ECF-100KR4-18-0044
Revision 0

Modeling of Updated Design Alternatives for the 100-KR-4 Feasibility Study

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
Richland, Washington 99352

Approved for Public Release;
Further Dissemination Unlimited

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ENVIRONMENTAL CALCULATION COVER PAGE (Continued)

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Terms

CERCLA	*Comprehensive Environmental Response, Compensation and Liability Act of 1980*
COC	contaminant of concern
CTS	contaminant treatment system
ECF	environmental calculation file
FS	feasibility study
GWFTM	Groundwater Flow and Transport Model
HISI	Hanford Information Systems Inventory
IX	ion-exchange
MNA	monitored natural attenuation
OU	operable unit
P&T	pump and treat
PRZ	periodically rewetted zone
RI	remedial investigation
ROD	record of decision
RPO	remedial process optimization
SSP&A	S.S. Papadopulos & Associates, Inc.
STOMP	Subsurface Transport Over Multiple Phases

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1 Purpose

The purpose of this environmental calculation file (ECF) is to present the results of groundwater flow and contaminant transport modeling for the *Comprehensive Environmental Response, Compensation and Liability Act of 1980* (CERCLA) Remedial Investigation (RI) and Feasibility Study (FS), undertaken for the 100-K Area of the Hanford Site. The RI/FS will support final remedy selection and provide the basis for a final Record of Decision (ROD). The modeling effort focused on the evaluation of remedial alternatives to prevent the migration of contaminants of concern (COCs) toward the Columbia River and reduce COC concentrations in the aquifer below target values within reasonable timeframes.

Design components and system performance in 100-K were evaluated over subareas that were defined geographically in correspondence with the portions of the recent Cr(VI) plume footprints across 100-K. Hence, the alternative designs focus on system operations in the following subareas:

- KW: the subarea encompassing the KW reactor and extending to the Columbia River
- KE: the subarea encompassing the KE reactor and extending roughly to the western half of the 116-K-2 trench, and downgradient to the Columbia River
- KN: the subarea encompassing the remaining portion of 100-K, extending to the boundary of the 100-KR-4 Operable Unit (OU)
- 100-N: the portion of the 100-N Area where extraction and injection wells are present as part of the 100-K pump and treat (P&T) systems

The remedy designs address the portion of the Cr(VI) plume that straddles the 100-K/100-N boundary, hereinafter referred to as the K-N Boundary plume. Figure 1-1 illustrates these subareas relative to the Cr(VI) plumes used as the initial condition for the model simulations discussed in this calculation file.

The following seven alternative remedy designs were evaluated with respect to groundwater contamination:

- Alternative 1: No Action; operation of the interim remedy is suspended at the end of December 2019
- Alternative 2: Soil flushing for Cr(VI) and carbon-14 in KW and KE; P&T in KW and KE; and monitored natural attenuation (MNA) for KN and K-N Boundary
- Alternative 3: Soil flushing for Cr(VI) and carbon-14 in KW and KE; P&T in KW, KE, KN, and K-N Boundary; and MNA
- Alternative 4: Soil flushing for Cr(VI) in KW, KE, and KN; soil flushing of carbon-14 in KW and KE; P&T in KW, KE, KN, and K-N Boundary; and MNA
- Alternative 5: Soil flushing for Cr(VI) and carbon-14 in KW, KE; RTD for Cr(VI) in KN; P&T in KW, KE, KN, and K-N Boundary; and MNA
- Alternative 6: River protection P&T (all areas); and MNA
- Alternative 7: same as Alternative 4, with soil flushing and in situ solidification for strontium-90 continuing sources, and P&T with radiological treatment of the influent for strontium-90

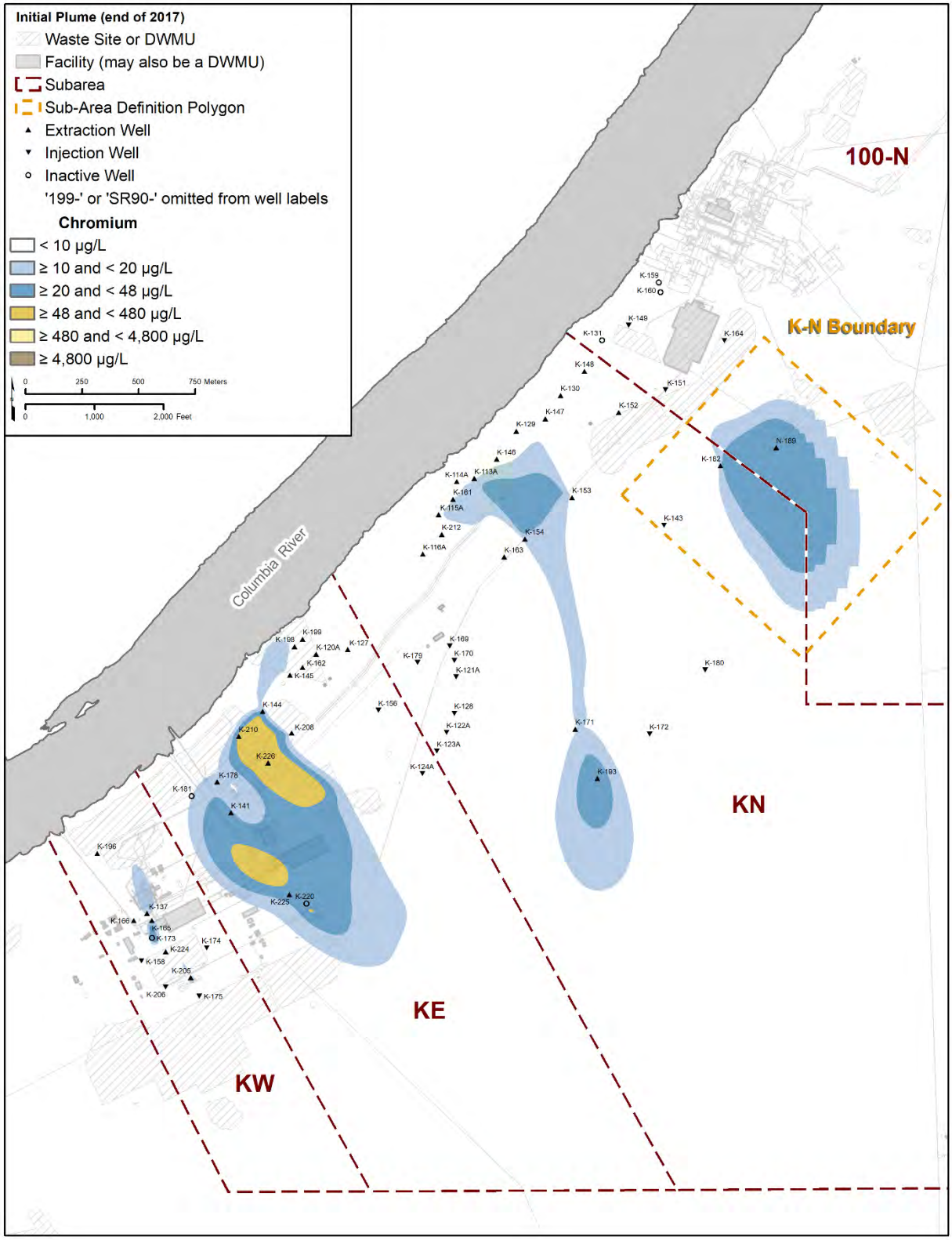

Figure 1-1. Geographic Subareas for Design Considerations and System Performance Evaluation

The proposed remedial alternatives include the following design components:

- P&T considering the current extraction and injection well configuration and Cr(VI) treatment, as part of the interim remedial action
- Modifications to the operation of the interim P&T wells
- New P&T wells to be added in the existing well configuration
- Potential treatment options for strontium-90
- Soil flushing via infiltration galleries at locations where continuing sources of Cr(VI) and carbon-14 are identified
- In situ solidification as potential treatment of strontium-90 continuing sources
- Radiological treatment of the strontium-90 P&T influent

Alternative 1 considers no further action after 2019 and evaluates the fate and transport of contaminants under ambient aquifer conditions. Alternatives 2, 3, 4, and 5 utilize combinations of the design components listed above, aiming at both river protection (in parts of or the entire shoreline) and mass recovery for aquifer restoration under reasonable timeframes which are determined through the evaluation process. Alternative 6 focuses exclusively on river protection from further discharges of COCs to the river. Alternative 7 evaluates focused actions for strontium-90 continuing-source treatment and aquifer restoration in KW and KE.

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2 Methodology

The methodology implemented for evaluating remedial alternatives relies on using groundwater flow and contaminant transport models to simulate:

- Aquifer response to groundwater extraction and injection at select well locations, river-stage variations, natural areal recharge, and anthropogenic recharge where soil flushing is applied using areal infiltration schemes
- Fate and transport of dissolved and sorbed contaminant plumes
- Mass loading from continuing sources in the periodically rewetted zone (PRZ) due to water table fluctuations in response to pumping and river-stage variations, natural areal recharge, and anthropogenic recharge from soil flushing (Cr(VI) and carbon-14).

Model simulations were performed using the 100-K groundwater flow and contaminant transport model. A brief description of the groundwater flow and contaminant transport model, as well as the processes, design components, and the methodology for remedial design evaluations are provided in the following sections.

2.1 Overview of the Groundwater Model

The 100-K Groundwater Flow and Transport Model (GWFTM) provides a consistent, mass conservative hydrogeologic framework at the scale of the OU for comparing potential remediation actions required for the RI/FS. Model output used for this purpose could include groundwater potentials, hydraulic gradients, flow rates, future groundwater contamination concentrations, and likely influent concentrations for remedies that extract contaminated groundwater. Additionally, vadose zone source models implemented in the Subsurface Transport Over Multiple Phases (STOMP[1]) code allow assessment of soil remediation decisions on groundwater quality.

The 100-K GWFTM extends to the Columbia River on the north side of the model, and uses a general head boundary on the south, east and west sides of the model. A small portion in the southeast corner of the model was assigned no-flow boundary where basalt outcrops above water table. Land surface is the top of the model and the bottom of Ringold Formation Unit E comprises the lower model boundary. The 100-K GWFTM is restricted to approximately the center of the width of the Columbia River by a polyline lateral extent and is assigned a no-flow boundary condition for the cells north of the center line of the river.

Figure 2-1 shows all the features of 100-K GWFTM, including monitoring wells and the 2013 interpolated chromium plume. The flow and transport properties of the model are provided in Chapter 3. Details on the 100-K GWFTM are documented in CP-61711, *100-K Scale-Appropriate Fate and Transport Model*.

[1] Battelle Memorial Institute (Battelle) retains copyright on all versions, revisions, and operational modes of the STOMP software simulator, as permitted by the U.S. Department of Energy. STOMP is used here under a limited government use license.

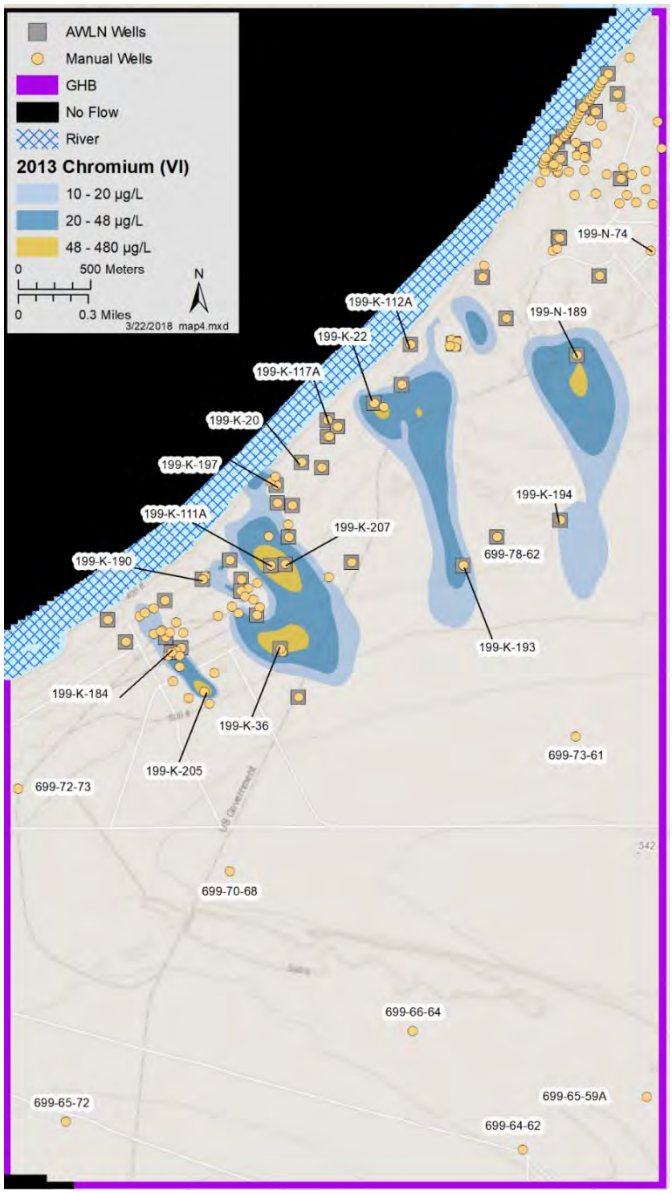

Figure 2-1. 100-K Groundwater Flow and Transport Model

2.2 Design Components

The following design components were evaluated and parameterized for model simulations.

2.2.1 P&T Well Operation and Contaminant Treatment

Three CERCLA interim action ion-exchange (IX) P&T systems are currently operational in the 100-KR-4 OU. The KR4 system was the first system installed and began operation in September 1997. This system was designed to remediate groundwater around the 116-K-2 Trench. The KW system was the second system installed, and it began remediating Cr(VI) in the KW Reactor area in January 2007. The third and newest system, KX, began operation in February 2009. The KX system is used primarily to treat Cr(VI) in groundwater that has migrated from the 116-K-2 Trench area toward the 100-N Area.

Layout and operations for configurations comprising existing and proposed extraction and injection wells are evaluated under each alternative remedial design.

These P&T systems currently address Cr(VI) treatment only, with treated water injected back into the aquifer at effluent concentrations consistently sampled at levels around 1.5 µg/L. All other COCs pass through the IX treatment system and are not removed under the current treatment process. The COCs in P&T systems effluent is recirculated in the aquifer via injection of combined influent concentration at the injection wells connected to each treatment plant.

For Alternative 7, radiological treatment for strontium-90 influent is incorporated in the design, assuming combined influent concentrations in groundwater extracted from the wells are treated at 80% efficiency, i.e. effluent concentrations are 20% of the influent concentration levels. More details on the radiological treatment for strontium-90 are provided in Section 3.2.5.

2.2.2 Mass Loading from Continuing Sources

The presence of continuing sources in the PRZ was evaluated as part of the RI process. Continuing sources were identified through evaluation of soil data, concentration trends in the aquifer, and numerical model calibration for Cr(VI), carbon-14, nitrate, strontium-90, and tritium. No continuing sources were identified for trichloroethene (TCE).

Mass releases from continuing sources occur as the water table fluctuates in response to pumping, areal recharge (natural or anthropogenic), and river-stage fluctuations. The general conceptual model implemented in the numerical simulation of the continuing sources, and the associated mass releases from those sources, is illustrated in Figure 2-2.

STOMP simulations were used for quantifying mass loadings in the aquifer due to the continuing sources in the PRZ, in response to water-table fluctuations and areal recharge features for each remedial alternative. Mass-loading time series for each COC, source location, and alternative are documented in ECF-100KR4-18-0019, *Development of Source/Sink Mixing Package for the Feasibility Study in the 100-KR-4 Operable Unit*.

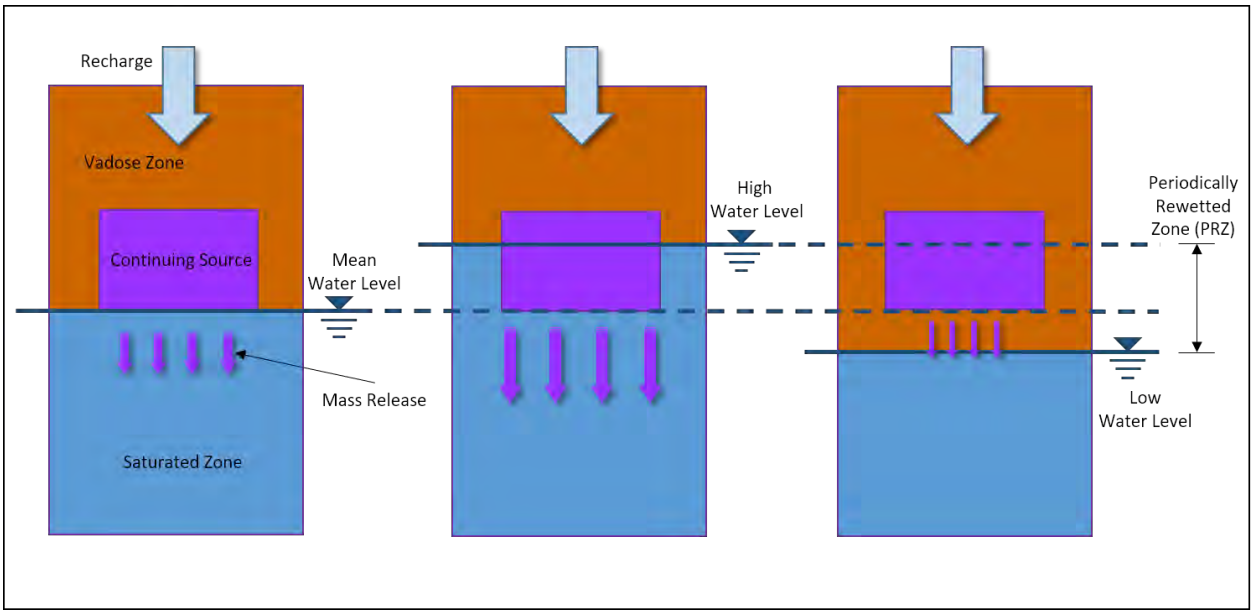

Figure 2-2. Conceptual Model of a Continuing Source

Figure 2-3 illustrates the conceptualization and column geometry of a strontium-90 continuing source near well 199-K-222. For the purposes of simulating the presence and mass releases of a continuing source, it is assumed that the lower 50% of the vadose zone (i.e., the lower half of the zone defined by bottom of the backfill to the average water table) is contaminated, and concentration is uniform throughout the soil column.

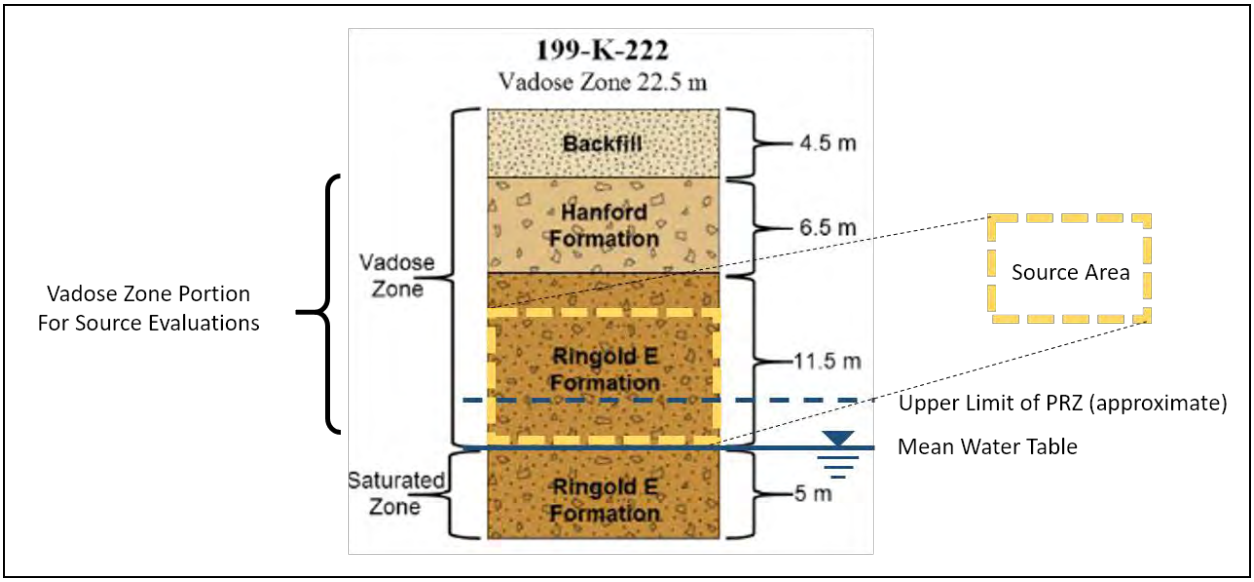

Figure 2-3 Model Simulation of the Strontium-90 Continuing Source at Well 199-K-222

2.2.3 Soil Flushing

Soil flushing calculations were based on the information presented in DOE/RL-2017-30, *100-K West Soil Flushing/Infiltration Treatability Test Plan*, detailing a treatability test plan for evaluating the practicality and effectiveness of in situ soil flushing to remove residual Cr(VI) within the vadose zone at the specified 100-KR-2 source OU waste site area overlying the 100-KR-4 Groundwater OU. The goal of soil flushing is to enhance the migration of Cr(VI) through the vadose zone, remove Cr(VI) from the deep portions of the vadose zone, where it presents a secondary source of groundwater contamination, and mobilize it into groundwater where the active P&T system can remove it.

A similar approach is applied to the continuing sources of carbon-14 that were identified in KW and KE.

Soil flushing is evaluated under Alternatives 2, 3, 4, 5 and 7, with infiltration schemes implemented in the groundwater model for Cr(VI) continuing sources in KW, KE and KN, and for carbon-14 continuing sources in KW and KE.

2.2.4 Strontium-90 Continuing Source Treatment

Alternative 7 uses in situ treatment (solidification) to immobilize strontium-90 overlying strontium-90 plumes in the three main areas where strontium-90 plumes are delineated: at waste sites 100-K-43/ 100-K-82/116-KW-2 near the KW reactor building; at waste sites 116-KE-3/UPR-100-K-1 near the KE reactor building; and at inferred continuing source K1/K2.

Solidification is achieved via jet injection that is assumed to achieve 65% treatment of the mass in the vadose zone. STOMP simulations of flow and transport in the vadose zone representing those continuing sources consider a 65% reduction of concentration at those sources once the jet-injection process is completed.

2.3 Groundwater Flow and Contaminant Transport Modeling

Implementing the design components described above into the groundwater flow and contaminant transport models is discussed in the following sections.

2.3.1 Predictive Simulations

Predictive simulations were based on transient-state (i.e., time-varying) conditions in the aquifer that reflect water-level changes due to pumping, river-stage variation, and natural/anthropogenic recharge. The flow modeling timeframe corresponds to a 300-year period (2018 to 2317). Transport simulations were performed for 125 years (2018 to 2142) for all COCs except for strontium-90, for which a 300-year period was considered (2018 to 2317). For the period 2018-2065, the simulation is discretized into twelve monthly stress periods. The remaining simulation timeframe is discretized into annual stress periods.

Initial conditions for the transport simulation for each COC reflect the corresponding simulated distributions, calculated using the 100-K models at the end of 2017.

2.3.2 Predictive Modeling Process

For each alternative design, a systematic process was followed to develop model input files, to perform the model simulation, and to post-process the model results to evaluate system performance. This procedure is summarized in the following steps:

- For each scenario, the P&T well configuration and operation were translated to a MODFLOW Multi-Node Well (MNW2) Package as input to the MODFLOW model.
- The MODFLOW model was executed and the hydraulic head solution of the flow model simulation was then post-processed to develop boundary conditions for an external simulation, using STOMP, for developing mass-release timeseries at each continuing source.
- Mass-release timeseries were imported to the contaminant transport model using the SSM Package.
- Transport simulations were performed for 300 years.
- Simulation results were post processed to generate plume maps at selected timeframes and concentration timeseries for each area of interest.

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3 Modeling Assumptions and Inputs

Modeling assumptions and inputs are discussed in the following sections.

3.1 Assumptions

This section outlines the assumptions for groundwater flow and transport modeling that underlie the calculations.

3.1.1 Groundwater Flow Modeling

Assumptions and limitations of the use of the 100-K GWFTM are discussed in CP-61711. The 100-K GWFTM was developed for assessing groundwater remediation options in 100-K and was calibrated using hydraulic head and concentration data from 2013 through 2016. The predictive model boundary conditions reflect assumptions on future conditions, such as river-stage variations that depend on upstream structure releases, which may change in the future.

3.1.2 Contaminant Transport Modeling

Contaminant transport modeling and projected plume migration calculations rely on the accuracy of the outputs of the groundwater flow simulations since the groundwater flow model forms the basis of the contaminant transport model, and the accuracy of the parameters and other assumptions and inputs to the contaminant transport model. The following are the key assumptions and limitations underlying the contaminant transport model, for purposes of the calculations presented herein. Most of these assumptions are fundamental to the use of contaminant fate and transport models.

- The initial conditions (plume) is a reasonable representation of the extent of contamination in groundwater under conditions at the commencement of the simulations.
- The transport parameters (porosity, dispersion, distribution coefficient) reasonably describe the processes that contaminants undergo in groundwater and on aquifer materials.
- Potential secondary sources are included in the model, but their associated mass loading over time can only be approximated given the most recent available data from P&T and monitoring wells in the general vicinity of those locations. Interpretation of contaminant distribution in the aquifer and the contributions from secondary sources are contingent upon the density of the monitoring network, the available monitoring data, and the complexity of the hydrogeologic setting. Uncertainty associated with these interpretations is therefore significant, with remedial process optimization (RPO) activities focusing on addressing those uncertainties over time. Implementation of a secondary source investigation will be decided based on evaluation of monitoring data and updated model simulations as part of the proposed, detailed performance monitoring evaluations, to determine whether there is further evidence for the presence of such sources.
- Transport calibration was mostly focused on the potential continuing source locations and initial concentration that was inferred from the annual groundwater monitoring report to select the most representative initial concentration for the transport models. Possible continuing source locations were identified based on prior knowledge and observed groundwater concentrations over the years. Based on available characterization data, a simple one-dimensional soil column was simulated for estimating a characteristic release rate curve at each potential source location. These characteristic release rate curves are based on a unit source concentration in the soil column, with scaling of these release rate curves performed to calibrate on the observed groundwater concentration at or near the source locations.

- Any scheduled or unforeseen shut-down periods of the system configurations (or components of them) will have direct effects on plume migration. The nature and extent of those effects cannot be determined a-priori and result in remedy performance that may differ from that presented in this calculation file.

3.2 Inputs

The migration of contaminants in response to current and projected extraction and injection well operations, river stage fluctuations, and mass releases into the aquifer from continuing sources in the vadose zone under natural and/or anthropogenic recharge, was simulated to support remedy design evaluations. Transport simulations were based on transient flow fields calculated by the groundwater flow model; an initial distribution of contaminants in groundwater derived from simulated plume migration at the end of 2017 using the calibrated 100-K model; and mass releases from the continuing sources.

Inputs to the groundwater flow and transport models are discussed in the following sections.

3.2.1 Extraction-Injection Wells

Flow and transport model simulations were performed for six alternative remedy designs. Alternative 1 (No Action) considers only wells of the interim (current) P&T remedy and anticipated/planned RPO modifications with operation through the end of 2019. Alternatives 2, 3, 4, and 5 incorporate additional extraction and injection wells, and other hydraulic and treatment features. Alternative 6 evaluates a configuration focusing primarily on river protection. Alternative 7 uses the configuration of Alternative 4 through 2032 and then implements a focused P&T well configuration for the strontium-90 plumes in KW and KE with a 90-year operation timeframe.

Soil flushing at the identified Cr(VI) continuing source areas is implemented in the model using injection wells at the top layer of each of the model cells representing the sources. These wells are identified by the “FW” prefix in the summary tables of Alternatives 2, 3, 4, 5, and 7, where soil flushing is included in the design.

Detailed descriptions of each alternative well configuration are presented in the following subsections.

3.2.1.1 Alternative 1

Alternative 1 considers a P&T well configuration reflecting current system operations with implementation of anticipated RPO modifications through the end of 2019. At that point the system is assumed to be shut down and plume migration patterns for all COCs are simulated assuming ambient aquifer conditions for the period from 2020 to 2317.

Figure 3-1 shows the extraction and injection well configuration for this Alternative. Table 3-1 presents detailed accounts of the pumping rates for all wells.

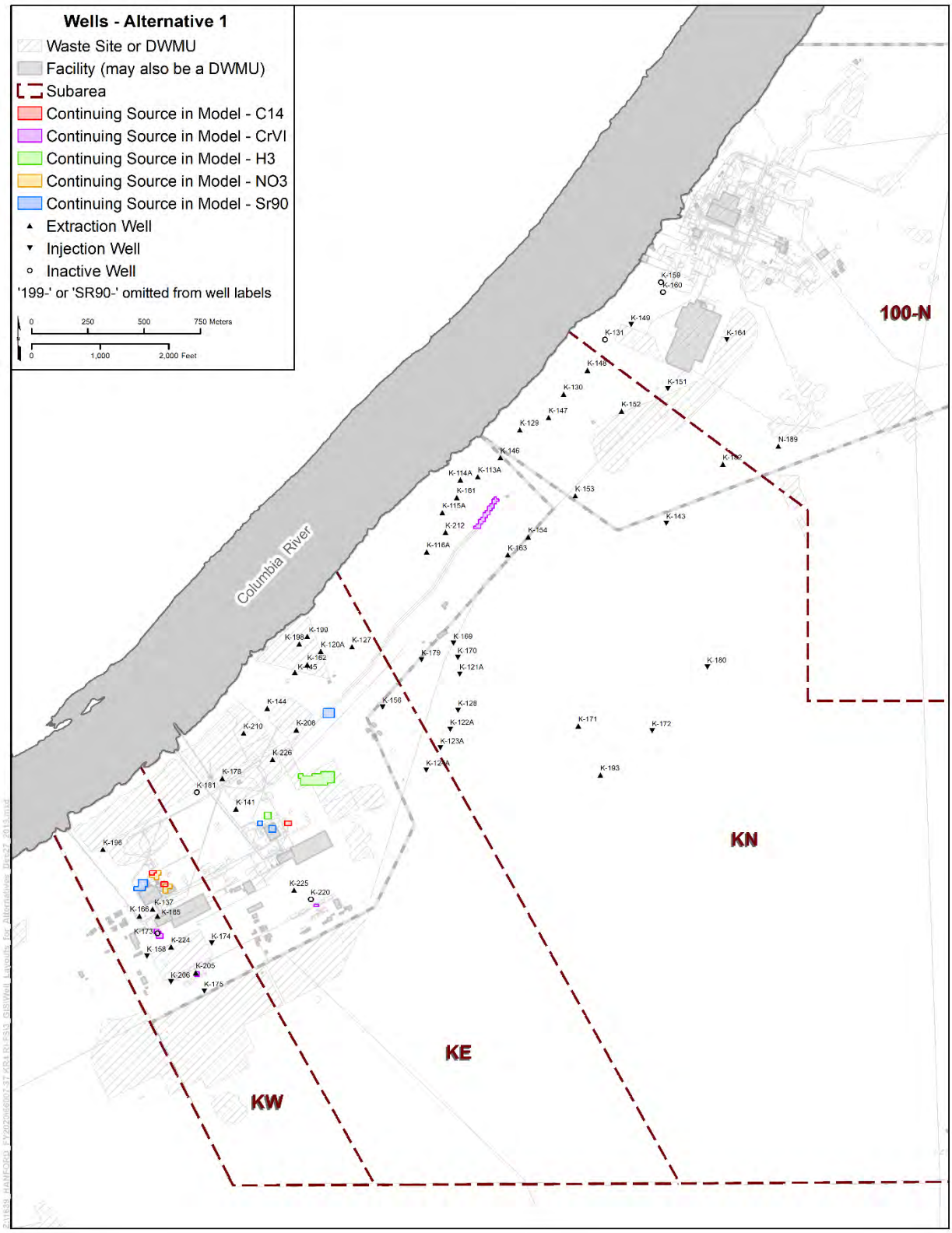

Figure 3-1. System Configuration – Alternative 1

Table 3-1. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 1

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Dec 2019	Jan 2020 - Dec 2317
199-K-113A	E[a]	KR4	570098.07	148294.45	(15.00)[b,c]	(15.00)	(15.00)	(15.00)	-
199-K-114A	E	KR4	570020.30	148280.55	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-115A	E	KR4	569939.99	148135.42	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-116A	E	KR4	569871.15	147960.50	(35.00)	(35.00)	(35.00)	(35.00)	-
199-K-120A	E	KR4	569399.62	147518.48	(35.00)	(35.00)	(35.00)	(35.00)	-
199-K-121A	I	KR4	570017.17	147418.26	47.50	47.50	47.50	47.50	-
199-K-122A	I	KR4	569975.07	147172.86	87.50	87.50	87.50	87.50	-
199-K-123A	I	KR4	569931.10	147090.24	47.50	47.50	47.50	47.50	-
199-K-124A	I	KR4	569867.94	146991.67	47.50	47.50	47.50	47.50	-
199-K-127	E	KR4	569539.23	147539.00	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-128	I	KR4	570009.54	147257.52	95.00	95.00	95.00	95.00	-
199-K-129	E	KR4	570283.65	148503.07	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-130	E	KX	570478.99	148661.18	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-131	E	KX	570662.00	148903.85	-	-	-	-	-
199-K-137	E	KW	568653.37	146374.51	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-141	E	KX	569024.22	146818.49	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-143	I	KX	570934.41	148088.28	50.00	50.00	50.00	50.00	-
199-K-144	E	KX	569163.34	147265.96	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-145	E	KR4	569284.60	147425.66	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-146	E	KX	570197.60	148379.78	(5.00)	(5.00)	(5.00)	(5.00)	-
199-K-147	E	KX	570411.64	148558.07	(15.00)	(15.00)	(15.00)	(15.00)	-

Table 3-1. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 1

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Dec 2019	Jan 2020 - Dec 2317
199-K-148	E	KX	570584.74	148767.86	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-149	I	KX	570778.25	148970.74	60.00	60.00	60.00	60.00	-
199-K-151	I	KX	570941.32	148686.44	60.00	60.00	60.00	60.00	-
199-K-152	E	KX	570736.25	148585.89	(40.00)	(40.00)	(40.00)	(40.00)	-
199-K-153	E	KX	570530.04	148210.08	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-153	I	KX	570530.04	148210.08	-		-		-
199-K-154	E	KX	570321.06	148027.01	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-156	I	KX	569674.01	147270.91	105.00	105.00	105.00	105.00	-
199-K-158	I	KW	568627.45	146164.41	50.00	112.50	50.00	112.50	-
199-K-159	I	KX	570911.73	149159.61	-	-	-	-	-
199-K-160	I	KX	570919.58	149116.02	-	-	-	-	-
199-K-161	E	KX	570004.64	148202.30	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-162	E	KR4	569340.00	147459.97	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-163	E	KX	570230.66	147947.93	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-164	I	KX	571202.22	148903.74	65.00	65.00	65.00	65.00	-
199-K-165	E	KW	568674.96	146342.42	(65.00)	(65.00)	(65.00)	(65.00)	-
199-K-166	E	KW	568594.56	146342.97	(45.00)	(45.00)	(45.00)	(45.00)	-
199-K-169	I	KX	569988.97	147554.98	145.00	145.00	145.00	145.00	-
199-K-170	I	KX	570009.01	147491.37	130.00	130.00	130.00	130.00	-
199-K-171	E	KX	570544.03	147187.86	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-172	I	KX	570871.69	147166.37	70.00	70.00	70.00	70.00	-

Table 3-1. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 1

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Dec 2019	Jan 2020 - Dec 2317
199-K-173	E	KW	568674.07	146266.88	-	-	-	-	-
199-K-174	I	KW	568915.38	146222.47	30.00	62.00	30.00	62.00	-
199-K-175	I	KW	568882.72	146008.84	30.00	68.00	30.00	68.00	-
199-K-178	E	KX	568963.01	146954.43	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-179	I	KX	569847.25	147481.92	80.00	80.00	80.00	80.00	-
199-K-180	I	KX	571116.08	147449.14	60.00	60.00	60.00	60.00	-
199-K-181	E	KX	568849.75	146892.82	-	-	-	-	-
199-K-182	E	KX	571185.32	148350.24	(65.00)	(65.00)	(65.00)	(65.00)	-
199-K-193	E	KX	570641.99	146969.58	(70.00)	(70.00)	(70.00)	(70.00)	-
199-K-196	E	KW	568433.30	146639.26	-	(30.00)	-	(30.00)	-
199-K-198	E	KR4	569304.19	147551.86	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-199	E	KR4	569339.76	147585.30	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-205	E	KW	568845.67	146090.86	-	(90.00)	-	(90.00)	-
199-K-206	I	KW	568734.33	146049.54	30.00	87.50	30.00	87.50	-
199-K-208	E	KX	569291.76	147170.23	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-210	E	KX	569058.13	147155.25	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-212	E	KX	569954.44	148047.71	(40.00)	(40.00)	(40.00)	(40.00)	-
199-K-220	E	KX	569356.25	146417.52	-	-	-	-	-
199-K-224	E	KW	568735.26	146205.95	-	(70.00)	-	(70.00)	-
199-K-225	E	KX	569281.59	146457.74	(45.00)	(45.00)	(45.00)	(45.00)	-
199-K-226	E	KX	569186.87	147038.68	(100.00)	(100.00)	(100.00)	(100.00)	-

Table 3-1. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 1

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Dec 2019	Jan 2020 - Dec 2317
199-N-189	E	KX	571431.65	148430.52	(30.00)	(30.00)	(30.00)	(30.00)	-

a. E: extraction; I: injection.

b. Pumping rates in gallons per minute.

c. Negative values indicate extraction.

3.2.1.2 Alternative 2

The interim action P&T system is expanded in Alternative 2 to include three additional extraction wells in KW and KE and focus on mass recovery in those two areas only. Soil flushing for Cr(VI) occurs in 2020, 2023 and 2026 at the KW continuing-source areas, and in 2021 for the KE continuing-source area. Soil flushing for carbon-14 occurs in 2025.

Well operation is assumed for a 15-year period from 2018 to 2032. During that time, some wells in KW follow a seasonal operation pattern, based on current system operations, but which is not applied to the remaining or proposed wells. This seasonal pattern in KW is maintained in all alternative designs, except for Alternative 6.

The P&T systems are shut down after that, with plume migration patterns for all COCs simulated assuming ambient aquifer conditions for the period from 2033 to 2317.

Figure 3-2 shows the extraction and injection well configuration for Alternative 2. Table 3-2 presents a detailed account of the pumping rates for all wells.

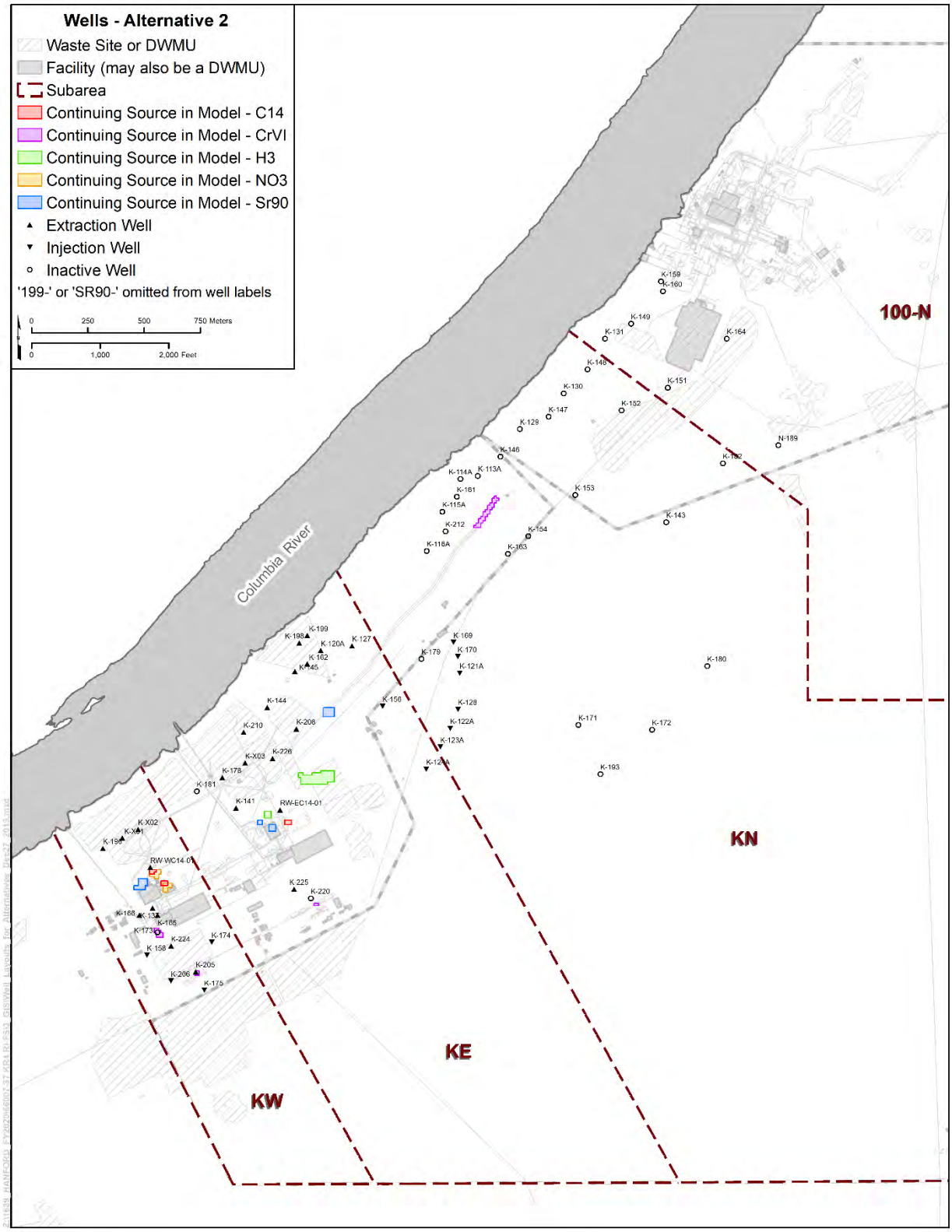

Figure 3-2. System Configuration – Alternative 2

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Table 3-2. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative **2**

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-113A	E[a]	KR4	570098.07	148294.45	(15.00)[b,c]	(15.00)	(15.00)	(15.00)	(15.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-114A	E	KR4	570020.30	148280.55	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-115A	E	KR4	569939.99	148135.42	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-116A	E	KR4	569871.15	147960.50	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-120A	E	KR4	569399.62	147518.48	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	-
199-K-121A	I	KR4	570017.17	147418.26	47.50	47.50	47.50	47.50	47.50	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	-
199-K-122A	I	KR4	569975.07	147172.86	87.50	87.50	87.50	87.50	87.50	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	-
199-K-123A	I	KR4	569931.10	147090.24	47.50	47.50	47.50	47.50	47.50	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	42.00	-
199-K-124A	I	KR4	569867.94	146991.67	47.50	47.50	47.50	47.50	47.50	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	43.00	-
199-K-127	E	KR4	569539.23	147539.00	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-128	I	KR4	570009.54	147257.52	95.00	95.00	95.00	95.00	95.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	-
199-K-129	E	KR4	570283.65	148503.07	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-130	E	KX	570478.99	148661.18	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-131	E	KX	570662.00	148903.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-137	E	KW	568653.37	146374.51	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-141	E	KX	569024.22	146818.49	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-143	I	KX	570934.41	148088.28	50.00	50.00	50.00	50.00	50.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-144	E	KX	569163.34	147265.96	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-145	E	KR4	569284.60	147425.66	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-146	E	KX	570197.60	148379.78	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-147	E	KX	570411.64	148558.07	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-148	E	KX	570584.74	148767.86	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-149	I	KX	570778.25	148970.74	60.00	60.00	60.00	60.00	60.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-151	I	KX	570941.32	148686.44	60.00	60.00	60.00	60.00	60.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-152	E	KX	570736.25	148585.89	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-153	E	KX	570530.04	148210.08	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-153	I	KX	570530.04	148210.08	-		-			-	-		-		-	-		-		-	-	-	-
199-K-154	E	KX	570321.06	148027.01	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-156	I	KX	569674.01	147270.91	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	-
199-K-158	I	KW	568627.45	146164.41	50.00	112.50	50.00	112.50	112.50	-	95.00	95.00	112.50	112.50	-	112.50	112.50	101.00	101.00	-	112.50	112.50	-

Table 3-2. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative **2**

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-159	I	KX	570911.73	149159.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-160	I	KX	570919.58	149116.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-161	E	KX	570004.64	148202.30	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-162	E	KR4	569340.00	147459.97	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-163	E	KX	570230.66	147947.93	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-164	I	KX	571202.22	148903.74	65.00	65.00	65.00	65.00	65.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-165	E	KW	568674.96	146342.42	(65.00)	(65.00)	(65.00)	(65.00)	(15.00)	(15.00)	(45.00)	(15.00)	(45.00)	(15.00)	(15.00)	(45.00)	(15.00)	(45.00)	(15.00)	(15.00)	(45.00)	(15.00)	-
199-K-166	E	KW	568594.56	146342.97	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	-
199-K-169	I	KX	569988.97	147554.98	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	-
199-K-170	I	KX	570009.01	147491.37	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	-
199-K-171	E	KX	570544.03	147187.86	(55.00)	(55.00)	(55.00)	(55.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-172	I	KX	570871.69	147166.37	70.00	70.00	70.00	70.00	70.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-173	E	KW	568674.07	146266.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-174	I	KW	568915.38	146222.47	30.00	62.00	30.00	62.00	62.00	-	60.00	60.00	62.00	62.00	-	62.00	62.00	55.00	55.00	-	62.00	62.00	-
199-K-175	I	KW	568882.72	146008.84	30.00	68.00	30.00	68.00	68.00	-	60.00	60.00	68.00	68.00	-	68.00	68.00	62.00	62.00	-	68.00	68.00	-
199-K-178	E	KX	568963.01	146954.43	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-179	I	KX	569847.25	147481.92	80.00	80.00	80.00	80.00	80.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-180	I	KX	571116.08	147449.14	60.00	60.00	60.00	60.00	60.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-181	E	KX	568849.75	146892.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-182	E	KX	571185.32	148350.24	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-193	E	KX	570641.99	146969.58	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-196	E	KW	568433.30	146639.26	-	(30.00)	-	(30.00)	(30.00)	(30.00)	-	(30.00)	-	(30.00)	(30.00)	-	(30.00)	-	(30.00)	(30.00)	-	(30.00)	-
199-K-198	E	KR4	569304.19	147551.86	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-199	E	KR4	569339.76	147585.30	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-205	E	KW	568845.67	146090.86	-	(90.00)	-	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(75.00)	(75.00)	(75.00)	(75.00)	(75.00)	-
199-K-206	I	KW	568734.33	146049.54	30.00	87.50	30.00	87.50	87.50	-	80.00	80.00	87.50	87.50	-	87.50	87.50	82.00	82.00	-	87.50	87.50	-
199-K-208	E	KX	569291.76	147170.23	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-210	E	KX	569058.13	147155.25	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-212	E	KX	569954.44	148047.71	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-220	E	KX	569356.25	146417.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3-2. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative **2**

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-224	E	KW	568735.26	146205.95	-	(70.00)	-	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(60.00)	(60.00)	(60.00)	(60.00)	(60.00)	-
199-K-225	E	KX	569281.59	146457.74	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	-
199-K-226	E	KX	569186.87	147038.68	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	-
199-K-X01	E	KW	568519.00	146686.00	-	-	-	-	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-X02	E	KW	568589.00	146724.00	-	-	-	-	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-X03	E	KX	569065.00	147019.00	-	-	-	-	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
199-N-189	E	KX	571431.65	148430.52	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FW-01[d]	I	KW	568665.00	146280.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-02	I	KW	568675.00	146280.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-03	I	KW	568665.00	146270.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-04	I	KW	568675.00	146270.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-05	I	KW	568685.00	146270.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-06	I	KW	568675.00	146260.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-07	I	KW	568685.00	146260.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-08	I	KW	568695.00	146260.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-09	I	KW	568675.00	146250.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-10	I	KW	568685.00	146250.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-11	I	KW	568695.00	146250.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-12	I	KW	568845.00	146090.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-13	I	KW	568855.00	146090.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-14	I	KW	568845.00	146080.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-15	I	KW	568855.00	146080.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-16	I	KW	569375.00	146390.00	-	-	-	-	-	-	17.50	17.50	-	-	-	-	-	-	-	-	-	-	-
FW-17	I	KW	569385.00	146390.00	-	-	-	-	-	-	17.50	17.50	-	-	-	-	-	-	-	-	-	-	-
FW-EC14-01	I	KW	569245.00	146760.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-02	I	KW	569255.00	146760.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-03	I	KW	569265.00	146760.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-04	I	KW	569245.00	146750.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-05	I	KW	569255.00	146750.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-

Table 3-2. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative **2**

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
FW-EC14-06	I	KW	569265.00	146750.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-WC14-01	I	KW	568645.00	146540.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.8182	-	-	-	-
FW-WC14-02	I	KW	568655	146540	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-03	I	KW	568665	146540	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-04	I	KW	568645	146530	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-05	I	KW	568655	146530	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-06	I	KW	568695	146490	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-07	I	KW	568705	146490	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-08	I	KW	568715	146490	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-09	I	KW	568695	146480	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-10	I	KW	568705	146480	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-11	I	KW	568715	146480	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
RW-EC14-01	E	KW	569220	146810	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	-
RW-WC14-01	E	KW	568643	146555	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-

a. E: extraction; I: injection.

b. Pumping rates in gallons per minute.

c. Negative values indicate extraction.

d. FW wells indicate infiltration for soil flushing.

3.2.1.3 Alternative 3

The interim action P&T system is further expanded in Alternative 3 to include extraction and injection wells focusing on river protection and mass recovery in KW, KE, KN and the K-N Boundary area. Soil flushing for Cr(VI) and carbn-14 continuing sources is the same as Alternative 2.

Well operation is assumed for a 15-year period from 2018 to 2032. The P&T systems are shut down after that, with plume migration patterns for all COCs simulated assuming ambient aquifer conditions for the period from 2033 to 2317.

Figure 3-3 shows the extraction and injection well configuration for Alternative 3. Table 3-3 presents a detailed account of the pumping rates for all wells.

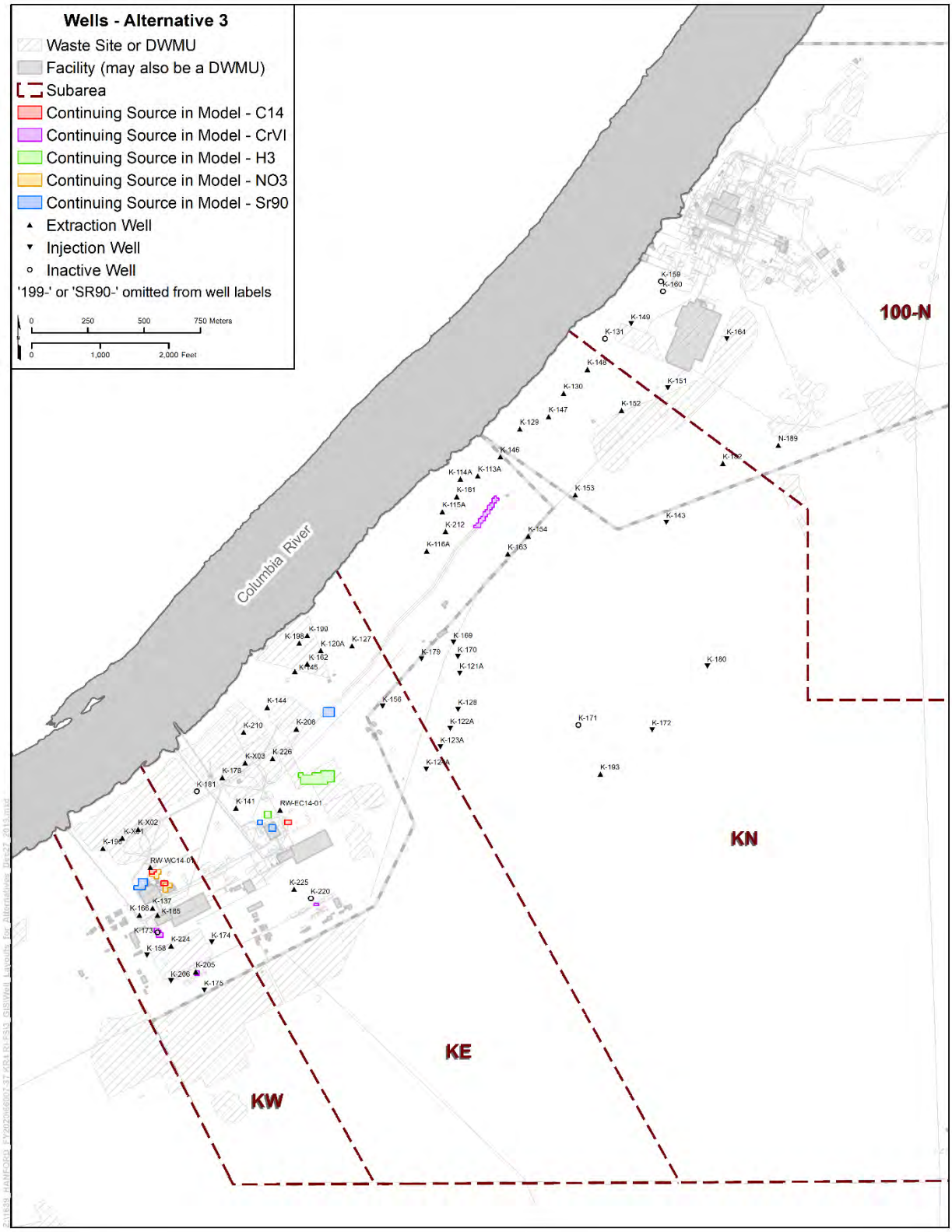

Figure 3-3. System Configuration – Alternative 3

Table 3-3. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 3

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-113A	E[a]	KR4	570098.07	148294.45	(15.00)[b,c]	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-114A	E	KR4	570020.30	148280.55	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-115A	E	KR4	569939.99	148135.42	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-116A	E	KR4	569871.15	147960.50	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	-
199-K-120A	E	KR4	569399.62	147518.48	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	-
199-K-121A	I	KR4	570017.17	147418.26	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	-
199-K-122A	I	KR4	569975.07	147172.86	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	-
199-K-123A	I	KR4	569931.10	147090.24	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	-
199-K-124A	I	KR4	569867.94	146991.67	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	-
199-K-127	E	KR4	569539.23	147539.00	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-128	I	KR4	570009.54	147257.52	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	-
199-K-129	E	KR4	570283.65	148503.07	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-130	E	KX	570478.99	148661.18	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-131	E	KX	570662.00	148903.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-137	E	KW	568653.37	146374.51	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-141	E	KX	569024.22	146818.49	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-143	I	KX	570934.41	148088.28	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	-
199-K-144	E	KX	569163.34	147265.96	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-145	E	KR4	569284.60	147425.66	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-146	E	KX	570197.60	148379.78	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	-
199-K-147	E	KX	570411.64	148558.07	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-148	E	KX	570584.74	148767.86	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-149	I	KX	570778.25	148970.74	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	-
199-K-151	I	KX	570941.32	148686.44	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	-
199-K-152	E	KX	570736.25	148585.89	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	-
199-K-153	E	KX	570530.04	148210.08	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-153	I	KX	570530.04	148210.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-154	E	KX	570321.06	148027.01	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-156	I	KX	569674.01	147270.91	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	-
199-K-158	I	KW	568627.45	146164.41	50.00	112.50	50.00	112.50	112.50	-	95.00	95.00	112.50	112.50	-	112.50	112.50	101.00	101.00	-	112.50	112.50	-

Table 3-3. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 3

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-159	I	KX	570911.73	149159.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-160	I	KX	570919.58	149116.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-161	E	KX	570004.64	148202.30	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-162	E	KR4	569340.00	147459.97	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-163	E	KX	570230.66	147947.93	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-164	I	KX	571202.22	148903.74	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	-
199-K-165	E	KW	568674.96	146342.42	(65.00)	(65.00)	(65.00)	(65.00)	(15.00)	(15.00)	(45.00)	(15.00)	(45.00)	(15.00)	(15.00)	(45.00)	(15.00)	(45.00)	(15.00)	(15.00)	(45.00)	(15.00)	-
199-K-166	E	KW	568594.56	146342.97	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	-
199-K-169	I	KX	569988.97	147554.98	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	-
199-K-170	I	KX	570009.01	147491.37	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	-
199-K-171	E	KX	570544.03	147187.86	(55.00)	(55.00)	(55.00)	(55.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-172	I	KX	570871.69	147166.37	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	-
199-K-173	E	KW	568674.07	146266.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-174	I	KW	568915.38	146222.47	30.00	62.00	30.00	62.00	62.00	-	60.00	60.00	62.00	62.00	-	62.00	62.00	55.00	55.00	-	62.00	62.00	-
199-K-175	I	KW	568882.72	146008.84	30.00	68.00	30.00	68.00	68.00	-	60.00	60.00	68.00	68.00	-	68.00	68.00	62.00	62.00	-	68.00	68.00	-
199-K-178	E	KX	568963.01	146954.43	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-179	I	KX	569847.25	147481.92	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	-
199-K-180	I	KX	571116.08	147449.14	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	-
199-K-181	E	KX	568849.75	146892.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-182	E	KX	571185.32	148350.24	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	-
199-K-193	E	KX	570641.99	146969.58	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	-
199-K-196	E	KW	568433.30	146639.26	-	(30.00)	-	(30.00)	(30.00)	(30.00)	-	(30.00)	-	(30.00)	(30.00)	-	(30.00)	-	(30.00)	(30.00)	-	(30.00)	-
199-K-198	E	KR4	569304.19	147551.86	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-199	E	KR4	569339.76	147585.30	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-205	E	KW	568845.67	146090.86	-	(90.00)	-	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(75.00)	(75.00)	(75.00)	(75.00)	(75.00)	-
199-K-206	I	KW	568734.33	146049.54	30.00	87.50	30.00	87.50	87.50	-	80.00	80.00	87.50	87.50	-	87.50	87.50	82.00	82.00	-	87.50	87.50	-
199-K-208	E	KX	569291.76	147170.23	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-210	E	KX	569058.13	147155.25	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-212	E	KX	569954.44	148047.71	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	-
199-K-220	E	KX	569356.25	146417.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 3-3. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 3

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-224	E	KW	568735.26	146205.95	-	(70.00)	-	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(60.00)	(60.00)	(60.00)	(60.00)	(60.00)	-
199-K-225	E	KX	569281.59	146457.74	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	-
199-K-226	E	KX	569186.87	147038.68	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	-
199-K-X01	E	KW	568519.00	146686.00	-	-	-	-	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-X02	E	KW	568589.00	146724.00	-	-	-	-	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-X03	E	KX	569065.00	147019.00	-	-	-	-	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
199-N-189	E	KX	571431.65	148430.52	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
FW-01[d]	I	KW	568665.00	146280.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-02	I	KW	568675.00	146280.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-03	I	KW	568665.00	146270.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-04	I	KW	568675.00	146270.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-05	I	KW	568685.00	146270.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-06	I	KW	568675.00	146260.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-07	I	KW	568685.00	146260.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-08	I	KW	568695.00	146260.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-09	I	KW	568675.00	146250.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-10	I	KW	568685.00	146250.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-11	I	KW	568695.00	146250.00	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-12	I	KW	568845.00	146090.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-13	I	KW	568855.00	146090.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-14	I	KW	568845.00	146080.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-15	I	KW	568855.00	146080.00	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-16	I	KW	569375.00	146390.00	-	-	-	-	-	-	17.50	17.50	-	-	-	-	-	-	-	-	-	-	-
FW-17	I	KW	569385.00	146390.00	-	-	-	-	-	-	17.50	17.50	-	-	-	-	-	-	-	-	-	-	-
FW-EC14-01	I	KW	569245.00	146760.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-02	I	KW	569255.00	146760.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-03	I	KW	569265.00	146760.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-04	I	KW	569245.00	146750.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-05	I	KW	569255.00	146750.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-

Table 3-3. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 3

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
FW-EC14-06	I	KW	569265.00	146750.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-WC14-01	I	KW	568645.00	146540.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-02	I	KW	568655.00	146540.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-03	I	KW	568665.00	146540.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-04	I	KW	568645.00	146530.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-05	I	KW	568655.00	146530.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-06	I	KW	568695.00	146490.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-07	I	KW	568705.00	146490.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-08	I	KW	568715.00	146490.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-09	I	KW	568695.00	146480.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-10	I	KW	568705.00	146480.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-11	I	KW	568715.00	146480.00	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
RW-EC14-01	E	KW	569220.00	146810.00	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	-
RW-WC14-01	E	KW	568643.00	146555.00	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-

a. E: extraction; I: injection.

b. Pumping rates in gallons per minute.

c. Negative values indicate extraction.

d. FW wells indicate infiltration for soil flushing.

3.2.1.4 Alternative 4

Alternative 4 is based on Alternative 3, with the addition of soil flushing for Cr(VI) at 116-K-2 in 2022. An additional extraction well is included in the design, downgradient of 116-K-2 to provide additional hydraulic containment for river protection.

Well operation is assumed for a 15-year period from 2018 to 2032. The P&T systems are shut down after that, with plume migration patterns for all COCs simulated assuming ambient aquifer conditions for the period from 2033 to 2317.

Figure 3-4 shows the extraction and injection well configuration for Alternative 3. Table 3-4 presents a detailed account of the pumping rates for all wells.

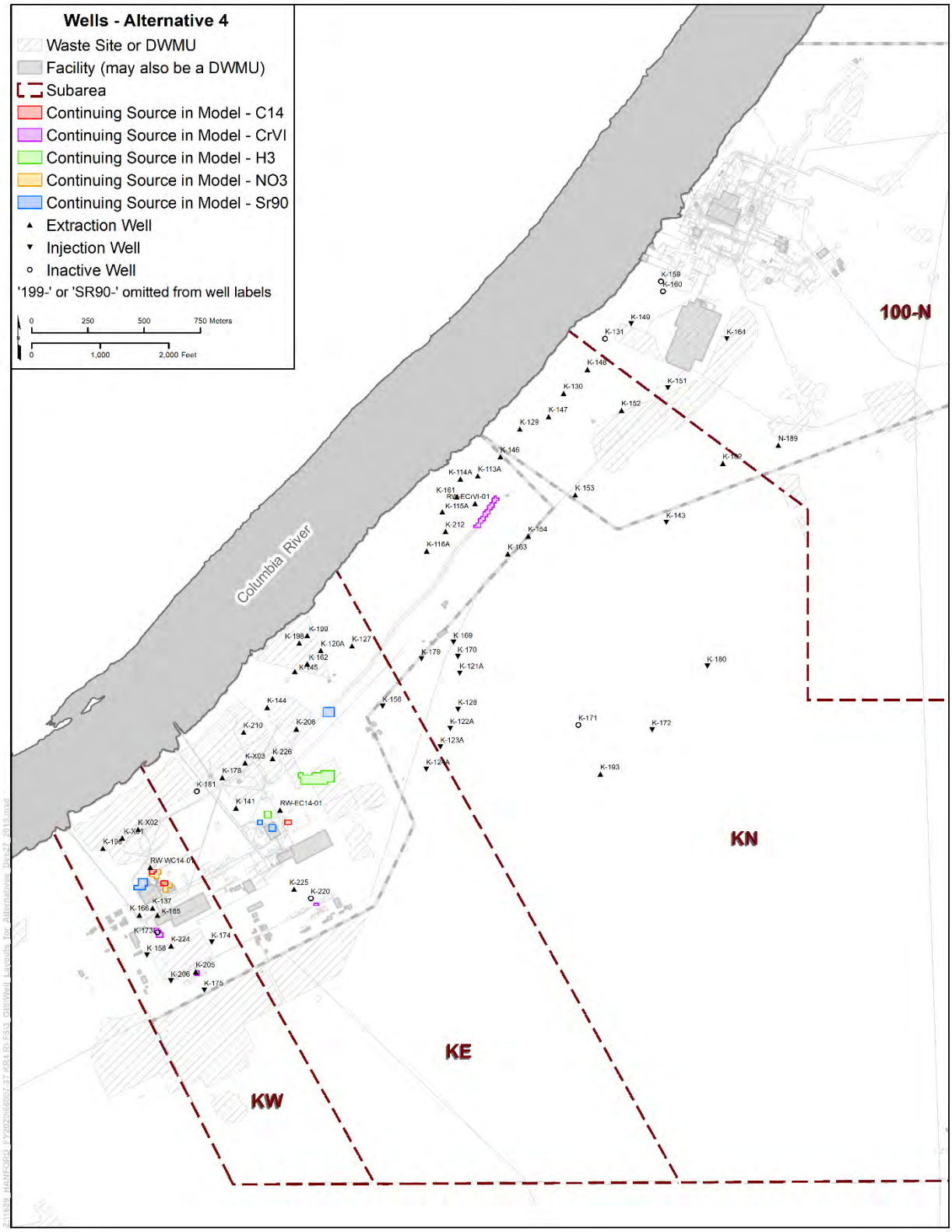

Figure 3-4. System Configuration – Alternative 4

Table 3-4. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 4

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-113A	E[a]	KR4	570098.07	148294.453	(15.00)[b,c]	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-114A	E	KR4	570020.302	148280.55	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-115A	E	KR4	569939.988	148135.417	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-116A	E	KR4	569871.149	147960.495	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	-
199-K-120A	E	KR4	569399.615	147518.477	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	-
199-K-121A	I	KR4	570017.165	147418.26	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	-
199-K-122A	I	KR4	569975.068	147172.859	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	87.50	-
199-K-123A	I	KR4	569931.103	147090.244	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	-
199-K-124A	I	KR4	569867.938	146991.673	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	-
199-K-127	E	KR4	569539.234	147539.002	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-128	I	KR4	570009.538	147257.52	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	95.00	-
199-K-129	E	KR4	570283.65	148503.07	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-130	E	KX	570478.99	148661.18	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-131	E	KX	570662	148903.85	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-137	E	KW	568653.37	146374.51	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-141	E	KX	569024.22	146818.49	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-143	I	KX	570934.41	148088.28	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	-
199-K-144	E	KX	569163.34	147265.96	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-145	E	KR4	569284.6	147425.66	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-146	E	KX	570197.6	148379.78	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	(5.00)	-
199-K-147	E	KX	570411.64	148558.07	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-
199-K-148	E	KX	570584.74	148767.86	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-152	E	KX	570736.25	148585.89	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(40.00)	(40.00)	(40.00)	-
199-K-153	E	KX	570530.04	148210.08	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-154	E	KX	570321.06	148027.01	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-156	I	KX	569674.01	147270.91	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	100.00	100.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	105.00	-
199-K-158	I	KW	568627.45	146164.41	50.00	112.50	50.00	112.50	112.50	-	95.00	95.00	112.50	112.50	-	112.50	112.50	101.00	101.00	-	112.50	112.50	-
199-K-159	I	KX	570911.73	149159.61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-160	I	KX	570919.58	149116.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-161	E	KX	570004.64	148202.3	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-

Table 3-4. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 4

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-162	E	KR4	569340	147459.97	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	(50.00)	-
199-K-163	E	KX	570230.66	147947.93	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	-
199-K-164	I	KX	571202.22	148903.74	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	-
199-K-165	E	KW	568674.96	146342.42	(65.00)	(65.00)	(65.00)	(65.00)	(15.00)	(15.00)	(45.00)	(15.00)	(45.00)	(15.00)	(15.00)	(45.00)	(15.00)	(45.00)	(15.00)	(15.00)	(45.00)	(15.00)	-
199-K-166	E	KW	568594.56	146342.97	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	-
199-K-169	I	KX	569988.97	147554.98	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	140.00	140.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	145.00	-
199-K-170	I	KX	570009.01	147491.37	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	125.00	125.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	130.00	-
199-K-171	E	KX	570544.03	147187.86	(55.00)	(55.00)	(55.00)	(55.00)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-172	I	KX	570871.69	147166.37	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	70.00	-
199-K-173	E	KW	568674.07	146266.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-174	I	KW	568915.38	146222.47	30.00	62.00	30.00	62.00	62.00	-	60.00	60.00	62.00	62.00	-	62.00	62.00	55.00	55.00	-	62.00	62.00	-
199-K-175	I	KW	568882.72	146008.84	30.00	68.00	30.00	68.00	68.00	-	60.00	60.00	68.00	68.00	-	68.00	68.00	62.00	62.00	-	68.00	68.00	-
199-K-178	E	KX	568963.01	146954.43	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-179	I	KX	569847.25	147481.92	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.00	-
199-K-180	I	KX	571116.08	147449.14	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	-
199-K-181	E	KX	568849.75	146892.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-182	E	KX	571185.32	148350.24	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	(65.00)	-
199-K-198	E	KR4	569304.19	147551.86	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-199	E	KR4	569339.76	147585.3	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-205	E	KW	568845.67	146090.86	-	(90.00)	-	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(90.00)	(75.00)	(75.00)	(75.00)	(75.00)	(75.00)	-
199-K-206	I	KW	568734.33	146049.54	30.00	87.50	30.00	87.50	87.50	-	80.00	80.00	87.50	87.50	-	87.50	87.50	82.00	82.00	-	87.50	87.50	-
199-K-208	E	KX	569291.76	147170.23	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(30.00)	(30.00)	(30.00)	-
199-K-210	E	KX	569058.13	147155.25	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
199-K-212	E	KX	569954.44	148047.71	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(40.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(35.00)	(40.00)	(40.00)	(40.00)	-
199-K-220	E	KX	569356.25	146417.52	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-224	E	KW	568735.26	146205.95	-	(70.00)	-	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(60.00)	(60.00)	(60.00)	(60.00)	(60.00)	-
199-K-225	E	KX	569281.59	146457.74	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	(45.00)	-
199-N-189	E	KX	571431.65	148430.52	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	(30.00)	-
199-K-149	I	KX	570778.25	148970.74	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	-
199-K-151	I	KX	570941.32	148686.44	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	-

Table 3-4. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 4

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
199-K-153	I	KX	570530.04	148210.08	-		-			-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-K-193	E	KX	570641.99	146969.58	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	(70.00)	-
199-K-226	E	KX	569186.87	147038.68	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	-
199-K-196	E	KW	568433.3	146639.26	-	(30.00)	-	(30.00)	(30.00)	(30.00)	-	(30.00)	-	(30.00)	(30.00)	-	(30.00)	-	(30.00)	(30.00)	-	(30.00)	-
199-K-X01	E	KW	568519	146686	-	-	-	-	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
199-K-X02	E	KW	568589	146724	-	-	-	-	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	(25.00)	-
FW-01[d]	I	KW	568665	146280	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-02	I	KW	568675	146280	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-03	I	KW	568665	146270	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-04	I	KW	568675	146270	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-05	I	KW	568685	146270	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-06	I	KW	568675	146260	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-07	I	KW	568685	146260	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-08	I	KW	568695	146260	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-09	I	KW	568675	146250	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-10	I	KW	568685	146250	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-11	I	KW	568695	146250	-	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-	-	5.91	-	-	-
FW-12	I	KW	568845	146090	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-13	I	KW	568855	146090	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-14	I	KW	568845	146080	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-15	I	KW	568855	146080	-	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-	-	66.25	-	-	-
FW-16	I	KW	569375	146390	-	-	-	-	-	-	17.50	17.50	-	-	-	-	-	-	-	-	-	-	-
FW-17	I	KW	569385	146390	-	-	-	-	-	-	17.50	17.50	-	-	-	-	-	-	-	-	-	-	-
199-K-X03	E	KX	569065	147019	-	-	-	-	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	(55.00)	-
FW-WC14-01	I	KW	568645	146540	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-02	I	KW	568655	146540	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-03	I	KW	568665	146540	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-04	I	KW	568645	146530	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-05	I	KW	568655	146530	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-06	I	KW	568695	146490	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-

Table 3-4. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 4

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
FW-WC14-07	I	KW	568705	146490	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-08	I	KW	568715	146490	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-09	I	KW	568695	146480	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-10	I	KW	568705	146480	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-WC14-11	I	KW	568715	146480	-	-	-	-	-	-	-	-	-	-	-	-	-	1.82	1.82	-	-	-	-
FW-EC14-01	I	KW	569245	146760	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-02	I	KW	569255	146760	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-03	I	KW	569265	146760	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-04	I	KW	569245	146750	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-05	I	KW	569255	146750	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-EC14-06	I	KW	569265	146750	-	-	-	-	-	-	-	-	-	-	-	-	-	1.67	1.67	-	-	-	-
FW-TR-01	I	KX	570175	148200	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	-
FW-TR-02	I	KX	570165	148190	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	-
FW-TR-03	I	KX	570175	148190	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-04	I	KX	570185	148190	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-05	I	KX	570165	148180	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-06	I	KX	570175	148180	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-07	I	KX	570155	148170	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-08	I	KX	570165	148170	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-09	I	KX	570145	148160	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-10	I	KX	570155	148160	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-11	I	KX	570165	148160	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-12	I	KX	570145	148150	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-13	I	KX	570155	148150	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-14	I	KX	570135	148140	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-15	I	KX	570145	148140	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-16	I	KX	570125	148130	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-17	I	KX	570135	148130	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-18	I	KX	570145	148130	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-19	I	KX	570125	148120	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	

Table 3-4. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 4

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Dec 2018	Jan-Jul 2019	Aug-Sep 2019	Oct-Dec 2019	Jan-Dec 2020	Jan-Jul 2021	Aug-Dec 2021	Jan-Jul 2022	Aug-Dec 2022	Jan-Dec 2023	Jan-Jul 2024	Aug-Dec 2024	Jan-Jul 2025	Aug-Dec 2025	Jan-Dec 2026	CY 2027-2032 Jan-Jul	CY 2027-2032 Aug-Dec	2033-2317
FW-TR-20	I	KX	570135	148120	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-21	I	KX	570115	148110	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-22	I	KX	570125	148110	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-23	I	KX	570105	148100	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-24	I	KX	570115	148100	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-25	I	KX	570125	148100	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-26	I	KX	570105	148090	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-27	I	KX	570115	148090	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-28	I	KX	570095	148080	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-29	I	KX	570105	148080	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-30	I	KX	570085	148070	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-31	I	KX	570095	148070	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
FW-TR-32	I	KX	570105	148070	-	-	-	-	-	-	-	-	0.47	0.47	-	-	-	-	-	-	-	-	
RW-WC14-01	E	KW	568643	146555	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.00)	(20.00)	(20.00)	(20.00)	(20.00)	
RW-EC14-01	E	KW	569220	146810	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.00)	(10.00)	(10.00)	(10.00)	(10.00)	
RW-ECrVI-01	E	KX	570086	148172	-	-	-	-	-	-	-	-	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	(15.00)	-	-	-	

a. E: extraction; I: injection.

b. Pumping rates in gallons per minute.

c. Negative values indicate extraction.

d. FW wells indicate infiltration for soil flushing.

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3.2.1.5 Alternative 5

Alternative 5 is also based on Alternative 3, with the addition of RTD for Cr(VI) at 116-K-2 in 2022. The addition of RTD is the only element that differentiates Alternatives 3 and 5, therefore the well configurations for these two alternatives are identical.

Well operation is assumed for a 15-year period from 2018 to 2032. The P&T systems are shut down after that, with plume migration patterns for all COCs simulated assuming ambient aquifer conditions for the period from 2033 to 2317.

Figure 3-5 shows the extraction and injection well configuration for Alternative 5. Given that the well configuration for this alternative is identical to Alternative 3, a detailed account of the pumping rates for all wells in Alternative 5 is included in Table 3-3.

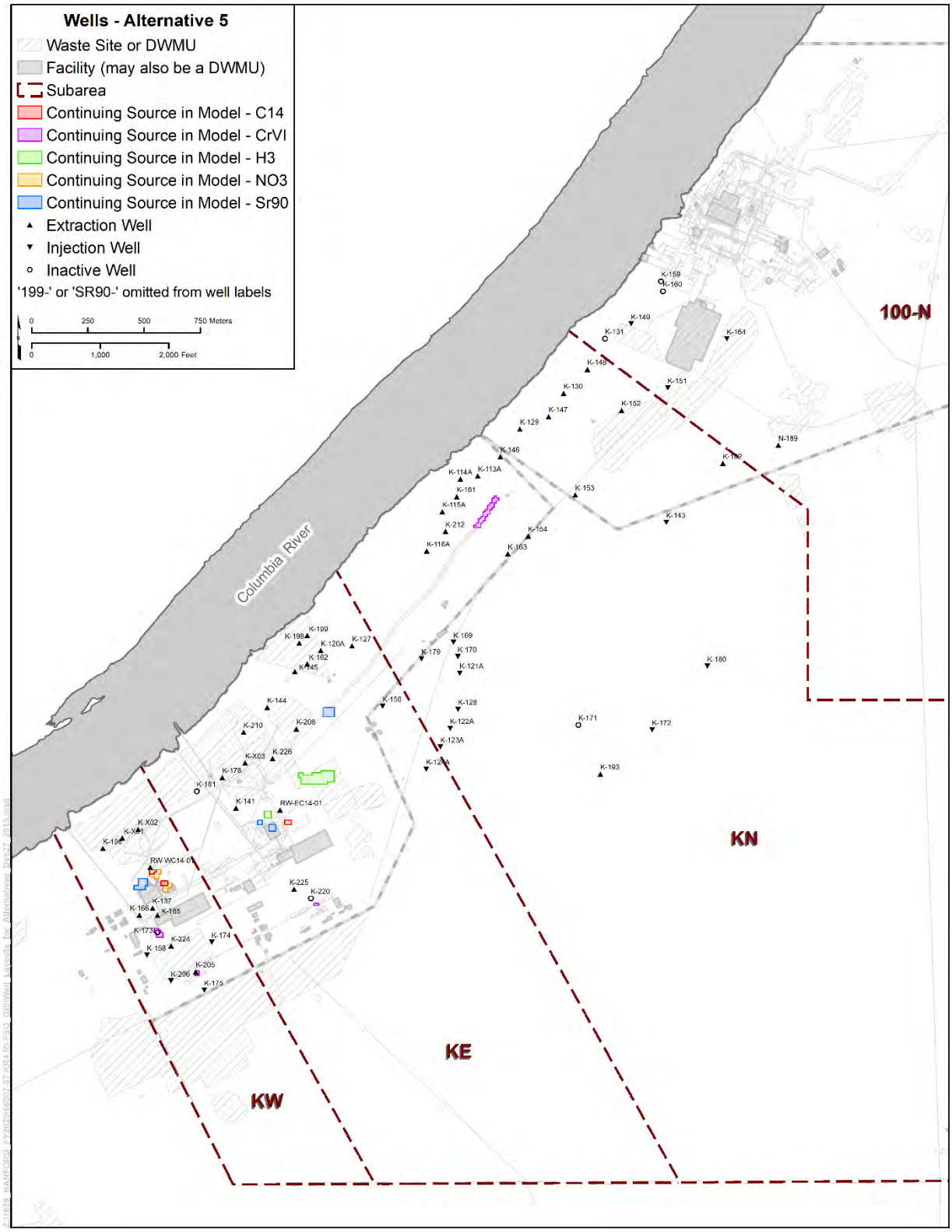

Figure 3-5. System Configuration – Alternative 5

3.2.1.6 Alternative 6

The well configuration for Alternative 6 focuses on river protection, using (a) a subset of the current extraction and injection wells operating as part of the KW, KR4 and KX systems; and (b) two additional extraction wells by the shoreline of KW, such that a sufficient hydraulic containment zone is established by the shoreline to prevent further discharges of the contaminant plumes to the river. The wells are operational for a 50-year period starting in October 2018 and extending through the end of 2068, at which point the system is turned off and plume migration occurs under ambient aquifer conditions. When the system is turned off after the 50-year period, concentration levels in the remaining Cr(VI) plume, which is the main target of the hydraulic containment system, are reduced such that concentrations reaching the shoreline after that timeframe remain below the 10 µg/L aquatic standard.

Figure 3-6 shows the extraction and injection well configuration for Alternative 6. Table 3-5 presents a detailed account of the pumping rates for all wells.

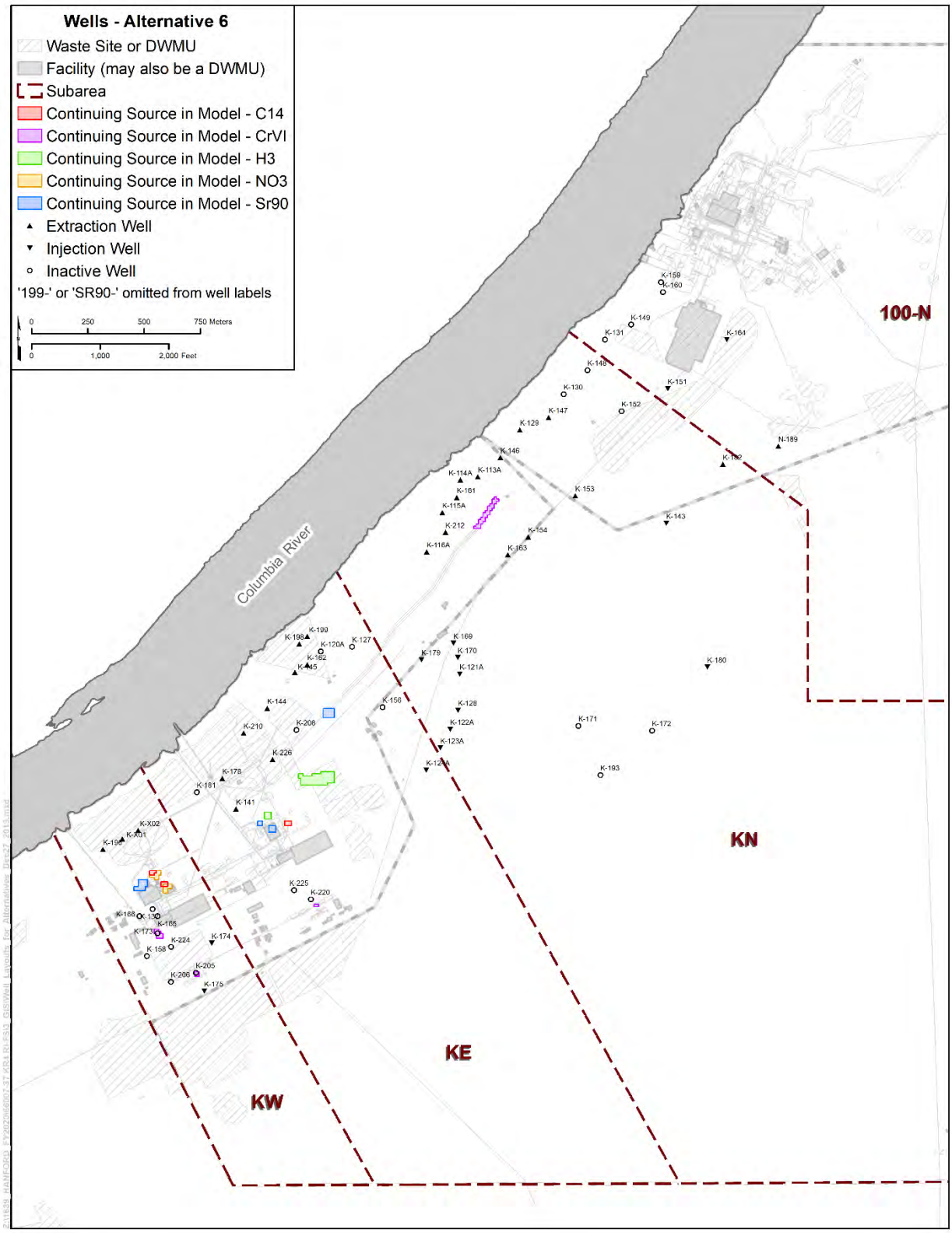

Figure 3-6. System Configuration – Alternative 6

Table 3-5. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 6

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Sep 2018	Oct 2018 – Dec 2068	Jan 2069 - Dec 2317
199-K-113A	E[a]	KR4	570098.07	148294.45	(15.00)[b,c]	(15.00)	(15.00)	-
199-K-114A	E	KR4	570020.30	148280.55	(30.00)	(30.00)	(30.00)	-
199-K-115A	E	KR4	569939.99	148135.42	(20.00)	(20.00)	(20.00)	-
199-K-116A	E	KR4	569871.15	147960.50	(35.00)	(35.00)	(35.00)	-
199-K-120A	E	KR4	569399.62	147518.48	(35.00)	(35.00)	-	-
199-K-121A	I	KR4	570017.17	147418.26	47.50	47.50	52.00	-
199-K-122A	I	KR4	569975.07	147172.86	87.50	87.50	52.00	-
199-K-123A	I	KR4	569931.10	147090.24	47.50	47.50	52.00	-
199-K-124A	I	KR4	569867.94	146991.67	47.50	47.50	52.00	-
199-K-127	E	KR4	569539.23	147539.00	(30.00)	(30.00)	-	-
199-K-128	I	KR4	570009.54	147257.52	95.00	95.00	52.00	-
199-K-129	E	KR4	570283.65	148503.07	(20.00)	(20.00)	(20.00)	-
199-K-130	E	KX	570478.99	148661.18	(15.00)	(15.00)	-	-
199-K-131	E	KX	570662.00	148903.85	-	-	-	-
199-K-137	E	KW	568653.37	146374.51	(30.00)	(30.00)	-	-
199-K-141	E	KX	569024.22	146818.49	(20.00)	(20.00)	(20.00)	-
199-K-143	I	KX	570934.41	148088.28	50.00	50.00	50.00	-
199-K-144	E	KX	569163.34	147265.96	(50.00)	(50.00)	(50.00)	-
199-K-145	E	KR4	569284.60	147425.66	(30.00)	(30.00)	(30.00)	-
199-K-146	E	KX	570197.60	148379.78	(5.00)	(5.00)	(5.00)	-
199-K-147	E	KX	570411.64	148558.07	(15.00)	(15.00)	(15.00)	-

Table 3-5. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 6

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Sep 2018	Oct 2018 – Dec 2068	Jan 2069 - Dec 2317
199-K-148	E	KX	570584.74	148767.86	(25.00)	(25.00)	-	-
199-K-149	I	KX	570778.25	148970.74	60.00	60.00	-	-
199-K-151	I	KX	570941.32	148686.44	60.00	60.00	60.00	-
199-K-152	E	KX	570736.25	148585.89	(40.00)	(40.00)	-	-
199-K-153	E	KX	570530.04	148210.08	(50.00)	(50.00)	(50.00)	-
199-K-153	I	KX	570530.04	148210.08	-		-	-
199-K-154	E	KX	570321.06	148027.01	(55.00)	(55.00)	(55.00)	-
199-K-156	I	KX	569674.01	147270.91	105.00	105.00	-	-
199-K-158	I	KW	568627.45	146164.41	50.00	112.50	-	-
199-K-159	I	KX	570911.73	149159.61	-	-	-	-
199-K-160	I	KX	570919.58	149116.02	-	-	-	-
199-K-161	E	KX	570004.64	148202.30	(15.00)	(15.00)	(15.00)	-
199-K-162	E	KR4	569340.00	147459.97	(50.00)	(50.00)	(50.00)	-
199-K-163	E	KX	570230.66	147947.93	(20.00)	(20.00)	(20.00)	-
199-K-164	I	KX	571202.22	148903.74	65.00	65.00	65.00	-
199-K-165	E	KW	568674.96	146342.42	(65.00)	(65.00)	-	-
199-K-166	E	KW	568594.56	146342.97	(45.00)	(45.00)	-	-
199-K-169	I	KX	569988.97	147554.98	145.00	145.00	130.00	-
199-K-170	I	KX	570009.01	147491.37	130.00	130.00	130.00	-
199-K-171	E	KX	570544.03	147187.86	(55.00)	(55.00)	-	-
199-K-172	I	KX	570871.69	147166.37	70.00	70.00	-	-

Table 3-5. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 6

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Sep 2018	Oct 2018 – Dec 2068	Jan 2069 - Dec 2317
199-K-173	E	KW	568674.07	146266.88	-	-	-	-
199-K-174	I	KW	568915.38	146222.47	30.00	62.00	60.00	-
199-K-175	I	KW	568882.72	146008.84	30.00	68.00	60.00	-
199-K-178	E	KX	568963.01	146954.43	(25.00)	(25.00)	(25.00)	-
199-K-179	I	KX	569847.25	147481.92	80.00	80.00	50.00	-
199-K-180	I	KX	571116.08	147449.14	60.00	60.00	60.00	-
199-K-181	E	KX	568849.75	146892.82	-	-	-	-
199-K-182	E	KX	571185.32	148350.24	(65.00)	(65.00)	(65.00)	-
199-K-193	E	KX	570641.99	146969.58	(70.00)	(70.00)	-	-
199-K-196	E	KW	568433.30	146639.26	-	(30.00)	(40.00)	-
199-K-198	E	KR4	569304.19	147551.86	(30.00)	(30.00)	(30.00)	-
199-K-199	E	KR4	569339.76	147585.30	(30.00)	(30.00)	(30.00)	-
199-K-205	E	KW	568845.67	146090.86	-	(90.00)	-	-
199-K-206	I	KW	568734.33	146049.54	30.00	87.50	-	-
199-K-208	E	KX	569291.76	147170.23	(30.00)	(30.00)	-	-
199-K-210	E	KX	569058.13	147155.25	(55.00)	(55.00)	(55.00)	-
199-K-212	E	KX	569954.44	148047.71	(40.00)	(40.00)	(40.00)	-
199-K-220	E	KX	569356.25	146417.52	-	-	-	-
199-K-224	E	KW	568735.26	146205.95	-	(70.00)	-	-
199-K-225	E	KX	569281.59	146457.74	(45.00)	(45.00)	-	-
199-K-226	E	KX	569186.87	147038.68	(100.00)	(100.00)	(100.00)	-

Table 3-5. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 6

Name	Type	System	Easting	Northing	Jan-Jul 2018	Aug-Sep 2018	Oct 2018 – Dec 2068	Jan 2069 - Dec 2317
199-K-X01	E	KW	568519.00	146686.00	-	-	(40.00)	-
199-K-X02	E	KW	568589.00	146724.00	-	-	(40.00)	-
199-N-189	E	KX	571431.65	148430.52	(30.00)	(30.00)	(30.00)	-

a. E: extraction; I: injection.

b. Pumping rates in gallons per minute.

c. Negative values indicate extraction.

3.2.1.7 Alternative 7

Alternative 7 is based on the configuration proposed for Alternative 4 for the P&T system operation during the first 15 years. After that, focused operation of new extraction and injection wells is proposed, targeting the strontium-90 plumes in KW and KE. The purpose of this proposed alternative is to evaluate the level of reduction of strontium-90 concentrations in the aquifer through the operation of extraction and injection wells that remove strontium-90 mass from the aquifer, in conjunction with continuing-source treatment in the vadose zone.

These proposed wells are proposed to operate for 90 years, during the period 2033-2122, extracting contaminated water that is treated at 80% efficiency in a new radiological treatment plant, where all the water is transferred for treatment. The treatment effluent is reinjected in the aquifer via the injection wells.

Continuing source treatment with mass reduction of 65% at the source, is achieved via jet injection, which assumes no fluid injection in the vadose or the aquifer.

Figure 3-7 shows the extraction and injection wells for Alternative 7 within the strontium-90 focus area in KW and KE. Table 3-6 provides a detailed account of the pumping rates after 2033, for the additional extraction and injection wells for the system configuration focusing on strontium-90 as part of Alternative 7. Pumping rates prior to 2033 are listed in Table 3-4.

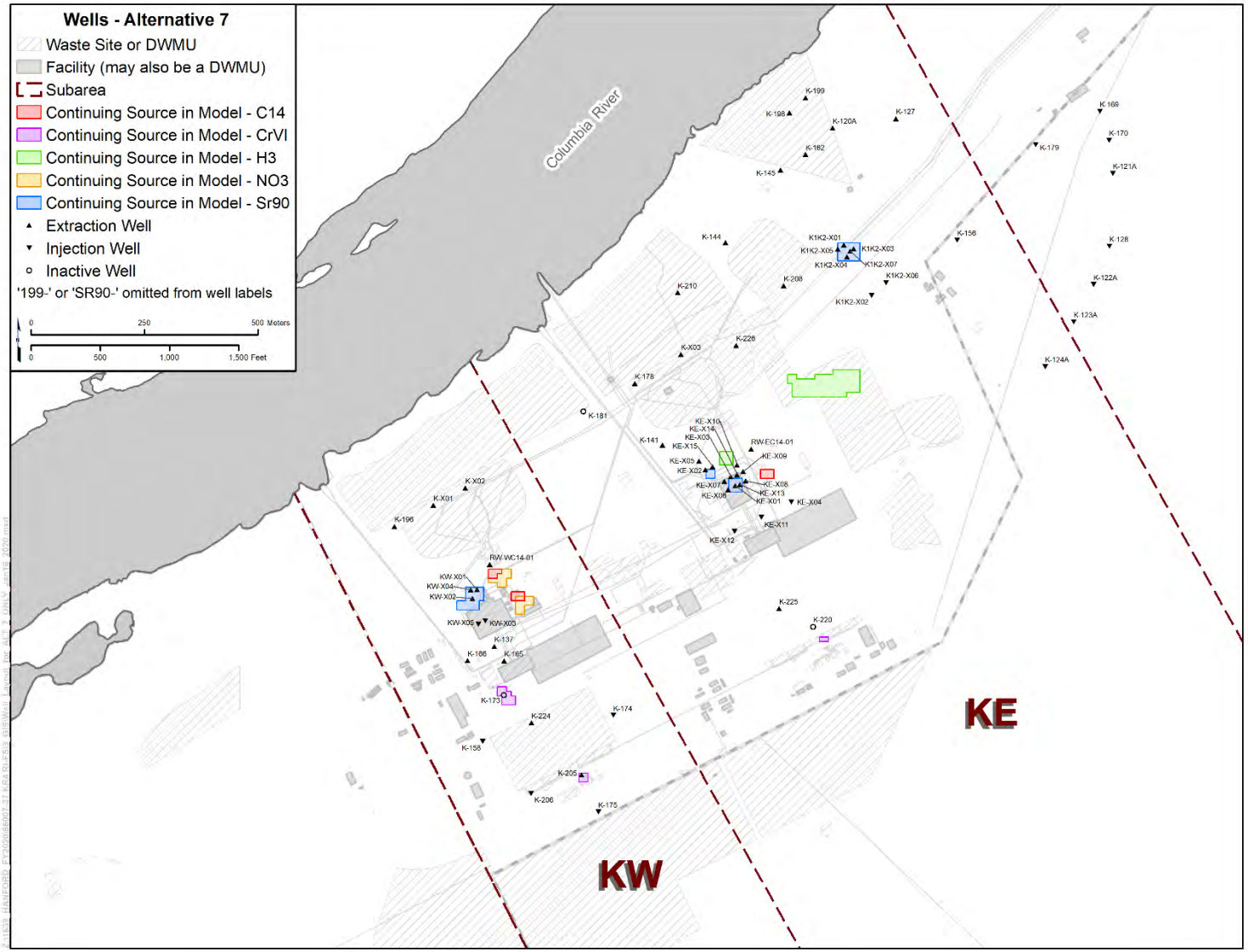

Figure 3-7. System Configuration – Alternative 7

Table 3-6. Names, Geographic Coordinates, and Extraction and Injection Rates of Proposed Wells – Alternative 7

Name	Type	System	Easting	Northing	2033-2122
SR90-KW-X01	E[a]	KW	568615.00	146500.00	(20.00)[b,c]
SR90-KW-X02	E	KW	568605.00	146480.00	(20.00)
SR90-KW-X03	I	KW	568633.00	146431.00	30.00
SR90-KW-X04	E	KW	568601.00	146499.00	(20.00)
SR90-KW-X05	I	KW	568618.00	146423.00	30.00
SR90-KE-X01	E	KW	569185.00	146729.00	(20.00)
SR90-KE-X02	E	KW	569119.00	146764.00	(20.00)
SR90-KE-X03	E	KW	569175.00	146749.00	(20.00)
SR90-KE-X04	I	KW	569308.00	146693.00	80.00
SR90-KE-X05	E	KW	569105.00	146783.00	(20.00)
SR90-KE-X06	E	KW	569169.00	146720.00	(20.00)
SR90-KE-X07	E	KW	569161.00	146739.00	(20.00)
SR90-KE-X08	E	KW	569208.00	146740.00	(20.00)
SR90-KE-X09	E	KW	569202.00	146760.00	(20.00)
SR90-KE-X10	E	KW	569189.00	146775.00	(20.00)
SR90-KE-X11	I	KW	569242.00	146659.00	80.00
SR90-KE-X12	I	KW	569183.00	146628.00	80.00
SR90-KE-X13	E	KW	569195.00	146732.00	(20.00)
SR90-KE-X14	E	KW	569189.00	146753.00	(20.00)
SR90-KE-X15	E	KW	569135.00	146771.00	(20.00)
SR90-K1K2-X01	E	KW	569424.00	147260.00	(20.00)
SR90-K1K2-X02	I	KW	569485.00	147149.00	50.00
SR90-K1K2-X03	E	KW	569446.00	147252.00	(20.00)
SR90-K1K2-X04	E	KW	569431.00	147234.00	(20.00)
SR90-K1K2-X05	E	KW	569411.00	147251.00	(20.00)
SR90-K1K2-X06	I	KW	569517.00	147177.00	50.00
SR90-K1K2-X07	E	KW	569438.00	147247.00	(20.00)

a. E: extraction; I: injection.

b. Pumping rates in gallons per minute.

c. Negative values indicate extraction.

3.2.2 Advective-Dispersive-Reactive Transport Parameters

The migration of Cr(VI), carbon-14, nitrate, strontium-90, TCE and tritium, in response to current and projected extraction and injection well operations, natural and anthropogenic areal recharge, and mass loadings into the aquifer due to continuing sources in the PRZ, was simulated to support remedy design evaluations.

Advective-dispersive-reactive transport is simulated using transport parameters listed in Table 3-7, as discussed in CP-61711.

Table 3-7. Contaminant Transport Parameter Values

Parameter	Value
Bulk Density, ρ_b (kg/m^3)	1,720
Mobile water content, θ_m (m^3/m^3)	0.18
Cr(VI) soil-water partitioning coefficient for mobile domain, K_d (m^3/Kg)	N/A
Cr(VI) first-order decay rate for the dissolved (liquid) phase (day^{-1})	N/A
Cr(VI) first-order decay rate for the sorbed phase (day^{-1})	N/A
Carbon-14 soil-water partitioning coefficient for mobile domain, K_d (m^3/Kg)	0.0
Carbon-14 first-order decay rate for the dissolved (liquid) phase (day^{-1})	3.311E-07
Carbon-14 first-order decay rate for the sorbed phase (day^{-1})	3.311E-07
Nitrate soil-water partitioning coefficient for mobile domain, K_d (m^3/Kg)	N/A
Nitrate first-order decay rate for the dissolved (liquid) phase (day^{-1})	N/A
Nitrate first-order decay rate for the sorbed phase (day^{-1})	N/A
Strontium-90 soil-water partitioning coefficient for mobile domain, K_d (m^3/Kg)	0.012
Strontium-90 first-order decay rate for the dissolved (liquid) phase (day^{-1})	6.5169E-05
Strontium-90 first-order decay rate for the sorbed phase (day^{-1})	6.5169E-05
TCE soil-water partitioning coefficient for mobile domain, K_d (m^3/Kg)	N/A
TCE first-order decay rate for the dissolved (liquid) phase (day^{-1})	N/A
TCE first-order decay rate for the sorbed phase (day^{-1})	N/A
Tritium soil-water partitioning coefficient for mobile domain, K_d (m^3/Kg)	0.0
Tritium first-order decay rate for the dissolved (liquid) phase (day^{-1})	1.540E-04
Tritium first-order decay rate for the sorbed phase (day^{-1})	0.0

3.2.3 Continuing Sources

A detailed description of the development and model implementation of continuing sources considered in these evaluations is provided in CP-61711. A detailed discussion on the calculation of mass-release time series from each source and the development of associated SSM Packages as inputs to the transport model for each COC and scenario is provided in ECF-100KR4-18-0019.

Figures 3-8 to 3-12 present maps of the model cells representing continuing sources.

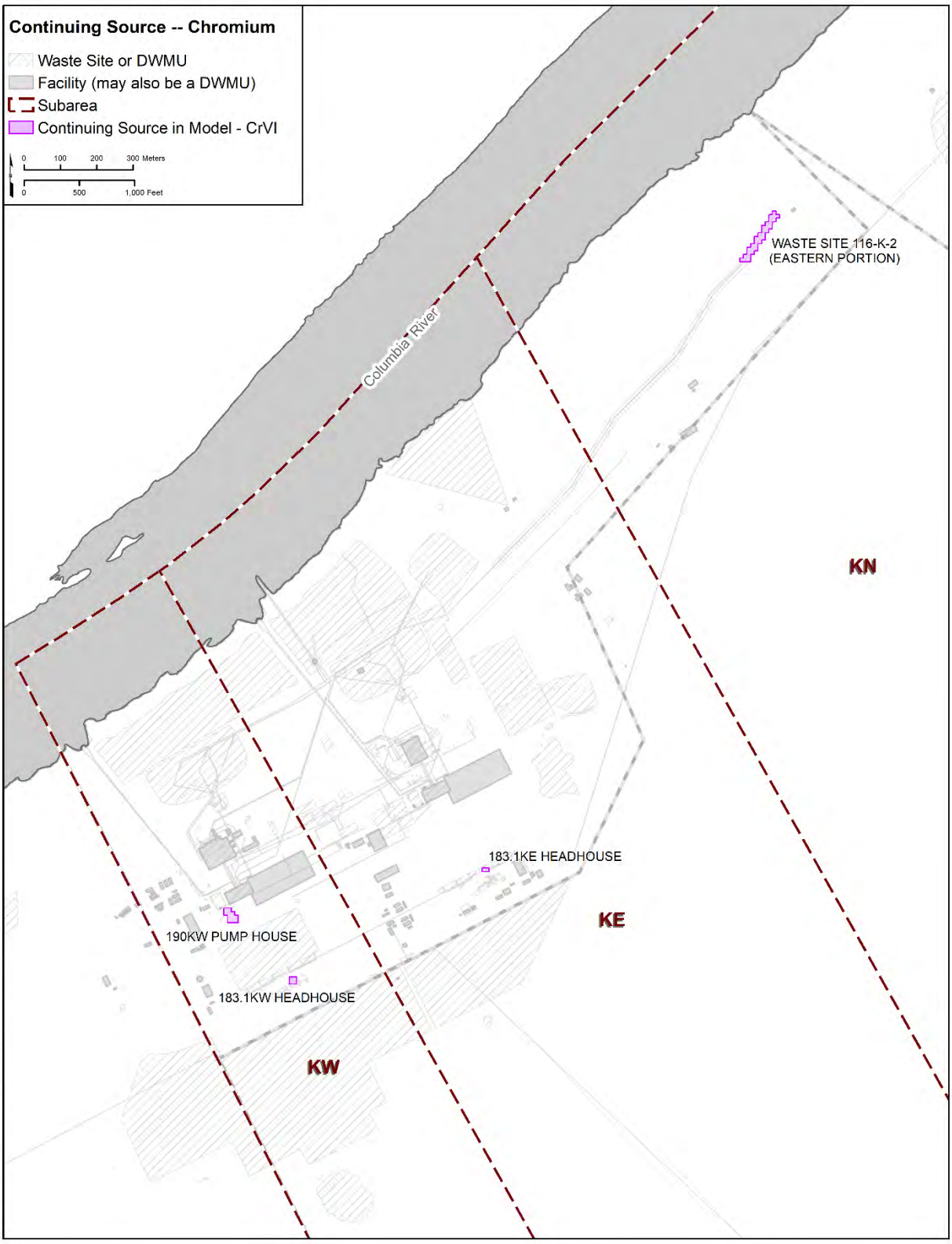

Figure 3-8. Model Cells Representing Continuing Source Locations for Cr(VI)

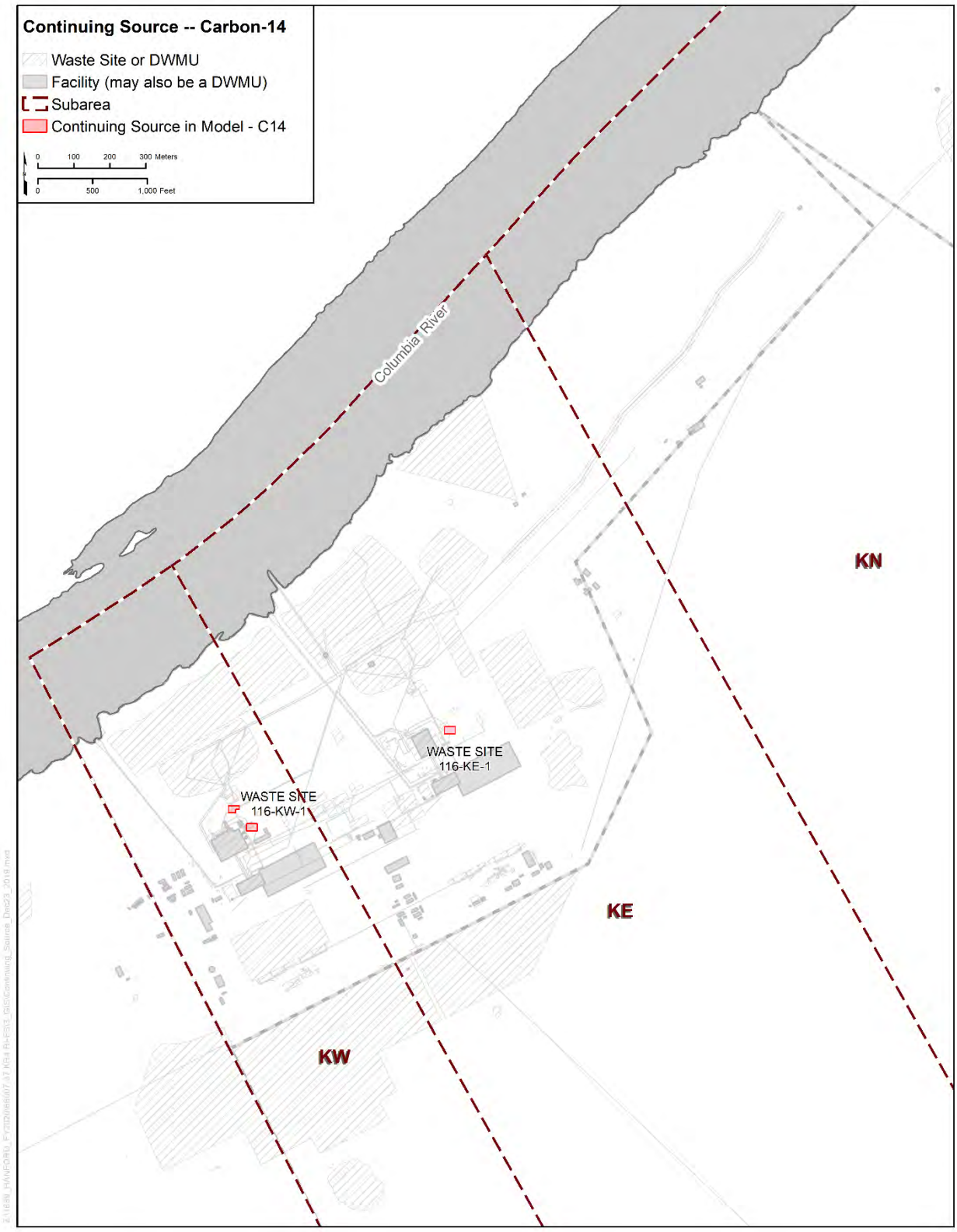

Figure 3-9. Model Cells Representing Continuing Source Locations for Carbon-14

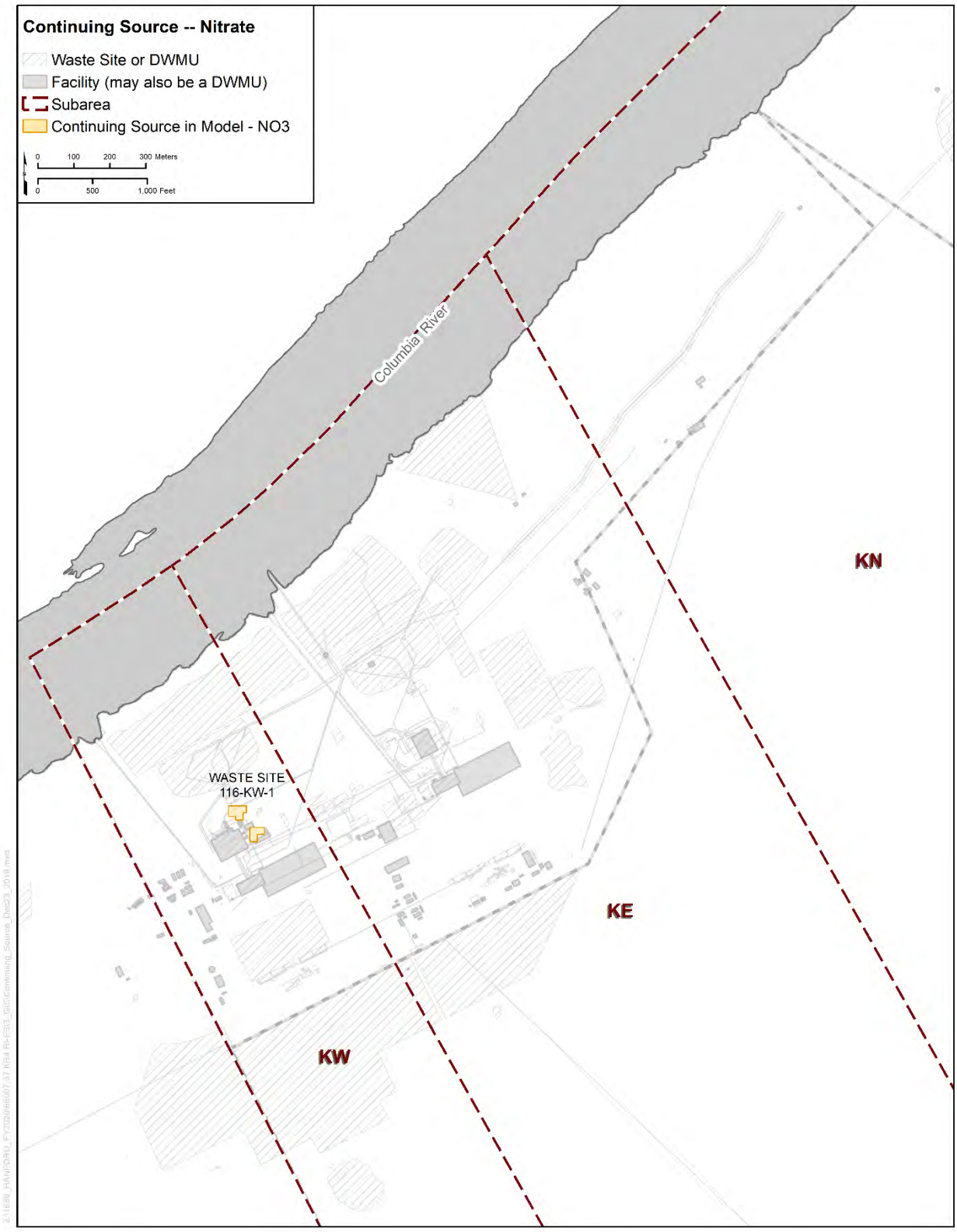

Figure 3-10. Model Cells Representing Continuing Source Locations for Nitrate

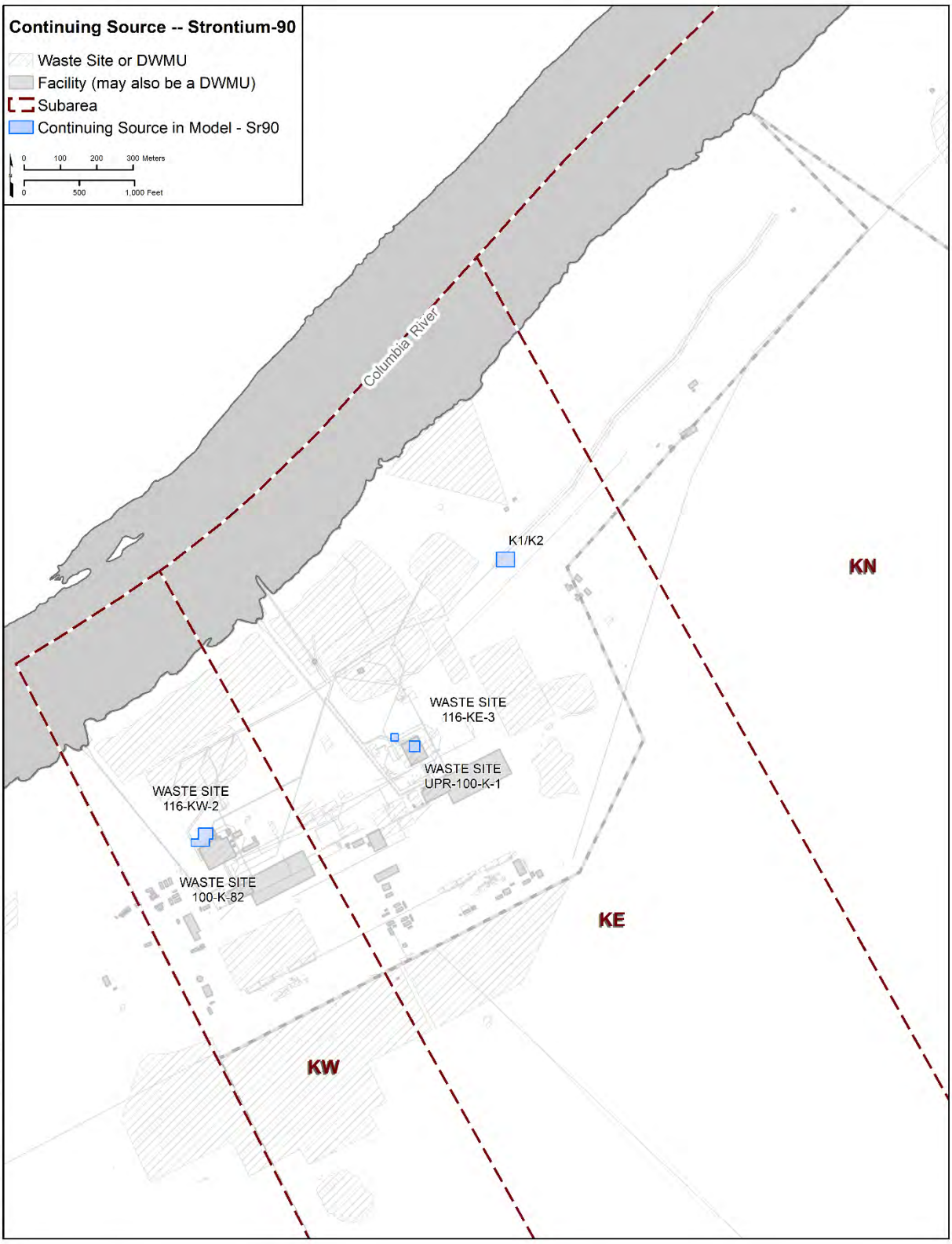

Figure 3-11. Model Cells Representing Continuing Source Locations for Strontium-90

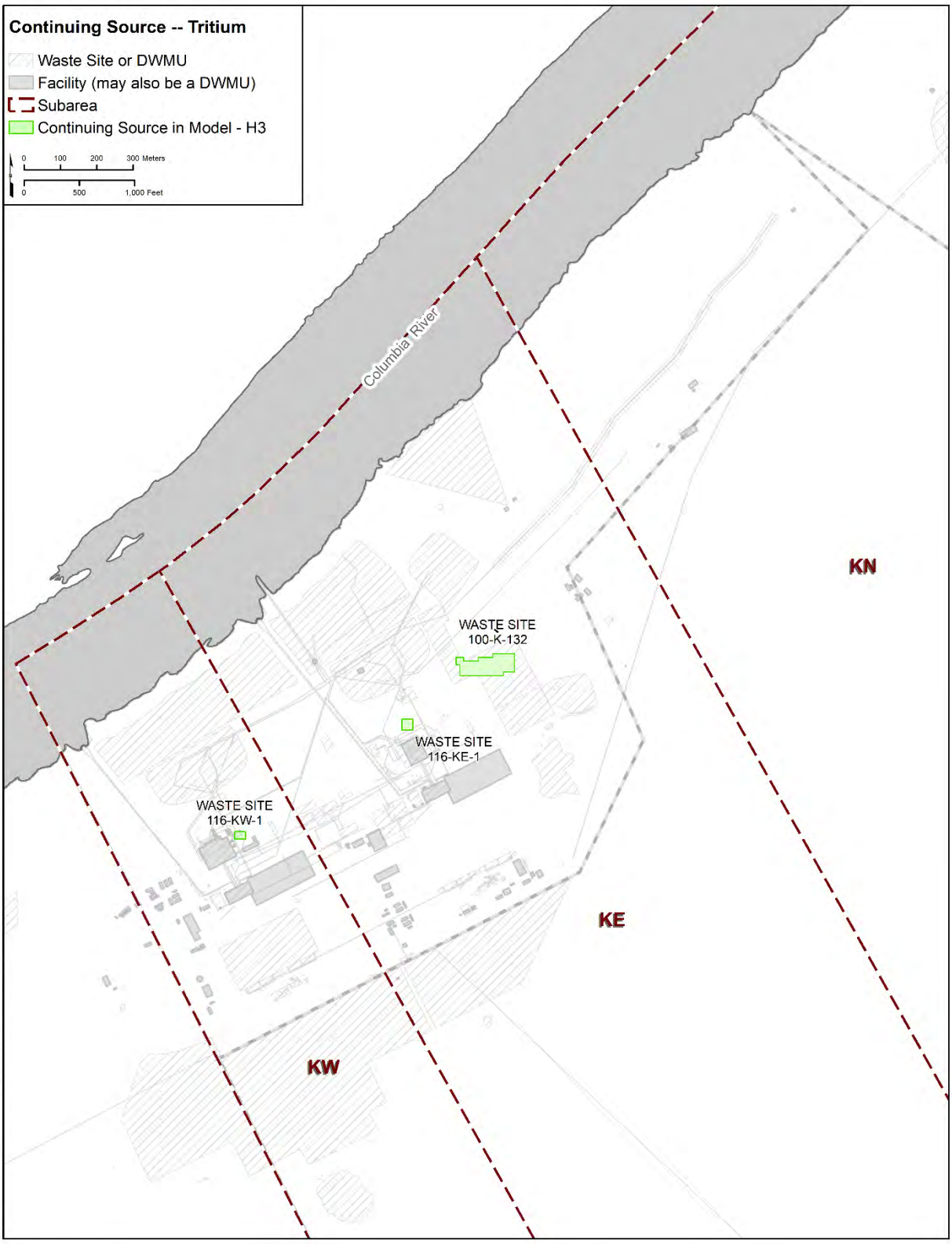

Figure 3-12. Model Cells Representing Continuing Source Locations for Tritium

3.2.4 Soil Flushing

Soil flushing is applied at Cr(VI) and carbon-14 continuing sources. Details about the soil-flushing flow rates at each continuing source are provided below.

3.2.4.1 Cr(VI)

The overall KW system capacity is about 330 gal/min. The design of the treatability test in KW assumed an initial infiltration rate of about 265 gal/min, over an area of approximately 50,000 ft^2, or 4,645 m^2. In the groundwater model, the equivalent area corresponding to continuing sources in KW is represented by 4 model cells at the 183.1 KW Headhouse. Even though the treatability test design area is much larger than the corresponding continuing-source area represented in the model, soil flushing in the model is applied only at the continuing-source model cells to ensure that the entire flushing volume is applied to the continuing source mass in the PRZ, and not a larger area that would encompass model cells without continuing-source mass. Therefore, it was assumed that the total available volume of water would be equally distributed to each model cell, producing an assumed infiltration rate of about 66.25 gal/min for each cell representing a continuing source in KW. Flushing at that source area was assumed to occur uninterruptedly for an entire year during 2020, 2023, and 2026.

The 190KW Pump House source area is represented by 11 model cells for about 65 gal/min of remaining total infiltration rate. Therefore, for equally distributed flow to the 11 model cells, the flow rate per model cell is about 5.91 gal/min. Flushing at that source area was assumed to occur uninterruptedly for an entire year during 2020, 2023, and 2026.

In KE there are two model cells representing the continuing source at the 181.1KE Headhouse. A total flow rate of 35 is assumed to be diverted from the KW treatment system for flushing of that source, for an infiltration rate of 17.5 gal/min per model cell. Flushing at that source was assumed to occur for one year in 2021.

Flushing of the 116-K-2 Cr(VI) source occurs for one year during 2022, using 15 gal/min distributed over 32 model cells, for a flow rate of about 0.47 gal/min per cell.

It should be noted that the treatability test design incorporates pH enhancement of treatment-plant effluent water, which should more efficiently mobilize Cr(VI) in the vadose zone. However, implementation of soil-flushing in the groundwater model only reflects displacement of Cr(VI) mass in the vadose zone, without incorporating pH enhancement effects. Hence, the simulated soil-flushing illustrates hydraulic effects only and it should be considered a conservative estimate of the anticipated additional effect that pH enhancements should have on Cr(VI) mobilization.

3.2.4.2 Carbon-14

Flushing of carbon-14 continuing sources in KW and KE is performed using water from the KW treatment system. In KW, the carbon-14 continuing source at 116-KW-1 comprises 11 model cells. Flushing assumes a total flow rate of 20 gal/min, resulting in an infiltration rate of about 1.82 gal/min per model cell.

In KE, the carbon-14 continuing source at 116-KE-1 comprises 6 model cells. Flushing assumes a total flow rate of 10 gal/min, resulting in an infiltration rate of about 1.67 gal/min per model cell.

3.2.5 Contaminant Treatment

Continuous treatment is implemented for Cr(VI) during P&T operations, at the KW, KR4, and KX treatment plants. It is assumed that the IX vessels remove Cr(VI) to a typical effluent concentration of 1.5 µg/L.

As mentioned in Section 2.2.1, strontium-90 treatment under Alternative 7 assumes concentration reduction at 80% efficiency through a radiological treatment process. This treatment efficiency is derived from strontium-90 treatment options evaluated in DOE/RL-95-110, *N-Springs Expedited Response Action Performance Evaluation Report*. There, operation of the clinoptilolite IX system showed that treatment of strontium-90 contaminated groundwater to the 8 pCi/L drinking water standard was not possible. During its 10 years of operation, the average strontium-90 influent concentration of 2,020 pCi/L was treated to an average effluent concentration of 380 pCi/L (81% removal efficiency, Table 2-6) prior to aquifer reinjection. As a divalent cation, strontium-90 competes with naturally occurring calcium and magnesium (also divalent cations) present in the extracted groundwater for sorption sites on IX resin, making treatment to the 8 pCi/L drinking water standard technically infeasible.

Hence, for the purposes of the evaluations for Alternative 7, a treatment efficiency of 80% was assumed for strontium-90. Implementation of this treatment option in the transport model is discussed in Section 3.2.6.

3.2.6 Treatment System Recirculation

The groundwater transport model was configured to simulate the circulation of extracted COCs (i.e., carbon-14, nitrate, strontium-90, tritium, and TCE) that are not actively removed by the treatment system. It is assumed that for those contaminants, groundwater that is recovered at the extraction wells is combined and then passes untreated through the treatment system. The combined water is then returned to the aquifer via the P&T injection wells. Combining the extracted water occurs within the above-ground treatment system so that the effluent concentration is generally lower (more dilute) than the highest influent concentration measured at the wellhead. This movement of contaminants through a P&T system is simulated using the Contaminant Treatment System (CTS) package implemented in MT3DMS (Bedekar et al., 2011, “Implementation of a Contaminant Treatment System (CTS) Module in MT3DMS”).

