Comments on Field Blank & Duplicate Frequencies
(Responses to Question #4 in MM’s 11/14/12 email)

1. Ken Hyer (Va USGS)

“Increase the number of QA samples in the table - for example, a 9 station network (that's 180 samples annually) need only collect 10 QA samples per year (4 ~~replicates~~ blanks and 6 duplicates - or only 5% QA)

“We collect 2 replicates and 1 blank at each site each year - because each site requires the collection of 20 samples annually, that's a total of 15% QA, with 10% directed towards replicates and 5% directed towards blanks.

“Also, for nutrients and sediments, I tend to feel that the duplicates provide more QA information than the blanks, so we weight our collection towards replicates.  If we were working with ppb level metals or low-level organics, I would favor the blanks equally or more, but since we're not working with low-level constituents with common contamination issues, I'd collect more replicates than blanks, and I'd increase the numbers provided in the table. “

MK: Agree with Ken in general; however, we must balance the above given the following:

(a) Whereas those operating 10 or less NTN sites per year could find QC sample and data collection are not difficult to work into their NTN data collection, those operating 15 to 20 total NTN stations per at the suggested percentages be taking QC samples at a frequency that actually could limit their ability to collect WQ samples, particularly for storm impacted events. For example 5% percent FBs for 20 stations would be 12 FBs or 1 per month; but 10% DS samples would require 24 DS. If half the DS samples are to be storm impacted, and we evenly distribute their collection, that would require 1 storm sample per month. That’s not likely possible to obtain for it would imply sampling 12 different storm or storm impacted events – one per month. In reality the only way to achieve those numbers would be at times to collect duplicate samples at two different stations for the same event. That would cut into collecting storm or storm impacted samples at other stations.

(b) Associated with all this QC will be increased resource requirements not just in personnel and time to collect these samples if they haven’t been collected before, but also to obtain, evaluate, and provide the QC WQ and associated metadata.

(c) Finally, whether or not it remains that sample contamination is not an issue; whereas precision is, and therefore fewer FBs are needed compared to DS, may not be the case once we start getting FB data below but near the WQP RLs. We may find a persistent low to moderate level bias exists in selected WQP data at or near the RLs. If that is the case, and say the problem is in readily bioavailable N and P nutrients (PO4F, HPO4F, NH4F, and or NO23F) we may find FBs are as important as DS.

Given all the above I made some revisions to the frequency of FB and DS collection that more align with Ken’s wishes. But did not stick with strict percentages he suggests. For those sampling at only a few stations we need a minimum greater than 5% for FBs; at the other end of the spectrum we capped the FBs at 12 per year and one per month; and the DS at 18 per year or 3 per every two months.

Bill Romano (MDNR) – Questions:

* 1. How will the station location, month, and river level affect a DI field blank? You are just pouring DI water from a bottle into a bunch of field equipment.  That should have no affect on what is in the DI water.  Am I completely missing something?

MK: The collection of FBs should reflect the environmental conditions under which samples are collected. **Ideally** it also should reflect variations in sample collection as under those varying environmental conditions as well. It could if FB samples would be collected by setting the total volume of blank water that ended up in the churn to a fixed volume. The latter would be obtained by determining the number of sample verticals that were going to be needed at the FB volume in the churn would then be obtained by taking the total volume needed in the churn dividing it by the number of sample vertical to determine the amount of water one would put in the sampler to be used, which would then be transferred to the churn, and this process repeated until the total volume of blank water needed in the churn was obtained. The above process under environmental conditions at the site, which could be windy, rainy, dusty, snowy, sleeting, as well as nice and sunny, would provide a realistic indication of whether or not samples are undergoing contamination during sample collection, and from there of sample processing, preservation, shipping, and during analysis by the lab. If one collected a couple dozen FBs in accordance with the above over several years, and we looked at below as well as above the RL data, one would have a pretty clear picture of whether or not there was a routine, occasional, or highly infrequent bias problem. Unfortunately, it generally takes a serious contamination problem before most folks are willing to perform the above.

