of small arms training activities and they have not been identified as COPECs in other environmental media at the IMR ranges. The detected concentrations of beryllium, iron, and vanadium are not substantially elevated with respect to background and do not exhibit the propensity to bioaccumulate significantly. Therefore, these constituents were not considered COPECs in sediment at the IMR ranges. Barium, manganese, and thallium, were all detected at concentrations that exceed background and have the potential to bioaccumulate. Therefore, these constituents were identified as COPECs in sediment at the IMR ranges.

Arsenic and nickel were also detected in sediment samples at the Skeet range at concentrations that exceeded their respective ESVs. Nickel was detected in one sediment sample, out of 13 samples collected, at an elevated concentration with respect to ESVs and arsenic was detected in three samples, out of 13 samples collected, at elevated concentrations with respect to background. Based on the relative infrequency of detection, the low magnitude of the HQ_{screen} value, the fact that nickel has not been identified as a COPEC in other environmental media at the IMR ranges, and it does not readily bioconcentrate or biomagnify, it was concluded that nickel is not a COPEC in sediment at the IMR ranges. Because arsenic was detected at concentrations that exceed the ESV and background levels and has the potential to bioaccumulate in lower trophic level organism, it was included as a COPEC in sediment. The sediment sample locations and COPEC concentrations are presented in Figure 2-5. Downstream sediment sample locations and COPEC concentrations are presented in Figure 2-6.

2.4 Groundwater

The rationale for assessing groundwater at the IMR ranges using surface water ESVs was to determine the potential for impacts to aquatic organisms from groundwater if groundwater intrusion to Remount Creek and its tributaries does occur.

2.4.1 Site Geology

The soils at the IMR ranges, fall into the Anniston and Allen gravelly loams, Jefferson stony fine sandy loam, and Stony rough land, Sandstone.

The Anniston and Allen gravelly loam series consists of deep, strongly acidic, well-drained soils that have developed in old local alluvium. The parent material washed from the adjacent, higher lying Linker, Muskingham, Ender and Montevallo soils, which developed from weathered sandstone, shale and quartzite. The surface soils are mainly dark reddish brown sandy loam. The subsoil is dark red fine sandy clay loam. Fragments of sandstone and quartzite are found on the surface and throughout the soil (U.S. Department of Agriculture [USDA], 1961).

The Jefferson Stony fine sandy loam contains soils that occur in small areas on fans and on foot slopes of the Choccolocco Mountains. The soil material is developed from old local alluvium that washed or sloughed from ridges of sandstone, shale and Weisner quartzite. The surface soil is dark grayish brown fine sandy loam and the subsoil is yellowish brown, light fine sandy clay (USDA, 1961).

The Stony Rough Land, sandstone series contains soils of the higher elevations of the Choccolocco Mountains. These soils are generally found in the rough, mountainous areas with many outcrops of sandstone and quartzite bedrock, loose rock fragments, and scattered patches of sandy soil material. It also includes rock escarpments on higher parts of the mountains, where quartzite of the Weisner Formation is common. Slopes are generally more than 25 percent. The soil material is generally shallow over bedrock; depth to bedrock is typically less than 3 feet.

The four ranges east of Iron Mountain Road are located near the southern boundary of the FTMC Geologic Window. Figure 2-7 is a geologic map of the vicinity of IMR ranges. Bedrock within the geologic window consists of Mississippian/Ordovician Floyd and Athens Shale, undifferentiated and Ordovician Little Oak and Newala Limestones. The boundary of the window is defined by the Jacksonville Fault, which locally extends in an irregular line west to east across the area. The fault strikes southwest to northeast across the western portion of Range 19 and the eastern portion of the Skeet Range. Bedrock southeast of the Jacksonville fault is mapped as the Cambrian Chilhowee Group, undifferentiated and the Cambrian Shady Dolomite.

