

## Appendix B

### Supporting Information for Monitored Facilities

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## Appendix – B Supporting Information for Monitored Facilities

### **M. J. Hartman**

This appendix provides supplemental information for *Resource Conservation and Recovery Act of 1976* (RCRA) and other regulated units on the Hanford Site that require groundwater monitoring, excluding *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* units (discussed in Appendix A). Site-specific discussions for each facility in Appendix B are found in the body of the document under the respective operable unit in which the facility lies (Figure 1.0-1 in the main text illustrates operable units).

RCRA groundwater monitoring continued during fiscal year 2008 at 24 waste management areas (Figure B-1). Estimates of groundwater velocity, hydrologic properties, and associated references are shown in Table B-1 for RCRA sites. To determine if a waste site has adversely affected groundwater quality under RCRA interim-status regulations (WAC 173-303-400 and by reference, 40 CFR 265.93), concentrations of indicator parameters in downgradient wells are compared to background concentrations. The indicator parameters under interim status are specific conductance, pH, total organic carbon, and total organic halides. The background values to which the indicator parameters are compared are 99% prediction limits, which are calculated for each facility based on samples from upgradient wells. The upper prediction limits also are known as critical mean values.

Critical mean values are recalculated annually, or if the number of analyses changes. Annual recalculation accounts for changing background conditions. Changes in the number of analyses are usually the result of changes in monitoring well networks (wells are added or deleted). If changes occur in a monitoring well network, critical mean values for that facility are recalculated for subsequent semiannual sampling events using the new well network.

To reliably indicate potential groundwater effects from a facility, the sample results have to be reasonably precise or quantifiable. Specific conductance and pH are field measured indicator parameters that are reasonably detectable and quantifiable. The parameters of total organic carbon and total organic halides, however, are much more variable and are often below levels of detection. Significant imprecision and variability occurs when measuring these parameters near detection limits. The variability in laboratory measurements of field blanks are used to estimate laboratory limits of quantitation (LOQ) during the sampling period. The LOQ is defined as ten times the standard deviation of the field blank analyses (see discussion in Section C.7.0). For detection monitoring the statistical comparison values for total organic carbon and total organic halides are the larger of the critical mean and the LOQ.

Table B-2 lists comparison values (critical mean values and LOQs) used in fiscal year 2008. Additional tables list updated critical mean values for use in fiscal year 2009 for each RCRA unit where these statistics apply. Tables B-3 through B-37 provide supporting information for the RCRA sites and Figures B-2 through B-17 show locations of monitoring wells and regulated units.

This appendix also provides constituent lists, well network configurations, and other ancillary information for regulated facilities that fall outside of RCRA programs. Some network wells in these facilities are shared with RCRA facilities. Figure B-18 shows the general locations of these facilities. Locations of monitoring wells are shown in Figures B-5, B-14, B-19, and B-20. Tables B-38 through B-44 list the constituents list and/or results summaries for the facilities.

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**Table B-1. Estimates of Groundwater Flow Rates at Hanford Site RCRA Facilities.**

Site	Flow Direction	Flow Rate (m/d)	Method	Hydraulic Conductivity (m/d) (source)	Effective Porosity <sup>a</sup>	Gradient <sup>b</sup>	Comments
116-N-1 LWDF	NW	0.03 to 0.53	Darcy	6.1 to 37 (PNL-8335)		0.0014	Gradient calculated between wells 199-N-34 and 199-N-2.
120-N-1 and 120-N-2	NW	0.05 to 0.82	Darcy	6.1 to 37 (PNL-8335)		0.0022	Gradient calculated between wells 199-N-72 and 199-N-26.
116-N-3 LWDF	N	0.02 to 0.38	Darcy	6.1 to 37 (PNL-8335)		0.0010	Gradient calculated between wells 199-N-28 and 199-N-81.
116-H-6 Evaporation Basins	E	0.20 to 5.6	Darcy	15 to 140 (PNL-6728)		0.0040	Gradient calculated between wells 199-H4-9 and 199-H4-12B.
216-A-29 Ditch	SE	0.053	Darcy	18 (WHC-SD-EN-DP-047)	0.25	0.00074	Average gradient calculated using well 299-E26-13 as upgradient well and wells 299-E26-12, 299-E25-26, 299-E25-28, 299-E25-32P, 299-E25-34, 299-E25-35, and 699-33-45.
216-B-3 Pond	SW	0.0062	Darcy	1.0 (WHC-SD-EN-EV-002; PNL-10195)	0.25	0.0015	Average gradient calculated using wells 699-44-39B as upgradient well and wells 699-43-44, 699-43-45, 699-42-42A, 699-42-42B, and 699-45-42.
216-B-63 Trench	SE	0.87	Darcy	182 (WHC-MR-0207)	0.2	0.00096	Average gradient calculated using wells 299-E27-16, 299-E27-17, 299-E33-36, 299-E33-37, 299-E34-8, 299-E27-18, 299-E27-19, and 299-E27-11.
216-S-10 Pond and Ditch	SE	0.23 to 6.81	Darcy	10 (WHC-SD-EN-DP-052) 12 to 150 (BNWL-1709)	0.1 to 0.2	0.005	Average gradient calculated between new upgradient well 699-33-76 and wells 299-W26-13, 299-W26-14, 299-32-76, and 299-33-75.
316-5 Process Trenches	SSE	0.18 to 18	Darcy	150 to 15,000 (PNL-6716)	0.25	0.00031	Gradient calculated between wells 399-1-18A and 399-1-17A.
IDF	E to SE	0.002 to 0.0075	Darcy	68 to 75 (PNNL-13652; PNNL-11957)		0.00001	Uncertainty in gradient and rate of flow. Flow direction inferred from plume maps.
LERF	SW	0.24	Darcy	39.8 (PNNL-14804)	0.25	0.0016	Gradient calculated from water-table map. New well data will be collected and analyzed in fiscal year 2009.
LLWMA 1	NW	Undetermined		2,500 to 7,500 (PNNL-14753)			Predominant flow to NW toward Gable Gap based on the plume maps. Gradient too low to determine flow rate.
LLWMA 2	W to SW	Undetermined		2,500 to 7,500 (PNNL-14753)		0.00005	Uncertain of flow direction. Gradient too low to determine flow rate.
LLWMA 3	ENE	0.04 to 0.16	Darcy	2.5 to 10 (PNNL-14753)	0.1 (PNNL-14753)	0.0016	Flow direction and gradient from water-table map.

**Table B-1. (cont.)**

Site	Flow Direction	Flow Rate (m/d)	Method	Hydraulic Conductivity (m/d) (source)	Effective Porosity <sup>a</sup>	Gradient <sup>b</sup>	Comments
LLWMA 4	E	0.4 to 1.0	Darcy	10 to 25 (PNNL-14753)		0.004	Flow direction and gradient are variable due to effects of pump-and-treat system.
NRDWL	SE	0.03 to 0.27	Darcy	518 to 1,524 (WHC-EP-0021)		0.00002	Uncertainty with gradient and rate of flow. Flow direction inferred from plume maps.
PUREX Cribs	SE	0.0011 to 0.54	Darcy	18 to 3,000 (PNNL-11523;)		0.00002	Uncertainty with gradient and rate of flow. Flow direction inferred from plume maps.
WMA A-AX	SE	0.13 to 0.40	Darcy	1,981 (PNL-8337; WHC-SD-EN-TI-019)		0.00002	Uncertainty with gradient and rate of flow. Flow direction inferred from plume maps.
WMA B-BX-BY	NW	Undetermined				0.00001	Gradient too low to determine flow rate. Flow direction inferred from plume maps.
WMA C	SW to SSW	0.20 to 0.40	Darcy	1,000 to 2,000 (WHC-SD-EN-TI-019)		0.00002	Uncertainty with gradient and rate of flow. Surveying and gyroscoping could improve numbers.
WMA S-SX	E to ESE	0.07 to 0.14	Contaminant travel time (PNNL-13441)	NA	NA	NA	Based on inferred contaminant travel time between 216-S-25 crib and downgradient wells 299-W23-15 and 299-W22-46, and between wells 299-W22-46 and 299-W22-83.
	E	0.012 to 0.30	Darcy	1.33 to 14.4 (PNNL-13514; PNNL-14113)	0.09 to 0.20	0.0019	Gradient determined by trend surface analysis.
WMA T	E	0.021 to 0.56	Darcy	1.04 to 28.1 (PNNL-14113; PNNL-13378)	0.1	0.002	Flow direction based on trend surface analysis. Flow direction and gradient influenced by pump and treat.
WMA TX-TY	Variable (see text)	NA	NA	14.2 to 19.9 (PNNL-13378; PNNL-14113; PNNL-14186)	NA	NA	Flow direction and rate influenced by 200-ZP-1 Pump-and-Treat System
WMA U	E to ENE	0.018 to 0.20	Darcy	1.69 to 9.5 (PNNL-13378)	0.10 to 0.20	0.0021	Gradient determined by trend surface analysis.

<sup>a</sup> Effective porosity assumed to be between 0.1 and 0.3, a representative range for the unconfined aquifer system, unless otherwise noted.

<sup>b</sup> March 2008 unless noted otherwise.

IDF = integrated Disposal Facility.

LERF = liquid effluent retention facility.

LLWMA = low-level waste management area.

LWDF = liquid waste disposal facility.

NA = not applicable.

NRDWL = nonradioactive Dangerous Waste Landfill.

PCE = tetrachloroethene.

PUREX = Plutonium-Uranium Extraction Plant.

WMA = waste management area.

**Table B-2. Upgradient/Downgradient Comparison Values Used for Statistical Comparisons at RCRA Sites in FY 2008.**

Quarter	Specific Conductance Critical Mean ( $\mu\text{S}/\text{cm}$ )	pH Critical Range	TOC Critical Mean <sup>a,b</sup> / LOQ ( $\mu\text{g}/\text{L}$ )	TOX Critical Mean <sup>a</sup> /LOQ ( $\mu\text{g}/\text{L}$ )	Comments
<b>116-N-1 (1301-N) Facility</b>					
Jan-Mar 2008	1,330	6.14–9.23	<b>1,820</b> /1,450	<b>31.6</b> /23.2	
Jul-Sep 2008	1,330	6.14–9.23	<b>1,820</b> /234	<b>31.6</b> /12.2	
<b>120-N-1 and 120-N-2 (1324-N/NA) Facilities</b>					
Oct-Dec 2007	582	7.70–8.49	<b>1,790</b> /1,480	<b>26.3</b> /22.9	Critical mean values calculated with 2 downgradient wells
Apr-Jun 2008	597	7.67–8.52	<b>1,890</b> /428	<b>27.9</b> /24.5	Critical mean values calculated with 3 downgradient wells
<b>116-N-3 (1325-N) Facility</b>					
Jan-Mar 2008	445	7.40–8.67	<b>1,860</b> /1,450	<b>28.3</b> /23.2	
Jul-Sep 2008	445	7.40–8.67	<b>1,860</b> /234	<b>28.3</b> /12.2	
<b>216-A-29 Ditch</b>					
Oct-Dec 2007	269	7.24–9.55	<b>1,090</b> /1,480	<b>26.1</b> /22.9	
Apr-Jun 2008	269	7.24–9.55	<b>1,090</b> /428	<b>26.1</b> /24.5	
<b>216-B-3 Pond</b>					
Jan-Mar 2007	328	7.07–9.30	<b>1,160</b> /1,450	<b>26.3</b> /23.2	
Jul-Sep 2007	328	7.07–9.30	<b>1,160</b> /234	<b>26.3</b> /12.2	
<b>216-B-63 Trench</b>					
Oct-Dec 2007	789	7.48–8.73	<b>1,050</b> /1,480	<b>22.2</b> / <b>22.9</b>	
Apr-Jun 2008	789	7.48–8.73	<b>1,050</b> /428	<b>22.2</b> / <b>24.5</b>	
<b>216-S-10 Pond and Ditch</b>					
Oct-Dec 2007	296	7.49–8.73	<b>1,300</b> /1,480	<b>%/22.9</b>	
Apr-Jun 2008	296	7.49–8.73	<b>1,300</b> /428	<b>%/24.5</b>	
<b>Low Level Waste Management Area 1</b>					
Oct-Dec 2007	828	7.68–8.29	<b>2,810</b> /1,480	<b>26.4</b> /22.9	
Apr-Jun 2008	828	7.68–8.29	<b>2,810</b> /428	<b>26.4</b> /24.5	
<b>Low Level Waste Management Area 2</b>					
Oct-Dec 2007	1,372	7.16–8.24	<b>3,900</b> /1,480	<b>65.7</b> /22.9	
Apr-Jun 2008	1,372	7.16–8.24	<b>3,900</b> /428	<b>65.7</b> /24.5	
<b>Low Level Waste Management Area 3</b>					
No statistical comparisons until the new baseline is established					
<b>Low Level Waste Management Area 4</b>					
Jan-Mar 2008	700	7.22–8.77	<b>790</b> /1,450	<b>13.3</b> / <b>23.2</b>	Critical mean values re-calculated because one upgradient well went dry
Jul-Sep 2008	700	7.22–8.77	<b>790</b> /234	<b>13.3</b> /12.2	
<b>Nonradioactive Dangerous Waste Landfill</b>					
Jan-Mar 2008	620	6.68–7.81	<b>1,020</b> /1,450	<b>26.8</b> /23.2	
Jul-Sep 2008	620	6.68–7.81	<b>1,020</b> /234	<b>26.8</b> /12.2	
<b>Waste Management Area C</b>					
Oct-Dec 2007	922	7.32–8.87	<b>3,400</b> /1,480	<b>35.1</b> /22.9	
Apr-Jun 2008	922	7.32–8.87	<b>3,400</b> /428	<b>35.1</b> /24.5	

<sup>a</sup> Upgradient/Downgradient comparison values (in bold) for TOC and TOX are the larger of calculated critical mean value and limit of quantitation for the respective quarter.

<sup>b</sup> Reported values rounded to the nearest 10  $\mu\text{g}/\text{L}$ .

<sup>c</sup> Critical mean value could not be calculated because essentially all measurements were below vendor specified method detection limit.

LOQ = limit of quantitation; based on field blanks collected and analyzed in the previous four quarters.

TOC = total organic carbon.

TOX = total organic halides.

**Table B-3. Monitoring Wells and Constituents for 100-N Area Units.**

Well Number <sup>a</sup>	Comment	WAC Compliant	Contamination Indicator Parameters				Other Parameters				Sampled as Scheduled in FY 2008
			Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Alpha <sup>b</sup>	Anions	Metals (filtered)	
<b>116-N-1 (1301-N) Liquid Waste Disposal Facility</b>											
199-N-105A		C	S	S	S	S	A		A	A	Yes
199-N-2		P	S	S	S	S	A		A	A	Yes
199-N-3		P	S	S	S	S	A		A	A	Yes
<b>199-N-34</b>		P	S	S	S	S	A		A	A	Yes
199-N-57		C	S	S	S	S	A		A	A	Yes
<b>120-N-1 and 120-N-2 (1324-N/NA) Facilities</b>											
199-N-59 <sup>c</sup>		C	S	S	S	S	A	A	A	A	Sampled once; insufficient water
<b>199-N-71</b>		C	S	S	S	S	A		A	A	Yes
199-N-72		C	S	S	S	S	A		A	A	Yes
199-N-73		C	S	S	S	S	A		A	A	Yes
199-N-77	Bottom of aquifer; no statistics	C	S	S	S	S	A	S	A	A	Yes
199-N-165 <sup>c</sup>	New well	C	S	S	S	S	A	A	A	A	Sampling to begin FY 2009
<b>116-N-3 (1325-N) Liquid Waste Disposal Facility</b>											
199-N-28	Information only; no statistics	P	S	S	S	S	A		A	A	Yes
199-N-32		P	S	S	S	S	S		S	S	Yes
199-N-41		P	S	S	S	S	A		A	A	Yes
<b>199-N-74</b>		C	S	S	S	S	A		A	A	Yes
199-N-81		C	S	S	S	S	A		A	A	Yes
<p>Requirements from PNNL-13914.</p> <p>Wells completed at the top of the unconfined aquifer unless specified otherwise.</p> <p><sup>a</sup>Bold italic = upgradient well.  <sup>b</sup>Monitored for <i>Atomic Energy Act of 1954</i>.  <sup>c</sup>Well 199-N-165 will replace well 199-N-59 in FY 2009.</p>											
<p>A = to be sampled annually.      C = well is constructed as a resource protection well under WAC 173-160.      FY = fiscal year.      P = constructed prior to WAC requirements.      S = to be sampled semiannually.      Spec. Cond. = specific conductance.      WAC = <i>Washington Administrative Code</i>.</p>											

**Table B-4. Critical Means for 116-N-1 Liquid Waste Disposal Facility for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	9	8	7.63	0.2561	3.3588	5.6174	[6.11 - 9.14]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	9	8	653.14	139.7550	21.3974	5.0413	1,396
Total organic carbon* ( $\mu\text{g}/\text{L}$ )	9	8	664.33	574.1893	86.4309	5.0413	3,716
Total organic halides* ( $\mu\text{g}/\text{L}$ )	9	8	6.76	3.6359	53.7615	5.0413	26.1

Based on semiannual sampling events from October 2006 through September 2008 for upgradient well 199-N-57 and from April 2007 through September 2008 for upgradient well 199-N-34.

\*For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation.

df = degrees of freedom (n-1).

FY = fiscal year.

n = number of background replicate averages.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 20 comparisons.

**Table B-5. Critical Means for 120-N-1 and 120-N-2 Liquid Waste Disposal Facilities for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	5	4	8.01	0.1253	1.5647	9.7291	[6.67 - 9.35]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	5	4	428.95	37.0268	8.6320	8.1216	758
Total organic carbon <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	5	4	330.10	56.6132	17.1503	8.1216	834
Total organic halides <sup>a,c</sup> ( $\mu\text{g}/\text{L}$ )	6	5	4.77	1.2868	26.9679	6.5414	13.9

Based on semiannual sampling events from December 2006 through June 2008 for upgradient well 199-N-71, except December 2005 through June 2008 for total organic carbon.

<sup>a</sup> For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

<sup>b</sup> Excluding erroneous data from December 2006.

<sup>c</sup> Excluding erroneous data from December 2007.

CV = coefficient of variation.

df = degrees of freedom (n-1).

FY = fiscal year.

n = number of background replicate averages.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 16 comparisons.

**Table B-6. Critical Means for 116-N-3 Liquid Waste Disposal Facility for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	5	4	7.97	0.0859	1.0782	9.7291	[7.05 - 8.89]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	5	4	383.95	11.6477	3.0336	8.1216	488
Total organic carbon* ( $\mu\text{g}/\text{L}$ )	5	4	252.80	133.9653	52.9926	8.1216	1,445
Total organic halides* ( $\mu\text{g}/\text{L}$ )	6	5	5.75	2.4873	43.2881	6.5414	23.3

Based on semiannual sampling events from September 2006 through September 2008 for upgradient well 199-N-74.

\* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation.  
df = degrees of freedom (n-1).  
FY = fiscal year.  
n = number of background replicate averages.  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 16 comparisons.

