Cameco

NUMERICAL GROUNDWATER FLOW AND SOLUTE TRANSPORT MODEL OF THE YEELIRRIE URANIUM DEPOSIT

Appendix A:
Solute Transport - Figures for Sensitivity Runs

Yeelirrie

January 2015

Geo-environmental Engineering, SHEQ,
Environmental Affairs

This Appendix accompanies the report “Numerical groundwater Flow and Solute Transport Model of the Yeelirrie Uranium Deposit”, Cameco (2015).

This Appendix includes supplementary figures for the solute transport sensitivity runs:

- Sensitivity run: source terms = 1.2 x source term base case
  - Figure A1 - A8 Arsenic
  - Figure A9 - A16 Molybdenum
  - Figure A17 - A24 Uranium
  - Figure A25 - A32 Vanadium

- Sensitivity run: Kd = 0.1 x Kd base case
  - Figure B1 - B8 Arsenic
  - Figure B9 - B16 Molybdenum
  - Figure B17 – B24 Vanadium

- Sensitivity run: percolation through cover = 0.2% of average annual precipitation
  - Figure C1 - C8 Arsenic
  - Figure C9 - C16 Molybdenum
  - Figure C17 – C24 Vanadium

- Sensitivity run: percolation through cover = 2.5% of average annual precipitation
  - Figure D1 - D8 Arsenic
  - Figure D9 - D16 Molybdenum
  - Figure D17 – D24 Vanadium

- Sensitivity run: extinction depth: 3.5 m
  - Figure E1 - E8 Arsenic
  - Figure E9 - E16 Molybdenum
  - Figure E17 – E24 Vanadium

Sensitivity Run
Source Terms = 1.2 x Source Terms Base Case

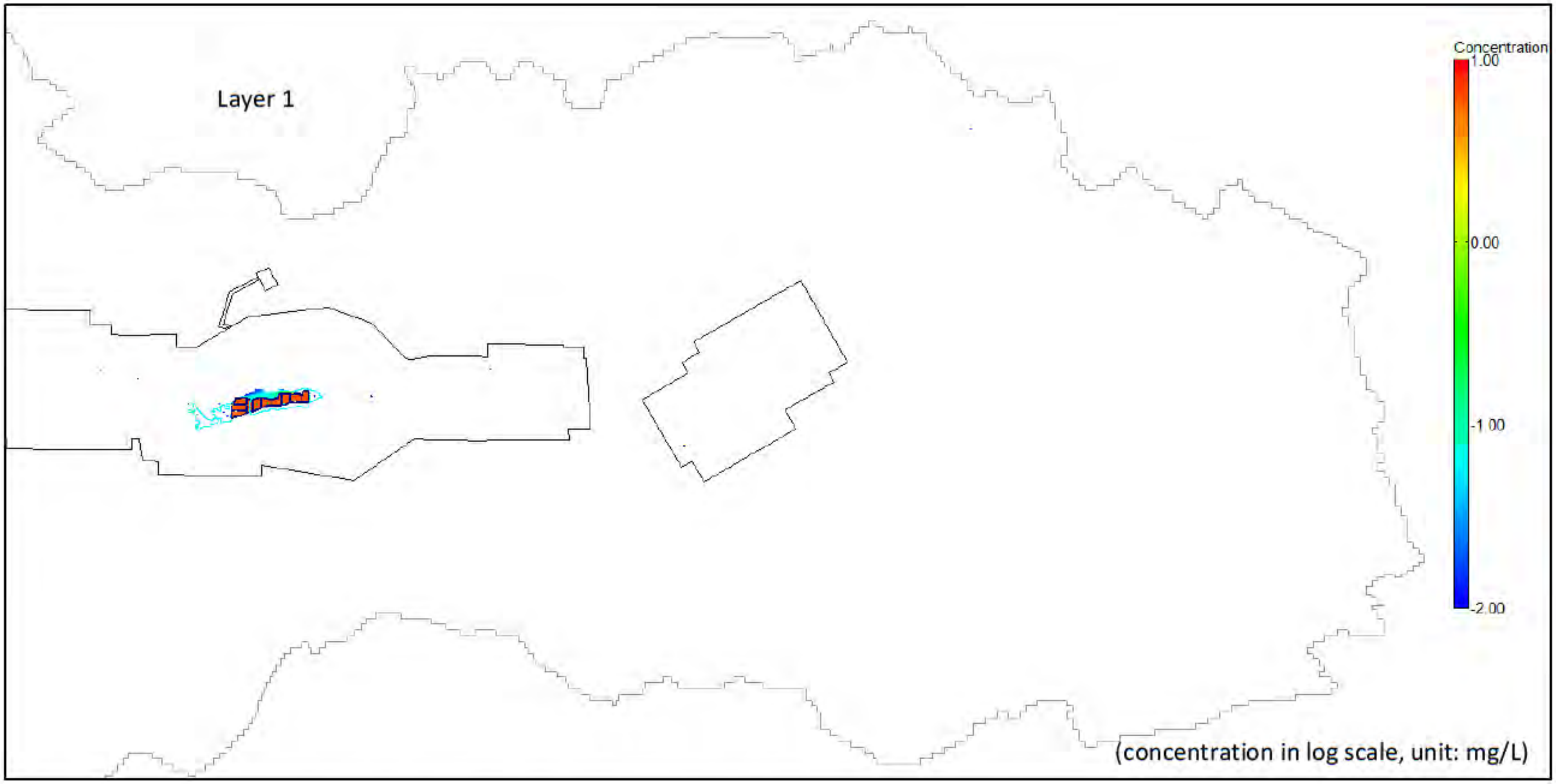


Figure A1 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 1 at year 15,000

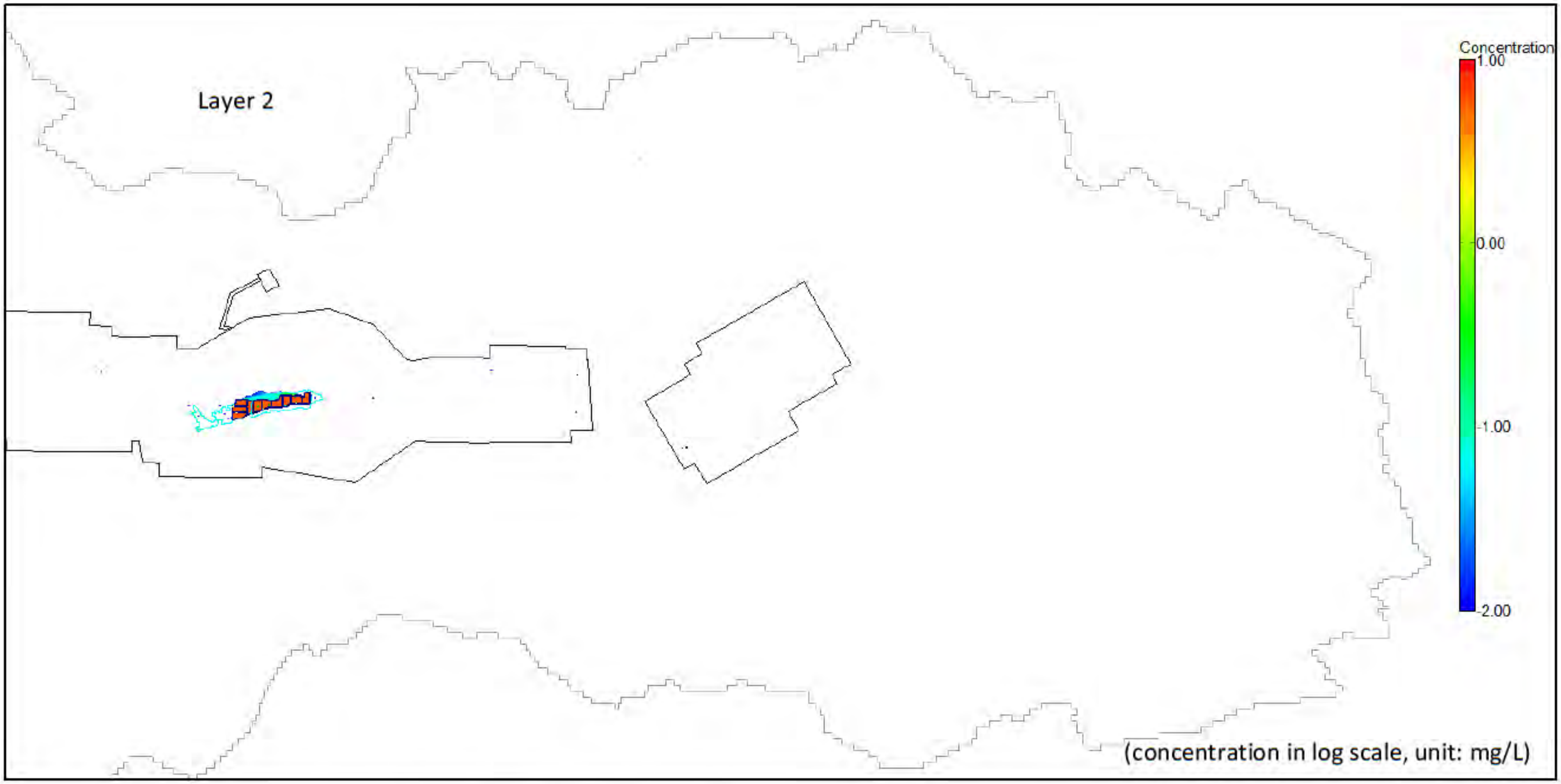


Figure A2 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 2 at year 15,000

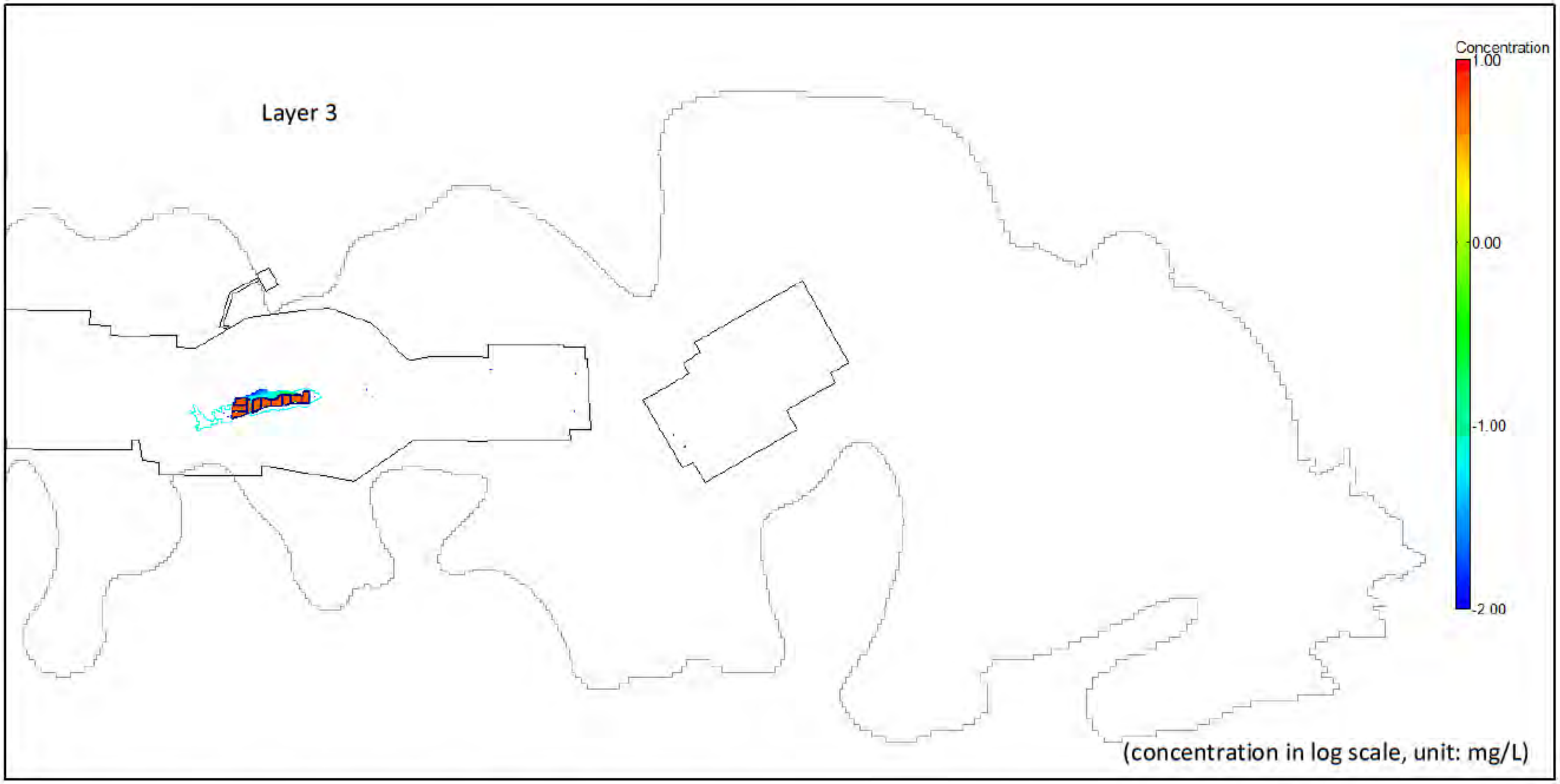


Figure A3 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 3 at year 15,000

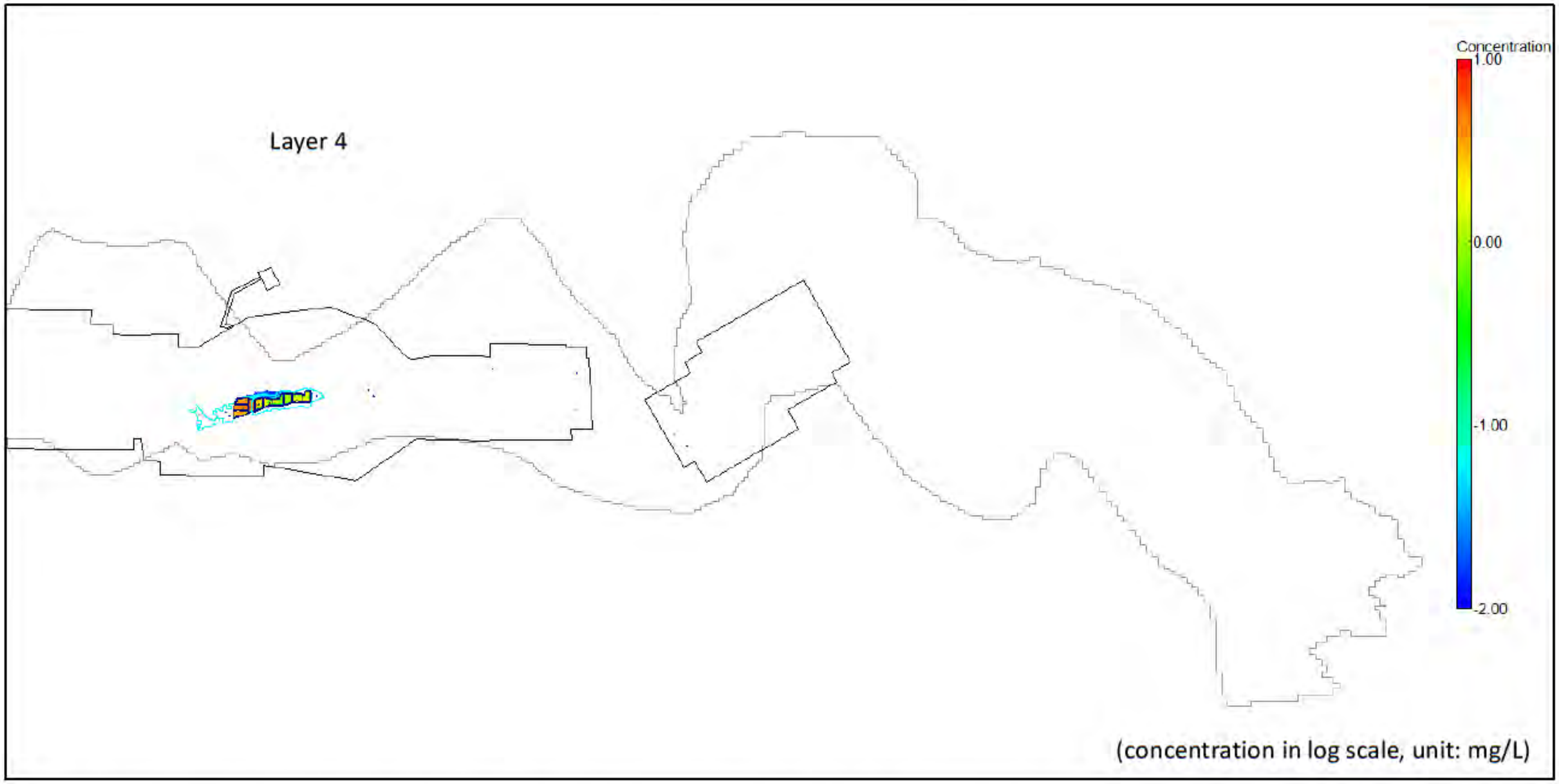


Figure A4 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 4 at year 15,000

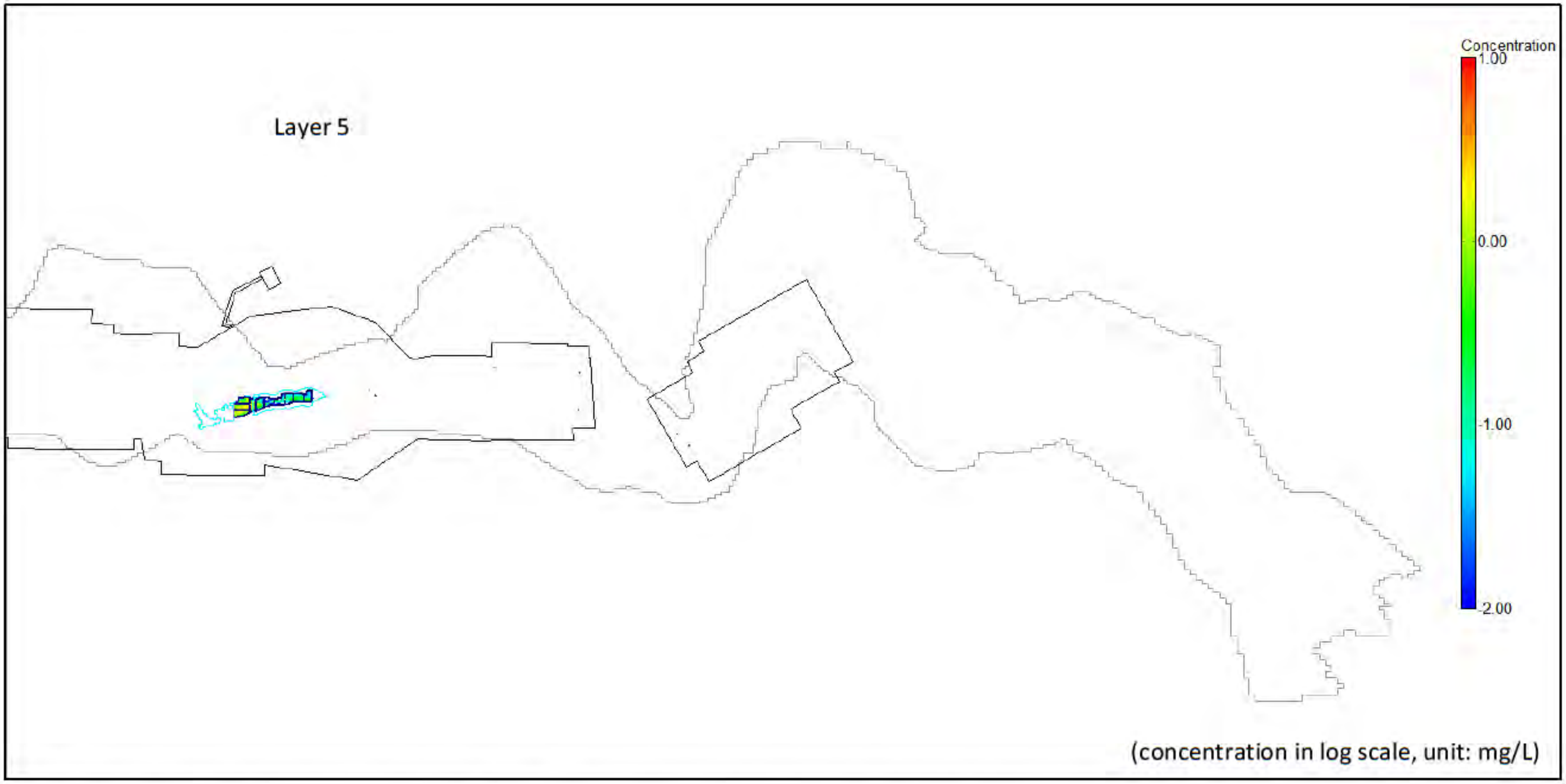


Figure A5 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 5 at year 15,000

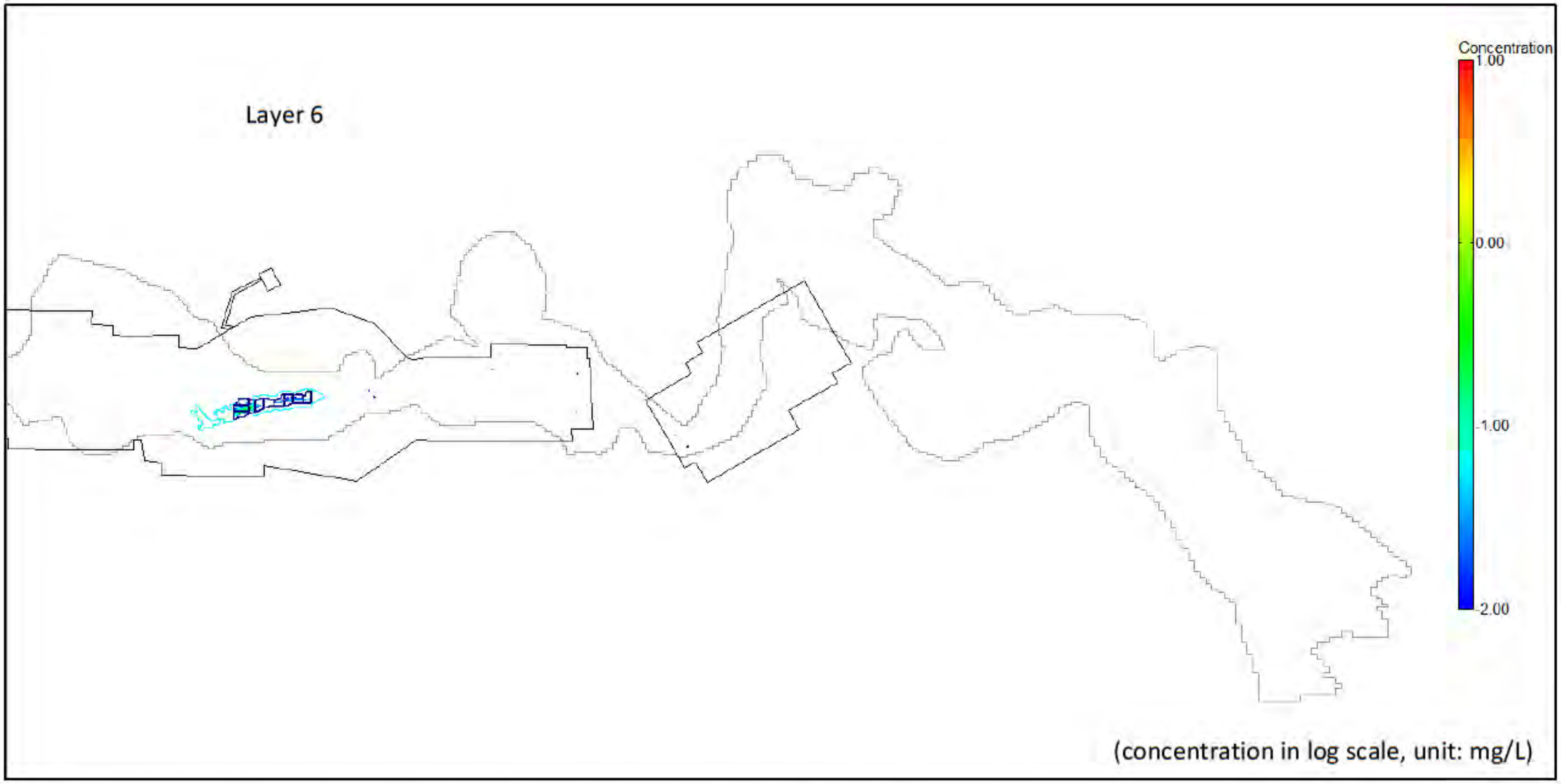


Figure A6 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 6 at year 15,000

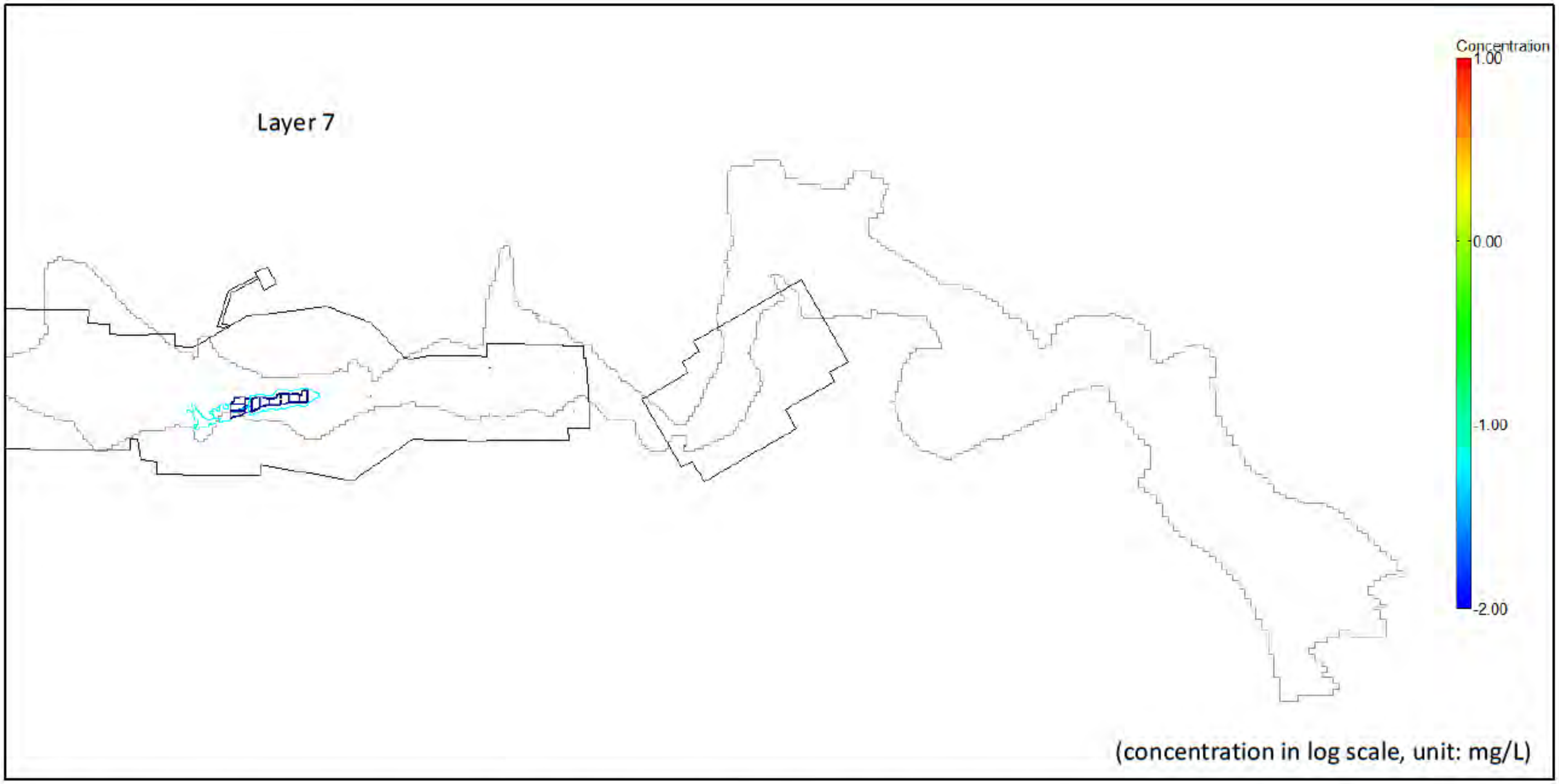


Figure A7 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 7 at year 15,000

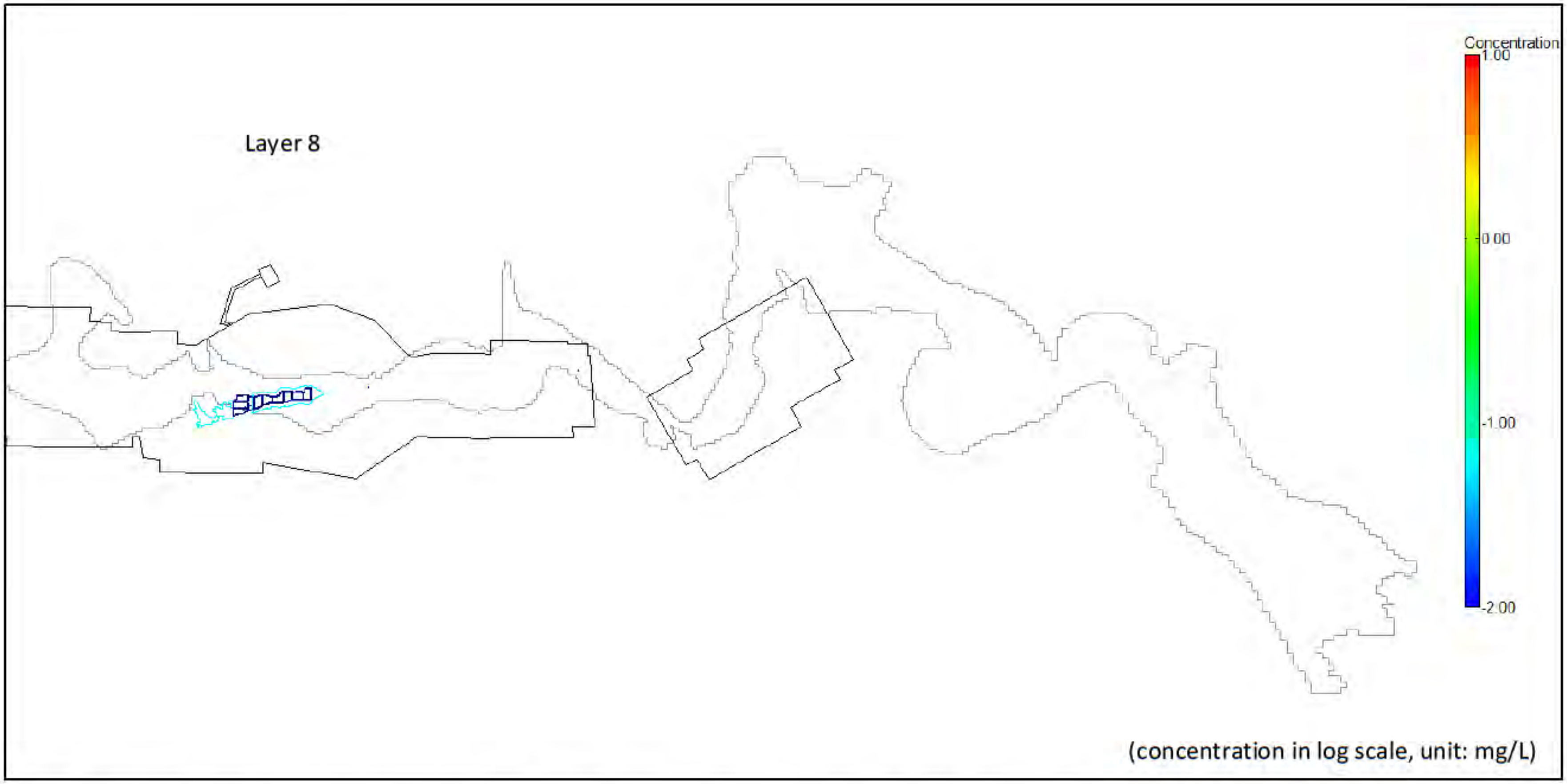


Figure A8 Effect of source term (increased by 20% relative to base case) on simulated arsenic transport plume in layer 8 at year 15,000

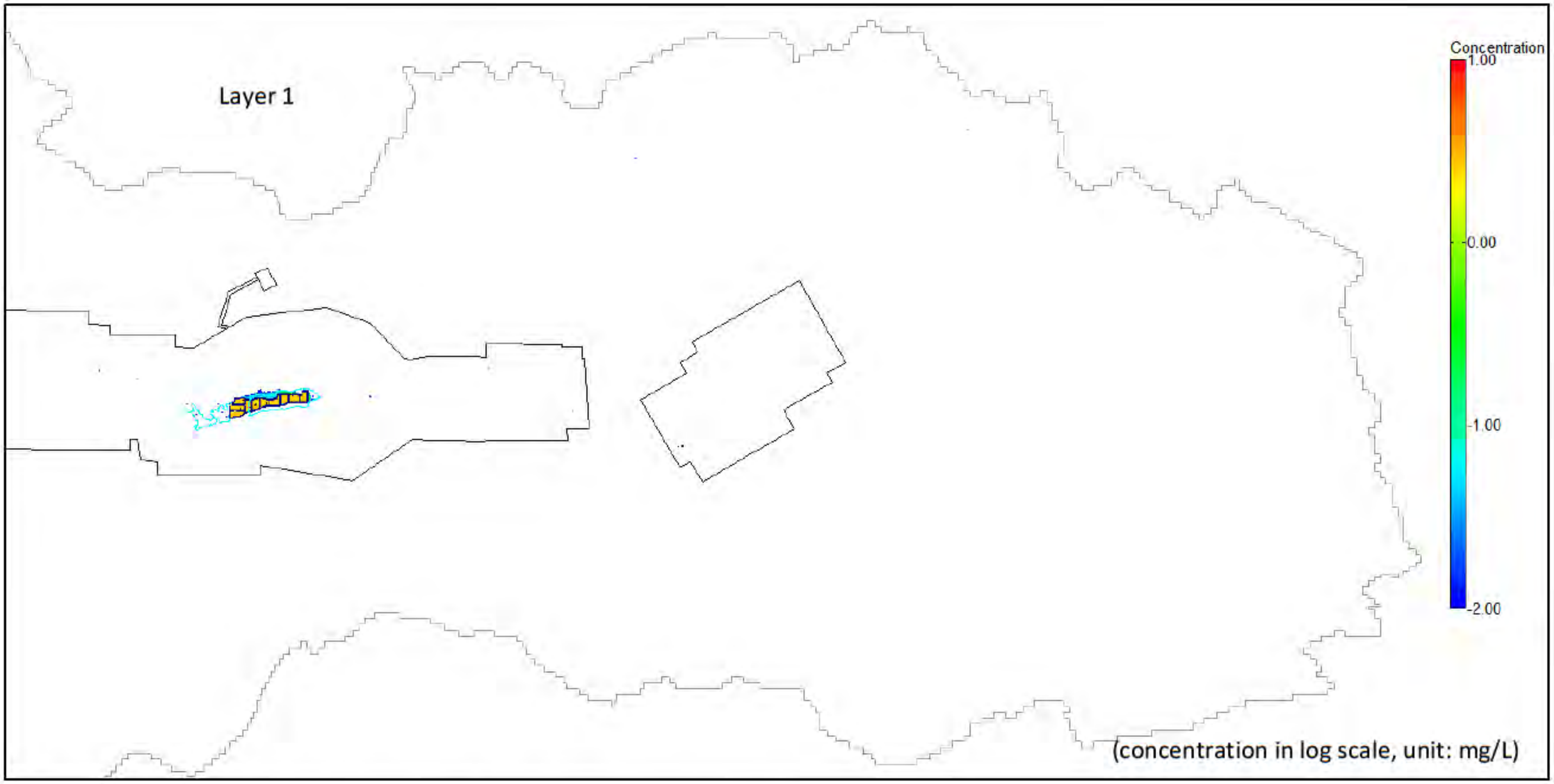


Figure A9 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 1 at year 15,000

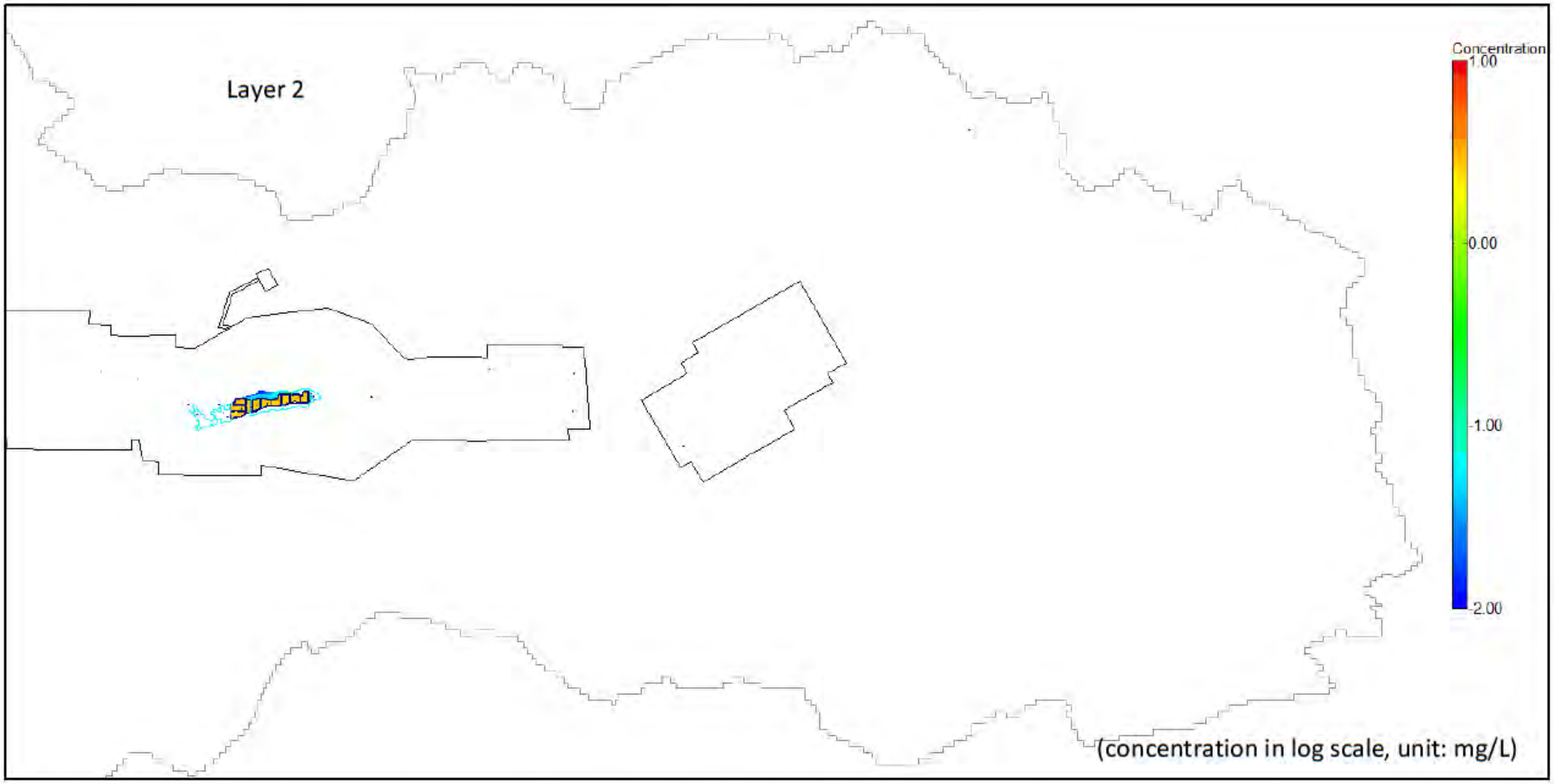


Figure A10 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 2 at year 15,000

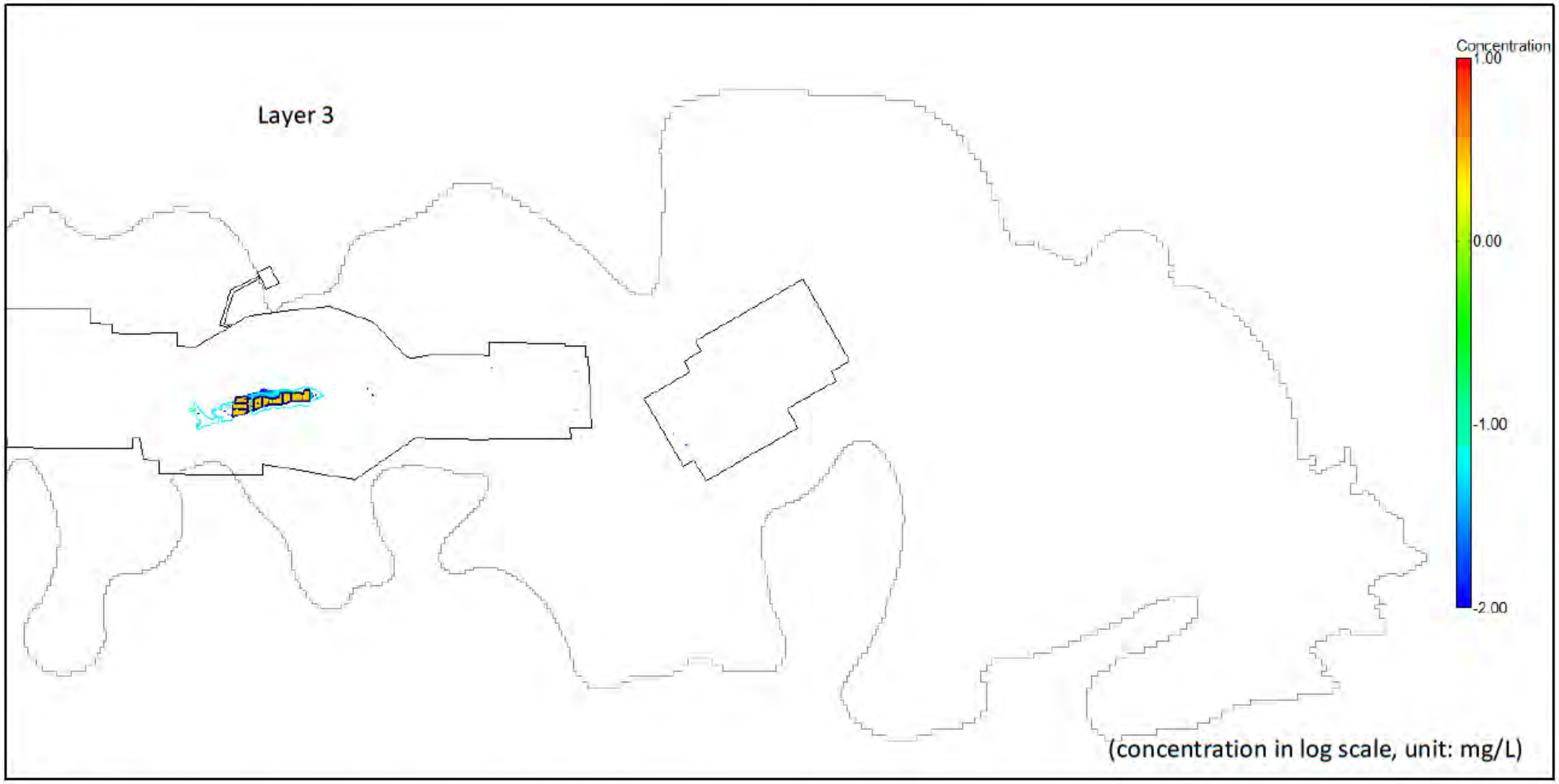


Figure A11 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 3 at year 15,000

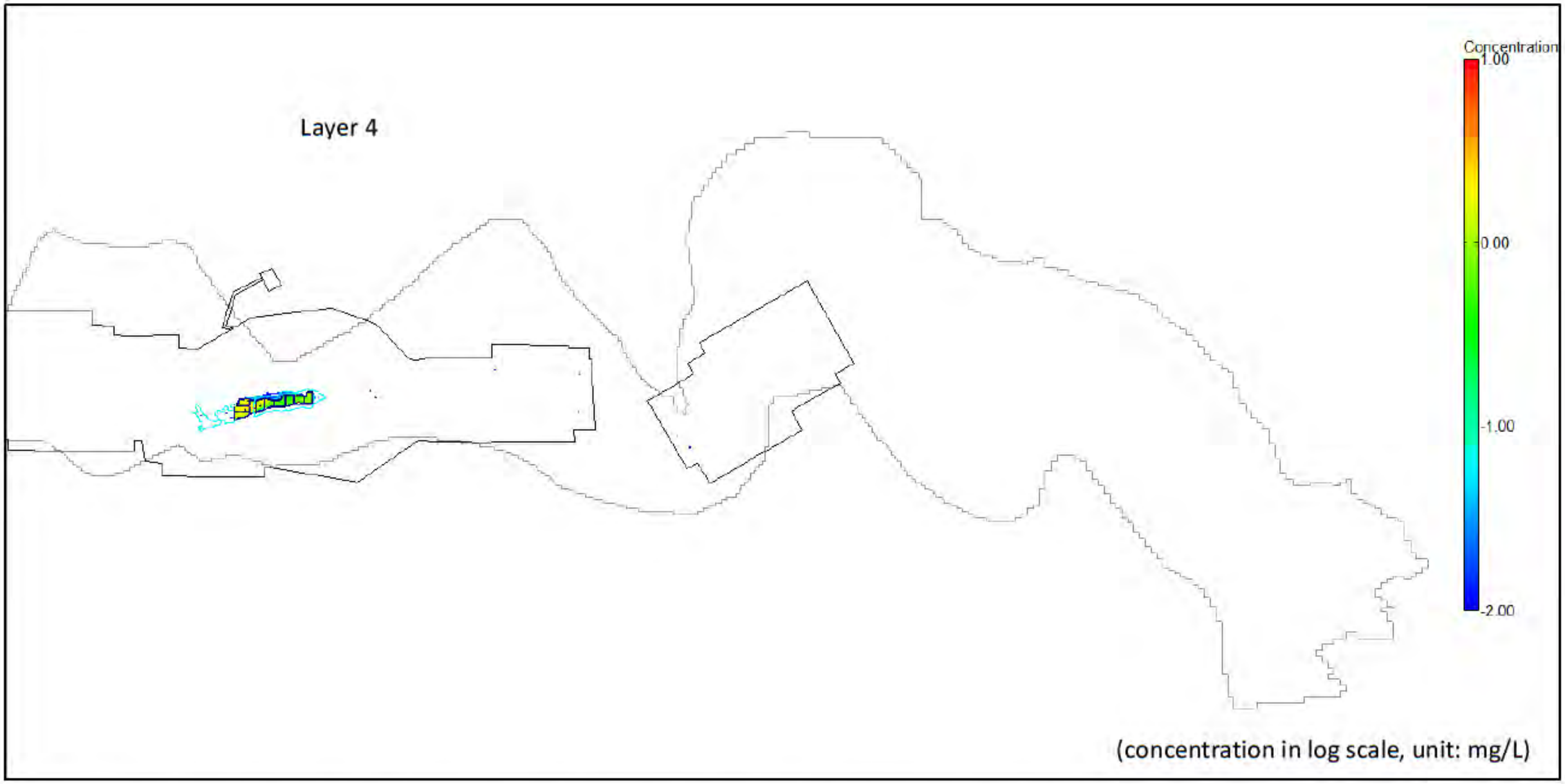


Figure A12 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 4 at year 15,000

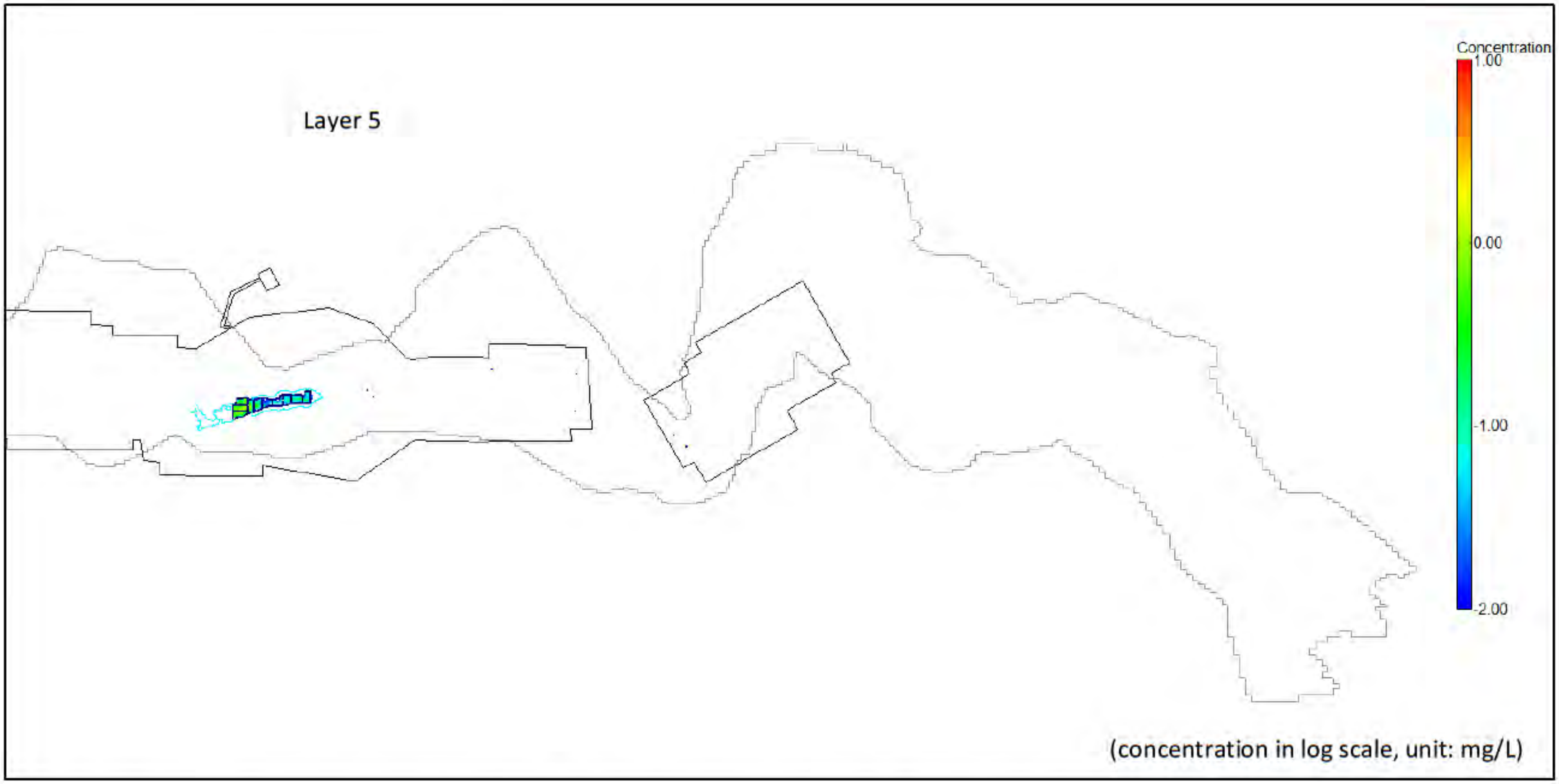


Figure A13 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 5 at year 15,000

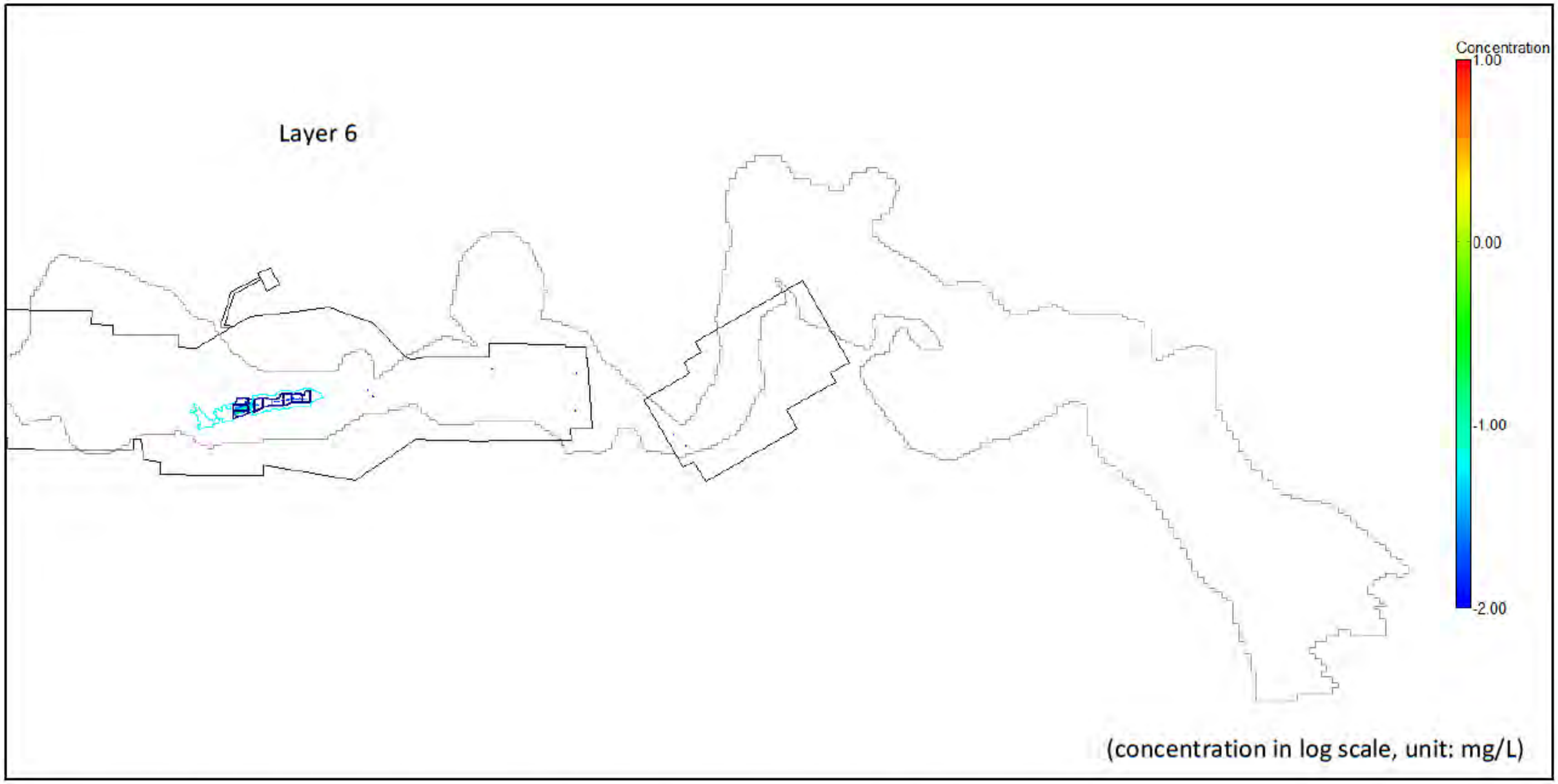


Figure A14 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 6 at year 15,000

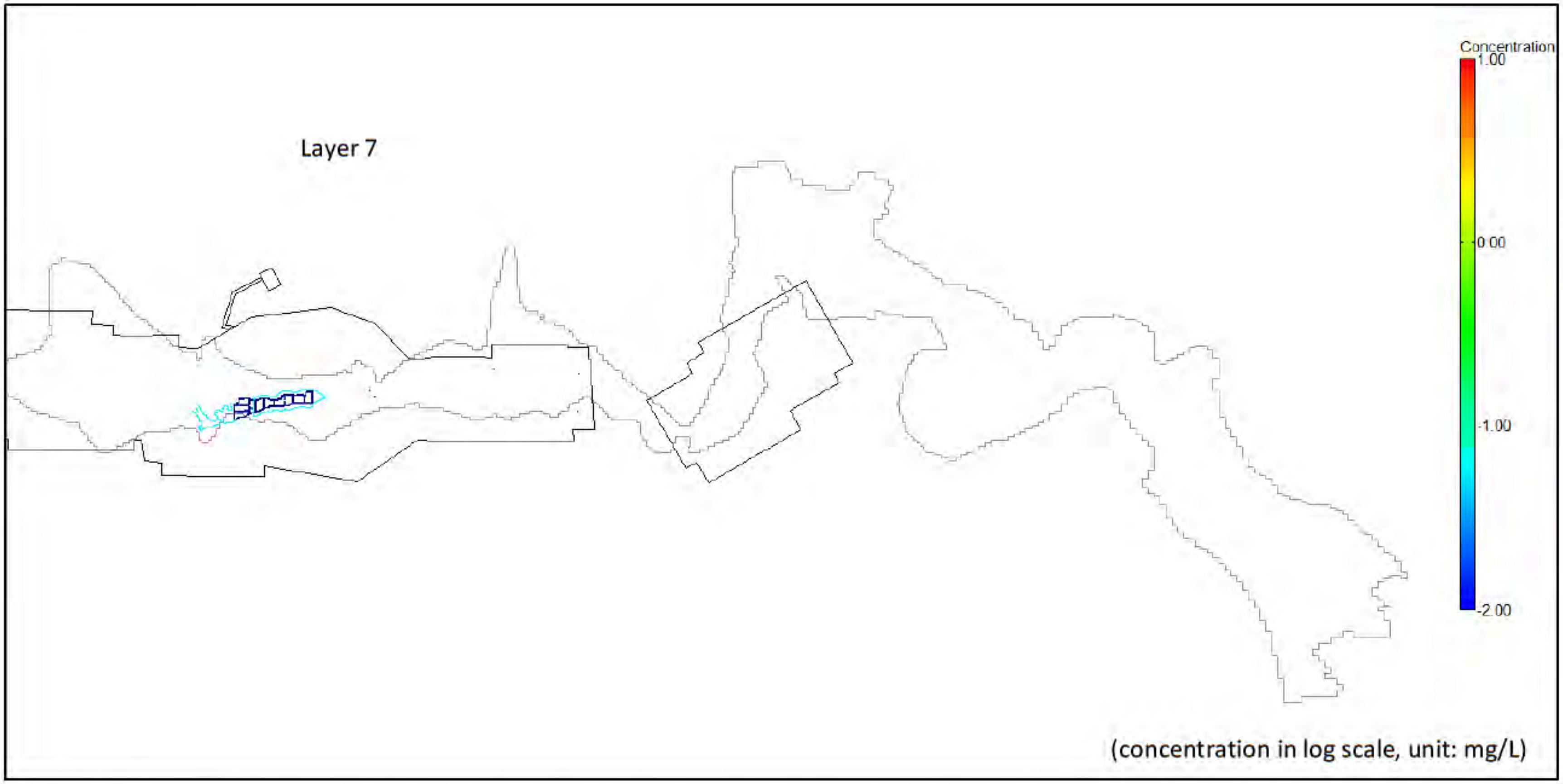


Figure A15 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 7 at year 15,000

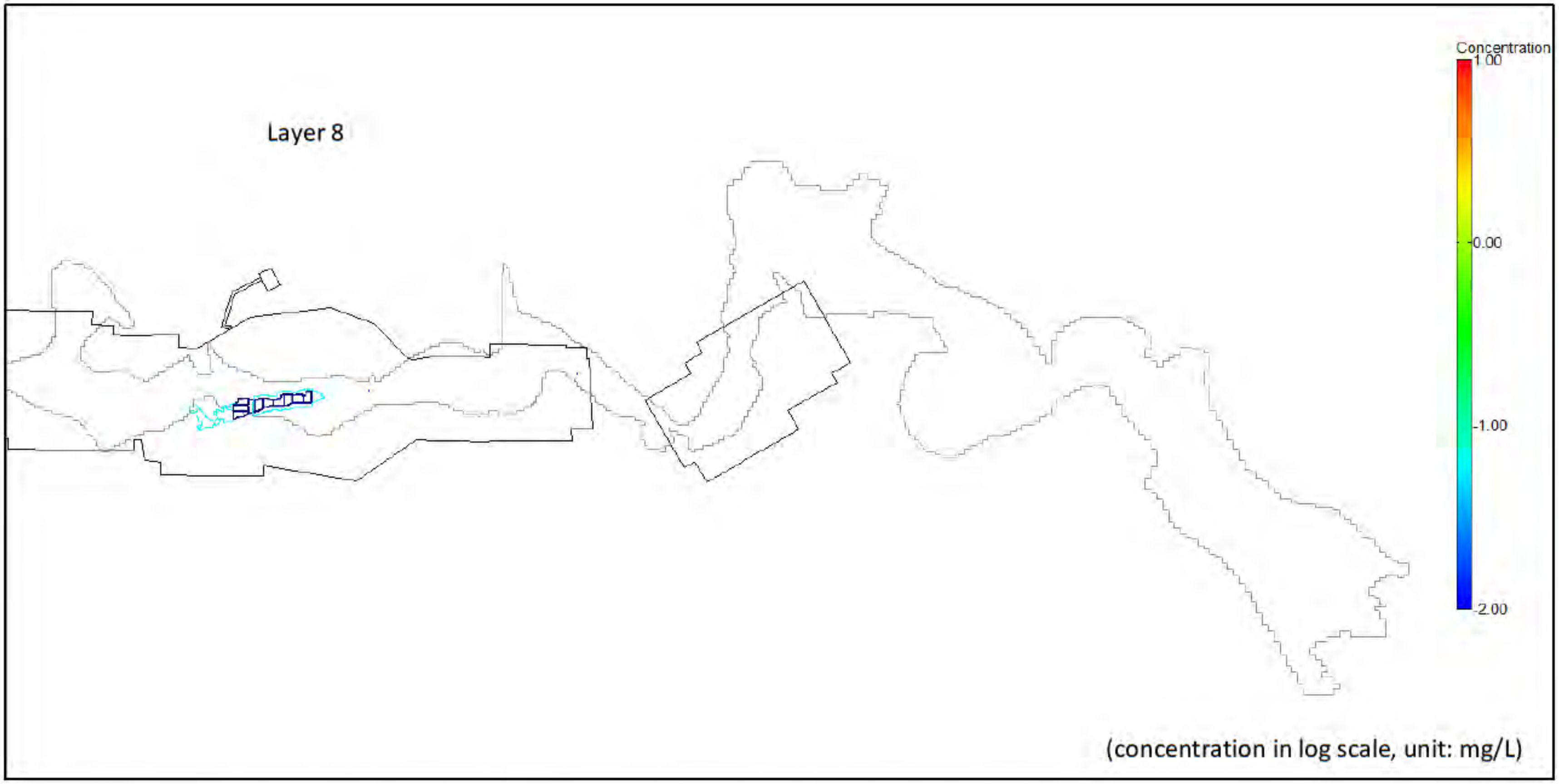


Figure A16 Effect of source term (increased by 20% relative to base case) on simulated molybdenum transport plume in layer 8 at year 15,000

