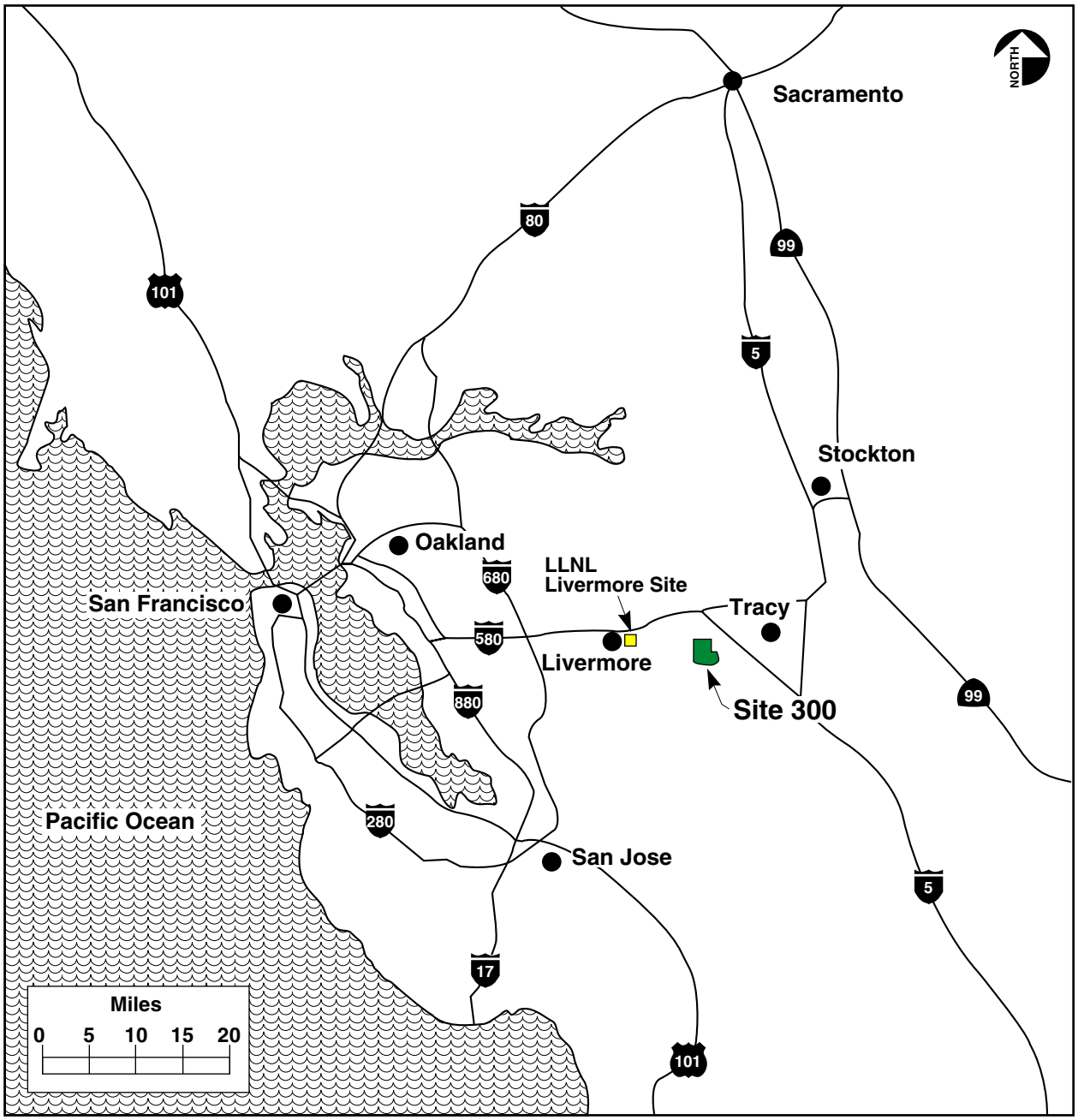

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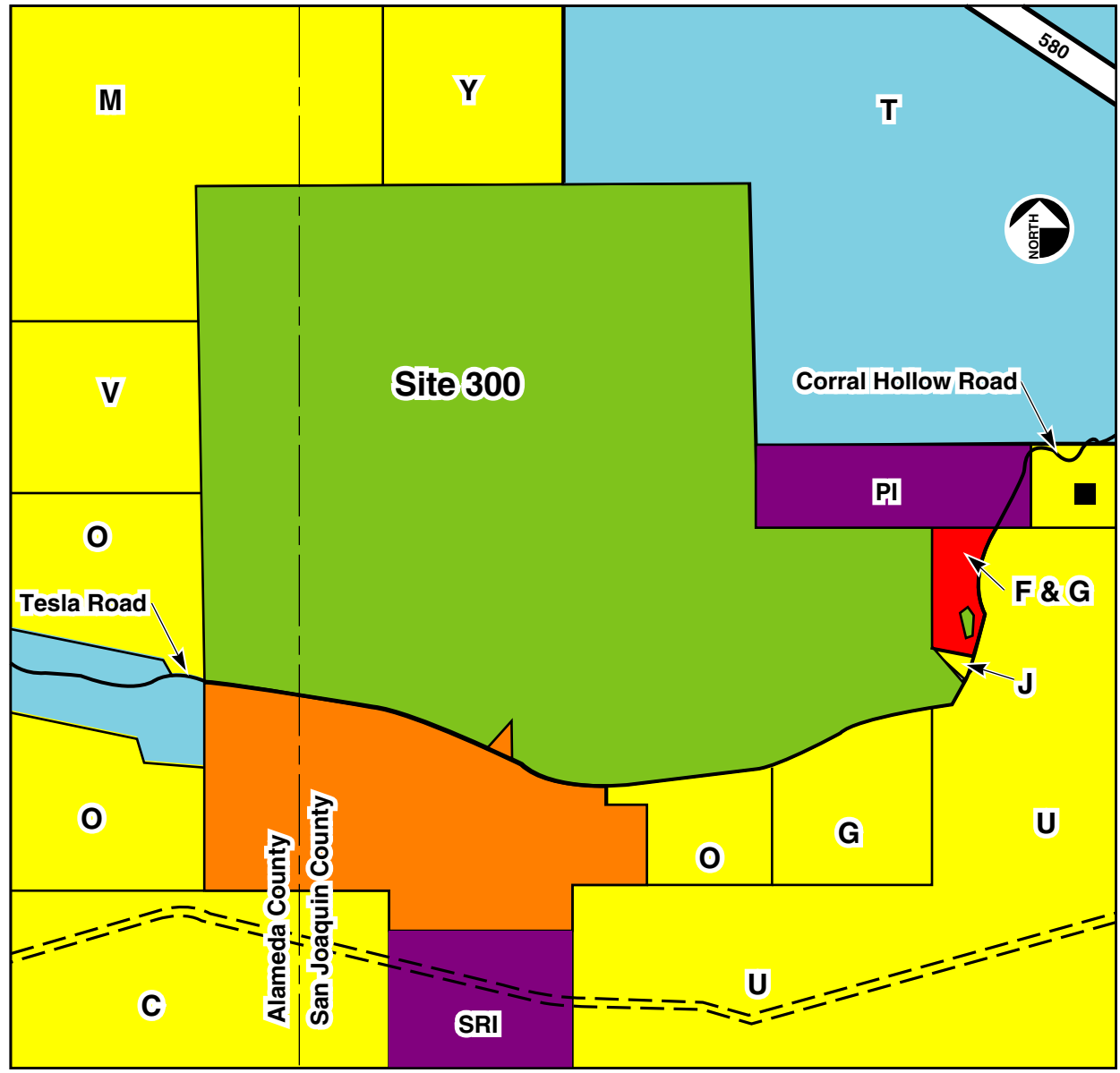
Figure 1-1. Location of LLNL Livermore Site and Site 300.



Legend

- Federal materials testing and research
- Private materials testing and research
- Private range land
- Residential development (actual/pending)
- Carnegie State Vehicular Recreation Area (SVRA)
- California Department of Fish and Game

G = Gallo Ranch
U = Union Livestock, Inc.
C = Connolly Ranch, Inc.
M = Mulqueeney Ranch
Y = Yroz Ranch land
V = Vieira Ranch land
T = Proposed Tracy Hills Development
O = Other ranch land
PI = Physics International
SRI = SRI International

F & G = Cal. Dept. of Fish and Game Wildlife Preserve
J = San Joaquin County
Hetch Hetchy aqueduct
Interstate 580
Broadcasting tower

Diagramatic
Approximate scale : feet
0 2000 4000

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Figure 1-2. Land use in the vicinity of Site 300.

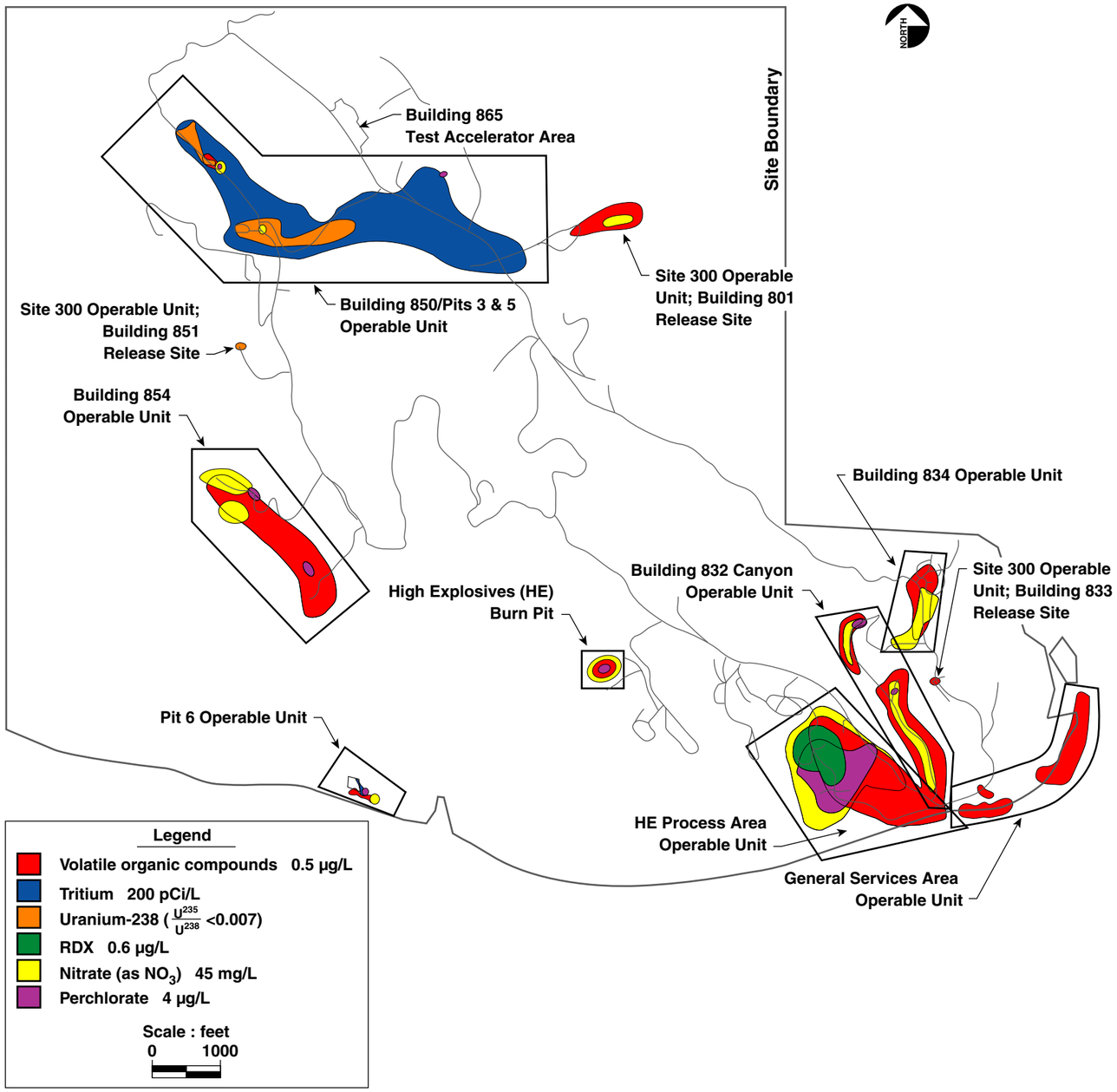

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Figure 1-3. Locations of Operable Units at LLNL Site 300.

General Services Area (GSA) Operable Unit (OU-1)

Contamination resulting from past solvent disposal, has caused volatile organic compound (VOC) contamination of soil, bedrock, and ground water. Two primary ground water plumes has been identified, both extending off site. The Central GSA ground water plume came from former sumps (dry wells). Dense Non-Aqueous Phase Liquids (DNAPLs) were detected in the past near this release site. The eastern GSA plume originated from a debris trench where solvent-contaminated craft-shop waste was buried. Ground water and vadose zone remediation is ongoing.

Building 834 Operable Unit (OU-2)

Past spills of trichloroethylene (TCE), used as a heat-exchange fluid, resulted in contamination of the vadose zone and a perched water-bearing unit. The deeper regional aquifer has not been affected. DNAPLs and Light Non-Aqueous Phase Liquids (LNAPLs) are present. Nitrate also has been detected in the perched water-bearing unit. Ground water and vadose zone remediation is ongoing, as is innovative technology development.

Pit 6 Operable Unit (OU-3)

From 1964 to 1973, approximately 1,900 yd^3 of waste was placed in nine unlined debris trenches and animal pits at the Pit 6 Landfill. The buried material included laboratory and shop debris, and biomedical waste. Contaminants potentially associated with the waste include organic solvents, PCBs, metals, and radionuclides. VOCs have been detected in the vadose zone, and VOC and tritium ground water plumes originated from the landfill. The landfill was capped in 1997.

HE Process Area Operable Unit (OU-4)

TCE was stored and used at the Building 815 steam plant to clean scale from boilers. Past spills of TCE resulted in contamination of the soil and ground water. HE compounds RDX and HMX are present in soil, and nitrate, perchlorate, and HE compounds are also present in ground water. Ground water remediation to control the VOC plume is planned as a removal action. In addition, VOCs, nitrate, and perchlorate have been detected in ground water in the vicinity of the former HE Burn Pits.

Building 850/Pits 3 & 5 Operable Unit (OU-5)

Contamination emanates from the Building 850 area, and from landfill Pits 3 and 5. Tritium is the primary contaminant in ground water, although uranium-238 and low concentrations of TCE have also been detected. Some uranium isotope signatures are characteristic of depleted uranium. Soil contaminants also include tritium, uranium-238, as well as PCB-bearing shrapnel from explosive experiments.

Building 854 Operable Unit (OU-6)

Facilities in this OU were used to test the stability of weapons and weapons components under various environmental conditions and mechanical and thermal stresses. VOCs, primarily TCE, were released to the subsurface as a result of these activities. TCE has been identified in the vadose zone and ground water, and VOCs, metals, PCBs, and tritium have been identified in the soil. Nitrate, perchlorate, and tritium have also been detected in ground water.

Building 832 Canyon Operable Unit (OU-7)

Facilities in this OU were used to test the stability of weapons and weapons components under various environmental conditions and mechanical stresses. TCE was used as a heat-exchange fluid. Contaminants released to the subsurface were primarily VOCs, although HE compounds have also been detected in the vadose zone. VOCs, nitrate, and perchlorate have been detected in ground water. A treatability study evaluating ground water and soil vapor extraction is underway.

Site 300 Operable Unit (OU-8)

This OU contains areas where source screening indicates that releases have occurred. Contaminants released to the subsurface include VOCs (for the Building 801 Dry Well, Building 833 Disposal Lagoon, Area north of Building 833, Building 833 Test Cell and Settling Basin, and Building 851 Firing Table); metals (Building 801 and Building 851 Firing Table); uranium-238 (Building 801, 845 and 851 Firing Tables); and an HE compound (Building 845 Firing Table). The Building 812 Firing Table and Waste Water Outflow and the Sandia Test Site are currently unconfirmed as release points, and are under investigation. The Building 865 Advanced Test Accelerator had a release of freon 113 to the ground water; further site characterization is planned.

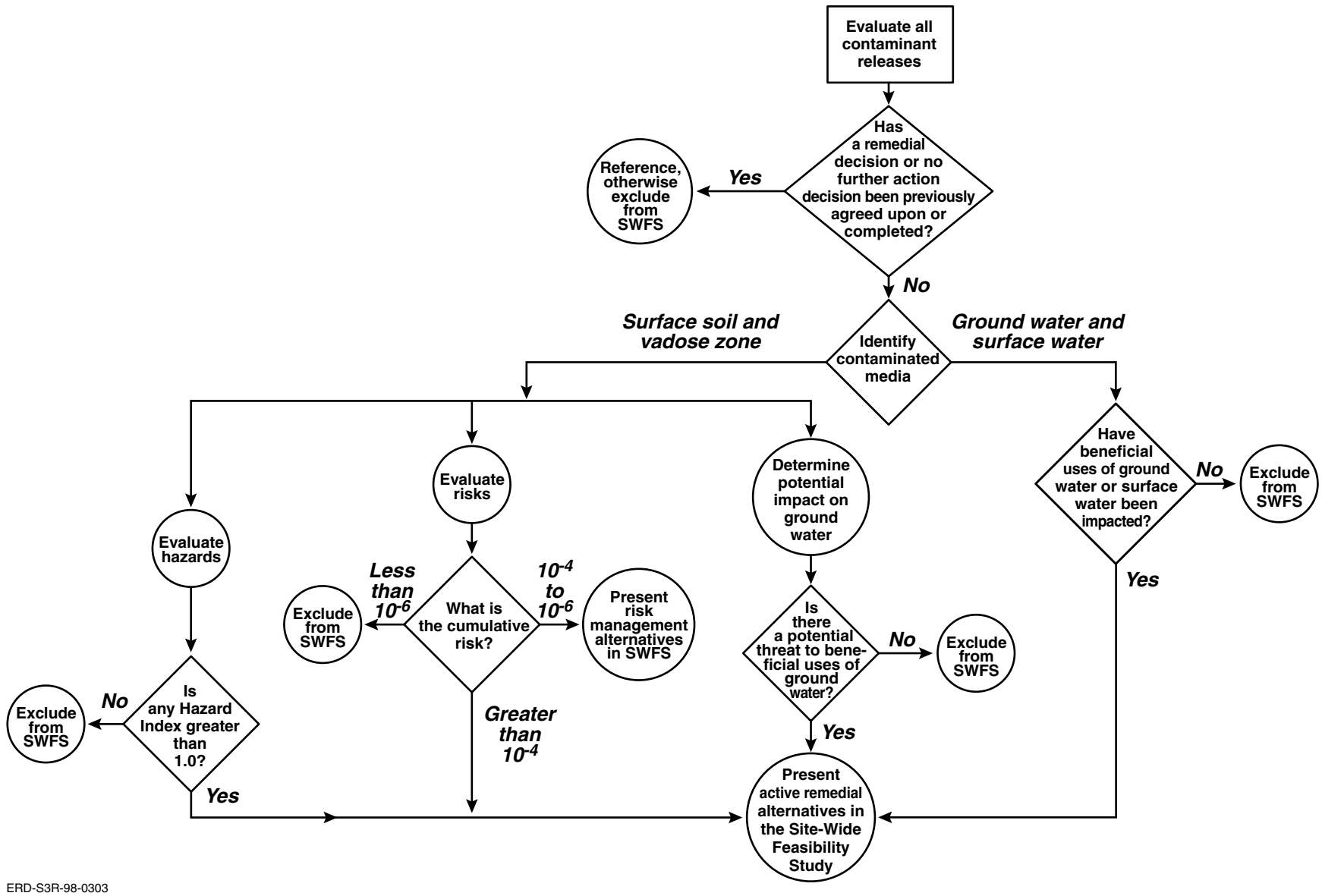

Figure 1-4. Flow chart for determining inclusion of contaminant release sites in the Site-Wide Feasibility Study (SWFS).

