



Protocol Implementation Plan for Monitoring Stream Condition in the Mediterranean Coast Inventory and Monitoring Network of Southern California

Standard Operating Procedures, Version 1.0



ON THE COVER

Photograph of Water Canyon, Santa Rosa Island in Channel Islands National Park.

Photograph by S. Ostermann-Kelm, National Park Service Mediterranean Coast Network

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Change History

Version numbers will be incremented by a whole number (e.g., Version 1.3 to Version 2.0) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.6 to Version 1.7) when there are minor modifications that do not affect requirements or procedures for publication in the series.

Revision Log. Provides an overview of the changes made to different versions of this protocol over time. Update cells and add new rows as needed.

Version #	Date	Revised by	Changes	Justification
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–
–	–	–	–	–

- 1) Version numbers increase incrementally by tenths (e.g., version 1.1, version 1.2, ...etc.) for minor changes. Major revisions should be designated with the next whole number (e.g. version 2.0, 3.0, 4.0 ...). Record the previous version number, date of revision, author of the revision, identify paragraphs and pages where changes are made, and the reason for making the changes along with the new version number.
- 2) Notify the MEDN Data Manager and MEDN Program Manager of any changes to the Protocol Narrative or SOPs so that the new version number can be incorporated in the Metadata of the project database.
- 3) Post new versions on the internet and forward copies to all individuals with a previous version of the Protocol Narrative or SOPs. For the most current versions, see the following website:
<https://www.nps.gov/im/medn/stream-condition.htm>.

Overview

These Standard Operating Procedures (SOPs) accompany the Mediterranean Coast Inventory and Monitoring Network's protocol implementation plan for monitoring stream condition (Federico et al. 2019). They provide details on the activities related to planning, field work, data collection, and data processing for the variables associated with the protocol implantation plan's components. These SOPs likewise accompany the Network's data quality standards document (Key and Ostermann-Kelm 2019).

Acknowledgements

We greatly appreciate R. Key's careful review and formatting of this document.

List of Acronyms and Abbreviations

303(d). Section of the Clean Water Act mandating that states submit a list of water bodies not meeting or not expected to meet water quality standards.

CHIS. Channel Islands National Park

EMZ. Ecological Management Zone. Synonymous with RMZ. These areas are defined as SAMO and additional areas of public lands surrounding SAMO.

HUC. Hydrologic unit code. The Watershed Boundary Dataset (WBD) maps the full areal extent of surface water drainage for the U.S. using a hierarchical system of nesting hydrologic units at various scales, each with an assigned hydrologic unit code (HUC)

MEDN. Mediterranean Coast Network of the NPS Inventory and Monitoring Program.

PIP. Protocol Implementation Plan

RMZ. Ecological Management Zone (includes SAMO and surrounding lands). Synonymous with EMZ. These areas are defined as SAMO and additional areas of public lands surrounding SAMO.

SAMO. Santa Monica Mountains National Recreation Area

SCCWRP. Southern California Coastal Water Research Program

SMC. Stormwater Monitoring Coalition. The goal of the SMC is to develop the technical information necessary to better understand stormwater mechanisms and impacts, and then develop the tools that will effectively and efficiently improve stormwater decision-making.

TMDL. Total maximum daily limit

SWAMP. Surface Water Ambient Monitoring Program. The mission of SWAMP is to provide resource managers, decision makers and the public with timely, high-quality information to evaluate the condition of all waters throughout California.

Additional information can be found at
https://www.waterboards.ca.gov/water_issues/programs/swamp/quality_assurance.html#qapgd

BMI. Benthic macroinvertebrates

PHAB. Physical Habitat Condition

GRTS. Generalized random tessellated stratified. GRTS is a form of spatially-balanced sampling that is a true probability design.

Standard Operating Procedure (SOP) 1: Field Season Planning and Coordination

1.0 Overview

This SOP has been created to contain information on agreements, planning, and coordination of the Mediterranean Coast Network's (MEDN) stream condition monitoring for the Santa Monica Mountains National Recreation Area (SAMO) and the Channel Islands National Park (CHIS).

1.1 Cooperative Agreement for Field Data Collection and Reporting

Currently, MEDN lacks the extensive personnel required to conduct stream channel monitoring on an annual basis. In addition, the training and additional equipment required to successfully complete the assessments are significant. As a result, it is impractical at this time for MEDN to assemble and train qualified personnel for a small number of sites (8-12) each year. Given that the California Department of Fish and Wildlife (CDFW) Aquatic Bioassessment Laboratory manages such monitoring programs throughout the state, it is more efficient to work through their program and with their trained and highly experienced staff.

To this end, MEDN has partnered with the CDFW through a Cooperative Agreement. This agreement stipulates that CDFW will complete the following each season:

- Assemble and train a qualified field crew
- Obtain the necessary Scientific Collection Permit (SCP) from the CA Department of Fish and Wildlife (CDFW). The following conditions apply:
- Download the SCP application and instructions from the following CDFW link: <https://www.wildlife.ca.gov/Licensing/Scientific-Collecting>.
- GIS coordinates for the sites sampled during each field season must be sent to James.Harrington@wildlife.ca.gov no later than 14 days before they are sampled.
- At the end of the field season, the final list of sites sampled must be confirmed in an email to James.Harrington@wildlife.ca.gov.
- Within one year of sample collection or upon the request of CDFW, all data produced for the current year under this permit must be in a format that can be uploaded to the California Environmental Database Exchange Network.
- Collect field data, macroinvertebrate samples, and water chemistry samples as outlined in the SWAMP Bioassessment Protocol (Ode 2007), and conduct a riverine wetland condition assessment per the California Rapid Assessment Method (CRAM) for wetlands, riverine module (CRAM 2013), and as further specified in SOPs 3, 4, and 5.
- Process and identify macroinvertebrate samples and calculate metrics to provide CSCI scores.
- Oversee laboratory analysis of water chemistry samples at a State-certified laboratory.
- Perform quality assurance/quality control (QA/QC) procedures on field and lab data.
- Submit annual reports to MEDN which summarizes the monitoring results, as described in SOP 9.

- Submit data deliverables to MEDN as outlined in the data management SOP 8.

This agreement must be renewed on an annual basis to reflect the current seasons sample rotation and selected parks/streams.

1.2 Coordination between CDFW, Park staff, and MEDN program manager

Close collaboration with SWAMP, use of experienced field crews, and good communication among the collaborators, park staff and I&M are all essential to the successful implementation of the stream condition monitoring protocol implementation plan (Federico et al. 2019). The WQ program lead and the MEDN program manager should be subscribed to the SWAMP listserv to receive notice of upcoming meetings, calibration workshops, and discussion of protocol changes or additions.

Advanced planning and close coordination is required on an annual basis. Each park has unique issues that will need to be addressed. At SAMO, monitoring must be coordinated with the aquatic amphibian protocol implemented by park staff. At CHIS, details of transportation to and from the island, overnight lodging, and transportation around the island need to be planned carefully approximately 6 months before fieldwork is scheduled.

As discussed in SOP 4, bioassessments are typically conducted between May 15 and July 15. Earlier sampling may be appropriate for non-perennial streams and may occur as early as March, but no less than 4 weeks after scouring events. These timing considerations will need to be coordinated with timing requirements for aquatic amphibian monitoring at SAMO and access logistics at CHIS.

As discussed in SOP 5, the window for CRAM assessments in CHIS streams is March through September; there does not need to be water in the streams for CRAM to be conducted.

The following lists identify planning start times and key issues to be addressed for each park:

SAMO:

December:

- o Plan coordination meeting in January.
- o Begin working on agreement or contract for funding protocol implementation.
- o Attend SMC/SWAMP work plan meetings and keeping up with listserv messages.

January/February: The WQ monitoring lead should hold a coordination meeting with the aquatic amphibian monitoring lead and the collaborator who will be doing the WQ field work (most likely CDFW crews) to discuss the topics below.

- o Review any changes to the methodology used by SWAMP and discuss the implications for NPS monitoring. Anything more than minor changes or additions to the 2016 version of the SWAMP protocol must be approved by the MEDN I&M Program Manager and Pacific West Region I&M Program Manager before implementation at SAMO.
- o Determine which amphibian monitoring locations will be visited that year, and the proposed set of sites for which bioassessments and CRAM assessments will be performed.

- o Share schedules for stream condition and amphibian monitoring. Determine if there are opportunities for synergies or efficiencies with fieldwork, or potential for interference. For example, a minimum of 4 days is needed between bioassessments/CRAM and amphibian monitoring to avoid potentially altering survey results.
- o Review any safety or access issues with the sites to be visited that year.

March: Finalize agreement or contract with CDFW or other collaborator by the end of March each year.

CHIS:

November:

- o Begin coordinating the field season for coming spring.
- o Draft the task agreement to fund protocol implementation, reserve housing for field crew during anticipated dates, coordinate housing with transportation, and arrange for a driver.
- o Contact California State University, Channel Islands Research Station Director (<https://www.csuci.edu/sri/visiting/>) to arrange housing and driver dates, and coordinate with CDFW field crew. As of 2017, Daniel Pickard is the contact person for CDFW field crews (address below). Also contact park natural resource staff and the island ranger to inform them of proposed sampling dates.

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Aquatic Invertebrate Taxonomist
Department of Fish & Wildlife, Aquatic Bioassessment Lab (ABL) – Chico
CSU Chico
Chico, CA 95929-0555
530-898-5573

December: Attend SMC/SWAMP workplan meetings and keep up with listserv messages.

January: The WQ monitoring lead should hold a coordination meeting or conference call with park staff and the collaborator who will be doing the WQ field work (most likely CDFW crews) to discuss the topics below.

- o Determine which sites will be monitored, and of those sites, where bioassessments will be conducted as opposed to only CRAM. Water availability may influence which month or year(s) the bioassessment sampling is conducted.
- o Collaboratively determine the detailed sampling schedule (which sites will be visited during each trip). Only trained, tested and approved staff or partners are allowed to drive on SRI. For this reason, on-island transportation will likely be provided through the California State University, Channel Islands (CSUCI) Research Station or NPS staff. Obtaining on-island transportation is essential and may, in part, dictate when and where sampling can occur.

- o Review any changes to the methodology used by SWAMP and discuss the implications for NPS monitoring. Anything more than minor changes or additions to the 2016 version of the SWAMP protocol must be approved by the MEDN I&M Program Manager and Pacific West Region I&M Program Manager before implementation at CHIS.
- o The protocol lead in consultation with park staff ensures that a park scientific research permit is approved for benthic macroinvertebrate and water quality sampling for the season. Permit application forms are available here:
<https://www.csuci.edu/sri/resources.htm>
- o Confirm transportation to and from the island. There are 3 options for transportation to the island: NPS boat, Island Packers boat, or Channel Islands Aviation plane. Island Packers (<http://islandpackers.com>) is the concessionaire that provides public transportation to the islands. In the spring and early summer, there are typically 3 trips to/from SRI per week. The boat ride is approximately 2.25 hours each way. Reservations for the park boat must be made through CHIS staff. Typically, the park boat visits SRI only once per week. Flights with Channel Islands Aviation (<http://www.flycia.com/>) can be reserved for almost any date (weather dependent) although the cost is considerably more than a boat trip. In some cases, it may be possible to split the cost of a flight with NPS staff or other researchers.
- o Confirm lodging reservations at the CSUCI Research Station.
<http://www.csuci.edu/sri/visiting/>
- o Prepare crews for remote and rustic accommodations on SRI. Weather on the islands is highly variable and almost always windy. Check “what to bring” list on CSUCI Research Station website (<https://www.csuci.edu/sri/resources.htm>). Gators are very helpful to avoid getting seeds and vegetation stuck in socks while hiking off trail.

March:

- o Finalize agreement or contract with CDFW or other collaborator by the end of March each year.
- o Keep in contact with park and island staff to monitoring rain and road conditions. Roads are typically closed after rain.

Standard Operating Procedure (SOP) 2: Site Selection

2.0 Overview

This SOP has been created to describe how the site selection process will occur at SAMO and CHIS.

2.1 SAMO Site Selection

SAMO monitoring sites will be a subset of the GRTS-selected aquatic amphibian monitoring sites from the amphibian monitoring protocol (Delaney et al. 2011). Amphibian monitoring is conducted annually at one of three rotating panels of 12 GRTS-selected sites, (in addition to 10 sentinel sites). Bioassessment and CRAM monitoring per the stream condition monitoring protocol implementation plan (Federico et al. 2019) will be conducted at 10 of the 12 rotating amphibian sites each year. The first three years of the program at SAMO will be used to finalize site selection, using a visiting order as shown in Tables 2.1.a, 2.1.b, and 2.1.c. The exact subset of sites that will be sampled will be determined the first occasion that a panel is visited, by using the first 10 sites considered to be physically appropriate for bioassessment and CRAM monitoring with respect to wadeability and perenniality. For all three rotating panels, there are 10 sites that are anticipated to meet the criteria. Once selected, sites should generally be visited in the order described in Tables 2.1.a, 2.1.b, and 2.1.c to ensure appropriate flow conditions.

Sites designated as “Back-up” in Tables 2.1.a, 2.1.b, and 2.1.c are those that may serve as back-ups sites in the event that one of the first 10 sites don’t work. Sites highlighted in gray are not expected to be appropriate for bioassessments. In the event that fewer than 10 sites in a rotating panel were found to be acceptable for bioassessment monitoring, the MEDN program manager, in consultation with park staff and the CDFW consultants, will either select from the sentinel sites, or choose to do only CRAM on the rotating sites that were not appropriate for bioassessments. This SOP will be updated after each of the initial three years of monitoring to document the final site selection for each of the rotating panels.

An additional sampling detail that needs to be determined is the overlap between the bioassessment / CRAM reach lengths and those of the amphibian monitoring. Amphibian monitoring is conducted along reaches of 250m, starting at the downstream end. Water quality monitoring will also start at the downstream end of the amphibian reach; however, there may be situations in which a monitoring reach contains localized pools with too deep to be wadable. In this case, the water quality reach may need to start at a different point such that it coincides with a fully wadable reach length. The CRAM Field Book for Riverine Wetlands, 6.1 (2013) specifies that the length of the Assessment Area should be 10x bankfull width, min 100m, max 200m. Ode (2007) for BMI and associated physical habitat measurements specifies a 150m reach length if wetted width < 10m, and a 250m reach length if the wetted width is >10m. Therefore, for streams <10m in width, CRAM will be conducted along a 100m reach and BMI monitoring will be conducted along a 150m reach, making it potentially feasible to place the 150m water quality length in a way to avoid deep pools. However, if the stream is >10m, BMI will need to be conducted along the entire 250m length and there will not be any leeway. These decisions will need to be made by DFW monitoring team in collaboration with

amphibian monitoring program lead at SAMO and the MEDN program manager during the first three years of the monitoring program at SAMO, and will be documented in a revision to this SOP.

Table 2.1.a. Amphibian monitoring sites, panel assignment R1, at SAMO prioritized by their anticipated suitability for benthic macroinvertebrate (BMI) sampling during the wet season (February thru April).

Stream Name	Stream Code	Stream Flow	Suitable for BMI sampling?	Proposed order for WQ Protocol
West Fork Trancas	R1_WFTRANCAS	Intermittent ¹	Yes	First Group
Eleanor	R1_ELEANOR	Intermittent ¹	Yes	
Little Sycamore	R1_LITTLESYC	Intermittent ¹	Yes	
Medea Creek	R1_MEDCRK	Perennial ¹	Yes ²	Second Group
Ramirez	R1_RAMICYN	Perennial ¹	Yes	
Solstice Canyon (upper)	R1_SOLSCRK	Perennial	Yes	Third Group
Las Flores	R1_LASFLORES	Perennial	Yes	
Liberty	R1_LIBCYN	Perennial	Yes	
Conejo Creek	R1_CONCRK	Perennial ¹	Maybe	Back-Up Site
Malibu Creek	R1_MALICRK	Perennial ¹	Maybe	Back-Up Site
Sullivan	R1_SULLCYN	Intermittent to dry	No	Back-up Site ³
Arroyo Conejo	R1_ARRCONEJO	Intermittent to dry	No	Back-up Site ³

Table 2.1.b. Amphibian monitoring sites, panel assignment R2, at SAMO prioritized by their anticipated suitability for benthic macroinvertebrate (BMI) sampling during the wet season (February thru April).

