AIM-NAMF Site Scouting and Design Management Guidance
Complied by: The BLM/USU National Aquatic Monitoring Center
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Contents

1.0 Introduction

Congratulations, your AIM-National Aquatic Monitoring Framework (AIM-NAMF) sample design is complete! This document outlines the processes that you will need to go through to successfully complete your sample design in an efficient and statistically rigorous manner. This document is meant to be used in conjunction with the **design management spreadsheet** (and example has been provided and your project specific version is stored on the Google Drive) and GIS files that you were provided, so make sure to have those files close at hand when working through this document. The spreadsheets contained in the design management file will help you keep track of each potential sample point in your design, and the completed version will be permanently stored in the AIM-NAMF sample design database and used during data analysis.

Sample Design Management Overview

Managing your sample design entails determining which points need to be sampled, ensuring that the field crew visits these points, and documenting which points were sampled and rejected. Proper design management is important because it will help you maintain the spatial balance and statistical validity of your sample design. Sample design management is a multi-step, iterative process (Figure 1) that begins prior to the start of the field season with the point evaluation process (i.e. scouting, Section 2.0) and

continues until the design is completed at the end of the final field season in the design.

This document provides detailed instructions about each step in the design management process and how to document the status of each point in your design. The first step in managing a design is to complete the point evaluation or 'scouting' process (Sections 2.0 and 2.6), during which points are either merged with an existing sample point location, selected for a field visit, or rejected (Section 2.3). Points that are rejected during either the scouting process or a field visit need to be replaced with 'oversample' points (Section 2.4). This is part of managing your sample design and is an iterative process to be repeated throughout a sample season (Figure 1). Frequently, several oversample points are needed to achieve the desired sample size as point rejections are common. Field trip planning should be performed in conjunction with the scouting and iterative sample design management processes to ensure that the appropriate points are visited and sampled throughout the field season. However, field trips should also be planned in a manner that maximizes field crew efficiency (Section 3.0). As sample points are visited, the status of each point should be updated within the design management files (Section 4.2) and the updated point status information is used to plan future field trips. At the end of every field season, the status of each point is reviewed for accuracy and the design is updated one final time (Section 4.3).

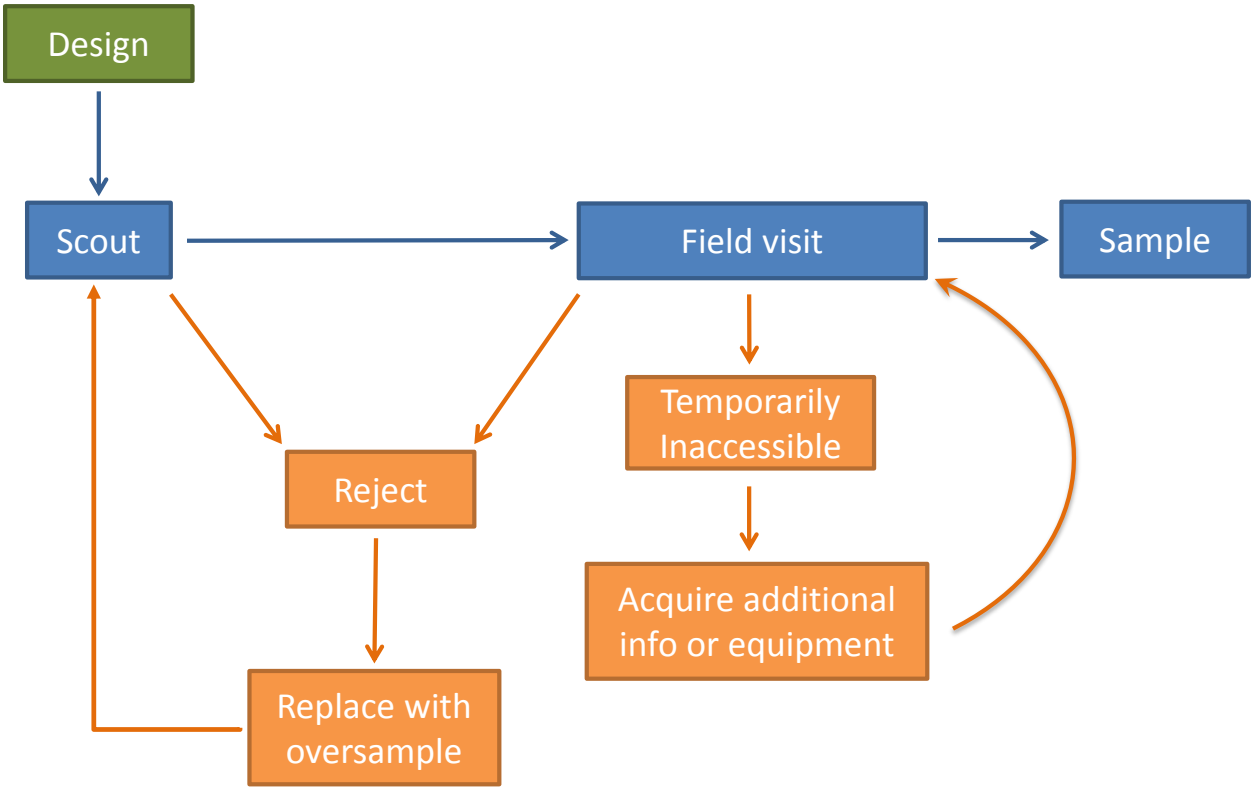

Figure 1. Design management process model showing the iterative process of scouting, rejecting points, replacing rejected points, and sampling. Blue boxes and arrows indicate the ideal scenario where all base sample points are scouted and successfully sampled. However, inevitably some base points will be rejected or at least not sampled on the first attempt. The orange boxes and arrows indicate how to proceed in these situations.

