, musk thistle and Canda thistle.

WHAT WE WANT TO KNOW

1) Are cottonwoods and other native tree species regenerating along the river?

2) What flows in the Mancos River support establishment of cottonwood seedlings?

3) What conditions are needed for woody shrub and tree species recruitment?

4) How widespread are tamarisk, Russian olive, Siberian elm, and other invasive plant species in the watershed?

REINTRODUCTIONS IN MESA VERDE NATIONAL PARK

Author: Paul Morey, Tova Spector

ROUNDTAIL CHUB

2002: 28 roundtail chub were captured in the Park in the early part of 2002 because the Park anticipated the river drying up during the summer.

2003: hatchery-raised fingerlings were released starting in 2003 and continued through 2015.

2004: electroshocking caught chubs that likely surivved the 2002 drought and after-effects of the siltation caused by the 2000 Bircher Fire.

2016: no releases due to CPW finding Rio Grande chub in the Mancos River during an electroshocking project.

CPW is still trying to determine how the Rio Grande chub could affect future conservation efforts of the roundtail chub.

BIGHORN SHEEP

1946: 14 Rocky Mountain bighorn sheep were captured from the Georgetown Colorado herd and released in the Park in 1946.

2007: the population from 1946 existed in and around the Park until 2007 when the skull of the last known ewe to inhabit the cuesta was found. Through this time period herds of bighorn sheep were often seen along the Mancos River including Weber Canyon and Menefee and Weber Mountains.

There were plans for additional releases of bighorn sheep to augment this population, but no release ever occurred.

Reintroductions in MVNP (CONTINUED)

BEAVER

2003: animal control officers brought a male and female beaver to the Colyer Ranch on the West Mancos River.

2004: the same two beavers found 1.5 miles upstream on the Echo Basin Ranch land where they had built several dams in a wide area of the river bottom and where histiroically there were beaver damns

Also in 2004, the Animal Control brought four adult beavers to be released at the southern boundary in Mesa Verde National Park. The released beavers immediately swm downstream toward UMUT lands. River pool survey crews did not find beaver dams on the park in 2005.

2005: spring floods tore out these dams, but by September of the same year, beavers were rebuilding the dams.

2009: Geoerge San Miguel saw a beaver dam impound the Mancos River on the Ute Tribal Park at Sandal House.

MVNP will continue to survey for beaver establishment within the Park boundaries and on adjacent lands.

SPECIES OF INTEREST

While reintroductions of some species have been attempted or are ongoing, there is widespread interest in better understanding the loss of certain species, namely otters and birds, and their habitat within the Park. (FULL LIST COMING FROM PAUL MOREY)

Historically otters lived in rivers throughout the Colorado River watershed. In recent years otters have been seen in the Dolores River, and in the pond in the Mormon Lake wetland.

Marilyn Colyer, a long-time employee of MVNP, wrote in her 2011 report: (draft language, not yet accurate)

"Now without fish the northern water shrew, the river otter, common mergansers, great blue herons, bald eagles, mink, and bear had no reason to be here. Perhaps the water shrew did stay, but what about the river otter that was observed three miles northeast of the park in a base stocked pond in December 2001. Other otters had been reported in Chicken Creek three years earlier. The Bircher Fire retardant drop and post-fire siltation combined with the drought may have delayed re-colonization by river otters on park land for many decades..."

WATER QUANTITY

QUESTION:

Is there enough water to meet stakeholder needs?

Author:Stephen Monroe

WHAT WE KNOW

Precipitation in Southwest Colorado occurs as both snow and rain in the winter-spring months and as intense mid-summer to early fall thunderstorms. The total volume of water flowing in the Mancos River is relatively small compared to other rivers in the region because of the relatively small size of the watershed. The amount and timing of streamflow in the Mancos River is critical to sustaining the many values that the river supports, including fish and riverside vegetation, agricultural production, and residential drinking water.

STREAMFLOW

The United States Geological Survey (USGS) began measuring streamflow in the Mancos River and its tributaries in 1898. Since that time, the agency and the Colorado Division of Water Resources (DWR) have operated streamflow gages at various locations on the river. Most of these data can be accessed online to evaluate trends in timing of peak flows, total annual discharge, minimum discharges, etc.

Flows reaching the lower end of the watershed for 1921-2016 represent cumulative discharge leaving the watershed. We used these data from the streamflow gage Mancos River near Towoac, CO to assess any trends in annual peak discharge and total annual flow over this period.

The streamflow gages in the upper and lower watershed also provide data describing annual discharge at these sites. Additionally, the USGS operated a streamflow gage on the Mancos River in Mesa Verde National Park (Mancos River at Anitas Flat below Mancos, CO) during the period 2003-2014. Data from this gage represents the volume of water leaving the Mancos Valley after agricultural and domestic uses have been diverted. Annual 7-day minimum discharge and average daily discharge data from the gage Mancos River at Anitas Flat below Mancos, CO. were used to evaluate low flows in the river.

WATER USE

The principal decreed diversions of water within the Mancos Watershed are for agricultural production, and for municipal consumption by the town of Mancos, the Mancos Rural Water Company, and Mesa Verde National Park. Water is supplied to these users from the West Mancos River through infrastructure including the Mesa Verde Diversion, the Jackson Gulch Reservoir and a system of pipelines and ditches known as the Mancos Project, administered by the Mancos Water Conservancy District (MWCD).

Detailed descriptions of the Mancos Project and each of the municipal entities are available in the MWCD Water Conservation and Management Plan (2002), and the Mancos Source Water Protection Plan (2009).

WATER QUANTITY (CONTINUED)

In 2011, the Colorado Water Conservation Board (CWCB) estimated that the crops grown on the 11,617 acres of irrigated land in the Mancos Valley could consume up to 31,560 acre feet per year if water supply was not limited. CWCB estimated that the actual water supply limited consumptive use (WSL CU) of those crops was 16,060 acre feet per year. Based on the difference between these estimates, the CWCB identified an annual shortage of 15,499 acre feet per year (SW Basin Roundtable 2015). For the period from 1960 to 2016, the average annual flow measured at the Mancos River near Towoac, CO gage was 31,864 acre feet.

SNAPSHOT

Total annual discharge is the volume of water flowing past a specific point in a year and reflects the amount of precipitation runoff, groundwater discharge and consumptive use (evaporation and transpiration) of water upstream of that point.

The Basin Implimentation Plan shows that the majority of flow volume in the Mancos River at Mancos River near Towoac, CO occurs during the months March through June, with the amount of average flows varying widely between drought years and wet years when large floods take place. During the period 1922 to 2017, the total annual flow in the Mancos River at Mancos River near Towoac, CO varied from 2,426 to 120,983 acre feet per year).

Average total annual discharge from 1922 (prior to construction of the Mancos Project) was 43,708 acre feet and from 1952 to 2017, the average total annual discharge was 31,611 acre feet. Twenty four of the 66 years between 1952 and 2017 had total annual flow less than the 16,060 acre feet per year WSL CU, and annual flow in 41 of the years was below the IWR of 31,560 acre feet per year. IWR and WSL CU are not projected to decrease significantly by 2050 (SW Basin Roundtable 2015).

Extended periods of warm, dry weather cause decreases in streamflow and changes in runoff timing and the total amount of water available. For small rivers, this can result in transition from perennial flow regimes to intermittent flow pattern. Conditions described by most climate change scenarios indicate perennial streams with small average flows and high low-flow variability are most likely to experience increasing number and length of dry periods. Extreme low flows or a transition from perennial to intermittent flows can cause reductions in habitat availability for fish and other species, habitat fragmentation, water temperature extremes, reductions in dissolved oxygen levels (oxygen is necessary for fish, invertebrates, plants, and other species) and other changes in water quality.

WATER QUANTITY (CONTINUED)

WHAT WE WANT TO KNOW

Water is the most essential physical attribute supporting all human and ecosystem needs and activities. Long-term continuous monitoring data streamflow are extremely valuable for documenting and understanding changes in water availability and use. The streamflow gage on the Mancos River with the longest history is Mancos River near Towoac, CO. Other gages have been operated intermittently throughout time, and at inconsistent locations.

Agricultural and municipal use data can be accessed on request from the Colorado Division of Water Resources, the Town of Mancos, Mancos Rural Water Company, and Mesa Verde National Park.

Flow is not monitored in any of the Mancos Valley's major agricultural diversions. Implementation of a monitoring network would improve water management and increase efficient use and distribution of water.

FOREST HEALTH: insects & disease

QUESTION:

How healthy are our forests?

Author: Rebecca Samulski

WHAT WE KNOW

Forest stand diversity, insects and disease

The diversity of a forest tree size, age and species is an indicator of forest health. When a forest is very uniform, with mostly the same kinds of trees of the same ages, this uniform habitat supports a very narrow range of other plants and animals. A disturbance such as drought, wildfire, insects or disease is more devastating in a less diverse forest, impacting the entire forest in the same way. In contrast, a more diverse forest supports a greater assortment of plants and animals. In a forest with mixed species and/or ages of tree, some may be less impacted by a disturbance than others, allowing the forest to bounce back more quickly than the uniform forest.