Stream Name	Stream Code	Stream Flow	Suitable for BMI sampling?	Proposed order for WQ Protocol
Circle X (Grotto Trail)	R2_CIRCLEX	intermittent ¹	Yes	First Group
Escondido Creek	R2_ESCONDIDO	intermittent ¹	Yes	
Las Flores (year 2)	R2_LASFLORES	intermittent ¹	Yes	
Suttphur Creek (Santa Maria Road)	R2_SUTTPHUR	intermittent ¹	Yes	
Rustic Creek (Will Rogers SHP)	R2_RUSTIC	intermittent to perennial ¹	Yes	Second Group
Sostoma Trail (above Tropical Terrace)	R2_SOSTOMA	perennial ¹	Yes	
Bulldog Motorway (off Malibou Lake)	R2_BULLDOG	perennial	Yes	Third Group
Santa Ynez Canyon Trail	R2_SANTAYNEZ	perennial	Yes	
Las Virgenes Creek (near City Hall)	R2_LASVIRGENES	perennial ¹	Yes	Back-Up Site
Triunfo Creek	R2_TRIUNFO	perennial ¹	Maybe	Back-Up Site
Cheeseboro Creek (above connector)	R2_CHEESEBORO	dry almost always	No	Back-up Site ³
Olsen Road (CLU)	R2_OLSEN	dry	No	Back-up Site ³

Table 2.1.c. Amphibian monitoring sites, panel assignment R3, at SAMO prioritized by their anticipated suitability for benthic macroinvertebrate (BMI) sampling during the wet season (February thru April).

Stream Name	Stream Code	Stream Flow	Suitable for BMI sampling?	Proposed order for WQ Protocol
Arroyo Sequit (Oak Valley)	R3_ARRSEQOV	Intermittent ¹	Yes ²	First Group
Cold Creek (off Stunt Road)	R3_COLD CRK	Perennial ¹	Yes	
Malibu Creek (at Cross Creek)	R3_CROSSCRK	Perennial ¹	Yes ²	
Tuna Canyon (from PCH)	R3_TUNACYN	Perennial ¹	Yes ²	
Topanga Creek (at Summit Road)	R3_TOPACRK	Perennial	Yes ²	Second Group
Topanga Creek (off Topanga Blvd)	R3_TOPANGA	Perennial	Yes ²	
Liberty Canyon (above pitfalls)	R3_LIBCYN	Perennial	Yes	
Lachusa Creek (replaced Malibu Nature Preserve)	R3_LACHUSA	Perennial	Yes ²	
Conejo Creek (year 3)	R3_CONCRK	Perennial ¹	Maybe ²	Back-Up Site
Malibu Creek (Craggs Road)	R3_CRAGSRD	Perennial ¹	Maybe	Back-Up Site
Ladyface	R3_LADYFACE	Perennial ¹	Maybe ²	Back-Up Site
Malibu Creek SP (rock pool)	R3_MALICRKSP	Perennial ¹	Maybe ²	Back-Up Site
Malibu Nature Preserve	R3_MALINP	Dry	No	no longer in program

Footnotes for tables 2.1.a, 2.1.b, and 2.1.c

¹ See program stream supplemental document for additional information noted about this stream flow.

² See program stream supplemental document for additional information noted about BMI suitability.

³ Back-up site, CRAM protocol only.

2.2 CHIS Site Selection

In the first year (2016), sampling targeted only the Melack and Cooper sites. Of the 9 sites, only 2 were sampleable for BMI, and all were sampled for CRAM. The purpose of this was to compare the sites sampled in 2006 with those sampled in 2016 to evaluate changes to the island over a decade.

Site selection during the second and third years of the first rotation of sampling

Sites should be evaluated in numeric order (from low to high) according the sample draw. If sites are rejected, the next-lowest numbered site should be evaluated. Therefore, sites in Panel 2 may serve as replacements for sites in Panel 1, sites in Panel 3 may serve as replacements for sites in Panels 2, and so on. Sites from the sample overdraw may be needed to complete Panel 3. The initial assignment of a site to a panel during the sample draw creation should be considered tentative, and a more permanent assignment occurs after the first round of sampling. At the end of the first rotation of sampling, a total of 30 probabilistic sites will be sampled for CRAM and assigned to one of three 10-

site panels, as determined by the site number. Sites where BMI sampling is likely to be possible will be identified, allowing refinement of subsequent sampling plans, if necessary.

Site selection during the second rotation

Sites assigned to panel 1 during the first rotation will be revisited for CRAM assessment. If a site becomes temporarily unsampleable (e.g., inaccessible because a road washed out), crews shall instead find the lowest-numbered substitute among sites targeted for sampling in future years, and revisit the temporarily unsampleable site in a future year within the rotation when accessibility is reestablished. If a site becomes permanently unsampleable, then crews shall evaluate the next lowest-numbered site from the oversample.

Because resource allocation allows no more than 10 BMI samples to be analyzed in any rotation, BMI collection will be limited to no more than 4 sites in the first year, and no more than 7 sites in the first two years combined. If a site becomes unsampleable for BMI, CRAM should still be assessed at the site; the unexpended resources may be reallocated towards other analytes or other sites at the discretion of the project manager. This plan may be revised in light of information provided by site evaluations during the first rotation.

Standard Operating Procedure (SOP) 3: Field Measurements of Water Chemistry (SAMO)

3.0 Overview

Field measurements of water quality parameters will be performed annually at aquatic amphibian monitoring locations, in accordance with the amphibian monitoring protocol (Delaney et al. 2011). Measurements will include the four core parameters identified by NPS Water Resources Division: dissolved oxygen, temperature, pH, and specific conductance, as well as turbidity.

3.1 Summary of Parameters

Dissolved oxygen (D.O.) is the amount of oxygen present in the water column. Depletion of oxygen may indicate excessive algae growth and decay, and can be used to monitor some of the effects of excess nutrients. Some aquatic species of concern (i.e. steelhead trout and newt larvae) are dependent on relatively high levels of D.O.

Water temperature is a critical parameter in water quality monitoring because of its significant influence on oxygen solubility. The amount of D.O. that water can absorb is inversely proportional to water temperature. As water temperature increases, oxygen solubility decreases. At the same time, biological oxygen demand (B.O.D.) increases with increasing water temperature because many organisms' metabolic rates increase at higher temperatures.

The pH level in streams is an important biological indicator because low pH levels are harmful to most living organisms. The pH of surface water is the measure of how acidic or basic the water is on a scale of 0-14, with 7.0 being neutral. The pH in rivers should be between 6.5 and 8.5 to protect freshwater life. It is important to remember that the pH scale is logarithmic, not linear, and a change from 8.5 to 6.5 means that the water is 100 times more acidic.

Specific conductance, or conductivity, is an indirect measure of the amount of dissolved minerals in water. These minerals may be naturally occurring as a result of leaching from bedrock and soil. They may also occur due to animal and human wastes, or agricultural sources. Conductivity is expressed in units of electrical conductance, i.e. Siemens per centimeter at 25 degrees Celsius.

Turbidity is a measurement of water clarity and how much the material suspended in water decreases the passage of light. It is influenced by the amount of suspended particles in the water column. Turbidity is a concern for a number of reasons: suspended particles absorb more heat, which in turn reduces the concentration of DO; higher turbidity reduces the penetration of light, thereby reducing photosynthesis and the production of DO; suspended particles can physically impact freshwater biota, such as by clogging fish gills, and can also blanket the stream bottom, smothering fish eggs and benthic macroinvertebrates. Turbidity is measured in nephelometric turbidity units (NTU).

3.2 Field Instruments

The following instruments, or equivalents, will be used for field measurements:

- For dissolved oxygen, temperature, and conductivity: YSI Pro2030.

<https://www.ysi.com/pro2030>

- For pH: Hanna HI98128 pHep®5. <http://hannainst.com/hi98128-phep-ph-tester.html>
- For turbidity: Oakton T-100 Turbidity meter.
<http://www.4oakton.com/proddetail.asp?parent=304&prod=305&value=detail>

Calibration kits should be purchased from the manufacturer for each instrument. Calibration, storage and maintenance (e.g., battery replacement and electrode replacement) should be performed according to the manufacturer's instructions / user's manual.

3.3 Instrument Use

Measure and record water quality parameters at the downstream end of the reach, prior to any other upstream sampling activities in order to avoid influence by field crews. Measurements should be taken by immersing probes to a depth of approximately 0.2 m, at the midpoint of the flow width. Meters should be rinsed with deionized water between measurements as described in the user's manuals.

Standard Operating Procedure (SOP) 4: Bioassessment Monitoring

4.0 Overview

Macroinvertebrate assemblages, physical habitat conditions and stream water chemistry will be monitored using the bioassessment protocol for wadeable streams designed by the California Surface Water Ambient Monitoring Program (SWAMP) (Ode et al. 2016a). The detailed SWAMP protocol, including QAPPs and SOPs can be downloaded from the California State Water Resources Control Board's SWAMP website:

https://www.waterboards.ca.gov/water_issues/programs/swamp/bioassessment/ and https://www.waterboards.ca.gov/water_issues/programs/swamp/quality_assurance.html.

Below we provide a brief overview of the sampling; however, this protocol implementation plan is written with the understanding that only field crew members that have extensive training through the California Bioassessment College will be collecting data. Furthermore, the protocol may be updated and fine-tuned by SWAMP over time.

The WQ program lead must understand and document any small changes or additions to the SWAMP protocol for the coming year and consult with the network and regional I&M program managers before implementing those changes.

4.1 Bioassessment Components at MEDN Parks

MEDN bioassessment monitoring at both SAMO and CHIS will entail the following components from the SWAMP protocol (Ode et al. 2016a):

- Reach delineation and scoring notable field conditions
- Water chemistry
- Field measurements: Turbidity, temperature, specific conductivity, pH, dissolved oxygen
- Sample collection for: total nitrogen, total phosphorus, selenium, chloride, sulfate
- Benthic macroinvertebrate sampling
- Physical habitat measurements

At CHIS, bioassessment monitoring will also include recording aquatic amphibian presence/ absence.

4.2 Sampleability, Seasonal Assessment Window, and Time Requirements

Sampling will be restricted to wadeable streams that are flowing at the time of assessment, meaning that it may be used in both perennial and nonperennial streams as long as sampleability criteria are met. A reach is considered "sampleable" with this protocol if at least half of the reach has a wetted width of at least 0.3 m (the width of a D-frame net) and there are no more than three transects that are completely dry within the monitoring reach at the time of assessment. If more than three transects are completely dry, then the stream reach should not be sampled for biota; however, the reach may be shifted in order to reduce the number of dry transects, thus allowing biota to be sampled (for more details, see Section 2 on reach delineation and transect placement). The wadeability limitation is determined by the practical ability to safely obtain a consistent sample of the benthic community

from a reach. In general, a reach is considered wadeable if it is less than one meter deep for at least half the length of the reach.

The field season for bioassessment is defined as 30 days after the last significant rain event in spring extending to before the first significant rain event in the fall (usually April through September). In order to appropriately apply California Stream Condition Index (CSCI) scoring, monitoring at SAMO will be conducted between April and May. Depending on the weather patterns in any given year, sampling could start as early as February (e.g., years with unusually dry or warm winters), or as late as August (e.g., years with unusually late-season storms).

The SWAMP protocol estimates field crew size and time as follows: “These methods are designed to be completed by either two or three (or more) person field crews. A very experienced field crew can expect to complete the full suite of physical habitat measurements and the two BMI sampling protocols in approximately two hours. Less experienced crews will probably take closer to three or four hours to complete the work depending on the complexity of the reach. Note that this estimate includes only time at the site, not travel time between sites.”

The timing of sampling will be consistent with guidance provided in the Stormwater Monitoring Coalition Workplan (Mazor, 2015b):

“Typically, sites will be sampled between May 15 and July 15. Earlier sampling may be appropriate for nonperennial streams with relatively short durations, and may occur as early as March. Sampling should take place at least 4 weeks after storm events to avoid the effects of scouring. In years with severe or late- season winter storms, sampling of certain sites may be delayed until later in the summer if stream flows are too high to allow safe sampling during the normal index period. The appropriateness of a sampling date must be determined on a site- by- site basis at the discretion of the sampling crew or others who have experience with a site.

Typical sampling periods are presented in the following table:”

Table 4.1. Typical sampling periods

Scenario	Typical sampling period
Nonperennial stream in a typical year	March 1 through May 1
Nonperennial stream in a dry year	February 15 through April 15
Perennial stream in a typical year	May 15 through July 15
Perennial stream in a dry year	April 15 through June 15

4.3 Holding Times for Water Chemistry Samples

Because of access and travel logistics on CHIS, teams must be aware of holding time limits for water chemistry samples. Table 4.2 shows the maximum holding times allowed for each parameter.

Table 4.2. Maximum holding times for water quality parameters sampled at both parks.

Water Quality Parameter	SAMO	CHIS	Max Holding Time
Nitrogen, Total (TN)	X	X	28 days (if acidified, otherwise 48 hours)
Phosphorus, Total (TN)	X	X	28 days (if acidified, otherwise 48 hours)
Chloride (Cl ⁻)	X	X	28 days
Sulfate (SO ₄)	X	X	28 days
Selenium (Se), total	X	X	Up to 6 months if acidified

Standard Operating Procedure (SOP) 5: Riverine Wetland Functional Assessment

5.0 Overview

Riverine wetland conditions will be monitored using the California Rapid Assessment Method (CRAM) for wetlands, using the riverine module which can be downloaded from <http://www.cramwetlands.org/documents#field+books+and+sops>. The latest versions of the Riverine Field book and datasheet are both currently v6.1 (2013). Below we provide a brief overview of the sampling; however, this protocol implementation plan is written with the understanding that only field crew members that have extensive training through the California Bioassessment College will be collecting data.

5.1 Wetland Functional Assessment Background

CRAM can be applied to seven main types of wetlands (riverine and riparian, lacustrine, depressionnal, estuarine, wet meadows, vernal pools, and playas). The maximum CRAM score possible represents the best condition that is likely to be achieved for the type of wetland being assessed. The overall score for a wetland therefore indicates condition relative to the best achievable condition for that wetland type in the state, and is based on four attributes (described below). Each of the four attributes has associated metrics, which are scored by matching the correct score from a list of descriptive narrative conditions for each metric to what is observed in the wetland. Metric scores are then compiled into numerical scores for each attribute and an overall score for the wetland. The four attributes are:

- Landscape Context describes the area around a wetland. The land near the wetland and the adjacent landscape can determine whether or not a wetland is buffered from adjacent stressors and, therefore, is a key attribute for overall wetland condition.
- Hydrology is the most important direct determinant of wetland function. The physical structure of a wetland is largely determined by the magnitude, duration, and intensity of water movement. The hydrology of a wetland also affects nutrient cycling, sediment entrapment, and pollution filtration.
- Physical Structure and the physical complexity of a wetland relates to its capacity for supporting a diverse biological community. This attribute looks at the diversity and spatial organization of physical aspects of the wetland habitat.
- Biotic Structure of a wetland include plants and algae. These primary producers support wetland wildlife higher in the food web, and also affect water flow, energy and cycling and water quality.

CRAM provides guidelines for identifying stressors that might account for low scores. The assessment is accompanied by a stressor checklist that allows researchers and managers to explore possible relationships between CRAM scores and particular stressors.

5.2 Wetland Functional Assessment Background

The seasonal “window” for conducting CRAM assessments should correspond to the growing season for the characteristic plant community of the wetland type to be assessed; however, riverine wetlands should not be assessed during high water, for safety reasons and because some indicators of channel

condition may not be visible. Riverine wetlands should be assessed late in the growing season, near the onset of base flow. For SAMO and CHIS streams, the assessment window is March through September. A CRAM assessment typically takes a team of two people less than 4 hours of field time plus one half day of office preparation and data analysis (CRAM Factsheet 2008).

Standard Operating Procedure (SOP) 6: Regulatory Status Monitoring (SAMO)

6.0 Overview

Annual monitoring of the listing status and Total Maximum Daily Load (TMDL) promulgation for streams within the SAMO Ecological Management Zone (EMZ) is a desktop activity that will be conducted annually. The regulatory status information summarized in Appendix A of this Water Quality Protocol serves as baseline; annual monitoring will look for changes from the baseline in two ways:

1. Changes to the list of impaired streams, which may include the addition of streams, the de-listing of streams, and/or changes in the listing category of streams
2. The promulgation of new TMDLs for listed streams within the SAMO EMZ.