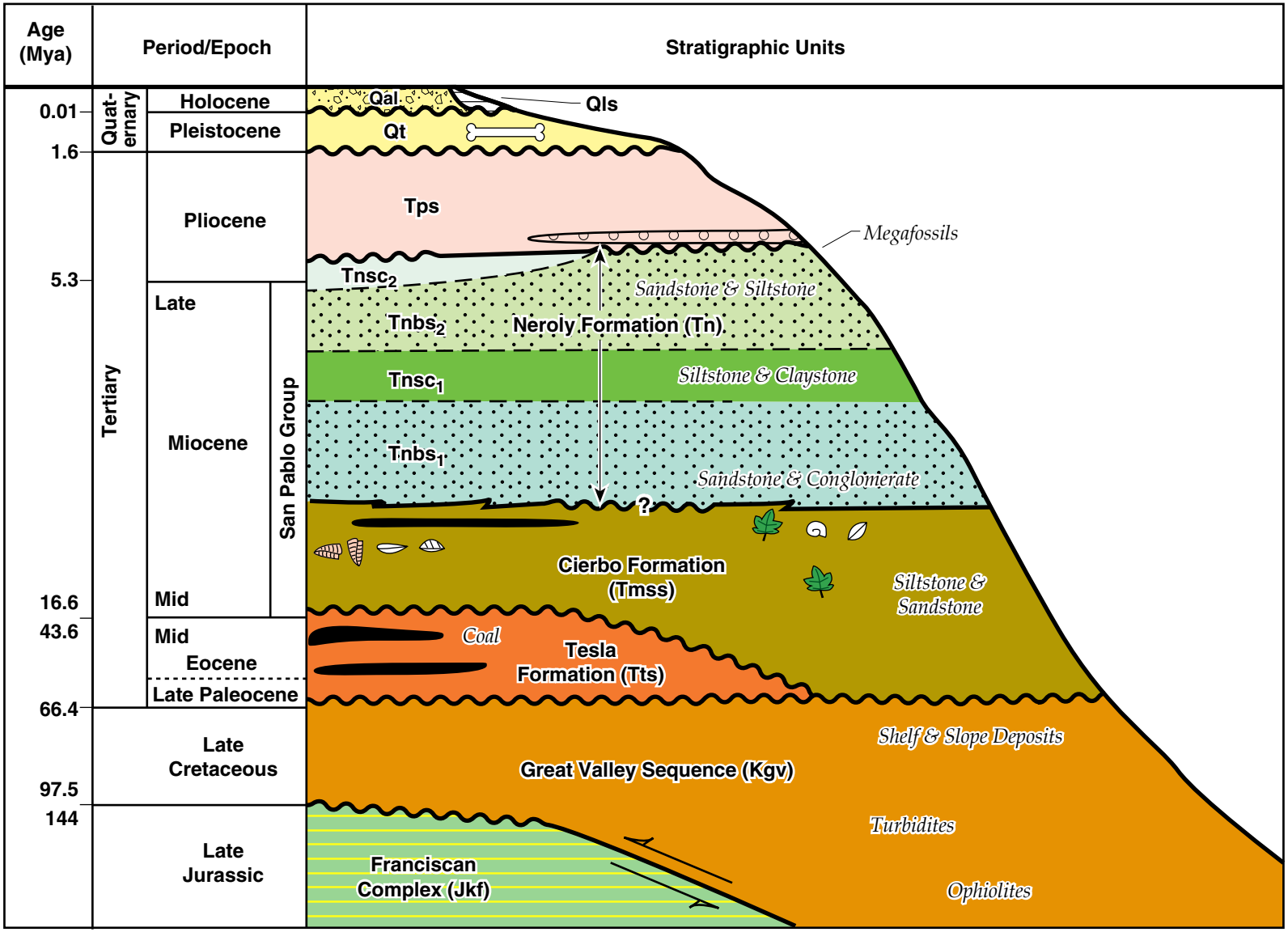

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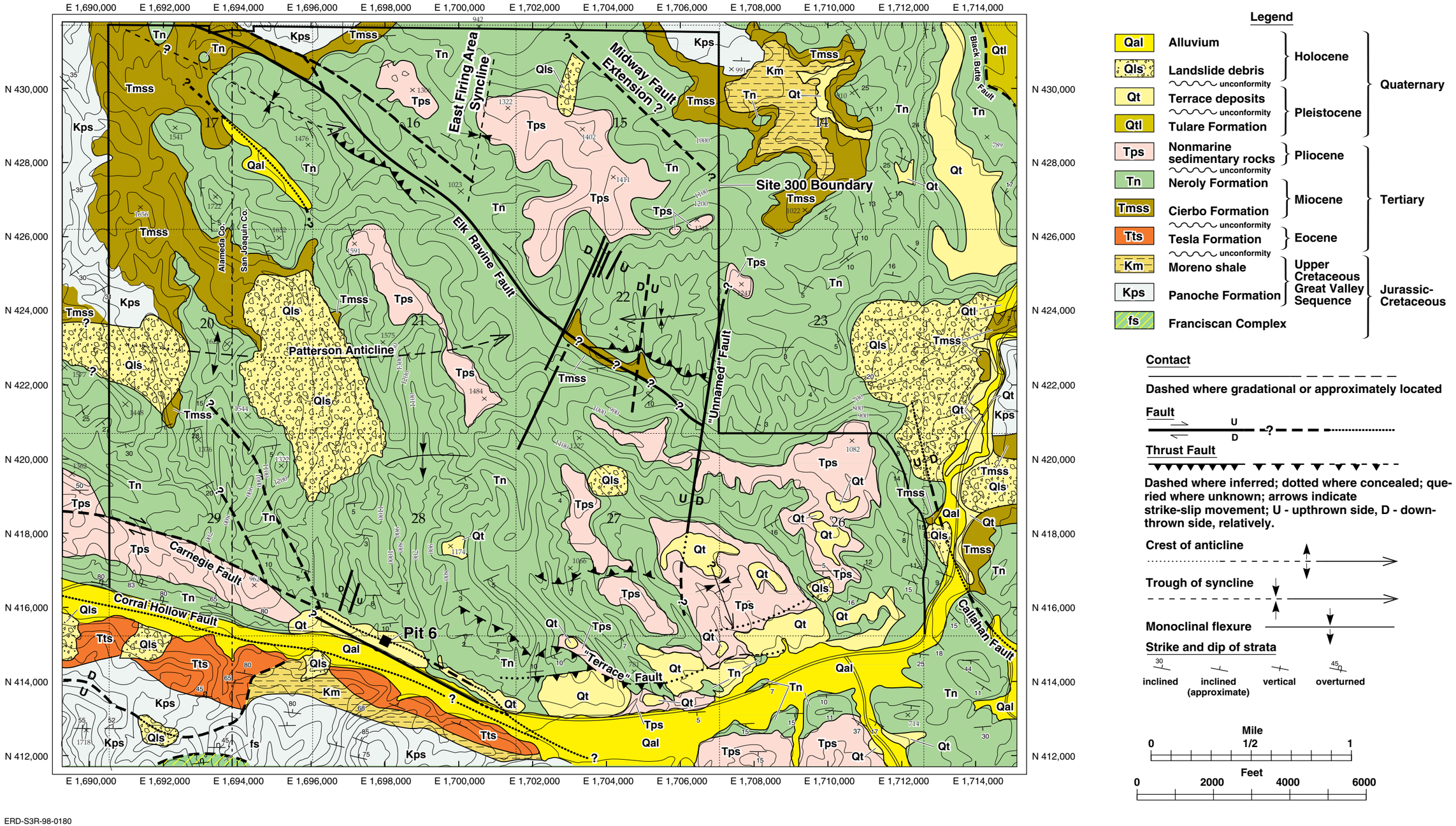
Figure 1-5. Schematic stratigraphy of Site 300.



ERD-S3R-98-0180

Figure 1-6. Geologic map of Site 300 area (modified from Dibblee, 1980; Raymond, 1969; and Dugan and Mateik, 1990).

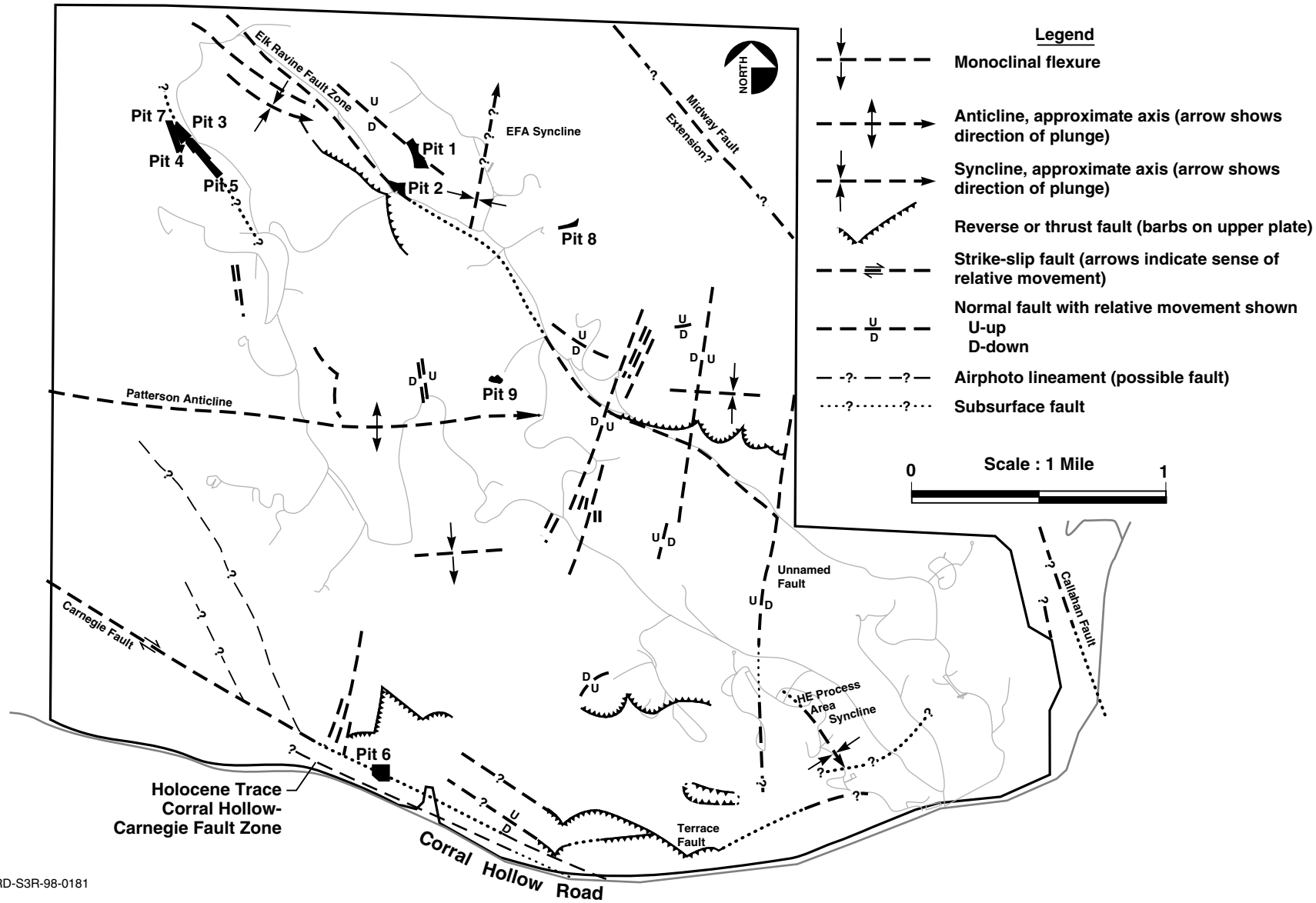


Figure 1-7. Map showing principal folds and faults of Site 300.

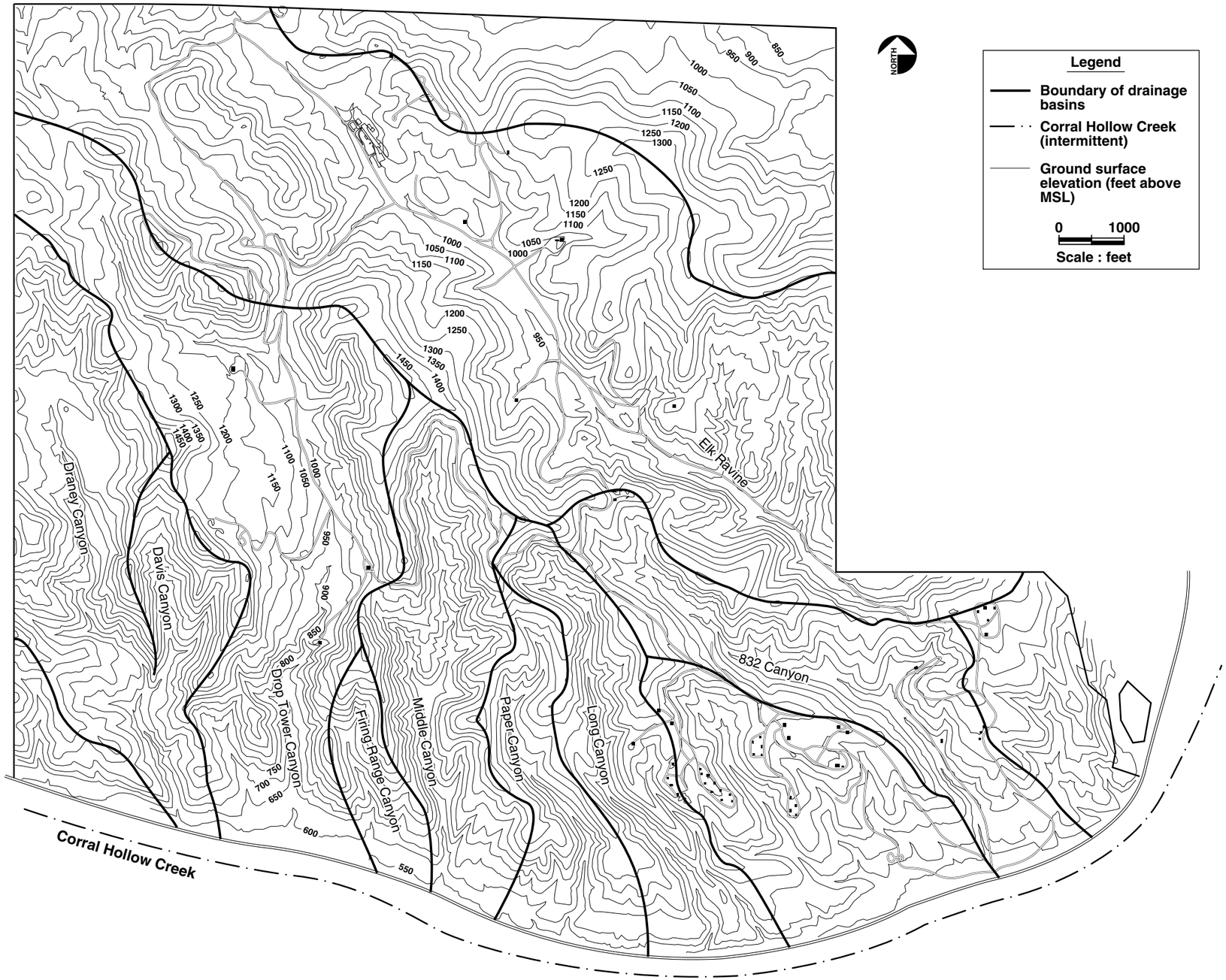


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Figure 1-8. Surface water drainage basins at Site 300.

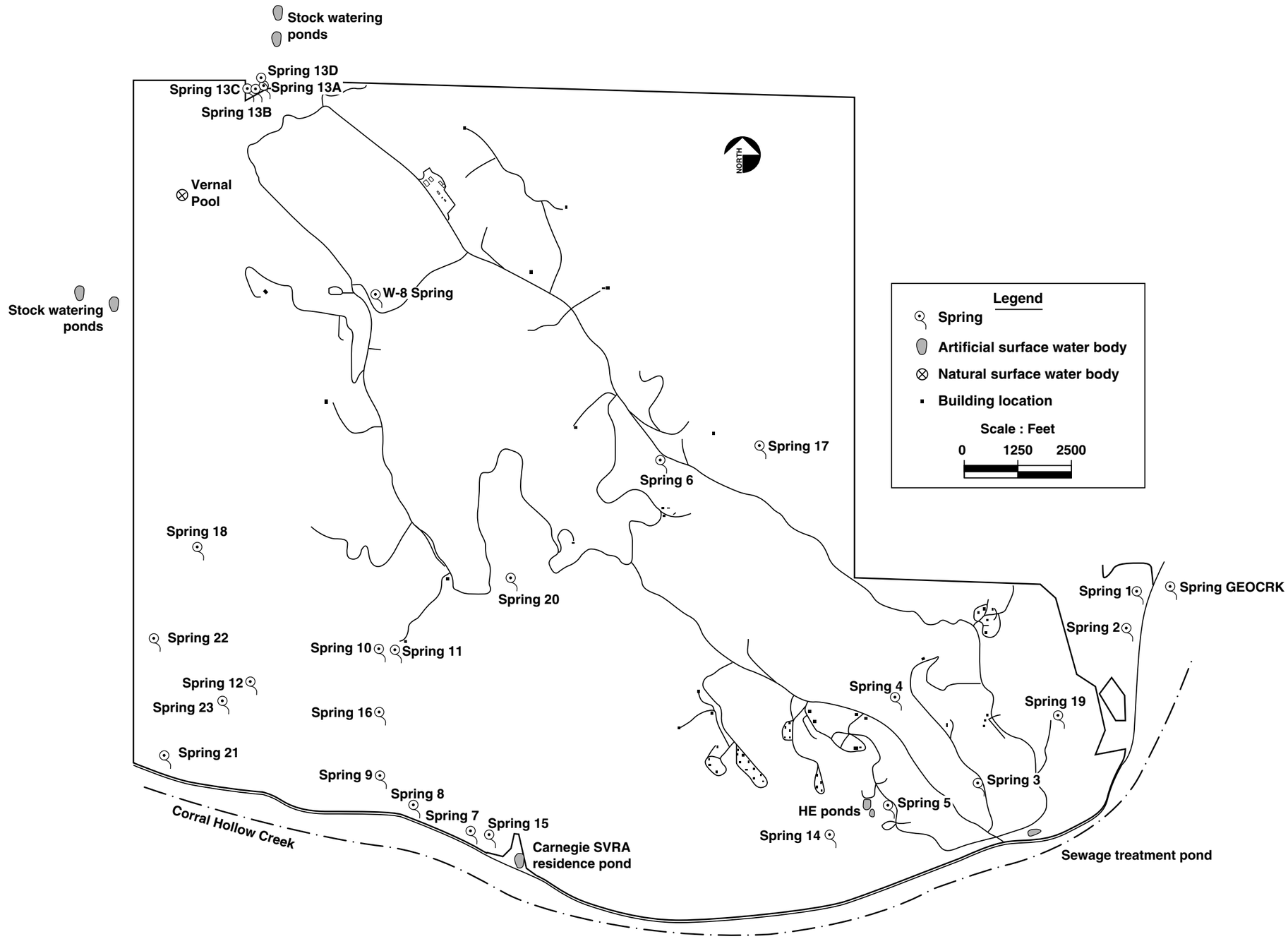

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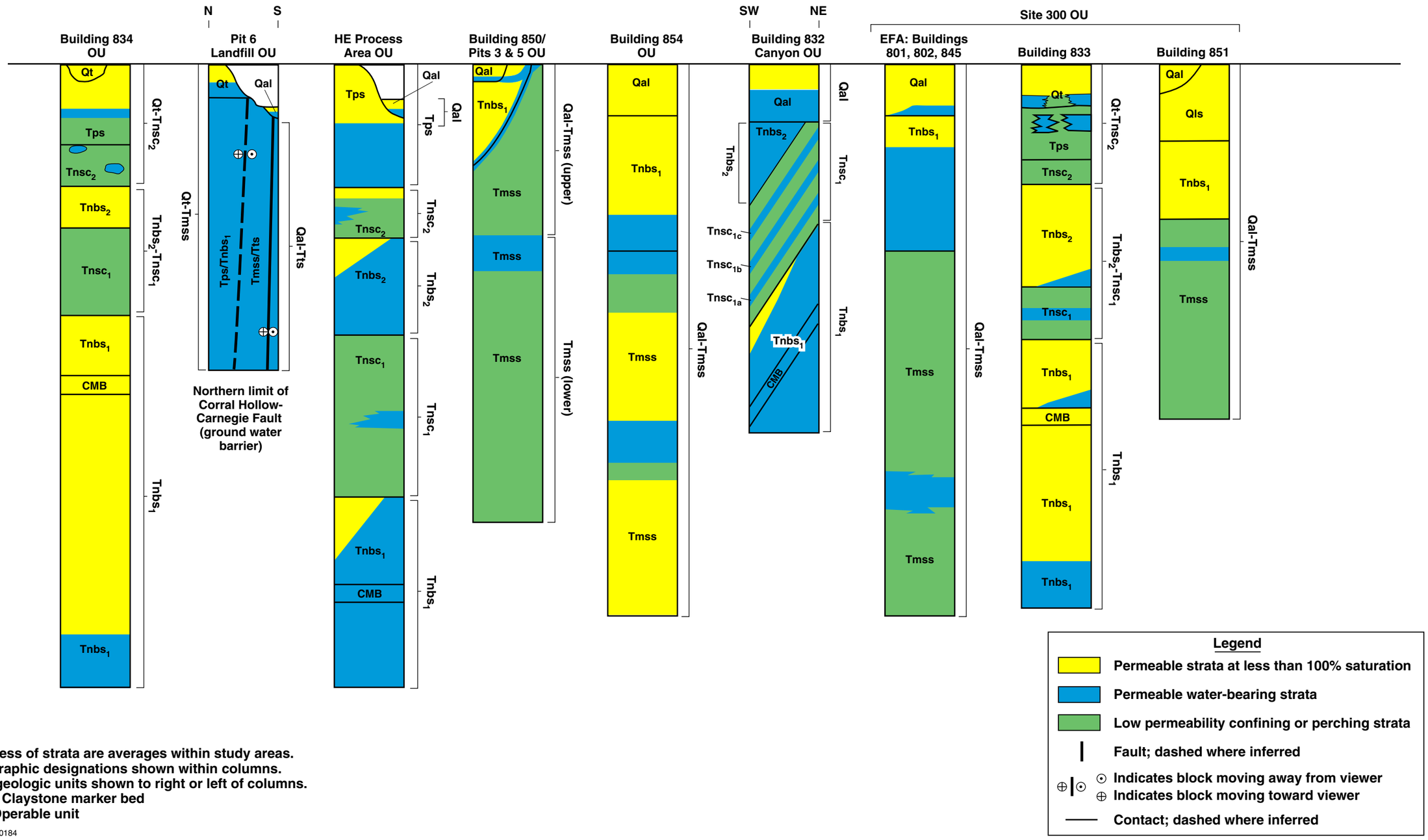
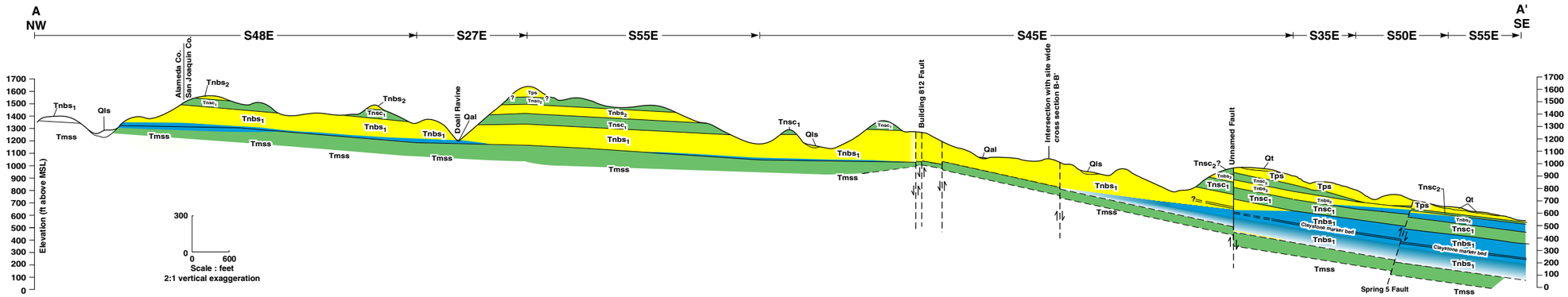
Figure 1-9. Springs and surface water body locations at Site 300.