* 1. Algorithm for selecting randomized sites that are stratified by flow conditions?

MK: One provided in next revision.

* 1. Will there be additional money to pay for processing duplicate and field blank sediment samples?

MK: If the NTN Workgroup defines them as WQPs to be covered, then I expect that if their inclusion results in increased costs, those costs will have to be included in the grant requests. The issue of what WQPs should be covered by FBs and DSs and whether or not this should be similar for both types of QC samples needs to be fully discussed by the NTN Workgroup. It has been a challenge to get them to fully and really discuss it.

1. Michelle Titman (VDEQ-VRO) – Cindy said other regions expected to respond similarly.

“They have us doing more blanks than duplicates.  It would be much easier for scheduling if these numbers were the same.  That way you are doing blanks and duplicates on the same station.  In VRO we are already following their procedures for blanks.”

MK: Agree, from a field logistics standpoint this would certainly be ideal. However, there is some evidence that FBs are not needed to the extent DS are needed. See Ken Hyer’s comments. Until we get two to three years of data and can analyze the o for we really don’t have the full extent of the data needed to assess what the best frequency of data collection would be in terms of FBs versus DSs.

1. Molly Pucket (PADEP)

“In our quality assurance plans for water chemistry sampling, we collect 1 duplicate and 1 blank water sample at a frequency of one in 20 or at least once on each survey, if fewer than 20 samples are collected.”

MK: I don’t quite know how to interpret the above. What does on each survey mean? If PADEP minimally collects 1 FB and 1 DS at each NTN Station at which they sample each WY, they have 6 NTN Stations in WY2012, and thus would minimally collect a total of 6 FBs and 6 DS. They could meet the proposed FB guidance and distribute their collection across all six of their sites and collect one FB every two months. However they fall short by half on DSs. They’d need to collect 1 DS per moth and hit every NTN Station twice during the WY.

**Based on these comments, the proposed numbers of blanks and duplicates are revised in the tables below. The intent of the revisions is to:**

a) Lessen the *current* requirements for collection groups with 1-5 stations, with blanks and duplicates having the same minimum frequencies.

b) Change the *proposed* number of **blanks** to 1 per station per year for collection groups sampling 6 or more stations. This would reduce the number of blanks currently required if sampling 6-11 stations, but increases the number if more than 12 stations. (Alternatively we could cap it at a frequency of 1/month.)

c) Change the *proposed* number of **duplicates** to 2 per station per year for collection groups sampling 6 or more stations. This would increase the number of duplicates currently required if ≥ 12 stations. **Field Blanks:** Revised Proposal for Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Stations per Collection Group  | Samples/WY | Blanks /WY | Proposed Distribution | Currently |
| 1-2 | 20-40 | Minimum 4 | Quarterly | 1/month |
| 3-5 | 60-100 | Minimum 6 | Every other month (minimum) |
| ≥ 6 | ≥ 120 | Minimum 1 per station/yr., maximum of 12 per year | Every other month (minimum) to monthly |

**Field Duplicates:** Revised Proposal for Frequency

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Stations per Collection Group | Samples/WY | Duplicates/ WY | Distribution | Currently |
| 1-2 | 20-40 | Minimum 4 | Quarterly | 1/month, or 1/20 samples |
| 3-5 | 60-100 | Minimum 6-10 | Every other month (minimum) |
| ≥ 6 | ≥ 120 | Minimum 2 per station/yr., maximum of 18 per year | Monthly, with 2 every other month |

**Randomly Select Stations, Temporal Distribution, and Event Types for Field Blanks**

**(Repeat process below for Duplicate Samples)**

For each Agency x Source Group for which your agency is the Source (see Landscape Table p. table below)