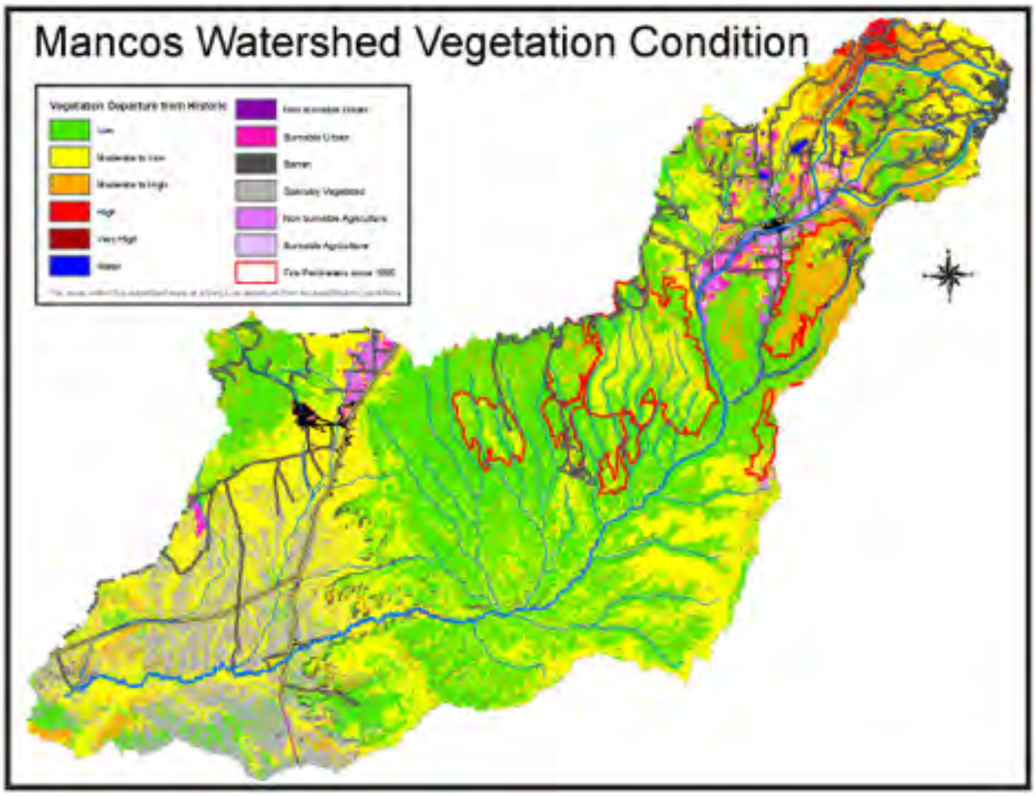
Above: Round-headed pine beetle outbreak in Cherry Creek, 2016
Below: scattered pockets of round-headed pine beetle across the Dolores Ranger District of San Juan National Forest, 2017.

Photographs courtesy of Dan West, CSFS Entomologist

SNAPSHOT

All forested areas within this watershed are divergent from modelled historic conditions with no part of the landscape modelled to the same or to have very low divergaence from historic vegetation. Many areas have been converted to irrigated or dryland agriculture. The piñon-juniper woodlands are the nearest to historicconditions, but the large fires of recent decades may reflect a larger scale divergence in the woodland structure than what is measurable in the LandFire pixel-by-pixel approximation. Areas that have burned within the last 20 years show a clear departure from the norm.

Sudden Aspen Decline (SAD), Spruce budworms, and piñon ips beetles have all caused serious declines in their host species during recent drought cycles. These are representative symptoms of an unhealthy forest. The 2017 Colorado State of the Forest Service Insect and Disease Aerial Detection Survey showed growth in round-headed pine beetle infestations in ponderosa pine straddling the Mancos Watershed. Pockets of freshly beetle-killed ponderosa trees were detected across the ponderosa pine zone.



WHAT WE WANT TO KNOW

Some very stand-specific data is taken annually for the Forest Inventory and Analysis National Program, but it is synthessized at a large scale. The specific cruise data gathered in the Mancos Watershed can likely be extracted from Regional and National databases by the Forest Service Office in Ogden, UT that manages the national program.

How healthy is forest succession after large fires in the watershed?

Can public and private land management influence insect and disease outbreaks?

FOREST HEALTH: wildfire risk

QUESTION:

What is the wildfire risk to community and ecosystem values in the Mancos Watershed?

Author: Rebecca Samulski

WHAT WE KNOW

Wildfire risk is an indicator of forest health and community resilience in the fire-adapted ecosystems of the Manos Watershed. Wildfire risk weighs the dynamics of the forest alongside the social landscape. Wildfire is an annual occurrence and the single most eminent natural disaster threat to people, property adn the landscape in the watershed and also an integral process for decomposition, nutrient transfer, stand succession, and maintenance of ecosystem diversity. Fires that burn at higher intensities tend to have greater impacts on runoff, erosion, and nutrient loading to the river system.

Overall, wildfire risk has been modelled across the Mancos Watershed. This risk evaluation represents the likelihood and intensity that an area will burn. This does not necessarily mean that a burn will have negative impacts on people or the environment. It is simply a measure of the risk based on elevation, slope, aspect, canopy cover. stand height, canopy base height, canopy density, and fire behavior model.

SNAPSHOT

Vegetated landscapes in the Mancos watershed are adapted to wildfire. For example, **ponderosa pine forests in this area historically burned at low intensities across small areas every 6-10 years, and across larger areas every 13-30.**

(continued on next page)

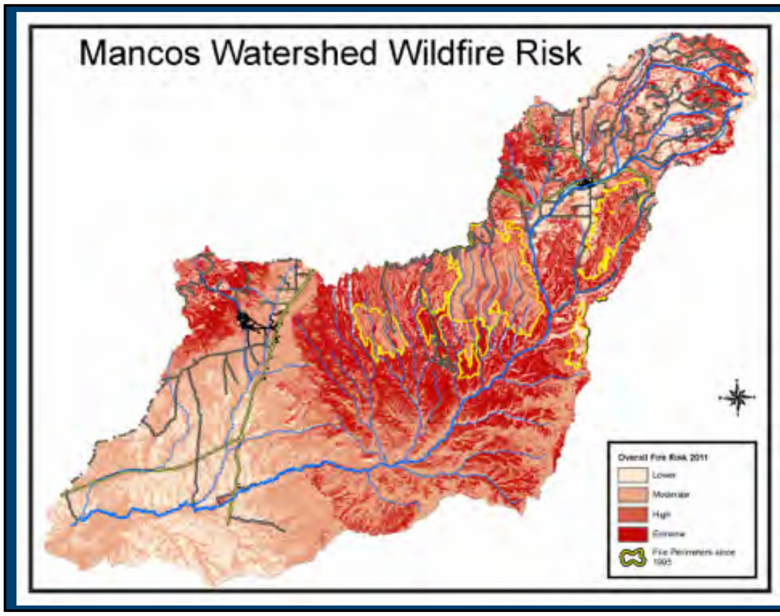
"Grazing, fire suppression, and logging have greatly changed the structure of our ponderosa pine forests. The general pattern observed in stand structure is an overall densification of forests and homogenization of forest structure across the landscape. Instead of being predominantly open forest structure with groups and clumps of large trees, much of the pon-derosa pine now has dense, continuous canopies lacking size and age diversity." SJNF Plan 2013

FOREST HEALTH: wildfire risk (CONTINUED)

Unlike ponderosa, piñon-juniper woodlands, aspens, mountain shrublands, and desert grasslands burn at stand replacing intensities. Pinyon-juniper woodlands burn at an average 400-year fire return interval, while aspen forests average closer to a140- year fire rotation. Aspen renewal has been managed largely through logging rather than fire through the last century. The spruce-fir, and mixed conifer forests of the Mancos watershed have a mixed intensity fire regime on the order of 35-year lower intensity fires to 200+ year stand replacement fires.

Most homes and businesses that could be directly impacted by fire lie within ponderosa pine, piñon-juniper woodland, grassland, or brush ecosystems in the middle part of the watershed. At higher elevations, fires in the San Juan National Forest may impact water quality, communications sites, and pose other risks to forest and community values. Fires further down in the watershed have had a greater impact on the river system itself.

The map below shows major wildfires within the Mancos watershed from 1996 through 2017. Note that the wildfire risk mapping was completed in 2011, prior to the Weber Fire in 2012, so the risk evaluation and forest structure within that fire footprint has changed drastically.



NOTE: wildfire risk mapping was completed in 2011, prior to the Weber Fire in 2012, so the risk evaluation and forest structure within that forest footpring has drastically changed.

WHAT WE WANT TO KNOW

A weighted evaluation of what are significant resources that may be damaged by wildfire or post-fire flooding has not been done within the Mancos Watershed.

Post-fire recovery and succession has not been well studied within the areas of the watershed that have burned

Fire regimes in grasses and shrublands are not well understood in the region.

AGRICULTURE: soil health

QUESTION:
Are soils in the Mancos River Valley healthy and funcitonal?

