

Spring, Seep and Hanging Garden Monitoring Protocol Implementation Plan for Park Units in the Southern Colorado Plateau Network

Standard Operating Procedure (SOP) # 4

Site Map and Vegetation Characterization

Version SCPN_Springs_SOP4_20180930

Revision History Log:

Previous Version #	Revision Date	Author	Changes Made	Reason for Change	New Version #

This SOP is adopted from the Northern Colorado Plateau Network's SOP # 4 Site Map and Vegetation Characterization, Version 1.00 (June 2016) in Weissinger, R., M. Moran, S. Monroe, and H. Thomas. 2017. Springs and seeps monitoring protocol for park units in the Northern Colorado Plateau Network, Version 1.00. Natural Resource Report NPS/NCPN/NRR—2017/1439. National Park Service, Fort Collins, Colorado.

A site sketch map and vegetation characterization should be completed at all sites during the initial site visit and following major trigger events such as fire, severe flooding, a 10% reduction in flow, or at management's request. The sketch map documents the site area, geomorphic surfaces, and repeat monitoring locations. Visual estimates of foliar cover for each vascular plant species are recorded for each geomorphic surface.

Site Sketch Map

After familiarizing yourselves with the spring, sub-divide the site based on geomorphic surfaces and draw an initial sketch map showing these features (example in Fig. 1). Use a laser rangefinder to estimate distances. If an area can be traversed without displacing soil and plant roots, a meter tape may be used to measure dimensions. The sketch map provides the basis for subsequent monitoring efforts at the spring, so be careful and thorough.

A sketch map is completed for each site to document the overall structural make-up of the site and to provide a visual reference for data collected in various aspects of the spring ecosystem monitoring. The following items should be identified and documented on the sketch map for each site:

Sketch Map	
Site name	Channel structural controls (e.g. bedrock ledge or riffle)
Artist	Pool locations
Date	GPS reading location
Estimate map scale	Photo points
Locations/dimensions of each geomorphic/habitat surface, delineated as polygons	Location of water quality measurements
Spring orifice	Location of water quantity measurements
Channel location	Indication of north (true)

(→) Direction of flow	Human features (e.g., spring box, trail, etc.)
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The purpose of the map is to provide a graphical representation of information recorded in other tabular data fields. An additional purpose of the sketch map is to document the location of specific study measurements such as photopoints, water quality and quantity measurement, etc.

Geomorphic Surface Polygon Delineation

Continuous landform/geomorphic surfaces will be drawn as polygons, as close to scale as possible on the map, so that the area covered by each geomorphic surface type can be estimated. Note that you may wish to create multiple polygons for a given geomorphic surface type, particularly if it is patchy or discontinuous across the spring site. Polygons will be labeled with a code (Table 1). These codes will be used to reference surface types shown on the map to geomorphic surfaces, the plant species list and other site characterization parameters.

Table 1. Definition of geomorphic surface types and codes.

Landform/Geomorphic Surface Types (modified from Springer et al. 2006)		
Surface Type	Surface Type Code	Description
Alcove Floor	ALC	Near-horizontal surface located inside an alcove
Backwall	BW	Vertical to sloping bedrock in alcove or cliff setting
Sloping Bedrock	SB	Sloping bedrock outside of an alcove or cliff setting
Colluvial (detritus) slopes	CS	Slopes of unconsolidated materials
Cave	C	A large natural hole in the side of a hill, cliff, or mountain
Channel	CH	A passage for water to flow along
High Gradient Cienega	HGC	Steeply sloping marshy area with diffuse flow
Low Gradient Cienega	LGC	Gently sloping to flat marshy area with unfocused flow
Spring Mound	SM	Buildup of materials surrounding a spring due to water quality properties, e.g. travertine
Pools	P	Pools of water resulting from springs or runoff in alcoves
Terrace	TE	Flat strip of land on the slope of a hill, associated with high water and floodplains
Tunnel	TU	A passage extending back from an opening in the rock, e.g. a mine shaft
Upland	UPL	Describes upland surfaces surrounding the spring, use in conjunction with other codes, e.g., UPL CS
Other	OTH	Describe in comments section