**Table B-7. Monitoring Wells and Constituents for 116-H-6 Evaporation Basins.**

Well Number	Comment	WAC Compliant	Permit-Specified				Other Parameters			Sampled as Scheduled in FY 2008
			Hex Cr (filtered)	Nitrate	Technetium-99 <sup>a</sup>	Uranium <sup>a</sup>	Alkalinity	Anions	Metals (filtered)	
199-H4-12A	Extraction well	C	A	A	A	A	A	A	A	Yes
199-H4-12C	Mid-depth unconfined	C	A	A	A	A	A	A	A	Yes
199-H4-3	Extraction well	P	A	A	A	A	A	A	A	Yes
199-H4-8		C	A	A	A	A	A	A	A	Yes

Requirements from PNNL-11573 and 2006 permit modification.<sup>b</sup>  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Radionuclides not typically subject to RCRA monitoring, but included in the current Hanford Facility RCRA Permit (WA7890008967) for this facility.

<sup>b</sup> Hanford Facility RCRA Permit (WA7890008967) Modification Notification Form, signed by GP Davis (Ecology), January 10, 2006. 183-H Solar Evaporation Basins, Part VI, Chapter 2, and Attachment 37.

A = to be sampled annually.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
Hex Cr = hexavalent chromium.  
P = constructed prior to WAC requirements.  
RCRA = Resource Conservation and Recovery Act of 1976.  
WAC = Washington Administrative Code.

**Table B-8. Monitoring Wells and Constituents for 216-A-29 Ditch.**

Well Number <sup>a</sup>	Comment	WAC Compliant	Contamination Indicator Parameters				Other Parameters				Sampled as Scheduled in FY 2008
			Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals	Phenols	
299-E25-26	Upper unconfined	C	S	S	S	S	S	S	A	A	Alkalinity once
299-E25-28	Deep unconfined; no statistics	C	S	S	S	S	S	S	A	A	TOC, TOX, and alkalinity once <sup>b</sup>
299-E25-32P		C	S	S	S	S	S	S	A	A	Alkalinity once
299-E25-34		C	S	S	S	S	S	S	A	A	Alkalinity once
299-E25-35		C	S	S	S	S	S	S	A	A	Alkalinity once
299-E25-48		C	S	S	S	S	S	S	A	A	Alkalinity once
299-E26-12		C	S	S	S	S	S	S	A	A	Alkalinity once
299-E26-13		C	S	S	S	S	S	S	A	A	Alkalinity once
<b>699-43-45</b>		C	S	S	S	S	S	S	A	A	Yes

Requirements from PNNL-13047.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.  
<sup>a</sup>Bold italic = Upgradient well.  
<sup>b</sup>Not needed for this supplemental well.

A = to be sampled annually.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
S = to be sampled semiannually.  
Spec. Cond. = specific conductance.  
TOC = total organic carbon.  
TOX = total organic halides.  
WAC = Washington Administrative Code.

**Table B-9. Critical Means for 216-A-29 Ditch for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	7	6	8.34	0.1301	1.5604	7.4012	[7.31 - 9.36]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	6	5	243.88	2.0233	0.8296	7.6037	260
Total organic carbon* ( $\mu\text{g}/\text{L}$ )	5	4	259.00	115.7800	44.7027	9.7291	1,493
Total organic halides* ( $\mu\text{g}/\text{L}$ )	6	5	4.25	2.7531	64.7796	7.6037	26.9

Based on semiannual sampling events from upgradient well 699-43-45: April 2006 through April 2008 for specific conductance and total organic halides; November 2006 through April 2008 for total organic carbon; January 2006 through April 2008 for pH.

\* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV= coefficient of variation.

df = degrees of freedom (n-1).

FY = fiscal year.

n = number of background replicate averages.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 32 comparisons.

**Table B-10. Monitoring Wells and Constituents for 216-B-3 Pond.**

Well Number <sup>a</sup>	Comment	WAC Compliant	Contamination Indicator Parameters				Other Parameters					Sampled as Scheduled in FY 2008	
			Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Alpha <sup>b</sup>	Anions	Beta <sup>b</sup>	Metals		
699-42-42B	Bottom of aquifer	C	S	S	S	S	A	S	A	S	A	A	Yes
699-43-44		C	S	S	S	S	A	S	A	S	A	A	Yes
699-43-45		C	S	S	S	S	A	S	A	S	A	A	Yes
<b>699-44-39B</b>		C	S	S	S	S	A	S	A	S	A	A	Yes

Requirements from PNNL-15479.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Monitored for *Atomic Energy Act of 1954*.

A = to be sampled annually.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
S = to be sampled semiannually.  
Spec. Cond. = specific conductance.  
WAC = *Washington Administrative Code*.

**Table B-11. Critical Means for 216-B-3 Pond for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	6	5	8.15	0.1630	2.0004	7.6037	[6.81 - 9.49]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	6	5	263.58	18.1856	6.8994	6.5414	392
Total organic carbon <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	5	4	255.30	106.7261	41.8042	8.1216	1,205
Total organic halides <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	5	4	2.05	0.8906	43.5524	8.1216	10.0

Based on semiannual sampling events from January 2006 through August 2008 for upgradient well 699-44-39B.

<sup>a</sup> For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.  
<sup>b</sup> Excluding erroneous data from February 2007.

CV = coefficient of variation.  
df = degrees of freedom (n-1).  
FY = fiscal year.  
n = number of background replicate averages.  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 16 comparisons.

**Table B-12. Monitoring Wells and Constituents for 216-B-63 Trench.**

Well Number <sup>a</sup>	WAC Compliant	Contamination Indicator Parameters				Other Parameters						Sampled as Scheduled in FY 2008
		Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Alpha <sup>b</sup>	Anions	Beta <sup>b</sup>	Metals	Phenols	
<b>299-E27-8</b>	C	S	S	S	S	A	S	A	S	A	A	Yes
<b>299-E27-9</b>	C	S	S	S	S	A	S	A	S	A	A	Yes
<b>299-E27-11</b>	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-16	C	S	S	S	S	A	S	A	S	A	A	Yes
<b>299-E27-17</b>	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-18	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E27-19	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E33-33	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E33-36	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E33-37	C	S	S	S	S	A	S	A	S	A	A	Yes
299-E34-8	C	S	S	S	S	A	S	A	S	A	A	Yes
<b>299-E34-10</b>	C	S	S	S	S	A	S	A	S	A	A	Yes

Requirements from PNNL-14112.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Monitored for *Atomic Energy Act of 1954*.

A = to be sampled annually.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
S = to be sampled semiannually.  
Spec. Cond. = specific conductance.  
WAC = *Washington Administrative Code*.

**Table B-13. Critical Means for 216-B-63 Trench for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	20	19	8.08	0.1178	1.4588	4.5718	[7.52 - 8.63]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	20	19	476.19	86.1044	18.0820	4.2669	853
Total organic carbon <sup>a</sup> ( $\mu\text{g}/\text{L}$ )	20	19	329.16	161.8590	49.1730	4.2669	1,037
Total organic halides <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	18	17	5.95	4.9727	83.5092	4.3706	28.3

Based on semiannual sampling events from November 2006 through April 2008 for upgradient wells 299-E27-8, 299-E27-9, 299-E27-17, and 299-E34-10, and October 2006 through April 2008 for upgradient well 299-E27-11.

<sup>a</sup> For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

<sup>b</sup> Excluding erroneous data from April 2008 for upgradient well 299-E27-9.

CV = coefficient of variation.

df = degrees of freedom (n-1).

FY = fiscal year.

n = number of background replicate averages.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 48 comparisons.

**Table B-14. Monitoring Wells and Constituents for 216-S-10 Pond and Ditch.**

Well Number*	Comment	WAC Compliant	Contamination Indicator Parameters				Other Parameters							Sampled as Scheduled in FY 2008	
			Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Carbon Tetrachloride	Chloroform	Hex Cr	Metals	Phenols	Vanadium	
299-W26-13		C	S	S	S	S	S	A	A	A	S	A	A	A	Alkalinity once
299-W26-14		C	S	S	S	S	S	A	A	A	S	A	A	A	Alkalinity once
299-W27-2	Bottom of aquifer; no statistics	C	S	S	S	S	S	A	A	A	S	A	A	A	Alkalinity once
699-32-76		C	S	S	S	S	S	A	A	A	S	A	A	A	New wells; to be sampled beginning in FY 2009
699-33-75		C	S	S	S	S	S	A	A	A	S	A	A	A	
<b>699-33-76</b>		C	S	S	S	S	S	A	A	A	S	A	A	A	

Requirements from PNNL-14070 and PNNL-14070-ICN-2.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

\* Bold italic = upgradient well.

A = to be sampled annually.

C = well is constructed as a resource protection well under WAC 173-160.

FY = fiscal year.

Hex Cr = hexavalent chromium.

S = to be sampled semiannually.

Spec. Cond. = specific conductance.

WAC = Washington Administrative Code.

**Table B-15. Critical Means for 216-S-10 Pond and Ditch for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	t <sub>c</sub>	Critical Mean
pH	4	3	8.11	2.2	10.8689	[7.49 - 8.73]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	4	3	269.8	0.04	13.745	296
Total organic carbon <sup>a</sup> ( $\mu\text{g}/\text{L}$ )	4	3	195.6	90.9	10.8689	1,300
Total organic halides <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	4	3	NC	NC	10.8689	NC

Based on semiannual sampling events from December 2001 through June 2003 for former upgradient well 299-W26-7 (dry in 2003). Background levels will be revised when data from new upgradient well are available.

<sup>a</sup> For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

<sup>b</sup> Critical mean not calculated because essentially all measurements were below detection limit. Upgradient/downgradient comparison value is limit of quantitation (updated quarterly).

df = degrees of freedom (n-1).

FY = fiscal year.

n = number of background replicate averages.

NC = not calculated.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 48 comparisons.

**Table B-17. Monitoring Wells and Constituents for 316-5 Process Trenches.**

Well Number	Comment	WAC Compliant	cis-1,2-Dichloroethene	Tetrachloroethene	Trichloroethene	Uranium*	Sampled as Scheduled in FY 2008
399-1-10A		C	S	S	S	S	Yes
399-1-10B	Lower unconfined	C	S	S	S	S	Yes
399-1-16A		C	S	S	S	S	Yes
399-1-16B	Lower unconfined	C	S	S	S	S	Yes
399-1-17A		C	S	S	S	S	Yes
399-1-17B	Lower unconfined	C	S	S	S	S	Yes
399-1-18A		C	S	S	S	S	Yes
399-1-18B	Lower unconfined	C	S	S	S	S	Yes
Requirements from WHC-SD-EN-AP-185. Wells completed at the top of the unconfined aquifer unless specified otherwise. * Radionuclides not typically subject to RCRA monitoring, but included in the current Hanford Facility RCRA Permit (WA7890008967) for this facility. C = well is constructed as a resource protection well under WAC 173-160. FY = fiscal year. RCRA = <i>Resource Conservation and Recovery Act of 1976</i> . S = to be sampled four times semiannually. WAC = <i>Washington Administrative Code</i> .							

**Table B-18. Monitoring Wells and Constituents for Integrated Disposal Facility.**

Well Number <sup>a</sup>	WAC Compliant	Indicator Parameters				Other Parameters						Sampled as Scheduled in FY 2008	
		Chromium (filtered, unfiltered)	Spec. Cond. (field)	pH (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals	Alpha <sup>b</sup>	Beta <sup>b</sup>	Iodine-129 <sup>b</sup>	
299-E17-22	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E17-23	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E17-25	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
299-E17-26	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
<b>299-E18-1</b>	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
<b>299-E24-21</b>	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes
<b>299-E24-24</b>	C	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S <sup>c</sup>	S	S	S	S	S	S	Yes

Requirements from DOE/RL-2003-12 and RPP-PLAN-26534.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Operational parameters monitored for DOE O 435.1.  
<sup>c</sup> To be sampled four times semiannually (total of eight times per well per year).

C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
S = to be sampled semiannually.  
Spec. Cond. = specific conductance.  
WAC = Washington Administrative Code.

**Table B-19. Monitoring Wells and Constituents for Liquid Effluent Retention Facility.**

Well Number <sup>a</sup>	WAC Compliant	Alkalinity	Alpha <sup>b</sup>	Ammonium	Anions	Beta <sup>b</sup>	Metals	Phenols	Volatile Organic Analyses	Sampled as Scheduled in FY 2008
299-E26-10	C	A	S	S	A	S	A	A	S	No VOA
<b>299-E26-11</b>	C	A	S	S	A	S	A	A	S	No VOA
299-E26-77	C	A	S	S	A	S	A	A	S	New well; first sampled 8/2008
299-E26-79	C	A	S	S	A	S	A	A	S	New well; to be sampled FY 2009

Requirements from WHC-SD-EN-AP-024.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Monitored for *Atomic Energy Act of 1954*.

A = to be sampled annually.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
S = to be sampled semiannually.  
WAC = Washington Administrative Code.

**Table B-20. Monitoring Wells and Constituents for Low-Level Waste Management Area 1.**

Well Number <sup>a</sup>	WAC Compliant	Contamination Indicator Parameters				Other Chemical Parameters				AEA Parameters <sup>b</sup>				Sampled as Scheduled in FY 2008		
		pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals	Mercury	Lead	Phenols	Iodine-129	Technetium-99	Tritium		
<b>299-E28-26</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
<b>299-E28-27</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
<b>299-E28-28</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-2	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-3	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
<b>299-E32-4</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-5	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-6	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-7	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-8	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-9	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E32-10	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
<b>299-E33-28</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
<b>299-E33-29</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E33-30	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
299-E33-34	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes
<b>299-E33-35</b>	C	S	S	S	S	A	S	S	A	A	A	S	S	S	S	Yes

Requirements from PNNL-14859-ICN-1 and DOE/RL-2000-72.

Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Bold italic = Upgradient well.<sup>b</sup> Monitored for *Atomic Energy Act of 1954*.

A = to be sampled annually.

C = well is constructed as a resource protection well under WAC 173-160.

FY = fiscal year.

S = to be sampled semiannually.

Spec. Cond. = specific conductance.

WAC = *Washington Administrative Code*.

**Table B-21. Critical Means for Low-Level Waste Management Area 1 for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	31	30	7.95	0.0917	1.1545	4.3444	[7.54 - 8.35]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	31	30	524.10	77.6529	14.8165	4.0948	847
Total organic carbon <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	32	31	301.30	196.7931	65.3154	4.0778	1,116
Total organic halides <sup>a,c</sup> ( $\mu\text{g}/\text{L}$ )	29	28	5.32	5.5623	104.6463	4.1327	28.7

Based on semiannual sampling events from December 2006 through June 2008 for upgradient wells 299-E28-26 and 299-E33-35; from December 2006 through July 2008 for upgradient well 299-E28-27; from January 2007 through June 2008 for upgradient wells 299-E28-28, 299-E33-28, and 299-E33-29; and from January 2007 through July 2008 for upgradient well 299-E32-4.

<sup>a</sup> For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

<sup>b</sup> Excluding erroneous data from January or February 2008.

<sup>c</sup> Excluding erroneous data from December 2006.

CV = coefficient of variation.

df = degrees of freedom (n-1).

FY = fiscal year.

n = number of background replicate averages.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 68 comparisons.

**Table B-22. Monitoring Wells and Constituents for Low-Level Waste Management Area 2.**

Well Number <sup>a</sup>	Comment	WAC Compliant	Contamination Indicator Parameters				Other Chemical Parameters					AEA Parameters <sup>b</sup>			Sampled as Scheduled in FY 2008		
			pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals	Mercury	Lead	Polychlorinated Biphenyls	Phenols	Iodine-129	Technetium-99	Tritium	Uranium
299-E27-8		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-E27-9		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
<b>299-E27-10</b>		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-E27-11		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Radionuclides once
299-E27-17		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-E34-2		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-E34-9		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-E34-10		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes
299-E34-12		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	Yes

Requirements from PNNL-14859-ICN-1 and DOE/RL-2000-72.

Wells completed at the top of the unconfined aquifer.

<sup>a</sup> Bold italic = Upgradient well.

<sup>b</sup> Monitored for DOE O 435.1.

A = to be sampled annually.

AEA = Atomic Energy Act of 1954.

C = well is constructed as a resource protection well under WAC 173-160.

FY = fiscal year.

S = to be sampled semiannually.

Spec. Cond. = specific conductance.

WAC = Washington Administrative Code.

**Table B-23. Critical Means for Low-Level Waste Management Area 2 for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	4	3	7.71	0.0382	0.4963	19.8889	[6.85 - 8.56]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	4	3	1023.69	14.7300	1.4389	15.7577	1,278
Total organic carbon <sup>a</sup> ( $\mu\text{g}/\text{L}$ )	5	4	738.85	209.0672	28.2963	10.0298	3,036
Total organic halides <sup>a,b</sup> ( $\mu\text{g}/\text{L}$ )	5	4	11.00	7.2861	66.2676	10.0298	91.0

Based on semiannual sampling events from April 2006 through April 2008 for upgradient well 299-E27-10.

<sup>a</sup> For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

<sup>b</sup> Excluding erroneous data from October 2007.

CV = coefficient of variation.  
df = degrees of freedom (n-1).  
FY = fiscal year.  
n = number of background replicate averages.  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 36 comparisons.

**Table B-24. Monitoring Wells and Constituents for Low-Level Waste Management Area 3.**

Well Number	Comment	WAC Compliant	Contamination Indicator Parameters				Other Chemical Parameters					AEA Parameters <sup>a</sup>			Sampled as Scheduled in FY 2008			
			pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals	Mercury	Lead	Phenols	Volatile Organic Analyses	Iodine-129	Technetium-99	Tritium	Uranium	
299-W7-3	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W7-4		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	No <sup>b</sup>
299-W8-1		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W10-14	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W10-29		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W10-30		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W10-31		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes

Requirements from PNNL-14859-ICN-1 and DOE/RL-2000-72.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Monitored for DOE O 435.1.  
<sup>b</sup> Well 299-W7-4 removed from network March 2008 due to cave-in potential.

A = to be sampled annually.  
AEA = *Atomic Energy Act of 1954*.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
S = to be sampled semiannually.  
Spec. Cond. = specific conductance.  
WAC = *Washington Administrative Code*.

**Table B-25. Monitoring Wells and Constituents for Low-Level Waste Management Area 4.**

Well Number <sup>a</sup>	Comment	WAC Compliant	Contamination Indicator Parameters				Other Chemical Parameters						AEA Parameters <sup>b</sup>			Sampled as Scheduled in FY 2008		
			pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Metals	Mercury	Lead	Phenols	Volatile Organic Analyses	Iodine-129	Technetium-99	Tritium	Uranium	
<b>299-W15-15</b>		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Not sampled; dry January 2008
299-W15-17	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W15-30		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W15-83		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W15-94		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W15-152		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
299-W15-224		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
<b>299-W18-21</b>		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
<b>299-W18-22</b>	Deep unconfined; no statistics	C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Yes
<b>299-W18-23</b>		C	S	S	S	S	A	S	S	A	A	A	A	S	S	S	S	Sampled once for RCRA; dry July 2008

Requirements from PNNL-14859-ICN-1 and DOE/RL-2000-72.

Wells completed at the top of the unconfined aquifer unless specified otherwise.

