UPPER COLUMBIA RIVER

FINAL
2019 Phase 3 Sediment Study Data Summary Report

Prepared for

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ACRONYMS AND ABBREVIATIONS

%D	percent difference
ACG	analytical concentration goal
AFDW	ash-free dry weight
Agreement	June 2, 2006, Settlement Agreement
ALS	ALS Environmental
AOI	area of interest
AVS	acid volatile sulfide
BERA	baseline ecological risk assessment
BHC	hexachlorocyclohexane
BMI	benthic macroinvertebrate
BSEM	backscattered scanning electron microscopy
COC	chain of custody
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DL	detection limit
DO	dissolved oxygen
DOC	dissolved organic carbon
DQO(s)	data quality objective(s)
EPA	U.S. Environmental Protection Agency
ESI	Environmental Standards, Inc.
FSP	field sampling plan
FSR	field summary report
ID	identification
LCS	laboratory control sample(s)
LOD	limit of detection
LOQ	limit of quantitation

MDL	method detection limit
MEL	Washington Department of Ecology Manchester Environmental Laboratory
MQO	measurement quality objective
MS/MSD	matrix spike/matrix spike duplicate
ORP	oxidation reduction potential
OU	operable unit
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PER	Pacific EcoRisk
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
RI/FS	remedial investigation and feasibility study
RL	reporting limit
RM	river mile
RPD	relative percent difference
SEM	simultaneously extracted metals
SOP	standard operating procedure
SQT	sediment quality triad
TAI	Teck American Incorporated
TAL	target analyte list
TDS	total dissolved solids
TIE	toxicity identification evaluation
TOC	total organic carbon
UCR	Upper Columbia River
YCT	yeast-Cerophyl-trout chow

UNITS OF MEASURE

°C	degrees Celsius
dw	dry weight
g	gram(s)
in.	inch(es)
kg	kilogram(s)
L	liter(s)
L:D	light to dark ratio (photoperiod)
m	meter(s)
mg	milligram(s)
mg/beaker-day	milligram(s) per beaker per day
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
mL	milliliter(s)
mL/beaker-day	milliliter per beaker per day
mm	millimeter(s)
mV	millivolt(s)
n/m^2	number(s) per square meter
ppm	parts per million
SU	standard unit(s)
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
µm	micrometer(s)
µmol/g	micromole(s) per gram
µmol/kg	micromole(s) per kilogram
µS/cm	microSiemens per centimeter

1 INTRODUCTION

This data summary report (herein, the report) presents the results of the 2019 Phase 3 sediment study (hereinafter, the study) for the Upper Columbia River (UCR) Site, (hereinafter, the Site[1]). The Site extends from the U.S.-Canada border (River Mile [RM] 745) to Grand Coulee Dam (RM 596). Analyses were conducted under the U.S. Environmental Protection Agency (EPA)-approved quality assurance project plan (QAPP) for the study (ERM 2019). This study was completed as part of the remedial investigation and feasibility study (RI/FS) and baseline ecological risk assessment (BERA) being conducted under the June 2, 2006, Settlement Agreement (Agreement) between Teck American Incorporated (TAI) and EPA. TAI is conducting the RI/FS and current sediment study with EPA oversight (USEPA 2006b).

EPA issued a level of effort letter and memorandum to TAI in January 2018 requiring sediment bed mapping and additional investigation of the nature and extent of sediment contamination at the Site to determine the spatial extent of areas in the upper reaches of the Site where sediments potentially toxic to benthic organisms might be present (USEPA 2018). EPA identified these reaches as the Upper Reach Operable Unit (OU), which encompasses the UCR from upstream of Marcus Flats at RM 709 to the U.S.-Canada border at RM 745. The sediment bed mapping was conducted throughout the Upper Reach OU in 2018 and 2019 (TAI 2019, 2020b; DEA 2020). Results from the sediment mapping work were used to inform the study design for collection in 2019 of data described in this report, which will be used along with previously collected data in the BERA to determine potential toxicity of sediments in the Upper Reach OU to benthic organisms and describe the metals concentrations associated with slag deposits.

1.1 PURPOSE AND DATA QUALITY OBJECTIVES

The objective of the study is to characterize sediment and porewater conditions in three areas of interest (AOIs) in the Upper Reach OU such that an overall understanding of risks to benthic organisms and the nature and the extent of contamination in this portion of the Site can be assessed. The three AOIs established for the study include 1) Deadman's Eddy,

[1] The Site as defined within the June 2, 2006, Settlement Agreement is the areal extent of hazardous substances contamination within the United States in or adjacent to the Upper Columbia River, including the Franklin D. Roosevelt Lake, from the U.S.-Canada border to the Grand Coulee Dam, and those areas in proximity to the contamination that are suitable and necessary for implementation of response actions.

2) China Bend, and 3) Evans (Map 1-1). Combined, these three AOIs cover approximately 5.5 river miles of the Upper Reach OU (15 percent).

Per the QAPP, the overarching risk question to be addressed by the study is: Do elevated metals concentrations associated with slag deposits pose unacceptable risk to benthic organisms in the UCR Upper Reach OU? The data quality objectives (DQOs) in the QAPP include primary and secondary goals. These goals and their associated study questions are provided below.

The primary goal of the study is to gather enough data to characterize the nature and magnitude of risks posed to benthic organisms in each AOI through exposure to metals concentrations associated with slag in contaminated deposits in sediment and porewater, (i.e., to address the overarching risk question). A sediment quality triad (SQT) data analysis approach that incorporates multiple lines of evidence will be used to answer the study questions where the lines of evidence consist of whole sediment and sediment porewater chemistry, whole sediment laboratory toxicity tests, and *in situ* benthic macroinvertebrate (BMI) community structure in the three AOIs.

The following study questions associated with the primary goal were included by EPA in the QAPP and will be addressed by the SQT approach (described in Section 2.1) and comparisons between the AOIs and reference locations.

1. The SQT analysis will be used to address the following specific questions:
    a) Do metals concentrations in UCR Upper Reach OU sediment and porewater exceed aquatic toxicity benchmarks for sediment and porewater?
    b) Do bioassay test organisms exposed to UCR Upper Reach OU sediment show responses indicative of sediment toxicity relative to laboratory control sediment?
    c) Do BMI community metrics indicate reduced species diversity and richness or increase pollution tolerance in some UCR Upper Reach OU locations?
    d) Do elevated metals associated with slag in depositional sediments cause toxicity in laboratory bioassays?
    e) Do elevated metals associated with slag in depositional sediments adversely affect BMI communities?
    f) Do sediment sample locations having elevated bioassay toxicity also have altered BMI metrics indicative of metals-related stress?

2. Secondary study questions associated with the primary study goal include comparisons of central tendency and distribution between AOIs and reference areas:
    a) Are bioassay results and BMI metrics at individual locations within the AOIs outside their respective reference envelopes?
    b) Do measures of central tendency in sediment and porewater metals chemistry, bioassay results, and BMI metrics differ from those of the reference areas?

Secondary goals for the study include the following:

1. Estimate the proportion of sediment facies in each AOI containing sampleable sand that exceeds an effects concentration or other benchmarks.
2. Map physical and chemical properties of surficial riverbed substrates and porewater in the three AOIs.
3. Verify the results of the sediment facies mapping completed in 2018 in the three AOIs.

The analyses and interpretations that will address these study goals and questions will be presented in the RI and BERA reports to be prepared per the Agreement (USEPA 2006b). The primary purpose of this report is to document how the study was conducted and report the data collected.

To meet the stated goals in the QAPP, sediment, BMI, and *in situ* porewater samples were collected from each AOI and from 18 reference locations in the Columbia River in Canada between September 10 and October 23, 2019. Between June 9 and July 30, 2020, 42-day *Hylella azteca* (*H. azteca*) bioassays using field sediment[2] from each AOI were performed. Chemical analyses were conducted by ALS Environmental (ALS), in Kelso, Washington. BMI community structure analysis was performed by EcoAnalysts, Inc. in Moscow, Idaho. All 42-day *H. azteca* bioassays were performed by Pacific EcoRisk (PER) at its Fairfield, California, laboratory. Analysis of sediment for the presence of slag using backscattered scanning electron microscopy (BSEM) was performed by the RJ Lee Group in Monroeville, Pennsylvania.

[2] Throughout this report the terms "field sediment" and "field porewater" are used to designate sediment and porewater samples collected from the Columbia River for the study. These terms are necessary to differentiate between field and laboratory bioassay-generated sediment and porewater samples.

The DQOs in the QAPP recognized that, because the above questions relating to the primary study goal will likely not directly identify causation of any observed effects, a toxicity identification evaluation (TIE) could be used to assess the cause of any observed toxicity. Based on the results of a TIE pilot study performed between 2018 and 2020 using sediment from the Site (Windward 2020a), EPA[3] and TAI agreed that that it is unlikely that robust and reliable methods could be developed that would meet DQOs for a TIE study or the DQOs for the Phase 3 sediment study. Therefore, EPA and TAI agreed that TIE testing would not be performed as part of the 2019 Phase 3 sediment study.

1.2 REPORT ORGANIZATION

The purpose of this report is to present a summary of work completed and associated data collected under the 2019 Phase 3 Sediment QAPP (ERM 2019). This report is organized into the following sections:

- **Section 1 – Introduction.** This section discusses the purpose and DQOs for the study and summarizes the report organization.
- **Section 2 – Study Design and Methods.** This section provides an overview of the study, including sampling locations and the chemical analyses, BMI analyses, bioassays, and BSEM analyses that were performed.
- **Section 3 – Quality Assurance Project Plan Deviations and Modifications**. This section discusses deviations from and modifications to the QAPP.
- **Section 4 – Data Validation and Bioassay Acceptability.** This section provides a summary of the validation assessment results for the sediment and porewater chemical analyses, BMI analyses, and a summary of the test acceptability results for the bioassays.
- **Section 5 – Summary of Data.** This section presents a summary of the analytical and bioassay results.
- **Section 6 – Assessment of Data Gaps.** This section summarizes data gaps identified following the completion of the study.
- **Section 7 – Summary.** This section summarizes the results of the study.
- **Section 8 – References.** This section presents bibliographic information for references cited in this report.

[3] December 21, 2020, letter from Kathryn Cerise (EPA) to Denise Mills (TAI), subject: EPAs [*sic*] comments on the *Draft Addendum Toxicity Identification Evaluation Pilot Study, November 2020.*

Figures, maps, and data tables, respectively, are provided after Section 8. Appendices, including the raw data, are provided in electronic format (see enclosed disk). Data may also be obtained directly from the project database, accessible at http://teck-ucr.exponent.com.

2 STUDY DESIGN AND METHODS

This section presents a summary of the study design and methods (including field collection methods and laboratory methods). Additional details are presented in the QAPP (ERM 2019).

2.1 STUDY DESIGN

The Phase 3 sediment study was designed using EPA's seven-step DQO process (USEPA 2006a). The overall goal was to gather enough data to characterize the nature and magnitude of risks posed to benthic organisms through exposure to slag-impacted sediment and porewater in the Upper Reach OU. An SQT approach will be used to address the overall study goal by independently evaluating each element of the triad: collocated sediment and porewater chemistry; toxicity in laboratory bioassays; and BMI community metrics (i.e., measures of BMI community structure, function, and/or stress/metals tolerance scores) in each of three AOIs and then assessing risk based on their correspondence in the overall triad approach (Chapman 1990).

2.1.1 Information Needs

The following types and sources of information were identified in the QAPP (ERM 2019) as necessary to meet the goals of the study:

- Sediment facies, bathymetry, and backscatter maps for each AOI. This work was completed in 2018 and 2019 (TAI 2019, 2020b; DEA 2020)
- Historical river channel geometry and bathymetry
- Analytical data for surface sediment and field-collected porewater samples from each AOI and from reference locations upstream of Trail, British Columbia
  - Surface (0 to 6 in.) sediment analytical data
    - Total target analyte list (TAL) metals[4]
    - BSEM (select sample locations)
    - Percent slag
    - Grain size
    - Total organic carbon (TOC)
    - Simultaneously extracted metals (SEM)

[4] TAL metals include: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

        - Acid volatile sulfide (AVS)
        - Organic chemicals (only for reference locations): polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and pesticides
    - Porewater chemistry data
        - Dissolved metals, including major cations[5]
        - Major anions (chloride, sulfate)
        - Alkalinity
        - TOC and dissolved organic carbon (DOC)
        - Sulfide at select locations (if field data indicate need)[6]
        - pH
    - Coordinates, imagery, and sediment descriptions at each sediment and field collected porewater sample location
- Sediment and porewater toxicity benchmarks (generic or site-specific)
- 42-day sediment bioassay data for AOI and reference area samples using the freshwater amphipod *H. azteca* with the following endpoints:[7]
    - 28-day survival, weight, and biomass
    - 42-day survival, weight, biomass, reproduction, and number of adult males and females
    - Synoptically collected sediment and porewater analytical data
        - Sediment
            - TAL metals (start of test only)
            - SEM (Days 7 and 21)
            - AVS (Days 7 and 21)
            - TOC (Start of test, Days 7 and 21)

[5] The dissolved metals list for porewater includes: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

[6] No sulfide analyses were performed based on measurement of oxidation-reduction potential and dissolved oxygen during porewater sampling.

[7] The bioassay test also measured survival and reproduction at Day 35. The Day 35 measurements for survival and reproduction are not themselves assessment endpoints and are therefore not summarized within the data summary report. Summaries of Day 35 measurements are provided in the PER report (Appendix F).

        - Porewater (Days 7 and 21)
            - Anions (chloride, sulfate)
            - Alkalinity
            - pH
            - DOC
            - Sulfide
            - Dissolved metals (including major cations)
- BMI survey data at each sampling location
    - BMI species
    - BMI abundance, by species
    - Ash-free dry weight (AFDW) of residual organic matter
    - Blotted wet-weight biomass
    - Calculated BMI density (per unit area)
    - Community metrics (e.g., diversity indices)
    - Near sediment bed water quality parameters (temperature, pH), collected during field porewater sampling.

Several of the data needs listed above did not require collection of new data during the study. These include the following:

- Historical river channel geometry and bathymetry, which can be approximated from the bathymetry digital elevation model and/or historical aerial photographs
- Position in river (river channel, seasonally flooded historical channel, seasonally flooded backwater), which can be assigned based on water depth, the bathymetry digital elevation model, and/or aerial photographs.

Other data needs were fulfilled using information recorded in the field at the time of sampling. These information types include the following:

- Coordinates, imagery, and sediment descriptions at each sediment and field collected porewater sample location
- Water depth
- Presence of macrophytes
- Porewater pH measurements
- Near sediment bed water quality parameters (temperature, pH), collected during porewater sampling.

To meet the remainder of the data needs described above, the following sampling and analysis process was used (Figure 2-1):

- Surface sediment (0 to 6 in.) was obtained from three AOIs and reference locations in British Columbia for use in BMI analysis, sediment chemistry, and potential use in bioassays
- Collocated field porewater obtained from each AOI and reference sampling locations as well as at porewater-only sampling locations within coarse riverbed substrates
- Sample aliquots for bioassay taken from a subset of samples that were collected for bulk sediment chemistry
- Synoptic sediment and porewater collected during subsequent bioassays
- Sediment samples used for bulk sediment chemistry were archived and a subset analyzed for slag content using BSEM.[8].

The following subsections present additional information on sampling locations, sediment and porewater chemistry analyses, bioassays (including the selection of bioassay locations), and BSEM sample analysis.

2.1.2 Sampling Locations

To support primary and secondary study goals, both statistical and judgmental sample size determinations were made. The statistically-based sample size determination for this study only considered the primary goal and study questions. Sample size determinations to support the secondary goals were based on professional judgment. This approach relied on sediment bed (facies) maps to define the target strata included in the sample designs, and to develop a project-specific texture triangle (Figure 2-2) that was used to map sediment facies derived from sediment composition (TAI 2019). The sediment facies maps were then used to define the areal extent of the four target strata included in the sample design as follows:

1. **Sampleable sand**. Sediment containing more than 50 percent finer-grained sediments, including "sand" and "mixed fines, predominantly sand" facies classes.

[8] In addition, total zinc data will be used to estimate percent slag in Phase 3 sediment samples using a total zinc regression model developed from Phase 2 and U.S. Geological Survey (Ingersoll et al. 2016) data. Regression model estimates will be confirmed with results from the subset of sediment samples analyzed for percent slag using BSEM.

2. **Mixed coarse**. Sediment containing 50 percent to 20 percent finer-grained sediment, with less than 50 percent boulder/cobble, including the "mixed coarse with sand" facies class.
3. **Mud**. Sediment containing sediment with more than 80 percent silt and clay.
4. **Coarse**. Coarse sediment having more than 50 percent boulder/cobble or more than 80 percent combined gravel plus boulder/cobble, including the "boulder/cobble", "mixed boulder/cobble", "gravel", and "coarse" facies classes.

To answer the primary study questions, a target of 21 statistically-based collocated sediment, porewater, and BMI community sample locations were required for the sampleable sand strata at Deadman's Eddy and Evans AOIs, and 12 locations were targeted at China Bend AOI (54 total samples). In addition, EPA requested two judgmentally determined sampleable sand locations be sampled within the China Bend AOI (Table 2-1).

Sample size determinations for the other three strata (mixed coarse, mud, and coarse) in the AOIs were made based on professional judgment to support the secondary goals of this study. These sample sizes include six samples for each AOI for the mixed coarse strata and porewater-only coarse strata. Five samples for both the China Bend and Evans AOIs were proposed for the mud strata; no mud strata were mapped at Deadman's Eddy AOI. Additionally, repeat sampling was performed at locations previously sampled by TAI in 2013 as part of the Phase 2 sediment study in the China Bend AOI (two locations) and Evans AOI (two locations), and two locations previously sampled by the Natural Resource Trustees in 2013 in the Deadman's Eddy AOI (Ingersoll et al. 2016). In total, 108 locations were targeted for sampling within the three AOIs (Table 2-1). The sampling design included the identification of alternate locations to be used when samples could not be collected from primary locations and that would be selected in consultation with EPA oversight in the field. The QAPP required that porewater sampling be attempted at all primary locations, regardless of whether sediment sampling at those locations was successful.

Eighteen reference locations were identified on the Columbia River in British Columbia, Canada and were targeted for sediment, porewater, and BMI community analysis (Table 2-1). Twelve samples from riverine reaches at Genelle and Birchbank eddies, and six locations in the lacustrine zone in Lower Arrow Lake were targeted.

Sampling locations are listed in Table 2-2 and are shown on Maps 2-1 through 2-3 for the AOIs and on Maps 2-4 through 2-6 for reference locations. Table 2-3 summarizes the successful sampling locations by AOI and target strata. The sampling completed met the study design as follows:

- The targeted number of samples to meet the sampling design were collected at all 18 reference locations and at the China Bend AOI.
- At Evans, the targeted number of samples to meet the sampling design were collected for sampleable sand (22 locations), mud (5 locations), and coarse (6 locations) strata and for the two repeat sample locations; however, only five of the targeted six locations were successfully sampled for the mixed coarse stratum. One sampleable sand location (EV059) included a successful sample for porewater, but refusals were encountered during sediment sampling. Of the five mixed coarse sampling locations completed at Evans AOI, at one location (EV020) a sediment sample was obtained but not a porewater or BMI sample and at another location (EV015) a porewater sample was obtained but not a sediment or BMI sample (Table 2-3).
- At Deadman's Eddy, the required number of samples were collected to meet the sampling design for the sampleable sand stratum (21 locations); however, at DM057 sufficient volume of sediment was collected for chemistry and for potential bioassay testing, but not for BMI analysis and a porewater sample was not collected. At DM044, enough sediment volume was collected for chemistry and BMI analysis and a porewater sample was collected, but the sediment volume was insufficient to collect a sample for potential bioassay testing. Attempts at all six primary and six alternate locations resulted in the successful collection of four out of six target sample locations for the mixed coarse stratum and five out of six target sample locations for the porewater-only coarse stratum.

2.1.3 Sediment and Porewater Chemistry and Physical Parameters

Sediment and porewater samples were analyzed for chemical and physical parameters shown in Table 2-4 and as summarized below. Analytical methods are listed in Table 2-5.

All field sediment samples were analyzed for the following:

- Total TAL metals
- Grain size
- TOC
- AVS
- SEM.

The only exceptions for field sediment analyses were mixed-coarse stratum samples from Evans AOI locations EV011, EV020, and EV022, where only a limited volume of sediment could be obtained. Sediment from EV011 was not analyzed for AVS and SEM; EV020 was not analyzed for grain size, AVS, and SEM; and EV022 was not analyzed for grain size, AVS, SEM, TOC, and mercury (Table 2-6).

In addition, all field sediment samples from reference locations were analyzed for organic chemicals (pesticides, PAHs, and PCBs).

Field porewater samples were analyzed for the following:

- Dissolved metals (including cations)
- DOC
- TOC
- Hardness (calculated from measured cations)
- Alkalinity
- Major anions (chloride, sulfate).

In accordance with the QAPP (ERM 2019) and prescribed in standard operating procedure (SOP) 7 of the field sampling plan (FSP) (Appendix A of the QAPP), porewater water quality parameters measured in the field included temperature, pH, dissolved oxygen (DO), and oxidation reduction potential (ORP). At all locations, DO was present and the ORP values measured were greater than or equal to −150 mV; therefore, analysis for sulfide was not performed (Table 2-4).

Bioassay laboratory sediment and porewater samples were generated at multiple times during the 42-day *H. azteca* bioassays and were analyzed for chemistry as shown in Table 2-4 and Table 2-5. Procedures for generating sediment and porewater samples during the 42-day *H. azteca* bioassay testing are described in Section 2.5. Bioassay-generated sediment and porewater samples were analyzed for the following parameters:

- Bioassay-generated sediment collected from homogenized sediment before start of test
  - TAL metals
  - TOC
- Bioassay-generated sediment collected at Day 7 and Day 21
  - SEM
  - AVS
  - TOC

- Centrifuged porewater collected at Day 7 and Day 21
  - Anions (chloride, sulfate)
  - Cations
  - Alkalinity
  - pH
  - DOC
  - Sulfide
  - Dissolved metals.

Sediment samples collected for 42-day *H. azteca* bioassays were analyzed for the full lists of parameters provided above; however, limited volumes of porewater were obtained by centrifugation for some Site and reference sediment samples on either Day 7 and/or Day 21. In total, across all batches and days, three samples had insufficient porewater collected for Priority 1 analytes (REF008 [Batch 1, Day 7], REF003 [Batch 1, Day 21], and CB029 [Batch 2, Day 7]), 28 samples had insufficient porewater collected for Priority 2 analytes, and 29 samples had insufficient porewater collected for Priority 3 and 4 analytes. As a result, bioassay-generated porewater samples were not analyzed for all of the parameters listed above. The volumes of porewater obtained by centrifugation and the associated analyses are described in Section 2.5.

2.1.4 Benthic Macroinvertebrates

Sediment samples for BMI analysis were collected at all successful surface sediment sampling locations[9] except a sampleable sand location (DM057) at Deadman's Eddy AOI and a mixed-coarse location (EV020) at Evans AOI where sufficient sample volume for BMI analysis could not be obtained. BMI sediment samples were partitioned into two size fractions (250 and 500 μm) and each fraction was analyzed for the following:

- Taxonomic enumeration
- Taxonomic identification
- AFDW of residual organic matter
- Blotted wet-weight biomass.

[9] Sediment for chemical/physical analysis, potential bioassay use, and BMI analysis was not successfully collected at mixed coarse location EV015 due to refusal. Only porewater was successfully collected at EV015.

2.1.5 Bioassays

Bioassays were conducted on select sediment samples using the 42-day *H. azteca,* survival, growth, and reproduction test. Endpoints[10] included in the following bioassay testing:

- 28-day survival, weight, and biomass
- 42-day survival, weight, biomass, reproduction, and number of adult male and female.

The Phase 3 sediment study specified that sediment from up to 14 sampleable sand and mud locations per AOI and from all 18 reference locations be tested in 42-day *H. azteca* bioassays. Sediment samples for use in 42-day *H. azteca* bioassays were selected to represent the range of metals concentrations and factors affecting bioavailability and to be spatially distributed across the mud and sampleable sand strata in each AOI. This selection process is documented in the EPA-approved Final 2019 Phase 3 Sediment Study Bioassay Sample Selection and Batching Recommendation Memorandum (Appendix B; Windward 2020a). A review of reference sediment chemistry data included in the memorandum identified that reference sample REF018 be excluded from use within bioassays due to a substantially higher percent TOC than other sediment samples from reference locations or from the AOIs (Appendix B). Therefore, this memorandum identifies 57 sediment samples from 40 AOI locations and 17 of the 18 reference locations tested in 42-day *H. azteca* bioassays (Table 2-6, Maps 2-1 to 2-6, and Appendix B). The 42-day *H. azteca* bioassay methods are described in Section 2.5.

2.1.6 Backscattered Scanning Electron Microscopy

To confirm the estimated percent slag relationship between total zinc concentration and percent slag (Section B4.2 of the QAPP[11]), 6 of the 56 sampleable sand samples from the three AOIs (i.e., 10.7 percent of those samples) were analyzed for percent slag using BSEM. These samples are identified in Table 2-6 and shown in Maps 2-1 to 2-3. Samples for BSEM analysis were selected based on analytical results for bulk sediment chemistry and field

[10] In addition to the 28-day and 42-day endpoints, the bioassay test also measured survival and reproduction at Day 35; however, Day 35 measurements for survival and reproduction are not themselves assessment endpoints and are therefore not summarized within the data summary report. Measurements for Day 35 are provided and summarized in the PER report (Appendix F).

[11] As described in the final BSEM sample selection memorandum (Appendix C), there was an error in QAPP Section B4.2 - Estimation of Percent Slag. The segmented linear regression equations provided in Section B4.2 are missing a square root sign on the left side of the equation (on percent slag). The equations shown in QAPP Figure B4-1 are correct; therefore, Figure B4-1 was referenced when preparing estimates of percent slag based on total zinc concentrations.

descriptions of the sediment samples and were approved by EPA (Appendix C). Further discussion on the selection criteria is provided in the BSEM technical memorandum included as Appendix C of this report.

2.2 FIELD SAMPLING METHODS

This section summarizes the collection and field processing methods for sediment, porewater, and BMI samples, which were carried out in accordance with the QAPP (ERM 2019) and the FSP (Appendix A to the QAPP). Field sampling was conducted by AECOM and its subcontractors, Gravity Environmental and Coastal Monitoring Associates, between September 10 and October 23, 2019. Samples were collected from 124 sampling locations within the three AOIs and reference areas. Sampling activities were conducted under the direct oversight of EPA or its authorized representatives. As specified in the Cultural Resources Coordination Plan for the study (Appendix E of the QAPP), a cultural monitor verified that cultural resources were not present in each sediment grab sample before sample processing. Three change requests and three field change requests were submitted to and approved by EPA for the field sampling component of this study. Change requests are summarized in Section 3.1 of this report and provided in Appendix D. Additional details and documentation about the field sampling effort are provided in the Field Summary Report (FSR) located in Appendix A of this report.

2.2.1 Sample Positioning

Sampling locations were accessed by boat and located using a vessel-mounted differential global positioning system and associated navigation software according to methods presented in detail in the SOP-1 of the FSP (ERM 2019). Upon arrival at a designated sampling location, the field-sampling team leader inspected the sediment bed composition using underwater video to verify that the observed sediment bed was consistent with the target strata (for locations at AOIs) or facies (for reference locations) specified in SOP-1 of the FSP. If the sediment bed did not match the target strata or facies, or if the location was determined to not be amenable to sample collection, the video was used to identify a suitable alternate location to sample. Physical location attributes (e.g., water depth, presence of vegetation) were recorded at each sampling location.

Field adjustments for AOI locations could be made anywhere within the contiguous target sediment facies, preferably within a 0.5-acre area. Vessel position relative to the sediment facies polygon boundaries were monitored in real time using the on-vessel navigation technology. For the 40 AOI locations where the target strata did not match surface sediment as observed by underwater camera, even after repositioning, the location was designated as a "mismatched strata" (Table 2-7 and Maps 2-1 to 2-3). When possible, sampling was performed at an alternate location with the same target strata (Table B1-1 of the QAPP), which resulted in the target number of samples being obtained at each AOI for each stratum, except for the mixed coarse and coarse strata at Deadman's Eddy AOI (Table 2-3). After making attempts at all available primary and alternate locations at Deadman's Eddy AOI, four out of six target samples were collected for the mixed coarse stratum and five out of six target samples were collected for the porewater-only coarse stratum. The numbers of primary and alternate locations from which samples were successfully obtained were Evans AOI 28 primary/11 alternate, China Bend AOI 25 primary/6 alternate, and Deadman's Eddy AOI 18 primary/12 alternate (Table 2-2).

Reference area sampling locations were to be within a 50- m radius circle centered on the proposed location coordinates, if possible. If the target sediment type could not be identified within 50 m of the specified location, sample locations were adjusted within the river reach based on real time video survey of the sediment. Modifications to the reference area sample locations beyond 50 m were discussed with the onboard EPA oversight personnel and communicated to the project leadership team for approval prior to sampling. Three reference sampling locations were shifted more than 50 m from the targeted locations (REF006, REF009, and REF010), as documented in Field Change Request No. 3 (additional detail provided in Section 3.1).

To obtain sufficient material, multiple successful sediment sampling attempts were composited for sediment and/or BMI samples. In total, 53 sediment and 11 BMI samples were composites of multiple grabs. At these locations, a composite centroid coordinate consisting of all successful sediment and BMI attempts was determined using the "Mean Center" function in ArcMap (Appendix H). The centroid coordinates are used in Maps 2-1 to 2-6 and in Table 2-2.

2.2.2 Bulk Sediment Collection for Chemical Analysis and Bioassay Testing

Sediment sample collection is described in Section 2.2.5 and in SOP-3 through SOP-6 of the QAPP FSP (ERM 2019). Depending on the target strata at a sediment sampling location, one of three sampling devices was used to collected bulk sediment for sediment chemistry and bioassays (Van Veen power grab, Modified Hamon grab, or freeze grab sampler). At three reference locations (REF003, REF004, and REF012), the water was too shallow for use of vessel-operated samplers (i.e., less than 1 m water depth), therefore sediment samples were collected using stainless steel hand tools.

For sediment sample collection in the AOIs, at least one video-guided attempt was made at each primary sampling location that could be safely accessed by boat. If sediment sampling at an AOI location was not possible or did not recover sufficient volume for the planned analyses, that location was recorded as a refusal, and sampling was repeated at a suitable alternate location. If the proposed number of sampleable sand samples were not obtained after attempting mechanical grab samples at all primary sampleable sand locations and available alternate sampleable sand locations, sampling locations were revisited using the freeze grab sampler. Refer to Figure A7-2 of the Phase 3 QAPP (ERM 2019) for the sediment sampling hierarchy for the sampleable sand stratum. Only one sampleable sand location (DM044) was revisited with the freeze grab sampler after the mechanical grab sampling devices were unable to retrieve an acceptable sample. Samples from the mixed coarse stratum were collected exclusively using the freeze grab sampler (Table 2-2).

After each grab sample was collected, the sample was evaluated for the sampling acceptability criteria appropriate to the sampling device, as detailed in SOP-3 through SOP-6 of the FSP. If the collected sediment sample met acceptability criteria, overlying water was removed and a bag of sediment filled and inspected for cultural resources (SOP-16) prior to filling sample containers with the bagged sediment for AVS and SEM analyses. The remaining sediment was transferred to a decontaminated transparent Lexan tub, inspected for cultural resources, and homogenized.

If samples did not meet the acceptability criteria, they were labeled "rejected" and temporarily placed in a decontaminated Lexan tub for potential use in case no acceptable sample could be collected. No "rejected" sediment samples were ultimately used. Unused material collected from the UCR was returned to the UCR at (or near) the location at which it was collected per the 2019 special use permit obtained from the National Park Service (Appendix A).

Homogenized sediment was assessed for the presence of coarse (greater than 5 mm) sediments or the presence of woody debris. Very coarse sediment (e.g., cobbles) and woody debris were removed by hand. If the sample contained sediments greater than 5 mm, the sample was sieved using a 5 mm stainless steel sieve and only material passing the sieve was homogenized and used for filling sample containers for chemical/physical analysis and potential bioassay testing. The total weight of the homogenized sediment sample and the weights of coarse materials removed by hand picking or sieving were measured and recorded. This information is summarized in Table 2-8. Sediment collected for BMI analysis (described in the next section) was not sieved in the field.

2.2.3 Benthic Macroinvertebrate Sample Collection

BMI sample collection was attempted at all sediment sampling locations and was performed concurrently with, and using the same equipment as, sediment sampling for chemical/physical parameter analysis and following the procedures described in SOP-8 (ERM 2019; FSP Attachment A2). Due to specific BMI sample processing steps, BMI samples were collected from separate sediment grabs than those grabs used for sediment chemistry and potential bioassays.

After a successful sample was determined to be acceptable and sediment characterized, the sample was placed into a Lexan tub for review by the cultural resources monitor. If the sediment sample was acquired using the freeze grab sampler, an additional gentle thawing step (soaking in warm/ambient river water) was required. Large gravel and debris were rinsed using river water and removed, and remaining sediments were transferred to pre-labeled plastic sampler containers. As stated in Section 2.2.1, compositing was required at 11 BMI sampling locations; at these locations, sediment from multiple successful grabs were mixed in a Lexan tub prior to being transferred to the pre-labeled plastic sampler containers. Ninety percent ethanol was added until the volume of ethanol was equal to the volume of sediment for BMI preservation. Material from unsuccessful grabs was returned to the UCR as described in Section 2.2.2.

2.2.4 Porewater Sample Collection

Sediment porewater was sampled from the top 0 to 6 in. of sediment from an anchored boat using the Trident probe developed by Coastal Monitoring Associates and were not collected concurrently with bulk sediment and BMI sampling. Porewater samples were collected in accordance with SOP-7 (ERM 2019; FSP Attachment A2) at locations shown in Table 2-2. The Trident probe is a direct-push sampler with integrated temperature and conductivity sensors. The decontaminated probe was inserted into the sediment, and porewater was collected by low-flow peristaltic pump extraction through a small-diameter Teflon sampling tube. The sampling tube was routed into a glovebox on the vessel. Porewater was collected into sampling containers inside a glovebox that has been purged with nitrogen to minimize oxidation.

During sampling, the following water quality parameters were measured in porewater and in near-bottom surface water: temperature, conductivity, pH, ORP, and total dissolved solids (TDS); DO was also measured for porewater. Procedures and water quality monitoring are described in SOP-7. Water quality measurements for porewater and surface water conducted during porewater sampling are presented in Table 2-9 and discussed in Appendix A. Conductivity and temperature were measured using sensors on the Trident probe and a handheld multimeter. The multimeter was also used to measure pH, TDS, and ORP. DO was measured using a YSI sensor. The data collected from sensors mounted to the Trident probe were preferred over the multimeter readings because the sensor data were collected in situ. Thus, the multimeter data for conductivity and temperature are not included in Table 2-9. Water quality data for porewater were collected at the beginning, middle, and end of porewater sampling at each location and compared to surface water data to monitor, in real time, for signs of overlying water being drawn in during porewater sample collection, as described in SOP-7 for the FSP (ERM 2019; Appendix A). The water quality data were also used in conjunction with real-time video of the Trident probe to verify correct probe placement in the sediment, particularly in cases where porewater and surface water chemistry were similar.[12] Decisions regarding probe placement were made with EPA oversight during the sampling effort. Near-bottom surface water quality parameters of temperature, conductivity, and pH measured during porewater sampling were also used for evaluations of BMI data at sampling locations.

For porewater locations where the sediment bed matched the target strata or facies, if sampling was not successful after a minimum of three failed attempts at a location, then the field team leader consulted with EPA oversight personnel to determine whether to log the location as a refusal and move to an alternate location or perform additional sampling attempts. A total of seven porewater sampling locations were logged as refusals due to the inability of the Trident probe to adequately penetrate the substrate: EV020, EV021, EV029, EV041, DM032, DM033, and DM057.

2.2.5 Field Quality Control Samples

Field quality control (QC) samples included sediment, porewater, and BMI duplicates, sediment and porewater EPA splits, and sediment and porewater rinsate blanks. In accordance with the QAPP (ERM 2019), field sediment, field porewater, and BMI duplicates were collected from 12, 8, and 9[13] locations, respectively (10 percent of sediment locations, 5 percent of porewater locations, and 5 percent of BMI sample locations) to assess the variability associated with sample processing.

[12] Trident Log Sheets in Appendix G of the Field Sampling Report (Appendix A) identify locations where videos of Trident probe placement were obtained. These videos are available on the “Downloads” page in the project database (http://teck-ucr.exponent.com).

[13] In order to reduce the potential for porewater drawdown, the total volume of porewater collected at any one location was minimized by collecting only one duplicate bottle at a given sample location (up to five bottles were filled at each sample location to be analyze for required parameters). This resulted in duplicate bottles being filled from 26 sample locations.

Field split samples for chemical analysis were provided to EPA in the field at the time of sampling.[14] Split samples for 42-day *H. azteca* bioassay testing were prepared in the field and stored at the analytical laboratory and shipped to EPA's bioassay testing laboratory at the same time that selected sediment samples for bioassay testing were shipped to PER, the bioassay testing laboratory used by TAI for the study.

Equipment rinsate blanks were collected to identify possible contamination from the sampling environment or from the sampling equipment (e.g., mechanical stainless steel paddle wheel mixer, scoops, bowls). Equipment rinsate blanks were generated once a week for each sampling crew for a total of 11 sediment and 6 porewater rinsate blanks. The field samples associated with each equipment blank are identified in Table 2-10.

2.2.6 Decontamination

All sampling equipment coming into direct contact with samples were decontaminated in accordance with SOP-14 and per the equipment-specific decontamination procedures specified in SOP-3 through SOP-7 (ERM 2019; FSP Attachment A2). Decontamination of sampling equipment was executed prior to beginning field work, between sampling stations, and at the conclusion of the field effort. Clean nitrile gloves were worn at each sampling station and when handling samples to reduce the potential for cross contamination. Gloves were changed and discarded between sampling stations to avoid transfer of potential contaminants.

2.2.7 Sample Identification, Labeling, and Shipping

This section identifies sample identification, labeling, and shipping for TAI samples. EPA split samples are described in Section 2.2.5. All distinct sediment, porewater, and BMI samples were identified and labeled according to SOP-9 (ERM 2019; FSP Attachment A2). Besides identifying the location identification (ID), Sample identifiers also identified the matrix type ("SE" for sediment, "PW" for porewater, "BMI" for benthic macroinvertebrate), sample type ("1" primary, "2" field duplicate, "3" field split, "4" equipment rinsate blank), and sampling date. Similar sample ID and labeling were applied to laboratory bioassay-generated sediment and porewater samples collected during the 42-day *H. azteca* bioassays, with some modifications. In addition to sample

[14] Following the field sampling effort, 10 additional sediment split samples were provided by TAI to EPA in September to determine whether inconsistencies observed between ALS and Washington Department of Ecology Manchester Environmental Laboratory (MEL) laboratories in two of three mixed coarse sediment samples were due to the variable nature of the mixed coarse stratum or to analytical differences.

matrix and location IDs, laboratory bioassay-generated sample IDs included an identifier for the bioassay organism and duration ("HA42" for a 42-day *H. azteca* bioassays) and the time of sampling (e.g., "T21" for Day 21). The 42-day *H. azteca* bioassay negative laboratory control sample IDs also included the test batch number (e.g., "B1" for Batch No. 1).

Sample containers were labeled with the project name, sample identifier, collection date and time, initials of the sampler, laboratory analyses, and any preservatives present in the sample. Field sediment and field porewater samples were stored in coolers on ice or in a refrigerated truck before delivery to ALS. A refrigerated truck was used for delivering field sediment and field porewater samples under chain-of-custody (COC) to ALS. BMI samples were delivered by field personnel from the field, under COC, to EcoAnalysts for taxonomic analysis.

Sediment for potential bioassay and BSEM analysis were held by ALS. Once samples for 42-day *H. azteca* bioassay testing and BSEM analysis were identified and approved by EPA (see memos in Appendix B and G, respectively), selected samples were shipped by commercial carrier, under COC, from ALS to either PER for 42-day *H. azteca* bioassay testing or RJ Lee Group for BSEM analysis. Sediment samples selected for 42-day *H. azteca* bioassays were shipped from ALS in a refrigerated box maintained at 4°C ± 2°C during transit and received by PER on May 6, 2020. Supplemental sediment sample volume for select samples was shipped from ALS to PER and received by PER on June 11, 2020, as described in Section 3.3. Sediment samples for BSEM analysis were shipped from ALS and received by RJ Lee Group on March 3, 2020.

Field samples were shipped to the analytical laboratories in accordance with methods and COC procedures described in SOP-12 of the FSP (ERM 2019; Appendix A).

2.3 CHEMICAL ANALYSIS METHODS

Chemical analyses were conducted on sediment and porewater samples shipped from the field to ALS between September 18 and October 25, 2019. Chemical analyses were also conducted on laboratory bioassay-generated sediment and porewater samples collected by PER as part of the 42-day *H. azteca* bioassay testing (Table 2-4). Sediment and porewater samples from the 42-day *H. azteca* bioassay tests were shipped from PER to ALS from June 11 to July 13, 2020. Samples were stored at ALS in accordance with the specifications in the QAPP (ERM 2019; Tables B3-1). Except for the three freeze grab samples from Evans identified in Section 2.1.3 and the footnotes in Table 2-6, sediment and porewater samples (including rinsate blanks) were analyzed for the chemicals listed in Table 2-4 using the preparation and analysis methods presented in Table 2-5. SOPs for the laboratory analyses are listed in Appendix G of the ALS's quality assurance (QA) manual, which is Appendix B of the QAPP (ERM 2019).

2.4 BENTHIC MACROINVERTEBRATE ANALYSIS METHODS

Sediment samples collected for BMI analysis were couriered from the field to EcoAnalysts, Inc.'s taxonomic laboratory between September 11 and October 25, 2019. BMI analyses were performed on field-collected sediment BMI samples in accordance with the procedures described in Appendix D of the QAPP (ERM 2019) and followed the protocols summarized in Section B.4.4 of the QAPP. Change Request 4, discussed in Section 3.1 of this report, modified the BMI analysis plan to include the measurement of AFDW and blotted wet-weight BMI biomass for each BMI sample's 250 and 500 μm size fractions (Appendix D). Refer to Table 2-2 for list of sampling locations at which BMI parameters were obtained.

2.5 BIOASSAY METHODS

Sediment toxicity testing was conducted on 57 bulk sediment samples using the amphipod *H. azteca* test method (USEPA 2000; ASTM 2019) and following PER's SOPs, which are included in Appendix C of the QAPP (ERM 2019), and the associated Change Request 6. Sampling locations for which 42-day *H. azteca* bioassay testing was performed are identified in Table 2-6 and include 40 locations within the Phase 3 AOIs and 17 reference locations.

The 42-day *H. azteca* bioassay test measured effects on survival, weight, biomass, growth, and reproduction. In addition to obtaining data on biological endpoints of the test organisms, porewater and sediment samples associated with the 42-day *H. azteca* bioassays were collected and analyzed for concentrations of metals and/or associated bioavailability parameters (see Table 2-4).

Biological endpoints were assessed and reported in accordance with applicable guidance (USEPA 2000; ASTM 2019) on Day 28 and upon completion of the 42-day *H. azteca* bioassays on Day 42 as shown in Figure 2-3.

Responses (endpoints) of test organisms measured included the following:

- Survival – number of surviving organisms divided by the initial number of organisms
- Weight – dry weight of surviving organisms divided by the number of surviving organisms

- Biomass – dry weight of surviving organisms divided by the initial number of organisms
- Reproduction – number of young divided by the number of surviving females, and number of surviving adult males and females.

Test conditions are summarized in Table 2-11. Test acceptability requirements (i.e., test acceptability criteria and performance goals[15]), including deviations from EPA (2000), are summarized in Table 2-12 and are evaluated in Section 4.5. 42-day *H. azteca* bioassay endpoint results are presented in Section 5.4. In order for a test to be considered acceptable, the test acceptability criteria (Table 2-12 Section A) must be met; other test requirements (Table 2-12 Sections B and C) are considered performance goals.

The general 42-day *H. azteca* bioassay methods are provided in Section 2.5.1. Methods used to collect the porewater and sediment samples are provided in Section 2.5.2, and QC samples associated with the 42-day *H. azteca* bioassays are described in Section 2.5.3. For additional details on the bioassay methods used refer to the Bioassay Laboratory Data Report (Appendix F).

2.5.1 General Bioassay Methods

The methods for the 42-day *H. azteca* bioassay test are summarized in this section and are described in detail in the bioassay laboratory report prepared by PER, An Evaluation of the Toxicity of Upper Columbia River Site Sediments to the Amphipod *Hyalella azteca* (provided in Appendix F of this report).

The 42-day *H. azteca* bioassays were initiated following the completion of field sampling and after an agreement had been reached with EPA on the selection and batching of the samples (Appendix B). Testing was conducted in three batches, with each batch consisting of 20 or 21 samples (i.e., Site samples from Phase 3 AOIs and reference samples) plus the negative laboratory control and quartz sand negative laboratory control samples. Table 2-13 provides a list of the samples included in each batch.

This test was performed using a 28-day static-renewal exposure of 8-day-old (known age) *H. azteca* to sediments, followed by a 14-day exposure to water, during which only reproduction was evaluated. The test was conducted in glass beakers, using 12 replicate 300 mL beakers for each sediment sample for biological measurement of 42-day *H. azteca*

[15] EPA (2000) guidance uses the term "test acceptability requirements," which includes criteria that must be met for a test to be considered acceptable and other criteria that should be met as a goal for conducting a good test. The two types of requirements are distinguished as follows: test acceptability criteria that must be met are referred to as "criteria," and those that should be met are referred to as "performance goals."

survival, growth, and reproduction. An additional 10 replicate chambers were run during the test to obtain porewater and sediment samples for chemistry analytical measurements with two replicate 300 mL beakers for sediment collection and eight 1- L beakers for porewater collection. Chemistry replicates are not true test replicates and were not assessed for biological endpoints (i.e., survival, growth, or reproduction). A schematic illustrating the number of 42-day *H. azteca* bioassay and chemistry-only replicates is presented in Figure 2-3.

Immediately prior to testing, each sample was homogenized in a decontaminated plastic tub using a decontaminated plastic scoop. A sediment sample was collected from the homogenized bulk sediment and sent to ALS for analysis of total metals. The homogenized sediment was distributed directly into both bioassay and chemistry test chambers. Test chambers (both bioassay and chemistry test chambers) were allowed to equilibrate for 7 days prior to the introduction of the test organisms.

The 42-day *H. azteca* bioassays were initiated in June 2020, with Batch Nos. 1, 2, and 3 initiated on June 16, 17, and 18, respectively. The test was initiated by distributing 10 randomly selected 8-day-old (known age) amphipods to each bioassay test chamber. Each sediment chemistry replicate chamber was loaded with 10 randomly selected 7- to 8-day-old amphipods and each porewater chemistry replicate chamber was loaded with 30 randomly selected 7- to 8-day-old amphipods.[16] Initial dry weight measurements were obtained from the average of the dry weight of eight replicates of 10 randomly selected 8-day-old (known-age) organisms.

The tests were conducted at 23°C ±1°C with a photoperiod of 16 hours of light and 8 hours of dark (16L:8D). During the test, overlying water was exchanged twice each day (i.e., in the morning and evening) using a Brunson-style in-line flow splitter. Water quality parameters of the overlying water were measured according to EPA guidance (USEPA 2000) and as described in the PER SOP (see ERM 2019; Appendix C; Change Request 6); see Table 2-11 for the list of parameters and measurement schedule. Water quality measurements and operating conditions of the exposure system readings are provided in the bioassay laboratory report (Appendix F).

After the evening water change, each replicate was fed yeast-Cerophyl-trout chow (YCT)+TetraMin. The YCT was fed at 1.0 mL/replicate/day for the entire test period in the

[16] Test organisms were allowed to burrow into sediment in the chemistry test chambers to simulate the bioturbation that typically occurs in a sediment bioassay.

300-mL beakers and 3.0 mL/replicate/day in the 1- L beakers. The TetraMin food amount was increased each week to account for organism growth as follows:

- Week 1 (Day 0 to Day 6) – 0.25 mg/300-mL beaker/day and 0.75 mg/1-L beaker/day TetraMin fish flake suspension
- Week 2 (Day 7 to Day 13) – 0.5 mg/300-mL beaker/day and 1.5 mg/1-L beaker/day TetraMin fish flake suspension
- Week 3 (Day 14 to Day 20) – 1.0 mg/300-mL beaker/day and 3.0 mg/1-L beaker/day TetraMin fish flake suspension
- Week 4 (Day 21 to Day 27) – 1.5 mg/300-mL beaker/day TetraMin fish flake suspension
- Week 5 (Day 28 to Day 34) – 2.0 mg/300-mL beaker/day TetraMin fish flake suspension
- Week 6 (Day 35 to Day 42) – 2.5 mg/300-mL beaker/day TetraMin fish flake suspension.

Immediately prior to evening water renewal, a DO check was performed for all test chambers. For any sediment sample for which a test replicate overlying water DO level had decreased below 2.5 mg/L, all replicates for that sample were aerated, per EPA guidance; the date of aeration implementation was recorded. Aeration was also initiated for samples exhibiting a downward trend in daily DO measurements to help ensure that the DO concentration would not drop below 2.5 mg/L prior to the evening checks, using best professional judgment of the downward trend and the potential for concentrations to fall below 2.5 mg/L. Once aeration was initiated during either the sediment exposure period (Day 0 to Day 28) or water-only exposure period (Day 29 to Day 42), it was continued to the end of that testing period. Because the day for which aeration was initiated varied, the total duration of aeration also varied between treatments.

On Day 28, survival was assessed in all of the 12 replicates of the biological test chambers for each sediment sample, four of which were then terminated to obtain data for Day 28 weight and biomass[17]. Organisms from the remaining eight biological test chambers were transferred to water-only test chambers for the remainder of the toxicity test (i.e., Days 28

[17] For the four replicates terminated on Day 28, early reproduction was also monitored. If young were noted, reproduction was assessed in the other eight replicates associated with that sample.

to 42).[18] On Day 35, the number of offspring in the eight biological test chambers was recorded.

Test batches were terminated on Day 42, with Batches 1, 2, and 3 terminating on July 28, 29, and 30, respectively. Test organisms were collected, and the numbers of surviving adult male and female amphipods in each replicate were recorded. This information was used to calculate the number of young (i.e., neonates) produced per surviving female per replicate from Days 28 to 42. The surviving adult male and female amphipods from each replicate were dried at 60°C for 24 hours and weighed to the nearest 0.01 mg. The total weight of the dried amphipods from each replicate was divided by the number of surviving amphipods to obtain an average dry weight per amphipod for each replicate. Biomass was calculated by dividing the pooled amphipod dry weight for each replicate by the corresponding number of initial organisms.

Physico-chemical properties of the test chamber water column (overlying water) measured in accordance with the SOP for *Hyalella azteca* 42-Day Survival, Growth, and Reproduction Sediment Toxicity Test (ERM 2019; Appendix C; Change Request 6) included hardness (mg/L as calcium carbonate), alkalinity (mg/L as calcium carbonate), conductivity (µS/cm), pH, ammonia as NH_3-N (mg/L), temperature (°C), and DO (mg/L). The record of these measurements is provided in Appendices G, H, and I of the PER Laboratory Report (Appendix F).

2.5.2 Bioassay Quality Control Samples

Each batch included testing the negative laboratory control sample and the quartz sand negative laboratory control sample. The negative laboratory control sample consisted of Spring River sediment.[19] A description of control sample provenance is provided in the PER report (Appendix F, Sections 2.4.3 and 2.4.4). Twelve replicates of each type of control sample were included in each batch. Test acceptability criteria and performance goals are established for the negative laboratory control samples (i.e., the Spring River sediment in the Phase 3 sediment study bioassays) (Table 2-12). The quartz sand negative laboratory control sample was included in the bioassays to assess the potential for the composition of food and water to be inadequate to fully support survival, growth, and reproduction of amphipods. Its inclusion was based on the recommendation for a performance-based

[18] On Day 35, the number of offspring in the eight biological test chambers were recorded. Results from these counts are presented within the PER report (Appendix F).

[19] Field-collected freshwater sediment from Spring River, Missouri. Sample was collected by Missouri State University on December 21, 2019, shipped on ice, and stored at PER at 4±2 °C until used in testing.

evaluation of this issue, as discussed by EPA (Mount 2011). The performance-based guidelines for the quartz sand negative control sample suggested by EPA (Mount 2011) are provided in Table 2-12. As described in the EPA-approved bioassay sample selection and batching memorandum (Appendix B), two study samples (one AOI sample and one reference sample) were selected to be run in all of the batches as an additional inter-batch comparability control. The two samples included in all three batches were REF013 and DM008. In order to have sufficient volume for including each of these samples in all batches, sediment from the 5-gallon bucket (intended to be held for possible future TIEs) was used with EPA approval to augment the volume from the 2-gallon bucket collected specifically for the initial 42-day *H. azteca* bioassays (Appendix B). Using these two samples during the initial 42-day *H. azteca* bioassays limits their use for potential TIEs but provides valuable information on inter-batch variability, and other samples are available for use in potential TIEs.

In order to assess the sensitivity of the *H. azteca* test organisms to toxic stress, reference toxicant tests were performed. The reference toxicant tests consisted of 96-hour exposures to test water medium spiked with potassium chloride at concentrations ranging from 0.1 to 1.6 mg/L. The reference toxicant testing is described in Section 2.4.6 of the PER report (Appendix F) with results provided in Appendix M of the report.

As described in SOP-17 (ERM 2019; Appendix C), equipment rinsate blanks were prepared for equipment used to homogenize sediment samples for 42-day *H. azteca* bioassay testing. These rinsate blanks were analyzed for total metals to evaluate whether the homogenization equipment was effectively cleaned between samples.

2.5.3 Laboratory Bioassay-Generated Porewater and Sediment Samples

Laboratory bioassay-generated sediment and porewater samples were prepared at multiple times during the course of the 42-day *H. azteca* bioassay tests (Figure 2-3). Procedures for the collection of laboratory-generated bioassay porewater and sediment samples are included in the PER SOPs provided in Appendix C of the QAPP (ERM 2019) and were amended by Change Request 6, Revision 1 (Appendix D) as described in Section 3.3 below. The replicate chambers setup for preparing sediment and porewater chemistry samples contained test organisms to allow for bioturbation but were not used to evaluate biological endpoints. Sample containers containing the appropriate preservative(s) for all analyses and filters for collecting porewater samples for DOC and dissolved metal analyses were provided to PER by ALS. Analytical methods for laboratory bioassay-generated porewater and sediment samples are provided in Table 2-5.

Sediment samples were prepared from the bulk sediment prior to the start of the test and from chemistry replicate test chambers on Day 7 and Day 21 of the 42-day *H. azteca* bioassay tests. As described in Section 2.5.1, a subsample of homogenized bulk sediment was collected prior to the start of the test for analysis at ALS for total metals, TOC, and percent solids. On Day 7, one of the two established sediment chemistry replicates for each treatment was terminated and sediment was collected for analysis of AVS, SEM, and TOC as described in the PER report (Appendix F). The remaining Day 21 sediment chemistry replicates were similarly terminated and processed. One jar containing sediment obtained on Day 21, SE-DM002-HA42-T21-B2, broke during freezing. Per the SOP for Sediment Chemistry Collection included in QAPP Change Request No. 6, the sample container that broke during freezing was double-bagged under nitrogen and then placed inside another larger jar with nitrogen headspace by PER prior to shipment to ALS.

Sediment porewater samples were collected by centrifugation of sediment from porewater chemistry replicate chambers on Day 7 and Day 21 of the 42-day *H. azteca* bioassay test. On Day 7 of testing, four of the eight sediment porewater replicates for each treatment were terminated for collection of sediment porewater according to methods described in the PER report (Appendix F). Sediment was centrifuged at 4,300 g-force for 30 minutes at 4°C. The resulting supernatant porewater was carefully composited from each of the four replicates into a plastic beaker and a porewater volume assessment performed. If insufficient porewater volume was recovered for all the proposed analyses, priority sampling was performed (Table 2-4) as per QAPP Change Order Request No.6 (Appendix A). The priority for porewater subsampling for analysis was as follows:

- Priority 1 – Metals, DOC, and pH
- Priority 2 – Sulfide
- Priority 3 – Chloride and sulfate
- Priority 4 – Alkalinity.

After the sediment porewater volume assessment was performed, an aliquot of porewater was immediately measured for pH using a microprobe; the remaining porewater volume was either filtered into (for metals and DOC) or directly placed into (for sulfide, chloride sulfate, alkalinity) pre-cleaned and preserved sample containers provided by ALS. The remaining four Day 21 porewater replicates were similarly terminated and processed.

The total volume of porewater collected by centrifugation for each sample is provided in Table 2-14, along with an accounting of how the collected porewater was allocated for the various analyses. The total volume of porewater obtained for some samples was insufficient for filling bottles for all analyses; Table 2-14 identifies which analyses could not be performed due to limited porewater volume.

Sufficient porewater could not be generated for the full suite of Priority 1 porewater analyses (see above) for the following samples: REF008 (Batch 1, Day 7 [DOC]), REF003 (Batch 1, Day 21 [DOC]), and CB029 (Batch 2, Day 7 [Metals, DOC]).

Sufficient porewater could not be generated for Priority 2 porewater analyses (see above) for the following 28 samples (Tables 2-5 to 2-7 in Appendix F):

- Batch 1 – DM007 (Day 7s and 21), DM008 (Day 7s and 21), CB002 (Day 7), EV002 (Day 7), REF003 (Days 7 and 21), REF004 (Day 7), REF006 (Days 7 and 21), REF007 (Day 21), REF008 (Days 7 and 21), REF013 (Day 7)
- Batch 2 – 1-B6-NRT (Days 7 and 21), DM002 (Days 7 and 21), DM008 (Days 7 and 21), CB029 (Day 7), JS002 (Day 21), 4-B6 (Day 7), EV008 (Days 7 and 21), EV069 (Day 7), REF001 (Day 7), REF002 (Day 7)
- Batch 3 – DM018 (Day 21), CB006 (Days 7 and 21), CB014 (Day 7), CB044 (Day 21), REF005 (Day 21), REF009A (Day 7), REF011 (Days 7 and 21), CTL-SR-3 (Days 7 and 21), CTL-QS-3 (Day 7).

Sufficient porewater could not be generated for Priority 3 and 4 porewater analyses (see above) for the following 29 samples (Tables 2-5 to 2-7 in Appendix F):

- Batch 1 – DM007 (Days 7 and 21), DM008 (Days 7 and 21), CB002 (Day 7), EV002 (Day 7), REF003 (Days 7 and 21), REF004 (Day 7), REF006 (Days 7 and 21), REF007 (Day 21), REF008 (Days 7 and 21), REF013 (Day 7)
- Batch 2 – 1-B6-NRT (Days 7 and 21), DM002 (Days 7 and 21), DM008 (Days 7 and 21), CB029 (Day 7), JS002 (Day 21), 4-B6 (Day 7), EV008 (Days 7 and 21), EV069 (Day 7), REF001 (Day 7), REF002 (Day 7)
- Batch 3 – DM018 (Day 21), CB006 (Days 7 and 21), CB014 (Days 7 and 21), CB044 (Day 21), 4-B1 (Day 21), REF005 (Day 21), REF009A (Day 7), REF011 (Days 7 and 21), CTL-SR-3 (Days 7 and 21), CTL-QS-3 (Day 7).

Laboratory bioassay-generated porewater and sediment samples were identified using the nomenclature detailed in the Phase 3 QAPP (ERM 2019).

2.6 BACKSCATTERED SCANNING ELECTRON MICROSCOPY

Sediment analysis by BSEM was conducted on Phase 3 sediment samples from six sampleable sand locations (Table 2-6). BSEM analysis was performed to confirm the estimated percent slag relationship between total zinc concentration and percent slag (Section B4.2 of the QAPP). The samples selected for BSEM analysis were approved by EPA and are described in the TAI (2020a) final BSEM technical memorandum (TAI 2020a) and included in Appendix C to this report. The BSEM technical memorandum also describes the analytical and QA/QC procedures for the BSEM analysis.

Upon receipt at RJ Lee Group, the sediment samples were stored at 4 to 6°C until preparation. The samples were prepared for analysis by drying, sieving, mounting in epoxy, and polishing. The elemental composition and morphology of sediment samples were evaluated using computer controlled scanning electron microscopy with energy-dispersive X-ray spectroscopy. BSEM data were used, along with particle morphology and internal texture, to develop "rules" to classify the particles as slag or not. The classification rules employed for this study are the same as those established in the UCR Phase 2 sediment study (Windward 2017). The dominant slag (referred to as "Slag1" in Appendix G) has an elemental composition that is distinct and separate from other sediment. A minor slag (referred to as "Slag2") with elemental composition that overlapped minerals was also identified by inspection for morphology and internal structure. Another minor, chromium-rich slag with rare occurrences in sediment samples analyzed for the Phase 2 study (referred to as "Slag3") was not observed in samples analyzed for this study. The composition of altered slag was assessed using manual scanning electron microscopy techniques on a subset of particles with one or more alteration rims. Additional details on the analysis methods and results are presented in the Final BSEM Summary Report (Appendix G).

3 QUALITY ASSURANCE PROJECT PLAN DEVIATIONS AND MODIFICATIONS

This section discusses deviations from and modifications to the QAPP (ERM 2019) that were encountered during field sampling, BMI analysis, and 42-day *H. azteca* bioassays. There were no deviations or modifications associated with chemical analysis of sediment, porewater, or BSEM samples.

Procedures presented in the QAPP (ERM 2019) were followed to the extent possible during field sampling activities and laboratory analyses. Modifications were categorized as either changes or deviations. "Change request forms" were used to document changes to procedures specified in the QAPP and/or the FSP that were identified before, during, or after field sample collection, or for sample analysis. "Field change request forms" were used to document minor procedural adjustments implemented in the field based on the feasibility of sediment sample collection, and were typically specific to sampling locations. Change requests were prepared and submitted by TAI for EPA's review, and approved by EPA. Six change requests and three field change requests were approved for the study; three of the change requests were subsequently revised (Change Request Nos. 3, 4, and 6). The revised change requests were approved by EPA. All of the change requests prepared during the study, including revisions to Change Request Nos. 3, 4, and 6, are included in Appendix D to this report.

Deviations from methods described within the Phase 3 QAPP and FSP were identified within the FSR (Appendix A), BMI Laboratory Results Report (Appendix E), and Bioassay Laboratory Results Report (Appendix B). These deviations are summarized within the below sections.

3.1 FIELD CHANGES AND DEVIATIONS

Field changes and deviations are summarized in this section. Of the nine change requests and field change requests approved for the study, six related to field sampling activities: Change Request Nos. 2, 3, and 5, and Field Change Request Nos. 1 through 3. The three change requests not related to field sampling activities are described in Sections 3.2 and 3.3. There were four deviations related to field sampling.

Changes to the field sampling component of the study are summarized below. Refer to Appendix D for additional detail.

- **Change Request No. 2.** The procedure for BMI sampling was adjusted to specify that after sediment and preservative are added to BMI sample containers, the container should be closed, sealed, and then gently rolled to ensure proper preservation of the BMI samples. Buffered formalin (10 percent) as an alternative to ethanol was also approved for use as a BMI sample preservative; however, this alternative preservative was never used.

- **Change Request No. 3, Revision 1.** The procedure for BMI sampling was adjusted to allow for and describe a process of subsampling Van Veen power grab samples to collect representative samples that would be more manageable than the full volume of the primary grab samples that were initially collected for BMI analysis. The sampling procedure allowed for collecting half of the Van Veen power grab sediment samples to alleviate field and laboratory issues caused by having to manage excessive sediment volumes produced by the preliminary sampling approach. Ultimately, the procedures described in this change request were not used in the field due to smaller sample volumes obtained at the remaining Phase 3 sediment sampling locations.
- **Change Request No. 5.** This change added a step to the procedures for sediment and BMI sample collection to ensure consistent collection of imagery at sampling locations where the sediment bed did not match the target strata.
- **Field Change Request No. 1.** To prioritize collecting sediment for the full triad suite, sampling at additional sampleable sand locations was attempted using mechanical sampling methods within the historical river channel (below 1,220 ft) instead of using the freeze grab method from areas outside the historical channel (above 1,220 ft).
- **Field Change Request No. 2.** The procedure for collecting sediment samples from mixed coarse strata using the freeze grab method was adjusted to limit the time and energy expended to collect representative samples at the Evans AOI while ensuring the quality of the eventual results. This adjustment reduced the target volume of sediment collected for BMI analysis from 2.7 gallons to 1 gallon and limited the maximum time necessary to obtain sediment for BMI analysis to 4 hours per sampling location.
- **Field Change Request No. 3** Three reference area sampling locations (REF006, REF009, and REF010) at Genelle Eddy, BC, were moved more than 50 m from the target locations identified in the QAPP (ERM 2019) due to access issues at the target locations or issues with the sediment type and quantity at the target area.

Deviations from the QAPP that were identified during sampling activities and subsequent corrective actions, if required, were documented in Section 2.10 of the FSR (Appendix A).

The deviations are not expected to adversely affect the DQOs as outlined in the QAPP. The following deviations were noted:

- As a deviation to *SOP-6 Eckman, Cookie Cutter, or Scoop Grab Sediment Sample Collection*, the field team used a stainless steel shovel to collect sediment samples at reference area locations REF003 and REF004 and a stainless steel ice scoop to collect the sediment sample at REF012.
- As a deviation to *SOP-1 Positioning At Below-Water Stations*, the angle of the winch wire relative to vertical was not recorded at sampling locations in the Deadman's Eddy AOI where swift currents caused drift in the winch wire greater than 5 degrees. Because the water column was relatively shallow (i.e., 0.8 to 18 m), there was minimal impact to the spatial coordinate data for the samples obtained.
- As a deviation to FSP Section 2.2.7 (Sediment Quality Control Samples) and *SOP-3 Van Veen Power Grab Sediment Sample Collection*, EPA split sample REF011-SE-3-100119 was taken from a grab sample separate from the primary sample instead of from the same grab, as directed in SOP-3. The separate grab used for preparing the EPA split samples was not included in the location centroid calculated for location REF011 (Appendix H).
- As a deviation to Footnote 6 on page A-14 of the QAPP (ERM 2019), when shallow water conditions were encountered at repeat sampling locations 1-B5-NRT and 1-B6-NRT (Deadman's Eddy AOI), sediment sampling was performed using a Van Veen power grab sampler at the closest location accessible by vessel instead of using a hand-held sampling device and wading to the sampling location. As a result, the sampled locations of 1-B5-NRT and 1-B6-NRT were 9.4 and 20.2 m, respectively, away from the target locations where the sediment samples were previously collected for the Phase 2 sediment study in 2013.

3.2 BENTHIC MACROINVERTEBRATE ANALYSIS CHANGES AND DEVIATIONS

Change Request No. 4 was prepared to modify the BMI analysis procedures presented in the QAPP (ERM 2019) by adding AFDW and wet-weight biomass analysis for all of the BMI samples collected for the study. Residual AFDW in the BMI sample represents the particulate organic matter that many of the BMI sampled are likely to use as a food source. BMI wet-weight biomass provides additional information pertaining to the magnitude of the BMI community present in the sample (analogous to density). Revision 1 to Change Request No. 4 adjusted the approach for measuring wet-weight biomass to specify that the BMI would be blotted dry and weighed by the 250 μm and 500 μm sieve fractions instead of by major taxonomic group.

In addition to the above listed changes, there were two deviations from the QAPP during BMI analysis.

- Fractions which required a full resort due to low abundance were assessed at the laboratory MQO (80 percent) instead of the QAPP specified MQO (90 percent). This deviation is unlikely to have altered BMI results. Affected samples for each size fraction are
    - 250 μm – EV013-BMI-1-091319, EV048-BMI-1-092419, CB006-BMI-1-100919, CB027-BMI-1-101519, CB046-BMI-1-100819, JS001-BMI-1-101019, DM015-BMI-2-101019 (duplicate sample), DM024-BMI-1-101519, and REF013-BMI-1-092419
    - 500 μm – EV022-BMI-1-093019, EV037-BMI-2-092319 (duplicate sample), CB039-BMI-1-101219, and CB047-BMI-1-101119
- The 500 μm fractions of BMI samples from locations DM022, DM050, EV052, REF014, REF016, and REF017 were inadvertently ashed[20] prior to determining a dry weight; as a result, an AFDW could not be determined for these samples (Appendix E).

3.3 BIOASSAY CHANGES AND DEVIATIONS

One change request form (Change Request No. 6) was prepared by TAI and approved by EPA to modify the 42-day *H. azteca* bioassay procedures presented in the QAPP (ERM 2019). Change Request No. 6, Revision 1, is provided in Appendix D. This change primarily modified the QAPP for the methods and timing for collecting porewater and sediment samples during the 42-day *H. azteca* bioassays. The following modifications were included:

- Eliminating the collection of laboratory bioassay porewater using peepers.
- Amending the timing and procedures for collection of laboratory bioassay-generated sediment and porewater samples to
    - Include the collection of sediment collected at Day 7 (which was referred to as BULK in the sample ID) for analysis of TAL metals, percent moisture, and TOC.

[20] Oxidized in a muffle furnace at high temperature.

  - Update the timing for collection of laboratory bioassay-generated sediment chemistry and centrifuged porewater from chemistry chambers to Day 7 and Day 21.
  - Update the number of replicate chemistry chambers required to a total of 10 per treatment.
  - Specify that sediment samples will be equilibrated for 7 days with twice daily water changes prior to initiating the test.
  - Specify that porewater would be obtained via centrifugation at 4,300 g-force for 30 minutes and clarify that porewater would be obtained using 1.2 L of sediment distributed across four 1-L beakers with 700 mL of overlying water added to each beaker.
  - Update the general activity schedule in the 42-day *H. azteca* SOP (in Appendix C) was to reflect the procedures and timing for the changes described above.
- Replacing the Porewater Extraction via Centrifugation SOP (QAPP Appendix C) with a project-specific SOP, including details about centrifugation, filtration, priority of porewater analyses if sample volume is limited, and the order for subsampling the porewater after centrifugation. Under Revision 1 to the change request, the Porewater Extraction via Centrifugation SOP and QAPP Table B3-1, Part E, were amended to describe the absolute minimum volumes needed if the minimum sample volume is not obtained.

Deviations associated with the bioassays were noted as follows:

- Both the 2-gallon bucket and 5-gallon bucket of field-collected sediment were shipped from ALS to PER for use in the bioassay testing for 11 of the 57 samples for which bioassay testing was performed. Both the QAPP and the EPA-approved bioassay sample selection and batching memorandum (Appendix B) described that sediment from the 2-gallon bucket would be used for initial 42-day *H. azteca* bioassay testing and that the 5-gallon bucket containing sediment would be held and refrigerated at ALS for potential use in TIEs, if TIEs are performed; however the following exceptions occurred:
  - Seven samples (3-R7-2019, 3-R8-2019, CB010, CB029, CB047, JS002, and REF012) were identified as containing a likely insufficient volume in the 2-gallon bucket for bioassay testing in advance of sample shipment from ALS to PER. The 5-gallon buckets for those samples were shipped from ALS to PER at the same time as the 2-gallon buckets in anticipation of the supplemental volume that would be needed at the start of the bioassays.

- While loading test chambers on Day 7 of the Batch 1 bioassays, PER noted that two samples had insufficient volume for filling the 22 replicate chambers required for testing—EV002 in Batch 1, which only had enough volume for filling three of the four replicates designated for Day 21 porewater chemistry, and EV044[21] in Batch 3. In response, contents from the 5-gallon buckets for both samples were shipped from ALS on June 10, arriving at PER on June 11. The supplemental sediment for EV044 arrived in time to be combined (homogenized) with sediment from the 2-gallon bucket and used for Day-7 test chamber loading of EV044 Batch 3. The supplemental sediment arrived after the chambers for EV002 in Batch 1 had been filled, but a set of four replicates designated for Day 21 porewater chemistry for EV002 was also included in Batch 3. These replicates were established for use in the event that sufficient porewater was not obtained from the three replicates for Day 21 porewater for EV002 included in Batch 1. Because sufficient porewater was obtained on Day 21 from the three replicates EV044 included in Batch 1, the supplemental set of replicates included in Batch 3 were not used (i.e., no porewater was extracted from sediment in these replicates).

  Sediment samples were transferred from their 5-gallon buckets into Teflon bags at ALS and packed in coolers containing blue ice for shipment. During shipment, the bag containing sample EV002 split. Some porewater/overlying water was observed to have leaked into the cooler, but the EV002 split sample was not compromised.

- As described in the EPA-approved bioassay sample selection and batching memorandum (Appendix B), additional sediment volume was needed for two samples (DM008 and REF013) in order for them to be included in all three bioassay testing batches. The 5-gallon buckets for those samples were shipped from ALS to PER at the same time as the 2-gallon buckets. For both of these samples, sediment from the 2-gallon and 5-gallon buckets were homogenized prior to use.
- The shipments of additional sediment contained in 5-gallon buckets was necessary to ensure that all samples would have available sediment volume to meet QAPP requirements for the 42-day *H. azteca* bioassay testing. In cases where additional volume from the 5-gallon buckets was needed, the sample

[21] Upon identifying the insufficient volume in EV002, PER assessed the volume in the sediment samples across Batches 2 and 3 and identified EV044 as similarly insufficient in volume.

from both buckets was homogenized prior to use. Sediment volumes available from the 2-gallon buckets for these samples were insufficient for several reasons:

- Settling occurred in the 2-gallon buckets during transport and storage. The volumes measured by PER were less than the volumes recorded by the field crew for some samples.
- When completely filled, a 2-gallon bucket contained sufficient volume for all components originally planned for each bioassay, but it was not always possible to collect the full volume.
- The final methods for the collection of bioassay laboratory sediment and porewater during the Phase 3 bioassays, documented in Change Request 6 for the bioassays and associated sediment and porewater chemistry, increased from what was originally planned, making it more important for the 2-gallon buckets to be completely filled.

Because the use of sediment from the 5-gallon buckets enabled the initial 42-day bioassay testing to be completed per the requirements in the QAPP, this deviation had a positive impact on the quality of the bioassay testing data. However, as noted in Section 2.5.2 for samples DM008 and REF013, the use of sediment from the reserved 5-gallon buckets for samples 3-R7-2019, 3-R8-2019, CB010, CB029, CB047, EV002, EV044, JS002, and REF012 may prevent conducting TIEs for these samples. Other samples have sufficient sediment volumes for use in TIEs, if performed.

- Overlying water conductivity measurements for the Batch 3 tests taken during daily water renewals on July 9, 2020 (Day 21), were approximately 50 percent lower than expected based on measurements obtained previously in the Batch 3 tests. An investigation into the cause of the low conductivity measurements identified that the water used to perform the evening water change[22, 23] on July 8 (Day 20) consisted of deionized water rather than water with added salts. As a result, the overlying water quality in the Batch 3 test chambers was below the target range for a short period of time (less than 24 hours). Overlying water quality

[22] Due to the volume of water needed for testing, SAM-5S water was prepared daily for each test batch.

[23] Correctly prepared SAM-5S water was used to exchange overlying water in the Batch 1 (Day 23) and Batch 2 (Day 22) exposures on July 8, 2020. Review of PER QC records confirmed that this issue only occurred for Batch 3 and that the correct water quality specifications were confirmed for all other batches.

measurements obtained from Batch 3 test chambers on July 10 (Day 22) confirmed that conductivity was back within the expected range in all Batch 3 test chambers. Additional discussion of this brief excursion in water quality is provided in Section 4.5.2.

- Seven of the replicates had 11 test organisms recovered when survival was assessed on Day 28, indicating that an incorrect number of organisms had been added to those test chambers at test initiation. These included the following replicates:
  - Batch 1 – DM046 replicate C and EV051 replicate G
  - Batch 2 – 3-R8-2019 replicate C, 3-R8-2019 replicate G, EV005 replicate G, and EV064 replicate I
  - Batch 3 – JS001 replicate G.

  The number of replicates for which over addition of organisms occurred was low (i.e., 0.9 percent of the 804 total replicates in the study), and, therefore, it is unlikely to have an effect on the interpretation of results. For those replicates to which an incorrect number of organisms was added at test initiation, mean survival was calculated as the number of organisms retrieved from the sediment at the end of the test divided by the intended initial start count. Mean weight was calculated by dividing the dry weight of surviving organisms by the number of surviving organisms. Biomass was calculated by dividing the dry weight of survivors by the actual initial start count.

- The PER laboratory report (Appendix F) noted that anomalously low 28-day survival responses were identified for two replicates in Batch 1 (3-R7-2019 replicate F and REF017 replicate F). The cause of the low survival in these two replicates was not identified.

4 DATA VALIDATION AND BIOASSAY ACCEPTABILITY

Validation of the analytical chemistry data was performed by Environmental Standards, Inc. (ESI), of Valley Forge, Pennsylvania, in accordance with the QAPP based on EPA guidance from the following documents:

- Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA 540-R-08-005) (USEPA 2009)
- EPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review (EPA 540-R-2017-001) (USEPA 2017a)
- EPA Contract Laboratory Program National Functional Guidelines for Organic Superfund Methods Data Review (EPA 540-R-2017-002) (USEPA 2017b).

All chemistry data were validated per the QAPP (ERM 2019). Stage 2B validation was conducted for the majority of the chemistry data. Approximately 10 percent of the data underwent Stage 4 data validation. Data were qualified, as needed, based on an evaluation of the following laboratory and field QC criteria:

- Holding times
- Initial and continuing calibration results
- Laboratory and equipment rinsate blank concentrations
- Matrix spike/matrix spike duplicates (MS/MSDs)
- Post-digestion spike results
- Recoveries of laboratory control samples (LCS)
- Laboratory and field duplicate relative percent differences (RPDs)
- Interference check samples
- Serial dilutions
- Internal standards
- Instrument sensitivity
- Ongoing precision and recovery standard results
- Mass tuning
- Surrogate recoveries
- Labeled compound recoveries.

The results of the chemistry data validation are summarized in Sections 4.1, 4.2, and 4.3 for overall data quality of chemistry results, sample transport and holding times, and chemistry validation results, respectively. ESI reviewed laboratory QC samples as part of the data validation process. In Section 4.3, the numbers of qualified sample results (excluding laboratory QC results) are listed, followed by the numbers of qualified laboratory QC samples in parentheses. In addition to chemistry data validation, BMI identification data were validated by ESI using criteria provided in the QAPP. Results of the BMI data validation are summarized in Section 4.4. All ESI data validation reports for chemistry and BMI data are available on the "Downloads" page in the project database (http://teck-ucr.exponent.com).

The 42-day *H. azteca* bioassay data were evaluated by PER and TAI to determine whether the EPA test acceptability criteria as defined in the QAPP were met and the data were determined to be usable. The evaluation of acceptability criteria for 42-day *H. azteca* bioassay data is summarized in Section 4.5.

Results from the sediment analysis by BSEM did not undergo data validation, but were reviewed for quality by TAI. The BSEM analysis report (Appendix G) describes quality assurance and the results for QC samples, which included one replicate (reanalysis of a prepared sample) and two duplicates (analysis of a second prepared sample) that were analyzed to evaluate the reproducibility of the sample preparation and/or analysis methods.

4.1 OVERALL CHEMISTRY DATA QUALITY

A summary of the data validation qualifiers assigned to conventional parameters (i.e., alkalinity, DOC, TOC, sulfide, sulfate, chloride, and/or grain size), metals, and organic chemicals (i.e., PAHs, PCBs, and pesticides) by ESI are presented in Tables 4-1 to 4-5, along with the original laboratory data qualifiers. The data are deemed acceptable (i.e., usable) by the validator with the qualifiers presented, except for one rejected methoxychlor result in sediment, as detailed in Sections 4.3.1.3 and 4.3.1.9 and three rejected sulfide (AVS) results in bioassay sediment, as detailed in Sections 4.3.3 and 4.3.3.3. The qualifiers applied by ESI were as follows:

- "J" – The concentration was considered estimated due to one or more of the following:
  - Exceedance of project-specific holding time
  - Analytical interference

- LCS, MS/MSD, or reporting limit (RL)[24] standard recovery not within acceptable range
- High percent difference (%D) or RPD for field or laboratory QC samples, or
- Concentration is between the method detection limit (MDL) and the method RL

- "J+" – The concentration was considered estimated, but the results may be biased high.
- "J-" – The concentration was considered estimated, but the results may be biased low.
- "R" – The data point was unusable (i.e., rejected).
- "U" – The analyte was not detected at or above the MDL.
- "UJ" – The analyte was not detected, but the detection limit (DL) may be higher due to a low bias identified during the QA review.
- "UR" – The analyte was not detected, and the data point was unusable (i.e., rejected).
- "U*" – The analyte was considered nondetected because a similar concentration was detected in an associated field or laboratory blank sample.

Data quality indicators for precision, accuracy or bias, representativeness, completeness, and comparability were specified in the QAPP (ERM 2019). The data validator used the measurement quality objectives (MQOs) presented in QAPP Tables B5-1 and B5-2 to evaluate sediment and porewater data for the quantitative components of precision, accuracy or bias, representativeness, completeness, and comparability (i.e., precision and accuracy or bias). The MQOs for laboratory duplicate QC samples were also used by ESI to evaluate field duplicate RPDs.[25] The data validator also assessed sample handling, laboratory methods, and holding times to evaluate the representativeness and comparability of analytical data.

[24] RLs were determined by the laboratory based on analytical sensitivity and are included in the UCR project database.

[25] There was one exception for the RPD criteria used for porewater field duplicates for DOC and TOC. ESI used an RPD criterion of 20 percent for TOC/DOC in the porewater samples, whereas QAPP Table B5-2 specified an RPD of 17 percent. All of the porewater TOC and DOC field duplicate results met the 17 percent criterion and are correct as reported despite this discrepancy.

Due to limited sample volume there were no were no field duplicate samples collected for the laboratory bioassay-generated sediment samples. Also, there were no field duplicate or MS/MSD samples collected for the laboratory bioassay-generated porewater samples.

Data were qualified as necessary by ESI when MQOs were not met. A data completeness goal of 90 percent was specified in the QAPP for all sediment and porewater analytical parameter groups (ERM 2019). Data completeness was 100 percent for all analyte groups except pesticides (completeness was 99 percent due to one rejected result for methoxychlor in sediment) and conventional analyses (completeness was 99 percent due to two rejected results for sulfide [AVS] in bioassay sediment).

4.2 SAMPLE TRANSPORT AND HOLDING TIMES

There were no issues reported during transport of field sediment and field porewater samples to the laboratory, with the exception of elevated cooler temperatures (> 6°C) in seven coolers containing sediment and/or porewater samples with temperatures ranging from 6.8 to 12.3°C. The laboratory noted that the coolers did not contain ice but were delivered in a refrigerated truck. Table B3-1 of the QAPP specified that sediment and porewater samples should be cooled with ice during shipping to maintain the samples at < 6°C; however, temperature preservation is not required for metals (including mercury), hardness, or chloride in aqueous samples per the analytical methods, and data were not qualified for these analyses.

The detected results for mercury, AVS, and TOC in field sediment samples (35) were qualified as estimated by the validator (flagged "J") due to the elevated cooler temperatures. For the cooler received with a temperature of 12.3°C, National Functional Guidelines (USEPA 2017a) recommends rejection of not-detected results for temperatures above 10°C. The cooler receipt and preservation documentation completed by the laboratory does not identify which sediment and/or porewater samples were associated with the cooler received with a temperature 12.3°C. Because it is not known what, if any, samples from that cooler were analyzed, data were qualified estimated and not rejected.

The results for alkalinity, TOC, DOC, and sulfate in field porewater samples (20) were qualified as estimated by the validator (flagged "J") due to the elevated cooler temperatures.

The QAPP-specified (ERM 2019) holding time is 7 days from sampling to extraction for pesticide and PAH analyses. One of the two sediment equipment rinsate blanks collected at reference areas was received by the laboratory with insufficient holding time remaining (1 day) for extraction within the 7-day holding time. The sample was extracted 1 day past the 7-day holding time for aqueous samples. The DLs for all pesticide and PAH compounds in this field equipment rinse sample may be higher than reported, and the "not-detected" results were flagged "UJ" by the data validator. Positive results for pesticide and PAH compounds in this sample are considered estimated and were flagged "J" by the data validator.

One sediment sample was inadvertently not marked for grain size analysis on the original COC record. Grain size analysis for this sample was performed on a sample that had been stored frozen. Because freezing may alter the sediment composition, grain size results for this samples were flagged "J" and are considered estimated.

Sixteen laboratory bioassay-generated sediment samples were re-extracted 28 days past the QAPP-required 14-day holding time for sulfide (AVS) due to failed LCS recoveries for the initial analytical batch. The "not-detected" results were rejected (flagged "UR") by the data validator for two samples. Positive results for sulfide (AVS) in these samples were considered estimated (flagged "J") or estimated with a low bias (flagged "J-") by the data validator.

The BMI laboratory noted low or slightly low preservative for eight BMI samples. The samples were preserved with 90 percent ethanol upon collection and were to be stored in 70 percent ethanol following receipt at the laboratory and fractioning. The holding time for BMI analysis specified in the QAPP is 1 month, with the allowance that transfer of samples to 70 percent ethanol extends the holding time. The majority of samples were processed (i.e., rinsed, portioned, and stored in 70 percent ethanol) more than 1 month from collection. In addition, eight samples were received with less than the desired ratio of ethanol to sample (see Table 2-1 in Appendix E), and upon receipt by EcoAnalysts, the proper amount of ethanol was added to reach the desired 1:1 ratio. The laboratory did not indicate any sample degradation issues and noted that samples are well preserved once placed in fresh ethanol and can be held for extended periods (i.e., years). These sample transport and holding time discrepancies were assessed, and it was determined that BMI data were not impacted. No data qualifiers were assigned based on these discrepancies.

4.3 SEDIMENT AND POREWATER CHEMISTRY VALIDATION RESULTS

The data for metals, organic compounds, and conventional parameters are usable as qualified, except for one organic analyte (the pesticide methoxychlor) in one out of 20 reference sediment samples[26] qualified as rejected (flagged "R"; see Sections 4.3.1.3 and 4.3.1.9) and one conventional analyte (AVS) in three out of 134 bioassay sediment samples qualified as rejected (flagged "UR"; see Sections 4.3.3.3 and 4.3.3.5). Samples with

[26] Only reference sediment samples and associated field equipment blanks were analyzed for organics.

reported concentrations between the DL and the RL were qualified as estimated (flagged "J") unless previously qualified as "U*." The following subsections summarize the data validation results separately for field-collected sediment, field porewater, 42-day bioassay sediment, and 42-day bioassay porewater samples.

4.3.1 Field Sediment

This section summarizes the number of concentrations qualified by ESI for field sediment (Table 4-1) and associated field equipment blank samples (Table 4-2). Numbers of qualified sample results (excluding laboratory duplicate samples) are shown, followed by the number of qualified laboratory duplicate samples in parentheses for conventional and metal analytes. There were no laboratory duplicates analyzed for the organic compound analytes. Qualifiers were applied as needed based on an evaluation of various QC factors (e.g., LCS and MS recoveries, laboratory blank concentrations, field rinsate blank concentrations, and duplicate RPDs), as described in the subsections below.

4.3.1.1 Calibration

All calibration standard concentrations for the analysis of field sediment and equipment rinsate samples were within control limits with the exception of methoxychlor in one of 20 samples and 2,4′-dichlorodiphenyltrichloroethane (DDT) in one of two equipment rinse blanks. The positive results were qualified as an estimate (flagged "J") due to the high %Ds for these compounds in the associated continuing calibration verification analyses.

4.3.1.2 Blanks

Sediment concentrations were qualified as nondetected (flagged "U*") due to the presence of the analyte at similar concentrations in the associated calibration and/or preparation blanks for the following analytes and numbers of samples (number of laboratory duplicate samples flagged "U*" are shown in parentheses for metals analysis):

- Total Mercury – 18 (1) out of 116 (6)
- Total Thallium – 15 (0) out of 117 (2)
- SEM Zinc – 20 (1) out of 114 (6)
- Benzo(a)anthracene – 16 out of 20
- Naphthalene – 2 out of 20.

There were no sediment results qualified based on equipment rinsate blank analyses.

4.3.1.3 Matrix Spikes

Sediment concentrations were qualified as estimated (flagged "J"), estimated with a high bias (flagged "J+"), or estimated with a low bias (flagged "J-") due to MS/MSD recoveries that were not within control limits for the following inorganic analytes and numbers of samples (number of laboratory duplicate samples flagged "J" are shown in parentheses):

- Total Antimony – 57 (4) J; 46 (4) J- out of 117 (9)
- Total Barium – 14 J (1) out of 117 (9)
- Total Cadmium – 37 (2) J out of 117 (9)
- Total Copper – 7 (1) J out of 117 (9)
- Total Lead – 16 (1) J out of 117 (9)
- Total Manganese – 7 (1) J out of 117 (9)
- Total Potassium – 0 (1) J; 14 (0) J+ out of 117 (9)
- Total Sodium – 0 (1) J; 14 (0) J+ out of 117 (9).

The nondetected sediment concentration for total antimony in 13 (1) out of 117 (9) samples was qualified "UJ" due to low MS recovery.

Sediment concentrations were qualified as "UJ" due to MS/MSD recoveries that were not within control limits for the following pesticide analytes and numbers of samples indicated (e.g., 3 out of 20):

- alpha-Chlordane – 3 out of 20
- Dieldrin – 2 out of 20
- Endosulfan I – 4 out of 20
- Endosulfan II – 1 out of 20
- Endosulfan sulfate – 1 out of 20
- Endrin – 2 out of 20
- Hexachlorobutadiene – 4 out of 20
- cis-Nonachlor – 1 out of 20
- Aldrin – 3 out of 20
- alpha-Benzenehexachloride – 2 out of 20
- beta-Hexachlorocyclohexane (BHC) – 1 out of 20
- delta-BHC – 1 out of 20
- gamma-BHC – 2 out of 20
- 2,4'-DDT – 2 out of 20
- 2,4'-dichlorodiphenyldichloroethane [DDD] – 1 out of 20
- 4,4'-DDD – 1 out of 20
- 2,4'-Dichlorodiphenyldichloro-ethylene [DDE] – 1 out of 20
- 4,4'-DDE – 2 out of 20
- 4,4'-DDT– 1 out of 20
- Endrin aldehyde – 2 out of 20
- Endrin ketone – 1 out of 20
- Heptachlor – 1 out of 20
- Heptachlor epoxide – 4 out of 20
- Hexachlorobenzene – 2 out of 20
- Hexachlorobutadiene – 4 out of 20
- Oxychlordane – 3 out of 20
- Toxaphene – 1 out of 20
- trans-Chlordane – 2 out of 20
- trans-Nonachlor – 2 out of 20.

The nondetected sediment concentration for methoxychlor in 1 out of 20 samples was qualified "R" as rejected due to low (0 percent) MS recovery.

Sediment concentrations were qualified as "UJ" due to low MS/MSD recoveries that were not within control limits for the following PCB congeners and numbers of samples indicated (e.g., 2 out of 20):

- 2,3',4'-Trichlorobiphenyl – 2 out of 20
- 3,3',4,4'-Tetrachlorobiphenyl – 1 out of 20
- 2,2',3,3',4,5',6,6'-Octachlorobiphenyl – 1 out of 20
- 2,2',3,4,4',5,5',6-Octachlorobiphenyl – 1 out of 20
- 2,3',4',5-Tetrachlorobiphenyl – 1 out of 20
- 2,4,4',5-Tetrachlorobiphenyl – 1 out of 20
- 2,2',3,4',5'-Pentachlorobiphenyl – 1 out of 20
- 2,3,3',4',6-Pentachlorobiphenyl – 1 out of 20
- 2,2',3,5,5',6-Hexachlorobiphenyl – 1 out of 20.

4.3.1.4 Laboratory Control Samples

All LCS concentrations for the analysis of field equipment rinsate samples were within control limits. Sediment concentrations were qualified as "UJ" due to low LCS recoveries that were not within control limits for the following PCB congeners and numbers of samples:

- 2-Chlorobiphenyl – 3 out of 20
- 2,3',4'-Trichlorobiphenyl – 9 out of 20
- 2,2',3,4,4',5,5',6-Octachlorobiphenyl – 9 out of 20
- 2,4,4',5-Tetrachlorobiphenyl – 9 out of 20
- 2,2',3,5,5',6-Hexachlorobiphenyl – 9 out of 20
- 2,2',3,4',5'-Pentachlorobiphenyl – 9 out of 20.

The detected sediment concentration for 2-chlorobiphenyl in 1 out of 20 samples was qualified as (flagged "J") due to LCS recovery that was not within control limits.

Sediment concentrations were qualified as "UJ" due to low LCS recoveries that were not within control limits for the following pesticide analytes and numbers of samples:

- alpha-Chlordane – 3 out of 20
- Dieldrin – 3 out of 20
- Endosulfan I – 3 out of 20
- Endrin – 3 out of 20
- Aldrin – 3 out of 20
- alpha-Benzenehexachloride – 3 out of 20
- 2,4'-DDD – 3 out of 20
- 2,4'-DDE – 3 out of 20
- Endrin aldehyde – 4 out of 20
- Heptachlor epoxide – 3 out of 20
- Hexachlorobenzene – 3 out of 20
- Hexachlorobutadiene – 7 out of 20
- Oxychlordane – 3 out of 20
- trans-Nonachlor – 3 out of 20.

The detected sediment concentration for methoxychlor in 1 out of 20 samples was qualified as (flagged "J") due to LCS recovery that was not within control limits.

4.3.1.5 Laboratory Duplicates and Field Duplicates

Sediment concentrations were qualified as estimated (flagged "J") due to laboratory duplicate RPDs that were not within control limits for the following analytes and numbers of samples:

- SEM antimony – 8 (1) out of 114 (9)
- SEM chromium – 14 (1) out of 114 (9)
- SEM copper – 57 (4) out of 114 (9)
- SEM lead – 28 (2) out of 114 (9)
- SEM zinc – 25 (2) out of 114 (9)
- Sulfide (AVS) – 86 (7) out of 114 (9)
- Total aluminum – 15 (1) out of 117 (9)
- Total antimony – 7 (1) out of 117 (9)
- Total barium – 19 (2) out of 117 (9)
- Total cadmium – 37 (2) out of 117 (9)
- Total calcium – 7 (1) out of 117 (9)
- Total copper – 21 (2) out of 117 (9)
- Total iron – 14 (1) out of 117 (9)
- Total lead – 21 (2) out of 117 (9)
- Total magnesium – 14 (1) out of 117 (9)
- Total manganese – 14 (1) out of 117 (9)
- Total nickel – 14 (1) out of 117 (9)
- Total potassium – 7 (1) out of 117 (9)
- Total silver – 30 (2) out of 117 (9)
- Total thallium – 3 (1) out of 117 (9)
- Total zinc – 21 (2) out of 117 (9).

The nondetected sediment concentration for sulfide (AVS) in 9 (0) out of 114 (9) samples, SEM antimony in 7 (0) out of 114 (9), and SEM lead in 1 (0) out of 114 (9) samples were qualified as estimated (flagged "UJ") due to laboratory duplicate RPDs that were not within control limits.

The nondetected sediment concentration for SEM zinc in 4 (0) out of 114 (9) and total thallium in 4 (0) of 117 (9) samples had laboratory duplicate RPDs that were not within control limits; however, these were qualified "U*" due to method blank contamination (see Section 4.3.1.2).

Sediment concentrations were qualified as estimated (flagged "J") due to field duplicate RPDs that were not within control limits for the following analytes and numbers of samples:

- SEM antimony – 6 (1) out of 114 (9)
- SEM chromium – 8 (2) out of 114 (9)
- SEM copper – 10 (2) out of 114 (9)
- SEM lead – 10 (2) out of 114 (9)
- SEM zinc – 8 (2) out of 114 (9)
- Sulfide (AVS) – 18 (2) out of 114 (9)
- Total aluminum – 6 (1) out of 117 (9)
- Total antimony – 4 (0) out of 117 (9)
- Total arsenic – 4 (0) out of 117 (9)
- Total barium – 4 (1) out of 117 (9)
- Total cadmium – 4 (2) out of 117 (9)
- Total chromium – 4 (1) out of 117 (9)
- Total iron – 4 (1) out of 117 (9)
- Total lead – 6 (1) out of 117 (9)
- Total manganese – 4 (1) out of 117 (9)
- Total mercury – 2 (0) out of 117 (9)
- Total potassium – 2 (0) out of 117 (9)
- Total silver – 8 (0) out of 117 (9)
- Total thallium – 2 (0) out of 117 (9)
- Total zinc – 4 (1) out of 117 (9).

4.3.1.6 Interference Check Samples

Sediment concentrations were qualified as estimated (flagged "J") due to inductively coupled plasma interference for SEM antimony in 1 (0) out of 114 (9) samples, total cadmium in 12 (0) out of 117 (9) samples, and total nickel in 5 (0) out of 117 (9) samples.

Sediment concentrations were qualified as estimated with a high bias (flagged "J+") due to inductively coupled plasma interference for SEM antimony in 6 (0) out of 114 (9) samples, total cadmium in 5 (0) out of 117 (9) samples, and total nickel in 3 (0) out of 117 (9) samples.

4.3.1.7 Serial Dilutions

Sediment concentrations were qualified as estimated (flagged "J") due to high serial dilution %D for the following analytes and numbers of samples:

- SEM cadmium – 36 (2) out of 114 (9)
- SEM chromium – 28 (2) out of 114 (9)
- SEM lead – 47 (3) out of 114 (9)
- SEM nickel – 34 (2) out of 114 (9)
- SEM zinc – 24 (2) out of 114 (9)
- Total antimony – 14 (1) out of 117 (9)
- Total arsenic – 19 (1) out of 117 (9)
- Total barium – 19 (1) out of of 117 (9)
- Total cadmium – 19 (1) out of 117 (9)
- Total cobalt – 19 (1) out of 117 (9)
- Total copper – 19 (1) out of 117 (9)
- Total nickel – 19 (1) out of 117 (9)
- Total silver – 19 (1) out of 117 (9)
- Total vanadium – 19 (1) out of 117 (9).

The nondetected sediment concentration for total antimony in 5 (0) out of 117 (9) samples were qualified as estimated (flagged "UJ") due to high serial dilution %D that were not within control limits.

4.3.1.8 Internal Standards

All internal standard concentrations for the analysis of field sediment and equipment rinsate samples were within control limits.

4.3.1.9 Surrogate Recoveries

Sediment concentrations were qualified as "UJ" due to low surrogate recoveries that were not within control limits for the following pesticide analytes and numbers of samples:

- alpha-Chlordane – 13 out of 20
- Dieldrin – 13 out of 20
- Endosulfan I – 13 out of 20
- Endosulfan II – 13 out of 20
- Endosulfan sulfate – 13 out of 20
- Endrin – 13 out of 20
- cis-Nonachlor – 13 out of 20
- Aldrin – 13 out of 20
- 2,4'-DDE – 13 out of 20
- 4,4'-DDE – 13 out of 20
- 4,4'-DDT– 13 out of 20
- Endrin aldehyde – 13 out of 20
- Endrin ketone – 13 out of 20
- Heptachlor – 13 out of 20
- Heptachlor epoxide – 13 out of 20
- Hexachlorobenzene – 13 out of 20

- alpha-Benzenehexachloride – 13 out of 20
- beta-BHC – 12 out of 20
- delta-BHC – 13 out of 20
- gamma-BHC – 10 out of 20
- 2,4'-DDD – 13 out of 20
- 4,4'-DDD – 13 out of 20
- 2,4'-DDT – 13 out of 20
- Hexachlorobutadiene – 9 out of 20
- Methoxychlor – 11 out of 20
- Oxychlordane – 13 out of 20
- Toxaphene – 13 out of 20
- trans-Chlordane – 13 out of 20
- trans-Nonachlor – 13 out of 20.

The detected sediment concentration for gamma-BHC in 3 out of 20, methoxychlor in 1 out of 20 and hexachlorobutadiene in 3 out of 20 samples was qualified as an estimate (flagged "J") due to surrogate recovery that was not within control limits.

The detected sediment concentration for beta-BHC in 1 out of 20 samples and hexachlorobutadiene in 1 out of 20 samples was qualified as an estimate with a low bias (flagged "J-") due to surrogate recovery that was not within control limits.

The detected sediment concentration for pesticide methoxychlor in 1 out of 20 samples was qualified as rejected (flagged "R") due to surrogate recovery that was not within control limits. The methoxychlor result for this sediment sample (REF005-SE-1-100319) was also qualified as rejected due to MS recovery (see Section 4.3.2.3).

4.3.1.10 Dual Column Confirmations

Sediment concentrations were qualified as estimated (flagged "J") due to dual column confirmation results with RPDs that did not meet criteria for the following pesticide analytes and numbers of samples:

- Methoxychlor – 1 out of 20
- Hexachlorobutadiene – 1 out of 20.

The detected sediment concentration for PCB 70 in 1 out of 20 samples was qualified as an estimate (flagged "J") due to dual column confirmation results with RPDs that did not meet MQO criteria.

The detected equipment rinse blank concentrations were qualified as estimated (flagged "J") due to dual column confirmation results with RPDs that did not meet criteria for the following pesticide analytes and numbers of samples:

- Endosulfan II – 1 out of 20
- cis-Nonachlor – 2 out of 20.

4.3.2 Field Porewater

This section summarizes numbers of concentrations qualified by ESI for field porewater samples (Table 4-3). Numbers of qualified sample results (excluding laboratory duplicates samples) are shown, followed by the number of qualified laboratory duplicate samples in parentheses. Qualifiers were applied as needed based on an evaluation of various QC factors (e.g., LCS and MS recoveries, laboratory and equipment blank concentrations, and duplicate RPDs) as listed in the subsections below.

4.3.2.1 Calibration

All calibration standard concentrations for the analysis of field porewater samples were within control limits.

4.3.2.2 Blanks

Porewater concentrations were qualified as nondetected (flagged "U*") due to the presence of the analyte at a similar concentration in the associated calibration, preparation, and/or equipment rinsate blanks, including filter blanks,[27] for the following analytes and numbers of samples:

- Dissolved aluminum – 81 (7) out of 130 (9)
- Dissolved antimony – 31 (2) out of 130 (9)
- Dissolved beryllium – 7 (0) out of 130 (9)
- Dissolved cadmium –13 (1) out of 130 (9)
- Dissolved chromium – 129 (9) out of 130 (9)
- Dissolved manganese – 16 (0) out of 130 (9)
- Dissolved nickel – 70 (6) out of 130 (9)
- Dissolved silver – 15 (0) out of 130 (9)
- Dissolved sodium – 2 (0) out of 130 (7)
- Dissolved thallium – 34 (2) out of 130 (9)
- Dissolved vanadium – 14 (0) out of 130 (9)

[27] A series of filter blanks were prepared and analyzed by ALS in August 2019 to determine whether cartridge filters to be used for filtering porewater samples during the sampling program were free of contaminants. Some metals detected in the filter blanks were above the DL, and in some cases, above the RL. The filter blank identified as most representative for use during validation of field porewater concentrations contained antimony above the RL. A single batch of cartridge filters was used during the study, and field porewater antimony concentrations were qualified, when appropriate, based on filter blank results.

- Dissolved copper – 47 (3) out of 130 (9)
- Dissolved iron – 19 (1) out of 130 (7)
- Dissolved lead – 70 (5) out of 130 (9)
- Dissolved zinc – 89 (8) out of 130 (9)
- TOC – 9 (0) out of 128 (33).

Porewater concentrations were qualified as estimated with a high bias (flagged "J+") for alkalinity in 1 (1) out of 129 (15) samples due to equipment blank contamination.

4.3.2.3 Matrix Spikes

Porewater concentrations were qualified as estimated with a low bias (flagged "J-") due to MS/MSD recoveries that were not within control limits for sulfate in 20 (2) out of 129 (18) samples.

4.3.2.4 Laboratory Control Samples

All LCS concentrations for the analysis of field porewater samples were within control limits.

4.3.2.5 Laboratory and Field Duplicates

All laboratory duplicate RPDs were within control limits with the exception of dissolved chromium in 15 (1) out of 130 (9) and chloride in 6 (1) out of 129 (15) porewater samples. The dissolved chromium results were considered nondetected (flagged "U*") because a similar concentration was detected in an associated blank sample (see Section 4.3.2.2). The positive chloride results were qualified as estimated (flagged "J") due to laboratory duplicate RPDs that were not within control limits.

Porewater concentrations were qualified as estimated (flagged "J") due to field duplicate RPDs that were not within control limits for the following analytes and numbers of samples:

- Dissolved aluminum – 2 (0) out of 130 (9)
- Dissolved antimony – 2 (0) out of 130 (9)
- Dissolved cadmium - 2 (0) out of 130 (9)
- Dissolved cobalt – 14 (1) out of 130 (9)
- Dissolved lead – 4 (0) out of 130 (9)
- Dissolved manganese – 2 (0) out of 130 (9)
- Dissolved nickel – 2 (0) out of 130 (9)
- Dissolved silver – 2 (0) out of 130 (9)
- Dissolved thallium – 2 (0) out of 130 (9)

- Dissolved copper – 4 (0) out of 130 (9)
- Dissolved iron – 2 (0) out of 130 (9)
- Dissolved zinc – 2 (0) out of 130 (9).

4.3.2.6 Interference Check Samples

All interference check concentrations for the analysis of field porewater samples were within control limits.

4.3.2.7 Serial Dilutions

Porewater concentrations were qualified as estimated (flagged "J") due to high serial dilution %D for dissolved aluminum in 7 (1) out of 130 (9) samples. There were 5 (0) out of 130 (9) dissolved aluminum results with high serial %D that were considered nondetected (flagged "U*") because a similar concentration was detected in an associated blank sample (see Section 4.3.2.2).

4.3.2.8 Internal Standards

All internal standard concentrations for the analysis of field porewater samples were within control limits.

4.3.3 Bioassay Sediment

This section summarizes numbers of concentrations qualified by ESI for laboratory bioassay-generated sediment samples (Table 4-4). Numbers of qualified sample results (excluding laboratory QC samples) are shown, followed by the number of qualified laboratory QC samples in parentheses. Qualifiers were applied as needed based on an evaluation of various QC factors (e.g., LCS and MS recoveries, laboratory blank concentrations, and duplicate RPDs) as listed in the subsections below.

4.3.3.1 Calibration

All calibration standard concentrations for the analysis of laboratory bioassay-generated sediment samples were within control limits.

4.3.3.2 Blanks

Sediment concentrations were qualified as nondetected (flagged "U*") due to the presence of the analyte at similar concentrations in the associated calibration and/or preparation blanks for the following analytes and numbers of samples (number of laboratory duplicate samples flagged "U*" are shown in parentheses):

- Total potassium – 1 (1) out of 59 (4)
- Total silver – 3 (0) out of 59 (4)
- Total sodium – 2 (1) out 59 (4)
- Total thallium – 8 (1) out of 59 (4)
- Sulfide (AVS) – 6 (0) out of 134 (10)
- SEM antimony – 1 (0) out of 134 (10)
- SEM copper – 2 (0) out of 134 (10)
- SEM zinc – 2 (0) out of 134 (10).

The detected and nondetected sediment concentrations for total antimony in 19 (2) out of 59 (4) samples were qualified as estimated (flagged "J" or "UJ") due to negative bias for these analytes in the associated laboratory blank results.

4.3.3.3 Matrix Spikes

Sediment concentrations were qualified as estimated (flagged "J"), estimated with a high bias (flagged "J+") or estimated with a low bias (flagged "J-") due to MS/MSD recoveries that were not within control limits for the following inorganic analytes and numbers of samples (number of flagged laboratory duplicate samples are shown in parentheses):

- Total antimony – 14 (1) J; 16 (1) J- out of 59 (4)
- Total chromium – 18 (1) J- out of 59 (4)
- Total lead – 18 (1) J- out of 59 (4)
- Total sodium – 18 (1) J out of 59 (4)
- Sulfide (AVS) – 55(4) J; 4 (0) J+ out of 134 (10).

The nondetected sediment concentration for Sulfide (AVS) in 3 (0) out of 134 (10) samples and total antimony in 11 (1) out of 59 (4) were qualified "UJ" due to low MS recovery.

The nondetected sediment concentration for Sulfide (AVS) in 1 (1) out of 134 (10) samples was qualified "UR" as rejected due to low (0 percent) MS recovery.

4.3.3.4 Post Digestion Spikes

Sediment concentrations were qualified as estimated (flagged "J") or estimated with a high bias (flagged "J+") due to post-digestion spike recoveries that were not within control limits for the following inorganic analytes and numbers of samples (number of flagged laboratory duplicate samples are shown in parentheses):

- Total cadmium – 18 (1) J out of 59 (4)
- Total iron – 1 (1) J+ out of 59 (4)
- Total silver – 18 (1) J out of 59 (4).

4.3.3.5 Laboratory Control Samples

All LCS concentrations for the analysis of laboratory bioassay-generated sediment samples were within control limits. However, selected sediment samples required reanalysis due to a failed LCS analysis and were re-extracted after more than 28 days past the QAPP-required 14-day holding time, except for one sample, which was extracted 1 day past the 14-day holding time. Sulfide (AVS) concentrations were qualified as estimated (flagged "J"), estimated with a bias low (flagged "J-") or unusable (flagged "UR") due to sample re-extraction past the QAPP-required 14-day holding time for sulfide (AVS) for the following numbers of samples:

- Sulfide (AVS) – 2 (0) J; 13 (1) J-; 1 (0) UR out of 134 (10).

4.3.3.6 Laboratory Duplicates

Sediment concentrations were qualified as estimated (flagged "J") due to laboratory duplicate RPDs that were not within control limits for the following analytes and numbers of samples (number of flagged laboratory duplicate samples are shown in parentheses):

- Total arsenic – 18 (1) out of 59 (4)
- Total cobalt – 1 (1) out of 59 (4)
- Total lead – 1 (1) out of 59 (4)
- Total magnesium – 0 (1) out of 59 (4)
- Total manganese – 1 (1) out of 59 (4)
- Total nickel – 1 (1) out of 59 (4)
- Total sodium – 18 (1) out of 59 (4)
- Sulfide (AVS) – 18 (2) out of 134 (10)
- SEM cadmium – 31 (3) out of 134 (10)
- SEM copper – 7 (1) out of 134 (10).

Sediment concentrations were qualified "UJ" due to laboratory duplicate RPDs that were not within control limits for Sulfide (AVS) in 3 (0) out of 134 (10) samples.

4.3.3.7 Interference Check Samples

Sediment concentrations were qualified as estimated (flagged "J") or estimated with a high bias (flagged "J+") due to ICP interference for the following analytes and numbers of samples (number of flagged laboratory duplicate samples are shown in parentheses):

- Total antimony – 1 (0) J out of 59 (4)
- Total selenium – 4 (0) J out of 59 (4)
- SEM antimony – 7 (0) J; 3 (1) J+ out of 134 (10)
- SEM nickel – 2 (0) J+ out of 134 (10).

4.3.3.8 Serial Dilutions

Sediment concentrations were qualified as estimated (flagged "J") due to high serial dilution %D for the following analytes and numbers of samples (number of flagged laboratory duplicate samples are shown in parentheses):

- Total antimony – 13 (1) out of 59 (4)
- Total barium – 18 (1) out of 59 (4)
- Total cadmium – 18 (1) out of 59 (4)
- Total silver – 18 (1) out of 59 (4)
- SEM cadmium – 30 (3) out of 134 (10)
- SEM chromium – 18 (2) out of 134 (10)
- SEM nickel – 23 (2) out of 134 (10)
- SEM lead – 42 (4) out of 134 (10)
- SEM zinc – 11 (1) out of 134 (10).

Sediment concentrations were qualified "UJ" due to high serial dilution %D for total antimony in 5 (0) out of 59 (4) samples.

4.3.3.9 Internal Standards

All internal standard concentrations for the analysis of laboratory bioassay-generated sediment samples were within control limits.

4.3.4 Bioassay Porewater

This section summarizes numbers of concentrations qualified by ESI for laboratory bioassay-generated porewater samples (Table 4-5). Numbers of qualified sample results (excluding laboratory QC samples) are shown, followed by the number of qualified laboratory duplicate samples in parentheses. Qualifiers were applied as needed based on an evaluation of various QC factors (e.g., LCS and laboratory and equipment blank concentrations) as listed in the subsections below.

4.3.4.1 Calibration

All calibration standard concentrations for the analysis of laboratory bioassay-generated porewater samples were within control limits.

4.3.4.2 Blanks

Porewater sample concentrations were qualified as nondetected (flagged "U*") due to the presence of the analyte at similar concentrations in the associated calibration, preparation and/or equipment blanks including filter blanks for the following analytes and numbers of samples indicated (e.g., 40 out of 133):

- Dissolved aluminum – 40 out of 133
- Dissolved beryllium – 1 out of 133
- Dissolved chromium – 123 out of 133
- Dissolved copper – 2 out of 133
- Dissolved iron – 7 out of 133
- Dissolved lead – 2 out of 133
- Dissolved manganese – 2 out of 133
- Dissolved nickel – 21 out of 133
- Dissolved vanadium – 1 out of 133
- Dissolved zinc – 48 out of 133.

The detected and nondetected porewater concentration for dissolved potassium in 5 out of 133 samples were qualified as estimated with a low bias (flagged "J-" or "UJ") due to negative bias for these analytes in the associated laboratory blank results.

4.3.4.3 Matrix Spikes

No MS/MSD analyses were performed using laboratory bioassay-generated porewater samples due to insufficient sample volume for the laboratory to conduct MS/MSD analyses.

4.3.4.4 Laboratory Control Samples

Porewater concentration was qualified as estimated with a high bias (flagged "J+") due to high LCS or LCS duplicate recoveries that were not within control limits for total sulfide in 1 out of 93 samples.

4.3.4.5 Laboratory Duplicates

For the laboratory bioassay-generated porewater samples, there were insufficient sample volumes for the laboratory to conduct the laboratory duplicate analyses.

4.3.4.6 Interference Check Samples

All interference-check concentrations for the analysis of laboratory bioassay-generated porewater and samples were within control limits.

4.3.4.7 Serial Dilutions

All serial dilution %Ds for the analysis of 42-day *H. azteca* bioassay laboratory-generated porewater samples were within control limits.

4.3.4.8 Internal Standards

All internal standard concentrations for the analysis of laboratory bioassay-generated porewater samples were within control limits.

4.4 BENTHIC MACROINVERTEBRATE DATA VALIDATION RESULTS

A QA review was performed by ESI for BMI data in accordance with the requirements specified in the QAPP. Criteria for verifying and validating BMI data are included in the project-specific SOPs included in QAPP Appendix D and summarized in QAPP Table B5-3. The QA review included an examination of sample custody, condition on receipt, holding times, sorting efficacy, identification similarity, and results reporting. ESI used professional judgment to determine the usability of the reported results and compliance relative to the processes and procedures utilized by the BMI laboratory.

The following sections summarize data validation results for BMI sorting and taxonomic identification (Section 4.4.1) and AFDW and wet-weight biomass (Section 4.4.2).

4.4.1 Sorting and Taxonomic Identification

Data validation for BMI enumeration included a review of sorting efficacy and taxonomic identification. The QC procedures, their associated criteria, and a summary of data validation findings for sorting efficacy and taxonomic identification are provided here.

As described in the SOP (Appendix D to the QAPP), a laboratory QC technician at EcoAnalysts assessed 20 percent of the sorted material for any remaining organisms. An efficiency of greater than or equal to 90 percent was considered passing. Low sorting efficiencies (less than 90 percent) were observed during sorting for the 500-µm fractions of 4 samples (3 primary and 1 duplicate) and the 250-µm fractions of 9 samples (8 primary and 1 duplicate). All samples not meeting the 90 percent efficiency goal were fully re-sorted by the QC technician. Efficiency scores greater than or equal to 80 percent were considered passing for re-sorted samples. All re-sorted samples passed the 80 percent sort efficiency QC, however, evaluation at 80 percent is a deviation from the QAPP specified MQO of 90 percent (Section 3.2). Because these samples underwent a full-sample QC and met the laboratory MQO for sort efficiency, data from affected samples were not qualified.

After the original taxonomist identified the sorted organisms for each sample fraction, 10 percent of the samples were reidentified by a QC taxonomist. The identifications and counts by the QC taxonomist were compared to the original taxonomist's count (target similarity greater than or equal to 90 percent) and any discrepancies were reconciled. Of the 10 percent of samples that were reidentified by a QC taxonomist, low percent similarities (less than 90 percent) were observed for the *Chironomidae* portions of one 500-µm sample and one 250-µm sample. In both cases, the QC taxonomist noted the discrepancies and corrected the identifications in the final data. The final data reviewer noted a few instances where specimen counts differed slightly between the QC summary and the full taxonomic report. Because the differences were within the project similarity goal specified in the QAPP, these data were not qualified.

4.4.2 AFDW and Biomass

Blotted wet-weight biomass results that were low or undetectable were reported at the RL of “0.001 g” and flagged “<” by the laboratory. During data validation, these results were flagged as “not-detected” and assigned “U” qualifiers. Two 500-µm samples (3-R8-2019-BMI-1-101619 and REF018-BMI-1-092519) were noted as having no specimens available to perform a wet-weight biomass determination and reported with a result of “0.” These results were also flagged as “not-detected” and assigned “U” qualifiers.

4.5 42-DAY BIOASSAY TEST ACCEPTABILITY ASSESSMENT

The 42-day *H. azteca* bioassay incorporated standard QA/QC procedures for evaluating the validity of the test results according to EPA (USEPA 2000) and ASTM (2019) guidelines and as described in the QAPP (ERM 2019). Standard QA/QC procedures included the use of a negative laboratory control, reference toxicant tests (to assess the sensitivity of test organisms to toxic stress), and the periodic measurement of water quality during testing. In addition, a quartz sand negative laboratory control sample was included to assess the potential for the composition of food, water, and other test conditions to be inadequate to fully support survival, growth, and reproduction of amphipods. Its inclusion was based on the recommendation for a performance-based evaluation of this issue as discussed by EPA (Mount 2011). A full discussion of the QA/QC procedures is included in the PER bioassay laboratory report (Appendix F).

This section evaluates the test acceptability criteria, performance goals, and additional requirements detailed in Table 2-12 for the 42-day *H. azteca* bioassays. As previously stated in Section 2, the test acceptability criteria (Table 2-12 Section A) must be met in order for a test to be considered acceptable; all other test requirements (Table 2-12 Sections B and C) are considered performance goals or additional requirements for testing.

4.5.1 Test Acceptability Criteria

There are three test acceptability criteria relating to survival of *H. azteca* in negative laboratory controls, age of the amphipods at the start of the test, and the source of test organisms. The specific acceptability criteria are listed below along with an assessment of the 42-day *H. azteca* bioassay data against the criteria. All test acceptability criteria were met, indicating that the bioassay testing results are of acceptable quality for use.

1. Mean survival of *H. azteca* in the negative laboratory controls on Day 28 must be greater than or equal to 80 percent. Mean survival of *H. azteca* in Spring River negative laboratory control samples are shown in Table 4-6. The mean 28-day survival exceeded the 80 percent criterion in each of the three test batches, ranging from 89 to 94 percent.

2. Age of *H. azteca* at the start of the test should be 7 to 8 days old. *H. azteca* known to be 8 days old were used for the 42-day test exposures.

3. All organisms in a test must be from the same source. If organisms are purchased, vendor information must be reported. All *H. azteca* used in these tests were obtained from a single commercial supplier: Aquatic BioSystems, Inc., of Fort Collins, Colorado. Test organisms were received in three different batches to coincide with the start of each test batch.

4.5.2 Performance Goals

There are five performance goals identified in QAPP Table B4-3 (also shown in Table 2-12). Each performance goal is provided below, along with an assessment of the goal and a description of where supporting information is found.

1. Mean survival of *H. azteca* in the negative laboratory control on Day 42 should be greater than or equal to 80 percent. The mean 42-day survival in the Spring River negative laboratory control exceeded the 80 percent criterion in each of the three test batches, ranging from 84 to 90 percent (Table 4-6).

2. Mean weight of *H. azteca* in the negative laboratory control should be greater than or equal to 0.35 mg dry/individual on Day 28 and greater than or equal to 0.5 mg dry/individual on Day 42. Mean weights of *H. azteca* in Spring River negative laboratory control samples are shown in Table 4-6. Means weights exceeded the minimum criteria for both Day 28 and Day 42.

3. Mean reproduction of *H. azteca* in the negative laboratory control by Day 42 should be greater than or equal to 6.0 offspring per female. The mean numbers of offspring per female for the negative laboratory control on Day 42 are shown in Table 4-6. The mean number of offspring per female ranged from 7 to 11, which exceeded the minimum criterion of 6.0 offspring per female.

4. Hardness, alkalinity, and ammonia in the overlying water typically should not vary by more than 50 percent during the sediment exposure, and DO should be maintained above 2.5 mg/L in the overlying water. Water quality measurements during bioassay testing are included for Batches 1, 2, and 3 and are included in Appendices G, H, and I, respectively, of the PER lab report (Appendix F). Ammonia did not vary by more than 50 percent for any samples tested. Hardness and alkalinity also did not vary by more than 50 percent, with the exception of several samples in Batch 3 that varied by more than 50 percent between Day 0 and Day 21. As described in Section 3.3, this variation in water quality was the result of using improperly prepared water for the afternoon water change on Day 20. After the procedural deviation was identified, PER performed supplemental water chemistry measurements for Batch 3 test chambers on Day 21 (see Appendix J to the PER report). A comparison of alkalinity and hardness measurements from Day 0 and Day 21 found that, as a result of the improper water used for renewals on Day 20, alkalinity decreased by greater than 50 percent in two Batch 3 samples (REF009A and REF011), and hardness decreased by greater than 50 percent in nine Batch 3 samples (DM026, CB010, 4-B1, EV027, EV044, REF005, REF012, CTL-SR-3, and CTL-QS-3). The largest decrease for alkalinity was 57 percent; the largest decrease for hardness was 55 percent. Water quality measurements indicate that the excursion in water quality was brief (less than 24 hours), and alkalinity and hardness measurements on Day 28 did not vary by more than 50 percent from measurements on Day 0. Alkalinity and hardness did not decrease to levels that would be expected to negatively affect *H. azteca*; therefore, data for Batch 3 samples are not likely to have been affected by this brief water quality excursion.

   DO measurements during bioassay testing are provided in Appendices G, H, and I of the PER lab report (Appendix F) and are summarized in Table 4-7. Measured DO stayed above 2.5 mg/L for all samples in Batch 1 and for most samples in Batches 2 and 3 for the duration of testing. Aeration was performed for select samples in Batches 2 and 3 (see Table 4-7) when either the test replicate overlying water DO level fell below the 2.5 mg/L lower limit during the course of the test or when a downward trend in DO was noted by laboratory technicians, indicating a potential for DO to drop below 2.6 mg/L. Aeration start and stop dates and the low DO measurement that served as the aeration trigger are shown in Table 4-7.

5. The daily mean test temperature should be within ±1°C of 23°C. The instantaneous temperature should be within ±3°C of 23°C. Overlying water temperatures measured during the bioassay tests are provided in Appendices G, H, and I of the PER lab report (Appendix F). Overlying (instantaneous) water temperatures were

maintained within ±3°C of 23°C, and daily mean temperatures were maintained within ±1°C of 23°C.

4.5.3 Additional Requirements

Table B4-3 of the QAPP includes seven additional requirements for testing; these are also listed in Table 2-12. Each of these additional requirements were met for the Phase 3 bioassay testing, as described below.

1. Ninety-six-hour water-only reference toxicity tests were performed to assess genetic strain or life-stage sensitivity of test organisms to a known toxicant, potassium chloride. The 96-hour reference toxicant tests were conducted with the same batch of test organisms as those used in the sediment bioassays. Reference toxicity test results for *H. azteca* were acceptable. LC50 (concentration that is lethal to 50 percent of an exposed population) values for the reference toxicity tests conducted for the test organisms fell within ± 2 standard deviations of the laboratory's historical mean value, indicating that the test organisms responded as anticipated to the known toxicant. The positive control results are provided in Appendix N of the PER laboratory report (Appendix F).

2. Initial dry weights of organisms were determined and reported. Eight replicates of 10 randomly selected 8-day-old (known-age) organisms were collected, dried, and weighed to determine the mean dry weight of the test organisms at Day 0. Mean dry weights for *H. azteca* at the time of test initiation are provided in Table 4-8. Supporting data for initial dry weights of organisms is provided in Appendix F of the PER lab report (Appendix F).

3. All biological test chamber replicates and sediment chemistry chamber replicates were prepared identically and contained the same amount of sediment and overlying water. Porewater chemistry chamber replicates were also prepared identically. Test chambers were prepared as described in the QAPP and Change Request 6.

4. Standard negative laboratory control (Spring River) sediment and quartz sand negative laboratory control samples were included in each testing batch. Results for both the negative laboratory control and quartz sand negative laboratory control are presented in Section 5. Table 2-12 also identifies suggested EPA performance-based guidelines for the quartz sand negative laboratory control. The quartz sand negative laboratory control sample did not meet these guidelines in any of the three batches, as discussed in more detail in Section 6.4.

5. Test organisms were cultured and tested at 23°C (±1°C), as described in PER lab report Sections 2.4.1 and 2.4.5 (Appendix B).

6. Natural physio-chemical characteristics of test sediment collected from the field were within the tolerance limits of the test organisms described by EPA (2000). As noted by EPA (2000), *H. azteca*, a freshwater species, are tolerant of wide-ranging conditions in terms of salinity, DO, and grain-size. They have been cultured at salinity levels up to 15 parts per thousand and tolerate DO levels down to 1.2 mg/L (the lowest measured DO in the current study was 2.3 mg/L) without a reduction in weight or reproduction. *H. azteca* tolerate grain-size characteristics ranging from 90 percent silt and clay material to 100 percent sand.

   Natural waters where *H. azteca* are found may have pH fluctuating in the range of 6 to 9 (Stumm and Morgan 1981). Field-measured porewater pH ranged from 6.38 to 10.2. In the study bioassays, overlying water with a pH of 7.8 to 8.2 was prepared to mitigate pH in the porewater within the bioassay chambers, resulting in only four porewater samples with a measured pH greater than 9: PWCE-CB002-HA42-T21-B1 (9.26), PWCE-CB020-HA42-B1 (9.11), PWCE-EV051-HA42-T21-B1 (9.06), and PWCE-JS001-HA42-T7-B3 (9.1). None of the sediment samples with porewater pH greater than 9 had bioassay responses significantly different than the negative laboratory control (Spring River) for any endpoint (one-tailed *t*-test, $\alpha = 0.05$). Overlying water pH was between 6 and 9 for all samples.

7. The source of overlying water and control samples is documented in Section 2.5.1 and in the PER lab report (Appendix F).

Although not identified as an additional requirement for testing in Table 2-12, the EPA-approved bioassay sample selection and batching memorandum (Appendix B) identified that two bulk sediment samples (one from the Site and one from reference) along with two control samples would be run in all 3 batches as an inter-batch comparability control. Results for these inter-batch comparability control samples are presented in Section 5.4 and discussed in Section 6.4.

5 SUMMARY OF DATA

This section includes summary statistics for all usable data, an evaluation of field QC samples, and a summary of MDLs for nondetected results. Summary statistics for field-collected media (field sediment, field porewater, and BMI) and bioassay-collected media (laboratory bioassay-generated sediment and porewater) are presented by sampling location type (i.e., Site and reference) and include the number of detected values and the minimum, maximum, and mean values for analytes and other measured parameters. Statistics are also provided for water quality parameters measured during field porewater sampling, including surface water quality measurements collected just above the sediment bed. Rejected data (see Section 4) were not included in the data summaries; however, all data are included in the project database. This section also provides BSEM analysis results and a summary of bioassay results.

Summary statistics are presented in tables, and sample-specific results are present in tables and figures, as follows:

- Sediment data
  - Field – Tables 5-1a and 5-1b; Figures 5-1a to 5-1cb
  - Bioassay – Tables 5-2a to 5-2c; Figures 5-2a to 5-2aj
- Porewater data
  - Field – Tables 5-3a to 5-3b; Figures 5-3a to 5-3bp
  - Bioassay – Tables 5-4a and 5-4b; Figures 5-4a to 5-4ac
- Surface water data (measured during collection of field porewater samples)
  - Field – Table 5-5a to 5-5b; Figures 5-5a to 5-5j
- BMI data
  - Tables 5-6 and 5-7; Figures 5-6a to 5-7f
- 42-day *H. azteca* bioassay data[28]
  - Tables 5-8 and 5-9; Figures 5-8a to 5-8m
- BSEM data
  - Tables 5-10 to 5-12; Figure 5-9
- Field QC summaries and evaluation of method detection limits
  - Tables 5-13 to 5-20.

[28] For Day 35 measurements results, please refer to Tables 3-2c, 3-3c, and 3-4c of Appendix F.

In accordance with the final Data Management Plan (Exponent 2019), field duplicate samples were averaged prior to calculating summary statistics[29] (detected values were averaged; if there were no detected values, the minimum DL was used). In the summary statistics, nondetected results are represented in calculations as one-half of the DL. Data for EPA split samples, equipment rinsate blanks, and laboratory QA/QC samples, such as MS/MSDs, are not included in the data summaries.

Table A7-1 of the QAPP (ERM 2019) identified ecological screening criteria for porewater and toxicity benchmark values for sediment that were used to derive analytical concentration goals (ACGs), which provide the target concentration required for the chemical analysis. For some analytes, more than one screening value was included in the QAPP; in such cases, the lowest value was used as the ACG. The actual DLs for nondetected samples were compared with ACGs,[30] as summarized in Tables 5-17 to 5-20.

5.1 SEDIMENT CHEMISTRY

5.1.1 Field Sediment

For field sediment, summary statistics for conventional parameters, metals, SEM, and organics are presented by sampling location type (i.e., Site and reference) in Table 5-1a. In addition, grain-size values adjusted for the removal of coarse sediment during field sampling are presented in Table 5-1b. Results are presented in box-and-whisker plots by sample area and target strata in Figures 5-1a to 5-1ao and in bar graphs in Figures 5-1ap to 5-1aq, while Figures 5-1ar to 5-1cb present results in scatter plots by river mile. Summary statistics and plots are included for calculated values (i.e., values that are calculated from other results) for the following parameters:

- Excess SEM
- Organic carbon-normalized excess SEM
- Normalized grain size and grain size summations for (total) sand, (total) gravel, and mud (silt plus clay)

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[29] For BMI data, duplicates came from separate grab attempts than those used for primary samples. Therefore, results from duplicate sampling locations were not averaged with primary sample results for the summary statistics in Section 5 tables and figures, which only include primary sample results.

[30] Ecological screening criteria and porewater toxicity benchmark values were not specified in the QAPP for all analytes. Analytes with nondetected results but no ACGs are excluded from Tables 5-17 to 5-20.

- Grain size adjusted for removal of coarse sediment for sand, gravel, and mud
- Total PCB congeners and Aroclors
- Total PAHs, including high molecular weight and low molecular weight sums
- Total pesticides classes, including total chlordane, total DDD, total DDE, total DDT, and total DDx.[31]

5.1.2 Bioassay Sediment

For laboratory bioassay-generated sediment analysis, summary statistics for conventional parameters, metals (only for bulk analysis), and SEM (only for Day 7 and Day 21) are presented individually for control, reference, and Site samples in Tables 5-2a to 5-2c for homogenized bulk sediment, Day 7, and Day 21, respectively. Results are present by individual sample in Figures 5-2a to 5-2b for conventional parameters, Figures 5-2c to 5-2x for metals, and Figures 5-2y to 5-2ag for individual SEM and AVS. Calculated values for total SEM, excess SEM, and excess SEM organic carbon-normalized are presented in Figures 5-2ah to 5-2aj.

5.2 POREWATER CHEMISTRY

5.2.1 Field Porewater

For field porewater, summary statistics for conventional parameters and dissolved metals are presented by sampling location type (i.e., Site and reference) in Table 5-3a. Results are presented in box-and-whisker plots by sample area and target strata in Figures 5-3a to 5-3ah, while Figures 5-3ai to 5-3bp present results in scatter plots by river mile. Summary statistics and plots are also provided for water quality parameters measured during field porewater sampling for conductivity, DO, pH, ORP, temperature, and TDS (Table 5-3a, Figures 5-3g to 5-3l, and Figures 5-3ao to 5-3at). Water quality parameters are listed by sample in Table 5-3b.

5.2.2 Bioassay Porewater

For laboratory bioassay-generated porewater analysis, summary statistics for conventional parameters and dissolved metals are grouped by batch and presented individually for control, reference, and Site samples in Table 5-4a and Table 5-4b for Day 7 and Day 21, respectively. Figures 5-4a to 5-4g present 42-day *H. azteca* bioassay results by

[31] DDT, DDE, and DDD are collectively referred to as DDx.

individual sample for conventional parameters and Figures 5-4h to 5-4ac present dissolved metals.

5.2.3 Field Surface Water

During field porewater sampling operations, surface water from 1 ft above the sediment-water interface was sampled and analyzed in the field for water quality parameters, including conductivity, pH, ORP, temperature, and TDS. Summary statistics for these parameters are presented by sampling location type (i.e., Site and reference) in Table 5-5a, while Table 5-5b presents water quality parameters by sample. Results are presented in box-and-whisker plots by sample area and target strata in Figures 5-5a to 5-5e, while Figures 5-5f to 5-5j present results in scatter plots by river mile.

5.3 BENTHIC MACROINVERTEBRATES

For BMI, summaries are provided separately for the 500 µm and 250 µm size fractions. Summary statistics for typical community metric results are presented by sampling location (i.e., AOI and reference) in Table 5-6.[32] These metrics were calculated from sample enumeration results and include Shannon-Weaver H' (log 10),[33] species richness, corrected abundance, and total density. Taxonomic enumeration, blotted wet-weight biomass, and residual AFDW summary statistics are presented in Table 5-7. Results for AFDW and blotted wet-weight biomass[34] are presented by box-and-whisker plots by sample area and target strata in Figures 5-6a and 5-6b, while Figures 5-6c to 5-6d present results in scatter plots by river mile. AFDW and wet-weight biomass were measured on the subset of BMI measured for a given sample; therefore, the percent subsampled was used to create a corrected AFDW and wet-weight biomass. BMI metric results are presented in box-and-whisker plots by sample area and target strata in Figures 5-7a to 5-7c, while Figures 5-7d to 5-7f present results in scatter plots by river mile.

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[32] For two samples (3-R8-2019-BMI-1-101619 and REF018-BMI-1-092519), the > 500 µm fraction contained zero invertebrates. Some BMI metrics, including Shannon-Weaver H', cannot be calculated for zero counts, while for others, including species richness, a zero count for a fraction results in a zero for a BMI metric.

[33] Shannon-Weaver (H') is a commonly used ecological index for diversity.

[34] EcoAnalysts determined AFDW of residual organic matter and wet-weight biomass based on the subsampled BMI for a given sample; therefore, Section 5 figures and tables present a corrected value which uses the percent subsampled.

5.4 42-DAY *H. AZTECA* BIOASSAYS

Data summaries for the 42-day *H. azteca* bioassay endpoints are presented in Table 5-8. Results for each endpoint are presented on Figures 5-8a to 5-8i. Results are grouped by batch and presented individually for control, reference, and Site samples. In addition, inter-batch comparability results are presented in Table 5-9 and are presented in Figures 5-8j to 5-8m by assessment endpoint, batch, and sample.

5.5 BACKSCATTERED SCANNING ELECTRON MICROSCOPY

Slag analysis using BSEM was performed to confirm regression model (Section B4.2 of the QAPP) estimates on a subset of six sediment samples from the sampleable sand stratum from sampling locations in Evans (1 sample), China Bend (4 samples), and Deadman's Eddy (1 sample) (Maps 2-1 through 2-3). Results for the percentages of slag identified are presented in Table 5-10 and Figure 5-9. Ranges in slag content were 1.15 to 45.3 percent for Slag 1, 0 to 2.15 percent for Slag 2, and 0.05 to 0.46 percent for Altered Slag (Slag 3 was not identified in any sample). Across all samples, Slag 1 represented between 87 to 99 percent of total slag.

A comparison between the modeled percent slag (estimated based on the sediment total zinc concentration via segmented linear regression) and the percent slag determined by BSEM is provided in Table 5-10. The RPDs between BSEM percent slag and the modeled percent slag ranged from 6.3 to 77.8 percent. Model residuals (calculated as the difference between the BSEM result and linear regression result) were a mixture of positive and negative values, indicating that the segmented linear regression did not consistently over predict or under predict percent slag for these sediment samples.

For each sample, the sediment size distributions among the three size classes analyzed (larger than 4 mm, 4 to 2 mm, and less than 2 mm) are presented in Table 5-11. The majority of the sediment particles in the samples were less than 2 mm in size.[35] Table 5-12 presents the percentages of Slag 1 particles in the various size classes for each sample. Slag 1 particles were primarily sand size and ranged from less than 22 μm to 1,410 μm in apparent size.[36]

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[35] Assessment of larger particles (2 to 4 mm in size) was conducted using optical and scanning electron microscopy. Only samples CB007 and EV001 contained particles in this size range. No slag particles were observed in sample CB007. One Slag particle, identified as Slag 2, was observed in sample EV001.

[36] Precise particle size cannot be determined for BSEM analysis; the mounted cross-sectional distance may not always intersect the maximum diameter for each particle.

Acceptance criteria for BSEM analysis were not developed for the QAPP; however, RPDs[37] calculated for QC sample analyses (duplicate analyses and replicate analyses) are provided below.

- **Replicate analyses (analysis of sample remounts)**. The Total Slag RPDs for the two samples with duplicate mounts (Phase 3 sample CB014 and Phase 2 sample SE-4-B6) were 3.0 and 5.8 percent, respectively.
- **Duplicate analyses (reanalysis of the same sample mount)**. The Total Slag RPDs for the two samples with reanalyzed mounts (DM046 and EV001) were 6.7 and 5.9 percent, respectively.

5.6 FIELD QC SUMMARY

Field duplicates were collected for 12 field sediment and 9 BMI samples. For field porewater, in order to reduce the potential for porewater drawdown, the total volume of porewater collected at any one location was minimized by collecting only one duplicate bottle at a given sample location (up to five bottles were filled at each sample location to be analyzed for required parameters). This resulted in field duplicate bottles being filled from 26 sample locations to collect up to 8 porewater field duplicates per parameter. Eight porewater field duplicates were collected for dissolved metals; seven field duplicates were collected for alkalinity, chloride, and sulfate; and six field duplicates were collected for TOC and DOC.

Duplicate RPDs are summarized in Table 5-13 through Table 5-16. MQOs presented in Tables B5-1, B5-2, and B5-3 of the QAPP, were used to evaluate field duplicates for field sediment, field porewater, and BMI, respectively (ERM 2019). Results for field duplicate pairs with RPDs greater than the analytical precision criterion were qualified as estimated (flagged “J”) by the data validator. Duplicate RPDs greater than then MQOs and that were five time the RL were as follows (summarized by type of sampling location):

- Site Samples
  - Sediment
    - All conventional parameters - 6 out of 20 data points (30 percent)
      - Sulfide (6/10; 60 percent)

[37] Acceptance criteria for BSEM analysis are not available.

    - All metals – 27 out of 230 data points (12 percent)
        - Aluminum (2/10; 20 percent), Antimony (2/10; 20 percent), Arsenic (3/10; 30 percent), Barium (1/10; 10 percent), Beryllium (1/10; 10 percent), Cadmium (2/10; 20 percent), Chromium (2/10; 20 percent), Iron (1/10; 10 percent), Lead (3/10; 30 percent), Magnesium (1/10; 10 percent), Manganese (2/10; 20 percent), Potassium (1/10; 10 percent), Silver (4/10; 40 percent), and Zinc (2/10; 20 percent)
    - All SEM metals – 15 out of 80 data points (19 percent)
        - Antimony (1/10; 10 percent), Chromium (2/10; 20 percent), Copper (4/10; 40 percent), Lead (4/10; 40 percent), and Zinc (4/10; 40 percent)
  - Porewater
    - All Metals – 12 out of 132 data points (9 percent)
        - Aluminum (1/6; 16.7 percent), Cadmium (1/6; 16.7 percent), Cobalt (3/6; 50 percent), Copper (2/6; 33.3 percent), Iron (1/6; 16.7 percent), Lead (2/6; 33.3 percent), Manganese (1/6; 16.7 percent), and Zinc (1/6; 16.7 percent)
  - BMI
    - Criteria for precision were not established in the QAPP; the maximum RPD for total richness was 67 percent
- Reference Samples
  - Sediment
    - All Metals – 2 out of 46 data points (4 percent)
        - Aluminum (1/2; 50 percent) and Barium (1/2; 50 percent)
    - All SEM metals – 1 out of 16 data points (6 percent)
        - Copper (1/2; 50 percent)
  - Porewater
    - All Metals – 3 out of 44 data points (5 percent)
        - Antimony (1/2; 50 percent) and Cobalt (2/2; 100 percent)
  - BMI
    - Criteria for precision were not established in the QAPP; the maximum RPD for total richness was 31 percent.

5.7 EVALUATION OF DETECTION LIMITS FOR NONDETECTED SAMPLES

Tables 5-17 to 5-20 present the minimum and maximum DLs for nondetected metals results compared with the ACGs and QAPP MRLs for field sediment, field porewater, laboratory bioassay-generated sediment, and laboratory bioassay-generated porewater, respectively. Nondetected reference location sediment results for organics are compared with ACGs and QAPP MRLs in Table 5-17. All comparisons for DLs include primary samples and field duplicate QC samples.

As stated above, per the QAPP, ACGs provide the target concentration required for the chemical analysis. However, the study QAPP (Section D2) also describes that reporting limits for nondetected results will be compared to the MRL goals to evaluate method sensitivity for each sample. Therefore, DLs for nondetected results are also compared to QAPP target MRLs in Tables 5-17 through 5-20. It should be noted that the comparisons presented in Tables 5-17 through 5-20 include sample results qualified as nondetected based on blank contamination; for these results, the reported positive results have replaced the DL.

5.7.1 Field Sediment

The DLs for all nondetected field sediment samples were less than the ACGs for analytes except the pesticide toxaphene. Of the 20 field-collected reference sediment samples measured for toxaphene, all had nondetected results and 1 had an DL greater than the ACG (Table 5-17).

5.7.2 Field Porewater

The DLs for all nondetected metals in field porewater samples were less than the ACGs (Table 5-18).

5.7.3 Bioassay Sediment

The DLs for all nondetected metals in laboratory bioassay-generated sediment samples were less than the ACGs (Table 5-19).

5.7.4 Bioassay Porewater

The DLs for all nondetected metals in laboratory bioassay-generated porewater samples were less than the ACGs (Table 5-20).

6 PRELIMINARY DATA USABILITY ASSESSMENT

This section discusses the sufficiency of the data for meeting the study objectives regarding sample size and representativeness, as presented in the QAPP (ERM 2019). In addition, this section discusses whether the DQOs associated with analytical and bioassay data were met (i.e., whether the data validation or test acceptability evaluations resulted in rejection of results, and whether MDLs exceeded ACGs). This section also provides a description of potential implications on the interpretation of results from the study.

Collectively, the discussion in this section presents a preliminary data usability assessment for the study data. The final determination of usability of the data to answer the study questions and for addressing the overarching risk question will be presented in detail in the Phase 3 Sediment Study Data Analysis Technical Memorandum (Phase 3 Tech Memo) and/or in the draft aquatic BERA. The draft Phase 3 Technical Memorandum (TAI 2021) presents the results of TAI's analysis of the study data, focusing on the goals, study questions, and analytical approaches explicitly established in the 2019 Phase 3 Sediment Study QAPP. These analyses will represent a significant portion of the effects assessment for the BMI assessment endpoint in the Upper Reach OU portion of the draft aquatic BERA.

6.1 SAMPLE SIZE AND REPRESENTATIVENESS

Field sampling was carried out in conformance with the QAPP (ERM 2019) and communications with EPA before and during sampling (Appendix A). As anticipated, refusals and low sample volume due to coarse substrates and mismatches between observed facies and target strata were the primary reasons not all targeted locations were successfully sampled (Table 2-3 and Maps 2-1 to 2-3). Most of the primary sample locations targeted in the thalweg of Deadman’s Eddy AOI could not be successfully sampled due to strata mismatches, refusal, or in some cases, safety issues (Map 2-3). Per the QAPP, sampling was performed at alternate locations at Deadman’s Eddy AOI to meet the sample requirements of the study design.

In some cases, after visiting all primary and alternate locations within an AOI, the target number of samples per stratum could not be obtained. As a result, the final number of locations per AOI differed from the target number defined in the QAPP for some strata (Table 2-3). The final number of Site locations successfully sampled is 106, two fewer then the target of 108. A summary of successful samples for each media type targets is provided below.

- **Sediment.** Sediment was collected from 87 Site locations versus a target of 90 locations (97 percent) within the three AOIs and from all 18 reference locations.

Sufficient volume for possible use in 42-day *H. azteca* bioassays was obtained from 99 percent (71/72) of mud, sampleable sand, and repeat sample locations and did not limit the final number of samples selected for bioassays (Appendix B). Sufficient sediment volume for 42-day *H. azteca* bioassays was collected from all reference locations. The overall completeness goal for sediment samples in the QAPP is 90 percent.

- **Porewater.** Porewater was collected from 104 Site locations (96 percent), including 17 (94 percent) from porewater only locations (coarse stratum locations) out of a target of 108 and 18, respectively. Field porewater was successfully collected from all 18 reference locations. The overall completeness goal for porewater samples in the QAPP is 90 percent.

- **BMI.** BMI were collected from 85 (94 percent) Site locations (target of 90) within the three AOIs and from all 18 reference locations. The overall completeness goal for BMI sampling locations in the QAPP is 80 percent.

6.2 CHEMICAL ANALYSIS AND DETECTION LIMITS

All chemical analyses were performed as specified in the QAPP (ERM 2019). All chemistry results were deemed usable by the data validator, with the exception of a one field chemistry result for methoxychlor (1/20) at a reference location due to low MS recovery and two bioassay sediment chemistry results for sulfide (2/134) due to low MS recovery and analysis outside of the 14-day holding time outlined in the QAPP for sulfide (see Sections 4.3.1.3, 4.3.3.3, and 4.3.3.5).

As discussed in Section 5.7.1, DLs for all nondetected data points were less than the ACG, with the exception of toxaphene at one reference location where the actual MDL was 74 micrograms per kilogram, versus an ACG of 70 micrograms per kilogram (Table 5-17). The toxaphene ACG is based on an equilibrium partitioning sediment guideline for the protection of aquatic life (USEPA 2004). The slightly-elevated DL for toxaphene in this sample does not impact use of analytical results for achieving the DQOs specified in the QAPP.

6.3 BENTHIC MACROINVERTEBRATE DATA

Collected BMI samples were analyzed as specified in the QAPP (ERM 2019) and all BMI samples were deemed usable by the data validator (Section 4.4); however, as discussed in

Section 3.2, the 500 µm fractions of six BMI samples were inadvertently ashed[38] prior to determining a dry weight; therefore AFDW are not available for these samples. AFDW was added in Change Request No. 4 (Appendix D) to contextualize results and is not part of the MQOs for BMI samples listed in Table B5-3 of the QAPP (ERM 2019) and therefore do not impact the usability of BMI data.

In addition, for 11 primary samples—3 from the 500 µm size fraction and 8 from the 250 µm size fraction—sort efficiency was ultimately assessed using a laboratory MQO of 80 percent instead of the QAPP-specified MQO of 90 percent. This deviation, discussed in Section 3.2, is unlikely to affect comparability to other BMI samples and therefore does not impact the usability of BMI data. All other QAPP MQOs for BMI samples were met.

Finally, for two BMI samples (3-R8-2019-BMI-1-101619 and REF018-BMI-1-092519) the > 500 µm size fraction had zero counts for invertebrates. For these samples, some BMI metrics (e.g., Shannon-Weaver diversity metric, relative abundances, and tolerance indices) cannot be calculated, while for others (e.g., species richness), the BMI metric values will be zero and incorporated into the analyses of BMI community metrics. Several additional samples had relatively low abundances of invertebrates in either size fraction (e.g., 3-R8, CB012, CB014, DM023, DM025, DM026, DM036, and DM039 had fewer than 30 organisms in the 250 to 500 µm size fraction, while 3-R7, CB005, CB036, CB039, CB040, DM036, DM038, DM039, and EV026 had fewer than 30 organisms in the > 500 µm size fraction). Samples with fewer organisms (i.e., low abundance) have a higher probability of having fewer species, but it is not uncommon for community metrics to be correlated with other community metrics.

6.4 42-DAY *H. AZTECA* BIOASSAYS

The sediments used for 42-day *H. azteca* bioassay testing represent a range of conventional parameters, metal, and excess SEM concentrations (Figures 5-2a to Figure 5-2aj). Maps 2-1 through 2-3 present the Site locations where sediment samples were obtained to perform 42-day *H. azteca* bioassays.

The 42-day *H. azteca* bioassay results are considered usable for addressing risk questions identified in the QAPP, although use of some bioassay results will be qualified based on the poor performance observed for quartz sand negative control samples. PER negative laboratory control sediment (Spring River) survival results passed acceptability criteria on Day 28 and passed performance goals for survival on Day 42 for *H. azteca*. The quartz sand negative control sample did not meet EPA's suggested performance-based

[38] Oxidized in a muffle furnace at high temperature.

guidelines (Mount 2011) in any of the three batches. No obvious reason for the poor performance of quartz sand has been identified (e.g., chemistry indicative of toxicity). Poor performance in the quartz sand negative control samples complicates interpretation of the study's bioassay results; the implications[39] of quartz sand negative control performance on bioassay data interpretation are addressed in the draft Phase 3 Technical Memorandum (TAI 2021). Positive control results, used to assess the sensitivity of organisms to a known toxicant, were within the typical response range for this species, indicating that these test organisms were responding to toxic stress in a consistent and typical fashion across all batches.[40] Water quality performance goals required that hardness, alkalinity, and ammonia in overlying water should not vary by more than 50 percent during sediment exposure, and DO should be maintained above 2.5 mg/L in the overlaying water (see QAPP Table B4-3). Hardness and alkalinity were outside of performance goals for a brief time (less than 24 hours) in Batch 3 as a result of a deviation in water renewal discussed in Section 3.3. On day 20 of testing, alkalinity decreased by greater than 50 percent in two Batch 3 samples and hardness decreased by greater than 50 percent in nine Batch 3 samples. The largest decrease for alkalinity was 57 percent; the largest decrease for hardness was 55 percent. No deviations in hardness and alkalinity occurred in Batches 1 and 2. These brief decreases in Batch 3 are not expected to negatively affect *H. azteca* survival, growth, or reproduction. In addition, aeration was triggered due to downward trends in DO measurements in some samples. Aeration was immediately started in all replicates for affected samples (Table 4-7) and was continued as necessary to maintain DO concentrations within the acceptable range.

The EPA-approved bioassay selection and batching memorandum (Appendix B) identified two bulk sediment samples (DM008 and REF013) along with the negative control (CTL-SR) and auxiliary control (CTL-QS) to be run in all 3 batches as inter-batch comparability controls. Differences between batches were determined through one-way analysis of variance (ANOVA) tests at alpha = 0.05 (Table 5-9 and Figures 5-8j to 5-8m). Results for DM008 and REF013 differed significantly in the Day 28 weight endpoint due to the low variability within each batch; however, the magnitude of the difference between batches remained low. Results for REF013 also differed significantly in the Day 42 reproduction endpoint. A higher degree of variability in reproduction results between batches relative to other endpoints is not unexpected due to both the length of the assay and inability of the assay to control the starting ratios of males to females per test chamber.

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[39] Implications include the selection of bioassay endpoints to be used for specific QAPP study questions and an uncertainty assessment for bioassay data interpretation.

[40] Positive control results are not used in determining the acceptability of 42-Day *H. azteca* bioassays (ERM 2019; Table B4-3) but do help to inform the sufficiency of bioassay data.

In total, comparability between batches for each sample, assessment endpoint, and day were high and suggest that test conditions between batches are comparable.

6.5 POTENTIAL IMPLICATIONS OF DATA QUALITY ISSUES ON DATA INTERPRETATION

As described above, with the exception of three sediment chemistry results that were qualified as rejected, all study data are considered usable for addressing the risk questions identified in the QAPP. The final determination of data usability, including statistical methods to quantify uncertainties, requires quantitative interpretation of the data. Although quantitative data interpretation is beyond the scope of a data summary report, the potential implications on data interpretation can be described qualitatively and used to identify the approach(es) that should be considered during data analysis.

The data quality issues described previously in this report are summarized below. These data quality issues may have implications on the analysis of QAPP study questions associated with the primary study goal. Data quality issues include the following:

- General
  - Sample size and representativeness
- Sediment and Porewater Chemistry
  - Samples flagged for high RPDs based on field duplicate and laboratory control sample duplicate results
  - High frequency (percentage) of sample results for select metals qualified as estimated based on high serial dilution values
  - Results qualified as nondetected based on blank contamination
  - Elevated DLs or RLs for some samples
- 42-day *H. Azteca* bioassays
  - Poor performance in the quartz sand negative laboratory control samples
  - Recovery of greater than 10 individuals on Day 28 in several bioassay replicates (overseeding)
  - Skewed sex ratios and presence of immature organisms were apparent in samples where amphipod performance was also poor
  - Low starting weights of the organisms
  - Differences of LC50 values among reference toxicant tests
  - Different aeration trigger values and the variability in the aeration periods

  - Variation in overlying water quality for hardness and alkalinity outside of performance goals for a brief time (less than 24 hours) as a result of a deviation in water renewal
  - Inter-batch comparability
- Benthic macroinvertebrate data
  - No (zero) or low numbers of invertebrates in some BMI samples
  - No dry weight determination for some BMI samples due to samples being inadvertently ashed prior to dry weight measurement
  - Use of alternate criteria for assessing sort efficiency.

The implications of these data quality issues will be discussed in detail in the Phase 3 Technical Memorandum and in the Upper Reach Operable Unit portion of the draft aquatic BERA.

7 SUMMARY

The purpose of this study was to collect sediment, porewater, and BMI samples from within three AOIs in the Upper Reach OU. These data will be used to characterize sediment and porewater conditions in the three AOIs such that an overall understanding of risk to benthic organisms and the nature and extent of contamination in this portion of the Upper Reach OU can be assessed.

Samples were collected according to the QAPP (ERM 2019) from 106 locations within the Site and 18 upriver reference locations in Canada. Site and reference sediment samples were analyzed for total metals, AVS, SEM, grain size, and TOC, and sediment samples from reference locations were also analyzed for organics. Porewater samples were analyzed for dissolved metals and conventional parameters necessary for evaluating bioavailability and toxicity of metals in water. BMI sample analyses included taxonomic enumeration, taxonomic ID, AFDW, and blotted wet-weight biomass. In addition, at six Site locations, a BSEM analysis was conducted to determine the percentage of slag present in the sample which will be used to confirm regression model estimates (amount of zinc as a function of percent slag). Finally, 42-day *H. azteca* bioassays were conducted using sediment collected from 40 Site locations and 17 reference location. Sediment samples used in 42-day *H. azteca* bioassays were evaluated and selected by TAI in consultation with EPA prior to the start of bioassays. Bioassay laboratory-generated sediment and porewater samples were collected and chemically analyzed during the 42-day *H. azteca* bioassay testing.

Sediment, porewater, and BMI samples were collected at 97, 96, and 94 percent of the targeted number of locations identified in the QAPP, respectively (ERM 2019). Media could not be collected at the remaining locations because of difficulties encountered attempting to sample coarse sediment substrates.

Verification and validation of all sediment, porewater, and BMI data were performed in accordance with the QAPP (ERM 2019), and qualifiers were assigned in the data as appropriate. All data are considered usable for addressing risk questions identified in the QAPP with the exception of one organic pesticide (methoxychlor) in a reference sediment sample and two sulfide results in laboratory bioassay-generated sediment samples (Section 6.2). Finally, 42-day *H. azteca* bioassay test data were evaluated according to the acceptability criteria from the QAPP (Table 2-12) and were also determined to be usable for addressing risk questions identified in the QAPP.

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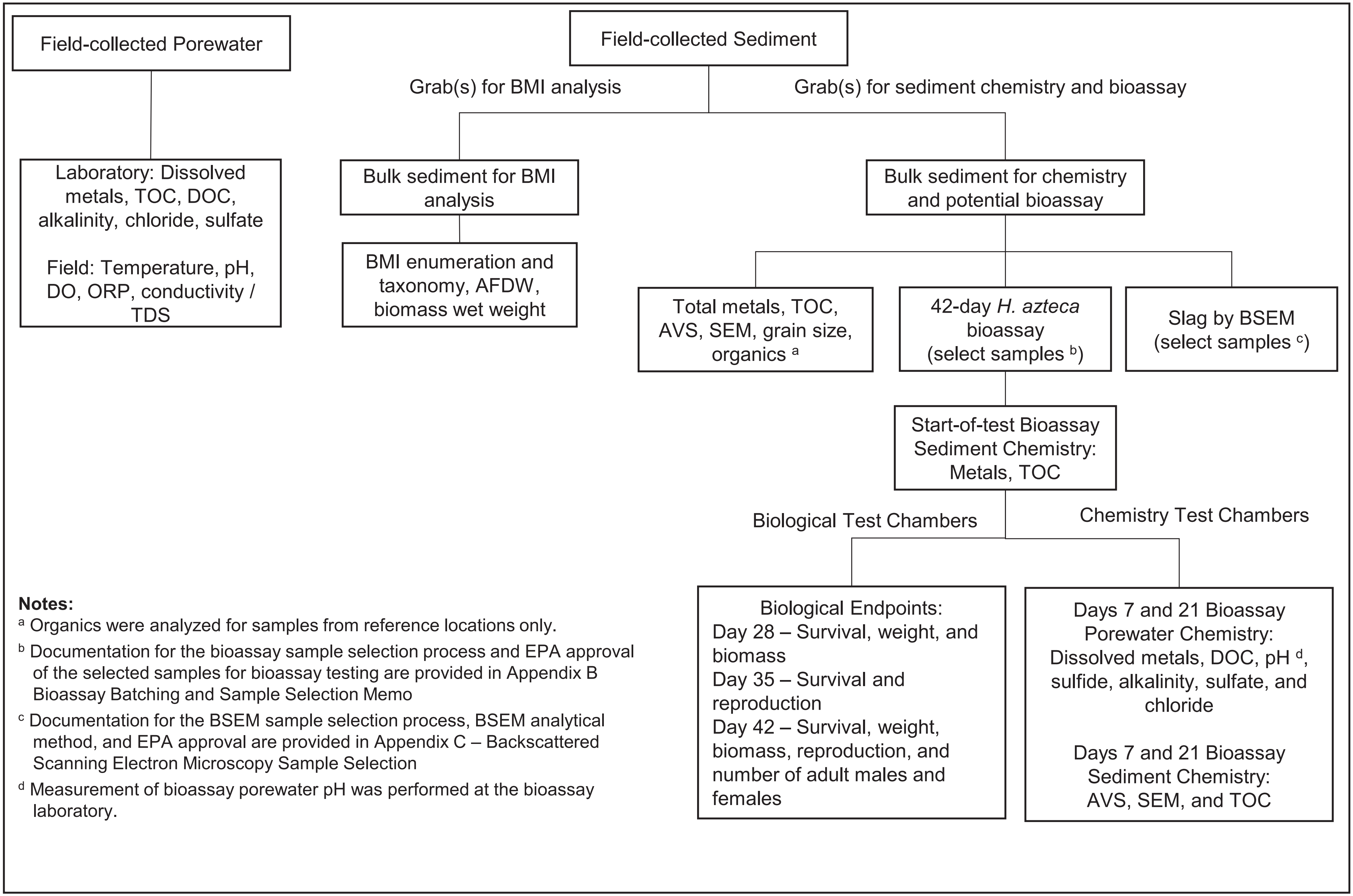
FIGURES



Notes:

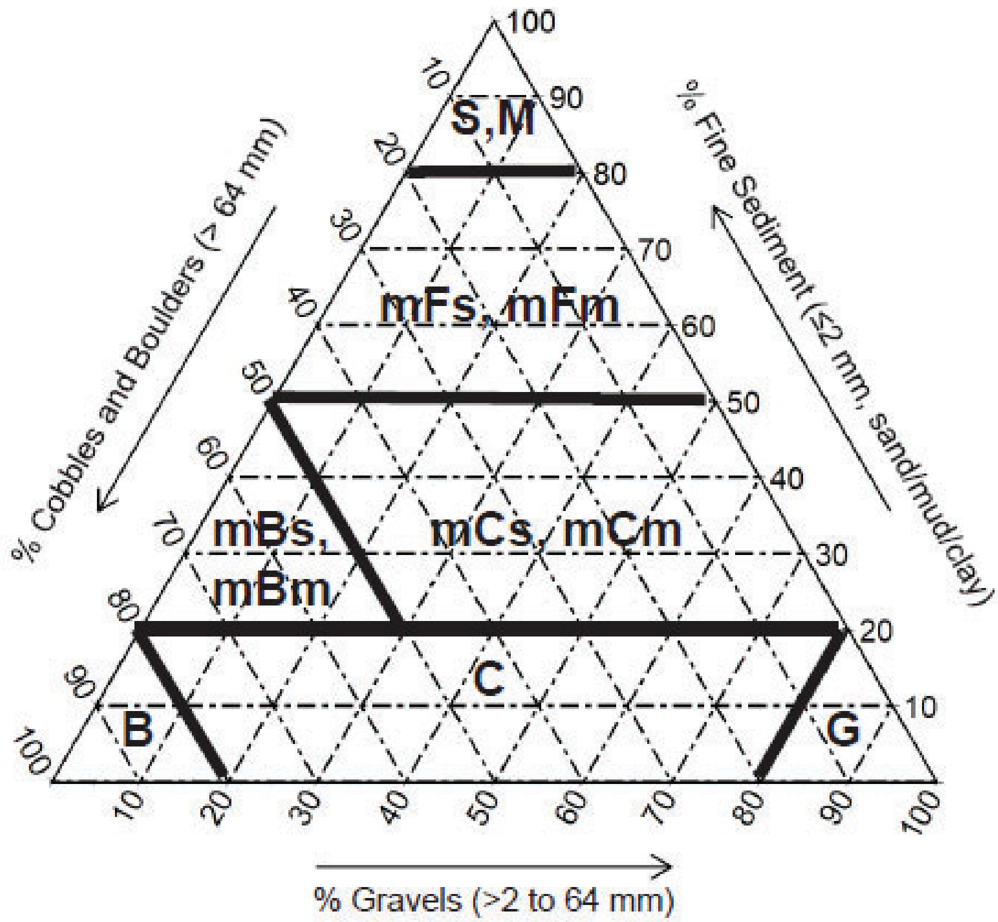
[a] Organics were analyzed for samples from reference locations only.

[b] Documentation for the bioassay sample selection process and EPA approval of the selected samples for bioassay testing are provided in Appendix B Bioassay Batching and Sample Selection Memo

[c] Documentation for the BSEM sample selection process, BSEM analytical method, and EPA approval are provided in Appendix C – Backscattered Scanning Electron Microscopy Sample Selection

[d] Measurement of bioassay porewater pH was performed at the bioassay laboratory.

Figure 2-1. Process for Analyses of Sediment and Porewater



Sediment Bed Surface Facies

M = mud (silt and clay, < 0.063 mm)

S = sand (0.063 mm – 2 mm)

G = gravel (2 mm – 64 mm)

B = boulder/cobble (> 64 mm)

mFm = mixed finer-grained, predominantly mud

mFs = mixed finer-grained, predominantly sand

mCm = mixed coarse, with mud

mCs = mixed coarse, with sand

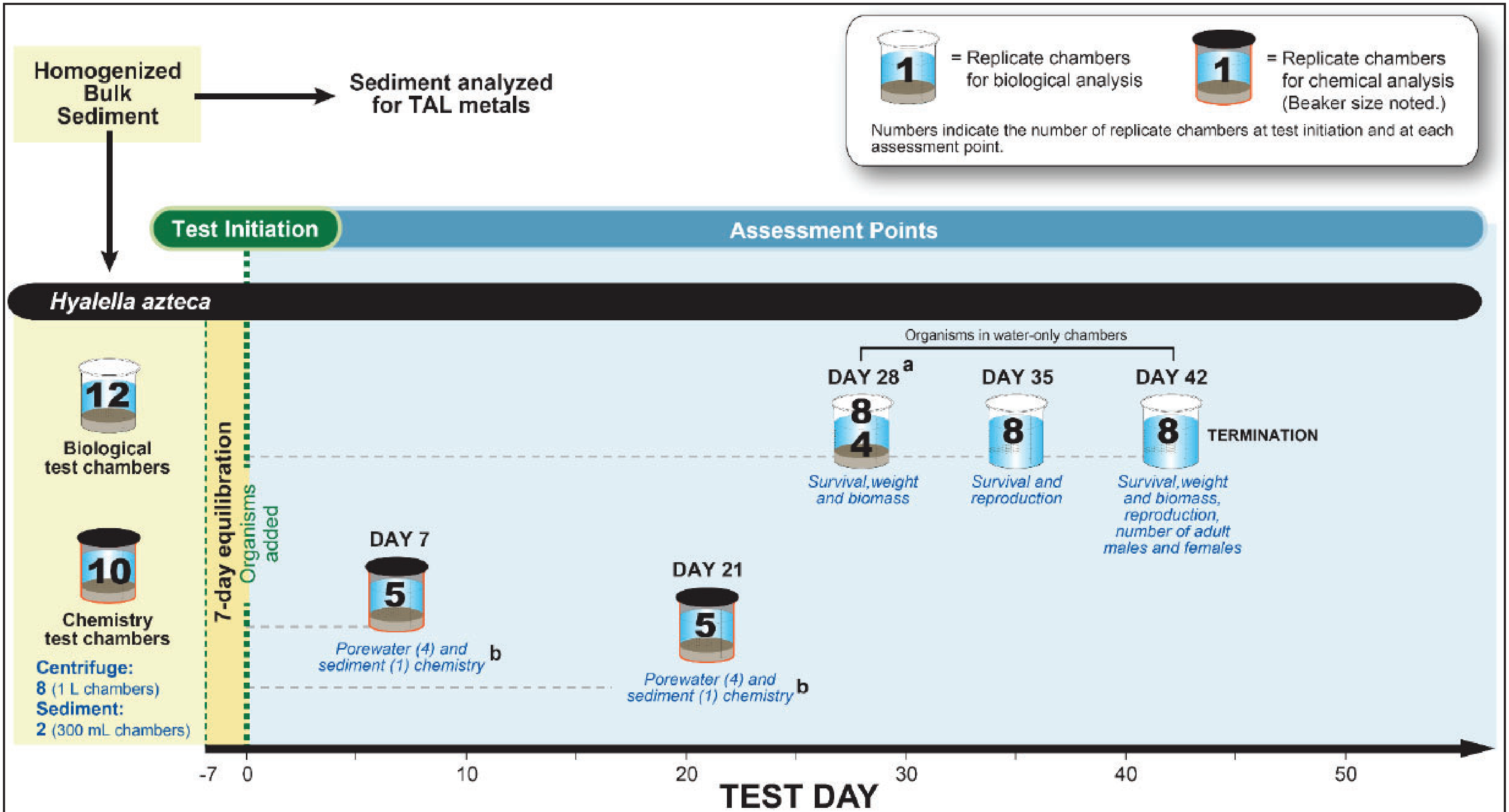
mBm = mixed boulder/cobble, with mud

mBs = mixed boulder/cobble, with sand

C = coarse

Note:
Bedrock is included as a sediment bed type in facies maps but is not shown in texture triangle.

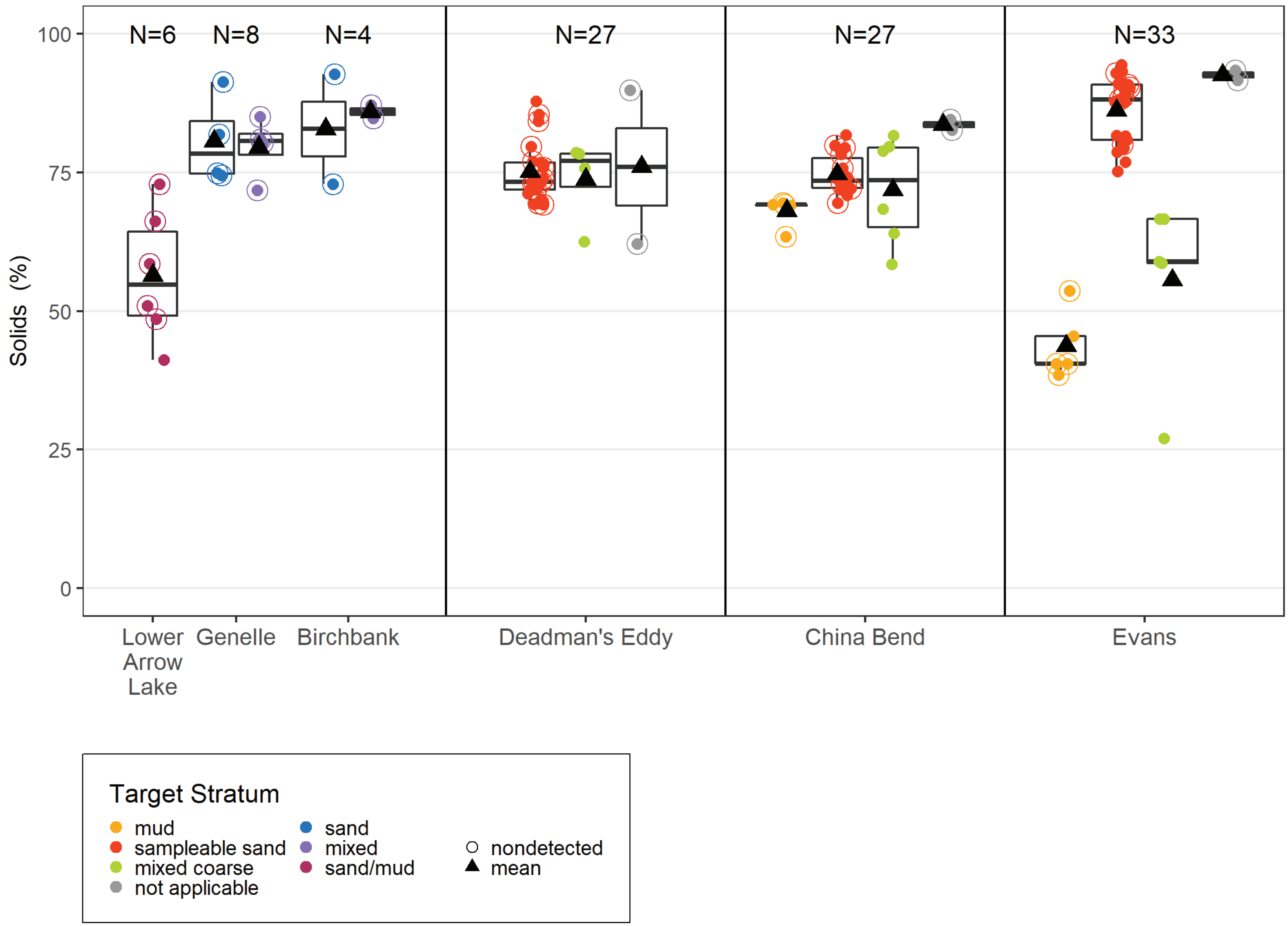
Figure 2-2. Texture Triangle for Sediment Bed Suface Facies



[a] On Day 28, survival evaluated in all 12 replicates; 4 replicates sacrificed to obtain dry weight and biomass, surviving amphipods in 8 replicates transferred to water-only chambers and continued to Day 42

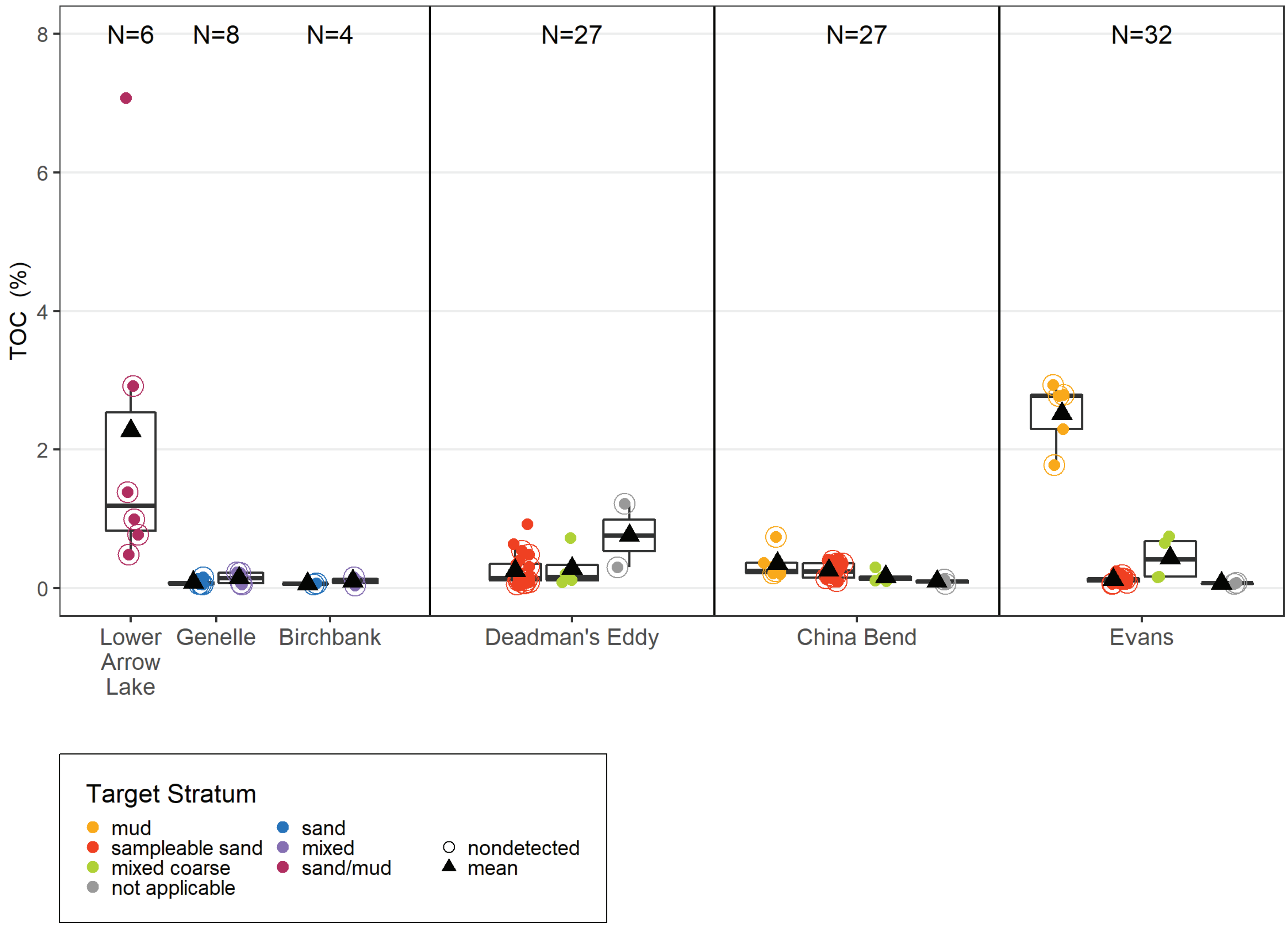
[b] Porewater from centrifugation analyzed for dissolved metals, DOC, pH, sulfide, alkalinity, sulfate, and chloride; sediment from chemistry test chambers analyzed for AVS, SEM, and TOC.