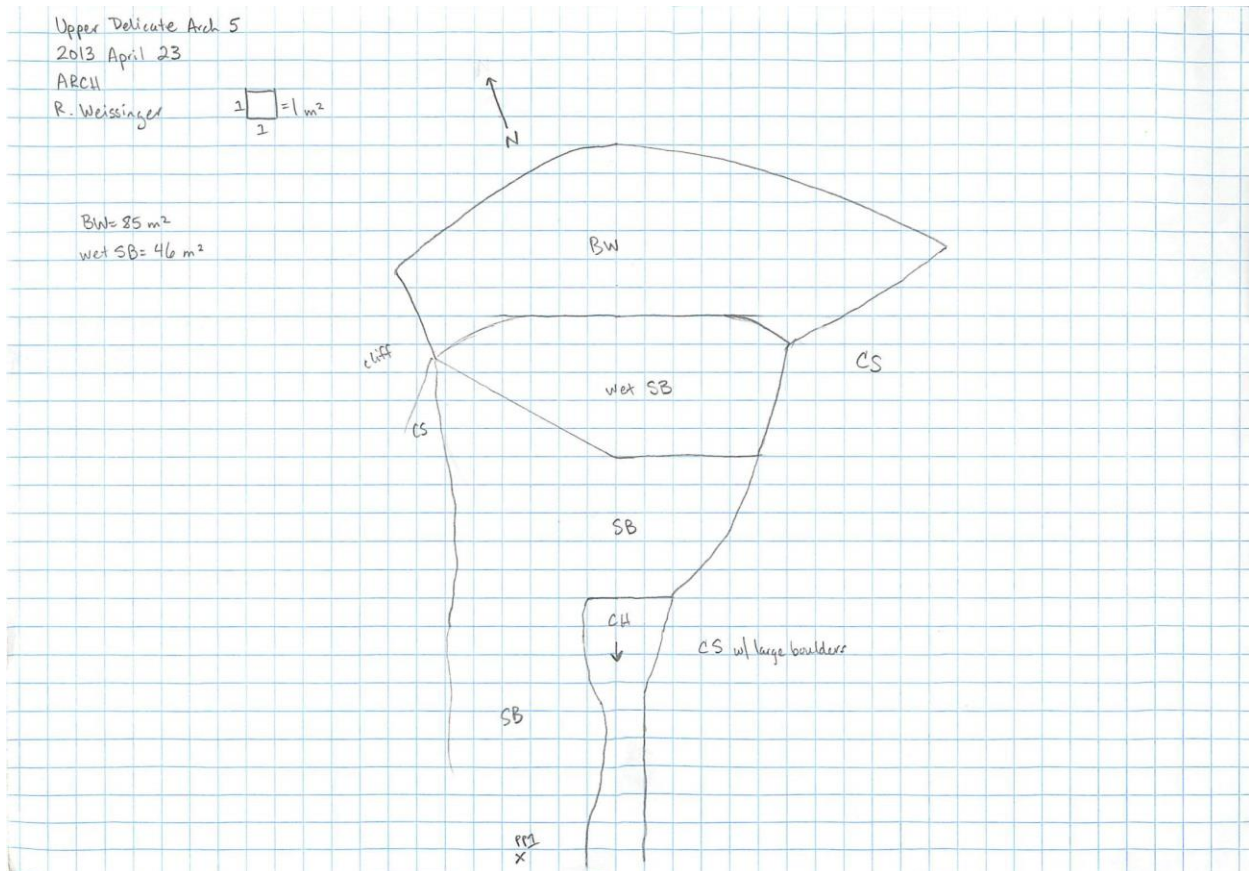


Figure 1. Example site sketch map showing geomorphic surfaces, photopoints, etc.

If possible, a panoramic photo should be taken of the site, and geomorphic surfaces can be drawn onto the photo in the office (Fig. 2). If a panoramic photo is not feasible, photos of the mapped edges of the spring with geomorphic surfaces drawn on can be helpful. See Appendix A for additional examples.