<sup>a</sup> Bold italic = Upgradient well.<sup>b</sup> Monitored for DOE O 435.1.

A = to be sampled annually.

AEA = *Atomic Energy Act of 1954*.

C = well is constructed as a resource protection well under WAC 173-160.

FY = fiscal year.

S = to be sampled semiannually.

Spec. Cond. = specific conductance.

WAC = *Washington Administrative Code*.**Table B-26. Critical Means for Low-Level Waste Management Area 4 for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	13	12	7.9648	0.1951	2.4490	4.8233	[6.99 - 8.94]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	12	11	515.6667	38.3759	7.4420	4.5477	697
Total organic carbon* ( $\mu\text{g}/\text{L}$ )	13	12	288.0769	125.5969	43.5984	4.4215	864
Total organic halides* ( $\mu\text{g}/\text{L}$ )	11	10	4.8343	2.9512	61.0471	4.7065	19.3

Based on semiannual sampling events from January 2006 through July 2007 for upgradient well 299-W15-15; from January 2008 through August 2008 for upgradient well 299-W18-21; and from February 2007 through May 2008 for upgradient well 299-W18-23.

\* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation.

df = degrees of freedom (n-1).

n = number of background replicate averages.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 24 comparisons.

**Table B-27. Monitoring Wells and Constituents for the Nonradioactive Dangerous Waste Landfill.**

Well Number*	Comment	WAC Compliant	Contamination Indicator Parameters				Other Parameters			Sampled as Scheduled in FY 2008	
			pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Anions	Metals	Phenols		
699-25-33A	Top of LPU; no statistics	C	S	S	S	S	S	A	A	S	Yes
699-25-34A		C	S	S	S	S	S	A	A	S	Yes
699-25-34B		C	S	S	S	S	S	A	A	S	Yes
699-25-34D		C	S	S	S	S	S	A	A	S	Yes
699-26-33		C	S	S	S	S	S	A	A	S	Yes
<b>699-26-34A</b>		C	S	S	S	S	S	A	A	S	Yes
699-26-34B		C	S	S	S	S	S	A	A	S	Yes
<b>699-26-35A</b>		C	S	S	S	S	S	A	A	S	Yes
<b>699-26-35C</b>	Top of LPU; no statistics	C	S	S	S	S	S	A	A	S	Yes

Requirements from PNNL-12227 and PNNL-12227-ICN-1.  
Wells completed at the top of the unconfined aquifer unless specified otherwise.

\* Bold italic = Upgradient well.

A = to be sampled annually.

C = well is constructed as a resource protection well under WAC 173-160.

FY = fiscal year.

LPU = low-permeability unit in upper Ringold Formation.

S = to be sampled semiannually.

Spec. Cond. = specific conductance.

WAC = Washington Administrative Code.

**Table B-28. Critical Means for Nonradioactive Dangerous Waste Landfill for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	8	7	7.25	0.0849	1.1717	6.4295	[6.67 - 7.83]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	8	7	543.94	9.0955	1.6722	5.7282	599
Total organic carbon* ( $\mu\text{g}/\text{L}$ )	8	7	285.41	122.6511	42.9742	5.7282	1,031
Total organic halides* ( $\mu\text{g}/\text{L}$ )	9	8	3.28	3.4586	105.3827	5.3162	22.7

Based on semiannual sampling events from September 2006 through August 2008 for upgradient well 699-26-34A and from February 2007 through August 2008 for upgradient well 699-26-35A.

\* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation.

df = degrees of freedom (n-1).

FY = fiscal year.

n = number of background replicate averages.

t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 28 comparisons.

**Table B-29. Monitoring Wells and Constituents for RCRA PUREX Cribs 216-A-10, 216-A-36B, and 216-A-37-1**

Well Number*	Comment	WAC Compliant	Primary RCRA Constituent	Supporting Parameters			Sampled as Scheduled in FY 2008
			Nitrate	Anions	Metals	Phenols	
299-E17-1	216-A-10	P	S	S	S	A	Yes
299-E17-14	216-A-36B	C	Q	Q	Q	A	Yes
299-E17-16	216-A-36B	C	S	S	S	A	Yes
299-E17-18	216-A-36B	C	S	S	S	A	Yes
299-E17-19	216-A-10	C	S	S	S	A	Yes
299-E24-16	216-A-10	C	Q	Q	Q	A	Yes
299-E24-18	Upgradient	C	S	S	S	A	Yes
299-E25-17	216-A-37-1	P	S	S	S	A	Yes
299-E25-19	216-A-37-1	P	Q	Q	Q	A	Yes
299-E25-31	Upgradient	C	S	S	S	A	Yes
699-37-47A	Downgradient	C	S	S	S	A	Yes
Additional wells	Far-field		*	*			See Appendix A for 200-PO-1
Requirements from PNNL-11523. Wells completed at the top of the unconfined aquifer. * Far-field wells sampled annually to triennially in conjunction with 200-PO-1 Operable Unit. A = to be sampled annually. C = well is constructed as a resource protection well under WAC 173-160. FY = fiscal year. P = constructed prior to WAC requirements. PUREX = Plutonium-Uranium Extraction Plant. Q = to be sampled quarterly. RCRA = <i>Resource Conservation and Recovery Act of 1976</i> . S = to be sampled semiannually. WAC = <i>Washington Administrative Code</i> .							

**Table B-30. Monitoring Wells and Constituents for Waste Management Area A-AX.**

Well Number <sup>a</sup>	WAC Compliant	Site-Specific Constituents										Sampled as Scheduled in FY 2008
		Nitrate	Sodium	Sulfate	Total Organic Carbon	Chromium	Lead	Alkalinity	Anions	Metals	Technetium-99 <sup>b</sup>	
299-E24-20	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E24-22	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E24-33	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-2	P	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-40	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-41	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-93	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-94	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E25-236	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	New well; sampling will begin FY 2009

Requirements from PNNL-15315.  
 Wells completed at the top of the unconfined aquifer.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> *Atomic Energy Act of 1954* parameter.

C = well is constructed as a resource protection well under WAC 173-160.  
 FY = fiscal year.  
 P = constructed prior to WAC requirements.  
 Q = to be sampled quarterly.  
 WAC = *Washington Administrative Code*.

**Table B-31. Monitoring Wells and Constituents for Waste Management Area B-BX-BY.**

Well Number*	WAC Compliant	RCRA Parameters				AEA Parameters				Sampled as Scheduled in FY 2008
		Alkalinity	Anions	Cyanide	Metals	Gamma	Technetium-99	Tritium	Uranium	
299-E28-8	P	Q	Q	Q	Q	S	Q	Q	Q	Cyanide and uranium 3X; gamma once
299-E33-7	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-9	P	Q	Q	Q	Q	S	Q	Q	Q	Sampled once; access limitations
299-E33-15	P	S	S	S	S	S	S	S	S	Yes
299-E33-16	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-17	P	A	A	A	A	A	A	A	A	Yes
299-E33-18	P	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-20	P	A	A	A	A	A	A	A	A	Yes
299-E33-21	P	A	A	A	A	A	A	A	A	Yes
299-E33-26	C	Q	Q	Q	Q	S	Q	Q	Q	Sampled 3X; schedule conflict
299-E33-31	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-32	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-38	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-39	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-41	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-42	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-43	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-44	C	Q	Q	Q	Q	S	Q	Q	Q	Yes
299-E33-47	C	Q	Q	Q	Q	Q	Q	Q	Q	4th delayed till 11/2008
299-E33-48	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-49	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-334	C	Q	Q	Q	Q	Q	Q	Q	Q	Sampled 3X; schedule conflict
299-E33-335	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-337	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-338	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-339	C	Q	Q	Q	Q	Q	Q	Q	Q	Yes
299-E33-341										New wells for 200-BP-5. Will be evaluated for possibly adding to WMA B-BX-BY network in FY 2009.
299-E33-342										
299-E33-343										
299-E33-344										
299-E33-345										

Requirements from PNNL-13022-ICN-3.

Wells completed at the top of the unconfined aquifer.

\* Gradient nearly flat. No upgradient wells defined.

A = to be sampled annually.

AEA = *Atomic Energy Act of 1954*.

C = well is constructed as a resource protection well under WAC 173-160.

FY = fiscal year.

P = constructed prior to WAC requirements.

Q = to be sampled quarterly.

RCRA = *Resource Conservation and Recovery Act of 1976*.

S = to be sampled semiannually.

WAC = *Washington Administrative Code*.

**Table B-32. Monitoring Wells and Constituents for Waste Management Area C.**

Well Number <sup>a</sup>	WAC Compliant	Contamination Indicator Parameters			Other Chemical Parameters				AEA Parameters				Sampled as Scheduled in FY 2008	
		pH (field)	Spec. Cond. (field)	Total Organic Carbon	Total Organic Halides	Alkalinity	Anions	Cyanide	Metals	Phenols	Beta	Gamma	Technetium-99	
299-E27-4	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes
<b>299-E27-7</b>	P	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes
299-E27-12	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes
299-E27-13	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes
299-E27-14 <sup>b</sup>	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes
299-E27-15	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes
299-E27-21	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Sampled 3X; schedule conflict
<b>299-E27-22</b>	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes
299-E27-23	C	Q	Q	S	S	Q	Q	Q	Q	A	Q	Q	Q	Yes

Requirement from PNNL-13024-ICN-4 and RPP-21895.  
Wells completed at the top of the unconfined aquifer.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Well is cross-gradient of 241-C Tank Farm but downgradient of a waste transfer line.

A = to be sampled annually.  
AEA = *Atomic Energy Act of 1954*.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
P = constructed prior to WAC requirements.  
Q = to be sampled quarterly.  
S = to be sampled semiannually.  
Spec. Cond. = specific conductance.  
WAC = *Washington Administrative Code*.

**Table B-33. Critical Means for Waste Management Area C for FY 2009 Comparisons.**

Constituent (unit)	n	df	Mean	Standard Deviation	CV (%)	t <sub>c</sub>	Critical Mean
pH	8	7	8.08	0.1338	1.6562	6.6987	[7.13 - 9.03]
Specific conductance ( $\mu\text{S}/\text{cm}$ )	8	7	690.41	47.4594	6.8741	5.9757	991
Total organic carbon* ( $\mu\text{g}/\text{L}$ )	9	8	644.83	417.9732	64.8188	5.5274	3,080
Total organic halides* ( $\mu\text{g}/\text{L}$ )	9	8	5.03	4.2470	84.3780	5.5274	29.8

Based on semiannual sampling events from December 2006 through June 2008 for upgradient wells 299-E27-7 and 299-E27-22.

\* For values reported below laboratory's specified method detection limit, one-half of the method detection limit is used in the critical mean calculation.

CV = coefficient of variation.  
df = degrees of freedom (n-1).  
FY = fiscal year.  
n = number of background replicate averages.  
t<sub>c</sub> = Bonferroni critical t-value for appropriate df and 36 comparisons.

**Table B-34. Monitoring Wells and Constituents for Waste Management Area S-SX.**

Well Number <sup>a</sup>	WAC Compliant	RCRA Parameters		Supporting Constituents						Sampled as Scheduled in FY 2008	
		Chromium	Nitrate	Alkalinity	Anions	Metals	Technetium-99	Tritium	Uranium		
299-W22-26 <sup>b</sup>	P	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-44	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-45	C	Q	Q	Q	Q	Q	Q	A	A		Sampled 3X; well access limitations
299-W22-47	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-48	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-49	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-50	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-69	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-72	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-80	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-81	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-82	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-83	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-84	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-85	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W22-86	C	Q	Q	Q	Q	Q	Q	A	A		Sampled 3X <sup>c</sup>
299-W23-15	C	Q	Q	Q	Q	Q	Q	A	A		Yes
299-W23-19	C	Q	Q	Q	Q	Q	Q	A	A	A	Yes
<b>299-W23-20</b>	C	Q	Q	Q	Q	Q	Q	A	A		Yes
<b>299-W23-21</b>	C	Q	Q	Q	Q	Q	Q	A	A		Yes

Requirements from PNNL-12114-ICN-3.  
Wells completed at the top of the unconfined aquifer.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Sampled in FY 2008. Will be added to upcoming revision of monitoring plan.  
<sup>c</sup> June sampling delayed until August. September cancelled.

A = to be sampled annually.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
P = constructed prior to WAC requirements.  
Q = to be sampled quarterly.  
RCRA = Resource Conservation and Recovery Act of 1976.  
WAC = Washington Administrative Code.

**Table B-35. Monitoring Wells and Constituents for Waste Management Area T.**

Well Number <sup>a</sup>	Comment	WAC Compliant Chromium (total, filtered)	Constituents of Concern		Constituents of Interest and Supporting Groundwater Quality Constituents								Sampled as Scheduled in FY 2008
			Nitrate	Alkalinity	Anions	Gamma Scan	Alpha	Beta	Iodine-129	Metals	Technetium-99	Tritium	
<b>299-W10-1</b>		P	Q	Q	Q	Q	A	A	Q	Q	Q	Q	Yes
299-W10-4		P	Q	Q	Q	Q	A	A	Q	Q	Q	Q	Yes
299-W10-8		P	Q	Q	Q	Q	A	A	Q	Q	Q	Q	Yes
299-W10-22		C	S	S	S	S			S	S	S		Alkalinity once
299-W10-23		C	Q	Q	Q	Q	A	A	Q	Q	Q	Q	Yes
299-W10-24		C	Q	Q	Q	Q	S	S	Q	Q	Q	Q	Yes
<b>299-W10-28</b>		C	Q	Q	Q	Q	A	A	Q	Q	Q	Q	Yes
299-W11-7		P	S	S	S	S			S	S	S	S	Yes
299-W11-12		P	Q	Q	Q	Q	A	A	Q	Q	Q	Q	Yes
299-W11-39		C	Q	Q	Q	Q	S	S	Q	Q	Q	Q	Yes
299-W11-40		C	Q	Q	Q	Q	A	A	Q	Q	Q	Q	Yes
299-W11-41		C	Q	Q	Q	Q	S	S	A	Q	Q	Q	Yes
299-W11-42		C	Q	Q	Q	Q	S	S	S	Q	Q	Q	Yes
299-W11-45	Screened 8.5 to 13 m below water table	C	Q	Q	Q	Q	A	A	A	Q	Q	Q	Alkalinity twice <sup>b</sup>
299-W11-46	Screened 6 to 12 m below water table	C	Q	Q	Q	Q	S	S	S	Q	Q	Q	Alkalinity 3X <sup>b</sup>
299-W11-47	Screened 9.1 to 18.2 m below water table	C	Q	Q	Q	Q	S	S	S	A	Q	Q	Yes
Requirements from PNNL-15301. Wells completed at the top of the unconfined aquifer.													
<sup>a</sup> Bold italic = Upgradient well. <sup>b</sup> Wells 299-W11-45 and -46 not sampled for WMA T in May due to aquifer testing, nor August due to Effluent Treatment Facility upgrades and maintenance. However, the wells were sampled four or more times during FY 2008 for other projects (e.g., 200-ZP-1).													
A = to be sampled annually. C = well is constructed as a resource protection well under WAC 173-160. FY = fiscal year. P = constructed prior to WAC requirements. Q = to be sampled quarterly. S = to be sampled semiannually. WAC = Washington Administrative Code.													

**Table B-36. Monitoring Wells and Constituents for Waste Management Area TX-TY.**

Well Number <sup>a</sup>	Comment	WAC Compliant	RCRA Parameters			AEA Parameters						Sampled as Scheduled in FY 2008
			Alkalinity	Anions	Metals	Alpha	Beta	Gamma	Iodine-129	Strontium-90	Technetium-99	
299-W10-26		C	Q	Q	Q	A	A	A		Q	Q	Yes
299-W10-27		C	Q	Q	Q	A	A	A		Q	Q	Yes
299-W14-6		P	Q	Q	Q	A	A			Q	Q	Yes
299-W14-11	Screened 11 to 14.6 m below water table	C	Q	Q	Q	S	S	S	Q	A	Q	Yes
299-W14-13		C	Q	Q	Q	S	S	S	Q	A	Q	Yes
299-W14-14		C	Q	Q	Q	A	A	A		Q	Q	Yes
299-W14-15		C	Q	Q	Q	A	A	A	Q		Q	Yes
299-W14-16		C	Q	Q	Q				Q		Q	Yes
299-W14-17		C	Q	Q	Q				Q		Q	Yes
299-W14-18		C	Q	Q	Q	A	A	A	Q		Q	Yes
299-W14-19		C	Q	Q	Q	A	A	A		Q	Q	Yes
<b>299-W15-40</b>	Extraction well	C	Q	Q	Q	A	A			Q	Q	Alkalinity 3X <sup>b,c</sup>
299-W15-41		C	Q	Q	Q	A	A	A	S		Q	Yes
<b>299-W15-44</b>	Extraction well	C	Q	Q	Q	A	A	A	S		Q	Yes <sup>b,c</sup>
299-W15-763		C	Q	Q	Q	A	A	A		Q	Q	Sampled 3X <sup>b</sup>
<b>299-W15-765</b>	Extraction well	C	Q	Q	Q	A	A	A	S		Q	Yes <sup>b,c</sup>

Requirements from PNNL-16005.  
Wells completed at the top of the unconfined aquifer.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Wells 299-W15-40, -44, -763, and -765 not sampled in August for WMA TX-TY due to 200-ZP-1 pump-and-treat upgrades.  
<sup>c</sup> Sampled at least 3X during FY 2008 for other projects (e.g., 200-ZP-1).

A = to be sampled annually.  
AEA = *Atomic Energy Act of 1954*.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
P = constructed prior to WAC requirements.  
Q = to be sampled quarterly.  
RCRA = *Resource Conservation and Recovery Act of 1976*.  
S = to be sampled semiannually.  
WAC = *Washington Administrative Code*.  
WMA = Waste Management Area.

**Table B-37. Monitoring Wells and Constituents for Waste Management Area U.**

Well Number*	WAC Compliant	RCRA Parameters			AEA Parameters				Sampled as Scheduled in FY 2008
		Alkalinity	Anions	Metals	Alpha	Beta	Gamma	Technetium-99	
299-W18-30	C	Q	Q	Q	A	A	A	Q	Yes
<b>299-W18-31</b>	C	Q	Q	Q	A	A	A	Q	Dry in FY 2008
<b>299-W18-40</b>	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-12	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-41	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-42	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-44	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-45	C	Q	Q	Q	A	A	A	Q	Yes
299-W19-47	C	Q	Q	Q	A	A	A	Q	Yes

Requirement from PNNL-13612-ICN-2.  
Wells completed at the top of the unconfined aquifer.

\* Bold italic = Upgradient well.

A = to be sampled annually.  
AEA = *Atomic Energy Act of 1954*.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
Q = to be sampled quarterly.  
RCRA = *Resource Conservation and Recovery Act of 1976*.  
WAC = *Washington Administrative Code*.