Under Alternative 7, the CTS package was configured to simulate strontium-90 treatment, for the wells included in the focused configuration addressing the strontium-90 plumes only, operating after the initial 15-year design period of the main P&T system. During this process, water contaminated with strontium-90 that is recovered at the extraction wells is combined, passes through the treatment system where concentrations are reduced to 80% of the influent concentrations via radiological treatment, and the effluent is then returned to the groundwater domain via injection wells.

3.2.7 Wellhead Treatment

Wellhead treatment is included in the designs for carbon-14. However, implementation of wellhead treatment at individual wells in the model is a tedious and labor-intensive process and is not included in the model simulations. Omitting the implementation of wellhead treatment in the model simulations does not impact the projected carbon-14 distribution in the aquifer given that:

- Carbon-14 recovery occurs primarily in the downgradient portions of KW and KE.
- Combined carbon-14 concentrations are below the applicable standard of 2,000 pCi/L, except for a brief exceedance of this threshold before the proposed configurations are fully implemented.
- Reinjection of the combined influent occurs mainly at inland locations that do not impact the delineation or migration of the carbon-14 plume. Also, after the first year of simulation, the simulated combined influent concentrations are below the 2,000 pCi/L standard.

3.3 Initial Distribution of COCs

The initial distribution of each COC in groundwater within the 100-K was obtained from the simulated results of the calibrated model in 100-K at the end of 2017.

Figures 3-13 through 3-18 show the initial distribution of Cr(VI), carbon-14, nitrate, strontium-90, TCE, and tritium, respectively, as used in the predictive model simulations.

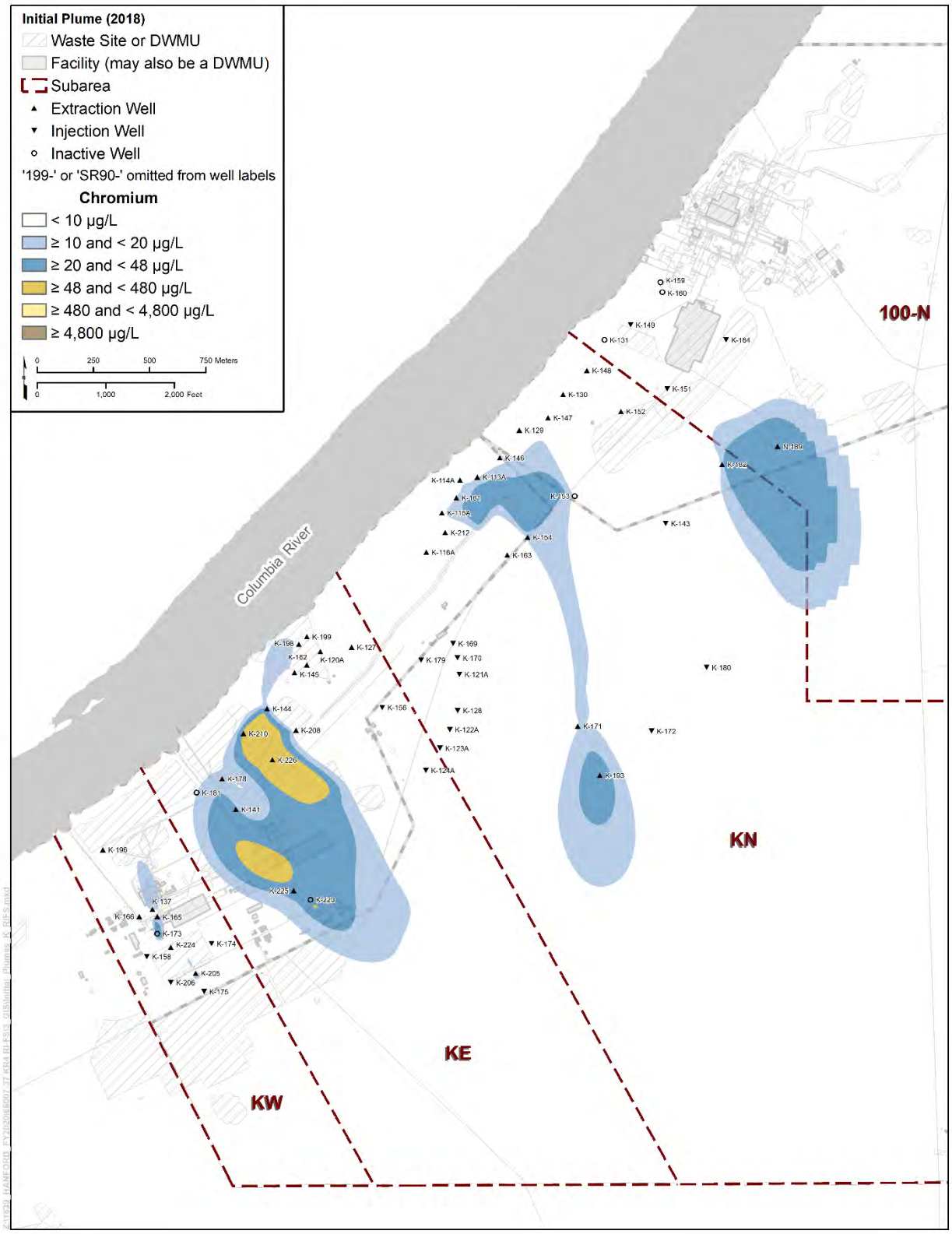

Figure 3-13. Initial Cr(VI) Distribution in 100-KR-4

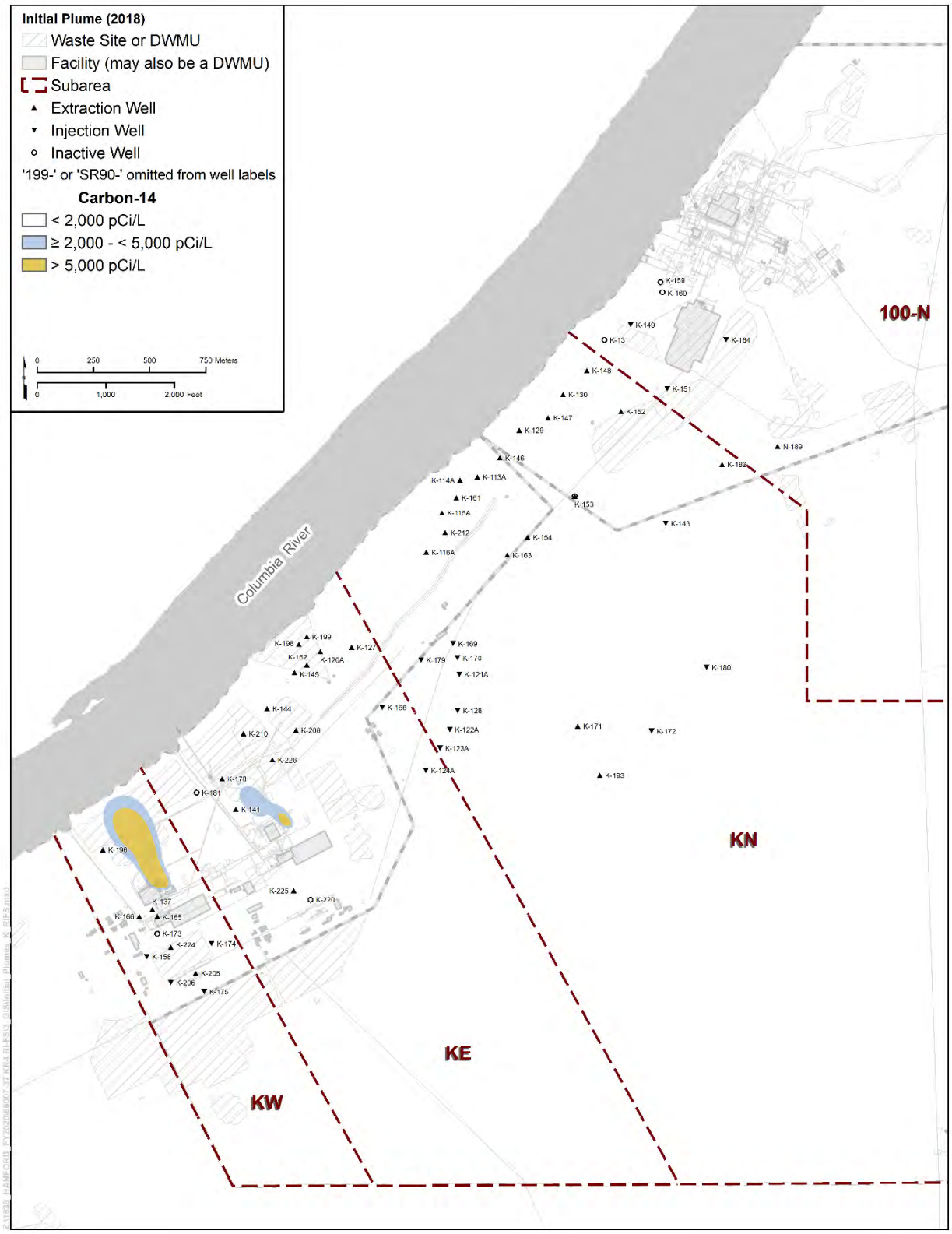

Figure 3-14. Initial Carbon-14 Distribution in 100-KR-4

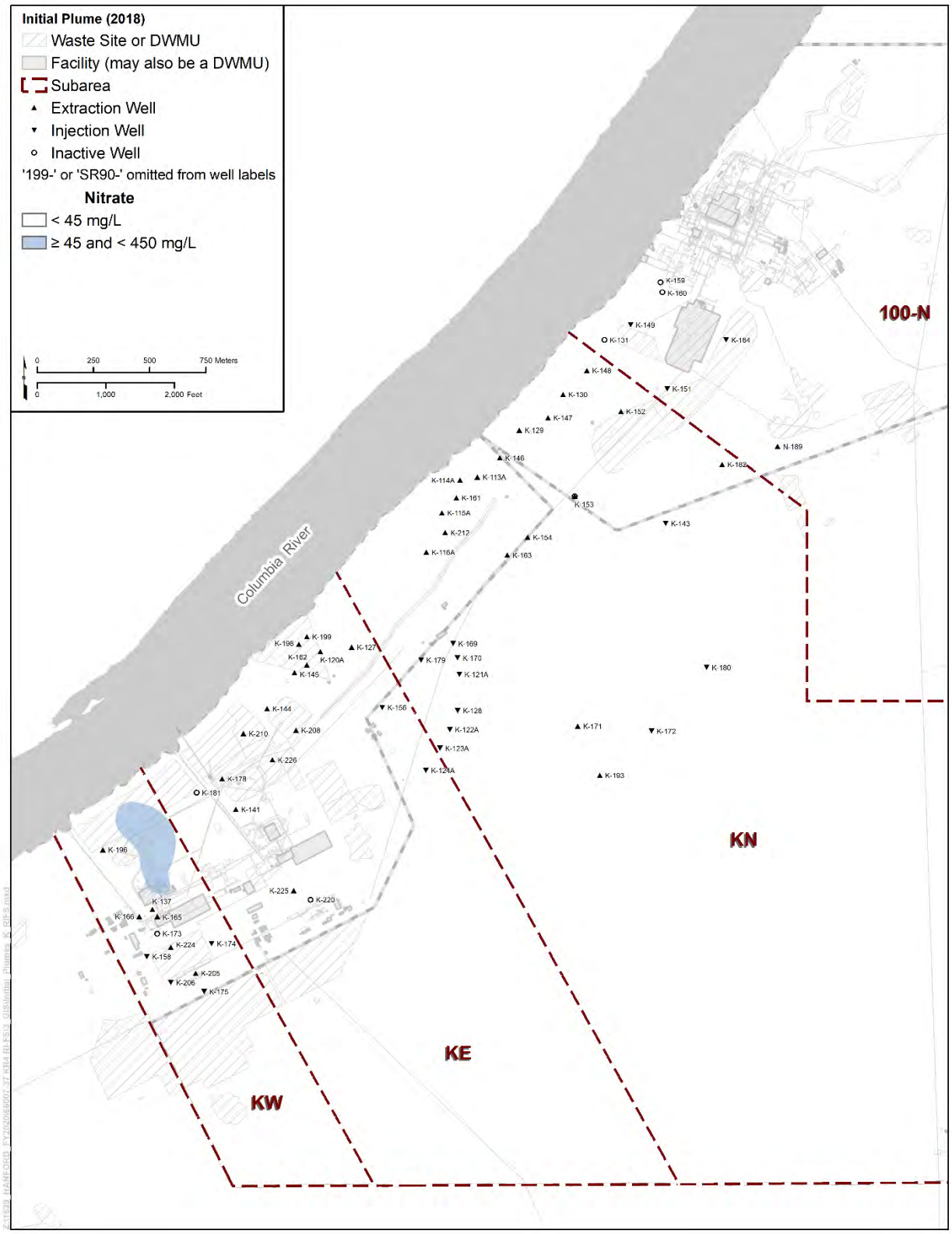

Figure 3-15. Initial Nitrate Distribution in 100-KR-4

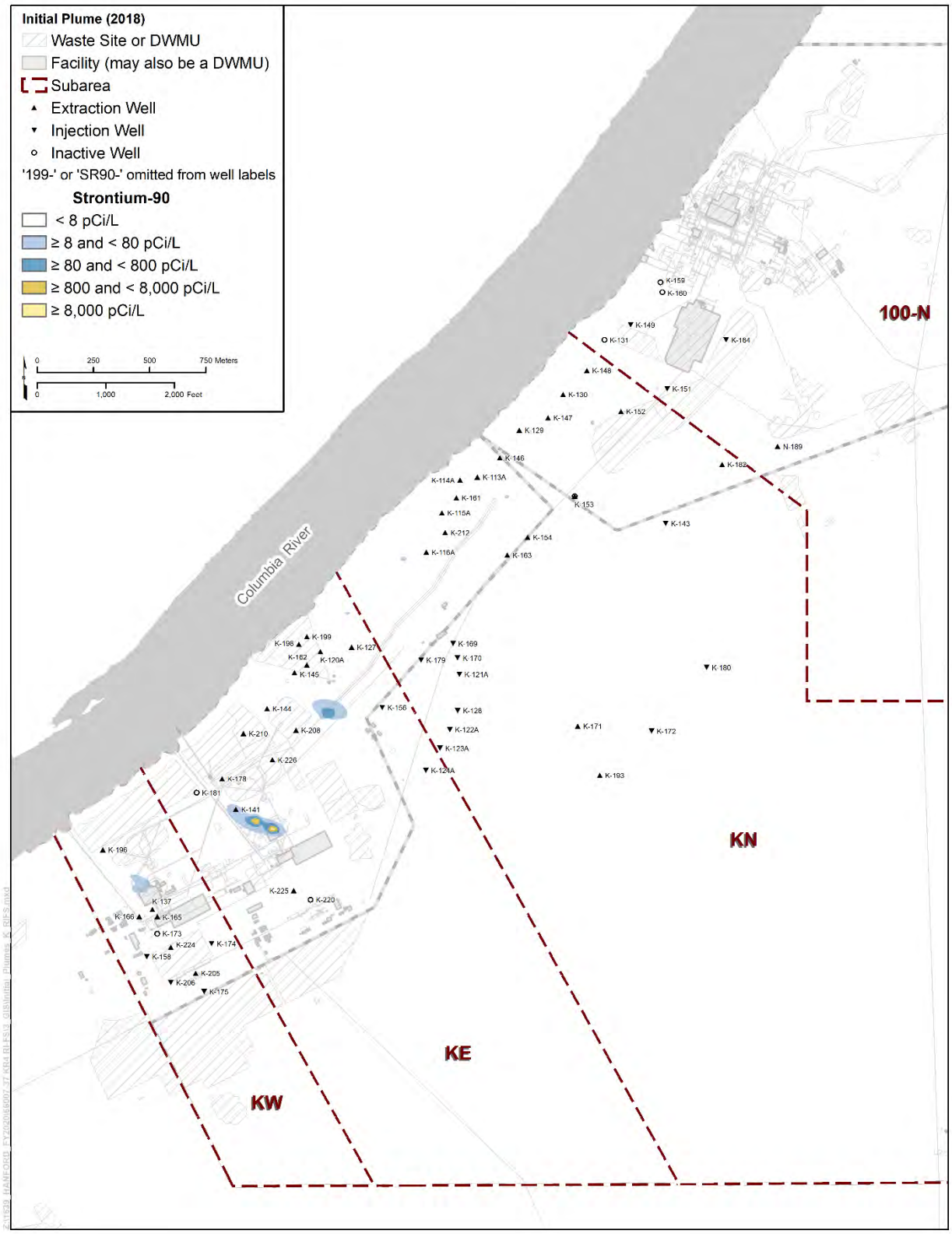

Figure 3-16. Initial Strontium-90 Distribution in 100-KR-4

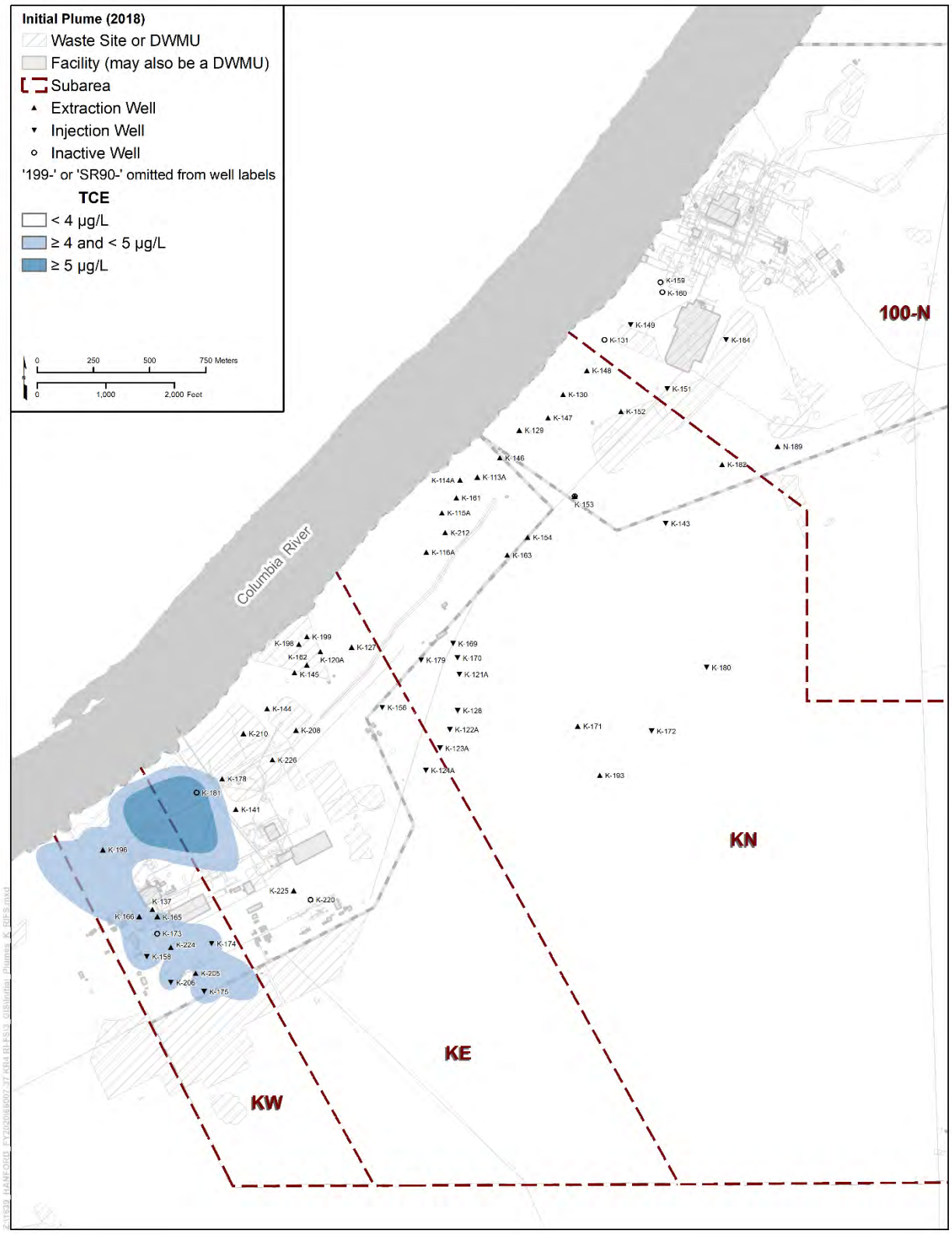

Figure 3-17. Initial TCE Distribution in 100-KR-4

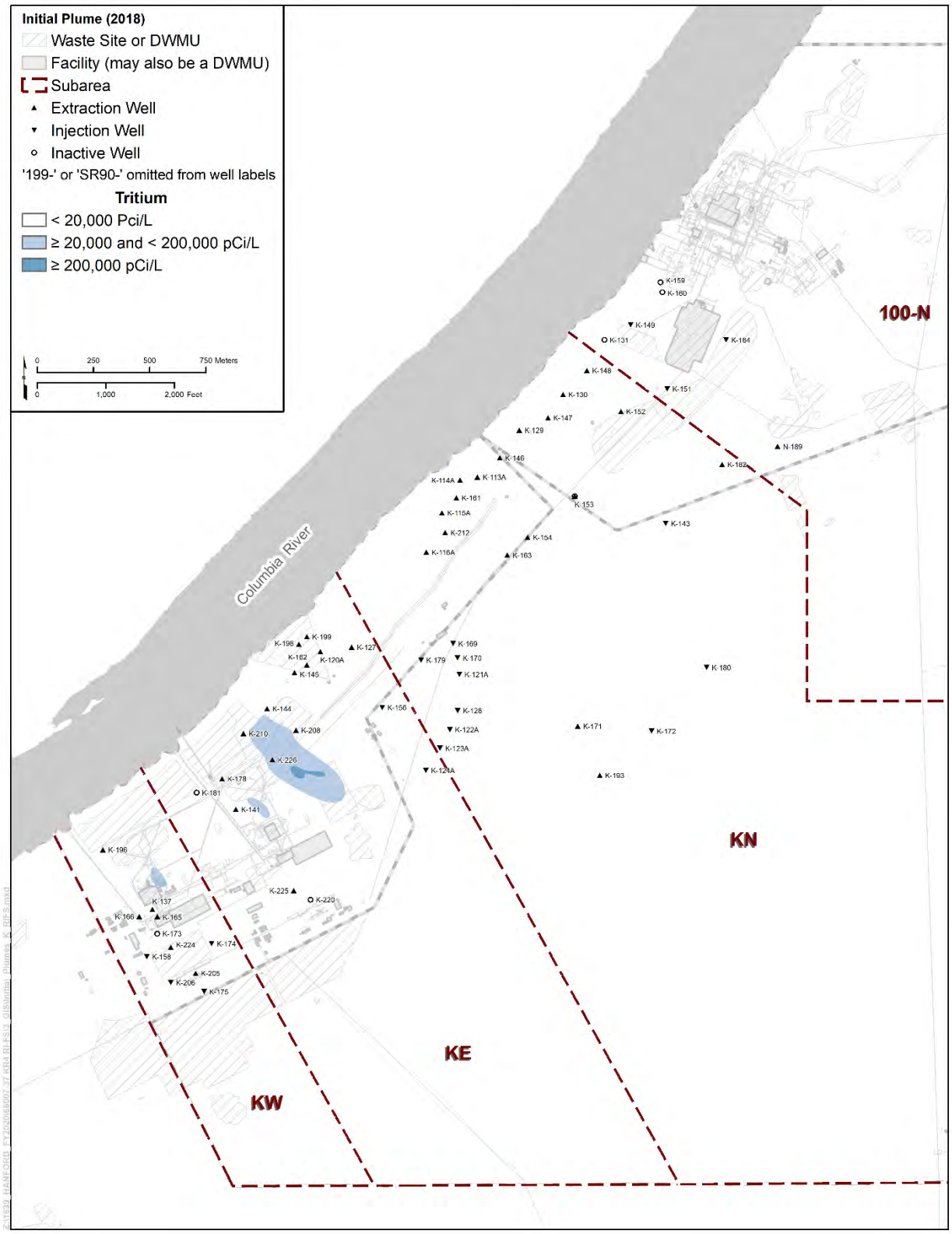

Figure 3-18. Initial Tritium Distribution in 100-KR-4

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4 Software Applications, Descriptions, Installation and Checkout, and Statements of Validity

Software use for this calculation was in accordance with PRC-PRO-IRM-309, *Controlled Software Management*.

4.1 Approved Software

The following software was used to perform calculations and was approved and compliant with PRC-PRO-IRM-309. This software is managed under the following documents consistent with PRC-PRO-IRM-309:

- CHPRC-00257, *MODFLOW and Related Codes Functional Requirements Document*
- CHPRC-00258, *MODFLOW and Related Codes Software Management Plan*
- CHPRC-00259, *MODFLOW and Related Codes Software Test Plan*
- CHPRC-00260, *MODFLOW and Related Codes Requirements Traceability Matrix*
- CHPRC-00261, *MODFLOW and Related Codes Acceptance Test Report*

CHPRC-00258 distinguishes between safety software and support software based on whether the managed software calculates reportable results or provides run support, visualization, or other similar functions. Following are brief descriptions of the software.

4.1.1 MODFLOW (Controlled Calculation Software)

- Software Title: MODFLOW-2000 (Harbaugh et al., 2000); solves transient groundwater flow equations using the finite-difference discretization technique.
- Software Version: Version 1.19.01 modified by S.S. Papadopulos & Associates, Inc. (SSP&A) to address dry cell issues and to use the Orthomin solver; approved as CHPRC Build 8 using the executable “mf2k-mst-chprc08dpv.exe” compiled to default double precision for real variables and optimized for speed. The MD5 Hash for this executable file is “4E7F29DD5496D2CBA7144ADACB13DAAD.”
- Hanford Information Systems Inventory (HISI) Identification Number: 2517 (Safety Software, graded Level C).
- Workstation type and property number (from which software is run): S.S. Papadopulos and Assoc., Inc., FE483.

4.1.2 MT3DMS (Controlled Calculation Software)

- Software Title: MT3DMS (Zheng and Wang, 1999), MT3DMS (Zheng, 2010).
- Software Version: Version 5.3 modified by SSP&A to address dry cell issues; approved as CHPRC Build 8 using executable “mt3d-mst-chprc08dpv.exe” compiled to default double precision for real variables and optimized for speed. The MD5 Hash for this executable file is “5C61432D2C898E83DDFE242C52A755AB.”
- HISI Identification Number: 2518 (Safety Software, graded Level C).
- Workstation type and property number (from which software is run): SSP&A, FE483.

4.2 Support Software

The following programs are classified as Support Software.

4.2.1 MODFLOW Suite Support Software

- **Groundwater Vistas™:** (Rumbaugh and Rumbaugh, *Groundwater Vistas Version 6*) provided graphical tools used for model quality assurance and model input/output review.

- **ArcGIS™:** (Mitchell, 1999, *The ESRI Guide to GIS Analysis Volume 1: Geographic Patterns & Relationships*) provided visualization tool for assessing simulated plume distributions, identifying extraction/injection well coordinates, and mapping auxiliary data.

The following scripts have been developed internally:

- **ALLOCATEQWELL**: Constructs a MODFLOW well package (WEL) or a multi-node well (MNW) package file.

- **READBIN_WRITEASC**: Reads binary output files generated by MODFLOW or MT3D and creates ASC files for plotting the spatial distribution of heads or concentrations, respectively.

- **READOUTGETMNW2NODES**: Constructs the MT3D recirculation input file (CTS Package) based on the flow model solution and MNW2 structure.

- **REWRITECTS SUITE:** reads CTS Package and applies 80% treatment to combined concentrations from wells included in the focused strontium-90 well configuration under Alternative 6.

- **CONCSTAT**: Reads MODFLOW/MT3D output files and calculates concentration timeseries, including maximum concentration in the aquifer and shoreline.

- **CONCSTAT_90**: Reads MODFLOW/MT3D output files and calculates concentration timeseries, including 90th percentile concentration in the aquifer and shoreline.

4.3 Software Installation and Checkout

Safety Software is checked out in accordance with procedures specified in CHPRC-00258. Executables are obtained from the CHPRC software owner who maintains the configuration managed copies in MKS Integrity™, installation tests identified in CHPRC-00259 performed and successful installation confirmed, and Software Installation and Checkout Forms are required and must be approved for installations used to perform model runs. Approved Users are registered in HISI for safety software. Copies of the Software Installation and Checkout Forms are provided in Appendix A of this ECF.

4.3.1 Statement of Valid Software Application

- The previously identified software was used consistent with intended use for CHPRC as identified in CHPRC-00257 and is a valid use of this software for the problem addressed in this application.

- The software was used within its limitations as identified in CHPRC-00257.

™Groundwater Vistas is a trademark of Environmental Simulations Incorporated, Reinholds, Pennsylvania.
™ArcGIS is a trademark of ESRI, Redlands, California.
MKS Integrity™ is a trademark of Parametric Technology Corporation, Waterloo, Canada.

4.3.2 Statement of Valid Software Application

- The previously identified software was used consistent with intended use for CHPRC as identified in CHPRC-00257 and is a valid use of this software for the problem addressed in this application.
- The software was used within its limitations as identified in CHPRC-00257.

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5 Calculation

The 100-K Area groundwater flow and contaminant transport model was used for the simulation of the alternative remedy designs and model results were post-processed to evaluate system performance under each alternative. Upon completion of model simulations for all alternatives and COCs and post-processing of the model results, the following maps and graphs were constructed to provide the basis for evaluation of system performance:

1. Maps depicting the simulated spatial distribution of each COC at different timeframes, based on the maximum concentration in each model cell across all layers. Maps are not shown if the COC was not present in the aquifer at concentrations above the corresponding applicable standard, listed in Table 5-11.
2. Timeseries plots of concentration statistics for each alternative and COC.
3. Timeseries plots of P&T influent concentrations for each COC for Alternatives 1 through 6. No influent concentration timeseries were developed for Alternative 7.

Table 5-1. COC Concentration Statistics – Applicable Standards and Cut-Offs

COC	Applicable Standard	Cut-Off Limit
Cr(VI)	10 µg/L	0.1 µg/L
Nitrate	45 mg/L	0.45 mg/L
Carbon-14	2,000 pCi/L	20 pCi/L
Sr-90	8 pCi/L	0.08 pCi/L
TCE	5 µg/L	0.05 µg/L
Tritium	20,000 pCi/L	200 pCi/L

Statistical calculations were based on the simulated spatial COC distribution as calculated by the model and mapped by post-processing the model outputs. COC concentrations were considered in the calculations based on values at all model cells within geographically defined areas corresponding to KW, KE, KN, and 100-N (Figure 5-1). The extent of the COC spatial distribution was determined at each simulation time-step considering all concentration values, and plume depictions were developed considering the maximum concentration at each model cell across all model layers.

Calculation of concentration statistics at the shoreline were based on model cells within a 200 ft zone parallel to and inland of the high river-stage mark, as determined by the model river cells throughout the simulation timeframe.

Calculated concentration statistics for each subarea aquifer and its corresponding shoreline included the maximum and 90th percentile.

Concentrations above 1% of the applicable standard for each COC were considered for the calculation of the 90th percentile of COC concentration timeseries. This was done to ensure that a realistic representation of the COC plume extents and corresponding concentration statistics are calculated at each time step and that the performance metrics are consistent and directly comparable for each alternative, COC and area. The applicable standard for each COC and the corresponding cut-off limit is listed in Table 5-1.

Influent concentrations reflect mixing of the extracted water from each well and calculation of a combined concentration, based on the effluent concentration at the corresponding extraction well, as calculated by the model. The wells were grouped based on the assigned P&T plant rather than their geographic location.

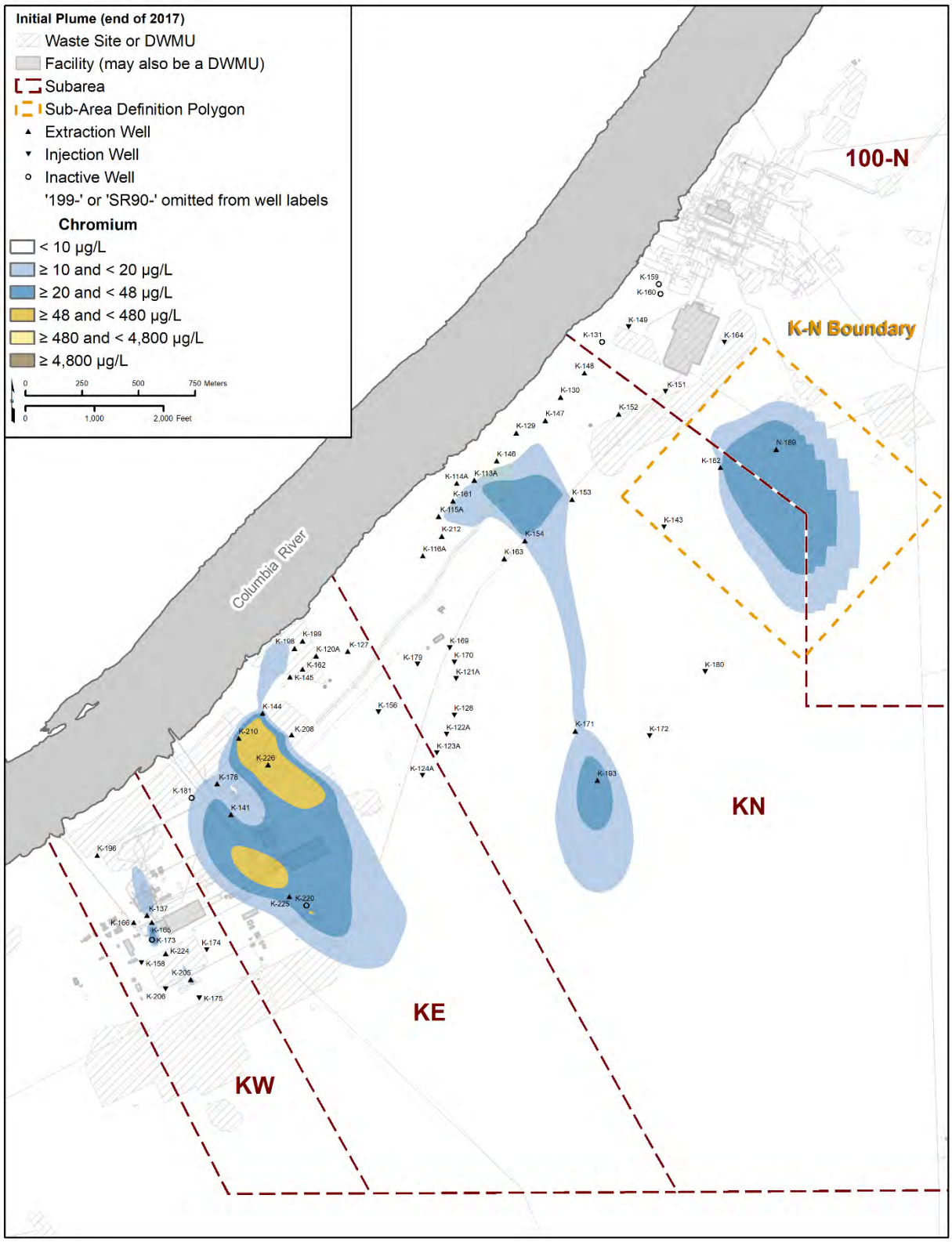

Figure 5-1. Subarea Boundaries for Concentration Statistics

6 Results and Discussion

The results of the calculations outlined in Chapter 5 are provided in the following sections for each COC.

6.1.1 Simulated Contaminant Distribution – Concentration Statistics: Cr(VI)

Results for Cr(VI) are grouped in the following sets of figures:

- Figures 6-1 to 6-42: simulated concentration distributions for each alternative, representing maximum COC concentration across all model layers.
- Figures 6-43 to 6-44: maximum concentration time series for each subarea and overall summary for the entire 100-K OU and the portion of 100-N OU encompassed by the 100-K Area model (all alternatives).
- Figures 6-45 to 6-46: 90th percentile concentration time series for each subarea and overall summary for the entire 100-K OU and the portion of 100-N OU encompassed by the 100-K Area model (all alternatives).
- Figures 6-47 to 6-49: combined influent concentration time series per treatment system for each alternative.

In the time series plots included in this section, results related to the portion of the aquifer encompassed by the model in 100-N are denoted as “NR”.

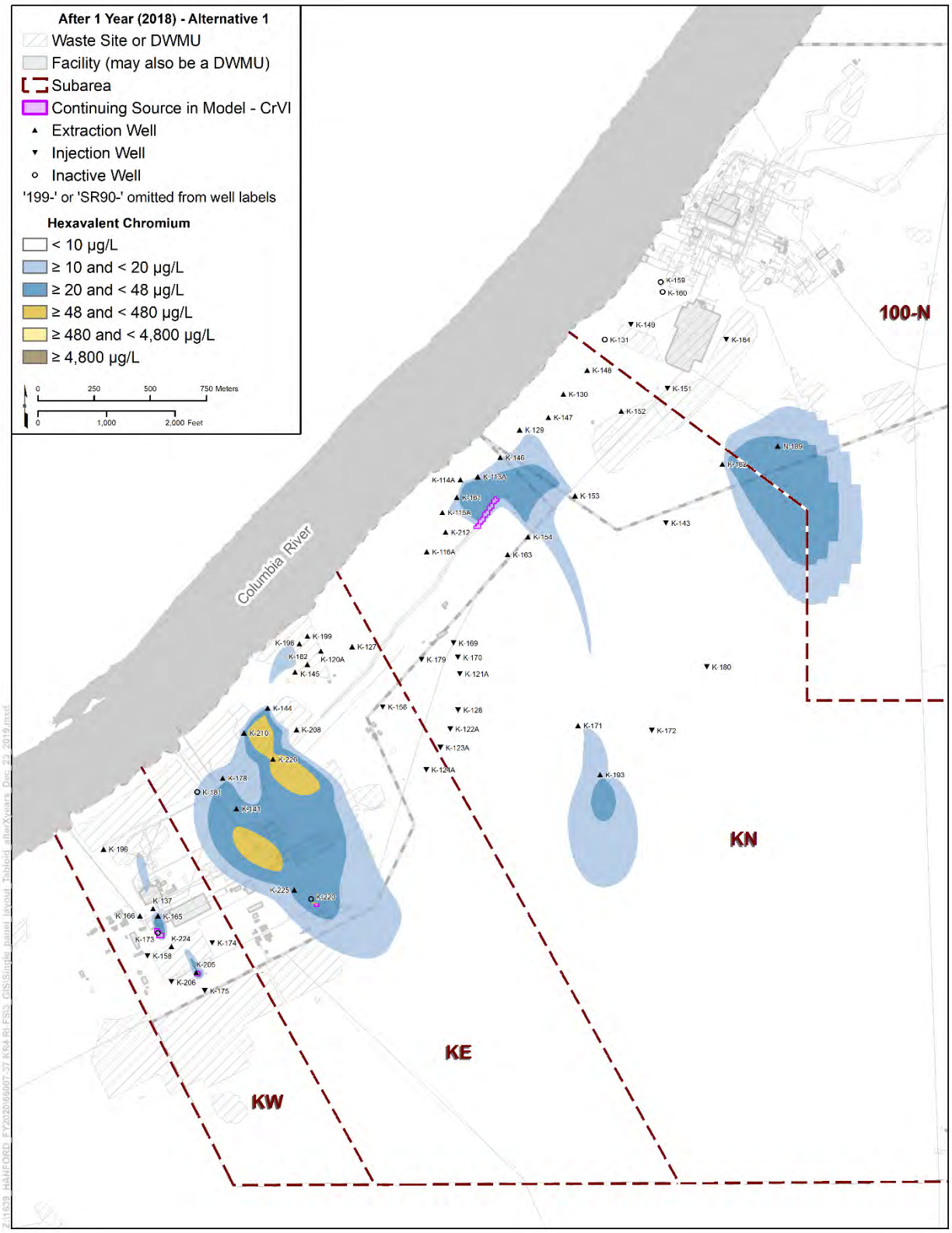

Figure 6-1. Cr(VI): Simulated Distribution after 1 Year (end of 2018) – Alternative 1

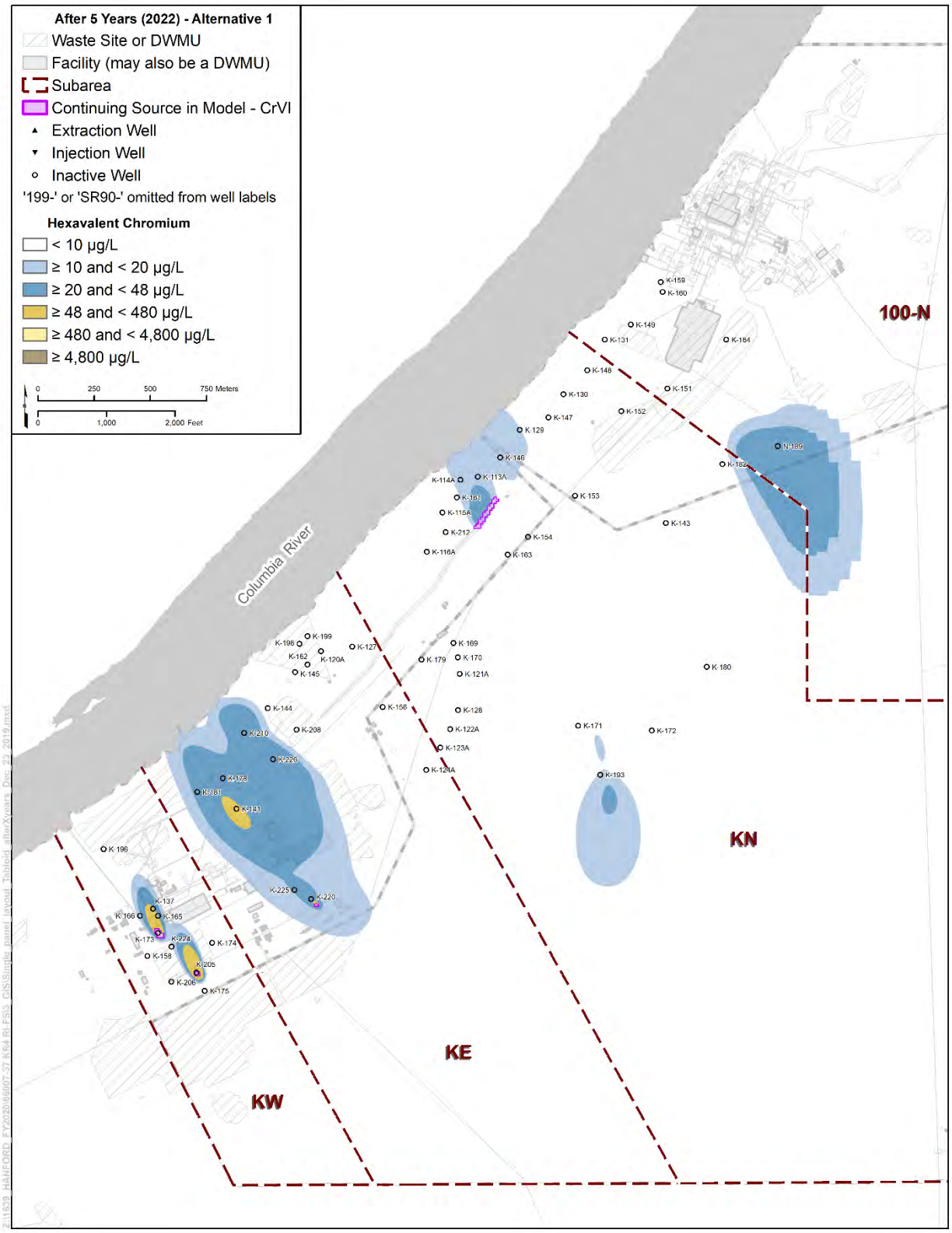

Figure 6-2. Cr(VI): Simulated Distribution after 5 Years (end of 2022) – Alternative 1

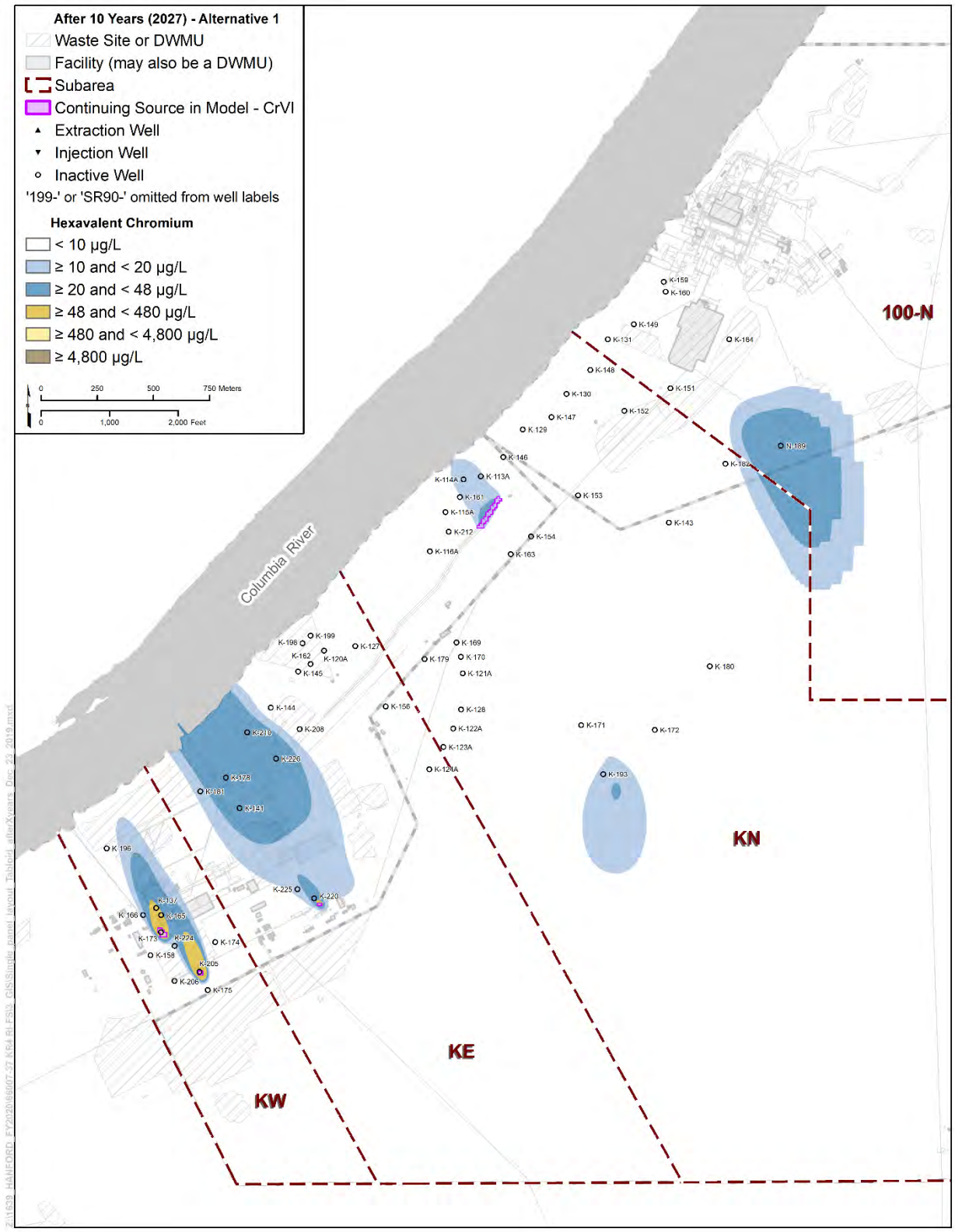

Figure 6-3. Cr(VI): Simulated Distribution after 10 Years (end of 2027) – Alternative 1

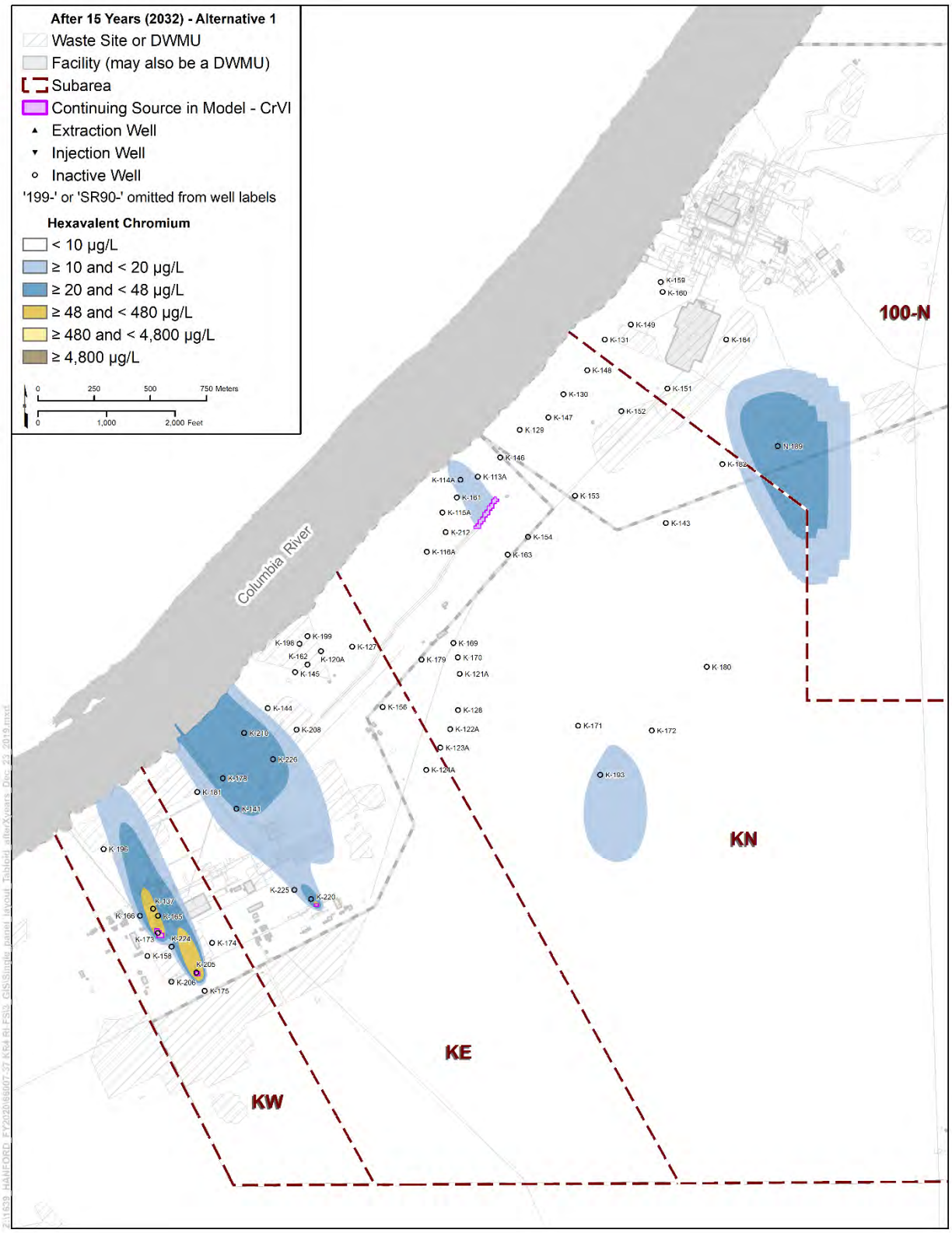

Figure 6-4. Cr(VI): Simulated Distribution after 15 Years (end of 2032) – Alternative 1

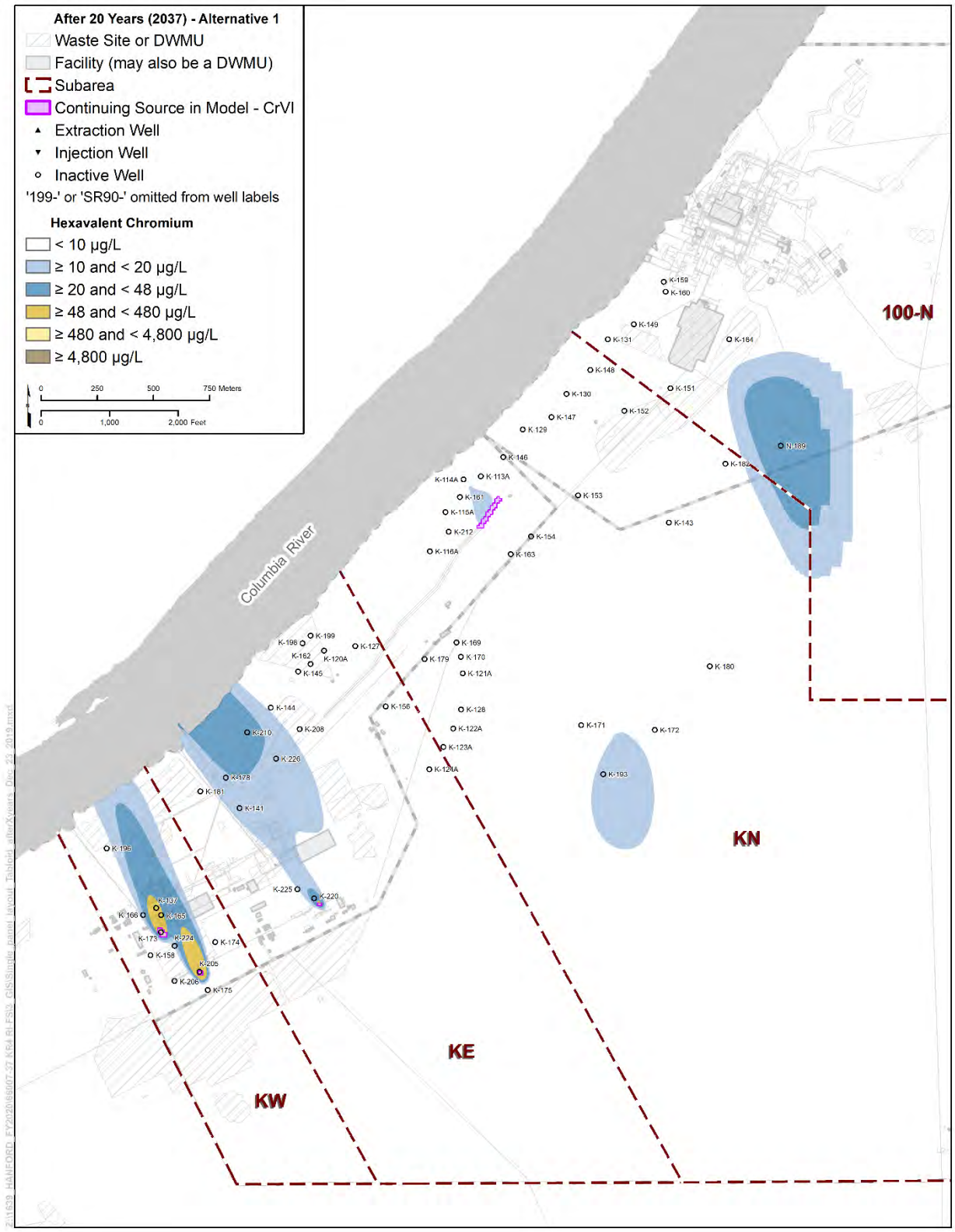

Figure 6-5. Cr(VI): Simulated Distribution after 20 Years (end of 2037) – Alternative 1

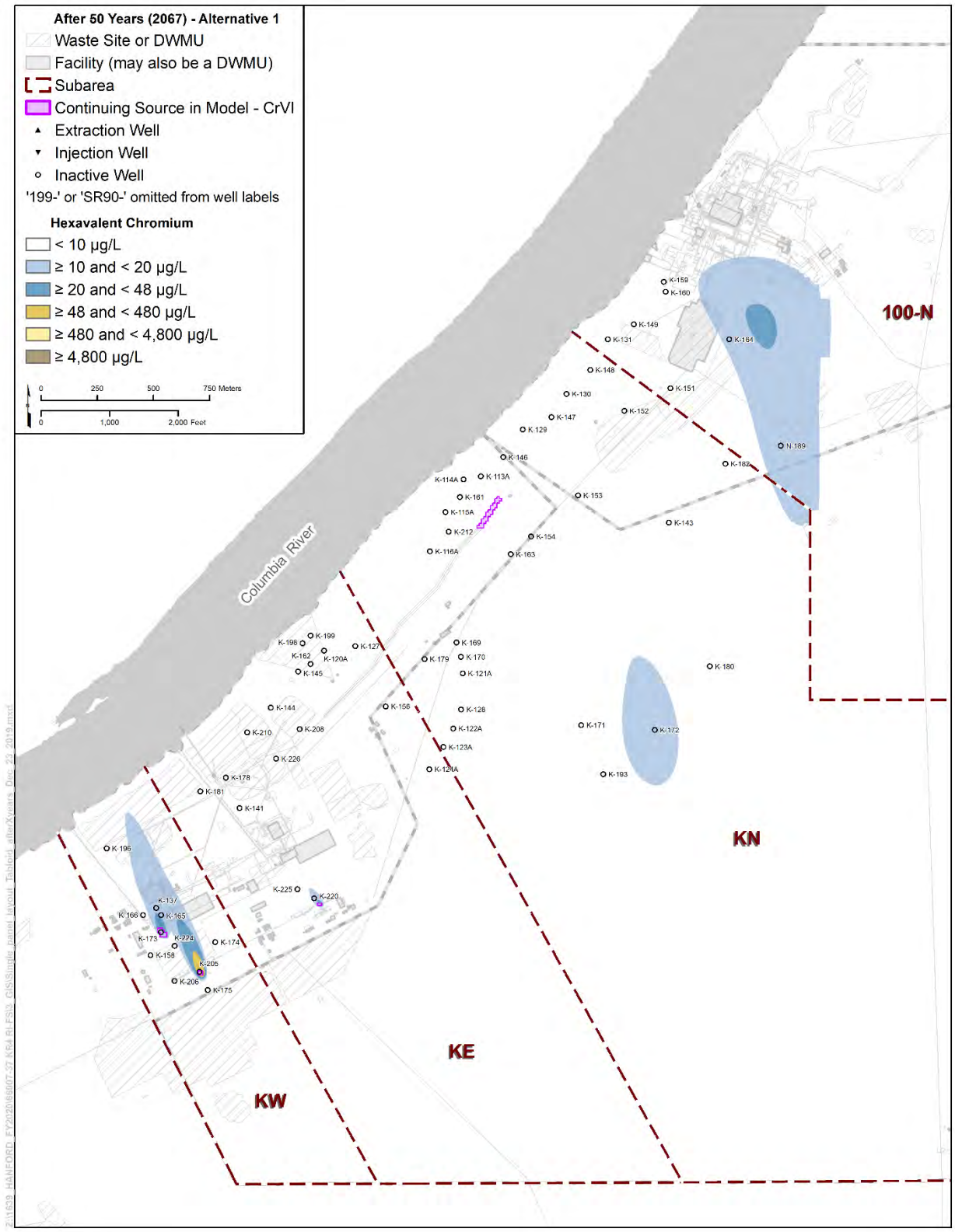

Figure 6-6. Cr(VI): Simulated Distribution after 50 Years (end of 2067) – Alternative 1

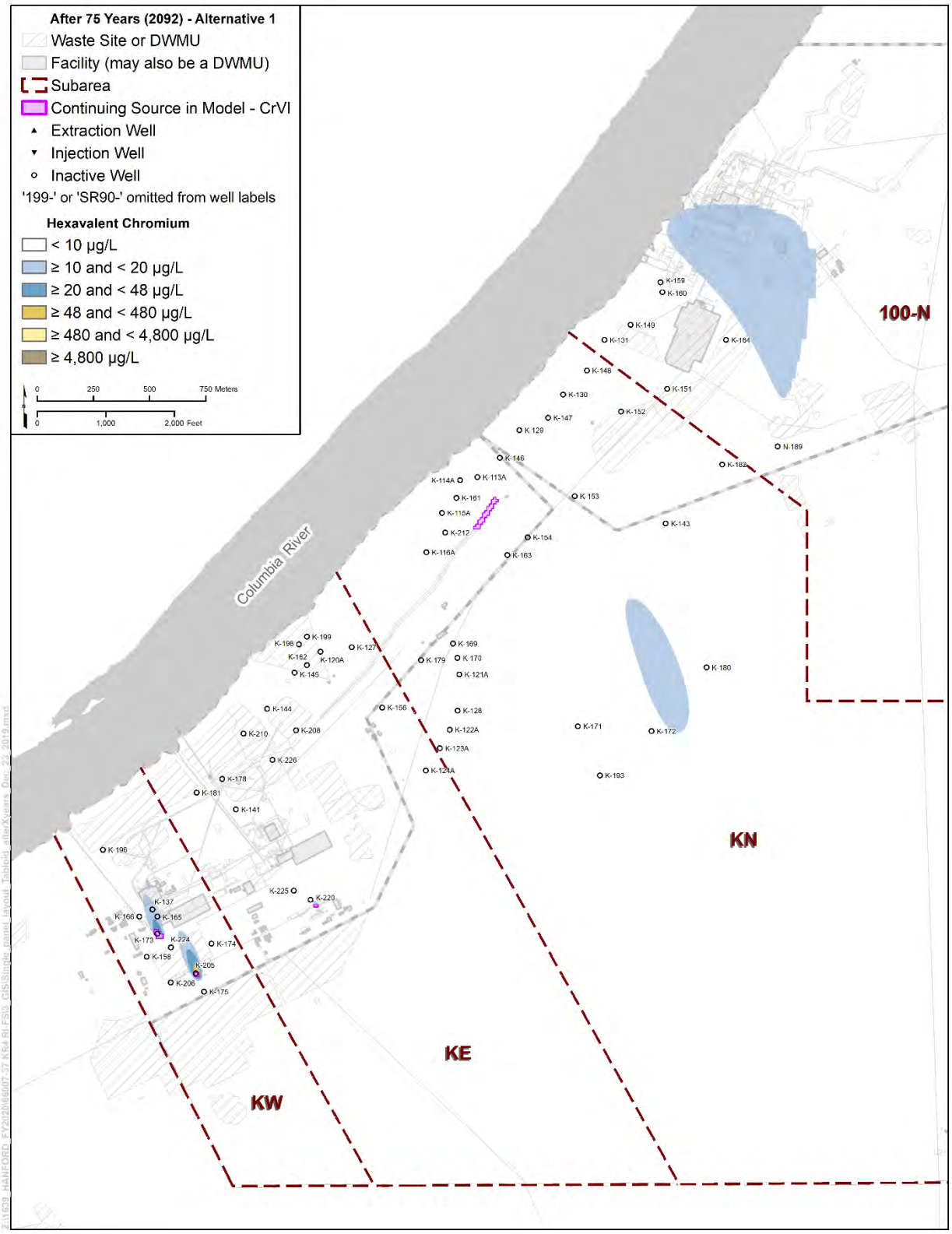

Figure 6-7. Cr(VI): Simulated Distribution after 75 Year (end of 2092) – Alternative 1

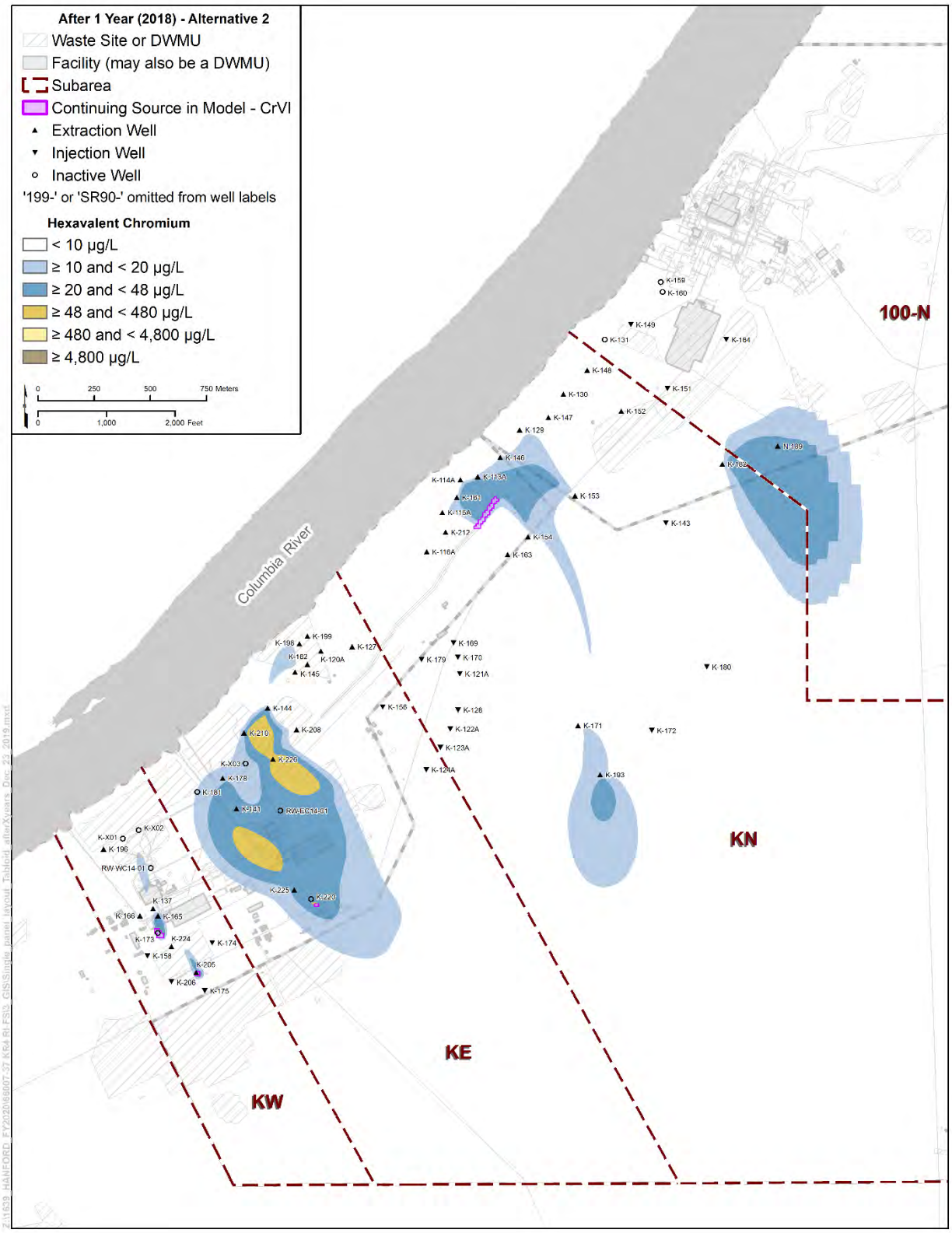

Figure 6-8. Cr(VI): Simulated Distribution after 1 Year (end of 2018) – Alternative 2

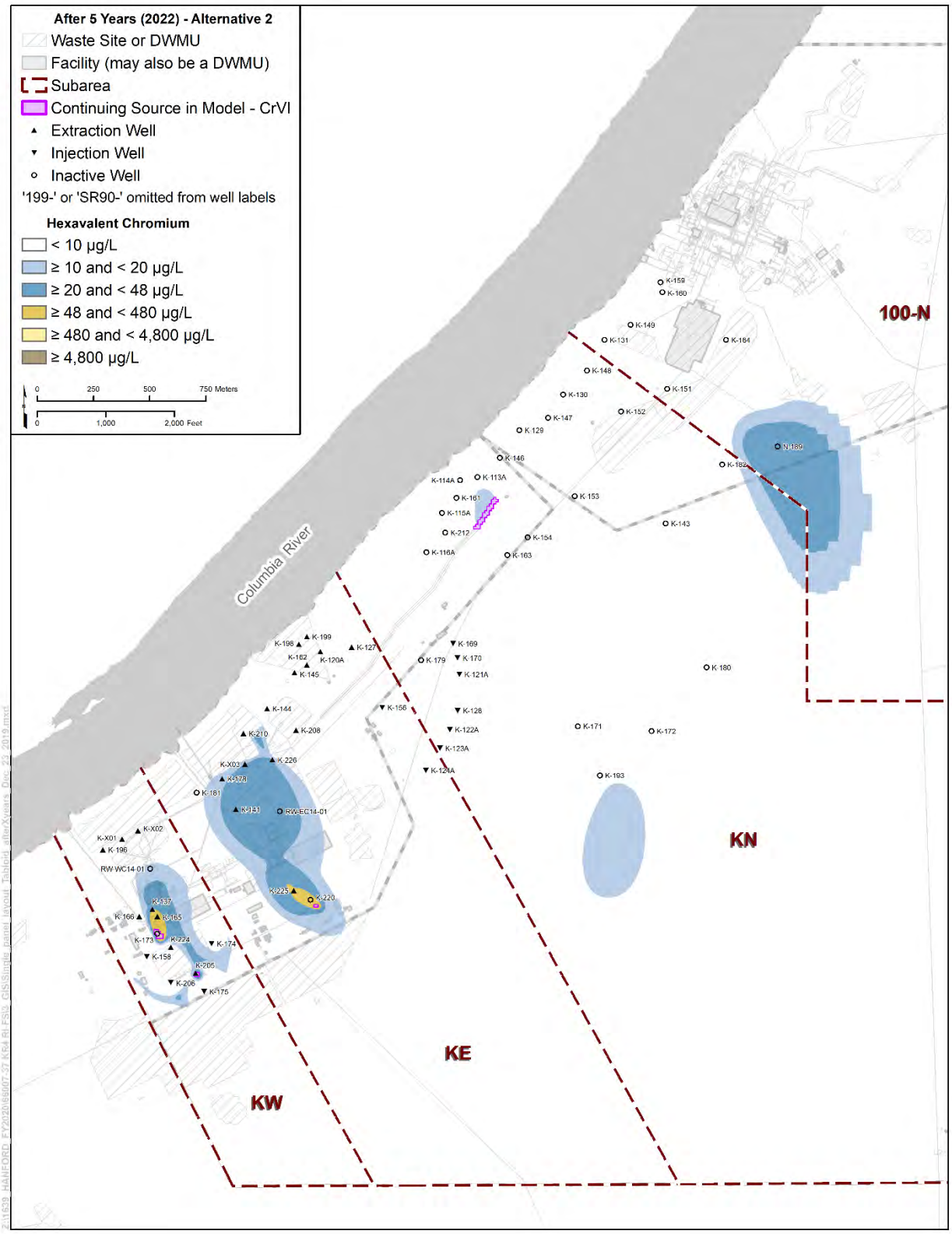

Figure 6-9. Cr(VI): Simulated Distribution after 5 Years (end of 2022) – Alternative 2

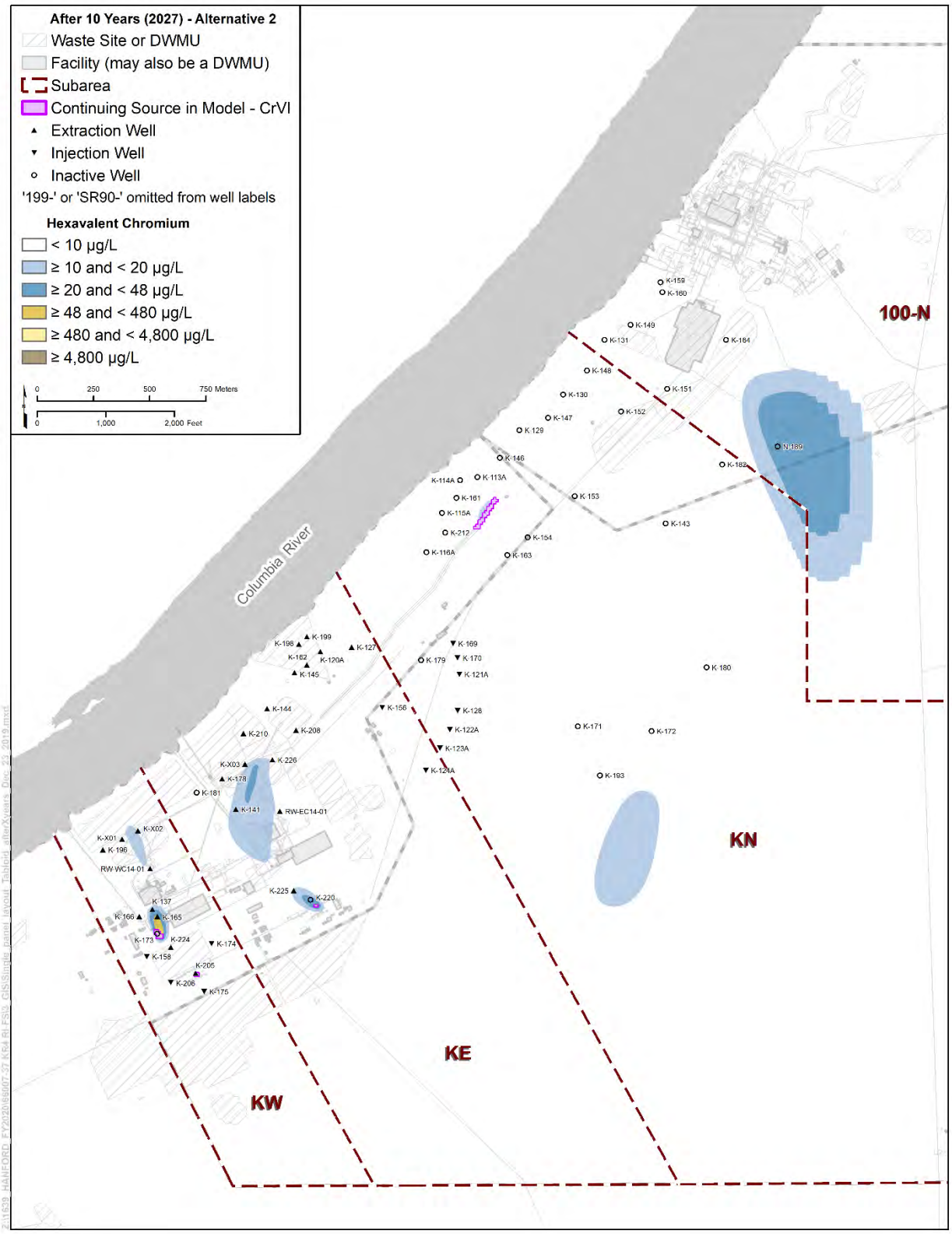

Figure 6-10. Cr(VI):Simulated Distribution after 10 Years (end of 2027) – Alternative 2

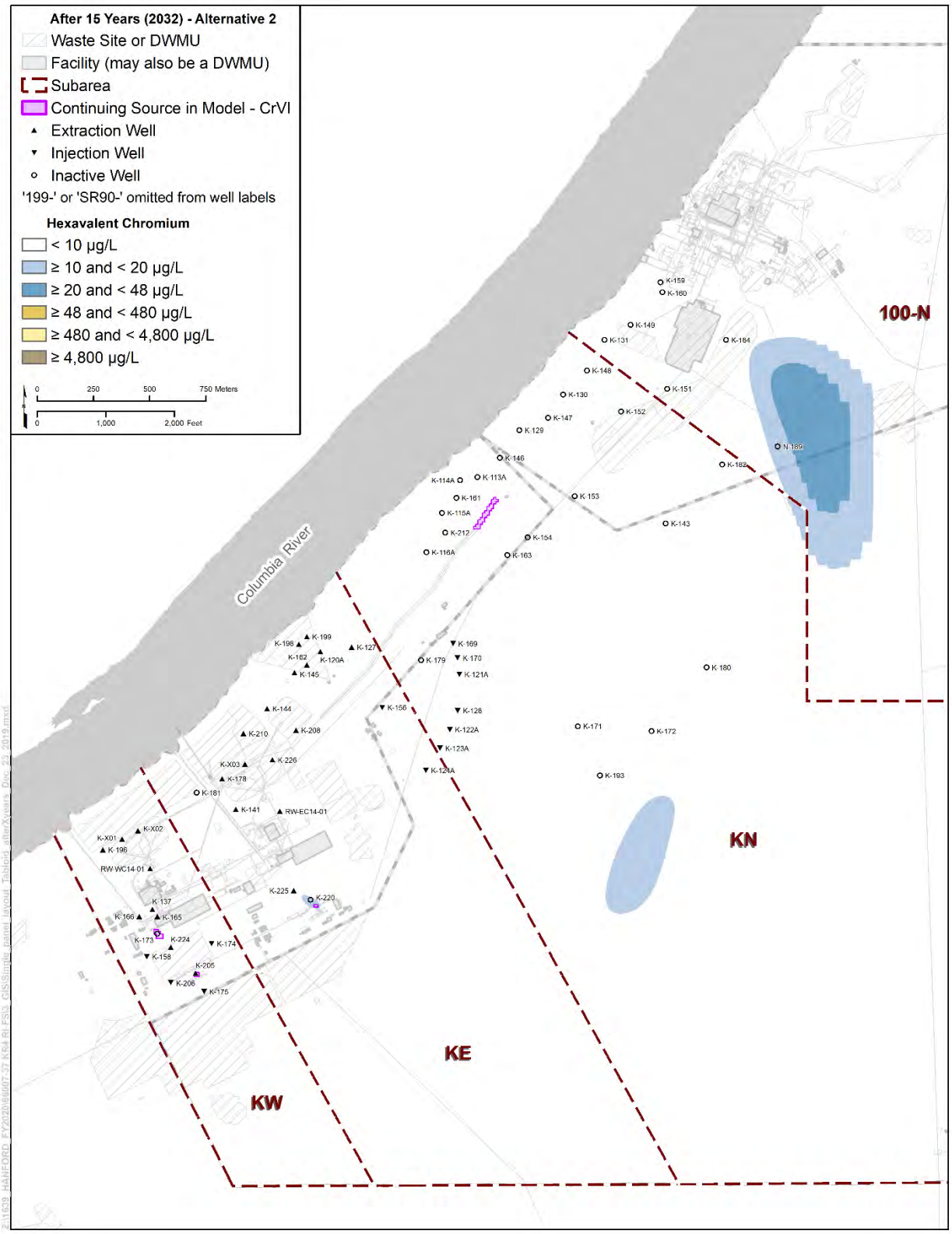

Figure 6-11. Cr(VI): Simulated Distribution after 15 Years (end of 2032) – Alternative 2

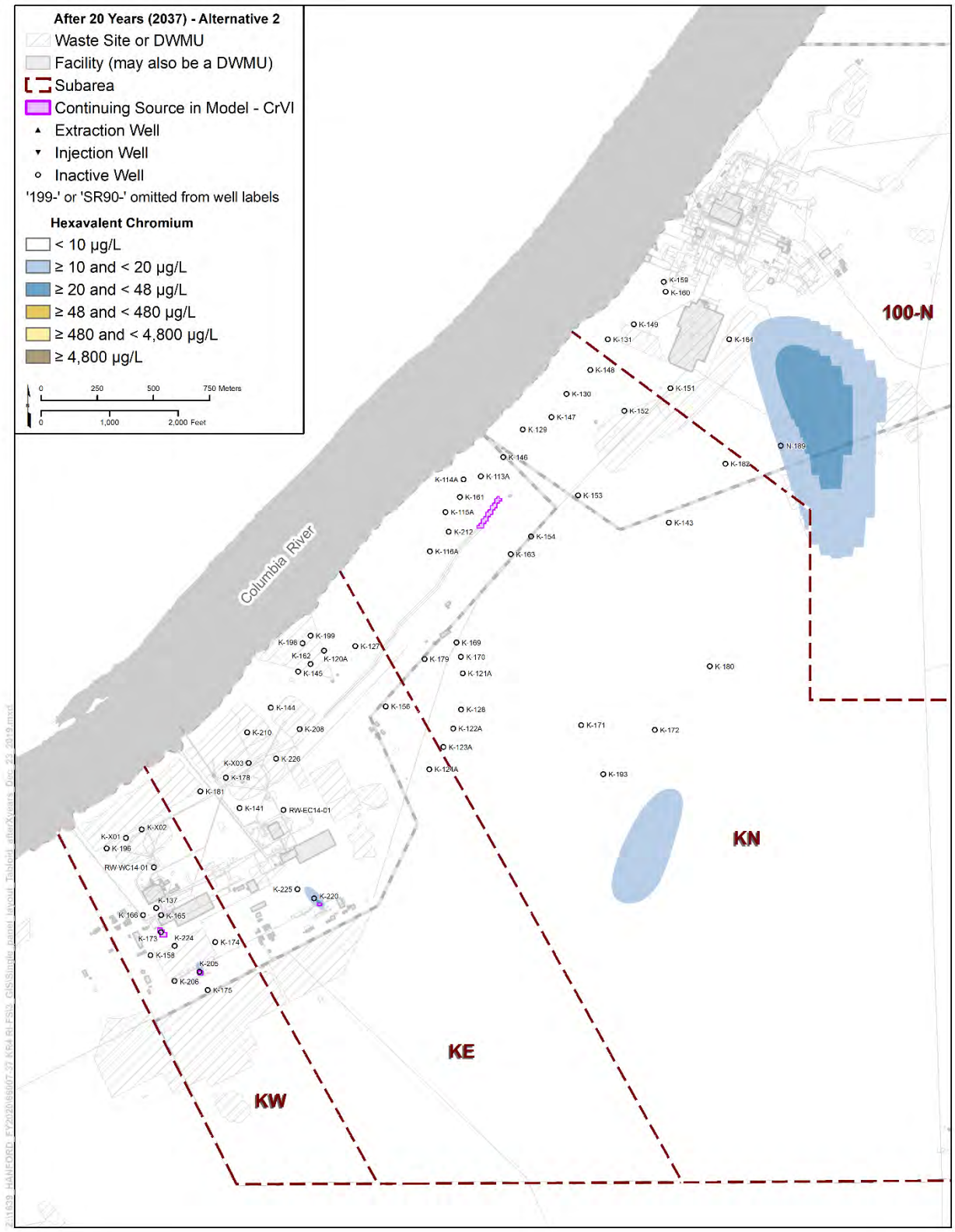

Figure 6-12. Cr(VI): Simulated Distribution after 20 Years (end of 2037) – Alternative 2

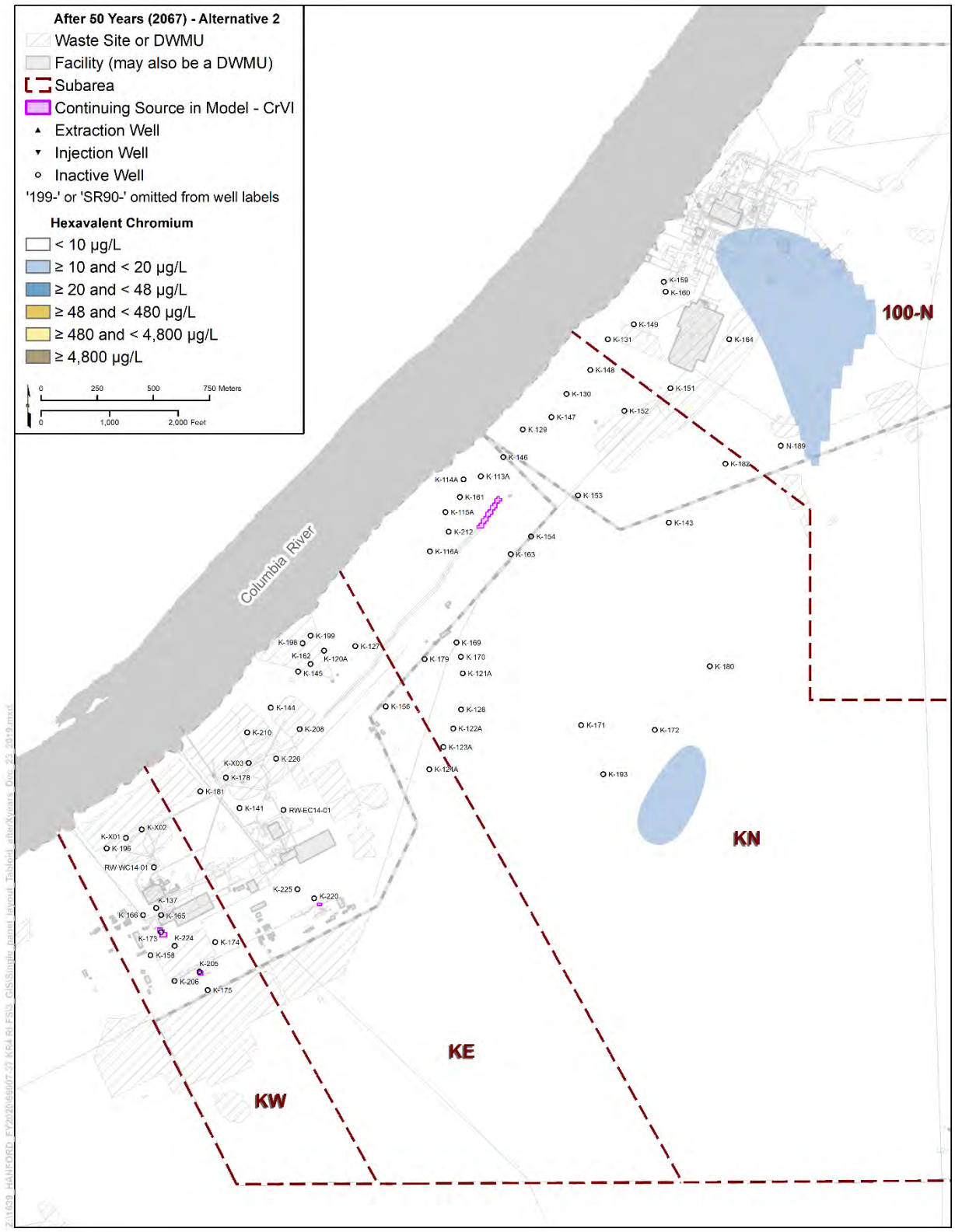

Figure 6-13. Cr(VI): Simulated Distribution after 50 Years (end of 2067) – Alternative 2

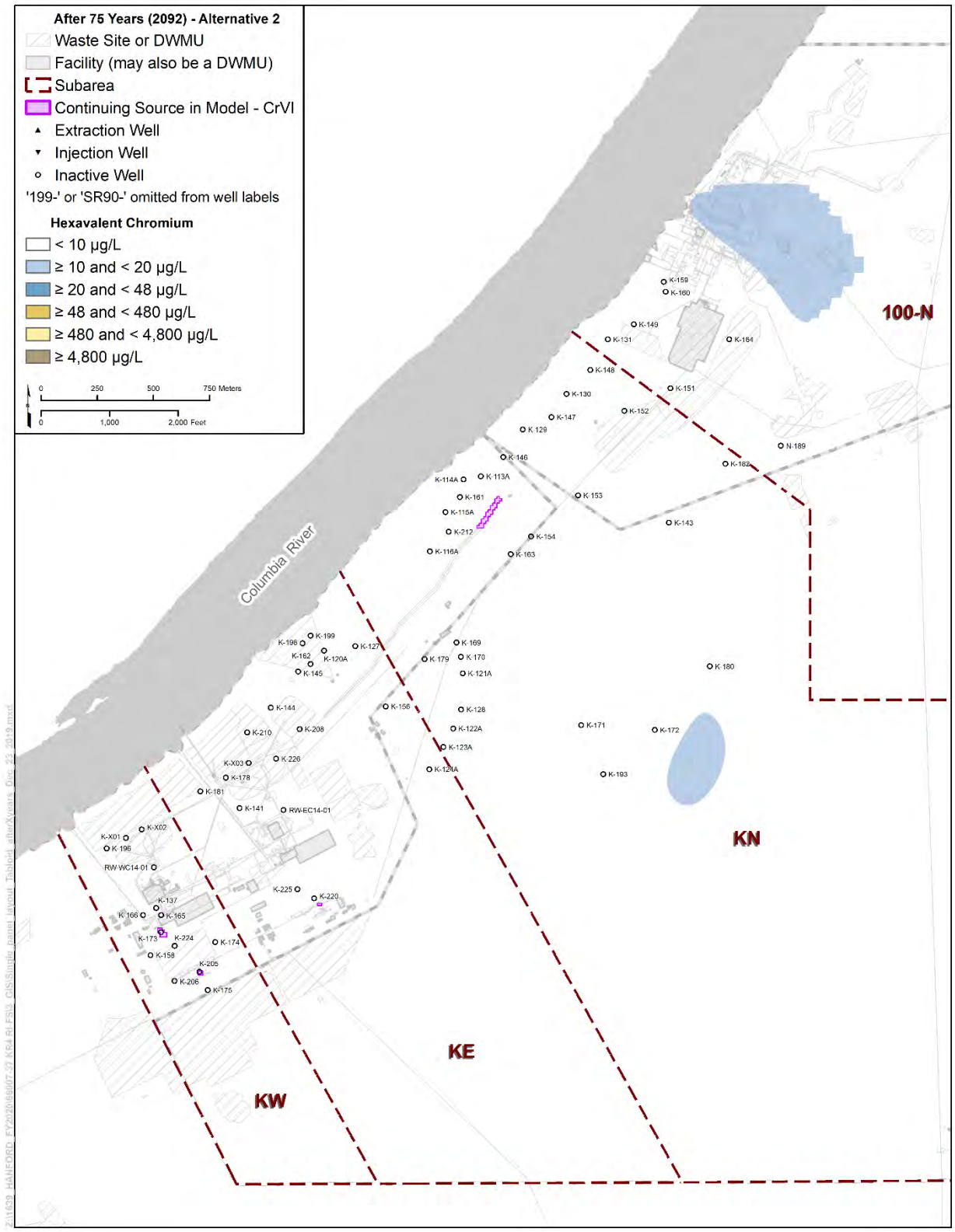

Figure 6-14. Cr(VI): Simulated Distribution after 75 Years (end of 2092) – Alternative 2

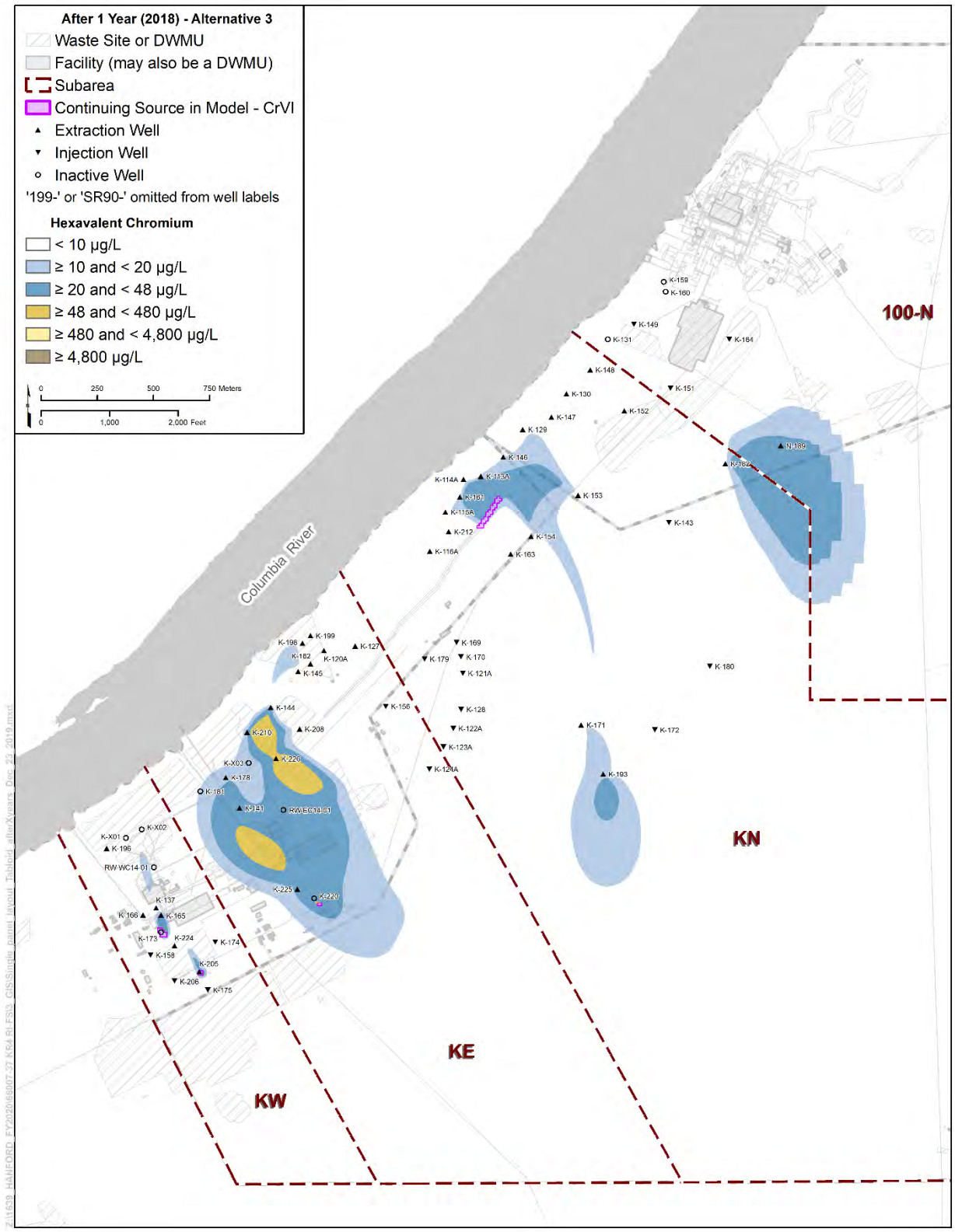

Figure 6-15. Cr(VI): Simulated Distribution after 1 Year (end of 2018) – Alternative 3

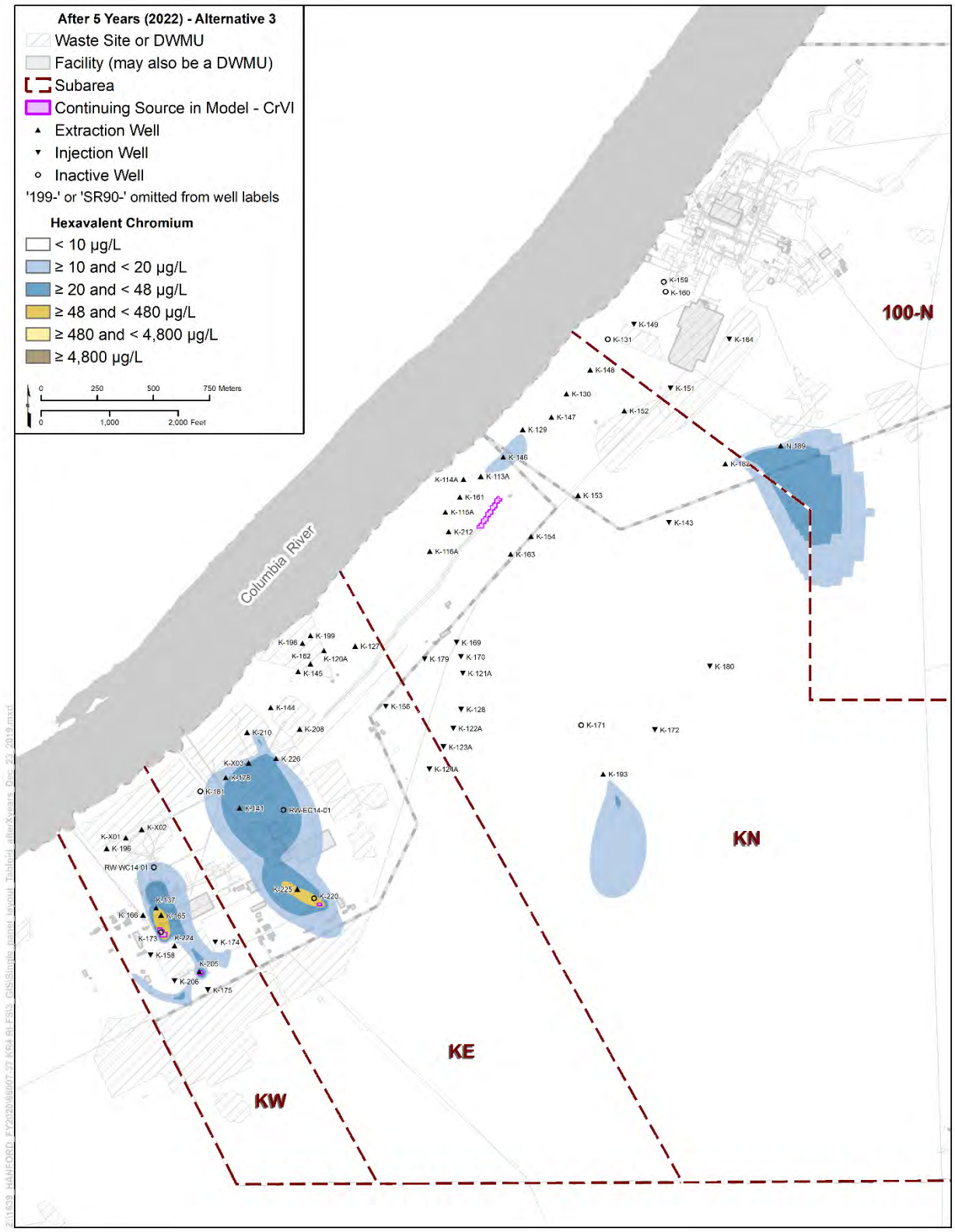

Figure 6-16. Cr(VI): Simulated Distribution after 5 Years (end of 2022) – Alternative 3

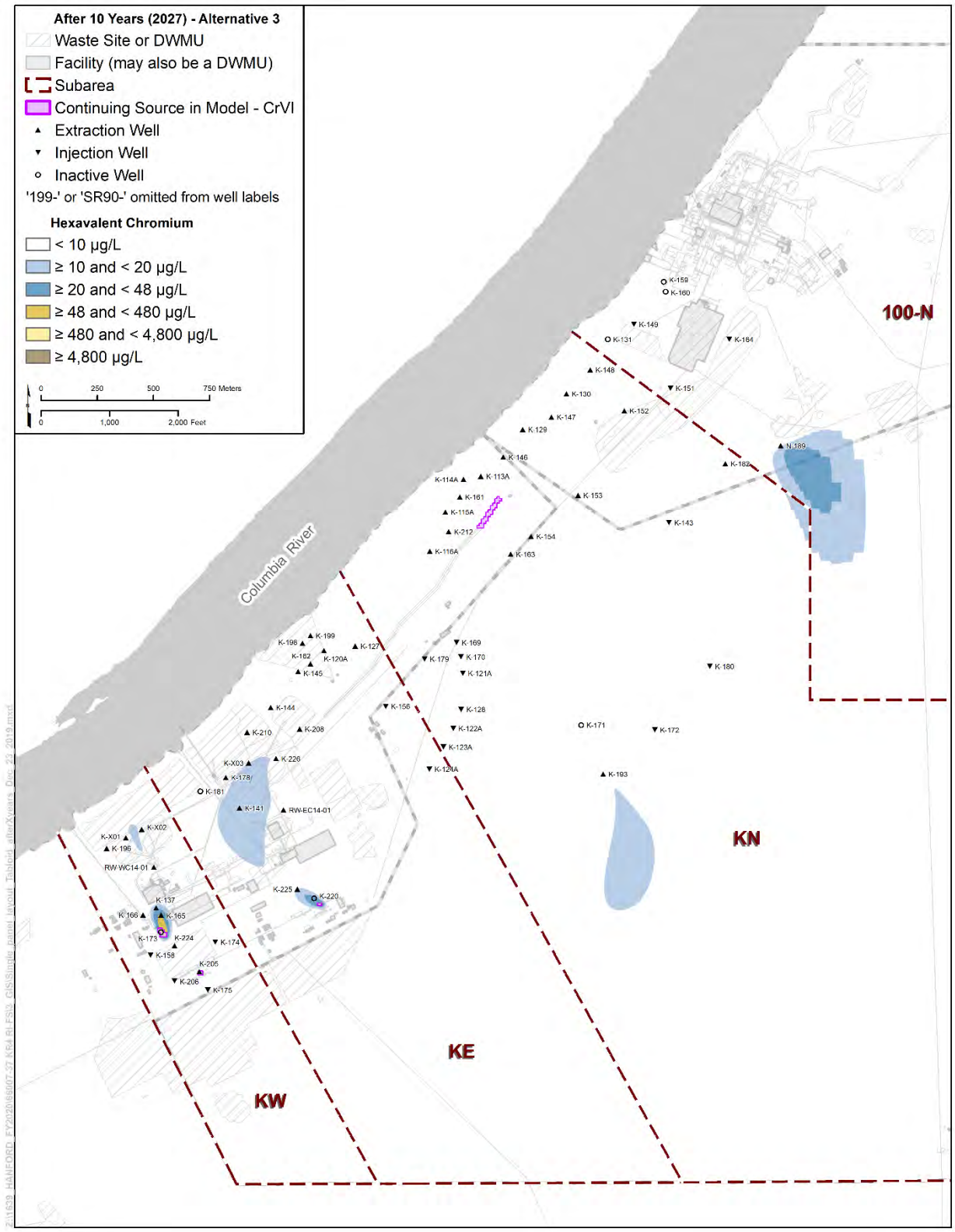

Figure 6-17. Cr(VI): Simulated Distribution after 10 Years (end of 2027) – Alternative 3

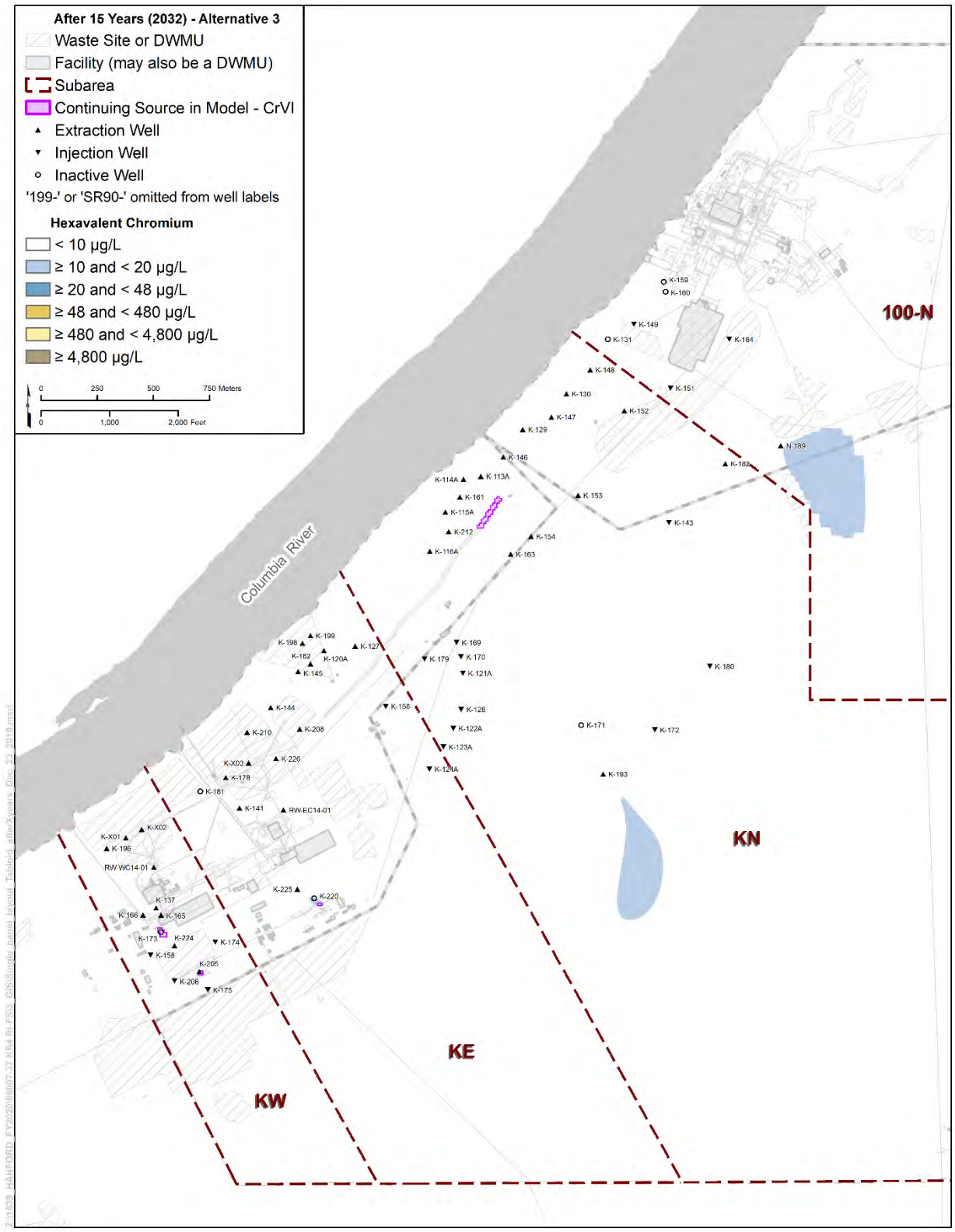

Figure 6-18. Cr(VI): Simulated Distribution after 15 Years (end of 2032) – Alternative 3

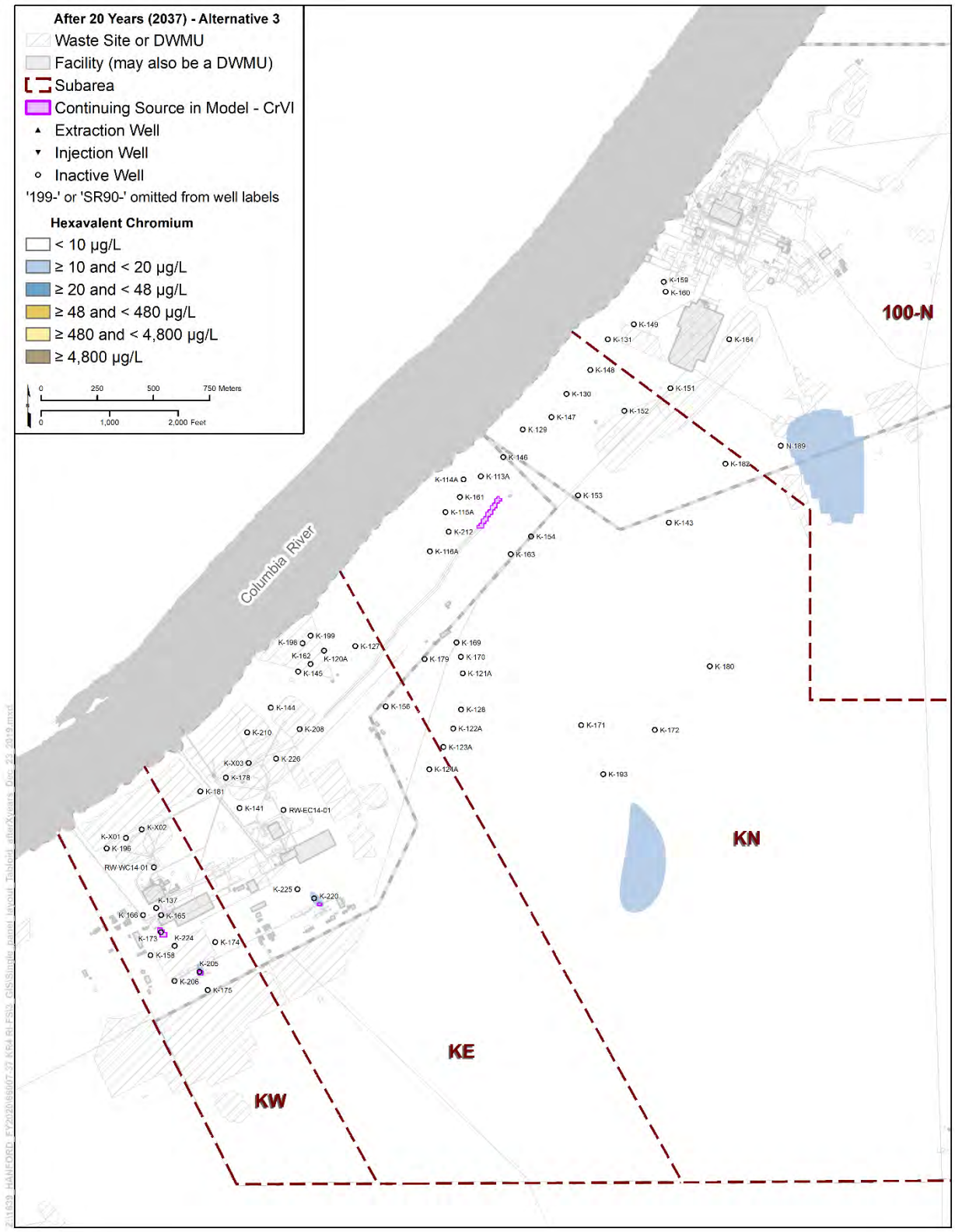

Figure 6-19. Cr(VI): Simulated Distribution after 20 Years (end of 2037) – Alternative 3

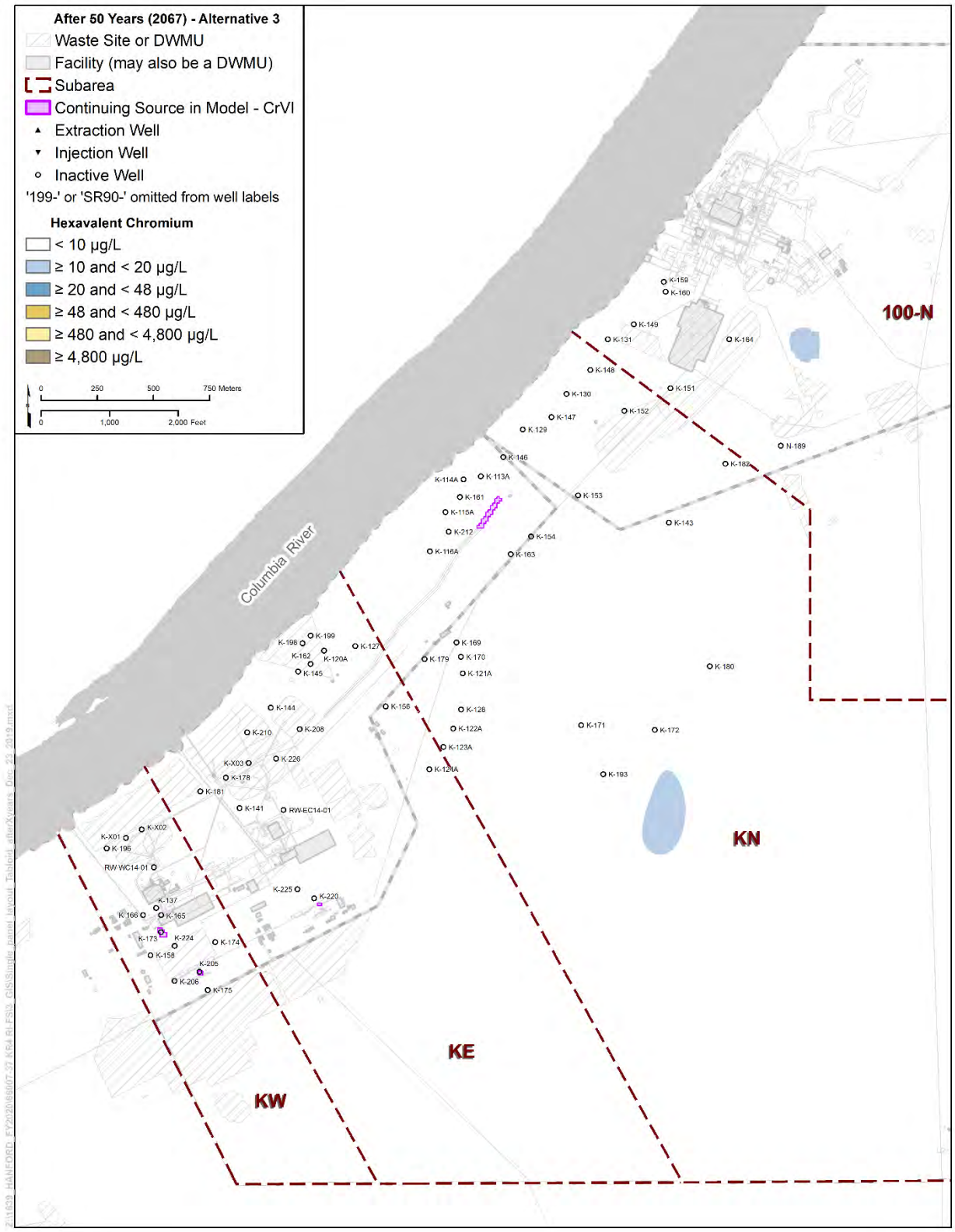

Figure 6-20. Cr(VI): Simulated Distribution after 50 Years (end of 2067) – Alternative 3

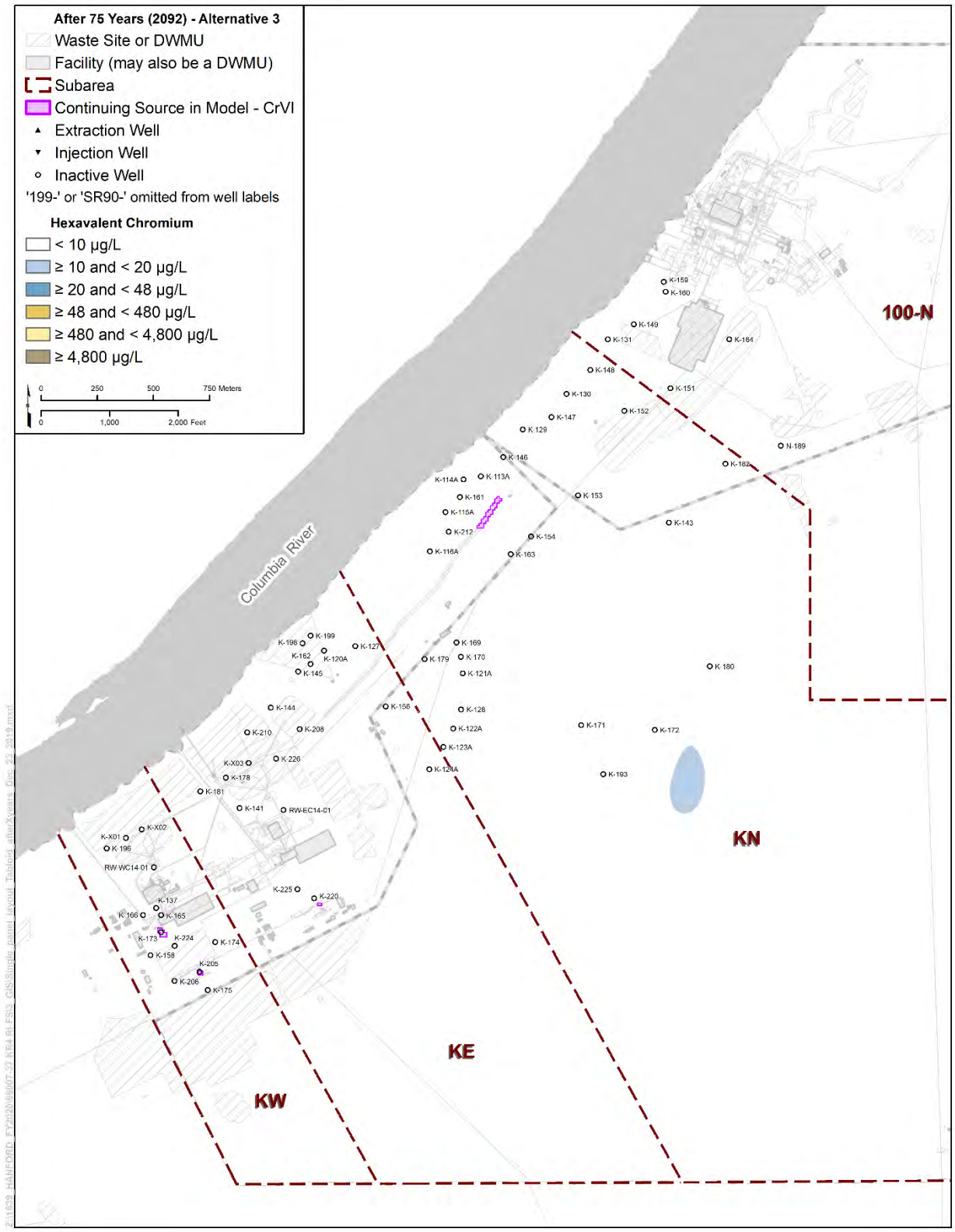

Figure 6-21. Cr(VI): Simulated Distribution after 75 Years (end of 2092) – Alternative 3

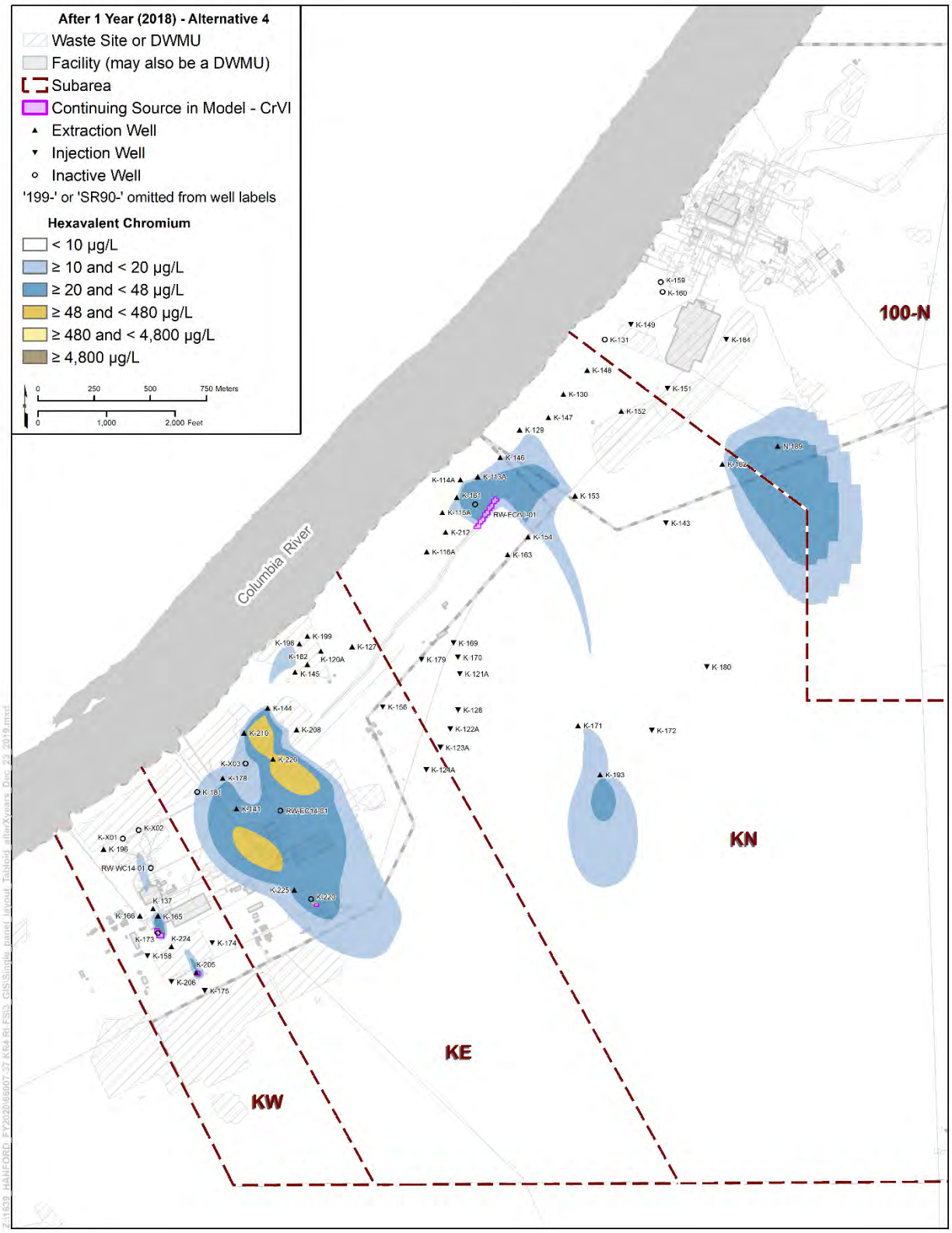

Figure 6-22. Cr(VI): Simulated Distribution after 1 Year (end of 2018) – Alternative 4

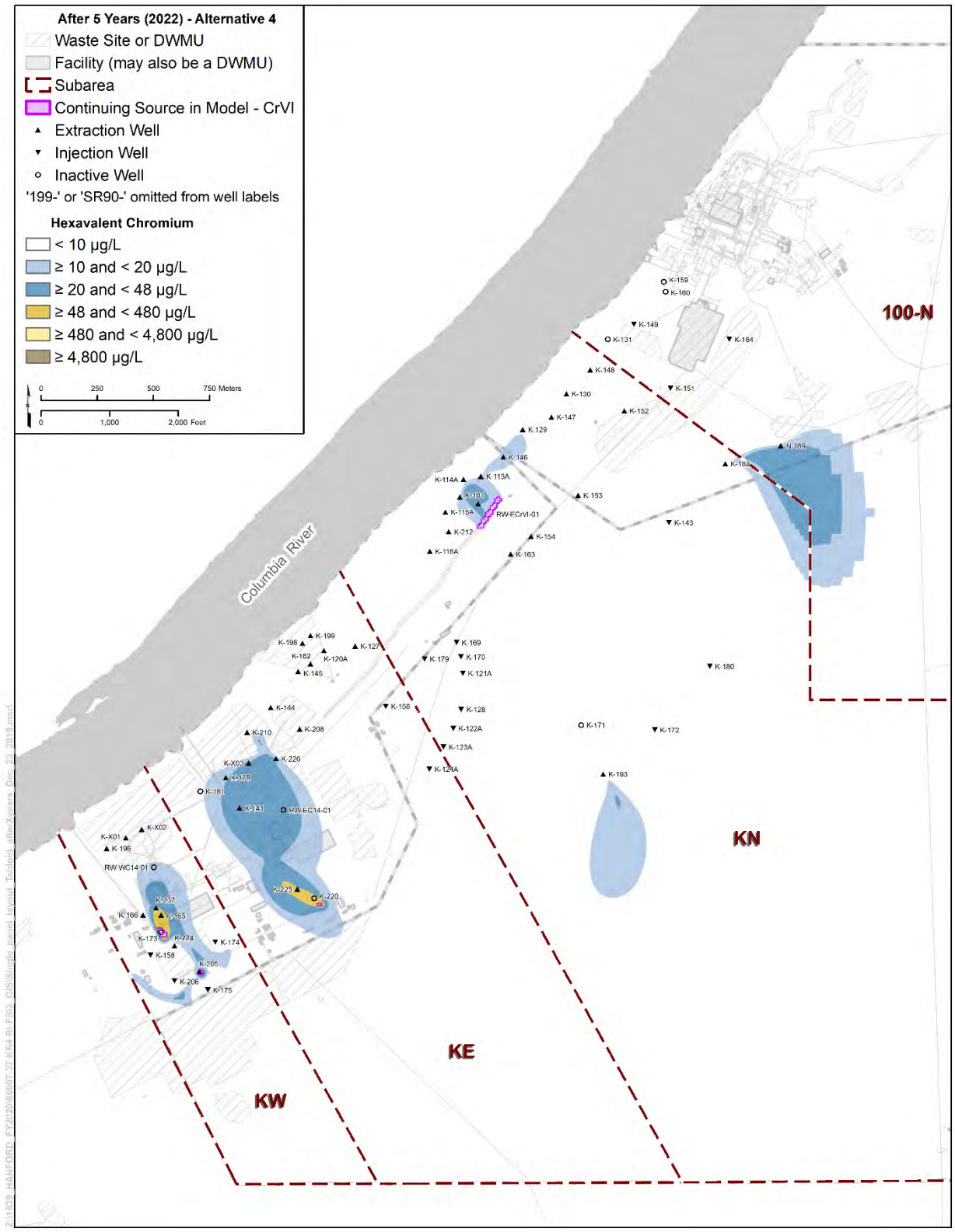

Figure 6-23. Cr(VI): Simulated Distribution after 5 Years (end of 2022) – Alternative 4