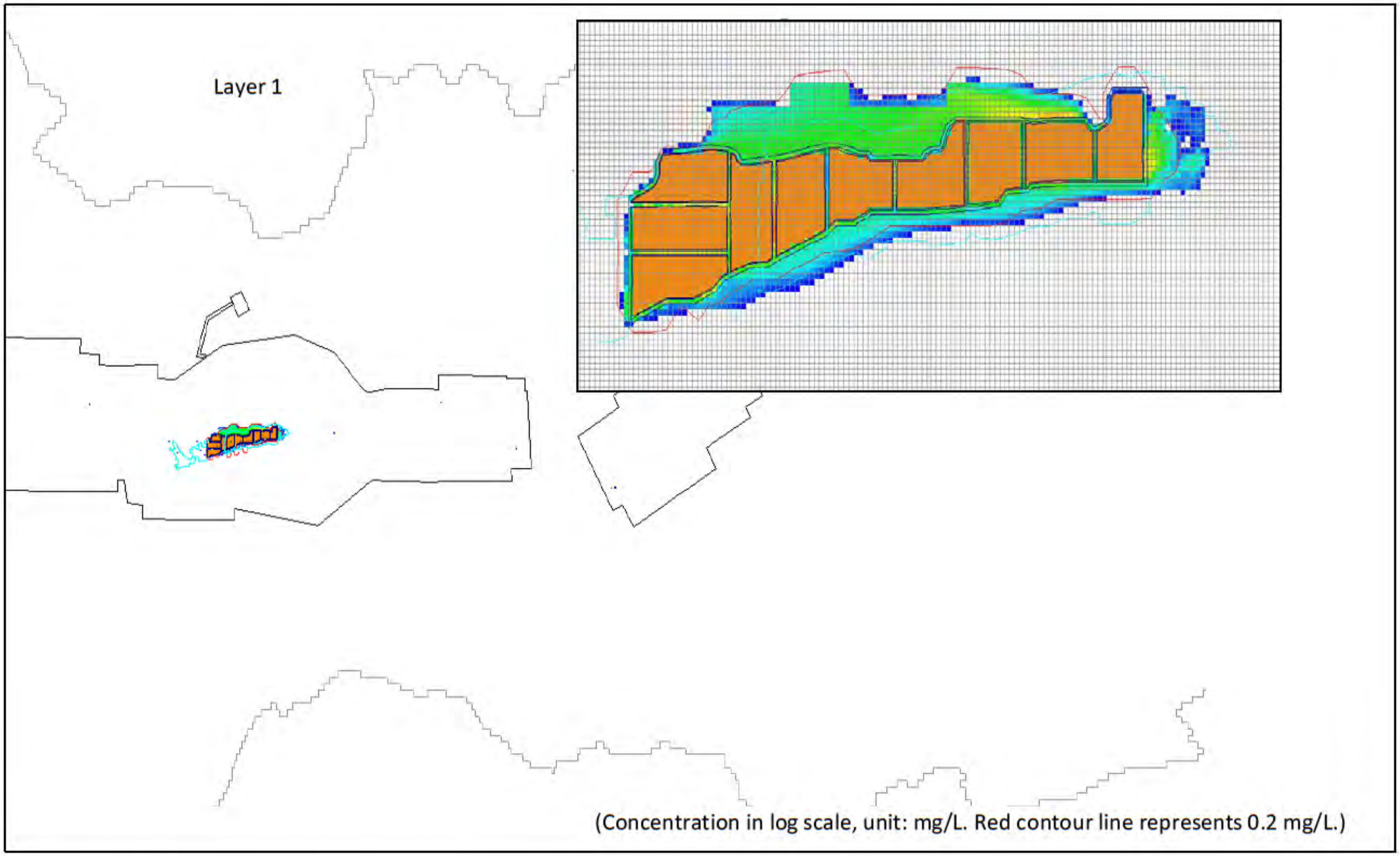


Figure A17 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 1 at year 15,000

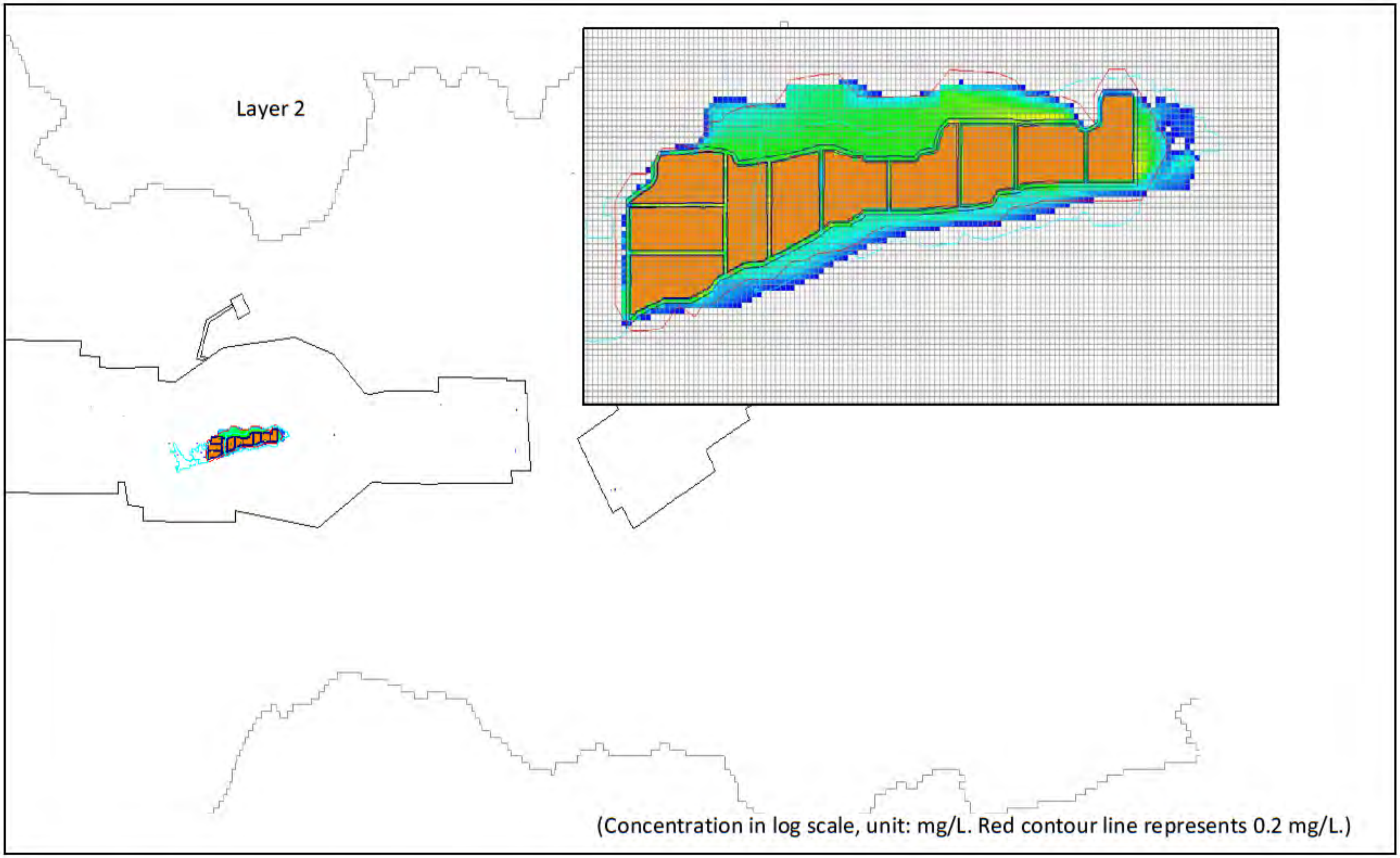


Figure A18 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 2 at year 15,000

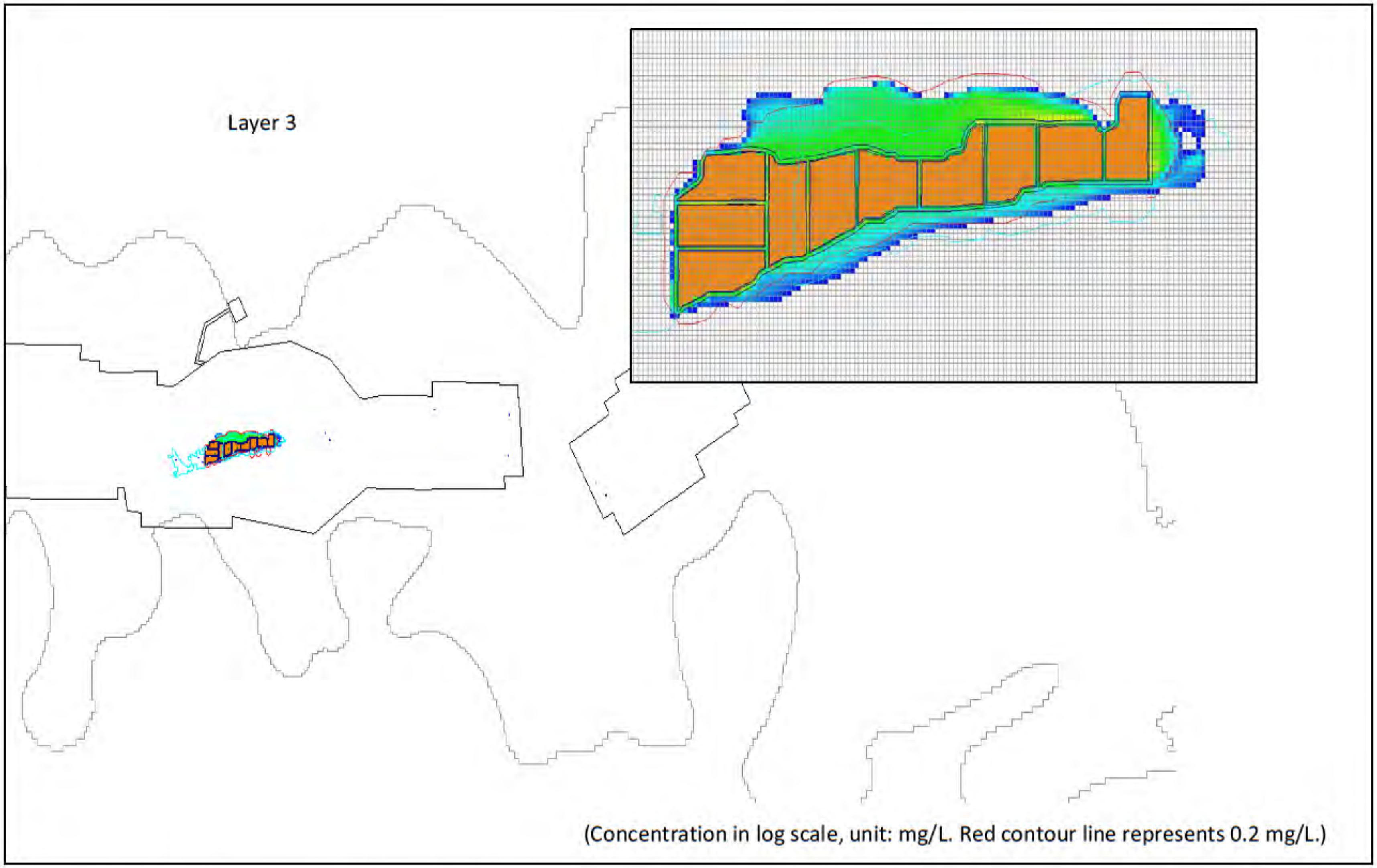


Figure A19 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 3 at year 15,000

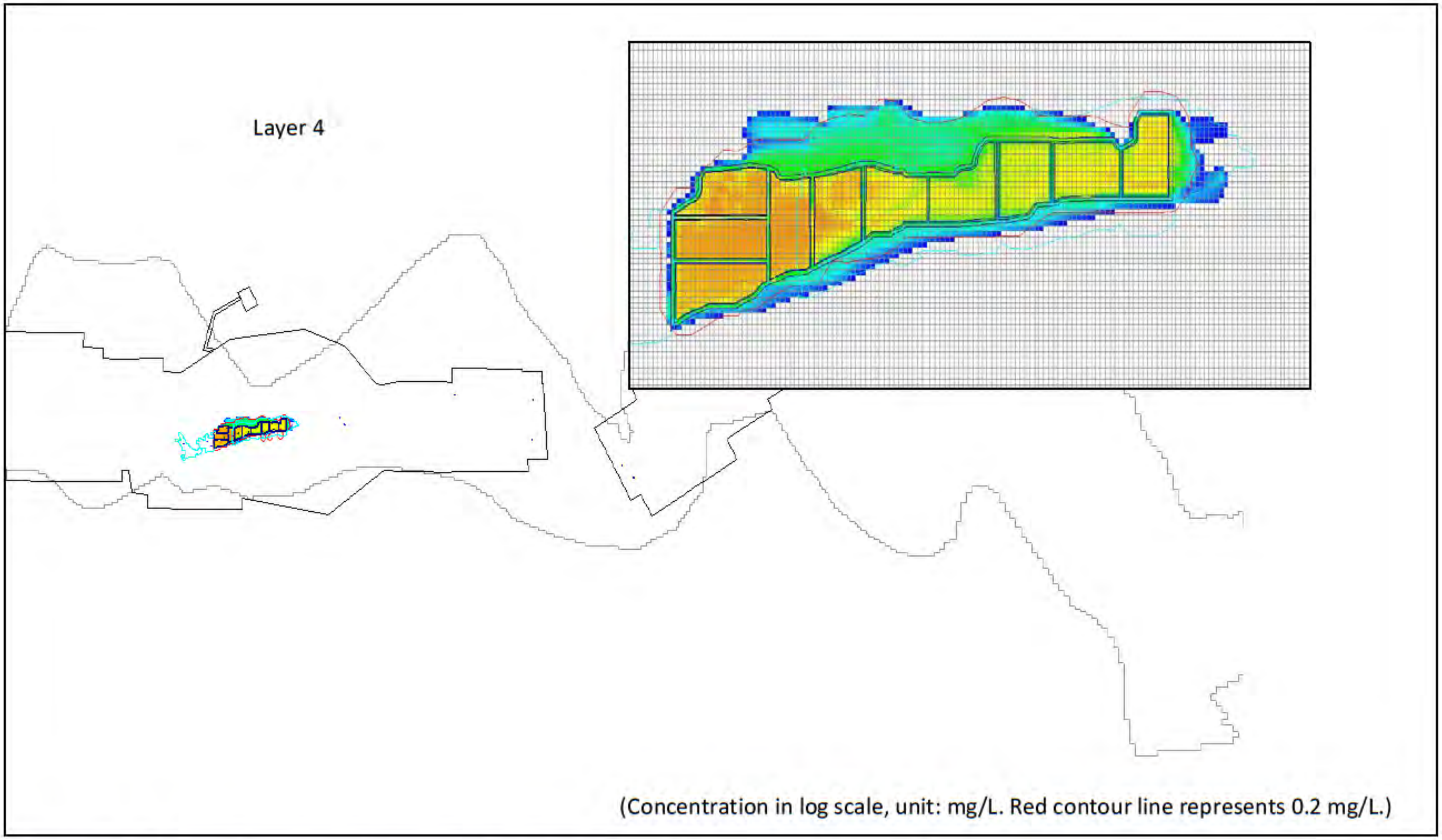


Figure A20 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 4 at year 15,000

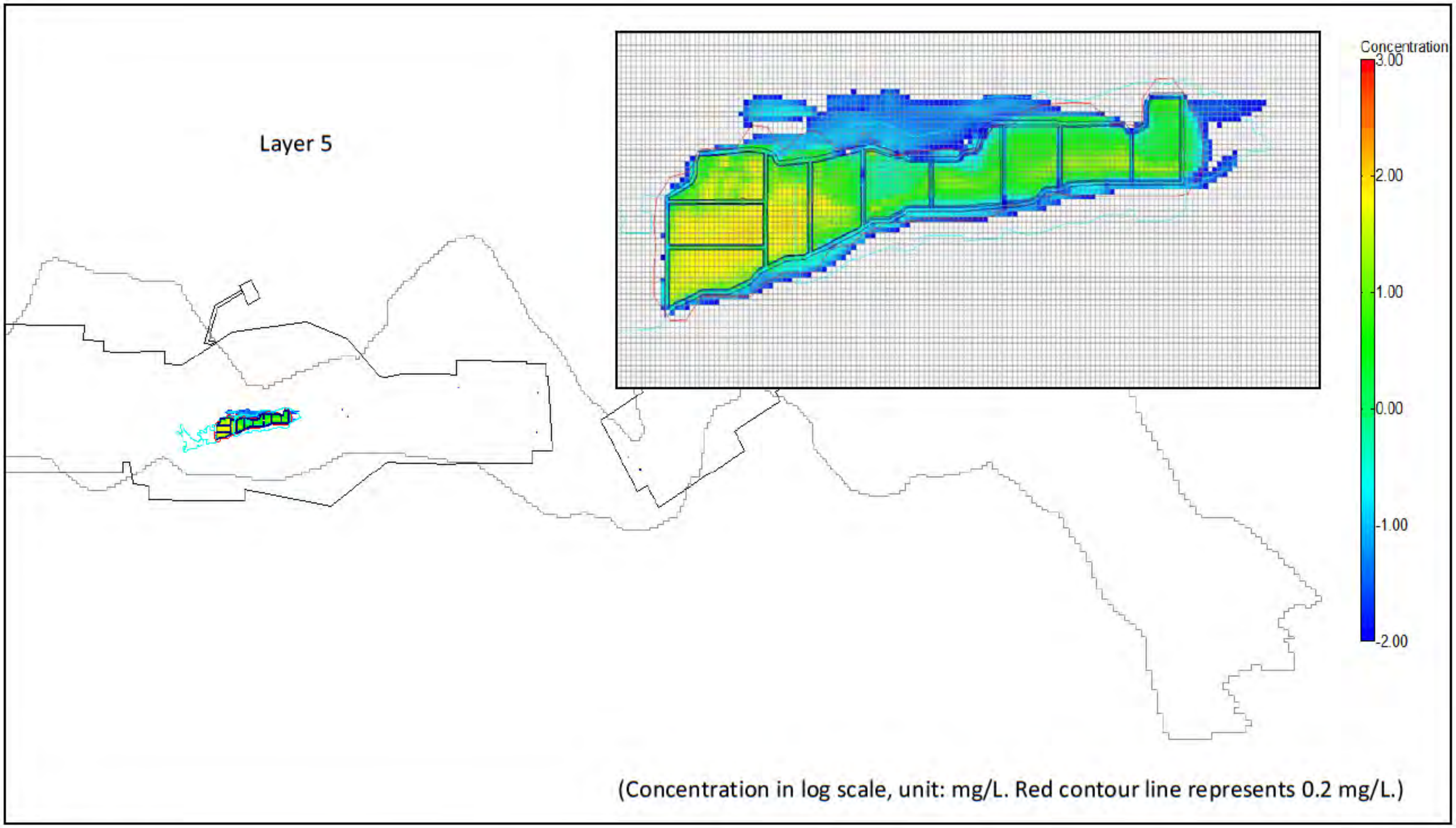
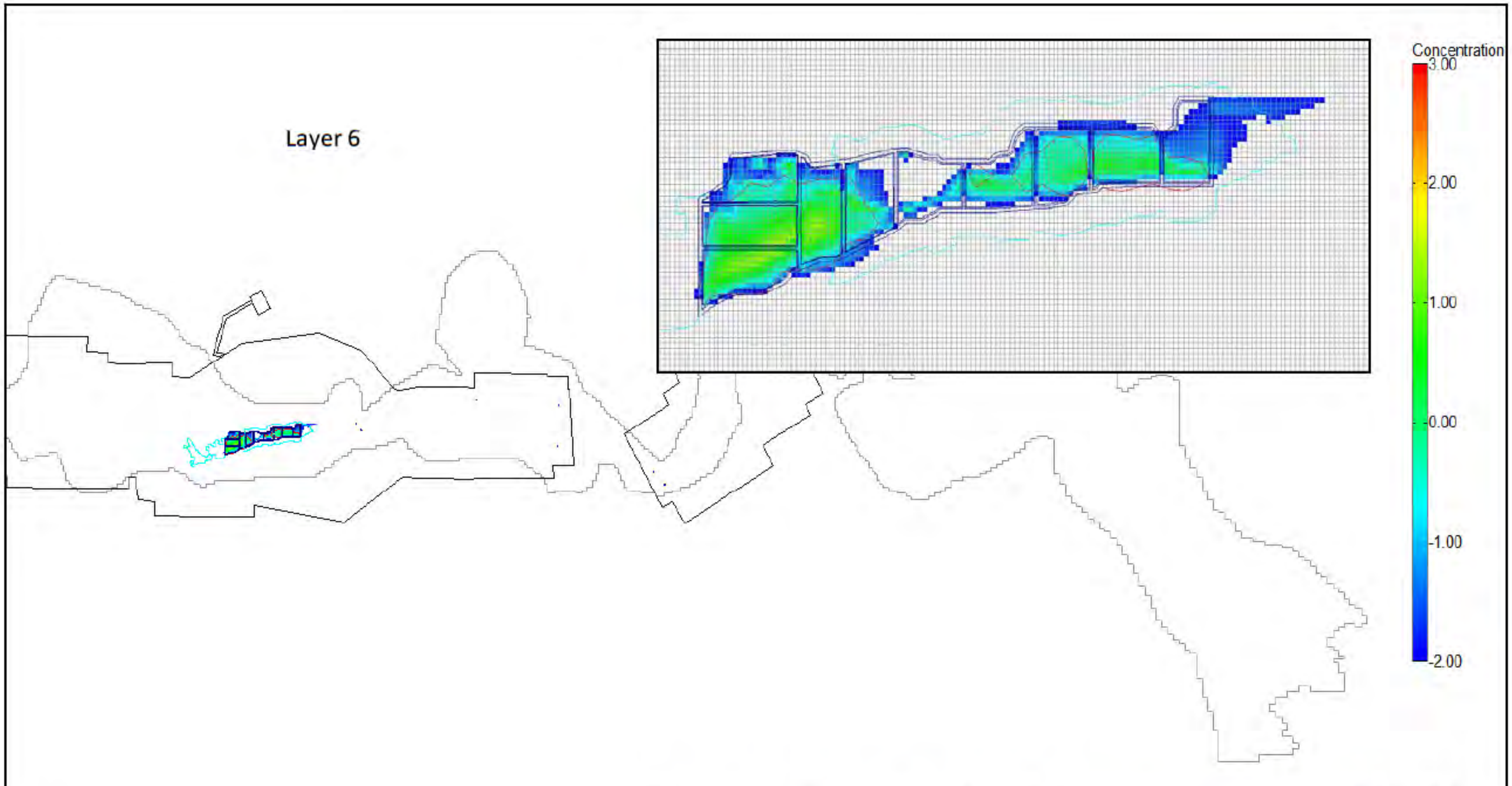


Figure A21 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 5 at year 15,000



(Concentration in log scale, unit: mg/L. Red contour line represents 0.2 mg/L.)

Figure A22 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 6 at year 15,000

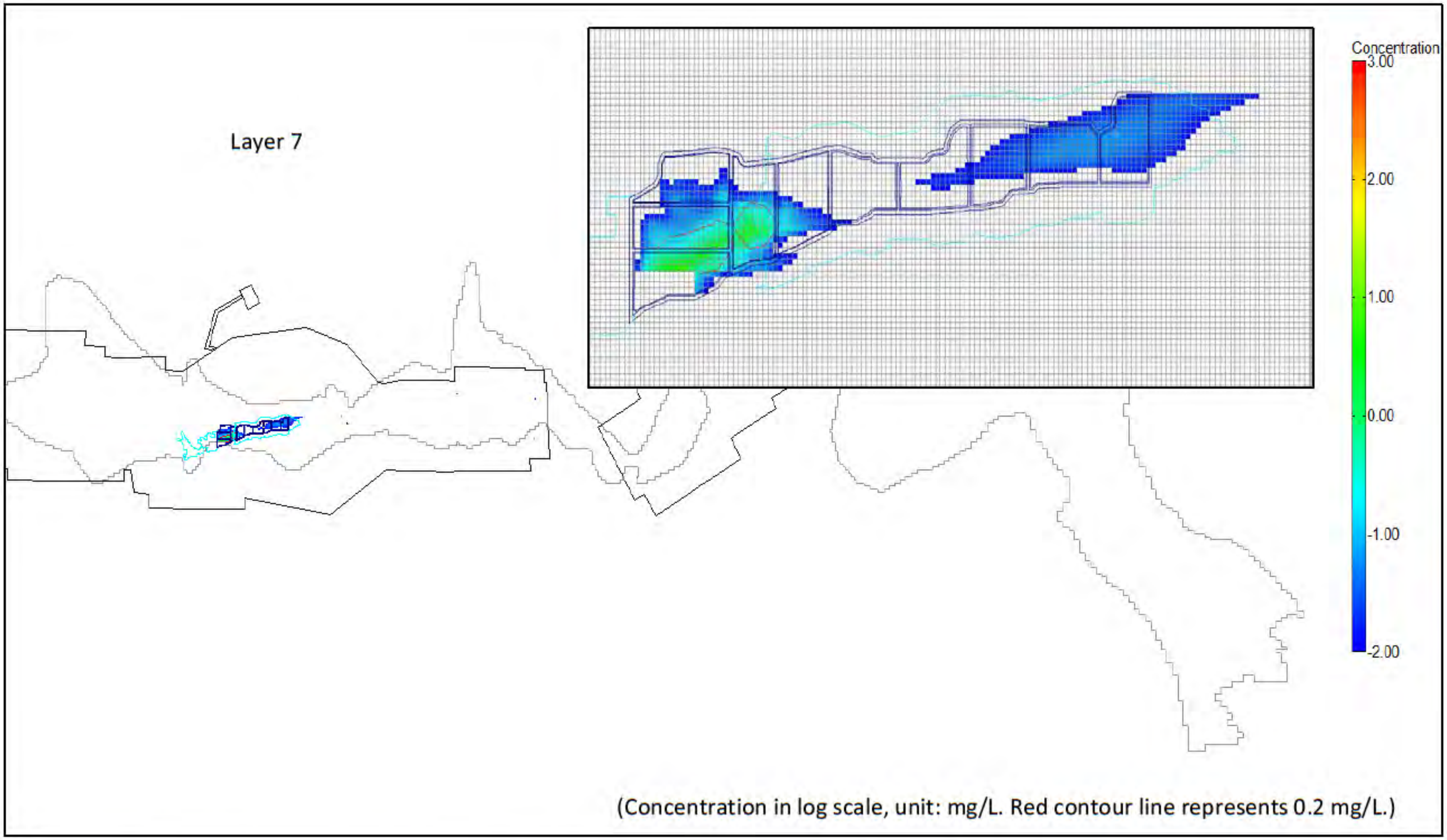


Figure A23 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 7 at year 15,000

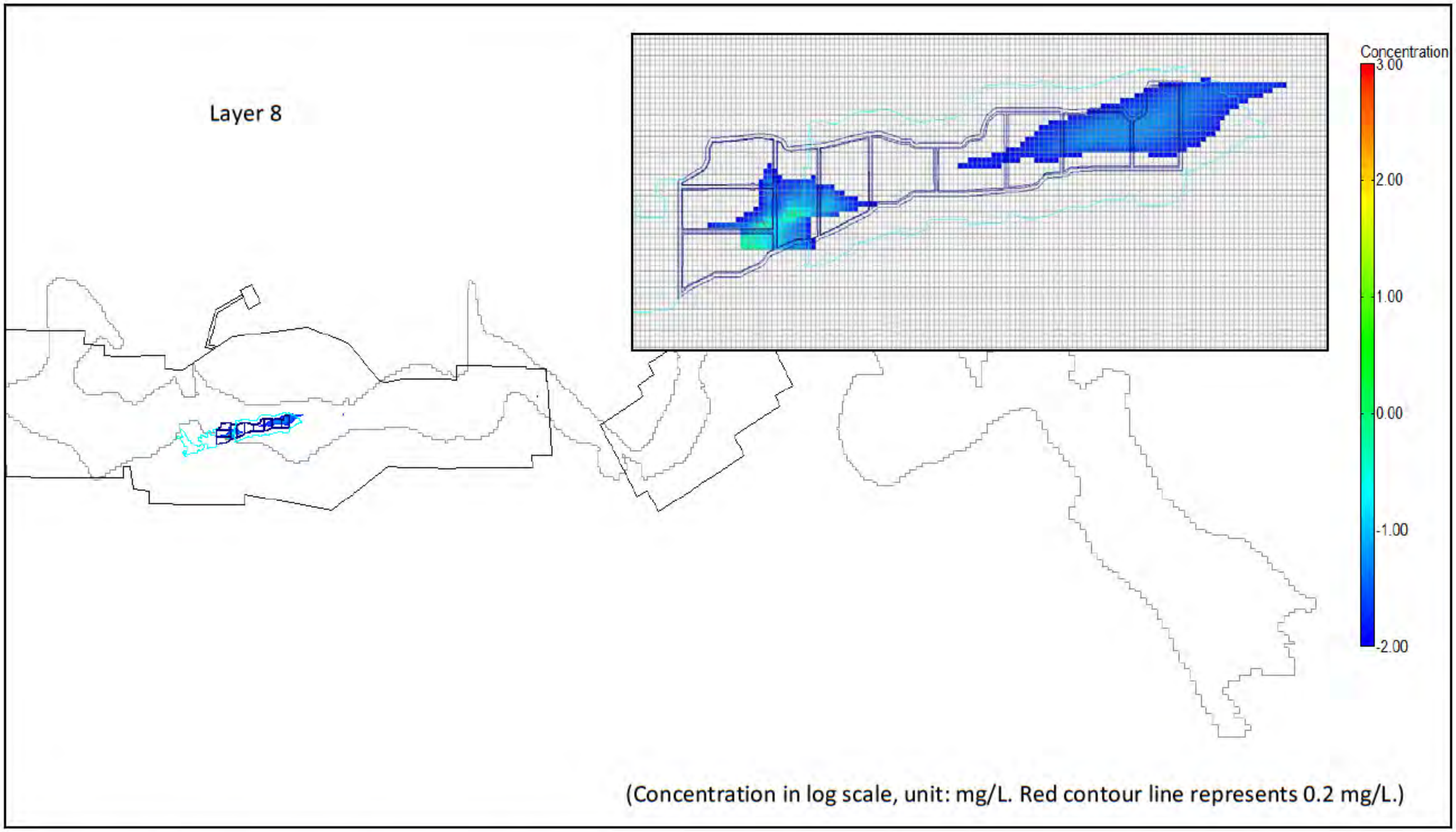


Figure A24 Effect of source term (increase by 20% relative to base case) on simulated uranium transport plume in layer 8 at year 15,000

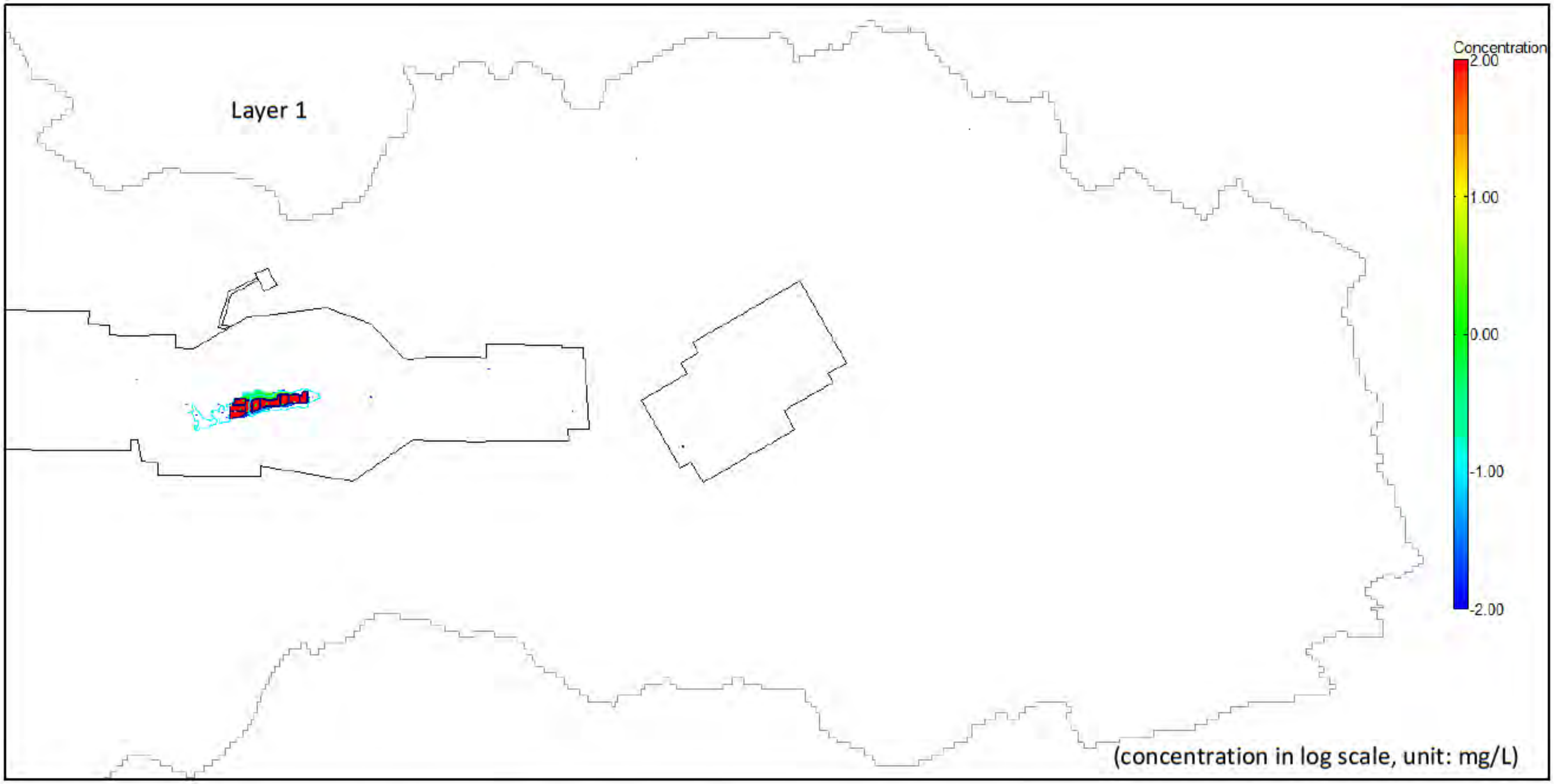


Figure A25 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 1 at year 15,000

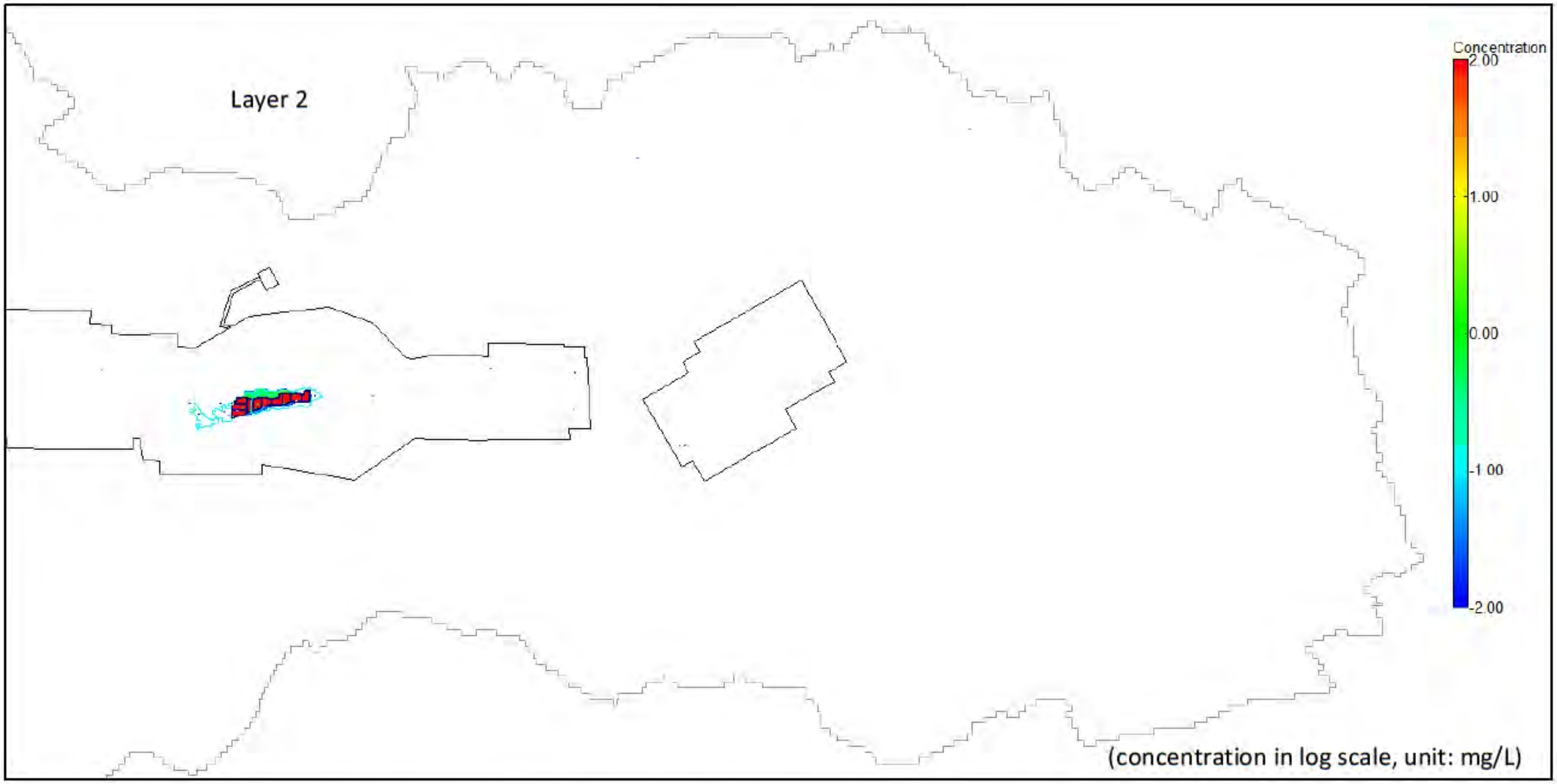


Figure A26 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 2 at year 15,000

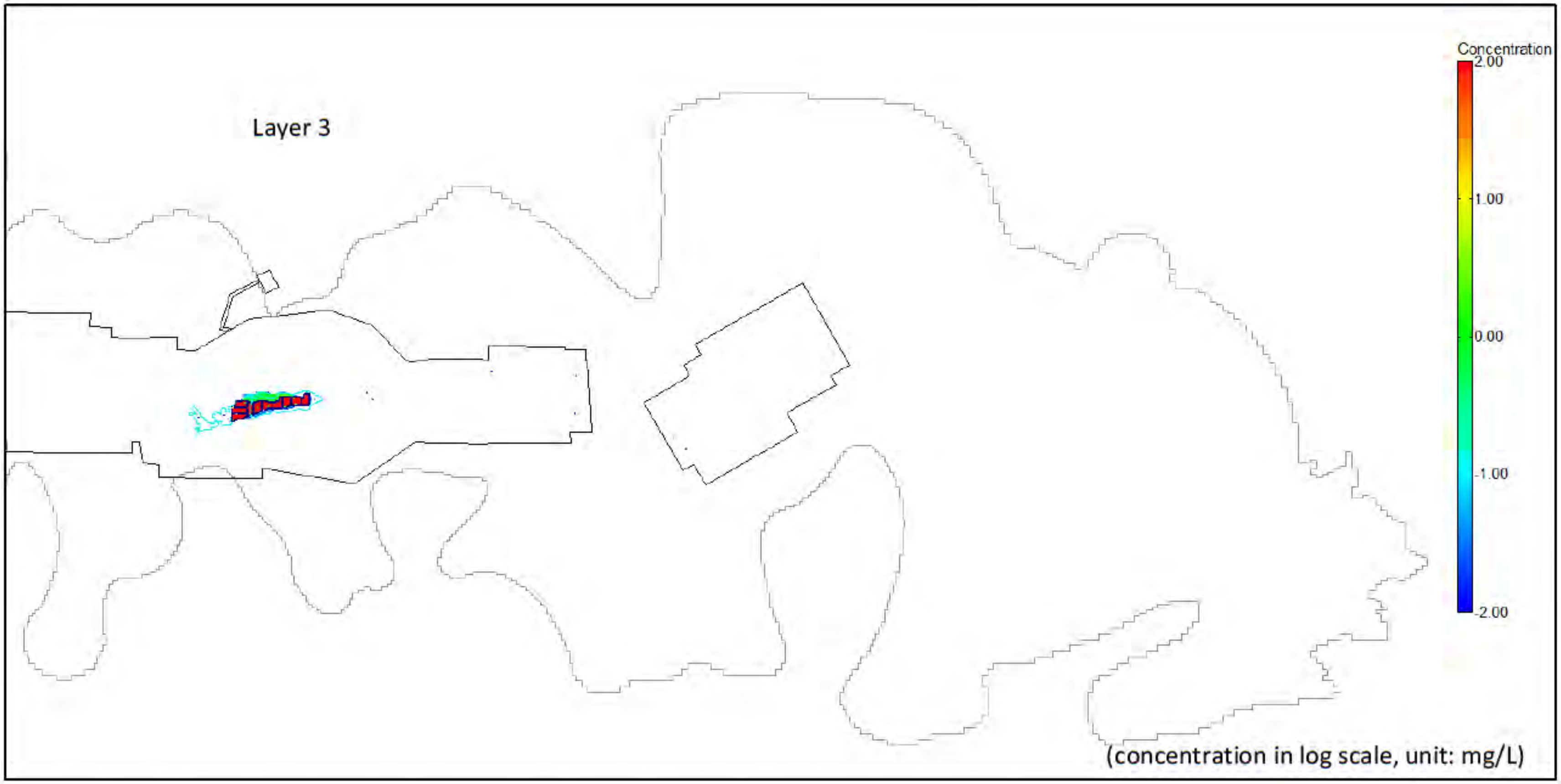


Figure A27 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 3 at year 15,000

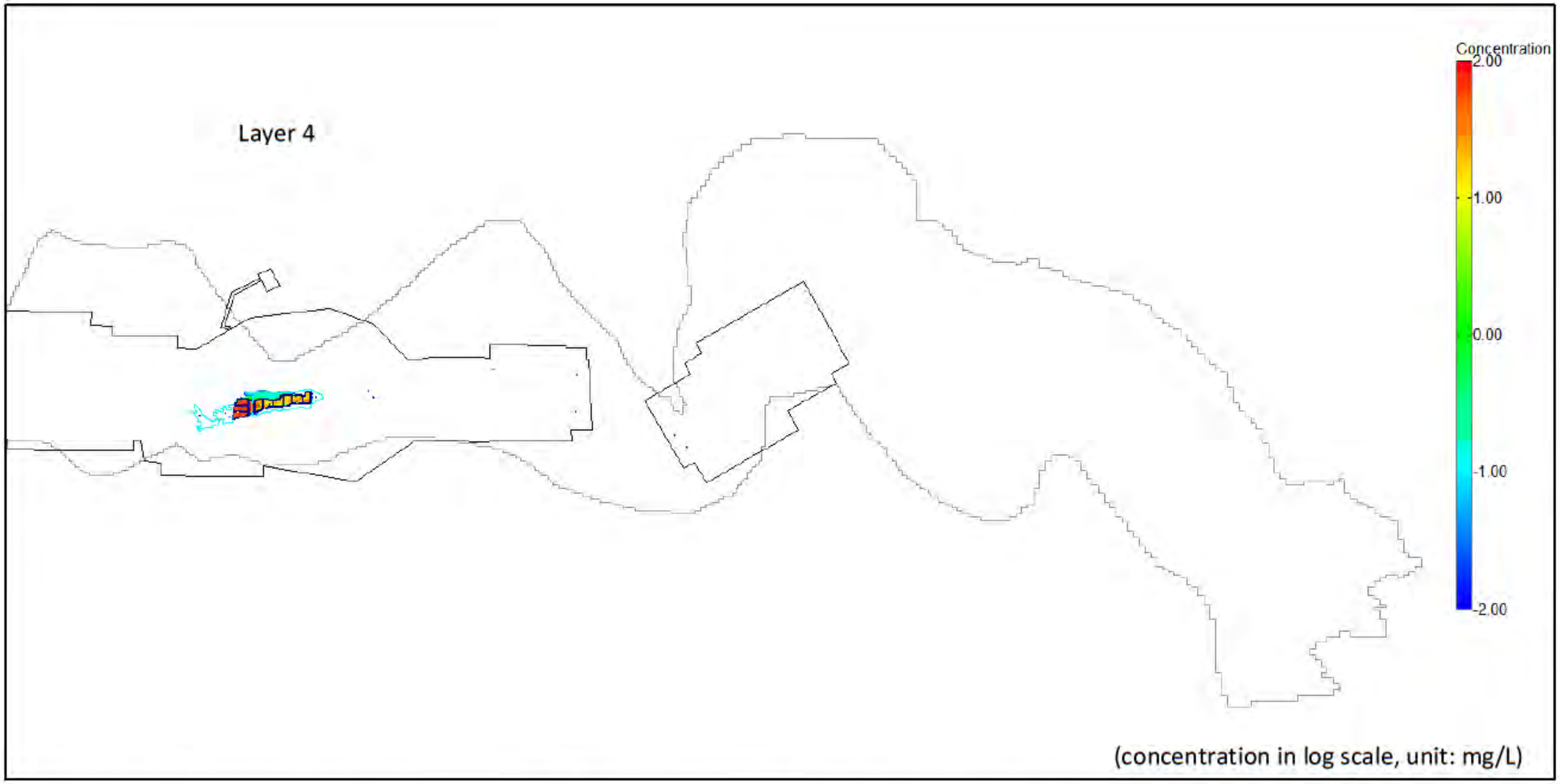


Figure A28 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 4 at year 15,000

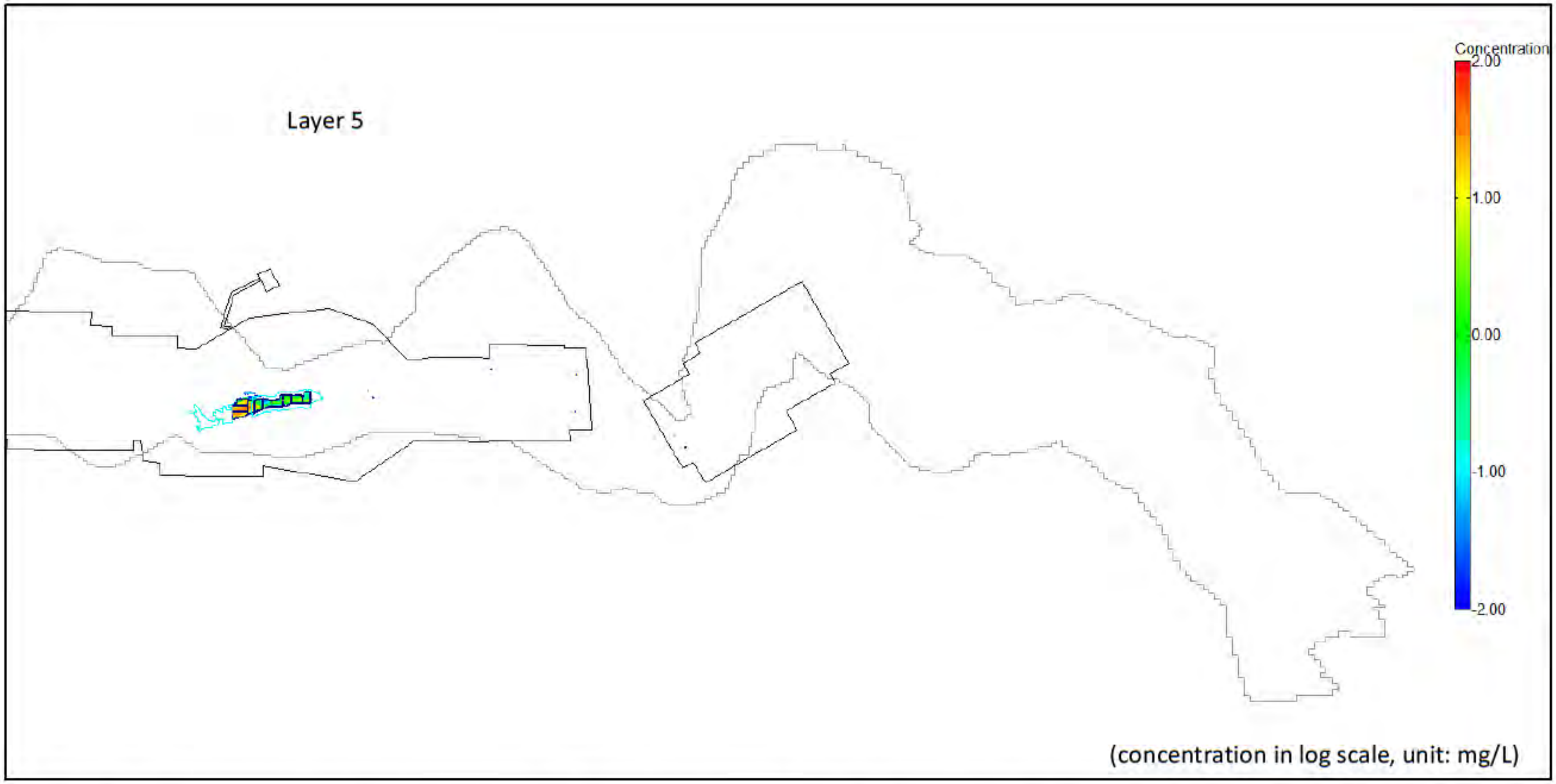


Figure A29 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 5 at year 15,000

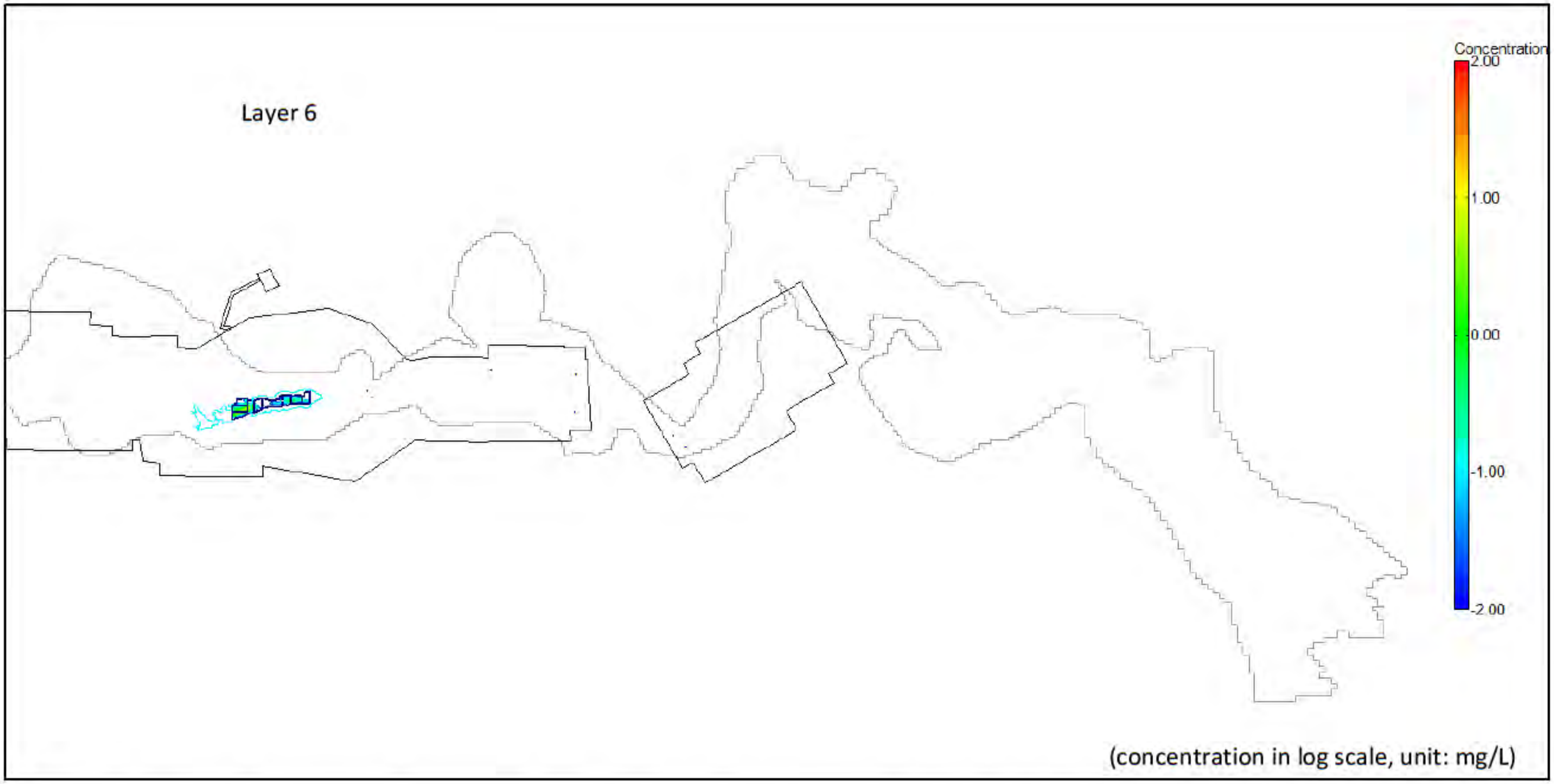


Figure A30 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 6 at year 15,000

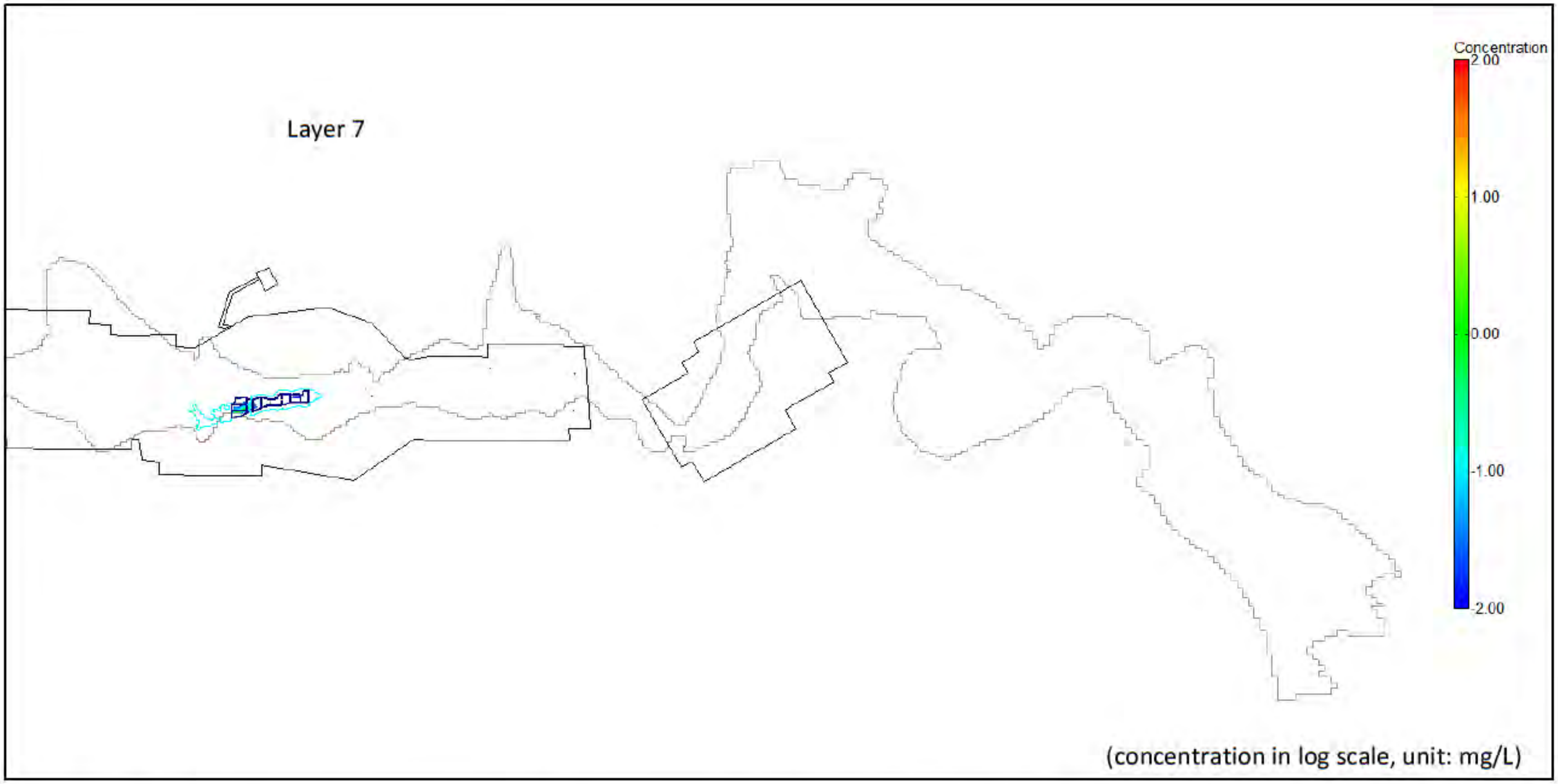


Figure A31 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 7 at year 15,000

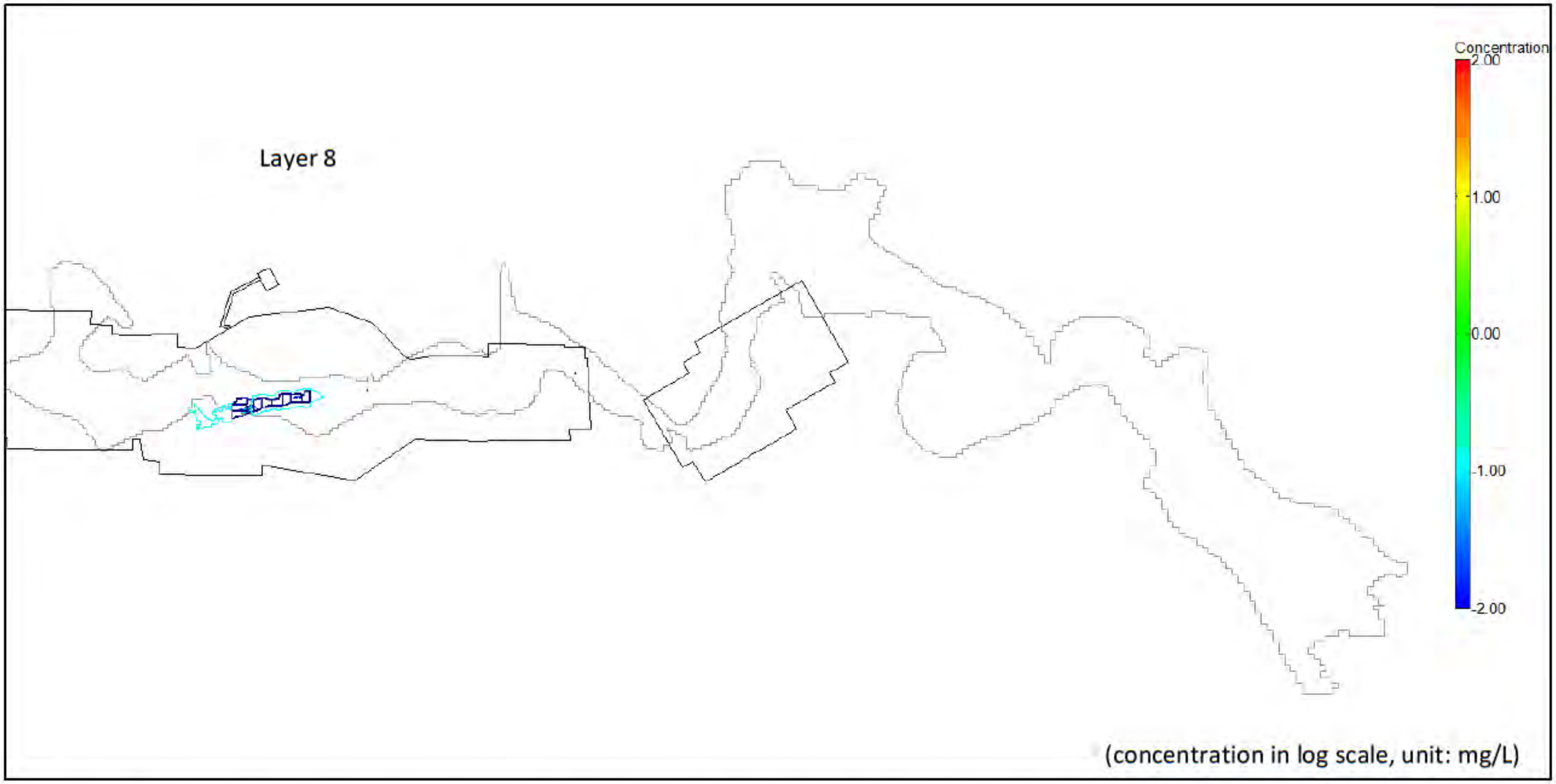


Figure A32 Effect of source term (increase by 20% relative to base case) on simulated vanadium transport plume in layer 8 at year 15,000