**Table B-38. Monitoring Wells and Constituents for the KE and KW Basins.**

Well Number	Comment	WAC Compliant	Alpha	Anions	Beta	Carbon-14	Metals	Strononium-90	Technetium-99	Tritium	Alkalinity	Uranium (total)	VOA	Sampled as Scheduled in FY 2008
<b>KE Basin</b>														
199-K-27	Decommissioned	P	Q/M	Q	Q/M		S	A/S	A/Q	Q/M	0/S	0/S		Yes until 5/2008, decommissioned
199-K-29		P	Q/M	Q	Q/M	A/S	A/S	0/S	0/Q	M	0/S			Missed one month*
199-K-30		P	Q	Q	Q	A/S	S		0/S	Q	0/S			Yes
199-K-32A		C	Q	Q	Q	A/S	A/S		A/S	Q	0/S			Yes
199-K-109A	Decommissioned	C	Q/M	Q	Q/M		S	A	A/Q	Q/M	0/S			Yes until 5/2008, decommissioned
199-K-110A		C	S	S	S		A/S			S	0/S			Yes
199-K-111A		C	Q/M	Q	Q/M	A	A/S		A/S	Q/M	0/S			Yes
199-K-141		C	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q			Yes
199-K-142		C	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q	0/Q			Yes
<b>KW Basin</b>														
199-K-31	Not included in monitoring plan	P	0/S	0/S	0/S		0/S		0/A	0/S	0/A			Yes
199-K-34		C	Q	Q	Q	A	S/Q	A	A	Q	0/A	0/A		Yes
199-K-106A		C	Q	Q	Q	A/S	S/Q		0/Q	Q	0/S		0/S	Yes
199-K-107A		C	Q	Q	Q	A	S/Q	A	A	Q	0/A	0/A		Yes
199-K-108A		C	S	S	S	0/S	S			S	0/S			Yes
199-K-132		C	S/Q	S/Q	S/Q	A/S	S/Q		0/S	S/Q	0/S		0/S	Yes
Requirements from PNNL-14033. NOTE: Frequency required under monitoring plan is listed first. Some constituents are sampled more frequently during basin cleanout; those frequencies are listed after the slash. For example, 0/Q means not required under monitoring plan but currently sampled quarterly. Wells completed at the top of the unconfined aquifer. * No access in August 2008 due to nearby demolition work A = to be sampled annually. C = well is constructed as a resource protection well under WAC 173-160. FY = fiscal year. M = to be sampled monthly. P = constructed prior to WAC requirements. Q = to be sampled quarterly. S = to be sampled semiannually. VOA = volatile organic analyte. WAC = Washington Administrative Code.														

**Table B-39. Monitoring Wells, Constituents, and Enforcement Limits for 200 Area Treated Effluent Disposal Facility.**

Well *	WAC Compliant	Constituents with Enforcement Limits			Other Constituents							Sampled as Scheduled in FY 2008	
		pH (6.5 – 8.5)	Cadmium (5 µg/L)	Lead (10 µg/L)	Specific Conductance	Alpha	Anions	Beta	Metals	Total Dissolved Solids	Trace Metals	Tritium	
699-40-36	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes
699-41-35	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes
<b>699-42-37</b>	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	A	Yes

Requirements from PNNL-13032.  
All wells completed at the top of the Ringold Formation confined aquifer.

\* Bold italic = Upgradient well.

A = to be sampled annually.  
C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
Q = to be sampled quarterly.  
WAC = *Washington Administrative Code*.

**Table B-40. Monitoring Wells and Constituents for Environmental Restoration Disposal Facility.**

Well Number <sup>a</sup>	WAC Compliant	Alkalinity	Alpha	Anions	Beta	Carbon-14	Iodine-129	Metals	Radium <sup>b</sup>	Total Dissolved Solids	Technetium-99	Total Organic Halides	Uranium	Volatile Organic Analyses	Sampled as Scheduled in FY 2008
699-35-66A	P	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-36-67	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Decommissioned for ERDF expansion
699-36-66B	C	S	S	S	S	S	S	S	S	S	S	S	S	S	New well; sampling began 3/2008
<b>699-36-70A</b>	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Yes
699-37-68	C	S	S	S	S	S	S	S	S	S	S	S	S	S	Decommissioned for ERDF expansion
699-37-66	C	S	S	S	S	S	S	S	S	S	S	S	S	S	New well; sampling began 3/2008

Requirements from WCH-198.  
Wells completed at the top of the unconfined aquifer.

<sup>a</sup> Bold italic = Upgradient well.  
<sup>b</sup> Total alpha energy emitted from radium.

C = well is constructed as a resource protection well under WAC 173-160.  
ERDF = Environmental Restoration Disposal Facility.  
FY = fiscal year.  
P = constructed prior to WAC requirements.  
S = to be sampled semiannually.  
WAC = *Washington Administrative Code*.

**Table B-41. Monitoring Wells and Constituents for Solid Waste Landfill.**

Well Number*	Comment	WAC Compliant	Required Parameters (WAC 173-304-490)												Other Parameters			Sampled as Scheduled in FY 2008	
			Ammonia	Chemical Oxygen Demand	Chloride	Iron (filtered)	Manganese (filtered)	Zinc (filtered)	Nitrate	Nitrite	pH (field)	Spec. Cond. (field)	Sulfate	Temperature (field)	Coliform	Total Organic Carbon	Anions	Metals (filtered)	Arsenic (filtered)
699-22-35		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-23-34A		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-23-34B		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-33	Information only; no statistics	P Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34A		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34B		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-24-34C		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
<b>699-24-35</b>		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
<b>699-26-35A</b>		C Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes

Requirements from PNNL-13014.  
Wells completed at the top of the unconfined aquifer.

\* Bold italic = Upgradient well.

C = well is constructed as a resource protection well under WAC 173-160.  
FY = fiscal year.  
P = constructed prior to WAC requirements.  
Q = to be sampled quarterly.  
Spec. Cond. = specific conductance.  
WAC = Washington Administrative Code.

**Table B-42. Analytical Results for Required Constituents at the Solid Waste Landfill.**

Constituent <sup>a</sup>	Background Threshold Value <sup>b</sup>	Date	699-22-35	699-23-34A	699-23-34B	699-24-33	699-24-34A	699-24-34B	699-24-34C	699-24-35	699-26-35A
Ammonium ion ( $\mu\text{g/L}$ )	90	Nov-Dec 2007	<12	<12	<12	<12	<12	<12	<12	22.5	<12
		Feb-Mar 2008	<12	17.4	<12	<12	12.5	25.6	<12	33.9	28.8
		May-Jun 2008	<12	<12	<12	17.1	<12	<12	22.3	13.7	<12
		Aug-Sep 2008	<12	24.3	<12	<12	<12	<12	17.5	15.8	<12
Chemical Oxygen Demand (mg/L)	10	Nov-Dec 2007	<10	<10	<10	<b>23</b>	<10	<10	<10	<10	<10
		Feb-Mar 2008	<10	<10	<10	<10	<10	<10	<10	<10	<10
		May-Jun 2008	<10	<10	<10	<10	<10	<10	<10	<10	<10
		Aug-Sep 2008	<b>16</b>	<b>18</b>	<10	<10	<10	<10	<10	<10	<10
Chloride (mg/L)	7.8	Nov-Dec 2007	6.8	5.96	7.14	6.91	7.01	6.86	6.73	6.37	6.42
		Feb-Mar 2008	6.95	7.18	7	7.35	7.66	7.08	7.25	6.45	7.62
		May-Jun 2008	6.75	6.62	6.53	7.28	7.34	7.04	7.05	6.31	7.28
		Aug-Sep 2008	6.75	6.6	6.22	6.96	7.56	6.84	6.88	6.16	7.17
Coliform Bacteria (col/100 mL)	1	Nov-Dec 2007	<0	<0	<0	<0	<0	<0	<0	<b>2</b>	<0
		Feb-Mar 2008	<1	<1	<1	<1	<1	<1	<b>1</b>	<1	<1
		May-Jun 2008	<1	<1	<1	<1	<1	<1	<1	<1	<1
		Aug-Sep 2008	<1	<1	<1	<1	<1	<1	<1	<1	<1
Iron, filtered (ug/L)	160	Nov-Dec 2007	<9	31.1	<9	<9	<9	<9	<9	<9	<9
		Feb-Mar 2008	20.5	36.1	30.8	29	41.8	37.2	34.4	19.9	<9
		May-Jun 2008	15.5	<25	20.6	<9	25.9	23.7	39.6	<25	<9
		Aug-Sep 2008	<25	<25	<25	<25	<25	109	41.7	<25	45
Manganese, filtered ( $\mu\text{g/L}$ )	18	Nov-Dec 2007	<4	<4	<4	<4	<4	<4	<4	<4	<4
		Feb-Mar 2008	<4	<4	<4	<4	<4	<4	<4	<4	<4
		May-Jun 2008	<4	<4	<4	<4	8.2	<4	<4	<4	<4
		Aug-Sep 2008	<4	<4	<4	<4	<4	6.3	<4	<4	<4
Nitrate (mg/L)	29	Nov-Dec 2007	17.8	17.8	17.7	15	13.5	15	14.4	12.9	17.1
		Feb-Mar 2008	17.3	19.3	17.8	15.4	14.2	15.8	14.6	12.9	18.3
		May-Jun 2008	17.8	19.1	17.4	15.2	14.2	15.8	14.8	13.9	18.5
		Aug-Sep 2008	18.2	19.2	16.8	14.9	14.3	15.8	16.1	12.7	17.6
Nitrite ( $\mu\text{g/L}$ )	148	Nov-Dec 2007	64.7	<32.8	<32.8	50.9	62.4	61.1	60.4	55.2	57.8
		Feb-Mar 2008	<65.7	<65.7	<65.7	<65.7	<65.7	<65.7	<65.7	<65.7	<65.7
		May-Jun 2008	<65	88.4	<65	<65	<65	<65	<65	<65	<65
		Aug-Sep 2008	<84.1	<84.1	<84.1	<84.1	<84.1	<84.1	<84.1	<84.1	<84.1
Field pH	6.68 - 7.84	Nov-Dec 2007	6.87	<b>6.59</b>	6.69	6.84	6.72	6.72	6.89	6.73	7.17
		Feb-Mar 2008	6.89	<b>6.63</b>	6.69	6.86	6.69	6.69	6.94	6.75	7.17
		May-Jun 2008	6.9	<b>6.55</b>	<b>6.62</b>	6.84	<b>6.65</b>	<b>6.66</b>	6.93	<b>6.62</b>	7.21
		Aug-Sep 2008	6.84	<b>6.52</b>	<b>6.56</b>	<b>6.66</b>	<b>6.61</b>	6.7	6.9	<b>6.65</b>	7.17
Specific Conductance ( $\mu\text{S}/\text{cm}$ )	583	Nov-Dec 2007	<b>827</b>	<b>744</b>	<b>761</b>	<b>746</b>	<b>665</b>	<b>703</b>	<b>706</b>	<b>587</b>	538
		Feb-Mar 2008	<b>828</b>	<b>755</b>	<b>766</b>	<b>753</b>	<b>664</b>	<b>686</b>	<b>732</b>	581	543
		May-Jun 2008	<b>824</b>	<b>755</b>	<b>783</b>	<b>756</b>	<b>672</b>	<b>733</b>	<b>735</b>	429	538
		Aug-Sep 2008	<b>827</b>	<b>770</b>	<b>775</b>	<b>765</b>	<b>676</b>	<b>707</b>	<b>750</b>	<b>589</b>	547
Sulfate (mg/L)	47.2	Nov-Dec 2007	43.2	46.5	40.3	42.5	45.6	43.4	43.4	42.9	46.5
		Feb-Mar 2008	43.4	<b>51.6</b>	<b>48.5</b>	42.4	<b>47.8</b>	<b>54.3</b>	43.5	46.5	40.9
		May-Jun 2008	44	<b>47.6</b>	46.4	44.6	46.6	<b>55.5</b>	42.9	46.6	41.1
		Aug-Sep 2008	46.6	<b>48.3</b>	43.7	43.9	<b>47.9</b>	<b>50.3</b>	41.8	44.8	39.3

**Table B-42. (cont.)**

Constituent <sup>a</sup>	Background Threshold Value <sup>b</sup>	Date	699-22-35	699-23-34A	699-23-34B	699-24-33	699-24-34A	699-24-34B	699-24-34C	699-24-35	699-26-35A
Temperature (°C)	20.7	Nov-Dec 2007	17.9	18	18.2	19.4	16.4	17.3	18.3	17.9	19.3
		Feb-Mar 2008	16.9	17.8	12.5	19.3	18.1	18.4	18.2	17.5	19
		May-Jun 2008	[25.9]	19.2	18.3	19.8	18.8	18.9	19.1	18.4	19.8
		Aug-Sep 2008	[24]	19.7	19.4	20	22.8	19.7	19.5	19.7	20
Total organic carbon (µg/L)	1,430	Nov-Dec 2007	952	1,120	462	869	789	831	771	573	983
		Feb-Mar 2008	1,210	1,050	[22,600]	[38,300]	[21,000]	[2,910]	[11,000]	[12,800]	386
		May-Jun 2008	1,050	730	1,240	948	999	760	968	663	511
		Aug-Sep 2008	<200	<200	<200	<200	<200	<200	240	370	350
Zinc, filtered (µg/L)	43.2	Nov-Dec 2007	<4	<4	<4	<4	<4	<4	<4	<4	<4
		Feb-Mar 2008	<4	<4	<4	9.3	<4	6.5	9.8	25.9	8
		May-Jun 2008	<4	<9	<4	8.8	<4	<4	12.4	9.2	6.8
		Aug-Sep 2008	<9	<9	<9	<9	<9	<9	<9	<9	<9

Results in bold exceed background threshold value.  
 Results in brackets are inconsistent with historical trends and are under review.

<sup>a</sup> WAC 173-304.  
<sup>b</sup> Numbers obtained from DOE/RL-2008-01, Table B.43.

**Table B-43. Results of Shapiro and Francia Test for Normality and Background Threshold Values for the Solid Waste Landfill.**

Constituent <sup>a</sup> (unit)	W-test Statistic <sup>b</sup> (log value)	W-test Statistic <sup>b</sup> (raw data)	W-test <sup>b</sup> Critical Value, W <sub>α</sub> <sup>c</sup>	Upper Tolerance Limit	Background Threshold Value
Ammonium (as NH <sub>3</sub> ) (µg/L)	NC	NC	NC	90 <sup>d</sup> 54 <sup>e</sup> WSCF 27.5 <sup>e</sup> STL	90
Chemical oxygen demand (µg/L)	NC	NC	NC	10,000 <sup>f</sup>	10,000
Chloride (µg/L)	0.954 s	0.962 s	0.963	7,820 <sup>d</sup>	7,820
Coliform bacteria (colonies/100 ml)	NC	NC	NC	1 <sup>f</sup>	1
Field pH	0.988 ns	NA	0.963	[6.68, 7.84] <sup>g</sup>	[6.68, 7.84]
Iron, dissolved (µg/L)	0.960 s	0.802 s	0.962	160 <sup>d</sup> 113 <sup>e</sup> WSCF 72 <sup>e</sup> STL	160
Manganese, dissolved (µg/L)	NC	NC	NC	10 <sup>d</sup> 18 <sup>e</sup> WSCF 4 <sup>e</sup> STL	18
Nitrate (as NO <sub>3</sub> <sup>-</sup> ) (µg/L)	0.833 s	0.844 s	0.963	29,000 <sup>d</sup>	29,000
Nitrite (as NO <sub>2</sub> <sup>-</sup> ) (µg/L)	NC	NC	NC	192 <sup>e</sup> WSCF 32 <sup>e</sup> STL	192
Specific conductance (µS/cm)	0.978 ns	NA	0.960	583 <sup>g</sup>	583
Sulfate (µg/L)	0.983 ns	NA	0.963	47,200 <sup>g</sup>	47,200
Temperature °C	0.953 s	0.961 s	0.963	20.7 <sup>d</sup>	20.7
Total organic carbon (µg/L)	NC	NC	NC	842 <sup>d</sup> 162 <sup>e</sup>	842
Zinc, dissolved (µg/L)	NC	NC	NC	42.3 <sup>d</sup> 40.5 <sup>e</sup> WSCF 23.4 <sup>e</sup> STL	42.3

<sup>a</sup> Constituents are specified in WAC 173-304-490(2)(d). Data collected from March 1993 to May 2000 from upgradient wells 699-24-35 and 699-26-35A.

<sup>b</sup> Shapiro and Francia (1972).

<sup>c</sup> Obtained from Table A-9 (Shapiro, 1980) for α = 5%.

<sup>d</sup> Maximum value reported.

<sup>e</sup> Based on limit of quantitation determined from field blanks (for total organic carbon) or laboratory blanks.

<sup>f</sup> Based on laboratory lowest detected result.

<sup>g</sup> Based on log-normal distribution.

NA = not applicable.

NC = not calculated; insufficient measured values.

ns = not significant at 0.05 level of significance.

s = significant at 0.05 level of significance.

STL = Severn Trent Laboratories (St. Louis).

WAC = Washington Administrative Code.

WSCF = Waste Sampling and Characterization Facility.

**Table B-44. Monitoring Wells, Constituents, and Enforcement Limits for the State-Approved Land Disposal Site.**

Well	Comment	WAC Compliant	Constituents with Enforcement Limits										Other Constituents			Sampled as Scheduled in FY 2008	
			pH (6.5 - 8.5)	Acetone (160 µg/L)	Benzene (5 µg/L)	Cadmium * (5 µg/L)	Chloroform (6.2 µg/L)	Copper * (70 µg/L)	Lead * (10 µg/L)	Mercury * (2 µg/L)	Sulfate (250 mg/L)	Total Dissolved Solids (500 mg/L)	Specific Conductance	Alpha	Beta	Strontium-90	Tritium
299-W6-6	Bottom of unconfined	C														A	Yes
299-W6-11		C														A	Yes
299-W6-12		C														A	Yes
299-W7-3	Bottom of unconfined	C														S	Yes
299-W8-1		C														A	Yes
699-48-71	Unconfined	P														A	Yes
699-48-77A	Ringold E, upper	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-48-77C	Ringold E, mid to lower	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-48-77D	Ringold E, upper	C	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Yes
699-49-79		P														A	Yes
699-51-75		P														S	Yes
699-51-75P	Lower unconfined	P														A	Yes

Requirements from PNNL-13121.

Wells completed at the top of the unconfined aquifer unless specified otherwise.

\* Filtered and unfiltered samples.

A = to be sampled annually.

C = well is constructed as a resource protection well under WAC 173-160.