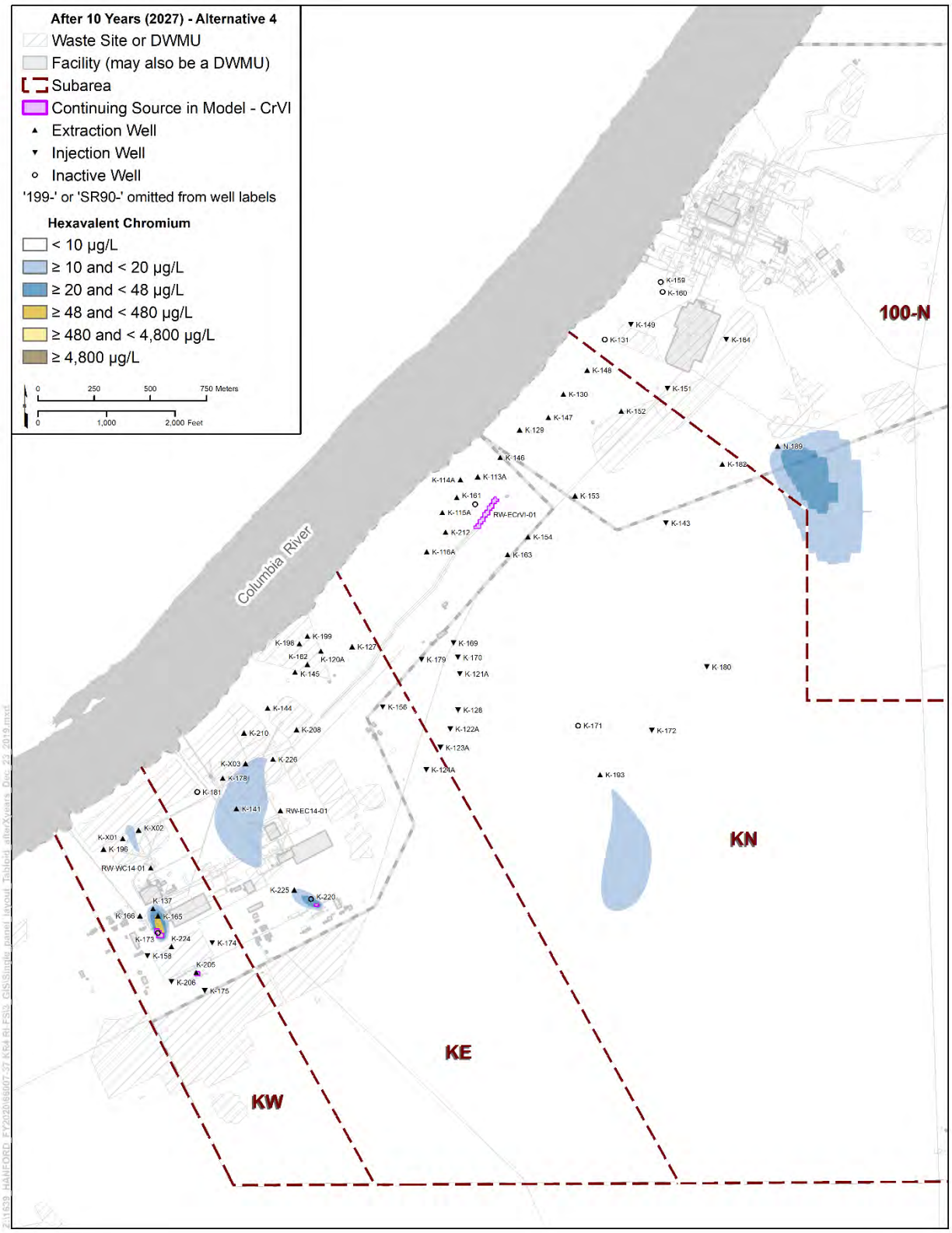

Figure 6-24. Cr(VI): Simulated Distribution after 10 Years (end of 2027) – Alternative 4

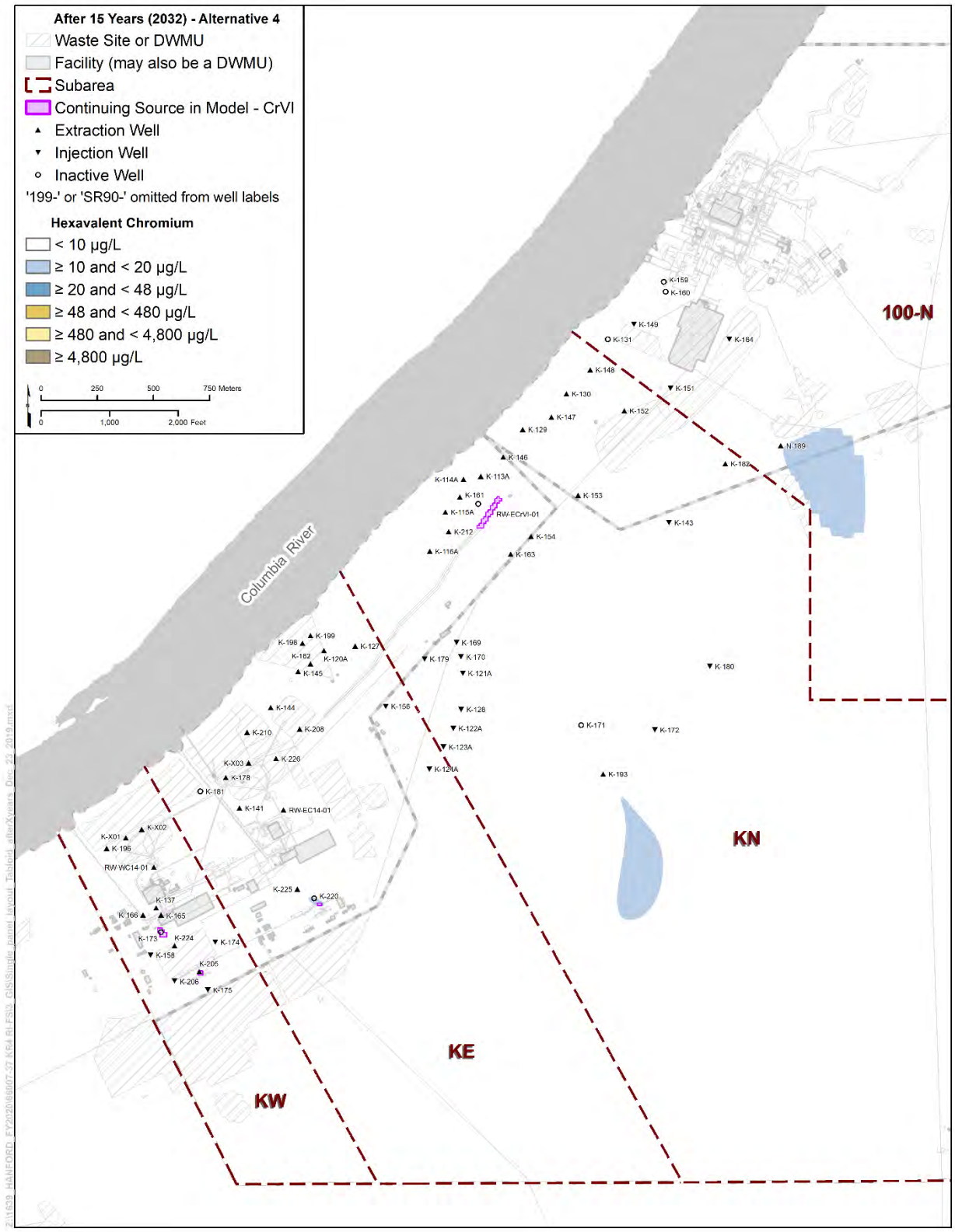

Figure 6-25. Cr(VI): Simulated Distribution after 15 Years (end of 2032) – Alternative 4

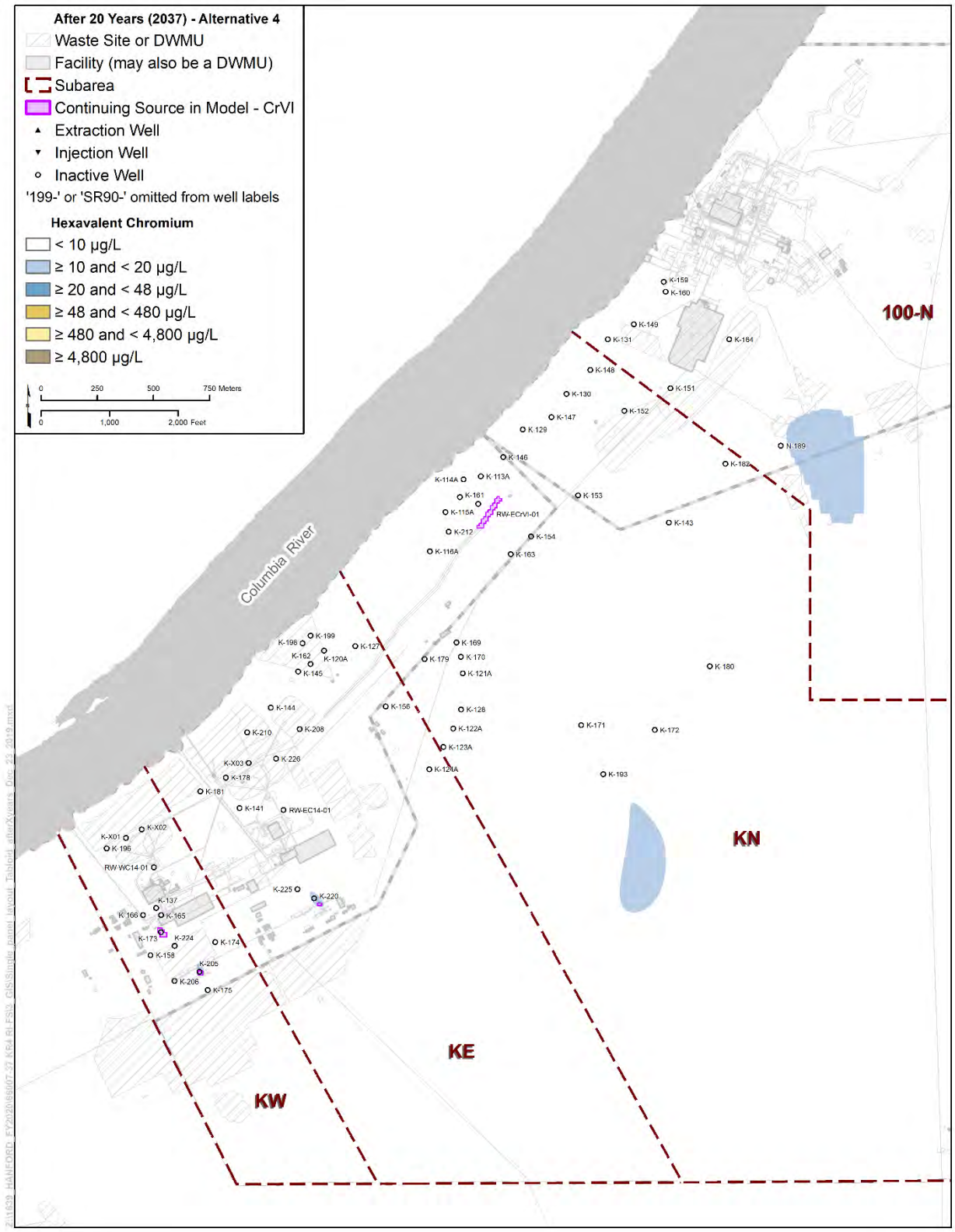

Figure 6-26. Cr(VI): Simulated Distribution after 20 Years (end of 2037) – Alternative 4

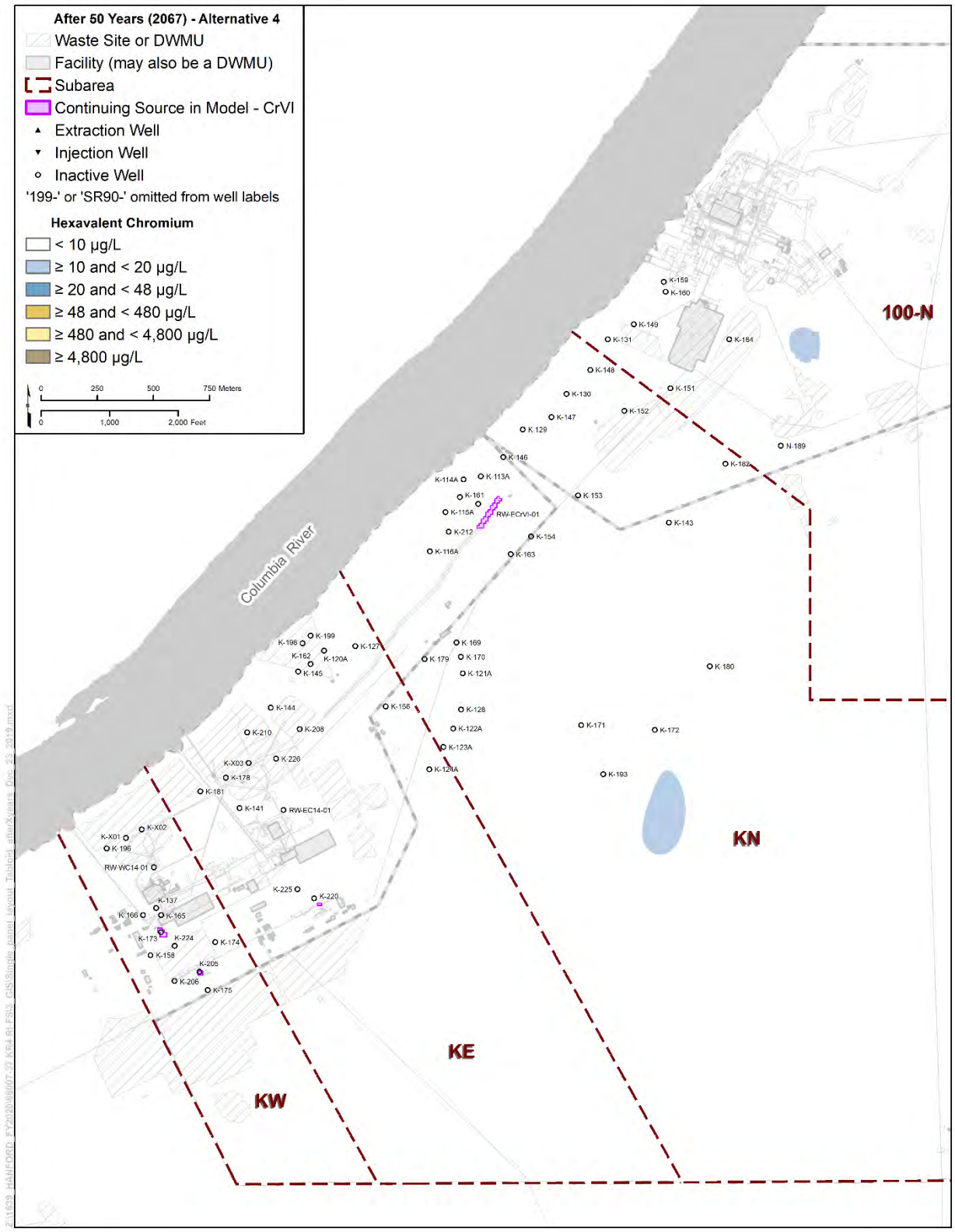

Figure 6-27. Cr(VI): Simulated Distribution after 50 Years (end of 2067) – Alternative 4

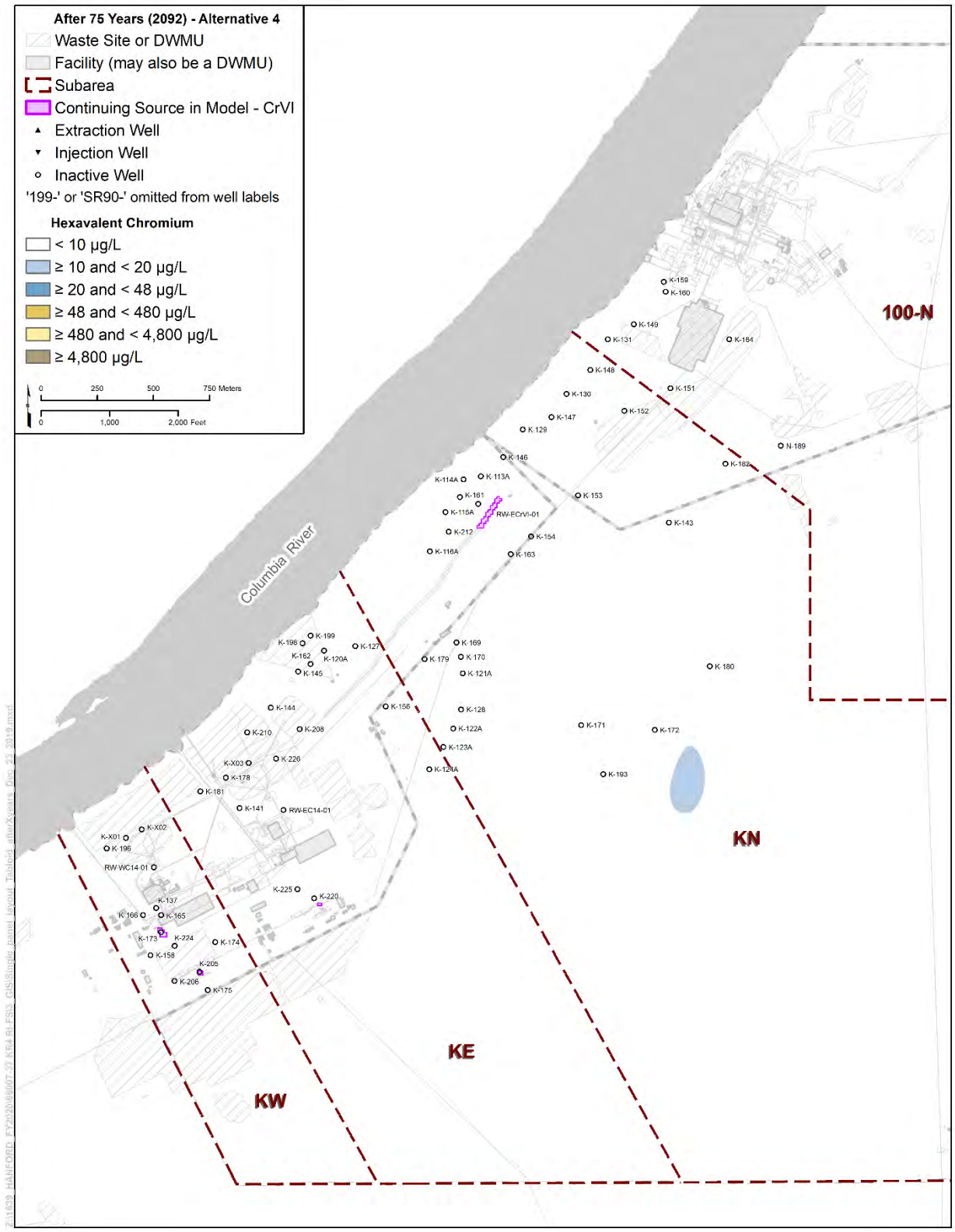

Figure 6-28. Cr(VI): Simulated Distribution after 75 Years (end of 2092) – Alternative 4

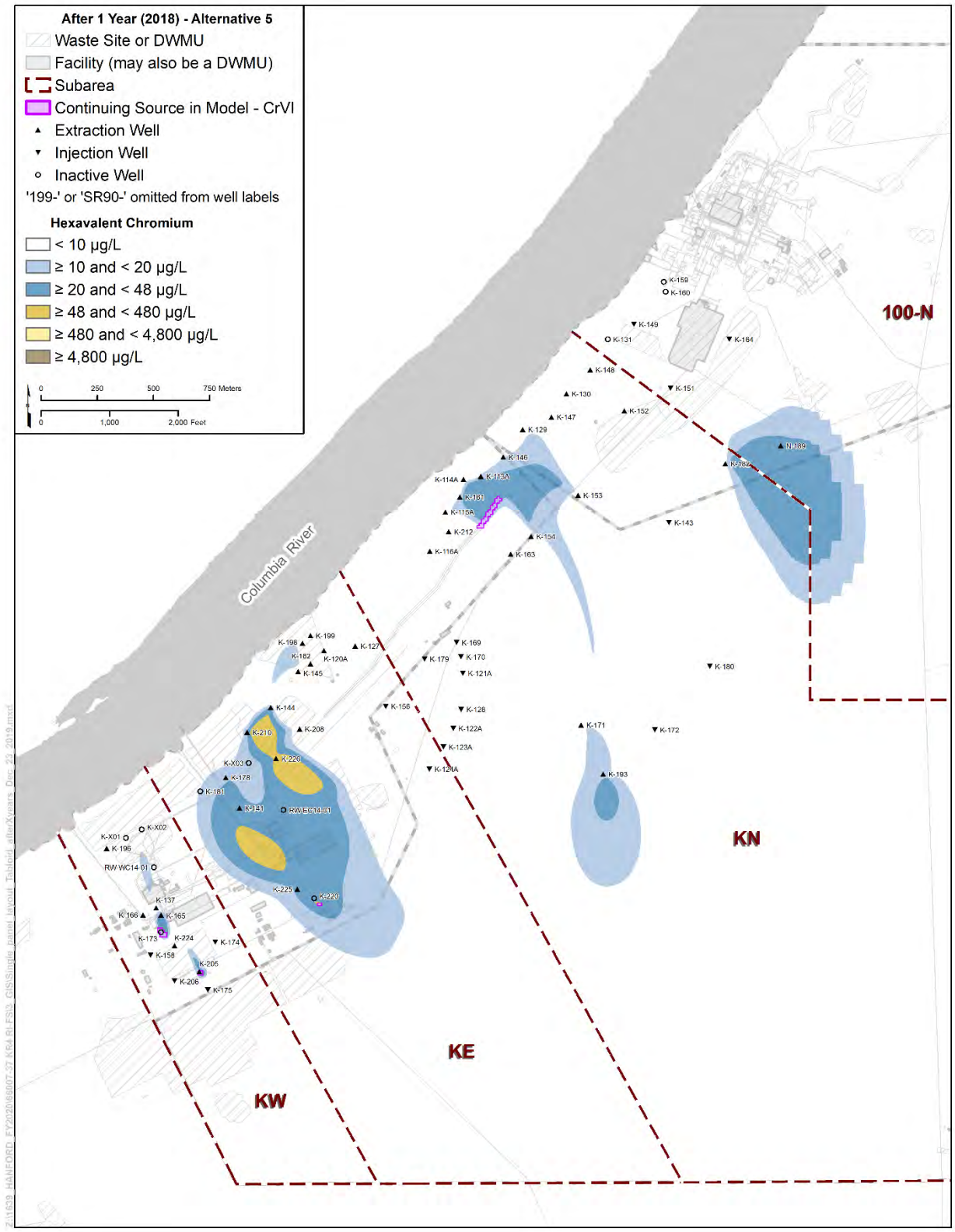

Figure 6-29. Cr(VI): Simulated Distribution after 1 Year (end of 2018) – Alternative 5

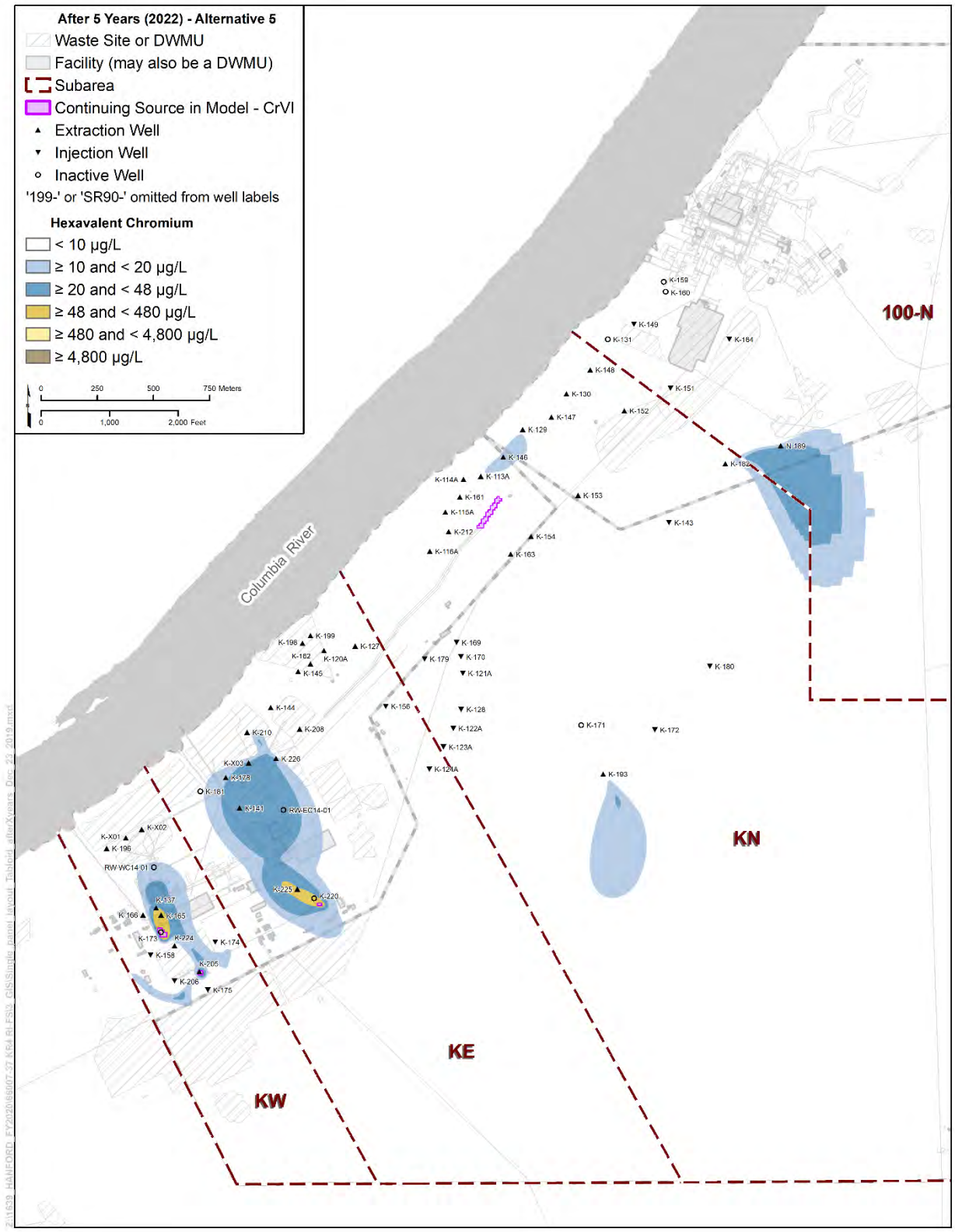

Figure 6-30. Cr(VI): Simulated Distribution after 5 Years (end of 2022) – Alternative 5

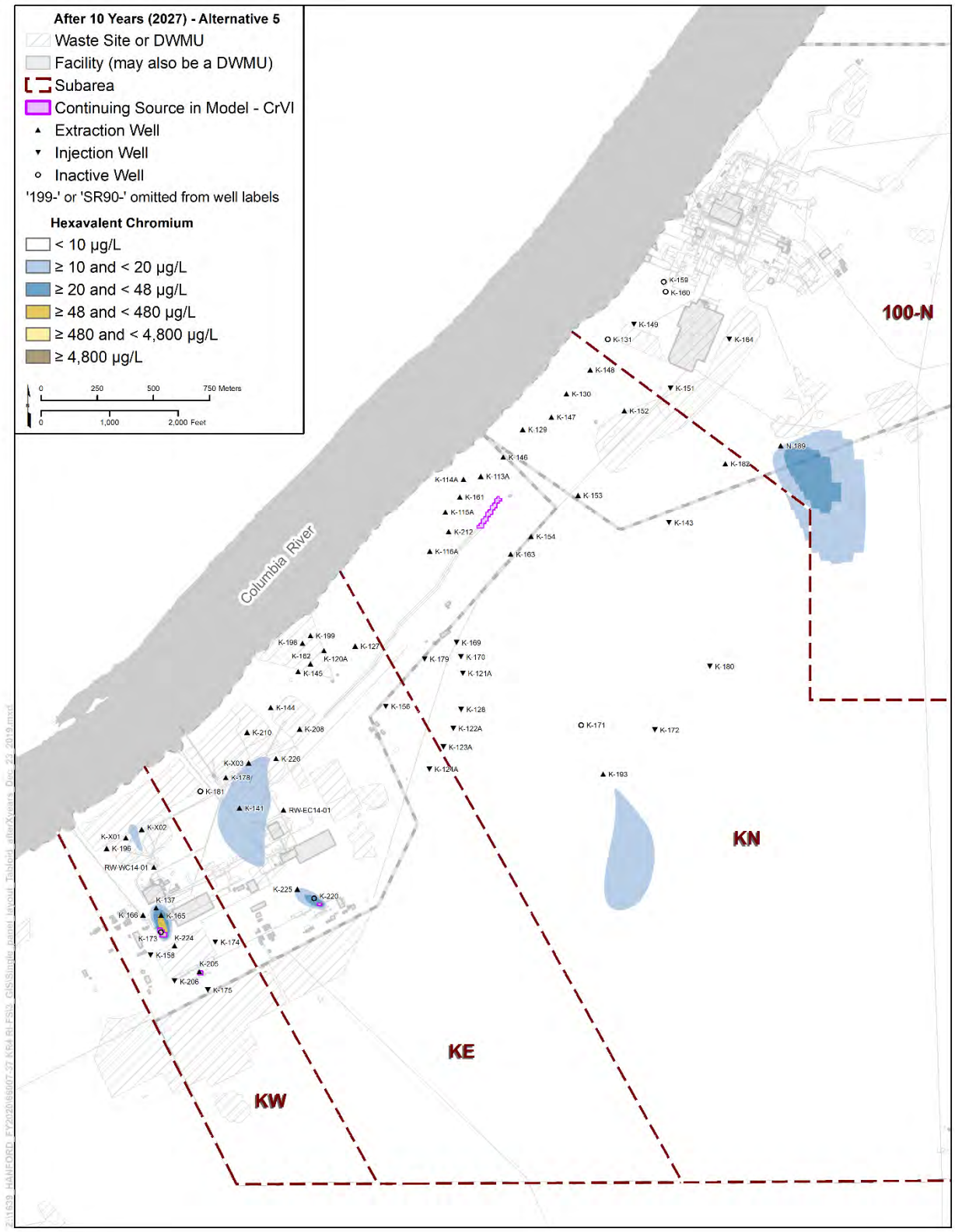

Figure 6-31. Cr(VI): Simulated Distribution after 10 Years (end of 2027) – Alternative 5

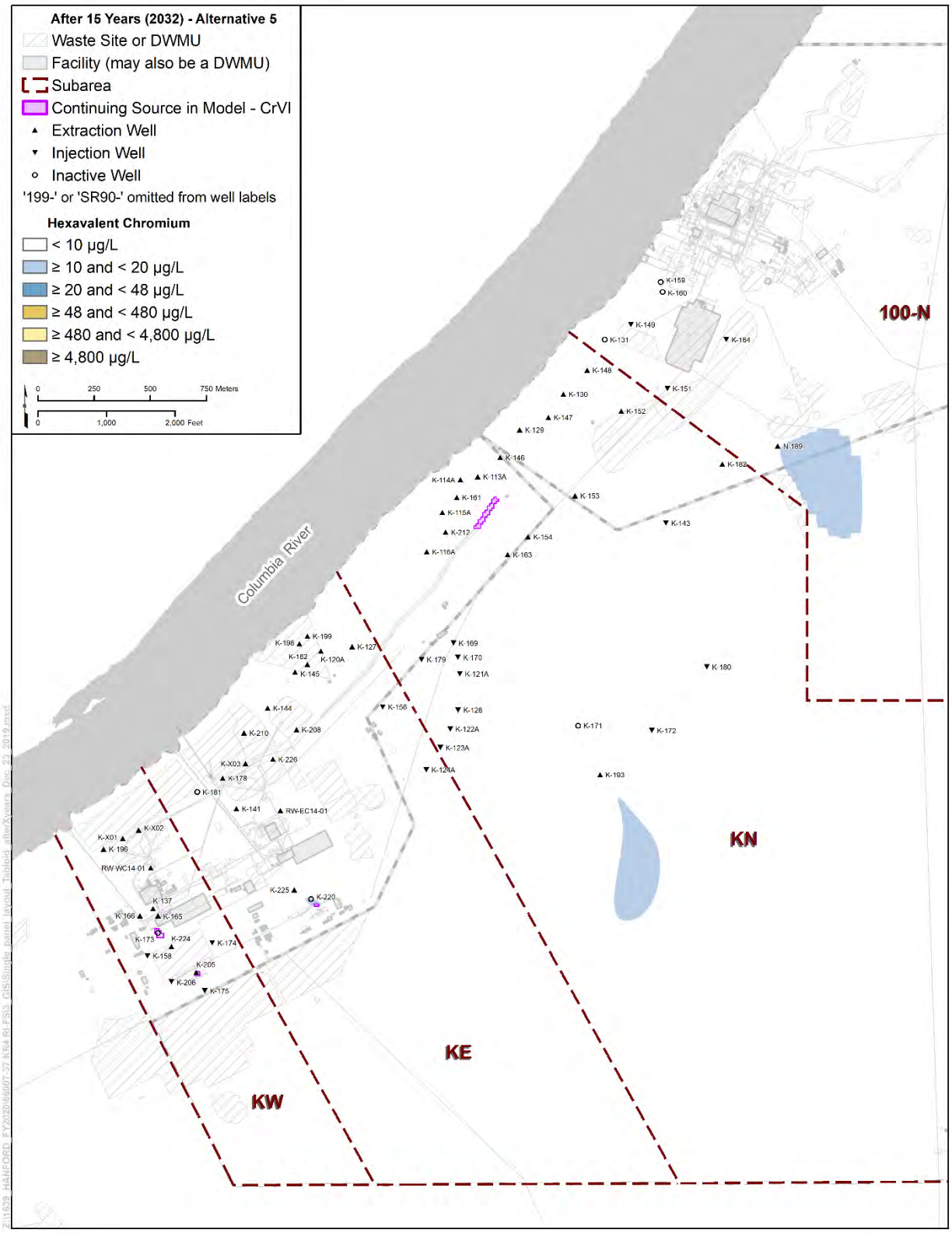

Figure 6-32. Cr(VI): Simulated Distribution after 15 Years (end of 2032) – Alternative 5

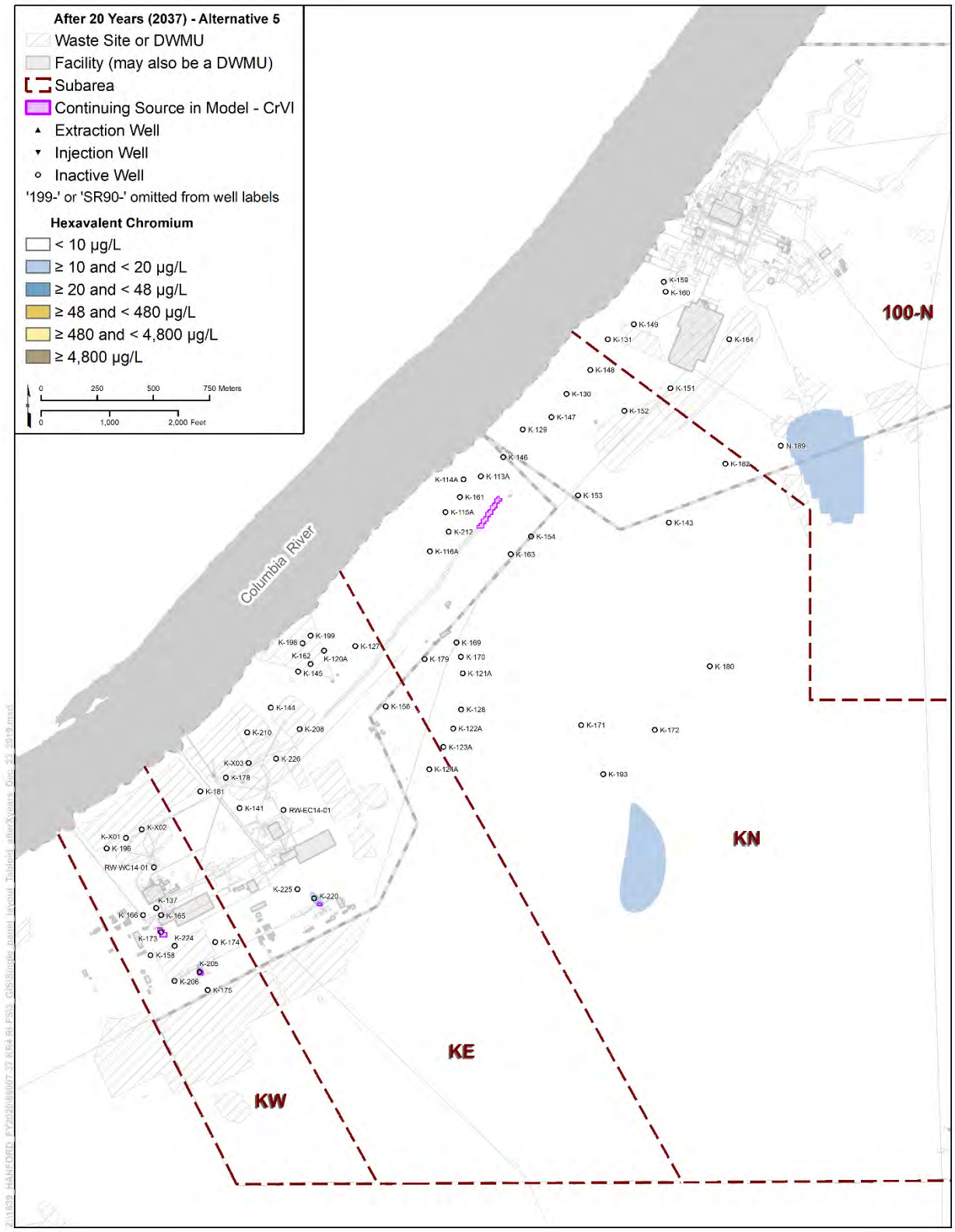

Figure 6-33. Cr(VI): Simulated Distribution after 20 Years (end of 2037) – Alternative 5

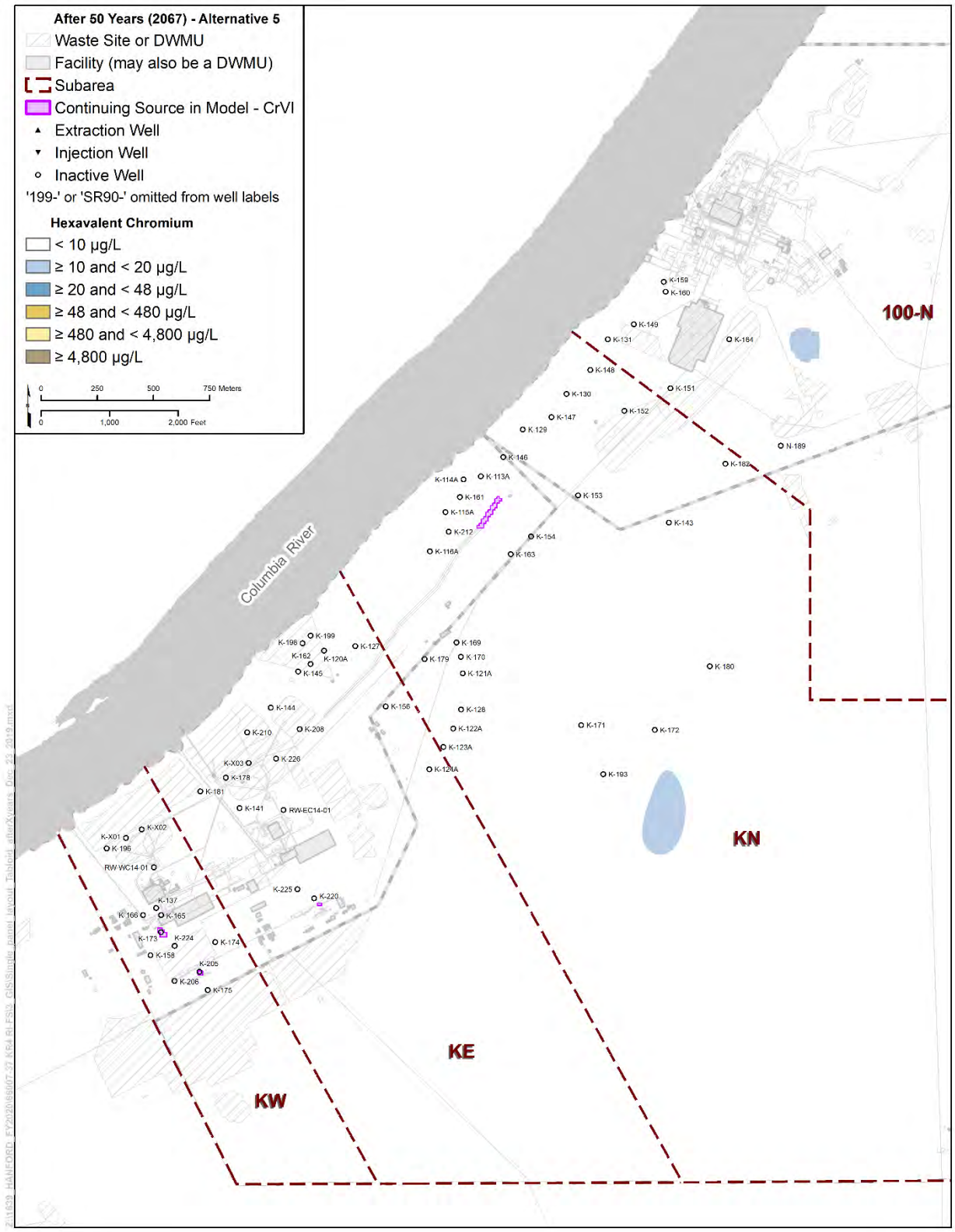

Figure 6-34. Cr(VI): Simulated Distribution after 50 Years (end of 2067) – Alternative 5

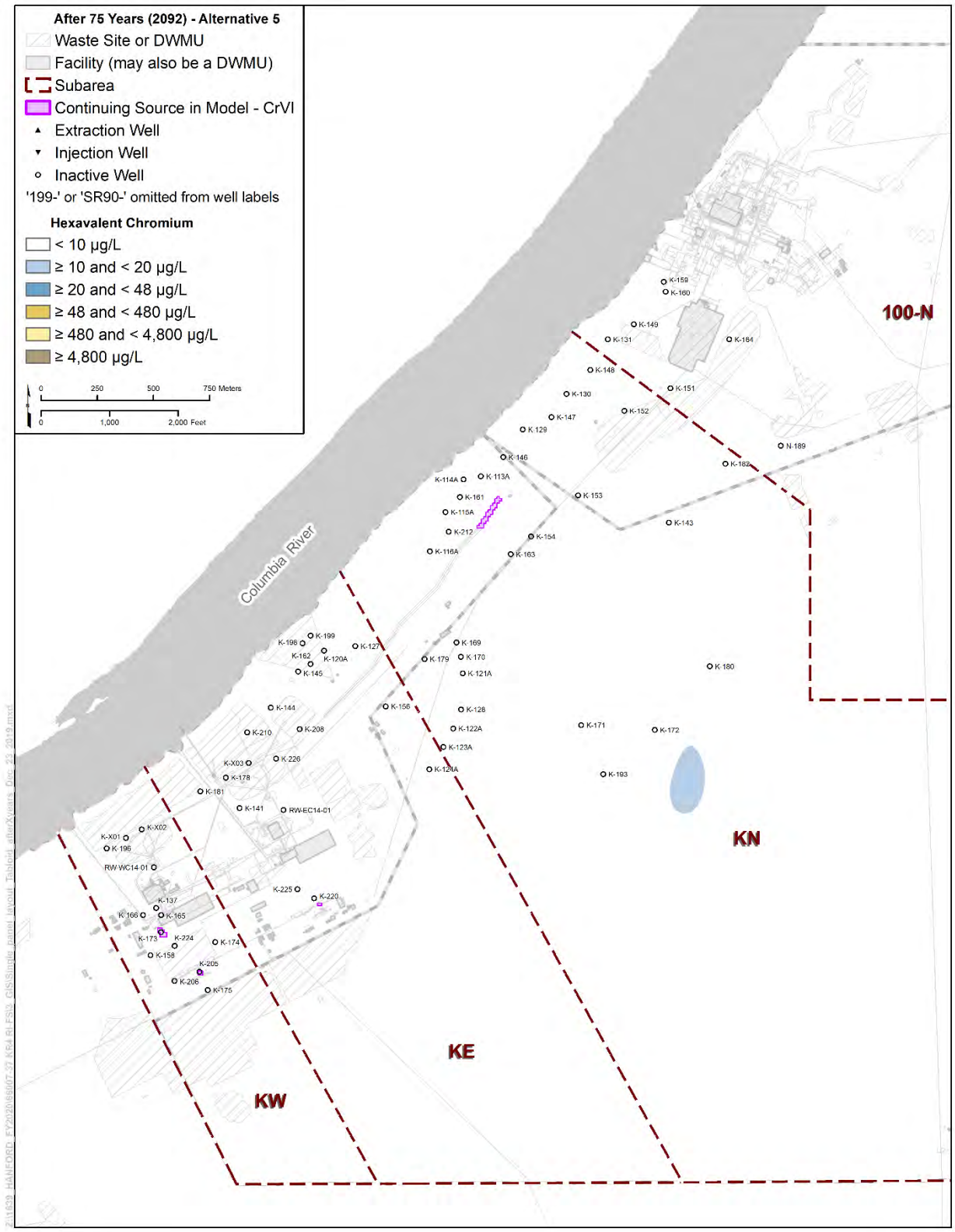

Figure 6-35. Cr(VI): Simulated Distribution after 75 Years (end of 2092) – Alternative 5

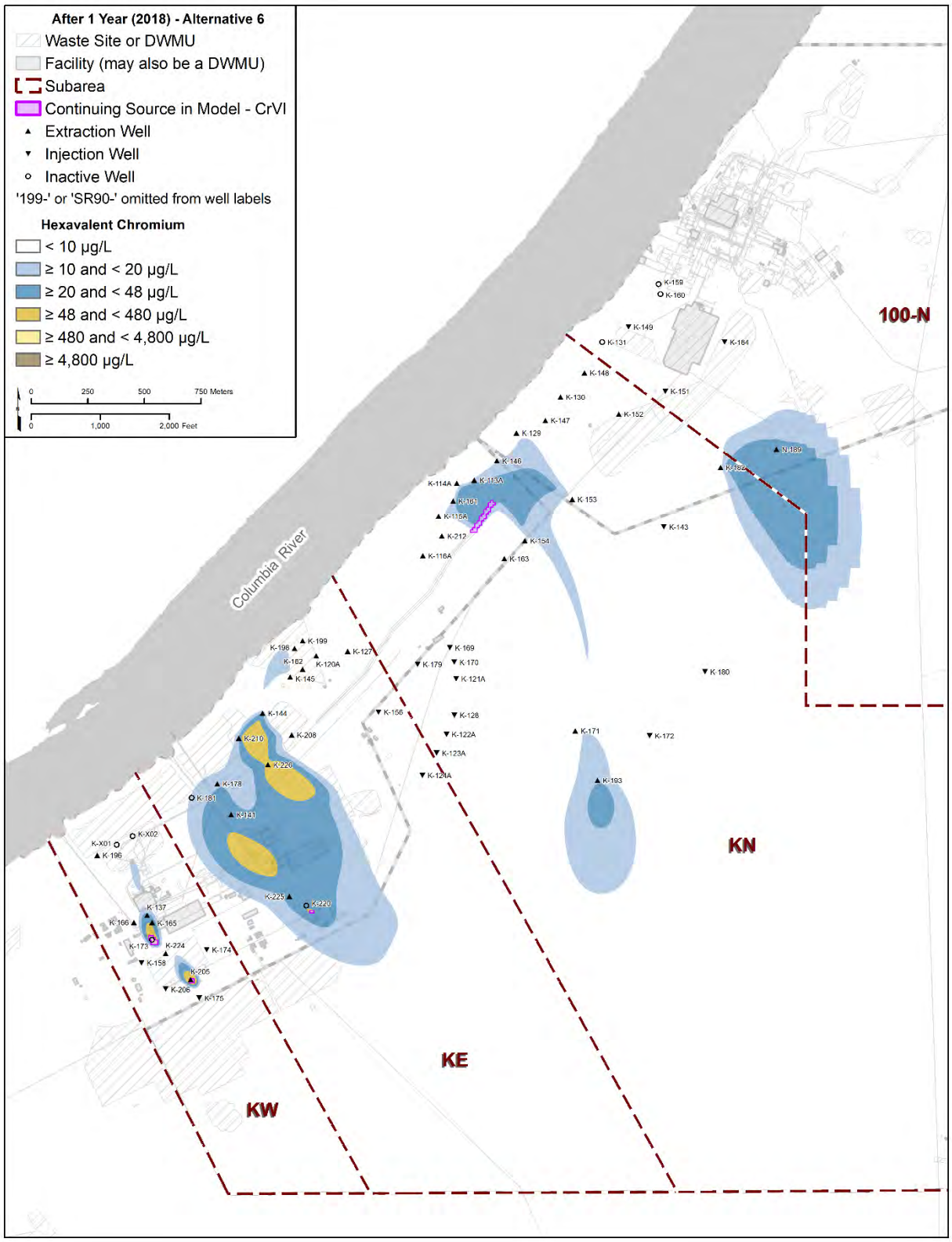

Figure 6-36. Cr(VI): Simulated Distribution after 1 Year (end of 2018) – Alternative 6

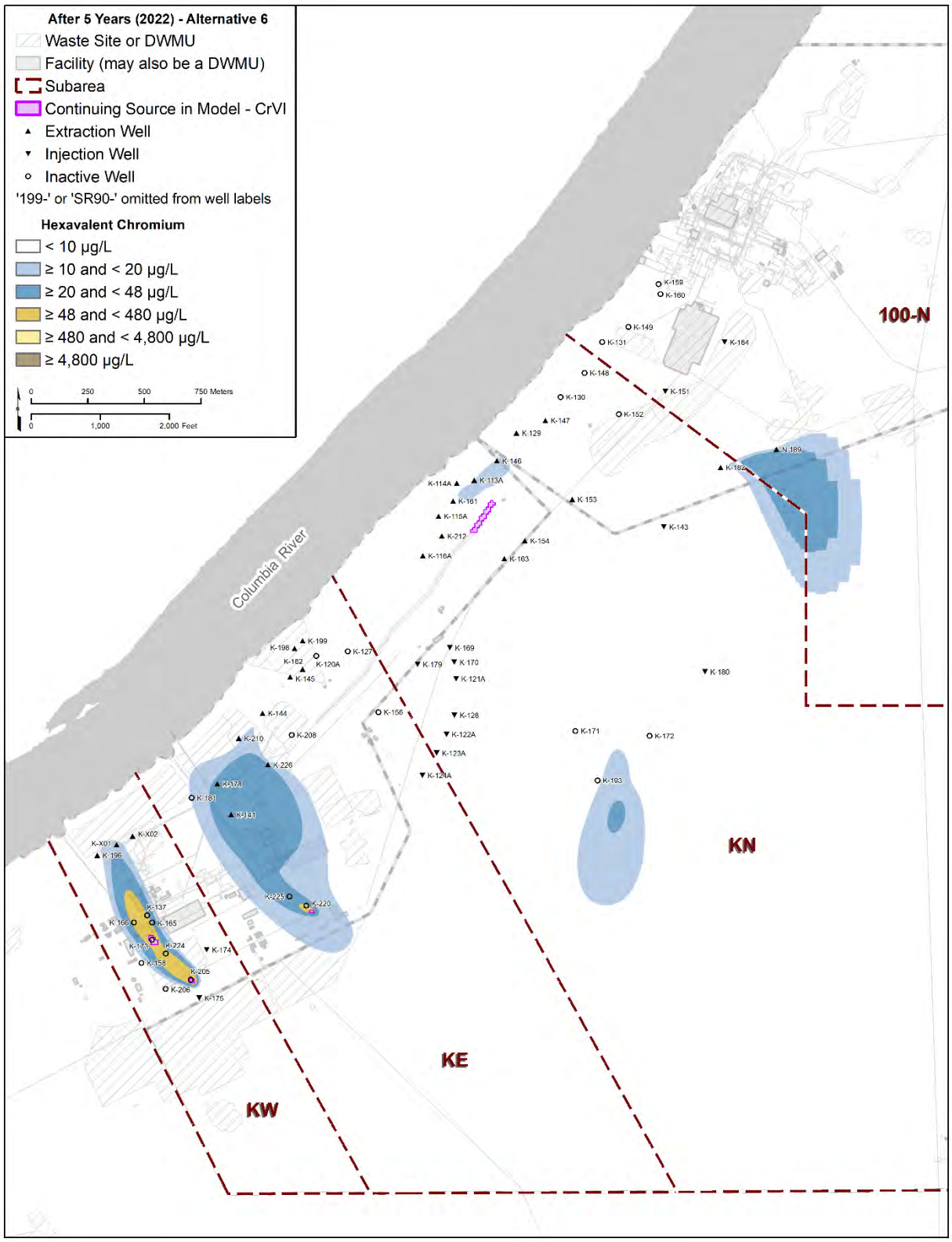

Figure 6-37. Cr(VI): Simulated Distribution after 5 Years (end of 2022) – Alternative 6

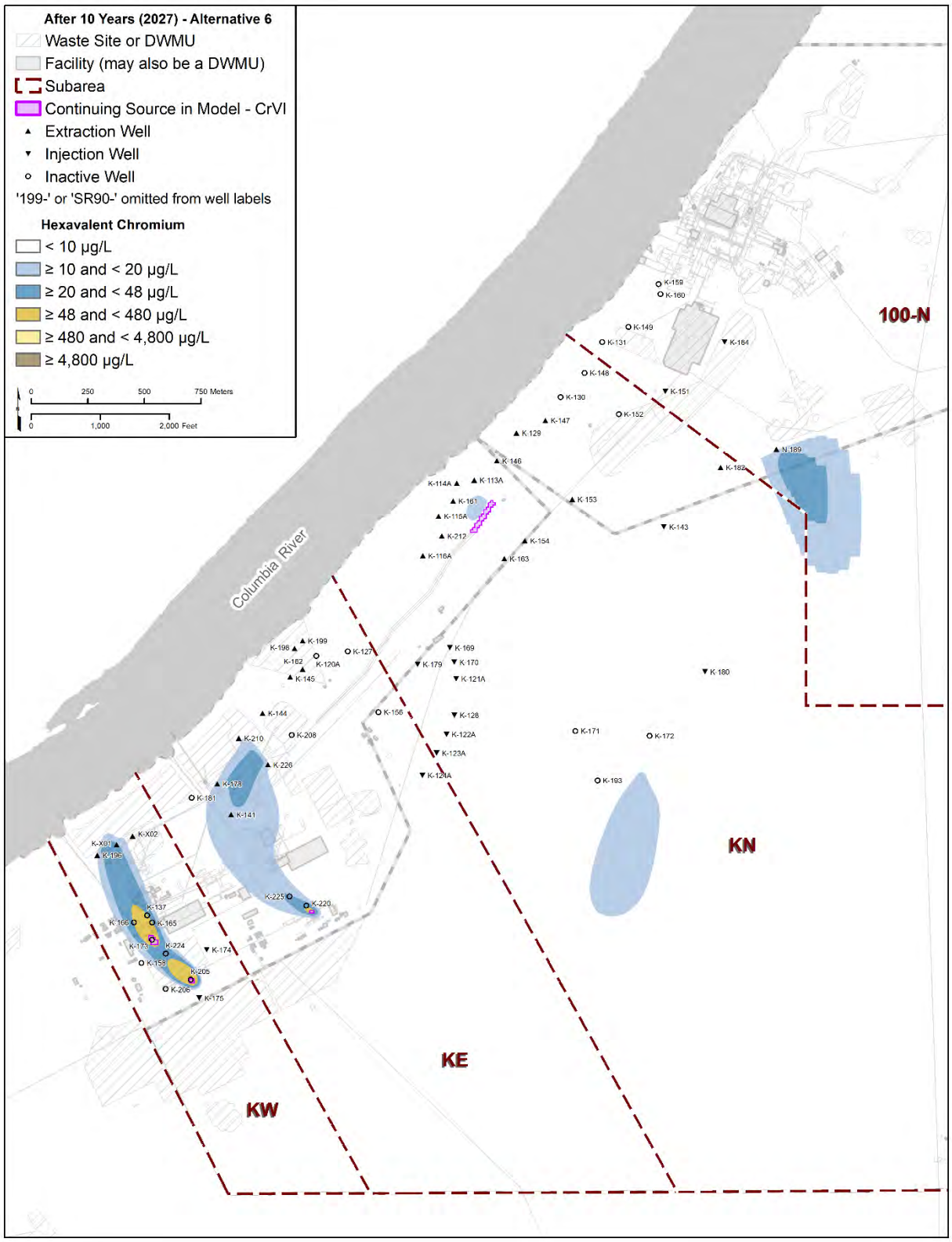

Figure 6-38. Cr(VI): Simulated Distribution after 10 Years (end of 2027) – Alternative 6

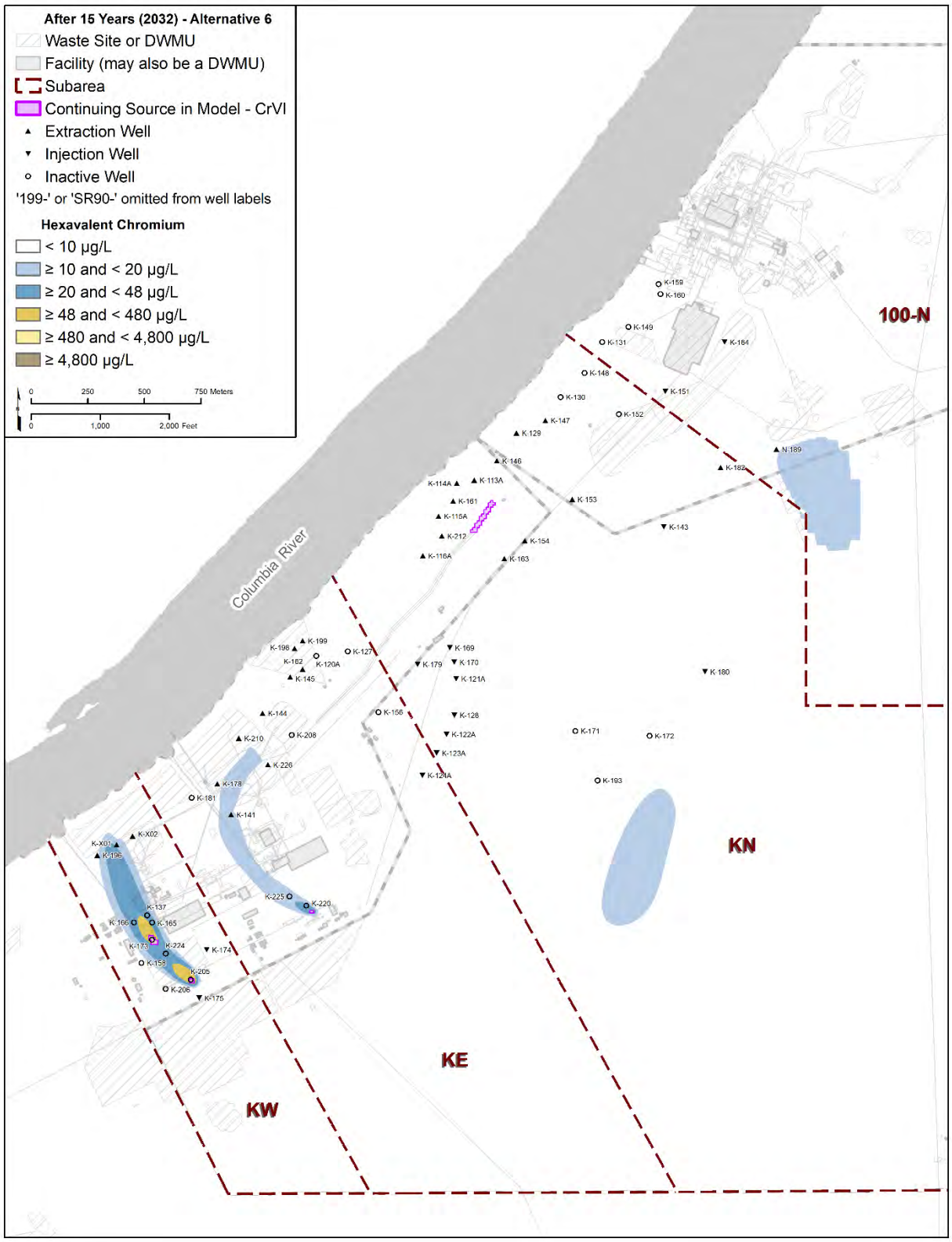

Figure 6-39. Cr(VI): Simulated Distribution after 15 Years (end of 2032) – Alternative 6

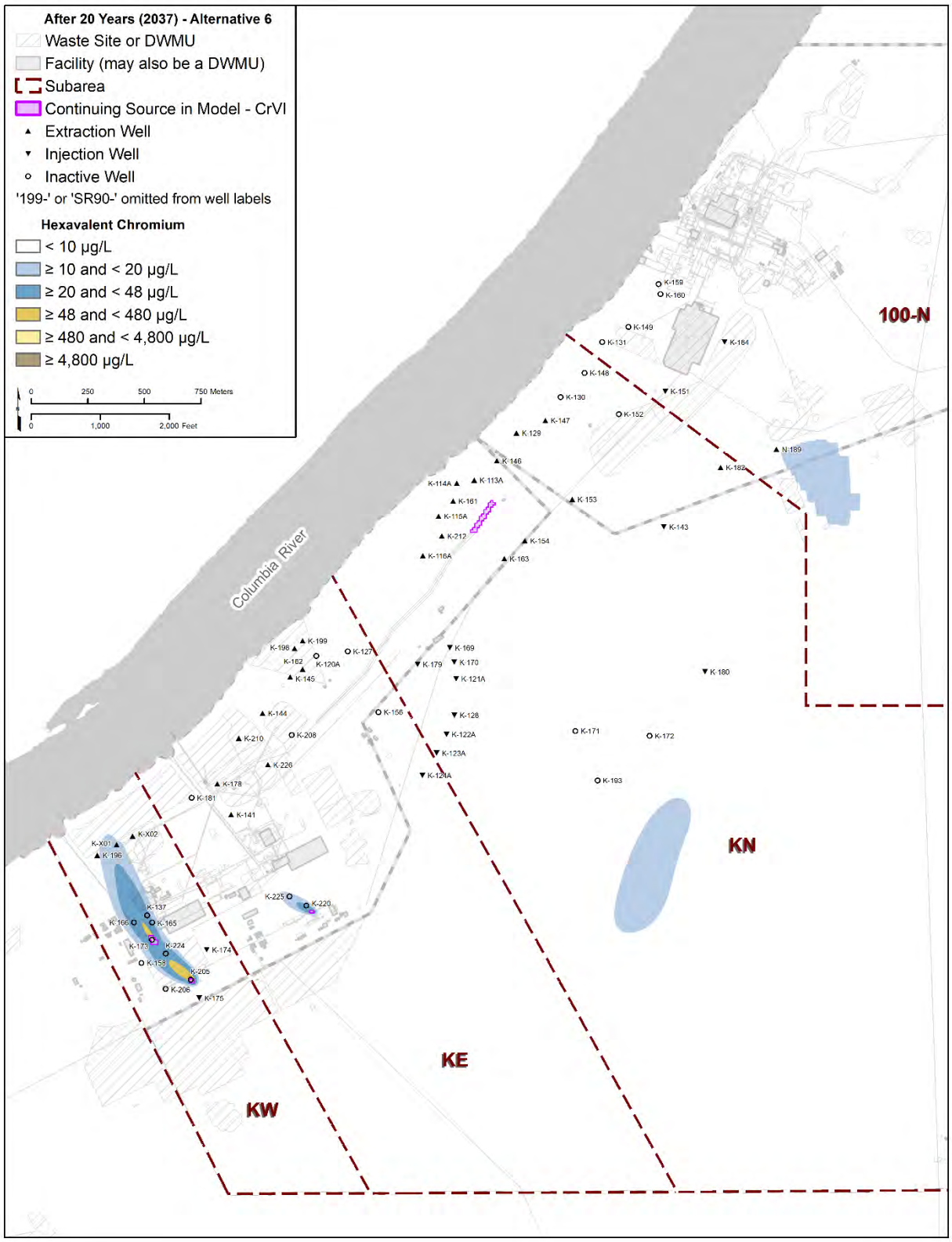

Figure 6-40. Cr(VI): Simulated Distribution after 20 Years (end of 2037) – Alternative 6

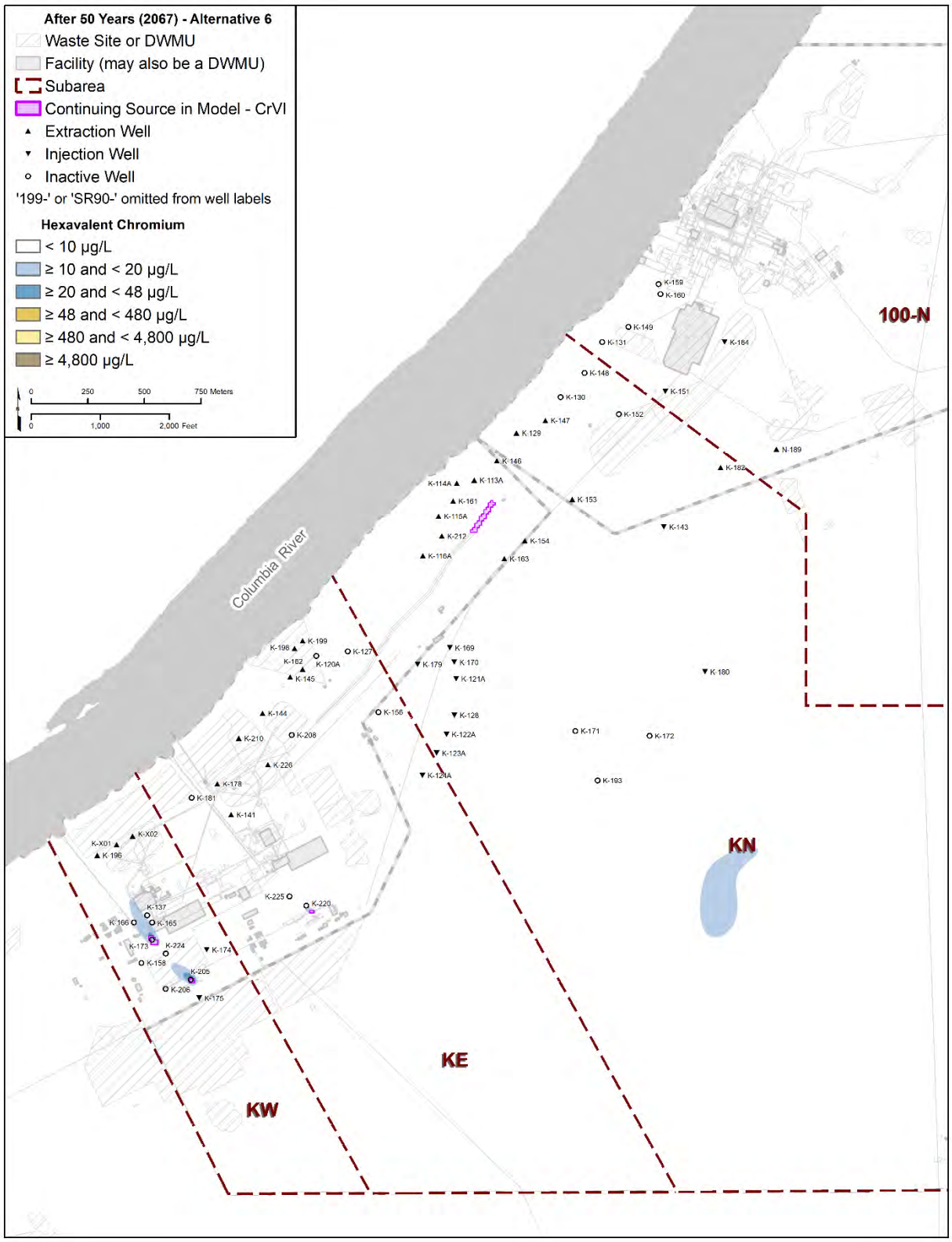

Figure 6-41. Cr(VI): Simulated Distribution after 50 Years (end of 2067) – Alternative 6

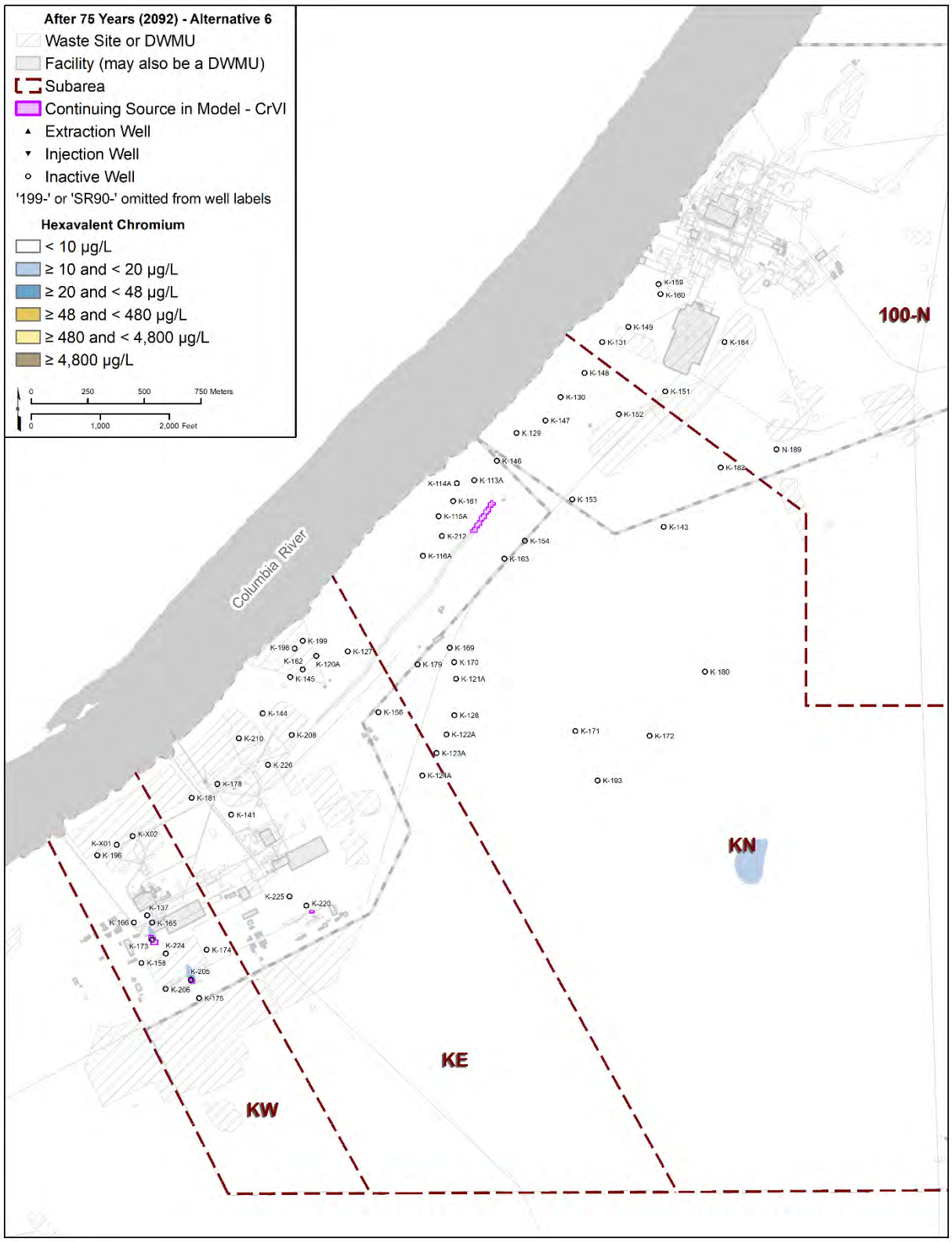

Figure 6-42. Cr(VI): Simulated Distribution after 75 Years (end of 2092) – Alternative 6

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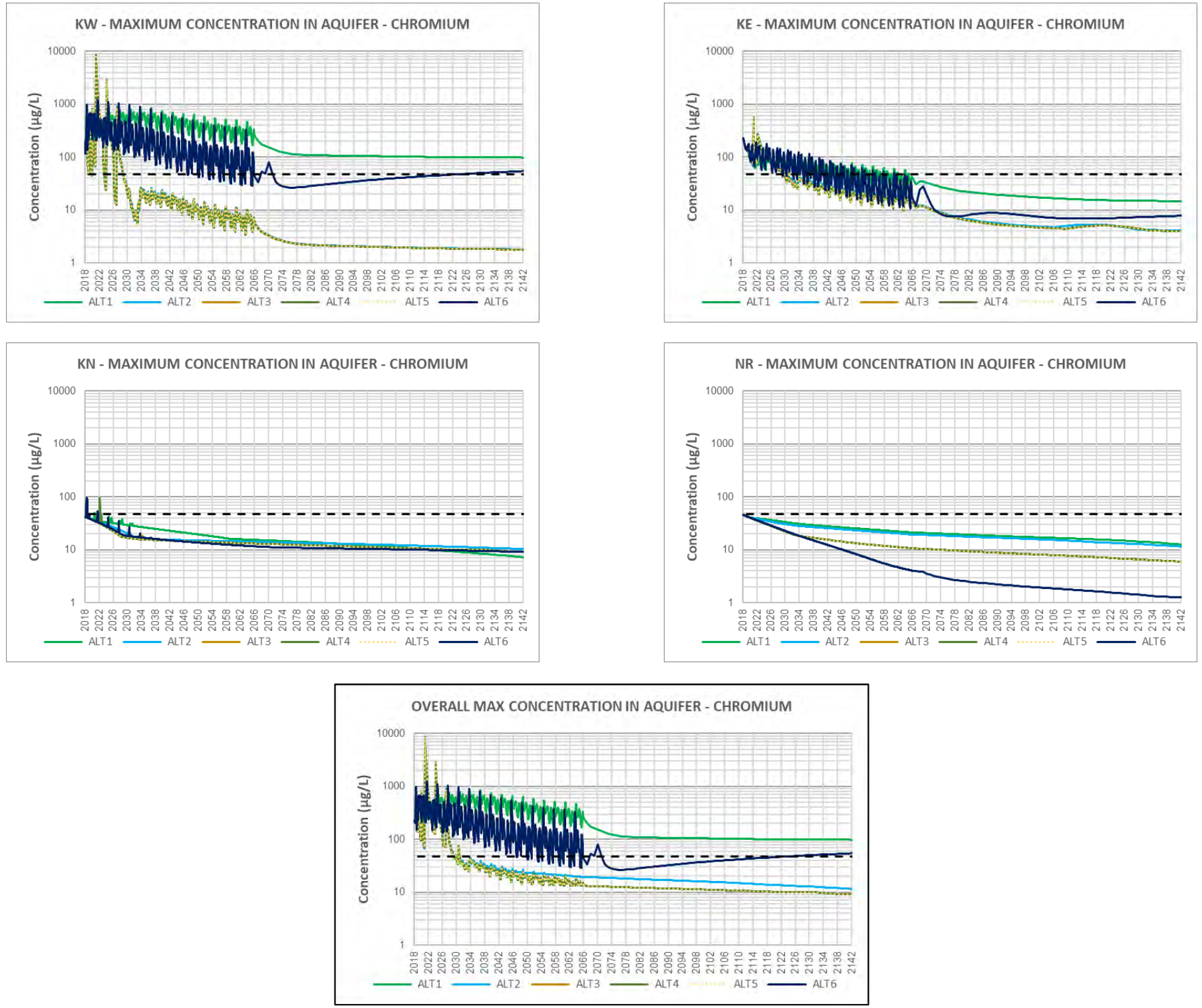


Figure 6-43. Cr(VI): Maximum Concentration Time Series in the Aquifer

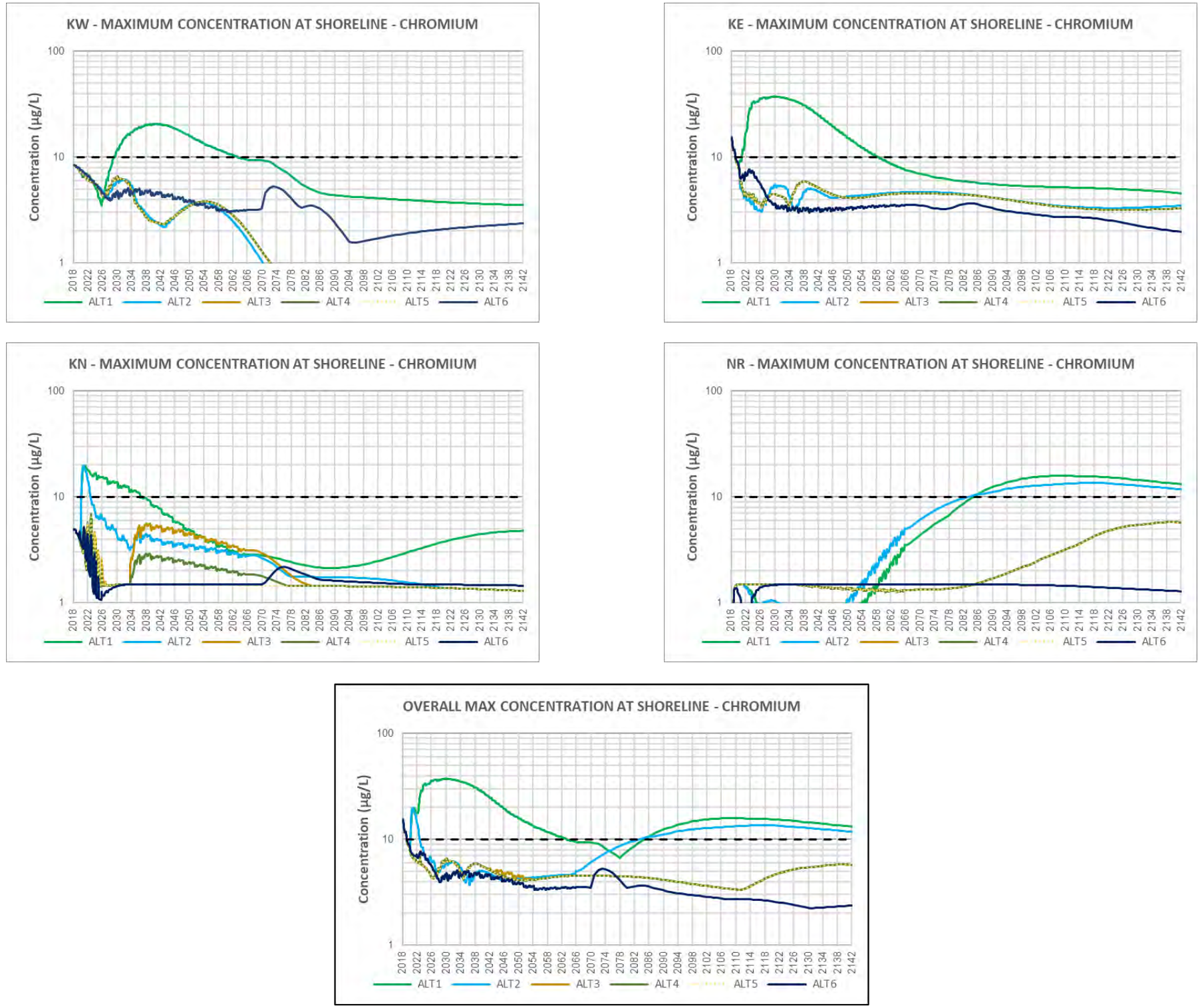
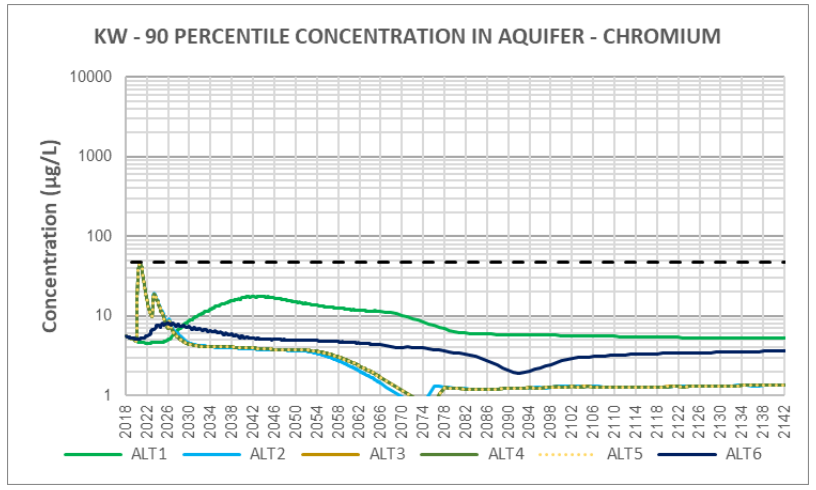
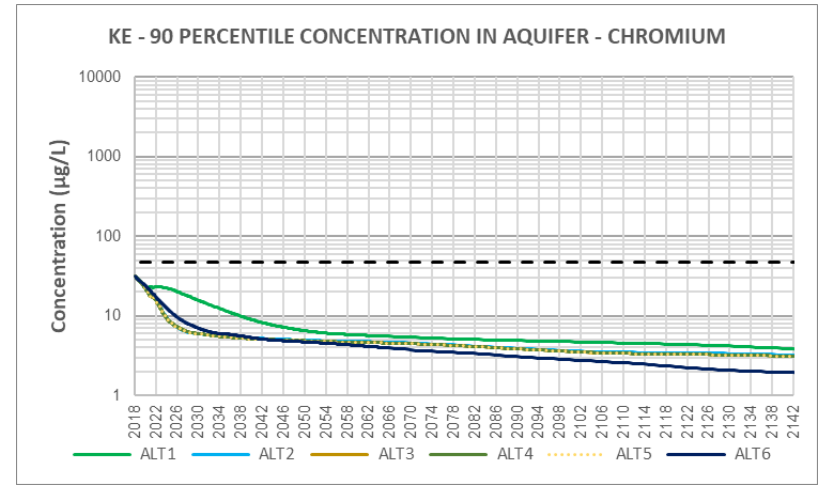
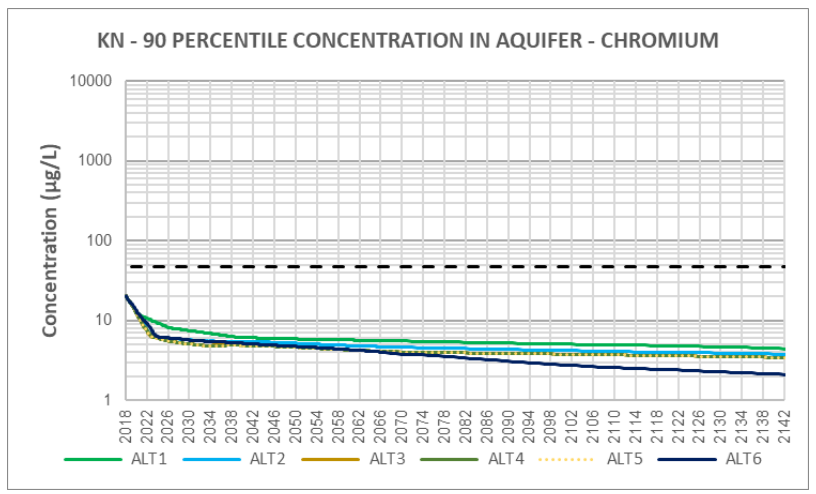
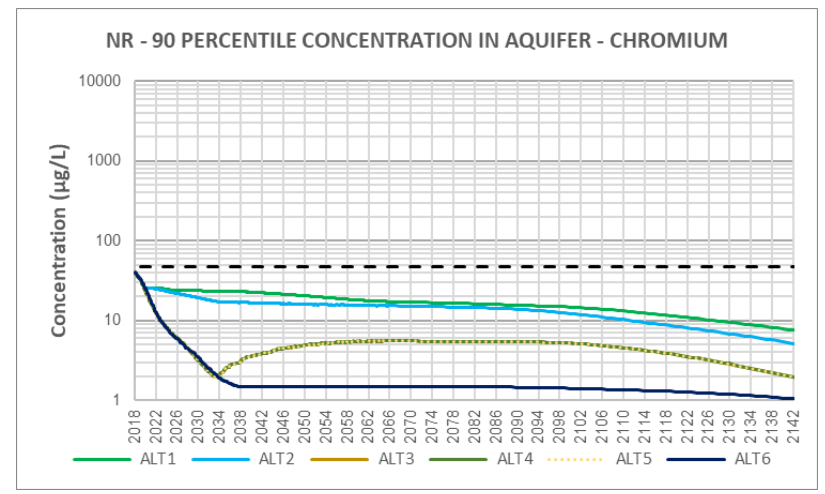


Figure 6-44. Cr(VI): Maximum Concentration Time Series at the Shoreline









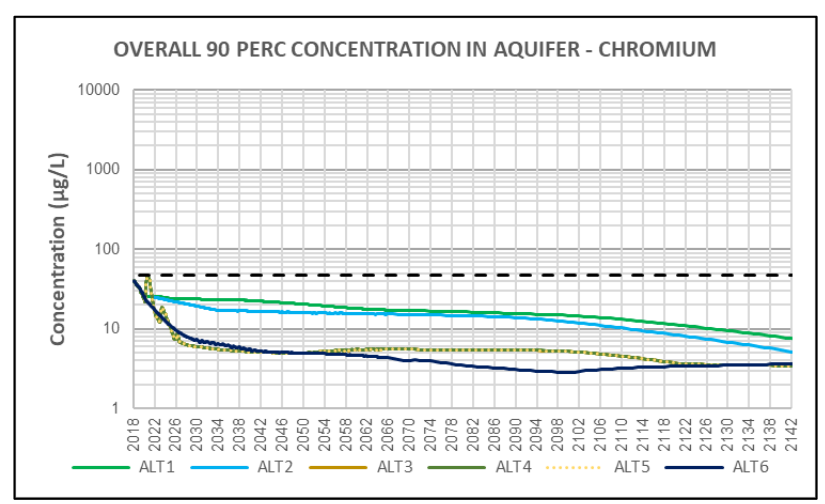


Figure 6-45. Cr(VI): 90th Percentile Concentration Time Series in the Aquifer – 100-K Model Domain

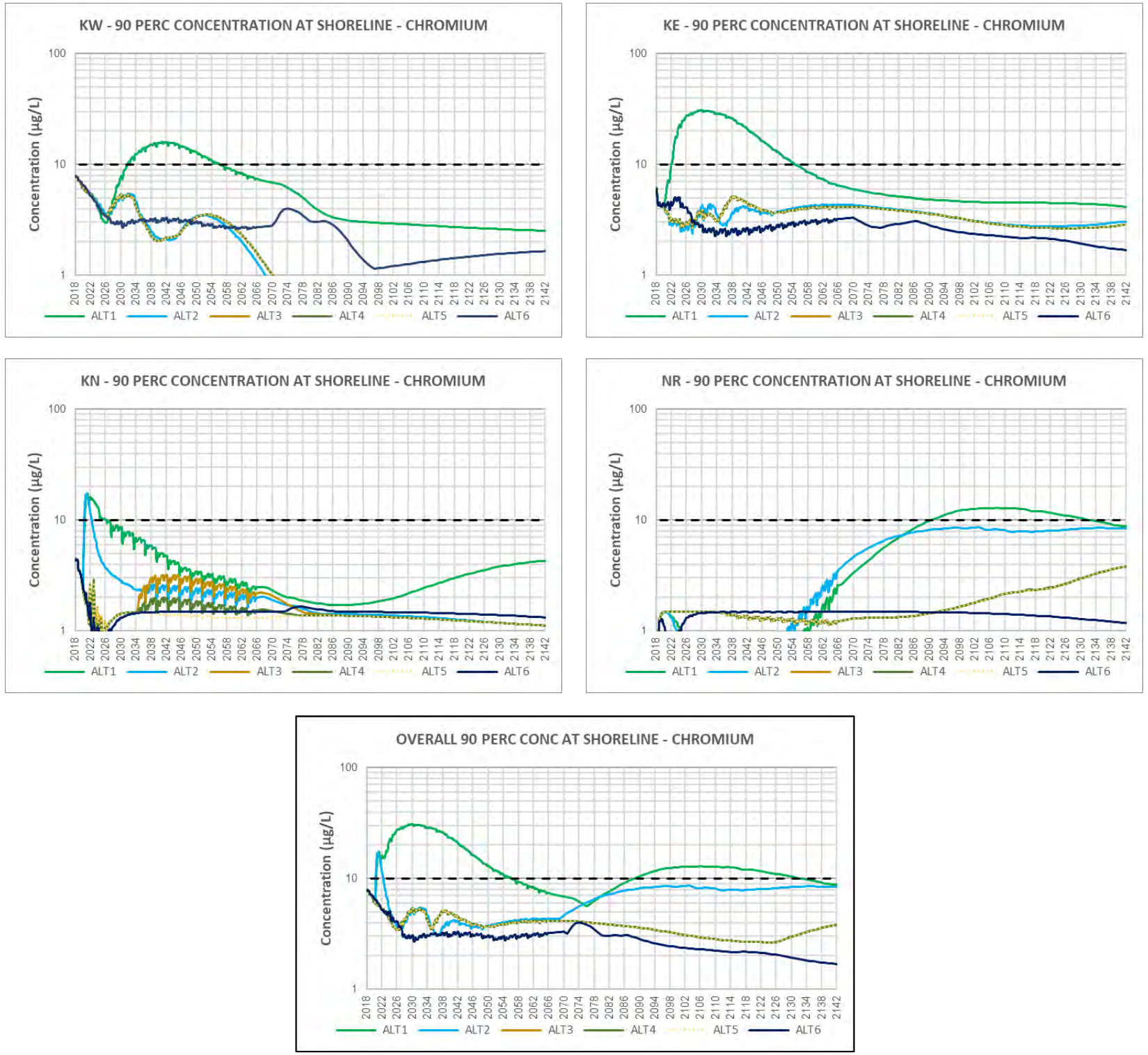


Figure 6-46. Cr(VI): 90th Percentile Concentration Time Series at the Shoreline – 100-K Model Domain

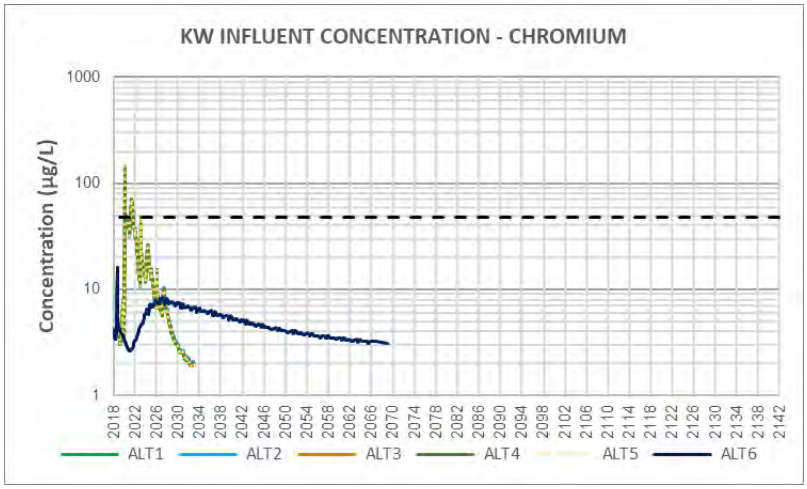


Figure 6-47. Cr(VI): Combined Influent Concentration Time Series – KW System

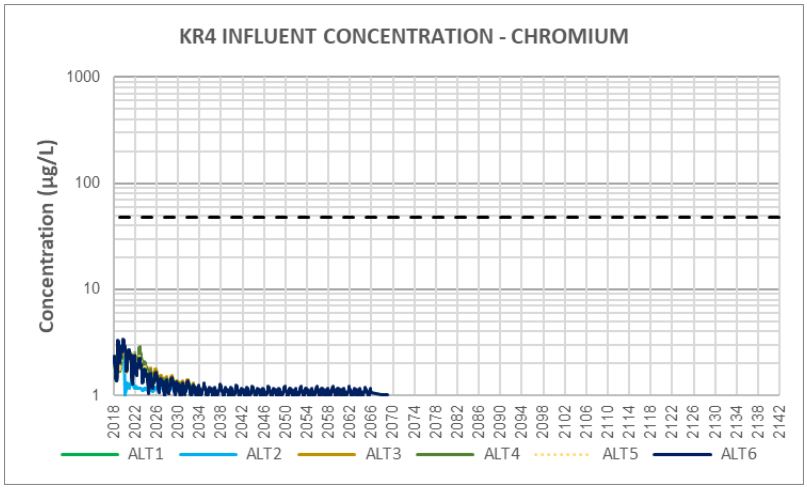


Figure 6-48. Cr(VI): Combined Influent Concentration Time Series – KR4 System

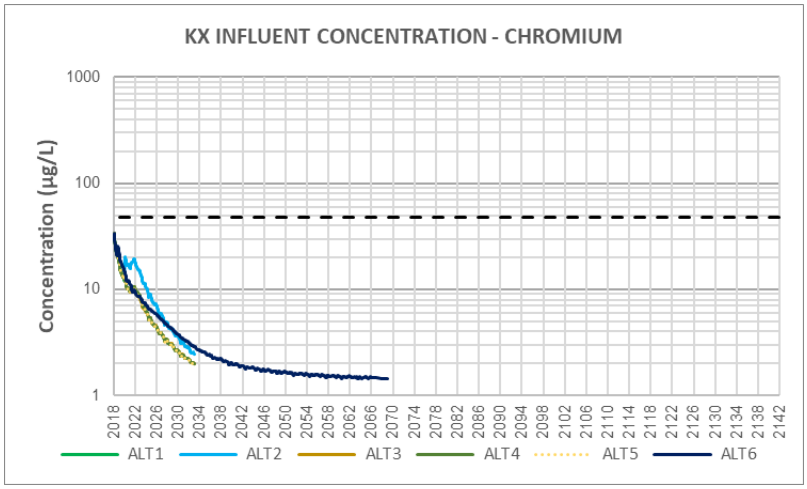


Figure 6-49. Cr(VI): Combined Influent Concentration Time Series – KX System

6.1.2 Simulated Contaminant Distribution – Concentration Statistics: Carbon-14

Results for carbon-14 are grouped in the following sets of figures:

- Figures 6-50 to 6-73: simulated concentration distributions for each alternative.
- Figures 6-74 to 6-75: maximum concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-76 to 6-77: 90th percentile concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-78 to 6-80: combined influent concentration time series per treatment system for each alternative.

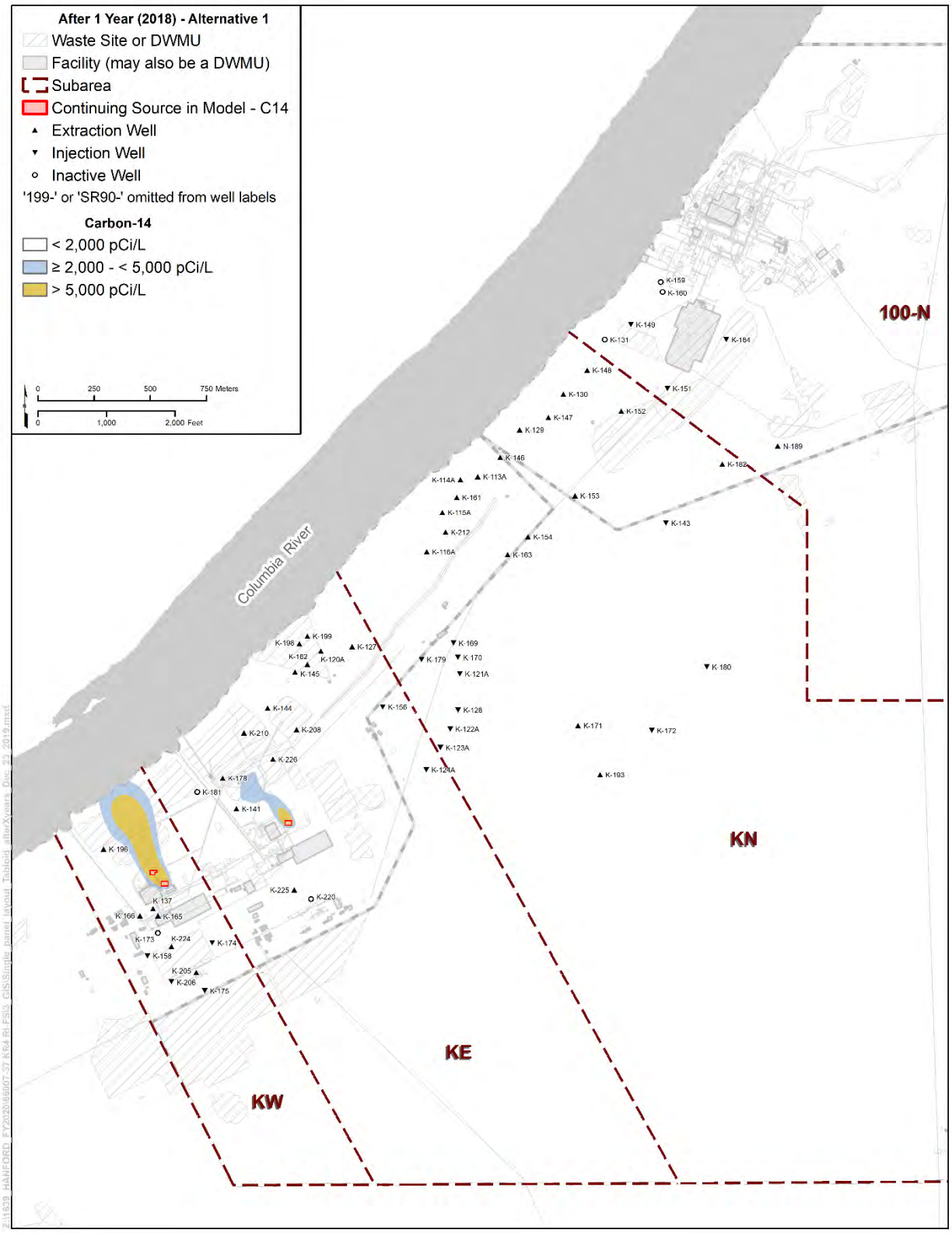


Figure 6-50. Carbon-14: Simulated Distribution after 1 Year (end of 2018) – Alternative 1

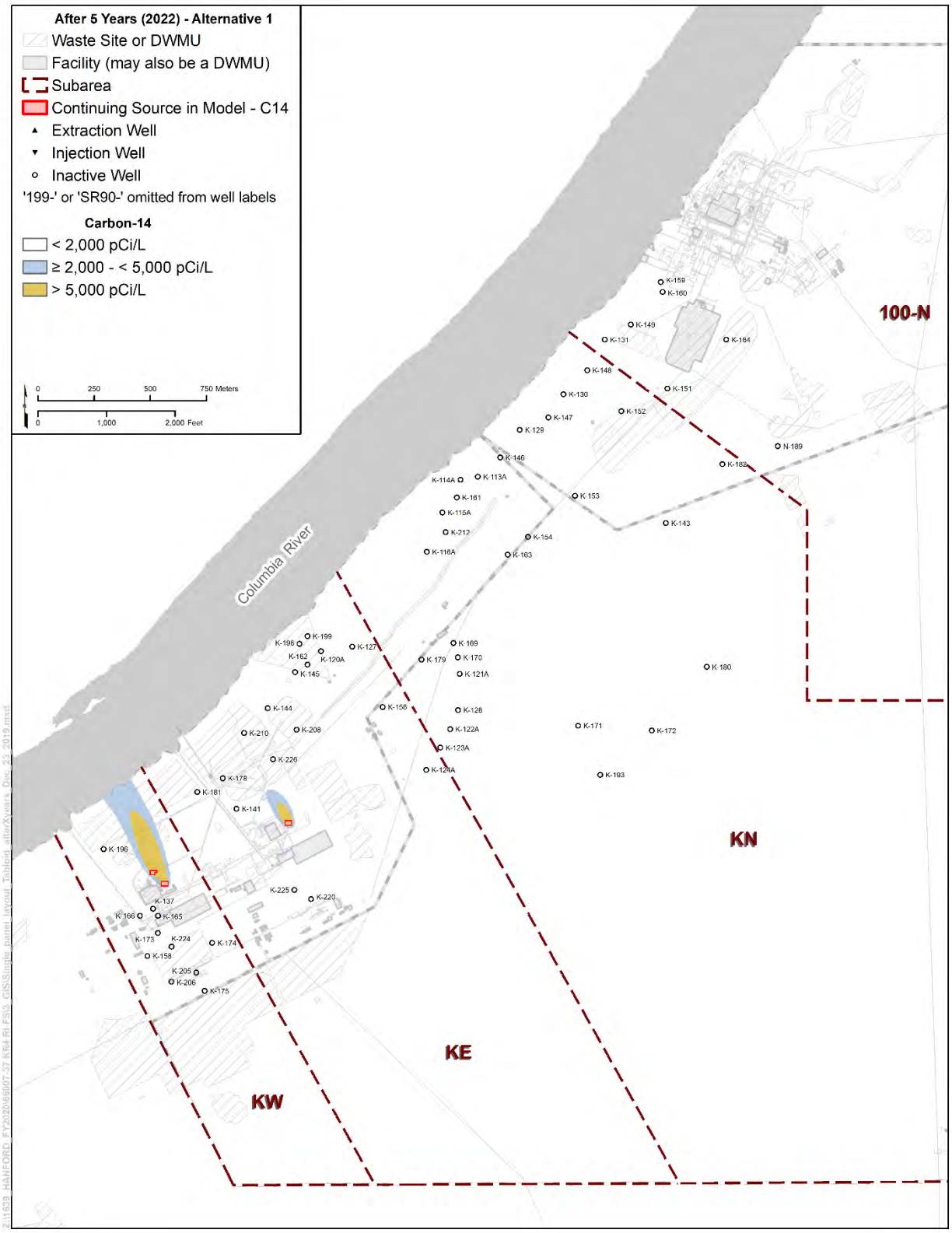


Figure 6-51. Carbon-14: Simulated Distribution after 5 Years (end of 2022) – Alternative 1

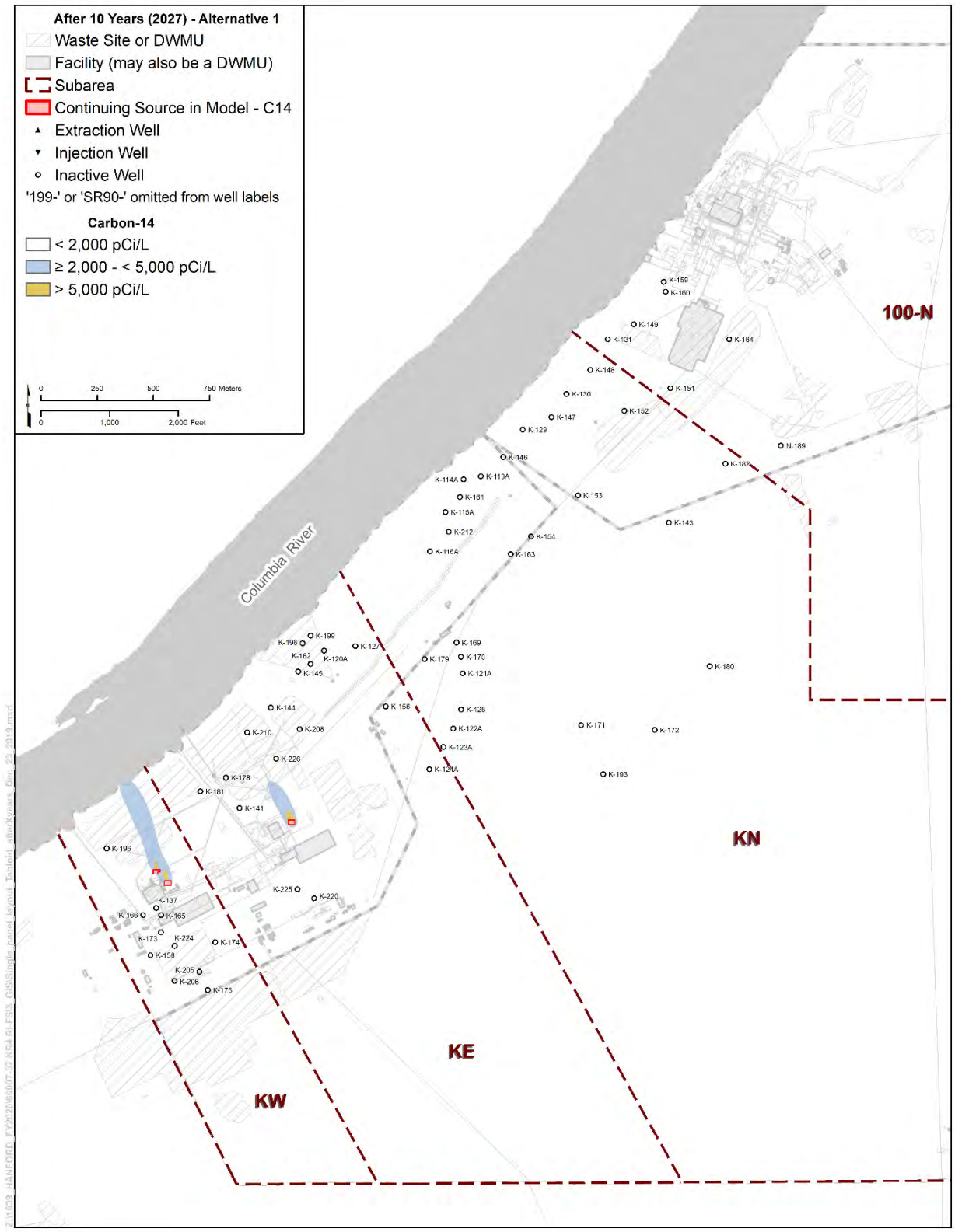


Figure 6-52. Carbon-14: Simulated Distribution after 10 Years (end of 2027) – Alternative 1

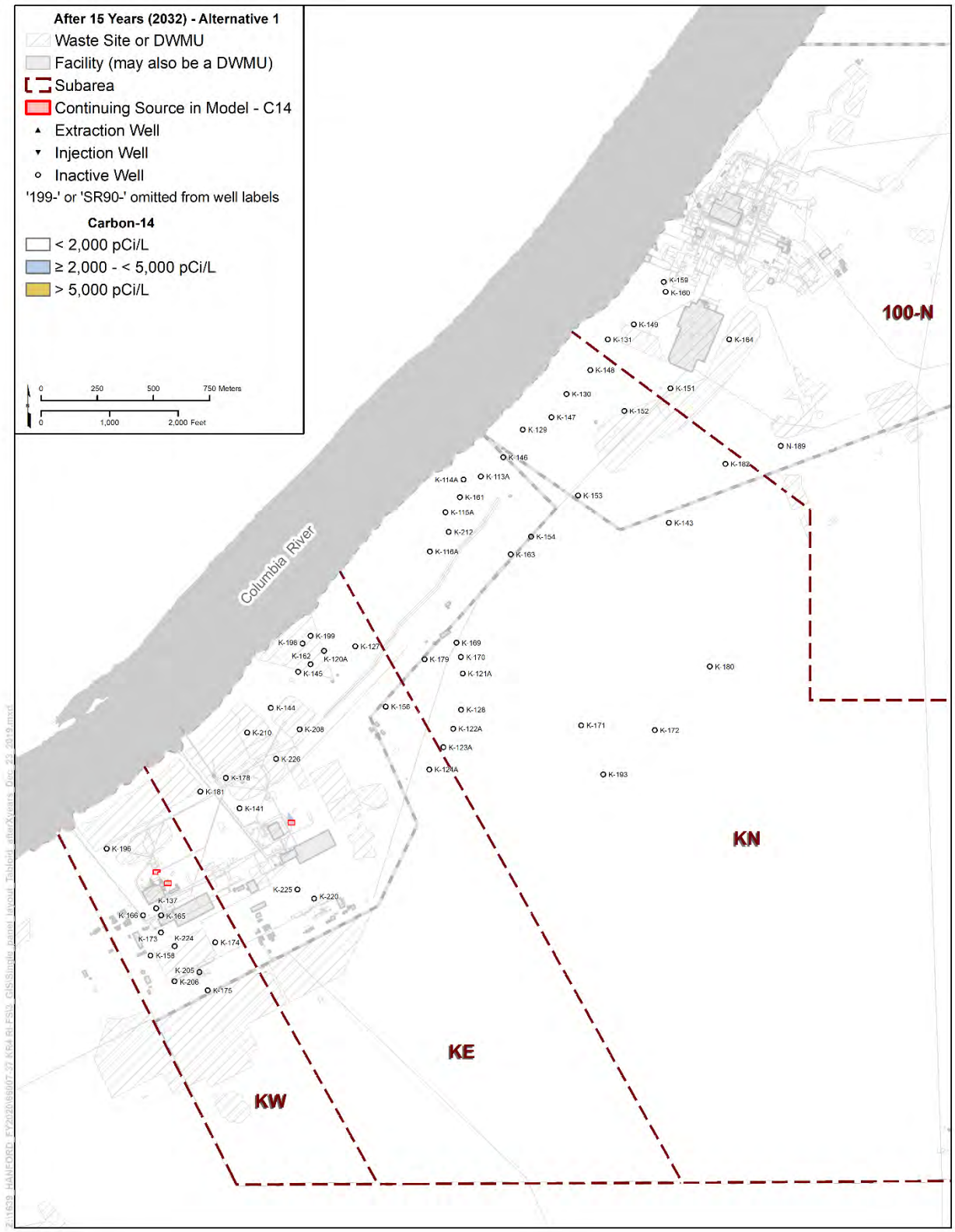


Figure 6-53. Carbon-14: Simulated Distribution after 15 Years (end of 2032) – Alternative 1

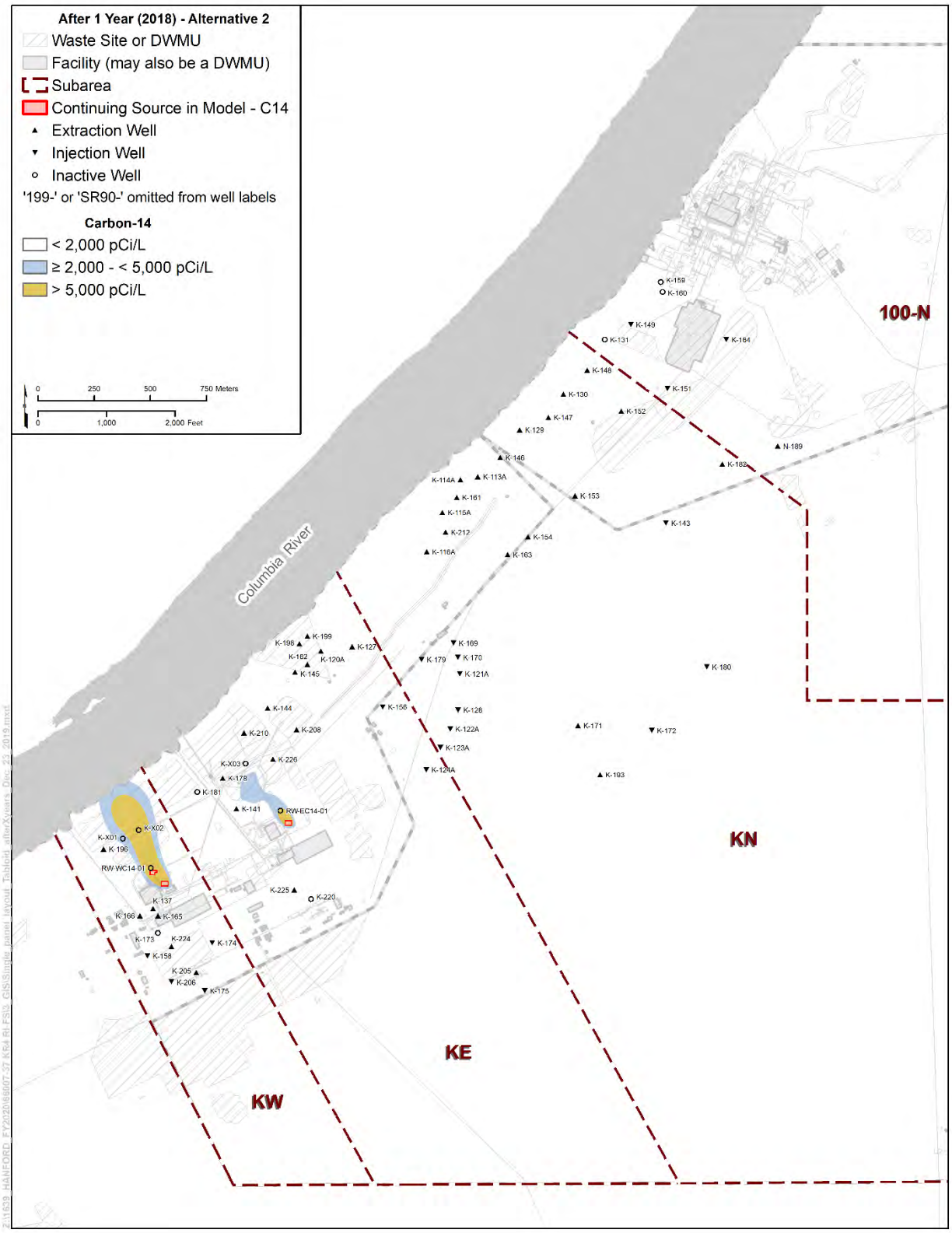


Figure 6-54. Carbon-14: Simulated Distribution after 1 Year (end of 2018) – Alternative 2

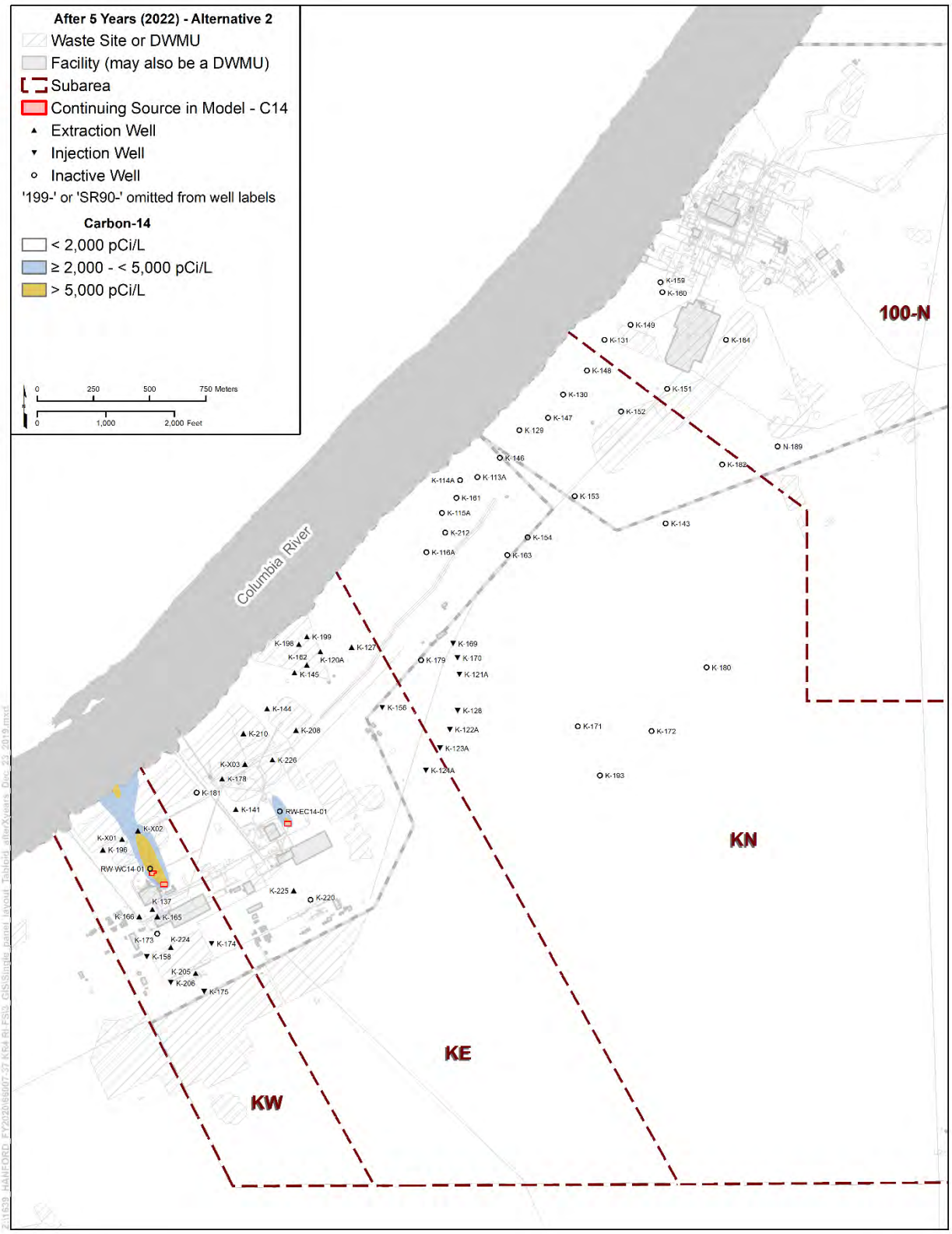


Figure 6-55. Carbon-14: Simulated Distribution after 5 Years (end of 2022) – Alternative 2

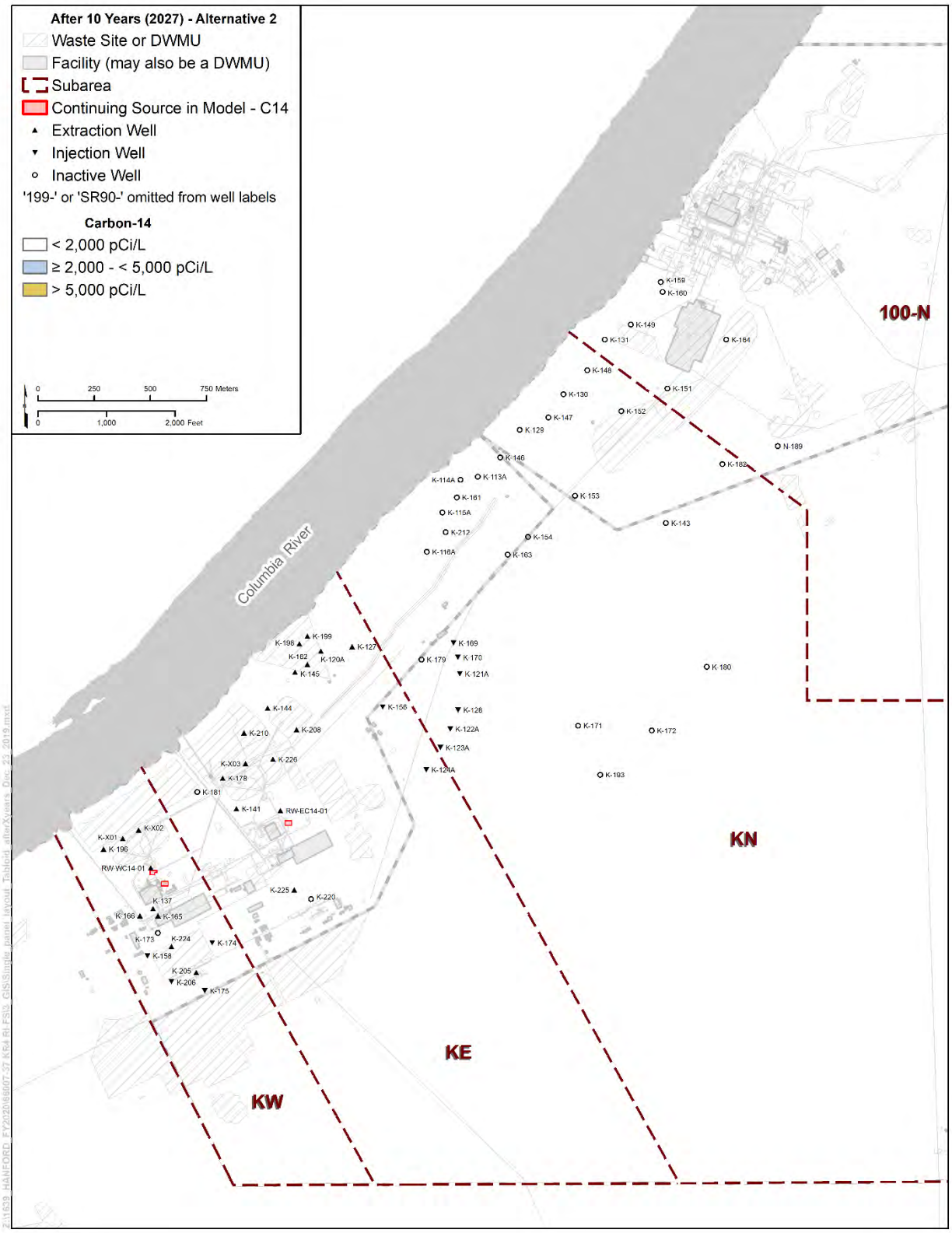


Figure 6-56. Carbon-14: Simulated Distribution after 10 Years (end of 2027) – Alternative 2

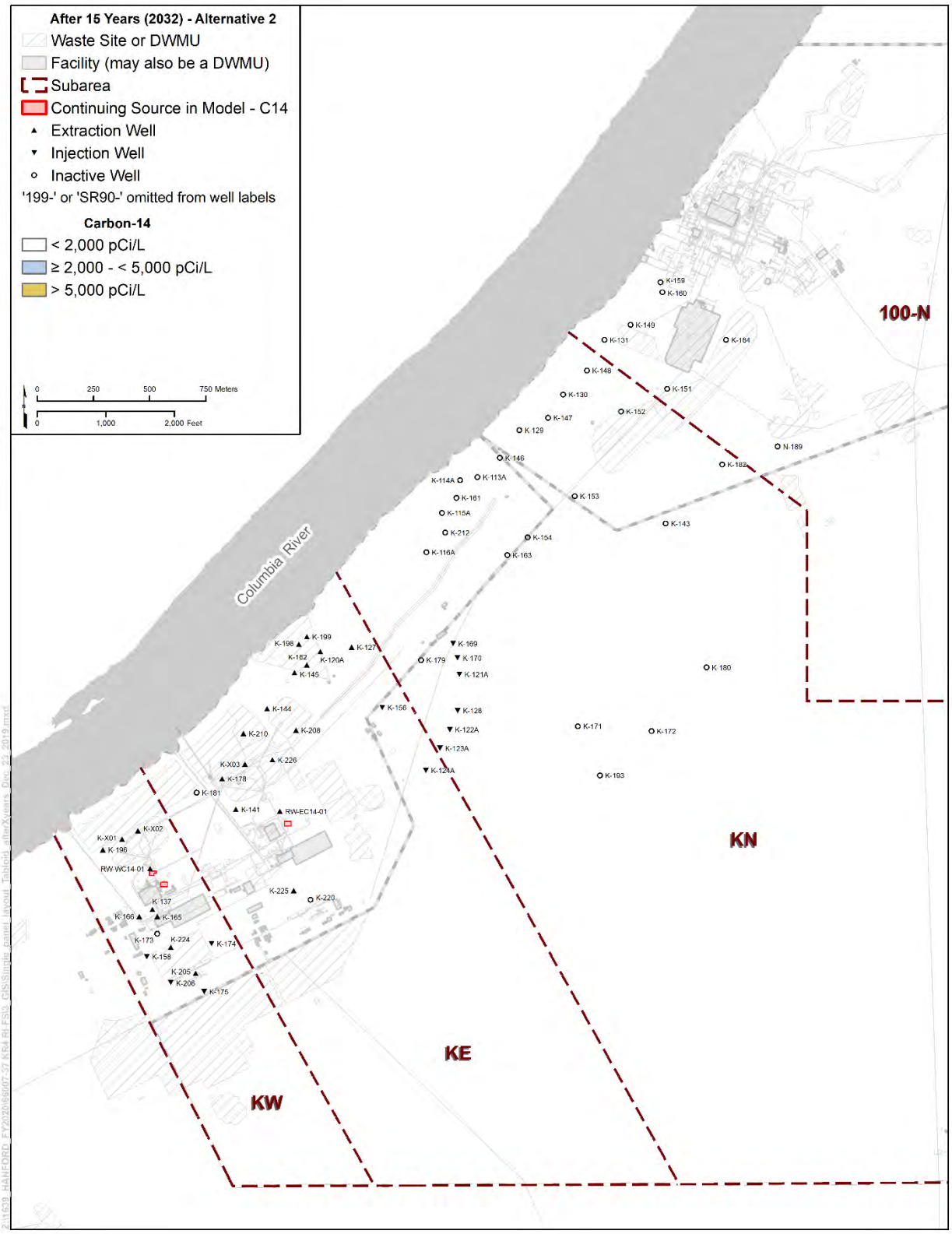


Figure 6-57. Carbon-14: Simulated Distribution after 15 Years (end of 2032) – Alternative 2