* Place individual markers for all Stations in that group in a bag;
* Use Field Blank Frequency Table and number of NTN stations in that group determine the number of FBs your agency will collect for that Group; sequentially select that number of markers from all the markers in the bag without replacement; and write down the order in which station markers are withdrawn from the bag as that will be order they are distributed through time for WY (if you have fewer Stations than the number of FBs needed, after you withdraw the last marker toss all markers back in bag and repeat the above process until you have the required number of FBs;
* For the first Station marker withdrawn, flip a coin to determine whether FB will be collected for either a nonstorm impacted event type or storm or storm impacted event type; and on basis of result, assign every other Station Marker in the order they were withdrawn that event type. The remaining unassigned Station Markers will all be the other event type.
* If more than one Agency is collecting data at a Station, FB collection is logically distributed among the Agencies dependent upon the FB Event Types (e.g., USGSVAWSC collects SI FBs) and or Time Periods they collect (e.g., NYSDEC and SRBC).
* Two examples:

**Example One for WY2013 (Assume everything is same as for WY2012)**

**From Group Table:** DEDNREC x DEDNREC x Primary x [304191, 302031]

**From FB Table**: DEDNREC needs 4 FBs, one per quarter

**Random selection from bag:** 302031 30419; placed **markers back in bag and repeated**

**selection** process: 304191 302031;

**Random selection of 1st Qtr FB event type:** NSI Event type, assigned 3rd qtr same Event\_Type and 2nd and 4th qtrs. SI event types

Summary Table

|  |
| --- |
| DEDNREC x DEDNREC x Primary x Stations (2) |
| Selection Seq. No.  | Station ID | Time of collection | Event\_ Type |
| 1 | 302031 | 1st Quarter  | NSI |
| 2 | 304191 | 2nd Quarter | SI |
| 3 | 304191 | 3rd Quarter | NSI |
| 4 | 302031 | 4th Quarter | SI |

**Approach:** DEDNREC will collect 1st FB for NSI and designated Station and at any monthly fixed interval sampling event in 1st quarter; collect a 2nd FB for SI event and designated Station any time during second quarter; collect a 3rd FB for NSI at designated Station and any monthly fixed interval sampling event in 3rd quarter; and collect a 4th FB for SI event at designated Station anytime during the 4th quarter of WY.

2nd Example:

**Example Two for WY2013 [Assume everything same as WY2012]**

**From Group Table:** PADEP x SRBC x Primary x [21 Stations]

**From FB Table:** DEDNREC needs 12 FBs, one per month in WY

**Random process**: Randomly selected 12 markers without replacement sequentially from bag containing 21 Station markers; on basis sequential order withdrawn, assigned month of collection; on basis of coin flip for 1st station, got SI Event\_Type and assigned 1st, 3rd, 5th, … odd sequence numbers this Event\_Type and all even selection sequence numbers an NSI Event Type.

**Summary Table**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Selection Seq. No.  | Station ID | Time of collection | Event\_Type | Quarter of Water Year |
| 1 | WQN0305\* | Oct  | SI |   |
| 2 | WQN0201\* | Nov | NSI | 1st |
| 3 | WQN0401\* | Dec | SI |   |
| 4 | WQN0229 | Jan | NSI |  |
| 5 | WQN0223 | Feb | SI | 2nd |
| 6 | WQN0272 | Mar | NSI |  |
| 7 | WQN0273\* | Apr | SI |   |
| 8 | WQN0282 | May | NSI | 3rd |
| 9 | WQN0204 | Jun | SI |   |
| 10 | WQN0404 | Jul | NSI |  |
| 11 | WQN0271 | Aug | SI | 4th |
| 12 | WQN0210 | Sep | NSI |   |
| \* Site where SRBC also collects baseflow and additional storm samples |

**Approach:** During 1st quarter of WY SRBC would collect one FB for SI event at each of the two sites indicated, and one FB for NSI at third site. Collection of these FBs would occur as close As possible to if not in the month indicated. However, SI events do not always conveniently occur at a given station in the desired time period desired so the quarter is the planning period in which they need to be taken.

An advantage for SRBC is it collects additional OS (Other storm or storm impacted) as well as ONS (Baseflow) samples at several of the randomly selected sites which will help ensure FBs of the specified Event\_Types are likely to be collected at the sites indicated at least in the Quarter if not month indicated.