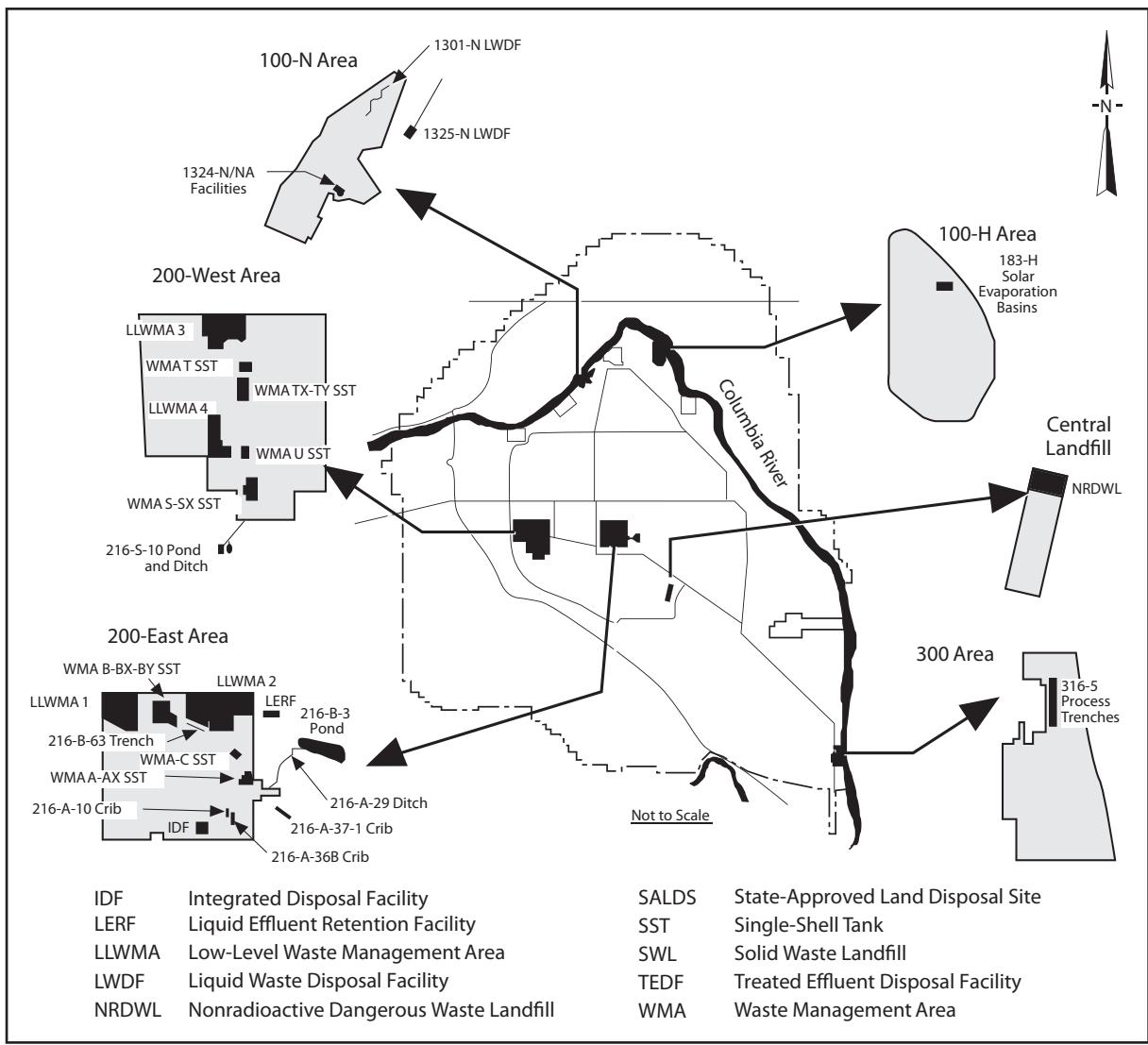
FY = fiscal year.

P = constructed prior to WAC requirements.

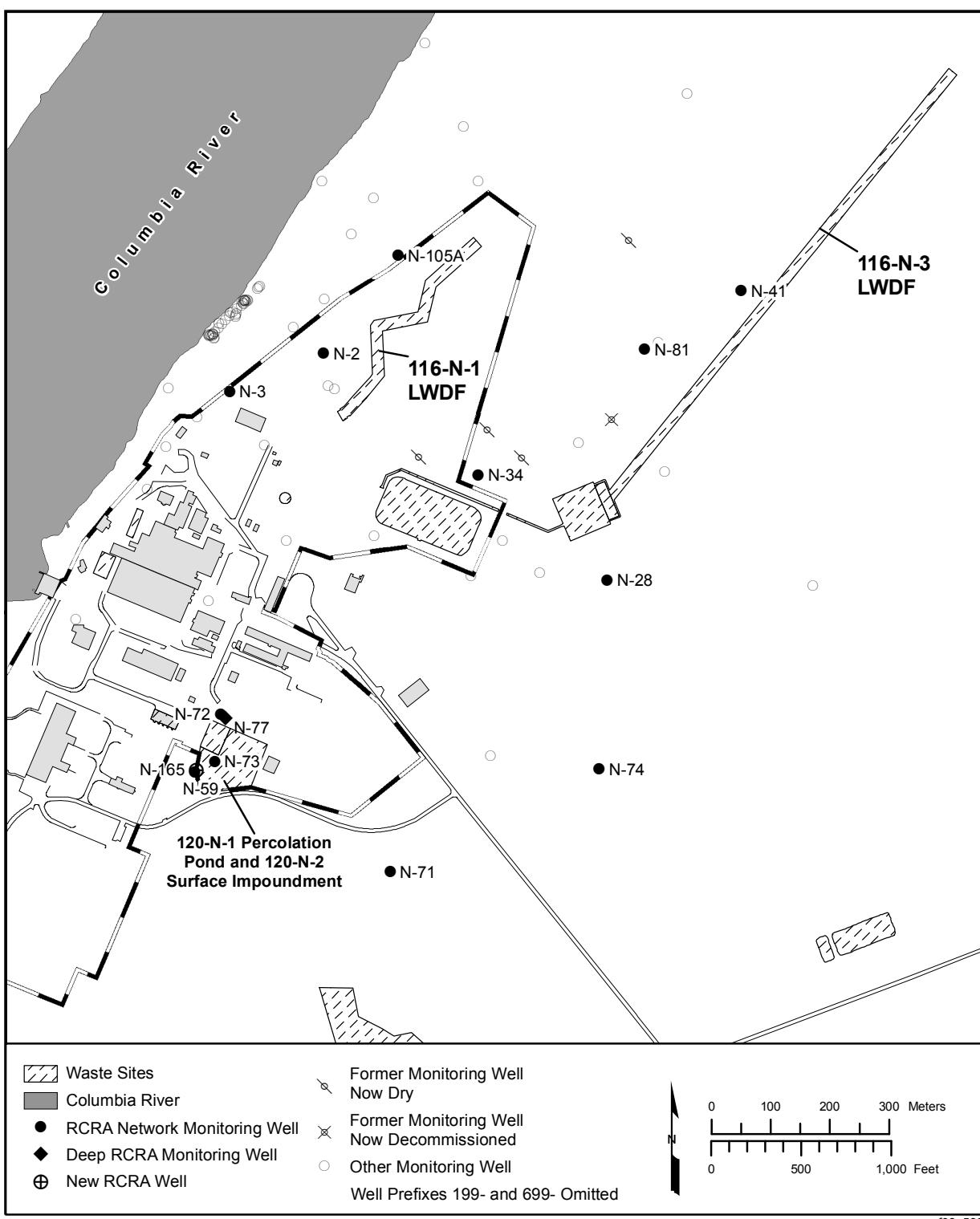
Q = to be sampled quarterly.

S = to be sampled semiannually.

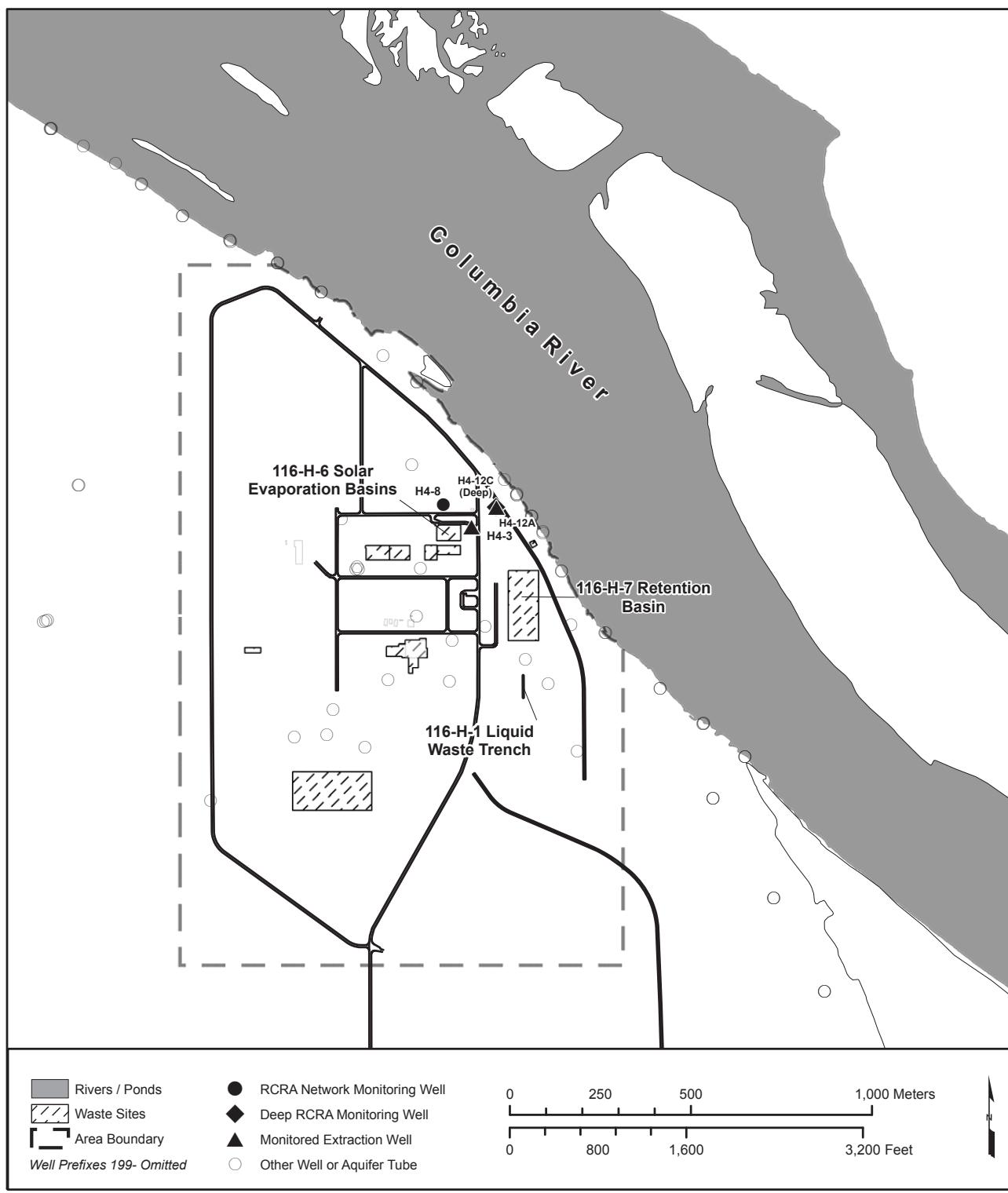
WAC = Washington Administrative Code.