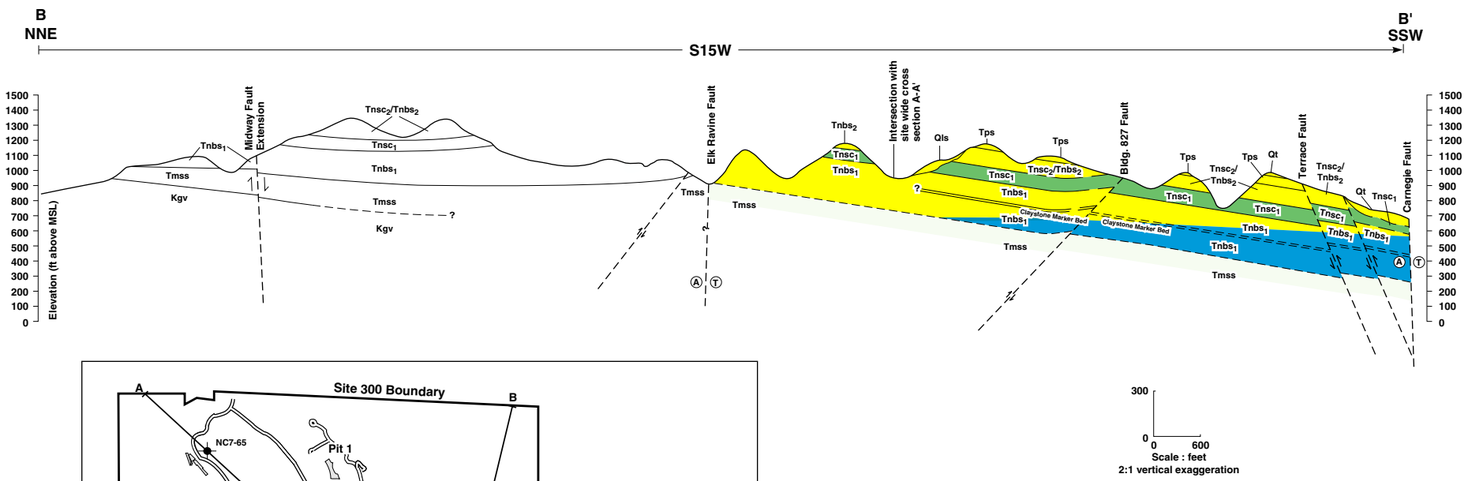


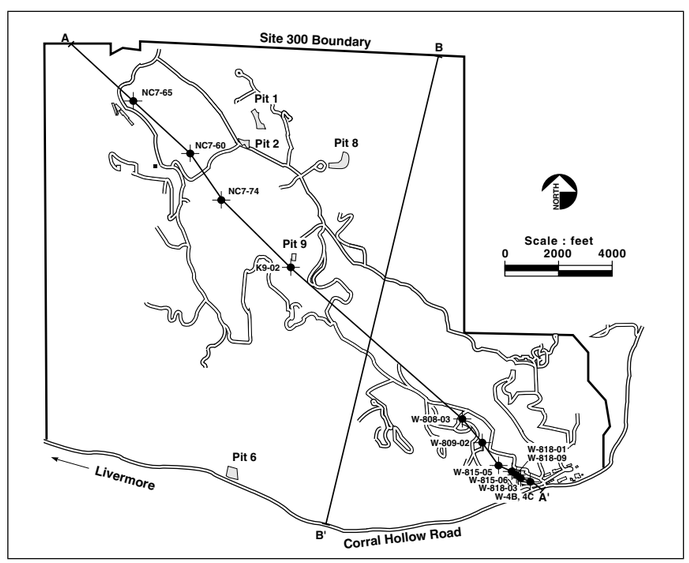
Notes:
Thickness of strata are averages within study areas.
Stratigraphic designations shown within columns.
Hydrogeologic units shown to right or left of columns.
CMB = Claystone marker bed
OU = Operable unit

ERD-S3R-98-0184

Figure 1-10. Stratigraphic and hydrogeologic units within the operable units (OUs) at Site 300.







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Legend

Lithologic Units

Quaternary Sediments

- **Qls** — Landslide deposits: Mixed soil and bedrock.
- **Qal** — Alluvium and Ravine Fill: Yellow brown, sandy silt, and silty sand with gravel lenses.
- **Qt** — Terrace Deposits: Franciscan source, pebble to boulder size gravel, locally overlain by sandy silt and clay, variably weathered and cemented.

unconformity

Tertiary Sedimentary Rocks

- **Tps** — Nonmarine tan and blue-green silty clay, with channel deposits of grey-brown sand and gravel.

local unconformity

Neroly Formation

- **$Tnsc_2$** — Upper Claystone: Interbedded poor to moderately lithified gray to light brown silty claystone, siltstone, and very fine grained silty sandstone. The $Tnsc_2$ unit is defined in the subsurface only.
- **$Tnbs_2$** — Upper Blue Sandstone: Fine-grained, blue-gray silty sandstone, locally medium to coarse-grained with pebble lenses and claystone rip-up clasts.
- **$Tnsc_2/Tnbs_2$** — Combined $Tnsc_2$ and $Tnbs_2$ unit
- **$Tnsc_1$** — Middle Claystone: Interbedded well lithified gray to light brown silty claystone, siltstone, and very fine-grained silty sandstone.
- **$Tnbs_1$** — Lower Blue Sandstone: Very fine to coarse-grained, blue-gray sandstone, locally grades to sandy siltstone and conglomerate. Includes claystone marker bed (CMB).

local unconformity

- **Tmss** — Cierbo Formation: Continental and shallow marine sedimentary rocks. Interbedded light yellow-brown, friable, quartz and mica rich sandstone and gray claystone.

unconformity

- **Kgv** — Great Valley Sequence: Marine sediments consisting of interbedded yellow-brown sandstone and gray shale.

Quaternary — Pilo-Pleistocene — Miocene — Upper Cretaceous

Color Legend

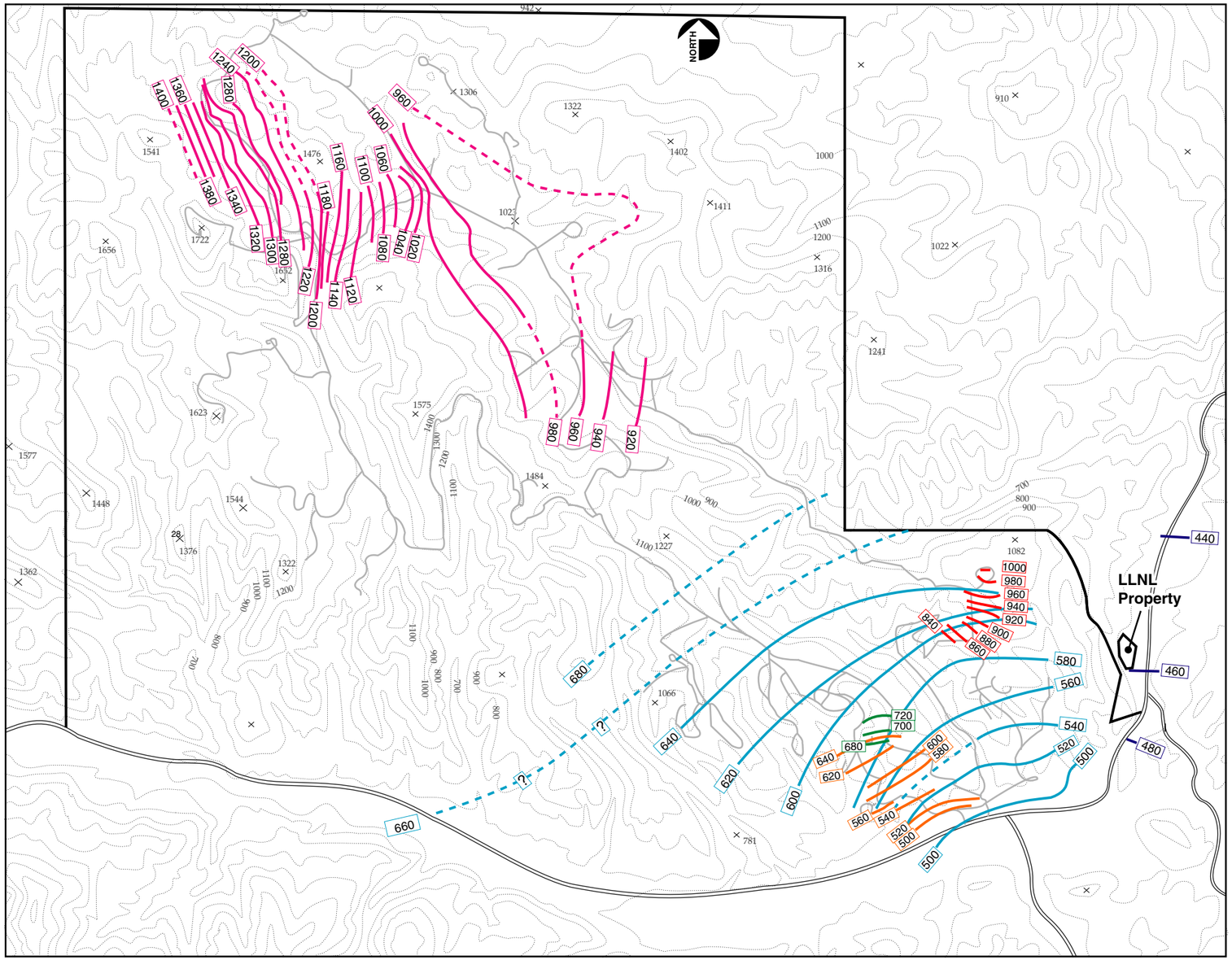
- Unsaturated permeable units
- Saturated permeable units
- Confining or perching strata
- Insufficient data to determine saturation condition

Geologic Symbols

? — — — Contact between lithologic units
- Solid: Contact exposed
- Dashed: Approximate
- Queried: Inferred

Fault, sense of motion shown where known.
- Solid: Fault exposed
- Dashed: Approximate
- Queried: Inferred
- A: Away
- T: Toward

Figure 1-11. Site-wide hydrogeologic cross sections A-A' and B-B'.



Legend

Qal-Tmss Unit (Northwest Site 300)

Contours include data from wells completed in the Doall Ravine alluvium, and from some wells completed in bedrock, primarily the Neroly Formation lower blue sandstone ($Tnbs_1$) and the Cierbo Formation (Tmss), which is in direct contact with the alluvium. The $Tnbs_1$ does not appear to be continuously saturated between the northern and southern parts of the site.

Tps Unit (Building 834)

Contours based on data from shallow wells completed in the perched water-bearing zone within the Pliocene nonmarine unit (Tps).

Tps Unit (HE Process Area)

Potentiometric surface contours are based on water levels measured in ground water monitor wells completed in the Pliocene nonmarine unit (Tps). Ground water in the Tps unit is perched in the northern part of the HE Process Area.

$Tnbs_2$ Unit (HE Process Area)

Data contoured are from wells completed in the Neroly Formation upper blue sandstone ($Tnbs_2$) unit. The $Tnbs_2$ aquifer is saturated in the HE Process Area in southeastern Site 300. Hydraulic conditions range from unconfined in the northern HE Process Area to flowing artesian near the southern site boundary. This unit serves as a local offsite water-supply aquifer.

$Tnbs_1$ Unit (Southern Site 300)

Contours based on data from wells completed in the Neroly Formation lower blue sandstone ($Tnbs_1$) unit. The $Tnbs_1$ unit is unsaturated in the central portion of the site. Ground water in the $Tnbs_1$ is under flowing artesian conditions near the southern site boundary. This unit is a water-supply aquifer.

Ground water potentiometric surface elevation contours in feet above mean sea level, dashed were approximately located and queried where uncertain.

Notes:

1) Ground water elevation data from December 1991.
2) Potentiometric contours shown on this plate are taken from figures presented in the hydrogeology sections of Chapters 9–14 in the SWRI report (Webster-Scholten, 1994). Wells and water level data used to generate potentiometric contours are included in those sections.

Feet: 0, 2000, 4000, 6000

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Figure 1-12. Potentiometric surface elevation map of major water-bearing units at Site 300.

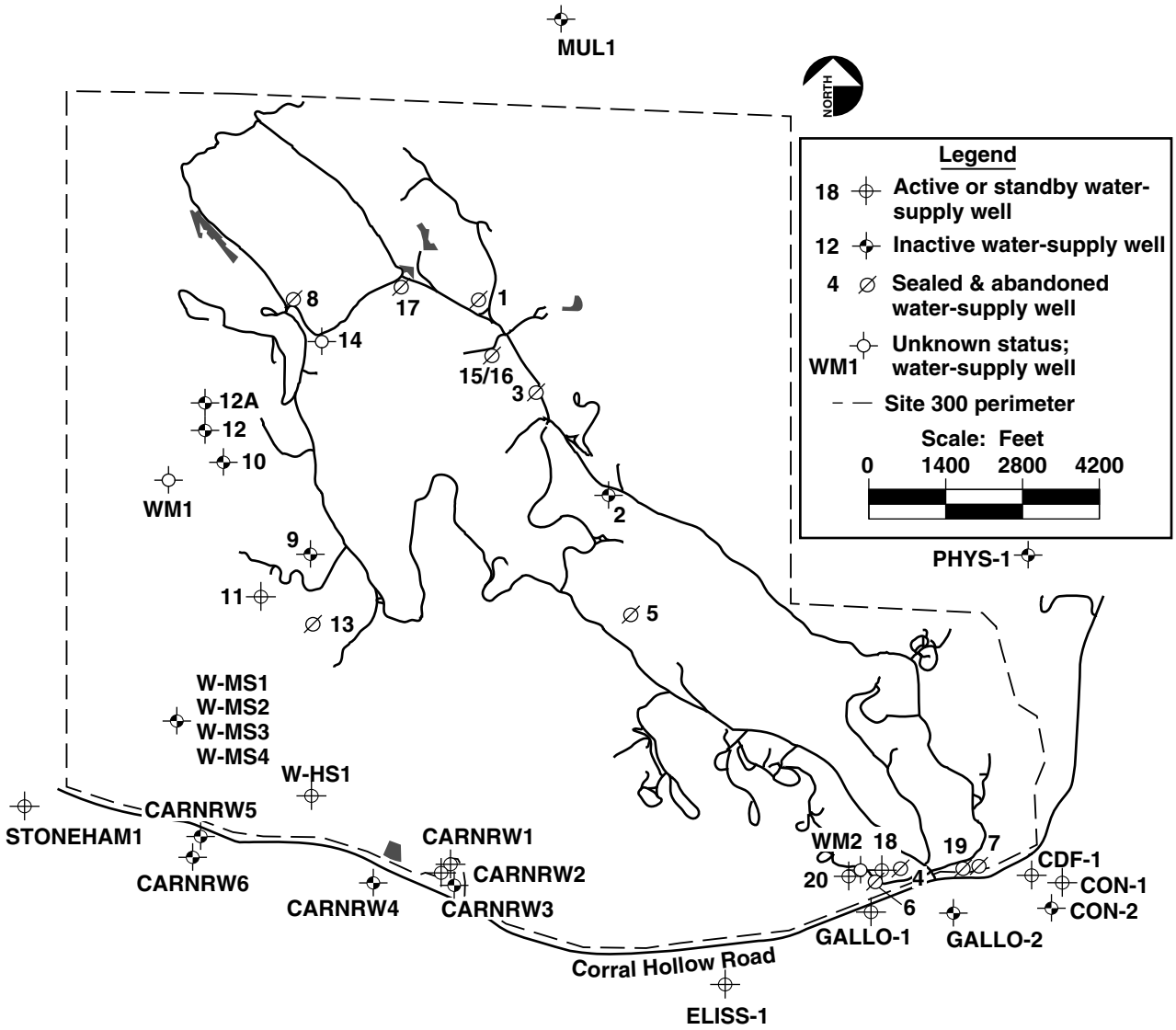

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Figure 1-13. Water-supply wells at and within 0.5 mi of Site 300.

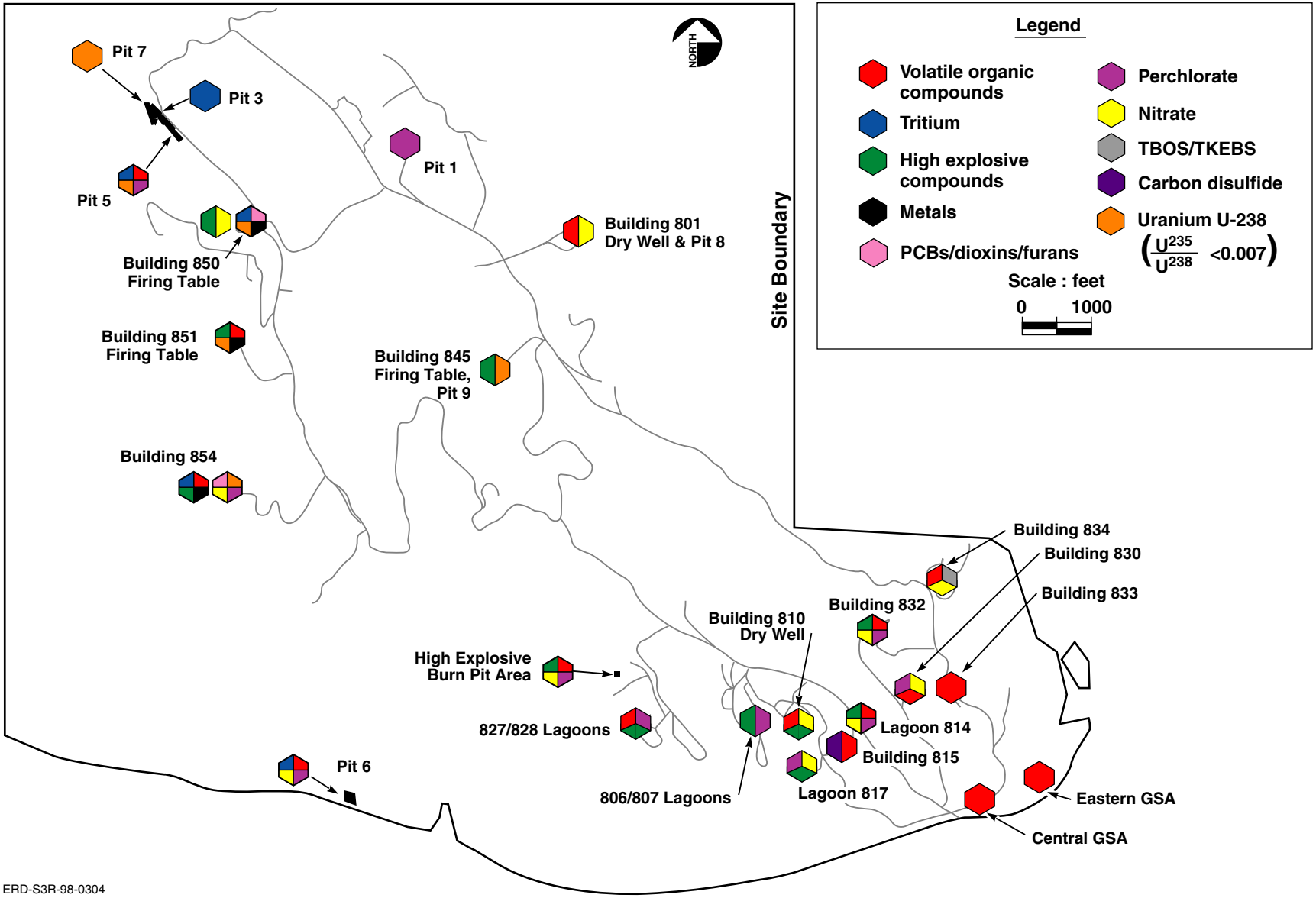


Figure 1-14. Contaminants of concern at LLNL Site 300.