Author: Travis Custer

WHAT WE KNOW

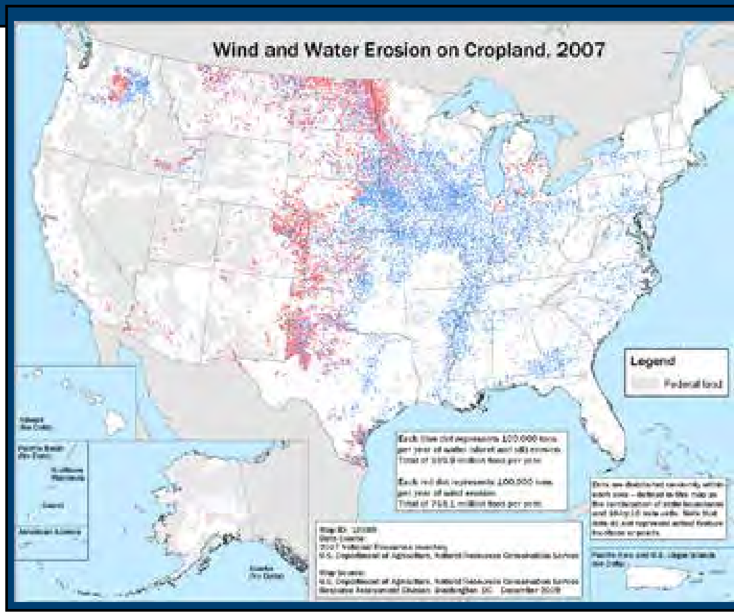
Healthy soil is the foundation of a resilient agricultural system. But soil degradation is a significant problem in global agricultural systems, leading to both agricultural impacts—such as reduced yield, and strained plant health—as well as loss of soil biodiversity. Soil degradation can negatively impact the greater functionality of ecological systems, sediment deposition into waterways, and increased noxious weed pressure. This indicator is intended to gauge the overall health of local soils and their capacity to support agricultural practices and healthy ecological systems in the Mancos River Valley.

While we currently lack a local protocol and metric for soil health, there are a number of resources being used on a national and international level that could be adopted here. There are available and adaptable agricultural and scientific standards for addressing soil health and the development of a local soil monitoring protocol, such as those identified by Cornell University and the Soil Carbon Coalition. These protocol are designed to look at indications of soil health and overall soil function as it relates to soil biology, plant health, and production. Major indicators include, but are not limited to, organic/total carbon content, pH, percent organic matter, micro/macro nutrient availability, biological activity and diversity, and nutrient cycling.

Typically, significant soil degradation is present in agricultural systems utilizing annual crop systems and heavy tillage practices. While these practices are not largely present in the Mancos Valley, long term soil health monitoring will still lend valuable insight into understanding and correlating soil conditions to other agricultural and ecological data and trends.

PHOTO/
IMAGE

AGRICULTURE: soil health (CONTINUED)



SNAPSHOT

Our fragile soils and environment in the desert southwest are vulnerable to serious soil erosion by both wind and water forces. The above graph from NRCS shows soil erosion by both wind (red) and water (blue), measured in 100,000 tons per year. Southwest Colorado is identified in this graph, and other areas of the county certainly face conditions of erosion due to agricultural impact.

WHAT WE WANT TO KNOW

Assessing soil conditions in the Mancos Valley, despite our lack of annual tillage, would provide important insight into local conditions so we might place them in the context of regional and national trends. Monitoring would facilitate the establishment of a baseline, and over subsequent years, provide a local trend. While understanding degradation is important, so is understanding positive soil-building attributes.

SOIL HEALTH DATA

Sampling protocol have been developed by Colorado State University for soil related projects in Montezuma and Dolores County, and local Conservation District offices have adapted other national testing protocol for local projects. These protocols could easily be adapted to this project.

ADDITIONAL GAPS

Identifying landowners interested in long-term monitoring of their operations. These monitoring sites would need to include both long-term management monitoring sites (where current agricultural operations impact soil), and fenced control sites where soils are left to their own accord.

AGRICULTURE: land quality & quantity

QUESTION:

How much land is currently being used for agriculture and how is that land poised to change in the future?

Author: Travis Custer

WHAT WE KNOW

The Mancos Valley, like many places across Colorado, continues to grow in population. Over time, this has resulted in the subdivision of larger parcels of land. This indicator looks at the distribution of land users and parcel sizes in order to identify trends and changes to our agricultural landscape and understand what, if any, potential impacts or needs this change creates.

SNAPSHOT

From an agricultural standpoint, parcelization (division of a large parcels in to many smaller ones) means more farms and ranches on fewer acres and more overall water users. It is important to understand what possible effects on the agricultural economy and infrastructure of the Mancos community this trend may have. Not only are there potential needs in terms of infrastructure, such as water delivery systems that no longer function appropriately for the multitude of smaller users relying on them, but also to understand potential effects of this trend on both the culture and economy of the community.

WHAT WE WANT TO KNOW

Gaps would include compiling historic changes to parcel size.

Future monitoring efforts might emphasize maintaining a GIS database or spreadsheet for these changes over time to look at trends.

AGRICULTURE: irrigation efficiency

QUESTION:

How is irrigiation consumptive use changing? And how efficient is our irrigation?

Author: Travis Custer

WHAT WE KNOW

The Mancos Valley has approximately 16,000 acres of irrigated land, fed by 46 diversions. To put this in perspective, Imperial County, CA irrigates 450,000 acres with just three. Having such a large amount of diversions and ditch systems poses both short term and long term challenges for irrigators. Many farmers and ranchers utilize multiple diversions and ditches to provide on-farm irrigation. Overall system functionality, quality of delivery, and maintenance are long term concerns for the agricultural community in the Mancos Valley. Additionally, improved delivery is of interest to many local landowners. This indicator looks at the state of current diversions from the Mancos River as well as on-farm irrigation systems currently employed in the Mancos Valley and their relative system efficiency. These systems include open ditch flood, gated pipe flood, and sprinkler irrigation systems.

AGRICULTURE: irrigation efficiency (CONTINUED)

WHAT WE WANT TO KNOW

The Mancos Conservation District has participated with ditch companies to improve structures on six major diversions, but a clear understanding of the remaining structures is still needed.

The mapping and surveying of structures and on farm systems will help to paint a whole picture of current and future needs to ensure water delivery systems stay in good repair, up to pace with technology, and are providing efficient application of precious water resources. Additionally, improvements in efficiency and delivery could help to make water available longer for more users in the Mancos Valley, thereby benefiting the entire community. As water becomes more scarce, and threat of drought an increasing reality, it is important for the valley to continually think about opportunities for improvement.

A comprehensive mapping project of the Mancos Valley irrigated lands would be a major accomplishment in the direction of understanding the current state of irrigation efficiency systems and delivery infrastructure. This mapping would assist the Mancos Conservation District and other agencies and partners to prioritize projects and work more closely with landowners to accomplish their goals. It has been identified that this mapping is beyond the scope of this initial phase, but should be earmarked for future funding requests.

SOURCES

B.U.G.S. Consulting, 2010. Benthic Macroinvertebrates on the Mancos River. BUGS. Consulting. Unpublished . 32pp.

Beatie, A. and Z. Smith. 2011. Mancos River Basin Instream Flow Report - Preliminary Evaluation of Flow Restoration Options. Colorado Water Trust.

Bureau of Reclamation. 2017. Quality of Water Colorado River Basin. Progress Report No. 25. United States Department of the Interior. Available at: https://www.usbr.gov/uc/progact/salinity/pdfs/PR24final.pdf

Butler, D. L., Osmundson, B.C., and Krueger, R.P. 1997. Field screening of water, soil, bottom sediment, and biota associated with irrigation drainage in the Dolores Project and the Mancos River basin, southwestern Colorado, 1994. Denver, Colo: U.S. Dept. of the Interior, U.S. Geological Survey.

Butler and Lieb 2002

Clow 2010 (In Water Quantity)

Colorado Department of Public Health and Environment. 2011. Temperature Criteria Methodology Policy Statement 06-1. Water Quality Control Commission. Available at: https://www.colorado.gov/pacific/sites/default/files/Policy 2006-1-2017.pdf

Colorado Department of Public Health and Environment. 2016. 2016 Integrated Water Quality Monitoring and Assessment Report. Available at: https://www.colorado.gov/pacific/cdphe/wqcc-reports-and-plans

Colorado Department of Public Health and Environment. 2017. Aquatic Life Use Attainment - Methodology to Determine Use Attainment for Rivers and Streams. Policy Statement 10-1. Water Quality Control Commission. Available at: https://coloradowater.charityfinders.com/documents/MRP/WQM Page/CO_Aquatic_Life_Use_Attainment.pdf

Colorado Department of Public Health and Environment. 2017. Colorado River Salinity Standards. Water Quality Control Commission. Available at: https://www.colorado.gov/pacific/sites/default/files/Regulation-39.pdf

Colorado Department of Public Health and Environment. 2017. Regulation No. 34 Classifications and Numeric Standards for San Juan and Dolores River Basins. Water Quality Control Commission. Available at: https://www.colorado.gov/pacific/sites/default/files/34_2017(12).pdf

Colorado Department of Public Health and Environment. 2017. The Basic Standards and Methodologies for Surface Water. Water Quality Control Commission. Available at: https://www.colorado.gov/pacific/sites/default/files/31_2018(01).pdf

Colorado River Basin Salinity Control Forum. 2017 Draft. 2017 Review Water Quality Standards for Salinity Colorado River System. Available at: http://www.coloradoriversalinity.org/docs/2017 Review - June Draft.pdf

SOURCES (CONTINUED)

Colorado Water Quality Control Division

Colyer, M. and San Miguel, G., 2006. “History and Nature along the Mancos River Corridor.” Conservation Service, Northern Plains Engineering Team. Lakewood, Colorado.

Dyer, M. and Stumpf, S. 2017. Water quality monitoring for the Mancos River in Mesa Verde National Park: 2014 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2017/1132. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/592233

Dyer, M., Monroe, S.A. and Stumpf, S.E. 2016. Water quality monitoring for the Mancos River in Mesa Verde National Park: 2012–2013 Summary Report. Natural Resource Data Series NPS/MEVE/NRDS—2016/1221. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/551391

Dyer, Melissa, and Monroe, S. A. 2013. Water quality monitoring for the Mancos River in Mesa Verde National Park: 2011 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2013/567. National Park Service, Fort Collins, Colorado. For the full RSRA methodology, please refer to the User’s Guide available for download at http://wildutahproject.org/files/images/rsra_ug_2013v1_withcover_reduced.pdf.