Figure 2-3. Bioassay Timeline for Sediment Samples



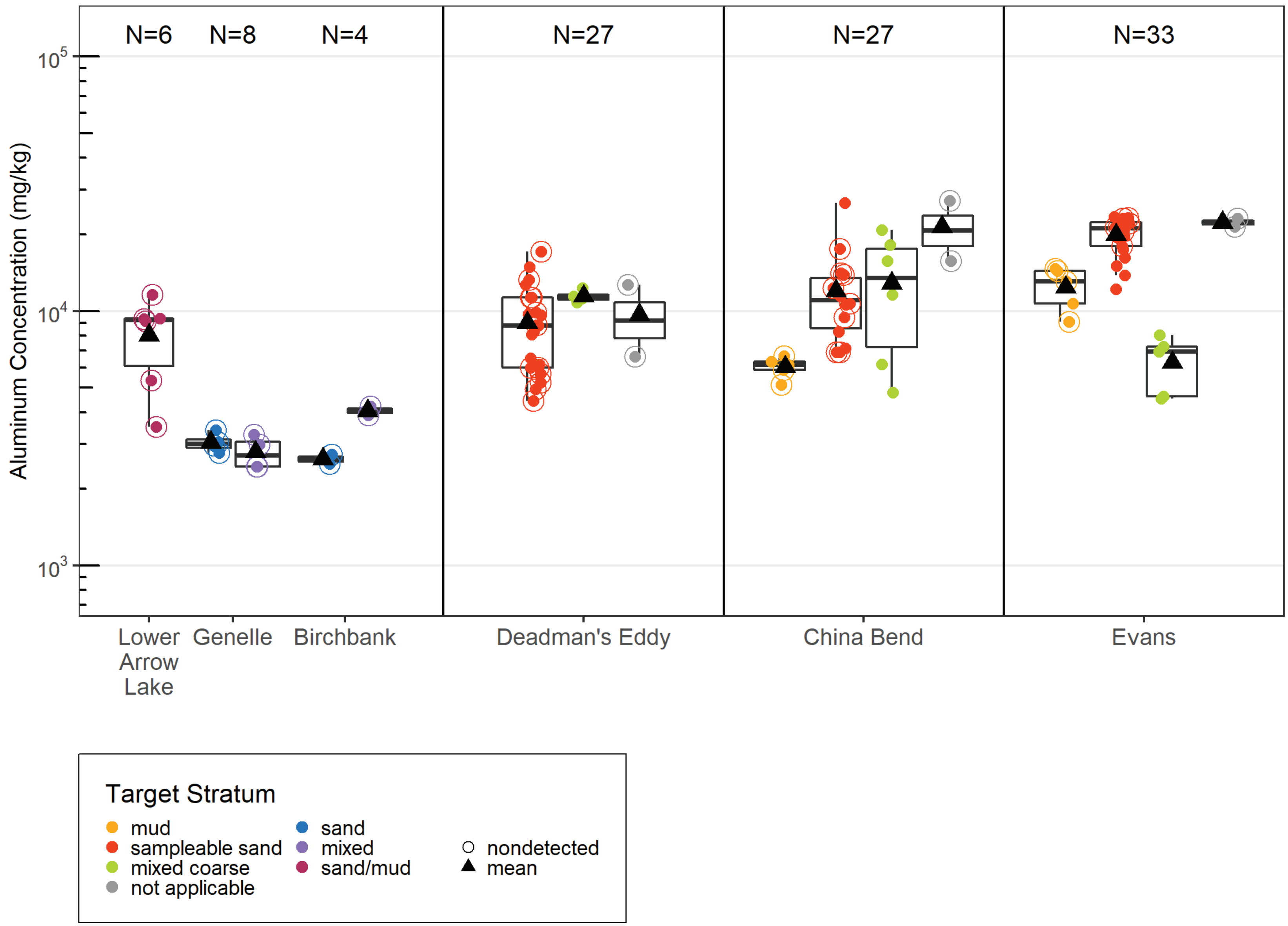
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1a. Solids in Field Sediment Samples



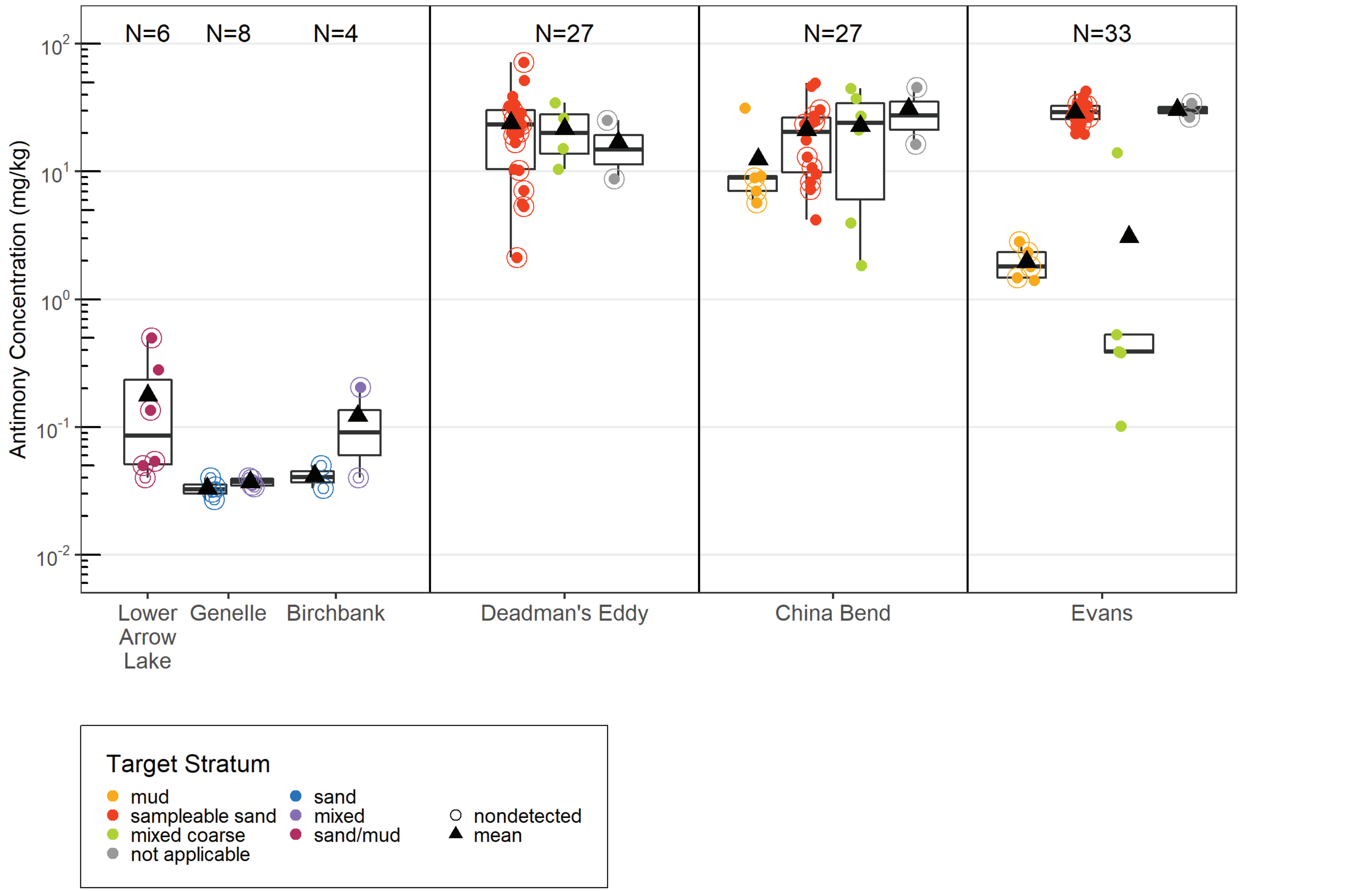
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1b. TOC in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1c. Aluminum in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1d. Antimony in Field Sediment Samples

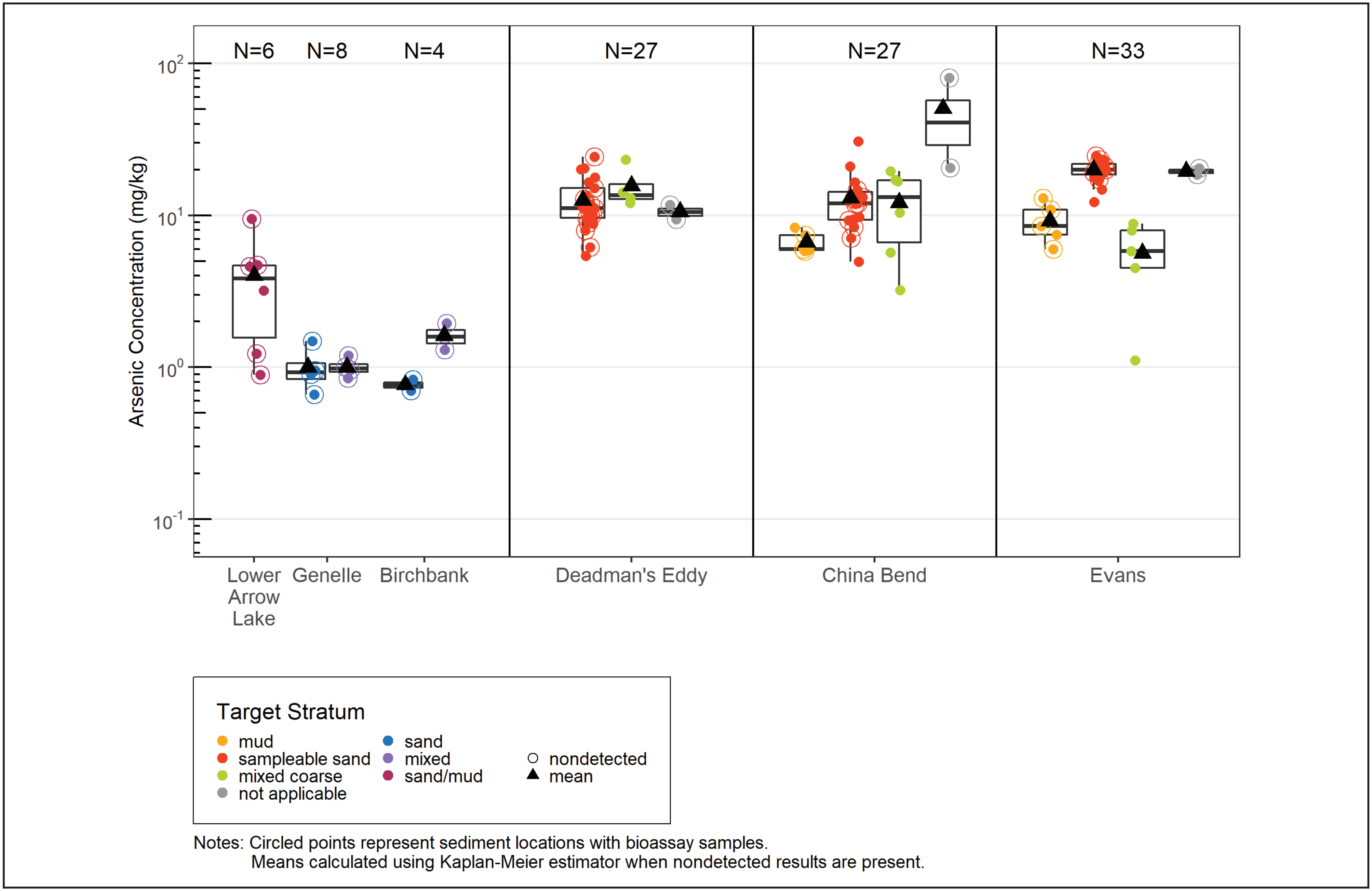
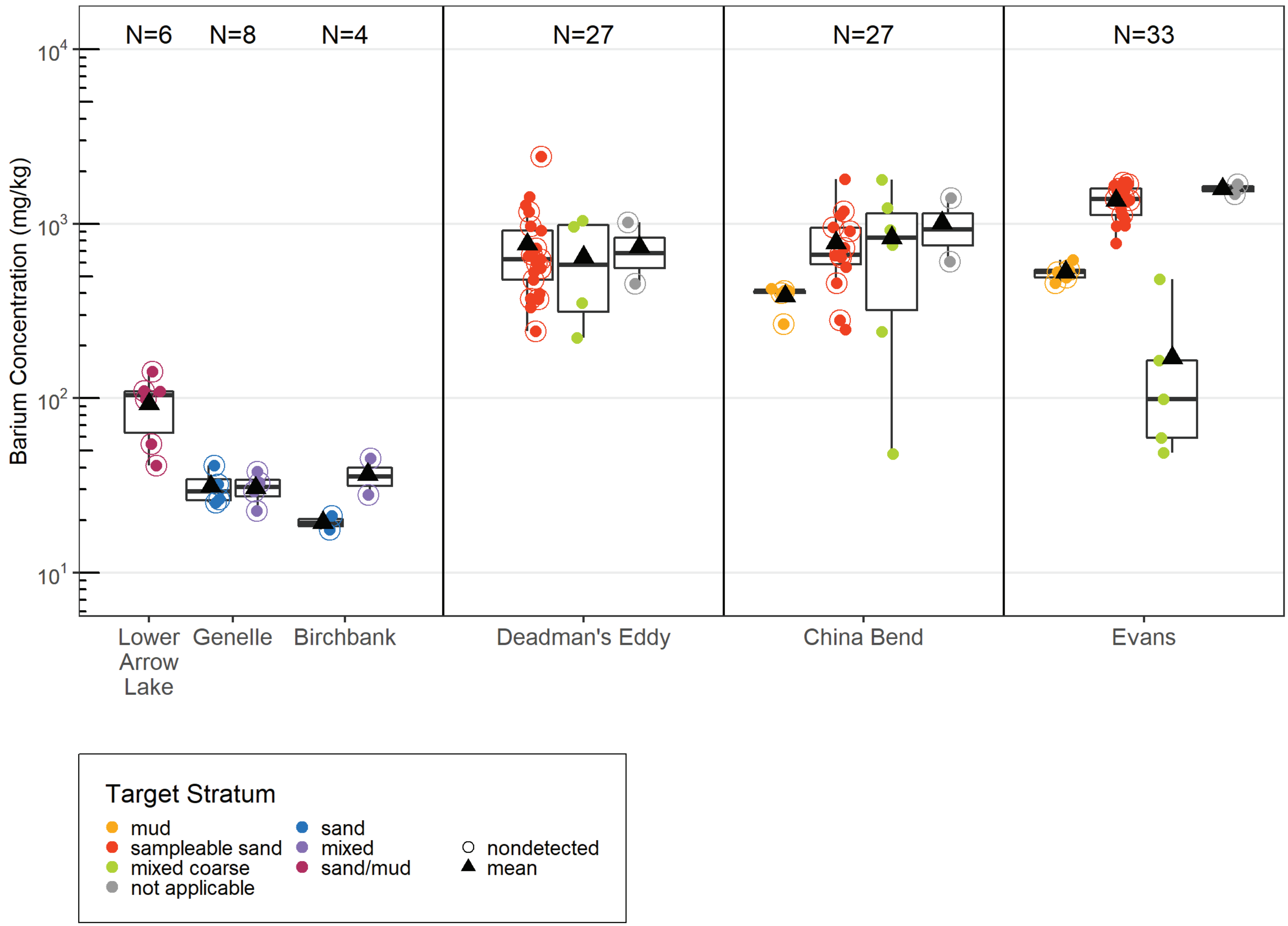
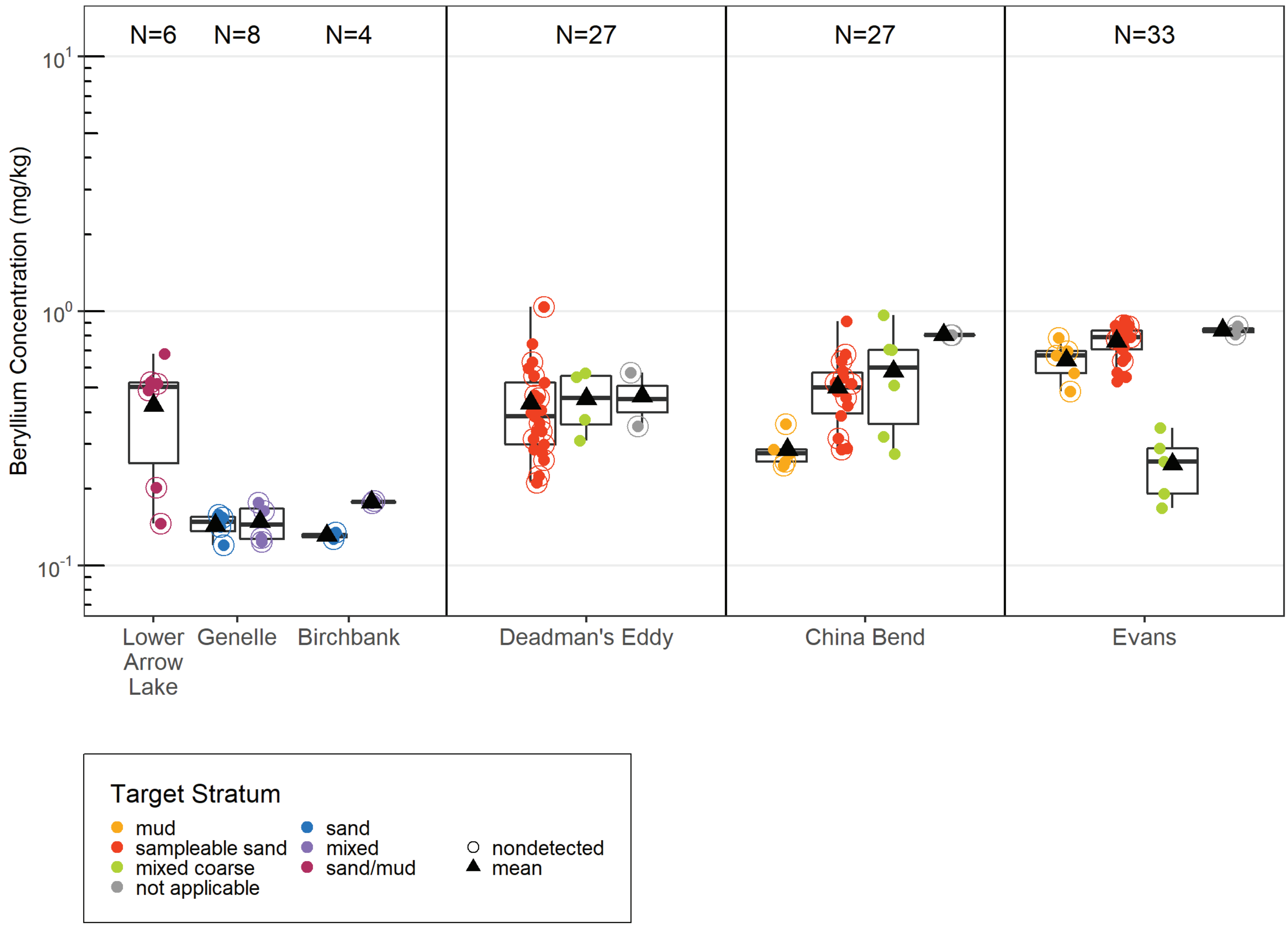


Figure 5-1e. Arsenic in Field Sediment Samples



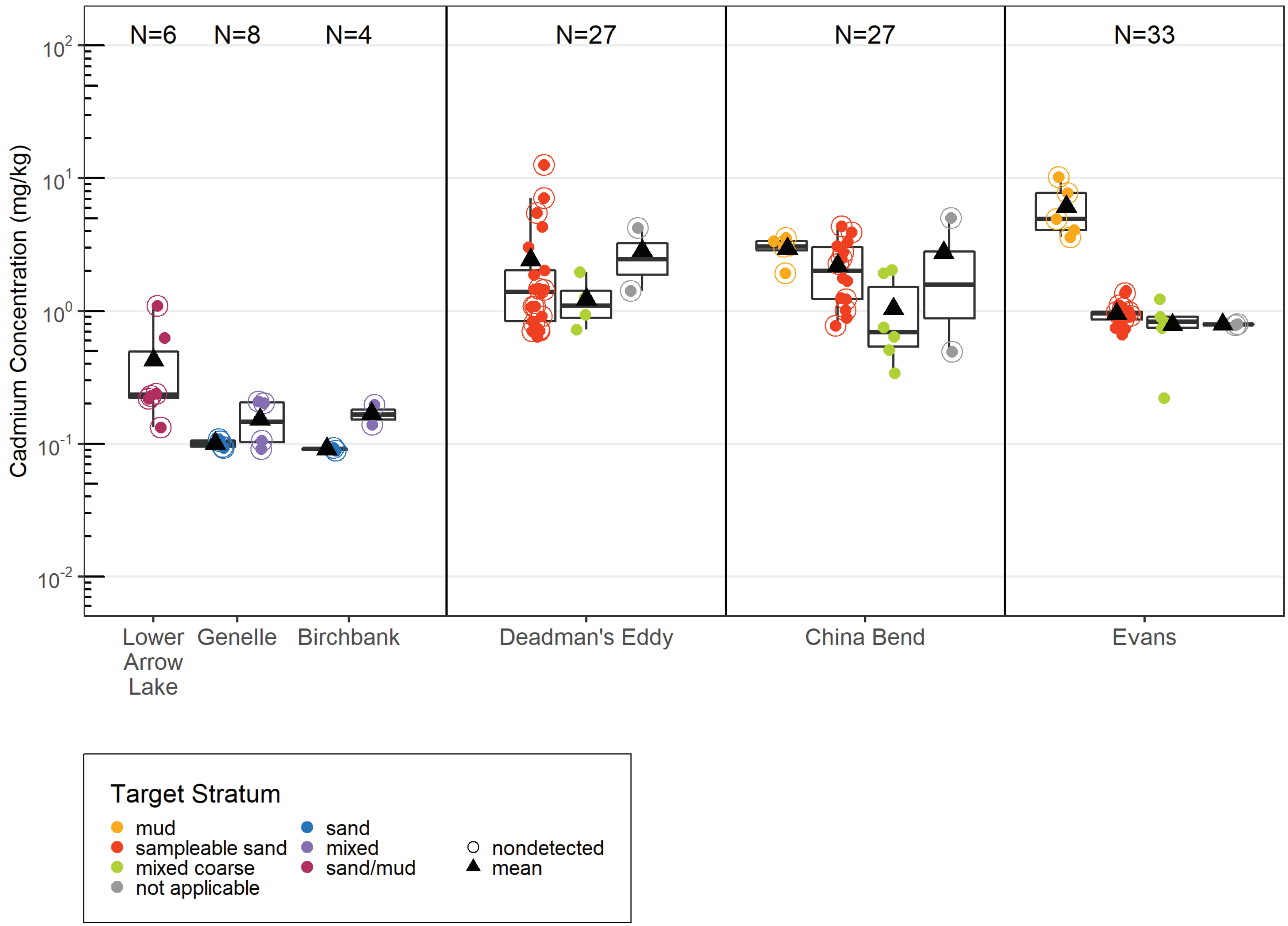
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1f. Barium in Field Sediment Samples



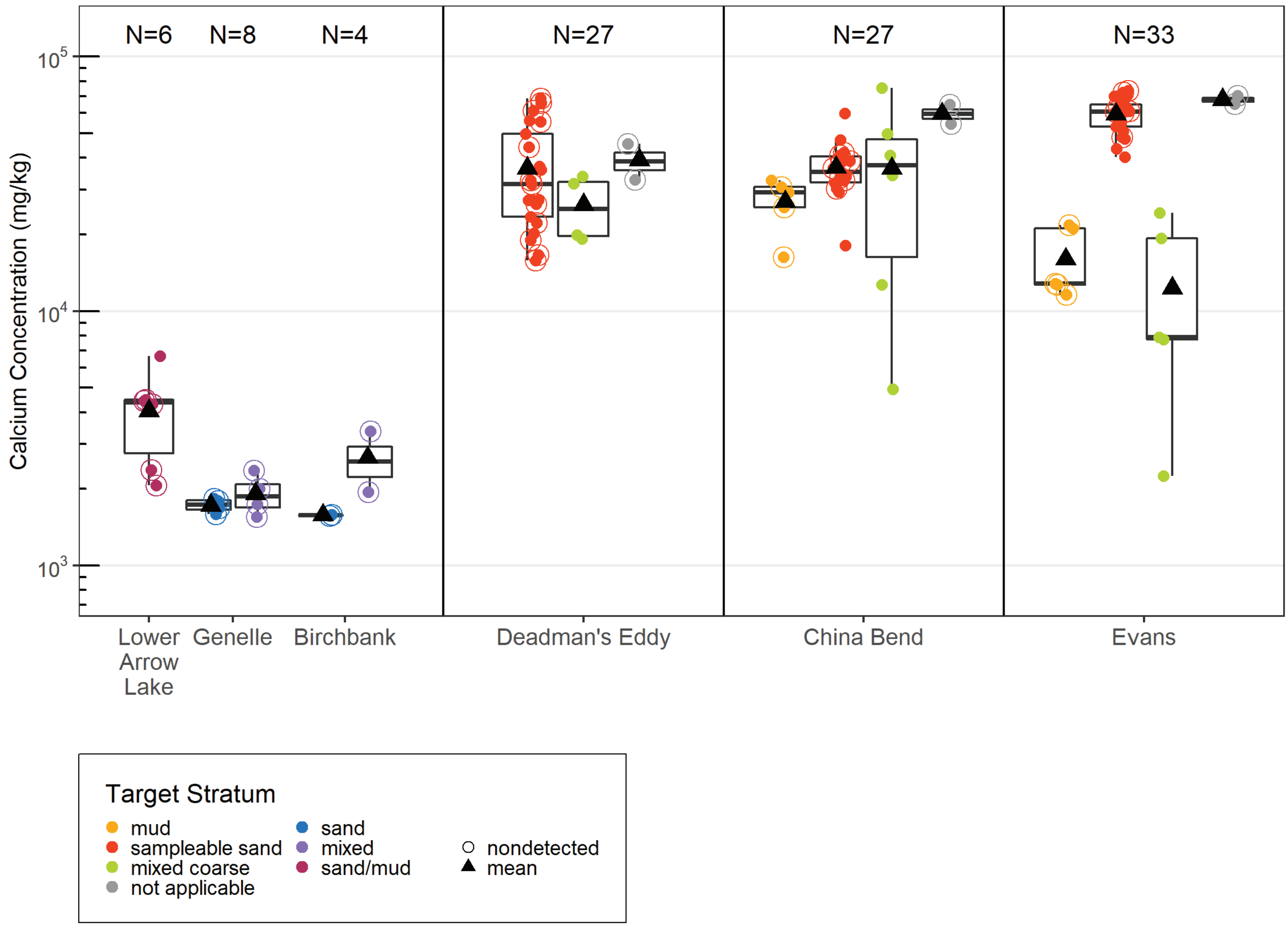
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1g. Beryllium in Field Sediment Samples



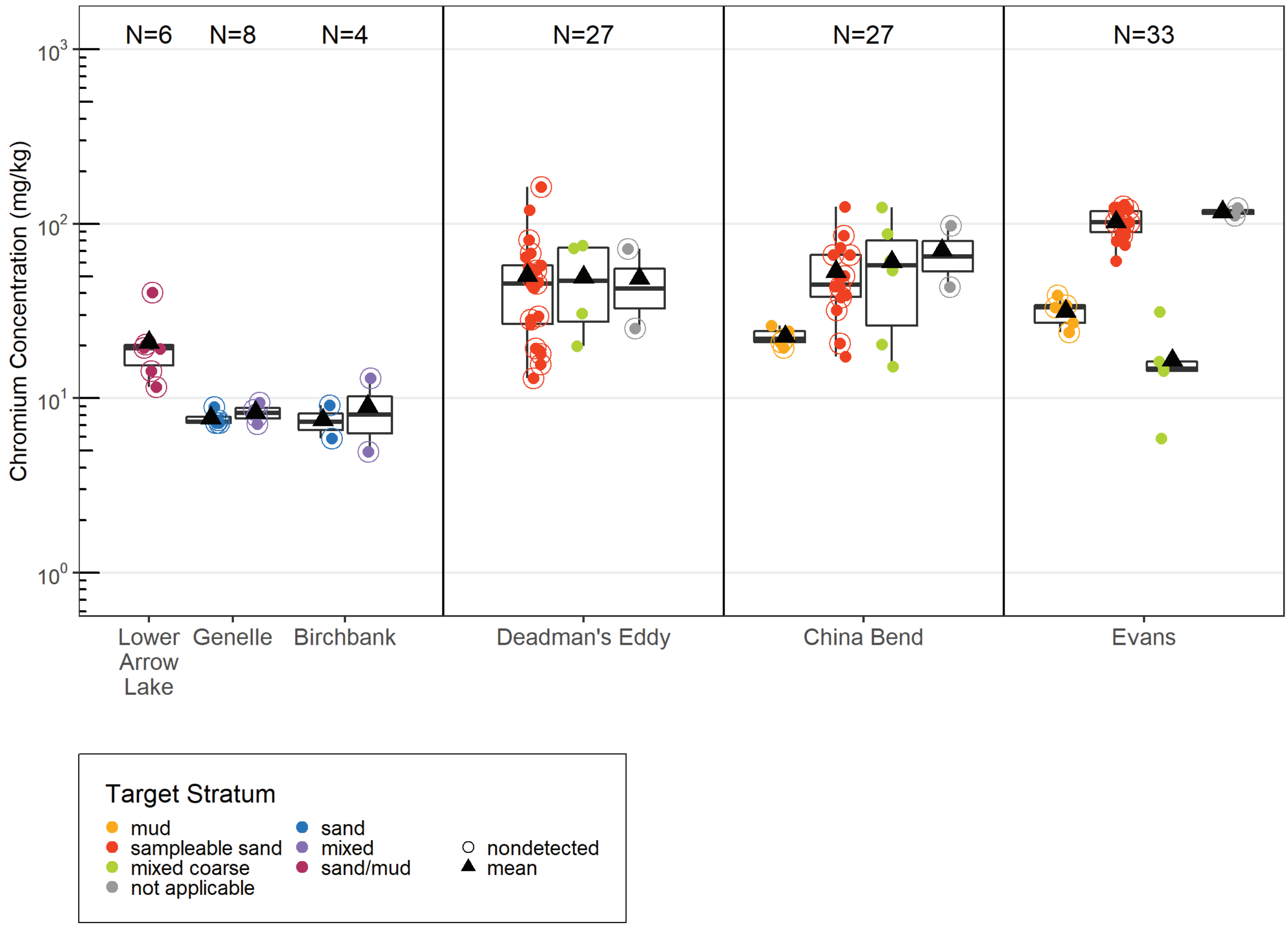
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1h. Cadmium in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1i. Calcium in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1j. Chromium in Field Sediment Samples

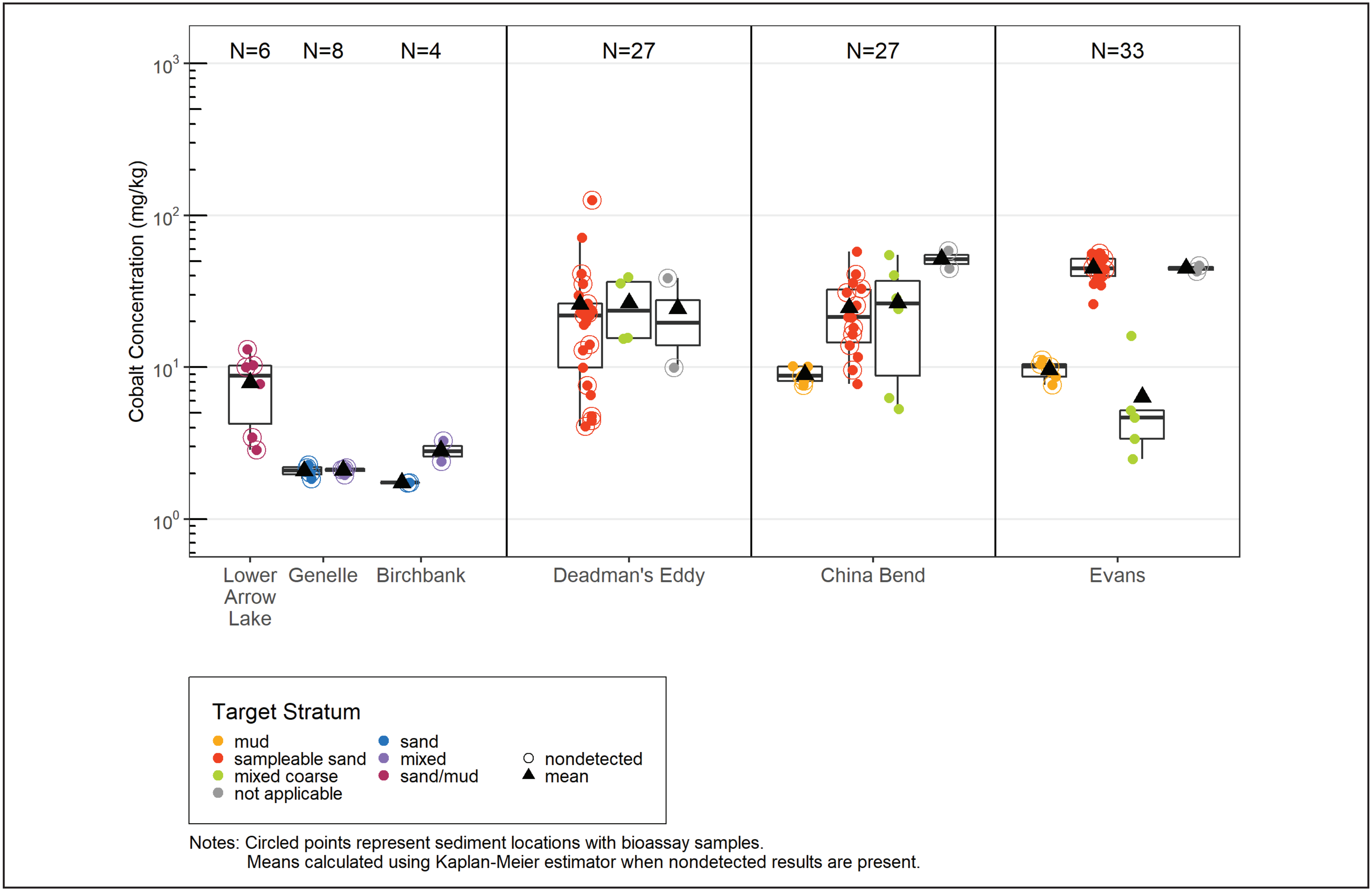
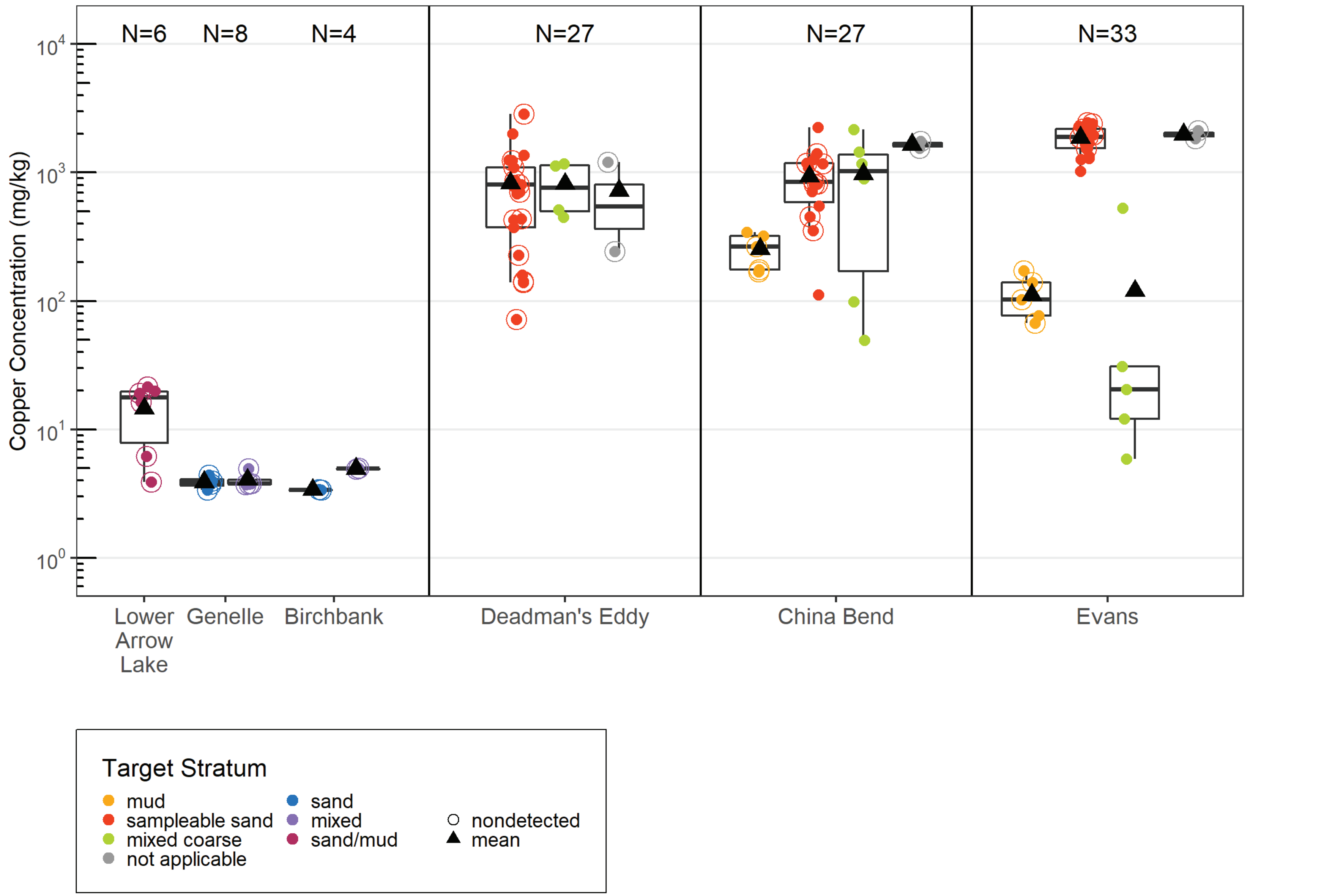
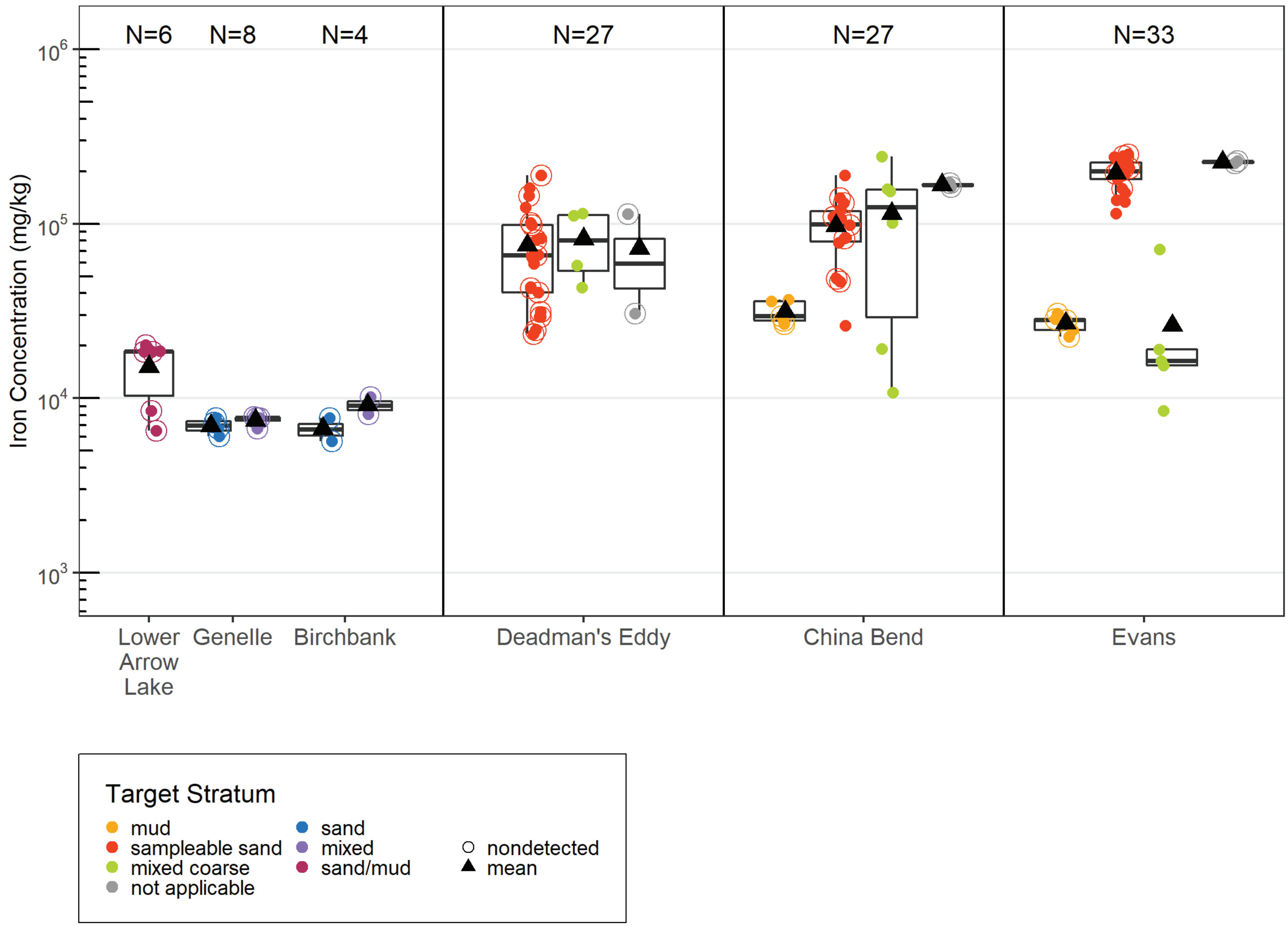


Figure 5-1k. Cobalt in Field Sediment Samples



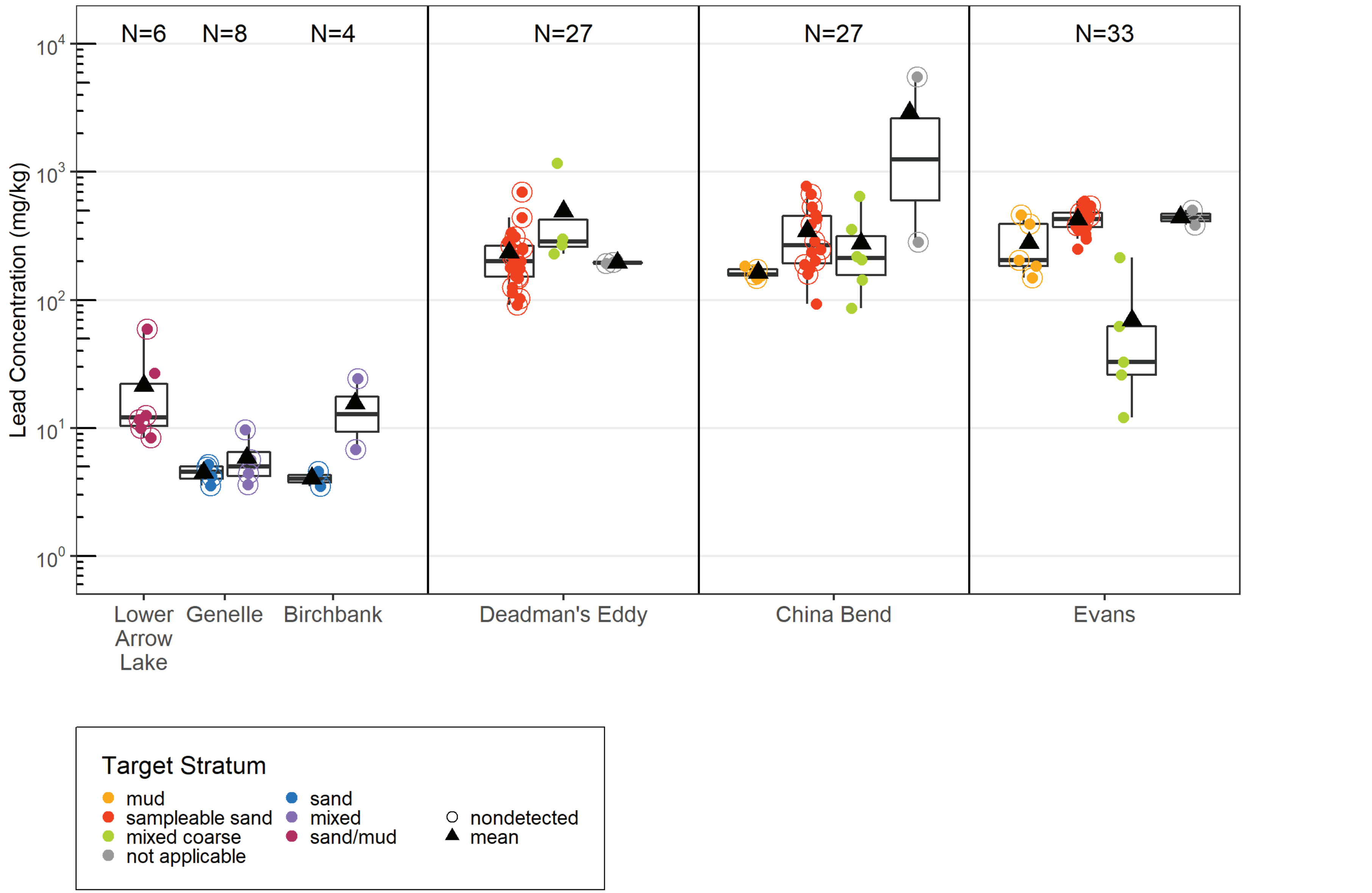
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1l. Copper in Field Sediment Samples



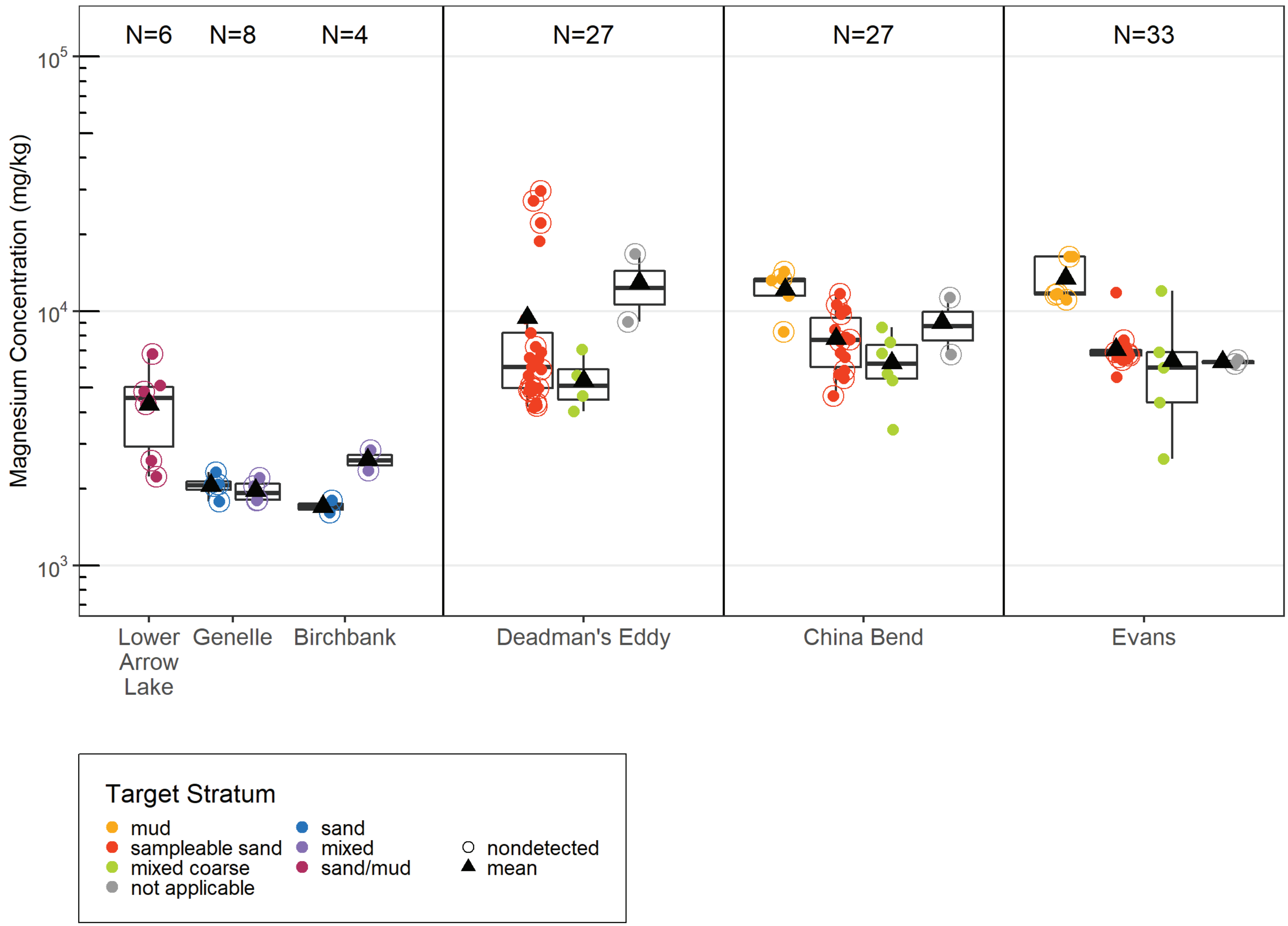
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1m. Iron in Field Sediment Samples



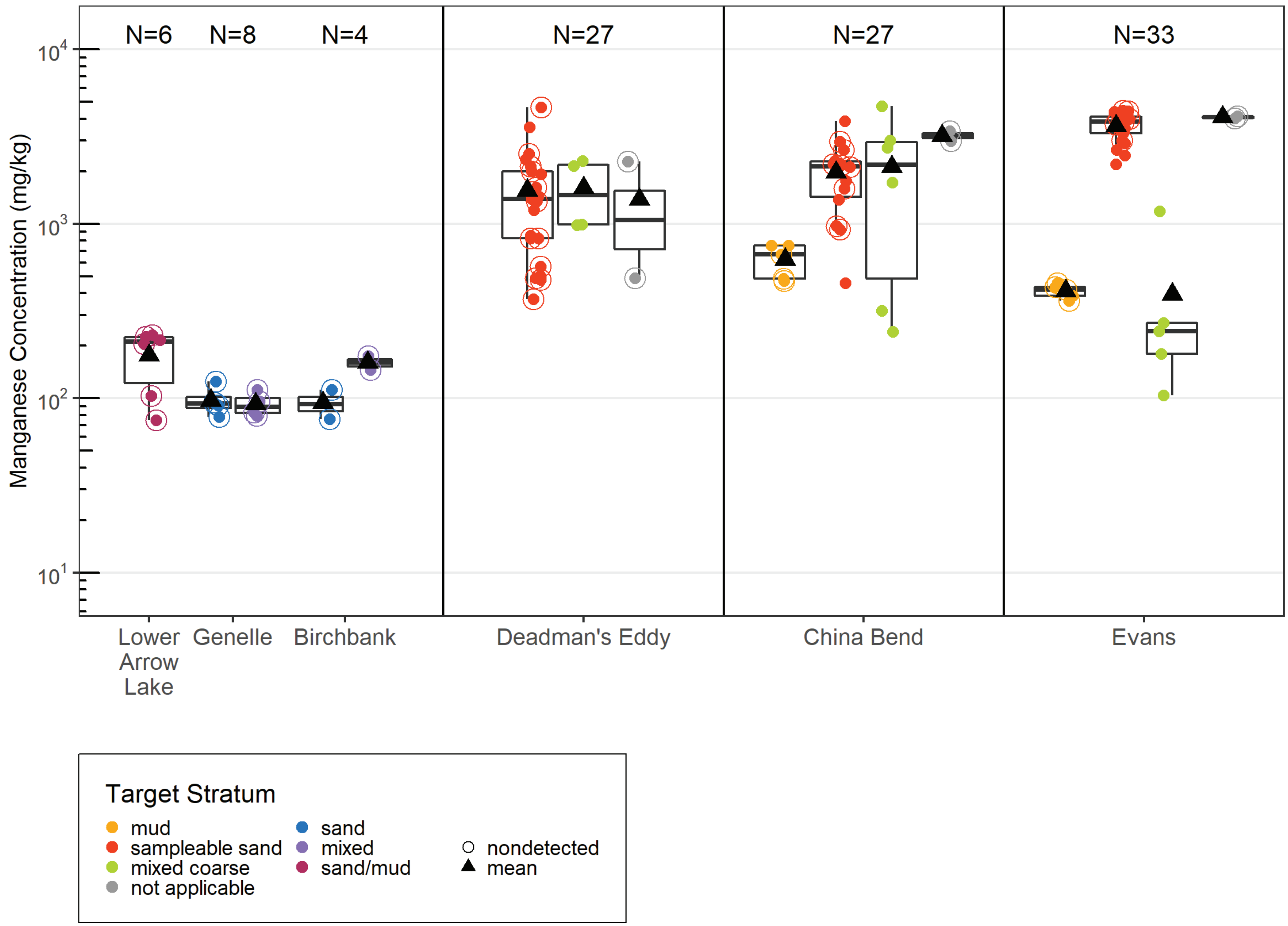
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1n. Lead in Field Sediment Samples



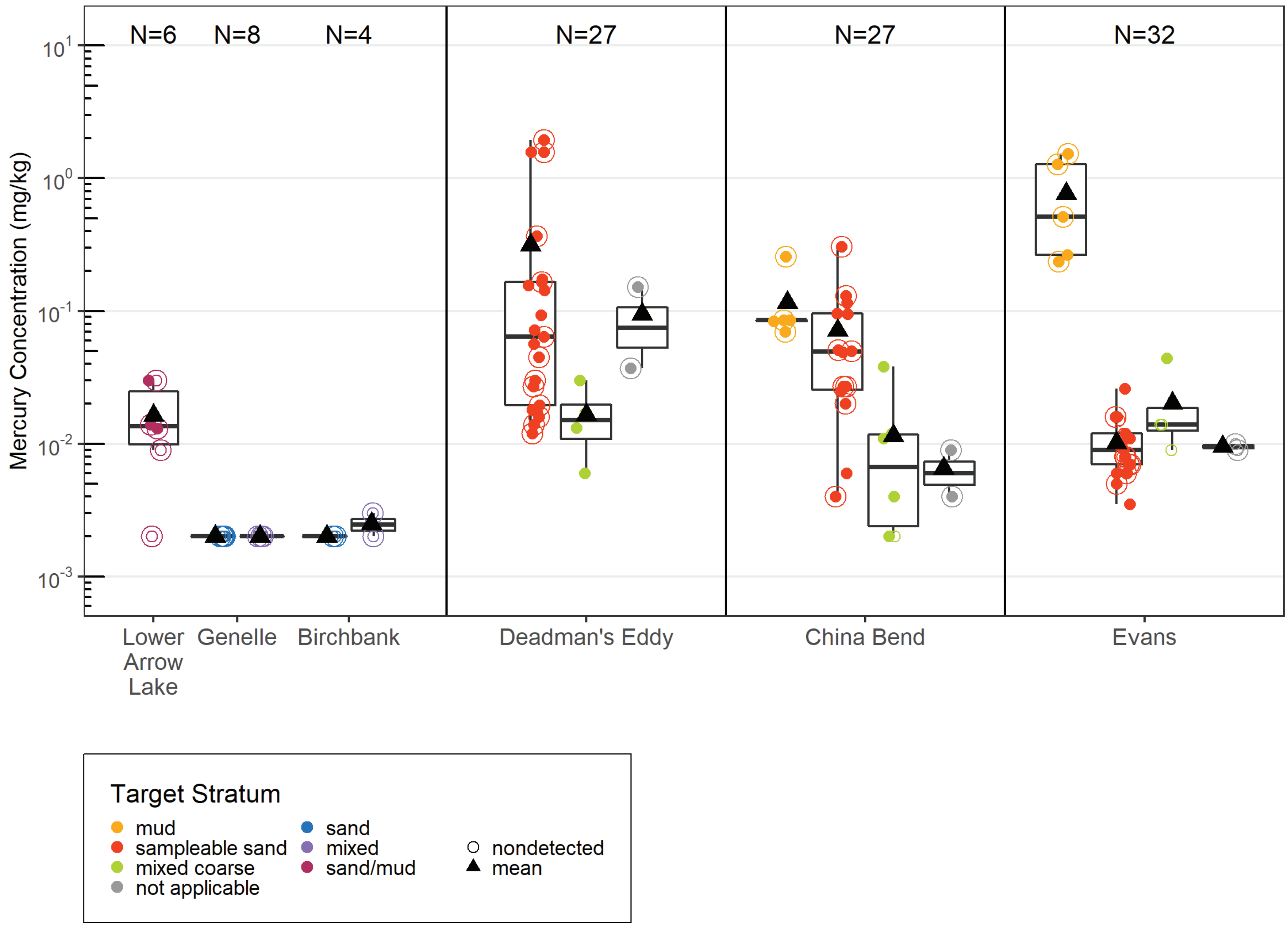
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1o. Magnesium in Field Sediment Samples



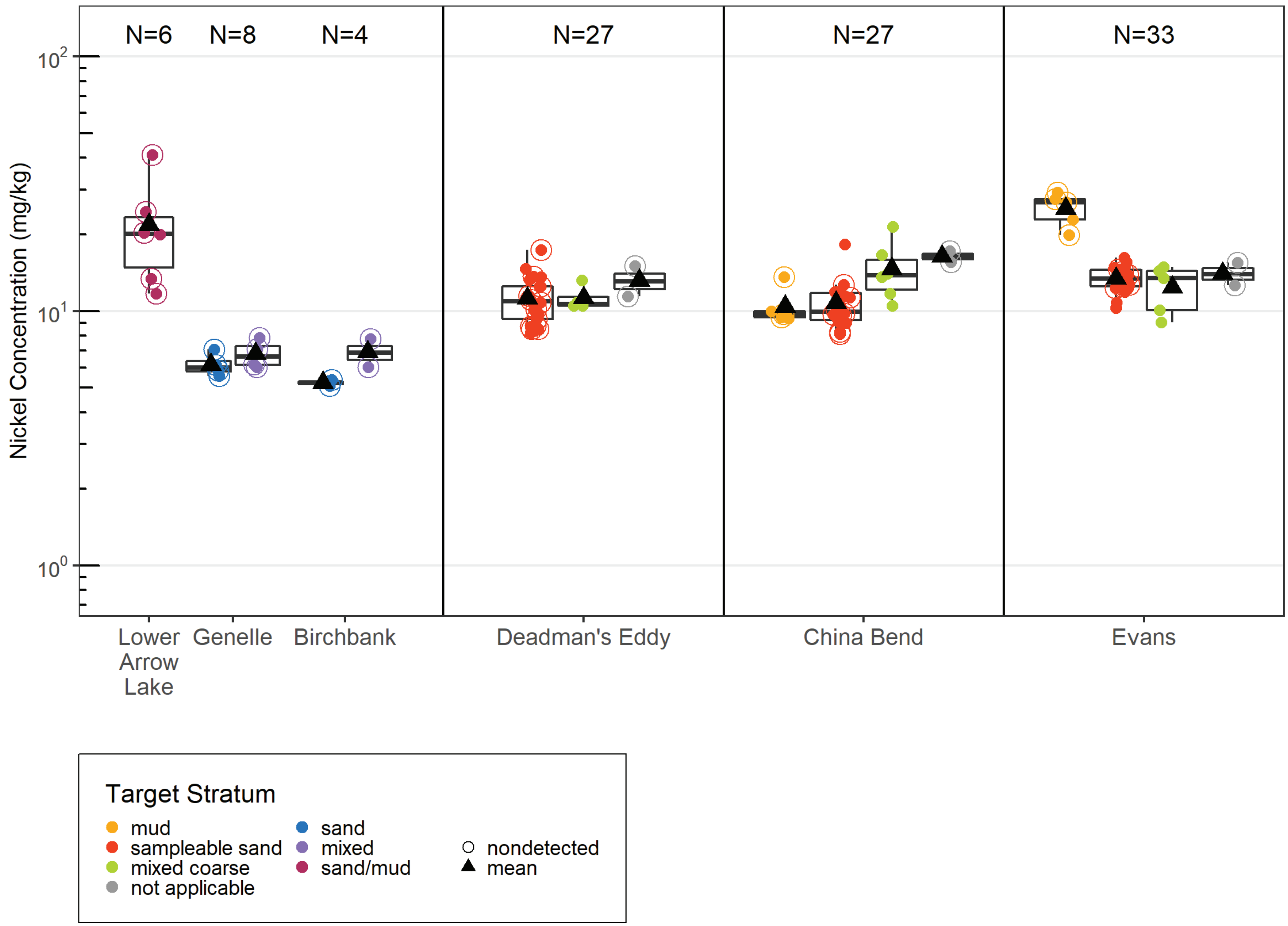
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1p. Manganese in Field Sediment Samples



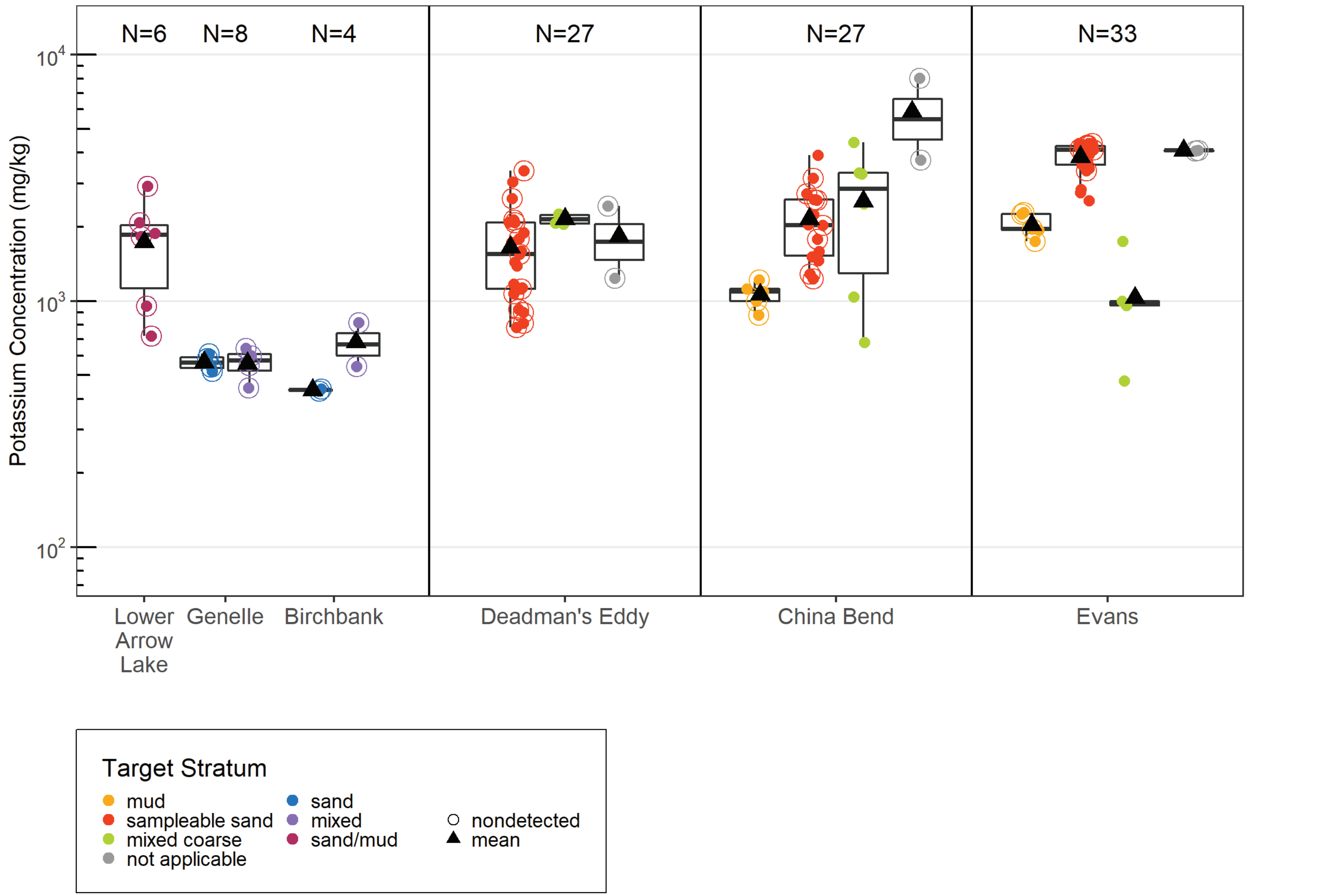
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1q. Mercury in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1r. Nickel in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1s. Potassium in Field Sediment Samples

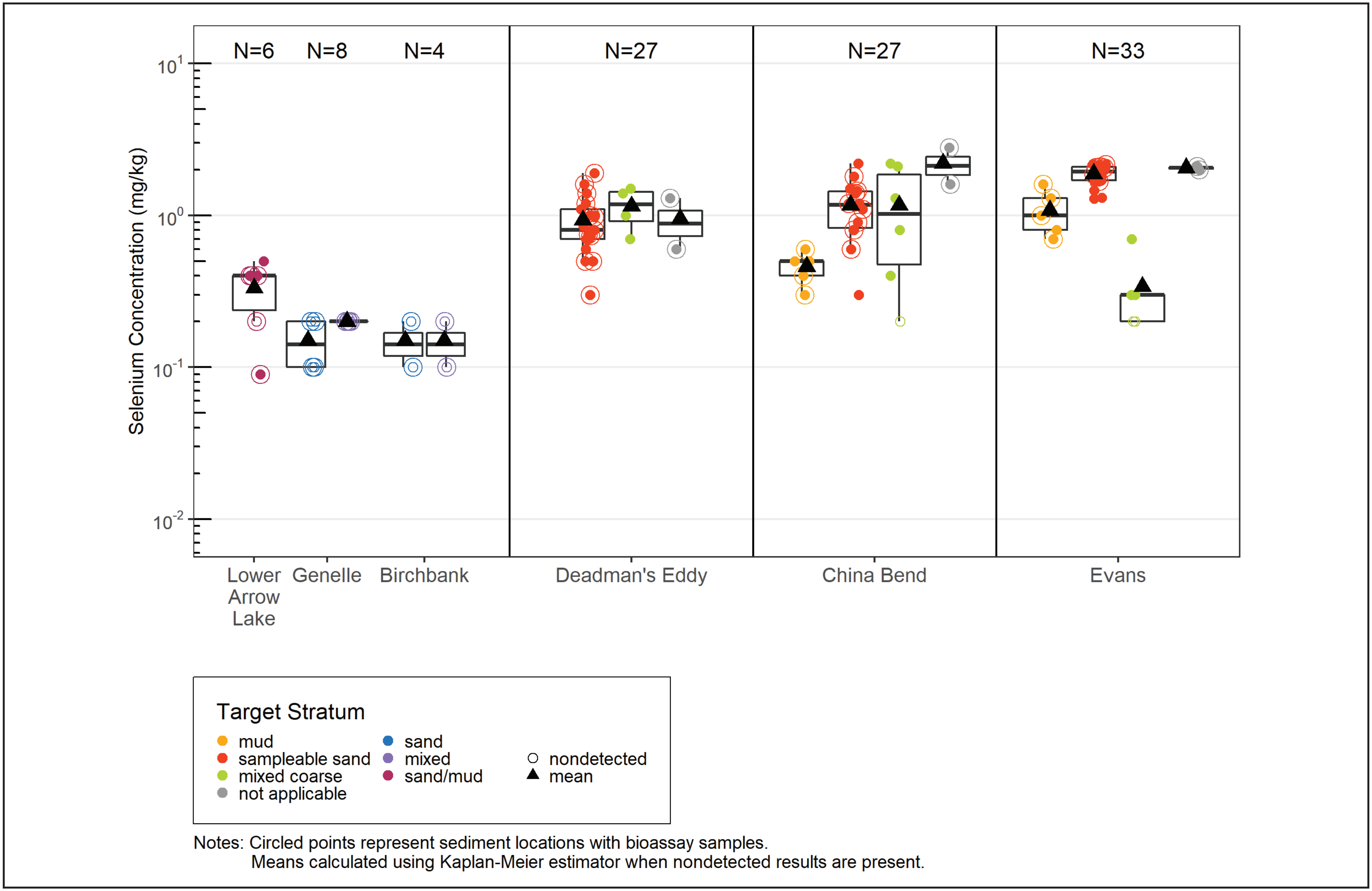


Figure 5-1t. Selenium in Field Sediment Samples

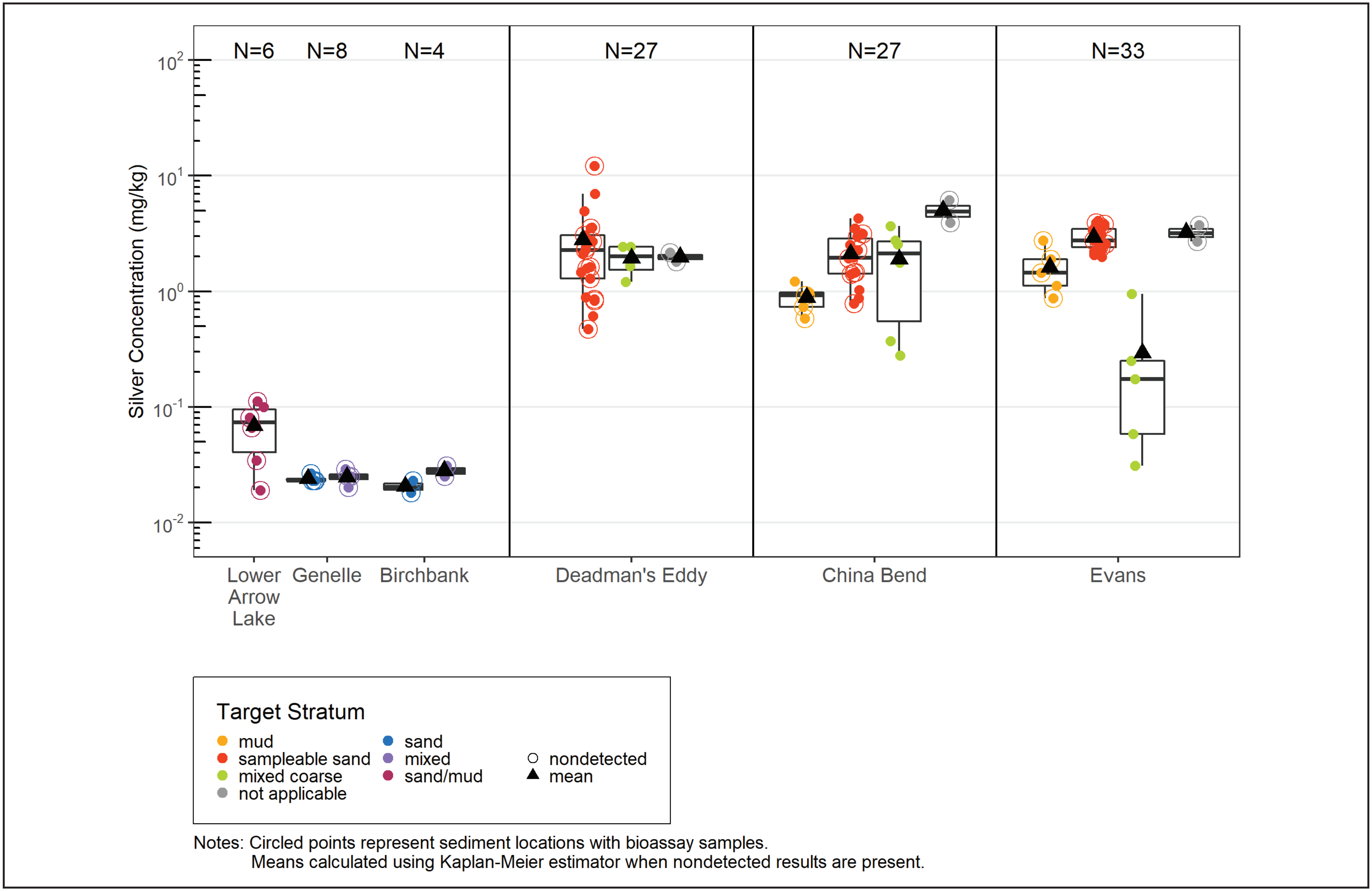


Figure 5-1u. Silver in Field Sediment Samples

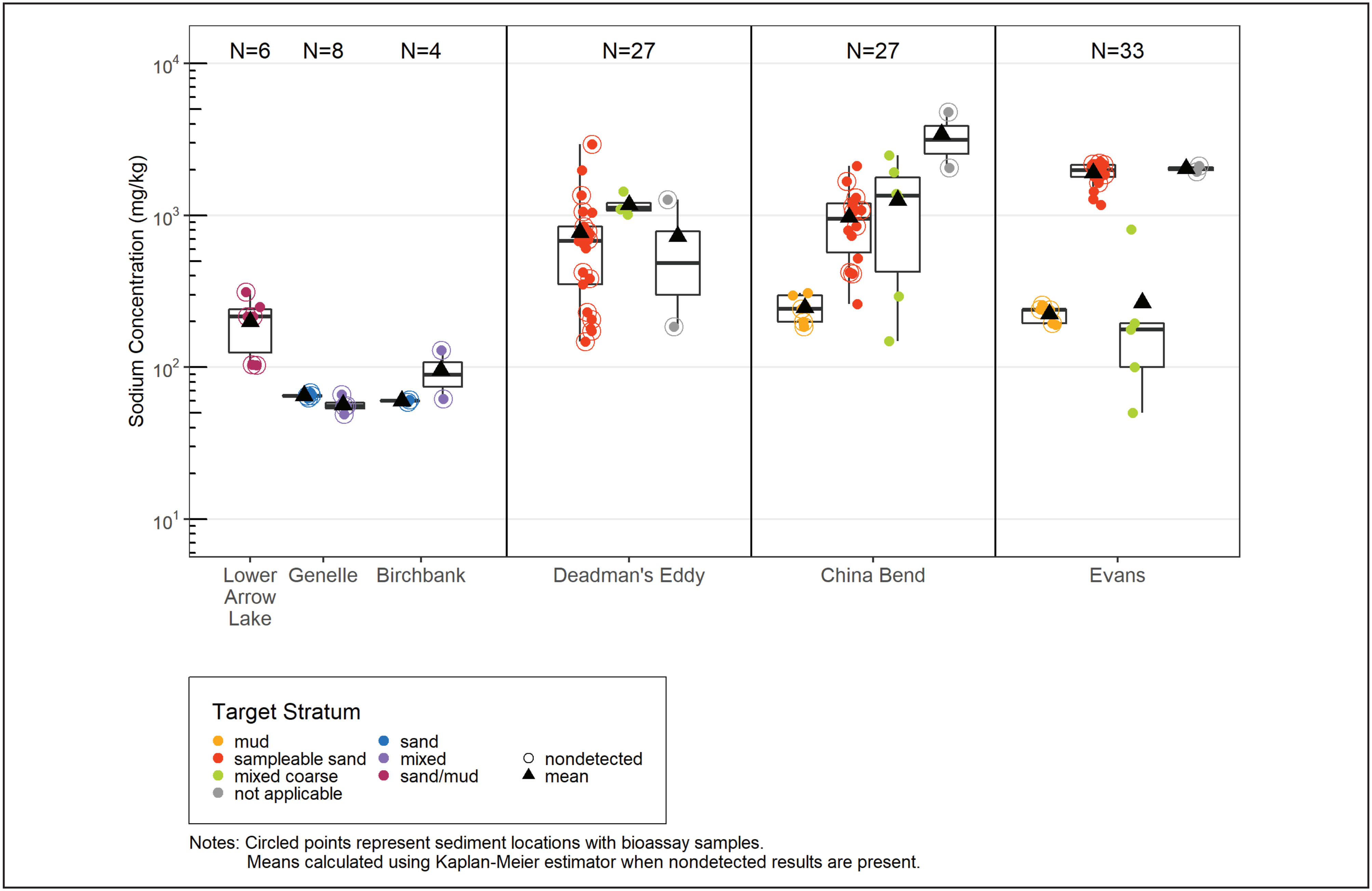
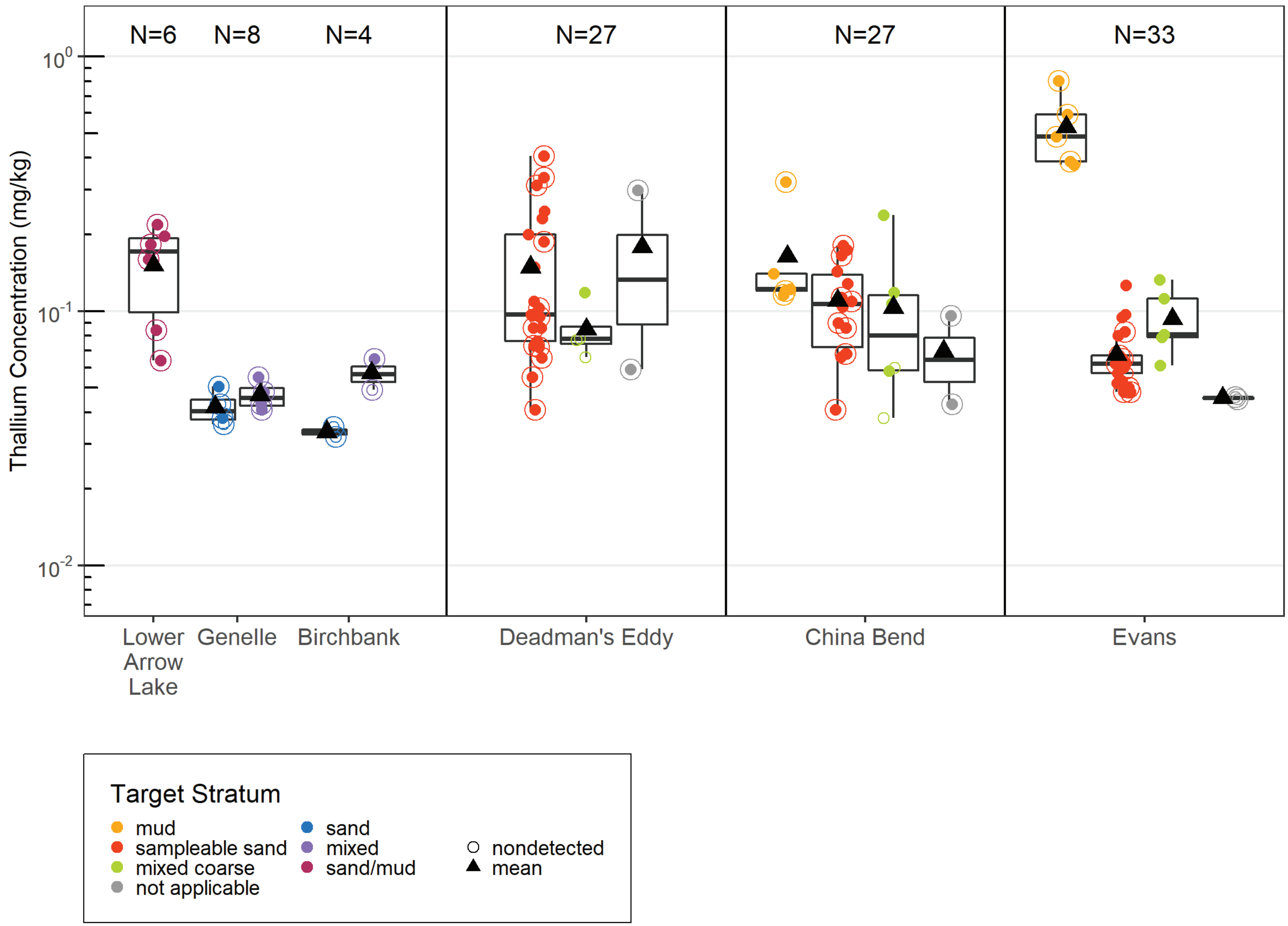
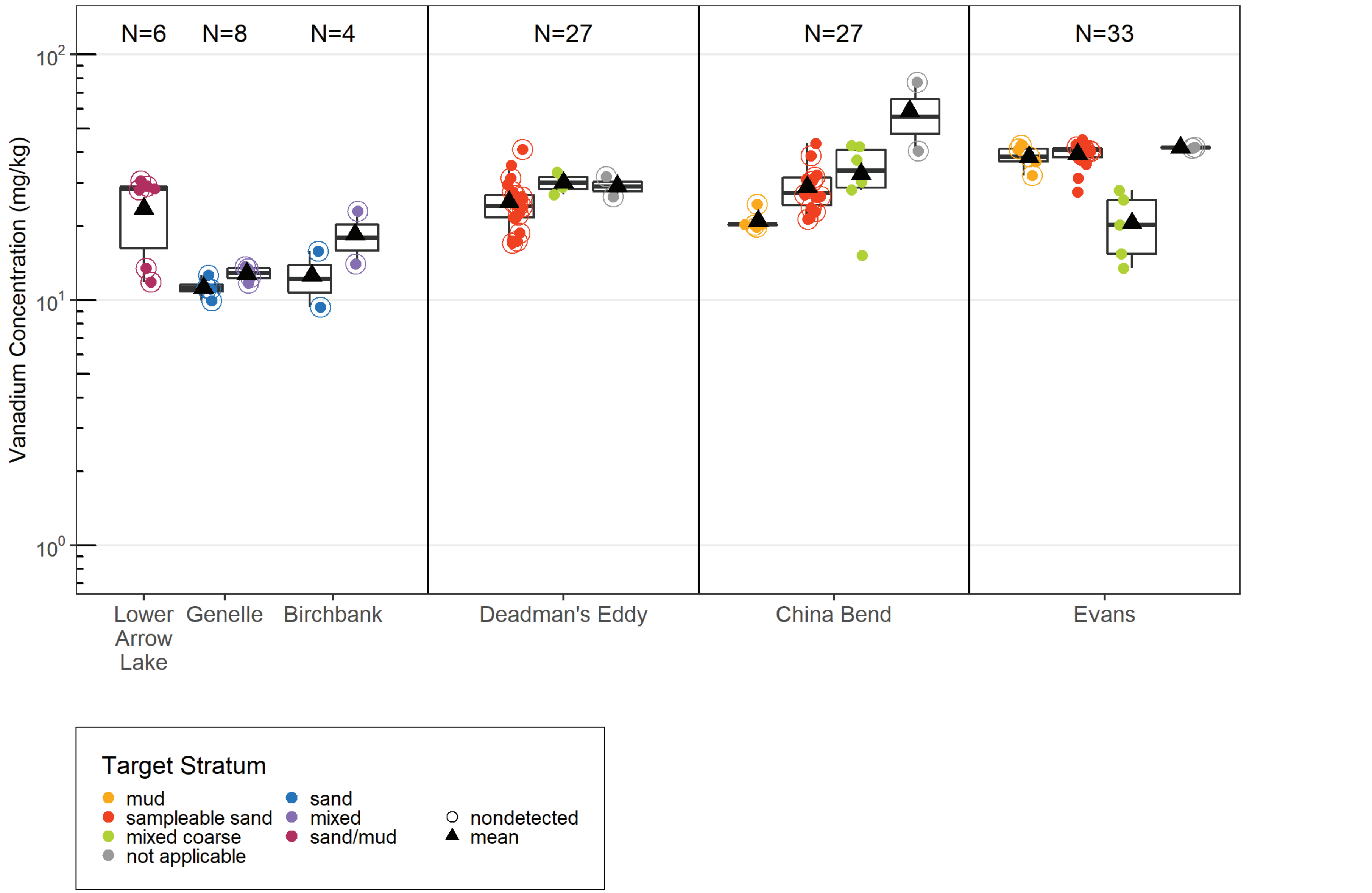


Figure 5-1v. Sodium in Field Sediment Samples



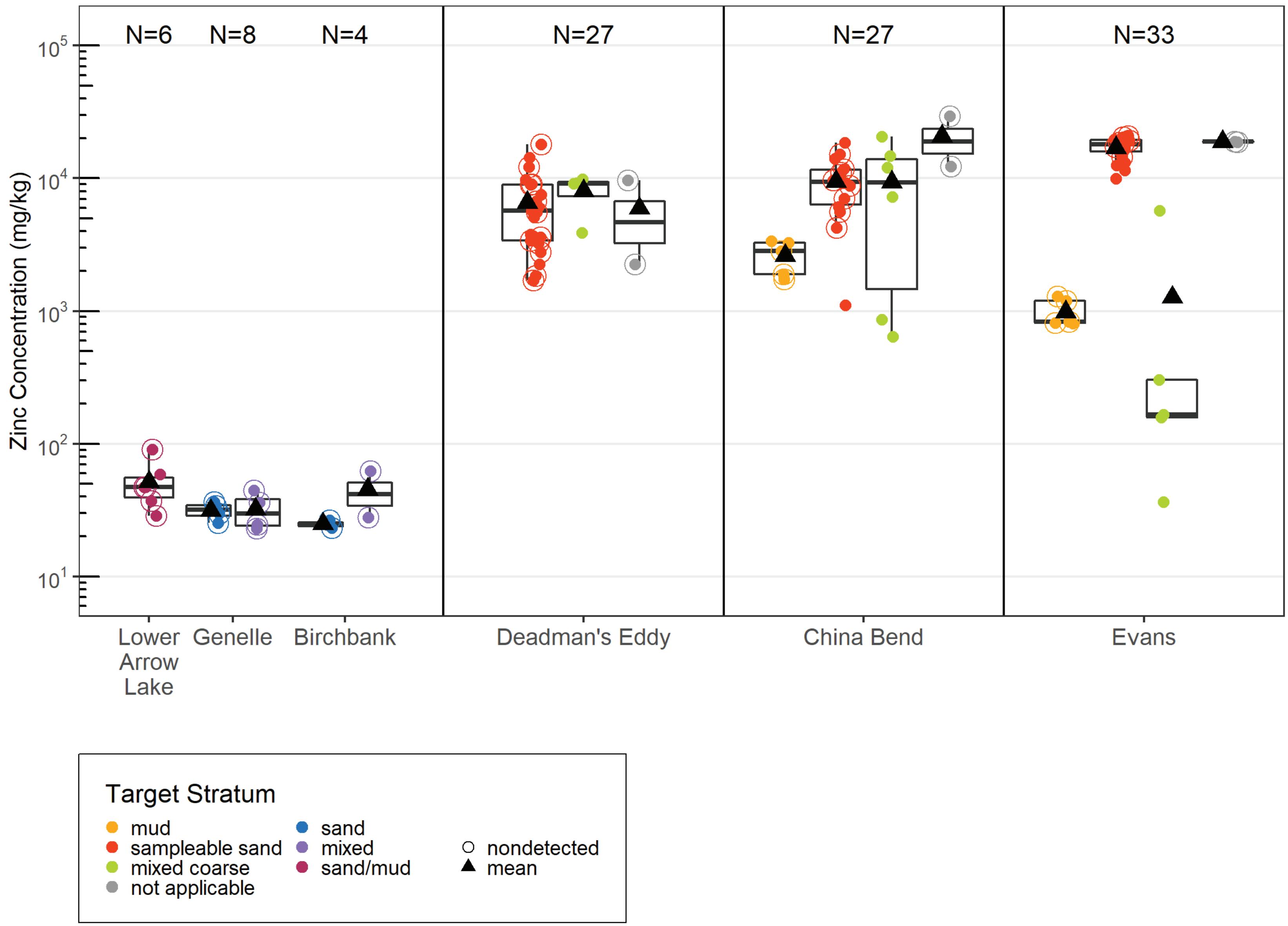
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1w. Thallium in Field Sediment Samples



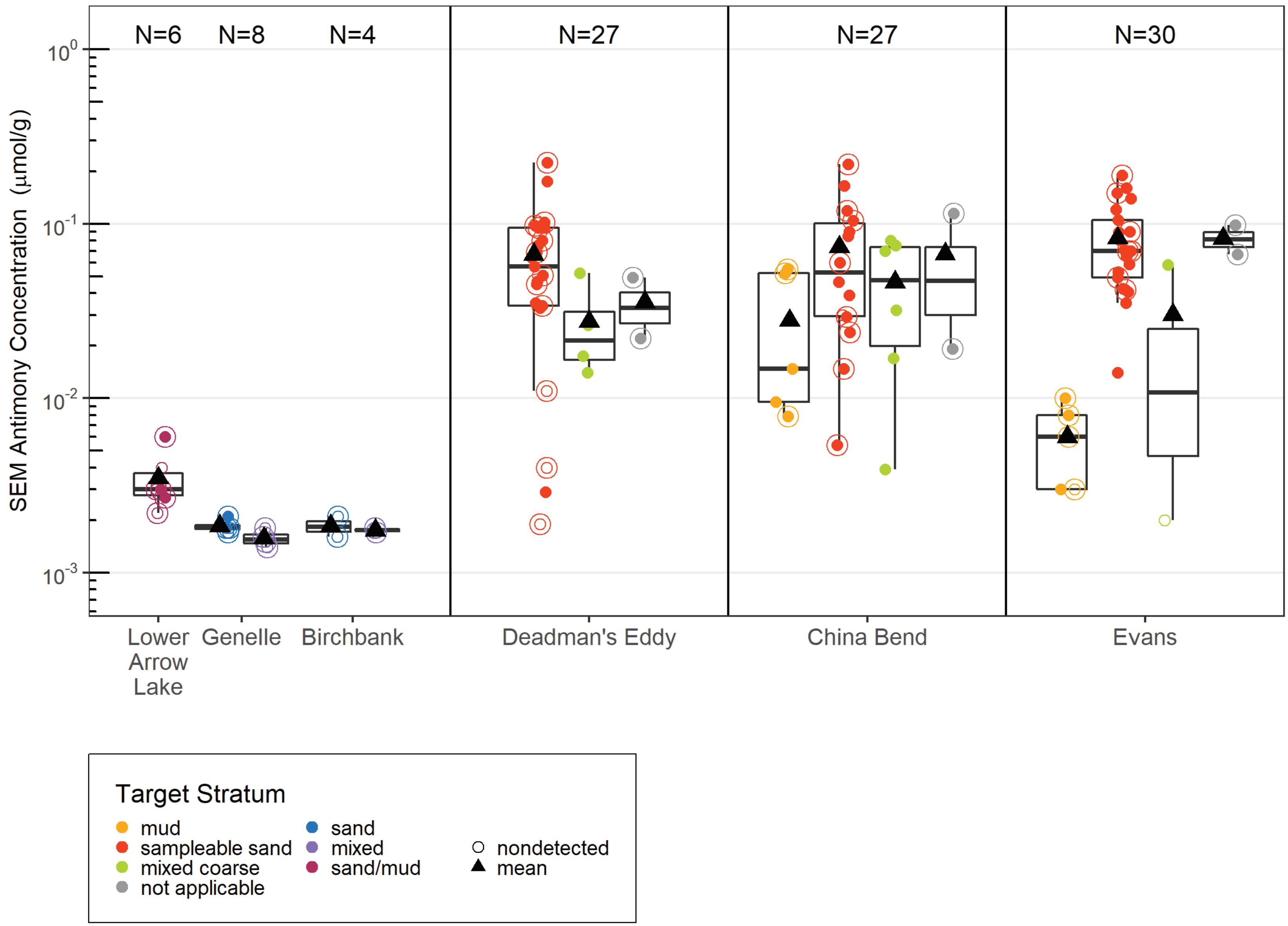
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1x. Vanadium in Field Sediment Samples



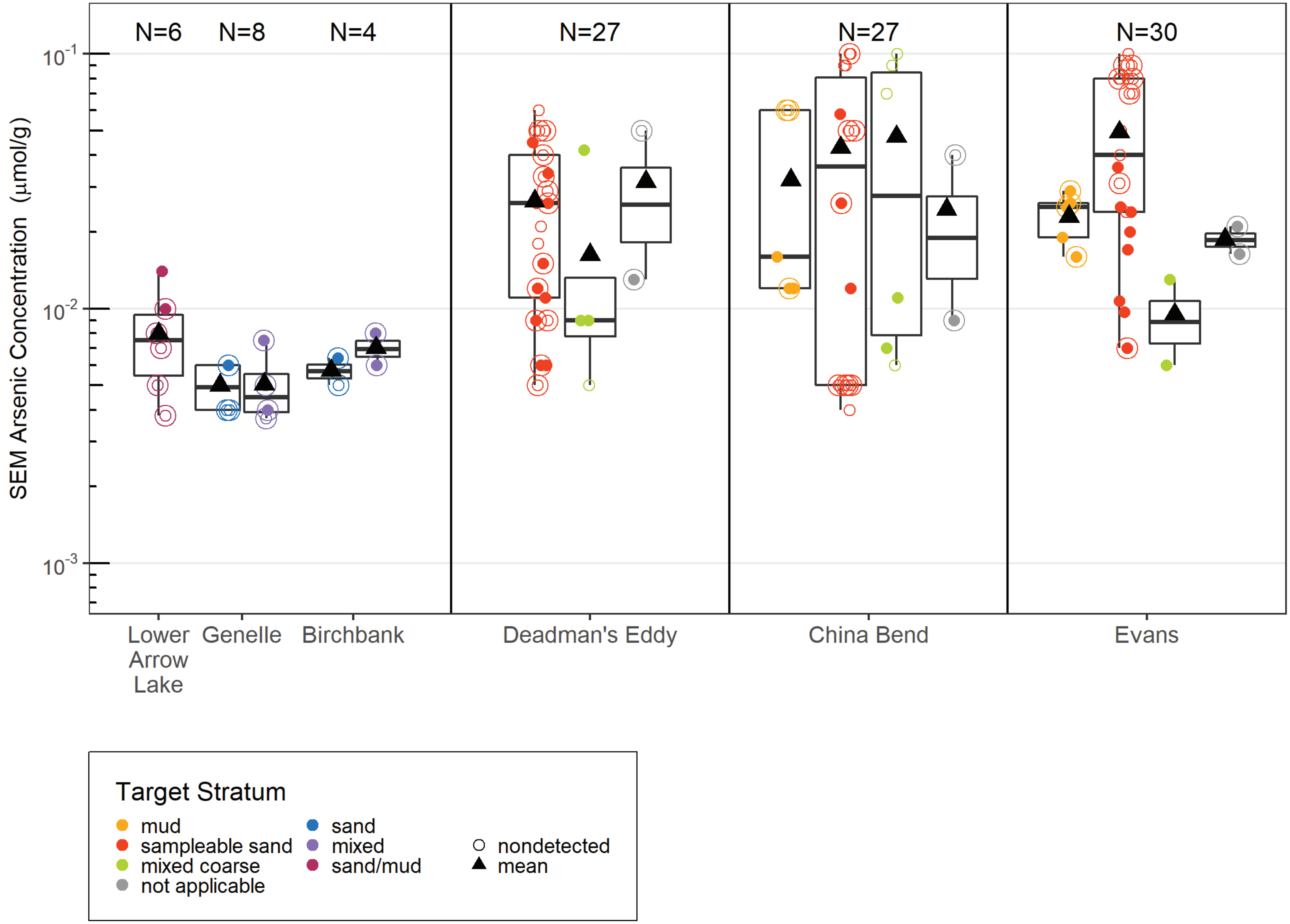
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1y. Zinc in Field Sediment Samples



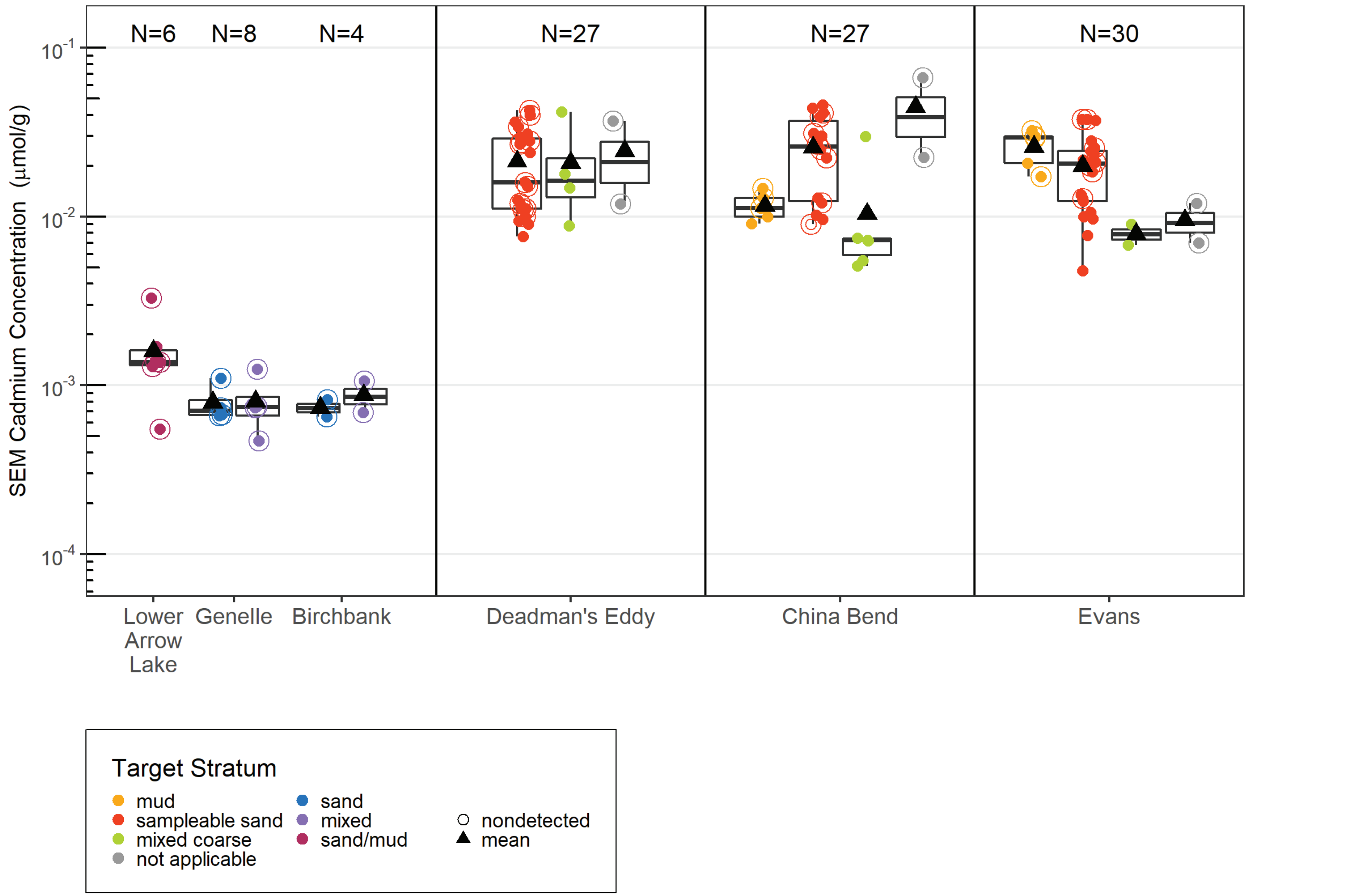
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1z. SEM Antimony in Field Sediment Samples



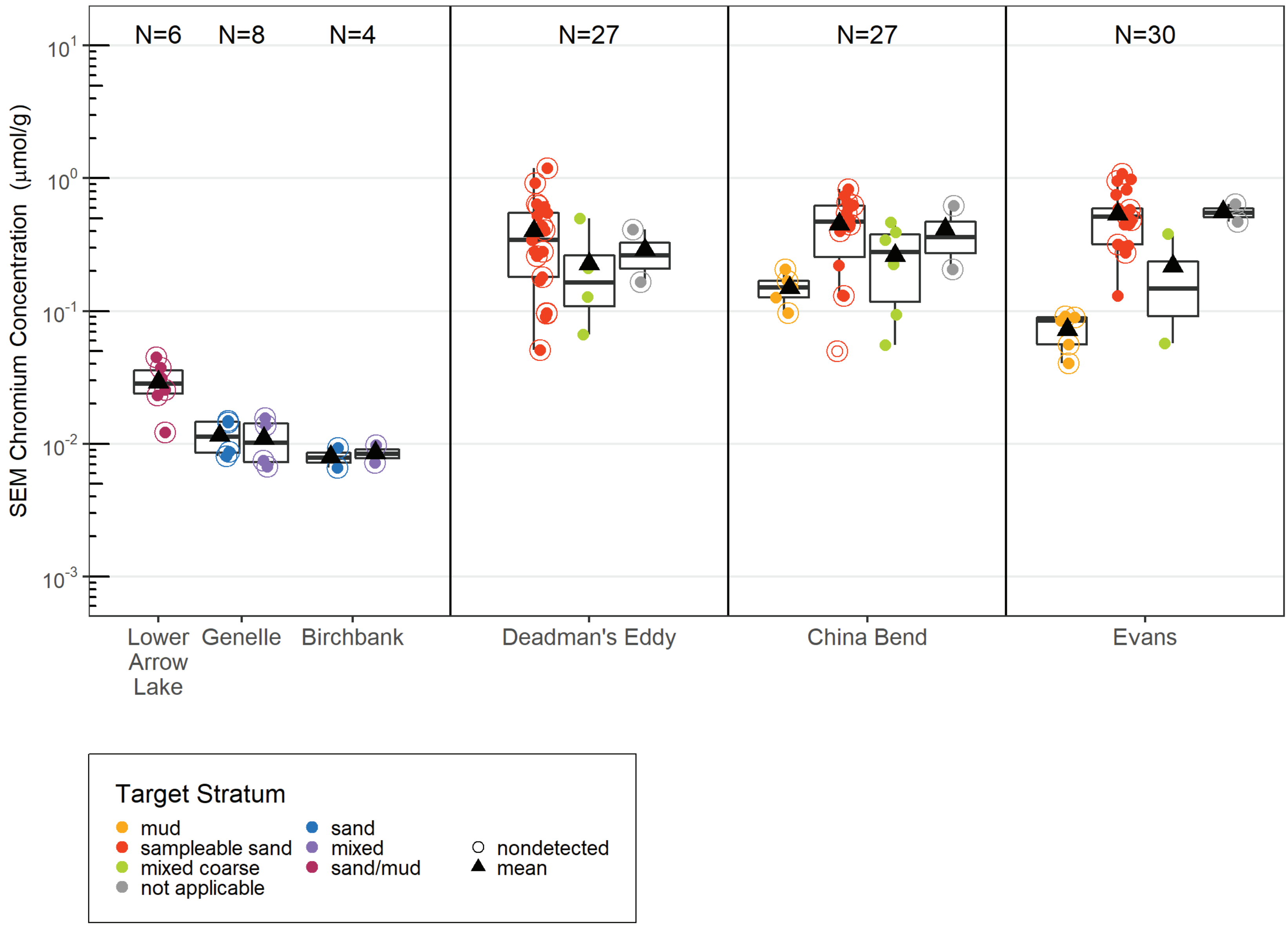
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1aa. SEM Arsenic in Field Sediment Samples



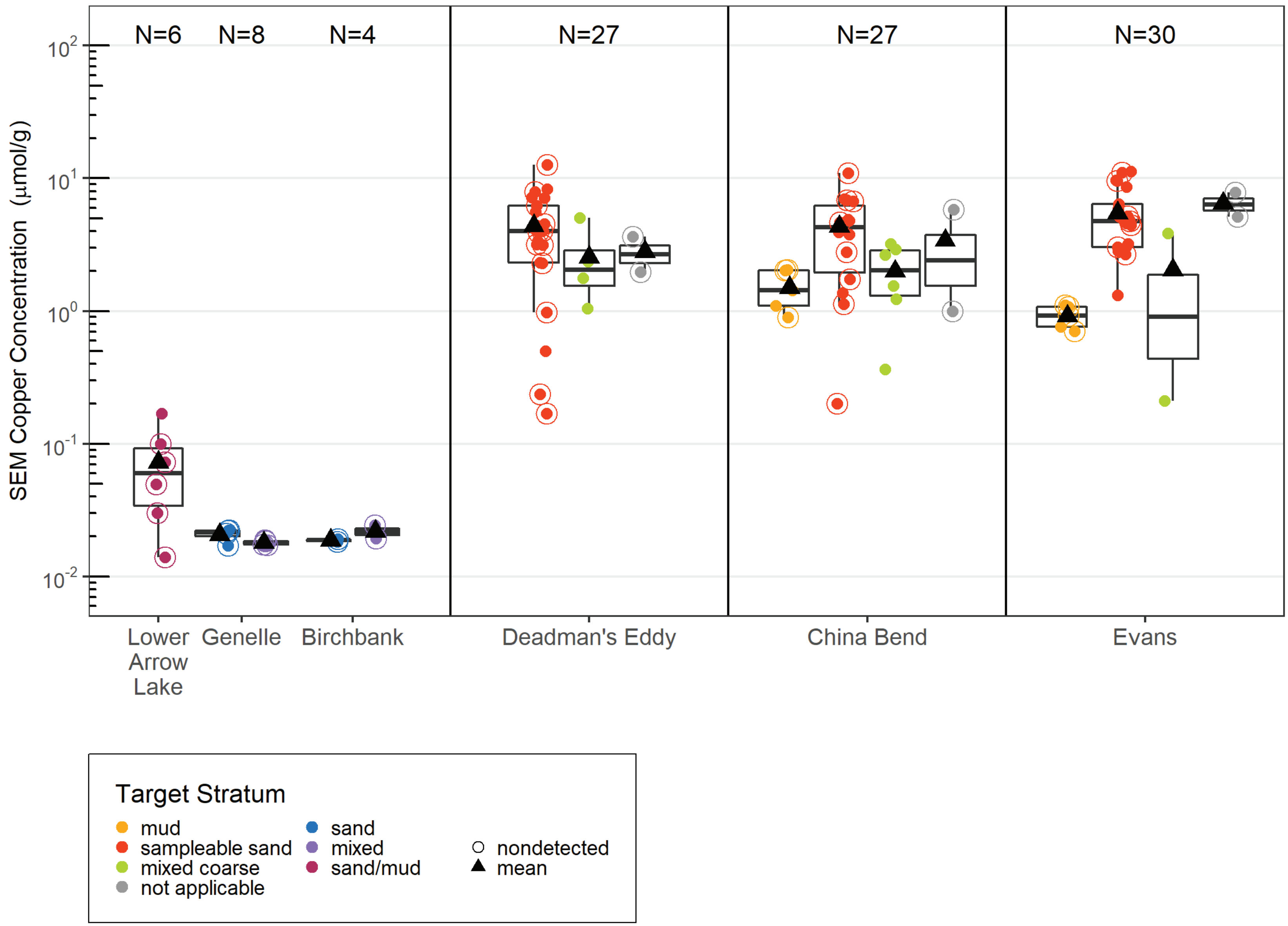
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ab. SEM Cadmium in Field Sediment Samples



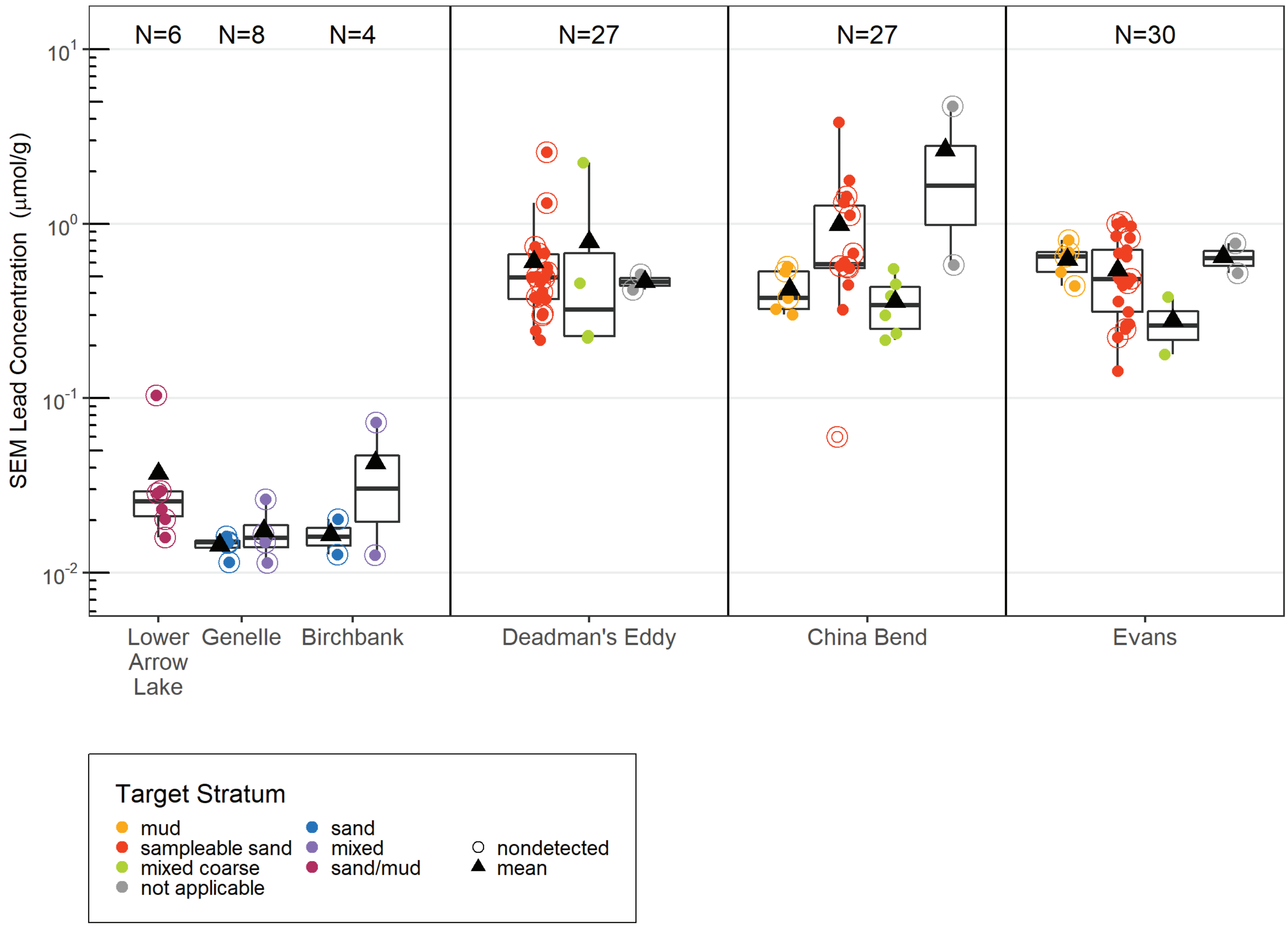
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ac. SEM Chromium in Field Sediment Samples



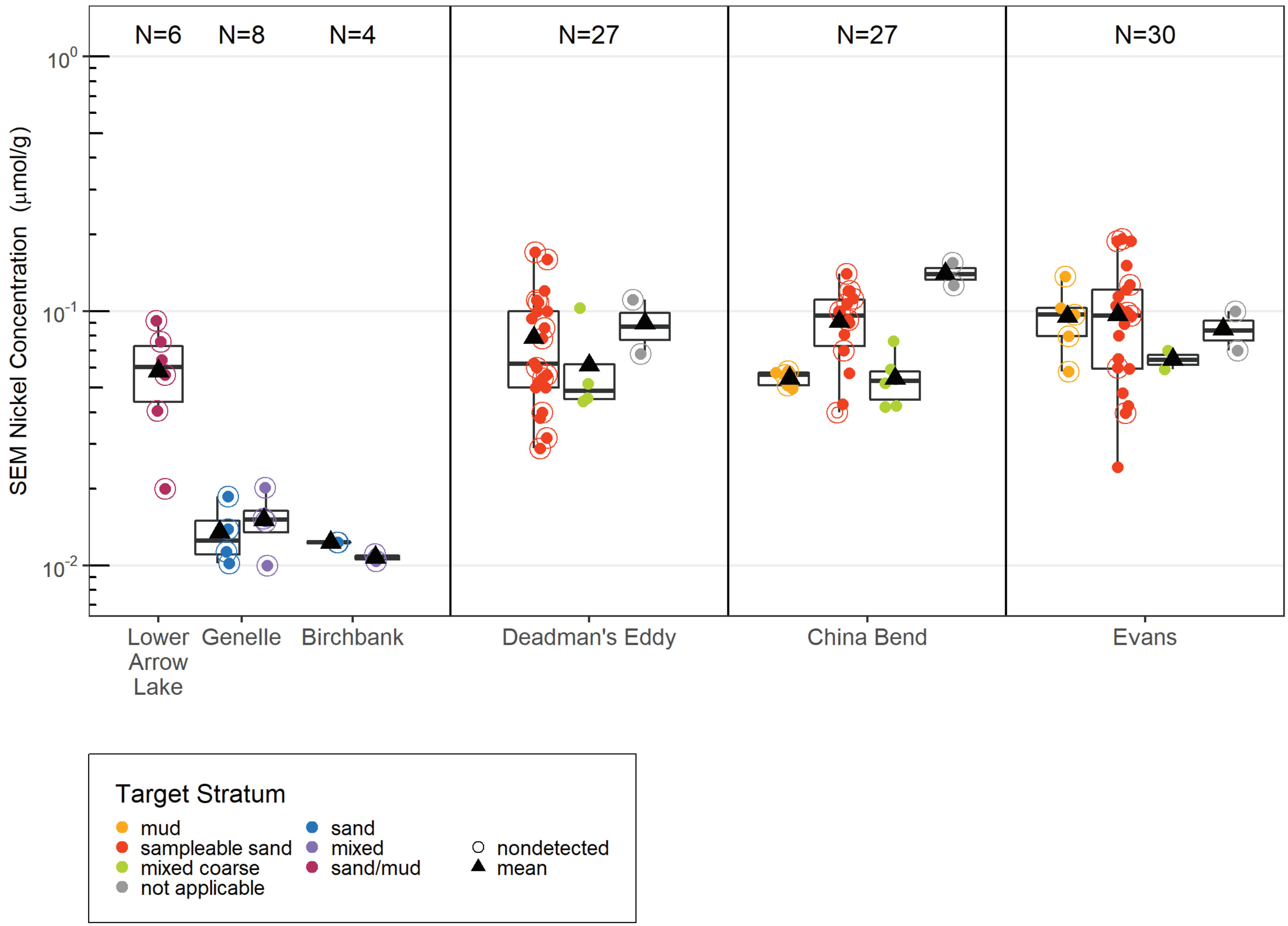
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ad. SEM Copper in Field Sediment Samples



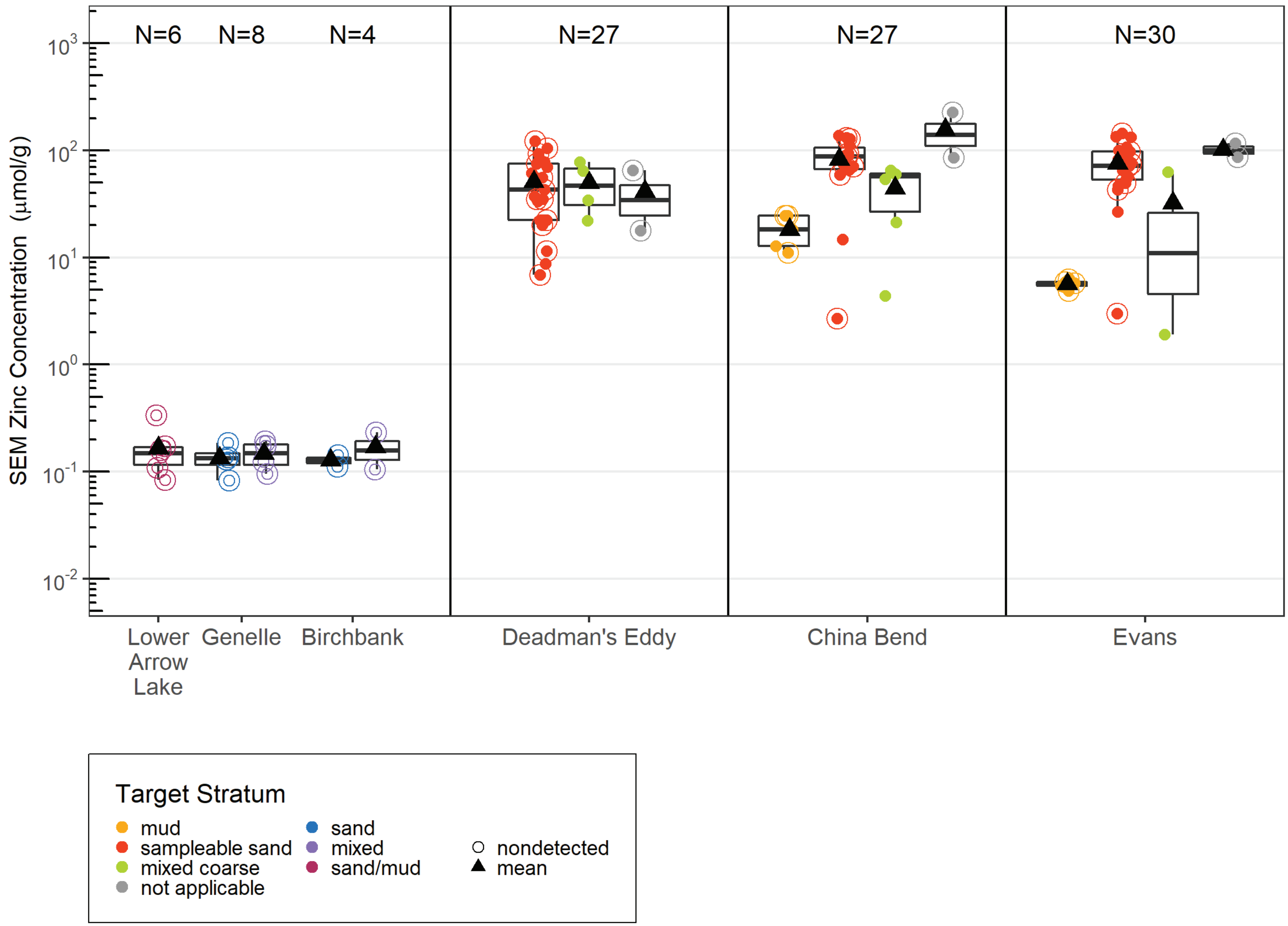
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ae. SEM Lead in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1af. SEM Nickel in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ag. SEM Zinc in Field Sediment Samples

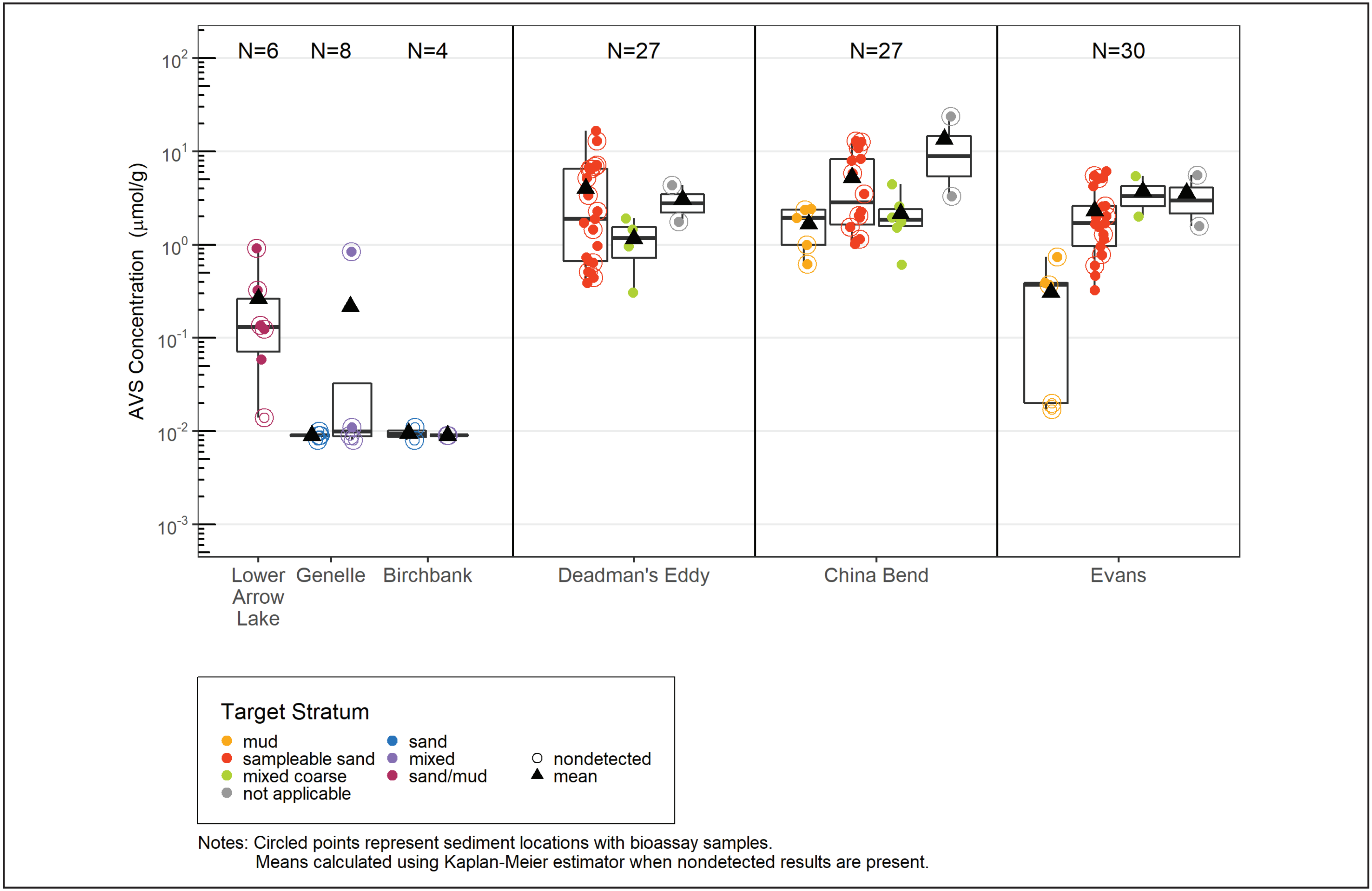
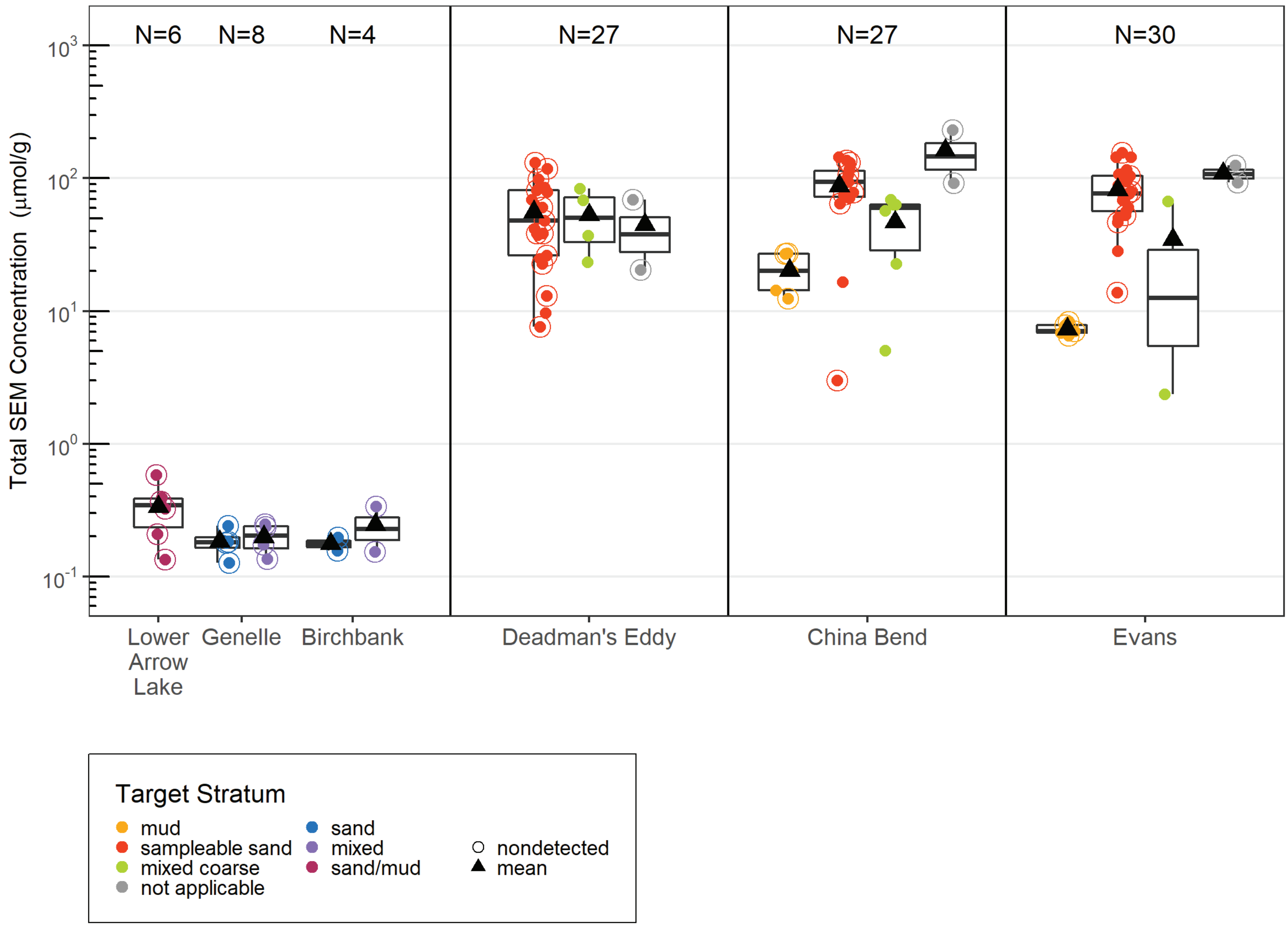
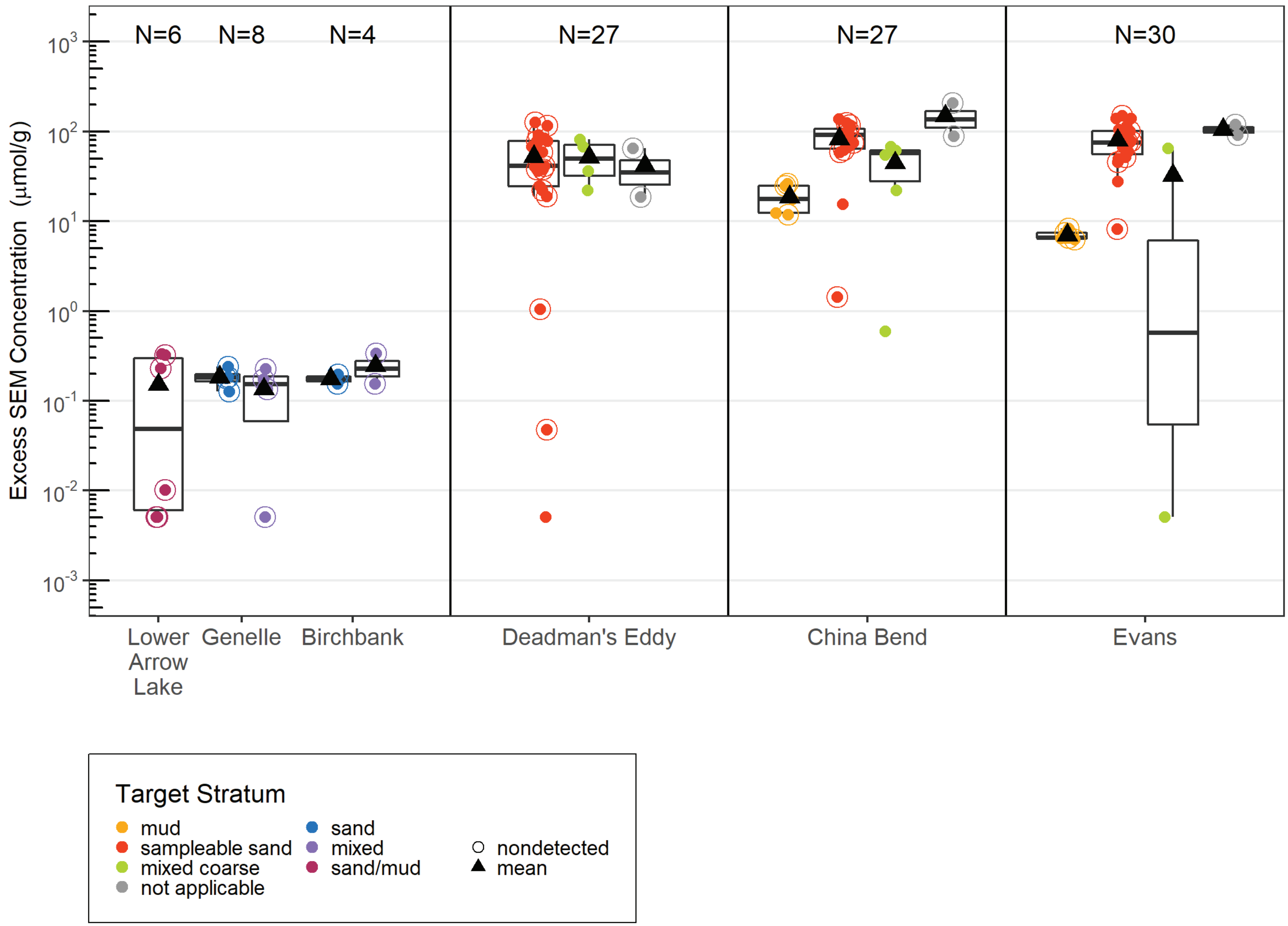


Figure 5-1ah. AVS in Field Sediment Samples



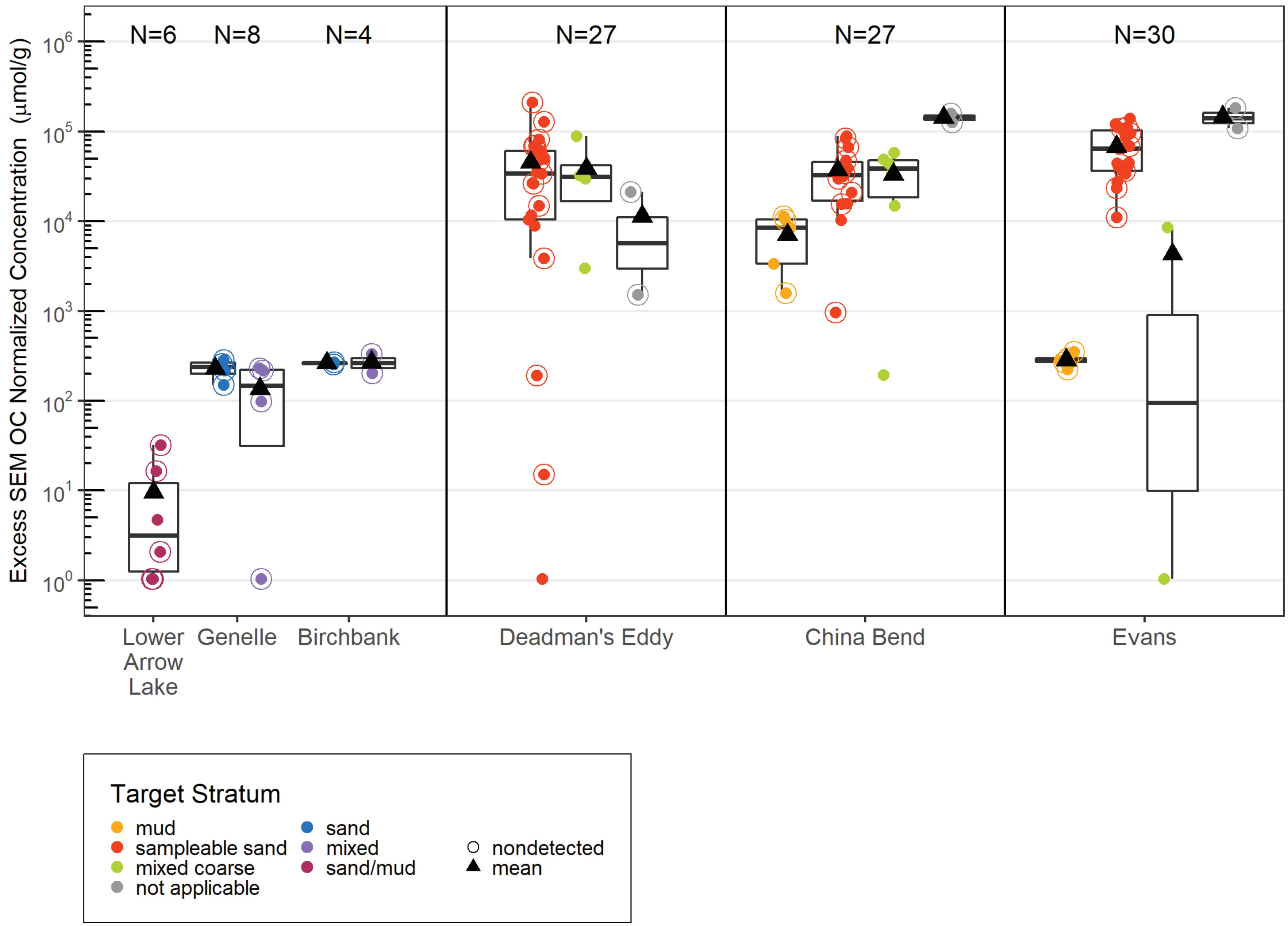
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ai. Total SEM in Field Sediment Samples



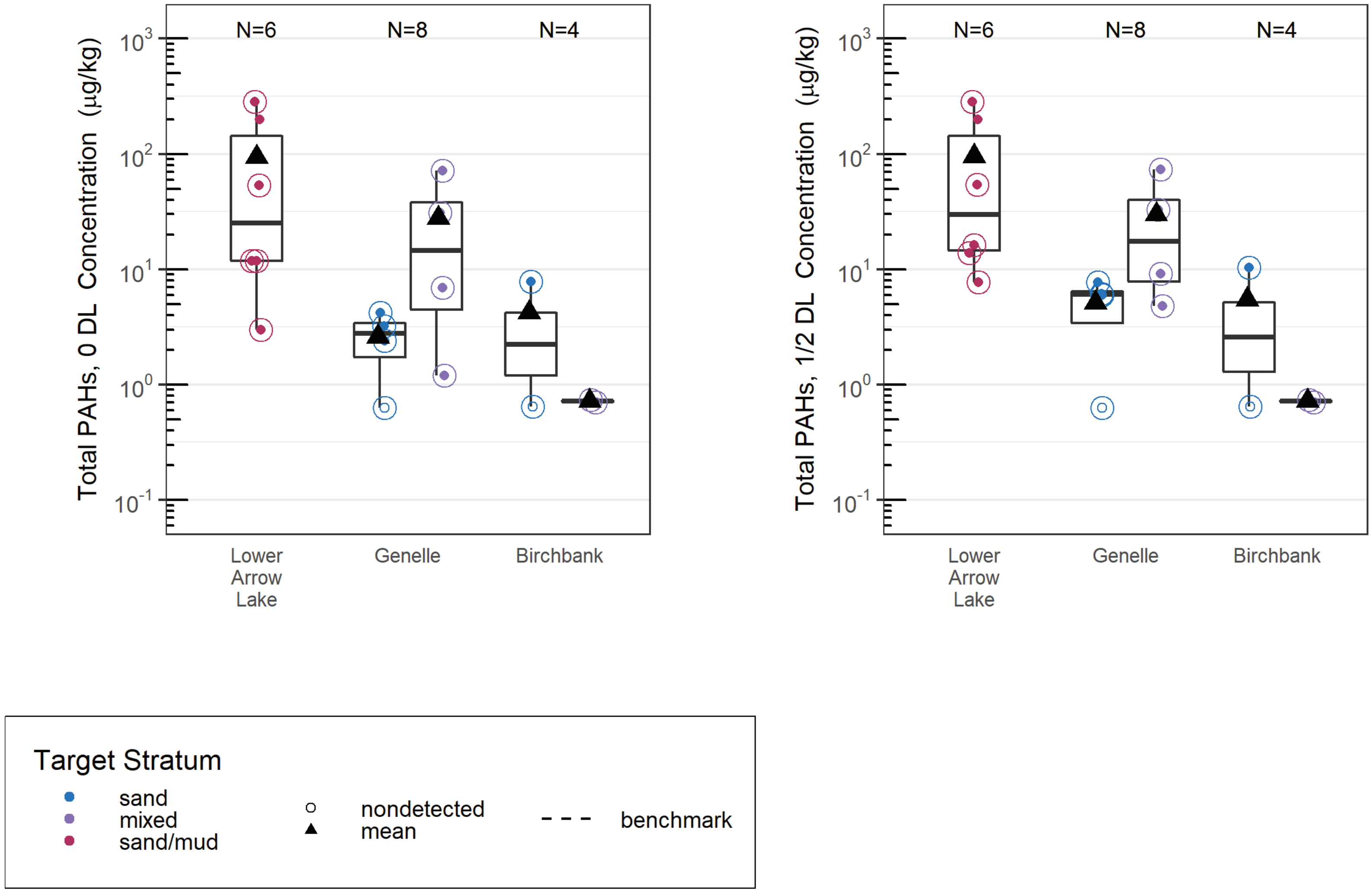
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1aj. Excess SEM in Field Sediment Samples



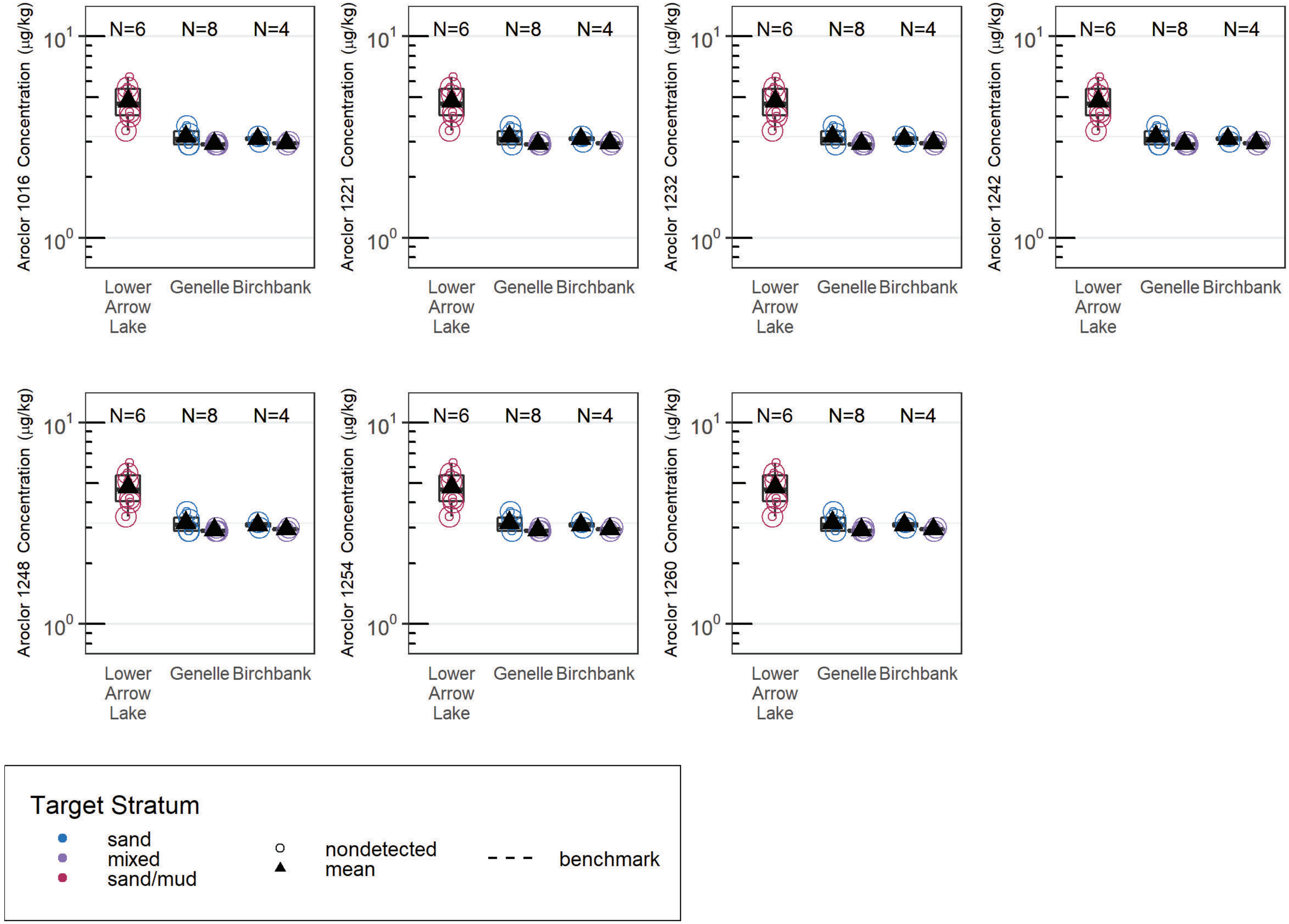
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ak. Excess SEM OC Normalized in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

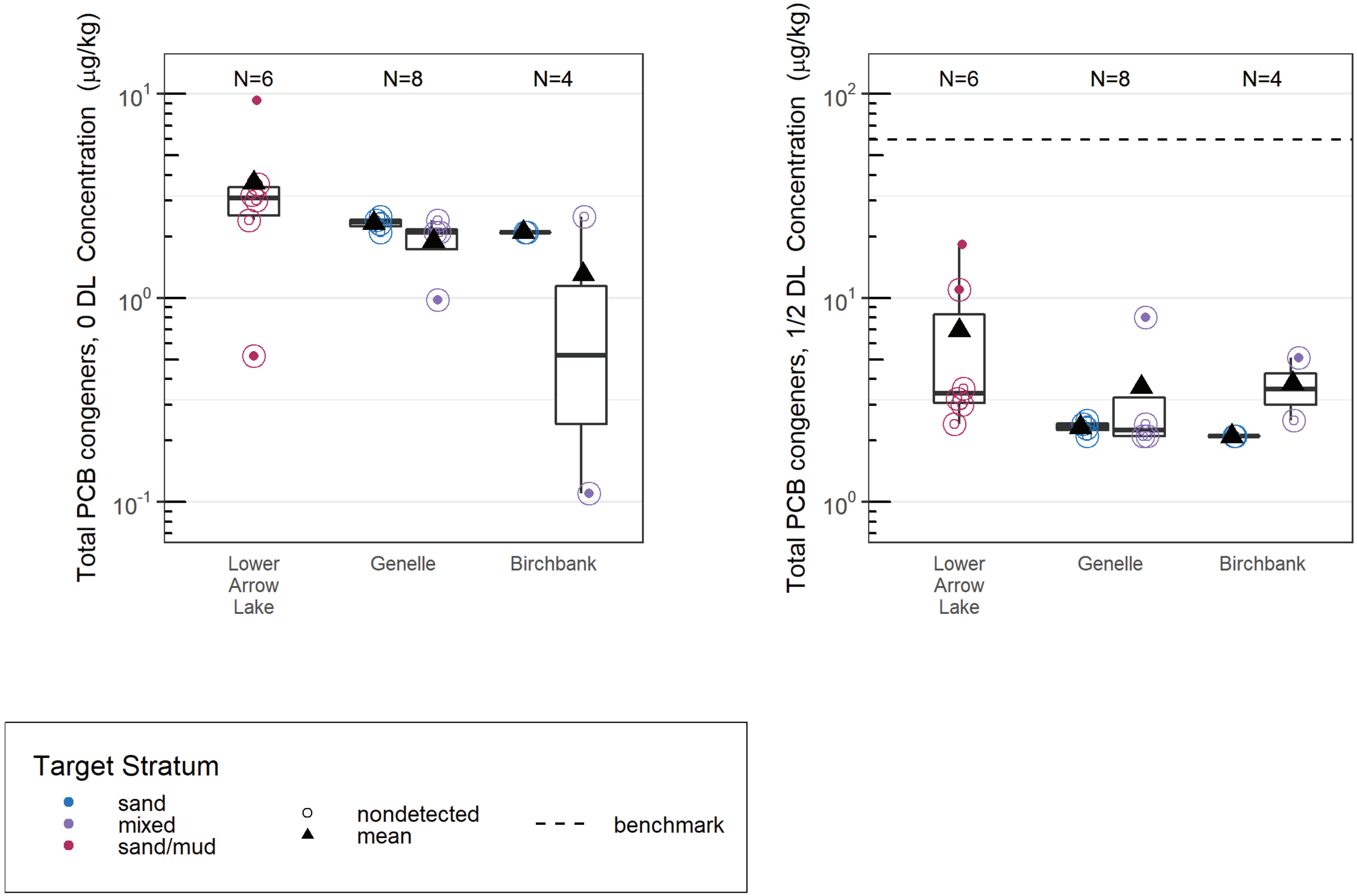
Figure 5-1al. Total PAHs in Field Sediment Samples



Notes: Circled points represent sediment locations with bioassay samples.

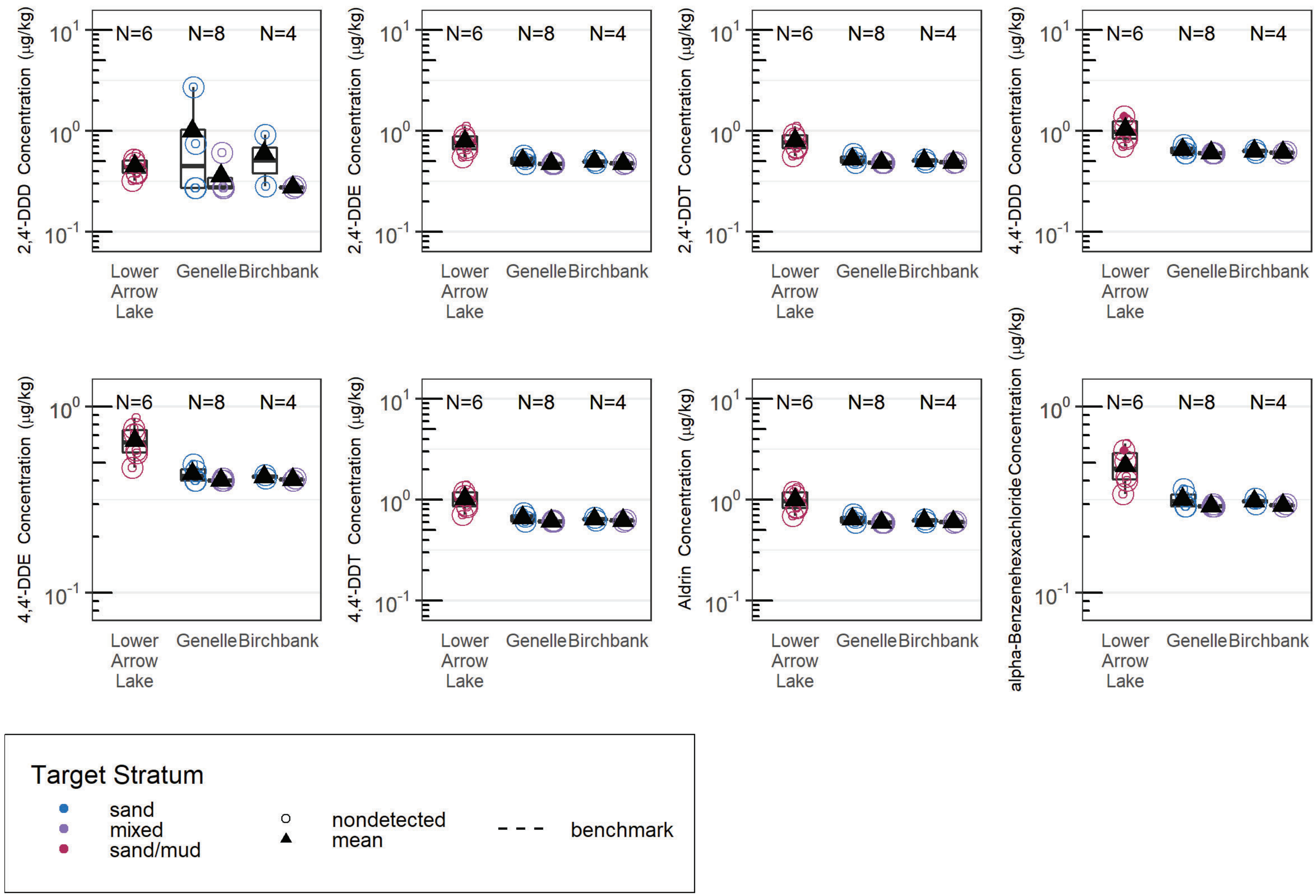
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1am. PCB Aroclors in Field Sediment Samples



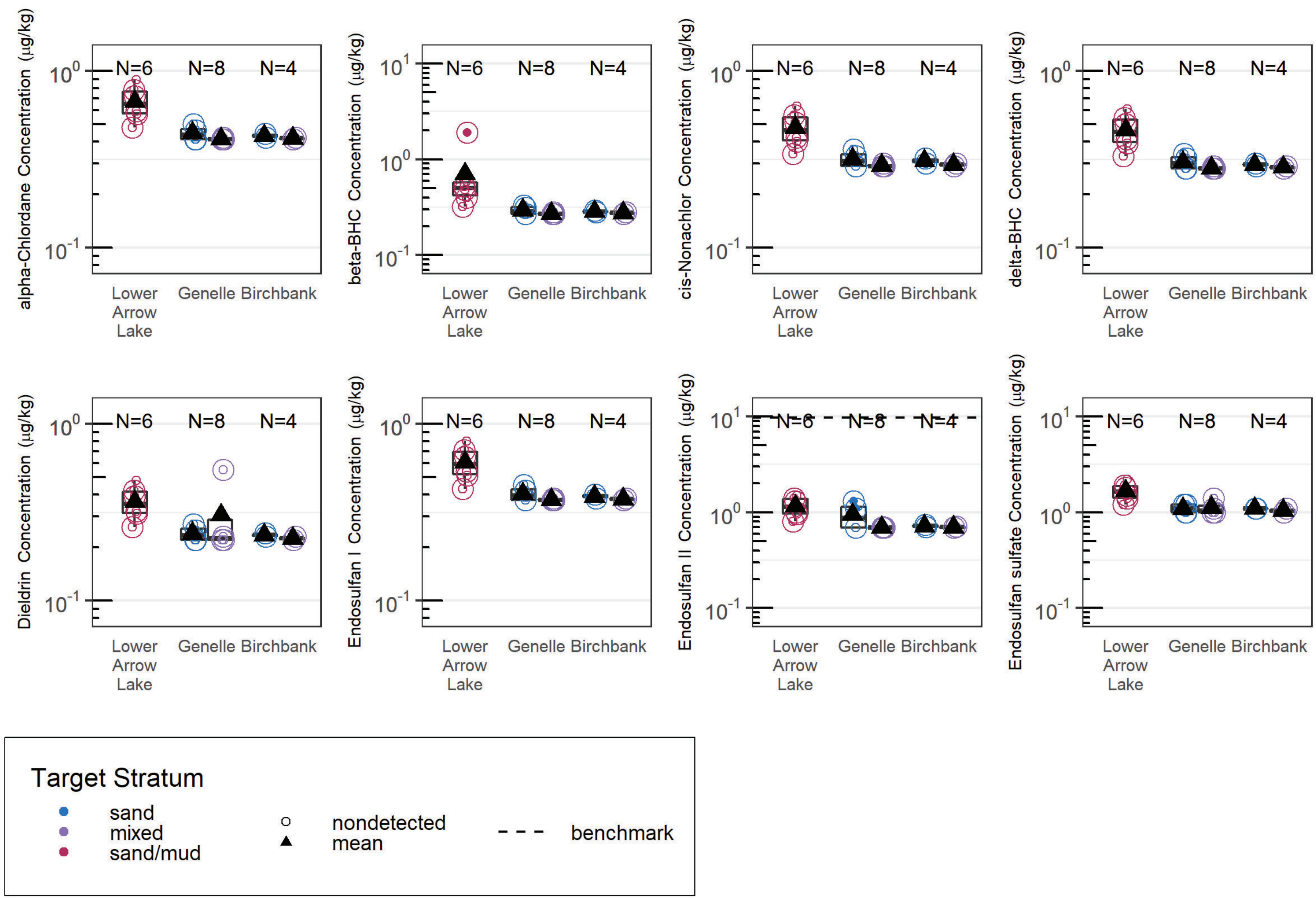
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Benchmark values are from Phase 3 QAPP Table A7-1.

Figure 5-1an. Total PCBs in Field Sediment Samples



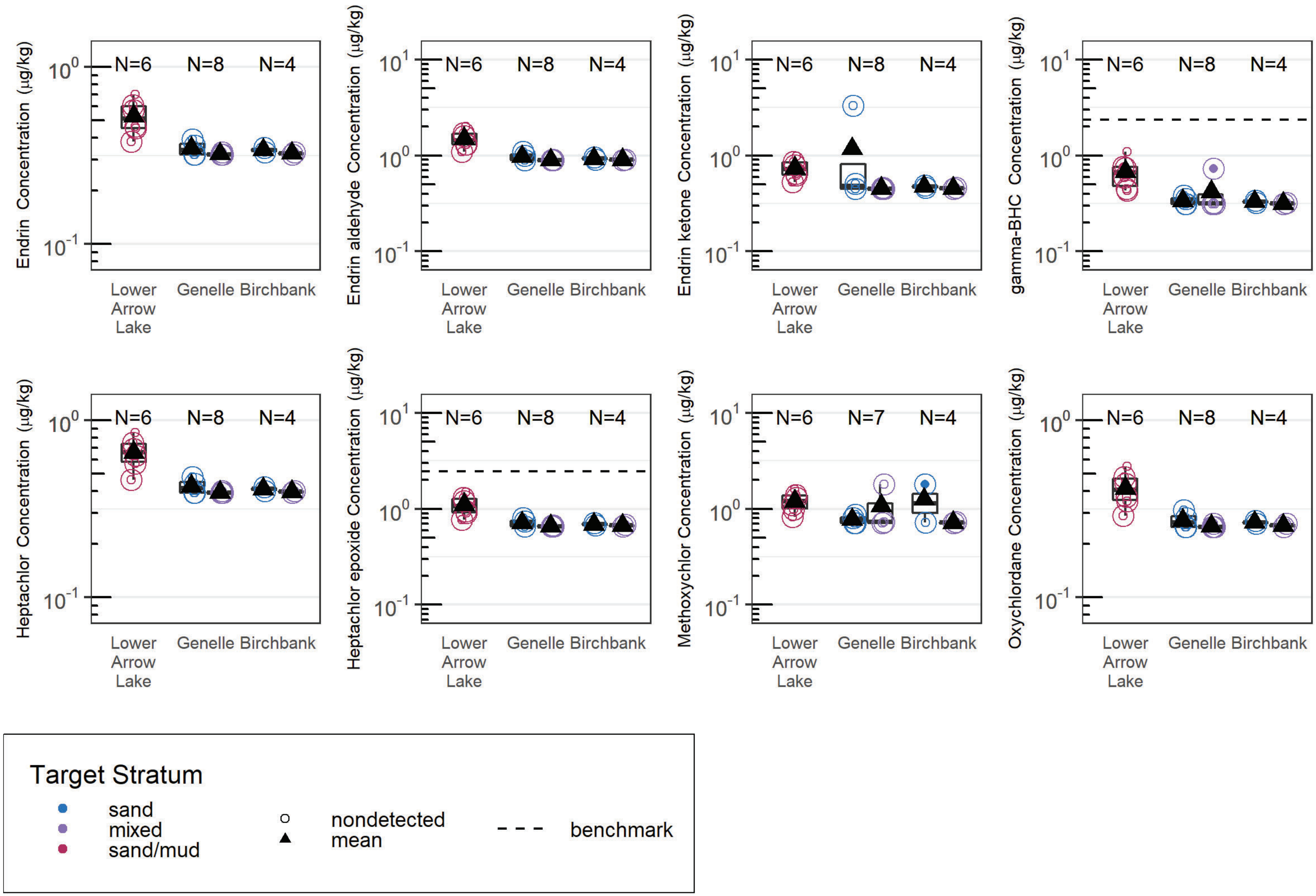
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-1ao-1. Pesticides in Field Sediment Samples



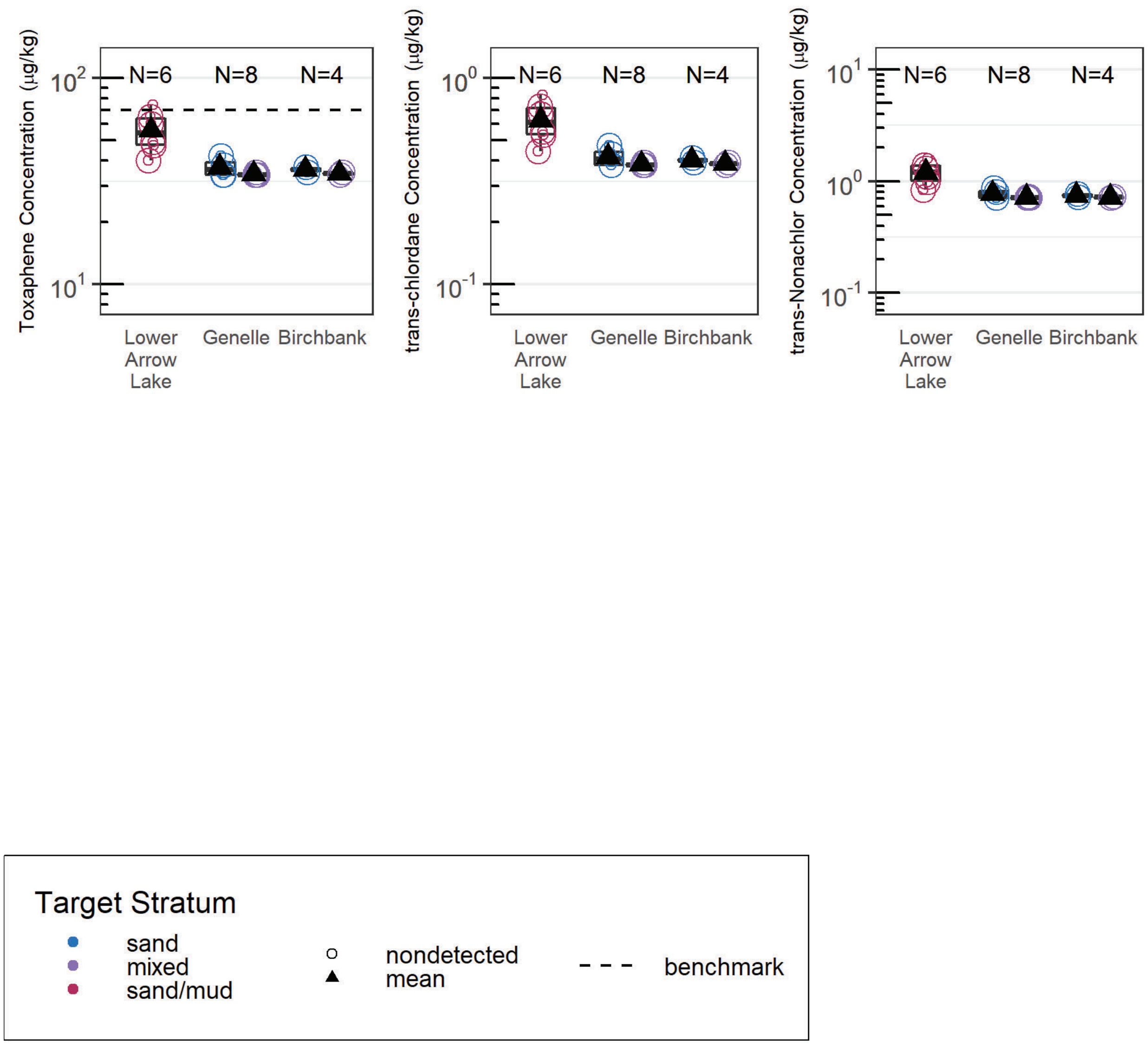
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Benchmark values are from Phase 3 QAPP Table A7-1.

Figure 5-1ao-2. Pesticides in Field Sediment Samples



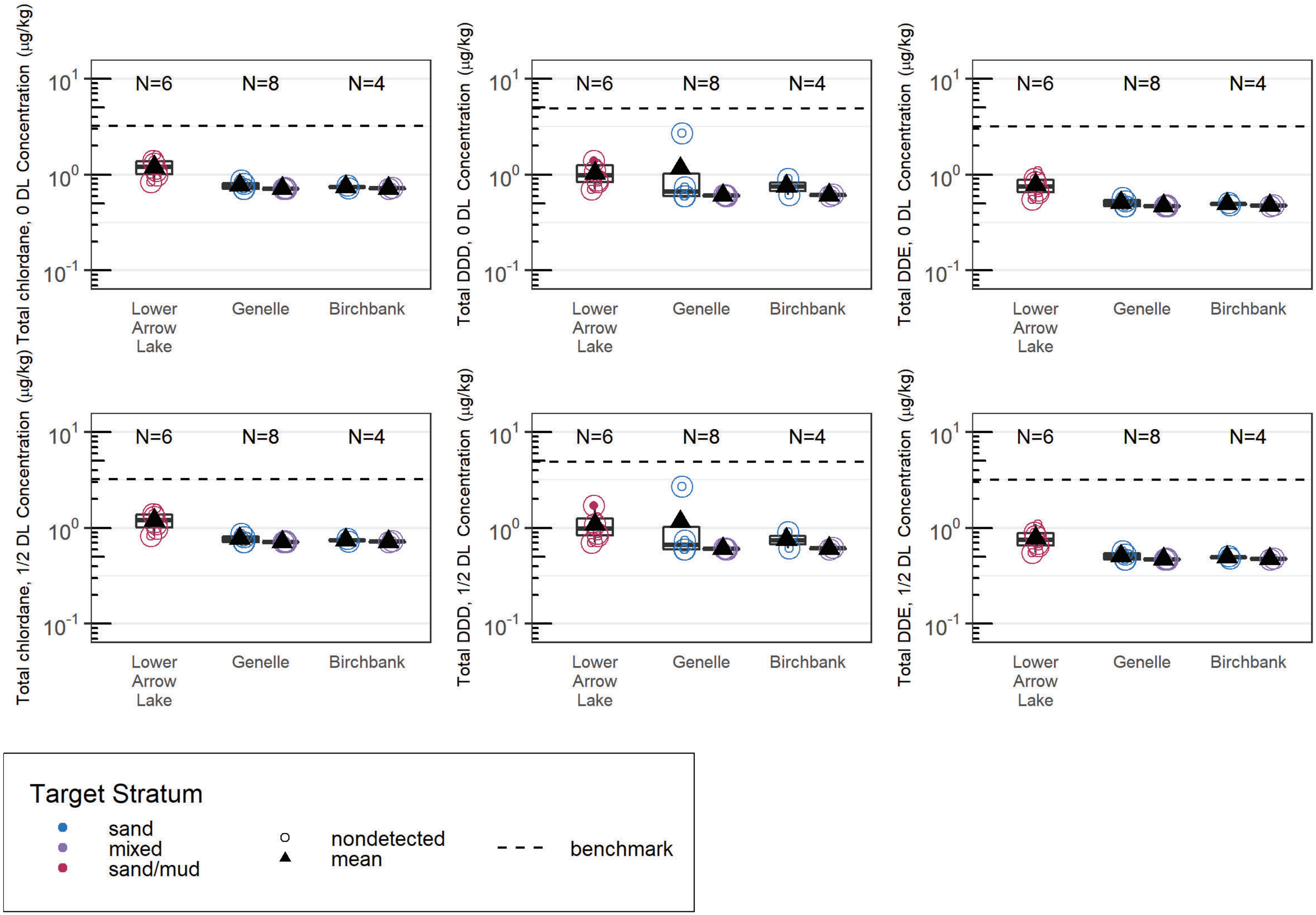
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Benchmark values are from Phase 3 QAPP Table A7-1.

Figure 5-1ao-3. Pesticides in Field Sediment Samples



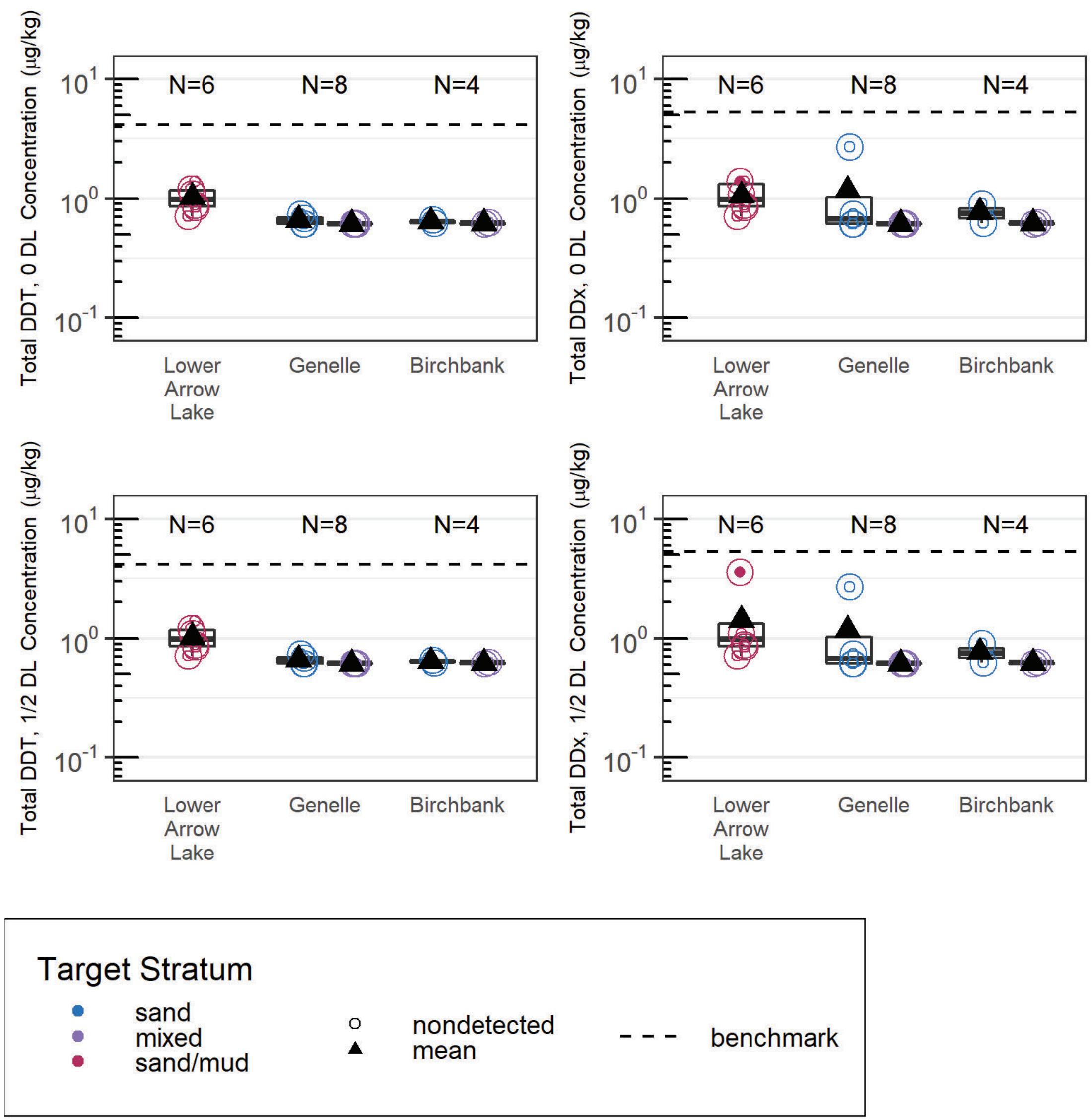
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Benchmark values are from Phase 3 QAPP Table A7-1.

Figure 5-1ao-4. Pesticides in Field Sediment Samples



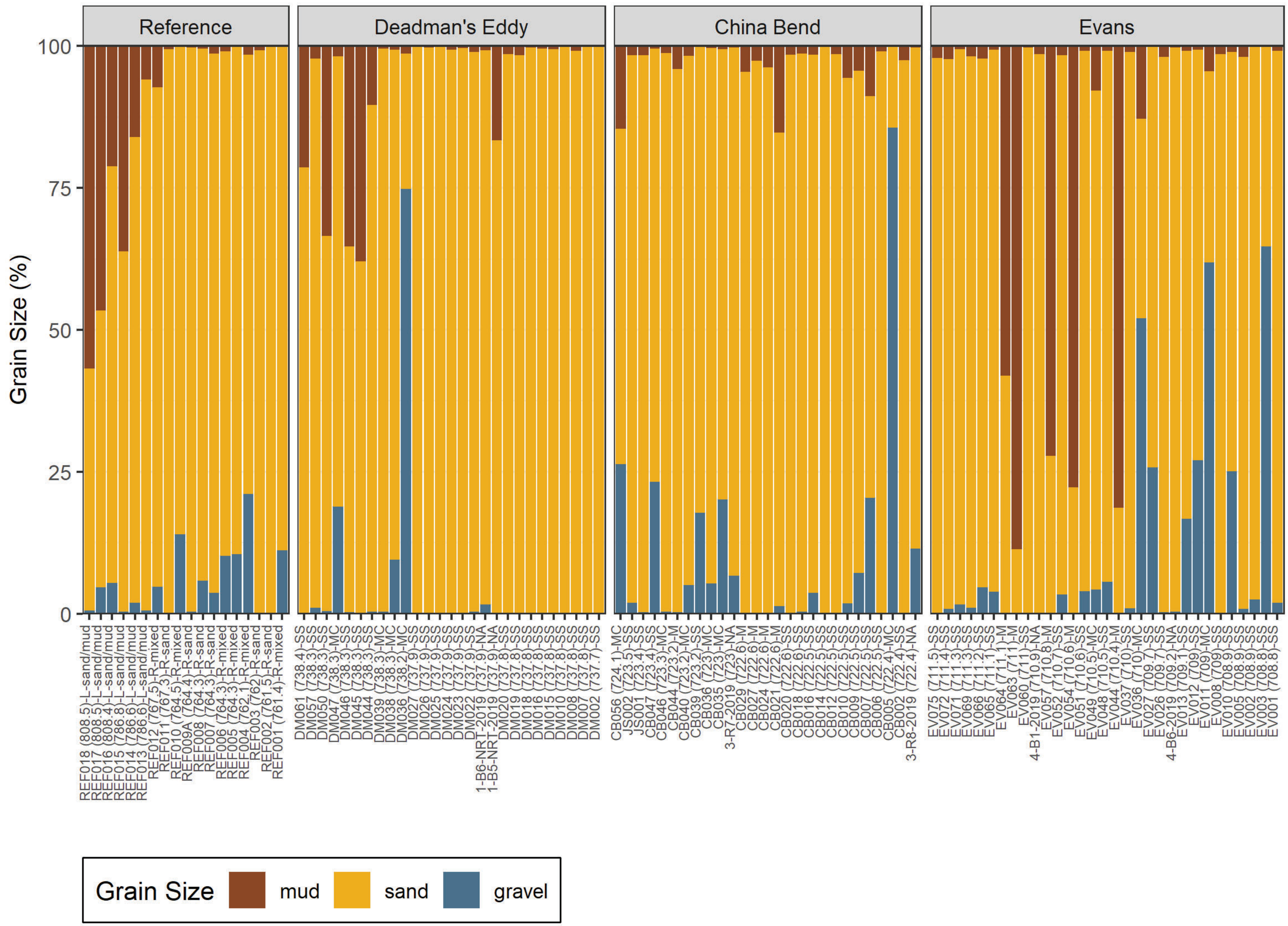
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Benchmark values are from Phase 3 QAPP Table A7-1.

Figure 5-1ao-5. Pesticides in Field Sediment Samples



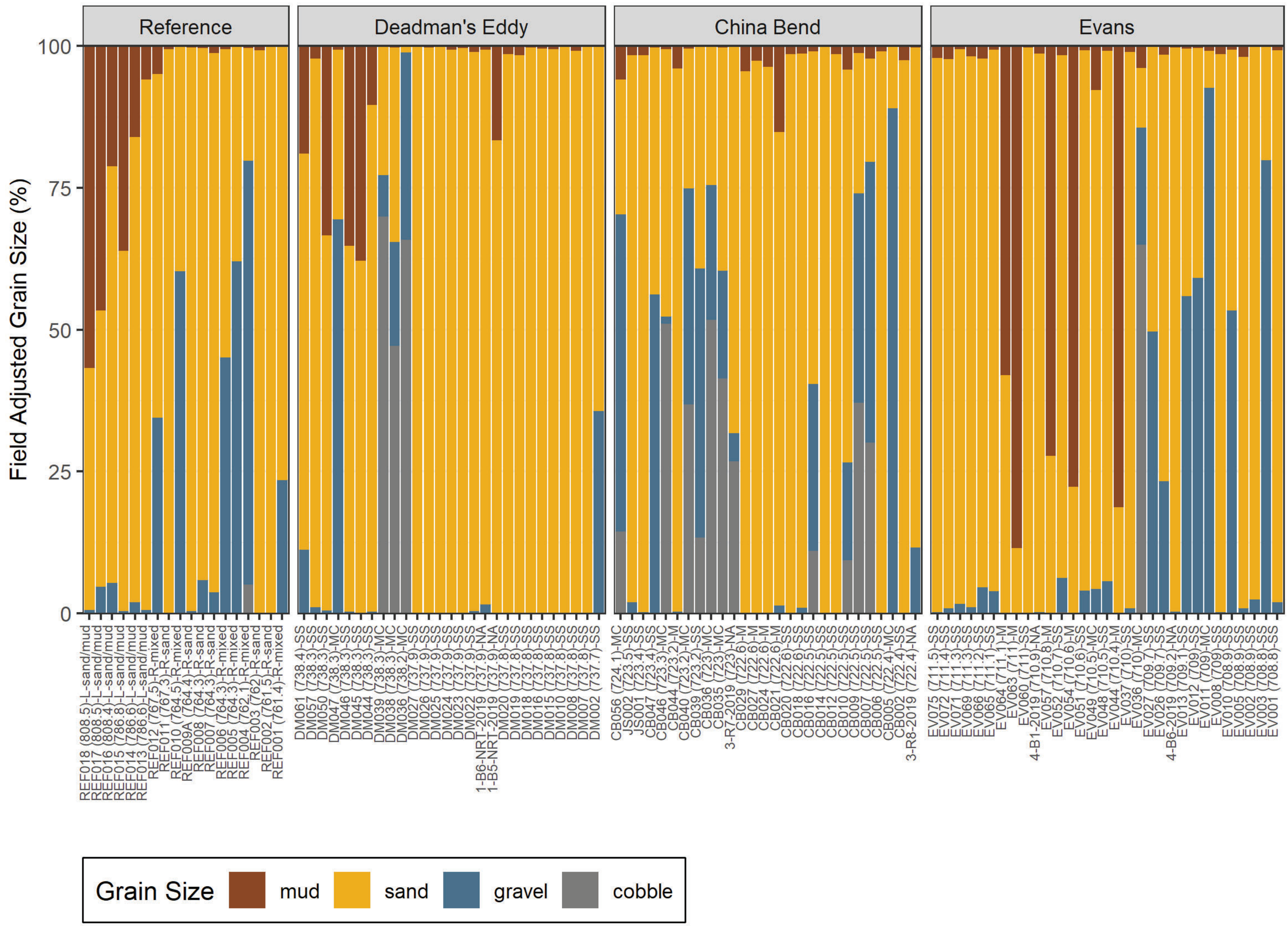
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Benchmark values are from Phase 3 QAPP Table A7-1.

Figure 5-1ao-6. Pesticides in Field Sediment Samples



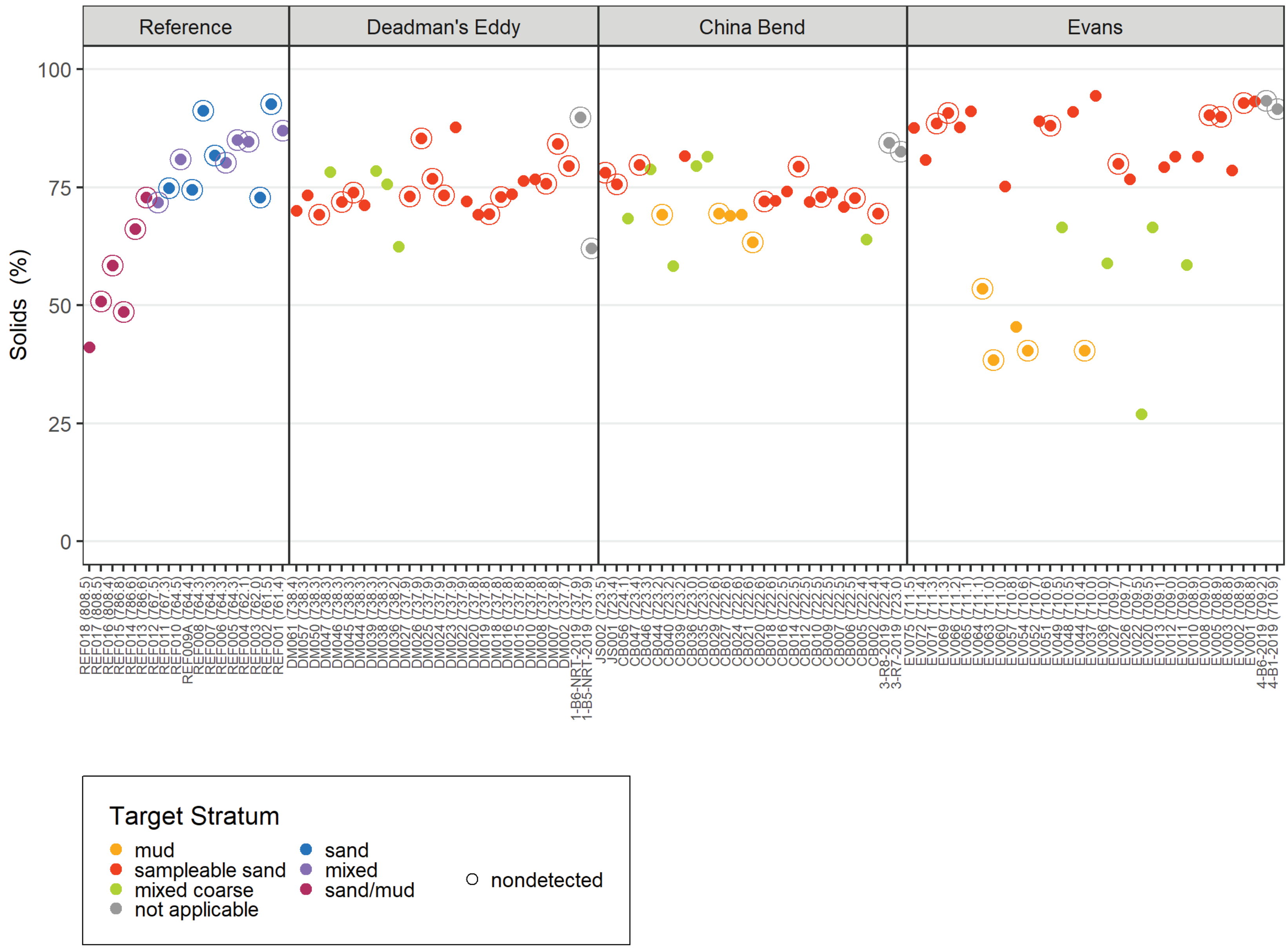
Notes: Target stratum abbreviations: M - mud, SS - sampleable sand, MC - mixed coarse, NA - not applicable.
Hydraulic condition abbreviations for reference locations: R - riverine, L - lacustrine.

Figure 5-1ap. Grain Size Distribution in Field Sediment Samples



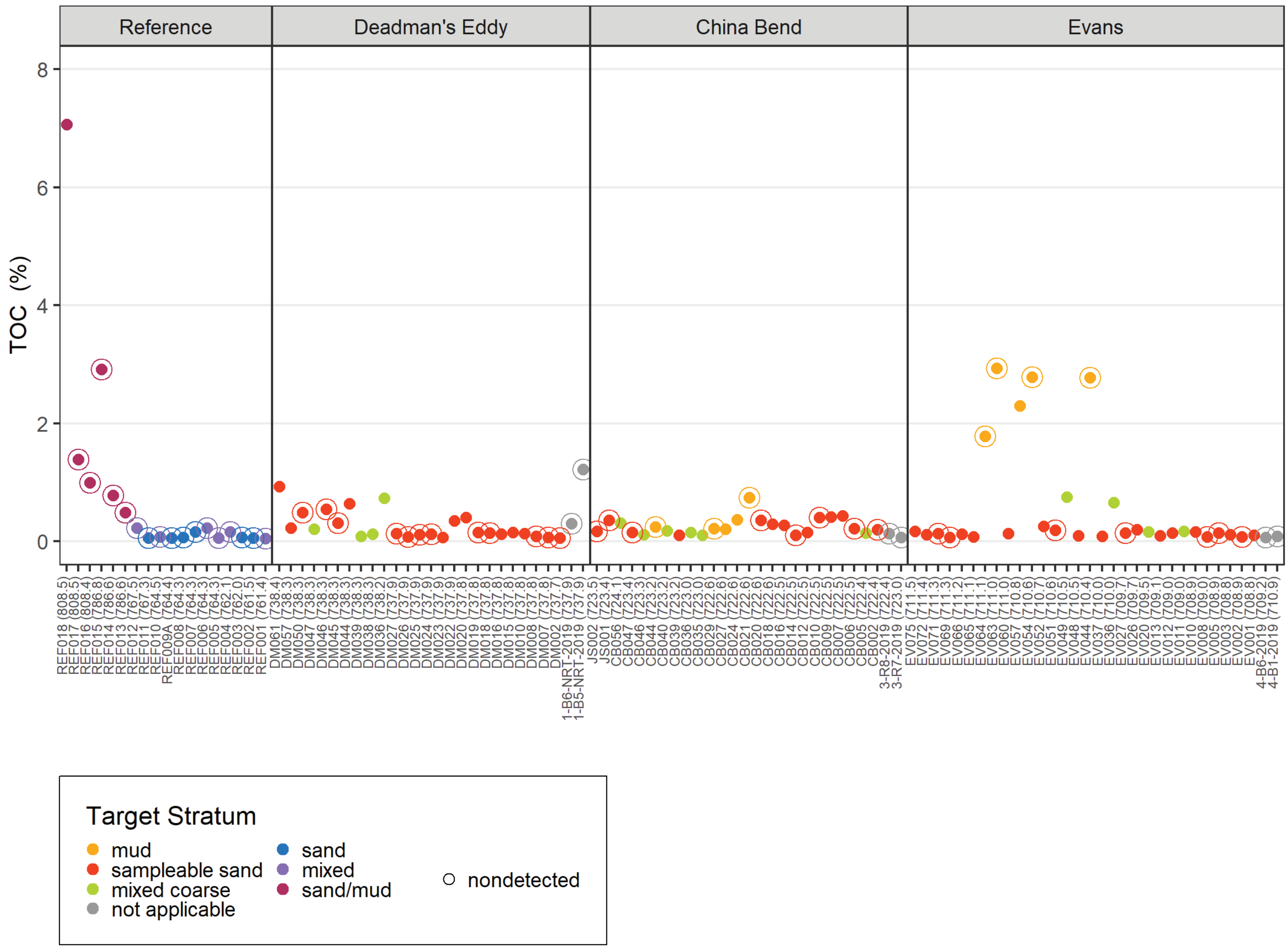
Notes: Target stratum abbreviations: M - mud, SS - sampleable sand, MC - mixed coarse, NA - not applicable.
Hydraulic condition abbreviations for reference locations: R - riverine, L - lacustrine.

Figure 5-1aq. Field Adjusted Grain Size Distribution in Field Sediment Samples



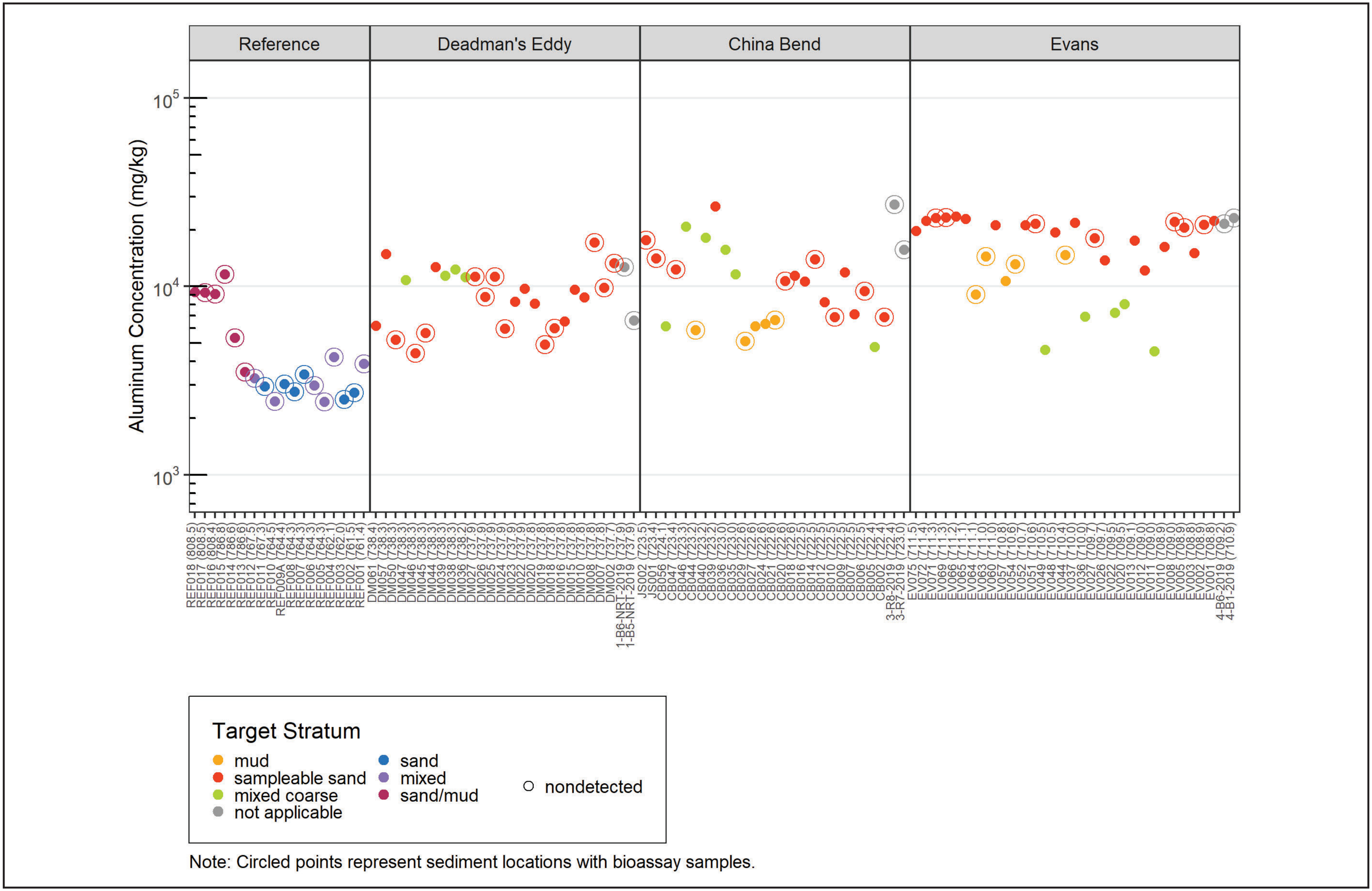
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1ar. Solids in Field Sediment Samples by River Mile



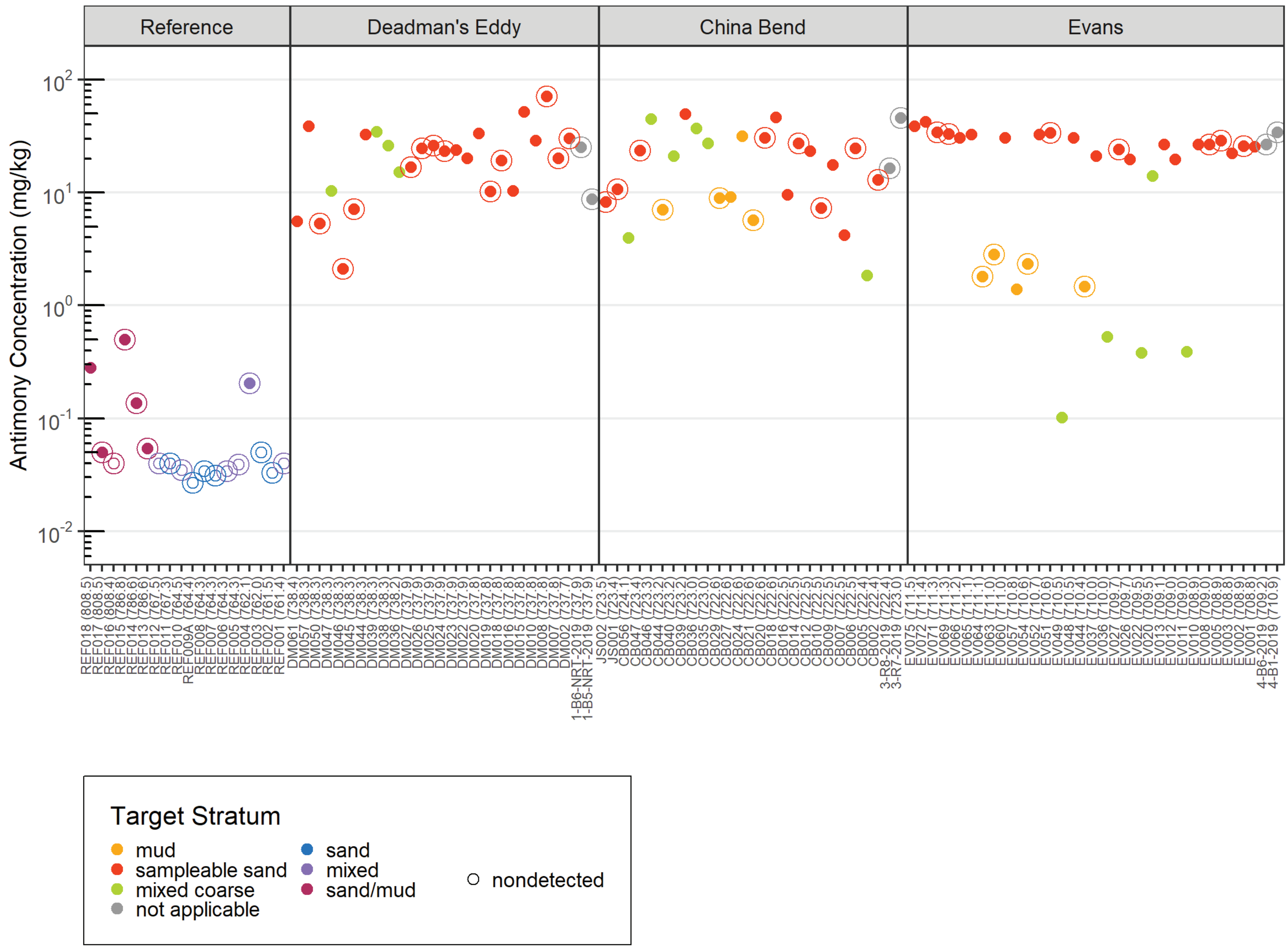
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1as. TOC in Field Sediment Samples by River Mile



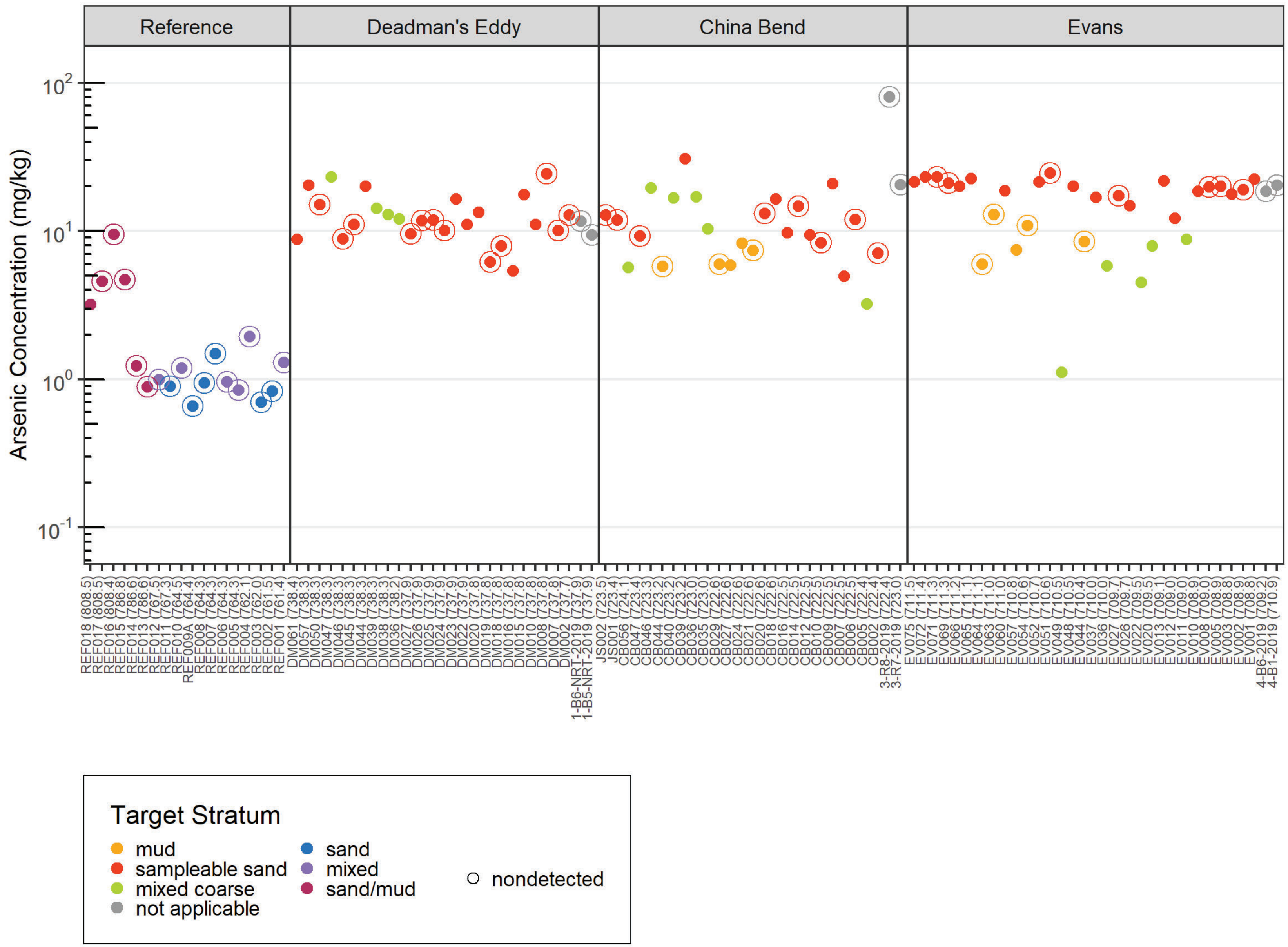
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1at. Aluminum in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1au. Antimony in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1av. Arsenic in Field Sediment Samples by River Mile

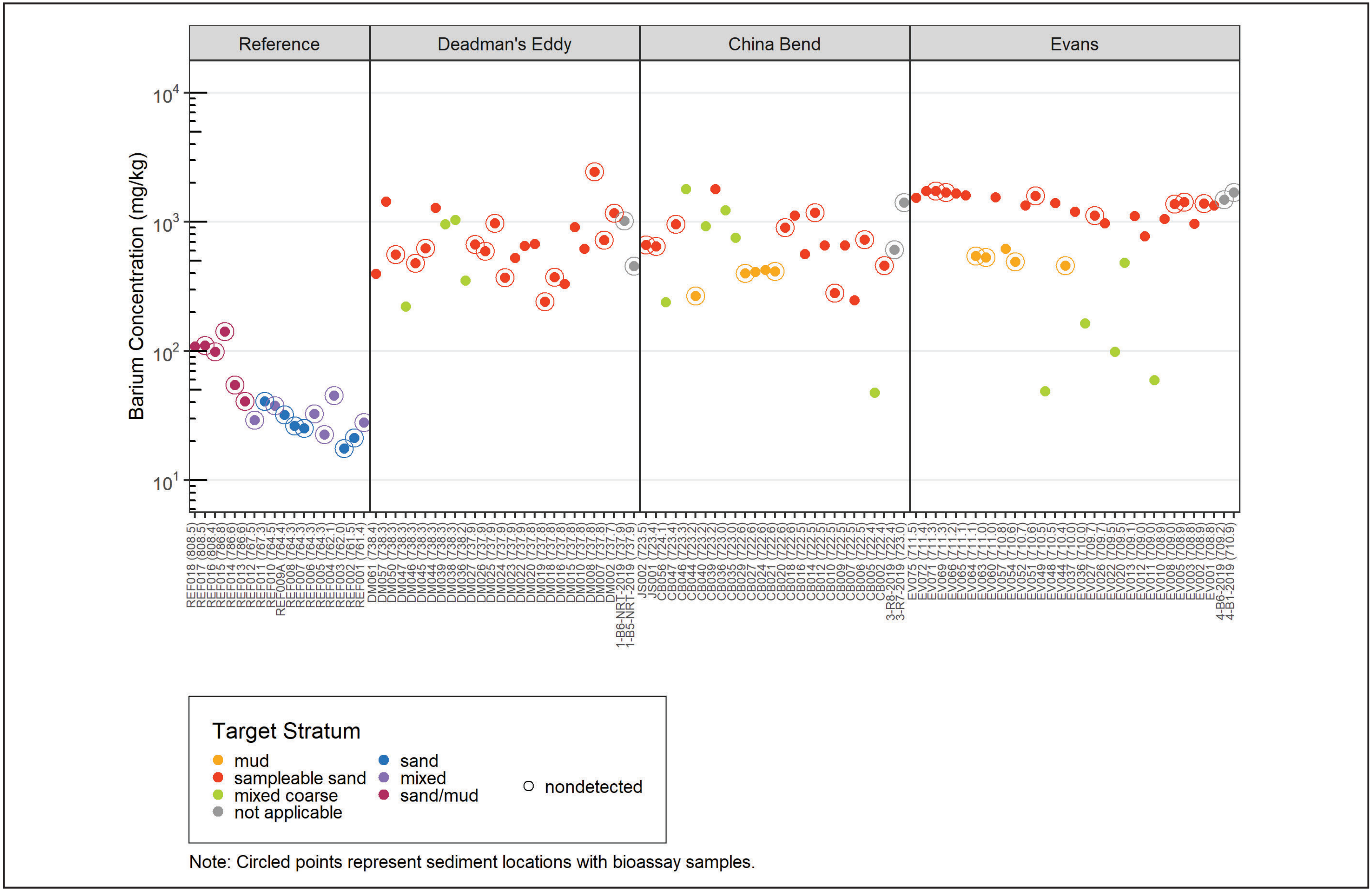
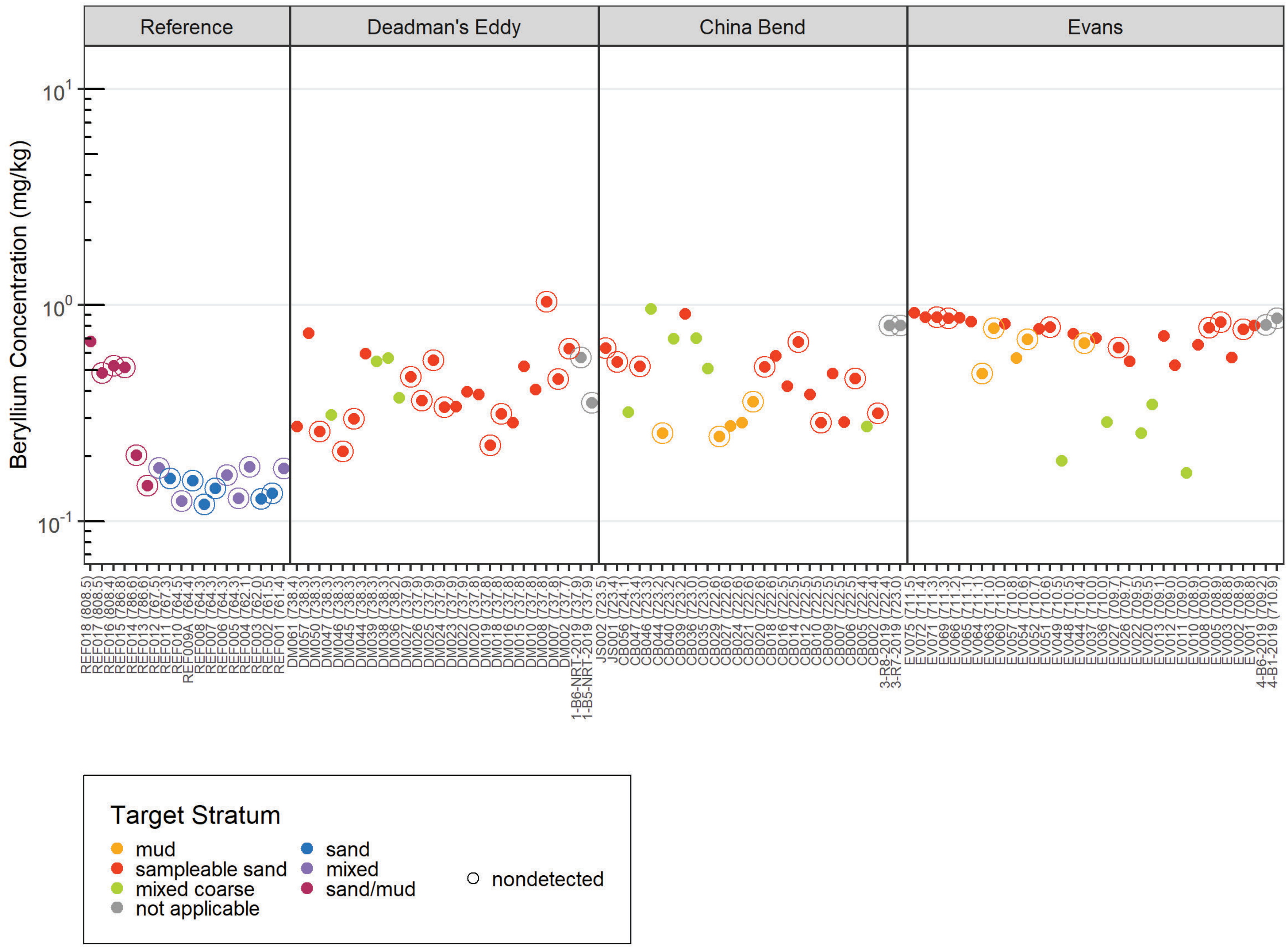
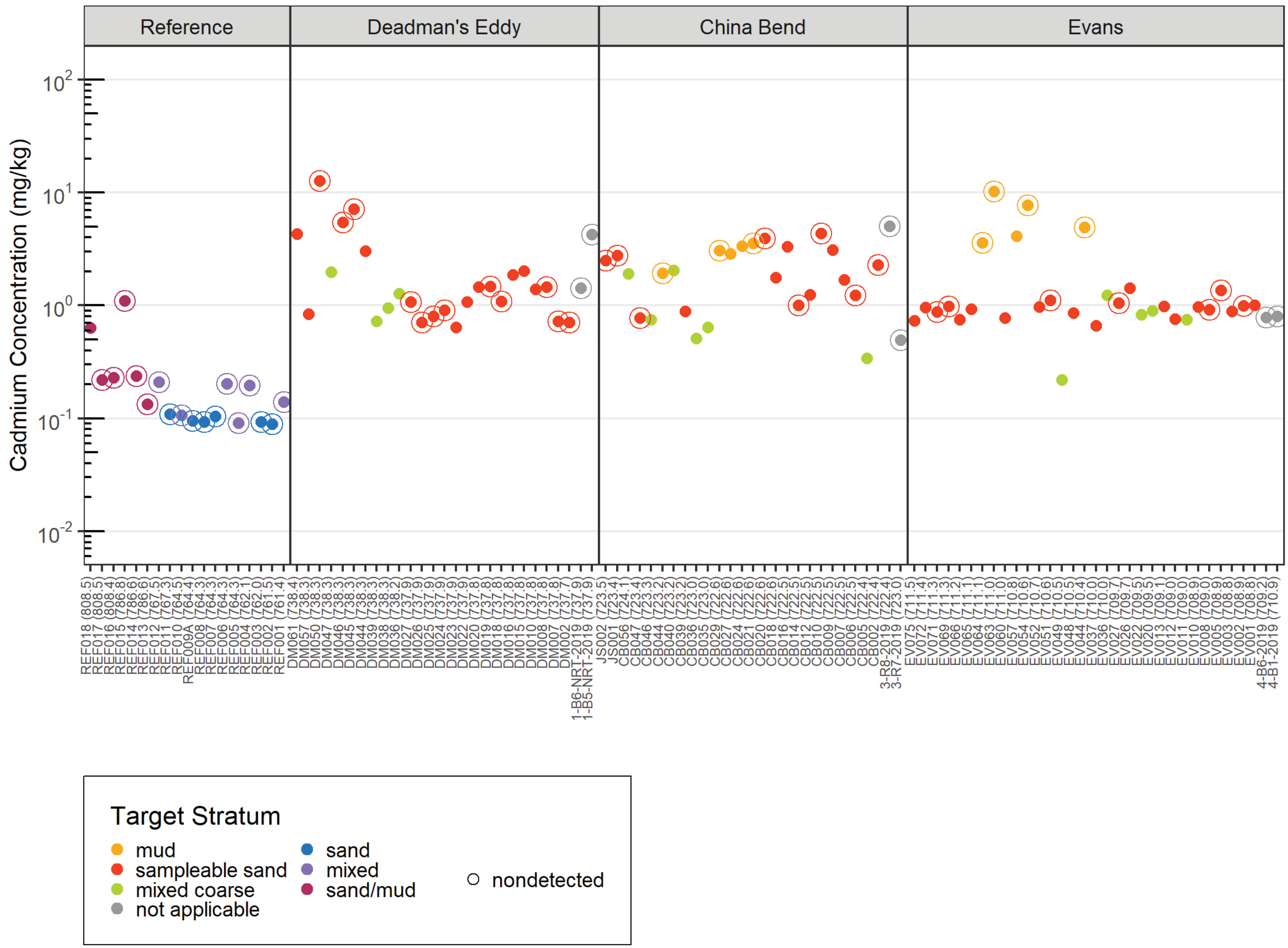


Figure 5-1aw. Barium in Field Sediment Samples by River Mile



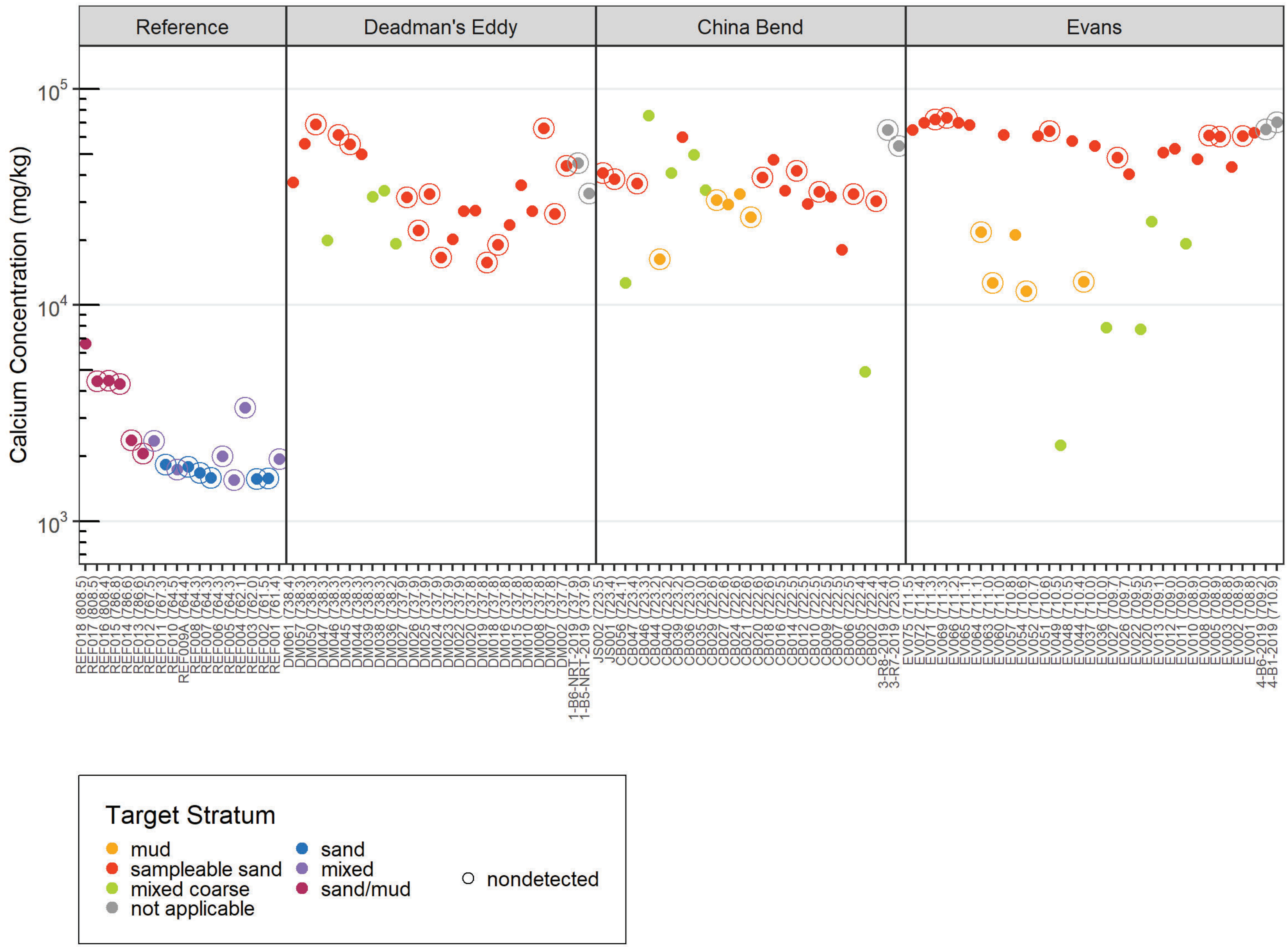
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1ax. Beryllium in Field Sediment Samples by River Mile



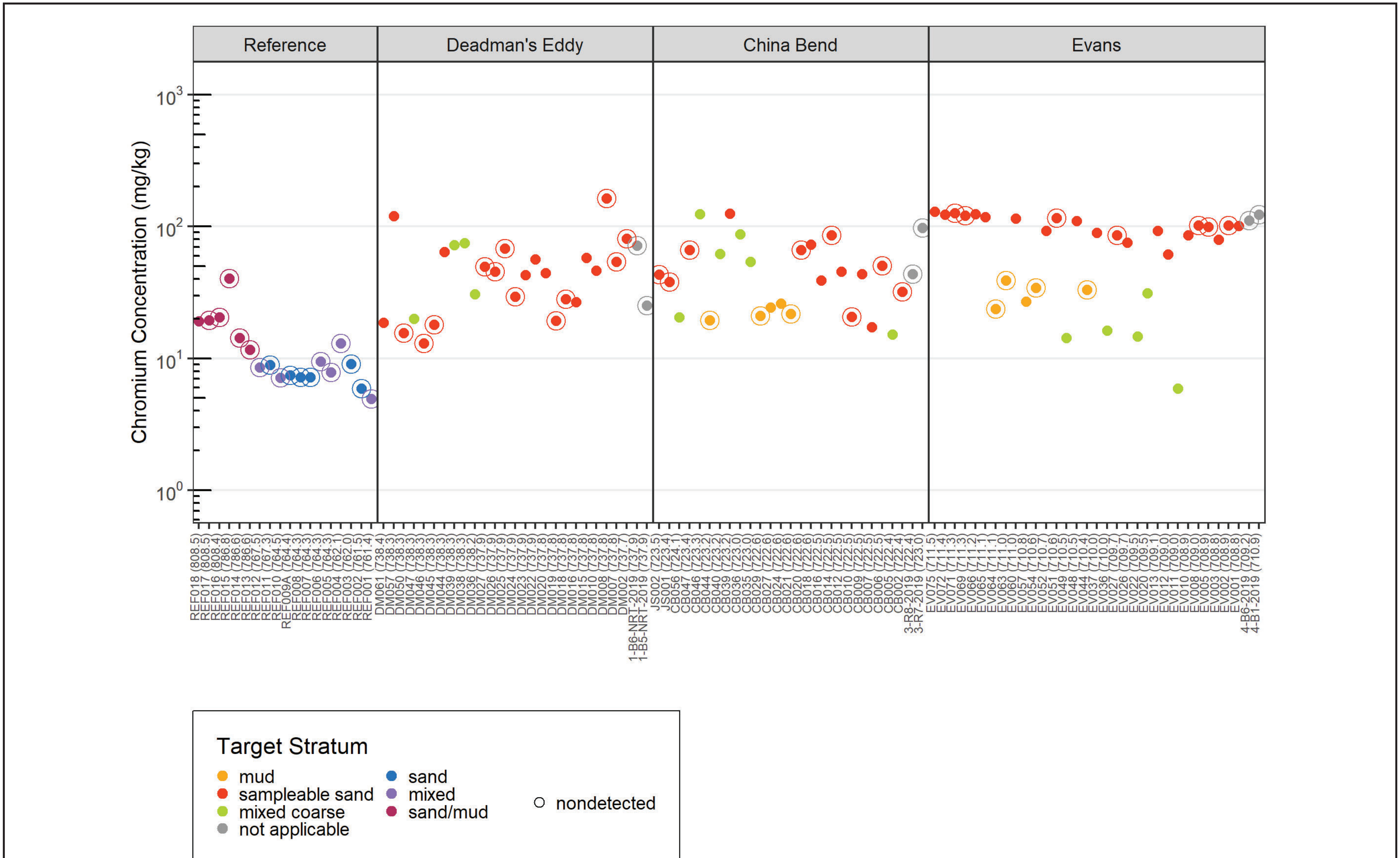
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1ay. Cadmium in Field Sediment Samples by River Mile



