EXECUTIVE SUMMARY

To meet Department of Defense (DoD) requirements and support the United States (U.S.) Army's Sustainable Range Program, the Army National Guard (ARNG) Directorate is conducting assessments to determine whether a release or substantial threat of release of munitions constituents of concern (MCOC) from an operational range footprint to an off-range area creates a potentially unacceptable risk to human health or the environment. The initial Phase I assessment was a qualitative evaluation of whether (a) a MCOC source existed on the operational range, (b) there is a potential migration mechanism, and (c) human or sensitive ecological receptors are present. For the operational range having a potentially complete source-receptor pathway, the ARNG Directorate conducted Phase II, a quantitative assessment of potentially complete pathways of MCOC. This Operational Range Assessment (ORA) Phase II Report presents evaluation of source-receptor pathways at the Camp Smith Training Site (Camp Smith), New York. EA Engineering, Science, and Technology, Inc. (EA) conducted this evaluation under contract W912DR-07-D-0042 to the U.S. Army Corps of Engineers (USACE)-Baltimore District in support of the ARNG Directorate.

Initially, the ORA Phase II establishes whether the source-receptor pathway identified during Phase I is complete or new information has been identified that would impact the Phase I's conclusions. To determine whether MCOC are potentially leaving an operational range footprint by an identified pathway (e.g., groundwater or surface water) and pose a potential risk to off-site receptors, the Phase II considers existing and any new sampling data. The ORA team may accomplish Phase II through reevaluating existing literature (e.g., prior sampling and/or reports), modeling, and/or collecting additional samples. In Camp Smith's Phase II report, all available information was used to establish a weight-of-evidence case that determines whether there has likely been a release from the operational range footprint that may pose a potentially unacceptable risk to an off-range receptor.

Camp Smith is located in southeastern New York. Camp Smith has an operational range complex of approximately 1,489 acres and 88 acres of non-operational area (cantonment area). There are 12 small arms ranges within Camp Smith which encompass approximately 38 acres, where only small arms ammunition (ammunition without projectiles that contain explosives—other than tracers—that is .50 caliber or smaller, or for shotguns) are used. Primary MCOC source areas include berms (i.e., impact backstops) associated with these operational ranges. Metal MCOC (i.e., antimony, copper, lead, and zinc) originating from these small arms ranges are the primary MCOC of concern.

The Phase II multi-season field sampling was conducted during August 2009 and April 2010. Samples were collected on Camp Smith property and also from locations immediately adjacent to Camp Smith. Surface water and sediment samples were collected from three locations along Putnam Brook: two locations downstream of the berm backstops and one location upstream of the berm backstops. Surface water and sediment samples were also collected from two locations within a tidal marsh, downstream of the berm backstops along Putnam Brook (Camp Smith tidal marsh), and from two locations within a reference marsh located upstream.

Dry and wet season surface water and sediment sampling was conducted to identify potential seasonal variations in water quality transport characteristics. Diurnal variations were accounted for in surface water quality along Putnam Brook using 24-hour composite samples at the Putnam Brook locations and weather variations were considered by collecting a 2-hour composite sample during a storm event. Due to the tidal influence at the marsh locations, diurnal variations in water quality were assessed through collection of grab samples at high and low tide. Sediment samples were collected as composited grab samples from all surface water sampling locations.

Surface water samples were analyzed for metals (i.e., lead, copper, zinc, and antimony) and water quality parameters. Sediment samples were analyzed for metals, total organic carbon, and simultaneously extracted metals/acid-volatile sulfides (SEM/AVS). The results for metals for surface water and sediment were compared to background and reference concentrations using a *t*-test of average concentrations and compared to New York State screening levels using 95 percent upper confidence limit of the mean (95% UCLM) sample concentrations.

Benthic macroinvertebrate populations were sampled to evaluate aquatic ecosystem health. Benthic macroinvertebrate surveys were conducted at each Putnam Brook sampling location, within the Camp Smith tidal marsh, and at the reference marsh.

Average surface water concentrations of lead, copper, and antimony in Putnam Brook, downstream of the berm backstops, were significantly higher than background concentrations found upstream. The 95% UCLM concentrations of lead in both downstream Putnam Brook locations also exceeded surface water screening levels. Average sediment concentrations of lead, copper, and zinc from both downstream Putnam Brook locations exceeded average background concentrations. Additionally, the 95% UCLM for lead, copper, and antimony exceeded associated screening levels at both downstream Putnam Brook sampling locations.

Analysis of SEM/AVS at the downstream Putnam Brook locations suggests that divalent metals may potentially be bio-available for uptake by benthic organisms. Results of the benthic macroinvertebrate sampling do not suggest that the benthic communities in the downstream portions of Putnam Brook are being impacted. However, the 95% UCLM concentrations of lead from both Putnam Brook sampling locations were an order of magnitude above sediment screening levels.

Average surface water concentrations of lead, copper, and antimony in the Camp Smith tidal marsh, downstream of the berm backstops, were significantly higher than reference concentrations taken upstream. The 95% UCLM concentration of lead in one of two Camp Smith tidal marsh locations exceeded the surface water screening level. Average sediment concentrations of lead, copper, zinc, and antimony metal concentrations in the Camp Smith tidal marsh samples were significantly higher than reference concentrations. Additionally, the 95% UCLM for lead, copper, and zinc exceeded associated screening levels.

Analysis of SEM/AVS at the downstream Camp Smith tidal marsh locations suggests that the bio-availability of divalent metals for uptake by benthic organisms may be limited. Results of the benthic macroinvertebrate sampling do not indicate that the benthic communities in the Camp Smith tidal marsh are being impacted. However, the 95% UCLM concentrations of lead from both sample locations in the marsh were an order of magnitude above sediment screening levels.

To assist in the assessment of the nature and extent of potential ecological risk from the MCOC, detected downstream of the berm backstops, a Screening Level Ecological Risk Assessment (SLERA) was performed. In addition to a quantitative assessment of potential risks using metals sampling results from the Phase II Quantitative Assessment, the SLERA incorporated the results of the SEM/AVS analyses and benthic macroinvertebrate sampling to provide an assessment of risks based on a qualitative weight of evidence approach.

The results of Camp Smith's ORA Phase II Quantitative Assessment confirm the presence of a surface water pathway and indicate that there is a reasonable expectation of a release of lead off the operational range footprint, as evidenced by both the difference between downstream and reference locations, and by screening level exceedances downstream. Based on the SLERA, the MCOC concentrations detected in Putnam Brook and the Camp Smith tidal marsh are not expected to present a potential risk to aquatic or

piscivorous ecological receptors. However, the SLERA did indicate there is a potential for risk to benthic organisms in Putnam Brook and the Camp Smith tidal marsh from exposure to lead.