1.1 Understanding Design Files

Key elements to any randomized AIM-NAMF design are described below. Knowledge of these design elements will aid in understanding the design management process and its importance. Each element described here directly corresponds to a column in the design management spreadsheet that was provided to you by the National Aquatic Monitoring Center (NAMC). Descriptions of additional design elements are provided in Table 3.

FID

The FID is associated with the original order that the points were generated in GIS, and can be used to track a given point back to the raw design output for data analysis purposes. FID can be largely ignored for the purposes of scouting and design management and should not be altered.

Order

All points in a design are intended to be sampled in the order in which they appear ***within each stratum*.** However, it is not always logistically practical to *visit* points in order. As a rule of thumb, start by evaluating and sampling the lowest numbered point in your design for each strata. If you skip a point or points (i.e. go out of order), be aware that the field crew must visit the points that were skipped before the end of the field season, or you will risk compromising the spatial balance and statistically validity of your design.

Site Codes

Each point in a design is given a unique identifier called a site code. Site codes are used to track the fate of each point (i.e. was it sampled or rejected) and all data and samples that are associated with that monitoring location. Therefore it is extremely important that site codes are accurately recorded when scouting points in a design or collecting data at the associated location. Always double (or triple) check site codes, especially when they are transcribed or copied.

Randomized site codes consist of a two or three letter prefix that represents the stratum in which the point falls, followed by a two letter code that represents the stream size category associated with the order of the stream, followed by a five digit number that is derived from the master sample point selection tool (e.g. PF-SS-12345). Generally, the portion of the site code that represents the stratum will be associated with the field office in which the point falls (e.g. PF = Price Field Office), but this is not always the case. If a point was sampled prior to the creation of the current design (i.e. it was originally generated for a different design), the first two letters of the code will correspond to the original strata to which the point belonged. For example, points that were sampled as a part of the Western Rivers and Streams Assessment will have site code prefixes associated with the ecoregion in which the point falls (e.g. XE, MP, etc.) Stream order categories are as follows unless stated otherwise: small streams (SS - 1st and 2nd order streams), large streams (LS - 3rd and 4th order streams), and rivers (RV - 5th order and above)[1]. The numeric portion of the code is randomly generated and is only unique to a given design.

Year

Year designations are used to ensure that designs are spatially balanced from year-to-year. When managing a design, make sure to only evaluate and sample points for the current year[2].

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[1] Stream size categories in Alaska may be calculated differently.

[2] At times, it can be appropriate to use points form a different panel, but this should not be done without prior discussion and approval form personnel at the NOC or NAMC.

Base and Oversample Points

Each point in a design is classified as either base or oversample. The number of base points will correspond with the desired sample size for the strata, and base points should be sampled before oversample points because they fall higher (i.e. above) in the sample frame. Ideally, all base points would be successfully sampled and no oversample points would be needed. However, for a variety of reasons, points are frequently rejected or fail (Section 2.3). Oversample points are included in each design to serve as replacements for base points that cannot be sampled. The number of oversample points included in a design will correspond with the point failure rates previously observed within the region for which the design was generated.

Strata and Multi-Density Categories

When a design is stratified, each strata becomes a separate reporting unit. Most AIM-NAMF designs are stratified in some way. For example, the study area for a design might be a BLM district, but the design is stratified by field offices within the district so that inference can be made at the field office scale.

However, to ensure that a sample design proportionally represents the number of kilometers (km) of small streams (SS), large streams (LS), and rivers (RV) within the area of interest, AIM-NAMF sample designs use multi-density categories. Sample sizes within a single multi-density category for a given strata are typically not sufficient for statistical analysis and data from the three categories within a strata are usually combined for analysis. Note that AIM-NAMF designs can be stratified by stream category (SS, LS, RV) if the objectives of the project require reporting on stream size categories separately. This decision should be made during the project planning phase of a project.

Tips for viewing design files:

- DO NOT sort the spreadsheets - many of the cells contain formulas that will cease to function if the spreadsheet is sorted!
- Your spreadsheet should be sorted first by order within each stratum, and second by the Base/Oversample designation. If this is not the case, contact the National Aquatic Monitoring Center for assistance.
- Sample size tables are shown on the top right corner of the Design Management and Scouting tab. If these numbers seem incorrect, revisit your design metadata file to view your desired sample size by stratum.

1.2 Adding Targeted Points

Any good monitoring effort includes a mix of randomly selected and targeted points. Targeted points are sample points that are located in areas of specific management interest or concern. Targeted points may be hand-selected or may be pre-existing monitoring locations at which continued data collection is desired (e.g. MIM, PFC, WRSA, or AIM sampling points not included in your random design). AIM-NAMF project leads are responsible for identifying targeted monitoring locations with the assistance of other resource specialists or ID team members.

Targeted Site Code Generation

Targeted points should be recorded and tracked in your project-specific Design Management Spreadsheet (Section 2.5), in the same fashion as randomly selected points. If the targeted point was hand-selected, you will need a site code for that monitoring location. Targeted site codes are generated and tracked by the National Aquatic Monitoring Center (NAMC). To request targeted site codes, first add the latitude, longitude (in decimal degrees) and stream name (if applicable) of the targeted points to the

project-specific Design Management Spreadsheet. Next, contact NAMC to request that targeted site codes be generated.