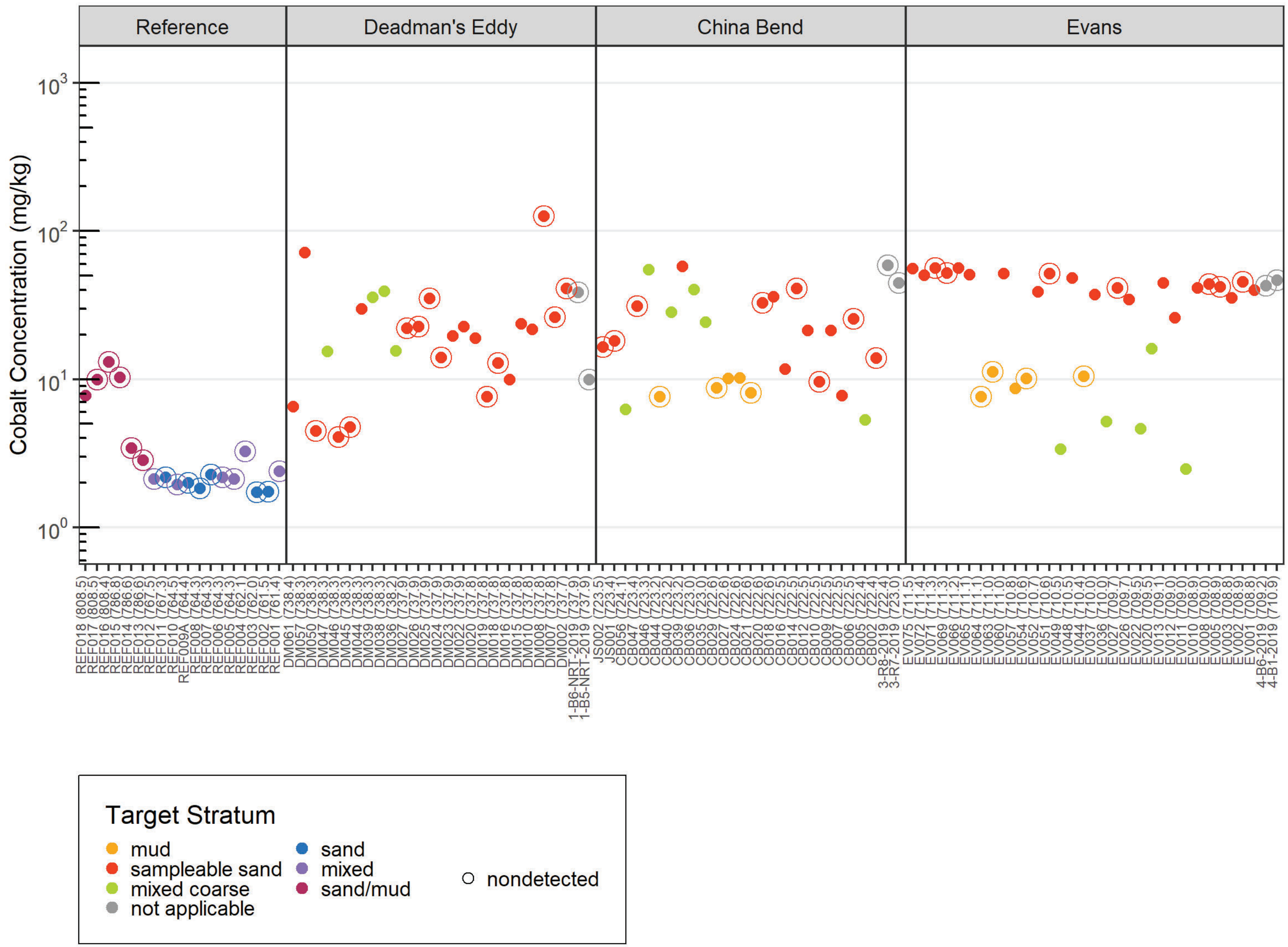
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1az. Calcium in Field Sediment Samples by River Mile



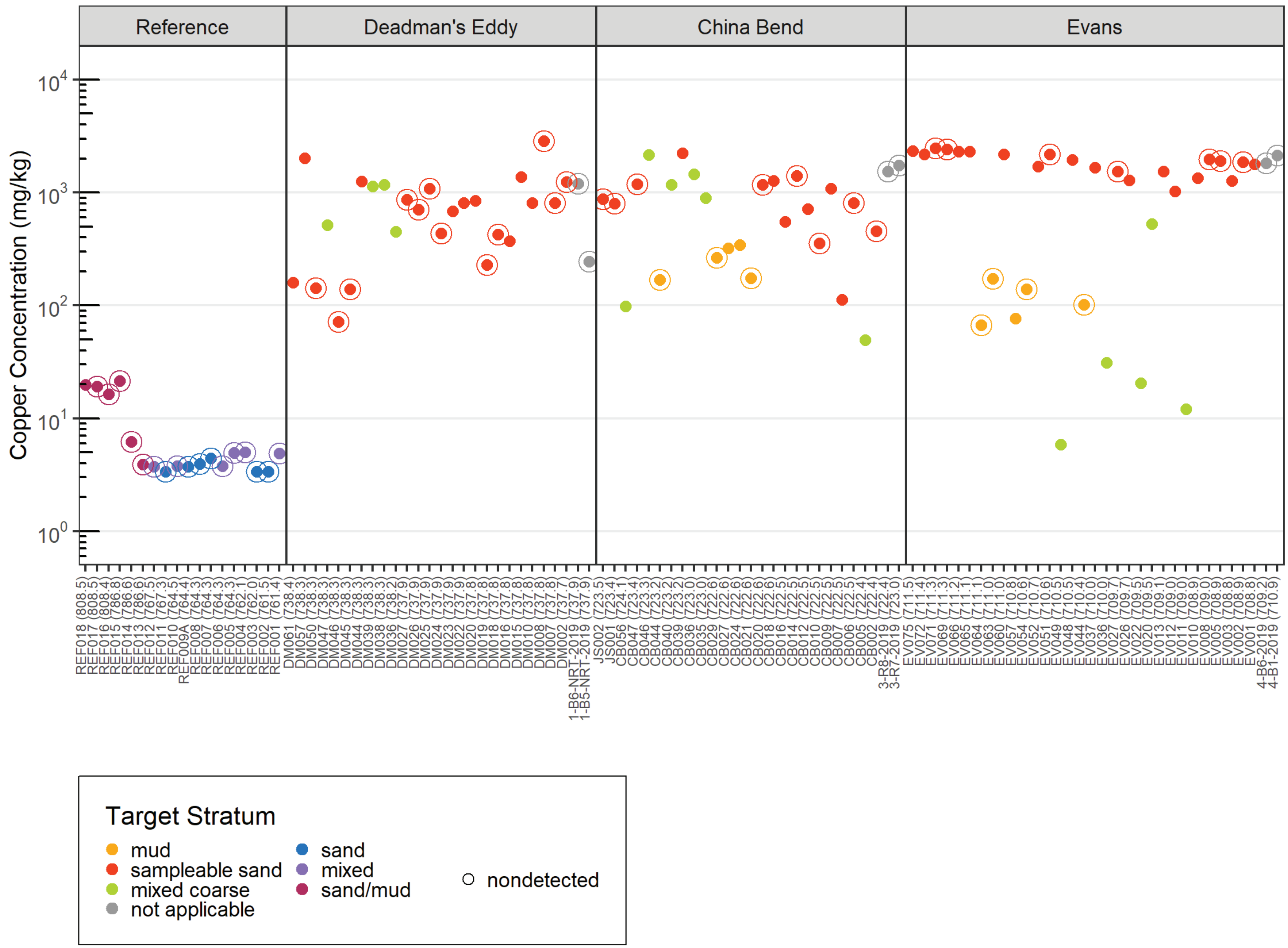
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1ba. Chromium in Field Sediment Samples by River Mile



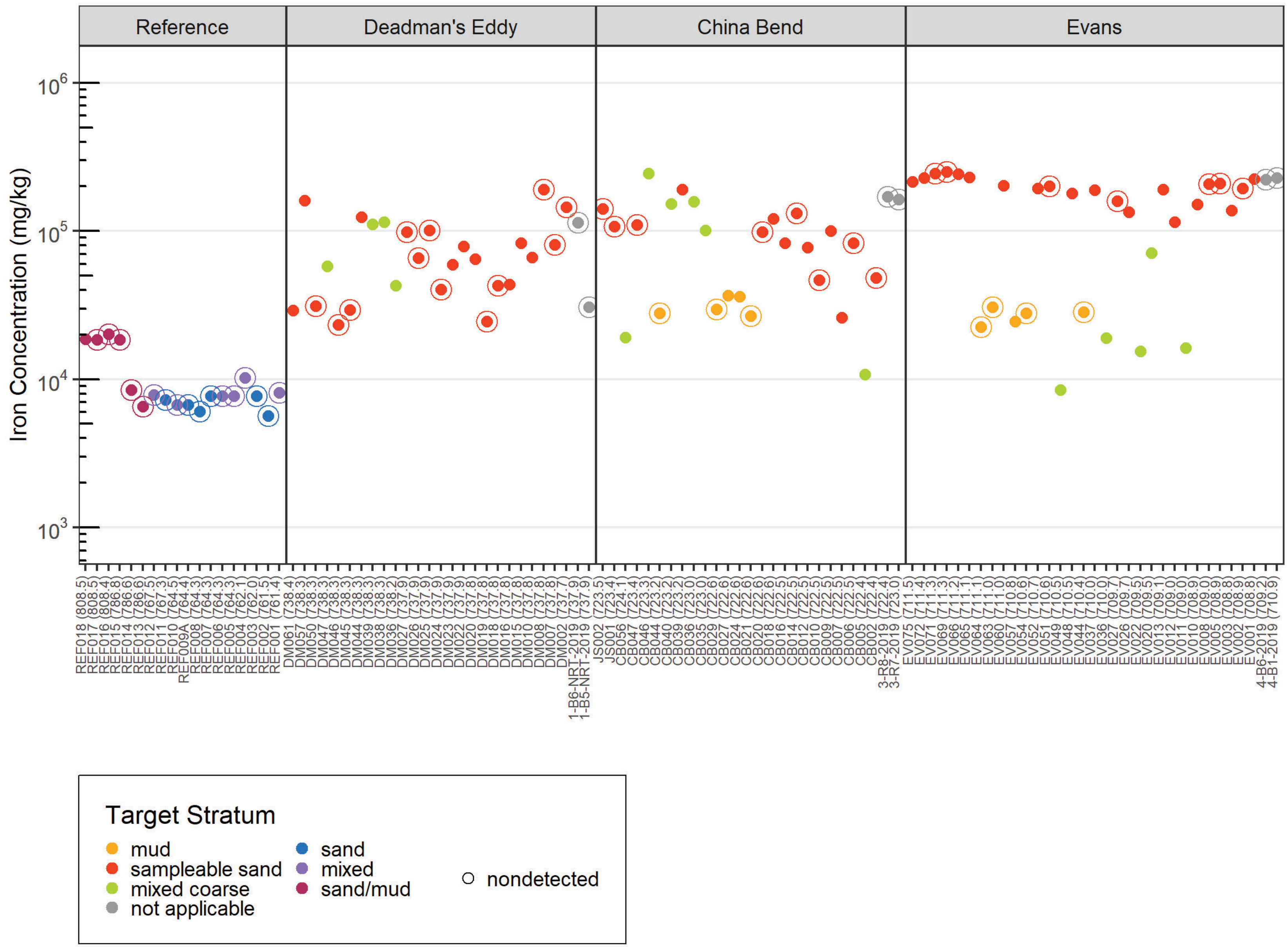
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bb. Cobalt in Field Sediment Samples by River Mile



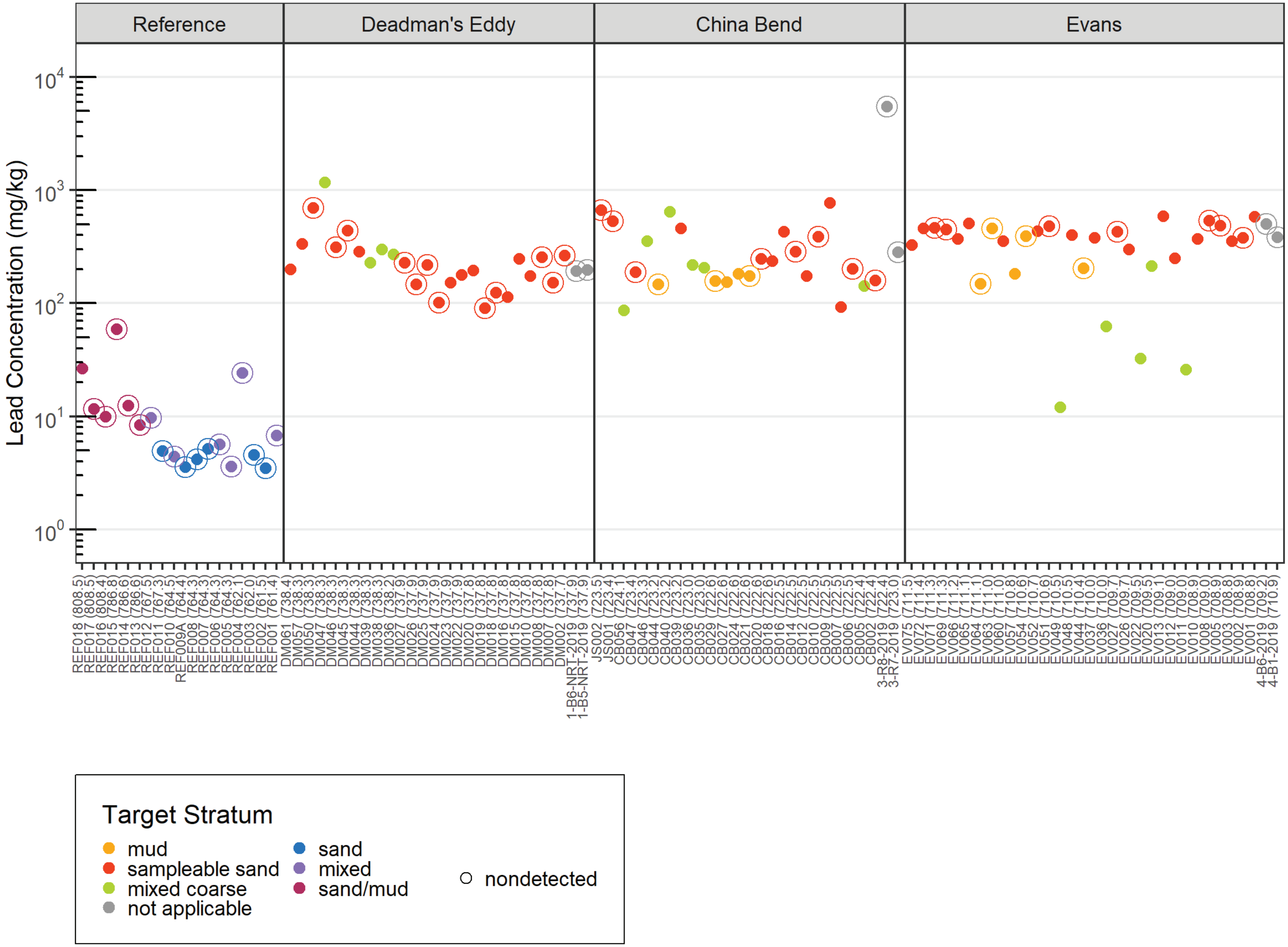
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bc. Copper in Field Sediment Samples by River Mile



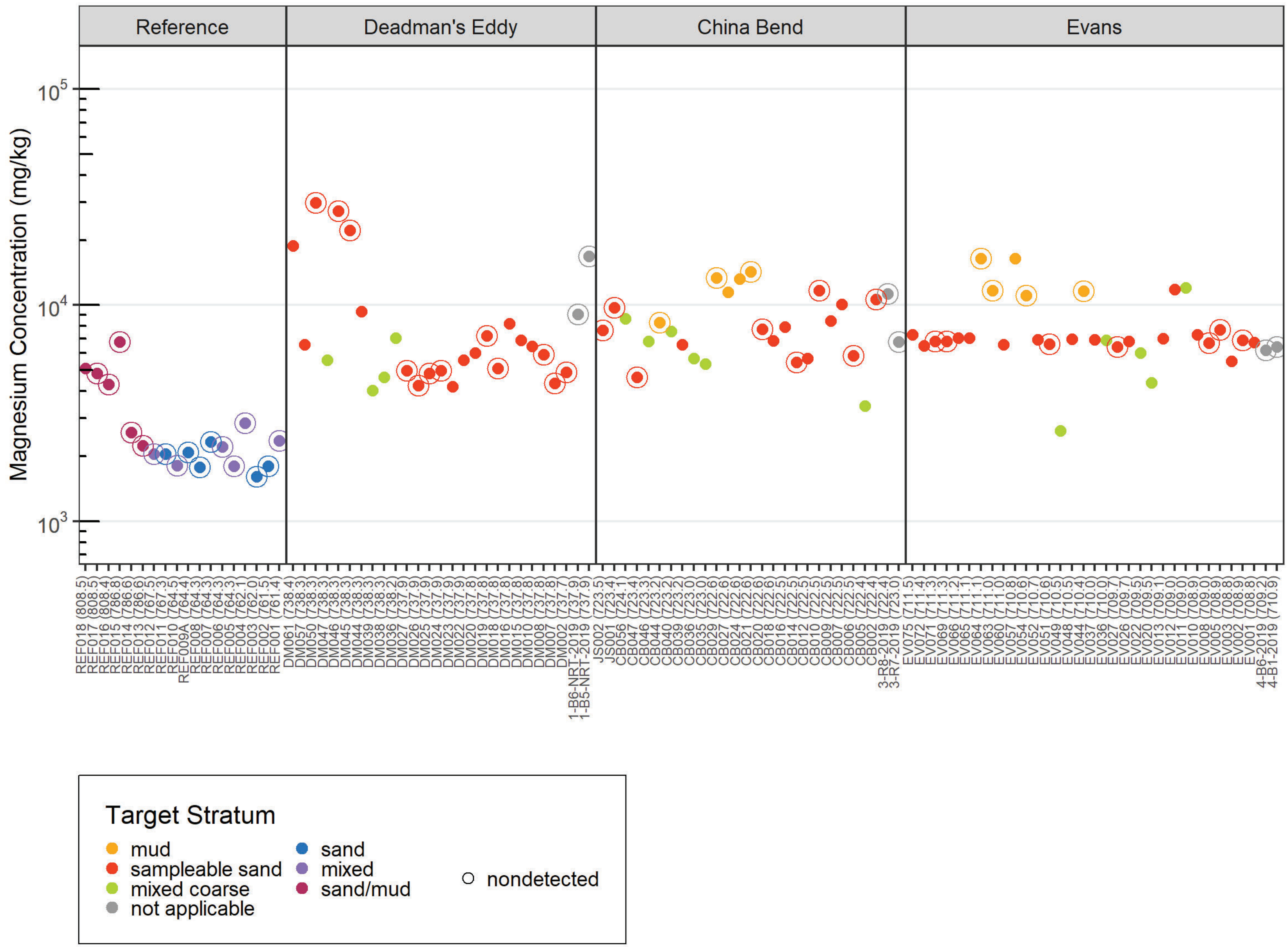
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bd. Iron in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1be. Lead in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bf. Magnesium in Field Sediment Samples by River Mile

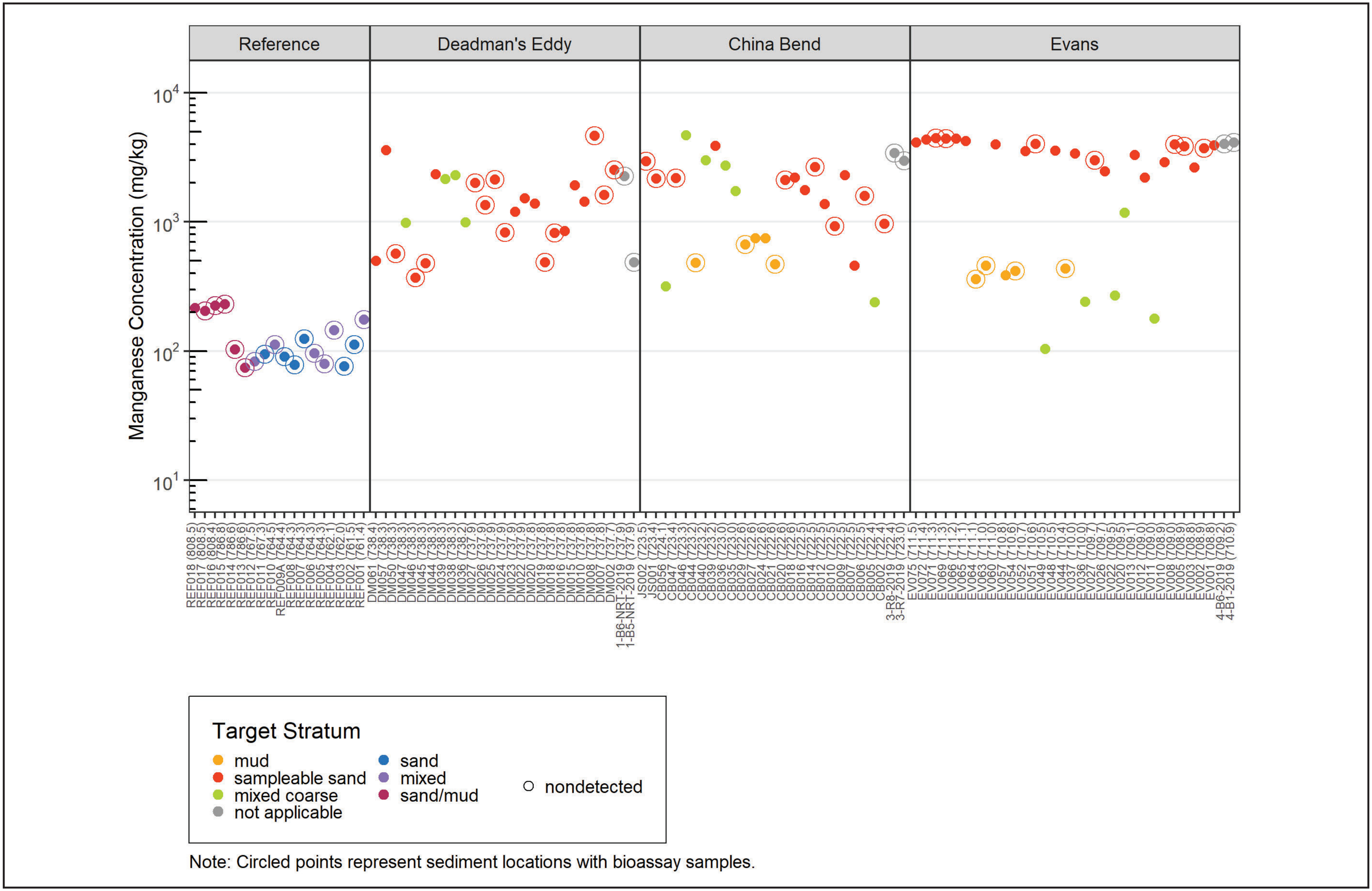


Figure 5-1bg. Manganese in Field Sediment Samples by River Mile

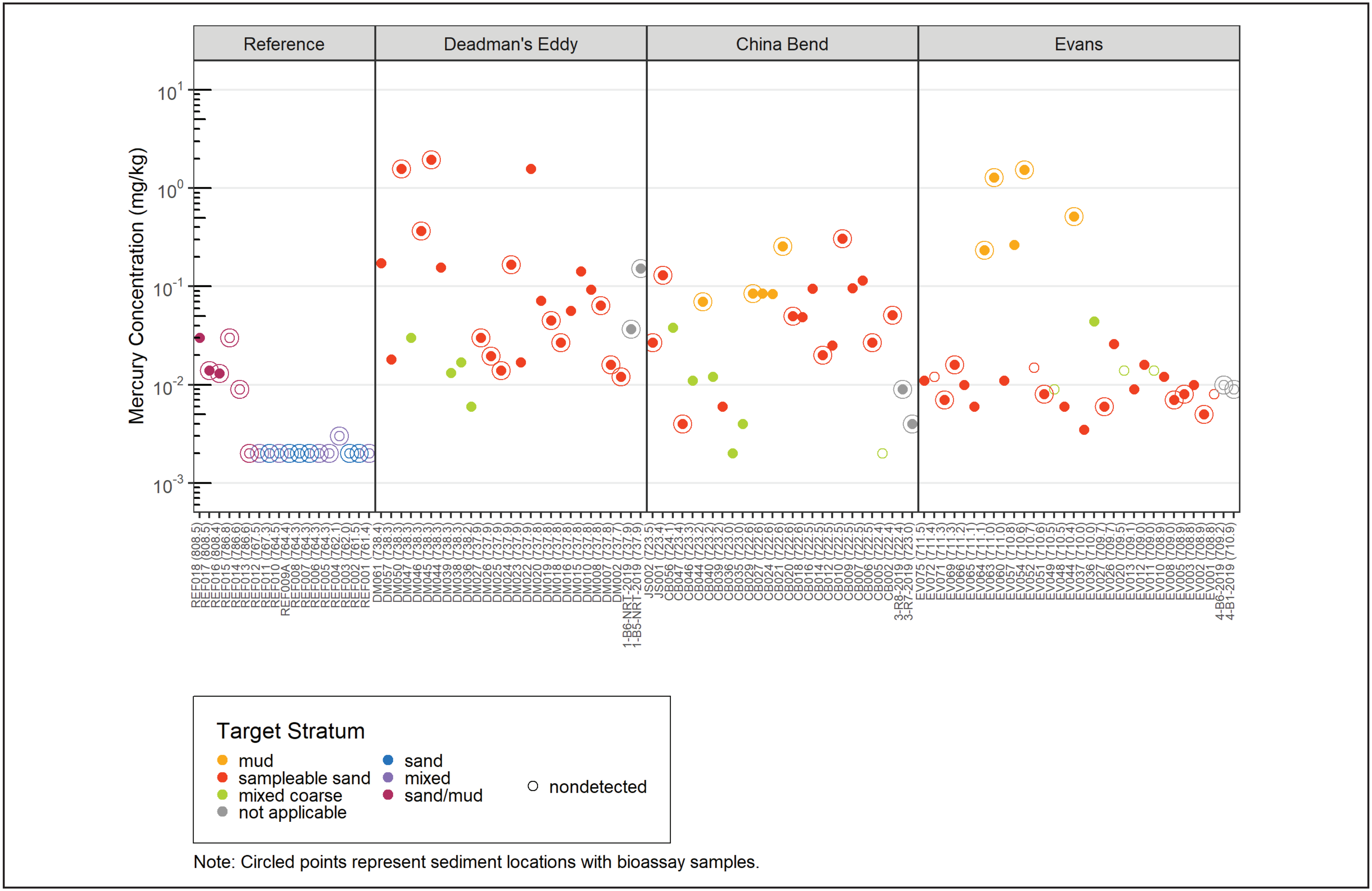
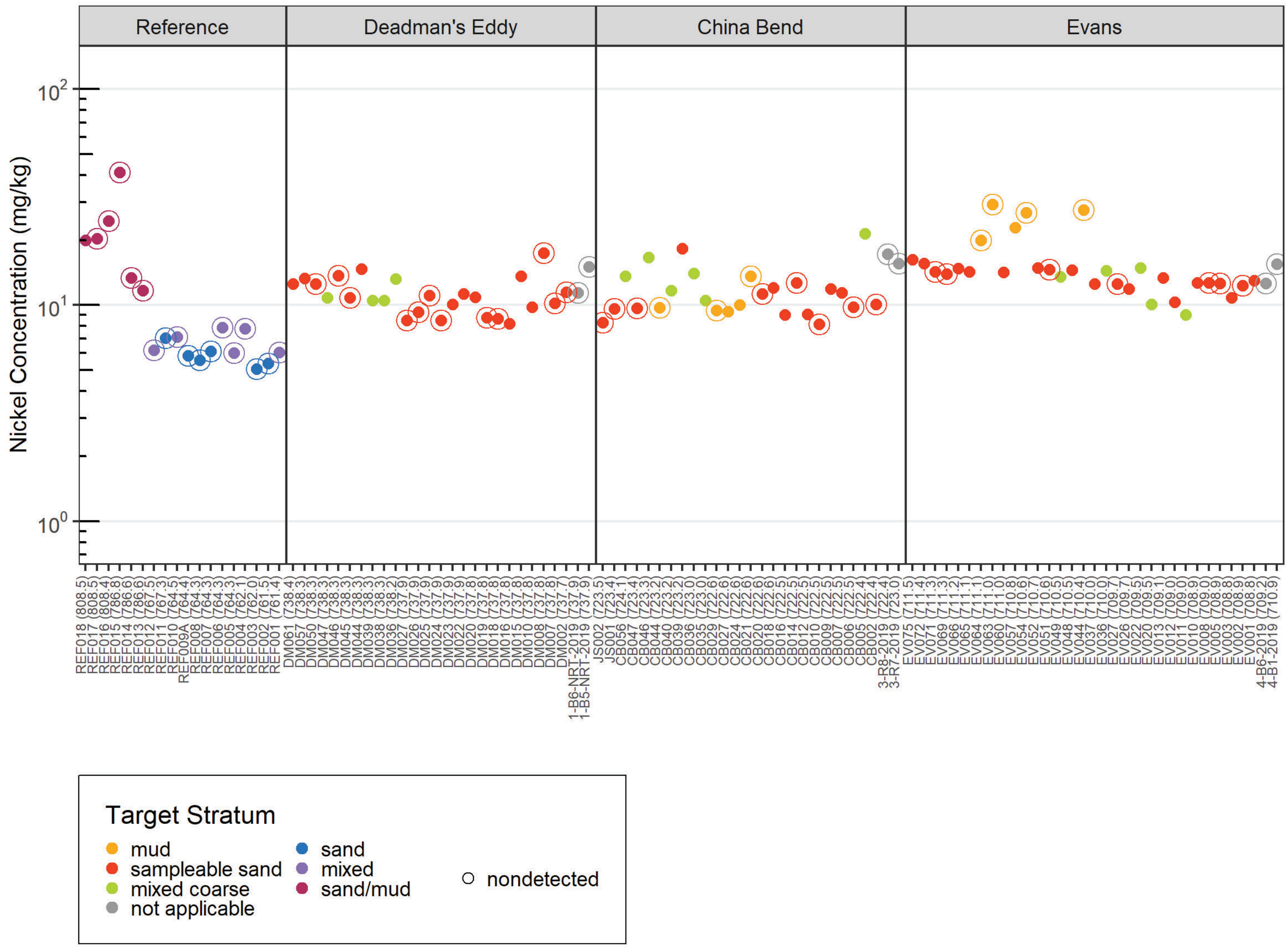


Figure 5-1bh. Mercury in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bi. Nickel in Field Sediment Samples by River Mile

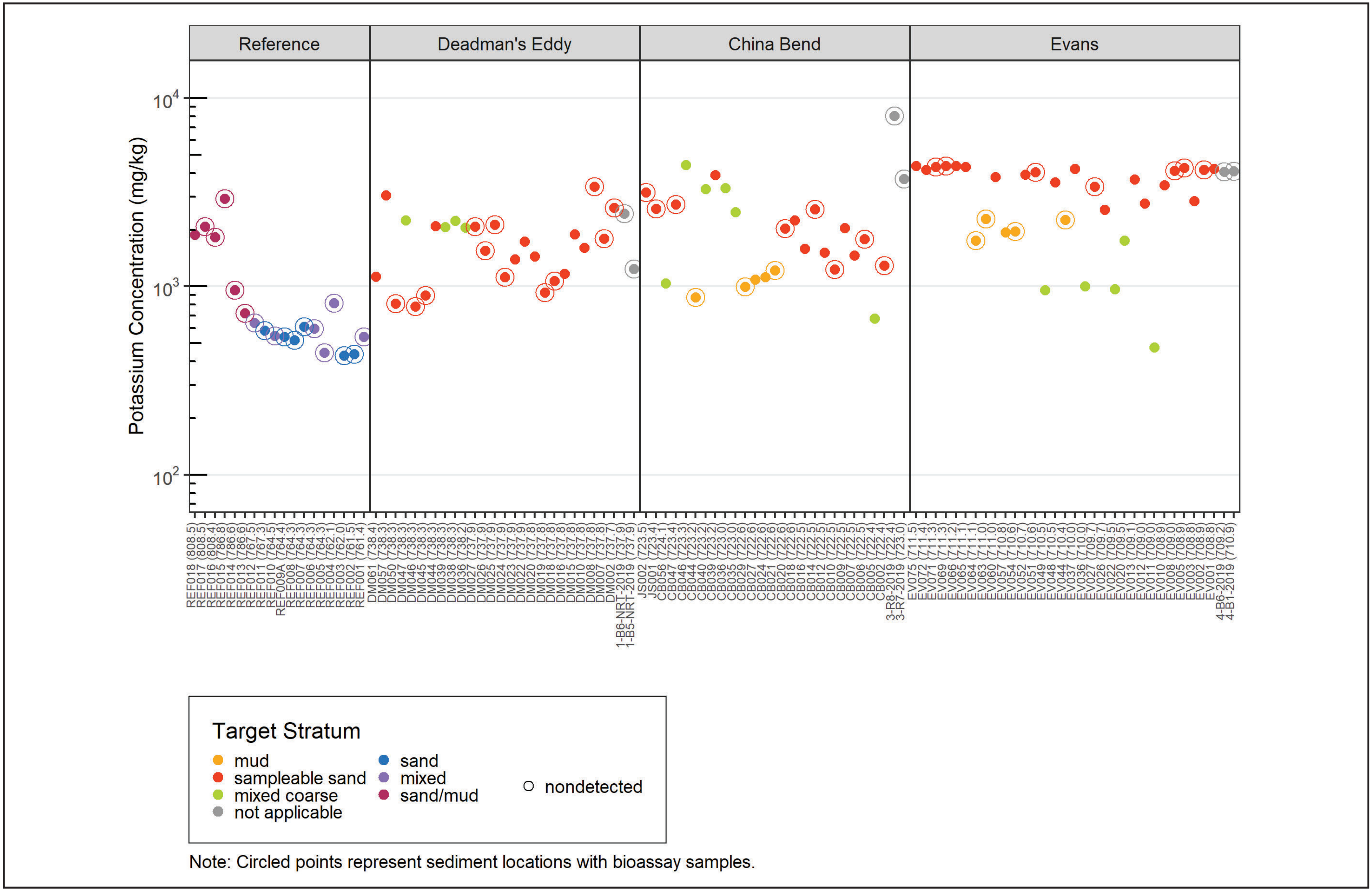
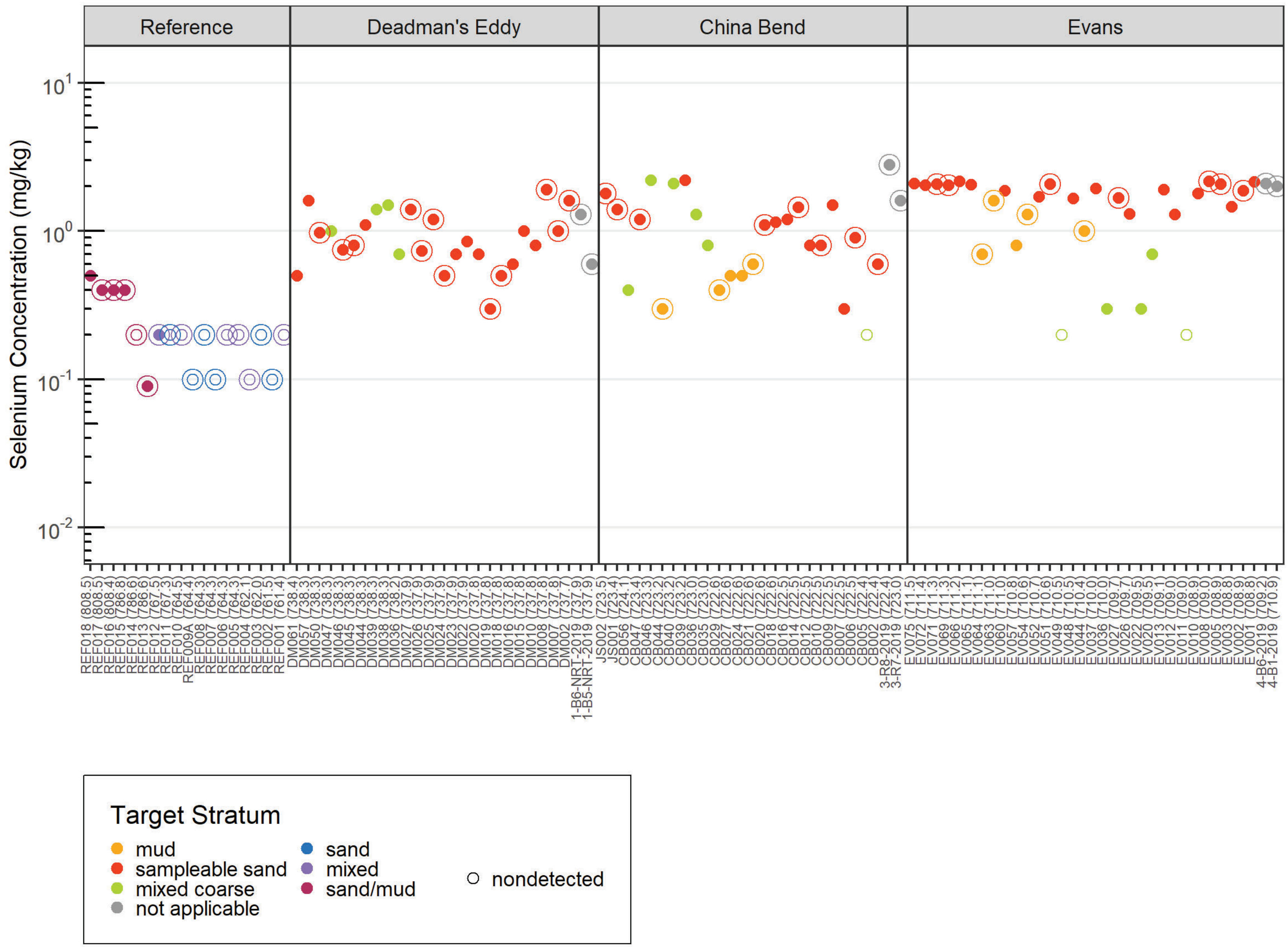
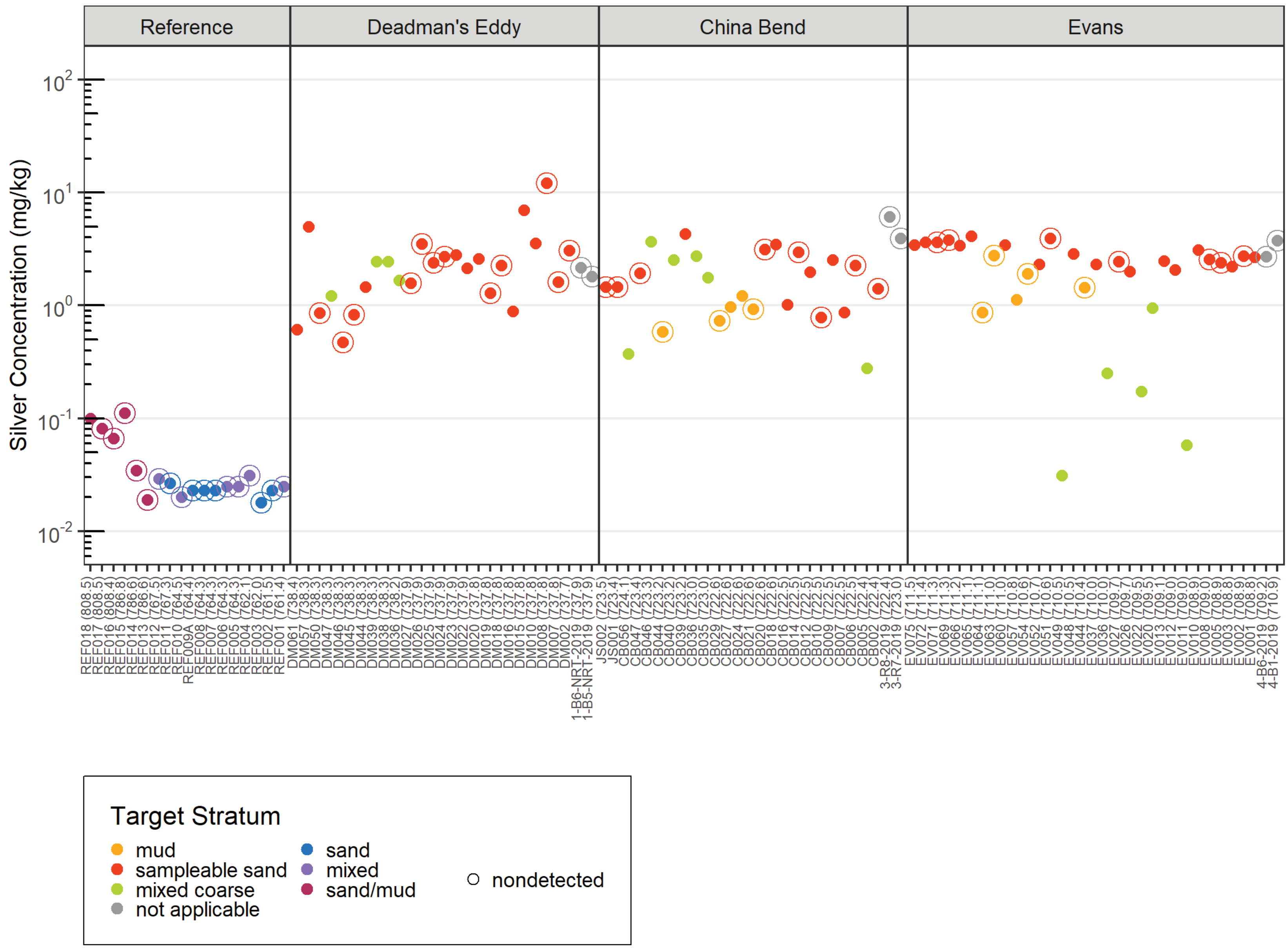


Figure 5-1bj. Potassium in Field Sediment Samples by River Mile



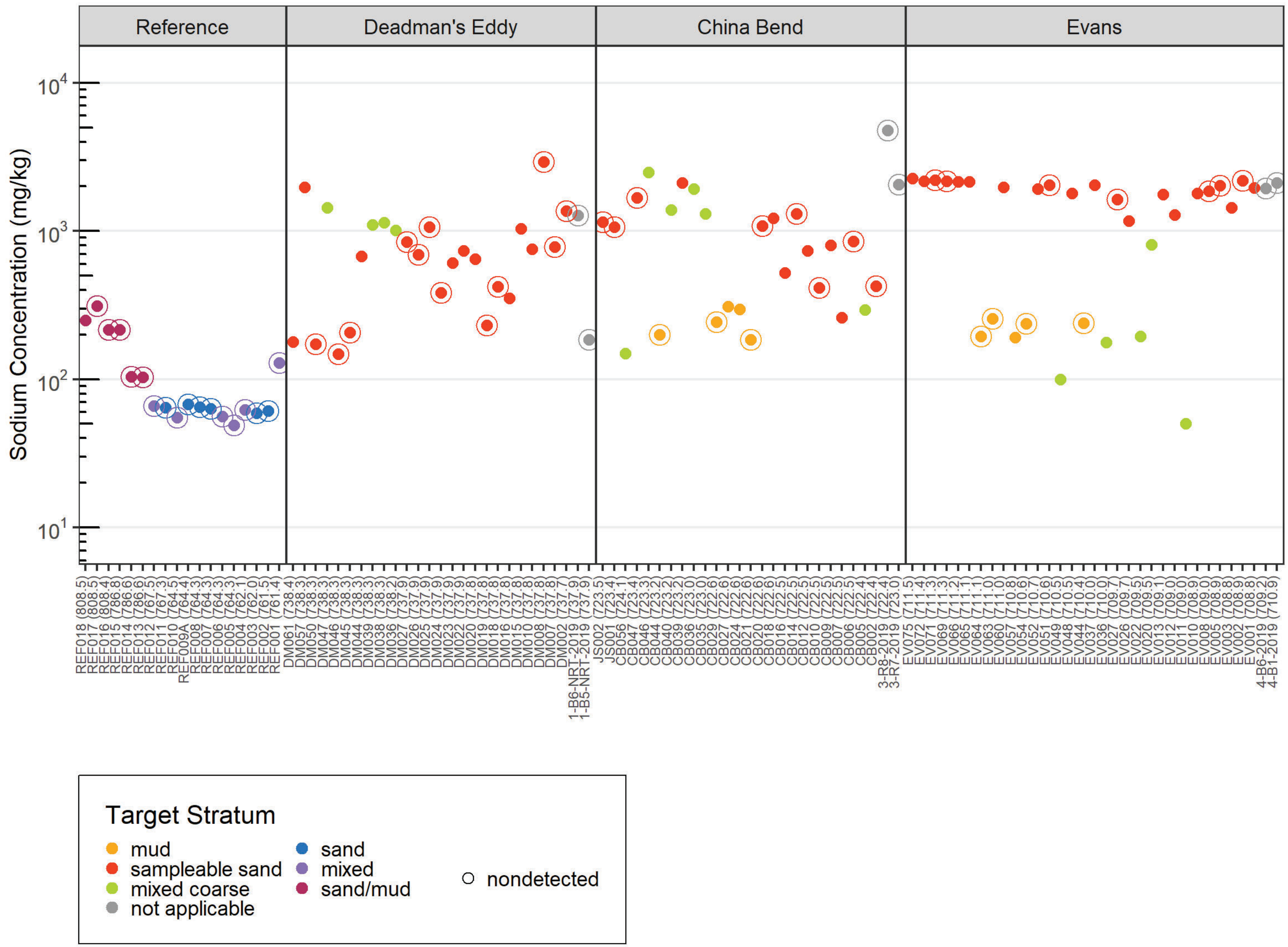
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bk. Selenium in Field Sediment Samples by River Mile



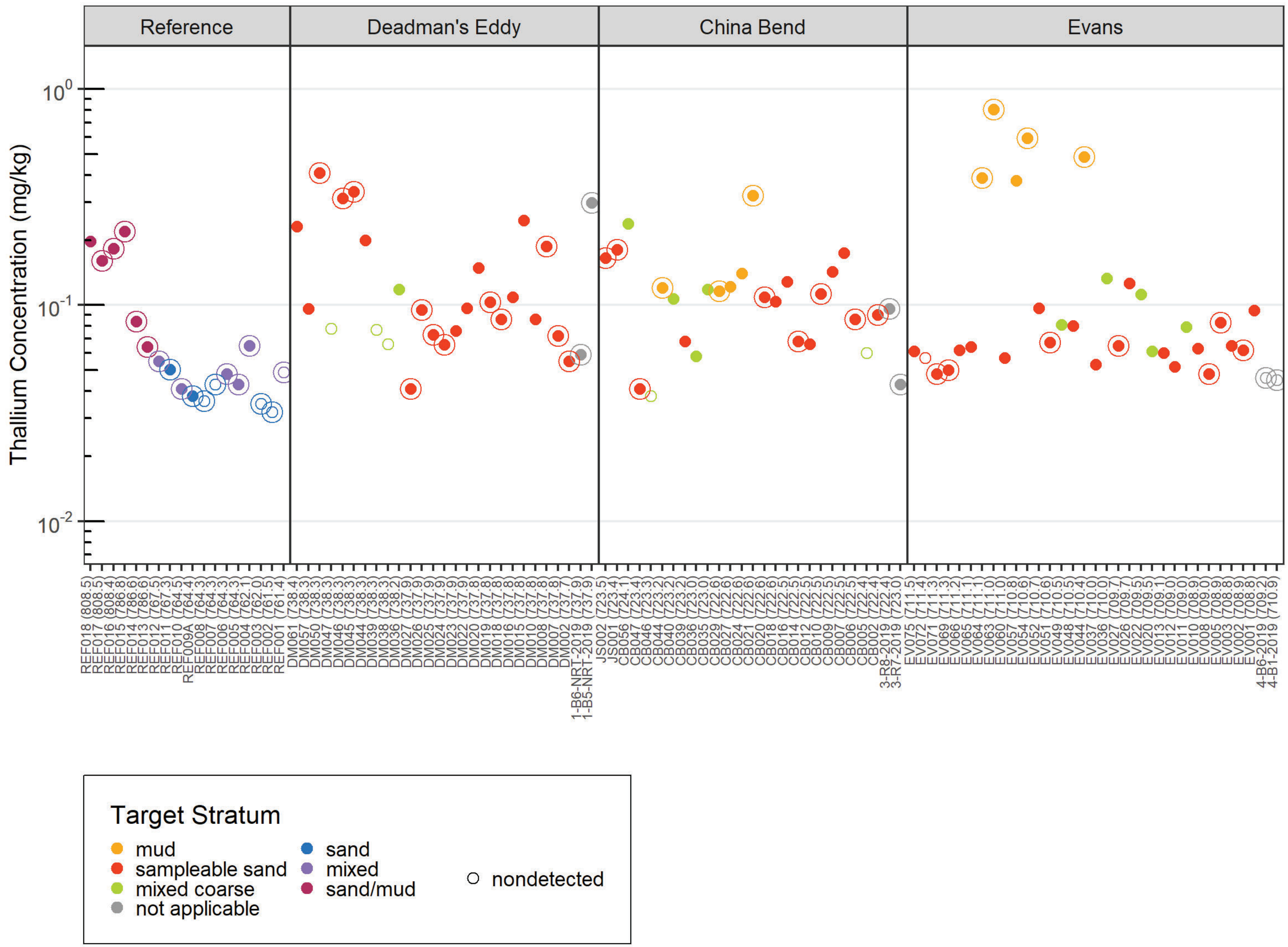
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bl. Silver in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bm. Sodium in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bn. Thallium in Field Sediment Samples by River Mile

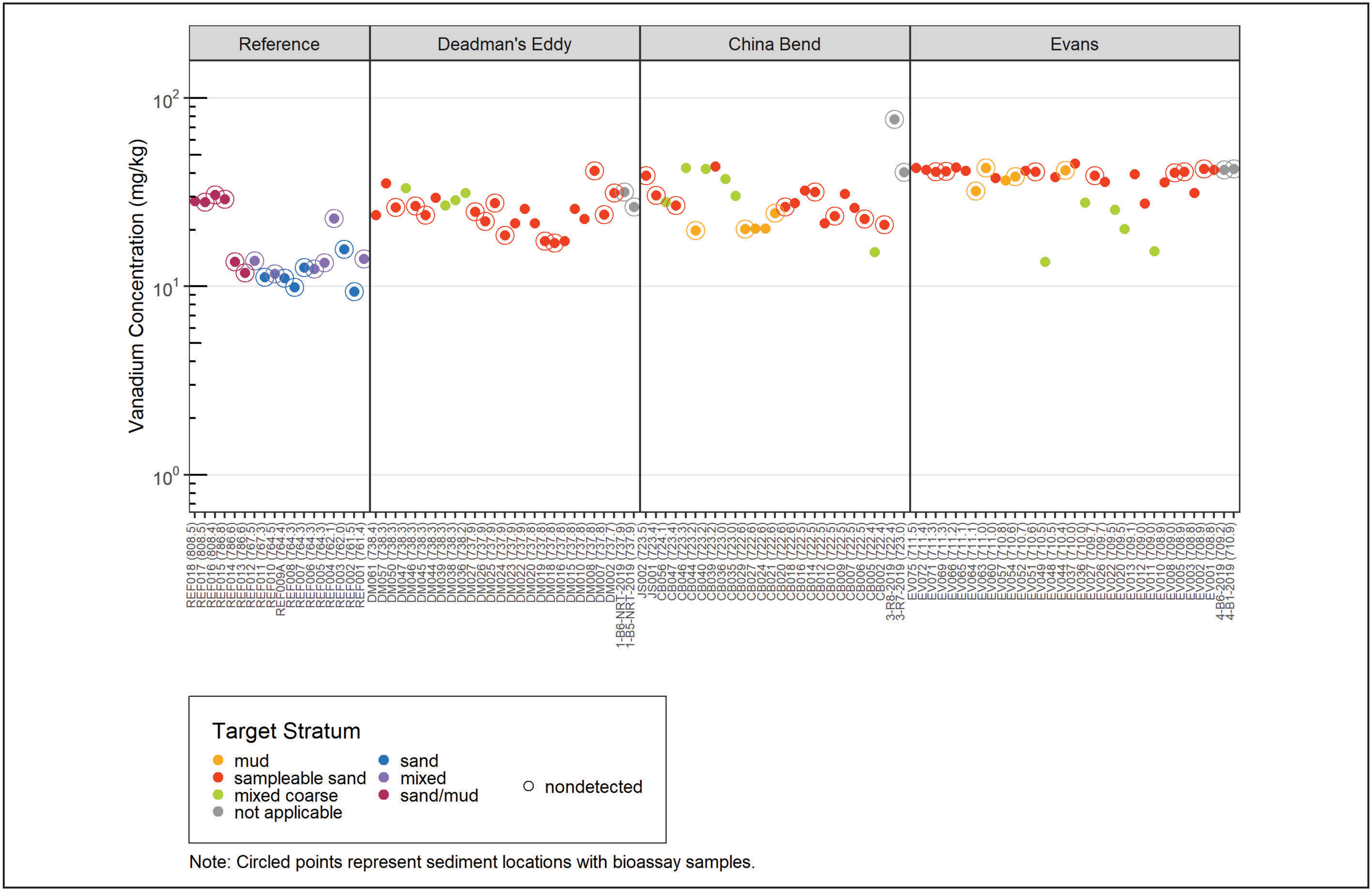
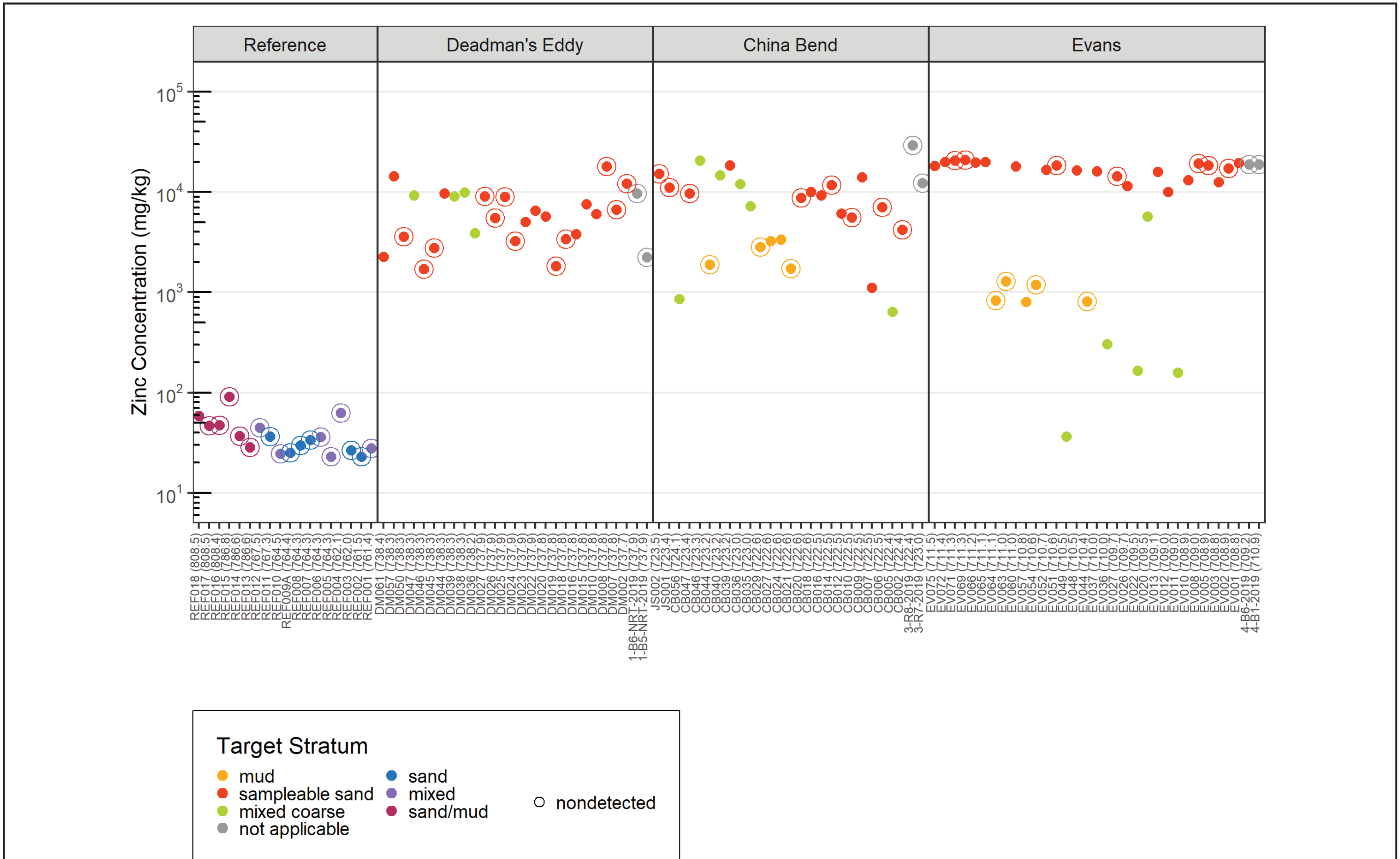
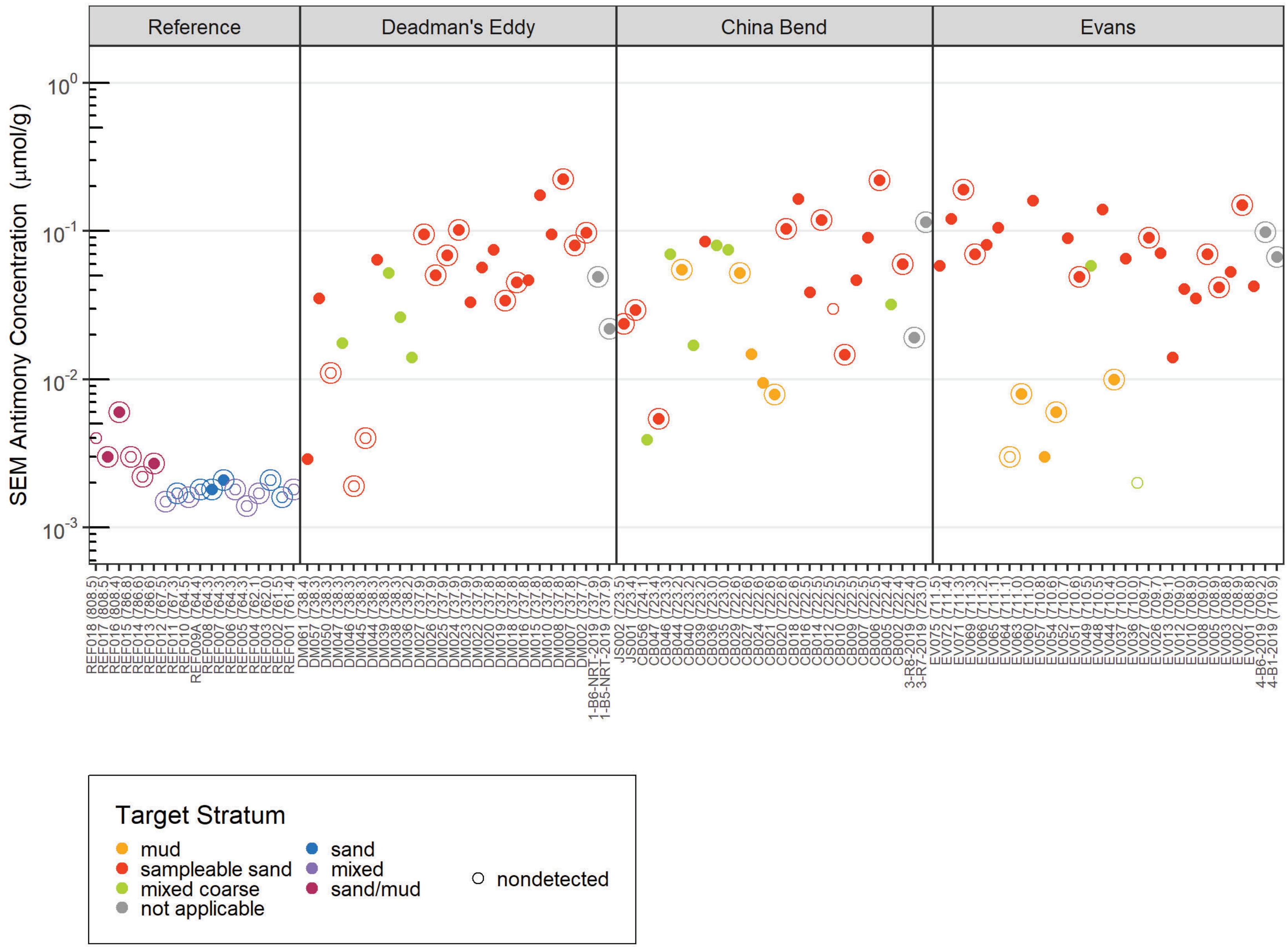


Figure 5-1bo. Vanadium in Field Sediment Samples by River Mile



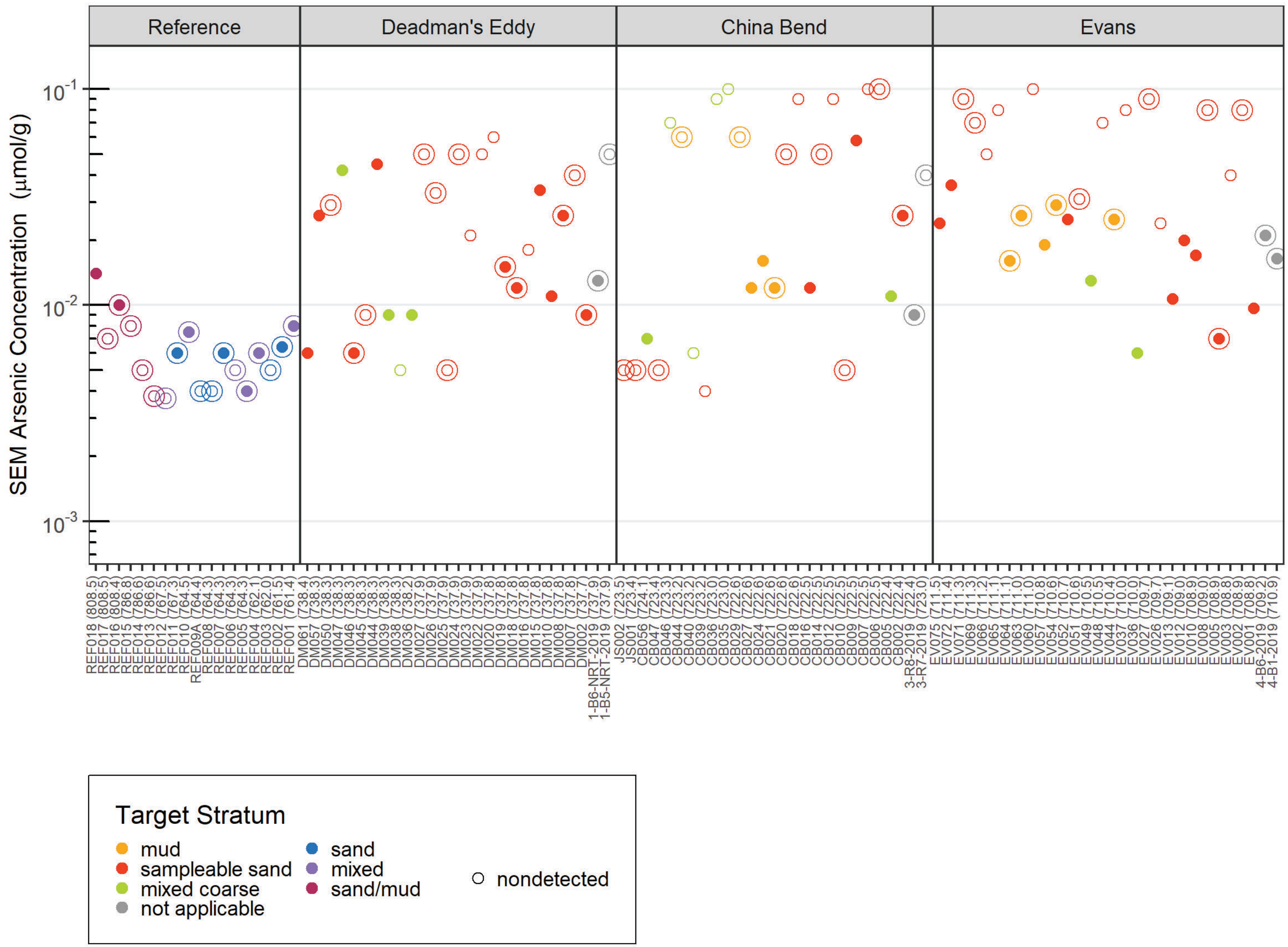
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bp. Zinc in Field Sediment Samples by River Mile



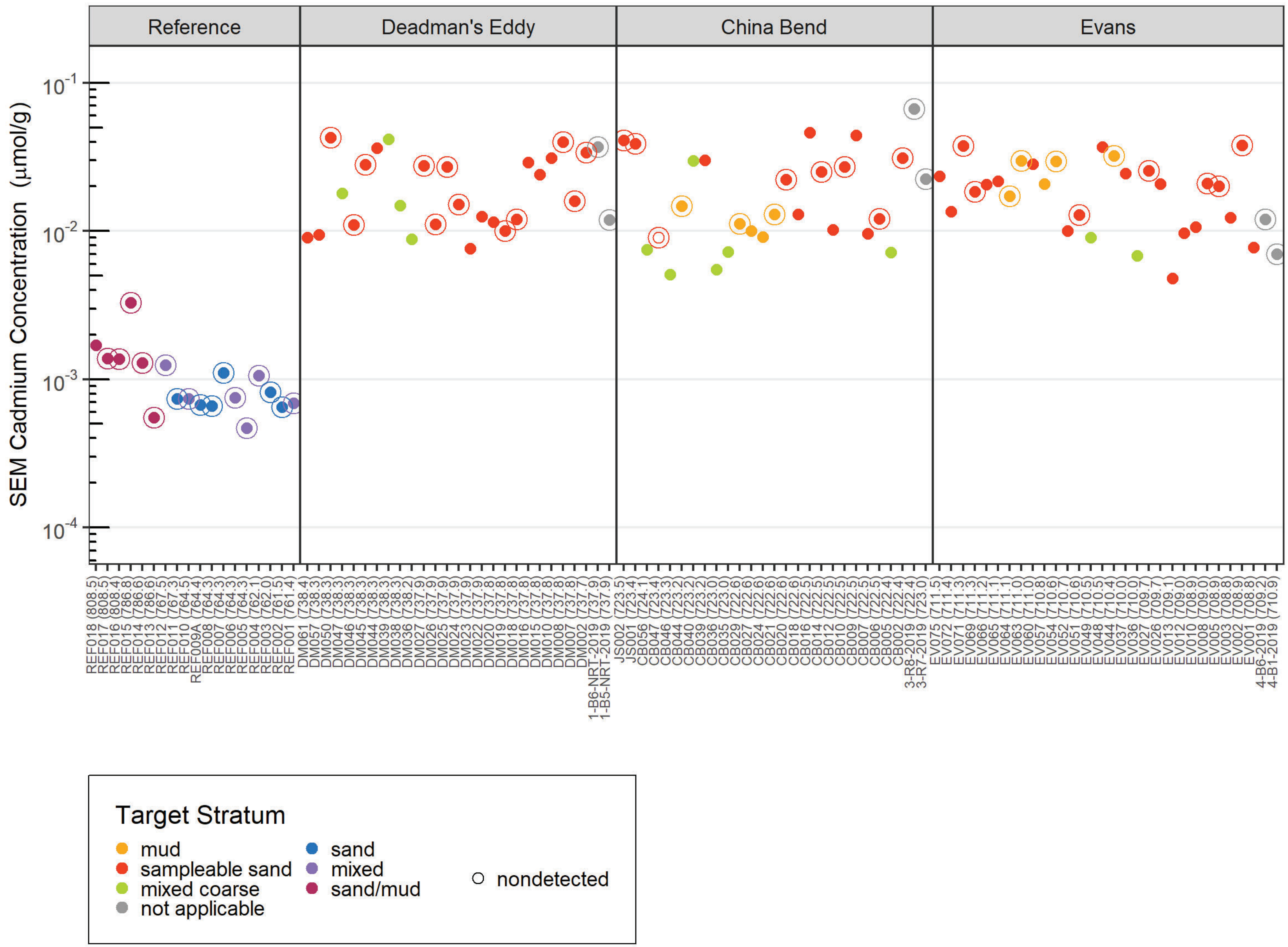
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bq. SEM Antimony in Field Sediment Samples by River Mile



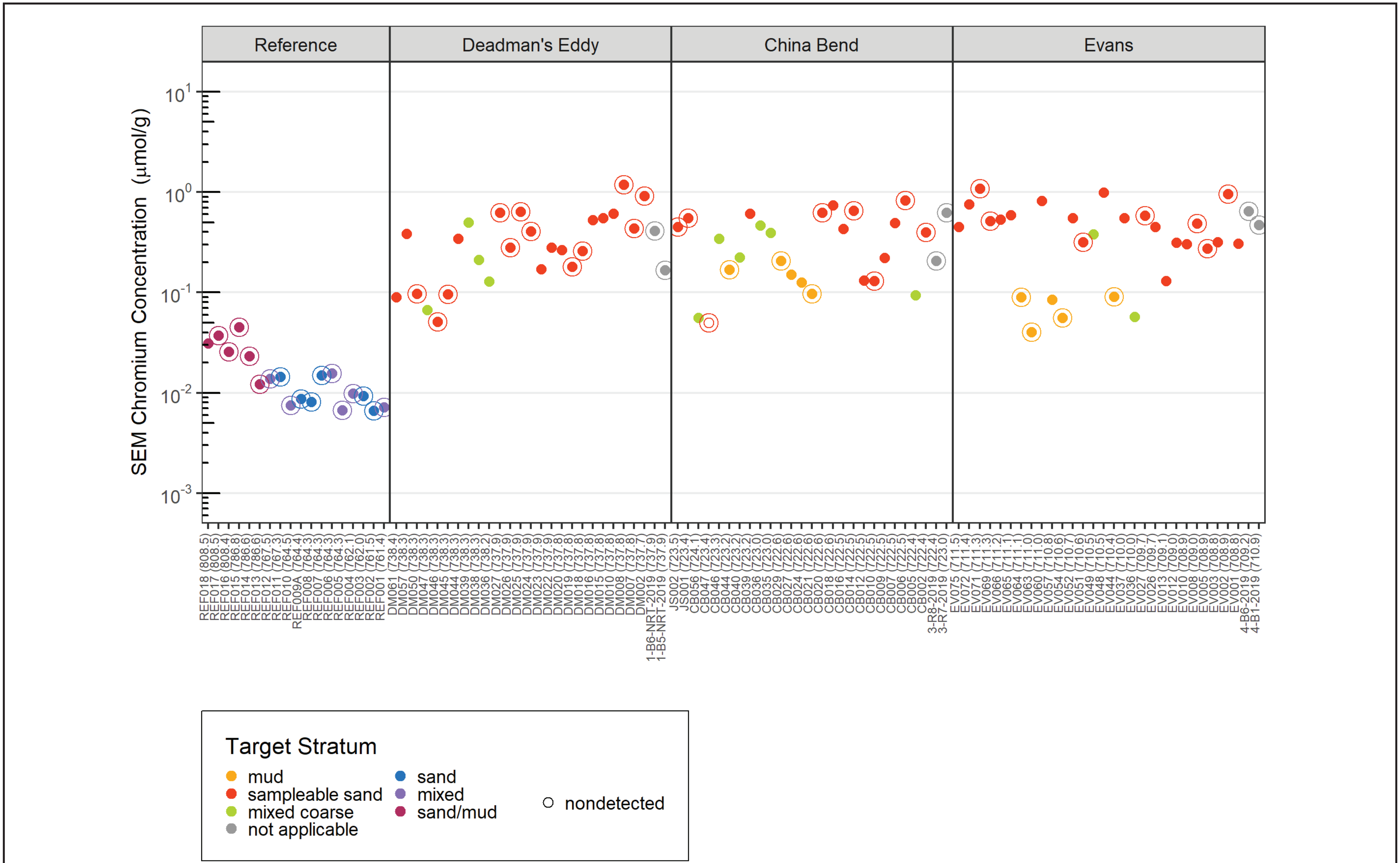
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1br. SEM Arsenic in Field Sediment Samples by River Mile



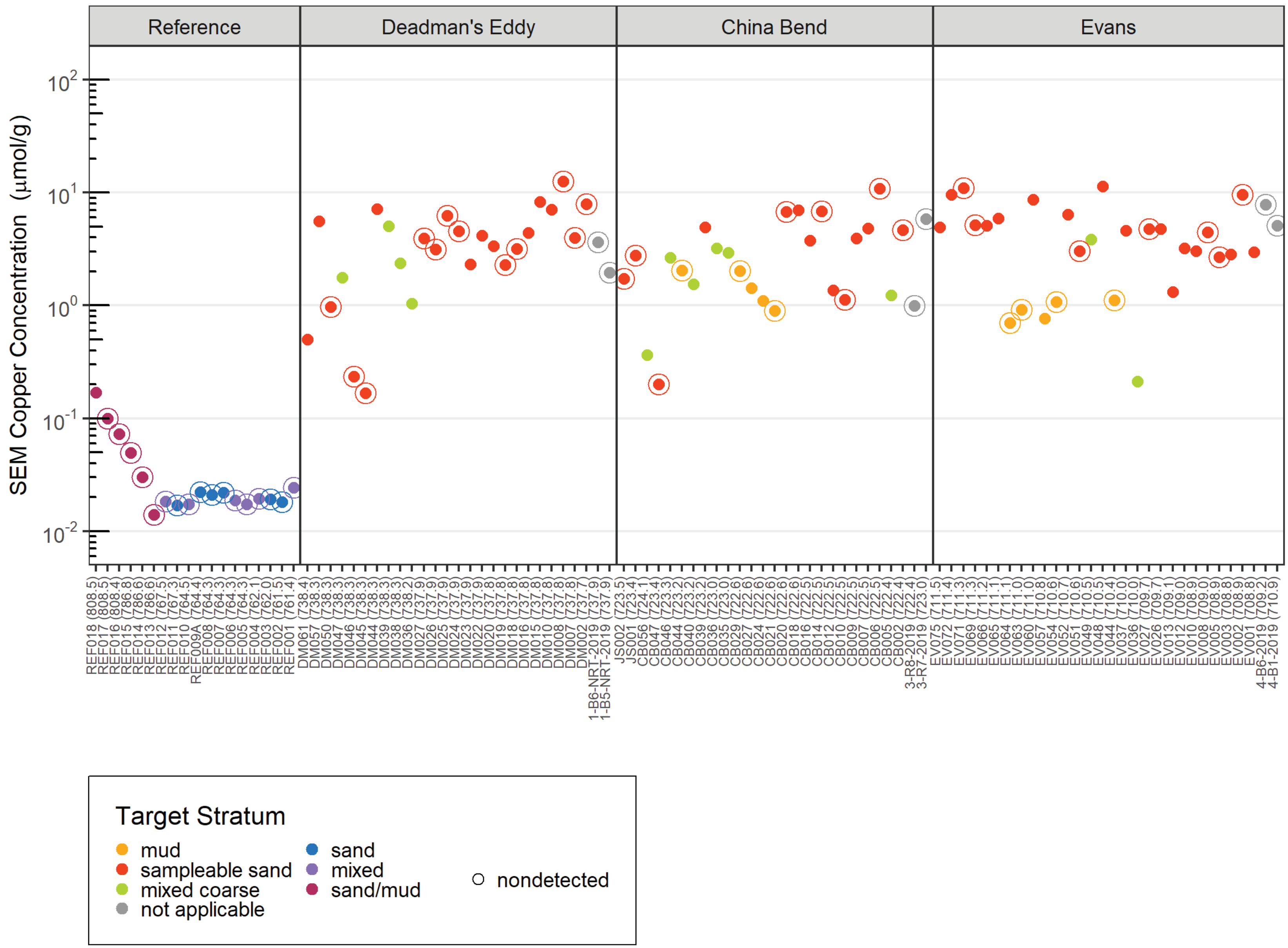
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bs. SEM Cadmium in Field Sediment Samples by River Mile



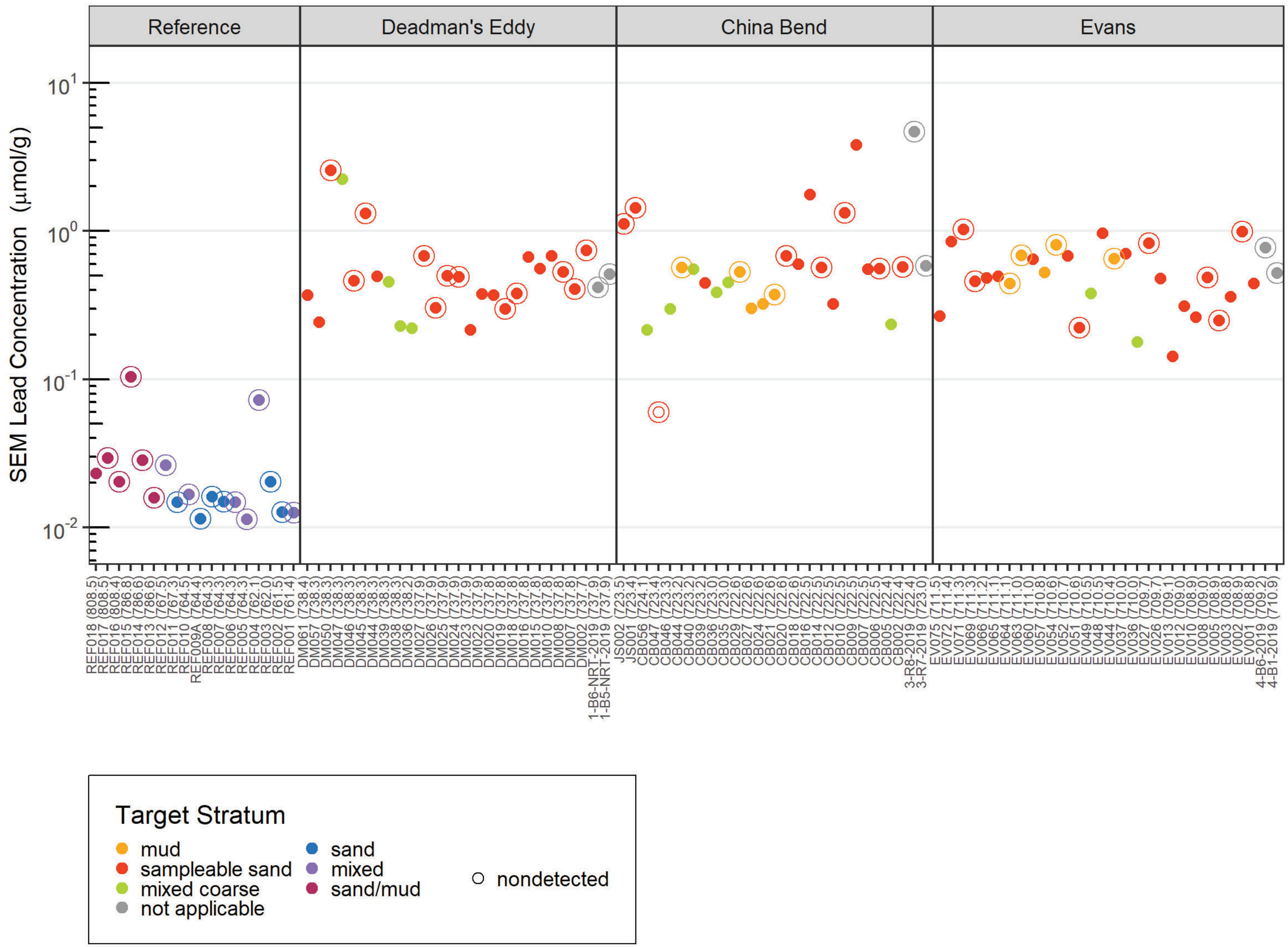
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bt. SEM Chromium in Field Sediment Samples by River Mile



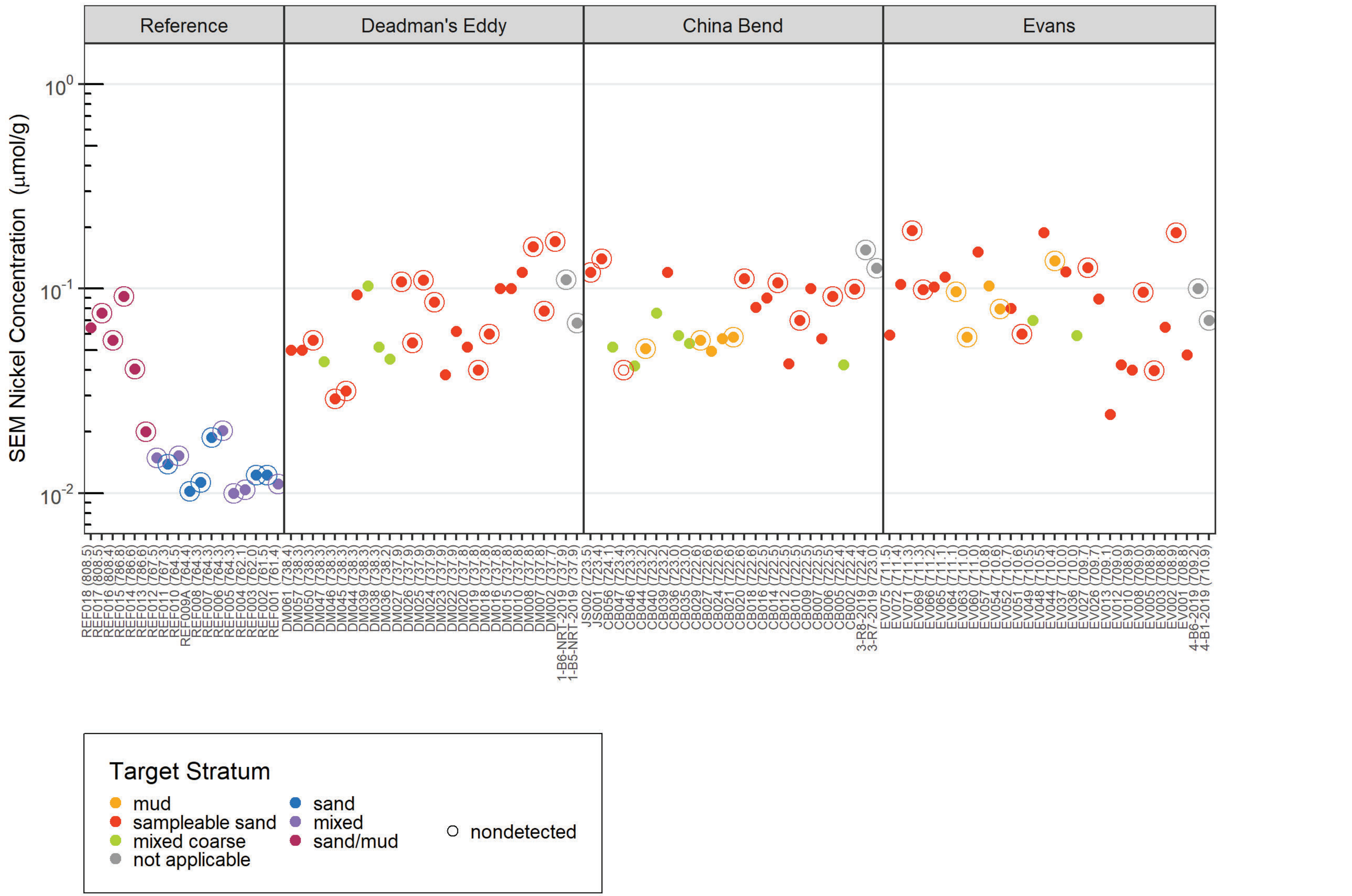
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bu. SEM Copper in Field Sediment Samples by River Mile



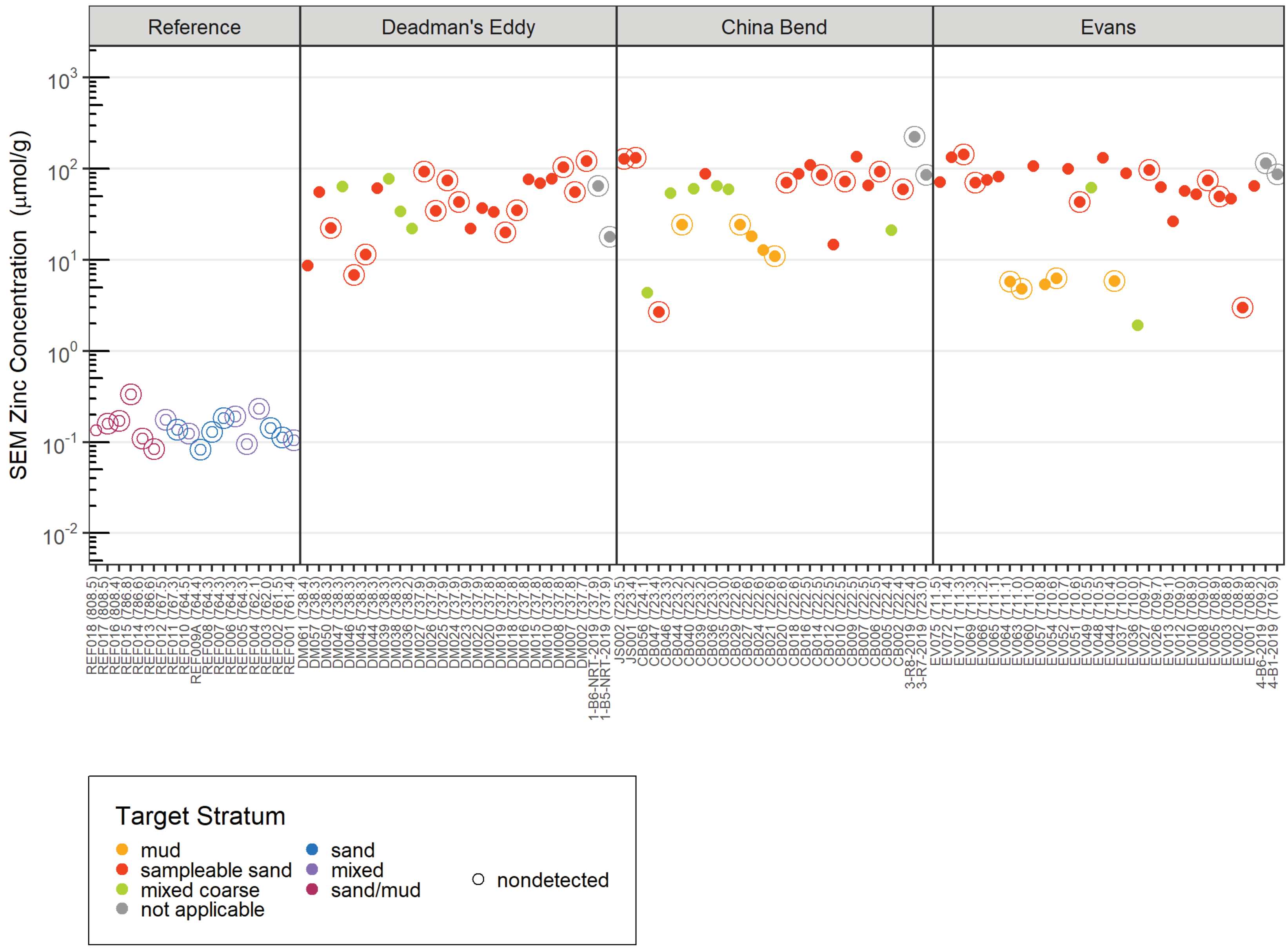
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bv. SEM Lead in Field Sediment Samples by River Mile



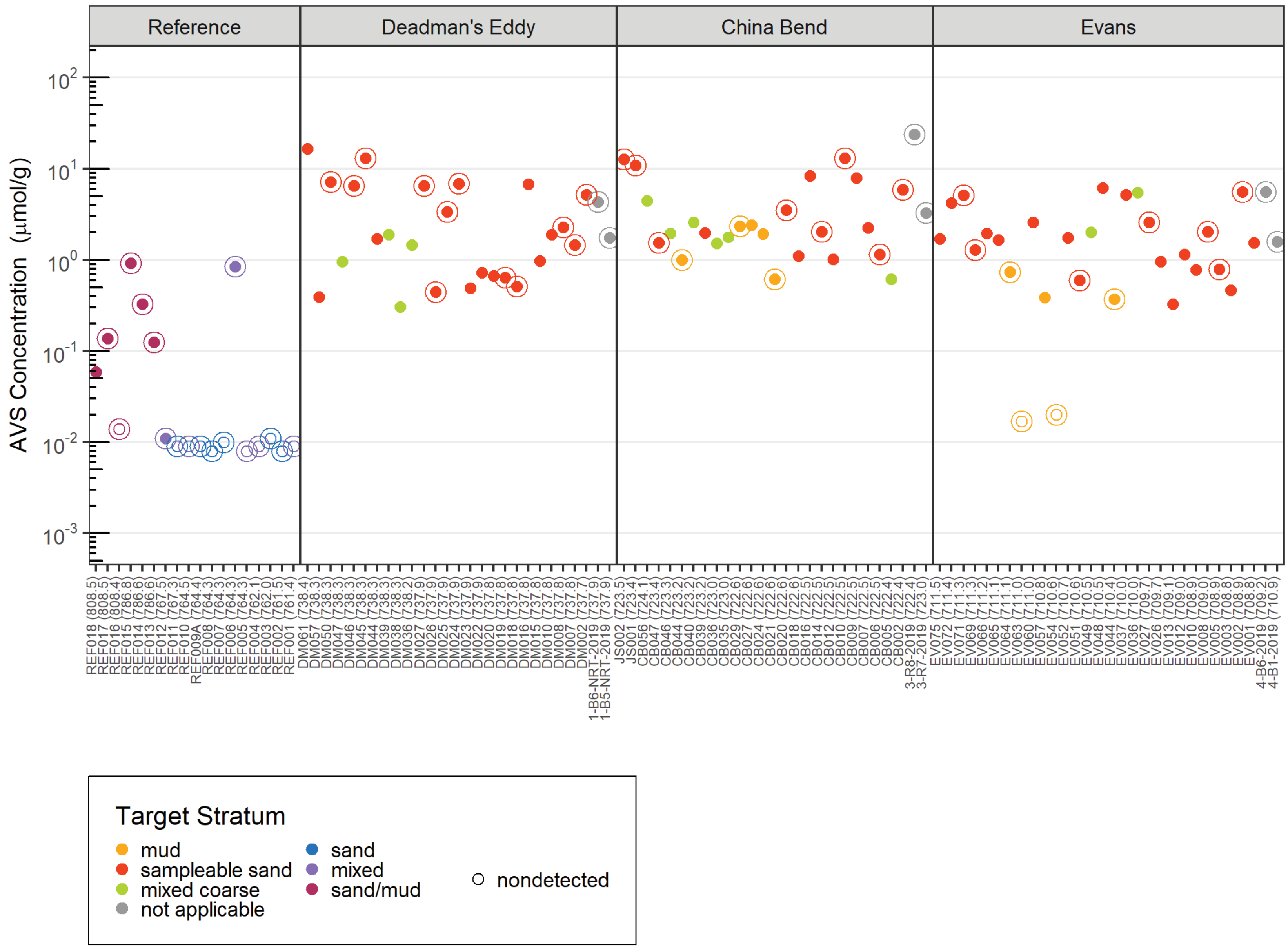
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bw. SEM Nickel in Field Sediment Samples by River Mile



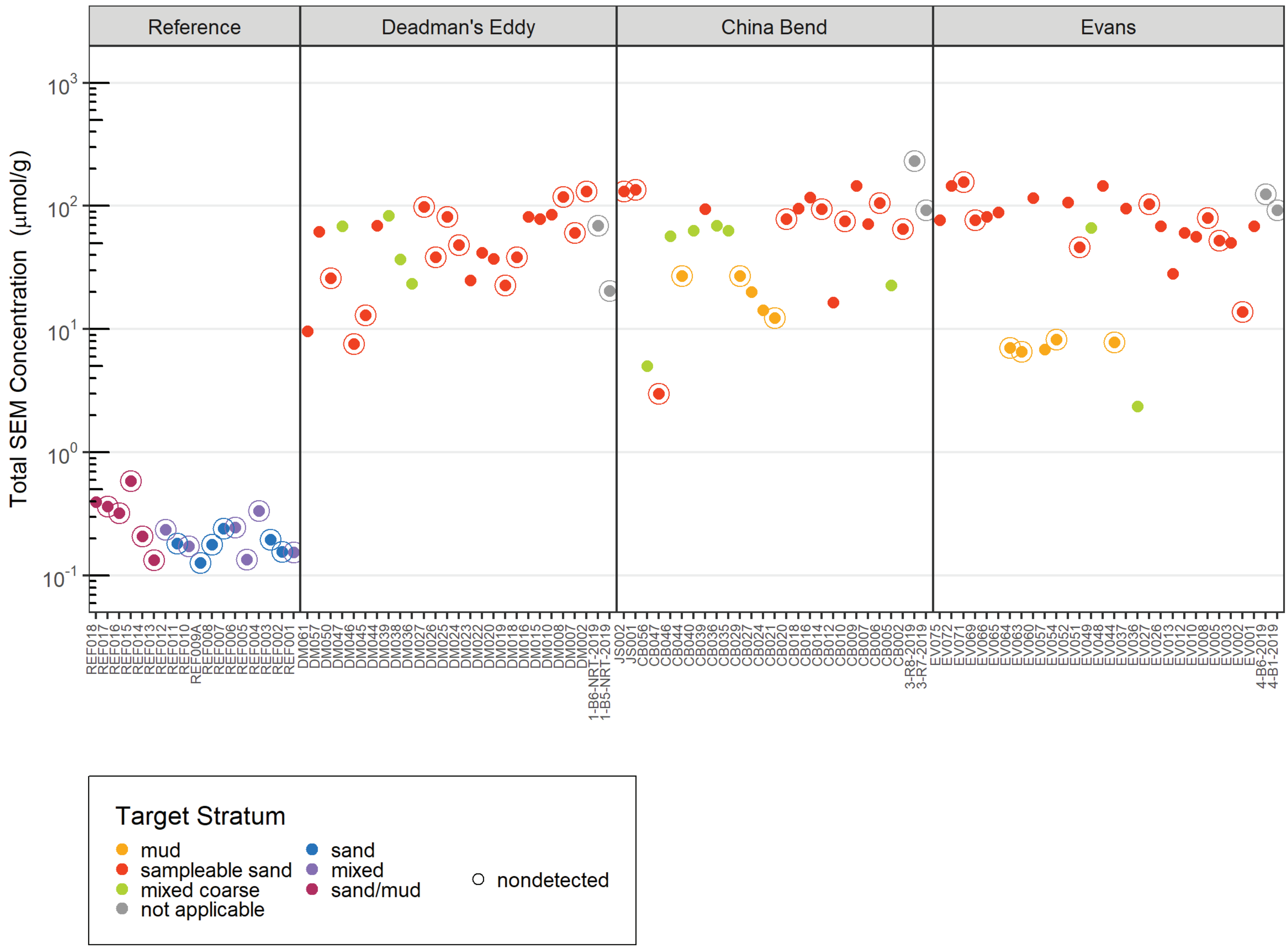
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bx. SEM Zinc in Field Sediment Samples by River Mile



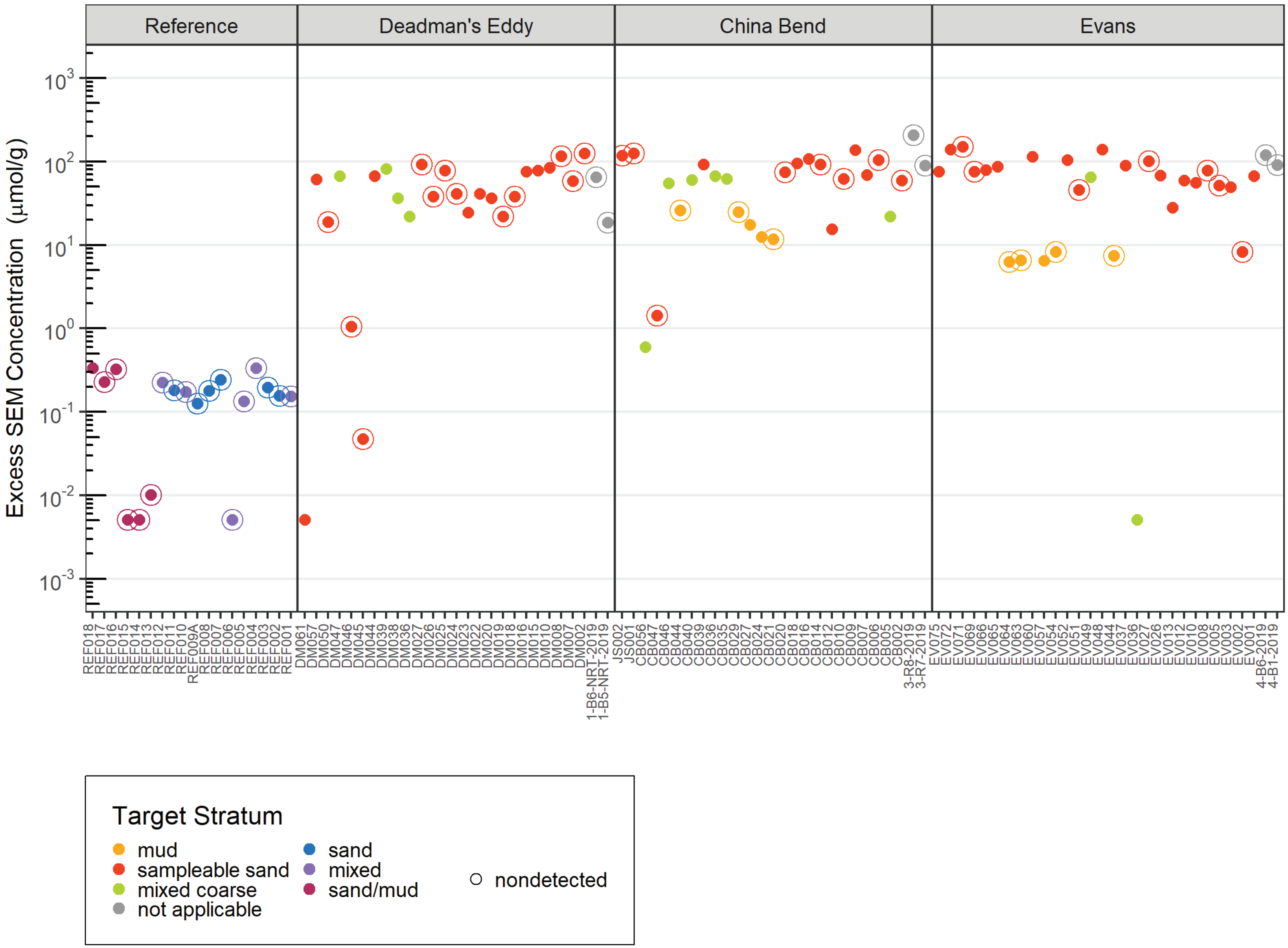
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1by. AVS in Field Sediment Samples by River Mile



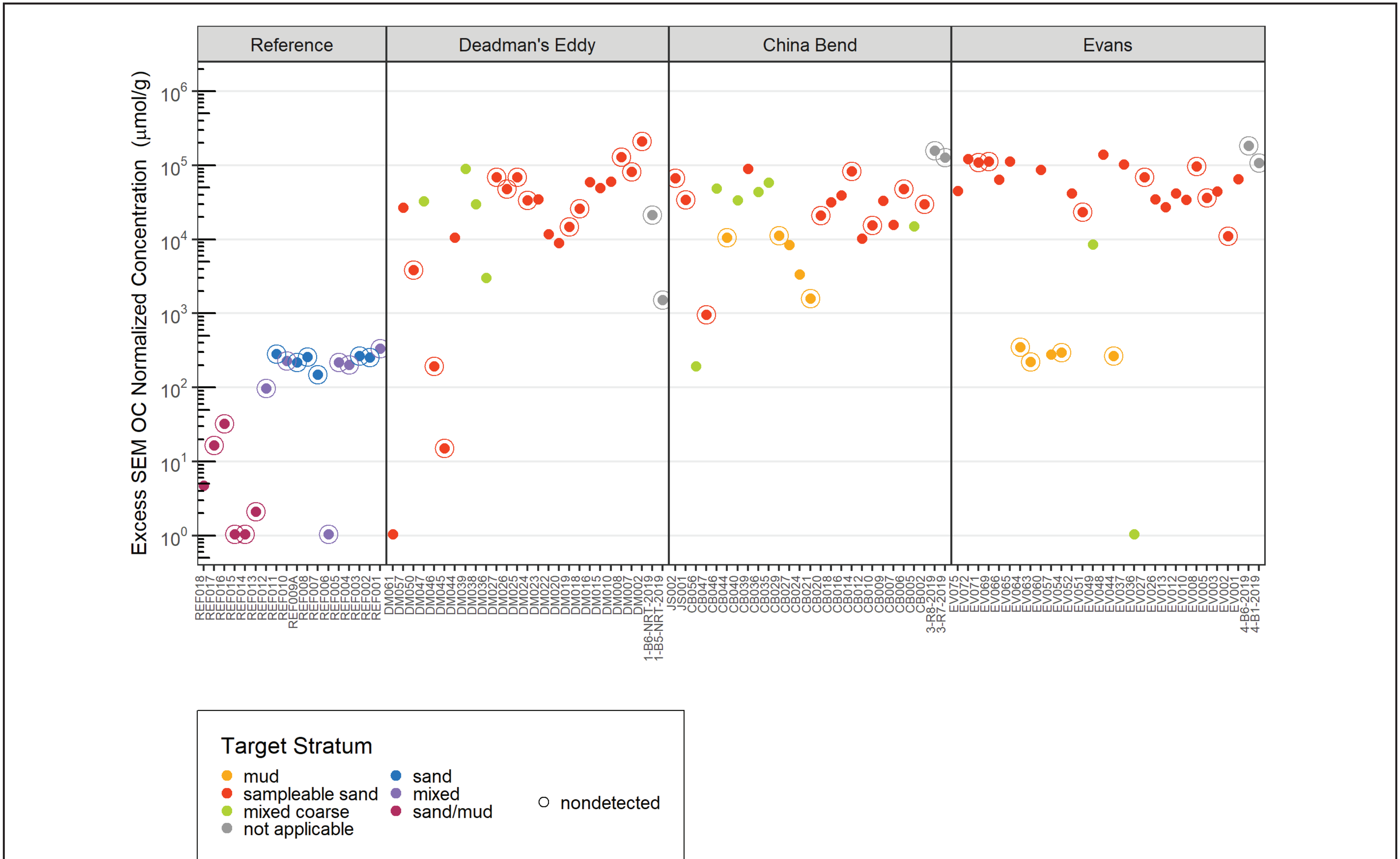
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1bz. Total SEM in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1ca. Excess SEM in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-1cb. Excess SEM OC Normalized in Field Sediment Samples by River Mile

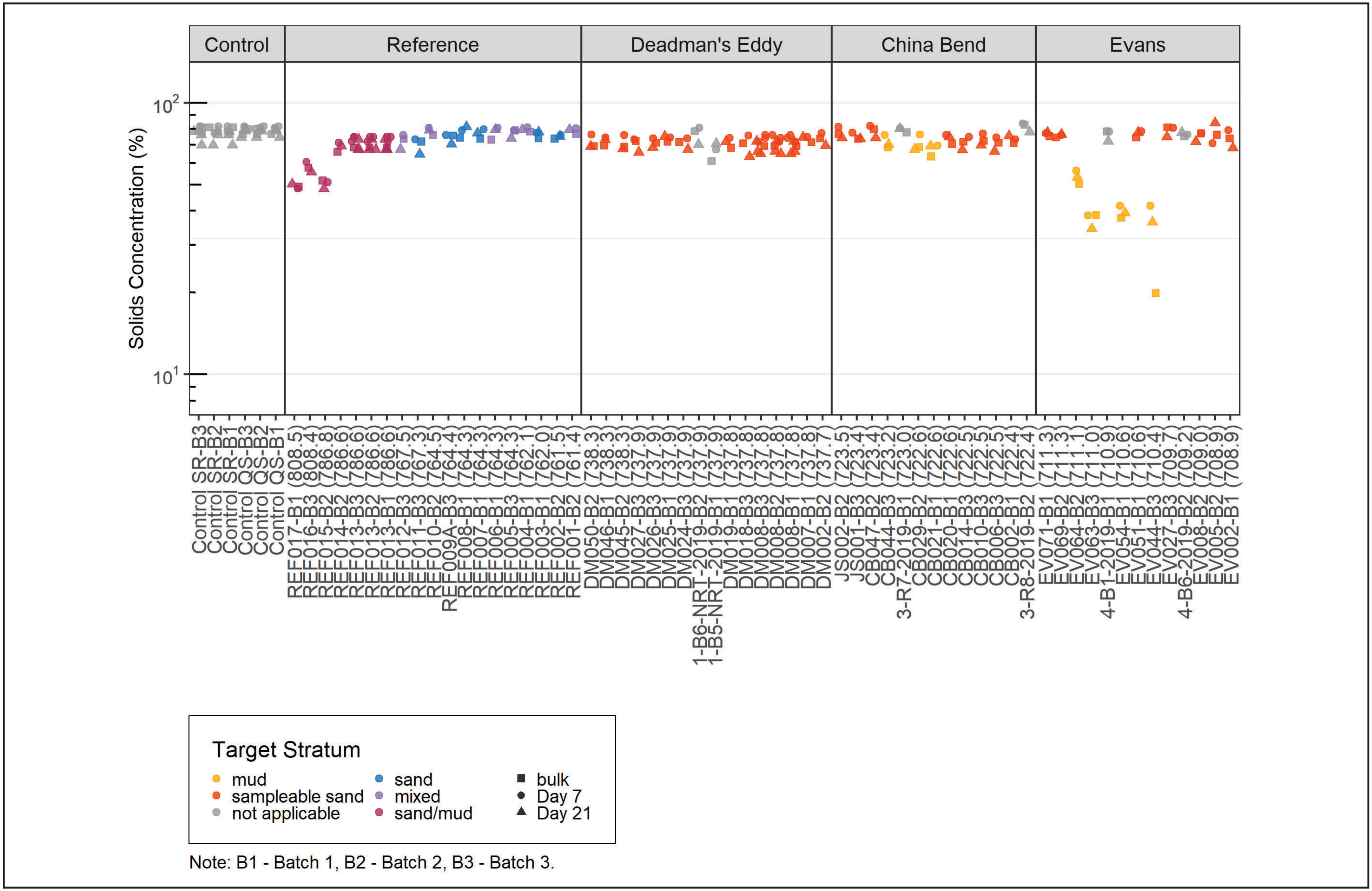
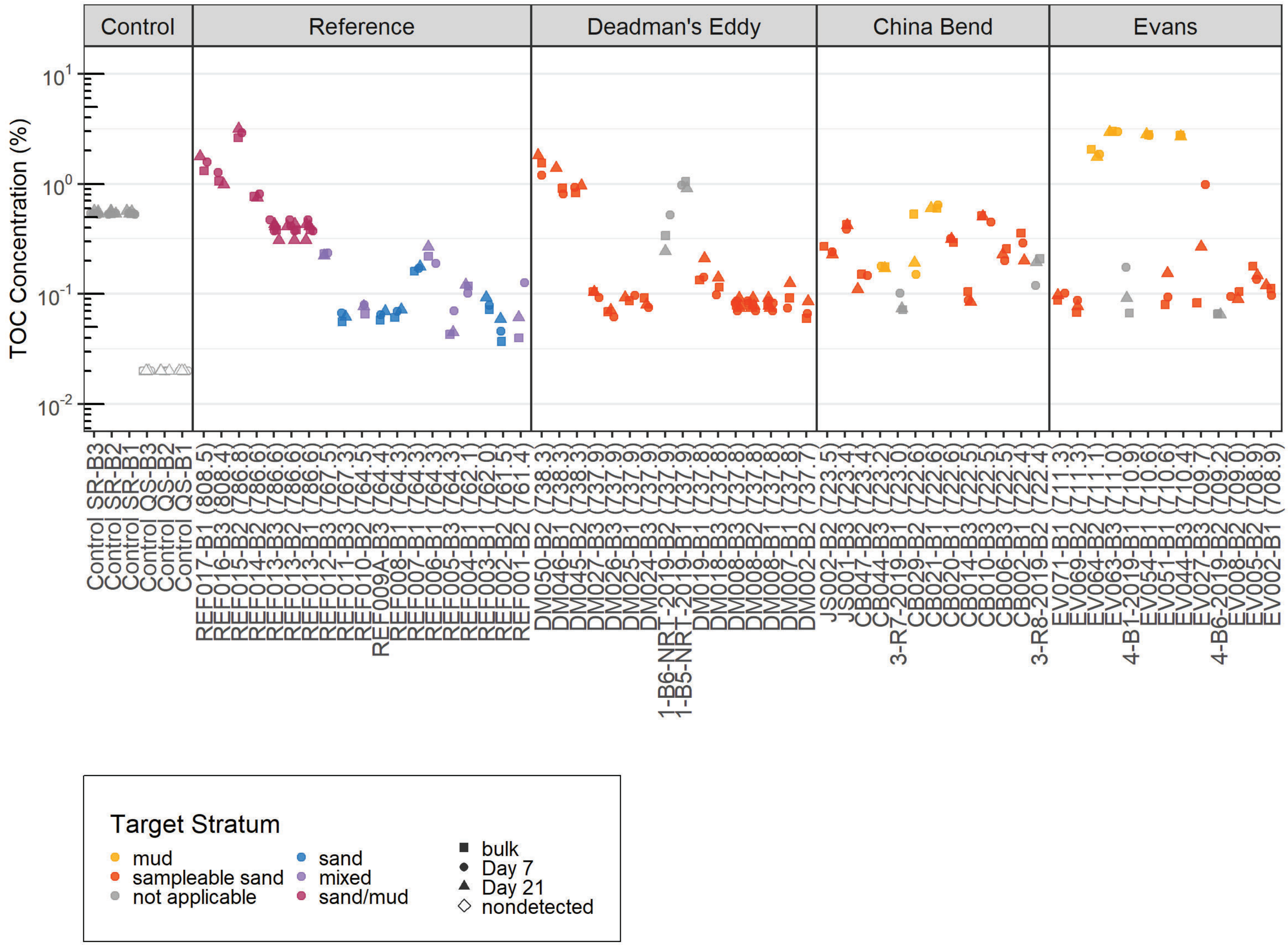
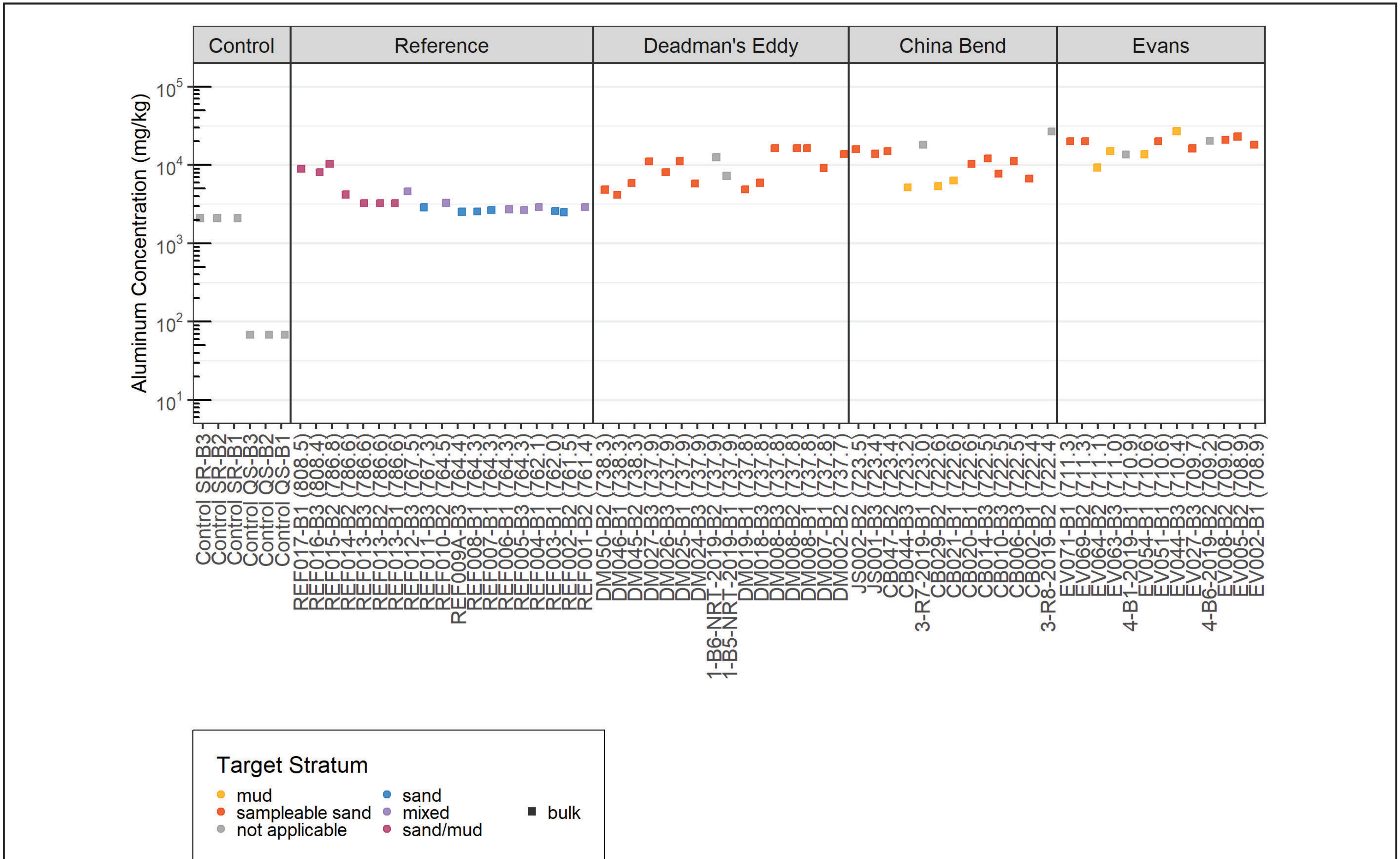


Figure 5-2a. Solids in Bioassay Sediment Samples



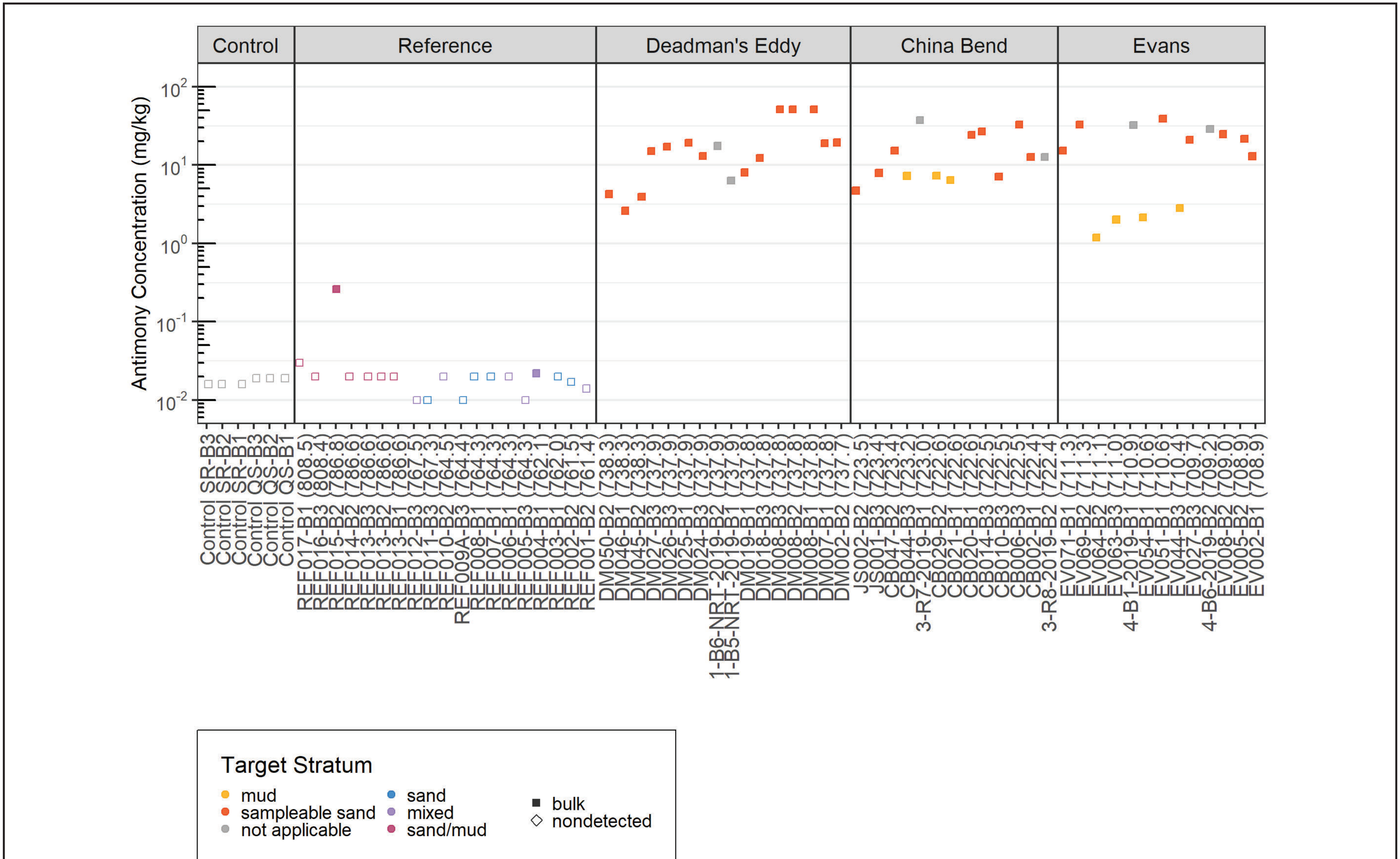
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2b. TOC in Bioassay Sediment Samples



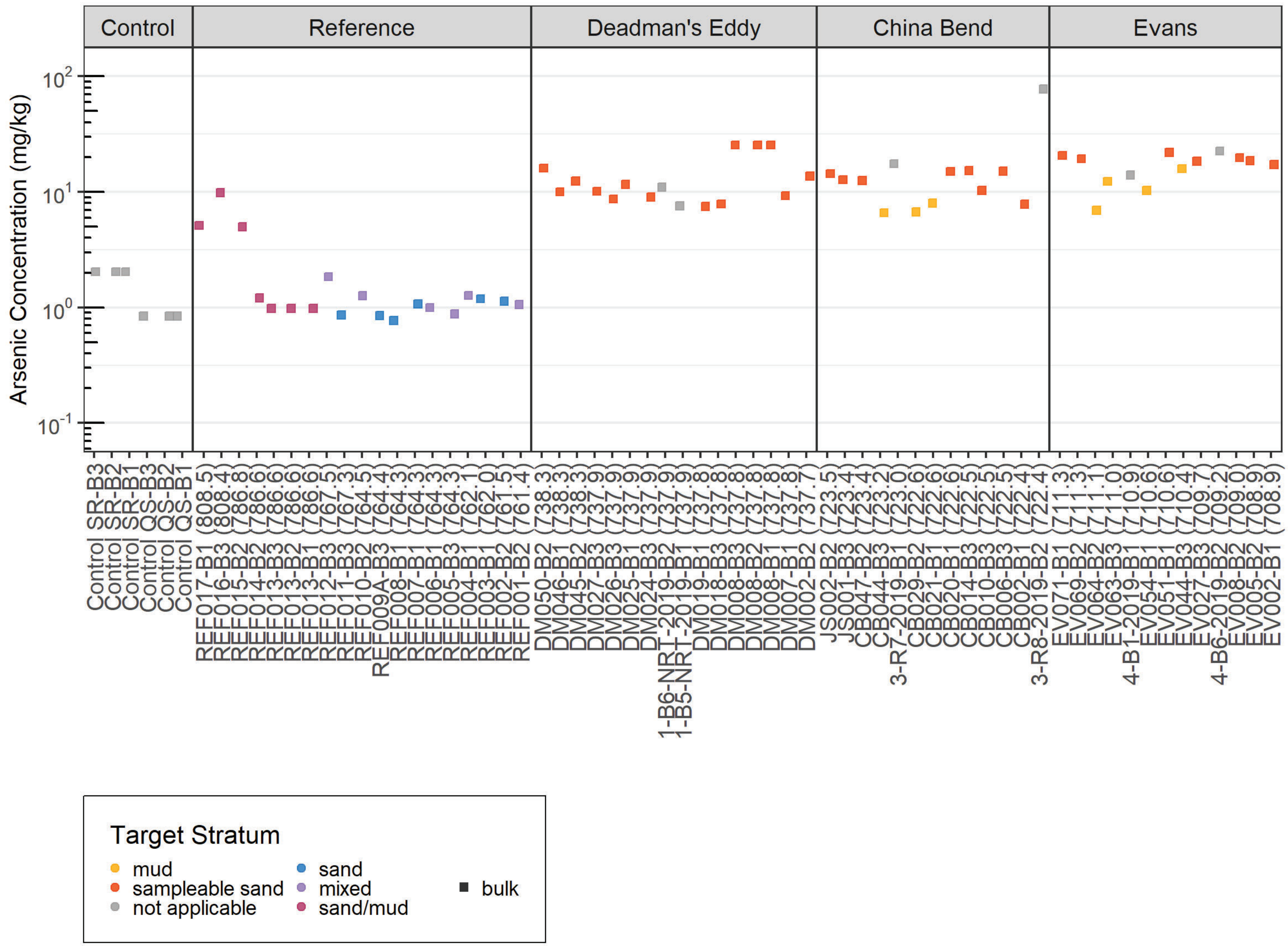
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2c. Aluminum in Bioassay Sediment Samples



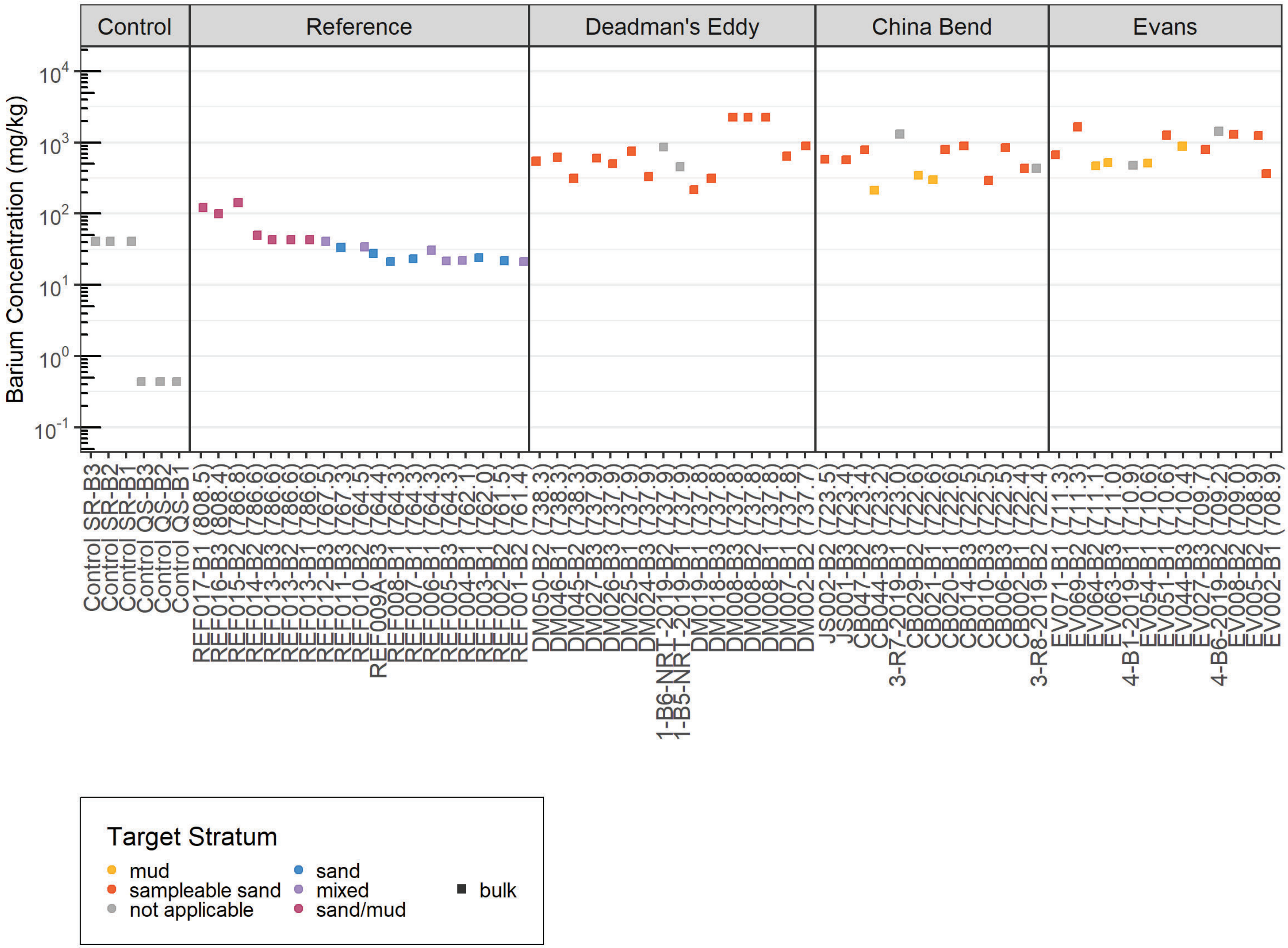
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2d. Antimony in Bioassay Sediment Samples



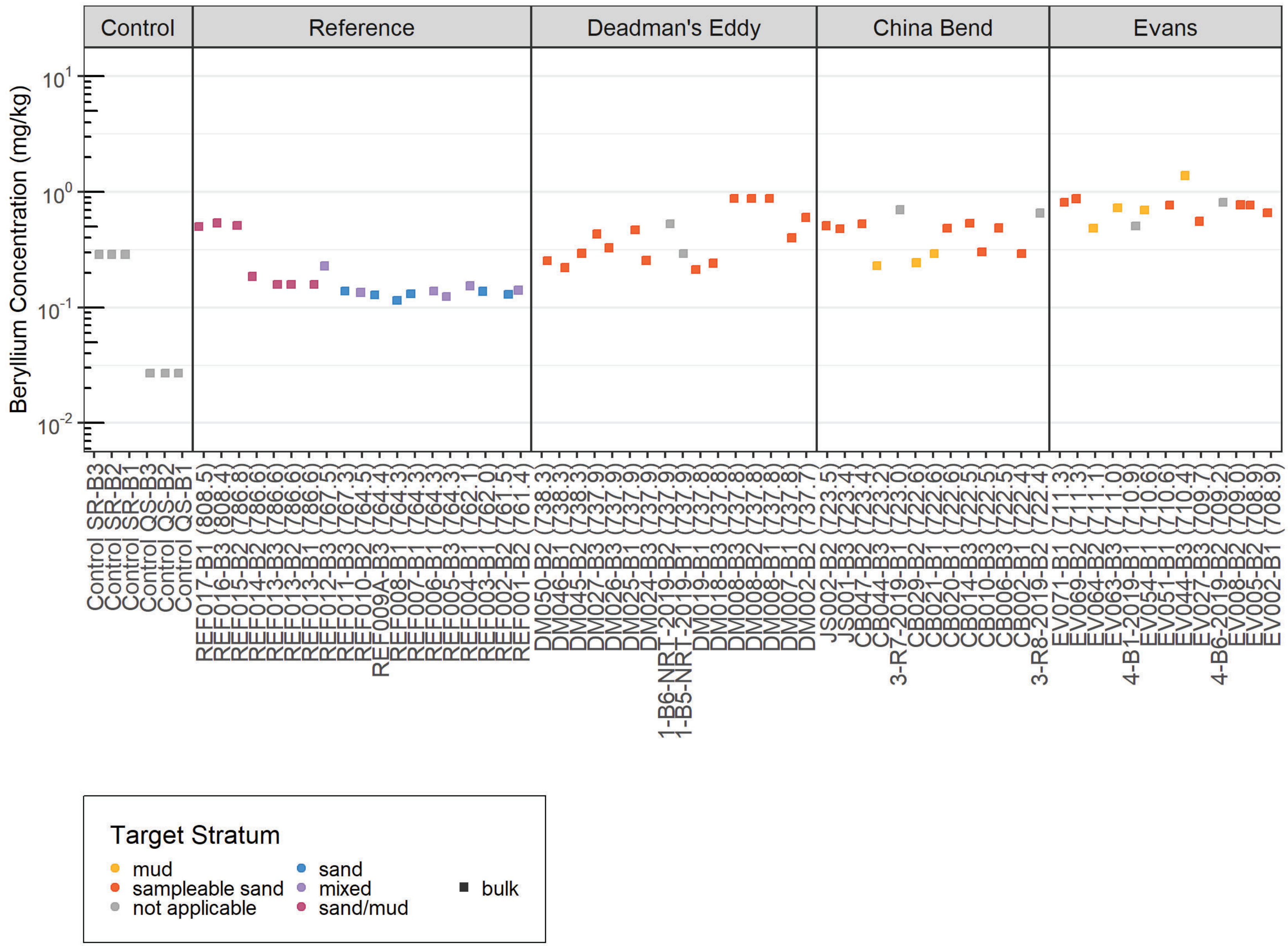
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2e. Arsenic in Bioassay Sediment Samples



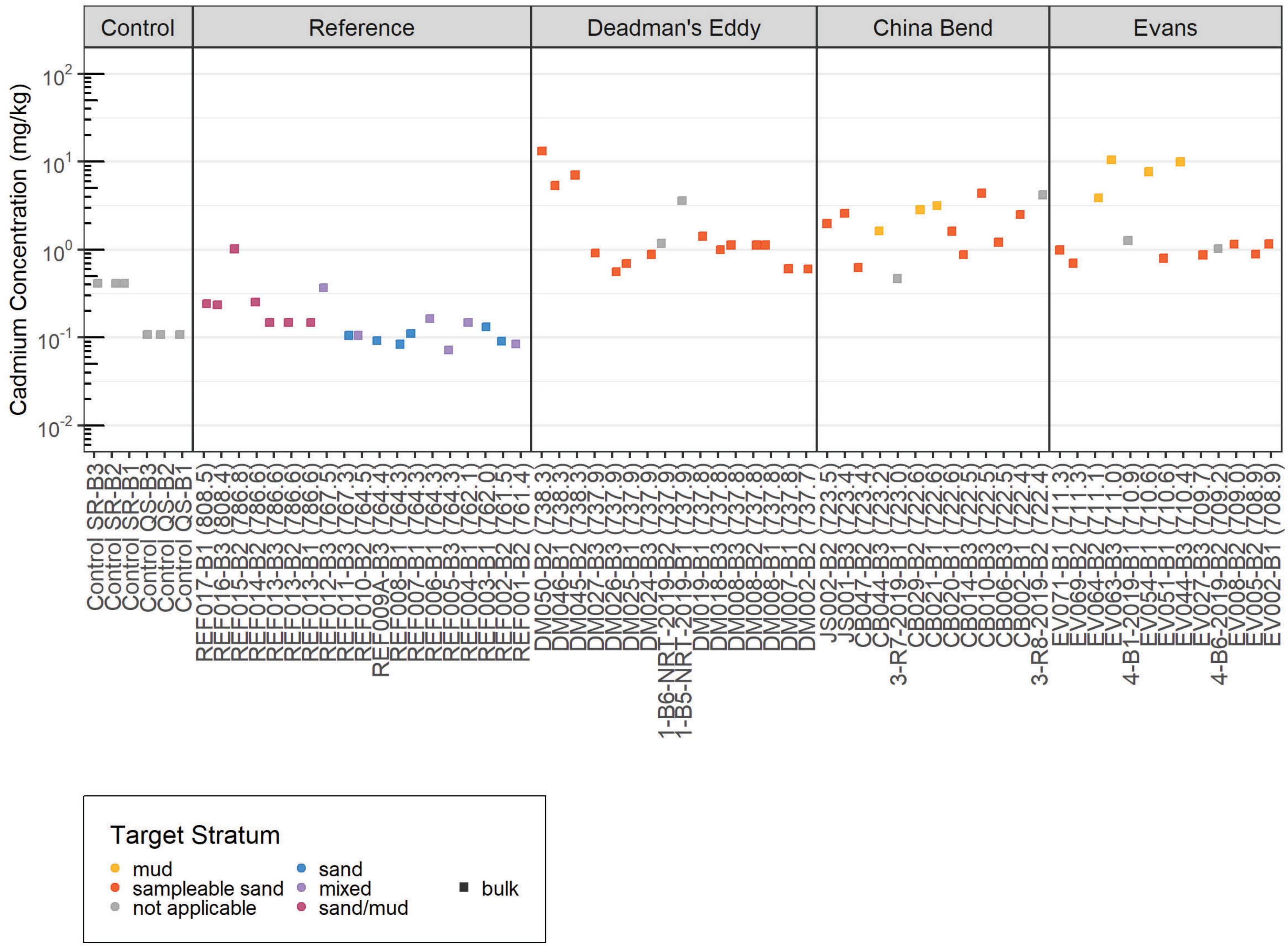
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2f. Barium in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2g. Beryllium in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2h. Cadmium in Bioassay Sediment Samples

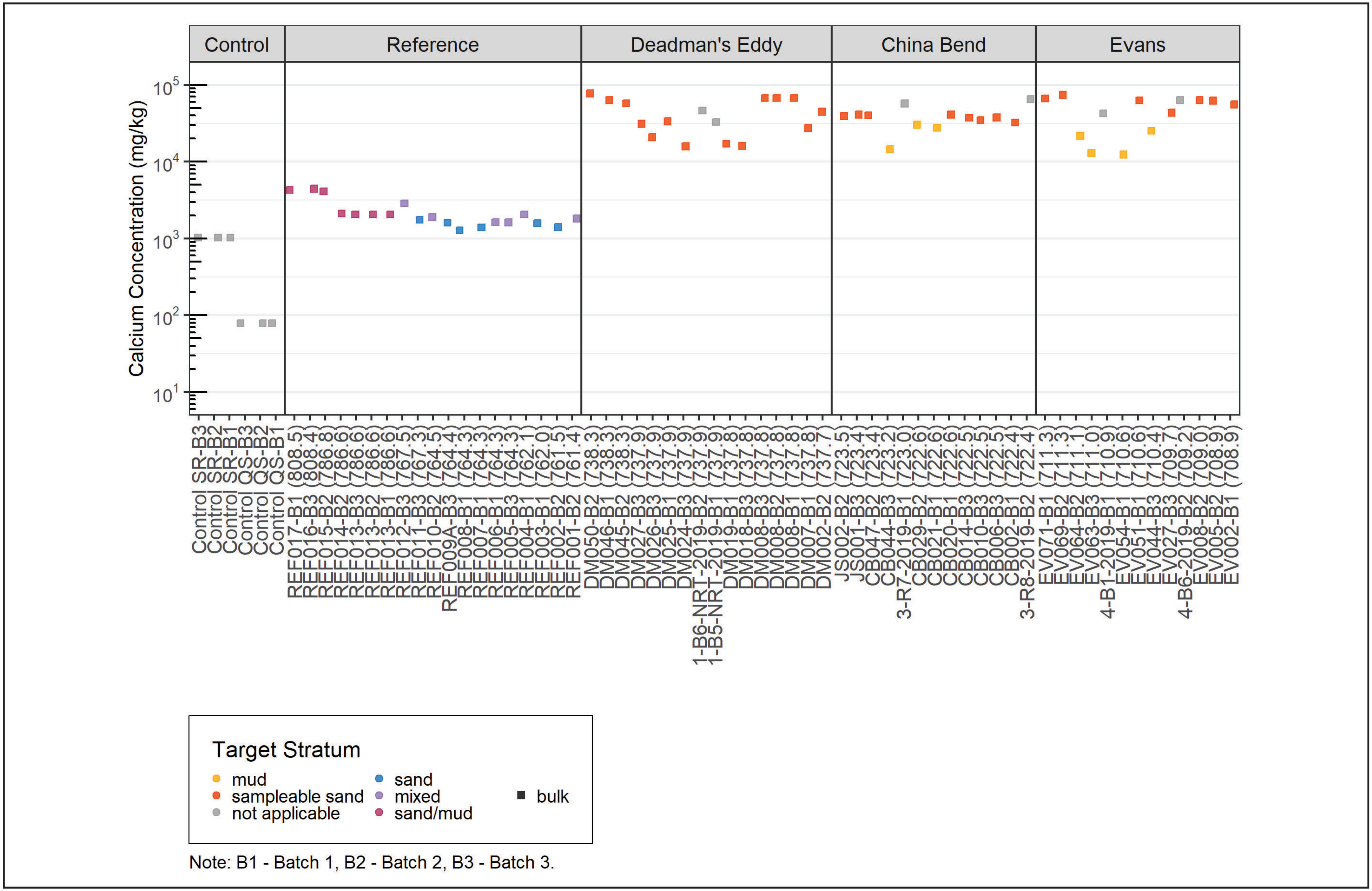


Figure 5-2i. Calcium in Bioassay Sediment Samples

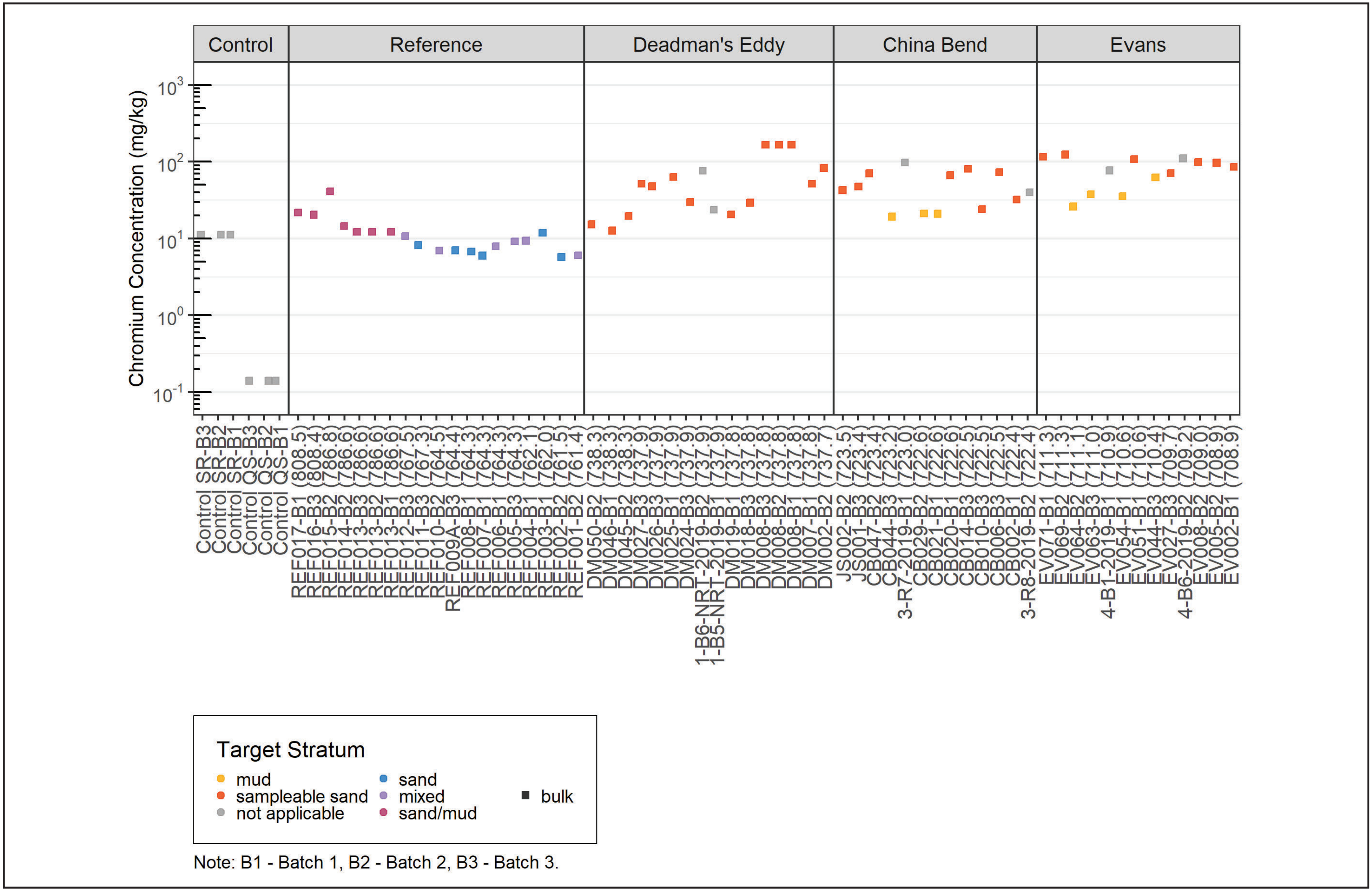
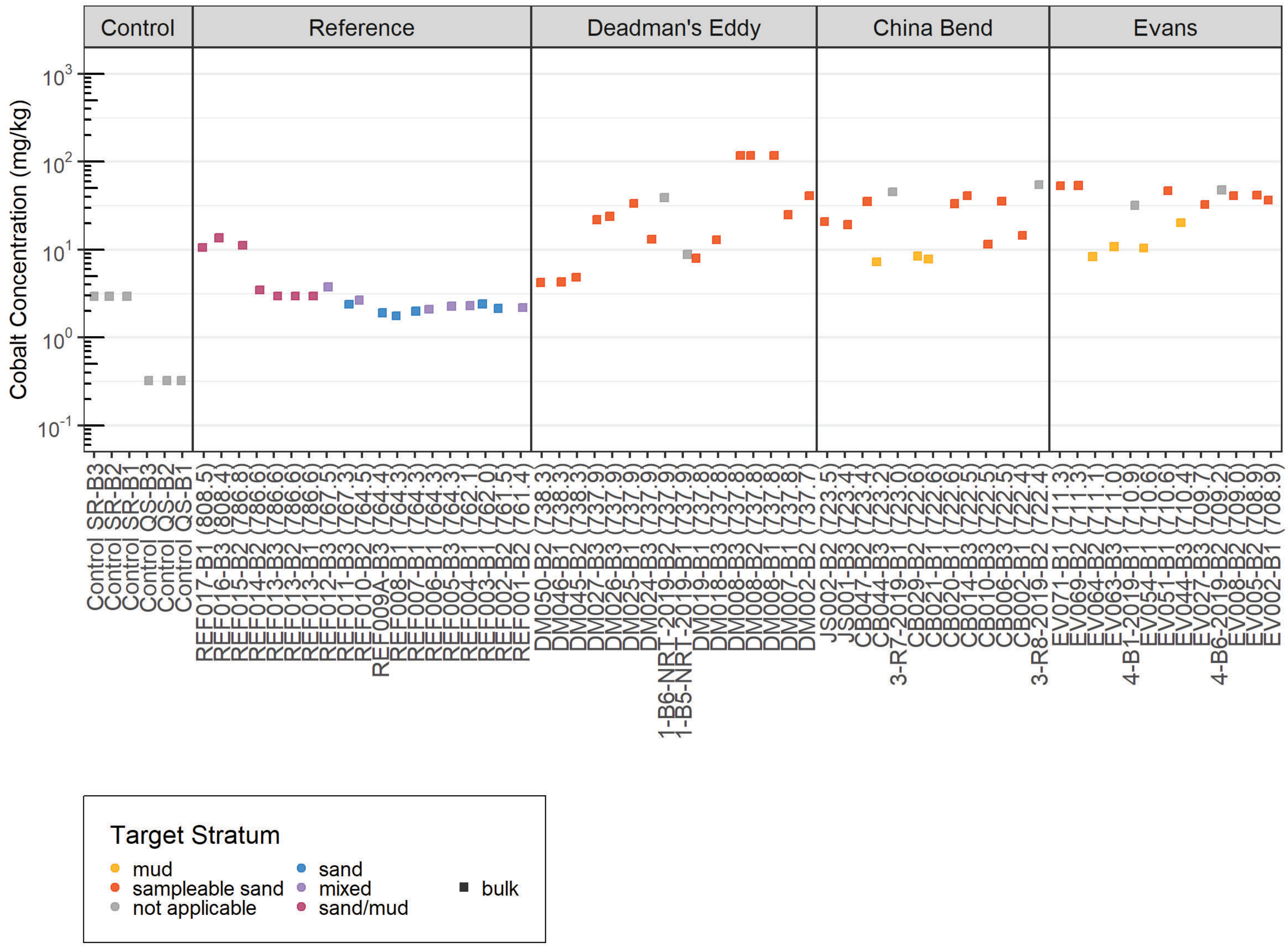


Figure 5-2j. Chromium in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2k. Cobalt in Bioassay Sediment Samples

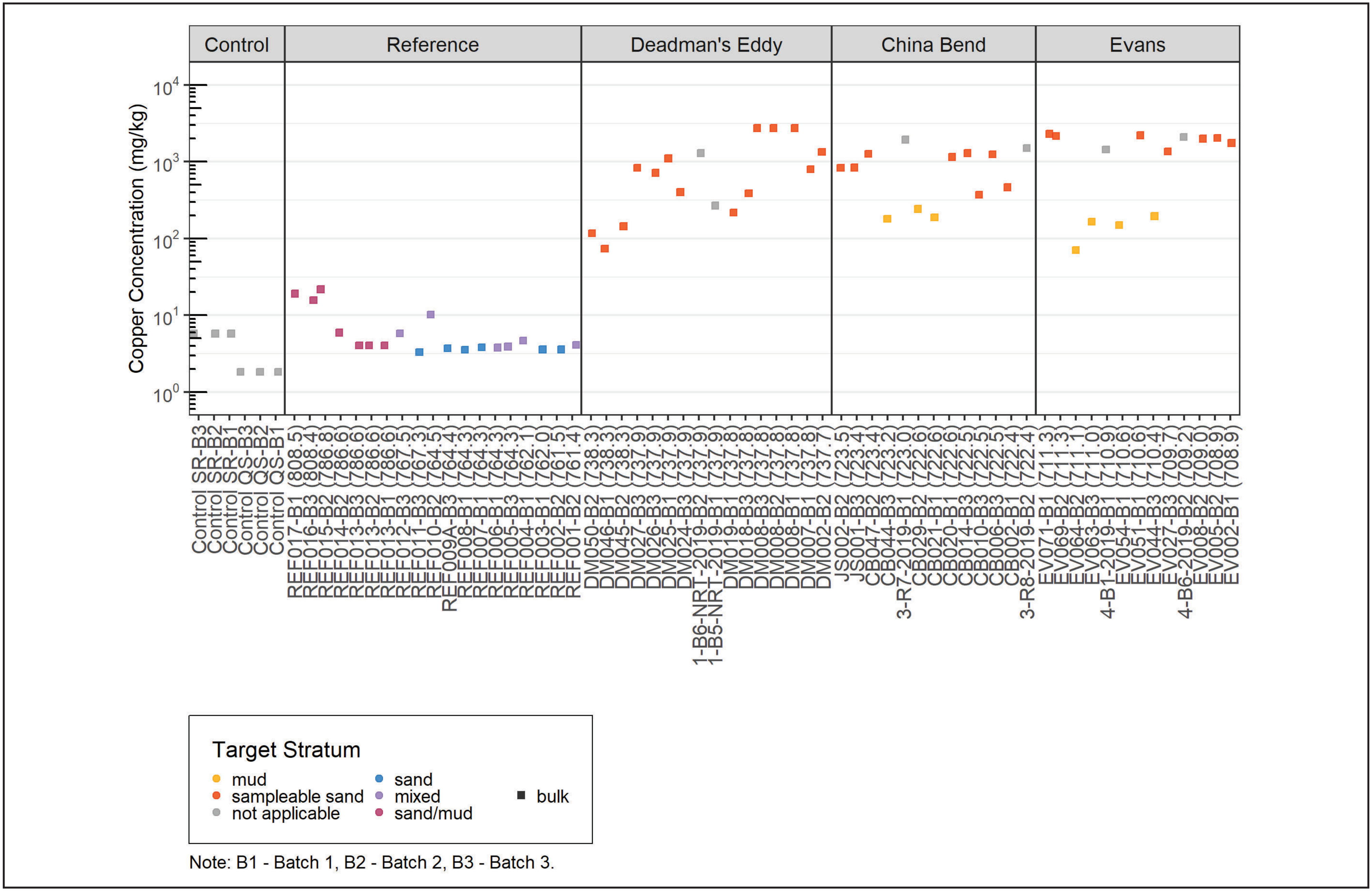
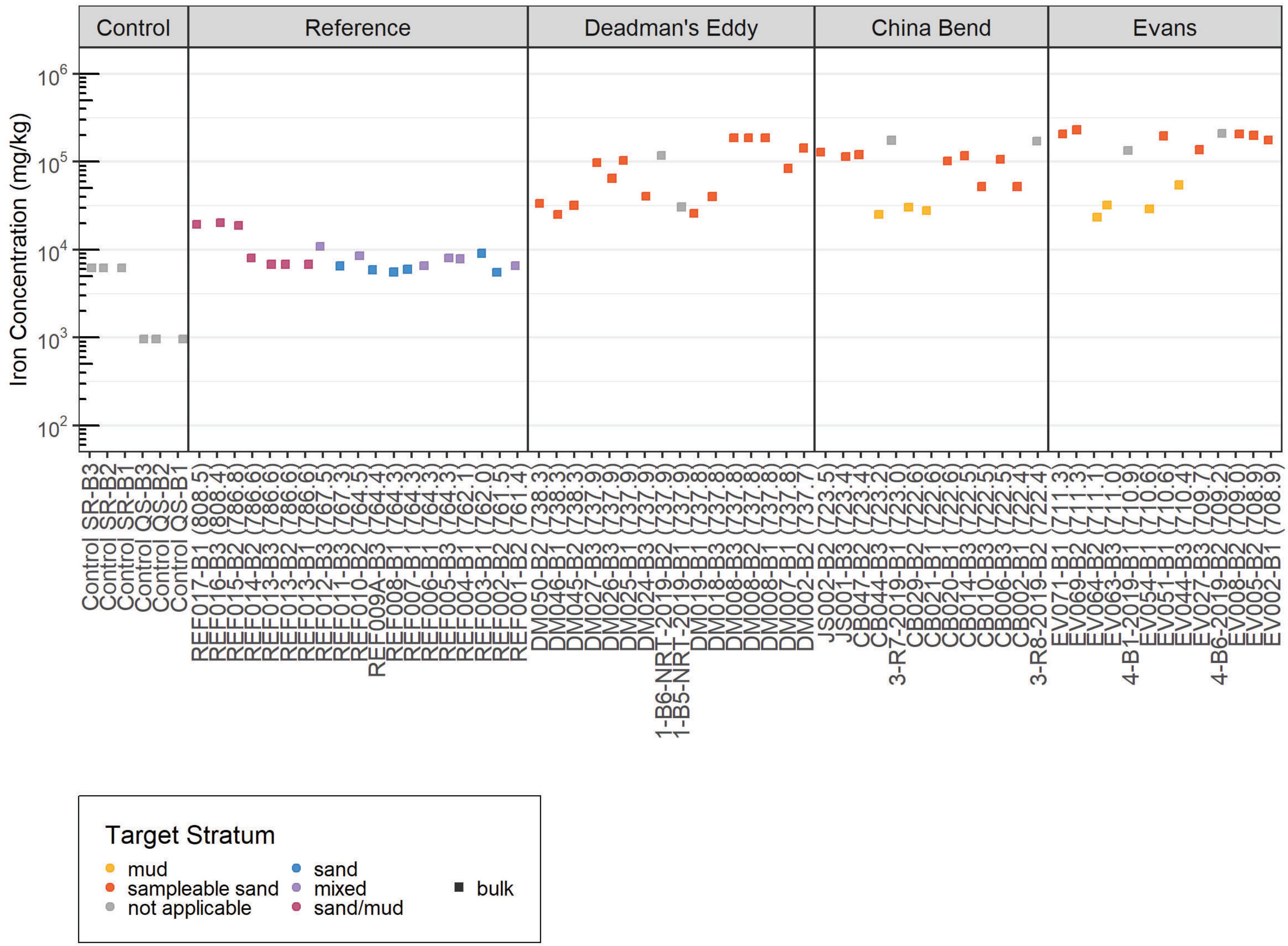


Figure 5-2l. Copper in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2m. Iron in Bioassay Sediment Samples

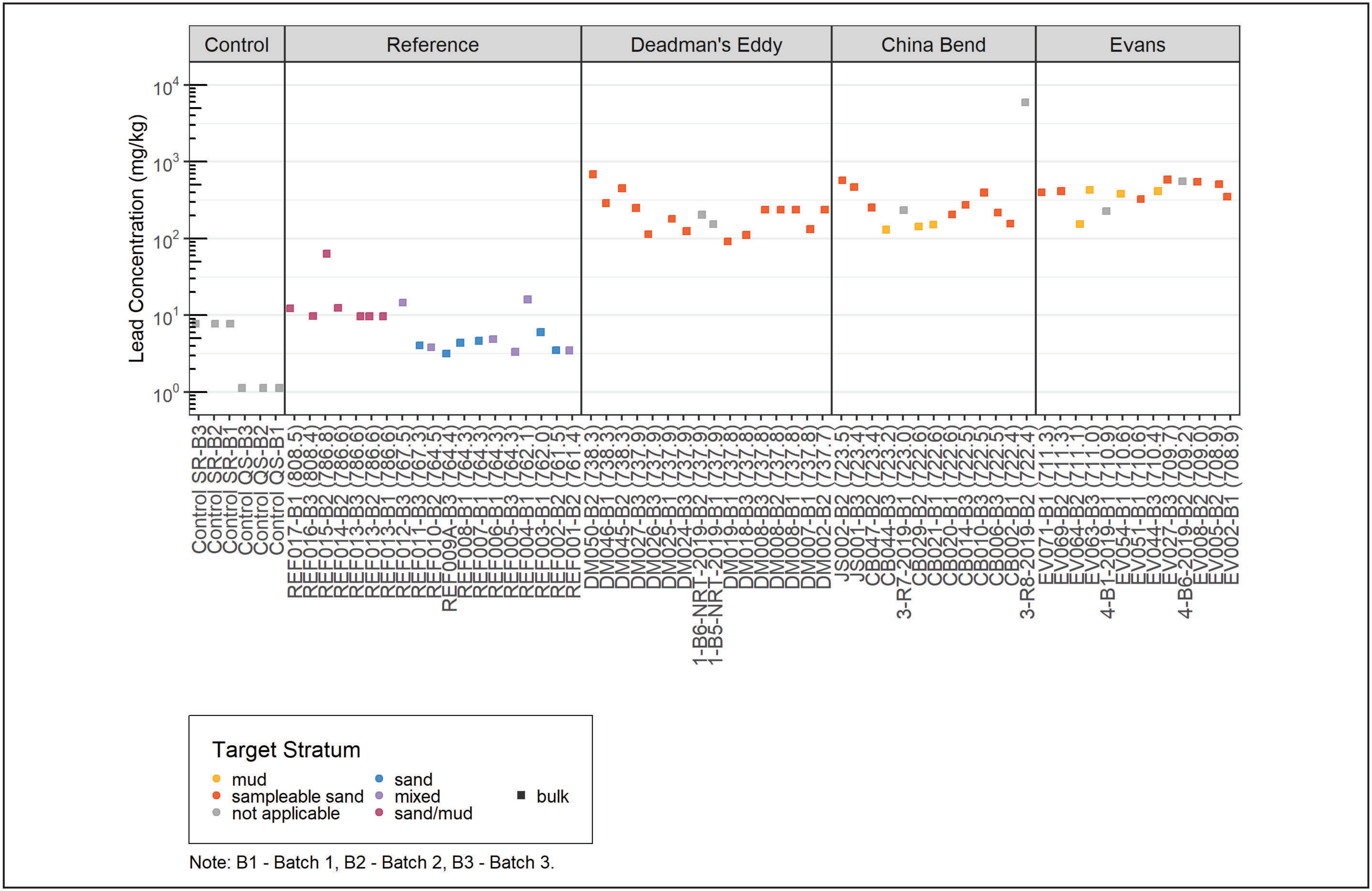


Figure 5-2n. Lead in Bioassay Sediment Samples

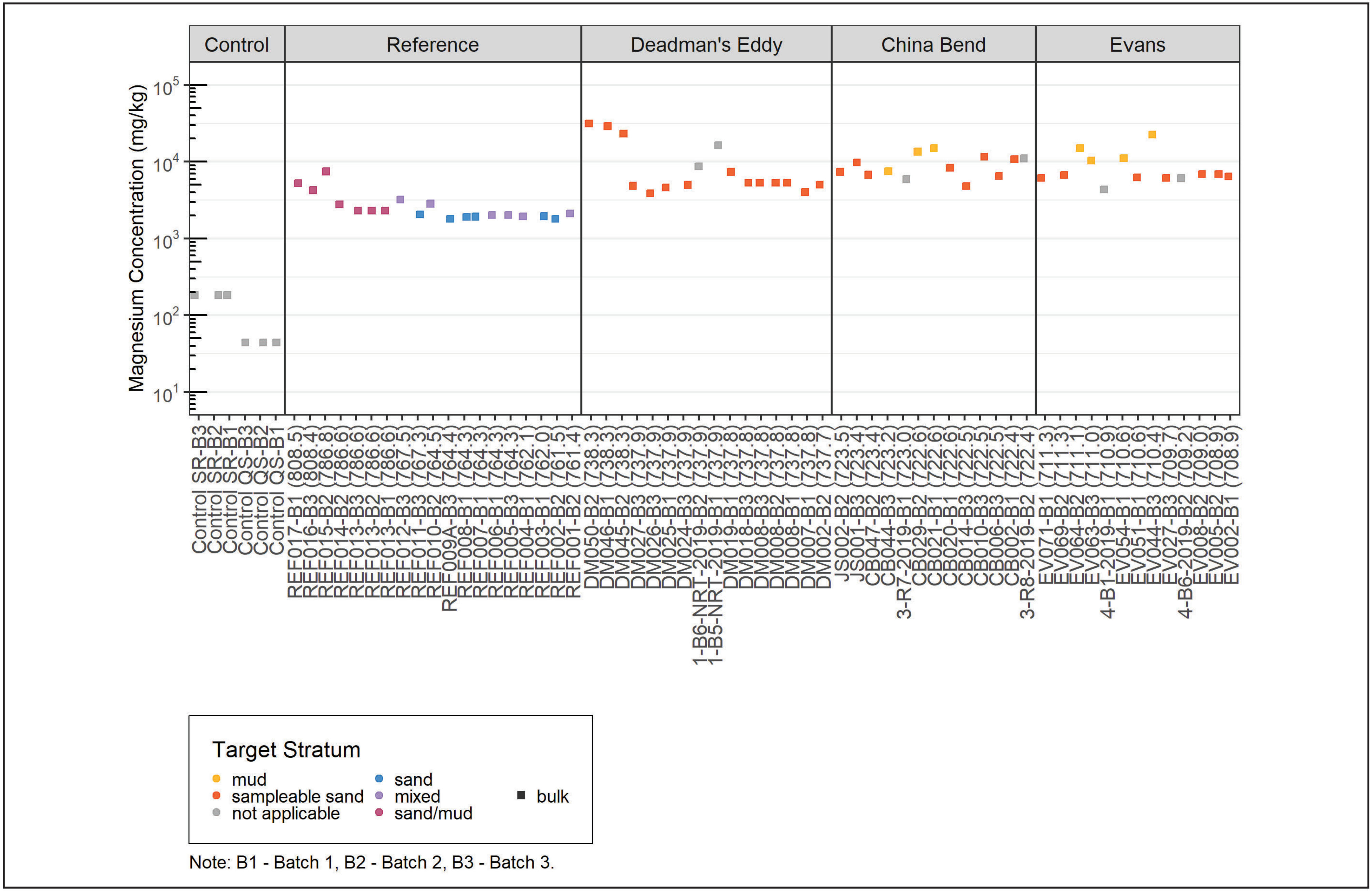
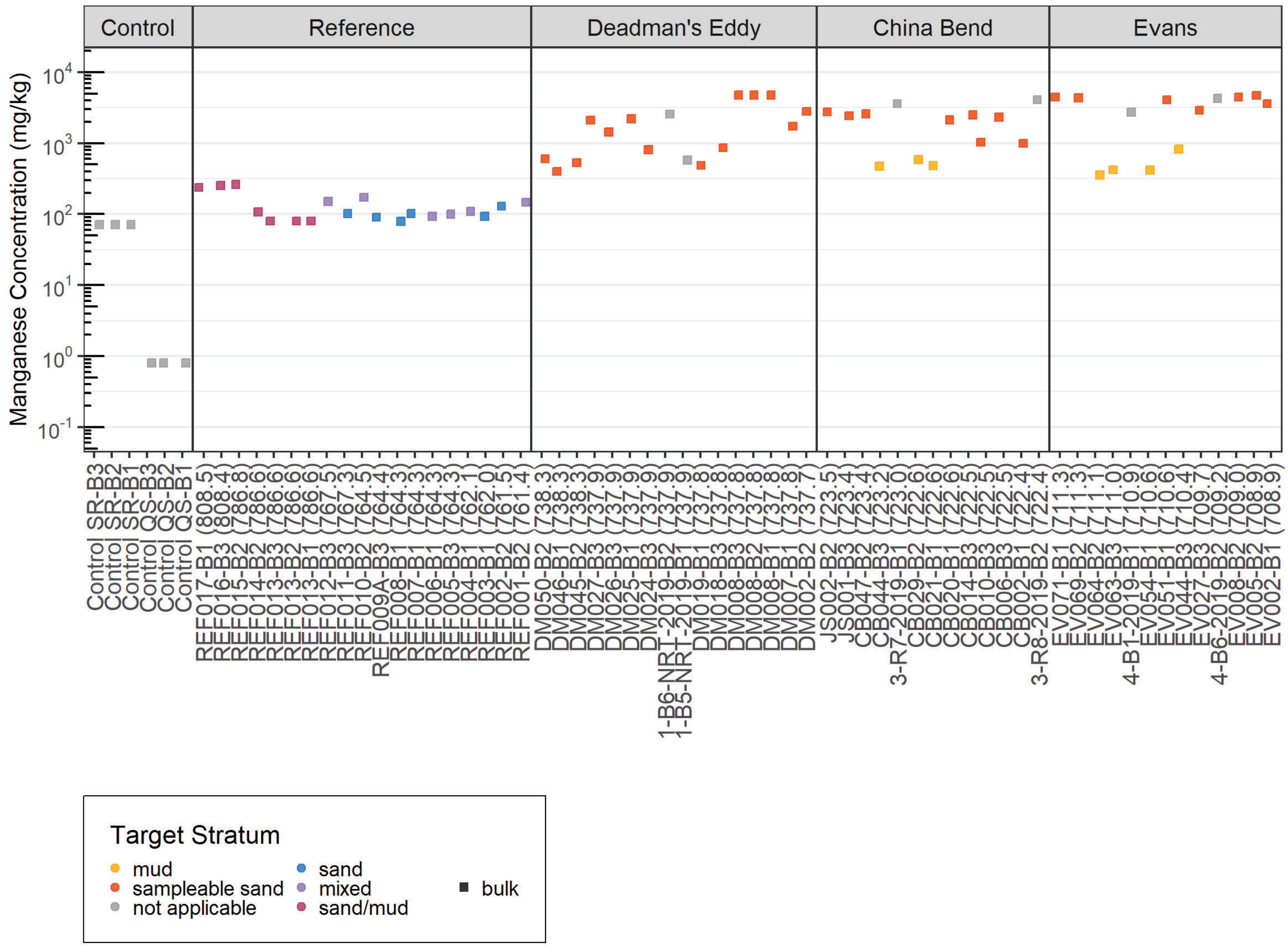
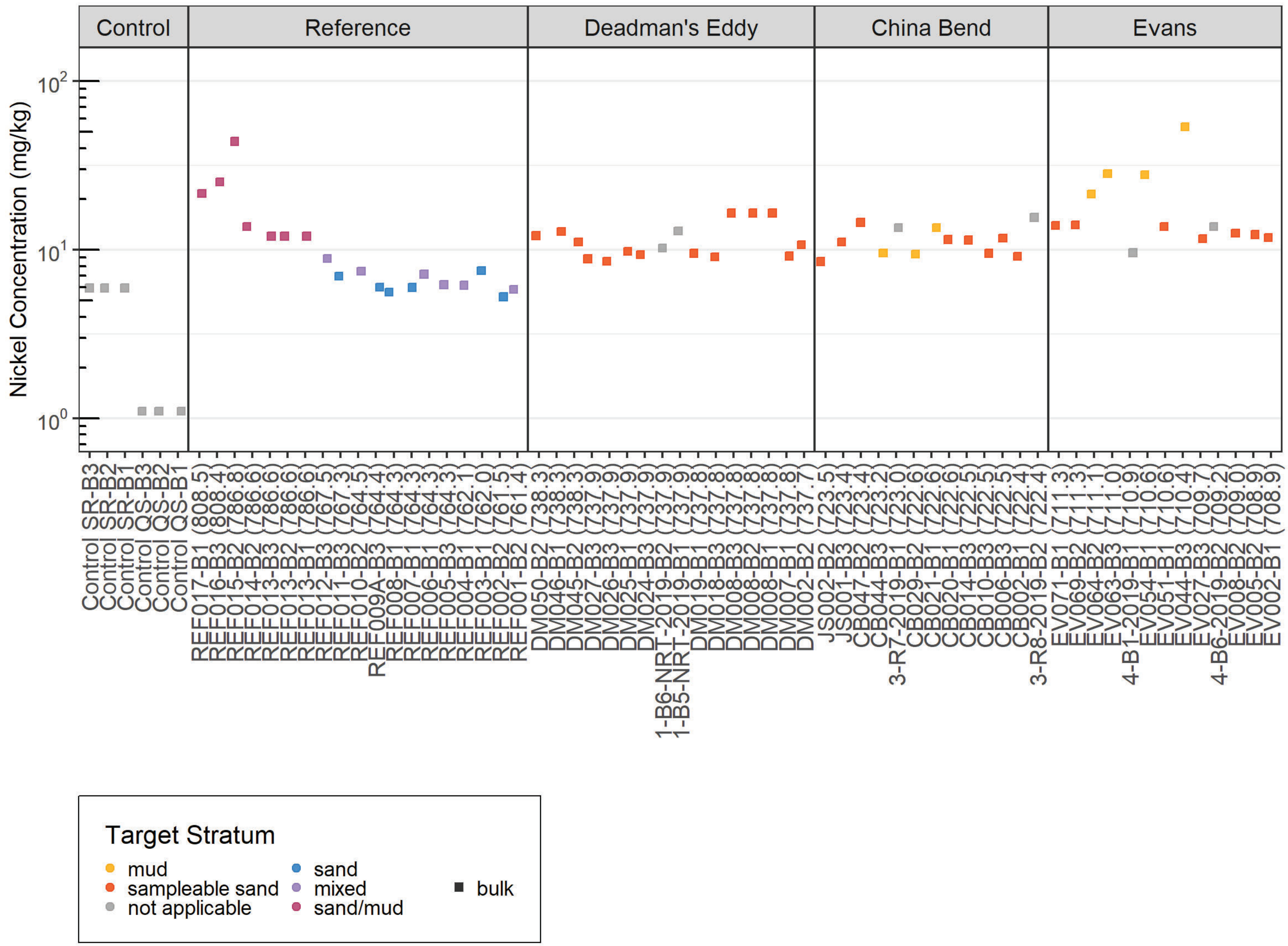


Figure 5-2o. Magnesium in Bioassay Sediment Samples



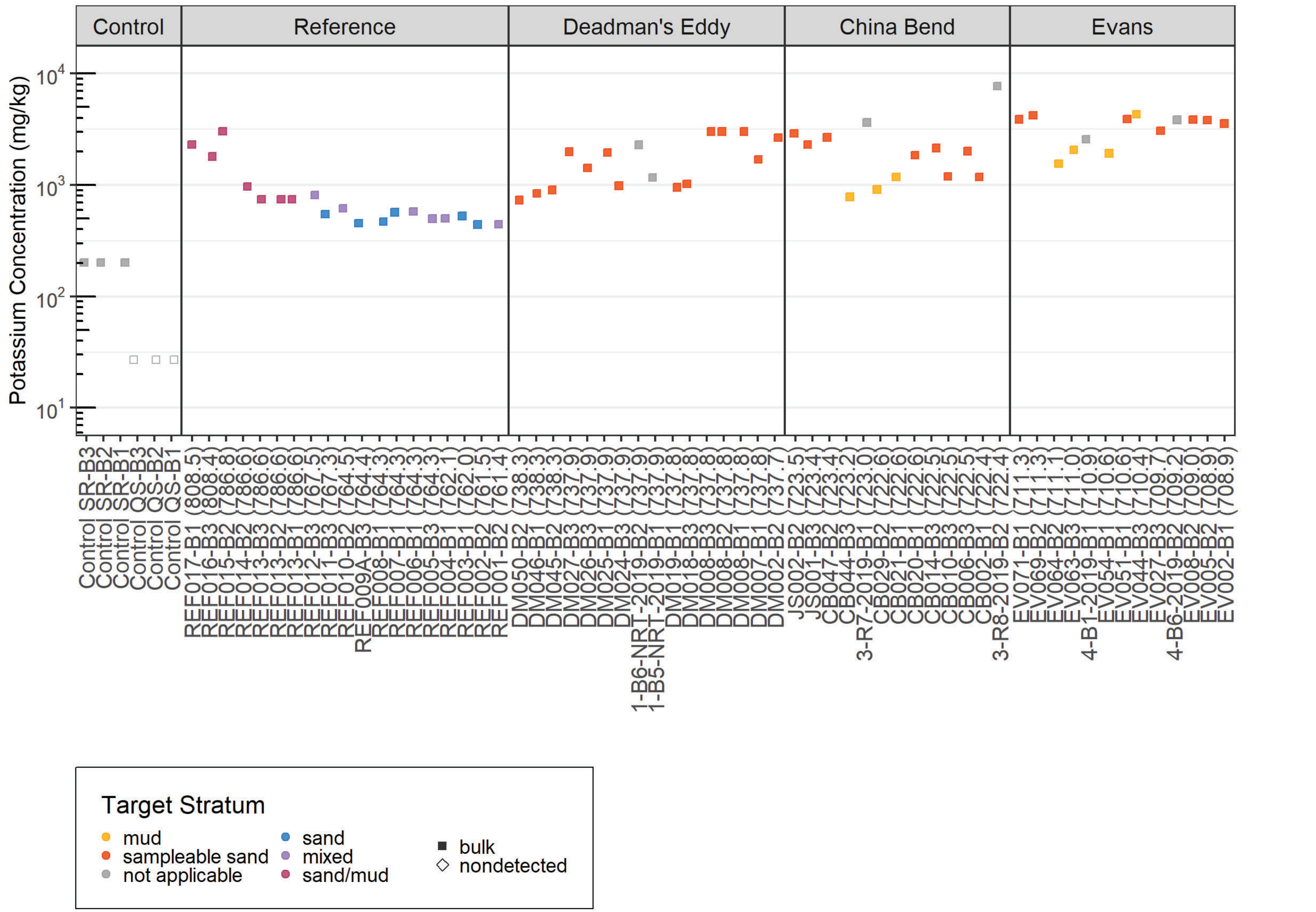
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2p. Manganese in Bioassay Sediment Samples



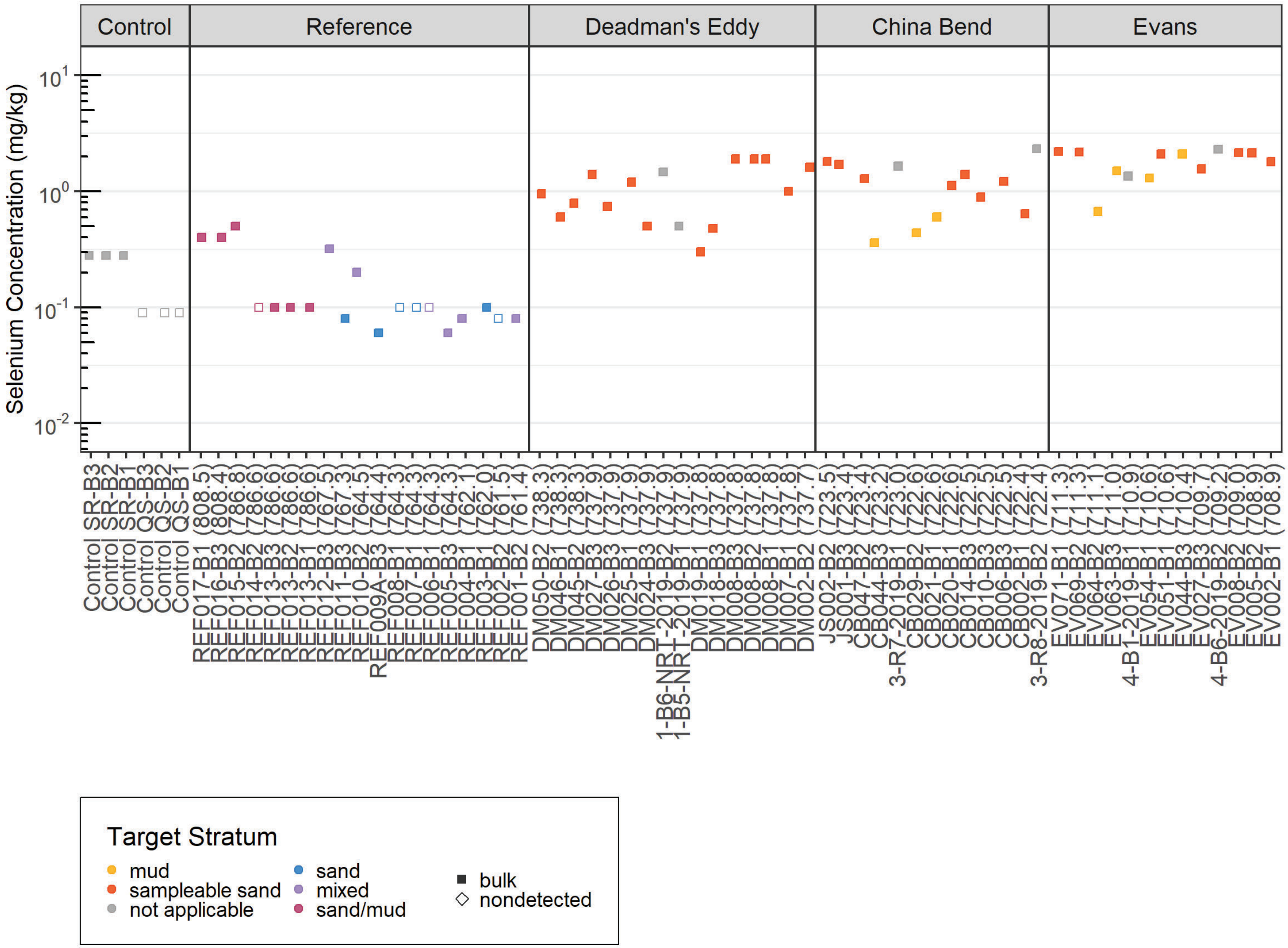
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2q. Nickel in Bioassay Sediment Samples



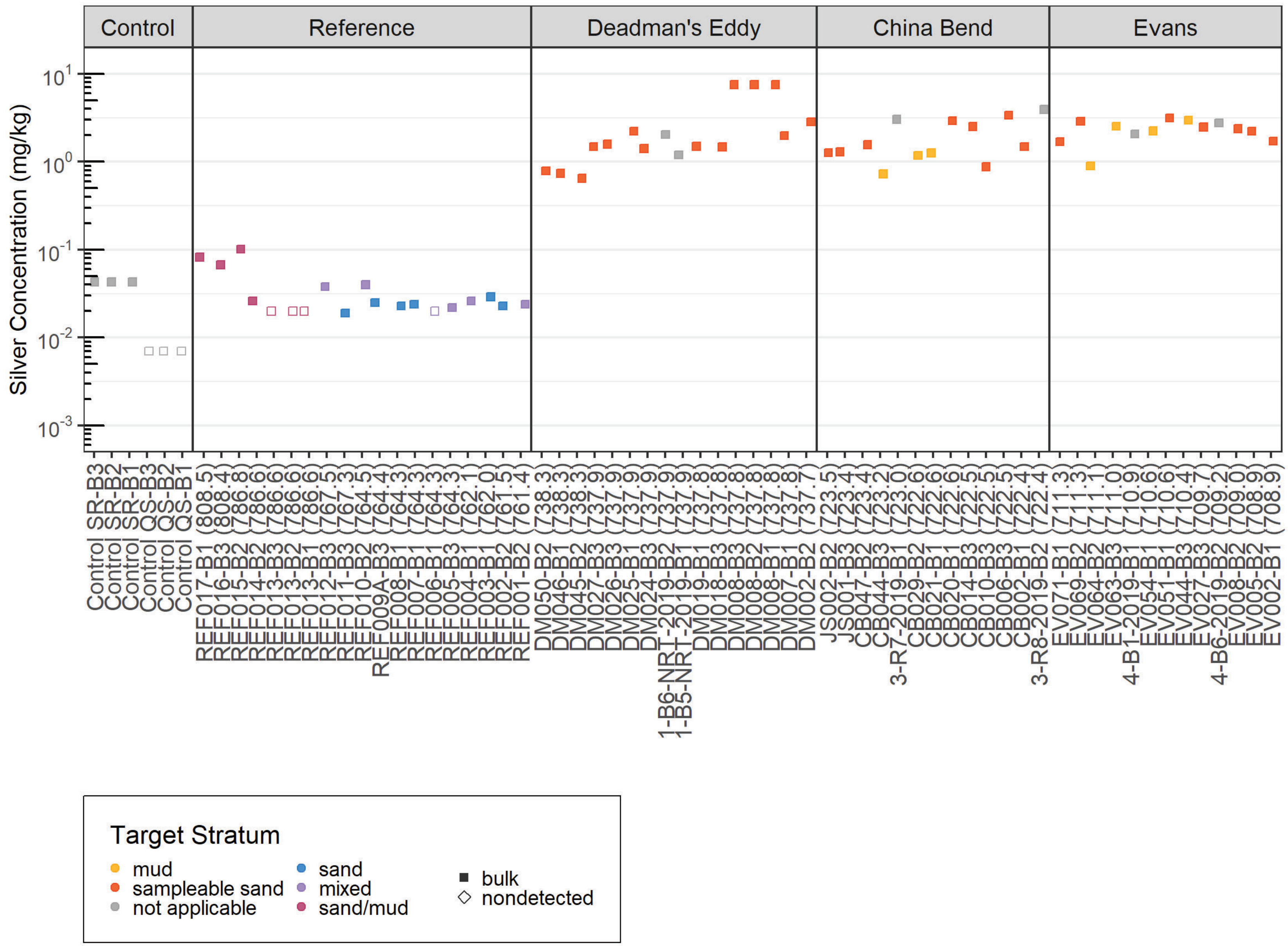
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2r. Potassium in Bioassay Sediment Samples



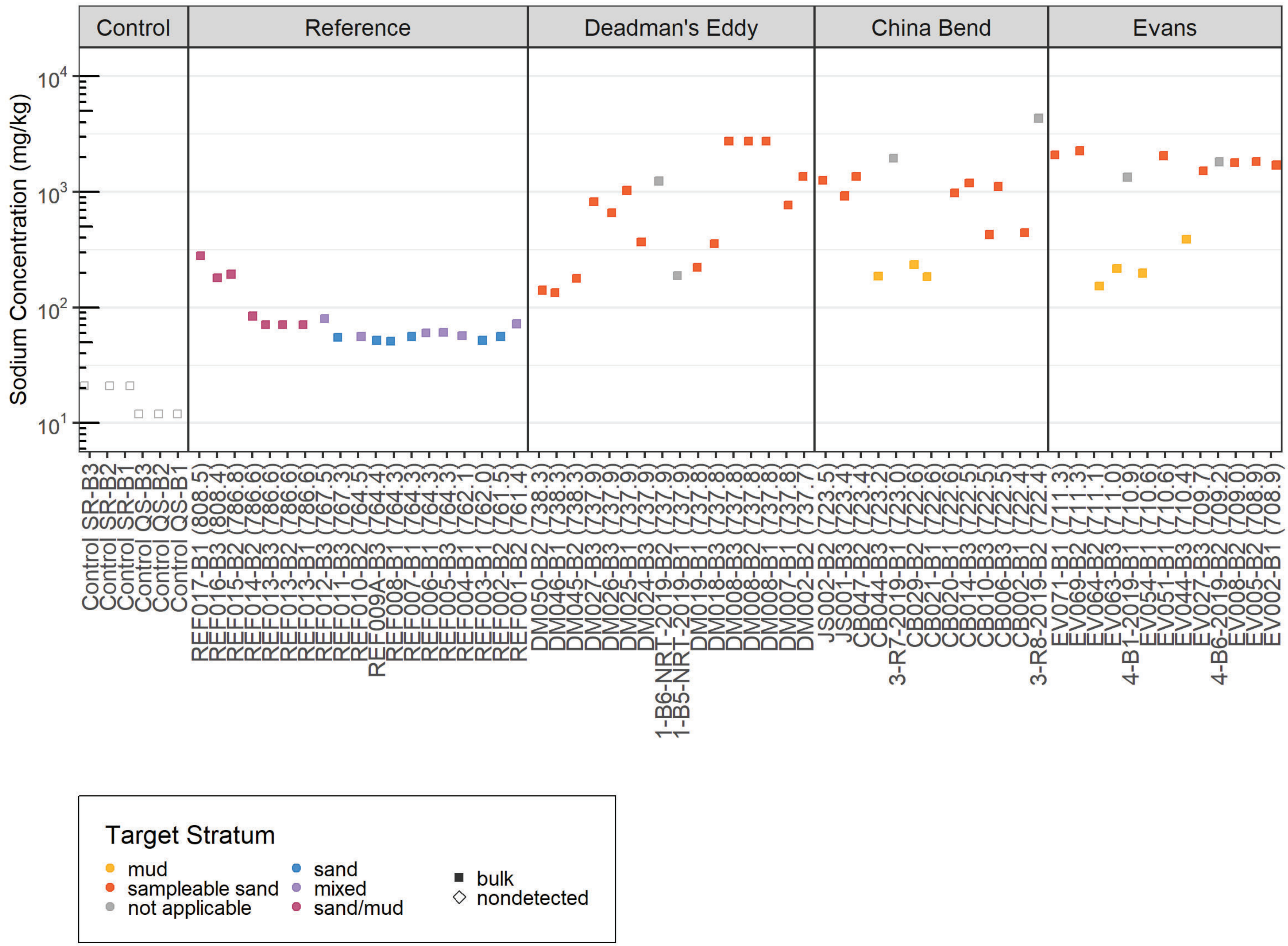
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2s. Selenium in Bioassay Sediment Samples



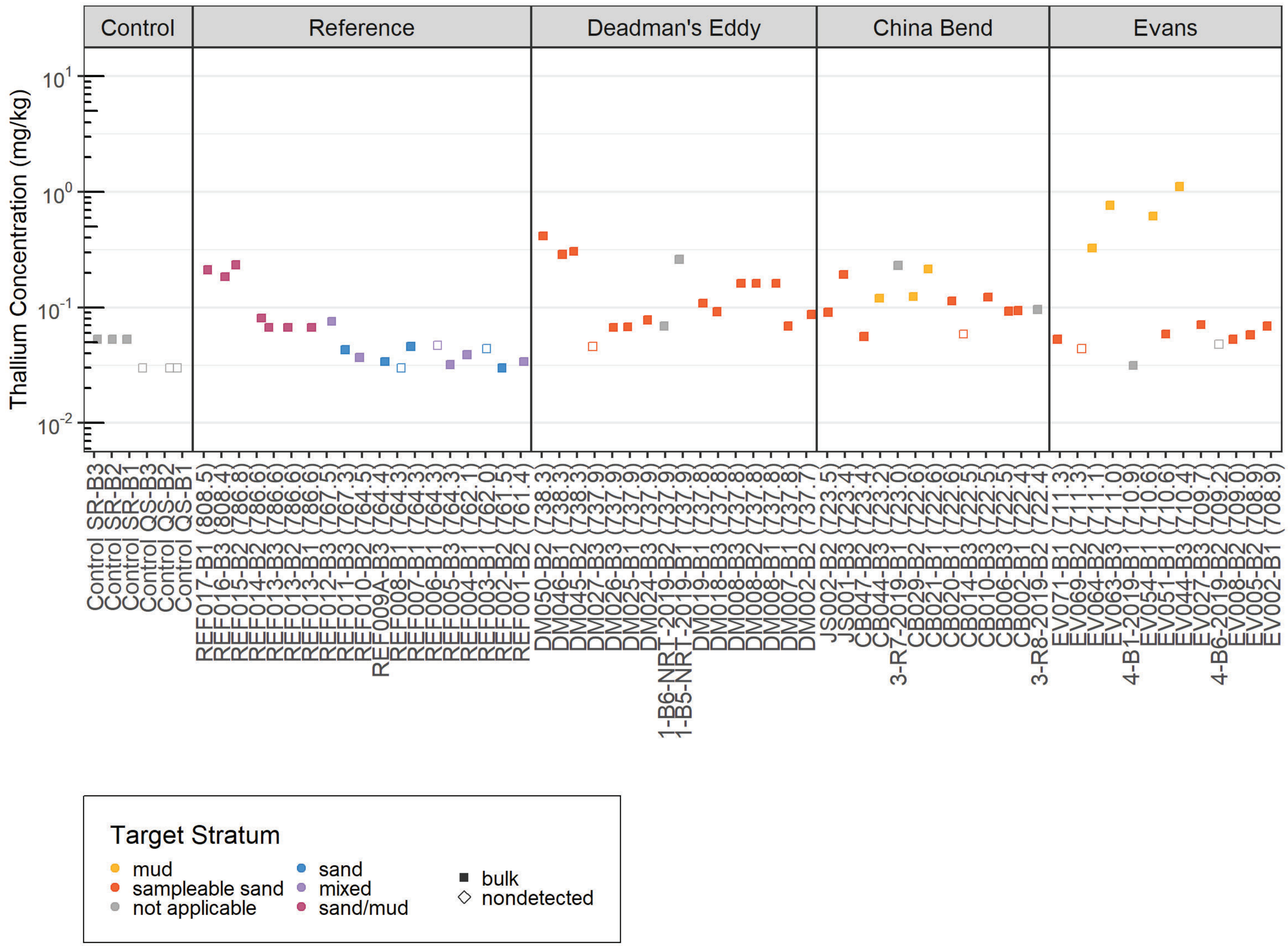
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2t. Silver in Bioassay Sediment Samples



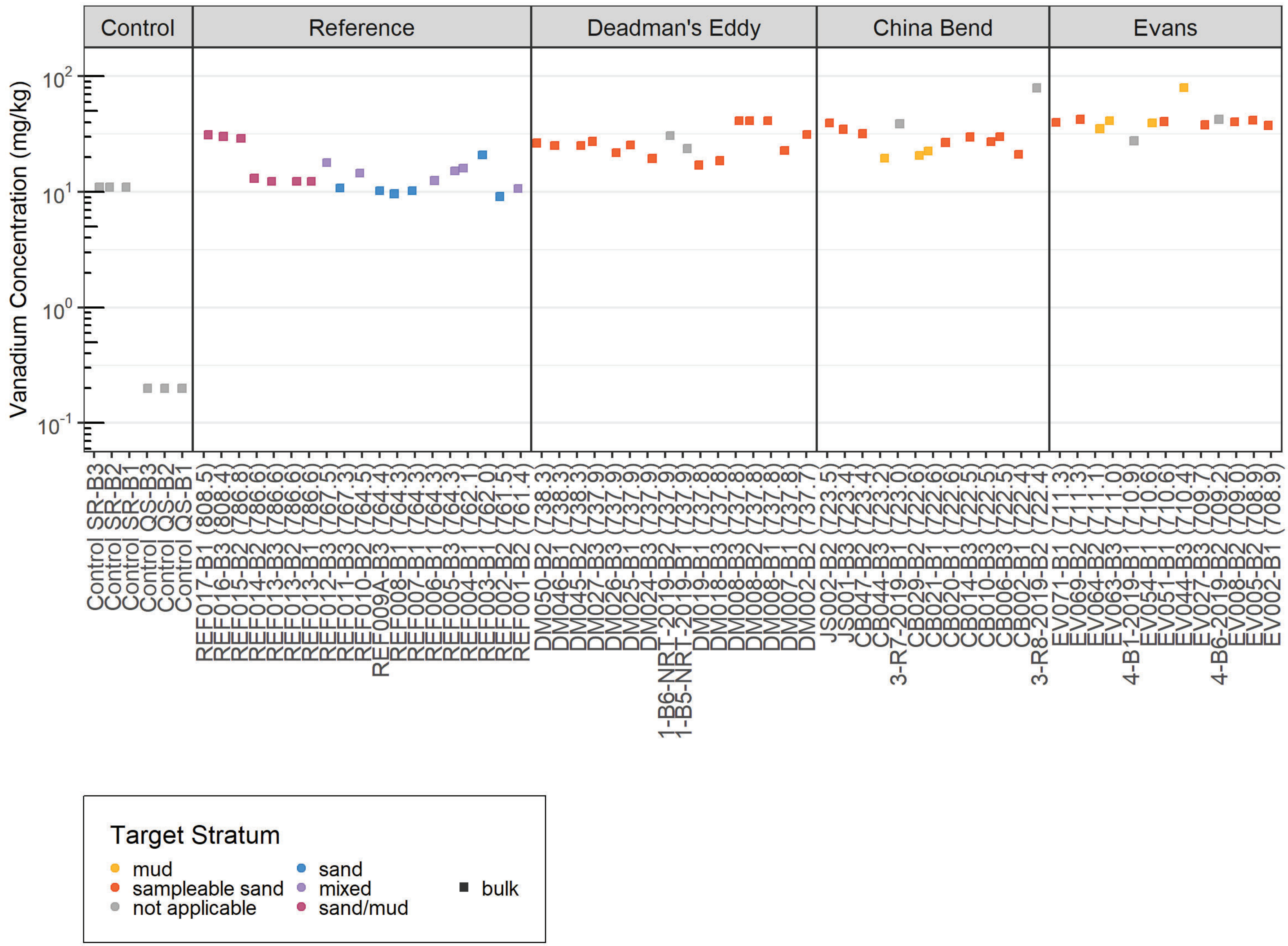
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2u. Sodium in Bioassay Sediment Samples



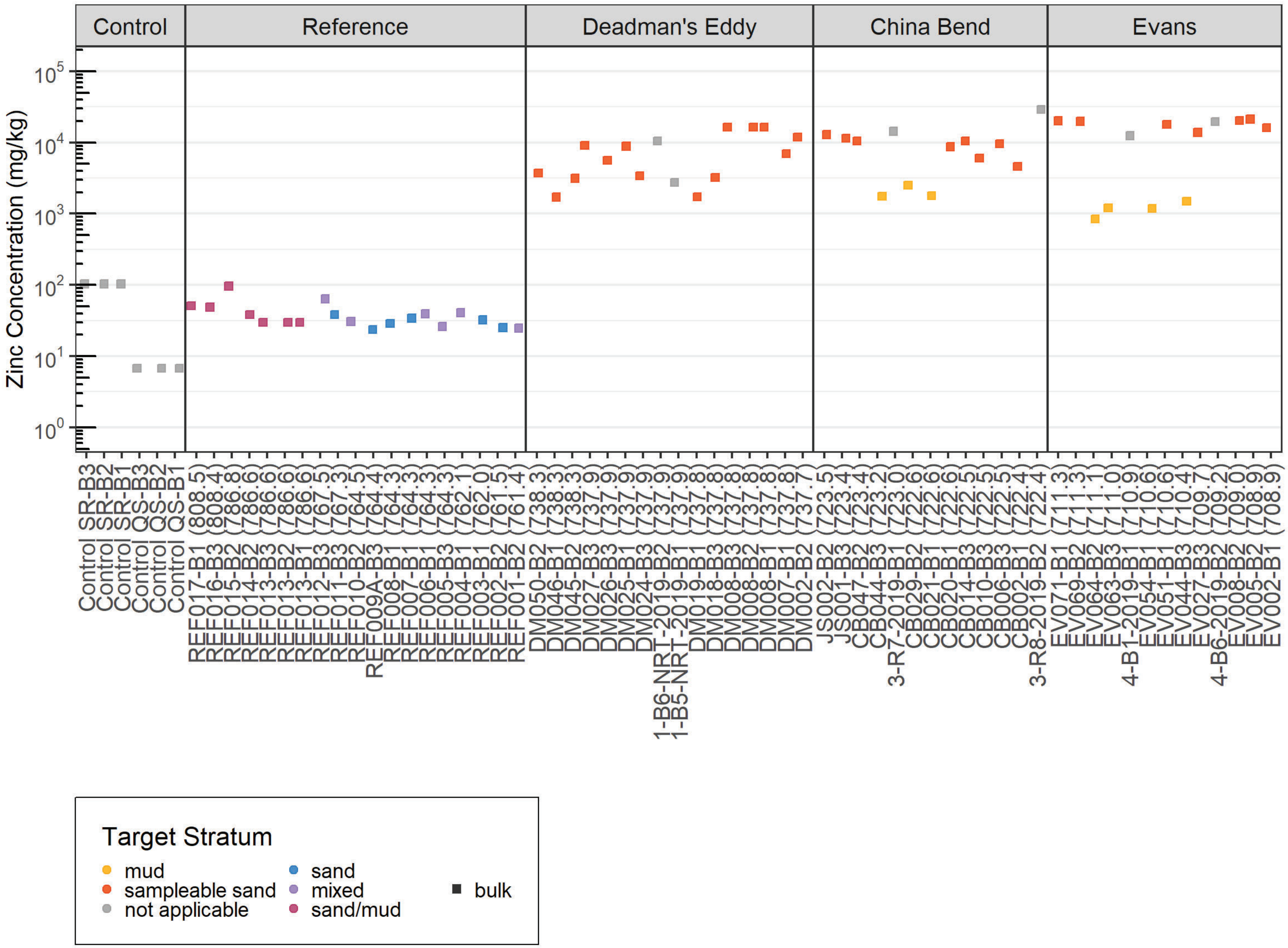
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2v. Thallium in Bioassay Sediment Samples