6.1 Background on Data Sources

A general explanation about the 303(d) list of impaired stream and the development of TMDLs can be found at this SWRCB website:

https://www.waterboards.ca.gov/water_issues/programs/tmdl/background.shtml

6.1.1 Data Sources for Impaired Streams

The State Water Resources Control Board (SWRCB) maintains a list of impaired waterbodies known as the 303(d) list. A stream is listed as impaired if monitoring data show that it does not meet the water quality objectives (CA State) or water quality criteria (US EPA) corresponding to the beneficial uses designated for that stream. The 303(d) list is updated approximately every 3-5 years, however, *various regions of the state are on different update schedules*. SAMO falls within Region 4, the Los Angeles Region. Both the LA Regional Water Quality Control Board (LARWQCB) and the State Water Resources Control Board (SWRCB) maintain information on the status of the 303(d) list for streams.

The following LARWQCB website reflects the latest 303(d) list that applies to waterbodies in Region 4: https://www.waterboards.ca.gov/losangeles/water_issues/programs/303d_list.shtml

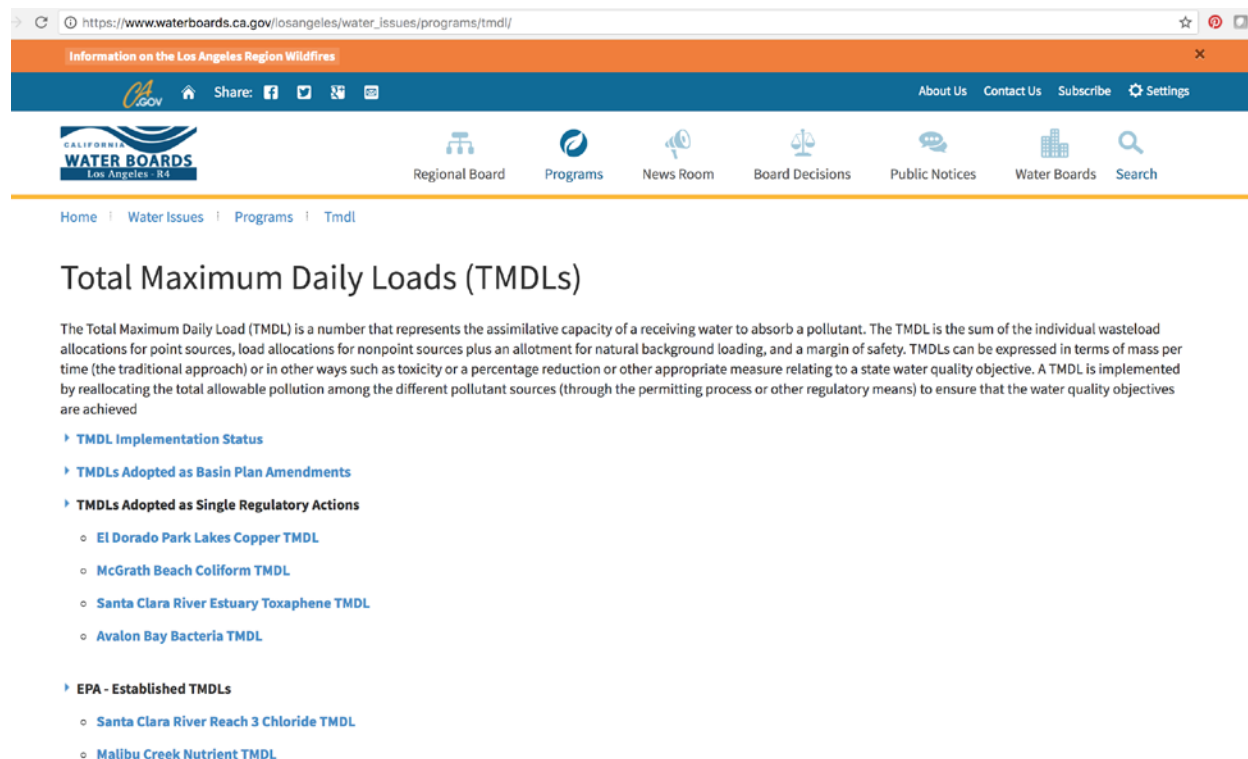
Appendix A1 of the stream condition monitoring protocol implementation plan (Federico et al. 2019) contains a list of all stream reaches by watershed within the SAMO EMZ (see Appendix table A1.7), along with associated impairment status as of the 2010 303(d) list (with the exception of Cold Creek, which reflects the 2012 list).

6.1.2 Data Sources for TMDLs

NPS properties may be identified in a TMDL as one of the “non-point sources” contributing to water quality impairments, and may have a load allocation assigned to them, which is a limit on the amount of the particular pollutant that can originate from that property. While NPS should be aware of all TMDLs which name them as non-point sources, not all TMDLs have been incorporated into the Basin Plan, which is the final action required for the TMDL to be in effect. As explained in the SWRCB website referenced above:

“Federal law requires that TMDLs be incorporated into the Basin Plans. The Basin Plan is a legal document that describes how a Regional Board would manage water quality. The TMDLs must be formally incorporated into the Basin Plan to be part of the basis for Regional Board actions. Basin Plan amendments are adopted through a public process that requires approval of the TMDLs by a Regional Board, the State Board, the Office of Administrative Law, and USEPA Region 9.”

Information about TMDL development and implementation in Region 4 is maintained on the following LARWQCB website: http://www.swrcb.ca.gov/losangeles/water_issues/programs/tmdl/ (see screen shot below, accessed December 21, 2017).



6.2 Monitoring Procedure

6.2.1 Ongoing Monitoring of Regulatory Developments

The Water Quality Monitoring Lead should subscribe to the LARWQCB mailing list for 303(d) listing and TMDL updates by going to the following website: http://www.swrcb.ca.gov/losangeles/resources/email_subscriptions/, and clicking on “subscribe.” A page will come up asking for name and email address, as well as a selection of subscription topics. Select Basin Planning – 303(d), and TMDLs for Calleguas Creek Watershed, Malibu Creek Watershed, and Santa Monica Bay Watershed.

Advanced information on proposed regulatory changes provides an opportunity for SAMO to provide input and to plan for potential new regulatory requirements.

6.2.2 Annual Monitoring of Changes in Impaired Stream Listings

The following steps should be completed on an annual basis to check for updates to the 303(d) list of impaired streams:

1. Access the LARWQCB website that shows the most recent 303(d) list available for Region 4: https://www.waterboards.ca.gov/rwqcb4/water_issues/programs/303d_list.shtml. Determine if there have been any changes in the last year; if not, no further action is required. However, if a new list has been issued since the previous year's review, proceed to step 2.
2. Download the list of 303(d) listed streams and check each of the listed stream reaches in the stream monitoring condition protocol implementation plan's Appendix Table A1.7 to determine if there are any changes to the pollutants for which each reach is listed. There were 19 reaches on the 303(d) list as of the baseline report in Appendix A, using the 2010 Integrated Report. The number of pollutants for which these reaches were impaired varied from one to ten.
3. Download the list of Category 3 reaches and determine if there are any changes. This can be quickly done by looking just at listings in Region 4. There were only 19 reaches on the Category 3 list as of the baseline report in Appendix A, using the 2010 Integrated Report.
4. Download the list of Category 2 reaches and determine if there any changes. This can be very quickly done by looking just at listings in Region 4. There were only two reaches on the Category 3 list as of the baseline report in Appendix A, using the 2010 Integrated Report.
5. Download the list of Category 1 reaches and determine if there are any changes. This can be very quickly done – there were no reaches listed in any Region as of the baseline report in Appendix A, using the 2010 Integrated Report.

Document the results of this review as described in section 6.2.4 below.

6.2.3 Annual Monitoring of New or Changed TMDLs

The following steps should be completed on an annual basis to check for updates to TMDLs:

1. Access the TMDL status list for Region 4, through the following LARWQCB website: http://www.swrcb.ca.gov/losangeles/water_issues/programs/tmdl/
2. Look for new TMDLs for watersheds within the SAMO EMZ, that were not listed on the TMDL status summary table in Appendix section A1.6 (reference Appendix table A1.7 for a list of watersheds).
3. Click on the link for "TMDLs Adopted as Basin Plan Amendments" and check that list for new TMDLs or new actions (further approvals or "in effect" designations) on TMDLs that were already listed in Appendix A1.6.
4. For any new TMDLs, read the document to determine if NPS is identified as a non-point source and if a load allocation had been assigned. Determine if action is required, consulting with SAMO Superintendent, Chief of Natural Resources, and legal counsel as needed.
5. Update Appendix A as appropriate to reflect the new TMDLs or changes to implementation status for TMDLs already identified.

Document the results of this review as described in section 6.2.4 below.

6.2.4 Documentation of Annual Monitoring

Annual reviews of impaired streams and TMDLs should be documented in a memo from the MEDN Program Manager to the SAMO Superintendent and SAMO Chief of Natural Resources. The memo should state the date of the review, summarize findings, reference electronic copies of all files downloaded, and include a copy of any modifications to stream condition monitoring protocol implementation plan Appendix A Table 1.7 - SAMO Waterbodies and Impairments. Table updates should be made in a new column, such that previous information is not deleted and a record is maintained of progress and trends in SAMO stream regulatory status.

Standard Operating Procedure (SOP) 7: GRTS Draw for Santa Rosa Island (CHIS)

7.0 Overview

The generalized random tessellated stratified (GRTS) design (Stevens 1997; Stevens and Olsen 1999, 2003, 2004) to determine sampling locations on Santa Rosa Island was performed by Raphael Mazor of the Southern California Coastal Water Research Project. The use of design-based estimation from GRTS sampling can reduce error variance and thus increase power to detect change. Confidence intervals and hypothesis testing can incorporate the neighborhood variance estimator for spatially balanced samples (Stevens and Olsen 2003). GRTS sampling is used in many water and stream condition monitoring programs (Diaz-Ramos et al. 1996; Mazor et al. 2015a).

7.1 Sample Design

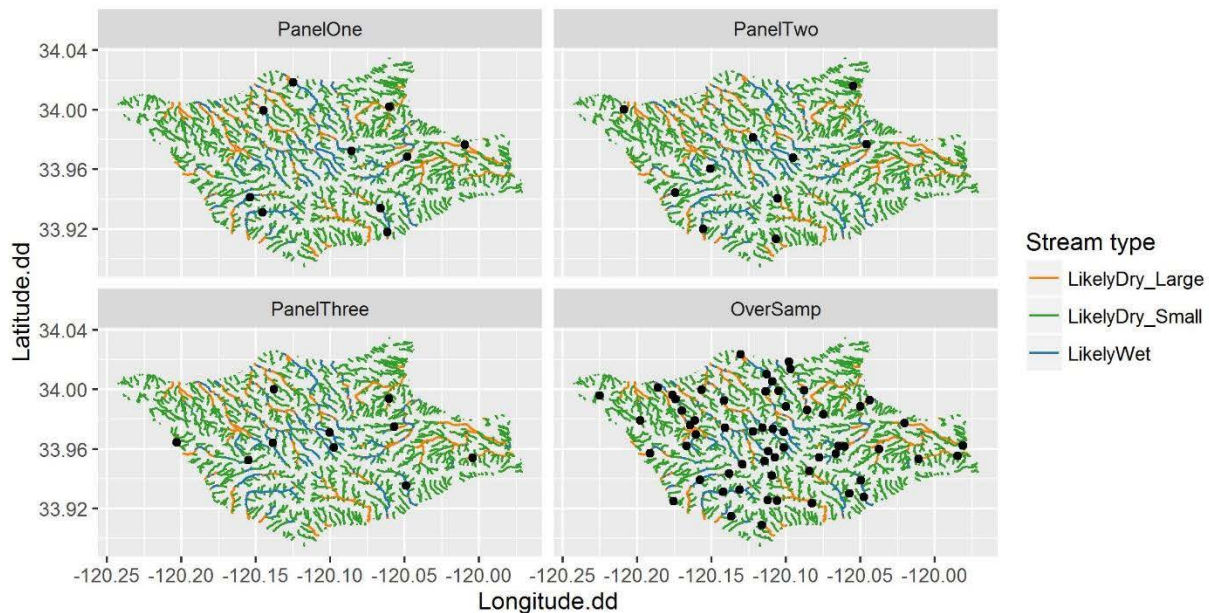


Figure 7.1. Map of the Streams on Santa Rosa Island. Each stratum is highlighted in a different color. Location of the sites in the sample draw are shown as small black dots.

Target population: Wadeable streams on Santa Rosa Island represented in National Parks Service's Derived Streams Overlay layer (R. Rudolph, pers. comm.). Because the survey will focus on CRAM (see SOP 5), which does not require flowing water for sampling, perennial, intermittent, and ephemeral streams are all part of the target population.

Sample frame: The frame was defined by the derived streams overlay layer for Santa Rosa Island. Streams were classified based on their likelihood of having flowing water during the sampling period: Likely dry and likely wet. These likelihoods were based on hydrologic surveys conducted in 2013 to find reaches with water. A 10-m buffer around each wet reach was overlaid onto the derived stream layer. Stream segments that were within the buffer and exceeded 200 m were classified as

likely wet. Smaller segments within the buffer, and all segments outside the buffer, were classified as likely dry.

Stratification: The sample frame was not divided into strata.

Multi-density categories: In order to improve representation of likely wet streams in the survey, the sampling probability of this stream-type was increased relative to other stream types:

Stream type	Total length (km)	# sites in design	Expected # sampled
Likely wet	67	16	10
Likely dry-small	488	7	10
Likely dry-large	106	7	10

Table 7.1. Multi-density categories for sample selection.

Sample Size: Expected sample size is 30, with approximately equal representation across multi-density categories.

Revisit design: Expected revisit design is a rotating panel with each of the 3 panels (Figure 7.1) being revisited every six years.

7.2 Site Reconnaissance and Evaluation

Every site must be evaluated *in order* by site code within each stratum. In order to calculate final weights and to integrate results from this survey with others conducted in the region, reasons for rejecting a site must be provided as clearly as possible. In this respect, data gathered from reconnaissance is no less valuable than data from sample collection! A list of all GRTS sites, their coordinates, stream order and strata is provided in Table 7.2.

The master spreadsheet with all field names and site evaluation status is stored on the H drive a mapped directory (\DIVISION\psrm\Inventory and Monitoring) on the park's server (\\inpsamo-hq1\)) in the following folder: \Vital_Signs\WaterQuality\Implementation Notes.

7.3 Statistical Analysis

Any statistical analysis of data must incorporate information about the monitoring survey design. In particular, when estimates of characteristics for the entire target population are computed, the statistical analysis must account for any stratification or unequal probability selection in the design. Procedures for doing this are available from the Aquatic Resource Monitoring web page given in the bibliography. A statistical analysis library of functions is available from the web page to do common population estimates in the statistical software environment R.

7.4 Sample Draw field definitions

Key fields in the sample draw are described below. The R code used to create the sample draw is provided in Figure 7.2.

StationCode: Unique site code generated by the grts function and modified for reporting purposes. Format is “316” (the hydrologic unit code associated with Santa Rosa Island) and “ROSA” (to indicate Santa Rosa Island), followed by a two-digit number that determines the order of evaluation.

Longitude and **Latitude:** Coordinates in decimal degrees (WGS1984)

X coord and **Y coord:** Coordinates in UTM Zone 11 N

mdcaty: Multi-density category (LikelyWet, LikelyDry_Large, and LikelyDry_Small).

wgt: Site weight in m

wgt_km: Site weight in km

panel: Design panel.

EvalStatus: Evaluation status. For a new survey, should be “NotEval” for every site.

All other fields are derived from the sample frame and refer to the stream segment from which the site was drawn. A subset of these fields are defined below:

Class: Segments that are over 200-m long and occur within a 10-m buffer of the stream survey layer are designated “Perennial”. Shorter segments within the buffer are designated as “Perennial_Isolated”. Segments outside the buffer are designated “Nonperennial”.