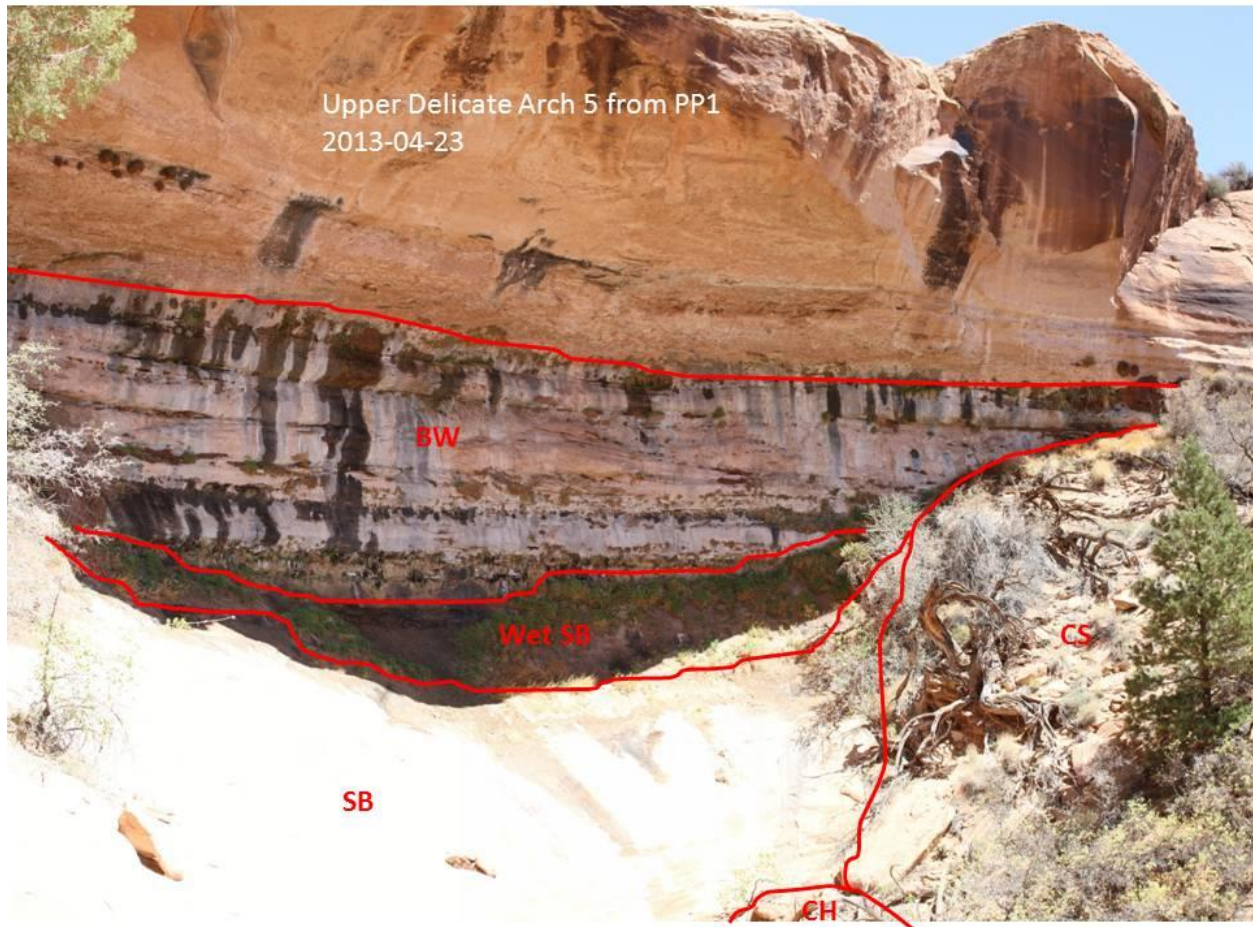


Figure 2. Example panoramic photo of site shown in Figure 1 sketch map, with geomorphic surfaces delineated.

Site Information

Geomorphic Surface Type

Record the geomorphic surface type code (listed above) for each polygon.

Polygon Area

Estimate or measure the **area of each polygon** (in square meters) and determine the **percent of the total spring area** represented by each polygon. Using the squares on the sketch map as a guide may be helpful.

Terrestrial and Aquatic Vegetation

Vegetation Characterization

Foliar cover of each vascular plant species will be estimated for the variety of terrestrial and aquatic landform/geomorphic surfaces at an individual spring site. The cover of moss and algae should also be estimated for each geomorphic surface. Spend 1 minute per 5-m² of vegetated area searching the site for additional species, for a maximum of two hours at larger sites. Do not include time spent keying plants in the allotted search time.

Vegetation Survey Start Time

Write in the 'local' time to the nearest minute upon beginning vegetation sampling, using an hour and minute format (**hhmm**). Use military time (add 12 to the hour beginning with 1pm through 11pm). Fill in all four digits. Examples are 0630 (6:30 am), 1402 (2:02 pm).

Vegetation Survey End Time

Write in the time to the nearest minute when vegetation sampling is completed, using an hour and minute format (**hhmm**). Use military time (add 12 to the hour beginning with 1pm through 11pm). Fill in all four digits. Examples are 0630 (6:30 am), 1402 (2:02 pm).