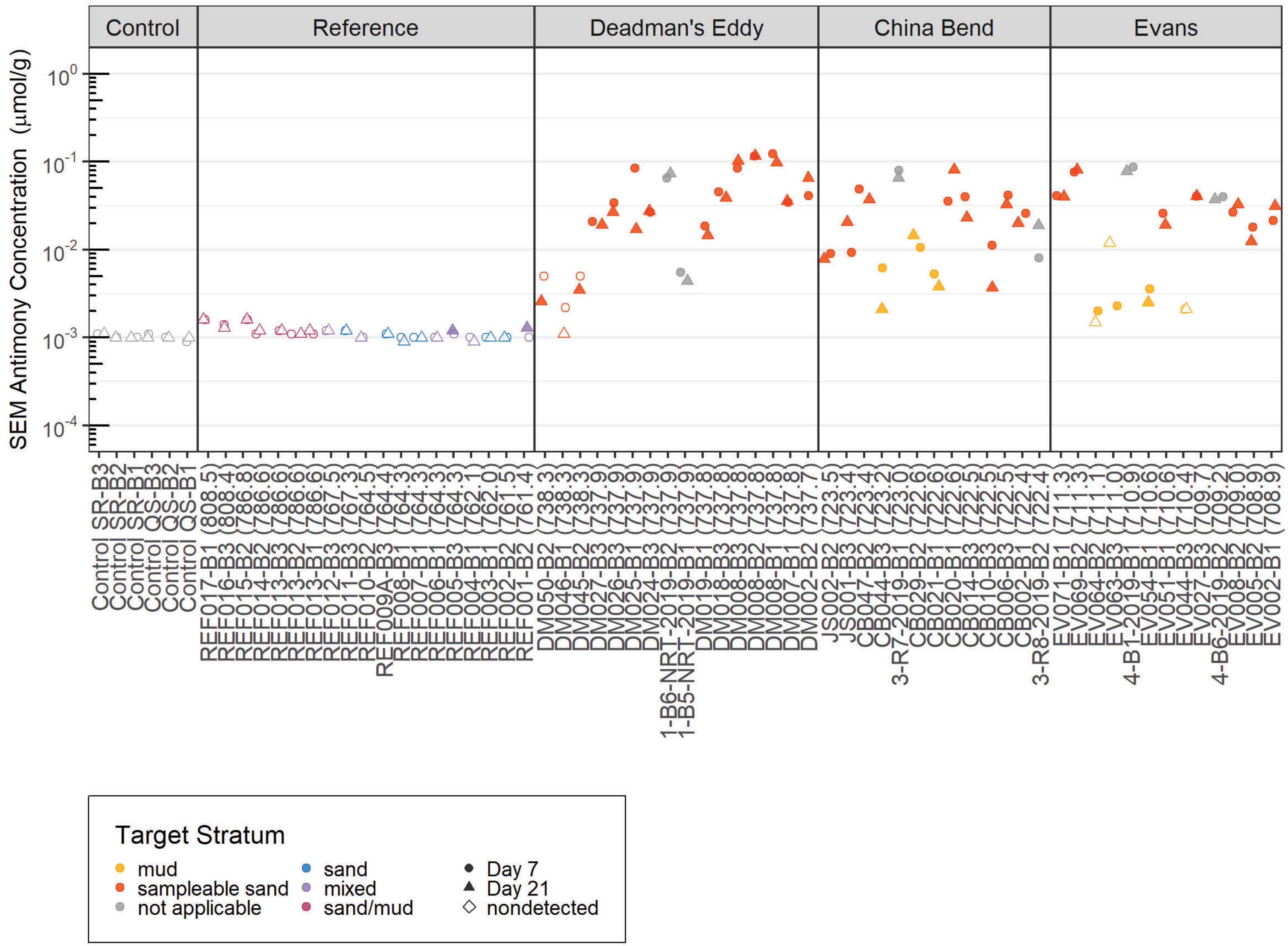
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2w. Vanadium in Bioassay Sediment Samples



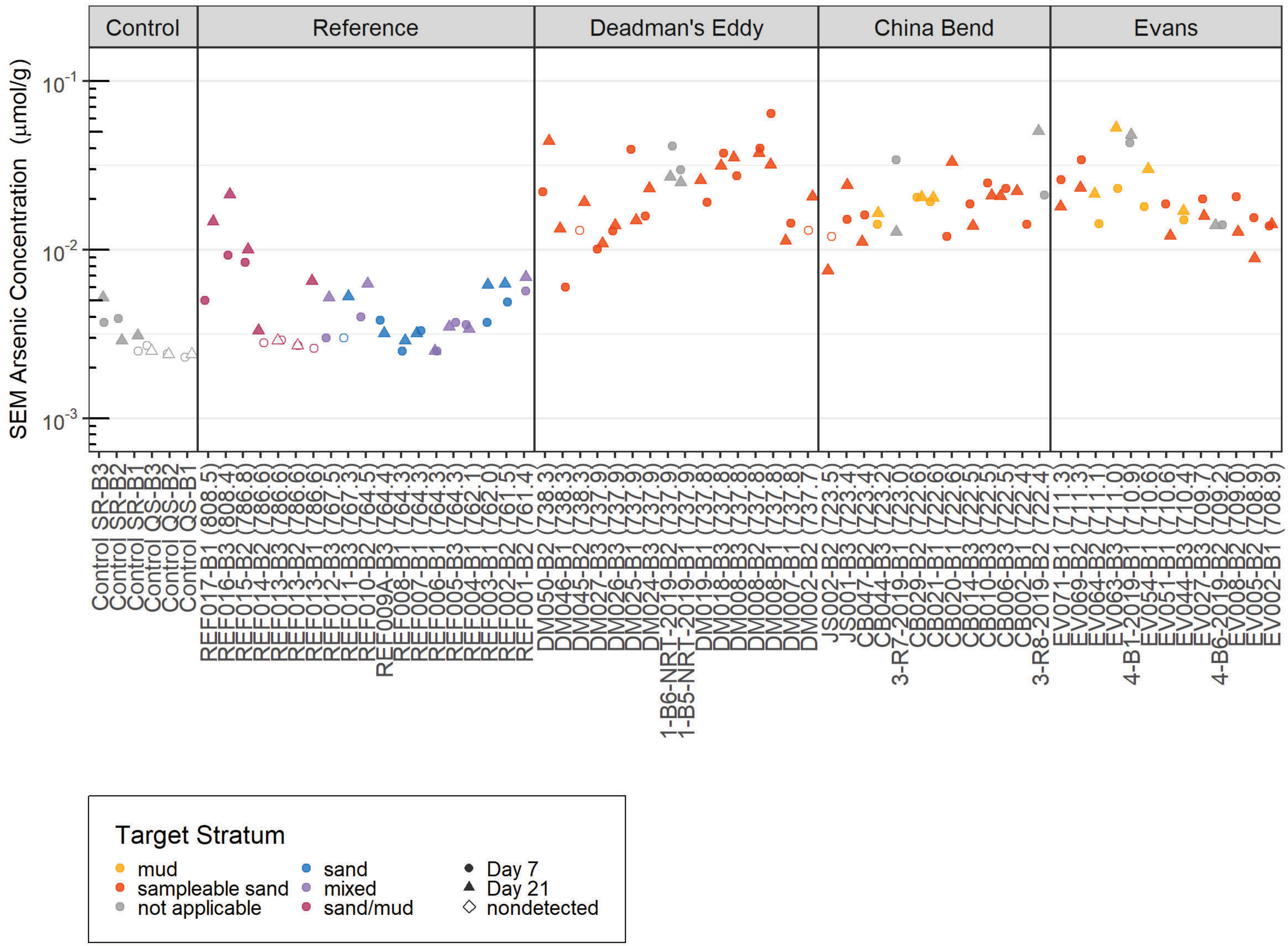
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2x. Zinc in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2y. SEM Antimony in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2z. SEM Arsenic in Bioassay Sediment Samples

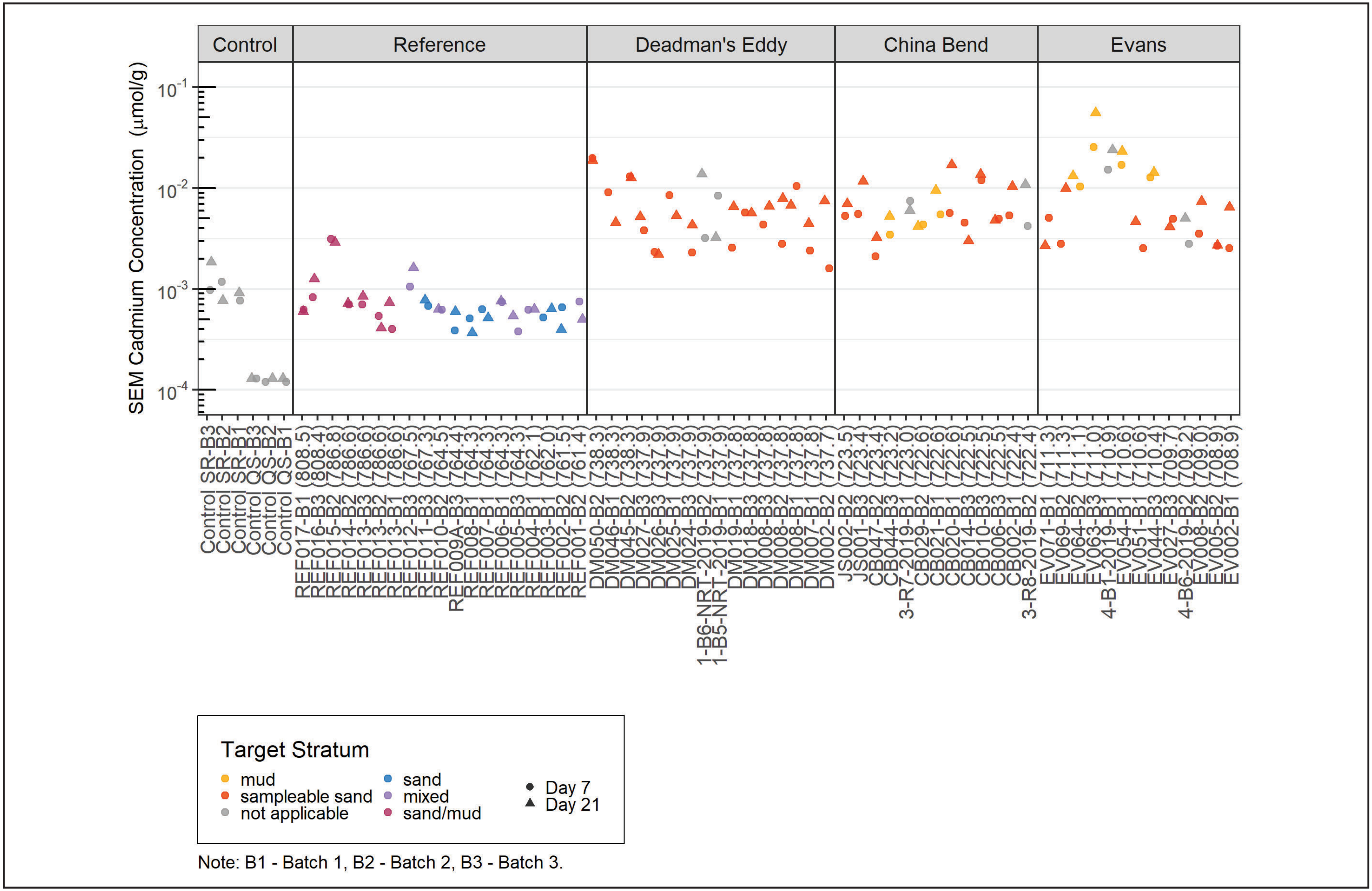
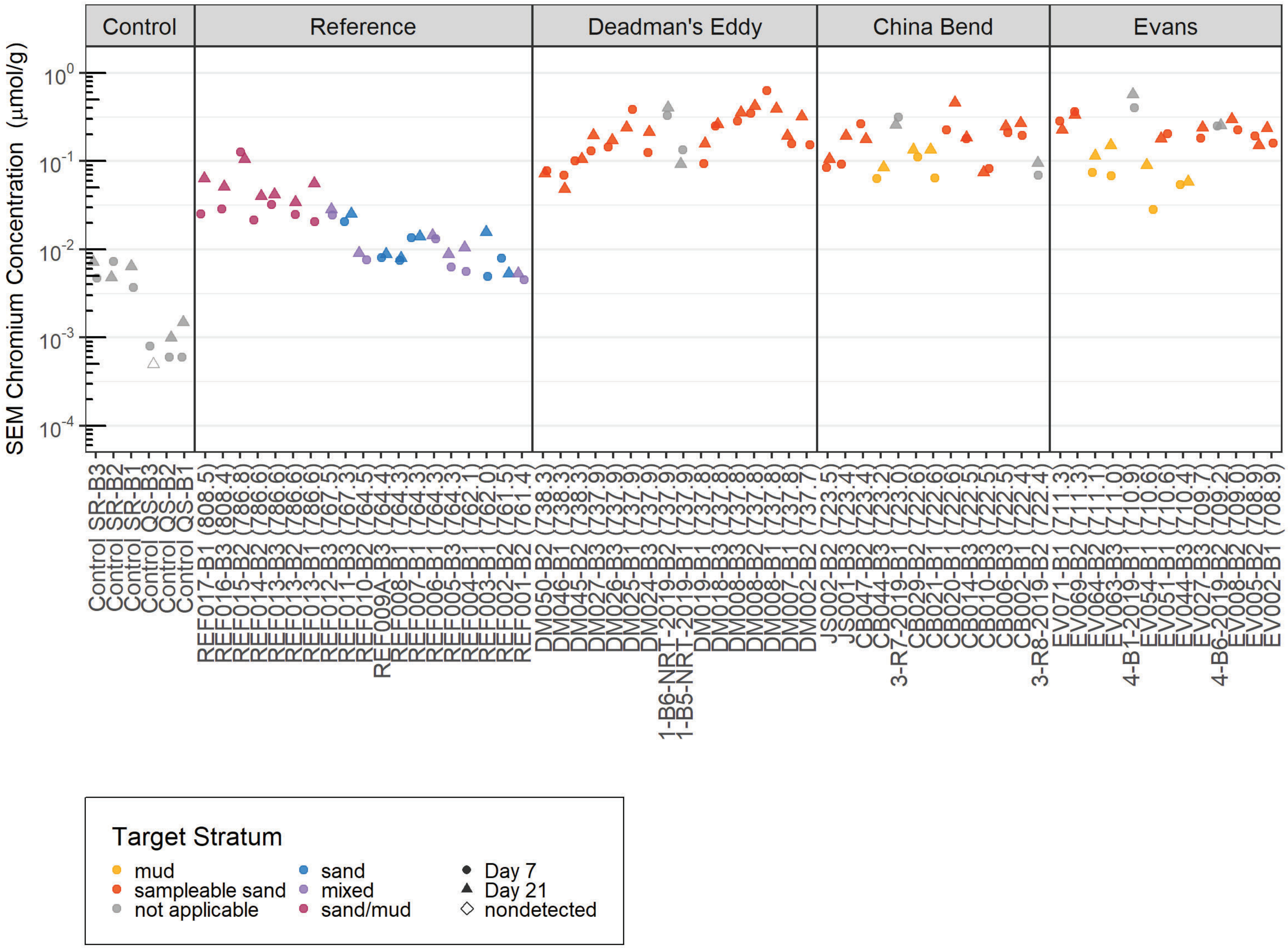
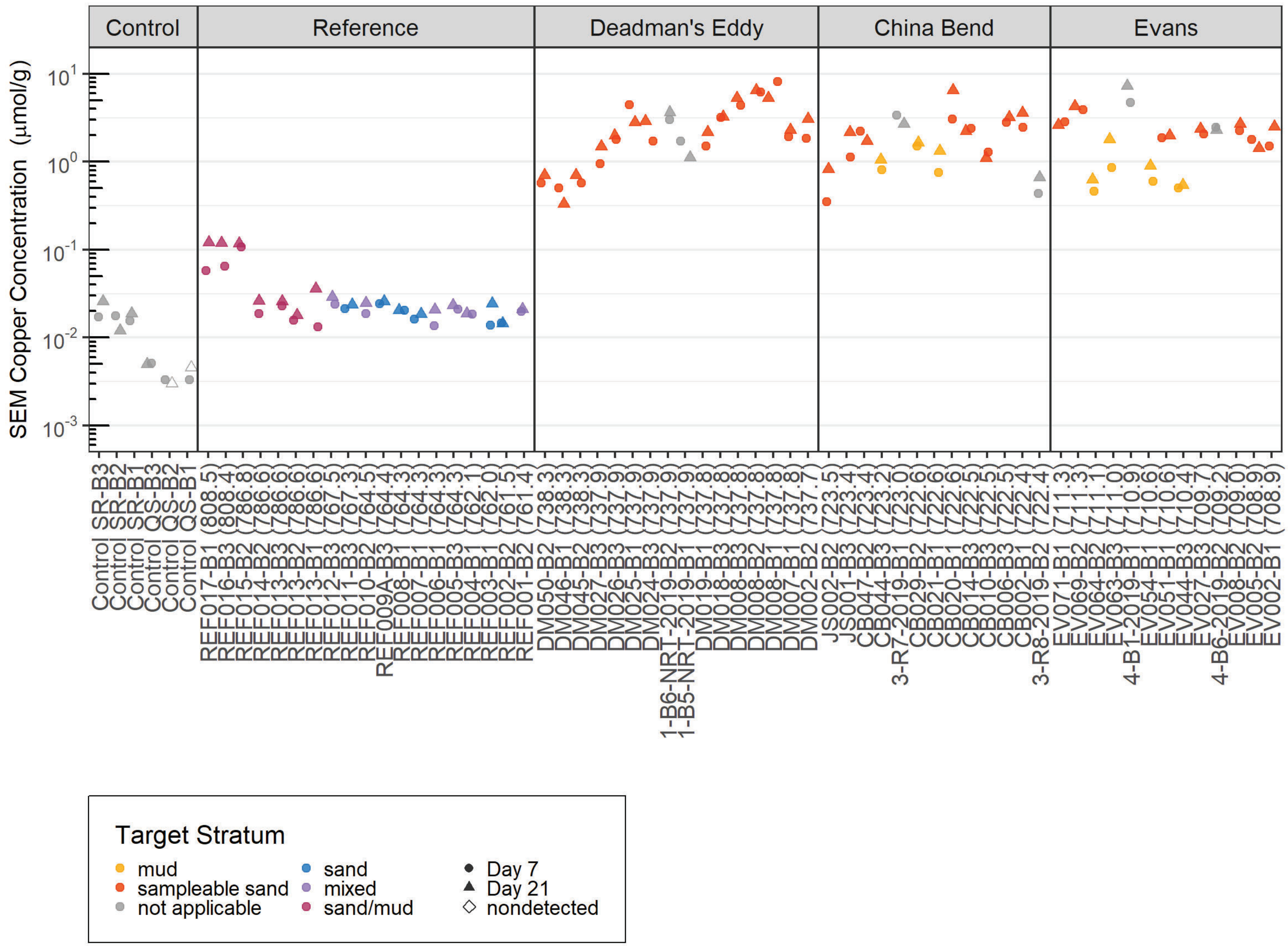


Figure 5-2aa. SEM Cadmium in Bioassay Sediment Samples



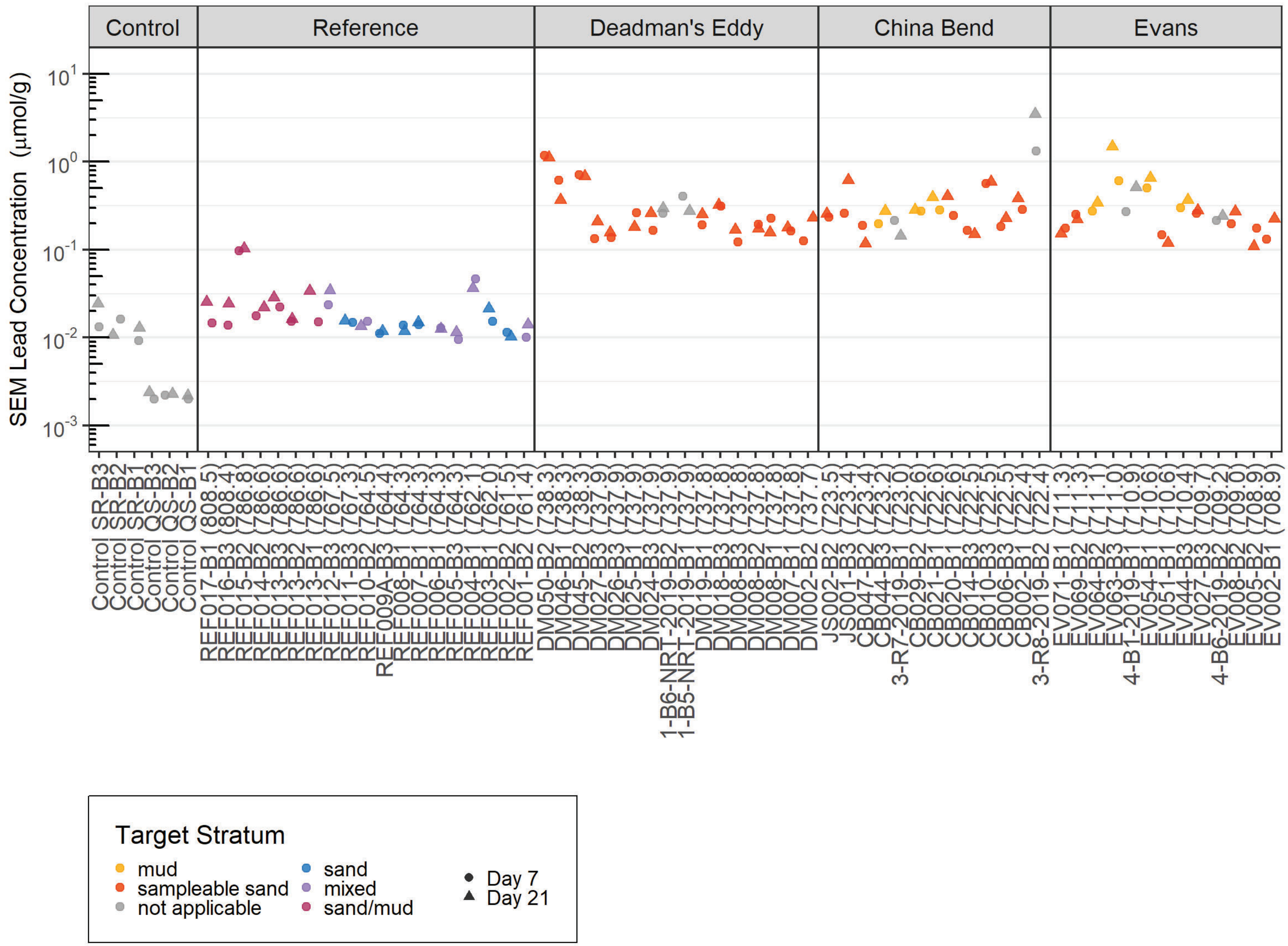
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2ab. SEM Chromium in Bioassay Sediment Samples



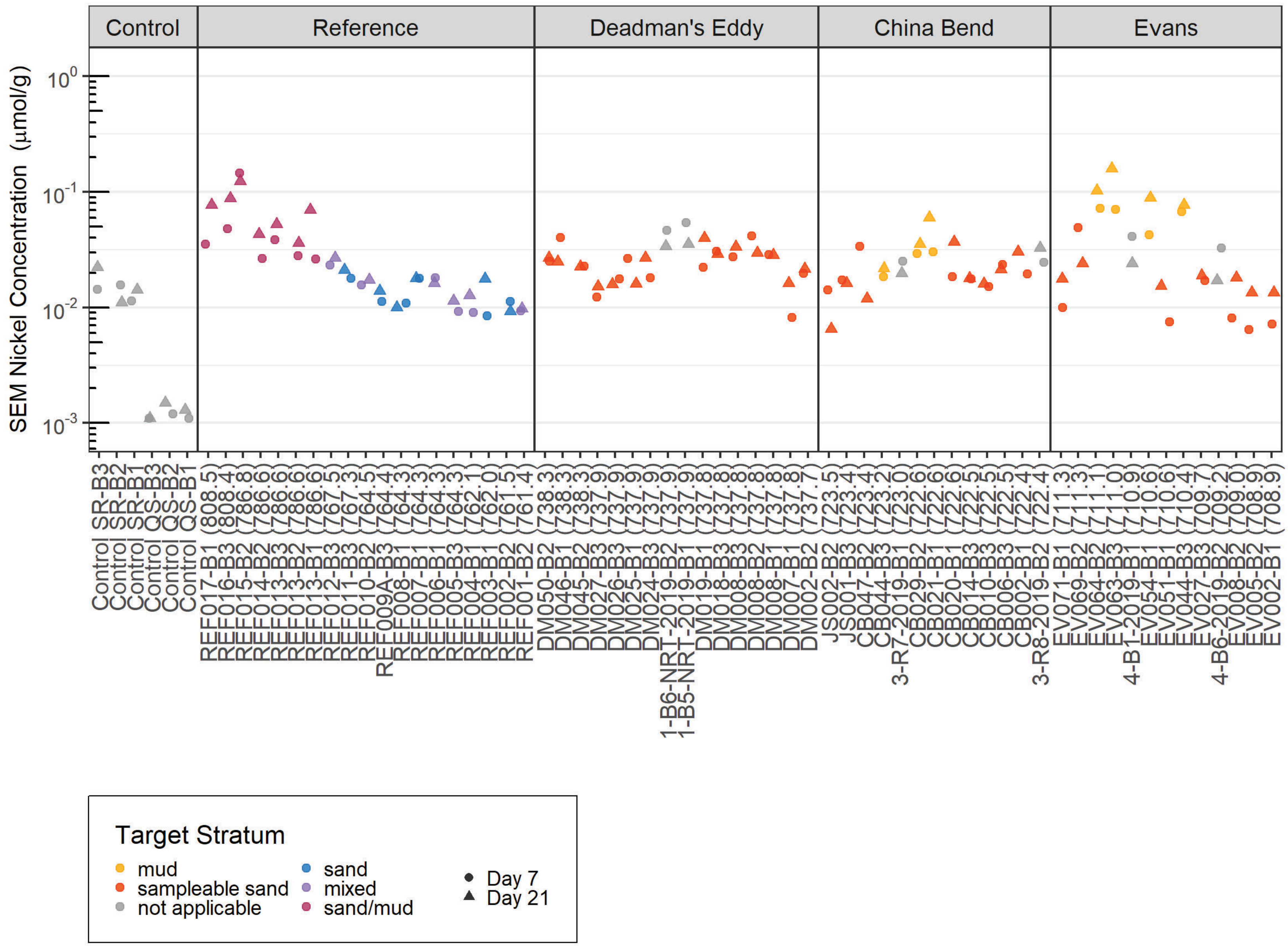
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2ac. SEM Copper in Bioassay Sediment Samples



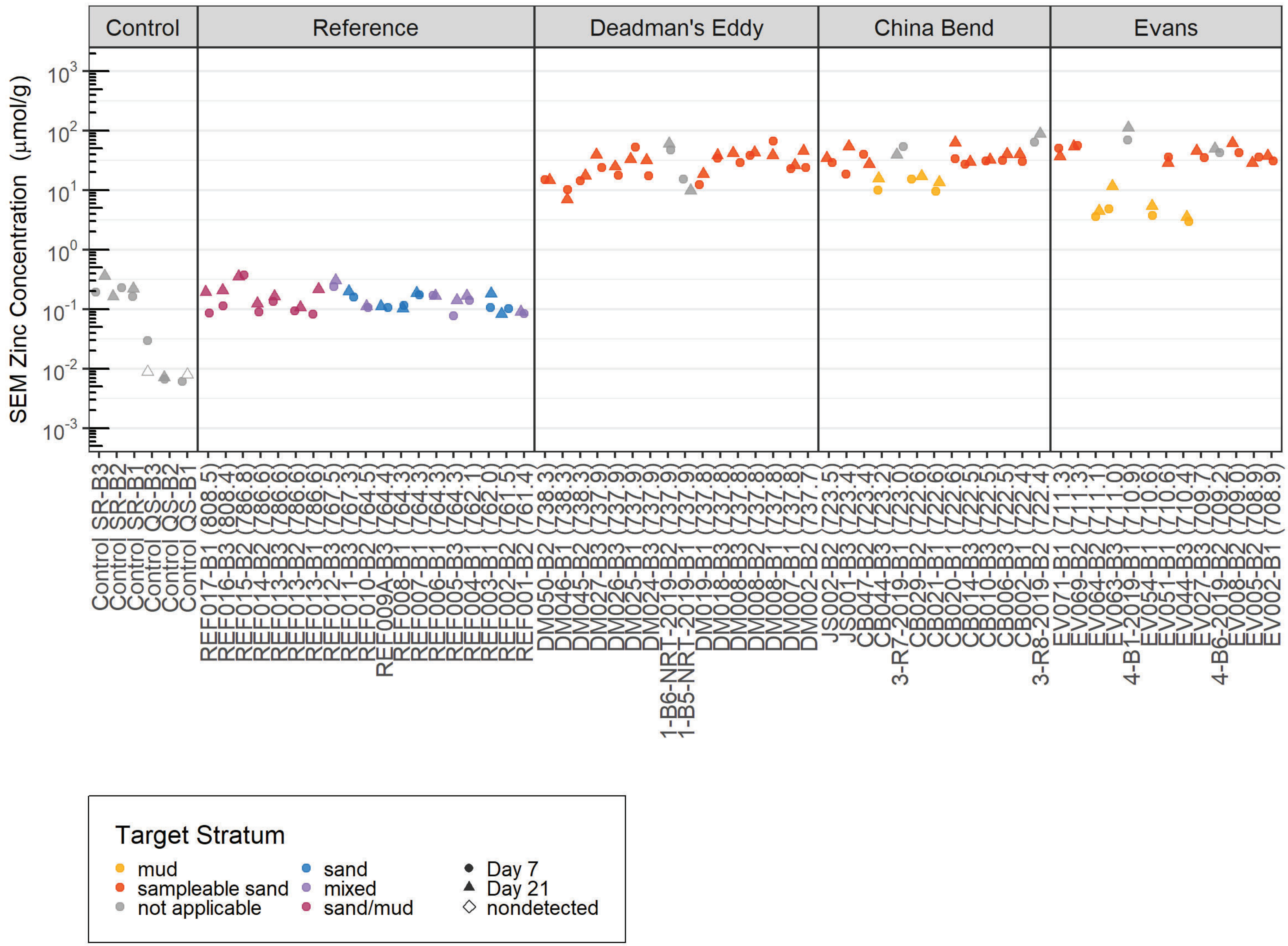
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2ad. SEM Lead in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2ae. SEM Nickel in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2af. SEM Zinc in Bioassay Sediment Samples

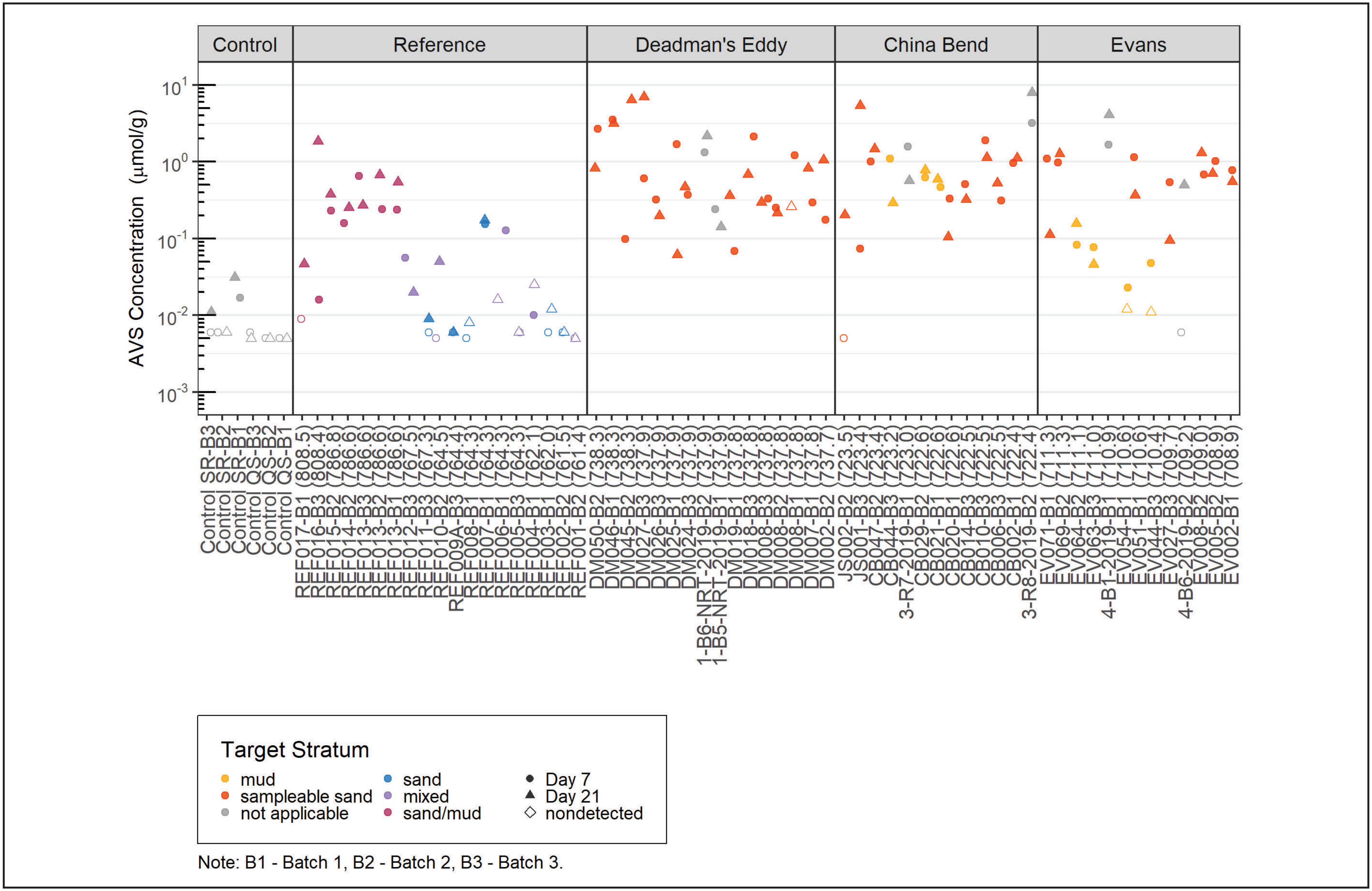
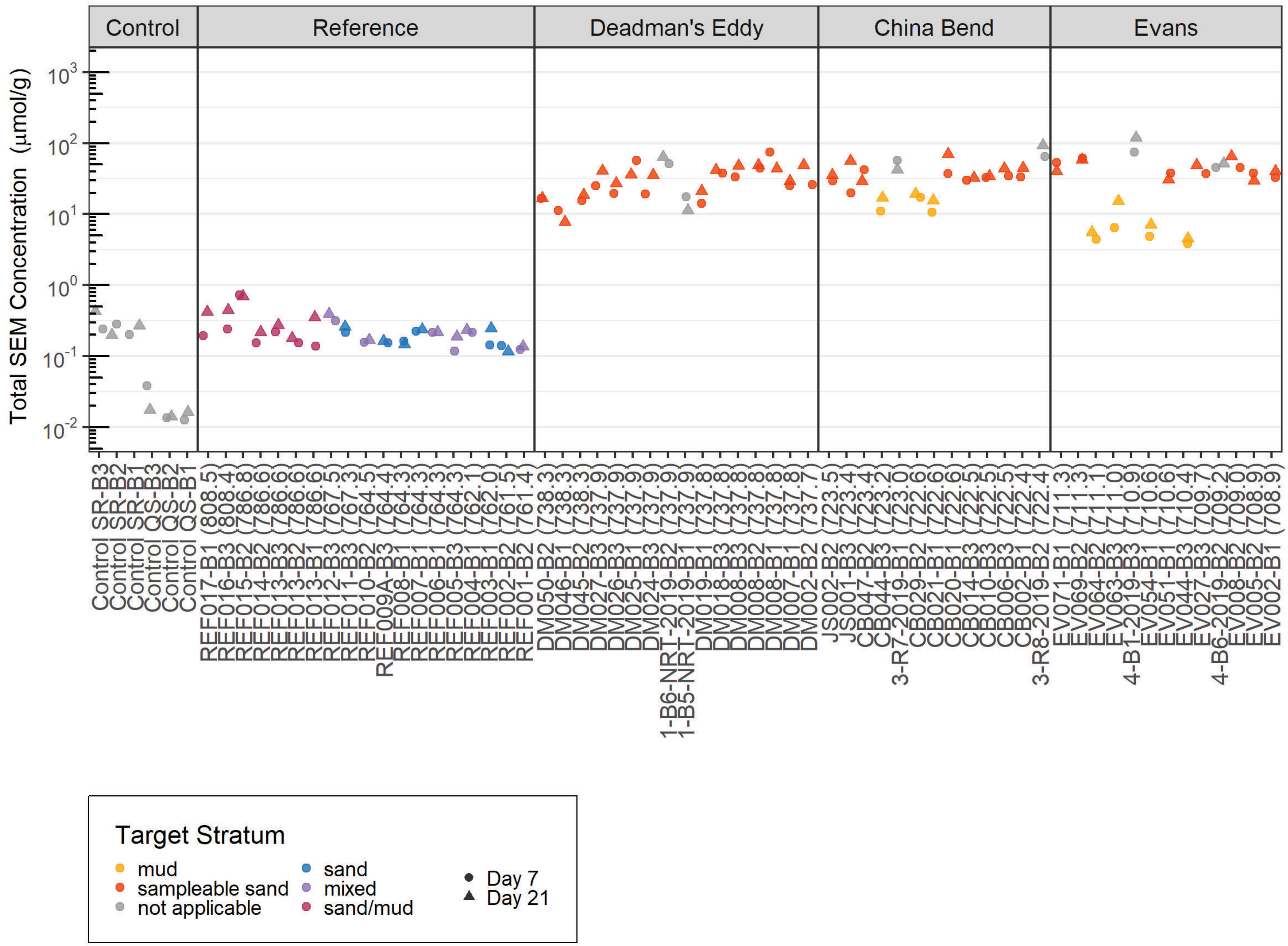
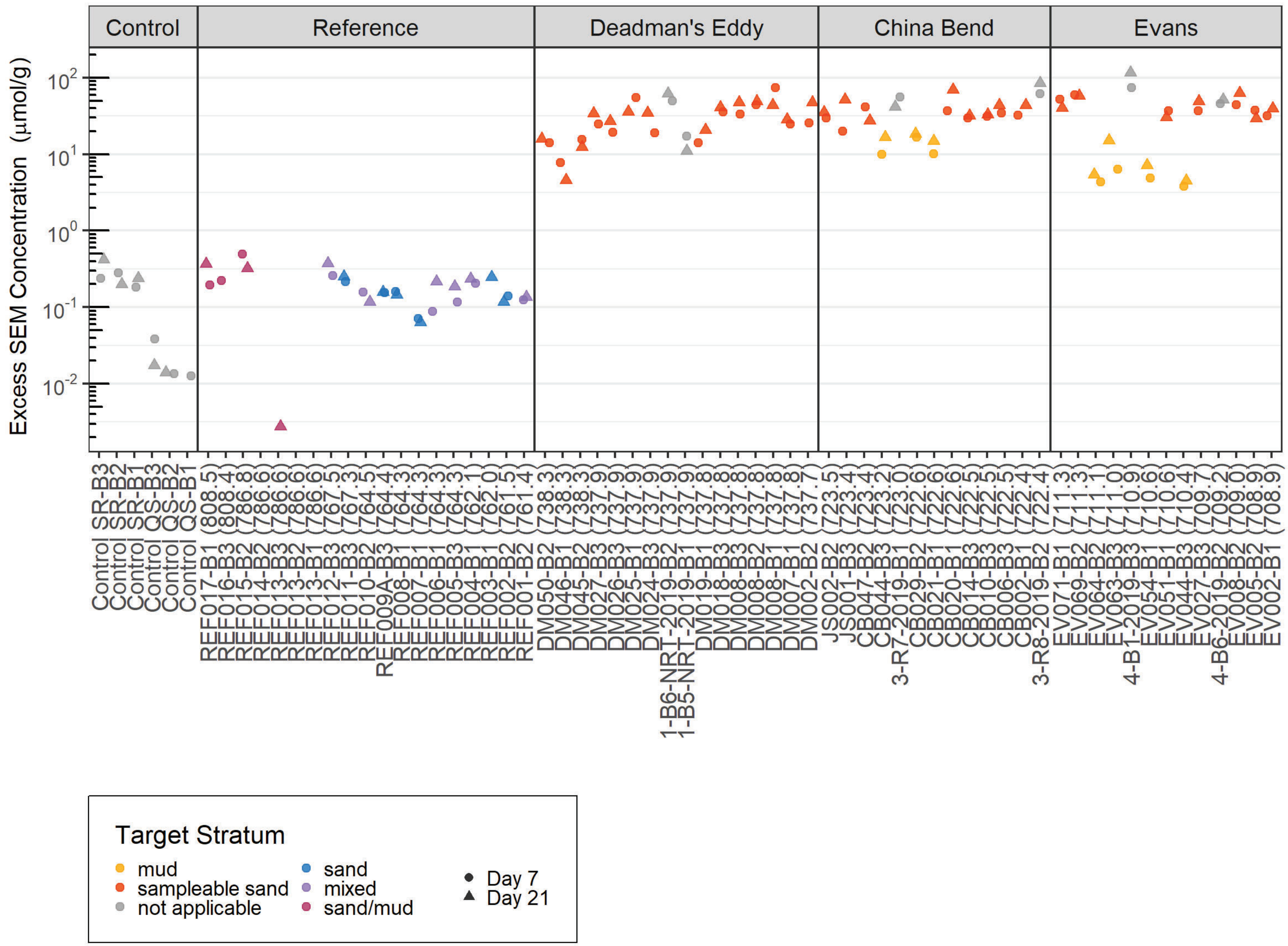


Figure 5-2ag. AVS in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2ah. Total SEM in Bioassay Sediment Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-2ai. Excess SEM in Bioassay Sediment Samples

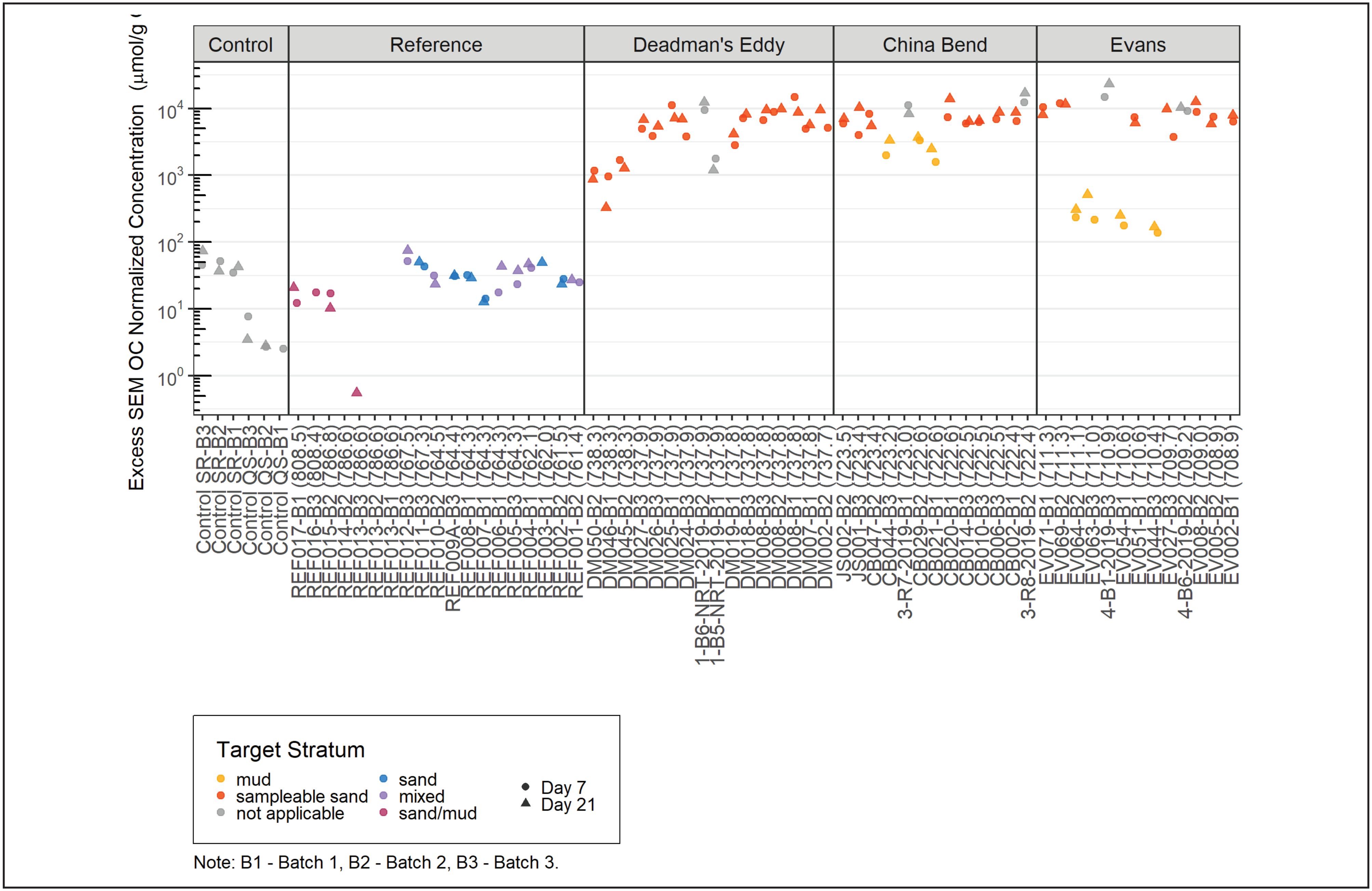
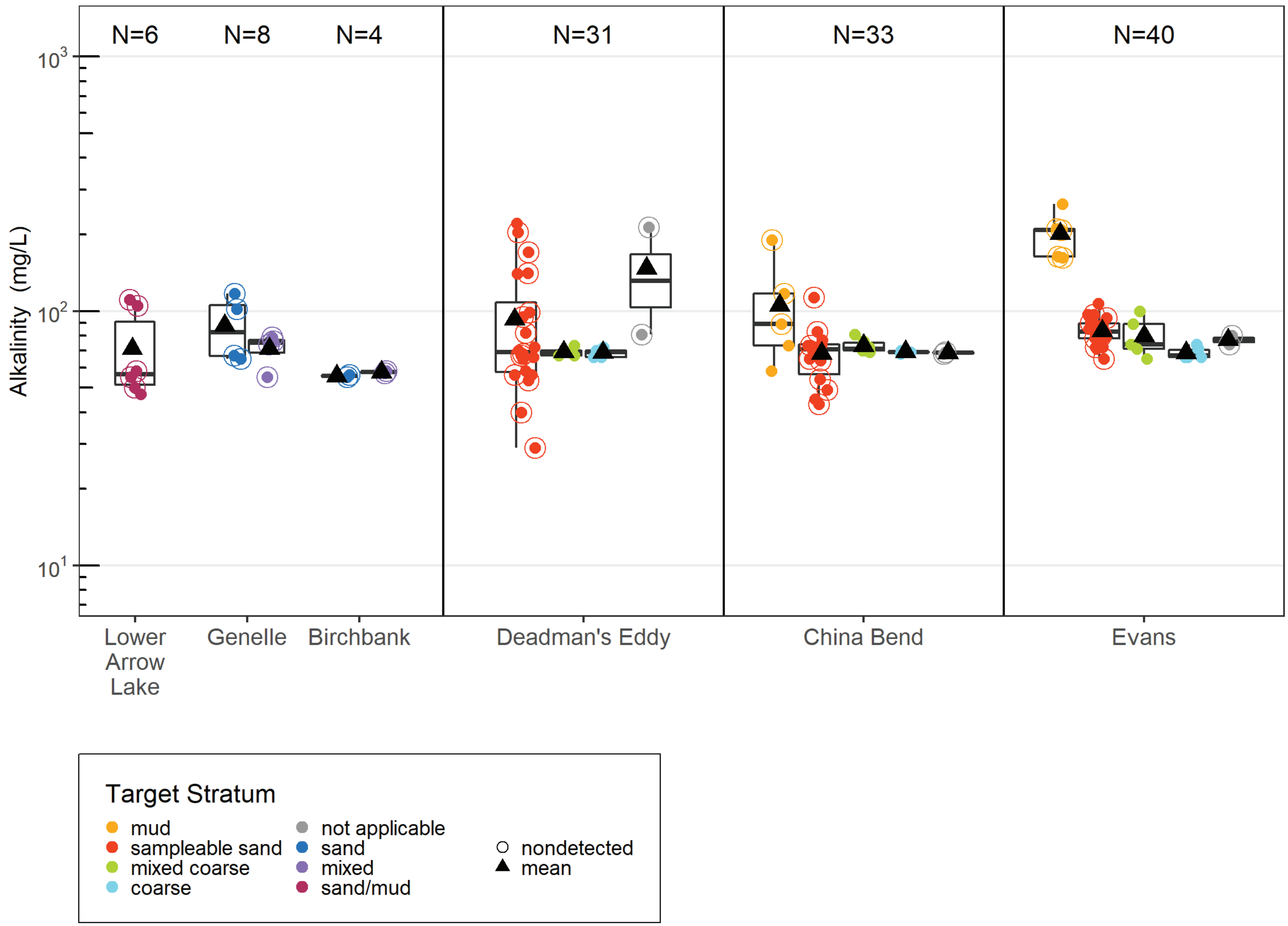
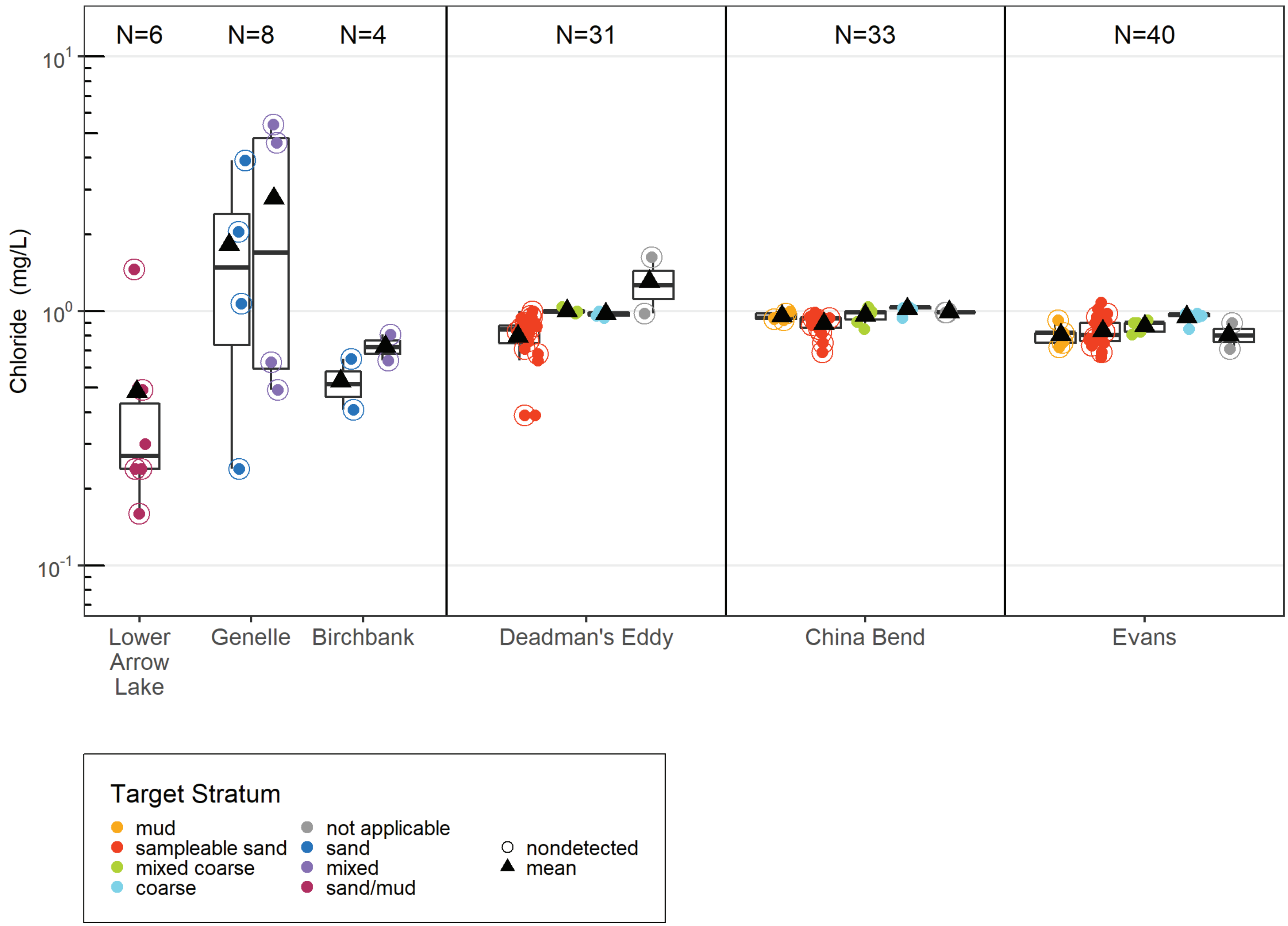


Figure 5-2aj. Excess SEM OC Normalized in Bioassay Sediment Samples



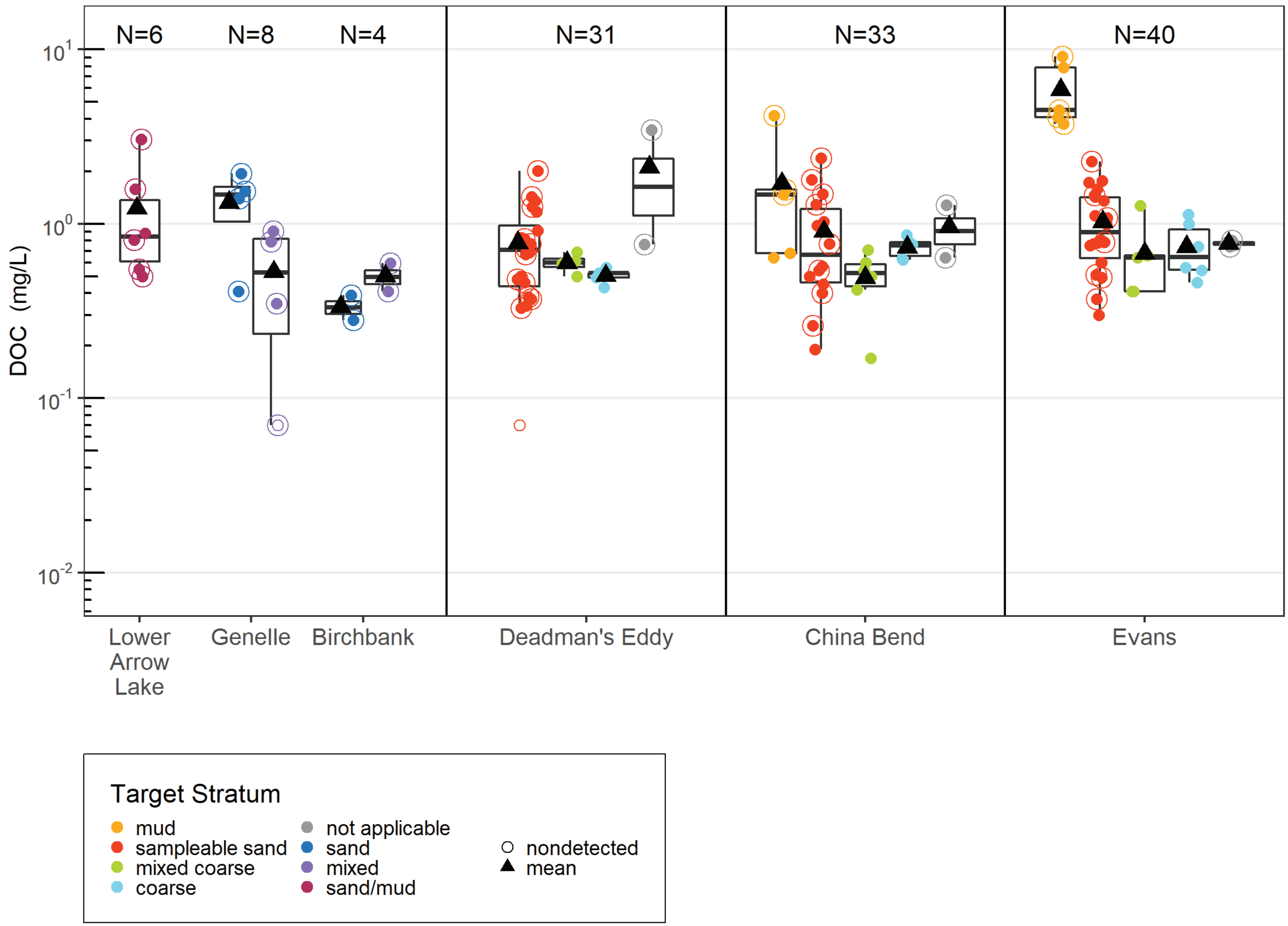
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3a. Alkalinity in Field Porewater Samples



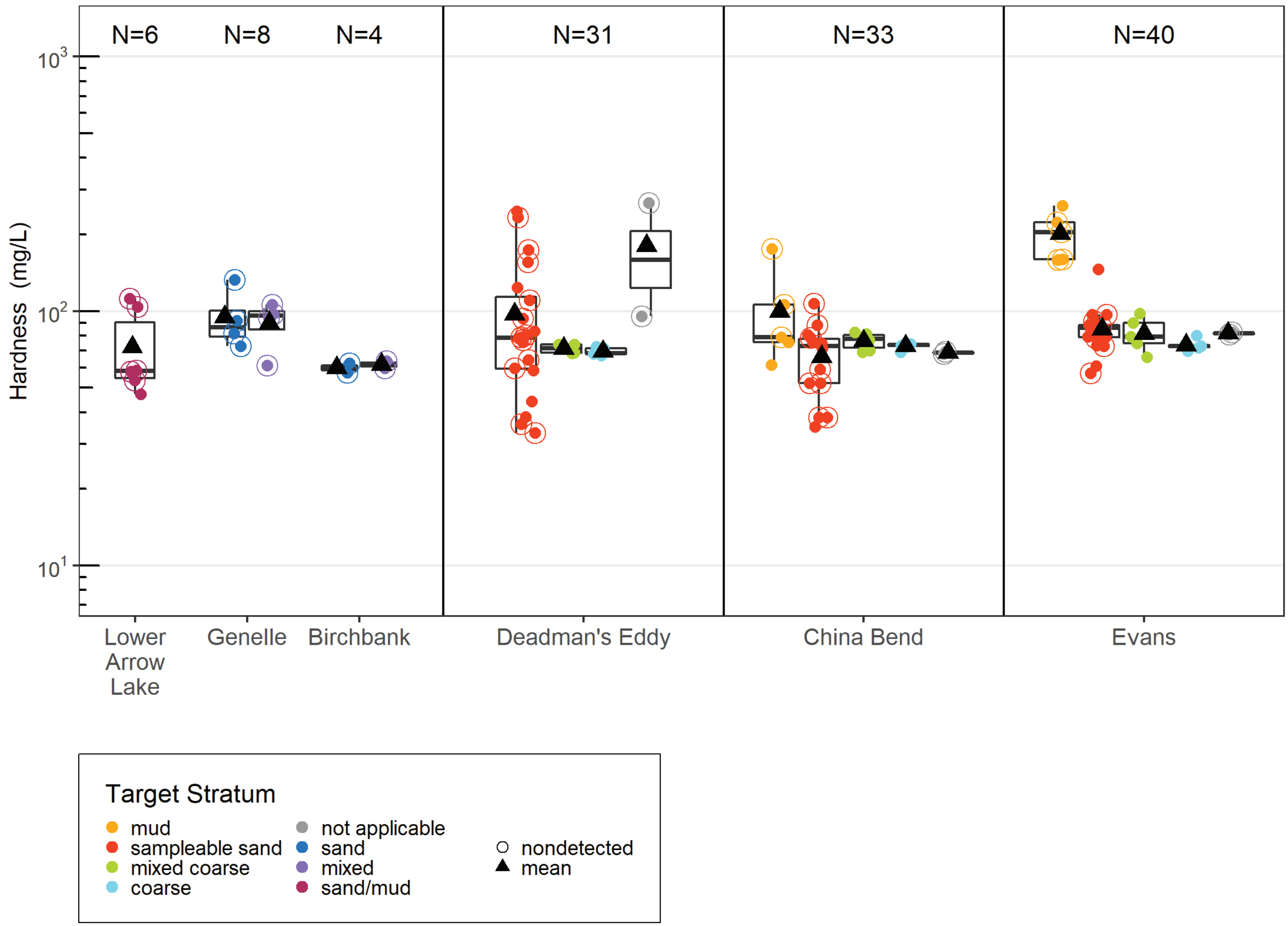
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3b. Chloride in Field Porewater Samples



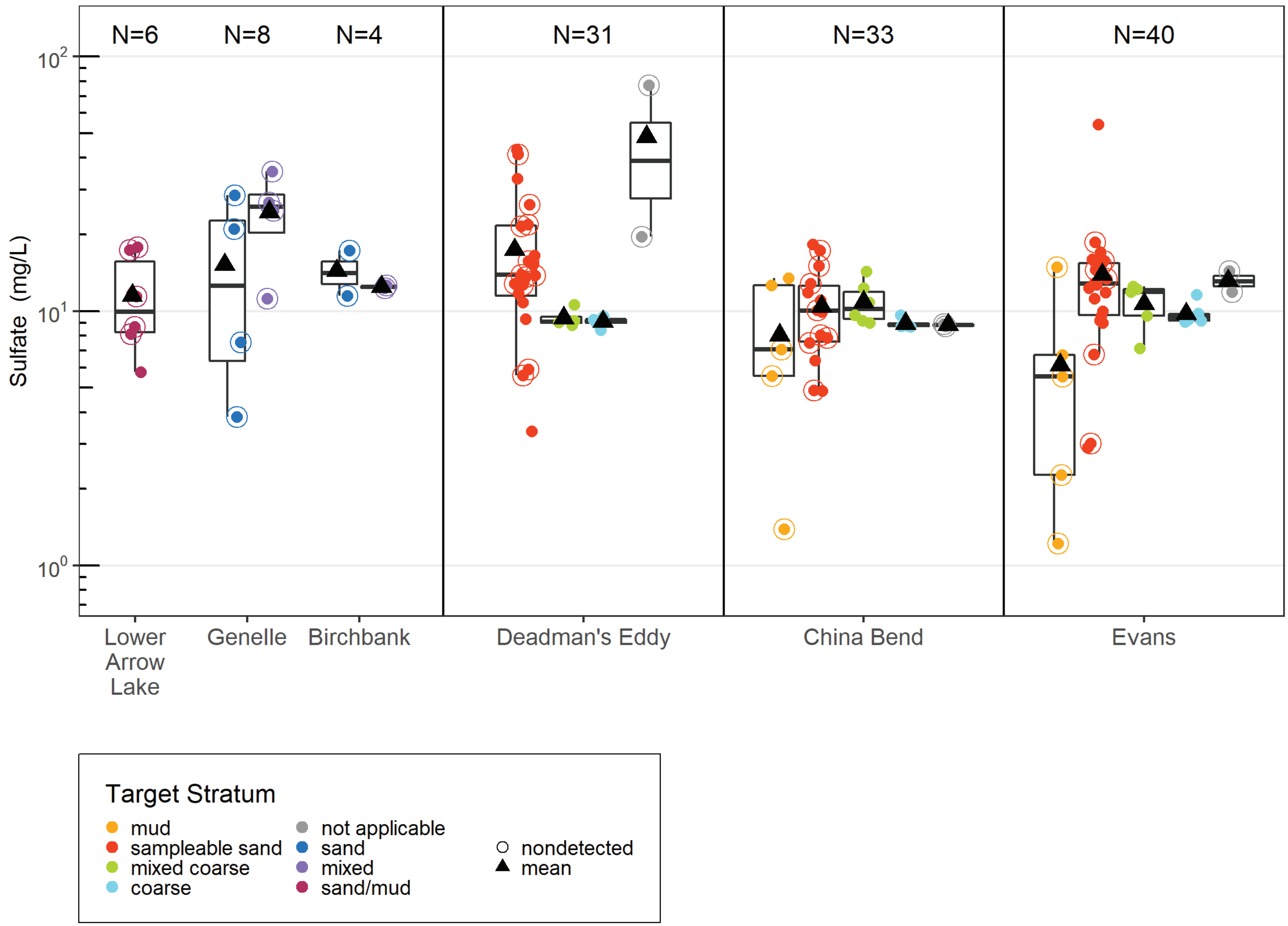
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3c. DOC in Field Porewater Samples



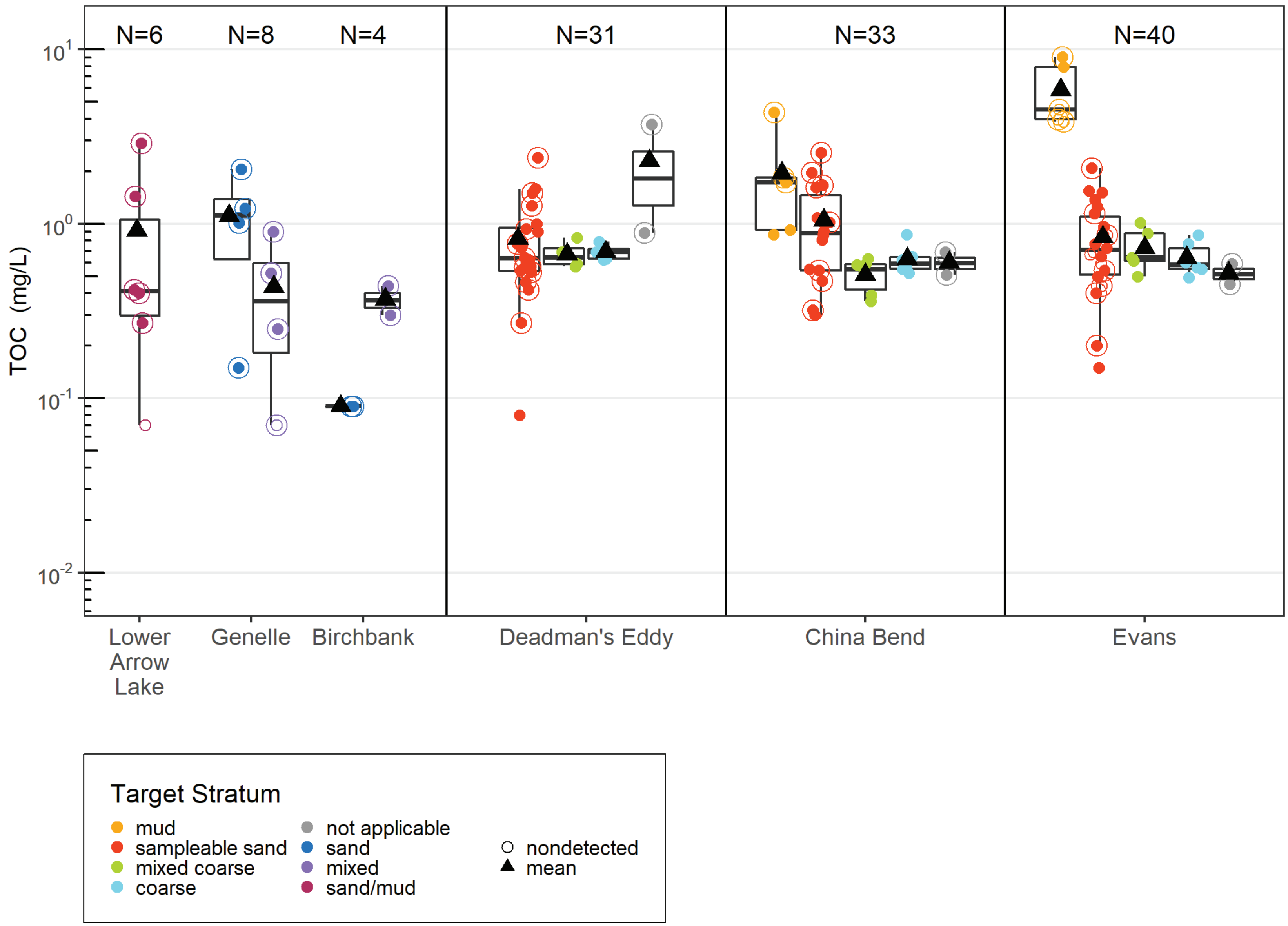
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3d. Hardness in Field Porewater Samples



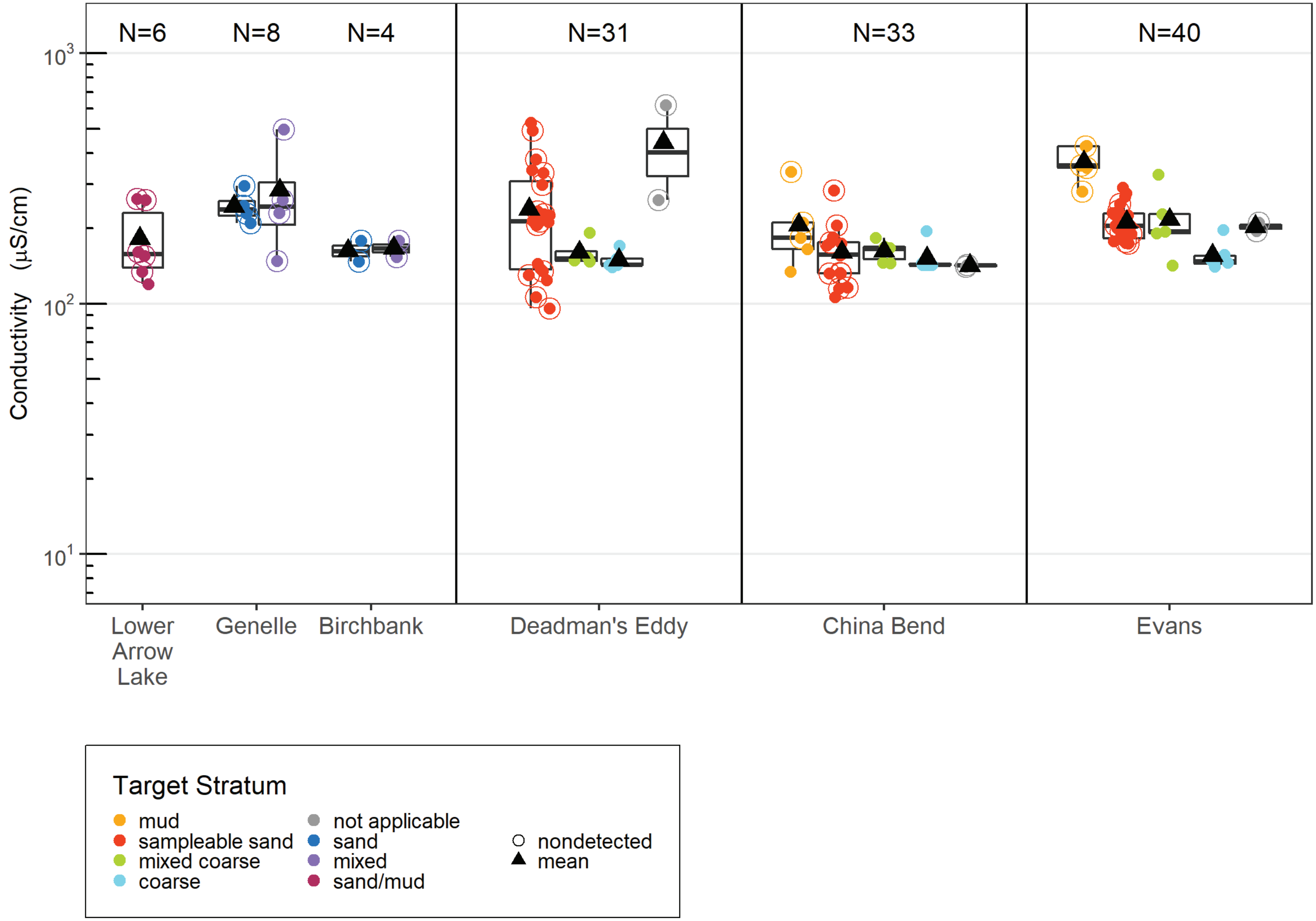
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3e. Sulfate in Field Porewater Samples



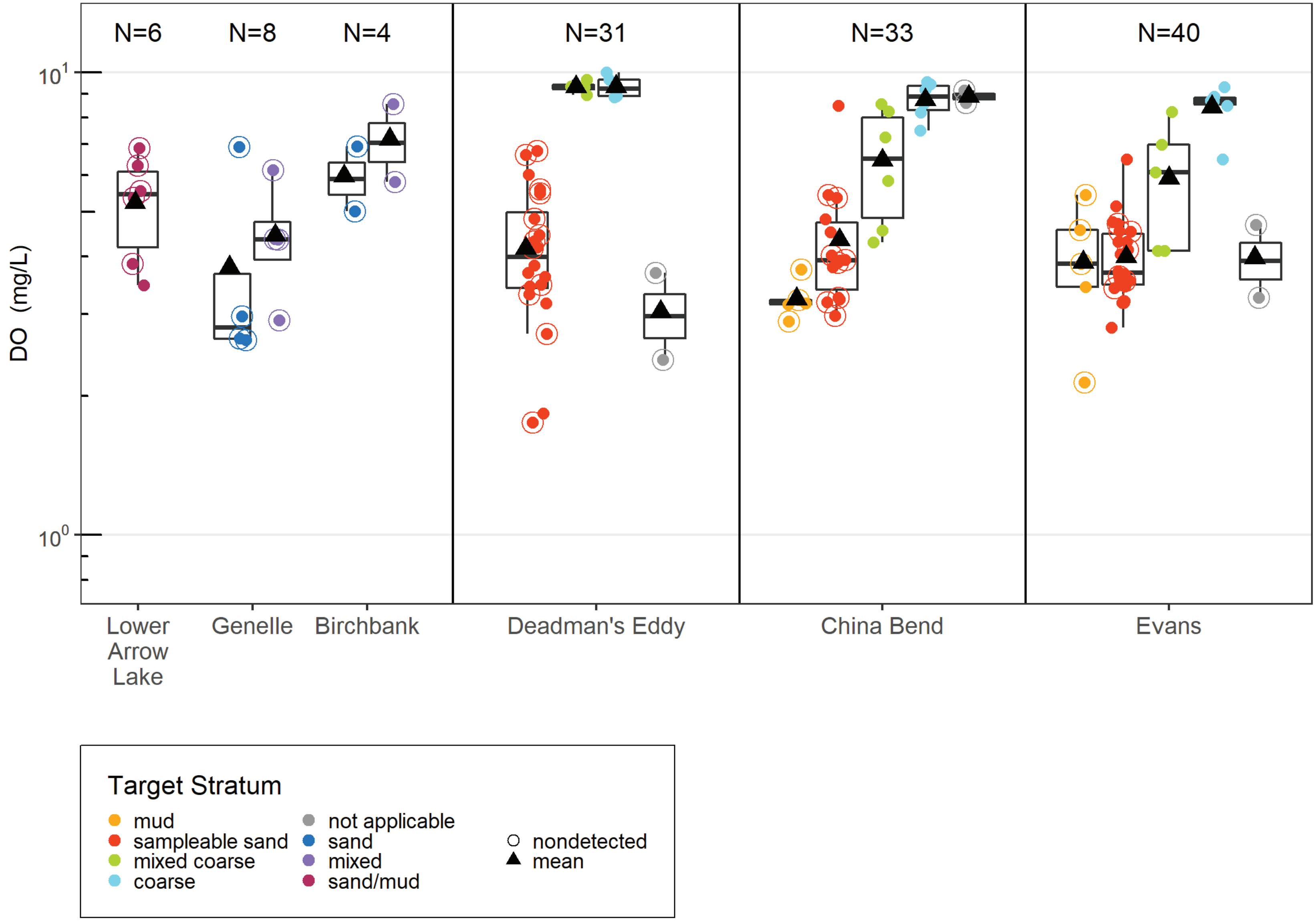
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3f. TOC in Field Porewater Samples



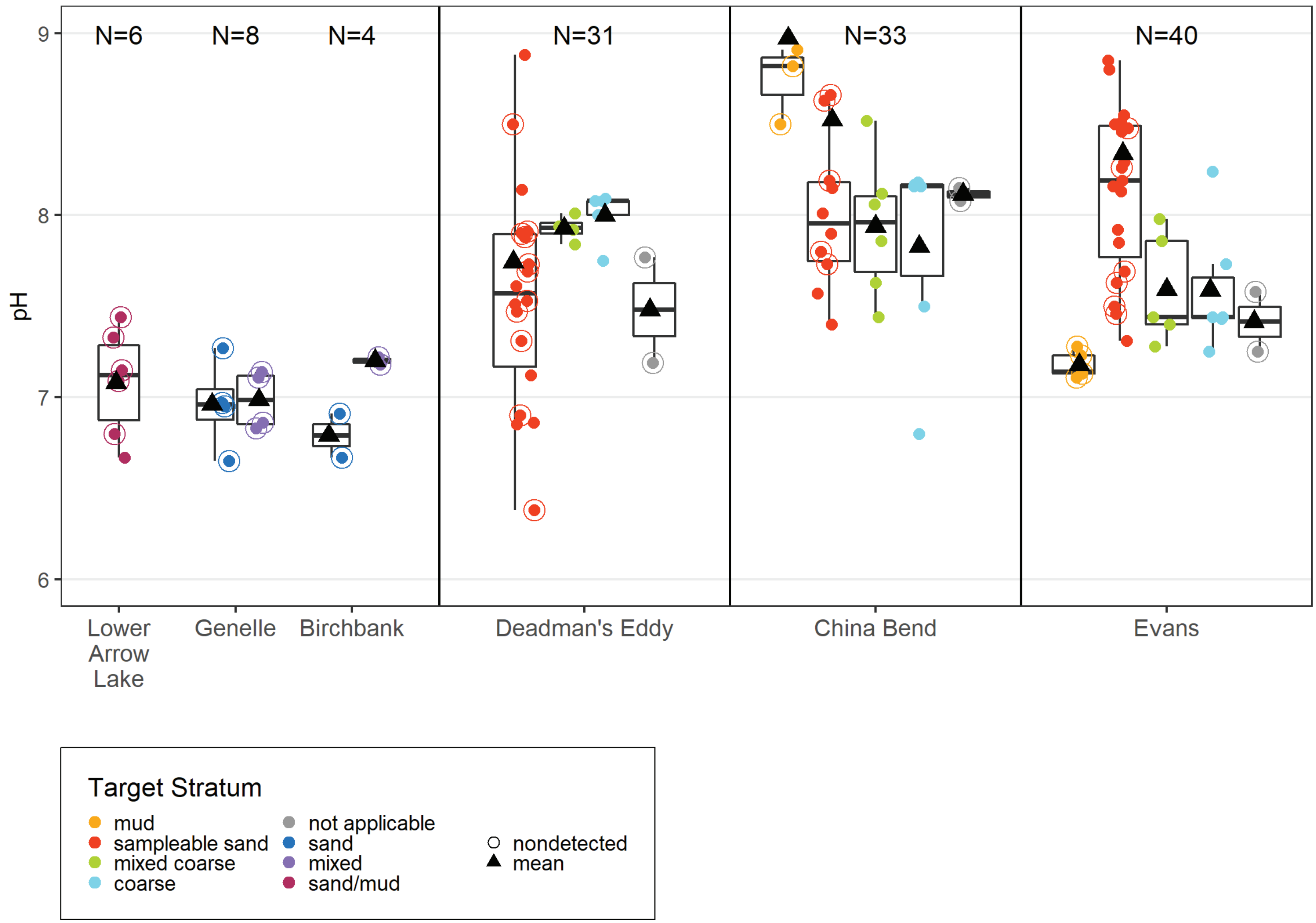
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of Trident sensor measurements.

Figure 5-3g. Conductivity in Field Porewater Samples



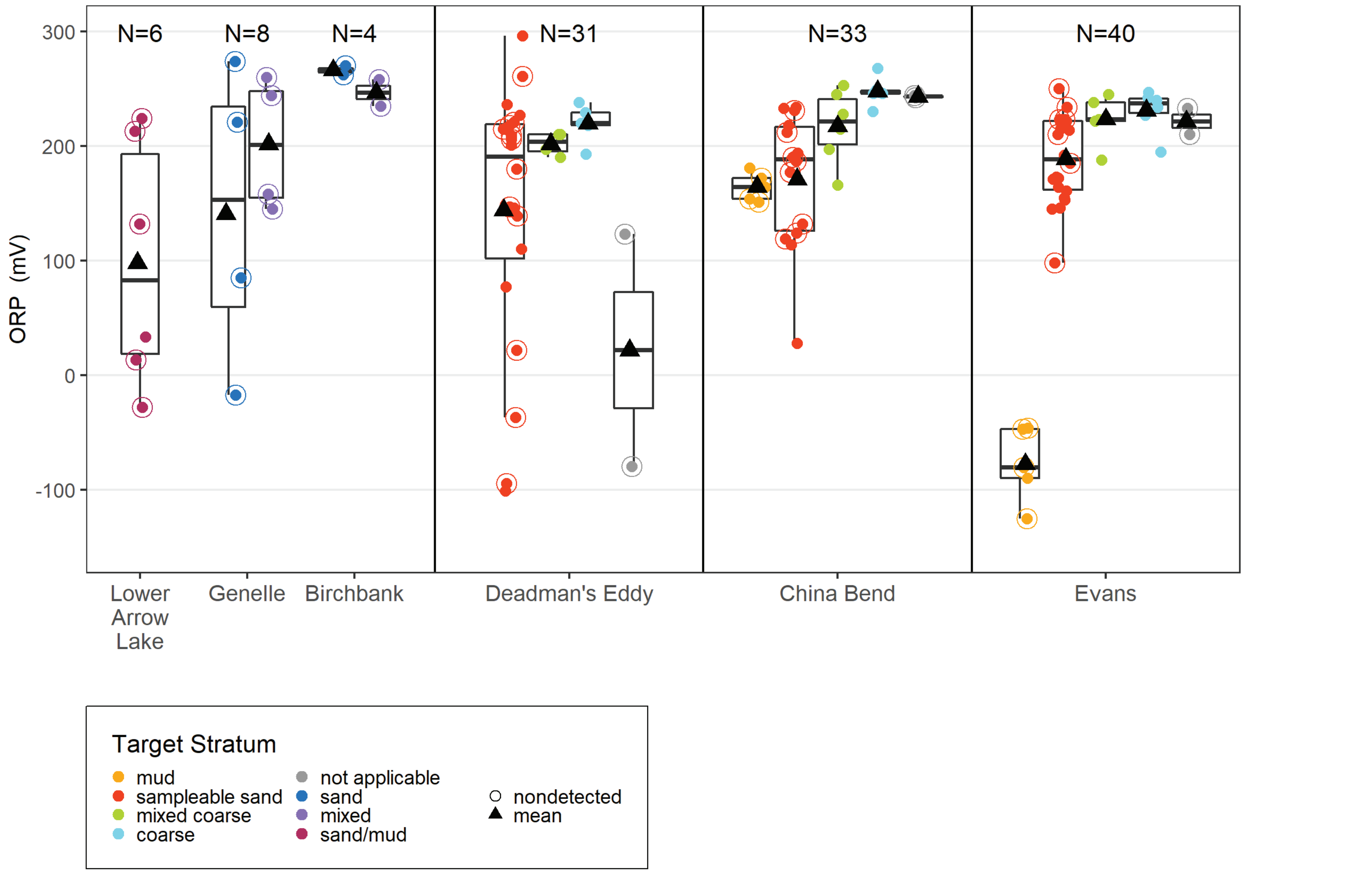
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of hand-held sensor measurements.

Figure 5-3h. DO in Field Porewater Samples



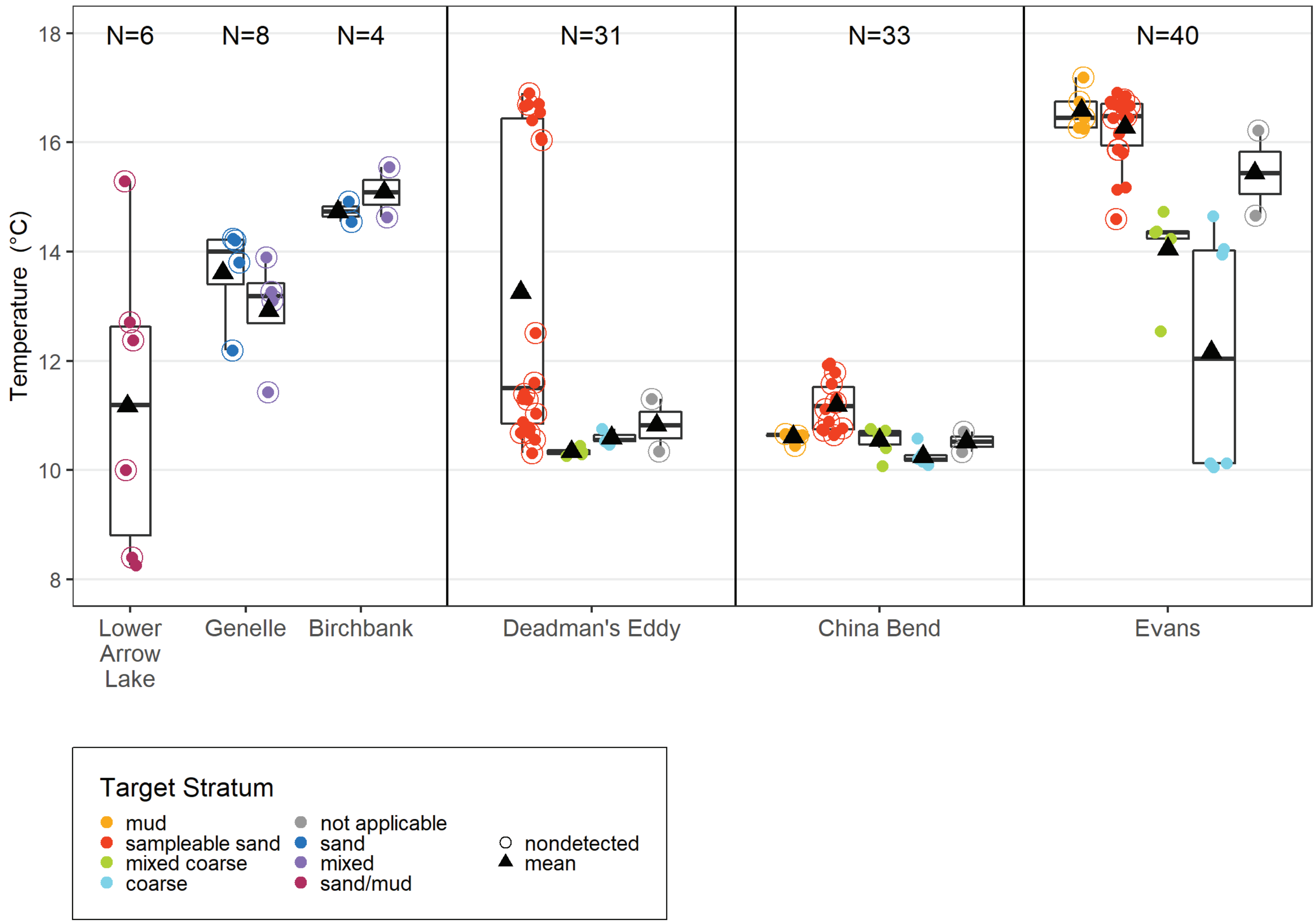
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of multimeter measurements.

Figure 5-3i. pH in Field Porewater Samples



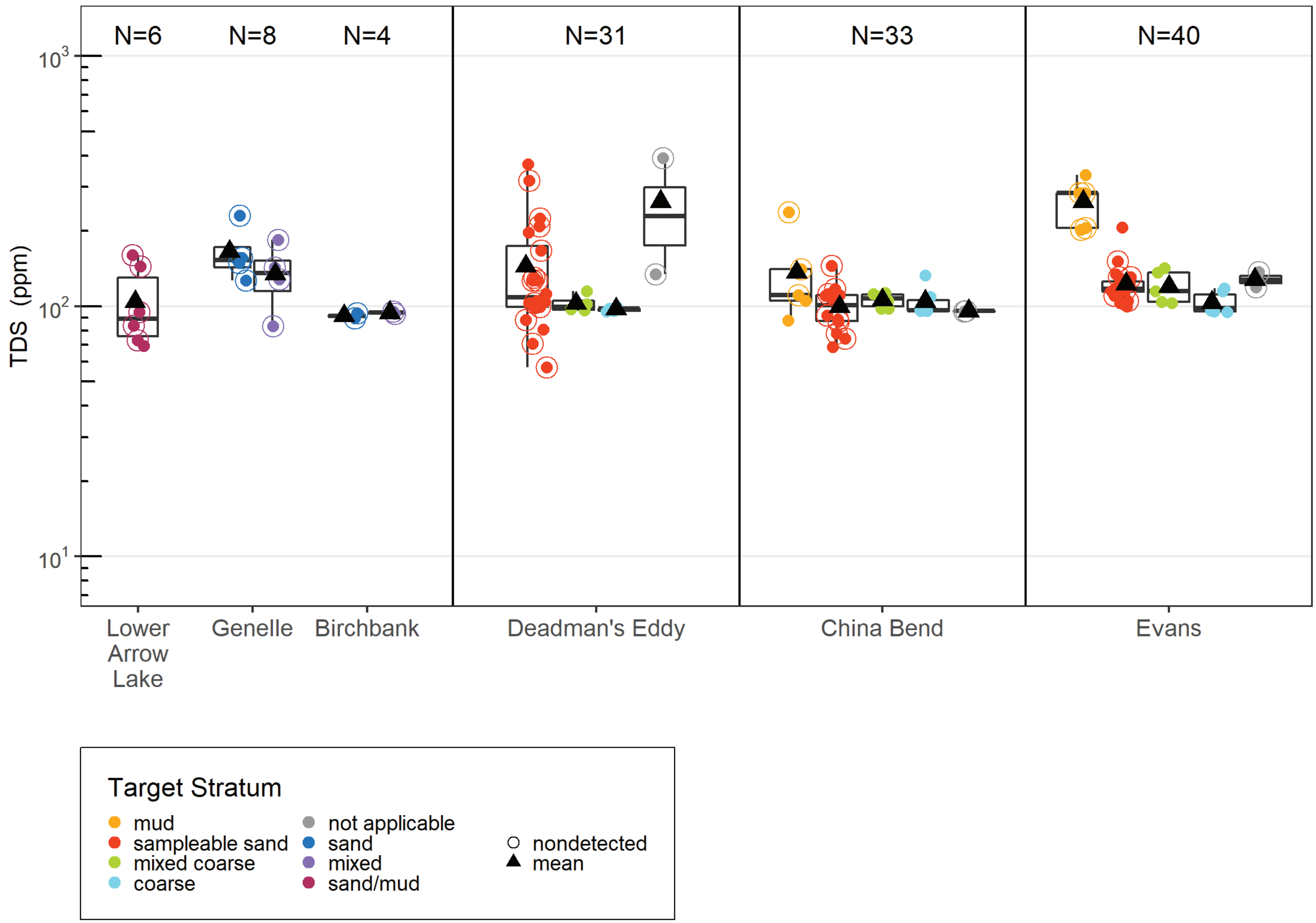
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of multimeter measurements.

Figure 5-3j. ORP in Field Porewater Samples



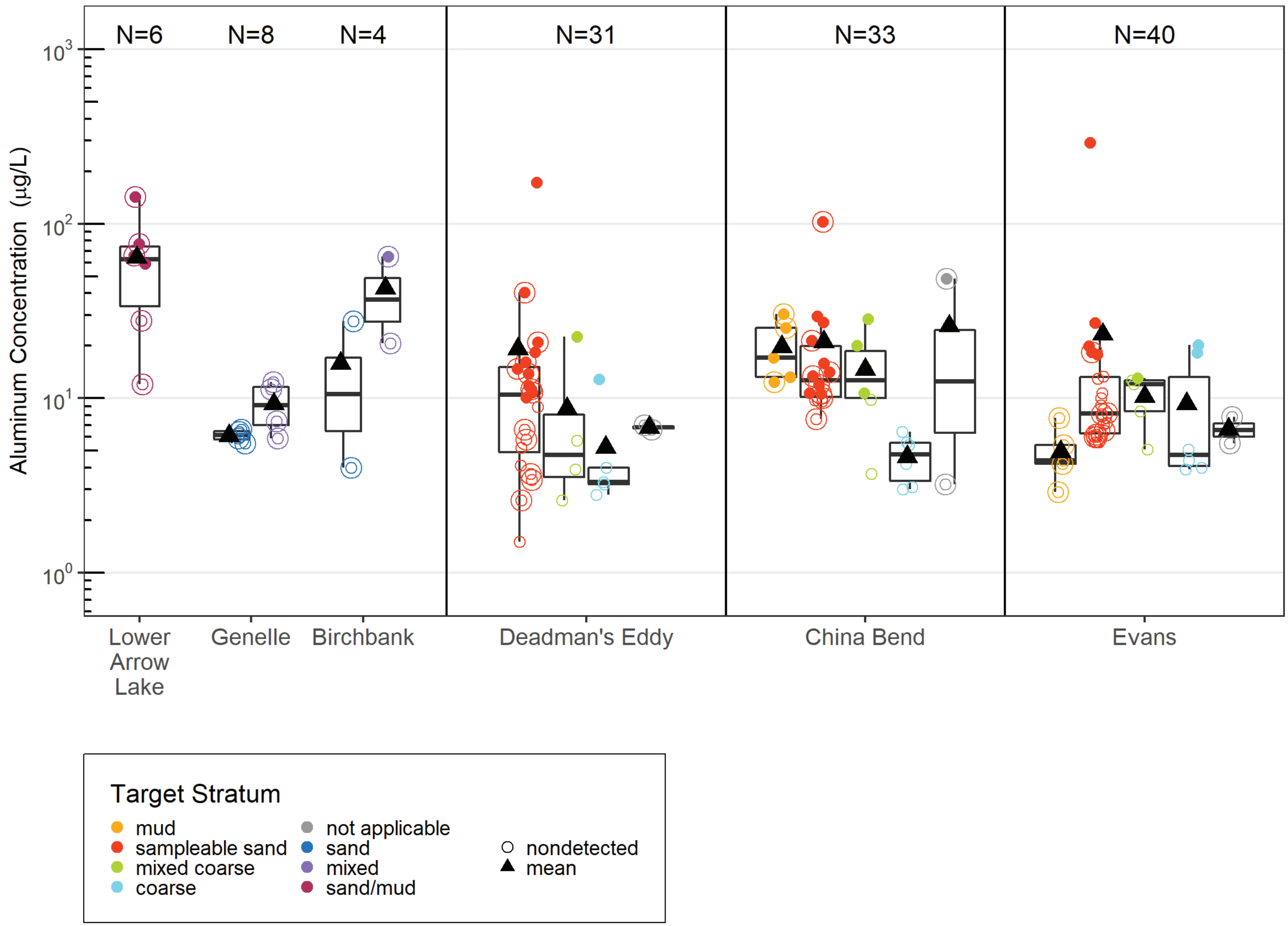
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of Trident sensor measurements.

Figure 5-3k. Temperature in Field Porewater Samples



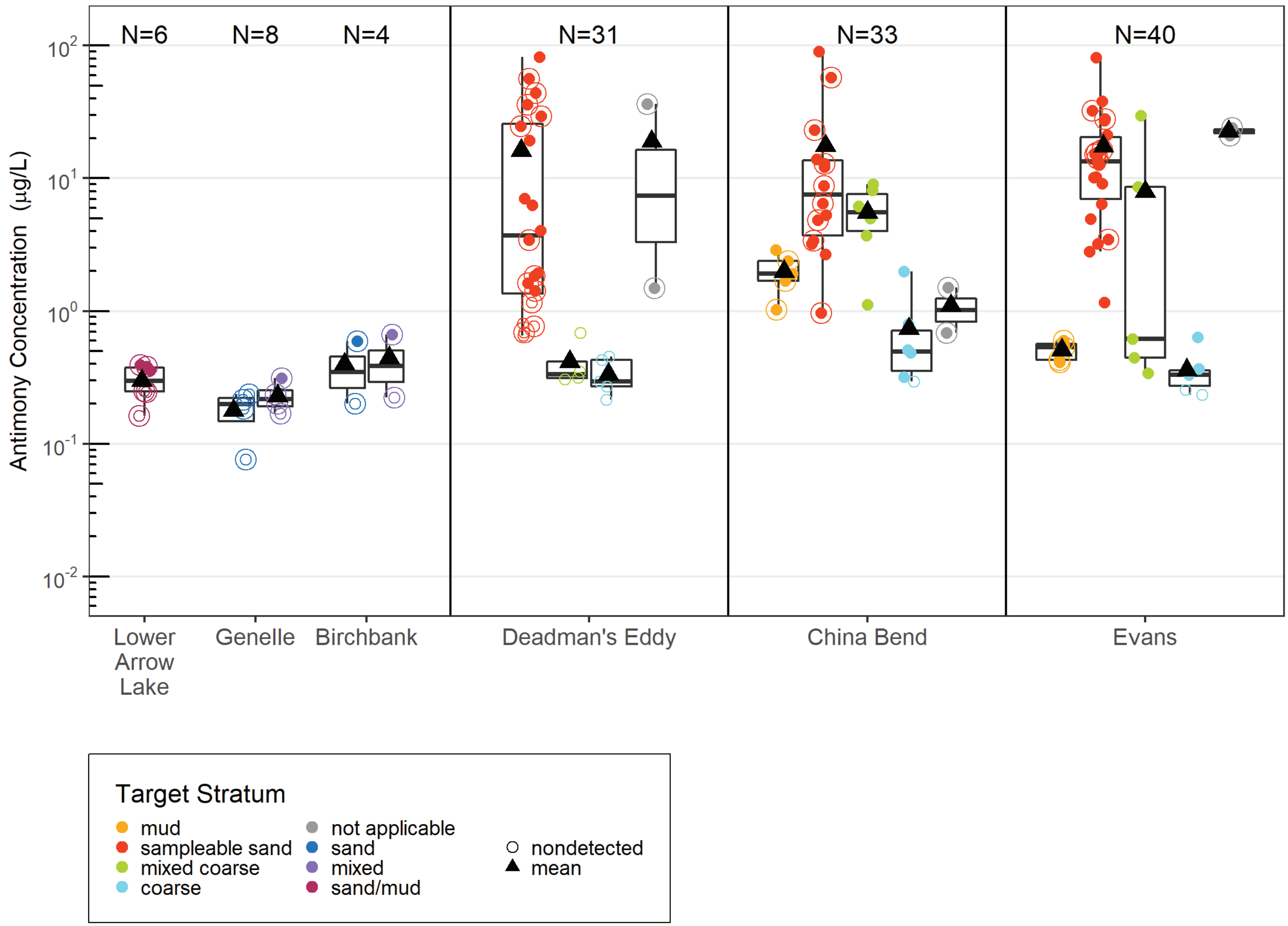
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of multimeter measurements.

Figure 5-3l. TDS in Field Porewater Samples



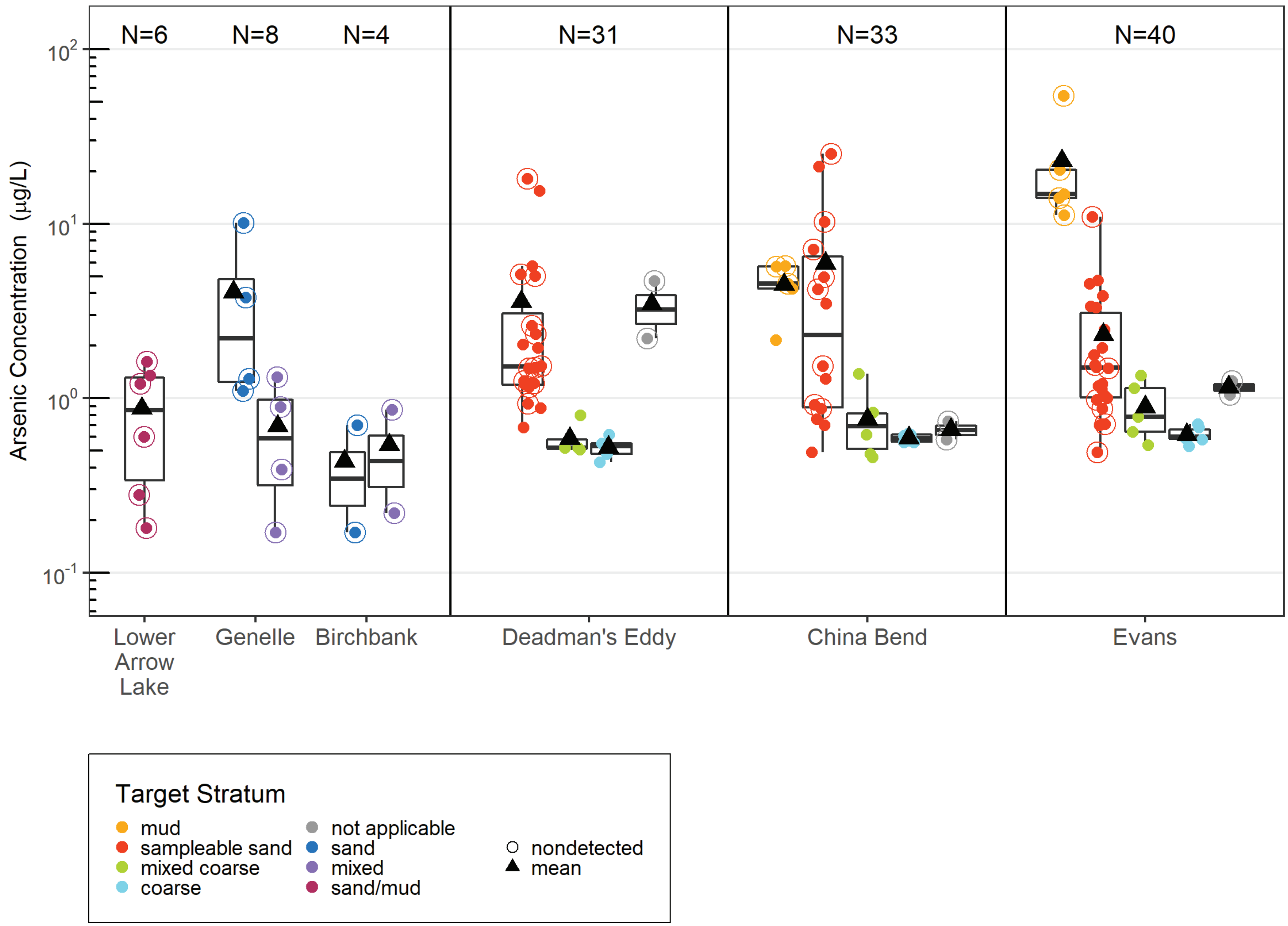
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3m. Dissolved Aluminum in Field Porewater Samples



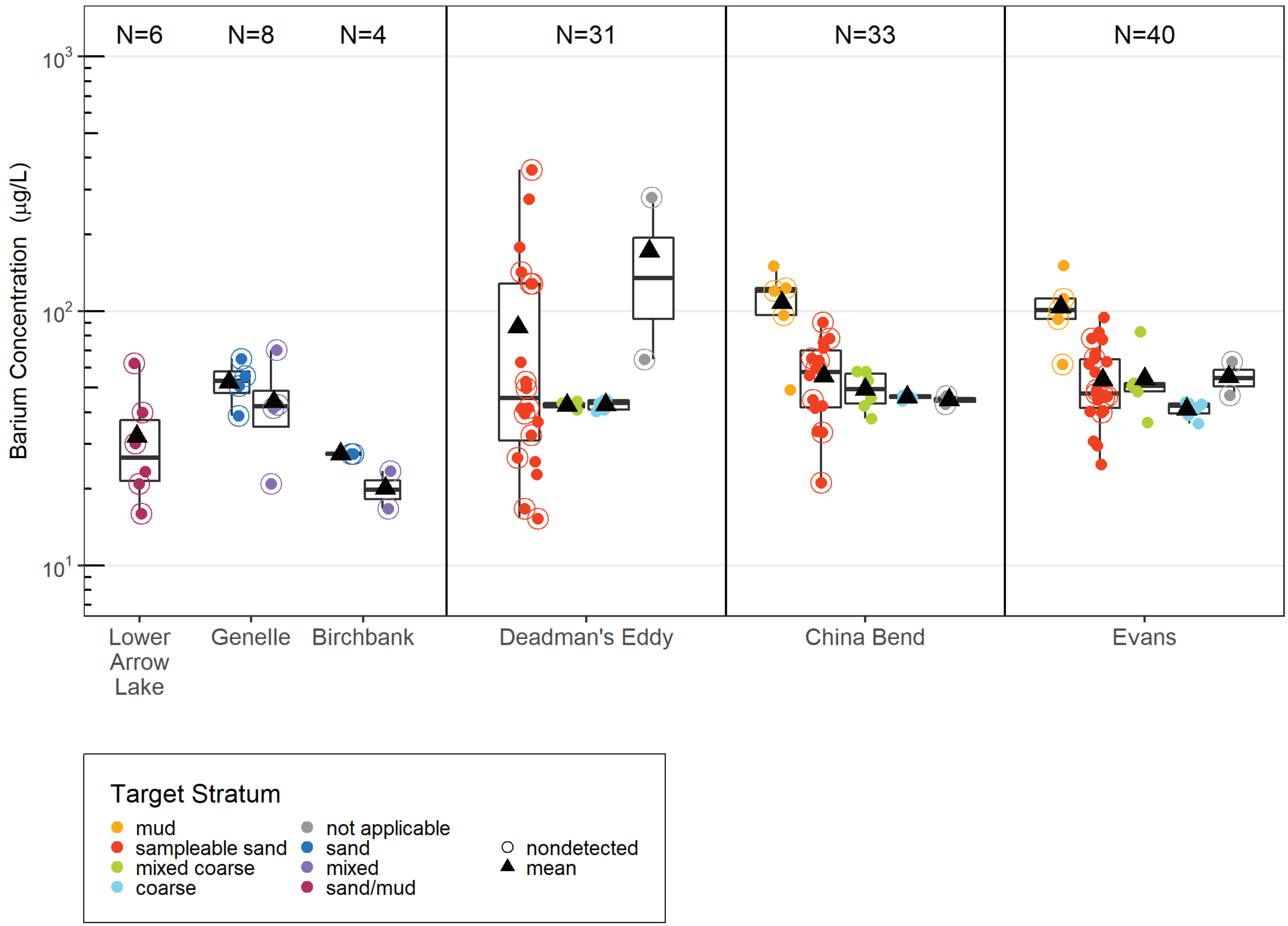
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3n. Dissolved Antimony in Field Porewater Samples



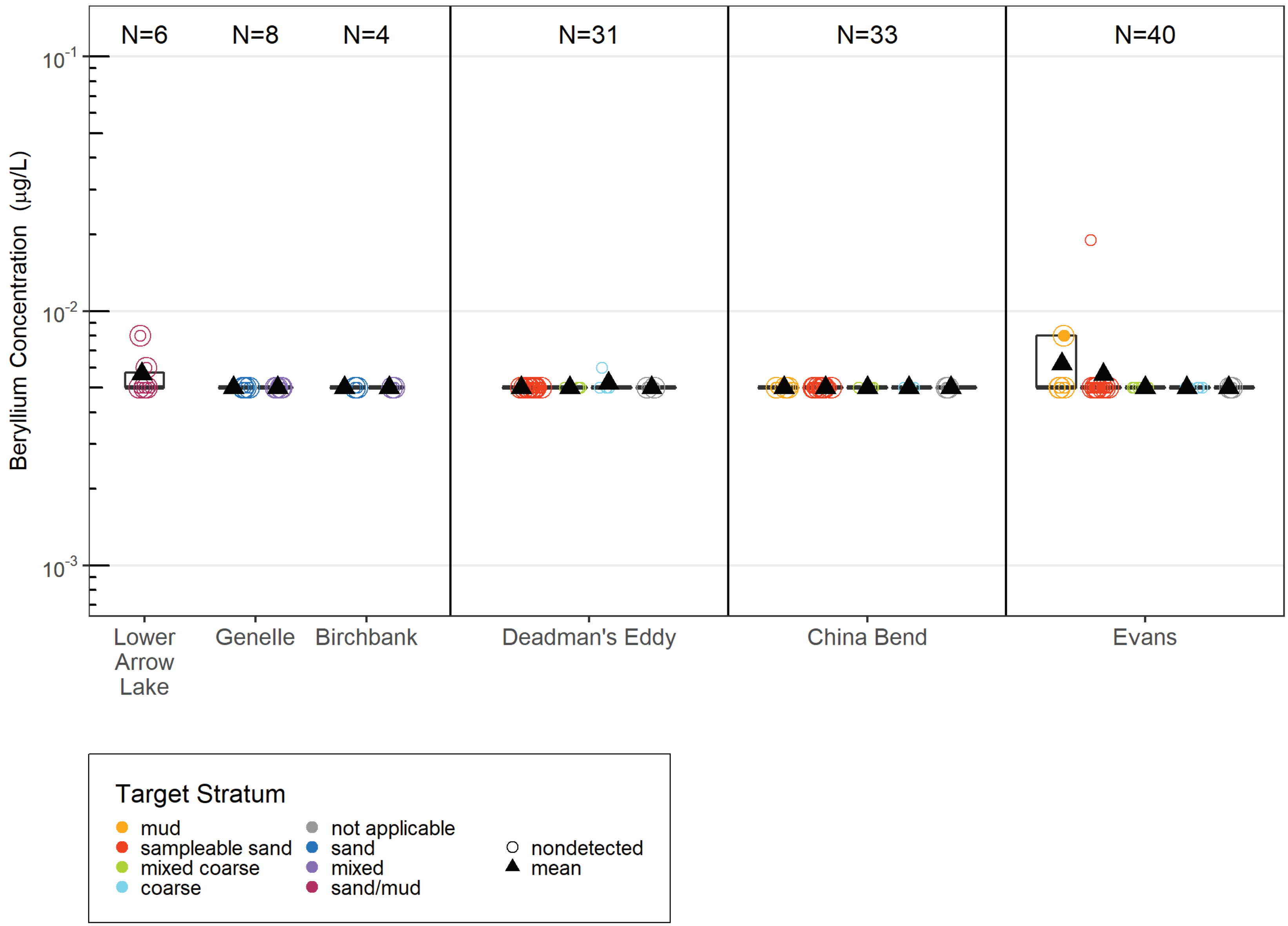
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3o. Dissolved Arsenic in Field Porewater Samples



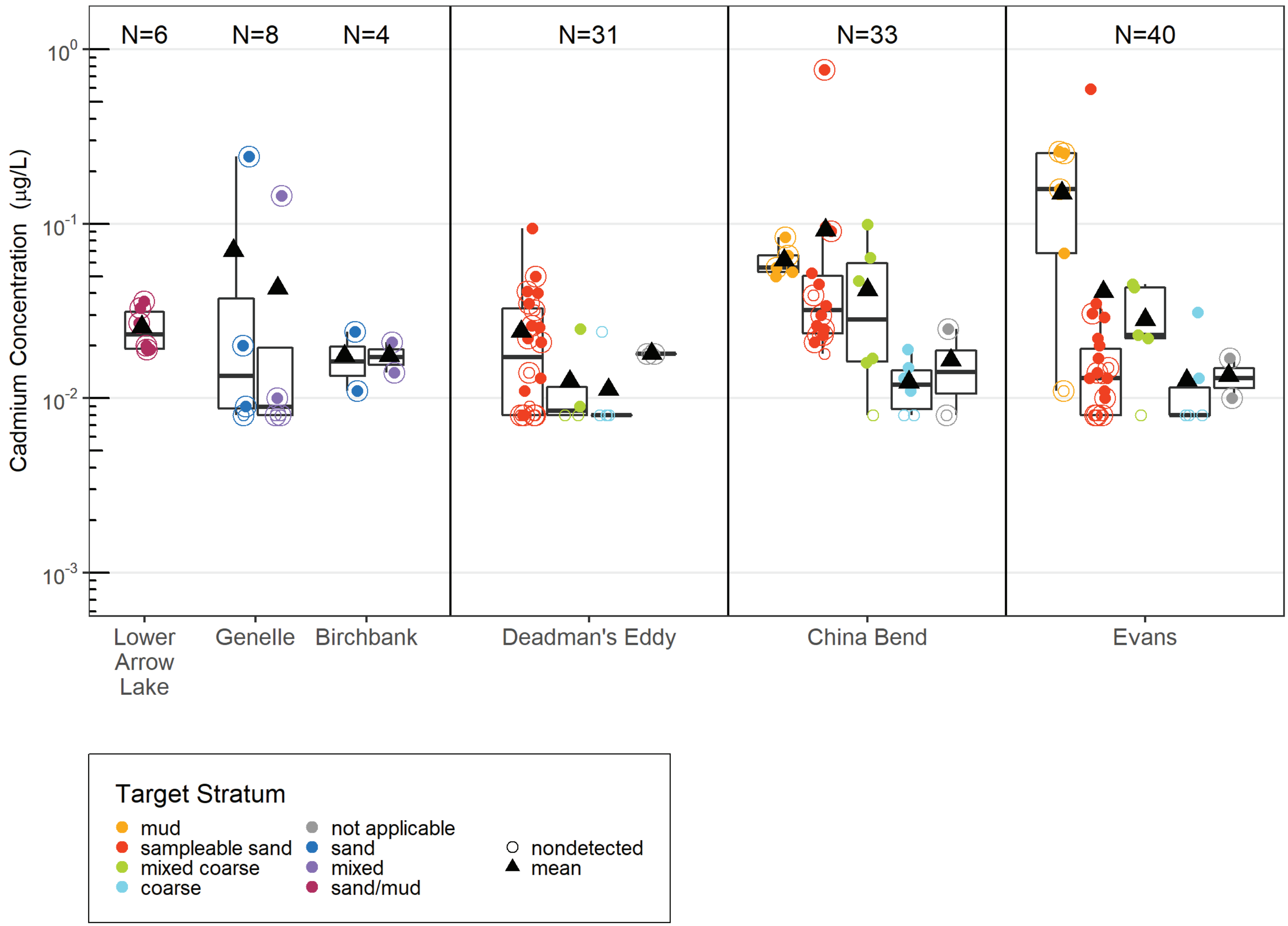
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3p. Dissolved Barium in Field Porewater Samples



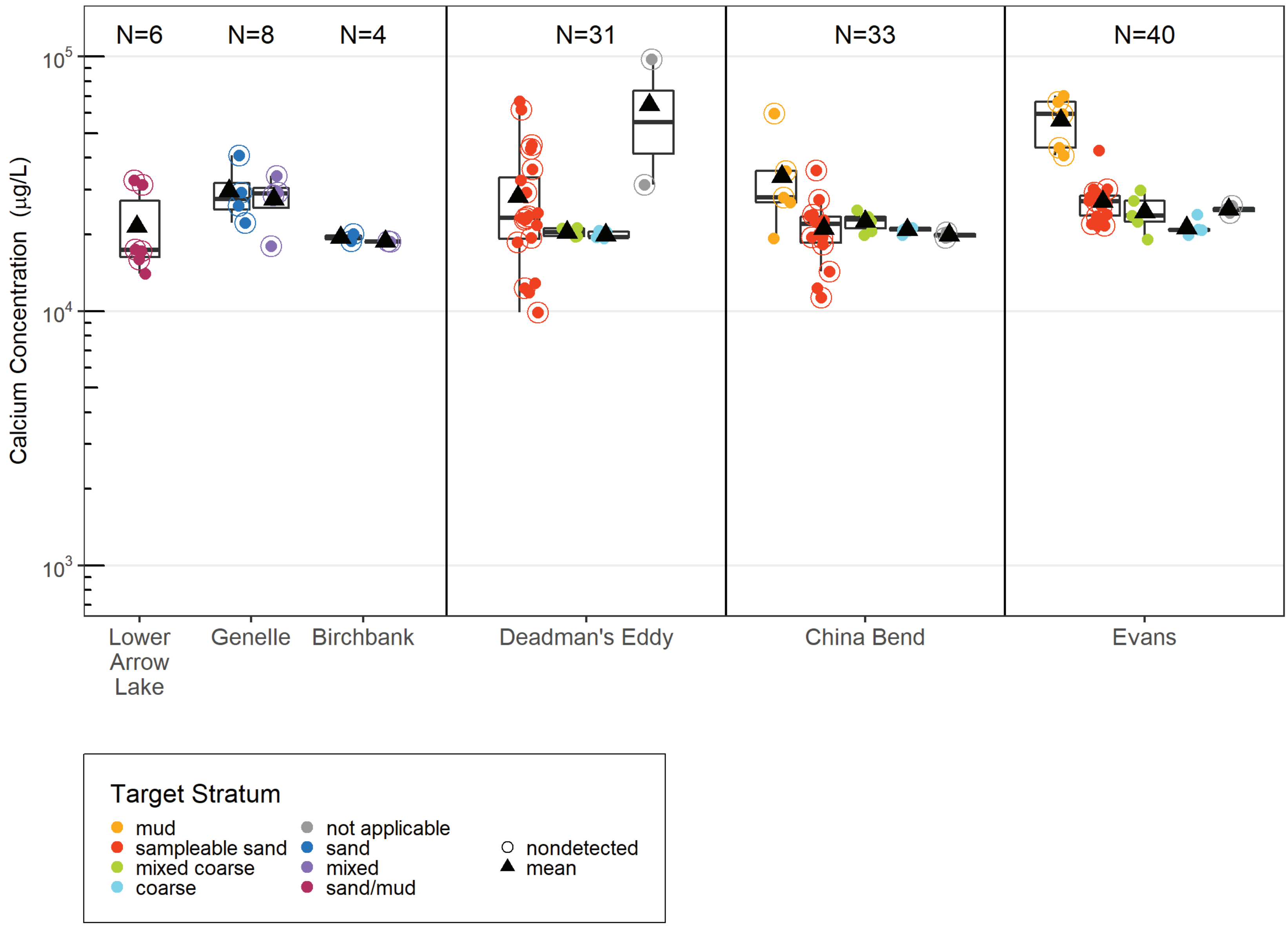
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3q. Dissolved Beryllium in Field Porewater Samples



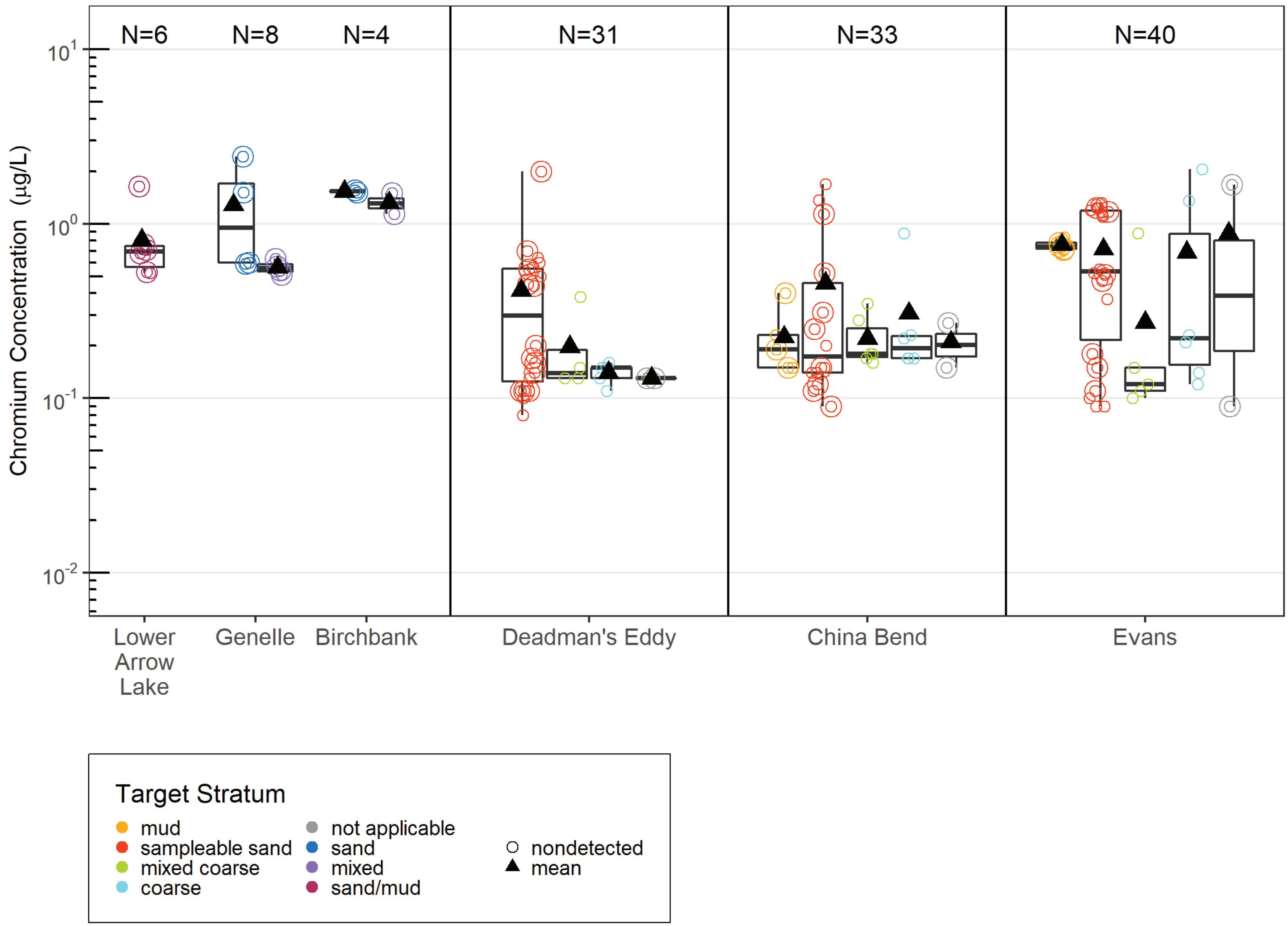
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3r. Dissolved Cadmium in Field Porewater Samples



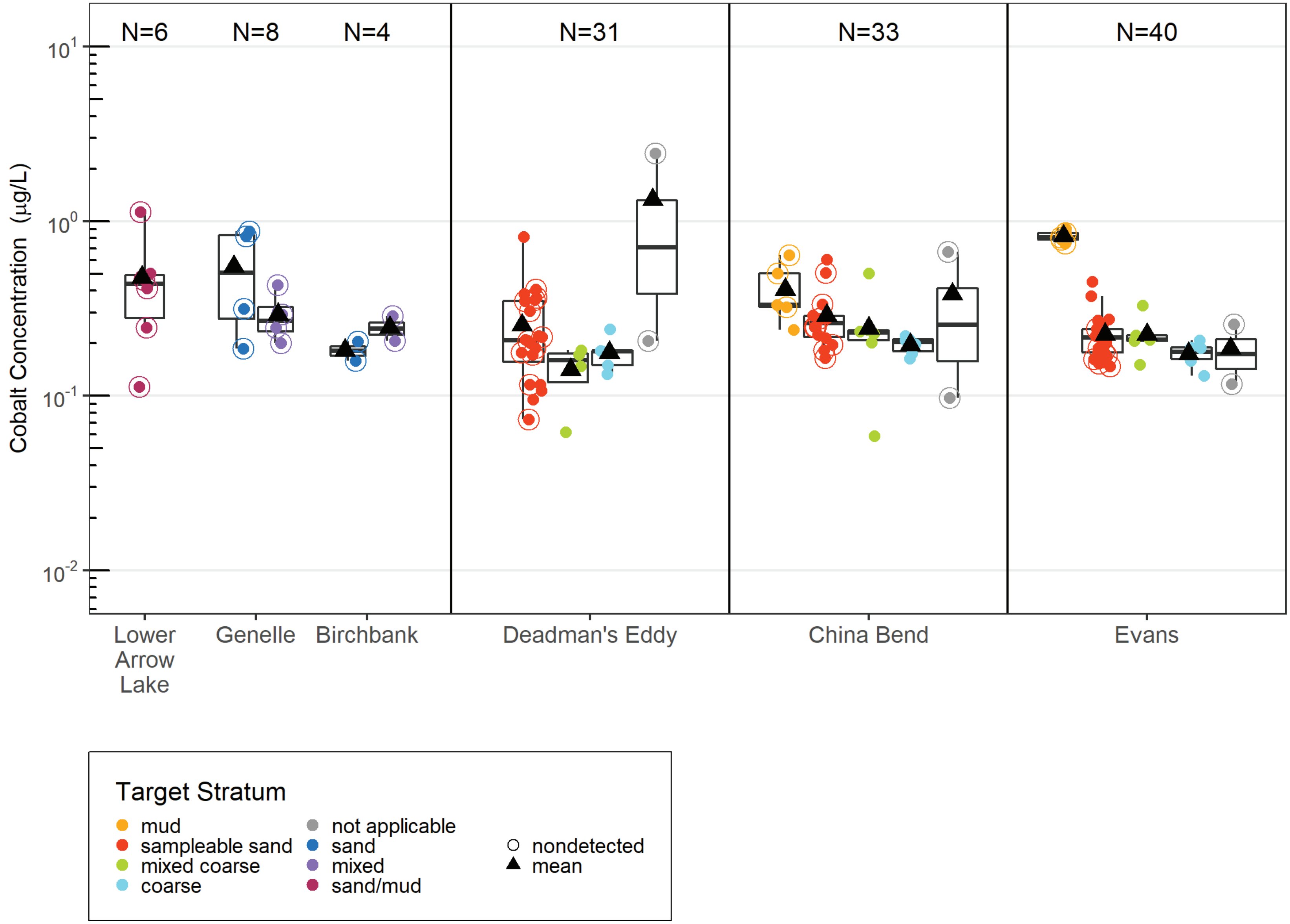
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3s. Dissolved Calcium in Field Porewater Samples



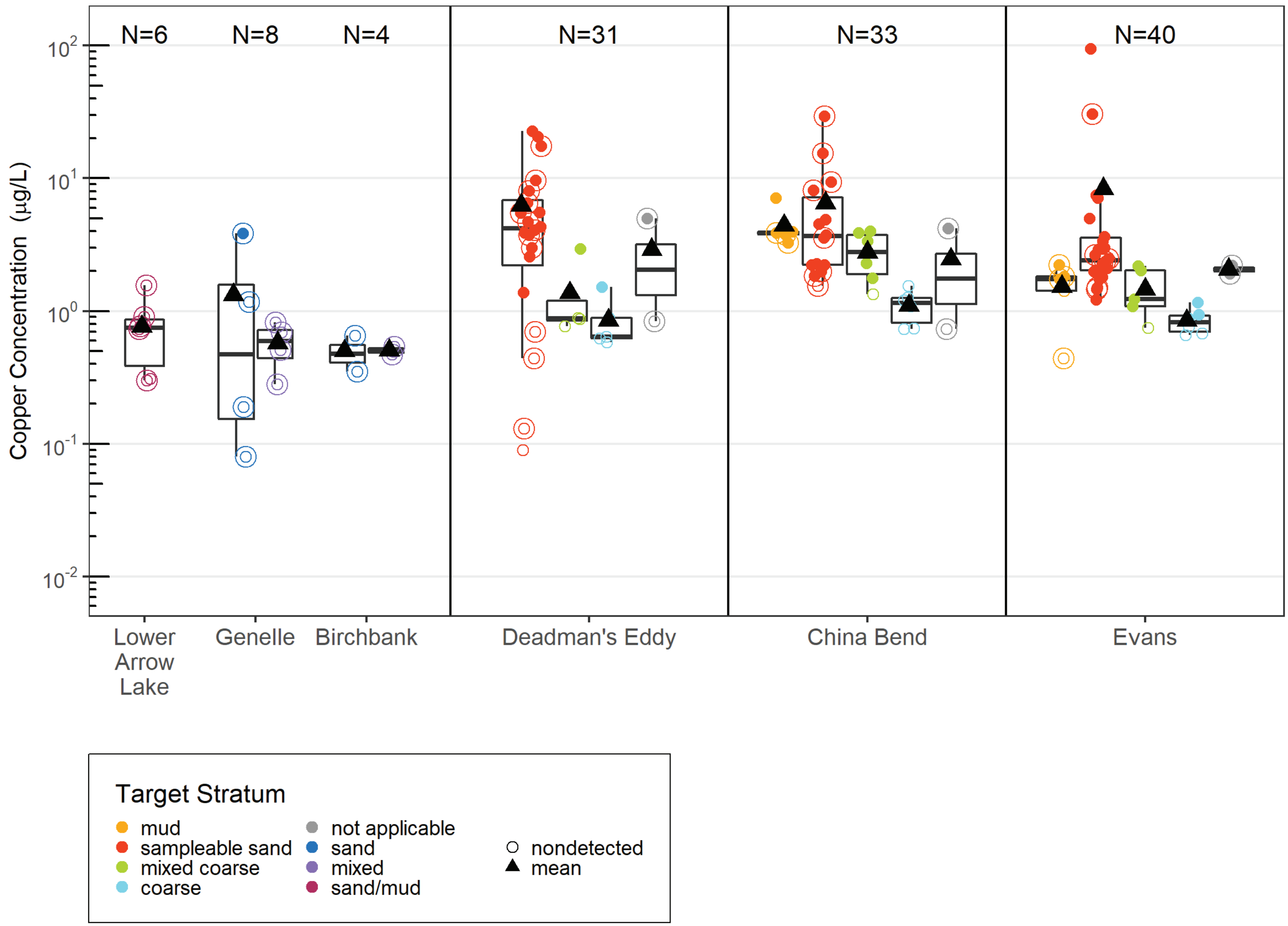
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3t. Dissolved Chromium in Field Porewater Samples



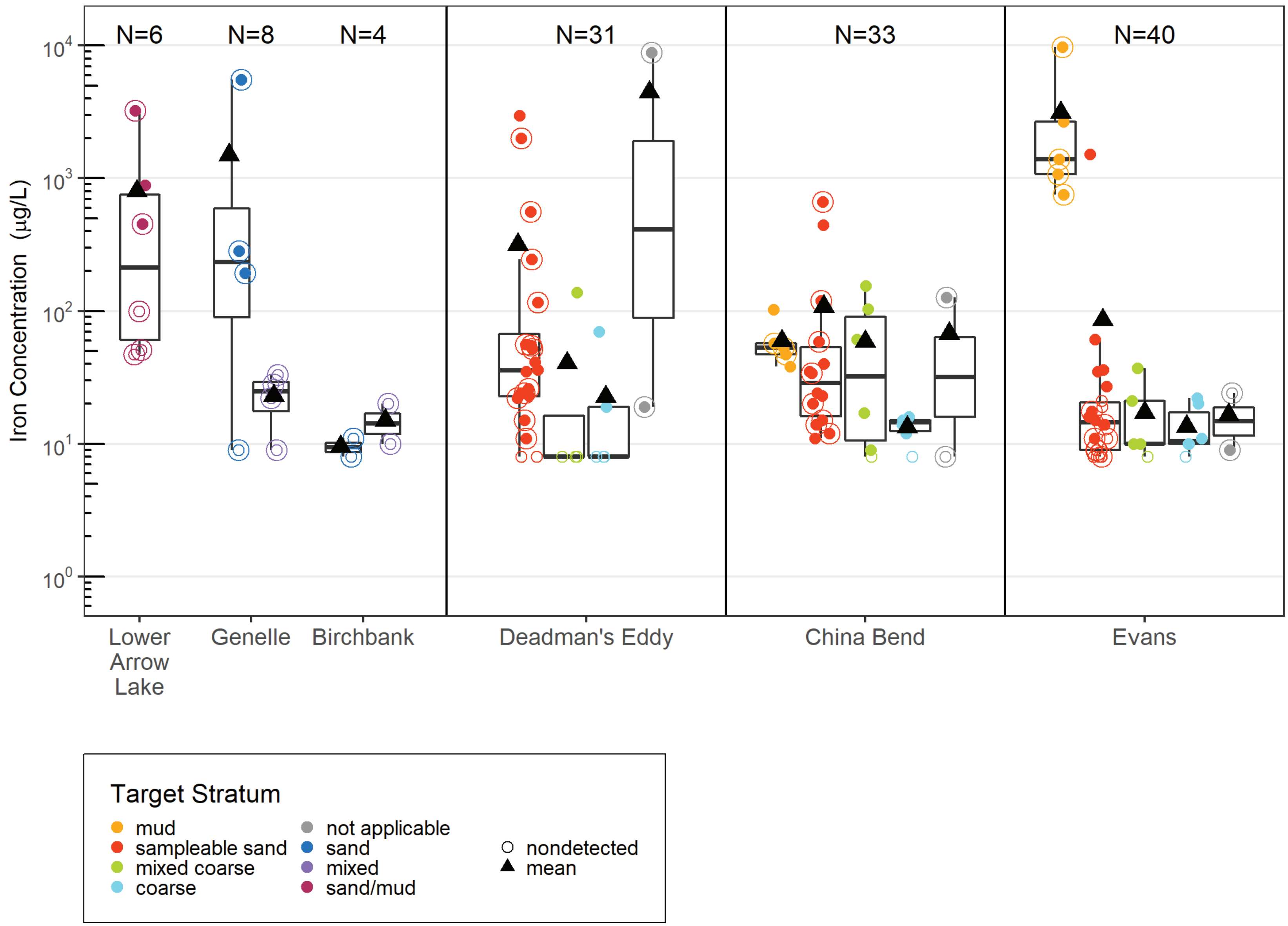
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3u. Dissolved Cobalt in Field Porewater Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3v. Dissolved Copper in Field Porewater Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3w. Dissolved Iron in Field Porewater Samples

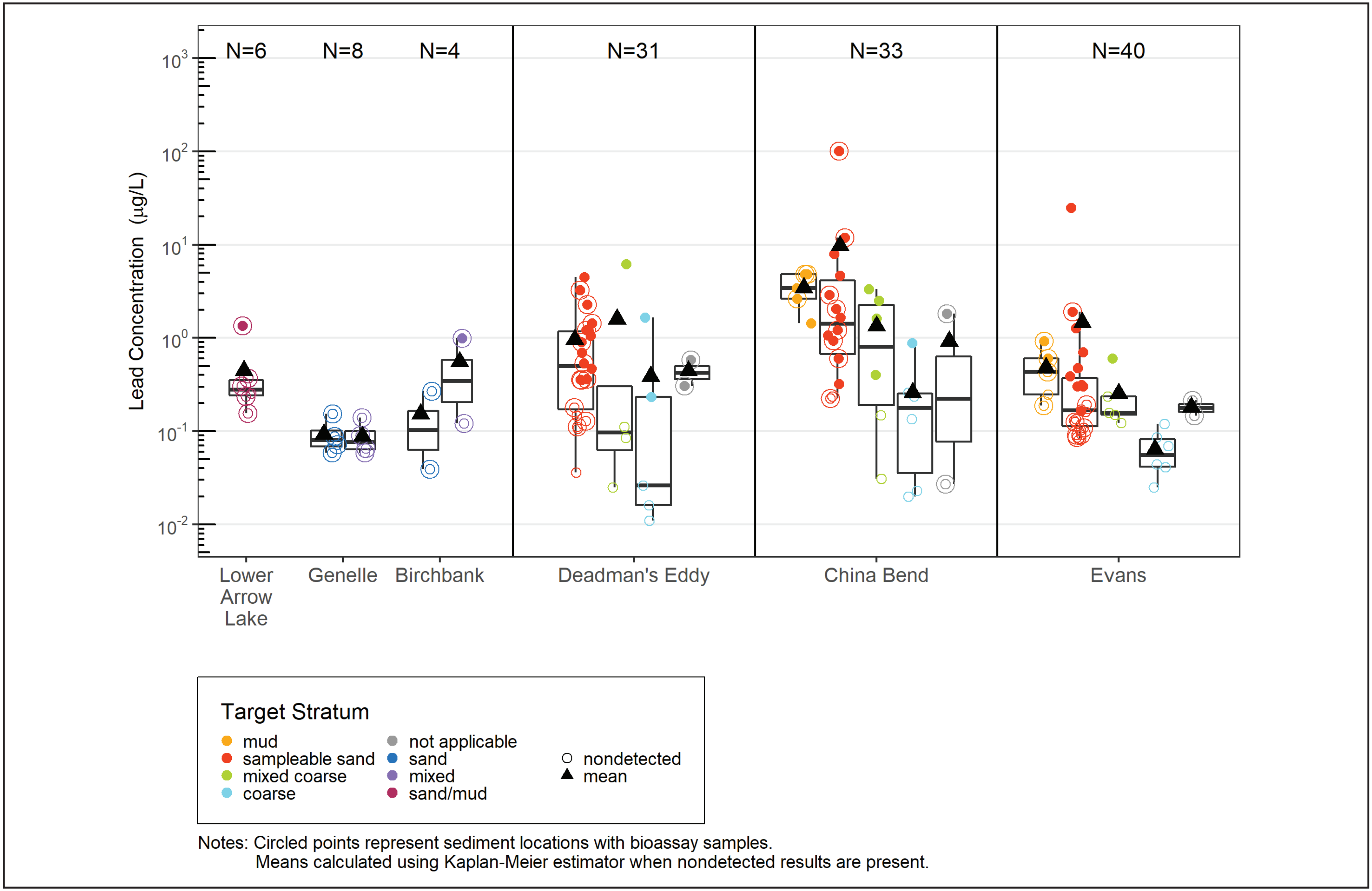
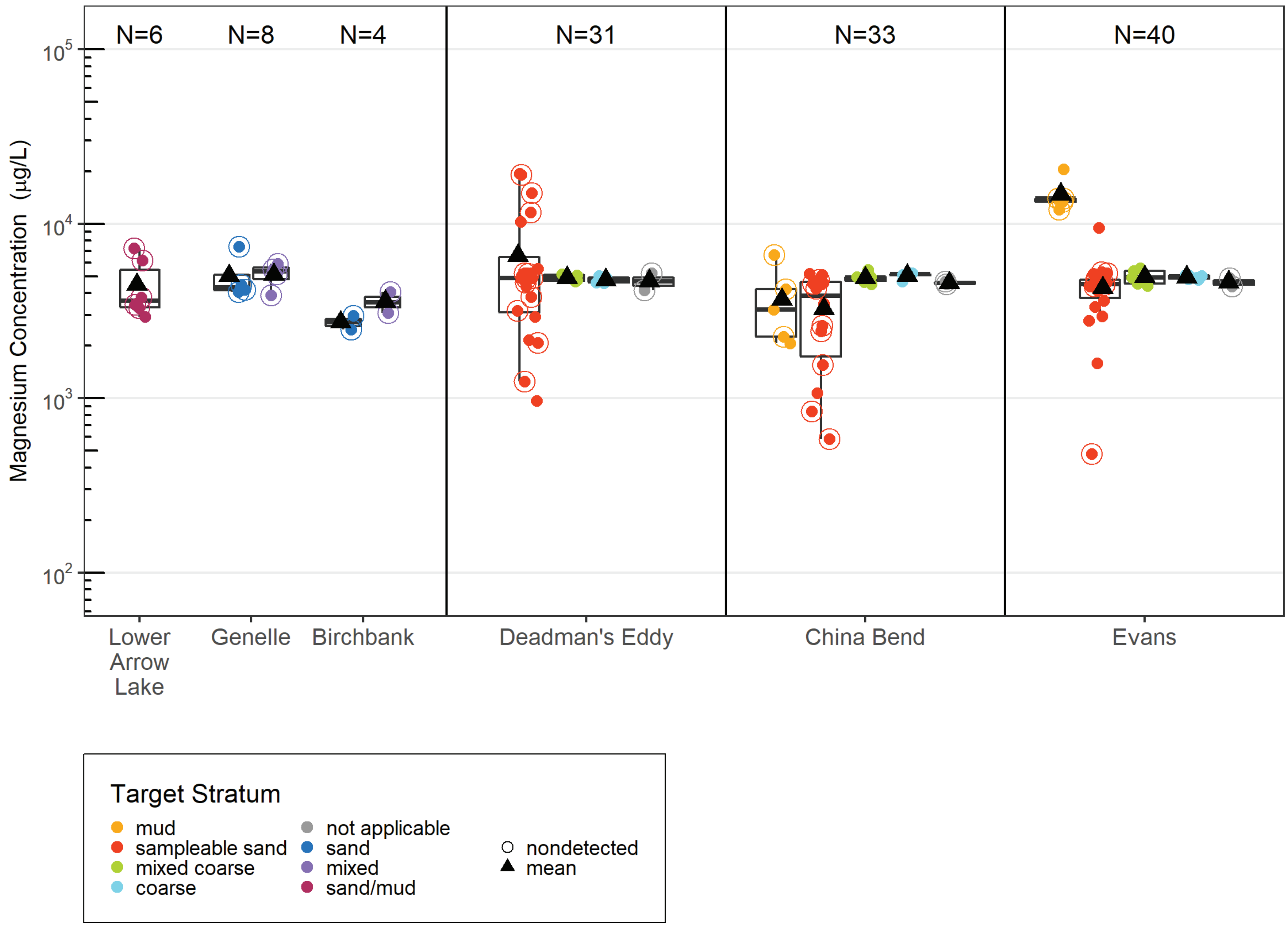
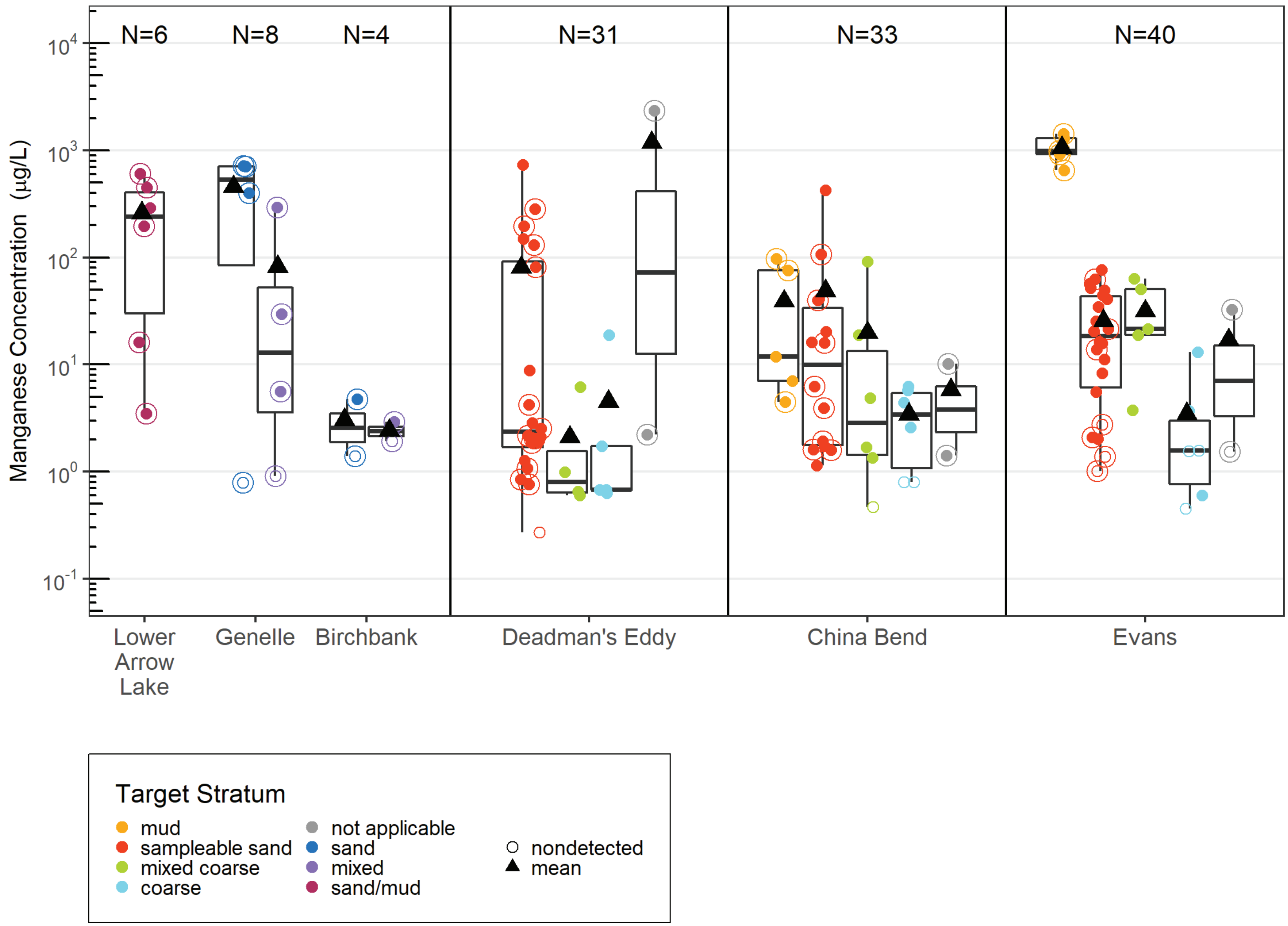


Figure 5-3x. Dissolved Lead in Field Porewater Samples



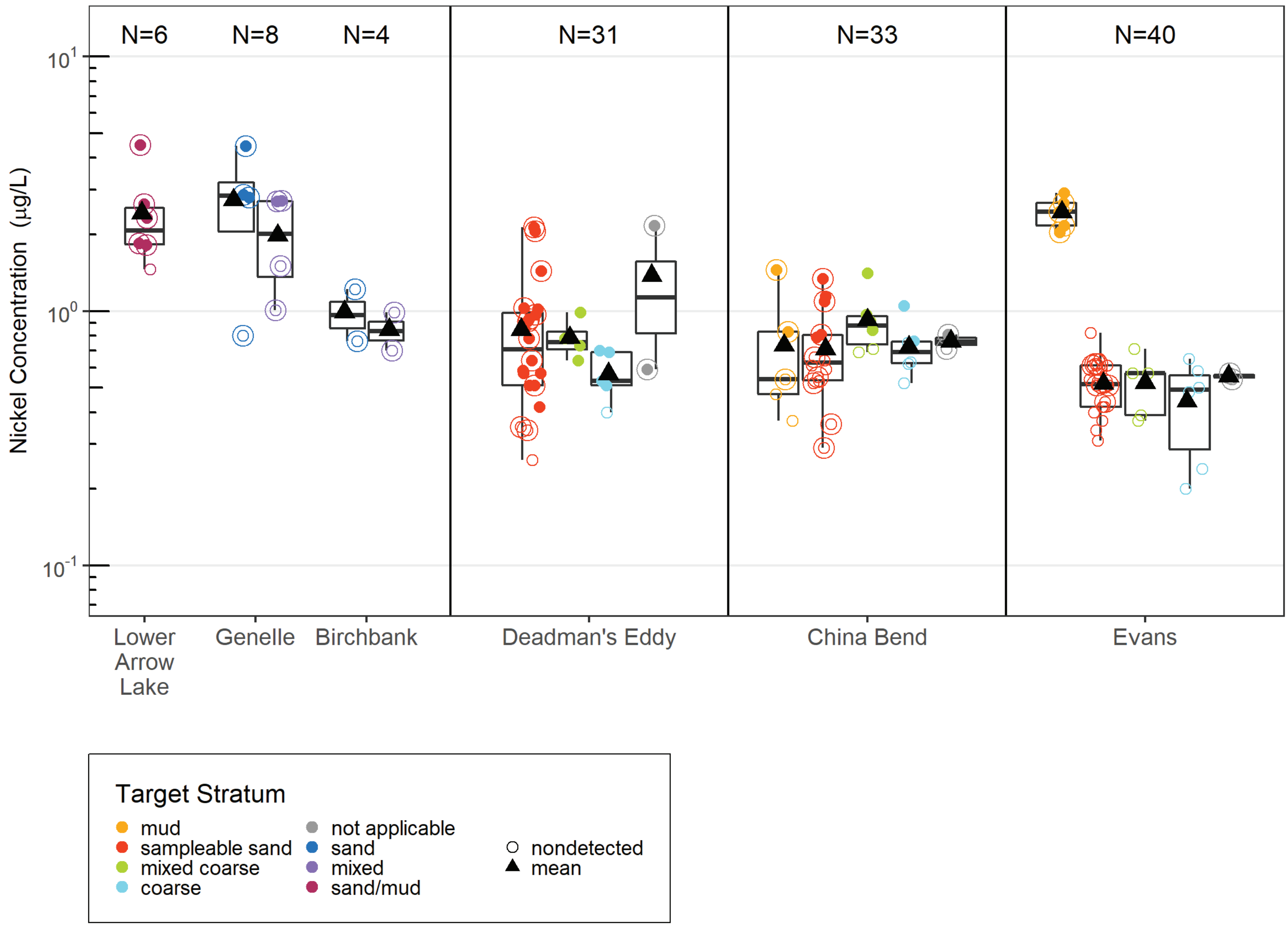
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3y. Dissolved Magnesium in Field Porewater Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3z. Dissolved Manganese in Field Porewater Samples



Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3aa. Dissolved Nickel in Field Porewater Samples

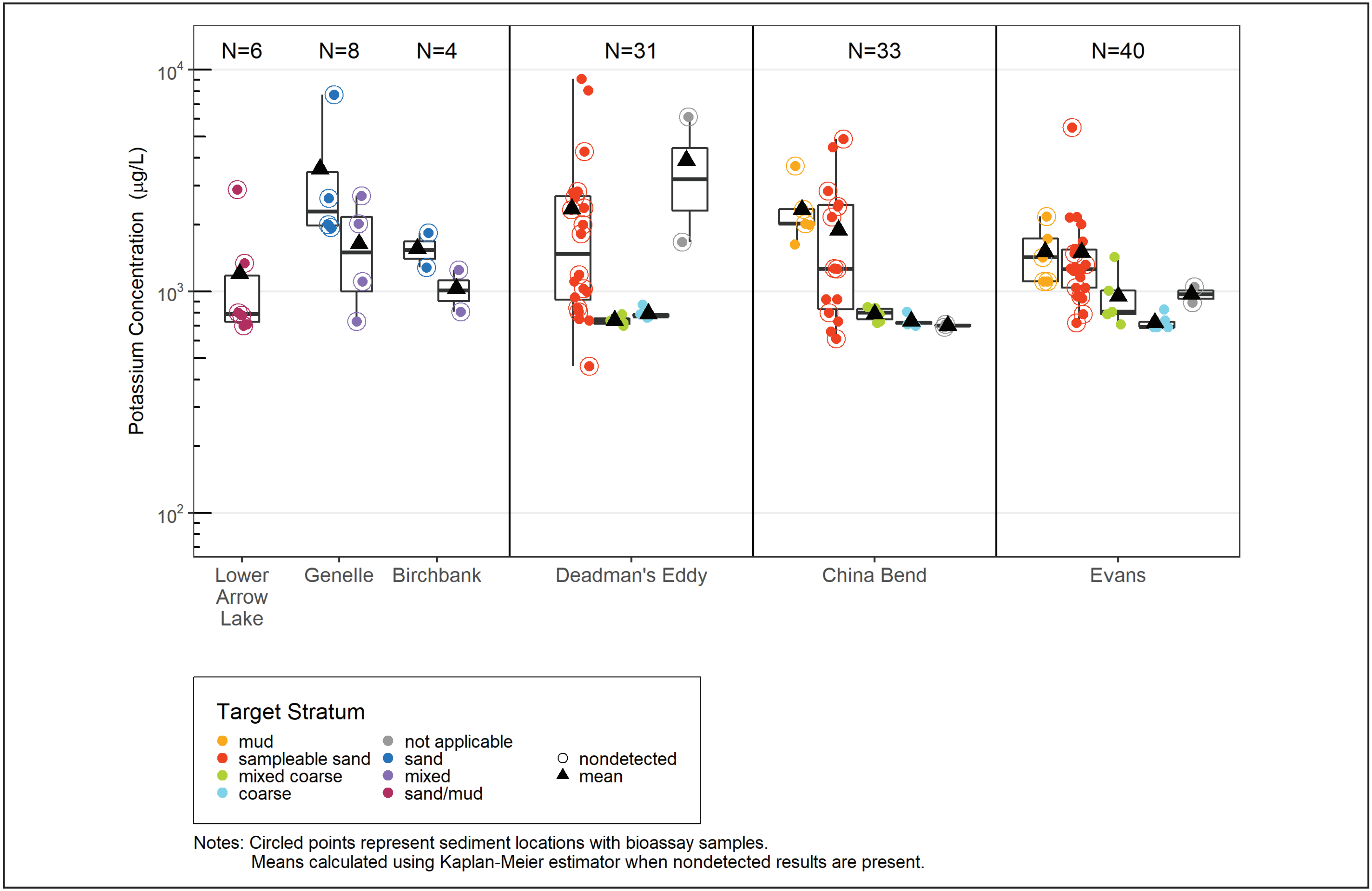
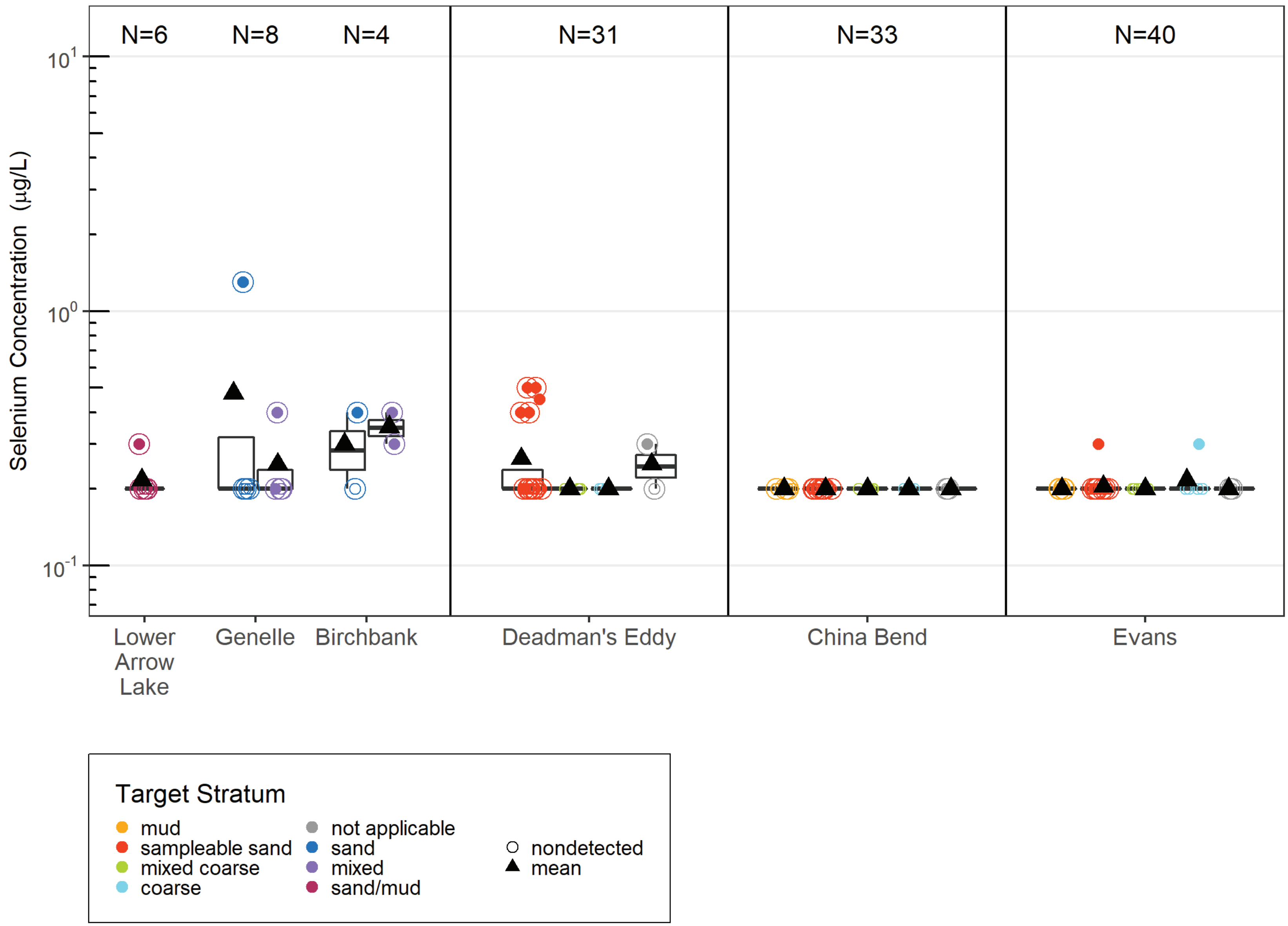
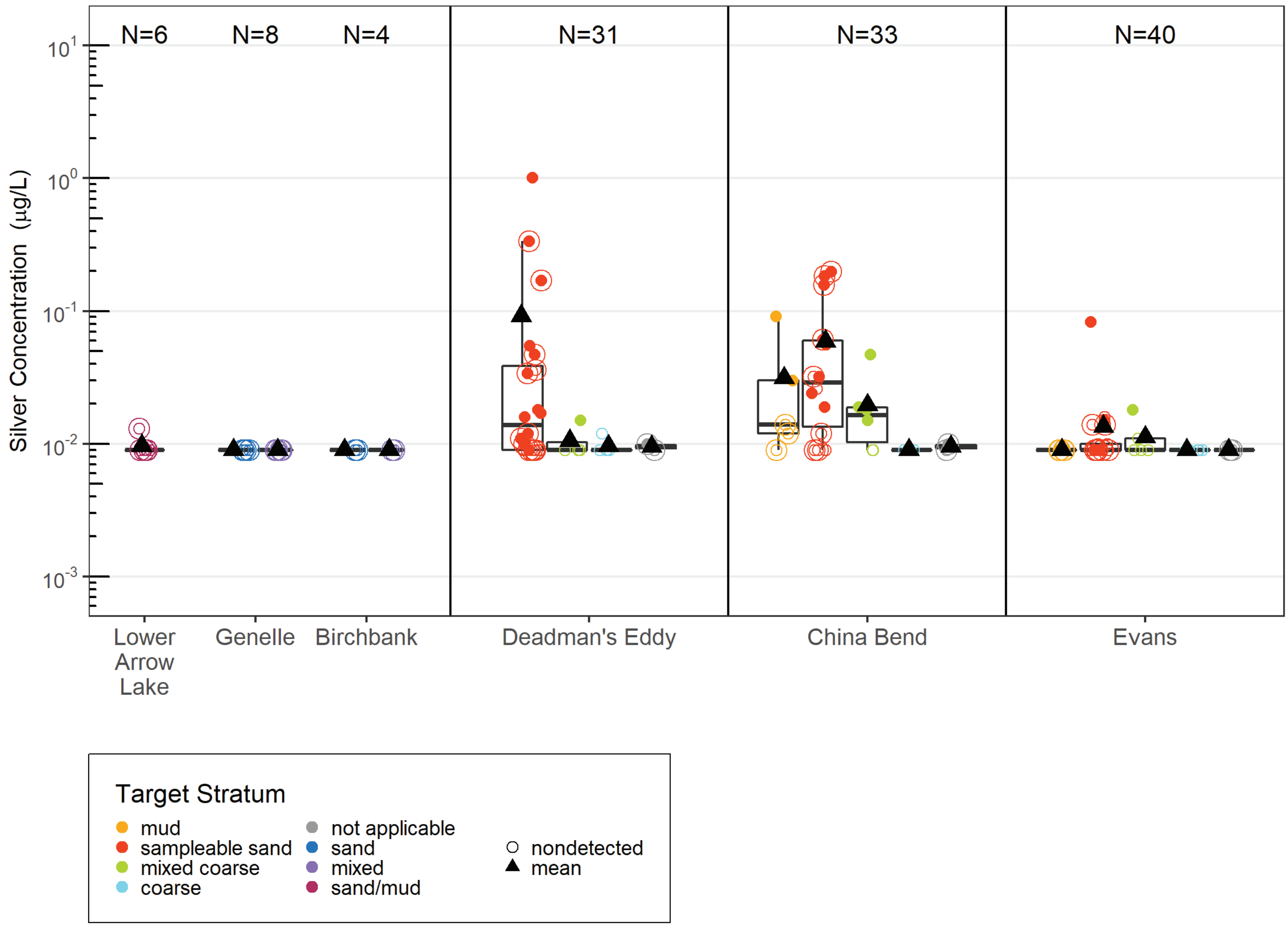


Figure 5-3ab. Dissolved Potassium in Field Porewater Samples



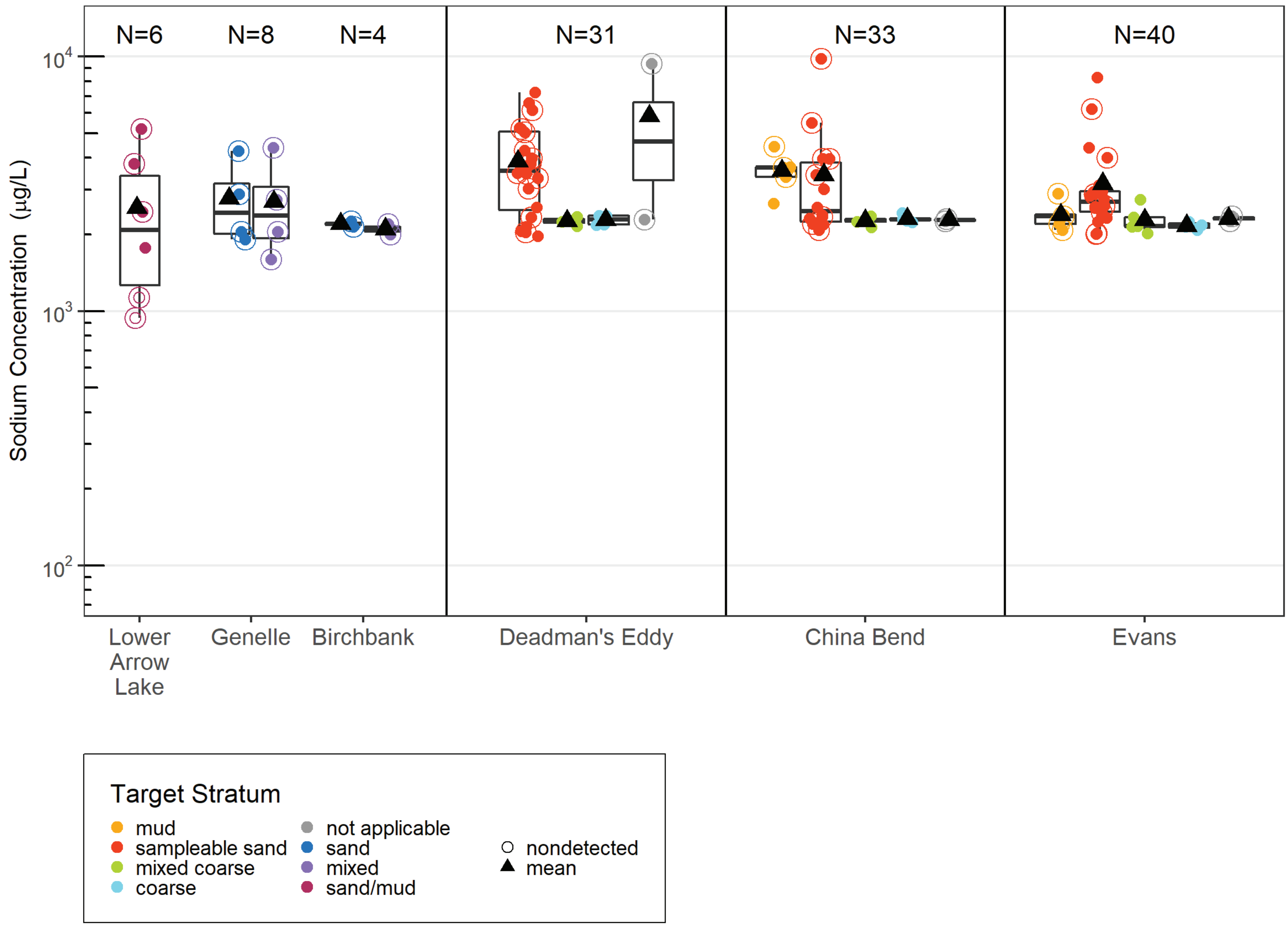
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3ac. Dissolved Selenium in Field Porewater Samples



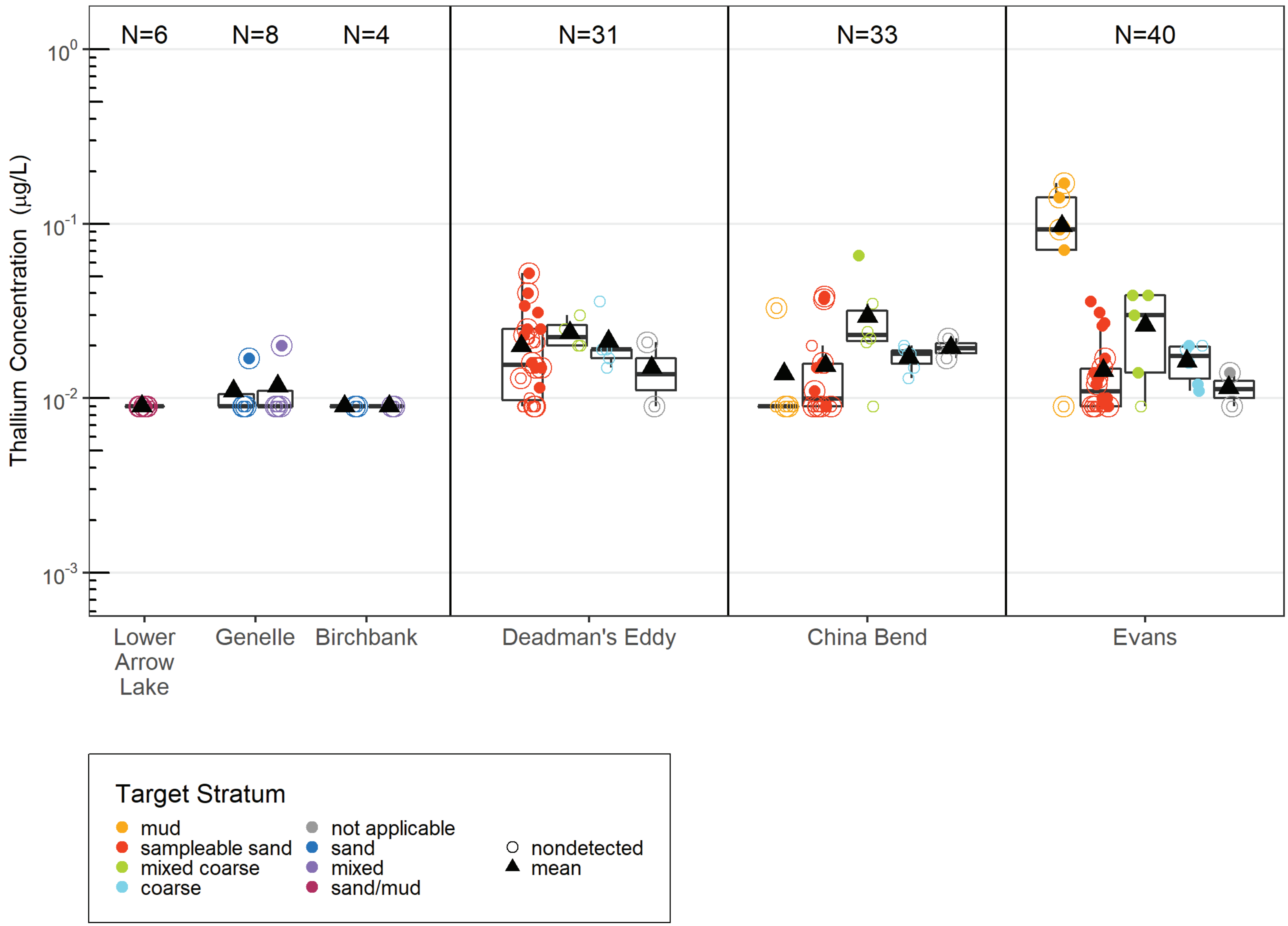
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3ad. Dissolved Silver in Field Porewater Samples



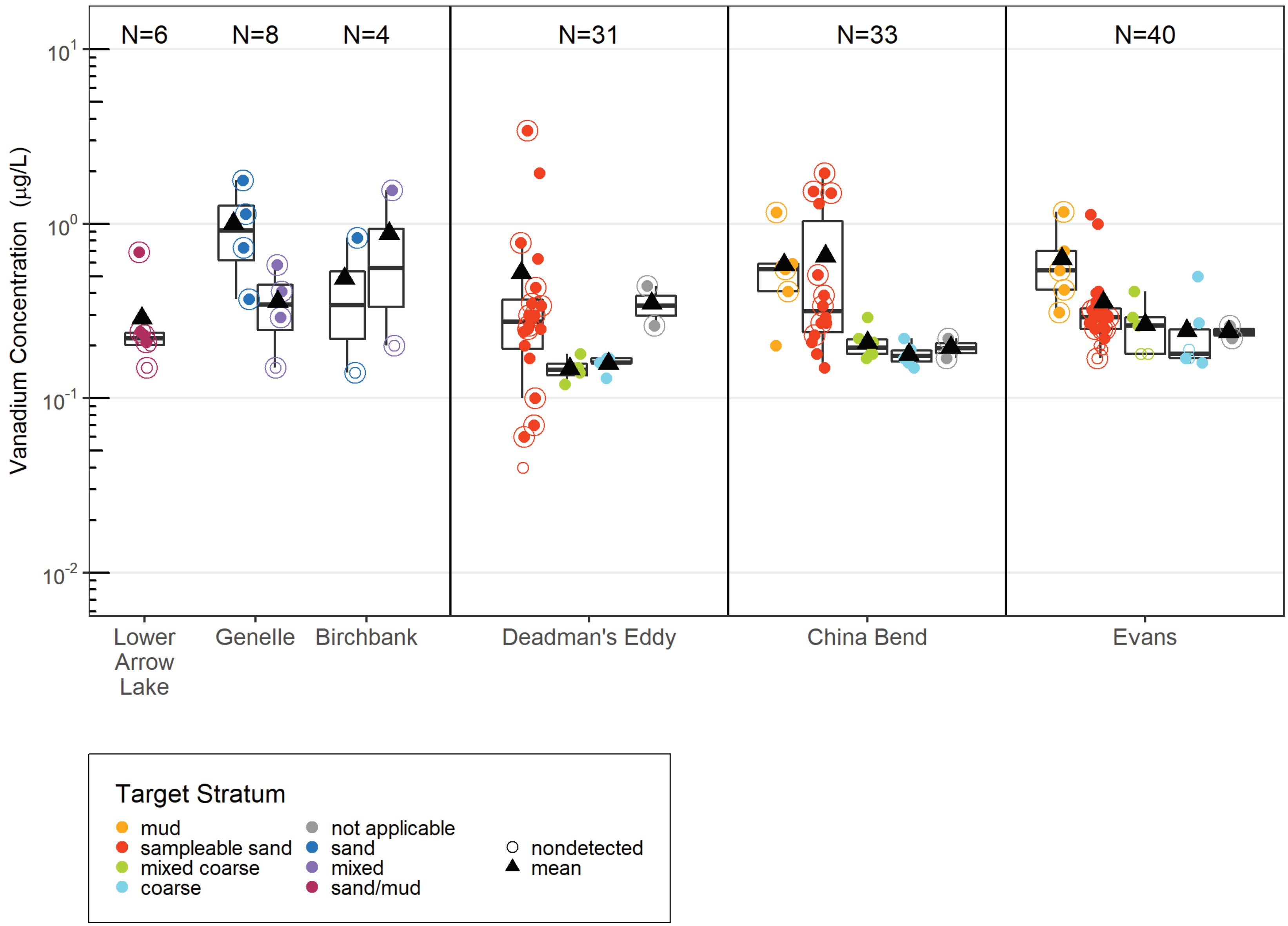
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3ae. Dissolved Sodium in Field Porewater Samples



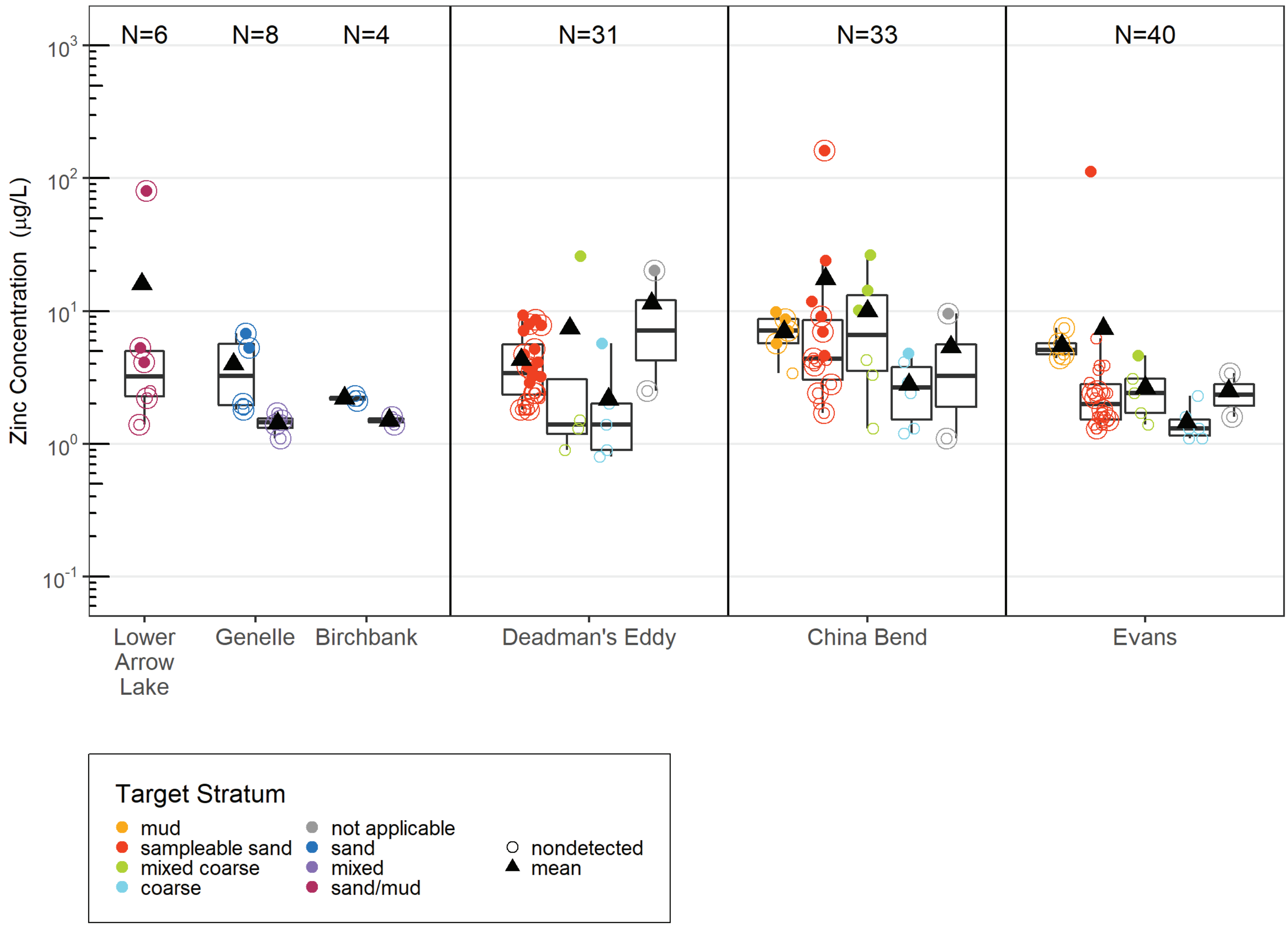
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3af. Dissolved Thallium in Field Porewater Samples



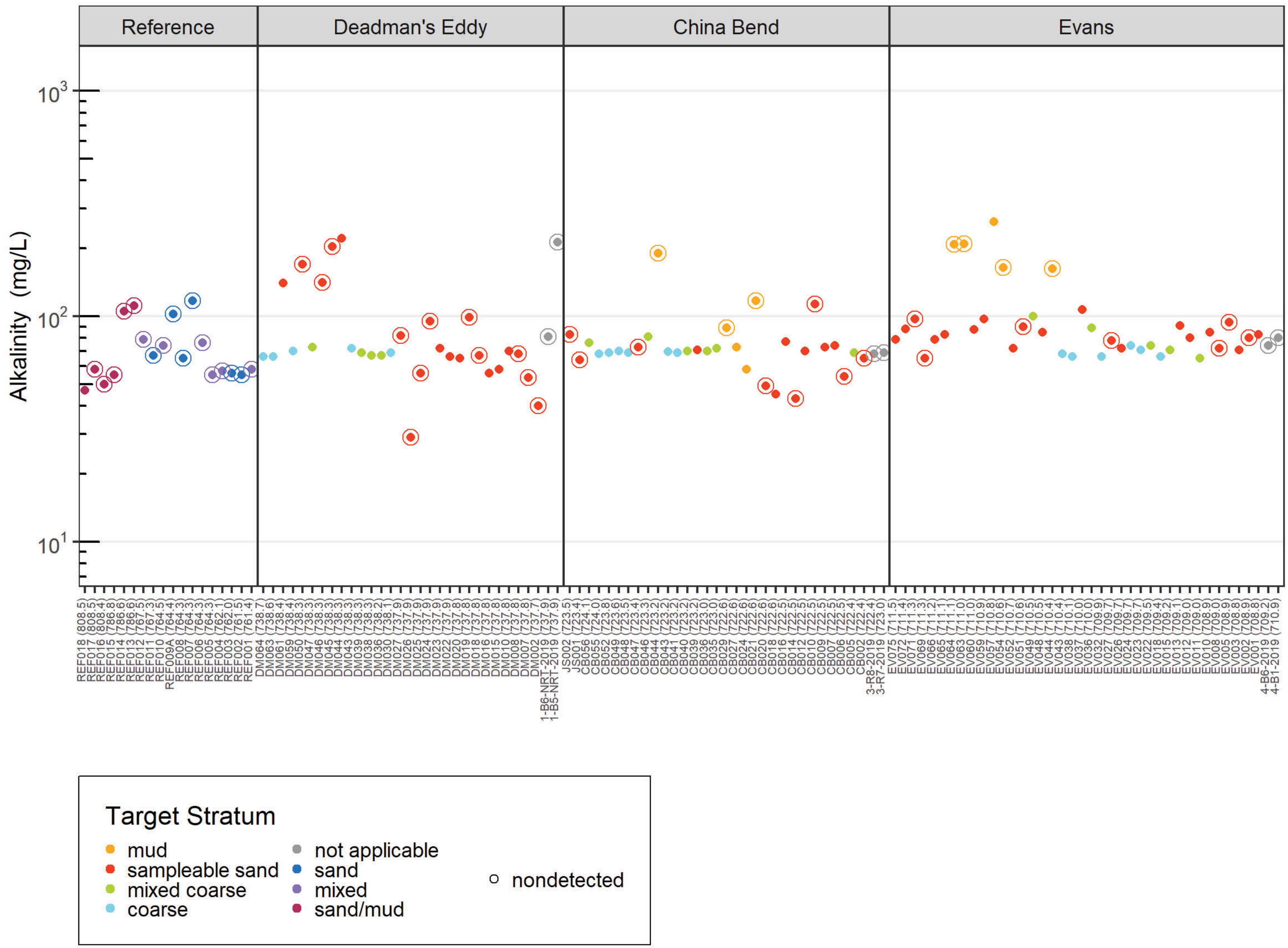
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3ag. Dissolved Vanadium in Field Porewater Samples



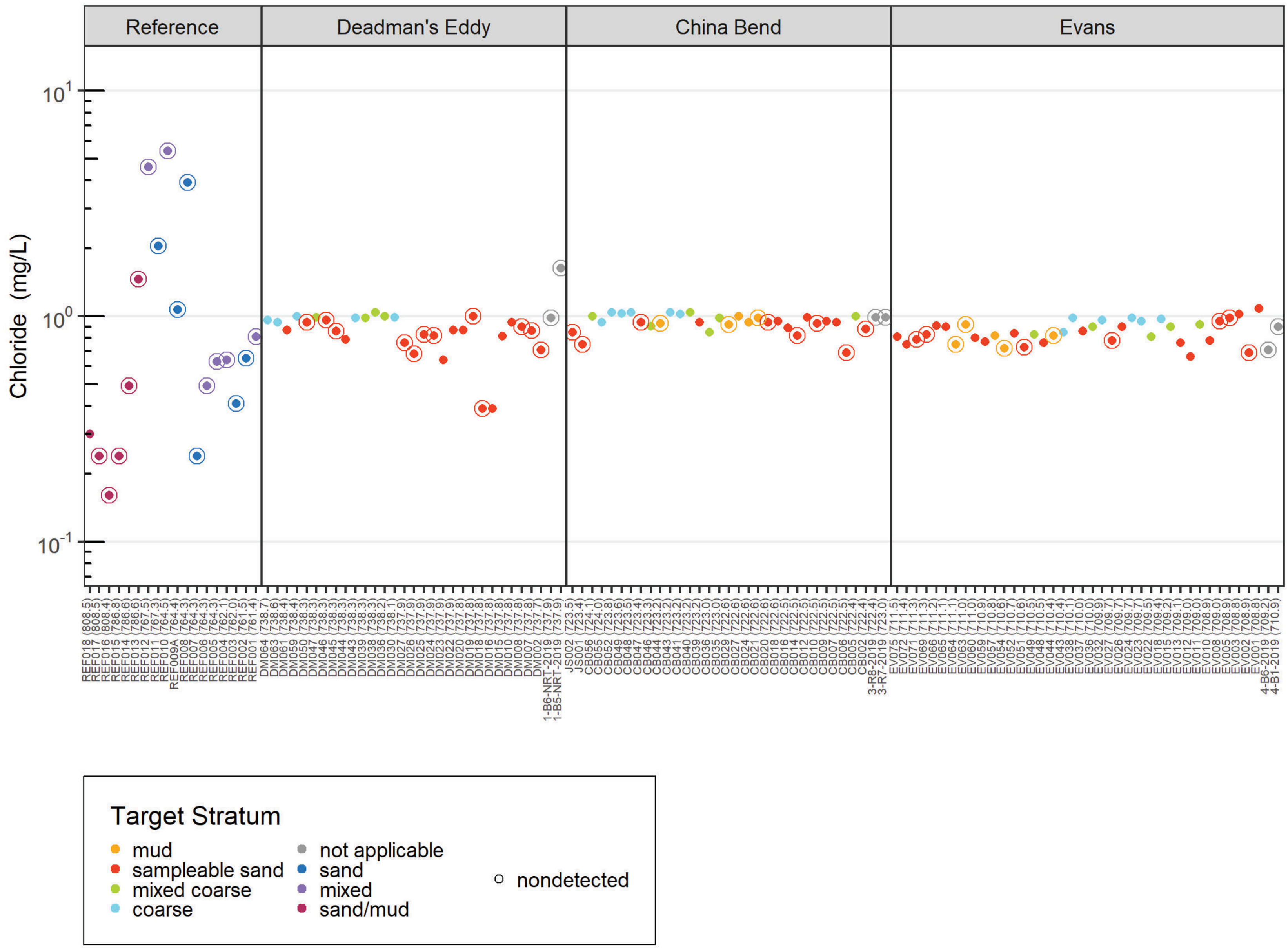
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.