Sensitivity Run

K_D = 0.1 x K_D Base Case

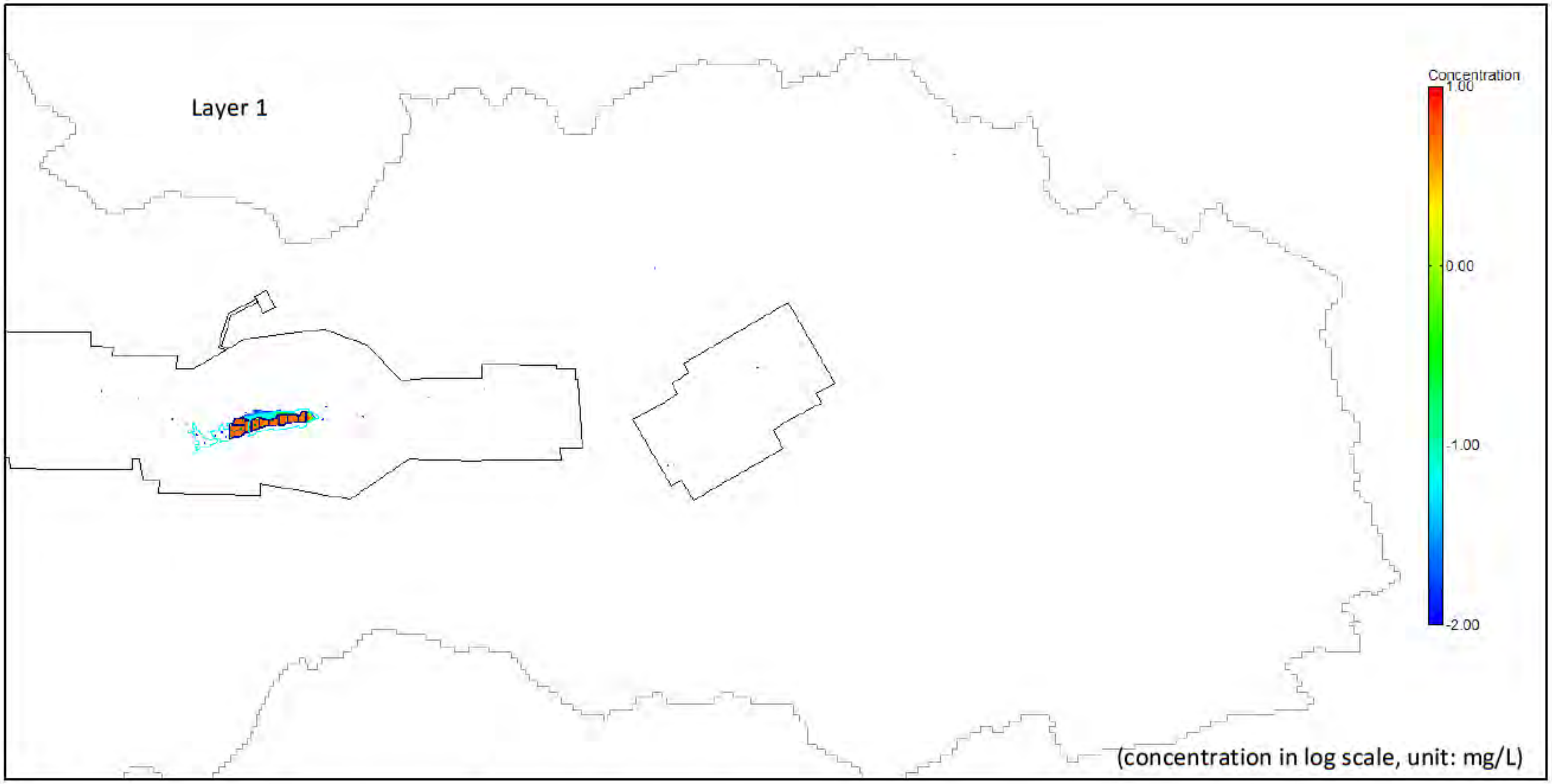


Figure B1 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 1 at year 15,000

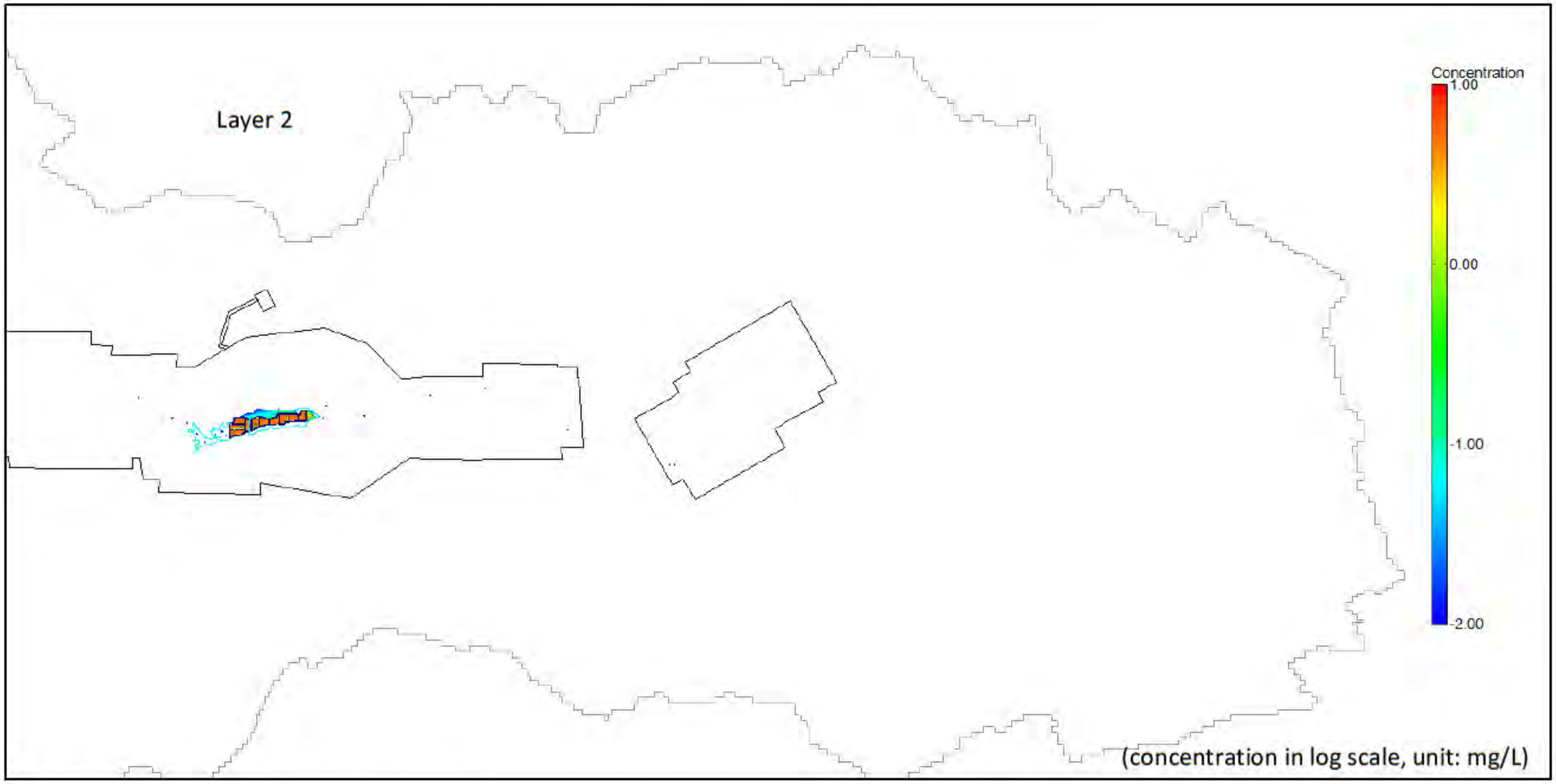


Figure B2 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 2 at year 15,000

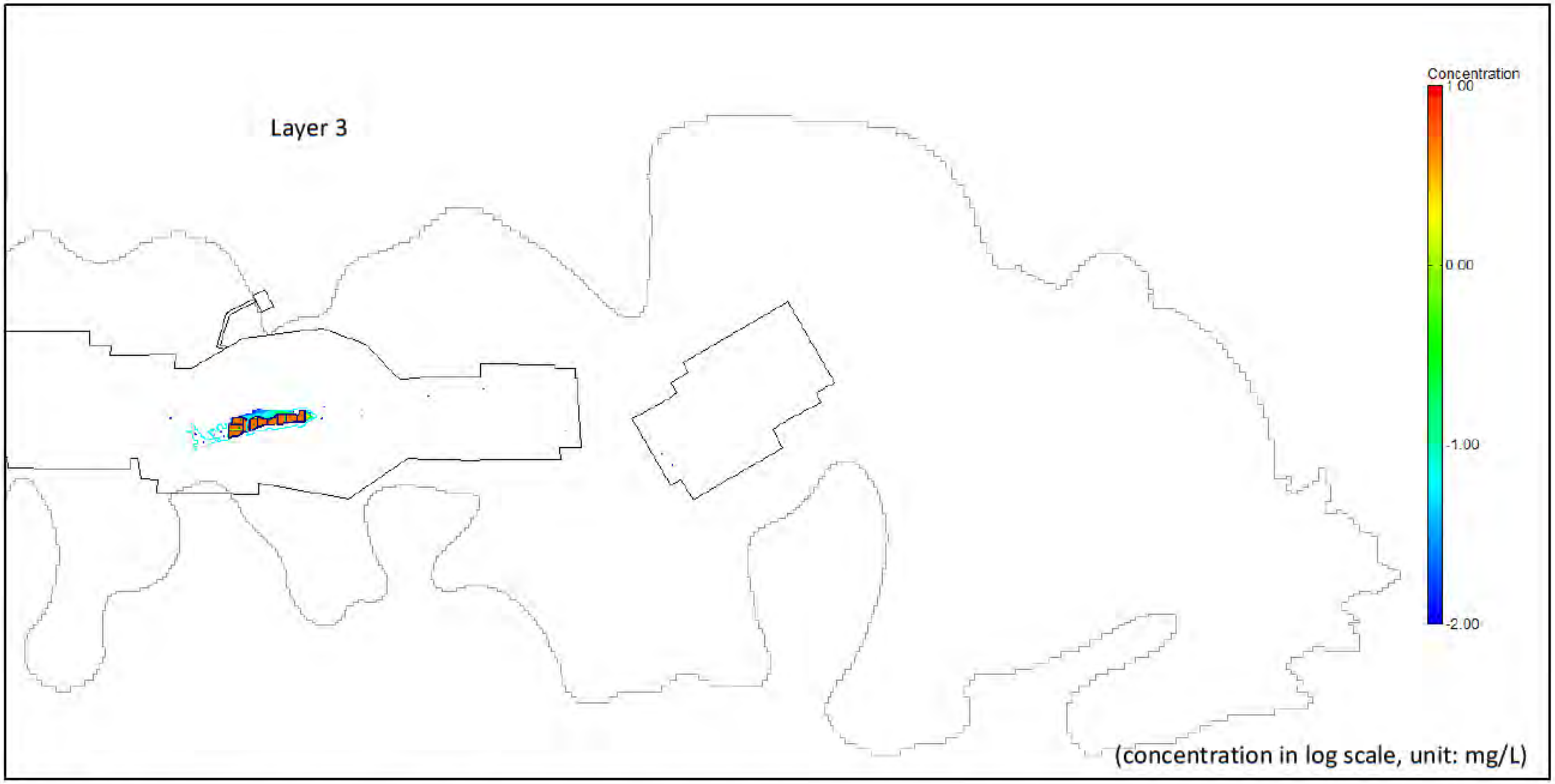


Figure B3 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 3 at year 15,000

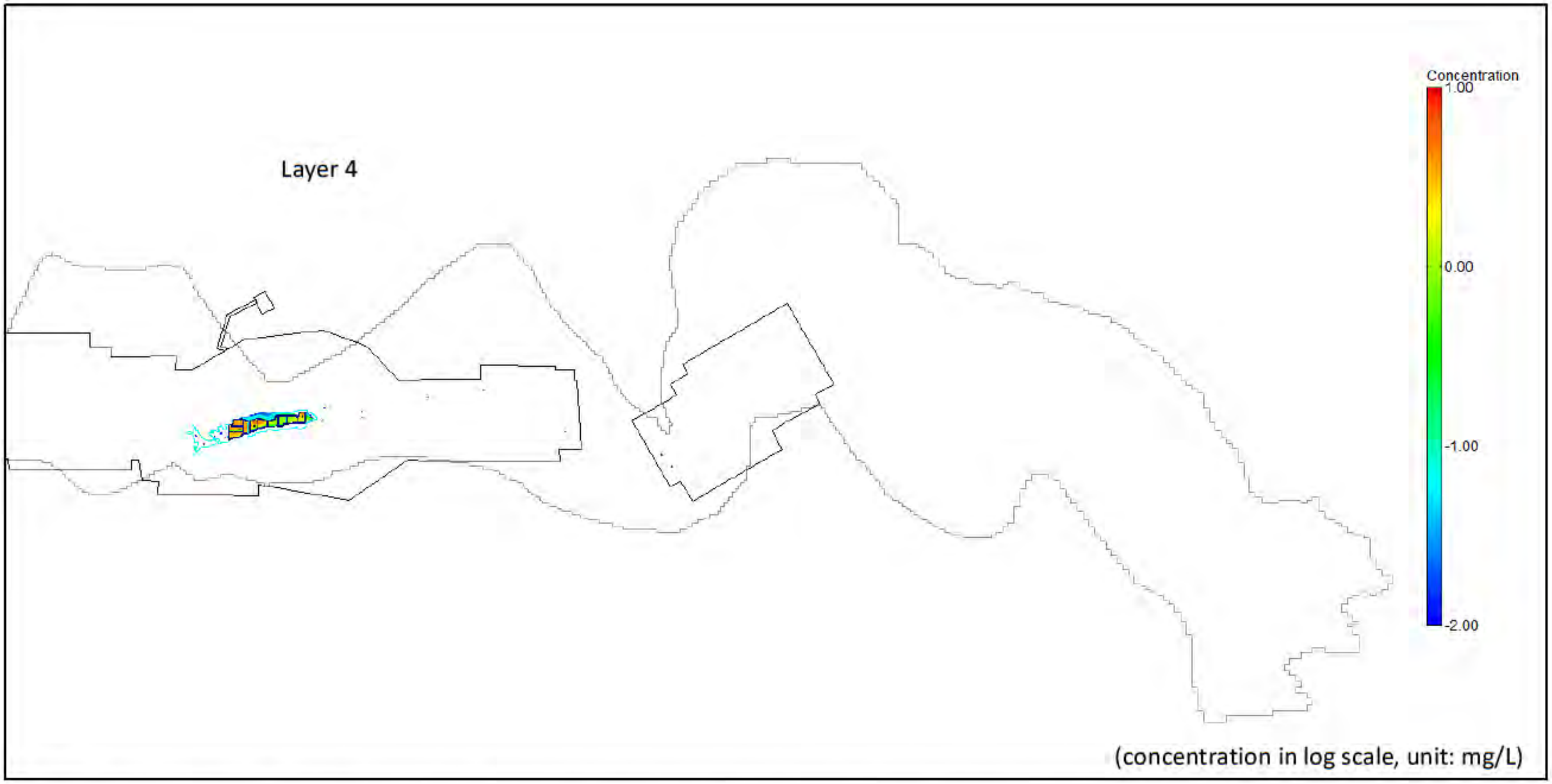


Figure B4 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 4 at year 15,000

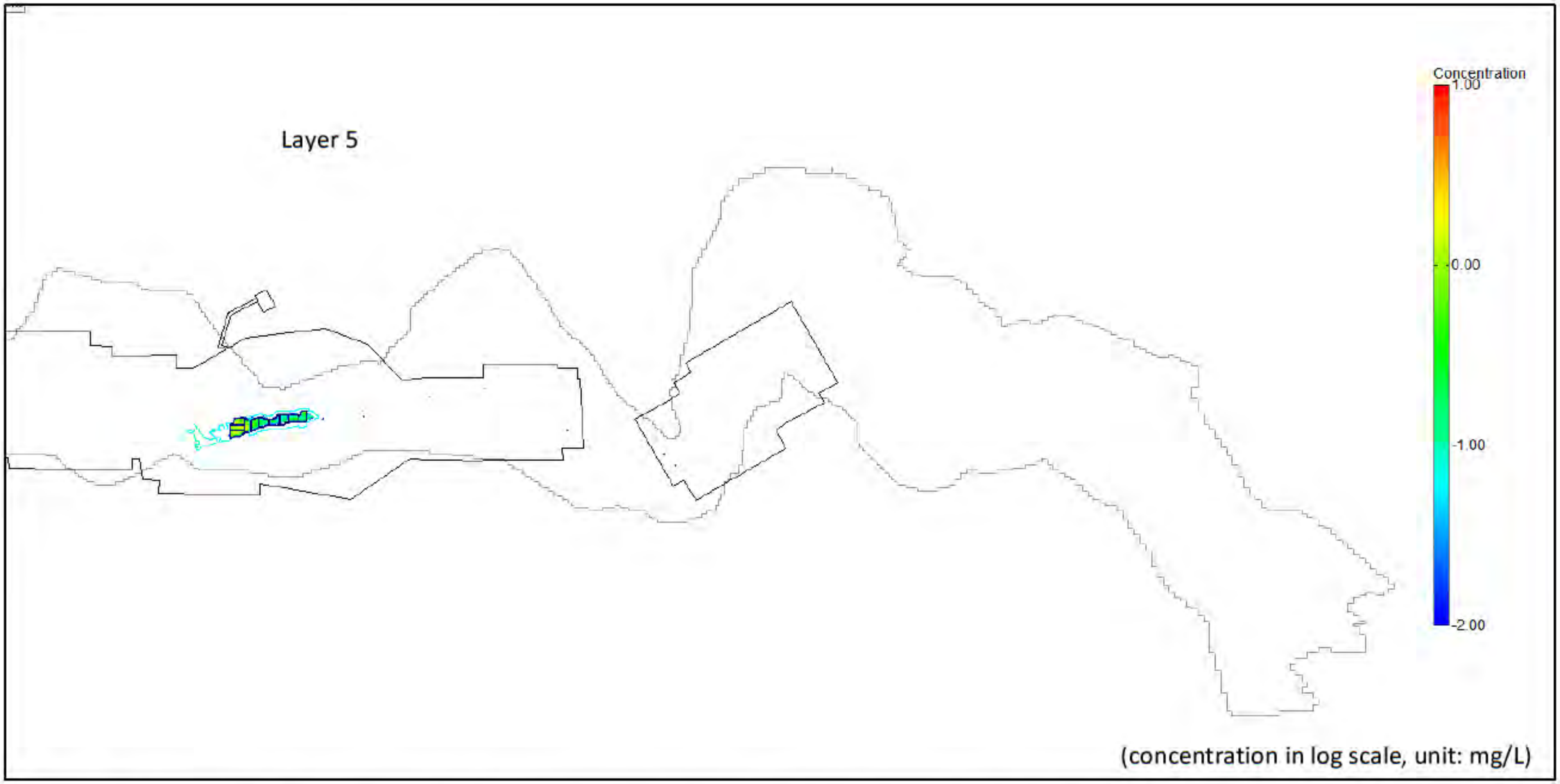


Figure B5 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 5 at year 15,000

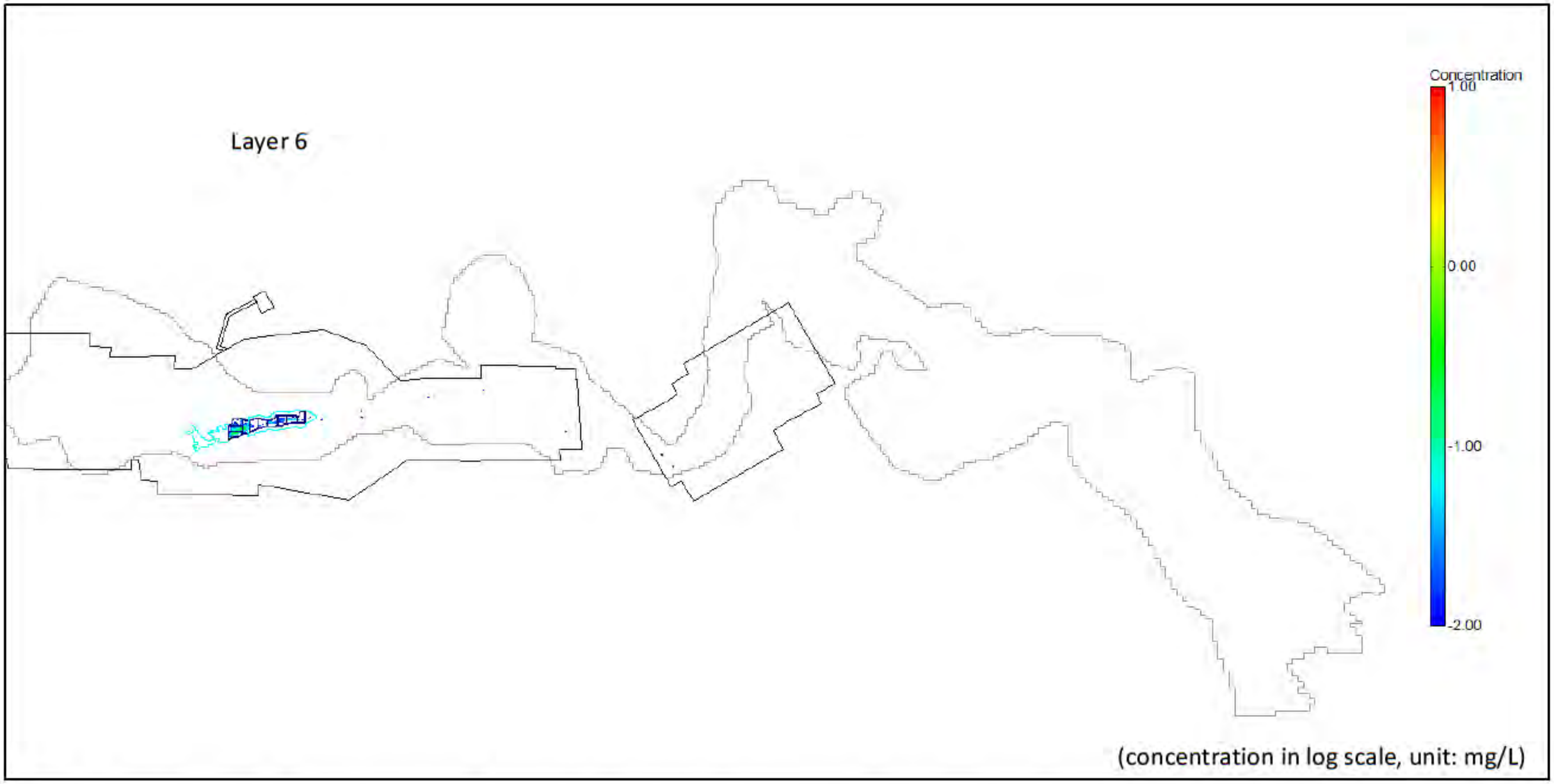


Figure B6 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 6 at year 15,000

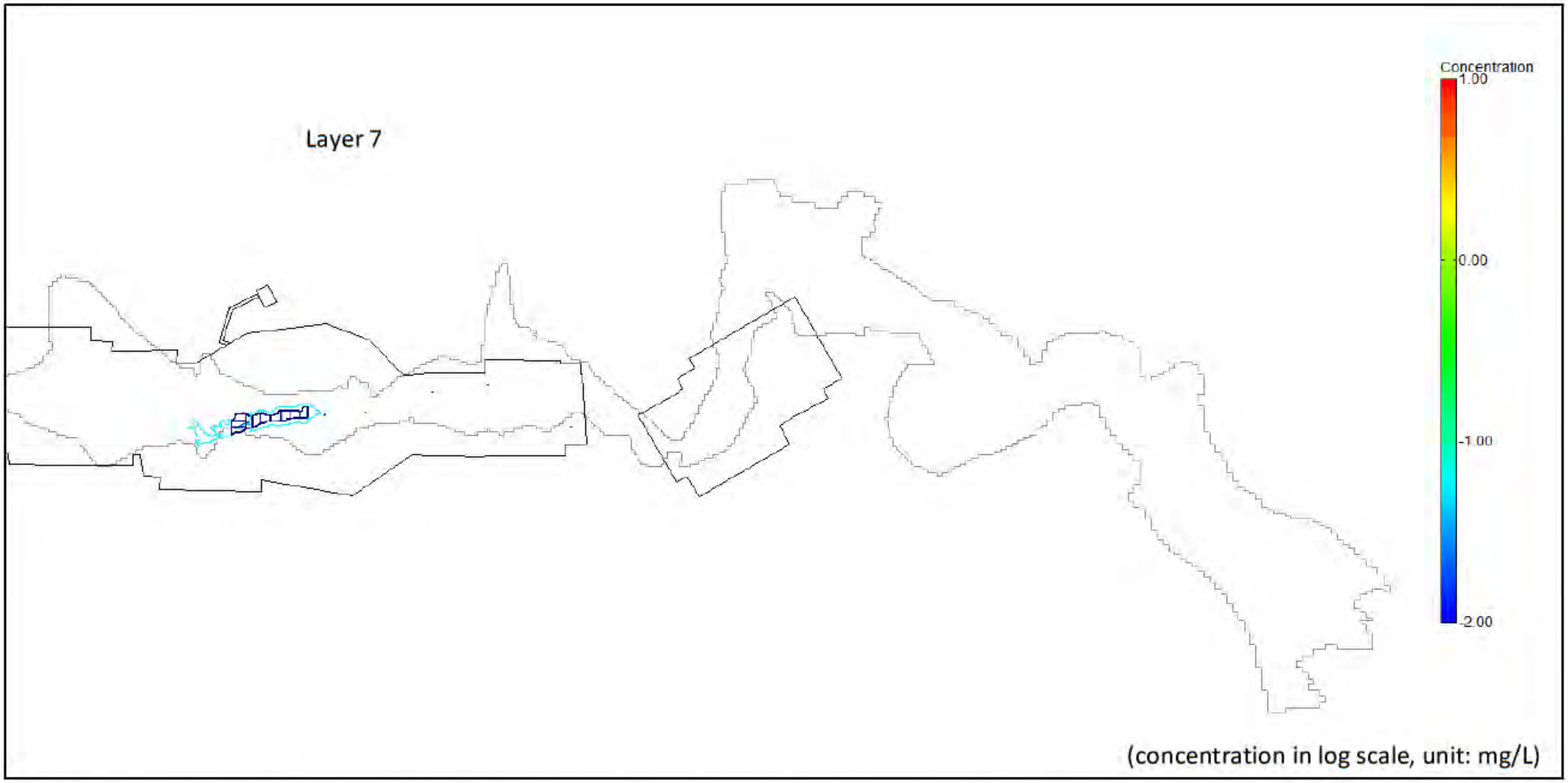


Figure B7 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 7 at year 15,000

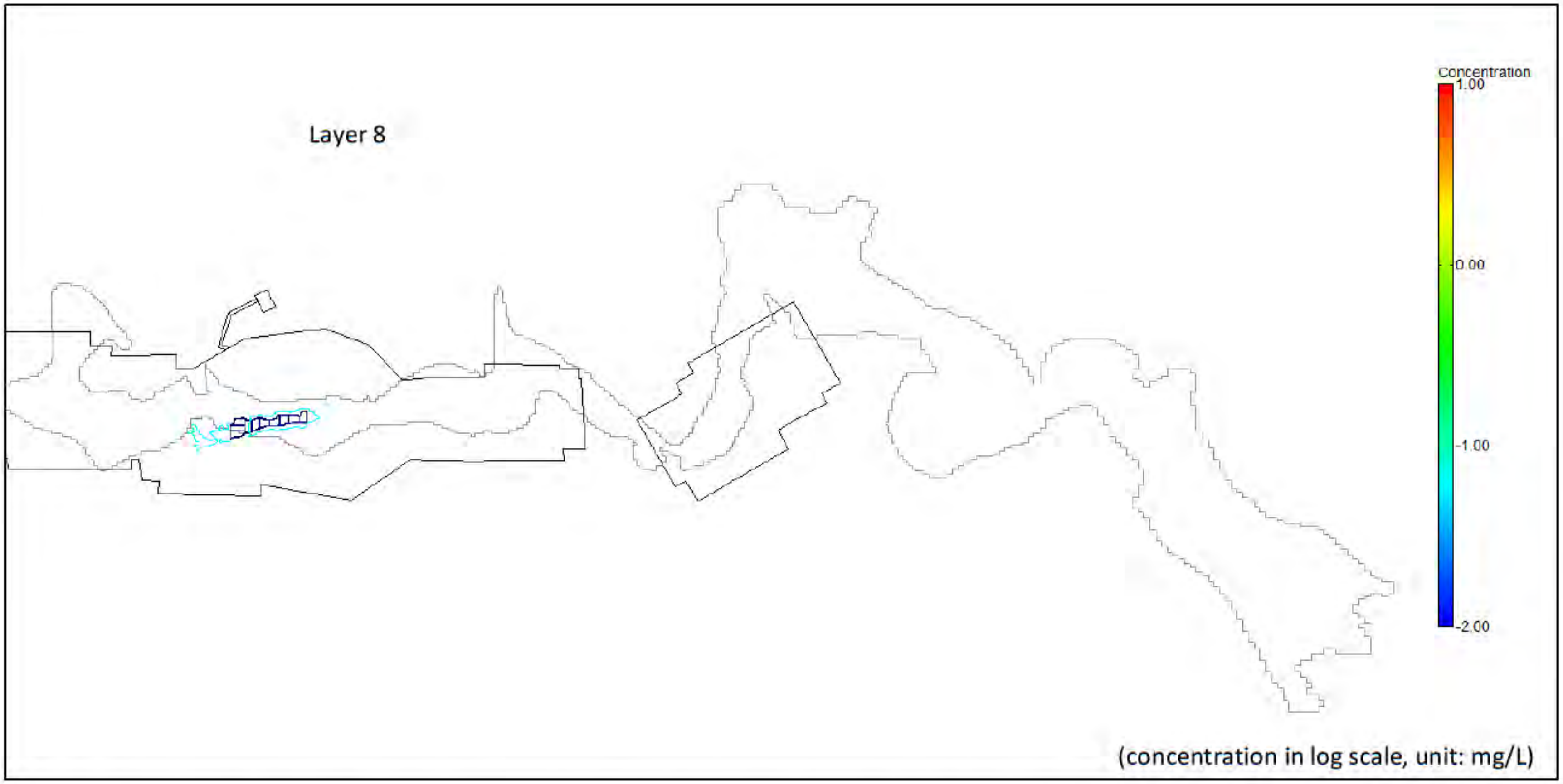


Figure B8 Effect of K_d (0.1 × base case K_d) on simulated arsenic transport plume in layer 8 at year 15,000

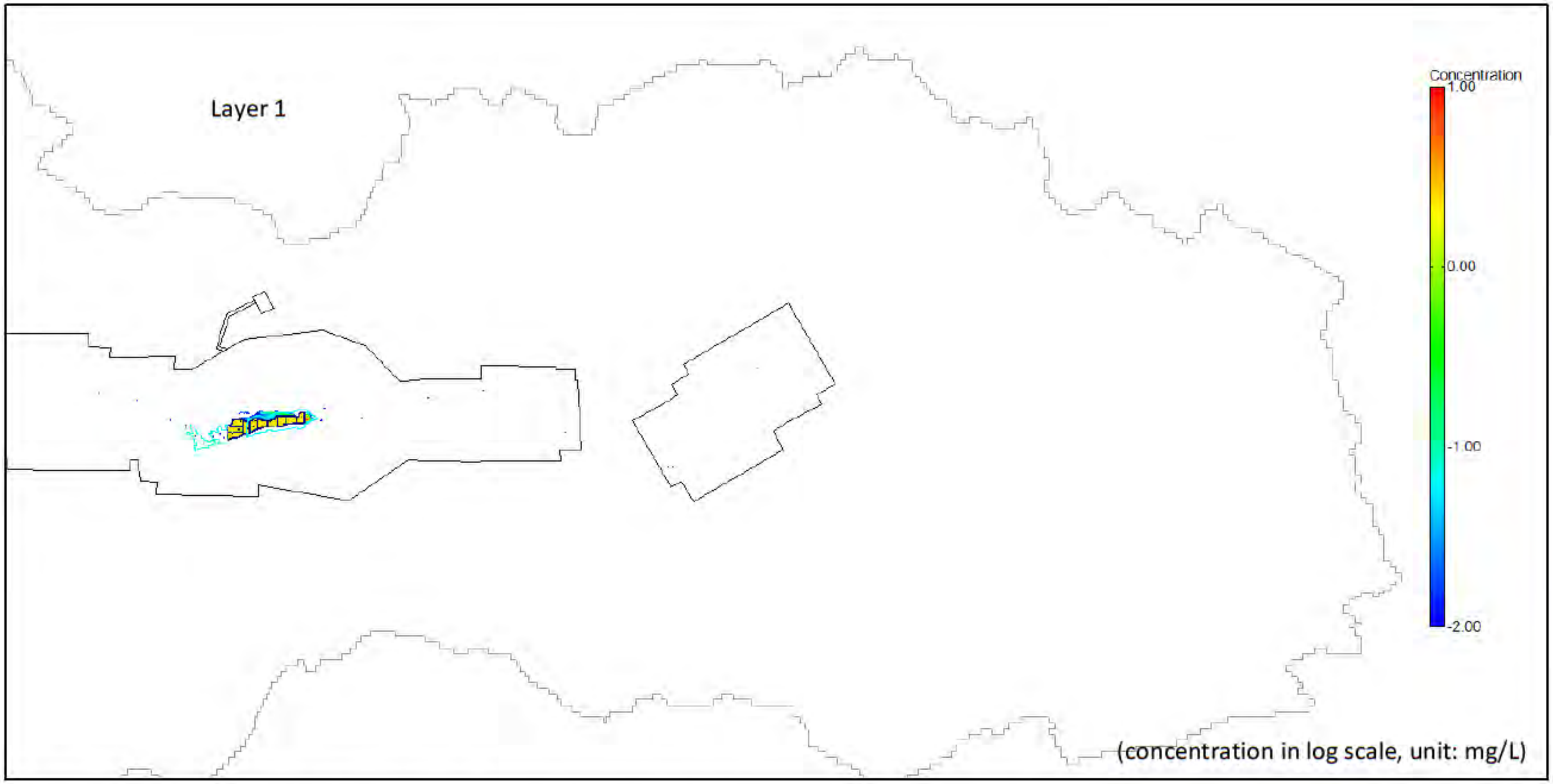


Figure B9 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 1 at year 15,000

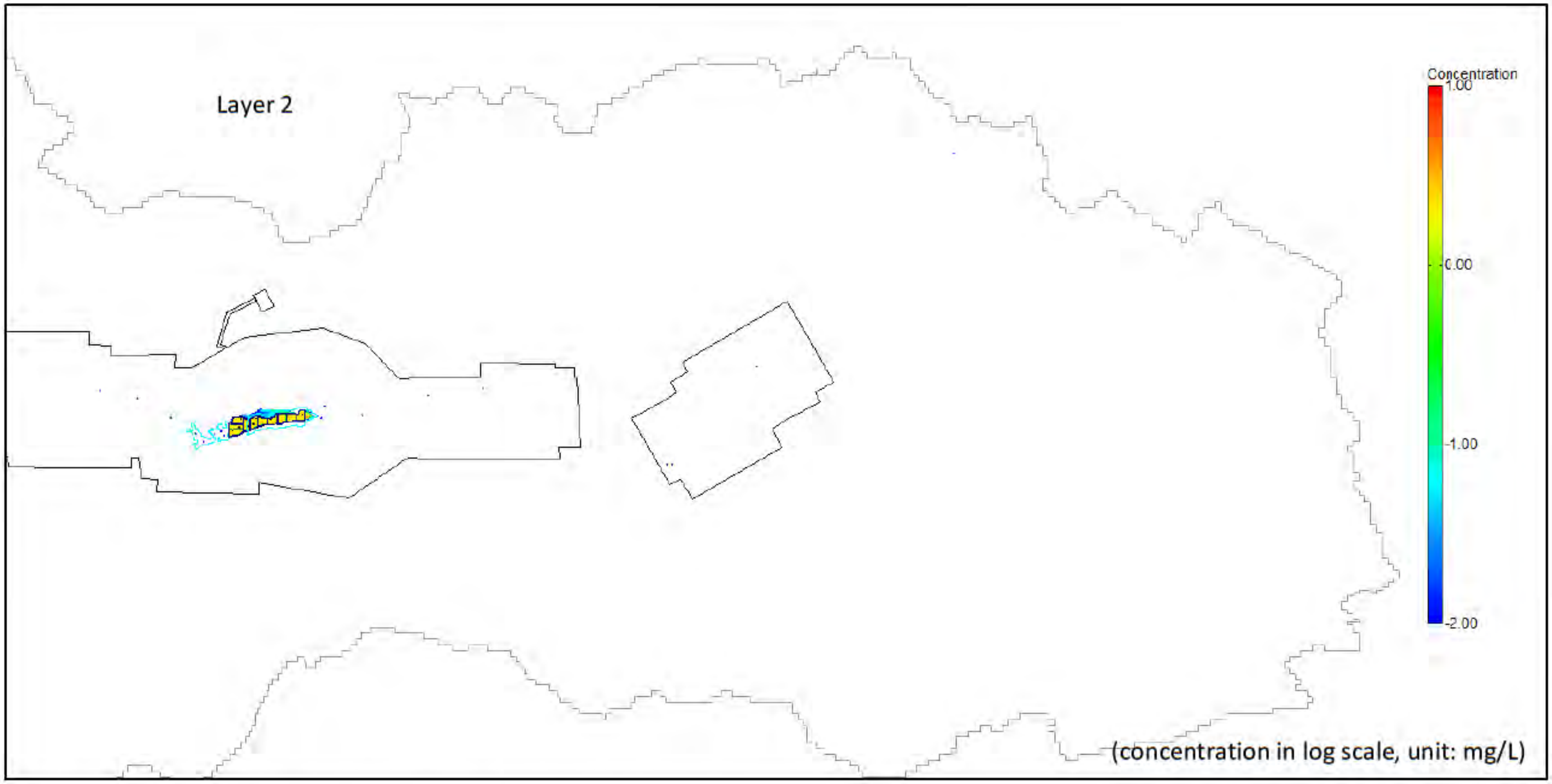


Figure B10 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 2 at year 15,000

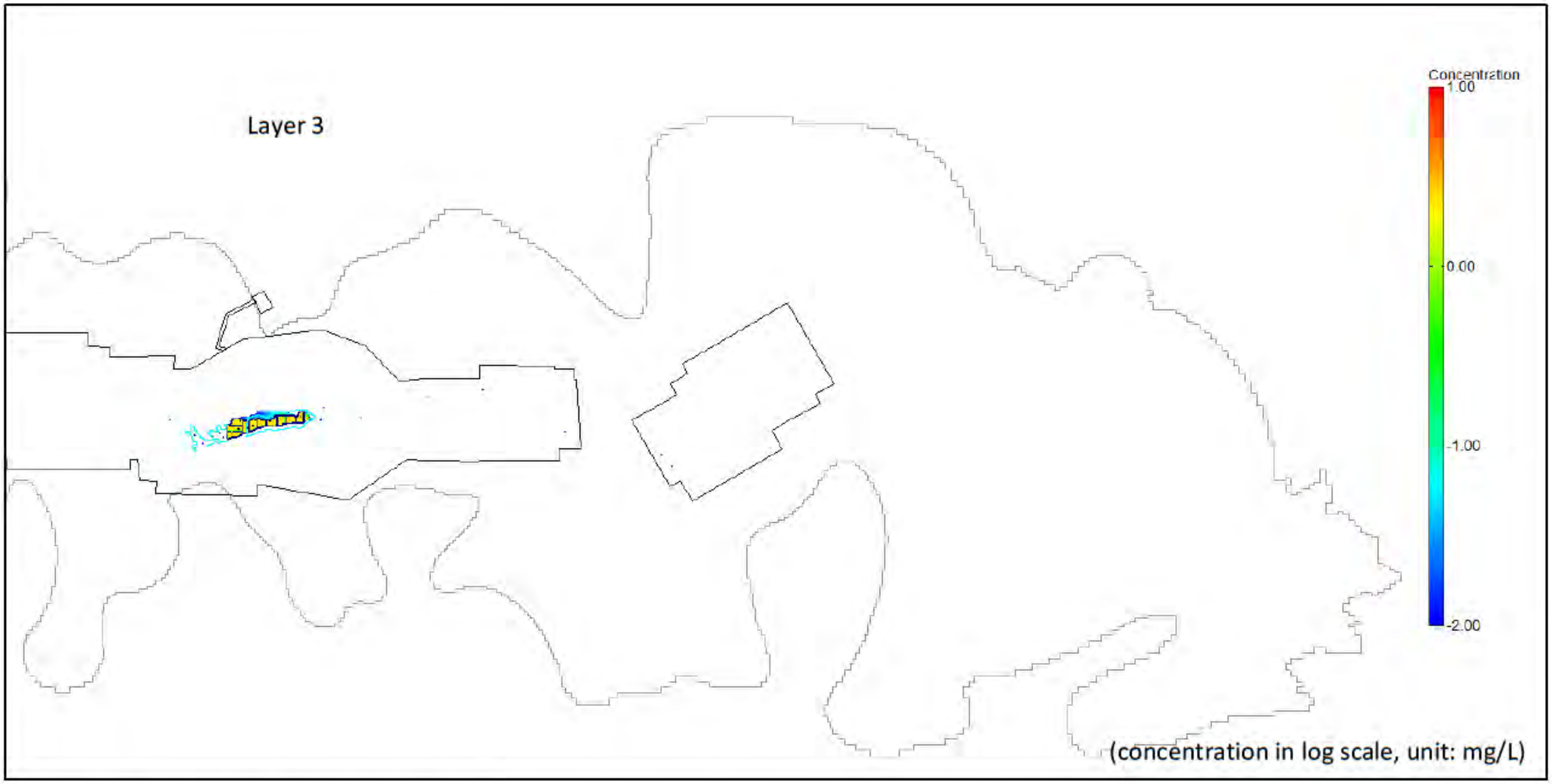


Figure B11 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 3 at year 15,000

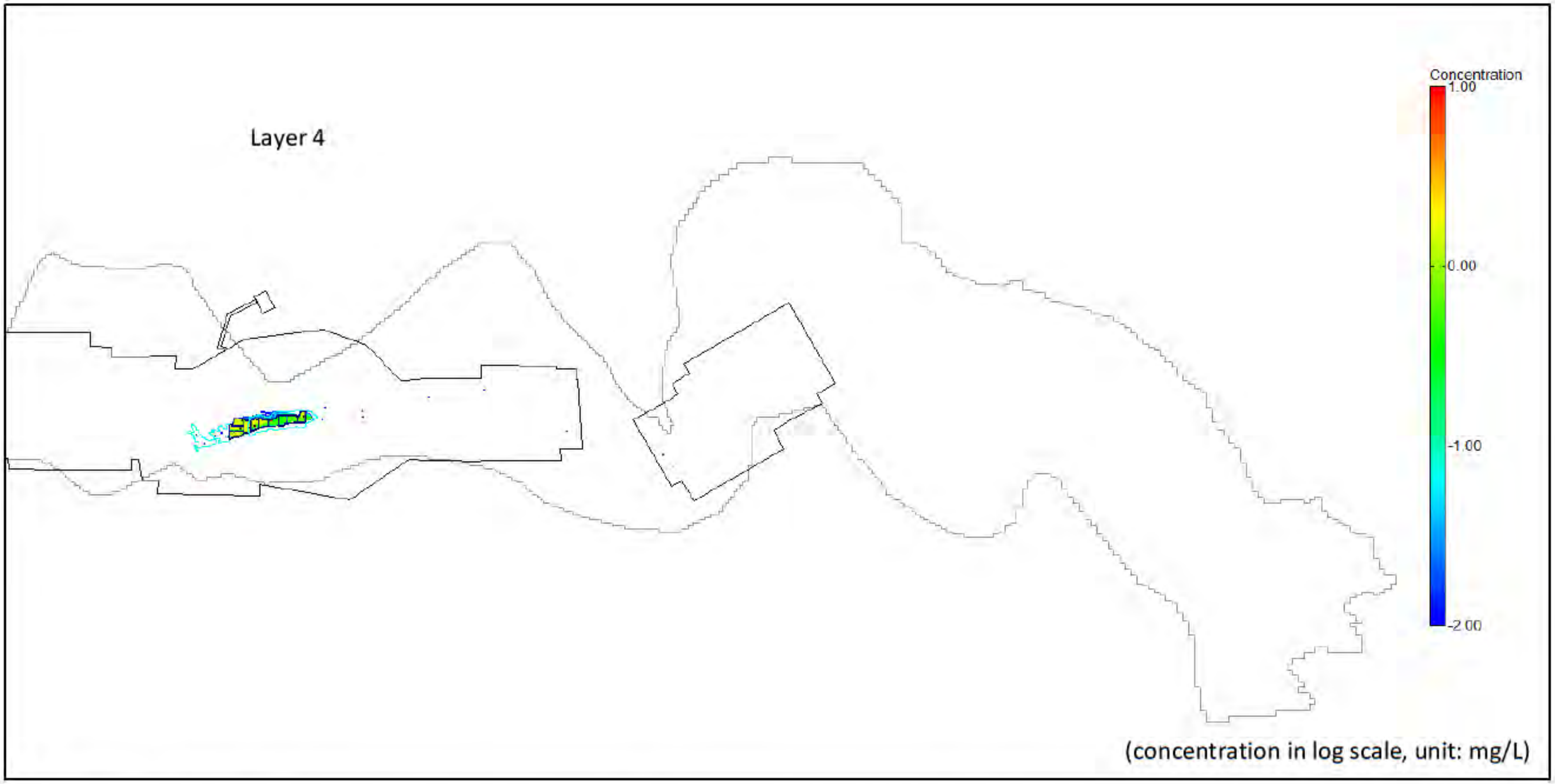


Figure B12 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 4 at year 15,000

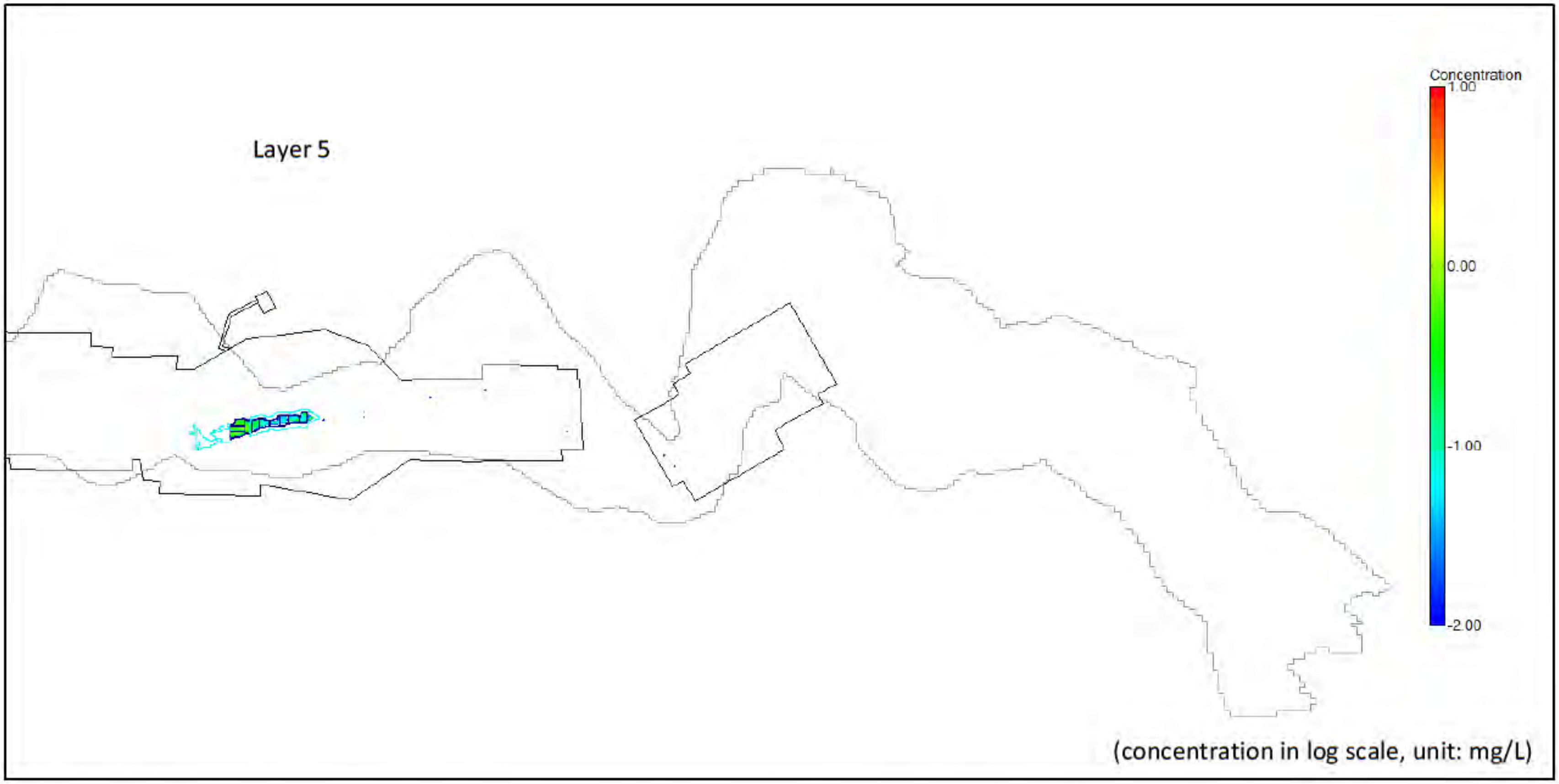


Figure B13 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 5 at year 15,000

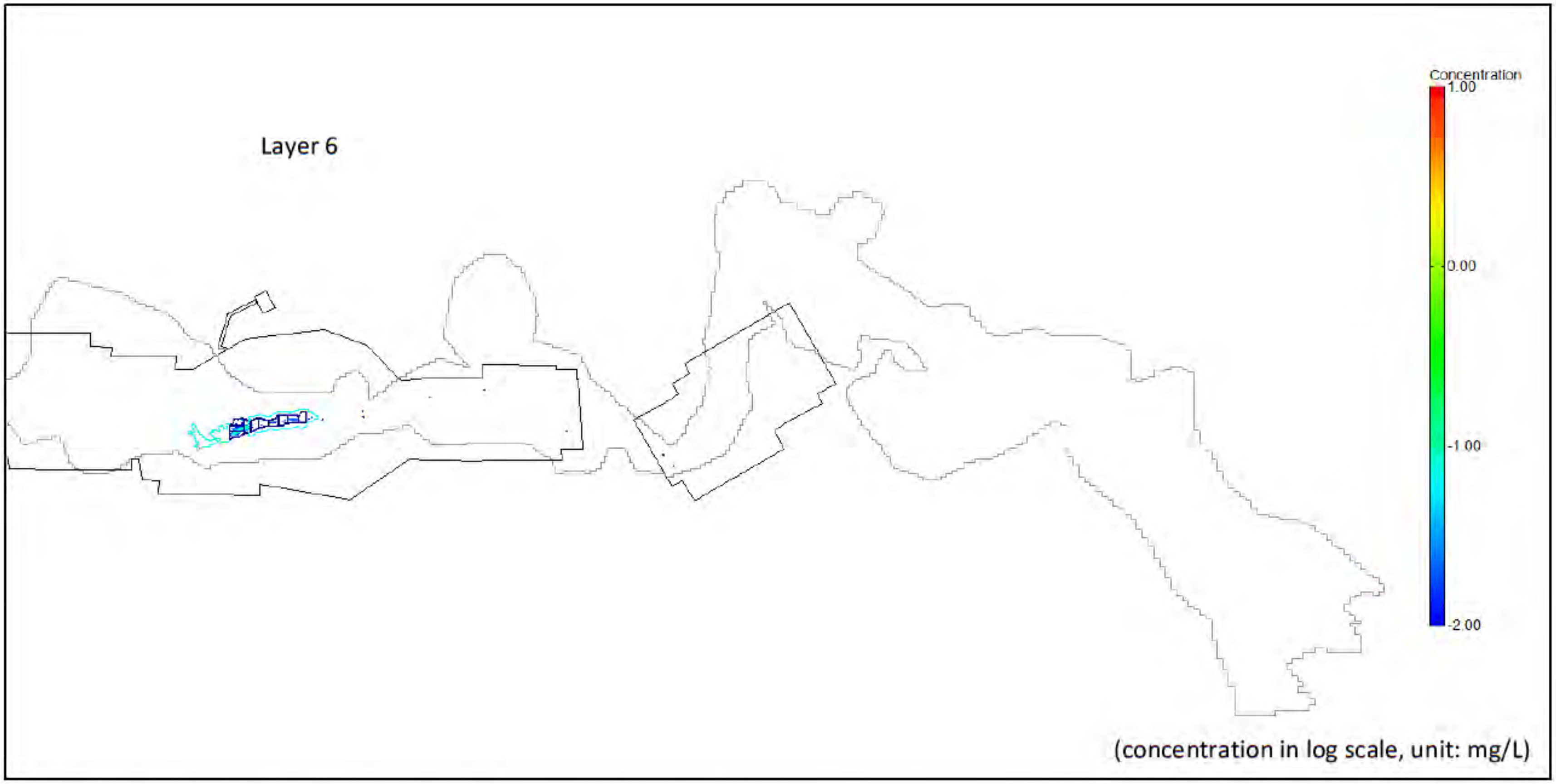


Figure B14 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 6 at year 15,000

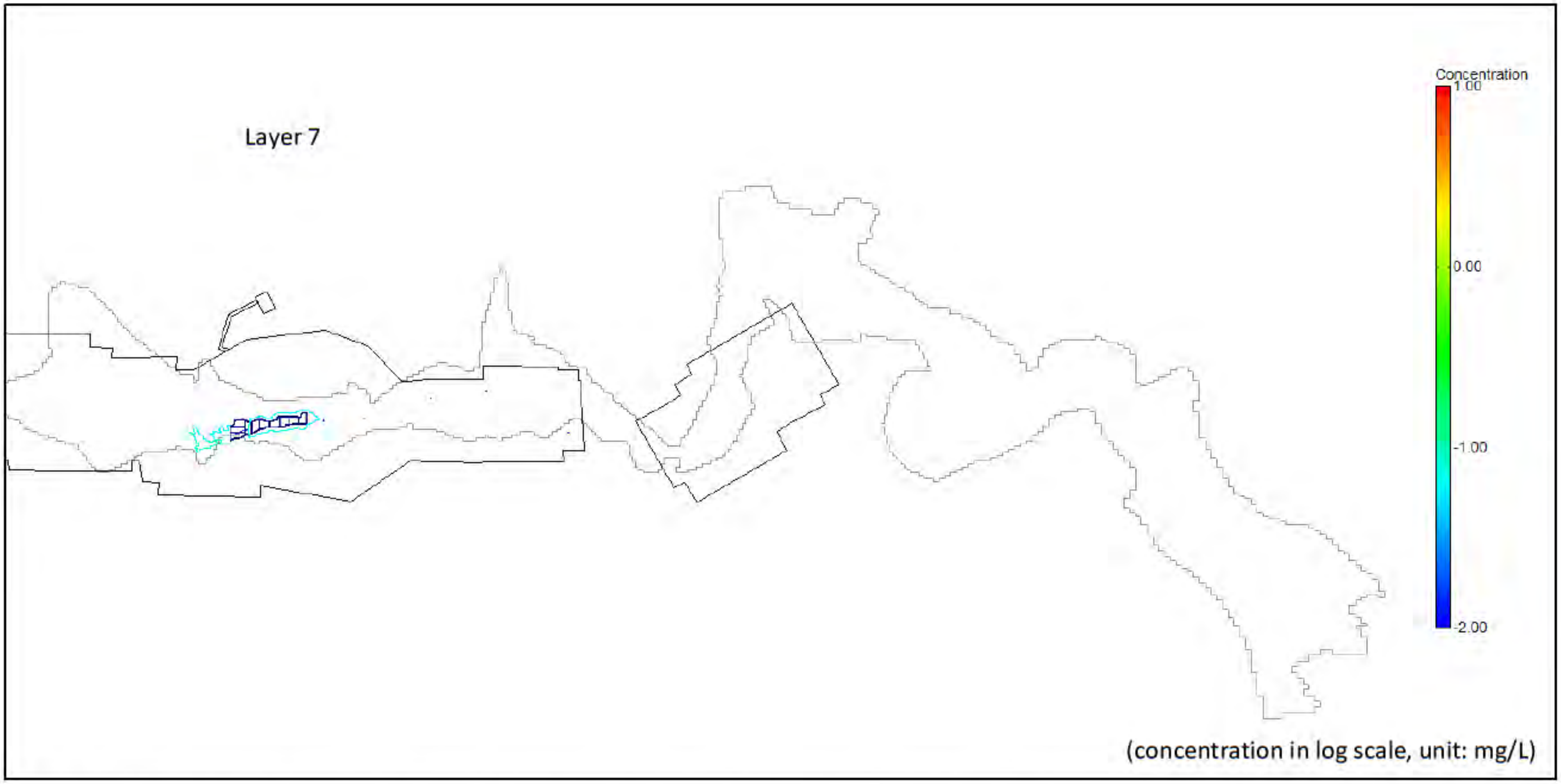


Figure B15 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 7 at year 15,000

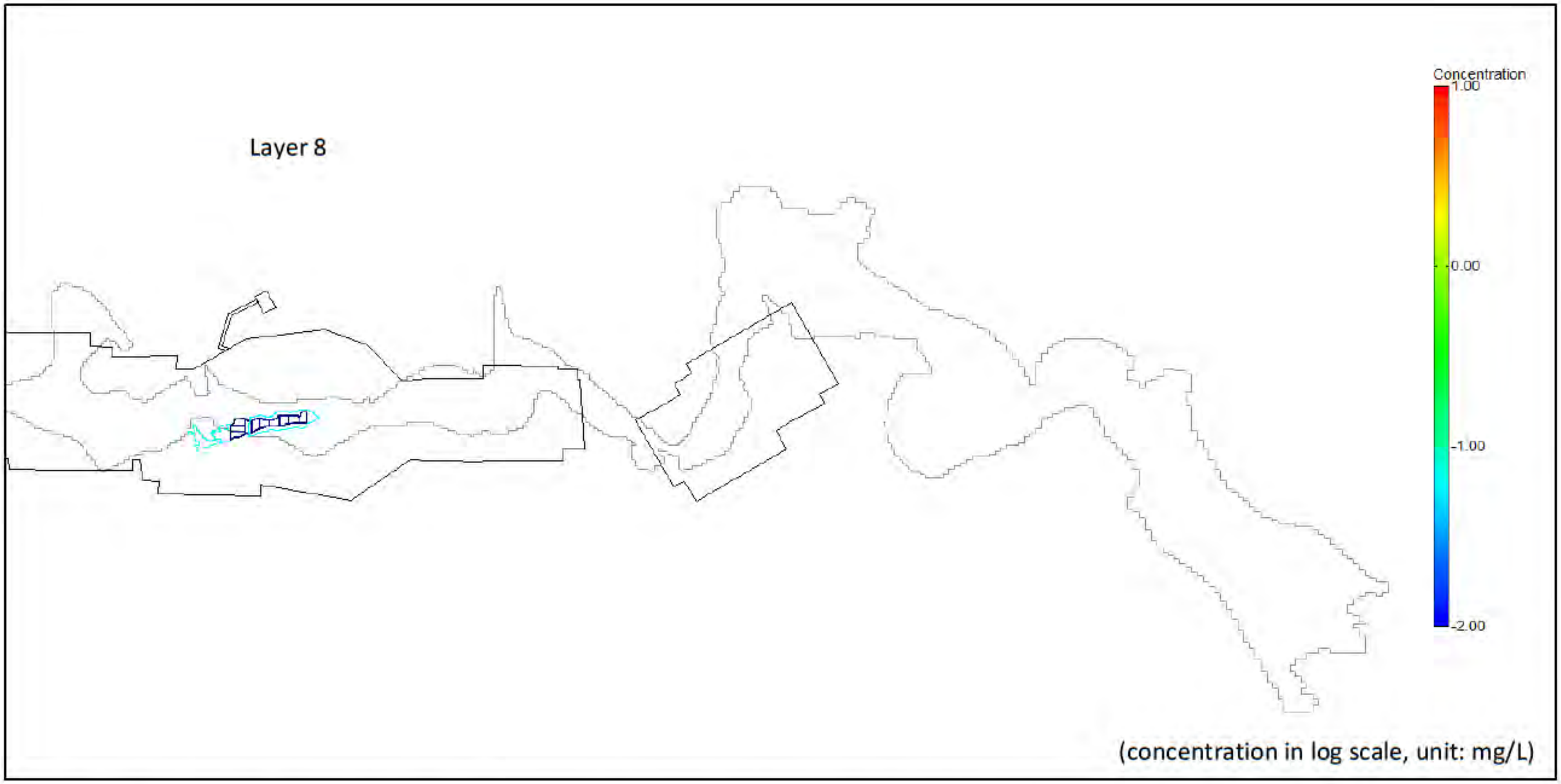


Figure B16 Effect of K_d (0.1 × base case K_d) on simulated molybdenum transport plume in layer 8 at year 15,000