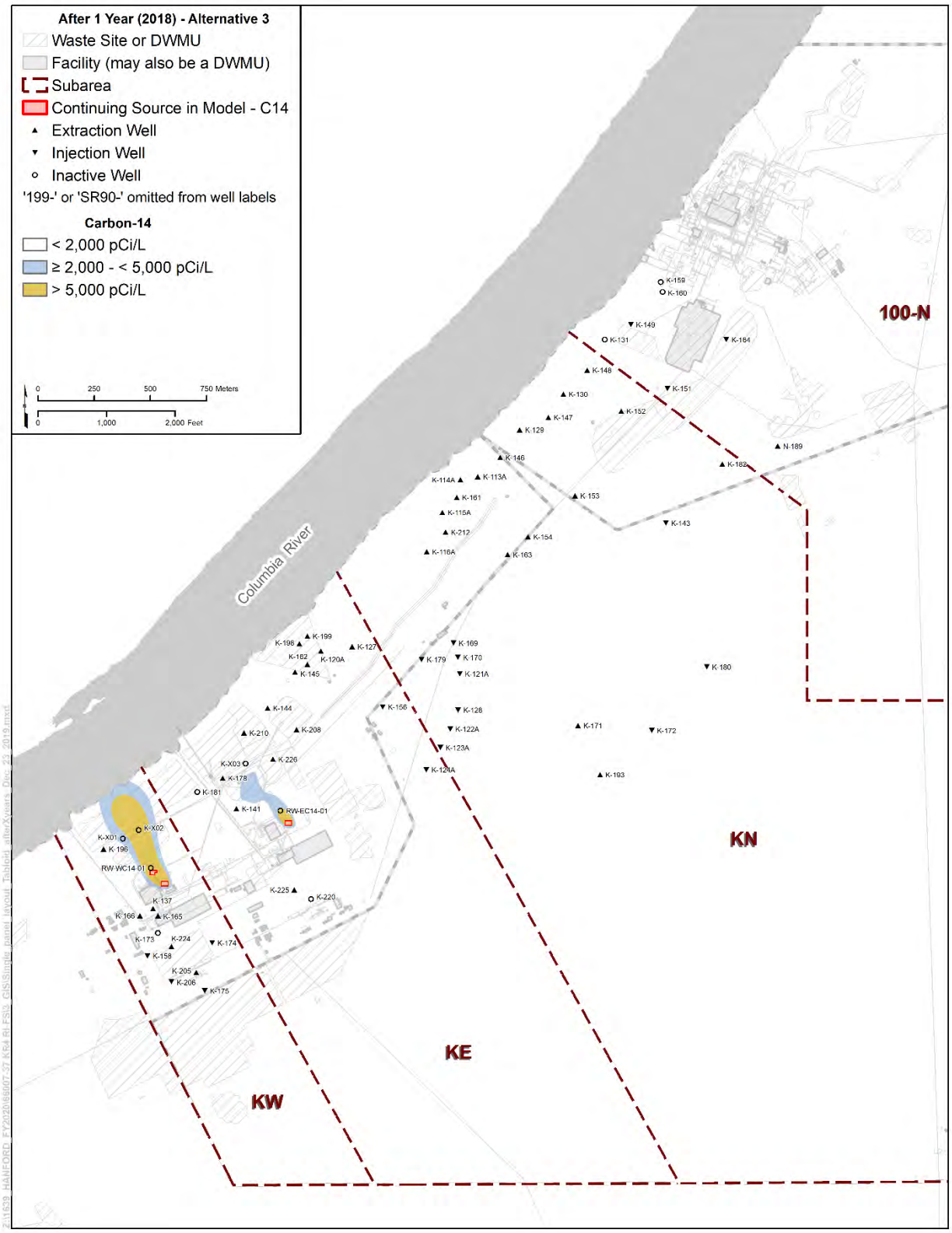


Figure 6-58. Carbon-14: Simulated Distribution after 1 Year (end of 2018) – Alternative 3

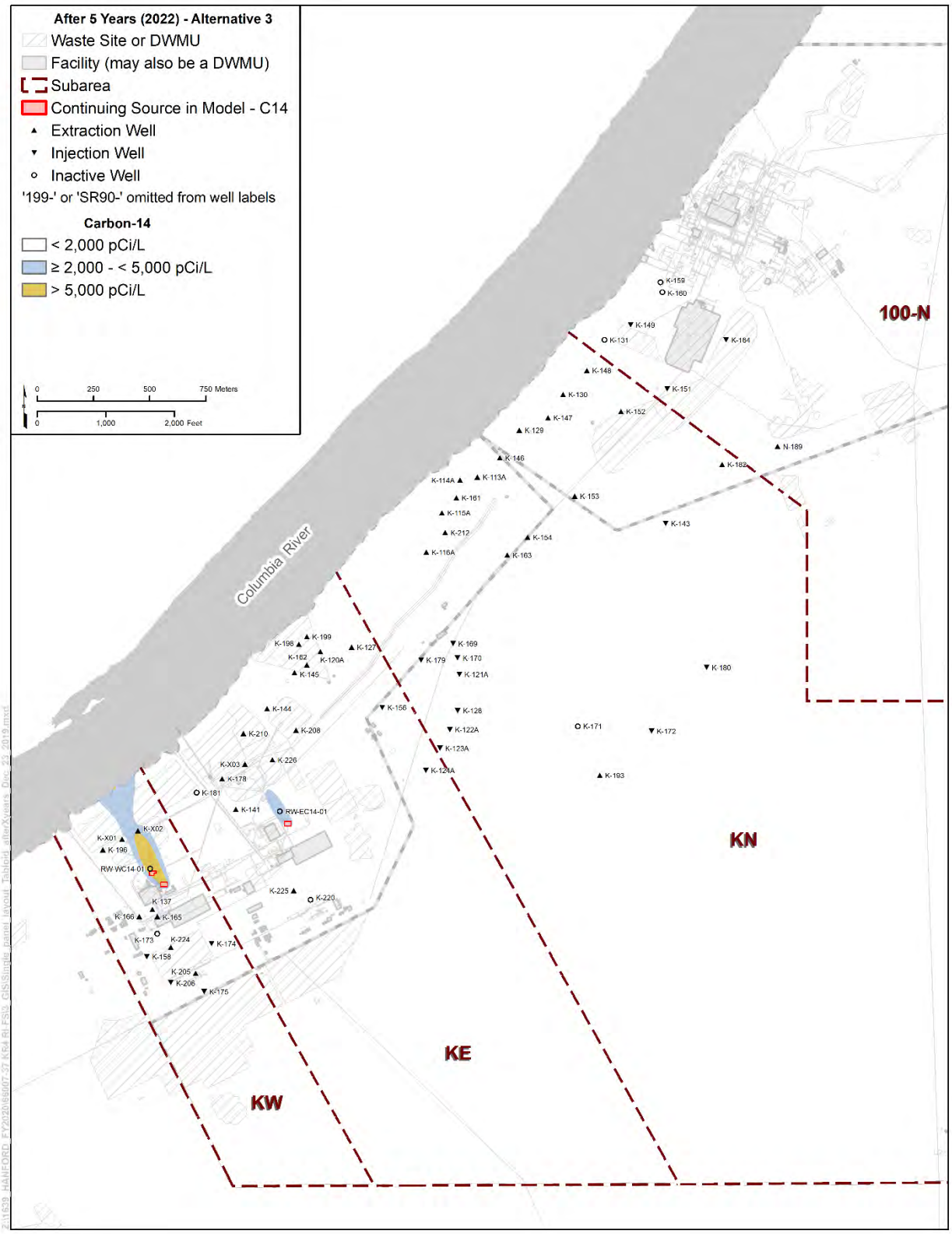


Figure 6-59. Carbon-14: Simulated Distribution after 5 Years (end of 2022) – Alternative 3

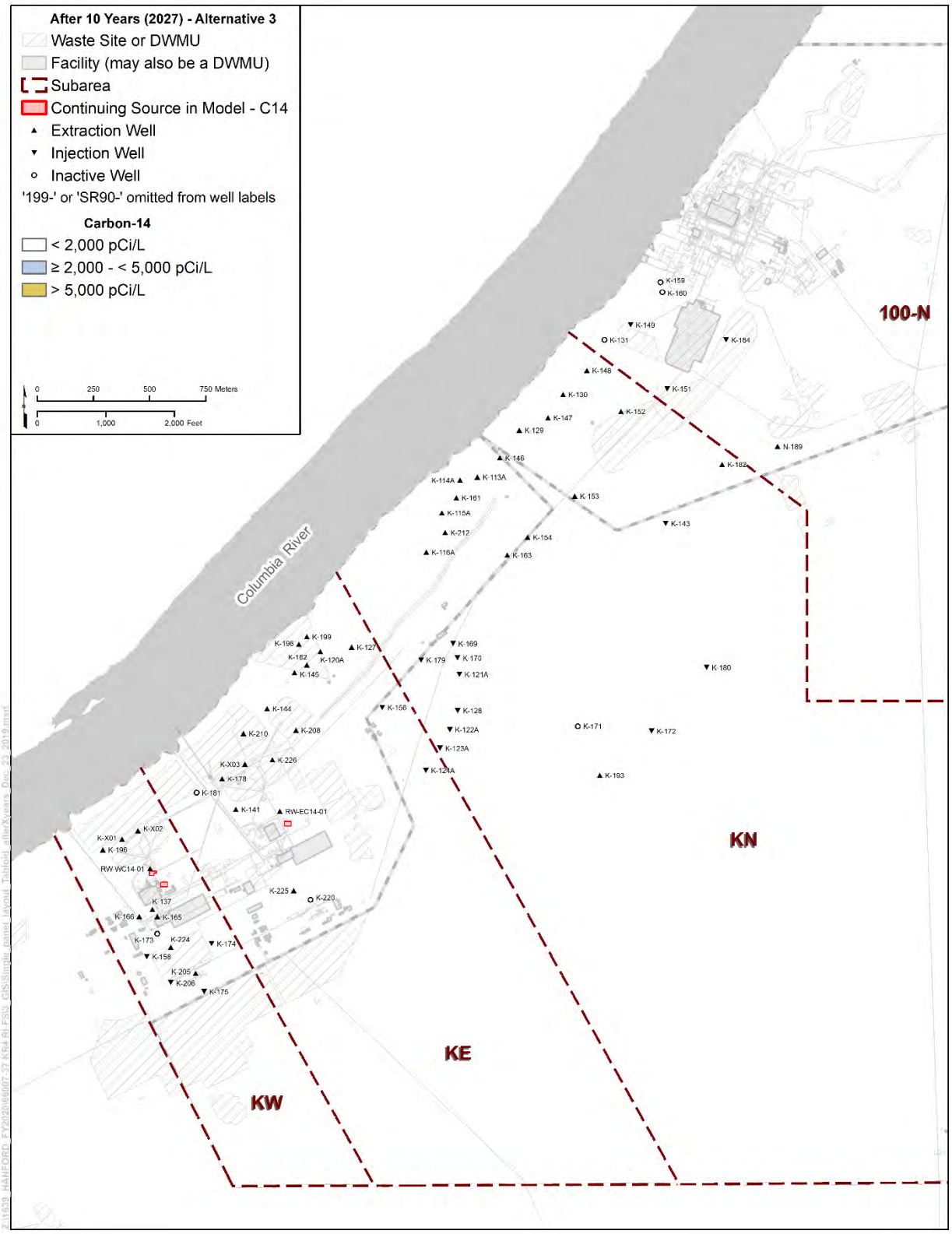


Figure 6-60. Carbon-14: Simulated Distribution after 10 Years (end of 2027) – Alternative 3

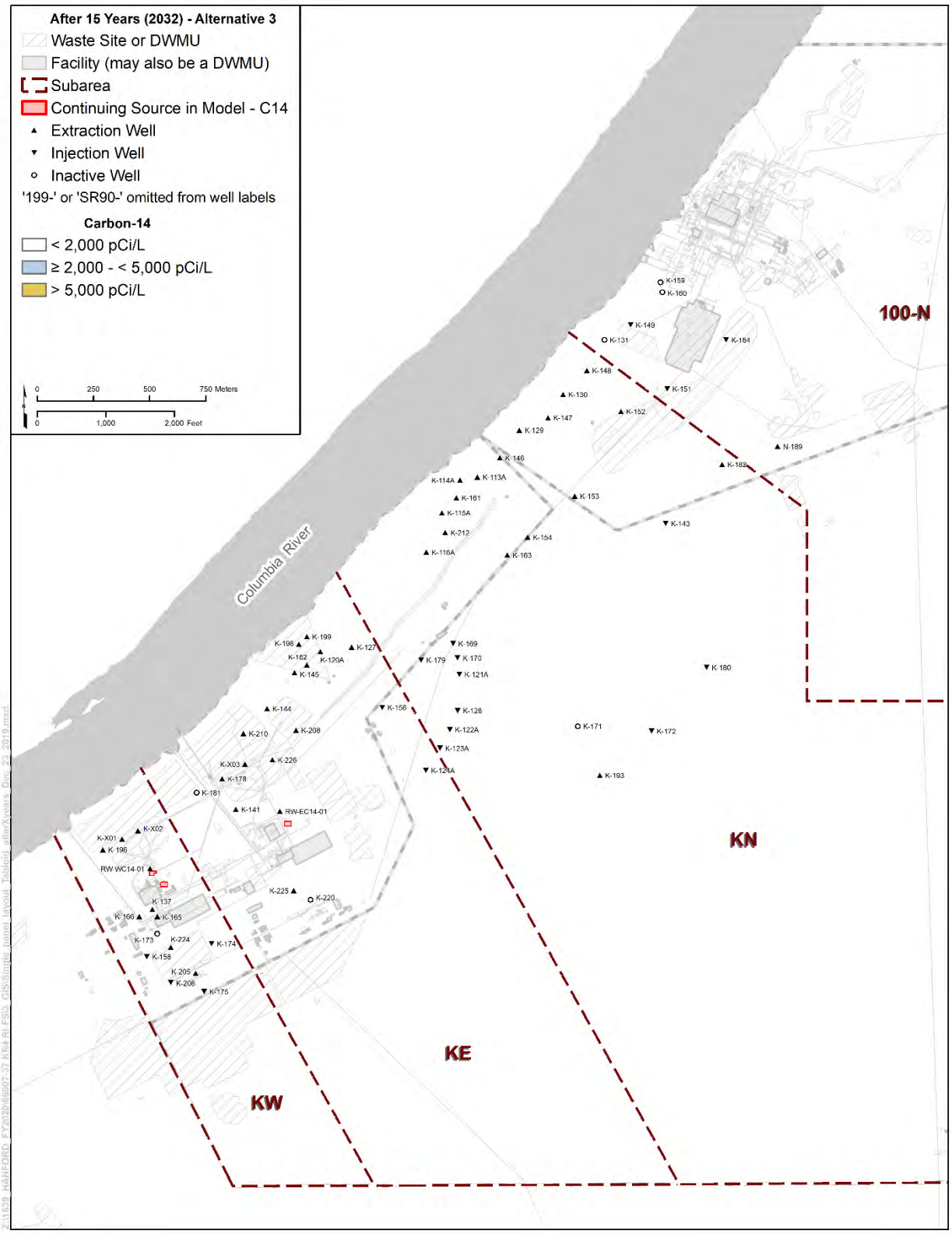


Figure 6-61. Carbon-14: Simulated Distribution after 15 Years (end of 2032) – Alternative 3

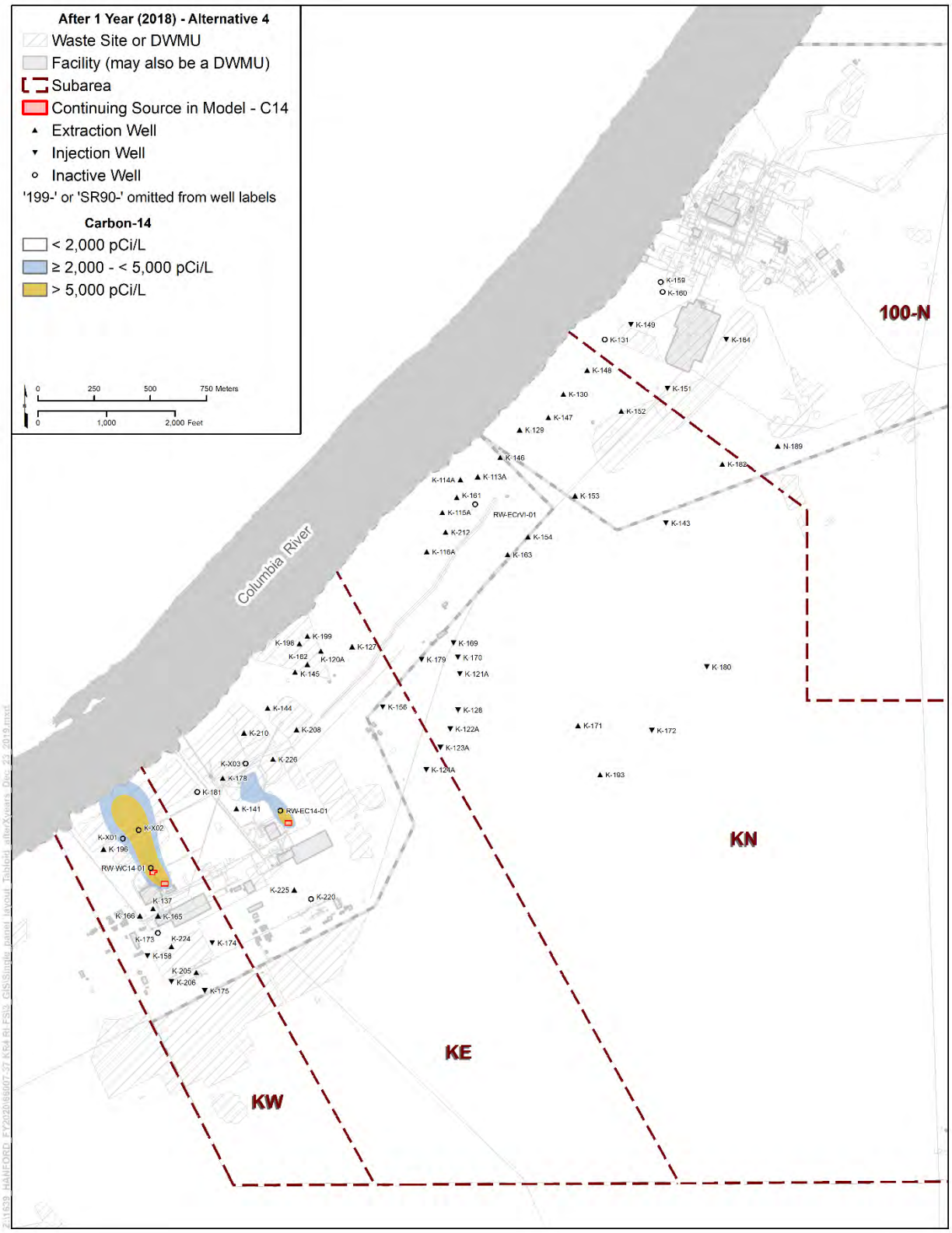


Figure 6-62. Carbon-14: Simulated Distribution after 1 Year (end of 2018) – Alternative 4

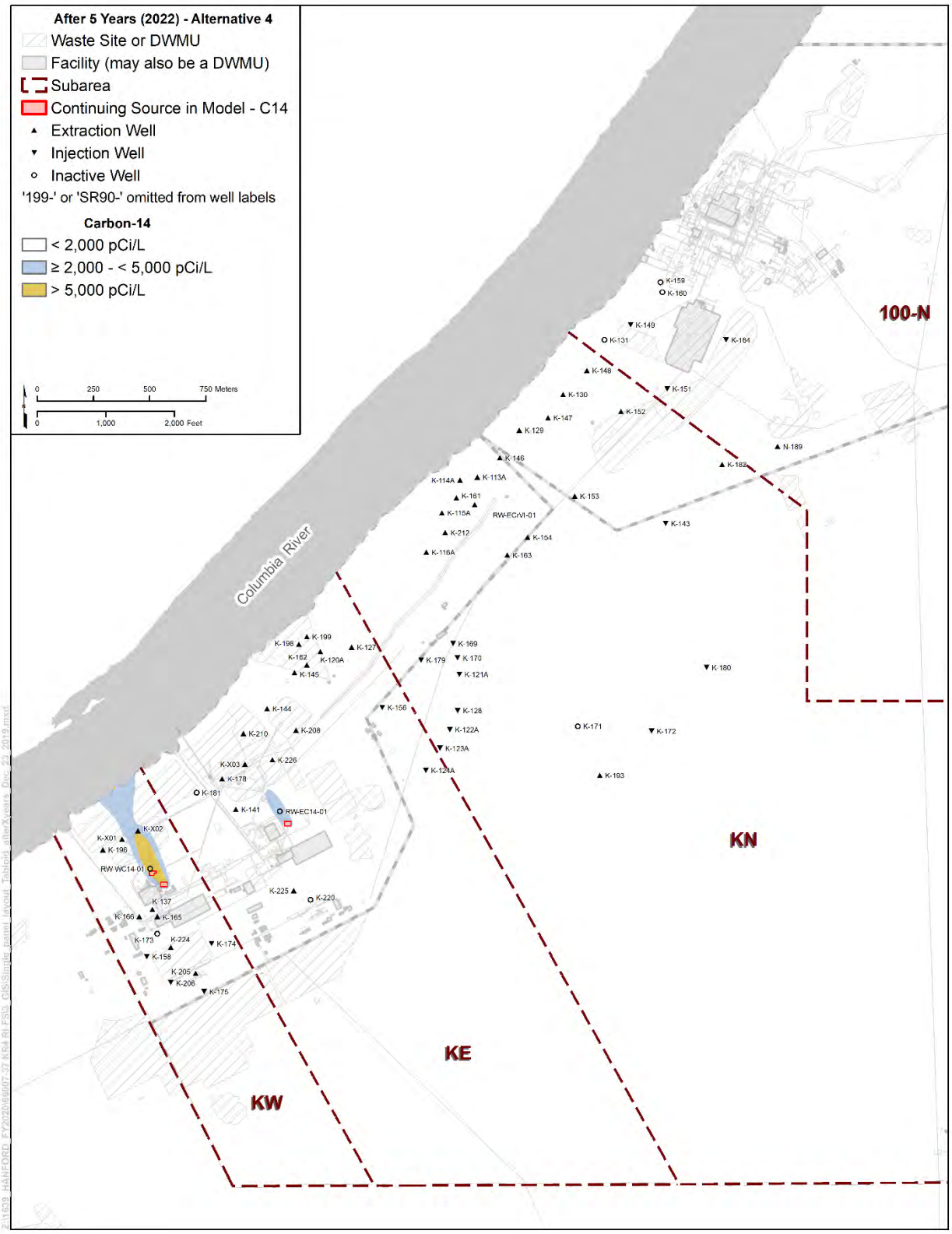


Figure 6-63. Carbon-14: Simulated Distribution after 5 Years (end of 2022) – Alternative 4

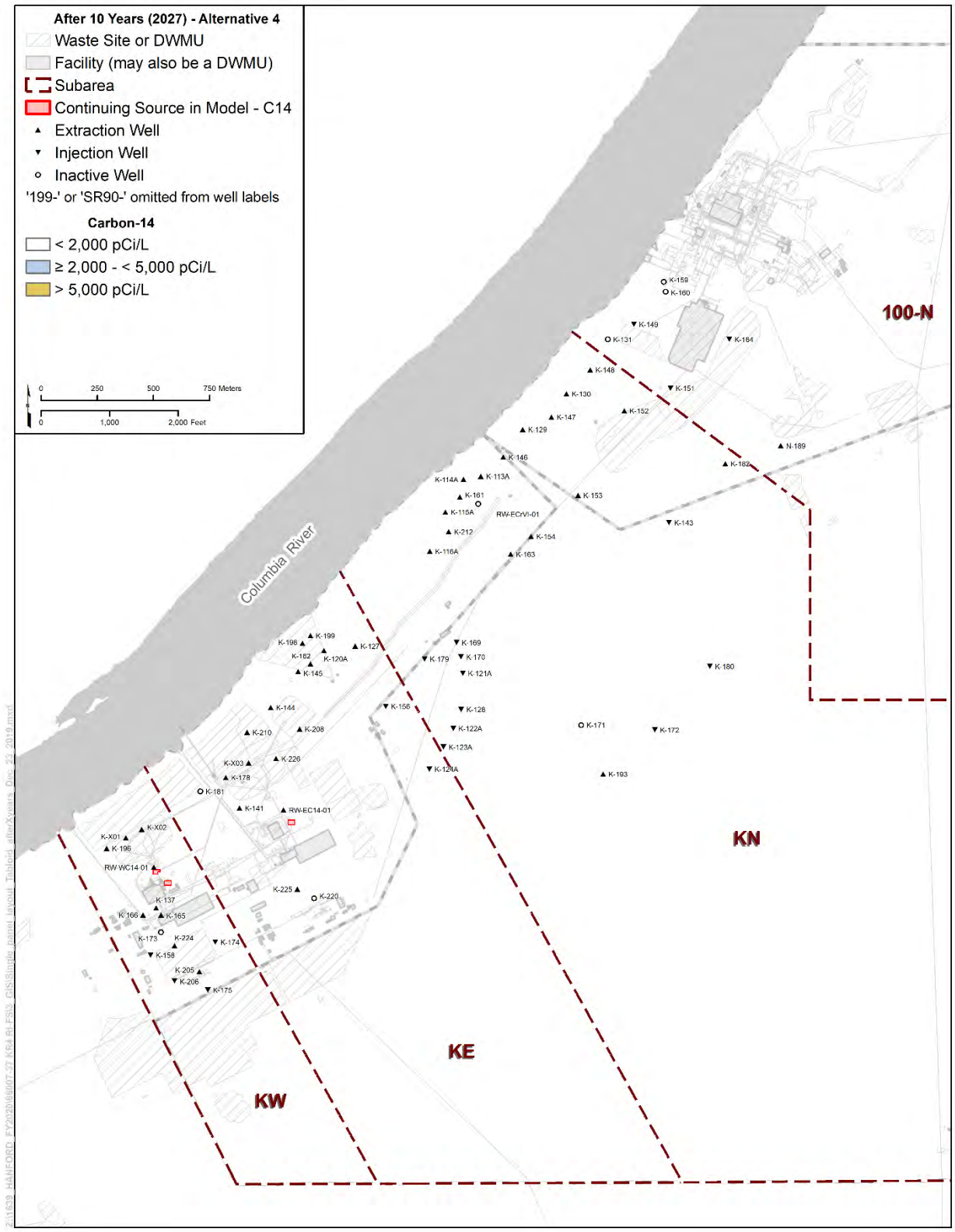


Figure 6-64. Carbon-14: Simulated Distribution after 10 Years (end of 2027) – Alternative 4

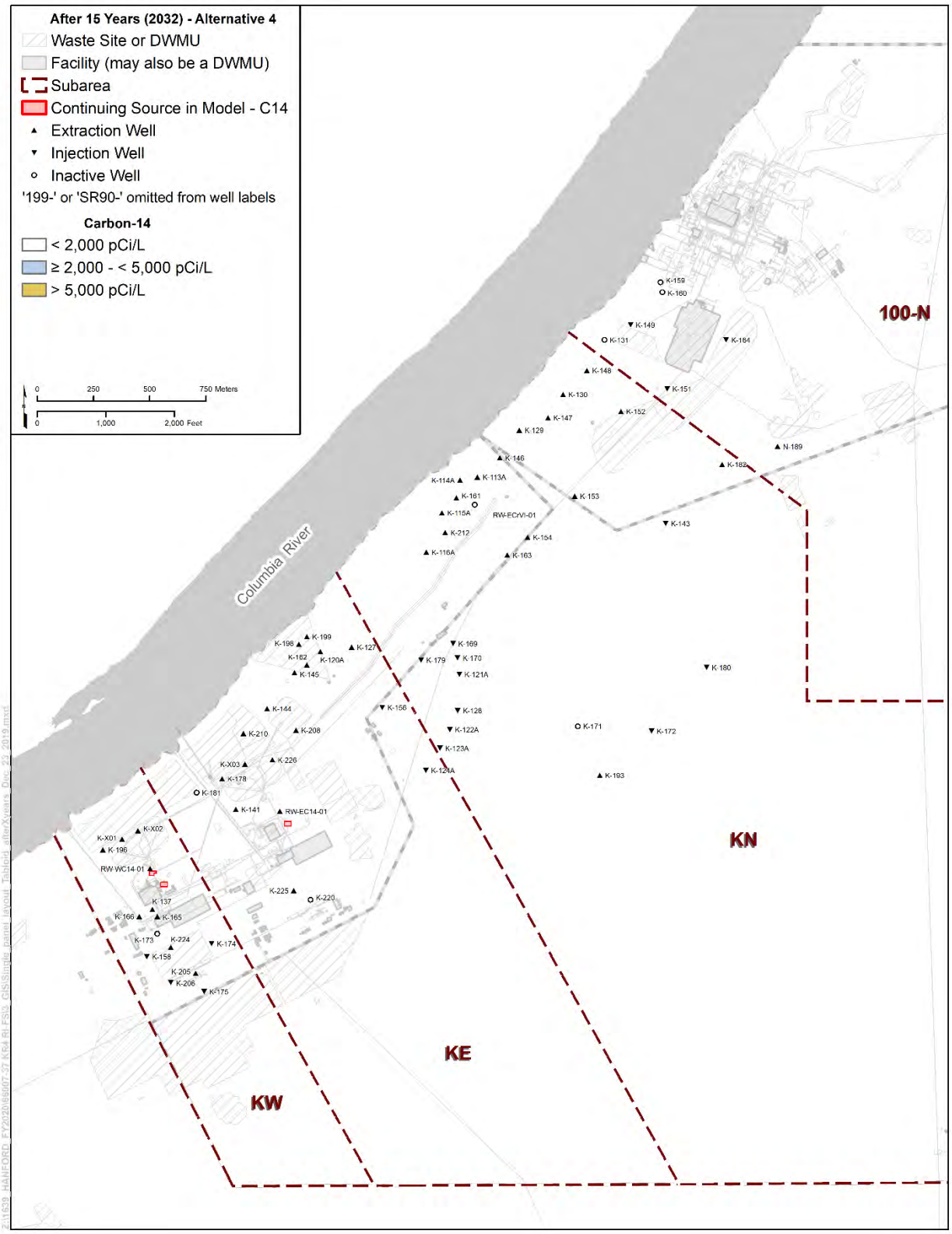


Figure 6-65. Carbon-14: Simulated Distribution after 15 Years (end of 2032) – Alternative 4

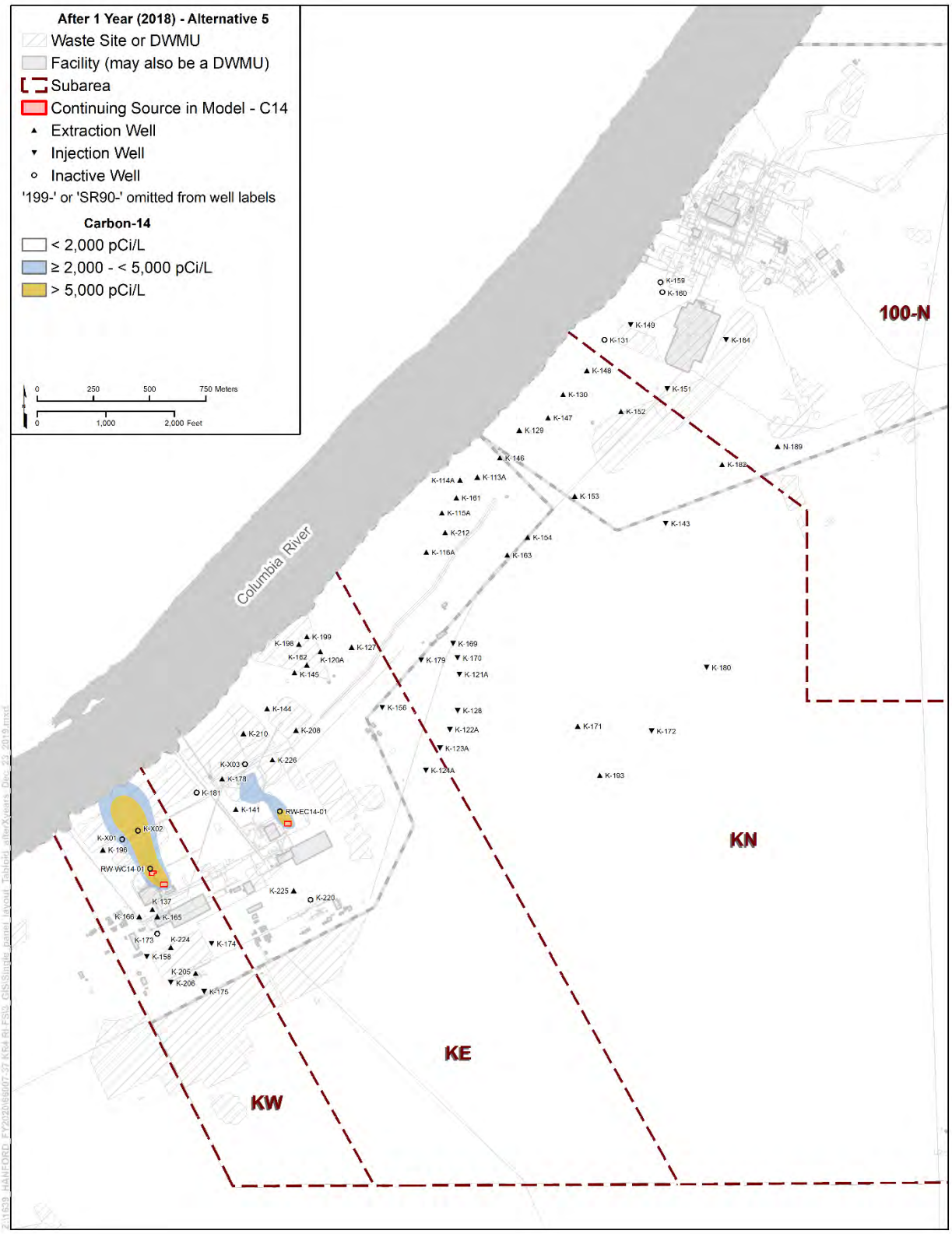


Figure 6-66. Carbon-14: Simulated Distribution after 1 Year (end of 2018) – Alternative 5

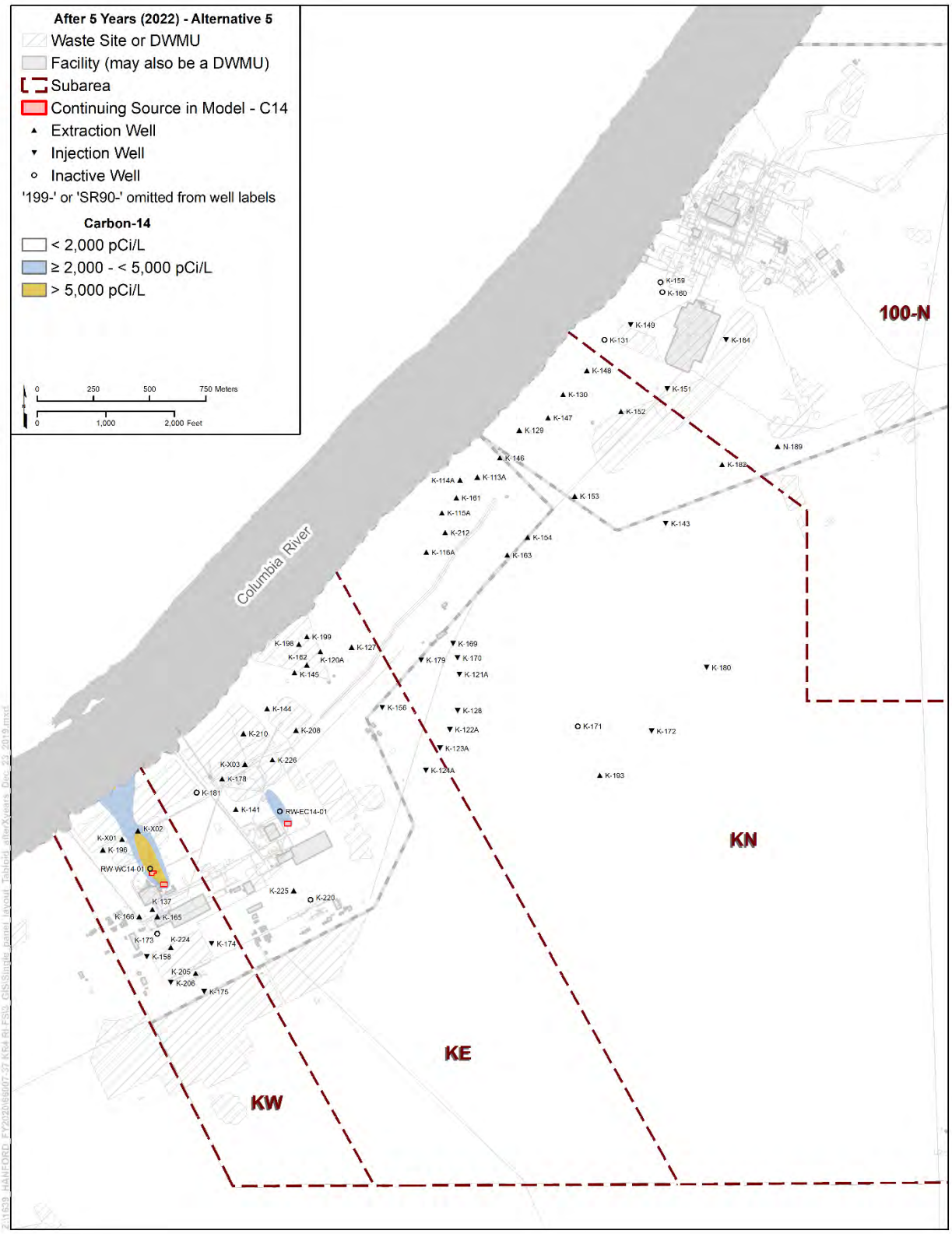


Figure 6-67. Carbon-14: Simulated Distribution after 5 Years (end of 2022) – Alternative 5

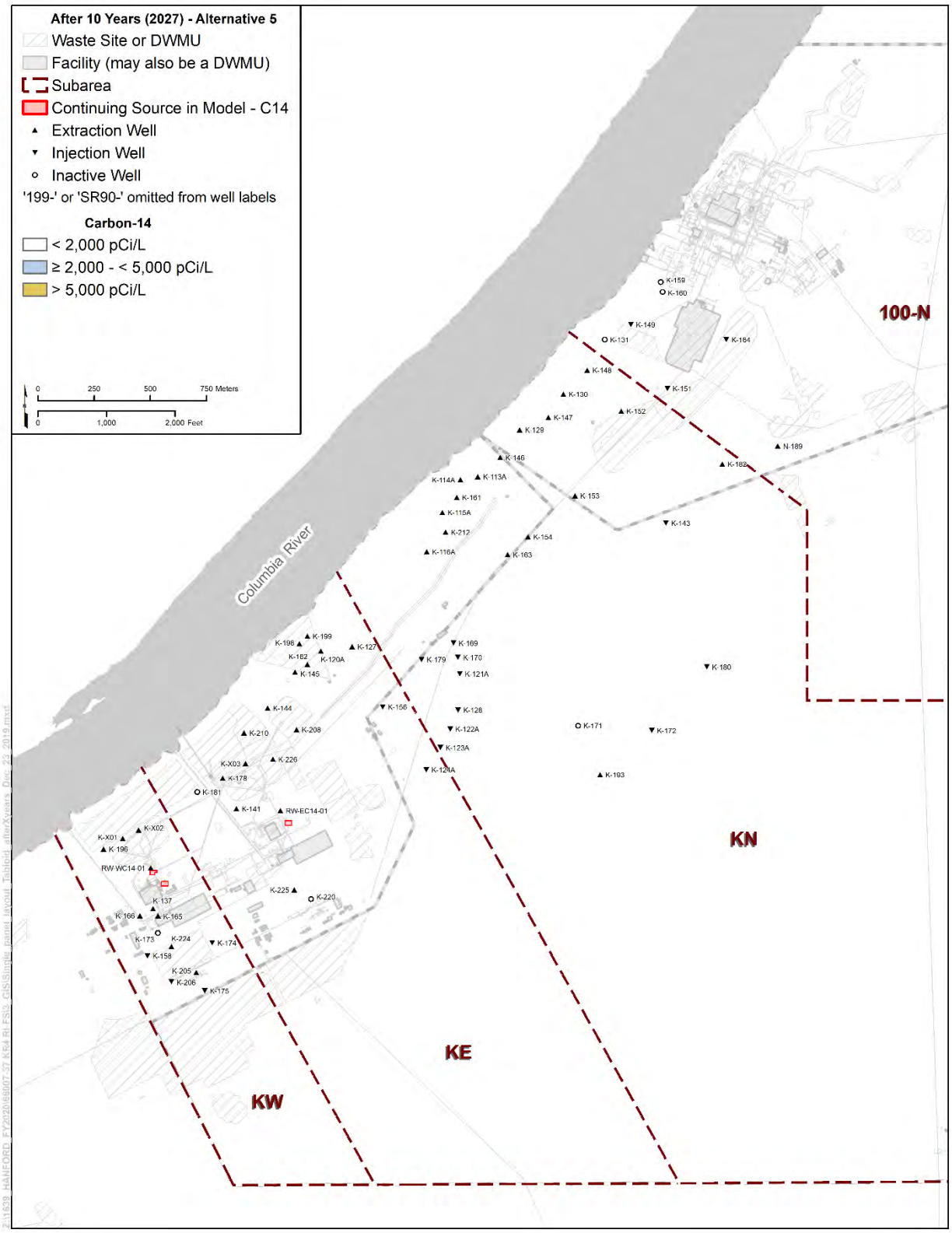


Figure 6-68. Carbon-14: Simulated Distribution after 10 Years (end of 2027) – Alternative 5

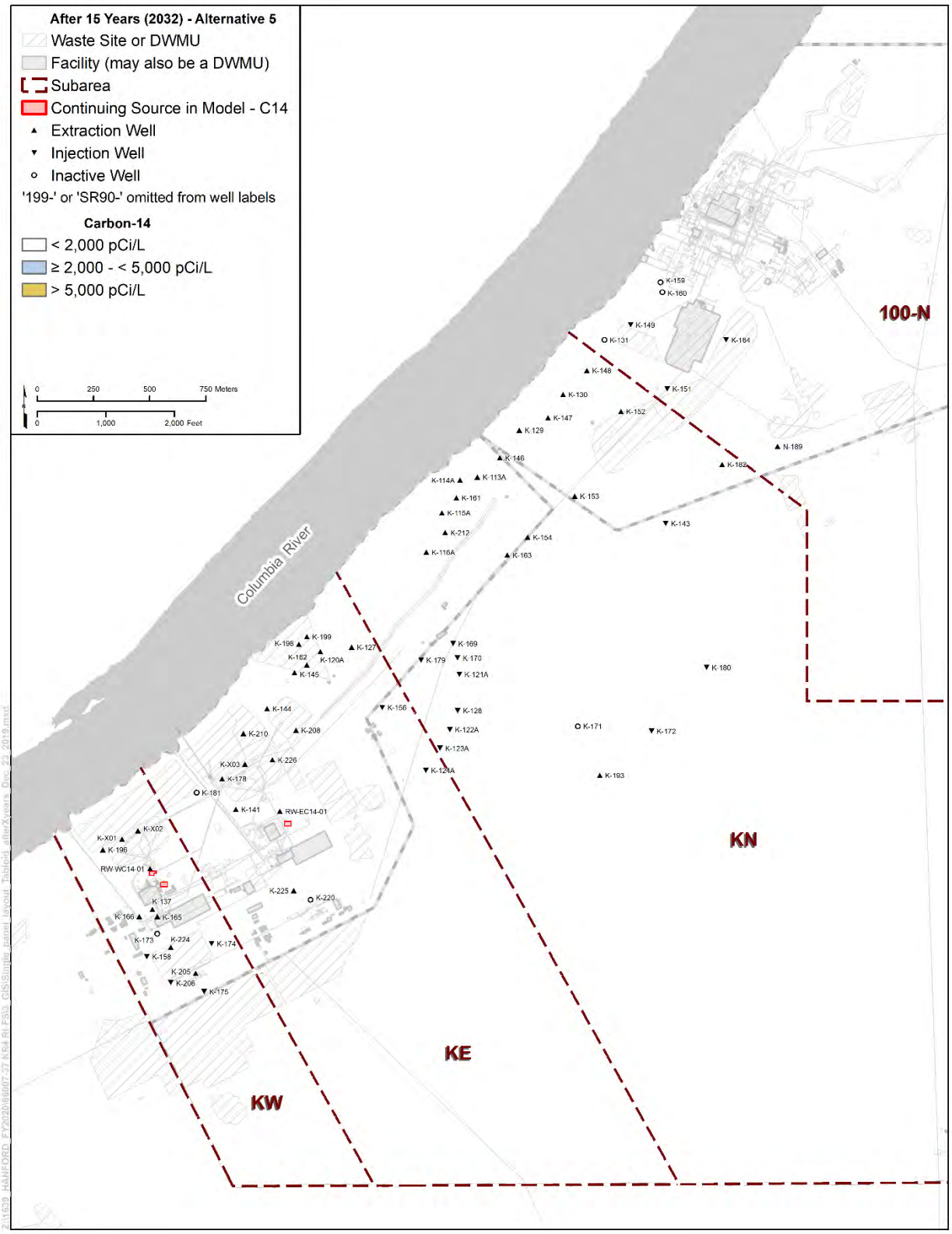


Figure 6-69. Carbon-14: Simulated Distribution after 15 Years (end of 2032) – Alternative 5

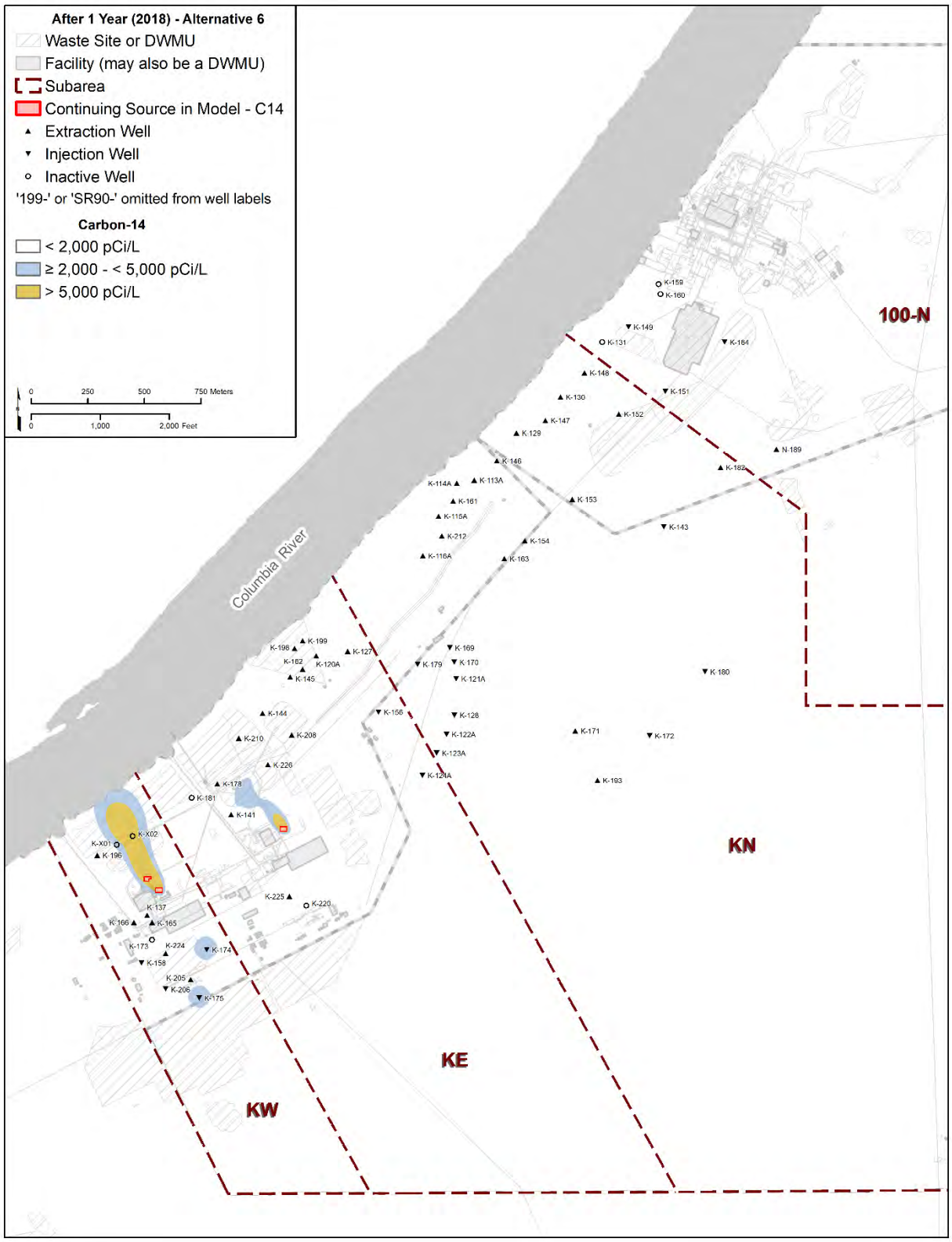


Figure 6-70. Carbon-14: Simulated Distribution after 1 Year (end of 2018) – Alternative 6

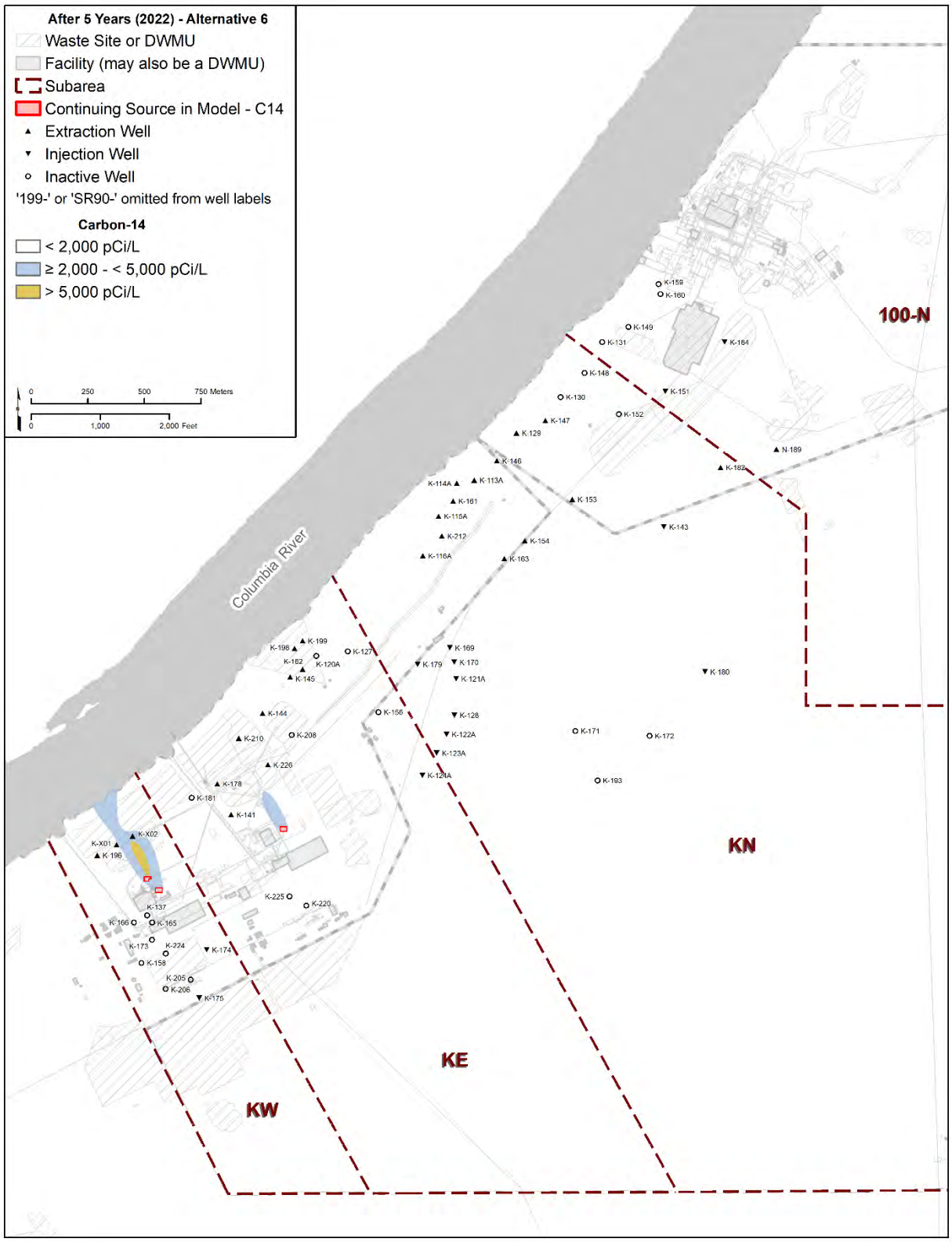


Figure 6-71. Carbon-14: Simulated Distribution after 5 Years (end of 2022) – Alternative 6

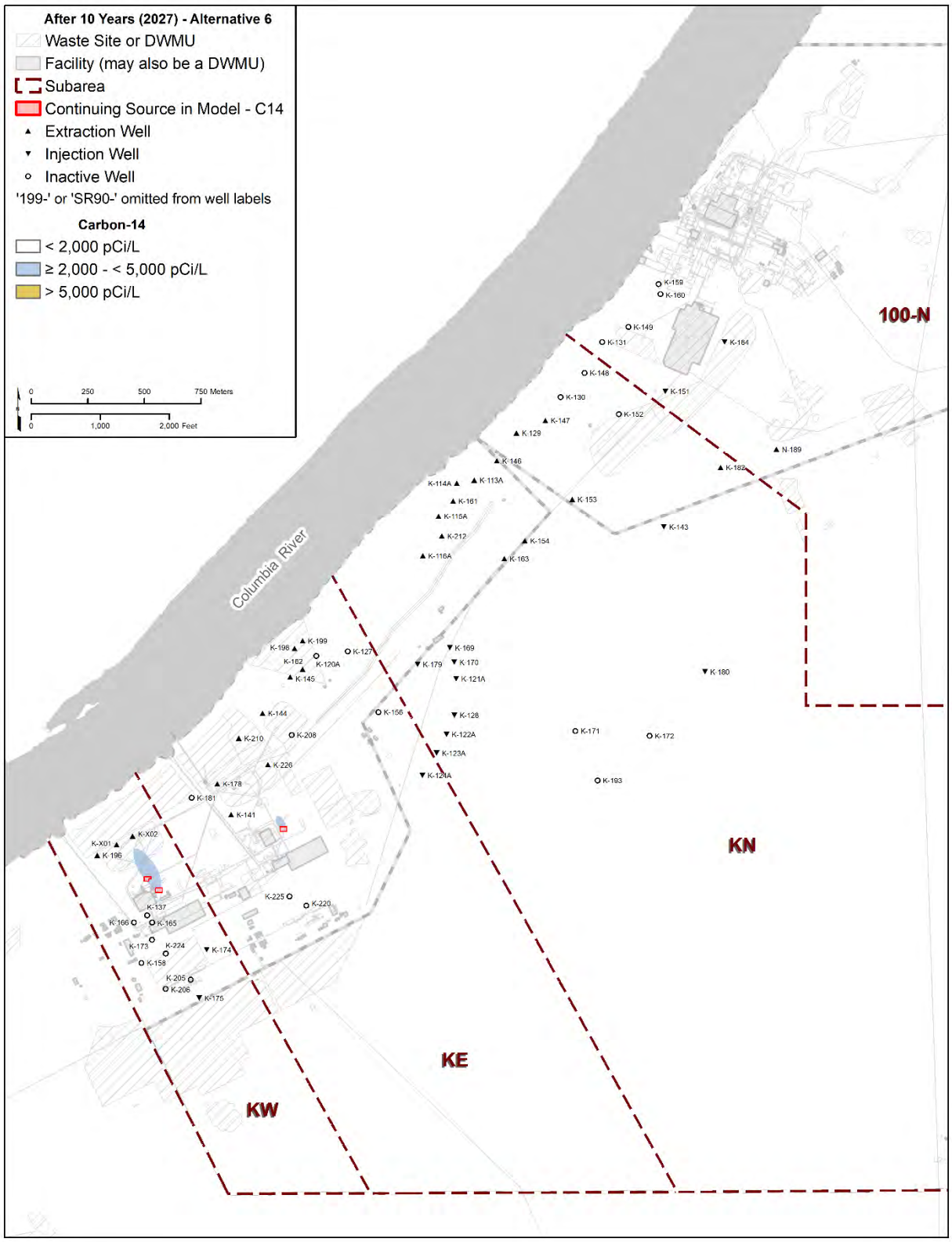


Figure 6-72. Carbon-14: Simulated Distribution after 10 Years (end of 2027) – Alternative 6

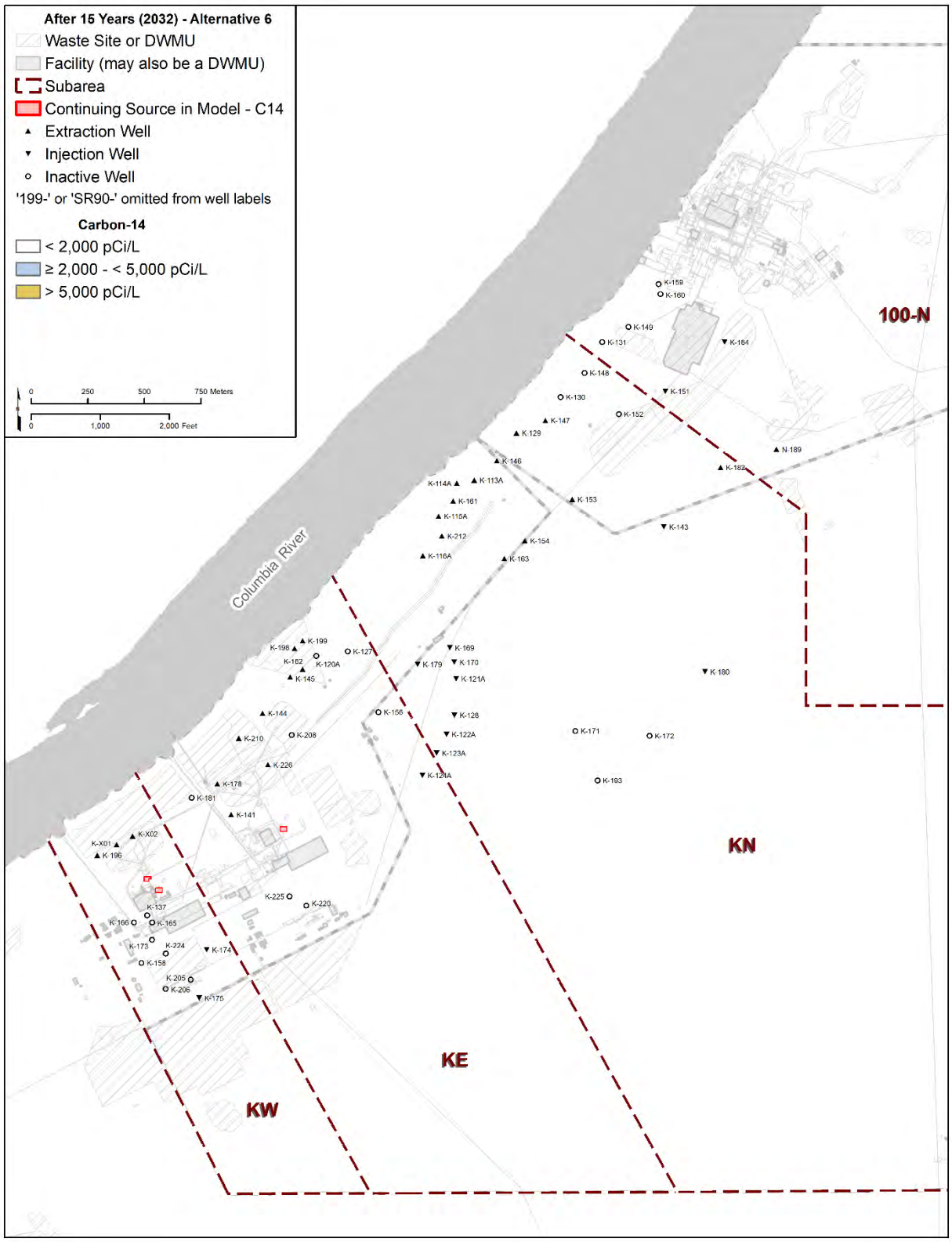


Figure 6-73. Carbon-14: Simulated Distribution after 15 Years (end of 2032) – Alternative 6

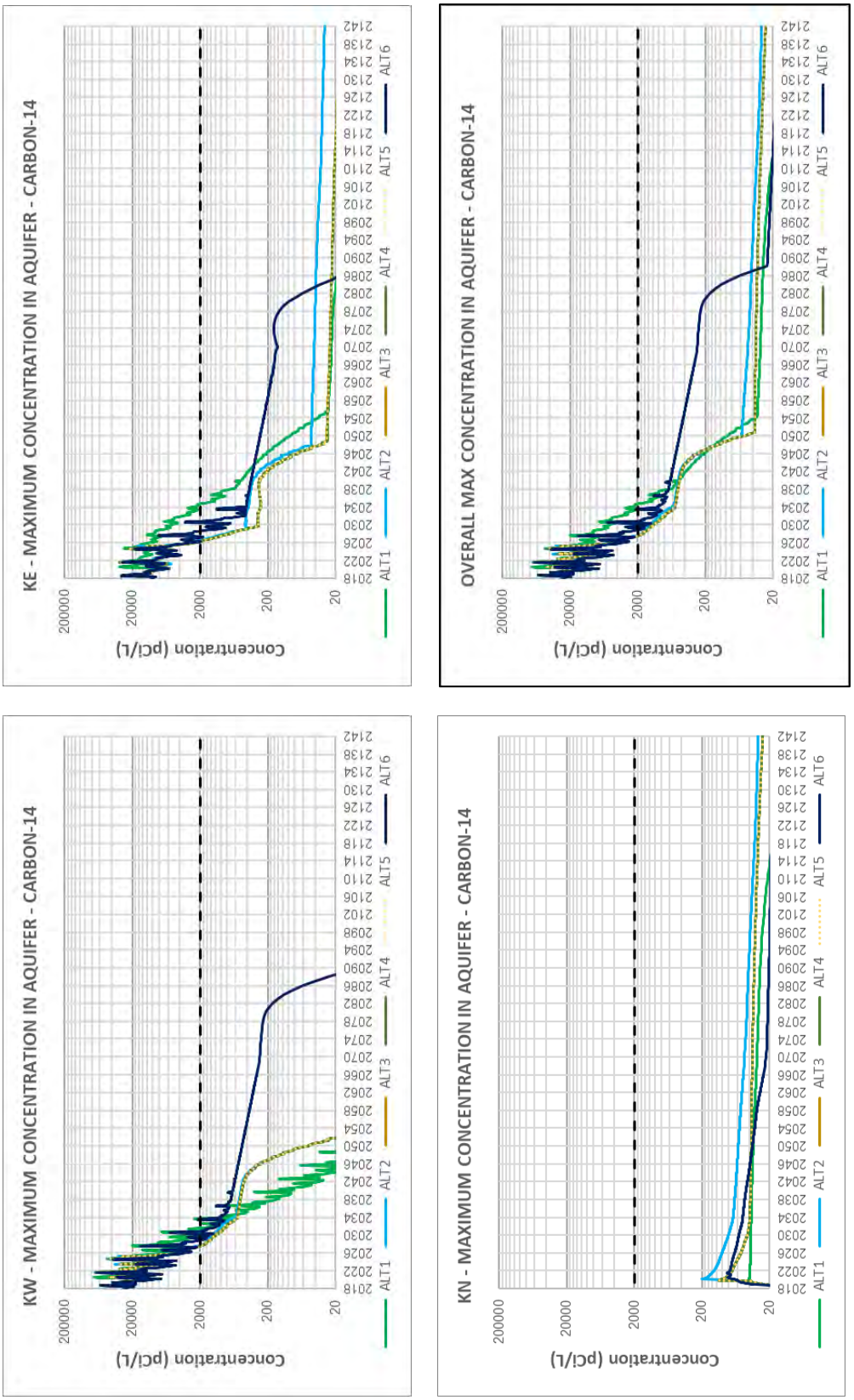


Figure 6-74. Carbon-14: Maximum Concentration Time Series in the Aquifer

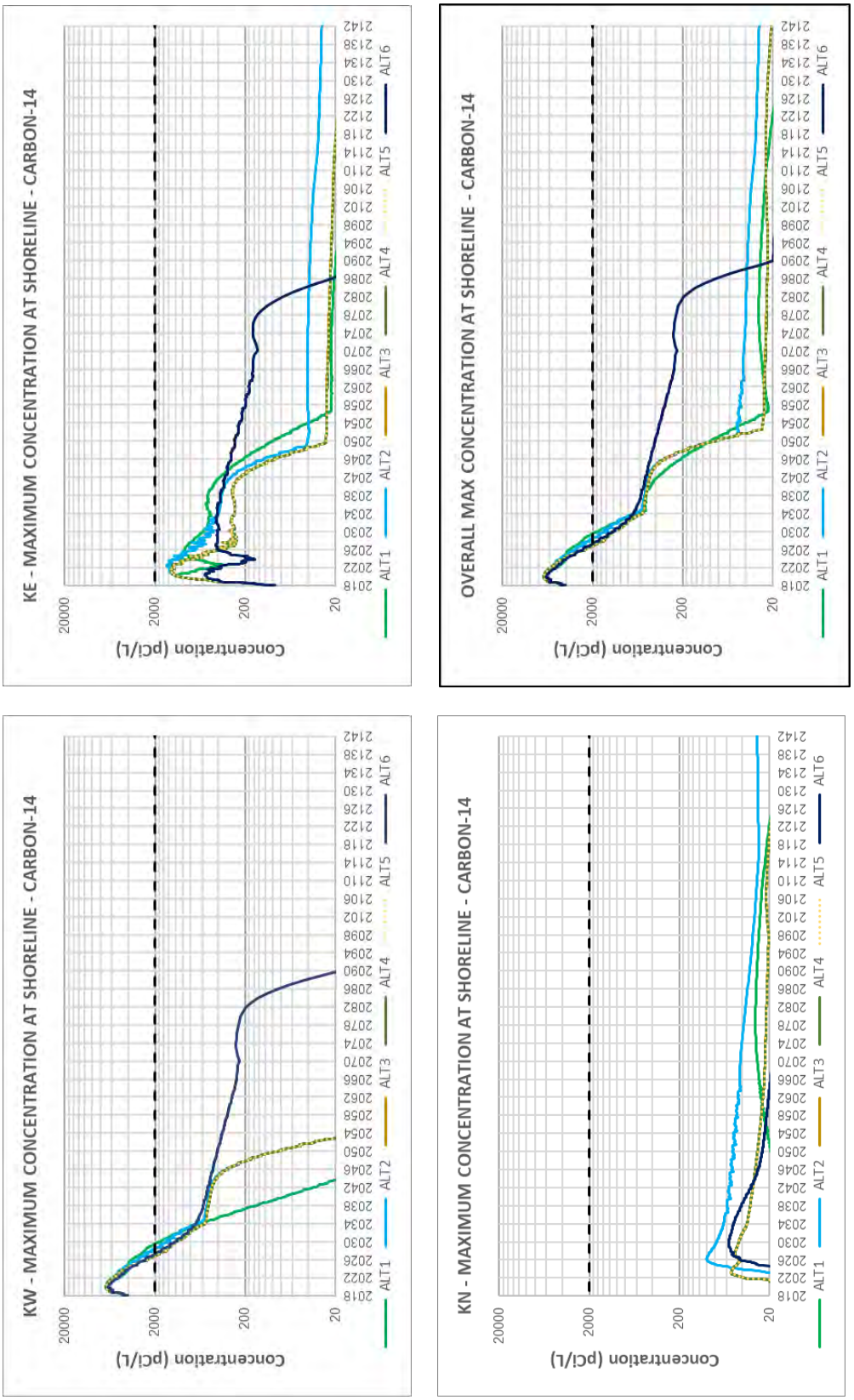


Figure 6-75. Carbon-14: Maximum Concentration Time Series at the Shoreline

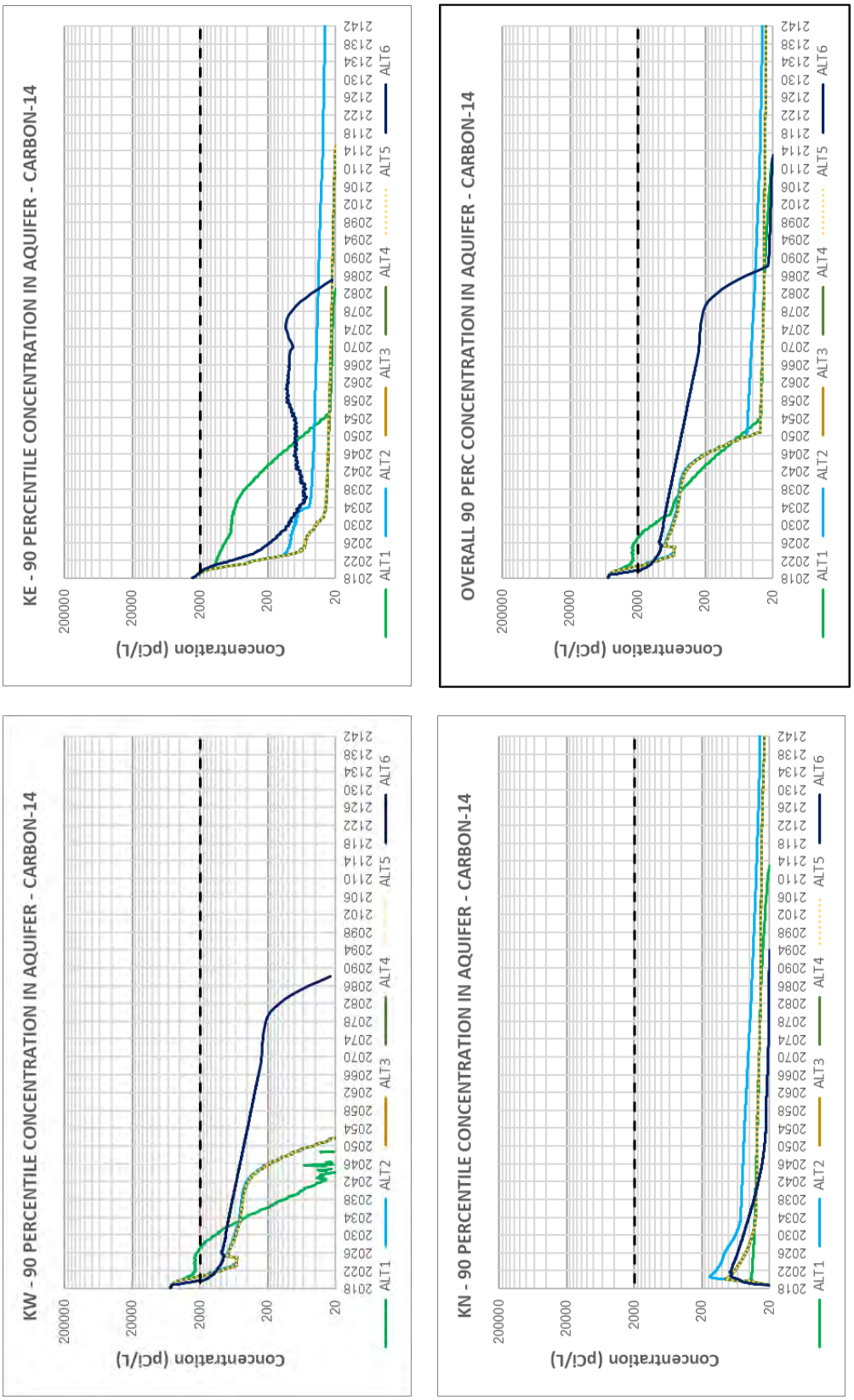


Figure 6-76. Carbon-14: 90th Percentile Concentration Time Series in the Aquifer

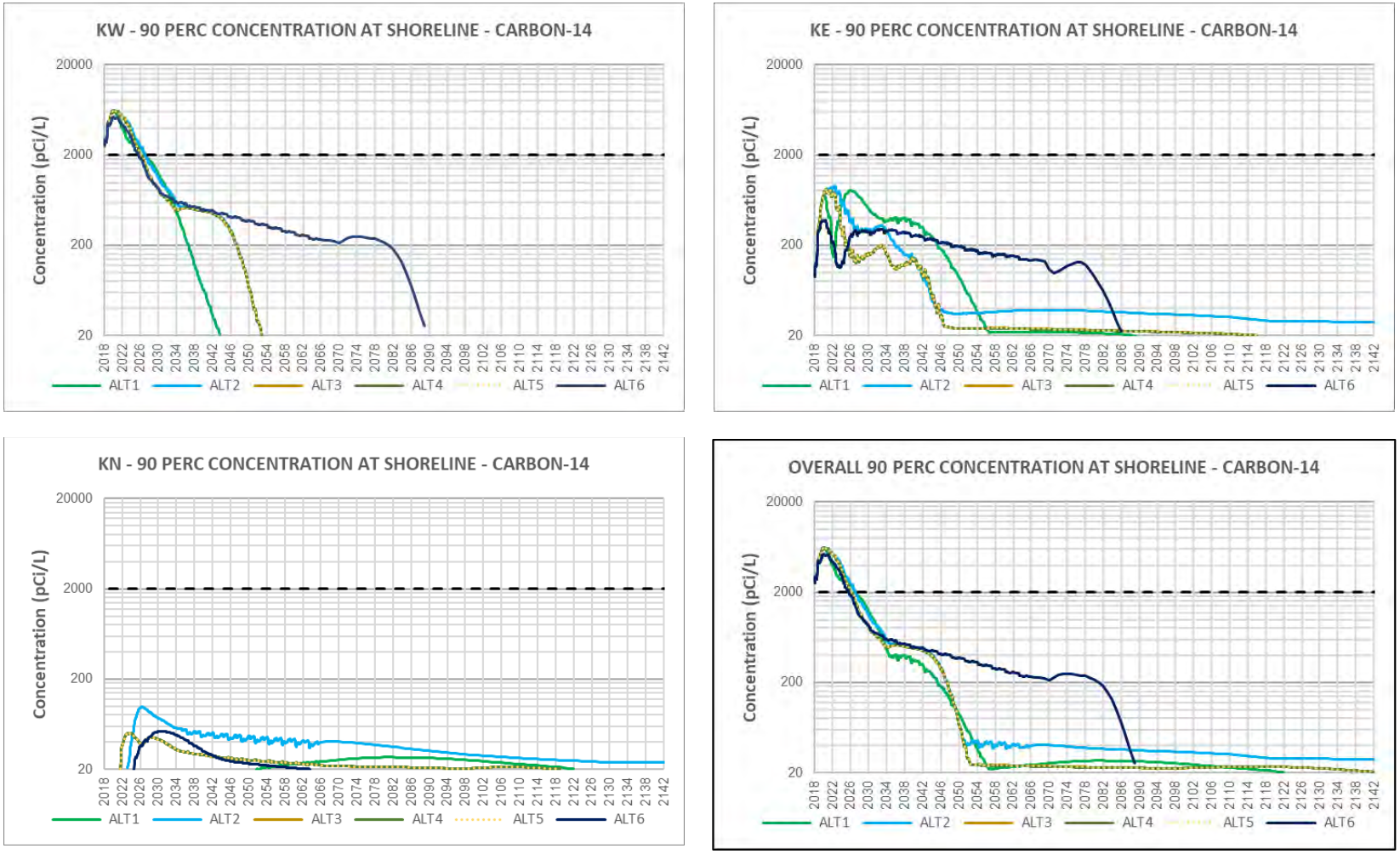


Figure 6-77. Carbon-14: 90th Percentile Concentration Time Series at the Shoreline

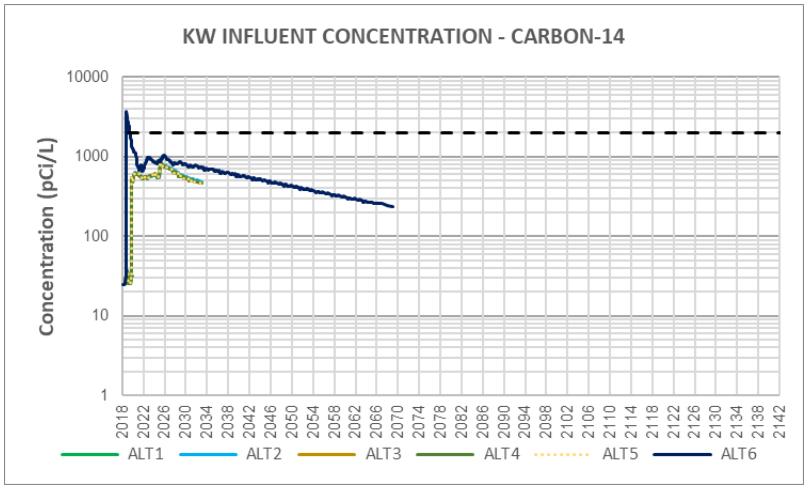


Figure 6-78. Carbon-14: Combined Influent Concentration Time Series – KW System

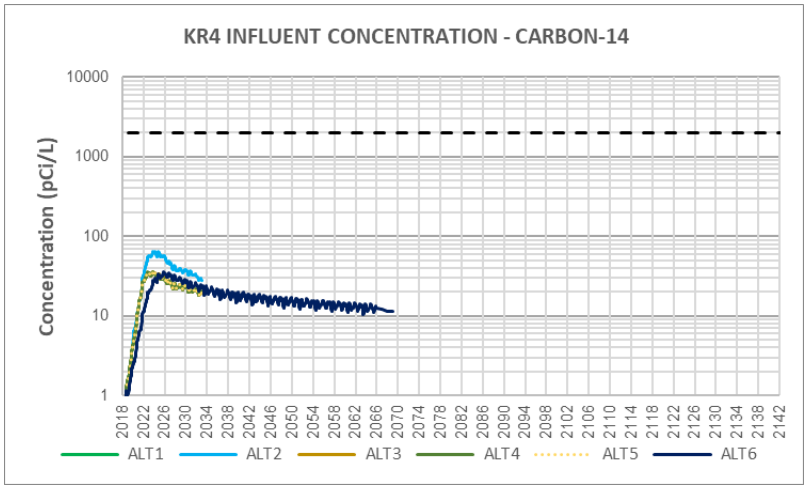


Figure 6-79. Carbon-14: Combined Influent Concentration Time Series – KR4 System

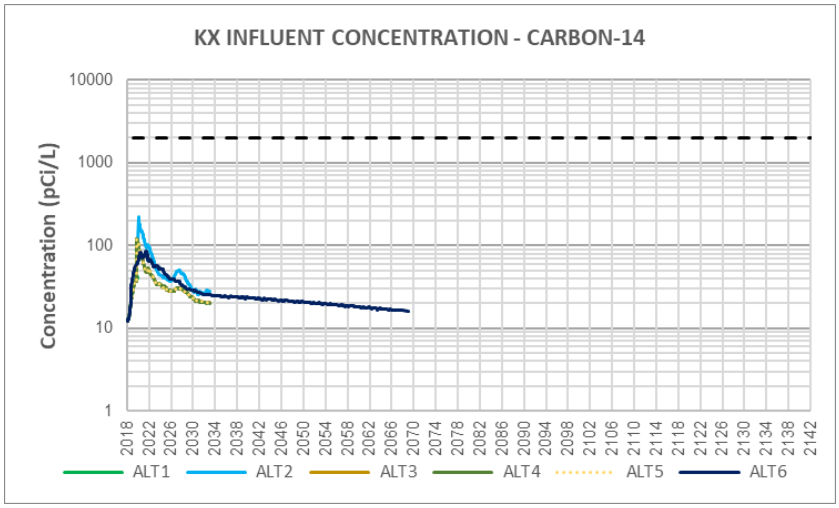


Figure 6-80. Carbon-14: Combined Influent Concentration Time Series – KX System

6.1.3 Simulated Contaminant Distribution – Concentration Statistics: Nitrate

Results for nitrate are grouped in the following sets of figures:

- Figures 6-81 to 6-98: simulated concentration distributions for each alternative.
- Figures 6-99 to 6-100: maximum concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-101 to 6-102: 90th percentile concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-103 to 6-105: combined influent concentration time series per treatment system for each alternative.

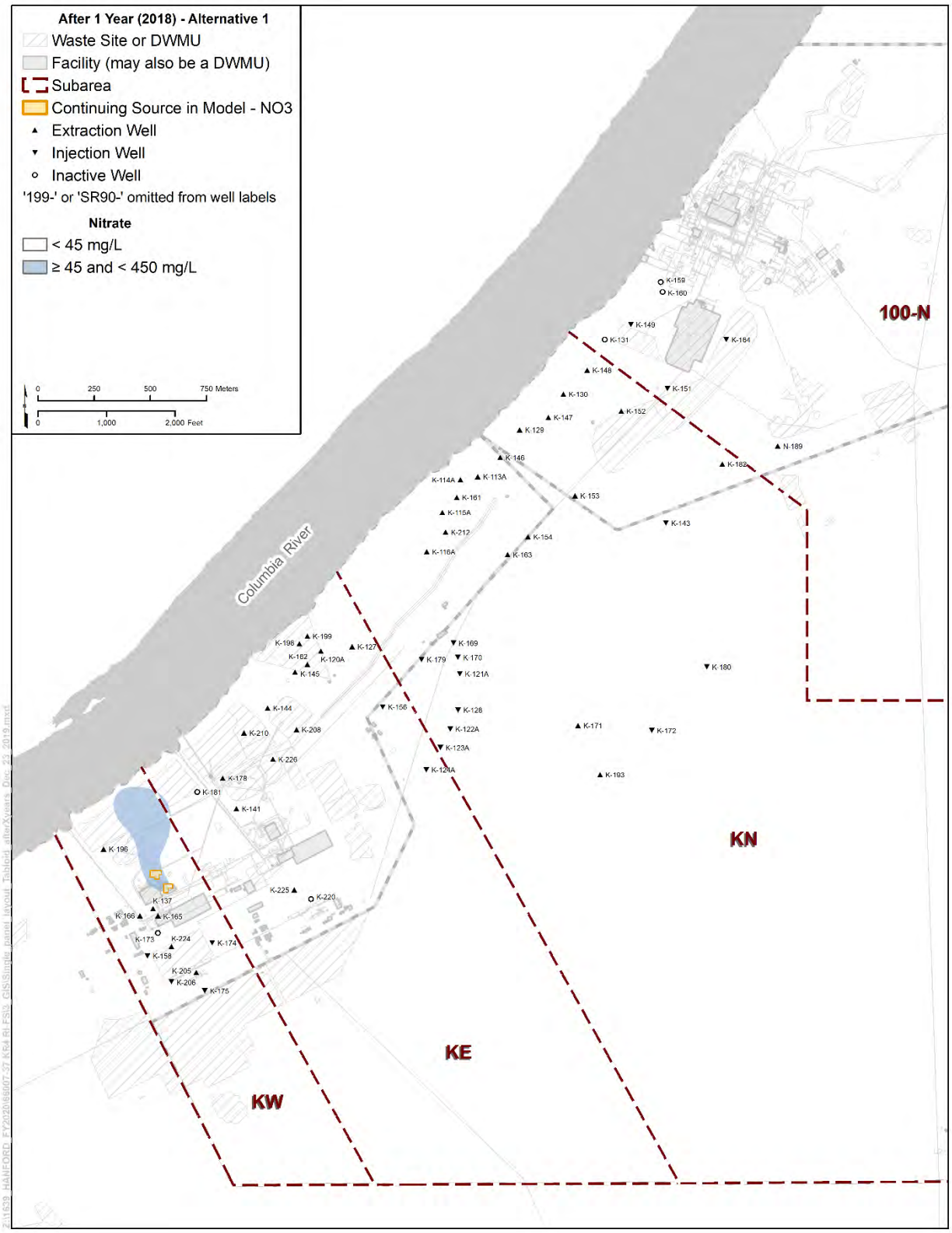


Figure 6-81. Nitrate: Simulated Distribution after 1 Year (end of 2018) – Alternative 1

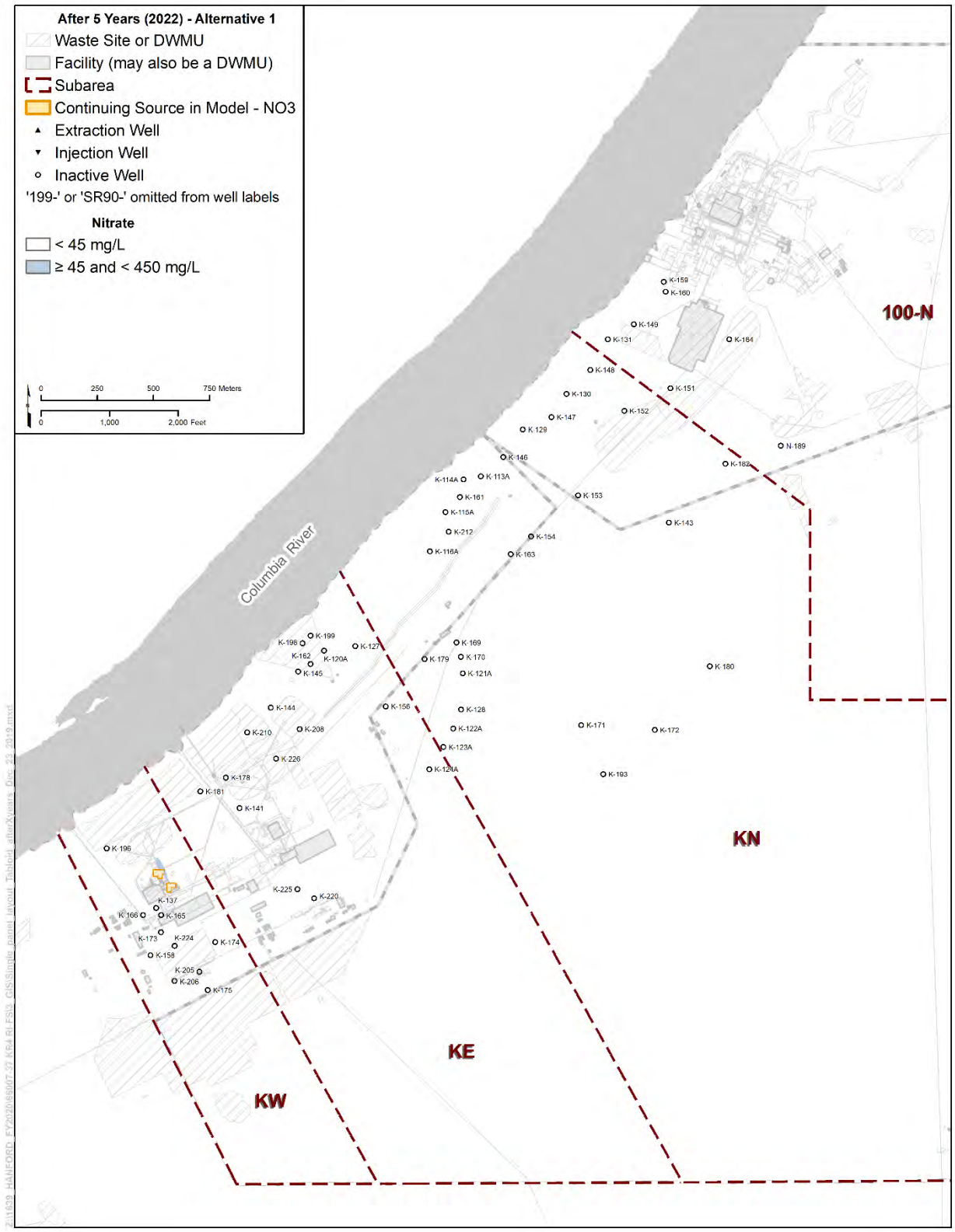


Figure 6-82. Nitrate: Simulated Distribution after 5 Years (end of 2022) – Alternative 1

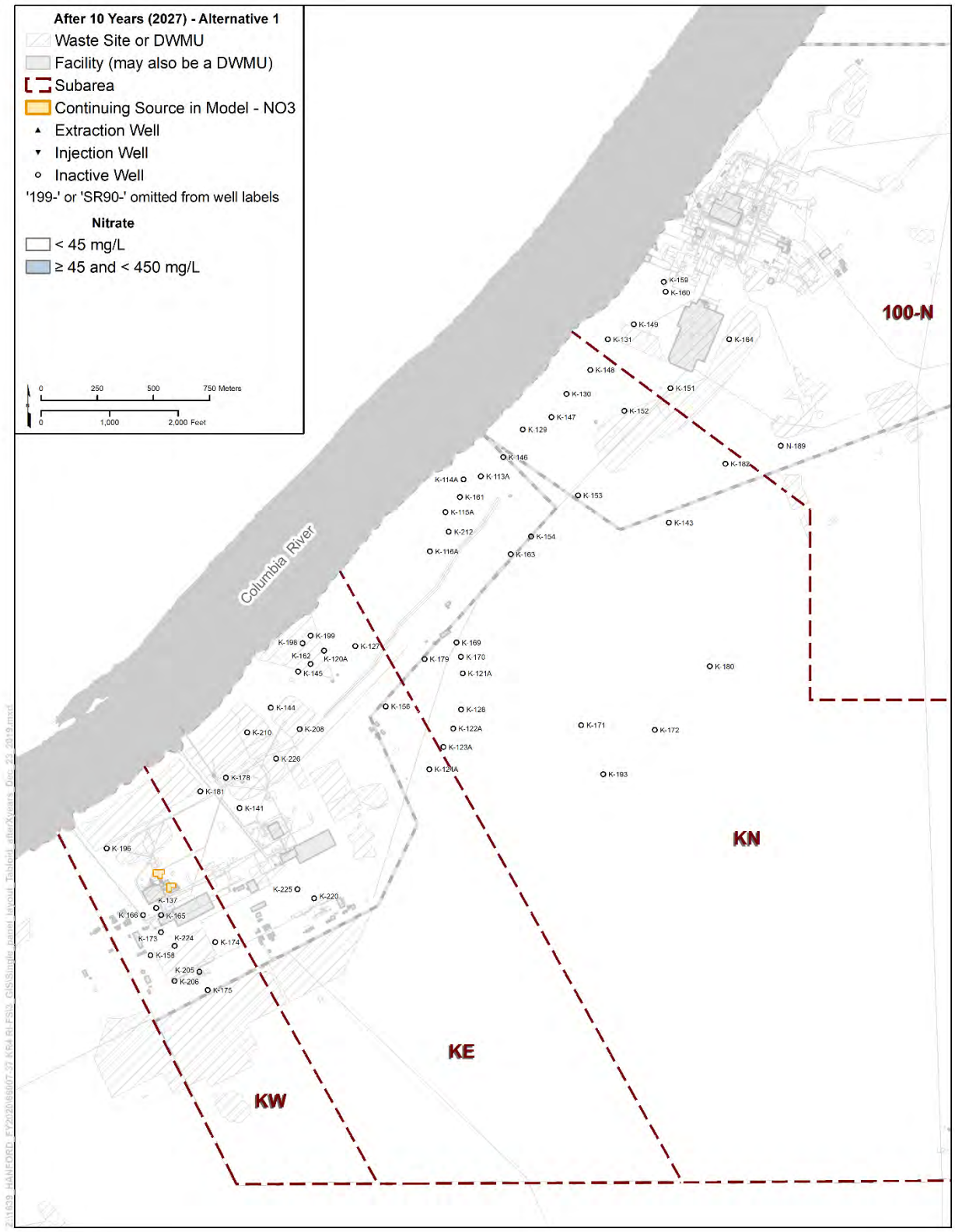


Figure 6-83. Nitrate: Simulated Distribution after 10 Years (end of 2027) – Alternative 1

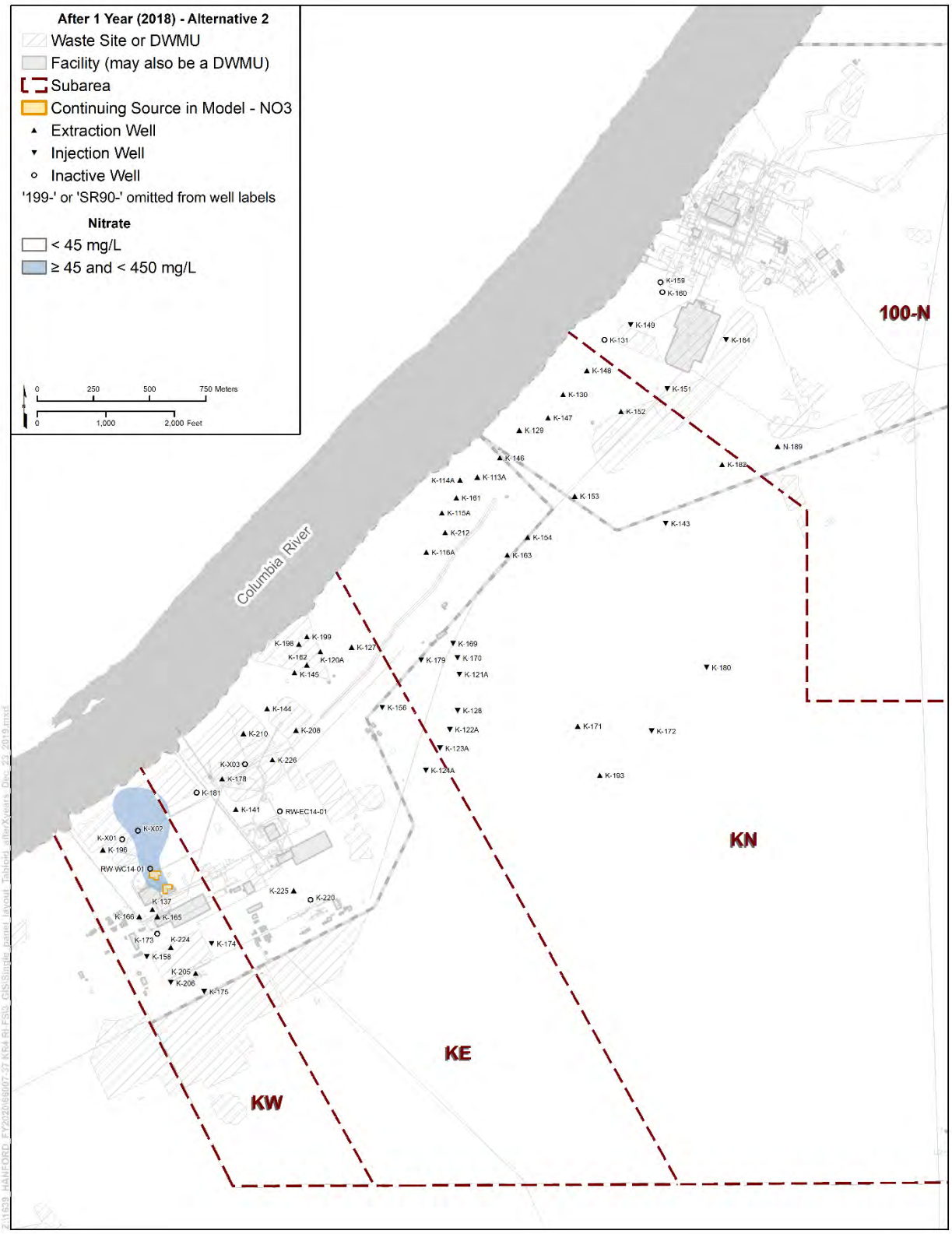


Figure 6-84. Nitrate: Simulated Distribution after 1 Year (end of 2018) – Alternative 2

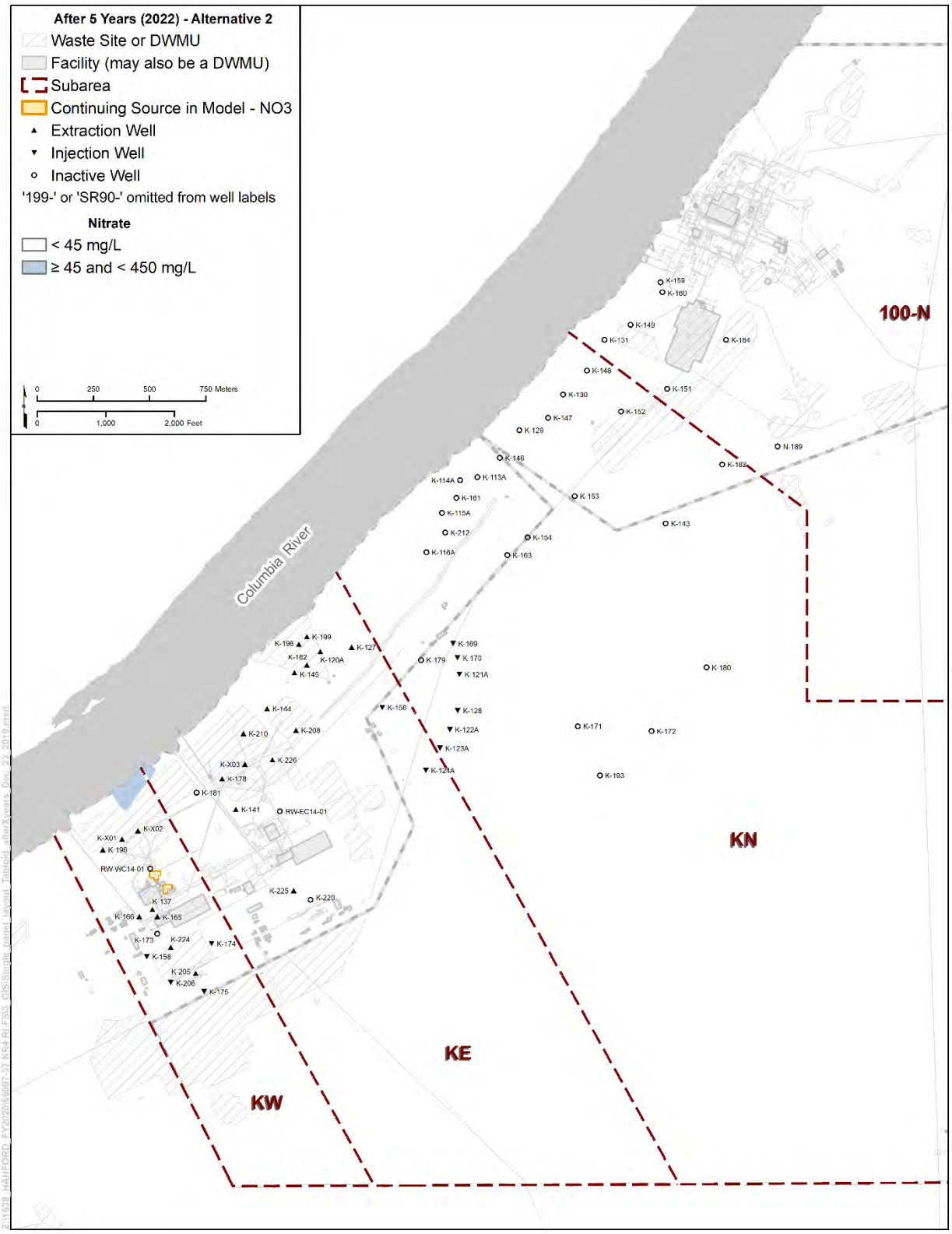


Figure 6-85. Nitrate: Simulated Distribution after 5 Years (end of 2022) – Alternative 2

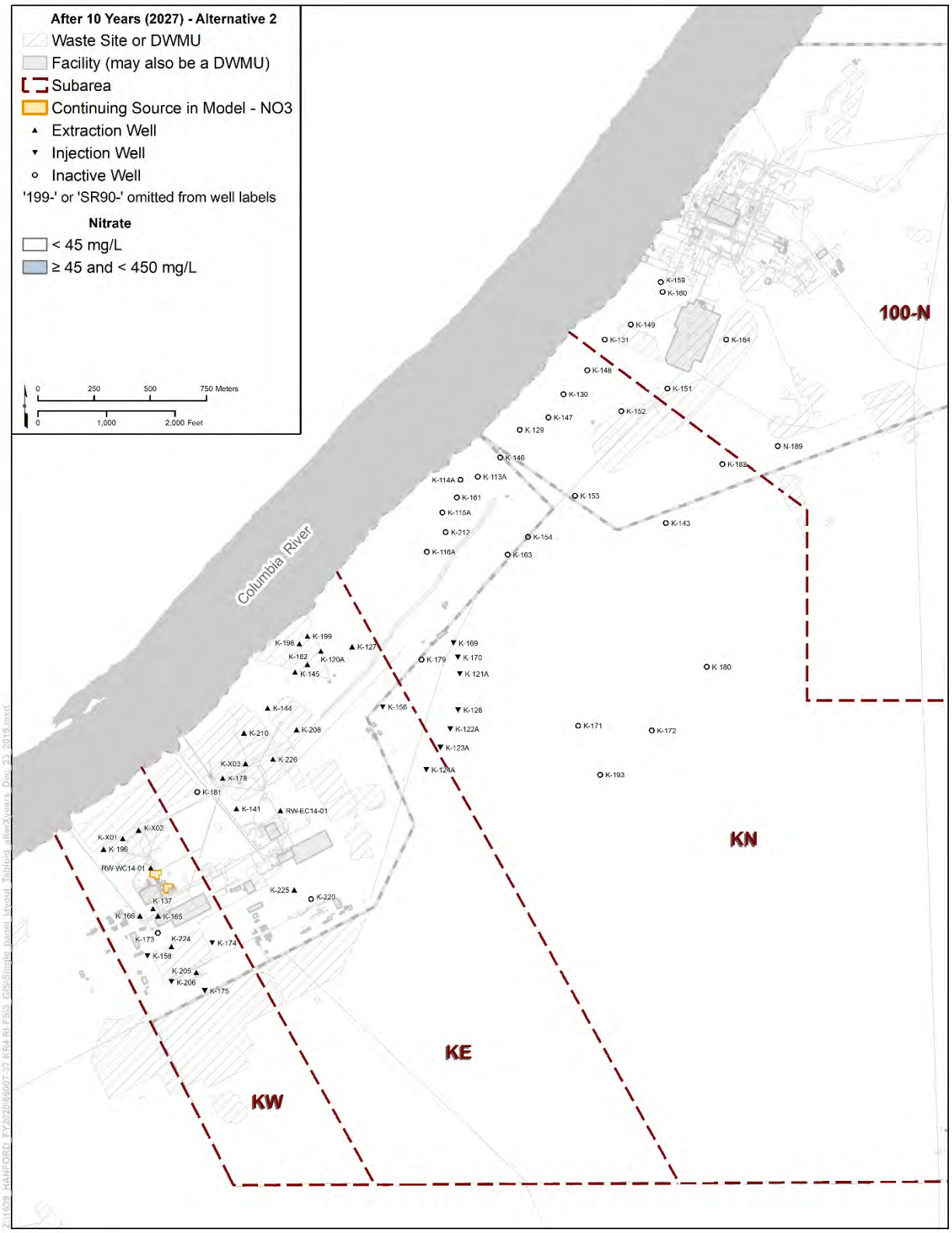


Figure 6-86. Nitrate: Simulated Distribution after 10 Years (end of 2027) – Alternative 2

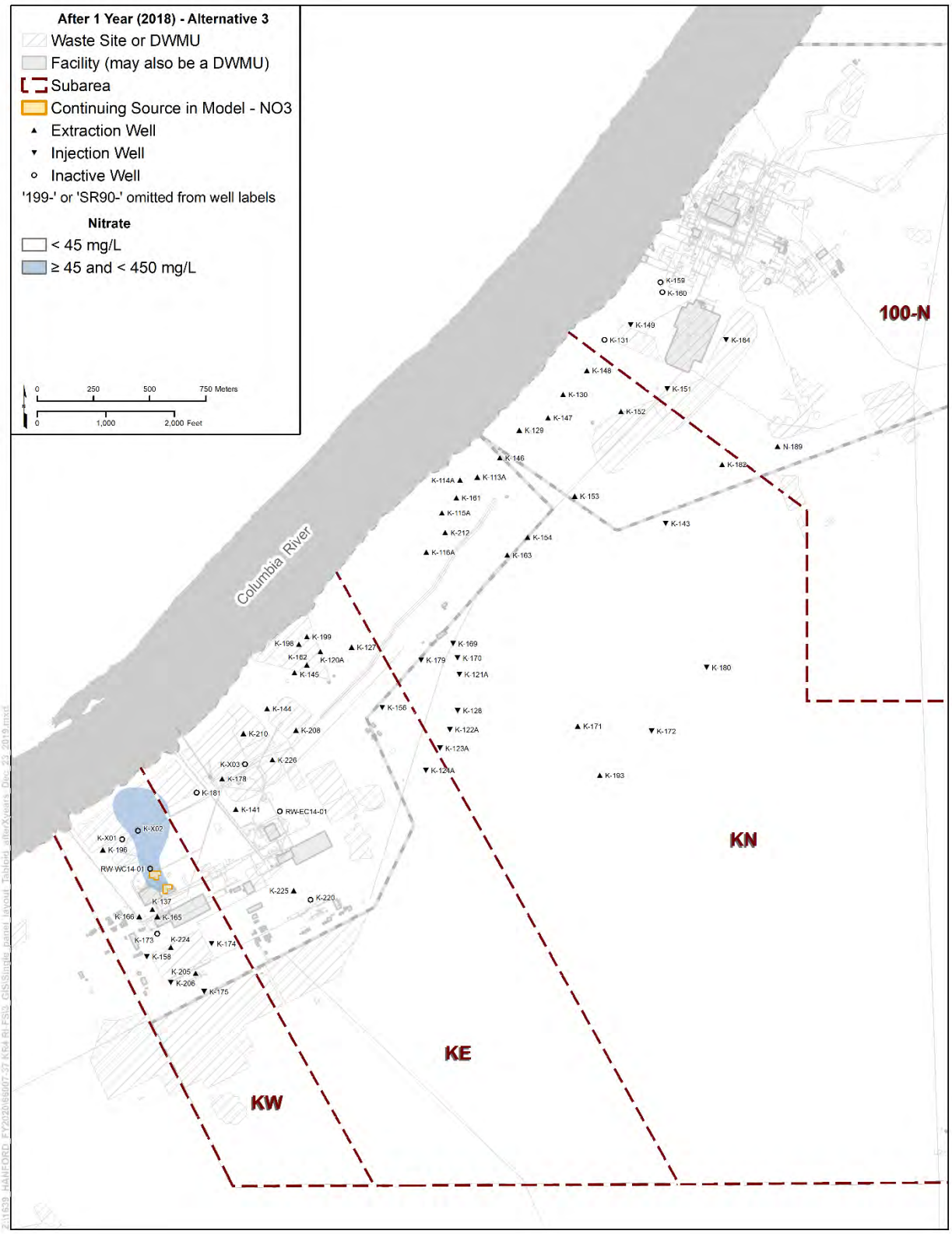


Figure 6-87. Nitrate: Simulated Distribution after 1 Year (end of 2018) – Alternative 3

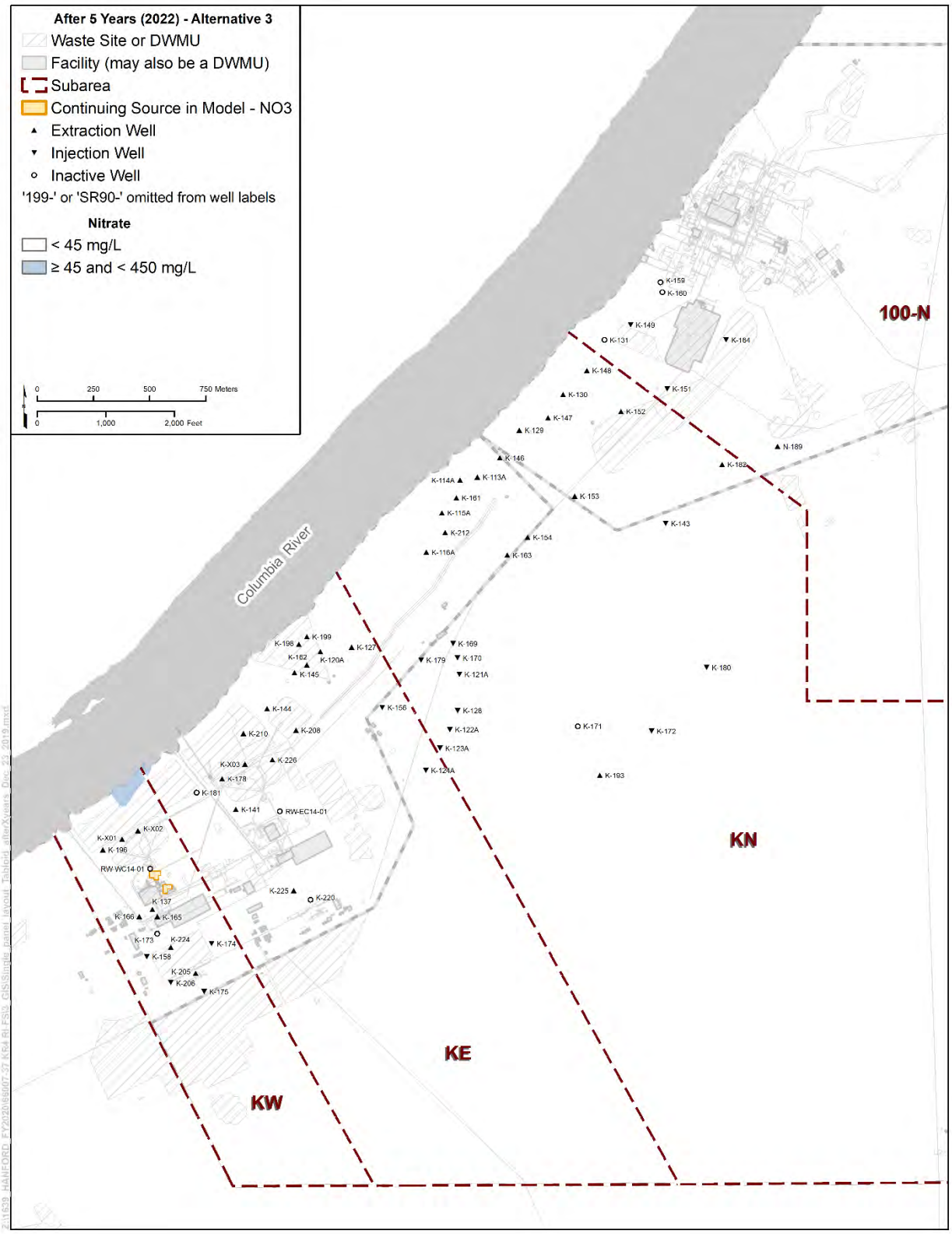


Figure 6-88. Nitrate: Simulated Distribution after 5 Years (end of 2022) – Alternative 3

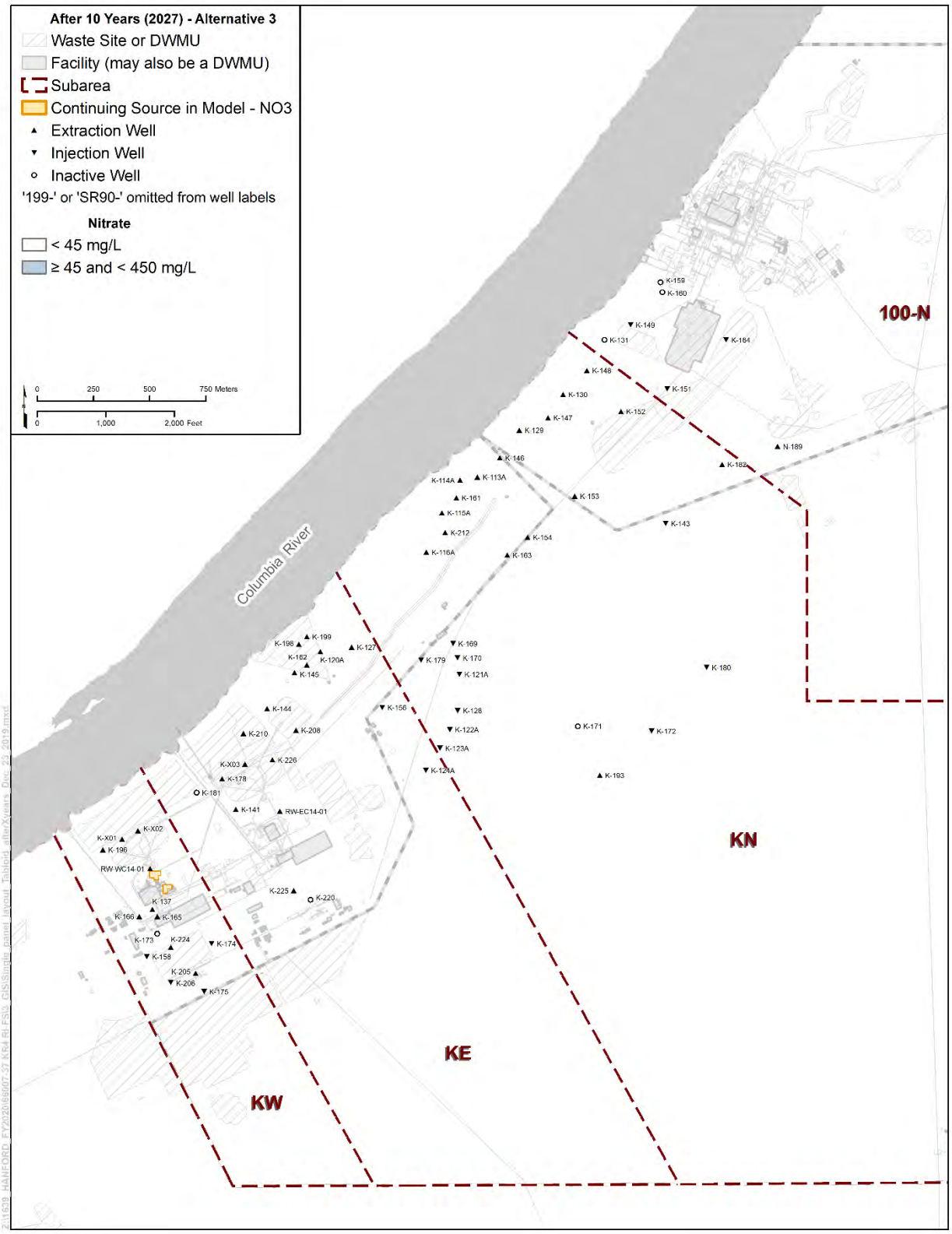


Figure 6-89. Nitrate: Simulated Distribution after 10 Years (end of 2027) – Alternative 3

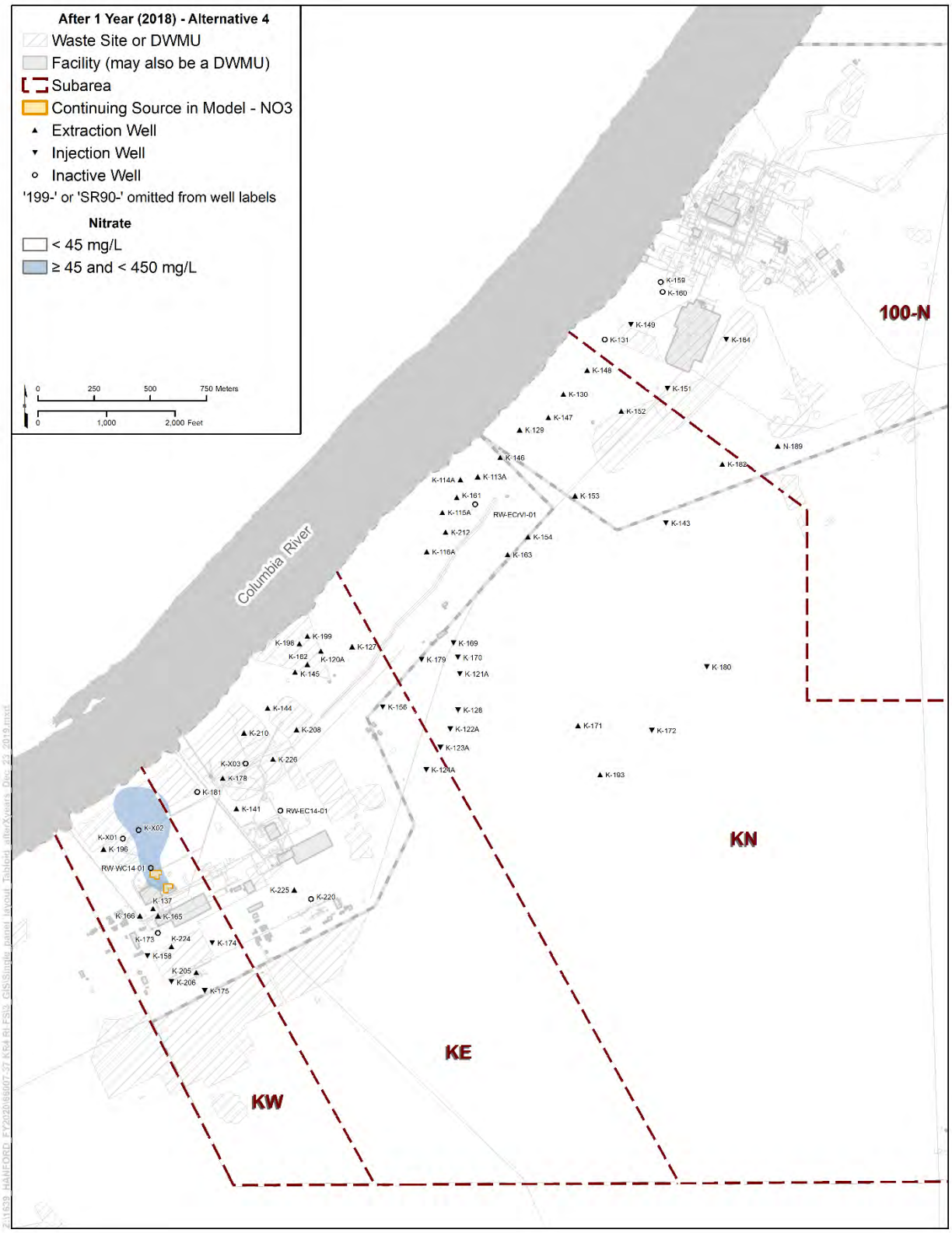


Figure 6-90. Nitrate: Simulated Distribution after 1 Year (end of 2018) – Alternative 4

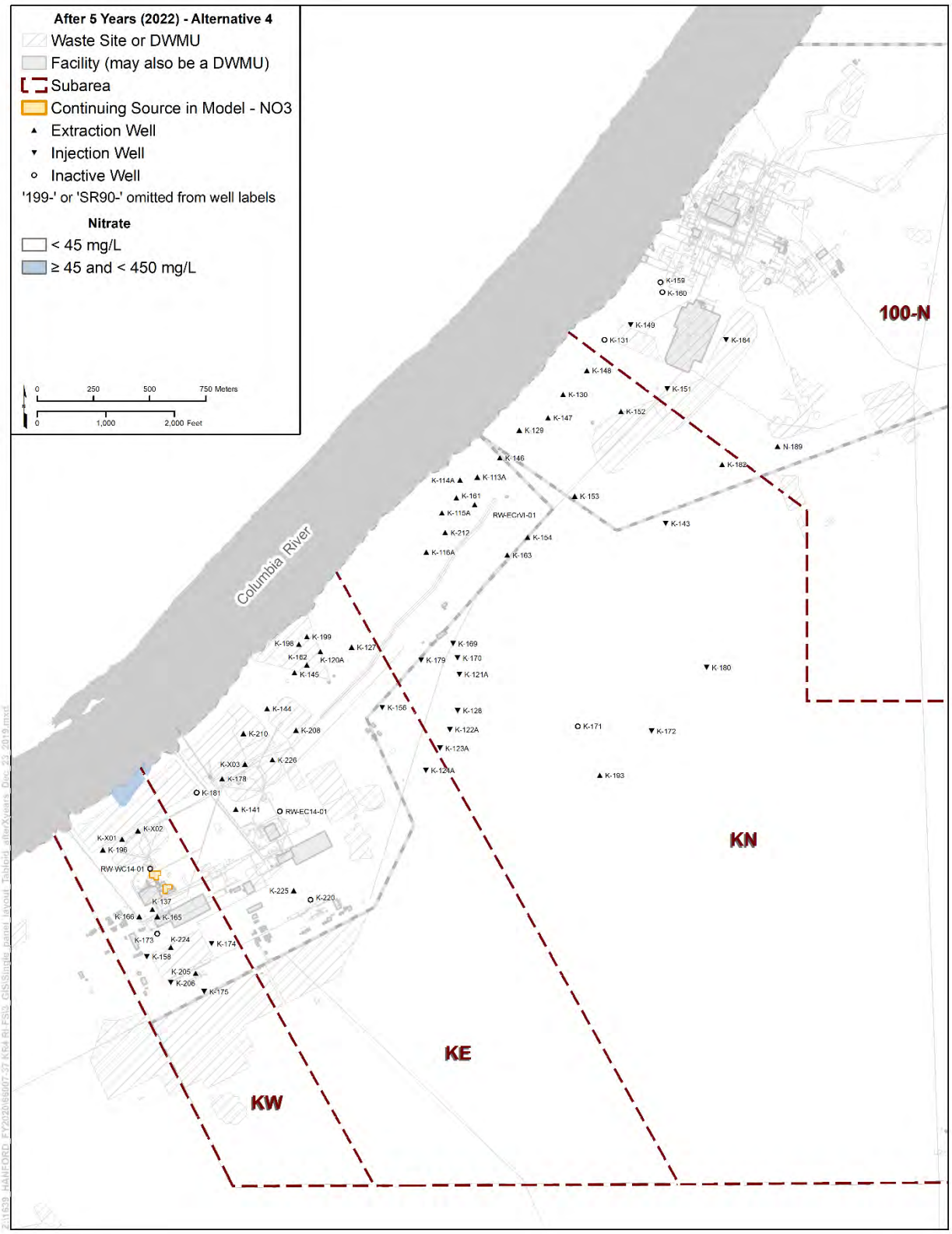


Figure 6-91. Nitrate: Simulated Distribution after 5 Years (end of 2022) – Alternative 4