Class2: Segments classified as “Perennial” in Class are designated as “LikelyWet”; all other segments are classified as “LikelyDry”.

Class3: Identical to the mdcaty field. Streams designated as “LikelyDry” in Class2 are subdivided, based on the field order_Stra. Specifically, sites in stream orders 1 or 2 are considered “small”, while those in stream orders 3 or 4 are considered “large”.

Table 7. 2. GRTS sample draw for Santa Rosa Island.

No.	StationCode	Longitude	Latitude	X coord	Y coord	panel	Class	Class2	order_ Stra	Name
1	316ROSA01	-120.0616833	33.91799222	216937.557	3757285.746	PanelOne	Perennial	LikelyWet	3	Wreck 3
2	316ROSA02	-120.0484976	33.96847745	218323.5963	3762850.083	PanelOne	Nonperennial	LikelyDry	4	Water 4
3	316ROSA03	-120.145519	33.93108373	209228.3031	3758972.719	excluded - Eagle nest	Perennial	LikelyWet	4	Trancion 4
4	316ROSA04	-120.1247163	34.01864613	211448.3776	3768628.069	PanelOne	Perennial	LikelyWet	4	Verde 4
5	316ROSA05	-120.0095944	33.97671494	221946.2968	3763657.595	PanelOne	Nonperennial	LikelyDry	3	Quemada 3D
6	316ROSA06	-120.0857213	33.9724287	214896.1444	3763391.436	PanelOne	Nonperennial	LikelyDry	2	Verde b
7	316ROSA07	-120.1537191	33.94141441	208505.2492	3760142.103	PanelOne	Perennial	LikelyWet	3	Acapluco 3
8	316ROSA08	-120.1446816	33.99963594	209539.1765	3766575.567	PanelOne	Nonperennial	LikelyDry	4	Soledad 4
9	316ROSA09	-120.0602632	34.00205677	217347.4091	3766607.712	PanelOne	Nonperennial	LikelyDry	4	Windmill 4
10	316ROSA10	-120.066204	33.93375744	216571.7336	3759047.18	PanelOne	Perennial	LikelyWet	3	Wreck 3
11	316ROSA11	-120.1508191	33.96054365	208838.6377	3762256.068	PanelOne	Perennial	LikelyWet	2	Tecolote 3A2b
12	316ROSA12	-120.1745539	33.94432194	206588.7568	3760524.131	PanelTwo	Nonperennial	LikelyDry	2	NA
13	316ROSA13	-120.0549864	34.01597513	217881.054	3768137.219	PanelTwo	Nonperennial	LikelyDry	2	NA
14	316ROSA14	-120.0952589	33.96778975	213999.0411	3762903.395	PanelTwo	Perennial	LikelyWet	1	NA
15	316ROSA15	-120.1056141	33.94038027	212949.7299	3759891.584	PanelTwo	Nonperennial	LikelyDry	3	Jolla Vieja 3B
16	316ROSA16	-120.2088228	34.00028811	203614.6831	3766831.865	PanelTwo	Nonperennial	LikelyDry	3	3C
17	316ROSA17	-120.1067449	33.91320577	212753.8416	3756880.051	PanelTwo	Nonperennial	LikelyDry	2	NA
18	316ROSA18	-120.0457508	33.9768437	218605.0823	3763770.656	PanelTwo	Perennial	LikelyWet	4	Water 4
19	316ROSA19	-120.1556192	33.92006269	208256.6561	3757778.736	PanelTwo	Perennial	LikelyWet	4	Trancion 4
20	316ROSA20	-120.1219079	33.98133744	211581.5749	3764481.118	PanelTwo	Perennial	LikelyWet	3	Soledad 3A
21	316ROSA21	-120.0044508	33.95391994	222347.5237	3761114.873	PanelTwo	Nonperennial	LikelyDry	2	Old Ranch House 32d
22	316ROSA22	-120.0570683	33.97490577	217552.6747	3763586.829	PanelThree	Perennial	LikelyWet	2	Water 3C2b
23	316ROSA23	-120.1384704	33.96394337	209991.7412	3762598.199	PanelThree	Perennial	LikelyWet	2	Arlington 32h
24	316ROSA24	-120.1378245	34.00015124	210174.5328	3766613.291	PanelThree	Nonperennial	LikelyDry	2	Dry 3B2b
25	316ROSA25	-120.0604557	33.99394405	217302.7209	3765708.237	PanelThree	Nonperennial	LikelyDry	3	Windmill 3A

No.	StationCode	Longitude	Latitude	X coord	Y coord	panel	Class	Class2	order_ Stra	Name
26	316ROSA26	-120.0977608	33.96094727	213744.8316	3762151.289	PanelThree	Perennial	LikelyWet	2	Soledad 3A2c
27	316ROSA27	-120.1548827	33.95250731	208435.536	3761376.068	PanelThree	Nonperennial	LikelyDry	1	NA
28	316ROSA28	-120.2031478	33.96437103	204014.4215	3762830.685	PanelThree	Nonperennial	LikelyDry	3	NA
29	316ROSA29	-120.0488689	33.93545649	218180.305	3759187.869	PanelThree	Perennial	LikelyWet	2	San Augustine 32a
30	316ROSA30	-120.1004182	33.97103645	213533.0537	3763278	PanelThree	Perennial	LikelyWet	2	Verde 3B2b
31	316ROSA31	-120.1304532	34.02355353	210935.0673	3769188.701	PanelThree	Perennial	LikelyWet	4	Verde 4
32	316ROSA32	-120.1697781	33.98573332	207172.4806	3765104.711	OverSamp	Nonperennial	LikelyDry	4	Tecolote 4
33	316ROSA33	-120.1160469	33.90902458	211879.3777	3756442.289	OverSamp	Nonperennial	LikelyDry	1	NA
34	316ROSA34	-120.0665024	33.95658757	216619.9078	3761580.717	OverSamp	Perennial	LikelyWet	3	Water 3A
35	316ROSA35	-120.138027	33.94346251	209963.1548	3760324.793	OverSamp	Nonperennial	LikelyDry	3	Acapluco 3
36	316ROSA36	-120.1048475	33.99919872	213218.3833	3766414.701	OverSamp	Nonperennial	LikelyDry	2	Verde 42a
37	316ROSA37	-119.9810693	33.96224837	224535.9169	3761975.664	OverSamp	Perennial	LikelyWet	4	Quemada 4
38	316ROSA38	-120.0826269	33.92366467	215019.4591	3757973.045	OverSamp	Nonperennial	LikelyDry	1	NA
39	316ROSA39	-120.140969	33.97409799	209795.3132	3763731.835	OverSamp	Perennial	LikelyWet	3	Arlington 3
40	316ROSA40	-120.1568288	33.99984912	208417.499	3766633.768	OverSamp	Nonperennial	LikelyDry	3	Soledad 3C
41	316ROSA41	-120.0857312	33.98613462	214941.0349	3764911.978	OverSamp	Perennial	LikelyWet	3	Lobo 3
42	316ROSA42	-120.107337	33.95432373	212837.3144	3761443.283	OverSamp	Perennial	LikelyWet	2	Arlington 32a
43	316ROSA43	-120.1124428	33.92562641	212268.6321	3758273.956	OverSamp	Perennial_ Isolated	LikelyDry	1	NA
44	316ROSA44	-120.1914028	33.95711468	205075.0627	3761991.764	OverSamp	Nonperennial	LikelyDry	3	Bee 3C
45	316ROSA45	-120.0474721	33.92759263	218283.5416	3758311.642	OverSamp	Nonperennial	LikelyDry	3	San Augustine 3
46	316ROSA46	-120.101328	33.97135	213450.0139	3763315.331	OverSamp	Perennial	LikelyWet	2	Verde 3B2b
47	316ROSA47	-120.0970259	34.01359553	213989.4253	3767989.979	OverSamp	Perennial	LikelyWet	3	Lobo 3
48	316ROSA48	-120.1739881	33.9934775	206810.0428	3765975.92	OverSamp	Nonperennial	LikelyDry	4	Tecolote 4
49	316ROSA49	-119.9847966	33.95550912	224169.6042	3761238.079	OverSamp	Nonperennial	LikelyDry	3	Old Ranch House 3
50	316ROSA50	-120.0647681	33.9619318	216797.9667	3762168.796	OverSamp	Perennial	LikelyWet	3	Water 3B
51	316ROSA51	-120.1310601	33.9327956	210571.1876	3759121.711	OverSamp	Nonperennial	LikelyDry	2	Trancion 42b

No.	StationCode	Longitude	Latitude	X coord	Y coord	panel	Class	Class2	order_ Stra	Name
52	316ROSA52	-120.100054	33.98869981	213626.0316	3765236.536	OverSamp	Perennial	LikelyWet	1	NA
53	316ROSA53	-120.0500881	33.98843538	218242.5242	3765068.532	OverSamp	Perennial	LikelyWet	4	Water 4
54	316ROSA54	-120.0575038	33.93023628	217364.5913	3758632.532	OverSamp	Nonperennial	LikelyDry	1	NA
55	316ROSA55	-120.1605969	33.96977319	207966.3304	3763307.844	OverSamp	Perennial	LikelyWet	2	Tecolote 3B2c
56	316ROSA56	-120.1417839	33.99243676	209782.4162	3765768.662	OverSamp	Perennial	LikelyWet	4	Soledad 4
57	316ROSA57	-120.0748733	33.98340851	215935.3664	3764579.364	OverSamp	Nonperennial	LikelyDry	1	NA
58	316ROSA58	-120.1157476	33.97408219	212126.4281	3763658.884	OverSamp	Perennial	LikelyWet	3	Soledad 3A
59	316ROSA59	-120.1093817	33.94191718	212606.5323	3760072.647	OverSamp	Perennial	LikelyWet	2	Jolla Vieja 3B2b
60	316ROSA60	-120.1666419	33.96191005	207380.602	3762452.752	OverSamp	Nonperennial	LikelyDry	2	Tecolote 3C2a
61	316ROSA61	-120.0202274	33.97742547	220965.9115	3763765.344	OverSamp	Nonperennial	LikelyDry	3	Quemada 3D
62	316ROSA62	-120.1142507	33.95200888	212190.3475	3761205.877	OverSamp	Perennial	LikelyWet	2	Arlington 32b
63	316ROSA63	-120.1128308	34.01013212	212517.6198	3767650.055	OverSamp	Perennial	LikelyWet	4	Verde 4
64	316ROSA64	-120.1762732	33.99634633	206608.749	3766300.744	OverSamp	Perennial	LikelyWet	4	Tecolote 4
65	316ROSA65	-120.1013566	33.9609203	213412.3387	3762158.351	OverSamp	Perennial	LikelyWet	3	Soledad 3A
66	316ROSA66	-120.1754767	33.92497131	206436.9388	3758379.987	OverSamp	Nonperennial	LikelyDry	1	NA
67	316ROSA67	-120.0496358	33.93900865	218121.1107	3759584.042	OverSamp	Perennial	LikelyWet	2	San Augustine 32a
68	316ROSA68	-120.1060022	33.92545893	212863.6973	3758237.318	OverSamp	Nonperennial	LikelyDry	1	NA
69	316ROSA69	-120.0604704	33.96153984	217193.9435	3762113.438	OverSamp	Nonperennial	LikelyDry	3	Water 3A
70	316ROSA70	-120.1091872	34.00538181	212838.2327	3767112.822	OverSamp	Perennial	LikelyWet	4	Verde 4
71	316ROSA71	-120.0879095	33.99930638	214783.8114	3766379.303	OverSamp	Perennial	LikelyWet	3	Lobo 3
72	316ROSA72	-120.129335	33.94978655	210788.2523	3761001.812	OverSamp	Perennial	LikelyWet	2	Arlington 32h
73	316ROSA73	-120.108802	33.97369612	212767.0891	3763596.548	OverSamp	Perennial	LikelyWet	2	Verde 3B2b
74	316ROSA74	-120.1860465	34.00110752	205722.0877	3766857.028	OverSamp	Nonperennial	LikelyDry	3	Tecolote 3E
75	316ROSA75	-120.1368825	33.91468416	209971.3183	3757128.889	OverSamp	Perennial	LikelyWet	2	3C2c
76	316ROSA76	-120.1425077	33.93135993	209507.7118	3758994.822	OverSamp	Perennial	LikelyWet	4	Trancion 4
77	316ROSA77	-120.0841911	33.94527735	214946.9167	3760375.057	OverSamp	Perennial	LikelyWet	2	Wreck 32e
78	316ROSA78	-120.1612512	33.97895633	207937.2982	3764328.5	OverSamp	Nonperennial	LikelyDry	1	NA
79	316ROSA79	-120.0375174	33.96007056	219310.8594	3761887.307	OverSamp	Nonperennial	LikelyDry	3	Quemada 3B

No.	StationCode	Longitude	Latitude	X coord	Y coord	panel	Class	Class2	order_ Stra	Name
80	316ROSA80	-120.0980261	34.01868345	213914.1182	3768557.228	OverSamp	Perennial	LikelyWet	3	Lobo 3
81	316ROSA81	-120.077533	33.95434091	215592.6949	3761362.046	OverSamp	Perennial	LikelyWet	3	Water 3A
82	316ROSA82	-120.1137255	33.99862231	212396.1064	3766375.673	OverSamp	Perennial	LikelyWet	4	Verde 4
83	316ROSA83	-120.04386	33.99270562	218832.1402	3765525.133	OverSamp	Nonperennial	LikelyDry	4	Water 4
84	316ROSA84	-120.1643989	33.97595222	207636.0781	3764004.204	OverSamp	Nonperennial	LikelyDry	3	Tecolote 3A
85	316ROSA85	-120.1220255	33.97193339	211538.9035	3763438.165	OverSamp	Nonperennial	LikelyDry	1	NA
86	316ROSA86	-120.2252461	33.9958814	202081.7249	3766390.665	OverSamp	Nonperennial	LikelyDry	1	NA
87	316ROSA87	-120.0110159	33.95323404	221738.3749	3761056.594	OverSamp	Nonperennial	LikelyDry	1	NA
88	316ROSA88	-120.1577257	33.93944537	208128.0515	3759935.06	OverSamp	Perennial	LikelyWet	3	Acapluco 3
89	316ROSA89	-120.1117843	33.95864375	212440.7216	3761935.018	OverSamp	Perennial	LikelyWet	2	Arlington 32a
90	316ROSA90	-120.1977347	33.97910649	204565.855	3764449.847	OverSamp	Nonperennial	LikelyDry	1	NA

Figure 7.2. R code used to create GRTS draw for Santa Rosa Island.

```
#Needed to draw sample with grts() function

library(spsurvey)

#Not needed to draw sample, but needed for some data visualizations

library(plyr)

library(ggplot2)

#Set working directory. Update so the path goes to the folder containing the shapefiles

setwd("C:/Users/Raphaelm/Documents/SCCWRP/Watershed-specific monitoring programs/Santa
Rosa Island/R sample draw")

#Read in the attribute table. Not needed, but helps to determine size of each mdcaty

att<-read.dbf("SRI_SampleFrame_031416_UTM11.dbf")

#Read in shapefile

shp <- read.shape("SRI_SampleFrame_031416_UTM11")

#Total size of each stratum

#Requires ddply from plyr package

ddply(att, .(Class3), summarise, Length_km=sum(length_mdm)/1000)

#Define the design: Three panels of 10 sites each, and one oversample of 60 sites

#mdcatys are likely dry, large streams (106 km), likely dry small streams (488 km), and likely wet
streams (67 km).

#10 sampled sites are desired in each mdcaty

#Rejection rates for the "likely wet" sites are probably higher than the other sites, so they are over-
represented in the sample draw.
```

```

#We expect that a number of them will actually be dry.

Unequaldsgn<-list("None"=list(panel=c(PanelOne=10, PanelTwo=10, PanelThree=10),

      seltype="Unequal",

      caty.n=c("LikelyWet"=16,"LikelyDry_Large"=7,"LikelyDry_Small"=7),

      over=60))

set.seed(2) #Setting the random seed ensures replicability. The number is arbitrary.

#Create the sample draw

#This function takes 10-30 seconds to execute

Unequalsites<-grts(design = Unequaldsgn,

      DesignID="UNEQUAL",

      type.frame="linear",

      src.frame="sp.object",

      sp.object=shp,

      in.shape=shp,

      att.frame=att,

      mdcaty="Class3",

      shapefile=F)

#Summarize sites per mdcaty and panel

addmargins(table(Unequalsites@data$panel,Unequalsites@data$mdcaty))

#Reproject from UTM11 to decimal degrees in wgs84

utmcoor<-SpatialPoints(cbind(Unequalsites@data$xcoord,Unequalsites@data$ycoord),
proj4string=CRS("+proj=utm +zone=11"))