A splay fault is mapped to the south of the Jacksonville Fault. The splay fault strikes southwest-northeast through the southeast corner of Range 13. A band (approximately 400 to 600 feet wide) of bedrock north of the splay fault is mapped as the Cambrian Shady Dolomite which conformably overlies bedrock of the Chilhowee Group. Bedrock north of the Shady Dolomite is mapped as the relatively older Cambrian Chilhowee Group. South of the splay fault, bedrock is also mapped as the Chilhowee Group, undifferentiated.

A north-south trending fault is inferred to extend south from the southwest corner of Range 19 through the western portions of Ranges 12 and 13 parallel to Iron Mountain Road. The direction of movement associated with the inferred fault is unknown.

During drilling at Range 12, the residuum encountered was red-orange to light purple clay, with some sand and some quartz-rich gravel. Bedrock underlying this range is mapped as the Cambrian Chilhowee Group, undifferentiated. Auger refusal was encountered at HR-70Q-MW02 (32 feet bgs) on quartzite and quartz-rich sandstone.

664000
666000
668000
1166000
1164000
1162000

Geologic Window

Skeet Range Area

Range 19 Area

Range 13 Area

Range 12 Area

Jacksonville Fault

Jacksonville Fault

Inferred Fault

Splay Fault

Oln

MOfa

Cch

Cs

Cch

Cs

28Aug00
i:\peter\projects\Iron_Mtn_Rd\profiles.apr

Legend

- Study Areas
- 5' Elevation Contours
- Streams
- Drainage Ditch
- Roads
- Fault
- Inferred Fault

Geology

- Cch — Cambrian - Chilhowee Group
- Cs — Cambrian - Shady Dolomite
- MOfa — Mississippian/Ordovician - Floyd & Athens Shale, Undifferentiated
- Oln — Ordovician - Little Oak and Newala Limestones

664000
666000
668000

Figure 2-7

Geologic Map - Iron Mountain Road Range Areas

Fort McClellan
Environmental Office

N

0 500 1000

State Plane feet, NAD83

September 2000

U.S Army Corps of Engineers
Mobile District
Fort McClellan
Calhoun County
Contract No. DACA21-96-D-0018

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At Range 13, the residuum encountered during drilling was yellow-orange to red clay, with some sand, little silt and little quartz-rich gravel. Bedrock underlying this range is mapped as the Cambrian Chilhowee Group, undifferentiated and the Cambrian Shady Dolomite. Auger refusal was encountered at HR-71Q-MW02 (64 feet bgs) within residuum. This hole was further advanced using an air rig to a total depth of 100 feet bgs, but was terminated within stiff clay without encountering bedrock.

At Range 19, the residuum encountered during drilling was red-orange to yellow to dark gray clay, with some sand and some coarse quartz-rich gravel. At the Skeet Range, the residuum encountered during drilling was brown to light brown clay with some silt and little quartz-rich gravel. Bedrock underlying Range 19 and the Skeet Range is mapped as primarily Ordovician Little Oak and Newala Limestone and Cambrian Chilhowee Group, undifferentiated. The Jacksonville fault is mapped extending through both ranges, striking southwest to northeast. Bedrock southeast of the fault is mapped as Cambrian Chilhowee Group, undifferentiated. A small area within the southwestern corner of Range 19 is mapped as Cambrian Shady Dolomite. At Range 19, auger refusal was encountered at HR-75Q-MW02 (60 feet bgs) and HR-75Q-MW03 (83 feet bgs) within stiff clay. No bedrock was encountered. At the Skeet Range, auger refusal was encountered at HR-69Q-MW02 (53 feet bgs) on very hard sandstone. When rock coring commenced, competent bedrock was not encountered until 77 feet bgs, on moderately hard, medium light gray limestone.

2.4.2 Surface Hydrology

Precipitation in the form of rainfall averages about 53 inches annually in Anniston, Alabama, with infiltration rates annually exceeding evapotranspiration rates (U.S. Department of Commerce, 1998). The major surface water features at the Main Post of FTMC include Remount Creek, Cane Creek, and Cave Creek. These waterways flow in a general northwest to westerly direction towards the Coosa River on the western boundary of Calhoun County. Remount Creek is the major surface water feature found at the IMR ranges. Remount Creek flows intermittently to the north. During the course of field investigations at the IMR ranges, surface water was not consistently observed flowing through the stream channel adjacent to the study area. During the majority of field observations, the stream channel appeared largely dry with some small (estimated 2 to 4 feet diameter) pools of surface water observed within depressions in the stream channel. Approximately two miles north of the study area Remount Creek discharges into Cane Creek.