Plant Scientific Name

The first step in the vegetation survey is to compile a list of species on the site being evaluated. Full scientific names will be recorded on field sheets. When identity of a plant species is uncertain a collection may be made for later verification (see plant collection section below). Specimens collected for later verification should be assigned a unique identifier for later reconciliation with the determined scientific name.

Species Prominence (Canopy Cover) Class

Once the overall site has been surveyed and the species list compiled, identification specimens collected and uniquely labeled, the botanist visually estimates the percent cover for each species by landform/geomorphic surface type noted on the site sketch map.

The following prominence/cover class scale will be used to characterize individual species cover on each of the identified landform/geomorphic surfaces at a site. This prominence scale was developed by Spence (1993, 2004) and has been applied in studies of over 200 spring sites across Colorado Plateau parks.

Classes for Estimating Foliar Vegetation Cover	
Class	Definition
1	<1% canopy cover
2	1 - <10% canopy cover
3	10 - < 25% canopy cover
4	25 - < 50% canopy cover
5	50 - < 95% canopy cover
6	95% or greater canopy cover

Unknown Plants

Sometimes it may be difficult or impossible to determine the specific identity of individual plants encountered during sampling. Crews may be unfamiliar with a plant or unable to distinguish one species from other similar species at the time of sampling.

When an unknown plant is encountered

- A. Search the immediate area, looking for specimens of the unknown plant that are more readily identifiable (i.e., due to the presence of flowers or fruits from current or previous seasons).
- B. If an identifiable specimen cannot be found, create a unique name using the following code: unk + 4 letter park code + S + date + your initials + collection number for the day (e.g., unkZION-S0409-ST1). Record this code in the appropriate column on your vegetation sampling datasheet instead of the species name.
- C. Take a photograph of the unknown plant.
- D. It is permissible to identify a plant only to the genus level if no identifiable parts are present for keying, or if hybridization makes species delineation difficult. Record the full Latin name of the genus followed by “sp.” (e.g., *Opuntia* sp., *Tamarix* sp., etc.).

Collecting unknown plants

Once it has become apparent that no identifiable plants can be found or that a plant with identifiable features cannot be keyed out in the field, a collection of the plant should be made if more than 10 individuals occur at the site.

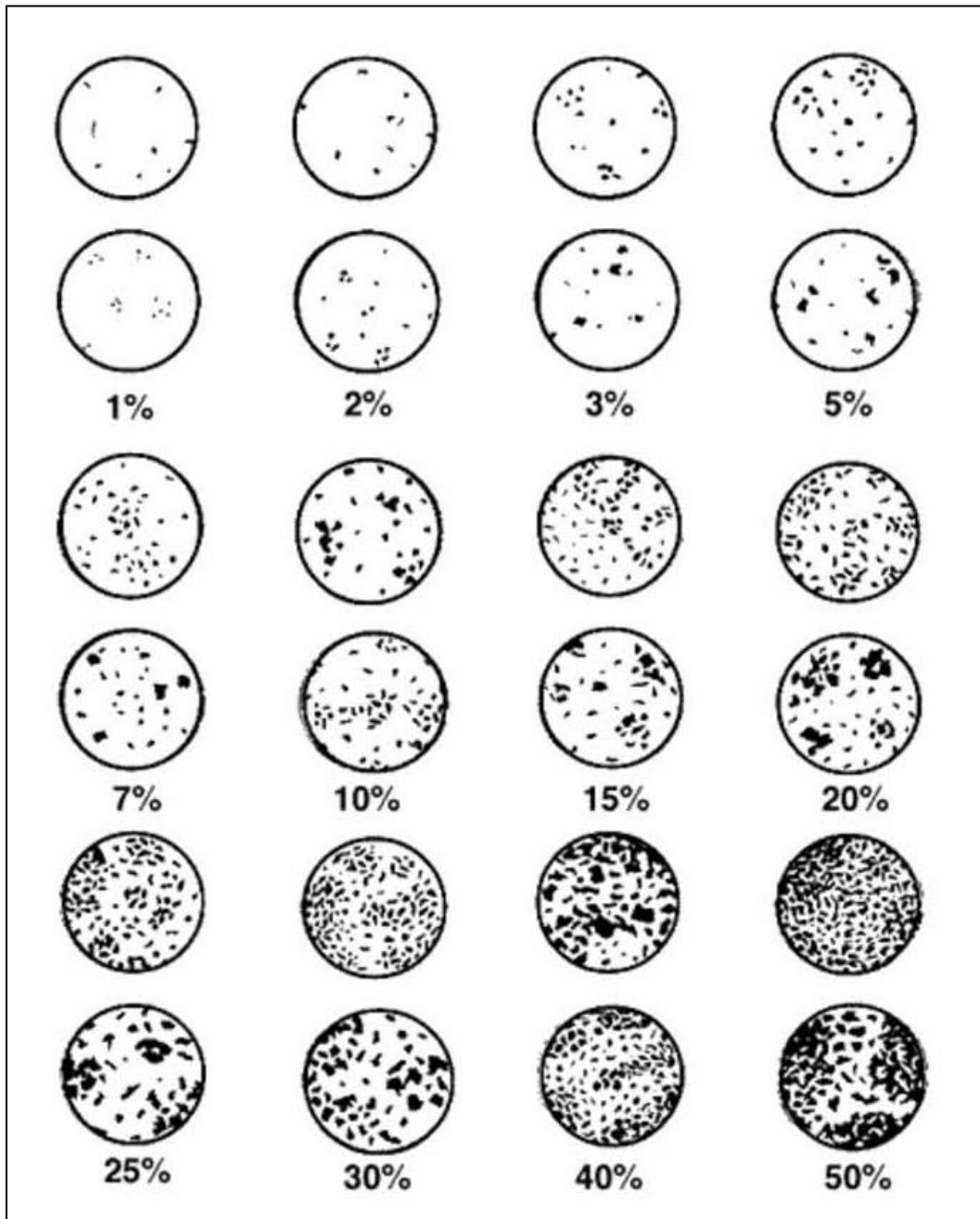
- A. Attempt to collect as many identifiable parts as possible, including flowers, fruits, leaves, and roots. It is especially important to collect roots of forbs and grasses. You may need to collect from more than one plant to achieve this goal.
- B. Wrap a piece of masking tape around the plant and use a fine-point Sharpie to label it with the unknown species code.
- C. Carefully place the specimen inside a resealable plastic bag labeled with the reach number, unknown species code, date, and collector.
- D. Place the sample in your backpack and in a shady spot until you get back to camp. Attempt to identify the plants when you return to camp.
- E. If the specimen cannot be identified right away, preserve the bag in a cooler as soon as possible. Make sure the specimen does not get wet. If a cooler is not available, press the plant between two sheets of newspaper.