```

```

longlatcoor<-spTransform(utmcoor,CRS("+proj=longlat"))

Unequalsites@data$Longitude<- longlatcoor@coords[,1]
Unequalsites@data$Latitude<- longlatcoor@coords[,2]

#Assign SWAMP-compatible site codes

#All of Santa Rosa Island is in hydrologic unit 316, so site codes start with 316

Unequalsites@data$StationCode<- paste0("316ROSA", substr(Unequalsites@data$siteID,9,10))
Unequalsites@data$StationNum<- as.numeric(substr(Unequalsites@data$siteID,9,10))


# Visualization of locations

Unequalsites@data$panel<-factor(Unequalsites@data$panel,
levels=c("PanelOne","PanelTwo","PanelThree", "OverSamp"))

#Simple visualization, with points plotted as a scatterplot

ggplot(data=Unequalsites@data, aes(x=Longitude, y=Latitude, color=mdcaty,
shape=mdcaty))+geom_point(aes(size=panel))+

facet_wrap(~panel)+coord_map()+scale_color_brewer(palette="Set1")+scale_size_manual(values=c
(5,5,5,2))+theme_classic(base_size=18)

#####Fancier visualization, overlaying the input linework

shp@data$id= rownames(shp@data)

shp.points<-fortify(shp, region=id)

shp.df<-join(shp.points, shp@data, by="id")

#Because I'd rather show the map with decimal degrees than UTM coordinates

```

```

utmcoor2<-SpatialPoints(shp.df[,c("long","lat")], proj4string=CRS("+proj=utm +zone=11"))
longlatcoor2<-spTransform(utmcoor2,CRS("+proj=longlat"))
shp.df$Longitude.dd<- longlatcoor2@coords[,1]
shp.df$Latitude.dd<- longlatcoor2@coords[,2]

SurveyMap<-ggplot(data=shp.df, aes(x=Longitude.dd,y=Latitude.dd, group=group, color=Class3))+
  geom_path()+coord_equal()+
  geom_point(data=Unequalsites@data, aes(x=Longitude, y=Latitude),color="black", group=NA)+
  facet_wrap(~panel)+
  scale_color_manual(name="Stream type", values=c("#ff7f00","#33a02c","#1f78b4"))

ggsave(SurveyMap, filename="SRI_SurveyMap.jpg", height=6, width=8, dpi=300)

#Export to a csv, which can then be distributed as needed
write.csv(Unequalsites@data, "SantaRosaIsland_SampleDraw_031416.csv")

```

Standard Operating Procedure (SOP) 8: Data Management

8.0 Overview

This SOP details the data management steps once data collection (Data Acquisition on the Data Management Life Cycle) has been completed at the end of each day (SAMO) or tour (CHIS). The following directions apply to all field data collected in the stream condition monitoring protocol implementation plan (Federico et al. 2019), including tabular data and spatial data. File-naming conventions and storage locations will be similar for both SAMO and CHIS.

8.1 Field Form Review and Data Entry

Following data collection, data entry and processing of spatial and non-spatial data will occur in the following steps:

1. **Data completeness.** The field crew members confirm that all data sheets are complete and attempt to verify the identity of any unknown plants. Data sheets are amended as needed by making corrections in red ink to distinguish them from field collected data.
2. **Review at the end of field day.** Data forms are reviewed at the end of each field day for legibility and correct spelling of species codes and are corrected in red ink as needed. Note: The person reviewing the data form should be someone other than the person who collected the data.
3. **Print out electronic data.** If data were collected electronically, download the data and generate paper copies for those data.
4. **Copy and scan data sheets.** Store copies separately from originals and place scanned copies in the appropriate project folder on the network.
5. **Data entry by two people.** Data will be entered into the local database copy on a daily basis. When possible, data are entered as partners, with one person reading the data out loud as another enters it into the database.
6. **Data entry into respective databases.** In-situ water chemistry data collected at SAMO under the Aquatic Amphibian monitoring protocol are entered and stored in an MS Access database housed on the park server. A detailed description of the database structure and schema can be found in the MEDN Aquatic Amphibian Monitoring Protocol. These data (in-situ water chemistry) will be exported to (sent to) SWAMP as necessary.

Site evaluation and vertebrate observation data are entered into Excel templates provided by SCCWRP. These data will be submitted to SCCWRP for use in analysis. These data will be available from SCCWRP upon request.

SWAMP (benthic macroinvertebrates, physical habitat conditions, and lab-based stream water chemistry) and CRAM (riverine wetland function) data collected under this protocol are entered into their respective databases. These databases are housed at and maintained by SCCWRP and serves as the designated repository for these data. A detailed explanation of these databases can be found on their respective websites.

- SWAMP: <http://www.sccwrp.org/Data/DataTools/BioassessmentDatabase.aspx>
- CRAM: <http://www.sccwrp.org/Data/DataTools/eCRAM.aspx>

All SWAMP and CRAM data submissions shall be completed within 8 months of sampling, with the exception of taxonomic data, which shall be completed within 12 months of sampling. Only data that have completed quality assurance procedures be submitted. If labs are unable to meet these deadlines, they should inform the project manager as early as practical.

For each database, the user interfaces with it through a series of custom-built forms. Each form has been designed in a way to (1) mimic existing field recording methodology, (2) minimize transcription error (i.e., look-up tables, drop-down menus, auto-filled fields, range limits), and (3) for MS Access databases, allow users that are unfamiliar with the program to query the database and export datasets for analysis. Instructions are provided on each form, where applicable, to help guide the user in making the correct selection.

7. **Data transfer to EPA Storet through CEDEN using WQX.** SCCWRP houses the Southern California Regional Data Center (SCRDC) for CEDEN and contains data collected through the SWAMP protocols. The WQX data flow for CEDEN data (and thus MEDN Water Quality Monitoring data) to EPA Storet is summarized as follows (Figure 9.1):
 - A. Stage data from CEDEN to the Node Flow Staging tables:
 - i. On a scheduled basis (Saturday), a process is initiated to extract, transform and load (ETL) ambient water quality monitoring data from the State's CEDEN database (on WB-SB-CEDEN-SQL server) to the CEDEN WQX Datamart database instance. The data is preprocessed and filtered based on the data that is available for consumption by EPA's WQX/STORET and other public entities.
 - ii. On a scheduled basis (Sunday), The CEDEN WQX Datamart and CEDEN Lookups databases is replicated to the WQX database instance.
 - iii. On a scheduled basis (Monday), a process is initiated to extract, transform and load (ETL) the selected ambient water quality monitoring data from the State's CEDEN WQX Datamart and CEDEN Lookups database to the Node Flow Staging tables. This process is initiated using the OpenNode2 scheduling mechanism.
 - B. On a scheduled interval, the CalEPA OpenNode2 will activate a process to extract the ambient water quality data from the Node Flow Staging tables, serialize this into a WQX compliant XML document, and submit the resulting XML file to the EPA CDX Node. Note: The Node will submit data to its partner's using the Node NAAS system account.

Note: steps A.iii and B above will be activated by the same OpenNode2 Node Schedule.
 - C. Submission processing by EPA Exchange Network:
 - i. The EPA CDX Node validates the XML file, and passes it to the internal EPA WQX Node. During this process, the NAAS credentials used by the

OpenNode2 to submit the data to CDX are translated to the relevant CDX Web user credentials that has access to manage data within WQX for the organization.

- ii. WQX sends a notification email to the CDX Web user account who submitted the data (e.g., the OpenNode2 NAAS system account), notifying the user of the receipt of the submission, any NAAS authorization issues and any schema validation errors encountered.
- iii. The WQX Node parses the XML, verifies that the CDX Web user has permissions to submit data, validates the data against the WQX business rules, and writes the valid data to the WQX database.
- iv. WQX sends a notification email to the CDX Web user account who submitted the data (e.g., the OpenNode2 NAAS system account), notifying the user of any WQX authorization issues, the final processing status, and any data validation errors encountered.
- v. On a periodic basis (typically weekly), the data in the WQX Database and the data in the WQX / STORET Warehouse are synchronized.

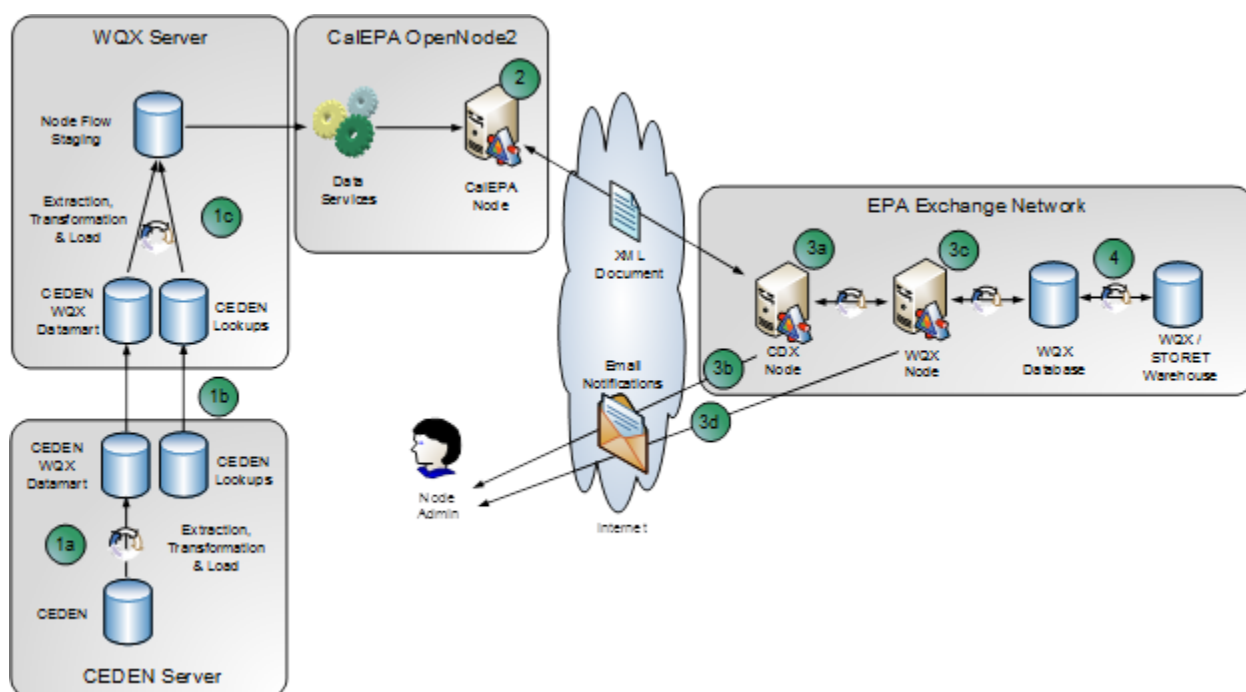


Figure 9.1. Flow diagram of SWAMP datasets to EPA Storet via CEDEN.

8.2 Data QA/QC: Verification and Validation

The field crew leader for each park oversees the verification and validation process. These two levels of QA/QC are undertaken before data can be distributed. First, verification or checks for transcription errors (i.e., data entered incorrectly) should be done immediately after data entry, preferably by a two person team. To do this, after the data have been entered and saved, the digital record is checked against the original datasheet by one partner reading the values on the field form and the other checking the database entries. Additionally, even if entered data are checked by two people, data verification reports should be generated, and if necessary, printed from the database after data entry. These digital outputs (i.e. data verification reports) of entered data can be used to verify entered data with the actual data (field form) and represent a physical hard copy of the entered data. If printed, data verification reports are filed behind the original field form.

Once verification for transcription errors has been completed, the data are validated by checking for inconsistent or null values by the field crew lead. Automated QA/QC queries (Data Validation Queries) set up in the database will facilitate the flagging of suspect records. Flagged records will need to be rechecked against the original field form, and if applicable, corrected in the database. If the error cannot be corrected, due to incomplete data collection in the field (e.g., fields not filled out) or incorrect data documentation in the field (e.g., wrong characters entered in the field), the record is to be remained flagged with notes on the error detailed in the comments field.

For the Aquatic Amphibian Monitoring program database at SAMO only. Data should be marked by the Program Lead as validated by clicking on the ‘Validate’ button for each survey component. The database stores the name and date of when the data were validated.

8.3 Data Certification

Once data have been checked, verified, and validated, the data can be certified for distribution. Data certification assumes all unflagged records have been collected according to the methods stated in the protocol, have been verified and validated by the Program Lead(s) and MEDN Data Manager, and are approved to be used for analysis.

For the Aquatic Amphibian Monitoring program database at SAMO only. Data ready to be used for analysis should be marked by the Program Lead or MEDN Data Manager as certified by clicking on the ‘Certify’ button for each survey component.

Note: Results sections of annual and trend reports will include a summary of the data verification and validation steps, the number and nature of the errors found, and how they were corrected. The database stores the name and date associated with data certification. Certified data will be posted annually to the NPS IRMA (Integrated Resource Management Applications) data system by the Data Manager.

8.4 Data Documentation (Metadata)

Data documentation or the creation of a metadata report should be completed by the Program Lead(s) and MEDN Data Manager upon season closeout. The development of metadata is defined as

structured information about the content, quality, and condition of data. The following information is required for the metadata report for the Invasive Plant Monitoring Program:

- Specified time period being documented (i.e., season, date range)
- Complete methods (including any deviations from the specified protocol) on field data collection, lab analysis, and other processing steps
- References for any models, analytical tools, or statistical procedures used to develop the dataset
- Data collection forms used
- Additional contact persons and their contact information
- Were any sensitive, rare, threatened or endangered species data collected?
 - If yes, what are the access constraints?: Public, NPS Only, MEDN Only, Park Only
- Verification of the data accuracy and completeness
 - Have all data been entered?
 - Have all data been verified for accuracy?
 - Have all data been validated for logical errors?
- Related datasets for cross referencing (i.e., Aquatic Amphibian Monitoring Program dataset)

8.5 Data Accessibility

All data are accessible to the public upon request to the Program Manager. Some data will also be made available directly to the public through web portals. Data stored in the SWAMP database will be made publically available through the California Data Exchange Network (CEDEN). Program data in eCRAM is directly accessible to the public once the project manager has designated the data as “public”.

Please see the CEDEN and eCRAM websites for additional information on accessing datasets.

- CEDEN: <http://www.ceden.org/index.shtml>
- CRAM: <http://www.cramwetlands.org/dataentry>

8.6 Physical File Organization

Field Forms

Copies of field forms are stored in labeled file cabinets at the MEDN Program Manager’s office. Original datasheets are maintained by the California Department of Fish and Wildlife Aquatic Bioassessment Lab.

Data Verification Reports

Data verification reports are generated from the database after data entry. Reports can be used to verify entered data with the actual data (field form). Final data verification reports represent a physical hard copy of the entered data and are filed behind the original field form.

Archives

Once data have been certified, the original paper field forms and final data verification reports for the year are archived with the respective park’s curator. A copy of the field form and data verification report should be made and kept in their respective site folders.