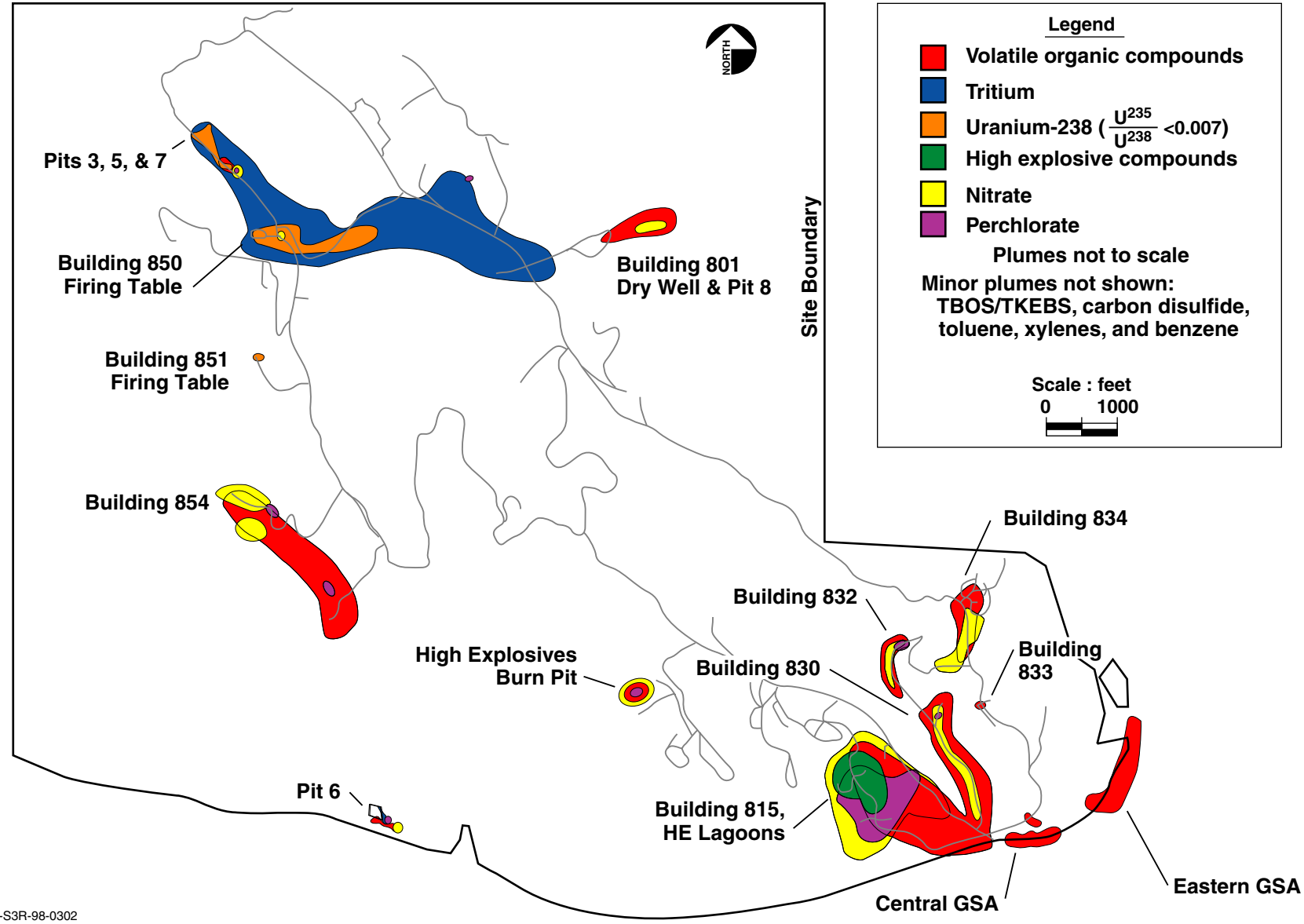


Figure 1-15. Extent of ground water contamination at LLNL Site 300.

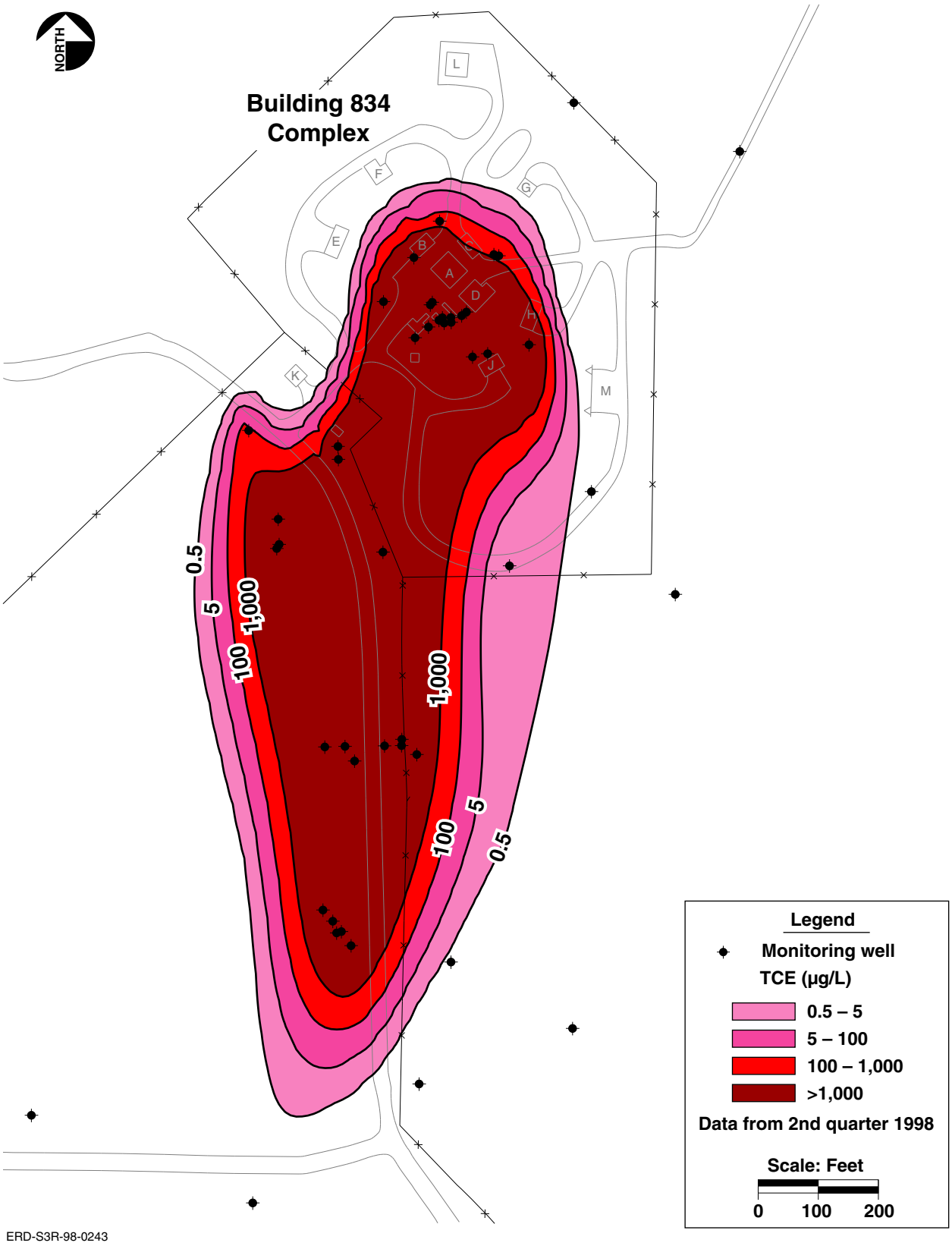


Figure 1-16. Distribution of TCE in ground water in the Building 834 area, OU2.

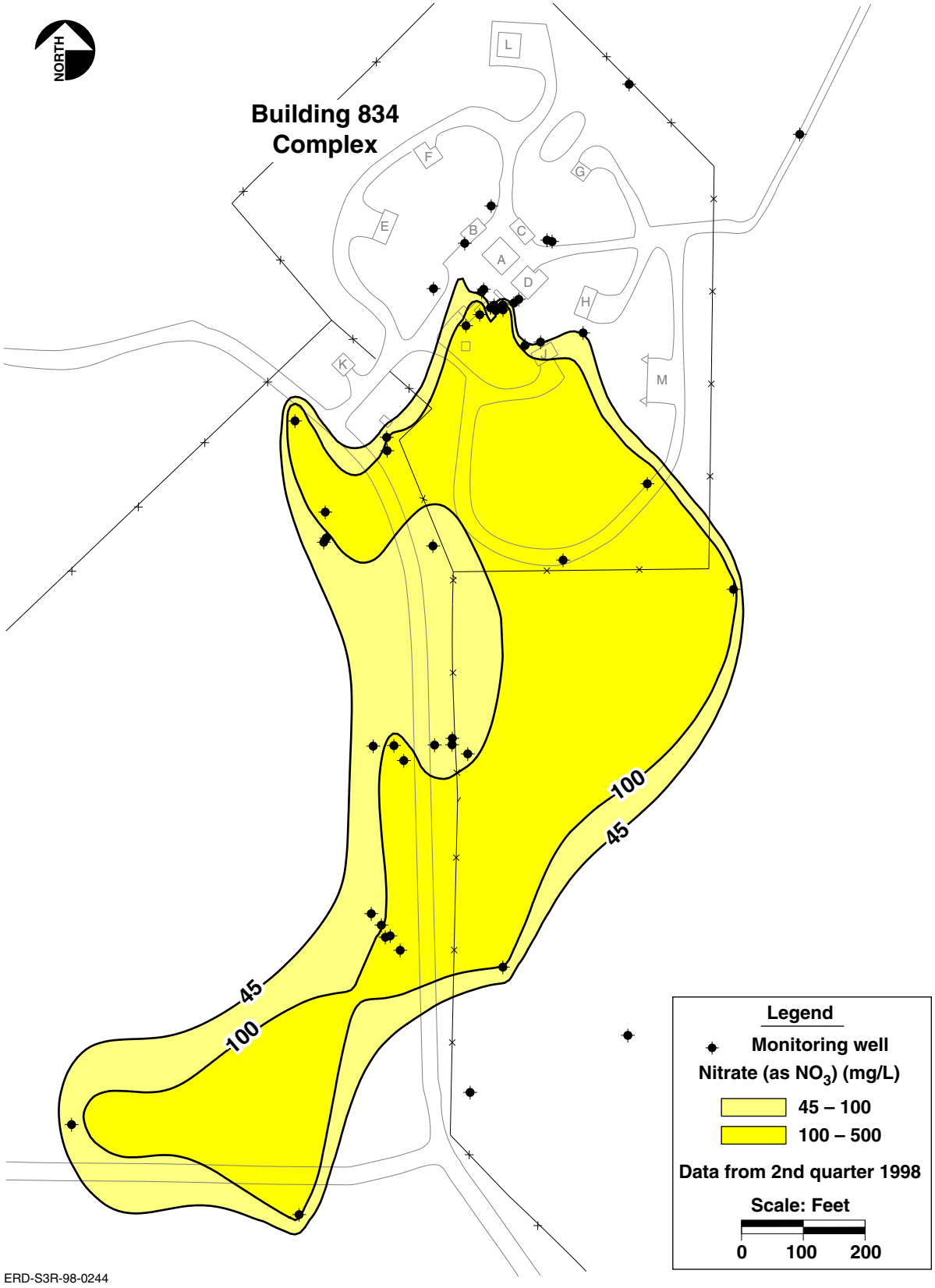


Figure 1-17. Distribution of nitrate in ground water in the Building 834 area, OU2.

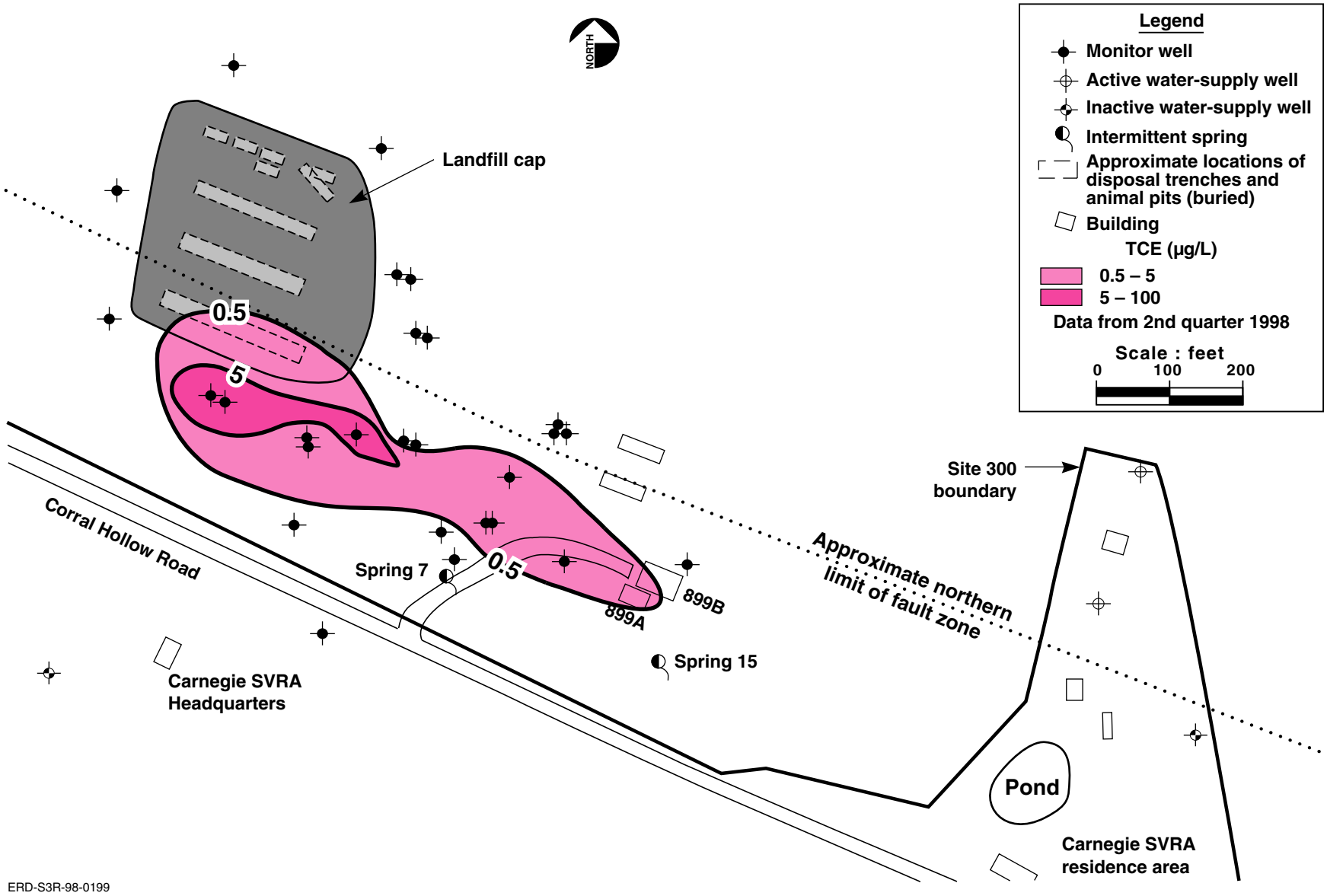


Figure 1-18. Distribution of TCE in ground water in the Pit 6 area, OU3.

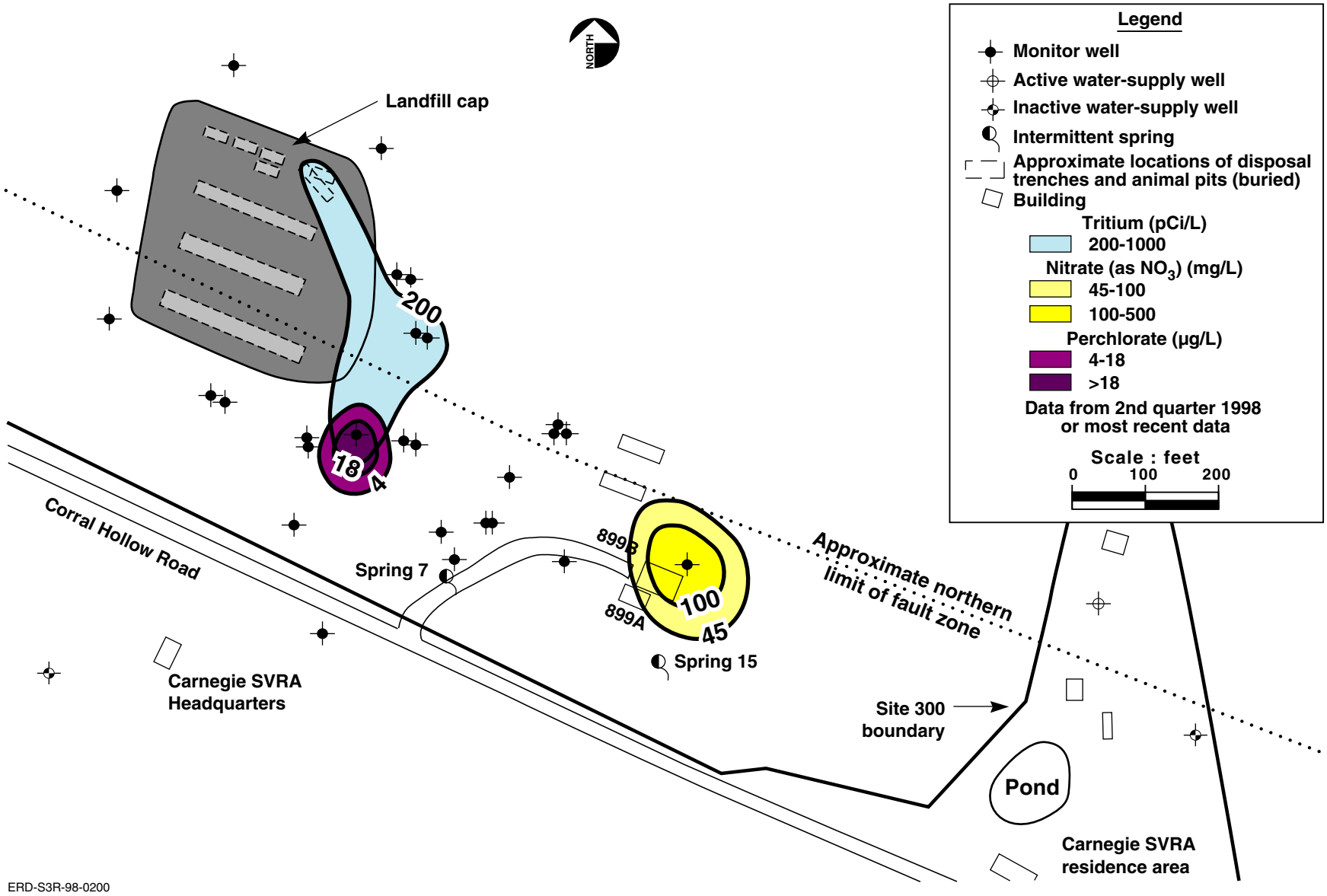
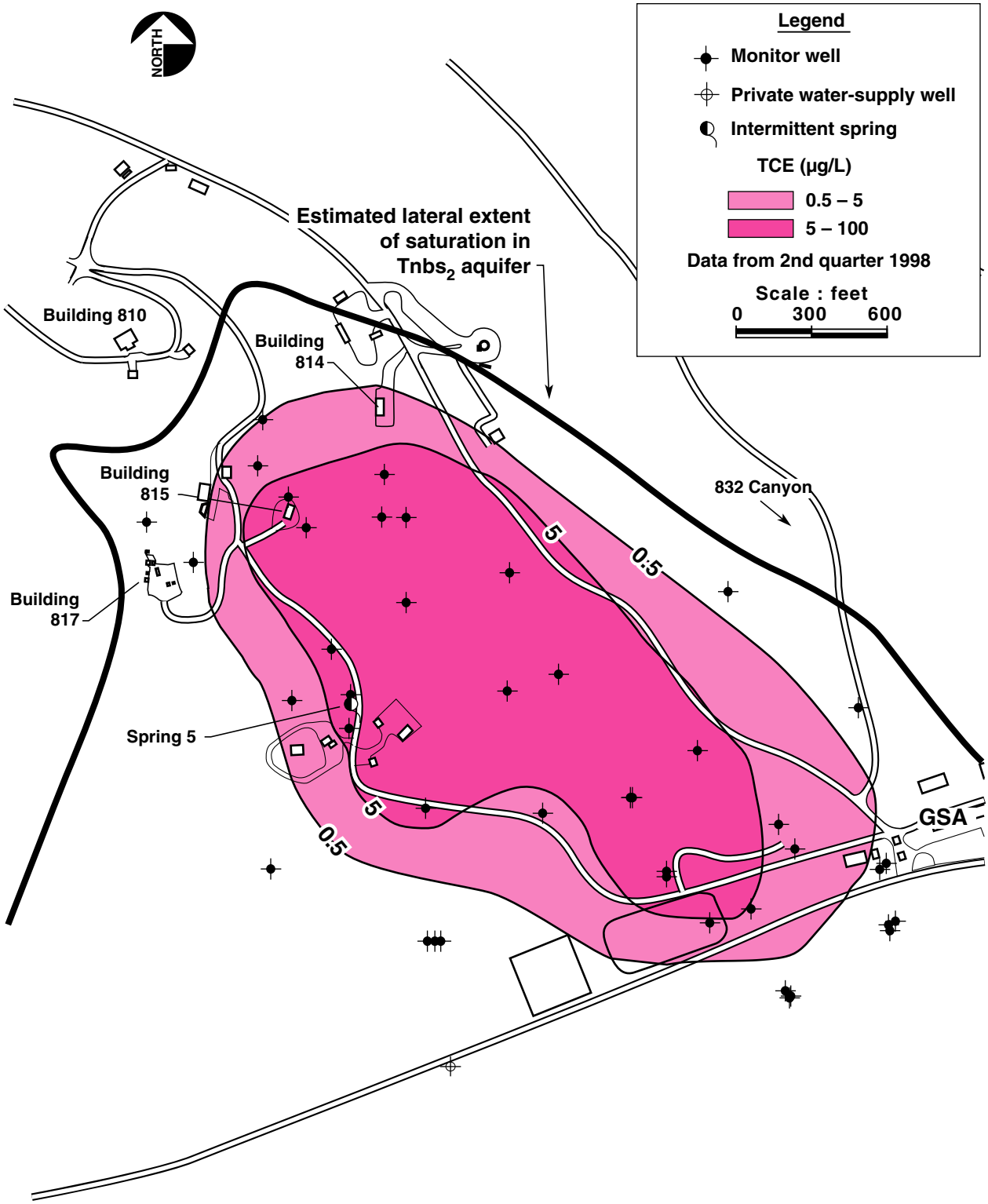
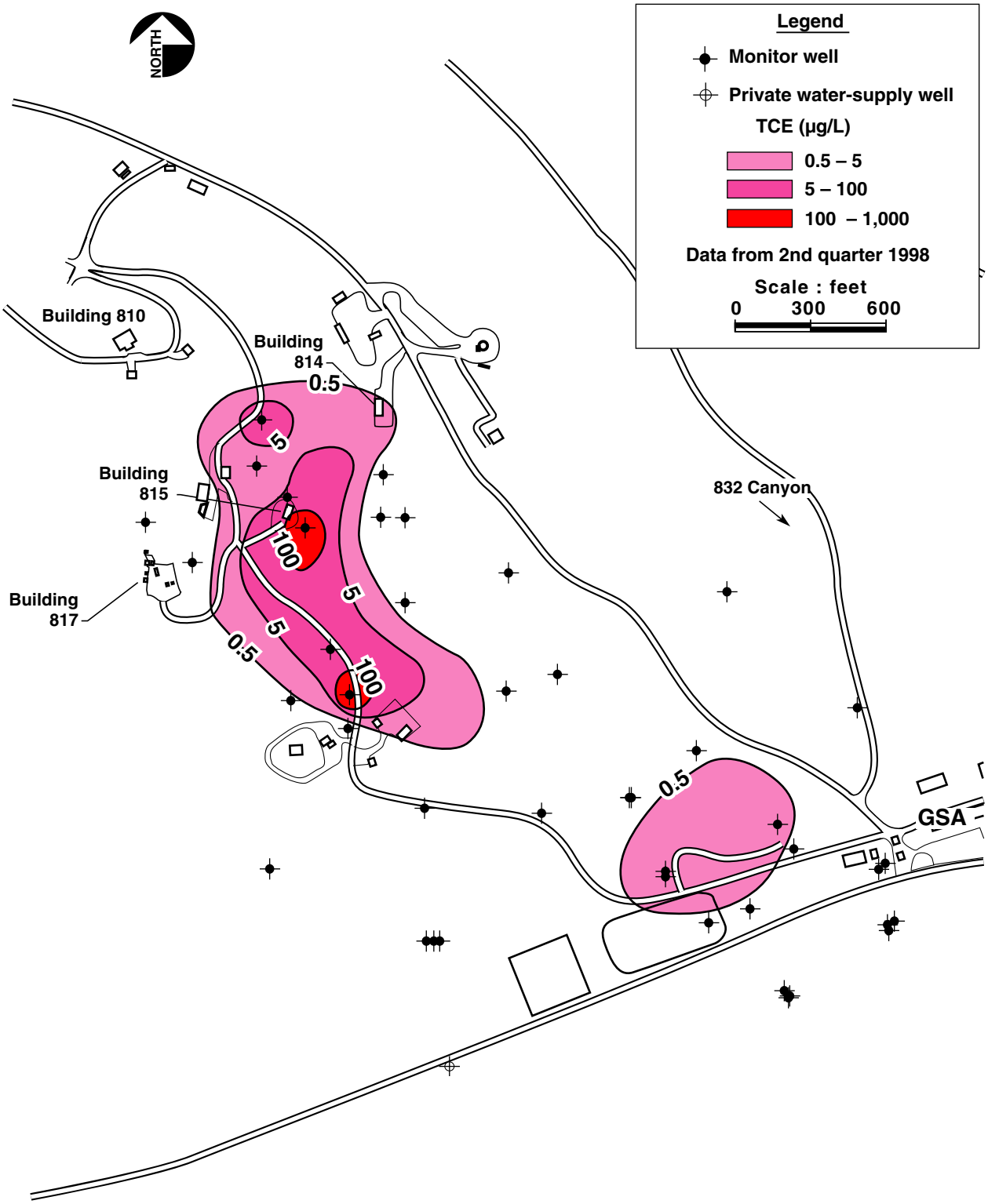