Lanci 2009, Mancos Watershed Diversions

Larrick, C. and Ashmore, J. 2013. Mancos River Water Quality and Trends Assessment: 2011-2012. Ute Mountain Ute Tribe. Available at: http://www.utemountainuteenvironmental.org/umep/assets/File/Water/Surface Monitoring and Assessment/M_River_WQ_Assessment_2013_Final_01242014.pdf

Larrick, C. and Clow, S. 2011. Water Quality Standards for Surface Waters of the Ute Mountain Ute Indian Reservation. Ute Mountain Ute Tribe. Available at: http://www.utemountainuteenvironmental.org/index.cfm/water-quality/surface-water/surface-water-quality-standards/

Larrick, C. and J. Ashmore. 2013. Mancos River Water Quality and Trends Assessment: 2011-2012. Ute Mountain Ute Tribe. Available at: http://www.utemountainuteenvironmental.org/umep/assets/File/Water/Surface Monitoring and Assessment/M_River_WQ_Assessment_2013_Final_01242014.pdf

Mancos Water Conservancy District. 2002. Water Conservation and Management Plan – Yesterday’s Water for Tomorrow. United States Bureau of Reclamation Southern Division Water Conservation Field Services Program.

Mancos Watershed Group (B.U.G.S)

Monroe, S. A., Bliss, C., Dyer, M. and Lawrence, K. 2012. Water quality monitoring for the Mancos River in Mesa Verde National Park: 2010 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2012/351. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/463365

Montezuma Land Conservancy (MLC), County GIS, FSA, USDA

National Park Service

SOURCES (CONTINUED)

Natural Resources Conservation Service. 2017. Colorado River Salinity Control Program, State of Colorado Salinity Control Unit Summary, FY 2015. United States Department of Agriculture. Available at: https://www.usbr.gov/uc/progact/salinity/pdfs/MonEval/2015/ColoradoProjectSummary2015.pdf

Oliver, A. and Lile, C. 2015. Basin Implementation Plan - Southwest Basin Roundtable. Harris Water Engineering, Inc.

Reynolds et. al. 2015 (In water quantity)

Rose, D. 2017, personal communication.

SJNF Plan 2013: Appendix K: Fire Regime and Condition Class (in range)

Soil Conservation Service. 1984. Irrigation Improvements: Mancos Valley Salinity Control Study prepared by Soil Conservation Service with the assistance of the Agricultural Stabilization and Conservation Service and the Agriculture Research Service of the United States Department of Agriculture.

Southwest Basin Roundtable, 2015. Basin Implementation Plan: environmental and recreational attribute mapping.

Spector, T. 2017. Personal Communication. National Park Service.

Stacey, P., 2006. Rapid Stream Riparian Assessment.

Stacey 2007 ?

Stene, E. 1994. Mancos Project. United States Bureau of Reclamation. Available at: https://www.usbr.gov/projects/pdf.php?id=133

Stumpf, S. E. 2016. Aquatic macroinvertebrate and physical habitat monitoring for the Mancos River in Mesa Verde National Park: 2015 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2017/1111. Na¬tional Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/58115

Stumpf, S. E. 2016. Aquatic macroinvertebrate and physical habitat monitoring for the Mancos River in Mesa Verde National Park: 2014 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2016/1061. Na¬tional Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/562699

Stumpf, S. E. and Monroe, S.A. 2014. Aquatic macroinvertebrate and physical habitat monitoring for the Mancos River in Mesa Verde National Park: 2012 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2014/684. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/562699

Stumpf, S. E., and Monroe, S.A. 2009. Aquatic macroinvertebrate and physical habitat monitoring for Mesa Verde National Park: 2007 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2009/002. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/152440

SOURCES (CONTINUED)

Stumpf, S. E., and Monroe, S.A. 2010. Aquatic macroinvertebrate and physical habitat monitoring for the Mancos River in Mesa Verde National Park: 2008 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2010/033. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/426978

Stumpf, S. E., and Monroe, S.A. 2011. Aquatic macroinvertebrate and physical habitat monitoring for the Mancos River in Mesa Verde National Park: 2009 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2011/288. National Park Service, Fort Collins, Colorado. Available at: https://irma.nps.gov/DataStore/DownloadFile/434892

Stumpf, S. E., and Monroe, S.A. 2012. Aquatic macroinvertebrate and physical habitat monitoring for the Mancos River in Mesa Verde National Park: 2010 Summary Report. Natural Resource Data Series NPS/SCPN/NRDS—2012/239. National Park Service, Fort Collins, Colorado. Available at: https://science.nature.nps.gov/im/units/scpn/publications.cfm?tab=2

SW Basin Roundtable 2015 (In water quantity)

USFS, Watershed Condition Classification: https://www.fs.fed.us/biology/watershed/condition_framework.html.

Ute Mountain Ute Tribe

White, J., CPW Aquatic Biologist, "Mancos River Fishery" powerpoint presentation, December 1, 2016

Whitenack, H. 2016. Mapping of Cottonwood Occurrence and Recruitment Post-Grazing along the Mancos River in Mesa Verde National Park, Colorado. National Park Service

Williams, C. 2009. Mancos Source Water Protection Plan. Colorado Rural Water Association. Available at: http://www.sanjuanwatershed.org/wp-content/uploads/2015/10/Mancos-River-Mancos-Source-Water-Protection-Plan.pdf

Yochum, S.E. 2004. Mancos Valley Salinity: Hydrologic Study Report. Natural Resources

DATA

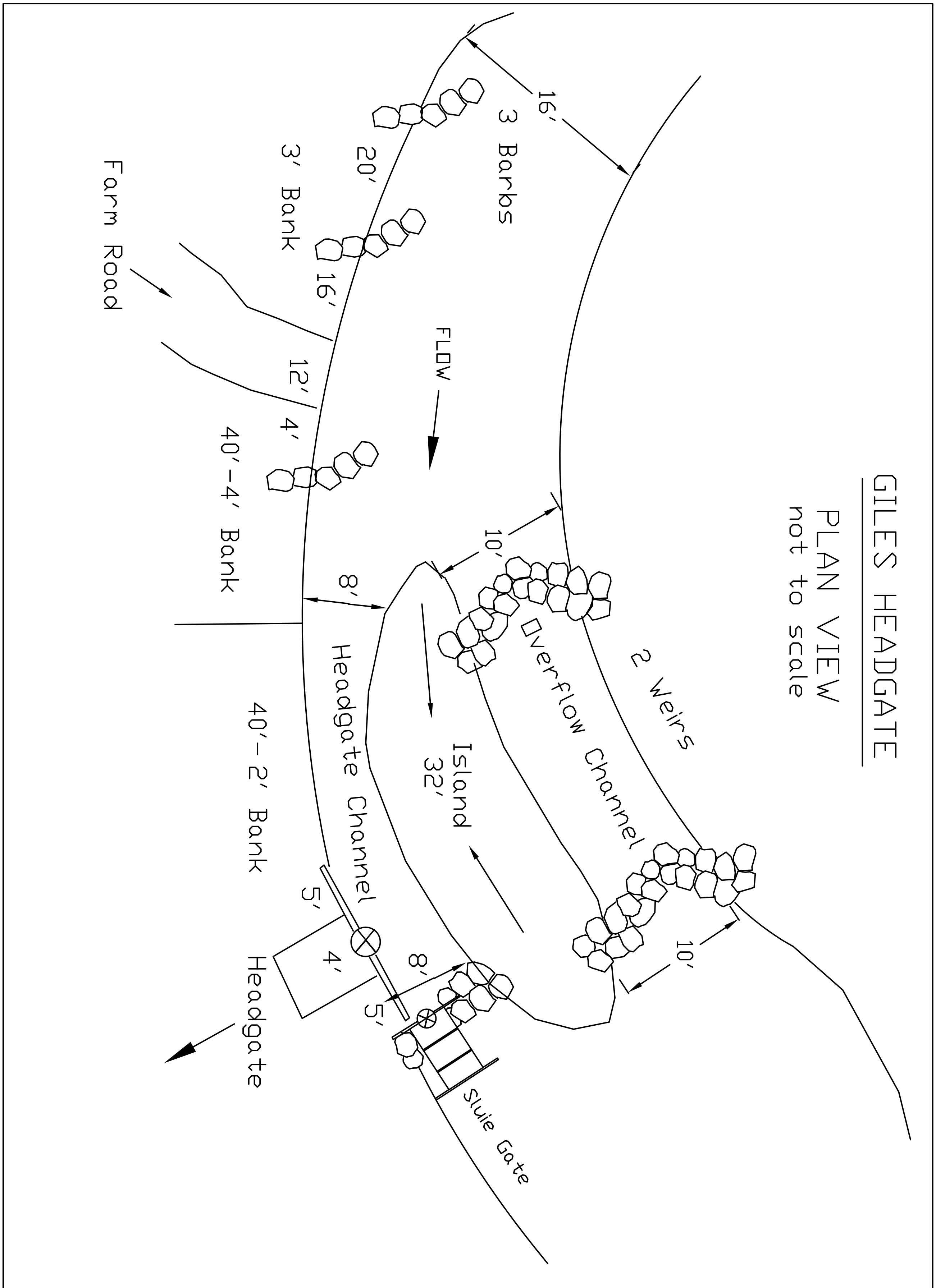
Streamflow data are available at:
http://www.dwr.state.co.us/Surfacewater/
For the full RSRA methodology, please refer to the User's Guide available for download at http://wildutahproject.org/files/images/rsra_ug_2013v1_withcover_reduced.pdf.