8.7 Digital File Organization

Documents and Non-GIS Files

All final digital documents and non-GIS files associated with the water quality monitoring protocol for SAMO and CHIS are located within the MEDN I&M folder on the SAMO network server. The data will be located on the SAMO H drive, a mapped directory (\DIVISION\psrm\Inventory and Monitoring) on the park's server (\\inpsamo-hq1\). There are several directories within the H drive where files can be located:

- Protocol and annual report documents and data summaries are located in:
\\Inventory_and_Monitoring\Vital_Signs\Water Quality
- The Aquatic Amphibian Monitoring Program Database used to store in-situ water chemistry data (SAMO only) is located in:
\\Inventory_and_Monitoring\Vital_Signs\Aquatic_Herps\Database
- The latest front-end user interface (MEDN_AquaticHerpetofaunaDatabase_v3.7) is located in this directory. Back-end data tables (MEDN_AquaticHerpetofaunaDatabase_be.accdb) are located in the 'Master' subdirectory.
- Field data and other documents are located in:
\\Inventory_and_Monitoring\Vital_Signs\Water Quality\Field Data

GIS Data

All GIS data associated with the invasive plant I&M protocol for SAMO are located on the park's "J" drive. The J drive is a mapped directory (\gis\data) on the park's server (\\inpsamo-hq1\)) and houses the park's GIS data. This drive is only accessible to staff within the park's Planning, Science, and Resource Management Division. GIS data for this protocol are located in: J:\data\water

All GIS data associated with the invasive plant I&M protocol for CHIS are located on the park's "T" drive. The T drive is a mapped directory (\SERVER) on the park's server (\\inpchis_02\)) and houses the park's monitoring and GIS data. This drive is only accessible to staff within the park's Resource Management Division. GIS data for this protocol are located in: T:\Im\Invasive_Plants_Monitoring

8.8 File Maintenance

All files on the park's server are backed up nightly. The server is maintained by each park's Information Technology Specialist.

Standard Operating Procedure (SOP) 9: Annual Status Reports and Periodic Synthesis Reports

9.0 Overview

This SOP details the various reporting needs associated with the Stream Condition protocol implementation plan.

9.1 Annual Report General Contents

Annual Status Reports will be the responsibility of the company or organization contracted to conduct the monitoring. Annual Reports should contain the following information at a minimum:

- A. A summary of results including:
 - A brief narrative of the year's survey methodology, effort, basic results, noteworthy observations
 - Any changes in the sampling or analysis procedures from those specified in the standard methods listed in SOPs 3, 4, 5 and 6.
 - A list of all sites monitored, dates and personnel
 - A table of results for each monitoring site, including water quality results, CSCI score and CRAM overall and component scores.
 - A map of the monitoring sites visited.
 - An example photo of each site.
 - A discussion of any special observations, problems encountered, unusual flow conditions, etc. as applicable for each site.
 - A table and an associated color-coded map summarizing CSCI and CRAM results by condition class (as discussed further in section 12.2 below).
 - A table comparing water quality results to water quality objectives / criteria / benchmarks (as discussed further in section 12.2 below)
- B. Detailed attachments (electronically):
 - Scans of the original field sheets for each monitoring site visited
 - Complete laboratory data results, including QA/QC, for all water chemistry analysis
 - Laboratory results for all taxonomy, including results of other standard indices such as Percent ETP, SoCA B-IBI, Shannon Diversity Index, etc.

9.2 Data Analysis for Annual Status Report

CSCI and CRAM scores should be placed into context by providing associated "condition classes," based on the scores of reference sites. Reference sites identified under the SWAMP Perennial Stream Assessment program should be used as the basis for defining condition classes, consistent with the presentation of results from the Southern California Monitoring Coalition (Mazor 2015a) perennial stream assessment reports. Table 9.1 should be used as a template for presenting CSCI and CRAM scores.

Table 9.1: Template for reporting CSCI and CRAM scores.

Indicator	N	Mean	SD	Class 1	Class 2	Class 3	Class 4
CSCI							
CRAM							

Mean CSCI scores and extent estimates for each condition class. N: number of sites used in the analysis. SD: Standard deviation. Class 1: % of streams with scores above the 30% percentile of reference sites. Class 2: % of streams with scores between the 10th and 30th percentiles of reference sites. Class 3: % of streams with scores between the 1st and 10th percentiles of reference sites. Class 4: % of streams with scores below the 1st percentile of reference sites. Reference sites are defined as those meeting the criteria specified in Ode et al. (2016b). Thresholds to make class assignments are derived from reference distributions, as reported in Mazor (2015b).

Water chemistry data should be compared to established water quality objectives from the Los Angeles Basin Plan (LARWQCB 2018) or water quality criteria from the US EPA where available. Where such objectives or criteria are not available, data should be compared to known benchmarks, which are non-regulatory values that reflect average conditions in healthy streams. Table 9.2 summarizes the water quality objectives or benchmarks for the water chemistry parameters identified for the stream condition monitoring protocol implementation plan (Federico et al. 2019).

Table 9.2: Water quality objectives and benchmarks for water chemistry parameters.

Parameter	Objective or criteria	Applicable Watershed or Beneficial Use	Source
Dissolved Oxygen	7 mg/L	All	LA Basin Plan (LARWQCB 2018)
Temperature	None defined	N/A	N/A
pH	6.5 – 8.5	All	LA Basin Plan (LARWQCB 2018)
Specific conductance	878 μ S/cm	All	Reference-derived threshold from Mazor 2015b
Turbidity	3.8 NTU	All	Reference-derived threshold from Mazor 2015b
Total Nitrogen	0.42 mg/L	All	Reference-derived threshold from Mazor 2015b
Total Phosphorous	1.71 mg/L	All	Reference-derived threshold from Mazor 2015b
Chloride	500 mg/L	Malibu Creek	LA Basin Plan (LARWQCB 2018)
	150 mg/L	Calleguas Creek	LA Basin Plan (LARWQCB 2018)
Sulfate	500 mg/L	Malibu Creek	LA Basin Plan (LARWQCB 2018)
	250 mg/L	Calleguas Creek	LA Basin Plan (LARWQCB 2018)
Total Selenium	0.05 mg/L	MUN beneficial use	LA Basin Plan (LARWQCB 2018)

9.3 Periodic Synthesis Reports

A park-specific synthesis report will be completed every 3 years, following completion of the 3-year monitoring cycles at each park. The report is to be delivered by the contractor to the MEDN Program Manager by December 30th of the required year with results from the previous three years analyzed.

The periodic status report will include the following information:

- A brief narrative of survey methodology, effort, basic results, noteworthy observations, and any changes in the sampling or analysis procedures.
- A list of personnel and training schedule from the time period.
- A table and accompanying map with the locations, date, and assessment type (CRAM or Bioassessment) for each stream surveyed in the time period.
- A brief description of field procedures, quality control and data handling, and data analysis methods.
- A table with all CSCI and CRAM scores from the survey time period, as well as summary statistics.
- A discussion of results and trends, when applicable. Trends will only be available starting in years 7-9 of the program, when sites from years 1-3 are re-visited.
- Recommendations for management actions, if appropriate, based on results of the periodic report.
- An accounting of time and fund resources that were needed to collect and analyze data, and complete the written periodic report.

Standard Operating Procedure (SOP) 10: Safety

10.0 Overview

Safety of field staff is a concern during monitoring, as well as traveling to and from monitoring sites. The purpose of this SOP is to state the safety policies of the Mediterranean Coast Network as they relate to the stream condition monitoring protocol implementation plan.

10.1 Weather and Field Attire

In the Santa Monica Mountains National Recreation Area, summer conditions are often hot, (between 80-110°F) and winter conditions can be cold and muddy (between 4– 70°F). Clothing worn for field surveys should be appropriate for weather conditions, and comfortable to wear while traversing streams. In addition, it is important to bring an extra change of clothes, since field attire will get wet. Field personnel should also carry snack food and drinking water into the field.

10.2 Off-road driving safety

Winter and spring conditions are the wet season in the Santa Monica Mountains (SMM), and many roads are not suitable for driving in muddy conditions. Off-road (4x4) driving should only be done by experienced field staff familiar with the dirt roads and trails in the SMM. Less experienced drivers should be accompanied by experienced staff with at least a year's familiarity with off-road conditions. All personnel must read an educational document regarding driving rules, regulations, and driving conditions. The document will then be signed by all drivers and kept by Monitoring Project Manager in a file at headquarters.

10.3 Animal Handling

There is no immediate danger in handling the local amphibians; however, amphibians can carry salmonella and California newt skin contains a toxin that should not be ingested. Therefore, hands must be washed thoroughly prior to eating and drinking.

Equally important is the safety of the animals themselves. Diseases and fungus, such as chytrid fungus (*Batrachochytrium dendrobatidis*), can easily be spread from one site to the next. Consequently, it is important to ensure that all field equipment (including footwear) has been disinfected with mild bleach solution prior to use between stream sites.

10.4 Other Field Hazards

Rattlesnakes (*Crotalus viridis*) are present in many study areas and caution should be used when traveling through streams, walking along trails or climbing through vegetation. In the event of a rattlesnake bite seek immediate medical attention. Draw a line or circle around the bite wound and take note of the time at which the incident occurred. This information is important in determining the extent of the swelling and in prescribing how much antivenin to use.

Poison Oak (*Toxicodendron diversilobum*) is found in more mesic habitats of southern California. Before doing any fieldwork personnel are to become familiar with the dangers associated with exposure to this native plant. If exposure occurs wash thoroughly with soap and rinse with plenty of

water upon returning from the field and then apply Tecnu® ointment (provided at headquarters). If a reaction occurs, seek medical attention.

10.5 Job Hazard Analysis

Job Step	Hazard	Safe Behavior/Procedure
1. Walking around carrying equipment.	1. Tripping hazards, injury from falling, sharp objects, slipping on rocky surfaces.	1. Pay careful attention to where stepping. Walk slowly. Secure all equipment so both hands are free.
2. Squatting, bending, and climbing on slippery surfaces.	2. Back strain, knee strain, fatigue, possible fall.	2. Stand upright and stretch occasionally. Secure yourself. Have someone spot you. Wear proper non-slip water shoes.
3. Walking through water.	3. Possible fall, hypothermia, drowning.	3. Pay careful attention to where stepping, work slowly, pay attention to submerged logs or vegetation, and get warm by exiting stream if shivering.
4. Entering low-light areas.	4. Eyes are not adjusted to changing light conditions. Tripping hazards or other injuries.	4. Stop moving when entering an area with different light conditions. Allow eyes to adjust. Use a flashlight when needed.
5. Walking through scattered and dense vegetation.	5. Potential for scrapes and cuts on exposed arms and legs from branches.	5. Stay on defined trails as much as possible. Wear appropriate clothing such as pants and a long-sleeved shirt. Proceed with caution through the shrubs and bushes.
6. Being in sun for hours.	6. Sunburn, dehydration, fatigue-induced inattention.	6. Wear sunscreen, sunglasses, and broad-brimmed hat. Bring water and snacks with you. Take breaks when needed.
7. Coming in contact with venomous reptiles and invertebrates.	7. Fatigue, illness, stinging sensation, paralysis.	7. Use caution when traversing stream. Make noise and walk heavily over exposed vegetation and on stream banks. Do not place hands, feet, or body in places you cannot visibly check first. Report any sightings to survey partner.
8. Coming in contact with poison oak.	8. Itchy rash, potentially strong allergic reaction	8. Identify poison oak in the study area. Avoid touching leaves, stems, and roots. Wear long sleeves and long pants. If touched, treat with Tecnu and shower at headquarters. Seek medical attention for serious allergic reaction.

Standard Operating Procedure (SOP) 11: Personnel Requirements and Training

11.0 Overview

This SOP explains the training procedures to prepare field staff for the collection of stream condition data.

11.1 Personnel Requirements – Roles and Responsibilities

- Water Quality Monitoring Lead – MEDN I&M Program Manager
- Field work will be contracted for the foreseeable future.

11.2 Personnel Training

Personnel conducting field work must have the following training:

11.2.1 Bioassessments

Personnel are required to have completed competency training per the California SWAMP Program Training SOP, as developed by the CA Department of Fish and Wildlife (DFW). This includes the following (all of which are sponsored by DFW):

- Complete “College of Bioassessment” training, including training in field protocols, conducted by DFW.
- Participate in an annual intercalibration and training exercise with other field crews (such as those hosted by DFW or SMC)
- Have at least 5 years’ experience conducting bioassessment at more than 100 sampling events, and at least some of this experience has occurred within southern California
- Participate in annual field audits, and can provide audit reports from within the last 2 years, if requested.
- Field crews must have all necessary permits to complete the required work (e.g., scientific collecting permits).

The following requirements apply to benthic macroinvertebrate taxonomists:

- Must be active members of a taxonomic organization, such as the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT), and participate in a taxonomic workshop in at least 3 of the past 5 years.
- Must be able to produce QA reports from within the last 2 years, if requested.

After attending the classes and field exercises/audits, field personnel must be listed on the Scientific Collection Permit (SCP) issued annual by DFW for the specific field work proposed.

11.2.2 California Rapid Assessment Method (CRAM)

Personnel are required to have completed the Practitioner CRAM Training, a 5-day training class that provides a broad understanding of the methodology, assumptions, and background to conduct field assessments for multiple types of wetlands. More information, including the 5-day course prospectus and a list of upcoming training classes, can be found at: <http://www.cramwetlands.org/training>

CRAM practitioners should under annual field audits and be able to produce audit reports from within the last 2 years, if requested.

11.2.3 Red-legged Frog Awareness Training

All field personnel need to be briefed by SAMO staff on precautions to be taken at red-legged frog reintroduction sites, in order to avoid impact to equipment, frog populations or associated habitat.

Standard Operating Procedure (SOP) 12: Equipment Disinfection

12.0 Overview

Recent identification of the New Zealand mudsnail (*Potamopyrgus antipodarum*) in streams within MEDN significantly increases the need for vigilance in cleaning of field equipment and personnel clothing to prevent the spread of this significant invasive mollusk. New Zealand mud snails are very small, easily overlooked, and reproduce parthenogenetically (most individuals in the U.S. are female, males are very rare). They brood their young releasing extremely small juveniles that are essentially invisible to the unaided eye. A single juvenile transported to an uncontaminated stream could be enough to permanently alter the macroinvertebrate community of that stream. In addition, chytrid fungus (*Batrachochytrium dendrobatidis*), which increases mortality of amphibians (e.g., Berger et al. 1998), has been found in the study area streams.

Potentially harmful infections and spread of the chytrid fungus and New Zealand mud snails can be prevented by proper cleaning and care of field equipment, field gear, personal wardrobe items, and field equipment. It is essential that all field equipment be in working order and thoroughly cleaned prior to use in the field.

12.1 Cleaning Procedures

Clean up procedures for field equipment should begin immediately after leaving the stream. All field equipment that has come in contact with stream water, including clothing and footwear, must be cleaned and disinfected before being introduced into another stream in order to prevent the spread of fungus, disease, or non-native species.

Wetted and presumably contaminated footwear must be removed at the stream bank and scrubbed clean of mud or other debris upon completion of sampling and placed in a heavy duty plastic garbage bag for the walk back to the field vehicle. Field crews must carry a hand-sized scrub brush for this purpose. Equipment in the heavy duty garbage bag is then frozen at -20°C as a treatment for New Zealand mud snails for at least 36 hours. At SAMO, freezers are located at Diamond X Ranch (need BC-1 key; Mulholland Dr., Calabasas, CA) and Rancho Sierra Vista barn (need BC-1 key; Via Goleta and Potrero Road, Newbury Park, CA, 91320). Use of freezers must be coordinated with park staff. At CHIS, island-specific gear was purchased new and stored at the CSUCI Research Station. All equipment is rinsed and washed with either a 10% bleach solution or in a regular hot-cycle washer with detergent before re-use. Sampling equipment that must be disinfected includes (but is not limited to) the following:

- Meter stick
- measuring tape
- nets
- water shoes
- nylon pants

Standard Operating Procedure (SOP) 13: Monitoring Site Locations and Driving Directions

13.0 Overview

This SOP explains locations and driving directions to established monitoring plots for the stream condition protocol implementation plan for SAMO and CHIS.

13.1 Driving Directions to Stream Survey Sites at SAMO

Listed below are the directions for all the stream sites monitored by NPS staff. Although monitoring under the stream condition monitoring protocol implementation plan will be at sites corresponding to the set of aquatic amphibian sites being visited in any given year (from the amphibian monitoring protocol (Delaney et al. 2011)), only some subset of those amphibian sites will be assessed under this plan. Furthermore, the specific sites within that subset will not be known until the monitoring program is completed for each of the initial 3 years, pending an assessment of site conditions, safety, and suitability for bioassessment monitoring. See SOP 2 for information on site selection.