Annotating datasheets

When updating data collection data sheets with identified plants, draw a line through the unknown code and write in the correct species code in the nearest available space. Initial and date the change on the datasheet.

Estimating Percent Cover

For this protocol cover estimates should be a percent of the total site or geomorphic surface polygon. Use the diagram below as an aid in estimating percent cover.



Park: ARCH

Site: Cn Cn3

Observer: RW

Date: 12 May 2015

Polygon Description

[illegible]

Geomorphic Surfaces

A - Alcove floor
BW - Backwall
C - Cave
CH - Channel
CS - Colluvial slope
HGC - High Gradient Cienega
LGC - Low Gradient Cienega
MAD - Unfocused Madicolous Flow
PP - Plunge pools
SB - Sloping Bedrock
TE - Terrace
OTH - Other

Plant Cover

6 - >95%
5 - 50-95%
4 - 25-50%
3 - 10-25%
2 - 1-10%
1 - <1%

Vegetation Cover			Start: 11:40	End: 12:35
Species	Surface	BW	CS	
Algae		5	1	
Moss		2	1	
<i>Grassus gambelii</i>			1	
<i>Toxicodendron rydbergii</i>			2	
<i>Rhus trilobata</i>	✓	1	1	
<i>Muhlenbergia andina</i>			2	
<i>Aquilegia microantha</i>	✓	1	3	
<i>Juniperus osteosperma</i>			1	
<i>Solidago velutina</i>			3	
<i>Primula spenciana</i>	✓	1	2	
<i>Smilacina stellata</i>			1	
<i>Carex anua</i>	✓	1	1	
<i>Mimulus eastwoodiae</i>	✓	2	1	
<i>Melilotus officinale</i>			1	
<i>Panicum acuminatum</i>				
<i>Mahonia fremontii</i>			1	
<i>Chrysopsis villosa</i>			1	
<i>Juniperus arcticus</i>			1	
<i>Epprechtia gigantea</i>			1	
<i>Asparagus officinale</i>			1	
<i>Oenothera</i> sp?			1	
wink pg - Agr sto RW 5/13/15			1	
<i>Hebeaena foenicula</i>			1	
<i>Adiantum capillus-veneris</i>			1	