Surface elevations range from about 875 to 975 feet above mean sea level (amsl) at Range 12, 875 to 925 feet amsl at Range 13, 850 to 925 feet amsl at Range 19, and about 800 to 925 feet amsl at the Skeet Range. Ground surface across the ranges generally slopes to the west forming the east side of Remount Creek valley. Surface water runoff in the area of the IMR ranges follows topography, flowing into Remount Creek, which flows to the north.

2.4.3 Hydrogeology

During soil boring and well installation activities, groundwater was encountered at depths ranging from 15 to 88 feet bgs. It appears that there are two ground water bearing zones present at the IMR ranges, one within the residuum and the other within the bedrock. Groundwater in residuum was encountered at depths ranging from 15 to 45 feet bgs. Groundwater in bedrock was encountered at 73 and 88 feet bgs. Groundwater was not encountered at HR-71Q-MW02, which was terminated at 100 feet bgs within residuum. Comparing the static water levels collected at the site on January 8, 2002 (Table 2-9) to the depths groundwater was encountered during drilling, it appears that groundwater in the residuum is under confined, or semi-confined conditions. Based on the approximate elevations that groundwater was encountered during drilling compared to the elevation of the Remount Creek stream bed, it appears that groundwater in the residuum at the IMR ranges does not contribute substantially to surface water flow within Remount Creek. Furthermore, comparing the static water levels from both January 2002 and November 2001 on either side of the creek to the location and elevation of Remount Creek, it appears that the potentiometric surface is below the base of the creek bed. This suggests that Remount Creek is not being fed by the residuum groundwater under base flow conditions. However, it does not rule out the possibility that during periods of heavy rainfall residuum may become saturated and locally and temporarily discharge to the surface water within Remount Creek. Based on static groundwater levels, the groundwater flow direction within the residuum at the site appears to be generally to the north, mirroring the flow direction of Remount Creek (Figure 2-8).

Several inorganic constituents were detected in groundwater at concentrations that exceeded their respective surface water ESVs (Table 2-7). Barium, beryllium, and cobalt were detected in one groundwater sample out of six samples collected at concentrations that exceeded their respective background threshold values. Manganese was detected in two groundwater samples out of six samples collected at concentrations that exceeded it's background threshold value.

Based on the infrequency of detection of these inorganic constituents at concentrations that exceed background, and the fact that they have not been identified as being associated with small arms training activities in other environmental media at the IMR ranges, it was concluded that