Site codes for targeted points will have a similar structure to the site codes for random points. Targeted site codes are assigned in a very similar fashion. The first two letters of the site code will associate the sample location with the project's field office or district, and the second two letters, "TR" will identify the site as targeted. Finally, targeted site codes will conclude with a 4-digit, randomly generated, number (e.g. RA-TR-1023).

Using Oversample and Previously Sampled Points as Targeted Monitoring Locations
Randomly generated oversample points in a new design and previously sampled points from earlier designs (e.g. WRSA) can also be used as targeted points. In the case of newly generated oversample points, you will use the site code for the point as it appears in the design and record that the location was targeted in the 'Scout Comment' column of the Design Management Spreadsheet. Previously sampled points being used as targeted points should be evaluated for merging with newly generated points in the current design (see sections 2.2 and 2.6). If the previously sampled point can be merged to a random point in the current design, than the newly generated site code should be used and the merge should be recorded as such in the Design Management Spreadsheet. If the previously sampled point cannot be merged use the old site code.

2.0 Point Evaluation (Scouting) and Rejection

The scouting process involves examining the landscape surrounding the location of each sample point using maps and aerial imagery to acquire information regarding the field crew's ability to access and sample the point. Scouting is an exercise typically performed in the office environment using GIS, maps and other information sources. During the scouting process you may identify points that cannot be sampled and reject them (Table 1). It is important to clearly document all scouting information because it will affect field crew efficiency, how a design needs to be managed (Section 4.0), and design statistical rigor.

Rejected base points will need to be replaced with oversample points (Section 2.4) that will also need to be scouted. The number of points that are rejected during the scouting process can provide insight on the number of oversample points that might be needed to meet your sample size goals. However, given that oversample points also fail, at times you will need to evaluate multiple oversample points before a replacement can be found.

2.1 Scouting Overview

What is the purpose of scouting?
The purpose of scouting is to determine whether or not a point should or can be visited by the field crew. The scouting process involves determining if each sample point is within the target population, nearby a previously established sampling location, and accessible to field crews. Based on the information obtained during the scouting process, each sample point will be classified as: 1) needing a 'field visit'; 2) needing review to potentially be 'merged' with an existing monitoring point; or 3) rejected because the sample point is inaccessible or not a member of the target population (Table 1).

Which points should be scouted?
The field crew will often not be able to sample all base points and therefore, each design contains several oversample points for each strata that can be used as replacements for rejected base points. To start, all base points and 30-50% of oversample points in each stratum should be scouted. Base points

should be scouted *before* oversample points because oversample points will only be visited and sampled if a base point is rejected. However, most projects will end up using a least a few oversample points, so it is beneficial to scout some oversample points before the start of the field season.

All targeted points should also be scouted to determine if they can be merged with pre-existing monitoring locations or points within a new randomized design (Sections 2.2 and 2.6).

Why is scouting important?
The scouting process is intended to help maximize field crew productivity. The value of this process cannot be underestimated as office scouting reduces the chances of having the field crew attempt to sample non-target, inaccessible, or redundant points. Field crew efficiency and productivity is often directly related to how well the sample points were scouted.

2.2 Merging Points

All randomly selected and targeted points should be screened to determine if they can be merged with pre-existing monitoring locations. Merging points reduce sampling effort redundancy, and will allow the comparison of data collected at different points in time for trend analysis. The merging criteria are thoroughly described in Section 2.6.

2.3 Rejecting Points

Sample points can be rejected for two major reasons: 1) the point is not a member of the target population (i.e., non-target); or 2) the point is inaccessible or cannot be sampled (Table 1). The reason for the differentiation between inaccessible and non-target points is that these two types of points have different impacts on the statistical inferences that can be made from the data. For most AIM-NAMF designs, the target population usually consists of all wadeable perennial rivers and streams on BLM lands (as defined in TR 1735-2) within the intended reporting area(s). See the metadata provided with your design file and the bulleted list below for additional guidance for what is not included in the target population.

On rare occasion, sample points may be rejected because they are too close to other sample points within the same monitoring design. This type of rejection can negatively impact the statistical rigor of the sample design, as the final status of the sample point will be unknown and failing to sample the site will create a hole in the design (Section 2.4).

The reasons that a point can be rejected as non-target include:

- The point is not on BLM land;
- No stream is present, but rather the point falls on a wetland, canal, ditch, or impoundment. Canals and ditches are defined as water conveyance features that run across slopes. Streams which have been heavily channelized should not be confused with canals and ditches;
- There is no evidence that a waterbody or stream channel was ever present at the point;
- The selected sample point falls on a stream that is dry and no evidence of perennial flow exists upstream or downstream of the point (e.g., ~250 m for small and large streams; or
- The selected sample points falls on a stream reach that contains less than 100 m of contiguous BLM land (i.e., the stream reach is too short to sample).

Sample points are rejected as being inaccessible if:

- The point cannot be accessed because of private land ownership;
- The point cannot be accessed because of unsafe terrain; or
- The sample point cannot be safely waded *or* sampled by boat (e.g., a high flow river with class IV and V rapids).

Sample points may be rejected as being too close to another point if:

- The point is in very close proximity to another point within the same design (can be any year)
- The geomorphic setting of the point is similar to the other point that is too close
- Note: points that are very close to a pre-existing monitoring location or a point within a different AIM-NAMF design, should be evaluated against the merge criteria - see section 2.3.