Figure 1-19. Distribution of tritium, nitrate, and perchlorate in ground water in the Pit 6 area, OU3.



ERD-S3R-98-0245

Figure 1-20. Distribution of TCE in the $Tnbs_2$ aquifer in the HE Process Area, OU4.



ERD-S3R-98-0284

Figure 1-21. Distribution of TCE in the Tps aquifer in the HE Process Area, OU4.

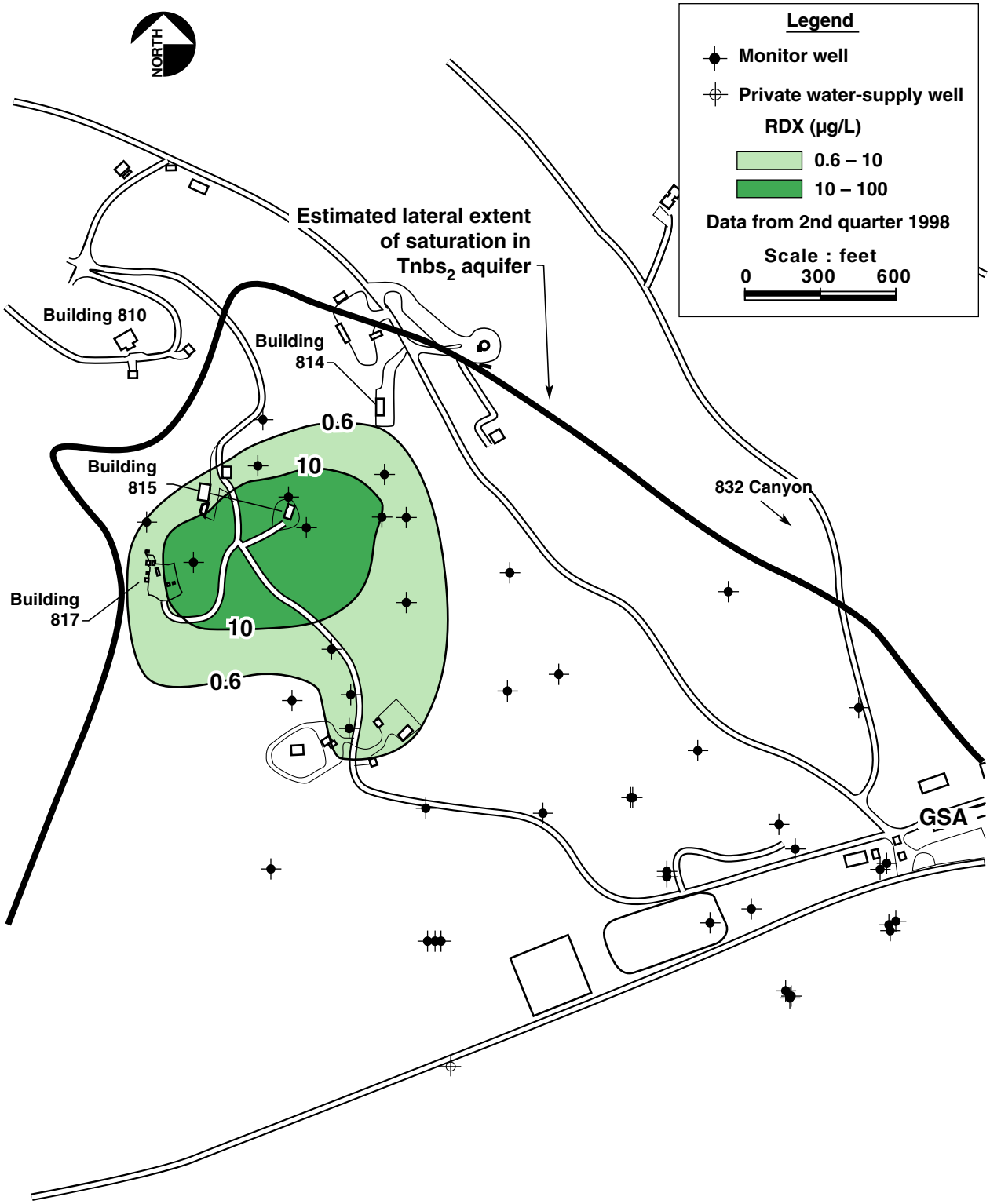


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Figure 1-22. Distribution of RDX in the $Tnbs_2$ aquifer in the HE Process Area, OU4.

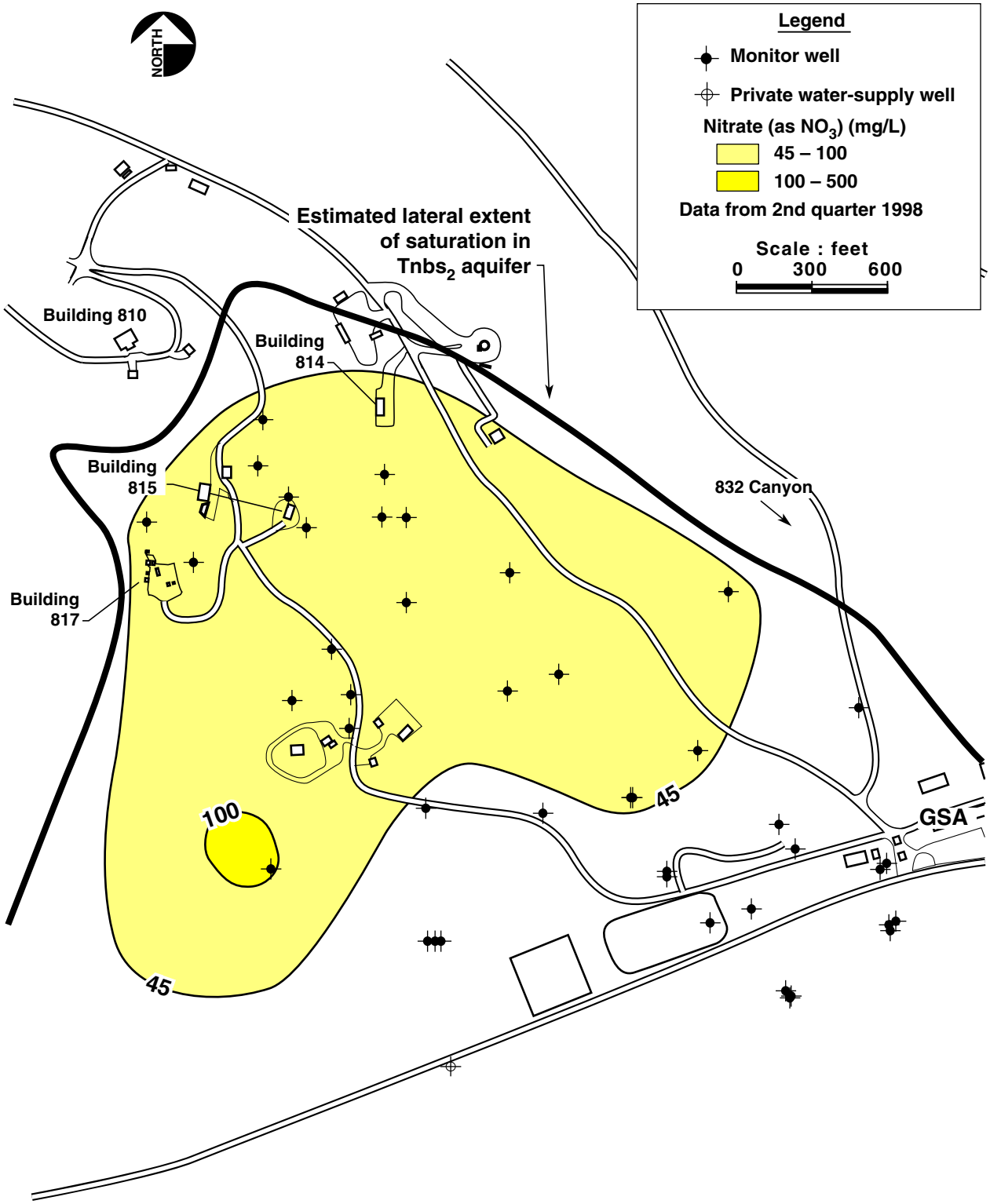

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Figure 1-23. Distribution of nitrate in the $Tnbs_2$ aquifer in the HE Process Area, OU4.

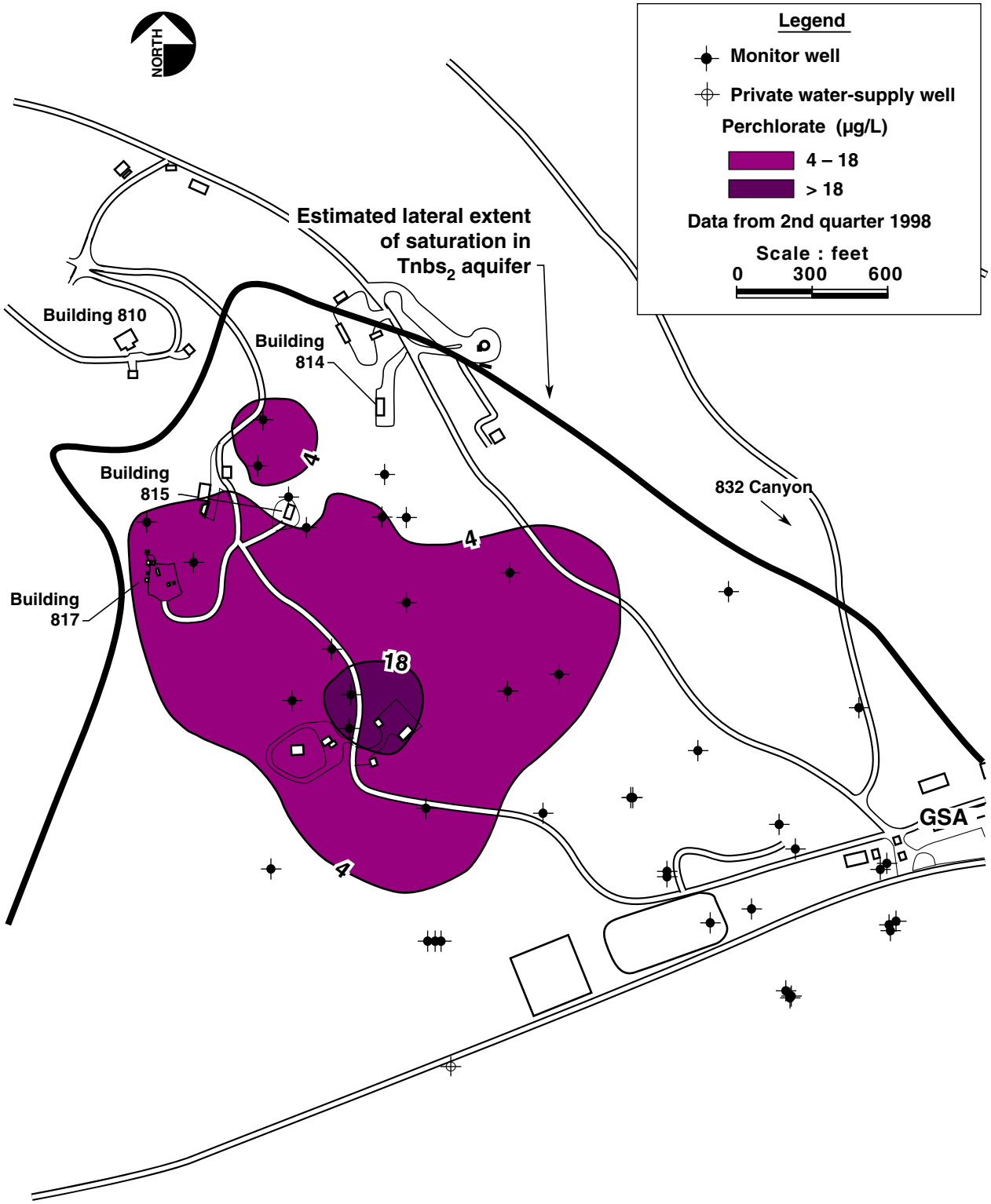

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Figure 1-24. Distribution of perchlorate in the $Tnbs_2$ aquifer in the HE Process Area, OU4.

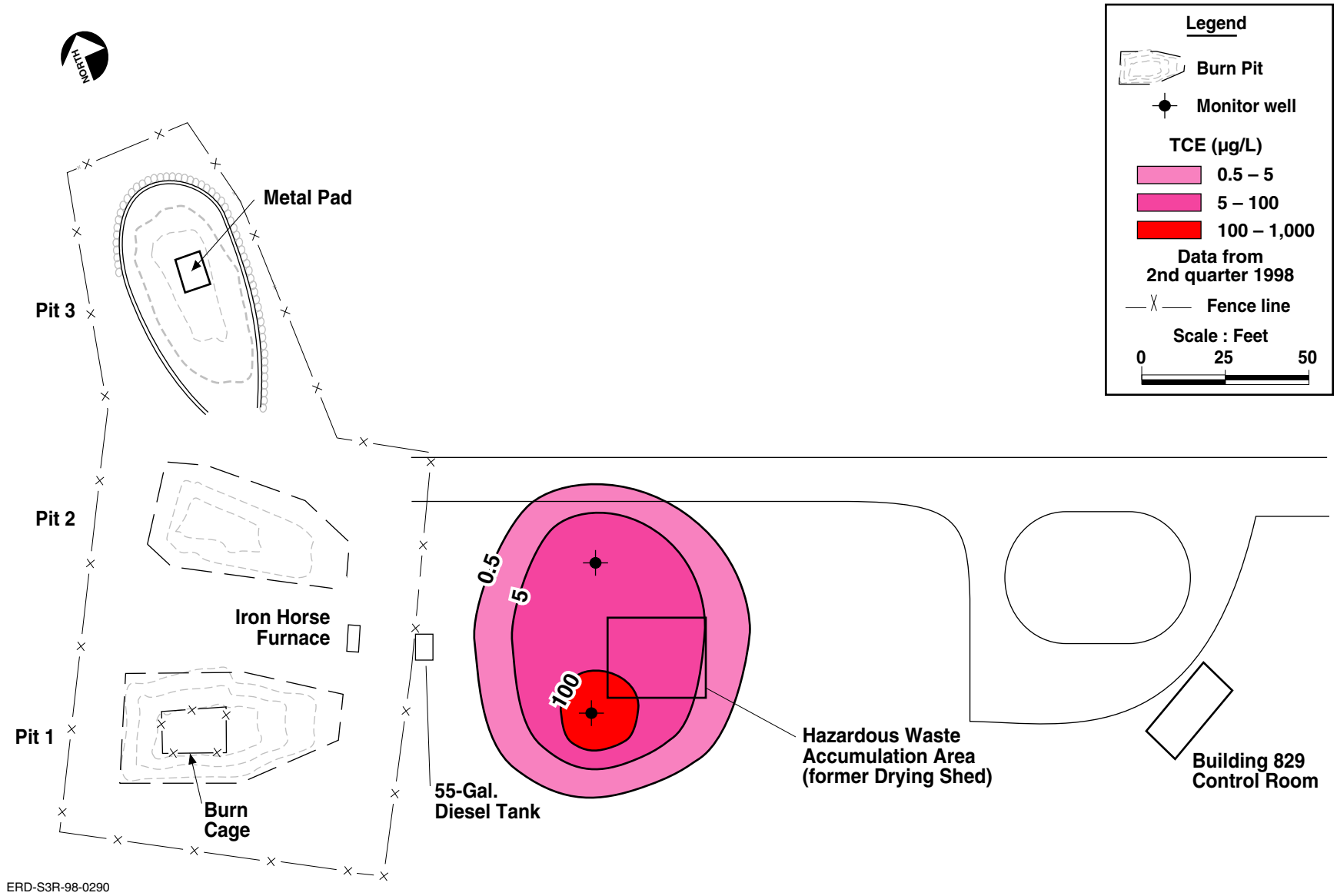


Figure 1-25. Distribution of TCE in ground water in the HE Burn Pit portion of the HE Process Area, OU4.