Table 13.1. SAMO Survey Site Coordinates

Survey Site	Site Name	Site Code	X Coord	Y Coord	Datum
SENTINEL	Big Sycamore Canyon	S_BIGSYC	319118	3779571	Nad27
SENTINEL	Carlisle Canyon	S_CARLISLE	326005	3776606	Nad27
SENTINEL	Erbes (Lower)	S_LANRNCHS	329684	3785897	Nad27
SENTINEL	Lang Ranch (N)	S_LANRNCHN	334010	3786741	Nad27
SENTINEL	Las Virgenes (N)	S_ULASVIR	342811	3782854	Nad27
SENTINEL	Las Virgenes (S)	S_LLASVIR	342125	3775434	Nad27
SENTINEL	Medea Creek (N)	S_UMEDCRK	337686	3781820	Nad27
SENTINEL	Medea Creek (S)	S_LMEDCRK	338558	3777073	Nad27
SENTINEL	Solstice Canyon	S_SOLSCRK	338744	3767519	Nad27
SENTINEL	Temescal Canyon	S_TEMECYN	358333	3770551	Nad27
RANDOM1	Arroyo Conejo	R1_ARRCONEJO	320243	3780686	Nad27
RANDOM1	Conejo Creek	R1_CONCRK	325853	3787363	Nad27
RANDOM1	Eleanor	R1_ELEANOR	328872	3777596	Nad27
RANDOM1	Las Flores	R1_LASFLORES	348997	3769453	Nad27
RANDOM1	Liberty	R1_LIBCYN	342106	3774948	Nad27
RANDOM1	Little Sycamore	R1_LITTLESYC	318892	3770914	Nad27
RANDOM1	Malibu Creek	R1_MALICRK	341388	3773312	Nad27
RANDOM1	Medea Creek	R1_MEDCRK	336947	3783656	Nad27
RANDOM1	Ramirez	R1_RAMICYN	334458	3767917	Nad27
RANDOM1	Solstice Canyon (upper)	R1_SOLSCRK	338247	3768156	Nad27
RANDOM1	Sullivan	R1_SULLCYN	359927	3772994	Nad27
RANDOM1	West Fork Trancas	R1_WFTRANCAS	327854	3772856	Nad27
RANDOM2	Bulldog Motorway (off Malibou Lake)	R2_BULLDOG	338183	3773945	Nad27

Survey Site	Site Name	Site Code	X Coord	Y Coord	Datum
RANDOM2	Cheeseboro Creek (above connector)	R2_CHEESEBORO	341204	3782573	Nad27
RANDOM2	Circle X (Grotto Trail)	R2_CIRCLEX	322423	3774459	Nad27
RANDOM2	Escondido Creek	R2_ESCONDIDO	336645	3767184	Nad27
RANDOM2	Las Flores (year 2)	R2_LASFLORES	348928	3767371	Nad27
RANDOM2	Las Virgenes Creek (near City Hall)	R2_LASVIRGENES	343597	3779915	Nad27
RANDOM2	Olsen Road (CLU)	R2_OLSEN	326791	3788580	Nad27
RANDOM2	Rustic Creek (Will Rogers SHP)	R2_RUSTIC	361042	3769456	Nad27
RANDOM2	Santa Ynez Canyon Trail	R2_SANTAYNEZ	355597	3772207	Nad27
RANDOM2	Sostoma Trail (above Tropical Terrace)	R2_SOSTOMA	338105	3768949	Nad27
RANDOM2	Suttphur Creek (Santa Maria Road)	R2_SUTTPHUR	353353	3776838	Nad27
RANDOM2	Triunfo Creek	R2_TRIUNFO	333491	3778100	Nad27
RANDOM3	Arroyo Sequit (year 3)	R3_ARRSEQ	323756	3773670	Nad27
RANDOM3	Cold Creek (off Stunt Road)	R3_COLDCKRK	347583	3773730	Nad27
RANDOM3	Conejo Creek (year 3)	R3_CONCRK	324278	3785975	Nad27
RANDOM3	Ladyface	R3_LADYFACE	337443	3779202	Nad27
RANDOM3	Liberty Canyon (above pitfalls)	R3_LIBCYN	341143	3777077	Nad27
RANDOM3	Malibu Creek (at Cross Creek)	R3_CROSSCRK	343917	3768988	Nad27
RANDOM3	Malibu Creek (Craggs Road)	R3_CRAGSRD	339724	3774729	Nad27
RANDOM3	Malibu Creek SP (rock pool)	R3_MALICRKSP	341176	3773571	Nad27
RANDOM3	Lachusa Creek	R3_LACHUSA	325238	3768189	Nad27
RANDOM3	Topanga Creek (at Summit Road)	R3_TOPACRK	353198	3774779	Nad27
RANDOM3	Topanga Creek (off Topanga Blvd)	R3_TOPANGA	352365	3772720	Nad27
RANDOM3	Tuna Canyon (from PCH)	R3_TUNACYN	353354	3767502	Nad27

The start point for all driving directions is the Santa Monica Mountains National Recreation Area headquarters at 401 West Hillcrest Blvd., Thousand Oaks, California.

A. Sentinel Sites

1. Big Sycamore Canyon (S_BIGSYC)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles.
- Turn LEFT onto LYNN RD. Drive 4.6 miles
- Turn LEFT onto SOUTH REINO RD. Drive 0.1 miles
- Turn RIGHT onto WEST POTRERO RD. Drive 0.4 miles
- Turn LEFT onto RANCHO SIERRA VISTA RD. Drive 0.4 miles to the Big Sycamore Canyon Trail head at Rancho Sierra Vista. Note: Entry to the trailhead with a vehicle requires a BC-1 key at the gate in front of the Satwiwa Culture Center.
- Drive 1.1 miles to the trailhead for the Upper Sycamore Canyon Trail and park vehicle.

- Hike approximately 0.5 miles along the Upper Sycamore Canyon Trail to the survey start point, where the water from the creek crosses the trail.

2. Carlisle Canyon (S_CARLISLE)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 2.1 miles
- Take the CA-23 S / WESTLAKE BLVD exit. Turn RIGHT onto CA-23 S / S WESTLAKE BLVD. Drive 2.7 miles.
- Turn RIGHT onto CARLISLE RD. Drive to end of public road and park vehicle. The survey start point is approximately 700 m up the private road, near a house on the creek (where a footbridge from the house crosses the stream).

3. Erbes (Lower) (S_LANRNCHS)

- Start out going EAST on HILLCREST DR. Drive 1.2 miles.
- Turn LEFT onto ERBES RD. Drive 1.4 miles.
- Turn LEFT onto MARVIEW DR. Drive 0.3 miles.
- Park vehicle in parking lot for Old Meadows Park. Walk across soccer field, survey start point is the culvert located at the downstream end of Old Meadows Park. You must hop the fence to enter the culvert.

4. Lang Ranch (North) (S_LANRNCHN)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles.
- MERGE onto US-101 S toward LOS ANGELES. Drive 1.5 miles.
- Merge onto CA-23 N toward FILLMORE. Drive 2.8 miles.
- Take the AVENIDA DE LOS ARBOLES exit. Turn RIGHT onto E AVENIDA DE LOS ARBOLES. Drive 1.4 miles.
- Turn RIGHT onto N WESTLAKE BLVD. Drive 0.2 miles.
- Turn LEFT onto LANG RANCH PKWY. Drive 0.4 miles.
- Park vehicle on LANG RANCH Road, in front of the entry to the Chumash Interpretive Center, 3290 Lang Ranch Pkwy, Thousand Oaks. The survey start point is above the Chumash Center at the large ten-foot boulder just before the waterfall off Westlake Boulevard.

5. Las Virgenes (North) (S_ULASVIR)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.9 miles
- Take the LAS VIRGENES RD exit toward MALIBU CANYON. Turn LEFT onto LAS VIRGENES RD.
- Drive to the end of LAS VIRGENES ROAD, stopping at the entrance gate for the Las Virgenes Canyon trailhead. Note: Entry to the trailhead with a vehicle requires a BC1 key. Drive across the stream and take the left fork on the road. Survey start point is the next stream crossing after the fork in the road.

6. Las Virgenes (South) (S_LLASVIR)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 1.1 mile.
- Turn RIGHT into White Oak Farm, just prior to the large Santa Monica National Recreation Area sign and turnout near Mulholland.
- The survey start point is the first bridge on the White Oak Farm road.

7. Medea Creek (North) (S_UMEDCRK)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 8.1 miles.
- Take the KANAN RD exit. Turn RIGHT onto KANAN RD/ CR-N9 S. Turn SHARP LEFT onto KANAN RD / CR-N9 N. Continue to follow KANAN RD. Drive 1.9 miles
- Turn LEFT onto FOUNTAINWOOD ST. The survey start point is at the culvert on Conifer St.

8. Medea Creek (South) (S_LMEDCRK)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 8.1 miles.
- Take the KANAN RD exit. Turn RIGHT onto KANAN RD/ CR-N9 S. Drive 0.3 miles.
- Turn LEFT onto CORNELL WAY. CORNELL WAY becomes CORNELL RD. Drive 2.1 miles.
- Turn RIGHT at gate before Paramount Ranch (near Pitfall Array 52). Gate requires a BC-1 key. The survey start point is near the large stream crossing into Paramount Ranch on the Bwana trail, there are planks of wood across the crossing.

9. Solstice Canyon (S_SOLSCRK)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn RIGHT onto PACIFIC COAST HWY / CA-1 N. Drive 2.2 miles.
- Turn RIGHT onto CORRAL CANYON RD. Drive 0.2 miles
- Turn LEFT into the entrance for Solstice Canyon. The survey start point is at entry gate above the parking lot, near the education pavilion. Note: entry through gates requires a BC-1 key.

10. Temescal Canyon (S_TEMECYN)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles

- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn LEFT onto PACIFIC COAST HWY / CA-1 S. Continue to follow CA-1 S. Drive 10 miles.
- Turn LEFT onto TEMESCAL CANYON RD. Drive 1.0 miles.
- Turn RIGHT onto W SUNSET BLVD. Drive 0.1 miles
- End at Temescal Gateway Park, 15601 W Sunset Blvd, Pacific Palisades.
- Park vehicle in the MRCA parking lot. Walk approximately 0.5 miles up the Topanga Canyon Trail into Topanga State Park. The survey start point is under the first footbridge along the trail that crosses the creek.

B. RANDOM 1 (R1) Stream survey sites

1. Sullivan Canyon (R1_SULLCYN)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn LEFT onto PACIFIC COAST HWY / CA-1 S. Continue to follow CA-1 S. Drive 10 miles.
- Turn LEFT onto TEMESCAL CANYON RD. Drive 1.0 miles.
- Turn RIGHT onto W SUNSET BLVD. Drive 3.6 miles
- Turn LEFT onto Mandeville CANYON RD. Drive 0.2 miles
- Turn LEFT onto WESTRIDGE RD. Drive 1.1 miles
- Turn LEFT onto W. BAYLISS RD. Drive 0.2 miles
- Turn LEFT onto QUEENSFERRY RD. Drive <0.1 mile
- PARK at end of street and walk down into SULLIVAN CANYON
- Walk approximately 1 mile upstream to where the trail begins to make an ascent away from the creek. Look for a large bedrock outcrop in the stream near two mature oak trees. This is the starting point.

2. Las Flores Canyon (R1_LASFLORES)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn LEFT onto PACIFIC COAST HWY / CA-1 S. Continue to follow CA-1 S. Drive 4 miles.
- Turn LEFT onto LAS FLORES CANYON RD. Drive 1.5 miles.
- Turn RIGHT onto GORGE RD. Drive approximately 1 mile to a black gate. Stream survey begins below gate. The gate and land behind is private property, do not park in front of it. There are ruins of a house, and an RV parked there.

3. Solstice Canyon (upper) (R1_SOLSCRK)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn RIGHT onto PACIFIC COAST HWY / CA-1 N. Drive 2.2 miles.
- Turn RIGHT onto CORRAL CANYON RD. Drive 0.2 miles
- Turn LEFT into the entrance for Solstice Canyon. Drive up the canyon and make a right after the bridge. At the next bridge (the Keller Bridge) park car in the parking area on the other side. Survey begins below the Keller bridge. Note: entry through gates requires a BC-1 key.

4. Ramirez Canyon (R1_RAMICYN). Streisand Center—Headquarters of the Santa Monica Mountains Conservancy.

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 8.5 miles
- Take the KANAN RD exit
- Turn RIGHT onto KANAN RD. Drive 12 miles.
- Turn LEFT onto PACIFIC COAST HWY. Drive 1.2 miles
- Turn LEFT onto WINDING WAY RD. Drive to next intersection.
- Turn LEFT onto DELAPLANE. Drive to the next intersection which is RAMIREZ CANYON RD.
- Turn RIGHT onto RAMIREZ CANYON RD. Drive to end of road and a gate. Push the button on the gate console and explain your purpose and they should let you in.
- Walk up the canyon passed the compound. Upstream of the compound there is a small trail. Take the trail about 500 meters to the end. The stream survey begins at the end of the trail.

5. Little Sycamore Creek (R1_LITTLESYC)

NOTE: We have permission to enter the camp to conduct stream surveys, however we need to call ahead the day you survey. The contact person is: JOHN J. BARD Executive Chef/Guest Services 310-457-7861.

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 8.5 miles
- Take the KANAN RD exit
- Turn RIGHT onto KANAN RD. Drive 12 miles.
- Turn RIGHT onto PACIFIC COAST HWY. Drive 10 miles
- Turn RIGHT onto YERBA BUENA
- Turn LEFT into CAMP HESS KRAMER

- Drive down into the camp and take the road that follows the creek (it crosses the creek several times). Follow road passed the campground and cabins (approximately 1.5 miles). Take the road across a deep culvert and park on the other side, near the bridge. Follow the creek up to another bridge (with yellow railings). The stream survey point begins immediately after the bridge.
6. West Fork Trancas (R1_WFTRANCAS)
- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 8.5 miles
 - Take the KANAN RD exit
 - Turn RIGHT onto KANAN RD. Drive 12 miles.
 - Turn RIGHT onto PACIFIC COAST HWY. Drive 5.5 miles
 - Turn RIGHT onto ENCINAL RD. Drive up the canyon to LA. COUNTY FIRE DEPARTMENT AND CAMP 13. Across Encinal Road north of the camp there is a dirt road and a boneyard. Look for a wooden cabin in the bone yard and this is where to begin surveying the stream.
7. Malibu Creek (R1_MALICRK). In Malibu Creek State Park.
- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
 - Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
 - Turn RIGHT onto LAS VIRGENES RD. Drive 1.5 miles.
 - Turn RIGHT into Malibu Creek State Park. At the fee booth tell them you're with the National Park Service conducting water quality or amphibian surveys and they should let you in free of charge.
 - Turn RIGHT at first gated dirt road along parking area. This is the trail to the Visitor Center/Century Lake. Drive 0.8 miles. **Note you will need a State Park Key or LA. County Fire Key to open the gate.**
 - Turn LEFT at second fork (do not cross at wet crossing) and cross the bridge, veer left. Drive 0.3 miles.
 - Turn Right at second fork to MOTT RD. Drive 0.5 miles.
 - Park vehicle at picnic area just before the gates to Salvation Army Camp.
 - Survey starts in big pool with large boulders, down from parking area.
8. Liberty Canyon (R1_LIBCYN). Confluence of Liberty and Las Virgenes Creeks near Pitfall Array 56.
- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
 - Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
 - Turn RIGHT onto LAS VIRGENES RD. Drive 1.0 mile.
 - Turn RIGHT on White Oak Farms (before Mulholland Rd.)
 - Follow dirt road over bridge. Then follow driveway of house on left. Park car on west end of the house and follow path to pitfall array 56. Survey point begins at confluence of both creeks, but survey will follow Liberty Creek.

9. North Medea Creek (R1_MEDCRK). North of Kanan Road in Oak Canyon Community Park.
 - Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 8.5 miles
 - Take the KANAN RD exit
 - Turn LEFT onto KANAN RD. Drive 3.0 miles
 - Turn RIGHT onto Hollytree Drive and turn into Oak Canyon Community Park.
 - Survey point begins above duck pond.

10. Eleanor (R1_ELEANOR). Carlisle Creek at Westlake Blvd. and Carlisle Canyon Rd. intersection.
 - Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 2.1 miles
 - Take the CA-23 S / WESTLAKE BLVD exit. Turn RIGHT onto CA-23 S / S WESTLAKE BLVD. Drive 2.7 miles.
 - Park at pullout marked by a sign that says “NO DUMPING”, right before CARLISLE RD. Begin survey by this sign. Upstream you will go under the road.