Agricultural water use information and data are available at: http://water.state.co.us/DataMaps/DataSearch/Pages/DataSearch.aspx

Water quality data are available at:
http://www.coloradowaterdata.org/
https://ofmpub.epa.gov/apex/STORETSummary/f?p=WATERSHEDUI:1:::::P1_ORG_CHAR,P1_HUC:1,14080107

Appendix 3

Design drawings for new diversion structures at the Graybeal, Giles and Samson Ditches.



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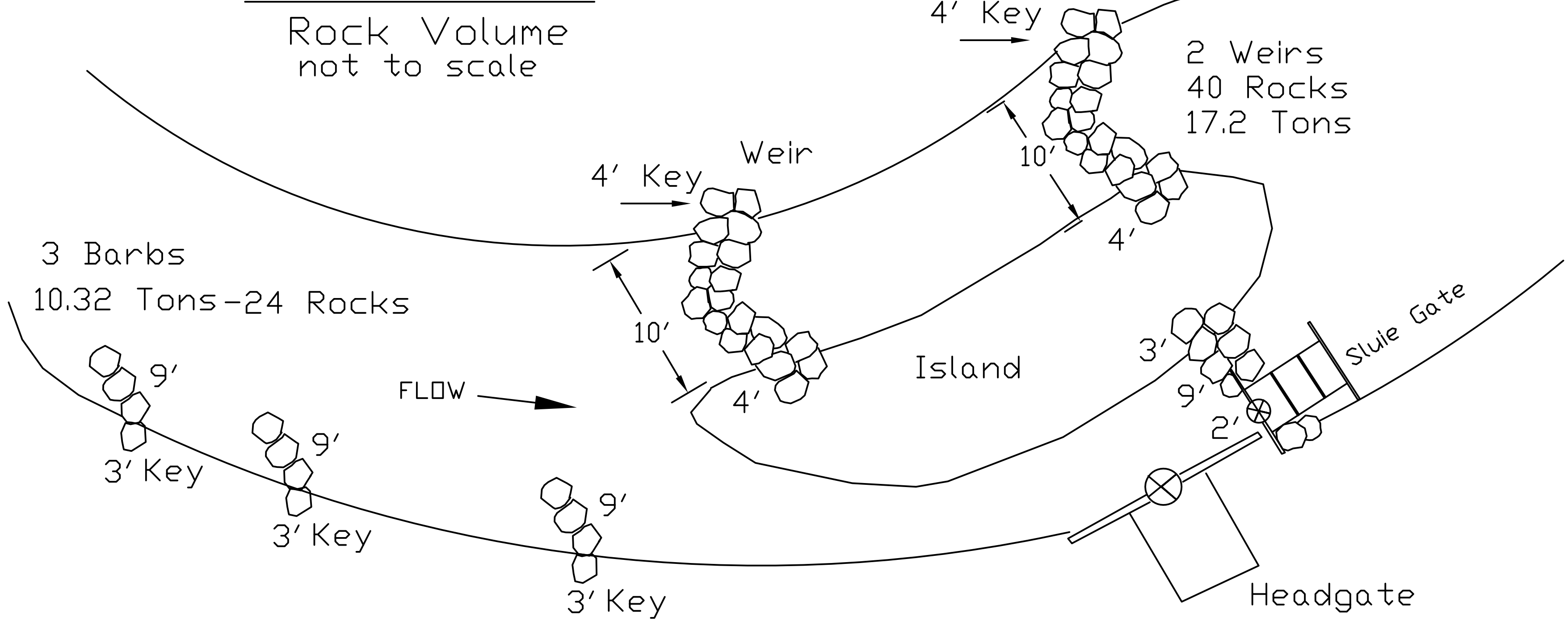
GILES HEADGATE

Rock Volume
not to scale



% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE DIMENSION-INCHES
100	48
50-70	38
35-70	26
0	18

TOTAL

27.5 Tons Quarry Rock
as per Typical Stone
Dimension Table

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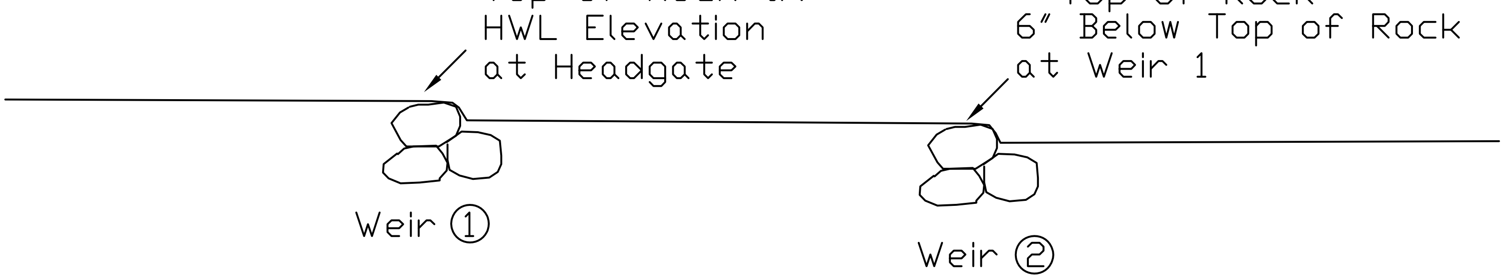
GILES HEADGATE