**Figure B-1. RCRA Units on the Hanford Site Requiring Groundwater Monitoring.**

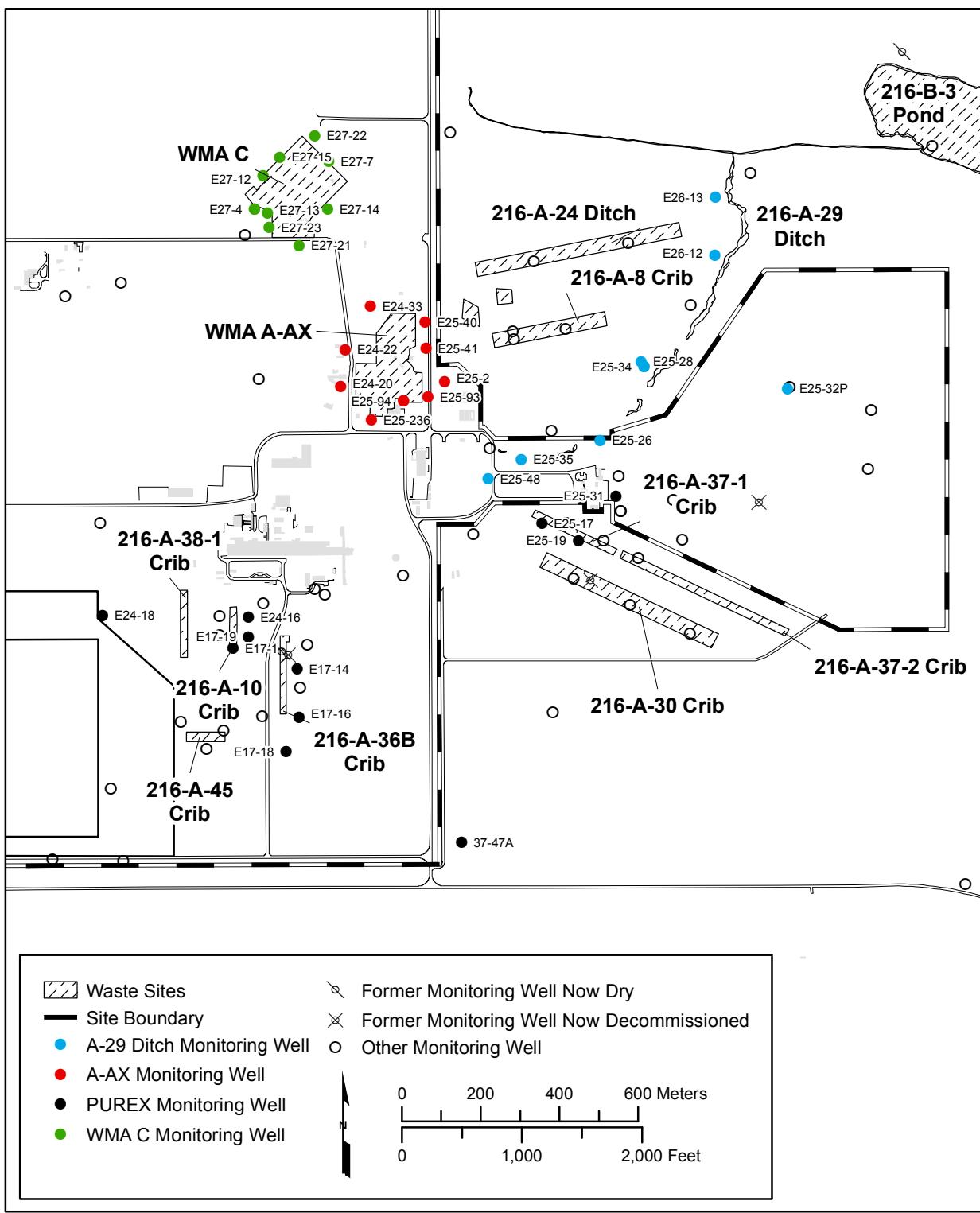
gwf08\_531

**Figure B-2. Groundwater Monitoring Wells for 100-N Area RCRA Sites.**

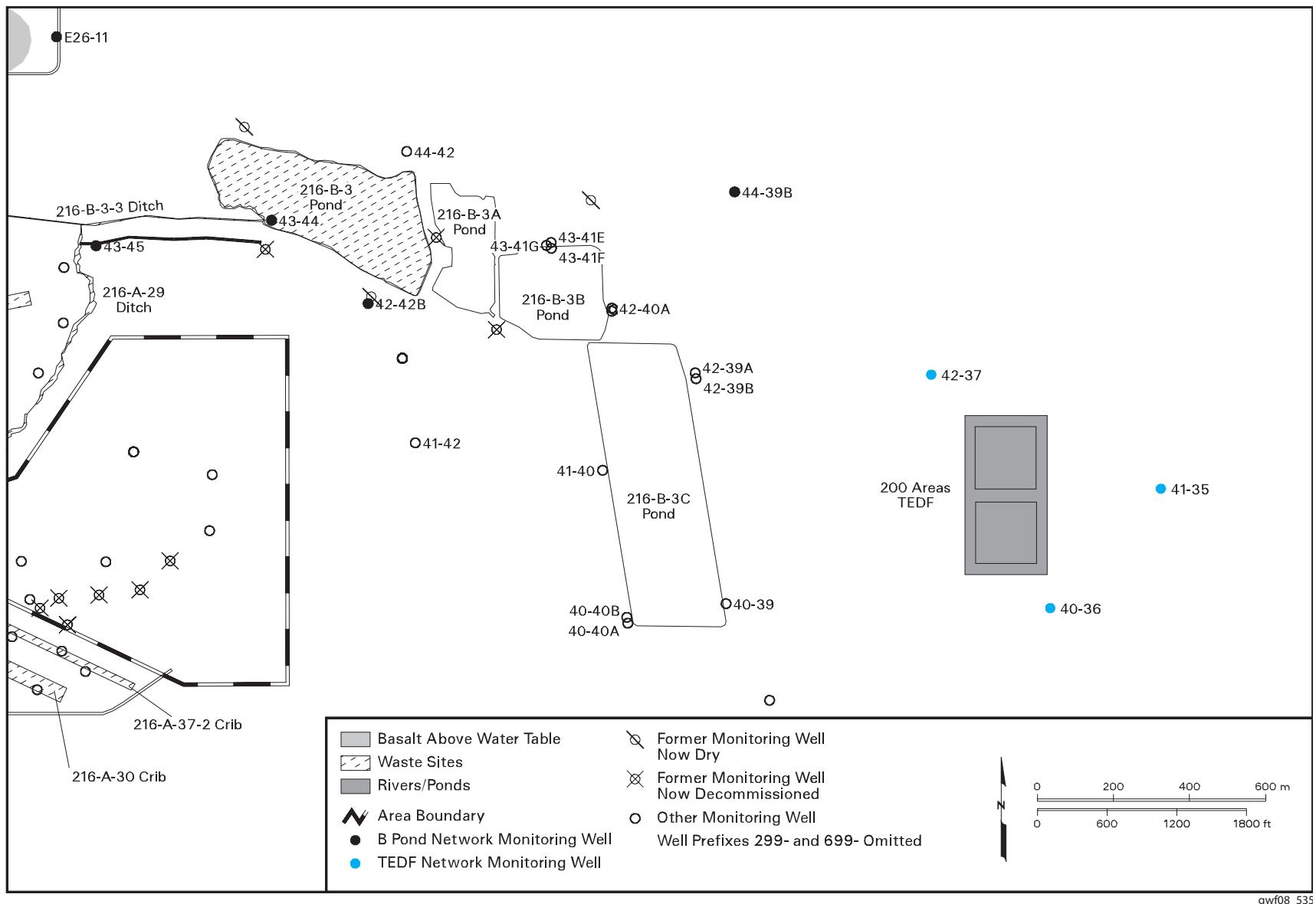
gwf08\_532

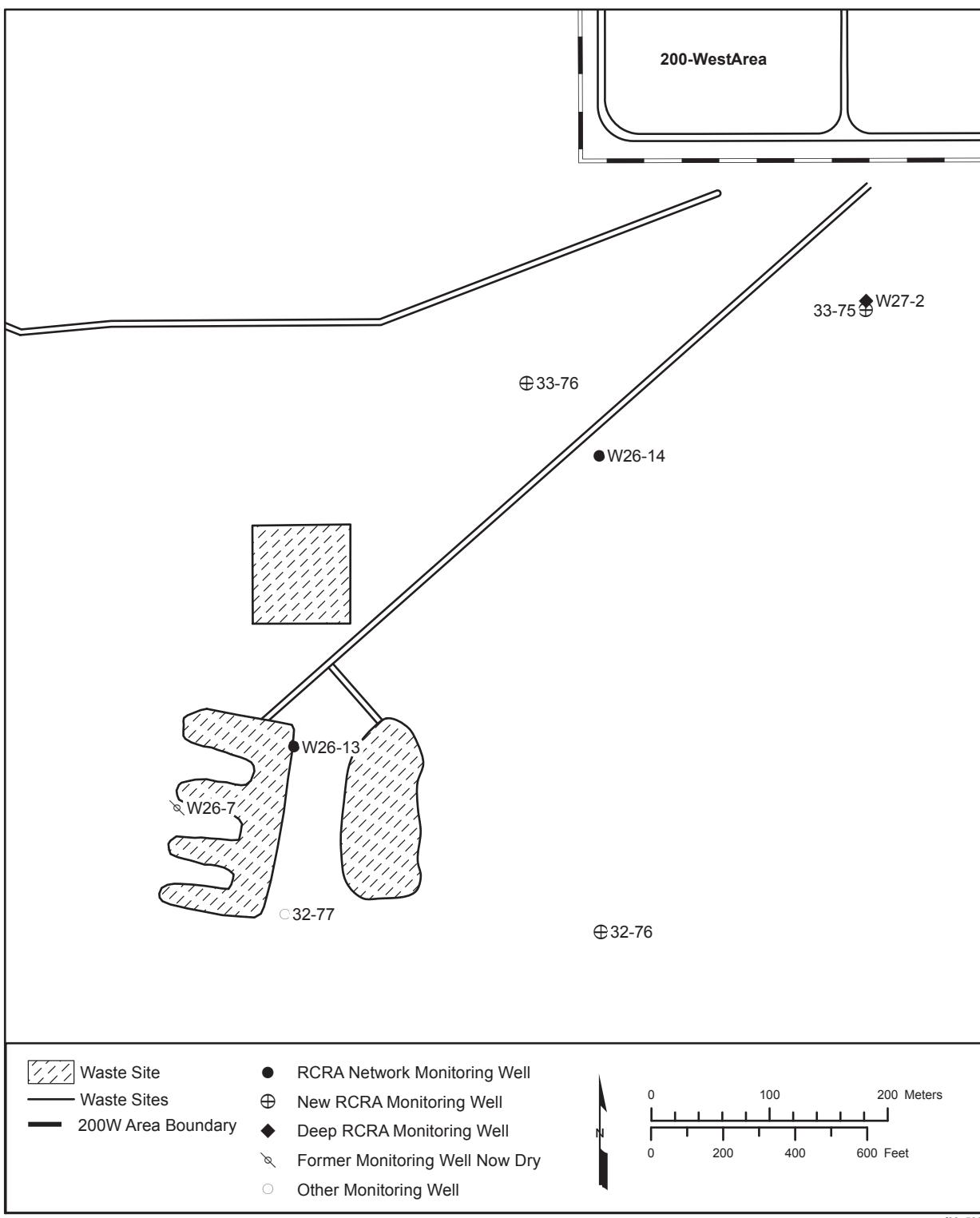
**Figure B-3. Groundwater Monitoring Wells at 116-H-6 Evaporation Basins.**

**Figure B-4. Groundwater Monitoring Wells at 216-A-29 Ditch, PUREX Cribs, and Waste Management Areas A-AX and C.**

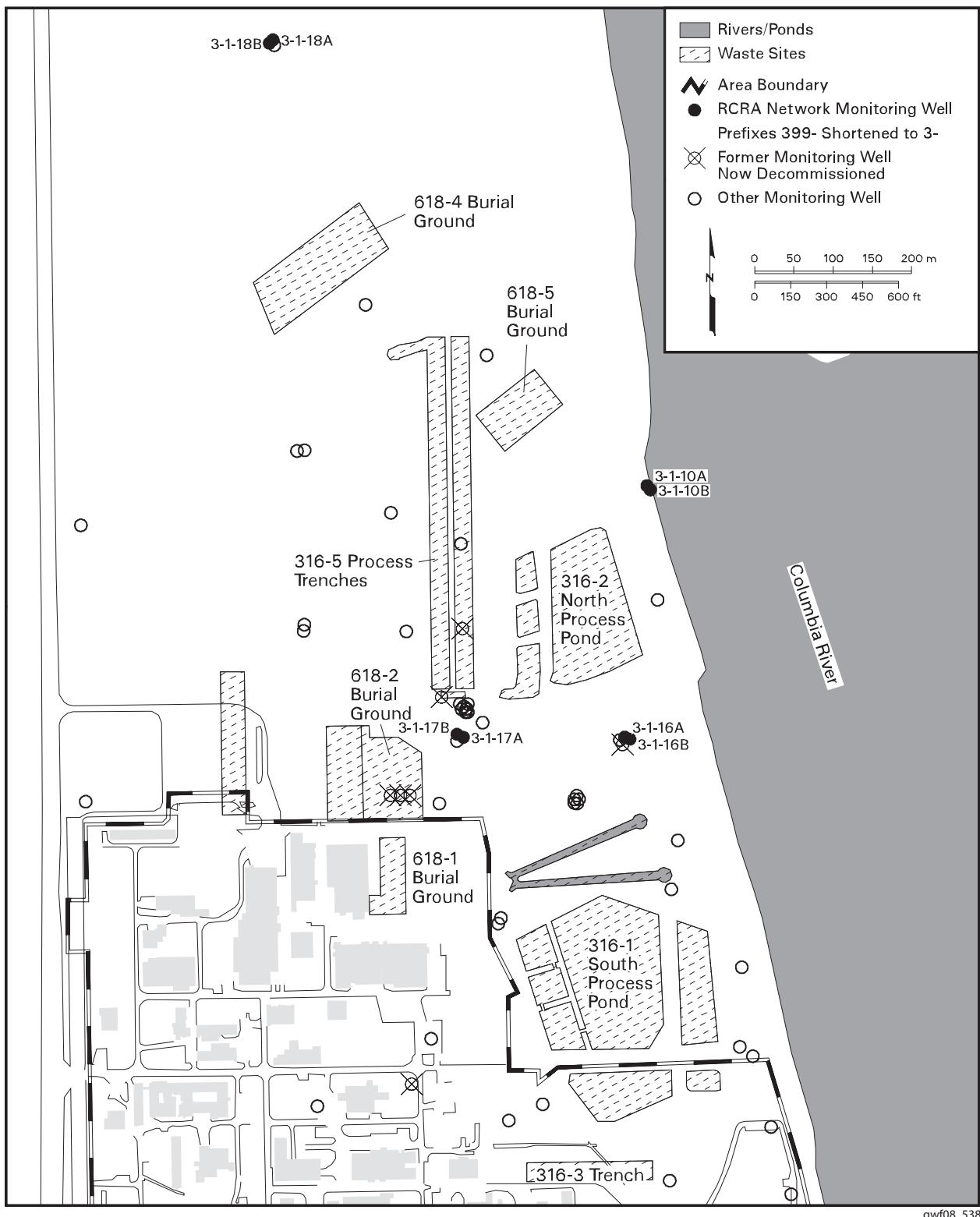


gwf08\_534

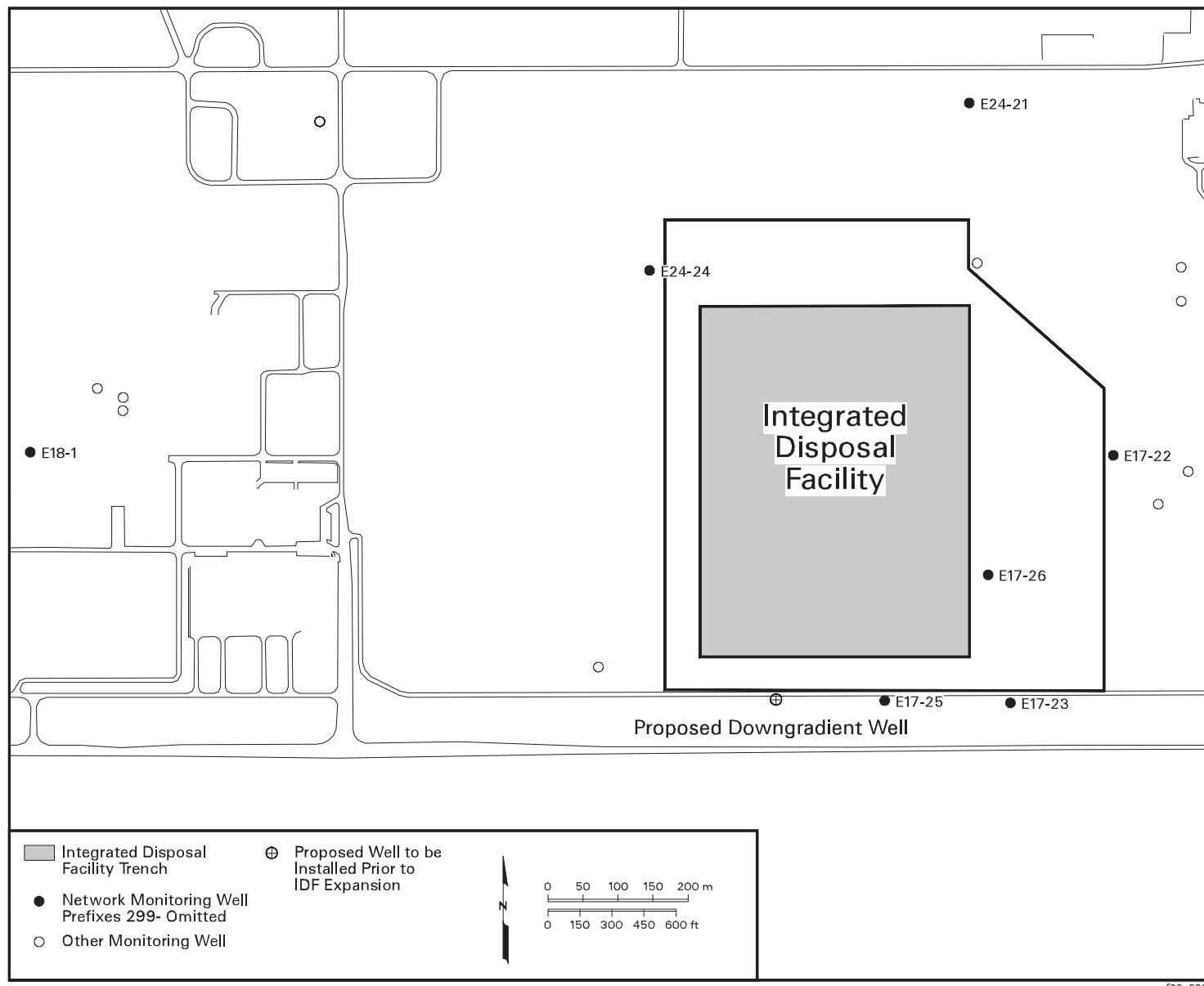
**Figure B-5. Groundwater Monitoring Wells at 216-B-3 Pond and 200 Area Treated Effluent Disposal Facility.**

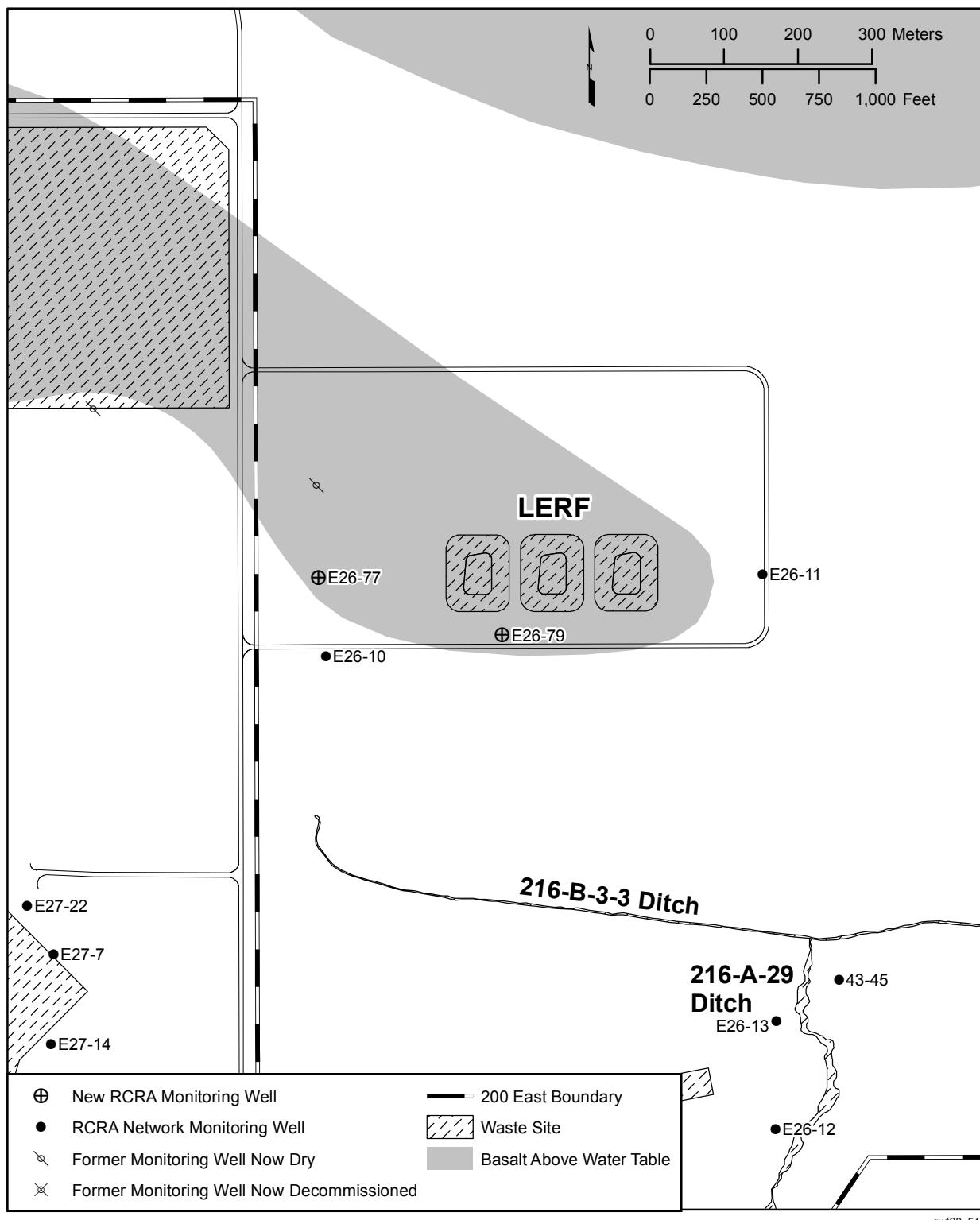
**Figure B-6. Groundwater Monitoring Wells at 216-S-10 Pond and Ditch.**

gwf08\_536

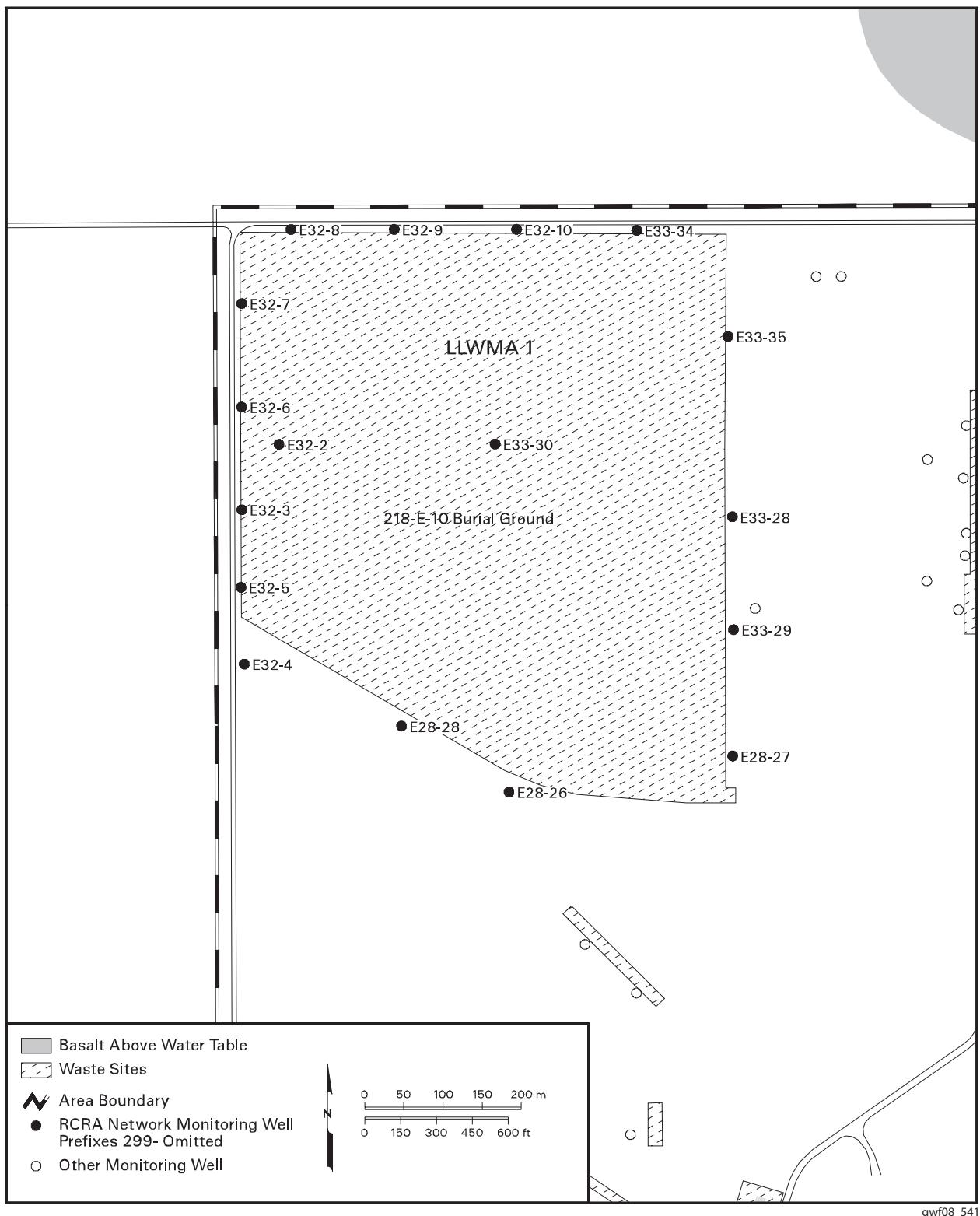
**Figure B-7. Groundwater Monitoring Wells at 316-5 Process Trenches.**