Figure 5-3ah. Dissolved Zinc in Field Porewater Samples



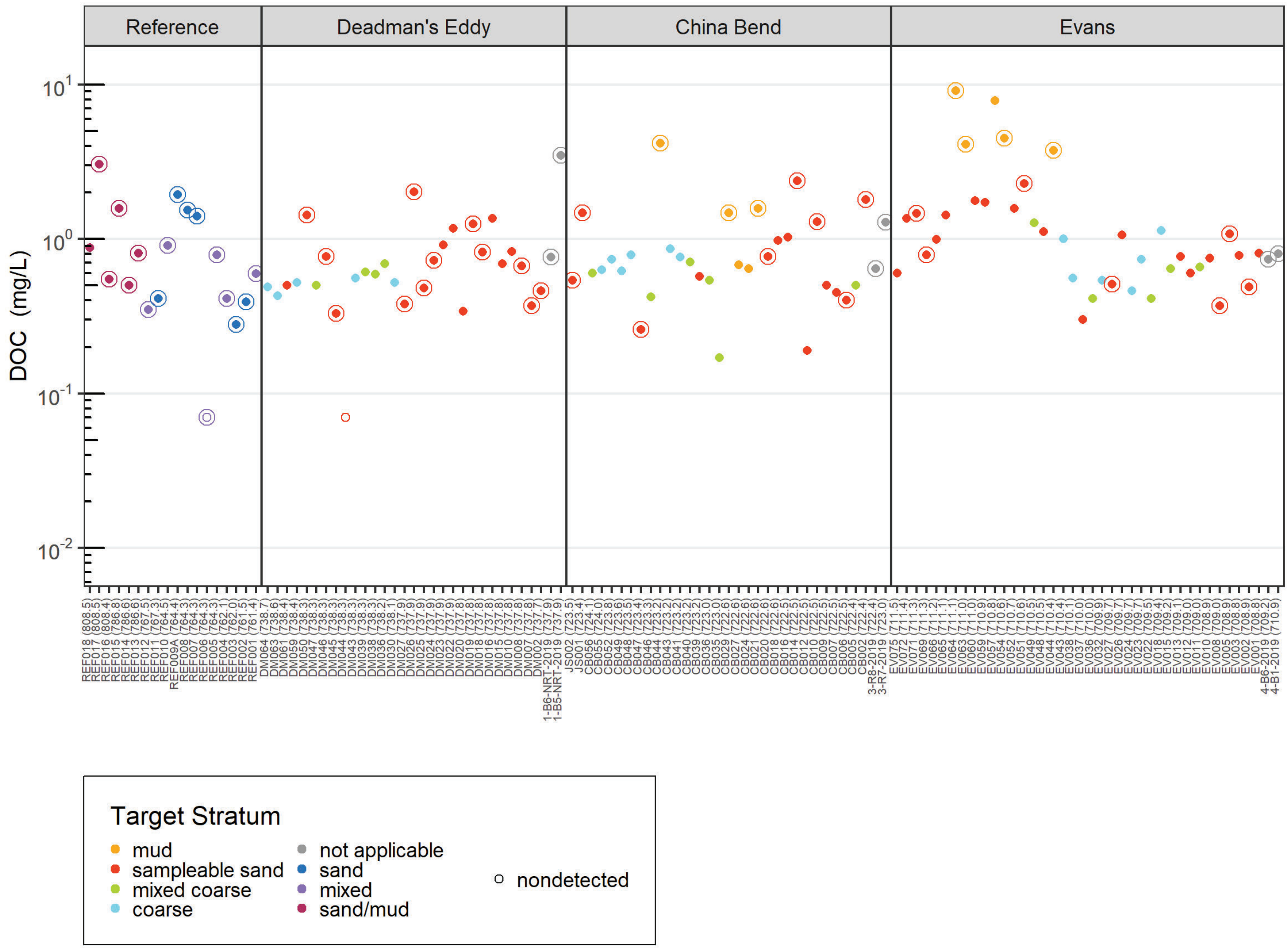
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3ai. Alkalinity in Field Porewater Samples by River Mile



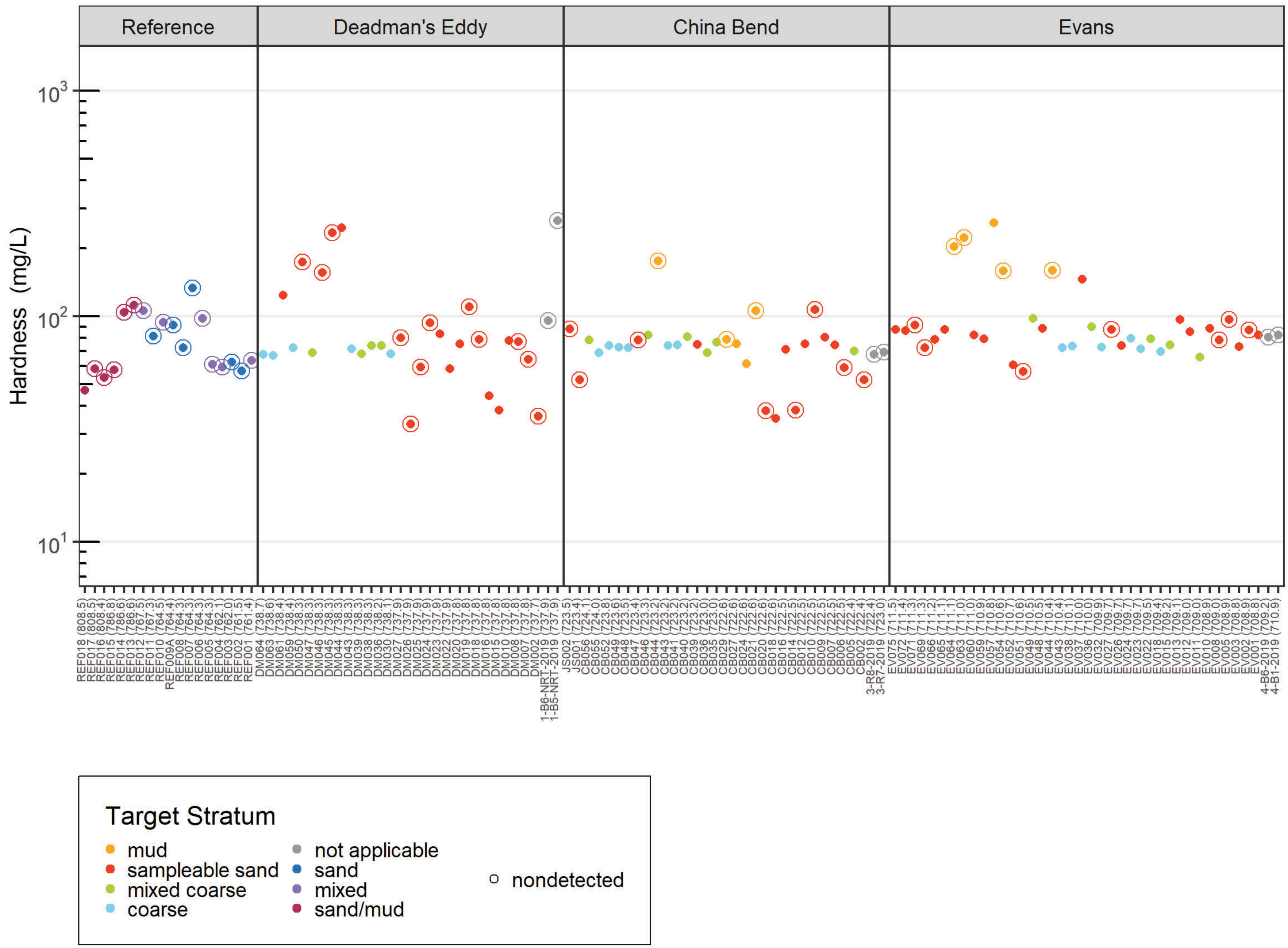
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3aj. Chloride in Field Porewater Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3ak. DOC in Field Porewater Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3al. Hardness in Field Porewater Samples by River Mile

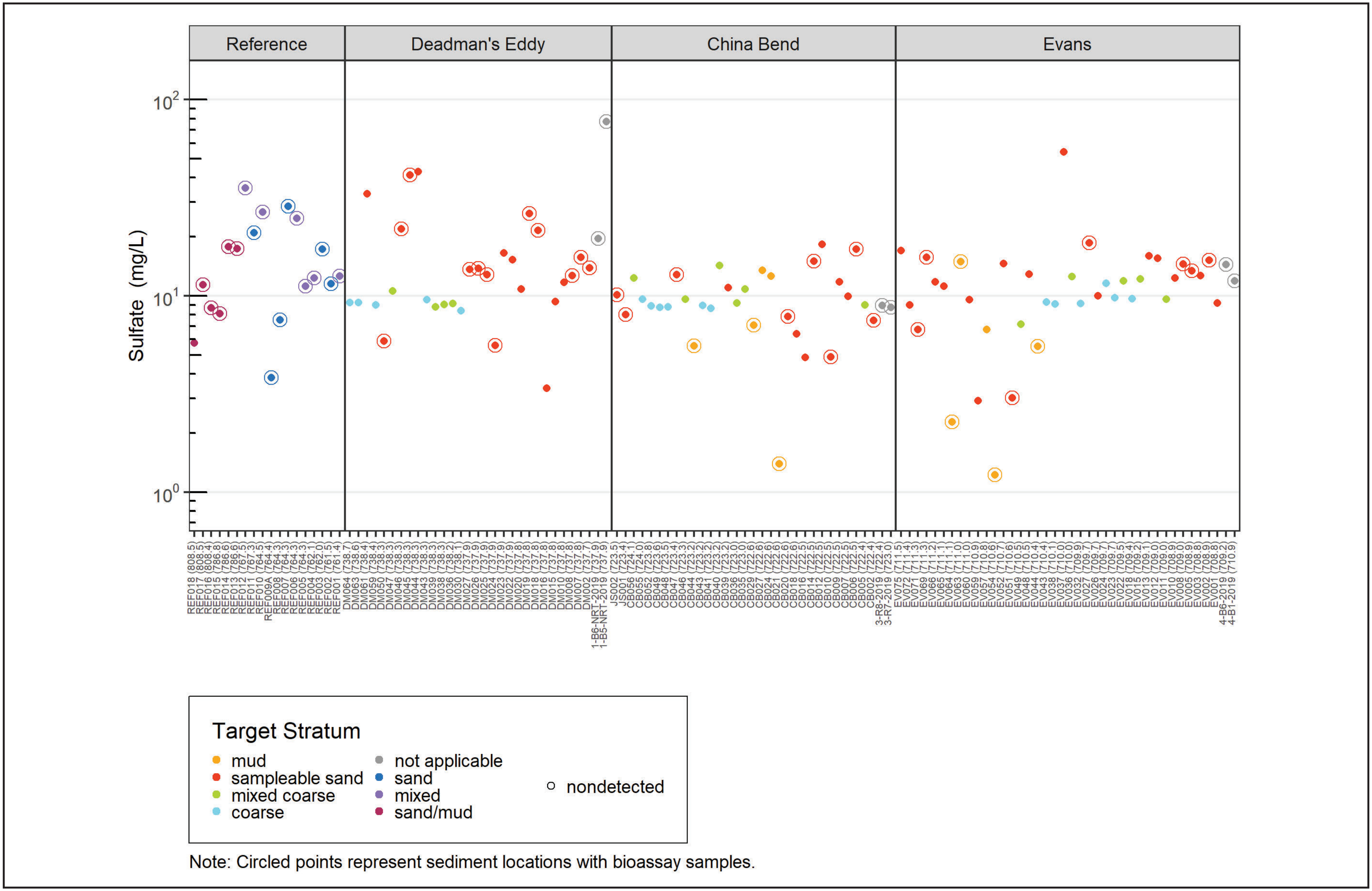
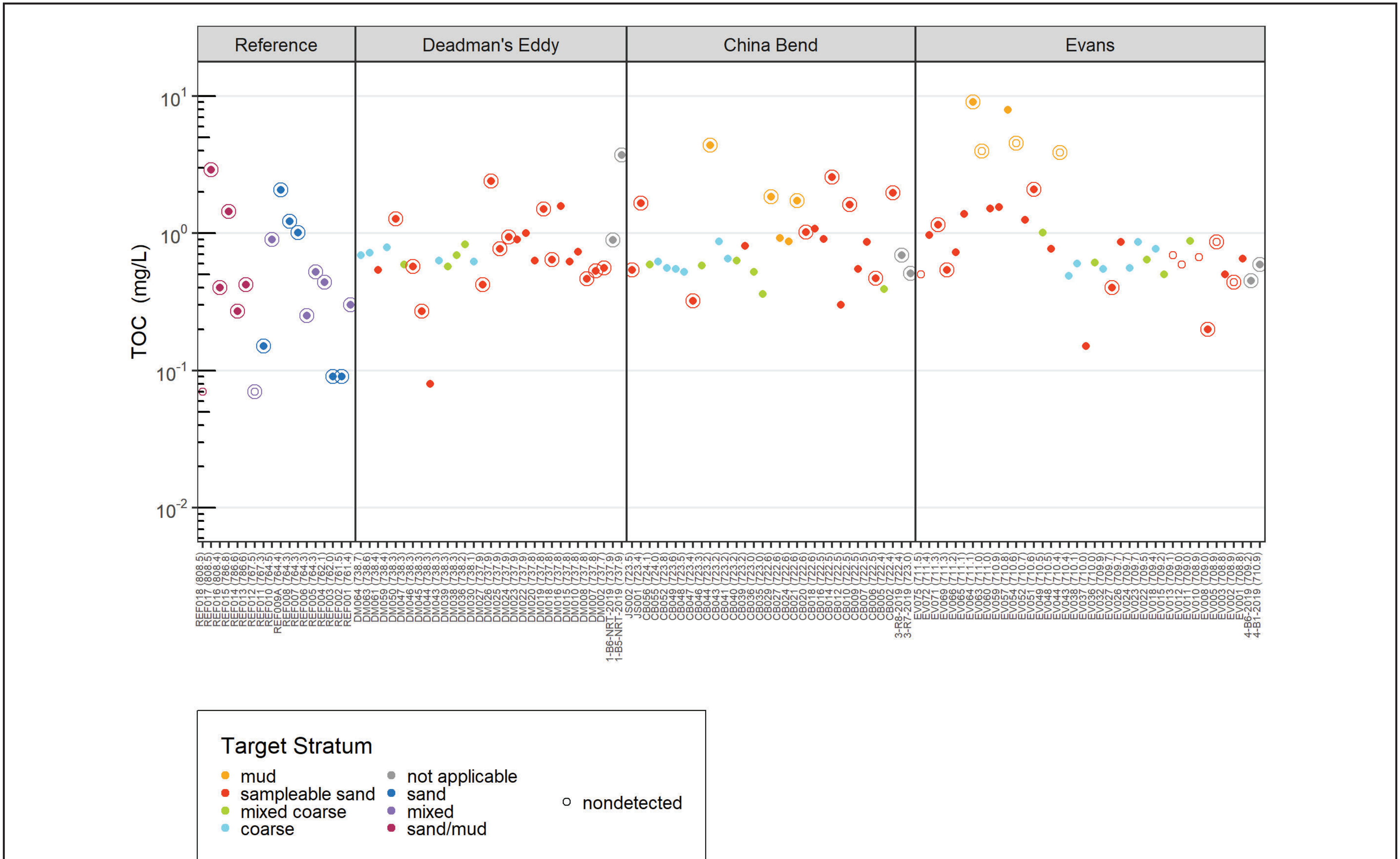
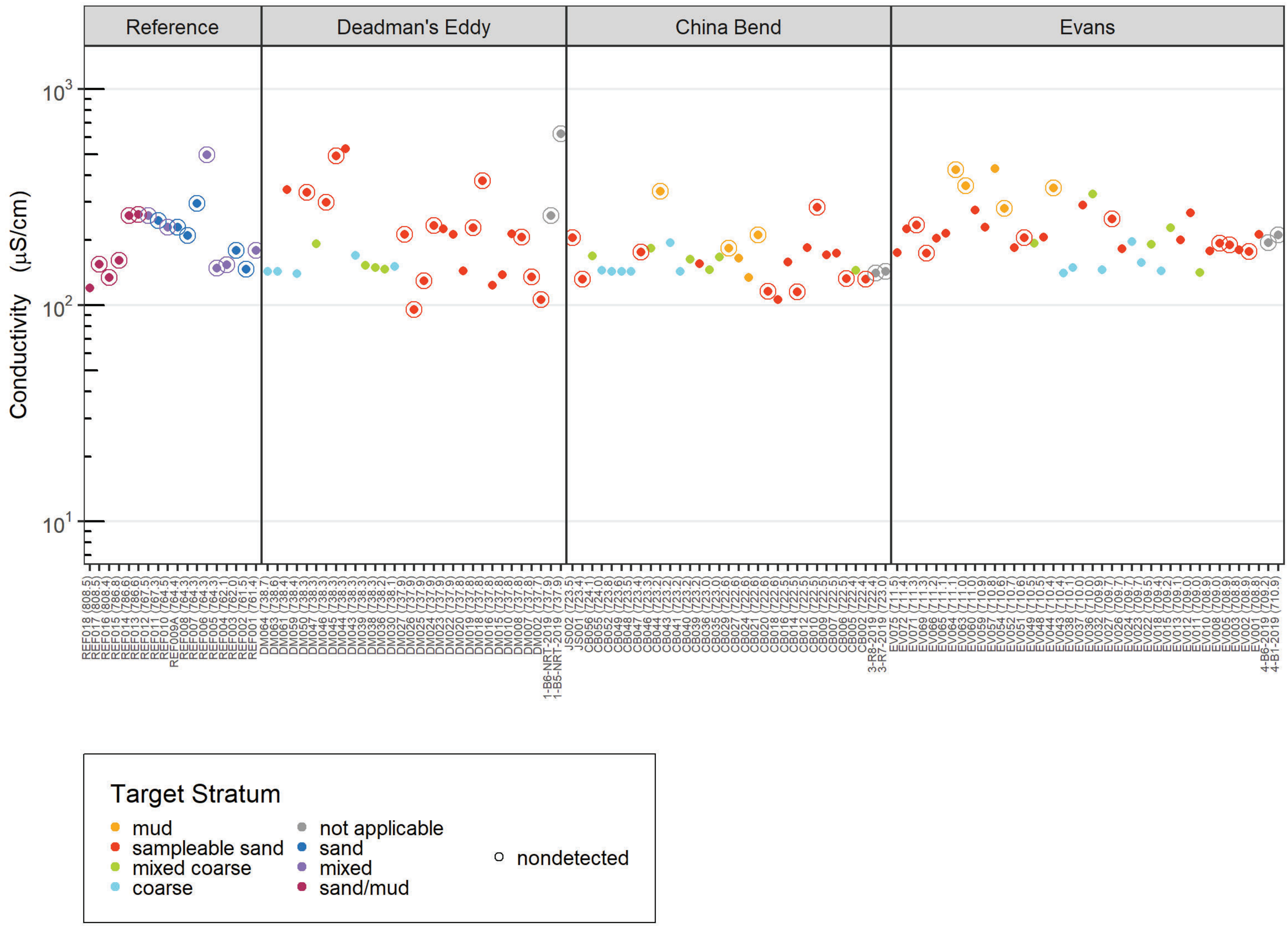


Figure 5-3am. Sulfate in Field Porewater Samples by River Mile



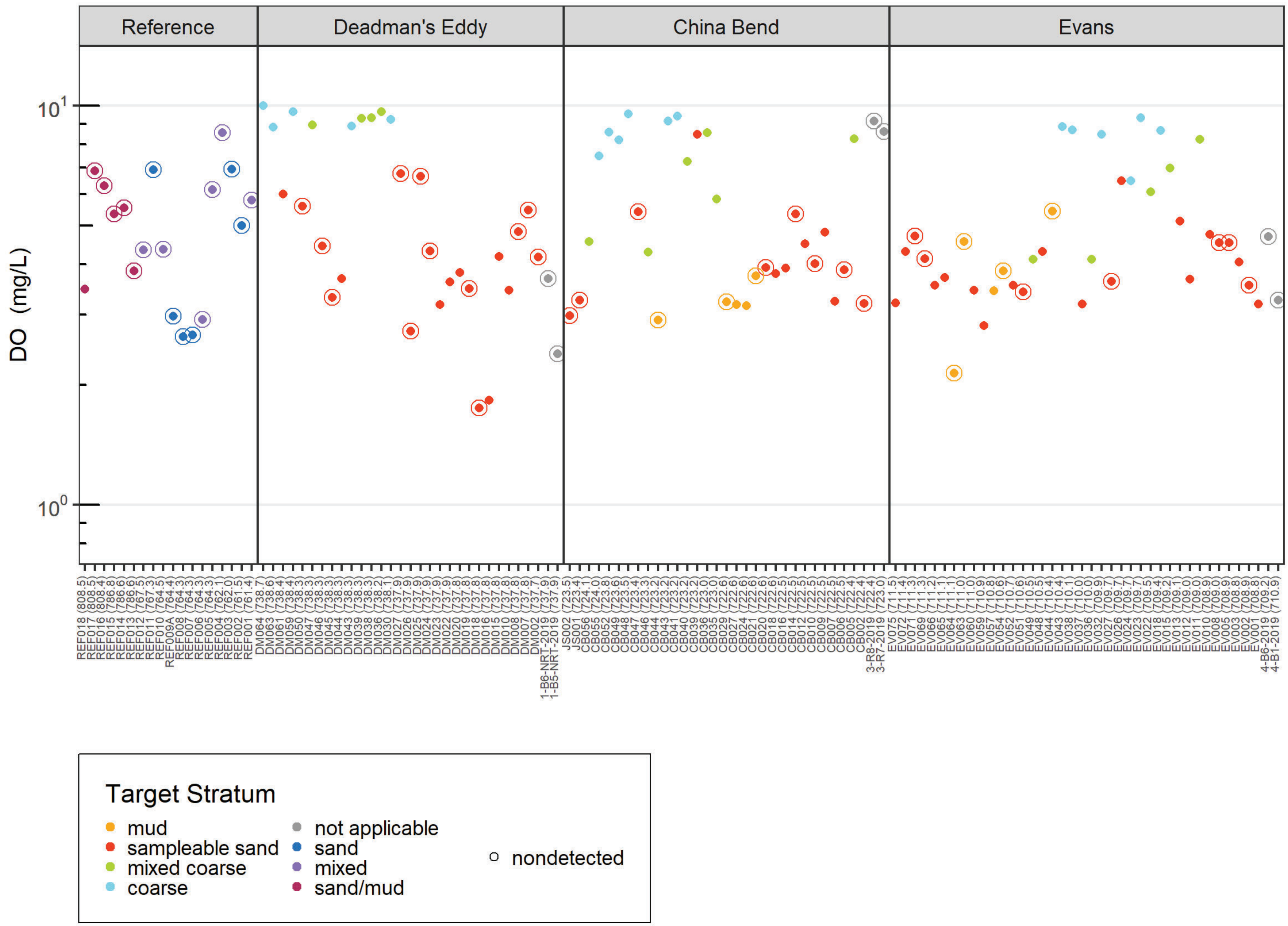
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3an. TOC in Field Porewater Samples by River Mile



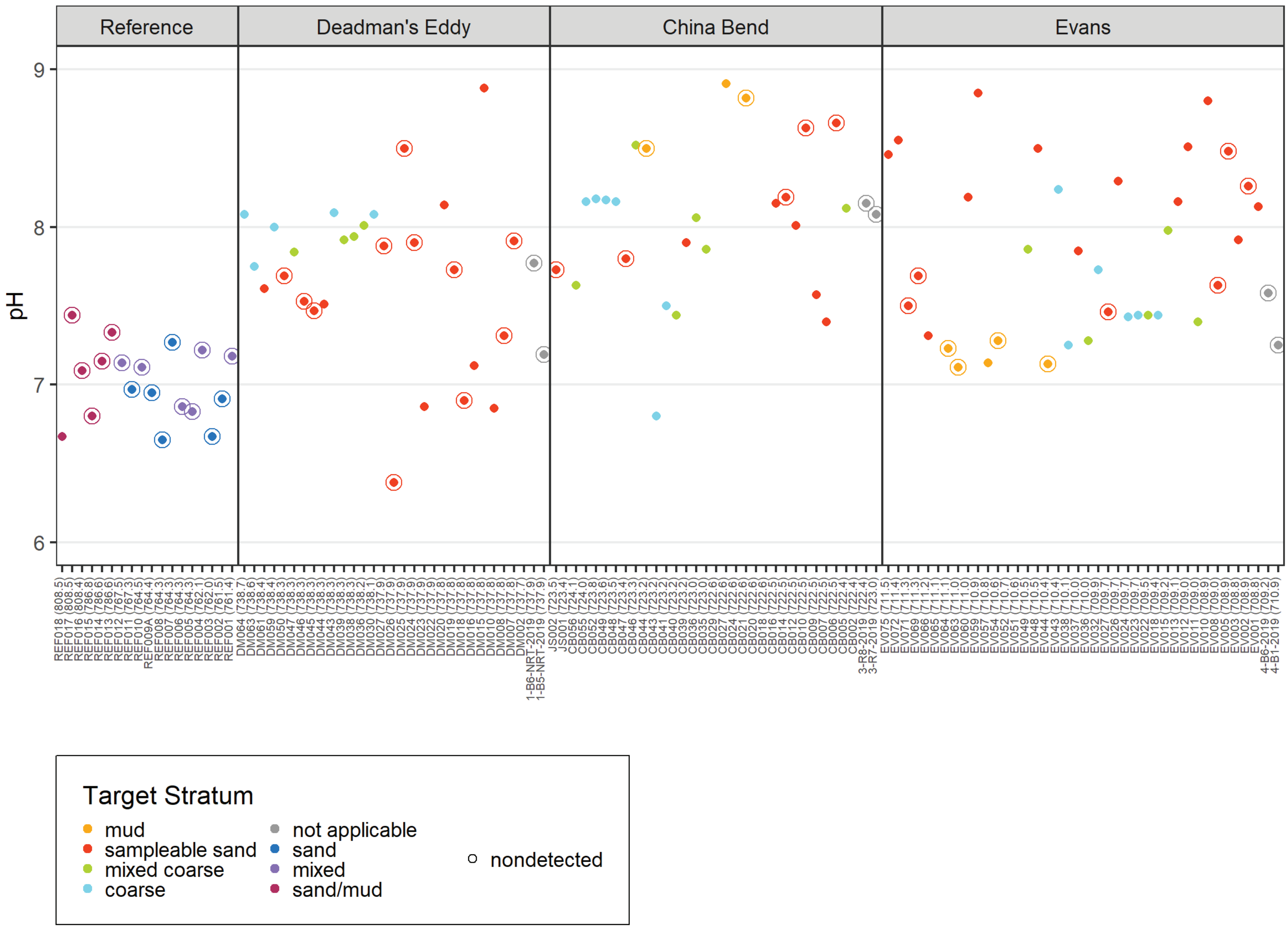
Note: Circled points represent sediment locations with bioassay samples.
Note: Displayed values are an average of the Trident sensor measurements.

Figure 5-3ao. Conductivity in Field Porewater Samples by River Mile



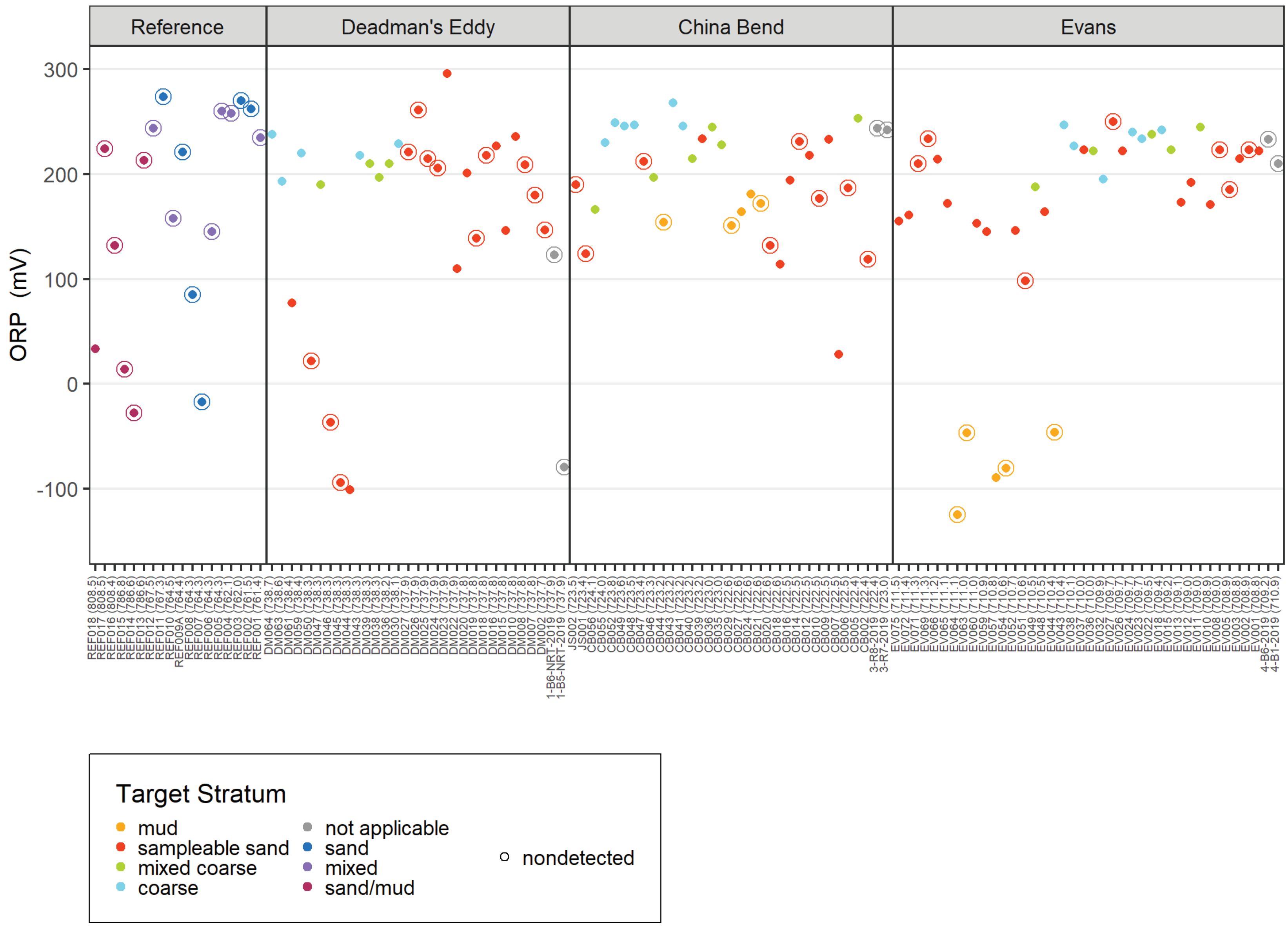
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the handheld sensor measurements.

Figure 5-3ap. DO in Field Porewater Samples by River Mile



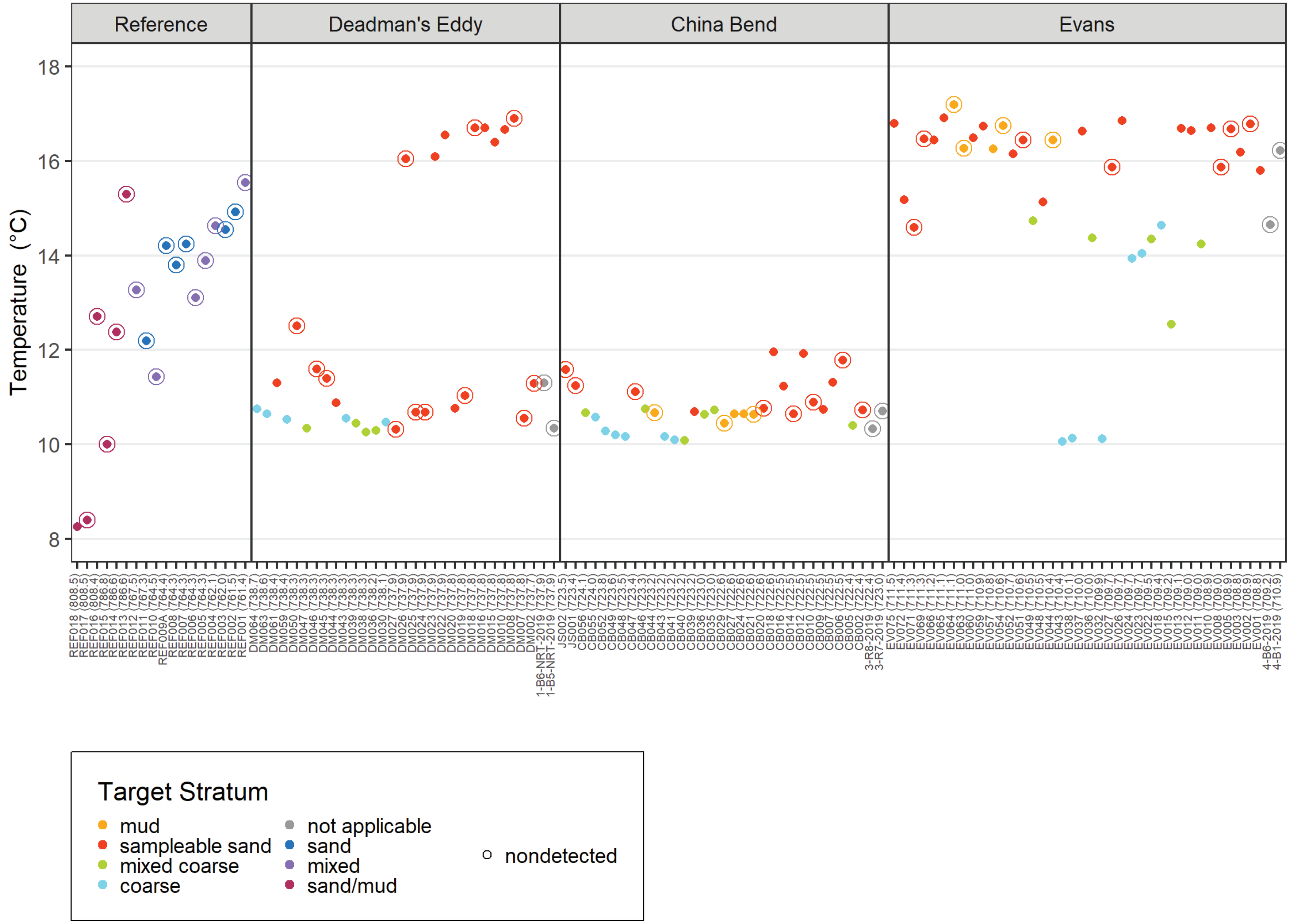
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the multimeter measurements.

Figure 5-3aq. pH in Field Porewater Samples by River Mile



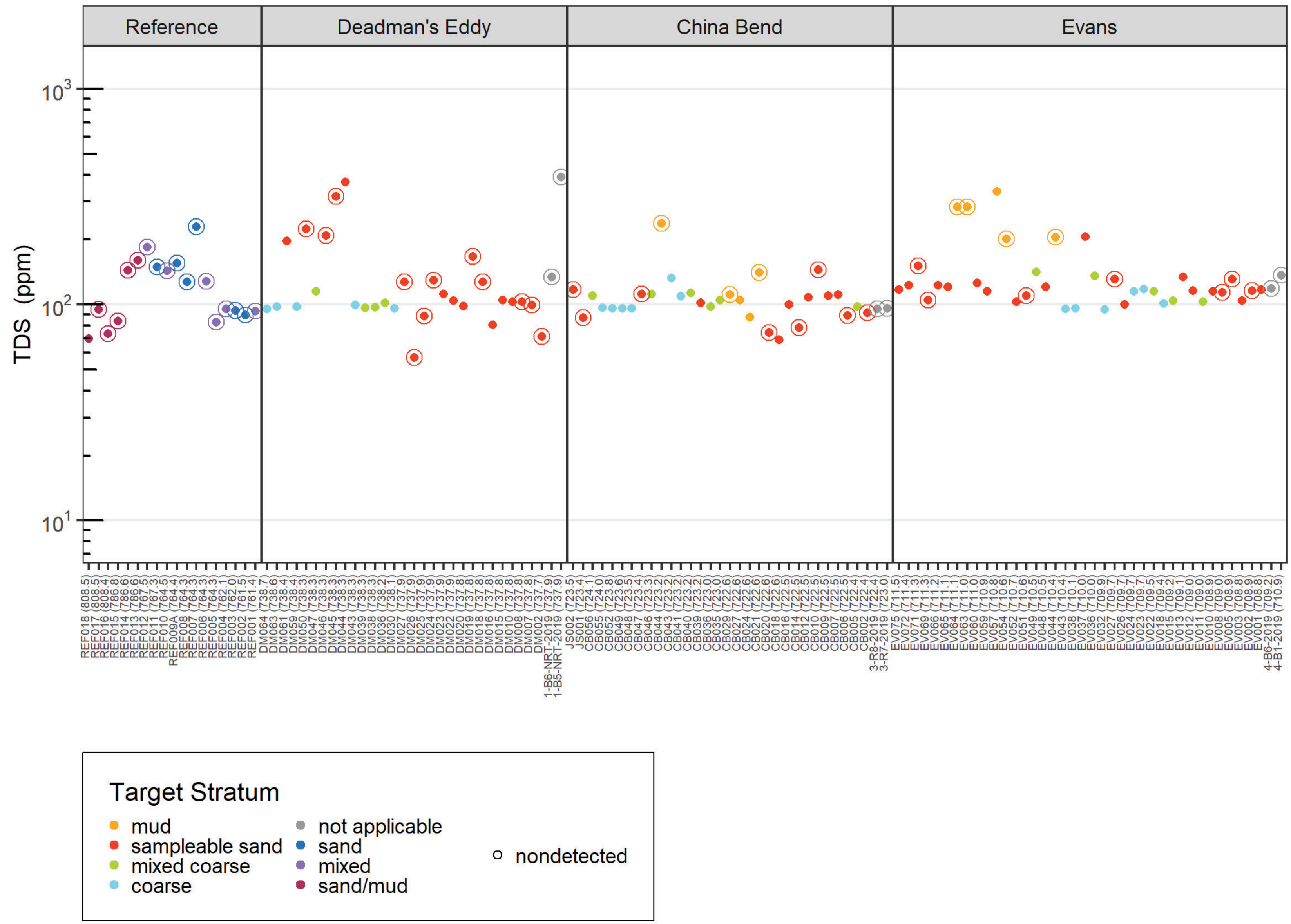
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the multimeter measurements.

Figure 5-3ar. ORP in Field Porewater Samples by River Mile



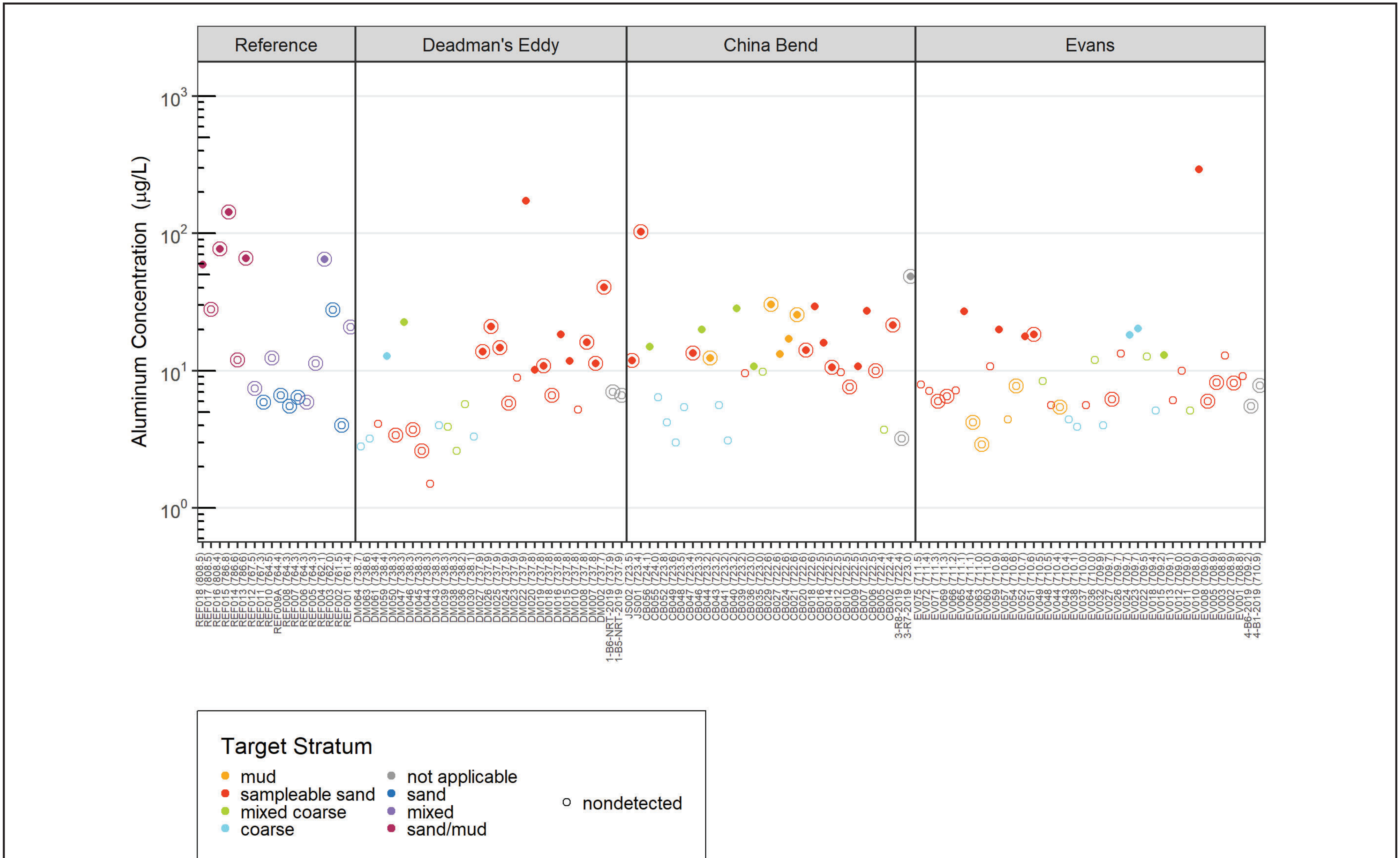
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the Trident sensor measurements.

Figure 5-3as. Temperature in Field Porewater Samples by River Mile



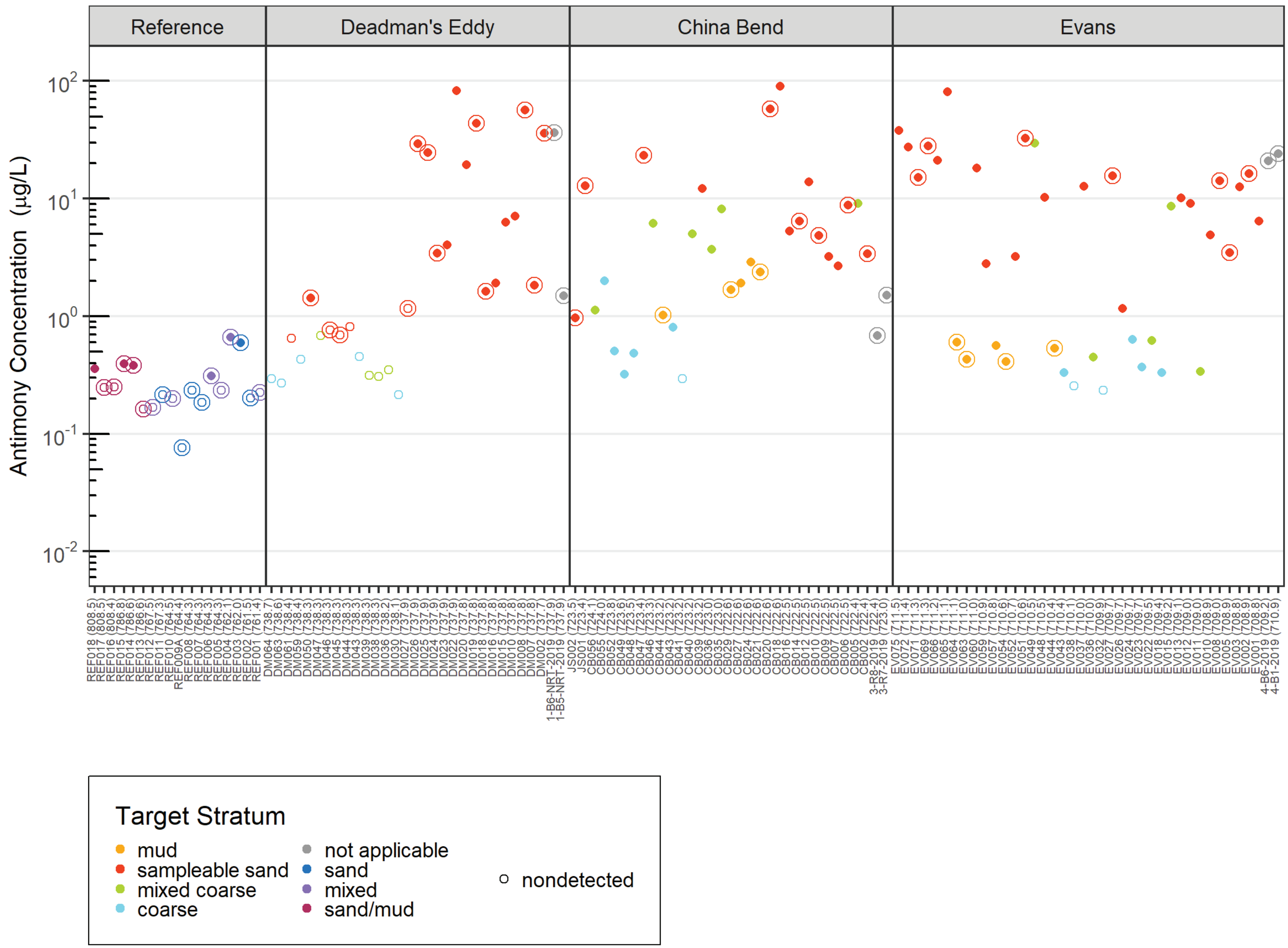
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the multimeter measurements.

Figure 5-3at. TDS in Field Porewater Samples by River Mile



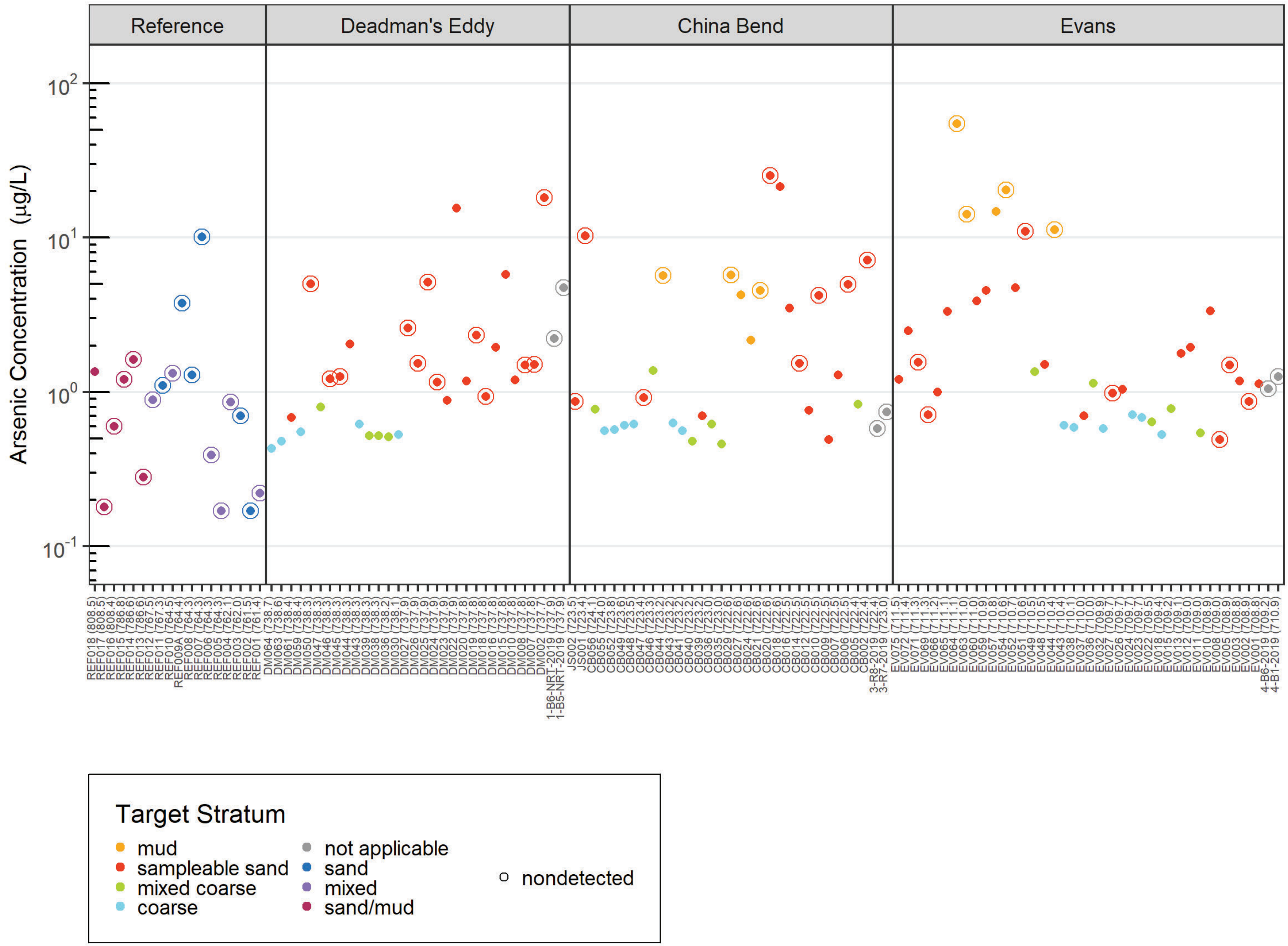
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3au. Dissolved Aluminum in Field Porewater Samples by River Mile



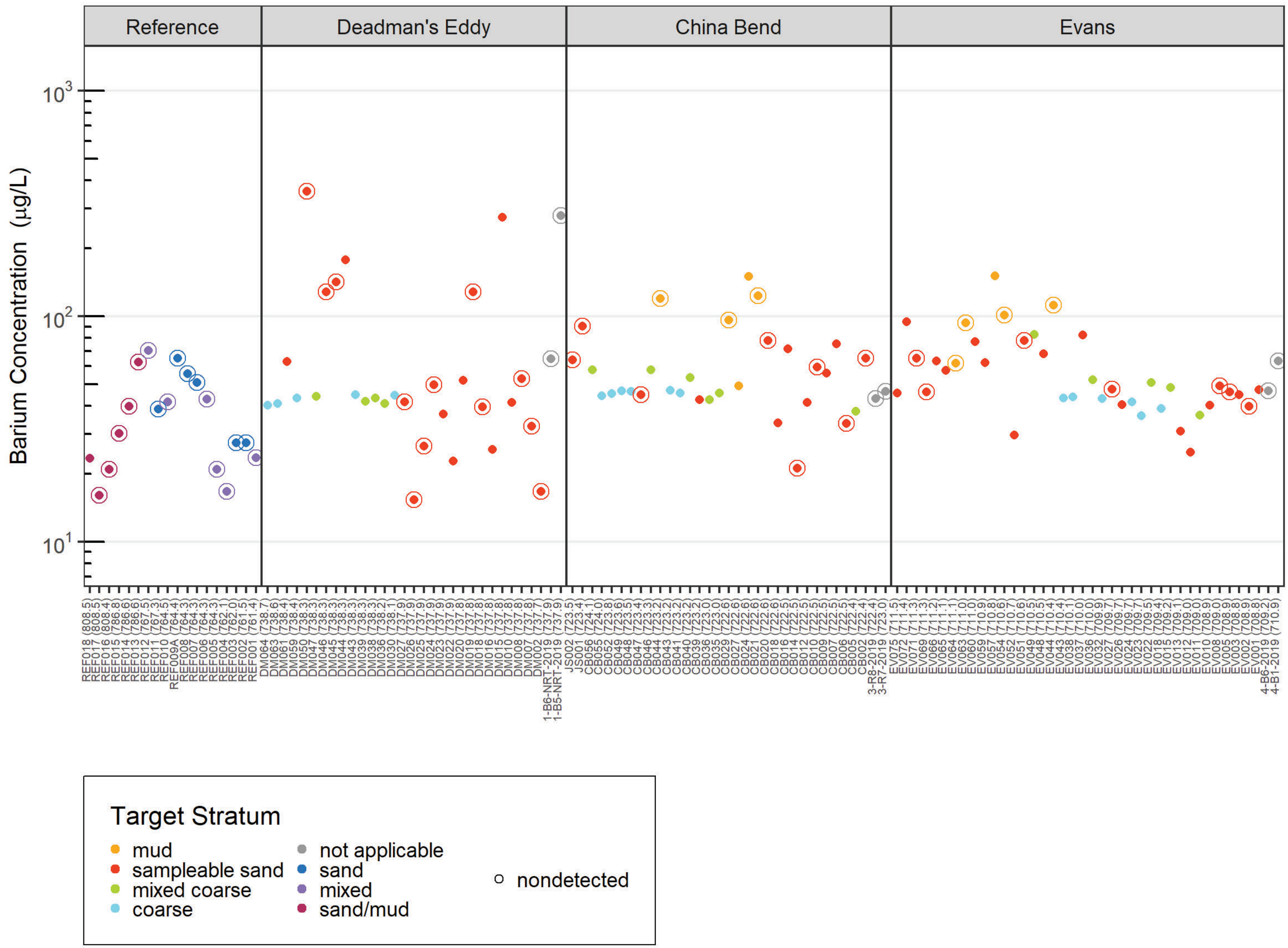
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3av. Dissolved Antimony in Field Porewater Samples by River Mile



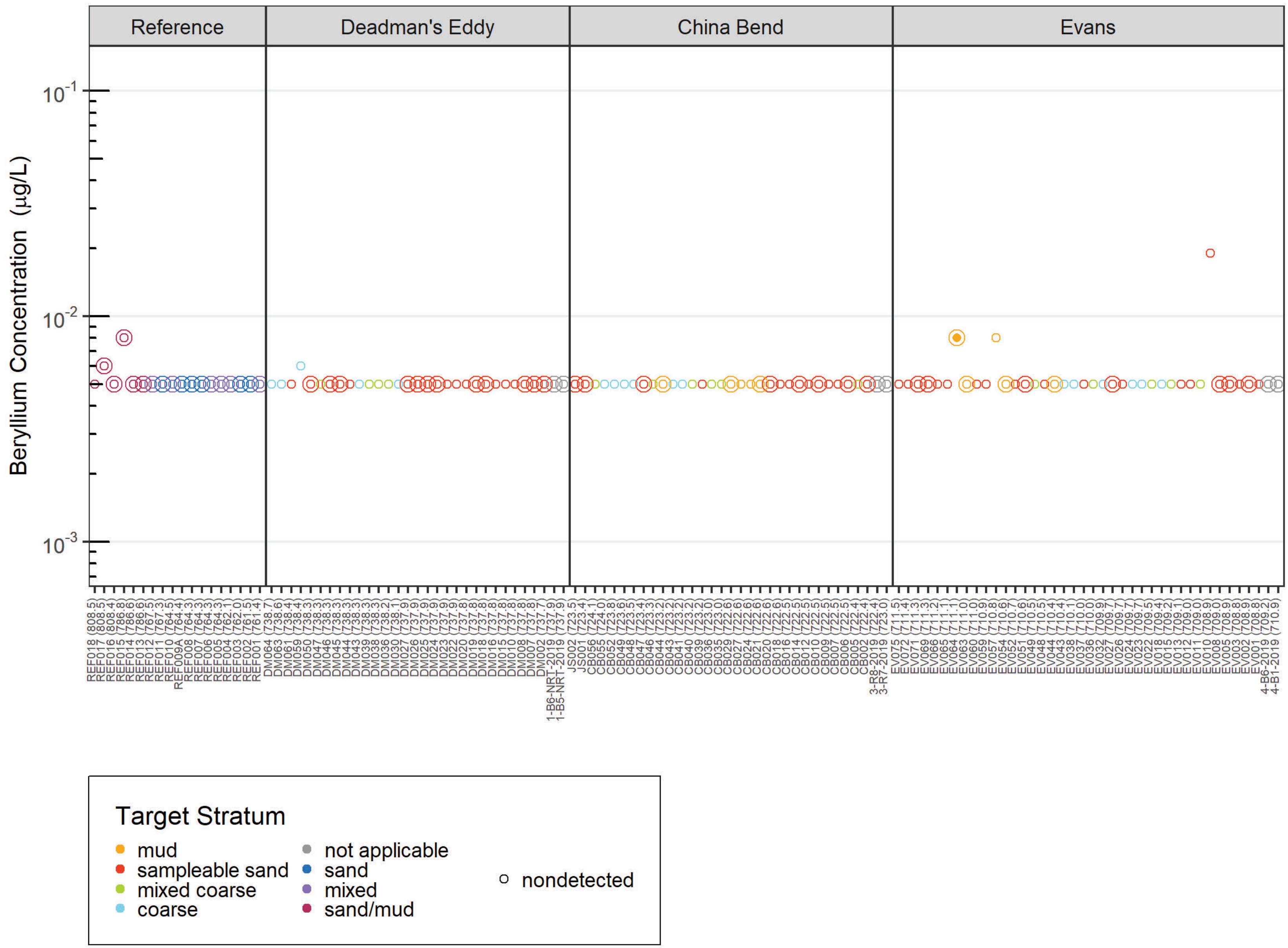
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3aw. Dissolved Arsenic in Field Porewater Samples by River Mile



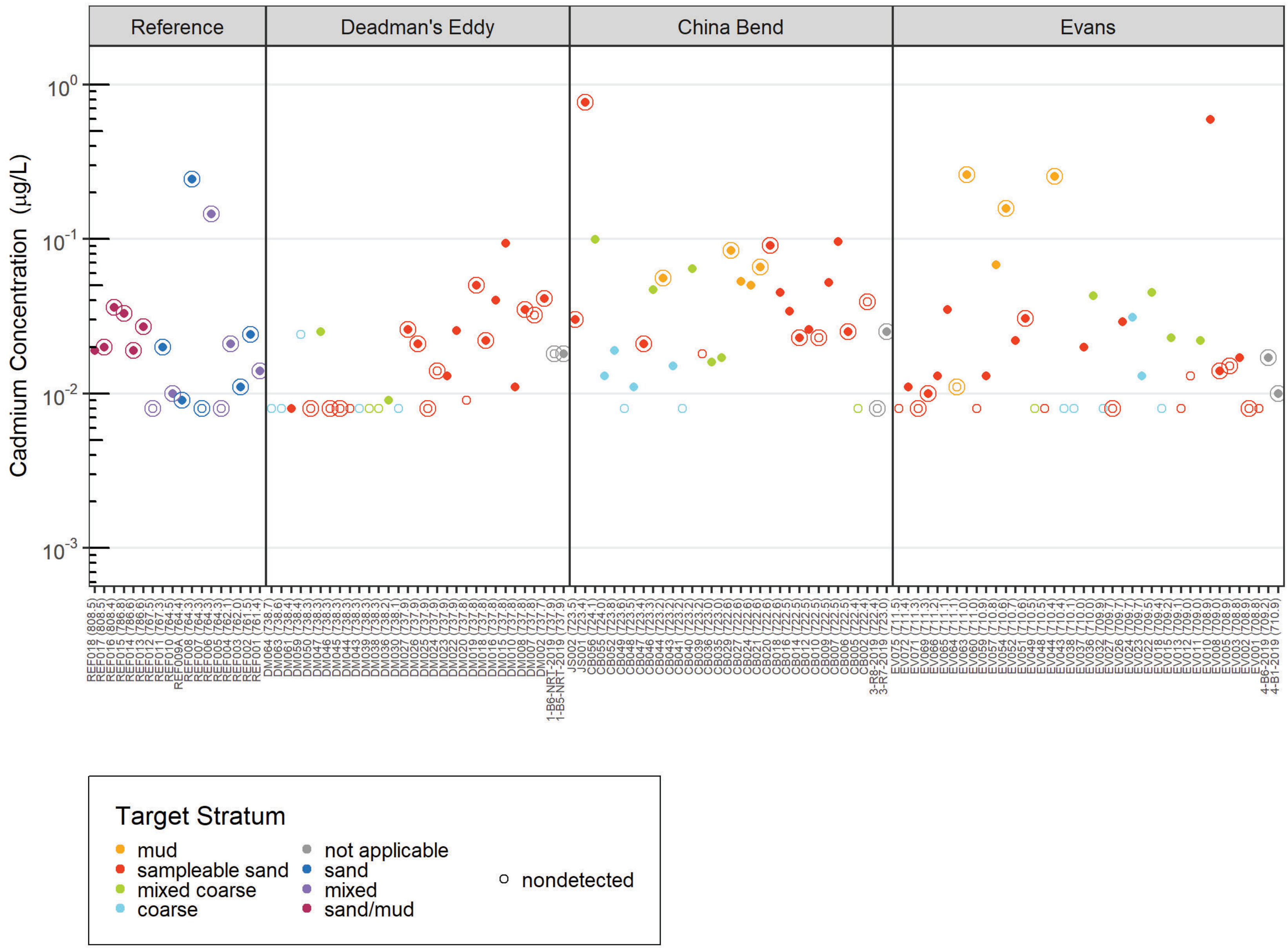
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3ax. Dissolved Barium in Field Porewater Samples by River Mile



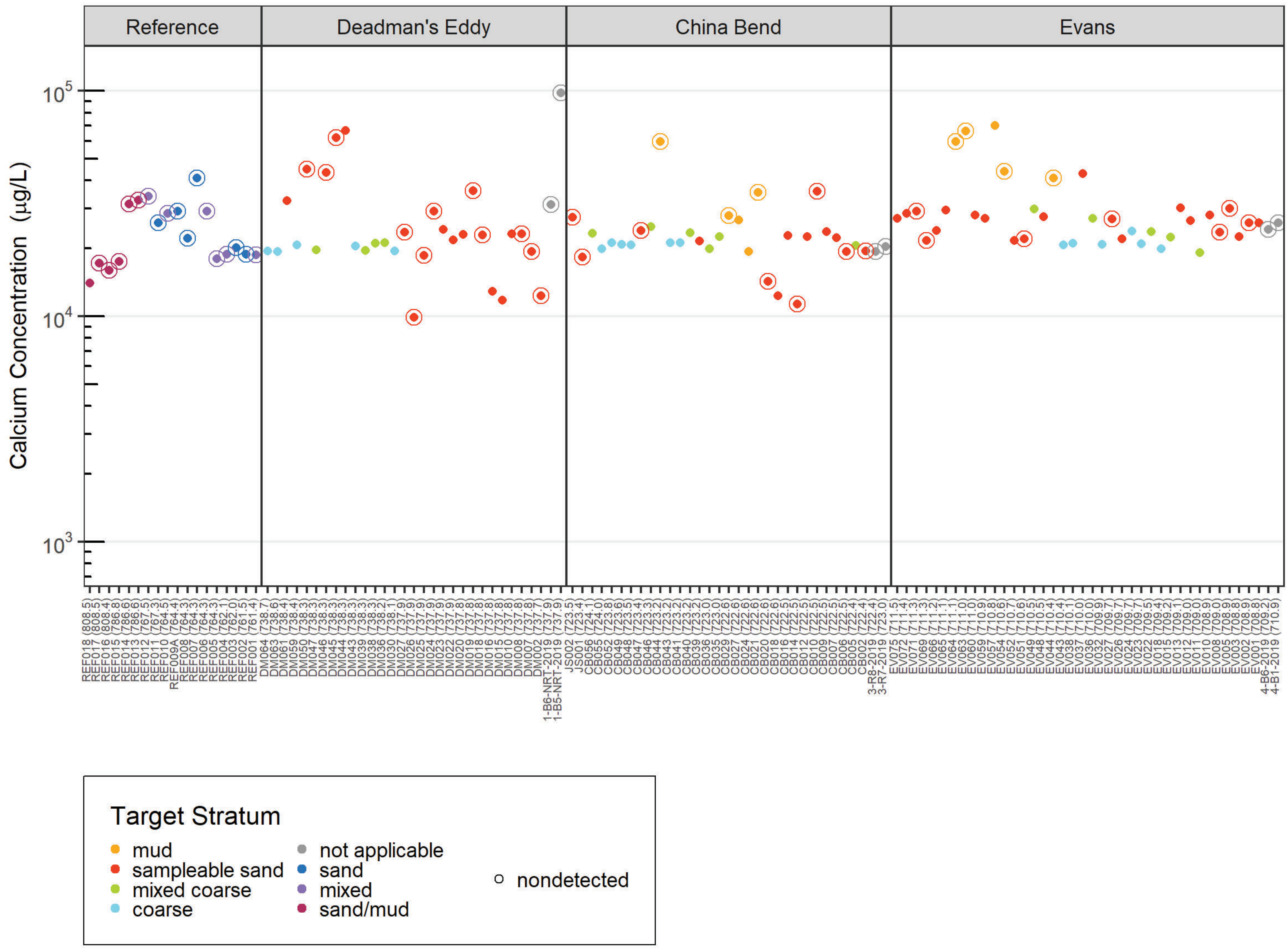
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3ay. Dissolved Beryllium in Field Porewater Samples by River Mile



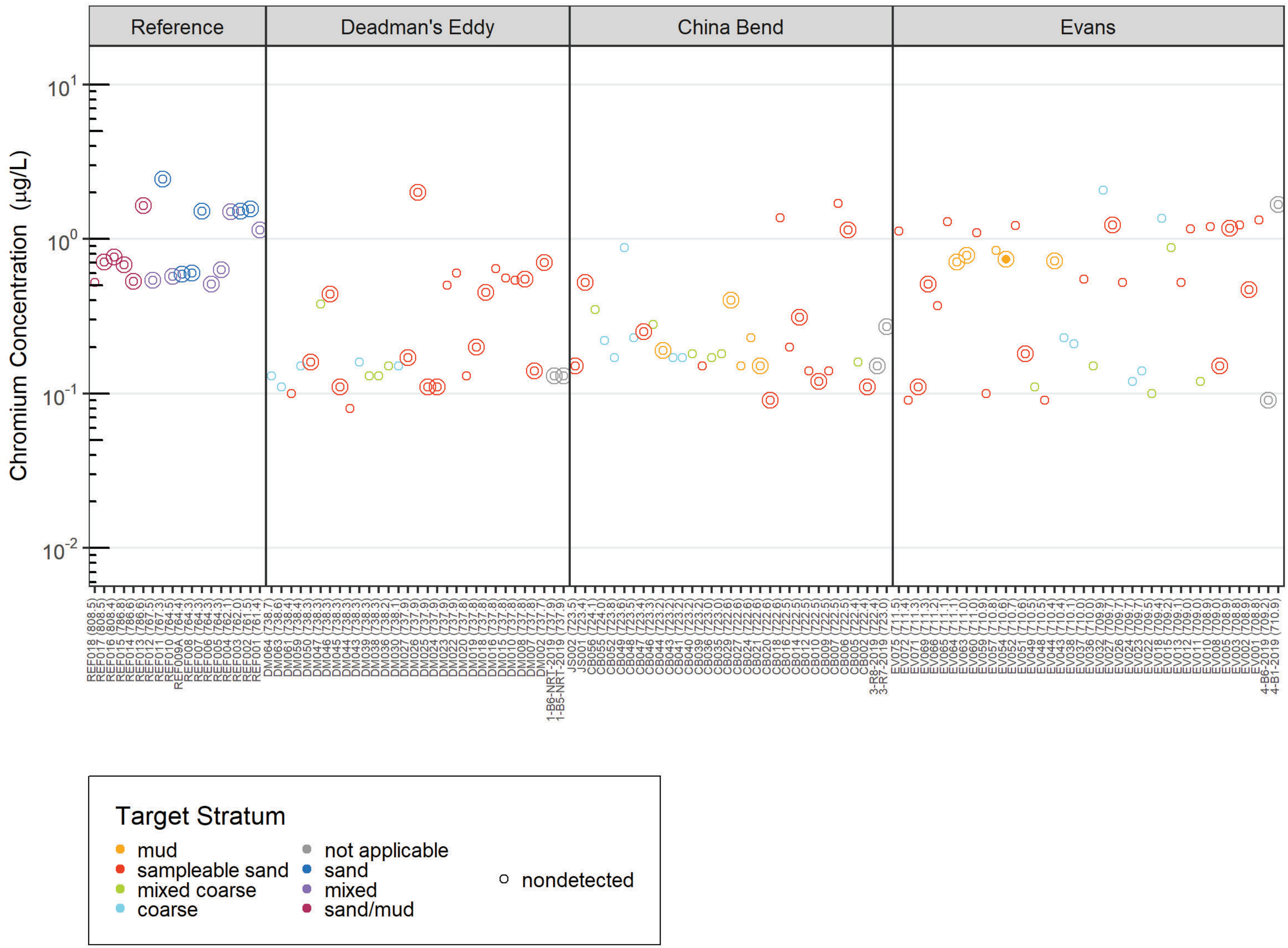
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3az. Dissolved Cadmium in Field Porewater Samples by River Mile



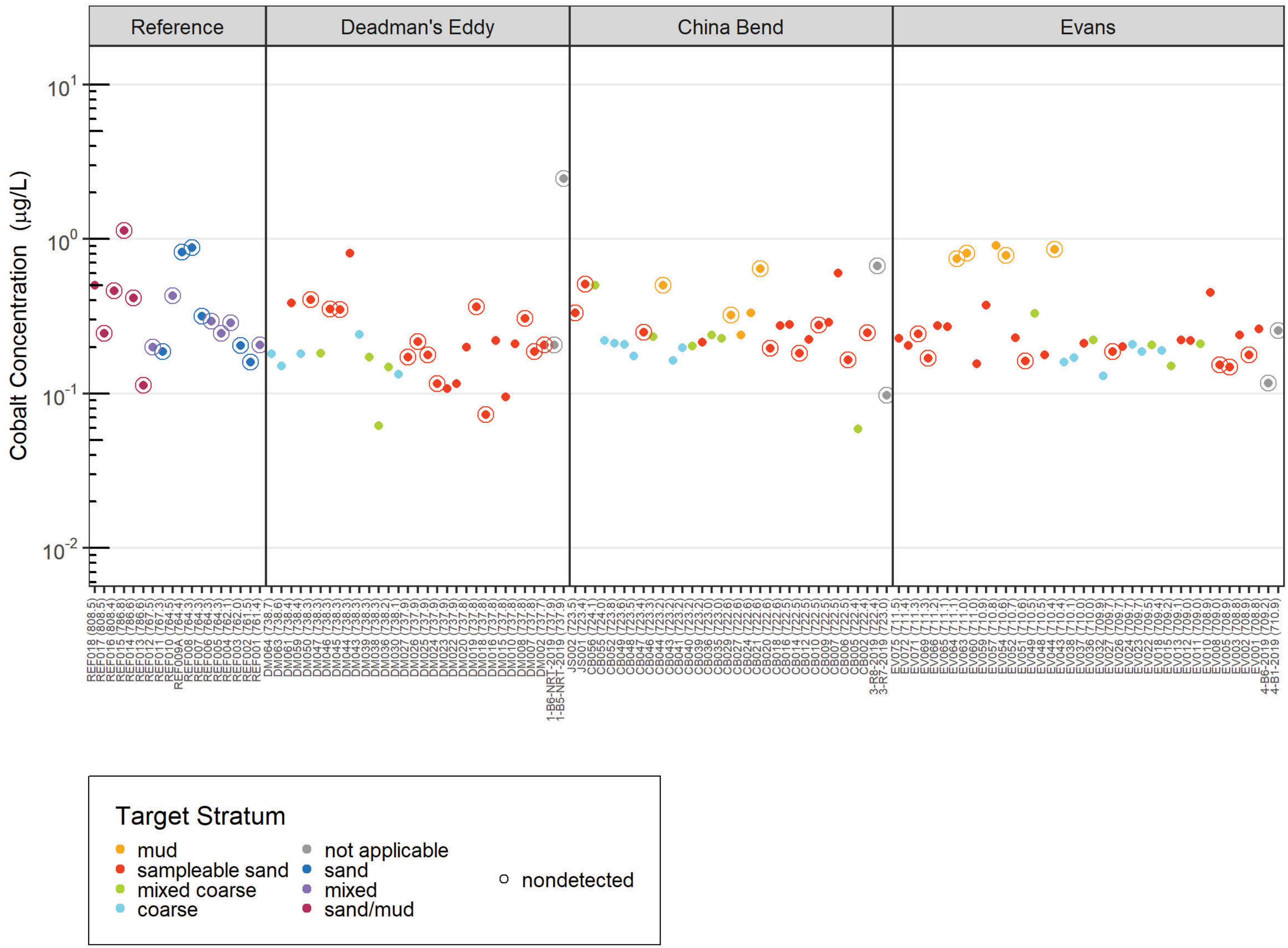
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3ba. Dissolved Calcium in Field Porewater Samples by River Mile



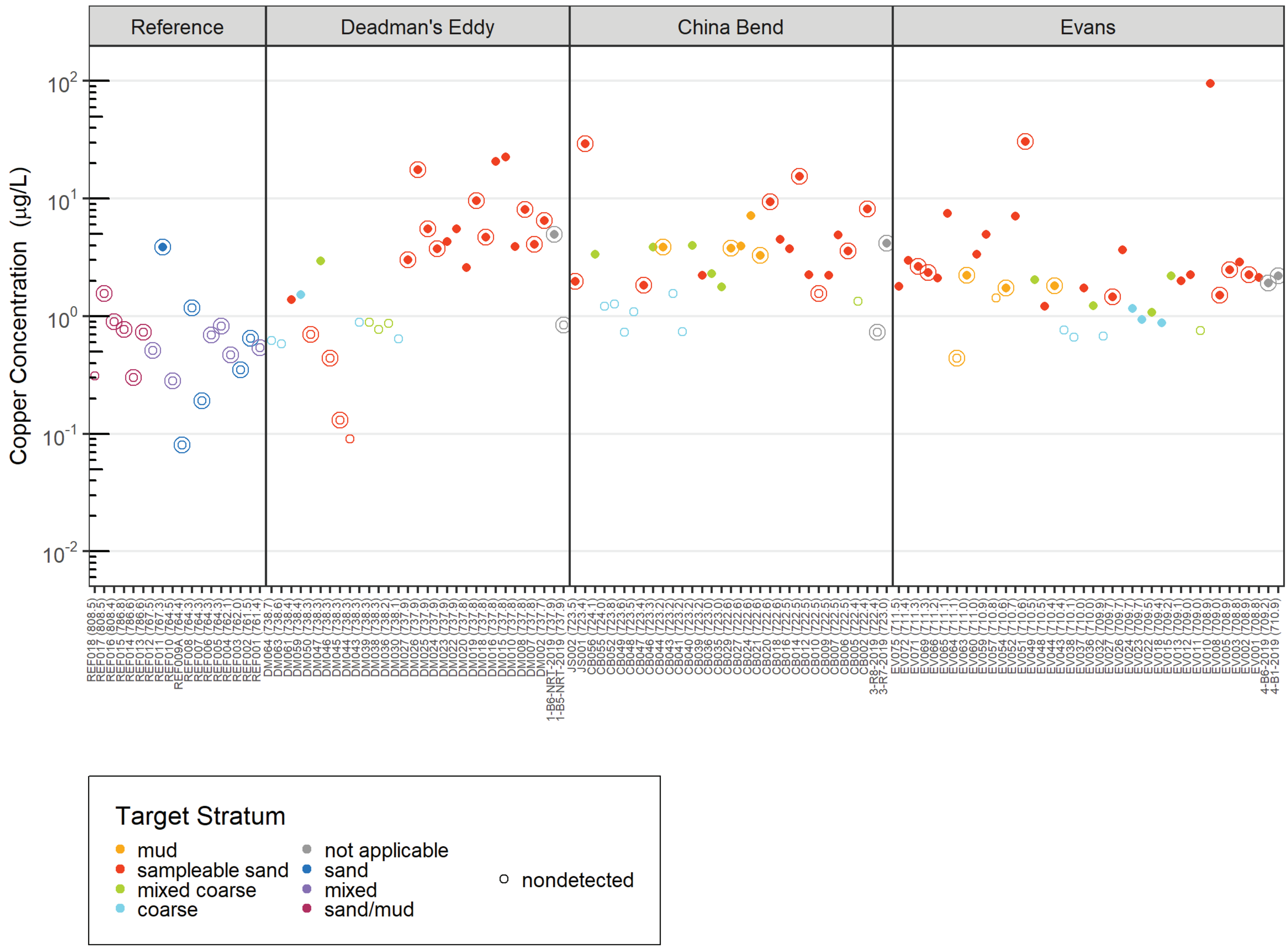
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bb. Dissolved Chromium in Field Porewater Samples by River Mile



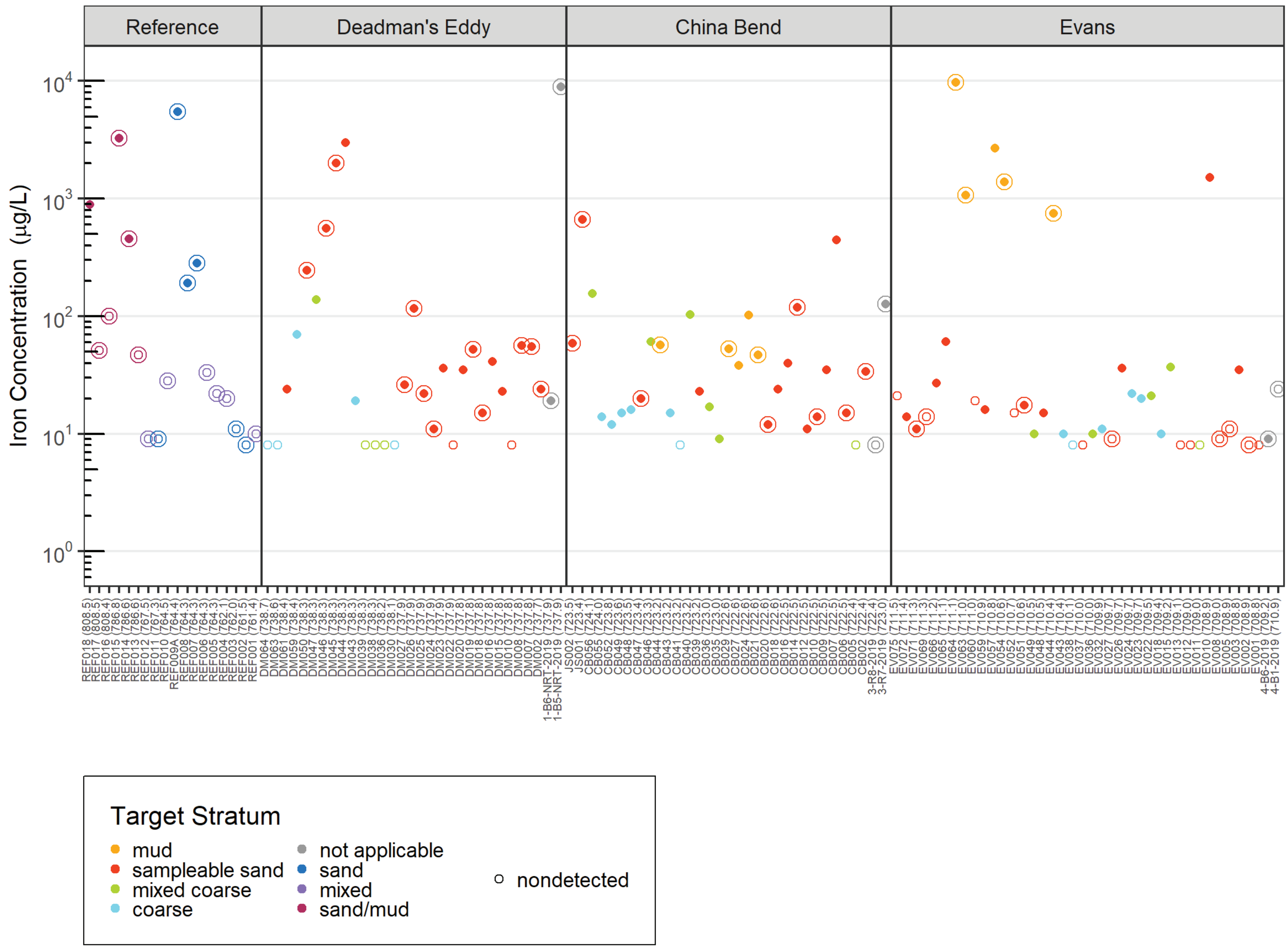
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bc. Dissolved Cobalt in Field Porewater Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bd. Dissolved Copper in Field Porewater Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3be. Dissolved Iron in Field Porewater Samples by River Mile

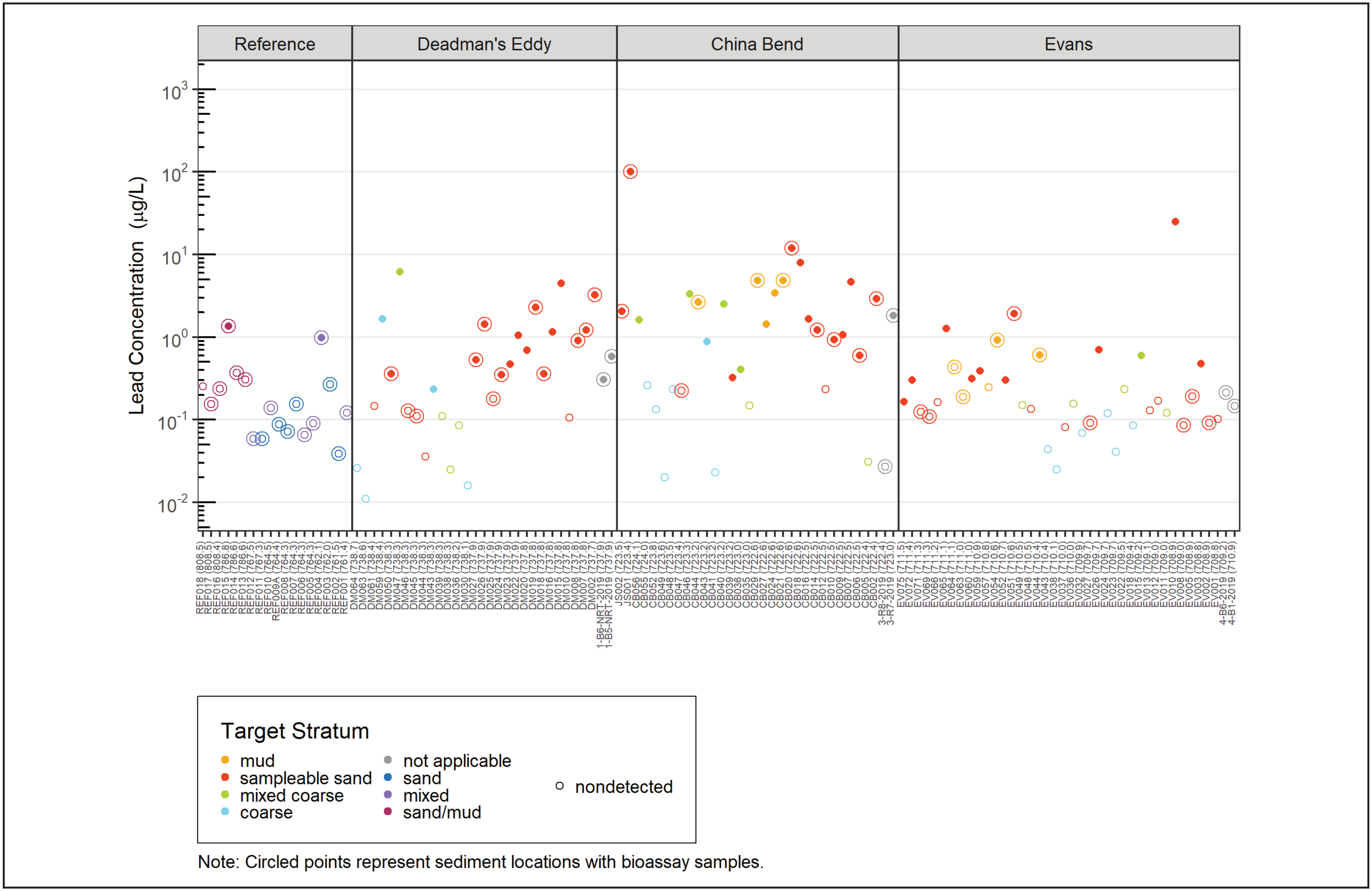
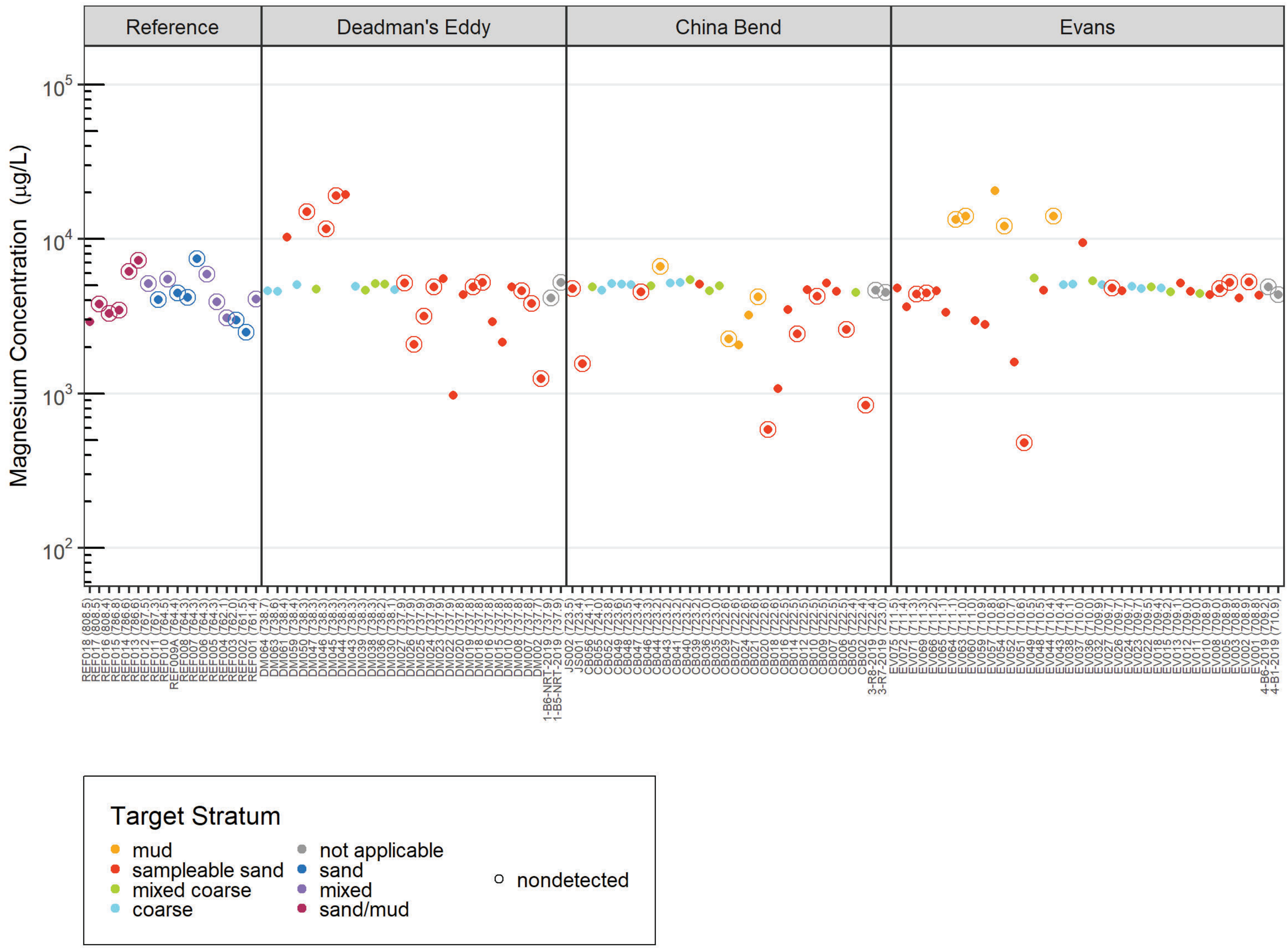
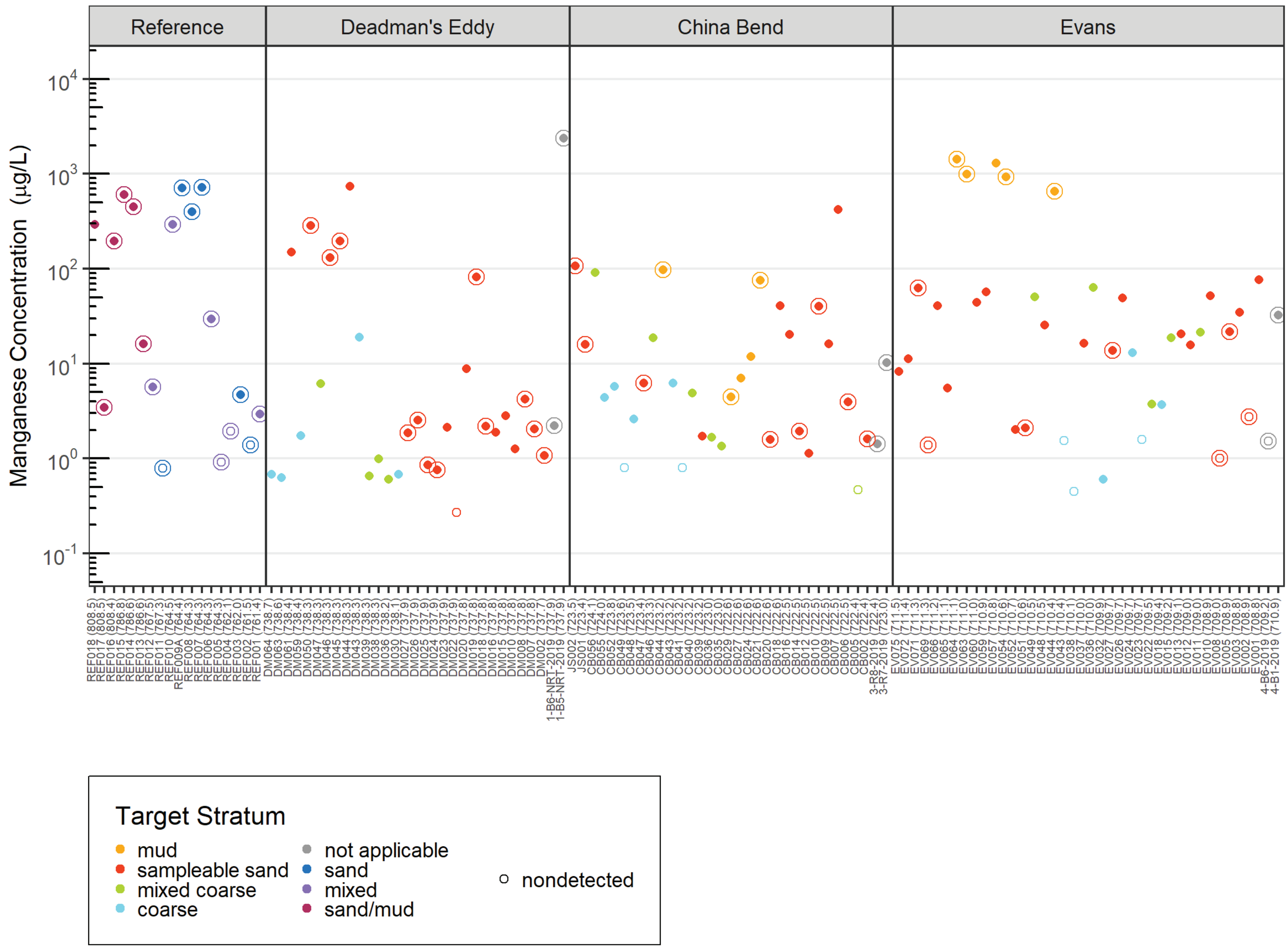


Figure 5-3bf. Dissolved Lead in Field Porewater Samples by River Mile



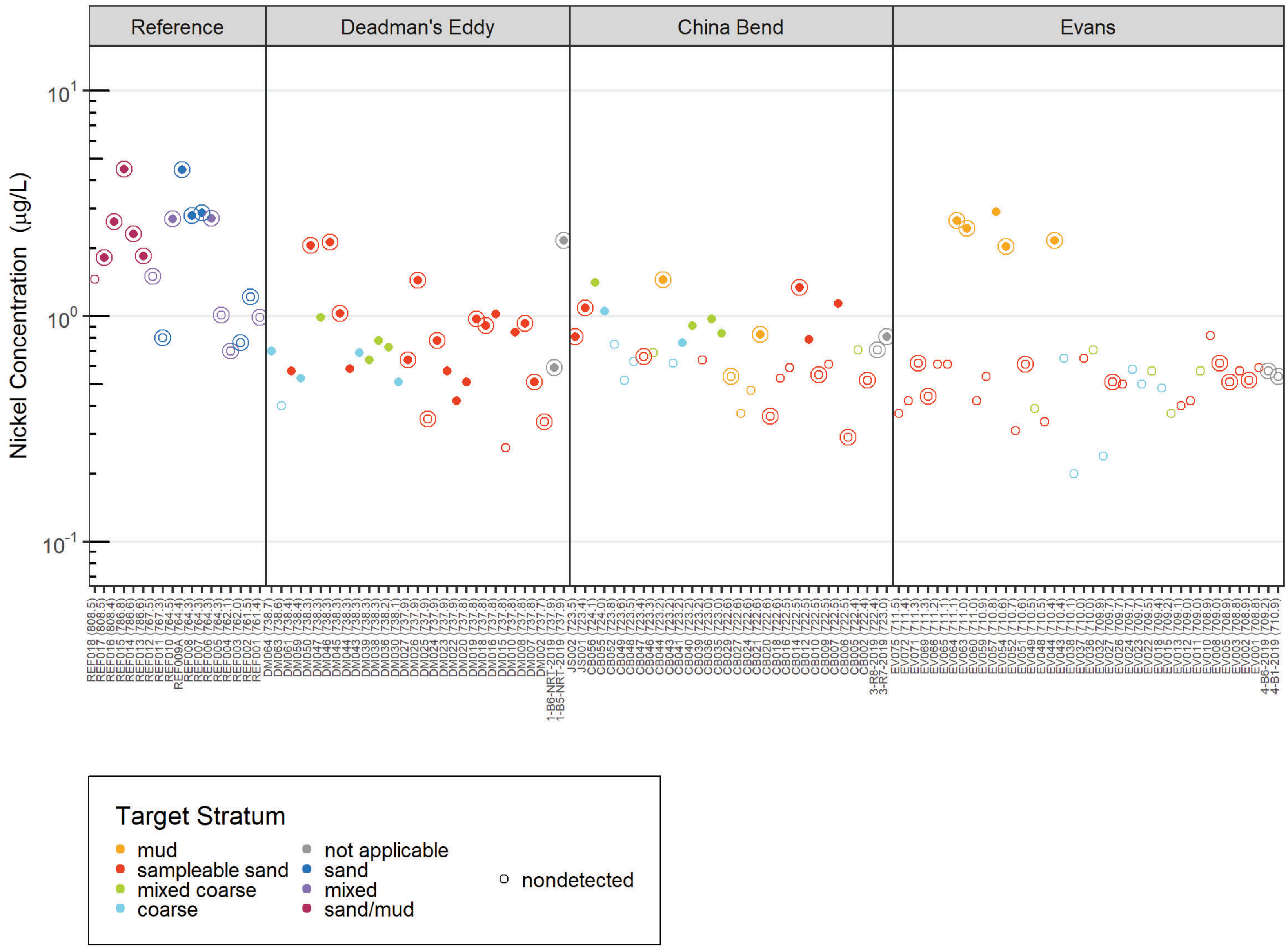
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bg. Dissolved Magnesium in Field Porewater Samples by River Mile



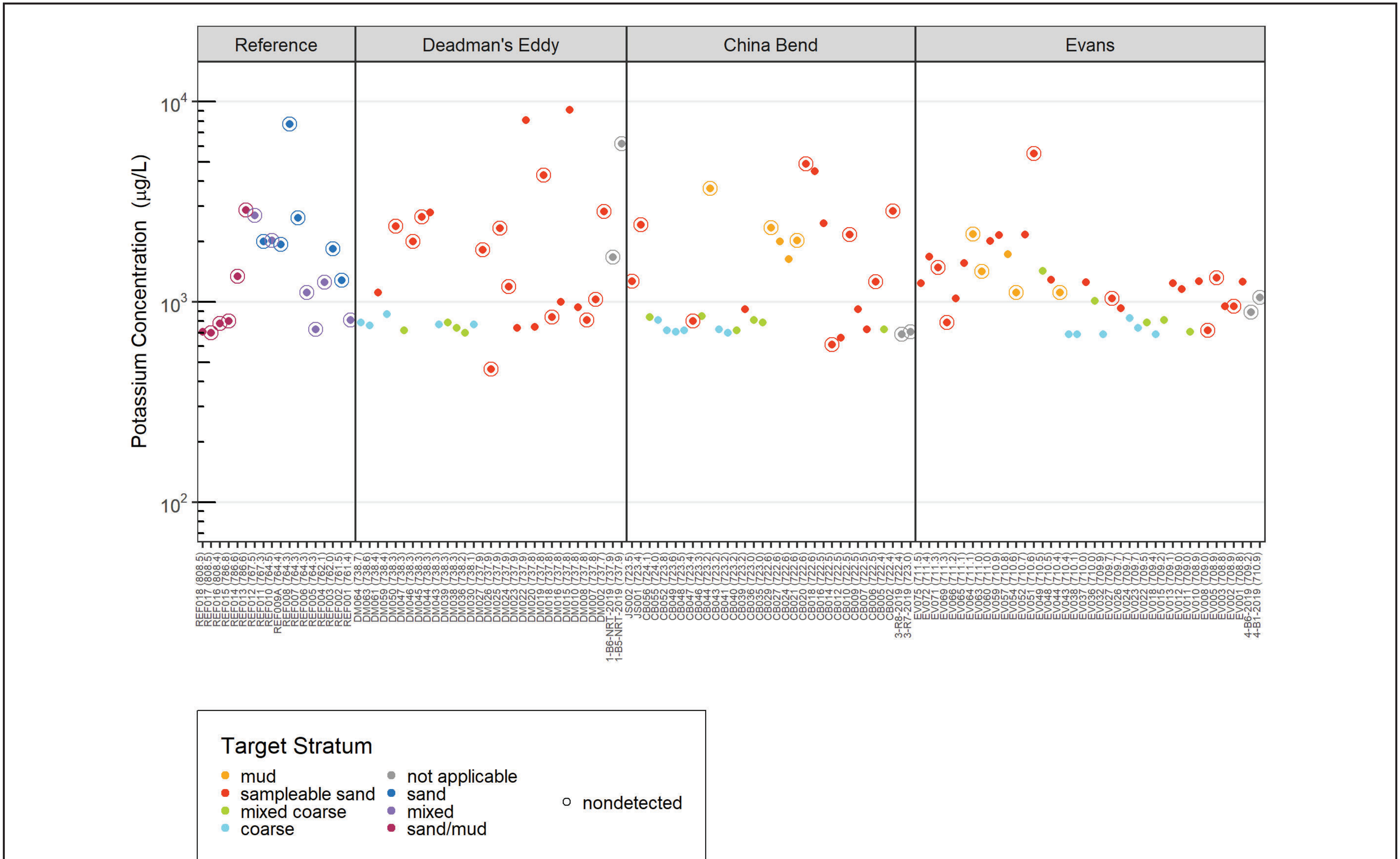
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bh. Dissolved Manganese in Field Porewater Samples by River Mile



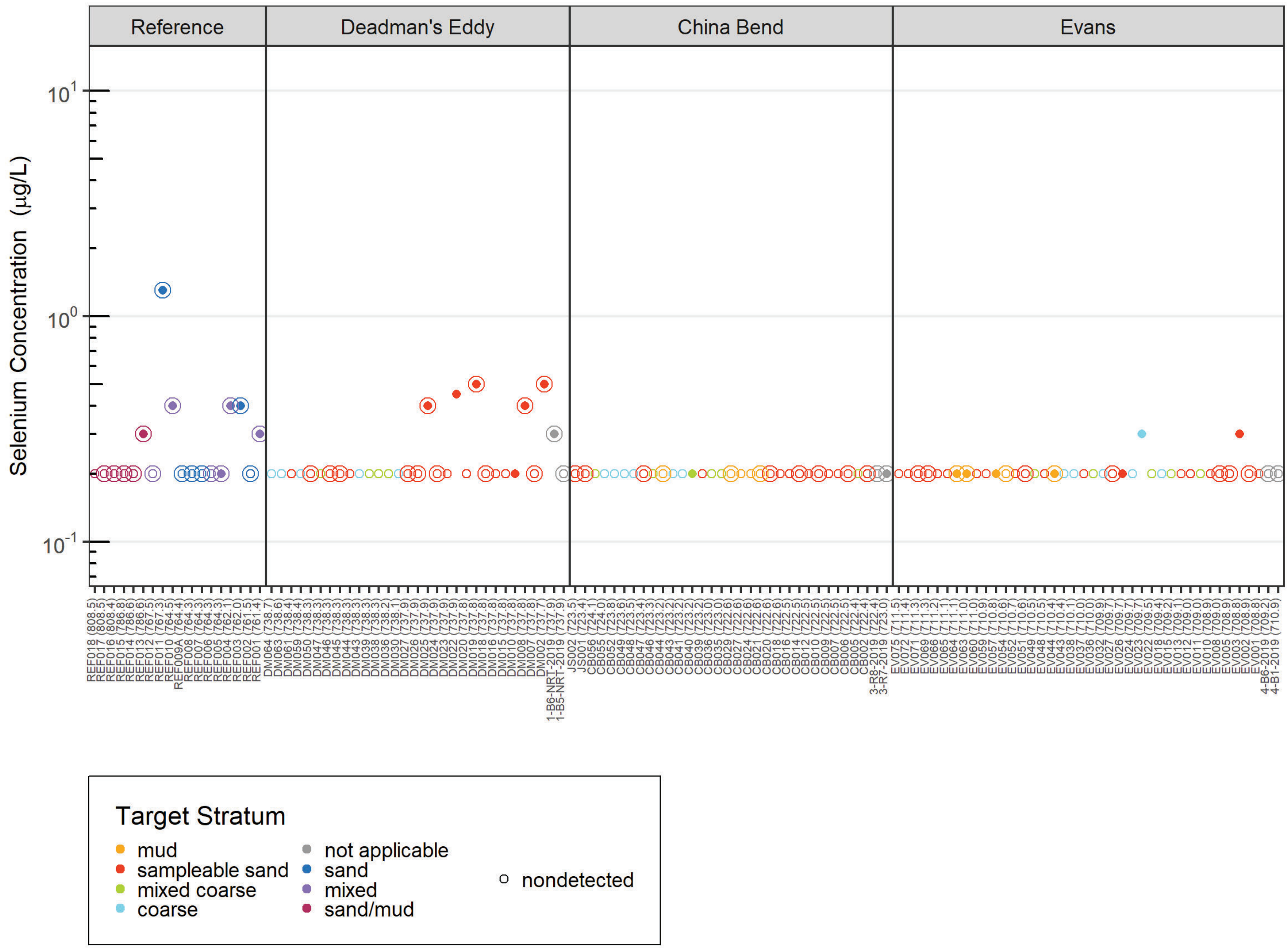
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bi. Dissolved Nickel in Field Porewater Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bj. Dissolved Potassium in Field Porewater Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bk. Dissolved Selenium in Field Porewater Samples by River Mile

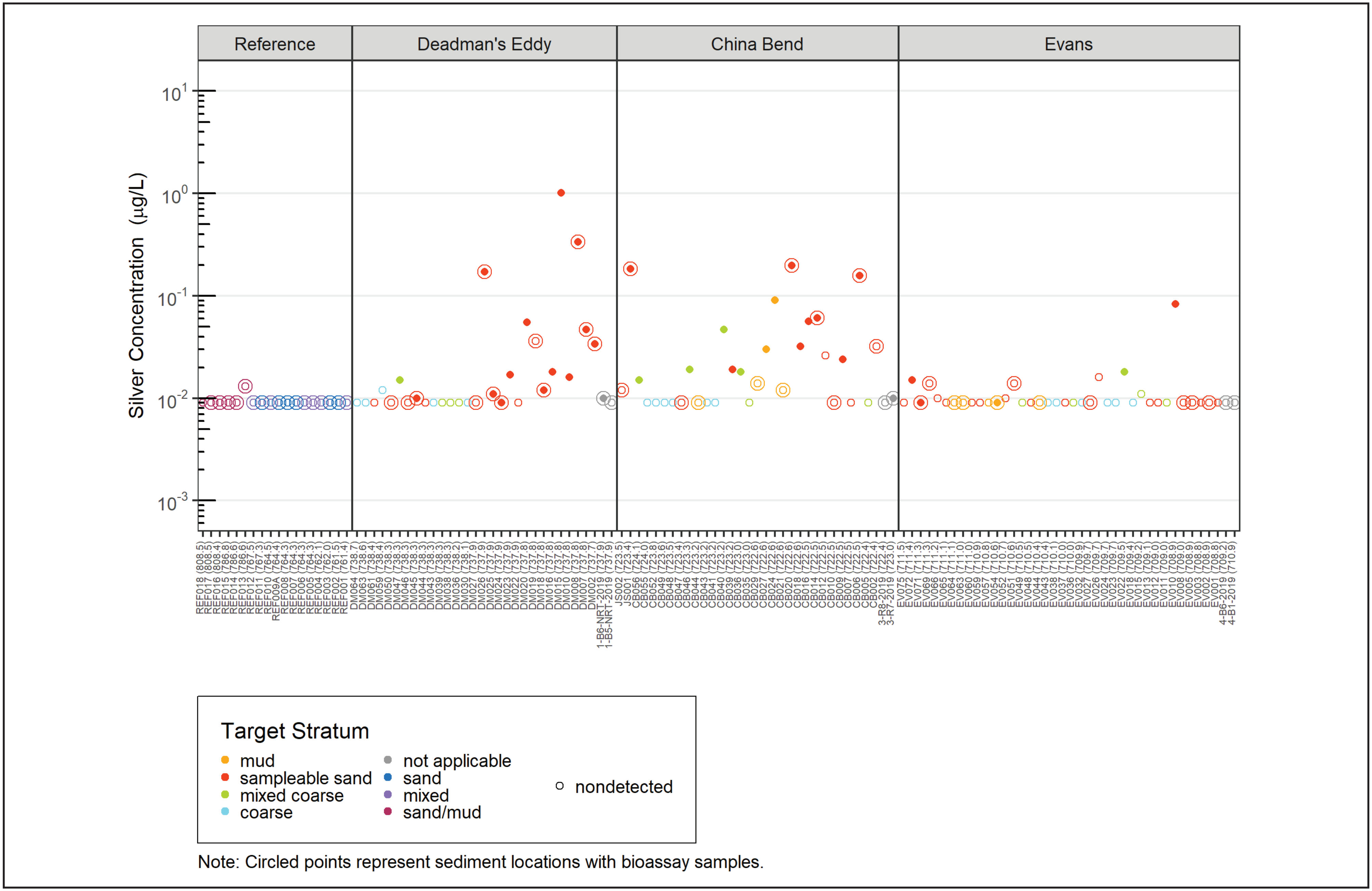
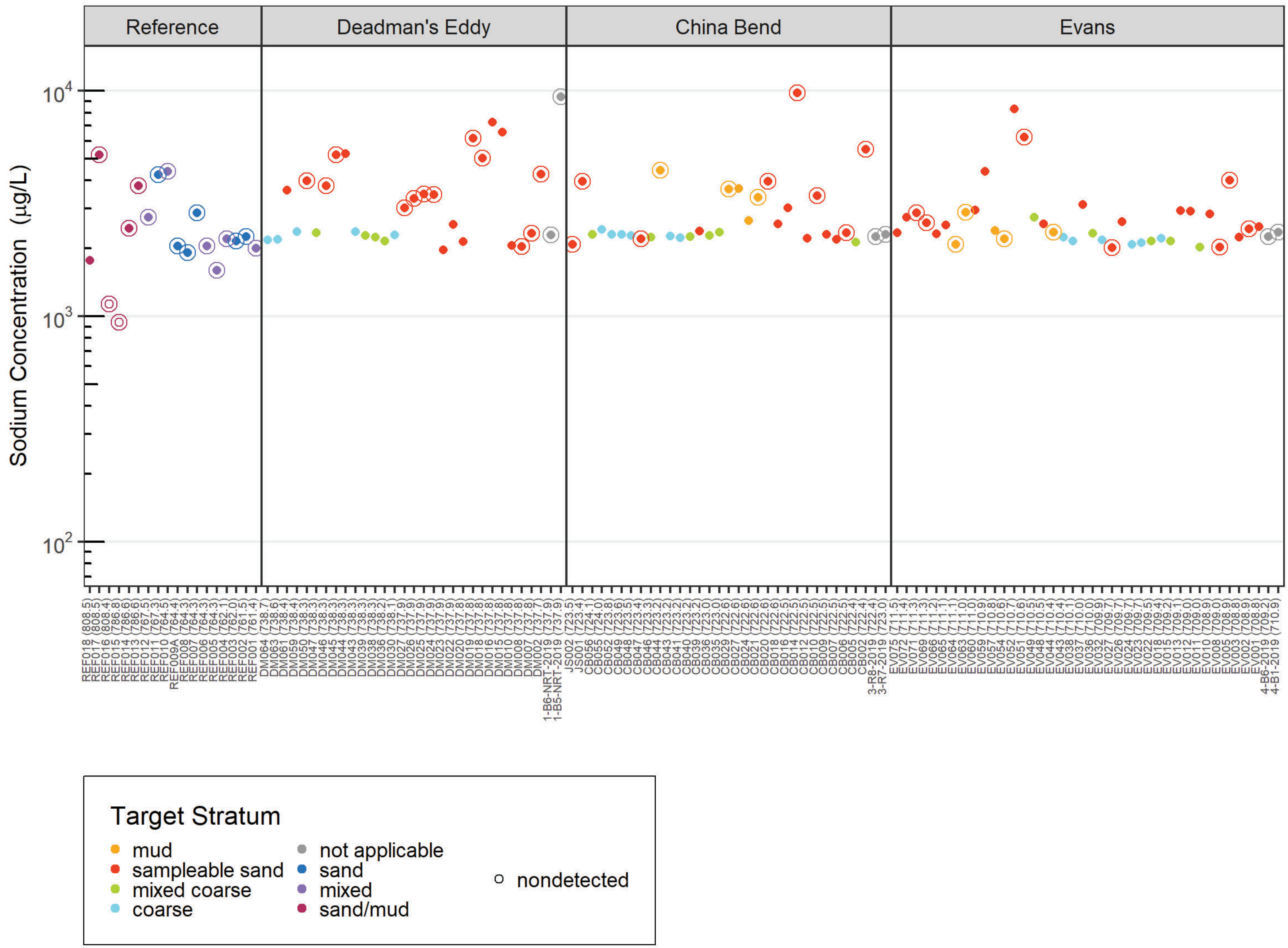
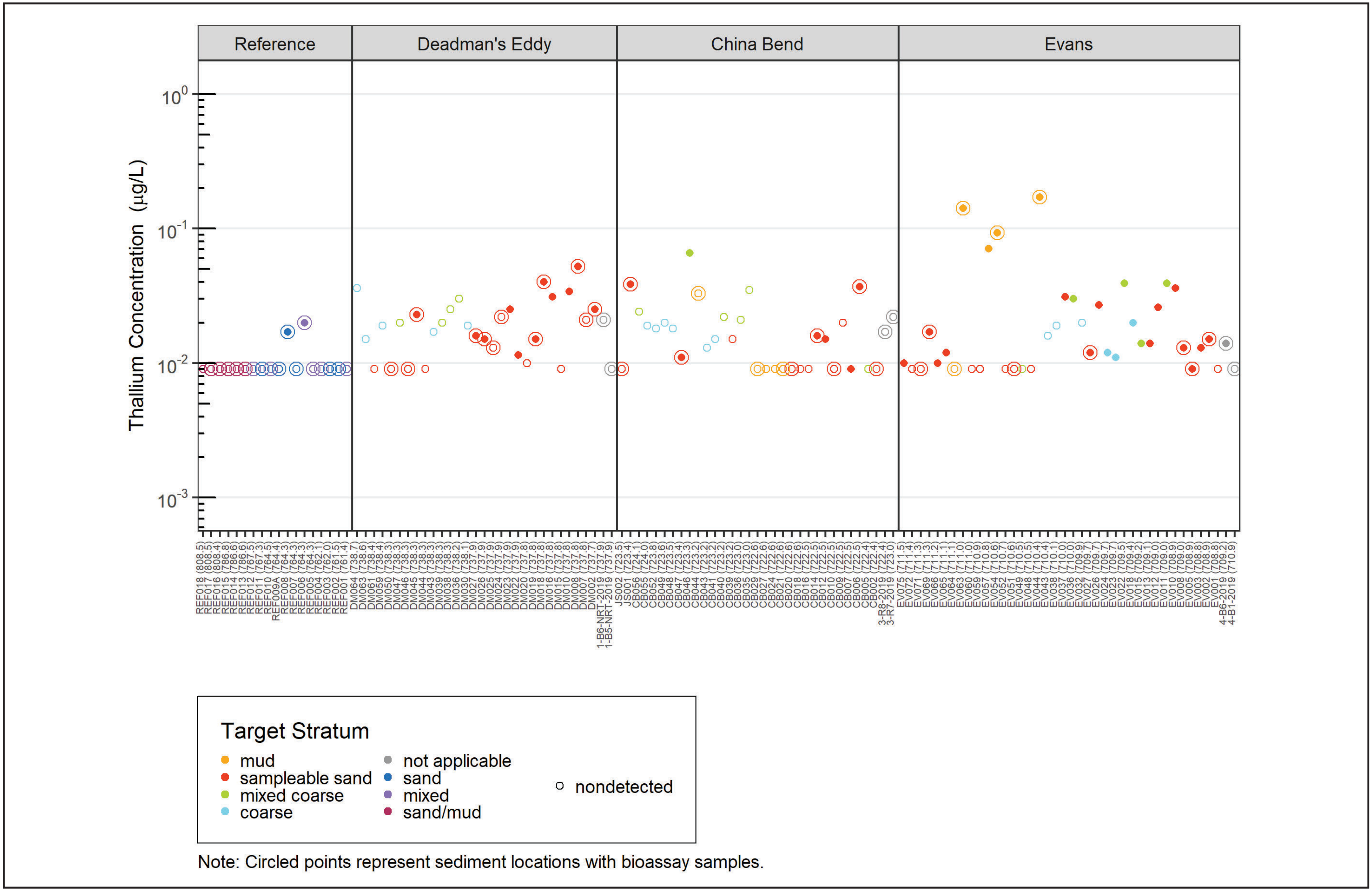


Figure 5-3bl. Dissolved Silver in Field Porewater Samples by River Mile



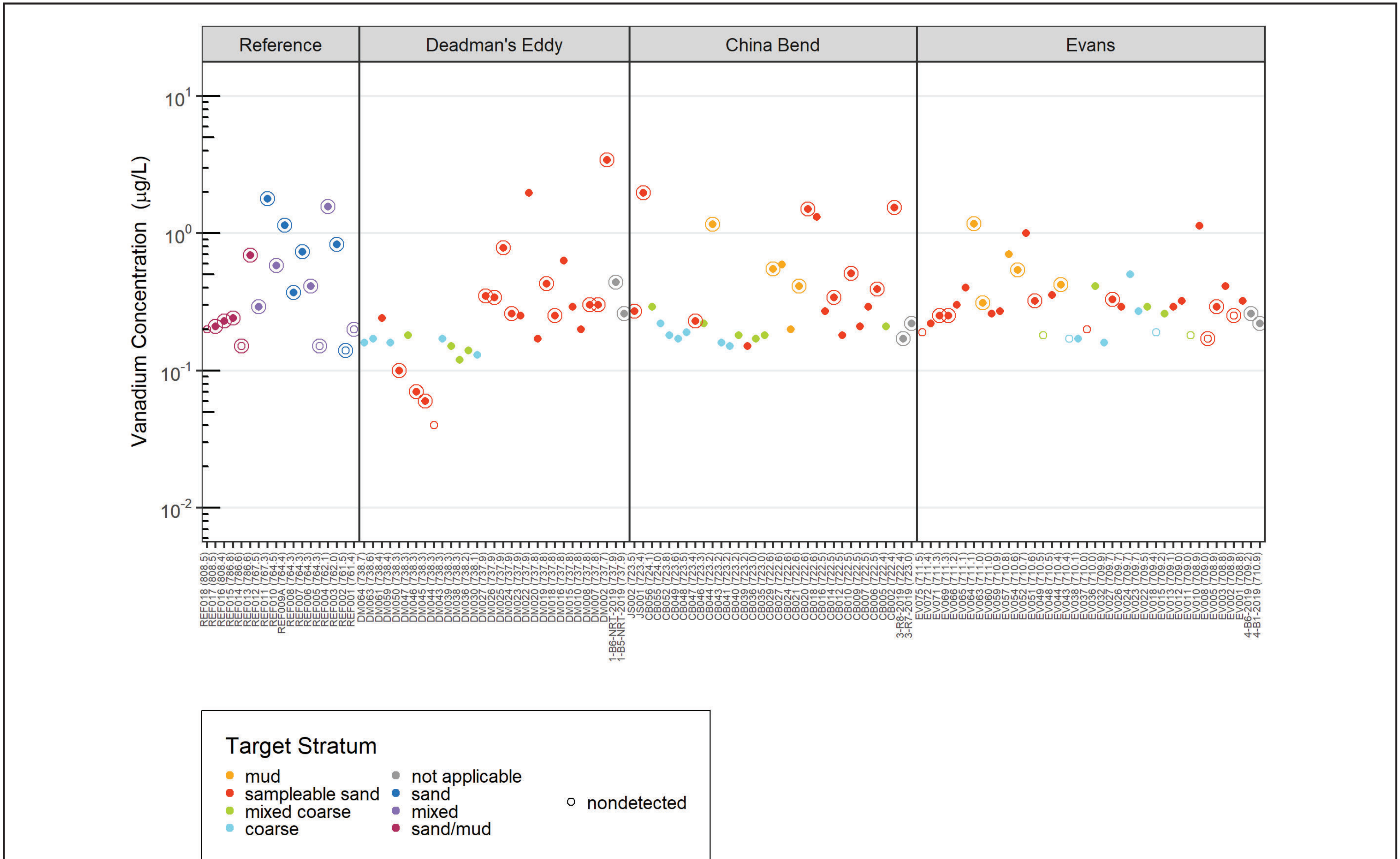
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bm. Dissolved Sodium in Field Porewater Samples by River Mile



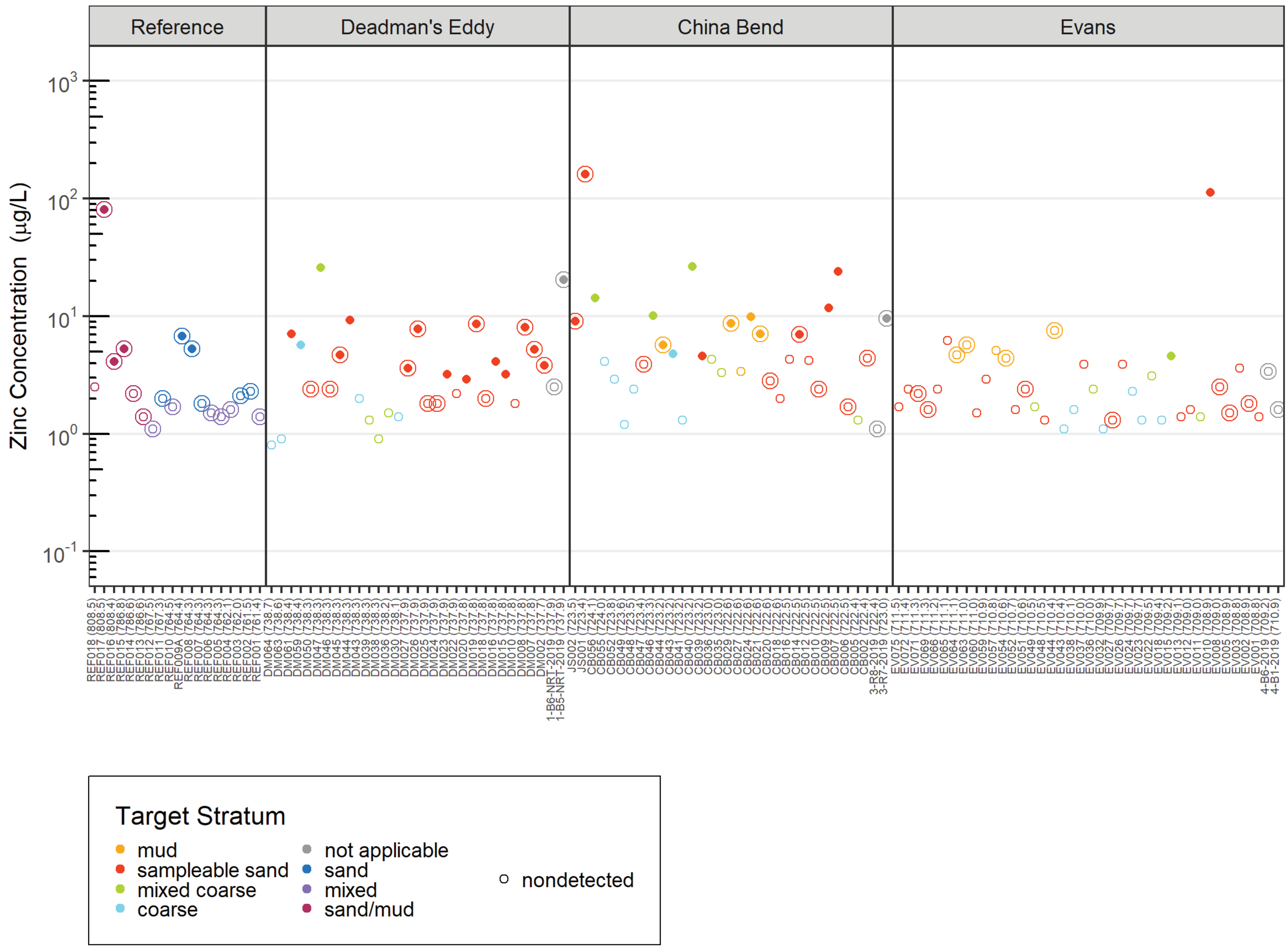
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bn. Dissolved Thallium in Field Porewater Samples by River Mile



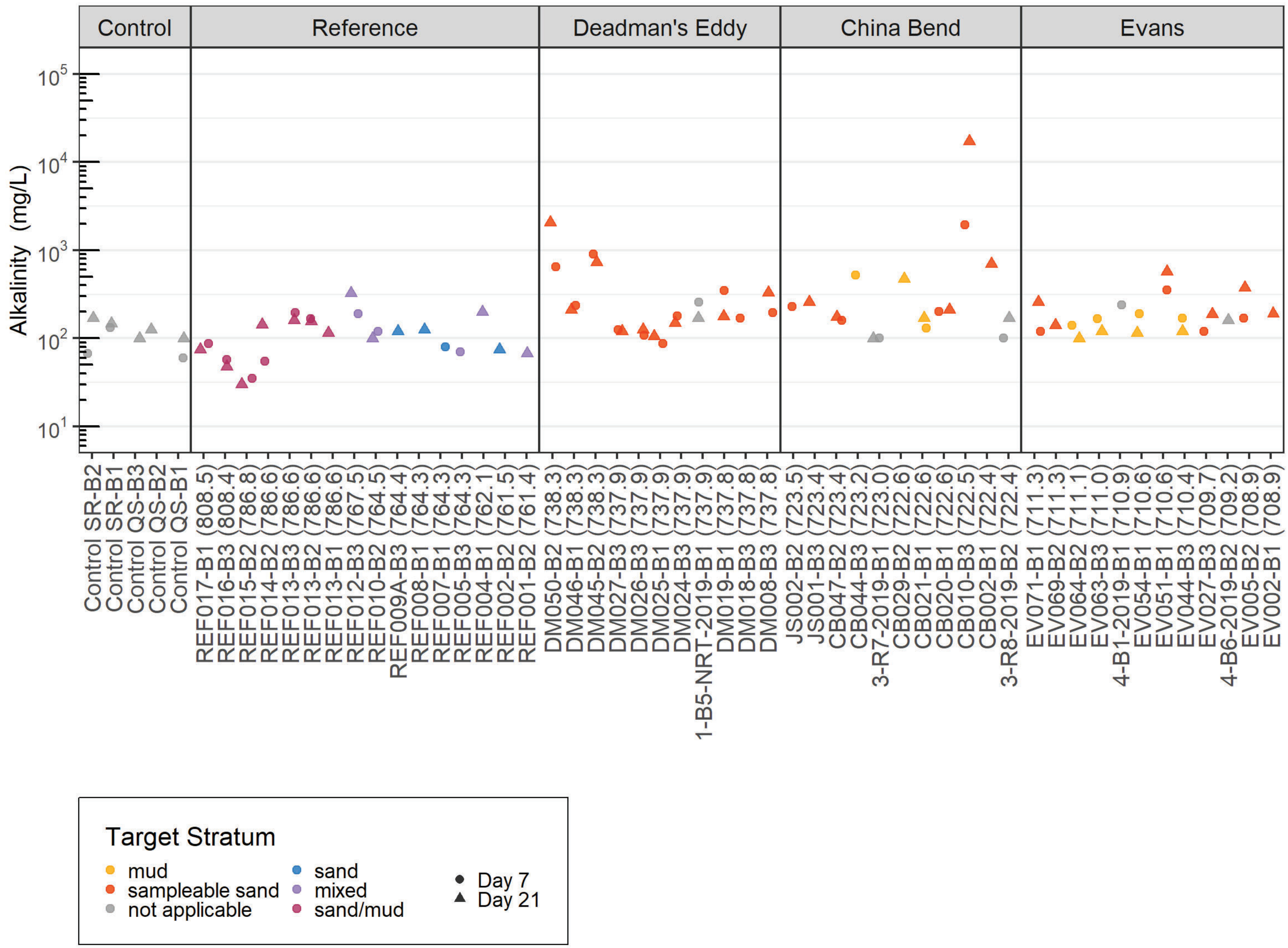
Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bo. Dissolved Vanadium in Field Porewater Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.

Figure 5-3bp. Dissolved Zinc in Field Porewater Samples by River Mile



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4a. Alkalinity in Bioassay Porewater Samples

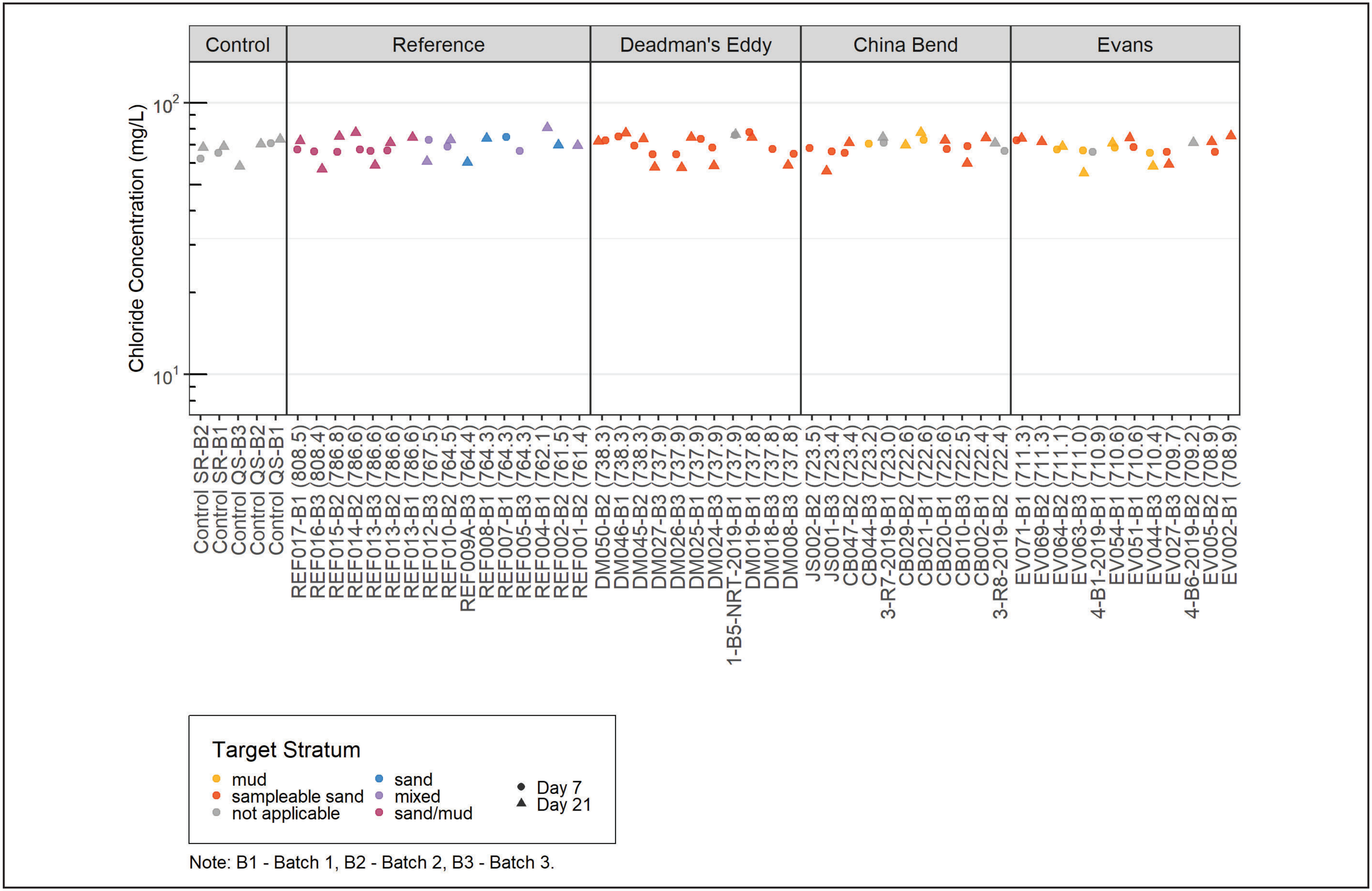
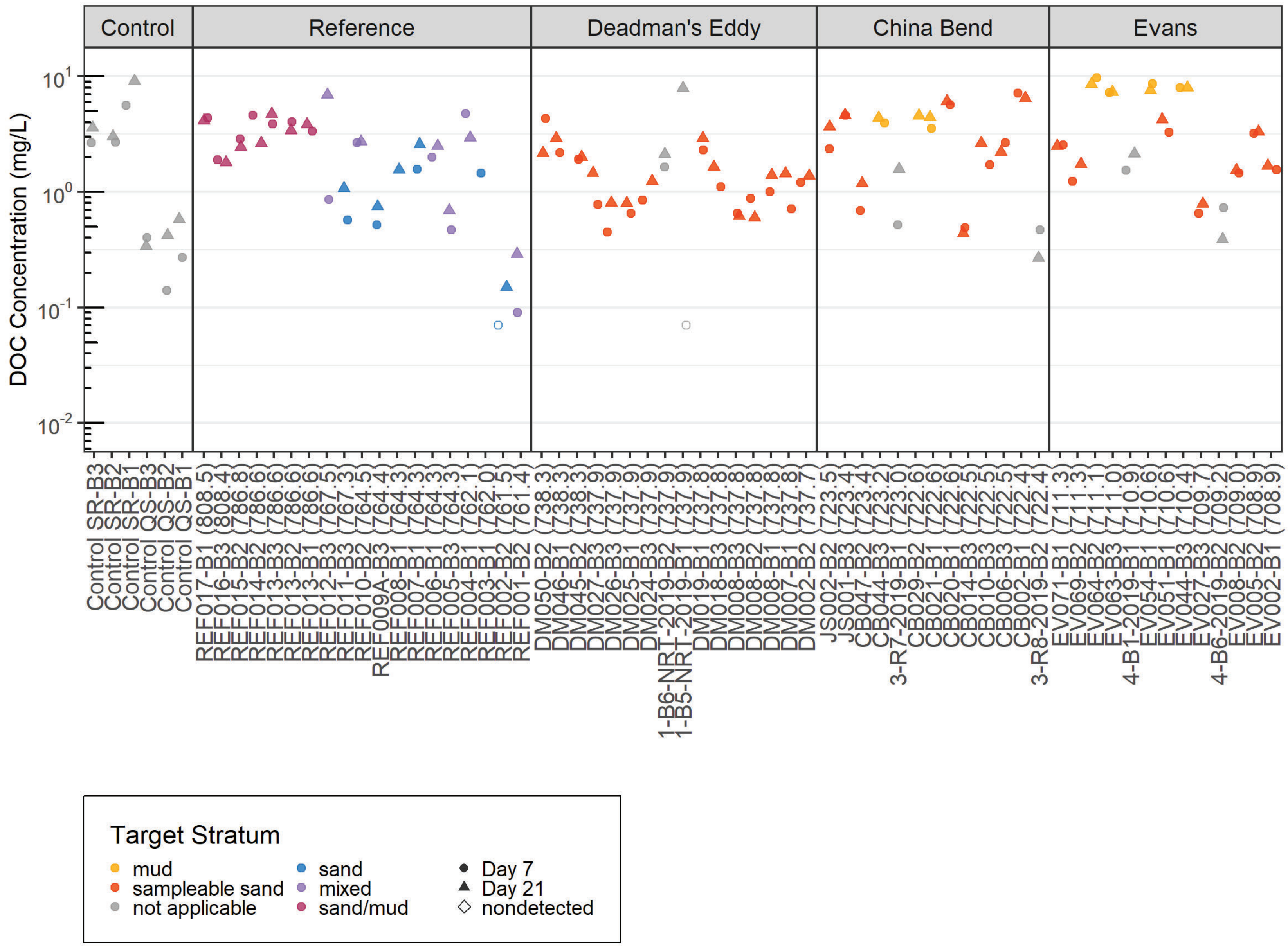
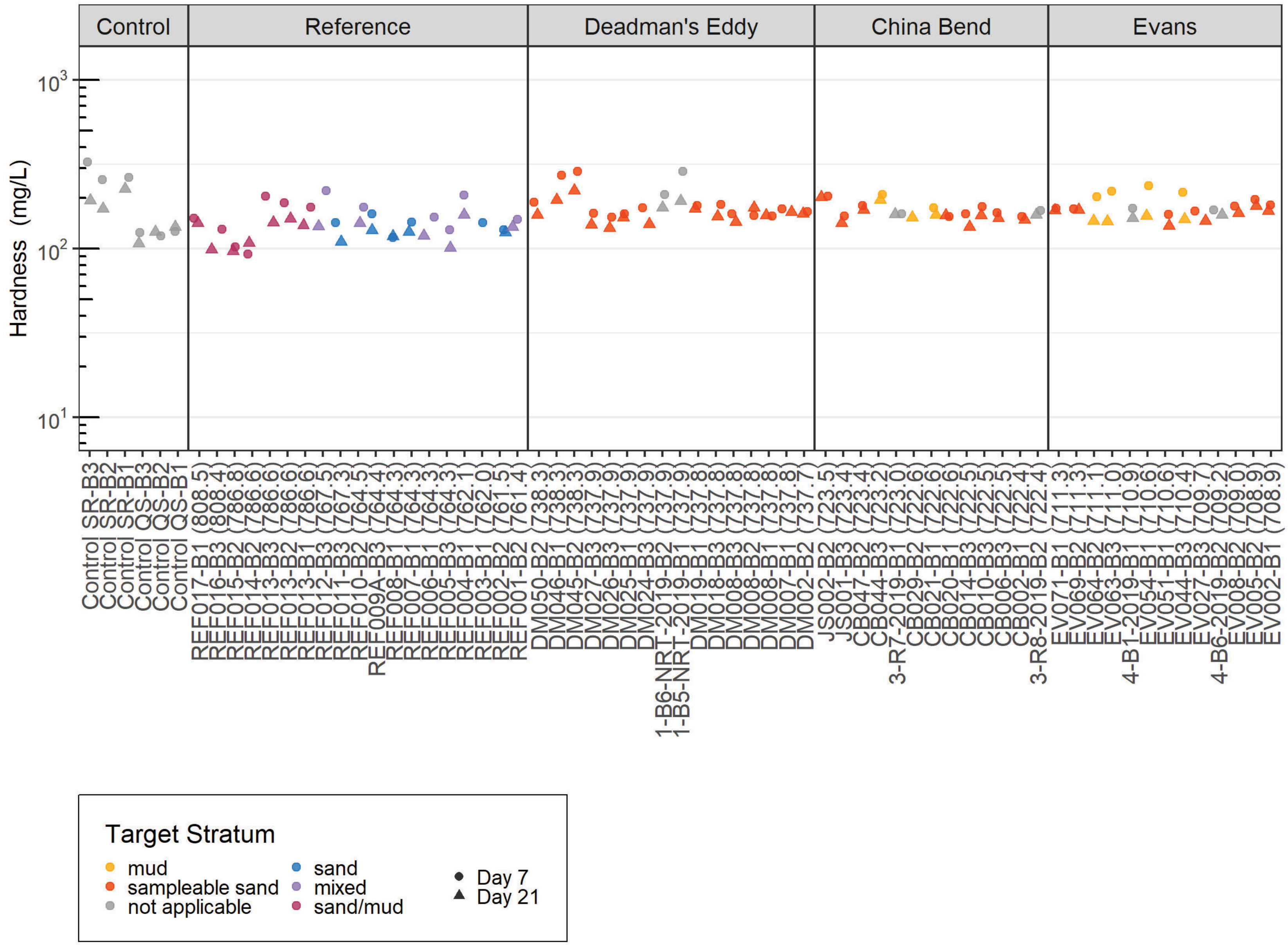


Figure 5-4b. Chloride in Bioassay Porewater Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4c. Dissolved DOC in Bioassay Porewater Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4d. Hardness in Bioassay Porewater Samples

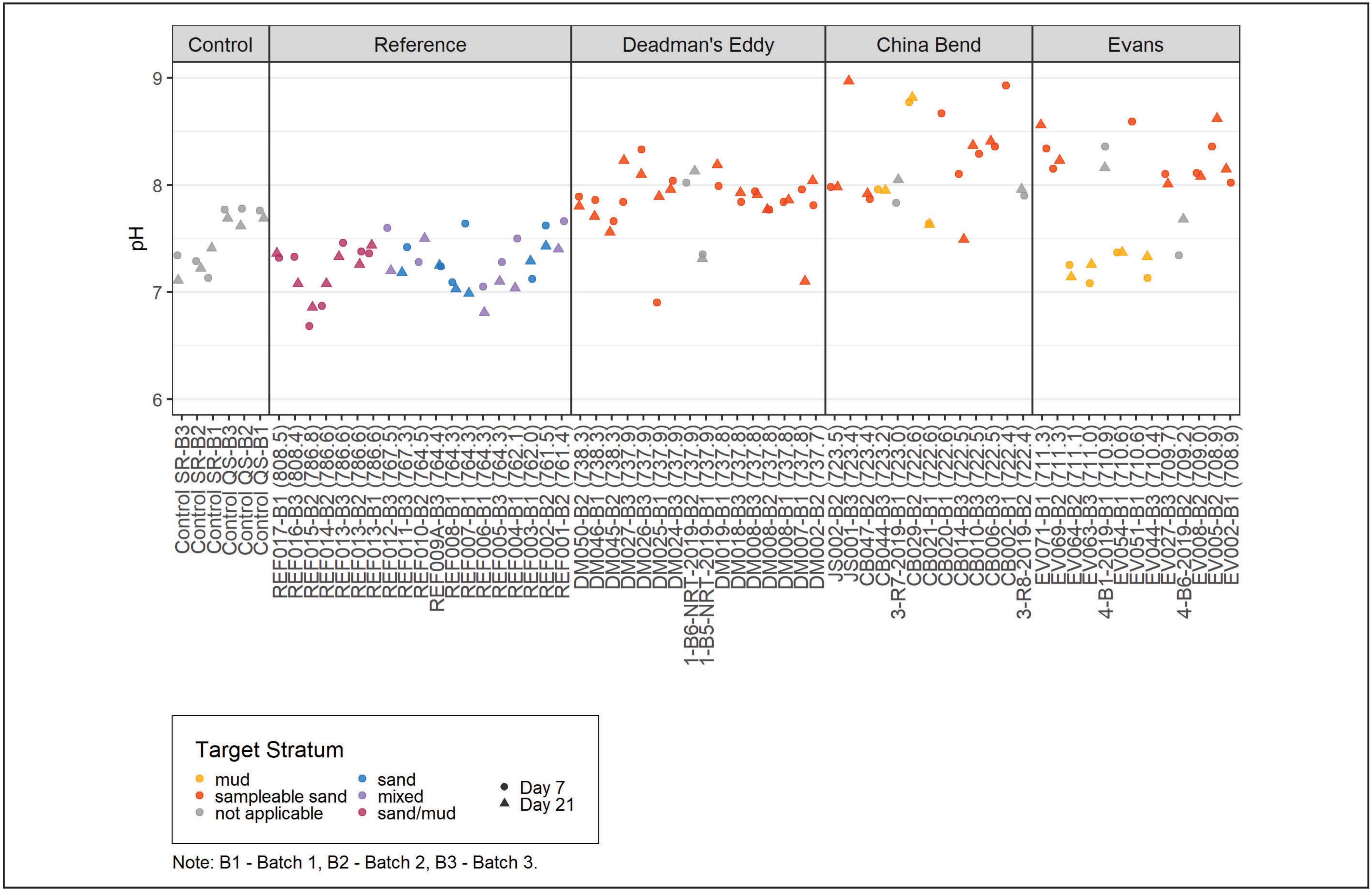
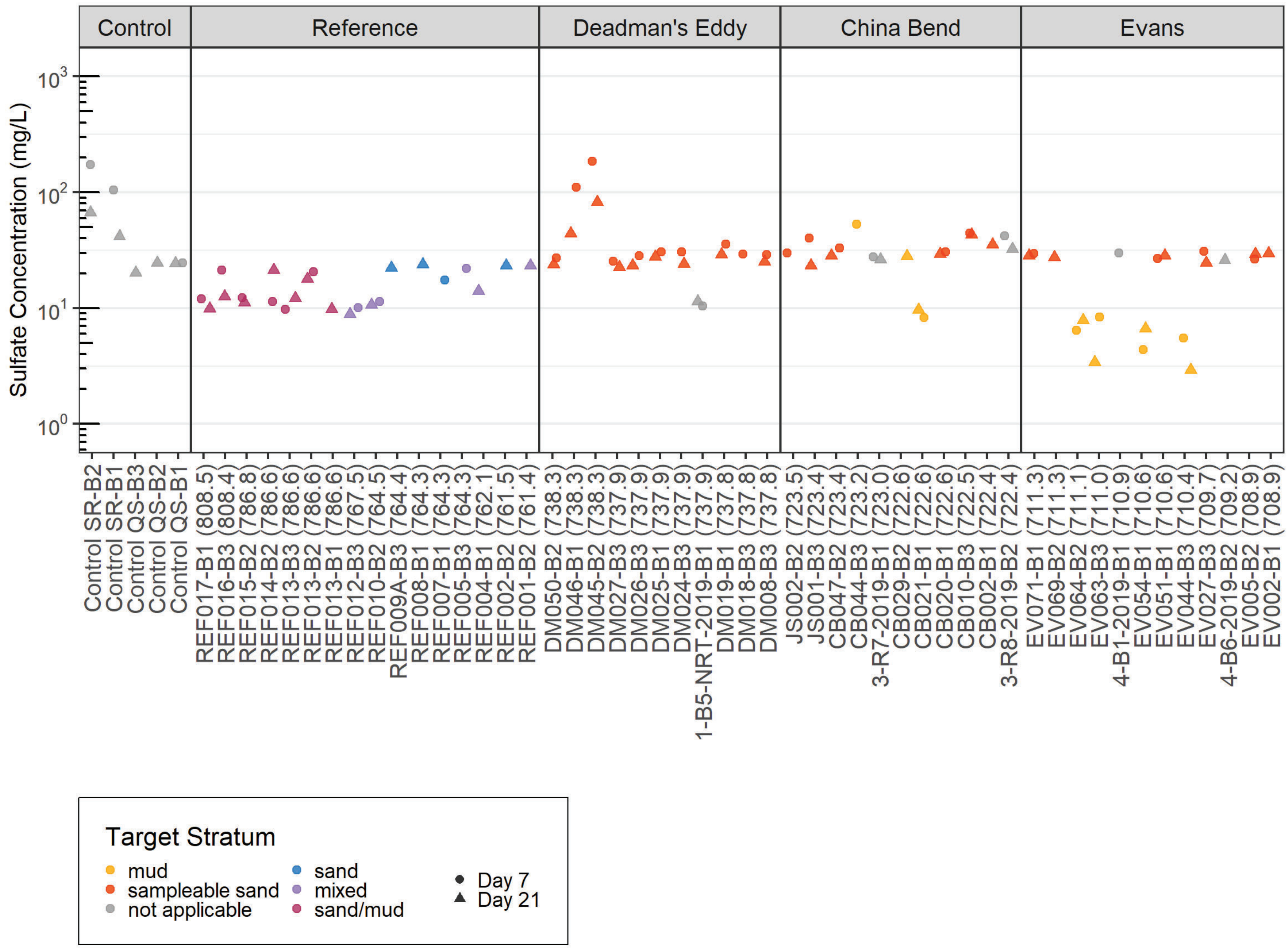
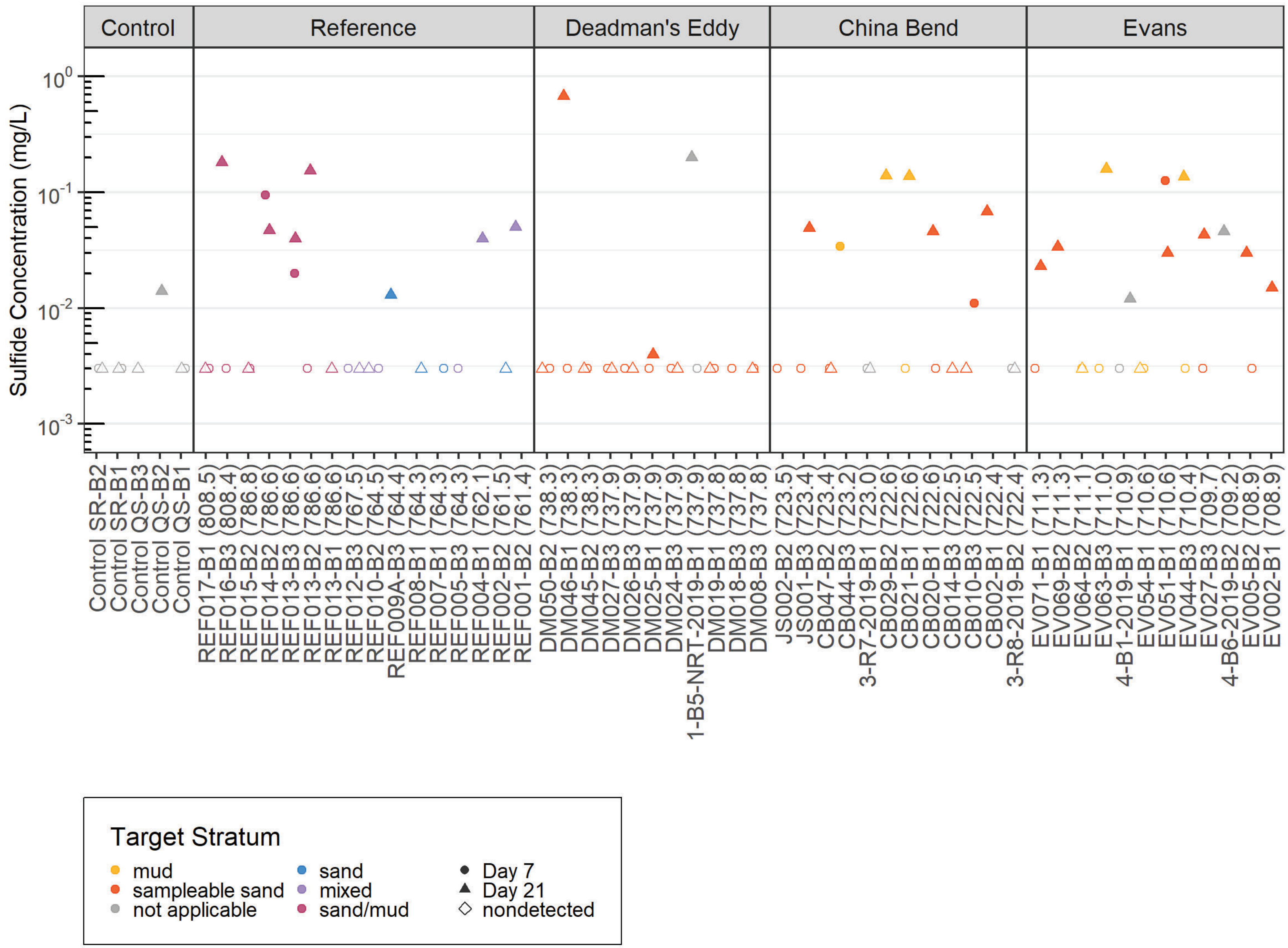


Figure 5-4e. pH in Bioassay Porewater Samples



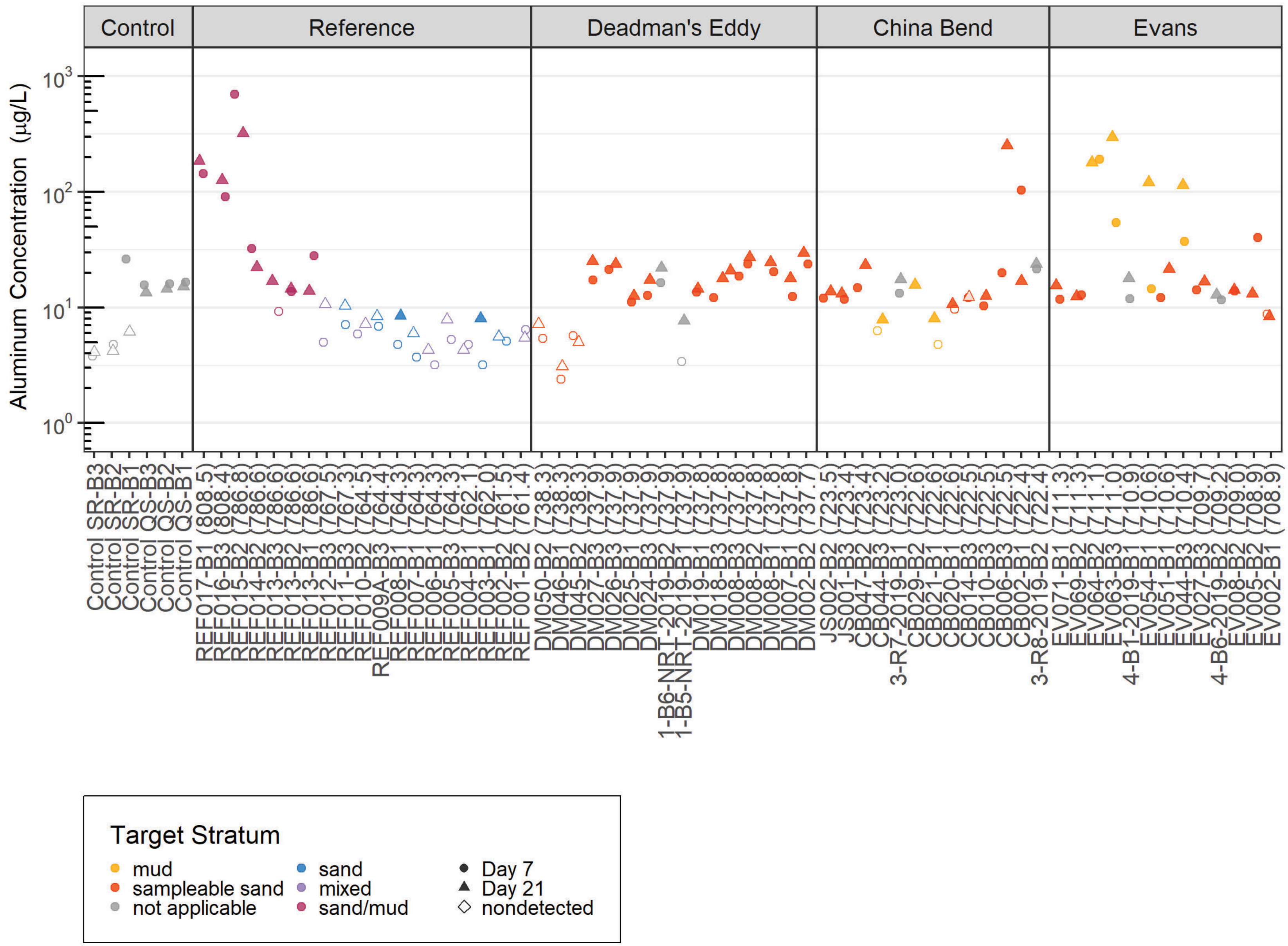
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4f. Sulfate in Bioassay Porewater Samples



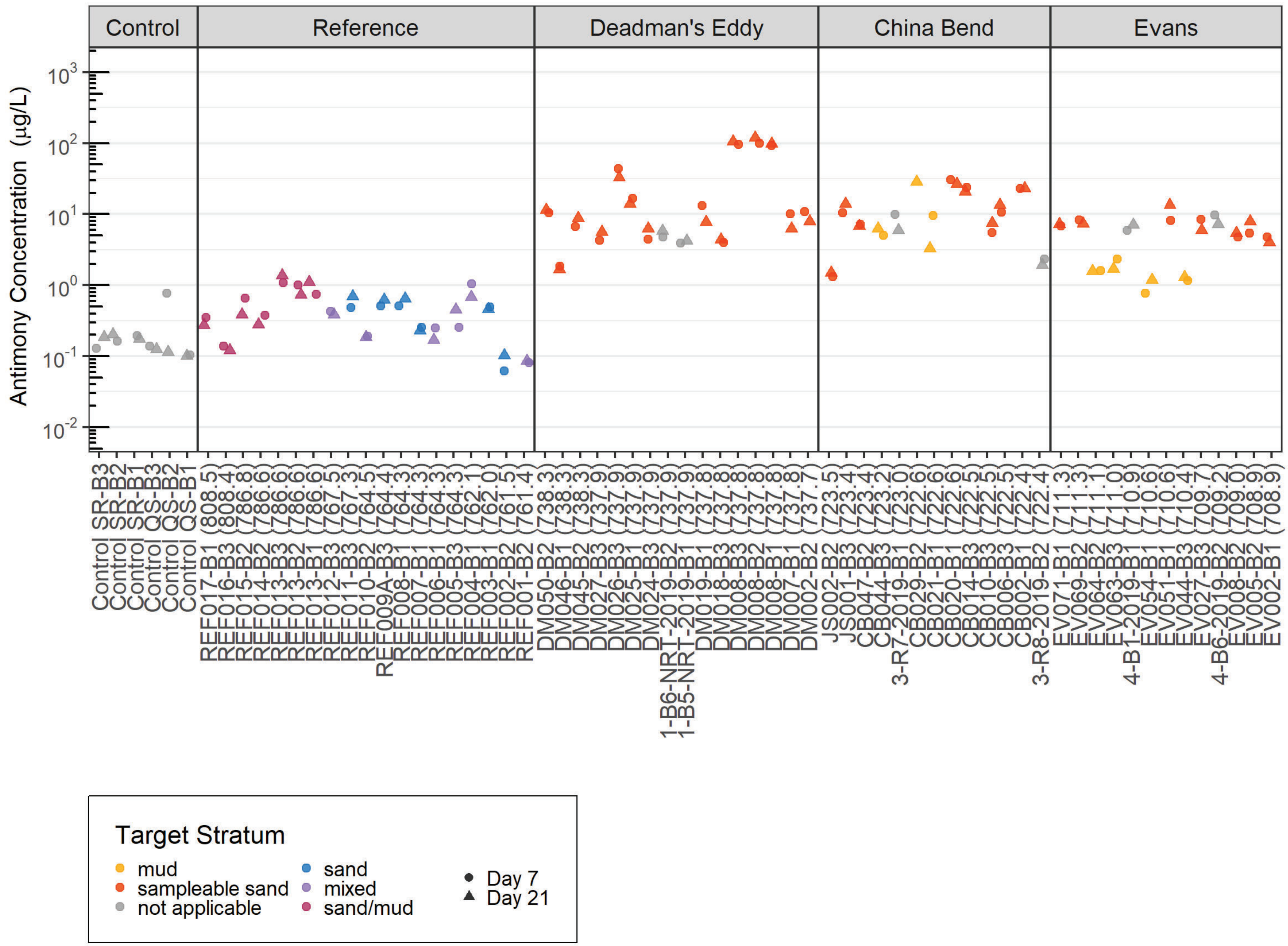
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4g. Sulfide in Bioassay Porewater Samples



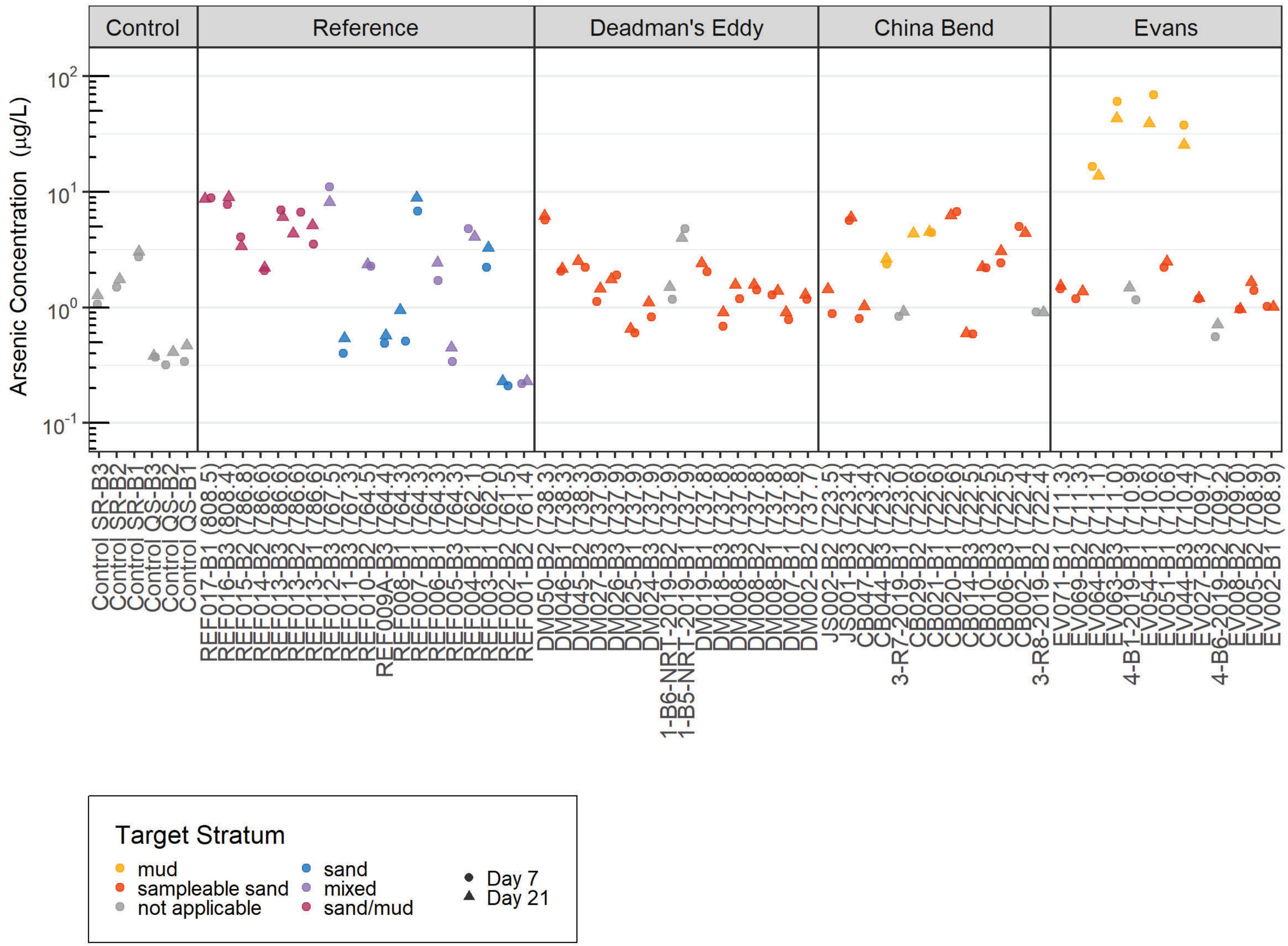
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4h. Dissolved Aluminum in Bioassay Porewater Samples



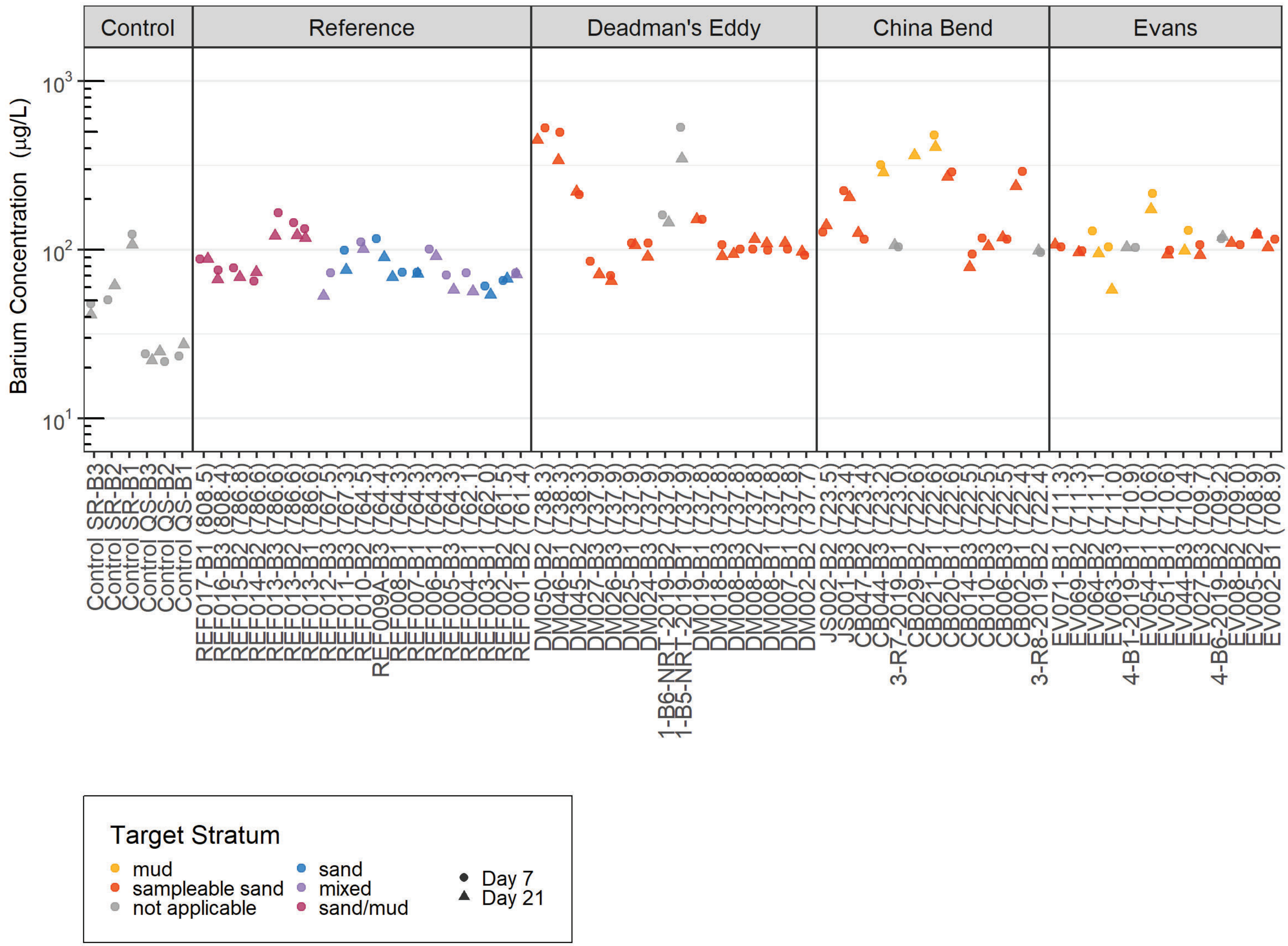
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4i. Dissolved Antimony in Bioassay Porewater Samples



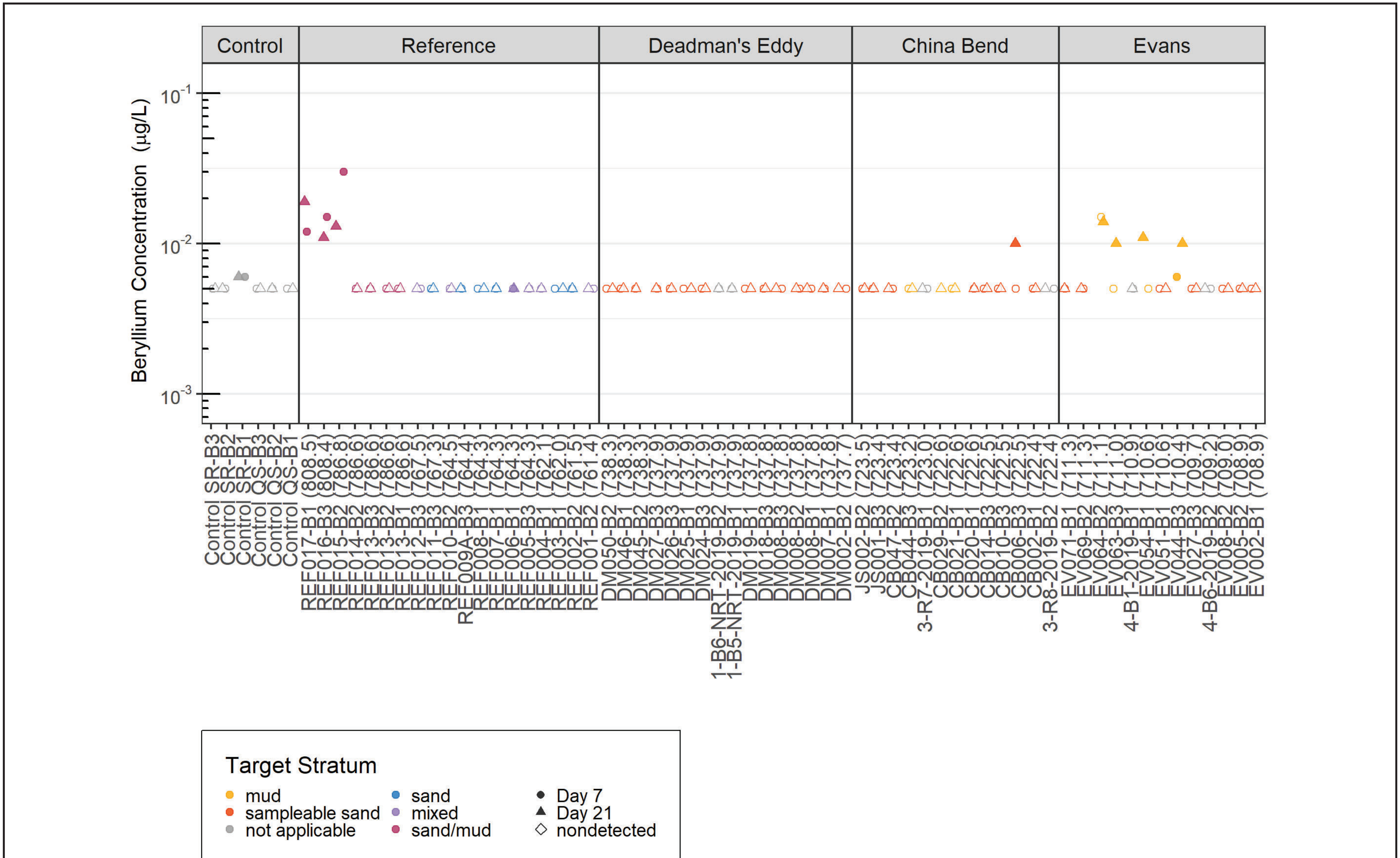
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4j. Dissolved Arsenic in Bioassay Porewater Samples



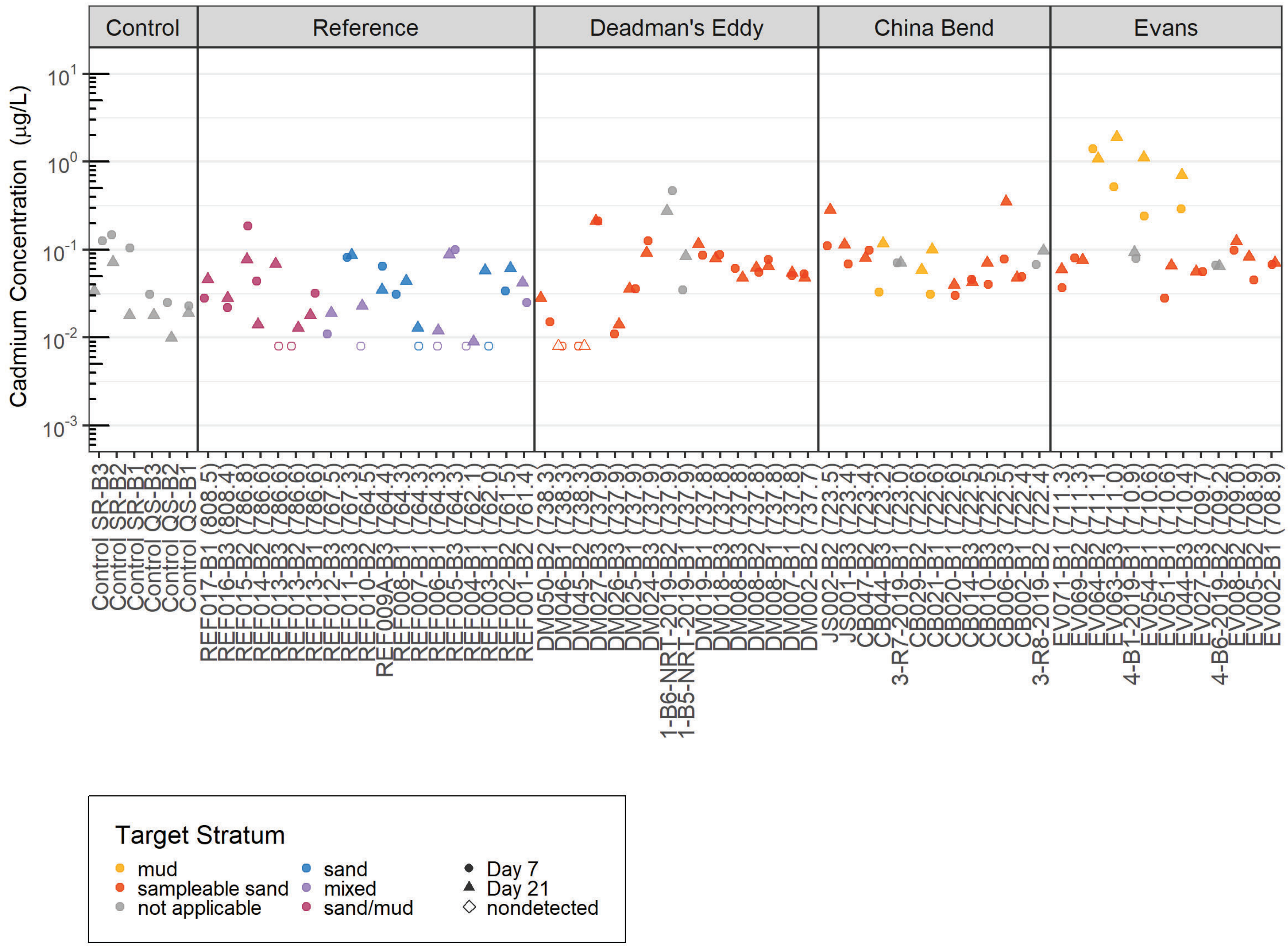
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4k. Dissolved Barium in Bioassay Porewater Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4l. Dissolved Beryllium in Bioassay Porewater Samples



Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4m. Dissolved Cadmium in Bioassay Porewater Samples

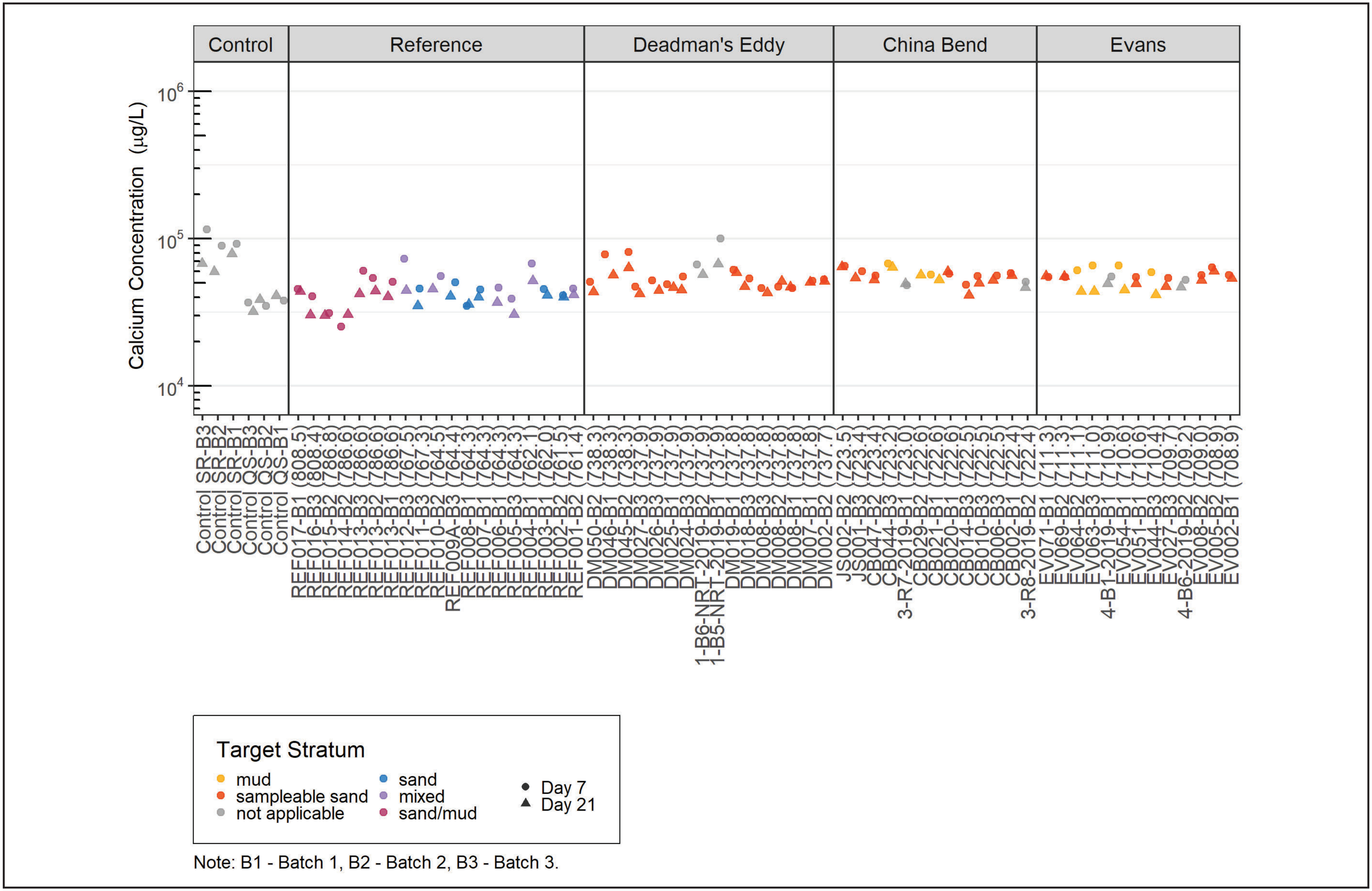
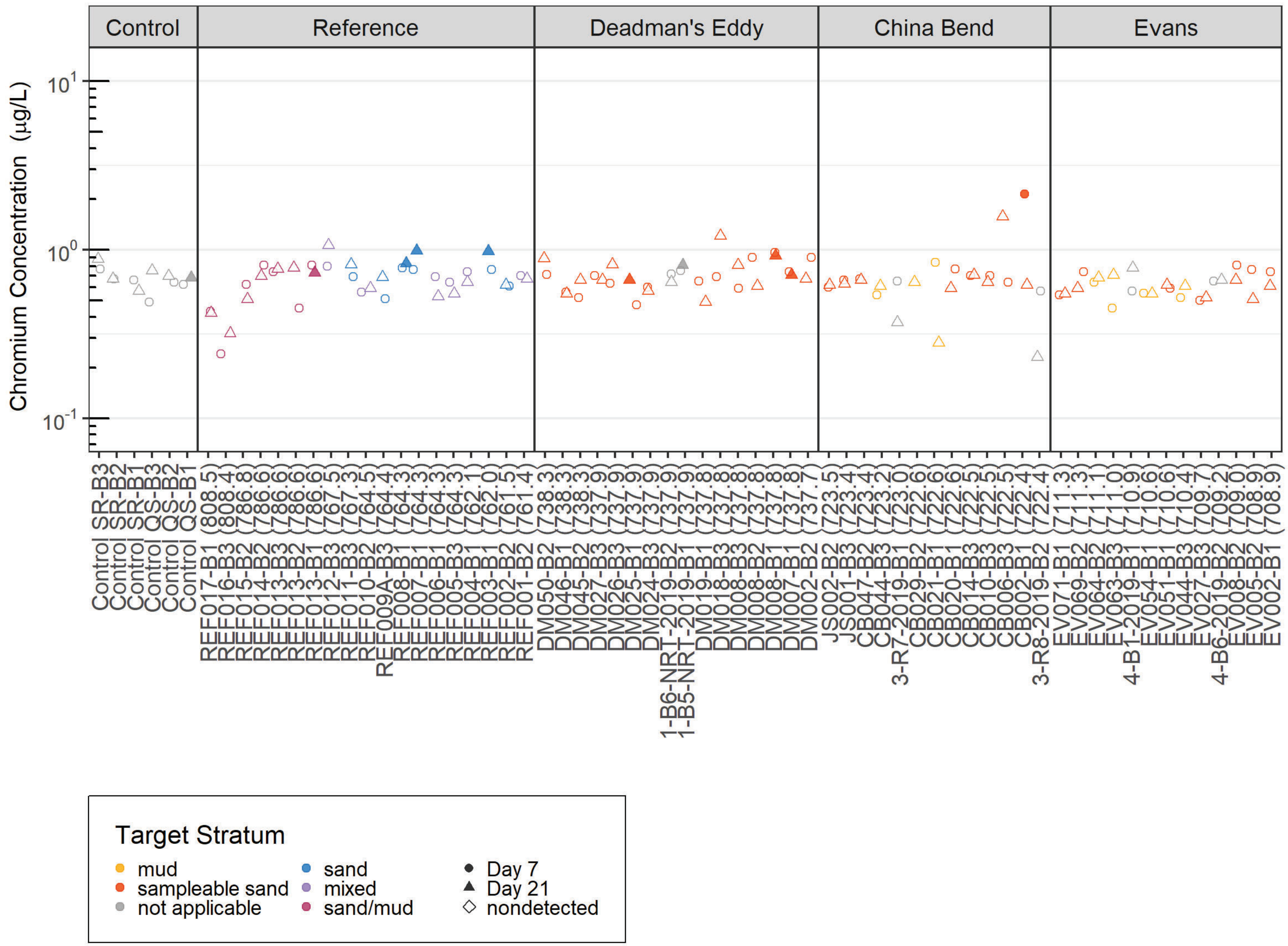
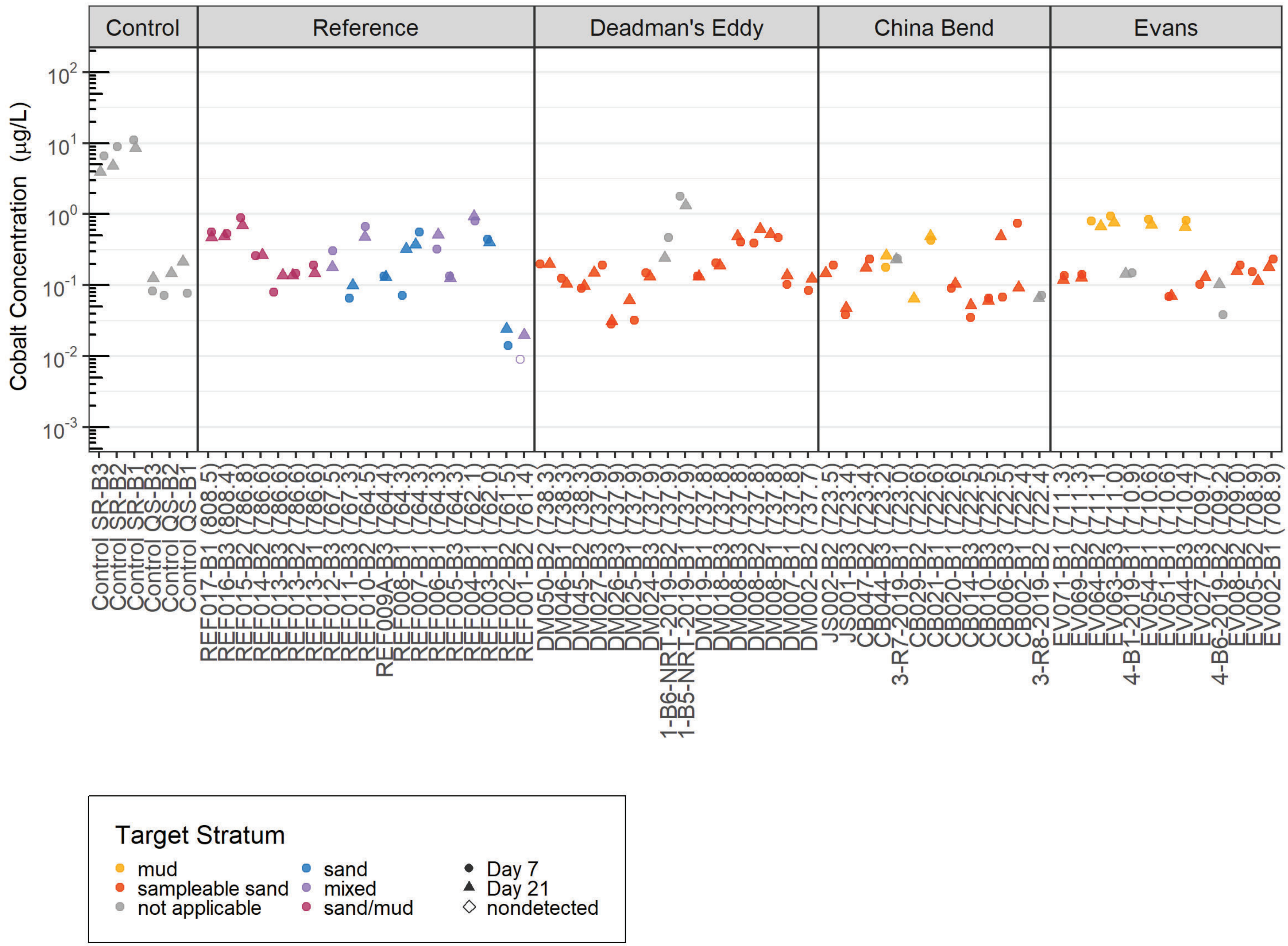


Figure 5-4n. Dissolved Calcium in Bioassay Porewater Samples



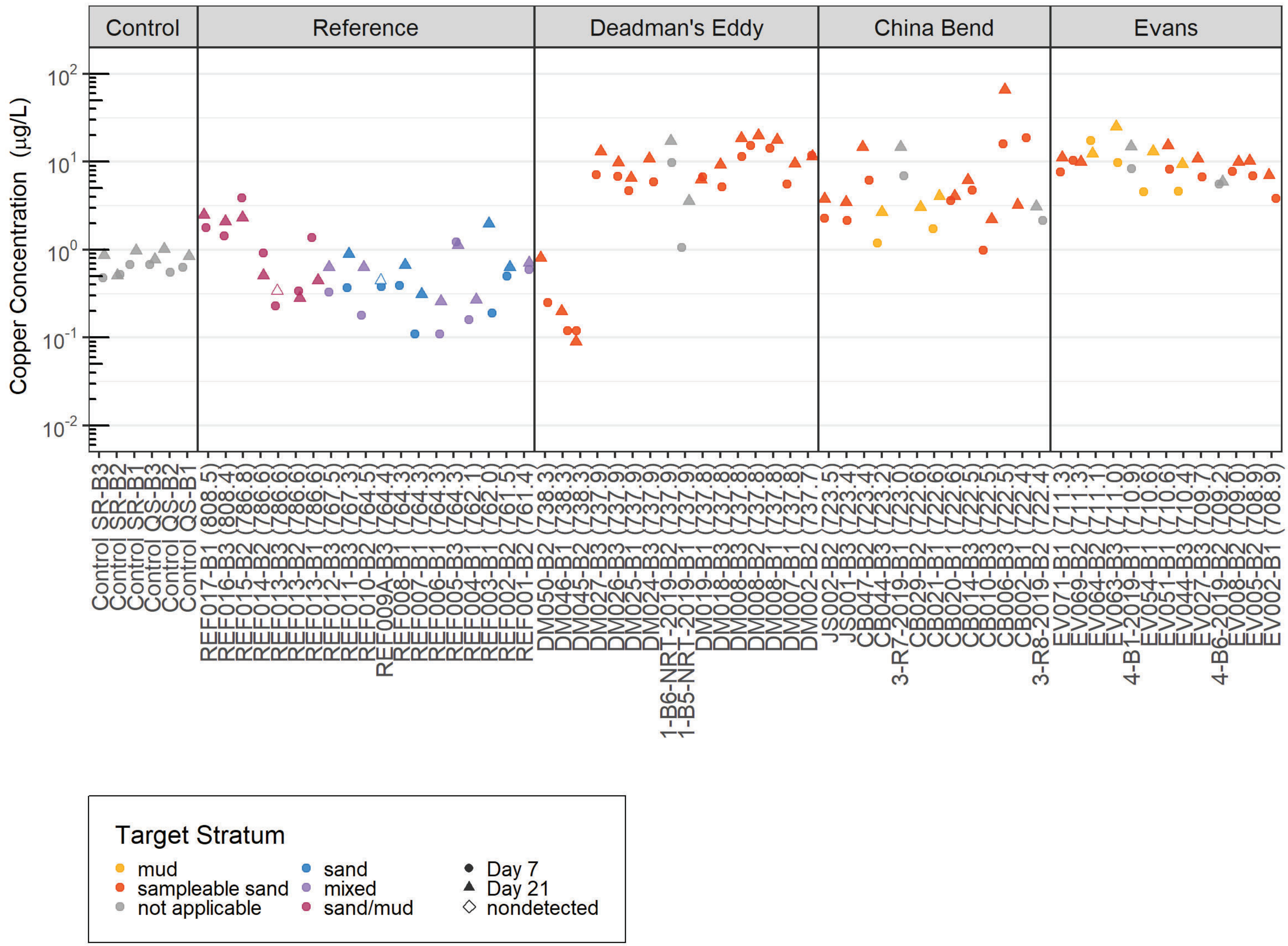
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4o. Dissolved Chromium in Bioassay Porewater Samples



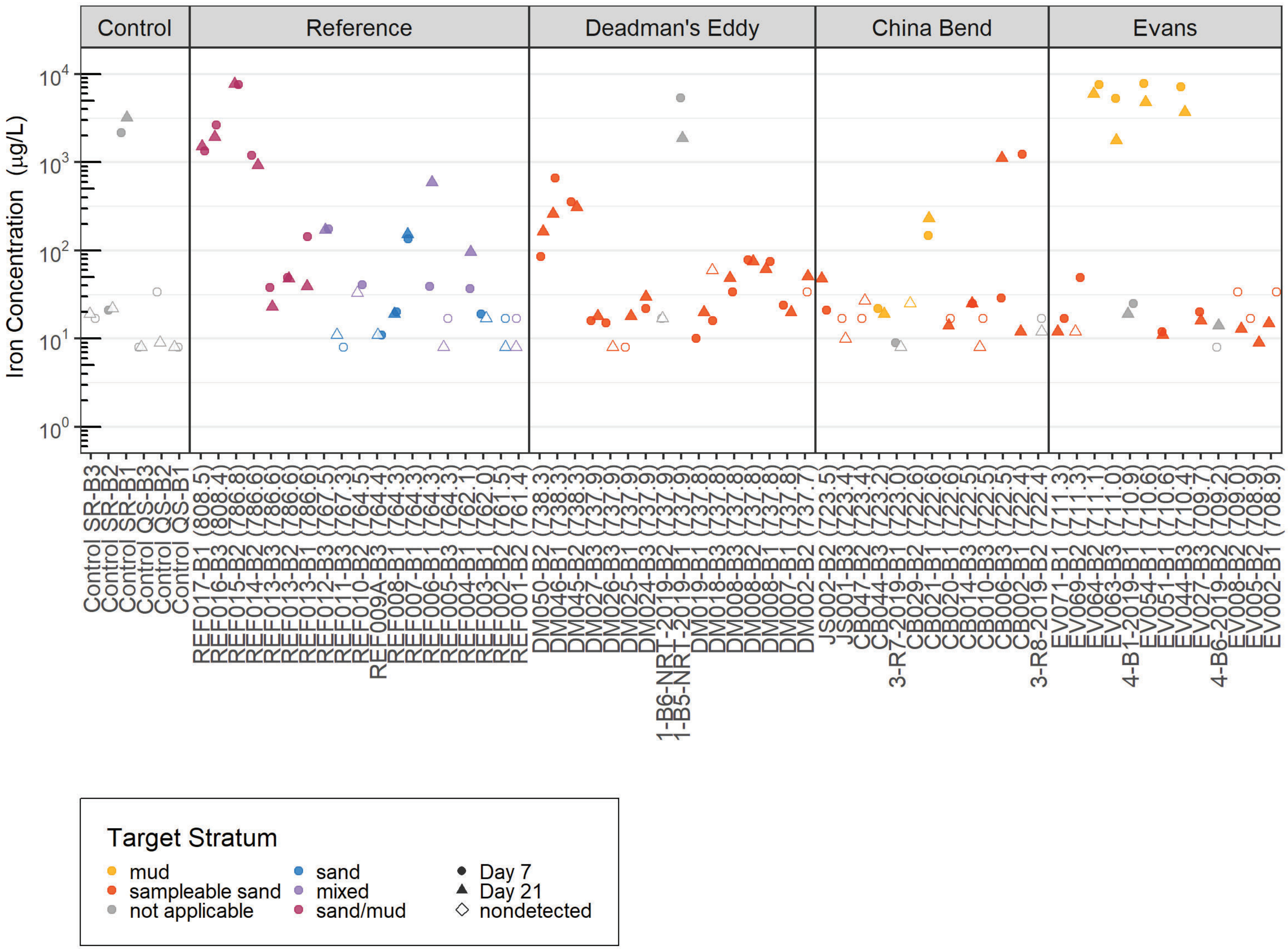
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4p. Dissolved Cobalt in Bioassay Porewater Samples



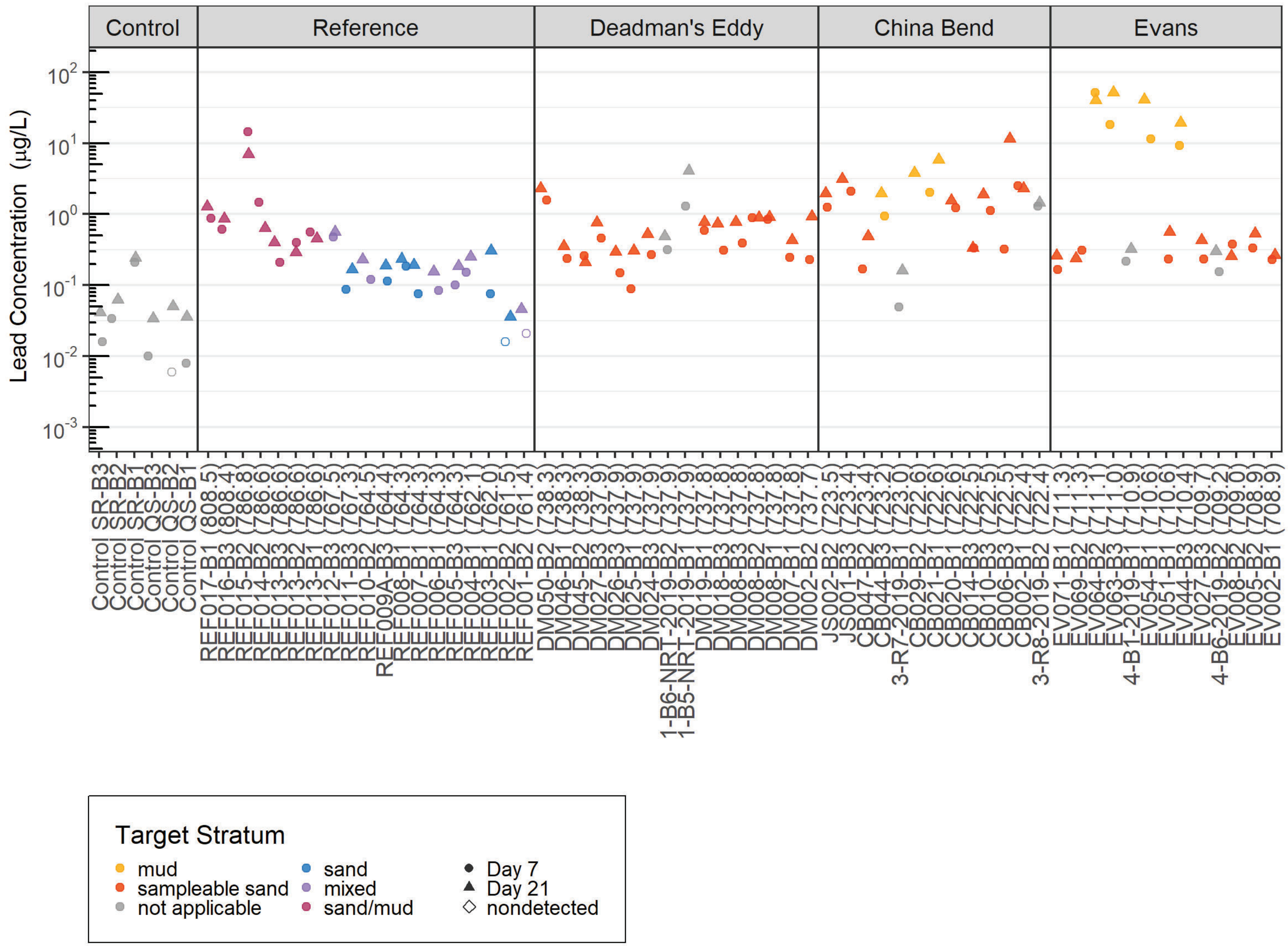
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4q. Dissolved Copper in Bioassay Porewater Samples



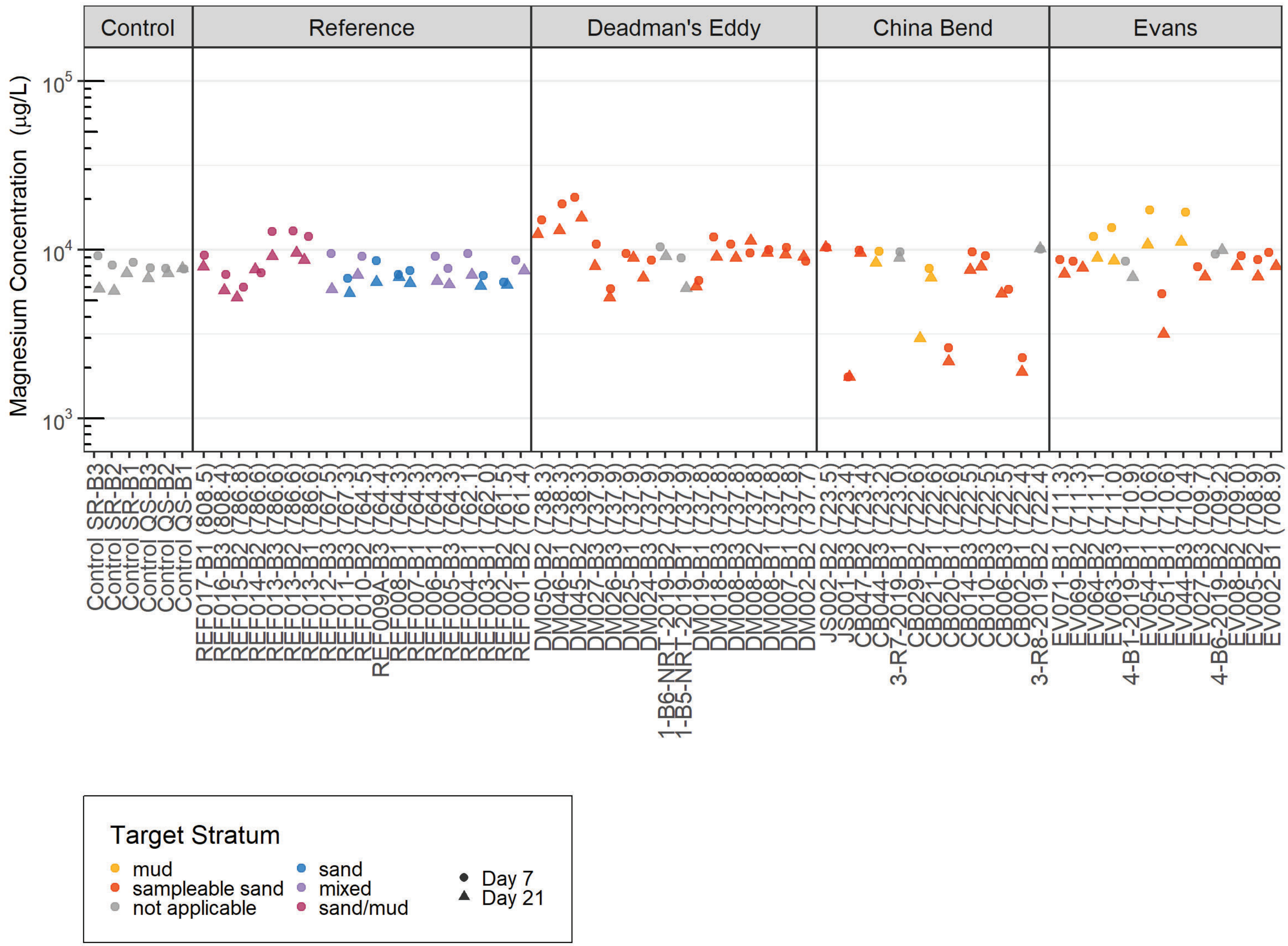
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4r. Dissolved Iron in Bioassay Porewater Samples



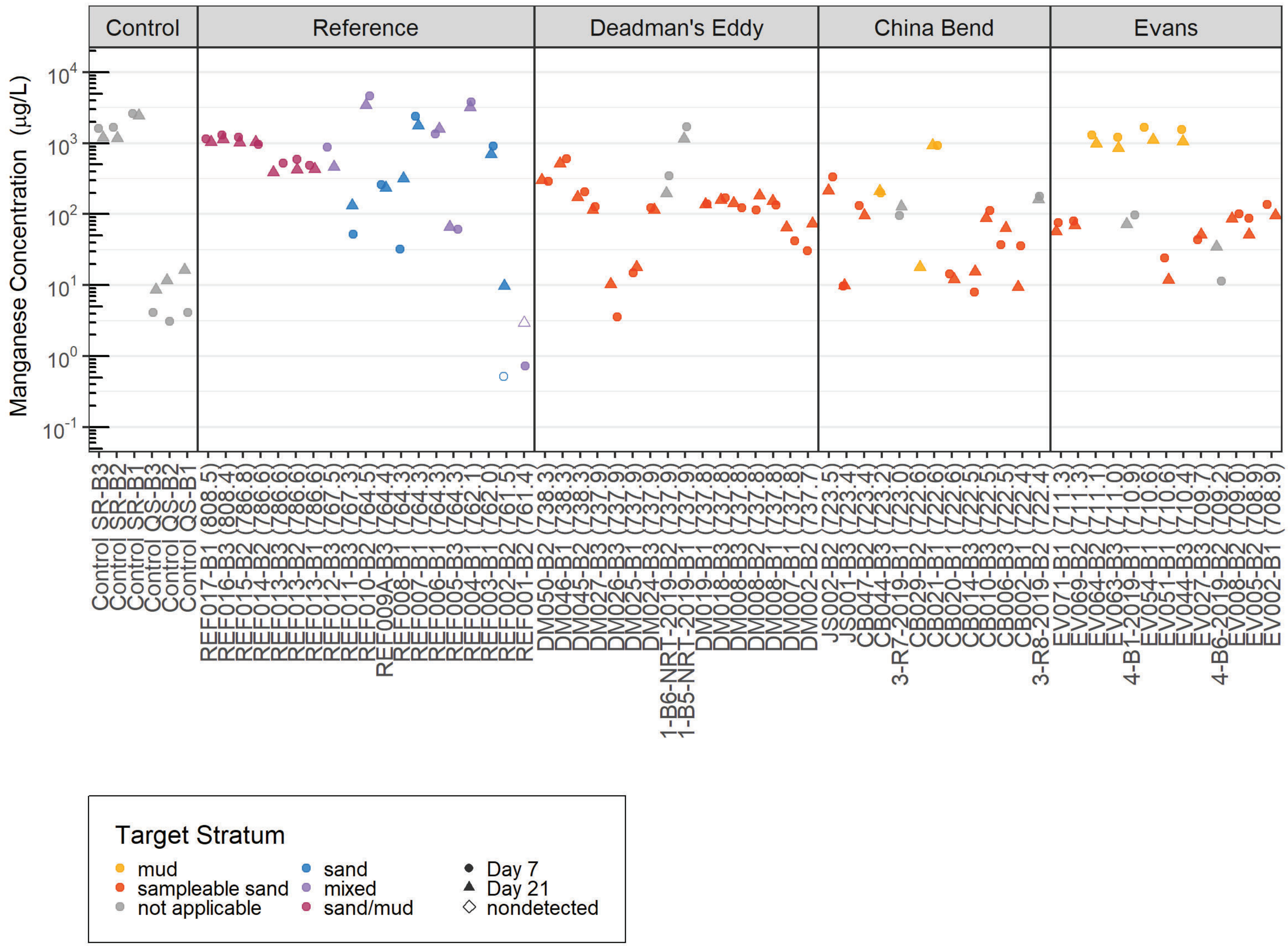
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4s. Dissolved Lead in Bioassay Porewater Samples