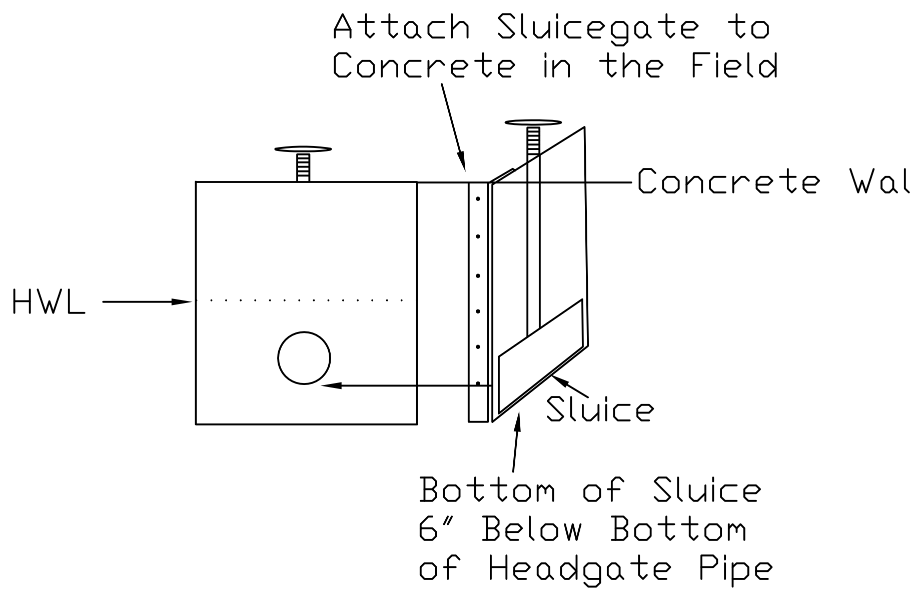
Profile Elevations

not to scale

Overflow Channel



Headgate Channel



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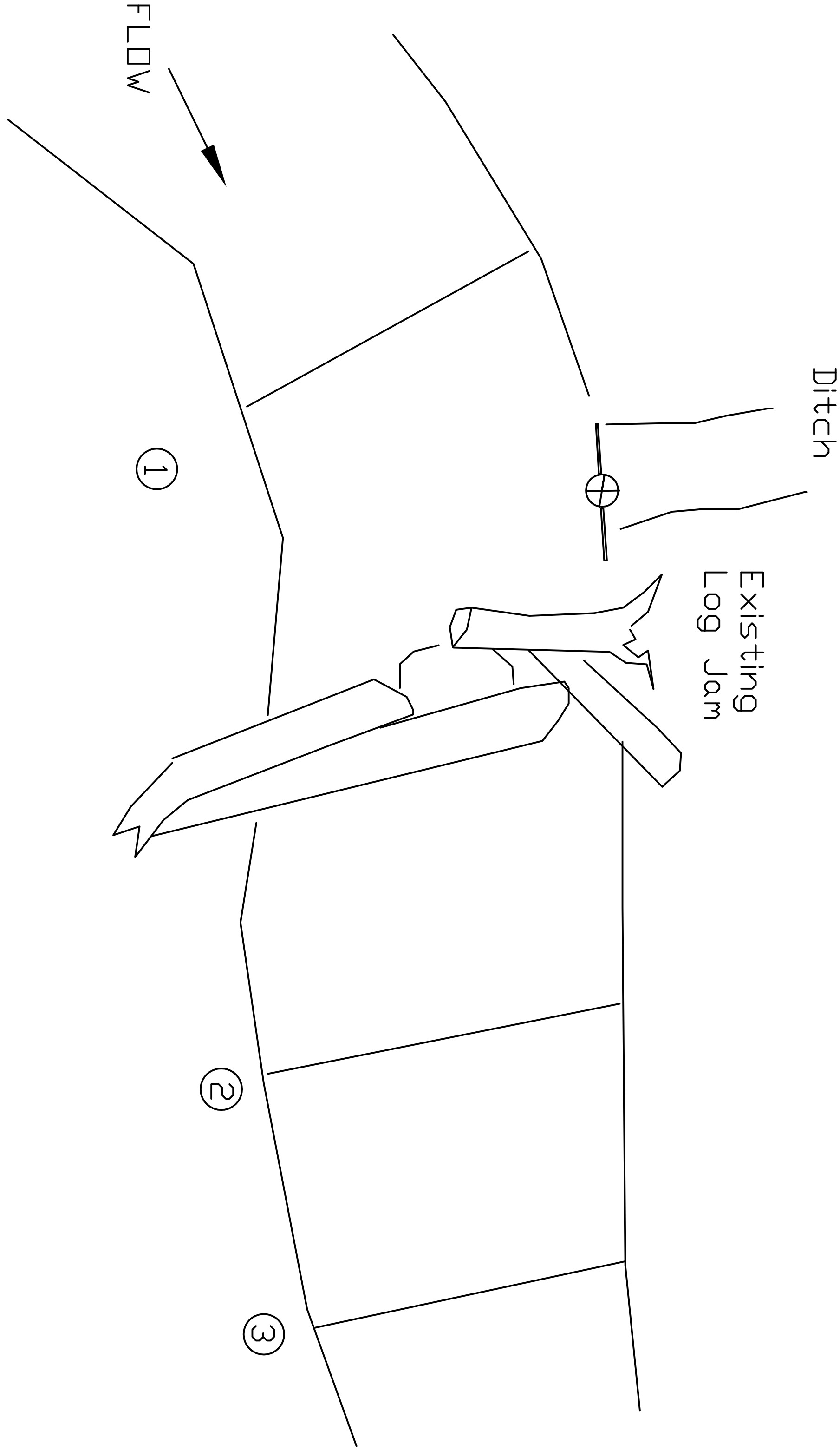

GRAYBEAL HEADGATE

CROSS SECTION LOCATIONS

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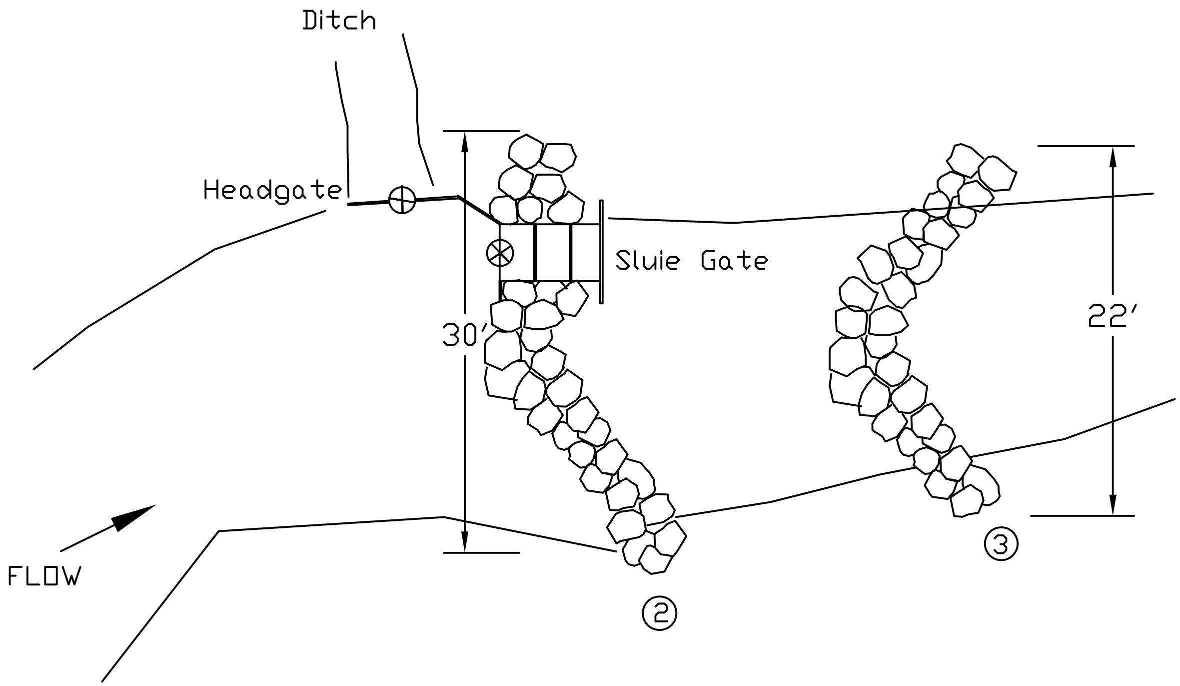
GRAYBEAL HEADGATE

PLAN VIEW
not to scale



% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE DIMENSION-INCHES
100	48
50-70	38
35-70	26
0	18

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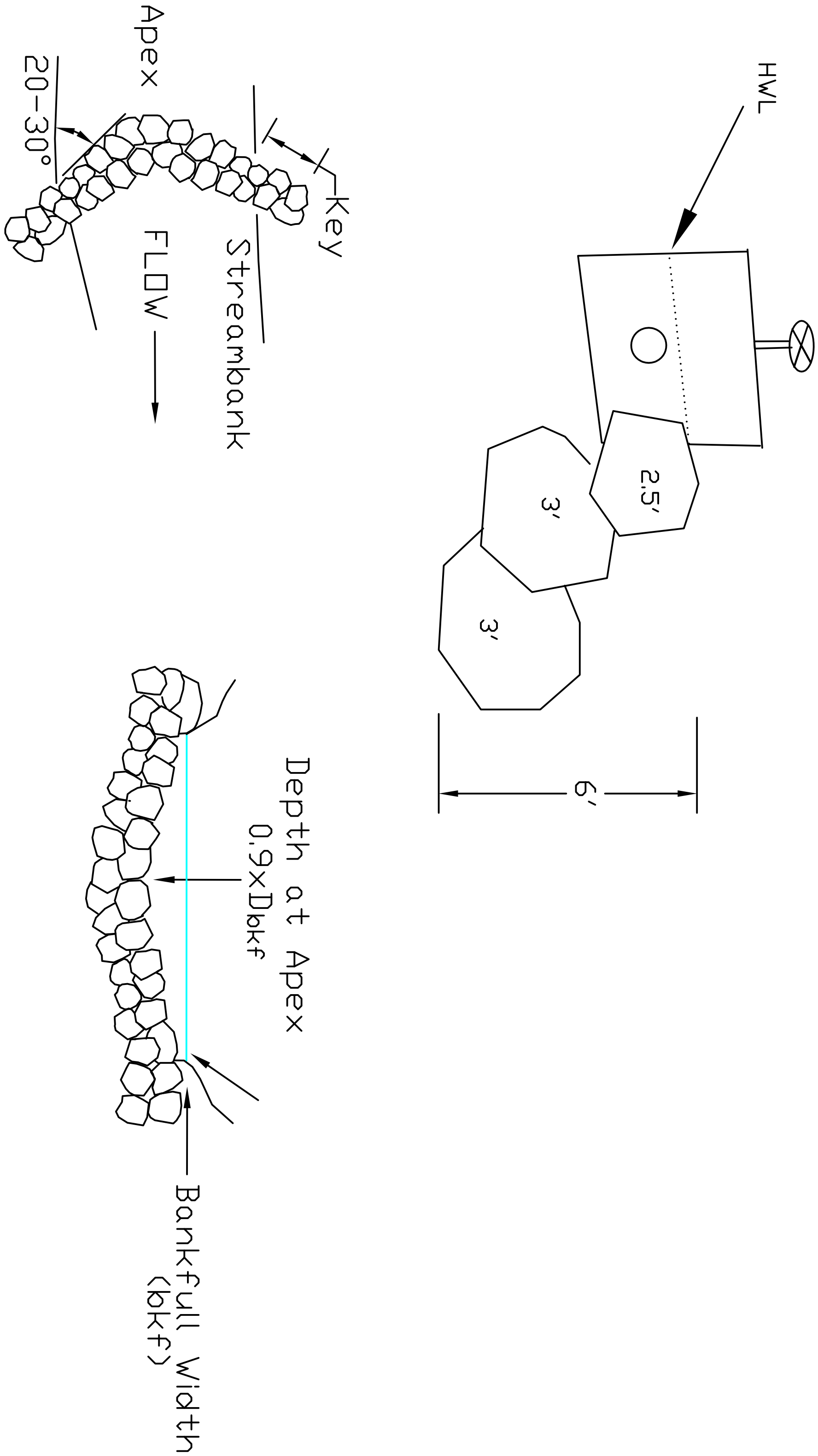
GRAYBEAL HEADGATE