Justifying Point Rejections

Point rejections should always be based on solid lines of evidence, and the lines of evidence used to reject a point should be documented in the design management spreadsheet. Most point rejections can be confirmed from just one source of information however, office-based point rejections due to intermittent or ephemeral flow should always be based on two lines of evidence and documented in the 'Reject Evidence 1' and 'Reject Evidence 2' columns of the spreadsheet (e.g., aerial imagery and local knowledge indicate that the sample point is dry). Gathering two lines of evidence regarding flow permanence from the office may not always be possible and, in this case, the point should be visited by the scout or the field crew to confirm whether or not perennial flow is present. **Note: Any field-based rejections MUST be documented in the data collection app (i.e. SARAH) and with photographic evidence!**

Table 1. Reasons for which aquatic AIM points were rejected or not sampled and respective status categories for unsampled points (i.e. revisit, permanently inaccessible, non-target).

Point Status	Reason not sampled	Description
Revisit	Different route or permission needed	The crew was unable to gain access to the point, but could gain access at a later date with landowner permission or by taking a different route.
	Not-wadeable	The water is too deep or swift to wade. Specify if the reach: 1) could be sampled when the water recedes, or 2) must be sampled by boat because the water will *always* be too high for wading. If it can't be sampled by boat, see Not-wadeable/Not-boatable below.
	Other	The crew started to access or sample but ran out of time; the crew was turned back by inclement weather; the point will require a backpacking crew, more capable truck, or ATV because it is remotely located or access road is too rugged; or various reasons not listed above, including illegal activities or active wildfire in the vicinity of the stream.
Permanently Inaccessible	Access denied private	This point can only be accessed by crossing private land and landowner permission was explicitly denied.
	Access denied terrain	All possible routes were attempted, but natural barriers such as cliffs, slopes over 50%, waterfalls, extremely dense vegetation, or beaver complexes prevented access.

	Not-wadeable/Not-Boatable	This point will *always* be unsafe to wade or boat. Examples include reaches with long segments of class V whitewater, and very steep creeks in highly constrained gorges.
Non-Target	Dry	The stream was determined to be dry (<5 main transects with water) either by field visit, or by two lines of evidence reviewed during office point evaluation. Specify if the reach was ***intermittent*** or ***ephemeral*** using the definitions of intermittent and ephemeral streams provided in Appendix A (pg. 97). Provide detailed notes if dry due to irrigation withdrawal.
	Lentic	The stream is a wetland, pond, or is otherwise impounded and no defined channel is present. Do not use this classification for lotic points inaccessible due beaver ponds.
	Map error	There is no evidence that a waterbody or stream channel exists, the stream is actually an artificial channel such as a diversion ditch, or the reach is not on BLM land.
	Reach too short	The sample points falls on a stream reach that contains less than 100 m of contiguous BLM land.

When to revisit points instead of rejecting:

If the crew was unable to gain access or sample a point, the point should be further evaluated to determine is a re-visit is necessary. Do not jeopardize sampling higher priority points to re-visit a point. In general a revisit should be scheduled if:

- The crew simply needed more time to successfully sample to point
- Additional information was obtained and has increased the probability of successfully accessing and/or sampling the point.
- The crew would be able to collect at least 50% of the data, the reach is NOT highly variable, and partial data collection will sufficiently capture this variability. However, partial data collection should only be used if all other options to collect a full sample have been exhausted and the point would otherwise be classified as 'permanently inaccessible' (Section 4.1).
- This specific crew was not adequately equipped to or capable of sampling the point, but the point could be sampled given access to additional equipment (e.g. backpacking or boating gear) or by another crew (consult NAMC for assistance). In some cases, a stronger or larger crew may be required. You may need to hire a stronger crew in the following year or get assistance from a different crew.

2.4 Replacing Rejected Points

If a point (base or oversample) is rejected as *inaccessible* or *non-target*, replace it with the first oversample point within a given stratum (lowest FID) to achieve your desired sample size. Oversample points should always be evaluated and used in order. Skipping points creates 'holes' in the sample design, and should always be avoided.

You will need to iteratively assess how many oversample points are needed because points are also rejected throughout the field season.

Holes in the Design

'Inaccessible' or 'unknown' points (points that were not visited and you know nothing about) that fall between 'sampled' points are considered 'holes' in the sample design (see example in Table 1). These 'holes' can have a negative effect on your data analysis by creating bias in condition determination

estimates.

Some 'holes' are inevitable due to denied access through private property or unsafe access or sampling conditions. Depending on the desired sample size, one or two 'holes' in a sample design are generally acceptable. However, if too many points are classified as 'inaccessible' or 'unknown' (e.g. 50% of points), a systematic bias may be created. For example, points 'inaccessible' due to cliffs may be very remote with little anthropogenic effects. Therefore, condition estimates for the entire target population may be poorer than they are in reality if these 'inaccessible' points are not sampled. Additionally, when there are many holes in a design, the 'sampled' points may not be equally distributed across the landscape. This scenario may cause certain region(s) of the landscape to be over or under-sampled and therefore not equally represented in statistical analyses of the data.

When actively managing a design during the period of implementation it can be difficult to determine how many resources should be used to successfully sample a point because the number of 'holes' that a design will eventually have is unknown. As designs progress, the importance of putting extra effort into accessing very remote points, or those with otherwise difficult access issues, will become more obvious. The number if holes within a design should be assessed periodically throughout implementation and discussed with staff at NAMC or the NOC. In the end, designs need to meet their original sample sizes and should have 30% or less of their points classified as holes for each stratum.