Table 2-9

Groundwater Elevations and Screening Intervals

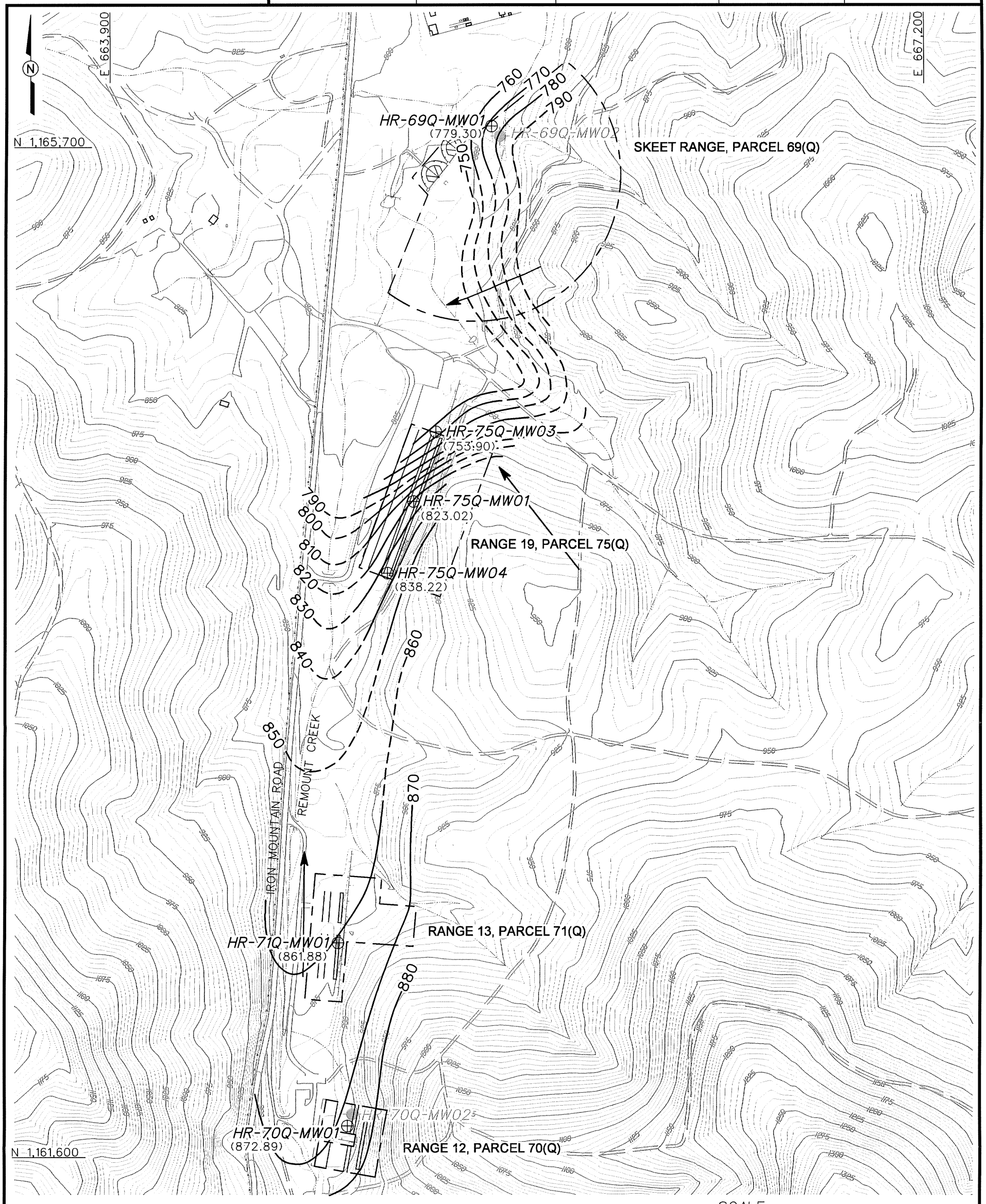
Fort McClellan, Calhoun County, Alabama

Well Location	Date	Depth to Water (ft BTOC)	Top of Casing Elevation (ft amsl)	Ground Elevation (ft amsl)	Groundwater Elevation (ft amsl)	Screen Interval (ft bgs)	Screen Interval (ft amsl)
HR-69Q-MW01	8-Jan-02	20.28	799.58	797.73	779.30	27 - 47	770.73 - 750.73
HR-69Q-MW02	8-Jan-02	20.5	799.58	797.73	779.08	92 - 102	705.73 - 695.73
HR-70Q-MW01	8-Jan-02	27	899.89	897.9	872.89	9.6 - 29.6	888.3 - 868.3
HR-70Q-MW02	8-Jan-02	77.29	899.9	897.88	822.61	66 - 76	831.88 - 821.88
HR-71Q-MW01	8-Jan-02	15.43	877.31	875.25	861.88	21 - 36	854.25 - 839.25
HR-75Q-MW01	8-Jan-02	21.31	844.33	842.56	823.02	21 - 36	821.56 - 806.56
HR-75Q-MW03	8-Jan-02	85.72	839.62	837.67	753.90	63 - 83	774.67 - 754.67
HR-75Q-MW04	8-Jan-02	9.71	847.93	846.19	838.22	23 - 38	823.19 - 808.19