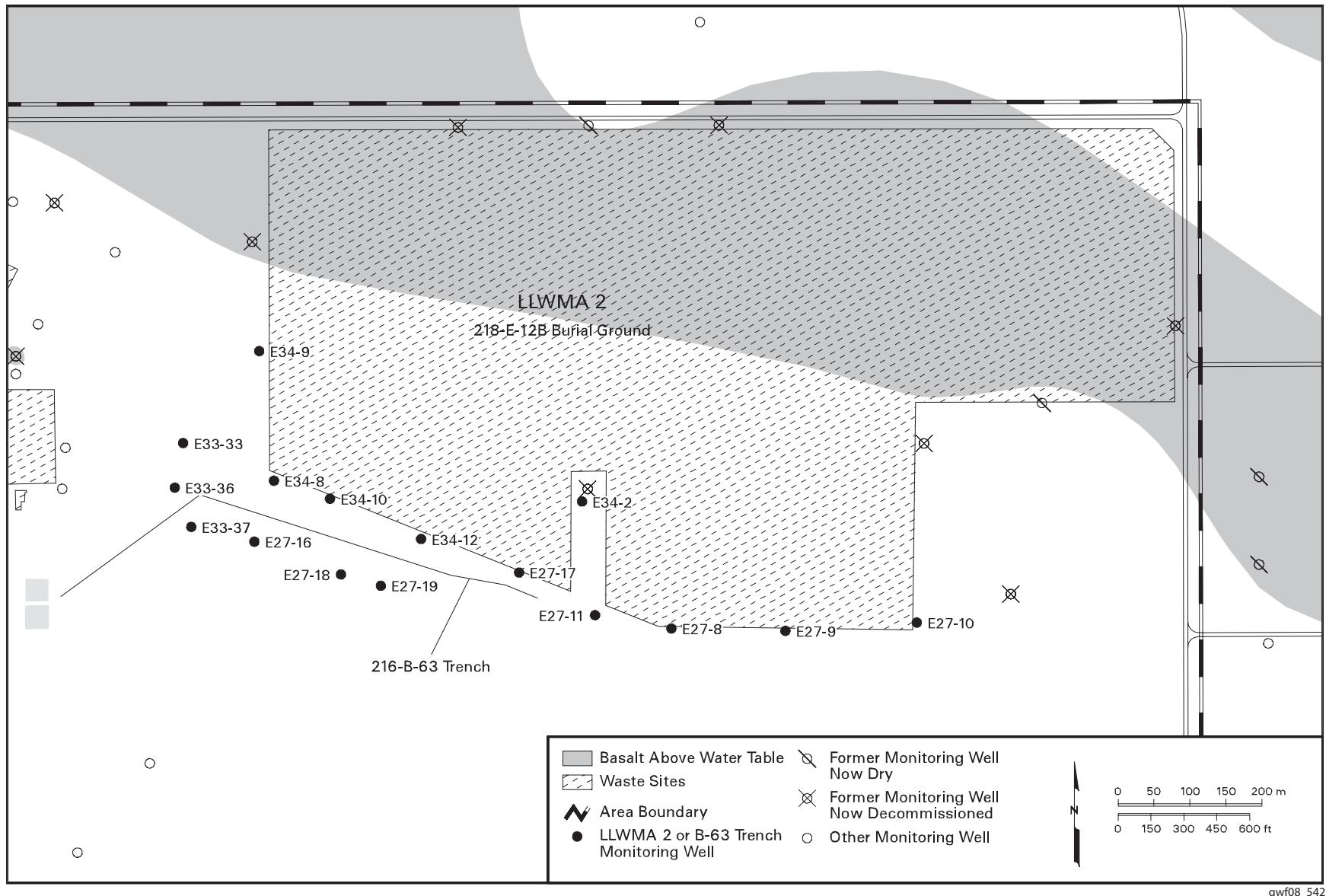
**Figure B-8. Groundwater Monitoring Wells at Integrated Disposal Facility.**

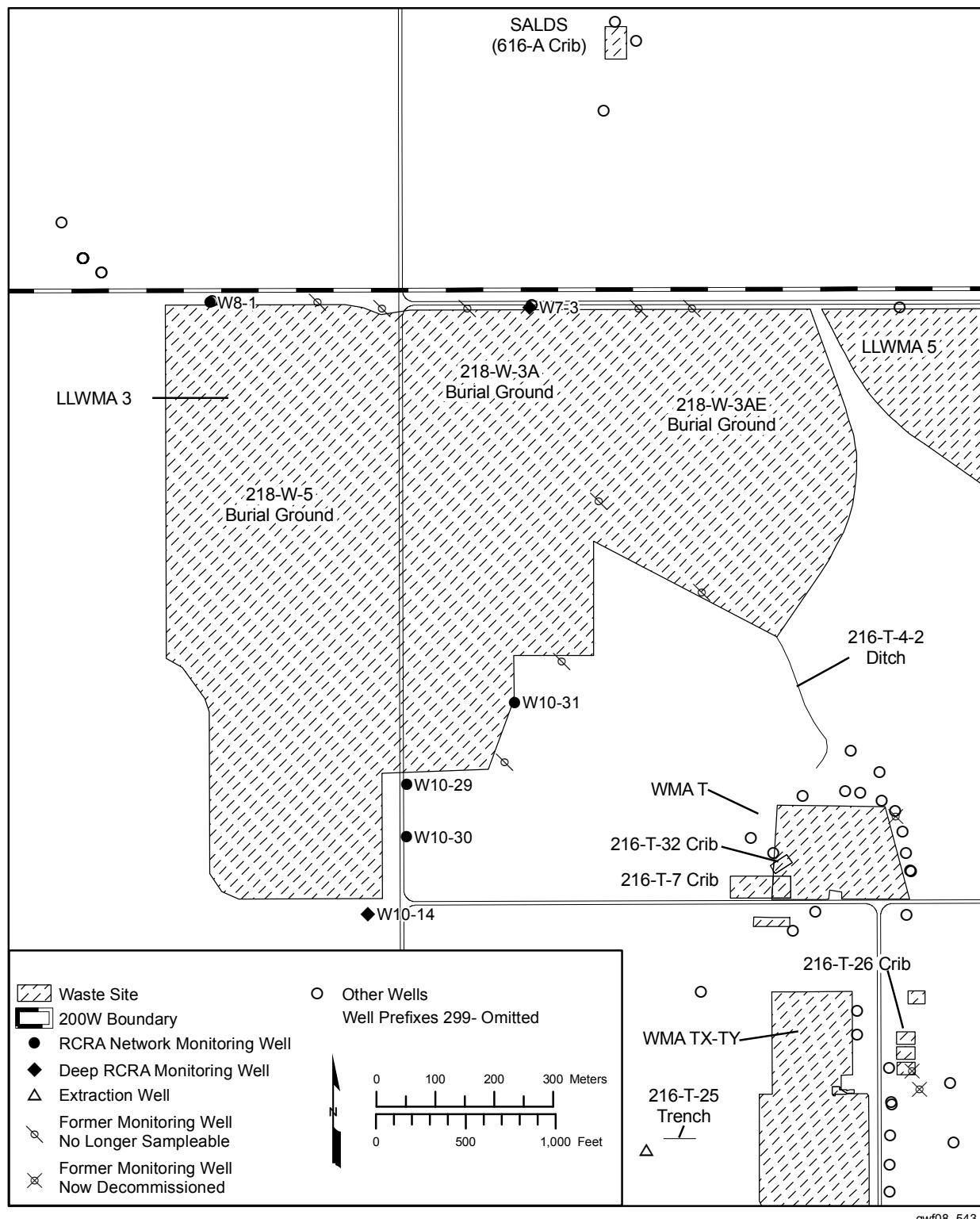


**Figure B-9. Groundwater Monitoring Wells at Liquid Effluent Retention Facility.**

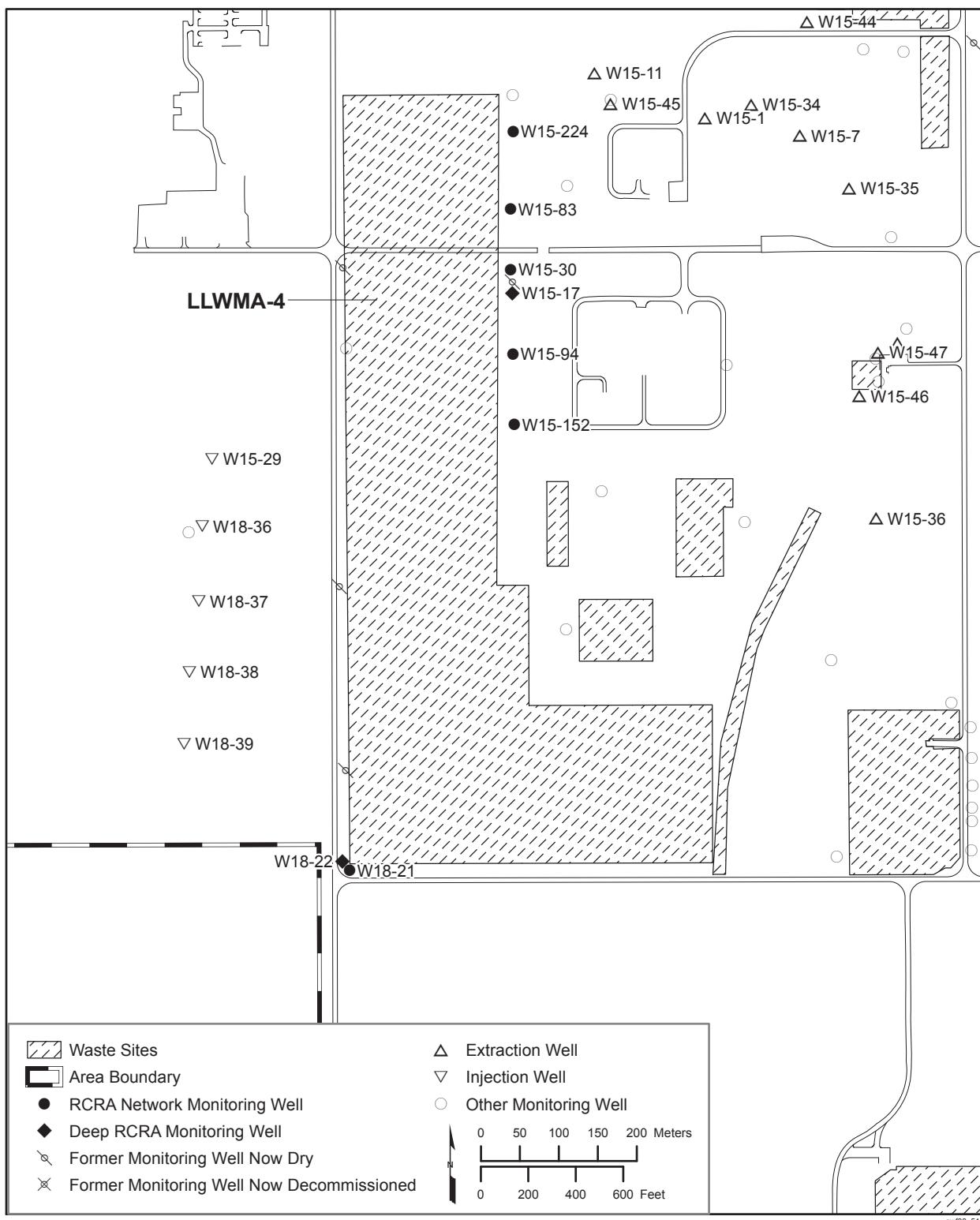
gwf08\_540

**Figure B-10. Groundwater Monitoring Wells at Low-Level Waste Management Area 1.**

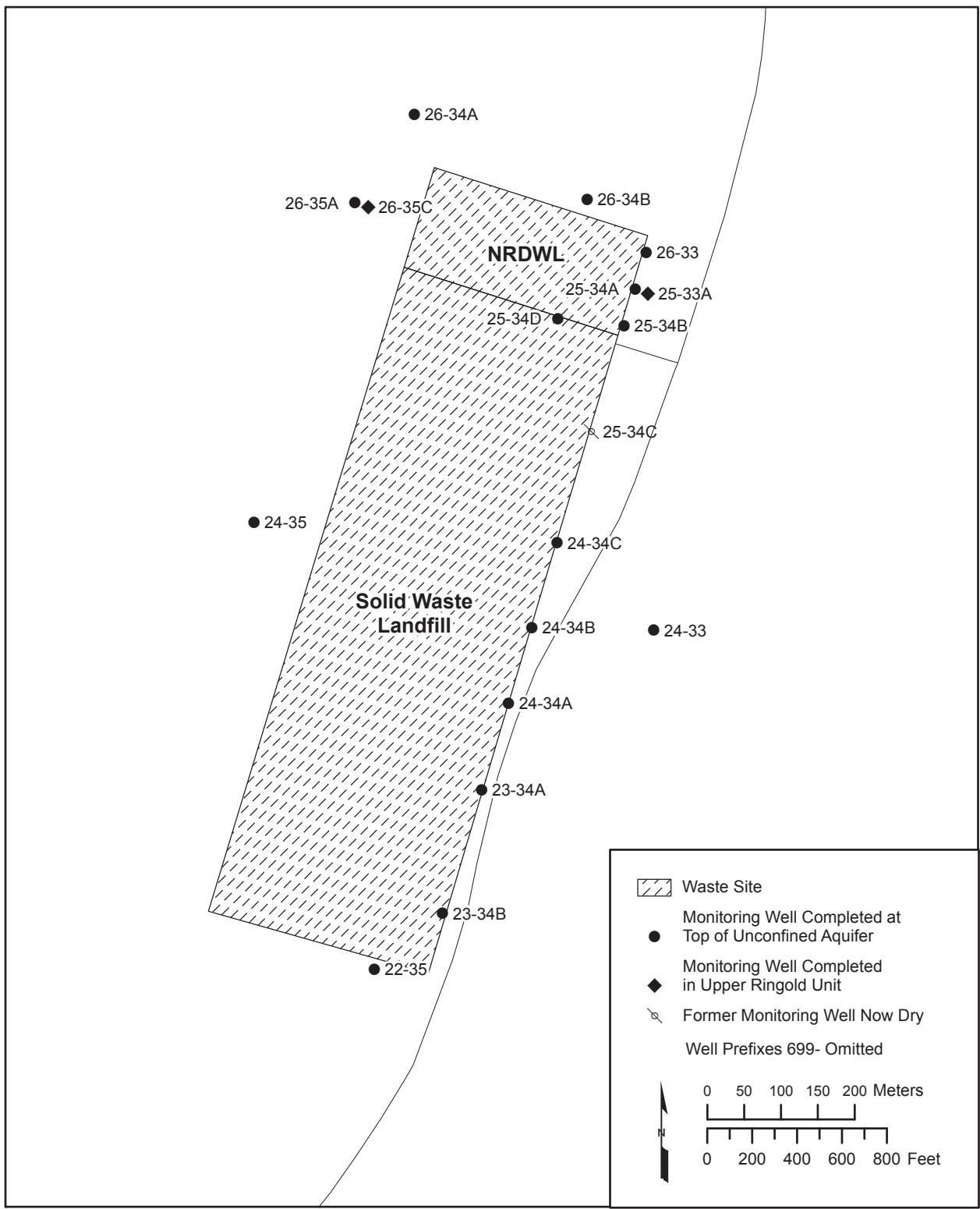
**Figure B-11. Groundwater Monitoring Wells at 216-B-63 Trench and Low-Level Waste Management Area 2.**

**Figure B-12. Groundwater Monitoring Wells at Low-Level Waste Management Area 3.**

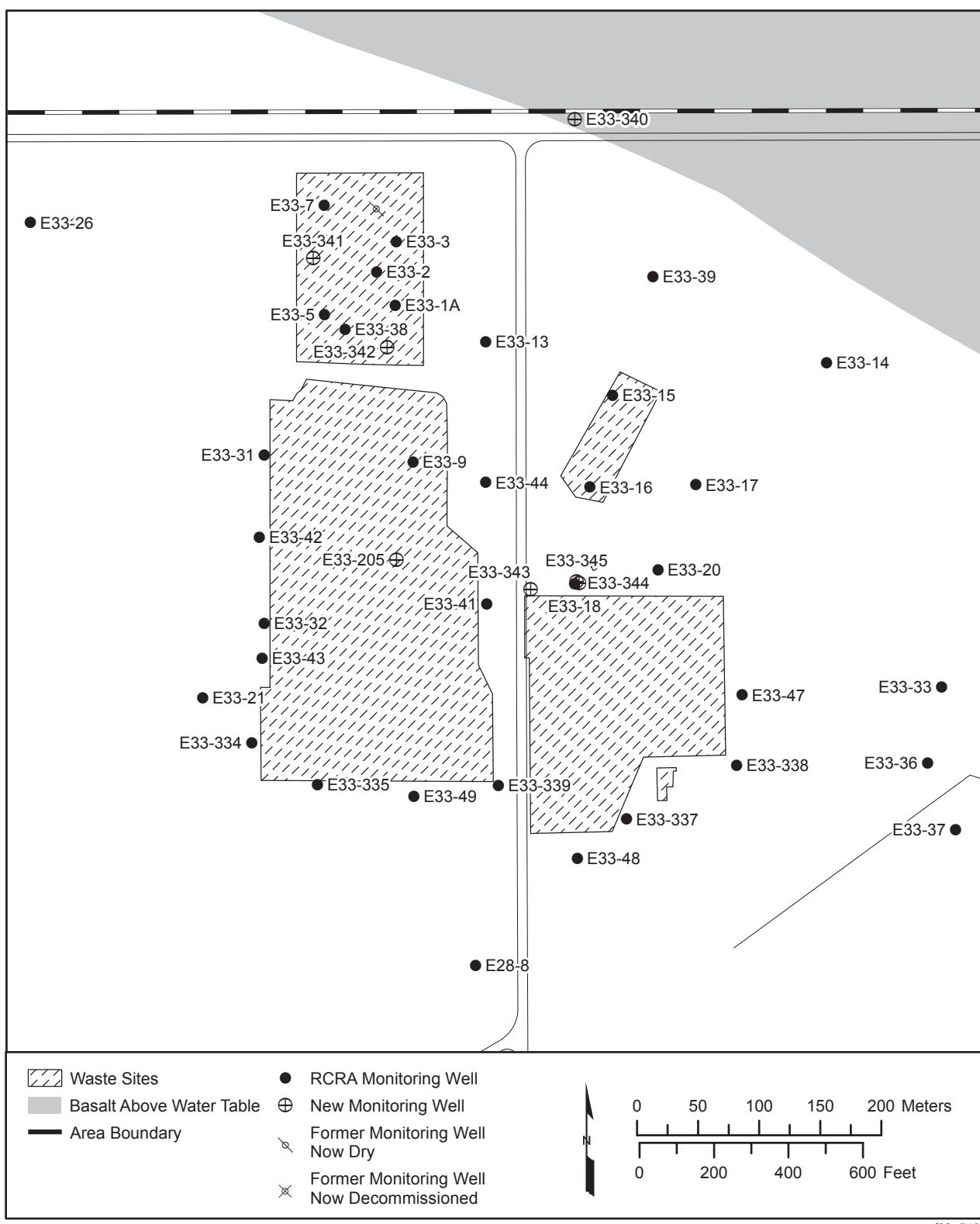
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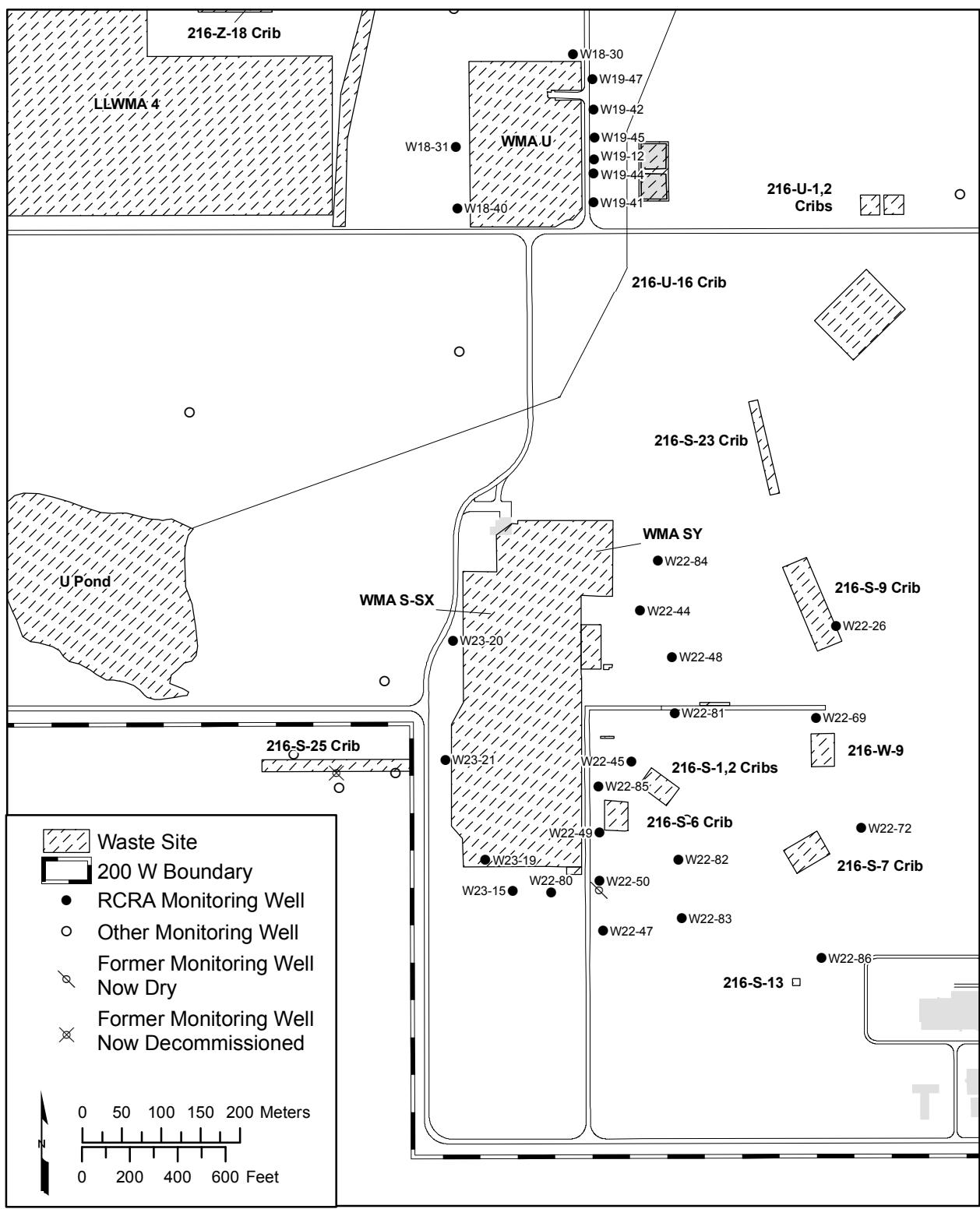
**Figure B-13. Groundwater Monitoring Wells at Low-Level Waste Management Area 4.**