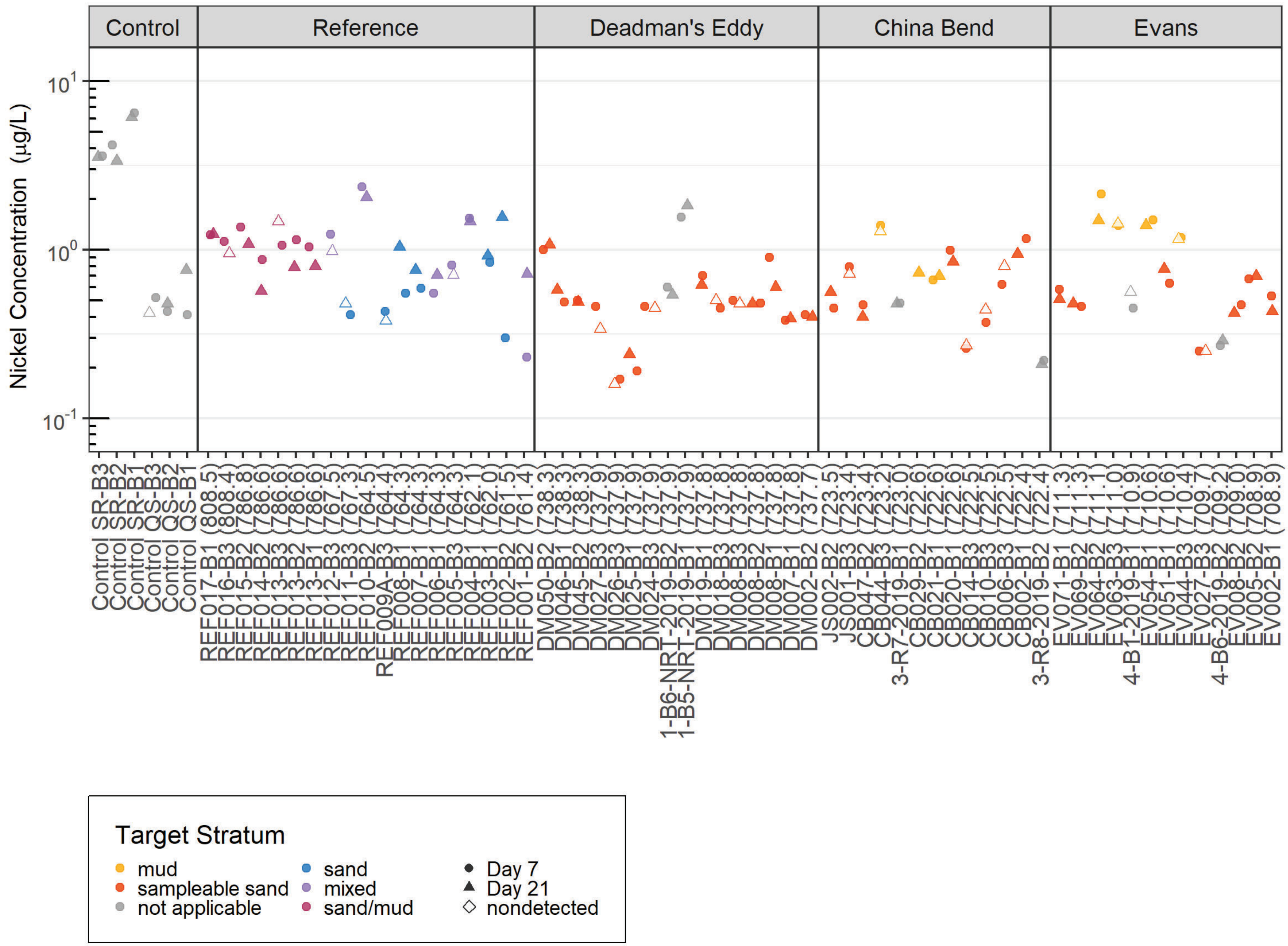
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4t. Dissolved Magnesium in Bioassay Porewater Samples



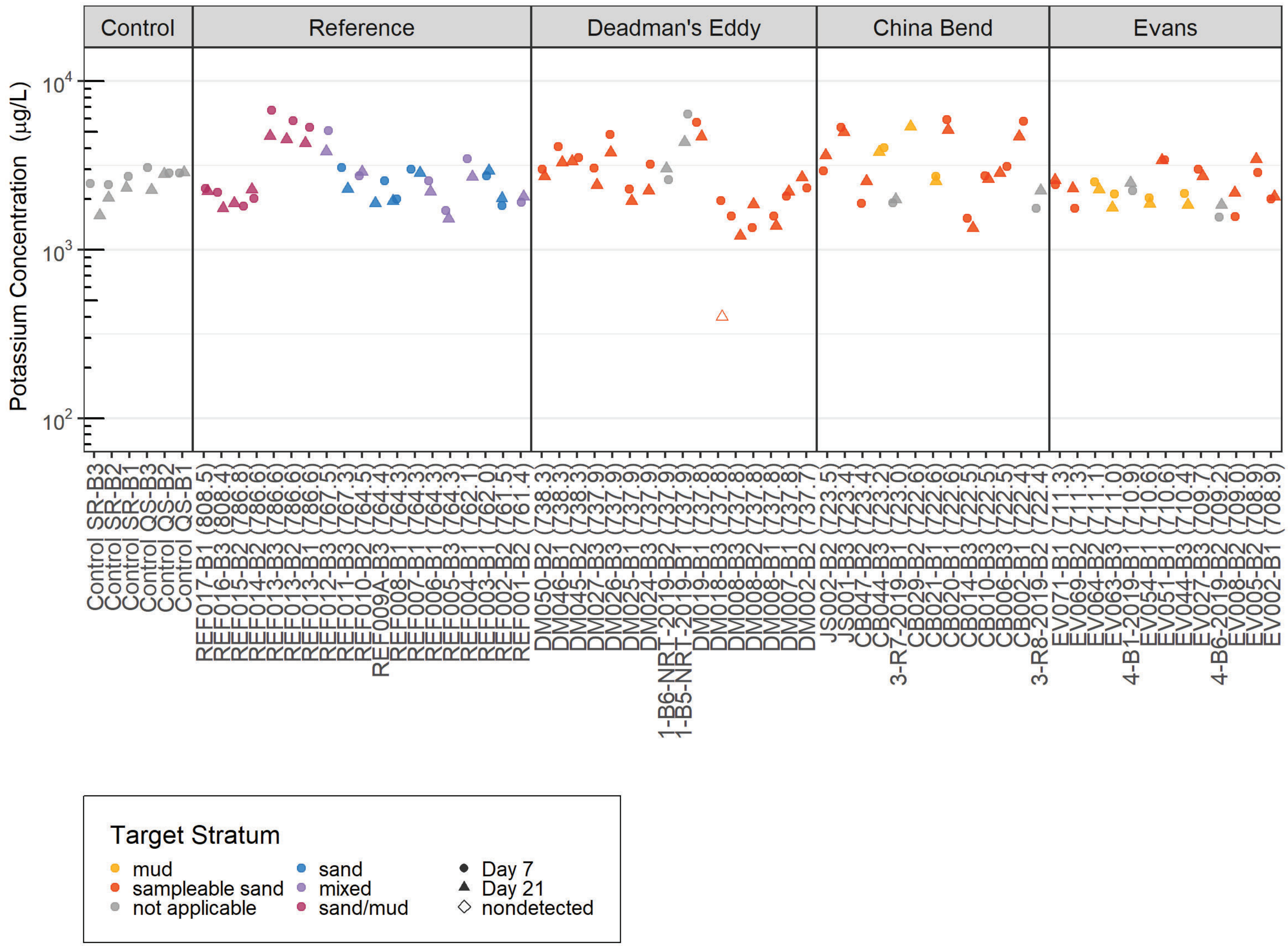
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4u. Dissolved Manganese in Bioassay Porewater Samples



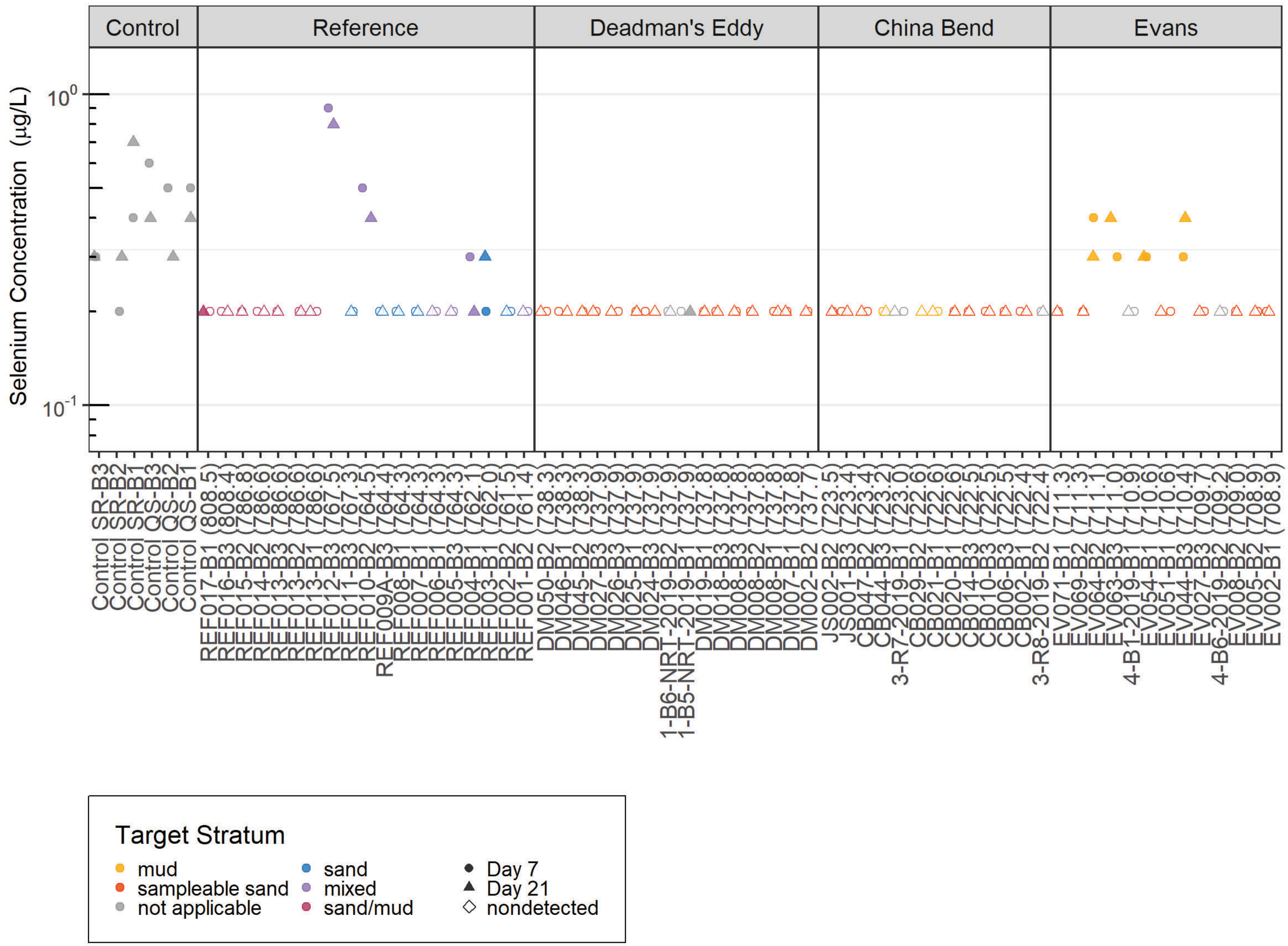
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4v. Dissolved Nickel in Bioassay Porewater Samples



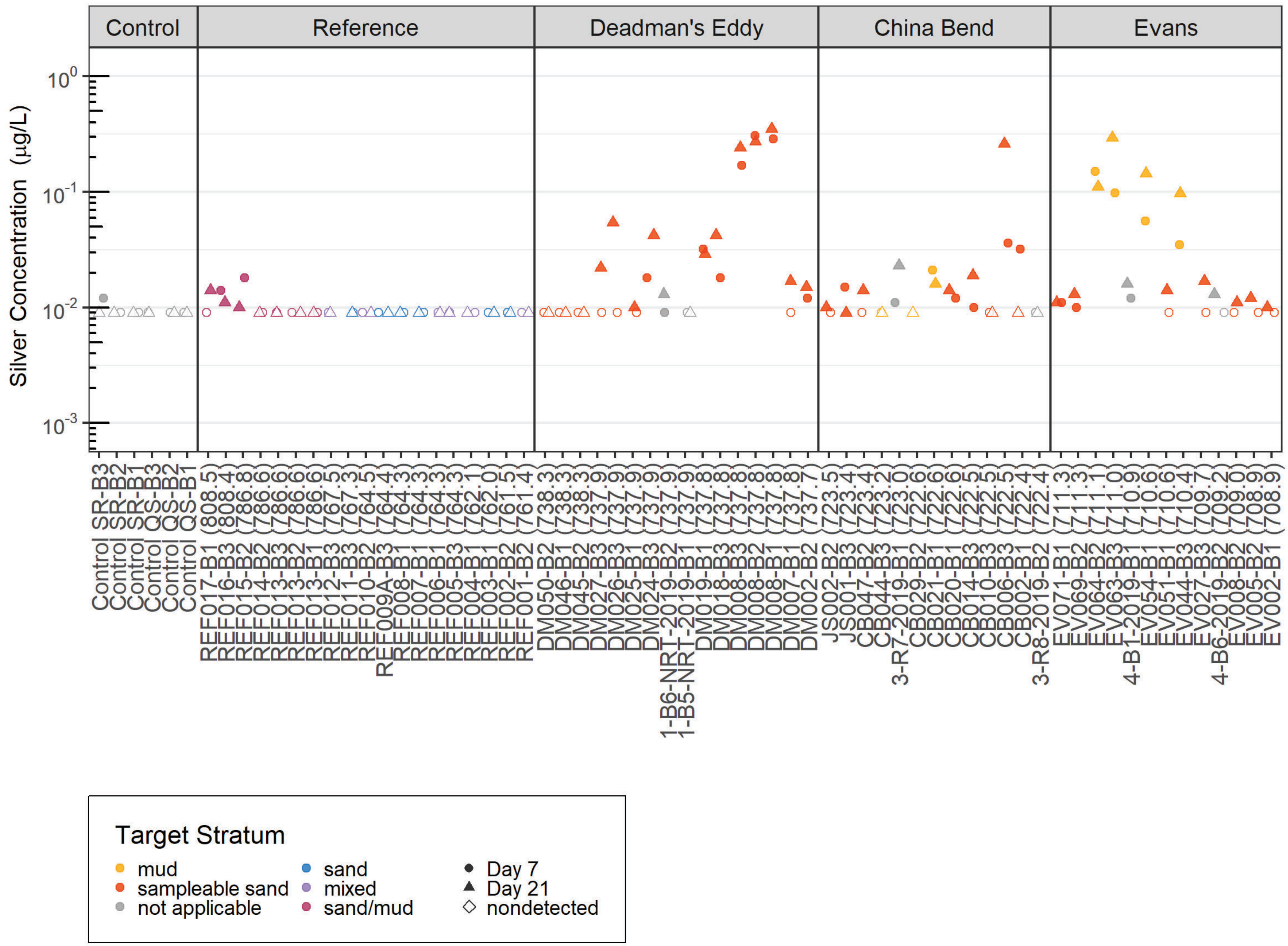
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4w. Dissolved Potassium in Bioassay Porewater Samples



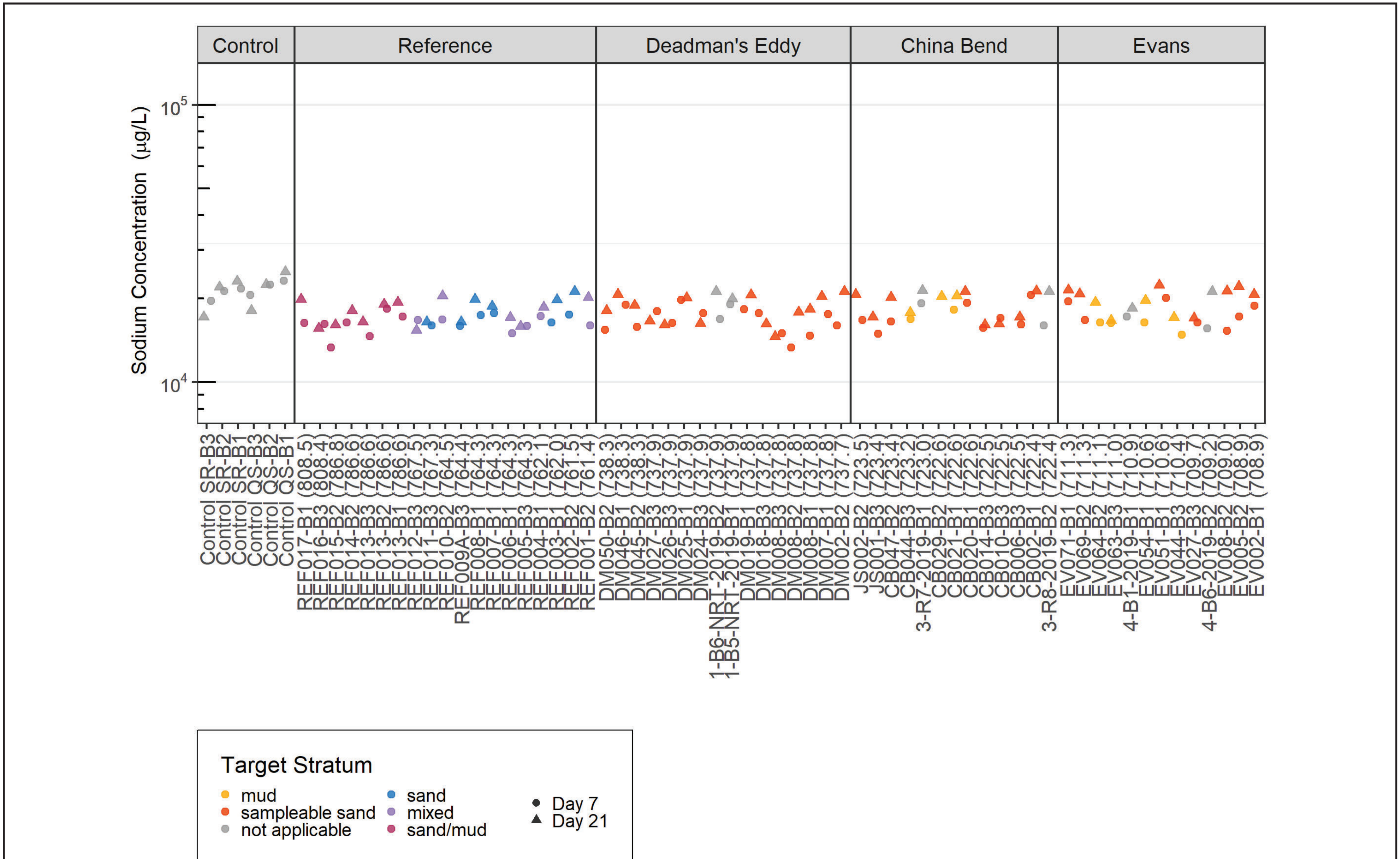
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4x. Dissolved Selenium in Bioassay Porewater Samples



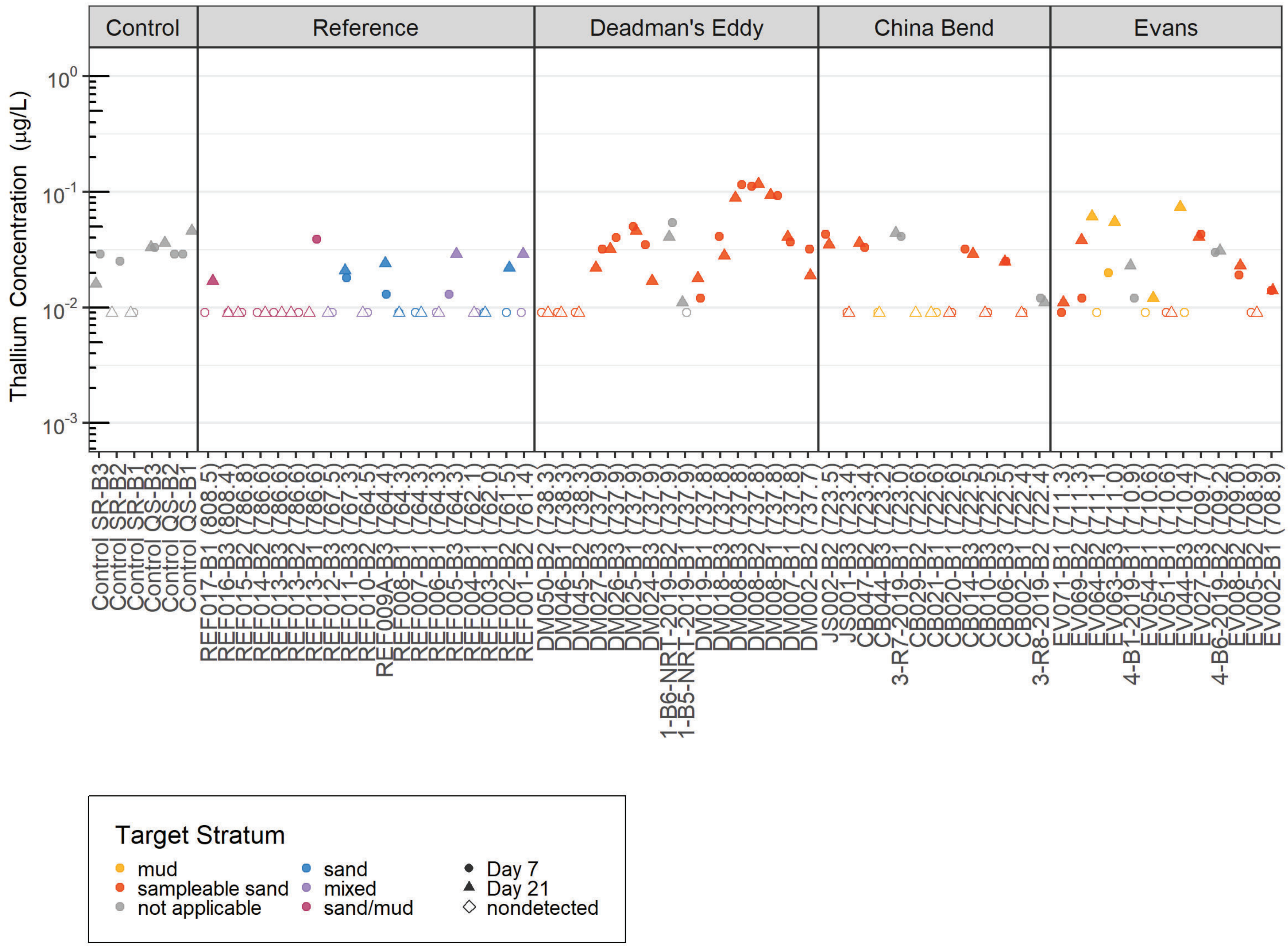
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4y. Dissolved Silver in Bioassay Porewater Samples



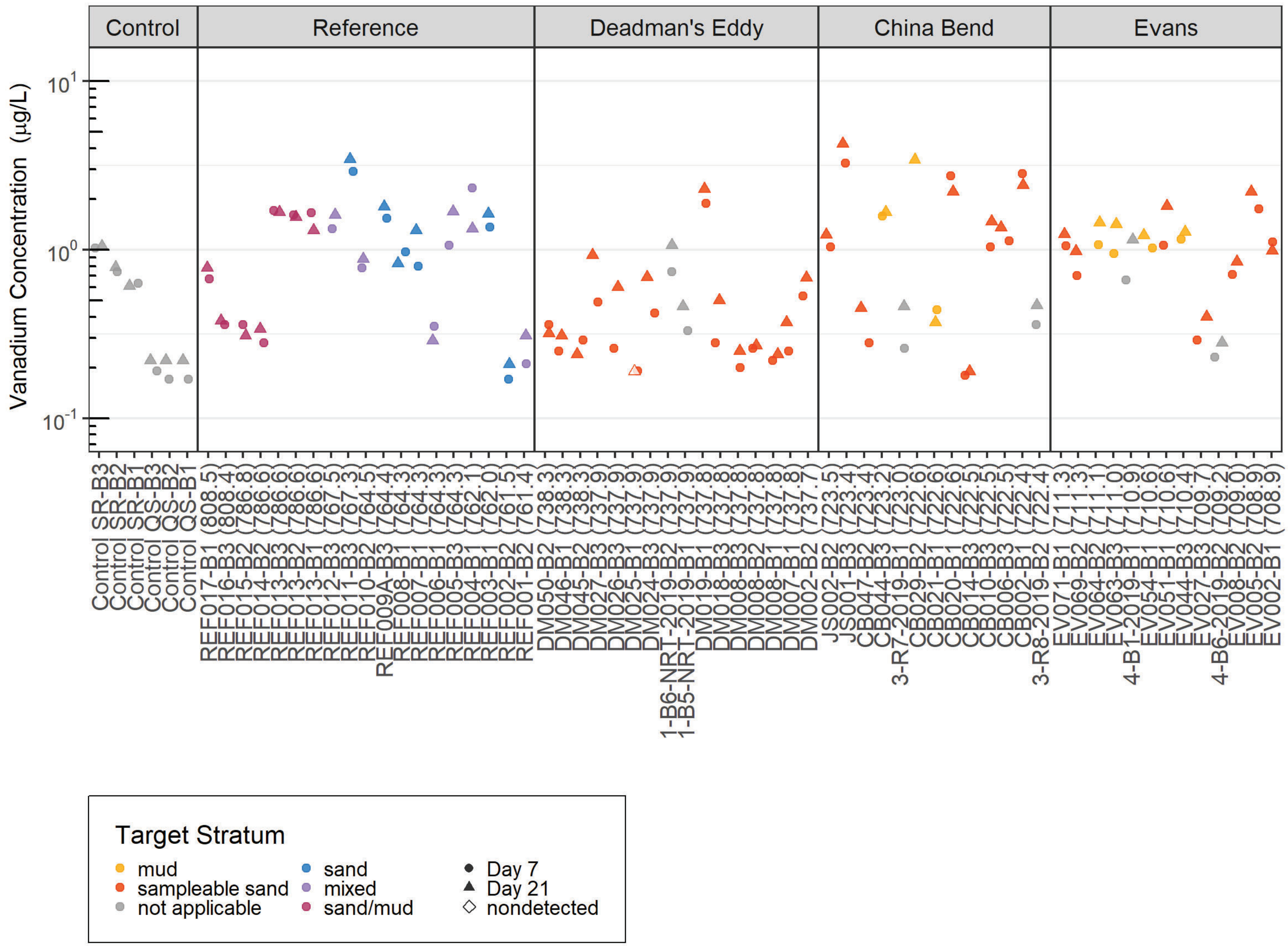
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4z. Dissolved Sodium in Bioassay Porewater Samples



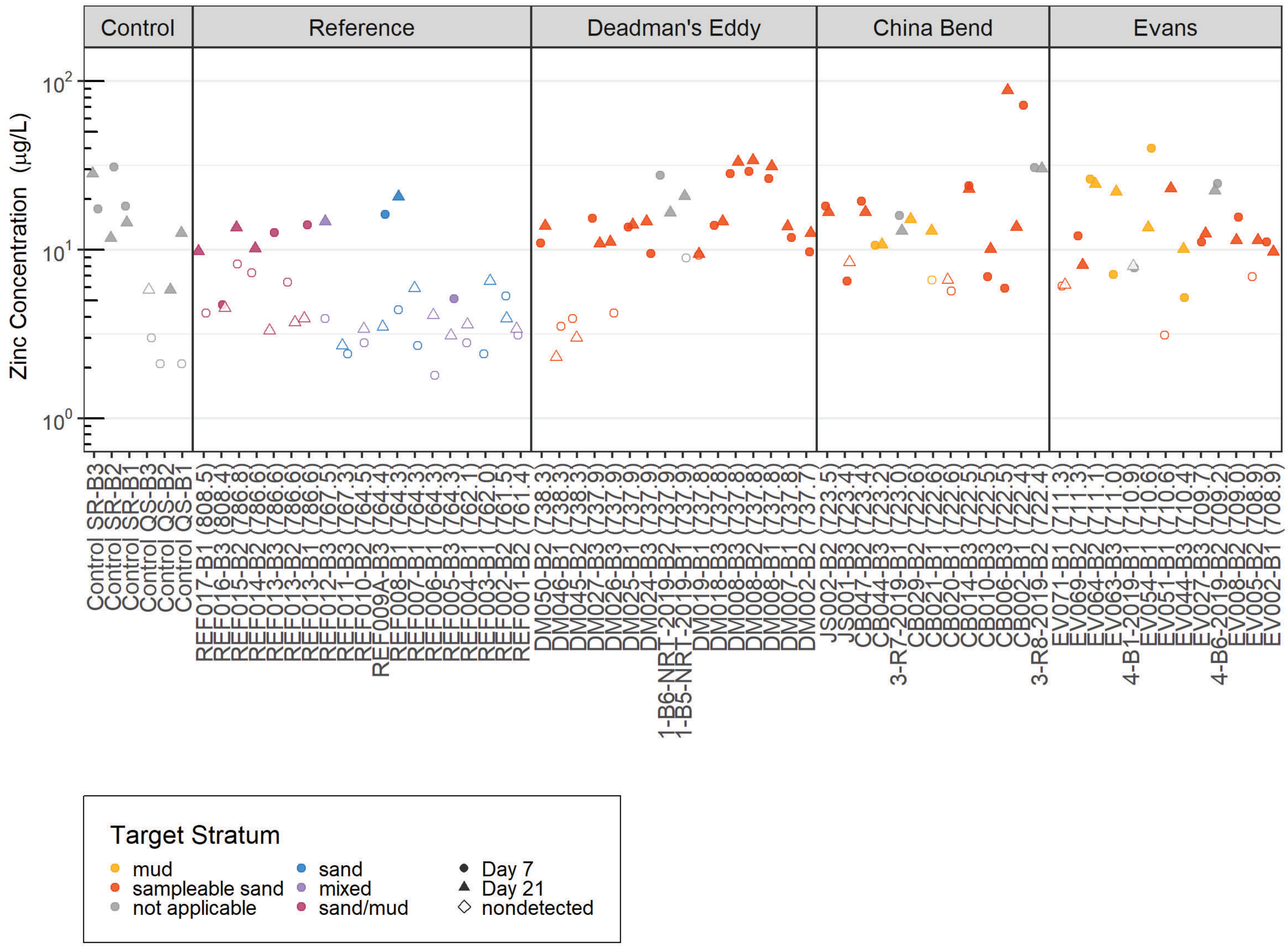
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4aa. Dissolved Thallium in Bioassay Porewater Samples



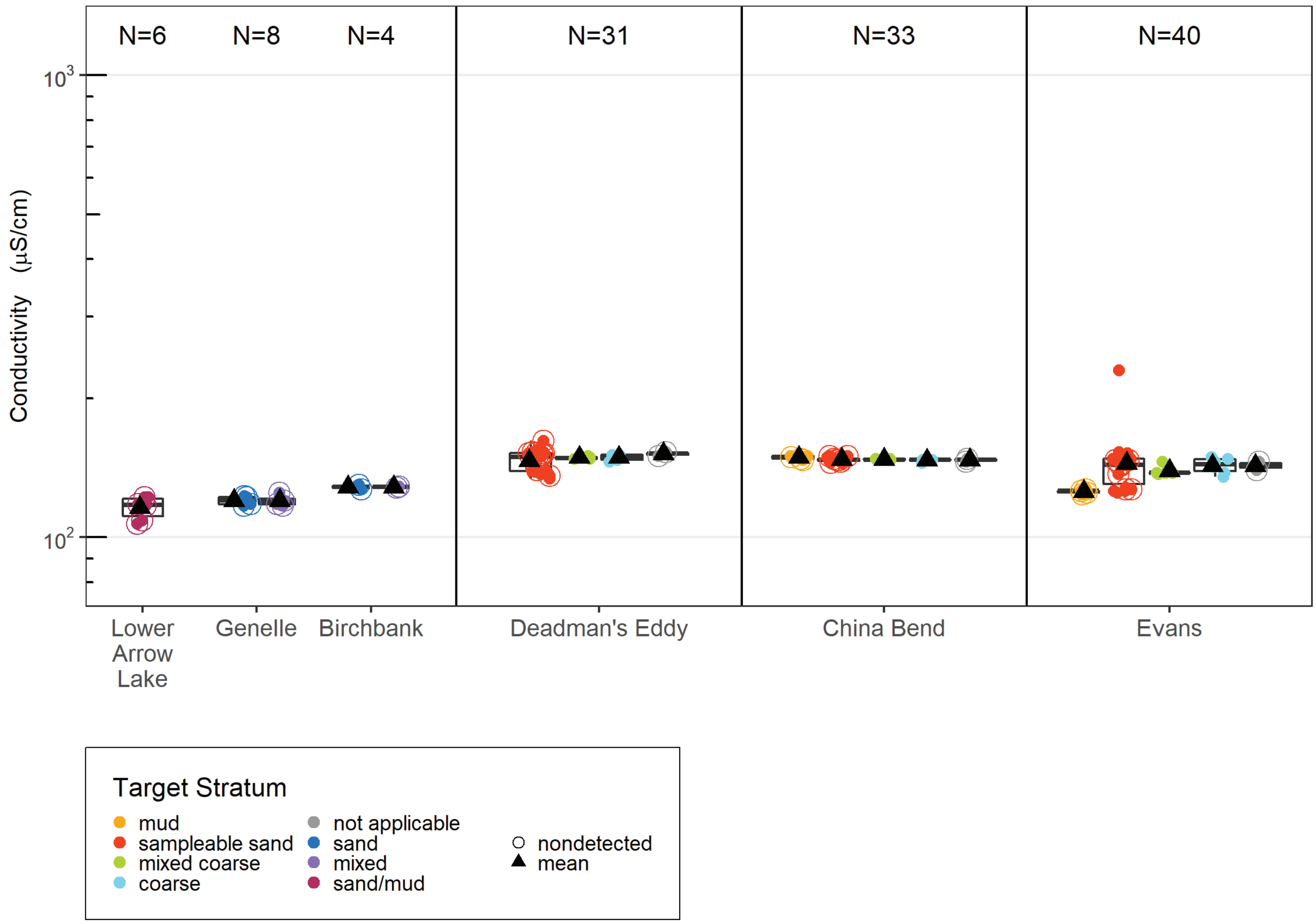
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4ab. Dissolved Vanadium in Bioassay Porewater Samples



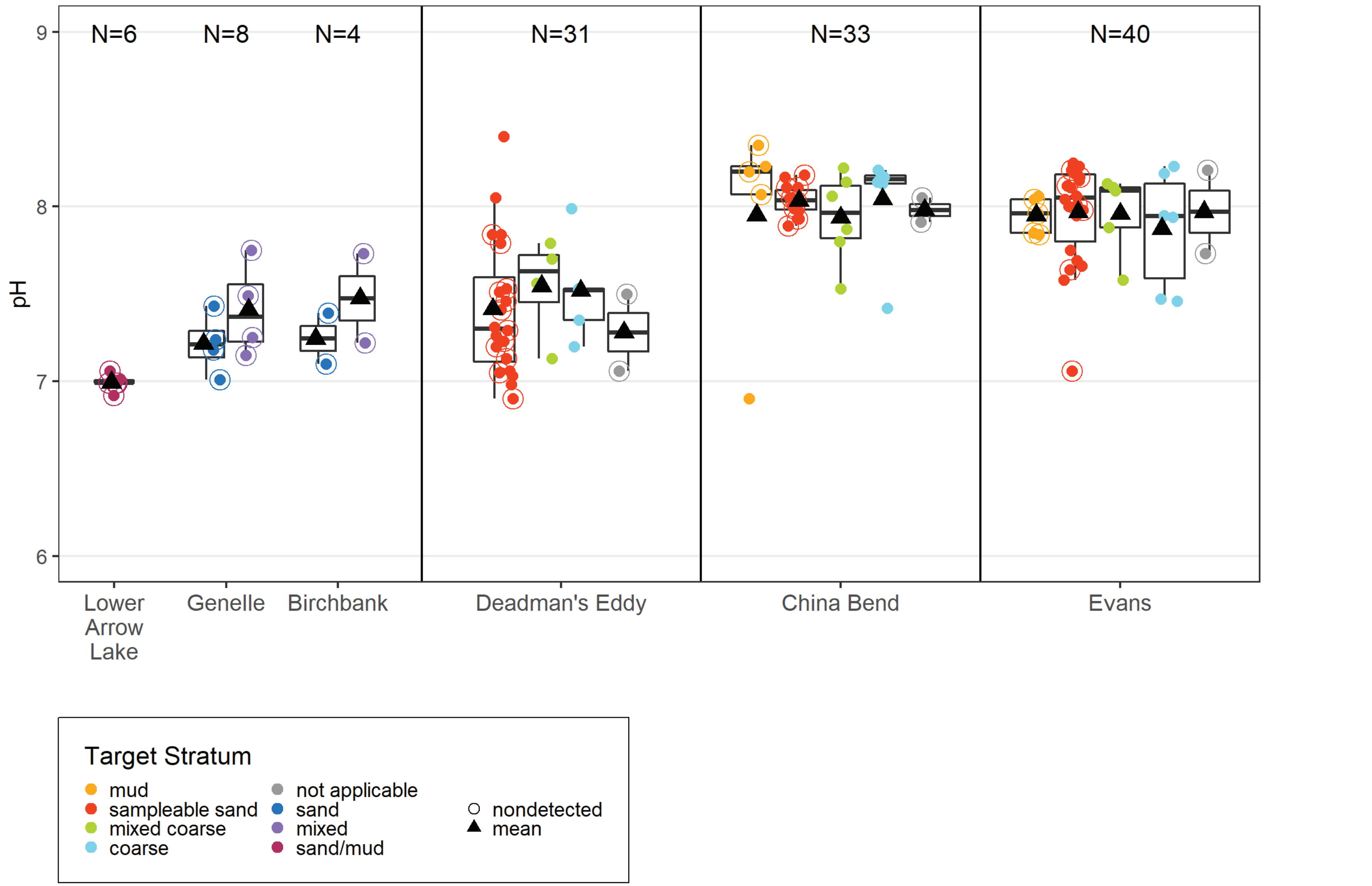
Note: B1 - Batch 1, B2 - Batch 2, B3 - Batch 3.

Figure 5-4ac. Dissolved Zinc in Bioassay Porewater Samples



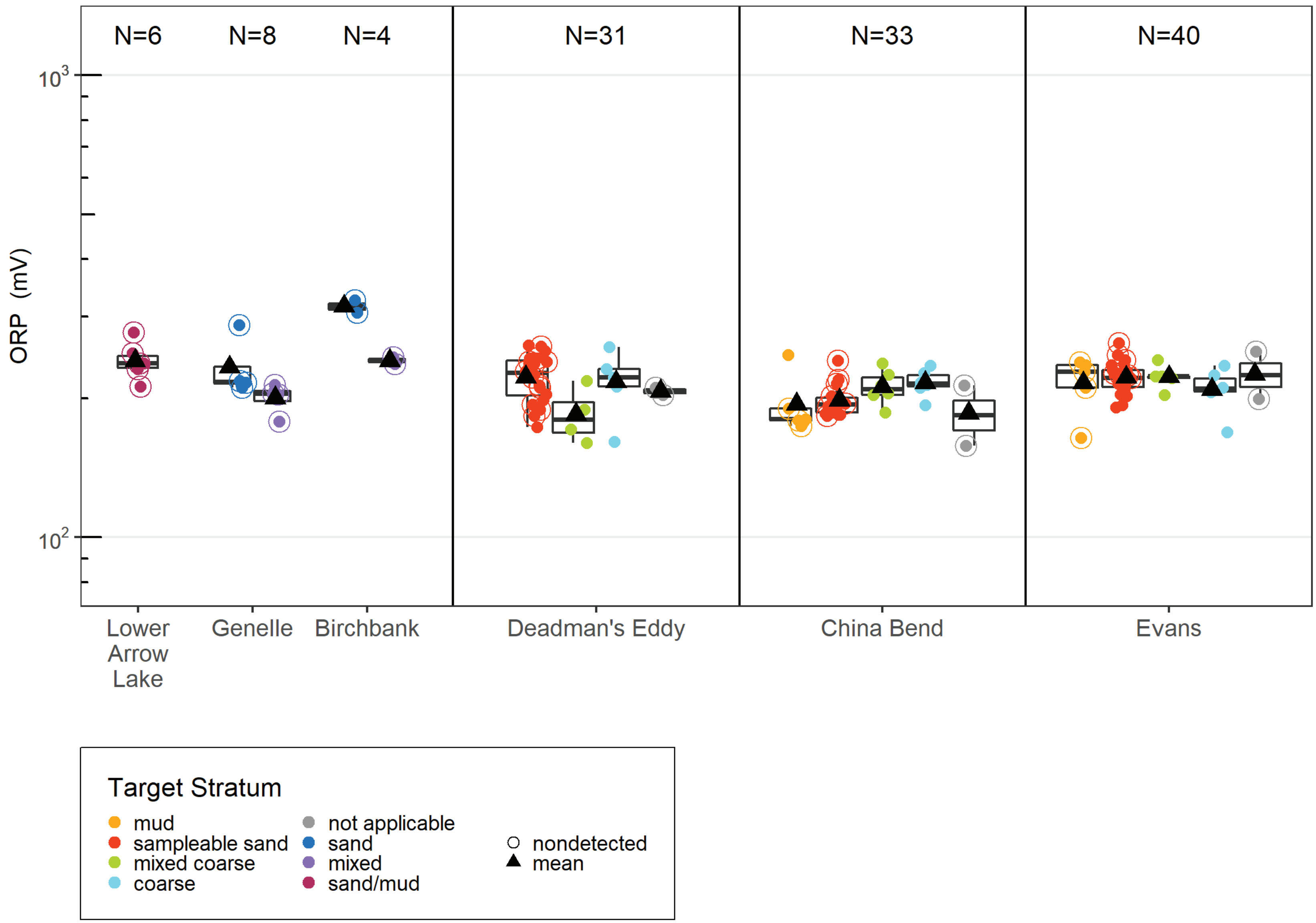
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of Trident sensor measurements.

Figure 5-5a. Conductivity in Field Surface Water Samples



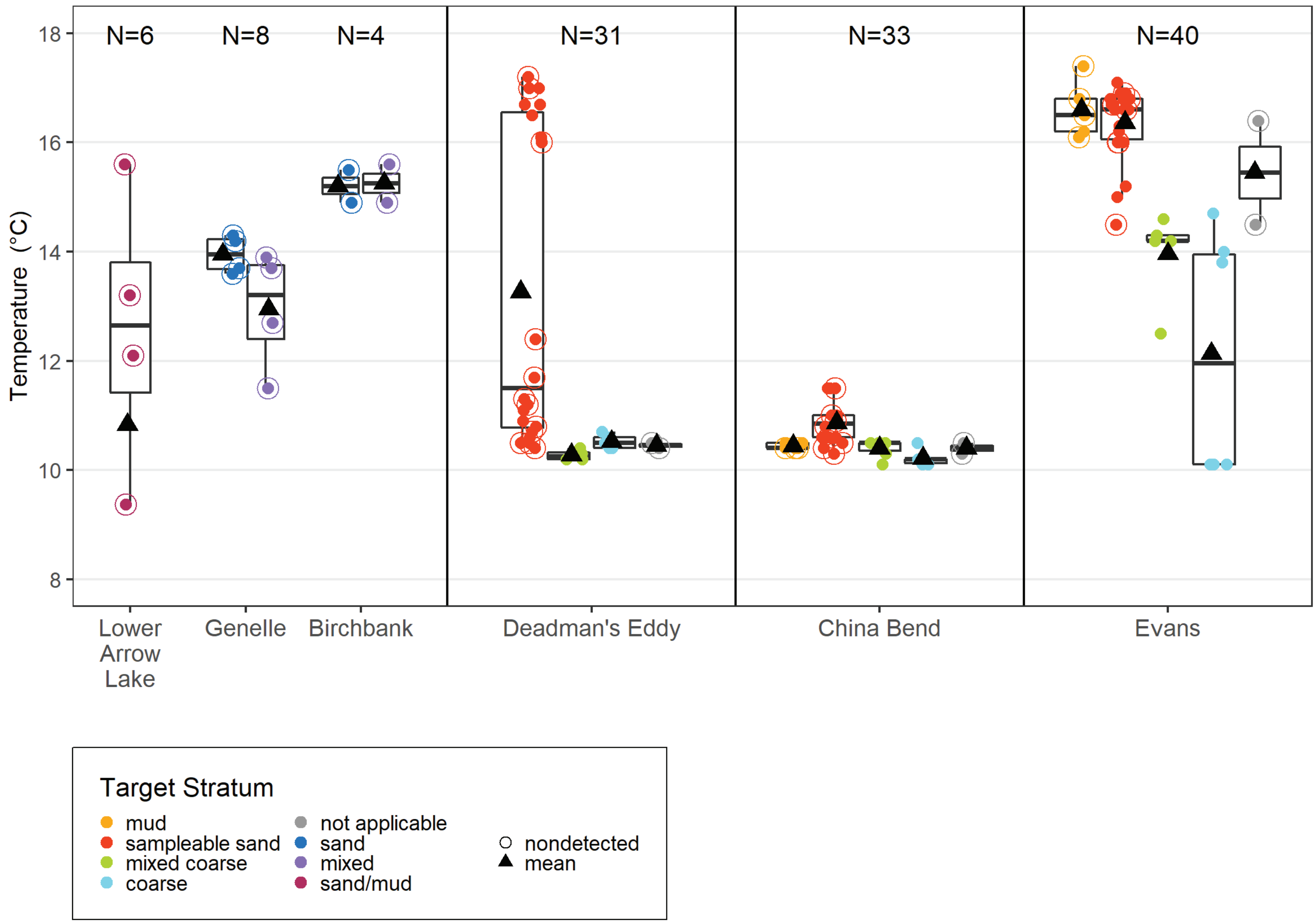
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of multimeter measurements.

Figure 5-5b. pH in Field Surface Water Samples



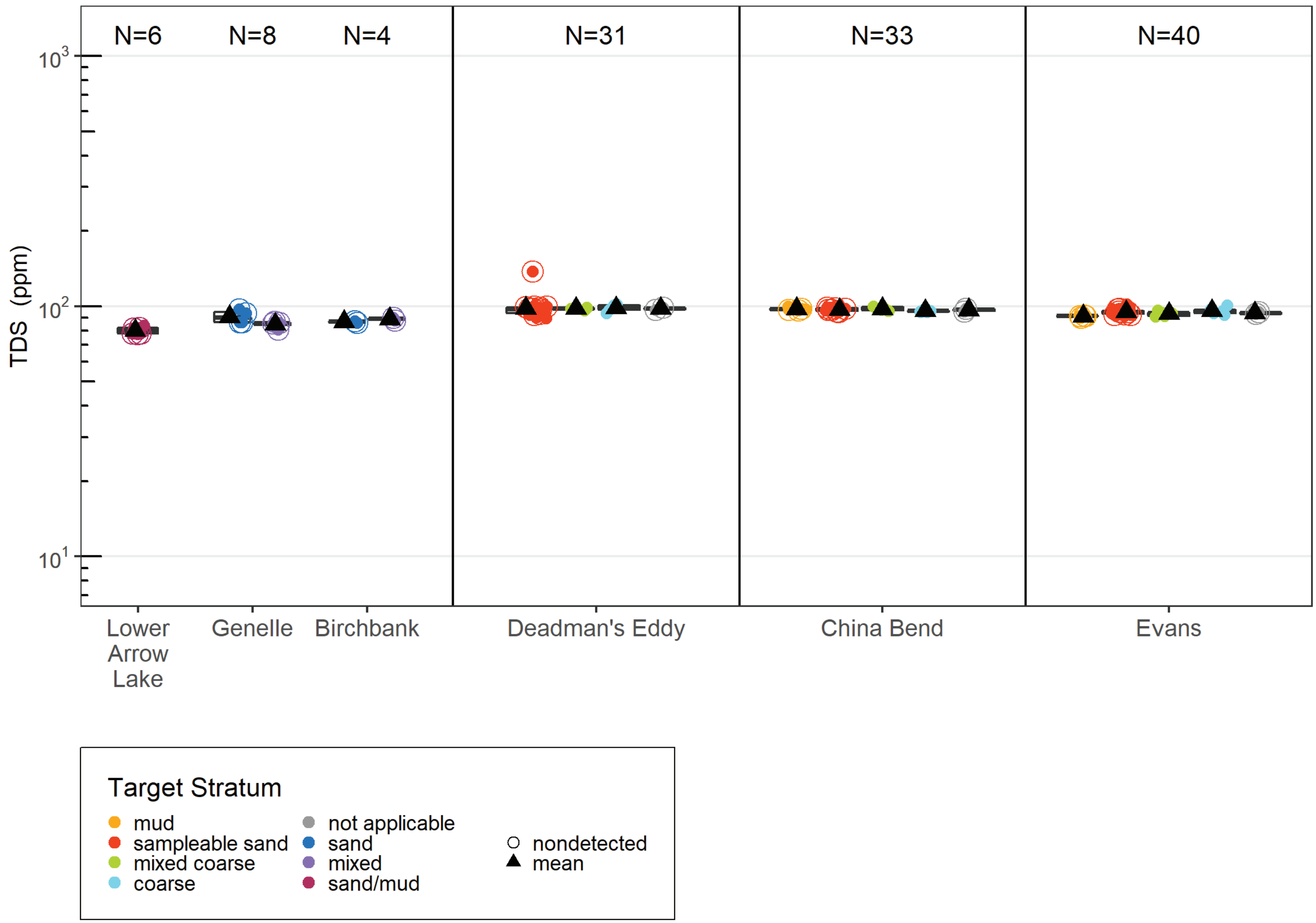
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of multimeter measurements.

Figure 5-5c. ORP in Field Surface Water Samples



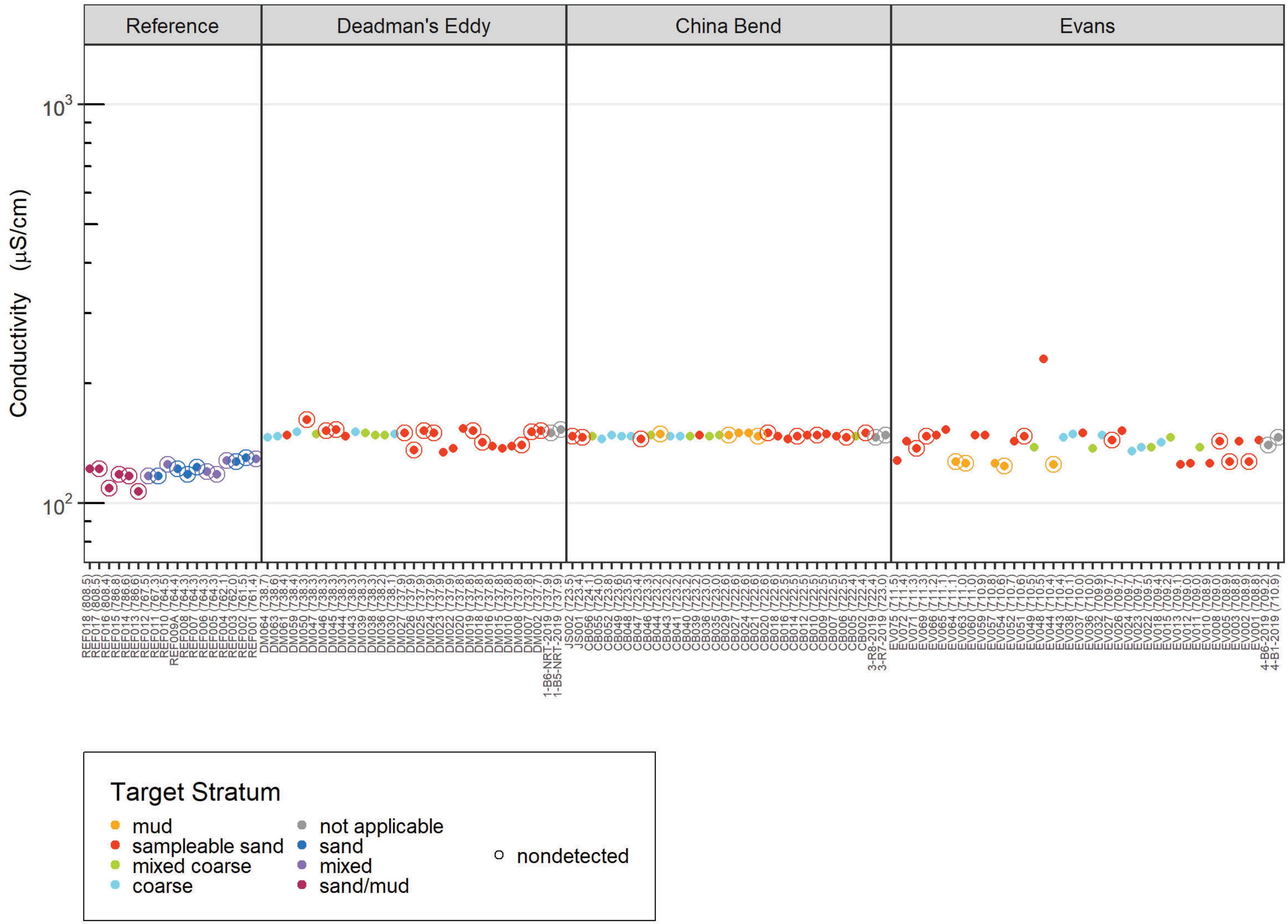
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of Trident sensor measurements.

Figure 5-5d. Temperature in Field Surface Water Samples



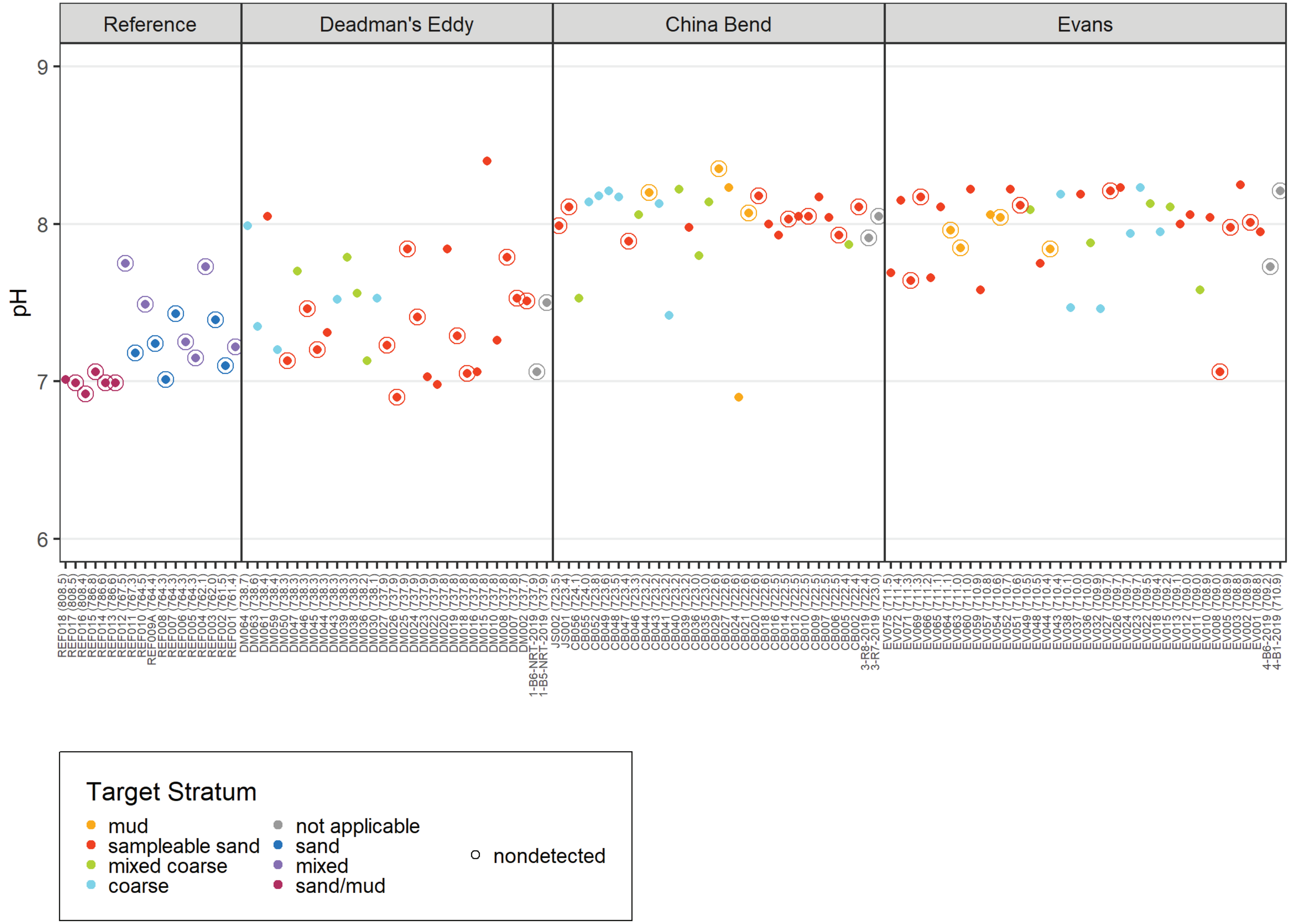
Notes: Circled points represent sediment locations with bioassay samples.
Means calculated using Kaplan-Meier estimator when nondetected results are present.
Displayed values are an average of multimeter measurements.

Figure 5-5e. TDS in Field Surface Water Samples



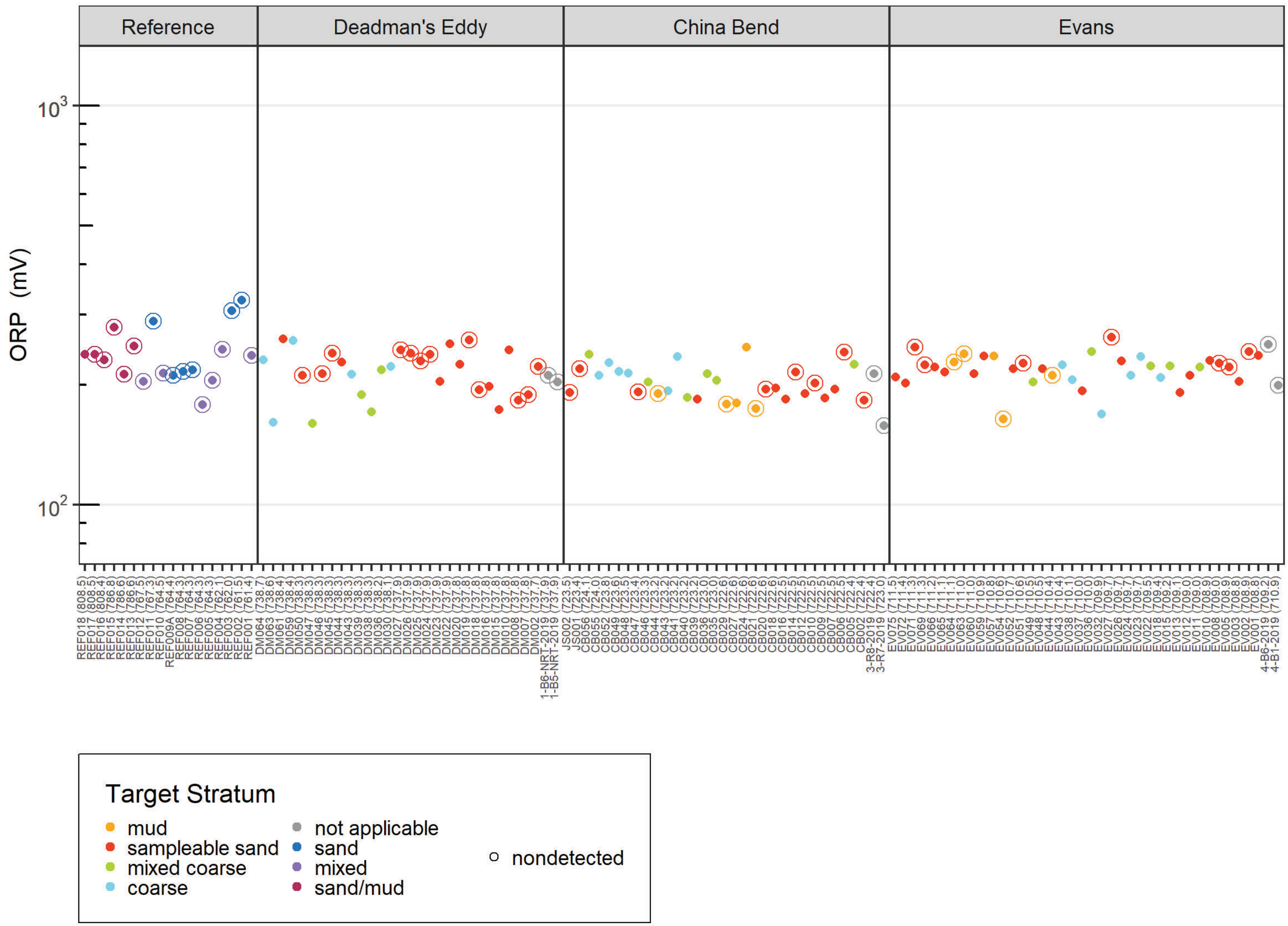
Note: Circled points represent sediment locations with bioassay samples.
Note: Displayed values are an average of the Trident sensor measurements.

Figure 5-5f. Conductivity in Field Surface Water Samples by River Mile



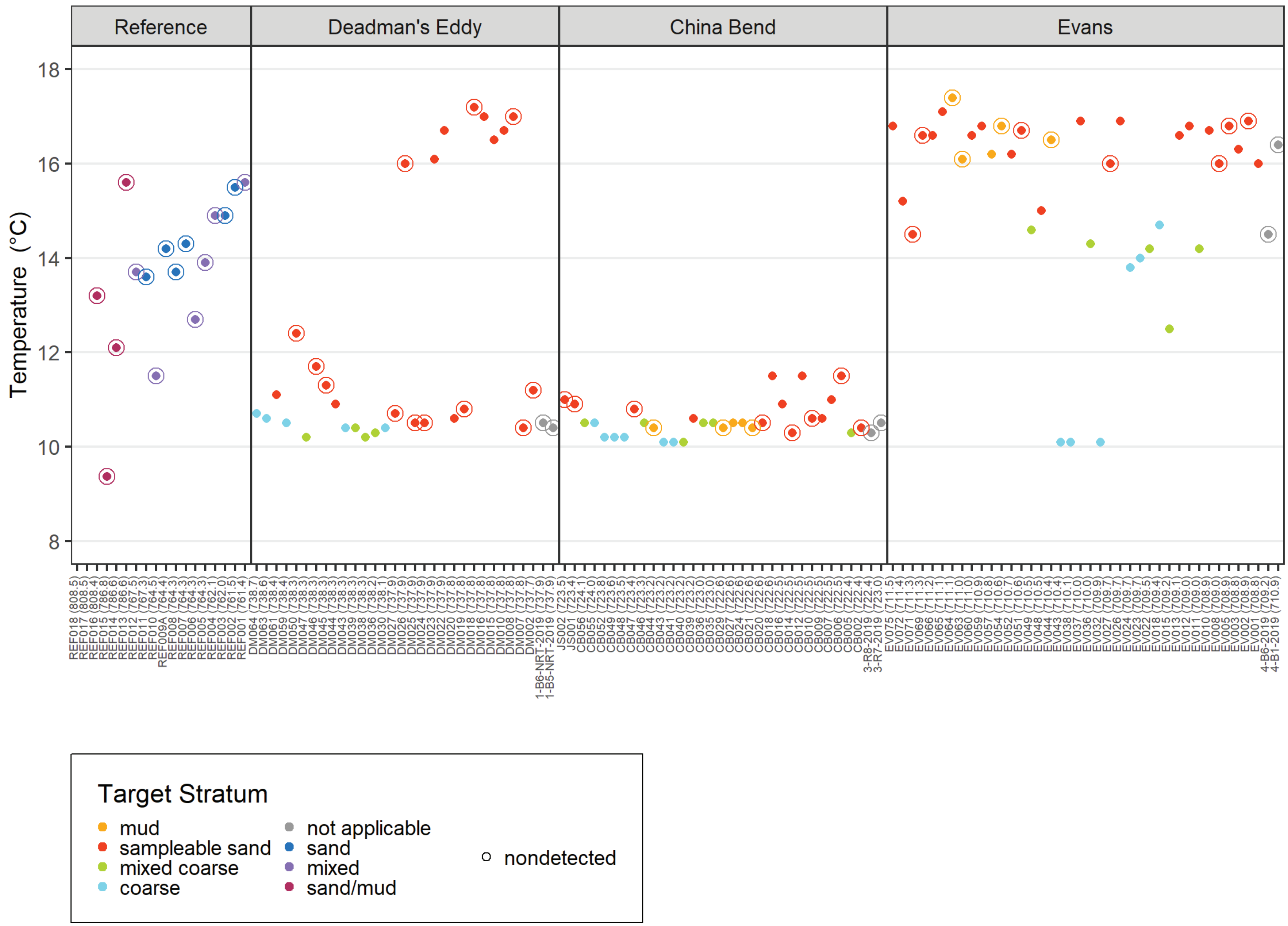
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the multimeter measurements.

Figure 5-5g. pH in Field Surface Water Samples by River Mile



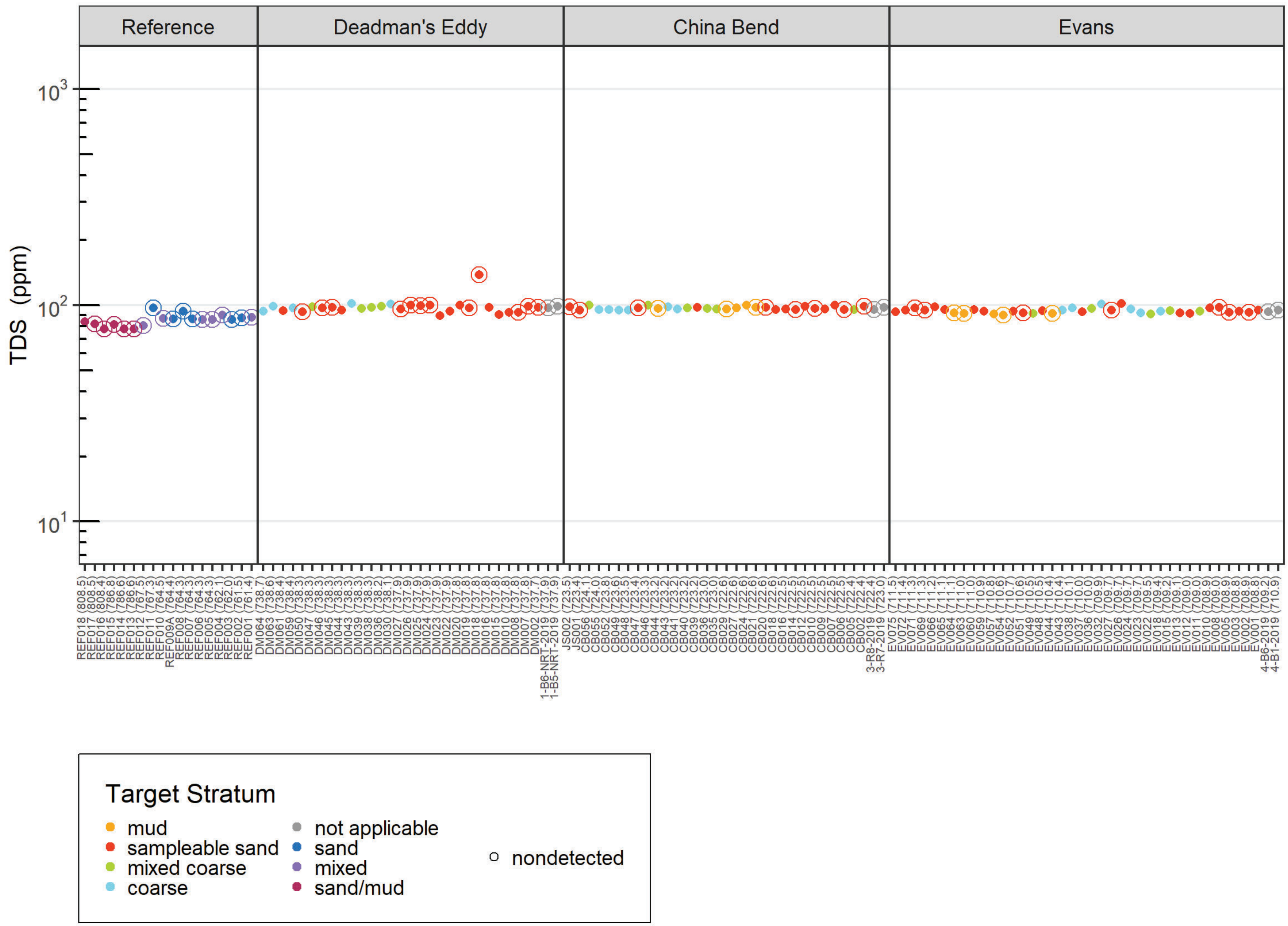
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the multimeter measurements.

Figure 5-5h. ORP in Field Surface Water Samples by River Mile



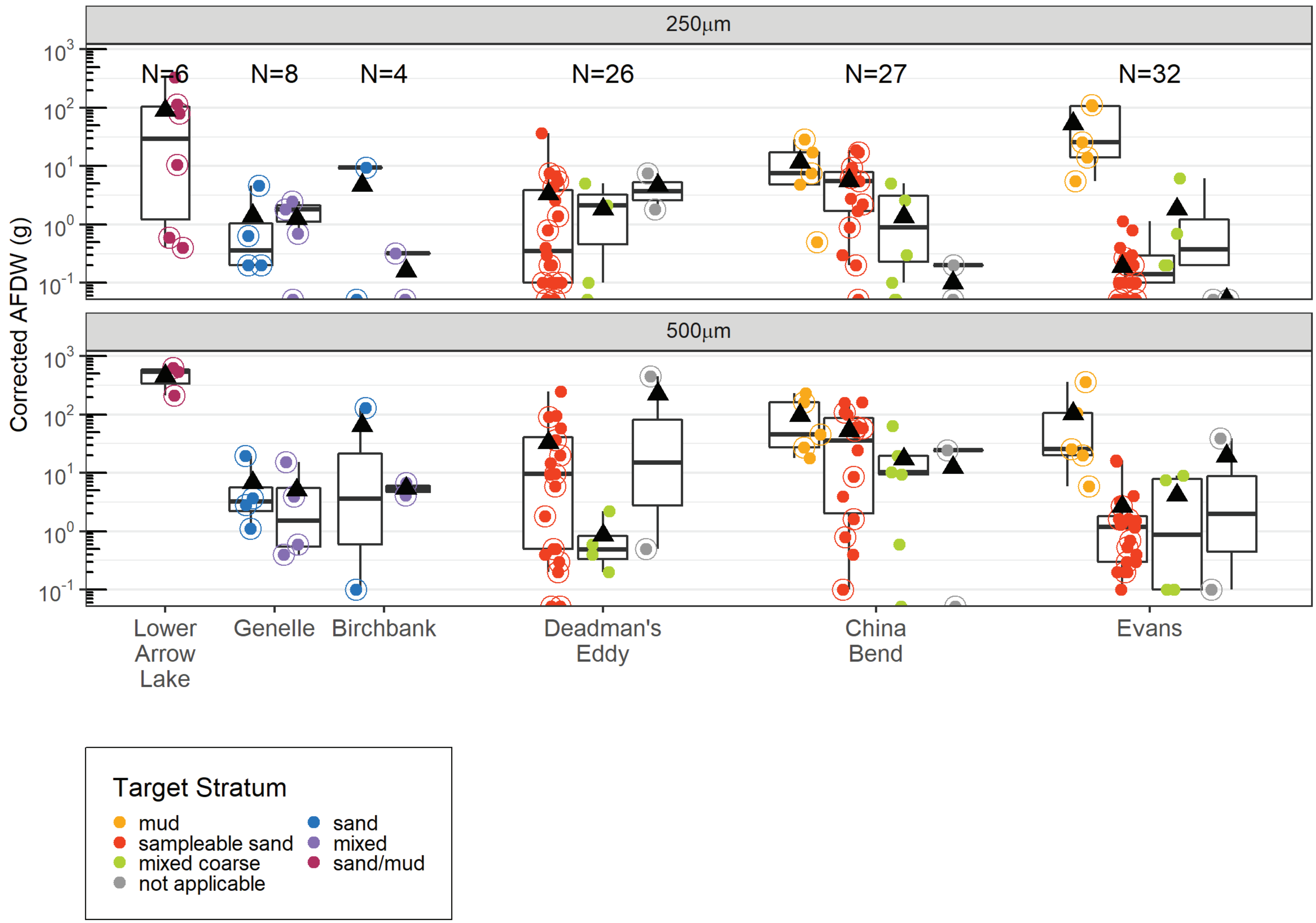
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the Trident sensor measurements.

Figure 5-5i. Temperature in Field Surface Water Samples by River Mile



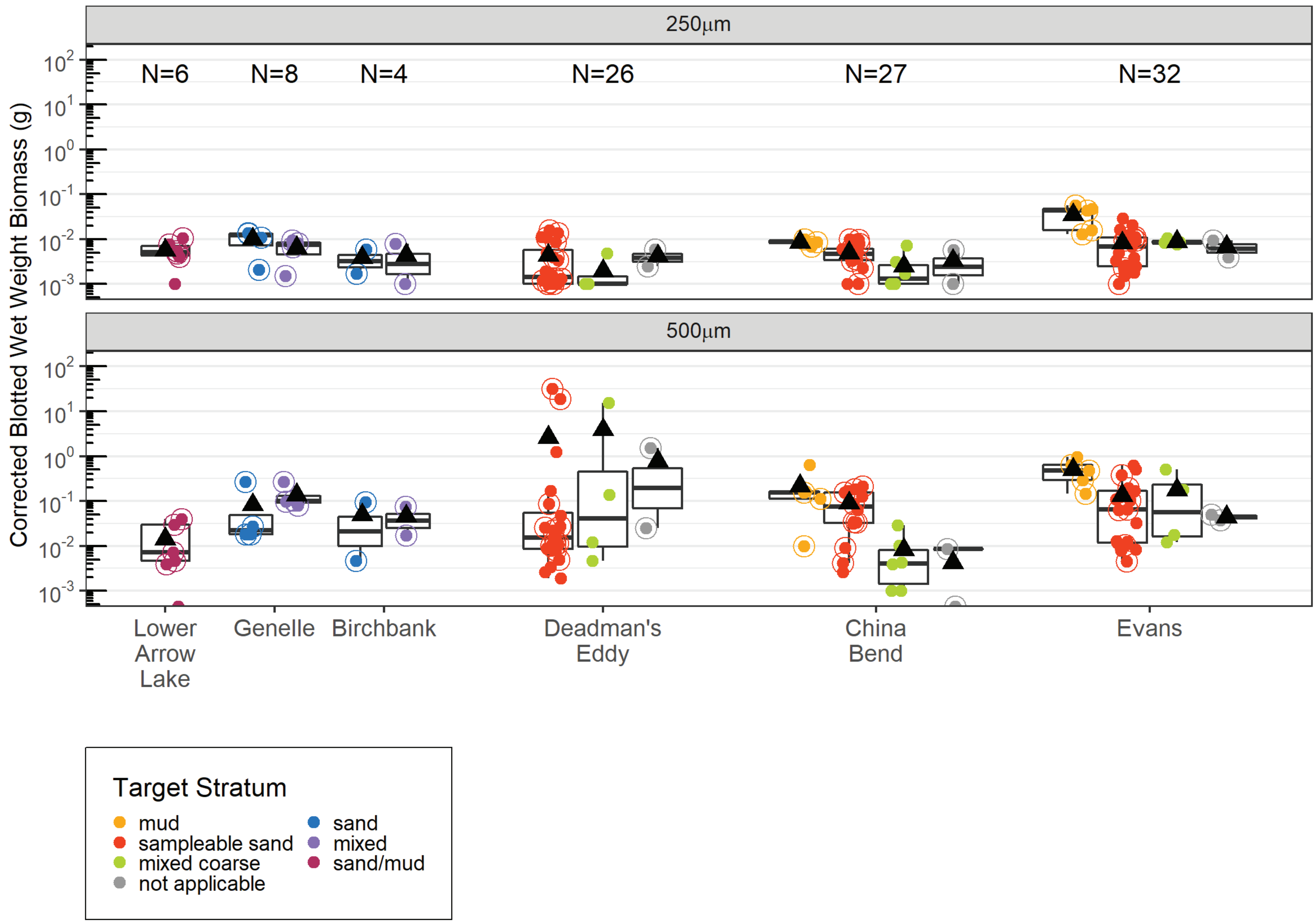
Note: Circled points represent sediment locations with bioassay samples.
Displayed values are an average of the multimeter measurements.

Figure 5-5j. TDS in Field Surface Water Samples by River Mile



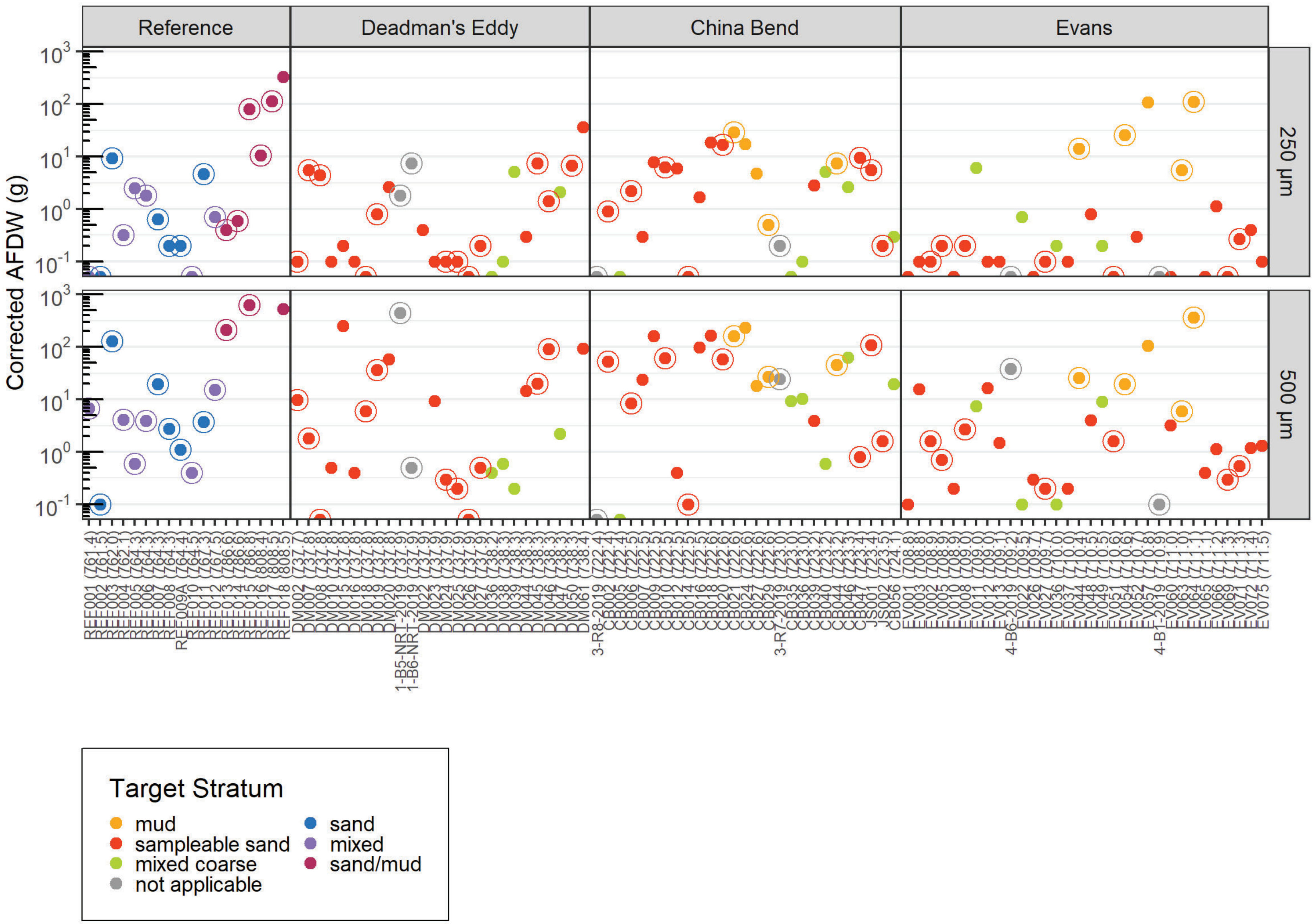
Notes: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.
AFDW corrected for percent subsampled.

Figure 5-6a. BMI Corrected AFDW in Field Sediment Samples



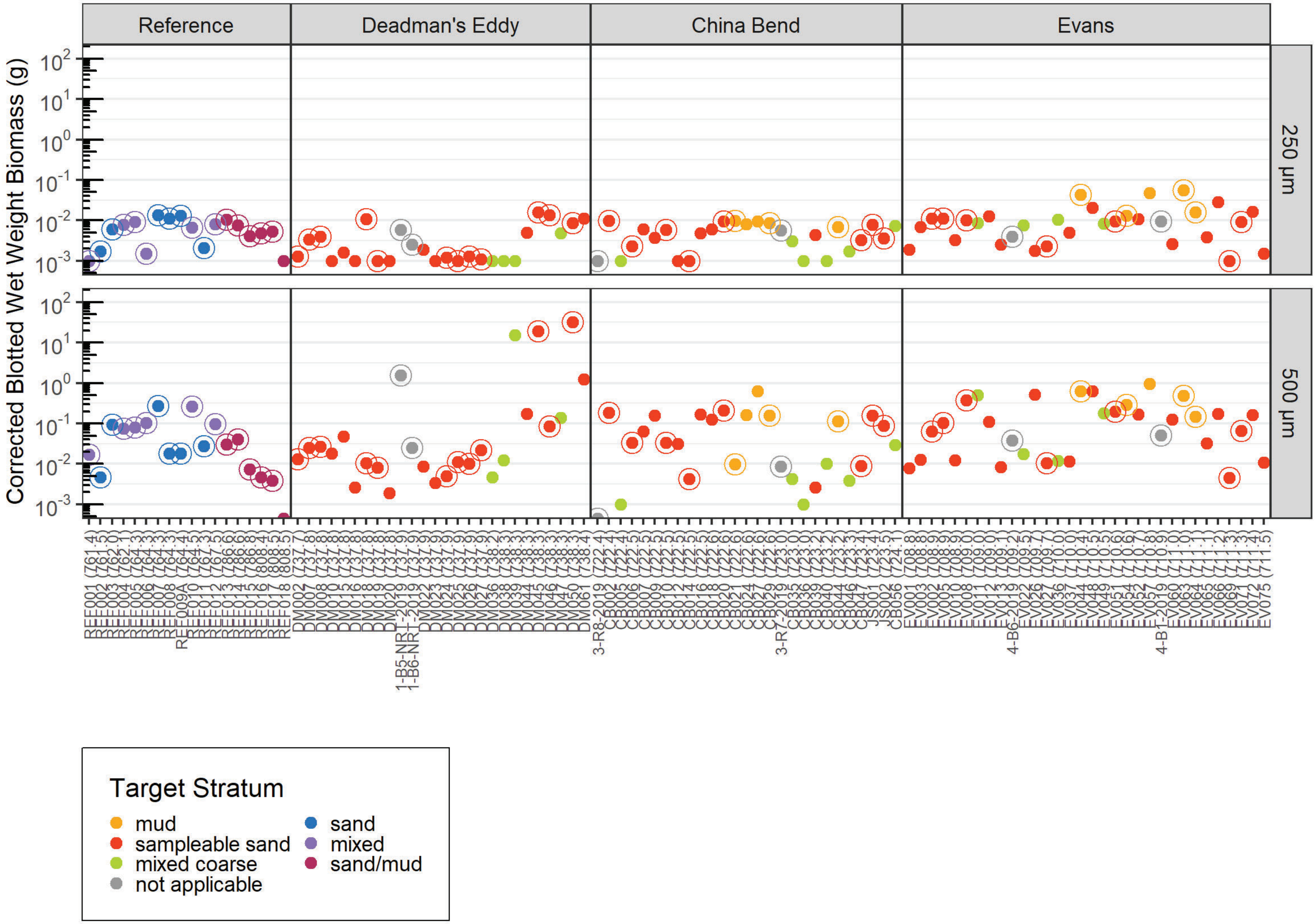
Notes: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.
Counted blotted mass corrected for percent subsampled.

Figure 5-6b. BMI Corrected Wet Weight Biomass in Field Sediment Samples



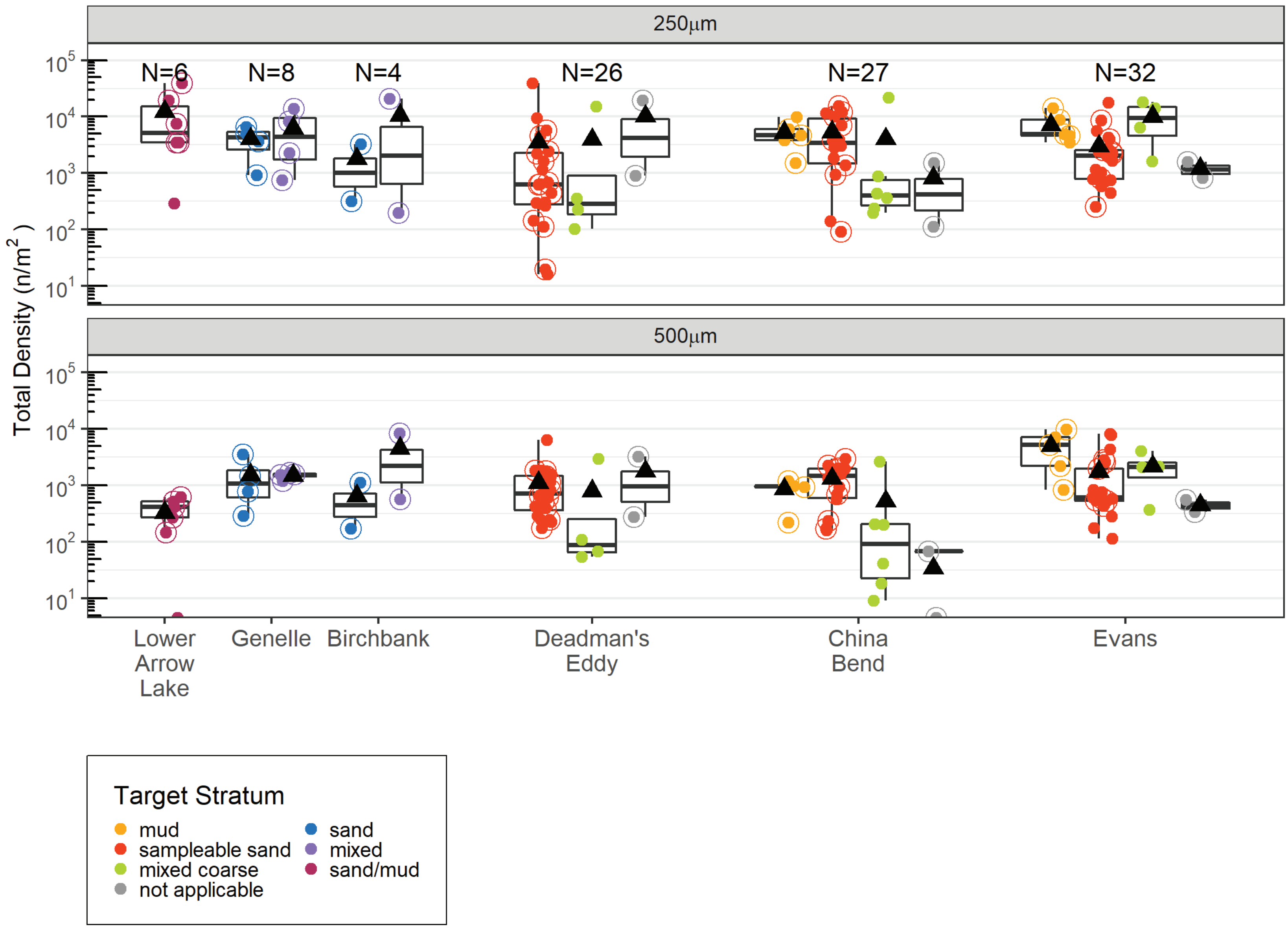
Notes: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.
AFDW corrected for percent subsampled.

Figure 5-6c. BMI Corrected AFDW in Field Sediment by River Mile



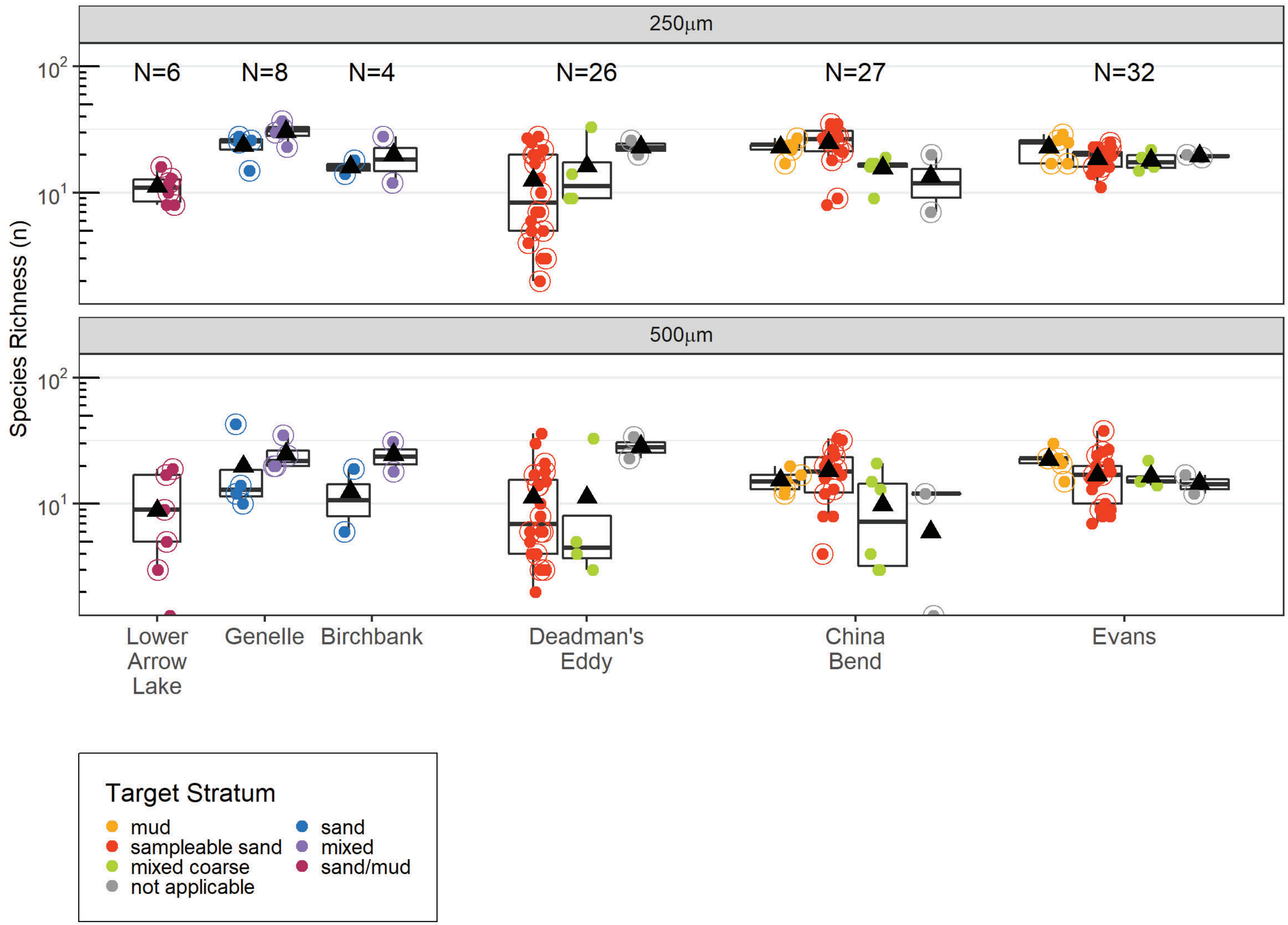
Notes: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.
Counted blotted mass corrected for percent subsampled.

Figure 5-6d. BMI Corrected Wet Weight Biomass in Field Sediment Samples by River Mile



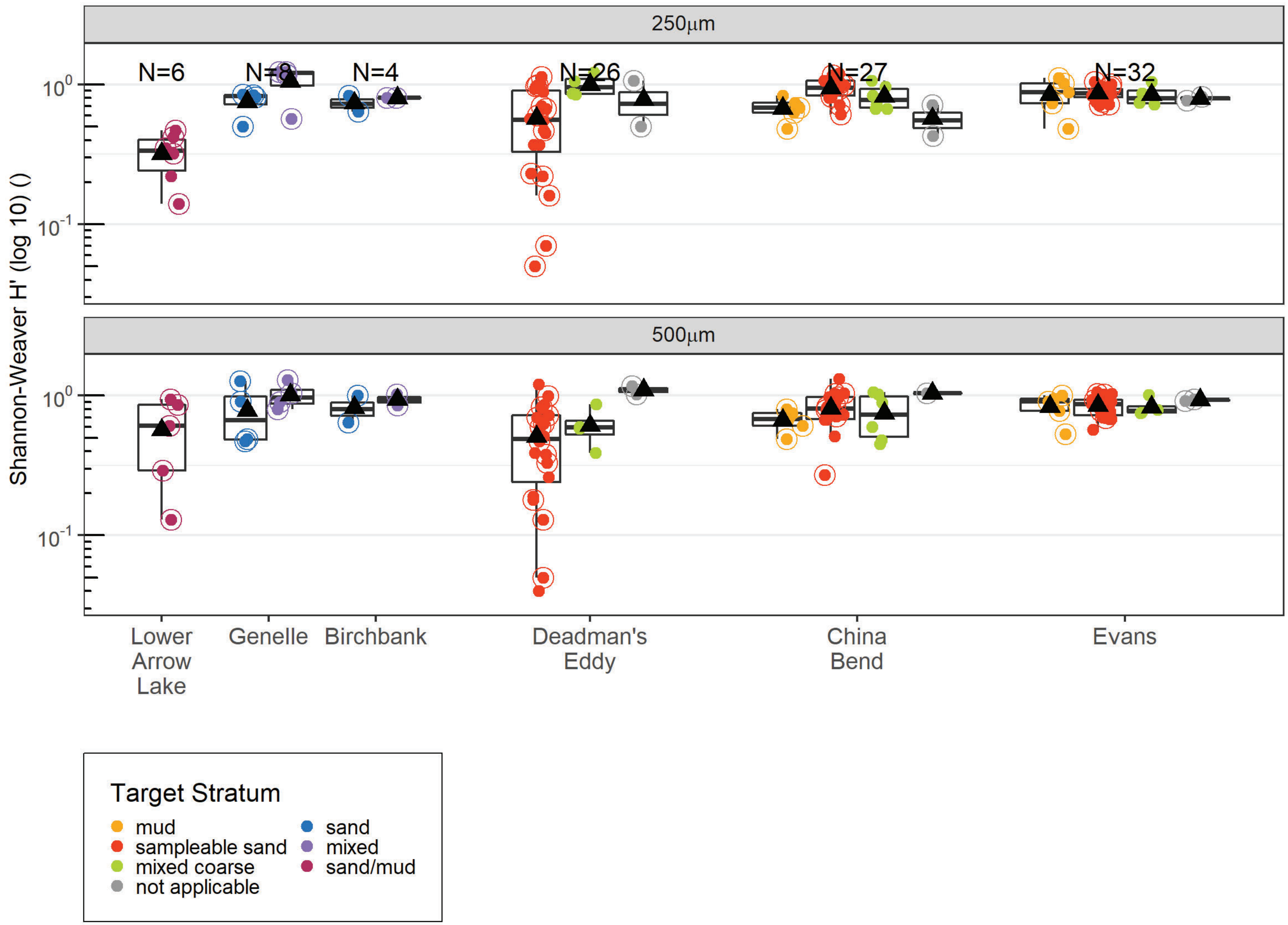
Note: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.

Figure 5-7a. BMI Total Density in Field Sediment Samples



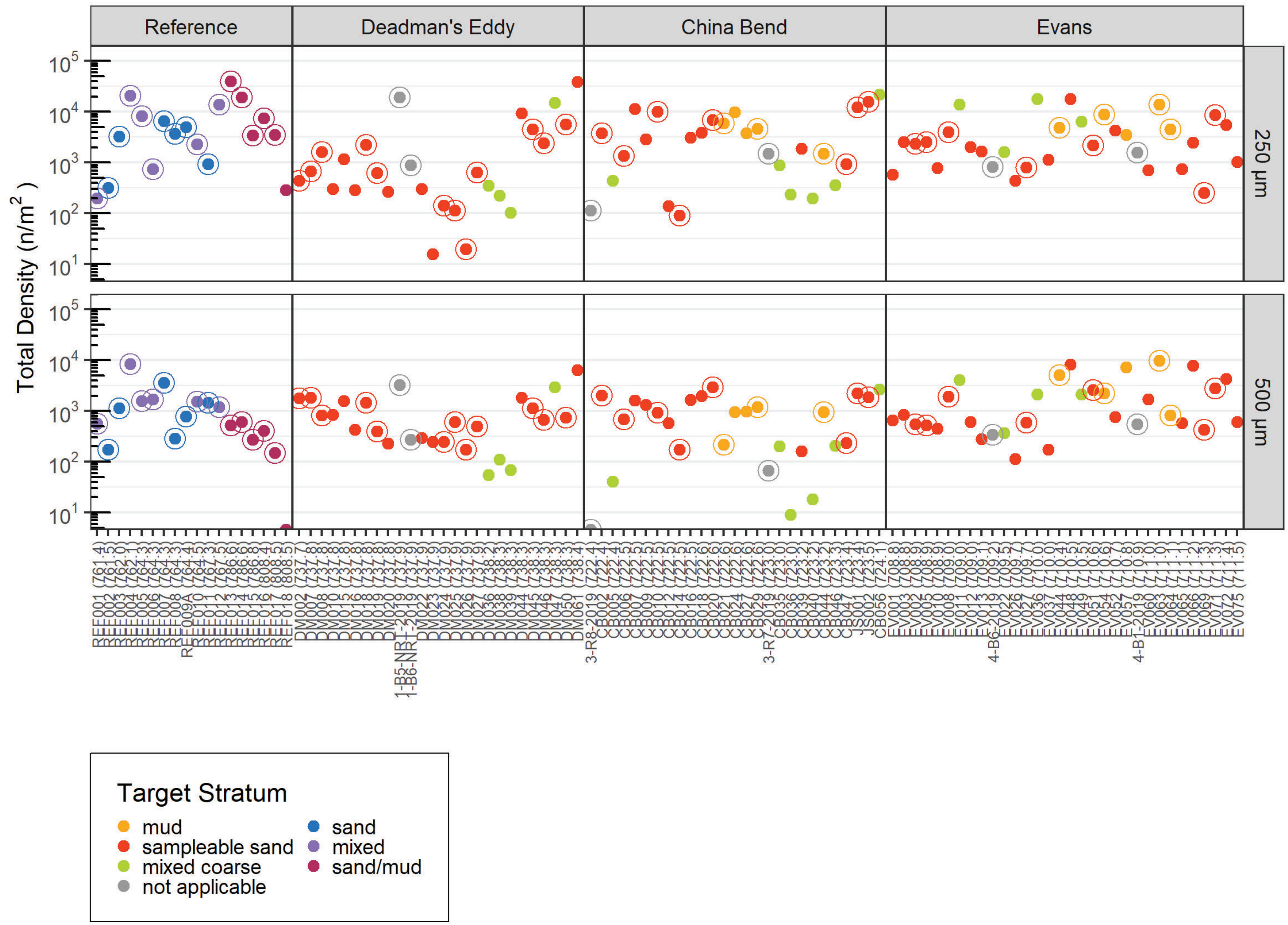
Note: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.

Figure 5-7b. BMI Species Richness in Field Sediment Samples



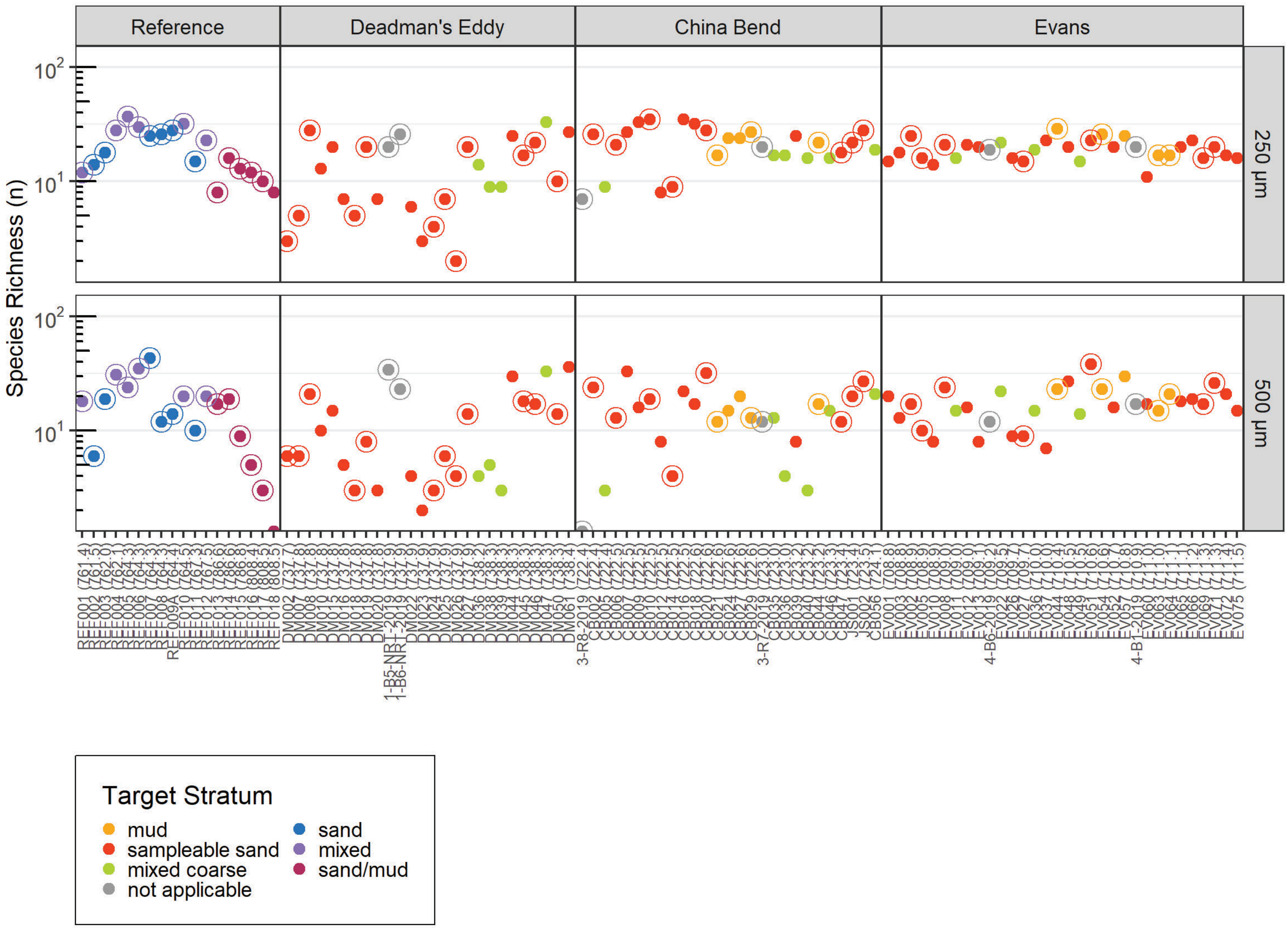
Note: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.

Figure 5-7c. BMI Shannon-Weaver H' (log 10) in Field Sediment Samples



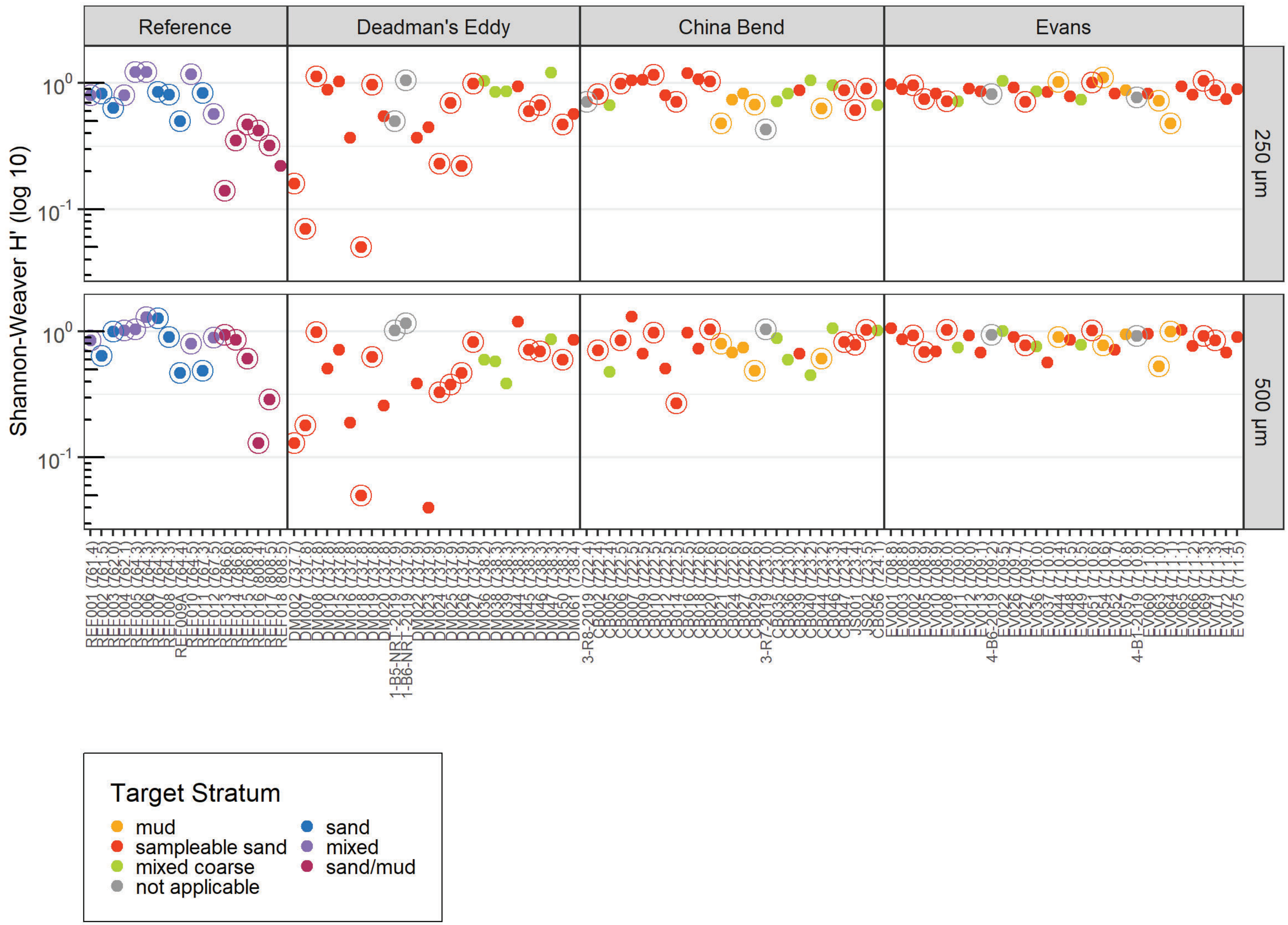
Note: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.

Figure 5-7d. BMI Total Density in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.

Figure 5-7e. BMI Species Richness in Field Sediment Samples by River Mile



Note: Circled points represent sediment locations with bioassay samples.
All mixed coarse Target Stratum samples were obtained using the freeze grab method.

Figure 5-7f. BMI Shannon-Weaver H' (log 10) in Field Sediment Samples by River Mile

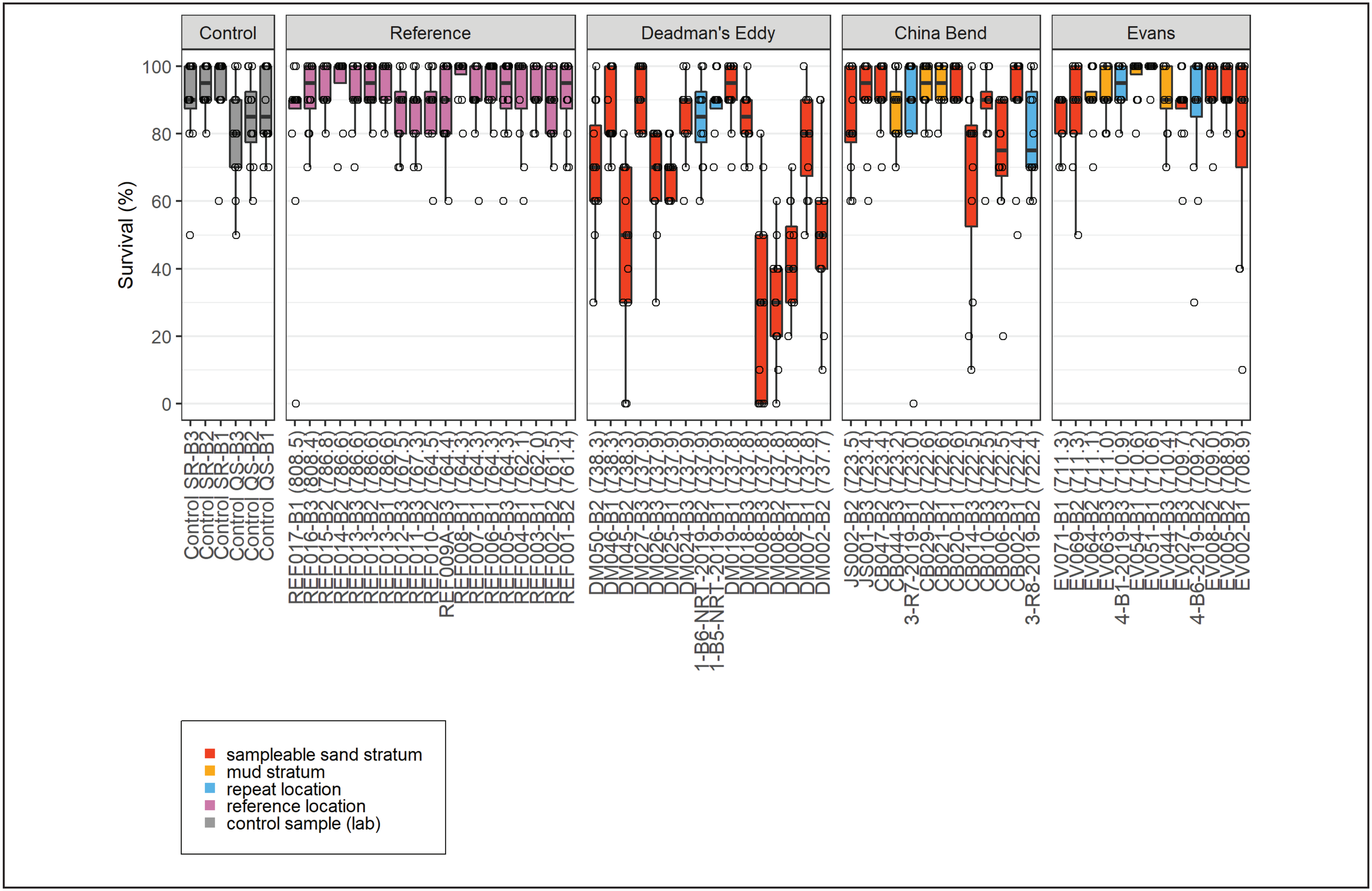


Figure 5-8a. Results for Day 28 Survival in the *Hyalella azteca* Bioassay

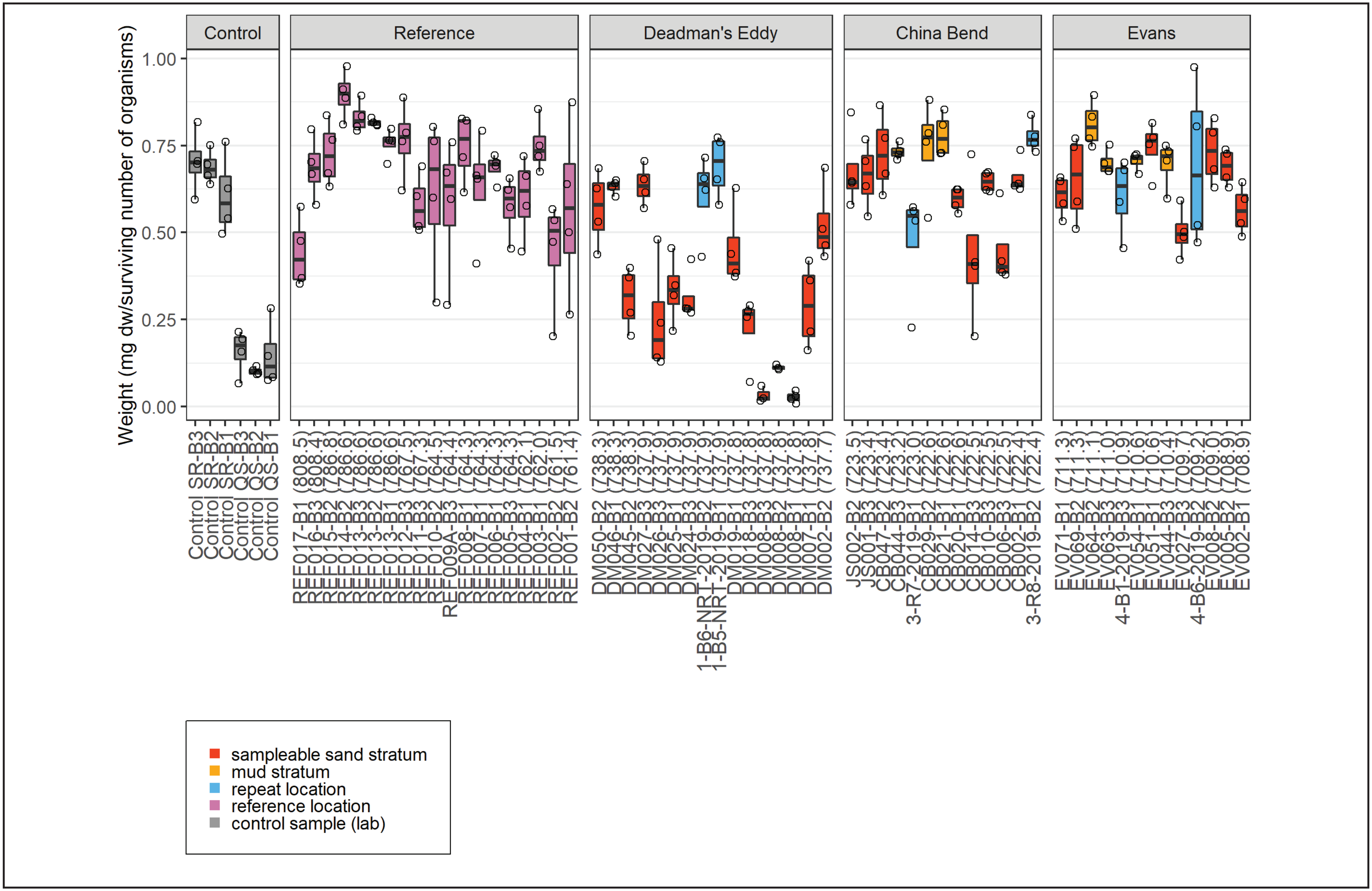


Figure 5-8b. Results for Day 28 Weight in the *Hyalella azteca* Bioassay

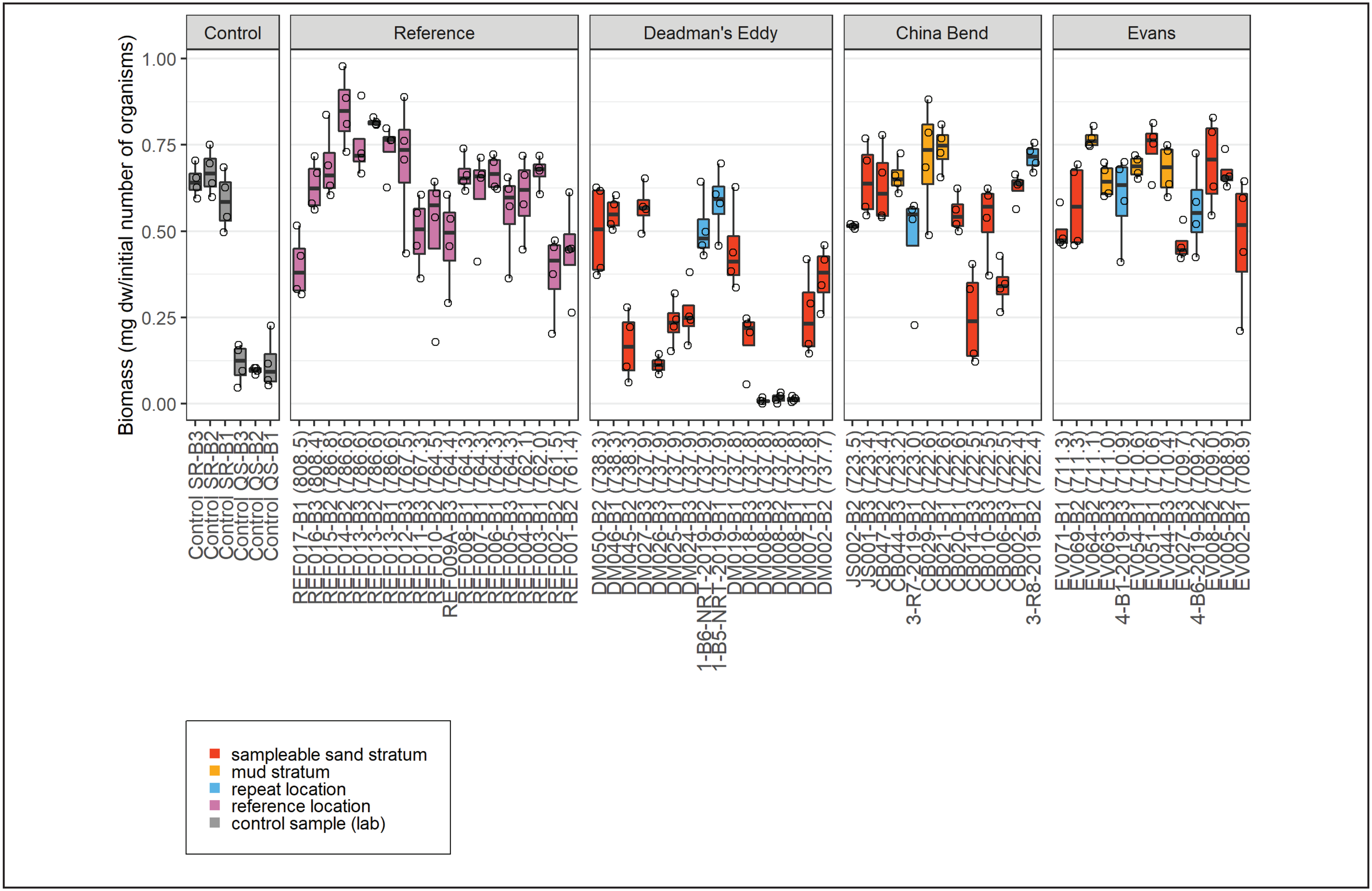


Figure 5-8c. Results for Day 28 Biomass in the *Hyalella azteca* Bioassay

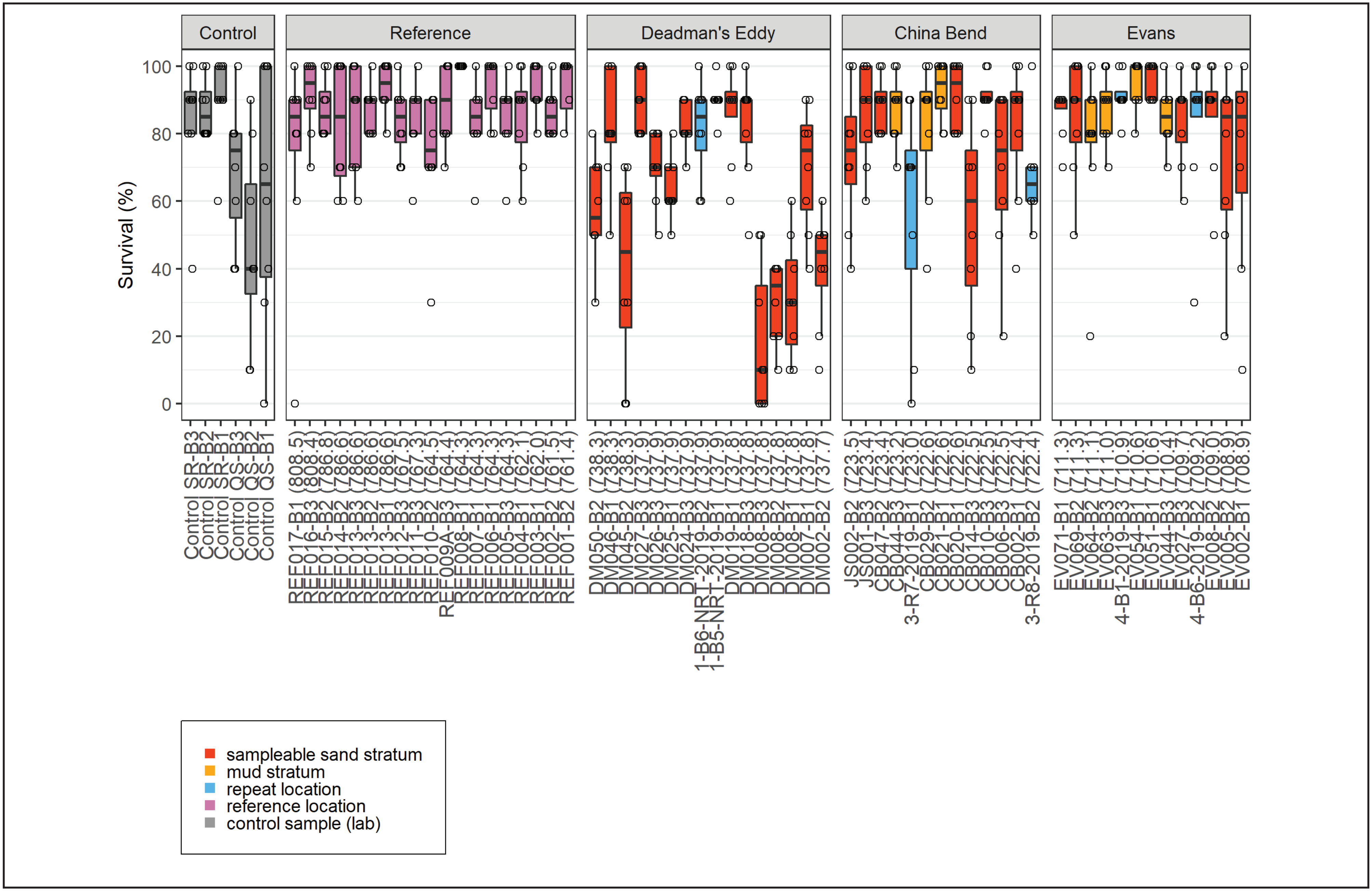


Figure 5-8d. Results for Day 42 Survival in the *Hyalella azteca* Bioassay

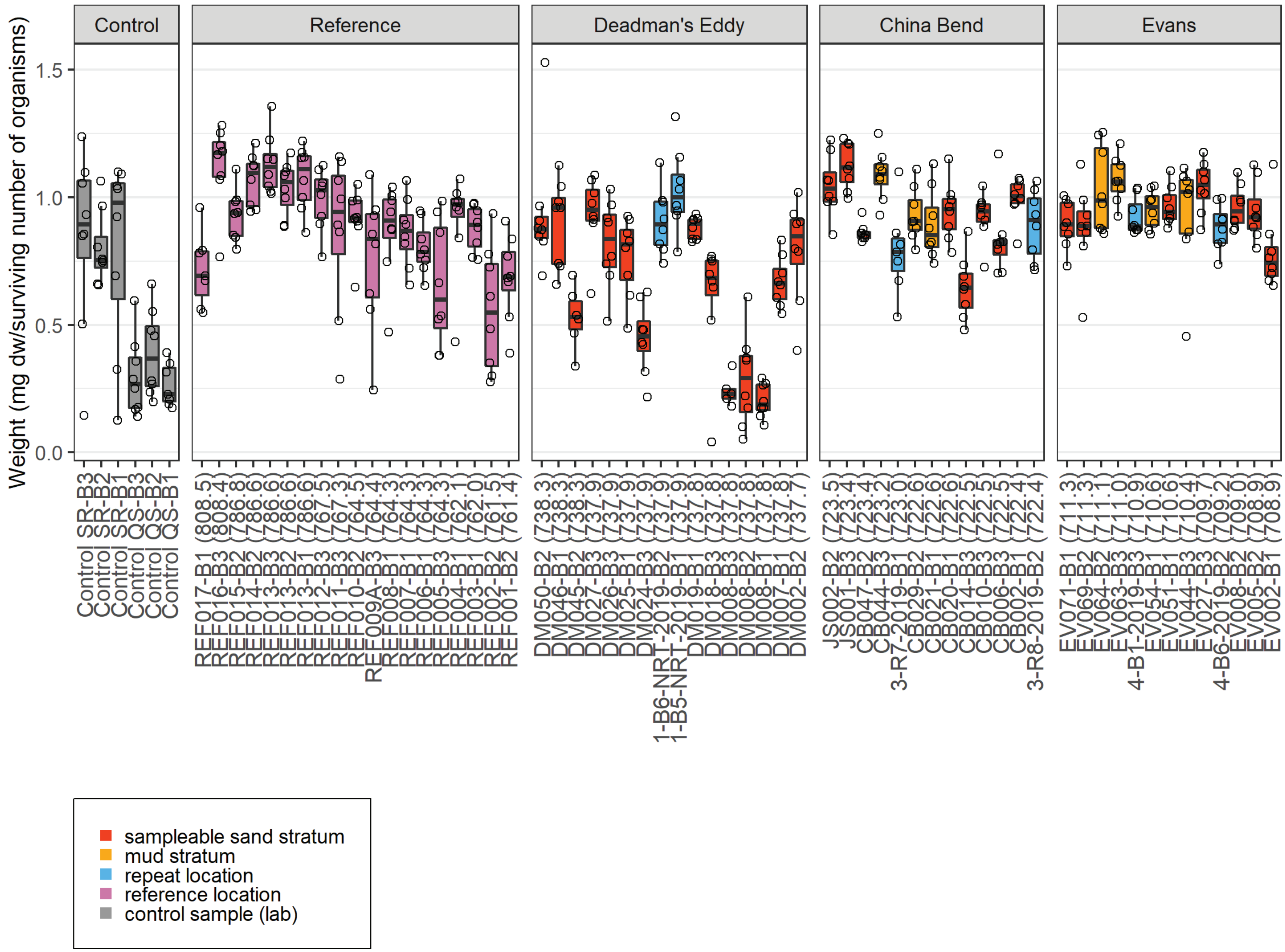


Figure 5-8e. Results for Day 42 Weight in the *Hyalella azteca* Bioassay

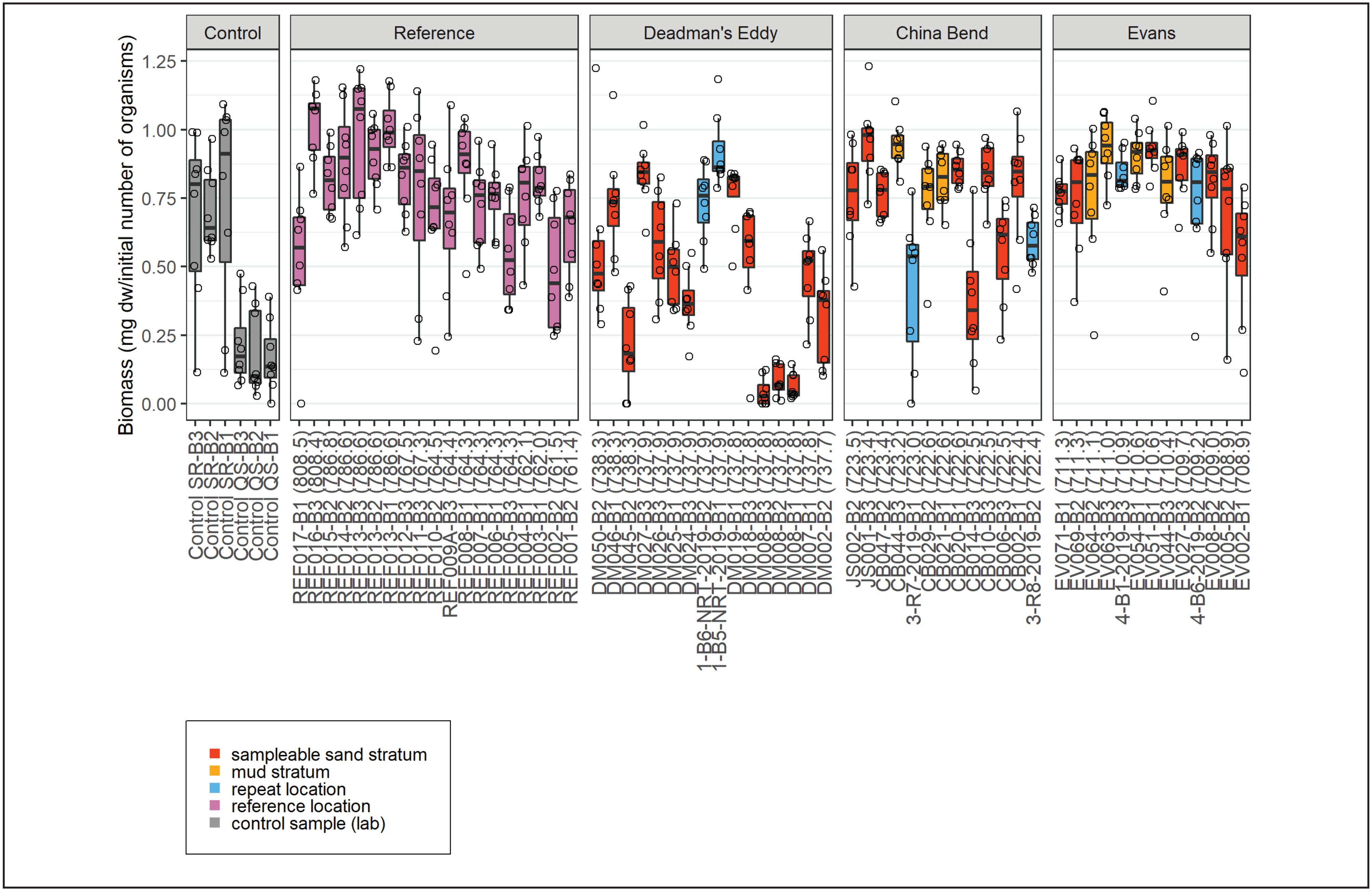


Figure 5-8f. Results for Day 42 Biomass in the *Hyalella azteca* Bioassay

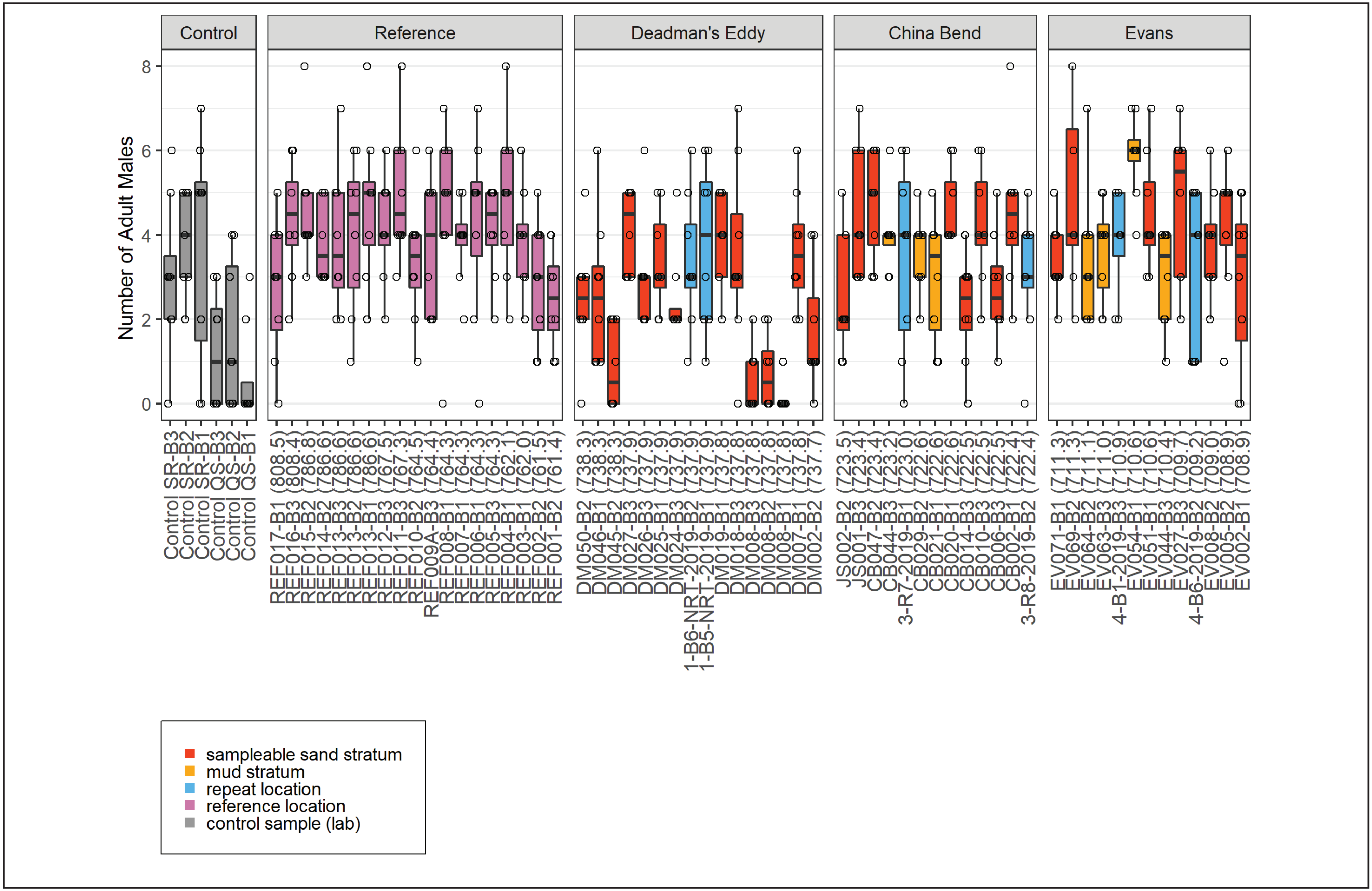


Figure 5-8g. Results for Number of Adult Males in the *Hyalella azteca* Bioassay

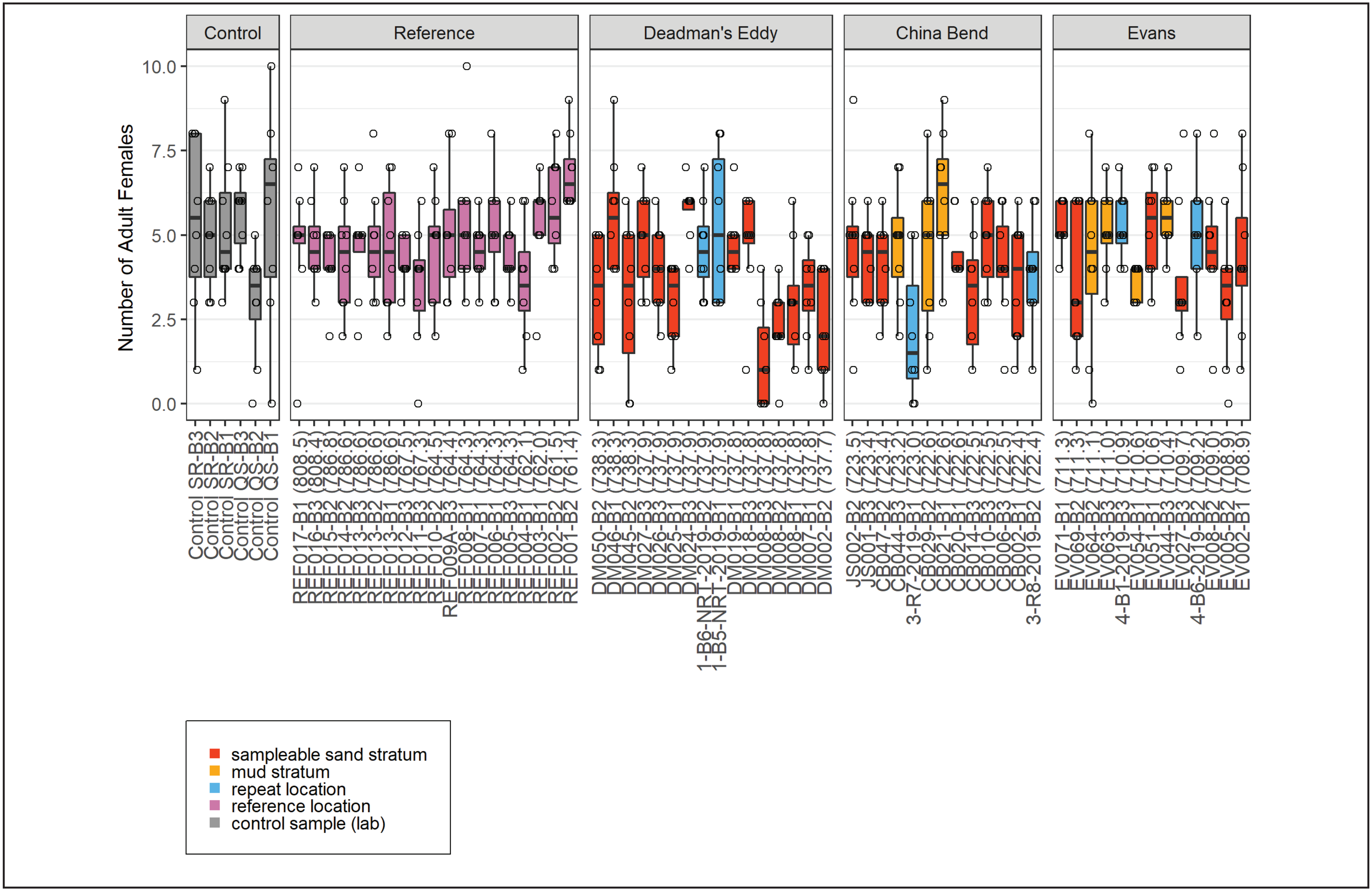


Figure 5-8h. Results for Number of Adult Females in the *Hyalella azteca* Bioassay

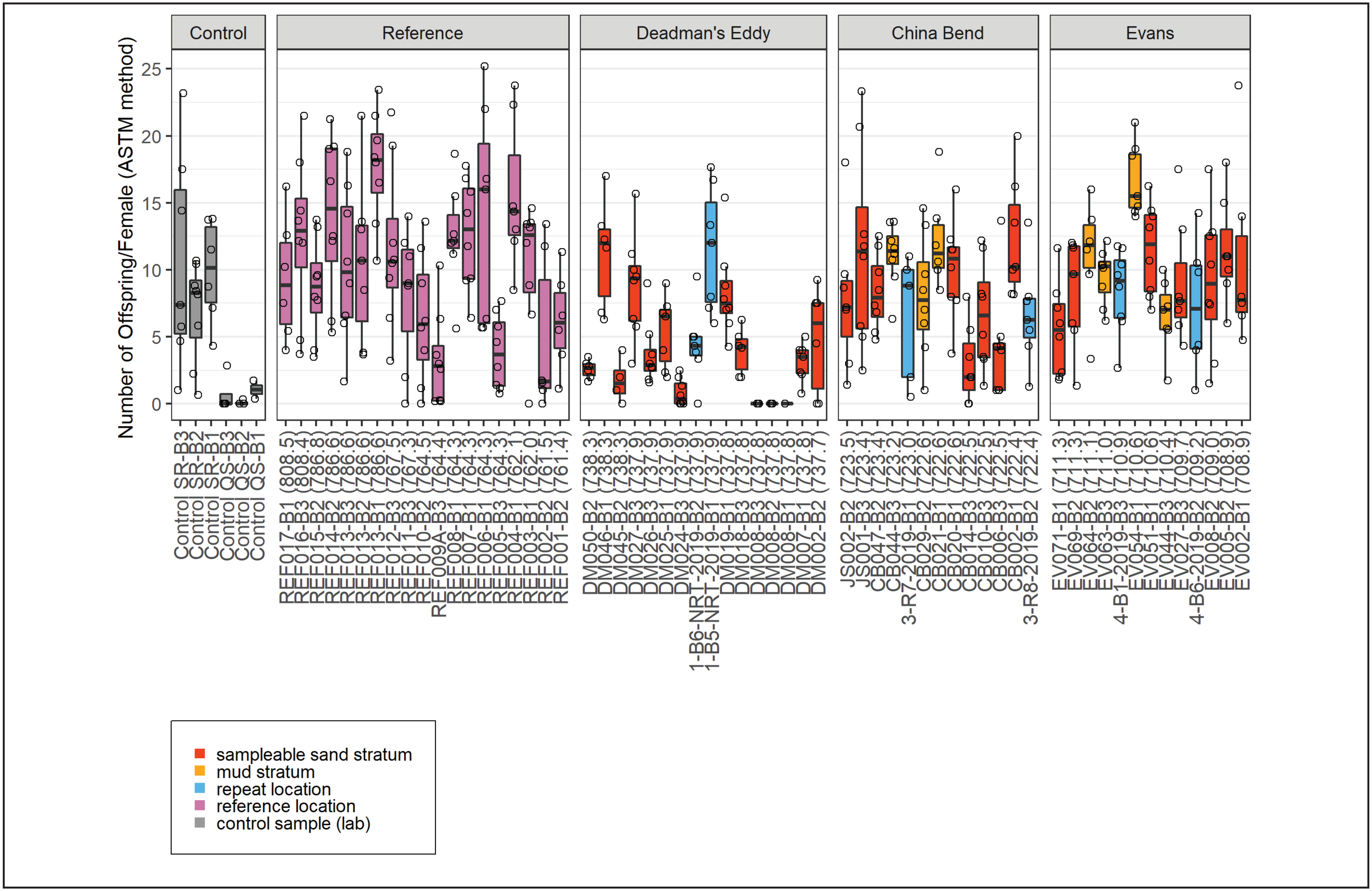


Figure 5-8i. Results for Number of Offspring/Female (ASTM method) in the *Hyalella azteca* Bioassay

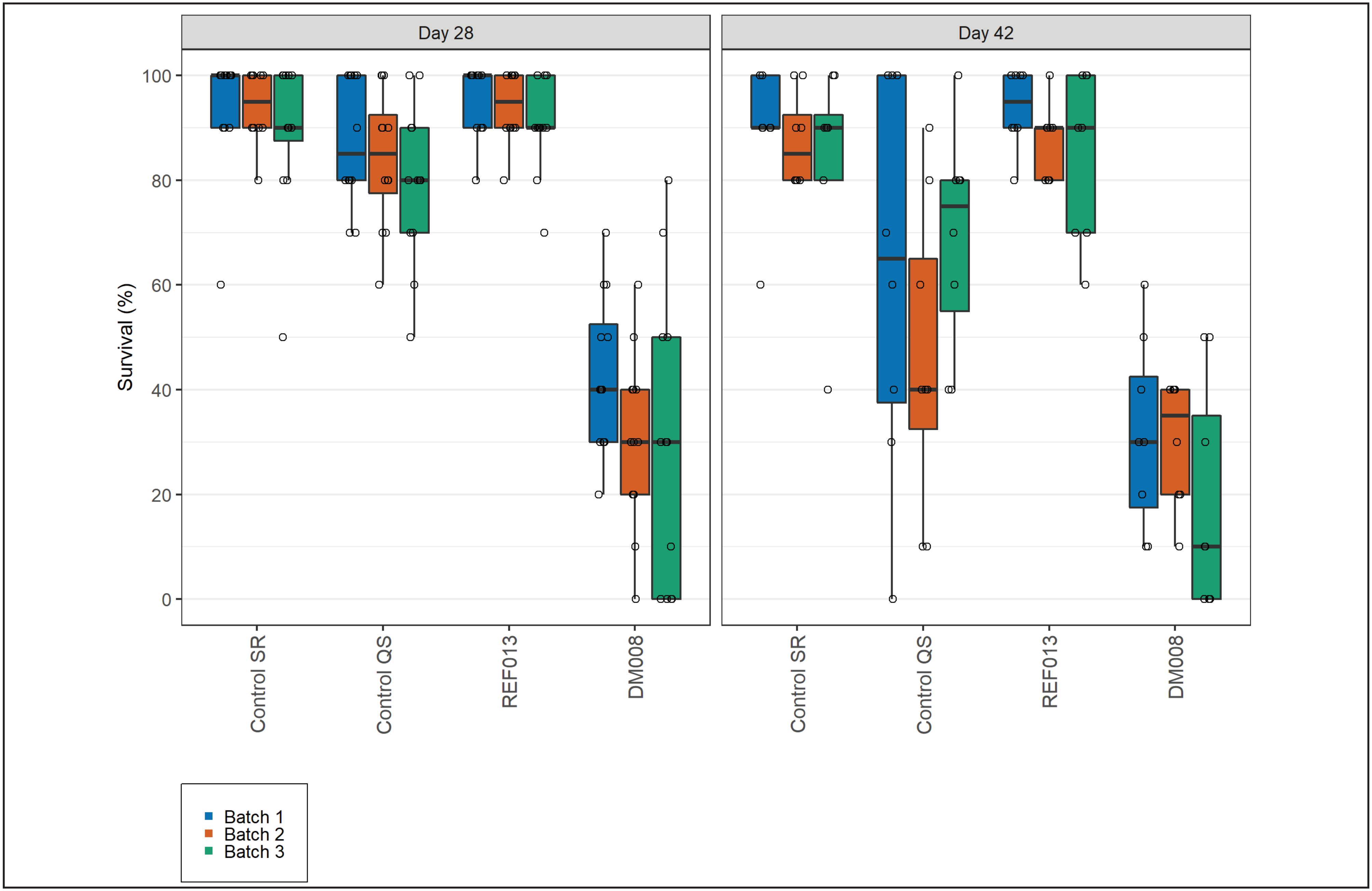


Figure 5-8j. Day 28 and Day 42 *Hyalella azteca* Survival Comparison Between Batches

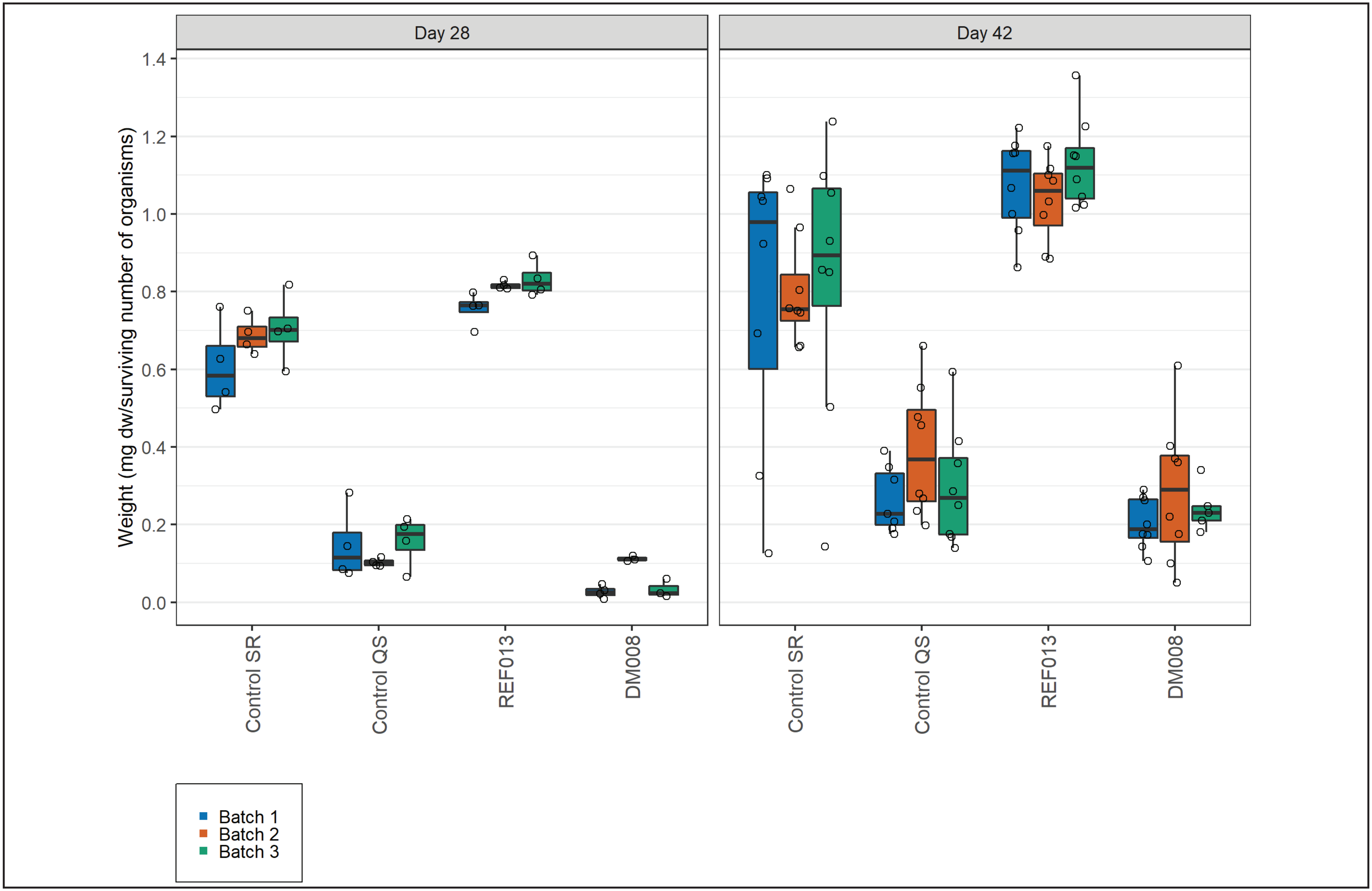


Figure 5-8k. Day 28 and Day 42 *Hyalella azteca* Weight Comparison Between Batches

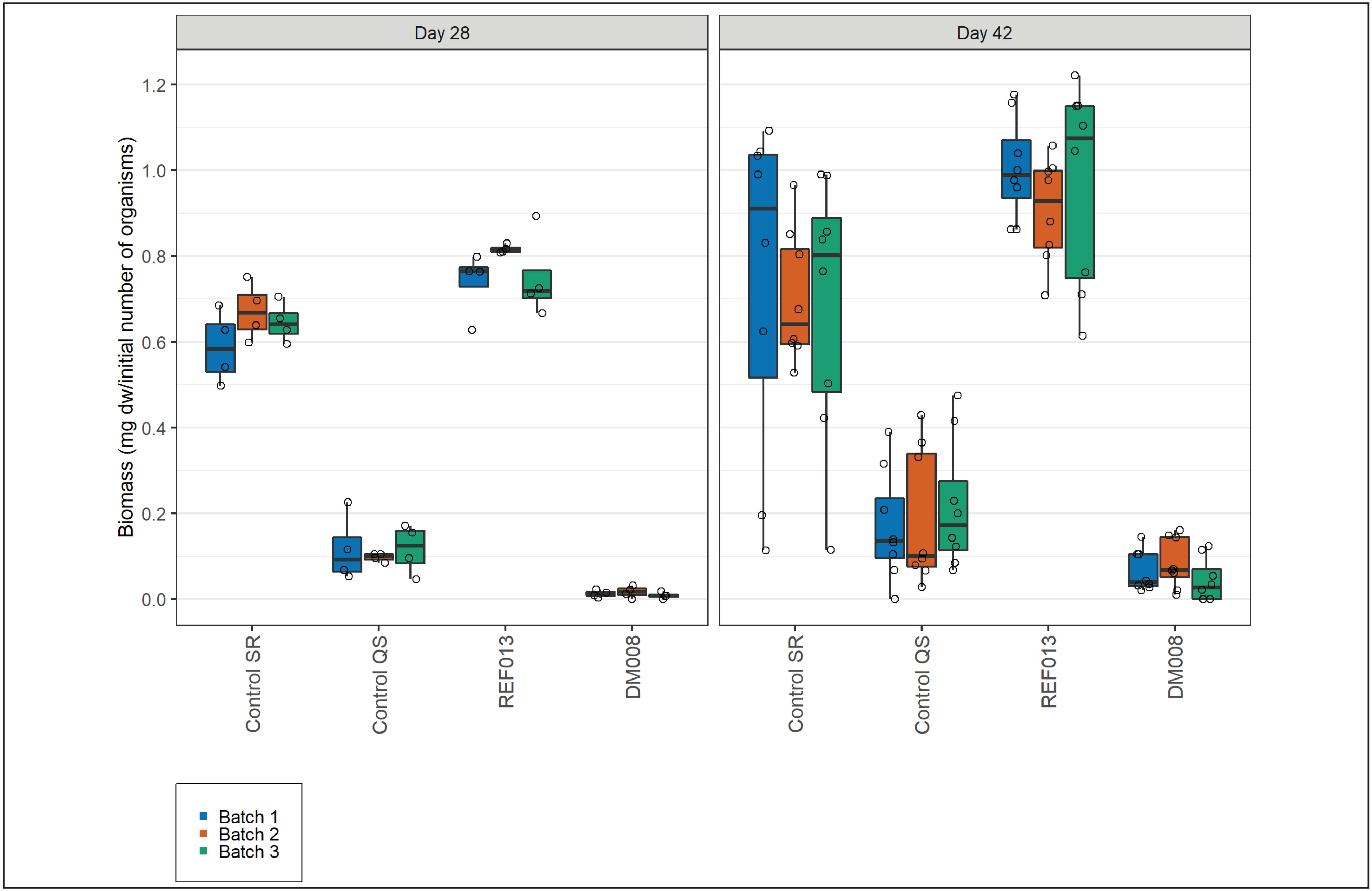


Figure 5-8I. Day 28 and Day 42 *Hyalella azteca* Biomass Comparison Between Batches

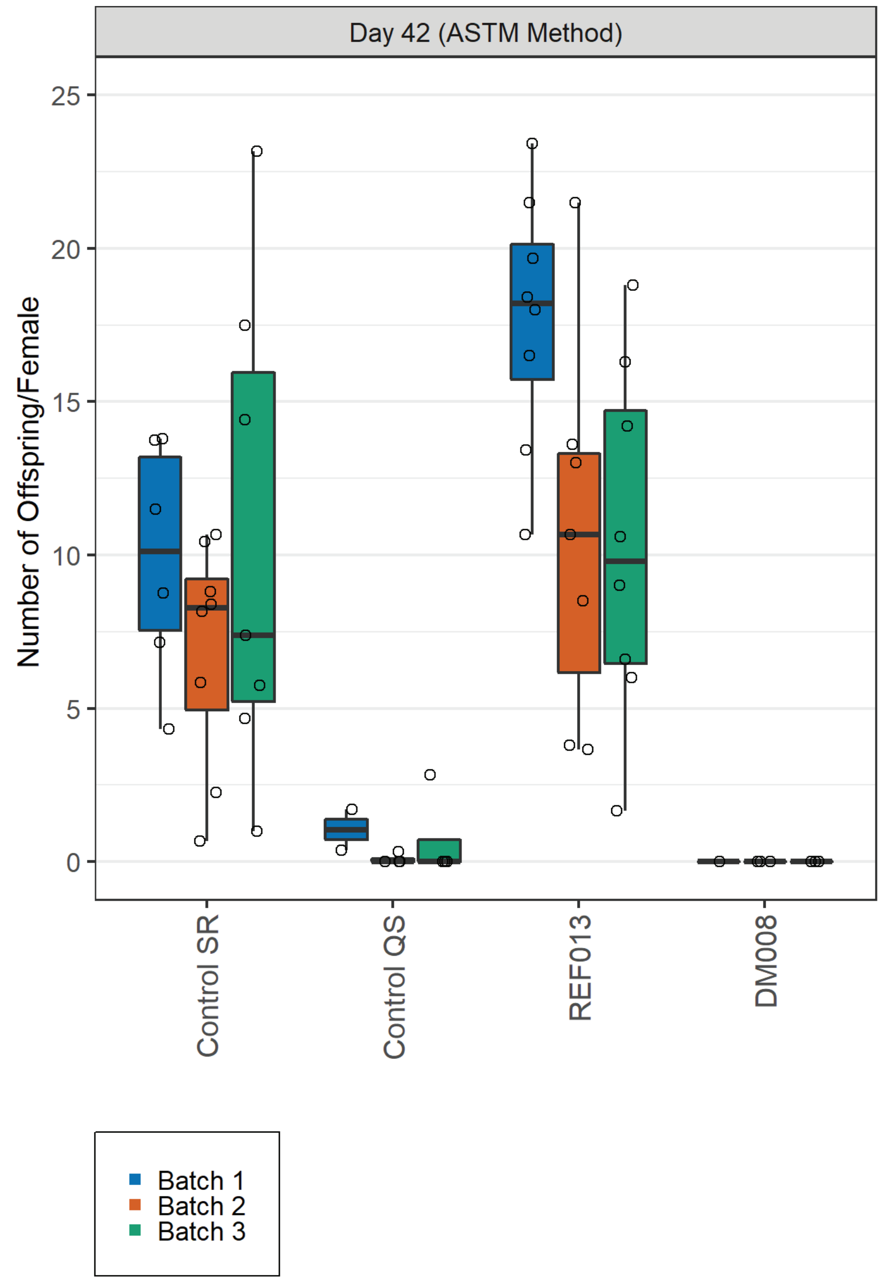
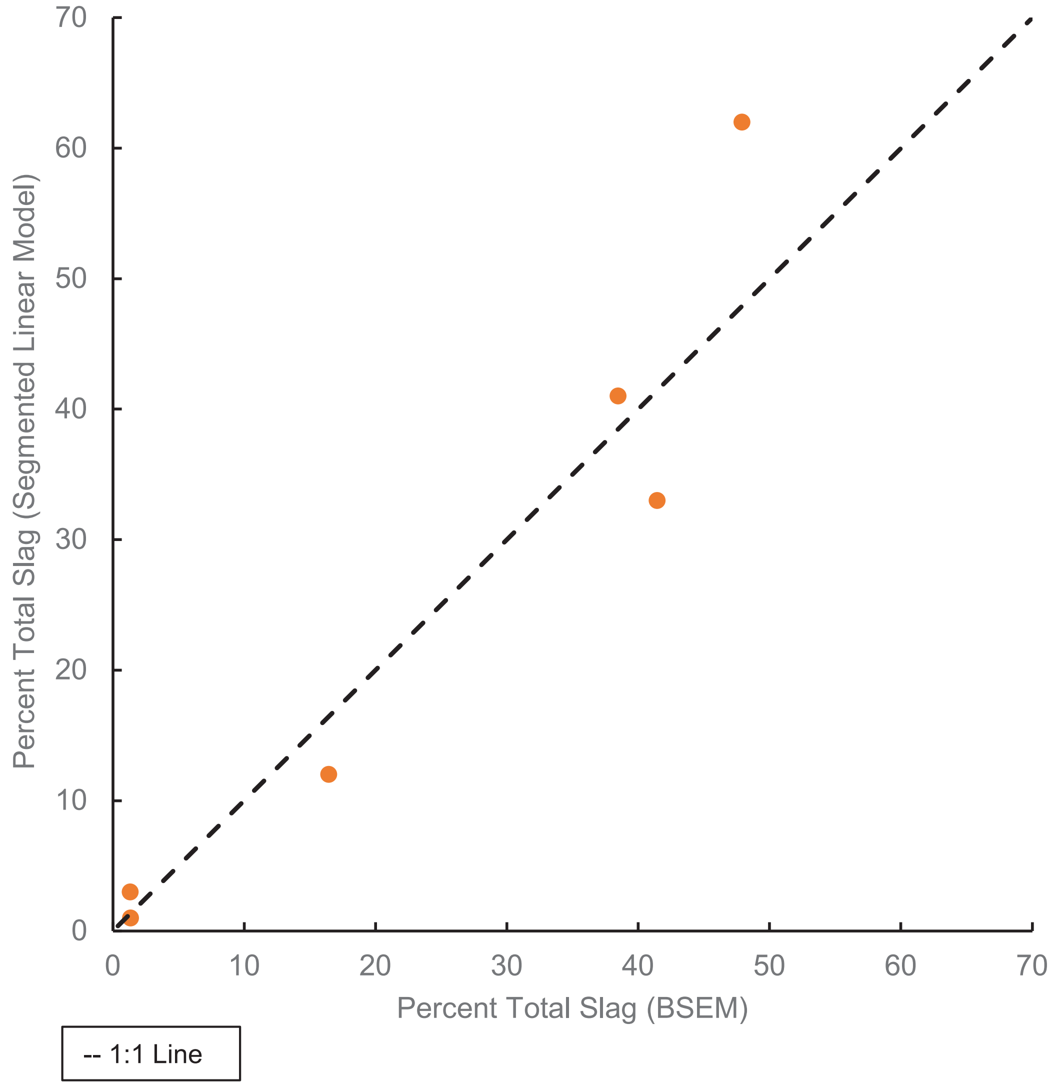


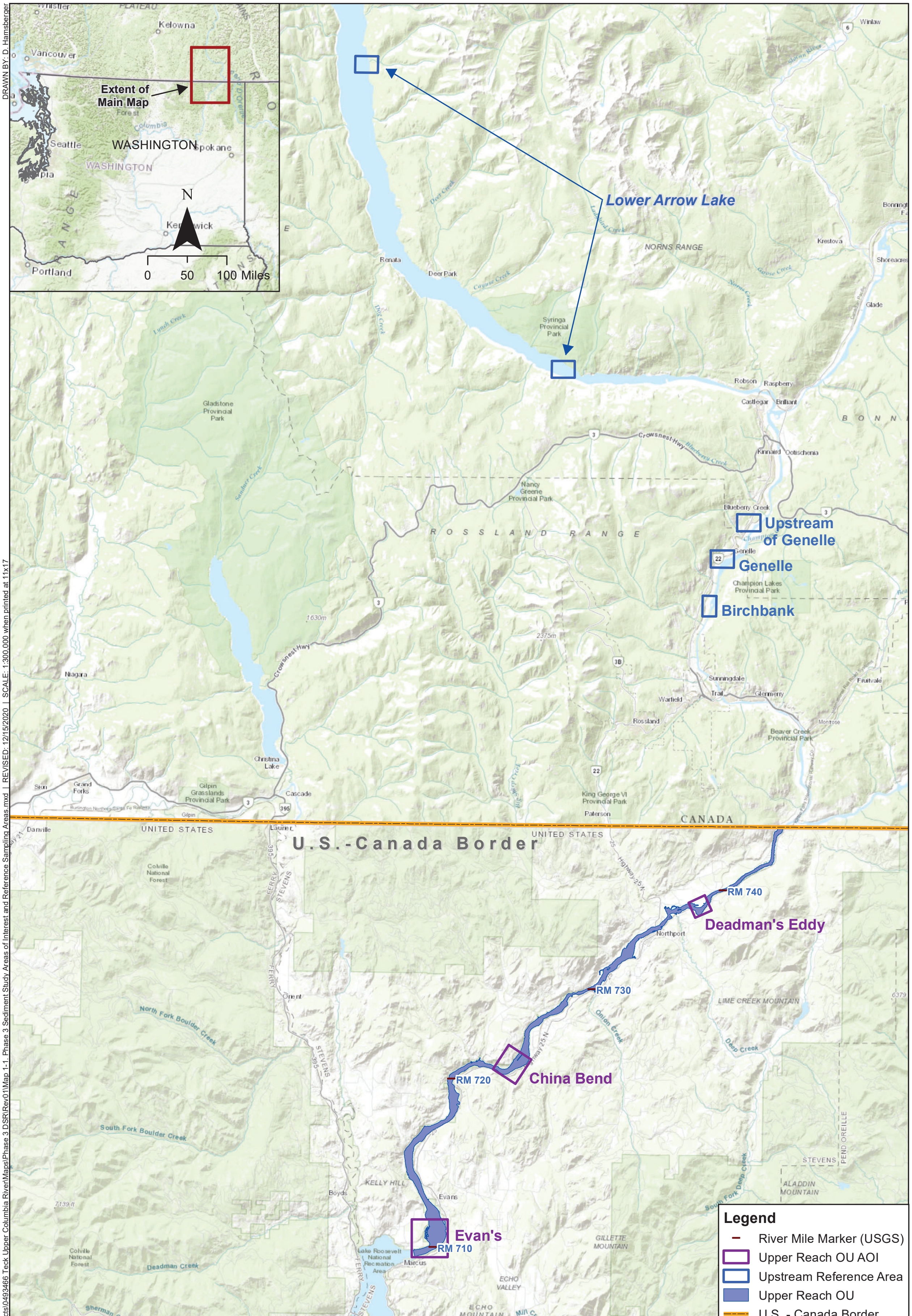
Figure 5-8m. Day 42 *Hyalella azteca* Number of Offspring/female Comparison Between Batches



Notes: Total slag equals sum of Slag 1 and Slag 2.
Segmented Linear Model is Defined in Section B4.2 of the QAPP
BSEM - Backscatter Scanning Electron Microscopy

Figure 5-9. Total Slag Content in Selected Field Sediment Samples

MAPS



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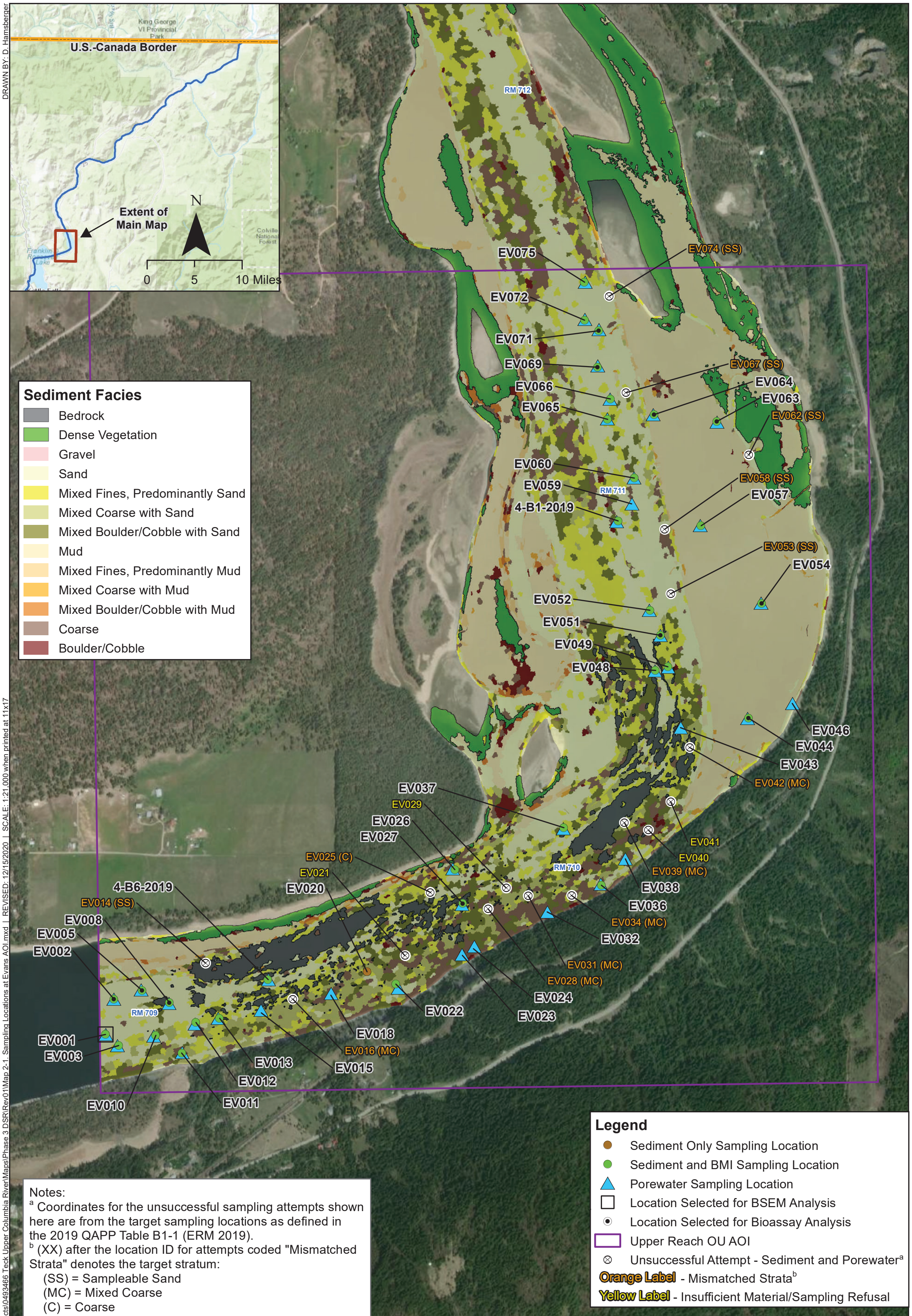
Map 1-1. **2019 Phase 3 Sediment Study AOIs and Reference Sampling Areas**
Upper Columbia River, Washington

Source: Esri - World Topographic Map; NAD 1983 UTM Zone 11N

FILE: \\uswafile01\Data\Projects\0493466 Teck Upper Columbia River\Maps\Phase 3 DSR\Rev01\Map 1-1. Phase 3 Sediment Study Areas of Interest and Reference Sampling Areas.mxd | REVISED: 12/15/2020 | SCALE: 1:300,000 when printed at 11x17 DRAWN BY: D. Harnsberger



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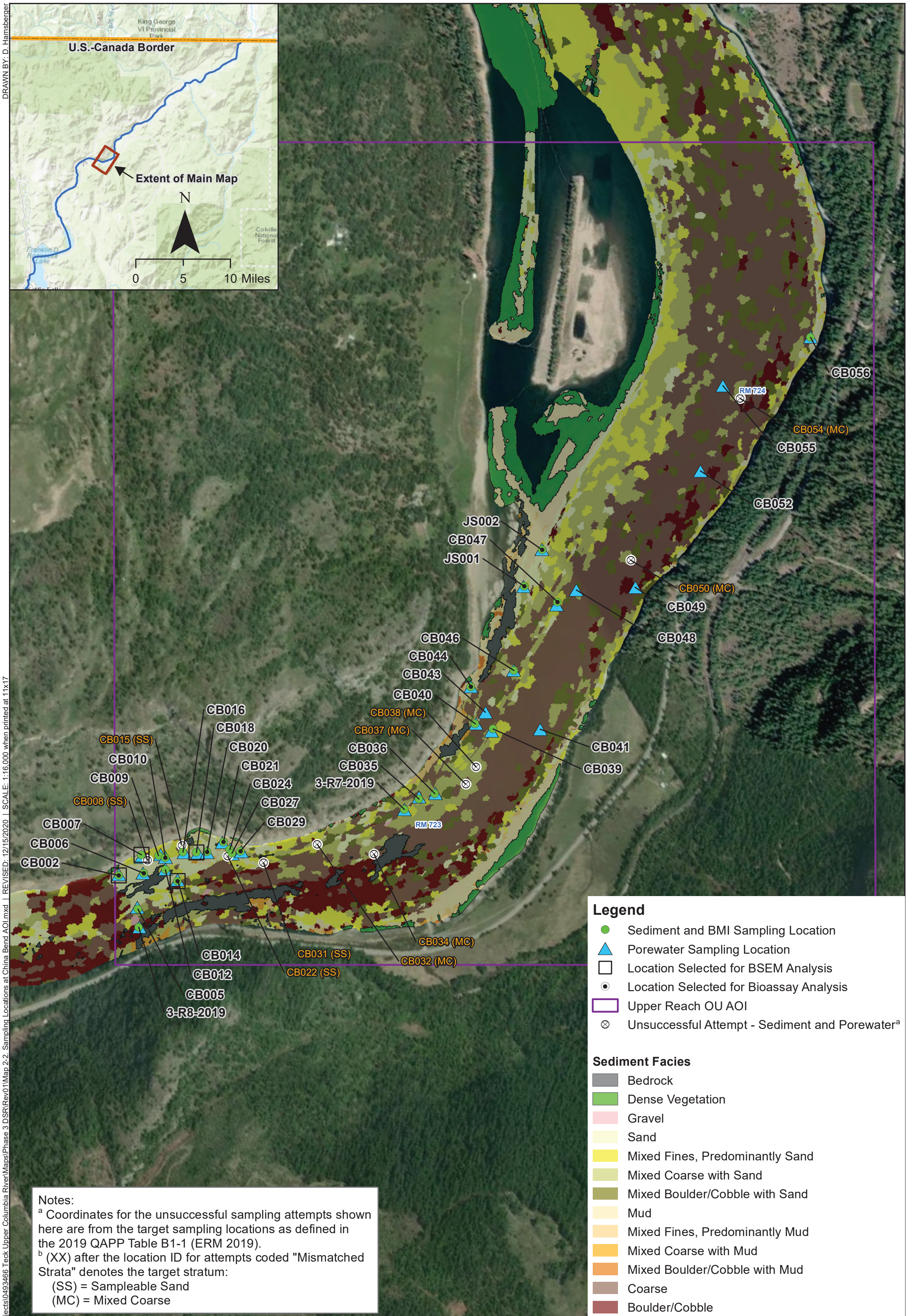
0 0.25 0.5 Km
0 0.1 0.2 Miles
N

Map 2-1. **2019 Sampling Locations at Evans AOI**
Upper Columbia River, Washington

Source: Esri - World Topoographic Map; WGS 1984 Web Mercator Auxiliary Sphere



DRAWN BY: D. Harnsberger

FILE: \\uswalfile01\Data\Projects\0493466 Teck Upper Columbia River\Maps\Phase 3 DSR\Rev01\Map 2-2. Sampling Locations at China Bend AOI.mxd | REVISED: 12/15/2020 | SCALE: 1:16,000 when printed at 11x17

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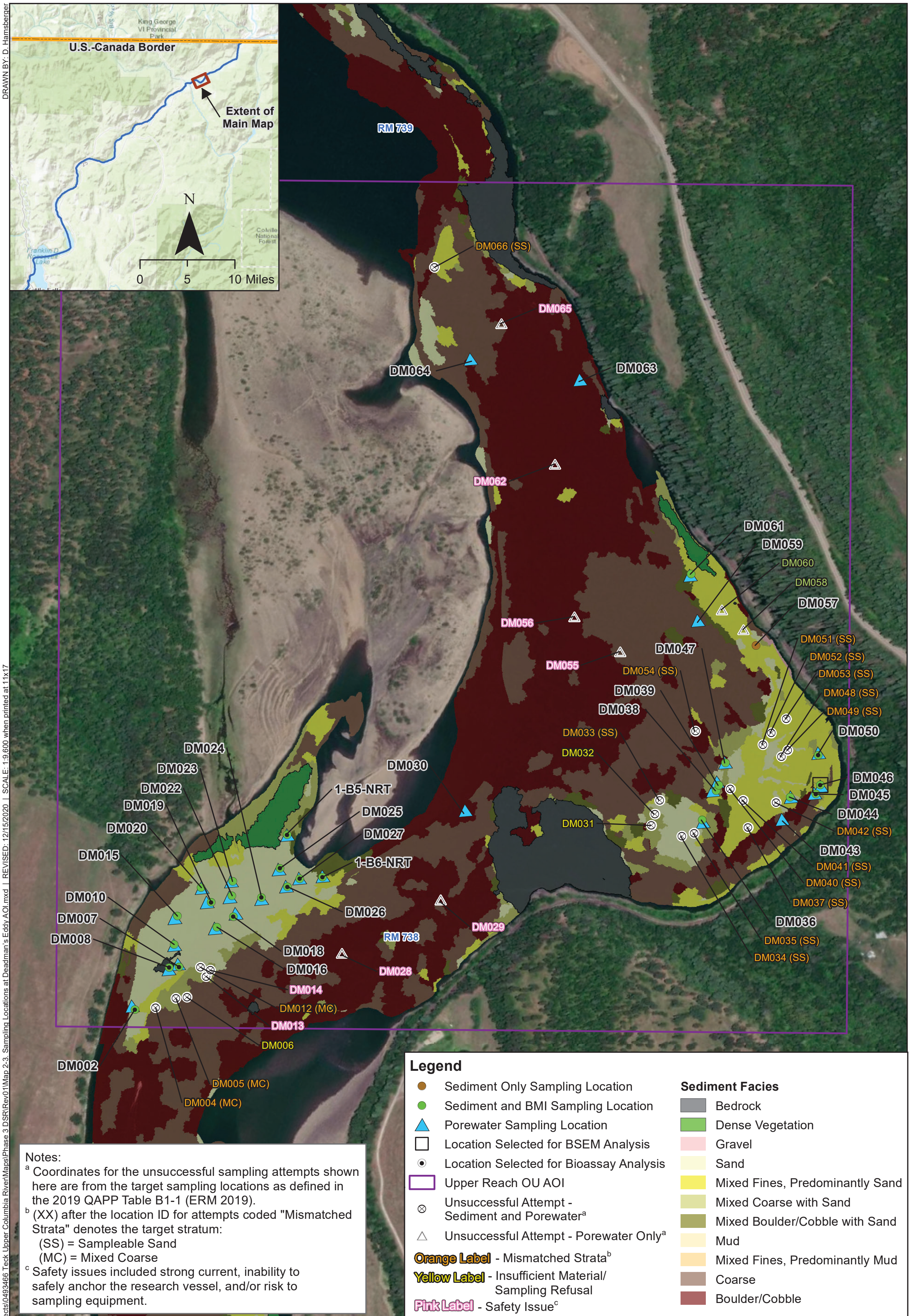
Km: 0 0.2 0.4
Miles: 0 0.1 0.2

N

Map 2-2. **2019 Sampling Locations at China Bend AOI**
Upper Columbia River, Washington

Source: Esri - World Topographic Map; WGS 1984 Web Mercator Auxiliary Sphere



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0 0.2 0.4 Km
0 0.1 0.2 Miles

Map 2-3. **2019 Sampling Locations at Deadman's Eddy AOI**
Upper Columbia River, Washington

Source: Esri - World Topoographic Map; WGS 1984 Web Mercator Auxiliary Sphere

DRAWN BY: D. Harnsberger

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ERM

Km: 0, 0.2, 0.4
Miles: 0, 0.1, 0.2
N

Map 2-4. **2019 Sampling Locations at Genelle, BC**
Columbia River, BC

FILE: \\uswalfile01\Data\Projects\0493466 Teck Upper Columbia River\Maps\Phase 3 DSR\Rev01\Map 2-4. Sampling Locations at Genelle, BC.mxd | REVISED: 12/15/2020 | SCALE: 1:12,000 when printed at 11x17

Source: Esri - World Topographic Map; WGS 1984 Web Mercator Auxiliary Sphere

DRAWN BY: D. Hamsberger

FILE: \uswalfile01\Data\Projects\0493466 Teck Upper Columbia River\Maps\Phase 3 DSR\Rev01\Map 2-5. Sampling Locations at Birchbank, BC.mxd | REVISED: 12/15/2020 | SCALE: 1:7,200 when printed at 11x17

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0 0.1 0.2 Km

0 0.05 0.1 Miles

N

Map 2-5. **2019 Sampling Locations at Birchbank, BC**
Columbia River, BC

Source: Esri - World Topographic Map; WGS 1984 Web Mercator Auxiliary Sphere

Environmental Resources Management
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ERM

0 0.2 0.4 Km
0 0.1 0.2 Miles
N

Map 2-6. **2019 Sampling Locations at Lower Arrow Lake, BC**
Columbia River, BC

DRAWN BY: D. Harnsberger

FILE: \\uswalfile01\Data\Projects\0493466 Teck Upper Columbia River\Maps\Phase 3 DSR\Rev01\Map 2-6. Sampling Locations at Lower Arrow Lake, BC.mxd | REVISED: 12/15/2020 | SCALE: 1:12,000 when printed at 11x17

Source: Esri - World Topographic Map; WGS 1984 Web Mercator Auxiliary Sphere

TABLES

Table 2-1. Summary of Phase 3 Sampling Design

Location	Primary Data Use	Secondary Data Uses	Sample Design	Target Stratum	Target Locations	Alternate Sample Locations	Media: Sed	Media: PW	Media: BMI	Comments
Deadman's Eddy AOI	Characterize nature and magnitude of risks posed to benthic organisms through exposure to contaminated sediment and porewater using SQT	- Characterize chemical and physical properties of surface sediment and porewater - Estimate proportion of sediment facies that exceed effects concentration or other benchmark - Refine sediment composition maps	stratified random	sampleable sand	21	21	X	X	X	Bioassay testing performed on select samples
				mixed coarse	6	6	X	X	X	
				mud	0	0				No mud mapped in AOI
				coarse	6	6		X		
		- Evaluate relationship between historical and Phase 3 results	biased	resample	2	NA	X	X	X	Bioassay testing performed on both samples
China Bend AOI	Characterize nature and magnitude of risks posed to benthic organisms through exposure to contaminated sediment and porewater using SQT	- Characterize chemical and physical properties of surface sediment and porewater - Estimate proportion of sediment facies that exceed effects concentration or other benchmark - Refine sediment composition maps	stratified random	sampleable sand	12	12	X	X	X	Bioassay testing performed on select samples
				mixed coarse	6	6	X	X	X	
				mud	5	5	X	X	X	Bioassay testing performed on select samples
				coarse	6	6		X		
		TBD	judgemental	sampleable sand	2	2	X	X	X	Two primary judgmental and two alternate judgmental sample locations were added at China Bend AOI as requested by EPA. These locations are not statistically-determined.
		- Evaluate relationship between historical and Phase 3 results	biased	resample	2	0	X	X	X	Bioassay testing performed on both samples
Evans AOI	Characterize nature and magnitude of risks posed to benthic organisms through exposure to contaminated sediment and porewater using SQT	- Characterize chemical and physical properties of surface sediment and porewater - Estimate proportion of sediment facies that exceed effects concentration or other benchmark - Refine sediment composition maps	stratified random	sampleable sand	21	21	X	X	X	Bioassay testing performed on select samples
				mixed coarse	6	6	X	X	X	
				mud	5	5	X	X	X	Bioassay testing performed on select samples
				coarse	6	6		X		
		- Evaluate relationship between historical and Phase 3 results	biased	resample	2	0	X	X	X	Bioassay testing performed on both samples
Reference	Reference comparisons		random - Genelle and Birchbank biased (resample) - Lower Arrow Lake	sampleable sand	18	0	X	X	X	Bioassay testing performed on all samples except REF018 [a]

Notes:

Target strata for reference locations could not be developed to the same extent as target strata in AOI locations due the lack of sediment bed mapping in reference locations. Reference locations included sand, mixed, and sand/mud strata (see Table 2-2).

[a] A review of reference sediment chemistry data identified that reference sample REF018 be excluded from use within bioassays due to a substantially higher percent total organic carbon (TOC) than other sediment samples from reference locations or from the areaa of interest (AOIs) (Appendix B).

[b] Initially, only reference area samples will be analyzed. However, aliquots from potential bioassay sample locations (sampleable sand and mud strata samples) will be archived frozen and may be analyzed for organic chemicals at a later date if needed.