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| NTN Groups for Field Blank and Duplicate Sample Frequency Determinations |
| AGENCY | SOURCE | STATION\_TYPE | EVENT\_TYPE | STATIONS |
| DEDNREC | DEDNREC | Primary | R, RSI, S, ONS or OS | 304191, 302031 |
| USGSWV | USGSWV | Primary | R, RSI, S, ONS or OS | 01604500, 01608500, 01616500, 01613030, 01616400, 01611500, 01618100  |
|
|
| USGSWV | USGSWV | Primary | R, RSI, S, ONS or OS | 01595300, 01614000, 01636500  |
| SRBC | SRBC  | Primary | R, RSI, S, ONS or OS | 01502500, 01503000, 01529500, 01511500 |
| SRBC | SRBC or NYSDEC  | Primary | R, RSI, S, ONS or OS | 01515000, 01531000 |
| MDDNR | MDDNR | Primary | R, RSI, S, ONS or OS | TUK0181, BEL0053, DER0015, GUN0258, NPA0165, GWN0115, PXT0972, TF1.2, GEO0009, WIL0013, ANT0047, CAC0148, MON0546, LXT0200, MGN0062, NWA0016, WCK0001, MKB0016, CVA0046, WIL0065 |
| MDDNR | USGSMD | Primary\_RIM | R, RSI, S, ONS or OS | 01491000, 01578310, 01594440, 01646580  |
| PADEP | SRBC | Primary | R, RSI, S, ONS or OS | WQN0201, WQN0214, WQN0273, WQN0301, WQN0305, WQN0401, WQN0204, WQN0210, WQN0223, WQN0229, WQN0243, WQN0263, WQN0271, WQN0272, WQN0302, WQN0404, WQN0445, WQN0448, WQN0226, WQN0281, WQN0282 |
| PADEP | USGSPA | Primary | R, RSI, S, ONS or OS | WQN0317, WQN0410, WQN0224, WQN0217, WQN0212, WQN0269, WQN0278, WQN0280  |
| PADEP | PADEP | Primary | R, RSI, S, ONS or OS | WQN0501, WQN0509, WQN0510, WQN0511, WQN0512, WQN0513 |
| VADEQ | USGSVA | Primary\_RIM | R, RSI, S, ONS or OS | 'TF5.0A, TF4.0P, TF5.0J, TF3.0, TF4.0M, 2-JMS113.20 |
| VADEQ | USGSVA | Primary | R, RSI, S, ONS or OS | 1BNFS010.34, 1BSMT004.60, 1BSSF003.56, 2-CHK035.26, 2-JMS113.20, 3-RAP030.21, 8-NAR005.42, 1BMDD005.81, 1ADIF000.86, 7-DRN010.48, 1ASOQ006.73 |
| VADEQ | VADEQ/SCRO or USGSVA | Primary | R, RSI, S, ONS, or OS | 2-JMS279.41, 2-APP110.93  |
| VADEQ | VADEQ/NRO or USGSVA | Primary | R, RSI, S, ONS, or OS | 1AACO014.57, 3-RPP147.49, 8-MPN094.94 |
| VADEQ | VADEQ/VRO or USGSVA | Primary | R, RSI, S, ONS, or OS | 2-RVN015.97, 1BSSF100.10  |
| VADEQ | VADEQ/NRO | Secondary | R (but w possibly RSI flows) or ONS | 3-RAP066.54, 3-ROB001.90, 8-POR008.97, 1ACAX004.57 |
| VADEQ | VADEQ/VRO | Secondary | R (but w possibly RSI flows) or ONS | 1BSTH027.85, 2-BCC004.71, 2-BLP000.79, 2-CFP004.67, 2-MCM005.12, 2-MRY014.78  |
| VADEQ | VADEQ/PRO | Secondary | R (but w possibly RSI flows) or ONS | 8-LTL009.54, 2-DPC005.20 |