Example

In the example design stratum below (*Table 2*), the desired sample size is seven. The first three points were sampled but the point XX-SS-1046 was rejected as non-target and needed to be replaced. The first possible replacement within the oversample was point XX-SS-1057, which also turned out to be non-target. Next, point XX-SS-1063 was evaluated to replace XX-SS-1046 and was sampled. The next point that were evaluated were XX-SS-1048, 1052, and 1055, two of which were sampled and one of which was rejected as inaccessible and needed to be replaced. The next available oversample point was XX-SS-1066, which was also inaccessible. The next point that should have been evaluated was XX-SS-1071 which was skipped for some unknown reason, thereby creating another hole. While the sample size (n=7) was finally met when XX-SS-1079 was sampled, the person managing the sample design inadvertently created another hole in their design by skipping point XX-SS-1071. This mistake will have a negative consequence on the statistical rigor of the design, especially since more than 30% of the points are classified as holes.

Table 2. Example design at the end of a study illustrating how to replace failed points with oversample points and the concept of 'holes'. In this example, the desired sample size for the stratum XX-SS is seven. There are two non-target points (not holes), two inaccessible points and one unknown point which combined creates a total of 3 holes. Note that the sample size was met when XX-SS-1071 was sampled, and only inaccessible and unknown points above that point (XX-SS-1052, 1066, 1071) are counted as holes. Therefore, XX-SS-1084 is not counted as a hole because it was not needed to meet the sample size.

Site code	Base_Oversample	Final Status	Design consequence
XX-SS-1000	Base	Sampled	Used in analysis
XX-SS-1020	Base	Sampled	Used in analysis
XX-SS-1035	Base	Sampled	Used in analysis
XX-SS-1046	Base	Non-target	Not a hole, replace with oversample
XX-SS-1048	Base	Sampled	Used in analysis

XX-SS-1052	Base	Inaccessible	HOLE, replace with oversample
XX-SS-1055	Base	Sampled	Used in analysis
XX-SS-1057	Oversample	Non-target	Not a hole; continue down in oversample to find replacement for XX-SS-1046
XX-SS-1063	Oversample	Sampled	Used to replace XX-SS-1046; point used in analysis
XX-SS-1066	Oversample	Inaccessible	HOLE; continue down in oversample to find replacement for XX-SS-1052
XX-SS-1071	Oversample	Unknown	HOLE
XX-SS-1079	Oversample	Sampled	Used to replace XX-SS-1052
XX-SS-1084	Oversample	Not needed	Sample size met ; point not needed

2.5 Tools, Files, and Sources of Information to Use for Scouting

Design Management Spreadsheet

One of the most important files you will use when scouting is the 'AIM-NAMF Design Management File'. Each project lead will receive a design-specific version of this file after the design process is complete, which is typically in late winter or early spring. The file will have several columns that are populated with data associated with each point and the design (e.g. latitude, longitude, strata, etc.). Several other columns will have been left blank for the person responsible for scouting to use for documenting scouting information (Table 3). Descriptions of how to use the blank columns in the design management spreadsheet are provided throughout this document

Note: The data in the pre-populated columns should not be altered in any way, and extreme caution should be use when sorting the design management spreadsheet. The use of data filters is always recommended over sorting.

Geospatial Files and Tools

The primary tools used for scouting are GIS, Google Earth, and knowledge of field office resource specialists. When looking at points in GIS, be sure to use the following projection: USGS version of the USA Contiguous Albers Equal Area Conic. GIS point files can be easily converted to a KMZ for viewing in Google Earth. Google Earth can be a very useful tool for identifying the locations of gates, potential access routes, and topographic barriers. Note that the imagery in Google Earth is often down-scaled in locations with significant topographic relief to avoid distortions in the imagery. When imagery has been down-scaled, terrain that is very steep may appear to have less relief. In these cases, it can be helpful to consult topographic maps to get a sense of how steep the terrain may actually be.

Geospatial files used to view and scout sampling points during the scouting process include:

- A GIS layer of sample point locations for the current year's panel (provided by NAMC)
- A GIS layer of all previously sampled AIM-NAMF points (provided by NAMC)
- GIS layers of other existing sample points within the study area that can be used to identify potential overlap between AIM points and other existing sample points (e.g. MIM, PFC).
- Scouting guidance: description of and guidance for completing the scouting processing (this document)
- GIS land ownership and management layers that can be used to identify the proximity of private land to each point and help determine access options
- Topographic base maps

Additional Sources of Information:

- aerial imagery
- flow gaging stations
- field office resource specialists
- field visits to points
- private landowners
- permittees
- previously collected assessment or monitoring data

2.6 Step-by-Step Instructions on the Scouting Process

Once you have all necessary tools and files close at hand, the scouting process can begin. There are 4 steps in the scouting process: 1) Determine if a point falls within close proximity to an existing monitoring location and should be merged with an existing sample point (e.g., PFC, MIM, or WRSA sample points), 2) determine whether a field visit is needed and how the point should be accessed, 3) Plan an access route to the sample point; and 3) document the information acquired during the scouting process.

Note: Throughout this section, we reference scouting each sample point, but the process of doing so should involve scouting potential access routes as well as the areas up and downstream of the sample point, since sample reaches extend a minimum of 75 m upstream and downstream of each sample point.

Step 1. Screen sample points to determine if they can be merged with existing sampling points

If they meet the criteria outlined below, randomly selected and targeted AIM-NAMF points can occasionally be merged with existing monitoring locations on the same stream that have been previously established by the BLM or other agency (e.g. WRSA, MIM, state sample point). In such instances, the location of the new sample point is moved to the location of the existing monitoring location to ensure spatial compatibility of monitoring data and reduce redundancy.

