SGW-59673
Revision 0

Monthly RCRA Groundwater Meeting Minutes September 23, 2015 with Ecology

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

ch2m:
SM

P.O. Box 1600
Richland, Washington 99352

Attached to: 1235757

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Date Published
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P.O. Box 1600
Richland, Washington 99352

APPROVED
By Ashley Jenkins at 8:36 am, Feb 02, 2016

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MEETING MINUTES

RCRA Groundwater Meeting Minutes September 23, 2015 with Ecology

September 23, 2015

Attendees:

Dib Goswami (Ecology)

Jeff Ayres (Ecology)

Dwayne Crumpler (Ecology)

Zelma Jackson (Ecology)

Matt Tonkin (SSP&A)

Joe Caggiano (Ecology)

John McDonald (CHPRC)

Craig Arola (CHPRC)

Greg Thomas (CHPRC)

Lee Brouillard (CHPRC)

Doug Hildebrand (RL)

Bill Faught (CHPRC)

CC: Jessica Ni (CHPRC)

From: Bill Faught

Date: January 27, 2016

This meeting was held in the Ecology Building, room number 3B, from 2:00 to 4:00 Pacific Standard Time on September 23, 2015. A summary of the discussion follows.

Objective:

The objective of this meeting was to brief Ecology on the content of the interim status groundwater monitoring plans for 216-A-29 Ditch, 216-B-3 Pond and Ditch, and LLWMA-2.

216-A-29 Discussion:

- Presented and discussed slides on Central Plateau groundwater flow and transport in the sub-region of the 216-A-29 Ditch facility.

- Defined best locations for 2 new monitoring wells based on transport model simulations for the draft revised monitoring plan.
- Discussed Dispersivity values in the model.

Presentation is provided as Appendix A.

216-B-3 Discussion:

- How much acid went into the pond upgradient and is now leaking out and going downgradient?
- Discussed the comparison to site background for SO_4 and NO_3.
- Are there other wells upgradient that have water?
- 500' from facility is there water if we were to put in a well? If so, how much?

Presentation is provided as Appendix B.

LLWMA-2 Waste Burial Trenches Discussion:

- The group was short on time and the discussion on this was directed to Table 3-3 "Main Differences between this Plan and Previous Plan."

Presentation is provided as Appendix C.

Actions:

1. CHPRC to address the process effluent acid disposal question and well location questions
2. CHPRC to make sure references from A-29 Ditch modeling slides are in AR
3. CHPRC to research background groundwater values for SO_4 and NO_3

Agreements Made:

- Wells locations discussed for A-29 are acceptable to Ecology for the draft plan.
- LLWMA-2 discussion was very brief and the group agreed that the draft plan should be submitted for Ecology review. The changes proposed in the draft plan include: deleting alkalinity, changing frequency of site specific constituents and GW quality parameters from semi-annual to annual, change monitoring well network to better align to GW flow direction (west-southwest to southwest).