BMI – benthic macroinvertebrate community
NA - not applicable
PW - porewater
Sed – surface sediment
SQT - sediment quality triad
TBD - to be determined

Sediment Target Analytes, Tests, and Measurements:
- Target analysis list metals
- Percent slag by backscatter scanning electron microscopy (10% sampleable sand sample locations)
- Grain size
- Simultaneously extracted metals
- Acid volatile sulfides
- 42-day sediment bioassays using the freshwater amphipod *H. azteca* (select samples)
- Organic chemicals (polychlorinated biphenyls [PCBs], polycyclic aromatic hydrocarbons [PAHs], pesticides) [b]

Porewater Target Analytes, Tests, and Measurements:
- Dissolved metals, including major cations
- Major anions (chloride, sulfate)
- Alkalinity
- Sulfide (if field data indicate need)
- TOC and dissolved organic carbon
- pH

BMI Community Measurements:
- BMI species
- BMI abundance, by species
- Physical location attributes

Table 2-2. Locations Sampled for the Phase 3 Sediment Study

Location ID	River Mile	Target Stratum	QAPP Location Type (Resampled, Primary, Alternate)	Sample Type(s)	Sample ID	Elevation (ft)	Sampling Method	Sample Coordinates [a] X_UTM_11N (m)	Sample Coordinates [a] Y_UTM_11N (m)	EPA Split Sample Type	Field Duplicates
Evans											
4-B1-2019	710.9	NA	R	SE, TX, BMI	4-B1-2019	1208.4	VanVeen	424499.2	5393516.2		
				PW	4-B1-2019-PW	1207.8	Trident	424493.5	5393513.3		
4-B6-2019	709.2	NA	R	SE, TX, BMI	4-B6-2019	1201.5	VanVeen	423101.2	5391739.6		
				PW	4-B6-2019-PW	1200.2	Trident	423103.4	5391740.2		
EV001	708.8	sampleable sand	A	SE, TX, BMI	EV001	1202.8	VanVeen	422460.4	5391534.2		
				PW	EV001-PW	1202.6	Trident	422461.4	5391534.3		SE chemistry
EV002	708.9	sampleable sand	P	SE, TX, BMI	EV002	1204.3	VanVeen	422495.0	5391672.7	SE bioassay	
				PW	EV002-PW	1204.3	Trident	422494.9	5391672.0		PW (DOC)
EV003	708.8	sampleable sand	A	SE, TX, BMI	EV003	1200.5	Hamon	422511.5	5391490.8		
				PW	EV003-PW	1200.6	Trident	422506.6	5391490.5		
EV005	708.9	sampleable sand	P	SE, TX, BMI	EV005	1202.7	Hamon	422606.3	5391704.7		
				PW	EV005-PW	1202.4	Trident	422602.5	5391707.4		
EV008	709.0	sampleable sand	P	SE, TX, BMI	EV008	1198.9	VanVeen	422713.0	5391655.5		
				PW	EV008-PW	1198.9	Trident	422711.8	5391652.4		
EV010	708.9	sampleable sand	P	SE, TX, BMI	EV010	1202.0	Hamon	422657.1	5391528.1		
				PW	EV010-PW	1201.6	Trident	422649.7	5391526.4	PW	
EV011	709.0	mixed coarse	A	SE, BMI	EV011	1213.6	freeze grab	422758.7	5391457.6		
				PW	EV011-PW	1213.8	Trident	422760.6	5391459.9		
EV012	709.0	sampleable sand	P	SE, TX, BMI	EV012	1200.8	Hamon	422815.4	5391576.3		
				PW	EV012-PW	1200.5	Trident	422812.9	5391570.9		
EV013	709.1	sampleable sand	P	SE, TX, BMI	EV013	1201.0	Hamon	422908.5	5391591.2		
				PW	EV013-PW	1201.3	Trident	422903.8	5391591.0		PW (metals)
EV015	709.2	mixed coarse	P	PW	EV015-PW	1201.9	Trident	423072.4	5391621.2	PW	
EV018	709.4	coarse	P	PW	EV018-PW	1206.3	Trident	423348.5	5391683.2		
EV020	709.5	mixed coarse	A	SE	EV020	1204.9	freeze grab	423490.5	5391765.1	SE chemistry	
EV022	709.5	mixed coarse	P	SE, BMI	EV022	1213.1	freeze grab	423602.0	5391715.6		
				PW	EV022-PW	1220.6	Trident	423611.6	5391700.9		
EV023	709.7	coarse	P	PW	EV023-PW	1234.9	Trident	423863.4	5391827.9		
EV024	709.7	coarse	P	PW	EV024-PW	1232.0	Trident	423912.7	5391859.4		
EV026	709.7	sampleable sand	P	SE, TX, BMI	EV026	1206.6	Hamon	423839.8	5392159.9		
				PW	EV026-PW	1209.6	Trident	423831.9	5392163.5		
EV027	709.7	sampleable sand	P	SE, TX, BMI	EV027	1202.5	Hamon	423869.1	5392027.6	SE bioassay	
				PW	EV027-PW	1202.0	Trident	423866.2	5392023.5		
EV032	709.9	coarse	A	PW	EV032-PW	1251.5	Trident	424200.9	5391990.1		
EV036	710.0	mixed coarse	P	SE, BMI	EV036	1242.3	freeze grab	424414.1	5392091.5	SE chemistry [c]	
				PW	EV036-PW	1238.2	Trident	424412.6	5392096.4		
EV037	710.0	sampleable sand	P	SE, TX, BMI	EV037	1205.2	VanVeen	424269.4	5392319.1	SE chemistry	SE chemistry
				PW	EV037-PW	1204.8	Trident	424267.8	5392315.5	PW	
EV038	710.1	coarse	A	PW	EV038-PW	1230.8	Trident	424510.0	5392193.4		
EV043	710.4	coarse	P	PW	EV043-PW	1202.5	Trident	424733.5	5392704.0		
EV044	710.4	mud	P	SE, TX, BMI	EV044	1256.3	VanVeen	424999.9	5392737.6	SE bioassay	
				PW	EV044-PW	1257.3	Trident	424996.4	5392737.3		
EV048	710.5	sampleable sand	P	SE, TX, BMI	EV048	1184.4	VanVeen	424637.8	5392929.7		
				PW	EV048-PW	1184.0	Trident	424636.1	5392927.6		PW (metals)
EV049	710.5	mixed coarse	P	SE, BMI	EV049	1210.9	freeze grab	424686.7	5392942.8	SE chemistry [c]	
				PW	EV049-PW	1210.9	Trident	424687.7	5392941.9		
EV051	710.6	sampleable sand	P	SE, TX, BMI	EV051	1204.6	VanVeen	424659.1	5393065.9		
				PW	EV051-PW	1204.6	Trident	424659.5	5393066.7		PW (metals)
EV052	710.7	sampleable sand	A	SE, TX, BMI	EV052	1207.0	VanVeen	424619.3	5393165.5		
				PW	EV052-PW	1207.1	Trident	424617.2	5393165.4	PW	
EV054	710.6	mud	P	SE, TX, BMI	EV054	1259.8	VanVeen	425058.5	5393185.6		
				PW	EV054-PW	1259.8	Trident	425056.1	5393188.0		
EV057	710.8	mud	P	SE, TX, BMI	EV057	1257.8	VanVeen	424823.8	5393493.0		
				PW	EV057-PW	1258.0	Trident	424820.6	5393493.9		
EV059	710.9	sampleable sand	P	PW	EV059-PW	1207.4	Trident	424553.9	5393581.7		
EV060	711.0	sampleable sand	A	SE, TX, BMI	EV060	1205.1	Hamon	424564.7	5393682.7		
				PW	EV060-PW	1205.3	Trident	424563.3	5393683.6		PW (sulfide/alkalinity/chloride)
EV063	711.0	mud	P	SE, TX, BMI	EV063	1255.9	VanVeen	424890.8	5393900.3		
				PW	EV063-PW	1255.9	Trident	424891.8	5393898.0	PW	
EV064	711.1	mud	P	SE, TX, BMI	EV064	1260.0	VanVeen	424645.6	5393929.8		
				PW	EV064-PW	1259.5	Trident	424642.8	5393930.7		
EV065	711.1	sampleable sand	P	SE, TX, BMI	EV065	1206.2	VanVeen	424462.7	5393913.6		SE chemistry
				PW	EV065-PW	1206.3	Trident	424462.6	5393916.0		
EV066	711.2	sampleable sand	A	SE, TX, BMI	EV066	1205.6	VanVeen	424475.0	5393993.4	SE chemistry [c]	
				PW	EV066-PW	1205.9	Trident	424473.5	5393993.7		PW (TOC)

Table 2-2. Locations Sampled for the Phase 3 Sediment Study

Location ID	River Mile	Target Stratum	QAPP Location Type (Resampled, Primary, Alternate)	Sample Type(s)	Sample ID	Elevation (ft)	Sampling Method	Sample Coordinates [a] X_UTM_11N (m)	Sample Coordinates [a] Y_UTM_11N (m)	EPA Split Sample Type	Field Duplicates
Evans (continued)											
EV069	711.3	sampleable sand	P	SE, TX, BMI	EV069	1203.9	VanVeen	424426.3	5394118.6	SE bioassay	
				PW	EV069-PW	1204.0	Trident	424427.6	5394124.6		PW (DOC)
EV071	711.3	sampleable sand	A	SE, TX, BMI	EV071	1198.6	VanVeen	424433.2	5394261.8		
				PW	EV071-PW	1198.5	Trident	424434.2	5394266.3		
EV072	711.4	sampleable sand	A	SE, TX, BMI	EV072	1204.2	VanVeen	424377.6	5394303.1		SE chemistry
				PW	EV072-PW	1204.2	Trident	424379.4	5394306.8		PW (TOC)
EV075	711.5	sampleable sand	P	SE, TX, BMI	EV075	1204.2	Hamon	424379.6	5394452.3		
				PW	EV075-PW	1204.4	Trident	424383.0	5394451.9		PW (sulfide/alkalinity/chloride)
China Bend											
3-R7-2019	723.0	NA	R	SE, TX, BMI	3-R7-2019	1220.7	VanVeen	430299.0	5407150.0		
				PW	3-R7-2019-PW	1220.7	Trident	430298.3	5407149.8		
3-R8-2019	722.4	NA	R	SE, TX, BMI	3-R8-2019	1156.6	Hamon	429439.6	5407286.7		
				PW	3-R8-2019-PW	1152.2	Trident	429441.4	5407286.3		
CB002	722.4	sampleable sand	A	SE, TX, BMI	CB002	1246.1	Hamon	429474.2	5407449.2		
				PW	CB002-PW	1246.6	Trident	429475.4	5407451.7		
CB005	722.4	mixed coarse	P	SE, BMI	CB005	1155.5	freeze grab	429466.8	5407333.6		
				PW	CB005-PW	1156.6	Trident	429468.4	5407339.0	PW (and duplicate)	
CB006	722.5	sampleable sand	P	SE, TX, BMI	CB006	1231.1	Hamon	429539.9	5407413.5		
				PW	CB006-PW	1232.5	Trident	429538.9	5407415.6		
CB007	722.5	sampleable sand	P	SE, TX, BMI	CB007	1265.1	Hamon	429564.6	5407463.9		
				PW	CB007-PW	1253.8	Trident	429560.1	5407458.2		
CB009	722.5	sampleable sand	P	SE, TX, BMI	CB009	1231.4	Hamon	429606.3	5407433.5		
				PW	CB009-PW	1233.2	Trident	429612.8	5407433.4		
CB010	722.5	sampleable sand	A	SE, TX, BMI	CB010	1218.7	Hamon	429620.2	5407417.6	SE bioassay	
				PW	CB010-PW	1220.1	Trident	429620.9	5407419.2		PW (DOC)
CB012	722.5	sampleable sand	P	SE, TX, BMI	CB012	1212.5	Hamon	429600.6	5407386.9	SE chemistry [c]	
				PW	CB012-PW	1214.6	Trident	429601.4	5407389.5	PW	
CB014	722.5	sampleable sand	P	SE, TX, BMI	CB014	1159.8	VanVeen	429612.9	5407339.4	SE bioassay	SE chemistry
				PW	CB014-PW	1162.8	Trident	429614.2	5407342.4		
CB016	722.5	sampleable sand	P	SE, TX, BMI	CB016	1219.3	Hamon	429673.6	5407403.1		
				PW	CB016-PW	1217.8	Trident	429675.4	5407400.5	PW	
CB018	722.6	sampleable sand	P	SE, TX, BMI	CB018	1218.7	Hamon	429706.4	5407381.4		SE chemistry
				PW	CB018-PW	1219.7	Trident	429709.4	5407377.4		
CB020	722.6	sampleable sand	A	SE, TX, BMI	CB020	1218.2	VanVeen	429734.5	5407364.0		
				PW	CB020-PW	1219.0	Trident	429733.4	5407363.2		
CB021	722.6	mud	P	SE, TX, BMI	CB021	1245.5	VanVeen	429791.4	5407362.3		
				PW	CB021-PW	1245.0	Trident	429788.4	5407363.6		PW (TOC)
CB024	722.6	mud	P	SE, TX, BMI	CB024	1225.2	VanVeen	429795.3	5407333.3		
				PW	CB024-PW	1226.7	Trident	429797.5	5407333.5		
CB027	722.6	mud	P	SE, TX, BMI	CB027	1215.0	VanVeen	429793.9	5407320.1		
				PW	CB027-PW	1214.8	Trident	429794.4	5407318.6		
CB029	722.6	mud	P	SE, TX, BMI	CB029	1236.2	VanVeen	429819.0	5407311.6	SE bioassay	
				PW	CB029-PW	1236.3	Trident	429820.9	5407309.5		
CB035	723.0	mixed coarse	P	SE, BMI	CB035	1219.7	freeze grab	430352.1	5407151.9	SE chemistry (and duplicate)	SE chemistry
				PW	CB035-PW	1220.2	Trident	430355.4	5407157.4		
CB036	723.0	mixed coarse	A	SE, BMI	CB036	1218.2	freeze grab	430400.6	5407139.4	SE chemistry [c]	
				PW	CB036-PW	1218.1	Trident	430402.6	5407139.4		
CB039	723.2	sampleable sand	P	SE, TX, BMI	CB039	1223.5	Hamon	430652.6	5407207.3		
				PW	CB039-PW	1223.1	Trident	430645.7	5407204.2		
CB040	723.2	mixed coarse	A	SE, BMI	CB040	1216.7	freeze grab	430616.3	5407248.9	SE chemistry [c]	
				PW	CB040-PW	1217.2	Trident	430618.7	5407248.6		
CB041	723.2	coarse	P	PW	CB041-PW	1226.4	Trident	430770.7	5407130.1	PW	
CB043	723.2	coarse	P	PW	CB043-PW	1222.7	Trident	430661.0	5407261.4		PW (sulfide/alkalinity/chloride)
CB044	723.2	mud	P	SE, TX, BMI	CB044	1242.5	VanVeen	430666.1	5407348.2		
				PW	CB044-PW	1243.5	Trident	430666.5	5407349.1		
CB046	723.3	mixed coarse	P	SE, BMI	CB046	1225.7	freeze grab	430800.2	5407319.5		
				PW	CB046-PW	1225.7	Trident	430800.1	5407321.0		PW (sulfide/alkalinity/chloride)
CB047	723.4	sampleable sand	P	SE, TX, BMI	CB047	1234.4	Hamon	431021.4	5407419.3	SE chemistry, SE bioassay	
				PW	CB047-PW	1234.2	Trident	431014.6	5407414.5	PW	
CB048	723.5	coarse	P	PW	CB048-PW	1231.8	Trident	431088.4	5407419.5		
CB049	723.6	coarse	P	PW	CB049-PW	1236.1	Trident	431241.1	5407330.8		
CB052	723.8	coarse	P	PW	CB052-PW	1219.0	Trident	431594.4	5407515.8		
CB055	724.0	coarse	P	PW	CB055-PW	1228.4	Trident	431789.6	5407692.9		

Table 2-2. Locations Sampled for the Phase 3 Sediment Study

Location ID	River Mile	Target Stratum	QAPP Location Type (Resampled, Primary, Alternate)	Sample Type(s)	Sample ID	Elevation (ft)	Sampling Method	Sample Coordinates [a] X_UTM_11N (m)	Sample Coordinates [a] Y_UTM_11N (m)	EPA Split Sample Type	Field Duplicates
China Bend (continued)											
CB056	724.1	mixed coarse	A	SE, BMI	CB056	1246.6	freeze grab	432088.6	5407672.1	SE chemistry [c]	
				PW	CB056-PW	1246.8	Trident	432089.3	5407672.1		
JS001	723.4	sampleable sand	P	SE, TX, BMI	JS001	1239.0	Hamon	430963.8	5407513.1	SE bioassay	
				PW	JS001-PW	1238.7	Trident	430961.7	5407514.3		PW (metals)
JS002	723.5	sampleable sand	P	SE, TX, BMI	JS002	1248.2	Hamon	431067.8	5407575.4		
				PW	JS002-PW	1247.8	Trident	431068.7	5407577.4		
Deadman's Eddy											
1-B5-NRT-2019	737.9	NA	R	SE, TX, BMI	1-B5-NRT-2019	1284.5	VanVeen	446376.7	5421110.4		
				PW	1-B5-NRT-2019-PW	1284.4	Trident	446376.6	5421109.9		
1-B6-NRT-2019	737.9	NA	R	SE, TX, BMI	1-B6-NRT-2019	1285.0	VanVeen	446333.7	5421021.8		
				PW	1-B6-NRT-2019-PW	1285.5	Trident	446335.3	5421022.4		
DM002	737.7	sampleable sand	P	SE, TX, BMI	DM002	1260.5	Hamon	445979.1	5421228.3		
				PW	DM002-PW	1256.2	Trident	445983.4	5421235.6		
DM007	737.8	sampleable sand	A	SE, TX, BMI	DM007	1258.9	VanVeen	446081.8	5421187.8		
				PW	DM007-PW	1260.2	Trident	446085.4	5421192.0		PW (sulfide/alkalinity/chloride)
DM008	737.8	sampleable sand	P	SE, TX, BMI	DM008	1263.8	Hamon	446073.1	5421203.4	SE bioassay	
				PW	DM008-PW	1262.7	Trident	446070.2	5421203.7		PW (TOC)
DM010	737.8	sampleable sand	P	SE, TX, BMI	DM010	1282.2	Hamon	446114.2	5421212.9	SE chemistry	
				PW	DM010-PW	1282.0	Trident	446113.6	5421212.5	PW	
DM015	737.8	sampleable sand	P	SE, TX, BMI	DM015	1282.4	Hamon	446162.9	5421228.2		
				PW	DM015-PW	1282.0	Trident	446157.6	5421231.7		PW (sulfide/alkalinity/chloride)
DM016	737.8	sampleable sand	P	SE, TX, BMI	DM016	1274.4	Hamon	446174.2	5421156.1		SE chemistry
				PW	DM016-PW	1275.6	Trident	446171.0	5421158.5		
DM018	737.8	sampleable sand	P	SE, TX, BMI	DM018	1277.7	Hamon	446203.6	5421137.0		
				PW	DM018-PW	1279.1	Trident	446210.5	5421136.0		
DM019	737.8	sampleable sand	A	SE, TX, BMI	DM019	1282.1	Hamon	446210.2	5421183.6		
				PW	DM019-PW	1282.5	Trident	446207.4	5421190.9		
DM020	737.8	sampleable sand	A	SE, TX, BMI	DM020	1271.8	Hamon	446226.8	5421210.8		
				PW	DM020-PW	1272.3	Trident	446226.9	5421209.7	PW	
DM022	737.9	sampleable sand	P	SE, TX, BMI	DM022	1281.4	VanVeen	446236.5	5421154.7		
				PW	DM022-PW	1281.2	Trident	446232.5	5421157.9		PW (metals)
DM023	737.9	sampleable sand	P	SE, TX, BMI	DM023	1278.8	VanVeen	446260.4	5421164.4		
				PW	DM023-PW	1279.8	Trident	446259.2	5421167.1		PW (DOC)
DM024	737.9	sampleable sand	A	SE, TX, BMI	DM024	1280.9	VanVeen	446255.5	5421105.5	SE bioassay	SE chemistry
				PW	DM024-PW	1280.2	Trident	446253.0	5421105.1		PW (DOC, TOC)
DM025	737.9	sampleable sand	A	SE, TX, BMI	DM025	1276.6	Hamon	446316.8	5421096.9	SE bioassay	
				PW	DM025-PW	1278.2	Trident	446314.2	5421098.9		
DM026	737.9	sampleable sand	P	SE, TX, BMI	DM026	1279.1	VanVeen	446291.7	5421071.6	SE bioassay	SE chemistry
				PW	DM026-PW	1281.3	Trident	446292.2	5421074.2	PW	
DM027	737.9	sampleable sand	A	SE, TX, BMI	DM027	1270.6	Hamon	446314.2	5421057.3	SE chemistry [c]	
				PW	DM027-PW	1270.6	Trident	446314.7	5421058.4		
DM030	738.1	coarse	A	PW	DM030-PW	1274.0	Trident	446548.0	5420839.4		
DM036	738.2	mixed coarse	P	SE, BMI	DM036	1249.7	freeze grab	446707.3	5420447.4	SE chemistry	
				PW	DM036-PW	1249.6	Trident	446705.0	5420445.3		
DM038	738.3	mixed coarse	A	SE, BMI	DM038	1264.6	freeze grab	446765.4	5420446.2	SE chemistry [c]	
				PW	DM038-PW	1264.0	Trident	446763.3	5420452.8		
DM039	738.3	mixed coarse	P	SE, BMI	DM039	1266.7	freeze grab	446776.3	5420446.3		
				PW	DM039-PW	1267.2	Trident	446780.8	5420451.5		
DM043	738.3	coarse	A	PW	DM043-PW	1268.7	Trident	446767.9	5420318.9		
DM044	738.3	sampleable sand	P	SE, BMI	DM044	1270.6	freeze grab	446810.2	5420321.8		
				PW	DM044-PW	1271.0	Trident	446811.0	5420321.4		PW (metals)
DM045	738.3	sampleable sand	A	SE, TX, BMI	DM045	1269.1	Hamon	446834.1	5420282.3		
				PW	DM045-PW	1267.5	Trident	446834.1	5420285.4		
DM046	738.3	sampleable sand	A	SE, TX, BMI	DM046	1270.3	VanVeen	446851.9	5420281.7	SE bioassay	
				PW	DM046-PW	1270.7	Trident	446850.5	5420280.8		
DM047	738.3	mixed coarse	P	SE, BMI	DM047	1271.6	freeze grab	446817.4	5420451.8	SE chemistry [c]	
				PW	DM047-PW	1271.4	Trident	446818.4	5420453.5	PW	
DM050	738.3	sampleable sand	P	SE, TX, BMI	DM050	1266.9	VanVeen	446899.0	5420307.2		
				PW	DM050-PW	1266.9	Trident	446902.9	5420309.2		
DM057	738.3	sampleable sand	P	SE, TX	DM057	1257.1	Hamon	447031.8	5420489.1		
DM059	738.4	coarse	P	PW	DM059-PW	1271.9	Trident	447028.9	5420602.5	PW	
DM061	738.4	sampleable sand	P	SE, TX, BMI	DM061	1280.4	VanVeen	447099.1	5420647.0		
				PW	DM061-PW	1280.1	Trident	447097.0	5420648.3		
DM063	738.6	coarse	P	PW	DM063-PW	1280.1	Trident	447334.1	5420971.4		
DM064	738.7	coarse	A	PW	DM064-PW	1267.9	Trident	447286.3	5421164.0		

Table 2-2. Locations Sampled for the Phase 3 Sediment Study

Location ID	River Mile	Target Stratum	QAPP Location Type (Resampled, Primary, Alternate)	Sample Type(s)	Sample ID	Elevation (ft)	Sampling Method	Sample Coordinates [a] X_UTM_11N (m)	Y_UTM_11N (m)	EPA Split Sample Type	Field Duplicates
Birchbank[b]											
REF001	761.4	mixed	Reference	SE, TX, BMI	REF001	na	VanVeen	447454.0	5446001.2		
				PW	REF001-PW	na	Trident	447483.0	5445987.2		PW (DOC)
REF002	761.5	sand	Reference	SE, TX, BMI	REF002	na	VanVeen	447492.5	5446070.3		
				PW	REF002-PW	na	Trident	447491.7	5446069.3		
REF003	762.0	sand	Reference	SE, TX, BMI	REF003	na	hand tool	447871.1	5446882.0		
				PW	REF003-PW	na	Trident	447864.6	5446885.4	PW	
REF004	762.1	mixed	Reference	SE, TX, BMI	REF004	na	hand tool	447859.0	5446933.5	SE bioassay	
				PW	REF004-PW	na	Trident	447850.6	5446937.9		
Genelle[b]											
REF005	764.3	mixed	Reference	SE, TX, BMI	REF005	na	Hamon	448591.1	5450159.0		
				PW	REF005-PW	na	Trident	448589.5	5450162.9		
REF006	764.3	mixed	Reference	SE, TX, BMI	REF006	na	Hamon	448648.9	5450148.1		
				PW	REF006-PW	na	Trident	448652.5	5450145.7		
REF007	764.3	sand	Reference	SE, TX, BMI	REF007	na	VanVeen	448723.1	5450204.5	SE bioassay	
				PW	REF007-PW	na	Trident	448723.1	5450208.7		
REF008	764.3	sand	Reference	SE, TX, BMI	REF008	na	VanVeen	448616.7	5450237.3		
				PW	REF008-PW	na	Trident	448615.3	5450241.0		PW (TOC)
REF009A	764.4	sand	Reference	SE, TX, BMI	REF009A	na	Hamon	448650.6	5450377.2		
				PW	REF009A-PW	na	Trident	448643.5	5450377.2		PW (metals)
REF010	764.5	mixed	Reference	SE, TX, BMI	REF010	na	Hamon	448688.2	5450497.2		
				PW	REF010-PW	na	Trident	448686.2	5450496.1		
REF011	767.3	sand	Reference	SE, TX, BMI	REF011	na	VanVeen	451256.3	5453271.1	SE chemistry	SE chemistry
				PW	REF011-PW	na	Trident	451256.2	5453268.8	PW	PW (sulfide/alkalinity/chloride)
REF012	767.5	mixed	Reference	SE, TX, BMI	REF012	na	steel scoop	451479.0	5453439.5		
				PW	REF012-PW	na	Trident	451457.3	5453408.9		
Arrow Lake[b]											
REF013	786.6	sand/mud	Reference	SE, TX, BMI	REF013	na	VanVeen	435360.2	5466486.5		
				PW	REF013-PW	na	Trident	435360.0	5466490.1		
REF014	786.6	sand/mud	Reference	SE, TX, BMI	REF014	na	VanVeen	435317.9	5466528.7		SE chemistry
				PW	REF014-PW	na	Trident	435276.2	5466530.8		PW (metals)
REF015	786.8	sand/mud	Reference	SE, TX, BMI	REF015	na	VanVeen	435187.2	5466559.1	SE bioassay	
				PW	REF015-PW	na	Trident	435190.7	5466559.2		
REF016	808.4	sand/mud	Reference	SE, TX, BMI	REF016	na	VanVeen	418673.6	5492199.4		
				PW	REF016-PW	na	Trident	418672.8	5492198.3		
REF017	808.5	sand/mud	Reference	SE, TX, BMI	REF017	na	VanVeen	418652.0	5492299.1		
				PW	REF017-PW	na	Trident	418634.2	5492296.5		
REF018	808.5	sand/mud	Reference	SE, TX, BMI	REF018	na	VanVeen	418572.3	5492363.6		
				PW	REF018-PW	na	Trident	418597.5	5492360.1	PW	

Notes:

[a] Sample coordinates for sediment samples are the centroid of associated grab samples.

[b] Elevations were not assigned to Phase 3 sediment study locations at reference areas in British Columbia because a bathymetry digital elevation model is not available for the Columbia River at the reference areas.

[c] Following the field sampling effort, ten additional sediment split samples were provided to EPA to determine if inconsistencies observed between ALS Environmental (ALS) and Washington Department of Ecology Manchester Environmental Laboratory (MEL) in two of three mixed coarse sediment samples were due to the variable nature of the mixed coarse stratum or to analytical differences.

BMI - benthic macroinvertebrate
DOC - dissolved organic carbon
NA - not applicable
na - not available
PW - porewater
SE - sediment
TOC - total organic carbon
TX - potential toxicity testing

QAPP Location Type
A - alternate
P - primary
R - resample

Table 2-3. Samples Collected by Target Stratum and Area for the Phase 3 Sediment Study

Location	Target Stratum	Number of Locations Targeted	Number of Locations Sampled	Number by Media SE	Number by Media PW	Number by Media BMI	Comments
Site Locations[a]							
Deadman's Eddy AOI	sampleable sand	21	21	21	20	20	DM057 collected SE and TX, but no BMI or PW samples DM044 collected SE, PW, and BMI but no TX samples
	mixed coarse	6	4	4	4	4	
	mud	0	0	0	0	0	
	coarse	6	5	0 [c]	5	0 [c]	
	resample[b]	2	2	2	2	2	
China Bend AOI	sampleable sand	14	14	14	14	14	
	mixed coarse	6	6	6	6	6	
	mud	5	5	5	5	5	
	coarse	6	6	0 [c]	6	0 [c]	
	resample[b]	2	2	2	2	2	
Evans AOI	sampleable sand	21	22	21	22	21	EV059 collected PW but no SE, TX, or BMI samples EV046 collected PW samples but did not analyze due to no colocated SE, TX, or BMI samples
	mixed coarse	6	6	5	5	4	EV020 collected SE but no PW or BMI samples EV015 collected PW but no SE or BMI samples
	mud	5	5	5	5	5	
	coarse	6	6	0 [c]	6	0 [c]	
	resample[b]	2	2	2	2	2	
	Total Site	108	106	87	104	85	
Reference Locations							
Reference	sand/mud	6	6	6	6	6	
	sand	6	6	6	6	6	
	mixed	6	6	6	6	6	
	Total Reference	18	18	18	18	18	

Notes:

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

[b] Per the quality assurance project plan (QAPP), the resample locations were included to better understand possible relationships between historical and Phase 3 results. The resampled locations at Deadman's Eddy AOI were 9.4 and 20.2 meters away from the reported locations where the sediment samples were collected by the Natural Resources Trustees in 2013 (see Section 3.1). At Evans AOI, the offsets between 2013 Phase 2 locations and resample locations were 1 m or less, and at China Bend AOI the offsets were 2 and 10 m from the 2013 Phase 2 locations. The minor offsets between sampled location in 2013 and 2018, as well as other factors such as a 6-year interval between sampling, could influence the comparability of results.

[c] The sampling design for coarse target stratum locations included porewater (PW) sampling only (no sediment or sediment for benthic macroinvertebrate analysis [BM]).

SE - sediment

TX - potential toxicity testing

Table 2-4. Analytes by Sample Matrix

	Field-Collected Samples			Bioassay-Generated Samples			Equipment Blanks		
Analyte	Sediment	Porewater	BMI	Sediment at Start of Test	Sediment During Test, Days 7 and 21	Centrifuged Porewater During Test, Days 7 and 21	Sediment Field Equipment Rinsate Blanks	Porewater Field Equipment Blanks	Porewater Bioassay Laboratory Equipment Blanks
Metals									
Total metals [a]	X			X			X		
Dissolved metals, including major cations [b]		X				X		X	X
AVS and SEM	X				X				
TOC	X	X		X	X			X	
Grain Size	X								
Percent slag by BSEM	X [c]								
pH		X [d]				X			
PCBs	X[e]						X[e]		
PAHs	X[e]						X[e]		
Pesticides	X[e]						X[e]		
Chloride		X				X		X	
Sulfate		X				X		X	
Alkalinity		X				X		X	
Sulfide		see note [f]				X			
DOC		X				X			
42-day Bioassay testing	X [c]								
BMI Abundance			X						
BMI Taxonomy			X						
AFDW and blotted wet-weight biomass			X						

Notes:

[a] Total metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

[b] Dissolved metals include aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

[c] Bioassay testing and backscatter electron microscopy (BSEM) only conducted on a subset of collected field sediment samples.

[d] Porewater pH was measured in the field during porewater sample collection.

[e] Organic analytes only measured for sediment samples and associated equipment blanks collected at reference locations.

[f] Sulfide was not analyzed for any field porewater samples because none of these samples met the criteria for dissolved oxygen and oxidation-reduction potential to trigger analysis for sulfide.

AFDW - ash free dry weight
AVS - acid volatile sulfide
BMI - benthic macroinvertebrate
DOC - dissolved organic carbon
PAHs - polycyclic aromatic hydrocarbons
PCBs - polychlorinated biphenyls
SEM - simultaneously extracted metals
TOC - total organic carbon

Table 2-5. Analytical Methods for Sediment and Porewater Samples

Analyte	Sample Preparation		Quantitative Analysis	
	Protocol	Procedure	Protocol	Procedure
Sediment Samples				
Total metals: aluminum (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), manganese (Mn), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl), vanadium (V), and zinc (Zn)	EPA 3050B	acid digestion	EPA 6020A	ICP/MS
Total metals: calcium (Ca), iron (Fe), magnesium (Mg), potassium (K), and sodium (Na)	EPA 3050B	acid digestion	EPA 6010C	ICP/AES
Mercury (total)	EPA 7471B	acid digestion	EPA 7471B	cold vapor AA
SEM-AVS [a]	NA	NA	EPA 6010C/SEM-AVS	ICP/AES
TOC	NA	NA	ASTM D4129-05	coulometric
Grain Size	NA	NA	ASTM D422	gravimetric
Pesticides	EPA 3546	microwave extraction	EPA 8081B LL	GC/ECD
PAHs	EPA 3546	microwave extraction	EPA 8270D SIM	GC/MS
PCB Congeners	EPA 3546	microwave extraction	8082A-Cong	GC/ECD
PCB Aroclors	EPA 3546	microwave extraction	8082A-LL	GC/ECD
Porewater Samples				
Dissolved metals: aluminum (Al), antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), iron (Fe)[b], lead (Pb), manganese (Mn), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl), vanadium (V), and zinc (Zn)	EPA CLP MET-DIG	acid digestion	EPA 6020A	ICP/MS
Dissolved metals: calcium (Ca), iron (Fe)[b], magnesium (Mg), potassium (K), and sodium (Na)	EPA CLP MET-DIG	acid digestion	EPA 6010C	ICP/AES
TOC and DOC	NA	NA	EPA 9060A	coulometric
Alkalinity as $CaCO_3$	NA	NA	SM 2320 B	titration
Hardness as $CaCO_3$	NA	NA	SM 2340C	calculated
Chloride, sulfate	NA	NA	EPA 300.0	ion chromatography
Sulfide			SM 4500-S2 D	coulometric

Notes:

42-day *H. azteca* bioassay tests were performed on select sediment samples; bioassay testing is not listed in this table. Sediment and porewater samples generated from replicate chambers during bioassay tests were analyzed following the methods listed above, as appropriate.

Sediment samples were analyzed for benthic macroinvertebrate (BMI) enumeration and taxonomy, as well as ash-free dry weight (AFDW) and biomass wet weight. BMI testing is not listed in this table.

[a] Simultaneously extracted metals (SEM) analysis was conducted for eight metals: Sb, As, Cd, Cr, Cu, Pb, Ni, and Zn.

[b] Dissolved iron was analyzed using inductively coupled plasma/atomic emission spectrometry (ICP/AES) (EPA 6010C) for field porewater samples collected from in situ sediment using the Trident probe and for bioassay laboratory-generated porewater samples prepared using centrifugation.

AA - atomic absorption
ASTM - American Society of Testing and Materials
$CaCO_3$ - calcium carbonate
DOC - dissolved organic carbon
ECD - electron capture detector
GC - gas chromatography
MS - mass spectrometry
NA - not applicable
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
SEM-AVS - simultaneously extracted metal minus acid volatile sulfide
SM - Standard Methods for the Examination of Water and Wastewater
TOC - total organic carbon

Table 2-6. Analyses Conducted for Phase 3 Field Sediment and Field Porewater Samples

			Analyses Conducted on Field-Collected Samples					Quality Control Analyses			
Sample Area	Location ID	Target Stratum [a]	Sediment Chemistry	Porewater Chemistry	BMI	Bioassay	BSEM	Field Duplicate Sediment Chemistry	Field Duplicate Porewater Chemistry	Field Duplicate BMI	Equipment Rinsate Blanks
China Bend											
	3-R7-2019	NA	X	X	X	X					
	3-R8-2019	NA	X	X	X	X					
	CB002	sampleable sand	X	X	X	X	X				
	CB005	mixed coarse	X	X	X						SE
	CB006	sampleable sand	X	X	X	X					
	CB007	sampleable sand	X	X	X		X				
	CB009	sampleable sand	X	X	X						
	CB010	sampleable sand	X	X	X	X			DOC		SE
	CB012	sampleable sand	X	X	X						
	CB014	sampleable sand	X	X	X	X	X	X			
	CB016	sampleable sand	X	X	X						PW
	CB018	sampleable sand	X	X	X		X	X			
	CB020	sampleable sand	X	X	X	X				X	
	CB021	mud	X	X	X	X			TOC		
	CB024	mud	X	X	X						
	CB027	mud	X	X	X						
	CB029	mud	X	X	X	X				X	
	CB035	mixed coarse	X	X	X			X			
	CB036	mixed coarse	X	X	X						
	CB039	sampleable sand	X	X	X						
	CB040	mixed coarse	X	X	X						
	CB041	coarse		X							
	CB043	coarse		X					sulfide/alkalinity/chloride		
	CB044	mud	X	X	X	X					
	CB046	mixed coarse	X	X	X				sulfide/alkalinity/chloride		
	CB047	sampleable sand	X	X	X	X					
	CB048	coarse		X							
	CB049	coarse		X							
	CB052	coarse		X							
	CB055	coarse		X							
	CB056	mixed coarse	X	X	X						
	JS001	sampleable sand	X	X	X	X			metals		
	JS002	sampleable sand	X	X	X	X					
Deadman's Eddy											
	1-B5-NRT-2019	NA	X	X	X	X					
	1-B6-NRT-2019	NA	X	X	X	X					
	DM002	sampleable sand	X	X	X	X					
	DM007	sampleable sand	X	X	X	X			sulfide/alkalinity/chloride		
	DM008	sampleable sand	X	X	X	X			TOC		
	DM010	sampleable sand	X	X	X						
	DM015	sampleable sand	X	X	X				sulfide/alkalinity/chloride	X	
	DM016	sampleable sand	X	X	X			X			
	DM018	sampleable sand	X	X	X	X					
	DM019	sampleable sand	X	X	X	X					
	DM020	sampleable sand	X	X	X						
	DM022	sampleable sand	X	X	X				metals		PW
	DM023	sampleable sand	X	X	X				DOC		
	DM024	sampleable sand	X	X	X	X		X	DOC, TOC	X	
	DM025	sampleable sand	X	X	X	X					SE
	DM026	sampleable sand	X	X	X	X		X			
	DM027	sampleable sand	X	X	X	X					
	DM030	coarse		X							

Table 2-6. Analyses Conducted for Phase 3 Field Sediment and Field Porewater Samples

			Analyses Conducted on Field-Collected Samples					Quality Control Analyses			
Sample Area	Location ID	Target Stratum [a]	Sediment Chemistry	Porewater Chemistry	BMI	Bioassay	BSEM	Field Duplicate Sediment Chemistry	Field Duplicate Porewater Chemistry	Field Duplicate BMI	Equipment Rinsate Blanks
Deadman's Eddy (continued)											
	DM036	mixed coarse	X	X	X						
	DM038	mixed coarse	X	X	X						BMI
	DM039	mixed coarse	X	X	X						
	DM043	coarse		X							
	DM044	sampleable sand	X	X	X				metals		
	DM045	sampleable sand	X	X	X	X					
	DM046	sampleable sand	X	X	X	X	X				
	DM047	mixed coarse	X	X	X						
	DM050	sampleable sand	X	X	X	X					SE
	DM057	sampleable sand	X								
	DM059	coarse		X							
	DM061	sampleable sand	X	X	X						
	DM063	coarse		X							
	DM064	coarse		X							
Evans											
	4-B1-2019	NA	X	X	X	X					
	4-B6-2019	NA	X	X	X	X					
	EV001	sampleable sand	X	X	X		X	X			
	EV002	sampleable sand	X	X	X	X			DOC		
	EV003	sampleable sand	X	X	X						
	EV005	sampleable sand	X	X	X	X					
	EV008	sampleable sand	X	X	X	X					
	EV010	sampleable sand	X	X	X						PW
	EV011	mixed coarse	X [b]	X	X						
	EV012	sampleable sand	X	X	X						
	EV013	sampleable sand	X	X	X				metals		SE
	EV015	mixed coarse		X							
	EV018	coarse		X							
	EV020	mixed coarse	X [c]								SE
	EV022	mixed coarse	X [d]	X	X						
	EV023	coarse		X							
	EV024	coarse		X							
	EV026	sampleable sand	X	X	X						
	EV027	sampleable sand	X	X	X	X					
	EV032	coarse		X							
	EV036	mixed coarse	X	X	X					X	
	EV037	sampleable sand	X	X	X			X		X	PW
	EV038	coarse		X							
	EV043	coarse		X							
	EV044	mud	X	X	X	X					PW
	EV048	sampleable sand	X	X	X				metals		
	EV049	mixed coarse	X	X	X						
	EV051	sampleable sand	X	X	X	X			metals		
	EV052	sampleable sand	X	X	X						
	EV054	mud	X	X	X	X					
	EV057	mud	X	X	X						
	EV059	sampleable sand		X							
	EV060	sampleable sand	X	X	X				sulfide/alkalinity/chloride		SE
	EV063	mud	X	X	X	X					
	EV064	mud	X	X	X	X					
	EV065	sampleable sand	X	X	X			X			

Table 2-6. Analyses Conducted for Phase 3 Field Sediment and Field Porewater Samples

			Analyses Conducted on Field-Collected Samples					Quality Control Analyses			
Sample Area	Location ID	Target Stratum [a]	Sediment Chemistry	Porewater Chemistry	BMI	Bioassay	BSEM	Field Duplicate Sediment Chemistry	Field Duplicate Porewater Chemistry	Field Duplicate BMI	Equipment Rinsate Blanks
Evans (continued)											
	EV066	sampleable sand	X	X	X				TOC		
	EV069	sampleable sand	X	X	X	X			DOC	X	
	EV071	sampleable sand	X	X	X	X					
	EV072	sampleable sand	X	X	X			X	TOC		BMI
	EV075	sampleable sand	X	X	X				sulfide/alkalinity/chloride		
Reference											
	REF001	mixed	X	X	X	X			DOC		
	REF002	sand	X	X	X	X					
	REF003	sand	X	X	X	X				X	
	REF004	mixed	X	X	X	X					
	REF005	mixed	X	X	X	X					
	REF006	mixed	X	X	X	X					
	REF007	sand	X	X	X	X					
	REF008	sand	X	X	X	X			TOC		
	REF009A	sand	X	X	X	X			metals		
	REF010	mixed	X	X	X	X					
	REF011	sand	X	X	X	X		X	sulfide/alkalinity/chloride	X	SE
	REF012	mixed	X	X	X	X					
	REF013	sand/mud	X	X	X	X					
	REF014	sand/mud	X	X	X	X		X	metals		SE
	REF015	sand/mud	X	X	X	X					
	REF016	sand/mud	X	X	X	X					
	REF017	sand/mud	X	X	X	X					
	REF018	sand/mud	X	X	X						PW

Notes:

[a] Material sampled was dependent on the target stratum, e.g., only porewater was sampled for the "coarse" target stratum.
[b] Sediment from EV011 was not analyzed for acid volatile sufide (AVS) and simultaneously extracted metals (SEM).
[c] Sediment from EV020 was not analyzed for grain size, AVS, and SEM.
[d] Sediment from EV022 was not analyzed for grain size, AVS, SEM, total organic carbon (TOC), and mercury.
BMI - benthic macroinvertebrate
BSEM - backscattered scanning electron microscopy
DOC - dissolved organic carbon
NA - not applicable
PW- porewater
SE - sediment

Table 2-7. Locations where Sediment Bed did not Match Target Stratum

Sample Area	Location ID	QAPP Location Type (Primary, Alternate)	Target Stratum	Observed Sediment Bed Composition vs Target Stratum	Dates Attempted	Location Coordinates [a] X_UTM_11N (m)	Location Coordinates [a] Y_UTM_11N (m)
Evans							
	EV014	P	sampleable sand	more coarse	9/20/2019	422857	5391808
	EV016	A	mixed coarse	more coarse	9/28/2019, 10/2/2019	423197	5391663
	EV025	A	coarse	more sandy	10/8/2019	423743	5392072
	EV028	A	mixed coarse	more coarse	9/30/2019, 10/1/2019	423968	5392005
	EV031	A	mixed coarse	more coarse	9/30/2019	424127	5392055
	EV034	P	mixed coarse	more coarse	9/27/2019	424297	5392053
	EV039	A	mixed coarse	more coarse	10/2/2019	424508	5392336
	EV042	P	mixed coarse	more coarse [b]	9/14/2019, 9/27/2019	424768	5392626
	EV046	P	sampleable sand	more coarse [c]	9/23/2019	425232	5392896
	EV053	P	sampleable sand	more coarse	9/11/2019, 9/12/2019, 10/23/2019	424702	5393228
	EV058	P	sampleable sand	more coarse	9/11/2019, 9/12/2019, 10/23/2019	424681	5393481
	EV062	P	sampleable sand	more coarse	9/24/2019, 10/23/2019	425015	5393767
	EV067	P	sampleable sand	more coarse	9/11/2019, 9/12/2019, 10/1/2019, 10/23/2019	424537	5394017
	EV074	A	sampleable sand	more coarse	9/25/2019	424476	5394396
China Bend							
	CB008	P	sampleable sand	more coarse	10/12/2019	429571	5407441
	CB022	P	sampleable sand	more coarse	10/14/2019, 10/23/2019	429779	5407320
	CB031	P	sampleable sand	more coarse	10/10/2019	429858	5407245
	CB032	P	mixed coarse	more coarse	10/8/2019	430023	5407204
	CB034	A	mixed coarse	more coarse	10/8/2019	430149	5407087
	CB037	A	mixed coarse	more coarse	10/4/2019	430494	5407113
	CB038	P	mixed coarse	more coarse	10/3/2019	430548	5407140
	CB050	P	mixed coarse	more coarse	10/17/2019	431274	5407406
	CB054	A	mixed coarse	more coarse	10/17/2019	431812	5407633
Deadman's Eddy							
	DM004	A	mixed coarse	more coarse	10/17/2019	445998	5421196
	DM005	A	mixed coarse	more coarse	10/17/2019	446028	5421170
	DM012	A	mixed coarse	more coarse	10/23/2019	446097	5421153
	DM033	P	sampleable sand	more coarse	9/19/2019, 9/20/2019, 10/23/2019	446708	5420531
	DM034	A	sampleable sand	more coarse	9/19/2019, 9/20/2019, 10/23/2019	446666	5420469
	DM035	P	sampleable sand	more coarse	9/20/2019, 10/12/2019	446680	5420451
	DM037	A	sampleable sand	more coarse	9/19/2019, 10/23/2019	446729	5420368
	DM040	P	sampleable sand	more coarse	9/16/2019, 10/23/2019	446779	5420425
	DM041	A	sampleable sand	more coarse	9/17/2019, 10/23/2019	446770	5420396
	DM042	P	sampleable sand	more coarse	9/17/2019, 10/23/2019	446791	5420341
	DM048	P	sampleable sand	more coarse	9/17/2019, 10/8/2019	446869	5420366
	DM049	A	sampleable sand	more coarse	9/18/2019, 10/23/2019	446884	5420360

Table 2-7. Locations where Sediment Bed did not Match Target Stratum

Sample Area	Location ID	QAPP Location Type (Primary, Alternate)	Target Stratum	Observed Sediment Bed Composition vs Target Stratum	Dates Attempted	Location Coordinates [a]	
						X_UTM_11N (m)	Y_UTM_11N (m)
Deadman's Eddy (continued)							
	DM051	P	sampleable sand	more coarse	9/17/2019, 10/23/2019	446875	5420405
	DM052	P	sampleable sand	more coarse	9/17/2019, 10/23/2019	446900	5420400
	DM053	A	sampleable sand	more coarse	9/18/2019, 10/23/2019	446934	5420386
	DM054	A	sampleable sand	more coarse	9/19/2019, 10/23/2019	446847	5420524
	DM066	P	sampleable sand	more coarse	9/18/2019, 10/23/2019	447409	5421290

Notes:

[a] Target location coordinates shown are from the Phase 3 QAPP (Table B1-1). Up to 3 video assisted attempts were made within the mapped sediment facies polygon at each target location to identify a sampling location where the sediment bed matched the target stratum.

[b] Surface material observed was sand with cobble/boulder, but underneath appeared to be bedrock.

[c] On 9/23 a porewater sample was collected. Prior to collection the sediment bed was inspected using the Trident and the sediment matched the target stratum. On 9/25 the sediment team observed the sediment bed with a wider camera and determined sediment bed did not match target (too coarse).

A - alternate
P - primary

Table 2-8. Field Sieving and Hand Removal of Coarse Sediment

Location ID	Sample ID	Sample Date	Single Grab or Composited Grabs	Sampling Equipment	Number of Accepted Grabs used in Composite (1= no composite)	Sieved in Field (5 mm sieve)	Material Removed by Hand (> 3 in.)	Total Sample Amount (kg)	Sample Amount < 5 mm (kg)	Sample Amount > 5 mm and < 3 in. (kg)	Sample Amount > 3 in. (kg)
1-B5-NRT-2019	1-B5-NRT-SE-1-101519	10/15/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
1-B6-NRT-2019	1-B6-NRT-SE-1-101619	10/16/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
3-R7-2019	3-R7-2019-SE-1-101519	10/15/2019	single	Van Veen	1	no	yes	31.70	23.20	nm	8.50
3-R8-2019	3-R8-2019-SE-1-101619	10/16/2019	single	Hamon	1	no	no	nm	nm	nm	nm
4-B1-2019	4-B1-2019-SE-1-092619	9/26/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
4-B6-2019	4-B6-2019-SE-1-092619	9/26/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
CB002	CB002-SE-1-101619	10/16/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
CB005	CB005-SE-1-101819	10/18/2019	composite	freeze grab	2	no	yes	5.50	4.20	1.30	nm
CB006	CB006-SE-1-100919	10/9/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
CB007	CB007-SE-1-100919	10/9/2019	composite	Hamon	2	yes	no	33.90	8.70	15.00	10.20
CB009	CB009-SE-1-101219	10/12/2019	composite	Hamon	3	yes	yes	27.50	7.70	9.60	10.20
CB010	CB010-SE-1-101219	10/12/2019	composite	Hamon	2	yes	yes	38.50	28.80	6.10	3.60
CB012	CB012-SE-1-100919	10/9/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
CB014	CB014-SE-1-101519	10/15/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
CB016	CB016-SE-1-101119	10/11/2019	single	Hamon	1	yes	yes	18.10	11.20	4.90	2.00
CB018	CB018-SE-1-100919	10/9/2019	composite	Hamon	2	no	yes	52.00	51.70	0.30	nm
CB020	CB020-SE-1-101419	10/14/2019	single	Van Veen	1	no	yes	nm	nm	<1	nm
CB021	CB021-SE-1-101419	10/14/2019	single	Van Veen	1	no	yes	nm	nm	<1	nm
CB024	CB024-SE-1-101419	10/14/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
CB027	CB027-SE-1-101419	10/14/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
CB029	CB029-SE-1-101519	10/15/2019	single	Van Veen	1	No	no	nm	nm	nm	nm
CB035	CB035-SE-1-100319	10/3/2019	composite	freeze grab	3	yes	yes	10.07	5.00	0.90	4.80
CB036	CB036-SE-1-100419	10/4/2019	single	freeze grab	1	yes	yes	5.80	1.50	1.30	3.00
CB039	CB039-SE-1-101119	10/11/2019	composite	Hamon	2	yes	yes	20.30	9.70	7.90	2.70
CB040	CB040-SE-1-101819	10/18/2019	composite	freeze grab	4	no	yes	8.70	2.30	3.20	2.70
CB044	CB044-SE-1-101519	10/15/2019	single	Van Veen	1	no	yes	nm	nm	<1	nm
CB046	CB046-SE-1-100819	10/8/2019	composite	freeze grab	2	no	yes	9.20	4.40	0.10	4.70
CB047	CB047-SE-1-101119	10/11/2019	composite	Hamon	4	yes	no	47.90	27.30	20.60	nm
CB056	CB056-SE-1-101719	10/17/2019	composite	freeze grab	3	no	yes	15.90	6.40	7.20	2.30
DM002	DM002-SE-1-100919	10/9/2019	composite	Hamon	3	yes	yes	85.50	55.10	30.40	nm
DM007	DM007-SE-1-101519	10/15/2019	composite	Van Veen	2	no	no	nm	nm	nm	nm
DM008	DM008-SE-1-101119	10/11/2019	composite	Hamon	7	no	no	nm	nm	nm	nm
DM010	DM010-SE-1-101119	10/11/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
DM015	DM015-SE-1-101019	10/10/2019	composite	Hamon	3	no	no	nm	nm	nm	nm
DM016	DM016-SE-1-101019	10/10/2019	composite	Hamon	3	no	no	nm	nm	nm	nm
DM018	DM018-SE-1-100919	10/9/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
DM019	DM019-SE-1-101419	10/14/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
DM020	DM020-SE-1-101419	10/14/2019	composite	Hamon	3	no	no	nm	nm	nm	nm
DM022	DM022-SE-1-092119	9/21/2019	composite	Van Veen	2	no	no	nm	nm	nm	nm
DM023	DM023-SE-1-092119	9/21/2019	single	Van Veen	1	no	no	34.30	34.30	nm	nm
DM024	DM024-SE-1-101519	10/15/2019	composite	Van Veen	2	no	no	nm	nm	nm	nm
DM025	DM025-SE-1-101219	10/12/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
DM026	DM026-SE-1-092119	9/21/2019	composite	Van Veen	2	no	no	nm	nm	nm	nm
DM027	DM027-SE-1-101419	10/14/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
DM036	DM036-SE-1-101819	10/18/2019	composite	freeze grab	3	no	yes	16.09	0.69	4.80	10.60
DM038	DM038-SE-1-101919	10/19/2019	single	freeze grab	1	no	yes	12.30	4.70	1.80	5.80
DM039	DM039-SE-1-101719	10/17/2019	single	freeze grab	1	no	yes	4.14	0.94	0.30	2.90
DM044	DM044-SE-1-101619	10/16/2019	single	freeze grab	1	no	no	nm	nm	nm	nm
DM045	DM045-SE-1-091919	9/19/2019	composite	Hamon	2	no	no	15.00	15.00	nm	nm
DM046	DM046-SE-1-092019	9/20/2019	single	Van Veen	1	no	no	31.30	31.30	nm	nm

Table 2-8. Field Sieving and Hand Removal of Coarse Sediment

Location ID	Sample ID	Sample Date	Single Grab or Composited Grabs	Sampling Equipment	Number of Accepted Grabs used in Composite (1= no composite)	Sieved in Field (5 mm sieve)	Material Removed by Hand (> 3 in.)	Total Sample Amount (kg)	Sample Amount < 5 mm (kg)	Sample Amount > 5 mm and < 3 in. (kg)	Sample Amount > 3 in. (kg)
DM047	DM047-SE-1-101819	10/18/2019	single	freeze grab	1	yes	no	6.90	2.60	4.30	nm
DM050	DM050-SE-1-092019	9/20/2019	single	Van Veen	1	no	no	44.50	44.50	nm	nm
DM057	DM057-SE-1-091819	9/18/2019	single	Hamon	1	no	no	6.10	6.10	nm	nm
DM061	DM061-SE-1-101219	10/12/2019	single	Hamon	1	no	yes	6.30	5.60	0.70	nm
EV001	EV001-SE-1-092619	9/26/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV002	EV002-SE-1-092419	9/24/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV003	EV003-SE-1-092019	9/20/2019	composite	Hamon	3	yes	no	80.20	45.70	34.50	nm
EV005	EV005-SE-1-091119	9/11/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV008	EV008-SE-1-092319	9/23/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV010	EV010-SE-1-091219	9/12/2019	composite	Hamon	5	yes	no	106.60	66.40	40.20	nm
EV011	EV011-SE-1-092819	9/28/2019	single	freeze grab	1	no	yes	1.82	0.35	1.47	nm
EV012	EV012-SE-1-091319	9/13/2019	composite	Hamon	5	yes	no	99.20	55.60	43.60	nm
EV013	EV013-SE-1-091319	9/13/2019	composite	Hamon	4	yes	no	104.00	55.00	49.00	nm
EV020	EV020-SE-1-100219	10/2/2019	composite	freeze grab	5	yes	yes	5.90	0.40	3.40	2.10
EV022	EV022-SE-1-092819	9/28/2019	single	freeze grab	1	no	yes	0.13	0.03	0.10	nm
EV026	EV026-SE-1-092019	9/20/2019	composite	Hamon	5	no	yes	20.80	16.00	4.80	nm
EV027	EV027-SE-1-092119	9/21/2019	composite	Hamon	3	yes	yes	72.90	49.50	23.40	nm
EV036	EV036-SE-1-091419	9/14/2019	composite	freeze grab	3	yes	yes	11.70	3.53	0.57	7.60
EV037	EV037-SE-1-092319	9/23/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV044	EV044-SE-1-092419	9/24/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV048	EV048-SE-1-092419	9/24/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV049	EV049-SE-1-092719	9/27/2019	single	freeze grab	1	no	no	nm	nm	nm	nm
EV051	EV051-SE-1-092419	9/24/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV052	EV052-SE-1-092619	9/26/2019	single	Van Veen	1	yes	no	45.27	43.90	1.30	nm
EV054	EV054-SE-1-091119	9/11/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV057	EV057-SE-1-091119	9/11/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV060	EV060-SE-1-092119	9/21/2019	composite	Hamon	3	no	no	nm	nm	nm	nm
EV063	EV063-SE-1-091019	9/10/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV064	EV064-SE-1-091019	9/10/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV065	EV065-SE-1-092519	9/25/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV066	EV066-SE-1-092519	9/25/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV069	EV069-SE-1-092519	9/25/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV071	EV071-SE-1-092519	9/25/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
EV072[a]	EV072-SE-1-092619	9/26/2019	single	Van Veen	1	no	no	<0.1	nm	nm	nm
EV075	EV075-SE-1-091119	9/11/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
JS001	JS001-SE-1-101019	10/10/2019	composite	Hamon	3	no	no	nm	nm	nm	nm
JS002	JS002-SE-1-101019	10/10/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
REF001	REF001-SE-1-092819	9/28/2019	single	Van Veen	1	yes	no	45.81	39.46	6.35	nm
REF002	REF002-SE-1-092819	9/28/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
REF003	REF003-SE-1-092719	9/27/2019	single	shovel	1	no	No	nm	nm	nm	nm
REF004	REF004-SE-1-092719	9/27/2019	single	shovel	1	yes	yes	210.65	53.89	146.15	10.61
REF005	REF005-SE-1-100319	10/3/2019	composite	Hamon	8	yes	yes	129.10	54.80	74.30	nm
REF006	REF006-SE-1-100219	10/2/2019	composite	Hamon	6	yes	yes	69.90	42.70	27.20	nm
REF007	REF007-SE-1-093019	9/30/2019	composite	Van Veen	2	no	no	51.50	51.50	nm	nm
REF008	REF008-SE-1-093019	9/30/2019	single	Van Veen	1	no	no	nm	nm	nm	nm
REF009A	REF009A-SE-1-100219	10/2/2019	composite	Hamon	2	no	no	nm	nm	nm	nm
REF010	REF010-SE-1-100319	10/3/2019	composite	Hamon	7	yes	yes	102.30	47.30	55.00	nm
REF011	REF011-SE-1-100119	10/1/2019	composite	Van Veen	3	no	no	nm	nm	nm	nm
REF012	REF012-SE-1-100419	10/4/2019	single	steel scoop	1	yes	yes	55.50	38.20	17.30	nm
REF013	REF013-SE-1-092419	9/24/2019	composite	Van Veen	2	no	no	nm	nm	nm	nm

Table 2-8. Field Sieving and Hand Removal of Coarse Sediment

Location ID	Sample ID	Sample Date	Single Grab or Composited Grabs	Sampling Equipment	Number of Accepted Grabs used in Composite (1= no composite)	Sieved in Field (5 mm sieve)	Material Removed by Hand (> 3 in.)	Total Sample Amount (kg)	Sample Amount < 5 mm (kg)	Sample Amount > 5 mm and < 3 in. (kg)	Sample Amount > 3 in. (kg)
REF014	REF014-SE-1-092619	9/26/2019	composite	Van Veen	2	no	no	nm	nm	nm	nm
REF015[b]	REF015-SE-1-092619	9/26/2019	composite	Van Veen	2	no	yes	nm	nm	nm	nm
REF016[b]	REF016-SE-1-092519	9/25/2019	composite	Van Veen	2	no	yes	nm	nm	nm	nm
REF017	REF017-SE-1-092519	9/25/2019	composite	Van Veen	2	no	no	nm	nm	nm	nm
REF018[b]	REF018-SE-1-092519	9/25/2019	composite	Van Veen	2	no	yes	nm	nm	nm	nm

Notes:

[a] EV072 field notes state "Fine-coarse sand w/trace (<1%) round gravel" though no sieving noted.

[b] REF015 and REF018 field notes state material removed was woody debris or branches. No notes on what was removed in REF016.

nm - not measured

Table 2-9. Water Quality Parameters for Field-Collected Surface Water and Porewater by Location

		pH					Temperature (°C)					Conductivity (µS/cm)					DO (mg/L)[a]				ORP (mV)					TDS (ppm)				
		Surface Water	Porewater				Surface Water	Porewater				Surface Water	Porewater				Porewater				Surface Water	Porewater				Surface Water	Porewater			
Location ID	Data	Measured Value	Measured Value (in order of time recorded)				Measured Value Trident	Measured Value (in order of time recorded) Trident				Measured Value Trident	Measured Value (in order of time recorded) Trident				Measured Value (in order of time recorded)				Measured Value	Measured Value (in order of time recorded)				Measured Value	Measured Value (in order of time recorded)			
Site Samples																														
China Bend																														
3-R7-2019-PW	10/17/19 10:35	8.05	8.07	8.09	8.08	NA	10.50	10.70	10.70	10.70	NA	0.15	0.14	0.14	0.14	NA	8.60	8.64	8.55	NA	158	238	240	248	NA	98.0	95.9	95.8	95.8	NA
3-R8-2019-PW	10/19/19 14:56	7.91	8.15	8.16	8.15	NA	10.33	10.33	10.33	10.33	NA	0.15	0.14	0.14	0.14	NA	8.98	9.33	9.12	NA	213	230	248	254	NA	95.2	95.7	95.1	95.1	NA
CB002-PW	10/16/19 15:39	8.11	9.43	9.90	9.99	NA	10.43	10.71	10.74	10.74	NA	0.15	0.13	0.13	0.14	NA	3.93	3.00	2.65	NA	183	143	114	101	NA	98.8	100.1	86.6	88.3	NA
CB005-PW	10/19/19 12:03	7.87	8.11	8.07	8.14	8.17	10.31	10.42	10.41	10.40	10.39	0.15	0.15	0.15	0.14	0.14	7.90	8.33	8.36	8.39	225	236	258	260	259	95.6	98.6	97.6	97.3	96.9
CB006-PW	10/10/19 11:00	7.93	8.75	8.32	8.92	NA	11.51	11.60	11.85	11.91	NA	0.15	0.13	0.13	0.13	NA	4.87	3.73	3.03	NA	241	212	179	171	NA	95.4	89.3	88.6	88.2	NA
CB007-PW	10/11/19 15:47	8.04	7.27	7.51	7.42	NA	11.04	11.31	11.32	11.32	NA	0.15	0.18	0.18	0.17	NA	3.51	3.12	3.07	NA	195	45	16	23	NA	99.8	123.2	105.9	105.3	NA
CB009-PW	10/14/19 15:15	8.17	7.59	7.53	7.59	NA	10.59	10.76	10.74	10.73	NA	0.15	0.17	0.17	0.17	NA	4.97	4.78	4.71	NA	185	218	245	237	NA	96.2	112.0	109.6	107.2	NA
CB010-PW	10/14/19 12:35	8.05	8.65	8.52	8.71	NA	10.58	10.88	10.91	10.88	NA	0.15	0.44	0.21	0.21	NA	4.05	4.81	3.20	NA	202	176	192	163	NA	96.8	147.7	141.6	145.5	NA
CB012-PW	10/10/19 13:23	8.05	8.09	8.03	7.92	NA	11.48	11.73	12.00	12.04	NA	0.15	0.18	0.19	0.19	NA	6.99	3.51	3.03	NA	190	221	216	218	NA	98.6	102.5	110.9	110.5	NA
CB014-PW	10/19/19 9:30	8.03	8.18	8.18	8.21	NA	10.34	10.62	10.65	10.66	NA	0.15	0.12	0.12	0.12	NA	6.10	5.55	4.44	NA	215	223	237	233	NA	95.2	80.0	77.4	76.7	NA
CB016-PW	10/12/19 13:31	7.93	8.39	8.21	7.86	NA	10.88	11.15	11.29	11.24	NA	0.15	0.17	0.16	0.15	NA	5.77	3.24	2.75	NA	184	188	196	199	NA	95.8	83.6	102.2	113.9	NA
CB018-PW	10/10/19 15:35	8.00	9.30	9.93	10.15	NA	11.50	11.90	11.96	12.02	NA	0.15	0.10	0.11	0.11	NA	3.77	3.70	3.90	NA	196	149	111	82	NA	95.7	68.5	66.9	71.2	NA
CB020-PW	10/15/19 9:59	8.18	9.86	10.11	10.25	NA	10.45	10.68	10.80	10.80	NA	0.15	0.11	0.12	0.12	NA	4.40	3.80	3.58	NA	195	144	133	118	NA	97.6	69.8	74.5	77.8	NA
CB021-PW	10/16/19 9:21	8.07	8.66	8.87	8.94	NA	10.40	10.51	10.67	10.71	NA	0.15	0.21	0.21	0.21	NA	4.41	3.48	3.35	NA	174	186	175	155	NA	97.7	138.7	142.5	141.4	NA
CB024-PW	10/15/19 14:02	6.90	9.04	9.23	9.36	NA	10.48	10.62	10.66	10.66	NA	0.15	0.13	0.13	0.14	NA	3.83	2.93	2.70	NA	248	180	185	177	NA	99.9	86.1	87.7	89.0	NA
CB027-PW	10/15/19 12:14	8.23	7.84	9.47	9.41	NA	10.46	10.60	10.67	10.67	NA	0.15	0.16	0.17	0.17	NA	3.95	2.82	2.75	NA	180	152	179	160	NA	97.2	104.7	105.0	105.0	NA
CB029-PW	10/16/19 11:30	8.35	9.35	9.44	9.47	NA	10.39	10.61	10.07	10.67	NA	0.15	0.18	0.19	0.19	NA	3.71	3.16	2.80	NA	179	145	174	134	NA	96.2	108.4	111.5	112.4	NA
CB035-PW	10/17/19 12:41	8.14	8.03	8.02	7.52	NA	10.51	10.73	10.73	10.73	NA	0.15	0.17	0.17	0.16	NA	5.93	5.70	5.87	NA	205	229	232	224	NA	96.0	106.2	104.0	106.0	NA
CB036-PW	10/18/19 9:49	7.80	8.01	8.11	8.07	NA	10.53	10.64	10.63	10.62	NA	0.15	0.15	0.15	0.15	NA	8.66	8.61	8.34	NA	213	236	250	248	NA	96.8	98.2	97.6	98.2	NA
CB039-PW	10/14/19 10:11	7.98	8.07	7.83	7.80	NA	10.58	10.65	10.71	10.70	NA	0.15	0.15	0.16	0.16	NA	8.61	8.75	8.04	NA	184	237	233	231	NA	97.7	100.9	101.8	102.3	NA
CB040-PW	10/21/19 9:47	8.22	7.34	7.73	7.25	NA	10.09	10.03	10.09	10.11	NA	0.15	0.17	0.16	0.16	NA	7.60	7.11	7.04	NA	186	215	205	226	NA	97.3	112.6	108.5	119.0	NA
CB041-PW	10/21/19 12:03	7.42	7.66	7.39	7.45	NA	10.13	10.08	10.11	10.11	NA	0.15	0.14	0.14	0.14	NA	9.45	9.55	9.25	NA	235	242	248	248	NA	96.0	103.3	107.5	115.1	NA
CB043-PW	10/21/19 14:29	8.13	8.18	7.02	5.20	NA	10.10	10.15	10.16	10.17	NA	0.15	0.19	0.20	0.20	NA	9.71	9.00	8.77	NA	193	249	251	303	NA	98.5	138.7	141.2	118.5	NA
CB044-PW	10/16/19 13:50	8.20	8.48	8.55	8.47	NA	10.42	10.64	10.68	10.68	NA	0.15	0.34	0.34	0.34	NA	3.53	2.70	2.48	NA	190	180	145	138	NA	96.8	230.5	242.3	240.2	NA
CB046-PW	10/17/19 14:51	8.06	8.35	8.54	8.66	NA	10.54	10.75	10.75	10.75	NA	0.15	0.19	0.18	0.18	NA	5.09	3.97	3.81	NA	203	194	202	196	NA	100.0	113.0	112.3	110.1	NA
CB047-PW	10/12/19 10:48	7.89	7.85	7.70	7.85	NA	10.84	11.11	11.12	11.12	NA	0.15	0.18	0.18	0.17	NA	6.18	5.09	5.01	NA	192	210	202	225	NA	96.9	110.4	111.7	114.0	NA
CB048-PW	10/22/19 9:54	8.17	8.15	8.16	8.16	NA	10.18	10.15	10.17	10.18	NA	0.15	0.14	0.14	0.14	NA	9.65	9.53	9.42	NA	214	244	237	259	NA	95.0	96.0	95.7	95.6	NA
CB049-PW	10/22/19 13:00	8.21	8.17	8.15	8.19	NA	10.21	10.20	10.20	10.21	NA	0.15	0.14	0.14	0.14	NA	8.39	8.31	7.90	NA	216	249	242	246	NA	94.8	96.2	95.8	95.8	NA
CB052-PW	10/22/19 15:13	8.18	8.20	8.17	8.17	NA	10.23	10.29	10.28	10.29	NA	0.15	0.14	0.14	0.14	NA	8.45	8.58	8.71	NA	227	249	242	255	NA	95.7	96.0	96.2	96.3	NA
CB055-PW	10/18/19 14:07	8.14	8.13	8.17	8.18	NA	10.53	10.57	10.58	10.58	NA	0.15	0.15	0.15	0.15	NA	7.03	7.77	7.64	NA	211	225	228	236	NA	95.5	97.2	96.1	96.0	NA
CB056-PW	10/18/19 12:01	7.53	7.74	7.45	7.70	NA	10.54	10.67	10.68	10.67	NA	0.15	0.17	0.17	0.17	NA	6.08	3.90	3.71	NA	238	177	158	164	NA	100.2	109.8	110.8	109.3	NA
JS001-PW	10/11/19 10:14	8.11	9.39	9.68	9.80	NA	10.89	11.05	11.32	11.37	NA	0.15	0.13	0.13	0.14	NA	4.29	2.92	2.56	NA	219	161	110	101	NA	95.0	84.4	87.7	88.2	NA
JS002-PW	10/11/19 13:11	7.99	7.91	7.40	7.87	NA	11.02	11.54	11.60	11.62	NA	0.15	0.20	0.21	0.21	NA	3.76	2.80	2.39	NA	191	204	200	165	NA	98.2	115.5	117.3	117.3	NA
Deadman's Eddy																														
1-B5-NRT-2019-PW	10/15/19 11:32	7.50	7.15	7.19	7.24	NA	10.39	10.20	10.37	10.45	NA	0.15	0.61	0.62	0.64	NA	2.60	2.46	2.11	NA	203	-56	-79	-104	NA	98.9	388.2	388.5	393.9	NA
1-B6-NRT-2019-PW	10/15/19 13:37	7.06	7.28	7.93	8.10	NA	10.50	11.16	11.33	11.42	NA	0.15	0.26	0.26	0.26	NA	3.79	3.96	3.31	NA	211	111	121	137	NA	97.0	134.1	132.4	136.4	NA
DM002-PW	10/10/19 11:55	7.51	8.54	9.44	9.78	NA	11.24	11.08	11.36	11.42	NA	0.15	0.10	0.11	0.11	NA	5.09	3.76	3.65	NA	222	183	125	133	NA	97.6	69.8	69.8	73.5	NA
DM007-PW	10/16/19 10:57	7.53	8.06	7.83	7.85	NA	10.42	10.48	10.57	10.61	NA	0.15	0.14	0.14	0.14	NA	5.62	6.35	4.47	NA	189	183	145	212	NA	98.6	91.2	118.4	89.0	NA
DM008-PW	9/19/19 13:02	7.79	7.19	7.73	7.02	NA	17.01	16.95	16.83	16.91	NA	0.14	0.21	0.21	0.20	NA	4.66	4.87	4.96	NA	183	177	199	252	NA	92.5	102.9	101.3	105.9	NA
DM010-PW	9/21/19 10:30	7.26	6.46	7.12	6.96	NA	16.72	16.60	16.69	16.72	NA	0.14	0.22	0.21	0.21	NA	3.54	3.81	3.00	NA	244	248	228	233	NA	92.5	104.8	103.8	100.7	NA
DM015-PW	9/20/19 9:46	8.40	9.33	8.54	8.78	NA	16.46	16.27	16.44	16.51	NA	0.14	0.14	0.14	0.14	NA	4.03	4.61	3.94	NA	173	132	151	155	NA	90.7	97.0	113.8	103.8	NA
DM016-PW	9/21/19 13:08	7.06	7.01	7.14	7.21	NA	16.96	16.70	16.70	16.71	NA	0.14	0.12	0.12	0.13	NA	2.23	1.76	1.49	NA	198	200	201	279	NA	97.5	77.5	83.9	79.9	NA
DM018-PW	9/20/19 13:38	7.05	6.84	7.12	6.74	NA	17.18	16.73	16.70	16.67	NA	0.14	0.39	0.39	0.35	NA	2.22	1.68	1.34	NA	194	206	209	239	NA	137.5	136.6	116.3	128.1	NA
DM019-PW	10/12/19 16:00	7.29	7.24	7.96	7.98	NA	10.77	11.01	11.04	11.04	NA	0.15	0.24	0.23	0.22	NA	3.81	3.55	3.07	NA	259	244	108	65	NA	97.3	168.6	168.9	162.3	NA
DM020-PW	10/14/19 15:07	7.84	8.02	8.14	8.25	NA	10.60	10.75	10.76	10.77	NA	0.15	0.16	0.14	0.14	NA	5.06	3.77	2.64	NA	225	220	187	195	NA	100.2	102.0	97.2	96.0	NA
DM022-PW	9/18/19 12:43	6.98	9.04	9.87	9.39	NA	16.70	16.50	16.57	16.59	NA	0.14	0.18	0.22	0.23	NA	4.57	3.31	2.97	NA	253	155	95	80	NA	93.8	92.7	107.0	111.4	NA
DM023-PW	9/19/19 9:45	7.03	6.72	7.07	6.79	NA	16.14	15.96	16.13	16.19	NA	0.13	0.22	0.23	0.23	NA	4.52	2.68	2.32	NA	204	287	295	306	NA	89.6	110.9	112.8	111.1	NA
DM024-PW	10/15/19 15:25	7.41	7.46	8.08	8.16	NA	10.53	10.66	10.70	10.70	NA	0.15	0.24	0.23	0.23	NA	4.43	4.36	4.16	NA	238	245	197	175	NA	100.3	129.3	126.6	133.9	NA
DM025-PW	10/14/19 12:32	7.84	7.80	8.64	9.06	NA	10.53	10.60	10.72	10.74	NA	0.15	0.13	0.13	0.13	NA	7.15	6.39	6.39	NA	229	235	213	197	NA	99.4	89.5	86.7	88.6	NA
DM026-PW	9/17/19 16:38	6.90	5.90	6.72	6.53	NA	15.99	16.03	16.05	16.05	NA	0.14	0.09	0.10	0.10	NA	2.86	3.10	2.21	NA	240	252	218	314	NA	100.0	55.1	59.1	56.7	NA

Table 2-9. Water Quality Parameters for Field-Collected Surface Water and Porewater by Location

Location ID	Data	pH Surface Water Measured Value	pH Porewater Measured Value (in order of time recorded)				Temperature (°C) Surface Water Measured Value Trident	Temperature (°C) Porewater Measured Value (in order of time recorded) Trident				Conductivity (µS/cm) Surface Water Measured Value Trident	Conductivity (µS/cm) Porewater Measured Value (in order of time recorded) Trident				DO (mg/L)[a] Porewater Measured Value (in order of time recorded)				ORP (mV) Surface Water Measured Value	ORP (mV) Porewater Measured Value (in order of time recorded)				TDS (ppm) Surface Water Measured Value	TDS (ppm) Porewater Measured Value (in order of time recorded)			
Deadman's Eddy (continued)																														
DM027-PW	10/12/19 11:30	7.23	7.08	8.19	8.38	NA	10.72	10.08	10.39	10.48	NA	0.15	0.21	0.22	0.22	NA	6.90	6.66	6.71	NA	244	260	200	202	NA	96.2	122.4	124.6	134.3	NA
DM030-PW	10/18/19 15:27	7.53	8.02	8.06	8.17	NA	10.42	10.47	10.46	10.46	NA	0.15	0.15	0.15	0.15	NA	9.06	9.34	9.30	NA	222	228	226	232	NA	101.3	95.8	95.8	95.7	NA
DM036-PW	10/21/19 14:00	7.13	7.93	7.90	8.19	NA	10.26	10.26	10.30	10.31	NA	0.15	0.15	0.15	0.15	NA	9.81	9.63	9.51	NA	218	212	208	210	NA	99.0	107.3	100.7	96.6	NA
DM038-PW	10/21/19 11:45	7.56	7.96	7.81	8.06	NA	10.24	10.23	10.27	10.29	NA	0.15	0.15	0.15	0.15	NA	9.37	9.32	9.26	NA	171	177	202	212	NA	97.6	96.2	98.9	96.4	NA
DM039-PW	10/18/19 11:09	7.79	7.88	7.79	8.08	NA	10.37	10.43	10.45	10.46	NA	0.15	0.15	0.15	0.15	NA	9.25	9.30	9.36	NA	189	200	213	216	NA	96.4	96.6	96.2	96.1	NA
DM043-PW	10/18/19 13:20	7.52	8.08	8.08	8.11	NA	10.42	10.56	10.54	10.55	NA	0.15	0.17	0.17	0.17	NA	8.71	8.90	9.10	NA	212	221	214	218	NA	102.0	99.9	99.8	99.5	NA
DM044-PW	10/11/19 11:32	7.31	7.41	7.47	7.66	NA	10.92	10.75	10.88	11.00	NA	0.15	0.53	0.53	0.53	NA	4.19	3.85	3.02	NA	228	-73	-97	-133	NA	95.0	358.6	361.1	386.2	NA
DM045-PW	10/10/19 13:54	7.20	7.25	7.55	7.61	NA	11.29	11.34	11.41	11.43	NA	0.15	0.51	0.49	0.48	NA	3.22	3.53	3.17	NA	240	-50	-107	-126	NA	98.0	319.3	316.8	318.1	NA
DM046-PW	10/9/19 12:02	7.46	7.29	7.57	7.72	NA	11.70	11.37	11.66	11.76	NA	0.15	0.30	0.30	0.30	NA	5.27	4.10	3.99	NA	213	10	-42	-78	NA	97.2	211.5	205.6	209.9	NA
DM047-PW	10/19/19 13:09	7.70	7.87	7.64	8.00	NA	10.23	10.31	10.34	10.36	NA	0.15	0.16	0.20	0.22	NA	9.15	8.95	8.71	NA	160	177	192	200	NA	98.4	96.8	121.1	127.0	NA
DM050-PW	10/8/19 11:24	7.13	7.27	7.95	7.85	NA	12.39	12.43	12.55	12.57	NA	0.16	0.35	0.32	0.33	NA	5.59	5.77	5.42	NA	211	32	-11	44	NA	93.5	228.8	221.0	223.2	NA
DM059-PW	10/16/19 14:00	7.20	7.93	7.95	8.12	NA	10.48	10.51	10.53	10.54	NA	0.15	0.14	0.14	0.14	NA	9.09	9.63	10.23	NA	258	232	215	213	NA	97.0	98.0	98.8	97.3	NA
DM061-PW	10/11/19 15:22	8.05	7.61	7.59	7.62	NA	11.15	11.29	11.31	11.32	NA	0.15	0.28	0.37	0.37	NA	6.50	5.89	5.63	NA	260	115	69	47	NA	94.2	163.5	191.9	236.7	NA
DM063-PW	10/17/19 11:52	7.35	7.42	7.94	7.89	NA	10.58	10.63	10.64	10.66	NA	0.15	0.14	0.14	0.14	NA	8.81	8.80	8.90	NA	161	188	192	200	NA	98.7	96.1	95.0	102.9	NA
DM064-PW	10/17/19 14:13	7.99	8.11	7.95	8.17	NA	10.71	10.76	10.76	10.75	NA	0.15	0.14	0.14	0.14	NA	9.85	9.98	10.24	NA	231	246	233	234	NA	93.8	98.9	93.8	93.9	NA
Evans																														
4-B1-2019-PW	9/27/19 11:51	8.21	7.72	7.36	6.68	NA	16.40	16.19	16.23	16.24	NA	0.15	0.21	0.21	0.21	NA	3.68	3.19	2.92	NA	199	183	211	235	NA	94.8	153.5	115.8	142.7	NA
4-B6-2019-PW	10/2/19 10:09	7.73	7.75	7.50	7.50	NA	14.51	14.59	14.69	14.70	NA	0.14	0.19	0.20	0.20	NA	5.45	4.58	4.04	NA	252	229	235	236	NA	93.1	112.1	121.4	122.1	NA
EV001-PW	9/28/19 14:57	7.95	8.06	8.14	8.18	NA	15.95	15.72	15.83	15.86	NA	0.14	0.21	0.21	0.21	NA	3.75	3.26	2.52	NA	237	224	223	219	NA	95.1	119.4	117.3	115.3	NA
EV002-PW	9/21/19 14:06	8.01	8.24	8.28	8.27	NA	16.89	16.75	16.90	16.71	NA	0.13	0.18	0.17	0.18	NA	3.55	NA	NA	NA	242	225	223	220	NA	92.7	114.8	116.9	117.1	NA
EV003-PW	9/27/19 14:15	8.25	8.13	7.79	7.83	NA	16.27	16.13	16.20	16.23	NA	0.14	0.18	0.18	0.18	NA	4.51	3.94	3.71	NA	204	215	215	216	NA	93.6	102.4	104.3	105.6	NA
EV005-PW	9/21/19 12:30	7.98	8.47	8.49	8.47	NA	16.84	16.69	16.66	16.68	NA	0.13	0.19	0.19	0.19	NA	4.53	NA	NA	NA	221	201	175	179	NA	92.6	130.1	132.0	132.3	NA
EV008-PW	9/28/19 9:43	7.06	7.33	7.85	7.72	NA	15.97	15.80	15.90	15.92	NA	0.14	0.20	0.19	0.19	NA	5.13	4.68	3.82	NA	226	202	230	238	NA	98.0	123.1	109.8	109.3	NA
EV010-PW	9/21/19 10:34	8.04	8.66	8.83	8.90	NA	16.74	16.71	16.71	16.70	NA	0.13	0.18	0.18	0.18	NA	4.75	NA	NA	NA	230	202	146	166	NA	97.3	113.0	116.0	117.0	NA
EV011-PW	10/3/19 14:31	7.58	7.35	7.29	7.55	NA	14.23	14.22	14.25	14.25	NA	0.14	0.14	0.14	0.14	NA	7.73	8.34	8.59	NA	221	245	250	241	NA	93.7	104.1	108.3	96.6	NA
EV012-PW	9/20/19 14:21	8.06	8.39	8.55	8.60	NA	16.80	16.66	16.64	16.64	NA	0.13	0.25	0.28	0.27	NA	3.67	NA	NA	NA	211	187	198	192	NA	91.5	114.6	116.3	116.7	NA
EV013-PW	9/20/19 12:36	8.00	7.91	8.19	8.38	NA	16.59	16.75	16.75	16.58	NA	0.13	0.20	0.20	0.20	NA	5.14	NA	NA	NA	191	146	201	173	NA	92.1	136.1	133.3	131.7	NA
EV015-PW	10/9/19 10:24	8.11	8.07	7.87	8.01	NA	12.45	12.53	12.56	12.55	NA	0.15	0.14	0.14	0.40	NA	6.93	6.89	7.12	NA	223	222	221	227	NA	94.3	105.0	103.0	102.5	NA
EV018-PW	10/2/19 14:03	7.95	8.11	6.89	7.33	NA	14.67	14.64	14.65	14.65	NA	0.14	0.15	0.15	0.14	NA	8.49	8.76	8.73	NA	208	223	251	253	NA	93.7	95.5	102.4	104.7	NA
EV022-PW	10/3/19 12:03	8.13	7.57	7.07	7.67	NA	14.24	14.32	14.35	14.39	NA	0.14	0.20	0.19	0.19	NA	6.50	5.95	5.83	NA	223	232	248	235	NA	91.1	109.8	108.6	127.3	NA
EV023-PW	10/4/19 11:17	8.23	7.49	7.47	7.35	NA	13.98	13.98	14.08	14.09	NA	0.14	0.16	0.16	0.16	NA	9.53	9.24	9.15	NA	235	227	233	242	NA	92.2	114.9	132.1	107.5	NA
EV024-PW	10/4/19 13:40	7.94	7.42	7.08	7.79	NA	13.82	13.88	13.98	13.97	NA	0.14	0.20	0.20	0.19	NA	6.68	6.48	6.32	NA	211	238	251	230	NA	95.8	126.3	111.1	108.5	NA
EV026-PW	9/24/19 11:23	8.23	8.27	8.26	8.35	NA	16.91	16.86	16.86	16.84	NA	0.15	0.18	0.18	0.18	NA	6.68	6.36	6.43	NA	229	219	228	220	NA	102.4	99.1	100.1	100.5	NA
EV027-PW	9/28/19 12:20	8.21	6.93	7.67	7.79	NA	15.98	15.81	15.89	15.91	NA	0.14	0.25	0.25	0.25	NA	4.85	3.16	2.89	NA	263	244	240	265	NA	95.1	149.1	121.2	122.9	NA
EV032-PW	10/22/19 11:10	7.46	7.88	7.66	7.65	NA	10.10	10.10	10.13	10.14	NA	0.15	0.15	0.15	0.15	NA	8.78	8.36	8.31	NA	169	176	198	210	NA	100.6	94.9	94.9	95.3	NA
EV036-PW	10/3/19 9:40	7.88	6.64	7.65	7.55	NA	14.27	14.30	14.41	14.42	NA	0.14	0.30	0.34	0.34	NA	4.46	4.35	3.56	NA	242	241	218	207	NA	96.5	136.0	138.3	134.5	NA
EV037-PW	9/24/19 14:54	8.19	7.98	7.99	7.63	7.79	16.93	16.71	16.62	16.60	16.60	0.15	0.28	0.29	0.30	0.30	4.45	3.27	2.55	2.45	193	231	210	232	220	93.1	192.1	204.7	215.6	209.6
EV038-PW	10/22/19 13:20	7.47	6.83	7.34	7.57	NA	10.07	10.13	10.12	10.12	NA	0.15	0.15	0.15	0.15	NA	9.48	8.30	8.31	NA	206	237	218	227	NA	97.3	97.7	95.4	95.2	NA
EV043-PW	10/23/19 12:32	8.19	8.26	8.24	8.23	NA	10.12	10.03	10.06	10.08	NA	0.15	0.14	0.14	0.14	NA	8.65	9.15	8.77	NA	224	241	248	253	NA	95.0	95.1	95.2	95.3	NA
EV044-PW	9/20/19 10:13	7.84	7.12	7.11	7.16	NA	16.48	16.50	16.40	16.44	NA	0.13	0.34	0.36	0.35	NA	5.44	NA	NA	NA	211	-36	-46	-56	NA	91.5	205.1	203.8	206.7	NA
EV048-PW	9/30/19 11:32	7.75	8.46	8.53	8.50	NA	15.00	14.99	15.20	15.22	NA	0.23	0.14	0.24	0.24	NA	4.65	4.54	3.74	NA	219	151	172	169	NA	94.5	119.1	121.0	122.2	NA
EV049-PW	10/1/19 15:06	8.09	7.96	7.90	7.73	NA	14.59	14.68	14.76	14.77	NA	0.14	0.19	0.20	0.20	NA	5.10	3.96	3.31	NA	203	189	186	190	NA	91.4	143.6	143.9	137.6	NA
EV051-PW	9/25/19 8:59	8.12	10.16	10.19	10.17	NA	16.71	16.44	16.44	16.45	NA	0.15	0.20	0.20	0.21	NA	3.65	3.85	2.77	NA	226	104	91	100	NA	92.4	93.5	109.6	126.1	NA
EV052-PW	9/27/19 9:33	8.22	9.51	9.71	9.65	NA	16.21	16.12	16.16	16.18	NA	0.14	0.18	0.19	0.19	NA	4.67	3.27	2.71	NA	219	151	145	141	NA	94.0	99.9	104.4	105.9	NA
EV054-PW	9/18/19 12:07	8.04	7.28	7.23	7.34	NA	16.77	16.77	16.74	16.74	NA	0.12	0.28	0.28	0.28	NA	3.86	NA	NA	NA	164	-60	-77	-104	NA	90.1	201.0	202.2	203.2	NA
EV057-PW	9/19/19 12:47	8.06	7.13	7.13	7.15	NA	16.23	16.31	16.17	16.29	NA	0.13	0.43	0.43	0.43	NA	3.44	NA	NA	NA	236	-86	-86	-97	NA	91.3	335.5	333.8	331.7	NA
EV059-PW	9/25/19 12:43	7.58	8.82	9.00	8.74	NA	16.80	16.75	16.74	16.74	NA	0.15	0.21	0.23	0.25	NA	3.86	2.22	2.35	NA	236	147	147	141	NA	93.9	110.5	115.8	120.0	NA
EV060-PW	9/26/19 13:58	8.22	8.82	7.87	7.89	NA	16.57	16.53	16.48	16.46	NA	0.15	0.33	0.26	0.24	NA	4.37	3.40	2.57	NA	213	150	152	157	NA	95.7	118.9	131.6	128.7	NA
EV063-PW	9/19/19 10:30	7.85	7.14	7.10	7.10	NA	16.14	16.28	16.27	16.27	NA	0.13	0.35	0.36	0.36	NA	4.57	NA	NA	NA	239	-41	-41	-59	NA	91.4	288.3	278.1	281.6	NA
EV064-PW	9/17/19 16:50	7.96	7.23	7.22	7.23	NA	17.37	17.20	17.18	17.19	NA	0.13	0.43	0.43	0.42	NA	2.34	1.69	2.39	NA	228	-116	-137	-123	NA	92.1	291.3	285.5	274.7	NA
EV065-PW	9/23/19 12:53	8.11	9.13	9.15	8.96	NA	17.10	16.89	16.93	16.92	NA	0.15	0.21	0.22	0.21	NA	3.85	3.62	3.65	NA	215	162	173	181	NA	95.7	114.9	114.5	132.5	NA

Table 2-9. Water Quality Parameters for Field-Collected Surface Water and Porewater by Location

		pH					Temperature (°C)					Conductivity (µS/cm)					DO (mg/L)[a]				ORP (mV)					TDS (ppm)				
		Surface Water	Porewater				Surface Water	Porewater				Surface Water	Porewater				Porewater				Surface Water	Porewater				Surface Water	Porewater			
Location ID	Data	Measured Value	Measured Value (in order of time recorded)				Measured Value Trident	Measured Value (in order of time recorded) Trident				Measured Value Trident	Measured Value (in order of time recorded) Trident				Measured Value (in order of time recorded)				Measured Value	Measured Value (in order of time recorded)				Measured Value	Measured Value (in order of time recorded)			
Evans (continued)																														
EV066-PW	9/26/19 11:43	7.66	7.50	7.34	7.09	NA	16.63	16.48	16.44	16.43	NA	0.15	0.20	0.21	0.21	NA	4.89	3.36	2.41	NA	221	197	212	234	NA	98.3	108.6	125.2	135.5	NA
EV069-PW	9/26/19 9:16	8.17	8.06	7.82	7.19	NA	16.64	16.46	16.48	16.48	NA	0.15	0.18	0.17	0.17	NA	4.44	4.28	3.71	NA	224	232	230	239	NA	94.7	103.6	102.3	108.2	NA
EV071-PW	10/1/19 9:44	7.64	7.37	7.28	7.85	NA	14.50	14.49	14.64	14.66	NA	0.14	0.31	0.20	0.20	NA	5.45	5.35	3.32	NA	248	201	219	211	NA	97.3	147.2	170.9	135.1	NA
EV072-PW	9/30/19 14:34	8.15	8.87	8.65	8.12	NA	15.18	15.13	15.20	15.21	NA	0.14	0.22	0.23	0.23	NA	4.63	4.06	4.25	NA	202	145	161	177	NA	95.1	121.7	127.4	119.1	NA
EV075-PW	9/18/19 14:55	7.69	8.54	8.49	8.34	NA	16.83	16.85	16.78	16.77	NA	0.13	0.17	0.18	0.18	NA	3.20	NA	NA	NA	209	164	167	135	NA	93.1	114.8	116.9	118.3	NA
Reference Samples																														
REF001-PW	9/27/19 13:40	7.22	6.70	7.34	7.51	NA	15.56	15.53	15.55	15.55	NA	0.13	0.18	0.18	0.18	NA	5.94	5.76	5.71	NA	237	268	214	222	NA	87.7	94.5	92.2	92.5	NA
REF002-PW	9/27/19 10:56	7.10	6.62	7.04	7.08	NA	15.47	14.89	14.93	14.94	NA	0.13	0.15	0.15	0.15	NA	5.33	4.98	4.72	NA	326	300	249	236	NA	87.2	84.0	95.5	88.8	NA
REF003-PW	9/28/19 11:21	7.39	6.73	6.95	6.32	NA	14.87	14.54	14.51	14.59	NA	0.13	0.18	0.18	0.18	NA	6.92	6.90	6.94	NA	306	271	258	282	NA	86.1	92.7	93.6	94.9	NA
REF004-PW	9/28/19 14:17	7.73	7.79	7.04	6.84	NA	14.86	14.70	14.60	14.60	NA	0.13	0.16	0.15	0.15	NA	8.48	8.54	8.63	NA	245	238	261	274	NA	90.2	90.1	101.2	95.3	NA
REF005-PW	10/1/19 15:44	7.15	6.92	6.81	6.76	NA	13.88	13.84	13.91	13.92	NA	0.12	0.15	0.15	0.15	NA	6.04	6.20	6.23	NA	205	213	274	293	NA	85.6	84.1	82.9	82.3	NA
REF006-PW	10/3/19 14:05	7.25	6.76	7.01	6.81	NA	12.72	13.05	13.13	13.13	NA	0.12	1.06	0.22	0.22	NA	2.03	4.66	2.05	NA	178	131	166	137	NA	85.7	130.1	124.0	130.6	NA
REF007-PW	9/30/19 16:32	7.43	7.00	7.43	7.38	NA	14.28	14.22	14.24	14.26	NA	0.12	0.29	0.30	0.30	NA	2.82	2.59	2.56	NA	218	38	-39	-51	NA	86.3	189.6	309.0	192.3	NA
REF008-PW	10/1/19 12:59	7.01	6.74	6.63	6.59	NA	13.70	13.73	13.81	13.86	NA	0.12	0.23	0.21	0.19	NA	3.09	2.47	2.37	NA	216	106	80	70	NA	93.8	120.7	117.9	142.4	NA
REF009A-PW	10/3/19 11:36	7.24	7.06	6.91	6.87	NA	14.18	14.19	14.21	14.23	NA	0.12	0.23	0.23	0.23	NA	3.76	2.88	2.27	NA	211	221	222	221	NA	86.3	163.8	160.2	144.0	NA
REF010-PW	10/4/19 10:21	7.49	7.54	6.78	7.01	NA	11.51	11.25	11.48	11.55	NA	0.13	0.23	0.23	0.23	NA	5.18	4.32	3.58	NA	214	160	165	148	NA	86.8	144.2	142.5	141.5	NA
REF011-PW	10/2/19 11:29	7.18	7.26	6.98	6.72	6.91	13.60	12.21	12.15	12.16	12.26	0.12	0.24	0.25	0.25	0.25	7.28	7.07	6.77	6.48	288	295	326	246	229	97.1	120.3	128.7	158.6	190.3
REF012-PW	10/2/19 15:37	7.75	7.10	7.01	7.32	NA	13.74	13.31	13.24	13.25	NA	0.12	0.26	0.26	0.26	NA	4.72	4.21	4.11	NA	204	285	250	196	NA	80.7	164.5	191.1	196.1	NA
REF013-PW	9/26/19 11:08	6.99	7.24	7.30	7.45	NA	15.58	15.38	15.25	15.26	NA	0.11	0.26	0.26	0.26	NA	4.21	3.73	3.65	NA	250	231	215	194	NA	77.9	157.8	162.4	159.9	NA
REF014-PW	9/24/19 14:18	6.99	7.00	7.21	7.23	NA	12.10	12.39	12.38	12.36	NA	0.12	0.25	0.26	0.26	NA	6.33	5.61	4.72	NA	212	0	-38	-46	NA	77.9	130.6	146.9	153.0	NA
REF015-PW	9/24/19 12:10	7.06	6.78	6.83	6.80	NA	9.37	10.35	9.91	9.75	NA	0.12	0.16	0.16	0.16	NA	5.67	5.96	4.46	NA	278	42	5	-6	NA	81.4	85.0	84.2	82.0	NA
REF016-PW	9/25/19 10:28	6.92	6.89	7.25	7.13	NA	13.24	12.52	12.89	12.70	NA	0.11	0.14	0.13	0.13	NA	6.58	6.24	6.05	NA	231	143	124	128	NA	77.5	73.7	73.5	72.7	NA
REF017-PW	9/25/19 12:20	6.99	7.19	7.57	7.55	NA	7.16	8.83	8.23	8.14	NA	0.12	0.16	0.16	0.15	NA	7.21	6.51	6.86	NA	238	252	209	212	NA	82.0	112.1	86.8	86.1	NA
REF018-PW	9/25/19 14:42	7.01	6.58	6.68	6.75	NA	7.54	8.52	8.18	8.07	NA	0.12	0.11	0.12	0.13	NA	3.41	3.91	3.10	NA	238	33	41	26	NA	83.7	77.0	65.1	66.1	NA

Notes:

[a] Dissolved oxygen (DO) not measured in surface water

NA - not applicable

ORP - oxidation reduction potential

TDS - total dissolved solids

Table 2-10. Equipment Blank-to-Sample Association

Equipment Blank Sample ID	Equipment Rinsed	Sample Area	Vessel	Sample Week Number	Associated Sample Count	Associated Samples	Date Collected
Sediment							
EV013-SE-4-091319	stainless steel spoon	Evans	Cayuse	1	10	EV005-SE-1-091119	9/11/2019
						EV010-SE-1-091219	9/12/2019
						EV012-SE-1-091319	9/13/2019
						EV013-SE-1-091319	9/13/2019
						EV036-SE-1-091419	9/14/2019
						EV054-SE-1-091119	9/11/2019
						EV057-SE-1-091119	9/11/2019
						EV063-SE-1-091019	9/10/2019
						EV064-SE-1-091019	9/10/2019
						EV075-SE-1-091119	9/11/2019
EV060-SE-4-092119	stainless steel scoop	Evans	Ingalls	2	4	EV003-SE-1-092019	9/20/2019
						EV026-SE-1-092019	9/20/2019
						EV027-SE-1-092119	9/21/2019
						EV060-SE-1-092119	9/21/2019
DM050-SE-4-092019	large stainless steel scoop	Deadman's Eddy	Cayuse	2	8	DM022-SE-1-092119	9/21/2019
						DM023-SE-1-092119	9/21/2019
						DM026-SE-1-092119	9/21/2019
						DM026-SE-2-092119	9/21/2019
						DM045-SE-1-091919	9/19/2019
						DM046-SE-1-092019	9/20/2019
						DM050-SE-1-092019	9/20/2019
						DM057-SE-1-091819	9/18/2019
EV072-BMI-4-092619[a]	Van Veen sampler	Evans	Ingalls	3	22	4-B1-2019-SE-1-092619	9/26/2019
						4-B6-2019-SE-1-092619	9/26/2019
						EV001-SE-1-092619	9/26/2019
						EV001-SE-2-092619	9/26/2019
						EV002-SE-1-092419	9/24/2019
						EV008-SE-1-092319	9/23/2019
						EV011-SE-1-092819	9/28/2019
						EV022-SE-1-092819	9/28/2019
						EV037-SE-1-092319	9/23/2019
						EV037-SE-2-092319	9/23/2019
						EV044-SE-1-092419	9/24/2019
						EV048-SE-1-092419	9/24/2019
						EV049-SE-1-092719	9/27/2019
						EV051-SE-1-092419	9/24/2019
						EV052-SE-1-092619	9/26/2019
						EV065-SE-1-092519	9/25/2019
						EV065-SE-2-092519	9/25/2019
						EV066-SE-1-092519	9/25/2019
						EV069-SE-1-092519	9/25/2019
						EV071-SE-1-092519	9/25/2019

Table 2-10. Equipment Blank-to-Sample Association

Equipment Blank Sample ID	Equipment Rinsed	Sample Area	Vessel	Sample Week Number	Associated Sample Count	Associated Samples	Date Collected
Sediment (continued)							
EV072-BMI-4-092619[a]	Van Veen sampler	Evans	Ingalls	3	22	EV072-SE-1-092619	9/26/2019
						EV072-SE-2-092619	9/26/2019
REF014-SE-4-092619	Van Veen sampler, mixing bowl, funnel	Reference	Cayuse	3	11	REF001-SE-1-092819	9/28/2019
						REF002-SE-1-092819	9/28/2019
						REF003-SE-1-092719	9/27/2019
						REF004-SE-1-092719	9/27/2019
						REF013-SE-1-092419	9/24/2019
						REF014-SE-1-092619	9/26/2019
						REF014-SE-2-092619	9/26/2019
						REF015-SE-1-092619	9/26/2019
						REF016-SE-1-092519	9/25/2019
						REF017-SE-1-092519	9/25/2019
						REF018-SE-1-092519	9/25/2019
EV020-SE-4-100219	freeze grab sampler and stainless steel bowl	China Bend	Ingalls	4	4	CB035-SE-1-100319	10/3/2019
						CB035-SE-2-100319	10/3/2019
						CB036-SE-1-100419	10/4/2019
		Evans				EV020-SE-1-100219	10/2/2019
REF011-SE-4-100119	two scoops	Reference	Cayuse	4	9	REF005-SE-1-100319	10/3/2019
						REF006-SE-1-100219	10/2/2019
						REF007-SE-1-093019	9/30/2019
						REF008-SE-1-093019	9/30/2019
						REF009A-SE-1-100219	10/2/2019
						REF010-SE-1-100319	10/3/2019
						REF011-SE-1-100119	10/1/2019
						REF011-SE-2-100119	10/1/2019
						REF012-SE-1-100319	10/2/2019
CB010-SE-4-101219	bowl	China Bend	Ingalls	5	8	CB009-SE-1-101219	10/12/2019
						CB010-SE-1-101219	10/12/2019
						CB016-SE-1-101119	10/11/2019
						CB039-SE-1-101119	10/11/2019
						CB046-SE-1-100819	10/8/2019
						CB047-SE-1-101119	10/11/2019
						JS001-SE-1-101019	10/10/2019
						JS002-SE-1-101019	10/10/2019
DM025-SE-4-101219	Hamon grab sampler	China Bend	Cayuse	5	14	CB006-SE-1-100919	10/9/2019
						CB007-SE-1-100919	10/9/2019
						CB012-SE-1-100919	10/9/2019
						CB018-SE-1-100919	10/9/2019
						CB018-SE-2-100919	10/9/2019
		Deadman's Eddy				DM002-SE-1-100919	10/9/2019
						DM008-SE-1-101119	10/11/2019
						DM010-SE-1-101119	10/11/2019
						DM015-SE-1-101019	10/10/2019

Table 2-10. Equipment Blank-to-Sample Association

Equipment Blank Sample ID	Equipment Rinsed	Sample Area	Vessel	Sample Week Number	Associated Sample Count	Associated Samples	Date Collected
Sediment (continued)							
DM025-SE-4-101219	Hamon grab sampler	Deadman's Eddy	Cayuse	5	14	DM016-SE-1-101019	10/10/2019
						DM016-SE-2-101019	10/10/2019
						DM018-SE-1-100919	10/9/2019
						DM025-SE-1-101219	10/12/2019
						DM061-SE-1-101219	10/12/2019
CB005-SE-4-101819	stainless steel scoop	China Bend	Ingalls	6	14	3-R7-2019-SE-1-101519	10/15/2019
						3-R8-2019-SE-1-101619	10/16/2019
						CB002-SE-1-101619	10/16/2019
						CB005-SE-1-101819	10/18/2019
						CB014-SE-1-101519	10/15/2019
						CB014-SE-2-101519	10/15/2019
						CB020-SE-1-101419	10/14/2019
						CB021-SE-1-101419	10/14/2019
						CB024-SE-1-101419	10/14/2019
						CB027-SE-1-101419	10/14/2019
						CB029-SE-1-101519	10/15/2019
						CB040-SE-1-101819	10/18/2019
						CB044-SE-1-101519	10/15/2019
						CB056-SE-1-101719	10/17/2019
DM038-BMI-4-101919[a]	freeze grab sampler	Deadman's Eddy	Cayuse	6	13	1-B5-NRT-SE-1-101519	10/15/2019
						1-B6-NRT-SE-1-101619	10/16/2019
						DM007-SE-1-101519	10/15/2019
						DM019-SE-1-101419	10/14/2019
						DM020-SE-1-101419	10/14/2019
						DM024-SE-1-101519	10/15/2019
						DM024-SE-2-101519	10/15/2019
						DM027-SE-1-101419	10/14/2019
						DM036-SE-1-101819	10/18/2019
						DM038-SE-1-101919	10/19/2019
						DM039-SE-1-101719	10/17/2019
						DM044-SE-1-101619	10/16/2019
						DM047-SE-1-101819	10/18/2019
Porewater							
DM022-PW-4-091819[b]	Trident driveframe #1	Deadman's Eddy	Tieton	NA	40	DM008-PW-1-091919	9/19/2019
						DM008-PW-2-091919	9/19/2019
						DM015-PW-1-092019	9/20/2019
						DM015-PW-2-092019	9/20/2019
						DM018-PW-1-092019	9/20/2019
						DM022-PW-1-091819	9/18/2019
						DM022-PW-2-091819	9/18/2019
						DM023-PW-1-091919	9/19/2019
						DM023-PW-2-091919	9/19/2019
						DM026-PW-1-091719	9/17/2019

Table 2-10. Equipment Blank-to-Sample Association

Equipment Blank Sample ID	Equipment Rinsed	Sample Area	Vessel	Sample Week Number	Associated Sample Count	Associated Samples	Date Collected
Porewater (continued)							
DM022-PW-4-091819[b]	Trident driveframe #1	Deadman's Eddy	Tieton	NA	40	DM010-PW-1-092119	9/21/2019
						DM016-PW-1-092119	9/21/2019
						DM002-PW-1-101019	10/10/2019
						DM019-PW-1-101219	10/12/2019
						DM027-PW-1-101219	10/12/2019
						DM044-PW-1-101119	10/11/2019
						DM044-PW-2-101119	10/11/2019
						DM045-PW-1-101019	10/10/2019
						DM046-PW-1-100919	10/9/2019
						DM050-PW-1-100819	10/8/2019
						DM061-PW-1-101119	10/11/2019
						1-B5-NRT-PW-1-101519	10/15/2019
						1-B6-NRT-PW-1-101519	10/15/2019
						DM007-PW-1-101619	10/16/2019
						DM007-PW-2-101619	10/16/2019
						DM020-PW-1-101419	10/14/2019
						DM024-PW-1-101519	10/15/2019
						DM024-PW-2-101519	10/15/2019
						DM025-PW-1-101419	10/14/2019
						DM030-PW-1-101819	10/18/2019
						DM039-PW-1-101819	10/18/2019
						DM043-PW-1-101819	10/18/2019
						DM047-PW-1-101919	10/19/2019
						DM059-PW-1-101619	10/16/2019
						DM063-PW-1-101719	10/17/2019
						DM064-PW-1-101719	10/17/2019
						DM036-PW-1-102119	10/21/2019
						DM038-PW-1-102119	10/21/2019
		Evans				EV032-PW-1-102219	10/22/2019
						EV038-PW-1-102219	10/22/2019
REF018-PW-4-092619	Trident probe	Reference	Tieton	NA	23	REF001-PW-1-092719	9/27/2019
						REF001-PW-2-092719	9/27/2019
						REF002-PW-1-092719	9/27/2019
						REF003-PW-1-092819	9/28/2019
						REF004-PW-1-092819	9/28/2019
						REF013-PW-1-092619	9/26/2019
						REF014-PW-1-092419	9/24/2019
						REF014-PW-2-092419	9/24/2019
						REF015-PW-1-092419	9/24/2019
						REF016-PW-1-092519	9/25/2019
						REF017-PW-1-092519	9/25/2019
						REF018-PW-1-092519	9/25/2019
						REF005-PW-1-100119	10/1/2019

Table 2-10. Equipment Blank-to-Sample Association

Equipment Blank Sample ID	Equipment Rinsed	Sample Area	Vessel	Sample Week Number	Associated Sample Count	Associated Samples	Date Collected
Porewater (continued)							
REF018-PW-4-092619	Trident probe	Reference	Tieton	NA	23	REF006-PW-1-100319	10/3/2019
						REF007-PW-1-093019	9/30/2019
						REF008-PW-1-100119	10/1/2019
						REF008-PW-2-100119	10/1/2019
						REF009A-PW-1-100319	10/3/2019
						REF009A-PW-2-100319	10/3/2019
						REF010-PW-1-100419	10/4/2019
						REF011-PW-1-100219	10/2/2019
						REF011-PW-2-100219	10/2/2019
						REF012-PW-1-100219	10/2/2019
EV010-PW-4-092119	Trident vibraframe	Evans	Yeti	NA	14	EV002-PW-1-092119	9/21/2019
						EV002-PW-2-092119	9/21/2019
						EV005-PW-1-092119	9/21/2019
						EV010-PW-1-092119	9/21/2019
						EV054-PW-1-091819	9/18/2019
						EV057-PW-1-091919	9/19/2019
						EV063-PW-1-091919	9/19/2019
						EV064-PW-1-091719	9/17/2019
						EV075-PW-1-091819	9/18/2019
						EV075-PW-2-091819	9/18/2019
						EV012-PW-1-092019	9/20/2019
						EV013-PW-1-092019	9/20/2019
						EV013-PW-2-092019	9/20/2019
						EV044-PW-1-092019	9/20/2019
EV044-PW-4-092019[b]	Trident probe vibraframe, Teflon	Evans	Yeti	NA	14	EV002-PW-1-092119	9/21/2019
						EV002-PW-2-092119	9/21/2019
						EV005-PW-1-092119	9/21/2019
						EV010-PW-1-092119	9/21/2019
						EV054-PW-1-091819	9/18/2019
						EV057-PW-1-091919	9/19/2019
						EV063-PW-1-091919	9/19/2019
						EV064-PW-1-091719	9/17/2019
						EV075-PW-1-091819	9/18/2019
						EV075-PW-2-091819	9/18/2019
						EV012-PW-1-092019	9/20/2019
						EV013-PW-1-092019	9/20/2019
						EV013-PW-2-092019	9/20/2019
						EV044-PW-1-092019	9/20/2019
EV037-PW-4-092419	Trident driveframe #2	Evans	Yeti	NA	32	4-B1-2019-PW-1-092719	9/27/2019
						EV001-PW-1-092819	9/28/2019
						EV003-PW-1-092719	9/27/2019
						EV008-PW-1-092819	9/28/2019
						EV026-PW-1-092419	9/24/2019

Table 2-10. Equipment Blank-to-Sample Association

Equipment Blank Sample ID	Equipment Rinsed	Sample Area	Vessel	Sample Week Number	Associated Sample Count	Associated Samples	Date Collected
Porewater (continued)							
EV037-PW-4-092419	Trident driveframe #2	Evans	Yeti	NA	32	EV027-PW-1-092819	9/28/2019
						EV037-PW-1-092419	9/24/2019
						EV051-PW-1-092519	9/25/2019
						EV051-PW-2-092519	9/25/2019
						EV052-PW-1-092719	9/27/2019
						EV059-PW-1-092519	9/25/2019
						EV060-PW-1-092619	9/26/2019
						EV060-PW-2-092619	9/26/2019
						EV065-PW-1-092319	9/23/2019
						EV066-PW-1-092619	9/26/2019
						EV066-PW-2-092619	9/26/2019
						EV069-PW-1-092619	9/26/2019
						EV069-PW-2-092619	9/26/2019
						4-B6-2019-PW-1-100219	10/2/2019
						EV011-PW-1-100319	10/3/2019
						EV018-PW-1-100219	10/2/2019
						EV022-PW-1-100319	10/3/2019
						EV023-PW-1-100419	10/4/2019
						EV024-PW-1-100419	10/4/2019
						EV036-PW-1-100319	10/3/2019
						EV048-PW-1-093019	9/30/2019
						EV048-PW-2-093019	9/30/2019
						EV049-PW-1-100119	10/1/2019
						EV071-PW-1-100119	10/1/2019
						EV072-PW-1-093019	9/30/2019
						EV072-PW-2-093019	9/30/2019
						EV043-PW-1-102319	10/23/2019
CB016-PW-4-101219	Trident driveframe	China Bend	Yeti	NA	39	3-R7-2019-PW-1-101719	10/17/2019
						3-R8-2019-PW-1-101919	10/19/2019
						CB002-PW-1-101619	10/16/2019
						CB005-PW-1-101919	10/19/2019
						CB006-PW-1-101019	10/10/2019
						CB007-PW-1-101119	10/11/2019
						CB009-PW-1-101419	10/14/2019
						CB010-PW-1-101419	10/14/2019
						CB010-PW-2-101419	10/14/2019
						CB012-PW-1-101019	10/10/2019
						CB014-PW-1-101919	10/19/2019
						CB016-PW-1-101219	10/12/2019
						CB018-PW-1-101019	10/10/2019
						CB020-PW-1-101519	10/15/2019
						CB021-PW-1-101619	10/16/2019
						CB021-PW-2-101619	10/16/2019

Table 2-10. Equipment Blank-to-Sample Association

Equipment Blank Sample ID	Equipment Rinsed	Sample Area	Vessel	Sample Week Number	Associated Sample Count	Associated Samples	Date Collected
Porewater (continued)							
CB016-PW-4-101219	Trident driveframe	China Bend	Yeti	NA	39	CB024-PW-1-101519	10/15/2019
						CB027-PW-1-101519	10/15/2019
						CB029-PW-1-101619	10/16/2019
						CB035-PW-1-101719	10/17/2019
						CB036-PW-1-101819	10/18/2019
						CB039-PW-1-101419	10/14/2019
						CB040-PW-1-102119	10/21/2019
						CB041-PW-1-102119	10/21/2019
						CB043-PW-1-102119	10/21/2019
						CB043-PW-2-102119	10/21/2019
						CB044-PW-1-101619	10/16/2019
						CB046-PW-1-101719	10/17/2019
						CB046-PW-2-101719	10/17/2019
						CB047-PW-1-101219	10/12/2019
						CB048-PW-1-102219	10/22/2019
						CB049-PW-1-102219	10/22/2019
						CB052-PW-1-102219	10/22/2019
						CB055-PW-1-101819	10/18/2019
						CB056-PW-1-101819	10/18/2019
						JS001-PW-1-101119	10/11/2019
						JS001-PW-2-101119	10/11/2019
						JS002-PW-1-101119	10/11/2019
		Evans				EV015-PW-1-100919	10/9/2019

Notes:

[a] Equipment blank collected from a benthic macroinvertebrate (BMI) sampling attempt but sampling method (Van Veen and freeze grab sampler) are consistent with sediment sample locations.

[b] Equipment blank samples were collected without the glass beads in the Trident probe.

NA - not applicable

Table 2-11. Test Conditions for the 42-Day *Hyalella azteca* Bioassay

Parameter	Conditions
Test type	Whole-sediment toxicity test with renewal of overlying water
Temperature	23 ± 1°C
Test duration	42 days
Light quality	Wide-spectrum fluorescent lights
Illuminance	About 100 to 1,000 lux
Photoperiod	16L:8D
Test chamber	300-mL high-form lipless beaker
Sediment volume	100 mL
Overlying water	SAM-5S reconstituted water (Borgmann 1996) modified to contain 0.4 mg bromide/L
Overlying water volume	175 mL in the sediment exposure from Day 0 to Day 28 270 mL for the water-only exposure from Day 28 to Day 42
Renewal of overlying water	2 intermittent volume additions/day (e.g., 1 volume addition every 12 hour)
Sediment equilibration	Equilibrate sediment samples in beakers for 7 days (Day -7 to Day 0) with twice daily water changes
Age of organisms[a]	7-to-8 days old at the start of the test with a goal of achieving starting weights in the range of 0.02 to 0.035 mg/organism. The weight of a representative sample of organisms at the start of sediment exposures will be documented.
Number of organisms/chamber	10 (add 30 organisms to the 1-L chemistry only chambers)
Number of replicate bioassay chambers/treatment	12 replicates for biological endpoints; 4 replicates will be sacrificed for 28-day growth measurements and 8 replicates will be continued on with the water-only exposure for 35-day survival and reproduction and 42-day survival, growth, and reproduction.
Number of replicate chemistry chambers/treatment	10 replicates for chemistry only as follows: ▪ 2 replicates to collect sediment samples for analysis of AVS, SEM, and TOC; 1 for sample collection on Day 7 and 1 for Day 21 ▪ 2 sets of 4 replicates (1 L of sediment distributed across 4, 1 L beakers per set) to equilibrate sediment for collecting porewater using centrifugation on Days 7 and 21; 500 mL overlying water per 1L beaker; porewater will be analyzed for dissolved metals (including major cations), dissolved organic carbon, pH, sulfide, chloride, sulfate, and alkalinity.
Feeding[a]	YCT and fish flake food (e.g., Tetramin) according to the following schedule: ▪ YCT: 1.0 mL/beaker-day ▪ Flake fish food suspension: – Week 1 – 0.25 mg/beaker-day – Week 2 – 0.5 mg/beaker-day – Week 3 – 1.0 mg/beaker-day – Week 4 – 1.5 mg/beaker-day – Week 5 – 2.0 mg/beaker-day – Week 6 – 2.5 mg/beaker-day

Table 2-11. Test Conditions for the 42-Day *Hyalella azteca* Bioassay

Parameter	Conditions
Aeration	None, unless DO in overlying water drops below 2.5 mg/L.
Test chamber cleaning	If screens become clogged during a test, gently brush the outside of the screen.
Overlying water quality	Hardness, alkalinity, and ammonia at Day 0, 28, 35, and 42; temperature and DO daily; conductivity weekly; pH three times/week. Concentrations of DO should be measured more often if DO drops more than 1 mg/L since the previous measurement.
Endpoints	28-day survival, weight, and biomass; 35-day survival and reproduction; and 42-day survival, weight, biomass reproduction, and number of adult males and females on Day 42.
Test acceptability	Minimum mean control survival of 80% on Day 28.

Notes:

[a] The specified parameter is a project-specific condition that has been modified from EPA guidance USEPA (2000) based on discussions with EPA in advance of the Phase 2 Sediment study (Windward 2017) and during bioassay webinars conducted to prepare for the Phase 3 sediment study (McCaig 2019).

AVS - acid volatile sulfide
DO - dissolved oxygen
SAM-5S - standard artificial medium - 5 salts
SEM - simultaneously extracted metals
TOC - total organic carbon
YCT - yeast, cereal leaves, and Tetramin

Table 2-12. Test Acceptability Requirements for a 42-Day Sediment Toxicity Test with *Hyalella azteca*

A.	**Test Acceptability Criteria**	
	1	Mean survival of *H. azteca* in the negative laboratory control sediment on Day 28 must be greater than or equal to 80%. The test will be repeated if this criterion is not met.
	2	Age of *H. azteca* at the start of the test should be 7-to-8 days old.
	3	All organisms in a test must be from the same source. If organisms are purchased, vendor information must be reported.
B.	**Performance Goals**	
	1	Mean survival of *H. azteca* in the negative laboratory control sediment on Day 42 should be greater than or equal to 80%.[a]
	2	Mean weight of *H. azteca* in the negative laboratory control sediment should be greater than or equal to 0.35 mg dw/individual on Day 28, and greater than or equal to 0.5 mg dw/individual on Day 42.[a]
	3	Mean reproduction of *H. azteca* in the negative laboratory control sediment by Day 42 should be greater than or equal to 6.0 young per female.[a]
	4	Hardness, alkalinity, and ammonia in the overlying water typically should not vary by more than 50% during the sediment exposure, and DO should be maintained above 2.5 mg/L in the overlying water.
	5	The daily mean test temperature should be within ±1°C of 23°C. The instantaneous temperature should be within ±3°C of 23°C.
C.	**Additional Requirements**	
	1	Data from 96-hour water-only reference toxicity tests will be used to assess genetic strain or life-stage sensitivity of test organisms to select chemicals.
	2	Initial dry weights of organisms should be determined and reported.
	3	All test chambers (and compartments) should be identical and should contain the same amount of sediment and overlying water.
	4	Negative laboratory control sediment, quartz sand negative control sediment, and appropriate treatment controls (in Toxicity Identification Evaluations) must be included in a test.
	5	Test organisms must be cultured and tested at 23°C (±1°C).
	6	Natural physio-chemical characteristics of test sediment collected from the field should be within the tolerance limits of the test organisms. (See USEPA [2000] for standard tolerance limits).
	7	Source of overlying water and control sediments must be documented and reported.

Source: USEPA (2000) and ASTM (2019)

Notes:

EPA (2000) guidance uses the term test acceptability requirements, which includes criteria that must be met for a test to be considered acceptable and other criteria that should be met as a goal for conducting a good test. For the purposes of providing clear language for the Phase 3 sediment study and as was used in the Phase 2 sediment study, the two types of requirements are distinguished as follows: test acceptability criteria that must be met are referred to as criteria and those that should be met are referred to as performance goals.

The text for Test Acceptability Criteria #1 and Performance Goals #1 through #3 has been modified from the quality assurance project plan (QAPP) to clarify that the criteria for mean survival, weight and reproduction apply to the negative laboratory control only. For the quartz sand negative control, these endpoints are not considered test acceptablity requirements.

[a] EPA's suggested performance-based guidelines for demonstration of food quality are as follows: 1) mean survival of *H. azteca* in the negative laboratory control sediment on Day 42 should be greater than or equal to 80%; 2) mean weight of *H. azteca* in the negative laboratory control sediment should be greater than or equal to 0.3 mg dw/individual on Day 28, and greater than or equal to 0.5 mg dw/individual on Day 42, and 3) mean reproduction of *H. azteca* in the negative laboratory control sediment by Day 42 should be greater than or equal to 4.0 young per female.

DO - dissolved oxygen

Table 2-13. Sample Batches for the 42-Day Bioassays

Sampling Location[a]	Sample Type	Sampling Area	Target Stratum
Batch 1			
1-B5-NRT	site	Deadman's Eddy AOI	NA
3-R7	site	China Bend AOI	NA
CB002	site	China Bend AOI	sampleable sand
CB020	site	China Bend AOI	sampleable sand
CB021	site	China Bend AOI	mud
DM007	site	Deadman's Eddy AOI	sampleable sand
DM008 [b]	site	Deadman's Eddy AOI	sampleable sand
DM019	site	Deadman's Eddy AOI	sampleable sand
DM025	site	Deadman's Eddy AOI	sampleable sand
DM046	site	Deadman's Eddy AOI	sampleable sand
EV002	site	Evans AOI	sampleable sand
EV051	site	Evans AOI	sampleable sand
EV054	site	Evans AOI	mud
EV071	site	Evans AOI	sampleable sand
REF003	reference	Birchbank	sand
REF004	reference	Genelle	mixed
REF006	reference	Genelle	mixed
REF007	reference	Genelle	sand
REF008	reference	Genelle	sand
REF013 [b]	reference	Lower Arrow Lake	sand/mud
REF017	reference	Lower Arrow Lake	sand/mud
Batch 2			
1-B6-NRT	site	Deadman's Eddy AOI	NA
3-R8	site	China Bend AOI	NA
4-B6	site	Evans AOI	NA
CB029	site	China Bend AOI	mud
CB047	site	China Bend AOI	sampleable sand
DM002	site	Deadman's Eddy AOI	sampleable sand
DM008 [b]	site	Deadman's Eddy AOI	sampleable sand
DM045	site	Deadman's Eddy AOI	sampleable sand
DM050	site	Deadman's Eddy AOI	sampleable sand
EV005	site	Evans AOI	sampleable sand
EV008	site	Evans AOI	sampleable sand
EV064	site	Evans AOI	mud
EV069	site	Evans AOI	sampleable sand
JS002	site	China Bend AOI	sampleable sand
REF001	reference	Birchbank	mixed
REF002	reference	Genelle	sand
REF010	reference	Lower Arrow Lake	mixed
REF013 [b]	reference	Lower Arrow Lake	sand/mud
REF014	reference	Lower Arrow Lake	sand/mud
REF015	reference	Lower Arrow Lake	sand/mud
Batch 3			
4-B1	site	Evans AOI	NA
CB006	site	China Bend AOI	sampleable sand
CB010	site	China Bend AOI	sampleable sand
CB014	site	China Bend AOI	sampleable sand
CB044	site	China Bend AOI	mud
DM008 [b]	site	Deadman's Eddy AOI	sampleable sand
DM018	site	Deadman's Eddy AOI	sampleable sand
DM024	site	Deadman's Eddy AOI	sampleable sand
DM026	site	Deadman's Eddy AOI	sampleable sand
DM027	site	Deadman's Eddy AOI	sampleable sand
EV027	site	Evans AOI	sampleable sand
EV044	site	Evans AOI	mud
EV063	site	Evans AOI	mud
JS001	site	China Bend AOI	sampleable sand
REF005	reference	Lower Arrow Lake	mixed
REF009A	reference	Genelle	sand
REF011	reference	Genelle	sand
REF012	reference	Upstream of Genelle	mixed
REF013 [b]	reference	Lower Arrow Lake	sand/mud
REF016	reference	Lower Arrow Lake	sand/mud

Notes:

Each batch also included one negative laboratory control sample (Spring River sediment) and one quartz sand negative control sample.

[a] Site samples include samples from the three Phase 3 sediment study areas of interest: Deadman's Eddy, China Bend, and Evans.

[b] Samples for locations DM008 and REF013 were included in each batch.

AOI - area of interest

NA - not applicable

Table 2-14. Bioassay Porewater Collection Summary

Sampling Location[a]	pH	Total Collected Volume (mL)	Volume Allocated per Analysis: Priority 1 Analytes: Metals Minimum Volume (15 mL)	Priority 1 Analytes: DOC Minimum Volume (25 mL)	Priority 1 Analytes: pH Minimum Volume (1 mL)	Priority 2 Analytes: Sulfide Minimum Volume (10 mL)	Priority 3 and 4 Analytes: Chloride/ Sulfate/ Alkalinity Minimum Volume (30 mL)
Batch 1							
Collection Day 7							
1-B5-NRT	7.35	130	20	40	1	25	38
3-R7	7.83	82	20	40	1	10	7
CB002	8.93	65	20	40	1	np	np
CB020	8.67	80	20	40	1	10	5
CB021	7.64	125	20	40	1	25	33
CTL-QS	7.76	105	20	40	1	10	30
CTL-SR	7.13	105	20	40	1	10	30
DM007	7.96	59	20	34	1	np	np
DM008	7.84	45	15	25	1	np	np
DM019	7.99	80	20	40	1	10	5
DM025	6.90	150	33	40	1	25	45
DM046	7.86	110	20	40	1	10	35
EV002	8.02	49	17	25	1	np	np
EV051	8.59	91	20	40	1	10	16
EV054	7.37	380	60	80	1	40	100
EV071	8.30	81	20	40	1	10	6
REF003	7.12	60	20	35	1	np	np
REF004	7.50	50	18	25	1	np	np
REF006	7.05	51	19	25	1	np	np
REF007	7.64	81	20	40	1	10	6
REF008	7.09	20	18	np	1	np	np
REF013	7.36	60	20	35	1	np	np
REF017	7.32	350	60	80	1	40	100
Collection Day 21							
1-B5-NRT	7.31	150	37	40	1	25	45
3-R7	8.05	145	32	40	1	25	45
CB002	9.26	80	20	40	1	10	7
CB020	9.11	100	20	40	1	10	27
CB021	7.63	200	60	80	1	25	32
CTL-QS	7.69	80	20	40	1	10	7
CTL-SR	7.41	115	32	40	1	10	30
DM007	7.10	50	22	25	1	np	np
DM008	7.86	30	15	12	1	np	np
DM019	8.19	138	25	40	1	25	45
DM025	7.89	90	20	40	1	10	17
DM046	7.71	140	27	40	1	25	45
EV002	8.15	100	20	40	1	10	27
EV051	9.06	95	20	40	1	10	25
EV054	7.37	450	60	80	1	40	100
EV071	8.56	90	20	40	1	10	17
REF003	7.29	20	18	np	1	np	np
REF004	7.04	93	20	40	1	10	23
REF006	6.81	70	27	40	1	np	np
REF007	6.99	43	15	25	1	np	np
REF008	7.03	60	15	25	1	10	7
REF013	7.44	130	20	40	1	25	42
REF017	7.36	350	60	80	1	40	100

Table 2-14. Bioassay Porewater Collection Summary

			Volume Allocated per Analysis				
			Priority 1 Analytes			Priority 2 Analytes	Priority 3 and 4 Analytes
Sampling Location[a]	pH	Total Collected Volume (mL)	Metals Minimum Volume (15 mL)	DOC Minimum Volume (25 mL)	pH Minimum Volume (1 mL)	Sulfide Minimum Volume (10 mL)	Chloride/ Sulfate/ Alkalinity Minimum Volume (30 mL)
Batch 2							
Collection Day 7							
1-B6-NRT	8.02	60	20	37	1	np	np
3-R8	7.90	95	20	40	1	10	22
4-B6	7.34	55	20	32	1	np	np
CB029	8.77	2	np	np	1	np	np
CB047	7.87	115	20	40	1	20	30
CTL-QS	7.78	60	20	37	1	np	np
CTL-SR	7.29	110	20	40	1	15	30
DM002	7.81	43	15	25	1	np	np
DM008	7.77	43	15	25	1	np	np
DM045	7.66	80	20	40	1	10	7
DM050	7.89	75	20	40	1	10	2
EV005	8.36	105	20	40	1	10	30
EV008	8.11	43	15	25	1	np	np
EV064	7.25	350	60	80	1	40	100
EV069	8.15	43	15	25	1	np	np
JS002	7.98	105	20	40	1	10	30
REF001	7.66	60	20	37	1	np	np
REF002	7.62	48	20	25	1	np	np
REF010	7.28	80	20	40	1	10	7
REF013	7.38	150	33	40	1	25	45
REF014	6.87	135	20	40	1	25	45
REF015	6.68	350	60	80	1	40	100
Collection Day 21							
1-B6-NRT	8.13	68	25	40	1	np	np
3-R8	7.96	250	60	80	1	40	67
4-B6	7.68	91	20	40	1	10	18
CB029	8.82	83	20	40	1	10	10
CB047	7.92	102	20	40	1	10	29
CTL-QS	7.62	80	20	40	1	10	7
CTL-SR	7.22	135	22	40	1	25	45
DM002	8.04	60	20	37	1	np	np
DM008	7.77	50	20	27	1	np	np
DM045	7.56	100	20	40	1	10	25
DM050	7.80	110	20	40	1	10	37
EV005	8.62	90	20	40	1	10	17
EV008	8.08	60	20	37	1	np	np
EV064	7.14	350	60	80	1	40	100
EV069	8.23	100	20	40	1	10	27
JS002	7.98	60	20	37	1	np	np
REF001	7.40	120	20	40	1	25	32
REF002	7.43	100	20	40	1	10	27
REF010	7.50	115	20	40	1	25	27
REF013	7.26	105	20	40	1	10	30
REF014	7.08	120	20	40	1	25	32
REF015	6.86	400	60	80	1	40	100

Table 2-14. Bioassay Porewater Collection Summary

			Volume Allocated per Analysis				
			Priority 1 Analytes			Priority 2 Analytes	Priority 3 and 4 Analytes
Sampling Location[a]	pH	Total Collected Volume (mL)	Metals Minimum Volume (15 mL)	DOC Minimum Volume (25 mL)	pH Minimum Volume (1 mL)	Sulfide Minimum Volume (10 mL)	Chloride/ Sulfate/ Alkalinity Minimum Volume (30 mL)
Batch 3							
Collection Day 7							
4-B1	8.36	90	20	40	1	10	17
CB006	8.36	43	15	25	1	np	np
CB010	8.29	90	20	40	1	10	17
CB014	8.10	58	26	25	5	np	np
CB044	7.96	92	20	40	10	10	10
CTL-QS	7.77	60	20	37	1	np	np
CTL-SR	7.34	70	27	40	1	np	np
DM008	7.94	95	20	40	1	10	22
DM018	7.84	95	20	40	1	10	22
DM024	8.04	100	20	40	1	10	27
DM026	8.33	105	20	40	1	13	30
DM027	7.84	83	20	40	1	10	10
EV027	8.10	100	20	40	1	10	27
EV044	7.13	400	60	80	10	40	100
EV063	7.08	500	60	80	10	40	100
JS001	9.10	78	20	40	1	10	5
REF005	7.28	90	20	40	1	10	17
REF009A	7.24	65	20	38	5	np	np
REF011	7.42	70	27	40	1	np	np
REF012	7.60	135	22	40	1	25	45
REF013	7.46	100	20	40	1	10	27
REF016	7.33	350	60	80	10	40	100
Collection Day 21							
4-B1	8.16	82	20	40	1	19	np
CB006	8.41	60	20	37	1	np	np
CB010	8.37	90	20	40	1	10	17
CB014	7.49	73	20	40	1	10	np
CB044	7.95	70	27	40	1	np	np
CTL-QS	7.69	78	20	40	1	10	5
CTL-SR	7.11	43	15	25	1	np	np
DM008	7.91	80	20	40	1	10	7
DM018	7.93	43	15	25	1	np	np
DM024	7.96	90	20	40	1	10	17
DM026	8.10	80	20	40	1	10	7
DM027	8.23	98	20	40	1	10	25
EV027	8.01	78	20	40	1	10	5
EV044	7.33	450	60	80	1	40	100
EV063	7.26	500	60	80	1	40	100
JS001	8.97	100	20	40	1	10	27
REF005	7.10	50	20	27	1	np	np
REF009A	7.25	78	20	40	1	10	5
REF011	7.18	60	20	37	1	np	np
REF012	7.20	102	20	40	1	10	30
REF013	7.33	105	20	40	1	10	30
REF016	7.08	400	60	80	1	40	100

Notes:

[a] Site samples include samples from the three Phase 3 sediment study areas of interest: Deadman's Eddy, China Bend, and Evans.
DOC - dissolved organic carbon

np - analysis not performed due to insufficient porewater volume

Table 4-1. Summary of Qualifiers for Field Sediment Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags						Number of Accepted Results with Validator Flags					
					J	U	J,X	J,P	U,i	P	J	J-	J+	U	U*	UJ
Conventional Parameters																
Solids	117	0 (0%)	156 (100%)	156 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sulfide (AVS)	114	0 (0%)	114 (100%)	98 (86%)	2 (2%)	14 (12%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	89 (78%)	0 (0%)	0 (0%)	5 (4%)	0 (0%)	9 (8%)
TOC	116	0 (0%)	116 (100%)	115 (99%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	35 (30%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Grain Size																
Clay	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Silt	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Very fine sand	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Fine sand	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium sand	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Coarse sand	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Very coarse sand	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Fine gravel	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Medium gravel	115	0 (0%)	115 (100%)	115 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Metals																
Aluminum	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	19 (16%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Antimony	117	0 (0%)	117 (100%)	101 (86%)	3 (3%)	13 (11%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	57 (49%)	46 (39%)	0 (0%)	0 (0%)	0 (0%)	13 (11%)
Arsenic	117	0 (0%)	117 (100%)	109 (93%)	8 (7%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	28 (24%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Barium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	38 (32%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Beryllium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cadmium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	39 (33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Calcium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (6%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (3%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cobalt	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	19 (16%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	40 (34%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Iron	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	16 (14%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Lead	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	39 (33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Magnesium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	14 (12%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Manganese	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	23 (20%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Mercury	116	0 (0%)	116 (100%)	47 (41%)	59 (51%)	10 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	68 (59%)	0 (0%)	0 (0%)	10 (9%)	18 (16%)	0 (0%)
Nickel	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	33 (28%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Potassium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (8%)	0 (0%)	14 (12%)	0 (0%)	0 (0%)	0 (0%)
Selenium	117	0 (0%)	117 (100%)	32 (27%)	68 (58%)	17 (15%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	68 (58%)	0 (0%)	0 (0%)	17 (15%)	0 (0%)	0 (0%)
Silver	117	0 (0%)	117 (100%)	102 (87%)	15 (13%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	56 (48%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sodium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	14 (12%)	0 (0%)	0 (0%)	0 (0%)
Thallium	117	0 (0%)	117 (100%)	104 (89%)	13 (11%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	14 (12%)	0 (0%)	0 (0%)	0 (0%)	15 (13%)	0 (0%)
Vanadium	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	19 (16%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Zinc	117	0 (0%)	117 (100%)	117 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	23 (20%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
SEM																
Antimony	114	0 (0%)	114 (100%)	58 (51%)	35 (31%)	21 (18%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	45 (39%)	0 (0%)	6 (5%)	14 (12%)	0 (0%)	7 (6%)
Arsenic	114	0 (0%)	114 (100%)	25 (22%)	28 (25%)	61 (54%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	28 (25%)	0 (0%)	0 (0%)	61 (54%)	0 (0%)	0 (0%)
Cadmium	114	0 (0%)	114 (100%)	97 (85%)	16 (14%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	52 (46%)	0 (0%)	5 (4%)	1 (1%)	0 (0%)	0 (0%)
Chromium	114	0 (0%)	114 (100%)	110 (96%)	3 (3%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	47 (41%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)
Copper	114	0 (0%)	114 (100%)	114 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	59 (52%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Lead	114	0 (0%)	114 (100%)	113 (99%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	81 (71%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)
Nickel	114	0 (0%)	114 (100%)	84 (74%)	29 (25%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	63 (55%)	0 (0%)	3 (3%)	1 (1%)	0 (0%)	0 (0%)
Zinc	114	0 (0%)	114 (100%)	114 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	53 (46%)	0 (0%)	0 (0%)	0 (0%)	20 (18%)	0 (0%)

Table 4-1. Summary of Qualifiers for Field Sediment Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags						Number of Accepted Results with Validator Flags					
					J	U	J,X	J,P	U,i	P	J	J-	J+	U	U*	UJ
Organics																
PAHs																
2-Methylnaphthalene	20	0 (0%)	20 (100%)	0 (0%)	7 (35%)	13 (65%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	0 (0%)	13 (65%)	0 (0%)	0 (0%)
Acenaphthene	20	0 (0%)	20 (100%)	0 (0%)	4 (20%)	16 (80%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (20%)	0 (0%)	0 (0%)	16 (80%)	0 (0%)	0 (0%)
Acenaphthylene	20	0 (0%)	20 (100%)	1 (5%)	3 (15%)	16 (80%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (15%)	0 (0%)	0 (0%)	16 (80%)	0 (0%)	0 (0%)
Anthracene	20	0 (0%)	20 (100%)	0 (0%)	9 (45%)	11 (55%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (45%)	0 (0%)	0 (0%)	11 (55%)	0 (0%)	0 (0%)
Benzo[a]anthracene	20	0 (0%)	20 (100%)	0 (0%)	18 (90%)	1 (5%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	3 (15%)	0 (0%)	0 (0%)	1 (5%)	16 (80%)	0 (0%)
Benzo[a]pyrene	20	0 (0%)	20 (100%)	0 (0%)	6 (30%)	14 (70%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	0 (0%)	14 (70%)	0 (0%)	0 (0%)
Benzo[b]fluoranthene	20	0 (0%)	20 (100%)	0 (0%)	8 (40%)	12 (60%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	8 (40%)	0 (0%)	0 (0%)	12 (60%)	0 (0%)	0 (0%)
Benzo[g,h,i]perylene	20	0 (0%)	20 (100%)	0 (0%)	9 (45%)	11 (55%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (45%)	0 (0%)	0 (0%)	11 (55%)	0 (0%)	0 (0%)
Benzo[k]fluoranthene	20	0 (0%)	20 (100%)	0 (0%)	5 (25%)	15 (75%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (25%)	0 (0%)	0 (0%)	15 (75%)	0 (0%)	0 (0%)
Chrysene	20	0 (0%)	20 (100%)	0 (0%)	10 (50%)	10 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10 (50%)	0 (0%)	0 (0%)	10 (50%)	0 (0%)	0 (0%)
Dibenzo[a,h]anthracene	20	0 (0%)	20 (100%)	0 (0%)	4 (20%)	16 (80%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (20%)	0 (0%)	0 (0%)	16 (80%)	0 (0%)	0 (0%)
Fluoranthene	20	0 (0%)	20 (100%)	3 (15%)	6 (30%)	11 (55%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	0 (0%)	11 (55%)	0 (0%)	0 (0%)
Fluorene	20	0 (0%)	20 (100%)	0 (0%)	5 (25%)	15 (75%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (25%)	0 (0%)	0 (0%)	15 (75%)	0 (0%)	0 (0%)
Indeno[1,2,3-cd]pyrene	20	0 (0%)	20 (100%)	0 (0%)	7 (35%)	13 (65%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	0 (0%)	13 (65%)	0 (0%)	0 (0%)
Naphthalene	20	0 (0%)	20 (100%)	4 (20%)	8 (40%)	8 (40%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	0 (0%)	8 (40%)	2 (10%)	0 (0%)
Phenanthrene	20	0 (0%)	20 (100%)	5 (25%)	9 (45%)	6 (30%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (45%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	0 (0%)
Pyrene	20	0 (0%)	20 (100%)	3 (15%)	9 (45%)	8 (40%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (45%)	0 (0%)	0 (0%)	8 (40%)	0 (0%)	0 (0%)
PCBs																
2-Chlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	18 (90%)	0 (0%)	1 (5%)	1 (5%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	16 (80%)	0 (0%)	3 (15%)
2,2',3,3',4,4'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,3',4,4',5-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,3',4,4',5,5'-Octachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,3',4,4',5,6-Octachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,3',4,5',6'-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	1 (5%)
2,2',3,3',4,5,6'-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,3',4,6'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4',5'-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10 (50%)	0 (0%)	10 (50%)
2,2',3,4',5',6-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4',5-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4',5,5',6-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4,4',5'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4,4',5',6-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4,4',5,5'-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4,4',5,5',6-Octachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10 (50%)	0 (0%)	10 (50%)
2,2',3,4,4',6,6'-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4,5'-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	18 (90%)	0 (0%)	0 (0%)	2 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,4,5,5'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,5'-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,5',6-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',3,5,5',6-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	17 (85%)	0 (0%)	0 (0%)	3 (15%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10 (50%)	0 (0%)	10 (50%)
2,2',4,4',5-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',4,4',5,5'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	1 (5%)	0 (0%)	18 (90%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)
2,2',4,5'-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',4,5,5'-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)

Table 4-1. Summary of Qualifiers for Field Sediment Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags						Number of Accepted Results with Validator Flags					
					J	U	J,X	J,P	U,i	P	J	J-	J+	U	U*	UJ
Organics (continued)																
PCBs																
2,2',5-Trichlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,2',5,5'-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	2 (10%)	17 (85%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	2 (10%)	0 (0%)	0 (0%)	18 (90%)	0 (0%)	0 (0%)
2,3',4'-Trichlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	9 (45%)	0 (0%)	11 (55%)
2,3',4',5-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	0 (0%)	1 (5%)	1 (5%)	0 (0%)	0 (0%)	18 (90%)	0 (0%)	1 (5%)
2,3',4,4'-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3',4,4',5'-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3',4,4',5',6-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3',4,4',5-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3',4,4',5,5'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3',4,4',6-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3-Dichlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	1 (5%)	15 (75%)	0 (0%)	1 (5%)	3 (15%)	0 (0%)	2 (10%)	0 (0%)	0 (0%)	18 (90%)	0 (0%)	0 (0%)
2,3,3',4'-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,3',4',6-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	1 (5%)
2,3,3',4,4'-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,3',4,4',5'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,3',4,4',5-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,3',4,4',5,5'-Heptachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,3',4,4',6-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,4,4'-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,4,4',5-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,3,4,4',5,6-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,4'-Dichlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,4',5-Trichlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	16 (80%)	0 (0%)	0 (0%)	4 (20%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,4,4'-Trichlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
2,4,4',5-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	10 (50%)	0 (0%)	10 (50%)
3,3',4,4'-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	1 (5%)
3,3',4,4',5-Pentachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
3,3',4,4',5,5'-Hexachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
3,4,4'-Trichlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
3,4,4',5-Tetrachlorobiphenyl	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Aroclor 1016	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Aroclor 1221	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Aroclor 1232	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Aroclor 1242	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Aroclor 1248	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Aroclor 1254	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Aroclor 1260	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Decachlorobiphenyl (PCB 209)	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)
Pesticides																
2,4'-DDD	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	15 (75%)	0 (0%)	0 (0%)	5 (25%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
2,4'-DDE	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
2,4'-DDT	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	14 (70%)
4,4'-DDD	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	13 (65%)
4,4'-DDE	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
4,4'-DDT	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
Aldrin	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	14 (70%)

Table 4-1. Summary of Qualifiers for Field Sediment Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags						Number of Accepted Results with Validator Flags					
					J	U	J,X	J,P	U,i	P	J	J-	J+	U	U*	UJ
Organics (continued)																
Pesticides																
alpha-Benzenehexachloride	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	13 (65%)
alpha-Chlordane	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	14 (70%)
beta-BHC	20	0 (0%)	20 (100%)	1 (5%)	0 (0%)	18 (90%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	7 (35%)	0 (0%)	12 (60%)
cis-Nonachlor	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
delta-BHC	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
Dieldrin	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
Endosulfan I	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	14 (70%)
Endosulfan II	20	0 (0%)	20 (100%)	0 (0%)	1 (5%)	16 (80%)	0 (0%)	1 (5%)	2 (10%)	0 (0%)	2 (10%)	0 (0%)	0 (0%)	5 (25%)	0 (0%)	13 (65%)
Endosulfan sulfate	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
Endrin	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	14 (70%)
Endrin aldehyde	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
Endrin ketone	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	18 (90%)	0 (0%)	0 (0%)	2 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
gamma-BHC	20	0 (0%)	20 (100%)	0 (0%)	3 (15%)	16 (80%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	3 (15%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	10 (50%)
Heptachlor	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
Heptachlor epoxide	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	14 (70%)
Hexachlorobenzene	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
Hexachlorobutadiene	20	0 (0%)	20 (100%)	1 (5%)	0 (0%)	13 (65%)	0 (0%)	5 (25%)	1 (5%)	0 (0%)	5 (25%)	1 (5%)	0 (0%)	4 (20%)	0 (0%)	10 (50%)
Methoxychlor	20	1 (5%)	19 (95%)	0 (0%)	0 (0%)	17 (89%)	0 (0%)	1 (5%)	1 (5%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	7 (37%)	0 (0%)	11 (58%)
Oxychlordane	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	19 (95%)	0 (0%)	0 (0%)	1 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (30%)	0 (0%)	14 (70%)
Toxaphene	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
trans-chlordane	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)
trans-Nonachlor	20	0 (0%)	20 (100%)	0 (0%)	0 (0%)	20 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (35%)	0 (0%)	13 (65%)

Notes:

Data excludes laboratory quality control (QC) sample data.

Accepted results are those deemed usable by the data validator.

Laboratory Flags

i The rethod reporting limit/method detection limit (MRL/MDL) or limit of detection/limit of quantitation (LOQ/LOD) is elevated due to a matrix/chromatographic interference.

J The result is an estimated value.

P The gas chromatography or high performance liquid chromatography confirmation criteria were exceeded. The relative percent difference (RPD) is greater than 40% between the two analytical results.

U The analyte was analyzed for, but was not detected at or above the MRL/MDL.

X The laboratory report case narrative contained additional information about this result.

Validator Flags

J Quantitation is approximate due to limitations identified during the quality assurance (QA) review (data validation).

J- Quantitation is approximate and biased low due to limitations identified during the QA review (data validation).

J+ Quantitation is approximate and biased high due to limitations identified during the QA review (data validation).

U This analyte was not detected at or above the associated detection limit.

U* This analyte should be considered nondetected because it was detected in an associated blank at a similar level.

UJ This analyte was not detected, but the detection limit is considered estimated due to bias identified during the QA review.

AVS - acid volatile sulfide
BHC - hexachlorocyclohexane
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyl
SEM - simultaneously extracted metals
TOC - total organic carbon

Table 4-2. Summary of Qualifiers for Field Equipment Blank Results

						Number of Accepted Results with Laboratory Flags								Number of Accepted Results with Validator Flags		
Analyte	Basis	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	J	U	*,J	*,U	*	J,P	*,J,P	U,i	J	U	UJ
Sediment Equipment Rinsate Blanks																
Metals																
Aluminum	Total	11	0 (0%)	11 (100%)	5 (45%)	6 (55%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (55%)	0 (0%)	0 (0%)
Antimony	Total	11	0 (0%)	11 (100%)	0 (0%)	2 (18%)	9 (82%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (18%)	9 (82%)	0 (0%)
Arsenic	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Barium	Total	11	0 (0%)	11 (100%)	10 (91%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (9%)	0 (0%)	0 (0%)
Beryllium	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Cadmium	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Calcium	Total	11	0 (0%)	11 (100%)	9 (82%)	2 (18%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (18%)	0 (0%)	0 (0%)
Chromium	Total	11	0 (0%)	11 (100%)	7 (64%)	3 (27%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (27%)	1 (9%)	0 (0%)
Cobalt	Total	11	0 (0%)	11 (100%)	1 (9%)	1 (9%)	9 (82%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (9%)	9 (82%)	0 (0%)
Copper	Total	11	0 (0%)	11 (100%)	6 (55%)	2 (18%)	3 (27%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (18%)	3 (27%)	0 (0%)
Iron	Total	11	0 (0%)	11 (100%)	1 (9%)	3 (27%)	7 (64%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (27%)	7 (64%)	0 (0%)
Lead	Total	11	0 (0%)	11 (100%)	10 (91%)	0 (0%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (9%)	0 (0%)
Magnesium	Total	11	0 (0%)	11 (100%)	8 (73%)	3 (27%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (27%)	0 (0%)	0 (0%)
Manganese	Total	11	0 (0%)	11 (100%)	7 (64%)	3 (27%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (27%)	1 (9%)	0 (0%)
Mercury	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Nickel	Total	11	0 (0%)	11 (100%)	1 (9%)	5 (45%)	5 (45%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (45%)	5 (45%)	0 (0%)
Potassium	Total	11	0 (0%)	11 (100%)	0 (0%)	1 (9%)	10 (91%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (9%)	10 (91%)	0 (0%)
Selenium	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Silver	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Sodium	Total	11	0 (0%)	11 (100%)	0 (0%)	4 (36%)	7 (64%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (36%)	7 (64%)	0 (0%)
Thallium	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Vanadium	Total	11	0 (0%)	11 (100%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (100%)	0 (0%)
Zinc	Total	11	0 (0%)	11 (100%)	3 (27%)	7 (64%)	1 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (64%)	1 (9%)	0 (0%)
Organics - PAHs																
2-Methylnaphthalene	Total	2	0 (0%)	2 (100%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
Acenaphthene	Total	2	0 (0%)	2 (100%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)
Acenaphthylene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Anthracene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Benzo[a]anthracene	Total	2	0 (0%)	2 (100%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
Benzo[a]pyrene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Benzo[b]fluoranthene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Benzo[g,h,i]perylene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Benzo[k]fluoranthene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Chrysene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Dibenzo[a,h]anthracene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Fluoranthene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Fluorene	Total	2	0 (0%)	2 (100%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
Indeno[1,2,3-cd]pyrene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Naphthalene	Total	2	0 (0%)	2 (100%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)
Phenanthrene	Total	2	0 (0%)	2 (100%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
Pyrene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Organics - PCBs																
2-Chlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,4'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,4',5-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,4',5,5'-Octachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,4',5,6-Octachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,5',6'-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)

Table 4-2. Summary of Qualifiers for Field Equipment Blank Results

Analyte	Basis	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags								Number of Accepted Results with Validator Flags		
						J	U	*,J	*,U	*	J,P	*,J,P	U,i	J	U	UJ
Sediment Equipment Rinsate Blanks (continued)																
Organics - PCBs																
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,5,6'-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,3',4,6'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4',5'-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4',5',6-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4',5-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4',5,5',6-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4,4',5'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4,4',5',6-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4,4',5,5'-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4,4',5,5',6-Octachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4,4',6,6'-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4,5'-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,4,5,5'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,5'-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,5',6-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',3,5,5',6-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',4,4',5-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',4,4',5,5'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',4,5'-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',4,5,5'-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',5-Trichlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,2',5,5'-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4'-Trichlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4',5-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4,4'-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4,4',5'-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4,4',5',6-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4,4',5-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4,4',5,5'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3',4,4',6-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3-Dichlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,3',4'-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,3',4',6-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,3',4,4'-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,3',4,4',5'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,3',4,4',5-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,3',4,4',5,5'-Heptachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,3',4,4',6-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,4,4'-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,4,4',5-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,3,4,4',5,6-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,4'-Dichlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,4',5-Trichlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,4,4'-Trichlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
2,4,4',5-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
3,3',4,4'-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
3,3',4,4',5-Pentachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
3,3',4,4',5,5'-Hexachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
3,4,4'-Trichlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)

Table 4-2. Summary of Qualifiers for Field Equipment Blank Results

Analyte	Basis	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags								Number of Accepted Results with Validator Flags		
						J	U	*,J	*,U	*	J,P	*,J,P	U,i	J	U	UJ
Sediment Equipment Rinsate Blanks (continued)																
Organics - PCBs																
3,4,4',5-Tetrachlorobiphenyl	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Aroclor 1016	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Aroclor 1221	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Aroclor 1232	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Aroclor 1242	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Aroclor 1248	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Aroclor 1254	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Aroclor 1260	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Decachlorobiphenyl (PCB 209)	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	0 (0%)
Organics - Pesticides																
2,4'-DDD	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
2,4'-DDE	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
2,4'-DDT	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)
4,4'-DDD	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
4,4'-DDE	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
4,4'-DDT	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Aldrin	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
alpha-Benzenehexachloride	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
alpha-Chlordane	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
beta-BHC	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)
cis-Nonachlor	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
delta-BHC	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Dieldrin	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)
Endosulfan I	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Endosulfan II	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)
Endosulfan sulfate	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Endrin	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)
Endrin aldehyde	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Endrin ketone	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
gamma-BHC	Total	2	0 (0%)	2 (100%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)
Heptachlor	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (100%)	1 (50%)	1 (50%)	0 (0%)
Heptachlor epoxide	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Methoxychlor	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Oxychlordane	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Toxaphene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
trans-chlordane	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
trans-Nonachlor	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Hexachlorobenzene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Hexachlorobutadiene	Total	2	0 (0%)	2 (100%)	0 (0%)	0 (0%)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (50%)	1 (50%)
Porewater Equipment Blanks																
Conventional Parameters																
Alkalinity	Total	6	0 (0%)	6 (100%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)
Chloride ion	Total	6	0 (0%)	6 (100%)	0 (0%)	1 (17%)	5 (83%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	5 (83%)	0 (0%)
Sulfate	Total	6	0 (0%)	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
TOC	Total	6	0 (0%)	6 (100%)	1 (17%)	0 (0%)	5 (83%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (83%)	0 (0%)
Metals/Metalloids																
Aluminum	Total	6	0 (0%)	6 (100%)	2 (33%)	4 (67%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (67%)	0 (0%)	0 (0%)
Antimony	Total	6	0 (0%)	6 (100%)	1 (17%)	1 (17%)	4 (67%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	4 (67%)	0 (0%)
Arsenic	Total	6	0 (0%)	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Barium	Total	6	0 (0%)	6 (100%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

Table 4-2. Summary of Qualifiers for Field Equipment Blank Results

Analyte	Basis	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags								Number of Accepted Results with Validator Flags		
						J	U	*,J	*,U	*	J,P	*,J,P	U,i	J	U	UJ
Porewater Equipment Blanks (continued)																
Metals/Metalloids																
Beryllium	Total	6	0 (0%)	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Cadmium	Total	6	0 (0%)	6 (100%)	0 (0%)	1 (17%)	5 (83%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	5 (83%)	0 (0%)
Calcium	Total	6	0 (0%)	6 (100%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	Total	6	0 (0%)	6 (100%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cobalt	Total	6	0 (0%)	6 (100%)	0 (0%)	2 (33%)	4 (67%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (33%)	4 (67%)	0 (0%)
Copper	Total	6	0 (0%)	6 (100%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Iron	Total	6	0 (0%)	6 (100%)	2 (33%)	1 (17%)	3 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	3 (50%)	0 (0%)
Lead	Total	6	0 (0%)	6 (100%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Magnesium	Total	6	0 (0%)	6 (100%)	5 (83%)	1 (17%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (17%)	0 (0%)	0 (0%)
Manganese	Total	6	0 (0%)	6 (100%)	4 (67%)	2 (33%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (33%)	0 (0%)	0 (0%)
Nickel	Total	6	0 (0%)	6 (100%)	3 (50%)	3 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (50%)	0 (0%)	0 (0%)
Potassium	Total	6	0 (0%)	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Selenium	Total	6	0 (0%)	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Silver	Total	6	0 (0%)	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Sodium	Total	6	0 (0%)	6 (100%)	2 (33%)	0 (0%)	4 (67%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	4 (67%)	0 (0%)
Thallium	Total	6	0 (0%)	6 (100%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (100%)	0 (0%)
Vanadium	Total	6	0 (0%)	6 (100%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	3 (50%)	3 (50%)	0 (0%)
Zinc	Total	6	0 (0%)	6 (100%)	1 (17%)	5 (83%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	5 (83%)	0 (0%)	0 (0%)

Notes:

Data excludes laboratory quality control (QC) sample data.

Accepted results are those deemed usable by the data validator.

Laboratory Flags

* The result is an outlier. The laboratory report case narrative contained additional information about this result.
i The rethod reporting limit/method detection limit (MRL/MDL) or limit of detection/limit of quantitation (LOQ/LOD) is elevated due to a matrix/chromatographic interference.
J The result is an estimated value that was detected outside the quantitation range.
P The gas chromatography or high performance liquid chromatography confirmation criteria were exceeded. The relative percent difference (RPD) is greater than 40% between the two analytical results.
U The analyte was analyzed for, but was not detected at or above the MRL/MDL.

Validator Flags

J Quantitation is approximate due to limitations identified during the quality assurance (QA) review (data validation).
U This analyte was not detected at or above the associated detection limit.
UJ This analyte was not detected, but the detection limit is considered estimated due to bias identified during the QA review.

BHC - hexachlorocyclohexane
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
PAH - polycyclic aromatic hydrocarbon
PCB - polychlorinated biphenyls
TOC - total organic carbon

Table 4-3. Summary of Qualifiers for Field Porewater Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags		Number of Accepted Results with Validator Flags				
					J	U	J	J-	J+	U	U*
Conventional Parameters											
Alkalinity	129	0 (0%)	129 (100%)	129 (100%)	0 (0%)	0 (0%)	18 (14%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)
DOC	128	0 (0%)	128 (100%)	99 (77%)	27 (21%)	2 (2%)	43 (34%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)
Hardness	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sulfate	129	0 (0%)	129 (100%)	129 (100%)	0 (0%)	0 (0%)	18 (14%)	20 (16%)	0 (0%)	0 (0%)	0 (0%)
TOC	128	0 (0%)	128 (100%)	101 (79%)	25 (20%)	2 (2%)	43 (34%)	0 (0%)	0 (0%)	2 (2%)	9 (7%)
Chloride	129	0 (0%)	129 (100%)	128 (99%)	1 (1%)	0 (0%)	7 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Metals											
Aluminum	130	0 (0%)	130 (100%)	112 (86%)	18 (14%)	0 (0%)	9 (7%)	0 (0%)	0 (0%)	0 (0%)	81 (62%)
Antimony	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)	31 (24%)
Arsenic	130	0 (0%)	130 (100%)	118 (91%)	12 (9%)	0 (0%)	12 (9%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Barium	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Beryllium	130	0 (0%)	130 (100%)	0 (0%)	8 (6%)	122 (94%)	1 (1%)	0 (0%)	0 (0%)	122 (94%)	7 (5%)
Cadmium	130	0 (0%)	130 (100%)	60 (46%)	38 (29%)	32 (25%)	31 (24%)	0 (0%)	0 (0%)	32 (25%)	13 (10%)
Calcium	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	130	0 (0%)	130 (100%)	77 (59%)	53 (41%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	129 (99%)
Cobalt	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	14 (11%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	130	0 (0%)	130 (100%)	128 (98%)	2 (2%)	0 (0%)	4 (3%)	0 (0%)	0 (0%)	0 (0%)	47 (36%)
Iron	130	0 (0%)	130 (100%)	69 (53%)	39 (30%)	22 (17%)	30 (23%)	0 (0%)	0 (0%)	22 (17%)	19 (15%)
Lead	130	0 (0%)	130 (100%)	128 (98%)	2 (2%)	0 (0%)	4 (3%)	0 (0%)	0 (0%)	0 (0%)	70 (54%)
Magnesium	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Manganese	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)	16 (12%)
Nickel	130	0 (0%)	130 (100%)	126 (97%)	4 (3%)	0 (0%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)	70 (54%)
Potassium	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Selenium	130	0 (0%)	130 (100%)	1 (1%)	23 (18%)	106 (82%)	23 (18%)	0 (0%)	0 (0%)	106 (82%)	0 (0%)
Silver	130	0 (0%)	130 (100%)	22 (17%)	29 (22%)	79 (61%)	20 (15%)	0 (0%)	0 (0%)	79 (61%)	15 (12%)
Sodium	130	0 (0%)	130 (100%)	130 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)
Thallium	130	0 (0%)	130 (100%)	36 (28%)	45 (35%)	49 (38%)	29 (22%)	0 (0%)	0 (0%)	49 (38%)	32 (25%)
Vanadium	130	0 (0%)	130 (100%)	90 (69%)	38 (29%)	2 (2%)	27 (21%)	0 (0%)	0 (0%)	2 (2%)	14 (11%)
Zinc	130	0 (0%)	130 (100%)	83 (64%)	47 (36%)	0 (0%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)	89 (68%)

Notes:

Data excludes laboratory quality control (QC) sample data.
Accepted results are those deemed usable by the data validator.
DOC - dissolved organic carbon
TOC - total organic carbon

Laboratory Flags

J The result is an estimated value.
U The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit (MRL/MDL).

Validator Flags

J Quantitation is approximate due to limitations identified during the quality assurance (QA) review (data validation).
J- Quantitation is approximate and biased low due to limitations identified during the QA review (data validation).
J+ Quantitation is approximate and biased high due to limitations identified during the QA review (data validation).
U This analyte was not detected at or above the associated detection limit.
U* This analyte should be considered nondetected because it was detected in an associated blank at a similar level.

Table 4-4. Summary of Qualifiers for 42-Day *Hyalella azteca* Bioassay Sediment Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags (%)				Number of Accepted Results with Validator Flags (%)					
					*	J	J,*	U	J	J-	J+	U	U*	UJ
Conventional Parameters														
Solids	193	0 (0%)	193 (100%)	193 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sulfide	134	2 (1%)	132 (99%)	84 (63%)	13 (10%)	11 (8%)	2 (2%)	22 (17%)	70 (53%)	13 (10%)	4 (3%)	19 (14%)	6 (5%)	3 (2%)
TOC	193	0 (0%)	193 (100%)	181 (94%)	0 (0%)	5 (3%)	0 (0%)	7 (4%)	5 (3%)	0 (0%)	0 (0%)	7 (4%)	0 (0%)	0 (0%)
Metals														
Aluminum	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Antimony	59	0 (0%)	59 (100%)	41 (69%)	0 (0%)	1 (2%)	0 (0%)	17 (29%)	15 (25%)	16 (27%)	0 (0%)	0 (0%)	0 (0%)	17 (29%)
Arsenic	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	18 (31%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Barium	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	18 (31%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Beryllium	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cadmium	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	18 (31%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Calcium	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	59	0 (0%)	59 (100%)	58 (98%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	1 (2%)	18 (31%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Cobalt	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Copper	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Iron	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)
Lead	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)	18 (31%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Magnesium	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Manganese	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nickel	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Potassium	59	0 (0%)	59 (100%)	58 (98%)	0 (0%)	1 (2%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (2%)	0 (0%)
Selenium	59	0 (0%)	59 (100%)	26 (44%)	0 (0%)	27 (46%)	0 (0%)	6 (10%)	27 (46%)	0 (0%)	0 (0%)	6 (10%)	0 (0%)	0 (0%)
Silver	59	0 (0%)	59 (100%)	56 (95%)	0 (0%)	3 (5%)	0 (0%)	0 (0%)	18 (31%)	0 (0%)	0 (0%)	0 (0%)	3 (5%)	0 (0%)
Sodium	59	0 (0%)	59 (100%)	57 (97%)	0 (0%)	2 (3%)	0 (0%)	0 (0%)	18 (31%)	0 (0%)	0 (0%)	0 (0%)	2 (3%)	0 (0%)
Thallium	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	8 (14%)	0 (0%)
Vanadium	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Zinc	59	0 (0%)	59 (100%)	59 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
SEM														
Antimony	134	0 (0%)	134 (100%)	64 (48%)	0 (0%)	16 (12%)	0 (0%)	54 (40%)	15 (11%)	0 (0%)	3 (2%)	54 (40%)	1 (1%)	0 (0%)
Arsenic	134	0 (0%)	134 (100%)	81 (60%)	0 (0%)	36 (27%)	0 (0%)	17 (13%)	36 (27%)	0 (0%)	0 (0%)	17 (13%)	0 (0%)	0 (0%)
Cadmium	134	0 (0%)	134 (100%)	118 (88%)	0 (0%)	16 (12%)	0 (0%)	0 (0%)	55 (41%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	134	0 (0%)	134 (100%)	128 (96%)	0 (0%)	5 (4%)	0 (0%)	1 (1%)	22 (16%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)
Copper	134	0 (0%)	134 (100%)	134 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	7 (5%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	0 (0%)

Table 4-4. Summary of Qualifiers for 42-Day *Hyalella azteca* Bioassay Sediment Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags (%)				Number of Accepted Results with Validator Flags (%)					
					*	J	J,*	U	J	J-	J+	U	U*	UJ
SEM (continued)														
Lead	134	0 (0%)	134 (100%)	128 (96%)	0 (0%)	6 (4%)	0 (0%)	0 (0%)	47 (35%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Nickel	134	0 (0%)	134 (100%)	128 (96%)	0 (0%)	6 (4%)	0 (0%)	0 (0%)	28 (21%)	0 (0%)	2 (1%)	0 (0%)	0 (0%)	0 (0%)
Zinc	134	0 (0%)	134 (100%)	134 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	11 (8%)	0 (0%)	0 (0%)	0 (0%)	2 (1%)	0 (0%)

Notes:

Data excludes laboratory quality control (QC) sample data.

Accepted results are those deemed usable by the data validator.

SEM - simultaneously extracted metals

TOC - total organic carbon

Laboratory Flags

* The result is an outlier. See case narrative.

J The result is an estimated value that was detected outside the quantitation range.

U The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit (MRL/MDL).

Validator Flags

J Quantitation is approximate due to limitations identified during the quality assurance (QA) review (data validation).

J- Quantitation is approximate and biased low due to limitations identified during the QA review (data validation).

J+ Quantitation is approximate and biased high due to limitations identified during the QA review (data validation).

U This analyte was not detected at or above the associated detection limit.

U* This analyte should be considered nondetected because it was detected in an associated blank at a similar level.

UJ This analyte was not detected, but the detection limit is considered estimated due to bias identified during the QA review.

Table 4-5. Summary of Qualifiers for 42-Day *Hyalella azteca* Bioassay Porewater Results

Analyte	Number of Samples	Number of Rejected Results	Number of Accepted Results	Number of Results with No Flags	Number of Accepted Results with Laboratory Flags		Number of Accepted Results with Validator Flags					
					J	U	J	J-	J+	U	U*	UJ
Conventional Parameters												
Alkalinity	90	0 (0%)	90 (100%)	90 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chloride ion	91	0 (0%)	91 (100%)	91 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
DOC	131	0 (0%)	131 (100%)	114 (87%)	15 (11%)	2 (2%)	15 (11%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	0 (0%)
Hardness	132	0 (0%)	132 (100%)	132 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sulfate	91	0 (0%)	91 (100%)	91 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Sulfide	93	0 (0%)	93 (100%)	11 (12%)	20 (22%)	62 (67%)	20 (22%)	0 (0%)	1 (1%)	62 (67%)	0 (0%)	0 (0%)
Metals												
Aluminum	133	0 (0%)	133 (100%)	126 (95%)	7 (5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	40 (30%)	0 (0%)
Antimony	133	0 (0%)	133 (100%)	133 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Arsenic	133	0 (0%)	133 (100%)	119 (89%)	14 (11%)	0 (0%)	14 (11%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Barium	133	0 (0%)	133 (100%)	133 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Beryllium	133	0 (0%)	133 (100%)	1 (1%)	15 (11%)	117 (88%)	14 (11%)	0 (0%)	0 (0%)	117 (88%)	1 (1%)	0 (0%)
Cadmium	133	0 (0%)	133 (100%)	102 (77%)	20 (15%)	11 (8%)	20 (15%)	0 (0%)	0 (0%)	11 (8%)	0 (0%)	0 (0%)
Calcium	133	0 (0%)	133 (100%)	133 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Chromium	133	0 (0%)	133 (100%)	133 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	123 (92%)	0 (0%)
Cobalt	133	0 (0%)	133 (100%)	130 (98%)	2 (2%)	1 (1%)	2 (2%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)
Copper	133	0 (0%)	133 (100%)	132 (99%)	1 (1%)	0 (0%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)
Iron	133	0 (0%)	133 (100%)	56 (42%)	42 (32%)	35 (26%)	38 (29%)	0 (0%)	0 (0%)	35 (26%)	7 (5%)	0 (0%)
Lead	133	0 (0%)	133 (100%)	126 (95%)	6 (5%)	1 (1%)	5 (4%)	0 (0%)	0 (0%)	1 (1%)	2 (2%)	0 (0%)
Magnesium	133	0 (0%)	133 (100%)	133 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Manganese	133	0 (0%)	133 (100%)	133 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)
Nickel	133	0 (0%)	133 (100%)	130 (98%)	3 (2%)	0 (0%)	2 (2%)	0 (0%)	0 (0%)	0 (0%)	21 (16%)	0 (0%)
Potassium	133	0 (0%)	133 (100%)	132 (99%)	0 (0%)	1 (1%)	0 (0%)	4 (3%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)
Selenium	133	0 (0%)	133 (100%)	0 (0%)	30 (23%)	103 (77%)	30 (23%)	0 (0%)	0 (0%)	103 (77%)	0 (0%)	0 (0%)
Silver	133	0 (0%)	133 (100%)	25 (19%)	36 (27%)	72 (54%)	36 (27%)	0 (0%)	0 (0%)	72 (54%)	0 (0%)	0 (0%)
Sodium	133	0 (0%)	133 (100%)	133 (100%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Thallium	133	0 (0%)	133 (100%)	40 (30%)	35 (26%)	58 (44%)	35 (26%)	0 (0%)	0 (0%)	58 (44%)	0 (0%)	0 (0%)
Vanadium	133	0 (0%)	133 (100%)	125 (94%)	8 (6%)	0 (0%)	7 (5%)	0 (0%)	0 (0%)	0 (0%)	1 (1%)	0 (0%)
Zinc	133	0 (0%)	133 (100%)	132 (99%)	1 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	48 (36%)	0 (0%)

Notes:
Data excludes laboratory quality control (QC) sample data.
Accepted results are those deemed usable by the data validator.
DOC - dissolved organic carbon

Laboratory Flags
* The result is an outlier. See case narrative.
J The result is an estimated value that was detected outside the quantitation range.
U The analyte was analyzed for, but was not detected at or above the method reporting limit/method detection limit (MRL/MDL).

Validator Flags
J Quantitation is approximate due to limitations identified during the quality assurance (QA) review (data validation).
J- Quantitation is approximate and biased low due to limitations identified during the QA review (data validation).
J+ Quantitation is approximate and biased high due to limitations identified during the QA review (data validation).
U This analyte was not detected at or above the associated detection limit.
U* This analyte should be considered nondetected because it was detected in an associated blank at a similar level.
UJ This analyte was not detected, but the detection limit is considered estimated due to bias identified during the QA review.

Table 4-6. Summary of Negative Control Performance for the 42-Day *Hyalella azteca* Bioassay

		Mean Survival (%)		Mean Dry Weight (mg/individual)[a]		Number of Offspring/Female[a]
Batch	Sample ID	Day 28	Day 42	Day 28	Day 42	Day 42
Negative Laboratory Control Test Acceptability Requirements [b]						
Acceptability Criteria		***≥80***	***nc***	***nc***	***nc***	***nc***
Performance Goals		***nc***	***≥80***	***≥0.35***	***≥0.5***	***≥6***
1	CTL-SR-1	94	90	0.6	0.8	10
2	CTL-SR-2	94	88	0.7	0.8	7
3	CTL-SR-3	89	84	0.7	0.8	11
Quartz Sand Negative Control Performance Guidelines [c]						
Performance Guidelines		***NA***	***≥80***	***≥0.3***	***≥0.5***	***≥4***
1	CTL-QS-1	88	63	0.1	0.3	1
2	CTL-QS-2	84	46	0.1	0.4	0
3	CTL-QS-3	79	69	0.2	0.3	1

Notes:

[a] Replicate samples with 100% mortality or lacking either male/female *H. azteca* were not included in the reported means. Results are the same when calculated excluding replicate samples with 100% mortality or ≤20% males or females in the reported mean.

[b] EPA (2000) guidance uses the term test acceptability requirements, which includes criteria that must be met for a test to be considered acceptable and other criteria that should be met as a goal for conducting a good test. For the purposes of providing clear language for the Phase 3 sediment study and as was used in the Phase 2 sediment study, the two types of requirements are distinguished as follows: test acceptability criteria that must be met are referred to as criteria and those that should be met are referred to as performance goals.

[c] Quartz sand negative control perfomance guidelines are suggested by EPA for demonstration of adequacy of food and water (Mount 2011).

NA - not applicable

nc - no criteria

Table 4-7. Summary of DO Results for the 42-Day *Hyalella azteca* Bioassays

Sample ID	DO Before Water Exchange (mg/L) Minimum	DO Before Water Exchange (mg/L) Mean	DO Before Water Exchange (mg/L) Maximum	DO After Water Exchange (mg/L) Minimum	DO After Water Exchange (mg/L) Mean	DO After Water Exchange (mg/L) Maximum	DO Value that Triggered Aeration (mg/L)	Date Aeration Started	Date Aeration Stopped
Batch 1 (Initiated 6/16/2020)									
Site Locations [a]									
1-B5-NRT	4.6	7.1	8.5	6.0	7.7	9.4	NA	NA	NA
3-R7	4.4	7.0	8.3	2.7	7.6	9.4	NA	NA	NA
CB002	4.3	7.1	8.7	3.0	7.7	9.4	NA	NA	NA
CB020	4.7	7.1	8.3	4.2	7.8	9.4	NA	NA	NA
CB021	4.4	7.2	8.4	3.0	7.7	9.4	NA	NA	NA
DM007	4.2	7.0	8.6	4.4	7.7	9.4	NA	NA	NA
DM008	3.9	7.1	8.6	4.4	7.7	9.4	NA	NA	NA
DM019	4.5	7.1	8.4	4.7	7.7	9.4	NA	NA	NA
DM025	4.6	7.1	8.4	5.2	7.8	9.4	NA	NA	NA
DM046	4.1	7.1	8.4	3.6	7.7	9.5	NA	NA	NA
EV002	4.4	7.2	8.5	5.9	7.8	9.5	NA	NA	NA
EV051	4.3	7.1	8.2	3.1	7.8	9.5	NA	NA	NA
EV054	4.2	6.9	8.4	4.2	7.7	9.4	NA	NA	NA
EV071	4.7	7.1	8.5	3.2	7.8	9.5	NA	NA	NA
Reference Locations									
REF003	4.5	7.1	8.2	6.0	7.8	9.4	NA	NA	NA
REF004	4.7	7.1	8.4	5.1	7.8	9.4	NA	NA	NA
REF006	4.6	7.1	8.3	4.6	7.8	9.3	NA	NA	NA
REF007	3.8	7.0	8.5	6.0	7.8	9.6	NA	NA	NA
REF008	4.3	7.1	8.5	4.8	7.8	9.5	NA	NA	NA
REF013	4.3	7.0	8.3	2.9	7.7	9.4	NA	NA	NA
REF017	3.6	7.1	8.0	4.6	7.7	9.4	NA	NA	NA
Negative Laboratory Control Samples (CTL-SR)									
CTL-SR-1	3.8	7.0	8.6	6.0	7.7	9.3	NA	NA	NA
Quartz Sand Negative Control Samples (CTL-QS)									
CTL-QS-1	4.6	7.2	8.5	5.4	7.8	9.4	NA	NA	NA
Batch 2 (Initiated 6/17/2020)									
Site Locations [a]									
1-B6-NRT	3.6	6.8	8.2	5.9	7.8	8.9	NA	NA	NA
3-R8	4.4	6.9	8.0	5.5	7.7	8.9	NA	NA	NA
4-B6	4.3	7.0	8.2	6.1	7.8	8.9	NA	NA	NA
CB029	5.1	6.8	8.0	5.9	7.7	8.9	NA	NA	NA

Table 4-7. Summary of DO Results for the 42-Day *Hyalella azteca* Bioassays

Sample ID	DO Before Water Exchange (mg/L) Minimum	DO Before Water Exchange (mg/L) Mean	DO Before Water Exchange (mg/L) Maximum	DO After Water Exchange (mg/L) Minimum	DO After Water Exchange (mg/L) Mean	DO After Water Exchange (mg/L) Maximum	DO Value that Triggered Aeration (mg/L)	Date Aeration Started	Date Aeration Stopped
Batch 2 (Initiated 6/17/2020) (continued)									
Site Locations [a]									
CB047	5.4	7.2	8.3	6.0	7.9	8.9	2.5	7/14/2020	7/29/2020 [b]
DM002	4.8	7.0	8.4	6.3	7.8	8.9	NA	NA	NA
DM008	4.9	6.9	8.0	6.2	7.8	9.0	NA	NA	NA
DM045	5.2	7.0	8.3	6.1	7.7	8.7	NA	NA	NA
DM050	4.1	6.9	8.0	6.0	7.7	8.7	NA	NA	NA
EV005	5.4	7.2	8.2	6.2	7.9	8.9	2.8	7/21/2020	7/29/2020
EV008	4.8	7.0	8.0	6.1	7.7	8.9	NA	NA	NA
EV064	5.4	7.2	8.5	6.3	7.8	8.7	2.7	7/21/2020	7/29/2020
EV069	4.7	6.9	8.4	6.0	7.7	8.9	NA	NA	NA
JS002	4.7	7.0	8.2	5.9	7.8	8.9	NA	NA	NA
Reference Locations									
REF001	4.2	7.0	8.3	6.2	7.8	9.1	NA	NA	NA
REF002	5.4	7.1	8.1	6.2	7.8	8.9	NA	NA	NA
REF010	4.5	6.9	8.1	6.0	7.7	9.0	2.7	7/14/2020	7/15/2020 [c]
REF013	4.7	6.9	8.2	5.7	7.7	8.9	NA	NA	NA
REF014	4.6	6.8	8.2	6.2	7.7	8.9	NA	NA	NA
REF015	4.9	7.0	8.2	5.0	7.7	9.0	NA	NA	NA
Negative Laboratory Control Samples (CTL-SR)									
CTL-SR-2	5.1	7.2	8.5	6.2	7.8	8.9	NA	NA	NA
Quartz Sand Negative Control Samples (CTL-QS)									
CTL-QS-2	4.6	7.0	8.5	4.4	7.7	9.0	NA	NA	NA
Batch 3 (Initiated 6/18/2020)									
Site Locations [a]									
4-B1	4.2	7.3	8.2	5.2	7.7	8.8	2.8	7/19/2020	7/30/2020
CB006	4.3	6.9	7.9	4.6	7.5	8.5	NA	NA	NA
CB010	3.4	6.9	8.1	2.0 [d]	7.5	8.5	NA	NA	NA
CB014	2.6	7.3	8.7	3.7	7.7	8.7	3.4	7/22/2020	7/30/2020
CB044	3.1	6.9	8.0	3.2	7.5	8.5	NA	NA	NA
DM008	4.3	7.0	8.0	4.3	7.5	8.6	NA	NA	NA
DM018	5.2	7.2	8.6	2.3	7.5	8.6	2.3	7/22/2020	7/30/2020
DM024	5.3	7.2	8.7	5.3	7.5	8.6	3.5	7/22/2020	7/30/2020
DM026	3.2	6.9	8.3	5.2	7.6	8.5	NA	NA	NA

Table 4-7. Summary of DO Results for the 42-Day *Hyalella azteca* Bioassays

Sample ID	DO Before Water Exchange (mg/L)			DO After Water Exchange (mg/L)			DO Value that Triggered Aeration (mg/L)	Date Aeration Started	Date Aeration Stopped
	Minimum	Mean	Maximum	Minimum	Mean	Maximum			
Batch 3 (Initiated 6/18/2020) (continued)									
Site Locations [a]									
DM027	3.5	6.9	8.5	5.3	7.5	8.7	NA	NA	NA
EV027	4.1	6.9	8.1	2.7	7.5	8.5	NA	NA	NA
EV044	3.5	7.2	8.5	4.5	7.7	8.7	2.3	7/22/2020	7/30/2020
EV063	4.5	6.9	8.3	4.7	7.6	8.7	NA	NA	NA
JS001	4.0	6.8	7.8	4.9	7.5	8.4	NA	NA	NA
Reference Locations									
REF005	3.4	7.2	8.5	4.7	7.7	8.5	3.5	7/22/2020	7/30/2020
REF009A	3.5	6.9	8.4	5.2	7.6	8.5	NA	NA	NA
REF011	4.2	7.0	8.4	5.1	7.6	8.6	NA	NA	NA
REF012	4.8	6.9	8.1	4.6	7.6	8.6	NA	NA	NA
REF013	2.6	6.8	8.0	5.0	7.6	8.6	NA	NA	NA
REF016	3.2	6.9	8.0	4.9	7.5	8.5	2.7	7/14/2020	7/16/2020 [c]
Negative Laboratory Control Samples									
CTL-SR-3	4.1	6.7	7.9	2.5	7.4	8.5	2.5	7/22/2020	7/30/2020
Quartz Sand Negative Control Samples									
CTL-QS-3	4.1	7.1	8.2	2.8	7.5	8.5	2.8	7/22/2020	7/30/2020

Notes:

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

[b] Aeration stopped on 7/15/20 (Day 28 of test) after transition to water-only exposure chambers. Aeration started again on 7/21/20 due to evening dissolved oxygen (DO) measurement of 2.3 mg/L and continued to end of test.

[c] Aeration was stopped on Test Day 28 after transition to water-only exposure chambers.

[d] The measured DO in sample CB010 was 2.0 mg/L after the morning water change. As this value was less than the measured “old” DO and the evening confirmation DO was 4.5 mg/L, this treatment was not aerated.

NA - not applicable

Table 4-8. Summary of Organism Starting Dry Weights (mg/individual) for 42-Day *Hyalella azteca* Bioassays

Batch	Replicates	Mean	SD
1	8	0.019	0.003
2	8	0.026	0.005
3	8	0.019	0.007

Notes:

SD - standard deviation

Table 5-1a. Field-Collected Sediment Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples [b]											
Conventional Parameters											
Solids (%)	87	87	27	74.7	94.4	NA	NA	NA	27	74.7	94.4
Sulfide (AVS) (umol/g)	84	82	0.307	3.43	23.9	0.017	0.0185	0.02	0.017	0.0185	23.9
TOC (%)	86	86	0.06	0.371	2.94	NA	NA	NA	0.06	0.371	2.94
Grain Size - Normalized (%)											
Clay	85	85	0	0.764	14.5	NA	NA	NA	0	0.764	14.5
Coarse sand	85	85	0.461	31.3	82.4	NA	NA	NA	0.461	31.3	82.4
Fine gravel	85	85	0	5.63	62.7	NA	NA	NA	0	5.63	62.7
Fine sand	85	85	0.144	16.6	63.5	NA	NA	NA	0.144	16.6	63.5
Medium gravel	85	85	0	2.11	51.9	NA	NA	NA	0	2.11	51.9
Medium sand	85	85	0.0766	27	73.3	NA	NA	NA	0.0766	27	73.3
Silt	85	85	0.0496	7.22	76.9	NA	NA	NA	0.0496	7.22	76.9
Very coarse sand	85	85	0.0301	6.83	71.6	NA	NA	NA	0.0301	6.83	71.6
Very fine sand	85	85	0.0197	2.54	19.5	NA	NA	NA	0.0197	2.54	19.5
Gravel (sum)	85	85	0	7.74	85.6	NA	NA	NA	0	7.74	85.6
Sand (sum)	85	85	11.4	84.3	99.9	NA	NA	NA	11.4	84.3	99.9
Mud (sum)	85	85	0.0786	7.98	88.5	NA	NA	NA	0.0786	7.98	88.5
Metals (mg/kg)											
Aluminum	87	87	4430	13000	27200	NA	NA	NA	4430	13000	27200
Antimony	87	87	0.102	21.5	71.6	NA	NA	NA	0.102	21.5	71.6
Arsenic	87	87	1.11	14.6	80.5	NA	NA	NA	1.11	14.6	80.5
Barium	87	87	47.8	863	2440	NA	NA	NA	47.8	863	2440
Beryllium	87	87	0.168	0.546	1.04	NA	NA	NA	0.168	0.546	1.04
Cadmium	87	87	0.22	2.01	12.7	NA	NA	NA	0.22	2.01	12.7
Calcium	87	87	2250	39700	75400	NA	NA	NA	2250	39700	75400
Chromium	87	87	5.88	61.4	163	NA	NA	NA	5.88	61.4	163
Cobalt	87	87	2.48	28.4	126	NA	NA	NA	2.48	28.4	126
Copper	87	87	5.87	1030	2860	NA	NA	NA	5.87	1030	2860
Iron	87	87	8490	108000	250000	NA	NA	NA	8490	108000	250000
Lead	87	87	12.1	367	5520	NA	NA	NA	12.1	367	5520
Magnesium	87	87	2620	8390	29700	NA	NA	NA	2620	8390	29700
Manganese	87	87	104	2070	4710	NA	NA	NA	104	2070	4710
Mercury	86	77	0.002	0.163	1.94	0.002	0.0103	0.015	0.002	0.00446	1.94
Nickel	87	87	8.14	13	29.2	NA	NA	NA	8.14	13	29.2
Potassium	87	87	474	2460	8020	NA	NA	NA	474	2460	8020
Selenium	87	84	0.3	1.26	2.8	0.2	0.2	0.2	0.2	1.23	2.8
Silver	87	87	0.031	2.34	12.2	NA	NA	NA	0.031	2.34	12.2
Sodium	87	87	50	1130	4780	NA	NA	NA	50	1130	4780
Thallium	87	79	0.041	0.14	0.803	0.038	0.0584	0.078	0.038	0.0453	0.803
Vanadium	87	87	13.5	31.4	77.4	NA	NA	NA	13.5	31.4	77.4
Zinc	87	87	36.4	9550	29300	NA	NA	NA	36.4	9550	29300

Table 5-1a. Field-Collected Sediment Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples (continued)											
SEM (µmol/g)											
Antimony	84	78	0.0029	0.0654	0.225	0.0019	0.00865	0.03	0.0019	0.00407	0.225
Arsenic	84	40	0.006	0.0187	0.058	0.004	0.0508	0.1	0.004	0.0295	0.1
Cadmium	84	83	0.00479	0.0207	0.0667	0.009	0.009	0.009	0.00479	0.0206	0.0667
Chromium	84	83	0.0403	0.391	1.19	0.05	0.05	0.05	0.0403	0.387	1.19
Copper	84	84	0.168	3.95	12.6	NA	NA	NA	0.168	3.95	12.6
Lead	84	83	0.143	0.68	4.71	0.06	0.06	0.06	0.06	0.672	4.71
Nickel	84	83	0.0243	0.0842	0.192	0.04	0.04	0.04	0.0243	0.0836	0.192
Zinc	84	84	1.91	60.2	226	NA	NA	NA	1.91	60.2	226
Total SEM	84	84	2.36	64.9	232	NA	NA	NA	2.36	64.9	232
Excess SEM	84	84	-6.92	~~61.5~~ 61.6	208	NA	NA	NA	-6.92	~~61.5~~ 61.6	208
Excess SEM OC Norm	84	84	-746	46200	209000	NA	NA	NA	-746	46200	209000
Reference Samples											
Conventional Parameters											
Solids (%)	18	18	41.2	73.1	92.7	NA	NA	NA	41.2	73.1	92.7
Sulfide (AVS) (umol/g)	18	7	0.011	0.345	0.92	0.008	0.00945	0.014	0.008	0.0094	0.92
TOC (%)	18	18	0.046	0.83	7.07	NA	NA	NA	0.046	0.83	7.07
Grain Size - Normalized (%)											
Clay	18	18	0	3.07	15.6	NA	NA	NA	0	3.07	15.6
Coarse sand	18	18	1.61	28	87.7	NA	NA	NA	1.61	28	87.7
Fine gravel	18	18	0	4.9	21.1	NA	NA	NA	0	4.9	21.1
Fine sand	18	18	0.329	19.5	66.3	NA	NA	NA	0.329	19.5	66.3
Medium gravel	18	18	0	0.385	2.21	NA	NA	NA	0	0.385	2.21
Medium sand	18	18	2.09	18.3	58.7	NA	NA	NA	2.09	18.3	58.7
Silt	18	18	0.0515	7.82	44.4	NA	NA	NA	0.0515	7.82	44.4
Very coarse sand	18	18	0.261	11.9	51.6	NA	NA	NA	0.261	11.9	51.6
Very fine sand	18	18	0.0309	5.94	22.5	NA	NA	NA	0.0309	5.94	22.5
Gravel (sum)	18	18	0	5.29	21.1	NA	NA	NA	0	5.29	21.1
Sand (sum)	18	18	42.7	83.8	99.9	NA	NA	NA	42.7	83.8	99.9
Mud (sum)	18	18	0.0699	10.9	56.7	NA	NA	NA	0.0699	10.9	56.7
Metals (mg/kg)											
Aluminum	18	18	2440	4710	11600	NA	NA	NA	2440	4710	11600
Antimony	18	6	0.05	0.204	0.5	0.027	0.0369	0.05	0.027	0.0368	0.5
Arsenic	18	18	0.66	2.05	9.5	NA	NA	NA	0.66	2.05	9.5
Barium	18	18	17.6	50.8	142	NA	NA	NA	17.6	50.8	142
Beryllium	18	18	0.12	0.241	0.678	NA	NA	NA	0.12	0.241	0.678
Cadmium	18	18	0.089	0.227	1.1	NA	NA	NA	0.089	0.227	1.1
Calcium	18	18	1550	2630	6650	NA	NA	NA	1550	2630	6650
Chromium	18	18	4.95	12.3	40.4	NA	NA	NA	4.95	12.3	40.4
Cobalt	18	18	1.73	4.07	13.1	NA	NA	NA	1.73	4.07	13.1
Copper	18	18	3.36	7.52	21.5	NA	NA	NA	3.36	7.52	21.5
Iron	18	18	5670	10000	20200	NA	NA	NA	5670	10000	20200
Lead	18	18	3.5	11.6	59.1	NA	NA	NA	3.5	11.6	59.1

Table 5-1a. Field-Collected Sediment Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Metals (mg/kg) (continued)											
Magnesium	18	18	1610	2810	6770	NA	NA	NA	1610	2810	6770
Manganese	18	18	74.6	129	231	NA	NA	NA	74.6	129	231
Mercury	18	3	0.013	0.019	0.03	0.002	0.0044	0.03	0.002	0.0041	0.03
Nickel	18	18	5.08	11.5	41.1	NA	NA	NA	5.08	11.5	41.1
Potassium	18	18	430	950	2930	NA	NA	NA	430	950	2930
Selenium	18	6	0.09	0.332	0.5	0.1	0.167	0.2	0.09	0.156	0.5
Silver	18	18	0.018	0.0391	0.112	NA	NA	NA	0.018	0.0391	0.112
Sodium	18	18	49	111	312	NA	NA	NA	49	111	312
Thallium	18	13	0.038	0.096	0.219	0.032	0.039	0.049	0.032	0.0371	0.219
Vanadium	18	18	9.37	16.6	30.6	NA	NA	NA	9.37	16.6	30.6
Zinc	18	18	22.9	39	90.8	NA	NA	NA	22.9	39	90.8
SEM (µmol/g)											
Antimony	18	5	0.0018	0.00312	0.006	0.0014	0.00202	0.004	0.0014	0.00193	0.006
Arsenic	18	9	0.004	0.00754	0.014	0.0037	0.00506	0.008	0.0037	0.00471	0.014
Cadmium	18	18	0.00047	0.00107	0.00329	NA	NA	NA	0.00047	0.00107	0.00329
Chromium	18	18	0.0066	0.0165	0.0451	NA	NA	NA	0.0066	0.0165	0.0451
Copper	18	18	0.014	0.0372	0.169	NA	NA	NA	0.014	0.0372	0.169
Excess SEM	18	18	-0.593	0.100	0.335	NA	NA	NA	-0.593	0.1	0.335
Excess SEM OC Norm	18	18	-264	120	315	NA	NA	NA	-264	120	315
Lead	18	18	0.0114	0.0259	0.104	NA	NA	NA	0.0114	0.0259	0.104
Nickel	18	18	0.01	0.0283	0.0918	NA	NA	NA	0.01	0.0283	0.0918
Total SEM	18	18	0.127	0.243	0.584	NA	NA	NA	0.127	0.243	0.584
Zinc	18	0	NA	NA	NA	0.0827	0.151	0.335	0.0827	0.151	0.335
Organics - PAHs (µg/kg)											
2-Methylnaphthalene	18	6	0.83	3.41	8.5	0.37	0.477	0.73	0.37	0.477	8.5
Acenaphthene	18	4	0.5	1.99	3.4	0.3	0.391	0.59	0.3	0.39	3.4
Acenaphthylene	18	3	1.75	7.62	17	0.28	0.363	0.55	0.28	0.363	17
Anthracene	18	8	0.37	2.63	7.2	0.29	0.378	0.57	0.29	0.372	7.2
Benzo[a]anthracene	18	3	5.6	7.17	9.8	0.27	0.815	1.6	0.27	0.815	9.8
Benzo[a]pyrene	18	5	0.74	4.4	8.1	0.38	0.493	0.75	0.38	0.492	8.1
Benzo[b]fluoranthene	18	7	1.1	4.9	10	0.38	0.494	0.75	0.38	0.494	10
Benzo[g,h,i]perylene	18	8	0.57	2.97	8.8	0.4	0.519	0.79	0.4	0.514	8.8
Benzo[k]fluoranthene	18	5	0.96	2.19	3.9	0.24	0.311	0.47	0.24	0.311	3.9
Chrysene	18	9	0.47	3.6	11	0.31	0.383	0.53	0.31	0.382	11
Dibenzo[a,h]anthracene	18	4	0.32	0.615	0.81	0.23	0.299	0.45	0.23	0.297	0.81
Fluoranthene	18	8	1.4	9.67	28	0.63	0.774	1.1	0.63	0.774	28
Fluorene	18	5	0.93	3.4	7.9	0.57	0.735	1.2	0.57	0.727	7.9
Indeno[1,2,3-cd]pyrene	18	6	0.61	2.9	6.5	0.36	0.461	0.71	0.36	0.458	6.5
Naphthalene	18	9	0.63	19.3	95	0.47	0.753	2	0.47	0.709	95
Phenanthrene	18	13	0.77	8.4	44	0.59	0.658	0.75	0.59	0.658	44
Pyrene	18	11	0.56	6.86	24	0.32	0.367	0.41	0.32	0.367	24

Table 5-1a. Field-Collected Sediment Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Organics - PAHs (µg/kg) (continued)											
Total HPAHs, 0 DL	18	12	0.56	26.4	101	0.63	0.705	0.79	0.56	0.682	101
Total HPAHs, 1/2 DL	18	12	3.07	27.8	101	0.63	0.705	0.79	0.63	0.705	101
Total LPAHs, 0 DL	18	13	0.95	28.7	181	0.59	0.658	0.75	0.59	0.658	181
Total LPAHs, 1/2 DL	18	13	2.32	29.6	181	0.59	0.658	0.75	0.59	0.658	181
Total PAHs, 0 DL	18	14	1.2	49.4	283	0.63	0.678	0.74	0.63	0.678	283
Total PAHs, 1/2 DL	18	14	4.8	51.8	283	0.63	0.678	0.74	0.63	0.678	283
Organics - PCBs (µg/kg)											
2-Chlorobiphenyl	18	1	8.3	8.3	8.3	2.1	2.61	5.3	2.1	2.61	8.3
2,2',3,3',4,4'-Hexachlorobiphenyl	18	0	NA	NA	NA	0.09	0.115	0.2	0.09	0.115	0.2
2,2',3,3',4,4',5-Heptachlorobiphenyl	18	0	NA	NA	NA	0.14	0.179	0.32	0.14	0.179	0.32
2,2',3,3',4,4',5,5'-Octachlorobiphenyl	18	0	NA	NA	NA	0.18	0.228	0.4	0.18	0.228	0.4
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	18	0	NA	NA	NA	0.14	0.179	0.32	0.14	0.179	0.32
2,2',3,3',4,4',5,6-Octachlorobiphenyl	18	0	NA	NA	NA	0.11	0.141	0.25	0.11	0.141	0.25
2,2',3,3',4,5',6'-Heptachlorobiphenyl	18	0	NA	NA	NA	0.16	0.204	0.36	0.16	0.204	0.36
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	18	0	NA	NA	NA	0.16	0.204	0.36	0.16	0.204	0.36
2,2',3,3',4,5,6'-Heptachlorobiphenyl	18	0	NA	NA	NA	0.11	0.141	0.25	0.11	0.141	0.25
2,2',3,3',4,6'-Hexachlorobiphenyl	18	0	NA	NA	NA	0.12	0.153	0.27	0.12	0.153	0.27
2,2',3,4',5'-Pentachlorobiphenyl	18	0	NA	NA	NA	0.093	0.14	0.47	0.093	0.14	0.47
2,2',3,4',5',6-Hexachlorobiphenyl	18	0	NA	NA	NA	0.14	0.179	0.32	0.14	0.179	0.32
2,2',3,4',5-Pentachlorobiphenyl	18	0	NA	NA	NA	0.18	0.228	0.4	0.18	0.228	0.4
2,2',3,4',5,5',6-Heptachlorobiphenyl	18	0	NA	NA	NA	0.16	0.204	0.36	0.16	0.204	0.36
2,2',3,4,4',5'-Hexachlorobiphenyl	18	0	NA	NA	NA	0.18	0.228	0.4	0.18	0.228	0.4
2,2',3,4,4',5',6-Heptachlorobiphenyl	18	0	NA	NA	NA	0.14	0.214	0.79	0.14	0.214	0.79
2,2',3,4,4',5,5'-Heptachlorobiphenyl	18	0	NA	NA	NA	0.11	0.141	0.25	0.11	0.141	0.25
2,2',3,4,4',5,5',6-Octachlorobiphenyl	18	0	NA	NA	NA	0.13	0.167	0.29	0.13	0.167	0.29
2,2',3,4,4',6,6'-Heptachlorobiphenyl	18	0	NA	NA	NA	0.15	0.222	0.71	0.15	0.222	0.71
2,2',3,4,5'-Pentachlorobiphenyl	18	0	NA	NA	NA	0.11	0.154	0.49	0.11	0.154	0.49
2,2',3,4,5,5'-Hexachlorobiphenyl	18	0	NA	NA	NA	0.096	0.124	0.22	0.096	0.124	0.22
2,2',3,5'-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.17	0.216	0.38	0.17	0.216	0.38
2,2',3,5',6-Pentachlorobiphenyl	18	0	NA	NA	NA	0.15	0.192	0.34	0.15	0.192	0.34
2,2',3,5,5',6-Hexachlorobiphenyl	18	0	NA	NA	NA	0.12	0.178	0.37	0.12	0.178	0.37
2,2',4,4',5-Pentachlorobiphenyl	18	0	NA	NA	NA	0.28	0.353	0.63	0.28	0.353	0.63
2,2',4,4',5,5'-Hexachlorobiphenyl	18	1	0.98	0.98	0.98	0.13	0.172	0.29	0.13	0.172	0.98
2,2',4,5'-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.13	0.167	0.29	0.13	0.167	0.29
2,2',4,5,5'-Pentachlorobiphenyl	18	0	NA	NA	NA	0.26	0.329	0.58	0.26	0.329	0.58
2,2',5-Trichlorobiphenyl	18	0	NA	NA	NA	0.22	0.278	0.49	0.22	0.278	0.49
2,2',5,5'-Tetrachlorobiphenyl	18	2	0.52	0.675	0.83	0.2	0.244	0.4	0.2	0.244	0.83
2,3',4'-Trichlorobiphenyl	18	0	NA	NA	NA	0.26	0.329	0.58	0.26	0.329	0.58
2,3',4',5-Tetrachlorobiphenyl	18	1	0.62	0.62	0.62	0.14	0.181	0.32	0.14	0.181	0.62
2,3',4,4'-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.19	0.249	0.43	0.19	0.249	0.43
2,3',4,4',5'-Pentachlorobiphenyl	18	0	NA	NA	NA	0.12	0.153	0.27	0.12	0.153	0.27
2,3',4,4',5',6-Hexachlorobiphenyl	18	0	NA	NA	NA	0.14	0.179	0.32	0.14	0.179	0.32
2,3',4,4',5-Pentachlorobiphenyl	18	0	NA	NA	NA	0.095	0.123	0.22	0.095	0.123	0.22

Table 5-1a. Field-Collected Sediment Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Organics - PCBs (µg/kg) (continued)											
2,3',4,4',5,5'-Hexachlorobiphenyl	18	0	NA	NA	NA	0.16	0.204	0.36	0.16	0.204	0.36
2,3',4,4',6-Pentachlorobiphenyl	18	0	NA	NA	NA	0.16	0.204	0.36	0.16	0.204	0.36
2,3-Dichlorobiphenyl	18	2	0.11	0.16	0.21	0.092	0.118	0.2	0.092	0.116	0.21
2,3,3',4'-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.12	0.153	0.27	0.12	0.153	0.27
2,3,3',4',6-Pentachlorobiphenyl	18	0	NA	NA	NA	0.16	0.204	0.36	0.16	0.204	0.36
2,3,3',4,4'-Pentachlorobiphenyl	18	0	NA	NA	NA	0.12	0.153	0.27	0.12	0.153	0.27
2,3,3',4,4',5'-Hexachlorobiphenyl	18	0	NA	NA	NA	0.13	0.167	0.29	0.13	0.167	0.29
2,3,3',4,4',5-Hexachlorobiphenyl	18	0	NA	NA	NA	0.12	0.153	0.27	0.12	0.153	0.27
2,3,3',4,4',5,5'-Heptachlorobiphenyl	18	0	NA	NA	NA	0.095	0.123	0.22	0.095	0.123	0.22
2,3,3',4,4',6-Hexachlorobiphenyl	18	0	NA	NA	NA	0.073	0.0933	0.17	0.073	0.0933	0.17
2,3,4,4'-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.13	0.167	0.29	0.13	0.167	0.29
2,3,4,4',5-Pentachlorobiphenyl	18	0	NA	NA	NA	0.12	0.162	0.4	0.12	0.162	0.4
2,3,4,4',5,6-Hexachlorobiphenyl	18	0	NA	NA	NA	0.14	0.232	1.1	0.14	0.232	1.1
2,4'-Dichlorobiphenyl	18	0	NA	NA	NA	0.29	0.366	0.65	0.29	0.366	0.65
2,4',5-Trichlorobiphenyl	18	0	NA	NA	NA	0.098	0.142	0.43	0.098	0.142	0.43
2,4,4'-Trichlorobiphenyl	18	0	NA	NA	NA	0.22	0.278	0.49	0.22	0.278	0.49
2,4,4',5-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.18	0.228	0.4	0.18	0.228	0.4
3,3',4,4'-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.2	0.277	0.64	0.2	0.277	0.64
3,3',4,4',5-Pentachlorobiphenyl	18	0	NA	NA	NA	0.17	0.216	0.38	0.17	0.216	0.38
3,3',4,4',5,5'-Hexachlorobiphenyl	18	0	NA	NA	NA	0.2	0.253	0.45	0.2	0.253	0.45
3,4,4'-Trichlorobiphenyl	18	0	NA	NA	NA	0.17	0.216	0.38	0.17	0.216	0.38
3,4,4',5-Tetrachlorobiphenyl	18	0	NA	NA	NA	0.18	0.228	0.4	0.18	0.228	0.4
Aroclor 1016	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Aroclor 1221	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Aroclor 1232	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Aroclor 1242	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Aroclor 1248	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Aroclor 1254	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Aroclor 1260	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Decachlorobiphenyl (PCB 209)	18	0	NA	NA	NA	0.22	0.278	0.49	0.22	0.278	0.49
Total PCB Aroclors, 0 DL	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Total PCB Aroclors, 1/2 DL	18	0	NA	NA	NA	2.9	3.62	6.3	2.9	3.62	6.3
Total PCB congeners, 0 DL	18	4	0.11	2.73	9.3	2.1	2.49	3.6	0.11	2.07	9.3
Total PCB congeners, 1/2 DL	18	4	5.1	10.6	18.3	2.1	2.49	3.6	2.1	2.49	18.3
Organics - Pesticides (µg/kg)											
2,4'-DDD	18	0	NA	NA	NA	0.27	0.546	2.7	0.27	0.546	2.7
2,4'-DDE	18	0	NA	NA	NA	0.47	0.588	1.1	0.47	0.588	1.1
2,4'-DDT	18	0	NA	NA	NA	0.48	0.599	1.1	0.48	0.599	1.1
4,4'-DDD	18	1	1.4	1.4	1.4	0.6	0.723	1.3	0.6	0.723	1.4
4,4'-DDE	18	0	NA	NA	NA	0.4	0.497	0.87	0.4	0.497	0.87
4,4'-DDT	18	0	NA	NA	NA	0.61	0.764	1.4	0.61	0.764	1.4
Aldrin	18	0	NA	NA	NA	0.59	0.741	1.3	0.59	0.741	1.3

Table 5-1a. Field-Collected Sediment Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Organics - Pesticides (µg/kg) (continued)											
alpha-Benzenehexachloride	18	1	0.58	0.58	0.58	0.29	0.35	0.63	0.29	0.349	0.63
alpha-Chlordane	18	0	NA	NA	NA	0.41	0.508	0.89	0.41	0.508	0.89
beta-BHC	18	1	1.9	1.9	1.9	0.27	0.335	0.59	0.27	0.335	1.9
cis-Nonachlor	18	0	NA	NA	NA	0.29	0.362	0.63	0.29	0.362	0.63
delta-BHC	18	0	NA	NA	NA	0.28	0.349	0.61	0.28	0.349	0.61
Dieldrin	18	0	NA	NA	NA	0.22	0.293	0.55	0.22	0.293	0.55
Endosulfan I	18	0	NA	NA	NA	0.37	0.459	0.8	0.37	0.459	0.8
Endosulfan II	18	2	1.1	1.2	1.3	0.69	0.872	1.5	0.69	0.858	1.5
Endosulfan sulfate	18	0	NA	NA	NA	0.99	1.29	2.2	0.99	1.29	2.2
Endrin	18	0	NA	NA	NA	0.32	0.399	0.7	0.32	0.399	0.7
Endrin aldehyde	18	0	NA	NA	NA	0.89	1.12	2	0.89	1.12	2
Endrin ketone	18	0	NA	NA	NA	0.45	0.712	3.3	0.45	0.712	3.3
gamma-BHC	18	3	0.73	0.743	0.76	0.31	0.41	1.1	0.31	0.402	1.1
Heptachlor	18	0	NA	NA	NA	0.39	0.491	0.85	0.39	0.491	0.85
Heptachlor epoxide	18	0	NA	NA	NA	0.66	0.826	1.5	0.66	0.826	1.5
Methoxychlor	17	1	1.8	1.8	1.8	0.71	0.981	1.8	0.71	0.978	1.8
Oxychlordane	18	0	NA	NA	NA	0.25	0.312	0.55	0.25	0.312	0.55
Total chlordane, 0 DL	18	0	NA	NA	NA	0.71	0.894	1.6	0.71	0.894	1.6
Total chlordane, 1/2 DL	18	0	NA	NA	NA	0.71	0.894	1.6	0.71	0.894	1.6
Total DDD, 0 DL	18	1	1.4	1.4	1.4	0.6	0.859	2.7	0.6	0.852	2.7
Total DDD, 1/2 DL	18	1	1.7	1.7	1.7	0.6	0.859	2.7	0.6	0.852	2.7
Total DDE, 0 DL	18	0	NA	NA	NA	0.47	0.588	1.1	0.47	0.588	1.1
Total DDE, 1/2 DL	18	0	NA	NA	NA	0.47	0.588	1.1	0.47	0.588	1.1
Total DDT, 0 DL	18	0	NA	NA	NA	0.61	0.764	1.4	0.61	0.764	1.4
Total DDT, 1/2 DL	18	0	NA	NA	NA	0.61	0.764	1.4	0.61	0.764	1.4
Total DDx, 0 DL	18	1	1.4	1.4	1.4	0.61	0.872	2.7	0.61	0.863	2.7
Total DDx, 1/2 DL	18	1	3.6	3.6	3.6	0.61	0.872	2.7	0.61	0.872	3.6
Toxaphene	18	0	NA	NA	NA	34	42.3	74	34	42.3	74
trans-chlordane	18	0	NA	NA	NA	0.38	0.473	0.83	0.38	0.473	0.83
trans-Nonachlor	18	0	NA	NA	NA	0.71	0.894	1.6	0.71	0.894	1.6
Hexachlorobenzene	18	0	NA	NA	NA	0.35	0.442	0.79	0.35	0.442	0.79
Hexachlorobutadiene	18	6	0.25	0.908	3.2	0.18	0.248	0.39	0.18	0.24	3.2

Notes:

All nondetected results use the full detection limit for summary statistics.