Process:

A. Assess the potential for 'merging' sample points, by examining the location of points in the AIM-NAMF design in relationship to pre-existing monitoring locations on the same stream.
    1. Points that fall in very close proximity to an existing sample location can be considered for merging - see below for the criteria.
    2. Note that points within the same design cannot be merged! If two points within the same design are very close to each other, one of the two points could potentially be dropped, but there will be negative consequences on the design (see Section 2.4).

B. After identifying points that can potentially be merged, determine if the criteria outline below can be met. Note that *all* criteria must be met to justify a point merge, and the decision to merge should be communicated to and verified with NAMC.

    1. The random sample point must be within the following distance of an existing monitoring location by stream size:
        i. Small streams (1st and 2nd order): 500 m
        ii. Large streams (3rd and 4th order): 1000 m
        iii. Rivers (5th+ order): 2000 m

2. If the sample point meets the distance criteria, the two points can be merged if the following three additional criteria can be met:
    i. No geomorphic differences exist between the two sample points. Specifically, determine if valley confinement and the subsequent extent of the floodplain area and vegetation type appear similar between the two sample points.

    ii. No perennial or intermittent tributaries enter between the two sample points.

    iii. No management changes exist between the two sample points. Specifically, determine if fence lines, changes in land ownership, or other land-use activities differ between points. Note that the knowledge of local resource specialists can be helpful when determining if differences in management exist.

C. If the above criteria are met, select 'merge' in the 'Scout Status' column of the design management spreadsheet, and <u>record the Site Code and GPS coordinates of the existing location to which the point will be merged in the 'Scout Comment' column</u>.

D. If the point cannot be merged, no action is required and you can move on the step 2.
    1. If a previously sampled location is included in your sample design, either as a random or targeted point, and the point cannot be merged with a randomly selected point in your design use the original site code.

<u>Step 2: Determine if a field visit is needed or possible</u>

Points that are possibly within the target population (e.g., perennial stream on BLM land within your reporting unit) receive a field visit. If a point is not within the target population (e.g. non-target-dry) or deemed to be permanently inaccessible (i.e. the point cannot be accessed due to private property or unnavigable terrain) then it is rejected (see Section 2.3 for rejection criteria). If a point is rejected during this step, fill in the point status and the corresponding rejection reason in the 'Scout Status' column of your design management spreadsheet. All possible rejection reasons are outlined in Table 1.

Process:

A. Examine the location of the point in Google Earth, GIS, and/or on a topographic map and try to determine the following:
    1. Does the point fall on or near an actual stream?
    2. Is the system likely to be perennial?
        i. If the point falls on a system that might not be perennial, the point is potentially a candidate for a non-target rejection. The next step is to look for a second source of information (e.g. local knowledge) that confirms or denies the observation.
    3. Is there a specific time of year that this point should be sampled based on when the stream might be influenced by runoff, weather, dam operations or irrigation withdrawals and returns?

B. Examine the location of the point in Google Earth, GIS, and/or on a topographic map to gain an understanding of potential access routes and the terrain both surrounding the point and along the proposed access route. In doing so, document answers to the following questions:

1. What are the driving directions to the access point and what will the road conditions be like? Provide multiple suggestions when possible.
2. How long (in miles) is the hike from the access point to the sample point?
3. How difficult is the hike (easy/moderate/hard/very difficult)?
4. Are there unique challenges that might affect access (e.g., cliff bands or private land to navigate around)?
5. Are there any specific access directions (e.g. access directly from the North and pick your way between the cliff bands) that need to be provided to the crew?

C. Examine the location of the point in relation to public and private land and determine if you need permission to cross private land to access the point. If so, research and document the answers to the following questions:
    1. Where is the private land in relation to the point (e.g. upstream, East, etc.)?
    2. Have you made arrangements to access the point? If, not what are the next steps toward arranging access?
    3. Who is the point of contact?
    4. How should the person be contacted?
    5. What are the access stipulations/directions from the landowner?

Record the outcome of this process using the drop down menu in the 'Scout Status' column of the design tracking spreadsheet. If a point visit is necessary and possible, select 'Field Visit' and record pertinent information in the in the 'Scout Comment' column. If a field visit is warranted, but the sample point will require a specialized field crew (e.g., backpacking because of long hike [i.e., 5 miles or more] boating because the system is not wadeable), note this in the 'Scout Comment' column. If the point was rejected (Section 2.3, Table 1), record the reason for rejection in the 'Scout Status' column.

Step 3: Document your scouting results

Scouting information needs to be tracked in the design management spreadsheet so that the information can be used to manage the design (Section 4.0).

Scouting information can also be tracked by creating separate documents, where all the detailed instructions for accessing points can be clearly spelled out. Often this level of documentation is unnecessary, however, this approach can be valuable when the person doing the scouting is not a member of the field crew, as it can aid in clearly conveying scouting information to the crew. If this approach is used, be sure to include both the Site Code and stream name with the scouting information.

Table 3. Column descriptions for AIM-NAMF design management spreadsheets. Shaded columns are pre-populated with design information, white fields with plain text are filled in by the person doing the scouting, and white fields with italicized text are auto-populated from the Field Tracking Spreadsheet that field crews complete after sampling trips. Final Status (in bold) is filled in by the project lead through and at the end of the field season.