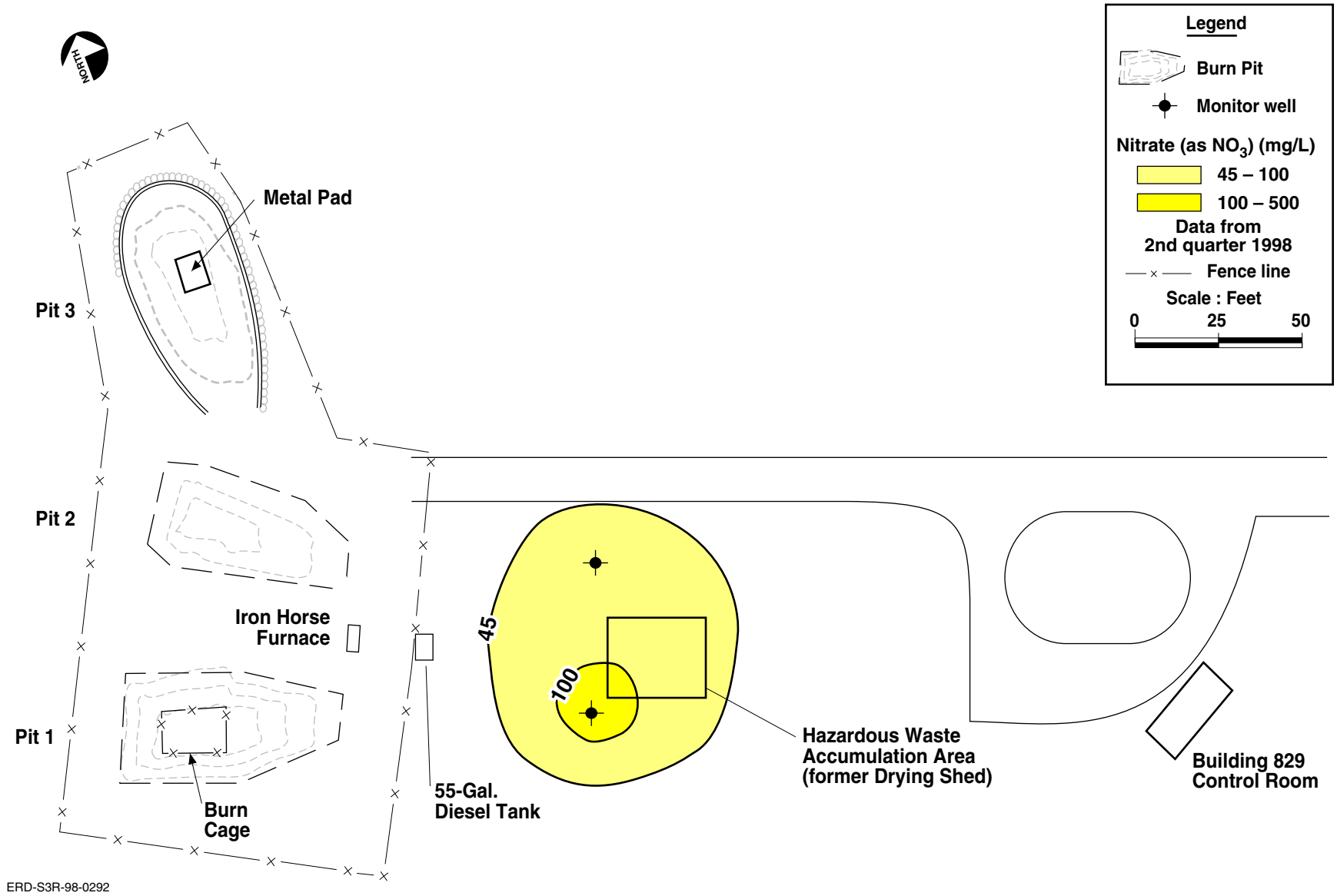


Figure 1-26. Distribution of nitrate in ground water in the HE Burn Pit portion of the HE Process Area, OU4.

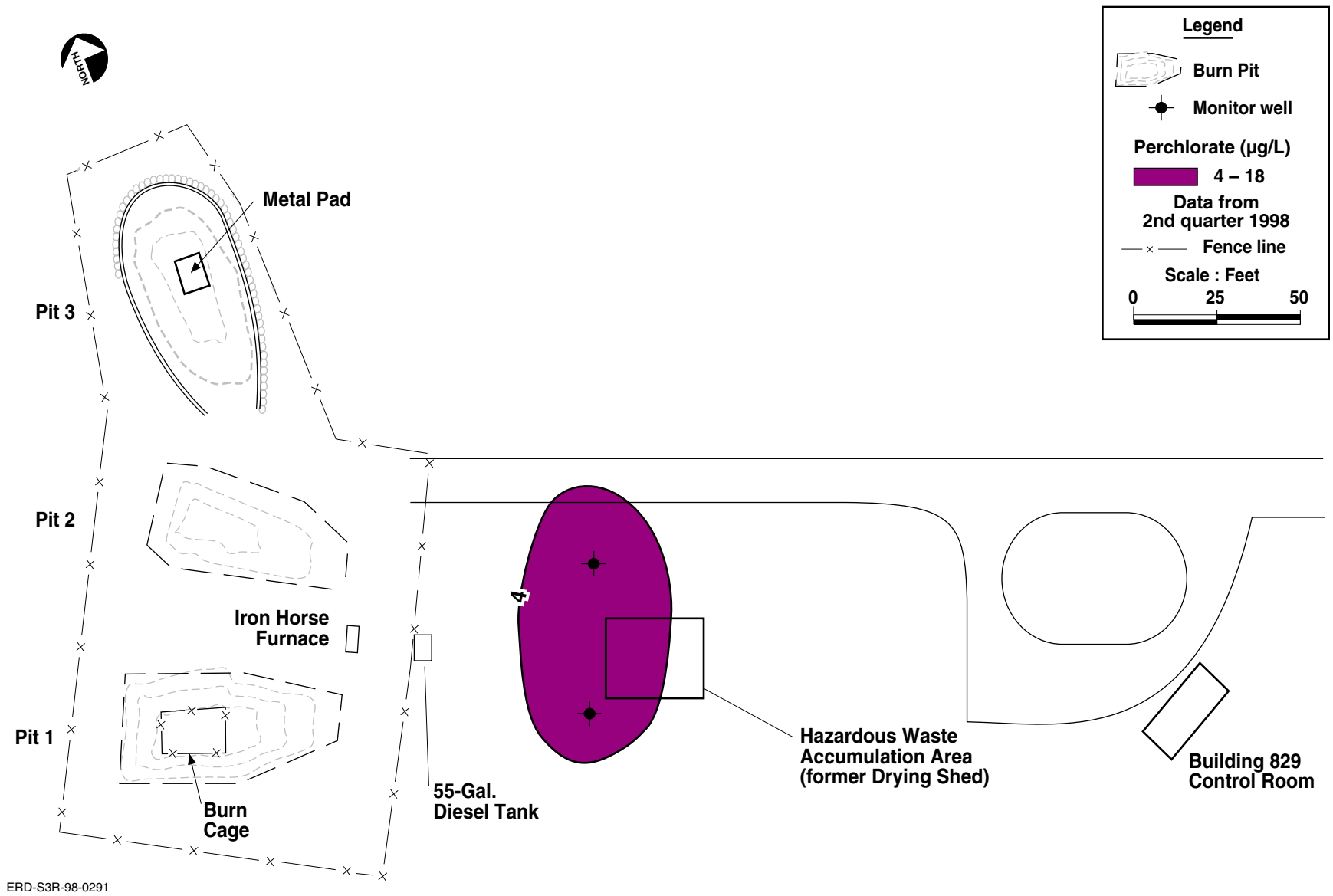
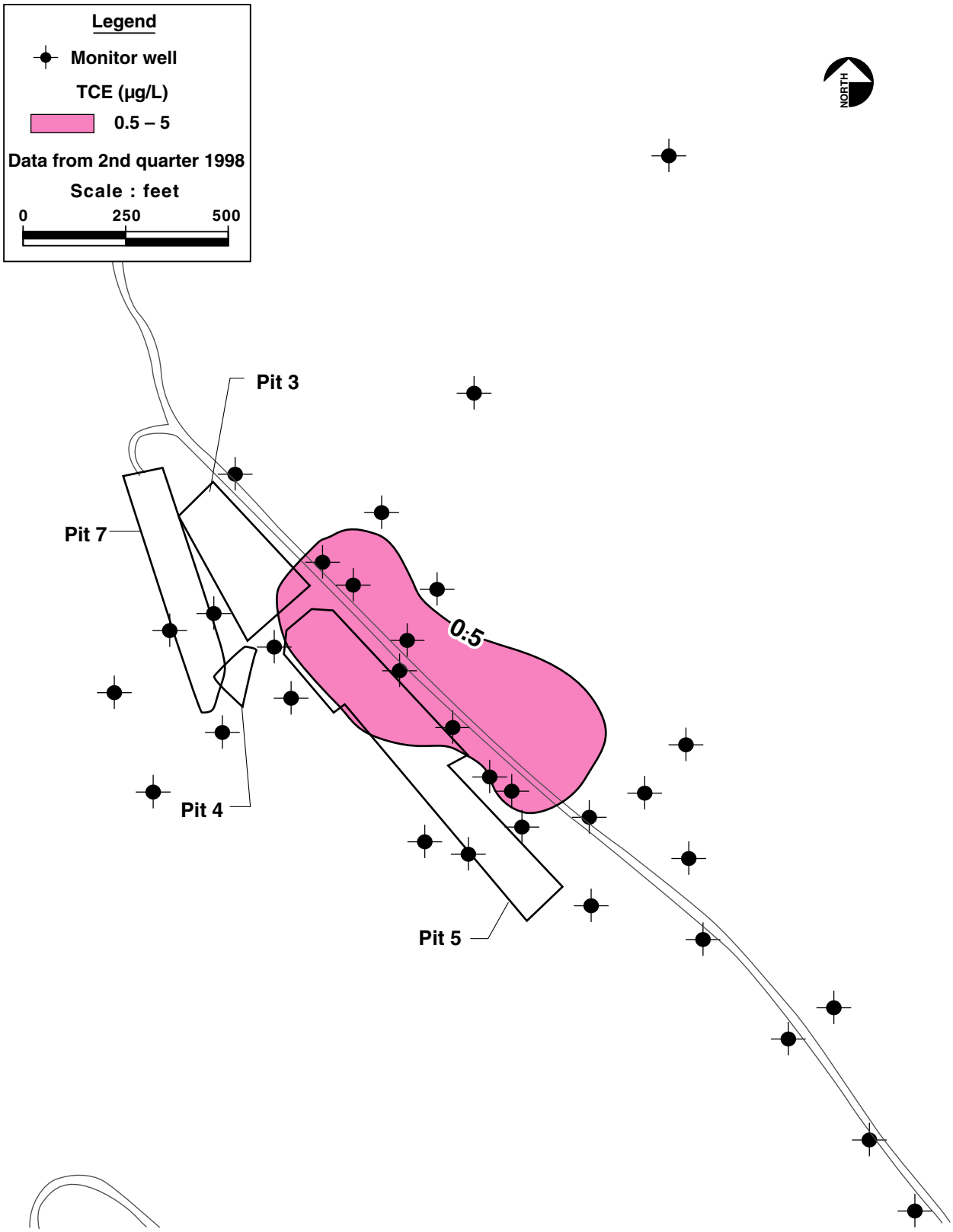
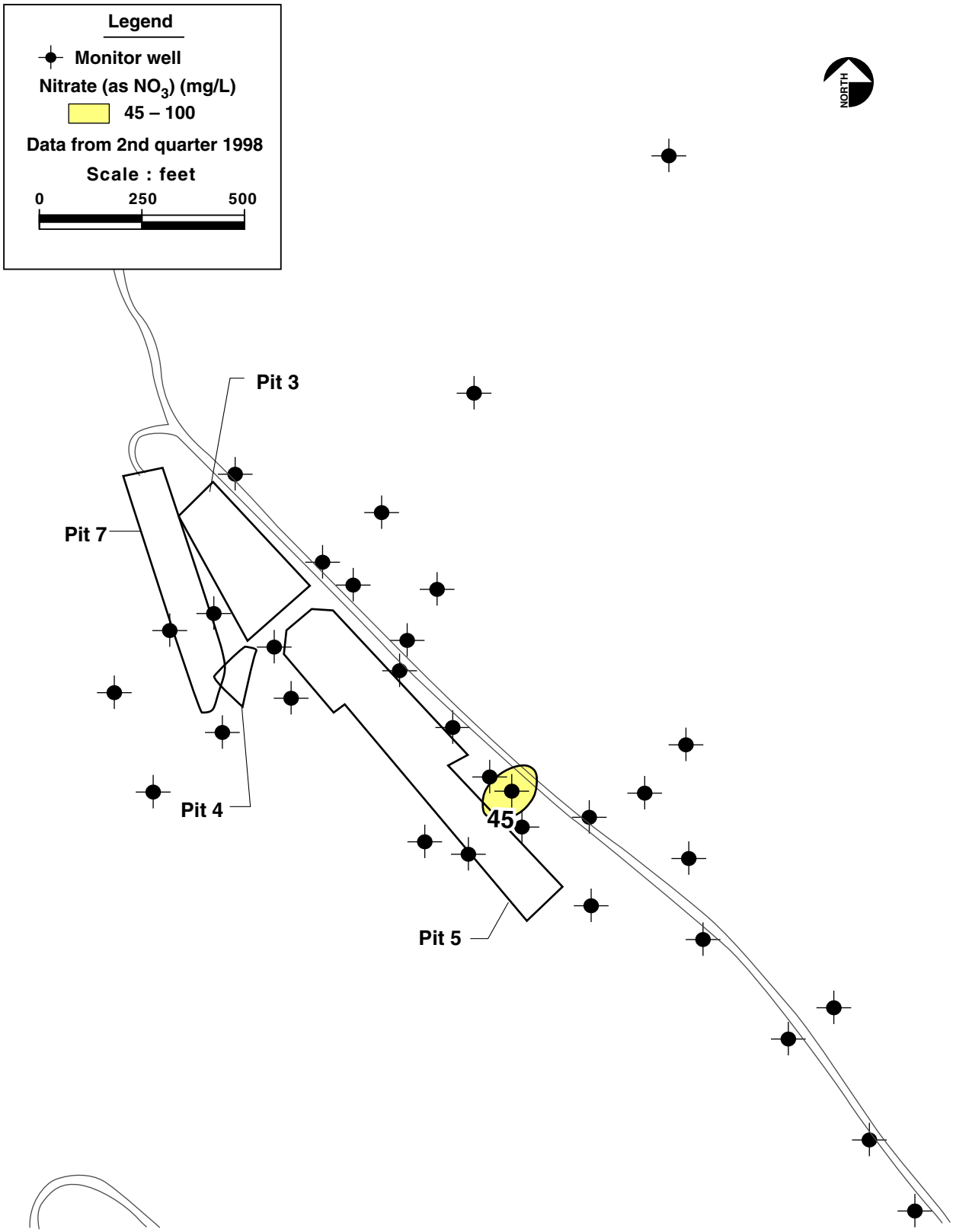


Figure 1-27. Distribution of perchlorate in ground water in the HE Burn Pit portion of the HE Process Area, OU4.



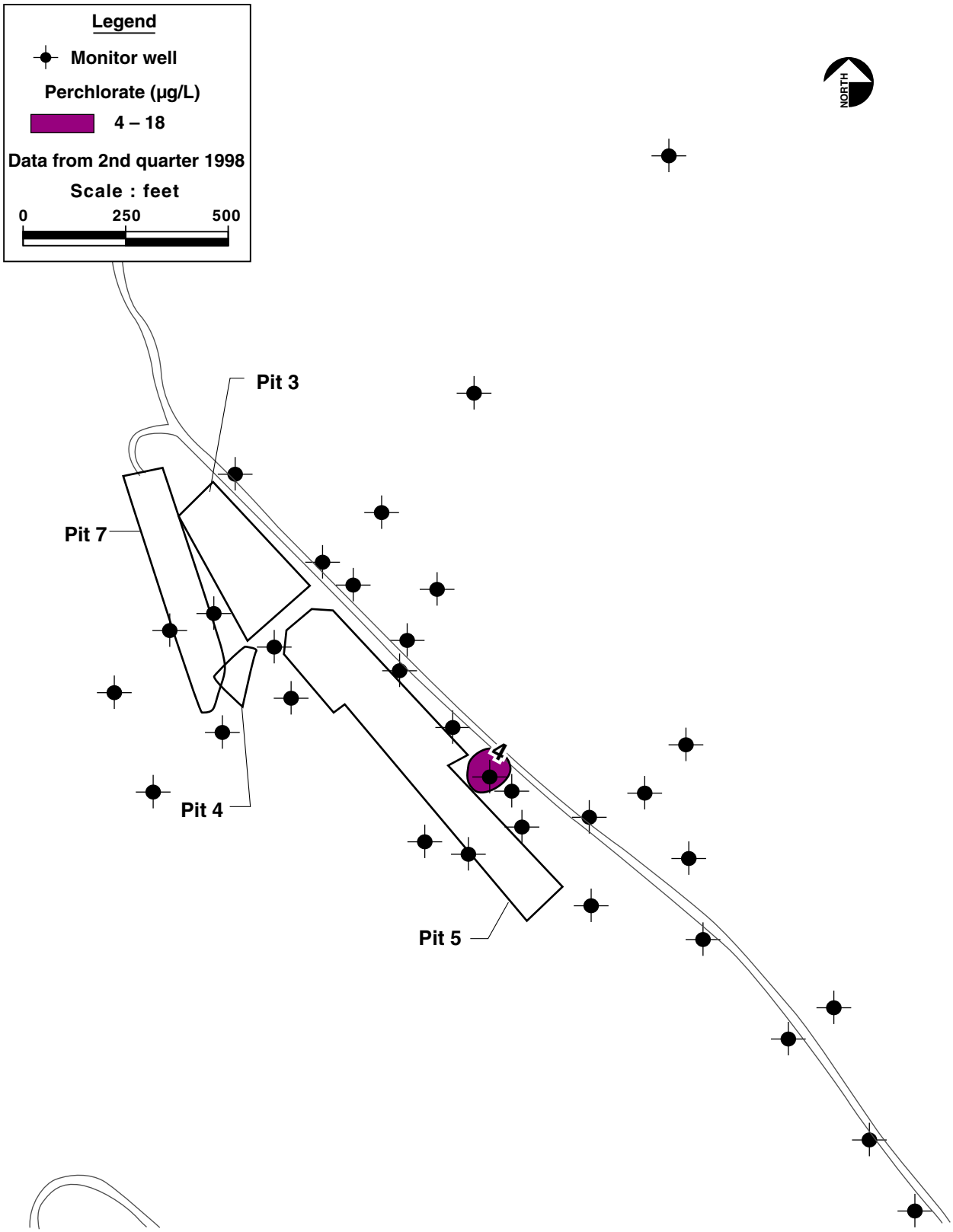
ERD-S3R-98-0249

Figure 1-28. Distribution of TCE in ground water in the Pits 3 and 5 area, OU5.



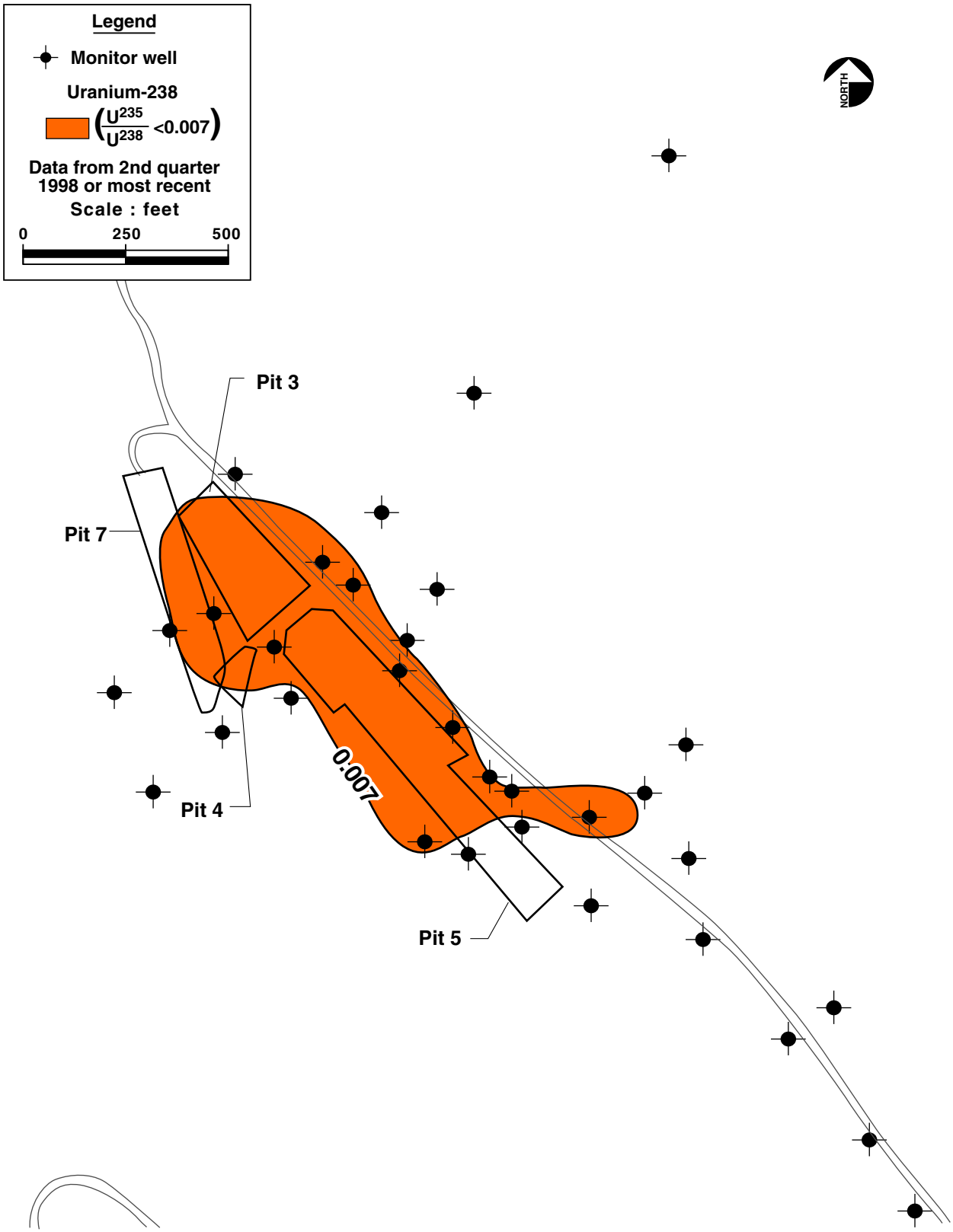
ERD-S3R-98-0283

Figure 1-29. Distribution of nitrate in ground water in the Pits 3 and 5 area, OU5.