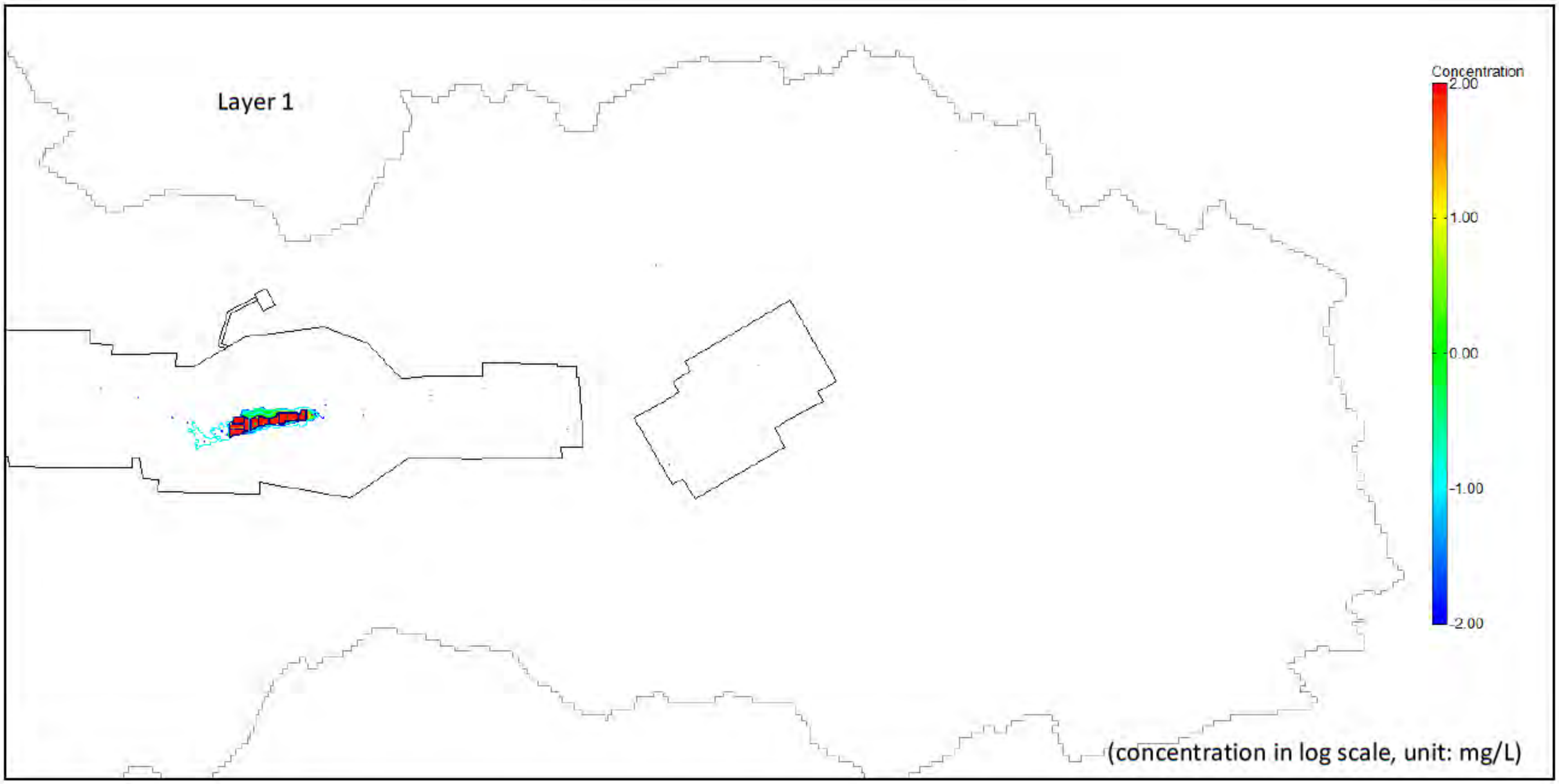


Figure B17 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 1 at year 15,000

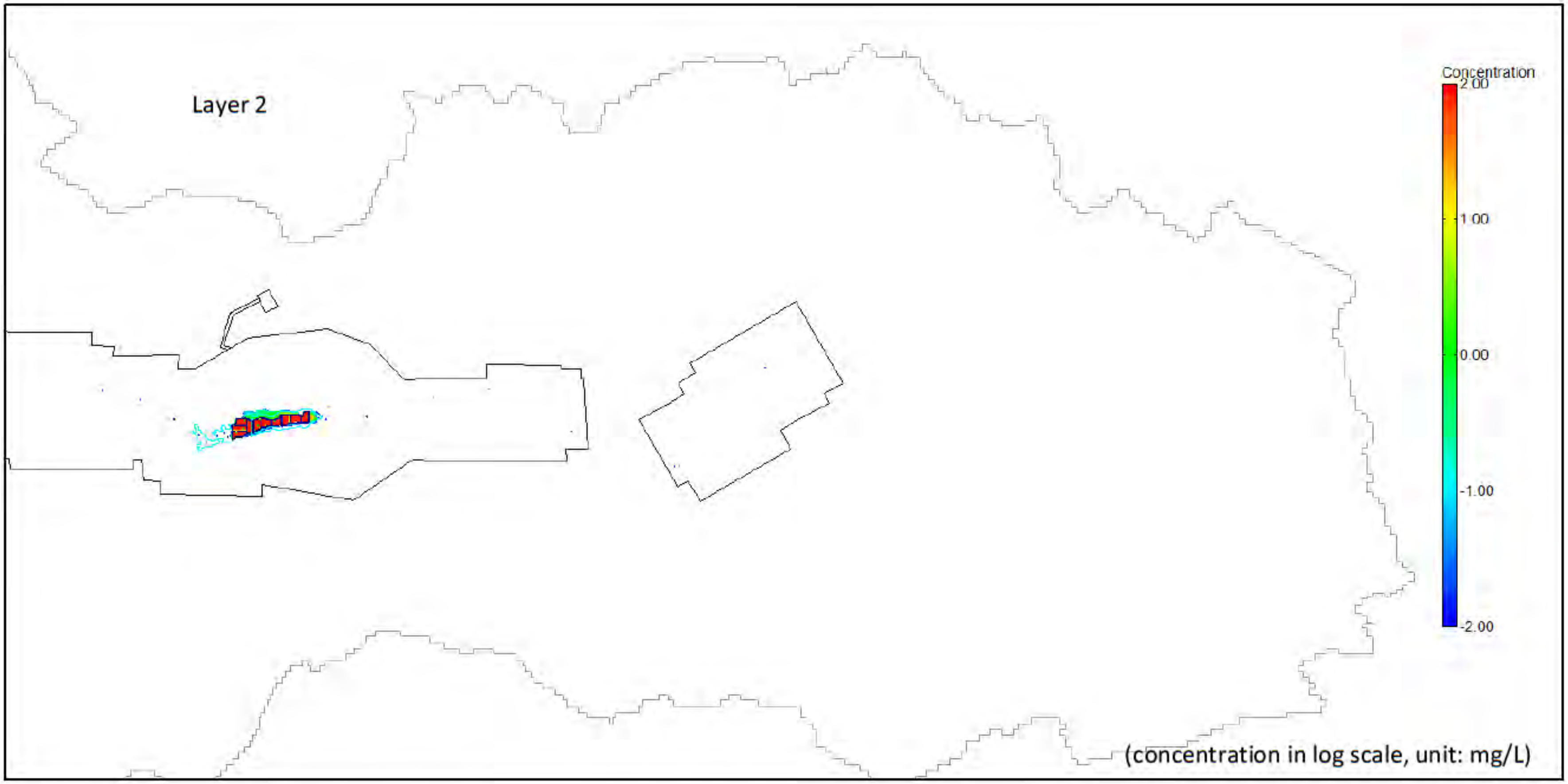


Figure B18 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 2 at year 15,000

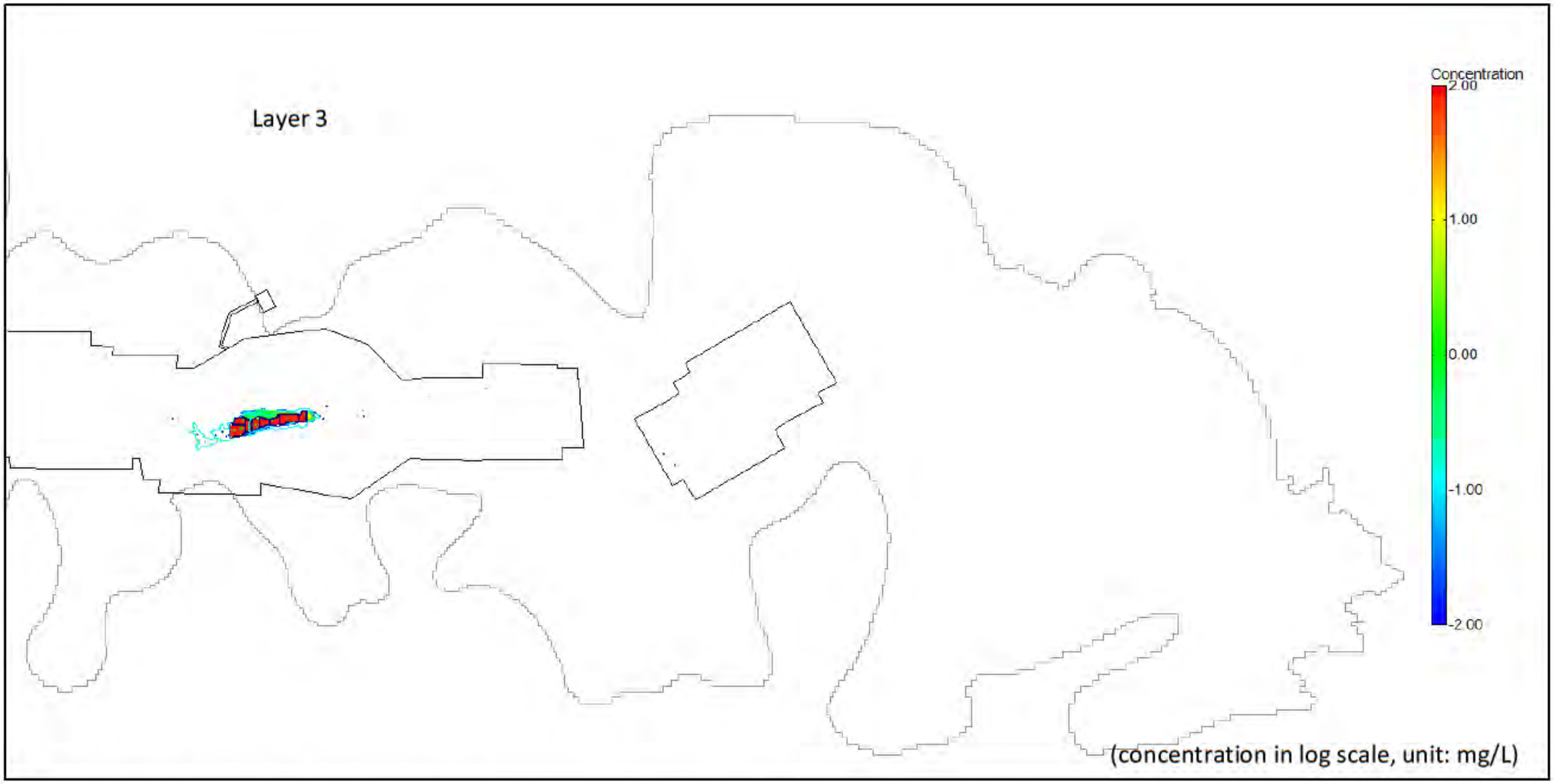


Figure B19 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 3 at year 15,000

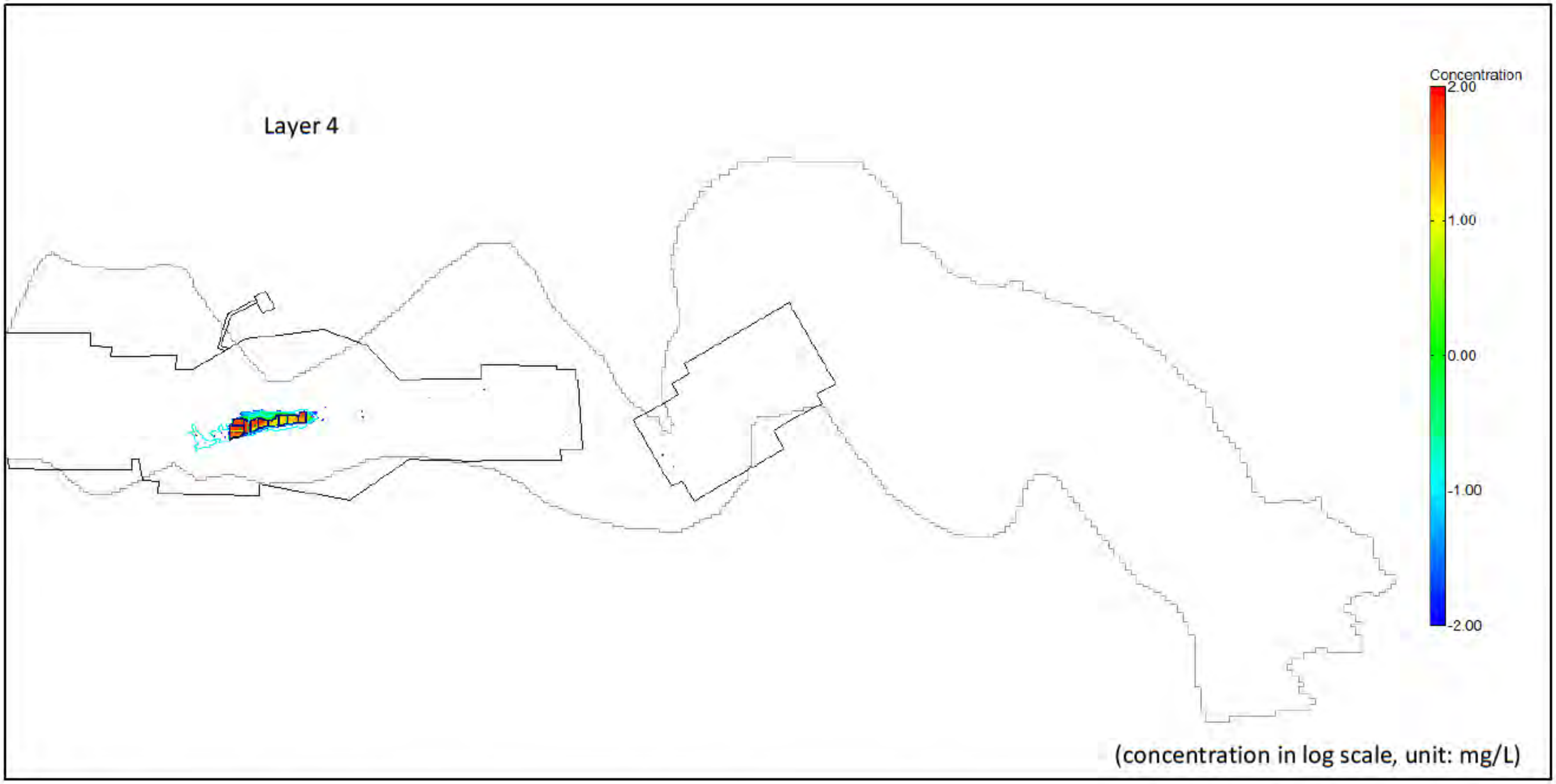


Figure B20 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 4 at year 15,000

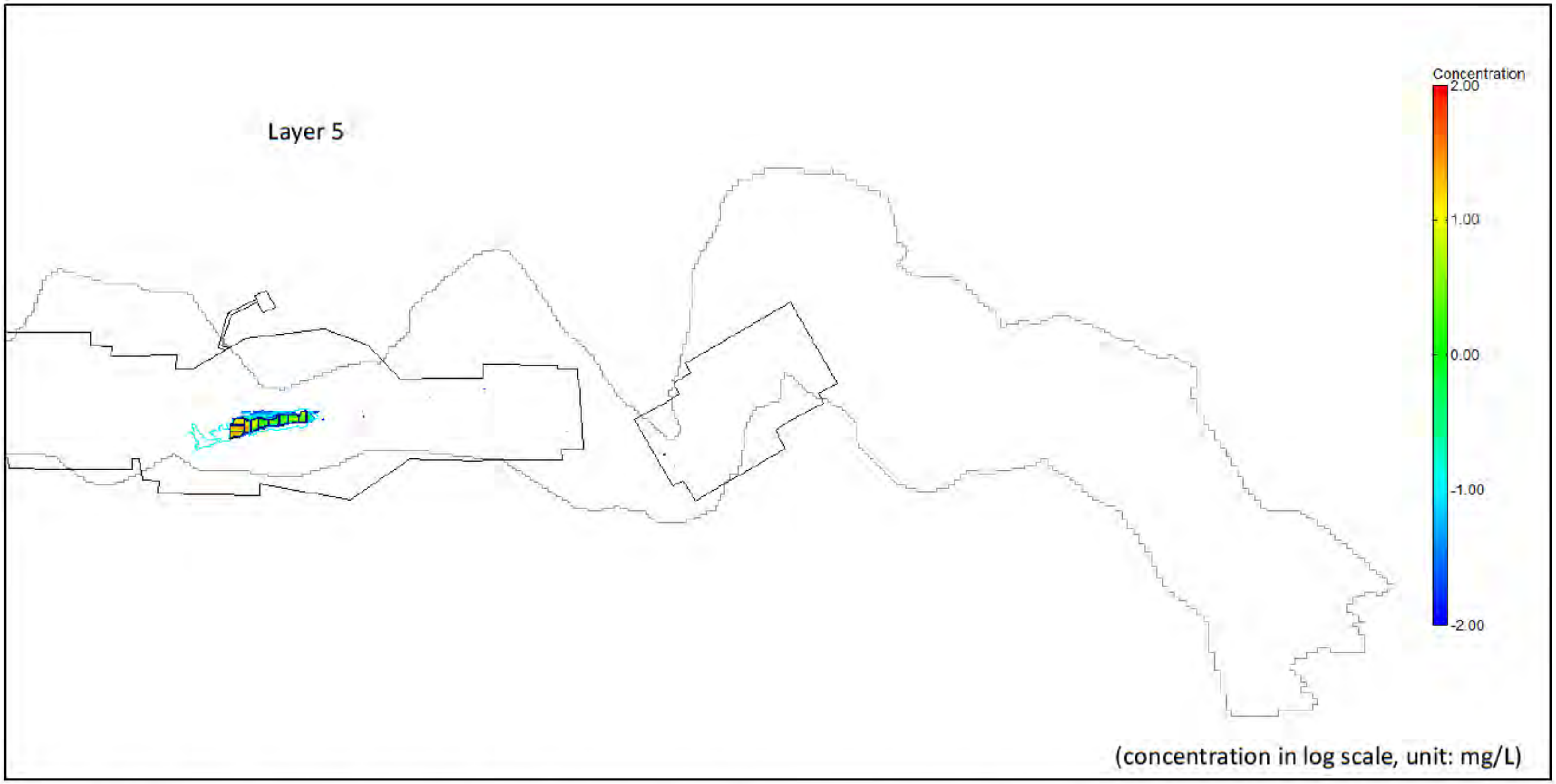


Figure B21 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 5 at year 15,000

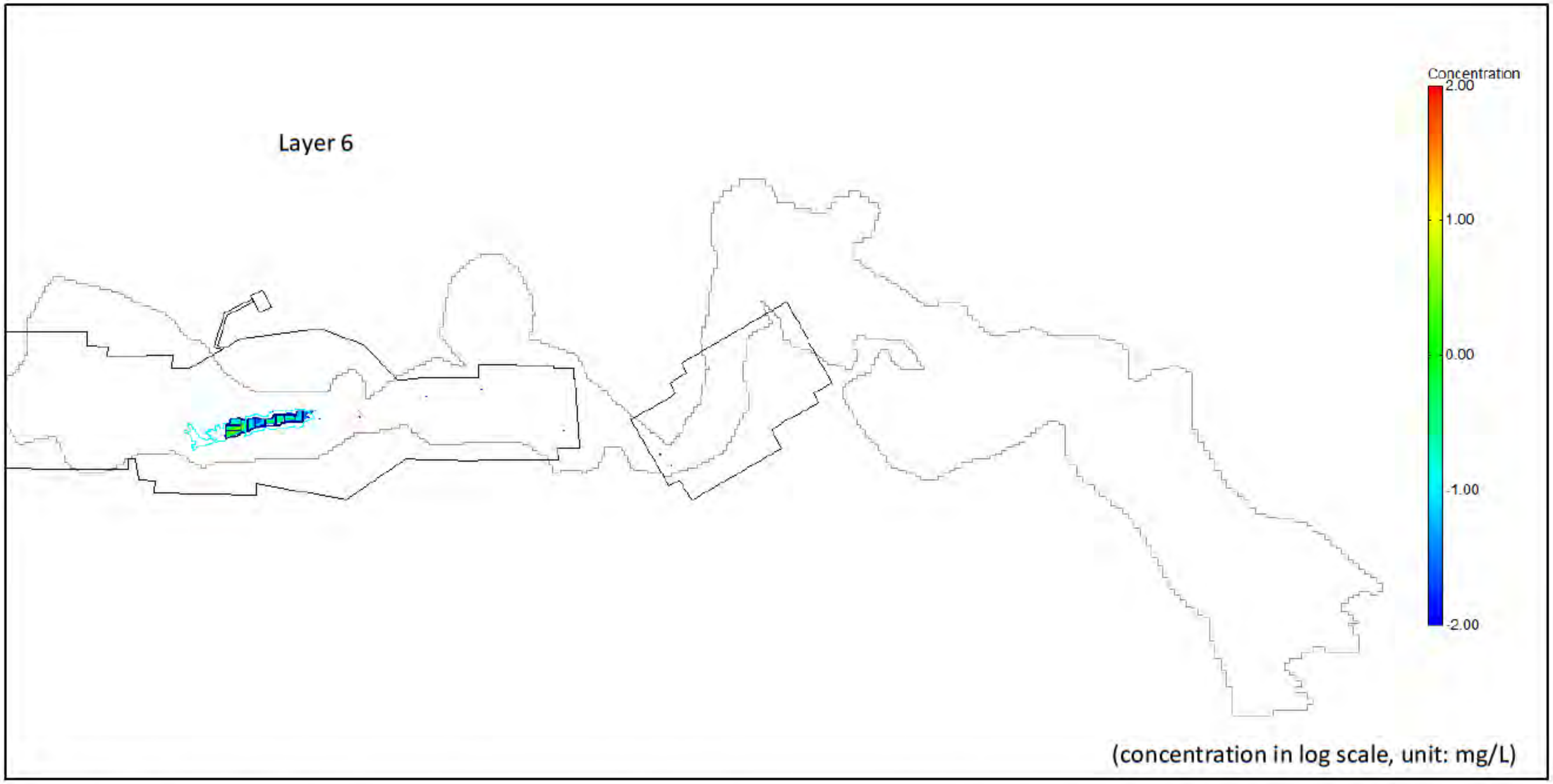


Figure B22 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 6 at year 15,000

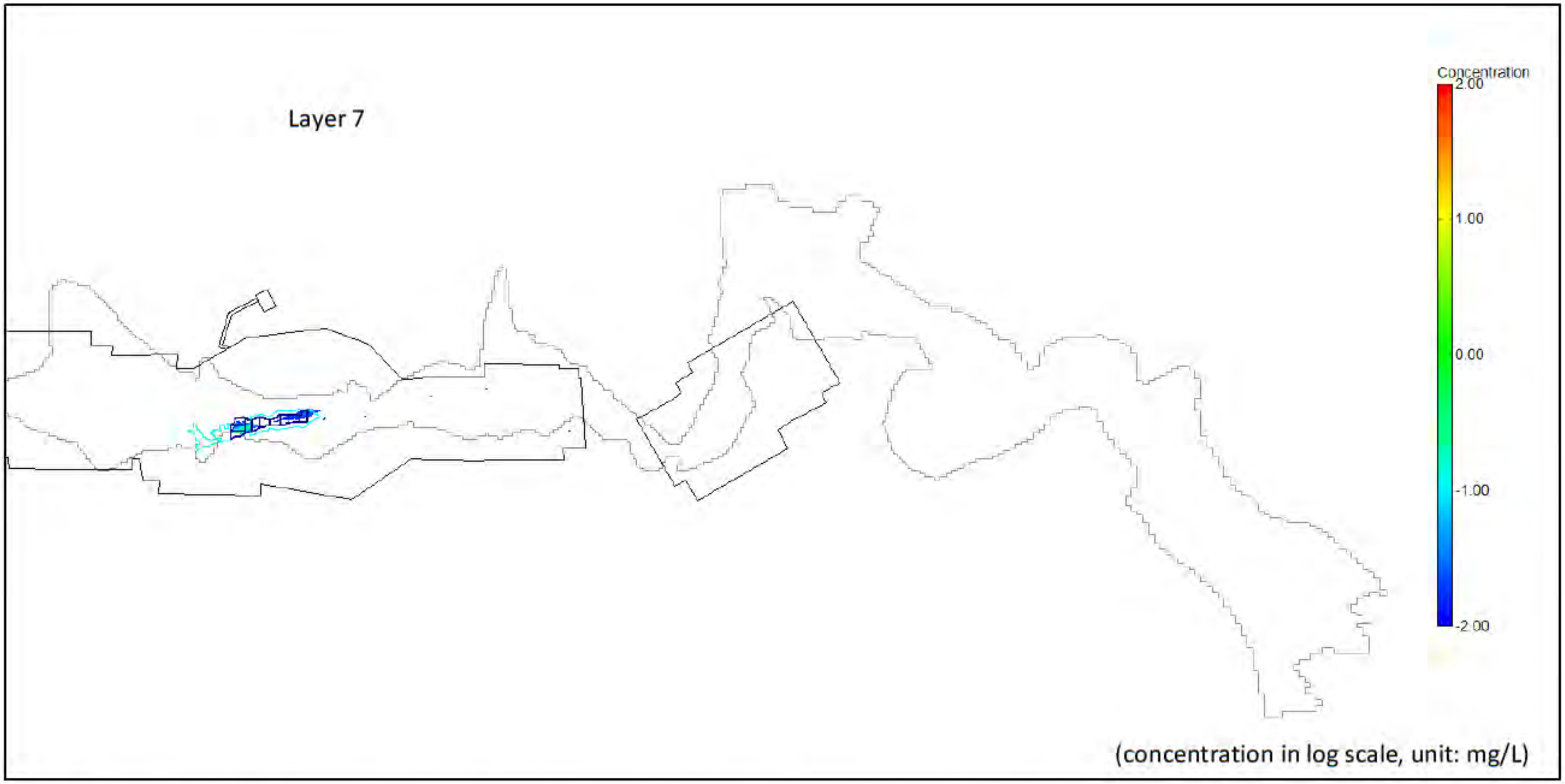


Figure B23 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 7 at year 15,000

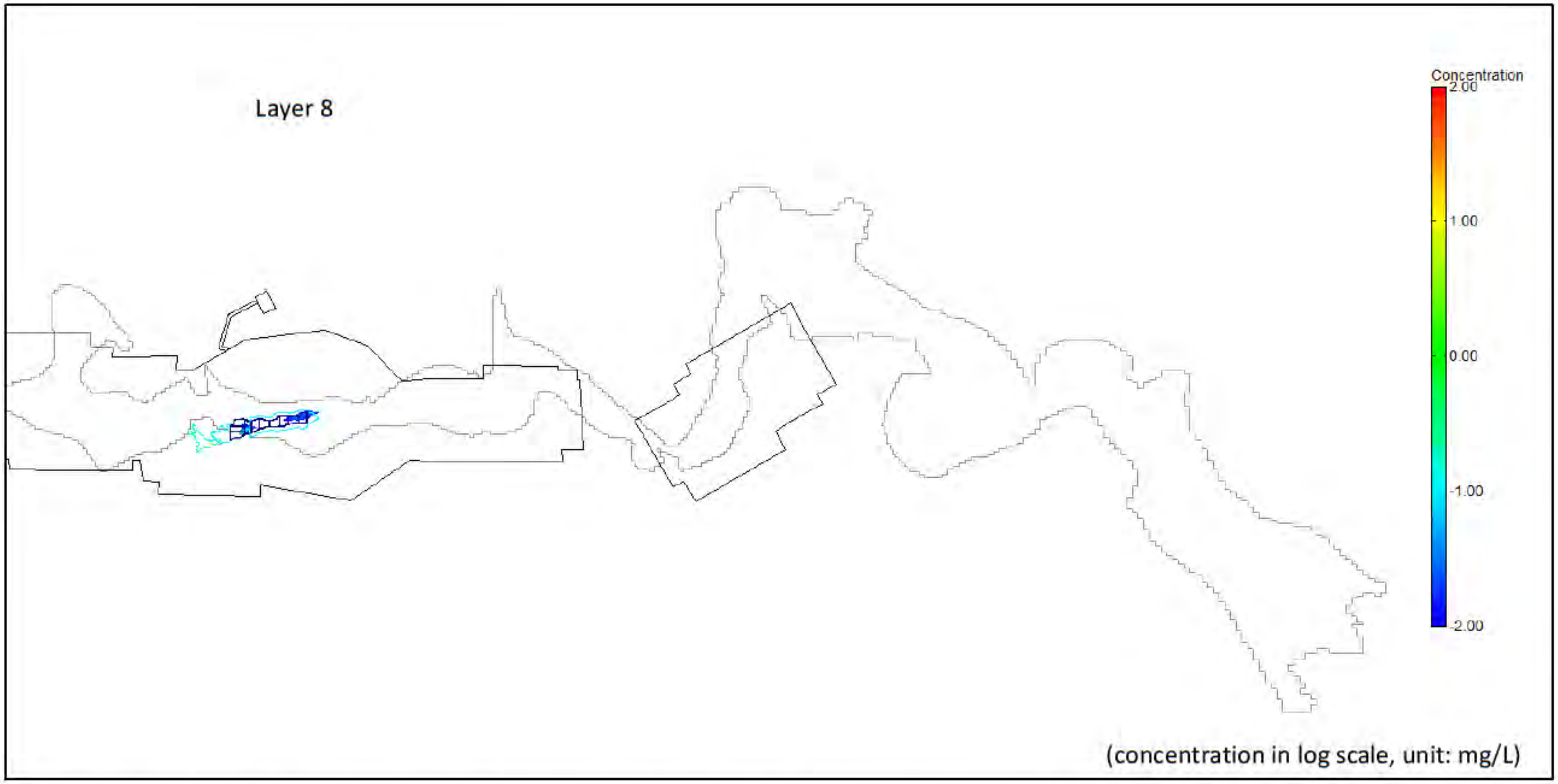


Figure B24 Effect of K_d (0.1 × base case K_d) on simulated vanadium transport plume in layer 8 at year 15,000

Sensitivity Run
Percolation Through Cover: 0.2% of Annual Average Precipitation

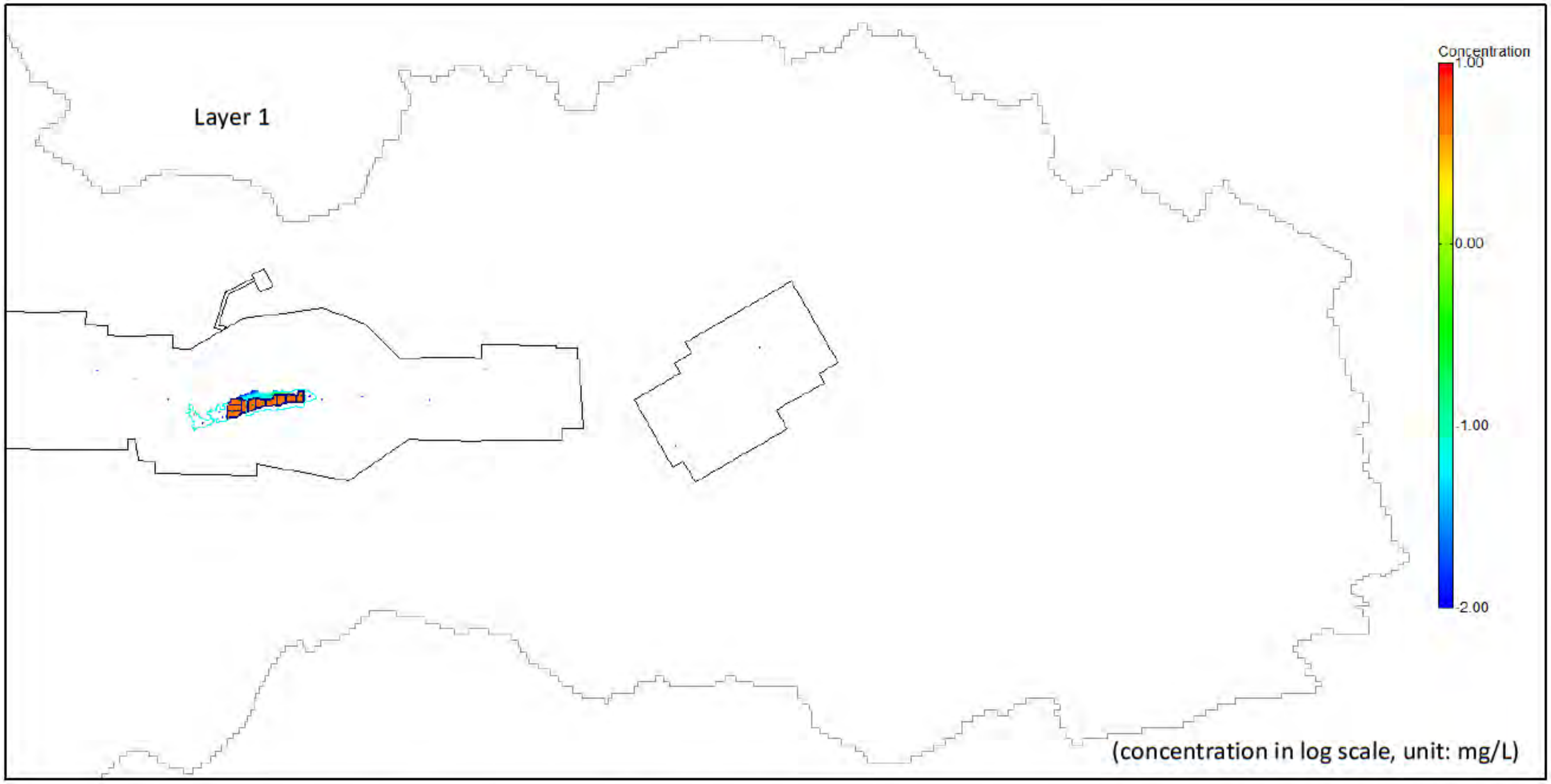


Figure C1 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 1 at year 15,000

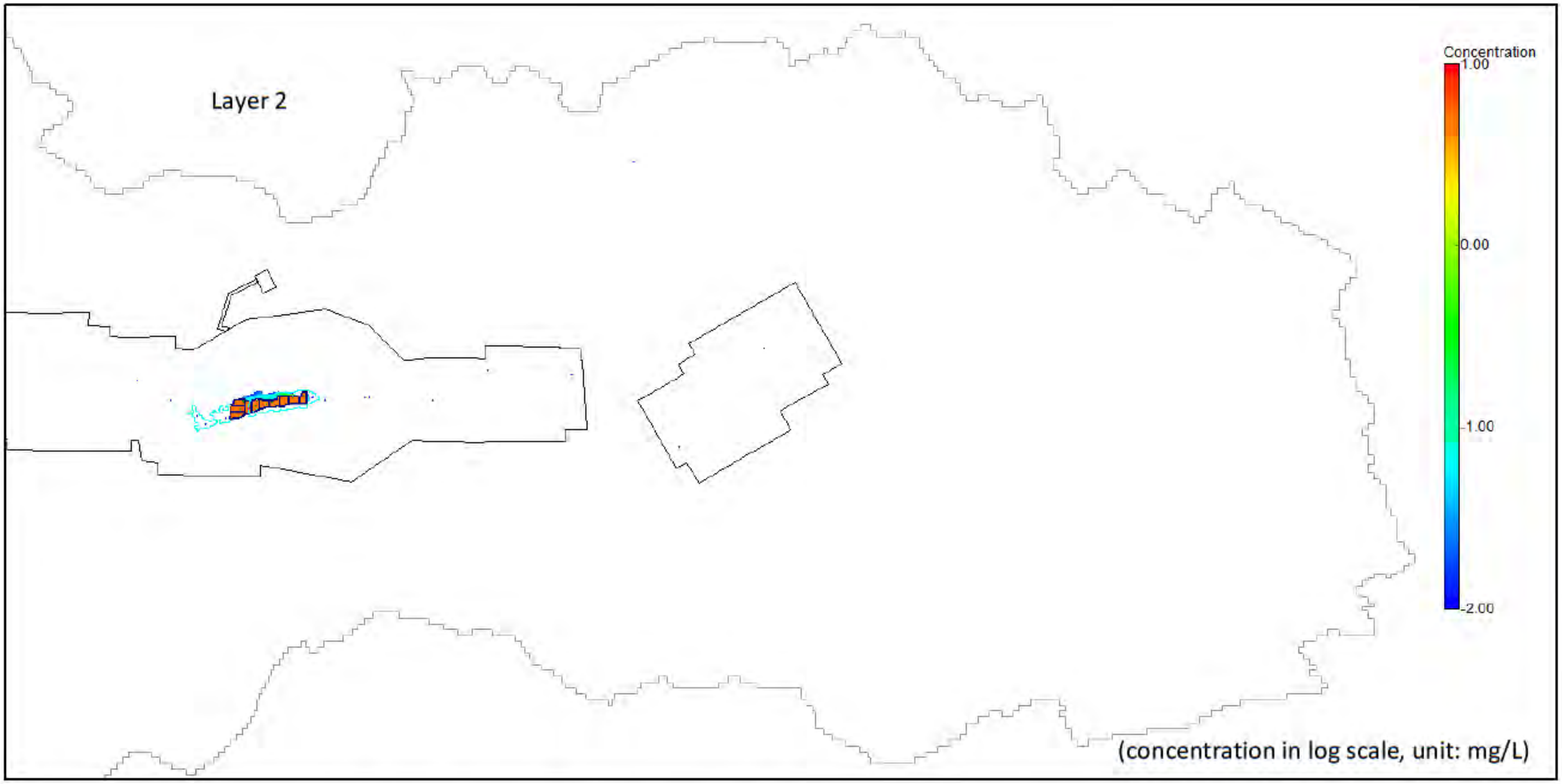


Figure C2 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 2 at year 15,000

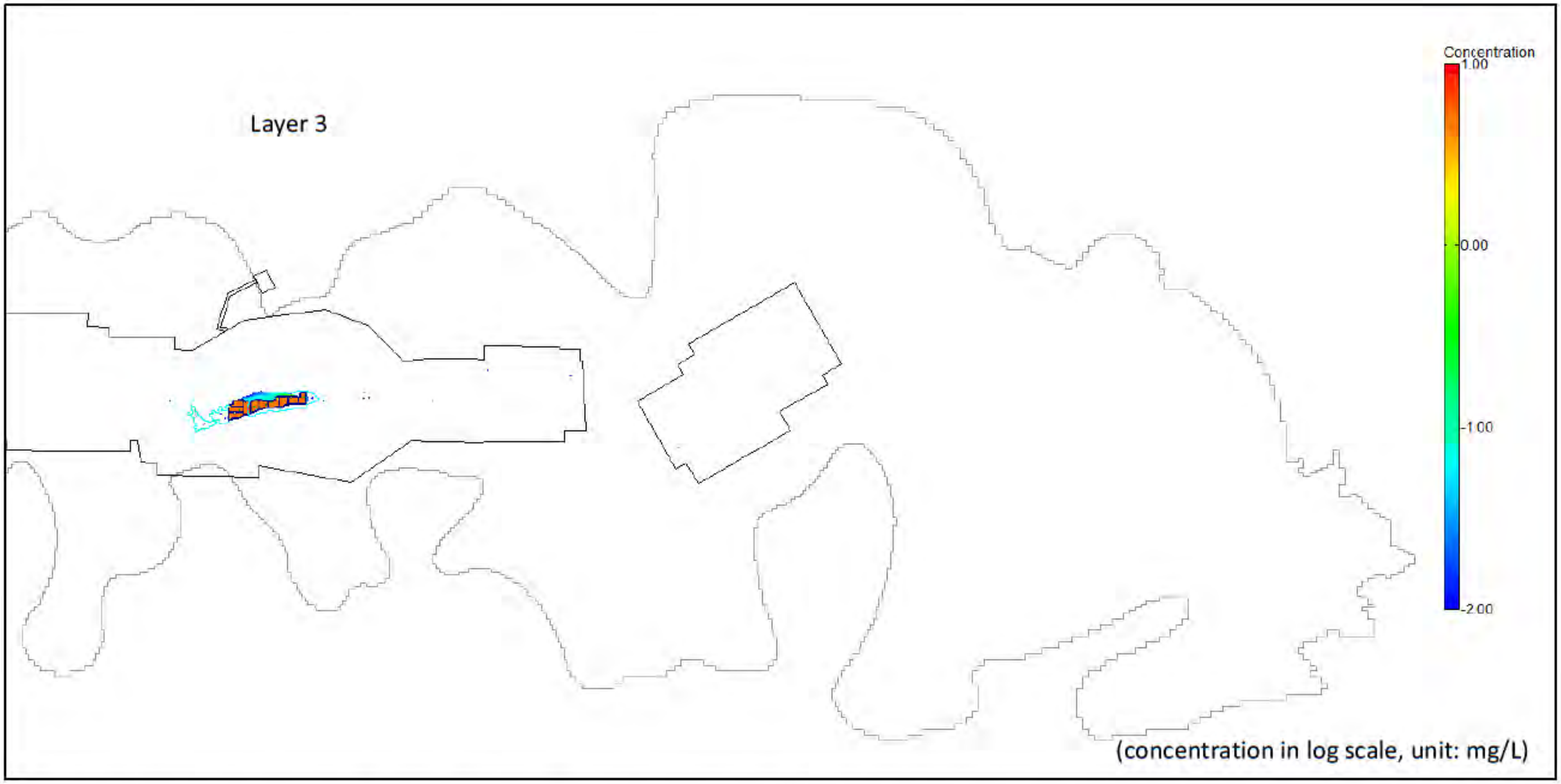


Figure C3 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 3 at year 15,000

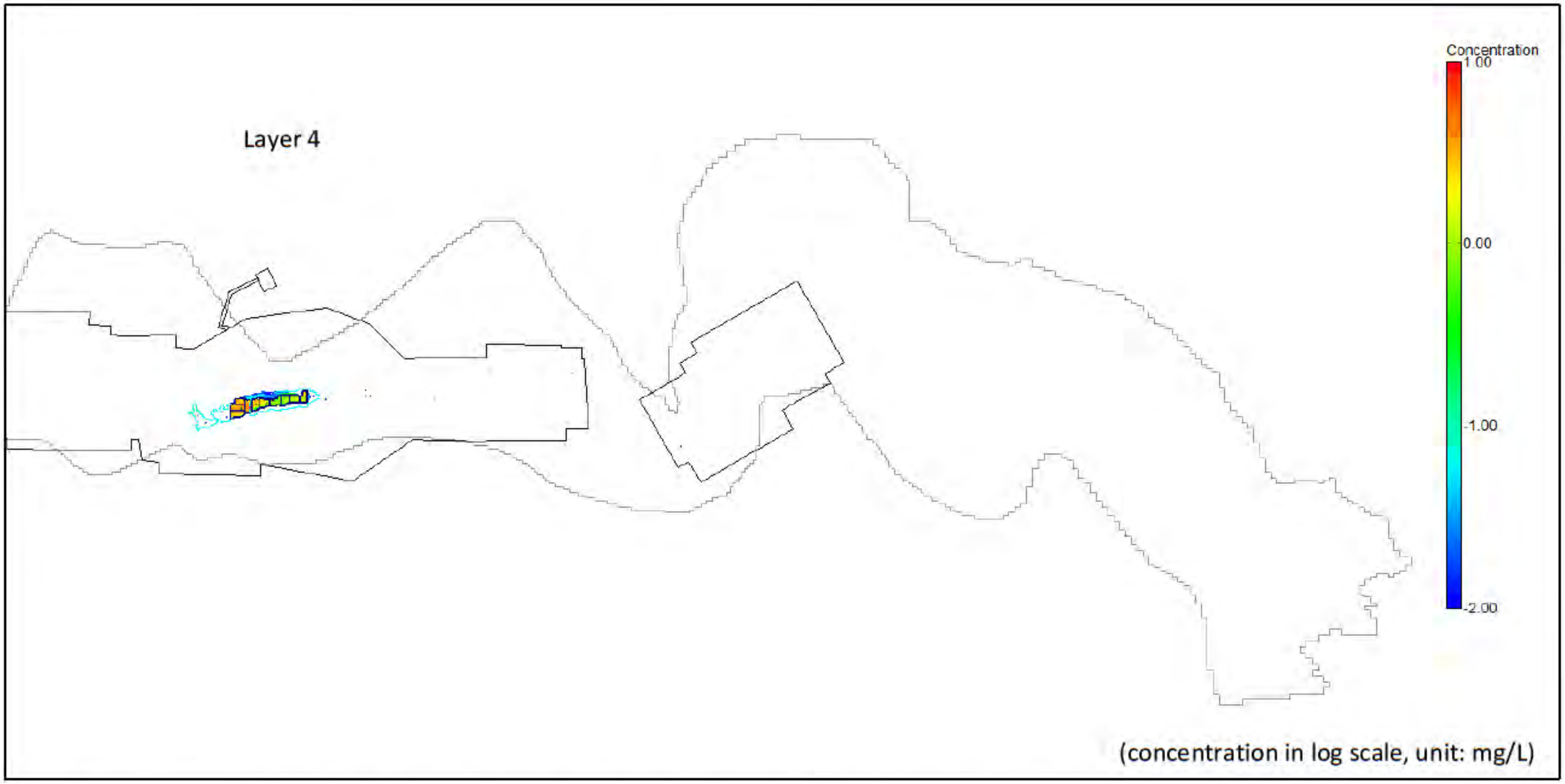


Figure C4 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 4 at year 15,000

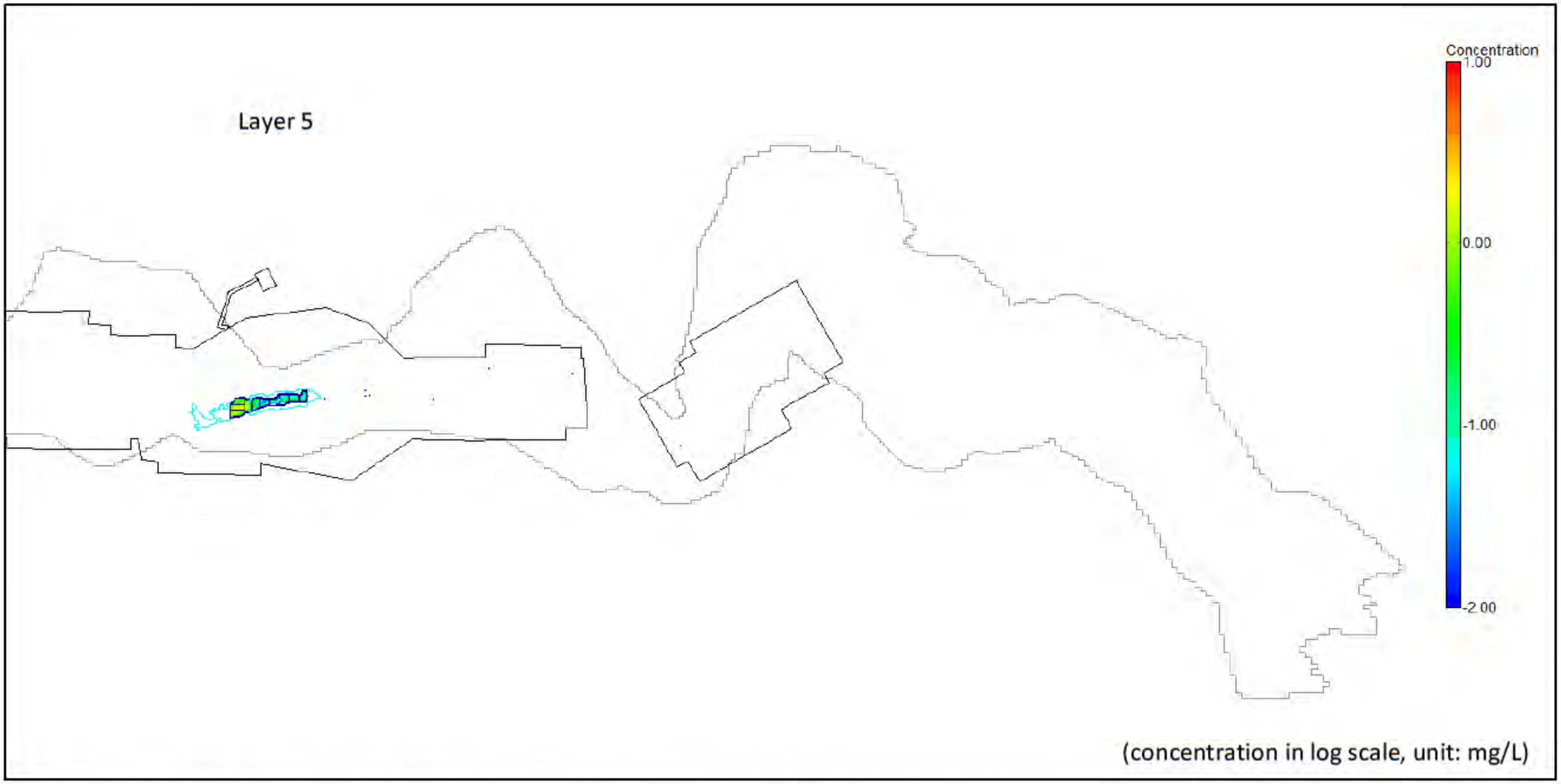


Figure C5 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 5 at year 15,000

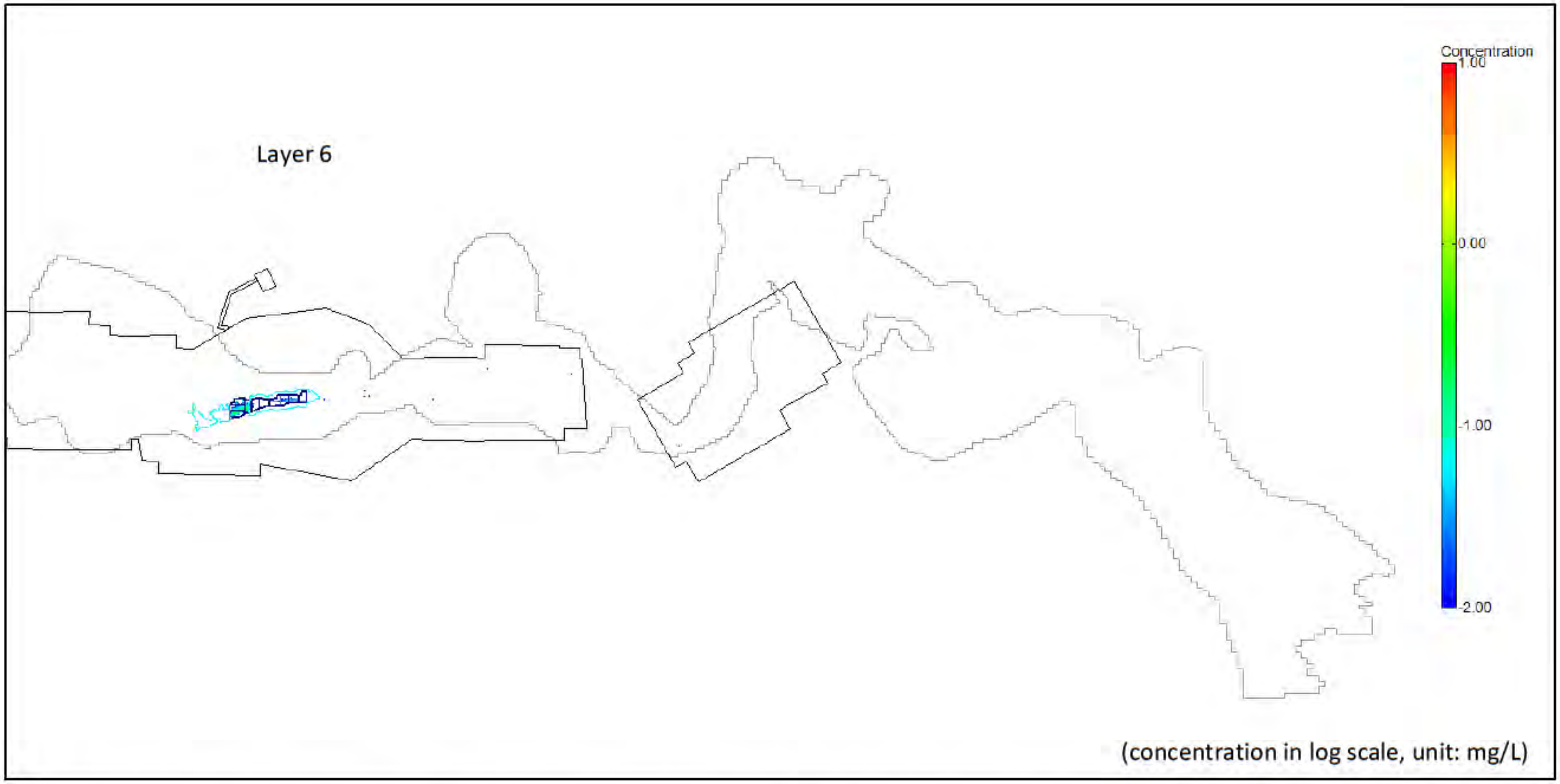


Figure C6 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 6 at year 15,000

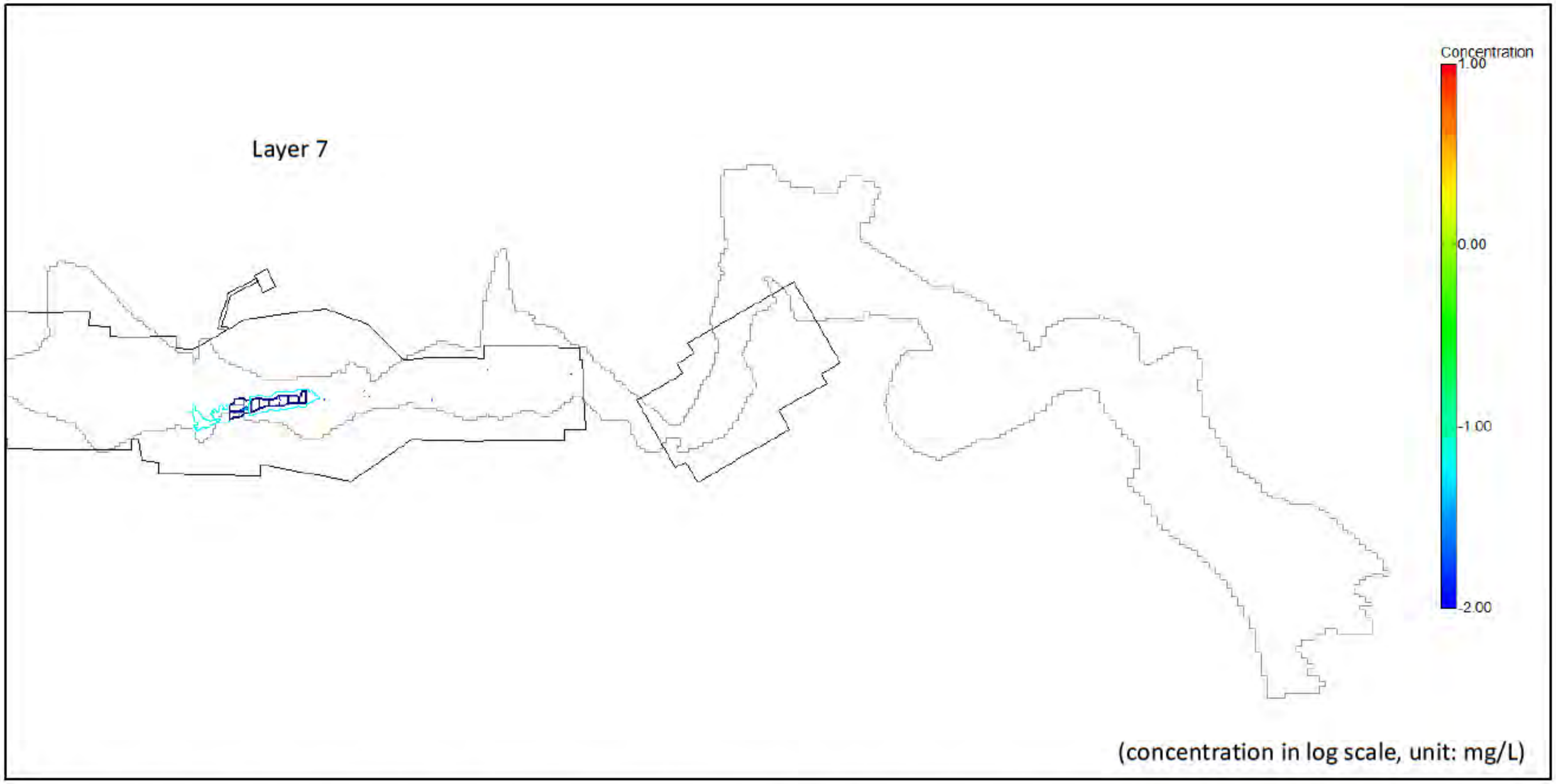


Figure C7 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 7 at year 15,000

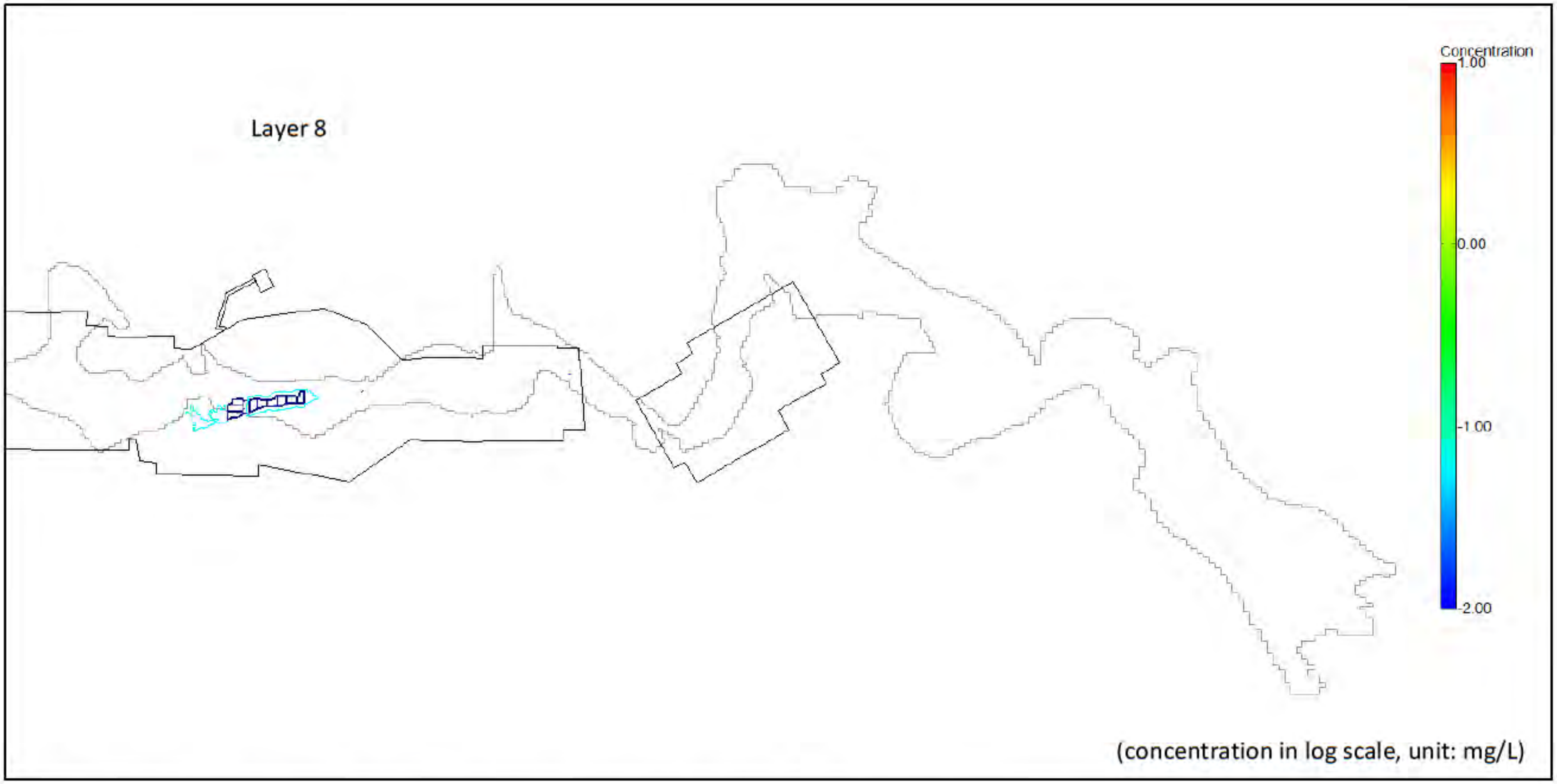


Figure C8 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated arsenic transport plume in layer 8 at year 15,000