Upstream to Downstream Hight
not to scale



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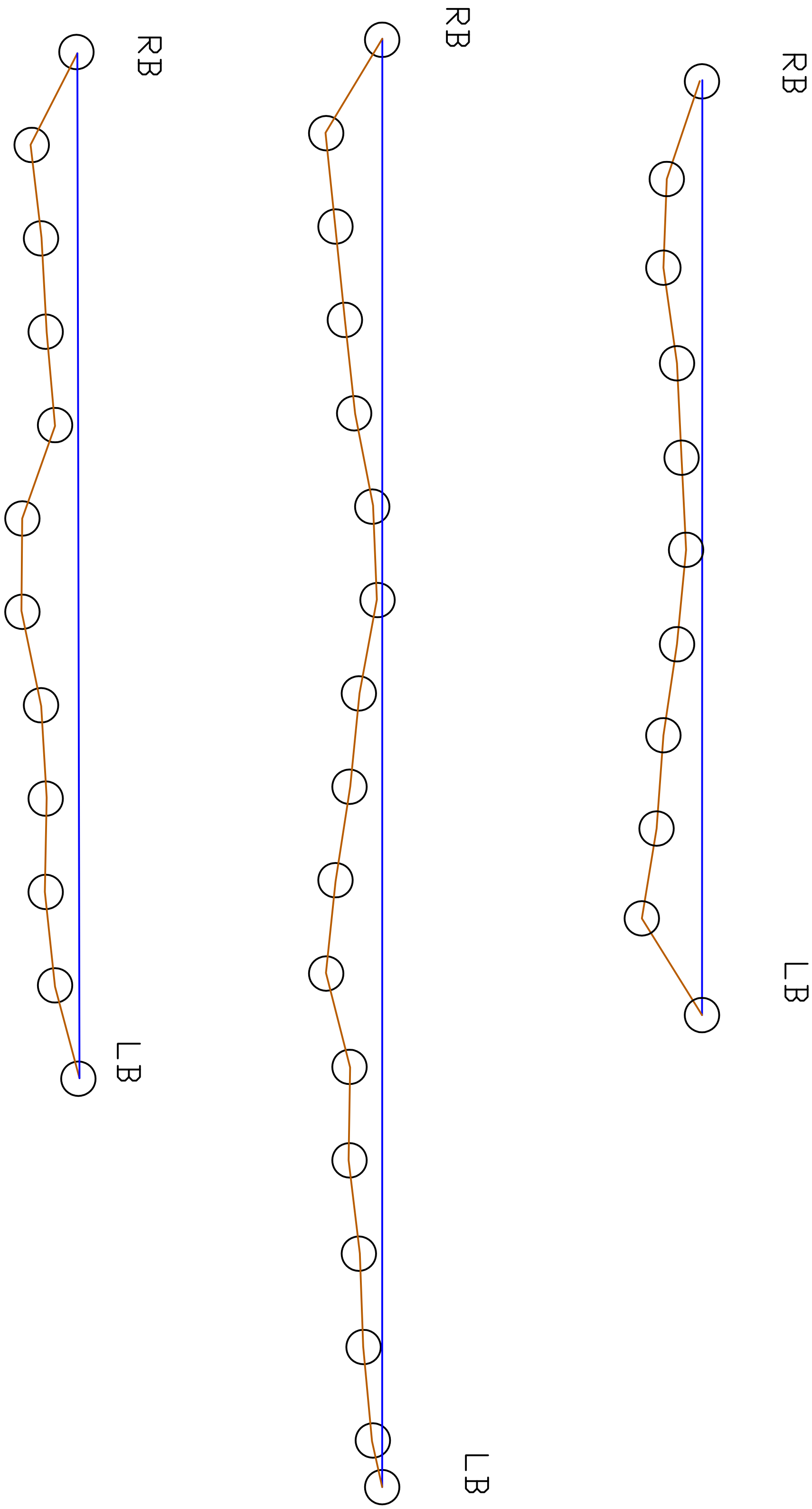
GRAYBEAL HEADGATE

Cross Sections
not to scale



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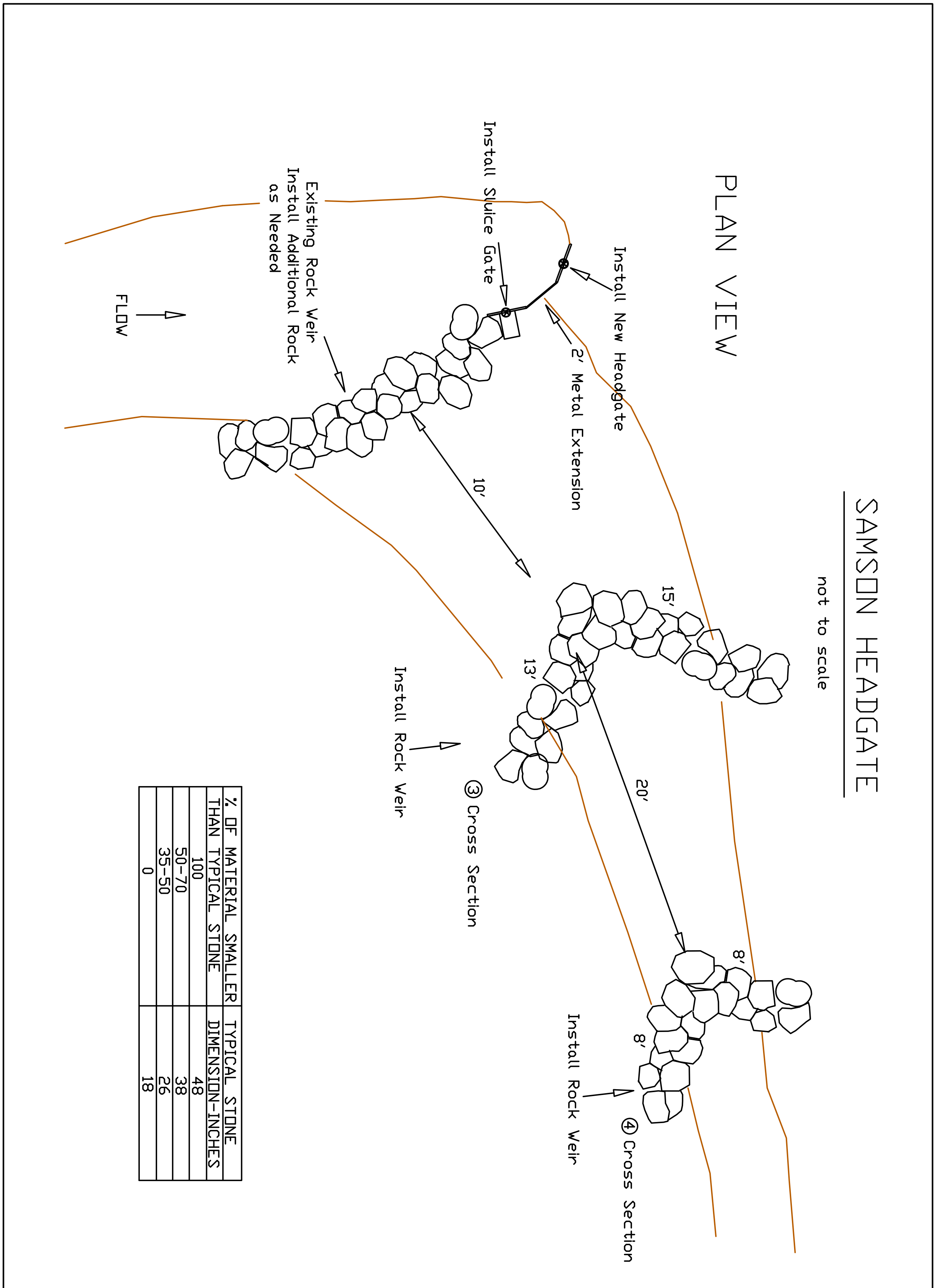

% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE DIMENSION-INCHES
100	48
50-70	38
35-50	26
0	18

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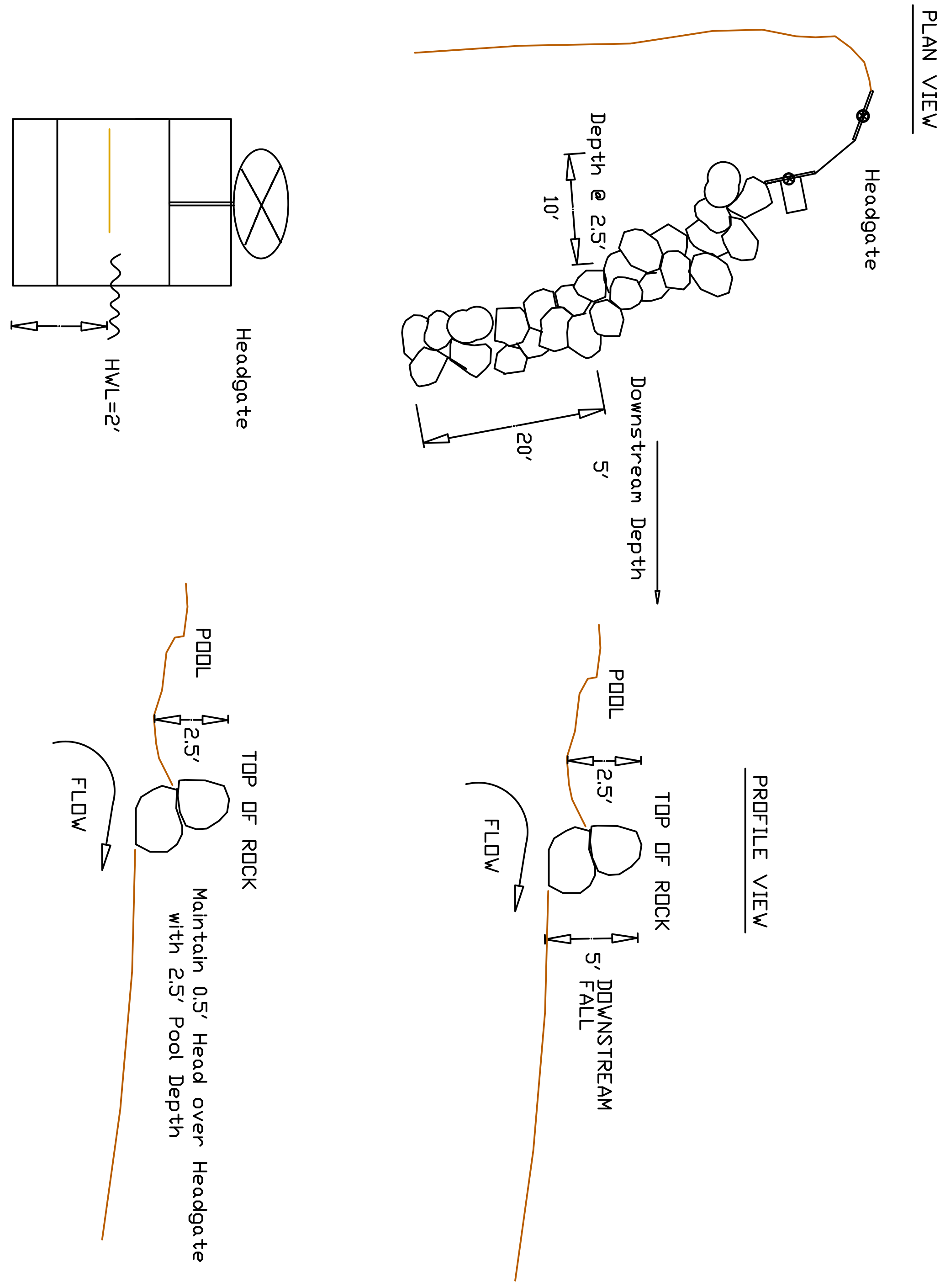
SAMSON HEADGATE