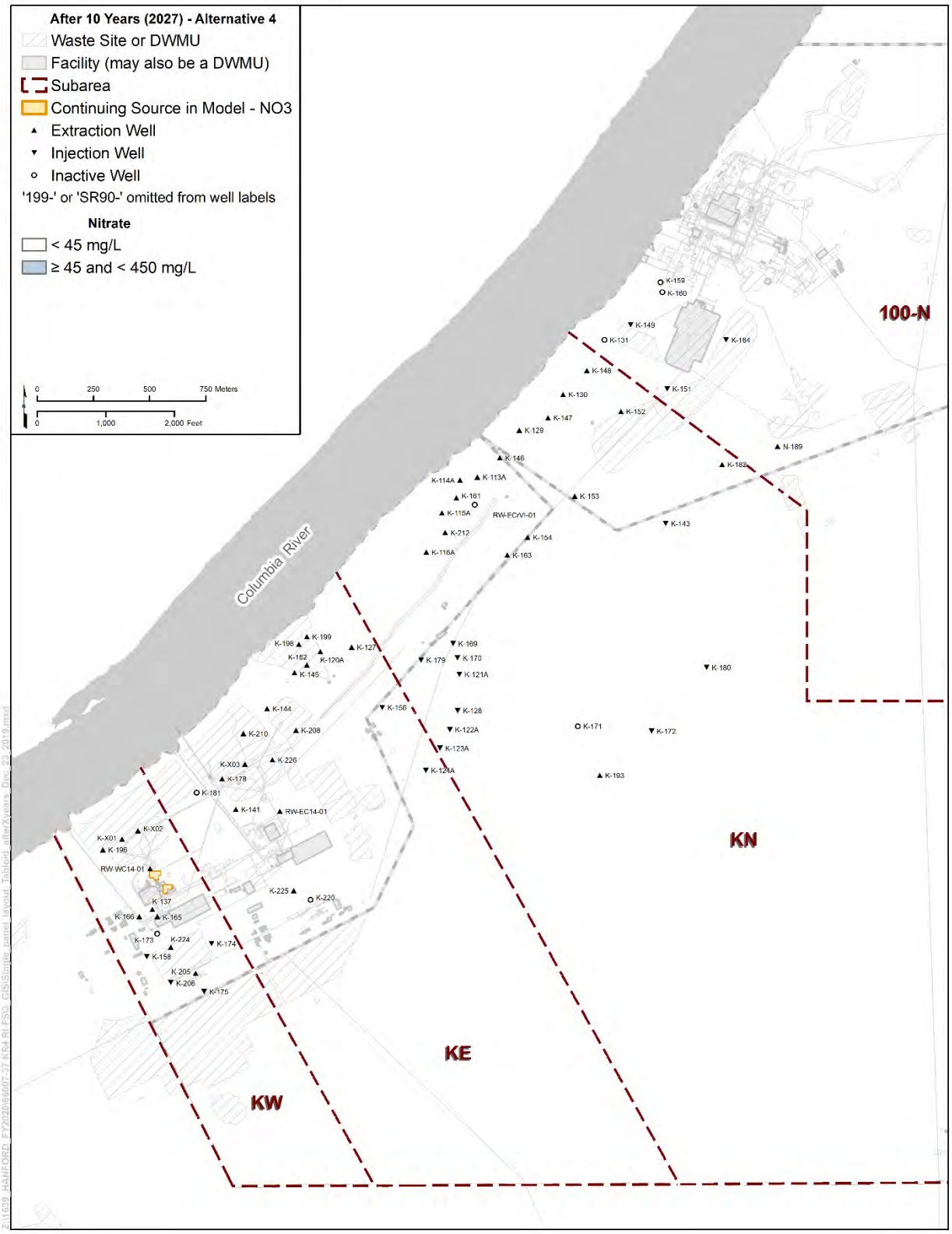


Figure 6-92. Nitrate: Simulated Distribution after 10 Years (end of 2027) – Alternative 4

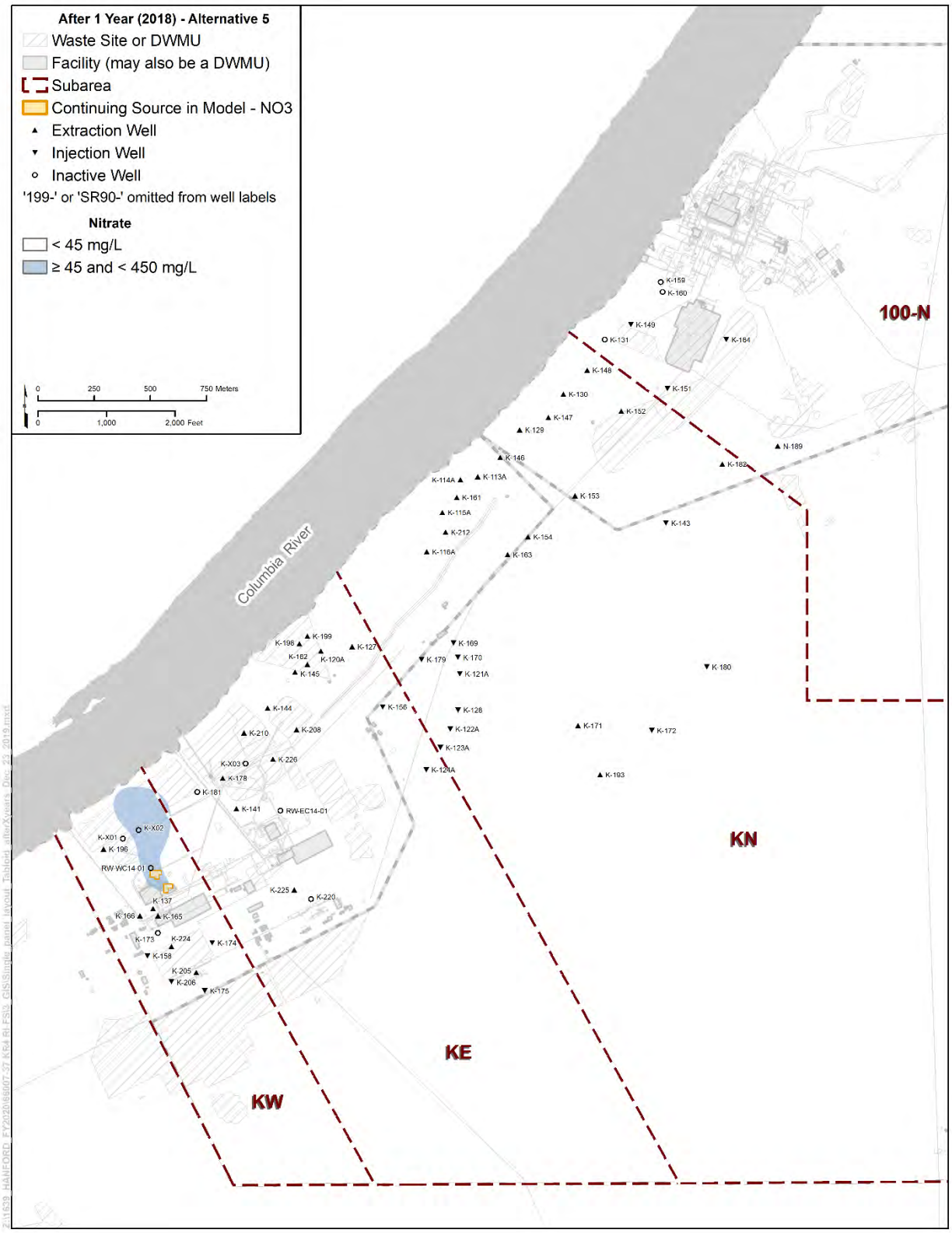


Figure 6-93. Nitrate: Simulated Distribution after 1 Year (end of 2018) – Alternative 5

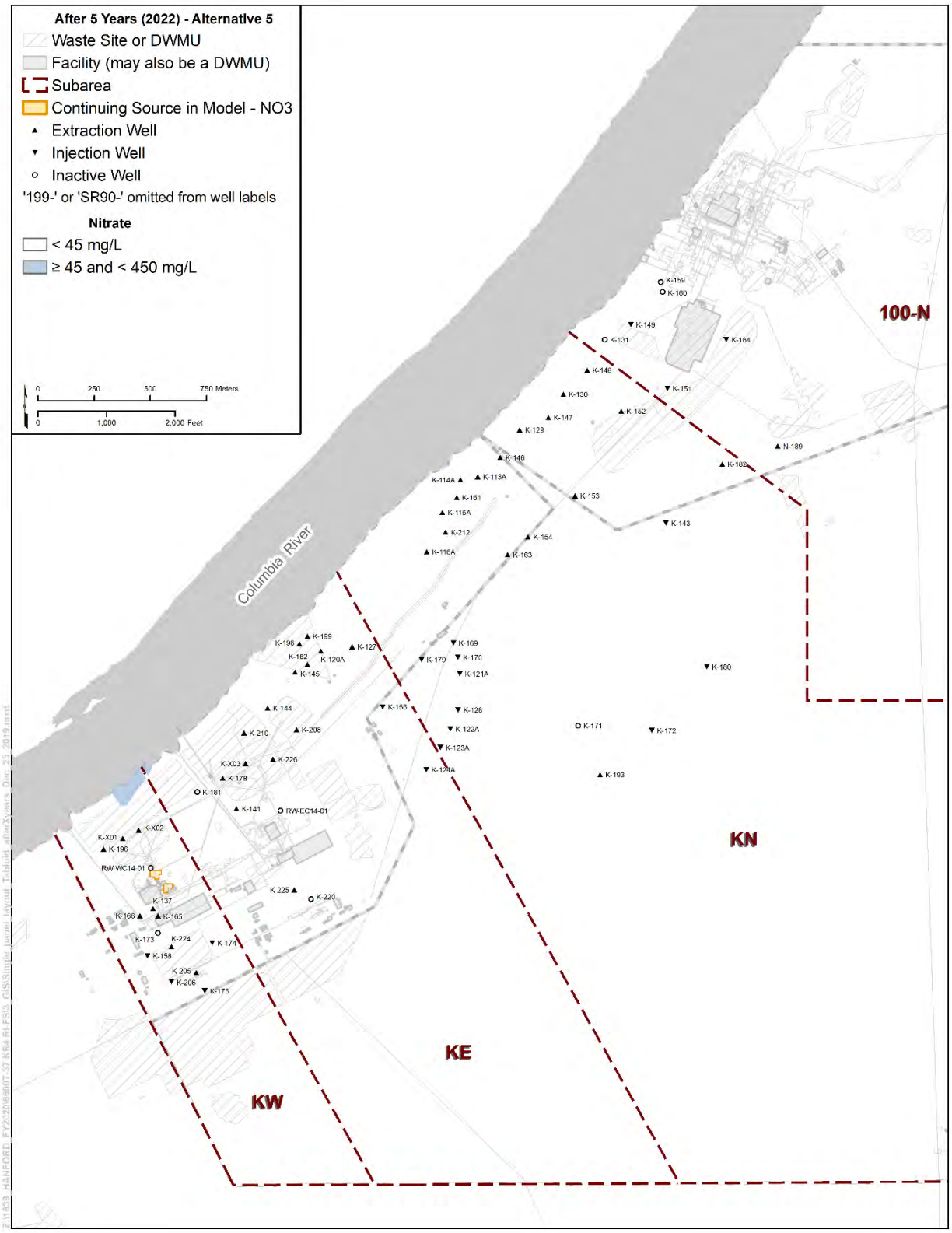


Figure 6-94. Nitrate: Simulated Distribution after 5 Years (end of 2022) – Alternative 5

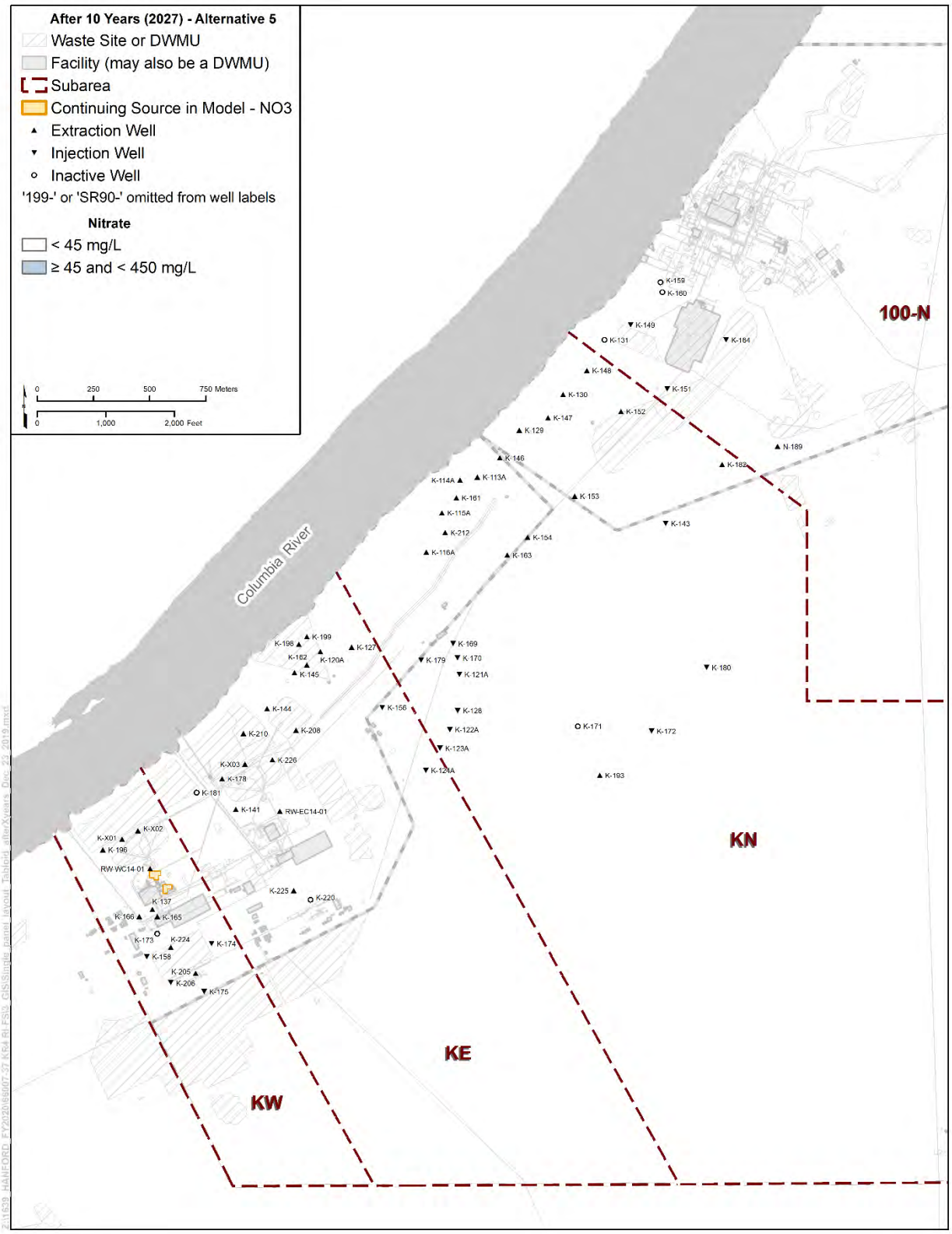


Figure 6-95. Nitrate: Simulated Distribution after 10 Years (end of 2027) – Alternative 5

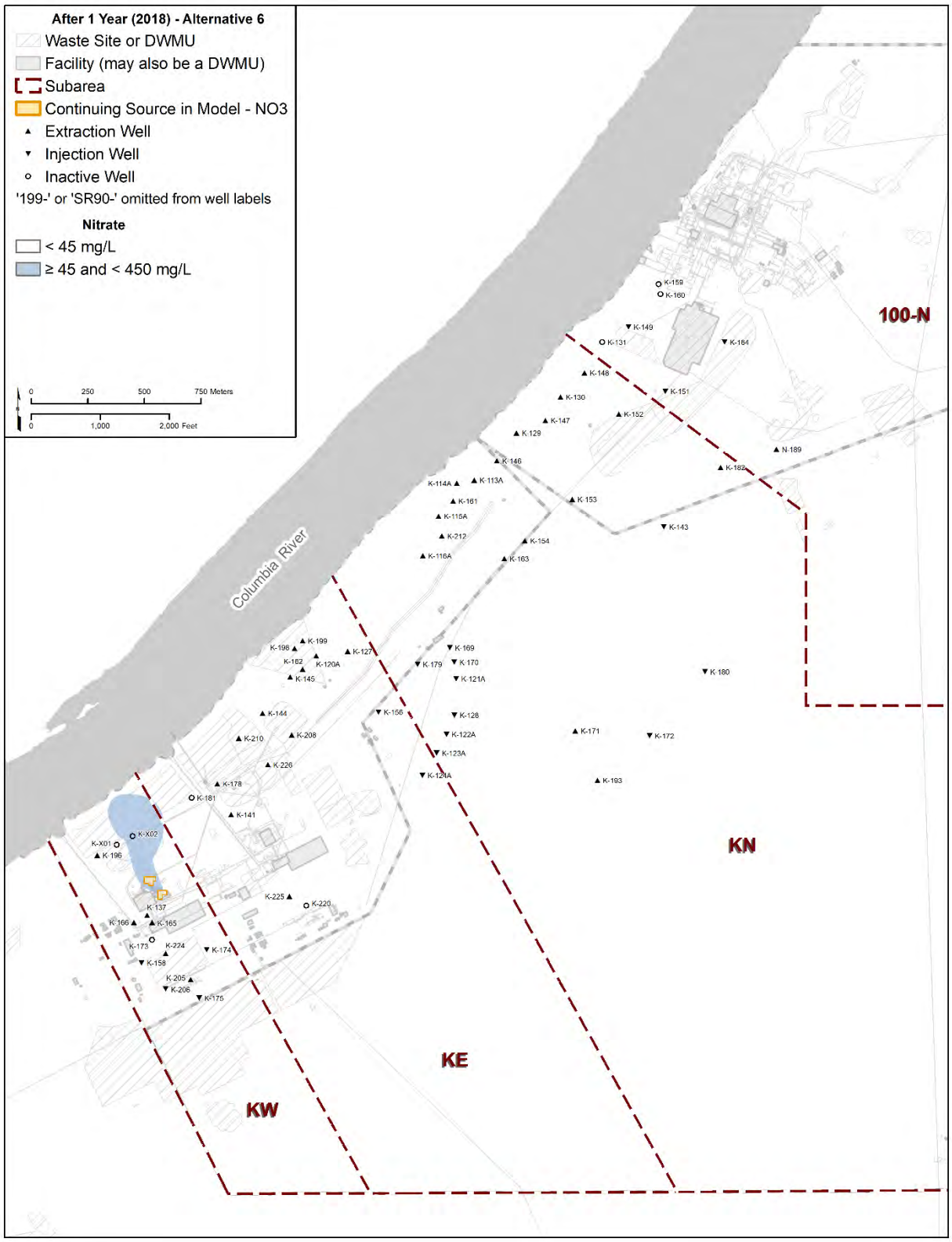


Figure 6-96. Nitrate: Simulated Distribution after 1 Year (end of 2018) – Alternative 6

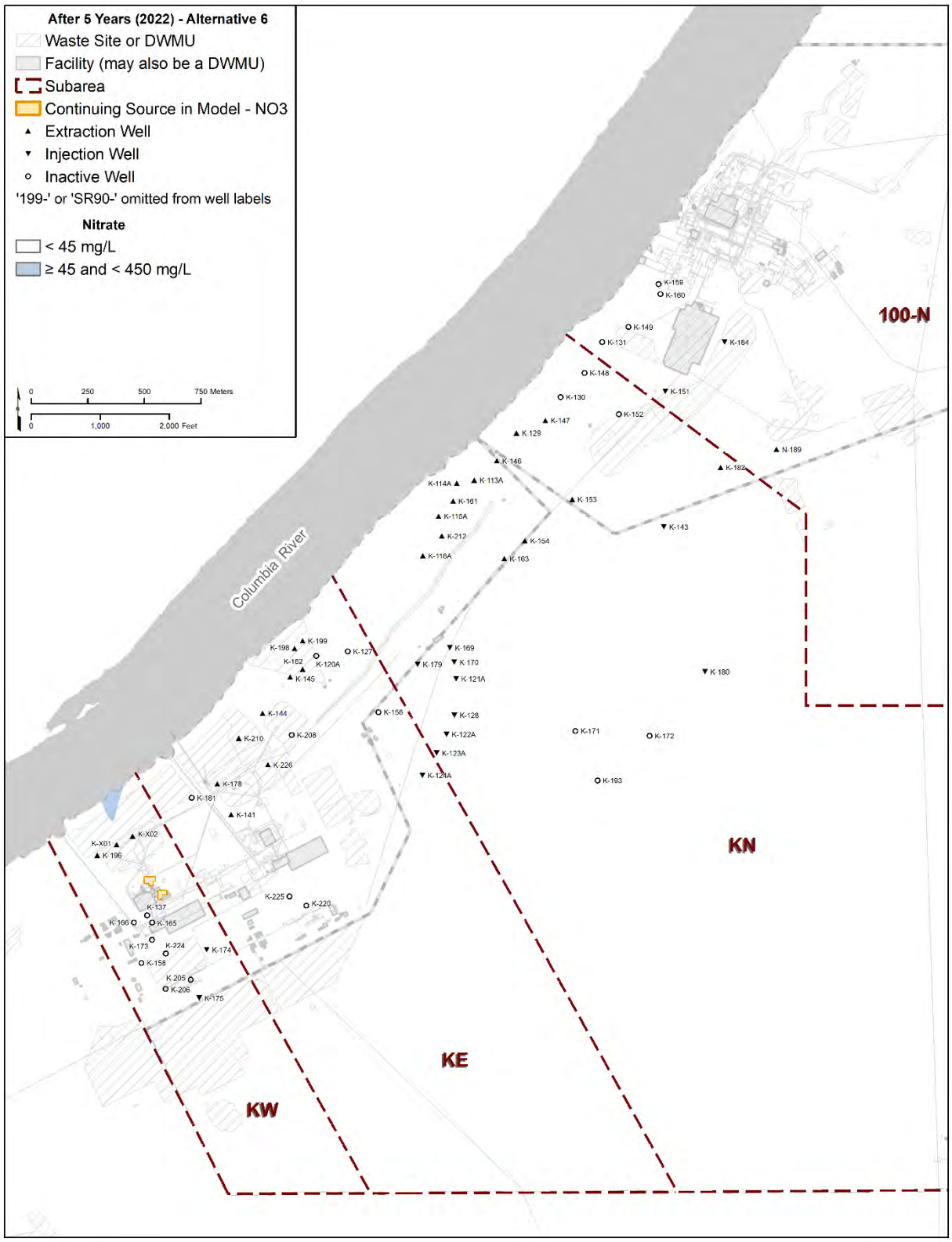


Figure 6-97. Nitrate: Simulated Distribution after 5 Years (end of 2022) – Alternative 6

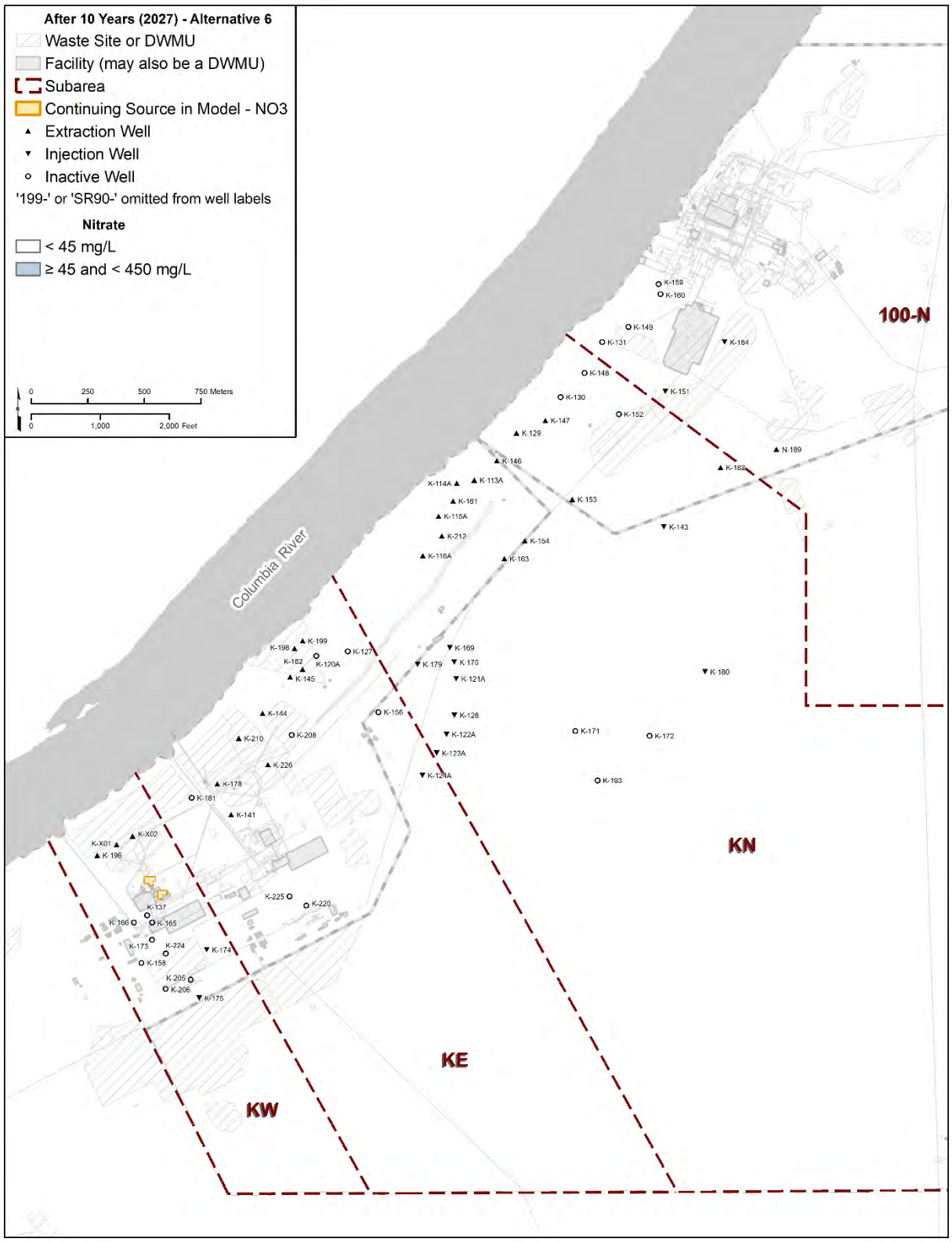


Figure 6-98. Nitrate: Simulated Distribution after 10 Years (end of 2027) – Alternative 6

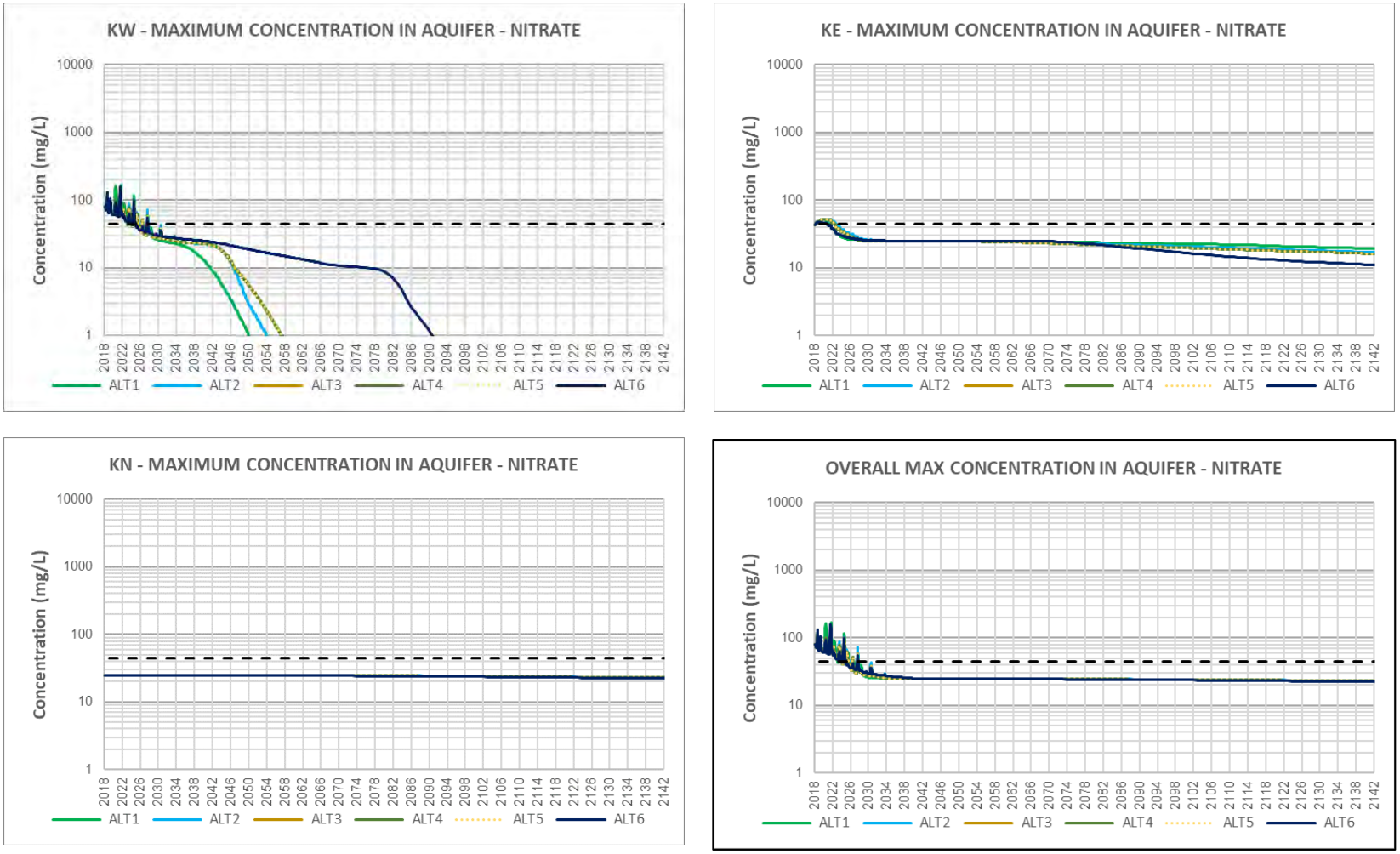


Figure 6-99. Nitrate: Maximum Concentration Time Series in the Aquifer

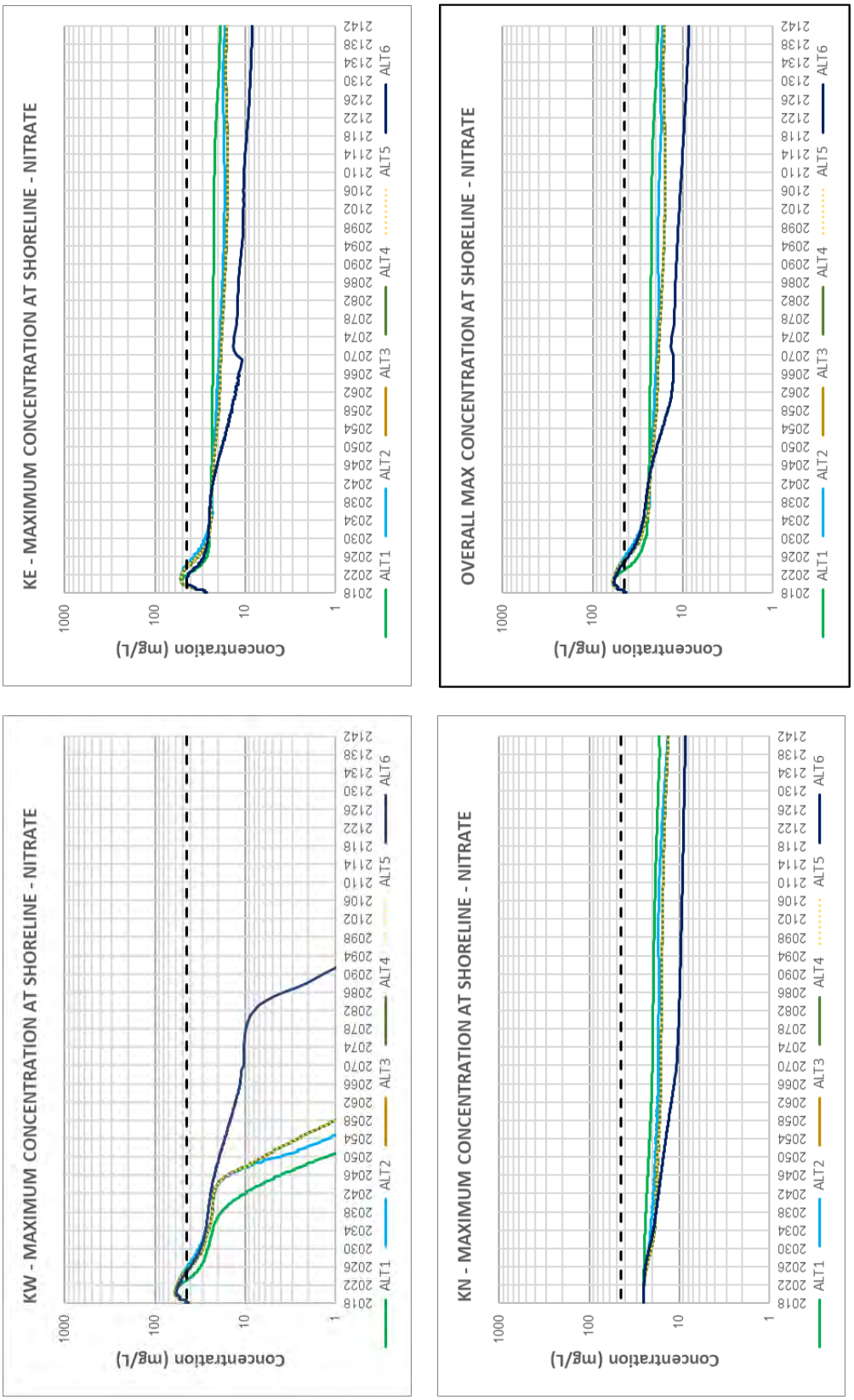


Figure 6-100. Nitrate: Maximum Concentration Time Series at the Shoreline

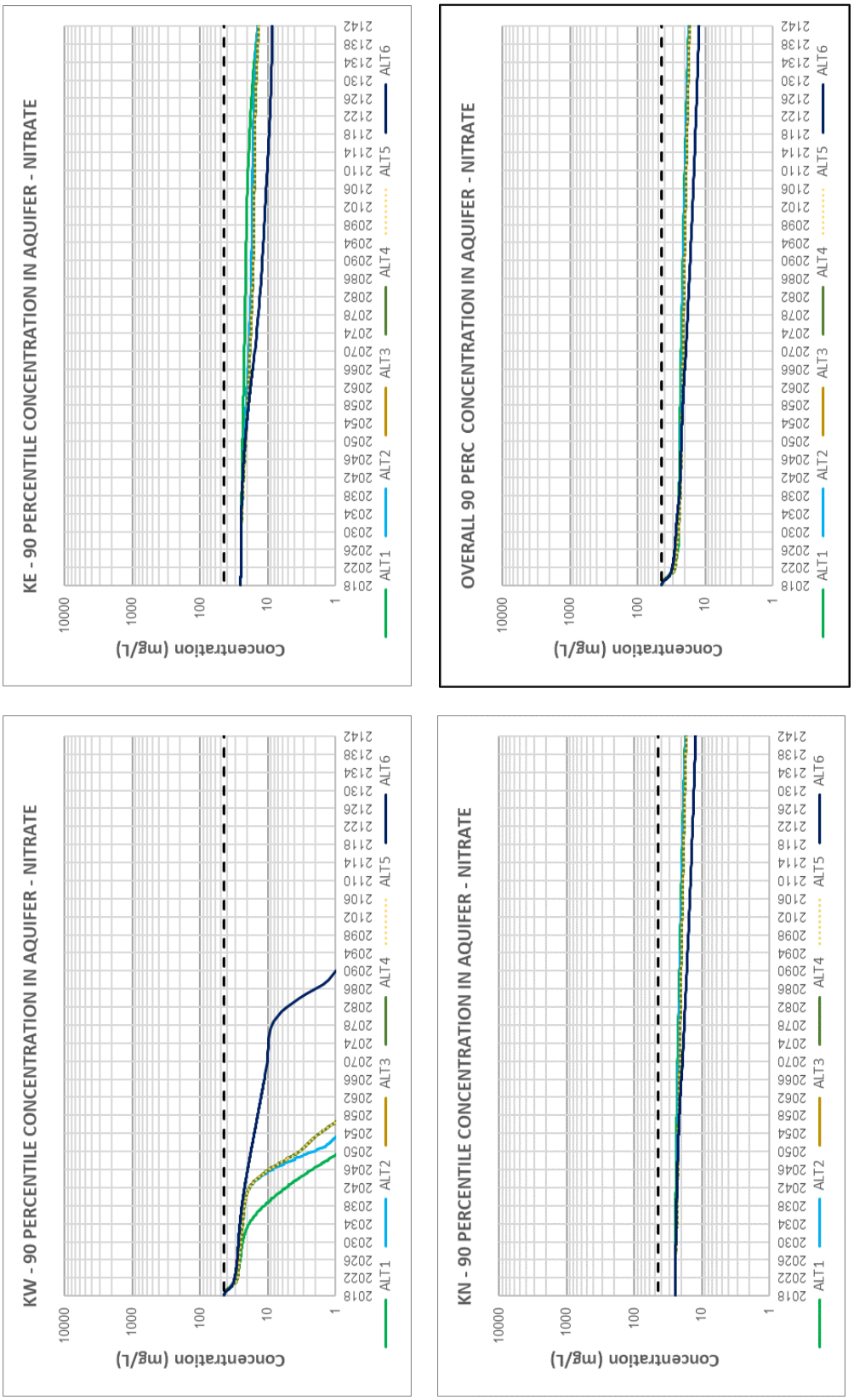


Figure 6-101. Nitrate: 90th Percentile Concentration Time Series in the Aquifer

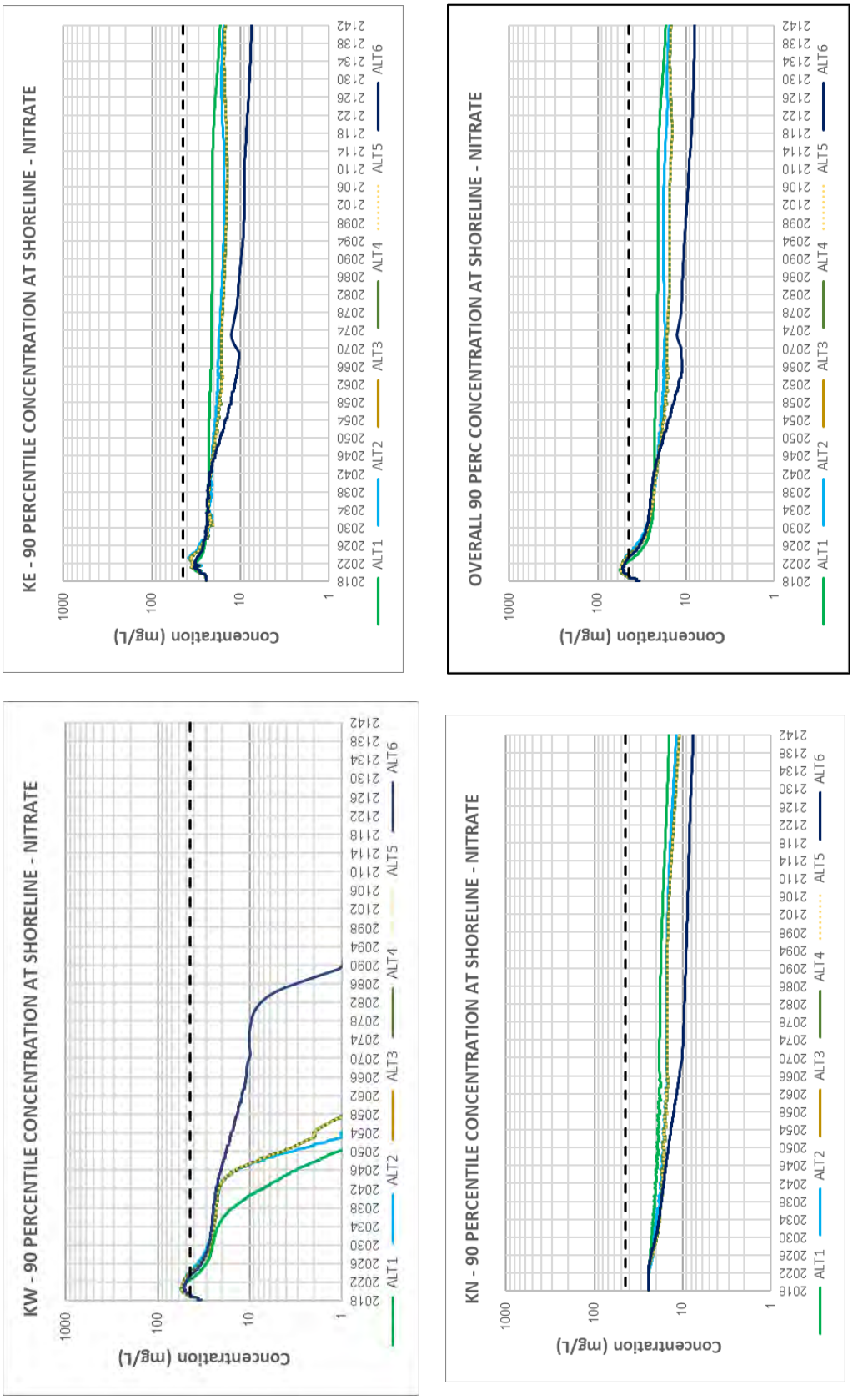


Figure 6-102. Nitrate: 90th Percentile Concentration Time Series at the Shoreline

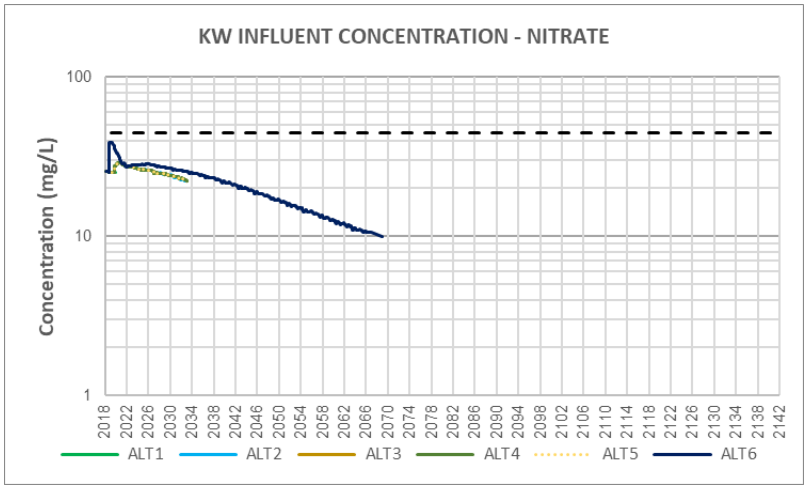


Figure 6-103. Nitrate: Combined Influent Concentration Time Series – KW System

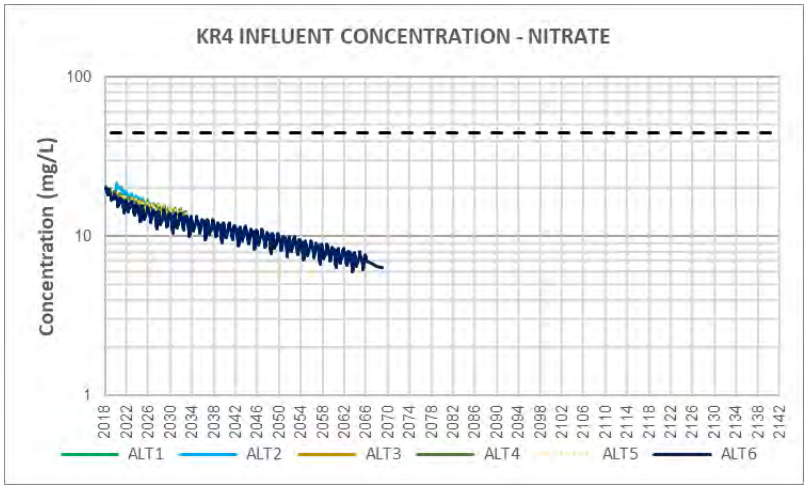


Figure 6-104. Nitrate: Combined Influent Concentration Time Series – KR4 System

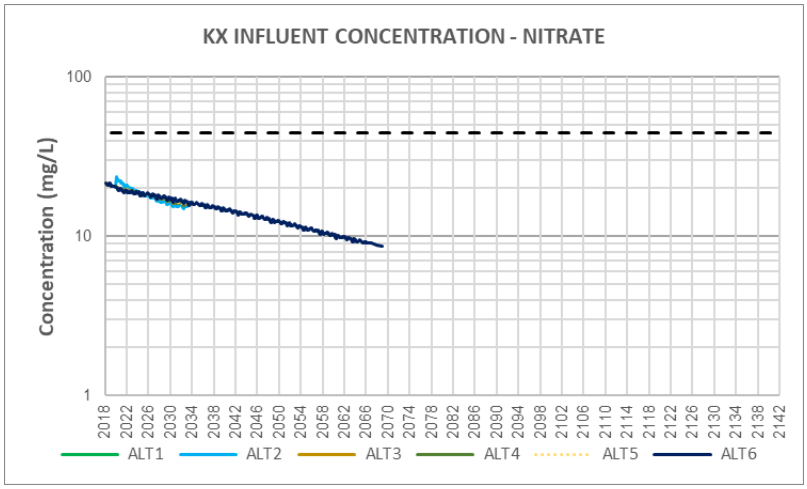


Figure 6-105. Nitrate: Combined Influent Concentration Time Series – KX System

6.1.4 Simulated Contaminant Distribution – Concentration Statistics: Strontium-90

Results for strontium-90 are grouped in the following sets of figures:

- Figures 6-106 to 6-168: simulated concentration distributions for each alternative.
- Figure 6-169: maximum concentration time series in the aquifer for each subarea and overall summary for the entire 100-K OU (Alternatives 1 to 6).
- Figure 6-170: maximum concentration time series in the aquifer for KW-KE strontium-90 plumes (Alternative 7).
- Figure 6-171: maximum concentration time series at the shoreline for each subarea and overall summary for the entire 100-K OU (Alternatives 1 to 6).
- Figures 6-172 to 6-173: 90th percentile concentration time series for each subarea and overall summary for the entire 100-K OU (Alternatives 1 to 6).
- Figures 6-174 to 6-176: combined influent concentration time series per treatment system for Alternatives 1 to 6.

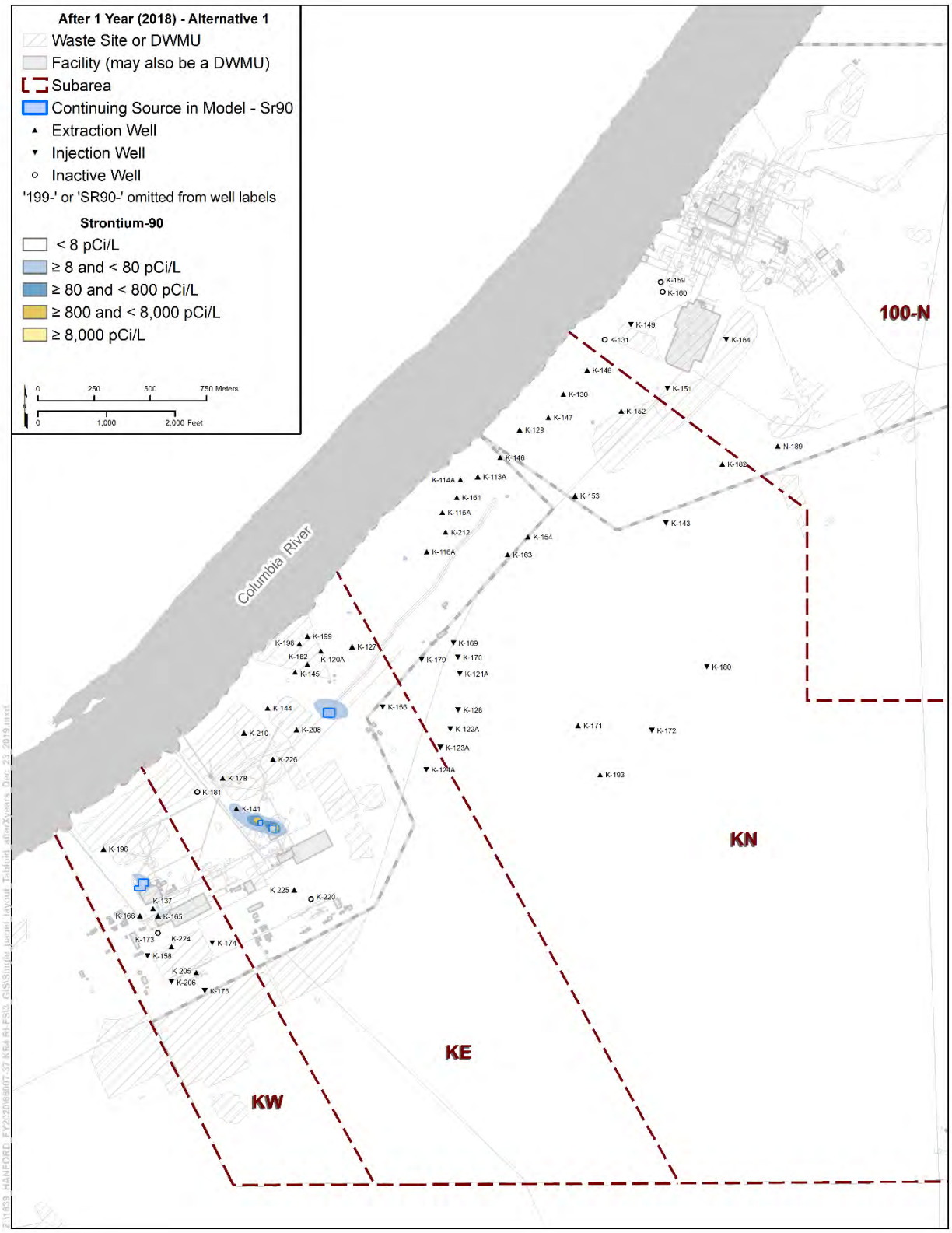


Figure 6-106. Strontium-90: Simulated Distribution after 1 Year (end of 2018) – Alternative 1

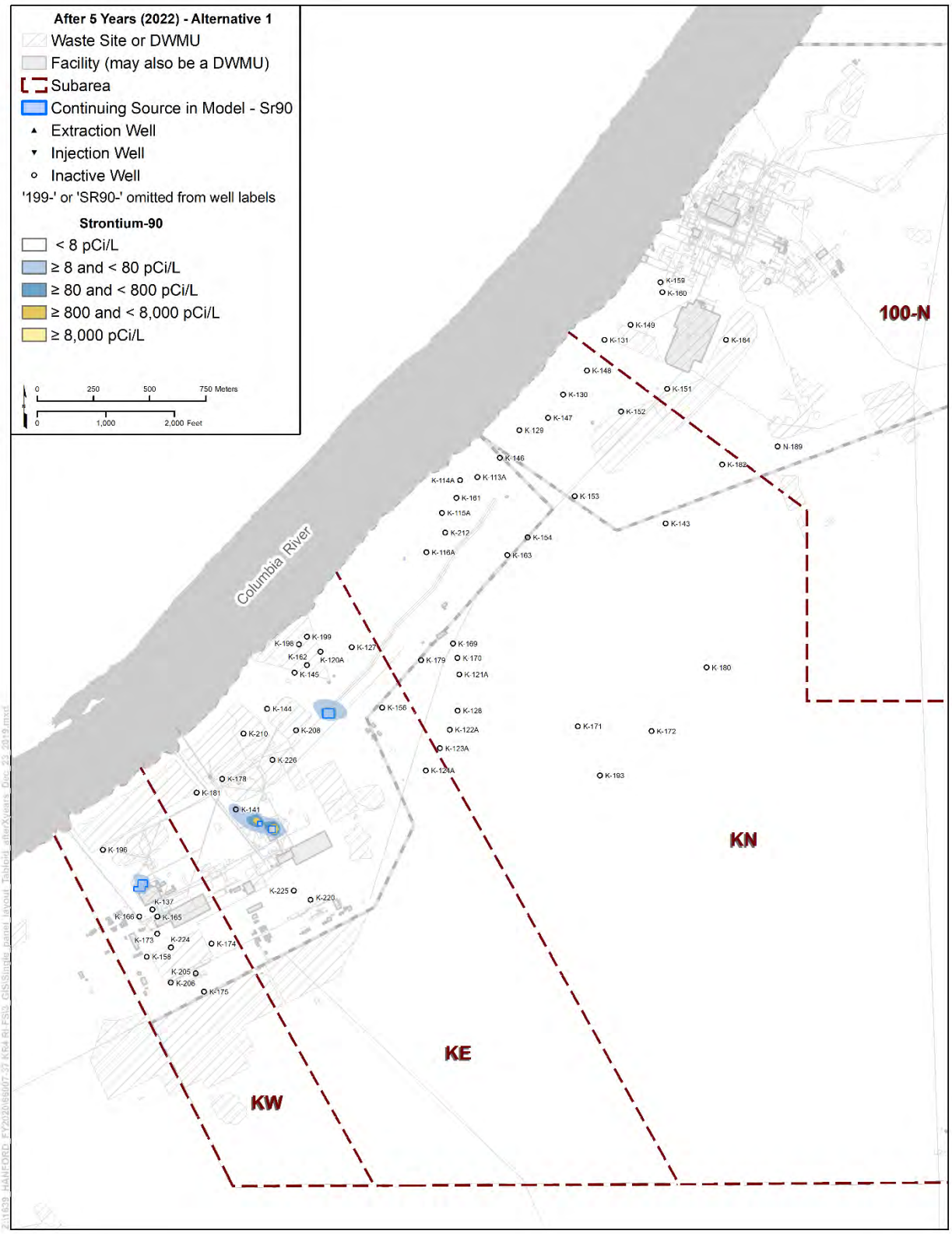


Figure 6-107. Strontium-90: Simulated Distribution after 5 Years (end of 2022) – Alternative 1

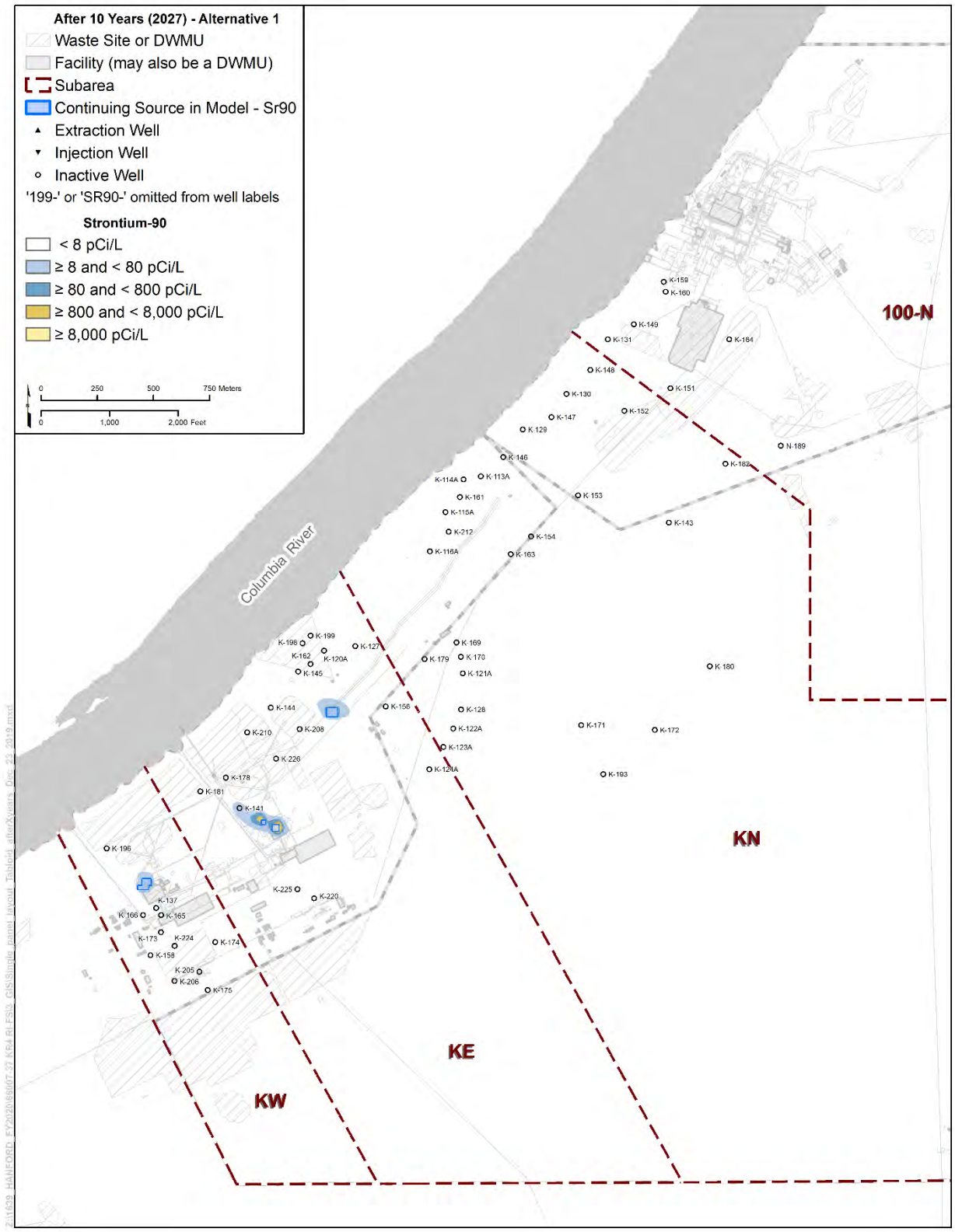


Figure 6-108. Strontium-90: Simulated Distribution after 10 Years (end of 2027) – Alternative 1

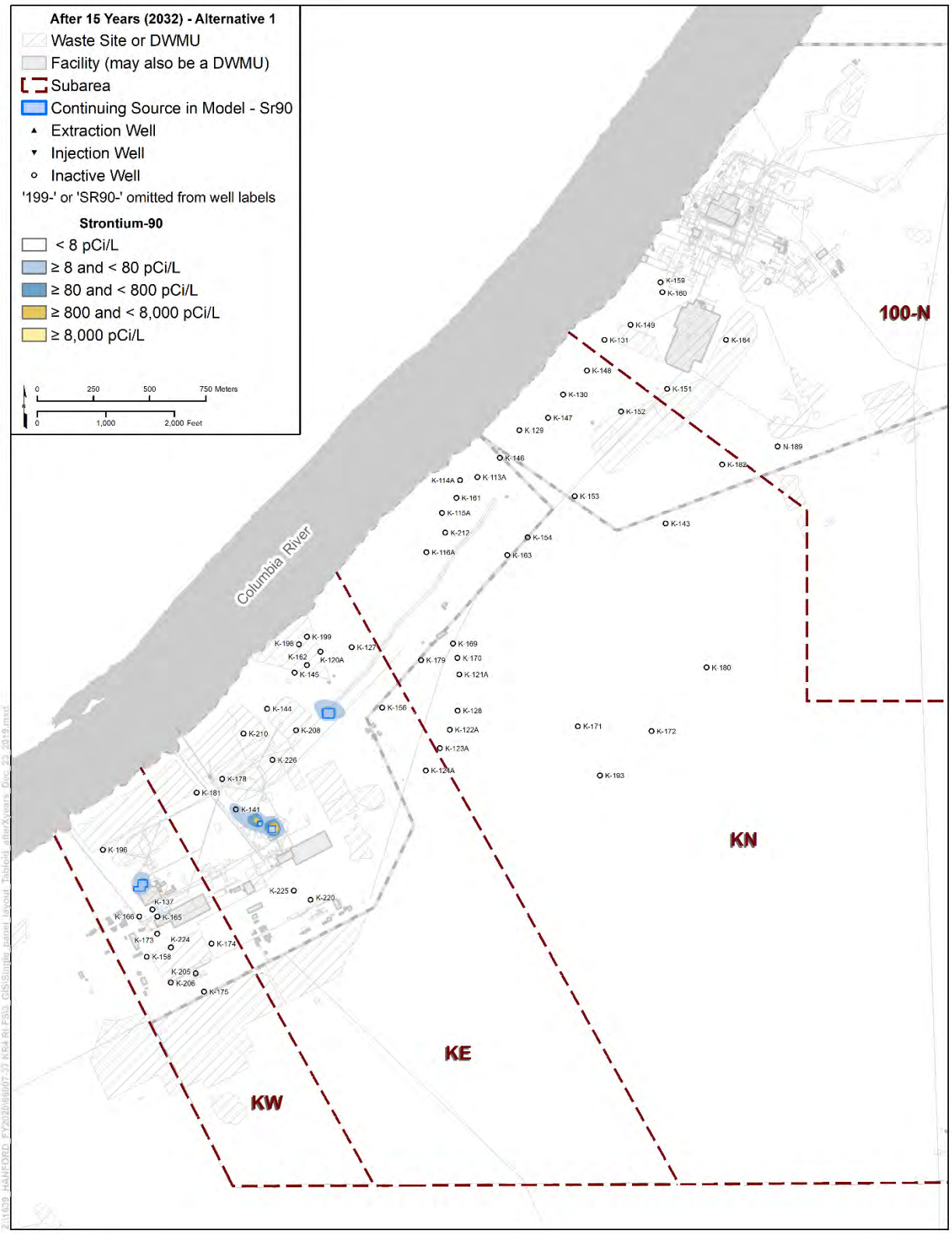


Figure 6-109. Strontium-90: Simulated Distribution after 15 Years (end of 2032) – Alternative 1

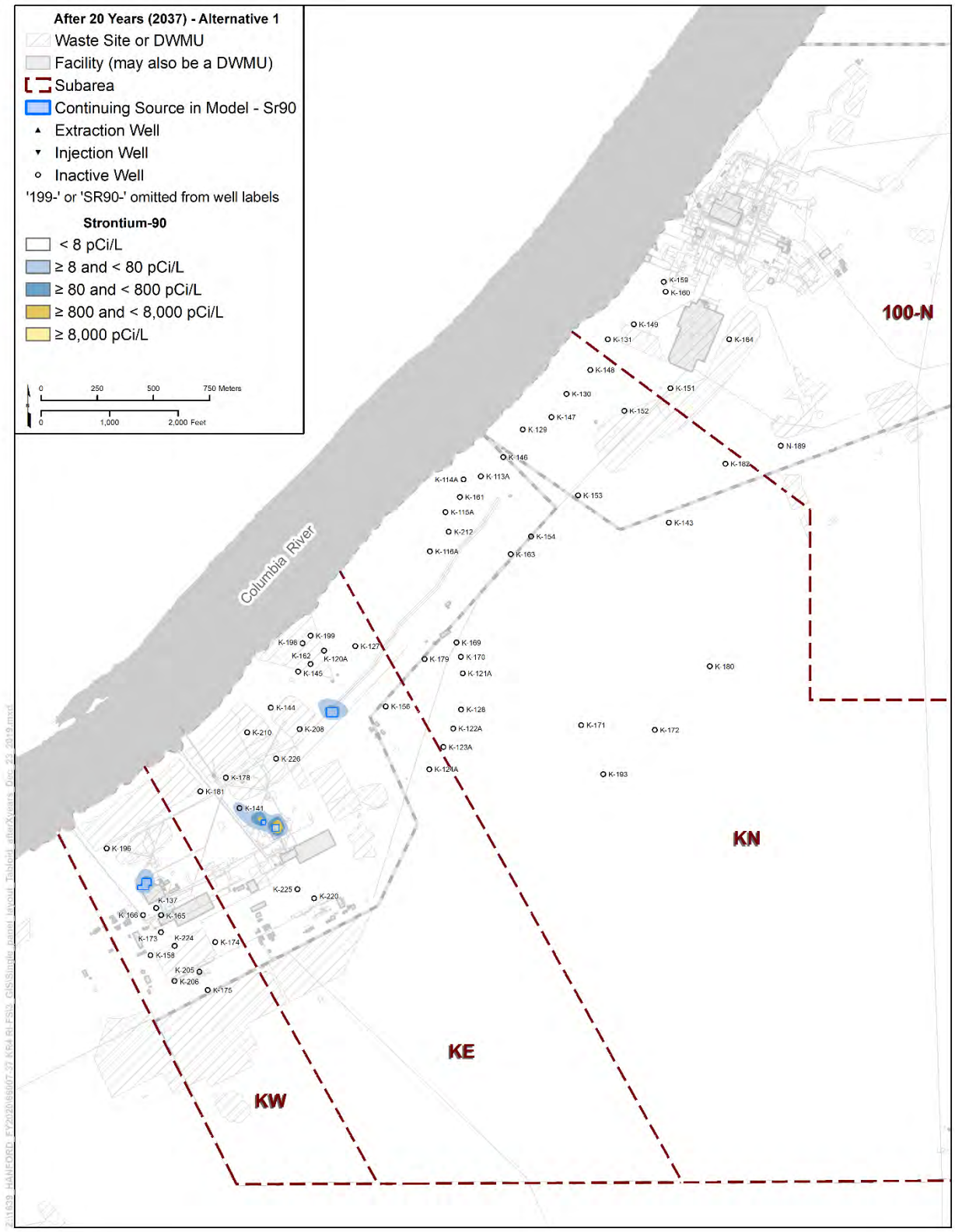


Figure 6-110. Strontium-90: Simulated Distribution after 20 Years (end of 2037) – Alternative 1

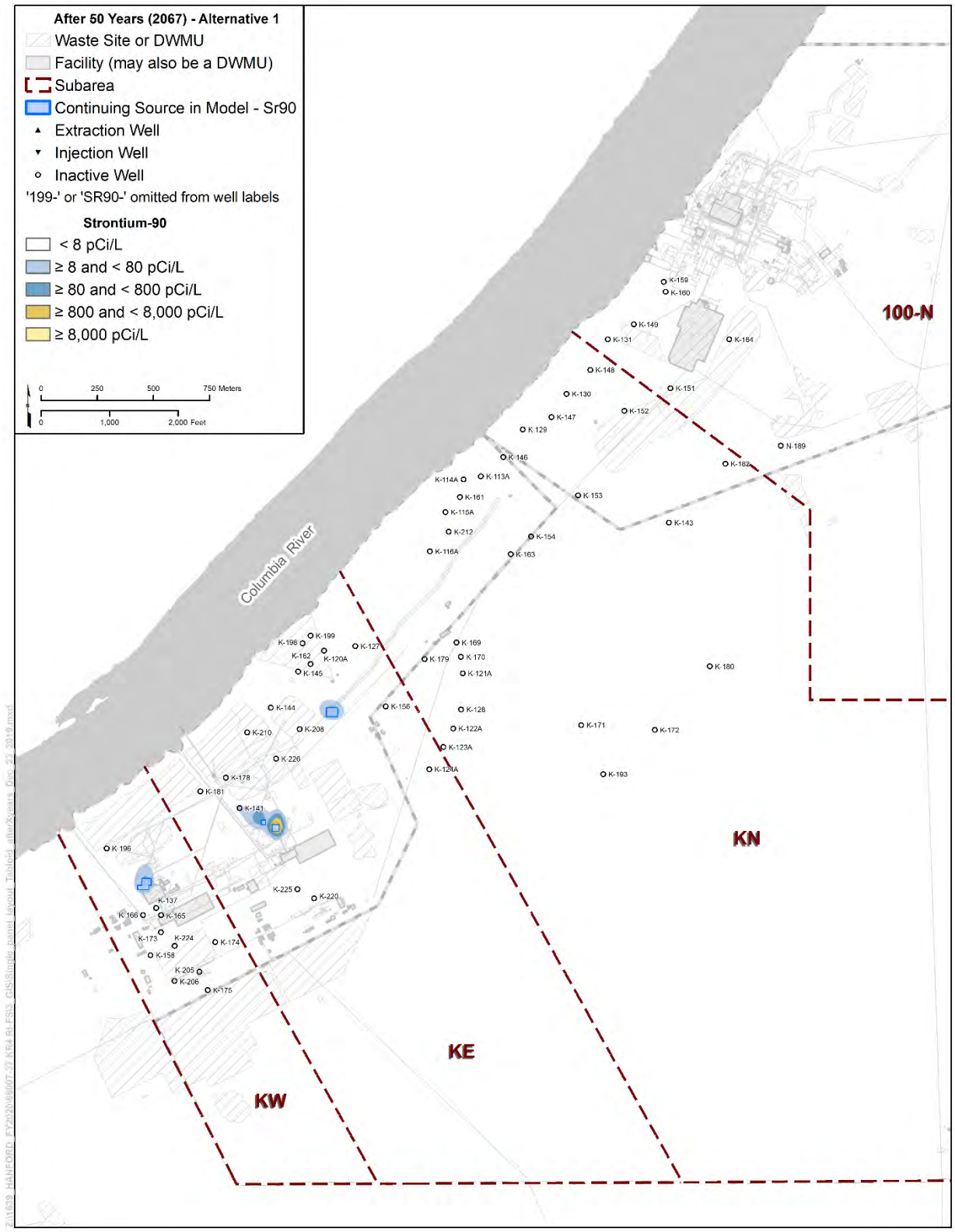


Figure 6-111. Strontium-90: Simulated Distribution after 50 Years (end of 2067) – Alternative 1

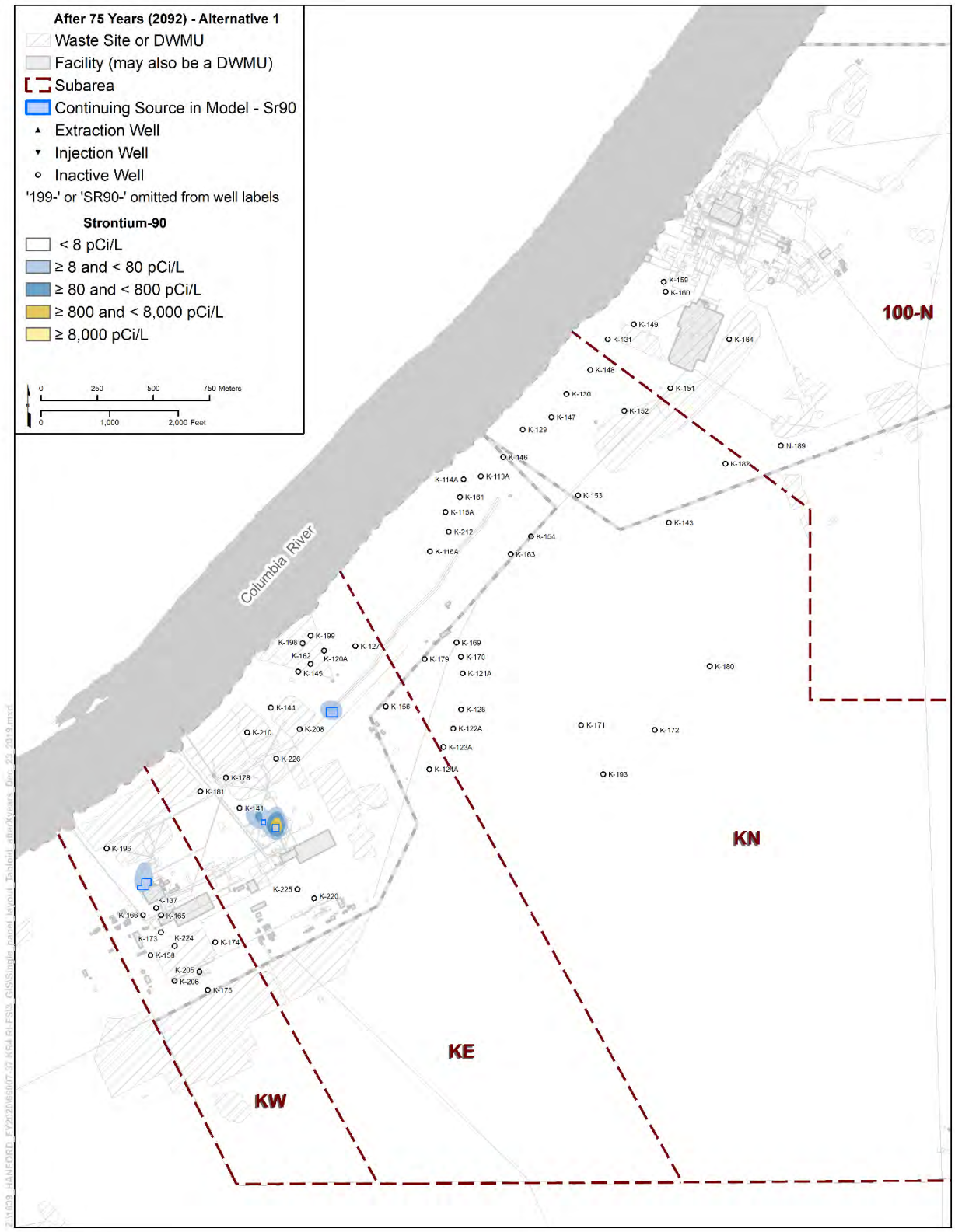


Figure 6-112. Strontium-90: Simulated Distribution after 75 Years (end of 2092) – Alternative 1

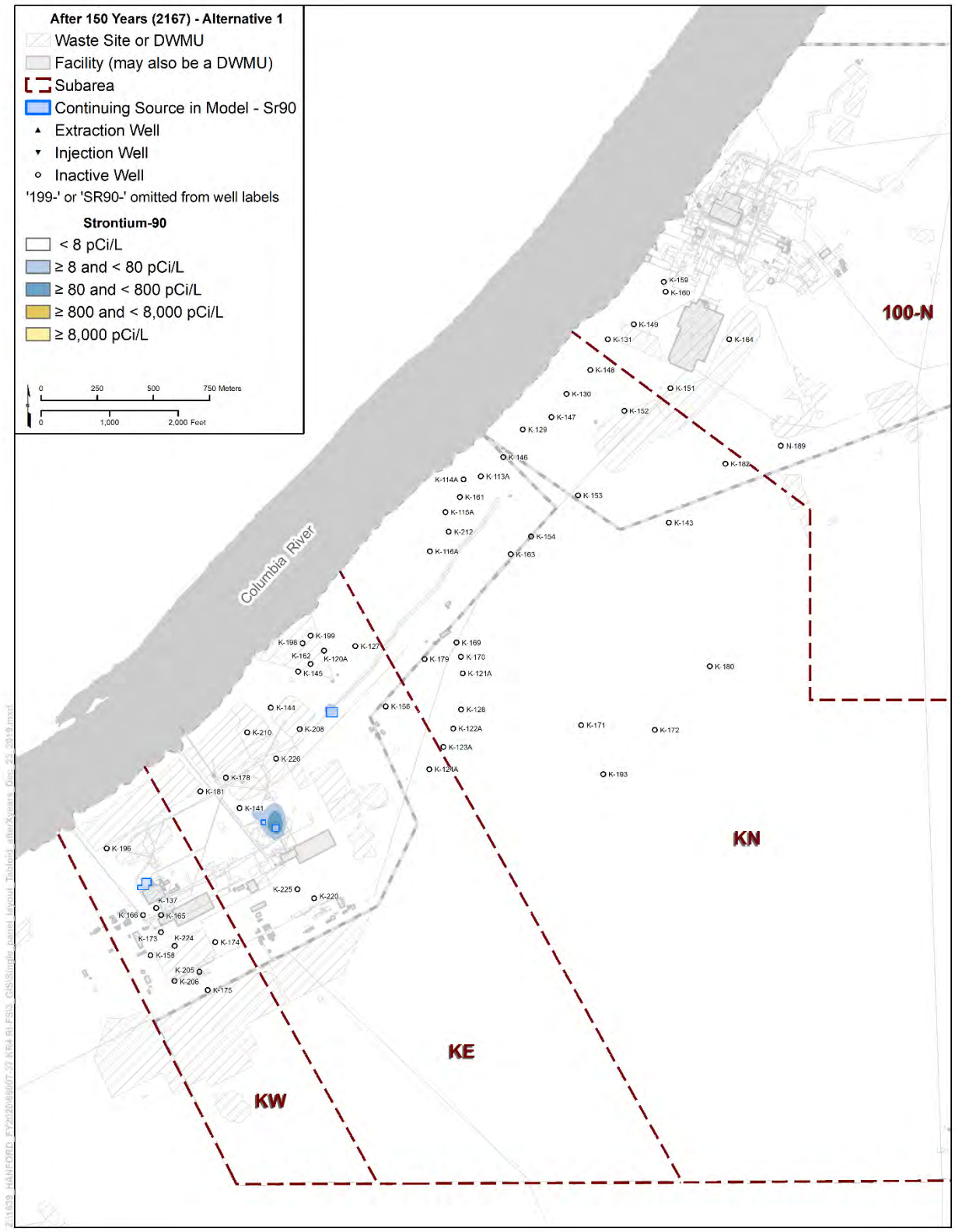


Figure 6-113. Strontium-90: Simulated Distribution after 150 Years (end of 2167) – Alternative 1

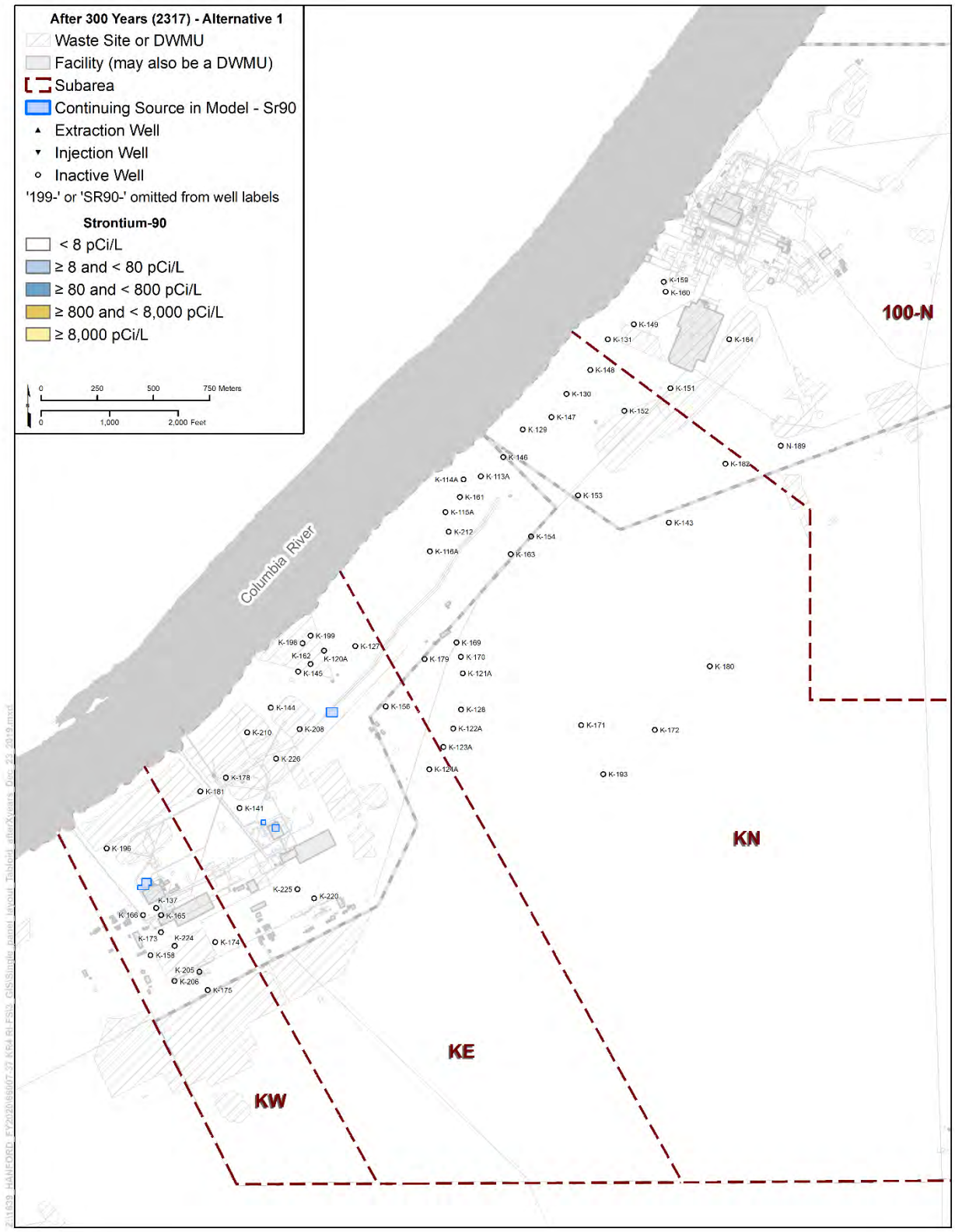


Figure 6-114. Strontium-90: Simulated Distribution after 300 Years (end of 2317) – Alternative 1

f

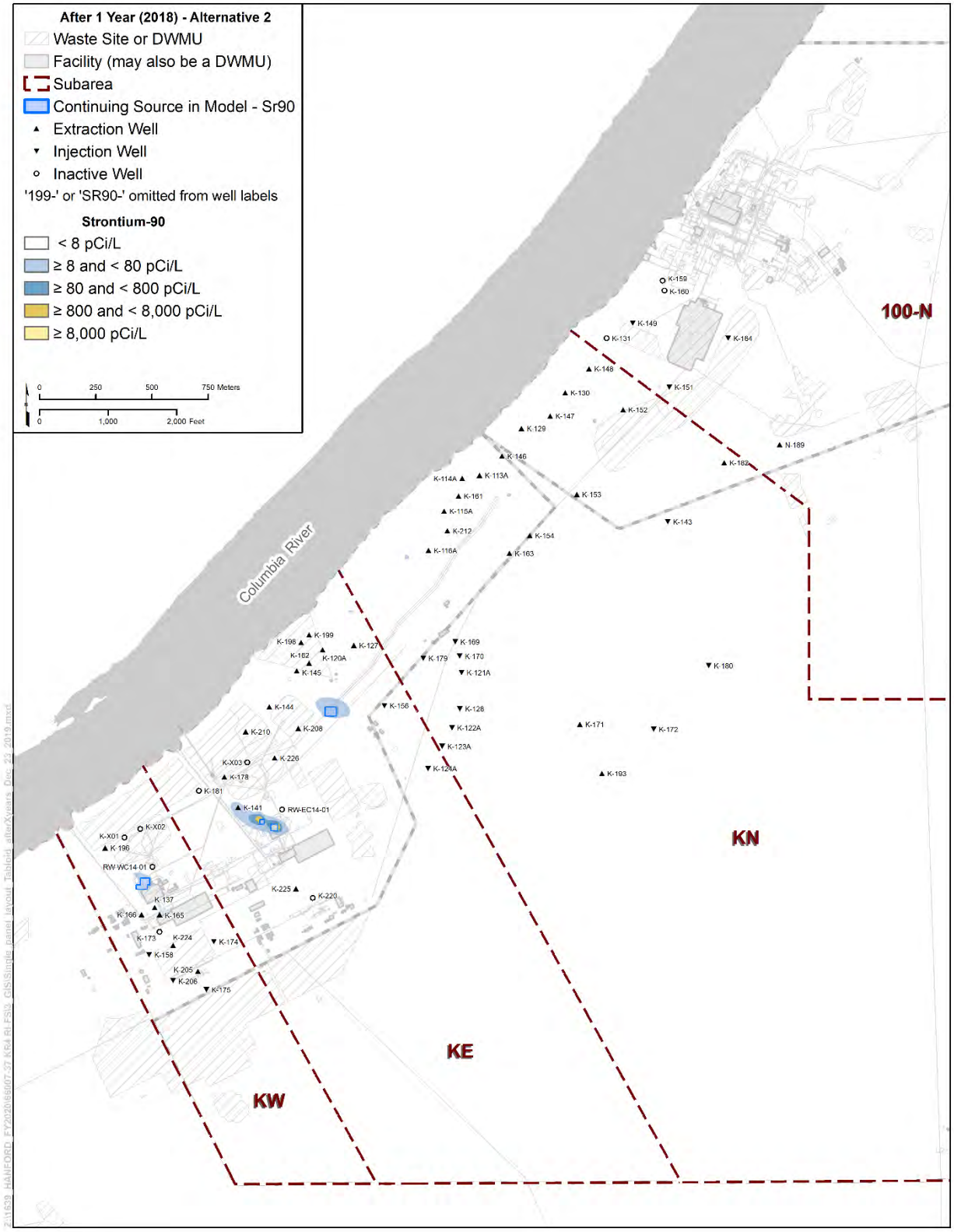


Figure 6-115. Strontium-90: Simulated Distribution after 1 Years (end of 2018) – Alternative 2

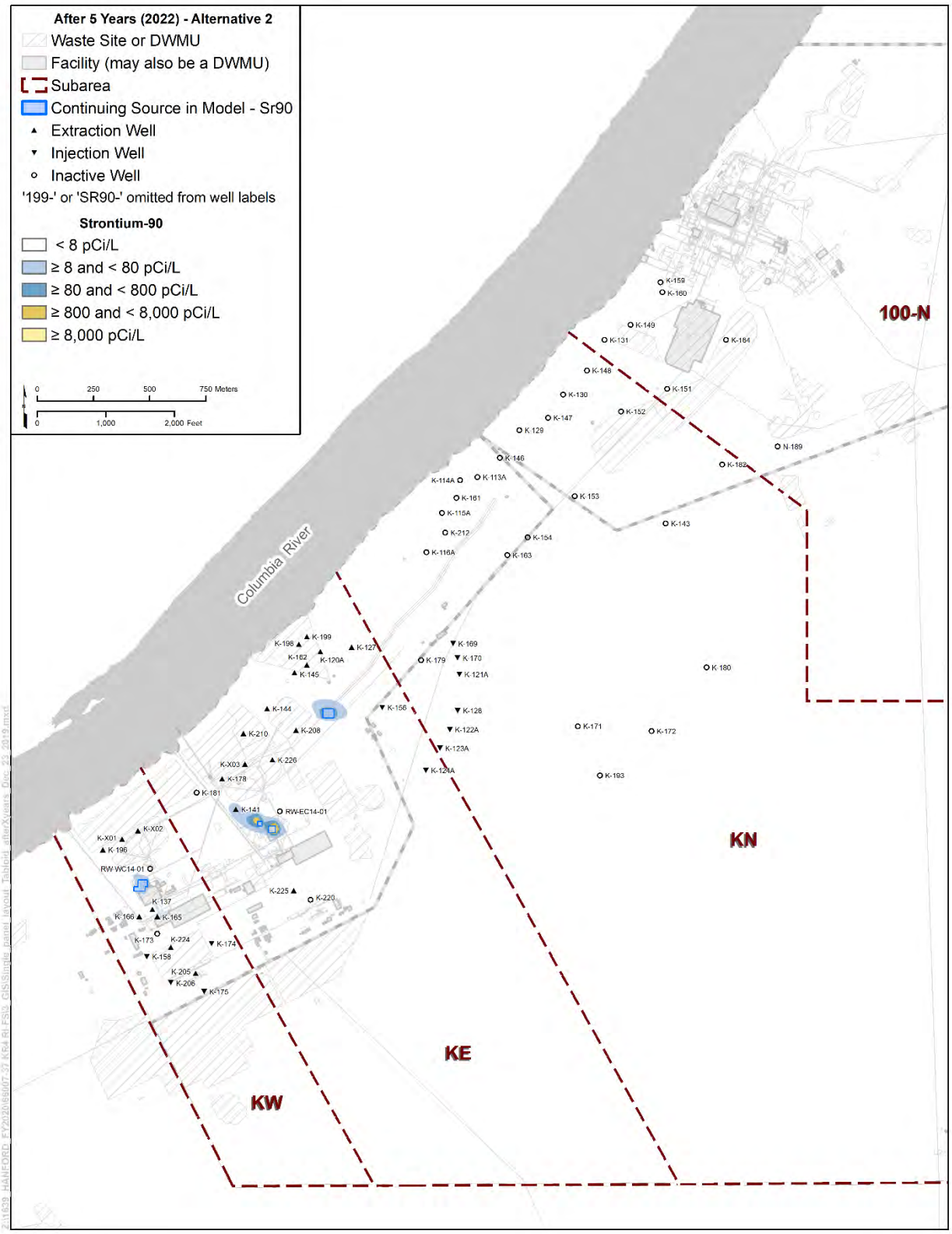


Figure 6-116. Strontium-90: Simulated Distribution after 5 Years (end of 2022) – Alternative 2

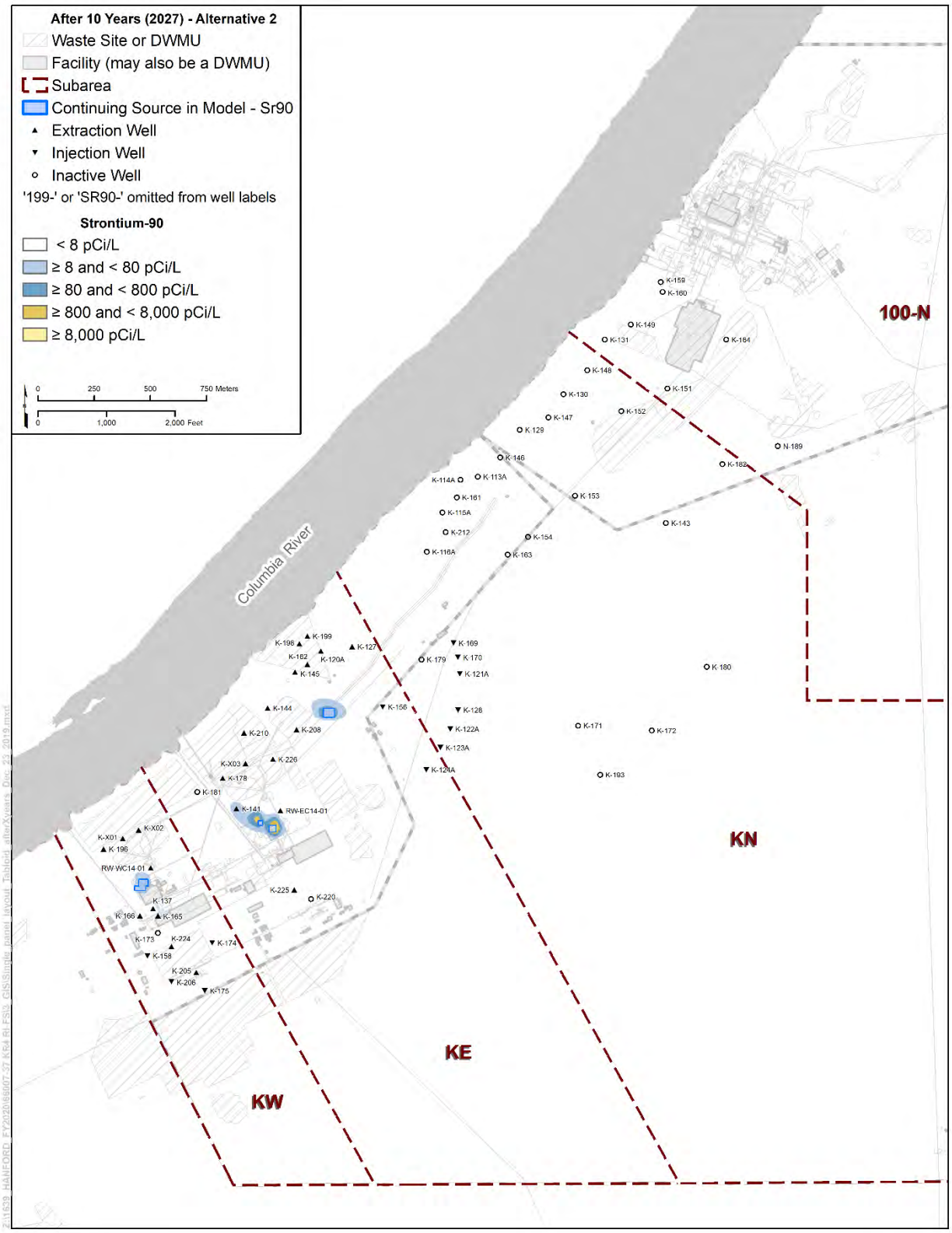


Figure 6-117. Strontium-90: Simulated Distribution after 10 Years (end of 2027) – Alternative 2

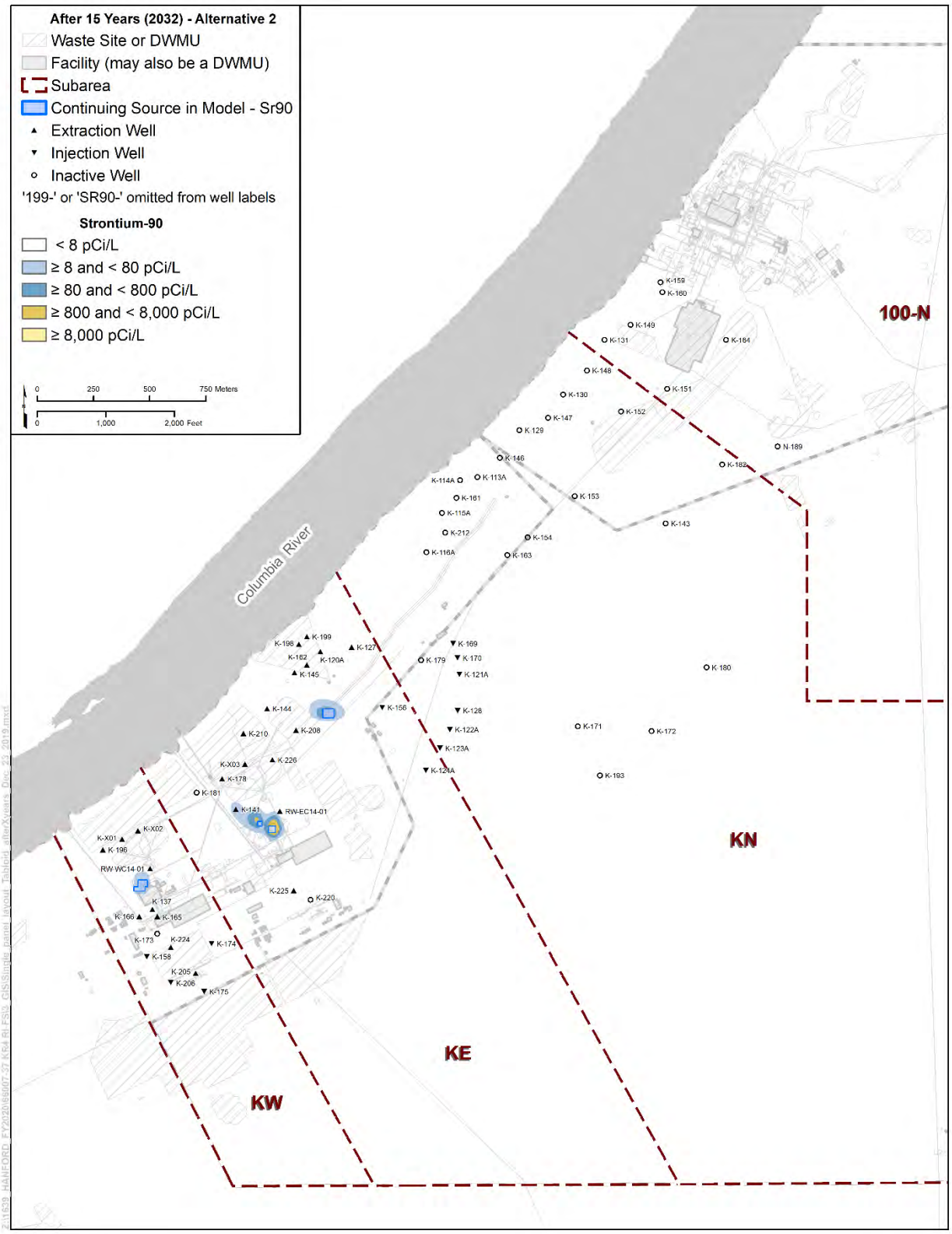


Figure 6-118. Strontium-90: Simulated Distribution after 15 Years (end of 2032) – Alternative 2

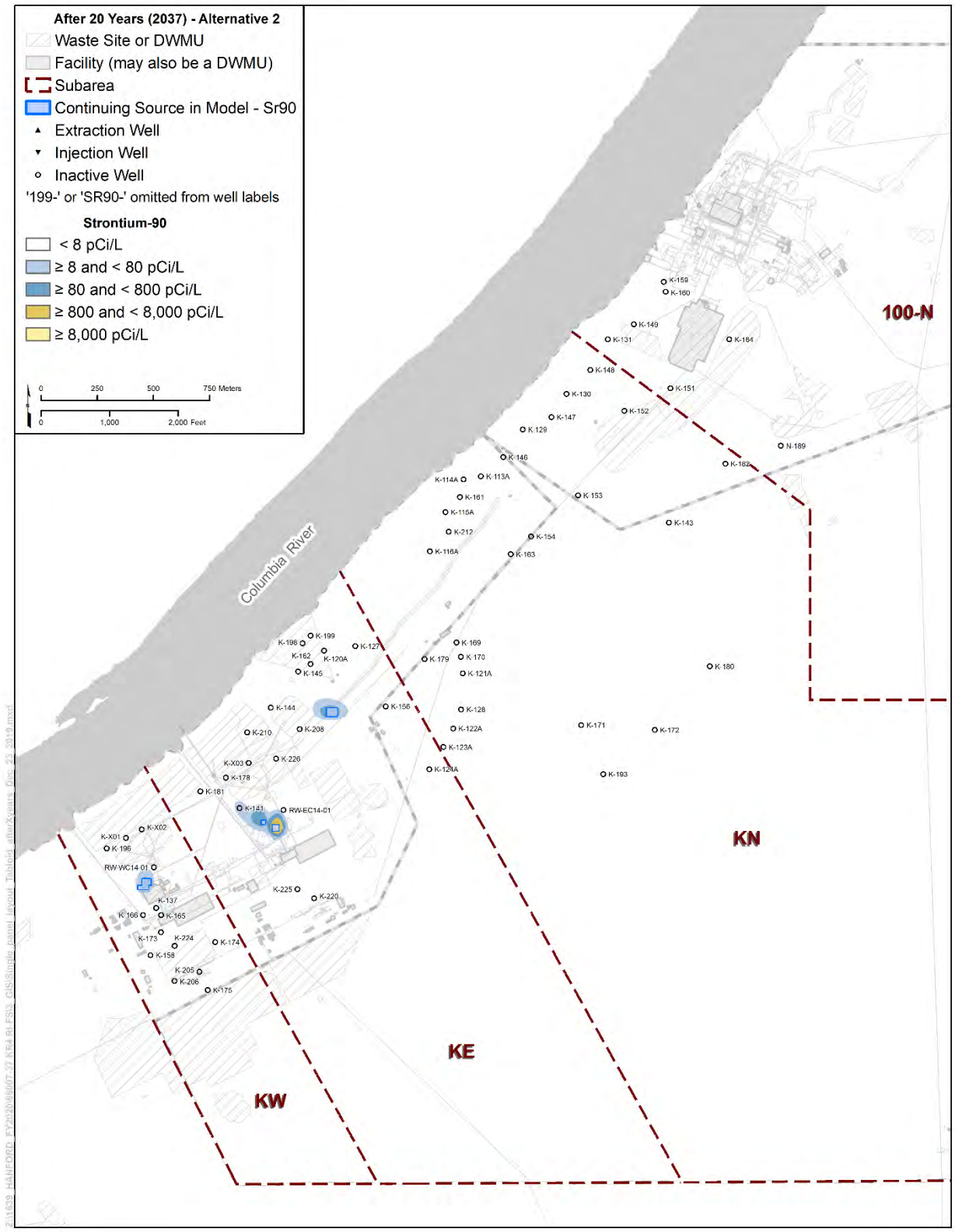


Figure 6-119. Strontium-90: Simulated Distribution after 20 Years (end of 2037) – Alternative 2

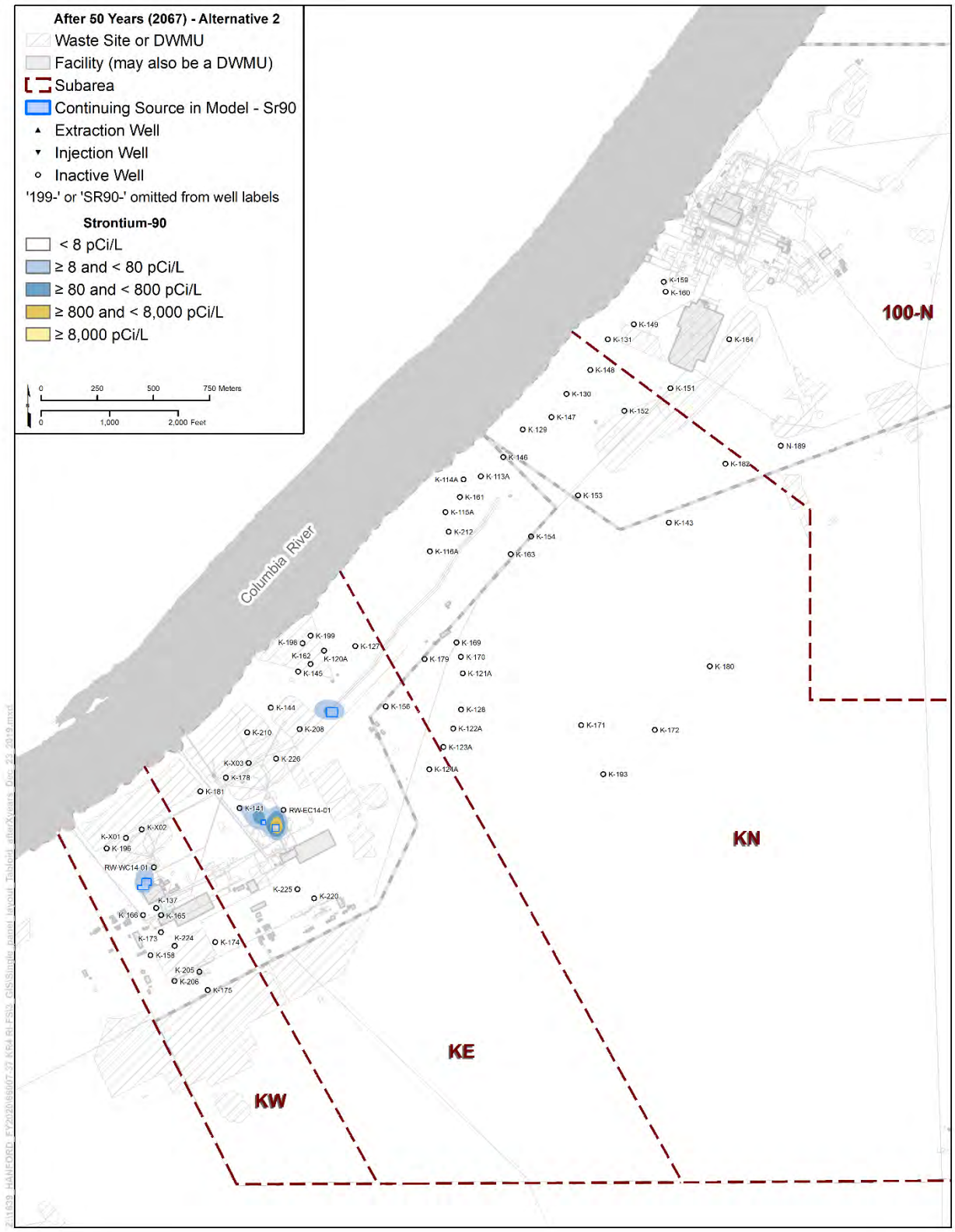


Figure 6-120. Strontium-90: Simulated Distribution after 50 Years (end of 2067) – Alternative 2

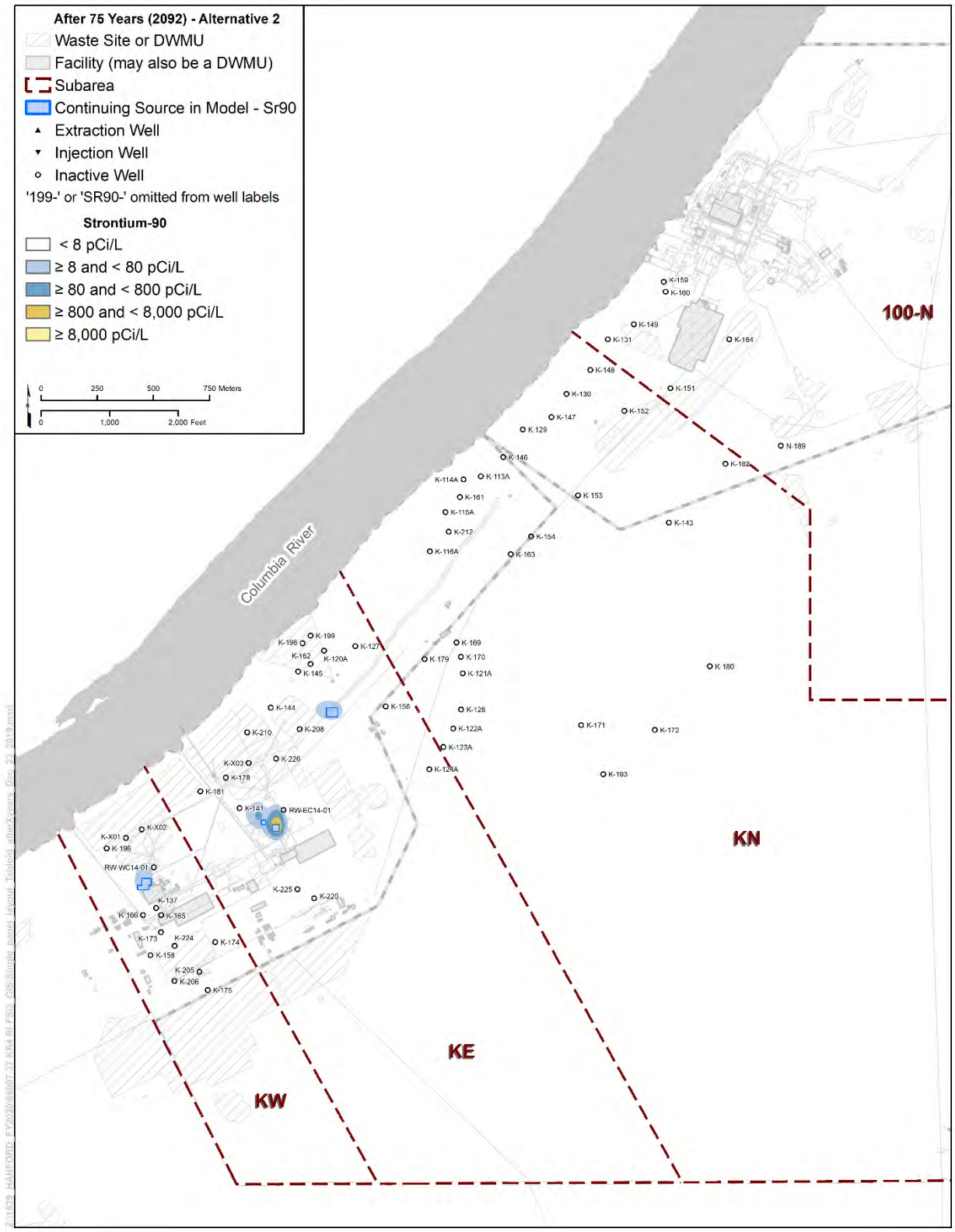


Figure 6-121. Strontium-90: Simulated Distribution after 75 Years (end of 2092) – Alternative 2

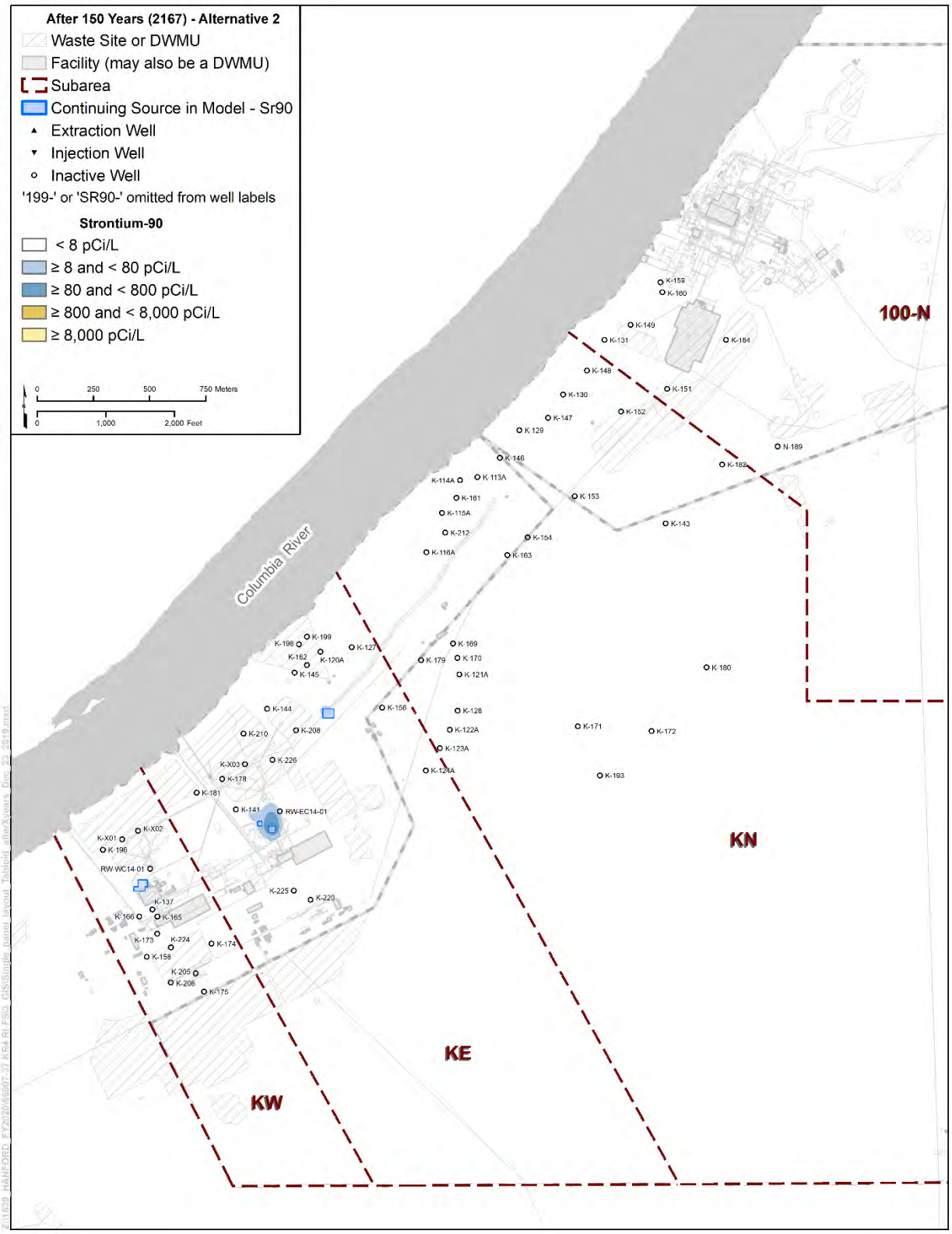


Figure 6-122. Strontium-90: Simulated Distribution after 150 Years (end of 2167) – Alternative 2

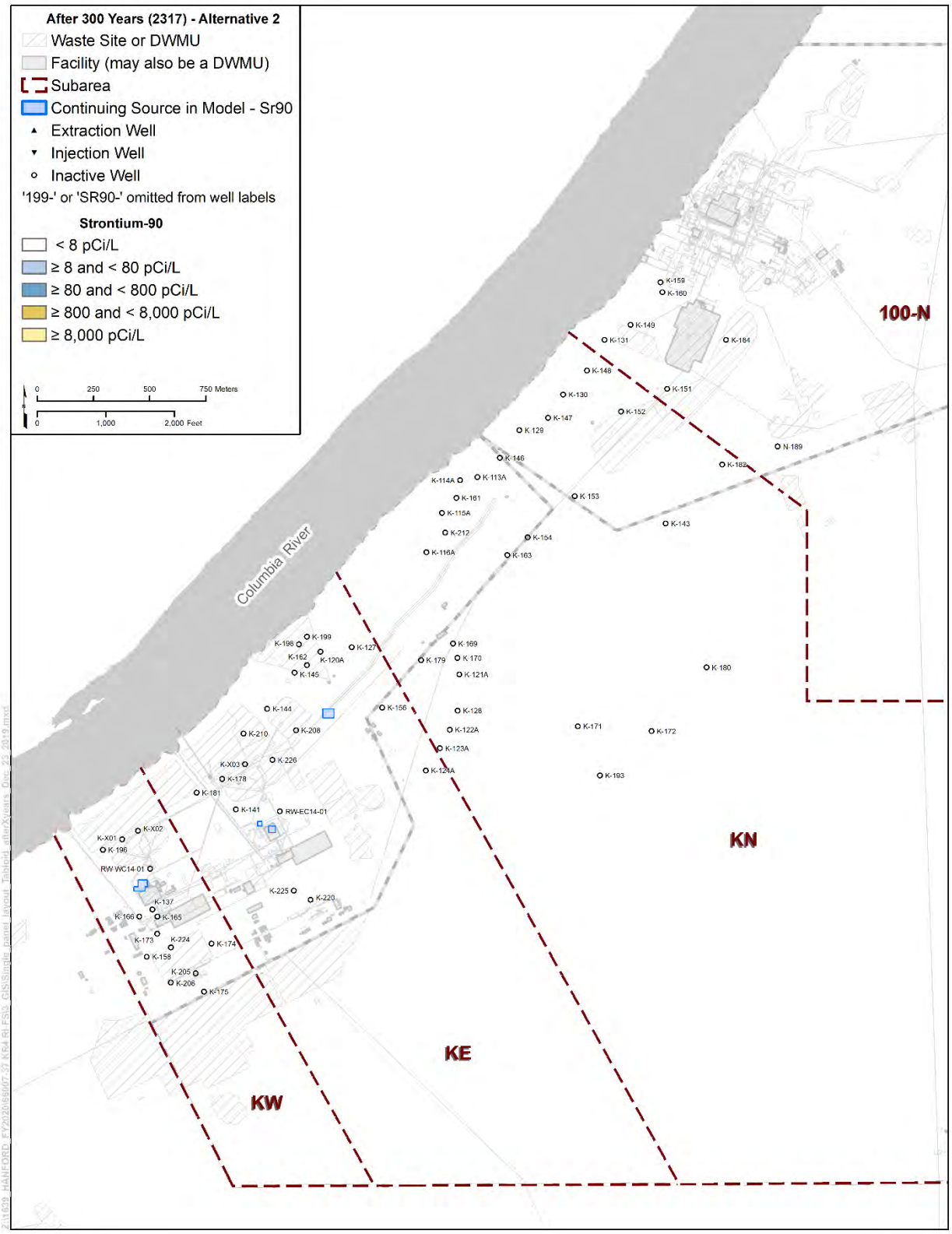


Figure 6-123. Strontium-90: Simulated Distribution after 300 Years (end of 2317) – Alternative 2

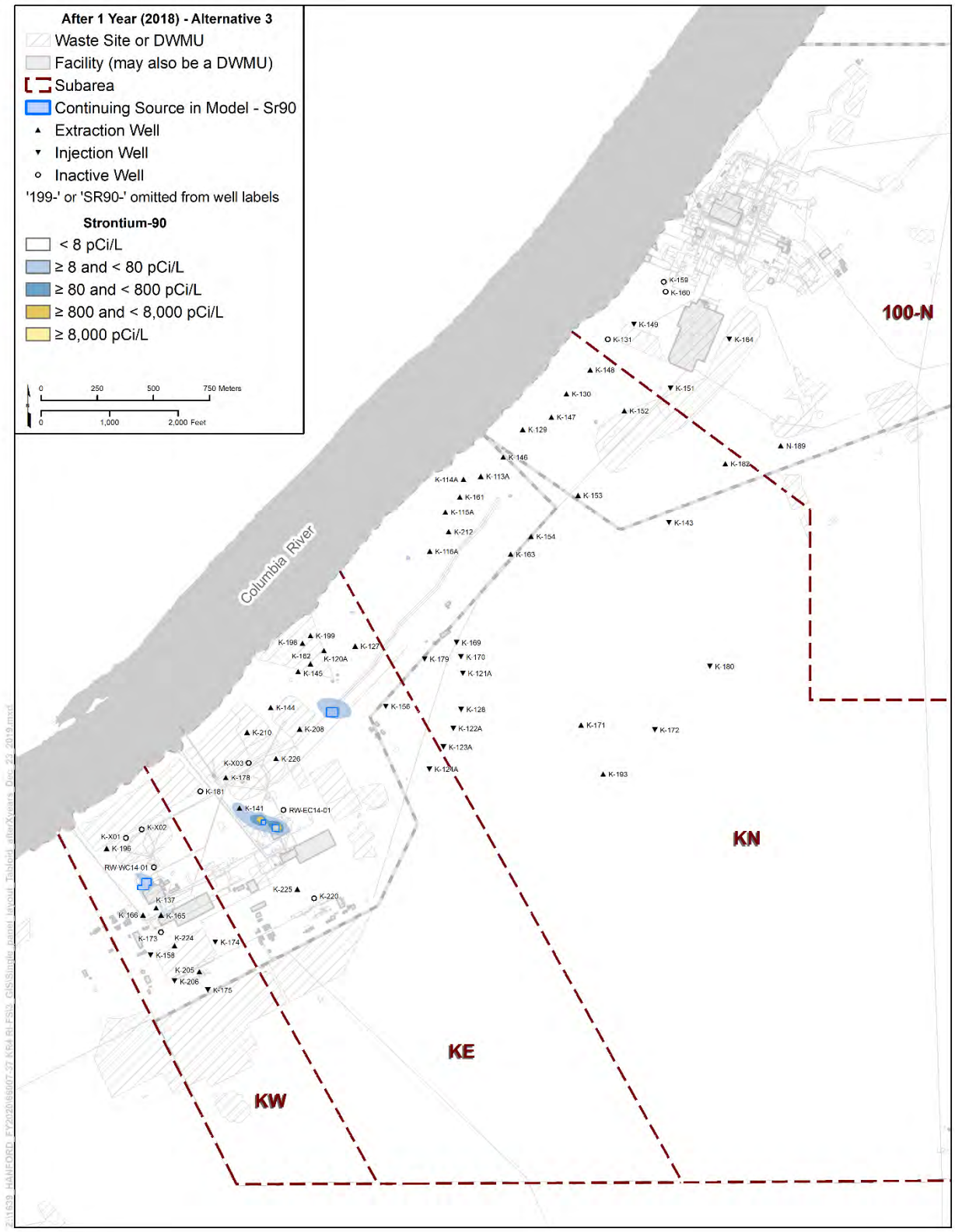


Figure 6-124. Strontium-90: Simulated Distribution after 1 Year (end of 2018) – Alternative 3

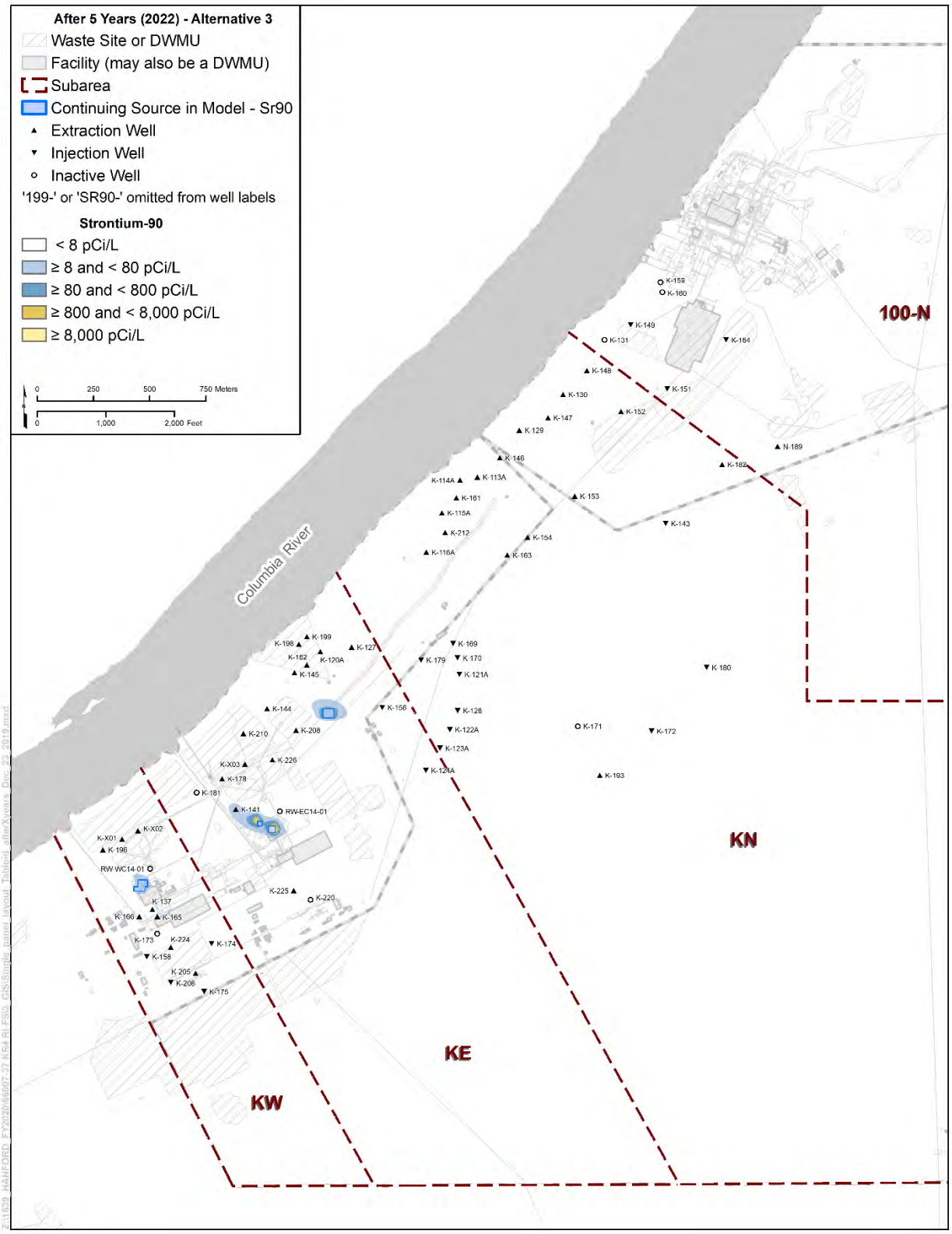


Figure 6-125. Strontium-90: Simulated Distribution after 5 Years (end of 2022) – Alternative 3