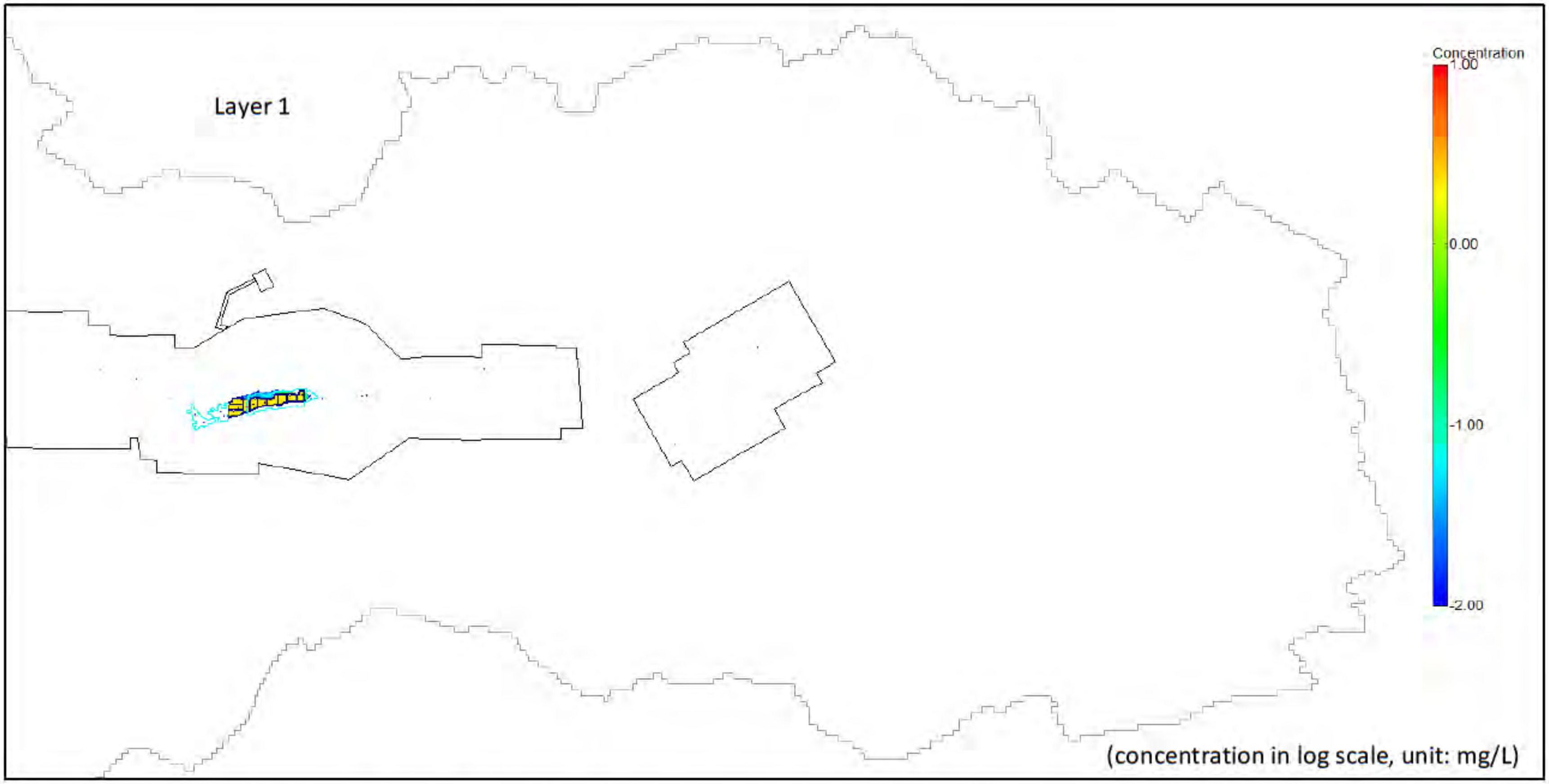


Figure C9 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 1 at year 15,000

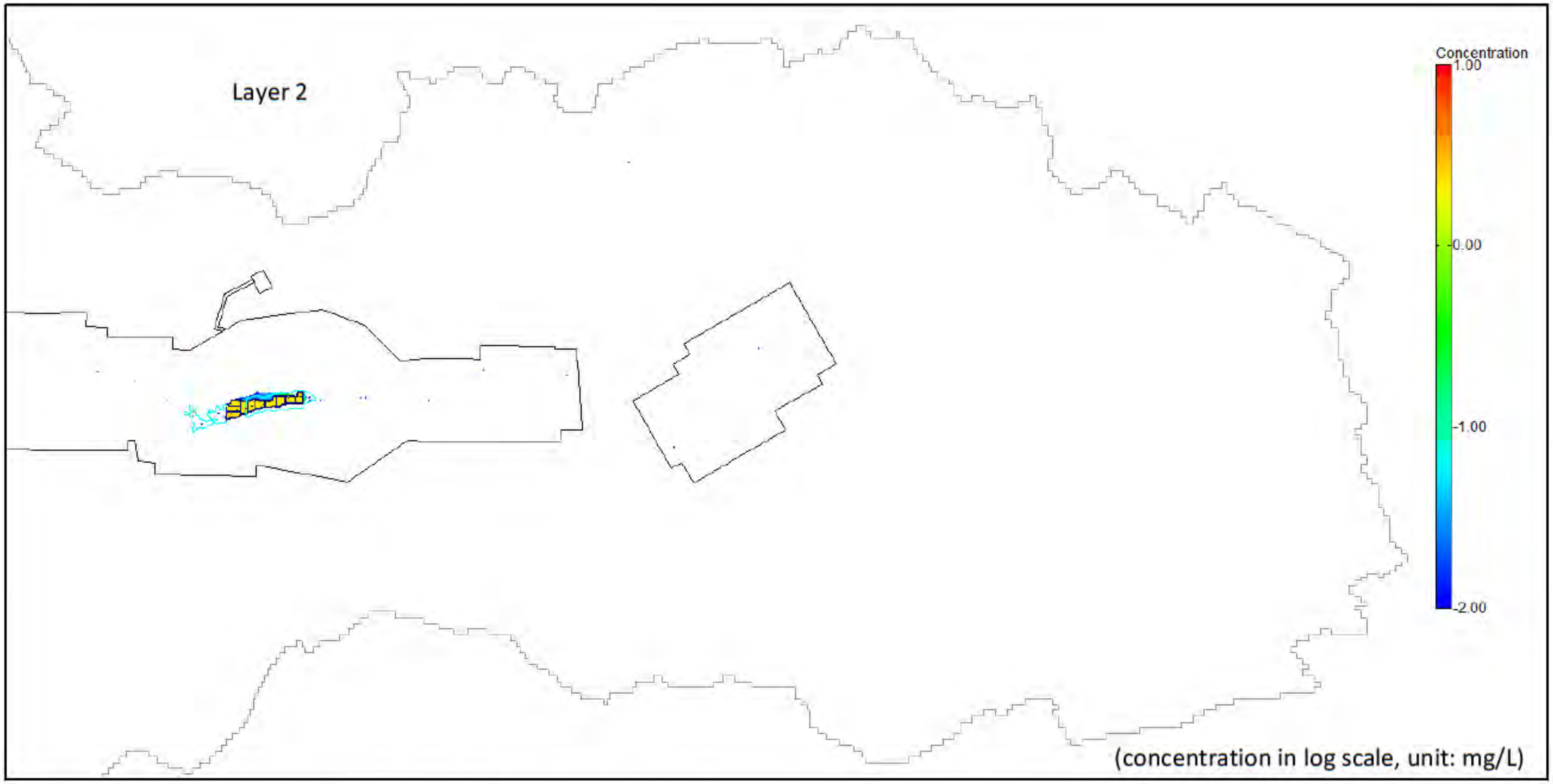


Figure C10 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 2 at year 15,000

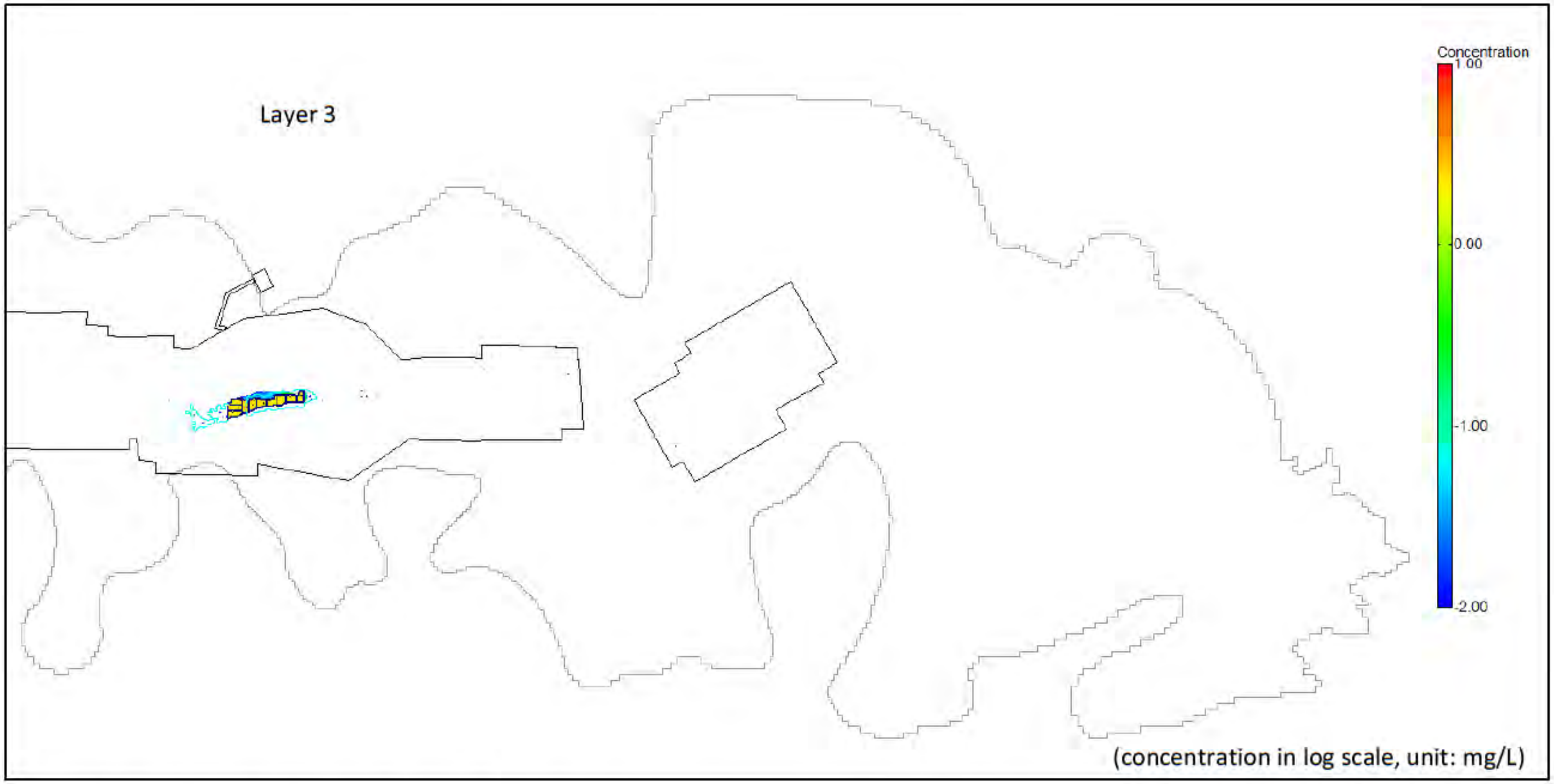


Figure C11 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 3 at year 15,000

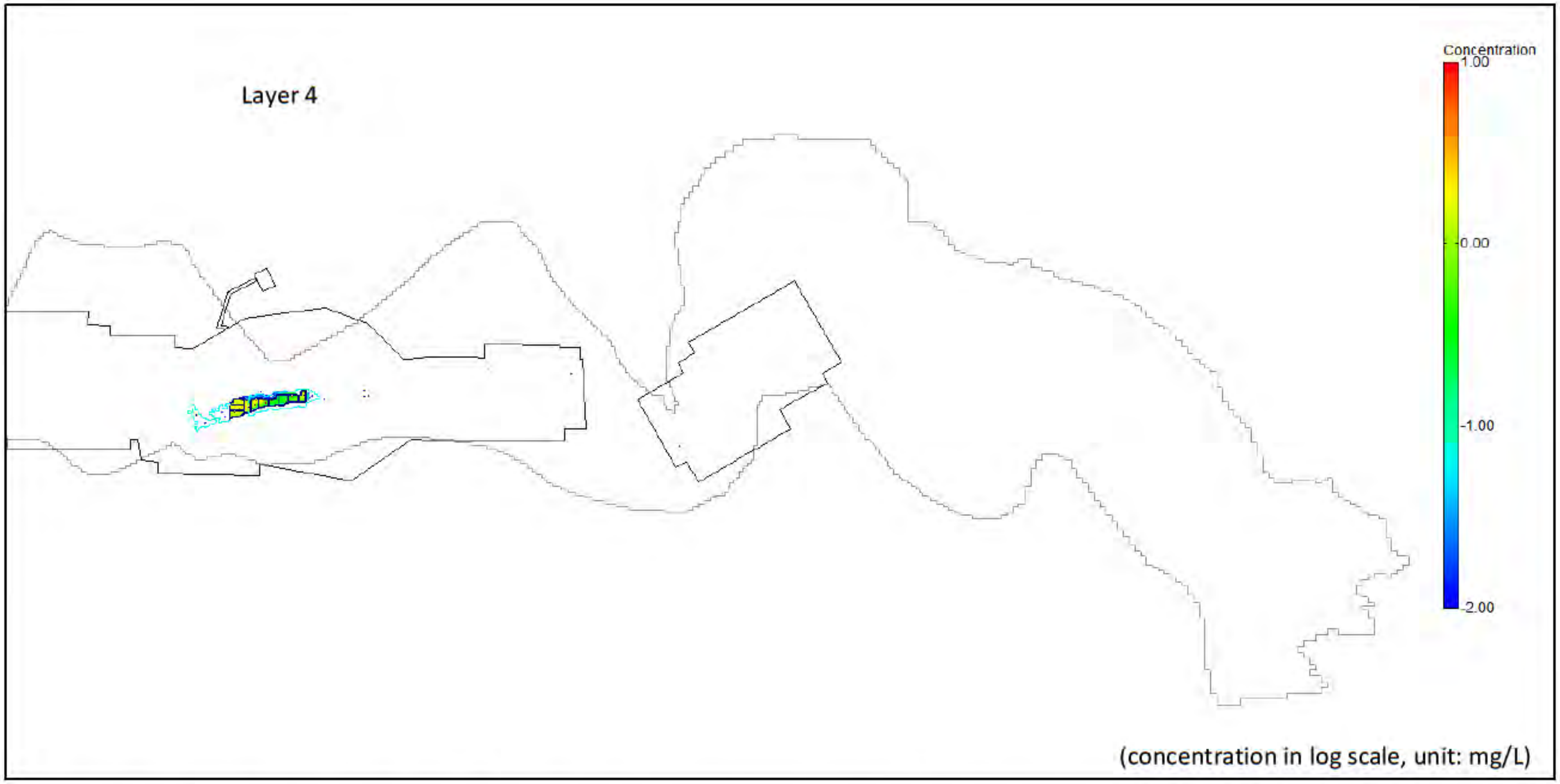


Figure C12 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 4 at year 15,000

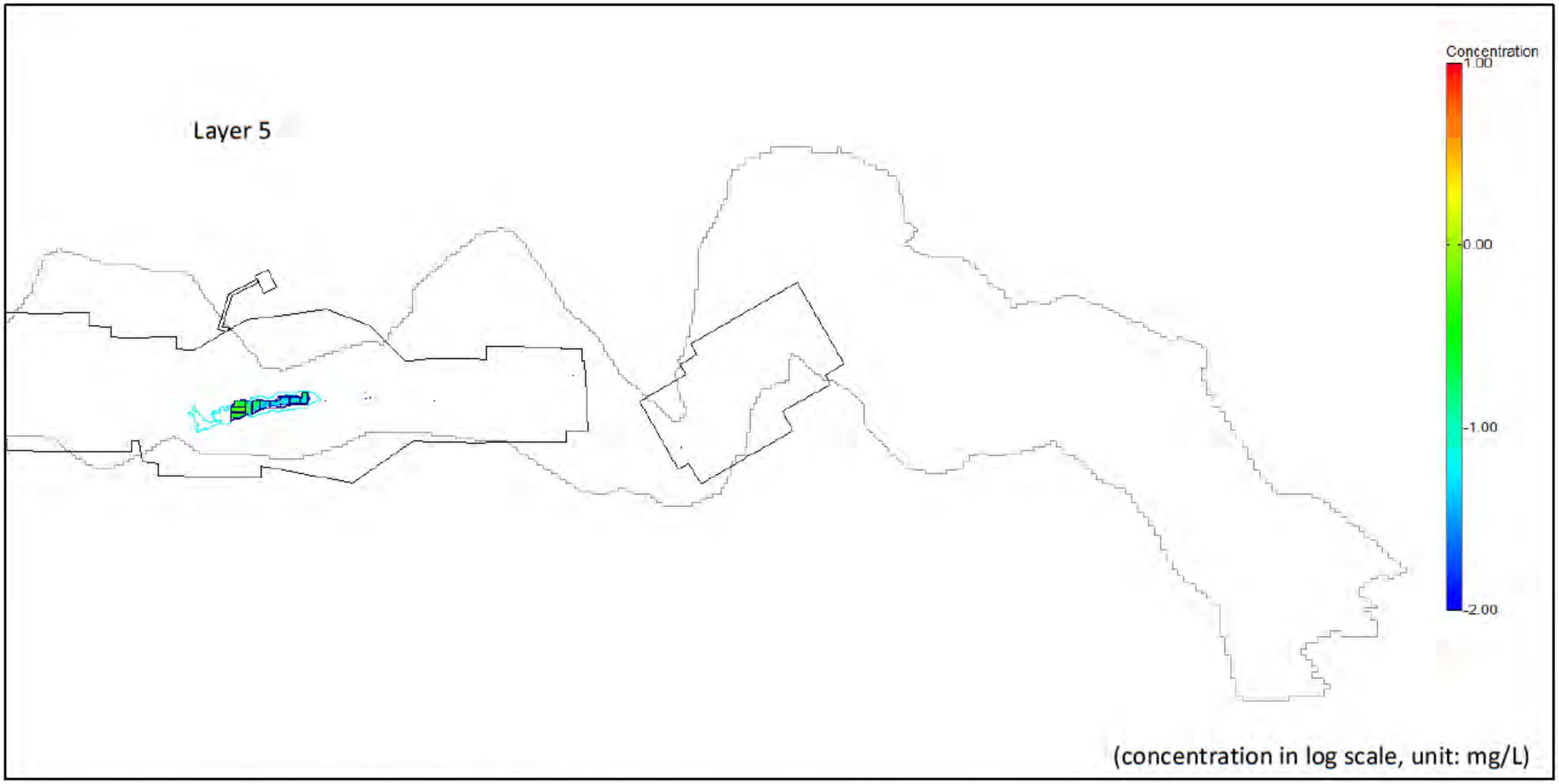


Figure C13 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 5 at year 15,000

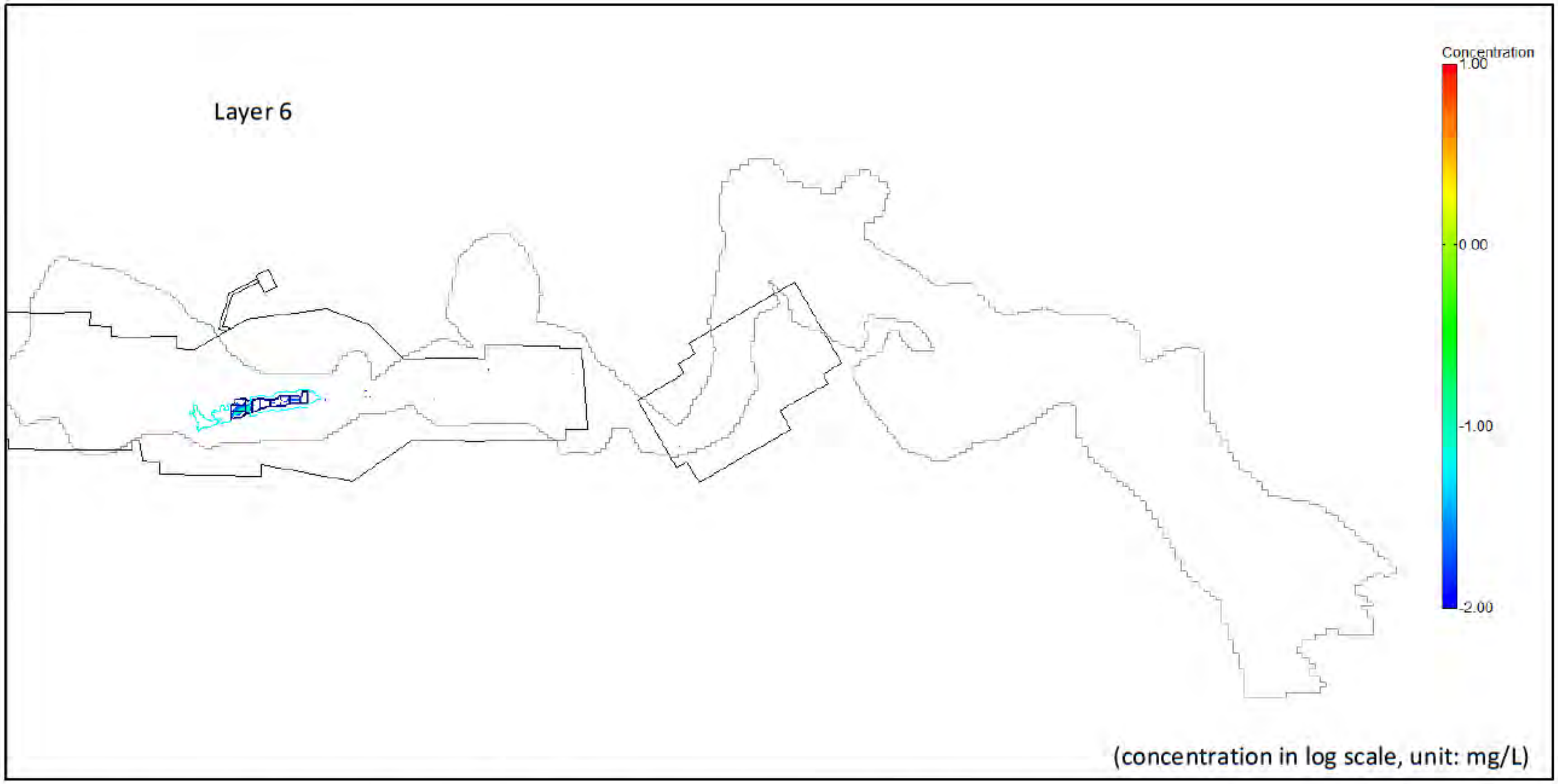


Figure C14 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 6 at year 15,000

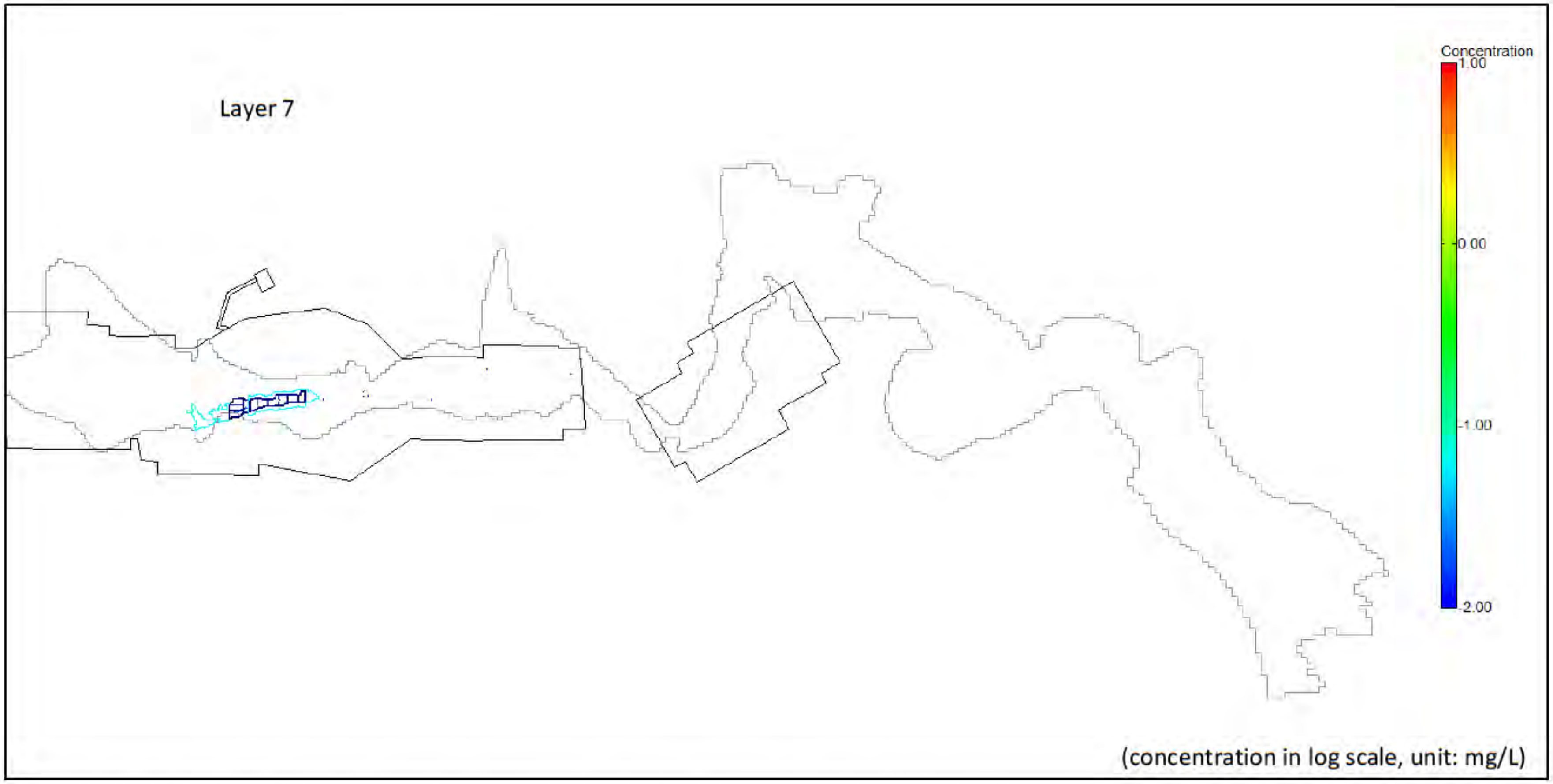


Figure C15 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 7 at year 15,000

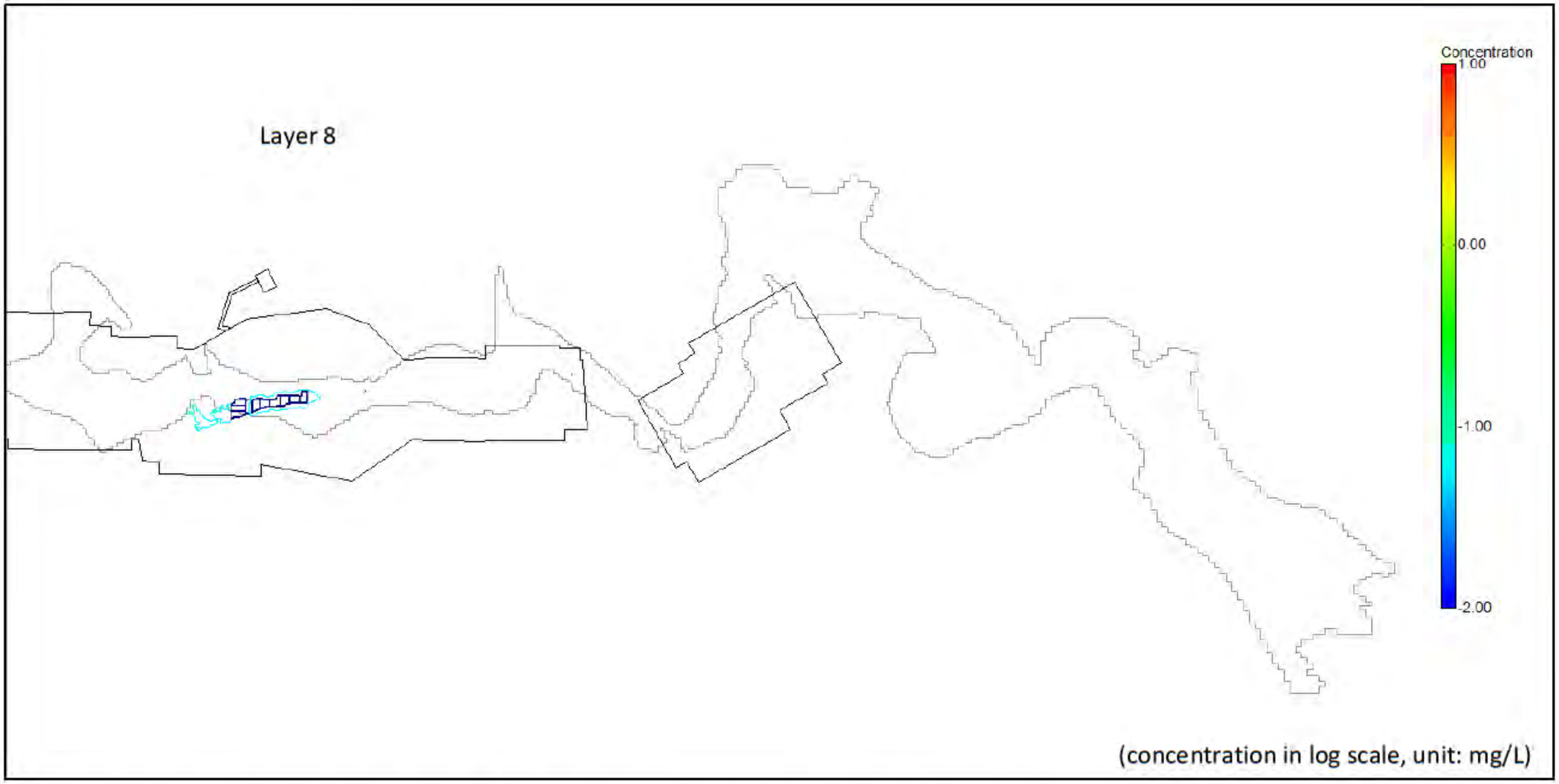


Figure C16 Effect of infiltration through talings and backfill cover (0.2% of annual precipitation) on simulated molybdenum transport plume in layer 8 at year 15,000

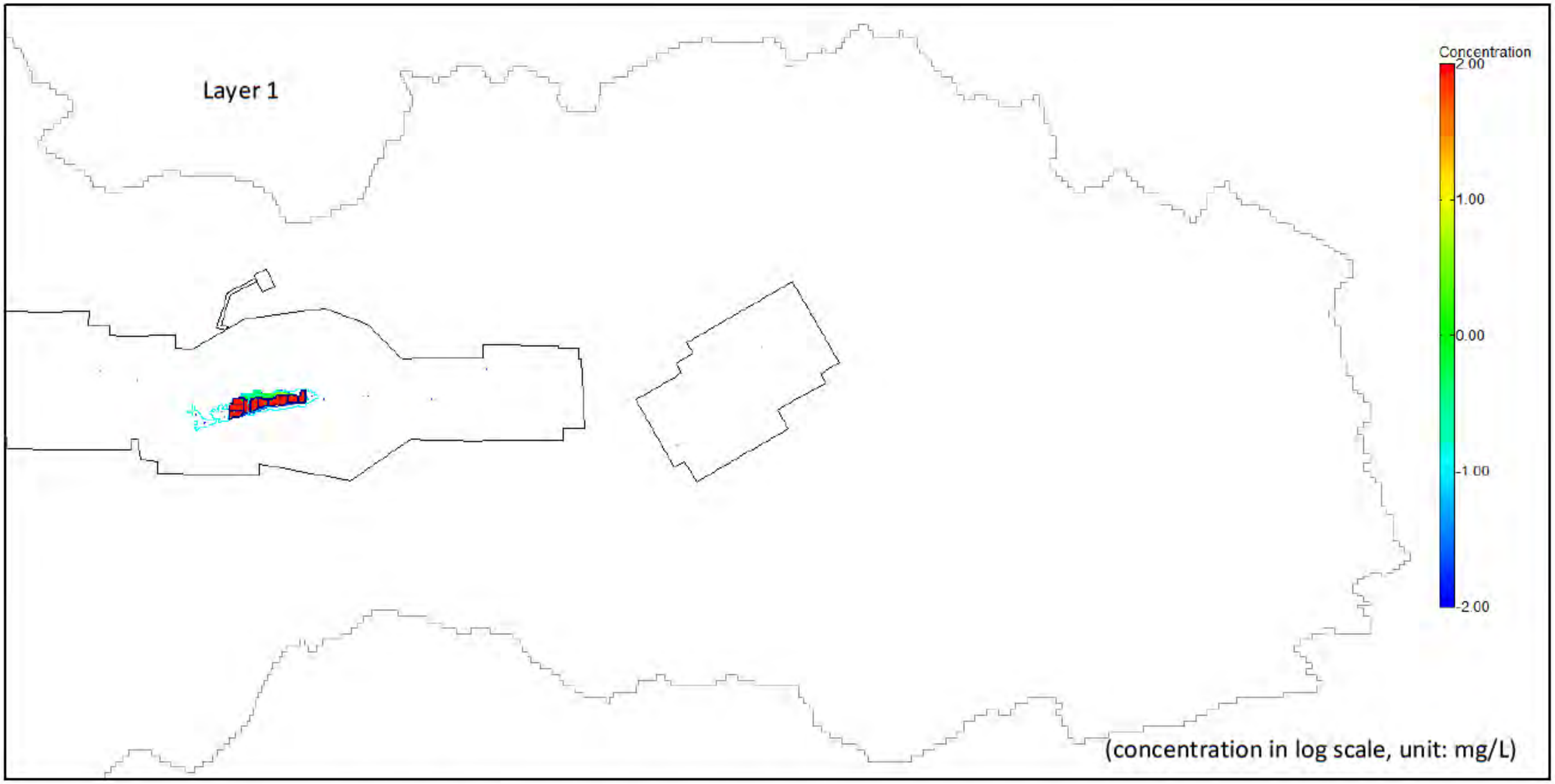


Figure C17 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 1 at year 15,000

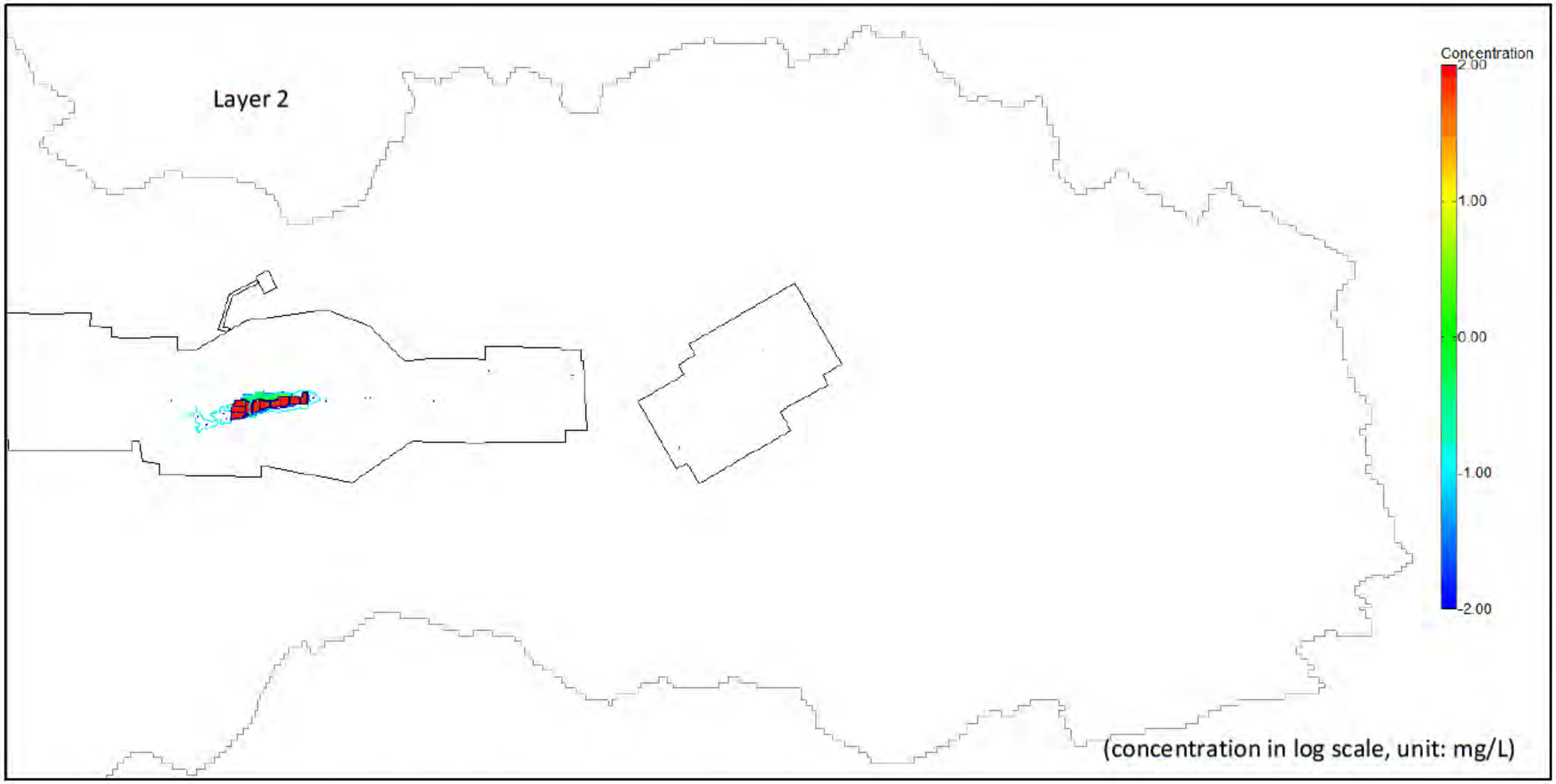


Figure C18 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 2 at year 15,000

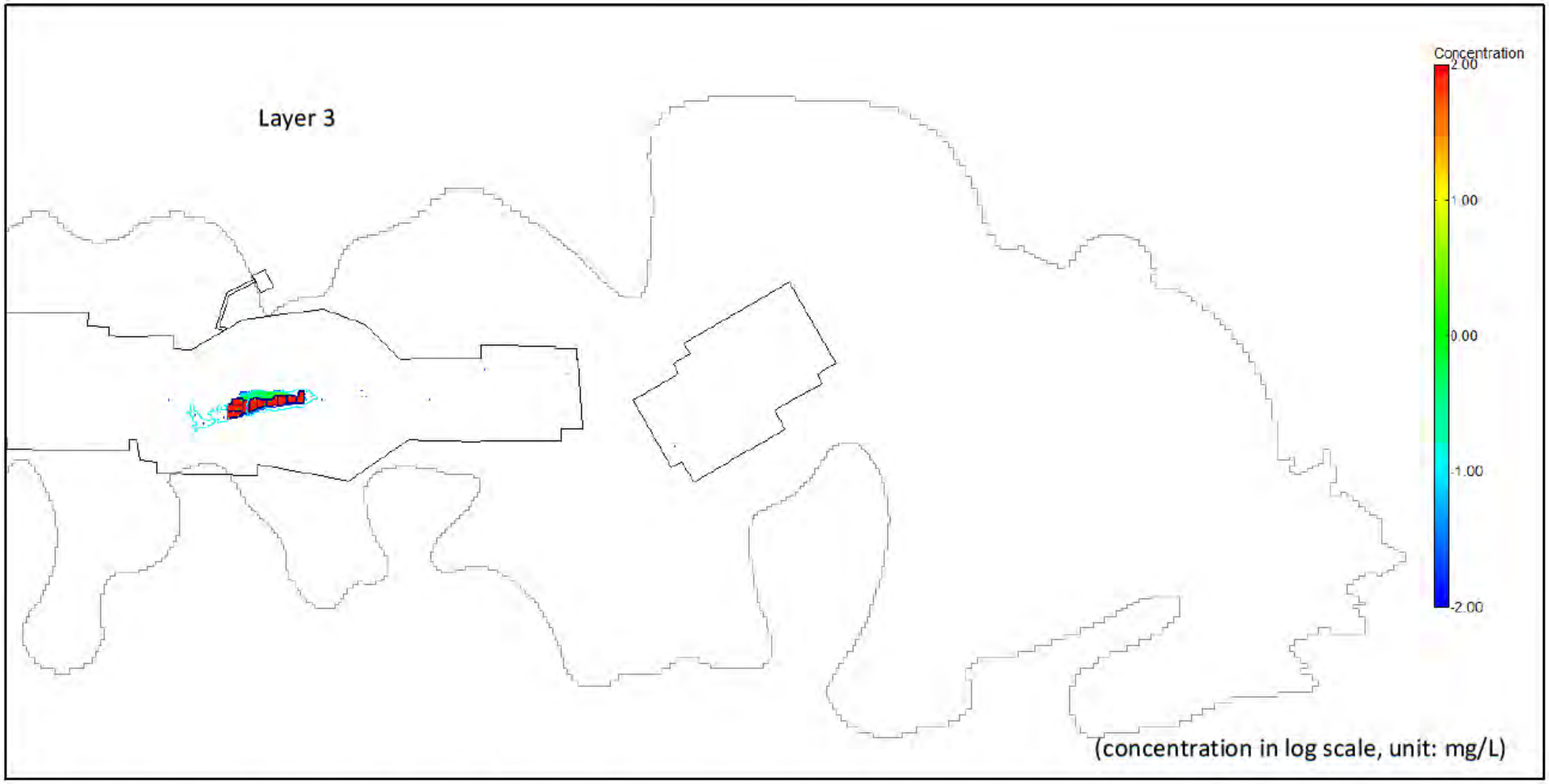


Figure C19 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 3 at year 15,000

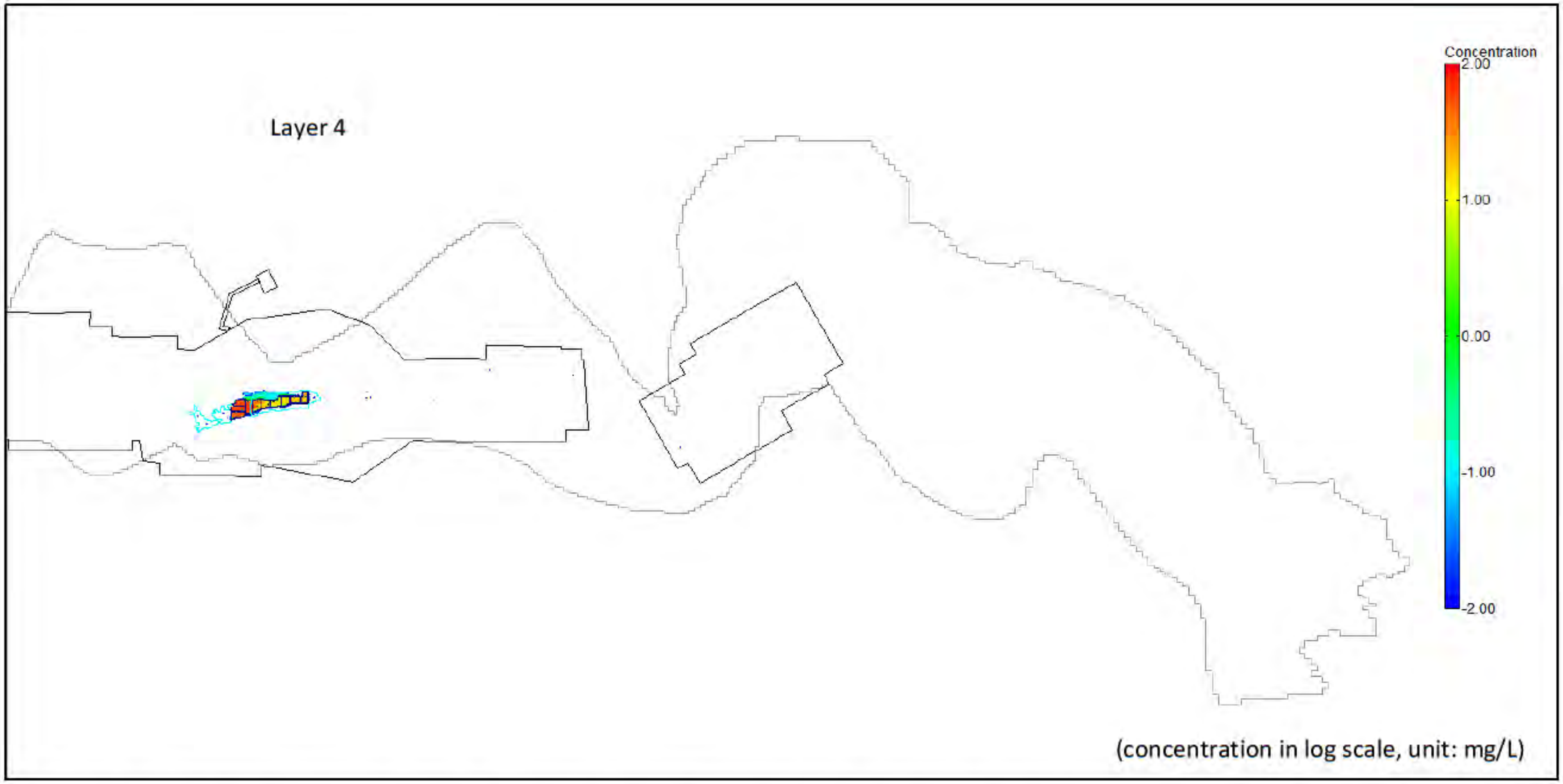


Figure C20 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 4 at year 15,000

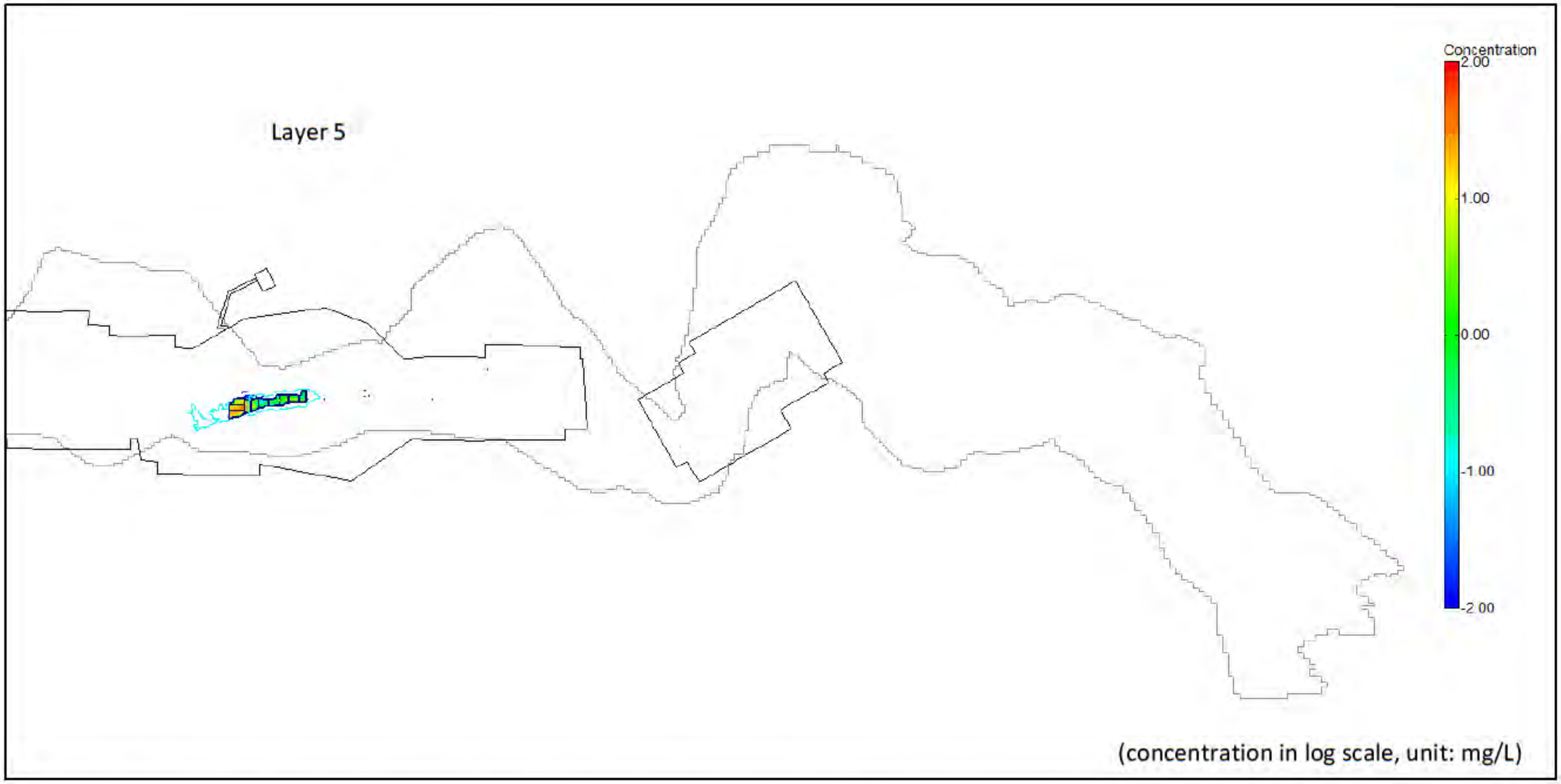


Figure C21 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 5 at year 15,000

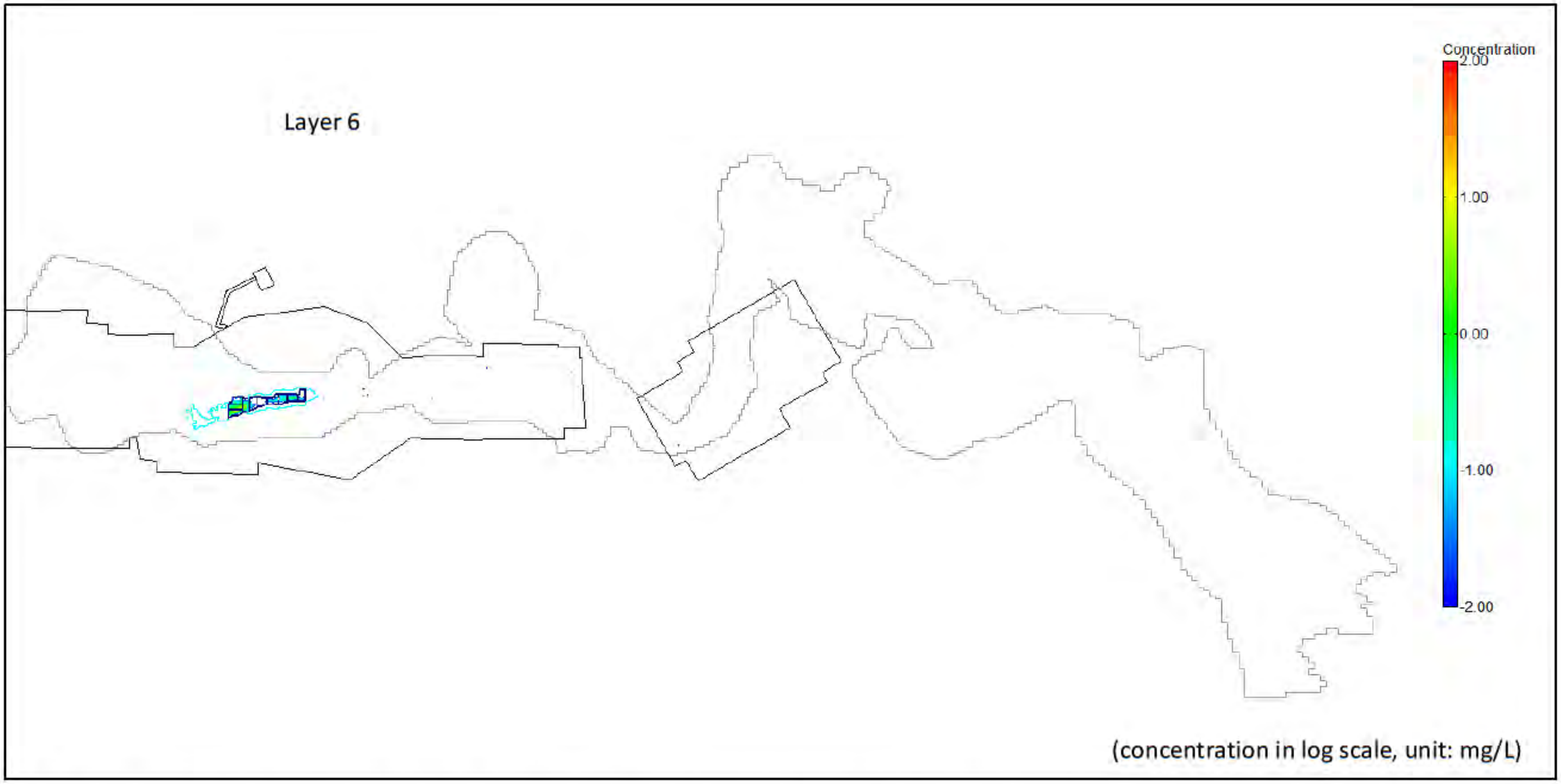


Figure C22 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 6 at year 15,000

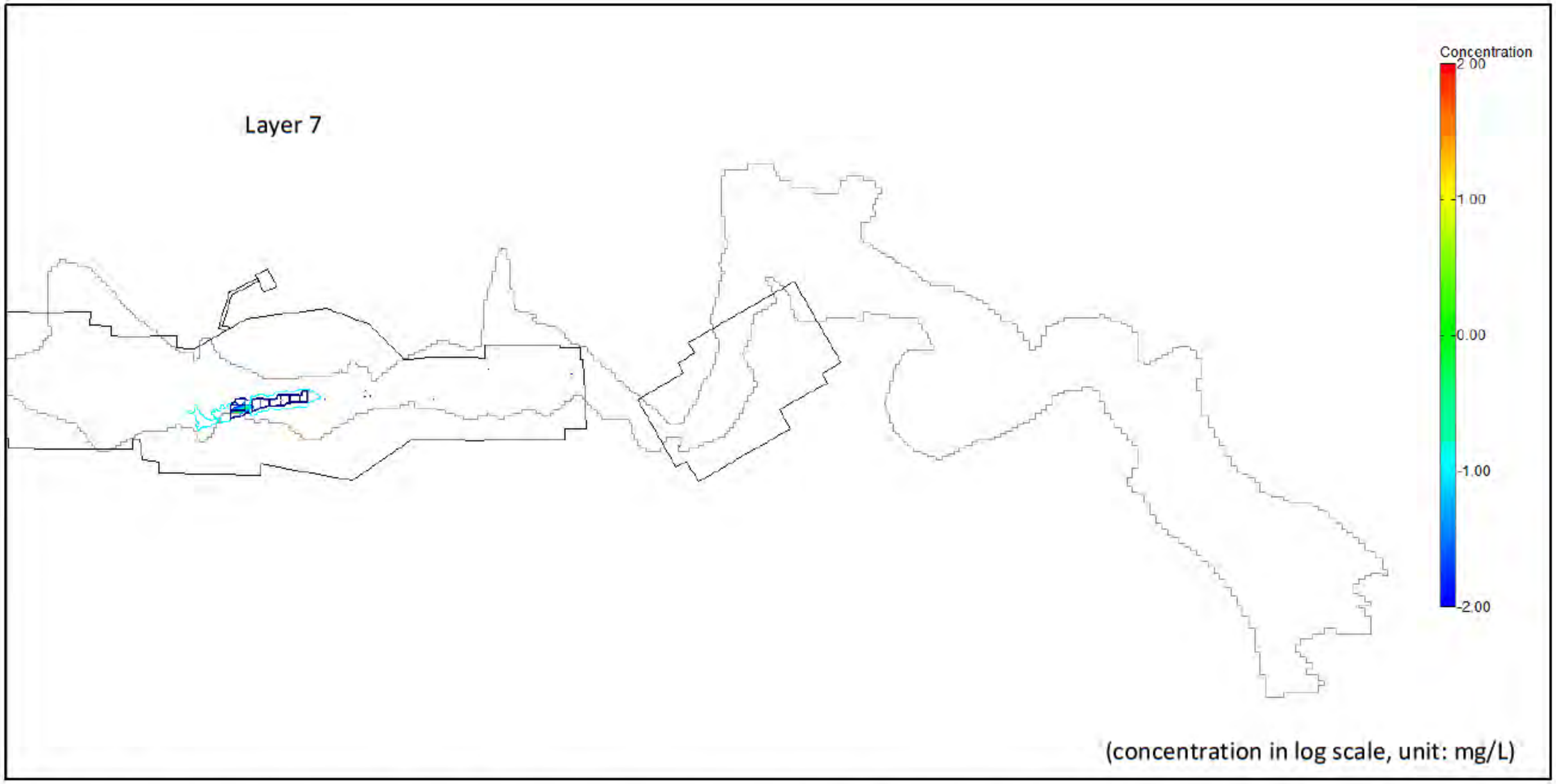


Figure C23 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 7 at year 15,000

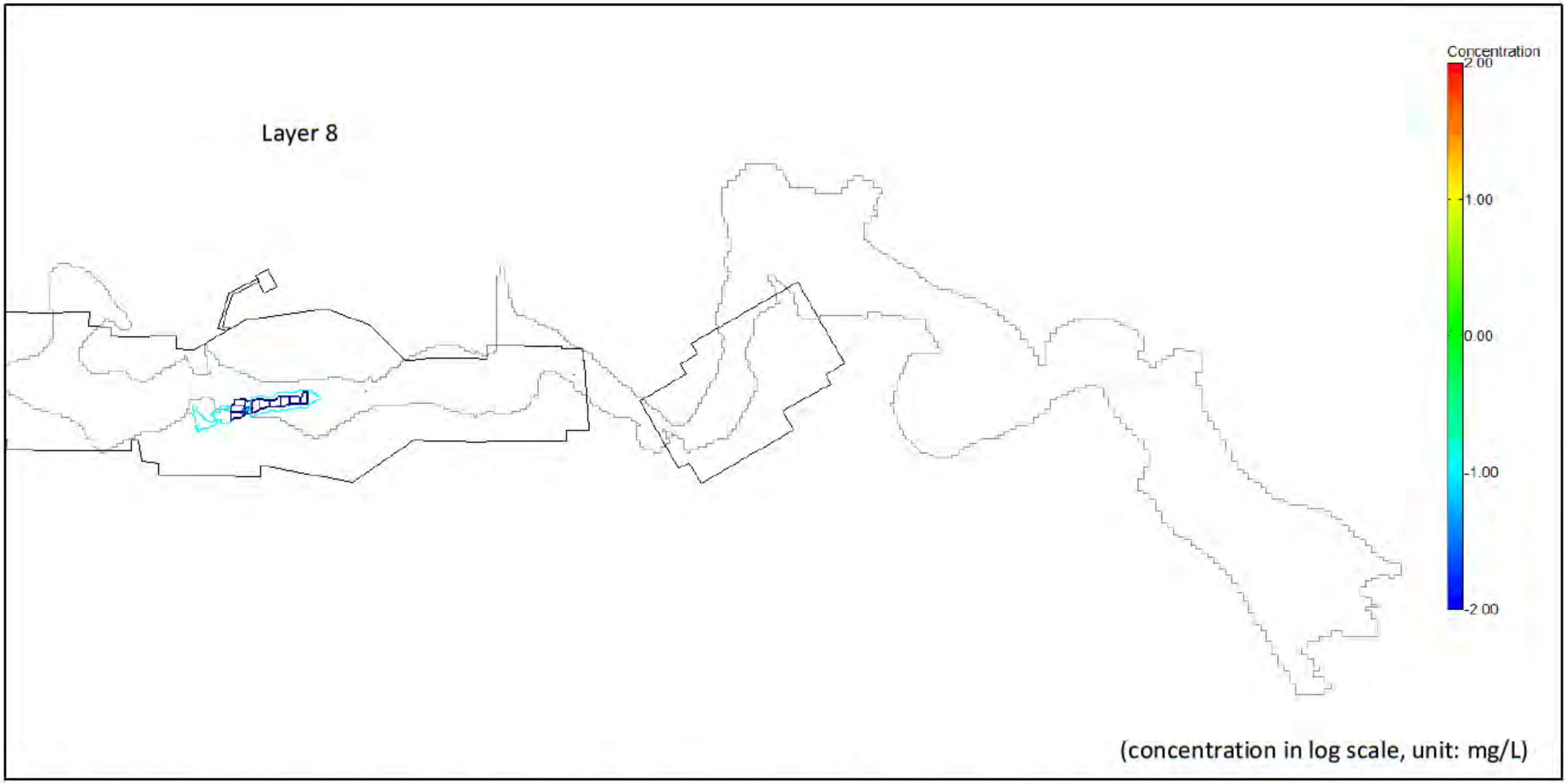


Figure C24 Effect of infiltration through tailings and backfill cover (0.2% of annual precipitation) on simulated vanadium transport plume in layer 8 at year 15,000