11. Arroyo Conejo (R1_ARRCONEJO). Arroyo Conejo Tributary south of Potrero Road near Rancho Sierra Vista at the Wendy Trail Head.
 - Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 4.7 miles
 - Turn LEFT onto REINO RD.
 - Turn LEFT onto POTRERO RD.
 - Drive to intersection of POTRERO RD. and WENDY DR. Park on Wendy Trail Head Take trail to where it crosses creek and begin survey.

12. Conejo Creek (R1_CONCRK)
 - Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn RIGHT onto LYNN RD. Drive 2.4 miles.
 - Turn LEFT onto W. AVENIDA DE LOS ARBOLES. Drive 1.0 miles.
 - Turn LEFT into the Wildwood Neighborhood Park/Fort Wildwood Park near the school parking log.
 - Take sidewalk past bathrooms and walk toward the wooden fort.
 - Before the fort take sidewalk on the left and follow it downhill to the creek.
 - Survey starts above Shenandoah Bridge.

C. RANDOM 2 (R2) Stream survey sites

1. Chesebro Canyon (R2_CHEESEBORO)
 - Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 9.4 miles
 - Take the CHESEBRO RD exit. Turn SLIGHT RIGHT onto CHESEBRO RD. Drive 0.1 mile.
 - Turn RIGHT onto CHESEBRO CANYON RD. Drive approximately 0.5 miles.

- Turn RIGHT onto CHESEBRO CANYON PARKING LOT.
 - Drive through gate and travel up canyon approximately 1.25 miles to intersection of CHESEBRO CANYON TRAIL and CHESEBRO RIDGE TRAIL
 - Stream survey begins near wet crossing (look for picnic tables as a marker).
2. Las Virgenes Creek (R2_LASVIRGENES). Near City Hall near 101 freeway.
- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 11.9 miles
 - Take the LAS VIRGENES RD exit. Drive 0.2 miles
 - Turn LEFT onto LAS VIRGENES RD. Drive 0.4 miles.
 - Turn RIGHT into the first driveway (parking lot) and drive toward the 101 freeway and park vehicle.
 - On the southeast side of the lot there is a gate to the creek. Begin the survey where this little access road drops into the creek.
3. Triunfo Creek (R2_TRIUNFO)
- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - MERGE onto US-101 S toward LOS ANGELES. Drive 8.1 miles
 - Take the KANAN RD exit- EXIT 36. Drive 0.2 miles
 - Turn RIGHT onto KANAN RD / CR-N9 S. Drive 3.2 miles
 - Turn RIGHT onto TRIUNFO CANYON ROAD and drive to end of road. There is a trailhead for the Santa Monica Mountains Conservancy, from the trailhead you can hike down into the creek to start the survey.
4. Olsen Road (R2_OLSEN). In Conejo Creek off of Olsen Rd., across from CLU University.
- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn RIGHT onto LYNN RD. Drive 3.1 miles. *Note: Lynn Road transitions into Olsen Road.*
 - Turn Left onto Campus Drive. Survey start point is at the creek and Campus Dr. Find a route into the creek at Campus Drive.
5. Circle X (Grotto Trail) (R2_CIRCLEX). West Fork of Arroyo Sequit in the Grotto of Circle X Ranch.
- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
 - Turn LEFT onto LYNN RD. Drive 0.1 miles
 - Merge onto US-101 S toward LOS ANGELES. Drive 4.1 miles.
 - Take the WESTLAKE BLVD / CA-23 S exit.
 - Turn RIGHT onto S WESTLAKE BLVD / CA-23 S. Continue to follow CA-23 S. Drive 7.0 miles.
 - Turn SLIGHT RIGHT onto MULHOLLAND HWY. Drive 0.4 miles.
 - Turn RIGHT onto LITTLE SYCAMORE CANYON RD. Drive 4.4 miles. *Note:*
 - *LITTLE SYCAMORE CANYON RD becomes YERBA BUENA RD. Circle X Ranch will be on your left park near the group parking lot.*

- Hike 1.75 miles down Grotto Canyon Trail. Once in the creek hike approximate 0.5 miles downstream.

6. Rustic Creek (R2_RUSTIC)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 26.0 miles.
- Merge onto I-405 S toward SANTA MONICA. Drive 6.5 miles.
- Take the exit toward SUNSET BLVD.
- Turn LEFT onto N CHURCH LN. Drive <0.1 miles
- Turn RIGHT onto SUNSET BLVD. Drive 4.5 miles
- Turn RIGHT onto WILL ROGERS STATE PARK RD. Follow the road past the polo field. Park the vehicle on the far northwestern side of the polo field.
- Walk 0.5 miles down into Rustic Creek on RUSTIC CANYON TRAIL. Survey starts where the creek and trail meet.

7. Bulldog Motorway (off Malibou Lake) (R2_BULLDOG)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 8.1 miles.
- Take the KANAN RD exit- EXIT 36.
- Turn RIGHT onto KANAN RD / CR-N9 S. Drive 0.3 miles.
- Turn LEFT onto CORNELL WAY/CORNELL RD. Drive 2.3 miles.
- CORNELL RD becomes LAKE VISTA DR. Drive 1.0 miles
- Turn LEFT on CRAGS RD. Drive 0.4 miles.
- Turn RIGHT to stay on CRAGS DR. Drive another 0.3 miles.
- Drive to end of road, for gate access use Los Angeles County Fire Key or park and walk 0.3 miles.
- When you reach a fork in the road, veer RIGHT onto BULLDOG MOTORWAY.
- Walk or drive up the road 0.4 miles to a water tank. Stream survey begins at culvert before the water tank.

8. Suttphur Creek (Santa Maria Rd.) (R2_SUTTPHUR)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 15.8 miles.
- Take EXIT 29 toward MULHOLLAND DR / VALLEY CIRCLE BLVD.
- Turn LEFT onto CALABASAS RD. Drive <0.1 miles.
- Turn RIGHT onto MULHOLLAND DR. Drive 2.1 miles.
- Turn RIGHT onto TOPANGA CANYON BLVD / CA-27. Drive 3.7 miles.
- Look for a pullout with a chain link fence around it. Walk around the fence, entrance is behind pepper tree. Creek survey begins by an old concrete shed.

9. Santa Ynez Canyon Trail (Pacific Palisades Dr.) (R2_SANTAYNEZ)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 11.2 miles.
- Take the LOST HILLS RD exit- EXIT 33.
- Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1.0 mile
- Turn RIGHT onto LAS VIRGENES RD. Drive 7.8 miles
- Turn LEFT onto PCH. Drive 8.7 miles.
- Turn LEFT onto SUNSET BLVD.
- Turn LEFT onto PALISADES DR. Drive 2.4 miles up.
- Turn LEFT onto VERDE DE LA MONTURA. The road ends by two gated communities, and there is a trail access on the left. Hike the trail to the first stream crossing after the unusual cement culvert.

10. Sostomo Trail (above Tropical Terrace) (R2_SOSTOMA). Solstice Creek near Sostomo Trail above Tropical Terrace.

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn RIGHT onto PACIFIC COAST HWY / CA-1 N. Drive 2.2 miles.
- Turn RIGHT onto CORRAL CANYON RD. Drive 0.2 miles. Turn LEFT into the entrance for Solstice Canyon. Go through gate (**need a BC-1 key**) in the parking lot near the Education Pavilion.
- Drive up the canyon and make a right after the first bridge. Drive all the way up to the end of the road and park at the burned out house pad called Tropical Terrace. Take the Sostomo Trail to Deer Valley Loop which is just to the left of the entrance to the Tropical Terrace. The creek survey begins at the first creek crossing on Sostomo Trail.

11. Las Flores Creek, year 2 (R2_LASFLORES)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn LEFT onto PACIFIC COAST HWY / CA-1 N. Drive 3.9 miles.
- Turn LEFT onto LAS FLORES CANYON ROAD
- On the left is a small city park with picnic tables. Survey begins here.

12. Escondido Creek (R2_ESCONDIDO)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 8.5 miles
- Take the KANAN RD exit
- Turn RIGHT onto KANAN RD. Drive 12 miles.
- Turn LEFT onto PACIFIC COAST HWY. Drive 1.2 miles
- Turn LEFT onto WINDING WAY. Veer RIGHT to stay on WINDING WAY
- Turn RIGHT onto WINDING WAY EAST take the road till it dead-ends at Escondido Canyon. Stream survey begins at the second creek crossing.

D. RANDOM 3 (R3) Stream survey sites

1. Arroyo Sequit (year 3) (R3_ARRSEQ)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 4.1 miles.
- Take the WESTLAKE BLVD / CA-23 S exit.
- Turn RIGHT onto S WESTLAKE BLVD / CA-23 S. Continue to follow CA-23 S. Drive 7.0 miles.
- Turn SLIGHT RIGHT onto MULHOLLAND HWY. Drive about 5.0 miles.
- Park at the pullout off Mulholland near Malibu Springs North Trail (Oak Alley, cross closed foot bridge). Walk 0.3 miles up trail that parallels stream. Begin stream survey near a steep dirt hill.

2. Cold Creek (off Stunt Rd.) (R3_COLDCKRK)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD, which turns into MALIBU CANYON RD. Drive 3.2 miles.
- Turn LEFT on MULHOLLAND RD. Drive 4.0 miles.
- Turn RIGHT on STUNT RD. Drive 0.8 miles up STUNT RD.
- Pull out from STUNT RD along hairpin turn just before CALABASAS PEAK MOTORWAY.
- Take trail 1/4 – 1/2 mile, passing a few runoff crosses along trail. Cut into stream at runoff crossing that is close to GPS coordinate 10-20 meters. Start where you connect with main creek, fallen sycamore tree.

3. Conejo Creek (R3_CONCRK)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn RIGHT onto LYNN RD. Drive 0.5 miles
- Turn LEFT on DOS RIOS. Drive 0.4 miles.
- Turn RIGHT on CALLE TRANCAS. Drive 0.3 miles.
- Enter the gated fire road off of CALLE TRANCAS.
- Survey start point is at the bottom of the fire road where it crosses the creek.

4. Malibu Creek (Craggs Rd.) (R3_CRAGSRD)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 1.5 miles.
- Turn RIGHT into Malibu Creek State Park. At the fee booth tell them you're with the National Park Service conducting water quality or amphibian surveys and they should let you in free of charge.
- Turn RIGHT at first gated dirt road along parking area. This is the trail to the Visitor Center/Century Lake. Drive 0.8 miles. **Note you will need a State Park Key or LA. County Fire Key to open the gate.**
- Drive down CRAGS RD. (fire road) towards the M*A*S*H site, park near Century Lake.
- Walk down CRAGS RD. (fire road) towards the M*A*S*H site. Survey starts at the bridge that crosses the creek, approximately 0.2 miles from the end of Century Lake.

5. Malibu Creek (at Cross Creek) (R3_CROSSCRK)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD, which turns into MALIBU CANYON RD. Drive approximately 9.5 miles.
- Park in very large dirt pullout on the west side of the road.
- Cross Malibu Canyon Rd. and walk north east down the COASTAL SLOPE TRAIL fire road. About 10m down (343783 / 3768823) take trail to left. Follow trail to bottom, but do not cross ditch at bottom, follow new trail to left. Watch for short trail down an embankment on the right. This will meet up with a strong trail, head north to starting point. Start in large pool with tall sycamore trees, and a large rusty pipe. Start above pipe.

6. Liberty canyon (R3_LIBCYN)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive approximately 10.5 miles
- Take the LIBERTY CANYON RD exit, head SOUTH on LIBERTY CANYON RD for 0.9 miles until you come to a black gate.
- Park car and walk from here. Take trail to the right toward PHANTOM TRAIL, when you get to the creek culvert. Follow this right trail until you get across from the GPS coordinates for the stream then walk through grass to the stream.

7. Malibu creek (rock pool) (R3_MALICRKSP). In Malibu Creek State Park.

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles

- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 1.5 miles.
- Turn RIGHT into Malibu Creek State Park. At the fee booth tell them you're with the National Park Service conducting water quality or amphibian surveys and they should let you in free of charge.
- Turn RIGHT at first gated dirt road along parking area. This is the trail to the Visitor Center/Century Lake. Drive 0.8 miles. **Note you will need a State Park Key or LA. County Fire Key to open the gate.**
- Turn LEFT at second fork (do not cross at wet crossing) and cross the bridge, veer left. Drive 0.3 miles.
- Turn Right at second fork to MOTT RD towards Salvation Army Gate. Drive 0.35 miles.
- Pass high pipe/bridge over the creek, continue on MOTT RD until you are even with the starting GPS coordinates. Take small deer trail down to sandy beach.

8. Topanga Creek

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 15.8 miles.
- Take EXIT 29 toward MULHOLLAND DR / VALLEY CIRCLE BLVD.
- Turn LEFT onto CALABASAS RD. Drive <0.1 miles.
- Turn RIGHT onto MULHOLLAND DR. Drive 2.1 miles.
- Turn RIGHT onto TOPANGA CANYON BLVD / CA-27. Drive 6.5 miles.
- Turn RIGHT on SUMMIT RD/STONEWALL TRAIL/HILLSIDE DR.
- Survey starts at the bridge that crosses the stream when you have turned off TOPANGA CANYON BLVD.

9. Topanga Creek (off Topanga Canyon Blvd.) (R3_TOPANGA)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 15.8 miles.
- Take EXIT 29 toward MULHOLLAND DR / VALLEY CIRCLE BLVD.
- Turn LEFT onto CALABASAS RD. Drive <0.1 miles.
- Turn RIGHT onto MULHOLLAND DR. Drive 2.1 miles.
- Turn RIGHT onto TOPANGA CANYON BLVD / CA-27. Drive 8.5 miles.
- Access from Topanga Canyon at 352367 / 3772883. Park on Topanga Canyon Blvd. and
- Drop into stream (on East side of Topanga Canyon Blvd., between houses (very steep). Start in pool below first overhanging house with red posts.

10. Malibu Nature Preserve

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- Merge onto US-101 S toward LOS ANGELES. Drive 4.1 miles.
- Take the WESTLAKE BLVD / CA-23 S exit.

- Turn RIGHT onto S WESTLAKE BLVD / CA-23 S. Continue to follow CA-23 S. Drive 5.4 miles.
- Turn SLIGHT LEFT onto MULHOLLAND HWY. Drive 1.1 miles.
- Turn LEFT onto CLARK RANCH RD. Drive 0.7 miles.
- Turn RIGHT onto ENCINAL CANYON RD. Drive 1.0 mile.
- Turn RIGHT onto PCH-Hwy 1. Drive 1.5 miles.
- Turn RIGHT into the Malibu Nature Preserve/Malibu Riding & Tennis Club.

11. Tuna Canyon (R3_TUNACYN)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 11.2 miles
- Take the LOST HILLS RD exit. Turn SLIGHT RIGHT onto LOST HILLS RD. Drive 1 mile.
- Turn RIGHT onto LAS VIRGENES RD. Drive 3.2 miles.
- LAS VIRGENES RD becomes MALIBU CANYON RD. Drive 4.6 miles.
- Turn LEFT onto PACIFIC COAST HWY / CA-1 N. Drive approximately 7 miles.
- Turn LEFT onto TUNA CANYON RD. Park near the intersection of TUNA CANYON RD and PCH.
- Stream is on the west side of TUNA CANYON RD, survey starts right above PCH.

12. Lady Face (R3_LADYFACE)

- Start out going WEST on W HILLCREST DR. Drive 0.5 miles
- Turn LEFT onto LYNN RD. Drive 0.1 miles
- MERGE onto US-101 S toward LOS ANGELES. Drive 8.5 miles
- Take the KANAN RD exit
- Turn RIGHT onto KANAN RD. Drive 0.1 miles.
- Turn RIGHT onto AGOURA RD. Drive 0.1 miles.
- Turn LEFT into a large pullout on AGOURA RD. There is a trail and a fire road that parallels the stream, begin survey at GPS coordinates approximately 50 meters from pullout.

13.2 Driving Directions to Stream Survey Sites at CHIS

Driving to sites on Santa Rosa Island will be done by approved drivers only. Road conditions and availability change quickly with the weather, so park staff must be consulted to provide the latest conditions and best directions to monitoring sites.

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