not to scale



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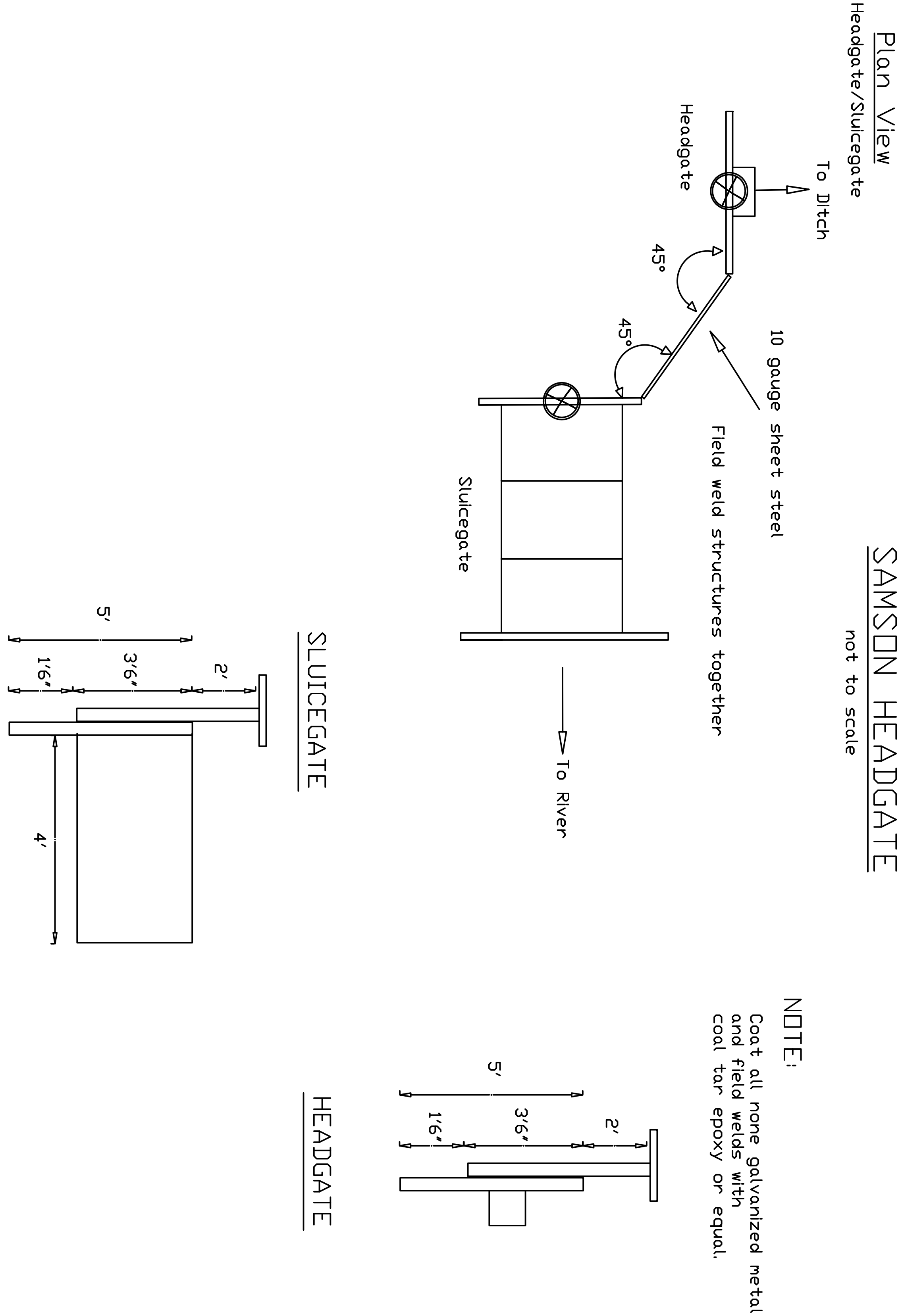

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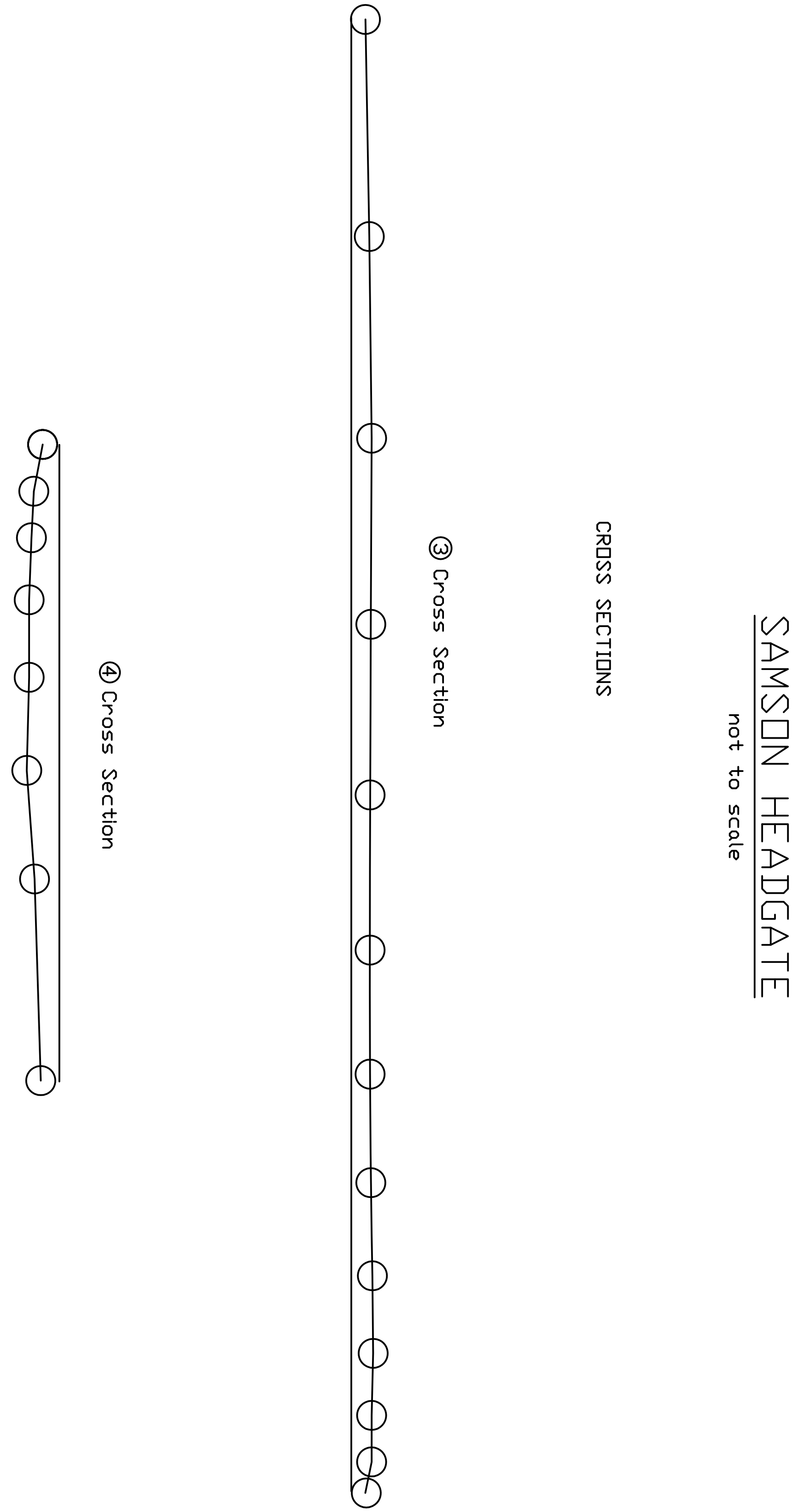

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