Sensitivity Run
Percolation Through Cover: 2.5% of Annual Average Precipitation

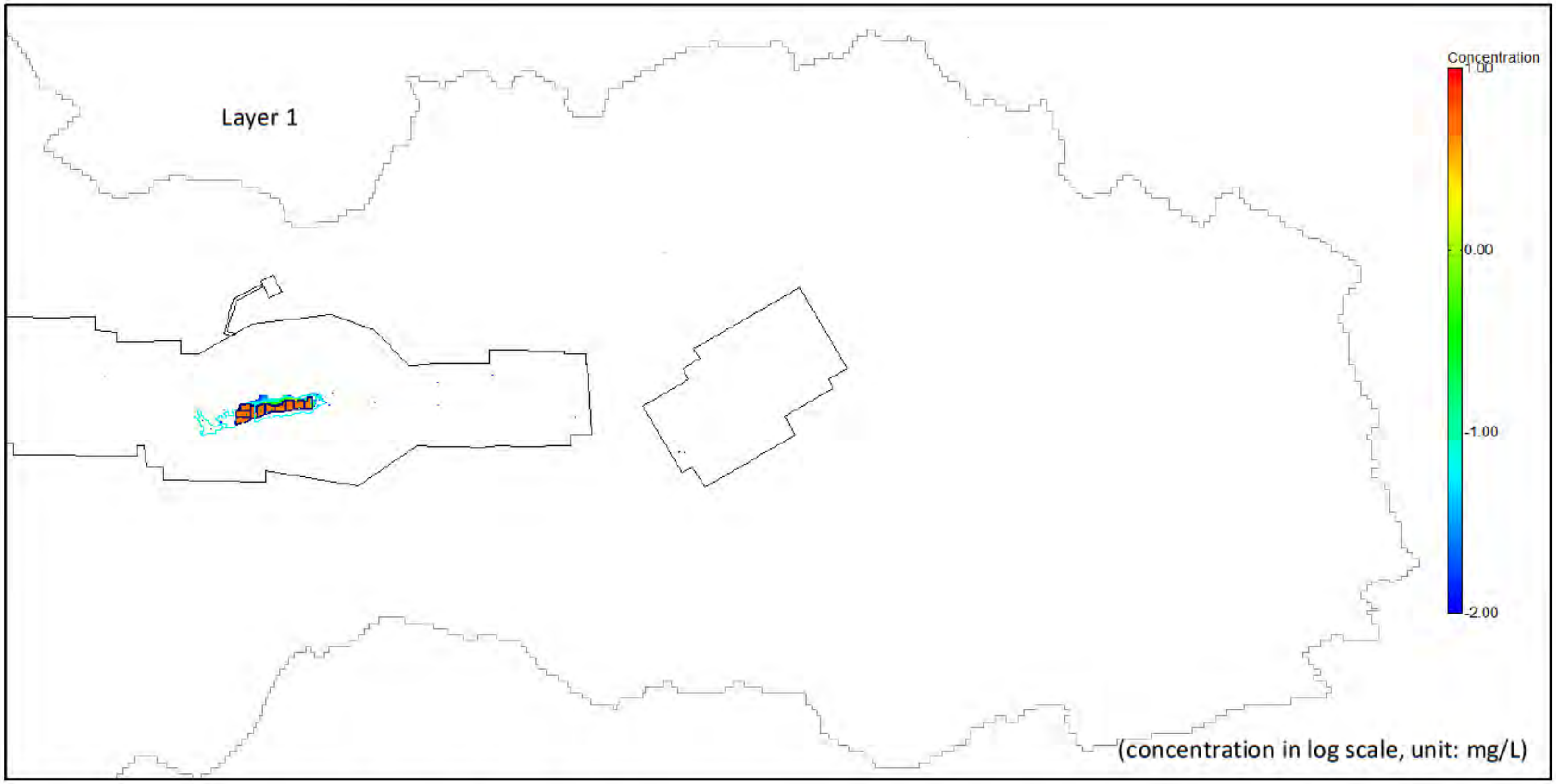


Figure D1 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 1 at year 15,000

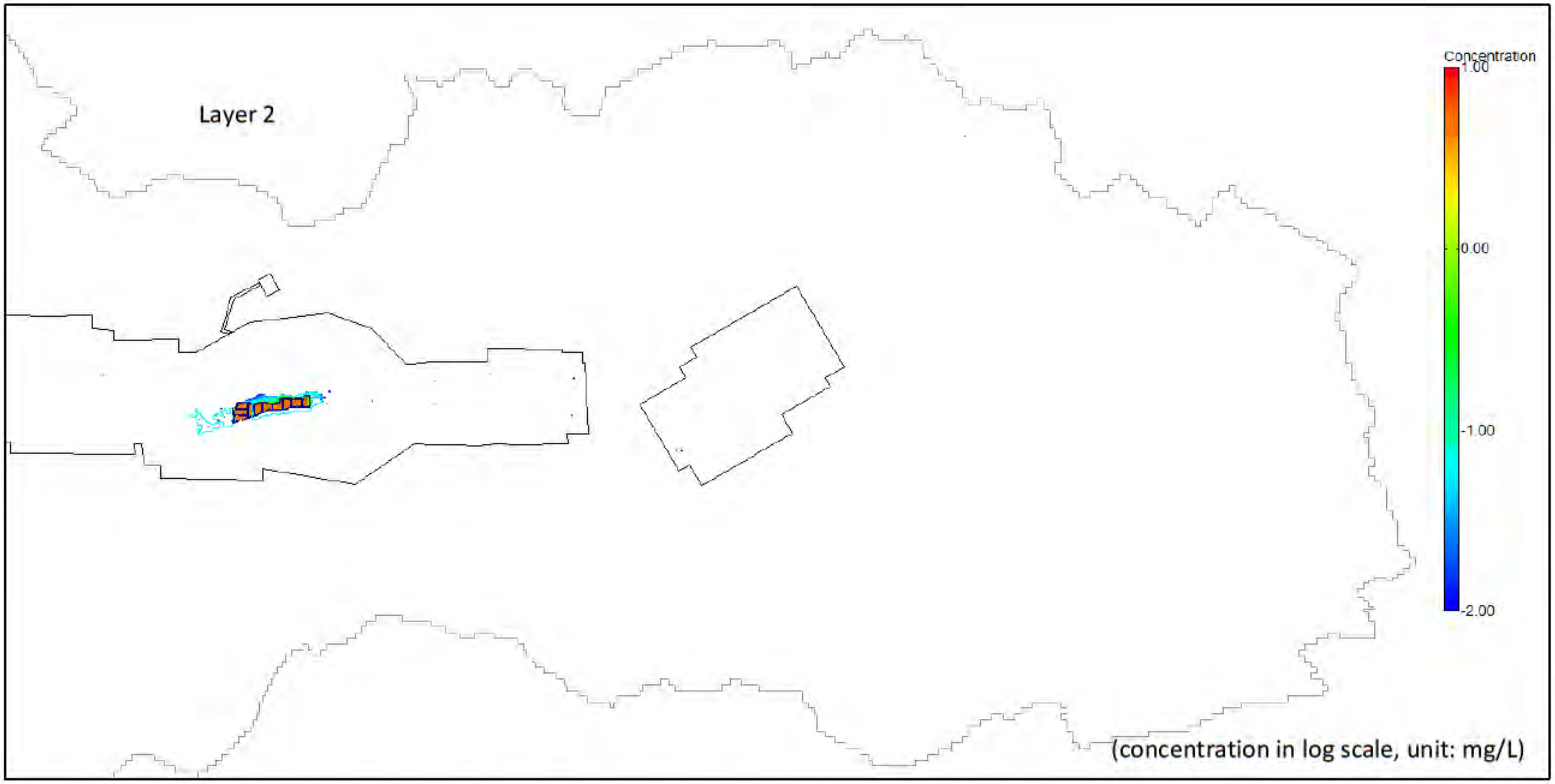


Figure D2 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 2 at year 15,000

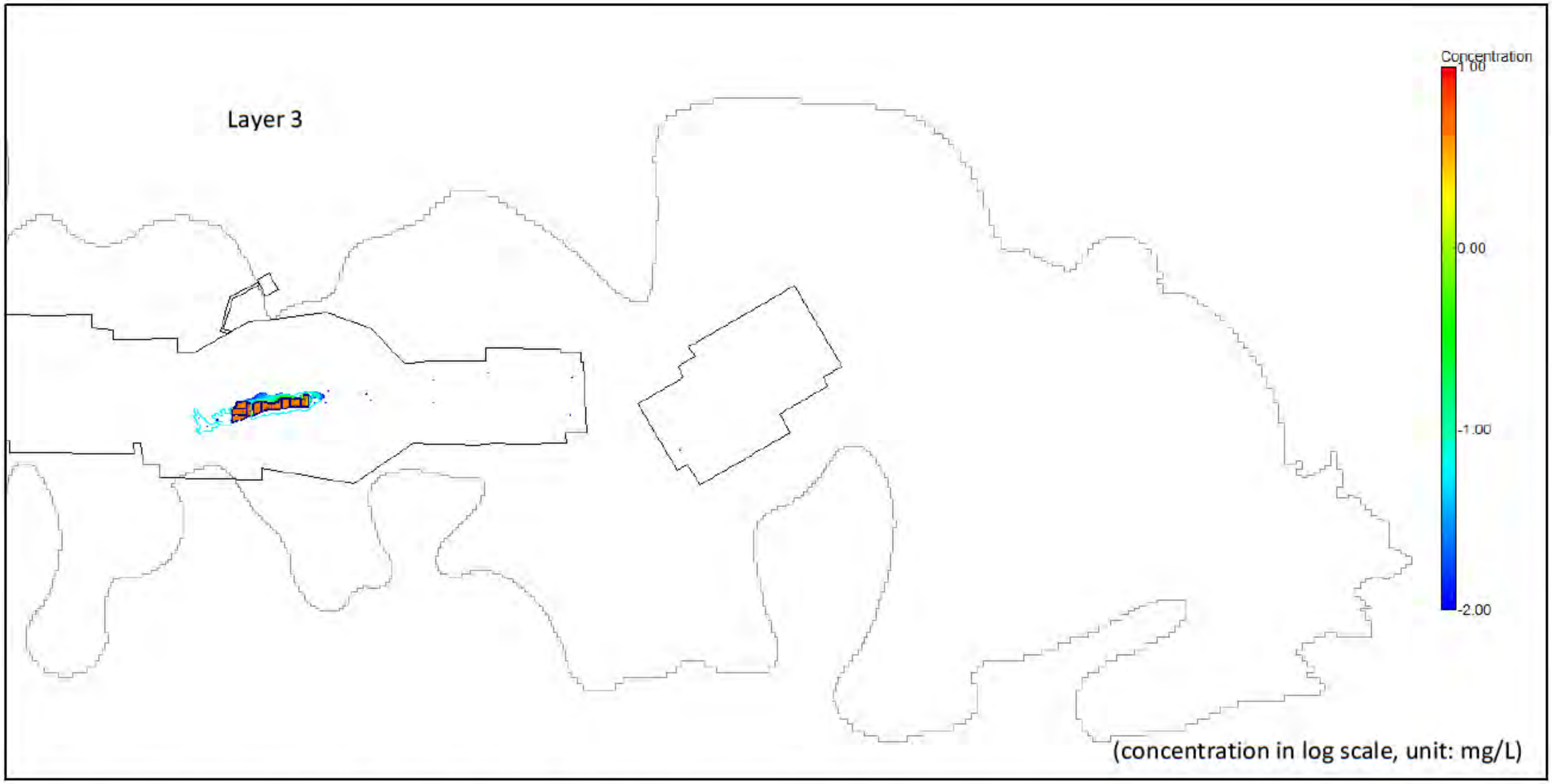


Figure D3 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 3 at year 15,000

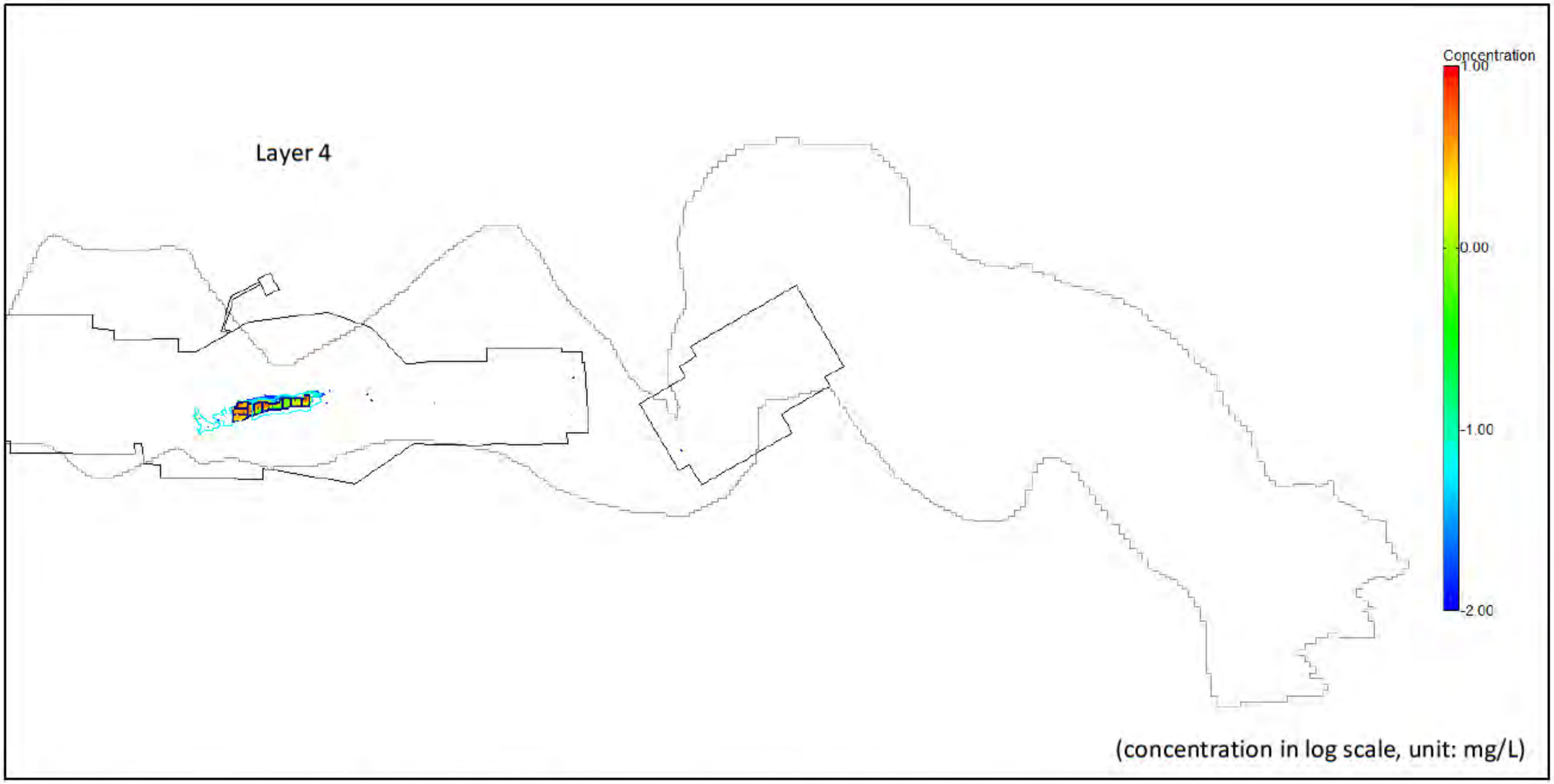


Figure D4 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 4 at year 15,000

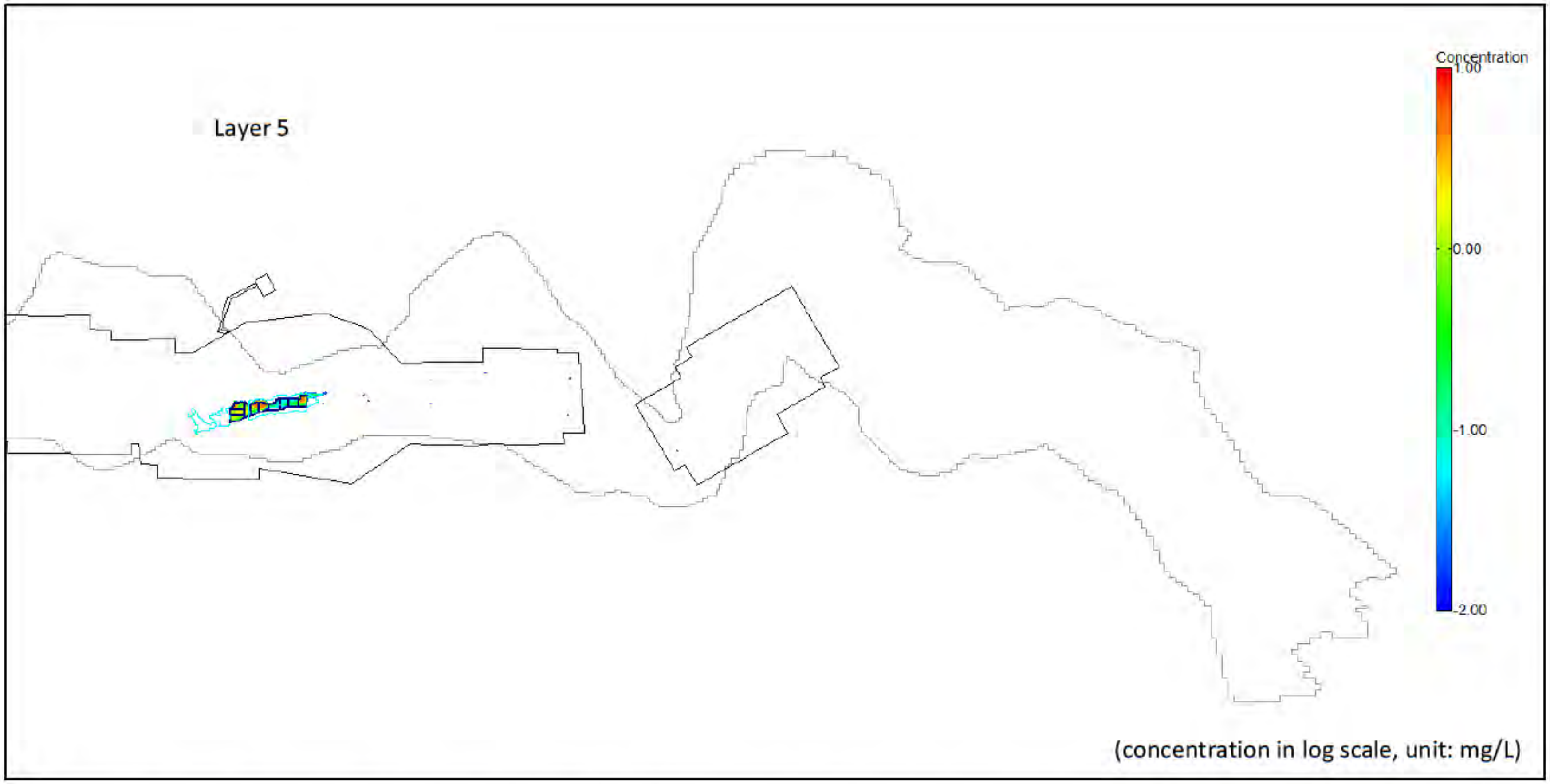


Figure D5 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 5 at year 15,000

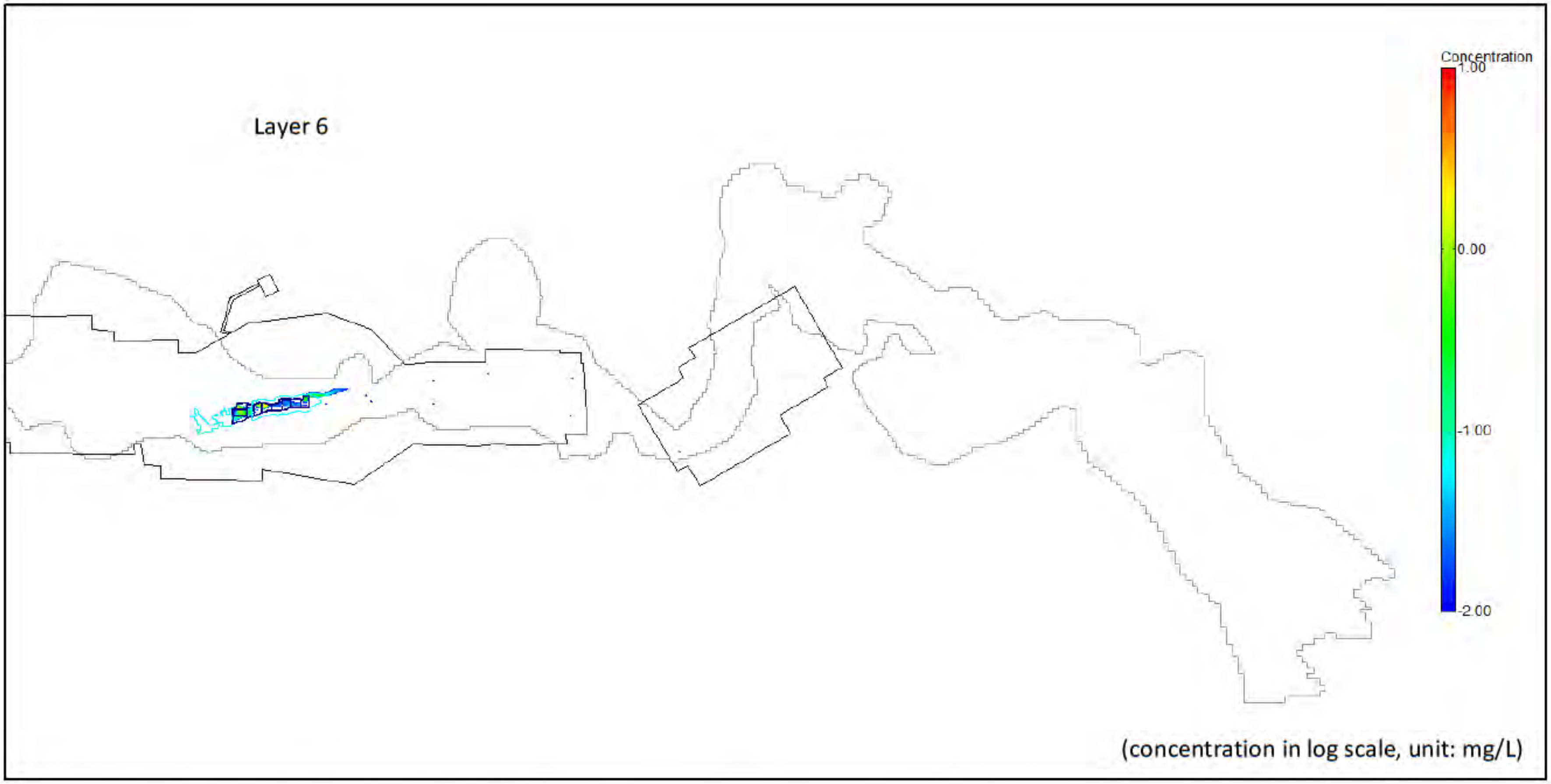


Figure D6 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 6 at year 15,000

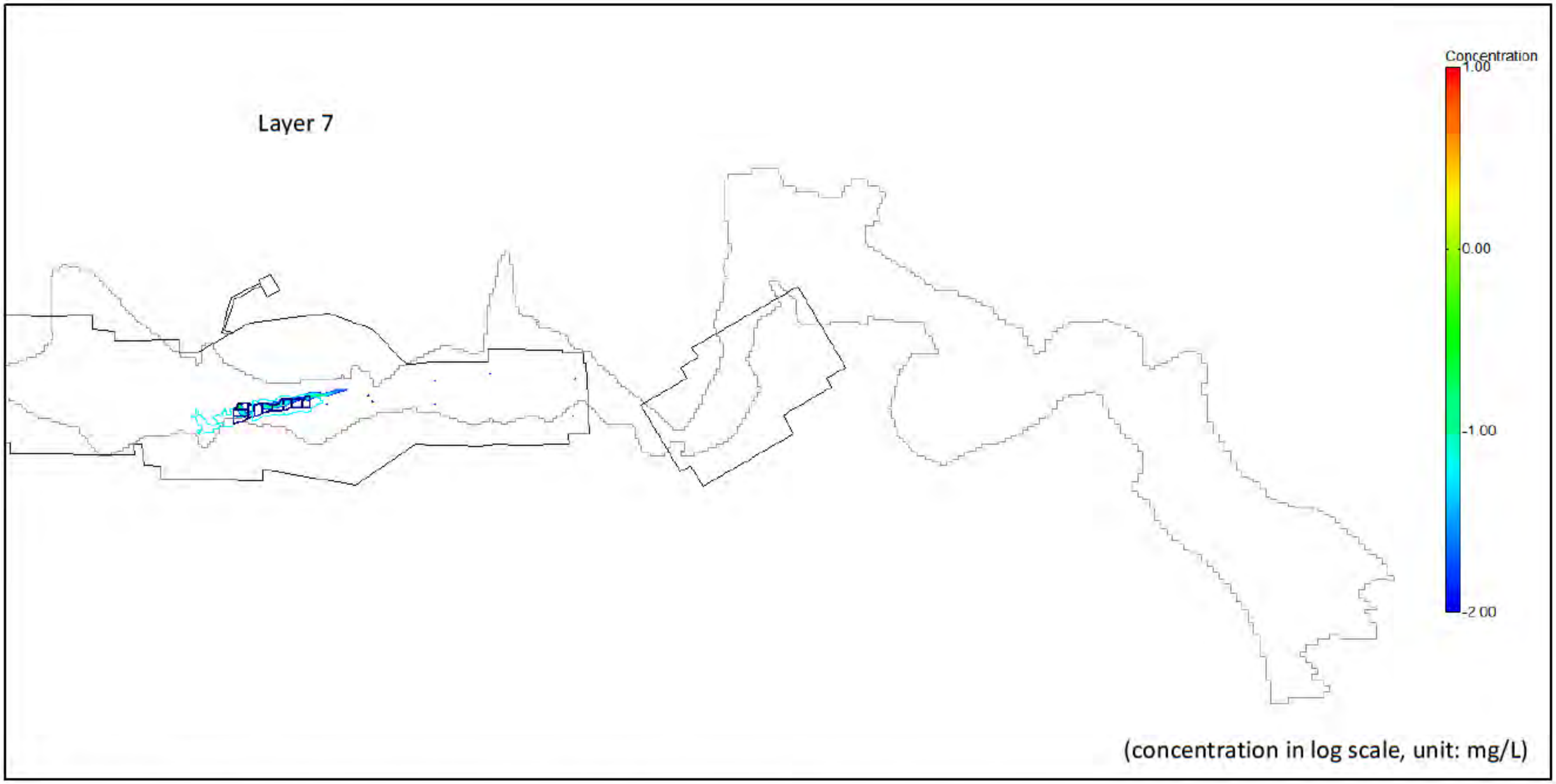


Figure D7 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 7 at year 15,000

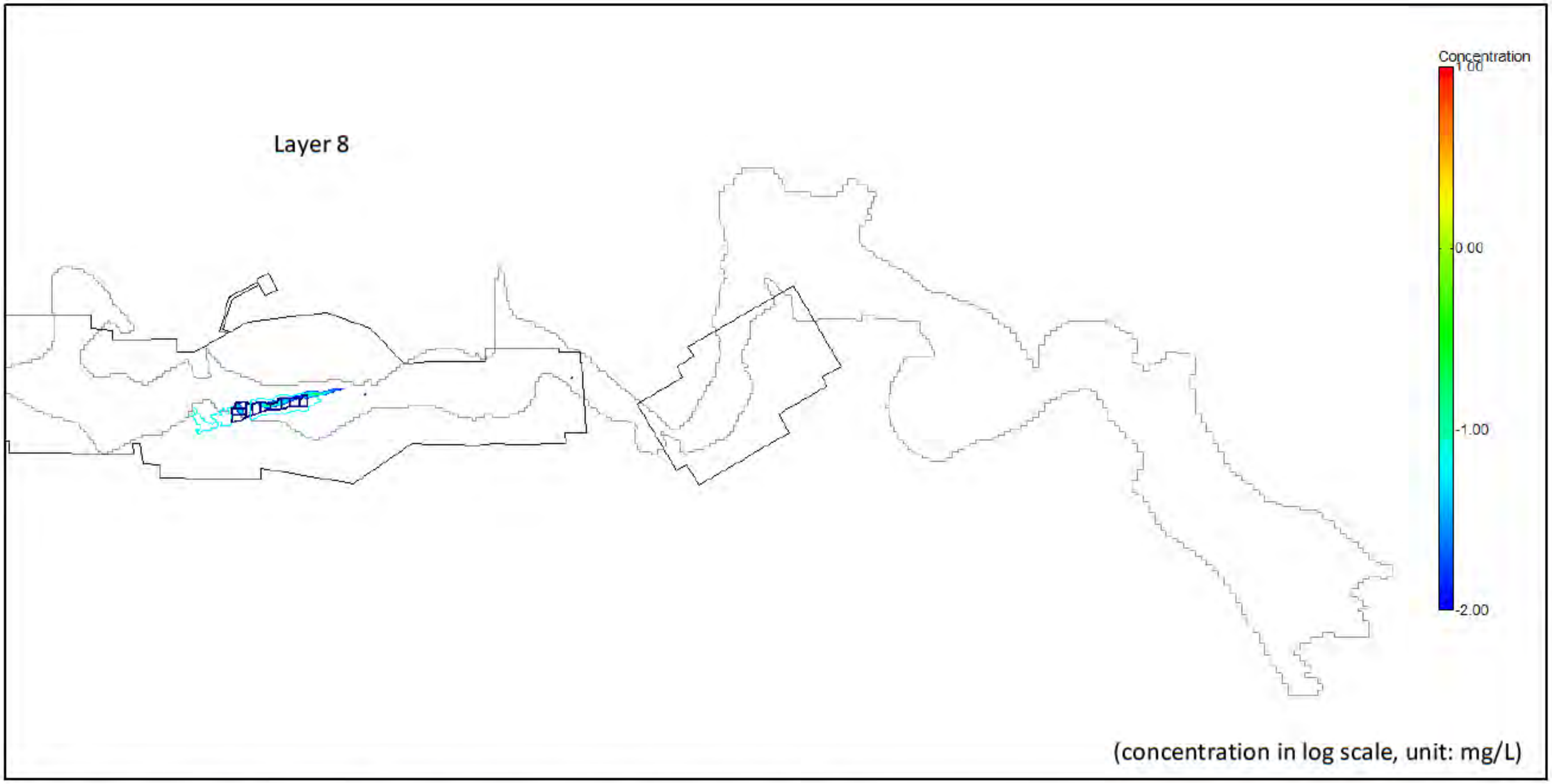


Figure D8 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated arsenic transport plume in layer 8 at year 15,000

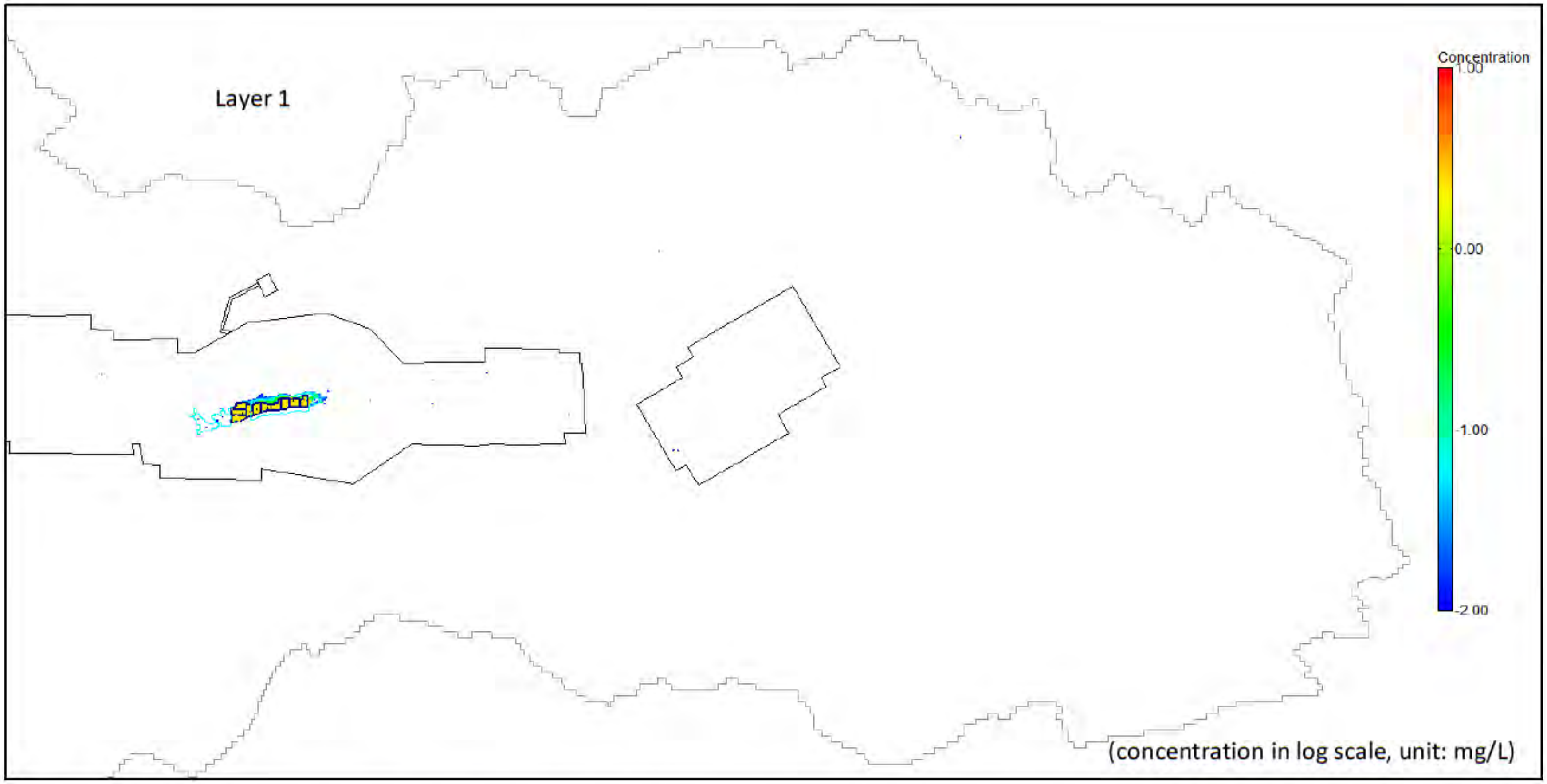


Figure D9 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 1 at year 15,000

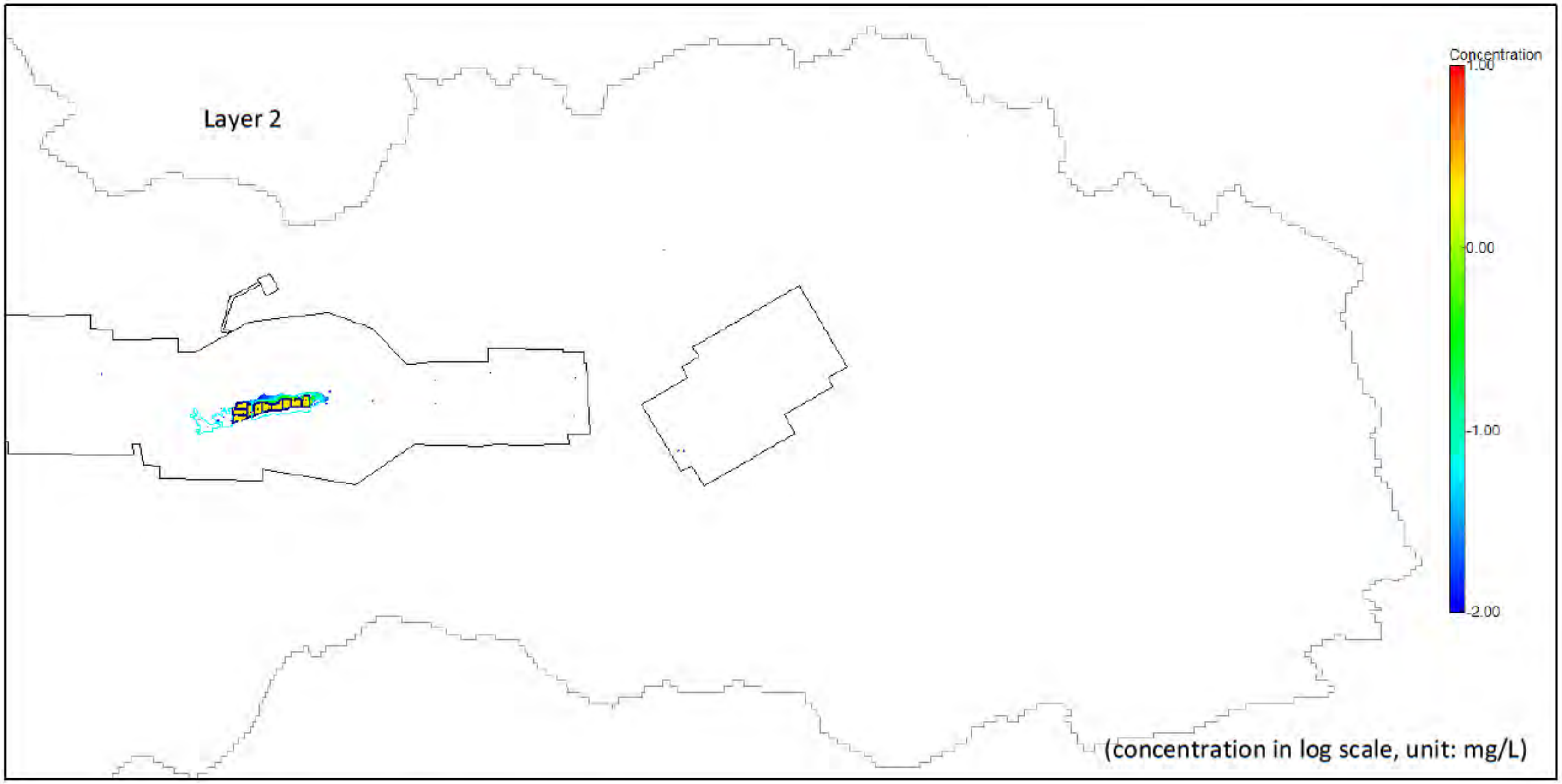


Figure D10 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 2 at year 15,000

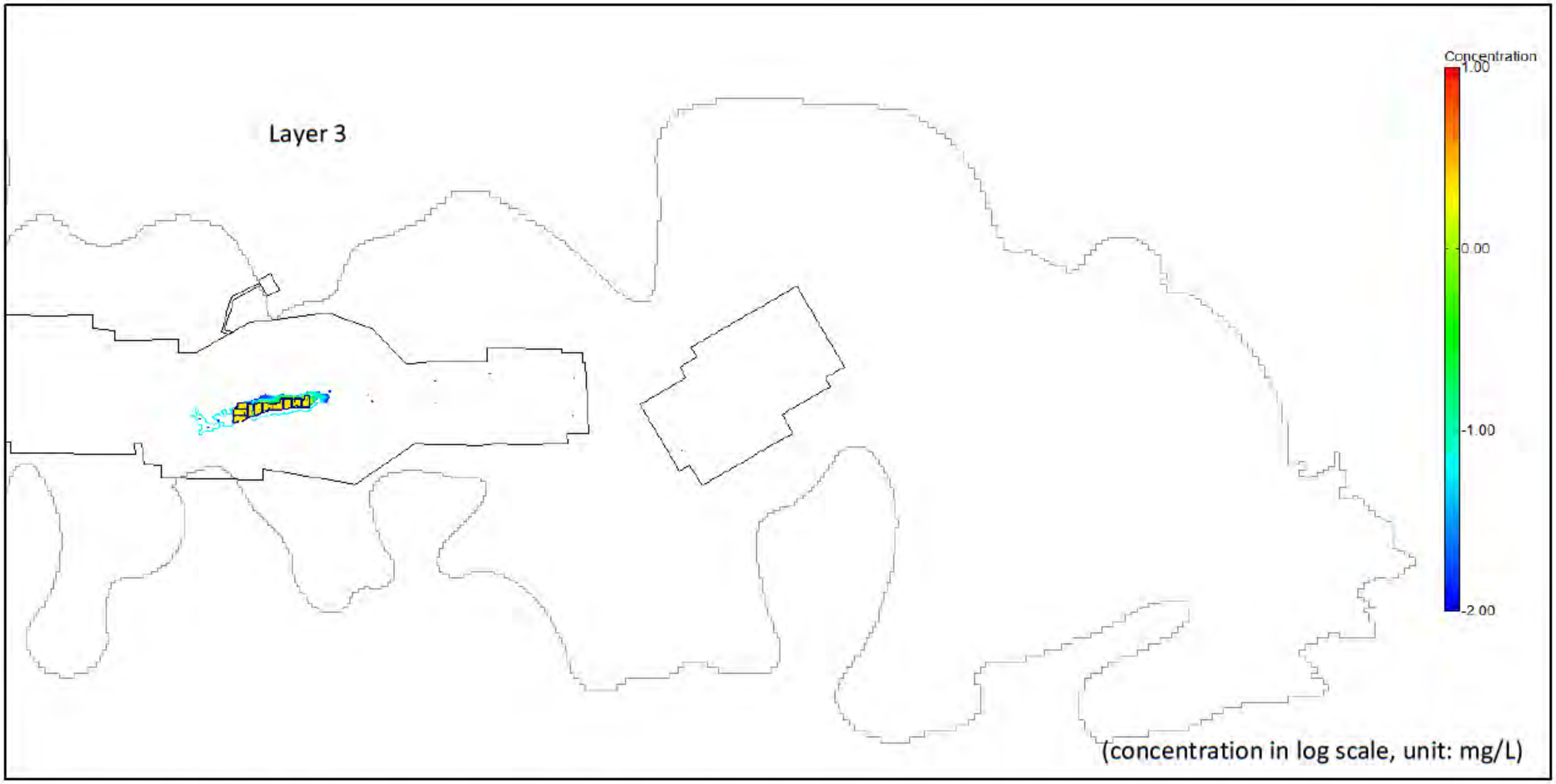


Figure D11 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 3 at year 15,000

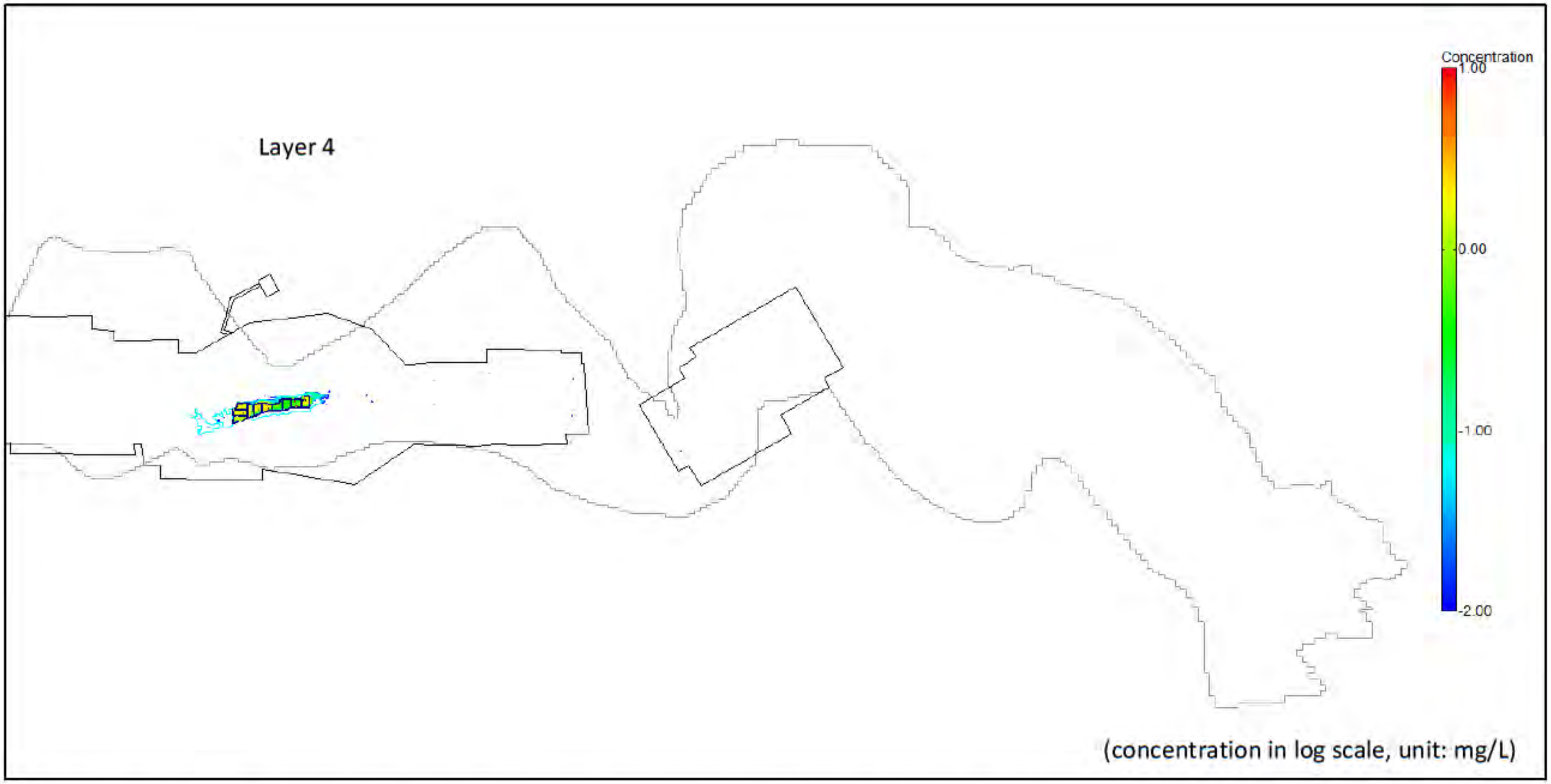


Figure D12 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 4 at year 15,000

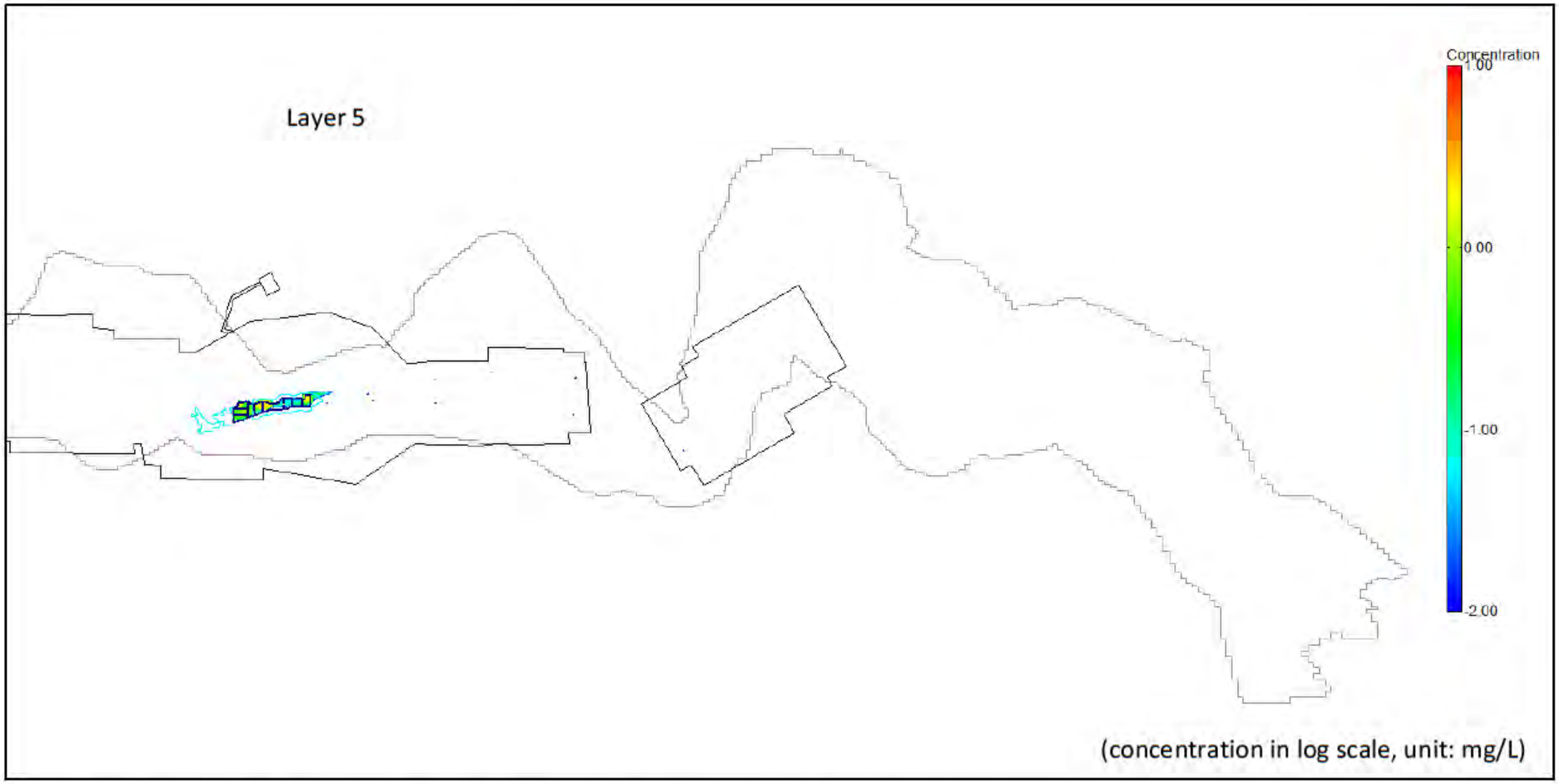


Figure D13 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 5 at year 15,000

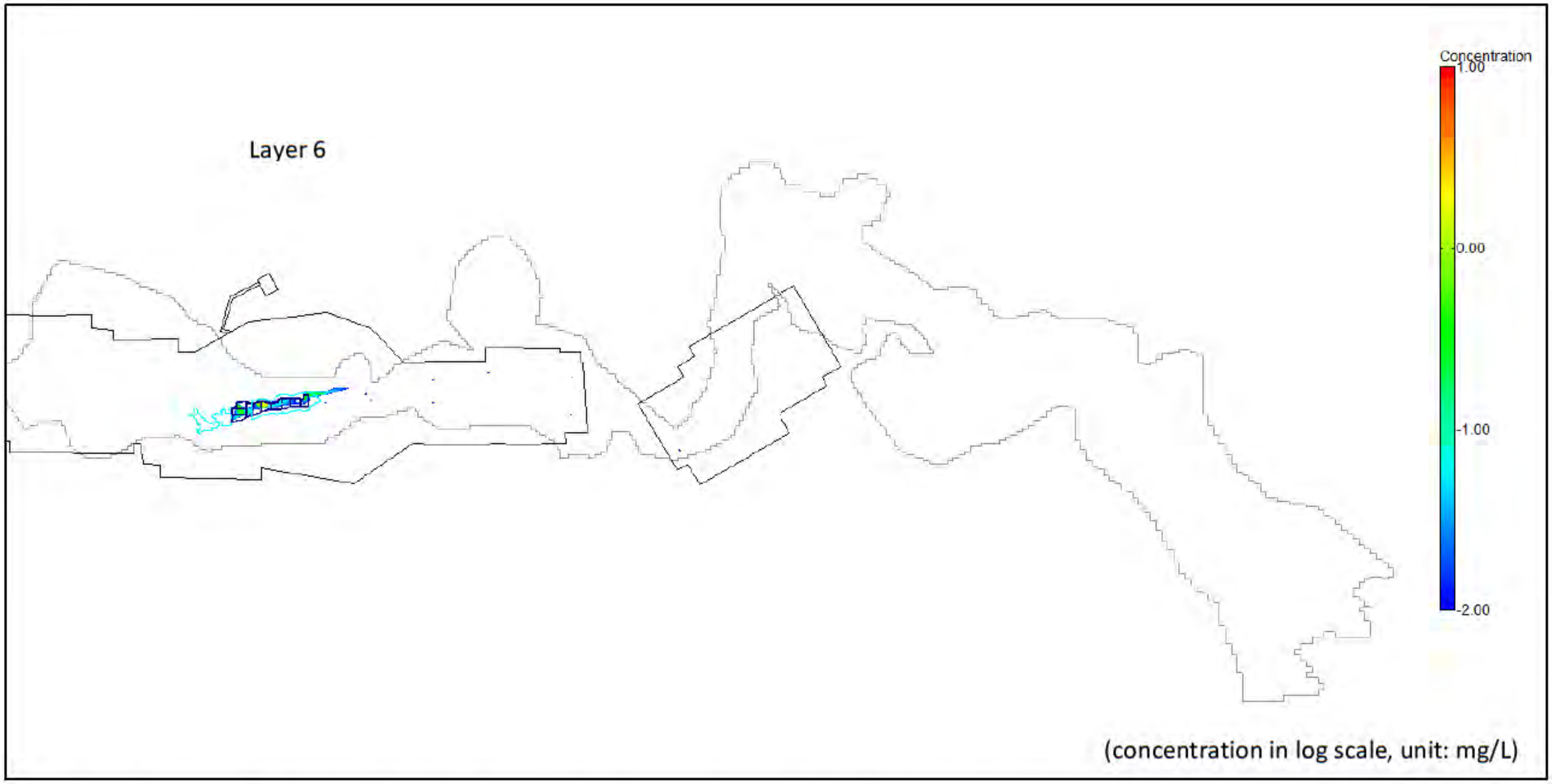


Figure D14 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 6 at year 15,000

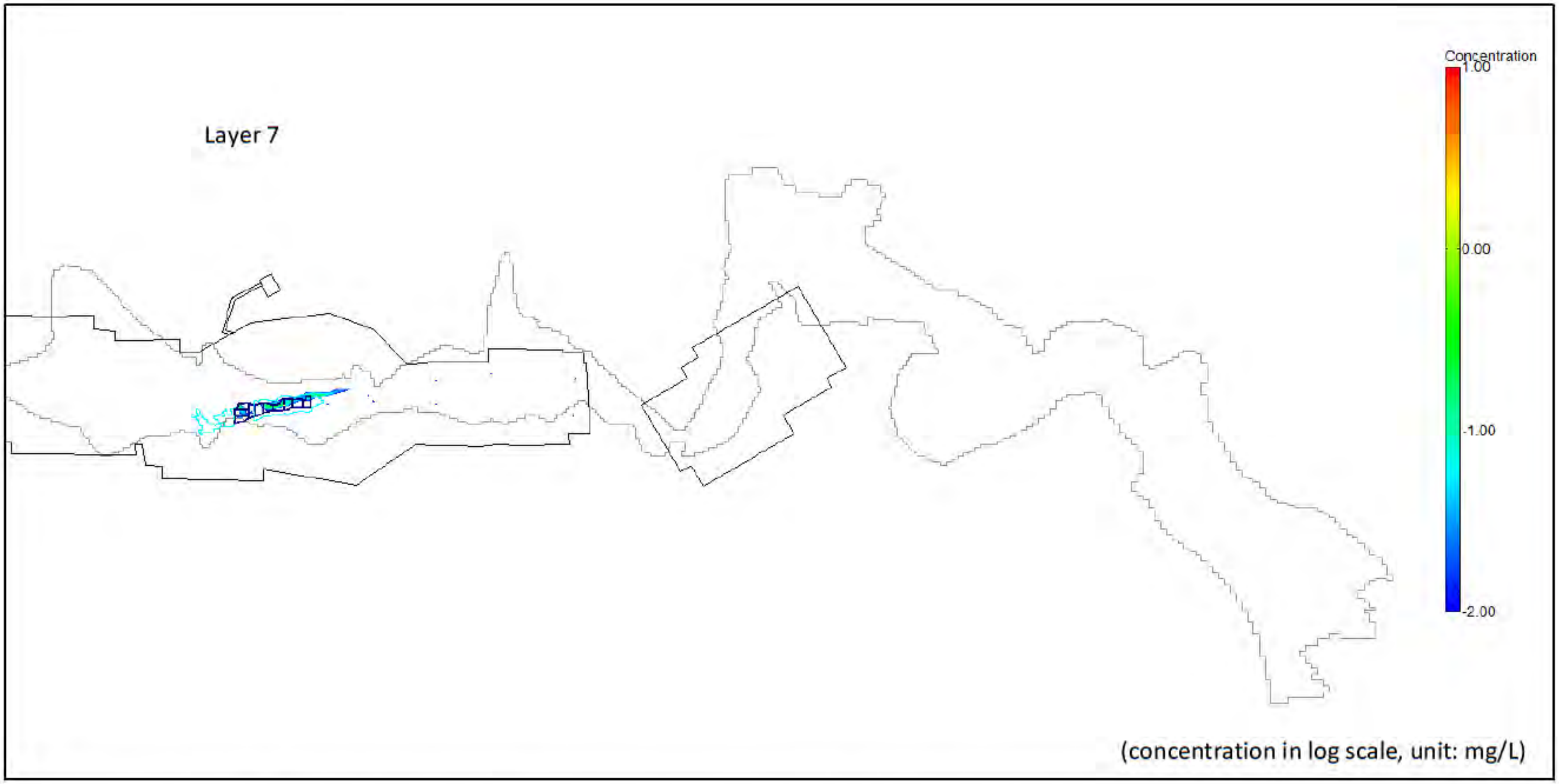


Figure D15 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 7 at year 15,000

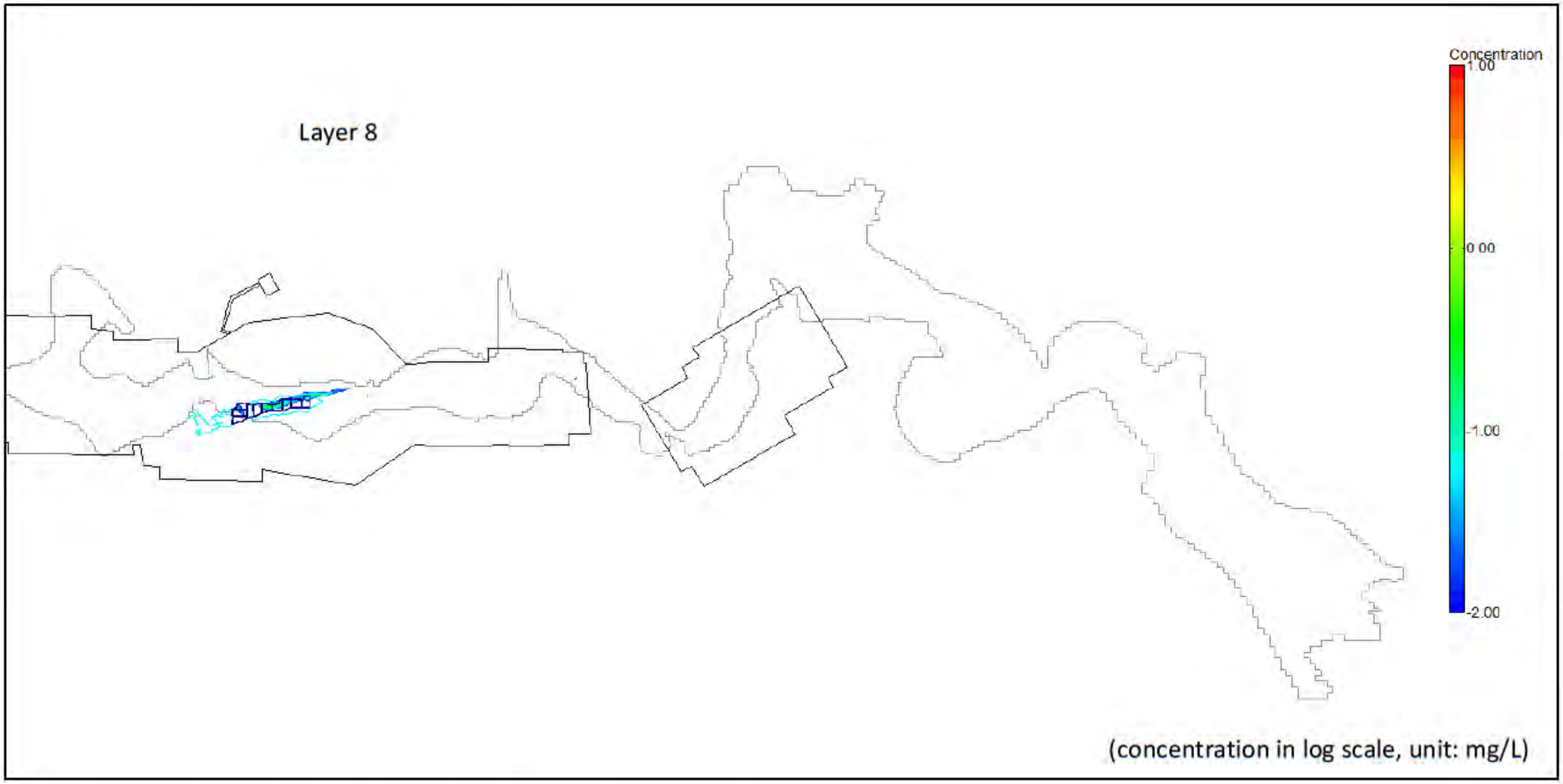


Figure D16 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated molybdenum transport plume in layer 8 at year 15,000

