

Monitoring Issues Related to Data Requirements for the Development of FAST Process, DUET, and U.S. EPA ESAR Standards for the Nontidal Water Quality Monitoring Program Nontidal Network

Developing a formal, automated, standardized, and timely (FAST) process, Data Upload and Evaluation Tool (DUET), and Environmental Sampling, Analysis, and Results (ESAR) Standards to obtain, review, qualify, aggregate, and publish annual (WY) water quality and related ancillary (meta) data for Nontidal Network monitoring requires defining data requirements that include technical elements of the monitoring design used to obtain these data. Defining these technical data requirements is constrained by differences between monitoring as it is currently (WY2012) conducted, and the most recent (2008) NTN Field Procedures that describe the monitoring sampling design and process in some detail (see Chapter V Rev. 0 (Final Draft) Nontidal WQ Field Procedures, November 18, 2008, attached). The latter was developed by the NTN Workgroup in 2008, and remains the most recent detailed document capable of describing how NTN sampling is conducted. In addition, this and other NTN Project documents do not describe selected aspects of the monitoring design in sufficient detail (gaps in guidance). These gaps in guidance contribute to differences in the collection, review, and qualification of NTN monitoring data among Data Collectors, which also prevents defining data requirements needed to develop and implement FAST, DUET, and ESAR Standards.

Noteworthy differences and gaps have been identified (Table 1), which reflect either inconsistencies between actual current (WY2012) monitoring compared to described monitoring (sampling or other data-related practices, including reviewing, reporting, or qualifying of submitted data) or due to simply a lack of guidance. The inconsistencies in monitoring need to be addressed by the NTN Workgroup. Collectively these inconsistencies result in differences in monitoring among Data Collectors which prevent defining technical data requirements needed to complete the development of the FAST process, DUET, and ESAR standards,. Ultimately, resolution of these inconsistencies is essential to achieve the following objectives of the FAST_DUET_ESAR process:

- (1) Routinely obtain NWQM Program-NTN Project Water Year (WY) monitoring data in a timely manner;
- (2) Routinely construct fully reviewed, qualified, and standardized NTN Project water quality and ancillary (meta) data databases in a timely manner;
- (3) Routinely provide these databases to CBP partners for internal and or external use in a timely manner; and
- (4) Routinely address the following fundamental questions often asked of any long-term monitoring program for each WY in a timely manner at more than an individual Data Collector level: (a) what is the purpose of the monitoring being conducted? (b) what is monitored? (c) where is monitoring conducted? (d) when is monitoring conducted? (e) how is monitoring conducted? (f) who is conducting monitoring? (g) what is the quality of the monitoring data, and (h) do the monitoring data meet monitoring data requirements?

Most NTN Data Providers are aware of these inconsistencies, which were raised in previous Nontidal Workgroup (NTWG) or independent sessions with NTN Project staff. In addition, proposed means to address most of these inconsistencies, in relation to identification of data requirements for FAST, DUET, and ESAR Standards, have been presented and discussed with most Data Collectors. However, since 2008 there have been modifications to the monitoring design, an increase Data Collectors new to the NTN Project, and the addition of many new WQ monitoring stations, which need to be addressed in the development of FAST, DUET, and ESAR Standards. A NTWG meeting, to be attended by all members, is requested in late September or early October to briefly (re)visit these inconsistencies and proposed solutions. The purpose of the meeting is to identify which inconsistencies require additional discussion to resolve, who needs to be involved in that discussion, and what is needed in advance of future discussion to expedite their resolution. Information will be provided in advance of this special NTWG meeting which briefly describes each of the inconsistencies and for most a proposed solution.

Table 1. Differences and gaps in the NTN Monitoring Design terms of current practices, and the most recent (2008) NTN Field Procedures related to data collection, review, qualifying, and submission which limit the completion of the development of the FAST process, DUET, and ESAR Standards.

Differences and gaps reflect inconsistencies between current sampling activities and 2008 NTN Field Procedures (Document attached) or other NTN Project-level guidance, or simply a lack of sufficient NTN Project level guidance on practices related to the collection, review, reporting, and qualifying of submitted data.

- (1) Monthly fixed time interval sampling is to include both routine and routine storm impacted samples, with the appropriate stream sample equipment used dependent on the flow condition.
Key issues are
 - (a) Degree to which the above is being done routinely (a conflict with 2008 Field Procedures) or only on rare occasions, and
 - (b) Regardless of frequency with which it is done, how to document this as part of DUET (meta) data upload (not covered in 2008 Field Procedures).
- (2) During drought periods, storm flows are unlikely; and encountering Routine Storm Impacted flows during monthly fixed time periods also are less likely during the randomly selected monthly fixed time interval. As the WY progresses under these conditions, interim monthly (not within fixed time interval).Routine or Routine Storm Impacted sampling is being conducted in addition monthly fixed interval sampling. However, such data are seasonally biased if drought breaks late in WY.
Key issues are
 - (a) Interim sampling is not discussed in 2008 Field Procedures, and therefore not addressed for all Data Collectors, and
 - (b) There currently is no way to distinguish the data from such interim sampling as part of the DUET data uploads.
- (3) 2008 NTN Field Procedures indicate quality control sampling is to include the collection of duplicate samples. Duplicate samples are to consist of field split samples from single churn, obtained either monthly or every 20 WQ samples. Field blanks are to be obtained monthly in the field, and the source(s) of field blank contamination investigated.
Key issues are
 - (a) The current collection of concurrent instead of duplicate field split samples, which are not described in field procedures, require characterization in order to upload data and process data with DUET;
 - (b) The specified frequency of duplicate sampling in guidelines for Data Collectors with few WQ sampling stations provides too few duplicate sample data;
 - (c) A lack of guidance to address whether duplicate sampling should be representative of all environmental conditions (all WQ sampling stations and all Sampling Event Types) or selected environmental conditions. The former is the norm for most long-term monitoring programs as WQ data are obtained from all WQ sampling stations and Event Types.
 - (d) The dual purposes of duplicate sample data, which are to determine the reproducibility of water quality measurements and to provide water quality data; which are not adequately described by current guidance as data quality objectives, but imply these data be qualified and uploaded by Data Collectors in a manner that differs from routine water quality data;
- (4) 2008 NTN Field Procedures indicate quality control sampling is to include the collection of Field Blanks (FBs). FBs are to be obtained monthly, in the field, and, the source(s) of FB contamination investigated.
Key issues are
 - (a) Current collection of field blanks in field office rather than at a sampling location, former generally is considered an equipment not field blank;