Column Name	Description	Use
Site Code	Unique identifier for each point in a design.	Tracking all data associated with a point. Always record Site Codes exactly as presented in the design spreadsheet.
Stream Name	NHD designated stream or river name	Navigating to and communicating about the location of the sample point

Latitude	X-coordinate of stream/river sample point (USGS Albers projection; projection information is provided in the design metadata file)	Plotting and navigating to the sample point
Longitude	Y-coordinate of stream/river sample point (USGS Albers projection; projection information is provided in the design metadata file)	Plotting and navigating to the sample point
Field Office	Field office boundaries within which the point falls	Identifying the geographic location of the sample point
Year	Year assigned for sampling, if applicable	Ensure spatial balance of sampling efforts between or among years
Strata	Stratum in which the point falls	Similar to the Site Code. Strata corresponds to reporting unit and stream size
Base_Over	Identifies if a point is base or oversample (a designation related to where the point falls within the sample frame - see Section 1.1)	Identifying which points to sample first, and design management
Scout Name	Person doing the scouting	Follow up on scouting information
Scout Date	Date scouting was completed	Tracking when scouting was completed
Scout Status	Scouting outcome: 'field visit', 'merge' or one of several rejections categories (Section 2.0, Table 1)	Hitch planning and design management
Scout Comment	Brief description of scouting knowledge; Site Codes and GPS coordinates of existing points to be merged with random points.	Hitch planning, tracking info on merged points
Scout_RejectEvidence1	Brief description of the primary source of evidence that was used to reject a point	Tracking reasons for failure
Scout_RejectEvidence2	Brief description of the second line of evidence to reject a point - only applies to dry, intermittent, or ephemeral points	Double checking that a point truly falls on a dry, intermittent, or ephemeral channel; or that multiple landowner access requests have been made
Visit Date	The most recent date that the crew visited, or attempted to visit, the point	Tracking data and samples, or determining if another field visit attempt should be made
Field Status	Whether or not the point was sampled. If the point was rejected, the reason for rejection is documented here (Section 2.3). This field is populated with a drop-down list of options.	Trip planning and design management
Final Status	The final status of a point, as approved by the project lead. Note that all Scout and Field status categories get rolled up into one of 5 possible outcomes (Section 4.1).	Design management, statistical analysis, permanent storage of design information

3.0 Trip Planning

Field trip planning is a process that begins prior to the start of the field season and continues through the field season. In the beginning of the season, trip planning can begin once all base points and 30-50% of oversample points in each stratum have been office scouted. After the start of the field season, planning a trip can begin after the status of each recently visited point has been updated in the field tracking and design management spreadsheets.

Trips are typically planned by selecting groups of base and needed oversample points (i.e. those that will be used to replace rejected base points) that are spatially close together. However, point proximity is

not the only factor that should be considered when planning trips. Care should be taken to ensure that priority is given to visiting points that fall higher in the sample frame and that points in each stratum are being visited. Such considerations become increasingly more important as the field season progresses, which is why sample designs need to be actively managed throughout the field season. When selecting points for trips, keep the following in mind:

Base points - may be visited in any order as long as you are confident that you will sample all base points within the stratum by the end of the field season. Whenever possible, base points should be prioritized before oversample points, unless you ***know*** the oversample point is needed to replace a based point that was rejected (Section 2.4).

Oversample points - can be visited before base points if you are confident that you will sample ALL base and replacement oversample points within a stratum prior to the oversample point in question by the end of the design.

Note: If there are oversample points that you *might* need, that are near base points that you plan to sample on a given trip, and it would be difficult or resource intensive to visit these oversample points at a later date, it may be advantageous to plan the trip so that both the base and oversample points are visited. **HOWEVER, determining how many oversample points you will need or how many you will have resources to sample can be a challenging guessing game. Therefore, the first trips should just consist of base points until you have a better idea of how many points are being rejected.**

Step 1. Select groups of points that are spatially close together

The number of points that should be selected for each sampling trip will depend on the length of trip, the distance between points, the difficulty of point access, and the likelihood of point failure. If the points are within 1-2 hours drive of each other, and the hike to each point is relatively short (less than about 2 miles each way), crews can typically sample one point per day. If drive time and hike distances are longer, more time will need to be budgeted per point.

NAMC strongly recommends adding several extra points to every trip, so that the crew has 'backup' options in the event that points are rejected or temporarily inaccessible. To determine how many backup points are necessary, try to gage the likelihood of rejection for each point scheduled on the trip. It is always better to over-prepare the crew, than to have them call the office mid-trip looking for more work.

Step 2. Review the scouting information to determine if additional information or contacts are needed

Each trip should be planned at least a week in advance to allow adequate time to contact private land owners, field office personnel, and other agency staff regarding access. Additionally, as the season progresses you may need to revisit points that have been attempted but not successfully sampled. Information gathered during previous attempts should be reviewed by the crew, so that they can determine what might need to be done differently (e.g. try a different access route) to successfully access and sample the point.

Step 3. Review driving directions, access instructions, and maps

Review the driving and access route on your gazetteer, and georeferenced maps (provided by NAMC) to determine if supplemental maps are needed or if the extent of any of the maps needs to be changed. In some cases, acquiring BLM surface management maps or topographic quad maps will be necessary to ensure that the crew is able to navigate to and access the point.

When reviewing maps, pay particular attention to areas of steep terrain or valley confinement that could prohibit access. If terrain impediments are identified, consider all other potential access routes, even if using such routes will require a longer hike.