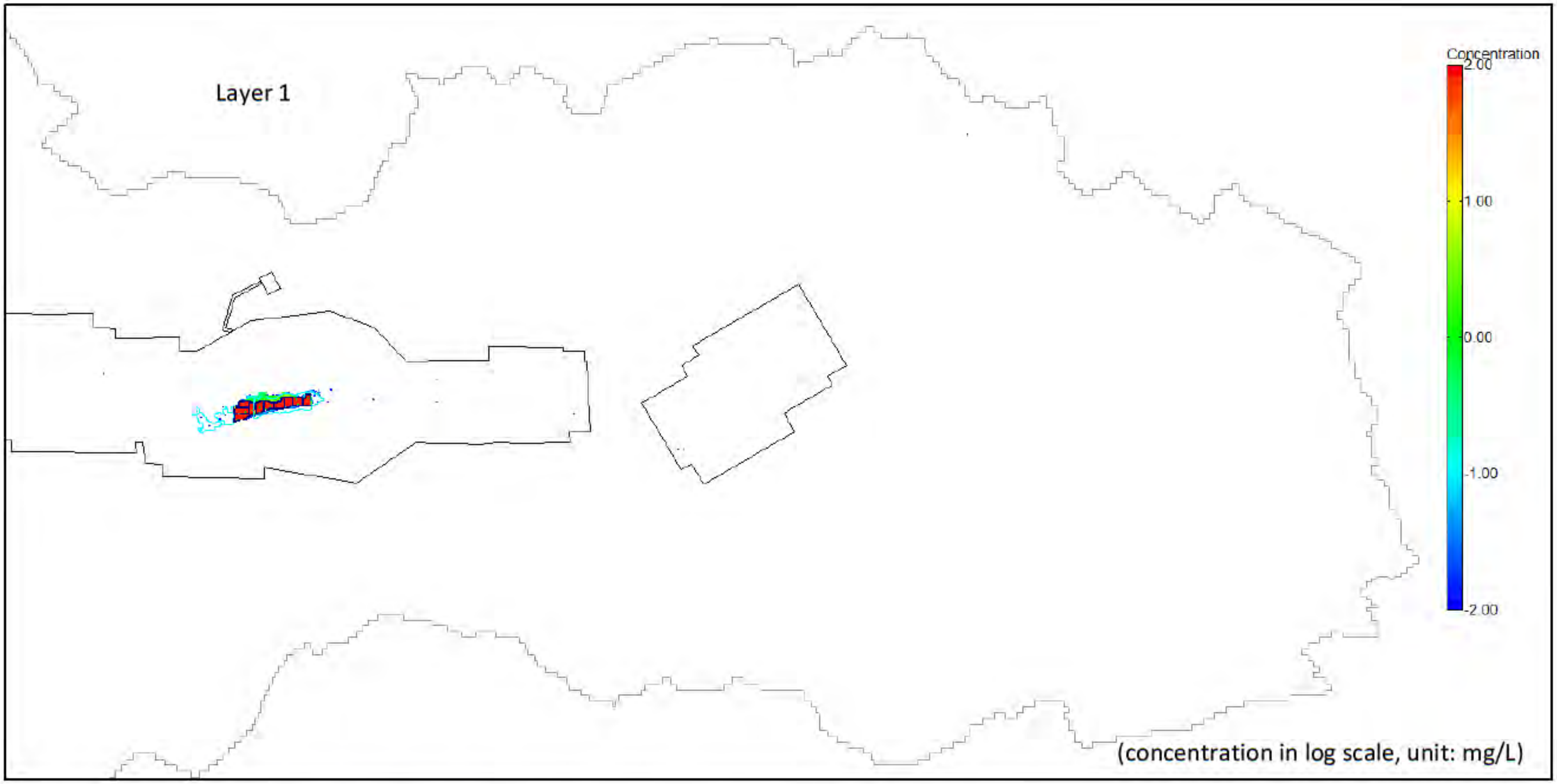


Figure D17 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 1 at year 15,000

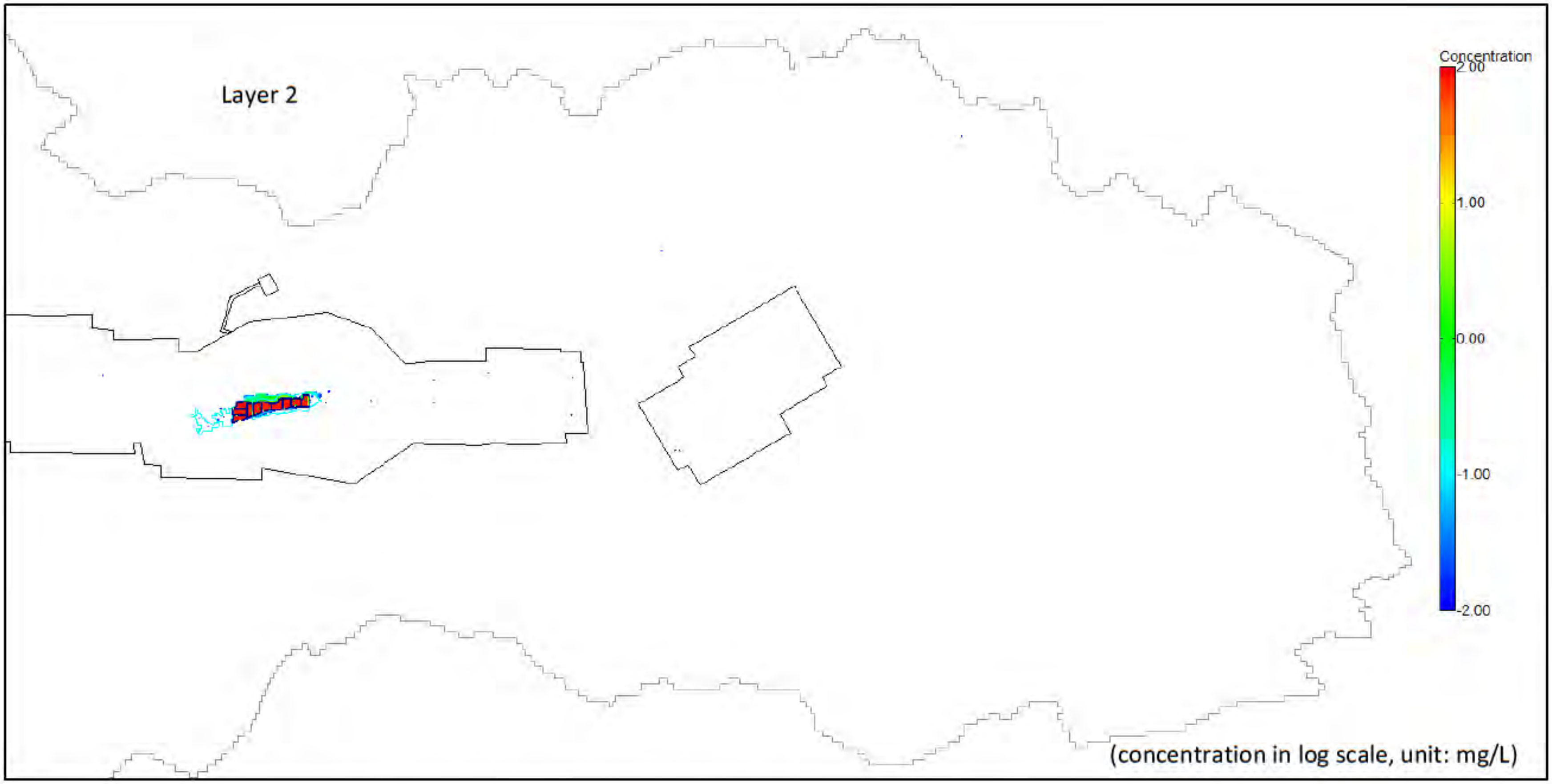


Figure D18 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 2 at year 15,000

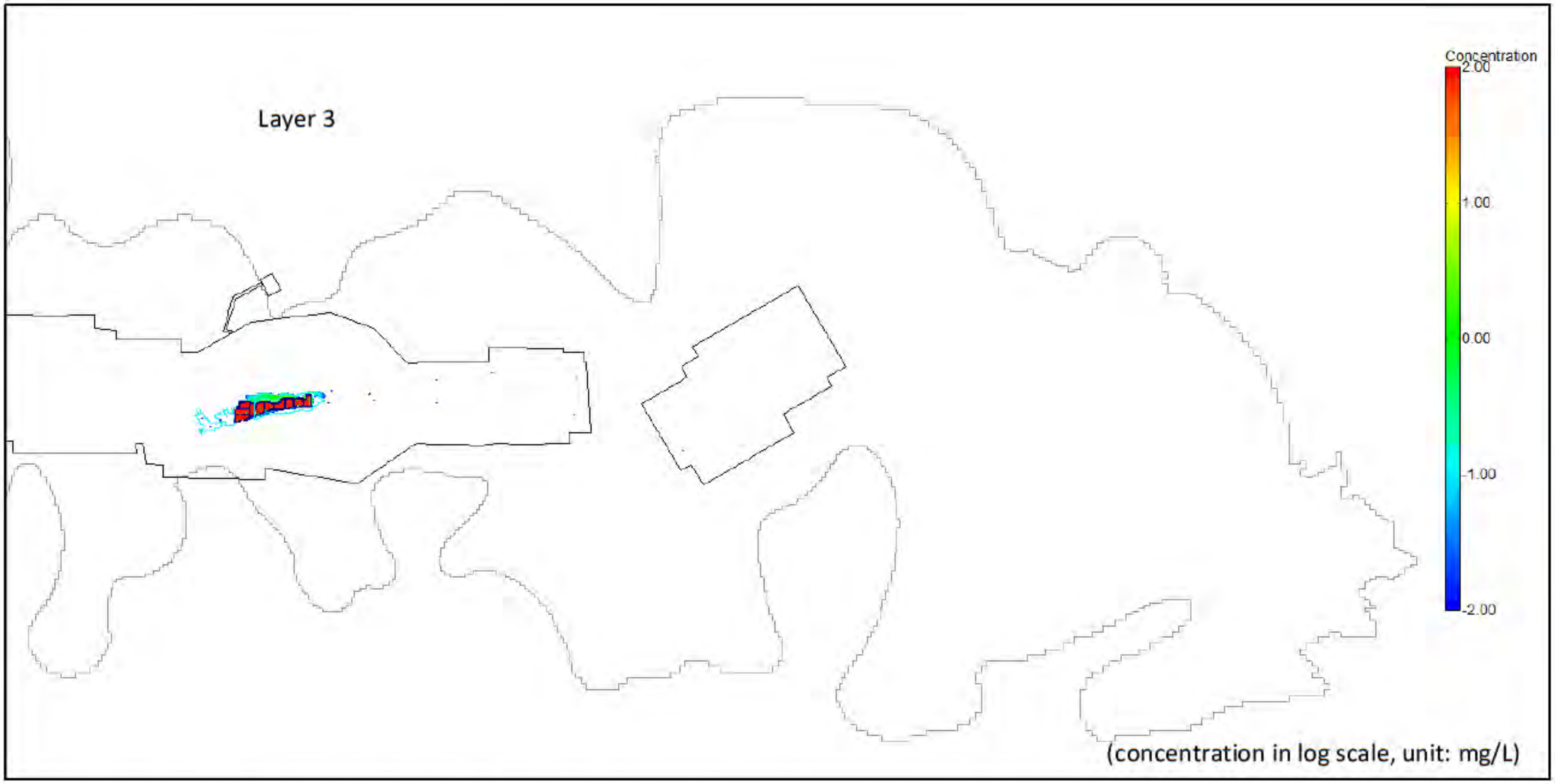


Figure D19 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 3 at year 15,000

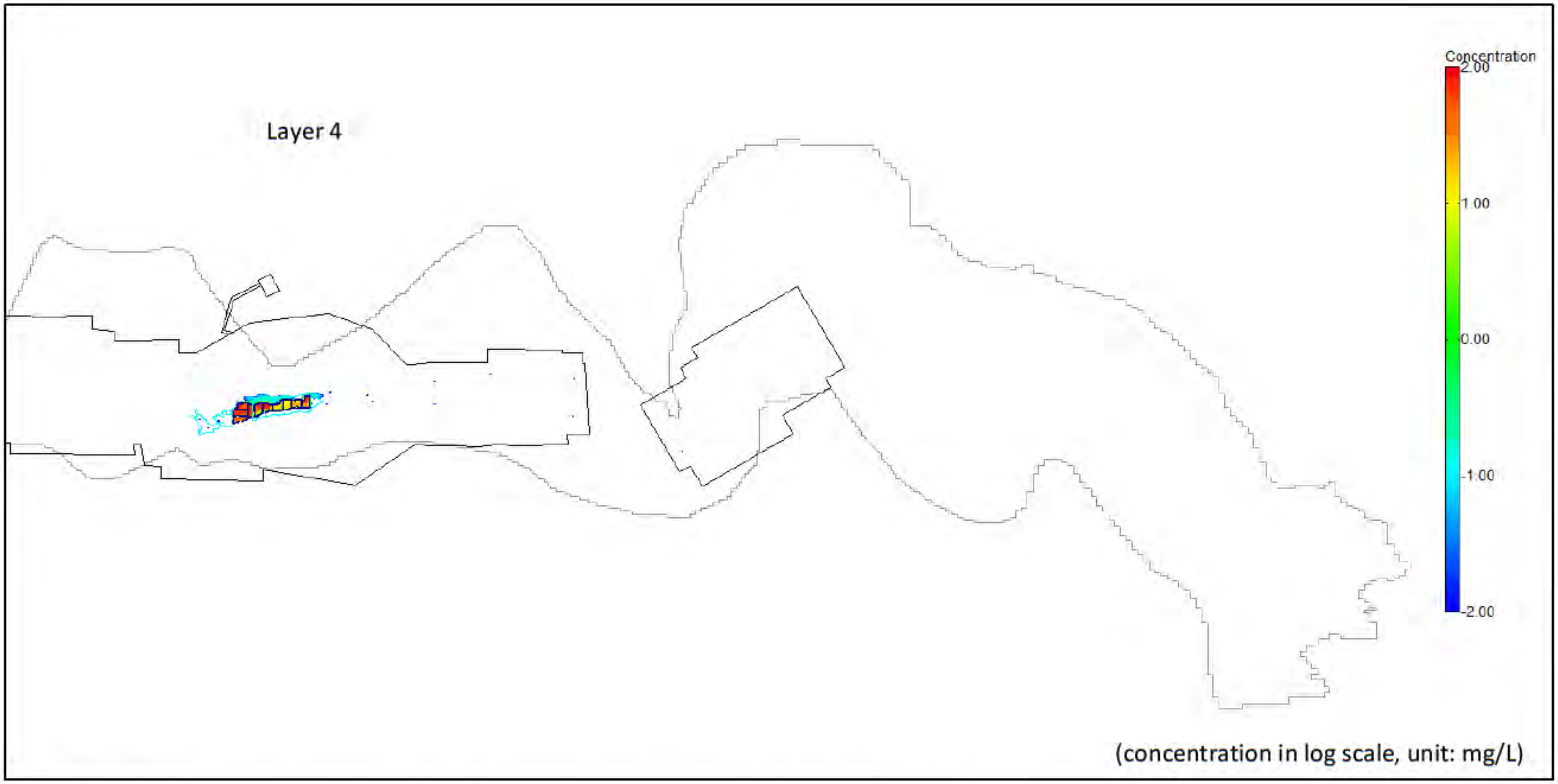


Figure D20 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 4 at year 15,000

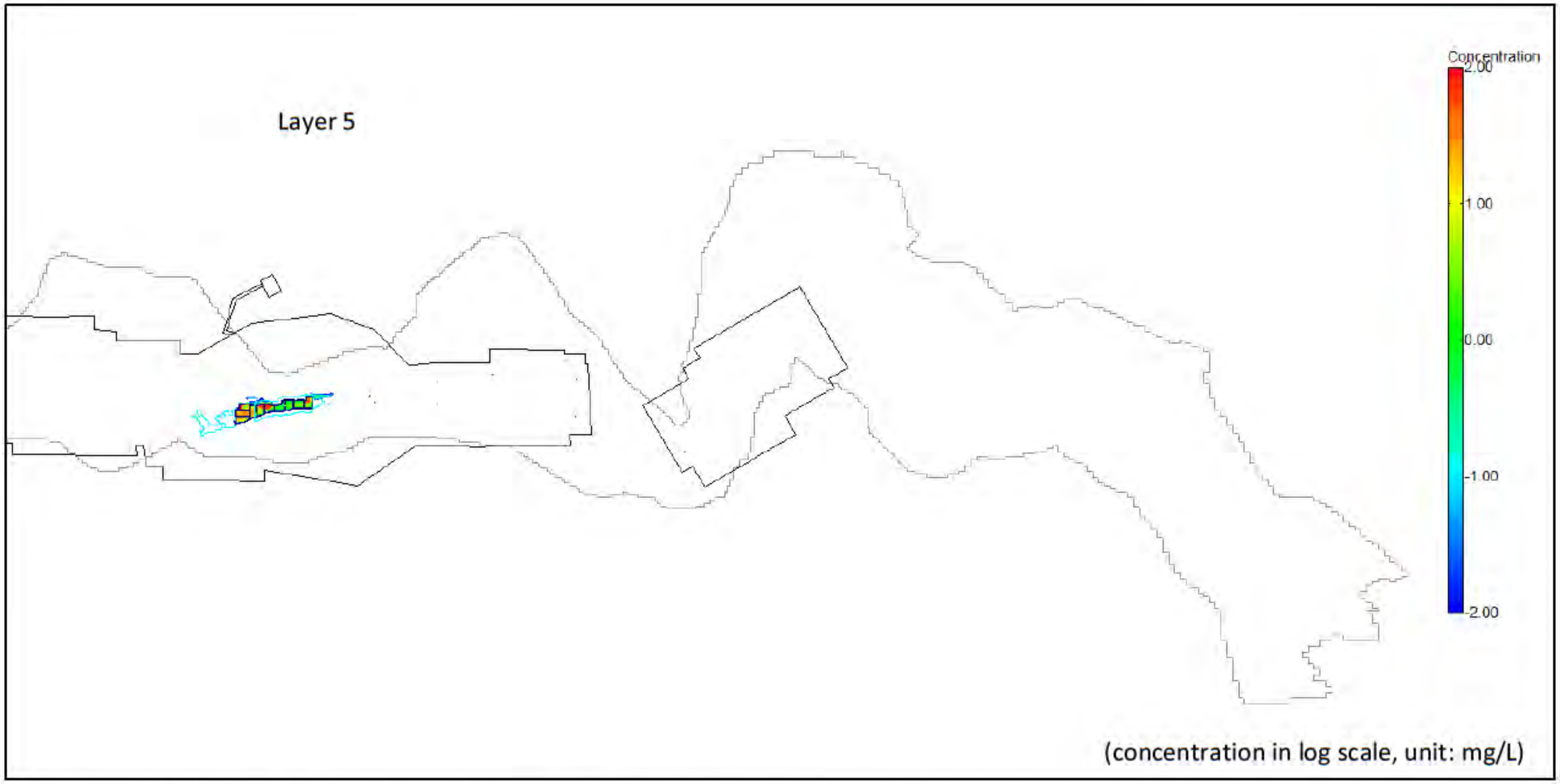


Figure D21 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 5 at year 15,000

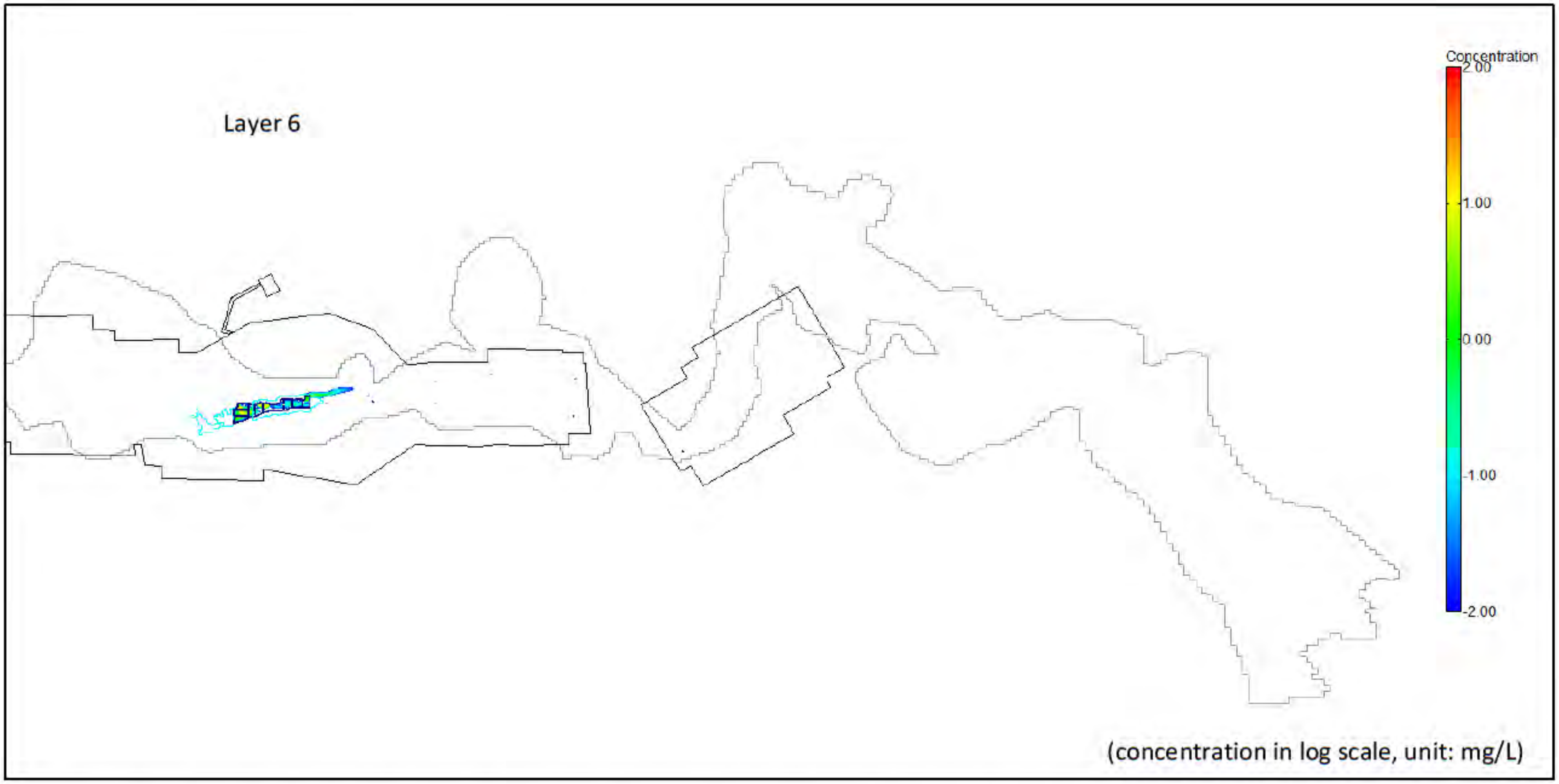


Figure D22 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 6 at year 15,000

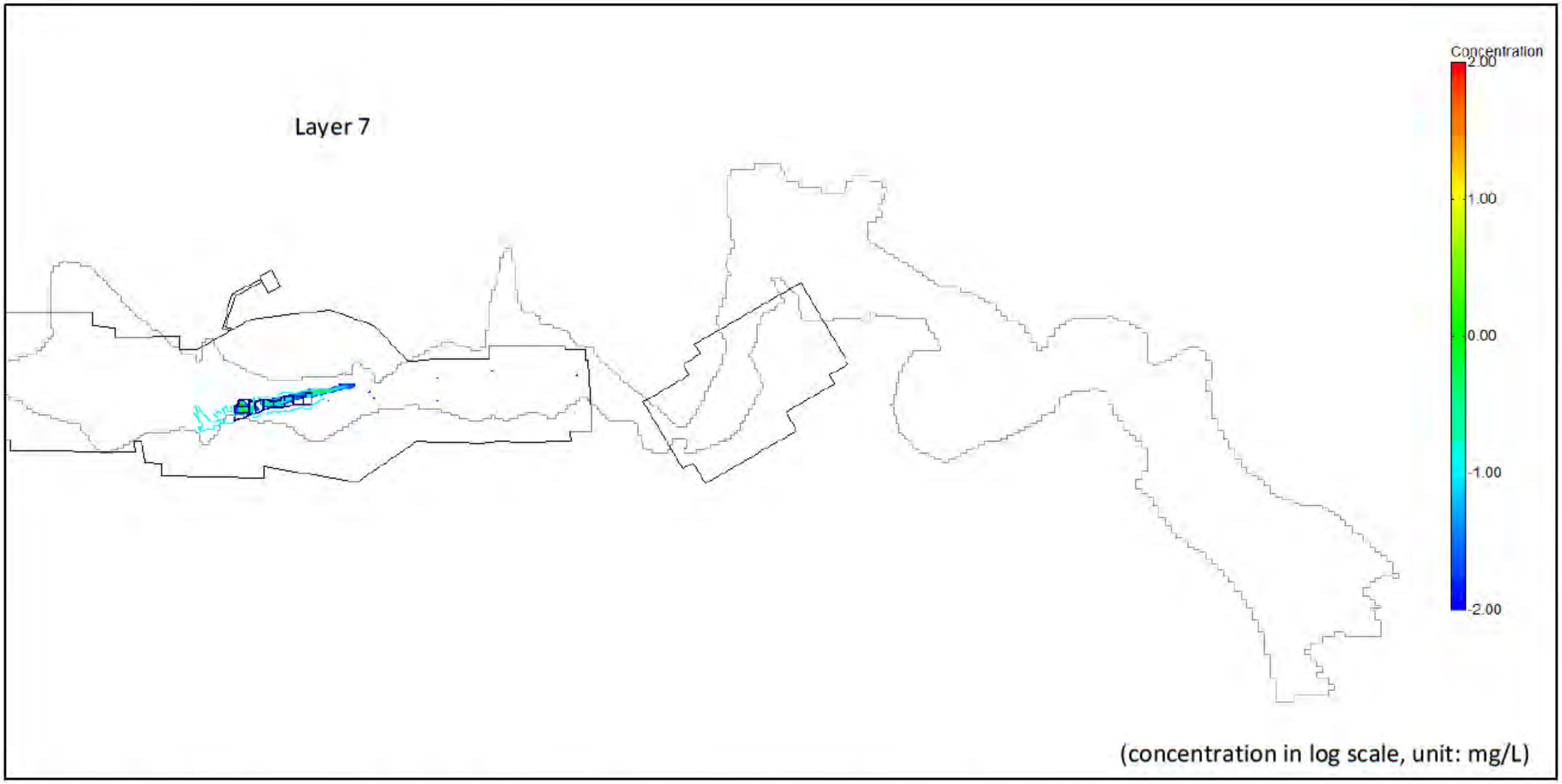


Figure D23 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 7 at year 15,000

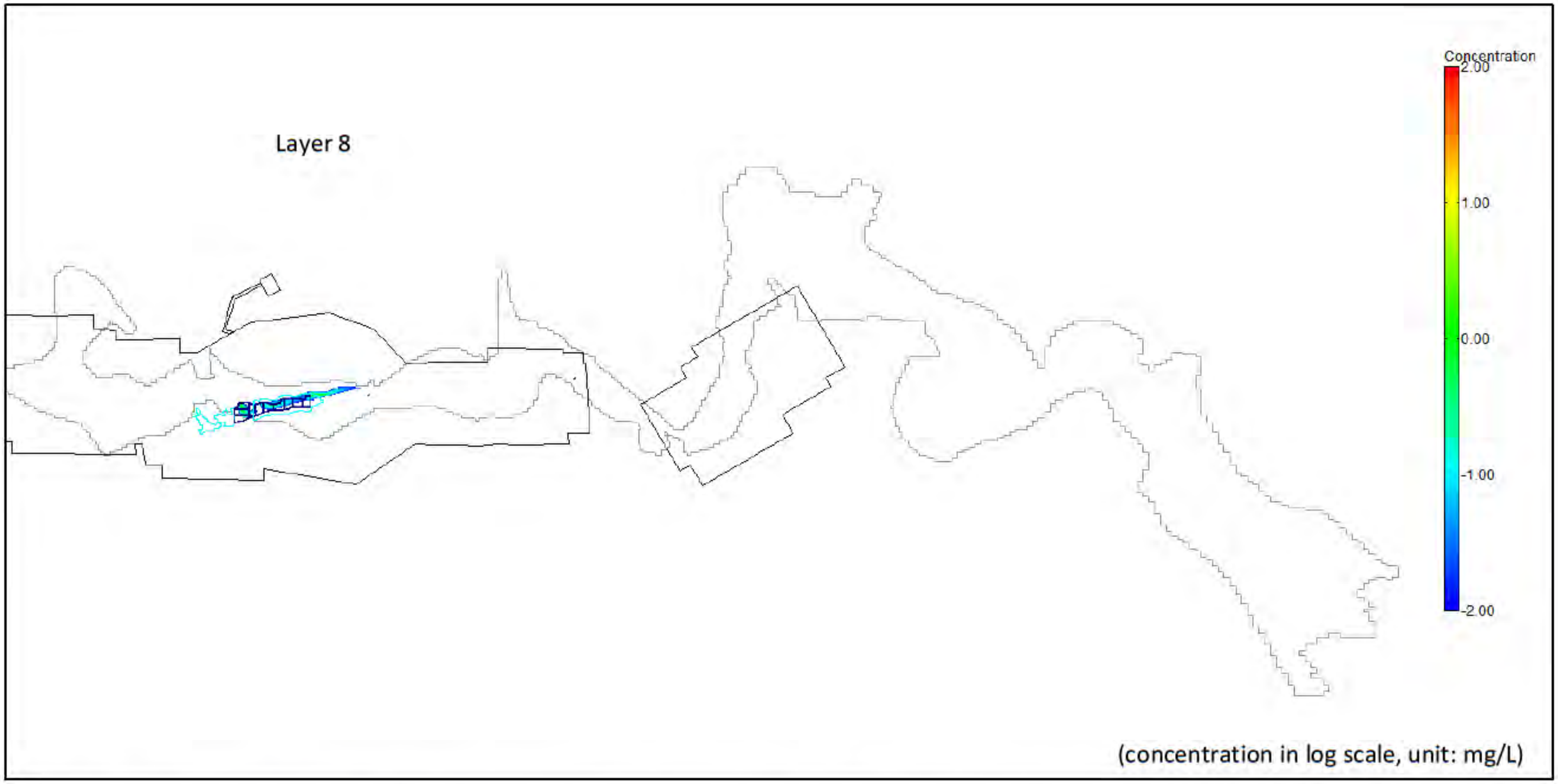


Figure D24 Effect of infiltration through tailings and backfill cover (2.5% of annual precipitation) on simulated vanadium transport plume in layer 8 at year 15,000

Sensitivity Run
Extinction Depth 3.5 m

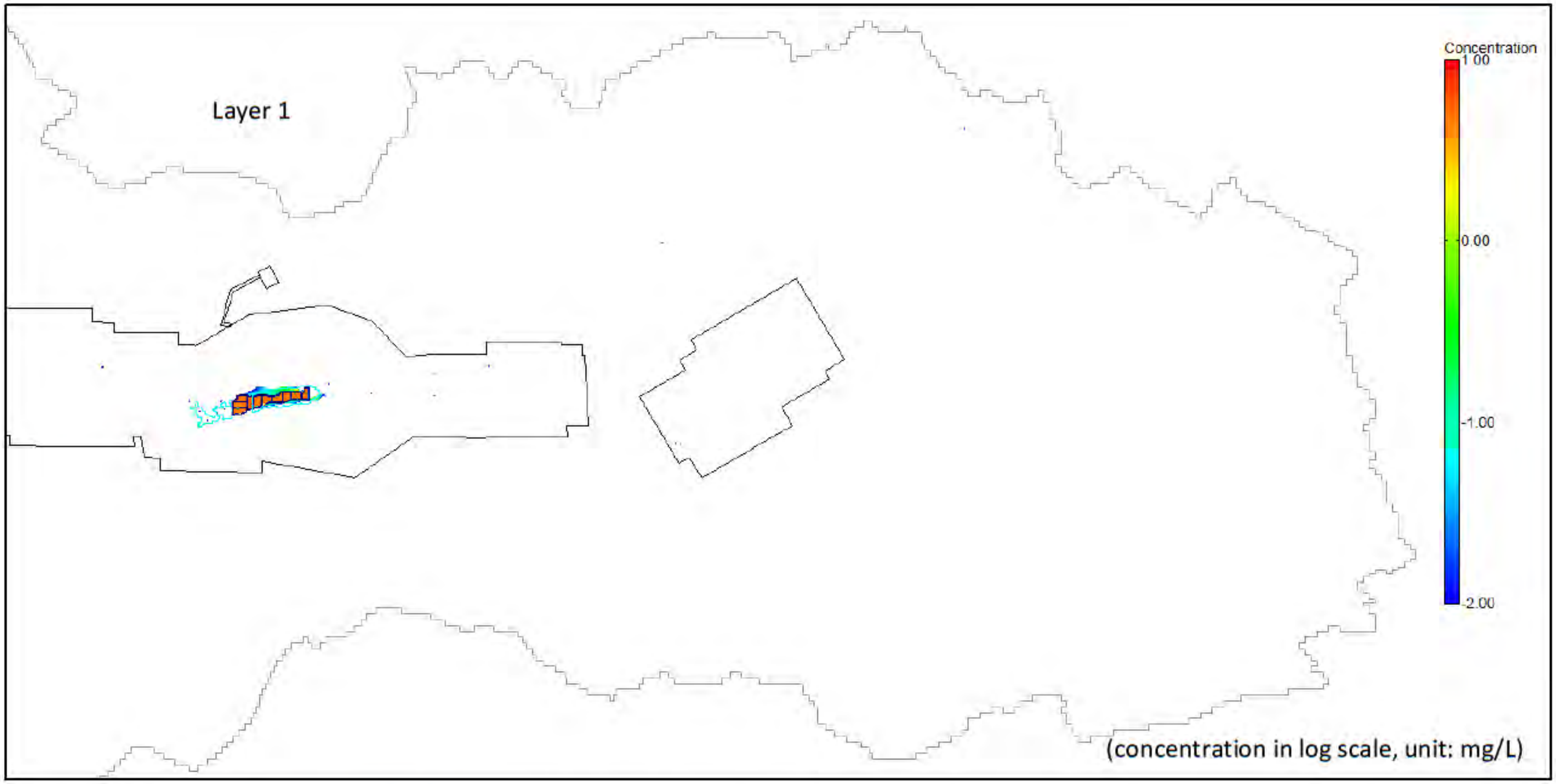


Figure E1 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 1 at year 15,000

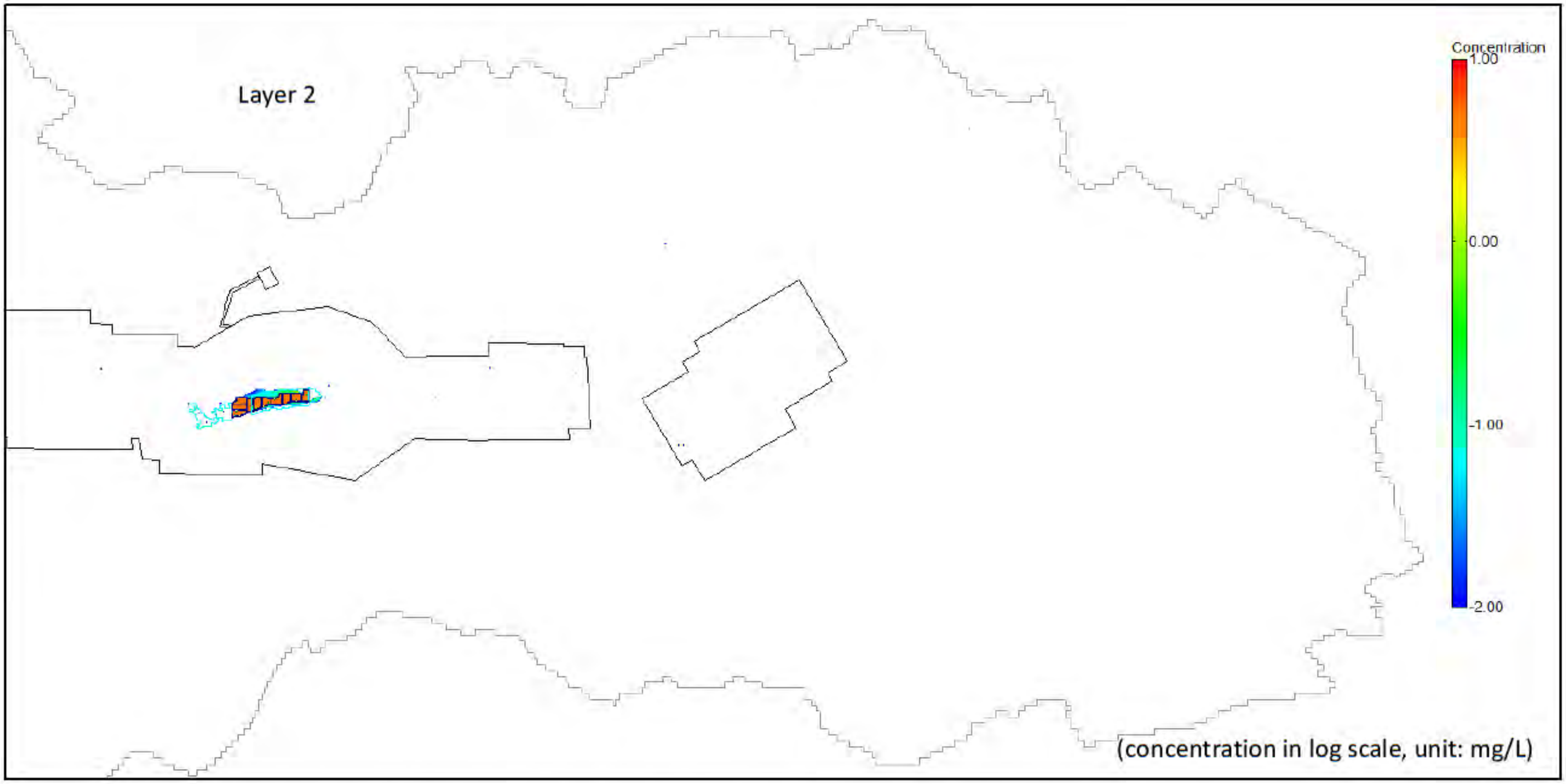


Figure E2 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 2 at year 15,000

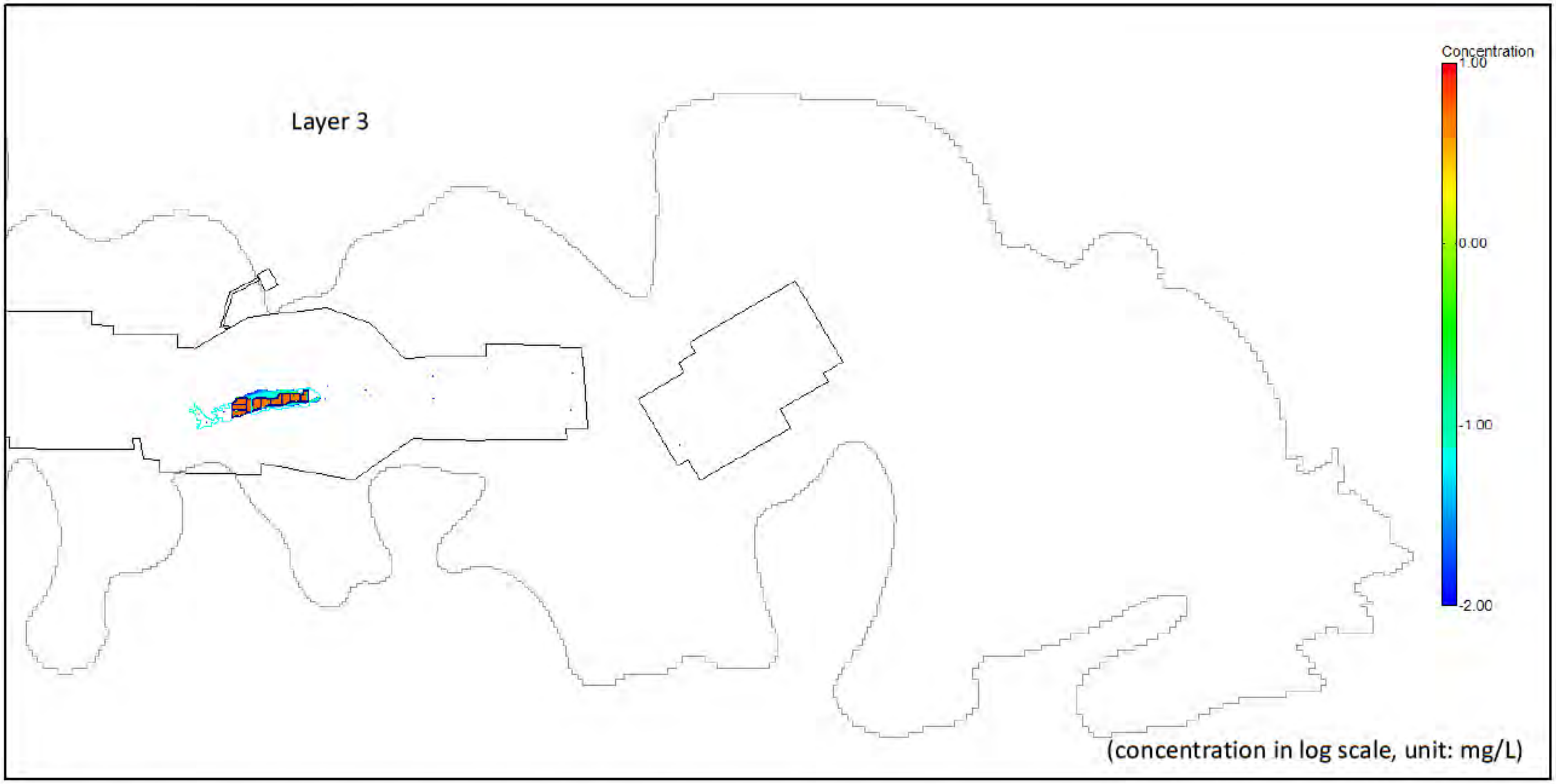


Figure E3 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 3 at year 15,000

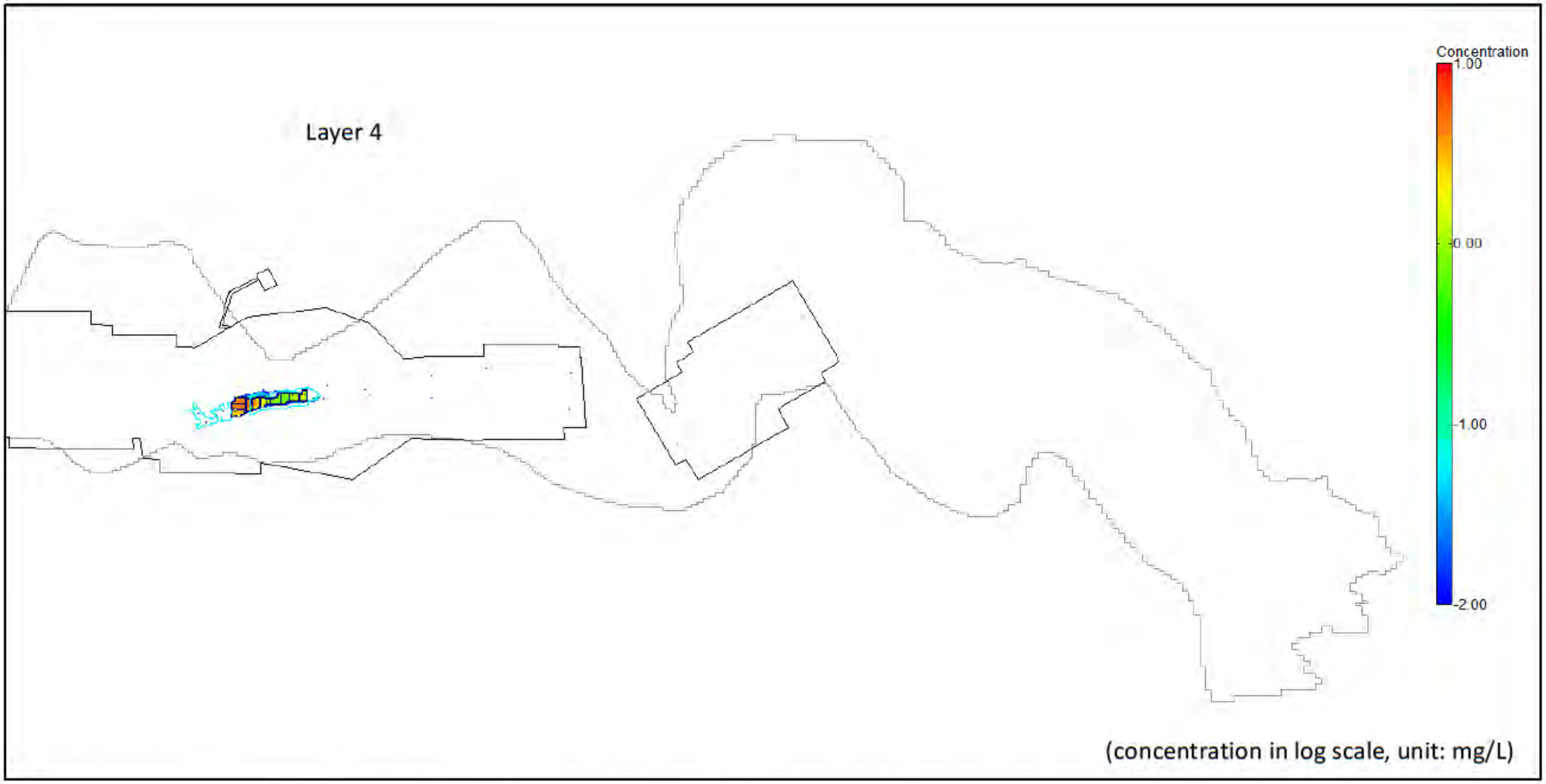


Figure E4 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 4 at year 15,000

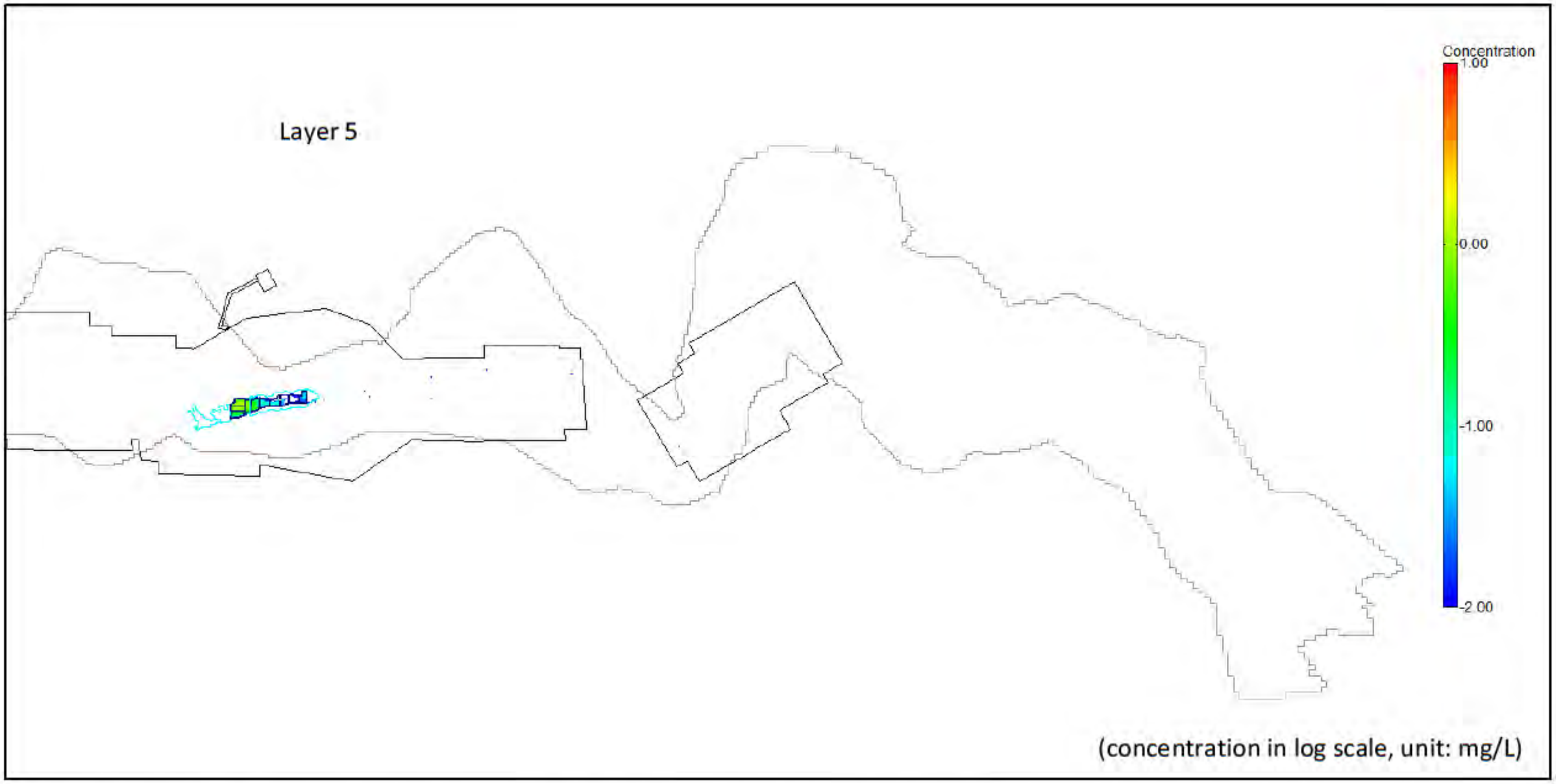


Figure E5 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 5 at year 15,000

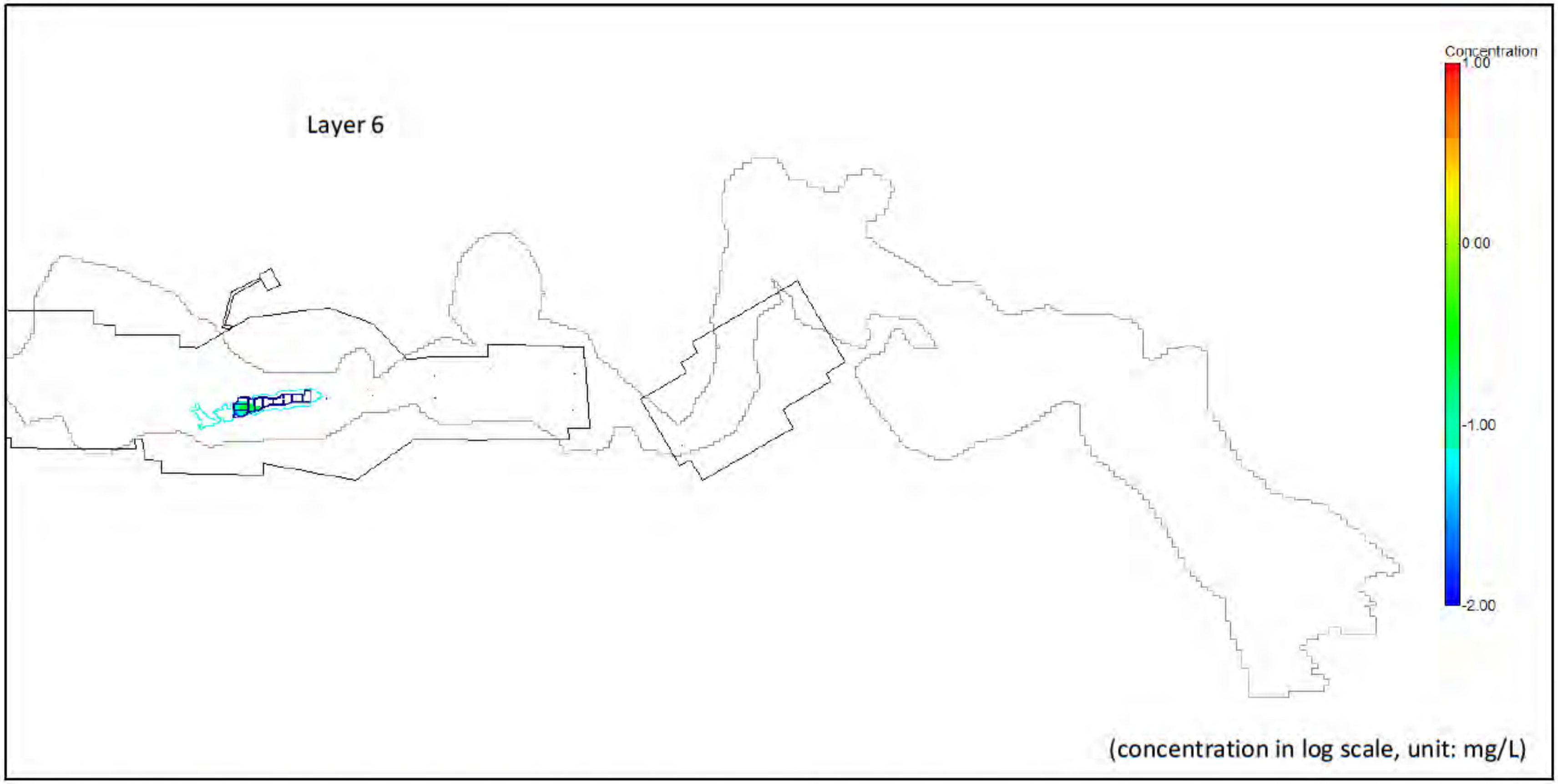


Figure E6 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 6 at year 15,000

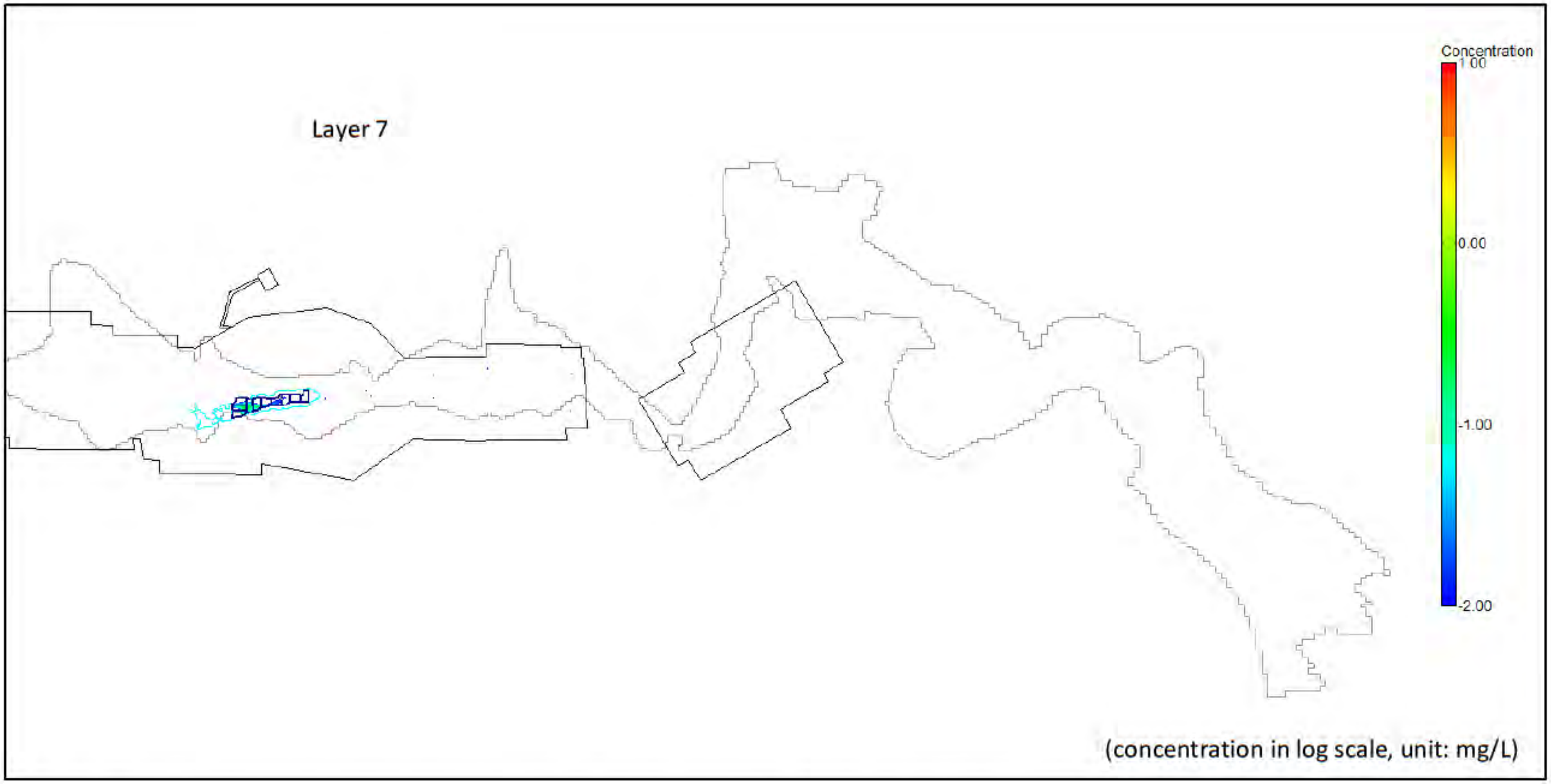


Figure E7 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 7 at year 15,000

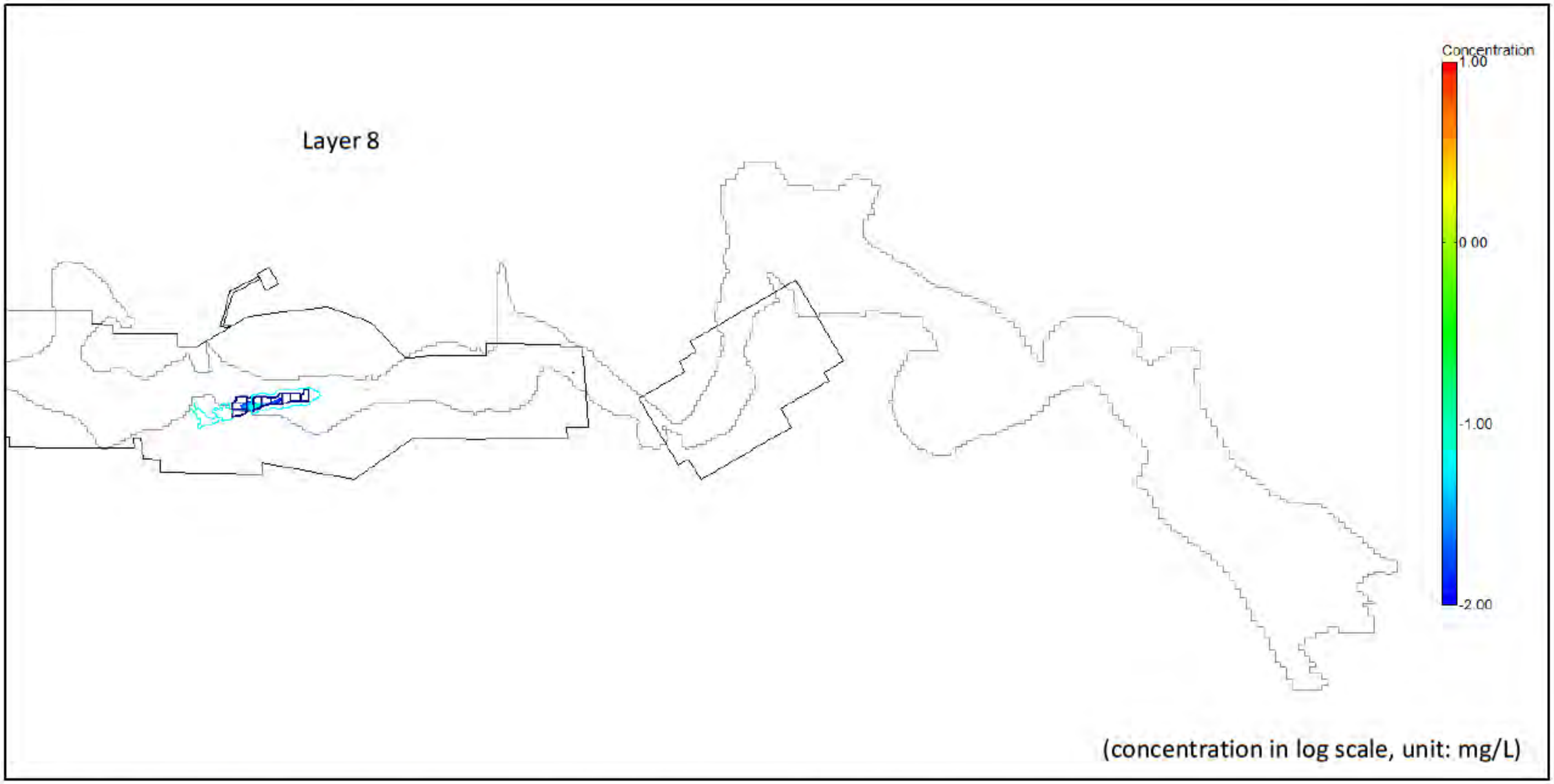


Figure E8 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated arsenic transport plume in layer 8 at year 15,000