ERD-S3R-98-0282

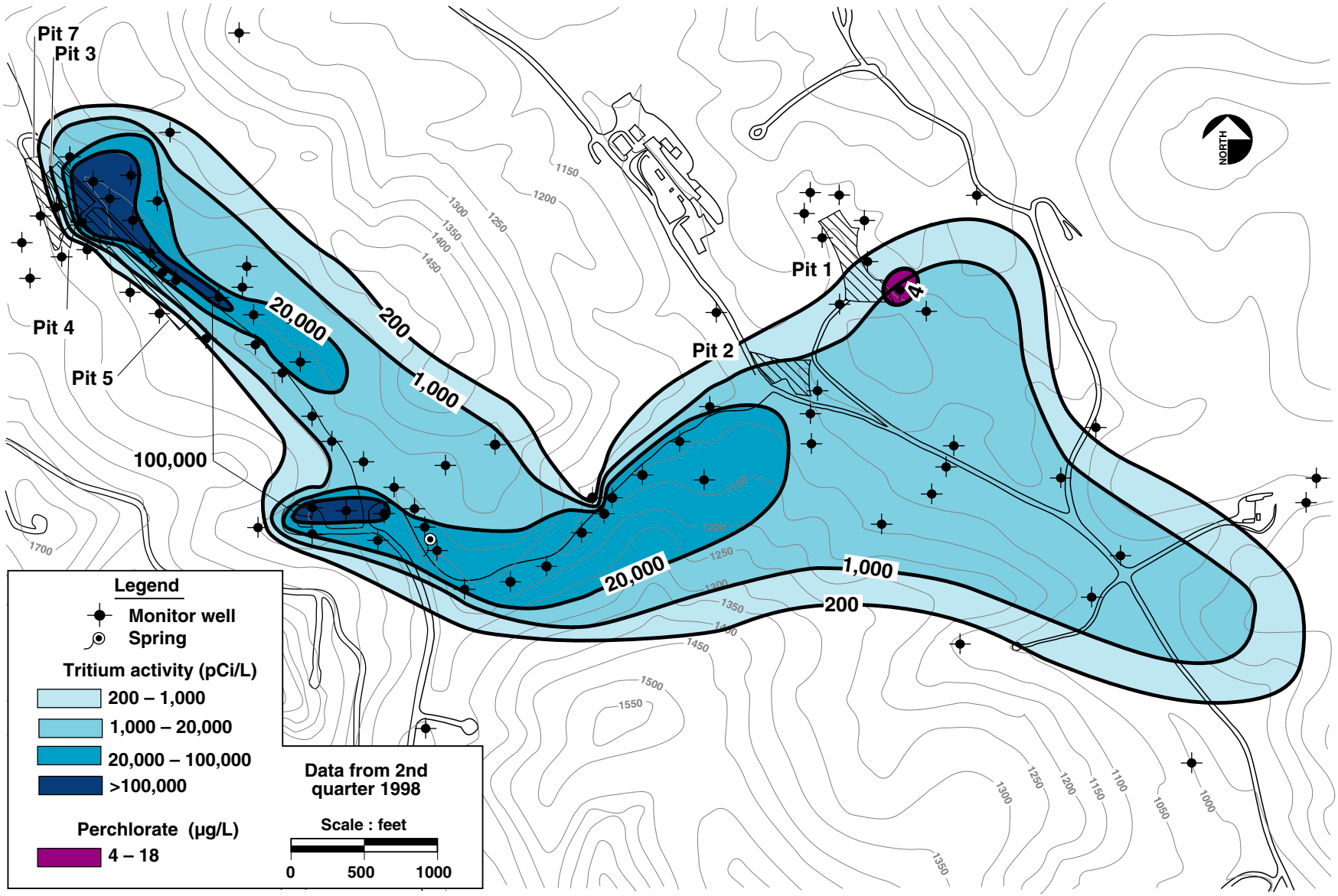
Figure 1-30. Distribution of perchlorate in ground water in the Pits 3 and 5 area, OU5.



ERD-S3R-98-0250

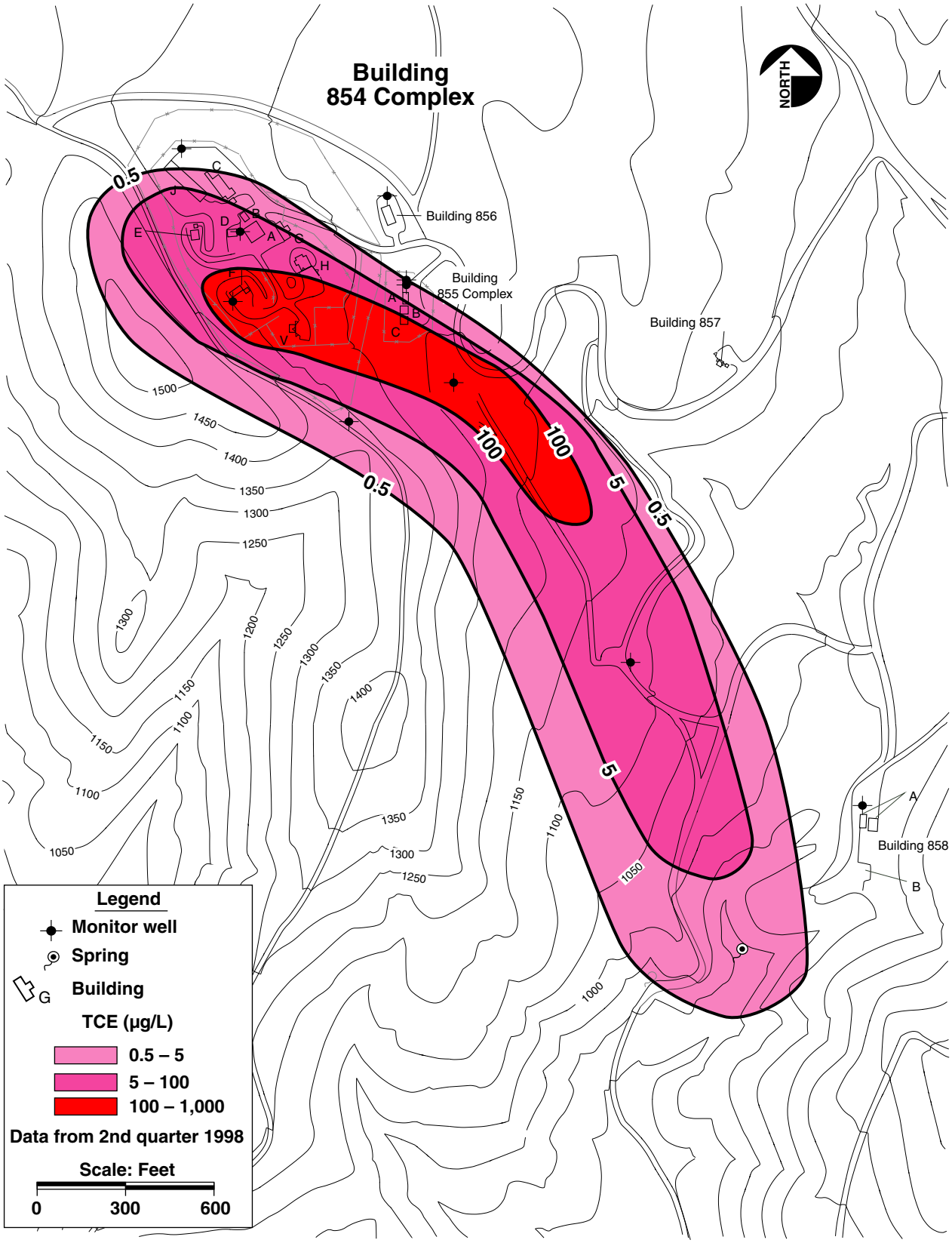
Figure 1-31. Distribution of uranium-238 in ground water in the Pits 3 and 5 area, OU5.

Figure 1-32. Distribution of uranium-238 and nitrate in ground water in the Building 850 area, OU5.



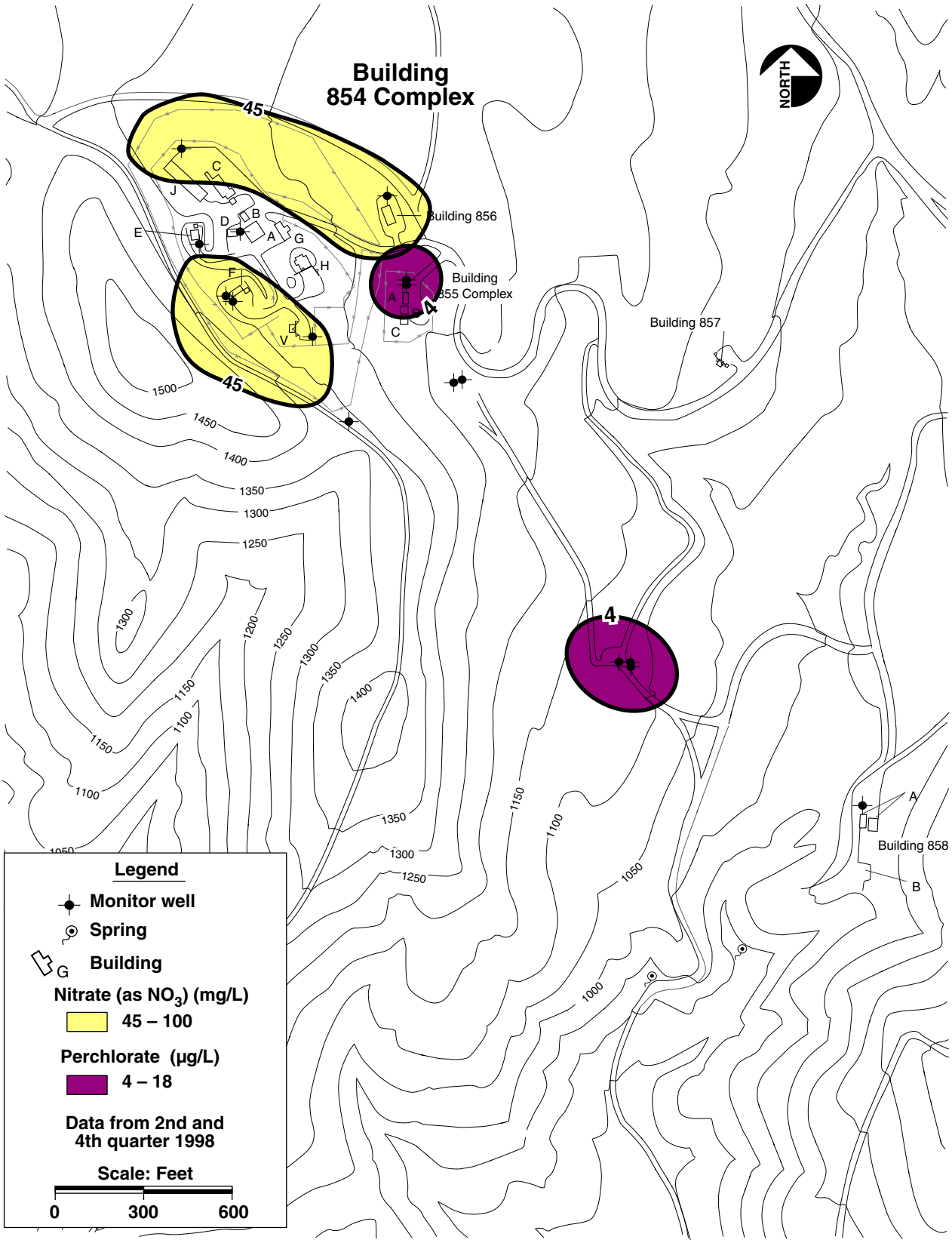
ERD-S3R-98-0220

Figure 1-33. Distribution of tritium and perchlorate in ground water in the first water-bearing zone in the Building 850/Pits 3 & 5 area, OU5.



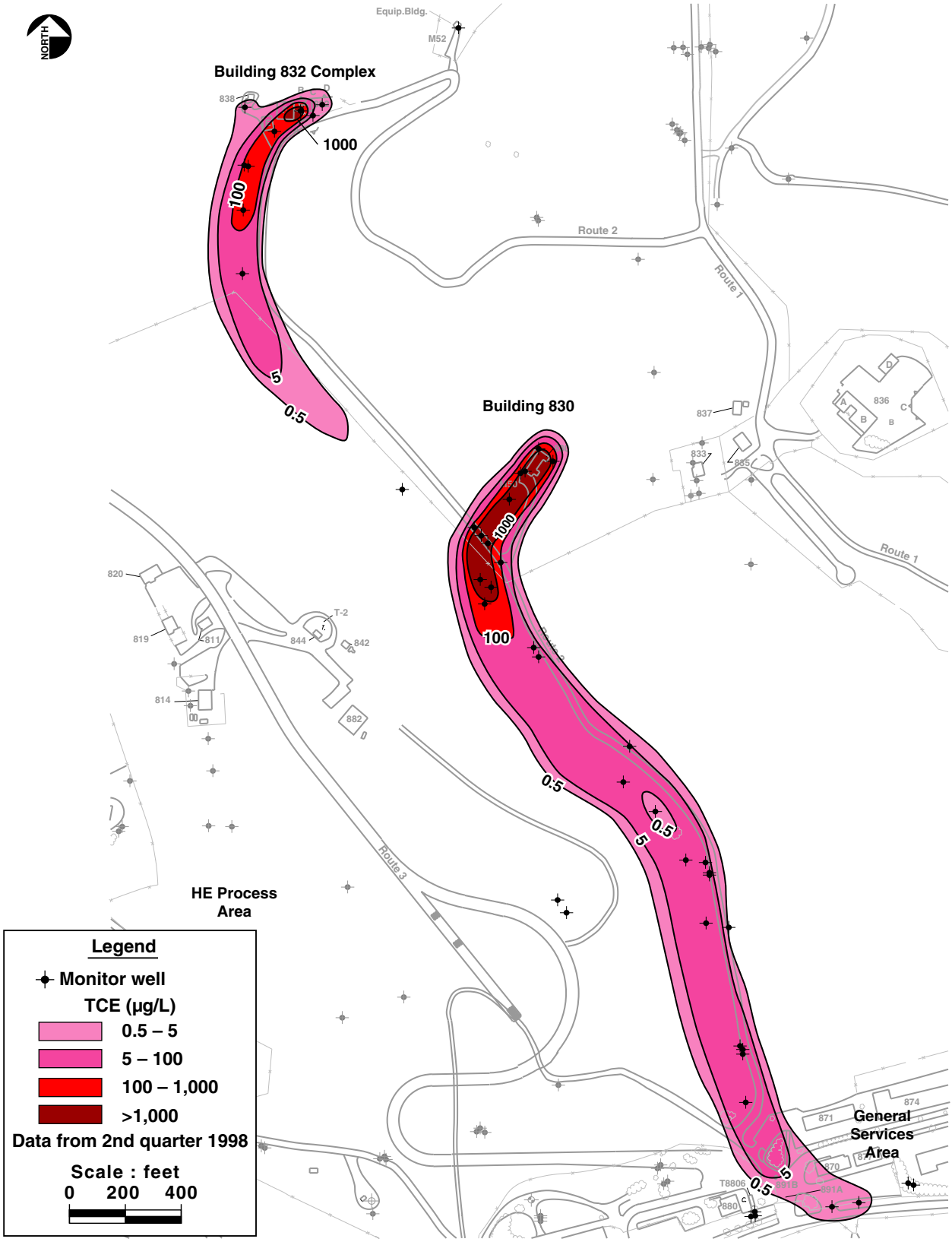
ERD-S3R-98-0248

Figure 1-34. Distribution of TCE in ground water in the Building 854 area, OU6.



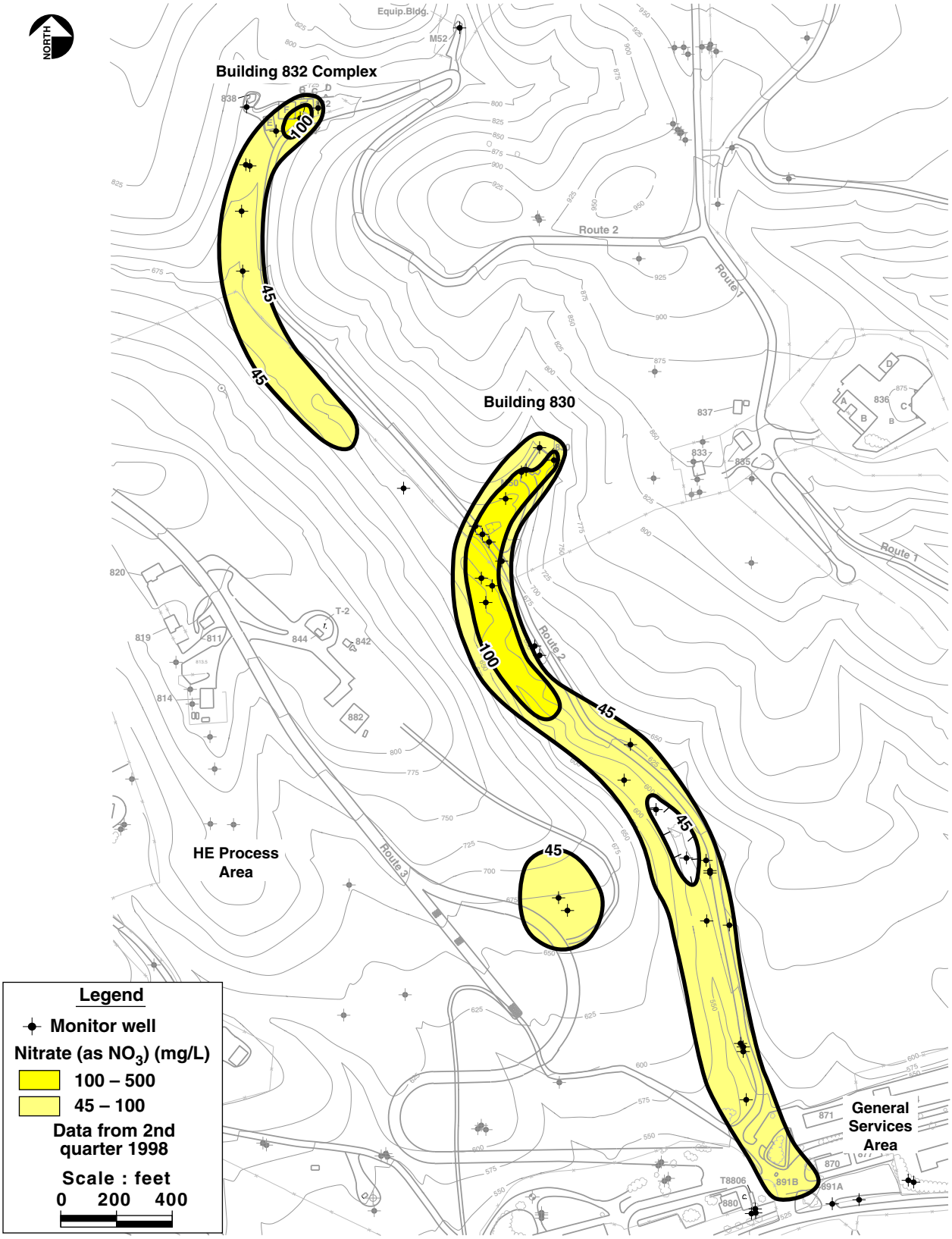
ERD-S3R-98-0256

Figure 1-35. Distribution of nitrate and perchlorate in ground water in the Building 854 area, OU6.



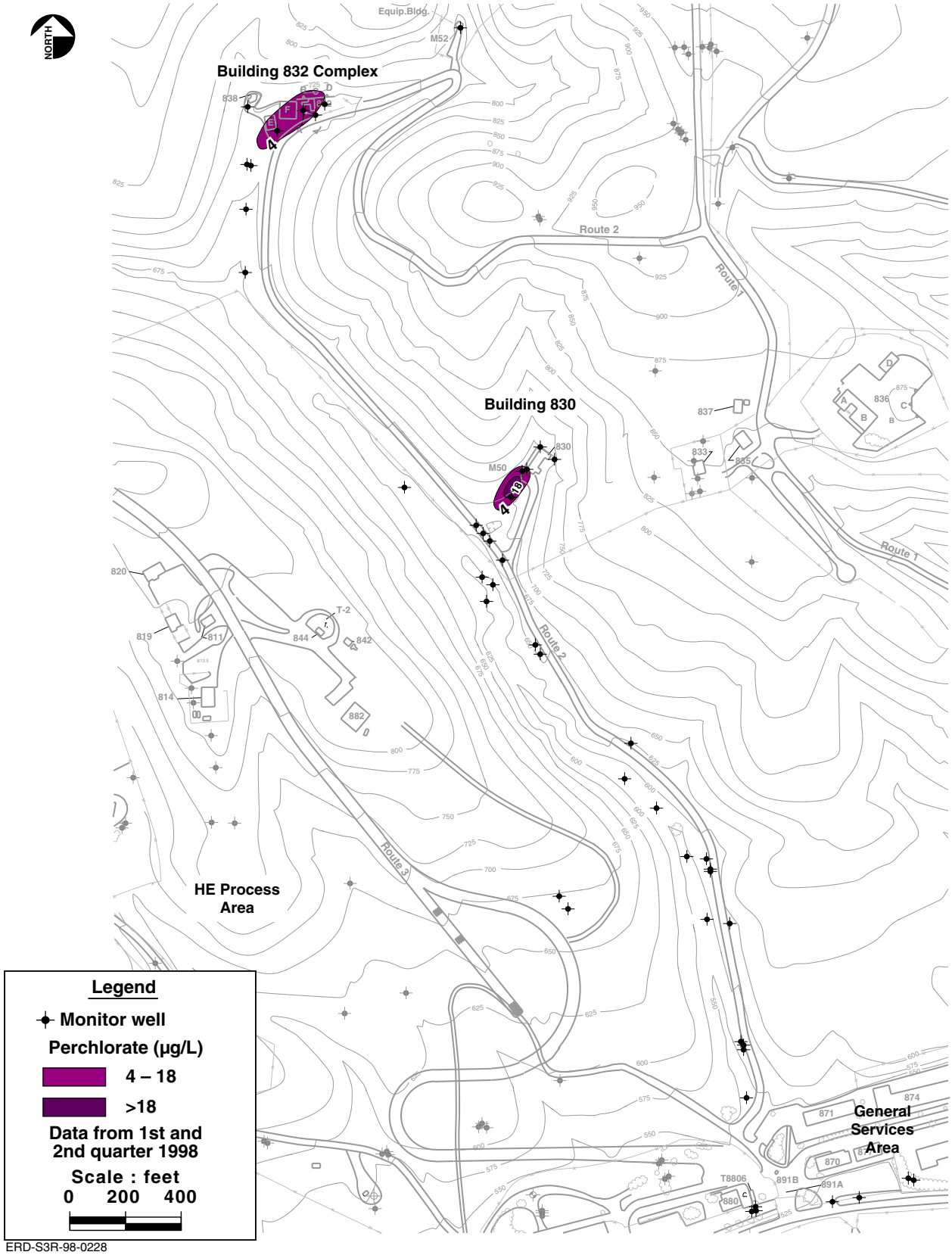
ERD-S3R-98-0227

Figure 1-36. Distribution of TCE in the combined Qal, $Tnbs_2$, and $Tnsc_1$ aquifers in the Building 832 Canyon, OU7.