**Figure B-14. Groundwater Monitoring Wells at Nonradioactive Dangerous Waste Landfill and 600 Area Central Landfill.**

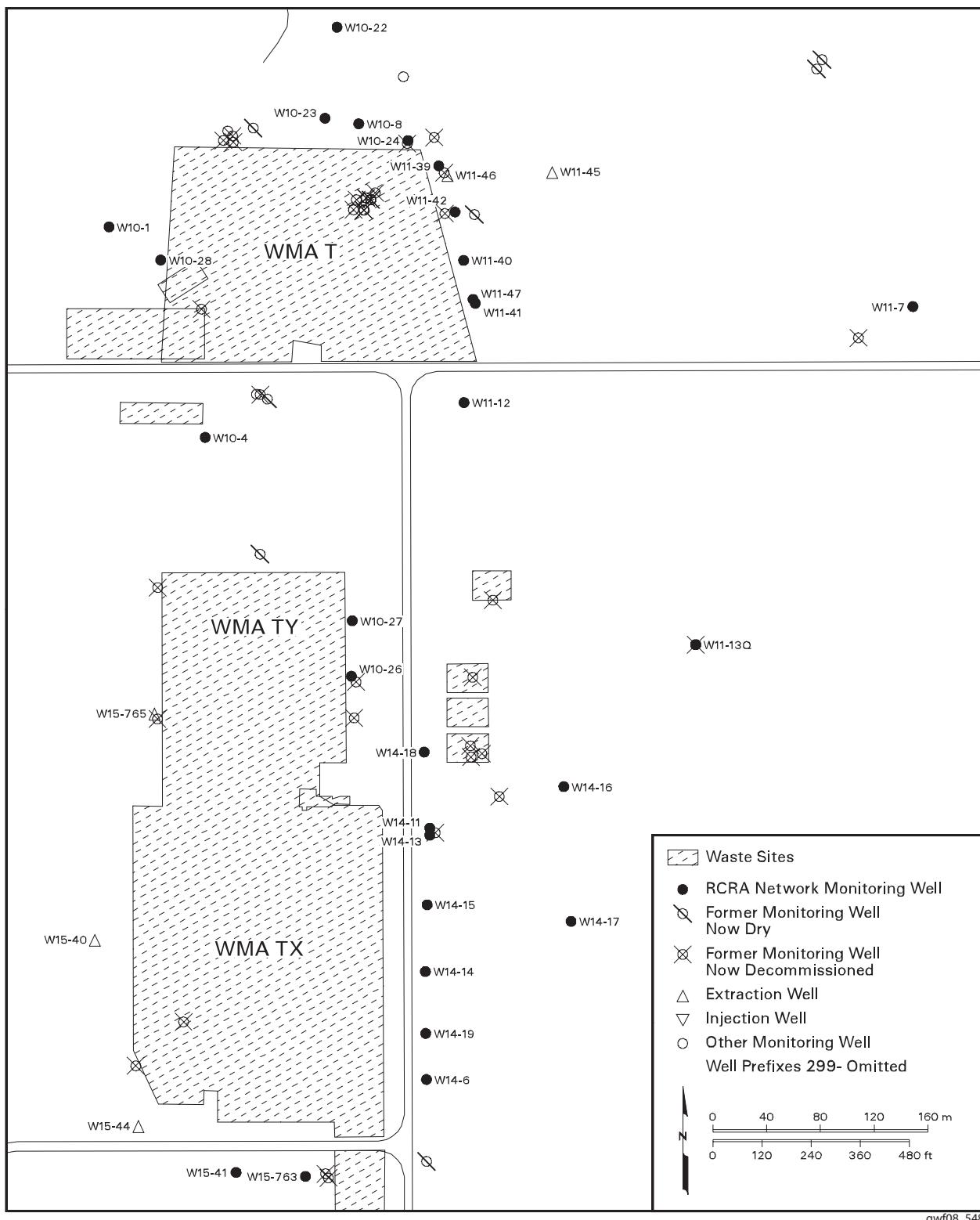


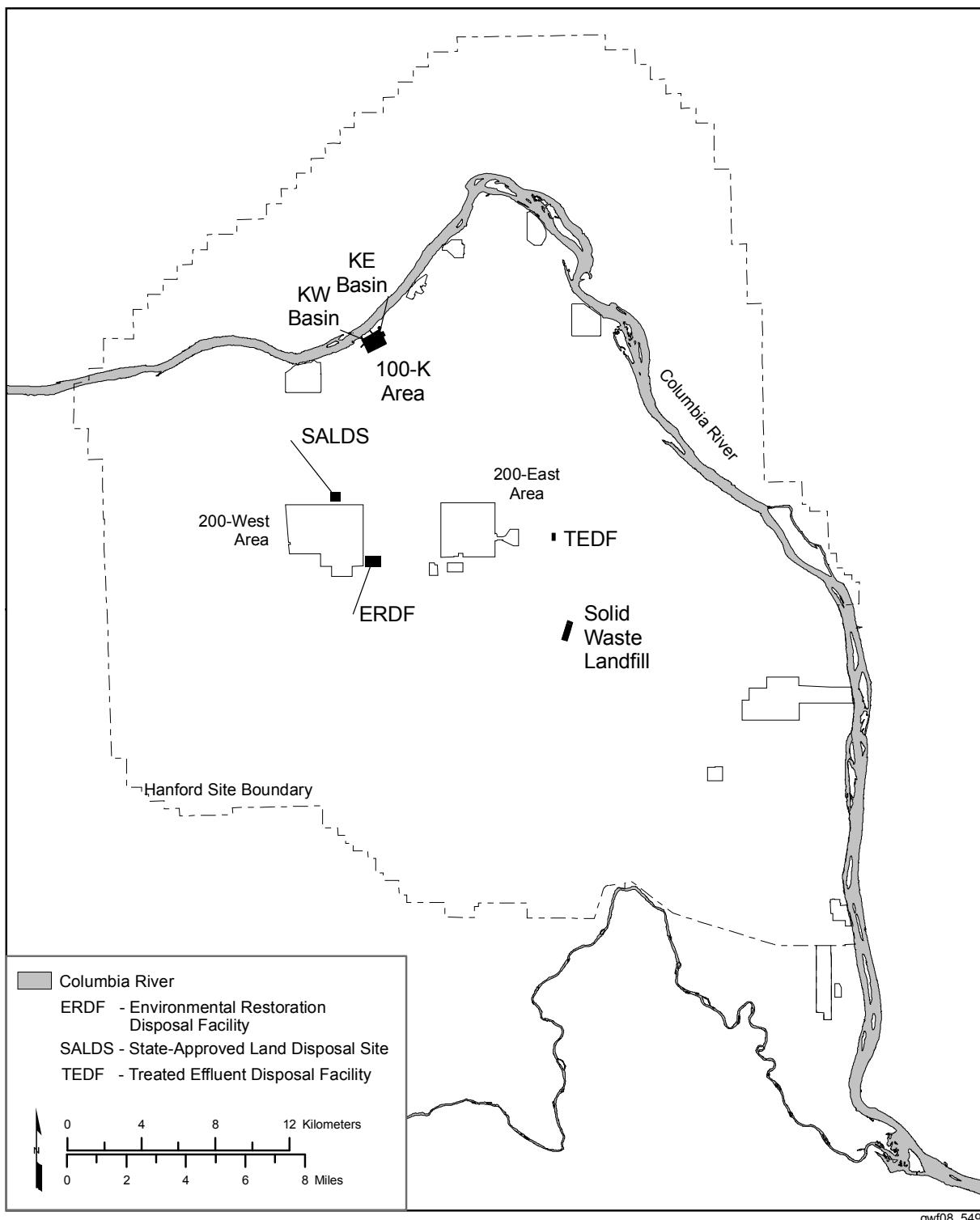
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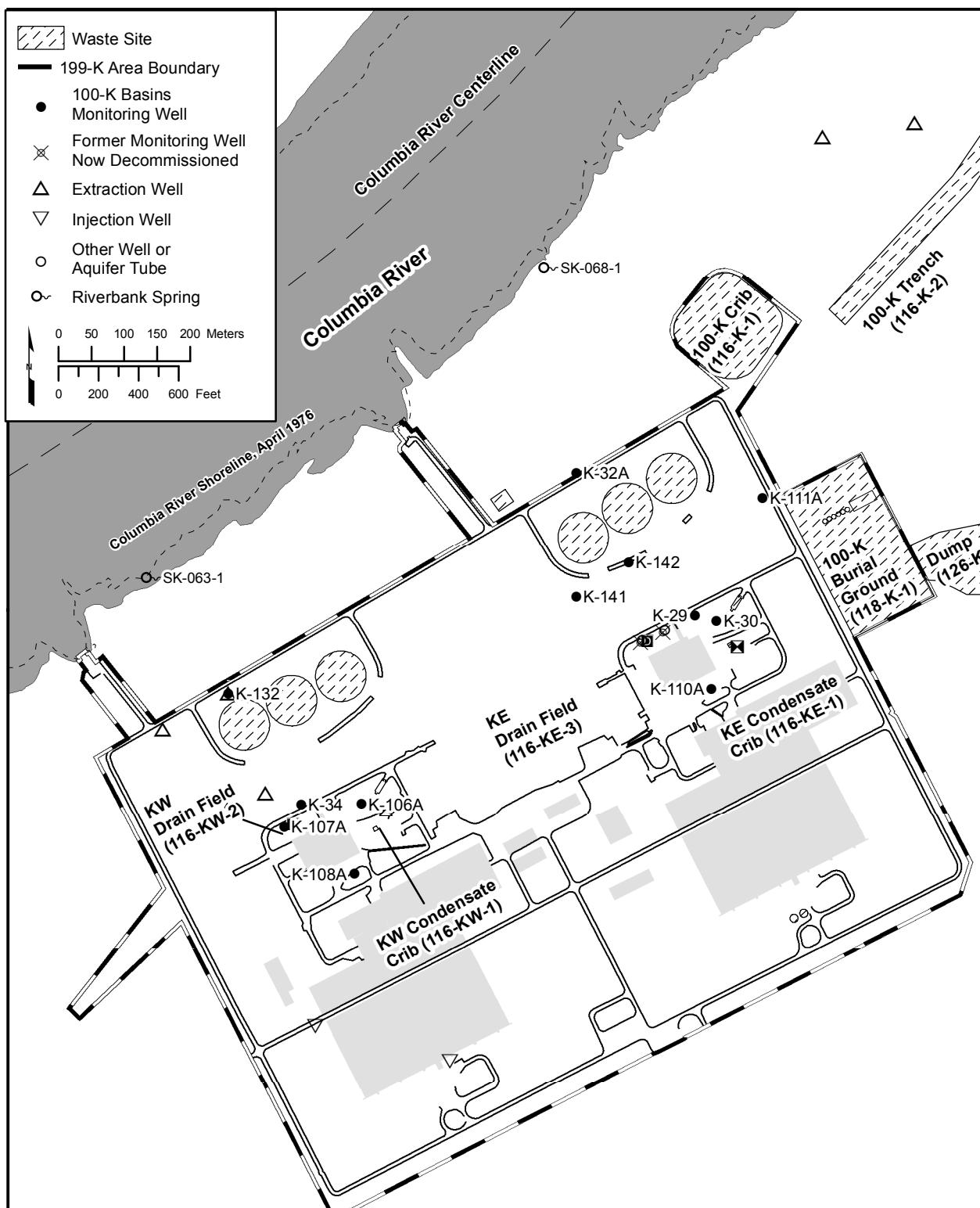
**Figure B-15. Groundwater Monitoring Wells at Waste Management Area B-BX-BY.**

**Figure B-16. Groundwater Monitoring Wells at Waste Management Areas S-SX and U.**

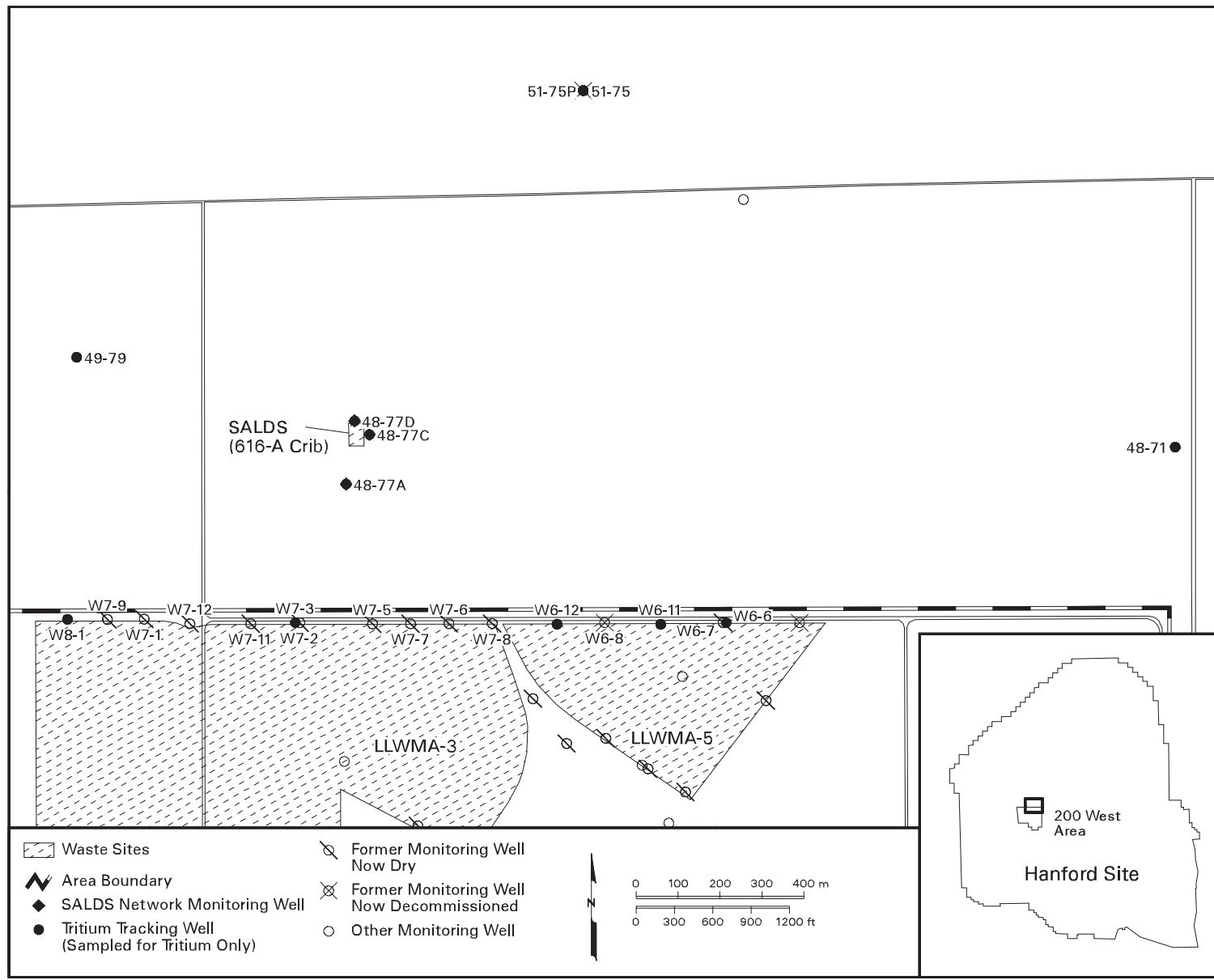
gwf08\_547

**Figure B-17. Groundwater Monitoring Wells at Waste Management Areas T and TX-TY.**

**Figure B-18. Regulated Units on the Hanford Site Requiring Groundwater Monitoring.**

**Figure B-19. Groundwater Monitoring Wells at 100-K Basins.**

**Figure B-20. Groundwater Monitoring Wells at State-Approved Land Disposal Site.**



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