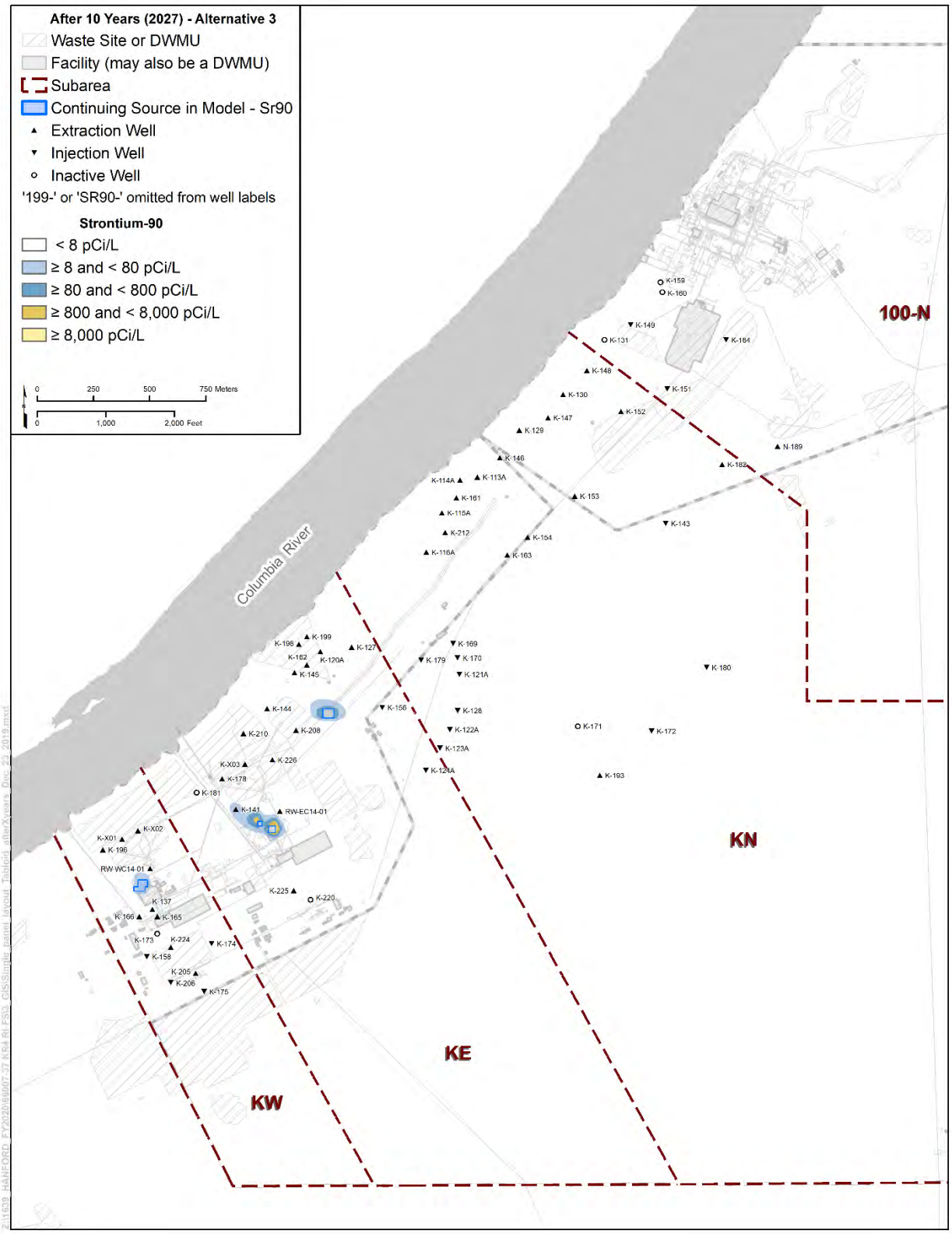


Figure 6-126. Strontium-90: Simulated Distribution after 10 Years (end of 2027) – Alternative 3

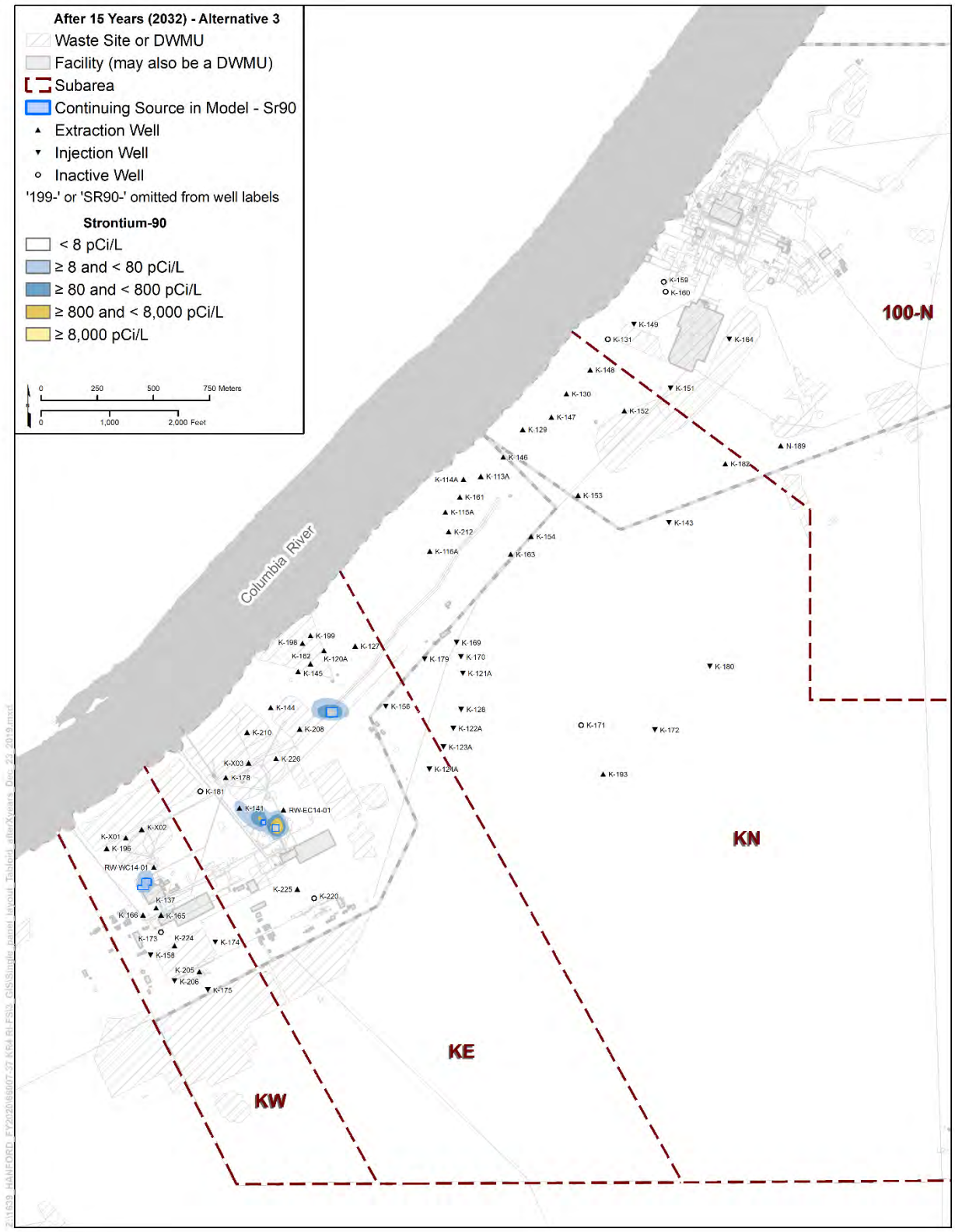


Figure 6-127. Strontium-90: Simulated Distribution after 15 Years (end of 2032) – Alternative 3

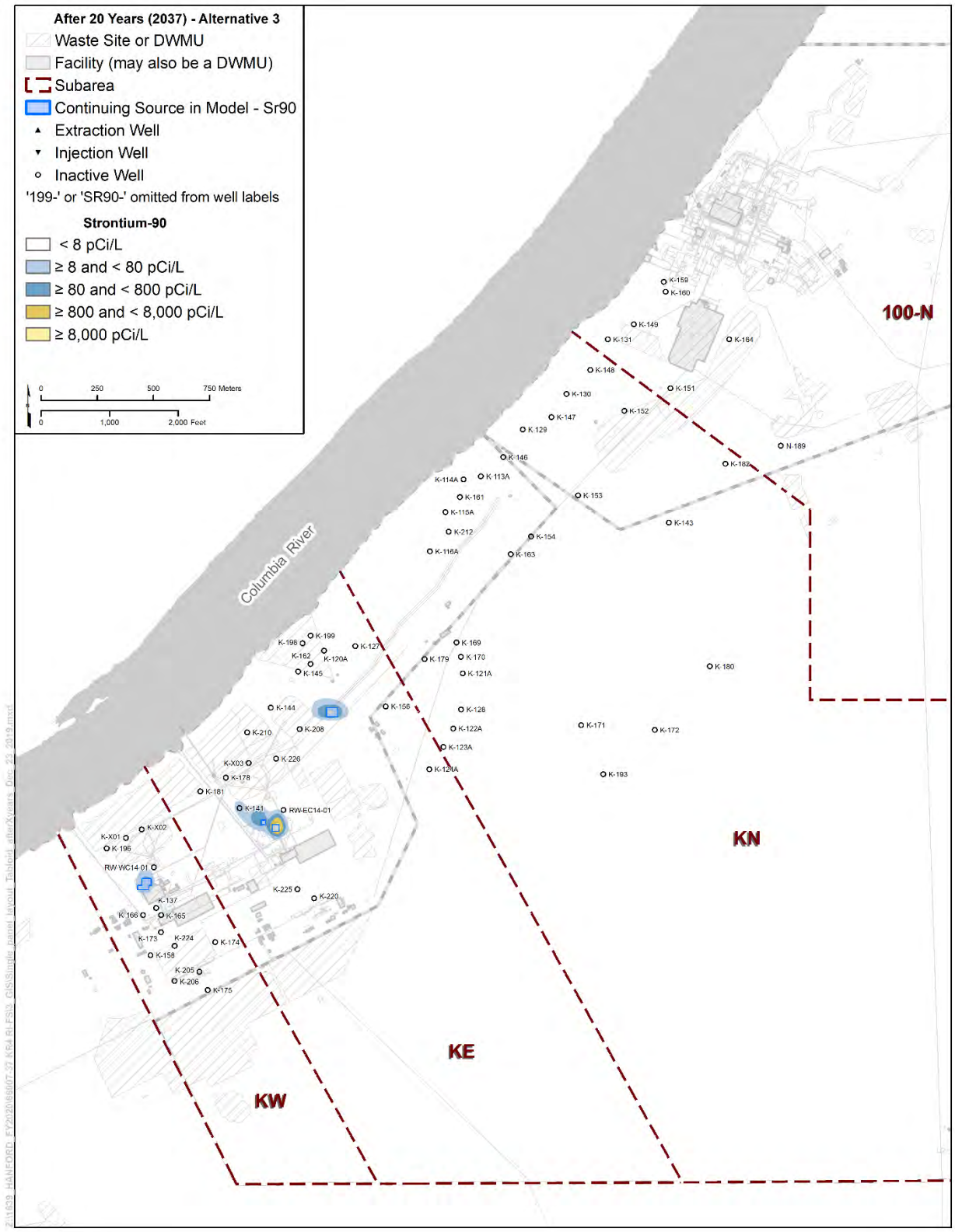


Figure 6-128. Strontium-90: Simulated Distribution after 20 Years (end of 2037) – Alternative 3

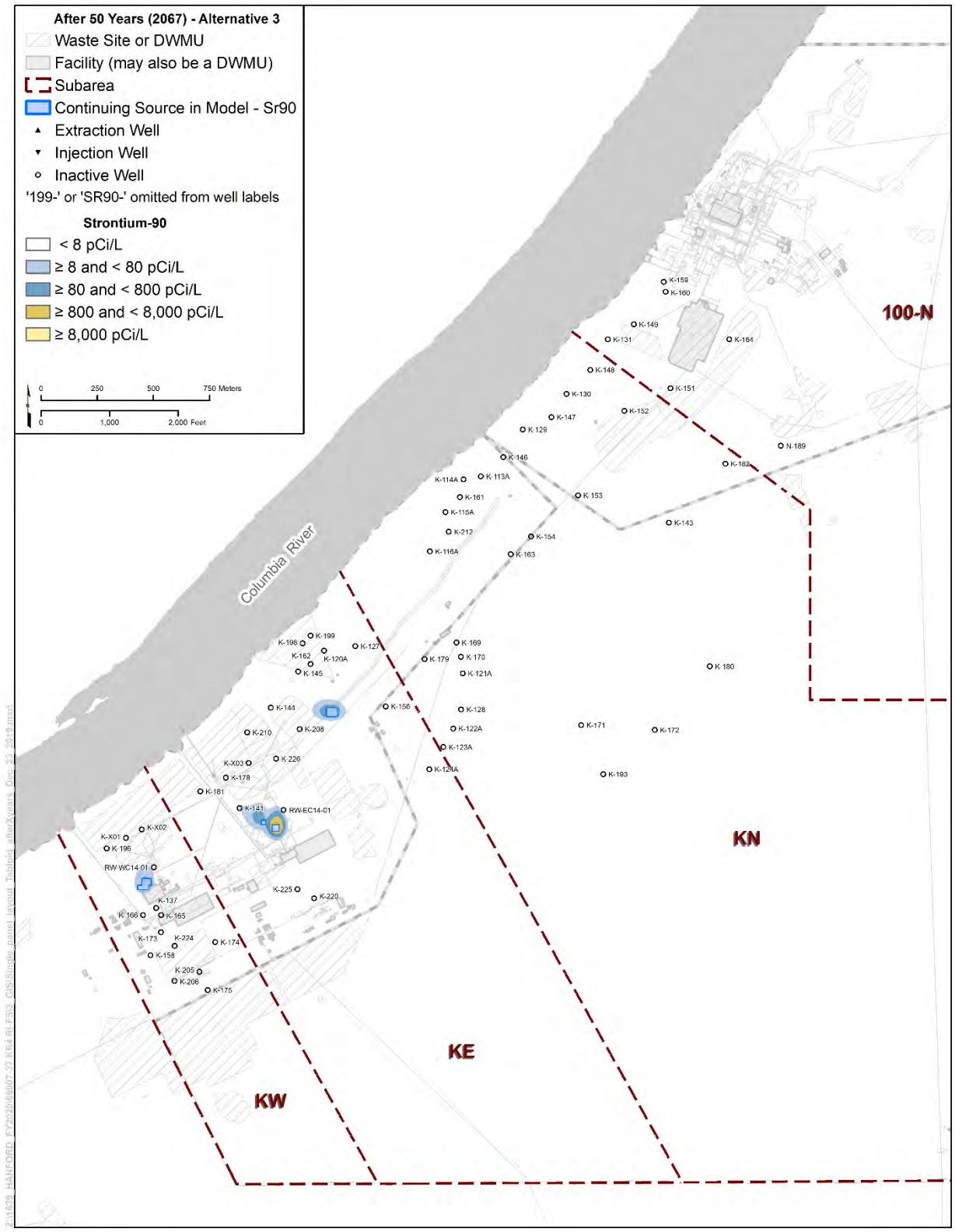


Figure 6-129. Strontium-90: Simulated Distribution after 50 Years (end of 2067) – Alternative 3

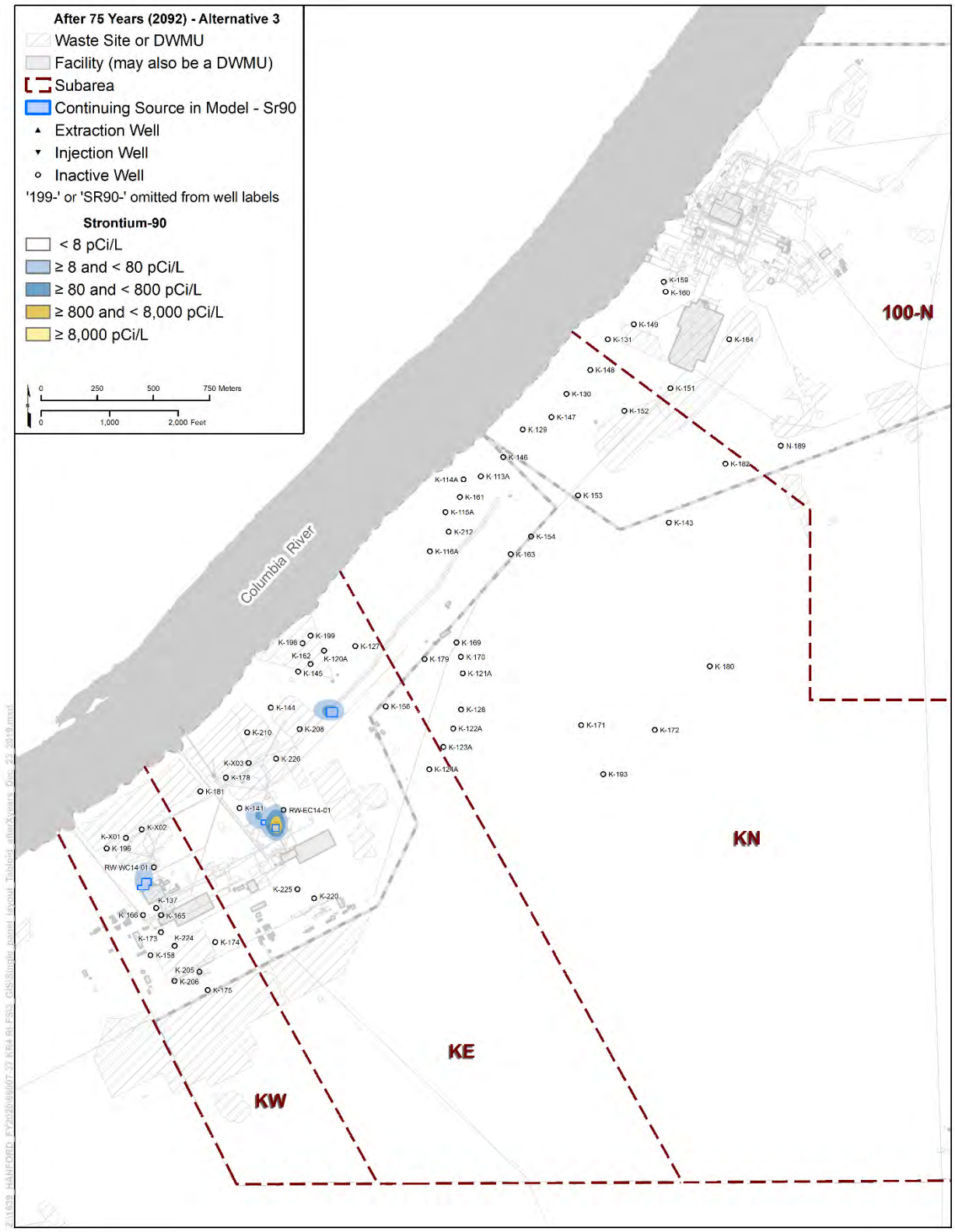


Figure 6-130. Strontium-90: Simulated Distribution after 75 Years (end of 2092) – Alternative 3

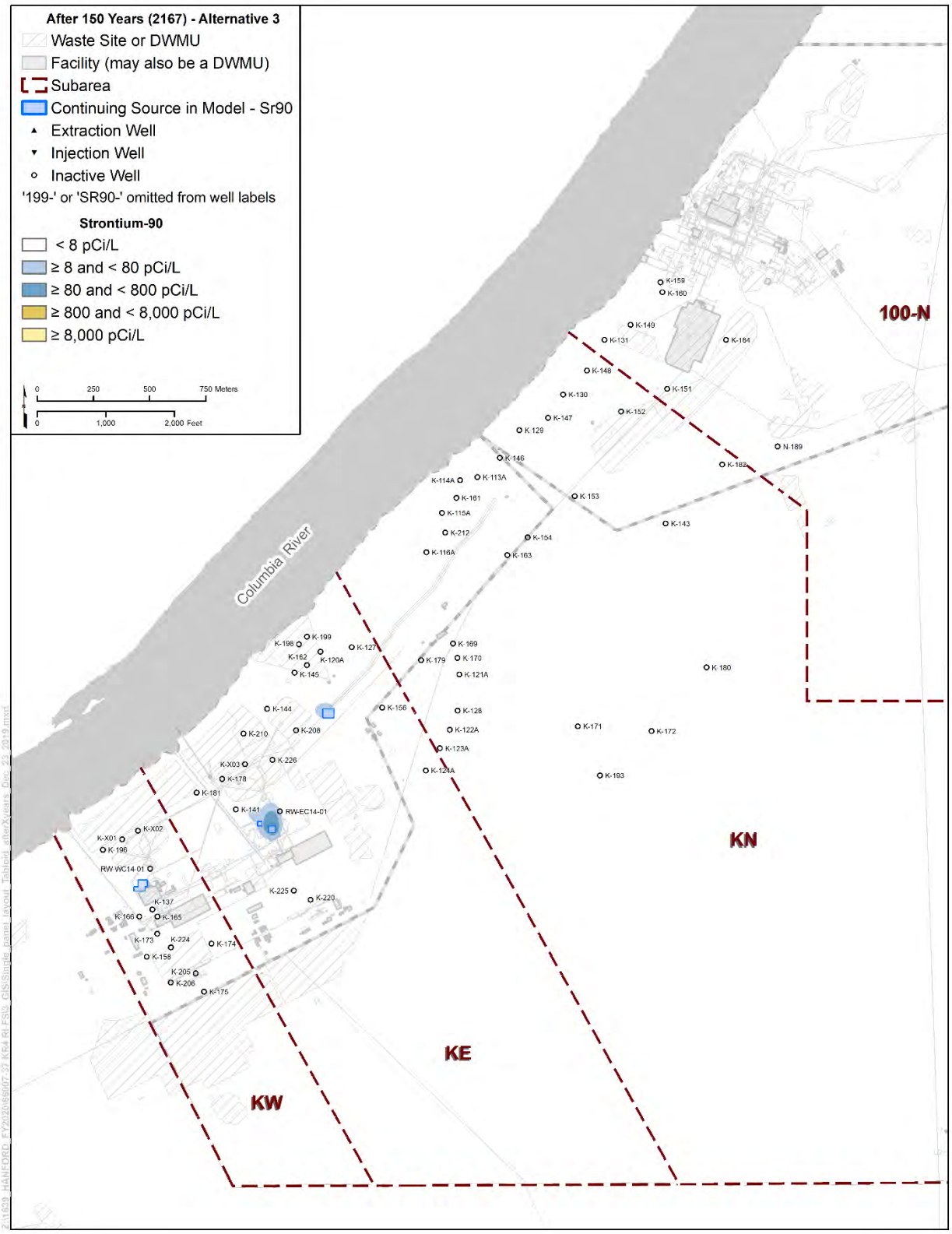


Figure 6-131. Strontium-90: Simulated Distribution after 150 Years (end of 2167) – Alternative 3

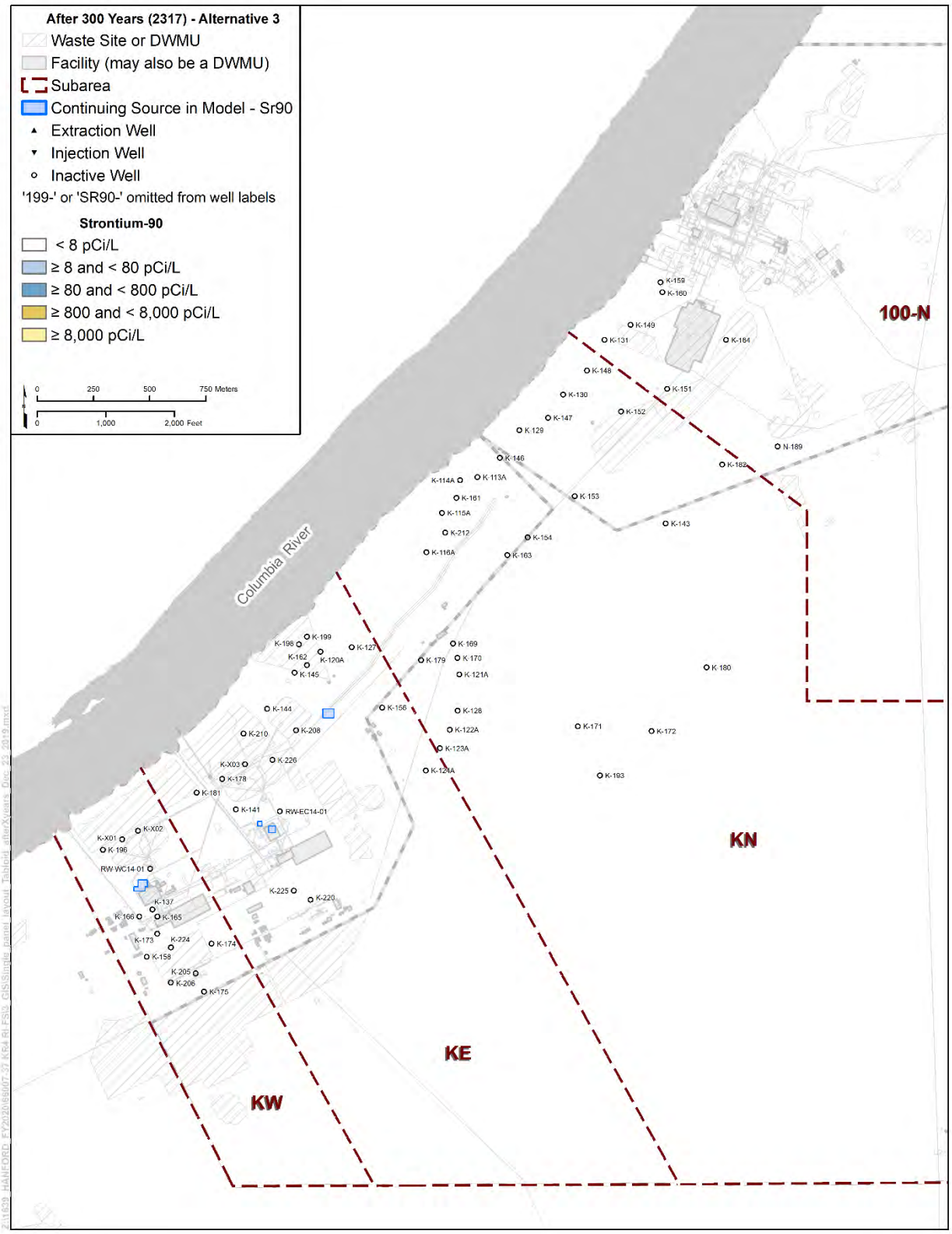


Figure 6-132. Strontium-90: Simulated Distribution after 300 Years (end of 2317) – Alternative 3

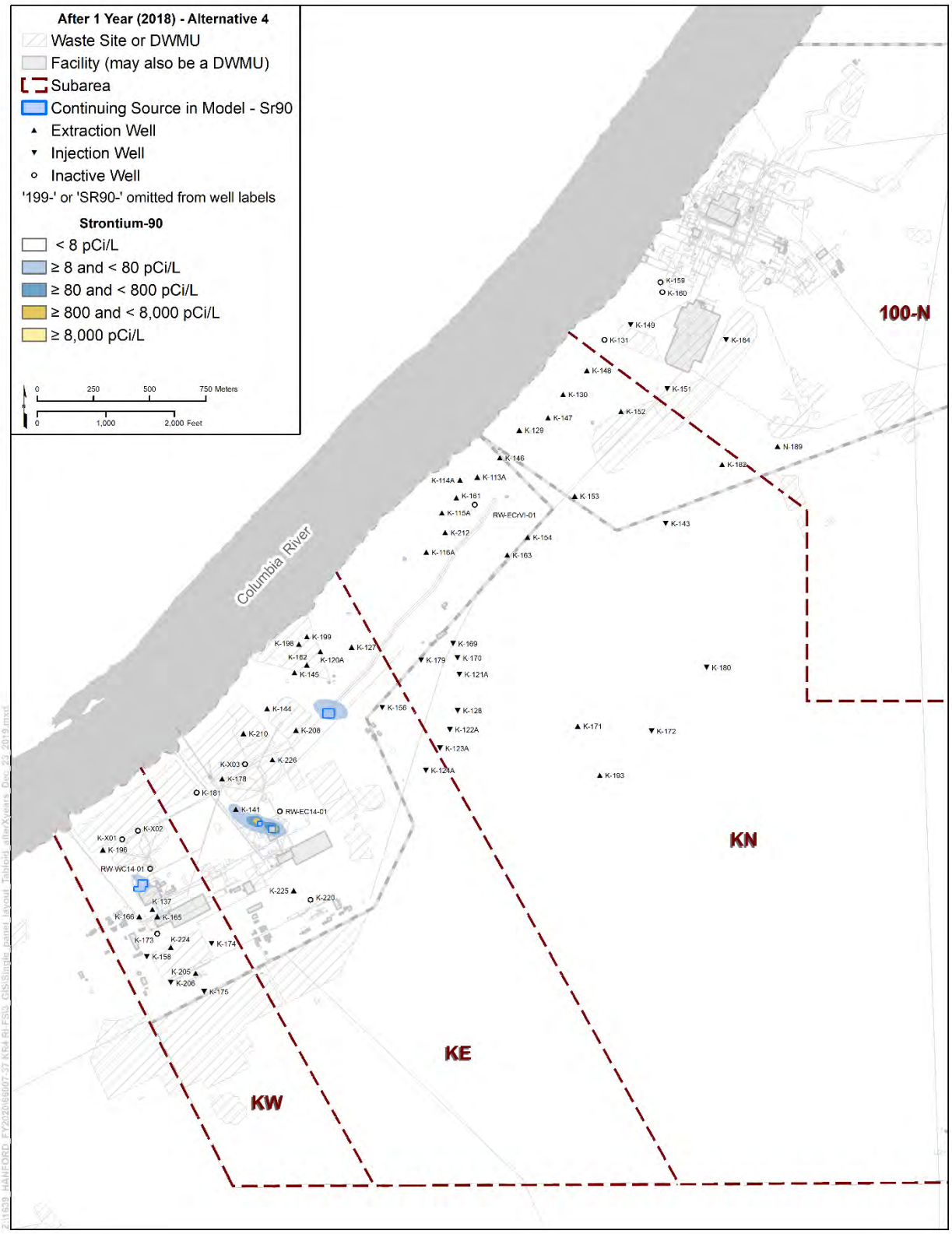


Figure 6-133. Strontium-90: Simulated Distribution after 1 Year (end of 2018) – Alternative 4

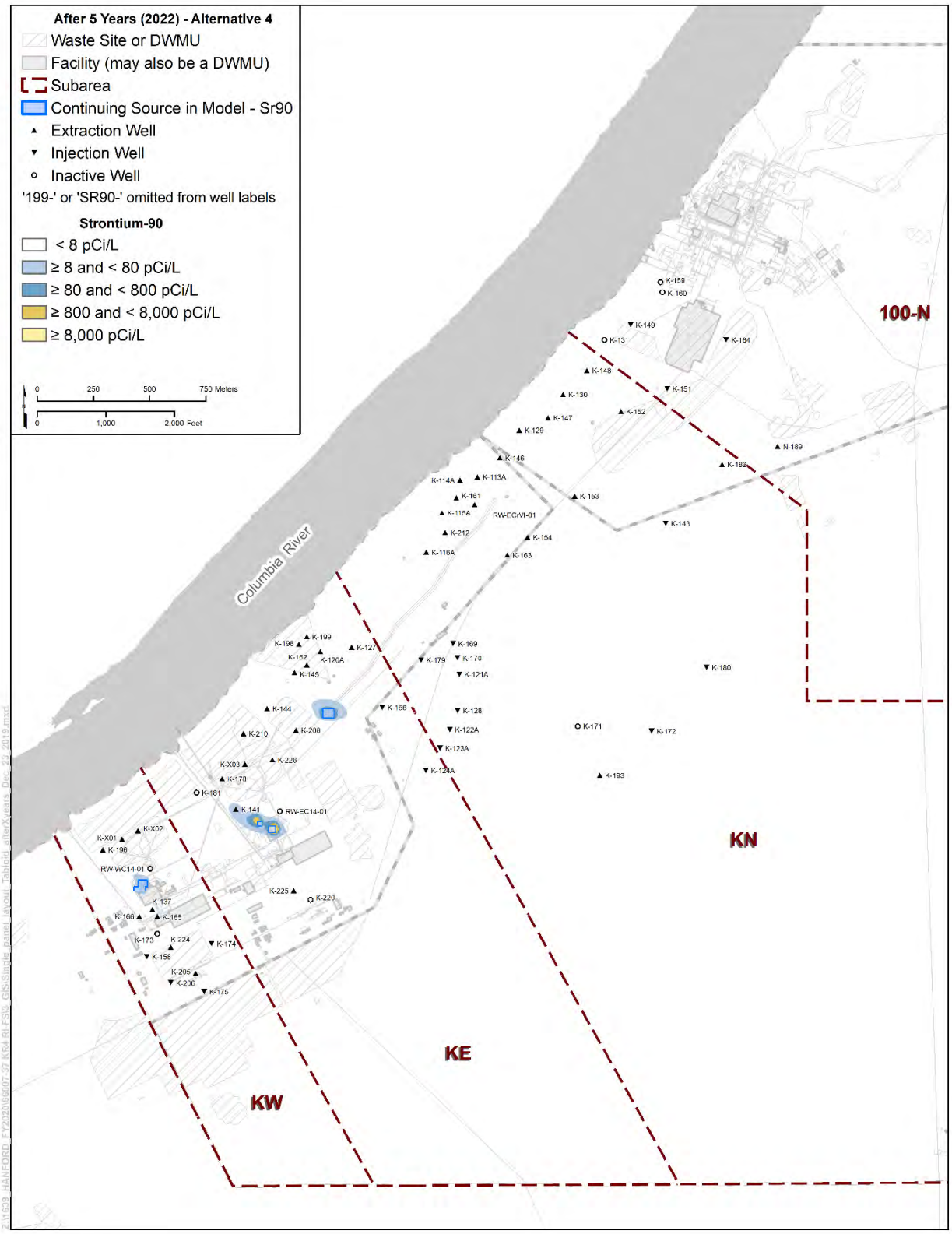


Figure 6-134. Strontium-90: Simulated Distribution after 5 Years (end of 2022) – Alternative 4

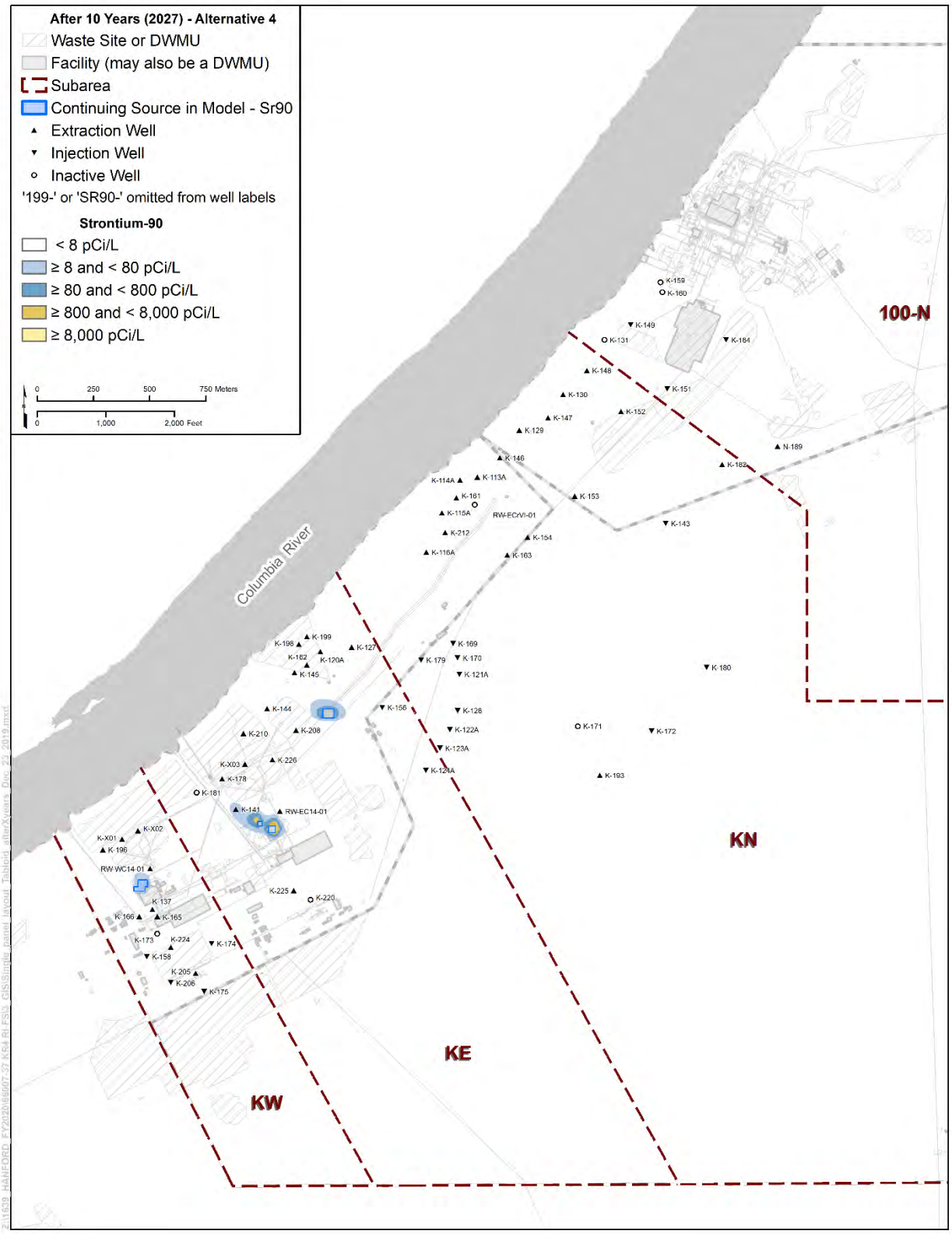


Figure 6-135. Strontium-90: Simulated Distribution after 10 Years (end of 2027) – Alternative 4

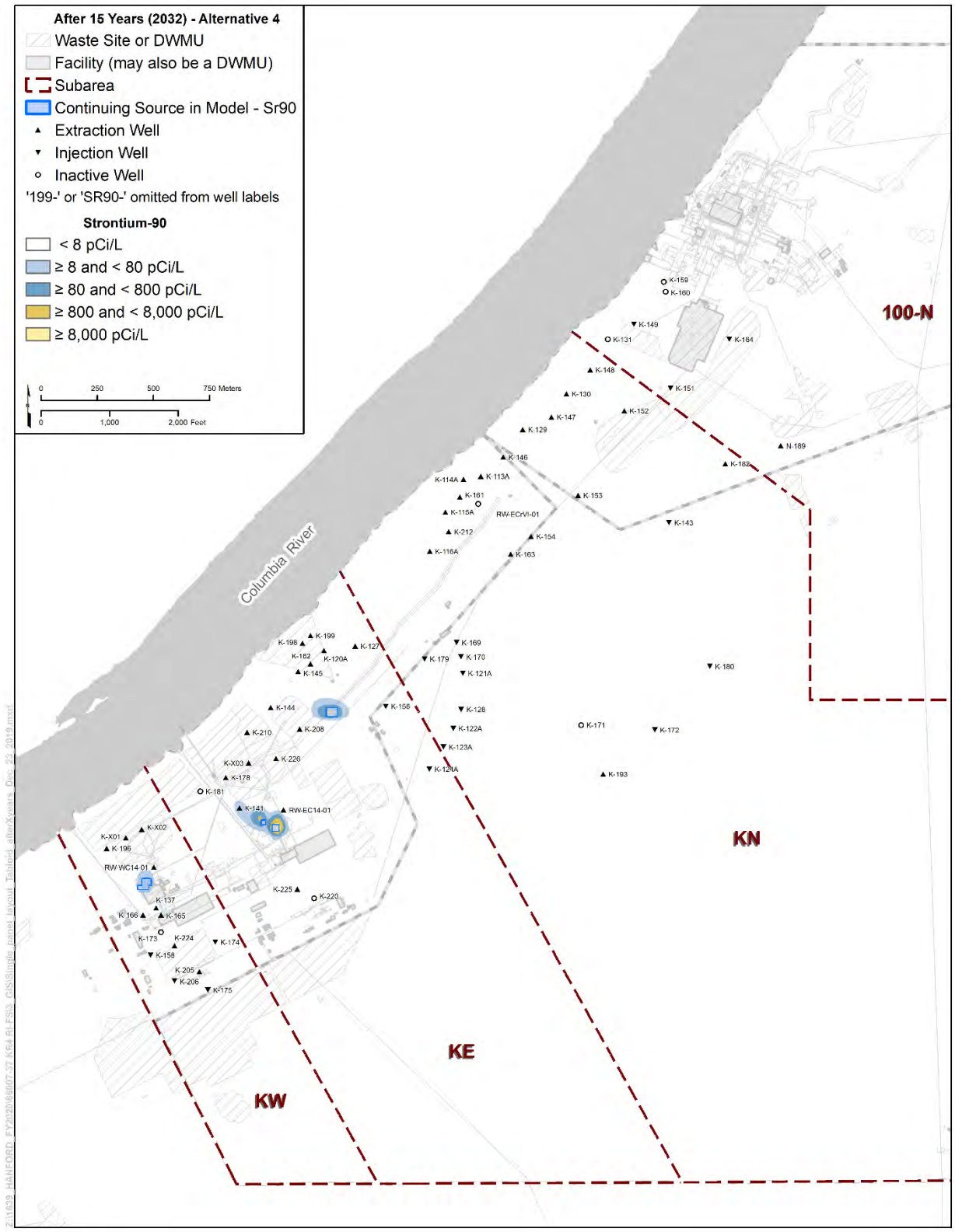


Figure 6-136. Strontium-90: Simulated Distribution after 15 Years (end of 2032) – Alternative 4

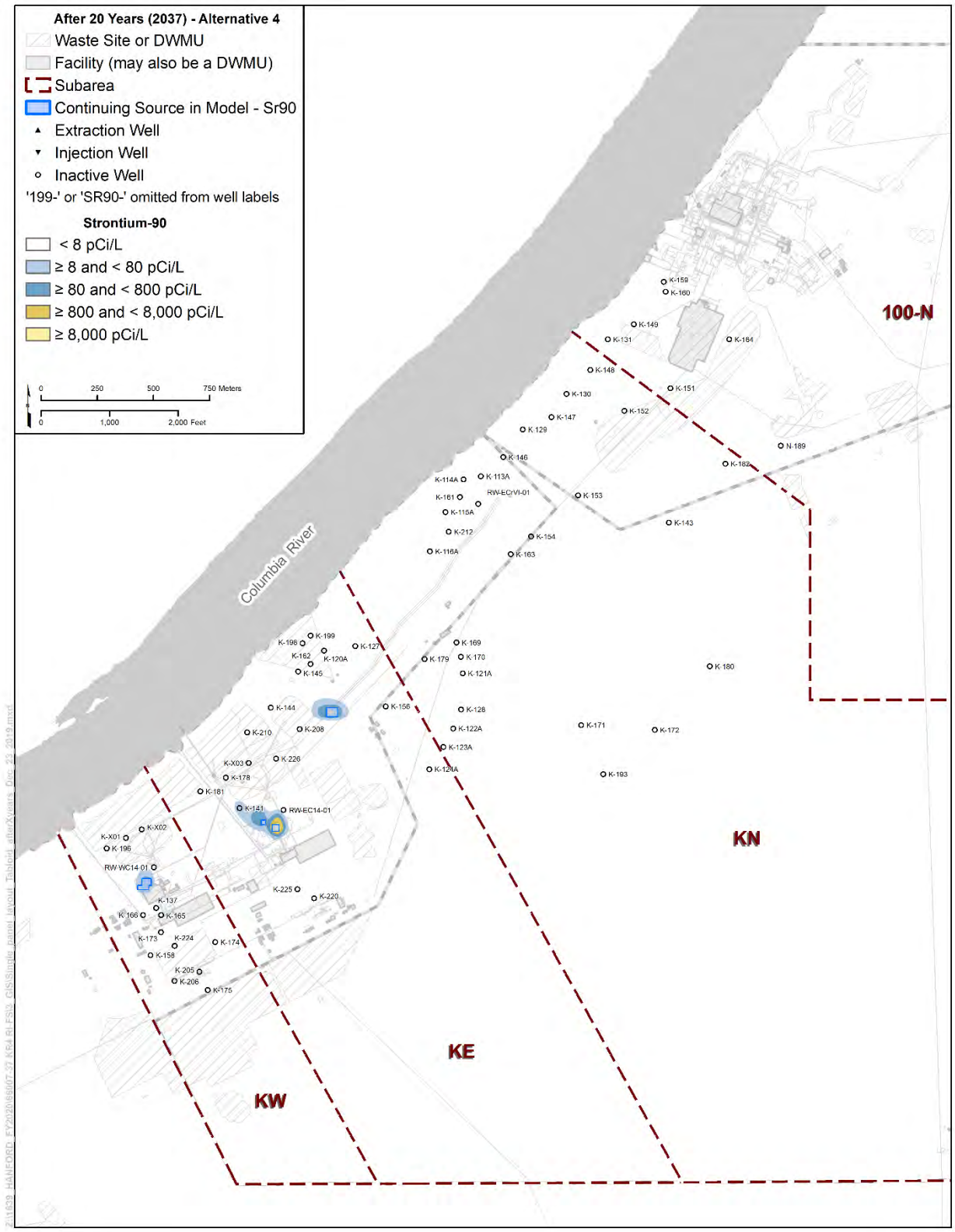


Figure 6-137. Strontium-90: Simulated Distribution after 20 Years (end of 2037) – Alternative 4

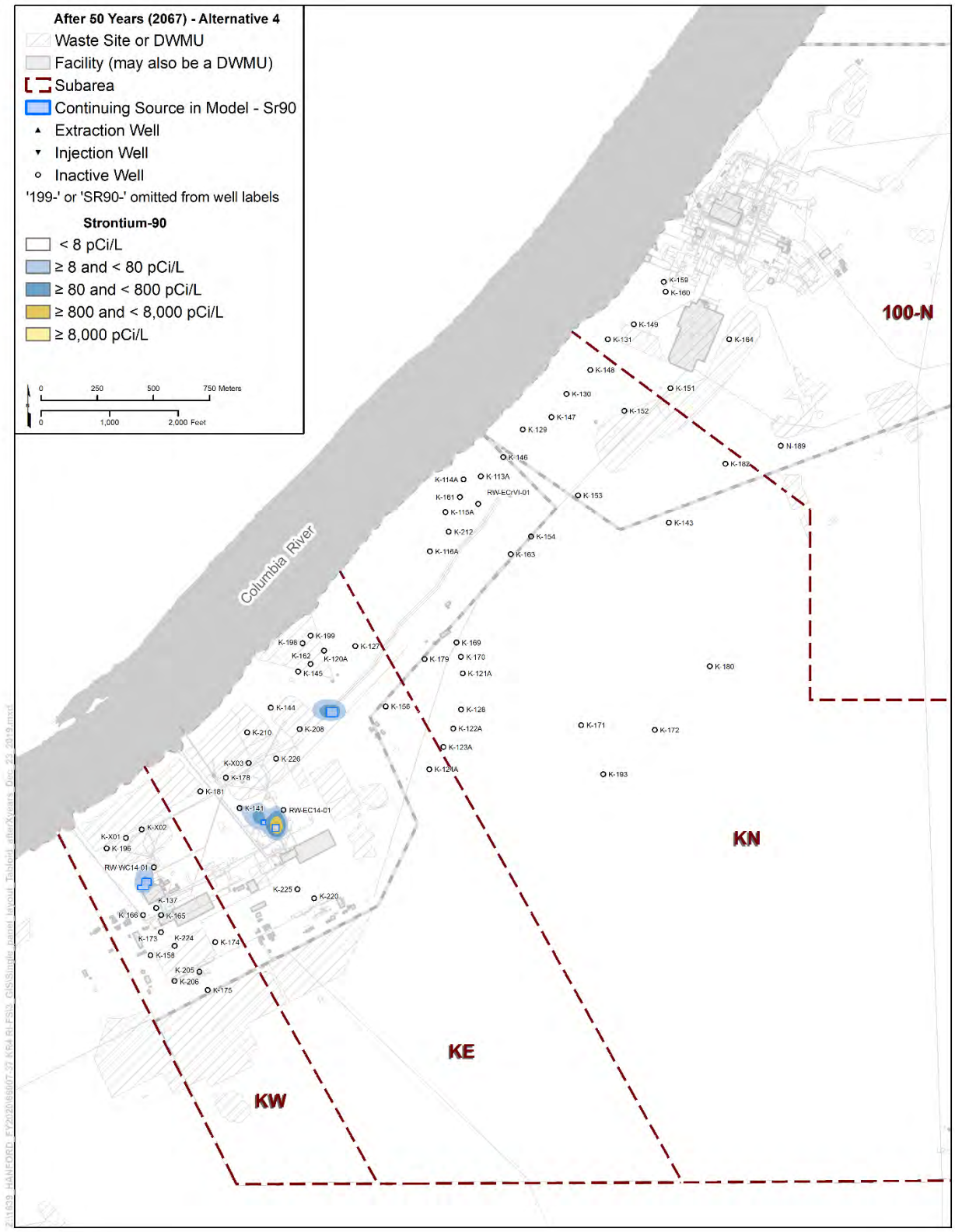


Figure 6-138. Strontium-90: Simulated Distribution after 50 Years (end of 2067) – Alternative 4

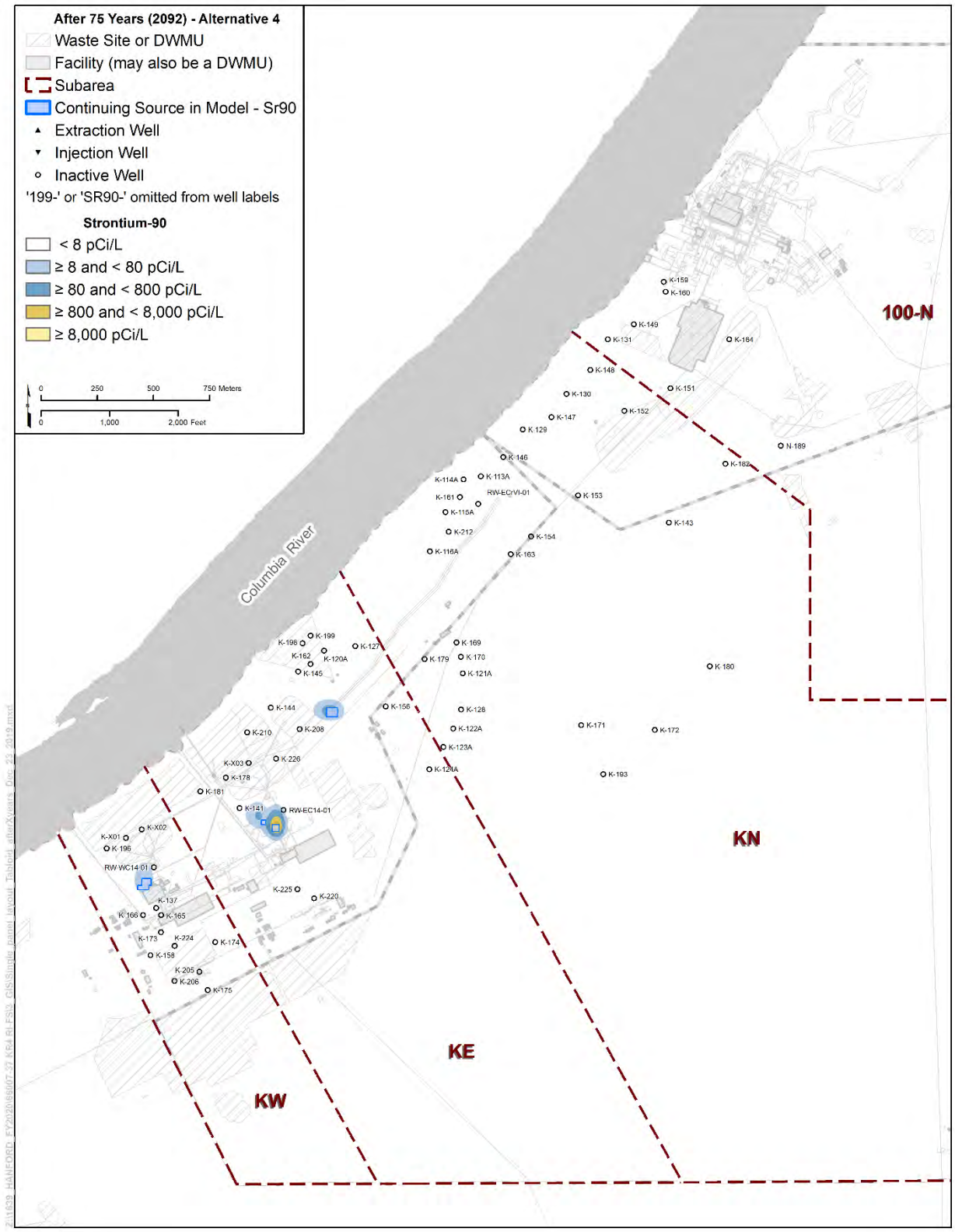


Figure 6-139. Strontium-90: Simulated Distribution after 75 Years (end of 2092) – Alternative 4

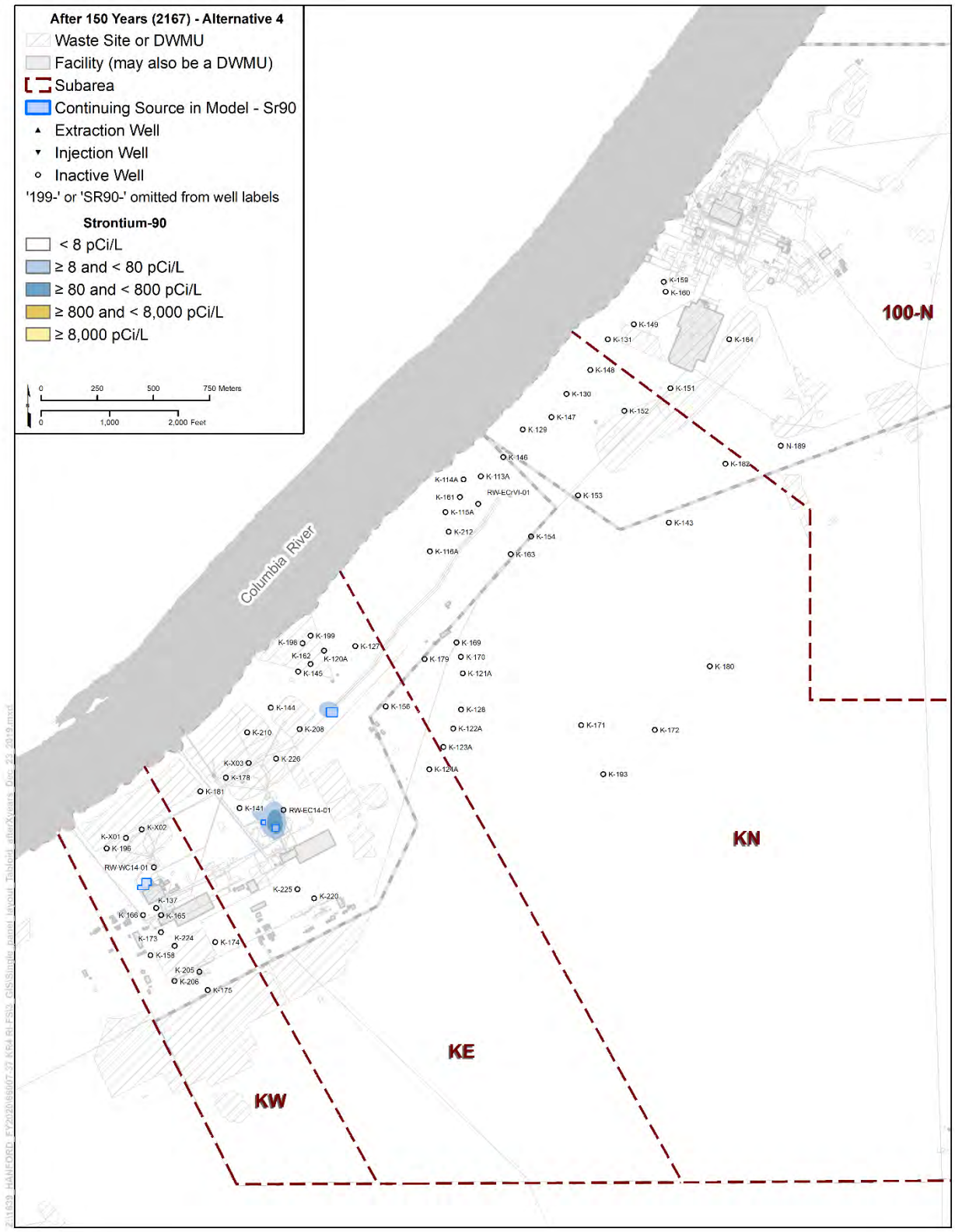


Figure 6-140. Strontium-90: Simulated Distribution after 150 Years (end of 2167) – Alternative 4

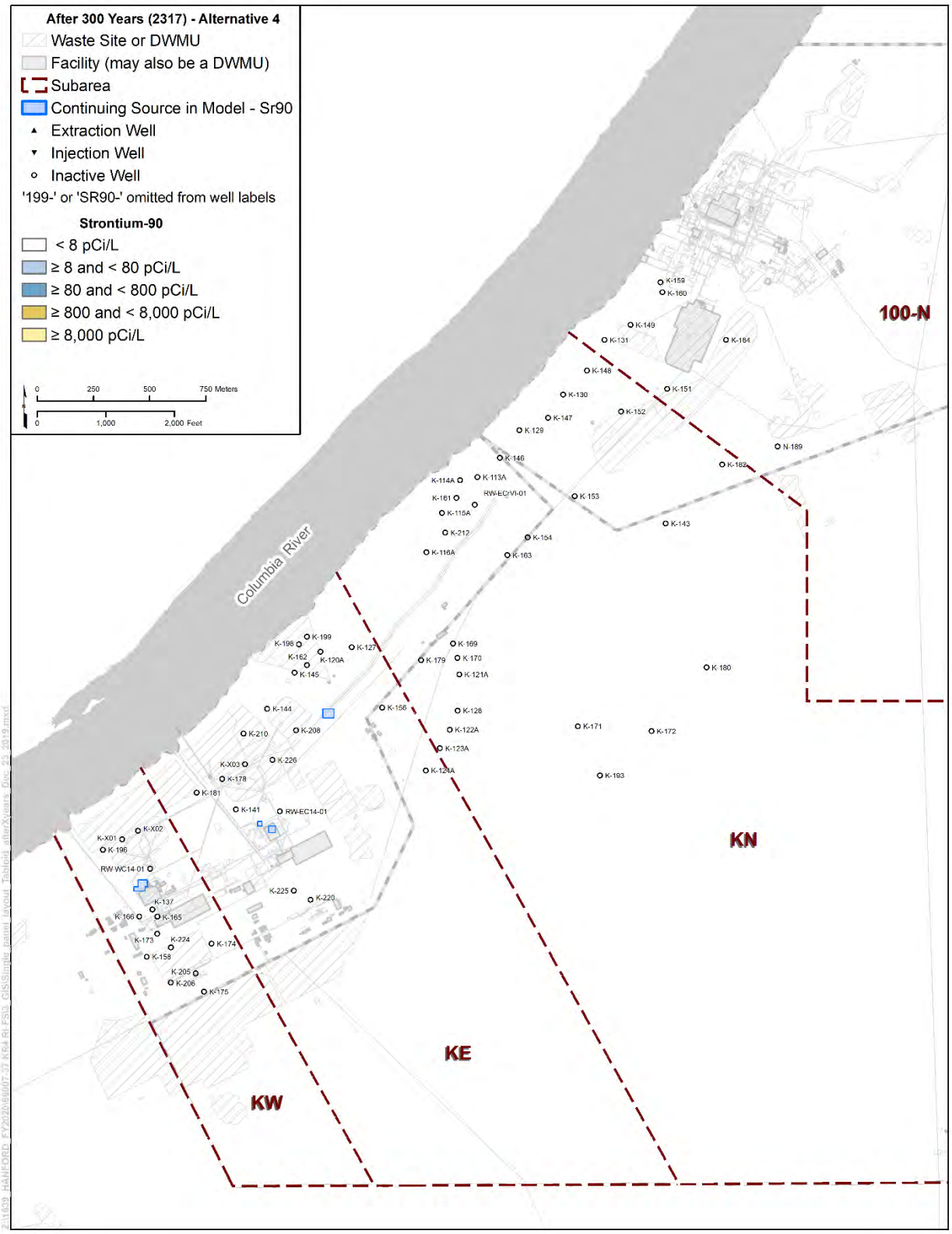


Figure 6-141. Strontium-90: Simulated Distribution after 300 Years (end of 2317) – Alternative 4

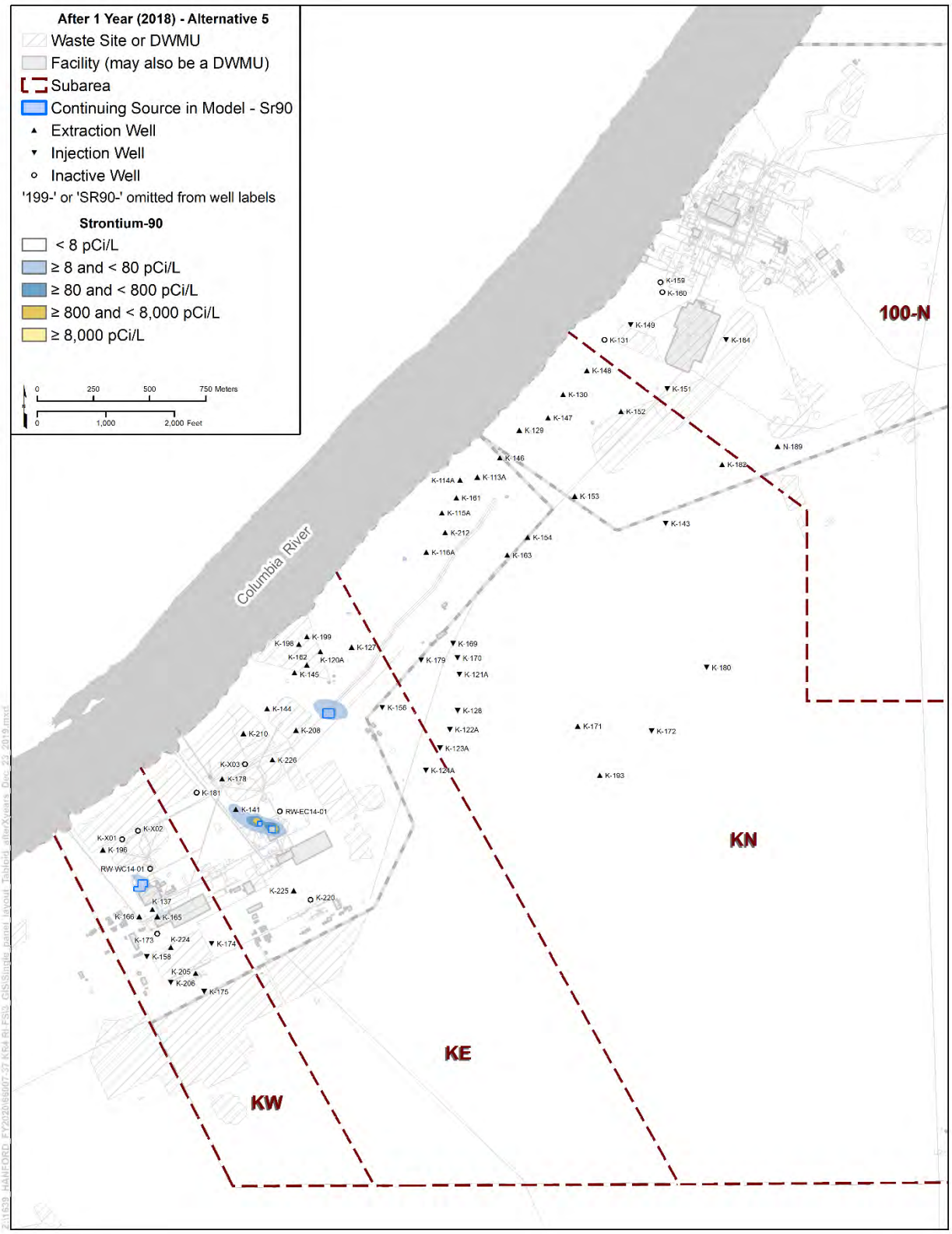


Figure 6-142. Strontium-90: Simulated Distribution after 1 Year (end of 2018) – Alternative 5

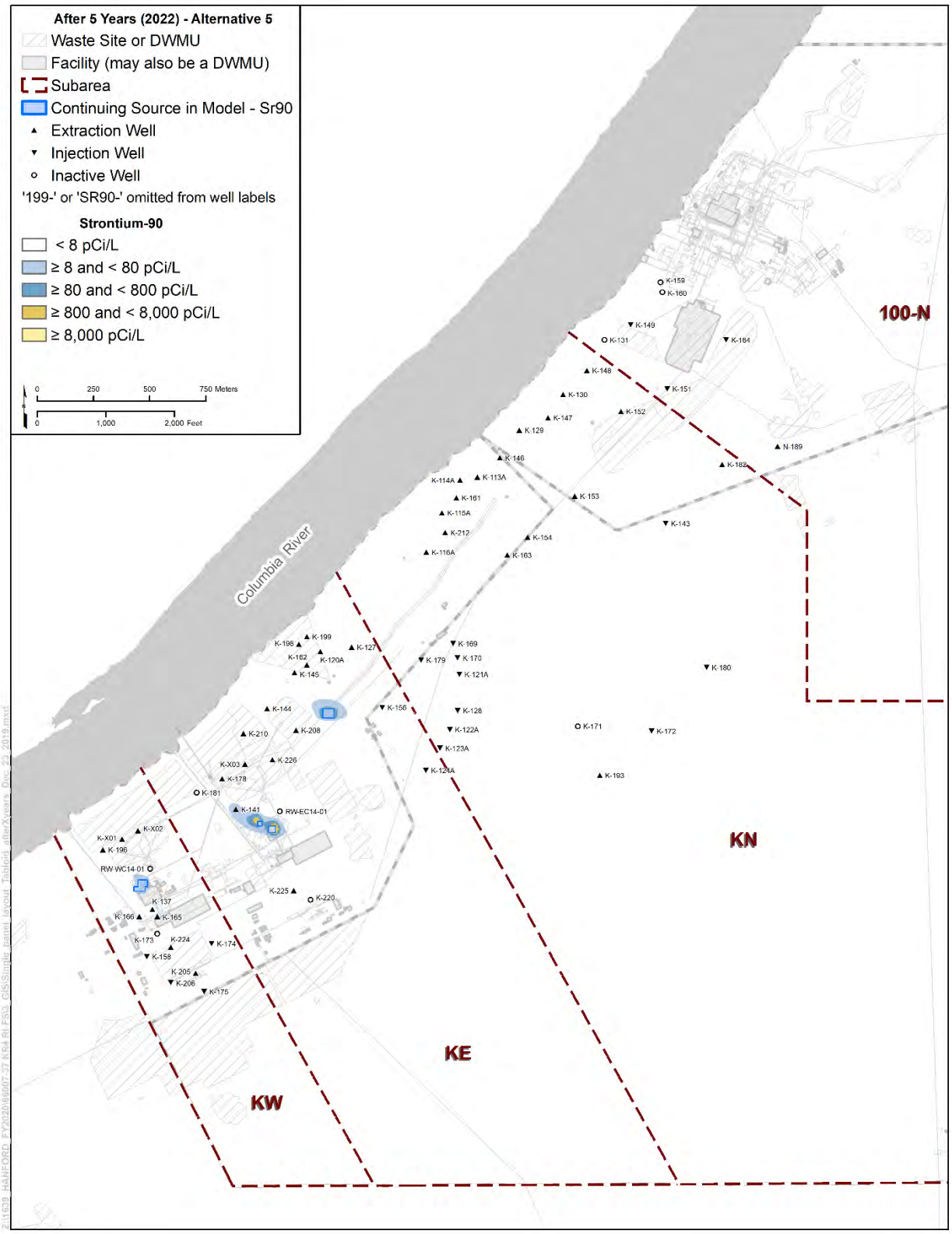


Figure 6-143. Strontium-90: Simulated Distribution after 5 Years (end of 2022) – Alternative 5

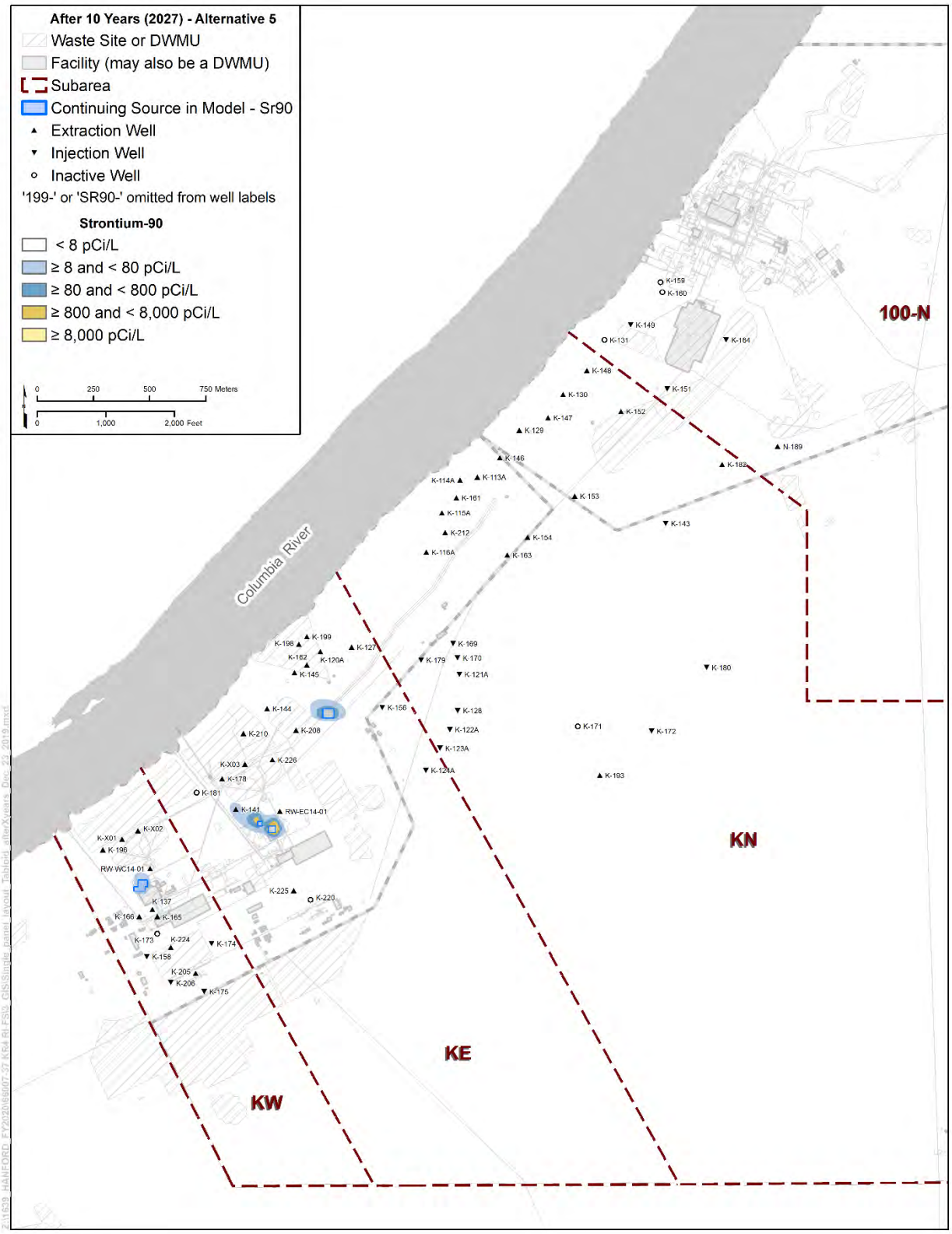


Figure 6-144. Strontium-90: Simulated Distribution after 10 Years (end of 2027) – Alternative 5

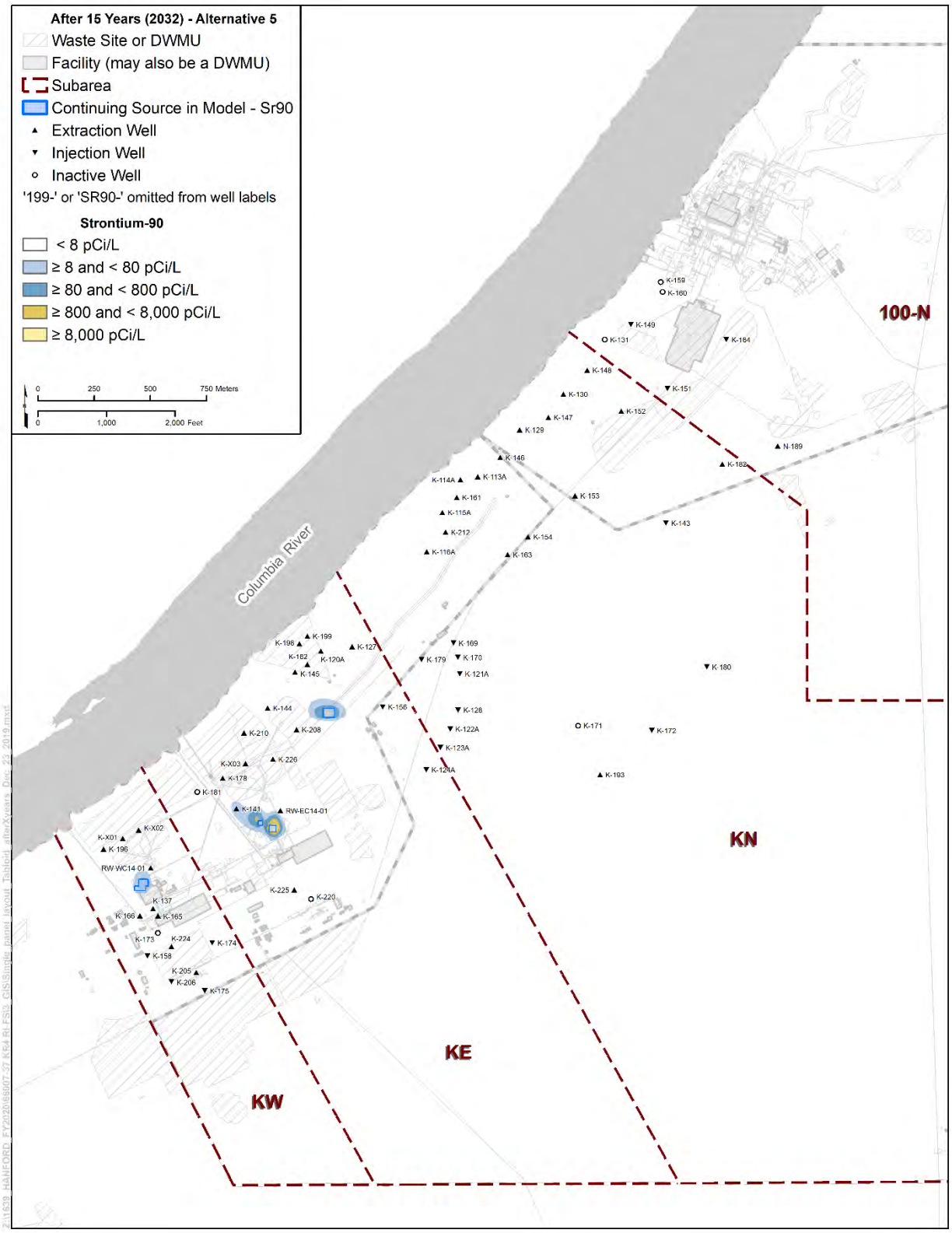


Figure 6-145. Strontium-90: Simulated Distribution after 15 Years (end of 2032) – Alternative 5

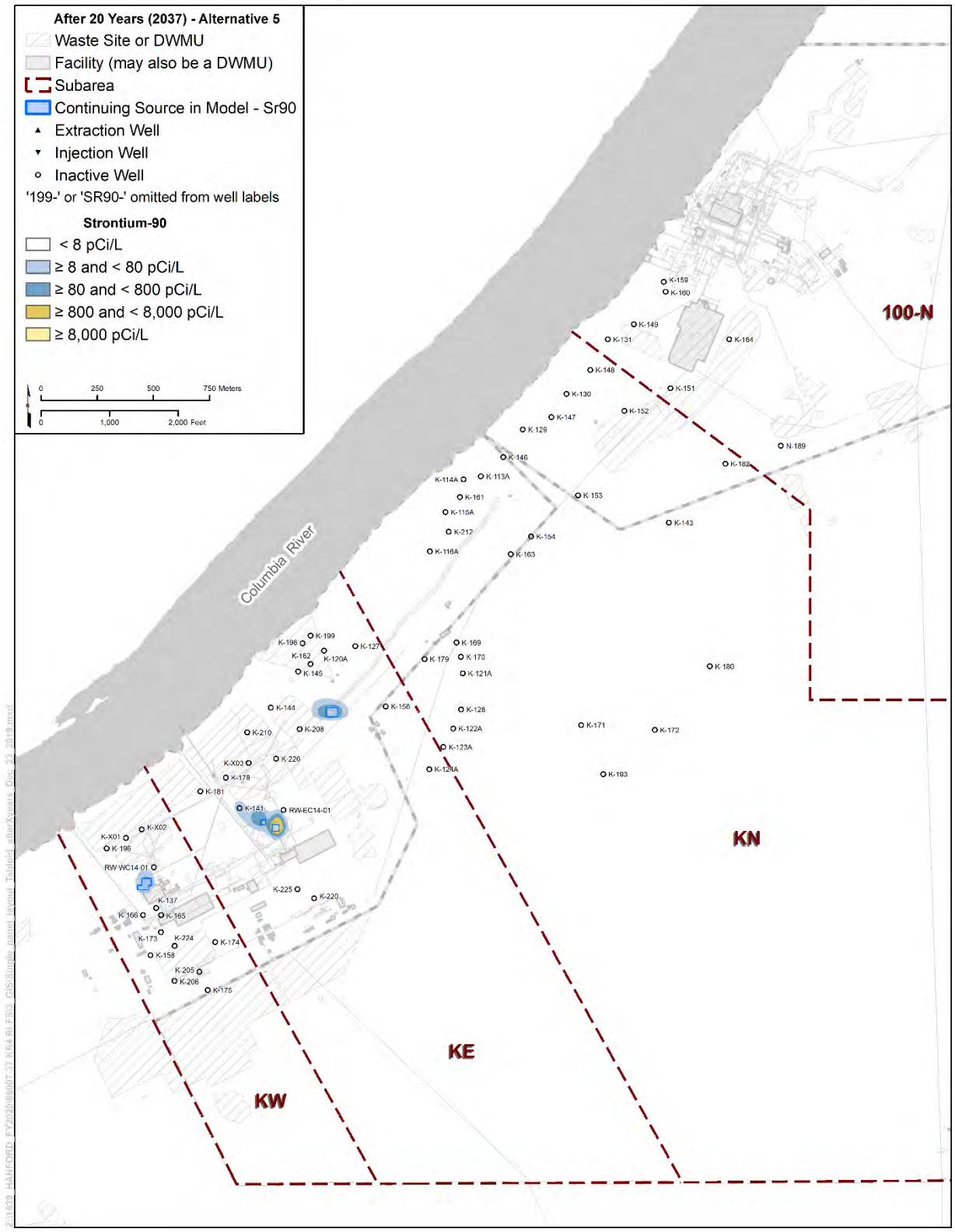


Figure 6-146. Strontium-90: Simulated Distribution after 20 Years (end of 2037) – Alternative 5

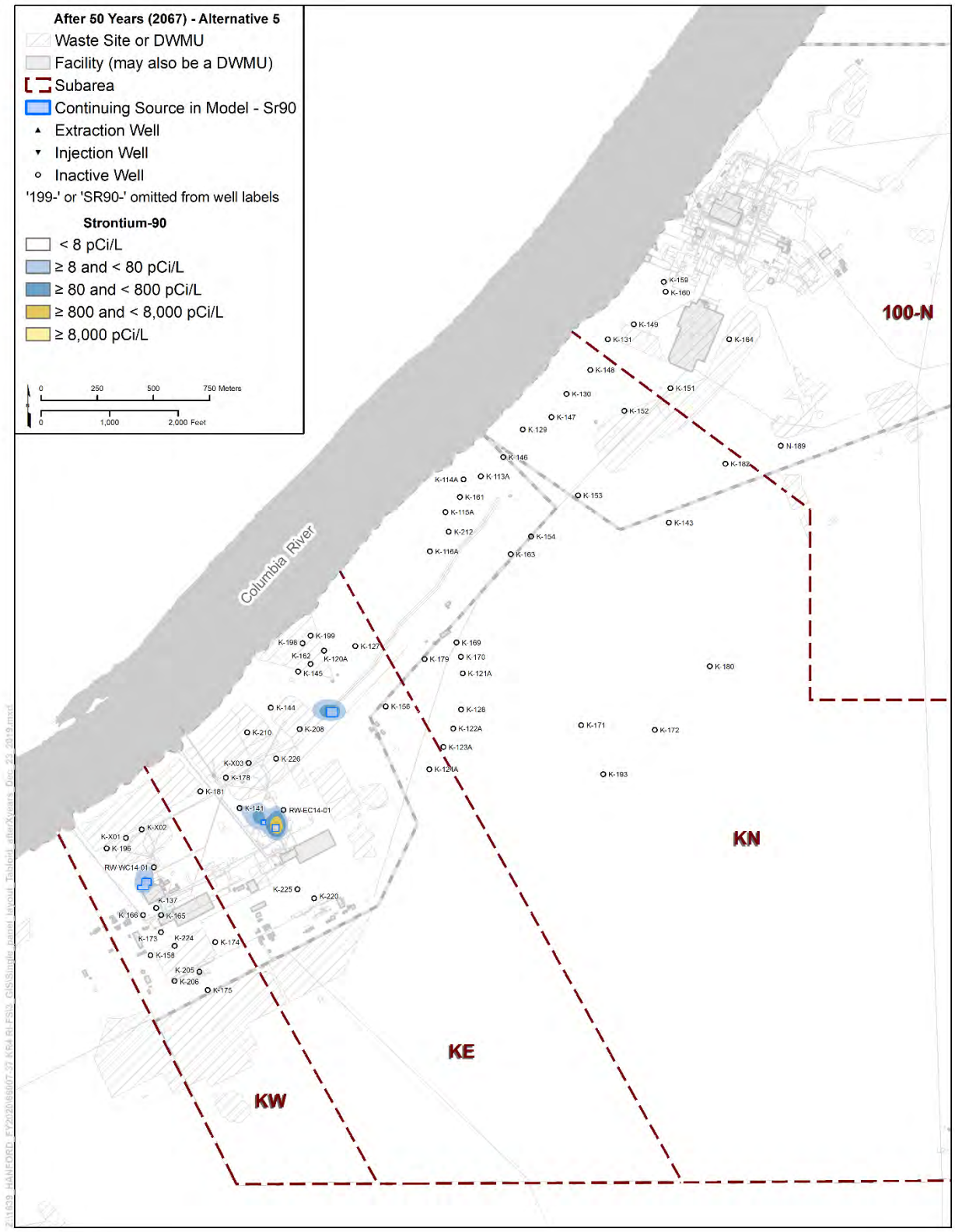


Figure 6-147. Strontium-90: Simulated Distribution after 50 Years (end of 2067) – Alternative 5

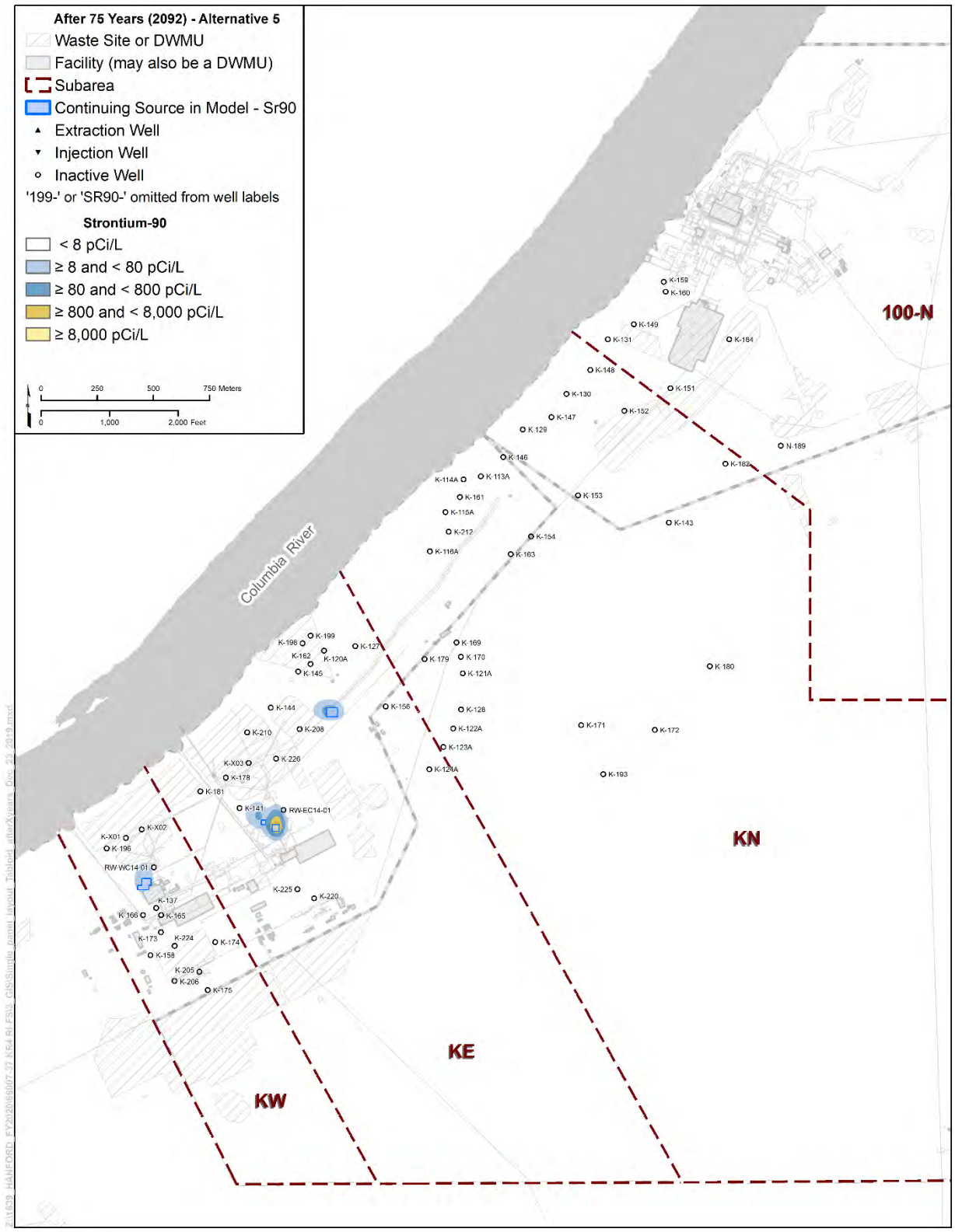


Figure 6-148. Strontium-90: Simulated Distribution after 75 Years (end of 2092) – Alternative 5

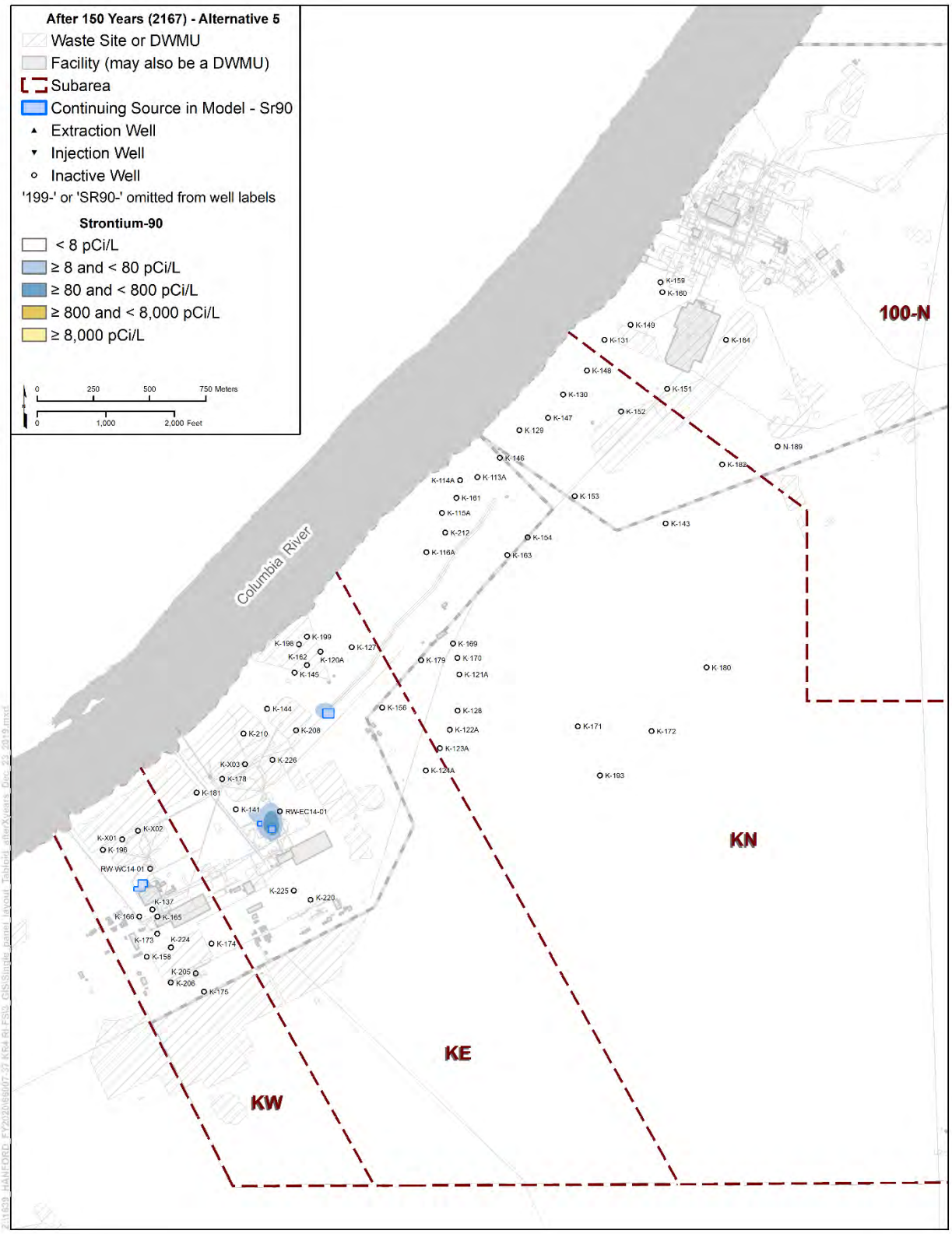


Figure 6-149. Strontium-90: Simulated Distribution after 150 Years (end of 2167) – Alternative 5

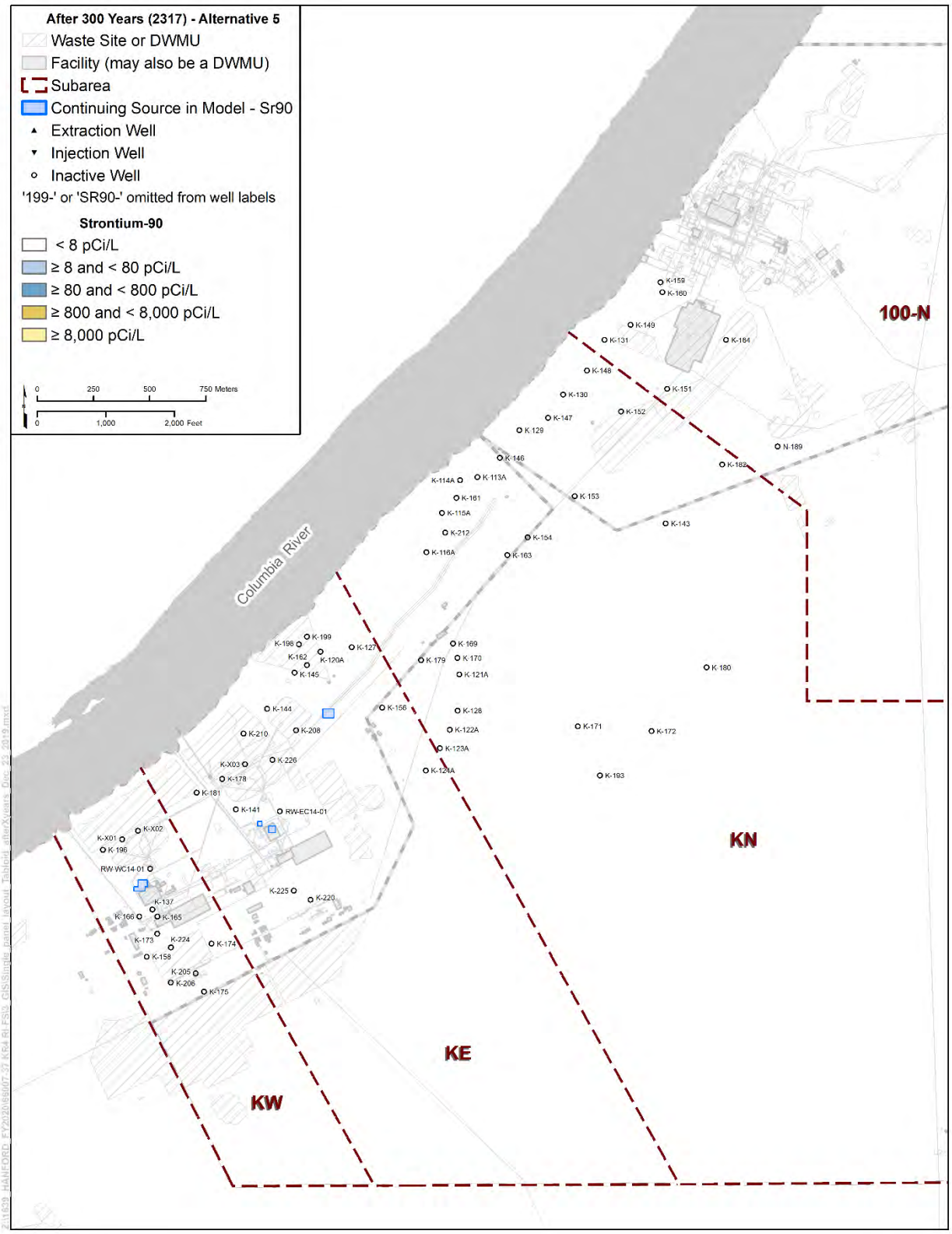


Figure 6-150. Strontium-90: Simulated Distribution after 300 Years (end of 2317) – Alternative 5

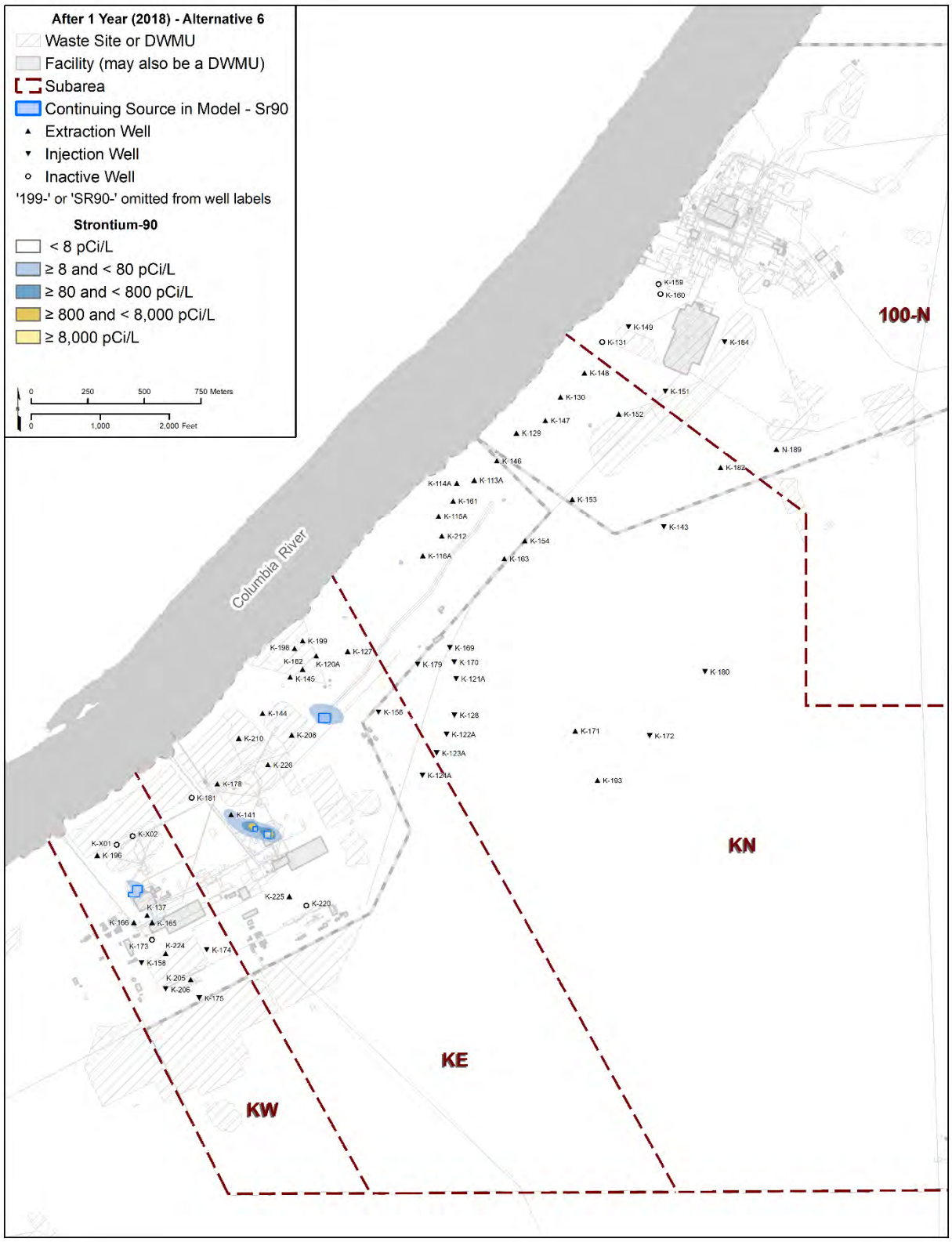


Figure 6-151. Strontium-90: Simulated Distribution after 1 Year (end of 2018) – Alternative 6

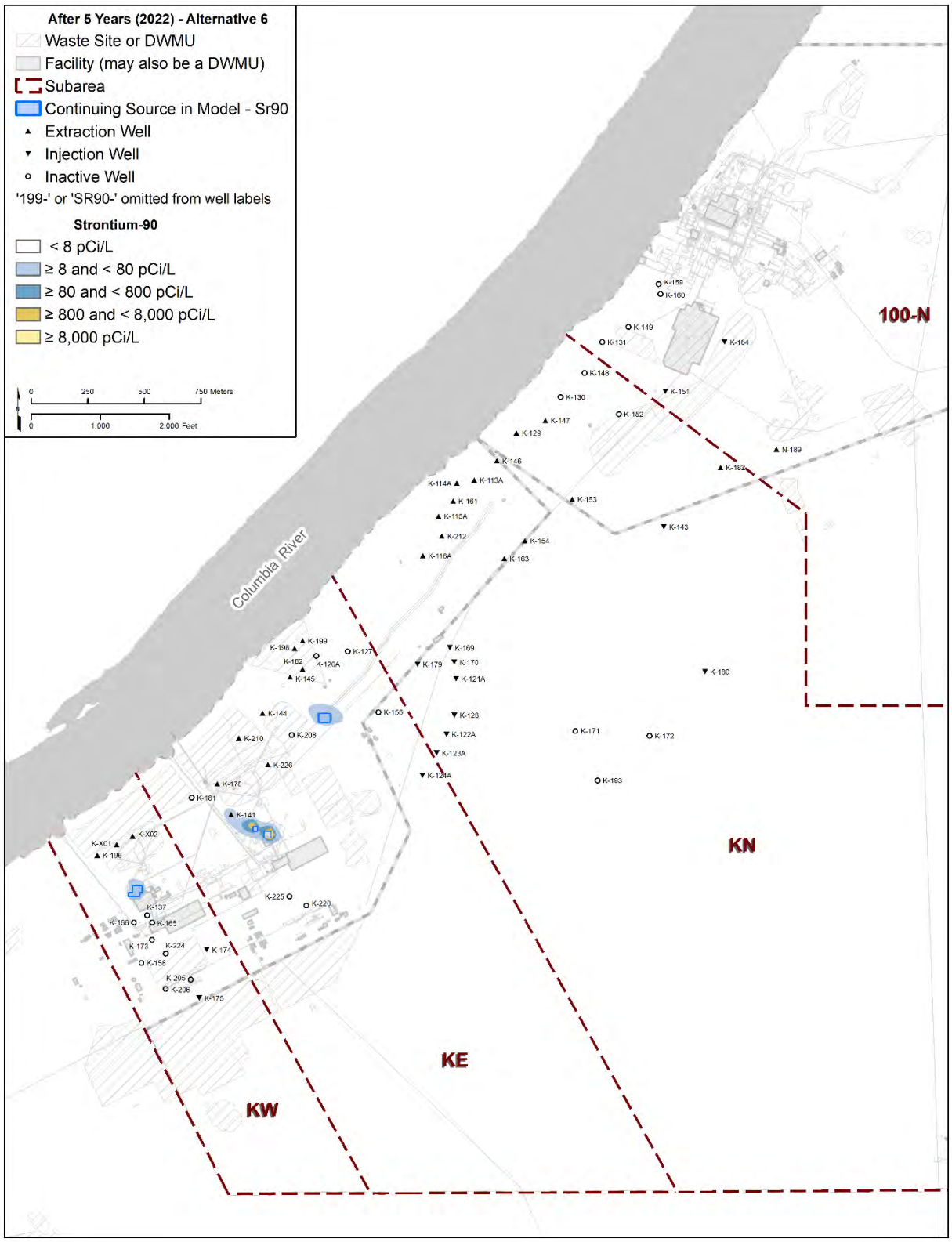


Figure 6-152. Strontium-90: Simulated Distribution after 5 Years (end of 2022) – Alternative 6

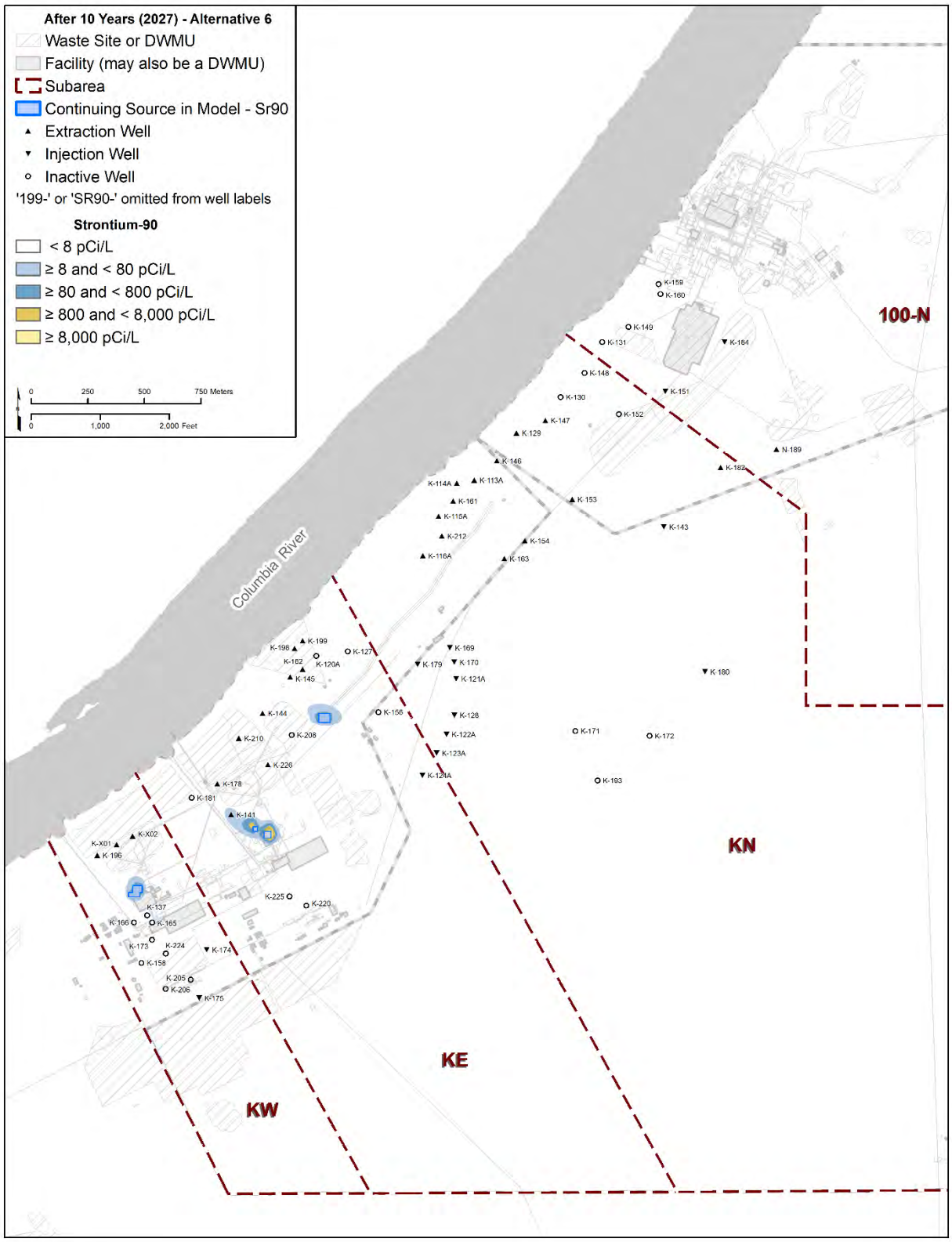


Figure 6-153. Strontium-90: Simulated Distribution after 10 Years (end of 2027) – Alternative 6

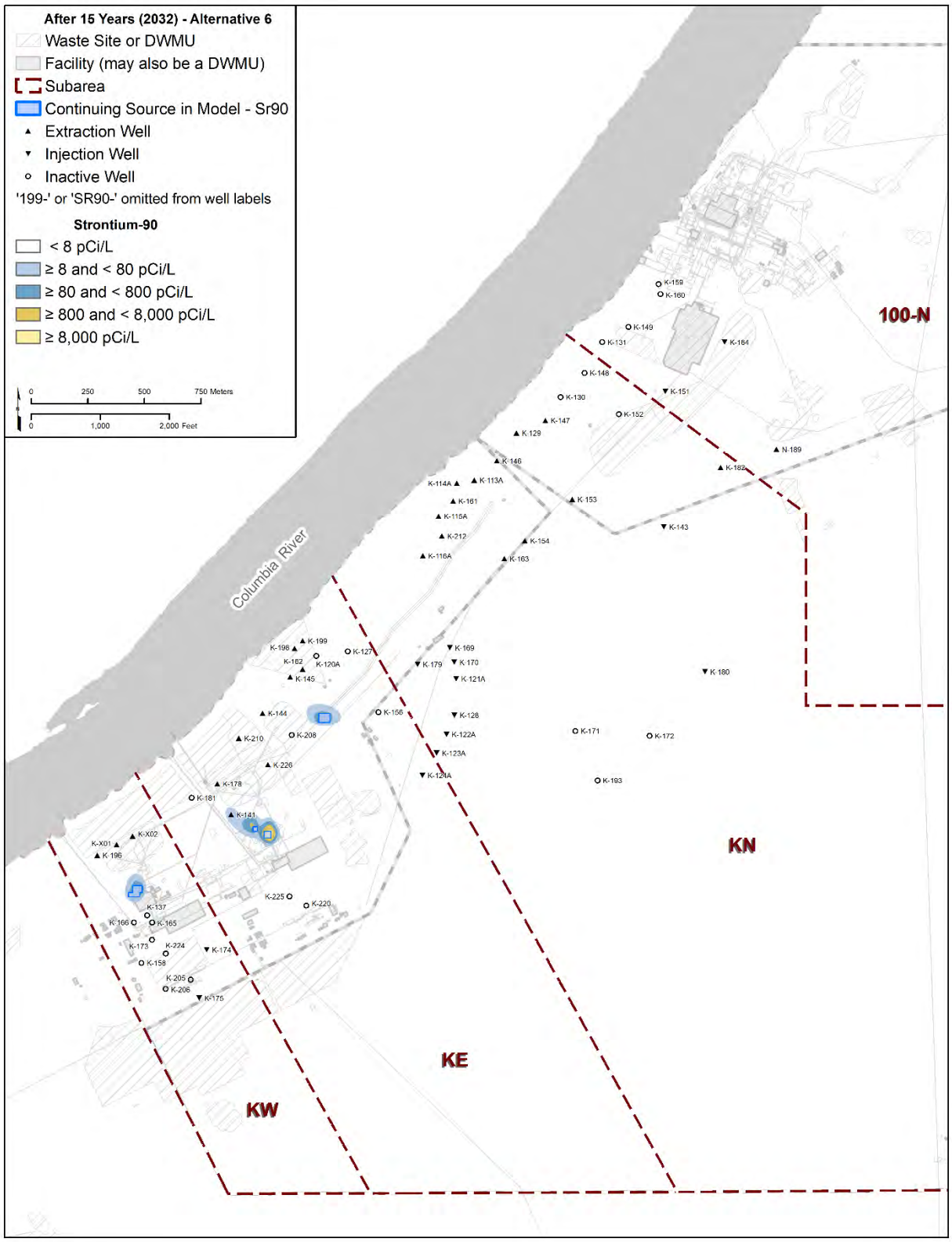


Figure 6-154. Strontium-90: Simulated Distribution after 15 Years (end of 2032) – Alternative 6

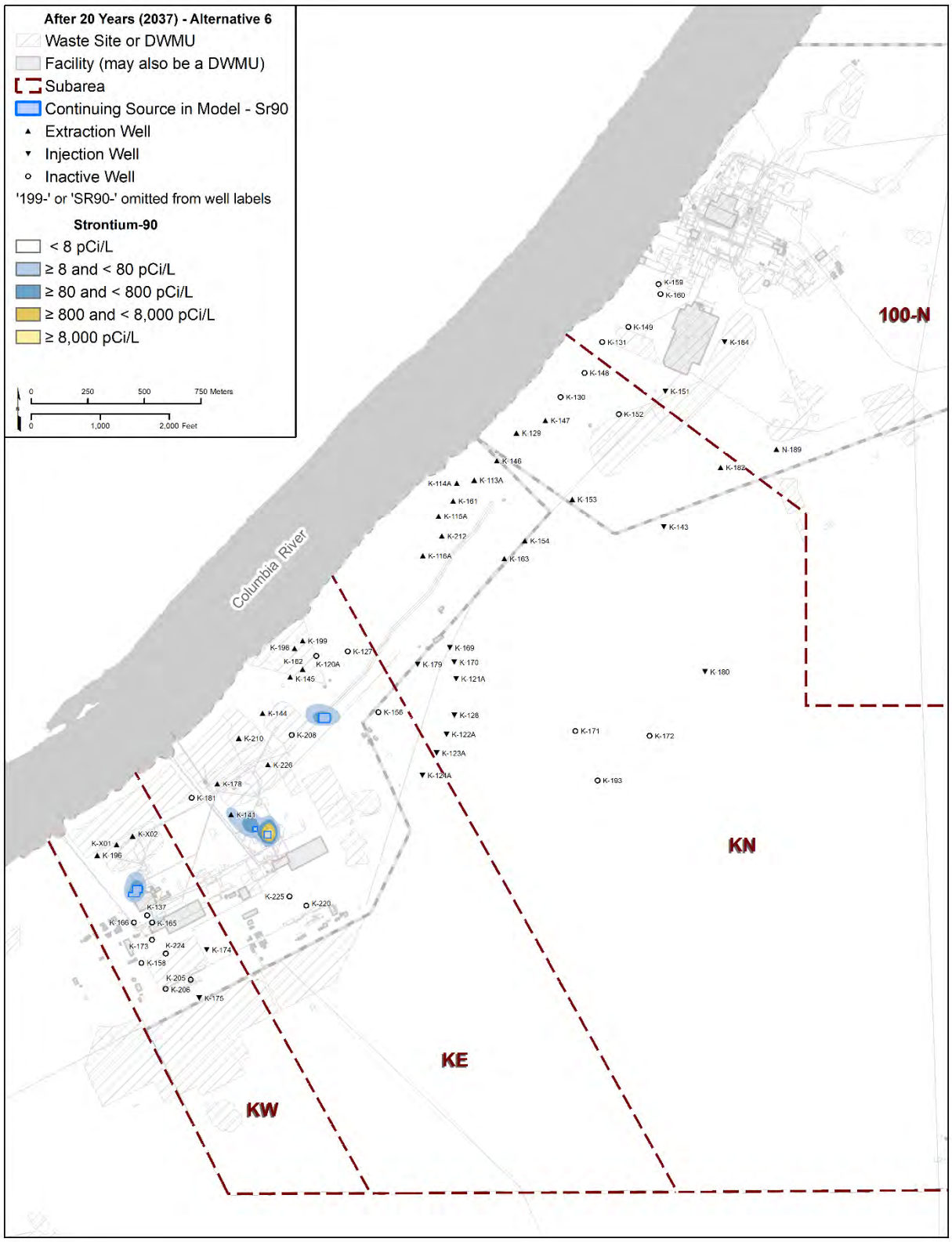


Figure 6-155. Strontium-90: Simulated Distribution after 20 Years (end of 2037) – Alternative 6

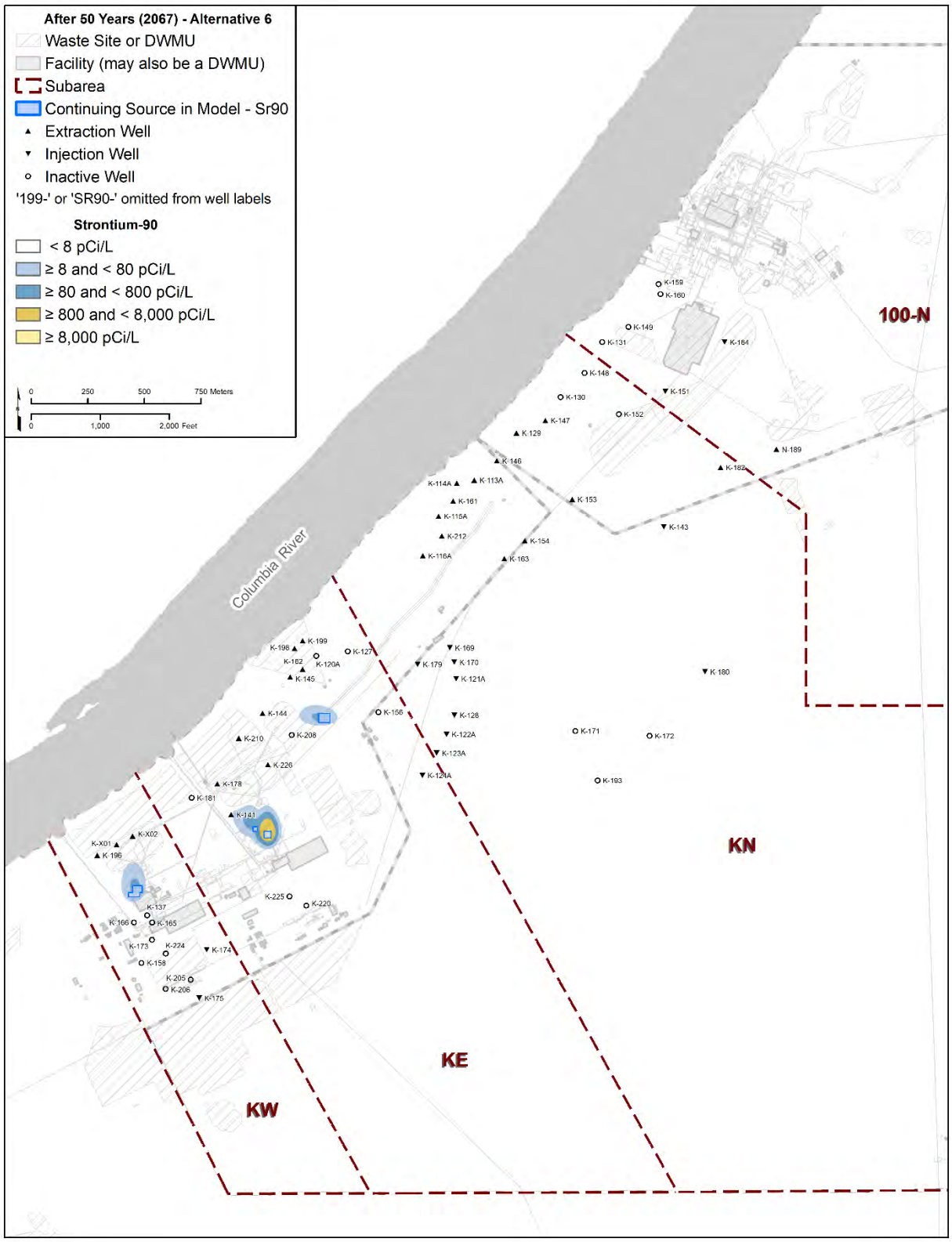


Figure 6-156. Strontium-90: Simulated Distribution after 50 Years (end of 2067) – Alternative 6

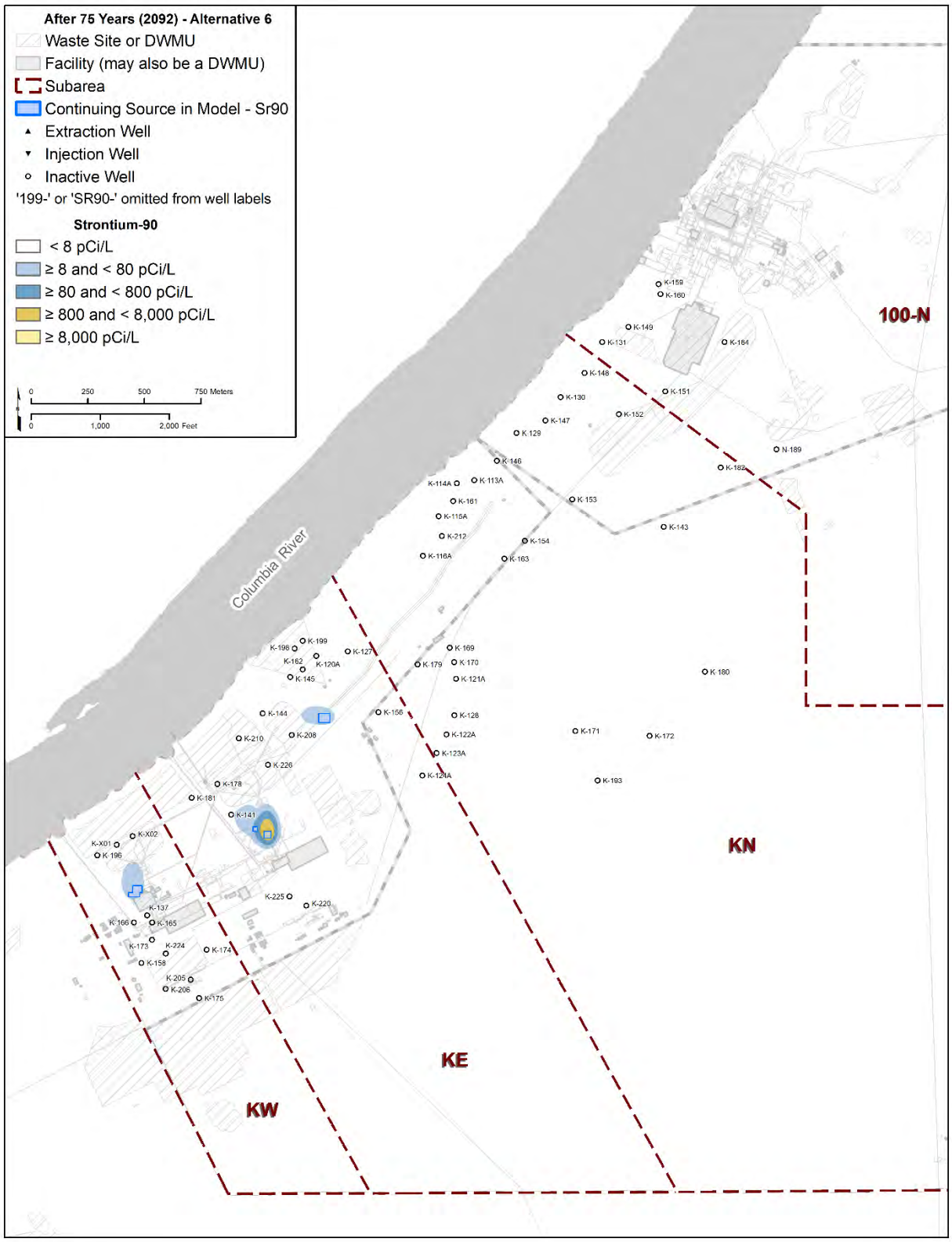


Figure 6-157. Strontium-90: Simulated Distribution after 75 Years (end of 2092) – Alternative 6

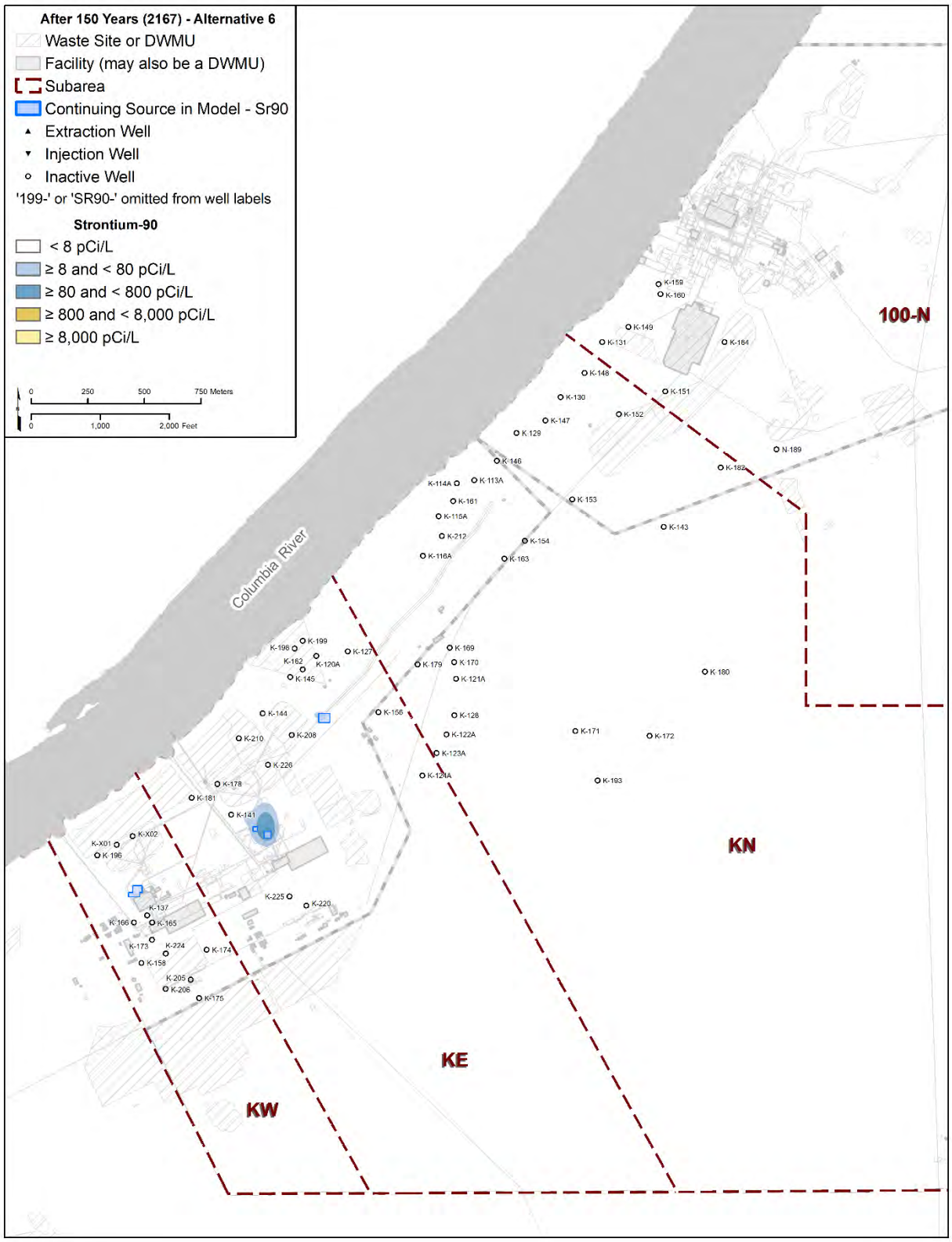


Figure 6-158. Strontium-90: Simulated Distribution after 150 Years (end of 2167) – Alternative 6