Step 4. Create a list of points to visit on the field trip

After reviewing all available information for each point in the area, plan the trip by creating a list of points that the crew should or could visit on their field trip, including backup points. This will help the crew be as efficient as possible while in the field. After developing the list of points to be visited, make sure the crew clearly understands any special access instructions for each point in the list before leaving the field office.

To help facilitate this process, a 'Trip Planning & Field Tracking' spreadsheet has been included as a part of the design management file. This spreadsheet is formatted with a drop-down menu of Site Codes. When a Site Code is selected, the stream name, latitude, longitude, and Scout Comment field will auto-populate. A 'Planning Notes' field has also been provided as a place to provide additional instructions.

Tips for trip planning:

- Schedule difficult points for the beginning of the field trip because the crew will have more time and energy to sample.
- Whenever possible, plan to visit a point that is easy to access at the end of the trip in case the crew is running short on time and energy.
- Color coding base and oversample points within the design management file can help avoid errors associated with sampling an oversample point that is not needed.

4.0 Managing Sample Designs

Sample design management is an iterative process that takes place throughout the field season. Following any scouting activities and every time the crew comes in from the field, the design management file needs to be updated to reflect which points were rejected, sampled, or need to be (re)scheduled for a field visit. Additionally, rejected points need to be replaced with oversample points and field trips need to be planned in a manner that ensures that the crew will visit enough points within each strata to satisfy the sample sizes for the current year's panel.

4.1 Point Status

To allow for proper statistical analysis of AIM data, the fate of each point within a design (i.e. was the point sampled, rejected, etc.) needs to be documented. Each point in a design will be assigned what is called a 'Point Status' regardless of whether or not they were visited. For consistency across projects, all AIM-NAMF points need to eventually be assigned one of the following five point status categories (see Table 1 for a list of reasons that a point can be rejected for being non-target or inaccessible):

1. **Sampled**
   When a point is sampled, it is considered member of the target population and the data is used for analysis and reporting.

2. **Non-Target**
   The point was not sampled because the selected reach location was ephemeral, lentic, a map error, etc., and therefore not considered a part of the target population (Table 1). The target population for most AIM-NAMF designs consists of all perennial streams within the desired

reporting unit. Non-target points are removed from the design and not considered in analysis.

3. **Permanently Inaccessible**
   The point was not sampled because of terrain barriers, or landowner access issues. **The decision to classify a point as permanently inaccessible should not be taken lightly, as omitting such a point can create a 'hole' or a gap in the design if that point falls prior to the last sampled point within a stratum, and thus reducing the design's statistical rigor.**

   The following circumstances are considered justifiable reasons for classifying a point as permanently inaccessible:
   - The only access point was on private land and access was explicitly denied by the landowner.
   - Access to the point is restricted due to natural terrain barriers such as cliffs, class V rapids, waterfalls, or the reach cannot ever be safely accessed and sampled.
   - The point is located in an extremely remote location and would take more than 3 days to access and sample.

   Note: Field crews are encouraged to hike up to 4 or 5 miles to access point, and some crews might need to access and sample points via an overnight backpack or raft-based sampling trip. The National Aquatic Monitoring Center (NAMC) can provide additional support for backpacking and raft-based sampling trips, please contact NAMC for more information.

4. **Unknown**
   Unknown points are those that were skipped in the sample design (i.e. 'holes) and that fall prior to your last sampled point within a stratum (i.e. have a *lower* FID number). Unknown points cannot be rejected because they were not evaluated.

   Unknown points will have a negative effect on the statistical rigor of the sample design and efforts should be taken to avoid having points with an Unknown status.

5. **Not Needed**
   These points are not needed to meet your desired sample size. These points will typically be oversample points and fall after (i.e. have a *higher* FID number) your last sampled point. Not needed points are not considered in analysis.

Ideally at the end of the study, no sample points classified as *inaccessible* or *unknown* (i.e. holes) would fall between *sampled* points.

4.2 Updating Design Files Following Field Trips

When the crew returns from a field trip, they are responsible for updating the status of each point that they visited or attempted to visit in the 'Field Tracking' spreadsheet of the design management file. At a minimum, the crew needs to provide the date that the point was visited, the 'Field Status' of the point (i.e. was the point sampled or rejected) and any relevant comments about the point (e.g. "water was too high due to snowmelt runoff, revisit later in the season").

The 'Field Status' assigned by the crew is automatically brought into the design managing spreadsheet, and should be approved by the project lead. If the project lead approves the field status, they should record that approval by selecting a 'Final Status' in the design management spreadsheet. If, for instance, the crew identified a point as being permanently inaccessible but the project lead does not approve that

field status because they have identified another possible access route, then the 'Final Status' should be left blank until the point can be evaluated further.

4.3 Reconciling Designs at the End of the Field Season

At the end of each field season, the design management file needs to be reconciled such that every point in the design is assigned a final 'Point Status' (Section 4.1). An exception to this rule is made if there are 'unknown' points within a design that will be implemented for another year(s) before completion. In this case, the 'Final Status' of such points can remain blank in the design management file, and those points can be visited in the following field season. However, any points that have an 'Unknown' of 'Inaccessible' 'Final Status' at the end of a design can have negative consequences on the design.

General Guidance Regarding Holes:

Manage the design such that each stratum has fewer than 30% holes. If you find that you have more than 30% holes, carefully review all 'inaccessible' points to determine which points might be feasible to sample. If possible, revisit and sample some of these points. If this is not possible, determine if NAMC can offer sampling assistance or consider increasing your sample size in this stratum to reduce the ratio of 'holes' to sampled points.