Elevations referenced to the North American Vertical Datum of 1988 (NAVD88).

bgs - below ground surface
BTOC - Below top of casing
ft - Feet
amsl - Above mean sea level

dbomar	08/07/02	STARTING DATE: 08/06/02	DATE LAST REV.:	DRAFT. CHCK. BY:	INITIATOR: D. ALLAN	DWG. NO.: ...\800486es.067
c:\cadd\design\800486es.067	01:50:51 PM	DRAWN BY: D. BOMAR	DRAWN BY:	ENGR. CHCK. BY: S. MORAN	PROJ. MGR.: J. YACOUB	PROJ. NO.: 800486



LEGEND:

- UNIMPROVED ROADS AND PARKING
- PAVED ROADS AND PARKING
- BUILDING
- 860 — TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL - 5 FOOT)
- 860 — GROUNDWATER ELEVATION CONTOURS (DASHED WHERE INFERRED)
- (861.88) — GROUNDWATER ELEVATION (FT MSL) (JANUARY 2002)
- GROUNDWATER FLOW DIRECTION
- TREES / TREELINE
- BOUNDARY OF FIRING LINE AND VISIBLE BULLET FRAGMENT IMPACTED AREAS
- BRIDGE
- CULVERT WITH HEADWALL
- SURFACE DRAINAGE / CREEK
- MANMADE SURFACE DRAINAGE FEATURE
- BERM
- RESIDUUM MONITORING WELL LOCATION
- BEDROCK MONITORING WELL LOCATION

SCALE

0 400 800 FEET

FIGURE 2-8
RESIDUUM POTENTIOMETRIC SURFACE MAP IRON MOUNTAIN ROAD PARCELS 69Q, 70Q, 71Q AND 75Q

U. S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT
FORT McCLELLAN
CALHOUN COUNTY, ALABAMA
Contract No. DACA21-96-D-0018

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these inorganic compounds are not COPECs in groundwater at the IMR ranges. 2-Nitrotoluene, 4-amino-2,6-dinitrotoluene, 1,2,4-trimethylbenzene, and 1,2-dimethylbenzene were initially identified as COPECs because there are no surface water ESVs associated with them. 4-Amino-2,6-dinitrotoluene, 1,2,4-trimethylbenzene, and 1,2-dimethylbenzene were detected in one groundwater sample out of six samples collected at concentrations of 4.7E-04, 3.6E-04, and 4.6E-04 mg/L, respectively. 2-Nitrotoluene was detected in three groundwater samples out of six samples collected at the IMR ranges ranging in concentration from 1.2E-03 to 3.9E-03 mg/L. These constituents have not been detected in any other environmental media at the IMR ranges.

As discussed in the SLERA for the IMR ranges, none of the constituents detected in groundwater at elevated concentrations relative to surface water ESVs were detected in surface water at elevated concentrations. In fact, the only constituent detected in surface water at elevated concentrations (lead) was not found in groundwater at elevated concentrations. Ecological receptors have the potential to be exposed to groundwater only through surface water exposure pathways. Although there may be groundwater/surface water interchange during periods of high precipitation, there does not appear to be a significant exchange of contaminants between the two media.

Based on the extremely low concentrations of the constituents detected in groundwater, the infrequency of detection, and the fact that none of the groundwater constituents were detected at elevated concentrations in surface water at the IMR ranges, it was concluded that these constituents are also not COPECs in groundwater at the IMR ranges.

2.5 Summary of COPECs

In order to focus on the constituents that are most prevalent at the IMR ranges and have the greatest potential to pose adverse ecological effects to local ecological communities and populations, the initial list of COPECs was scrutinized using additional lines of evidence. These additional lines of evidence included frequency of detection, magnitude of the HQ_{screen} value, association with Army activities, bioaccumulation and toxicity potential. Based on these additional lines of evidence, the following COPECs were identified at the IMR ranges:

- ***Surface Soil:*** antimony, copper, lead, and zinc
- ***Surface Water:*** lead
- ***Sediment:*** arsenic, barium, copper, lead, manganese, and thallium.