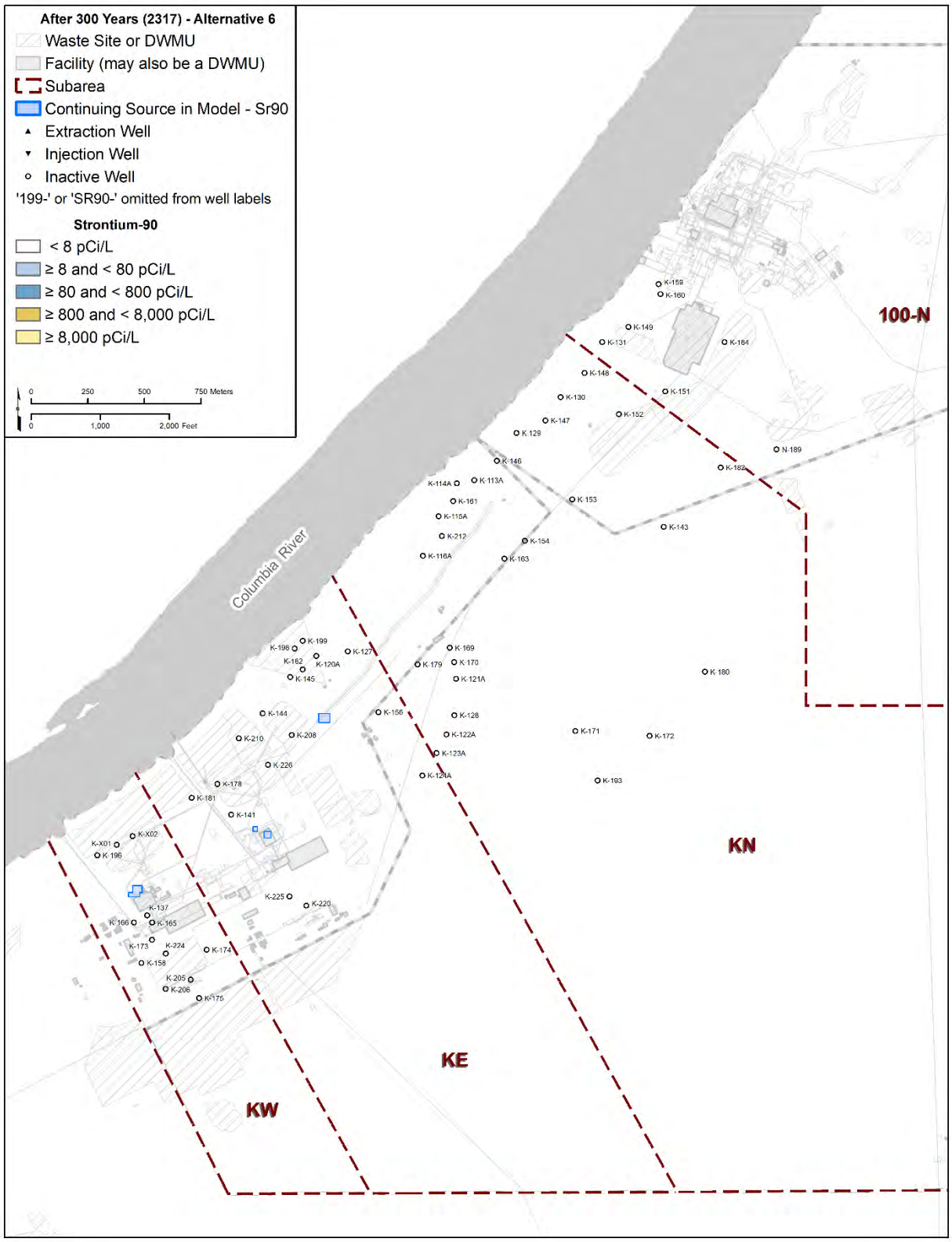


Figure 6-159. Strontium-90: Simulated Distribution after 300 Years (end of 2317) – Alternative 6

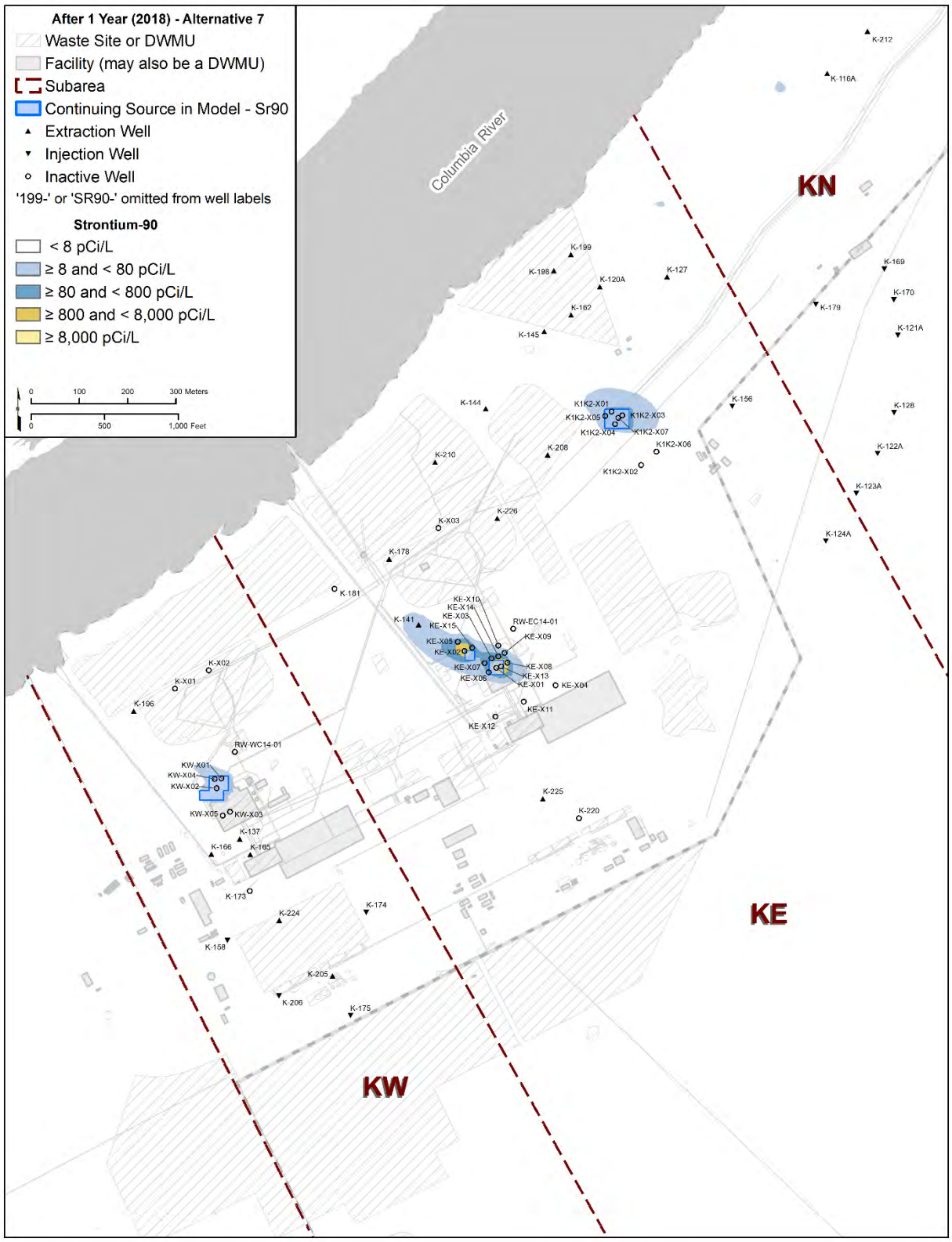


Figure 6-160. Strontium-90: Simulated Distribution after 1 Year (end of 2018) – Alternative 7

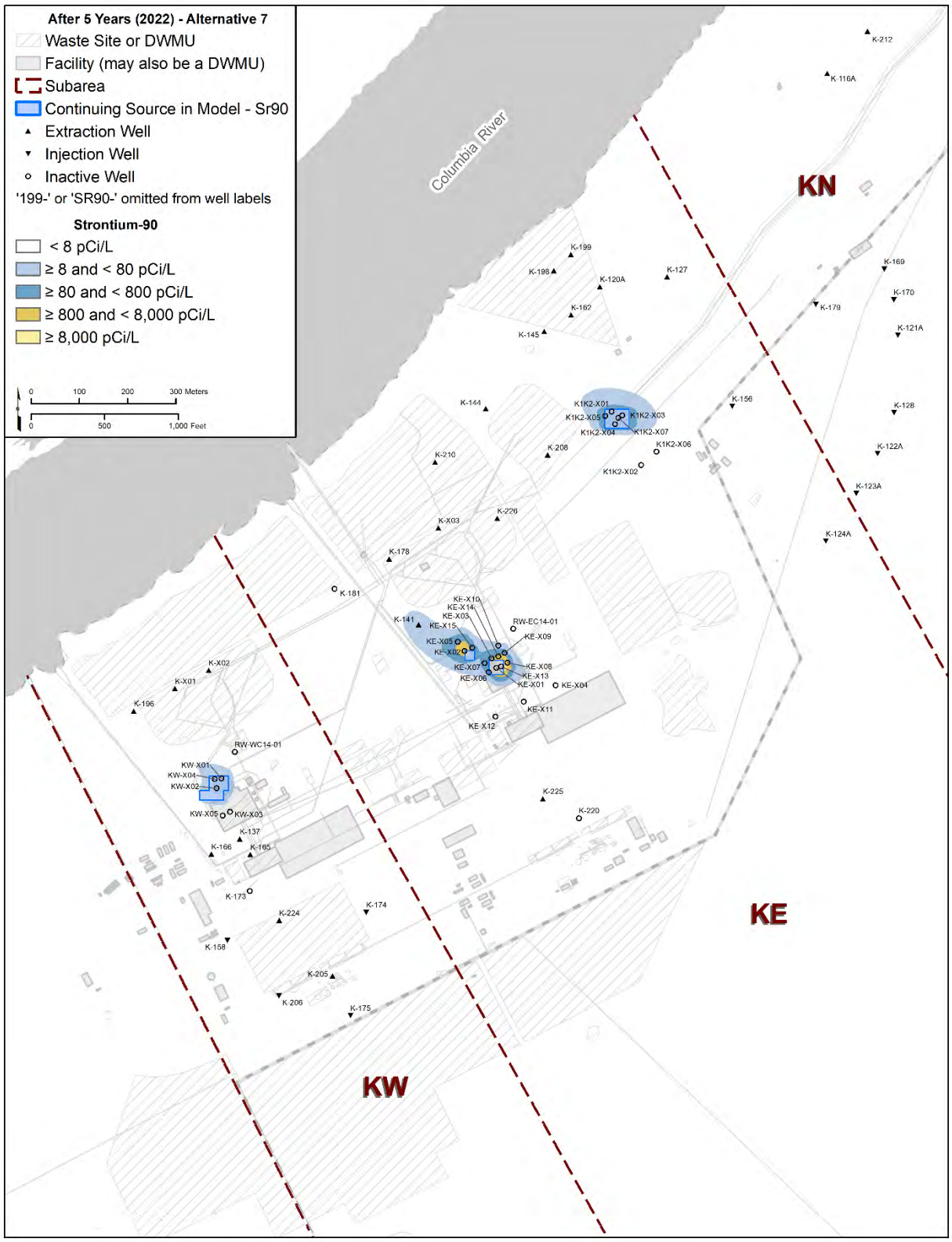


Figure 6-161. Strontium-90: Simulated Distribution after 5 Years (end of 2022) – Alternative 7

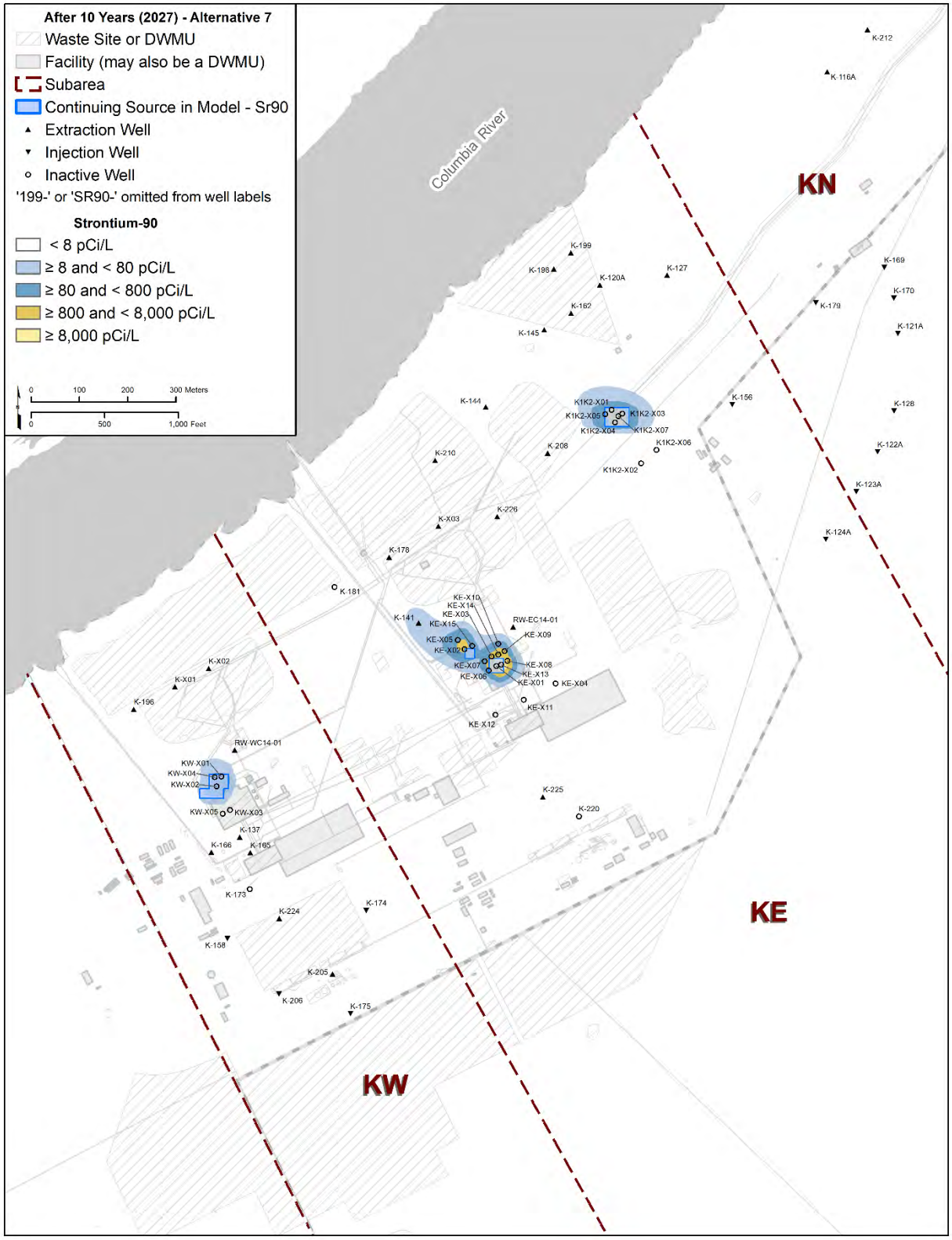


Figure 6-162. Strontium-90: Simulated Distribution after 10 Years (end of 2027) – Alternative 7

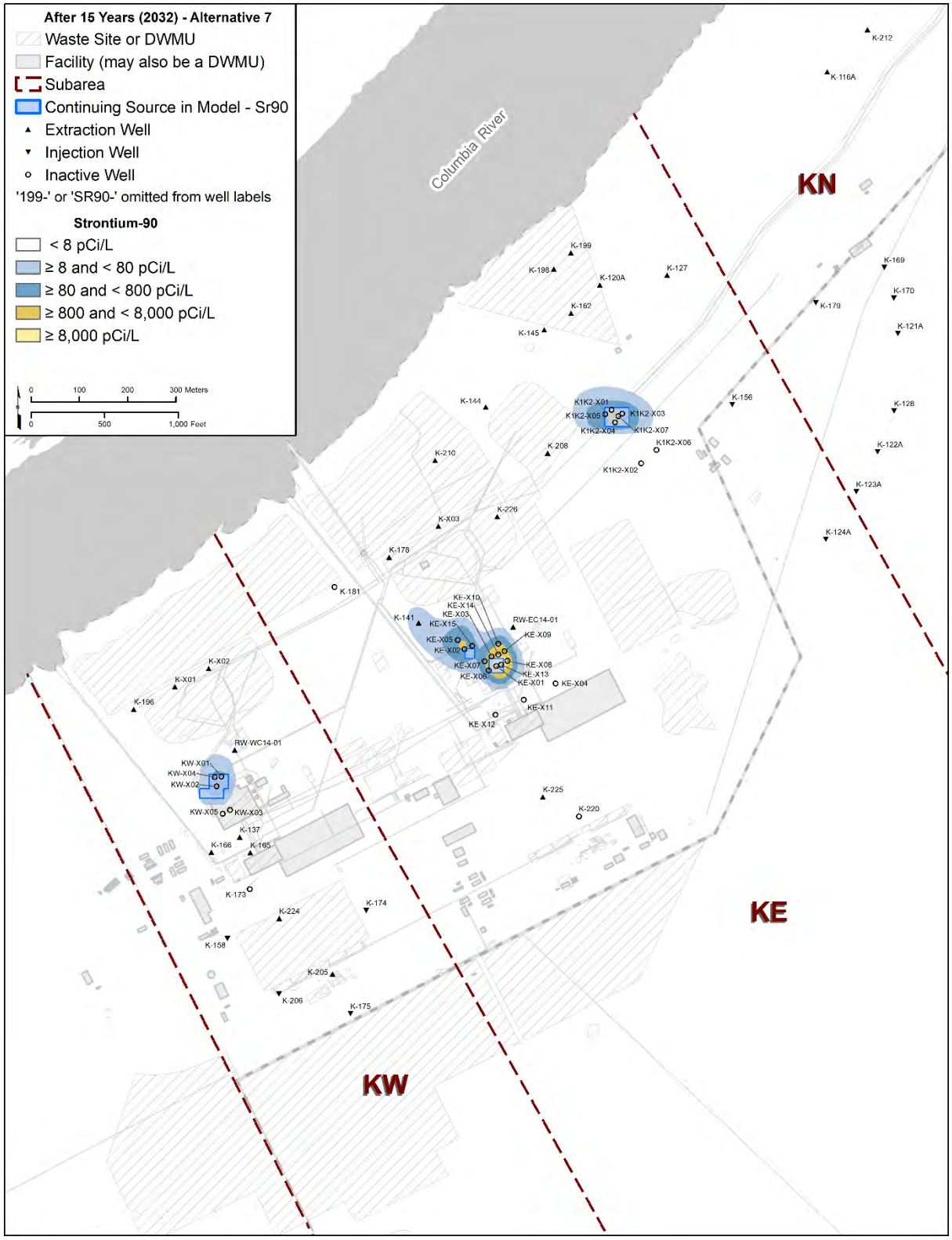


Figure 6-163. Strontium-90: Simulated Distribution after 15 Years (end of 2032) – Alternative 7

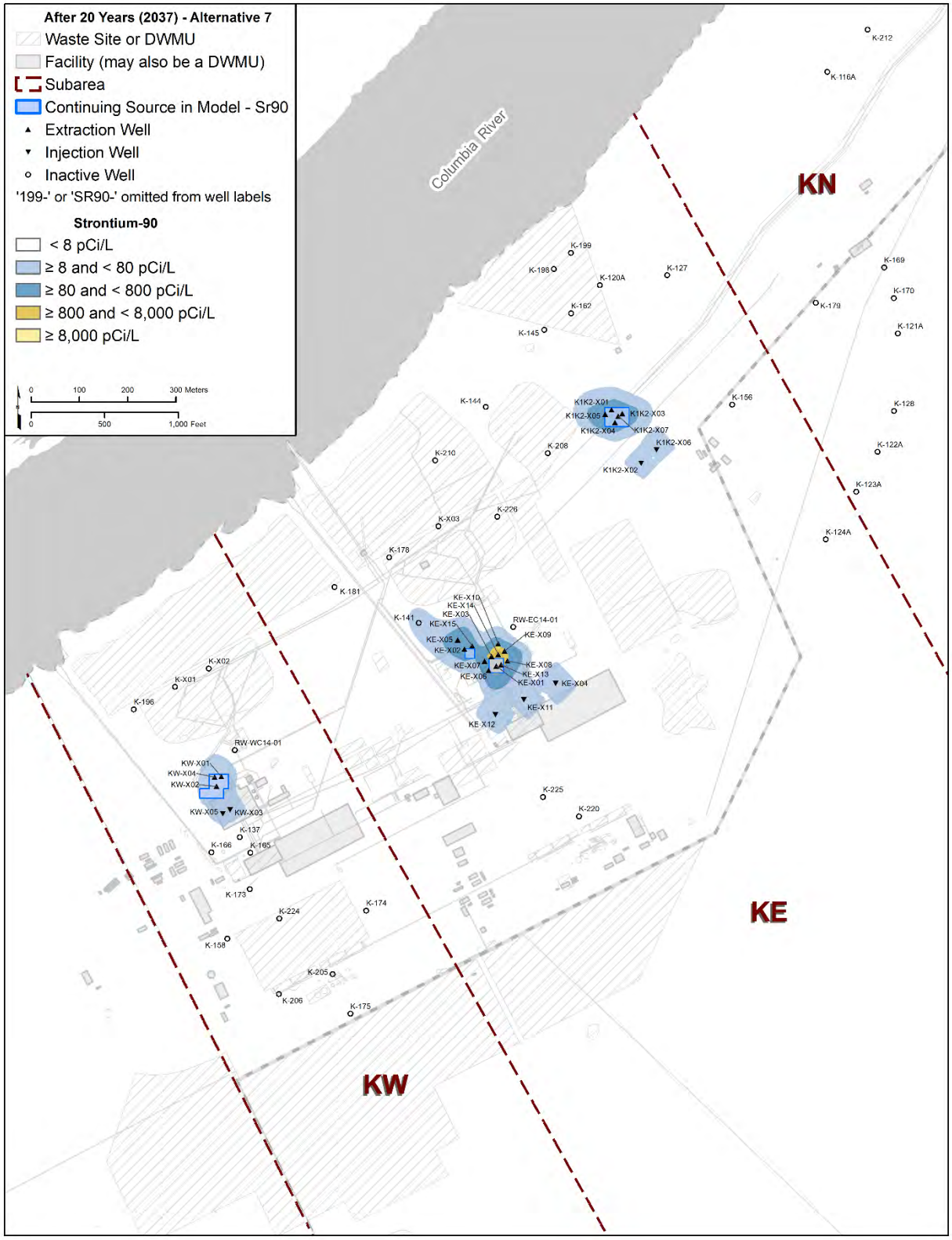


Figure 6-164. Strontium-90: Simulated Distribution after 20 Years (end of 2037) – Alternative 7

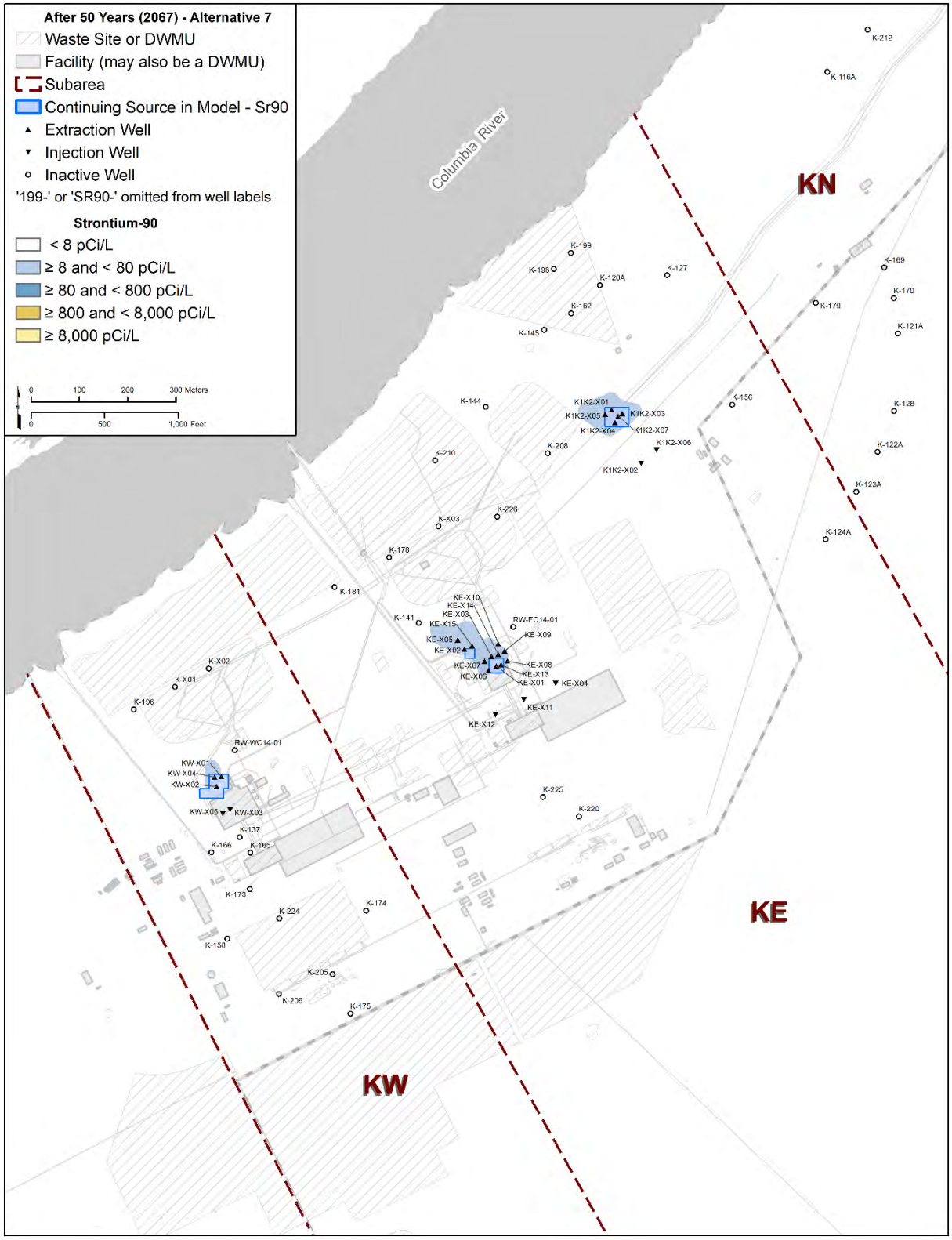


Figure 6-165. Strontium-90: Simulated Distribution after 50 Years (end of 2067) – Alternative 7

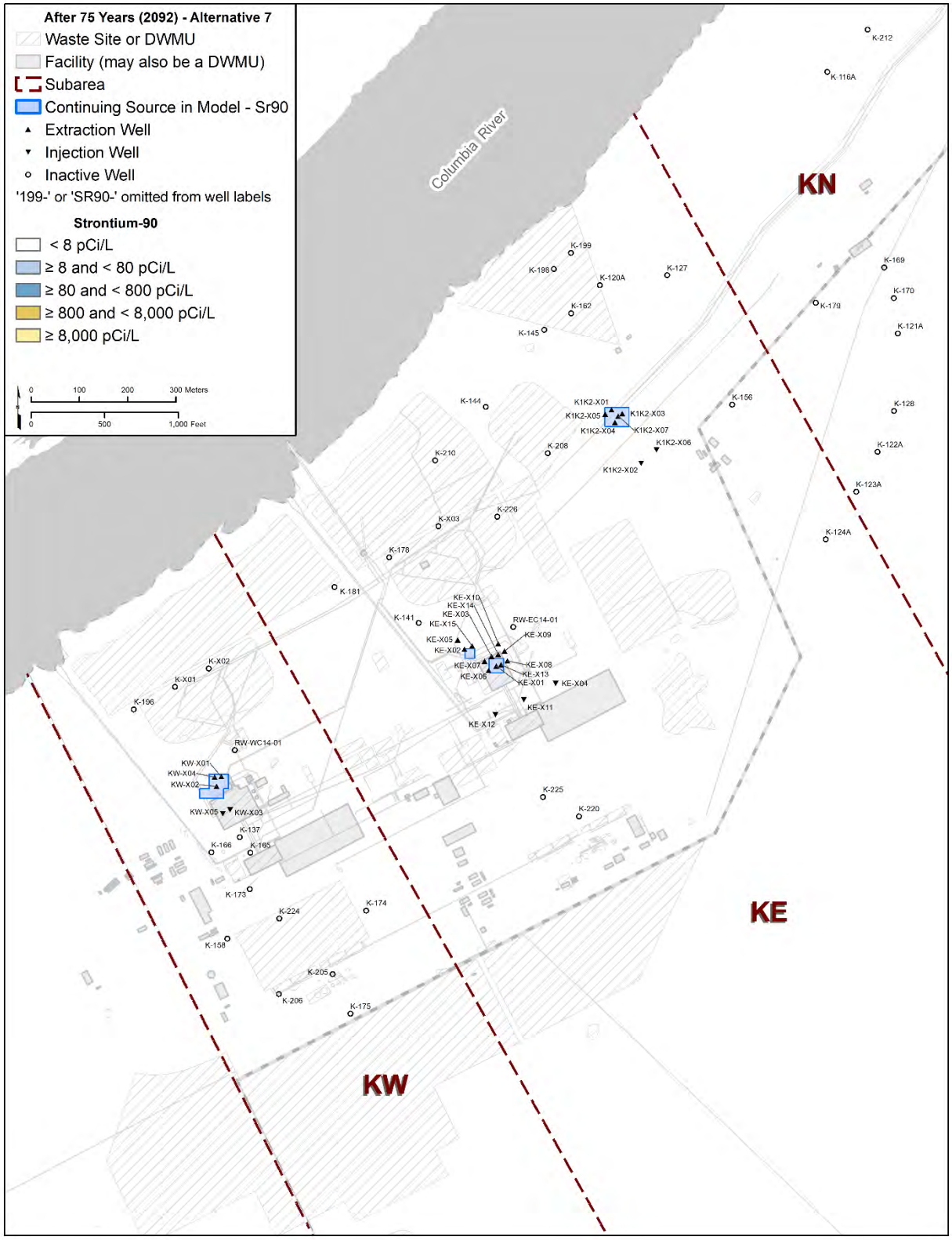


Figure 6-166. Strontium-90: Simulated Distribution after 75 Years (end of 2092) – Alternative 7

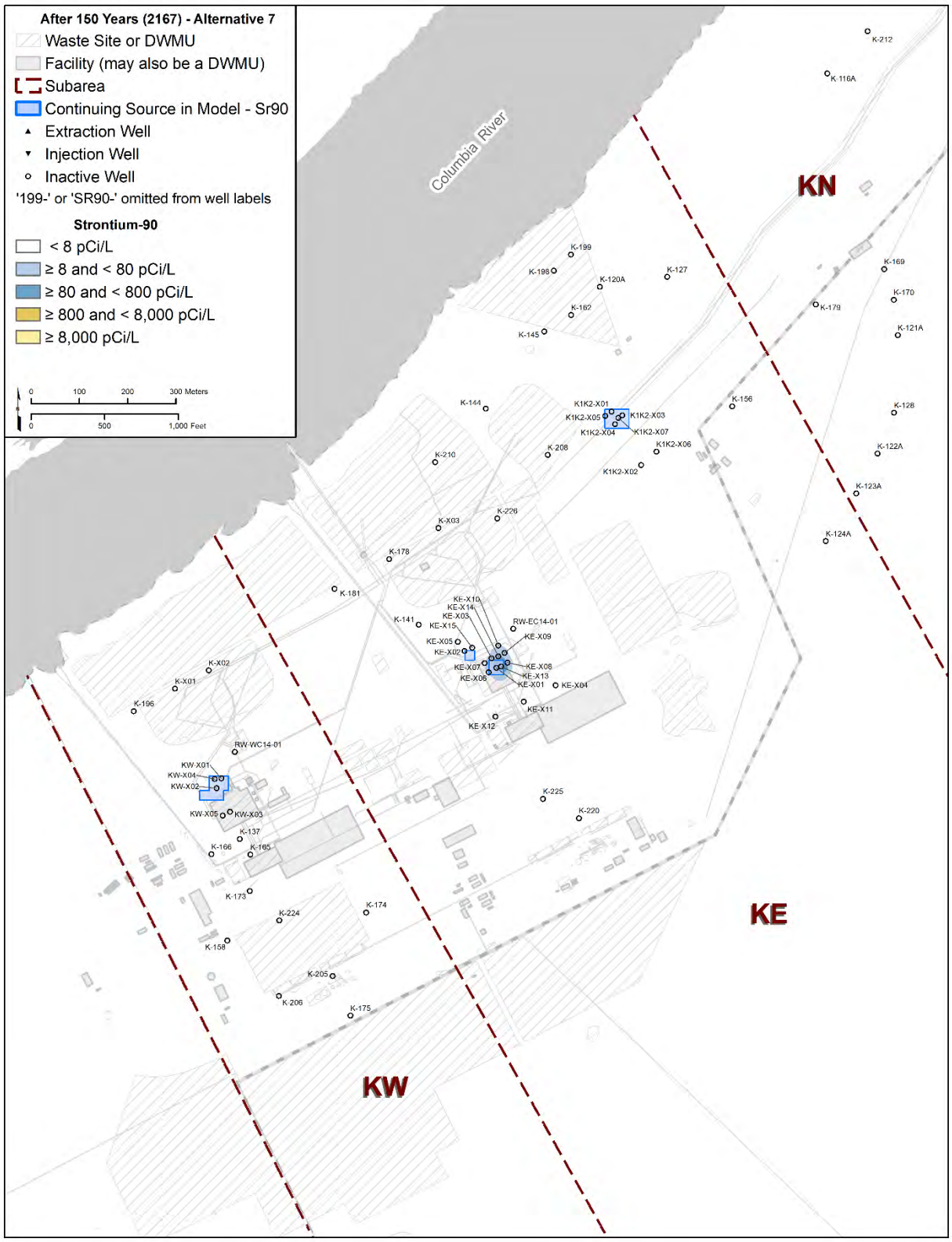


Figure 6-167. Strontium-90: Simulated Distribution after 150 Years (end of 2167) – Alternative 7

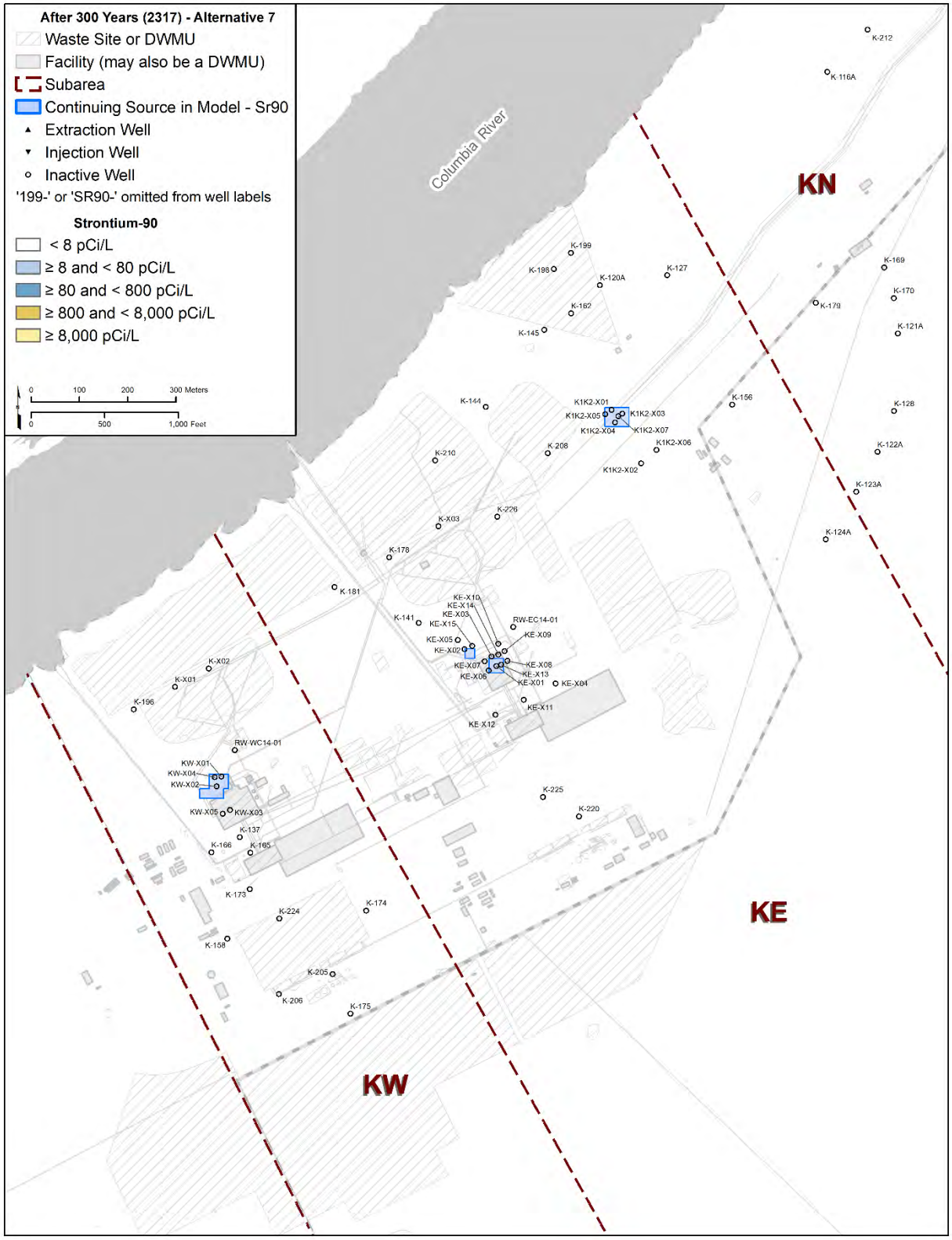


Figure 6-168. Strontium-90: Simulated Distribution after 300 Years (end of 2317) – Alternative 7

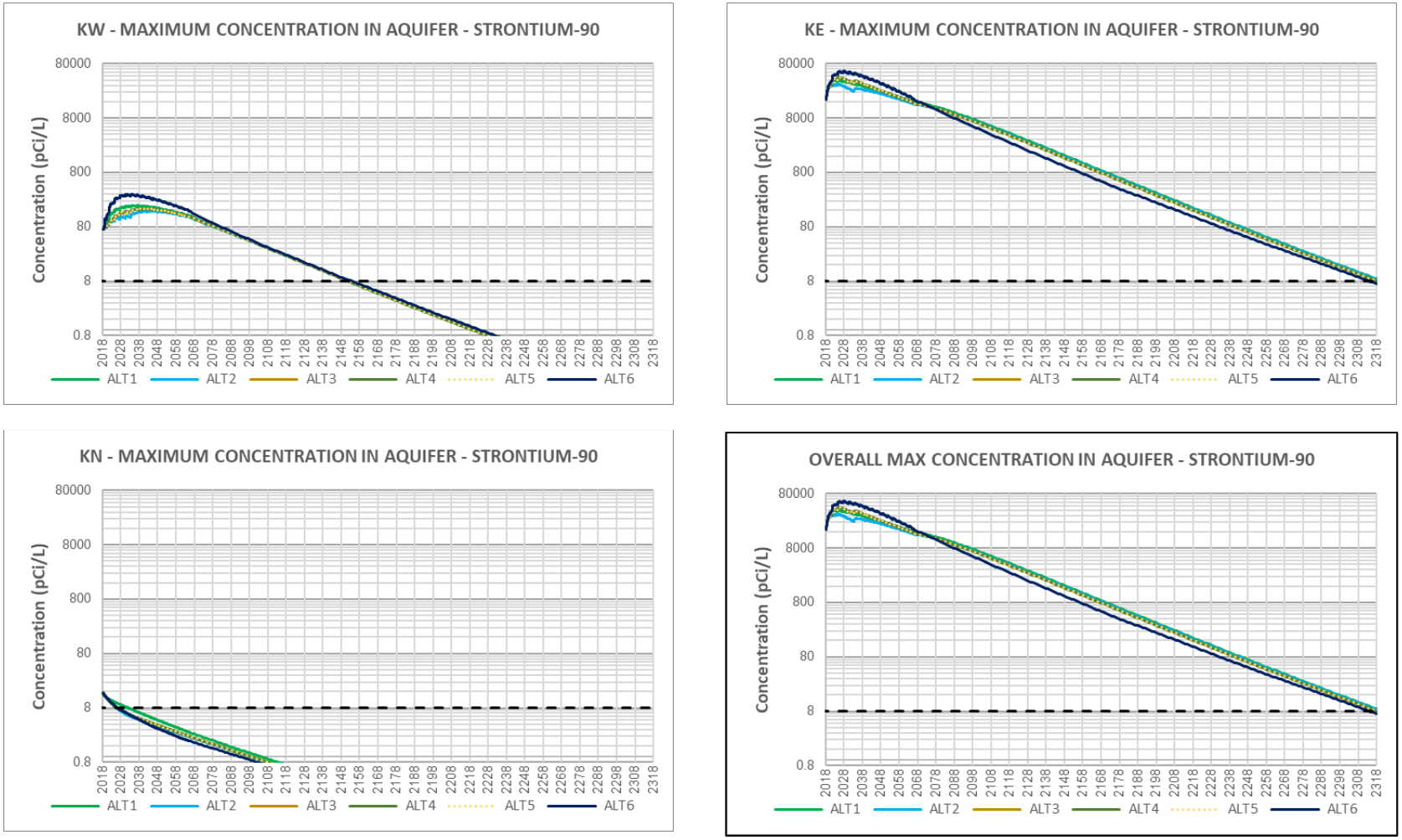
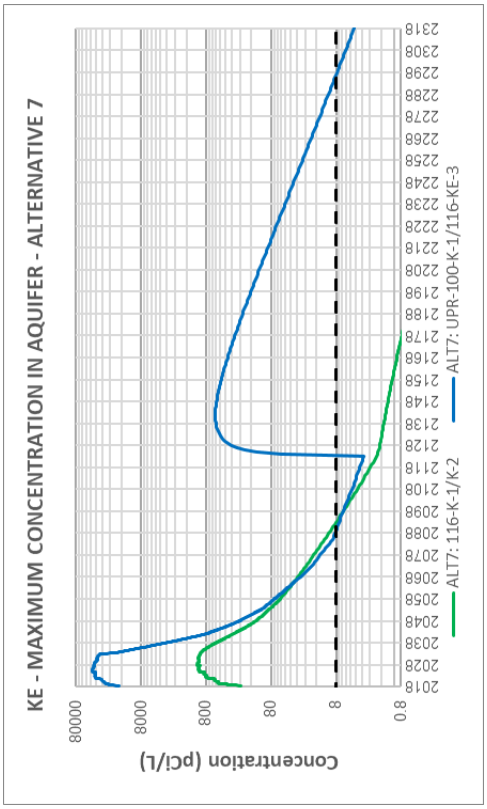


Figure 6-169. Strontium-90: Maximum Concentration Time Series in the Aquifer



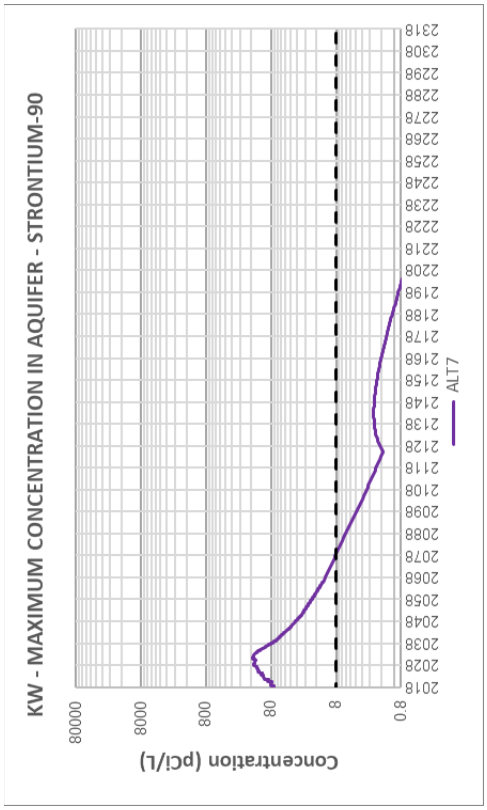


Figure 6-170. Strontium-90: Maximum Concentration Time Series in the Aquifer – Alternative 7

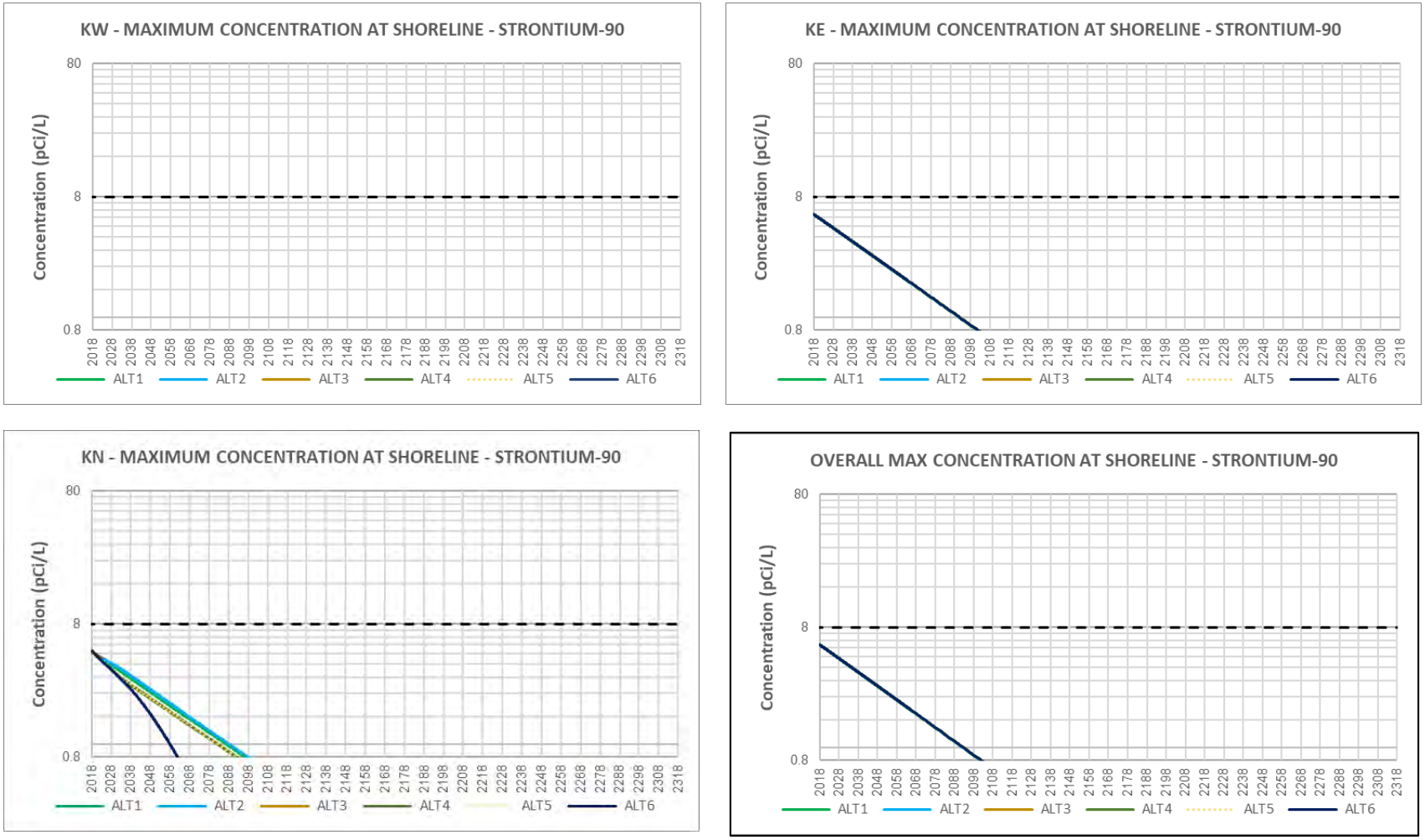


Figure 6-171. Strontium-90: Maximum Concentration Time Series at the Shoreline

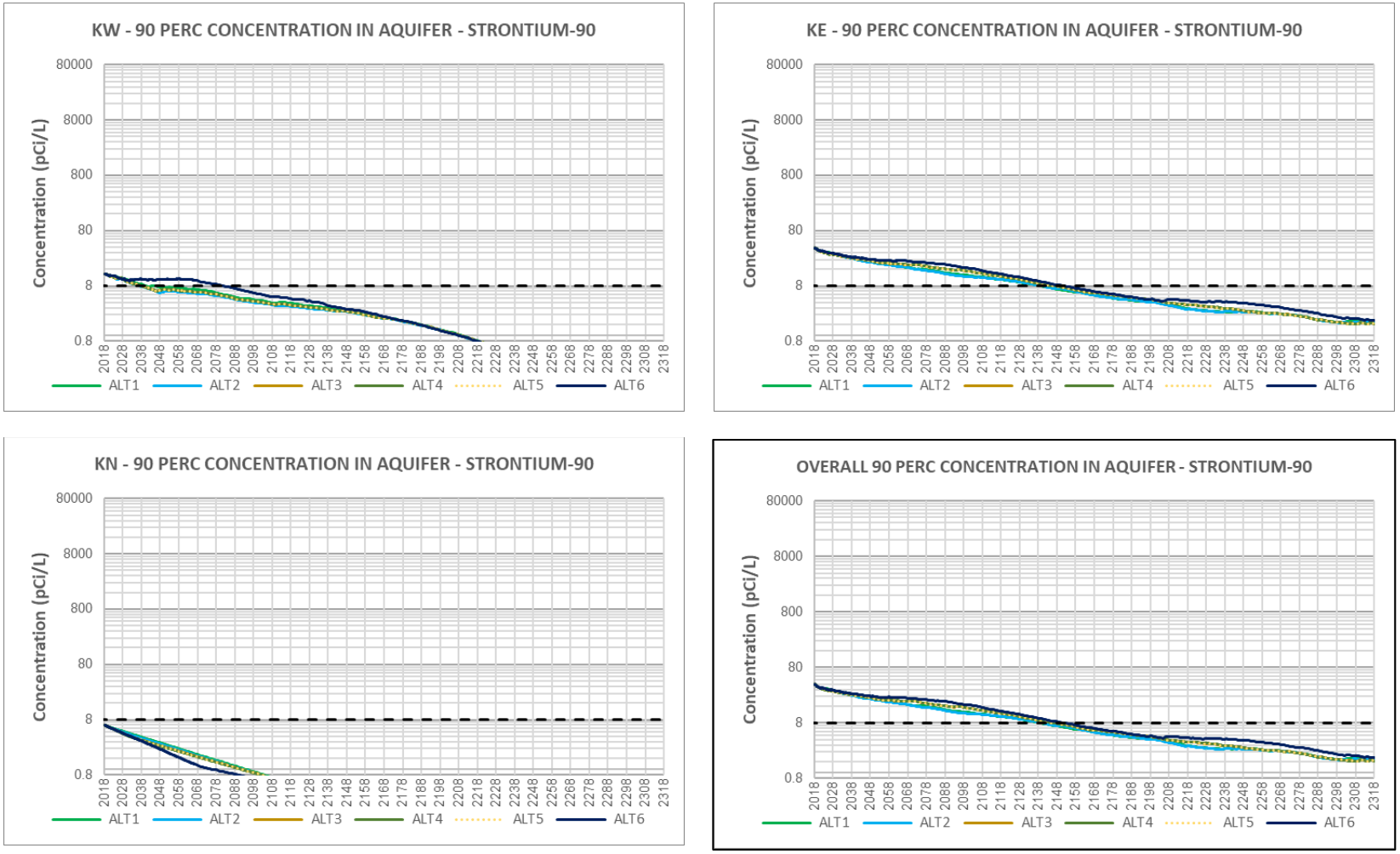
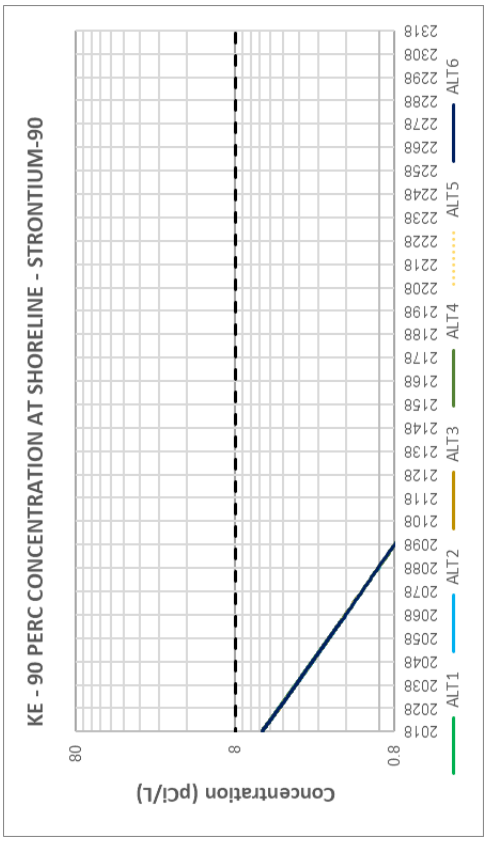
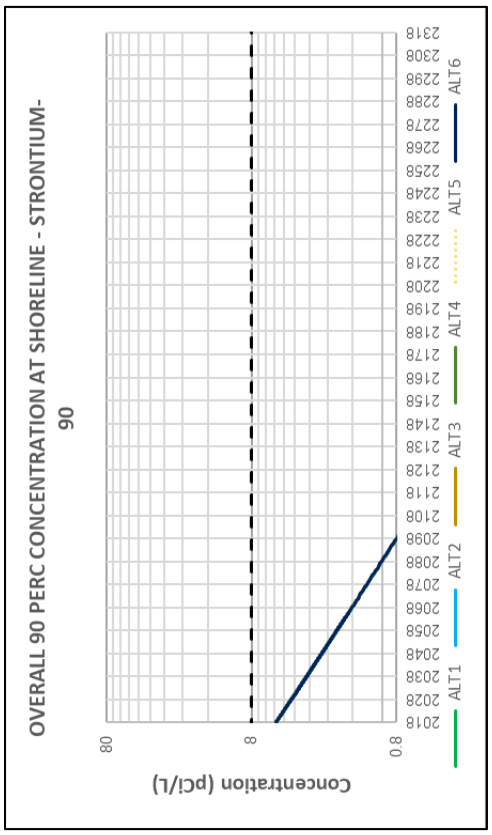
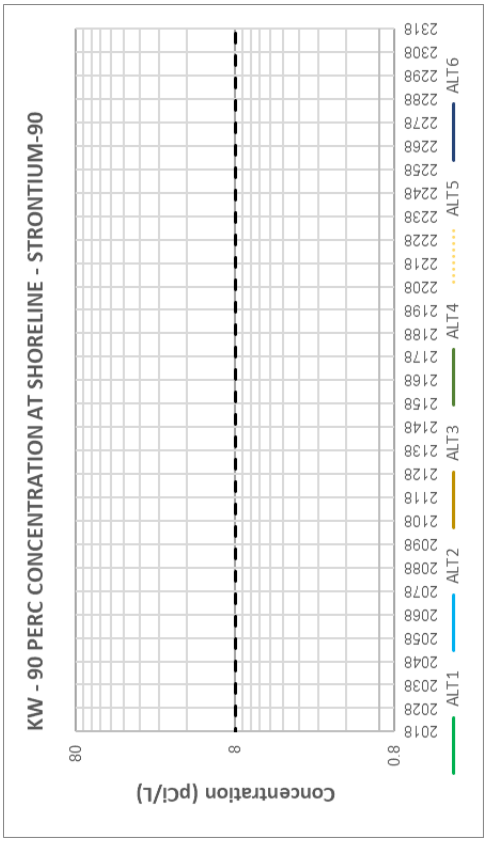


Figure 6-172. Strontium-90: 90th Percentile Concentration Time Series in the Aquifer







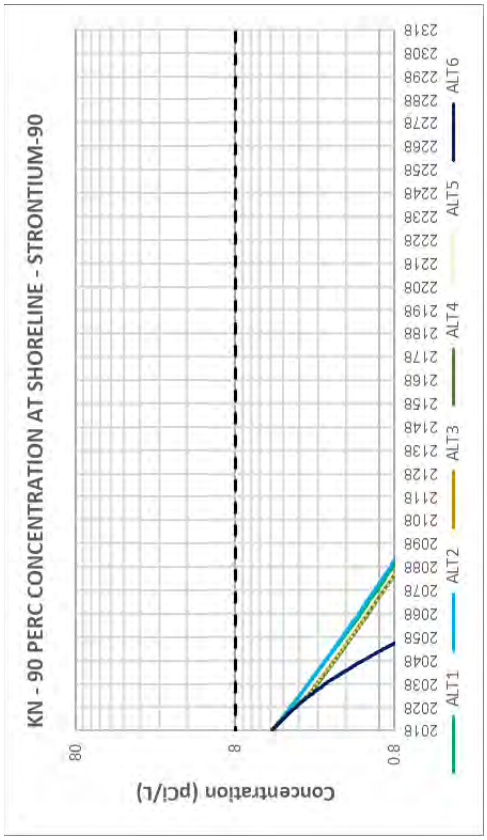


Figure 6-173. Strontium-90: 90th Percentile Concentration Time Series at the Shoreline

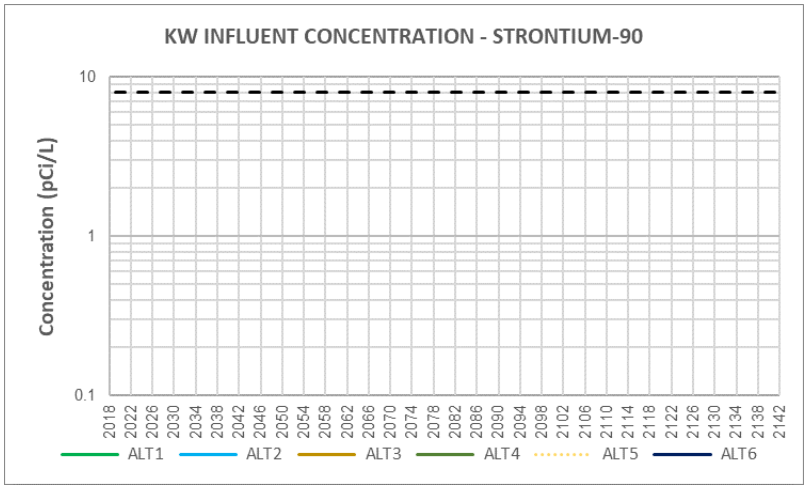


Figure 6-174. Strontium-90: Combined Influent Concentration Time Series – KW System

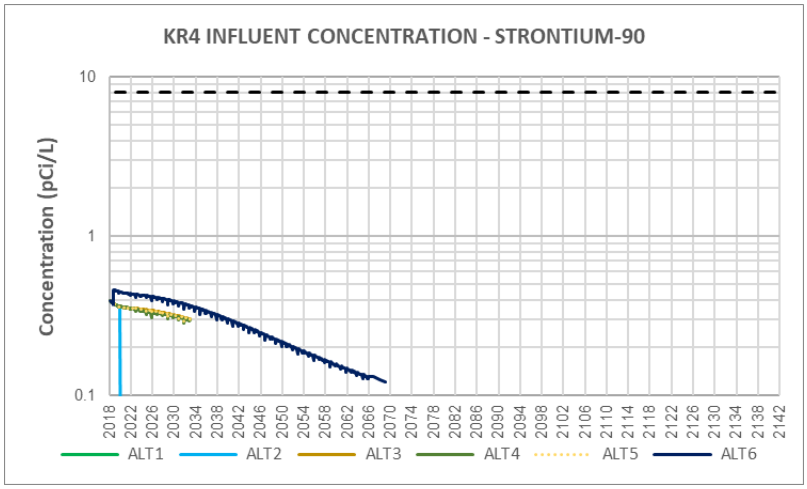


Figure 6-175. Strontium-90: Combined Influent Concentration Time Series – KR4 System

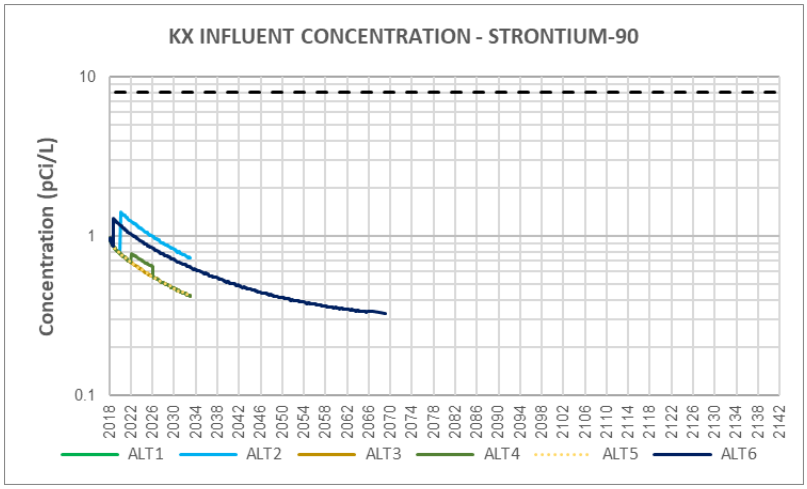


Figure 6-176. Strontium-90: Combined Influent Concentration Time Series – KX System

6.1.5 Simulated Contaminant Distribution – Concentration Statistics: TCE

Results for TCE are grouped in the following sets of figures:

- Figures 6-177 to 6-194: simulated concentration distributions for each alternative.
- Figures 6-195 to 6-196: maximum concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-197 to 6-198: 90th percentile concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-199 to 6-201: combined influent concentration time series per treatment system for each alternative.

TCE maps show plume concentrations above 4 µg/L which is the applicable preliminary remediation goal (PRG) for TCE.

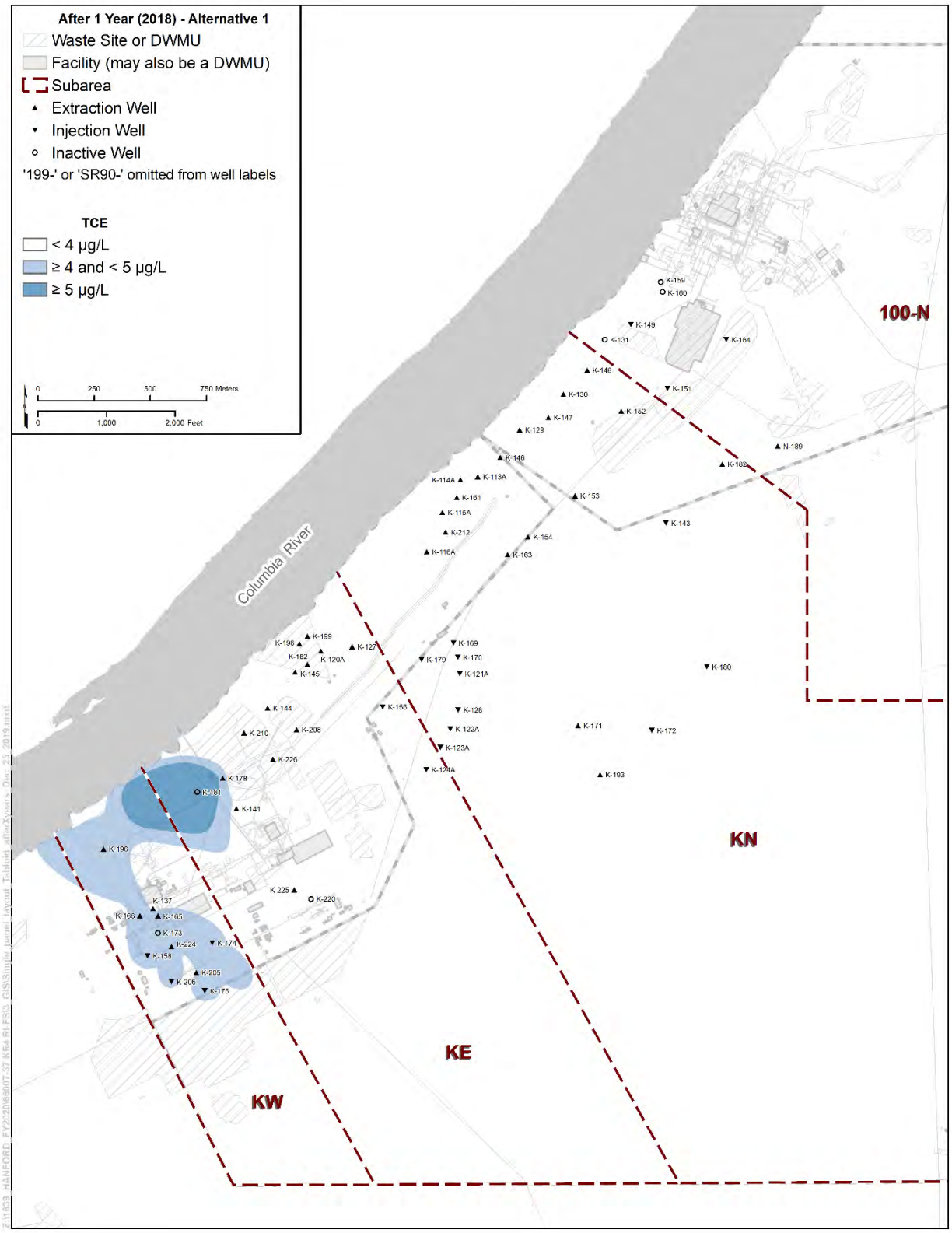


Figure 6-177. TCE: Simulated Distribution after 1 Year (end of 2018) – Alternative 1

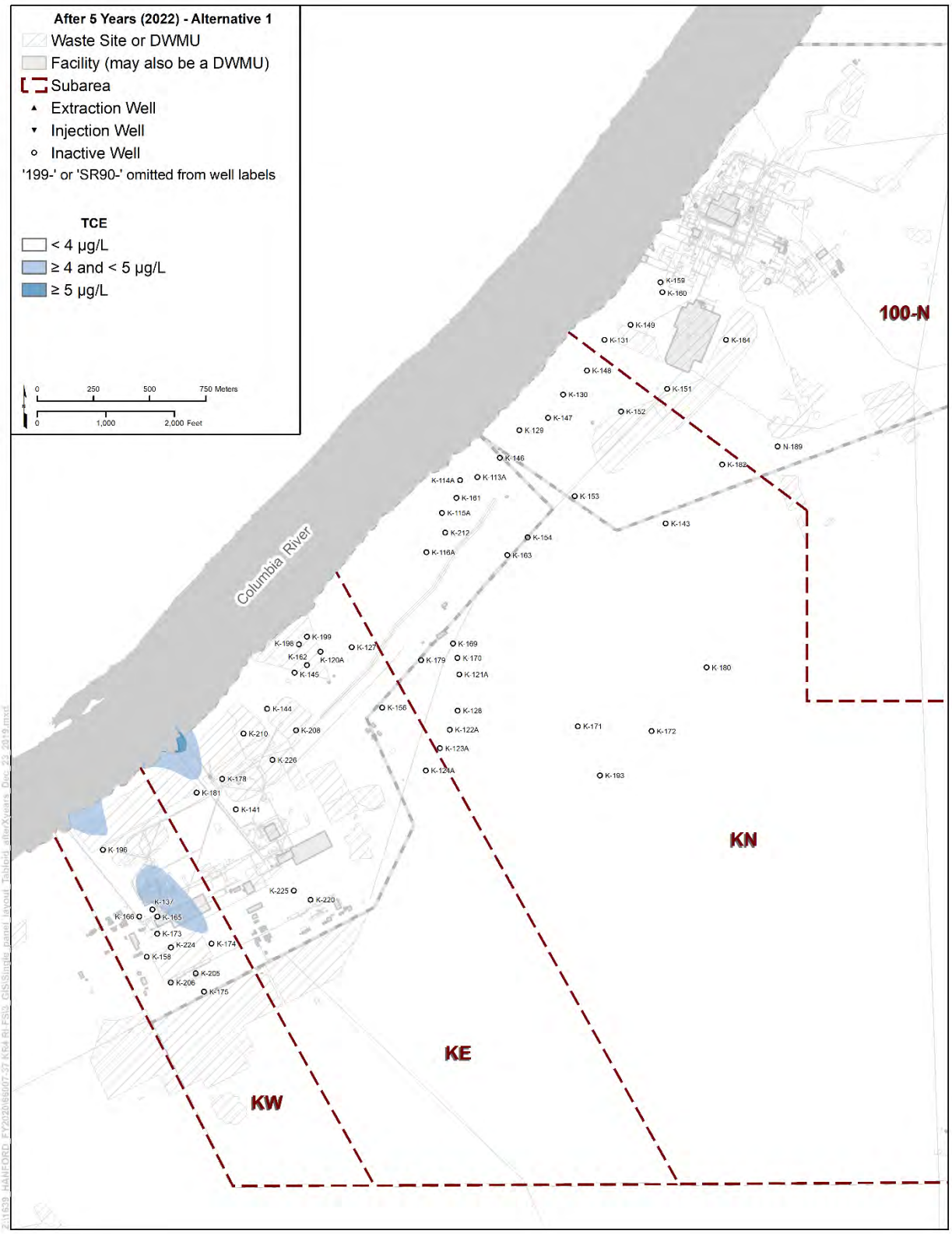


Figure 6-178. TCE: Simulated Distribution after 5 Years (end of 2022) – Alternative 1

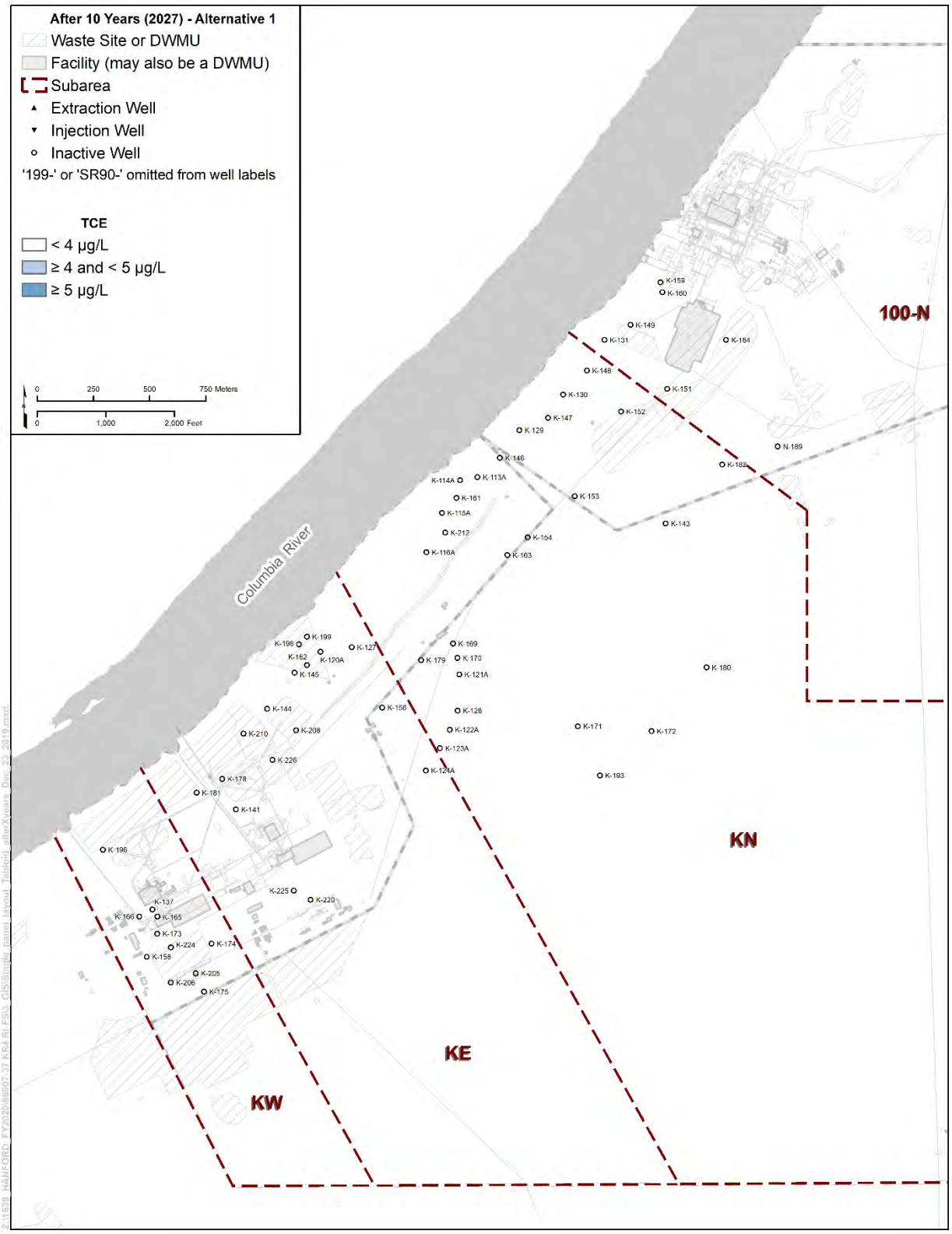


Figure 6-179. TCE: Simulated Distribution after 10 Years (end of 2027) – Alternative 1

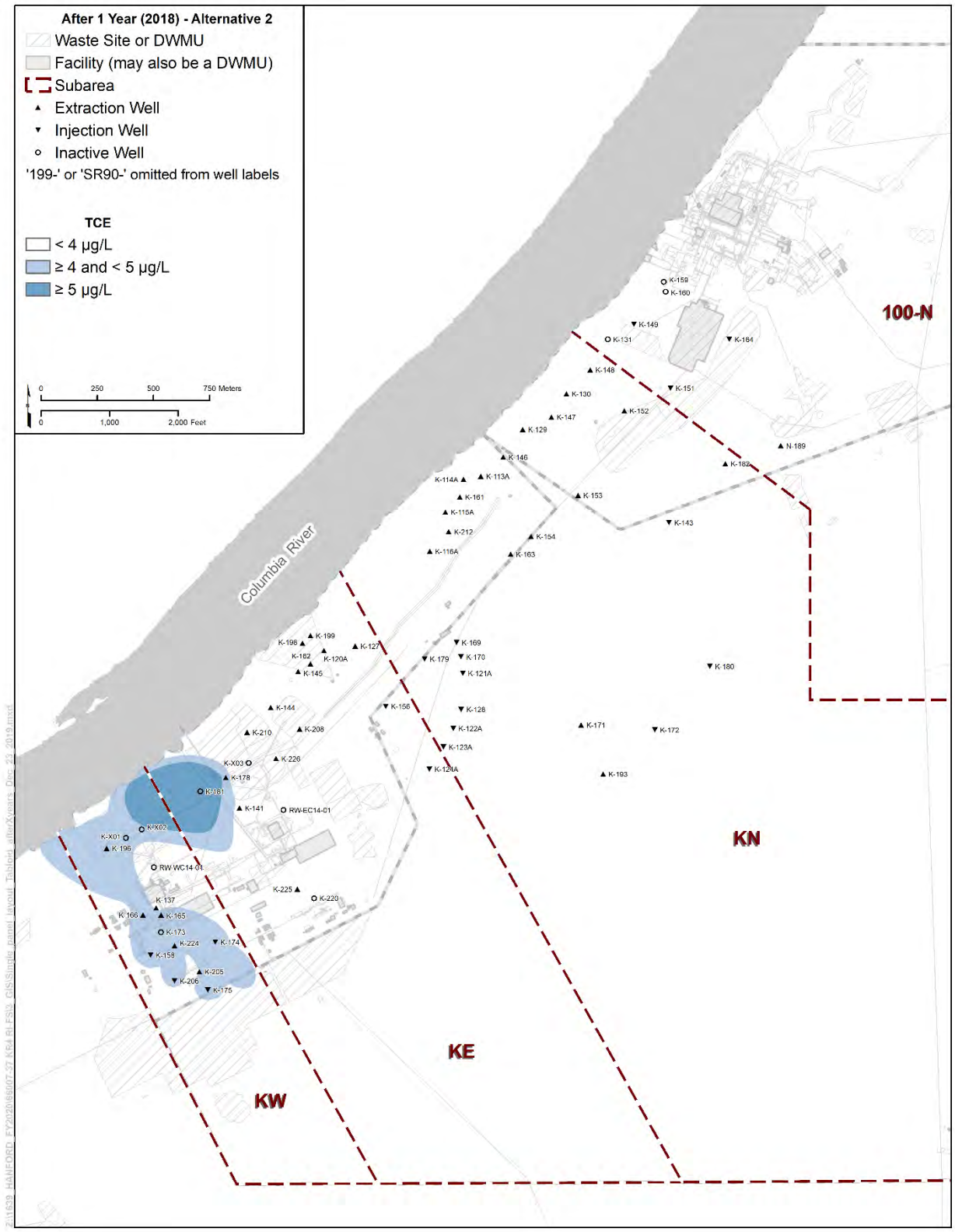


Figure 6-180. TCE: Simulated Distribution after 1 Year (end of 2018) – Alternative 2

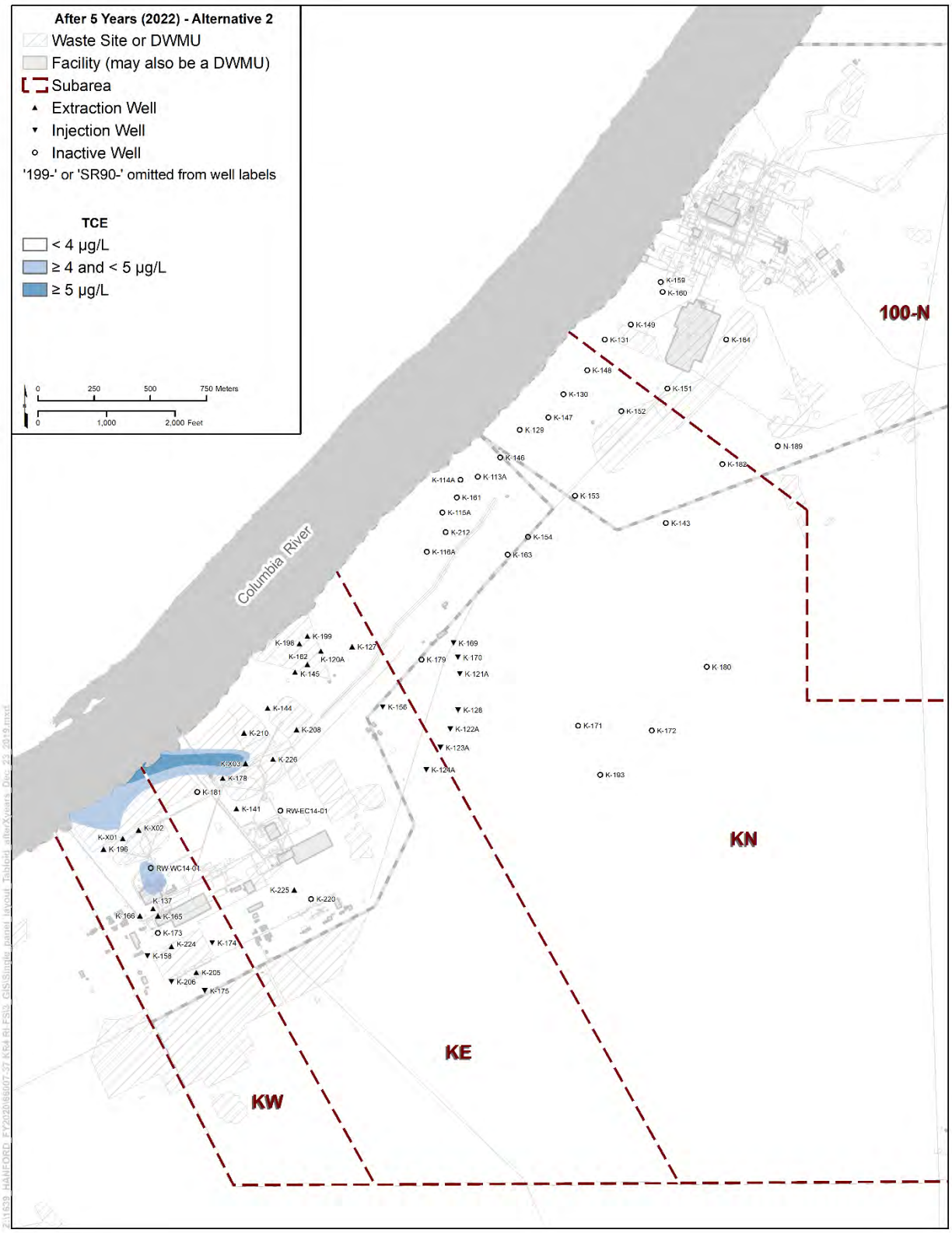


Figure 6-181. TCE: Simulated Distribution after 5 Years (end of 2022) – Alternative 2

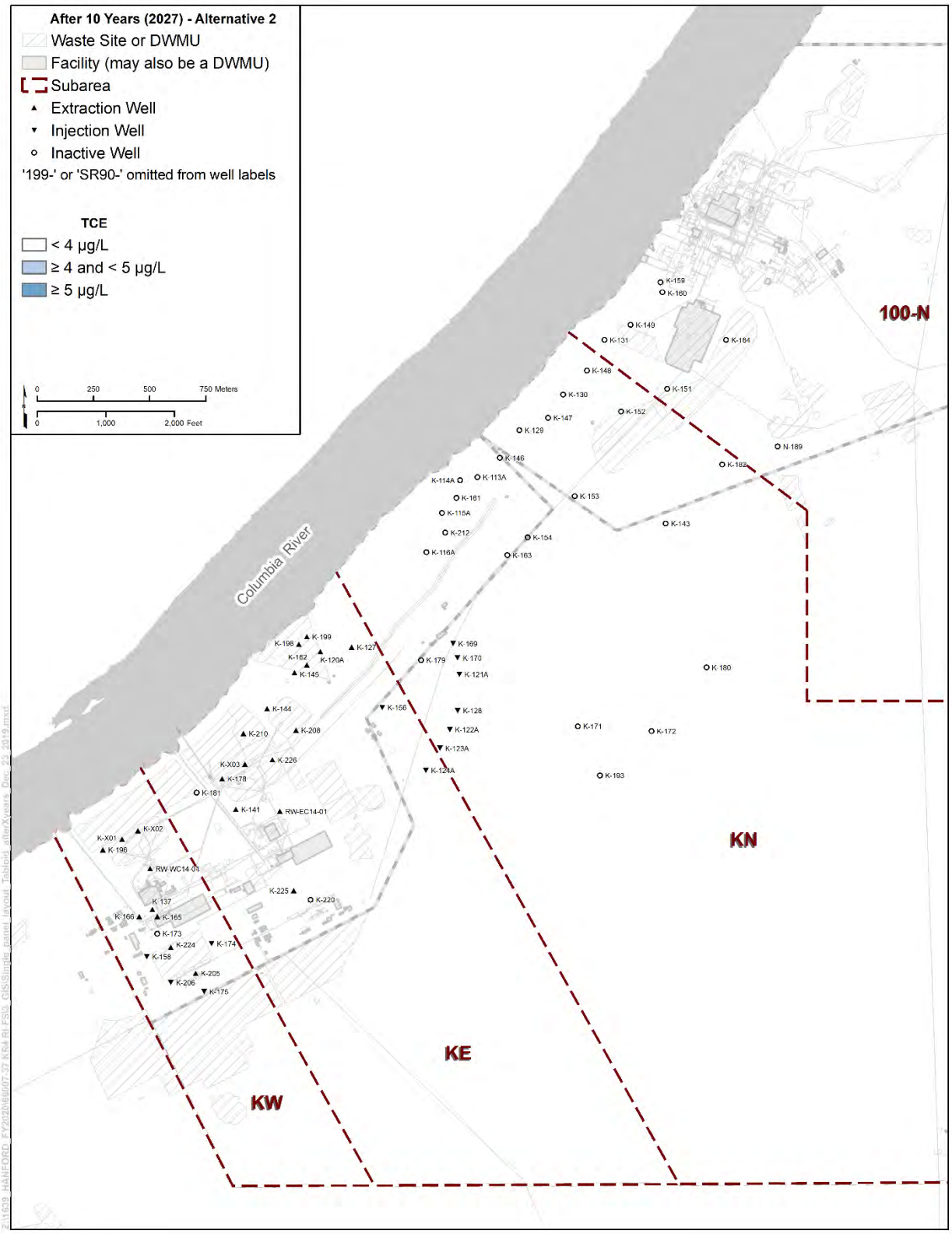


Figure 6-182. TCE: Simulated Distribution after 10 Years (end of 2027) – Alternative 2

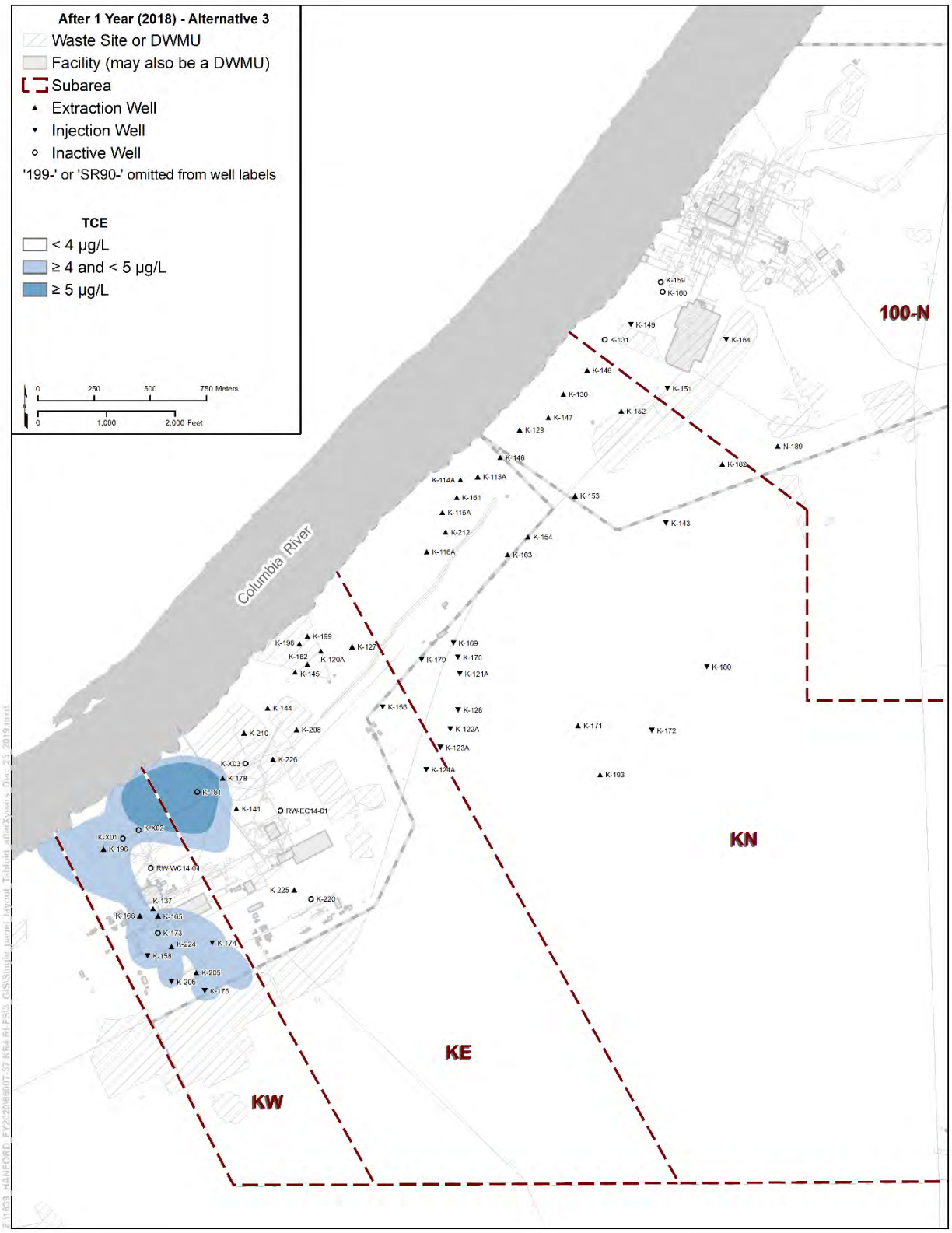


Figure 6-183. TCE: Simulated Distribution after 1 Year (end of 2018) – Alternative 3

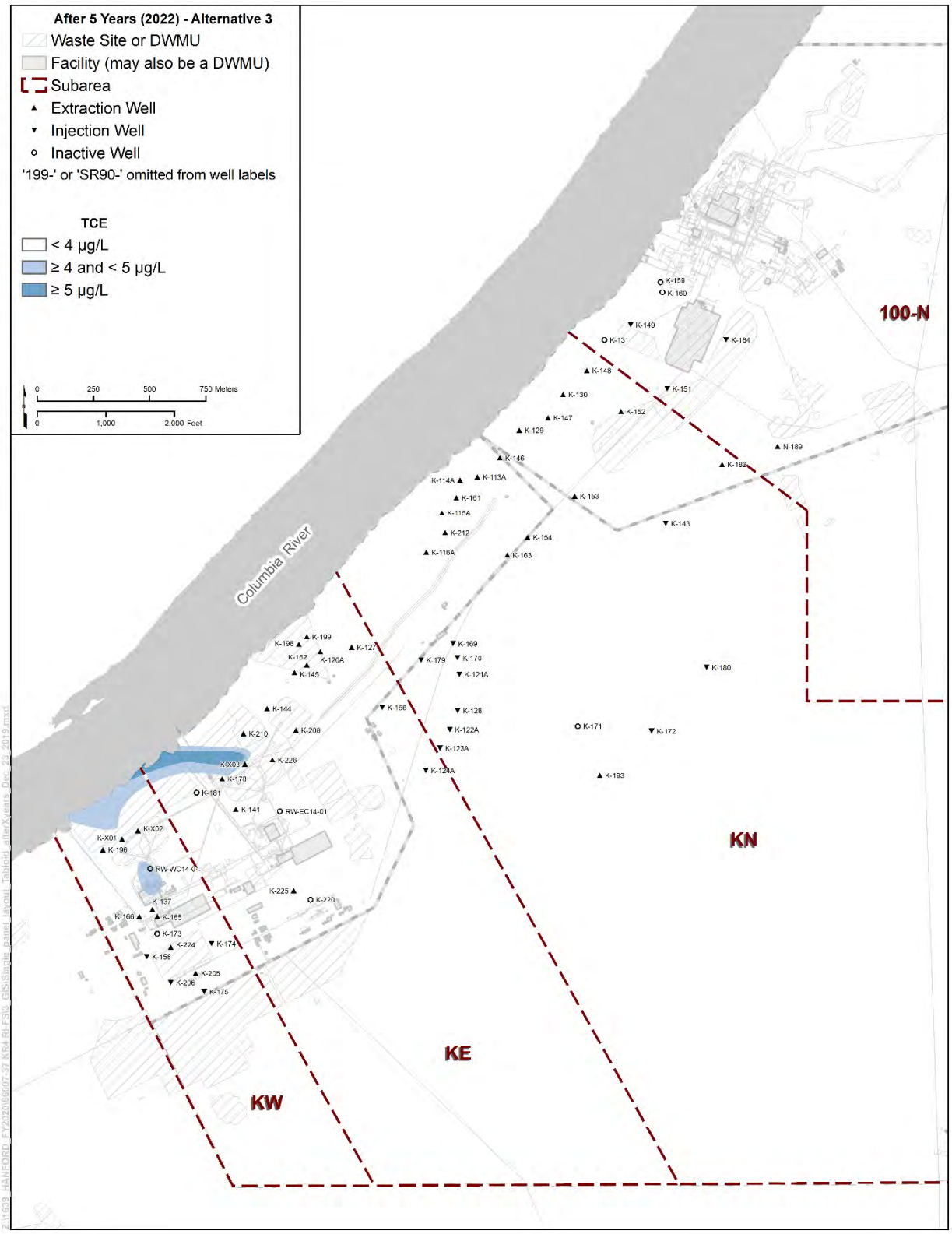


Figure 6-184. TCE: Simulated Distribution after 5 Years (end of 2022) – Alternative 3

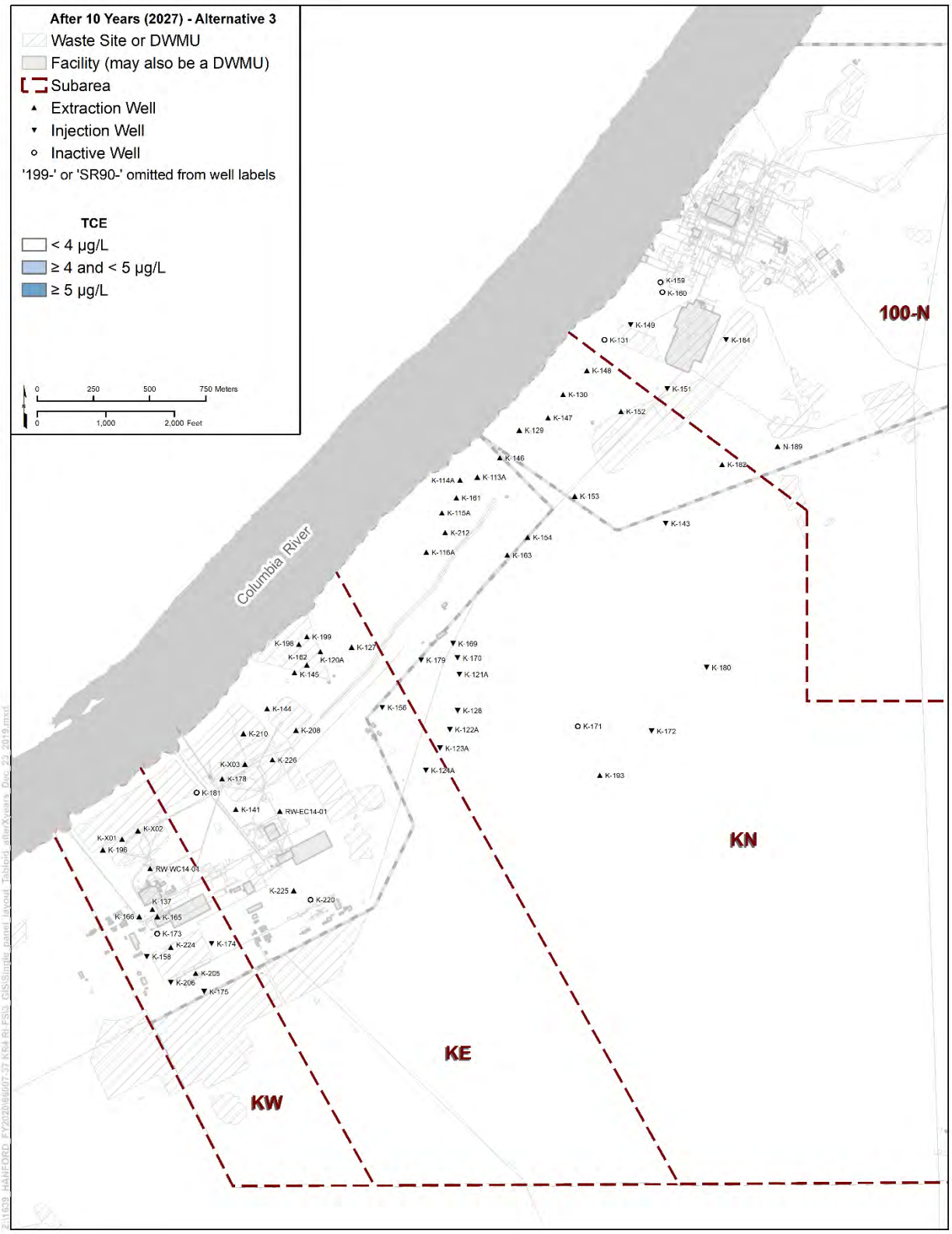


Figure 6-185. TCE: Simulated Distribution after 10 Years (end of 2027) – Alternative 3

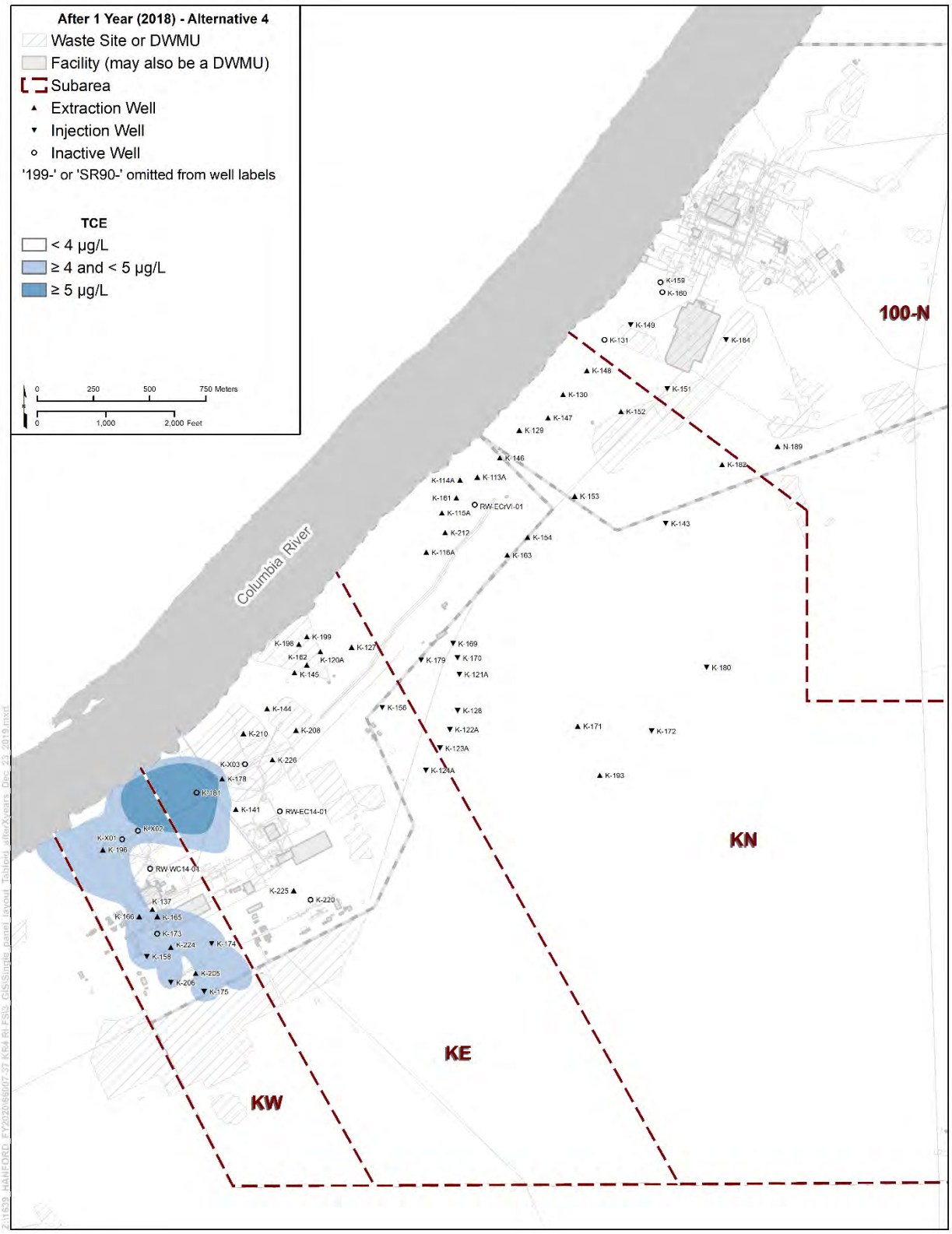


Figure 6-186. TCE: Simulated Distribution after 1 Year (end of 2018) – Alternative 4

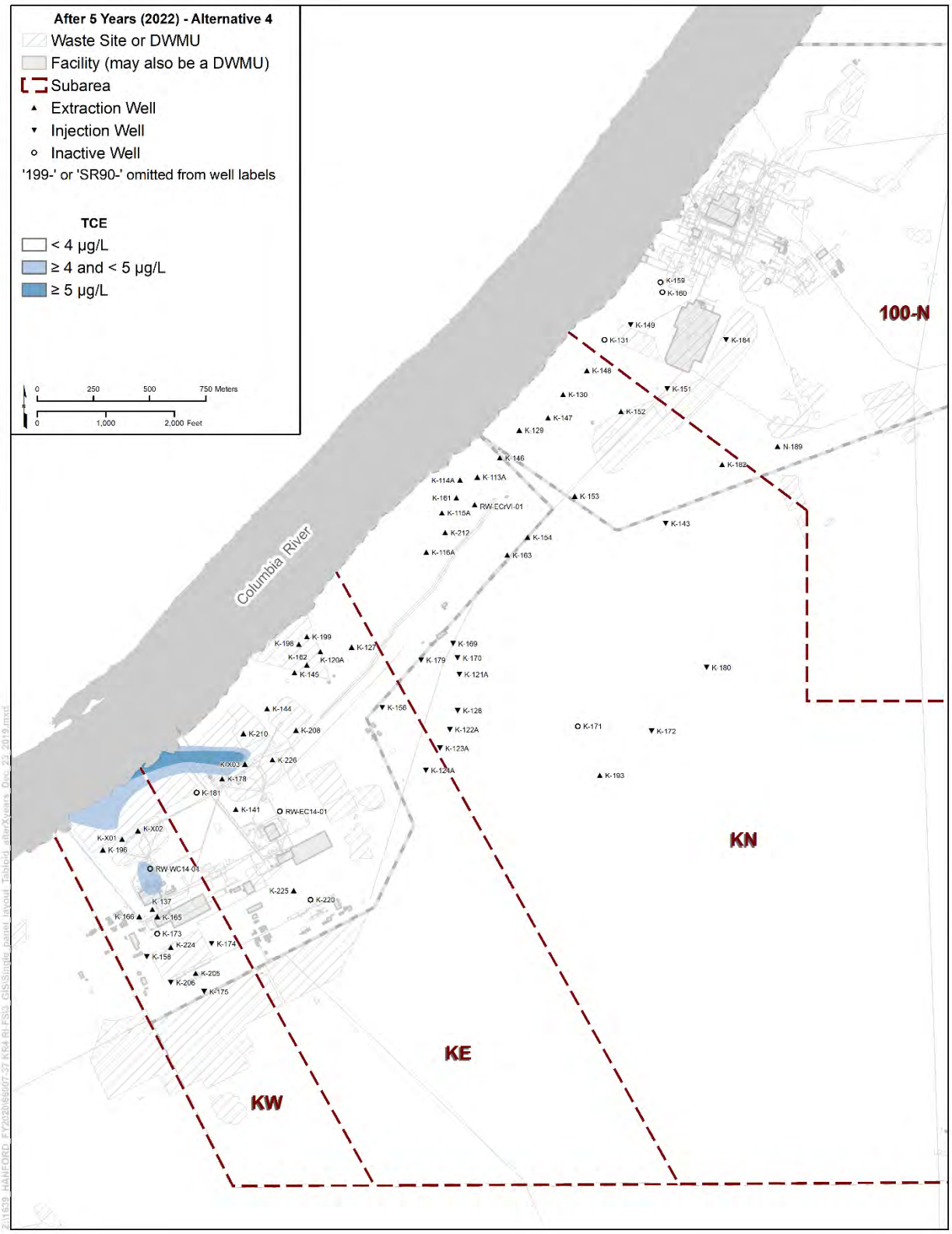


Figure 6-187. TCE: Simulated Distribution after 5 Years (end of 2022) – Alternative 4

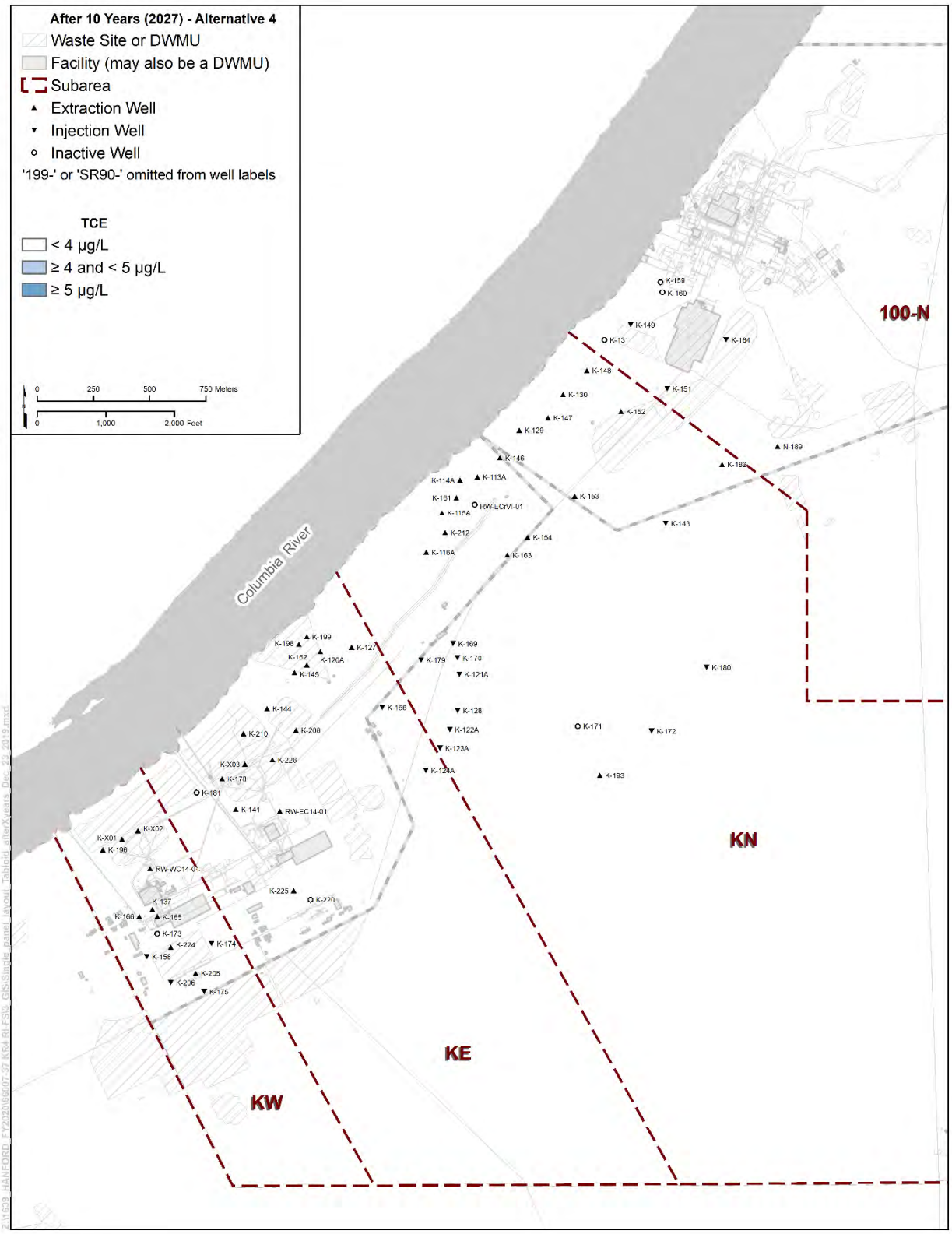


Figure 6-188. TCE: Simulated Distribution after 10 Years (end of 2027) – Alternative 4

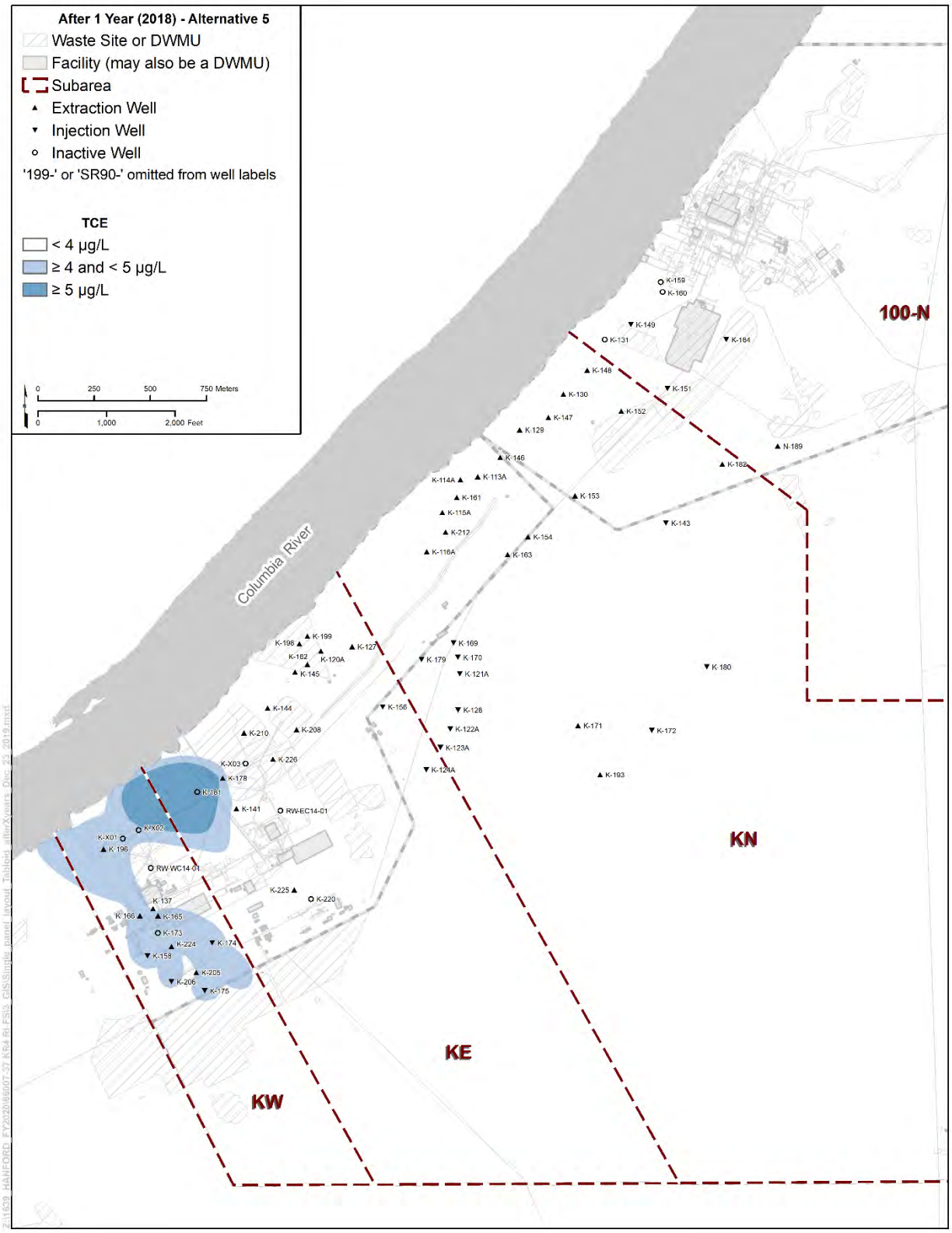


Figure 6-189. TCE: Simulated Distribution after 1 Year (end of 2018) – Alternative 5

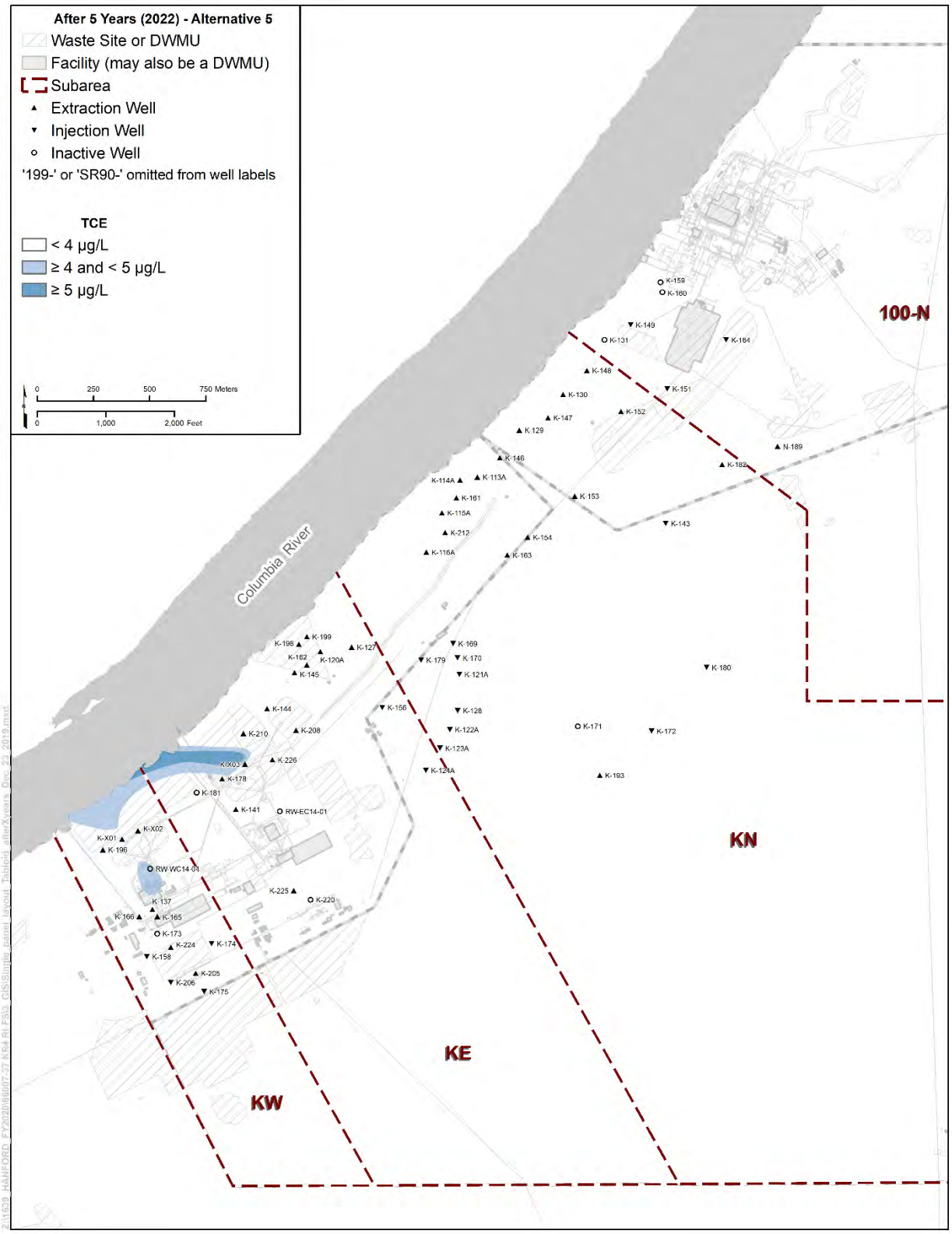


Figure 6-190. TCE: Simulated Distribution after 5 Years (end of 2022) – Alternative 5

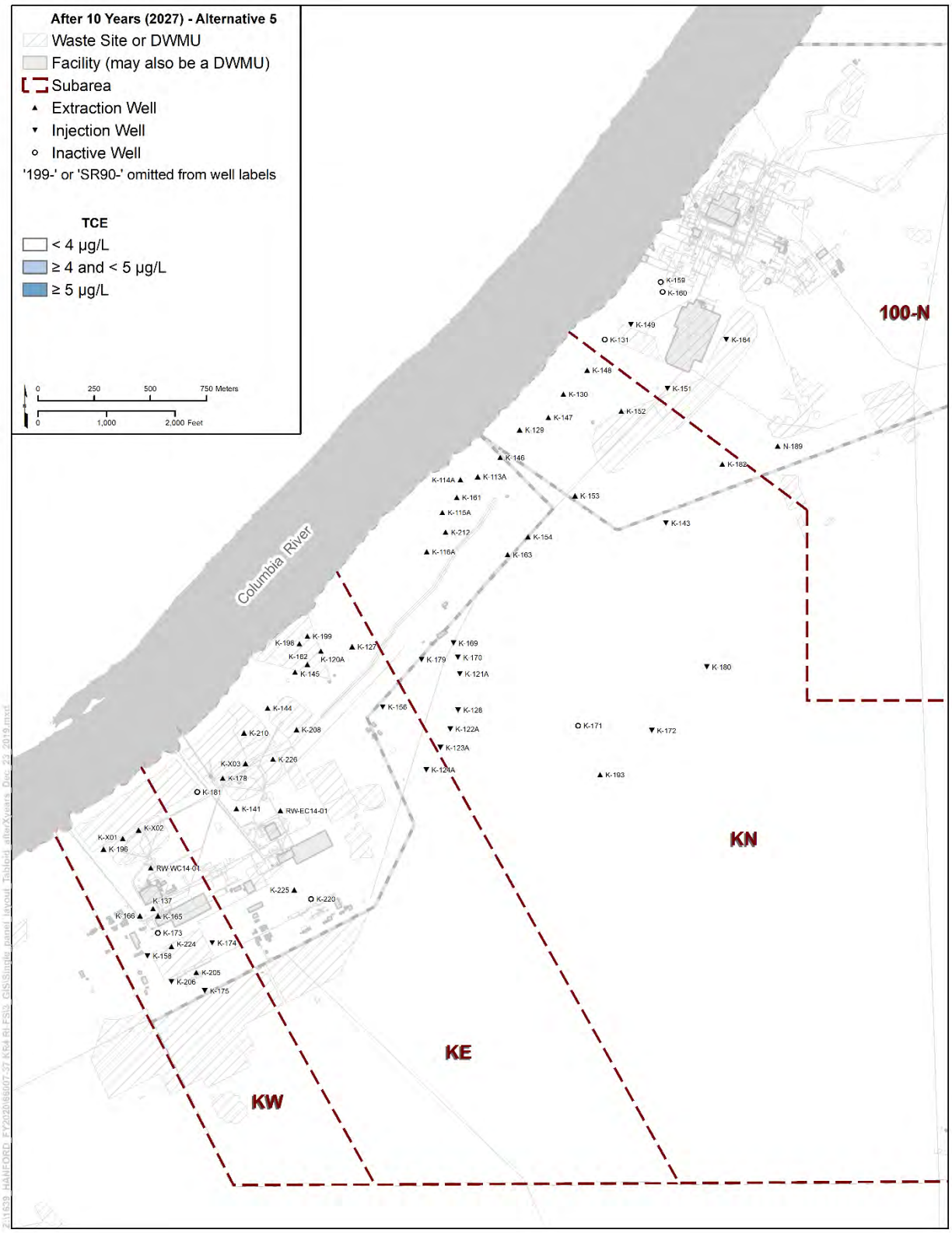


Figure 6-191. TCE: Simulated Distribution after 10 Years (end of 2027) – Alternative 5

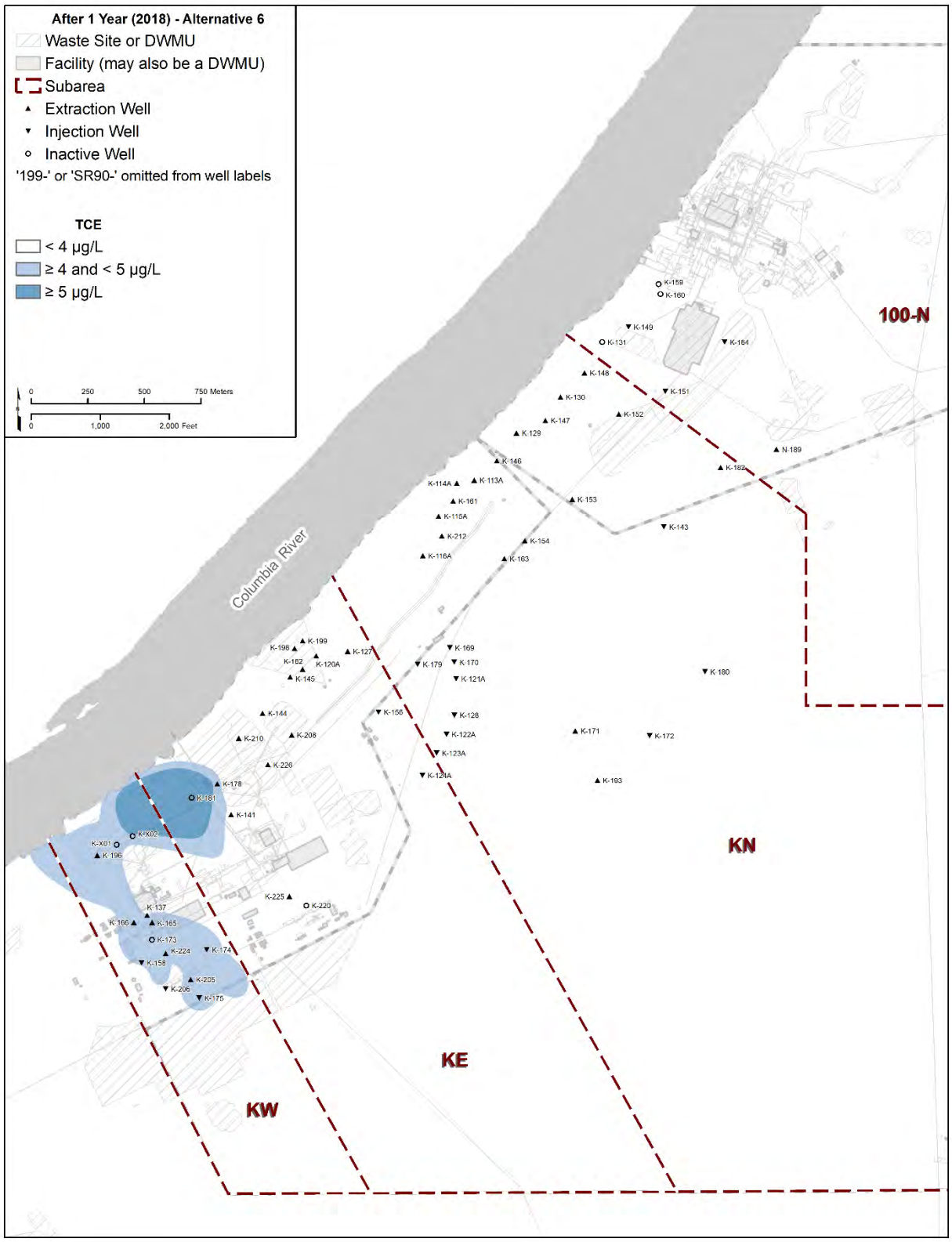


Figure 6-192. TCE: Simulated Distribution after 1 Year (end of 2018) – Alternative 6