[a] When appropriate, overall means are Kaplan Meier estimates.

[b] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

AVS - acid volatile sulfide
BHC - hexachlorocyclohexane
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichorodiphenyltrichloroethane
DDx - sum of 2,4'-DDD, 4,4'-DDD, 2,4'-DDE, 4,4'-DDE, 2,4'-DDT, and 4,4'-DDT
DL - detection limit
HPAH - high molecular weight polycyclic aromatic hydrocarbon
LPAH - low molecular weight polycyclic aromatic hydrocarbon

NA - not applicable
OC Norm - organic carbon normalized
PAH - polycylic aromatic hydrocarbon
PCBs - polychorinated biphenyls
SEM - simultaneously extracted metals
TOC - total organic carbon

Table 5-1b. Field-Collected Sediment Grain Size Adjusted for Removal of Coarse Sediment

Location ID	Sample ID	Target Sediment Facies per QAPP	Target Stratum per QAPP	Coarse Material Removed by Hand or Sieving	Sample Grain Size Analysis Results [a] Adjusted Gravel (%)	Adjusted Sand (%)	Adjusted Mud (%)	Sediment Facies Based on Adjusted Grain Size	Stratum Based on Adjusted Grain Size
1-B5-NRT-2019	1-B5-NRT-SE-1-101519	NA	NA	no	0.1	83.3	16.6	S	sampleable sand
1-B6-NRT-2019	1-B6-NRT-SE-1-101619	NA	NA	no	1.6	97.7	0.7	S	sampleable sand
3-R7-2019	3-R7-2019-SE-1-101519	C	NA	yes	4.9	68.1	0.1	mFs	sampleable sand
3-R8-2019	3-R8-2019-SE-1-101619	B	NA	no	11.5	88.2	0.3	S	sampleable sand
4-B1-2019	4-B1-2019-SE-1-092619	S	NA	no	0.2	98.4	1.4	S	sampleable sand
4-B6-2019	4-B6-2019-SE-1-092619	bedrock	NA	no	0.3	99.4	0.3	S	sampleable sand
CB002	CB002-SE-1-101619	S	sampleable sand	no	0.0	97.5	2.5	S	sampleable sand
CB005	CB005-SE-1-101819	mCs	mixed coarse	yes	89.0	10.8	0.1	G	coarse
CB006	CB006-SE-1-100919	S	sampleable sand	no	0.0	99.1	0.9	S	sampleable sand
CB007	CB007-SE-1-100919	mFs	sampleable sand	yes	49.5	18.2	2.2	mCs	mixed coarse
CB009	CB009-SE-1-101219	mFs	sampleable sand	yes	36.9	24.8	1.2	mCs	mixed coarse
CB010	CB010-SE-1-101219	mFs	sampleable sand	yes	17.2	69.3	4.1	mFs	sampleable sand
CB012	CB012-SE-1-100919	S	sampleable sand	no	0.0	98.6	1.4	S	sampleable sand
CB014	CB014-SE-1-101519	S	sampleable sand	no	0.0	99.8	0.2	S	sampleable sand
CB016	CB016-SE-1-101119	mFs	sampleable sand	yes	29.3	58.7	1.0	mFs	sampleable sand
CB018	CB018-SE-1-100919	S	sampleable sand	yes	1.0	97.7	1.3	S	sampleable sand
CB020	CB020-SE-1-101419	S	sampleable sand	yes	0.0	98.5	1.4	S	sampleable sand
CB021	CB021-SE-1-101419	M	mud	yes	1.4	83.4	15.2	S	sampleable sand
CB024	CB024-SE-1-101419	M	mud	no	0.1	96.2	3.7	S	sampleable sand
CB027	CB027-SE-1-101419	M	mud	no	0.0	97.4	2.6	S	sampleable sand
CB029	CB029-SE-1-101519	M	mud	no	0.0	95.5	4.5	S	sampleable sand
CB035	CB035-SE-1-100319	mCs	mixed coarse	yes	18.9	39.4	0.2	mCs	mixed coarse
CB036	CB036-SE-1-100419	mCs	mixed coarse	yes	23.8	24.4	0.1	mBs	coarse
CB039	CB039-SE-1-101119	mFs	sampleable sand	yes	47.4	39.2	0.1	mCs	mixed coarse
CB040	CB040-SE-1-101819	mCs	mixed coarse	yes	38.1	24.6	0.4	mCs	mixed coarse
CB044	CB044-SE-1-101519	M	mud	yes	0.3	95.7	4.0	S	sampleable sand
CB046	CB046-SE-1-100819	mCs	mixed coarse	yes	1.3	47.1	0.6	mBs	not defined [b]
CB047	CB047-SE-1-101119	mFs	sampleable sand	yes	56.2	43.5	0.2	mCs	mixed coarse
CB056	CB056-SE-1-101719	mCs	mixed coarse	yes	55.9	23.7	5.9	mCs	mixed coarse
DM002	DM002-SE-1-100919	S	sampleable sand	yes	35.7	64.3	0.1	mFs	sampleable sand
DM007	DM007-SE-1-101519	S	sampleable sand	no	0.0	99.9	0.1	S	sampleable sand
DM008	DM008-SE-1-101119	S	sampleable sand	no	0.0	99.1	0.8	S	sampleable sand
DM010	DM010-SE-1-101119	S	sampleable sand	no	0.0	99.8	0.2	S	sampleable sand
DM015	DM015-SE-1-101019	S	sampleable sand	no	0.1	99.4	0.6	S	sampleable sand
DM016	DM016-SE-1-101019	S	sampleable sand	no	0.0	99.5	0.4	S	sampleable sand
DM018	DM018-SE-1-100919	S	sampleable sand	no	0.0	99.7	0.3	S	sampleable sand
DM019	DM019-SE-1-101419	S	sampleable sand	no	0.0	98.4	1.6	S	sampleable sand
DM020	DM020-SE-1-101419	S	sampleable sand	no	0.1	98.5	1.5	S	sampleable sand
DM022	DM022-SE-1-092119	S	sampleable sand	no	0.4	98.6	1.1	S	sampleable sand
DM023	DM023-SE-1-092119	S	sampleable sand	no	0.0	99.6	0.3	S	sampleable sand

Table 5-1b. Field-Collected Sediment Grain Size Adjusted for Removal of Coarse Sediment

Location ID	Sample ID	Target Sediment Facies per QAPP	Target Stratum per QAPP	Coarse Material Removed by Hand or Sieving	Sample Grain Size Analysis Results [a] Adjusted Gravel (%)	Adjusted Sand (%)	Adjusted Mud (%)	Sediment Facies Based on Adjusted Grain Size	Stratum Based on Adjusted Grain Size
DM024	DM024-SE-1-101519	S	sampleable sand	no	0.0	99.3	0.7	S	sampleable sand
DM025	DM025-SE-1-101219	S	sampleable sand	no	0.1	99.8	0.1	S	sampleable sand
DM026	DM026-SE-1-092119	S	sampleable sand	no	0.1	99.7	0.2	S	sampleable sand
DM027	DM027-SE-1-101419	S	sampleable sand	no	0.0	99.8	0.2	S	sampleable sand
DM036	DM036-SE-1-101819	mCs	mixed coarse	yes	33.0	1.0	0.1	C	coarse
DM038	DM038-SE-1-101919	mCs	mixed coarse	yes	18.3	34.4	0.2	mCs	mixed coarse
DM039	DM039-SE-1-101719	mCs	mixed coarse	yes	7.3	22.6	0.1	mBs	coarse
DM044	DM044-SE-1-101619	mFs	sampleable sand	no	0.3	89.3	10.4	S	sampleable sand
DM045	DM045-SE-1-091919	mFs	sampleable sand	no	0.0	62.1	37.9	not defined [b]	sampleable sand
DM046	DM046-SE-1-092019	mFs	sampleable sand	no	0.2	64.5	35.2	not defined [b]	sampleable sand
DM047	DM047-SE-1-101819	mCs	mixed coarse	yes	69.4	29.9	0.7	mCs	mixed coarse
DM050	DM050-SE-1-092019	mFs	sampleable sand	no	0.5	66.1	33.4	not defined [b]	sampleable sand
DM057	DM057-SE-1-091819	mFs	sampleable sand	no	1.1	96.7	2.2	S	sampleable sand
DM061	DM061-SE-1-101219	S	sampleable sand	yes	11.2	69.8	19.0	not defined [b]	sampleable sand
EV001	EV001-SE-1-092619	S	sampleable sand	no	1.9	97.3	0.8	S	sampleable sand
EV002	EV002-SE-1-092419	S	sampleable sand	no	2.5	97.4	0.1	S	sampleable sand
EV003	EV003-SE-1-092019	mFs	sampleable sand	yes	79.9	20.0	0.1	mCs	mixed coarse
EV005	EV005-SE-1-091119	S	sampleable sand	no	0.9	97.2	2.0	S	sampleable sand
EV008	EV008-SE-1-092319	S	sampleable sand	no	0.2	98.4	1.5	S	sampleable sand
EV010	EV010-SE-1-091219	mFs	sampleable sand	yes	53.3	46.0	0.6	mCs	mixed coarse
EV011	EV011-SE-1-092819	mCs	mixed coarse	yes	92.6	6.5	0.8	G	coarse
EV012	EV012-SE-1-091319	mFs	sampleable sand	yes	59.1	40.6	0.4	mCs	mixed coarse
EV013	EV013-SE-1-091319	mFs	sampleable sand	yes	55.9	43.6	0.4	mCs	mixed coarse
EV020	EV020-SE-1-100219	mCs	mixed coarse	yes	nm	nm	nm	nm	nm
EV022	EV022-SE-1-092819	mCs	mixed coarse	yes	nm	nm	nm	nm	nm
EV026	EV026-SE-1-092019	mFs	sampleable sand	yes	23.3	75.2	1.5	S	sampleable sand
EV027	EV027-SE-1-092119	mFs	sampleable sand	yes	49.6	50.3	0.1	mFs	sampleable sand
EV036	EV036-SE-1-091419	mCs	mixed coarse	yes	20.6	10.6	3.8	C	coarse
EV037	EV037-SE-1-092319	S	sampleable sand	no	0.9	98.1	1.0	S	sampleable sand
EV044	EV044-SE-1-092419	M	mud	no	0.1	18.6	81.3	M	mud
EV048	EV048-SE-1-092419	S	sampleable sand	no	5.6	93.5	0.9	S	sampleable sand
EV049	EV049-SE-1-092719	mCs	mixed coarse	no	4.3	87.9	7.8	S	sampleable sand
EV051	EV051-SE-1-092419	S	sampleable sand	no	4.0	95.2	0.8	S	sampleable sand
EV052	EV052-SE-1-092619	S	sampleable sand	yes	6.1	92.1	1.6	S	sampleable sand
EV054	EV054-SE-1-091119	M	mud	no	0.0	22.3	77.7	M	mud
EV057	EV057-SE-1-091119	M	mud	no	0.0	27.8	72.2	not defined [b]	not defined [b]
EV060	EV060-SE-1-092119	S	sampleable sand	no	0.0	99.7	0.3	S	sampleable sand
EV063	EV063-SE-1-091019	M	mud	no	0.0	11.4	88.5	M	mud
EV064	EV064-SE-1-091019	M	mud	no	0.0	41.9	58.1	not defined [b]	not defined [b]

Table 5-1b. Field-Collected Sediment Grain Size Adjusted for Removal of Coarse Sediment

Location ID	Sample ID	Target Sediment Facies per QAPP	Target Stratum per QAPP	Coarse Material Removed by Hand or Sieving	Sample Grain Size Analysis Results [a] Adjusted Gravel (%)	Adjusted Sand (%)	Adjusted Mud (%)	Sediment Facies Based on Adjusted Grain Size	Stratum Based on Adjusted Grain Size
EV065	EV065-SE-1-092519	mFs	sampleable sand	no	3.9	95.5	0.6	S	sampleable sand
EV066	EV066-SE-1-092519	S	sampleable sand	no	4.6	93.2	2.2	S	sampleable sand
EV069	EV069-SE-1-092519	S	sampleable sand	no	1.1	97.1	1.9	S	sampleable sand
EV071	EV071-SE-1-092519	S	sampleable sand	no	1.7	97.8	0.6	S	sampleable sand
EV072	EV072-SE-1-092619	S	sampleable sand	no	0.9	96.8	2.3	S	sampleable sand
EV075	EV075-SE-1-091119	mFs	sampleable sand	no	0.2	97.7	2.1	S	sampleable sand
JS001	JS001-SE-1-101019	S	sampleable sand	no	0.2	98.1	1.7	S	sampleable sand
JS002	JS002-SE-1-101019	S	sampleable sand	no	2.0	96.4	1.6	S	sampleable sand
REF001	REF001-SE-1-092819	NA	mixed	yes	23.5	76.4	0.1	S	sampleable sand
REF002	REF002-SE-1-092819	NA	sand	no	0.0	99.9	0.1	S	sampleable sand
REF003	REF003-SE-1-092719	NA	sand	no	0.0	99.3	0.7	S	sampleable sand
REF004	REF004-SE-1-092719	NA	mixed	yes	74.8	19.8	0.4	mCs	mixed coarse
REF005	REF005-SE-1-100319	NA	mixed	yes	62.0	37.9	0.1	mCs	mixed coarse
REF006	REF006-SE-1-100219	NA	mixed	yes	45.1	54.3	0.6	mFs	sampleable sand
REF007	REF007-SE-1-093019	NA	sand	no	3.7	95.0	1.3	S	sampleable sand
REF008	REF008-SE-1-093019	NA	sand	no	5.8	93.8	0.4	S	sampleable sand
REF009	REF009A-SE-1-100219	NA	sand	no	0.4	99.3	0.3	S	sampleable sand
REF010	REF010-SE-1-100319	NA	mixed	yes	60.2	39.7	0.0	mCs	mixed coarse
REF011	REF011-SE-1-100119	NA	sand	no	0.0	99.5	0.5	S	sampleable sand
REF012	REF012-SE-1-100419	NA	mixed	yes	34.5	60.6	5.0	mFs	sampleable sand
REF013	REF013-SE-1-092419	NA	sand/mud	no	0.6	93.5	5.9	S	sampleable sand
REF014	REF014-SE-1-092619	NA	sand/mud	no	2.0	82.0	16.0	S	sampleable sand
REF015	REF015-SE-1-092619	NA	sand/mud	yes	0.3	63.5	36.1	not defined [b]	sampleable sand
REF016	REF016-SE-1-092519	NA	sand/mud	yes	5.4	73.4	21.2	not defined [b]	sampleable sand
REF017	REF017-SE-1-092519	NA	sand/mud	no	4.7	48.7	46.7	not defined [b]	not defined [b]
REF018	REF018-SE-1-092519	NA	sand/mud	yes	0.5	42.7	56.7	not defined [b]	not defined [b]

Notes:

[a] Grain size analysis results are adjusted for quantity of coarse material removed from the bulk sediment sample in the field by sieving or by hand. See Table 2-8 for summary of field sieving/coarse material removal.

[b] Sample texture does not match a defined sediment facies class and/or stratum defined for the Phase 3 study.

B - boulder/cobble
C - coarse
G - gravel
M - mud
mBs - mixed boulder/cobble, with sand
mCs - mixed coarse, with sand
mFs - mixed finer-grained, predominantly sand
NA - not applicable
nm - not measured; grain size analysis was not performed for this sample.
S - sand

Table 5-2a. 42-Day *Hyalella azteca* Bioassay Sediment Summary Statistics for Homogenized Bulk Sediment

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples [b]											
Conventional Parameters											
Solids (%)	40	40	19.9	69.2	82.8	NA	NA	NA	19.9	69.2	82.8
TOC (%)	40	40	0.06	0.523	2.99	NA	NA	NA	0.06	0.523	2.99
Metals (mg/kg)											
Aluminum	40	40	4180	12800	27000	NA	NA	NA	4180	12800	27000
Antimony	40	40	1.19	16.2	51.3	NA	NA	NA	1.19	16.2	51.3
Arsenic	40	40	6.59	14.9	77.6	NA	NA	NA	6.59	14.9	77.6
Barium	40	40	213	718	2260	NA	NA	NA	213	718	2260
Beryllium	40	40	0.213	0.524	1.38	NA	NA	NA	0.213	0.524	1.38
Cadmium	40	40	0.467	2.68	13.2	NA	NA	NA	0.467	2.68	13.2
Calcium	40	40	12400	41400	77200	NA	NA	NA	12400	41400	77200
Chromium	40	40	12.7	59.4	167	NA	NA	NA	12.7	59.4	167
Cobalt	40	40	4.24	28.2	118	NA	NA	NA	4.24	28.2	118
Copper	40	40	70.6	996	2740	NA	NA	NA	70.6	996	2740
Iron	40	40	23300	102000	231000	NA	NA	NA	23300	102000	231000
Lead	40	40	91.9	442	5920	NA	NA	NA	91.9	442	5920
Magnesium	40	40	3860	9700	31500	NA	NA	NA	3860	9700	31500
Manganese	40	40	355	2140	4770	NA	NA	NA	355	2140	4770
Nickel	40	40	8.5	13.6	53.5	NA	NA	NA	8.5	13.6	53.5
Potassium	40	40	730	2370	7700	NA	NA	NA	730	2370	7700
Selenium	40	40	0.3	1.31	2.33	NA	NA	NA	0.3	1.31	2.33
Silver	40	40	0.647	2.07	7.51	NA	NA	NA	0.647	2.07	7.51
Sodium	40	40	134	1050	4340	NA	NA	NA	134	1050	4340
Thallium	40	36	0.0315	0.19	1.11	0.044	0.0492	0.059	0.0315	0.044	1.11
Vanadium	40	40	17	33.1	79.6	NA	NA	NA	17	33.1	79.6
Zinc	40	40	846	9480	29000	NA	NA	NA	846	9480	29000
Reference Samples											
Conventional Parameters											
Solids (%)	17	17	49	70.1	78.9	NA	NA	NA	49	70.1	78.9
TOC (%)	17	17	0.037	0.43	2.62	NA	NA	NA	0.037	0.43	2.62
Metals (mg/kg)											
Aluminum	17	17	2500	4090	10300	NA	NA	NA	2500	4090	10300
Antimony	17	2	0.022	0.141	0.26	0.01	0.0174	0.03	0.01	0.0173	0.26
Arsenic	17	17	0.77	2.08	9.84	NA	NA	NA	0.77	2.08	9.84
Barium	17	17	21.3	45.9	143	NA	NA	NA	21.3	45.9	143
Beryllium	17	17	0.115	0.212	0.539	NA	NA	NA	0.115	0.212	0.539
Cadmium	17	17	0.072	0.204	1.02	NA	NA	NA	0.072	0.204	1.02
Calcium	17	17	1280	2230	4450	NA	NA	NA	1280	2230	4450
Chromium	17	17	5.72	12.1	41.2	NA	NA	NA	5.72	12.1	41.2
Cobalt	17	17	1.76	4.11	13.6	NA	NA	NA	1.76	4.11	13.6
Copper	17	17	3.32	7.11	21.8	NA	NA	NA	3.32	7.11	21.8
Iron	17	17	5510	9430	20200	NA	NA	NA	5510	9430	20200

Table 5-2a. 42-Day *Hyalella azteca* Bioassay Sediment Summary Statistics for Homogenized Bulk Sediment

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Metals (mg/kg)											
Lead	17	17	3.17	10.6	63.2	NA	NA	NA	3.17	10.6	63.2
Magnesium	17	17	1800	2800	7460	NA	NA	NA	1800	2800	7460
Manganese	17	17	79.2	136	263	NA	NA	NA	79.2	136	263
Nickel	17	17	5.25	11.5	43.9	NA	NA	NA	5.25	11.5	43.9
Potassium	17	17	441	901	3030	NA	NA	NA	441	901	3030
Selenium	17	12	0.06	0.198	0.5	0.08	0.096	0.1	0.06	0.0756	0.5
Silver	17	15	0.019	0.0379	0.101	0.02	0.02	0.02	0.019	0.0358	0.101
Sodium	17	17	51	89.2	280	NA	NA	NA	51	89.2	280
Thallium	17	14	0.03	0.082	0.233	0.03	0.0403	0.047	0.03	0.033	0.233
Vanadium	17	17	9.11	16.1	31.1	NA	NA	NA	9.11	16.1	31.1
Zinc	17	17	23.7	39.5	96.4	NA	NA	NA	23.7	39.5	96.4
Negative Laboratory Control Samples											
Conventional Parameters											
Solids (%)	1	1	81.1	81.1	81.1	NA	NA	NA	81.1	81.1	81.1
TOC (%)	1	1	0.537	0.537	0.537	NA	NA	NA	0.537	0.537	0.537
Metals (mg/kg)											
Aluminum	1	1	2100	2100	2100	NA	NA	NA	2100	2100	2100
Antimony	1	0	NA	NA	NA	0.016	0.016	0.016	0.016	0.016	0.016
Arsenic	1	1	2.03	2.03	2.03	NA	NA	NA	2.03	2.03	2.03
Barium	1	1	41	41	41	NA	NA	NA	41	41	41
Beryllium	1	1	0.287	0.287	0.287	NA	NA	NA	0.287	0.287	0.287
Cadmium	1	1	0.413	0.413	0.413	NA	NA	NA	0.413	0.413	0.413
Calcium	1	1	1030	1030	1030	NA	NA	NA	1030	1030	1030
Chromium	1	1	11.2	11.2	11.2	NA	NA	NA	11.2	11.2	11.2
Cobalt	1	1	2.95	2.95	2.95	NA	NA	NA	2.95	2.95	2.95
Copper	1	1	5.76	5.76	5.76	NA	NA	NA	5.76	5.76	5.76
Iron	1	1	6220	6220	6220	NA	NA	NA	6220	6220	6220
Lead	1	1	7.78	7.78	7.78	NA	NA	NA	7.78	7.78	7.78
Magnesium	1	1	183	183	183	NA	NA	NA	183	183	183
Manganese	1	1	71.3	71.3	71.3	NA	NA	NA	71.3	71.3	71.3
Nickel	1	1	5.93	5.93	5.93	NA	NA	NA	5.93	5.93	5.93
Potassium	1	1	201	201	201	NA	NA	NA	201	201	201
Selenium	1	1	0.28	0.28	0.28	NA	NA	NA	0.28	0.28	0.28
Silver	1	1	0.043	0.043	0.043	NA	NA	NA	0.043	0.043	0.043
Sodium	1	0	NA	NA	NA	21	21	21	21	21	21
Thallium	1	1	0.053	0.053	0.053	NA	NA	NA	0.053	0.053	0.053
Vanadium	1	1	11	11	11	NA	NA	NA	11	11	11
Zinc	1	1	103	103	103	NA	NA	NA	103	103	103
Quartz Sand Negative Control Samples											
Conventional Parameters											
Solids (%)	1	1	76.5	76.5	76.5	NA	NA	NA	76.5	76.5	76.5
TOC (%)	1	0	NA	NA	NA	0.02	0.02	0.02	0.02	0.02	0.02

Table 5-2a. 42-Day *Hyalella azteca* Bioassay Sediment Summary Statistics for Homogenized Bulk Sediment

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Quartz Sand Negative Control Samples (continued)											
Metals (mg/kg)											
Aluminum	1	1	68.4	68.4	68.4	NA	NA	NA	68.4	68.4	68.4
Antimony	1	0	NA	NA	NA	0.019	0.019	0.019	0.019	0.019	0.019
Arsenic	1	1	0.84	0.84	0.84	NA	NA	NA	0.84	0.84	0.84
Barium	1	1	0.441	0.441	0.441	NA	NA	NA	0.441	0.441	0.441
Beryllium	1	1	0.027	0.027	0.027	NA	NA	NA	0.027	0.027	0.027
Cadmium	1	1	0.108	0.108	0.108	NA	NA	NA	0.108	0.108	0.108
Calcium	1	1	78.7	78.7	78.7	NA	NA	NA	78.7	78.7	78.7
Chromium	1	1	0.14	0.14	0.14	NA	NA	NA	0.14	0.14	0.14
Cobalt	1	1	0.324	0.324	0.324	NA	NA	NA	0.324	0.324	0.324
Copper	1	1	1.84	1.84	1.84	NA	NA	NA	1.84	1.84	1.84
Iron	1	1	963	963	963	NA	NA	NA	963	963	963
Lead	1	1	1.13	1.13	1.13	NA	NA	NA	1.13	1.13	1.13
Magnesium	1	1	44.4	44.4	44.4	NA	NA	NA	44.4	44.4	44.4
Manganese	1	1	0.799	0.799	0.799	NA	NA	NA	0.799	0.799	0.799
Nickel	1	1	1.1	1.1	1.1	NA	NA	NA	1.1	1.1	1.1
Potassium	1	0	NA	NA	NA	27	27	27	27	27	27
Selenium	1	0	NA	NA	NA	0.09	0.09	0.09	0.09	0.09	0.09
Silver	1	0	NA	NA	NA	0.007	0.007	0.007	0.007	0.007	0.007
Sodium	1	0	NA	NA	NA	12	12	12	12	12	12
Thallium	1	0	NA	NA	NA	0.03	0.03	0.03	0.03	0.03	0.03
Vanadium	1	1	0.2	0.2	0.2	NA	NA	NA	0.2	0.2	0.2
Zinc	1	1	6.73	6.73	6.73	NA	NA	NA	6.73	6.73	6.73

Notes:

All nondetected results use the full detection limit for summary statistics.

[a] When appropriate, overall means are Kaplan Meier estimates.

[b] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

NA - not applicable

TOC - total organic carbon

Table 5-2b. 42-Day *Hyalella azteca* Bioassay Sediment Summary Statistics for Day 7

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples [b]											
Conventional Parameters											
Solids (%)	42	42	38.5	73	83.8	NA	NA	NA	38.5	73	83.8
Sulfide (AVS) (µmol/g)	42	40	0.023	0.887	3.5	0.005	0.0055	0.006	0.005	0.0055	3.5
TOC (%)	42	42	0.062	0.496	2.96	NA	NA	NA	0.062	0.496	2.96
SEM (µmol/g)											
Antimony	42	38	0.002	0.0373	0.123	0.0021	0.00358	0.005	0.002	0.00293	0.123
Arsenic	42	39	0.006	0.0228	0.064	0.012	0.0127	0.013	0.006	0.00907	0.064
Cadmium	42	42	0.0016	0.00662	0.0255	NA	NA	NA	0.0016	0.00662	0.0255
Chromium	42	42	0.0283	0.187	0.627	NA	NA	NA	0.0283	0.187	0.627
Copper	42	42	0.349	2.16	8.12	NA	NA	NA	0.349	2.16	8.12
Lead	42	42	0.123	0.312	1.32	NA	NA	NA	0.123	0.312	1.32
Nickel	42	42	0.0064	0.0276	0.0719	NA	NA	NA	0.0064	0.0276	0.0719
Zinc	42	42	2.94	29.8	70.2	NA	NA	NA	2.94	29.8	70.2
Reference Samples											
Conventional Parameters											
Solids (%)	19	19	48.4	73.2	81	NA	NA	NA	48.4	73.2	81
Sulfide (AVS) (µmol/g)	19	10	0.01	0.188	0.65	0.005	0.006	0.009	0.005	0.006	0.65
TOC (%)	19	19	0.046	0.48	2.9	NA	NA	NA	0.046	0.48	2.9
SEM (µmol/g)											
Antimony	19	1	0.0016	0.0016	0.0016	0.001	0.00112	0.0016	0.001	0.00112	0.0016
Arsenic	19	14	0.0025	0.00453	0.0093	0.0026	0.0028	0.003	0.0025	0.00271	0.0093
Cadmium	19	19	0.00038	0.000762	0.00314	NA	NA	NA	0.00038	0.000762	0.00314
Chromium	19	19	0.0045	0.0213	0.127	NA	NA	NA	0.0045	0.0213	0.127
Copper	19	19	0.0133	0.0277	0.108	NA	NA	NA	0.0133	0.0277	0.108
Lead	19	19	0.0095	0.0208	0.0971	NA	NA	NA	0.0095	0.0208	0.0971
Nickel	19	19	0.0085	0.0268	0.146	NA	NA	NA	0.0085	0.0268	0.146
Zinc	19	19	0.0771	0.135	0.375	NA	NA	NA	0.0771	0.135	0.375
Negative Laboratory Control Samples											
Conventional Parameters											
Solids (%)	3	3	77.2	79.1	81.7	NA	NA	NA	77.2	79.1	81.7
Sulfide (AVS) (µmol/g)	3	1	0.017	0.017	0.017	0.006	0.006	0.006	0.006	0.00967	0.017
TOC (%)	3	3	0.529	0.534	0.542	NA	NA	NA	0.529	0.534	0.542
SEM (µmol/g)											
Antimony	3	0	NA	NA	NA	0.001	0.00103	0.0011	0.001	0.00103	0.0011
Arsenic	3	2	0.0037	0.0038	0.0039	0.0025	0.0025	0.0025	0.0025	0.00337	0.0039
Cadmium	3	3	0.00077	0.000973	0.00117	NA	NA	NA	0.00077	0.000973	0.00117
Chromium	3	3	0.0037	0.00523	0.0073	NA	NA	NA	0.0037	0.00523	0.0073

Table 5-2b. 42-Day *Hyalella azteca* Bioassay Sediment Summary Statistics for Day 7

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Negative Laboratory Control Samples (continued)											
SEM (µmol/g) (continued)											
Copper	3	3	0.0156	0.0168	0.0177	NA	NA	NA	0.0156	0.0168	0.0177
Lead	3	3	0.0092	0.0128	0.0161	NA	NA	NA	0.0092	0.0128	0.0161
Nickel	3	3	0.0114	0.0138	0.0157	NA	NA	NA	0.0114	0.0138	0.0157
Zinc	3	3	0.164	0.196	0.23	NA	NA	NA	0.164	0.196	0.23
Quartz Sand Negative Control Samples											
Conventional Parameters											
Solids (%)	3	3	80	80.9	81.9	NA	NA	NA	80	80.9	81.9
Sulfide (AVS) (µmol/g)	3	0	NA	NA	NA	0.005	0.00533	0.006	0.005	0.00533	0.006
TOC (%)	3	0	NA	NA	NA	0.02	0.02	0.02	0.02	0.02	0.02
SEM (µmol/g)											
Antimony	3	0	NA	NA	NA	0.0009	0.001	0.0011	0.0009	0.001	0.0011
Arsenic	3	0	NA	NA	NA	0.0023	0.00247	0.0027	0.0023	0.00247	0.0027
Cadmium	3	3	0.00012	0.000123	0.00013	NA	NA	NA	0.00012	0.000123	0.00013
Chromium	3	3	0.0006	0.000667	0.0008	NA	NA	NA	0.0006	0.000667	0.0008
Copper	3	3	0.0033	0.0039	0.0051	NA	NA	NA	0.0033	0.0039	0.0051
Lead	3	3	0.002	0.00207	0.0022	NA	NA	NA	0.002	0.00207	0.0022
Nickel	3	3	0.0011	0.00113	0.0012	NA	NA	NA	0.0011	0.00113	0.0012
Zinc	3	3	0.0061	0.0142	0.0298	NA	NA	NA	0.0061	0.0142	0.0298

Notes:

All nondetected results use the full detection limit for summary statistics.

[a] When appropriate, overall means are Kaplan Meier estimates.

[b] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

AVS - acid volatile sulfide

NA - not applicable

SEM - simultaneously extracted metals

TOC - total organic carbon

Table 5-2c. 42-Day *Hyalella azteca* Bioassay Sediment Summary Statistics for Day 21

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean[a]	Overall Maximum
Site Samples [b]											
Conventional Parameters											
Solids (%)	42	42	34.3	68.9	84.3	NA	NA	NA	34.3	68.9	84.3
Sulfide (µmol/g)	42	39	0.046	1.37	7.92	0.011	0.0943	0.26	0.011	0.0306	7.92
TOC (%)	42	42	0.065	0.504	2.95	NA	NA	NA	0.065	0.504	2.95
SEM (µmol/g)											
Antimony	42	38	0.0021	0.0357	0.117	0.0011	0.00418	0.012	0.0011	0.00238	0.117
Arsenic	42	42	0.0075	0.0226	0.053	NA	NA	NA	0.0075	0.0226	0.053
Cadmium	42	42	0.0022	0.00941	0.0554	NA	NA	NA	0.0022	0.00941	0.0554
Chromium	42	42	0.0487	0.214	0.574	NA	NA	NA	0.0487	0.214	0.574
Copper	42	42	0.333	2.47	7.26	NA	NA	NA	0.333	2.47	7.26
Lead	42	42	0.109	0.413	3.49	NA	NA	NA	0.109	0.413	3.49
Nickel	42	42	0.0065	0.0318	0.16	NA	NA	NA	0.0065	0.0318	0.16
Zinc	42	42	3.54	35	112	NA	NA	NA	3.54	35	112
Reference Samples											
Conventional Parameters											
Solids (%)	19	19	48.2	70.4	81.4	NA	NA	NA	48.2	70.4	81.4
Sulfide (µmol/g)	19	12	0.006	0.356	1.86	0.005	0.0111	0.025	0.005	0.0097	1.86
TOC (%)	19	19	0.045	0.48	3.15	NA	NA	NA	0.045	0.48	3.15
SEM (µmol/g)											
Antimony	19	2	0.0012	0.00125	0.0013	0.0009	0.00115	0.0016	0.0009	0.00114	0.0016
Arsenic	19	17	0.0025	0.00651	0.0212	0.0027	0.0028	0.0029	0.0025	0.00268	0.0212
Cadmium	19	19	0.00037	0.000815	0.0029	NA	NA	NA	0.00037	0.000815	0.0029
Chromium	19	19	0.0053	0.0288	0.106	NA	NA	NA	0.0053	0.0288	0.106
Copper	19	19	0.0145	0.0384	0.121	NA	NA	NA	0.0145	0.0384	0.121
Lead	19	19	0.0103	0.0243	0.103	NA	NA	NA	0.0103	0.0243	0.103
Nickel	19	19	0.0093	0.0355	0.123	NA	NA	NA	0.0093	0.0355	0.123
Zinc	19	19	0.0828	0.169	0.35	NA	NA	NA	0.0828	0.169	0.35
Negative Laboratory Control Samples											
Conventional Parameters											
Solids (%)	3	3	69.8	74.8	78.4	NA	NA	NA	69.8	74.8	78.4
Sulfide (µmol/g)	3	2	0.011	0.021	0.031	0.006	0.006	0.006	0.006	0.016	0.031
TOC (%)	3	3	0.538	0.557	0.57	NA	NA	NA	0.538	0.557	0.57

Table 5-2c. 42-Day *Hyalella azteca* Bioassay Sediment Summary Statistics for Day 21

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean[a]	Overall Maximum
Negative Laboratory Control Samples (continued)											
SEM (µmol/g)											
Antimony	3	0	NA	NA	NA	0.001	0.00103	0.0011	0.001	0.00103	0.0011
Arsenic	3	3	0.0029	0.00373	0.0052	NA	NA	NA	0.0029	0.00373	0.0052
Cadmium	3	3	0.00077	0.00118	0.00186	NA	NA	NA	0.00077	0.00118	0.00186
Chromium	3	3	0.0048	0.00613	0.0072	NA	NA	NA	0.0048	0.00613	0.0072
Copper	3	3	0.0121	0.0189	0.0258	NA	NA	NA	0.0121	0.0189	0.0258
Lead	3	3	0.0107	0.016	0.0244	NA	NA	NA	0.0107	0.016	0.0244
Nickel	3	3	0.0111	0.0159	0.0223	NA	NA	NA	0.0111	0.0159	0.0223
Zinc	3	3	0.164	0.248	0.358	NA	NA	NA	0.164	0.248	0.358
Quartz Sand Negative Control Samples											
Conventional Parameters											
Solids (%)	3	3	74.5	77.6	79.7	NA	NA	NA	74.5	77.6	79.7
Sulfide (µmol/g)	3	0	NA	NA	NA	0.005	0.005	0.005	0.005	0.005	0.005
TOC (%)	3	0	NA	NA	NA	0.02	0.02	0.02	0.02	0.02	0.02
SEM (µmol/g)											
Antimony	3	0	NA	NA	NA	0.001	0.001	0.001	0.001	0.001	0.001
Arsenic	3	0	NA	NA	NA	0.0024	0.00243	0.0025	0.0024	0.00243	0.0025
Cadmium	3	3	0.00013	0.00013	0.00013	NA	NA	NA	0.00013	0.00013	0.00013
Chromium	3	2	0.001	0.00125	0.0015	0.0005	0.0005	0.0005	0.0005	0.001	0.0015
Copper	3	1	0.005	0.005	0.005	0.003	0.0038	0.0046	0.003	0.0038	0.005
Lead	3	3	0.0022	0.0023	0.0024	NA	NA	NA	0.0022	0.0023	0.0024
Nickel	3	3	0.0011	0.0013	0.0015	NA	NA	NA	0.0011	0.0013	0.0015
Zinc	3	1	0.0072	0.0072	0.0072	0.008	0.00845	0.0089	0.0072	0.00803	0.0089

Notes:

All nondetected results use the full detection limit for summary statistics.

[a] When appropriate, overall means are Kaplan Meier estimates.

[b] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

NA - not applicable

SEM - simultaneously extracted metals

TOC - total organic carbon

Table 5-3a. Field-Collected Porewater Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples [b]											
Conventional Parameters (mg/L)											
Alkalinity	104	104	29	86.9	263	NA	NA	NA	29	86.9	263
DOC	104	103	0.17	1.13	9.11	0.07	0.07	0.07	0.07	1.12	9.11
Hardness	104	104	33.2	89.2	266	NA	NA	NA	33.2	89.2	266
Sulfate	104	104	1.22	12.7	77.3	NA	NA	NA	1.22	12.7	77.3
TOC	104	95	0.08	1.05	9.05	0.44	1.79	4.52	0.08	0.293	9.05
Water Quality Parameters											
Conductivity (uS/cm)	104	104	95.7	206	621	NA	NA	NA	95.7	206	621
DO (mg/L)	104	104	1.75	5.33	10	NA	NA	NA	1.75	5.33	10
pH (SU)	104	104	6.38	8.02	10.2	NA	NA	NA	6.38	8.02	10.2
ORP (mV)	104	104	-125	173	296	NA	NA	NA	-125	173	296
Temperature (°C)	104	104	10.055	13	17.19	NA	NA	NA	10.055	13	17.19
TDS (ppm)	104	104	57	128	390	NA	NA	NA	57	128	390
Dissolved Metals (µg/L)											
Aluminum	104	41	10.1	31.2	291	1.5	6.23	13.3	1.5	6.16	291
Antimony	104	87	0.319	12.9	90.2	0.215	0.481	1.16	0.215	0.384	90.2
Arsenic	104	104	0.43	3.6	54.4	NA	NA	NA	0.43	3.6	54.4
Barium	104	104	15.3	64.9	359	NA	NA	NA	15.3	64.9	359
Beryllium	104	1	0.008	0.008	0.008	0.005	0.00517	0.019	0.005	0.00517	0.019
Cadmium	104	65	0.008	0.062	0.764	0.008	0.0113	0.039	0.008	0.00996	0.764
Calcium	104	104	9870	27000	97900	NA	NA	NA	9870	27000	97900
Chloride ion (mg/L)	104	104	0.39	0.89	1.63	NA	NA	NA	0.39	0.89	1.63
Chromium	104	1	0.74	0.74	0.74	0.08	0.457	2.06	0.08	0.455	2.06
Cobalt	104	104	0.059	0.291	2.45	NA	NA	NA	0.059	0.291	2.45
Copper	104	77	0.88	6.07	95	0.09	0.829	1.55	0.09	0.792	95
Iron	104	78	9	453	9720	8	10.2	24	8	9.18	9720
Lead	104	55	0.165	4.08	101	0.011	0.124	0.433	0.011	0.122	101
Magnesium	104	104	478	5280	20500	NA	NA	NA	478	5280	20500
Manganese	104	93	0.6	119	2360	0.27	1.14	2.74	0.27	0.721	2360
Nickel	104	46	0.42	1.1	2.91	0.2	0.515	0.82	0.2	0.497	2.91
Potassium	104	104	460	1560	9120	NA	NA	NA	460	1560	9120
Selenium	104	16	0.2	0.297	0.5	0.2	0.2	0.2	0.2	0.215	0.5
Silver	104	35	0.009	0.0819	1.01	0.009	0.0105	0.036	0.009	0.0102	1.01
Sodium	104	104	1970	3060	9810	NA	NA	NA	1970	3060	9810

Table 5-3a. Field-Collected Porewater Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples (continued)											
Thallium	104	44	0.009	0.0314	0.171	0.009	0.0151	0.036	0.009	0.0134	0.171
Vanadium	104	95	0.06	0.42	3.42	0.04	0.174	0.25	0.04	0.075	3.42
Zinc	104	33	2.9	16.9	162	0.8	2.47	7.5	0.8	2.4	162
Reference Samples											
Conventional Parameters (mg/L)											
Alkalinity	18	18	47	71.5	117	NA	NA	NA	47	71.5	117
DOC	18	17	0.28	0.964	3.05	0.07	0.07	0.07	0.07	0.914	3.05
Hardness	18	18	47	78.5	133	NA	NA	NA	47	78.5	133
Sulfate	18	18	3.83	15.7	35.4	NA	NA	NA	3.83	15.7	35.4
TOC	18	16	0.09	0.779	2.9	0.07	0.07	0.07	0.07	0.7	2.9
Water Quality Parameters [c]											
Conductivity (uS/cm)	18	18	120	215	497	NA	NA	NA	120	215	497
DO (mg/L)	18	18	2.64	5.03	8.55	NA	NA	NA	2.64	5.03	8.55
pH (SU)	18	18	6.65	7.01	7.44	NA	NA	NA	6.65	7.01	7.44
ORP (mV)	18	18	-28	166	274	NA	NA	NA	-28	166	274
Temperature (°C)	18	18	8.2577	12.9	15.544	NA	NA	NA	8.2577	12.9	15.544
TDS (ppm)	18	18	69.4	122	230	NA	NA	NA	69.4	122	230
Dissolved Metals (µg/L)											
Aluminum	18	5	59.2	81.9	143	4	11.8	27.9	4	11.8	143
Antimony	18	6	0.311	0.45	0.663	0.076	0.2	0.249	0.076	0.2	0.663
Arsenic	18	18	0.17	1.46	10.1	NA	NA	NA	0.17	1.46	10.1
Barium	18	18	16	37.4	70.3	NA	NA	NA	16	37.4	70.3
Beryllium	18	0	NA	NA	NA	0.005	0.00522	0.008	0.005	0.00522	0.008
Cadmium	18	15	0.009	0.0435	0.244	0.008	0.008	0.008	0.008	0.0376	0.244
Calcium	18	18	14000	24100	41000	NA	NA	NA	14000	24100	41000
Chloride ion (mg/L)	18	18	0.16	1.32	5.4	NA	NA	NA	0.16	1.32	5.4
Chromium	18	0	NA	NA	NA	0.51	0.996	2.43	0.51	0.996	2.43
Cobalt	18	18	0.113	0.394	1.13	NA	NA	NA	0.113	0.394	1.13
Copper	18	1	3.86	3.86	3.86	0.08	0.607	1.56	0.08	0.607	3.86
Iron	18	6	192	1760	5510	8	29	100	8	29	5510
Lead	18	2	0.989	1.17	1.35	0.039	0.155	0.368	0.039	0.155	1.35
Magnesium	18	18	2480	4450	7420	NA	NA	NA	2480	4450	7420
Manganese	18	14	2.92	266	716	0.79	1.25	1.93	0.79	1.25	716
Nickel	18	10	1.82	2.87	4.49	0.7	1.06	1.5	0.7	1.06	4.49
Potassium	18	18	700	1850	7720	NA	NA	NA	700	1850	7720

Table 5-3a. Field-Collected Porewater Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Dissolved Metals (µg/L) (continued)											
Selenium	18	7	0.2	0.471	1.3	0.2	0.2	0.2	0.2	0.306	1.3
Silver	18	0	NA	NA	NA	0.009	0.00922	0.013	0.009	0.00922	0.013
Sodium	18	16	1600	2730	5190	940	1040	1130	940	1040	5190
Thallium	18	2	0.017	0.0185	0.02	0.009	0.009	0.009	0.009	0.0101	0.02
Vanadium	18	13	0.21	0.697	1.78	0.14	0.168	0.2	0.14	0.168	1.78
Zinc	18	5	4.1	20.4	80.4	1.1	1.77	2.5	1.1	1.77	80.4

Notes:

All nondetected results use the full detection limit for summary statistics.

[a] When appropriate, overall means are Kaplan Meier estimates.

[b] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

[c] Water quality parameters were collected in the field during porewater sampling. Conductivity and temperature were measured via sensors on the Trident probe and with a handheld multimeter. The multimeter was also used to measure pH, total dissolved solids (TDS), and oxidation reduction potential (ORP). When available, data collected from sensors mounted to the Trident probe were used because they are in situ measurements and considered more representative of porewater conditions during sampling. Conductivity and temperature are the average of the Trident sensor measurements. pH, ORP, and TDS are the average of the multimeter measurements.

DO - dissolved oxygen

DOC - dissolved organic carbon

NA - not applicable

SU - standard units

TOC - total orgranic carbon

Table 5-3b. Water Quality Parameters for Field-Collected Porewater by Sample

Sample ID	Conductivity (µS/cm)	DO (mg/L)	pH (SU)	ORP (mV)	Temperature (^{0}C)	TDS (ppm)
Site Samples [a]						
China Bend						
3-R7-2019-PW	143	8.6	8.08	242	10.7	95.8
3-R8-2019-PW	141	9.14	8.15	244	10.3	95.3
CB002-PW	132	3.19	9.77	119	10.7	91.7
CB005-PW	145	8.25	8.12	253	10.4	97.6
CB006-PW	133	3.88	8.66	187	11.8	88.7
CB007-PW	174	3.23	7.4	28	11.3	111
CB009-PW	171	4.82	7.57	233	10.7	110
CB010-PW	284	4.02	8.63	177	10.9	145
CB012-PW	184	4.51	8.01	218	11.9	108
CB014-PW	115	5.36	8.19	231	10.6	78
CB016-PW	158	3.92	8.15	194	11.2	99.9
CB018-PW	106	3.79	9.79	114	12.0	68.8
CB020-PW	116	3.93	10.1	132	10.8	74.1
CB021-PW	211	3.75	8.82	172	10.6	141
CB024-PW	134	3.15	9.21	181	10.6	87.6
CB027-PW	165	3.17	8.91	164	10.6	105
CB029-PW	183	3.22	9.42	151	10.4	111
CB035-PW	167	5.83	7.86	228	10.7	105
CB036-PW	146	8.54	8.06	245	10.6	98
CB039-PW	156	8.47	7.9	234	10.7	102
CB040-PW	163	7.25	7.44	215	10.1	113
CB041-PW	143	9.42	7.5	246	10.1	109
CB043-PW	195	9.16	6.8	268	10.2	133
CB044-PW	337	2.9	8.5	154	10.7	238
CB046-PW	183	4.29	8.52	197	10.8	112
CB047-PW	176	5.43	7.8	212	11.1	112
CB048-PW	143	9.53	8.16	247	10.2	95.8
CB049-PW	143	8.2	8.17	246	10.2	95.9
CB052-PW	143	8.58	8.18	249	10.3	96.1
CB055-PW	145	7.48	8.16	230	10.6	96.4
CB056-PW	169	4.56	7.63	166	10.7	110
JS001-PW	132	3.26	9.62	124	11.2	86.8
JS002-PW	205	2.98	7.73	190	11.6	117
Deadman's Eddy						
1-B5-NRT-2019-PW	621	2.39	7.19	-79.7	10.3	390
1-B6-NRT-2019-PW	260	3.69	7.77	123	11.3	134
DM002-PW	106	4.17	9.25	147	11.3	71
DM007-PW	135	5.48	7.91	180	10.6	99.5
DM008-PW	206	4.83	7.31	209	16.9	103
DM010-PW	214	3.45	6.85	236	16.7	103
DM015-PW	138	4.19	8.88	146	16.4	105
DM016-PW	124	1.83	7.12	227	16.7	80.5
DM018-PW	377	1.75	6.9	218	16.7	127
DM019-PW	228	3.48	7.73	139	11.0	167
DM020-PW	144	3.82	8.14	201	10.8	98.4
DM022-PW	212	3.62	9.43	110	16.6	104
DM023-PW	226	3.17	6.86	296	16.1	112
DM024-PW	234	4.32	7.9	206	10.7	130
DM025-PW	130	6.64	8.5	215	10.7	88.3
DM026-PW	95.7	2.72	6.38	261	16.0	57
DM027-PW	213	6.76	7.88	221	10.3	127

Table 5-3b. Water Quality Parameters for Field-Collected Porewater by Sample

Sample ID	Conductivity (µS/cm)	DO (mg/L)	pH (SU)	ORP (mV)	Temperature (^{0}C)	TDS (ppm)
Site Samples (continued)						
Deadman's Eddy (continued)						
DM030-PW	151	9.23	8.08	229	10.5	95.8
DM036-PW	147	9.65	8.01	210	10.3	102
DM038-PW	149	9.32	7.94	197	10.3	97.2
DM039-PW	153	9.3	7.92	210	10.4	96.3
DM043-PW	170	8.9	8.09	218	10.6	99.7
DM044-PW	528	3.69	7.51	-101	10.9	369
DM045-PW	491	3.31	7.47	-94.3	11.4	318
DM046-PW	299	4.45	7.53	-36.7	11.6	209
DM047-PW	192	8.94	7.84	190	10.3	115
DM050-PW	333	5.59	7.69	21.7	12.5	224
DM059-PW	140	9.65	8	220	10.5	98
DM061-PW	342	6.01	7.61	77	11.3	197
DM063-PW	143	8.84	7.75	193	10.6	98
DM064-PW	143	10	8.08	238	10.8	95.5
Evans						
4-B1-2019-PW	211	3.26	7.25	210	16.2	137
4-B6-2019-PW	195	4.69	7.58	233	14.7	119
EV001-PW	213	3.18	8.13	222	15.8	117
EV002-PW	177	3.55	8.26	223	16.8	116
EV003-PW	180	4.05	7.92	215	16.2	104
EV005-PW	190	4.53	8.48	185	16.7	131
EV008-PW	194	4.54	7.63	223	15.9	114
EV010-PW	178	4.75	8.8	171	16.7	115
EV011-PW	142	8.22	7.4	245	14.2	103
EV012-PW	267	3.67	8.51	192	16.6	116
EV013-PW	200	5.14	8.16	173	16.7	134
EV015-PW	228	6.98	7.98	223	12.5	104
EV018-PW	144	8.66	7.44	242	14.6	101
EV022-PW	191	6.09	7.44	238	14.4	115
EV023-PW	157	9.31	7.44	234	14.0	118
EV024-PW	197	6.49	7.43	240	13.9	115
EV026-PW	182	6.49	8.29	222	16.9	99.9
EV027-PW	250	3.63	7.46	250	15.9	131
EV032-PW	146	8.48	7.73	195	10.1	95
EV036-PW	327	4.12	7.28	222	14.4	136
EV037-PW	291	3.18	7.85	223	16.6	206
EV038-PW	149	8.7	7.25	227	10.1	96.1
EV043-PW	141	8.86	8.24	247	10.1	95.2
EV044-PW	348	5.44	7.13	-46	16.4	205
EV048-PW	206	4.31	8.5	164	15.1	121
EV049-PW	194	4.12	7.86	188	14.7	142
EV051-PW	205	3.42	10.2	98.3	16.4	110
EV052-PW	185	3.55	9.62	146	16.2	103
EV054-PW	281	3.86	7.28	-80.3	16.8	202
EV057-PW	428	3.44	7.14	-89.7	16.3	334
EV059-PW	230	2.81	8.85	145	16.7	115
EV060-PW	276	3.45	8.19	153	16.5	126
EV063-PW	357	4.57	7.11	-47	16.3	283
EV064-PW	424	2.14	7.23	-125	17.2	284
EV065-PW	215	3.71	9.08	172	16.9	121
EV066-PW	204	3.55	7.31	214	16.5	123

Table 5-3b. Water Quality Parameters for Field-Collected Porewater by Sample

Sample ID	Conductivity (µS/cm)	DO (mg/L)	pH (SU)	ORP (mV)	Temperature (^{0}C)	TDS (ppm)
Site Samples (continued)						
Evans (continued)						
EV069-PW	174	4.14	7.69	234	16.5	105
EV071-PW	235	4.71	7.5	210	14.6	151
EV072-PW	225	4.31	8.55	161	15.2	123
EV075-PW	175	3.2	8.46	155	16.8	117
Reference Samples						
REF001-PW	179	5.8	7.18	235	15.5	93.1
REF002-PW	147	5.01	6.91	262	14.9	89.4
REF003-PW	179	6.92	6.67	270	14.5	93.7
REF004-PW	154	8.55	7.22	258	14.6	95.5
REF005-PW	148	6.16	6.83	260	13.9	83.1
REF006-PW	497	2.91	6.86	145	13.1	128
REF007-PW	295	2.66	7.27	-17.3	14.2	230
REF008-PW	210	2.64	6.65	85.3	13.8	127
REF009A-PW	229	2.97	6.95	221	14.2	156
REF010-PW	230	4.36	7.11	158	11.4	143
REF011-PW	246	6.9	6.97	274	12.2	149
REF012-PW	259	4.35	7.14	244	13.3	184
REF013-PW	262	3.86	7.33	213	15.3	160
REF014-PW	259	5.55	7.15	-28	12.4	144
REF015-PW	161	5.36	6.8	13.7	10.0	83.8
REF016-PW	134	6.29	7.09	132	12.7	73.3
REF017-PW	155	6.86	7.44	224	8.4	95
REF018-PW	120	3.47	6.67	33.3	8.3	69.4

Notes:

All nondetected results use the full detection limit for summary statistics.

Water quality parameters were collected in the field during porewater sampling. Conductivity and temperature were measured via sensors on the Trident probe and with a handheld multimeter. The multimeter was also used to measure pH, total dissolved solids (TDS), and oxidation reduction potential (ORP). Dissolved oxygen (DO) was also measured using a handheld instrument. When available, data collected from sensors mounted to the Trident probe were used because they are in situ measurements and considered more representative of porewater conditions during sampling. Conductivity and temperature are the average of the Trident sensor measurements. pH, ORP, and TDS are the average of the multimeter measurements. DO is the average of the handheld measurements.

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and

Table 5-4a. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 7

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples [b]											
Conventional Parameters											
Alkalinity (mg/L)	28	28	87.5	297	1930	NA	NA	NA	87.5	297	1930
DOC (mg/L)	41	40	0.45	2.6	9.74	0.07	0.07	0.07	0.07	2.54	9.74
Hardness (mg/L)	41	41	154	185	286	NA	NA	NA	154	185	286
pH (SU)	42	42	6.9	7.97	9.1	NA	NA	NA	6.9	7.97	9.1
Sulfate (mg/L)	29	29	4.4	35.1	185	NA	NA	NA	4.4	35.1	185
Sulfide (mg/L)	29	3	0.011	0.057	0.126	0.003	0.003	0.003	0.003	0.00859	0.126
Dissolved Metals (µg/L)											
Aluminum	41	33	10.3	25.7	192	2.4	5.79	9.6	2.4	5.79	192
Antimony	41	41	0.765	15.4	99.9	NA	NA	NA	0.765	15.4	99.9
Arsenic	41	41	0.56	6.28	69.4	NA	NA	NA	0.56	6.28	69.4
Barium	41	41	70.4	170	532	NA	NA	NA	70.4	170	532
Beryllium	41	1	0.006	0.006	0.006	0.005	0.00525	0.015	0.005	0.00524	0.015
Cadmium	41	39	0.011	0.131	1.4	0.008	0.008	0.008	0.008	0.125	1.4
Calcium	41	41	45900	57800	100000	NA	NA	NA	45900	57800	100000
Chloride ion (mg/L)	29	29	64.4	68.9	77.8	NA	NA	NA	64.4	68.9	77.8
Chromium	41	1	2.14	2.14	2.14	0.45	0.662	0.96	0.45	0.662	2.14
Cobalt	41	41	0.028	0.289	1.8	NA	NA	NA	0.028	0.289	1.8
Copper	41	41	0.12	6.68	18.8	NA	NA	NA	0.12	6.68	18.8
Iron	41	29	9	1250	7810	8	19.8	34	8	14.3	7810
Lead	41	41	0.049	2.78	51.1	NA	NA	NA	0.049	2.78	51.1
Magnesium	41	41	1750	9760	20400	NA	NA	NA	1750	9760	20400
Manganese	41	41	3.58	308	1690	NA	NA	NA	3.58	308	1690
Nickel	41	41	0.17	0.674	2.14	NA	NA	NA	0.17	0.674	2.14
Potassium	41	41	1350	2900	6360	NA	NA	NA	1350	2900	6360
Selenium	41	4	0.3	0.325	0.4	0.2	0.2	0.2	0.2	0.212	0.4
Silver	41	22	0.009	0.062	0.308	0.009	0.009	0.009	0.009	0.0374	0.308
Sodium	41	41	13300	17000	20600	NA	NA	NA	13300	17000	20600
Thallium	41	26	0.009	0.0384	0.115	0.009	0.009	0.009	0.009	0.0276	0.115
Vanadium	41	41	0.18	0.825	3.27	NA	NA	NA	0.18	0.825	3.27
Zinc	41	31	5.2	18.3	71.7	3.1	5.82	9.3	3.1	5.25	71.7
Reference Samples											
Conventional Parameters											
Alkalinity (mg/L)	10	10	35	106	195	NA	NA	NA	35	106	195
DOC (mg/L)	18	17	0.09	2.35	4.73	0.07	0.07	0.07	0.07	2.22	4.73
Hardness (mg/L)	19	19	92.8	153	220	NA	NA	NA	92.8	153	220
pH (SU)	19	19	6.68	7.31	7.66	NA	NA	NA	6.68	7.31	7.66
Sulfate (mg/L)	10	10	9.8	14.8	22.1	NA	NA	NA	9.8	14.8	22.1
Sulfide (mg/L)	10	2	0.02	0.0575	0.095	0.003	0.003	0.003	0.003	0.0139	0.095

Table 5-4a. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 7

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Dissolved Metals (µg/L)											
Aluminum	19	6	13.7	168	698	3.2	5.43	9.2	3.2	5.43	698
Antimony	19	19	0.062	0.467	1.07	NA	NA	NA	0.062	0.467	1.07
Arsenic	19	19	0.21	3.74	11.1	NA	NA	NA	0.21	3.74	11.1
Barium	19	19	60.6	91.4	165	NA	NA	NA	60.6	91.4	165
Beryllium	19	3	0.012	0.019	0.03	0.005	0.005	0.005	0.005	0.00721	0.03
Cadmium	19	12	0.011	0.055	0.187	0.008	0.008	0.008	0.008	0.0377	0.187
Calcium	19	19	25100	47200	72600	NA	NA	NA	25100	47200	72600
Chloride ion (mg/L)	10	10	65.8	68.2	74.6	NA	NA	NA	65.8	68.2	74.6
Chromium	19	0	NA	NA	NA	0.24	0.649	0.81	0.24	0.649	0.81
Cobalt	19	18	0.014	0.343	0.892	0.009	0.009	0.009	0.009	0.326	0.892
Copper	19	19	0.11	0.763	3.89	NA	NA	NA	0.11	0.763	3.89
Iron	19	15	11	898	7580	8	14.8	17	8	13.4	7580
Lead	19	17	0.076	1.18	14.4	0.016	0.0185	0.021	0.016	0.0185	14.4
Magnesium	19	19	5970	8650	12900	NA	NA	NA	5970	8650	12900
Manganese	19	18	0.72	1140	4630	0.52	0.52	0.52	0.52	1080	4630
Nickel	19	19	0.23	0.929	2.36	NA	NA	NA	0.23	0.929	2.36
Potassium	19	19	1700	3090	6730	NA	NA	NA	1700	3090	6730
Selenium	19	4	0.2	0.475	0.9	0.2	0.2	0.2	0.2	0.258	0.9
Silver	19	2	0.014	0.016	0.018	0.009	0.009	0.009	0.009	0.00974	0.018
Sodium	19	19	13300	16400	18400	NA	NA	NA	13300	16400	18400
Thallium	19	4	0.013	0.0207	0.039	0.009	0.009	0.009	0.009	0.0115	0.039
Vanadium	19	19	0.17	1.08	2.91	NA	NA	NA	0.17	1.08	2.91
Zinc	19	5	4.7	10.5	16.2	1.8	4.12	8.2	1.8	3.99	16.2
Negative Laboratory Control Samples											
Conventional Parameters											
Alkalinity (mg/L)	2	2	67.5	100	133	NA	NA	NA	67.5	100	133
DOC (mg/L)	3	3	2.65	3.65	5.62	NA	NA	NA	2.65	3.65	5.62
Hardness (mg/L)	3	3	257	282	325	NA	NA	NA	257	282	325
pH (SU)	3	3	7.13	7.25	7.34	NA	NA	NA	7.13	7.25	7.34
Sulfate (mg/L)	2	2	104	138	173	NA	NA	NA	104	138	173
Sulfide (mg/L)	2	0	NA	NA	NA	0.003	0.003	0.003	0.003	0.003	0.003
Dissolved Metals (µg/L)											
Aluminum	3	1	26.1	26.1	26.1	3.8	4.3	4.8	3.8	4.3	26.1
Antimony	3	3	0.129	0.161	0.193	NA	NA	NA	0.129	0.161	0.193
Arsenic	3	3	1.07	1.76	2.73	NA	NA	NA	1.07	1.76	2.73
Barium	3	3	47.6	73.7	123	NA	NA	NA	47.6	73.7	123
Beryllium	3	1	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.00533	0.006

Table 5-4a. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 7

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Negative Laboratory Control Samples (continued)											
Dissolved Metals (µg/L) (continued)											
Cadmium	3	3	0.104	0.126	0.148	NA	NA	NA	0.104	0.126	0.148
Calcium	3	3	89400	98700	115000	NA	NA	NA	89400	98700	115000
Chloride ion (mg/L)	2	2	62.3	63.8	65.3	NA	NA	NA	62.3	63.8	65.3
Chromium	3	0	NA	NA	NA	0.66	0.7	0.77	0.66	0.7	0.77
Cobalt	3	3	6.54	8.84	11	NA	NA	NA	6.54	8.84	11
Copper	3	3	0.48	0.56	0.68	NA	NA	NA	0.48	0.56	0.68
Iron	3	2	21	1090	2150	17	17	17	17	729	2150
Lead	3	3	0.016	0.087	0.211	NA	NA	NA	0.016	0.087	0.211
Magnesium	3	3	8090	8570	9200	NA	NA	NA	8090	8570	9200
Manganese	3	3	1620	1960	2590	NA	NA	NA	1620	1960	2590
Nickel	3	3	3.59	4.73	6.44	NA	NA	NA	3.59	4.73	6.44
Potassium	3	3	2430	2540	2710	NA	NA	NA	2430	2540	2710
Selenium	3	3	0.2	0.3	0.4	NA	NA	NA	0.2	0.3	0.4
Silver	3	1	0.012	0.012	0.012	0.009	0.009	0.009	0.009	0.01	0.012
Sodium	3	3	19600	20900	21700	NA	NA	NA	19600	20900	21700
Thallium	3	2	0.025	0.027	0.029	0.009	0.009	0.009	0.009	0.021	0.029
Vanadium	3	3	0.63	0.797	1.02	NA	NA	NA	0.63	0.797	1.02
Zinc	3	3	17.4	22.1	30.8	NA	NA	NA	17.4	22.1	30.8
Quartz Sand Negative Control Samples											
Conventional Parameters											
Alkalinity (mg/L)	1	1	60	60	60	NA	NA	NA	60	60	60
DOC (mg/L)	3	3	0.14	0.27	0.4	NA	NA	NA	0.14	0.27	0.4
Hardness (mg/L)	3	3	119	123	126	NA	NA	NA	119	123	126
pH (SU)	3	3	7.76	7.77	7.78	NA	NA	NA	7.76	7.77	7.78
Sulfate (mg/L)	1	1	24.6	24.6	24.6	NA	NA	NA	24.6	24.6	24.6
Sulfide (mg/L)	1	0	NA	NA	NA	0.003	0.003	0.003	0.003	0.003	0.003
Dissolved Metals (µg/L)											
Aluminum	3	3	15.7	16.1	16.5	NA	NA	NA	15.7	16.1	16.5
Antimony	3	3	0.104	0.339	0.773	NA	NA	NA	0.104	0.339	0.773
Arsenic	3	3	0.32	0.343	0.37	NA	NA	NA	0.32	0.343	0.37
Barium	3	3	21.7	23	24.1	NA	NA	NA	21.7	23	24.1
Beryllium	3	0	NA	NA	NA	0.005	0.005	0.005	0.005	0.005	0.005
Cadmium	3	3	0.023	0.0263	0.031	NA	NA	NA	0.023	0.0263	0.031
Calcium	3	3	34800	36400	37700	NA	NA	NA	34800	36400	37700
Chloride ion (mg/L)	1	1	70.8	70.8	70.8	NA	NA	NA	70.8	70.8	70.8
Chromium	3	0	NA	NA	NA	0.49	0.583	0.64	0.49	0.583	0.64
Cobalt	3	3	0.072	0.077	0.082	NA	NA	NA	0.072	0.077	0.082
Copper	3	3	0.55	0.62	0.68	NA	NA	NA	0.55	0.62	0.68

Table 5-4a. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 7

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Quartz Sand Negative Control Samples (continued)											
Dissolved Metals (µg/L) (continued)											
Iron	3	0	NA	NA	NA	8	16.7	34	8	16.7	34
Lead	3	2	0.008	0.009	0.01	0.006	0.006	0.006	0.006	0.008	0.01
Magnesium	3	3	7700	7740	7800	NA	NA	NA	7700	7740	7800
Manganese	3	3	3.1	3.78	4.13	NA	NA	NA	3.1	3.78	4.13
Nickel	3	3	0.41	0.453	0.52	NA	NA	NA	0.41	0.453	0.52
Potassium	3	3	2840	2920	3070	NA	NA	NA	2840	2920	3070
Selenium	3	3	0.5	0.533	0.6	NA	NA	NA	0.5	0.533	0.6
Silver	3	0	NA	NA	NA	0.009	0.009	0.009	0.009	0.009	0.009
Sodium	3	3	20600	22100	23200	NA	NA	NA	20600	22100	23200
Thallium	3	3	0.029	0.0303	0.033	NA	NA	NA	0.029	0.0303	0.033
Vanadium	3	3	0.17	0.177	0.19	NA	NA	NA	0.17	0.177	0.19
Zinc	3	0	NA	NA	NA	2.1	2.4	3	2.1	2.4	3

Notes:

[a] When appropriate, overall means are Kaplan Meier estimates.

[b] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

All nondetected results use the full detection limit for summary statistics.

DOC - dissolved organic carbon

NA - not applicable

Table 5-4b. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 21

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Site Samples [b]											
Conventional Parameters											
Alkalinity (mg/L)	30	30	100	870	17300	NA	NA	NA	100	870	17300
DOC (mg/L)	42	42	0.27	2.95	8.57	NA	NA	NA	0.27	2.95	8.57
Hardness (mg/L)	42	42	132	161	221	NA	NA	NA	132	161	221
pH (SU)	42	42	7.1	8.03	9.26	NA	NA	NA	7.1	8.03	9.26
Sulfate (mg/L)	30	30	2.94	26.2	82.5	NA	NA	NA	2.94	26.2	82.5
Sulfide (mg/L)	32	18	0.004	0.103	0.678	0.003	0.003	0.003	0.003	0.0592	0.678
Dissolved Metals (µg/L)											
Aluminum	42	38	7.7	40.1	297	3.1	6.9	12.3	3.1	5.9	297
Antimony	42	42	1.18	16	120	NA	NA	NA	1.18	16	120
Arsenic	42	42	0.6	4.86	43.3	NA	NA	NA	0.6	4.86	43.3
Barium	42	42	57.7	155	448	NA	NA	NA	57.7	155	448
Beryllium	42	5	0.01	0.011	0.014	0.005	0.005	0.005	0.005	0.00571	0.014
Cadmium	42	40	0.014	0.205	1.9	0.008	0.008	0.008	0.008	0.196	1.9
Calcium	42	42	41100	51300	67100	NA	NA	NA	41100	51300	67100
Chloride ion (mg/L)	30	30	55	68.7	77.5	NA	NA	NA	55	68.7	77.5
Chromium	42	4	0.66	0.775	0.92	0.23	0.653	1.57	0.23	0.646	1.57
Cobalt	42	42	0.031	0.256	1.33	NA	NA	NA	0.031	0.256	1.33
Copper	42	42	0.09	10.5	66.2	NA	NA	NA	0.09	10.5	66.2
Iron	42	32	9	650	5960	8	18.7	60	8	12.6	5960
Lead	42	42	0.162	4.92	51.6	NA	NA	NA	0.162	4.92	51.6
Magnesium	42	42	1760	8010	15500	NA	NA	NA	1760	8010	15500
Manganese	42	42	9.45	238	1160	NA	NA	NA	9.45	238	1160
Nickel	42	28	0.21	0.664	1.83	0.16	0.631	1.43	0.16	0.392	1.83
Potassium	42	41	1210	2820	5380	400	400	400	400	2760	5380
Selenium	42	5	0.2	0.32	0.4	0.2	0.2	0.2	0.2	0.214	0.4
Silver	42	33	0.009	0.0678	0.351	0.009	0.009	0.009	0.009	0.0552	0.351
Sodium	42	42	14600	19200	22400	NA	NA	NA	14600	19200	22400
Thallium	42	30	0.011	0.0379	0.117	0.009	0.009	0.009	0.009	0.0297	0.117
Vanadium	42	41	0.19	1.08	4.24	0.19	0.19	0.19	0.19	1.06	4.24
Zinc	42	36	8.1	18.6	88.3	2.3	5.75	8.4	2.3	5.67	88.3
Reference Samples											
Conventional Parameters											
Alkalinity (mg/L)	14	14	30	124	325	NA	NA	NA	30	124	325
DOC (mg/L)	18	18	0.15	2.51	6.97	NA	NA	NA	0.15	2.51	6.97
Hardness (mg/L)	18	18	96.6	126	158	NA	NA	NA	96.6	126	158
pH (SU)	19	19	6.81	7.19	7.5	NA	NA	NA	6.81	7.19	7.5

Table 5-4b. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 21

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Reference Samples (continued)											
Conventional Parameters (continued)											
Sulfate (mg/L)	14	14	8.84	15.8	23.9	NA	NA	NA	8.84	15.8	23.9
Sulfide (mg/L)	14	7	0.013	0.075	0.181	0.003	0.003	0.003	0.003	0.039	0.181
Dissolved Metals (µg/L)											
Aluminum	19	9	8	79.7	321	4.3	7.02	10.7	4.3	6.85	321
Antimony	19	19	0.085	0.472	1.36	NA	NA	NA	0.085	0.472	1.36
Arsenic	19	19	0.23	3.74	8.97	NA	NA	NA	0.23	3.74	8.97
Barium	19	19	53.4	79.8	122	NA	NA	NA	53.4	79.8	122
Beryllium	19	4	0.005	0.012	0.019	0.005	0.005	0.005	0.005	0.00647	0.019
Cadmium	19	19	0.009	0.0398	0.088	NA	NA	NA	0.009	0.0398	0.088
Calcium	19	19	30100	39100	51700	NA	NA	NA	30100	39100	51700
Chloride ion (mg/L)	14	14	57	69.6	80.9	NA	NA	NA	57	69.6	80.9
Chromium	19	4	0.73	0.882	0.99	0.32	0.645	1.06	0.32	0.635	1.06
Cobalt	19	19	0.02	0.313	0.924	NA	NA	NA	0.02	0.313	0.924
Copper	19	17	0.26	0.955	2.5	0.34	0.395	0.45	0.26	0.301	2.5
Iron	19	12	19	1100	7730	8	13.7	33	8	13	7730
Lead	19	19	0.036	0.711	7.04	NA	NA	NA	0.036	0.711	7.04
Magnesium	19	19	5200	6930	9610	NA	NA	NA	5200	6930	9610
Manganese	19	18	9.78	968	3450	2.97	2.97	2.97	2.97	917	3450
Nickel	19	13	0.57	1.05	2.05	0.38	0.828	1.47	0.38	0.619	2.05
Potassium	19	19	1530	2670	4740	NA	NA	NA	1530	2670	4740
Selenium	19	5	0.2	0.38	0.8	0.2	0.2	0.2	0.2	0.247	0.8
Silver	19	3	0.01	0.0117	0.014	0.009	0.009	0.009	0.009	0.00942	0.014
Sodium	19	19	15400	18200	21200	NA	NA	NA	15400	18200	21200
Thallium	19	6	0.017	0.0237	0.029	0.009	0.009	0.009	0.009	0.0136	0.029
Vanadium	19	19	0.21	1.14	3.45	NA	NA	NA	0.21	1.14	3.45
Zinc	19	5	9.8	13.8	20.7	2.7	3.96	6.5	2.7	3.96	20.7
Negative Laboratory Control Samples											
Conventional Parameters											
Alkalinity (mg/L)	2	2	148	159	170	NA	NA	NA	148	159	170
DOC (mg/L)	3	3	3	5.24	9.15	NA	NA	NA	3	5.24	9.15
Hardness (mg/L)	3	3	172	197	226	NA	NA	NA	172	197	226
pH (SU)	3	3	7.11	7.25	7.41	NA	NA	NA	7.11	7.25	7.41
Sulfate (mg/L)	2	2	41.6	54.1	66.6	NA	NA	NA	41.6	54.1	66.6
Sulfide (mg/L)	2	0	NA	NA	NA	0.003	0.003	0.003	0.003	0.003	0.003

Table 5-4b. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 21

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Negative Laboratory Control Samples (continued)											
Dissolved Metals (µg/L)											
Aluminum	3	0	NA	NA	NA	4.1	4.83	6.2	4.1	4.83	6.2
Antimony	3	3	0.175	0.187	0.201	NA	NA	NA	0.175	0.187	0.201
Arsenic	3	3	1.28	2.03	3.05	NA	NA	NA	1.28	2.03	3.05
Barium	3	3	41.1	69.8	107	NA	NA	NA	41.1	69.8	107
Beryllium	3	1	0.006	0.006	0.006	0.005	0.005	0.005	0.005	0.00533	0.006
Cadmium	3	3	0.018	0.0413	0.072	NA	NA	NA	0.018	0.0413	0.072
Calcium	3	3	59400	68500	78700	NA	NA	NA	59400	68500	78700
Chloride ion (mg/L)	2	2	68.4	68.7	69	NA	NA	NA	68.4	68.7	69
Chromium	3	0	NA	NA	NA	0.57	0.707	0.88	0.57	0.707	0.88
Cobalt	3	3	3.97	5.78	8.52	NA	NA	NA	3.97	5.78	8.52
Copper	3	3	0.51	0.783	0.97	NA	NA	NA	0.51	0.783	0.97
Iron	3	1	3180	3180	3180	19	20.5	22	19	20.5	3180
Lead	3	3	0.041	0.115	0.241	NA	NA	NA	0.041	0.115	0.241
Magnesium	3	3	5690	6280	7260	NA	NA	NA	5690	6280	7260
Manganese	3	3	1170	1610	2460	NA	NA	NA	1170	1610	2460
Nickel	3	3	3.36	4.34	6.1	NA	NA	NA	3.36	4.34	6.1
Potassium	3	3	1600	1990	2320	NA	NA	NA	1600	1990	2320
Selenium	3	3	0.3	0.433	0.7	NA	NA	NA	0.3	0.433	0.7
Silver	3	0	NA	NA	NA	0.009	0.009	0.009	0.009	0.009	0.009
Sodium	3	3	17200	20800	23100	NA	NA	NA	17200	20800	23100
Thallium	3	1	0.016	0.016	0.016	0.009	0.009	0.009	0.009	0.0113	0.016
Vanadium	3	3	0.61	0.817	1.05	NA	NA	NA	0.61	0.817	1.05
Zinc	3	3	11.7	18.2	28.4	NA	NA	NA	11.7	18.2	28.4
Quartz Sand Negative Control Samples											
Conventional Parameters											
Alkalinity (mg/L)	3	3	100	108	125	NA	NA	NA	100	108	125
DOC (mg/L)	3	3	0.34	0.447	0.58	NA	NA	NA	0.34	0.447	0.58
Hardness (mg/L)	3	3	107	122	134	NA	NA	NA	107	122	134
pH (SU)	3	3	7.62	7.67	7.69	NA	NA	NA	7.62	7.67	7.69
Sulfate (mg/L)	3	3	20.2	23	24.5	NA	NA	NA	20.2	23	24.5
Sulfide (mg/L)	3	1	0.014	0.014	0.014	0.003	0.003	0.003	0.003	0.00667	0.014
Dissolved Metals (µg/L)											
Aluminum	3	3	13.5	14.4	15.2	NA	NA	NA	13.5	14.4	15.2
Antimony	3	3	0.101	0.114	0.125	NA	NA	NA	0.101	0.114	0.125
Arsenic	3	3	0.38	0.42	0.47	NA	NA	NA	0.38	0.42	0.47

Table 5-4b. 42-Day *Hyalella azteca* Bioassay Porewater Summary Statistics for Day 21

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean [a]	Overall Maximum
Quartz Sand Negative Control Samples (continued)											
Dissolved Metals (µg/L) (continued)											
Barium	3	3	22.1	24.8	27.5	NA	NA	NA	22.1	24.8	27.5
Beryllium	3	0	NA	NA	NA	0.005	0.005	0.005	0.005	0.005	0.005
Cadmium	3	3	0.01	0.0157	0.019	NA	NA	NA	0.01	0.0157	0.019
Calcium	3	3	31800	37100	40900	NA	NA	NA	31800	37100	40900
Chloride ion (mg/L)	3	3	58.3	67.3	73.2	NA	NA	NA	58.3	67.3	73.2
Chromium	3	1	0.68	0.68	0.68	0.7	0.725	0.75	0.68	0.71	0.75
Cobalt	3	3	0.126	0.163	0.215	NA	NA	NA	0.126	0.163	0.215
Copper	3	3	0.77	0.877	1.02	NA	NA	NA	0.77	0.877	1.02
Iron	3	0	NA	NA	NA	8	8.33	9	8	8.33	9
Lead	3	3	0.034	0.04	0.05	NA	NA	NA	0.034	0.04	0.05
Magnesium	3	3	6770	7260	7750	NA	NA	NA	6770	7260	7750
Manganese	3	3	8.56	12.2	16.3	NA	NA	NA	8.56	12.2	16.3
Nickel	3	2	0.48	0.62	0.76	0.42	0.42	0.42	0.42	0.553	0.76
Potassium	3	3	2260	2640	2870	NA	NA	NA	2260	2640	2870
Selenium	3	3	0.3	0.367	0.4	NA	NA	NA	0.3	0.367	0.4
Silver	3	0	NA	NA	NA	0.009	0.009	0.009	0.009	0.009	0.009
Sodium	3	3	18100	21900	25000	NA	NA	NA	18100	21900	25000
Thallium	3	3	0.033	0.0383	0.046	NA	NA	NA	0.033	0.0383	0.046
Vanadium	3	3	0.22	0.22	0.22	NA	NA	NA	0.22	0.22	0.22
Zinc	3	2	5.8	9.2	12.6	5.8	5.8	5.8	5.8	8.07	12.6

Notes:

All nondetected results use the full detection limit for summary statistics.

[a] When appropriate, overall means are Kaplan Meier estimates.

[b] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

DOC - dissolved organic carbon

NA - not applicable

Table 5-5a. Field Surface Water Summary Statistics

Analyte	Number of Results	Number of Detected Results	Minimum Detected Result	Mean Detected Result	Maximum Detected Result	Minimum Nondetected Result	Mean Nondetected Result	Maximum Nondetected Result	Overall Minimum	Overall Mean	Overall Maximum
Site Samples [a]											
Conductivity (µS/cm)	104	104	124	145	230	NA	NA	NA	124	145	230
pH (SU)	104	104	6.9	7.81	8.4	NA	NA	NA	6.9	7.81	8.4
ORP (mV)	104	104	158	213	263	NA	NA	NA	158	213	263
Temperature (°C)	104	104	10.1	12.9	17.4	NA	NA	NA	10.1	12.9	17.4
TDS (ppm)	104	104	89.6	96.3	138	NA	NA	NA	89.6	96.3	138
Reference Samples											
Conductivity (µS/cm)	18	18	107	120	130	NA	NA	NA	107	120	130
pH (SU)	18	18	6.92	7.22	7.75	NA	NA	NA	6.92	7.22	7.75
ORP (mV)	18	18	178	239	326	NA	NA	NA	178	239	326
Temperature (°C)	18	18	7.16	13	15.6	NA	NA	NA	7.16	13	15.6
TDS (ppm)	18	18	77.5	85.2	97.1	NA	NA	NA	77.5	85.2	97.1

Notes:

All nondetected results use the full detection limit for summary statistics.

Water quality parameters were collected in the field during porewater sampling. Conductivity and temerature were measured via sensors on the Trident probe and with a handheld multimeter. The multimeter was also used to measure pH, total dissolved solids (TDS), and oxidation reduction potential (ORP). When available, data collected from sensors mounted to the Trident probe were used because they are in situ measurements and considered more representative of porewater conditions during sampling. Conductivity and temperature are the average of the Trident sensor measurements. pH, ORP, and TDS are the average of the multimeter measurements.

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

NA - not applicable

Table 5-5b. Field Surface Water-Quality Parameters by Sample

Sample ID	Conductivity (µS/cm)	pH	ORP (mV)	Temperature (°C)	TDS (ppm)
Site Samples [a]					
China Bend					
3-R7-2019-PW	148	8.05	158	10.5	98
3-R8-2019-PW	146	7.91	213	10.3	95.2
CB002-PW	150	8.11	183	10.4	98.8
CB005-PW	147	7.87	225	10.3	95.6
CB006-PW	146	7.93	241	11.5	95.4
CB007-PW	147	8.04	195	11	99.8
CB009-PW	149	8.17	185	10.6	96.2
CB010-PW	148	8.05	202	10.6	96.8
CB012-PW	148	8.05	190	11.5	98.6
CB014-PW	147	8.03	215	10.3	95.2
CB016-PW	145	7.93	184	10.9	95.8
CB018-PW	147	8.00	196	11.5	95.7
CB020-PW	150	8.18	195	10.5	97.6
CB021-PW	147	8.07	174	10.4	97.7
CB024-PW	150	6.9	248	10.5	99.9
CB027-PW	150	8.23	180	10.5	97.2
CB029-PW	148	8.35	179	10.4	96.2
CB035-PW	148	8.14	205	10.5	96
CB036-PW	147	7.8	213	10.5	96.8
CB039-PW	148	7.98	184	10.6	97.7
CB040-PW	147	8.22	186	10.1	97.3
CB041-PW	147	7.42	235	10.1	96
CB043-PW	147	8.13	193	10.1	98.5
CB044-PW	149	8.20	190	10.4	96.8
CB046-PW	148	8.06	203	10.5	100
CB047-PW	145	7.89	192	10.8	96.9
CB048-PW	147	8.17	214	10.2	95
CB049-PW	147	8.21	216	10.2	94.8
CB052-PW	148	8.18	227	10.2	95.7
CB055-PW	145	8.14	211	10.5	95.5
CB056-PW	147	7.53	238	10.5	100
JS001-PW	146	8.11	219	10.9	95.0
JS002-PW	147	7.99	191	11.0	98.2
Deadman's Eddy					
1-B5-NRT-2019-PW	153	7.50	203	10.4	98.9
1-B6-NRT-2019-PW	150	7.06	211	10.5	97
DM002-PW	152	7.51	222	11.2	97.6
DM007-PW	151	7.53	189	10.4	98.6
DM008-PW	140	7.79	183	17.0	92.5
DM010-PW	139	7.26	244	16.7	92.5
DM015-PW	137	8.40	173	16.5	90.7
DM016-PW	139	7.06	198	17.00	97.5
DM018-PW	142	7.05	194	17.2	138
DM019-PW	152	7.29	259	10.8	97.3
DM020-PW	154	7.84	225	10.6	100
DM022-PW	137	6.98	253	16.7	93.8
DM023-PW	134	7.03	204	16.1	89.6
DM024-PW	150	7.41	238	10.5	100
DM025-PW	152	7.84	229	10.5	99.4

Table 5-5b. Field Surface Water-Quality Parameters by Sample

Sample ID	Conductivity (µS/cm)	pH	ORP (mV)	Temperature (°C)	TDS (ppm)
Site Samples (continued)					
Deadman's Eddy (continued)					
DM026-PW	136	6.90	240	16.0	100
DM027-PW	150	7.23	244	10.7	96.2
DM030-PW	149	7.53	222	10.4	101
DM036-PW	148	7.13	218	10.3	99.0
DM038-PW	148	7.56	171	10.2	97.6
DM039-PW	150	7.79	189	10.4	96.4
DM043-PW	151	7.52	212	10.4	102
DM044-PW	147	7.31	228	10.9	95.0
DM045-PW	153	7.20	240	11.3	98.0
DM046-PW	152	7.46	213	11.7	97.2
DM047-PW	149	7.70	160	10.2	98.4
DM050-PW	162	7.13	211	12.4	93.4
DM059-PW	151	7.20	258	10.5	97.00
DM061-PW	148	8.05	260	11.1	94.2
DM063-PW	147	7.35	161	10.6	98.7
DM064-PW	146	7.99	231	10.7	93.8
Evans					
4-B1-2019-PW	146	8.21	199	16.4	94.8
4-B6-2019-PW	140	7.73	252	14.5	93.1
EV001-PW	144	7.95	237	16.0	95.1
EV002-PW	127	8.01	242	16.9	92.7
EV003-PW	143	8.25	204	16.3	93.6
EV005-PW	127	7.98	221	16.8	92.6
EV008-PW	143	7.06	226	16.0	98.0
EV010-PW	126	8.04	230	16.7	97.3
EV011-PW	138	7.58	221	14.2	93.7
EV012-PW	126	8.06	211	16.8	91.5
EV013-PW	125	8.00	191	16.6	92.1
EV015-PW	146	8.11	223	12.5	94.3
EV018-PW	142	7.95	208	14.7	93.7
EV022-PW	138	8.13	223	14.2	91
EV023-PW	138	8.23	235	14.0	92.2
EV024-PW	135	7.94	211	13.8	95.8
EV026-PW	152	8.23	229	16.9	102
EV027-PW	144	8.21	263	16.0	95.1
EV032-PW	148	7.46	169	10.1	101
EV036-PW	137	7.88	242	14.3	96.4
EV037-PW	150	8.19	193	16.9	93.1
EV038-PW	149	7.47	206	10.1	97.3
EV043-PW	146	8.19	224	10.1	95
EV044-PW	125	7.84	211	16.5	91.4
EV048-PW	230	7.75	219	15.0	94.5
EV049-PW	138	8.09	203	14.6	91.4
EV051-PW	147	8.12	226	16.7	92.4
EV052-PW	143	8.22	219	16.2	94
EV054-PW	124	8.04	164	16.8	90.1
EV057-PW	126	8.06	236	16.2	91.3
EV059-PW	148	7.58	236	16.8	93.8
EV060-PW	148	8.22	213	16.6	95.7

Table 5-5b. Field Surface Water-Quality Parameters by Sample

Sample ID	Conductivity (µS/cm)	pH	ORP (mV)	Temperature (°C)	TDS (ppm)
Site Samples (continued)					
Evans (continued)					
EV063-PW	126	7.85	239	16.1	91.4
EV064-PW	127	7.96	228	17.4	92.1
EV065-PW	153	8.11	215	17.1	95.7
EV066-PW	148	7.66	221	16.6	98.3
EV069-PW	147	8.17	224	16.6	94.7
EV071-PW	137	7.64	248	14.5	97.3
EV072-PW	143	8.15	202	15.2	95.1
EV075-PW	128	7.69	209	16.8	93.1
Reference Samples					
REF001-PW	129	7.22	237	15.6	87.7
REF002-PW	130	7.10	326	15.5	87.2
REF003-PW	127	7.39	306	14.9	86.1
REF004-PW	128	7.73	245	14.9	90.2
REF005-PW	118	7.15	205	13.9	85.6
REF006-PW	120	7.25	178	12.7	85.7
REF007-PW	123	7.43	218	14.3	86.3
REF008-PW	118	7.01	216	13.7	93.8
REF009A-PW	122	7.24	211	14.2	86.3
REF010-PW	125	7.49	214	11.5	86.8
REF011-PW	117	7.18	288	13.6	97.1
REF012-PW	117	7.75	204	13.7	80.7
REF013-PW	107	6.99	250	15.6	77.9
REF014-PW	117	6.99	212	12.1	77.9
REF015-PW	118	7.06	278	9.37	81.4
REF016-PW	109	6.92	231	13.2	77.5
REF017-PW	122	6.99	238	7.16	82
REF018-PW	122	7.01	238	7.54	83.7

Notes:

Water quality parameters were collected in the field during porewater sampling. Conductivity and temerature were measured via sensors on the Trident probe and with a handheld multimeter. The multimeter was also used to measure pH, total dissolved solids (TDS), and oxidation reduction potential (ORP). When available, data collected from sensors mounted to the Trident probe were used because they are in situ measurements and considered more representative of porewater conditions during sampling.

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

Table 5-6. BMI Community Metric Results

Location	Sampling Method [a]	Filter Size	Metric	Number of Results	Minimum	Mean	Maximum
Evans	conventional samplers	250 µm	Shannon-Weaver H' (log 10)	28	0.48	0.86	1.11
			species richness	28	11	19.4	29
			corrected abundance	28	63	857	4,460
			total density	28	252	3,610	17,800
		500 µm	Shannon-Weaver H' (log 10)	28	0.53	0.85	1.06
			species richness	28	7	17.7	38
			corrected abundance	28	17	539	2,430
			total density	28	113	2,240	9,710
	freeze grab sampler	250 µm	Shannon-Weaver H' (log 10)	4	0.72	0.84	1.04
			species richness	4	15	18	22
			corrected abundance	4	468	1,110	2,060
			total density	4	1,619	10,100	18,100
		500 µm	Shannon-Weaver H' (log 10)	4	0.75	0.83	1.01
			species richness	4	14	16.5	22
			corrected abundance	4	134	259	590
			total density	4	367	2,170	4,040
China Bend	conventional samplers	250 µm	Shannon-Weaver H' (log 10)	21	0.43	0.84	1.20
			species richness	21	7	23.2	35
			corrected abundance	21	17	894	2,490
			total density	21	92	4,860	15,700
		500 µm	Shannon-Weaver H' (log 10)	20	0.27	0.79	1.32
			species richness	21	0	16.4	33
			corrected abundance	21	0	198	734
			total density	21	0	1,080	2,940
	freeze grab sampler	250 µm	Shannon-Weaver H' (log 10)	6	0.67	0.82	1.06
			species richness	6	9	15.7	19
			corrected abundance	6	32	610	3,200
			total density	6	196	4,010	21,900
		500 µm	Shannon-Weaver H' (log 10)	6	0.45	0.75	1.06
			species richness	6	3	9.8	21
			corrected abundance	6	3	81.2	387
			total density	6	9	521	2,650

Table 5-6. BMI Community Metric Results

Location	Sampling Method [a]	Filter Size	Metric	Number of Results	Minimum	Mean	Maximum
Deadman's Eddy	conventional samplers	250 µm	Shannon-Weaver H' (log 10)	21	0.05	0.57	1.13
			species richness	21	2	13	28
			corrected abundance	21	4	909	9,840
			total density	21	16	3,870	39,400
		500 µm	Shannon-Weaver H' (log 10)	21	0.04	0.53	1.17
			species richness	21	2	12	36
			corrected abundance	21	34	238	1,590
			total density	21	176	1,140	6,350
	freeze grab sampler	250 µm	Shannon-Weaver H' (log 10)	5	0.85	0.98	1.22
			species richness	5	9	18	33
			corrected abundance	5	15	1,000	2,740
			total density	5	103	5,040	15,100
		500 µm	Shannon-Weaver H' (log 10)	5	0.39	0.73	1.20
			species richness	5	3	15	33
			corrected abundance	5	4	200	540
			total density	5	55	1,000	2,940
Reference	conventional samplers	250 µm	Shannon-Weaver H' (log 10)	18	0.14	0.68	1.23
			species richness	18	8	19.7	37
			corrected abundance	18	50	1,540	9,910
			total density	18	200	7,770	39,600
		500 µm	Shannon-Weaver H' (log 10)	17	0.13	0.80	1.30
			species richness	18	0	16.9	43
			corrected abundance	18	0	218	891
			total density	18	0	1,350	8,432

Notes:

Corrected abundance values use the percent subsampled to adjust total abundance counts to represent the total sample.

Values reported in this table do not include data from benthic macroinvertebrat (BMI) duplicate samples. Primary and duplicate BMI samples came from separate successful sampler grabs, therefore, results cannot be combined.

[a] The conventional samplers used for the Phase 3 sediment study were a Van Veen power grab and modified Hamon grab. Hand tools (stainless steel shovel or scoop) were used at locations REF003, REF004 and REF012.

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Site Samples [c]						
500 µm Sample Fraction						
Aeolosomatida	*Aeolosoma* sp.	1	1.14	1.14	1.14	1.14
Amphipoda	*Amphipoda*	4	9.86	2.47	1.00	6.86
Amphipoda	*Crangonyx* sp.	18	203.22	11.29	1.00	117.60
Amphipoda	*Gammarus* sp.	1	2.00	2.00	2.00	2.00
Amphipoda	*Hyalella* sp.	1	9.00	9.00	9.00	9.00
Anthoathecatae	*Hydra* sp.	2	2.00	1.00	1.00	1.00
Arhynchobdellida	*Erpobdella* sp.	1	12.00	12.00	12.00	12.00
Coleoptera	*Haliplus* sp.	1	1.51	1.51	1.51	1.51
Coleoptera	*Zaitzevia* sp.	1	1.00	1.00	1.00	1.00
Decapoda	*Pacifastacus leniusculus*	1	1.00	1.00	1.00	1.00
Diptera	*Ablabesmyia* sp.	8	63.44	7.05	1.00	36.00
Diptera	*Ceratopogoninae*	40	214.81	5.37	1.00	68.00
Diptera	*Chironomus* sp.	16	706.50	41.56	1.00	237.71
Diptera	*Cladopelma* sp.	1	34.29	34.29	34.29	34.29
Diptera	*Corynoneura* sp.	2	2.00	1.00	1.00	1.00
Diptera	*Cricotopus* sp.	4	12.51	2.50	1.00	6.00
Diptera	*Cricotopus/Orthocladius* sp.	7	8.14	1.16	1.00	2.00
Diptera	*Cryptochironomus* sp.	21	92.41	4.40	1.00	27.00
Diptera	*Cryptotendipes* sp.	5	15.00	3.00	1.00	5.00
Diptera	*Demicryptochironomus* sp.	4	11.00	2.75	1.00	8.00
Diptera	*Dicrotendipes* sp.	11	313.18	26.10	1.00	96.00
Diptera	*Diptera*	1	1.00	1.00	1.00	1.00
Diptera	*Eukiefferiella claripennis* gr.	1	1.00	1.00	1.00	1.00
Diptera	*Eukiefferiella* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Hemerodromia* sp.	3	3.00	1.00	1.00	1.00
Diptera	*Heterotrissocladius marcidus* gr.	5	30.63	5.11	1.00	16.80
Diptera	*Hydrosmittia* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Micropsectra* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Microtendipes pedellus* gr.	11	298.51	27.14	1.00	218.00
Diptera	*Monodiamesa* sp.	8	24.00	2.67	1.00	12.00
Diptera	*Nanocladius* sp.	8	21.00	2.63	1.00	11.46
Diptera	*Orthocladiinae*	2	3.00	1.50	1.00	2.00
Diptera	*Orthocladius (Euorthocladius)*	1	1.14	1.14	1.14	1.14
Diptera	*Orthocladius* sp.	8	29.00	3.22	1.00	8.00
Diptera	*Pagastiella* sp.	27	147.43	5.46	1.00	24.00
Diptera	*Parachironomus* sp.	15	43.82	2.92	1.00	11.00
Diptera	*Paracladius* sp.	3	10.26	3.42	1.00	6.86
Diptera	*Paracladopelma* sp.	10	32.23	2.93	1.00	10.29
Diptera	*Parakiefferiella* sp.	38	367.69	9.43	1.00	110.81
Diptera	*Paralauterborniella nigrohalteralis*	20	187.97	9.40	1.00	40.00
Diptera	*Paratanytarsus* sp.	3	8.01	2.67	1.00	4.00
Diptera	*Paratendipes* sp.	49	3,685.07	75.21	1.00	1,043.10
Diptera	*Pentaneura* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Pentaneurini*	16	94.15	5.88	1.00	31.00
Diptera	*Phaenopsectra* sp.	9	84.15	7.65	1.00	34.00
Diptera	*Polypedilum* sp.	49	866.82	17.69	1.00	117.71
Diptera	*Potthastia gaedii* gr.	1	1.00	1.00	1.00	1.00
Diptera	*Potthastia longimana* gr.	10	13.29	1.33	1.00	2.29
Diptera	*Procladius* sp.	43	2,975.36	69.19	1.00	702.86
Diptera	*Psectrocladius* sp.	5	10.92	2.18	1.00	6.00
Diptera	*Pseudochironomus* sp.	6	8.14	1.36	1.00	3.00
Diptera	*Rheocricotopus* sp.	1	1.51	1.51	1.51	1.51
Diptera	*Robackia demeijerei*	28	1,524.55	54.45	1.00	407.00
Diptera	*Simulium* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Stempellina* sp.	2	5.00	2.50	1.00	4.00
Diptera	*Stempellinella* sp.	3	5.29	1.76	1.00	2.29
Diptera	*Stenochironomus* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Stictochironomus* sp.	2	8.00	4.00	1.00	7.00
Diptera	*Sublettea* sp.	1	4.00	4.00	4.00	4.00
Diptera	*Synorthocladius* sp.	1	10.00	5.00	2.00	8.00
Diptera	*Tanytarsus* sp.	37	474.34	11.57	1.00	102.86

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Site Samples [c] (continued)						
500 µm Sample Fraction						
Diptera	*Thienemanniella* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Thienemannimyia* gr. sp.	8	56.12	7.02	1.00	18.00
Diptera	*Tribelos jucundum*	4	27.02	6.76	1.00	18.00
Diptera	*Xenochironomus xenolabis*	1	7.00	7.00	7.00	7.00
Enchytraeida	*Enchytraeidae*	3	6.00	2.00	1.00	3.00
Ephemeroptera	*Baetidae*	2	4.43	2.22	1.00	3.43
Ephemeroptera	*Baetis* sp.	1	1.00	1.00	1.00	1.00
Ephemeroptera	*Caenis latipennis*	1	1.00	1.00	1.00	1.00
Ephemeroptera	*Caenis* sp.	1	1.51	1.51	1.51	1.51
Ephemeroptera	*Ephemerella* sp.	10	52.33	5.23	1.00	32.00
Ephemeroptera	*Ephemerellidae*	2	2.14	1.07	1.00	1.14
Hoplonemertea	*Prostoma* sp.	42	1,039.18	24.74	1.00	221.61
Hygrophila	*Galba* sp.	1	9.04	9.04	9.04	9.04
Hygrophila	*Gyraulus* sp.	4	73.26	18.32	1.00	66.26
Hygrophila	*Helisoma anceps*	3	13.94	4.65	1.51	9.00
Hygrophila	*Lymnaeidae*	5	6.00	1.20	1.00	2.00
Hygrophila	*Physa* sp.	3	6.00	2.00	1.00	3.00
Hygrophila	*Physella* sp.	1	6.00	6.00	6.00	6.00
Hygrophila	*Stagnicola* sp.	1	3.00	3.00	3.00	3.00
Hygrophila	*Valvata humeralis*	5	258.99	51.80	1.00	252.99
Hygrophila	*Valvata tricarinata*	9	171.49	19.05	1.00	132.52
Isopoda	*Caecidotea* sp.	25	980.03	39.20	1.00	351.00
Littoridinomorpha	*Fluminicola* sp.	3	3.00	1.00	1.00	1.00
Lumbriculida	*Lumbriculidae*	9	37.00	4.11	1.00	10.00
Megaloptera	*Sialis* sp.	1	3.00	3.00	3.00	3.00
Opisthopora	*Lumbricina*	1	1.00	1.00	1.00	1.00
Rhynchobdellida	*Helobdella elongata*	1	4.52	4.52	4.52	4.52
Rhynchobdellida	*Helobdella* sp.	1	6.00	6.00	6.00	6.00
Rhynchobdellida	*Helobdella stagnalis*	5	23.01	4.60	2.00	9.00
Rhynchobdellida	*Theromyzon* sp.	1	1.00	1.00	1.00	1.00
Schizodonta	*Unionacea*	1	1.00	1.00	1.00	1.00
Trichoptera	*Apatania* sp.	1	1.00	1.00	1.00	1.00
Trichoptera	*Brachycentrus occidentalis*	1	2.00	2.00	2.00	2.00
Trichoptera	*Ceraclea* sp.	14	22.00	1.57	1.00	5.00
Trichoptera	*Cheumatopsyche* sp.	1	2.00	2.00	2.00	2.00
Trichoptera	*Hydropsyche* sp.	3	6.00	2.00	1.00	4.00
Trichoptera	*Leptoceridae*	2	2.00	1.00	1.00	1.00
Trichoptera	*Mystacides alafimbriata*	3	18.00	6.00	1.00	16.00
Trichoptera	*Mystacides* sp.	3	30.00	10.00	1.00	27.00
Trichoptera	*Oecetis* sp.	18	96.50	5.36	1.00	24.00
Trichoptera	*Polycentropodidae*	1	2.00	2.00	2.00	2.00
Trichoptera	*Trichoptera*	1	3.00	3.00	3.00	3.00
Trombidiformes	*Arrenurus* sp.	11	17.86	1.62	1.00	4.57
Trombidiformes	*Aturidae*	1	1.00	1.00	1.00	1.00
Trombidiformes	*Forelia* sp.	5	6.14	1.23	1.00	2.00
Trombidiformes	*Frontipoda* sp.	1	1.14	1.14	1.14	1.14
Trombidiformes	*Hygrobates* sp.	43	234.75	5.46	1.00	20.00
Trombidiformes	*Lebertia* sp.	57	770.33	13.51	1.00	76.42
Trombidiformes	*Limnesia* sp.	5	28.72	5.74	1.00	18.29
Trombidiformes	*Mideopsis* sp.	16	32.53	2.03	1.00	6.00
Trombidiformes	*Neumania* sp.	1	1.14	1.14	1.14	1.14
Trombidiformes	*Pionidae*	3	6.00	2.00	1.00	3.00
Trombidiformes	*Sperchon* sp.	15	26.74	1.78	1.00	4.00
Trombidiformes	*Torrenticola* sp.	31	131.47	4.24	1.00	21.00
Tubificida	*Aulodrilus americanus*	2	19.41	9.71	1.41	18.00
Tubificida	*Aulodrilus limnobius*	12	66.36	5.53	1.00	27.43
Tubificida	*Aulodrilus pigueti*	1	27.00	27.00	27.00	27.00
Tubificida	*Aulodrilus pluriseta*	26	443.19	17.05	1.00	104.00
Tubificida	*Dero digitata*	1	10.29	10.29	10.29	10.29
Tubificida	*Dero* sp.	1	1.00	1.00	1.00	1.00

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Site Samples [c] (continued)						
500 µm Sample Fraction						
Tubificida	*Limnodrilus hoffmeisteri*	6	16.82	2.80	1.00	4.00
Tubificida	*Nais* sp.	2	2.00	1.00	1.00	1.00
Tubificida	*Pristina* sp.	3	16.00	5.33	2.00	9.00
Tubificida	*Specaria josinae*	2	4.84	2.42	1.41	3.43
Tubificida	*Tubifex tubifex*	1	30.00	30.00	30.00	30.00
Tubificida	*tubificoid Naididae* w/ cap setae	7	39.11	5.59	1.00	19.00
Tubificida	*tubificoid Naididae* w/o cap setae	24	274.88	11.45	1.00	44.00
Tubificida	*Uncinais uncinata*	2	3.82	1.91	1.00	2.82
Unionoida	*Anodonta* sp.	8	13.41	1.68	1.00	6.00
Veneroida	*Musculium* sp.	18	285.03	15.84	1.00	185.14
Veneroida	*Pisidium* sp.	37	3,889.67	105.13	1.00	768.00
Veneroida	*Sphaeriidae*	20	989.57	49.48	1.00	548.57
Not specified	*Acari*	4	4.33	1.08	1.00	1.33
Not specified	*Gastropoda*	2	2.00	1.00	1.00	1.00
Not specified	*Nematoda*	78	3,167.67	40.61	1.00	1,462.86
Not specified	none present in sample	1	0.00	0.00	0.00	0.00
Not specified	*Oribatei*	4	8.00	2.00	1.00	5.00
Not specified	*Ostracoda*	36	424.87	11.80	1.00	110.81
Not specified	*Turbellaria*	19	73.82	3.89	1.00	21.00
NA	AFDW (g)	82	3,024.86	36.89	0.00	449.93
NA	corrected counted blotted wet-weight biomass (g)	85	78.25	0.92	0.00	31.95
250 µm Sample Fraction						
Aeolosomatida	*Aeolosoma* sp.	6	28.69	4.78	1.00	11.00
Amphipoda	*Amphipoda*	6	158.33	26.39	1.00	96.00
Anthoathecatae	*Hydra* sp.	11	29.96	2.72	1.00	7.00
Calanoida	*Calanoida*	4	22.20	5.55	1.00	19.20
Cyclopoida	*Cyclopoida*	54	1,227.04	22.72	1.00	272.00
Diplostraca	*Cladocera*	50	1,220.59	24.41	1.00	243.20
Diptera	*Ablabesmyia* sp.	6	54.01	9.00	2.29	16.00
Diptera	*Brillia* sp.	1	2.09	2.09	2.09	2.09
Diptera	*Ceratopogoninae*	17	172.82	10.17	1.00	42.67
Diptera	*Chironomus* sp.	6	67.61	11.27	1.00	32.00
Diptera	*Cladopelma* sp.	3	108.57	36.19	16.00	72.00
Diptera	*Cladotanytarsus* sp.	4	44.40	11.10	1.00	24.00
Diptera	*Constempellina* sp.	3	25.98	8.66	1.71	20.00
Diptera	*Corynoneura* sp.	2	2.00	1.00	1.00	1.00
Diptera	*Cricotopus* sp.	5	21.60	4.32	1.00	9.60
Diptera	*Cricotopus/Orthocladius* sp.	17	101.47	5.97	1.00	52.00
Diptera	*Cryptochironomus* sp.	10	96.97	9.70	1.00	42.67
Diptera	*Cryptotendipes* sp.	9	64.76	7.20	1.00	26.67
Diptera	*Dicrotendipes* sp.	8	235.58	29.45	1.00	96.00
Diptera	*Empididae*	1	4.00	4.00	4.00	4.00
Diptera	*Eukiefferiella* sp.	2	9.00	4.50	1.00	8.00
Diptera	*Harnischia* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Hemerodromia* sp.	2	2.14	1.07	1.00	1.14
Diptera	*Heterotrissocladius marcidus* gr.	5	21.53	4.31	1.00	7.38
Diptera	*Micropsectra* sp.	2	111.71	55.86	2.00	109.71
Diptera	*Microtendipes pedellus* gr.	13	359.33	27.64	1.00	156.00
Diptera	*Monodiamesa* sp.	4	41.00	10.25	1.00	38.00
Diptera	*Nanocladius* sp.	27	209.41	7.76	1.00	70.62
Diptera	*Orthocladiinae*	2	3.67	1.84	1.00	2.67
Diptera	*Orthocladius* sp.	3	12.14	4.05	1.00	10.00
Diptera	*Pagastia* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Pagastiella* sp.	24	230.94	9.62	1.00	85.33
Diptera	*Parachironomus* sp.	18	125.07	6.95	1.00	29.26
Diptera	*Paracladius* sp.	3	7.28	2.43	1.00	4.57
Diptera	*Paracladopelma* sp.	11	37.84	3.44	1.00	11.43
Diptera	*Parakiefferiella* sp.	66	1,895.10	28.71	1.00	492.00
Diptera	*Paralauterborniella nigrohalteralis*	28	465.53	16.63	1.00	81.07
Diptera	*Paratanytarsus* sp.	3	26.00	8.67	1.00	21.00

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Site Samples [c] (continued)						
250 µm Sample Fraction						
Diptera	*Paratendipes* sp.	55	8,079.65	146.90	1.00	2,056.83
Diptera	*Pentaneurini*	31	952.73	30.73	1.00	237.71
Diptera	*Phaenopsectra* sp.	19	202.59	10.66	1.00	54.86
Diptera	*Polypedilum* sp.	53	755.38	14.25	1.00	144.00
Diptera	*Potthastia longimana* gr.	12	26.53	2.21	1.00	10.67
Diptera	*Procladius* sp.	46	3,247.88	70.61	1.00	939.43
Diptera	*Psectrocladius* sp.	2	18.09	9.05	2.09	16.00
Diptera	*Pseudochironomus* sp.	1	1.14	1.14	1.14	1.14
Diptera	*Rheocricotopus* sp.	2	3.09	1.55	1.00	2.09
Diptera	*Robackia demeijerei*	21	822.00	39.14	1.00	331.00
Diptera	*Simuliidae*	10	27.80	2.78	1.00	8.00
Diptera	*Stempellina* sp.	5	17.10	3.42	2.29	6.86
Diptera	*Stempellinella* sp.	2	3.00	1.50	1.00	2.00
Diptera	*Stictochironomus* sp.	1	1.71	1.71	1.71	1.71
Diptera	*Sublettea* sp.	2	9.00	4.50	1.00	8.00
Diptera	*Synorthocladius* sp.	2	145.00	72.50	1.00	144.00
Diptera	*Tanytarsini*	1	2.00	2.00	2.00	2.00
Diptera	*Tanytarsus* sp.	56	1713.18	30.59	1.00	261.33
Diptera	*Thienemanniella* sp.	1	8.00	8.00	8.00	8.00
Diptera	*Thienemannimyia* gr. sp.	7	143.57	20.51	1.00	100.00
Diptera	*Tribelos jucundum*	2	6.40	3.20	1.83	4.57
Diptera	*Tvetenia discoloripes* gr.	1	12.00	12.00	12.00	12.00
Enchytraeida	*Enchytraeidae*	8	54.16	6.77	1.00	20.57
Ephemeroptera	*Ephemerella* sp.	8	98.00	12.25	1.00	62.00
Ephemeroptera	*Ephemerellidae*	7	28.14	4.02	1.14	8.00
Harpacticoida	*Harpacticoida*	66	14,235.20	215.68	1.00	1,968.00
Hoplonemertea	*Prostoma* sp.	51	1,807.76	35.45	1.00	251.43
Hygrophila	*Lymnaeidae*	1	1.00	1.00	1.00	1.00
Isopoda	*Caecidotea* sp.	8	271.52	33.94	1.00	219.43
Lumbriculida	*Lumbriculidae*	4	11.37	2.84	1.00	4.80
Plecoptera	*Chloroperlidae*	1	1.00	1.00	1.00	1.00
Plecoptera	*Plecoptera*	2	4.00	2.00	1.00	3.00
Trichoptera	*Amiocentrus aspilus*	1	1.00	1.00	1.00	1.00
Trichoptera	*Ceraclea* sp.	4	5.00	1.25	1.00	2.00
Trichoptera	*Glossosoma* sp.	1	1.00	1.00	1.00	1.00
Trichoptera	*Leptoceridae*	5	7.33	1.47	1.00	2.00
Trichoptera	*Oecetis* sp.	5	15.36	3.07	1.00	9.60
Trichoptera	*Trichoptera*	5	86.00	17.20	1.00	80.00
Trombidiformes	*Arrenurus* sp.	2	2.14	1.07	1.00	1.14
Trombidiformes	*Atractides* sp.	6	14.57	2.43	1.00	4.57
Trombidiformes	*Aturidae*	13	39.58	3.04	1.00	8.00
Trombidiformes	*Feltria* sp.	7	11.43	1.63	1.00	3.43
Trombidiformes	*Halacaridae*	10	25.71	2.57	1.00	5.71
Trombidiformes	*Hygrobates* sp.	5	7.80	1.56	1.00	3.66
Trombidiformes	*Lebertia* sp.	53	524.03	9.89	1.00	52.97
Trombidiformes	*Limnesia* sp.	2	2.85	1.43	1.14	1.71
Trombidiformes	*Pionidae*	11	16.01	1.46	1.00	3.20
Trombidiformes	*Sperchon* sp.	5	5.85	1.17	1.00	1.71
Trombidiformes	*Torrenticola* sp.	42	789.79	18.80	1.00	124.00
Trombidiformes	*Torrenticolidae*	11	34.26	3.11	1.00	8.00
Tubificida	*Amphichaeta americana*	2	69.33	34.67	5.33	64.00
Tubificida	*Arcteonais lomondi*	3	24.87	8.29	1.78	18.29
Tubificida	*Aulodrilus americanus*	2	3.29	1.65	1.00	2.29
Tubificida	*Aulodrilus limnobius*	10	94.87	9.49	1.00	73.14
Tubificida	*Aulodrilus pigueti*	3	132.54	44.18	2.25	128.00
Tubificida	*Aulodrilus pluriseta*	32	744.54	23.27	1.00	164.00
Tubificida	*Chaetogaster diastrophus*	11	171.53	15.59	1.00	80.00
Tubificida	*Dero digitata*	2	23.31	11.66	9.60	13.71
Tubificida	*Dero* sp.	5	238.67	47.73	2.67	188.00
Tubificida	*Nais behningi*	5	32.00	6.40	2.00	11.00

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Site Samples [c] (continued)						
250 µm Sample Fraction						
Tubificida	*Nais* sp.	7	50.87	7.27	1.00	36.57
Tubificida	*Pristina* sp.	24	585.55	24.40	1.00	333.71
Tubificida	*Slavina appendiculata*	5	24.29	4.86	1.00	14.40
Tubificida	*Specaria josinae*	10	390.02	39.00	1.00	124.80
Tubificida	*tubificoid Naididae* w/ cap setae	11	69.99	6.36	1.00	18.29
Tubificida	*tubificoid Naididae* w/o cap setae	26	598.17	23.01	1.00	128.00
Tubificida	*Uncinais uncinata*	2	7.77	3.89	3.20	4.57
Tubificida	*Vejdovskyella comata*	2	19.29	9.65	1.00	18.29
Veneroida	*Corbicula* sp.	1	1.00	1.00	1.00	1.00
Veneroida	*Corbiculoidea*	1	1.00	1.00	1.00	1.00
Veneroida	*Pisidium* sp.	8	70.08	8.76	1.71	24.00
Veneroida	*Sphaeriidae*	18	66.43	3.69	1.00	13.33
Not specified	*Acari*	21	101.55	4.84	1.00	13.71
Not specified	*Gastropoda*	1	1.00	1.00	1.00	1.00
Not specified	*Nematoda*	79	19,158.35	242.51	1.00	7,040.00
Not specified	*Oribatei*	61	1,443.09	23.66	1.00	305.00
Not specified	*Ostracoda*	76	9,251.32	121.73	1.00	1,015.17
Not specified	*Tardigrada*	5	24.30	4.86	1.00	10.97
Not specified	*Turbellaria*	12	38.56	3.21	1.00	12.00
NA	AFDW (g)	85	505.42	5.95	0.00	111.60
NA	corrected counted blotted wet-weight biomass (g)	85	0.634	0.007	0.001	0.056
Reference Samples						
500 µm Sample Fraction						
Amphipoda	*Crangonyx* sp.	3	39.20	13.07	2.00	27.20
Anthoathecatae	*Hydra* sp.	2	3.00	1.50	1.00	2.00
Coleoptera	*Zaitzevia* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Ceratopogoninae*	5	13.00	2.60	1.00	6.00
Diptera	*Chironomus* sp.	3	31.80	7.95	1.00	27.20
Diptera	*Cladopelma* sp.	1	2.00	2.00	2.00	2.00
Diptera	*Cladotanytarsus* sp.	3	9.00	3.00	1.00	6.40
Diptera	*Corynoneura* sp.	2	2.00	1.00	1.00	1.00
Diptera	*Cricotopus* sp.	2	2.00	1.00	1.00	1.00
Diptera	*Cricotopus/Orthocladius* sp.	2	8.00	4.00	3.00	5.00
Diptera	*Cryptochironomus* sp.	7	126.80	18.11	1.00	92.80
Diptera	*Demicryptochironomus* sp.	4	6.20	1.55	1.00	2.00
Diptera	*Dicrotendipes* sp.	5	31.80	6.36	1.00	16.00
Diptera	*Heterotrissocladius marcidus* gr.	3	14.60	4.87	1.60	11.00
Diptera	*Microtendipes pedellus* gr.	11	96.80	8.80	1.00	34.00
Diptera	*Monodiamesa* sp.	4	11.80	2.95	1.00	4.80
Diptera	*Nanocladius* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Orthocladius* sp.	5	60.80	12.16	2.00	33.60
Diptera	*Pagastia* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Pagastiella* sp.	1	2.00	2.00	2.00	2.00
Diptera	*Paracladopelma* sp.	5	55.80	11.16	1.00	19.20
Diptera	*Parakiefferiella* sp.	7	109.00	13.63	1.00	58.00
Diptera	*Paralauterborniella nigrohalteralis*	2	8.80	4.40	4.00	4.80
Diptera	*Paratanytarsus* sp.	1	3.20	3.20	3.20	3.20
Diptera	*Paratendipes* sp.	3	38.80	12.93	2.00	19.20
Diptera	*Pentaneurini*	1	2.00	2.00	2.00	2.00
Diptera	*Phaenopsectra* sp.	5	43.40	7.23	1.00	35.20
Diptera	*Polypedilum* sp.	11	239.40	18.42	1.00	96.00
Diptera	*Potthastia longimana* gr.	2	7.40	3.70	1.00	6.40
Diptera	*Procladius* sp.	6	18.80	3.13	1.00	5.00
Diptera	*Protanypus* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Psectrocladius* sp.	3	6.20	1.55	1.00	2.00
Diptera	*Robackia demeijerei*	10	614.00	61.40	1.00	246.00
Diptera	*Stempellina* sp.	1	1.60	1.60	1.60	1.60
Diptera	*Stempellinella* sp.	1	1.60	1.60	1.60	1.60
Diptera	*Stictochironomus* sp.	3	12.00	4.00	2.00	6.00
Diptera	*Sublettea* sp.	1	1.60	1.60	1.60	1.60

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Reference Samples (continued)						
500 µm Sample Fraction						
Diptera	*Synorthocladius* sp.	5	92.20	11.53	1.00	27.20
Diptera	*Tanytarsus* sp.	6	56.00	9.33	1.00	32.00
Diptera	*Thienemannimyia* gr. sp.	9	112.00	12.44	1.00	68.80
Enchytraeida	*Enchytraeidae*	10	108.60	10.86	1.00	52.80
Ephemeroptera	*Ephemerella* sp.	4	27.00	6.75	3.00	9.00
Ephemeroptera	*Ephemerellidae*	1	4.80	4.80	4.80	4.80
Ephemeroptera	*Rhithrogena* sp.	1	1.00	1.00	1.00	1.00
Hoplonemertea	*Prostoma* sp.	10	34.00	3.40	1.00	12.80
Hygrophila	*Galba* sp.	2	14.80	7.40	2.00	12.80
Hygrophila	*Gyraulus* sp.	4	9.80	2.45	1.00	4.80
Hygrophila	*Menetus opercularis*	1	1.00	1.00	1.00	1.00
Hygrophila	*Planorbidae*	1	1.60	1.60	1.60	1.60
Hygrophila	*Stagnicola* sp.	3	5.60	1.87	1.00	3.00
Hygrophila	*Valvata humeralis*	3	17.40	5.80	1.00	10.00
Hygrophila	*Valvata* sp.	3	16.00	5.33	1.00	14.00
Hygrophila	*Valvata tricarinata*	4	6.60	1.65	1.00	3.00
Isopoda	*Caecidotea* sp.	2	44.20	22.10	1.00	43.20
Littoridinomorpha	*Fluminicola* sp.	3	8.00	2.67	2.00	4.00
Lumbriculida	*Lumbriculidae*	3	22.80	7.60	2.00	11.20
Odonata	*Gomphidae*	1	1.00	1.00	1.00	1.00
Opisthopora	*Lumbricina*	1	1.00	1.00	1.00	1.00
Plecoptera	*Plecoptera*	1	1.00	1.00	1.00	1.00
Rhynchobdellida	*Helobdella stagnalis*	2	4.00	2.00	1.00	3.00
Trichoptera	*Ceraclea* sp.	4	19.60	4.90	1.00	14.00
Trichoptera	*Cheumatopsyche* sp.	2	6.00	3.00	2.00	4.00
Trichoptera	*Glossosomatidae*	1	1.00	1.00	1.00	1.00
Trichoptera	*Hydropsyche* sp.	6	109.00	15.57	1.00	90.00
Trichoptera	*Mystacides* sp.	3	15.00	5.00	2.00	7.00
Trichoptera	*Oecetis* sp.	1	1.00	1.00	1.00	1.00
Trichoptera	*Protoptila* sp.	2	24.00	12.00	2.00	22.00
Trombidiformes	*Hygrobates* sp.	2	2.60	1.30	1.00	1.60
Trombidiformes	*Lebertia* sp.	6	13.80	2.30	1.00	4.00
Trombidiformes	*Sperchon* sp.	2	6.00	3.00	1.00	5.00
Trombidiformes	*Torrenticola* sp.	2	2.60	1.30	1.00	1.60
Tubificida	*Aulodrilus limnobius*	1	1.00	1.00	1.00	1.00
Tubificida	*Dero* sp.	3	12.20	4.07	1.00	8.00
Tubificida	*Nais* sp.	2	2.00	1.00	1.00	1.00
Tubificida	*Rhyacodrilus sodalis*	1	3.00	3.00	3.00	3.00
Tubificida	*Ripistes parasita*	1	3.20	3.20	3.20	3.20
Tubificida	*Slavina appendiculata*	1	3.00	3.00	3.00	3.00
Tubificida	*Specaria josinae*	1	1.60	1.60	1.60	1.60
Tubificida	*tubificoid Naididae* w/ cap setae	3	3.60	1.20	1.00	1.60
Tubificida	*tubificoid Naididae* w/o cap setae	8	142.20	17.78	1.00	99.20
Tubificida	*Uncinais uncinata*	5	49.80	9.96	1.00	25.60
Veneroida	*Pisidium* sp.	8	322.60	40.33	3.00	230.40
Veneroida	*Sphaeriidae*	5	13.00	2.60	1.00	4.00
Not specified	*Acari*	1	1.00	1.00	1.00	1.00
Not specified	*Nematoda*	15	766.00	51.07	6.00	302.40
Not specified	none present in sample	1	0.00	0.00	0.00	0.00
Not specified	*Oribatei*	1	2.00	2.00	2.00	2.00
Not specified	*Ostracoda*	4	55.80	13.95	1.00	28.80
Not specified	*Turbellaria*	5	117.00	23.40	13.00	34.00
NA	AFDW (g)	15	1,570.38	104.69	0.10	635.70
NA	corrected counted blotted wet-weight biomass (g)	18	1.15	0.06	0.00	0.27
250 µm Sample Fraction						
Anthoathecatae	*Hydra* sp.	3	59.54	19.85	4.00	29.54
Cyclopoida	*Cyclopoida*	12	431.38	35.95	1.52	160.00
Diplostraca	*Cladocera*	11	1,841.77	167.43	1.00	803.20
Diptera	*Ceratopogoninae*	2	4.19	2.10	1.52	2.67
Diptera	*Chironomini*	1	6.98	6.98	6.98	6.98
Diptera	*Cladotanytarsus* sp.	6	29.25	4.88	1.00	12.80

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Reference Samples (continued)						
250 µm Sample Fraction						
Diptera	*Corynoneura* sp.	2	5.92	2.96	1.00	4.92
Diptera	*Cricotopus (Nostococladius) nostocicola*	1	1.00	1.00	1.00	1.00
Diptera	*Cricotopus* sp.	1	5.00	5.00	5.00	5.00
Diptera	*Cricotopus/Orthocladius* sp.	7	42.73	6.10	3.00	12.31
Diptera	*Cryptochironomus* sp.	7	97.56	13.94	1.00	60.00
Diptera	*Dicrotendipes* sp.	1	1.78	1.78	1.78	1.78
Diptera	*Eukiefferiella claripennis* gr.	1	3.00	3.00	3.00	3.00
Diptera	*Hemerodromia* sp.	1	4.00	4.00	4.00	4.00
Diptera	*Heterotrissocladius marcidus* gr.	3	23.47	7.82	1.00	12.00
Diptera	*Microtendipes pedellus* gr.	7	203.31	29.04	1.00	172.31
Diptera	*Nanocladius* sp.	1	14.77	14.77	14.77	14.77
Diptera	*Orthocladius (Euorthocladius)*	1	1.00	1.00	1.00	1.00
Diptera	*Orthocladius* sp.	3	11.00	3.67	1.00	8.00
Diptera	*Parachironomus* sp.	2	6.25	3.13	1.33	4.92
Diptera	*Paracladius* sp.	1	8.00	8.00	8.00	8.00
Diptera	*Paracladopelma* sp.	9	112.64	12.52	1.33	66.46
Diptera	*Parakiefferiella* sp.	12	338.04	28.17	1.00	152.00
Diptera	*Paralauterborniella nigrohalteralis*	2	22.29	11.15	4.00	18.29
Diptera	*Paratanytarsus* sp.	2	8.71	4.36	1.33	7.38
Diptera	*Paratendipes* sp.	8	55.15	6.89	1.00	20.00
Diptera	*Pentaneurini*	9	105.27	11.70	1.00	60.00
Diptera	*Phaenopsectra* sp.	6	144.43	24.07	2.67	99.20
Diptera	*Polypedilum* sp.	13	429.26	33.02	1.00	226.46
Diptera	*Procladius* sp.	2	4.72	2.36	1.52	3.20
Diptera	*Rheotanytarsus* sp.	2	2.00	1.00	1.00	1.00
Diptera	*Robackia demeijerei*	11	249.78	22.71	1.00	56.00
Diptera	*Stempellina* sp.	1	4.00	4.00	4.00	4.00
Diptera	*Stempellinella* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Stictochironomus* sp.	1	1.00	1.00	1.00	1.00
Diptera	*Synorthocladius* sp.	7	79.90	9.99	1.00	46.77
Diptera	*Tanypodinae*	1	4.00	4.00	4.00	4.00
Diptera	*Tanytarsus* sp.	10	153.27	15.33	1.00	51.69
Diptera	*Thienemannimyia* gr. sp.	4	22.07	5.52	1.71	7.38
Diptera	*Tvetenia discoloripes* gr.	1	4.00	4.00	4.00	4.00
Enchytraeida	*Enchytraeidae*	14	368.52	26.32	1.00	105.60
Ephemeroptera	*Baetis* sp.	1	2.46	2.46	2.46	2.46
Ephemeroptera	*Ephemerella* sp.	1	1.33	1.33	1.33	1.33
Ephemeroptera	*Ephemerellidae*	7	301.52	43.07	1.00	113.78
Harpacticoida	*Harpacticoida*	17	16,522.79	971.93	1.00	9,234.29
Hoplonemertea	*Prostoma* sp.	10	65.90	6.59	1.00	36.92
Hygrophila	*Planorbidae*	2	5.00	2.50	2.00	3.00
Lumbriculida	*Lumbriculidae*	7	18.16	2.59	1.33	6.40
Plecoptera	*Plecoptera*	4	6.79	1.70	1.00	2.46
Trichoptera	*Ceraclea* sp.	2	6.25	3.13	1.33	4.92
Trichoptera	*Glossosoma* sp.	1	1.00	1.00	1.00	1.00
Trichoptera	*Hydropsyche* sp.	1	7.00	7.00	7.00	7.00
Trichoptera	*Leptoceridae*	1	12.31	12.31	12.31	12.31
Trichoptera	*Mystacides* sp.	1	1.33	1.33	1.33	1.33
Trichoptera	*Protoptila* sp.	2	3.46	1.73	1.00	2.46
Trombidiformes	*Atractides* sp.	2	21.23	10.62	4.00	17.23
Trombidiformes	*Aturidae*	1	2.46	2.46	2.46	2.46
Trombidiformes	*Estelloxus* sp.	1	1.00	1.00	1.00	1.00
Trombidiformes	*Feltria* sp.	1	1.00	1.00	1.00	1.00
Trombidiformes	*Halacaridae*	4	130.48	32.62	3.05	104.00
Trombidiformes	*Hygrobates* sp.	1	1.00	1.00	1.00	1.00
Trombidiformes	*Lebertia* sp.	3	43.03	14.34	2.46	36.57
Trombidiformes	*Torrenticola* sp.	2	4.20	2.10	1.00	3.20
Trombidiformes	*Torrenticolidae*	2	5.00	2.50	1.00	4.00
Tubificida	*Arcteonais lomondi*	2	19.20	9.60	3.20	16.00
Tubificida	*Chaetogaster diaphanus*	1	1.33	1.33	1.33	1.33
Tubificida	*Dero* sp.	1	8.00	8.00	8.00	8.00

Table 5-7. BMI Taxonomy, Blotted Wet-Weight Biomass, and Residual Ash-Free Dry Weight Results

Order	Genus / Measurement	Number of Locations Observed/ Measured	Corrected Abundance / Mass [a, b]	Mean Abundance / Mass [a, b]	Min Abundance / Mass [a, b]	Max Abundance / Mass [a, b]
Reference Samples (continued)						
250 µm Sample Fraction						
Tubificida	*Nais behningi*	1	4.92	4.92	4.92	4.92
Tubificida	*Nais* sp.	5	119.69	23.94	3.00	88.00
Tubificida	*Pristina* sp.	1	1.00	1.00	1.00	1.00
Tubificida	*Quistadrilus multisetosus*	1	1.00	1.00	1.00	1.00
Tubificida	*Slavina appendiculata*	1	16.00	16.00	16.00	16.00
Tubificida	*Specaria josinae*	1	2.00	2.00	2.00	2.00
Tubificida	*tubificoid Naididae* w/ cap setae	2	27.56	13.78	8.89	18.67
Tubificida	*tubificoid Naididae* w/o cap setae	8	98.02	12.25	1.71	35.20
Tubificida	*Uncinais uncinata*	6	31.24	5.21	1.78	12.80
Veneroida	*Pisidium* sp.	1	25.60	25.60	25.6	25.60
Veneroida	*Sphaeriidae*	3	12.31	4.10	1.33	6.98
Not specified	*Acari*	6	33.35	5.56	1.00	16.00
Not specified	*Nematoda*	17	4,293.91	252.58	2.00	1,232.29
Not specified	*Oribatei*	13	209.57	16.12	2.00	43.00
Not specified	*Ostracoda*	14	613.81	43.84	1.00	438.86
Not specified	*Tardigrada*	2	10.67	5.34	2.67	8.00
Not specified	*Turbellaria*	5	34.04	6.81	4.00	9.60
NA	corrected AFDW (g)	18	559.06	31.06	0.00	332.20
NA	corrected counted blotted wet-weight biomass (g)	18	0.116	0.006	0.001	0.014

Notes:

Corrected counted blotted wet-weight biomass is blotted wet mass of counted benthic macroinvertebrates, corrected for percent subsampled.

[a] Abundance counts, ash free dry weight (AFDW), and counted blotted wet-weight biomass were determined on the subsample counted, corrected values use the percent subsampled to adjust values to represent the total sample.

[b] AFDW and counted blotted wet-weight biomass are mass values measured in grams.

[c] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

Values reported in this table do not include data from benthic macroinvertebrate (BMI) duplicate samples. Primary and duplicate BMI samples came from separate successful sampler grabs, therefore, results cannot be combined.

Mass values reported for each species include all observed life stages.

NA - not applicable

Table 5-8. Results for the 42-Day *Hyalella azteca* Bioassays

	Survival (%)				Weight[a,b] (mg/individual)				Biomass[c] (mg/individual)				Number of Offspring / Female	
	Day 28		Day 42 [d]		Day 28		Day 42		Day 28		Day 42		Day 42 (ASTM Method)[e]	
Sample ID	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Batch 1 (Initiated 06/16/2020)														
Site Locations [f]														
1-B5-NRT-2019	88	8.3	90	5.3	0.691	0.092	1.025	0.160	0.585	0.099	0.919	0.131	11.6	4.7
3-R7-2019	84	27.8	56	34.2	0.474	0.165	0.787	0.176	0.474	0.165	0.425	0.269	6.5	4.8
CB002	88	16.4	81	21.0	0.660	0.052	0.995	0.081	0.626	0.044	0.803	0.206	12.3	4.5
CB020	94	5.1	91	9.9	0.595	0.035	0.946	0.113	0.551	0.055	0.855	0.060	10.1	3.7
CB021	94	6.7	93	8.9	0.780	0.062	0.893	0.137	0.740	0.065	0.821	0.108	12.3	3.7
DM007	78	14.8	70	18.5	0.290	0.121	0.670	0.098	0.257	0.125	0.474	0.151	3.1	1.4
DM008	43	15.0	31	18.1	0.026	0.016	0.203	0.066	0.013	0.008	0.064	0.047	0	0
DM019	93	9.7	86	14.1	0.456	0.118	0.882	0.043	0.446	0.128	0.760	0.124	8.3	3.4
DM025	68	7.2	64	9.2	0.335	0.098	0.766	0.154	0.235	0.069	0.490	0.135	5.4	2.7
DM046[g]	86	11.6	83	17.5	0.631	0.020	0.900	0.168	0.551	0.047	0.736	0.198	11.2	4.1
EV002	77	29.9	73	32.0	0.564	0.070	0.786	0.154	0.473	0.195	0.541	0.234	10.8	7.1
EV051[g]	99	2.9	96	5.2	0.744	0.078	0.967	0.076	0.744	0.078	0.931	0.092	11.5	3.4
EV054	97	6.5	95	7.6	0.705	0.026	0.953	0.074	0.687	0.032	0.904	0.090	16.6	2.6
EV071	85	8.0	86	7.4	0.606	0.059	0.895	0.094	0.498	0.057	0.768	0.071	5.5	3.5
Reference Locations														
REF003	93	7.5	93	7.1	0.750	0.077	0.878	0.089	0.671	0.047	0.811	0.094	10.3	4.9
REF004	91	13.8	85	14.1	0.601	0.119	0.905	0.201	0.601	0.119	0.758	0.186	15.5	5.5
REF006	96	6.7	94	9.2	0.686	0.040	0.803	0.101	0.668	0.050	0.753	0.122	14.0	8.2
REF007	90	11.3	84	11.9	0.630	0.159	0.863	0.134	0.611	0.135	0.724	0.158	12.7	4.1
REF008	97	6.5	100	0.0	0.746	0.100	0.868	0.185	0.666	0.053	0.868	0.185	12.5	4.0
REF013	95	6.7	94	7.4	0.756	0.042	1.075	0.125	0.738	0.076	1.004	0.118	17.7	4.2
REF017	81	27.5	74	32.0	0.442	0.103	0.715	0.144	0.398	0.093	0.529	0.261	9.3	4.6
Negative Laboratory Control														
CTL-SR-1	94	11.6	90	13.1	0.607	0.116	0.792	0.377	0.588	0.084	0.740	0.392	9.9	3.8
Quartz Sand Negative Control														
CTL-QS-1	88	12.2	63[i]	37.3	0.147[i]	0.095	0.265[h]	0.085	0.116	0.078	0.170	0.129	1.0[i]	0.9
Batch 2 (Initiated 6/17/2020)														
Site Locationsf														
1-B6-NRT-2019	84	13.1	81	14.6	0.606	0.123	0.906	0.128	0.508	0.095	0.731	0.139	4.4	2.8
3-R8-2019[g]	80	15.3	67	14.9	0.775	0.045	0.892	0.134	0.714	0.038	0.591	0.089	6.6	3.8
4-B6-2019	85	21.5	83	23.1	0.693	0.239	0.883	0.089	0.564	0.126	0.733	0.226	7.3	5.0
CB029	93	7.8	81	21.0	0.743	0.143	0.932	0.104	0.710	0.168	0.750	0.178	8.0	4.5
CB047	92	9.4	89	8.3	0.728	0.114	0.862	0.035	0.634	0.114	0.765	0.081	8.4	2.8
DM002	52	23.7	40	16.9	0.523	0.113	0.792	0.203	0.370	0.088	0.318	0.170	4.8	4.0
DM008	31	16.8	30	12.0	0.112	0.007	0.286	0.184	0.017	0.014	0.085	0.059	0.0	0.0
DM045	46	26.8	40	29.3	0.310	0.090	0.528	0.122	0.168	0.100	0.212	0.168	1.8	1.7
DM050	69	19.3	58	15.8	0.570	0.109	0.940	0.251	0.502	0.138	0.557	0.292	2.6	0.7
EV005[g]	92	5.8	73	27.1	0.688	0.053	0.945	0.114	0.669	0.047	0.692	0.270	11.4	4.0
EV008	92	9.4	85	16.9	0.732	0.092	0.961	0.084	0.698	0.133	0.810	0.150	9.1	5.3
EV064[g]	90	8.5	76	24.5	0.811	0.066	1.033	0.168	0.768	0.027	0.759	0.245	11.1	4.3
EV069	87	15.0	85	17.7	0.654	0.125	0.878	0.171	0.574	0.126	0.743	0.197	8.3	4.1
JS002	83	15.0	74	21.3	0.678	0.115	1.046	0.119	0.515	0.006	0.759	0.187	7.8	5.4
Reference Locations														
REF001	91	11.6	94	9.2	0.569	0.255	0.684	0.165	0.443	0.142	0.642	0.172	6.2	3.6
REF002	89	10.0	86	7.4	0.445	0.166	0.558	0.244	0.376	0.124	0.482	0.219	4.9	6.0
REF010	88	11.4	74	20.0	0.616	0.229	0.913	0.120	0.493	0.214	0.692	0.233	6.4	4.8
REF013	94	6.7	88	7.1	0.816	0.010	1.035	0.105	0.816	0.010	0.906	0.121	10.7	6.2

Table 5-8. Results for the 42-Day *Hyalella azteca* Bioassays

	Survival (%)				Weight[a,b] (mg/individual)				Biomass[c] (mg/individual)				Number of Offspring / Female	
	Day 28		Day 42 [d]		Day 28		Day 42		Day 28		Day 42		Day 42 (ASTM Method)[e]	
Sample ID	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Batch 2 (Initiated 6/17/2020) (continued)														
Reference Locations														
REF014	94	10.8	83	19.1	0.896	0.069	1.069	0.102	0.851	0.106	0.880	0.210	14.0	6.0
REF015	93	6.2	88	8.9	0.727	0.093	0.931	0.100	0.691	0.104	0.815	0.119	8.7	3.7
Negative Laboratory Control														
CTL-SR-2	94	6.7	88	8.9	0.688	0.048	0.801	0.143	0.671	0.067	0.702	0.154	6.9	3.7
Quartz Sand Negative Control														
CTL-QS-2	84	13.1	46[i]	29.2	0.102[i]	0.010	0.391[h]	0.169	0.097	0.009	0.187	0.159	0.1[i]	0.2
Batch 3 (Initiated 6/18/2020)														
Site Locations[f]														
4-B1-2019	94	6.7	91	6.4	0.606	0.112	0.925	0.072	0.595	0.132	0.842	0.067	8.4	3.1
CB006	73	20.1	69	24.7	0.449	0.111	0.836	0.146	0.344	0.067	0.553	0.181	4.3	4.2
CB010	88	11.1	91	6.4	0.646	0.030	0.926	0.094	0.534	0.114	0.845	0.104	6.7	4.0
CB014	66	29.7	55	30.2	0.436	0.216	0.646	0.122	0.250	0.139	0.369	0.237	3.0	2.9
CB044	88	9.4	88	10.4	0.733	0.022	1.087	0.098	0.659	0.049	0.946	0.087	11.1	2.4
DM008	29	28.4	19	21.7	0.033	0.024	0.242	0.061	0.008	0.007	0.044	0.051	0.0	0.0
DM018	84	9.0	83	15.8	0.223	0.103	0.606	0.243	0.185	0.088	0.527	0.227	4.0	1.7
DM024	85	11.7	83	7.1	0.314	0.073	0.448	0.138	0.262	0.088	0.369	0.118	0.8	1.0
DM026	68	15.4	70	10.7	0.248	0.163	0.817	0.171	0.113	0.025	0.584	0.190	3.7	2.4
DM027	91	9.0	90	9.3	0.636	0.057	0.939	0.146	0.570	0.066	0.838	0.113	8.8	3.9
EV027	88	10.6	84	13.0	0.501	0.070	1.041	0.100	0.461	0.049	0.865	0.111	9.1	4.6
EV044	91	10.0	85	9.3	0.697	0.068	0.932	0.217	0.679	0.074	0.787	0.186	6.6	2.7
EV063	92	7.2	88	10.4	0.701	0.036	1.069	0.090	0.647	0.049	0.933	0.118	9.5	2.1
JS001[g]	91	13.1	86	15.1	0.663	0.095	1.122	0.090	0.647	0.107	0.960	0.147	11.6	7.4
Reference Locations														
REF005	91	12.4	85	12.0	0.576	0.088	0.659	0.244	0.553	0.131	0.547	0.181	3.9	2.7
REF009A	88	12.7	89	12.5	0.580	0.203	0.759	0.270	0.472	0.135	0.670	0.263	3.3	3.5
REF011	87	9.8	85	12.0	0.580	0.085	0.865	0.311	0.494	0.107	0.759	0.332	8.1	5.2
REF012	88	10.6	84	10.6	0.765	0.110	0.992	0.121	0.698	0.191	0.828	0.132	11.7	6.2
REF013	91	9.0	85	16.0	0.831	0.045	1.132	0.116	0.750	0.099	0.970	0.235	10.4	5.8
REF016	92	10.3	91	11.3	0.687	0.090	1.126	0.163	0.632	0.073	1.018	0.139	12.5	6.0
Negative Laboratory Control														
CTL-SR-3	89	14.4	84	19.2	0.704	0.091	0.834	0.354	0.645	0.047	0.685	0.310	10.6	8.0
Quartz Sand Negative Control														
CTL-QS-3	79	15.1	69[i]	21.0	0.158[h]	0.066	0.298[h]	0.153	0.117	0.057	0.217	0.152	0.7	1.4

Notes:

[a] Weight is the total weight divided by the number of survivors.

[b] Replicate samples with 100% mortality were not included in the reported means.

[c] Biomass is the total weight divided by the initial number of organisms introduced into the test chamber.

[d] Due to the removal of replicates for measuring weight at Day 28, mean survival for Day 42 may be higher if mortalities occurred in the removed replicate samples.

[e] According to ASTM Method 1706, replicate samples with 100% mortality or ≤20% males or females were not included in the reported means (ASTM 2019).

[f] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

[g] One or more replicates for this sample had more than 10 test organisms recovered when survival was assessed on Day 28, indicating that an incorrect number of organisms had been added to those test chambers at test initiation. For these samples mean survival was calculated as the number of organisms retrieved from the sediment at the end of the test divided by the assumed initial start count. Mean weight was calculated by dividing the dry weight of surviving organisms by the number of surviving organisms. Biomass was calculated by dividing the dry weight of survivors by the assumed initial start count for the following samples:

Batch 1 - DM046 replicate C and EV051 replicate G

Batch 2 - 3-R8-2019 replicate C, 3-R8-2019 replicate G, EV005 replicate G, and EV064 replicate I

Batch 3 - JS001 replicate G.

[h] The quartz sand negative control did not meet EPA suggested performance-based guidelines for demonstration of adequacy of food and water (Mount 2011).

SD - standard deviation

Table 5-9. Repeat Sample Comparability Across Batches for the 42-Day *Hyalella azteca* Bioassays

Endpoint	Test Day	Location ID	Batch 1 Mean	Batch 1 SD	Batch 2 Mean	Batch 2 SD	Batch 3 Mean	Batch 3 SD	ANOVA p-value ≤ 0.05[a]
Survival (%)	Day 28	DM008	43.3	15.0	30.8	16.8	29.2	28.4	No
		REF013	95.0	6.7	94.2	6.7	90.8	9.0	No
		CTL-QS	87.5	12.2	84.2	13.1	79.2	15.1	No
		CTL-SR	94.2	11.6	94.2	6.7	89.2	14.4	No
	Day 42	DM008	31.3	18.1	30.0	12.0	18.6	21.7	No
		REF013	93.8	7.4	87.5	7.1	85.0	16.0	No
		CTL-QS	62.5	37.3	46.3	29.2	68.8	21.0	No
		CTL-SR	90.0	13.1	87.5	8.9	83.4	19.2	No
Weight [c,d] (mg/individual)	Day 28	DM008	0.026	0.016	0.112	0.007	0.033	0.024	Yes ($p = 0.001$)[b]
		REF013	0.756	0.042	0.816	0.010	0.831	0.045	Yes ($p = 0.036$)[b]
		CTL-QS	0.147	0.095	0.102	0.010	0.158	0.066	No
		CTL-SR	0.607	0.116	0.688	0.048	0.704	0.091	No
	Day 42	DM008	0.203	0.066	0.286	0.184	0.242	0.061	No
		REF013	1.075	0.125	1.035	0.105	1.132	0.116	No
		CTL-QS	0.265	0.085	0.391	0.169	0.298	0.153	No
		CTL-SR	0.792	0.377	0.801	0.143	0.834	0.354	No
Biomass [d,e] (mg/individual)	Day 28	DM008	0.013	0.008	0.022	0.010	0.011	0.006	No
		REF013	0.738	0.076	0.816	0.010	0.750	0.099	No
		CTL-QS	0.116	0.078	0.097	0.001	0.117	0.057	No
		CTL-SR	0.588	0.084	0.671	0.067	0.645	0.047	No
	Day 42	DM008	0.064	0.047	0.085	0.059	0.070	0.047	No
		REF013	1.004	0.118	0.906	0.121	0.970	0.235	No
		CTL-QS	0.194	0.118	0.187	0.159	0.217	0.152	No
		CTL-SR	0.740	0.392	0.702	0.154	0.685	0.310	No
Number of offspring/female (ASTM Method) [g]	Day 42	DM008	0	NA	0	0	0	0	NA
		REF013	17.699	4.155	10.676	6.222	10.394	5.753	Yes ($p = 0.023$)[f]
		CTL-QS	1.045	0.947	0.083	0.167	0.708	1.417	No
		CTL-SR	9.879	3.809	6.902	3.699	10.552	7.972	No

Notes:

[a] Results between batches compared using an one-way analysis of variance (ANOVA) with alpha = 0.05.

[b] The low variability, assessed by standard deviation (SD), within each batch drove the significant ANOVA result, however, the magnitude of the difference in means between batches remains low.

[c] Weight is the total weight divided by the number of survivors.

[d] Replicate samples with 100% mortality were not included in the reported means.

[e] Biomass is the total weight divided by the initial number of organisms introduced into the test chamber.

[g] According to ASTM Method 1706, replicate samples with 100% mortality or ≤ 20% males or females were not included in the reported means (ASTM 2020).

[f] Variable results between batches for the Day 42 reproduction endpoint were not unexpected due to both the length of the bioassay and inability of the assay to control the starting ratios of males to females per test chamber.

NA = not applicable

Table 5-10. Slag Content of Sediment Samples Estimated Using BSEM

	Slag Determined by BSEM (%)				Ratio of Slag 1 to Total Slag	Modeled Percent Slag		Agreement Between Modeled and BSEM Estimated Slag	
Sample ID	Slag 1	Slag 2	Altered Slag	Total Slag [a]		Zinc (mg/kg)	Slag (%)	RPD	Residual [b] (%)
CB002	16.1	0.13	0.25	16.18	0.995	4,220	12	29.7	4.2
CB007	1.30	0.00	0.05	1.30	1.00	1,110	1	26.1	0.3
CB014	38.1	0.19	0.20	38.3	0.996	12,400	41	6.9	-2.7
CB018	41.0	0.18	0.26	41.18	0.996	10,100	33	22.1	8.2
DM046	1.15	0.03	0.14	1.17	0.98	1,710	3	87.8	-1.8
EV001	45.3	2.15	0.46	47.45	0.95	19,800	62	26.6	-14.6

Notes:

[a] Total slag is the sum of Slag 1 and Slag 2.

[b] Residual = observed value (backscatter electron miscroscopy [BSEM]) - predicted value (segmented linear regression model).

RPD - relative percent difference

Table 5-11. Particle Sizes in Samples Evaluated for Slag Content

Sample ID	Total Dry Sample	Sample and Split Weights by Sieve Size (g)[a]			
		> 4 mm	Weight of Split	4 to 2 mm	< 2 mm
CB002	233.45	0.00	8.62	0.00	8.62
CB007	195.25	5.47	12.52	2.73	9.72
CB014	260.59	0.00	6.62	0.00	6.62
CB018	263.76	1.17	10.45	0.00	10.44
DM046	237.85	0.00	10.84	0.00	10.80
EV001	266.57	0.82	10.89	0.13	10.76

Notes:

[a] The weights for the > 4 mm sample is presented for the entire sample, whereas the 4 to 2 mm and < 2 mm weights are for the sample splits.

Table 5-12. Percent Distribution by Size Class for Particles Identified as Slag 1

				Size Class (µm) for Slag 1 Particles																	Percent in Strata	
Sample ID	River Mile	X-coordinate	Y-coordinate	< 22	22 to 31	31 to 44	44 to 62	62 to 88	88 to 125	125 to 177	177 to 250	250 to 350	350 to 500	500 to 710	710 to 1,000	1,000 to 1,410	1,410 to 2,000	2,000 to 2,830	2,830 to 4,000	> 4,000	Total % Slag 1[a]	Mud < 62 µm	Sand 62 to 2,000 µm
CB002	722	429474	5407449	0.00	0.10	0.20	0.90	1.40	1.70	7.70	23.70	35.10	23.80	5.30	0.00	0.00	0.00	0.00	0.00	0.00	16.05	1.20	98.70
CB007	723	429565	5407464	0.00	0.40	0.00	1.20	1.30	6.20	19.40	40.00	19.30	12.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	1.60	98.20
CB014	723	429613	5407339	0.00	0.10	0.30	0.30	1.10	1.20	3.20	10.50	28.70	35.60	17.20	1.90	0.00	0.00	0.00	0.00	0.00	38.08	0.70	99.40
CB018	723	429707	5407381	0.00	0.10	0.30	0.70	1.30	1.50	5.50	16.60	28.30	32.40	11.60	1.70	0.00	0.00	0.00	0.00	0.00	41.00	1.10	98.90
DM046	738	446852	5420282	0.20	0.60	0.30	2.20	5.10	6.20	21.50	25.90	17.20	17.50	3.30	0.00	0.00	0.00	0.00	0.00	0.00	1.15	3.30	96.70
EV001	709	422460	5391534	0.00	0.10	0.10	0.20	0.40	0.60	0.80	2.80	8.40	26.30	37.50	19.20	3.60	0.00	0.00	0.00	0.00	45.30	0.40	99.60

Notes:

These data are based on apparent particle sizes that were estimated by computerized methods that detect particle periphery in the plane of the polished section during electron microscopy analysis. There are uncertainties associated with these estimates because the actual particle size can only be measured where the analyzed polished section of the sample bisects a particle's exact maximum circumference, which is unknown to the investigator.

[a] Content of Slag 1 relative to total sample material.

Table 5-13. Summary of Field Duplicate RPDs for Field Sediment

Analyte	Number of Paired Samples	MQO	Number of RPDs > MQO	Number of RPDs > MQO if 5x RL	Max RPD
Site Samples[a]					
Conventional Parameters					
Solids (%)	10	NA	NA	NA	10.3
Sulfide (AVS) (µmol/g)	10	45	8	6	162
TOC (%)	10	20	2	0	58.3
Grain Size - Normalized (%)					
Medium gravel	10	NA	NA	NA	200
Fine gravel	10	NA	NA	NA	200
Very coarse sand	10	NA	NA	NA	162
Coarse sand	10	NA	NA	NA	73.0
Medium sand	10	NA	NA	NA	28.0
Fine sand	10	NA	NA	NA	169
Very fine sand	10	NA	NA	NA	125
Silt	10	NA	NA	NA	153
Clay	10	NA	NA	NA	100
Metals (mg/kg)					
Aluminum	10	20	2	2	27.6
Antimony	10	20	2	2	80.7
Arsenic	10	20	3	3	71.2
Barium	10	20	1	1	27.1
Beryllium	10	20	1	1	20.2
Cadmium	10	20	2	2	48.9
Calcium	10	20	0	0	15.6
Chromium	10	20	2	2	23.6
Cobalt	10	20	0	0	13.2
Copper	10	20	0	0	19.0
Iron	10	20	1	1	36.1
Lead	10	20	3	3	52.2
Magnesium	10	20	1	1	20.2
Manganese	10	20	2	2	29.6
Mercury	10	20	4	0	125
Nickel	10	20	0	0	15.3
Potassium	10	20	1	1	26.6
Selenium	10	20	2	0	66.7
Silver	10	20	4	4	91.3
Sodium	10	20	0	0	17.6
Thallium	10	20	4	0	55.9
Vanadium	10	20	0	0	16.7
Zinc	10	20	2	2	35.4
SEM (µmol/g)					
Antimony	10	30	4	1	93.6
Arsenic	10	30	2	0	115
Cadmium	10	30	4	0	75.9
Chromium	10	30	4	2	78.1
Copper	10	30	4	4	108
Lead	10	30	5	4	72.8
Nickel	10	30	3	0	80.0
Zinc	10	30	4	4	104
Reference Samples					
Conventional Parameters					
Solids (%)	2	NA	NA	NA	5.87
Sulfide (AVS) (µmol/g)	2	45	1	0	122
TOC (%)	2	20	0	0	7.75
Grain Size - Normalized (%)					
Medium gravel	2	NA	NA	NA	200
Fine gravel	2	NA	NA	NA	7.63
Very coarse sand	2	NA	NA	NA	43.5
Coarse sand	2	NA	NA	NA	21.2
Medium sand	2	NA	NA	NA	20.7
Fine sand	2	NA	NA	NA	42.2
Very fine sand	2	NA	NA	NA	43.1
Silt	2	NA	NA	NA	44.7
Clay	2	NA	NA	NA	33.3
Aluminum	2	20	1	1	27.0
Antimony	2	20	0	0	6.64

Table 5-13. Summary of Field Duplicate RPDs for Field Sediment

Analyte	Number of Paired Samples	MQO	Number of RPDs > MQO	Number of RPDs > MQO if 5x RL	Max RPD
Reference Samples (continued)					
Metals					
Arsenic	2	20	0	0	4.88
Barium	2	20	1	1	30.1
Beryllium	2	20	0	0	3.80
Cadmium	2	20	0	0	15.1
Calcium	2	20	0	0	3.38
Chromium	2	20	0	0	1.40
Cobalt	2	20	0	0	5.98
Copper	2	20	0	0	4.38
Iron	2	20	0	0	4.55
Lead	2	20	0	0	7.29
Magnesium	2	20	0	0	4.88
Manganese	2	20	0	0	5.91
Mercury	2	20	0	0	NA
Nickel	2	20	0	0	5.39
Potassium	2	20	0	0	18.2
Selenium	2	20	0	0	NA
Silver	2	20	2	0	41.5
Sodium	2	20	0	0	12.6
Thallium	2	20	1	0	25.7
Vanadium	2	20	0	0	2.69
Zinc	2	20	0	0	13.5
SEM (μmol/g)					
Antimony	2	30	0	0	NA
Arsenic	2	30	1	0	33.3
Cadmium	2	30	1	0	33.5
Chromium	2	30	1	0	41.4
Copper	2	30	1	1	49.6
Lead	2	30	0	0	28.5
Nickel	2	30	0	0	28.1
Zinc	2	30	0	0	NA
Organics - PAHs (μg/kg)					
2-Methylnaphthalene	2	40	0	0	17.1
Acenaphthene	2	40	0	0	NA
Acenaphthylene	2	40	1	0	62.9
Anthracene	2	40	0	0	28.2
Benzo[a]anthracene	2	40	0	0	NA
Benzo[a]pyrene	2	40	1	0	87.2
Benzo[b]fluoranthene	2	40	1	0	96.3
Benzo[g,h,i]perylene	2	40	1	0	107
Benzo[k]fluoranthene	2	40	0	0	NA
Chrysene (μg/kg)	2	40	1	0	91.9
Dibenzo[a,h]anthracene	2	40	0	0	NA
Fluoranthene	2	40	1	0	41.0
Fluorene	2	40	0	0	NA
Indeno[1,2,3-cd]pyrene	2	40	1	0	123
Naphthalene	2	40	0	0	16.2
Phenanthrene	2	40	0	0	17.3
Pyrene	2	40	1	0	51.3
Organics - PCBs (μg/kg)					
2-Chlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,4'-Hexachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,4',5-Heptachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,4',5,5'-Octachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,4',5,6-Octachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,5',6'-Heptachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,5,6'-Heptachlorobiphenyl	2	40	0	0	NA
2,2',3,3',4,6'-Hexachlorobiphenyl	2	40	0	0	NA
2,2',3,4',5'-Pentachlorobiphenyl	2	40	0	0	NA
2,2',3,4',5',6-Hexachlorobiphenyl	2	40	0	0	NA
2,2',3,4',5-Pentachlorobiphenyl	2	40	0	0	NA
2,2',3,4',5,5',6-Heptachlorobiphenyl	2	40	0	0	NA

Table 5-13. Summary of Field Duplicate RPDs for Field Sediment

Analyte	Number of Paired Samples	MQO	Number of RPDs > MQO	Number of RPDs > MQO if 5x RL	Max RPD
Reference Samples (continued)					
Organics - PCBs (µg/kg) (continued)					
2,2',3,4,4',5'-Hexachlorobiphenyl	2	40	0	0	NA
2,2',3,4,4',5',6-Heptachlorobiphenyl	2	40	0	0	NA
2,2',3,4,4',5,5'-Heptachlorobiphenyl	2	40	0	0	NA
2,2',3,4,4',5,5',6-Octachlorobiphenyl	2	40	0	0	NA
2,2',3,4,4',6,6'-Heptachlorobiphenyl	2	40	0	0	NA
2,2',3,4,5'-Pentachlorobiphenyl	2	40	0	0	NA
2,2',3,4,5,5'-Hexachlorobiphenyl	2	40	0	0	NA
2,2',3,5'-Tetrachlorobiphenyl	2	40	0	0	NA
2,2',3,5',6-Pentachlorobiphenyl	2	40	0	0	NA
2,2',3,5,5',6-Hexachlorobiphenyl	2	40	0	0	NA
2,2',4,4',5-Pentachlorobiphenyl	2	40	0	0	NA
2,2',4,4',5,5'-Hexachlorobiphenyl	2	40	0	0	NA
2,2',4,5'-Tetrachlorobiphenyl	2	40	0	0	NA
2,2',4,5,5'-Pentachlorobiphenyl	2	40	0	0	NA
2,2',5-Trichlorobiphenyl	2	40	0	0	NA
2,2',5,5'-Tetrachlorobiphenyl	2	40	0	0	NA
2,3',4'-Trichlorobiphenyl	2	40	0	0	NA
2,3',4',5-Tetrachlorobiphenyl	2	40	0	0	NA
2,3',4,4'-Tetrachlorobiphenyl	2	40	0	0	NA
2,3',4,4',5'-Pentachlorobiphenyl	2	40	0	0	NA
2,3',4,4',5',6-Hexachlorobiphenyl	2	40	0	0	NA
2,3',4,4',5-Pentachlorobiphenyl	2	40	0	0	NA
2,3',4,4',5,5'-Hexachlorobiphenyl	2	40	0	0	NA
2,3',4,4',6-Pentachlorobiphenyl	2	40	0	0	NA
2,3-Dichlorobiphenyl	2	40	0	0	NA
2,3,3',4'-Tetrachlorobiphenyl	2	40	0	0	NA
2,3,3',4',6-Pentachlorobiphenyl	2	40	0	0	NA
2,3,3',4,4'-Pentachlorobiphenyl	2	40	0	0	NA
2,3,3',4,4',5'-Hexachlorobiphenyl	2	40	0	0	NA
2,3,3',4,4',5-Hexachlorobiphenyl	2	40	0	0	NA
2,3,3',4,4',5,5'-Heptachlorobiphenyl	2	40	0	0	NA
2,3,3',4,4',6-Hexachlorobiphenyl	2	40	0	0	NA
2,3,4,4'-Tetrachlorobiphenyl	2	40	0	0	NA
2,3,4,4',5-Pentachlorobiphenyl	2	40	0	0	NA
2,3,4,4',5,6-Hexachlorobiphenyl	2	40	0	0	NA
2,4'-Dichlorobiphenyl	2	40	0	0	NA
2,4',5-Trichlorobiphenyl	2	40	0	0	NA
2,4,4'-Trichlorobiphenyl	2	40	0	0	NA
2,4,4',5-Tetrachlorobiphenyl	2	40	0	0	NA
3,3',4,4'-Tetrachlorobiphenyl	2	40	0	0	NA
3,3',4,4',5-Pentachlorobiphenyl	2	40	0	0	NA
3,3',4,4',5,5'-Hexachlorobiphenyl	2	40	0	0	NA
3,4,4'-Trichlorobiphenyl	2	40	0	0	NA
3,4,4',5-Tetrachlorobiphenyl	2	40	0	0	NA
Aroclor 1016	2	40	0	0	NA
Aroclor 1221	2	40	0	0	NA
Aroclor 1232	2	40	0	0	NA
Aroclor 1242	2	40	0	0	NA
Aroclor 1248	2	40	0	0	NA
Aroclor 1254	2	40	0	0	NA
Aroclor 1260	2	40	0	0	NA
Decachlorobiphenyl (PCB 209)	2	40	0	0	NA
Organics - Pesticides (µg/kg)					
2,4'-DDD	2	40	0	0	NA
2,4'-DDE	2	40	0	0	NA
2,4'-DDT	2	40	0	0	NA
4,4'-DDD	2	40	0	0	NA
4,4'-DDE	2	40	0	0	NA
4,4'-DDT	2	40	0	0	NA
Aldrin	2	40	0	0	NA
alpha-Benzenehexachloride	2	40	0	0	NA
alpha-Chlordane	2	40	0	0	NA
beta-BHC	2	40	0	0	NA

Table 5-13. Summary of Field Duplicate RPDs for Field Sediment

Analyte	Number of Paired Samples	MQO	Number of RPDs > MQO	Number of RPDs > MQO if 5x RL	Max RPD
Reference Samples (continued)					
Organics - Pesticides (µg/kg)					
cis-Nonachlor	2	40	0	0	NA
delta-BHC	2	40	0	0	NA
Dieldrin	2	40	0	0	NA
Endosulfan I	2	40	0	0	NA
Endosulfan II	2	40	0	0	NA
Endosulfan sulfate	2	40	0	0	NA
Endrin	2	40	0	0	NA
Endrin aldehyde	2	40	0	0	NA
Endrin ketone	2	40	0	0	NA
gamma-BHC	2	40	0	0	NA
Heptachlor	2	40	0	0	NA
Heptachlor epoxide	2	40	0	0	NA
Methoxychlor	2	40	0	0	NA
Oxychlordane	2	40	0	0	NA
Toxaphene	2	40	0	0	NA
trans-chlordane	2	40	0	0	NA
trans-Nonachlor	2	40	0	0	NA
Hexachlorobenzene	2	40	0	0	NA
Hexachlorobutadiene	2	40	0	0	NA

Notes:

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.
AVS - acid volatile sulfide
BHC - benzee hexachloride
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichorodiphenyltrichloroethane
MQO - measurement quality objective, if available
NA - not applicable
PAH - polycyclic aromatic hydrocarbon
PCBs - polychlorinated biphenyls
RL - reporting limit
RPD - relative percent difference, only calculated when both field duplicate and parent are detected
SEM - simultaneously extracted metals
TOC - total organic carbon

5-14. Summary of Field Duplicate RPDs for Field Porewater

Analyte (Unit)	Number of Paired Samples	MQO	Number of RPDs > MQO	Number of RPDs > MQO if 5x RL	Maximum RPD
Site Samples[a]					
Conventional Parameters (mg/L)					
Alkalinity	6	20	0	0	1.87
Chloride	6	20	0	0	17.3
DOC	5	17	2	0	19.1
Hardness	6	NA	NA	NA	2.06
Sulfate	6	20	0	0	4.13
TOC	5	17	2	0	40.9
Metals (µg/L)					
Aluminum	6	20	1	1	69.3
Antimony	6	20	0	0	17.9
Arsenic	6	20	0	0	5.83
Barium	6	20	0	0	10.1
Beryllium	6	20	0	0	NA
Cadmium	6	20	1	1	60.5
Calcium	6	20	0	0	1.45
Chromium	6	20	0	0	NA
Cobalt	6	20	5	3	89.7
Copper	6	20	2	2	127
Iron	6	20	2	1	64.4
Lead	6	20	2	2	85.6
Magnesium	6	20	0	0	10.5
Manganese	6	20	1	1	57.4
Nickel	6	20	1	0	24.9
Potassium	6	20	0	0	7.44
Selenium	6	20	1	0	22.2
Silver	6	20	1	0	101
Sodium	6	20	0	0	5.3
Thallium	6	20	1	0	54.5
Vanadium	6	20	1	0	31.2
Zinc	6	20	1	1	55.1
Reference Samples					
Conventional Parameters (mg/L)					
Alkalinity	1	20	0	0	0
Chloride	1	20	0	0	0.976
DOC	1	17	0	0	1.68
Hardness	2	NA	NA	NA	0.984
Sulfate	1	20	0	0	0
TOC	1	17	0	0	0
Metals (µg/L)					
Aluminum	2	20	0	0	NA
Antimony	2	20	1	1	32.2
Arsenic	2	20	0	0	6.81
Barium	2	20	0	0	0.77
Beryllium	2	20	0	0	NA
Cadmium	2	20	2	0	31.6
Calcium	2	20	0	0	1.03
Chromium	2	20	0	0	NA
Cobalt	2	20	2	2	30.9
Copper	2	20	0	0	NA
Iron	2	20	0	0	6.72
Lead	2	20	0	0	NA
Magnesium	2	20	0	0	1.3
Manganese	2	20	0	0	2.55
Nickel	2	20	0	0	13.7
Potassium	2	20	0	0	2.06
Selenium	2	20	0	0	NA
Silver	2	20	0	0	NA
Sodium	2	20	0	0	0.816
Thallium	2	20	0	0	NA
Vanadium	2	20	0	0	1.75
Zinc	2	20	0	0	5.88

Notes:

[a] Site samples include samples from the three Phase 3 sediment study areas of interest: Deadman's Eddy, China Bend, and Evans.
DOC - dissolved organic carbon
MQO - measurement quality objective, if available
NA - not applicable
RL - reporting limit
RPD - relative percent difference, only calculated when both field duplicate and parent are detected
TOC - total organic carbon

Table 5-15. Summary of Field Duplicate RPDs for BMI Total Richness

Richness Measure (size fraction)	Number of Paired Samples	MQO	Maximum RPD
Site Samples[a]			
Total richness (250 µm)	7	not established	51
Total richness (500 µm)	7	not established	67
Reference Samples			
Total richness (250 µm)	2	not established	31
Total richness (500 µm)	2	not established	26

Notes:

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

BMI - benthic macroinvertebrate

MQO - measurement quality objective, if available

RPD - relative percent difference, only calculated when both field duplicate and parent are detected

Table 5-16. Summary of Field Duplicate RPDs for BMI Wet Weights and Residues

Analyte (units)	Number of Paired Samples	MQO	Maximum RPD
Site Samples[a]			
250 µm Fraction			
Corrected AFDW (g)	7	not established	120
Corrected counted blotted wet-weight biomass (g)	7	not established	99
500 µm Fraction			
Corrected AFDW (g)	6	not established	199
Corrected counted blotted wet-weight biomass (g)	7	not established	74
Reference Samples			
250 µm Fraction			
Corrected AFDW (g)	2	not established	191
Corrected counted blotted wet-weight biomass (g)	2	not established	112
500 µm Fraction			
Corrected AFDW (g)	2	not established	129
Corrected counted blotted wet-weight biomass (g)	2	not established	115

Notes:

Corrected counted blotted wet-weight biomass is blotted wet mass of counted benthic macroinvertebrates (BMI), corrected for percent subsampled.

Ash-free dry weight (AFDW), and counted blotted wet-weight biomass were determined on the subsample counted, to represent the total sample.

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

MQO - measurement quality objective, if available
NA - not applicable
RPD - relative percent difference, only calculated when both field duplicate and parent are detected

Table 5-17. Comparisons of Actual DLs with ACGs and QAPP MRLs for Nondetected Analytes For Field Sediment Samples

Analyte	ACG	QAPP MRL	QAPP MDL	Minimum Actual DL	Maximum Actual DL	Number of ACG Exceedances / Total Nondetected Results	Number of Nondetected Results above QAPP MRL
Site Samples [a]							
Metals (mg/kg)							
Mercury	0.18	0.02	0.002	0.002	0.015	0 / 11	0 / 11
Selenium	2	1	0.09	0.2	0.2	0 / 3	0 / 3
Thallium	NA	0.02	NA	0.038	0.078	NA	9 / 9
Reference Samples							
Metals (mg/kg)							
Antimony	2	0.05	0.02	0.027	0.05	0 / 13	0 / 13
Mercury	0.18	0.02	0.002	0.002	0.03	0 / 17	1 / 17
Selenium	2	1	0.09	0.1	0.5	0 / 14	0 / 14
Thallium	NA	0.02	NA	0.032	0.09	NA	6 / 6
Organics - PAHs (µg/kg)							
2-Methylnaphthalene	469	5	0.39	0.37	0.73	0 / 13	0 / 13
Acenaphthene	1060	5	0.76	0.3	0.59	0 / 16	0 / 16
Acenaphthylene	470	5	0.59	0.28	0.55	0 / 16	0 / 16
Anthracene	57.2	5	0.58	0.29	0.57	0 / 11	0 / 11
Benzo[a]anthracene	108	5	0.72	0.27	1.6	0 / 17	0 / 17
Benzo[a]pyrene	150	5	0.76	0.38	0.75	0 / 14	0 / 14
Benzo[b]fluoranthene	11000	5	0.92	0.38	0.75	0 / 12	0 / 12
Benzo[g,h,i]perylene	4020	5	0.85	0.4	0.79	0 / 11	0 / 11
Benzo[k]fluoranthene	11000	5	0.87	0.24	0.47	0 / 15	0 / 15
Chrysene	166	5	0.8	0.31	0.53	0 / 10	0 / 10
Dibenzo[a,h]anthracene	33	5	0.8	0.23	0.45	0 / 16	0 / 16
Fluoranthene	423	5	0.98	0.63	1.1	0 / 11	0 / 11
Fluorene	77.4	5	0.61	0.57	1.2	0 / 15	0 / 15
Indeno[1,2,3-cd]pyrene	4120	5	0.87	0.36	0.71	0 / 13	0 / 13
Naphthalene	176	5	0.6	0.47	2	0 / 10	0 / 10
Phenanthrene	204	5	1.4	0.59	0.75	0 / 6	0 / 6
Pyrene	195	5	0.76	0.32	0.41	0 / 8	0 / 8
Organics - PCBs (µg/kg)							
2-Chlorobiphenyl	NA	5	NA	2.1	5.3	NA	1 / 19
Decachlorobiphenyl	NA	0.5	NA	0.22	0.49	NA	0 / 20
2,2',3,3',4,4'-Hexachlorobiphenyl	NA	0.5	NA	0.09	0.2	NA	0 / 20
2,2',3,3',4,4',5-Heptachlorobiphenyl	NA	0.5	NA	0.14	0.32	NA	0 / 20
2,2',3,3',4,4',5,5'-Octachlorobiphenyl	NA	0.5	NA	0.18	0.4	NA	0 / 20
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	NA	0.5	NA	0.14	0.32	NA	0 / 20
2,2',3,3',4,4',5,6-Octachlorobiphenyl	NA	0.5	NA	0.11	0.25	NA	0 / 20
2,2',3,3',4,5',6'-Heptachlorobiphenyl	NA	0.5	NA	0.16	0.36	NA	0 / 20
2,2',3,3',4,5',6,6'-Octachlorobiphenyl	NA	0.5	NA	0.16	0.36	NA	0 / 20
2,2',3,3',4,5,6'-Heptachlorobiphenyl	NA	0.5	NA	0.11	0.25	NA	0 / 20
2,2',3,3',4,6'-Hexachlorobiphenyl	NA	0.5	NA	0.12	0.27	NA	0 / 20
2,2',3,4',5'-Pentachlorobiphenyl	NA	0.5	NA	0.093	0.47	NA	0 / 20
2,2',3,4',5',6-Hexachlorobiphenyl	NA	0.5	NA	0.14	0.32	NA	0 / 20
2,2',3,4',5-Pentachlorobiphenyl	NA	0.5	NA	0.18	0.4	NA	0 / 20
2,2',3,4',5,5',6-Heptachlorobiphenyl	NA	0.5	NA	0.16	0.36	NA	0 / 20
2,2',3,4,4',5'-Hexachlorobiphenyl	NA	0.5	NA	0.18	0.4	NA	0 / 20
2,2',3,4,4',5',6-Heptachlorobiphenyl	NA	0.5	NA	0.14	0.79	NA	1 / 20
2,2',3,4,4',5,5'-Heptachlorobiphenyl	NA	0.5	NA	0.11	0.25	NA	0 / 20
2,2',3,4,4',5,5',6-Octachlorobiphenyl	NA	0.5	NA	0.13	0.29	NA	0 / 20

Table 5-17. Comparisons of Actual DLs with ACGs and QAPP MRLs for Nondetected Analytes For Field Sediment Samples

Analyte	ACG	QAPP MRL	QAPP MDL	Minimum Actual DL	Maximum Actual DL	Number of ACG Exceedances / Total Nondetected Results	Number of Nondetected Results above QAPP MRL
Reference Samples (continued)							
Organics - PCBs (µg/kg) (continued)							
2,2',3,4,4',6,6'-Heptachlorobiphenyl	NA	0.5	NA	0.15	0.71	NA	1 / 20
2,2',3,4,5'-Pentachlorobiphenyl	NA	0.5	NA	0.11	0.49	NA	0 / 20
2,2',3,4,5,5'-Hexachlorobiphenyl	NA	0.5	NA	0.096	0.22	NA	0 / 20
2,2',3,5'-Tetrachlorobiphenyl	NA	0.5	NA	0.17	0.38	NA	0 / 20
2,2',3,5',6-Pentachlorobiphenyl	NA	0.5	NA	0.15	0.34	NA	0 / 20
2,2',3,5,5',6-Hexachlorobiphenyl	NA	0.5	NA	0.12	0.37	NA	0 / 20
2,2',4,4',5-Pentachlorobiphenyl	NA	0.5	NA	0.28	0.63	NA	2 / 20
2,2',4,4',5,5'-Hexachlorobiphenyl	NA	0.5	NA	0.13	0.29	NA	0 / 19
2,2',4,5'-Tetrachlorobiphenyl	NA	0.5	NA	0.13	0.29	NA	0 / 20
2,2',4,5,5'-Pentachlorobiphenyl	NA	0.5	NA	0.26	0.58	NA	2 / 20
2,2',5-Trichlorobiphenyl	NA	0.5	NA	0.22	0.49	NA	0 / 20
2,2',5,5'-Tetrachlorobiphenyl	NA	0.5	NA	0.2	0.4	NA	0 / 18
2,3',4'-Trichlorobiphenyl	NA	0.5	NA	0.26	0.58	NA	2 / 20
2,3',4',5-Tetrachlorobiphenyl	NA	0.5	NA	0.14	0.32	NA	0 / 19
2,3',4,4'-Tetrachlorobiphenyl	NA	0.5	NA	0.19	0.43	NA	0 / 20
2,3',4,4',5'-Pentachlorobiphenyl	NA	0.5	NA	0.12	0.27	NA	0 / 20
2,3',4,4',5',6-Hexachlorobiphenyl	NA	0.5	NA	0.14	0.32	NA	0 / 20
2,3',4,4',5-Pentachlorobiphenyl	NA	0.5	NA	0.095	0.22	NA	0 / 20
2,3',4,4',5,5'-Hexachlorobiphenyl	NA	0.5	NA	0.16	0.36	NA	0 / 20
2,3',4,4',6-Pentachlorobiphenyl	NA	0.5	NA	0.16	0.36	NA	0 / 20
2,3-Dichlorobiphenyl	NA	0.5	NA	0.092	0.31	NA	0 / 18
2,3,3',4'-Tetrachlorobiphenyl	NA	0.5	NA	0.12	0.27	NA	0 / 20
2,3,3',4',6-Pentachlorobiphenyl	NA	0.5	NA	0.16	0.36	NA	0 / 20
2,3,3',4,4'-Pentachlorobiphenyl	NA	0.5	NA	0.12	0.27	NA	0 / 20
2,3,3',4,4',5'-Hexachlorobiphenyl	NA	0.5	NA	0.13	0.29	NA	0 / 20
2,3,3',4,4',5-Hexachlorobiphenyl	NA	0.5	NA	0.12	0.27	NA	0 / 20
2,3,3',4,4',5,5'-Heptachlorobiphenyl	NA	0.5	NA	0.095	0.22	NA	0 / 20
2,3,3',4,4',6-Hexachlorobiphenyl	NA	0.5	NA	0.073	0.17	NA	0 / 20
2,3,4,4'-Tetrachlorobiphenyl	NA	0.5	NA	0.13	0.29	NA	0 / 20
2,3,4,4',5-Pentachlorobiphenyl	NA	0.5	NA	0.12	0.4	NA	0 / 20
2,3,4,4',5,6-Hexachlorobiphenyl	NA	0.5	NA	0.14	1.1	NA	1 / 20
2,4'-Dichlorobiphenyl	NA	0.5	NA	0.29	0.65	NA	2 / 20
2,4',5-Trichlorobiphenyl	NA	0.5	NA	0.098	0.43	NA	0 / 20
2,4,4'-Trichlorobiphenyl	NA	0.5	NA	0.22	0.49	NA	0 / 20
2,4,4',5-Tetrachlorobiphenyl	NA	0.5	NA	0.18	0.4	NA	0 / 20
3,3',4,4'-Tetrachlorobiphenyl	NA	0.5	NA	0.2	0.64	NA	1 / 20
3,3',4,4',5-Pentachlorobiphenyl	NA	0.5	NA	0.17	0.38	NA	0 / 20
3,3',4,4',5,5'-Hexachlorobiphenyl	NA	0.5	NA	0.2	0.45	NA	0 / 20
3,4,4'-Trichlorobiphenyl	NA	0.5	NA	0.17	0.38	NA	0 / 20
3,4,4',5-Tetrachlorobiphenyl	NA	0.5	NA	0.18	0.4	NA	0 / 20
Aroclor 1016	NA	10	NA	2.9	6.3	NA	0 / 20
Aroclor 1221	NA	20	NA	2.9	6.3	NA	0 / 20
Aroclor 1232	NA	10	NA	2.9	6.3	NA	0 / 20
Aroclor 1242	NA	10	NA	2.9	6.3	NA	0 / 20
Aroclor 1248	NA	10	NA	2.9	6.3	NA	0 / 20
Aroclor 1254	230	10	2.1	2.9	6.3	0 / 20	0 / 20
Aroclor 1260	138	10	2.1	2.9	6.3	0 / 20	0 / 20

Table 5-17. Comparisons of Actual DLs with ACGs and QAPP MRLs for Nondetected Analytes For Field Sediment Samples

Analyte	ACG	QAPP MRL	QAPP MDL	Minimum Actual DL	Maximum Actual DL	Number of ACG Exceedances / Total Nondetected Results	Number of Nondetected Results above QAPP MRL
Reference Samples (continued)							
Organics - Pesticides (ug/kg)							
2,4'-DDD	NA	1	NA	0.27	2.7	NA	1 / 20
2,4'-DDE	NA	1	NA	0.47	1.1	NA	1 / 20
2,4'-DDT	NA	1	NA	0.48	1.1	NA	1 / 20
4,4'-DDD	96	1	0.1	0.6	1.3	0 / 19	2 / 19
4,4'-DDE	21	1	0.085	0.4	0.87	0 / 20	0 / 20
4,4'-DDT	19	1	0.078	0.61	1.4	0 / 20	3 / 20
Aldrin	NA	1	NA	0.59	1.3	NA	3 / 20
alpha-Benzenehexachloride	NA	1	NA	0.29	0.63	NA	0 / 19
alpha-Chlordane	NA	1	NA	0.41	0.89	NA	0 / 20
beta-BHC	NA	1	NA	0.27	1.4	NA	1 / 19
cis-Nonachlor	NA	1	NA	0.29	0.63	NA	0 / 20
delta-BHC	91	1	0.07	0.28	0.61	0 / 20	0 / 20
Dieldrin	1.9	1	0.083	0.22	0.55	0 / 20	0 / 20
Endosulfan I	2.03	1	0.06	0.37	0.8	0 / 20	0 / 20
Endosulfan II	9.8	1	0.091	0.69	1.5	0 / 18	5 / 18
Endosulfan sulfate	NA	1	NA	0.99	2.2	NA	15 / 20
Endrin	2.22	1	0.057	0.32	0.7	0 / 20	0 / 20
Endrin aldehyde	NA	1	NA	0.89	2	NA	8 / 20
Endrin ketone	NA	1	NA	0.45	3.3	NA	1 / 20
gamma-BHC	2.37	1	0.051	0.31	1.1	0 / 17	1 / 17
Heptachlor	NA	1	NA	0.39	0.85	NA	0 / 20
Heptachlor epoxide	2.47	1	0.23	0.66	1.5	0 / 20	3 / 20
Hexachlorobenzene	NA	1	NA	0.35	0.79	NA	0 / 20
Hexachlorobutadiene	NA	1	NA	0.18	0.39	NA	0 / 14
Methoxychlor	13.3	1	0.15	0.71	1.8	0 / 19	6 / 19
Oxychlordane	NA	1	NA	0.25	0.55	NA	0 / 20
Toxaphene	70	50	14	34	74	1 / 20	4 / 20
trans-chlordane	NA	1	NA	0.38	0.83	NA	0 / 20
trans-Nonachlor	NA	1	NA	0.71	1.6	NA	5 / 20

Notes:

Data include sample results qualified as nondetected based on blank contamination; for these results, the reported positive results have replaced the detection limit (DL).

Data exclude laboratory quality control sample data.

Data include only samples with nondetected results with both a quality assurance project plan (QAPP) method detection limit (MDL) and an analytical concentration goal (ACG) or method reporting limit (MRL) value.

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

BHC - hexachlorocyclohexane

DDD - dichlorodiphenyldichloroethane

DDE - dichlorodiphenyldichloroethylene

DDT - dichorodiphenyltrichloroethane

NA - not applicable

PAH - polycyclic aromatic hydrocarbon

PCB - polychlorinated biphenyl

Table 5-18. Comparisons of Actual DLs with ACGs and QAPP MRLs for Nondetected Analytes for Field Porewater Samples

Analyte	ACG	QAPP MRL	QAPP MDL	Minimum Actual DL	Maximum Actual DL	Number of ACG Exceedances / Total Nondetected Results	Number of Nondetects above QAPP MRL
Site Samples[a]							
Conventional Parameters (mg/L)							
DOC	NA	0.5	NA	0.07	0.07	NA	0 / 1
TOC	NA	0.5	NA	0.44	4.52	NA	7 / 9
Metals (µg/L)							
Aluminum	87	4	0.2	1.5	13.3	0 / 66	48 / 66
Antimony	NA	0.05	NA	0.215	1.16	NA	18 / 18
Beryllium	NA	0.02	NA	0.005	0.019	NA	0 / 109
Cadmium	0.19	0.02	0.008	0.008	0.039	0 / 42	4 / 42
Chromium	53	0.2	0.03	0.08	2.06	0 / 109	56 / 109
Copper	6.4	0.1	0.05	0.09	1.55	0 / 28	27 / 28
Iron	1000	1	0.3	8	24	0 / 29	29 / 29
Lead	1.6	0.02	0.006	0.011	0.433	0 / 52	49 / 52
Manganese	NA	0.2	NA	0.27	2.74	NA	12 / 12
Nickel	37	0.2	0.04	0.2	0.82	0 / 62	61 / 62
Selenium	1.5	1	0.2	0.2	0.2	0 / 93	0 / 93
Silver	NA	0.02	NA	0.009	0.036	NA	4 / 74
Thallium	NA	0.02	NA	0.009	0.036	NA	12 / 63
Vanadium	NA	0.2	NA	0.04	0.25	NA	1 / 10
Zinc	74	2	0.5	0.8	25	0 / 75	37 / 75
Reference Samples							
Conventional Parameters (mg/L)							
DOC	NA	0.5	NA	0.07	0.07	NA	0 / 1
TOC (mg/L)	NA	0.5	NA	0.07	0.07	NA	0 / 2
Metals (µg/L)							
Aluminum	87	4	0.2	4	27.9	0 / 15	14 / 15
Antimony	NA	0.05	NA	0.076	0.249	NA	13 / 13
Beryllium	NA	0.02	NA	0.005	0.008	NA	0 / 20
Cadmium	0.19	0.02	0.008	0.008	0.008	0 / 3	0 / 3
Chromium	53	0.2	0.03	0.51	2.43	0 / 20	20 / 20
Copper	6.4	0.1	0.05	0.08	1.56	0 / 19	17 / 19
Iron	1000	1	0.3	8	100	0 / 12	12 / 12
Lead	1.6	0.02	0.006	0.039	0.55	0 / 18	18 / 18
Manganese	NA	0.2	NA	0.79	1.93	NA	4 / 4
Nickel	37	0.2	0.04	0.7	1.5	0 / 8	8 / 8
Selenium	1.5	1	0.2	0.2	0.2	0 / 13	0 / 13
Silver	NA	0.02	NA	0.009	0.013	NA	0 / 20
Sodium	NA	200	NA	940	1130	NA	2 / 2
Thallium	NA	0.02	NA	0.009	0.009	NA	0 / 18
Vanadium	NA	0.2	NA	0.14	0.2	NA	0 / 6
Zinc	74	2	0.5	1.1	2.6	0 / 14	5 / 14

Notes:

Data include sample results qualified as nondetected based on blank contamination; for these results, the reported positive results have replaced the detection limit (DL).

Data exclude laboratory quality control sample data.

Data include only samples with nondetected results with both a quality assurance project plan (QAPP) method detection limit (MDL) and an analytical concentration goal (ACG) or method reporting limit (MRL) value.

[a] Site samples include samples from the three Phase 3 sediment study areas of interest (AOIs): Deadman's Eddy, China Bend, and Evans.

DOC - dissolved organic carbon

NA - not applicable

TOC - total organic carbon

Table 5-19. Comparison of Actual DLs with ACGs and QAPP MRLs for Nondetected Analytes for 42-Day Hyalella azteca Bioassay Sediment Samples

Analyte	ACG	QAPP MRL	QAPP MDL	Minimum Actual DL	Maximum Actual DL	Number of ACG Exceedances / Total Nondetected Results	Number of Nondetects above QAPP MRL
Conventional Parameters (%)							
TOC	NA	0.05	NA	0.02	0.02	NA	0 / 7
Metals (mg/kg)							
Antimony	2	0.05	0.02	0.01	0.03	0 / 17	0 / 17
Potassium	NA	40	NA	27	27	NA	0 / 1
Selenium	2	1	0.09	0.08	0.1	0 / 6	0 / 6
Silver	1	0.02	0.004	0.007	0.02	0 / 3	0 / 3
Sodium	NA	40	NA	12	21	NA	0 / 2
Thallium	NA	0.02	NA	0.03	0.059	NA	8 / 8

Notes:

Data include sample results qualified as nondetected based on blank contamination; for these results, the reported positive results have replaced the detection limit (DL).

Data exclude laboratory quality control sample data.

Data include only samples with nondetected results with both a quality assurance project plan (QAPP) method detection limit (MDL) and an analytical concentration goal (ACG) or method reporting limit (MRL) value.

NA - not applicable

TOC - total organic carbon

Table 5-20. Comparisons of Actual DLs with ACGs and QAPP MRLs for Nondetected Analytes for 42-Day *Hyalella azteca* Bioassay Porewater Samples

Analyte	ACG	QAPP MRL	QAPP MDL	Minimum Actual DL	Maximum Actual DL	Number of ACG Exceedances / Total Nondetected Results	Number of Nondetect Results above QAPP MRL
Conventional Parameters (mg/L)							
DOC	NA	0.5	NA	0.07	0.07	NA	0 / 2
Sulfide	NA	0.05	NA	0.003	0.003	NA	0 / 62
Metals (µg/L)							
Aluminum	87	4	0.2	2.4	12.3	0 / 40	33 / 40
Beryllium	NA	0.02	NA	0.005	0.015	NA	0 / 118
Cadmium	0.19	0.02	0.008	0.008	0.008	0 / 11	0 / 11
Chromium	53	0.2	0.03	0.23	1.57	0 / 123	123 / 123
Cobalt	NA	0.02	NA	0.009	0.009	NA	0 / 1
Copper	6.4	0.1	0.05	0.34	0.45	0 / 2	2 / 2
Iron	1000	1	0.3	8	60	0 / 42	42 / 42
Lead	1.6	0.02	0.006	0.006	0.021	0 / 3	1 / 3
Manganese	NA	0.2	NA	0.52	2.97	NA	2 / 2
Nickel	37	0.2	0.04	0.16	1.47	0 / 21	20 / 21
Potassium	NA	200	NA	400	400	NA	1 / 1
Selenium	1.5	1	0.2	0.2	0.2	0 / 103	0 / 103
Silver	NA	0.02	NA	0.009	0.009	NA	0 / 72
Thallium	NA	0.02	NA	0.009	0.009	NA	0 / 58
Vanadium	NA	0.2	NA	0.19	0.19	NA	0 / 1
Zinc	74	2	0.5	1.8	9.3	0 / 48	47 / 48

Notes:

Data include sample results qualified as nondetected based on blank contamination; for these results, the reported positive results have replaced the detection limit (DL).

Data exclude laboratory quality control sample data.

Data include only samples with nondetected results with both a quality assurance project plan (QAPP) method detection limit (MDL) and an analytical concentration goal (ACG) or method reporting limit (MRL) value.

DDT - dichorodiphenyltrichloroethane

DOC - dissolved organic carbon

NA - not applicable