- (b) The specified frequency of FB sampling in guidelines for Data Collectors with few WQ sampling stations is excessive number of FBs;
 - (c) A lack of guidance to address whether FB sampling should be representative of all environmental conditions (all WQ sampling stations and all Sampling Event Types) or selected environmental conditions. The former is the norm for most long-term monitoring programs as the WQ data are obtained from all WQ sampling stations and Event Types;
 - (d) The data quality objectives for FBs require FB data and results of contaminated blank investigations be provided; are needed to assess whether or not associated WQP data are positively biased, and qualify such data; these data quality objectives are not adequately described by current guidance as data quality objectives;
 - (e) As part of the above (d), FBs with measureable concentrations above the MDL but below the Reporting level need to be evaluated in terms of contaminant sources if contaminated FBs also are occasionally observed with concentrations above the Reporting level; this requirement differs from how the former have and are treated by selected Data Collectors; and
 - (f) The interpretation of FB data in relation to whether or not the associated WQ parameter data should be qualified as biased has not been adequately addressed or defined by NTN Project guidance, but is required to achieve an assessment of the quality of NTN WQ parameter data under DUET.
- (5) Historically, the USGS calculated selected water quality parameters to normalize NTN nutrient and sediment from Data Collectors to assess trends and loads. In addition, the CBP independently calculated selected water quality parameters. With DUET, all water quality parameters will be calculated by DUET, and the calculated value qualified and documented. However, to determine whether or not a water quality parameter should be calculated, the quality of the monitoring data used to perform the calculation needs to be checked. The checks are based on logical assumptions—for example, that a dissolved or particulate constituent for either a nutrient (N, P, or C) or sediment should have concentration value which is less than its related total concentrations value. These checks are best performed by each Data Collector working with their analytical laboratory. Selected consistency checks have been identified for each Data Collector given the data they are expected to provide, and include checks that are necessary to ensure selected water quality parameters can be calculated. Common codes for all Data Collectors have been identified to document and provide check results.

Key Issues are:

- (a) Selected but not all Data Collectors have developed consistency checks; other Data Collectors have not; however, all need to routinely conduct such checks in a consistent manner given selected check results will lead to discarding some measured water quality data; in addition, any water quality parameters that would have been calculated from the discarded water quality data will not be calculated;
 - (b) All need to adopt reasonably similar check criteria for a similar type of consistency check; which currently is not necessarily the case;
 - (c) Common codes to document check results needs to be provided along with the checked water-quality parameters; and
 - (d) Selected check results will result in checked water quality parameter concentrations be assigned null values in place of original concentration values; for duplicate samples, null values need to be assigned after precision statistics have been calculated, and before values are nulled to meet data quality objectives; selected Data Collectors have check programs in place where this could be a problem.
- (6) All NTN water quality sampling is conducted in relation to a U.S. stream gages to enable the calculation of nutrient and sediment loads. 2008 NTN field procedures indicate water-quality sampling locations are to be in close proximity to a gage; however this distance is not explicitly defined. Also the underlying data quality objectives, also not explicitly stated, are to

provide reasonably accurate data for USGS to estimate loads, and for CBP staff to model Nontidal watershed water quality characteristics, in relation to a known basin area.

Key Issues:

- (a) It is not explicitly known for all NTN water quality stations whether low or high, or alternate, as well as normal, sampling locations are being used; however, multiple sampling locations are being used at at least some Stations;
 - (b) It is not explicitly known in all cases where these non-normal sampling locations are in relation to the USGS gage;
 - (c) It is not explicitly known in all cases when these non-normal sampling locations if used are being used in relation to the water quality data being submitted;
 - (d) Considerable but other important metadata related to the nature and establishment of the normal as well as other possible sampling locations are unavailable but necessary to meet US EPA ESAR standard and CBP Geospatial standard requirements, and to enable accurate characterization of the resultant water quality data for use (by the USGS for loads, by the CBP staff for nontidal WQ modeling, and possibly other end users of the NTN WQ data;
 - (e) Not all Data Collectors were present when the procedures developed to provide the above information was presented; it also was recommended given the technical nature of the data and procedures that this technical and other technical issues be revisited by the NTWG.
- (7) Automated and continuous data collection and sampling has and continues to be conducted at at least 4 non-NTN stations within the CB Nontidal watershed. Data are very similar in type to the data routinely being collected by the NTN. **Key Issue:** Guidance is lacking in the form of protocols for monitoring and data management. However, as the need for increased numbers of monitoring Stations available within the CB Nontidal watershed increases, it will become increasingly difficult to obtain the human resources to be everywhere that monitoring is needed every time it is needed., This is already an acute challenge when it comes to data collection for storm impacted and storm flows.
- (8) Implementation of the FAST process, DUET, and ESAR Standards begins with WY2012 NTN Project data. **Key Issue:** USGS requested information on whether above would be used process historical (pre-WY2012) data. This will be addressed during the requested Nontidal Workgroup meeting.
-