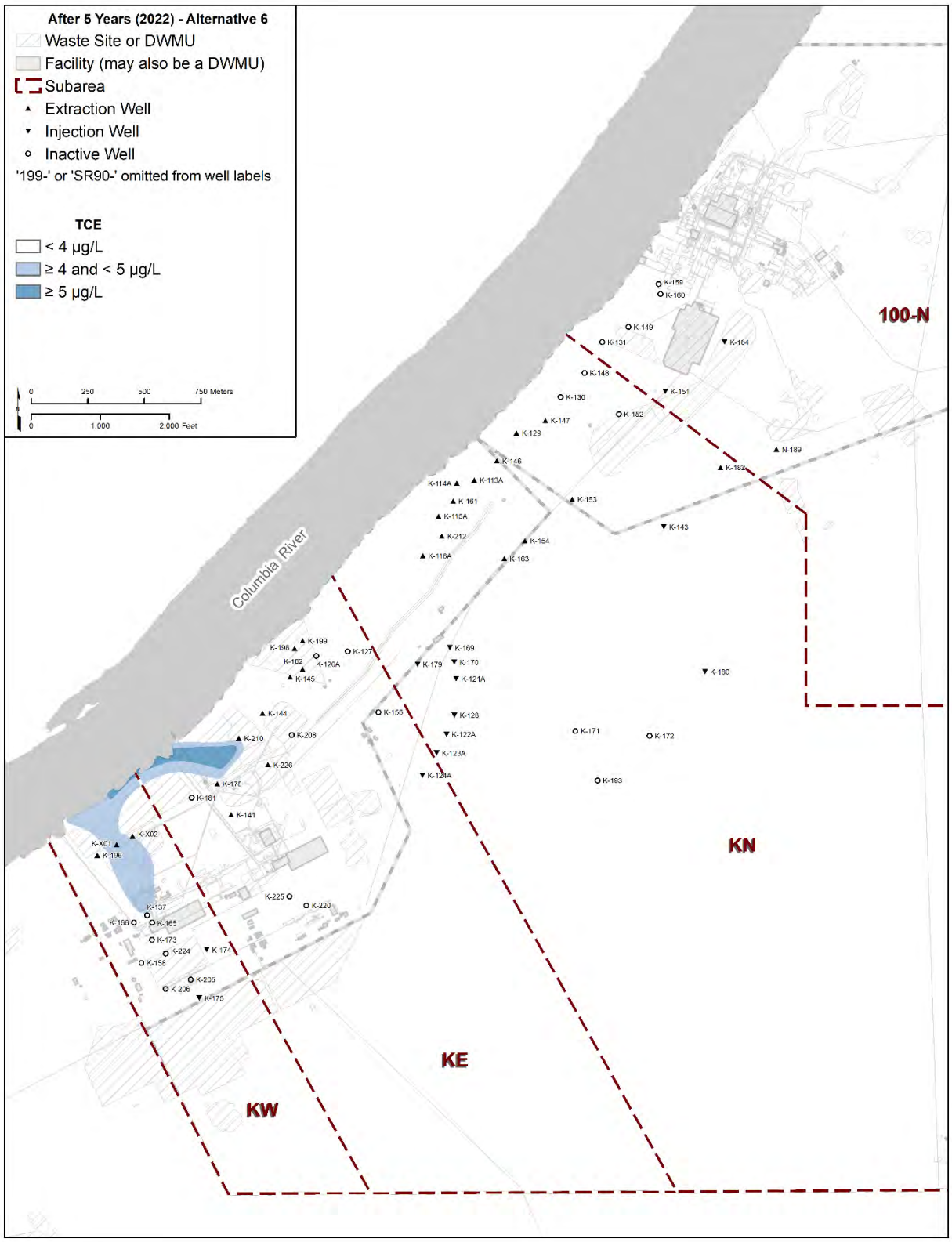


Figure 6-193. TCE: Simulated Distribution after 5 Years (end of 2022) – Alternative 6

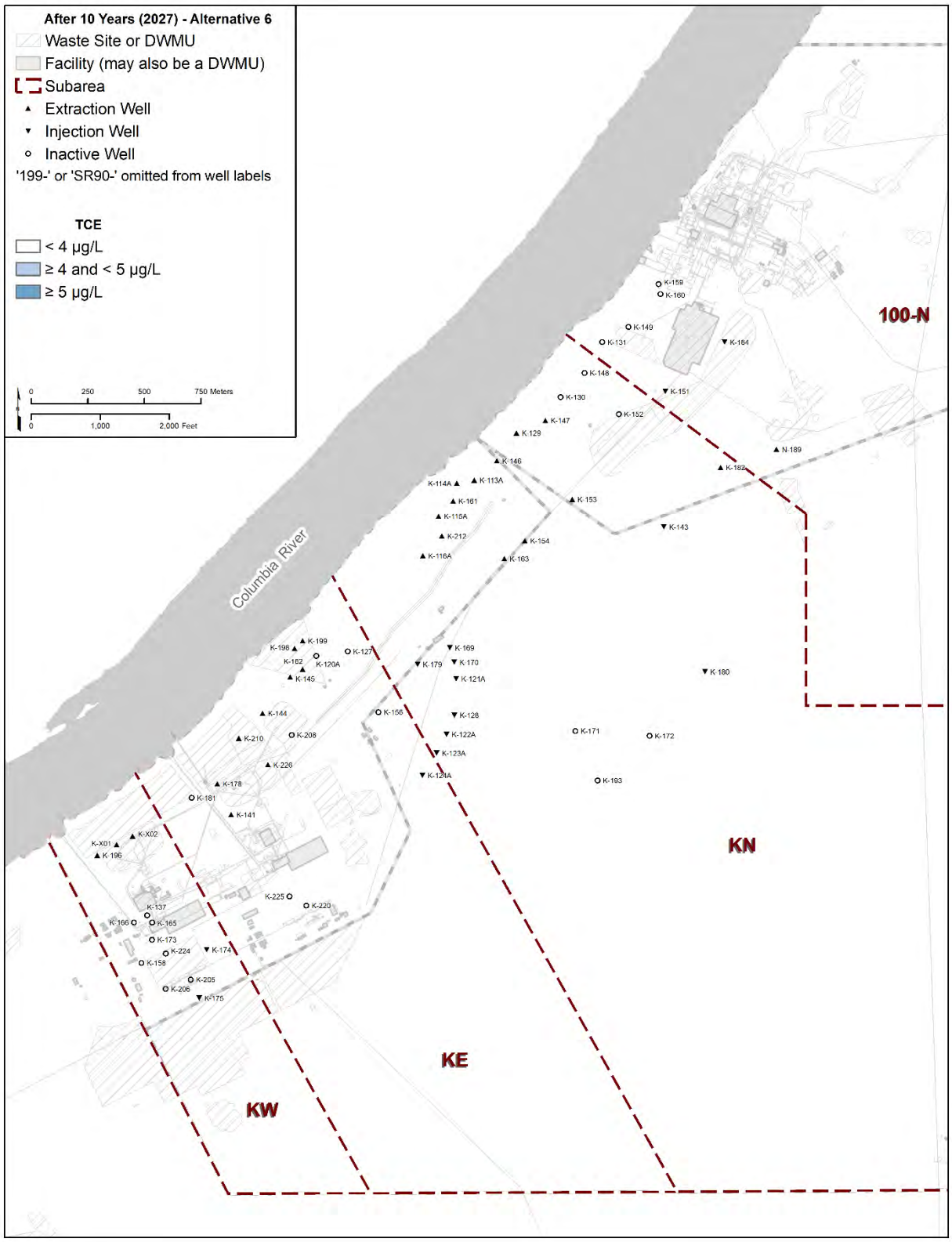
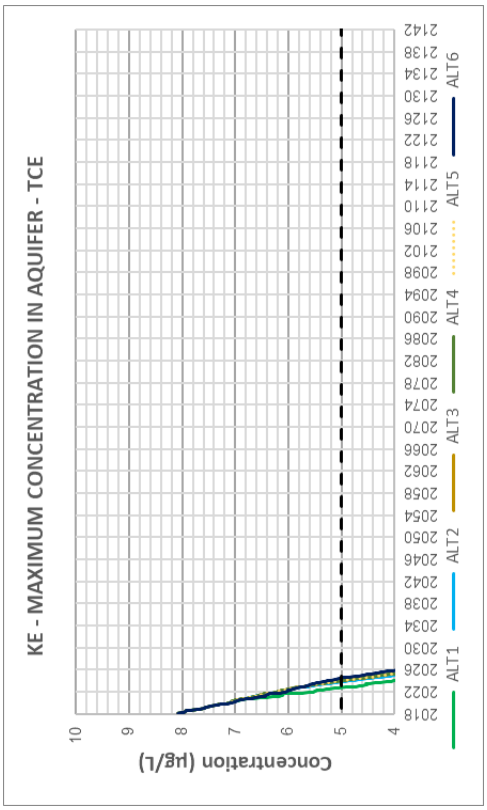
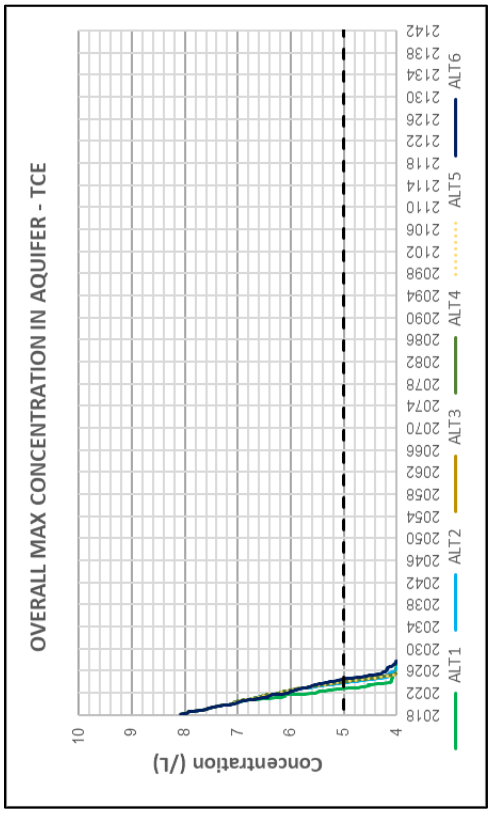
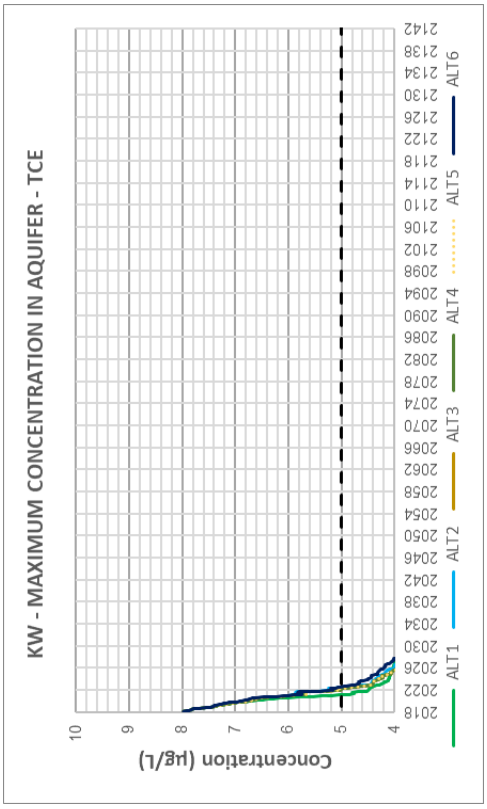


Figure 6-194. TCE: Simulated Distribution after 10 Years (end of 2027) – Alternative 6







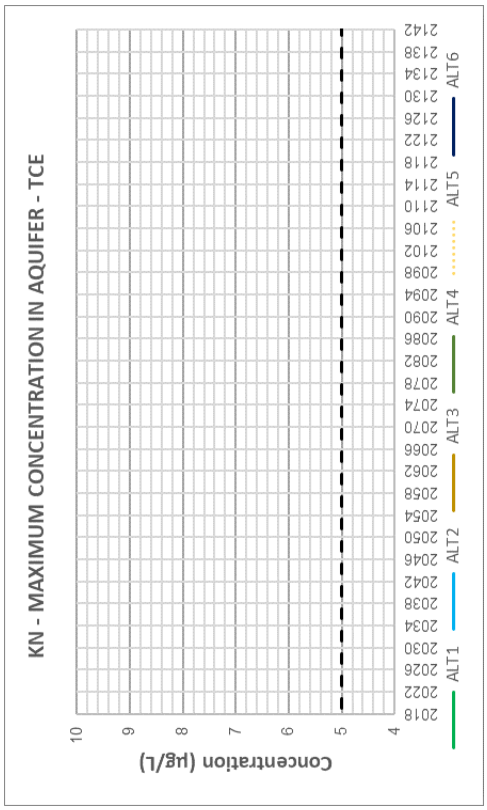


Figure 6-195. TCE: Maximum Concentration Time Series in the Aquifer

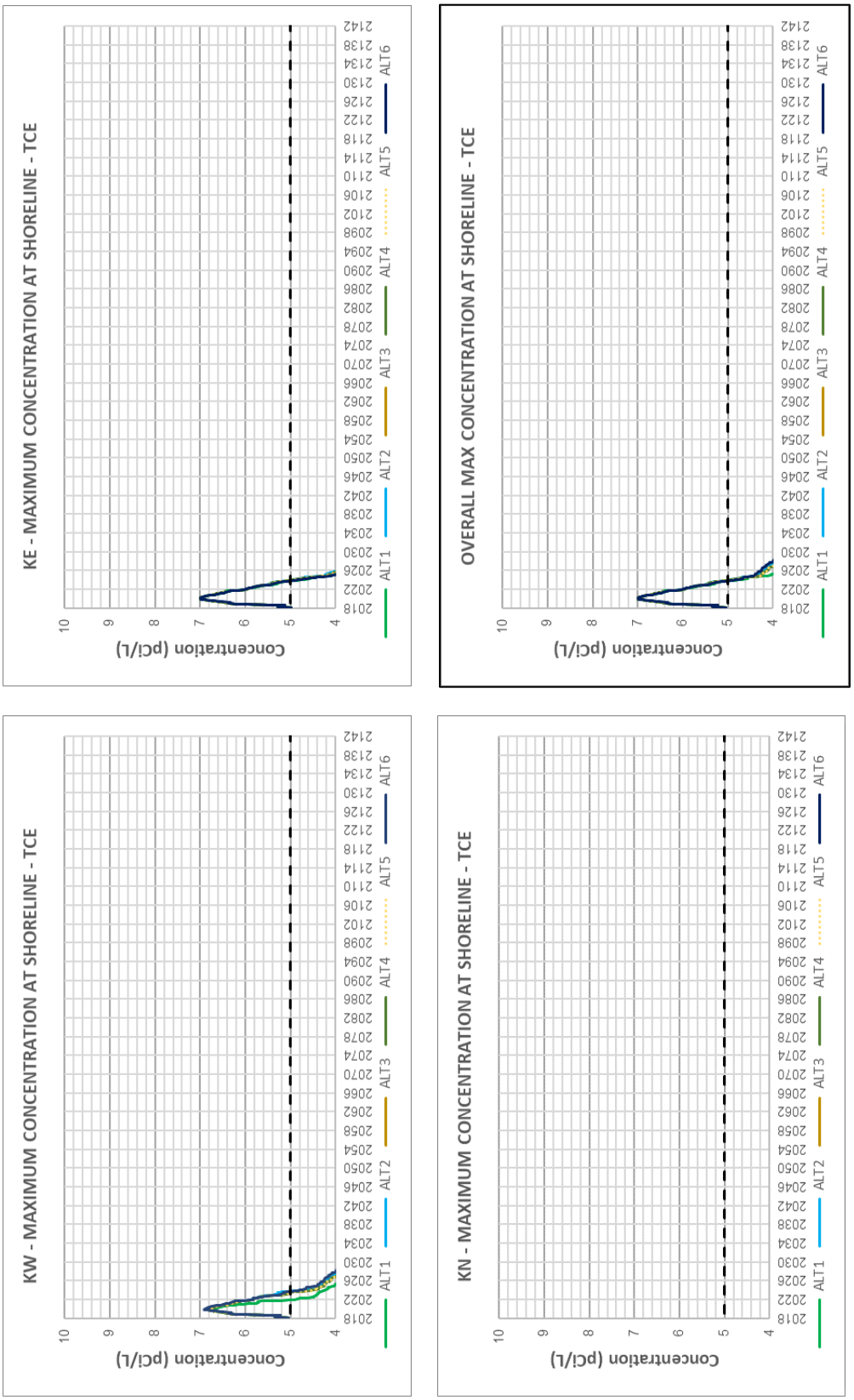


Figure 6-196. TCE: Maximum Concentration Time Series at the Shoreline

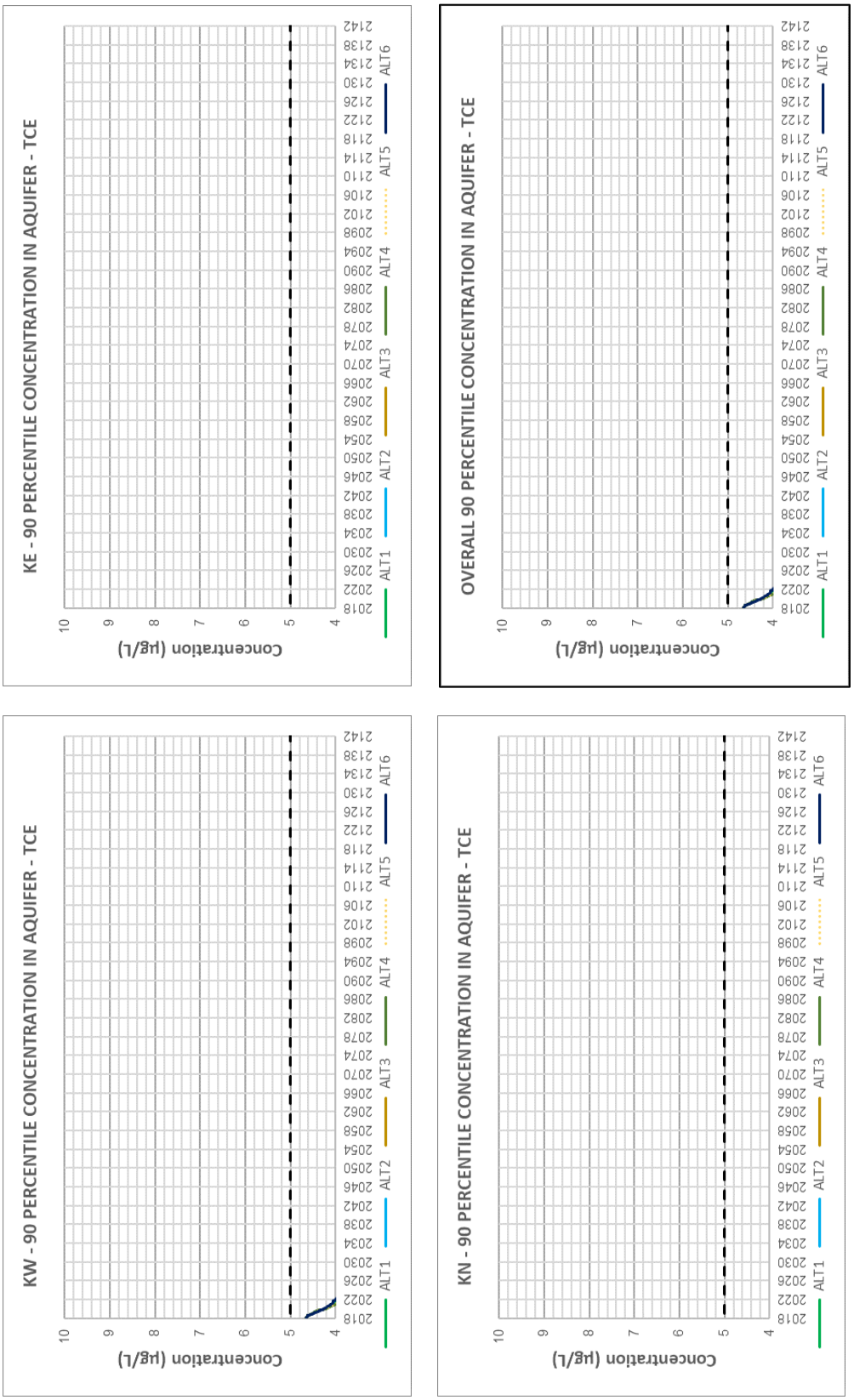


Figure 6-197. TCE: 90th Percentile Concentration Time Series in the Aquifer

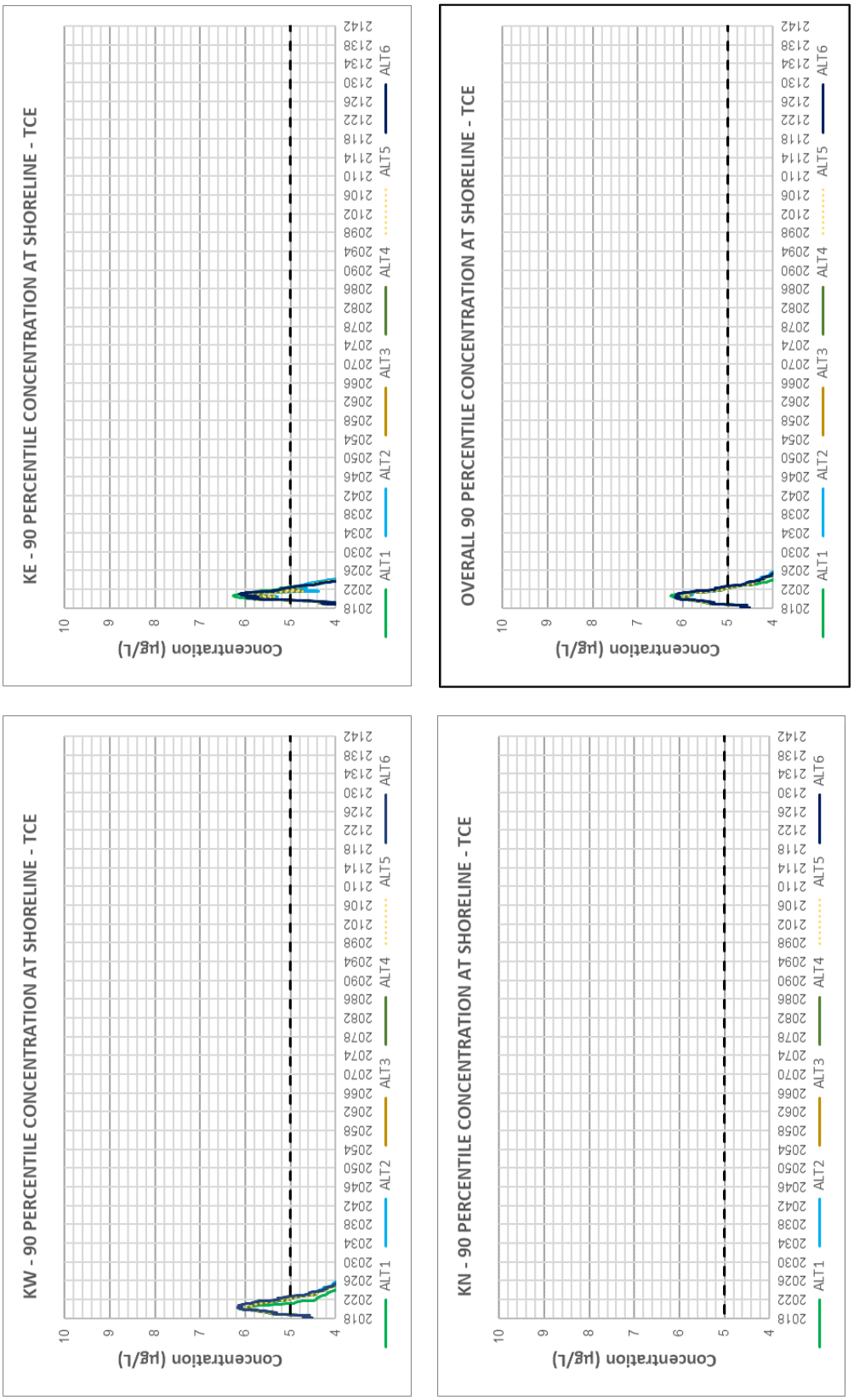


Figure 6-198. TCE: 90th Percentile Concentration Time Series at the Shoreline

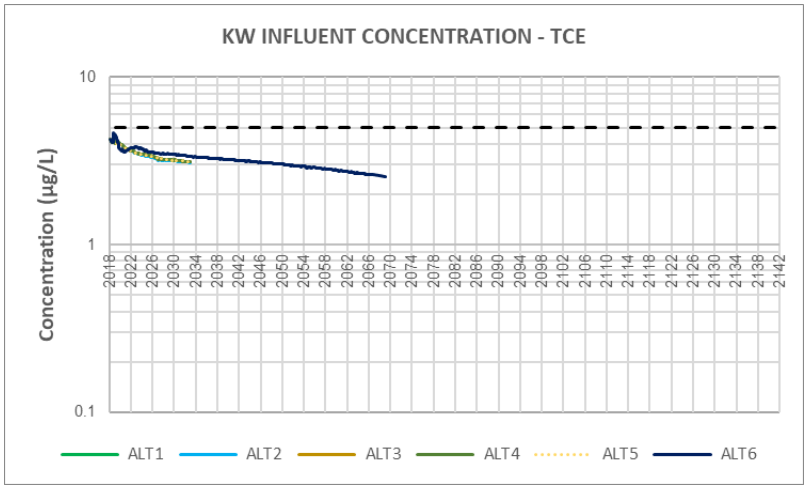


Figure 6-199. TCE: Combined Influent Concentration Time Series – KW System

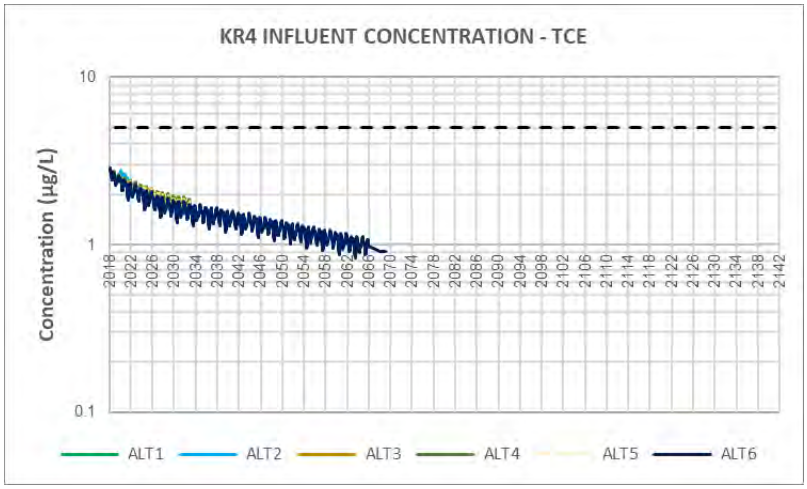


Figure 6-200. TCE: Combined Influent Concentration Time Series – KR4 System

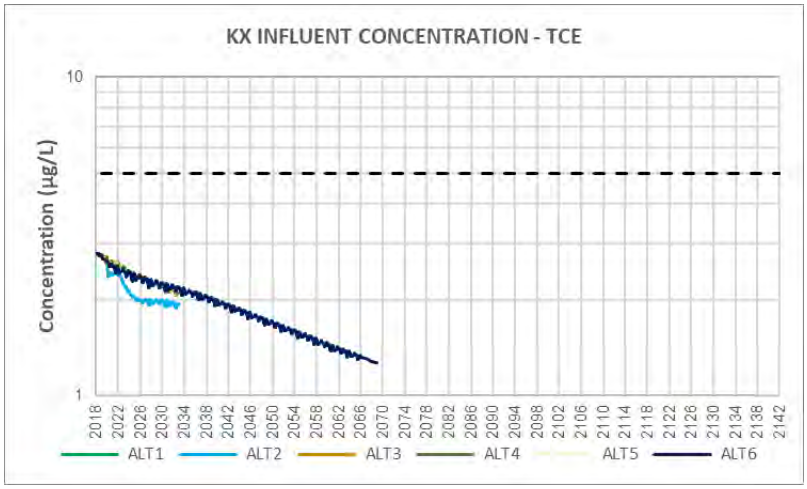


Figure 6-201. TCE: Combined Influent Concentration Time Series – KX System

6.1.6 Simulated Contaminant Distribution – Concentration Statistics: Tritium

Results for tritium are grouped in the following sets of figures:

- Figures 6-202 to 6-219: simulated concentration distributions for each alternative.
- Figures 6-220 to 6-221: maximum concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-222 to 6-223: 90th percentile concentration time series for each subarea and overall summary for the entire 100-K OU (all alternatives).
- Figures 6-224 to 6-226: combined influent concentration time series per treatment system for each alternative.

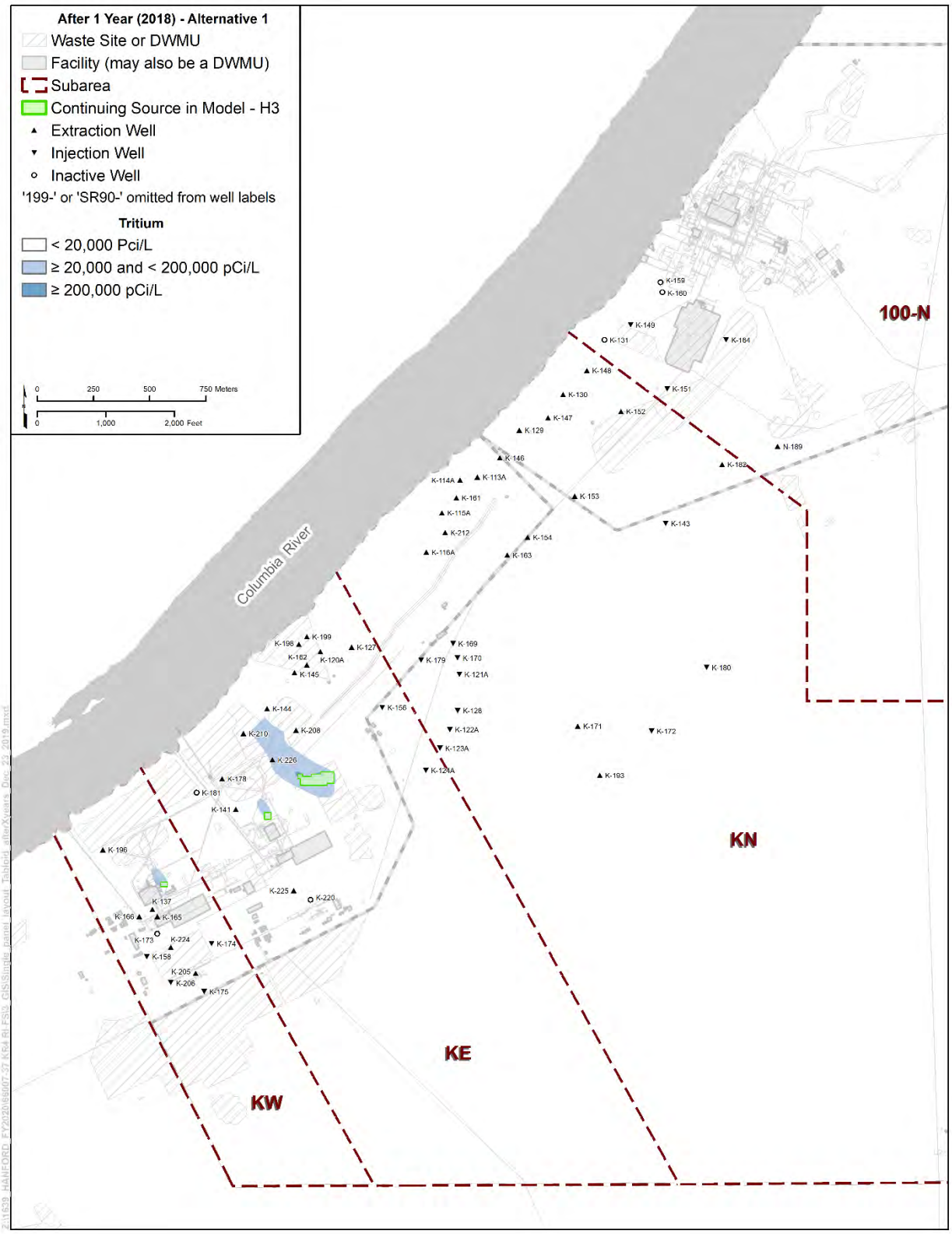


Figure 6-202. Tritium: Simulated Distribution after 1 Year (end of 2018) – Alternative 1

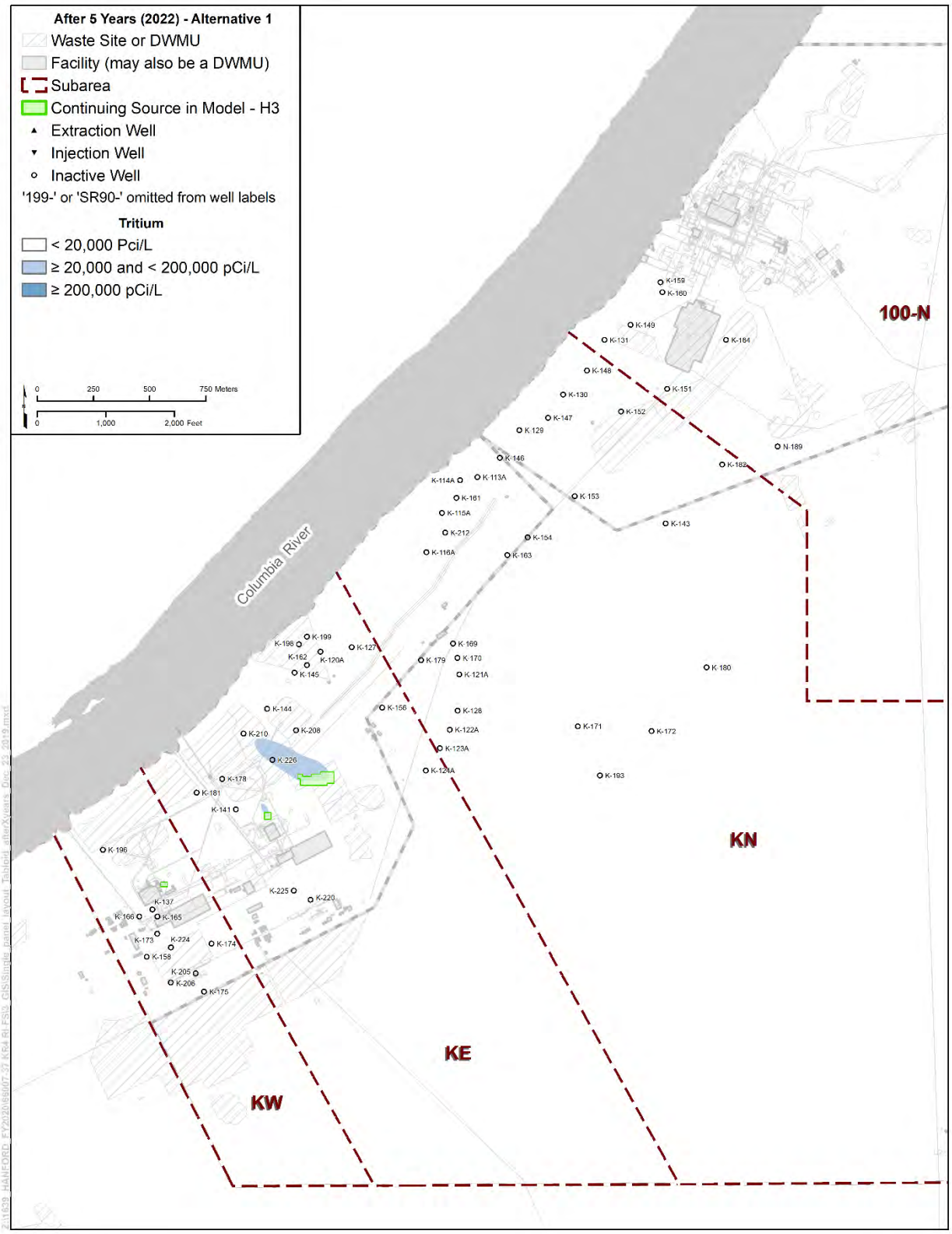


Figure 6-203. Tritium: Simulated Distribution after 5 Years (end of 2022) – Alternative 1

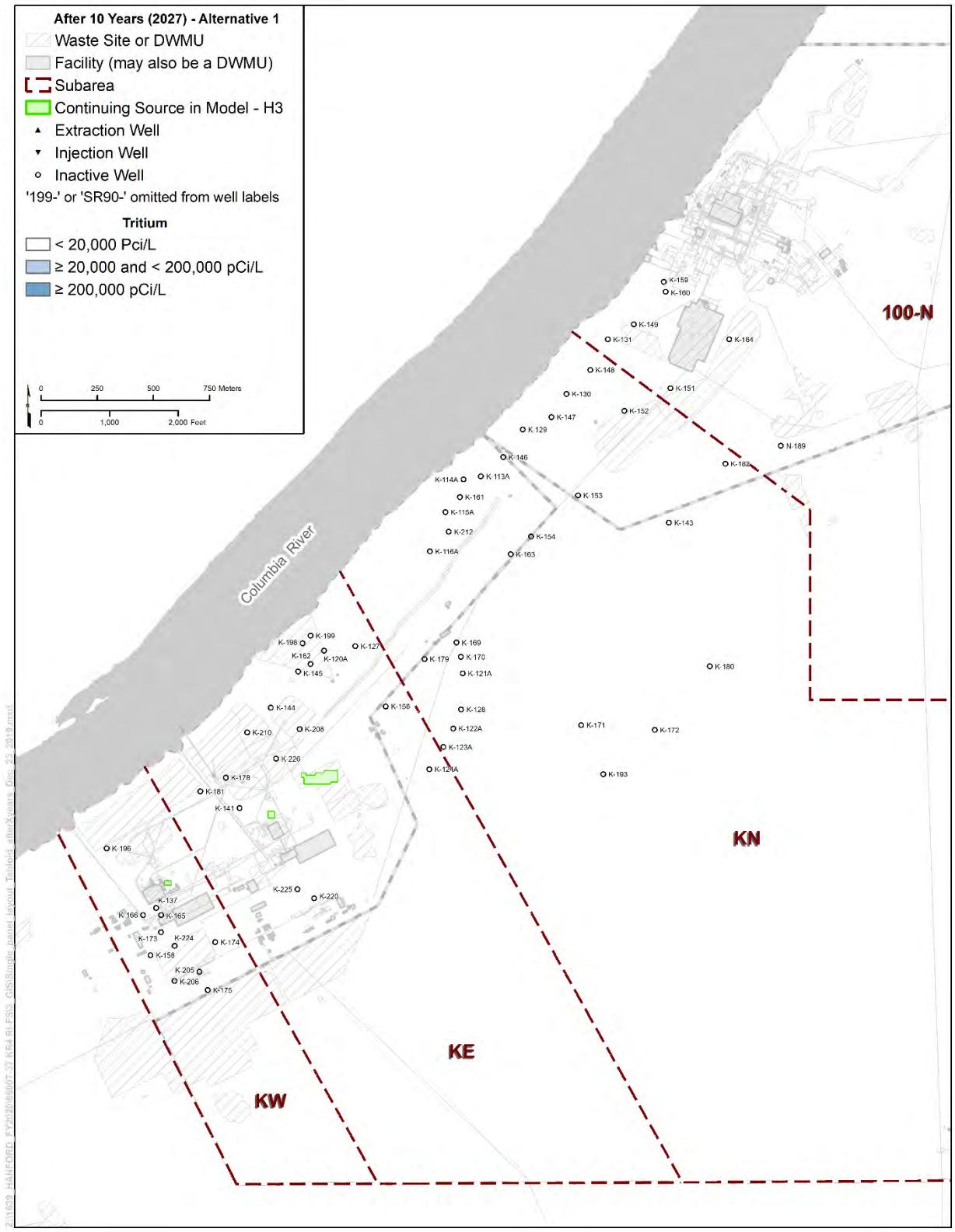


Figure 6-204. Tritium: Simulated Distribution after 10 Years (end of 2027) – Alternative 1

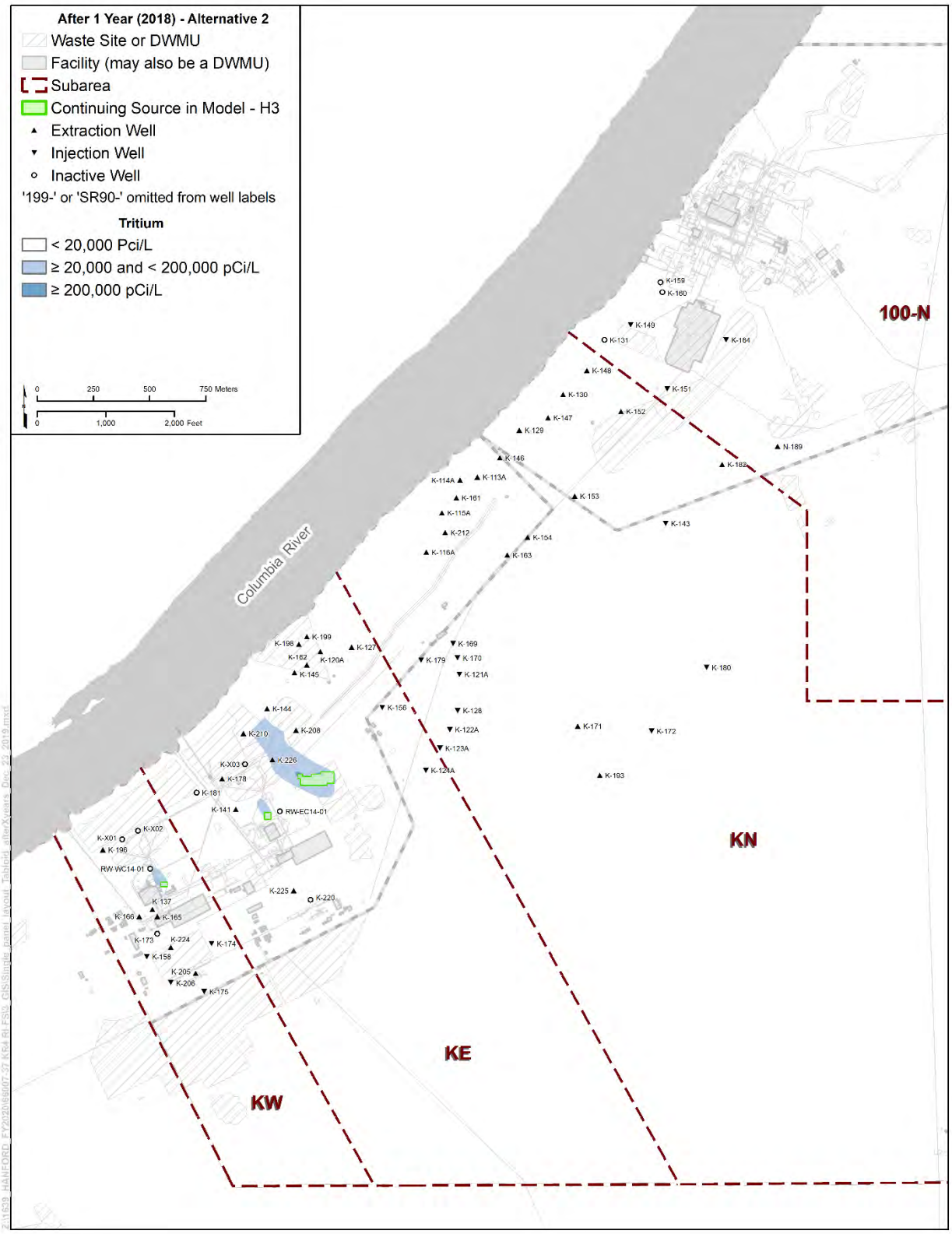


Figure 6-205. Tritium: Simulated Distribution after 1 Year (end of 2018) – Alternative 2

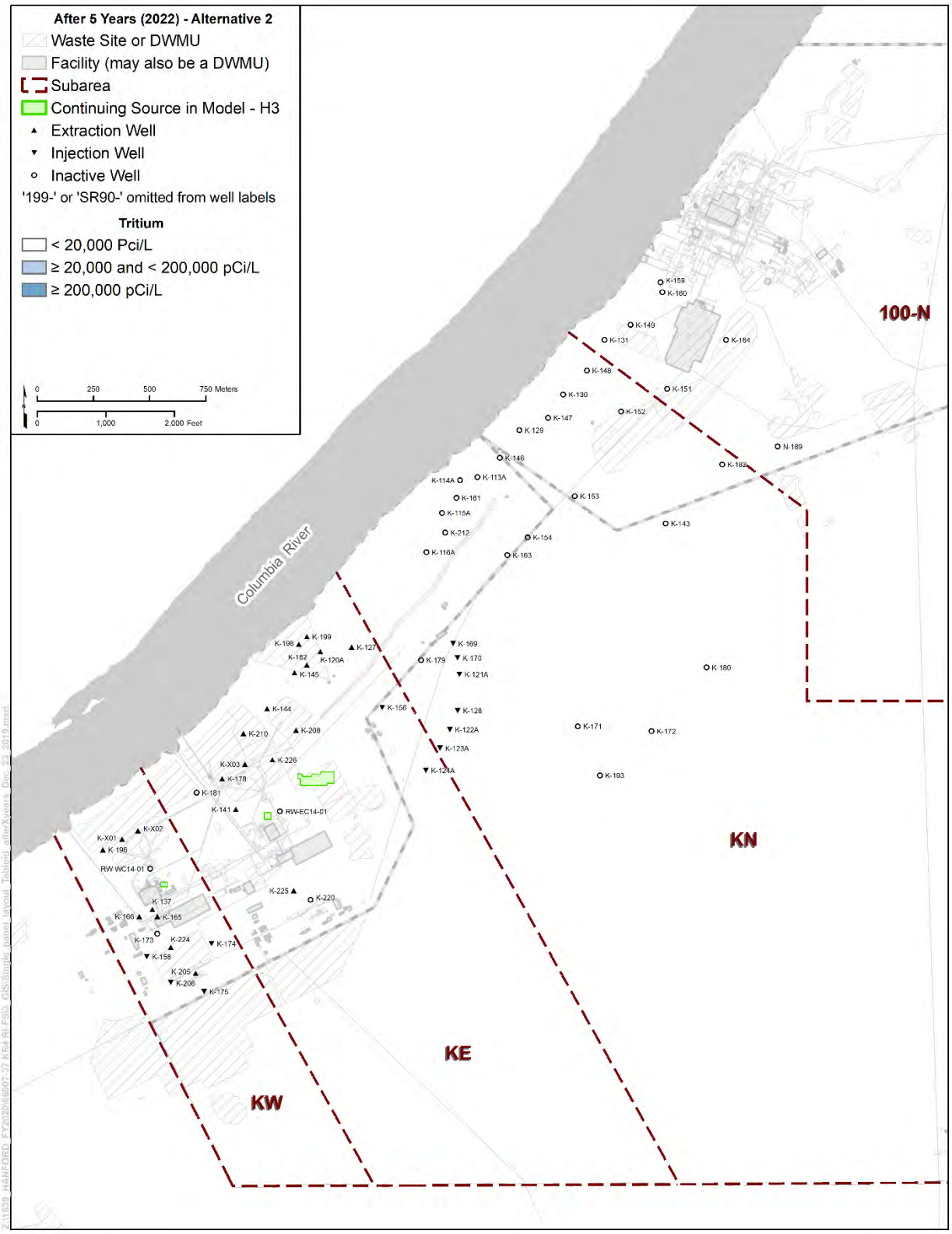


Figure 6-206. Tritium: Simulated Distribution after 5 Years (end of 2022) – Alternative 2

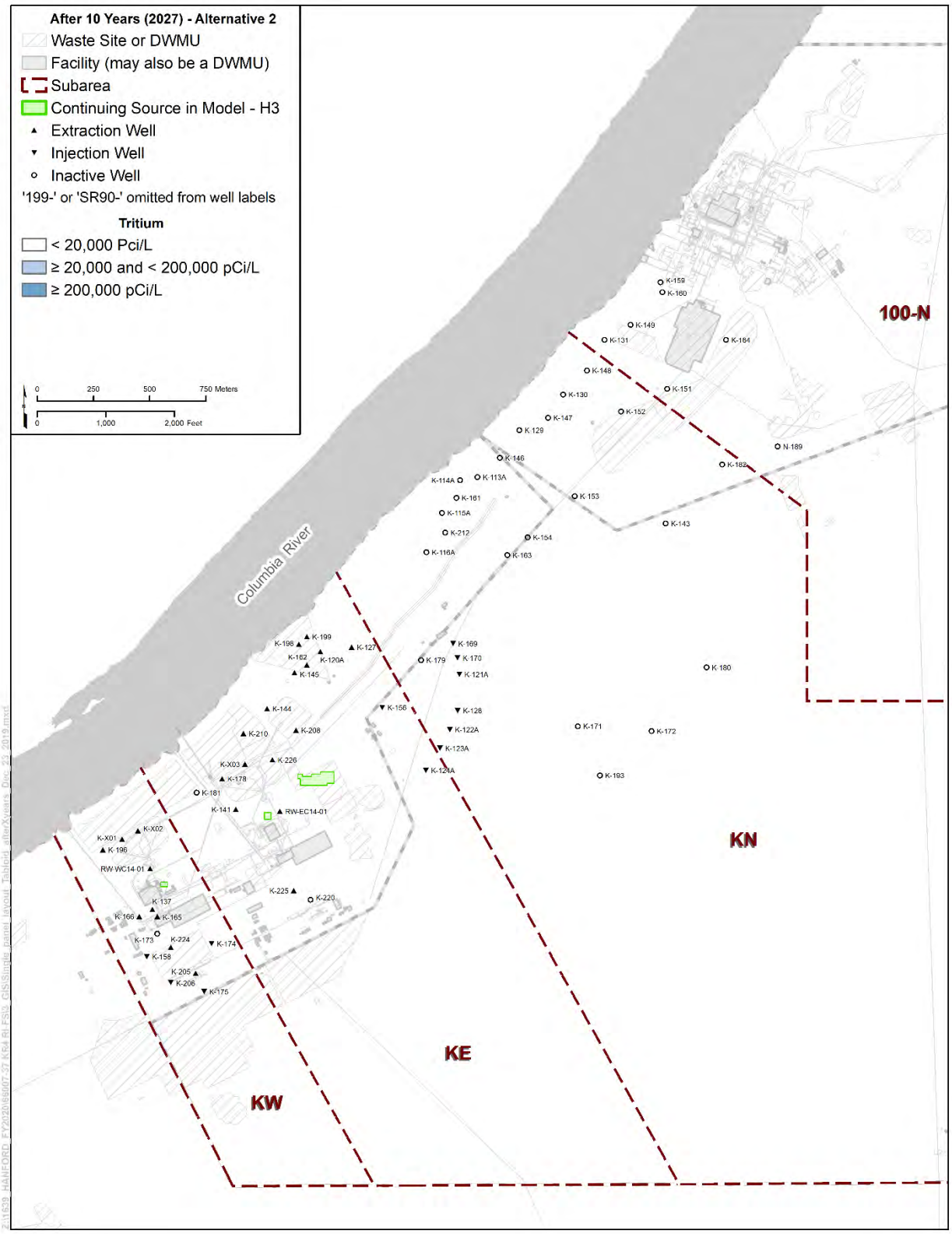


Figure 6-207. Tritium: Simulated Distribution after 10 Years (end of 2027) – Alternative 2

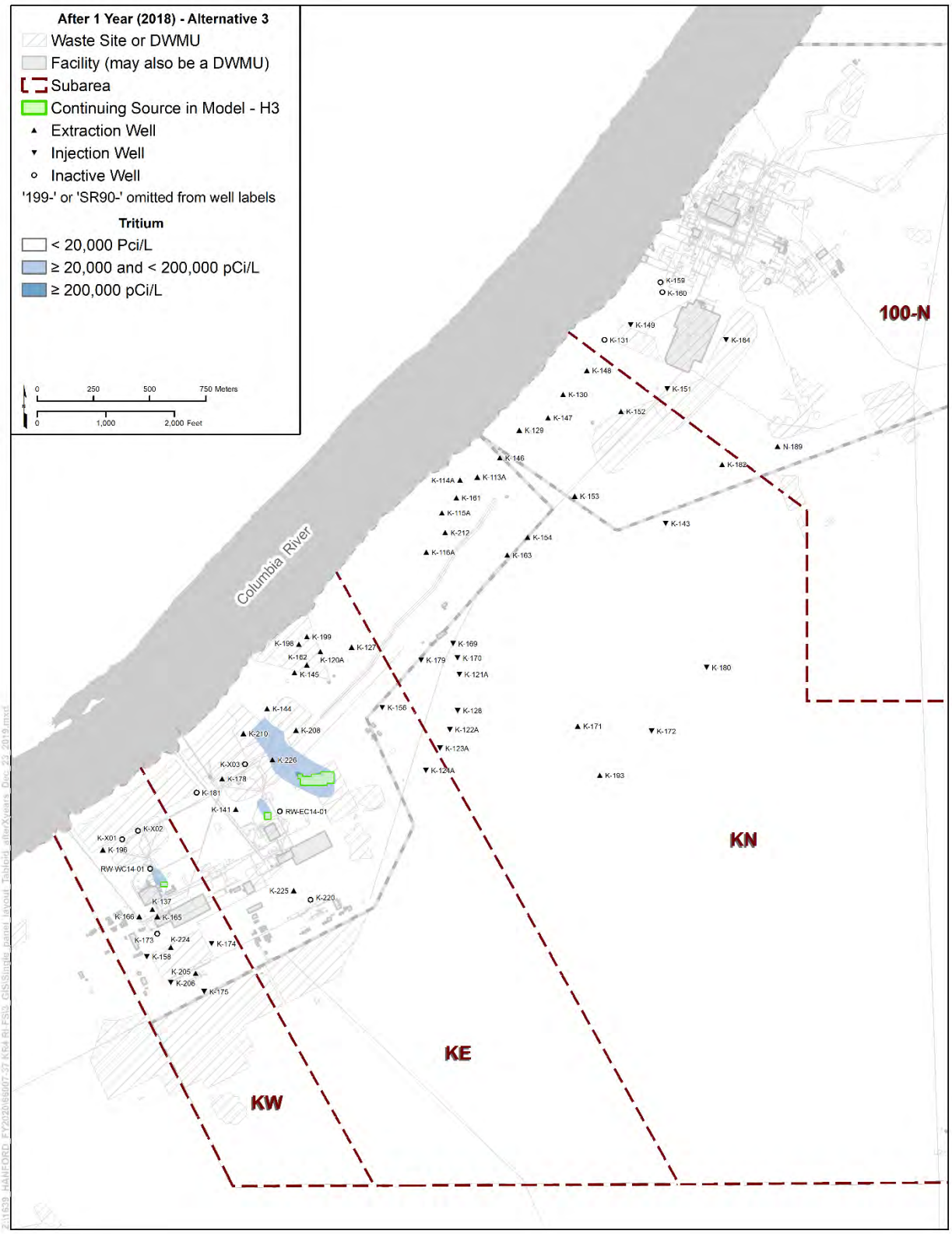


Figure 6-208. Tritium: Simulated Distribution after 1 Year (end of 2018) – Alternative 3

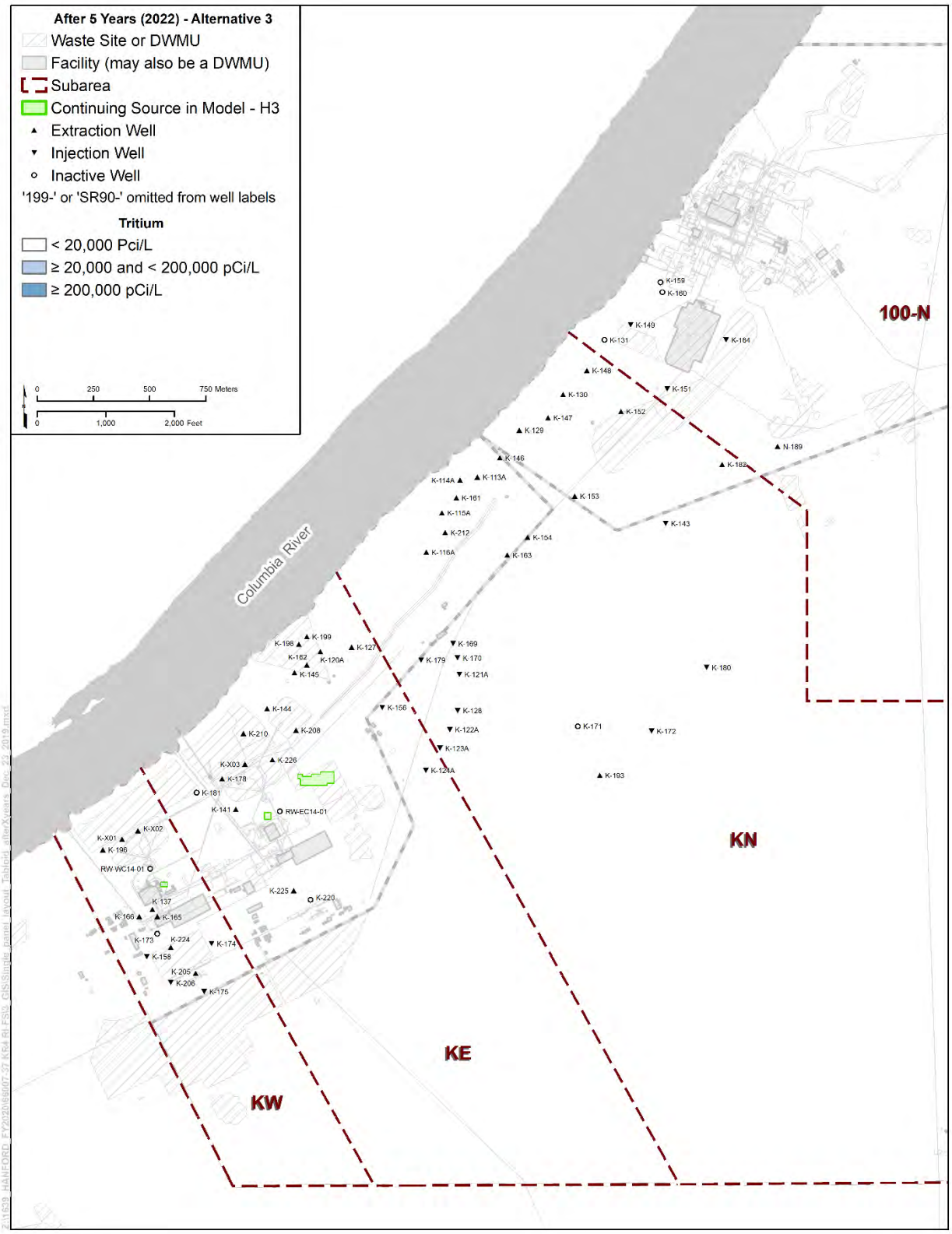


Figure 6-209. Tritium: Simulated Distribution after 5 Years (end of 2022) – Alternative 3

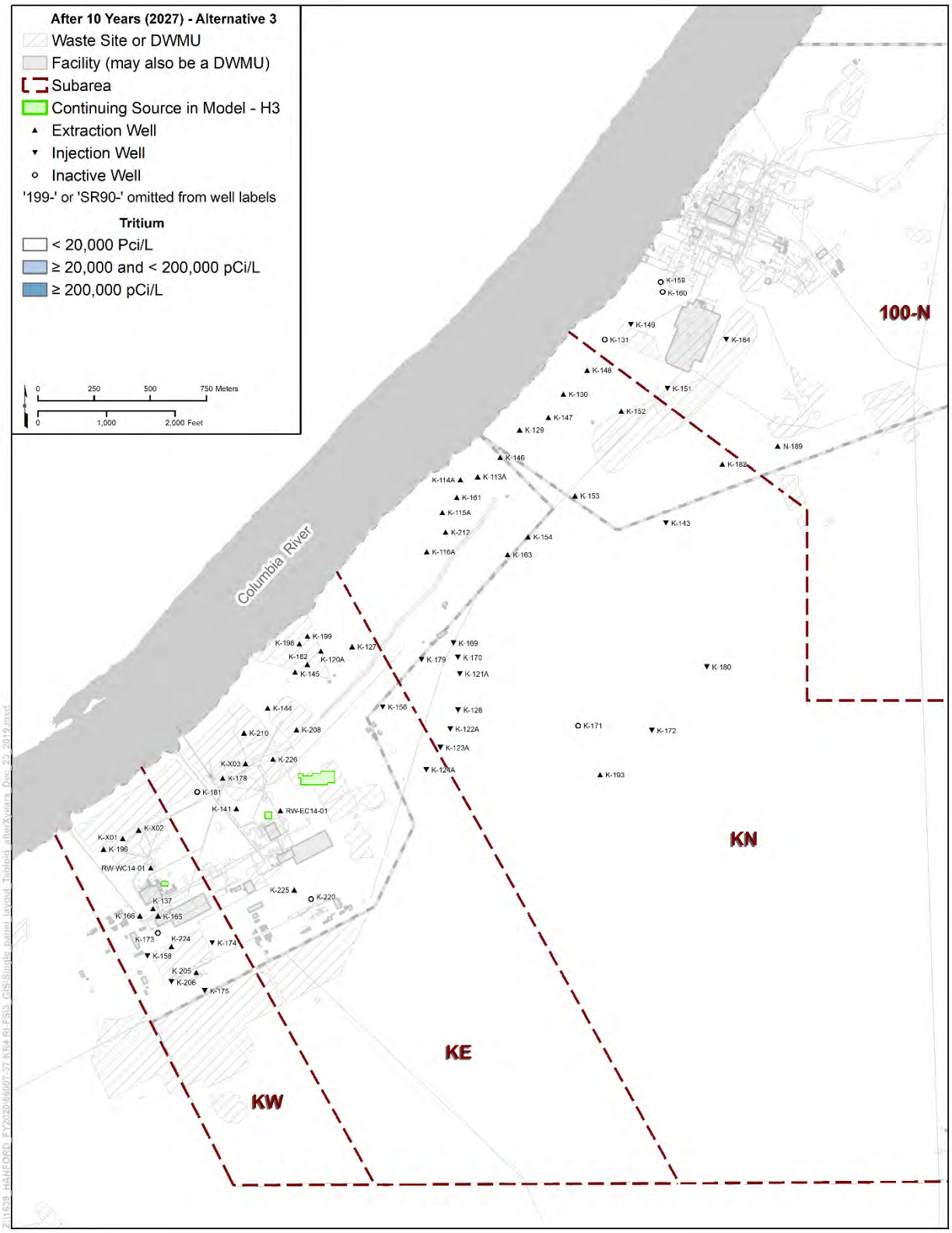


Figure 6-210. Tritium: Simulated Distribution after 10 Years (end of 2027) – Alternative 3

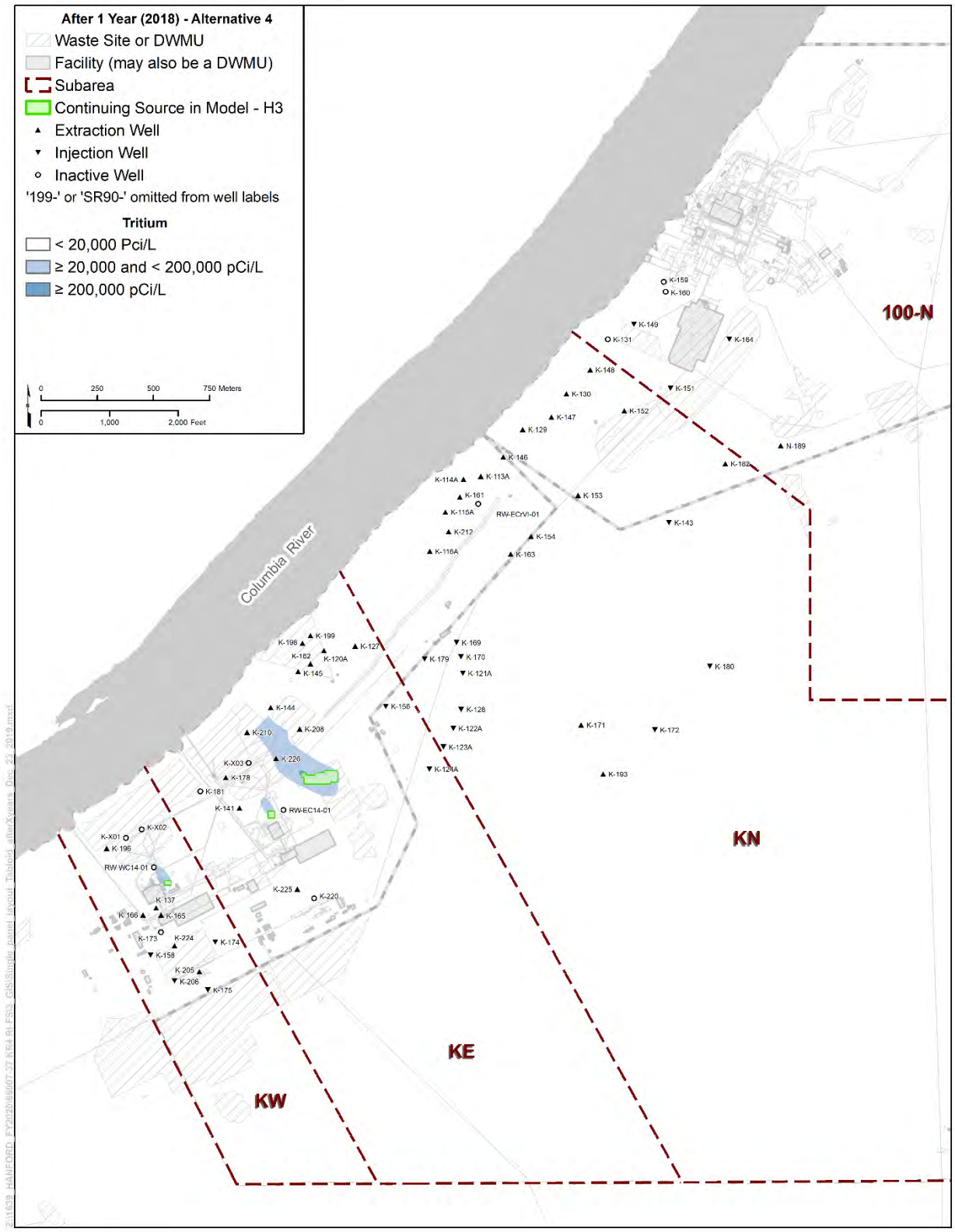


Figure 6-211. Tritium: Simulated Distribution after 1 Year (end of 2018) – Alternative 4

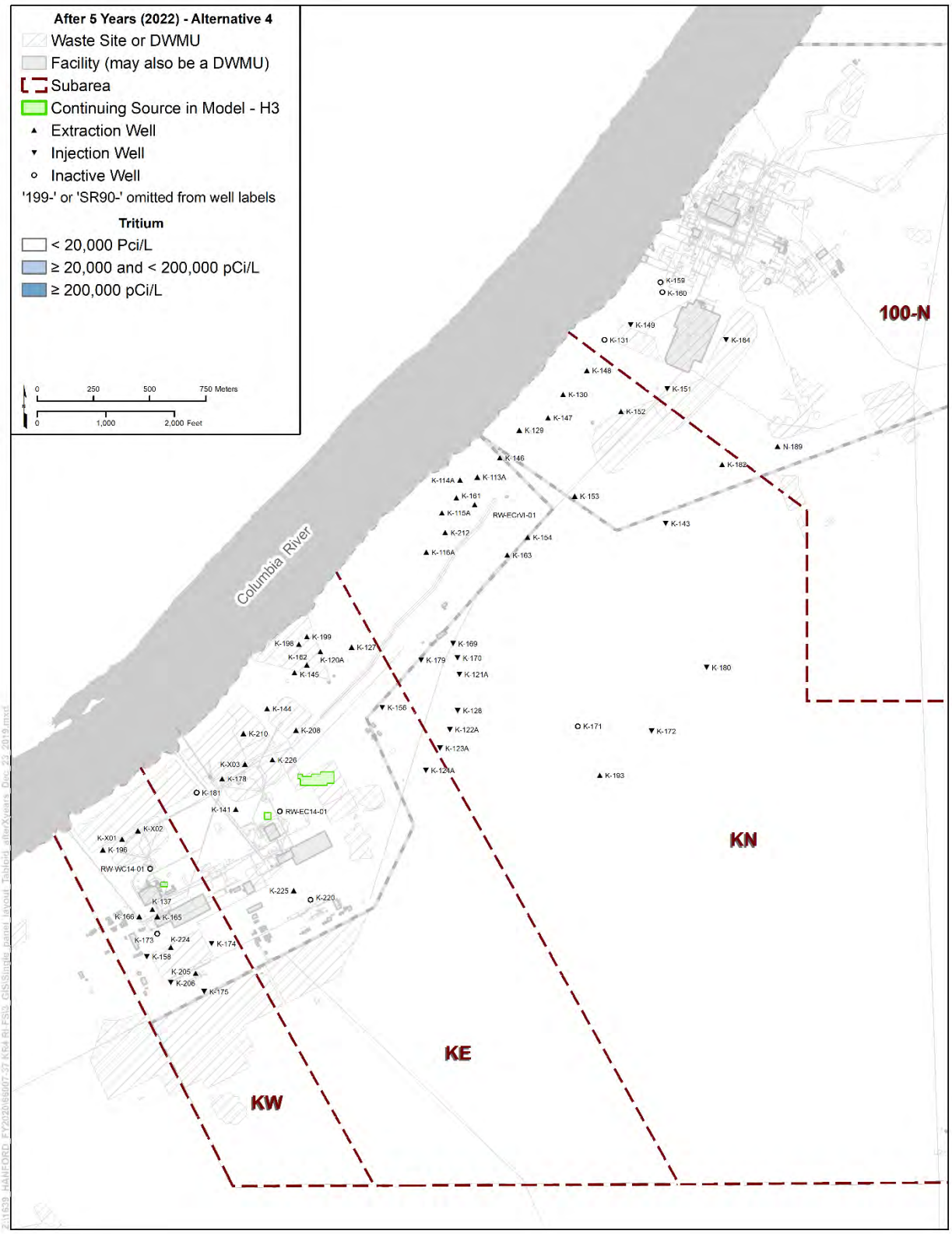


Figure 6-212. Tritium: Simulated Distribution after 5 Years (end of 2022) – Alternative 4

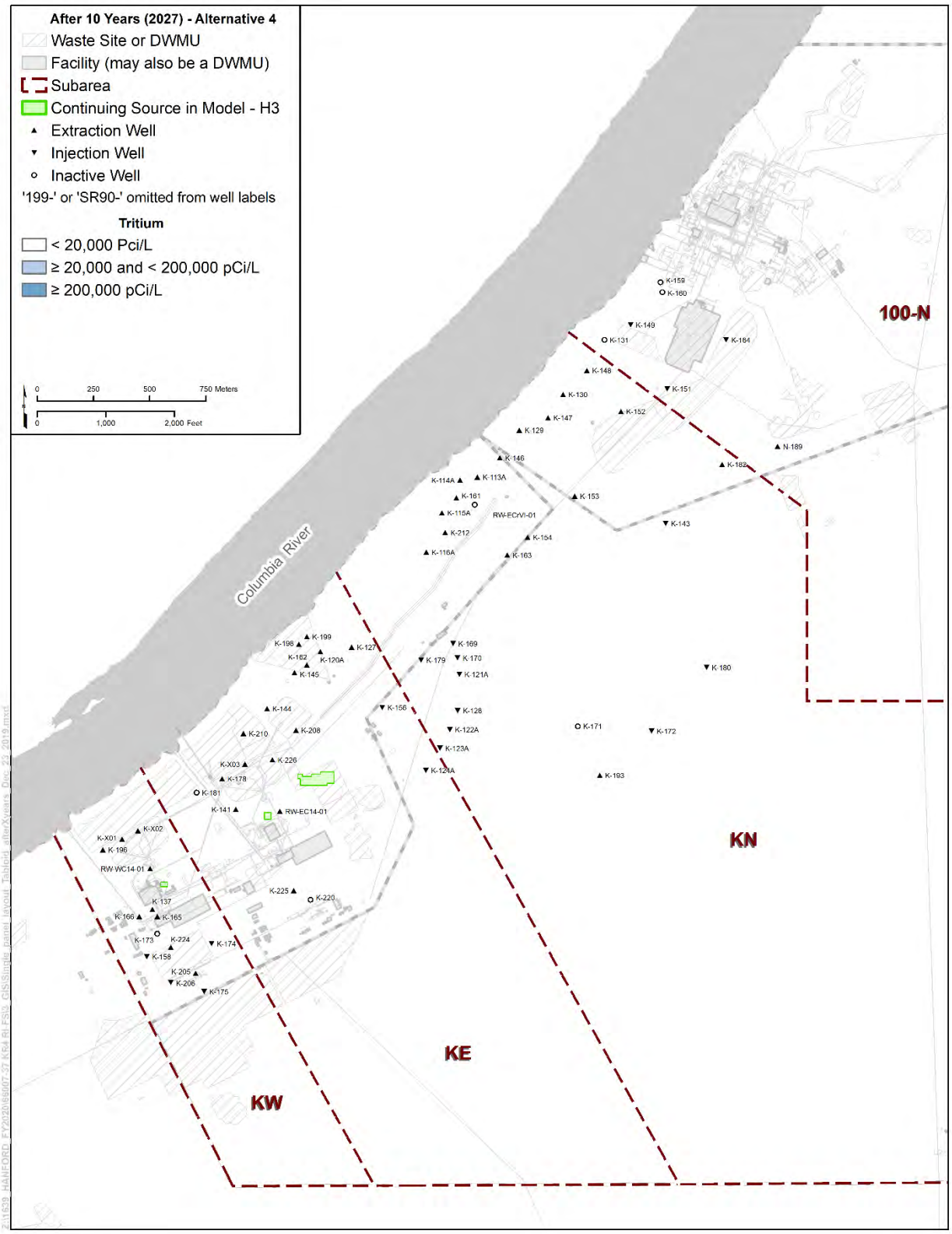


Figure 6-213. Tritium: Simulated Distribution after 10 Years (end of 2027) – Alternative 4

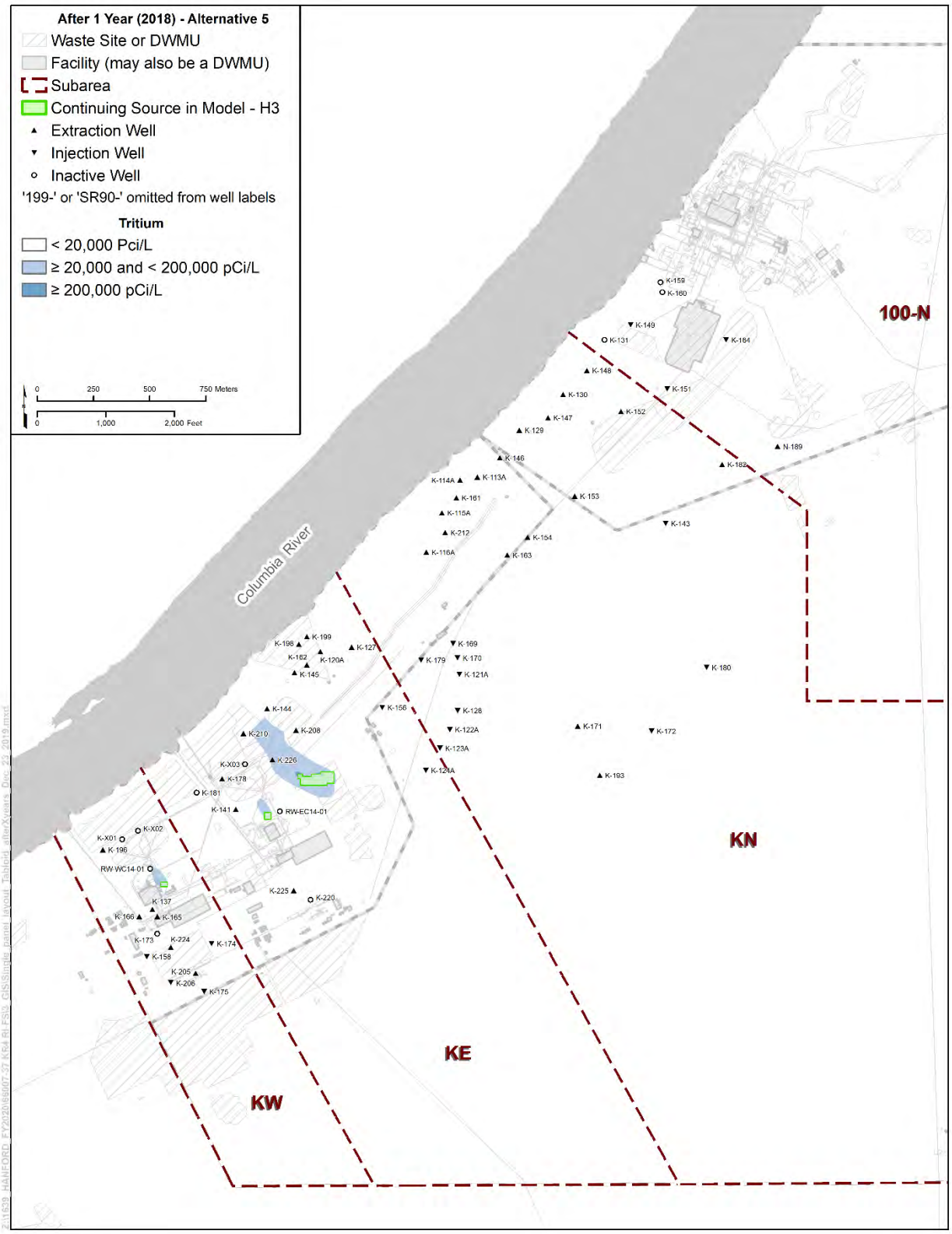


Figure 6-214. Tritium: Simulated Distribution after 1 Year (end of 2018) – Alternative 5

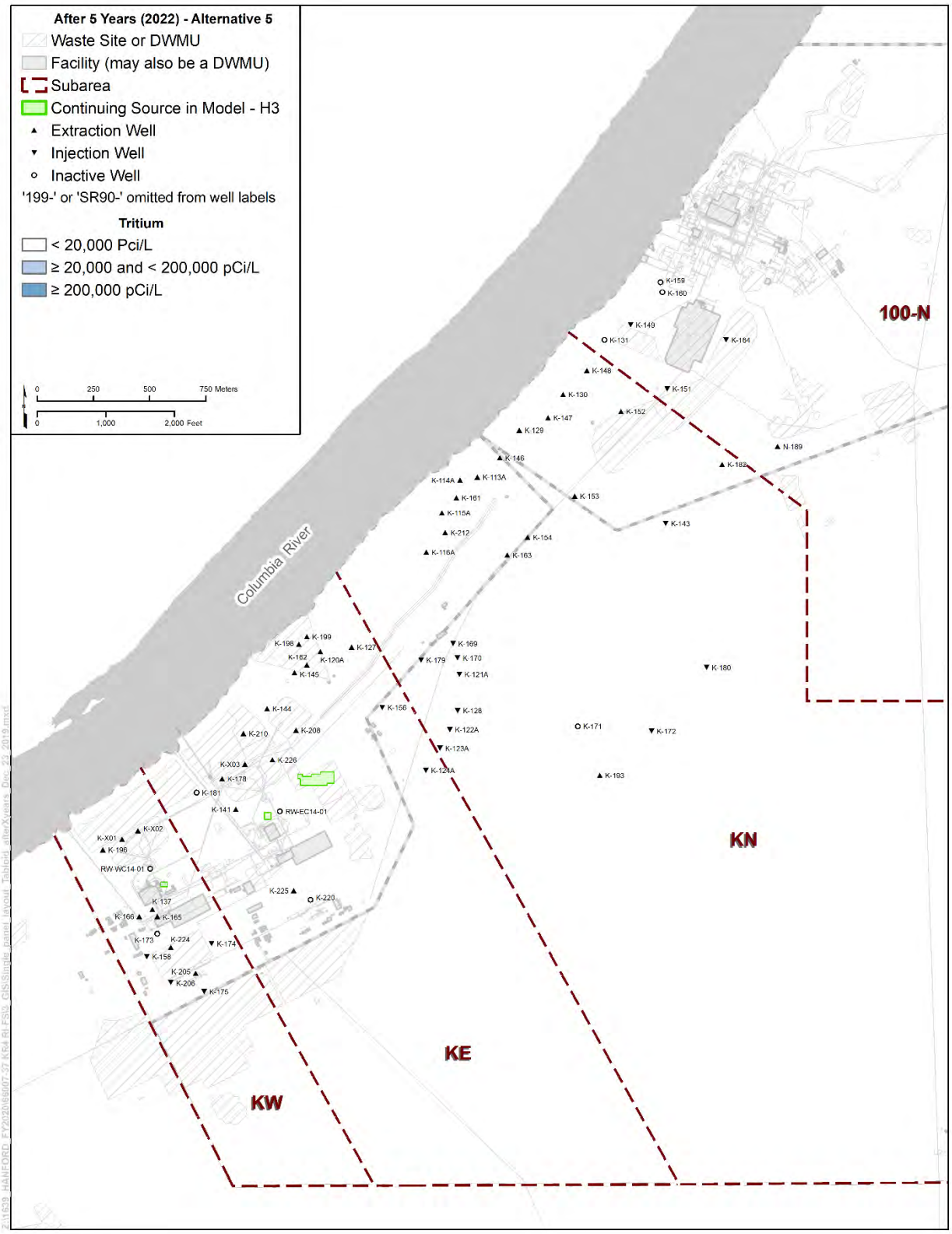


Figure 6-215. Tritium: Simulated Distribution after 5 Years (end of 2022) – Alternative 5

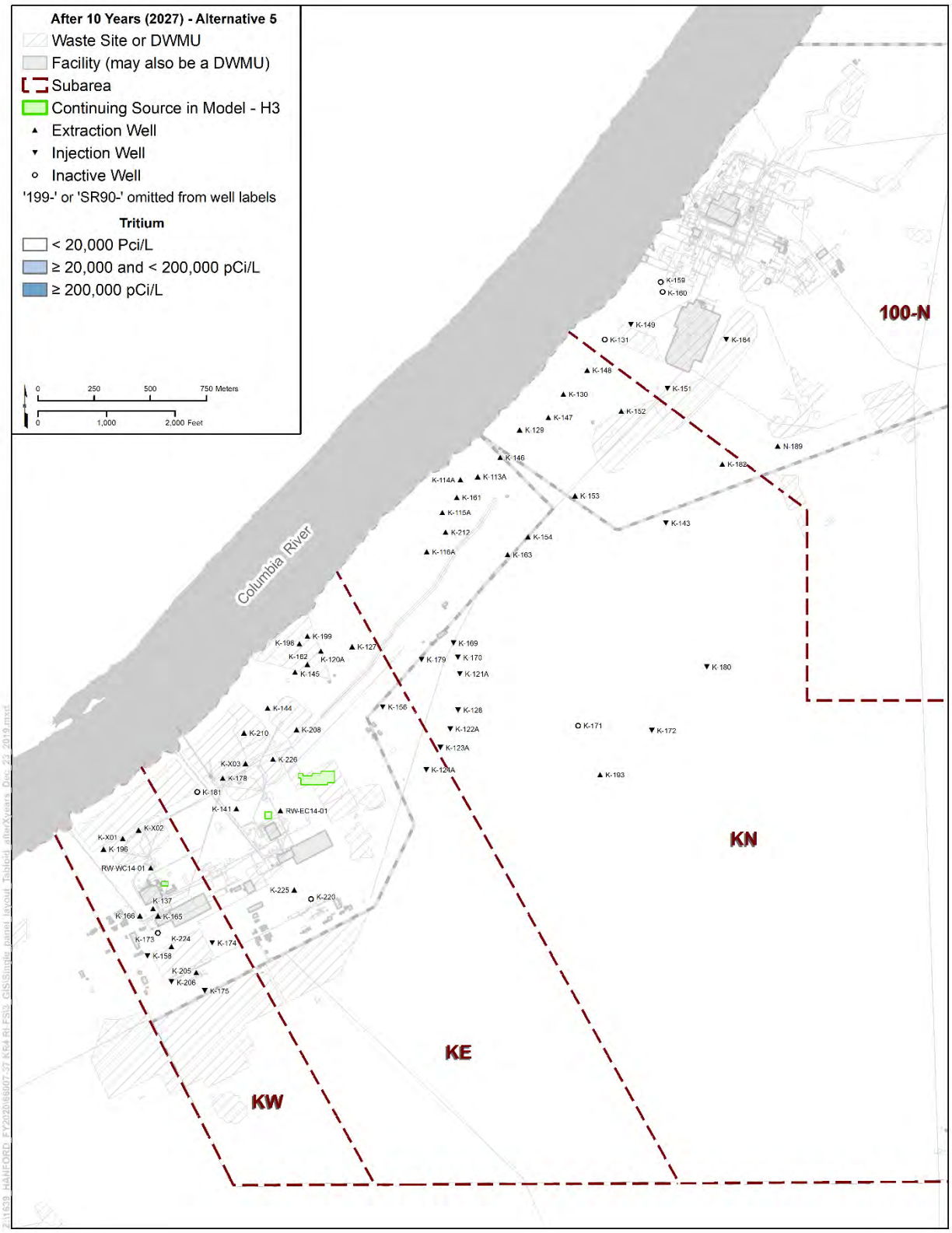


Figure 6-216. Tritium: Simulated Distribution after 10 Years (end of 2027) – Alternative 5

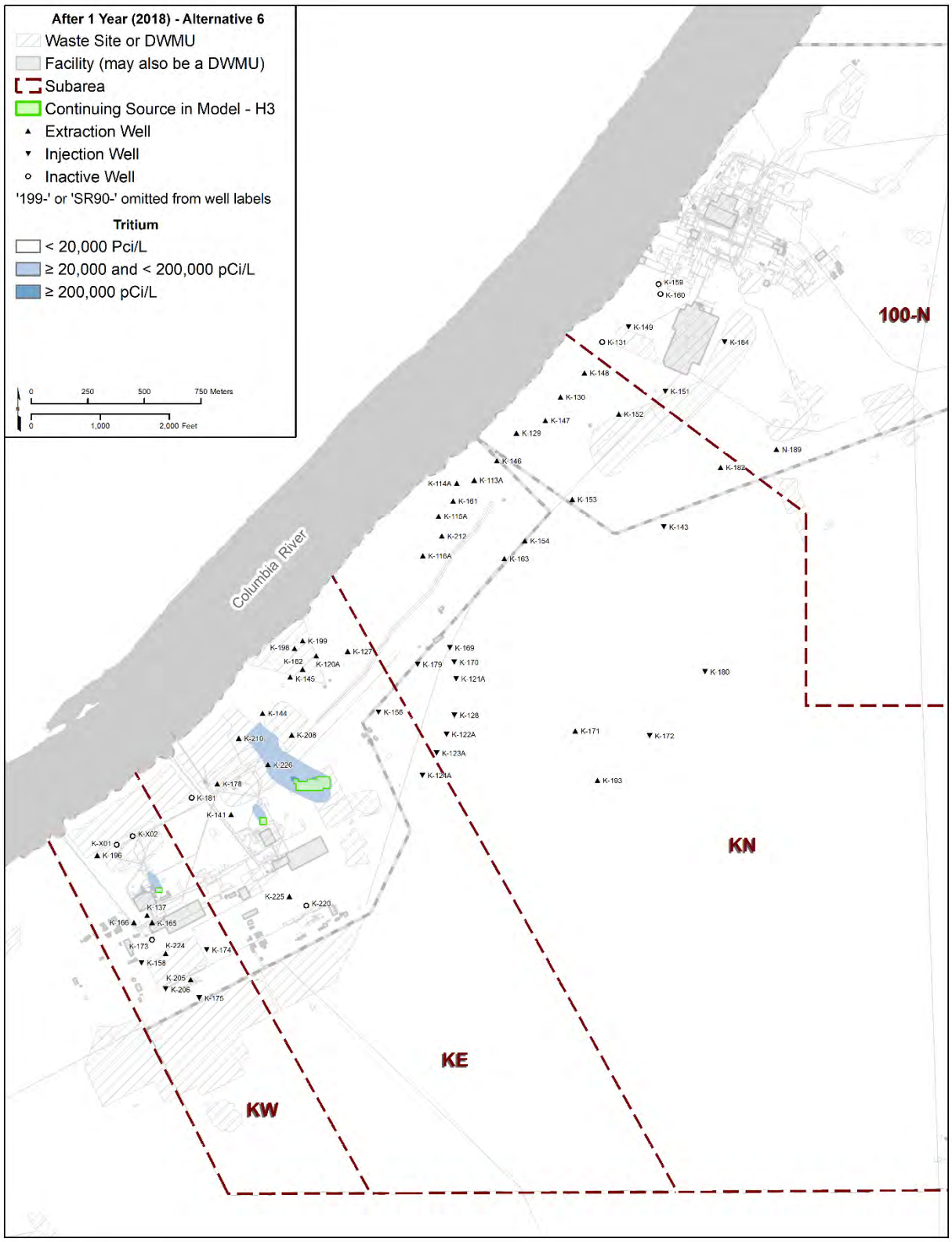


Figure 6-217. Tritium: Simulated Distribution after 1 Year (end of 2018) – Alternative 6

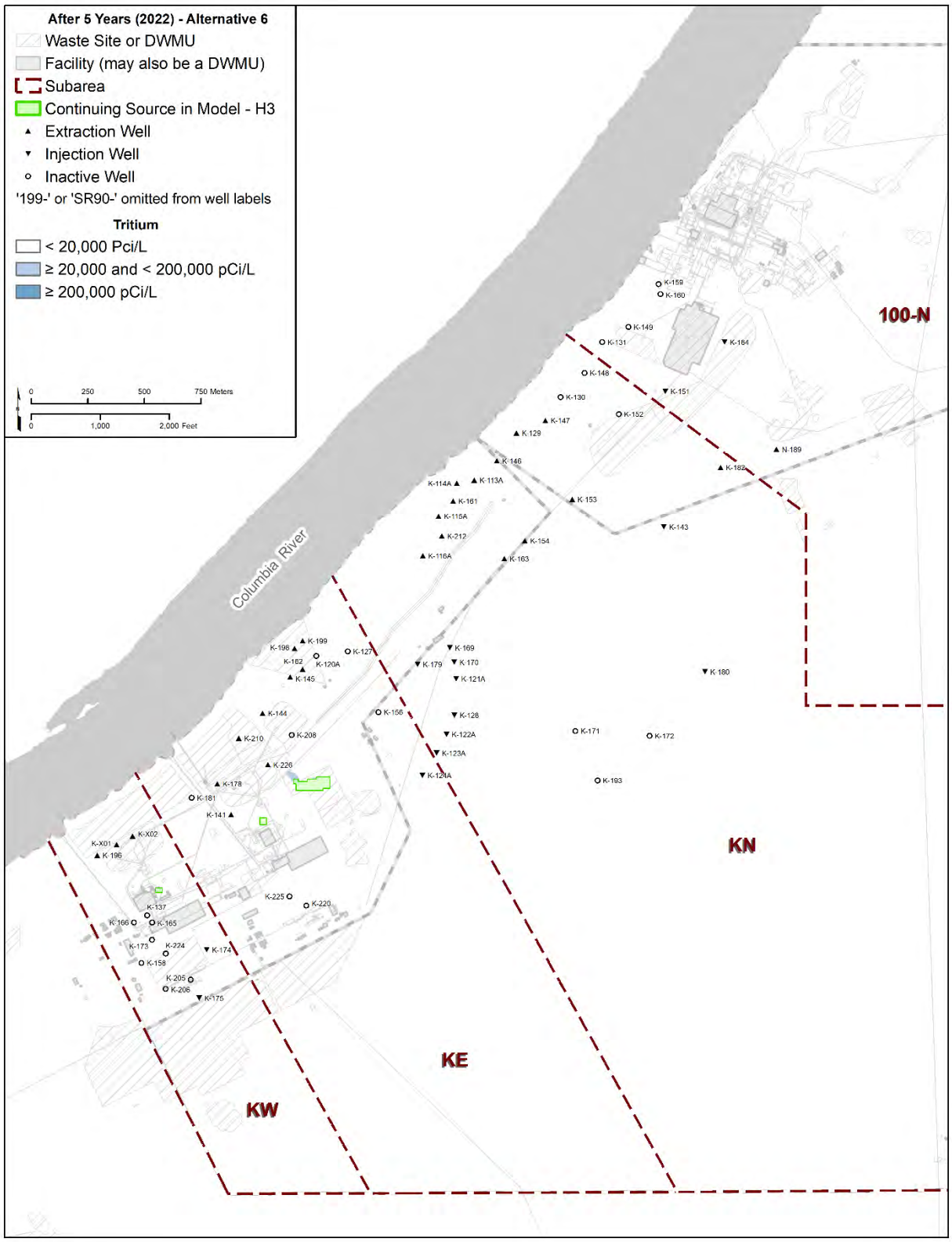


Figure 6-218. Tritium: Simulated Distribution after 5 Years (end of 2022) – Alternative 6

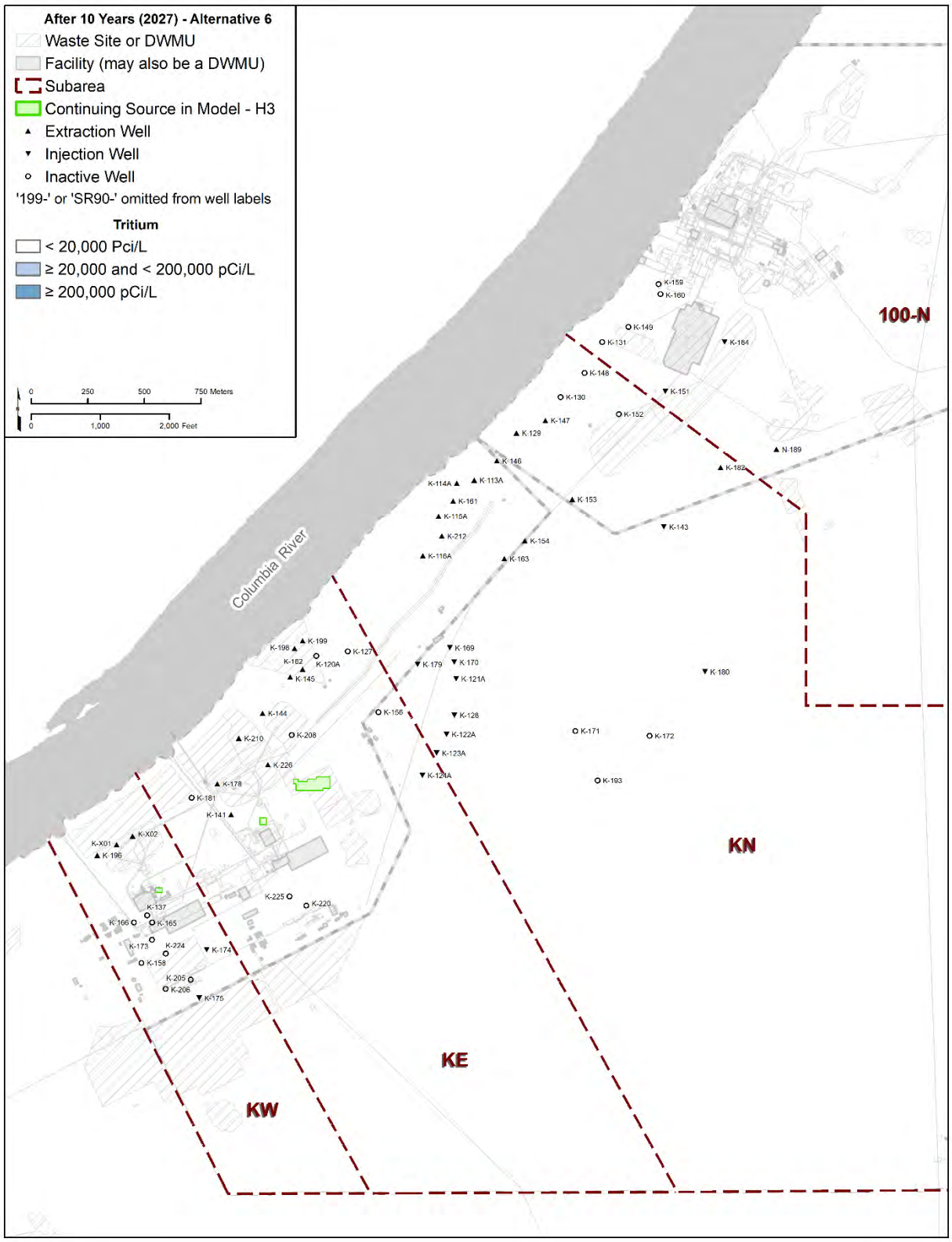


Figure 6-219. Tritium: Simulated Distribution after 10 Years (end of 2027) – Alternative 6

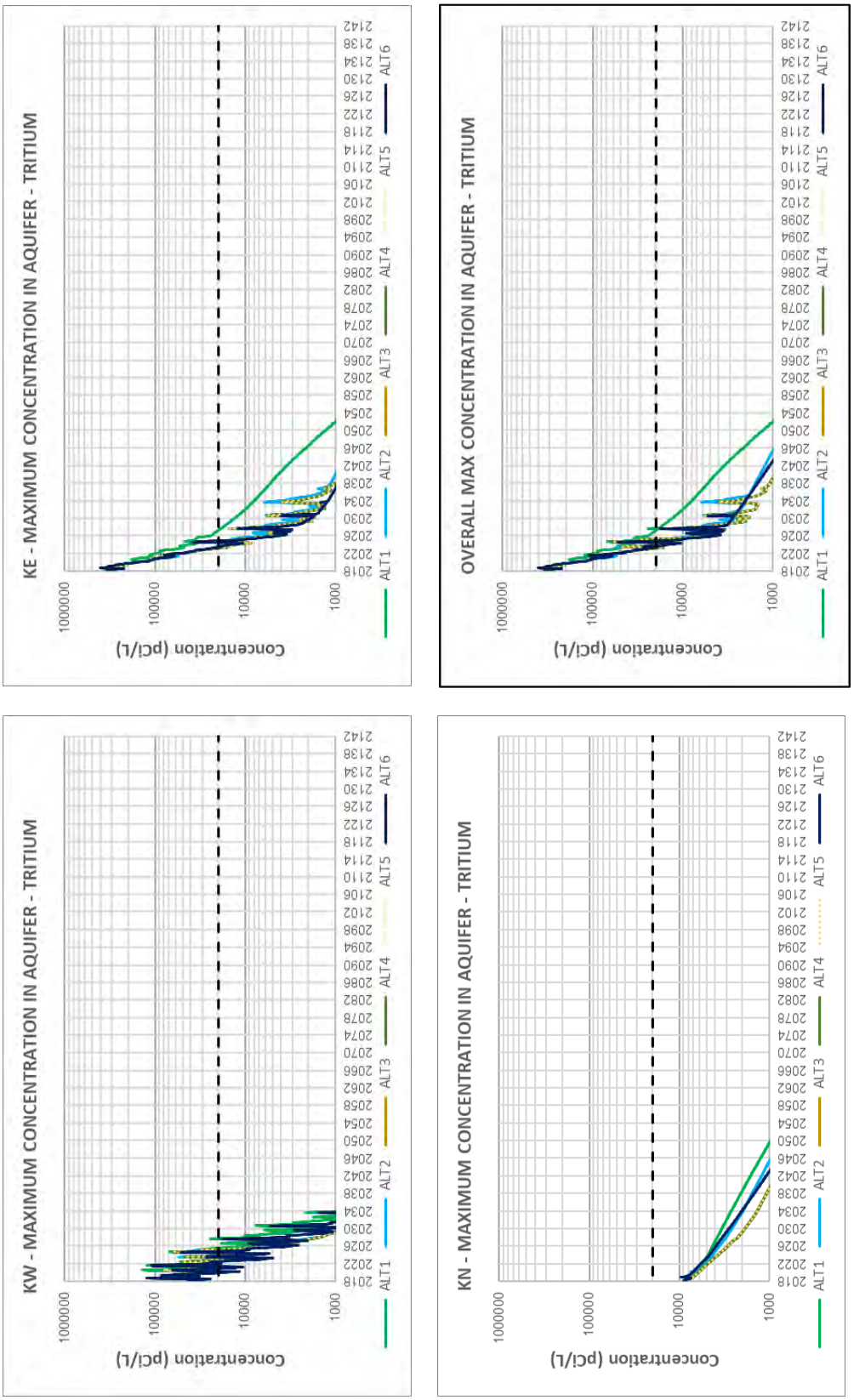


Figure 6-220. Tritium: Maximum Concentration Time Series in the Aquifer

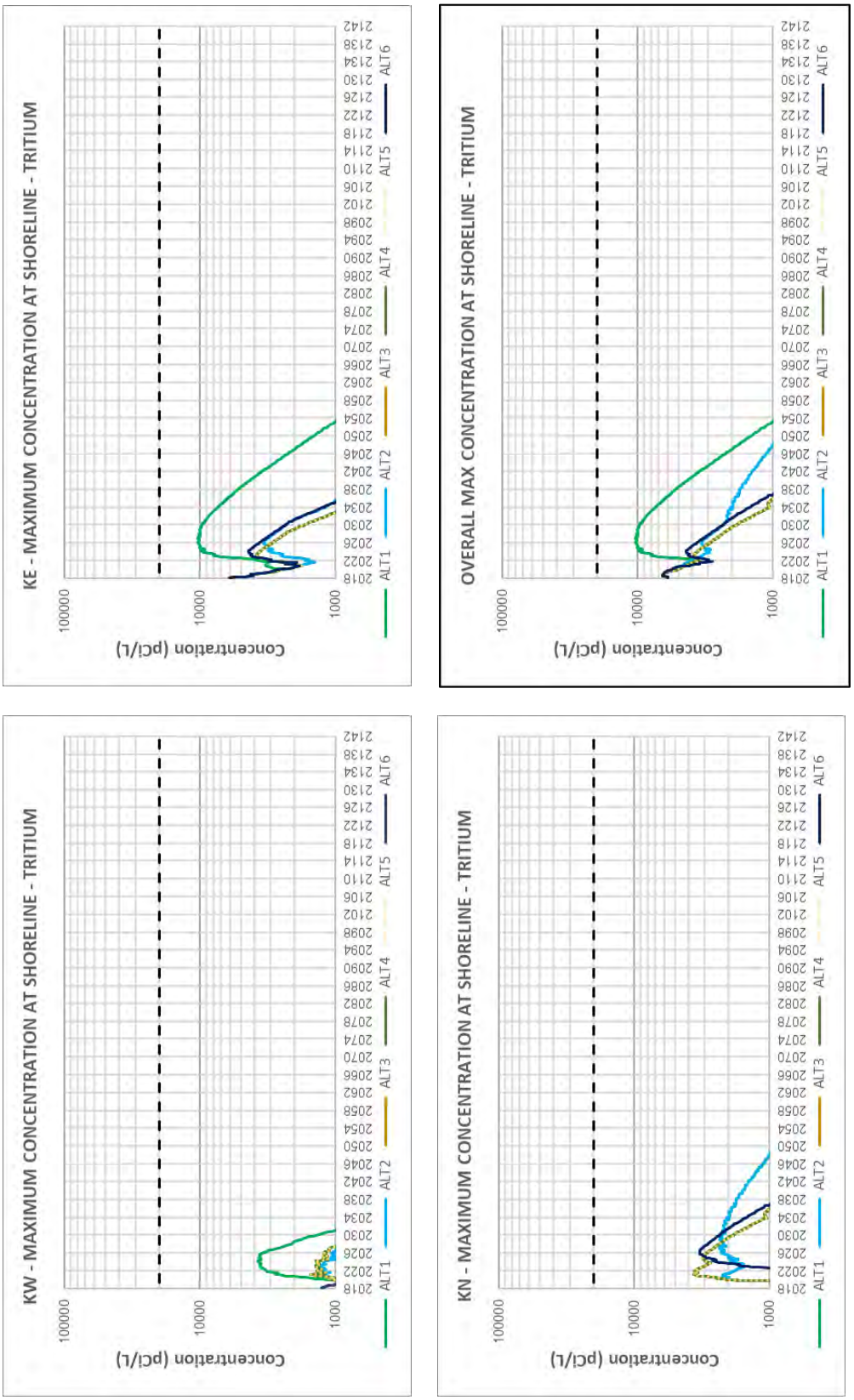


Figure 6-221. Tritium: Maximum Concentration Time Series at the Shoreline

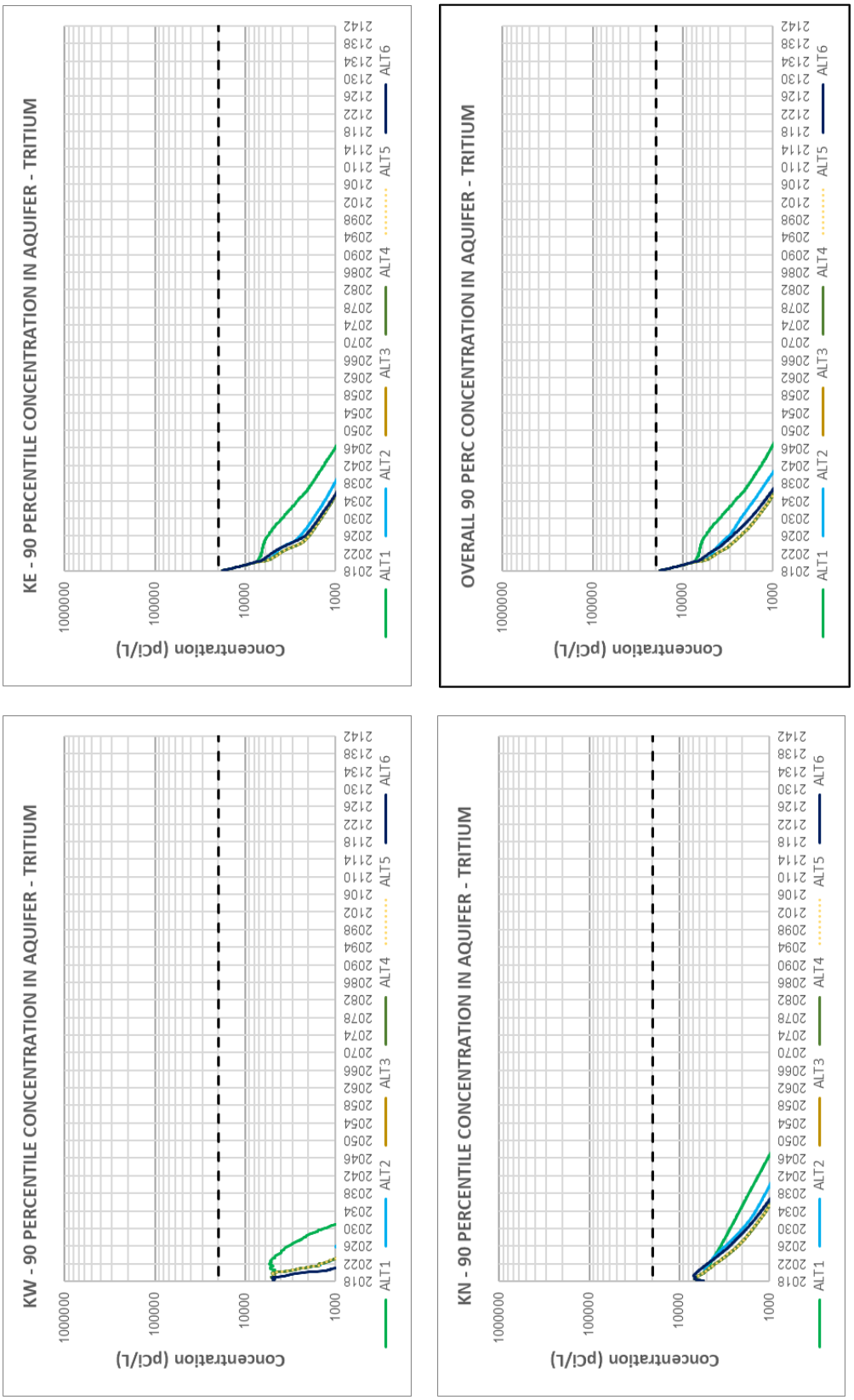


Figure 6-222. Tritium: 90th Percentile Concentration Time Series in the Aquifer

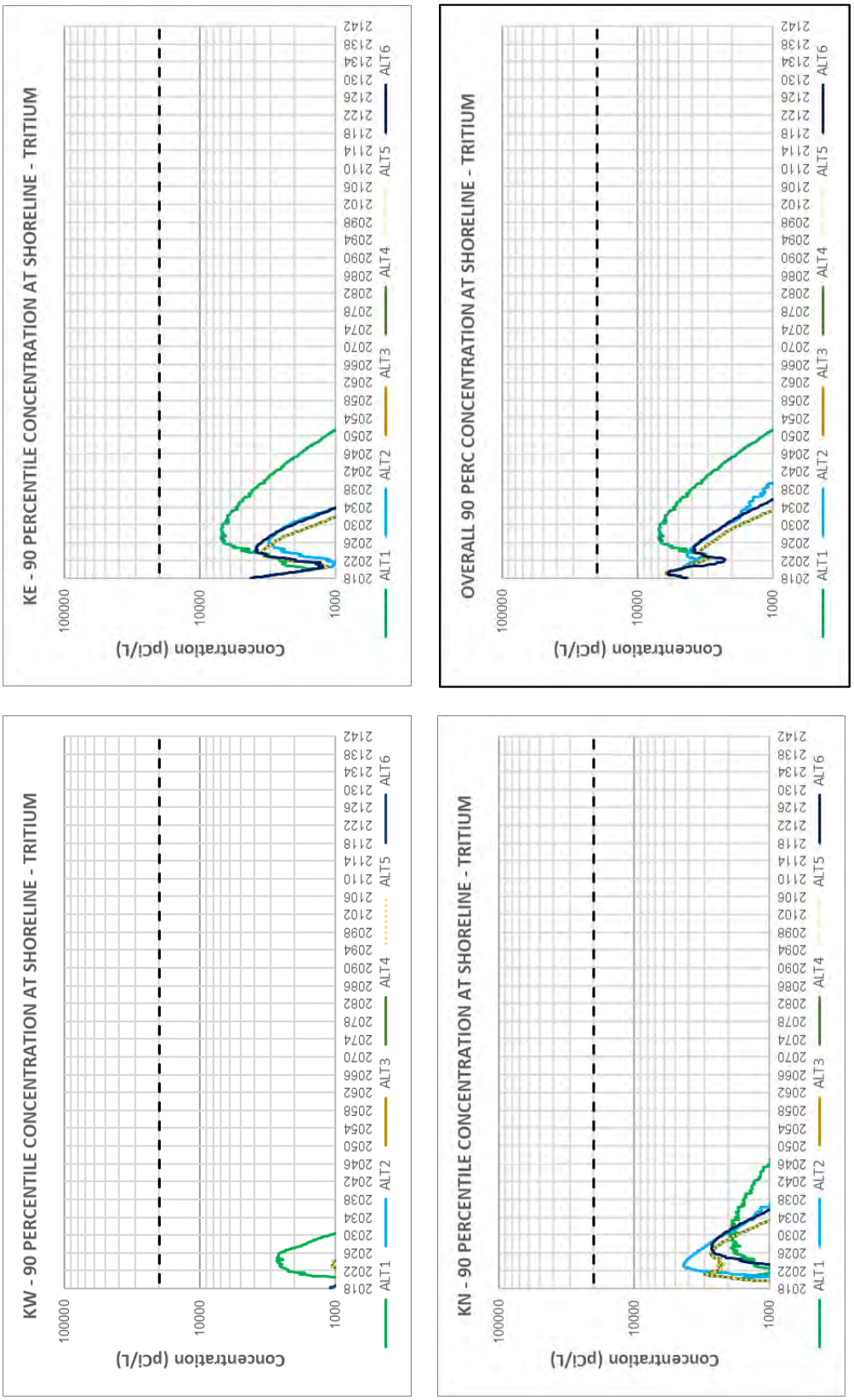


Figure 6-223. Tritium: 90th Percentile Concentration Time Series at the Shoreline

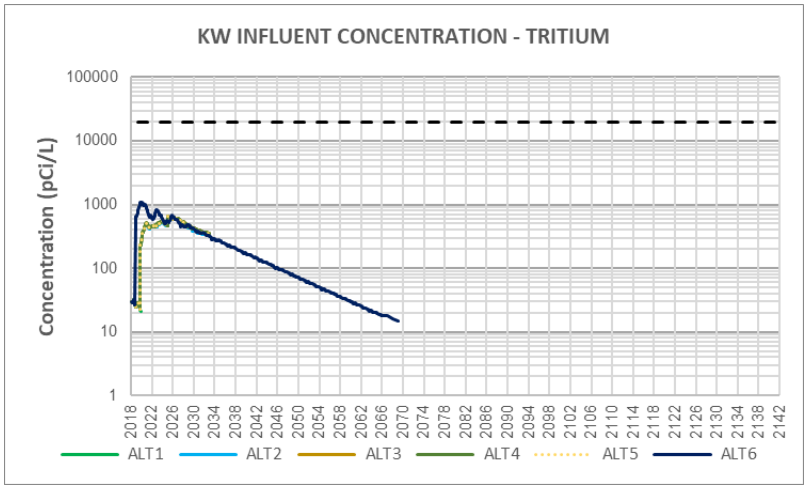


Figure 6-224. Tritium: Combined Influent Concentration Time Series – KW System

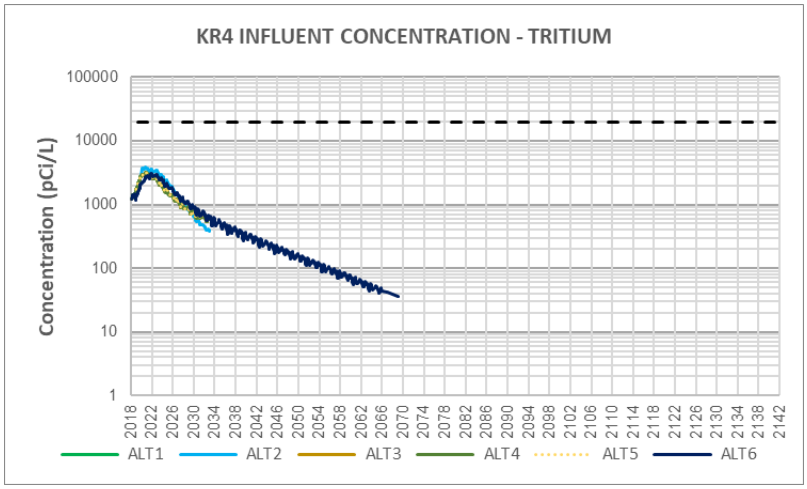


Figure 6-225. Tritium: Combined Influent Concentration Time Series – KR4 System

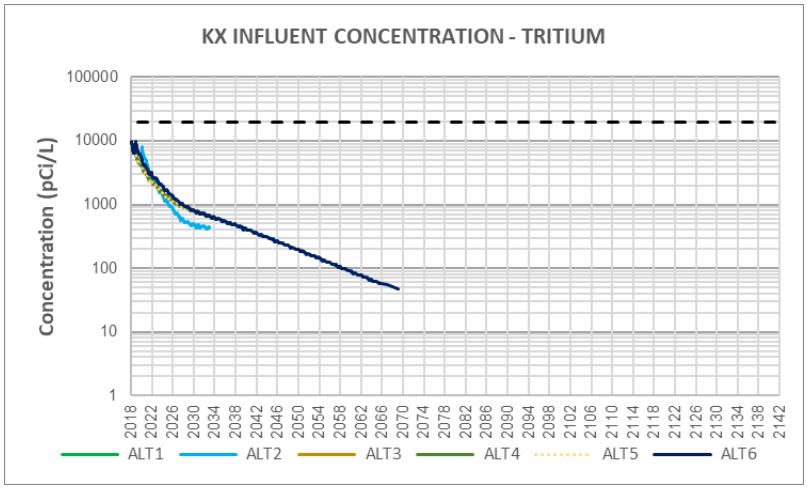


Figure 6-226. Tritium: Combined Influent Concentration Time Series – KX System

6.1.7 Discussion

Model results suggest continuous plume migration and ultimate discharge to the river for the majority of COCs under the no action alternative. On the other hand, implementation of Alternative 6 ensures river-protection once the proposed well configuration and operation establishes hydraulic gradient reversal. Alternatives 2, 3, 4, 5 and 7 provide different levels of river protection and aquifer restoration for each COC.

Alternative 2 comprises all components of river protection, mass recovery and continuing-source treatment for Cr(VI), which is the focal COC of this evaluation. Once the proposed additional extraction wells are in place and operational, river protection is established. Soil flushing of the continuing sources in KW and KE reduces mass releases into the aquifer, ultimately leading to aquifer restoration within a 15-year timeframe. This means that, the remaining mass in the aquifer is present at concentrations consistently below the cleanup standard of 48 µg/L, and plume migration to the river results in discharges at concentrations below the 10 µg/L aquatic cleanup standard. However, the proposed configuration under Alternative 2 focuses only on the Cr(VI) plumes in KW and KE, with the remaining plumes in 100-K not addressed, which migrate to the river at ambient aquifer conditions. The continuing source at 116-K-2 is not addressed under this alternative, but mass releases from that source do not result in elevated concentrations in the aquifer or in an emanating plume that extends to the river.

Carbon-14 concentrations are addressed by the proposed configuration, with persisting mass remaining at the shoreline for some period, due to limited hydraulic containment between the river and the existing and proposed nearshore wells in KW. Soil flushing is applied to the continuing source areas with extraction wells operating downgradient of those areas, providing hydraulic containment near the source. Limited rebounding of carbon-14 in the aquifer after system shutdown occurs for a period of approximately two years, however, no exceedances are projected at the shoreline any time after 2032, when the system is turned off.

All other COCs, except for strontium-90, are projected to have limited presence in the aquifer and shoreline, both in magnitude and time.

Strontium-90 plumes in KW and KE are strongly impacted by the presence of continuing sources, although their marginal plume mobility should be attributed to its high K_d. In addition, its low decay rate, combined with high concentrations currently present in the aquifer, result in prolonged cleanup timeframes. Under Alternative 2, no existing or proposed extraction wells address directly the existing strontium-90 plumes in KW and KE.

Alternative 3 utilizes the same design components as Alternative 2 but expands the configuration to include all extraction and injection wells currently connected to the three P&T systems in 100-K. This includes the wells inside 100-N, addressing Cr(VI) contamination near the K-N boundary. Aquifer restoration is achieved across the entire OU. River protection along the entire shoreline in 100-K is achieved under Alternative 3, with aquifer restoration for all other COCs, including strontium-90, similar to Alternative 2.

Alternative 4 differs from Alternative 3 due to the addition of soil-flushing at the Cr(VI) continuing source at 116-K-2. An extraction well is added downgradient of the source to enhance hydraulic containment near the shoreline. As in Alternative 3, aquifer restoration and river protection are achieved within the 15-year operation timeframe of the proposed configuration.

Alternative 5 is also based on Alternative 3, however RTD is included for the Cr(VI) continuing source at 116-K-2. No mass loadings from the PRZ occur after RTD is completed and therefore the design is more

aggressive than Alternatives 3 and 4, however aquifer restoration and river protection are accomplished within the same timeframe.

Alternative 6 comprises extraction wells mainly along the shoreline, to ensure that hydraulic containment is achieved where COC plumes are present and expected to migrate toward the river. Injection wells are included in the system to facilitate recirculation of the extracted water and, in select locations, enhance hydraulic containment. However, given the presence of continuing sources, it is projected that the proposed configuration under Alternative 6 will require a 50-year operation timeframe to ensure that no COC plume will discharge to the river at concentrations exceeding the corresponding cleanup standard.

Alternative 7 focuses on strontium-90 in KW and KE. The proposed configuration is based on Alternative 4 design for the first 15 years, with additional extraction and injection wells proposed for enhanced mass recovery within the delineated strontium-90 plumes. Given its high K_d, a large number of extraction wells is required to induce expedited mobilization of strontium-90 in the aquifer toward the wells and ensure mass recovery of the dissolved plume. Operation of these wells induces an expanded cone of depressions in the vicinity of the continuing sources, essentially separating them from the water table. At the same time, in situ solidification of strontium-90 in the continuing source locations within the vadose zone is expected to reduce mass loadings in the aquifer. As seen in the model results, although mass recovery is achieved due to the presence of a large number of extraction wells, source treatment in the vadose zone does not achieve enough mass reduction and, therefore, when the wells are turned off, the water table recovers and comes in contact with the remaining mass in the source area, resulting in mass releases that cause extensive rebounding in aquifer concentrations above the cleanup standard. At that point, aquifer restoration is mainly achieved via strontium-90 decay, with cleanup timeframes similar to the other alternatives, where strontium-90 was not directly addressed.

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7 References

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Appendix A

Software Installation and Checkout Forms

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CHPRC SOFTWARE INSTALLATION AND CHECKOUT FORM

Software Owner Instructions:

Complete Fields 1-13, then run test cases in Field 14. Compare test case results listed in Field 15 to corresponding Test Report outputs. If results are the same, sign and date Field 19. If not, resolve differences and repeat above steps.

Software Subject Matter Expert Instructions:

Assign test personnel. Approve the installation of the code by signing and dating Field 21, then maintain form as part of the software support documentation.

GENERAL INFORMATION:

1. Software Name: MODFLOW and Related Codes Software Version No.: Bld 8

EXECUTABLE INFORMATION:

2. Executable Name (include path):

Following executable files in directory: _____

MD5 Signature (unique ID)	Executable File Name	
919F74196F5FB5BF0364FC373011B507	mf2k-chprc08dpl.exe	MODFLOW-2000 double precision
EAF037703ADD2C62CDD9CBC47468D2F6	mf2k-chprc08spl.exe	MODFLOW-2000 single precision
4E7F29DD5496D2CBA7144ADACB13DAAD	mf2k-mst-chprc08dpv.exe	MODFLOW-2000-MST single prec
CEB80288C616E0552E4CE5A2D4719387	mf2k-mst-chprc08spv.exe	MODFLOW-2000-MST double prec
ECA9828530B68D2D7C34078C019D5D0C	mt3d-chprc08dpl.exe	MT3DMS double precision
0920CC235862665D9400A3FC80F682DD	mt3d-chprc08spl.exe	MT3DMS single precision
5C61432D2C898E83DDFE242C52A755AB	mt3d-mst-chprc08dpv.exe	MT3DMS-MST double precision
68F89DAF2E6913D2578DE53CBD34FBA0	mt3d-mst-chprc08spv.exe	MT3DMS-MST single precision

3. Executable Size (bytes): MD5 signatures listed above uniquely identify executable files

COMPILATION INFORMATION:

4. Hardware System (i.e., property number or ID):

Vendor Provided (SSP&A)

5. Operating System (include version number):

Vendor Provided (SSP&A)

INSTALLATION AND CHECKOUT INFORMATION:

6. Hardware System (i.e., property number or ID):

FE 483

7. Operating System (include version number):

Windows 10 Pro

8. Open Problem Report? ◉ No ○ Yes PR/CR No.

TEST CASE INFORMATION:

9. Directory/Path:

E:\Projects\1393-Hanford-FY2016\MODFLOW-CHPRC-Build-8-distribution\test-windows

10. Procedure(s):

CHPRC-00259 Rev 3, MODFLOW and Related Codes Software Test Plan

11. Libraries:

N/A (static linking)

12. Input Files:

MF-ITC-1 and MT-ITC-1 inputs

13. Output Files:

MF-ITC-1 and MT-ITC-1 outputs

CHPRC SOFTWARE INSTALLATION AND CHECKOUT FORM (continued)

1. Software Name: MODFLOW and Related Codes Software Version No.: Bld 8

14. Test Cases:

MF-ITC-1 (both standard and MST versions of MODFLOW)- run for single & double precision
MT-ITC-1 - run for single and double precision

15. Test Case Results:

```
MODFLOW, MODFLOW-MST, and MT3DMS-MST Installation Testing Log
Eight instances of /FC: no differences encountered/ in log below indicates
that all installation tests were successful.
Ben-PC
Wed 04/06/2016
11:39 AM

---------- TESTRESULTS.LOG

---------- TESTRESULTS.LOG

---------- TESTRESULTS.LOG

---------- TESTRESULTS.LOG

---------- TESTRESULTS.LOG

---------- TESTRESULTS.LOG

---------- TESTRESULTS.LOG

---------- TESTRESULTS.LOG
```

16. Test Performed By: PRASHANTH KHAMBHAMMETTU

17. Test Results: (●) Satisfactory, Accepted for Use ( ) Unsatisfactory

18. Disposition (include HISI update):

Prepared By:

19. Software Owner (Signature)	WE Nichols Print	Date

20. Test Personnel:

Sign	PRASHANTH KHAMBHAMMETTU Print	4/6/2016 Date
Sign	Print	Date
Sign	Print	Date

Approved By:

21. Software SME (Signature)	N/R (CHPRC-00258 Rev 3) Print	Date

A-6005-149 (REV 0)