ERD-S3R-98-0224

Figure 1-37. Distribution of nitrate in the combined Qal, $Tnbs_2$ and $Tnsc_1$ aquifers in the Building 832 Canyon, OU7.



ERD-S3R-98-0228

Figure 1-38. Distribution of perchlorate in the combined Qal, $Tnbs_2$ and $Tnsc_1$ aquifers in the Building 832 Canyon, OU7.

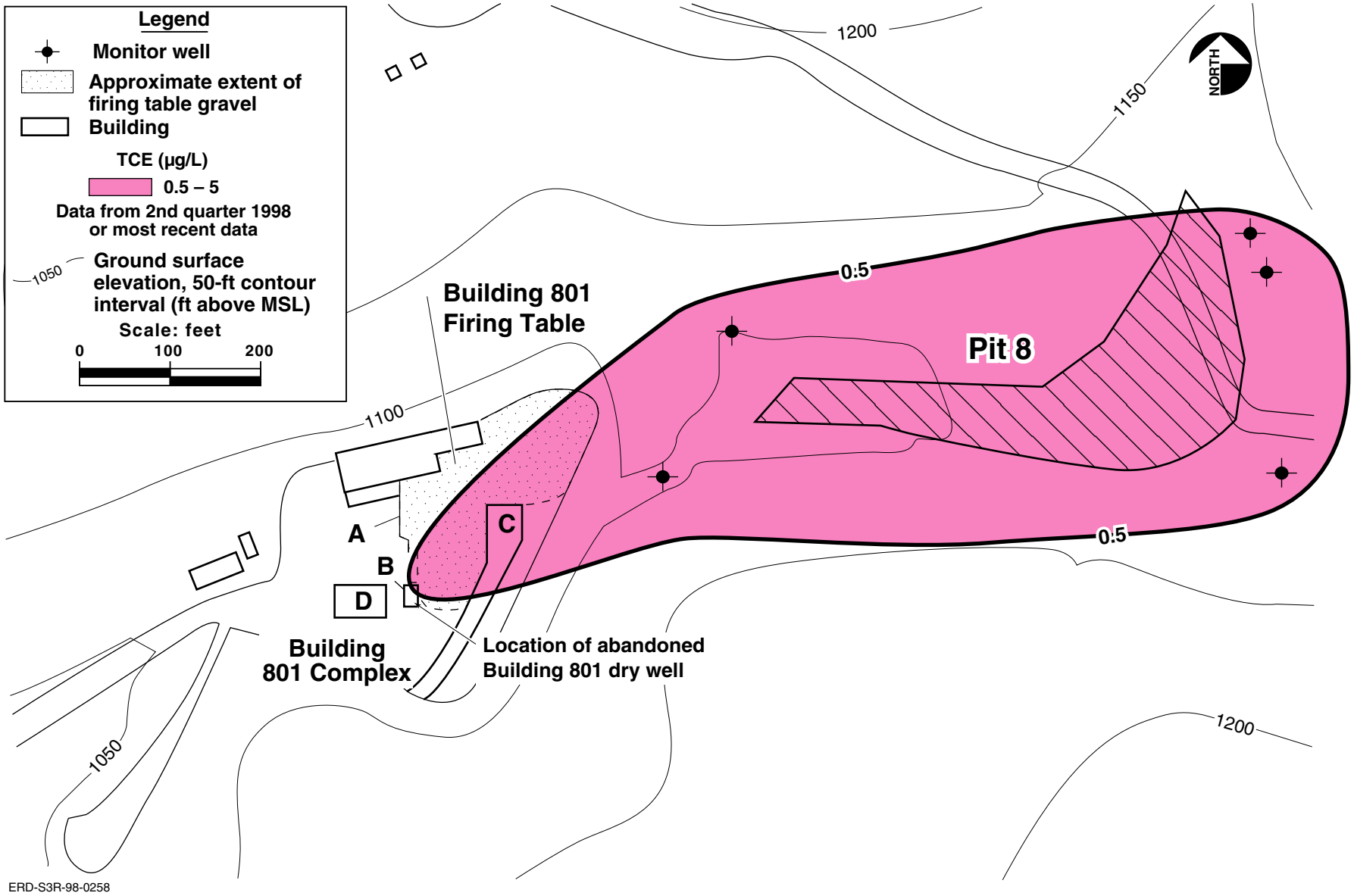


Figure 1-39. Distribution of TCE in ground water in the Building 801 and Landfill Pit 8 area, OU8.

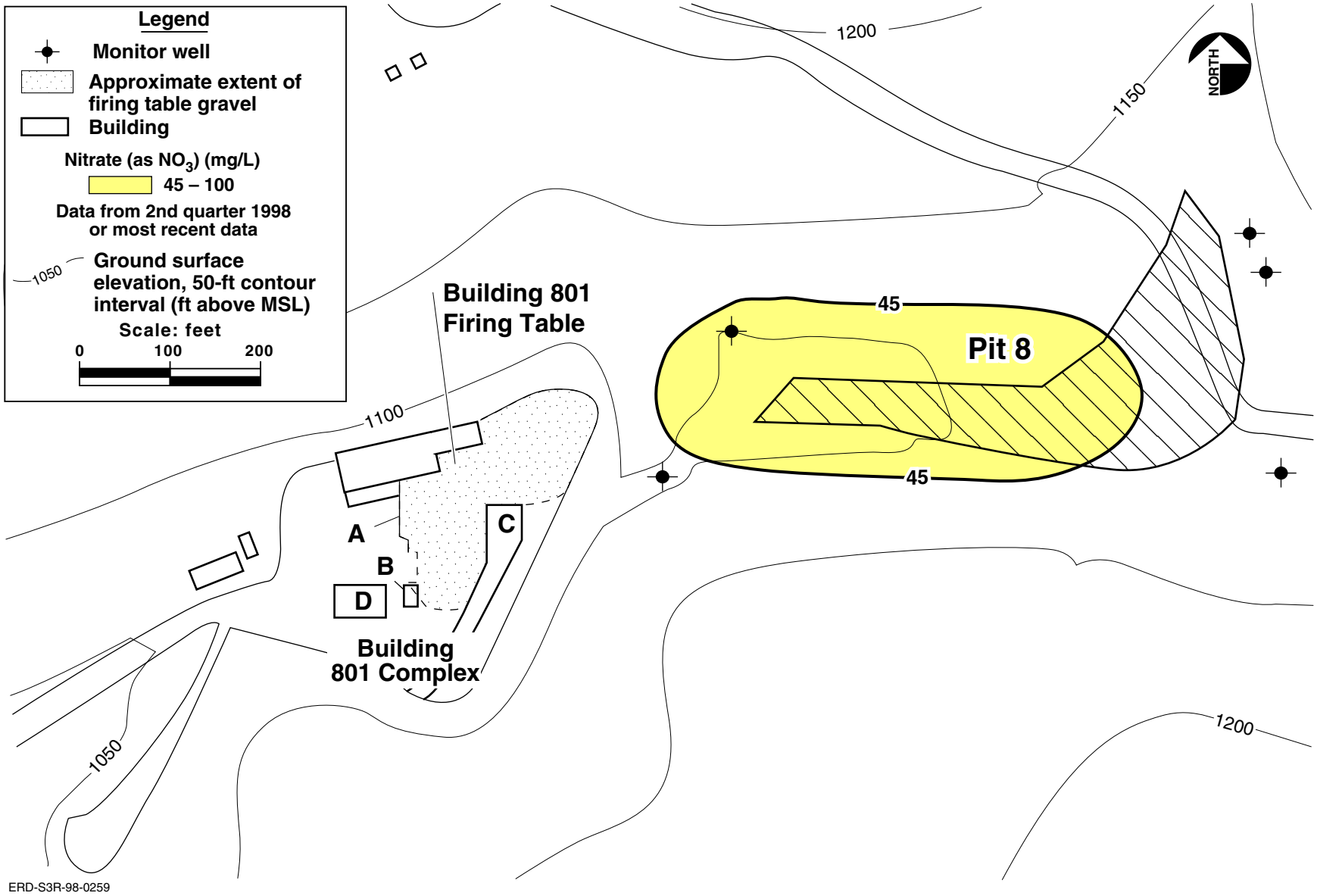
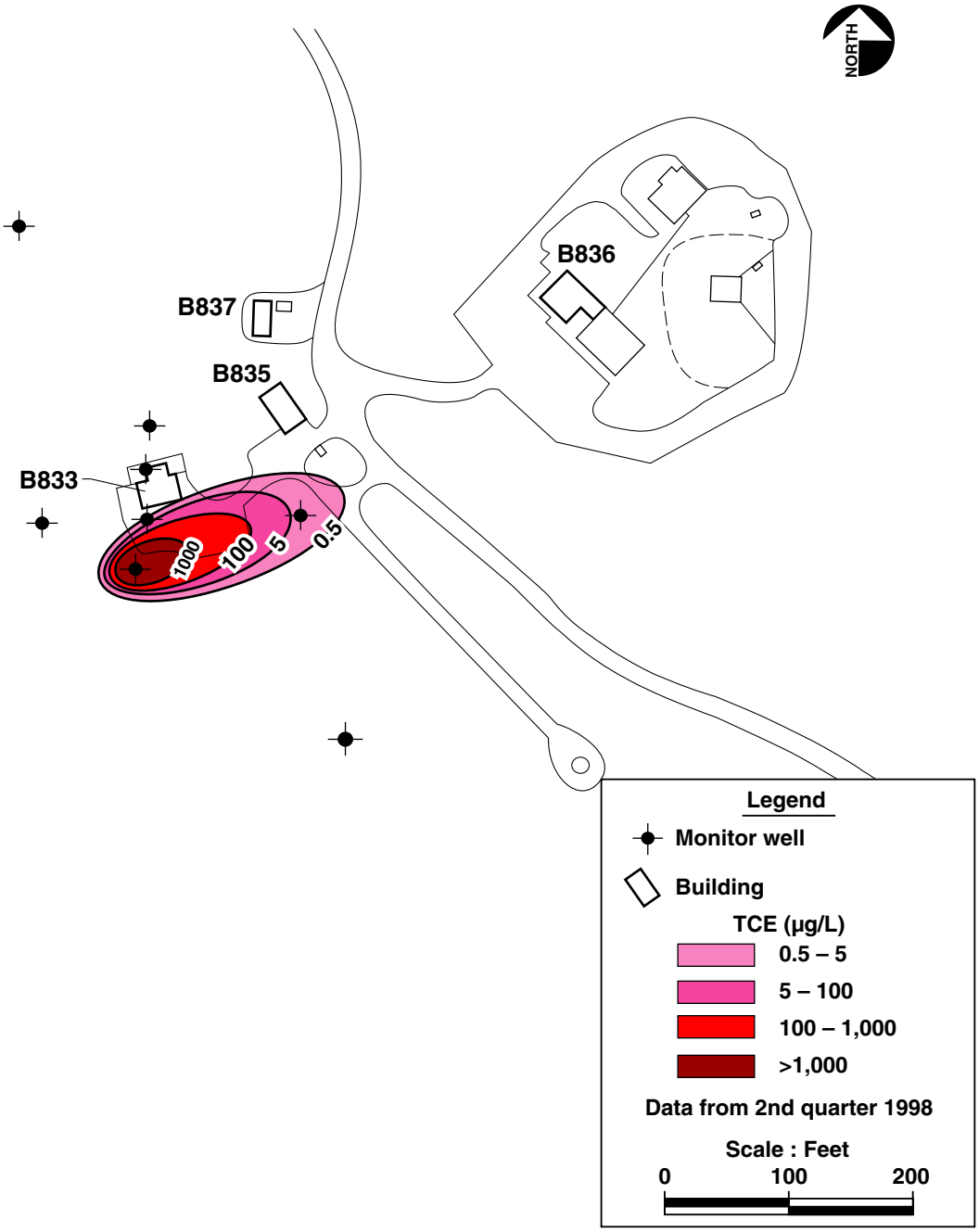


Figure 1-40. Distribution of nitrate in ground water in the Building 801 and Landfill Pit 8 area, OU8.



ERD-S3R-98-0221

Figure 1-41. Distribution of TCE in ground water in the Building 833 area, OU8.

ERD-S3R-98-0263

Figure 1-42. Distribution of uranium-238 in ground water in the Building 851 Firing Table area, OU8.

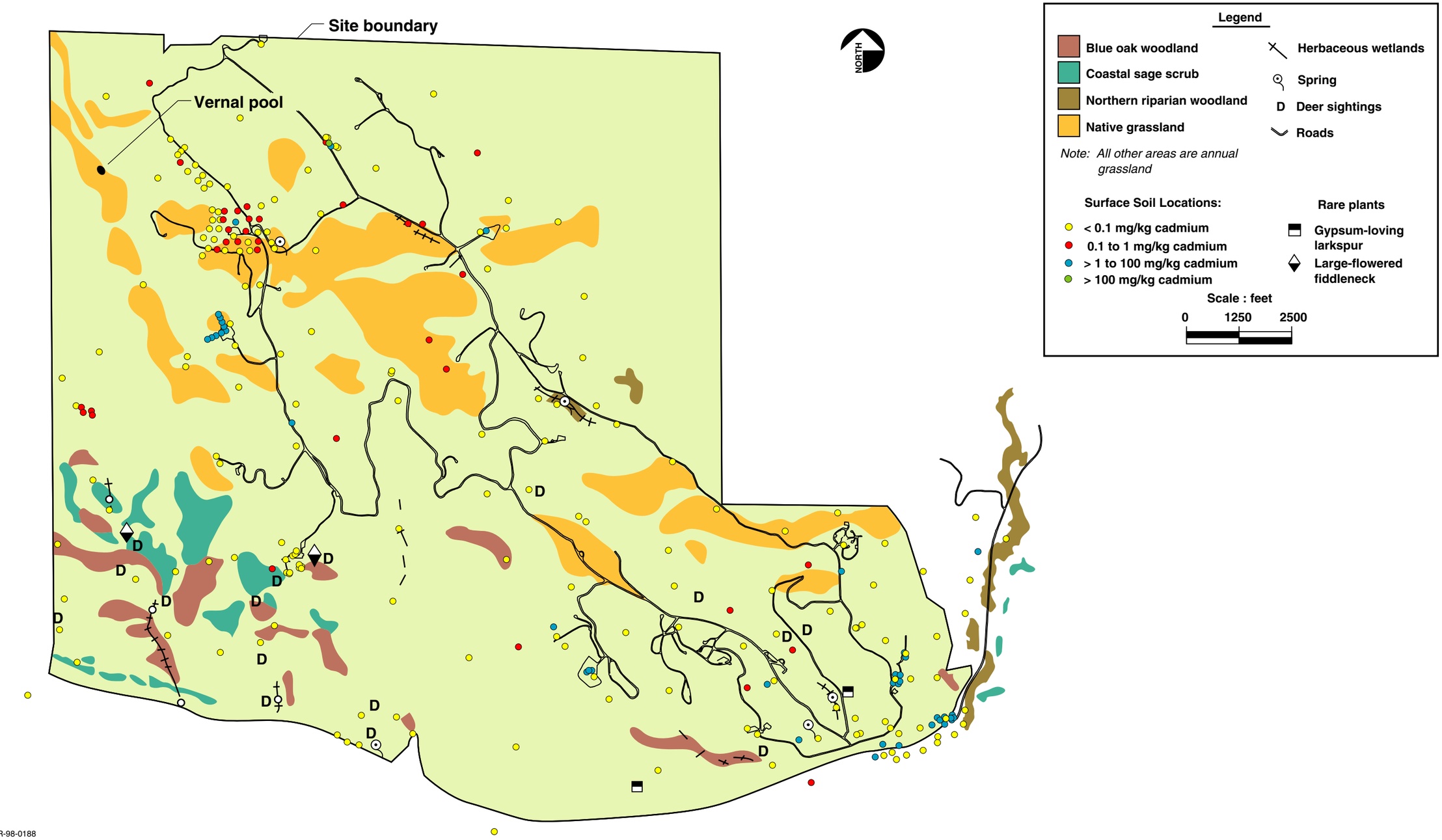
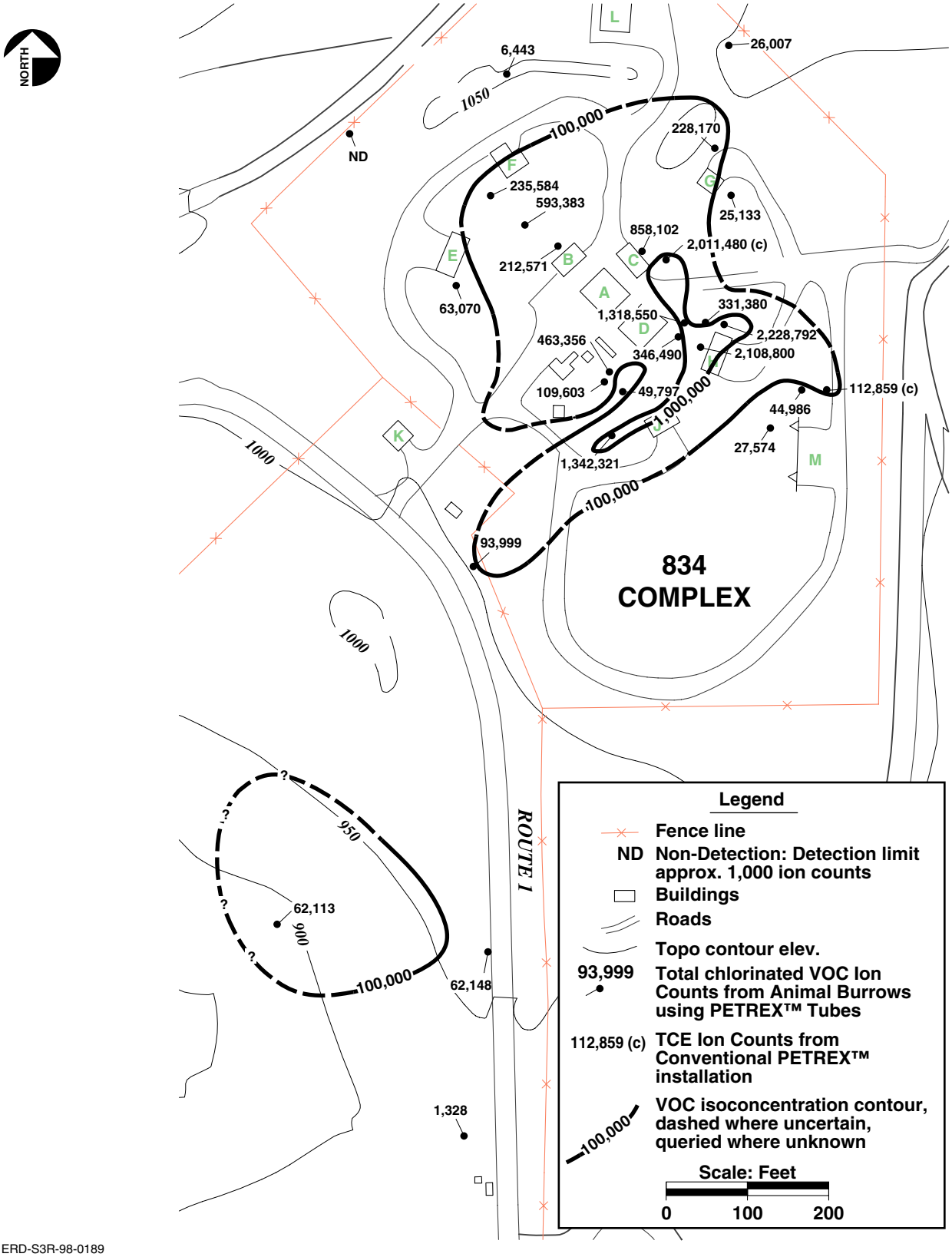


Figure 1-43. Cadmium concentrations in surface soil in relation to deer sightings recorded during 1994.



ERD-S3R-98-0189

Figure 1-44. Total chlorinated VOCs in subsurface burrows as indicated using PETREX™ passive soil vapor survey conducted during the summer of 1994.