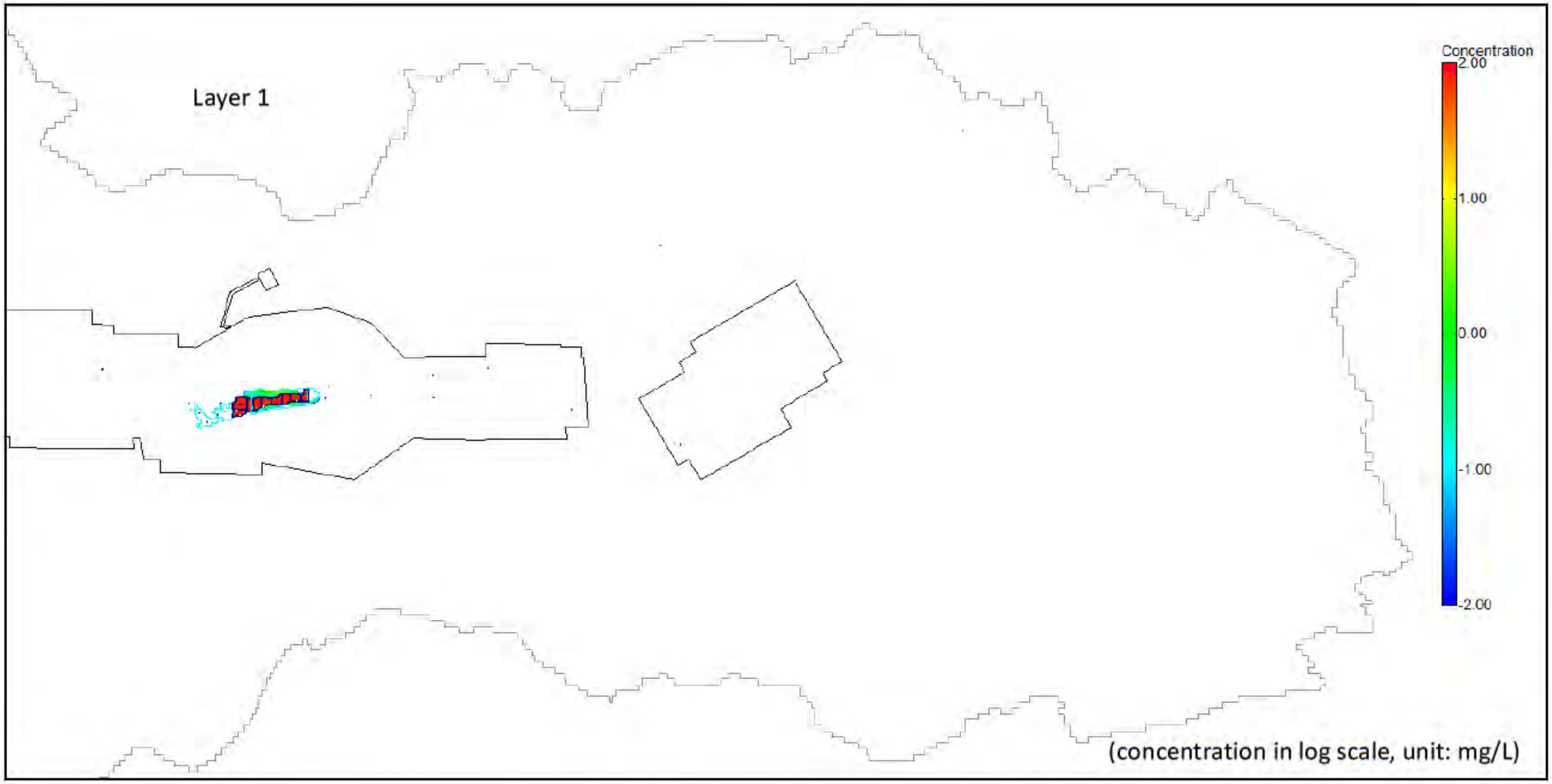


Figure E9 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 1 at year 15,000

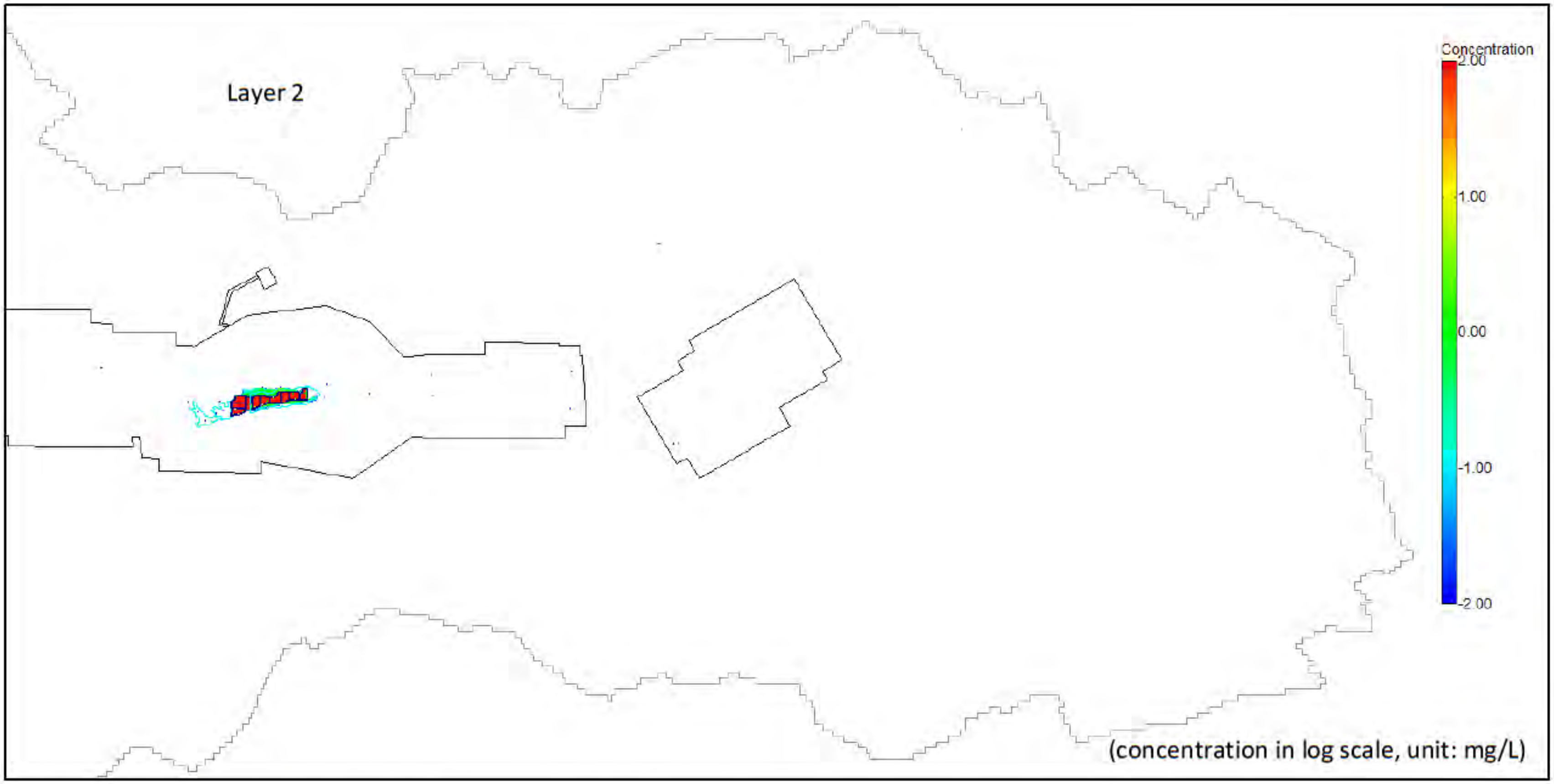


Figure E10 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 2 at year 15,000

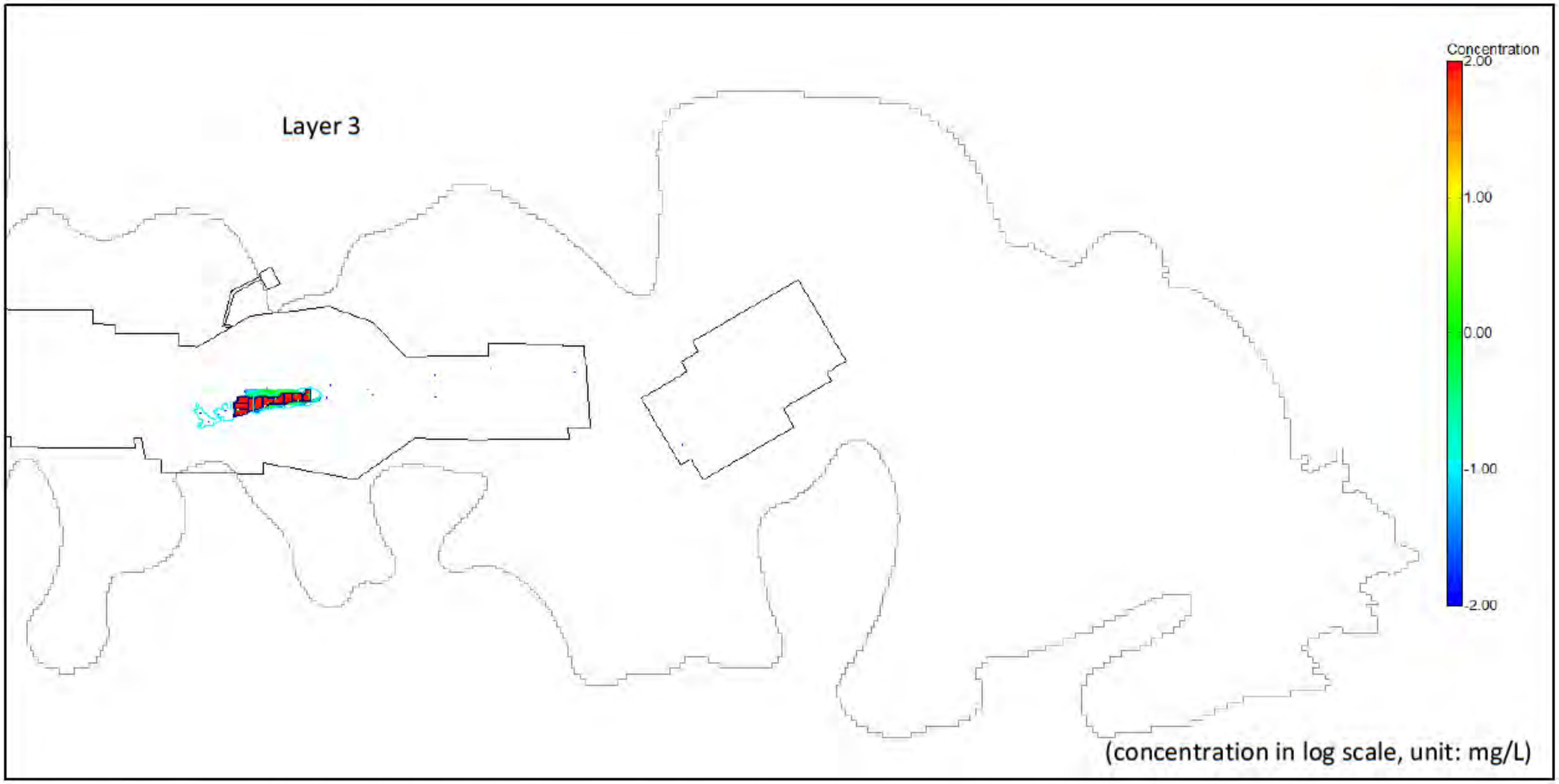


Figure E11 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 3 at year 15,000

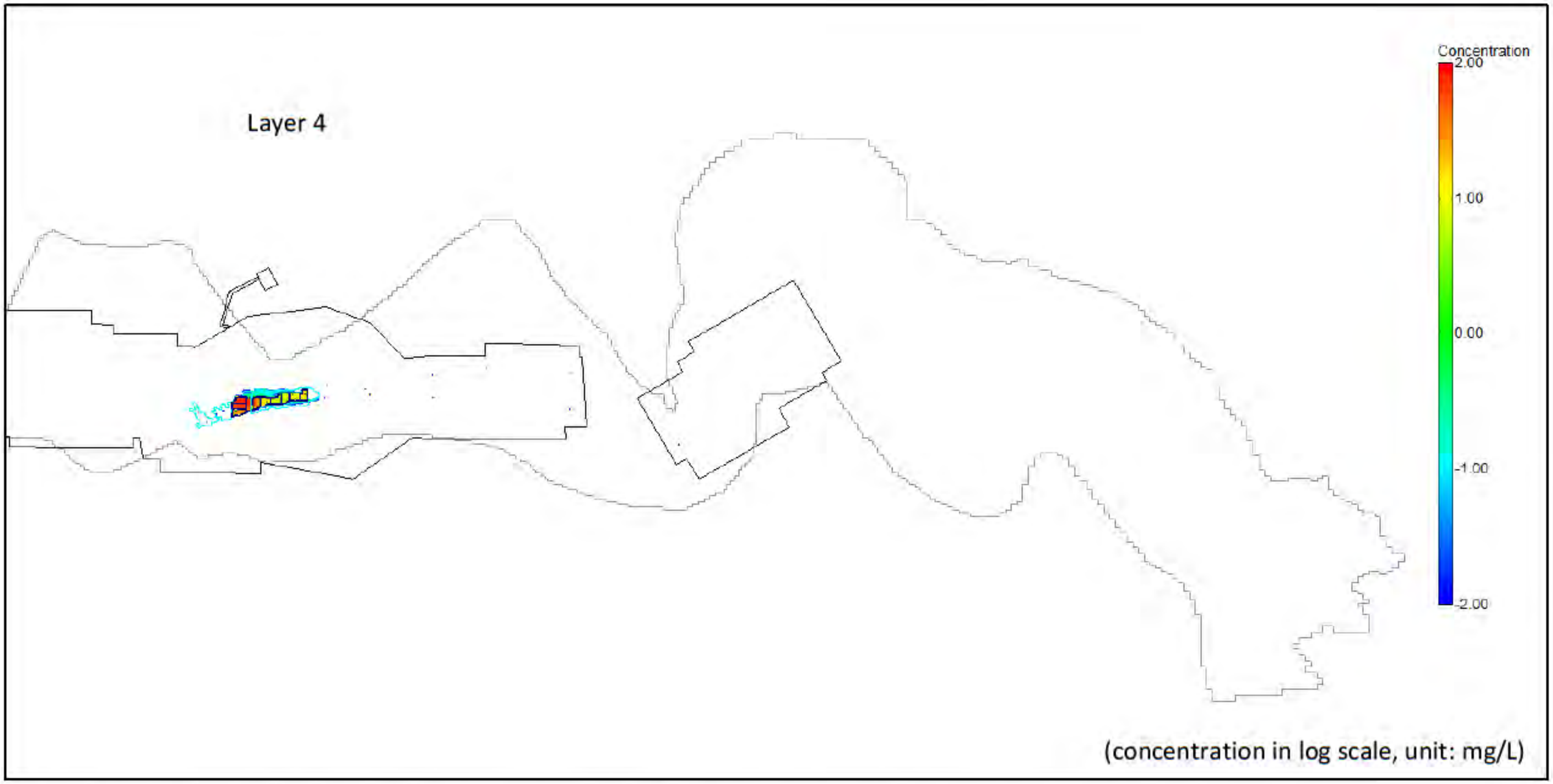


Figure E12 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 4 at year 15,000

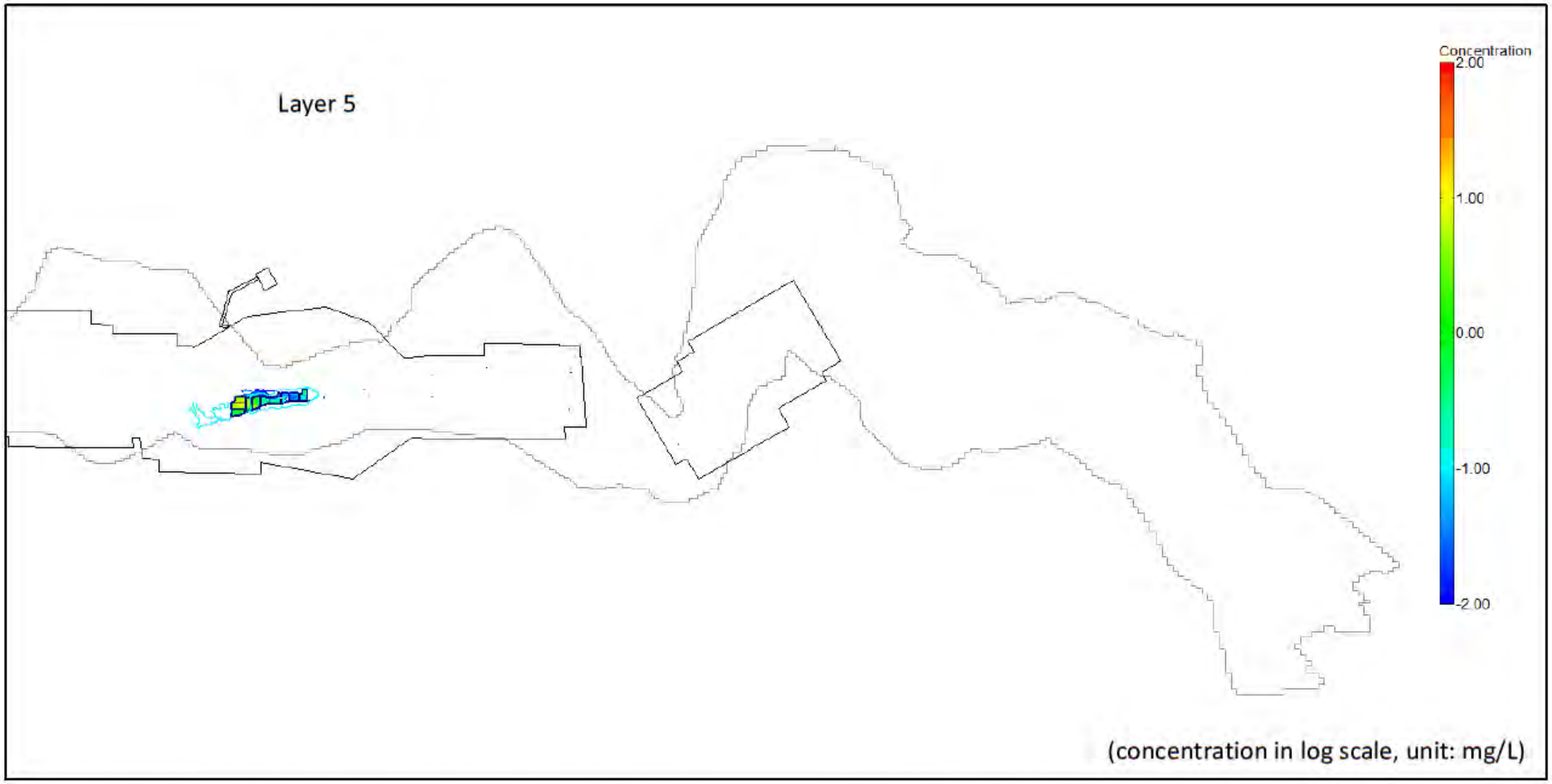


Figure E13 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 5 at year 15,000

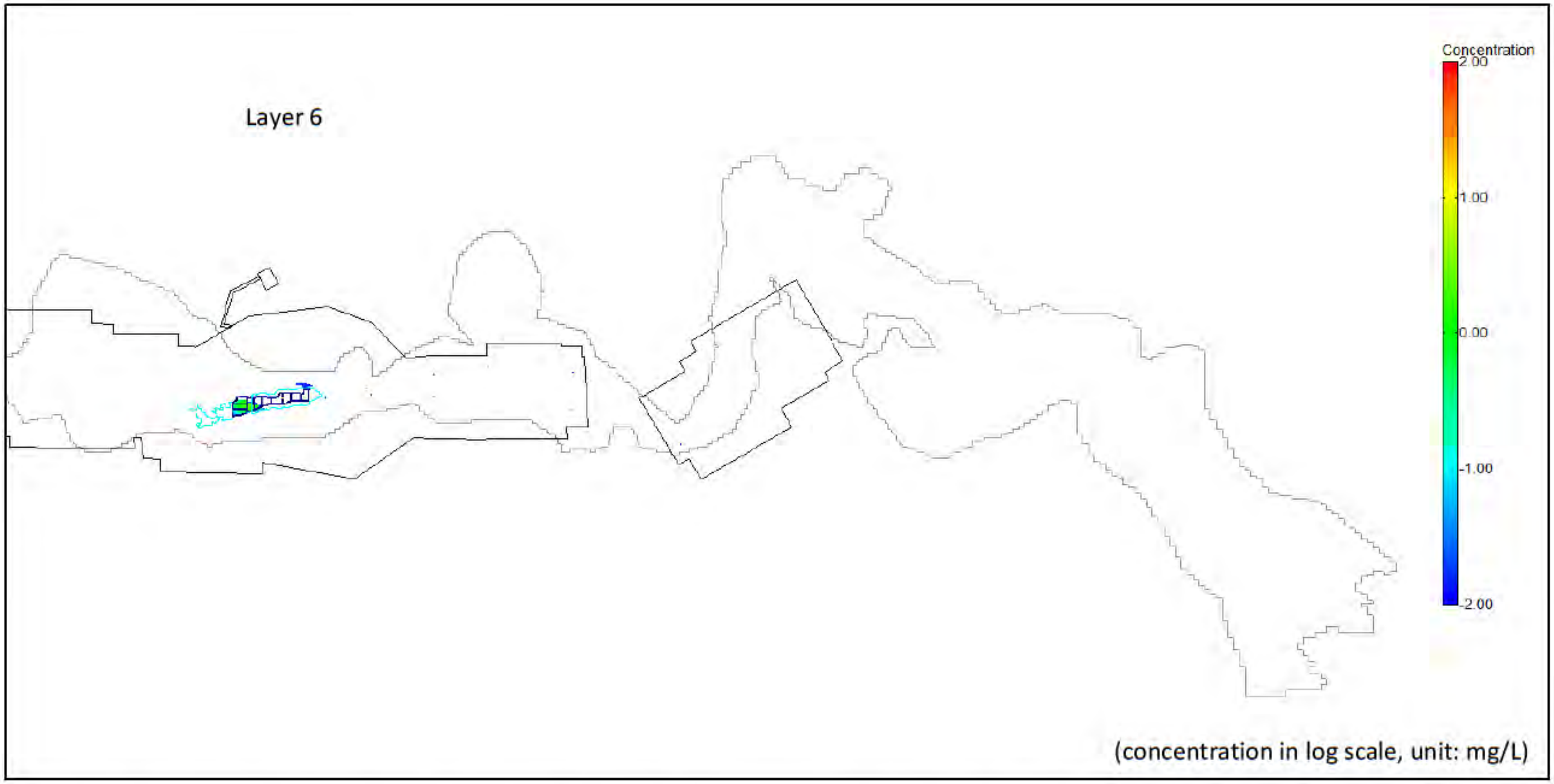


Figure E14 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 6 at year 15,000

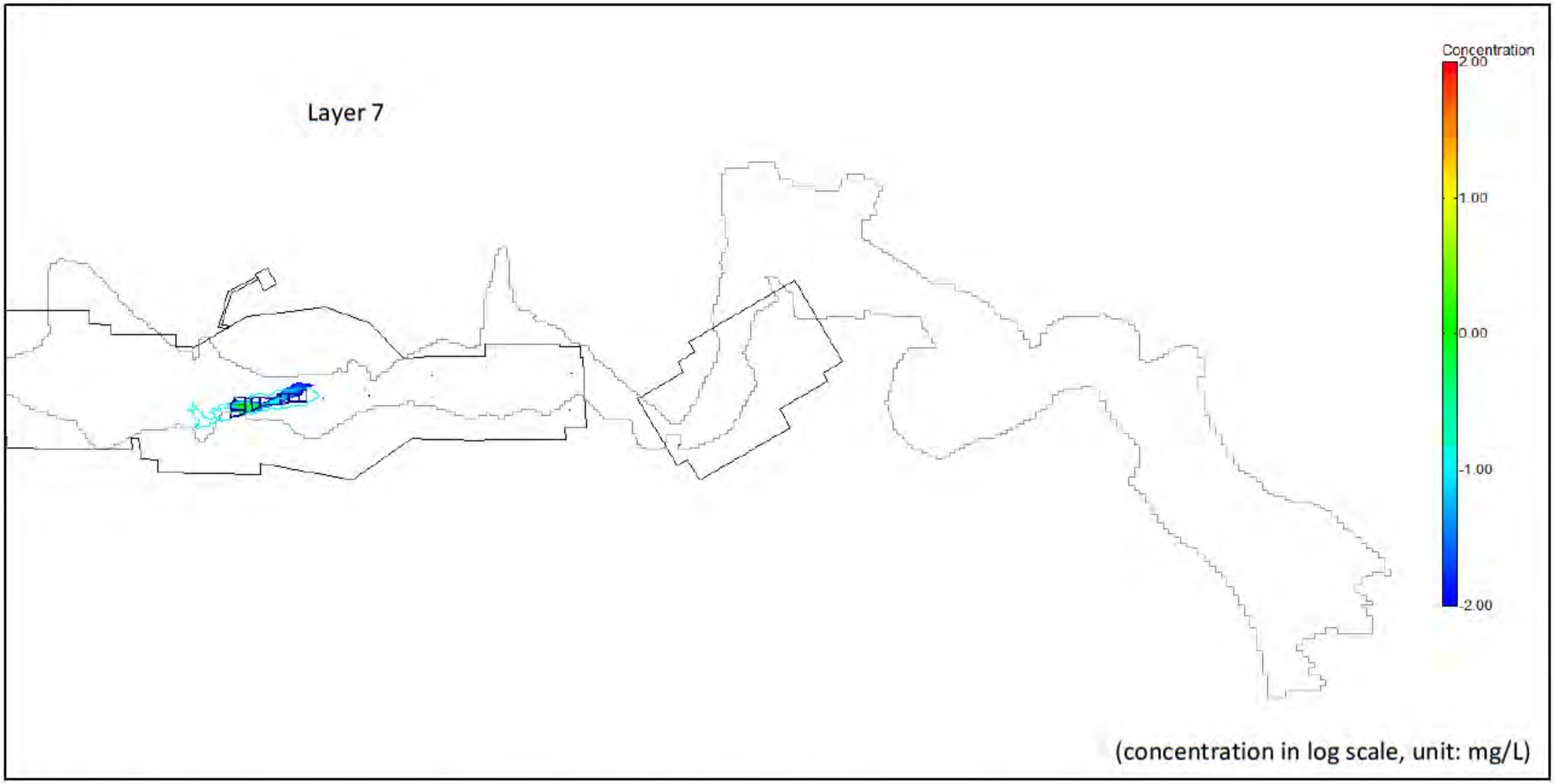


Figure E15 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 7 at year 15,000

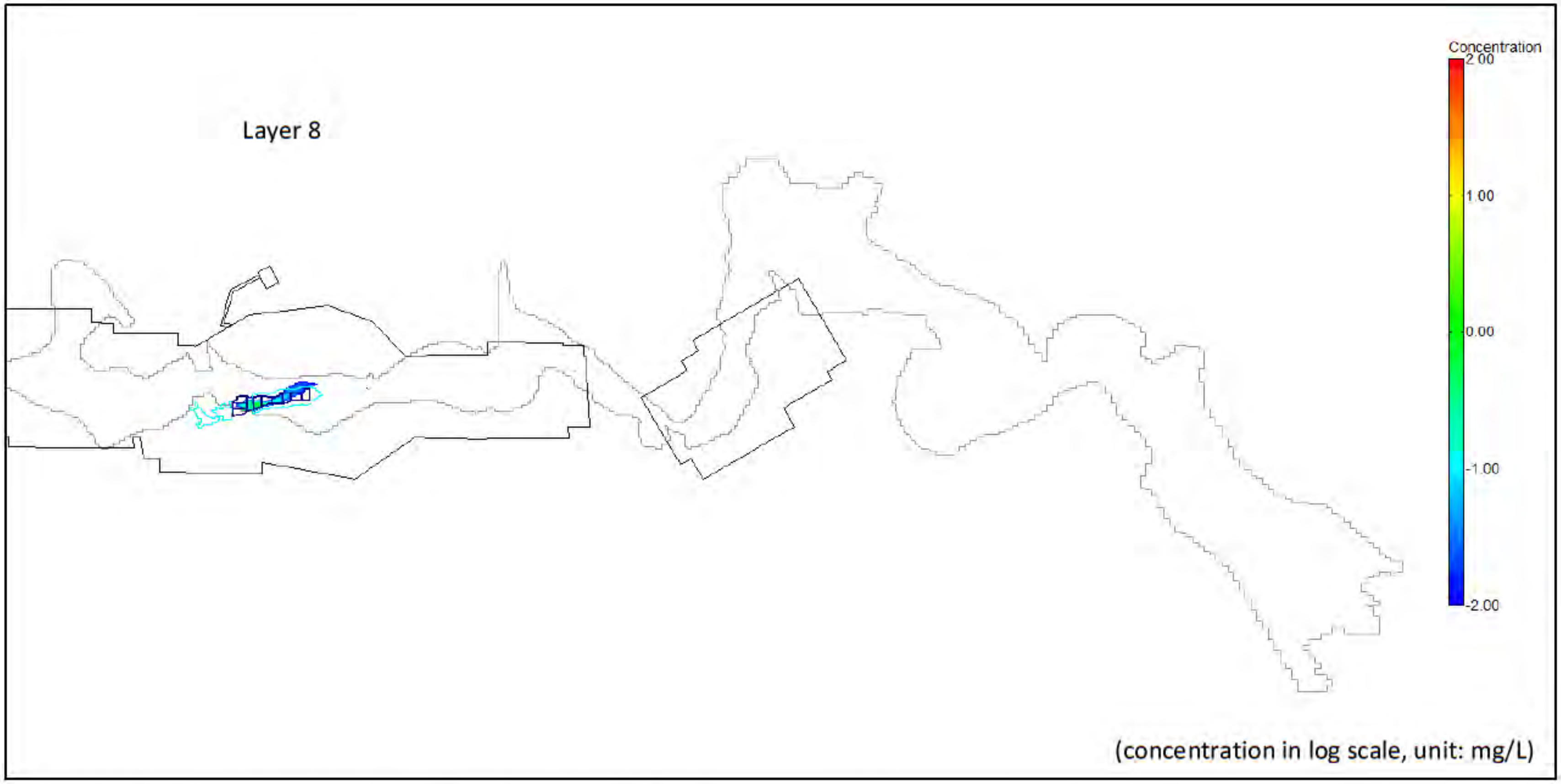


Figure E16 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated vanadium transport plume in layer 8 at year 15,000

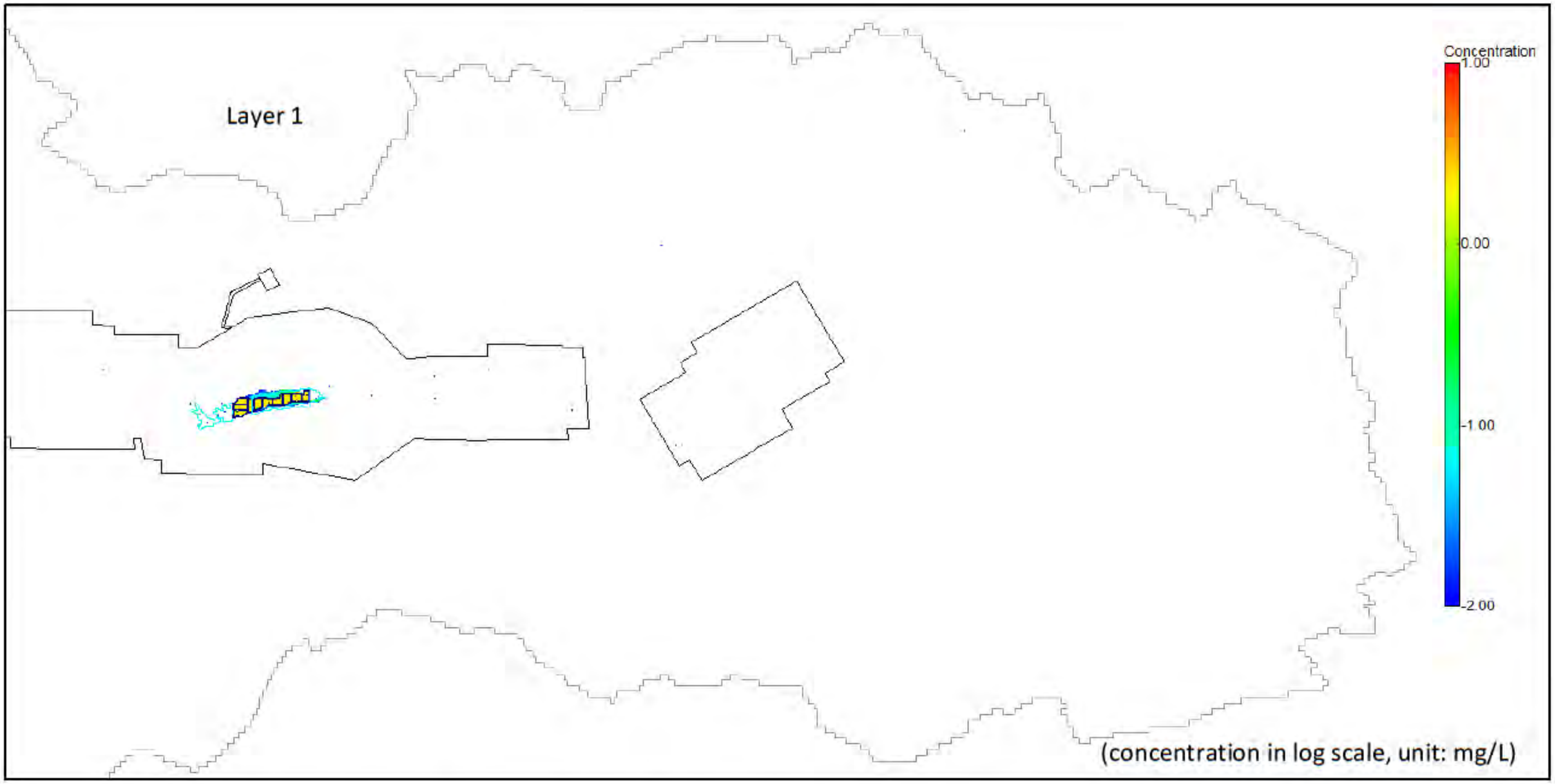


Figure E17 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated molybdenum transport plume in layer 1 at year 15,000

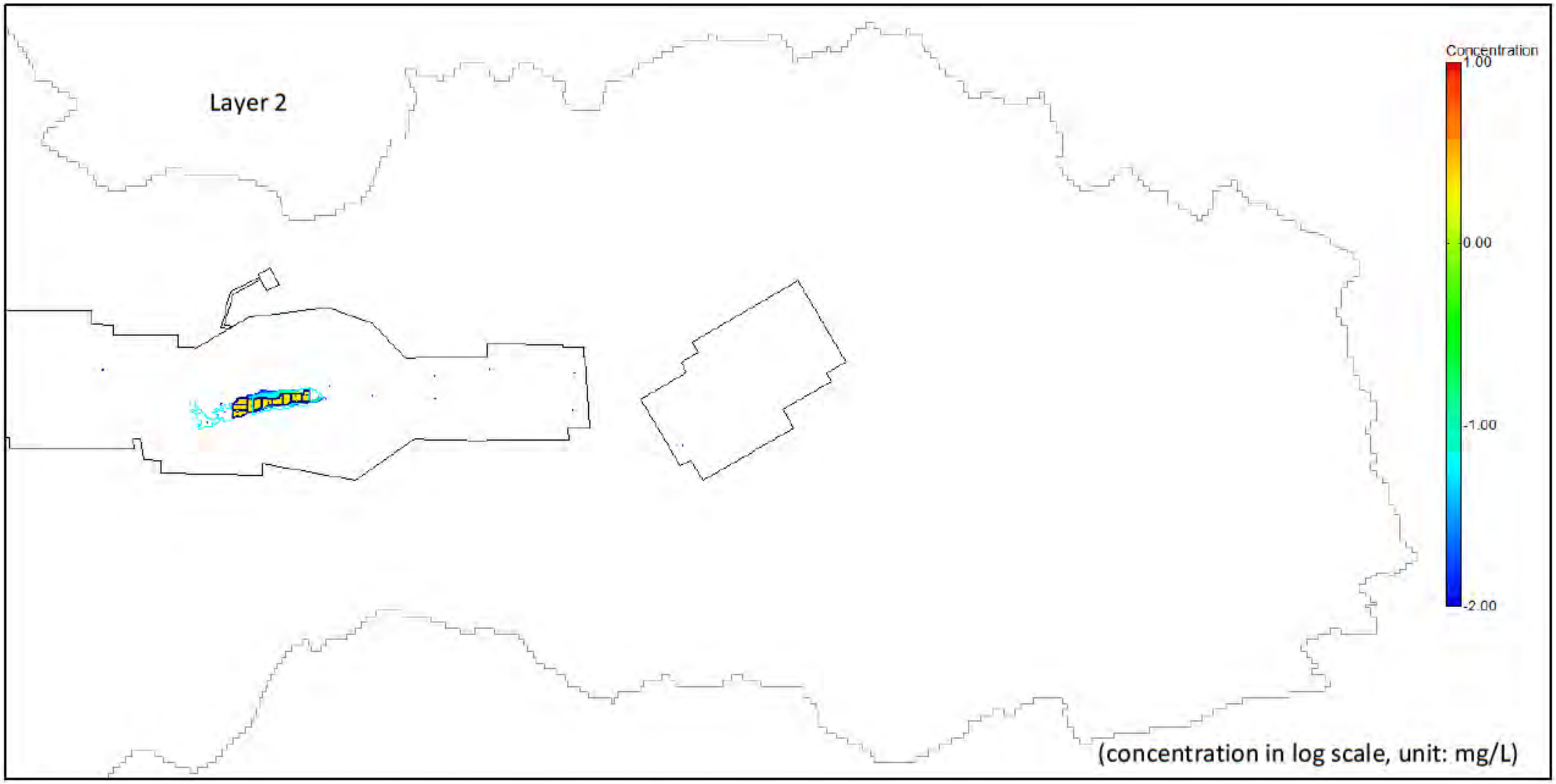


Figure E18 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated molybdenum transport plume in layer 2 at year 15,000

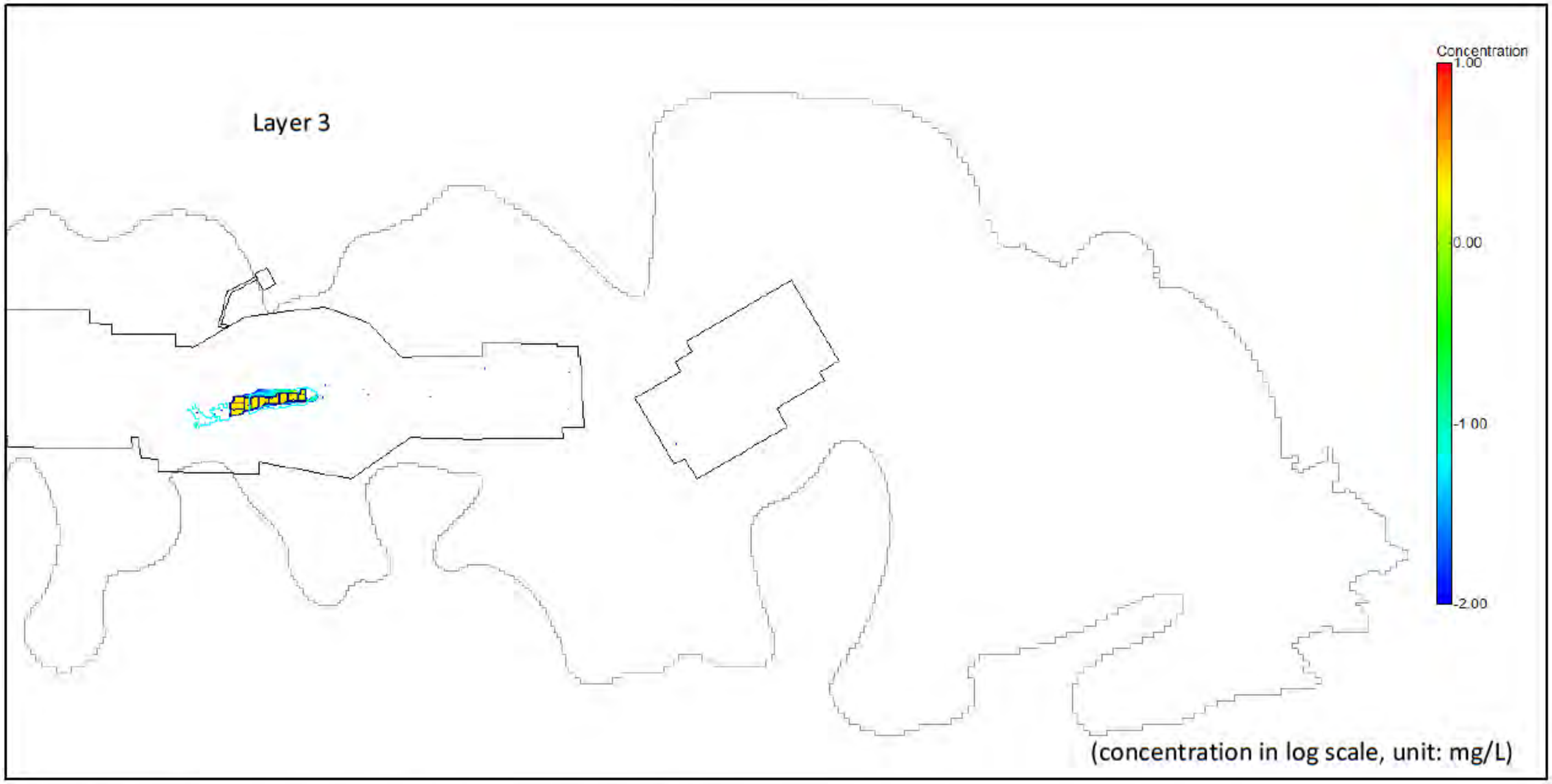


Figure E19 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated molybdenum transport plume in layer 3 at year 15,000

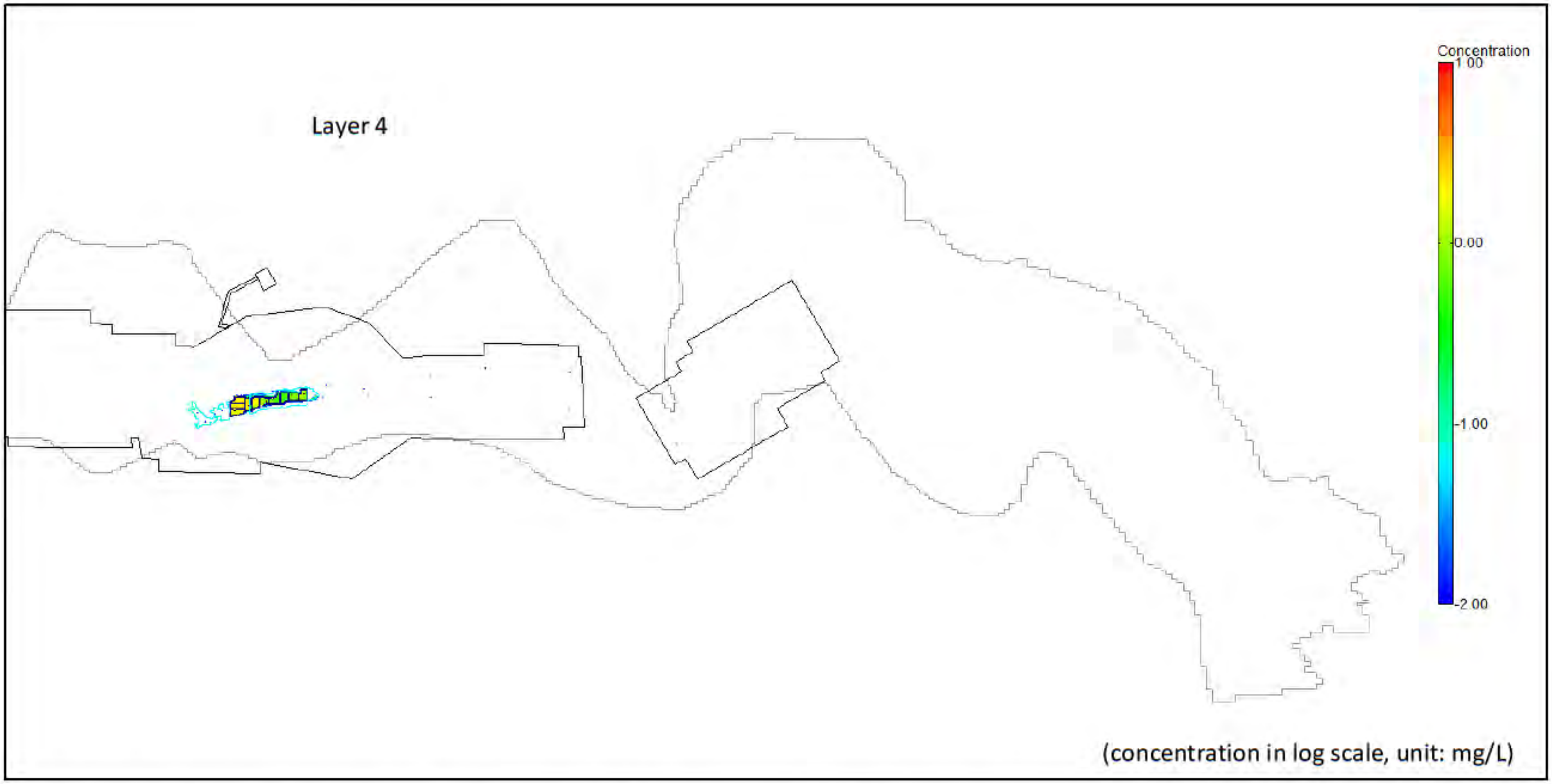


Figure E20 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated molybdenum transport plume in layer 4 at year 15,000

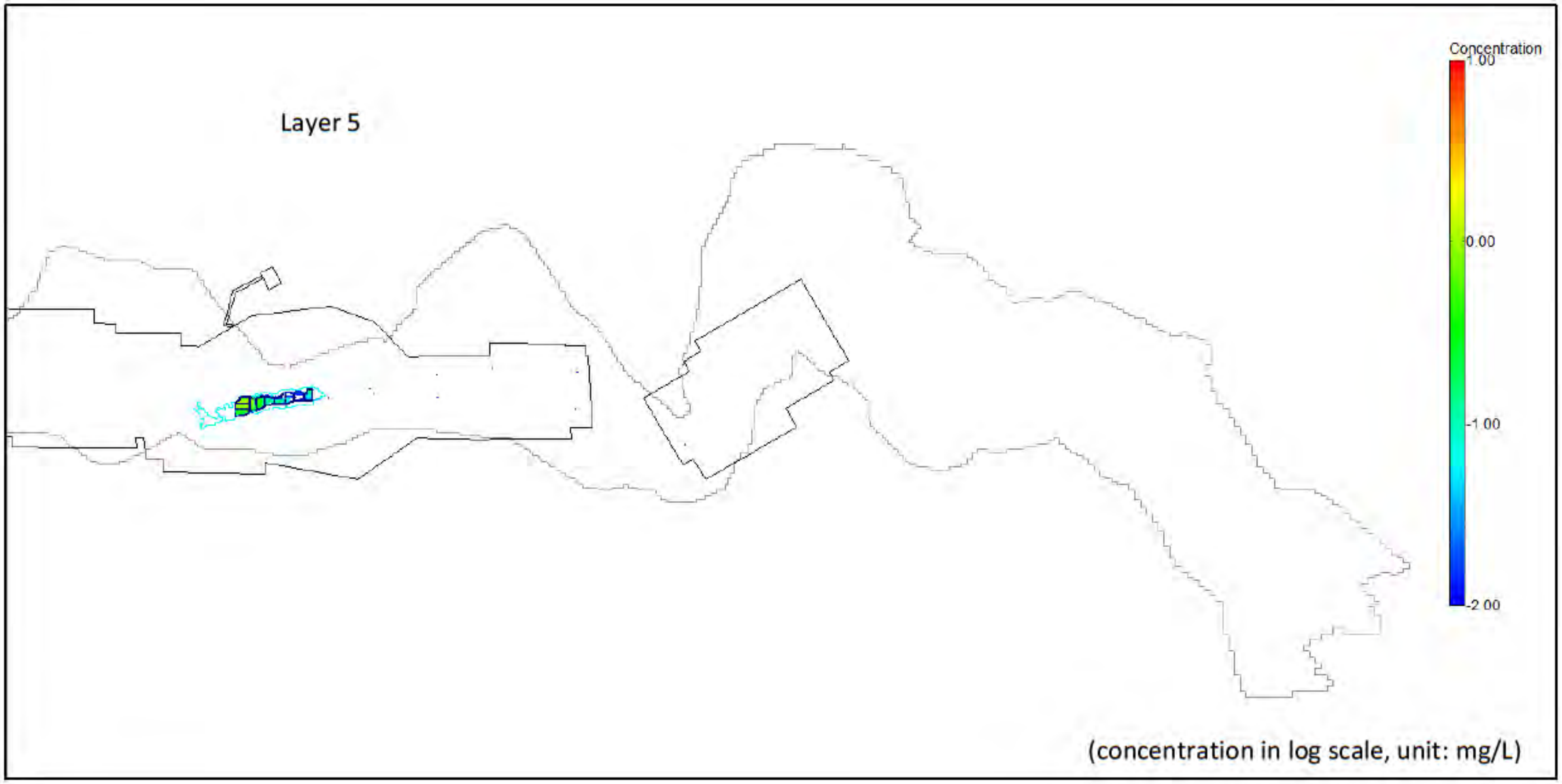


Figure E21 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated molybdenum transport plume in layer 5 at year 15,000

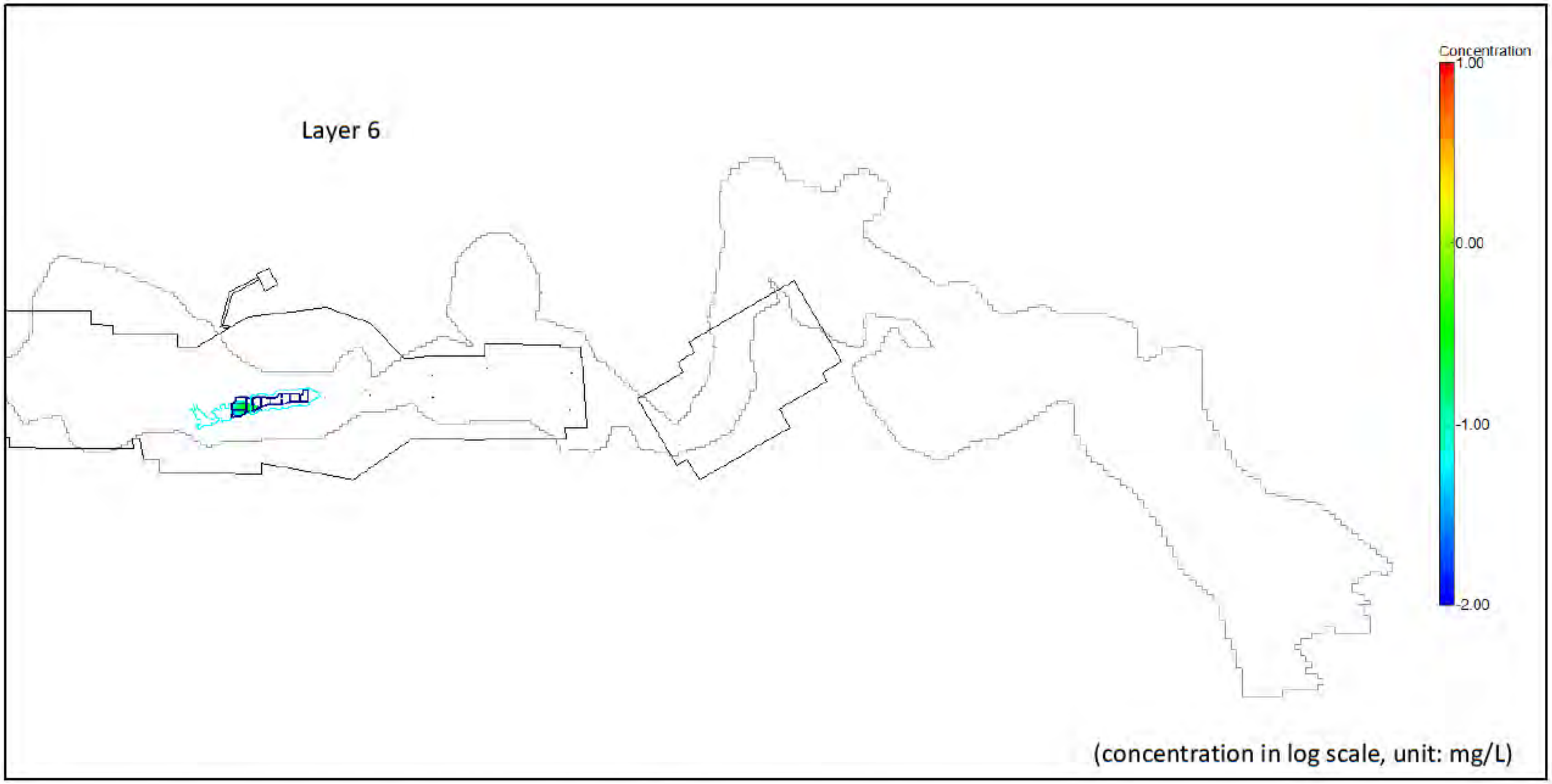


Figure E22 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated molybdenum transport plume in layer 6 at year 15,000

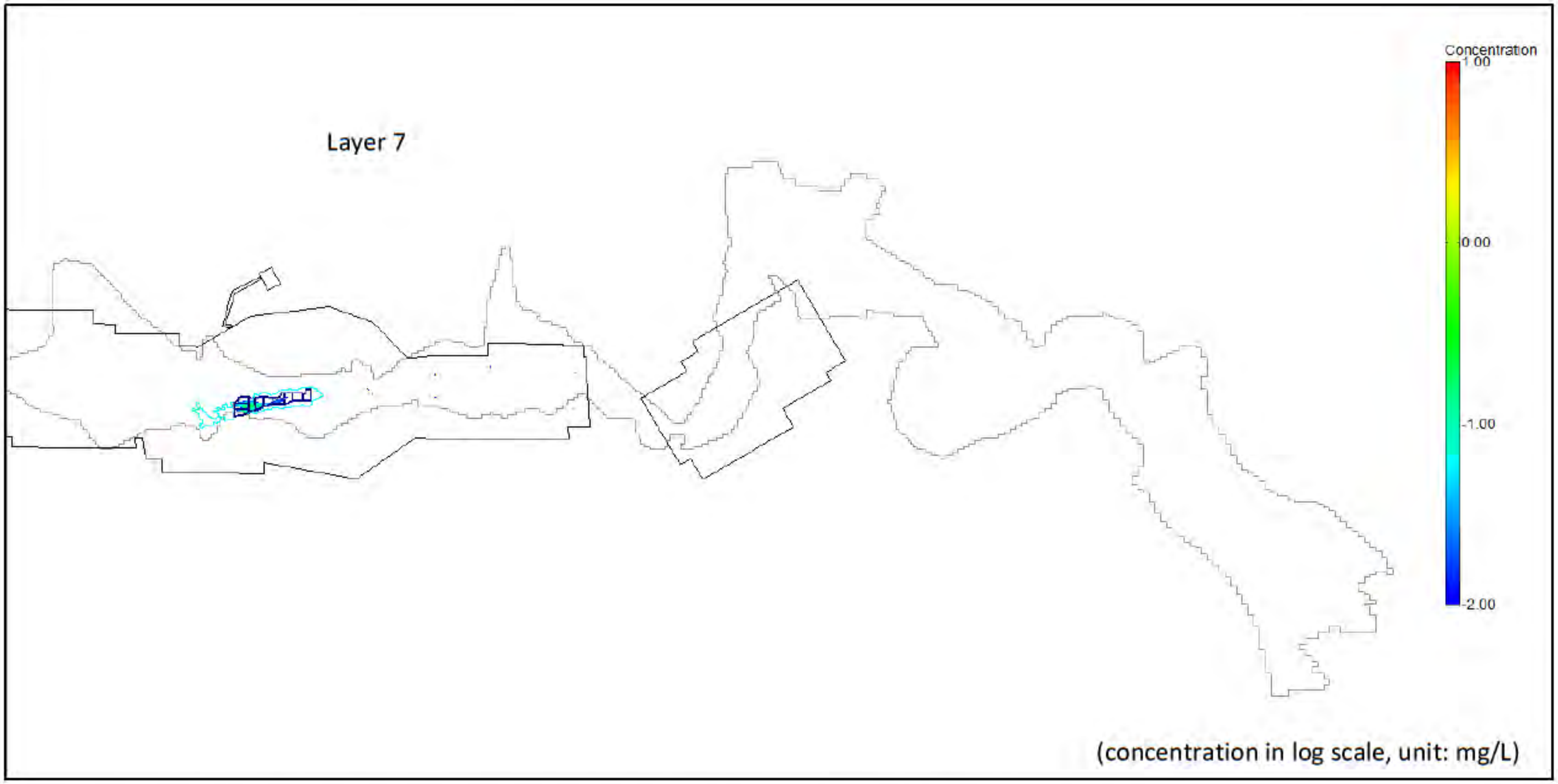


Figure E23 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on simulated molybdenum transport plume in layer 7 at year 15,000

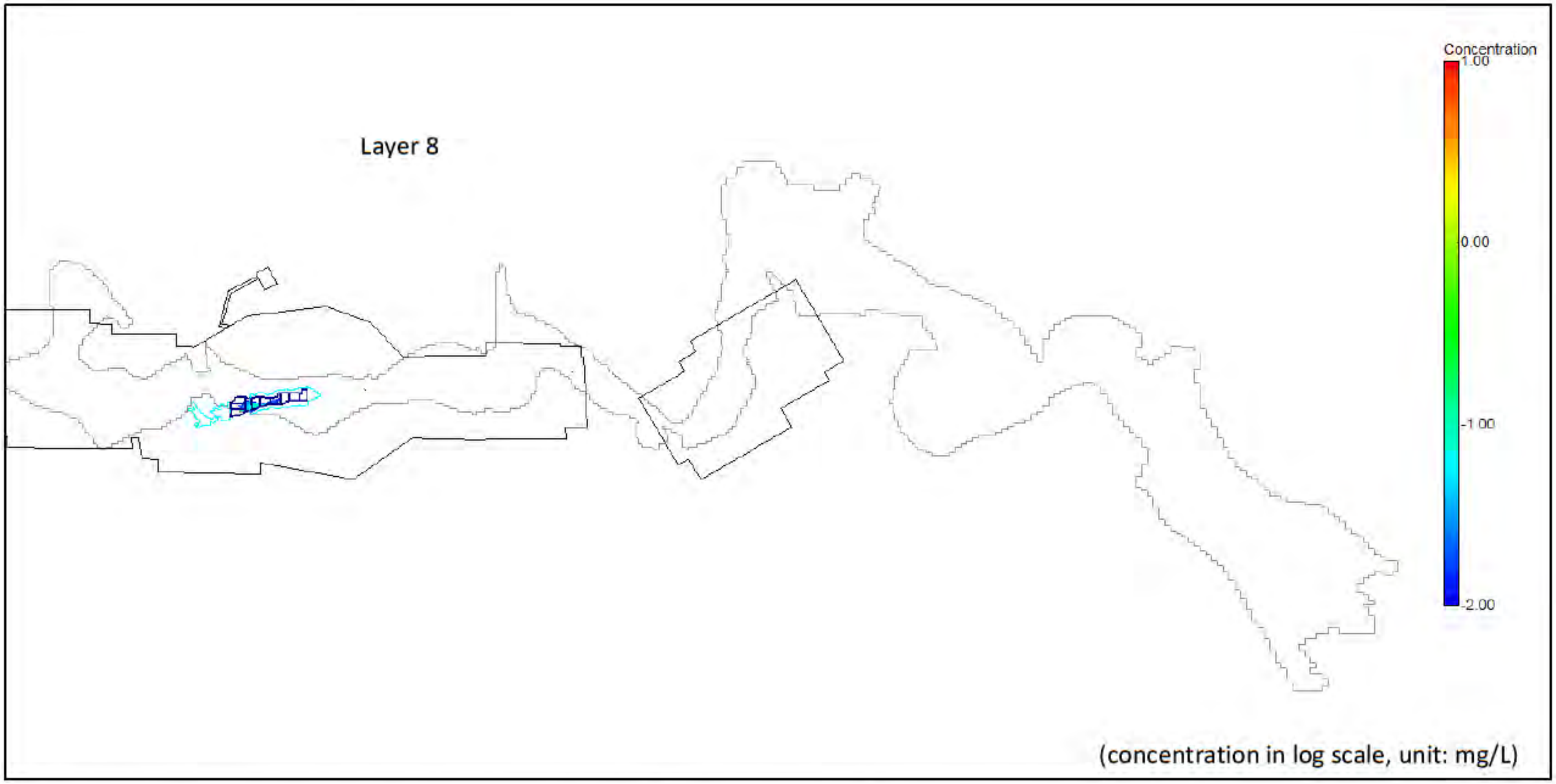


Figure E24 Effect of extinction depth (assumed to be 3.5 m compared to 5 m in base case) on imulated molybdenum transport plume in layer 8 at year 15,000