Appendix A

216-A-29 Flow Path Presentation

By Matt Tonkin

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216-A-29 Ditch

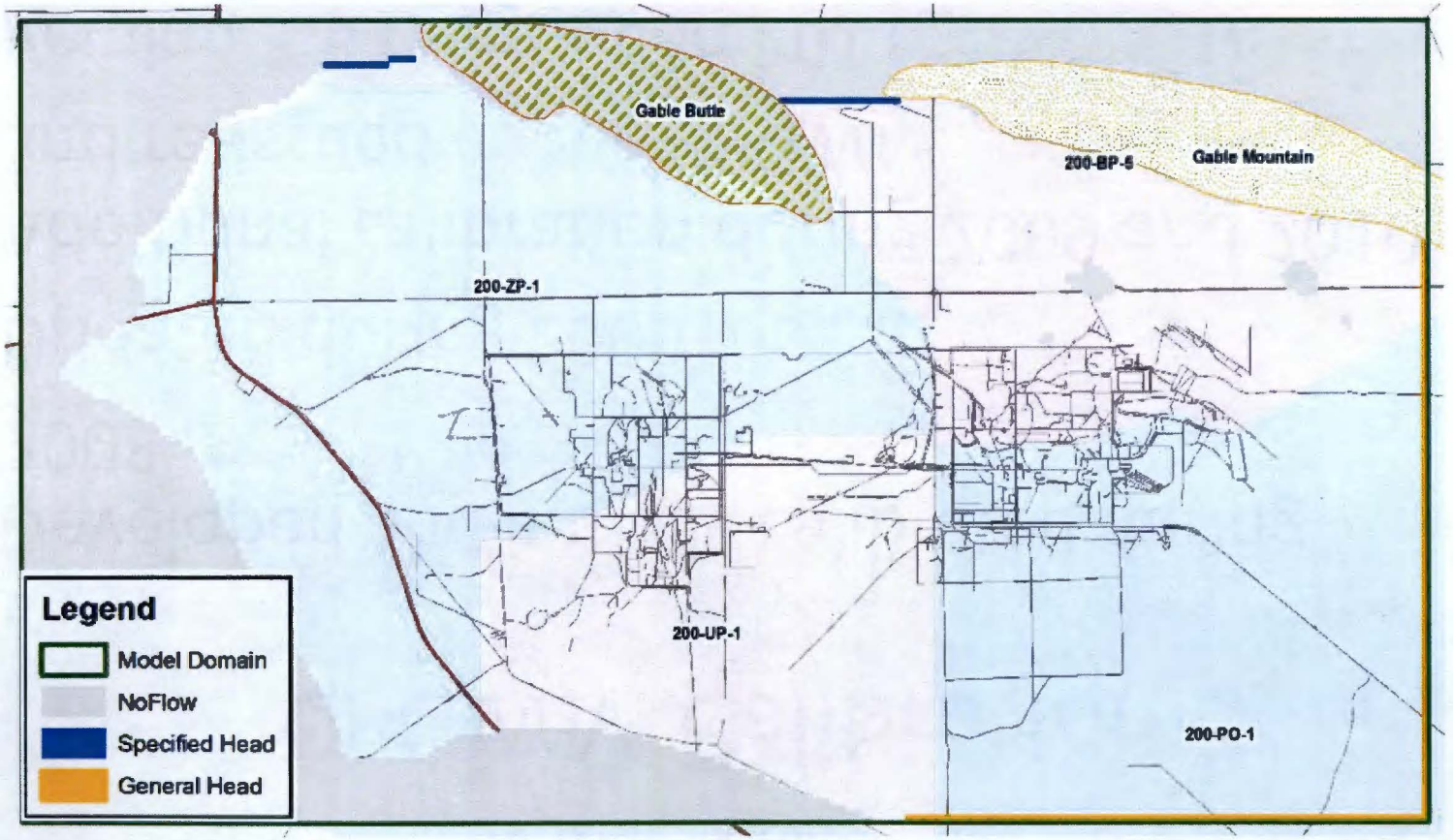
Proposition

- Tools and methods developed and used for 200-ZP-1 can be used to assess flow paths and fate-and-transport near 216-A-29:
  - Central Plateau Groundwater Model (CPGWM)
  - Hydraulic monitoring and mapping
- These tools incorporate and evaluate changes in heads, flow, hydraulic gradients and likely migration pathways as groundwater conditions throughout the Central Plateau develop

For Discussion Purposes Only

CPGWM

- The CPGWM encompasses 2-West and 2-East



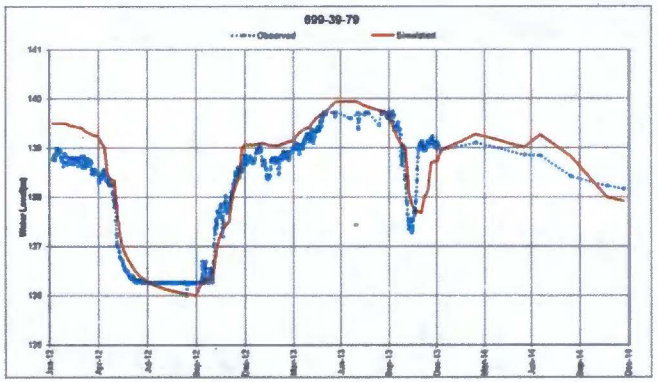
CPGWM Calibration

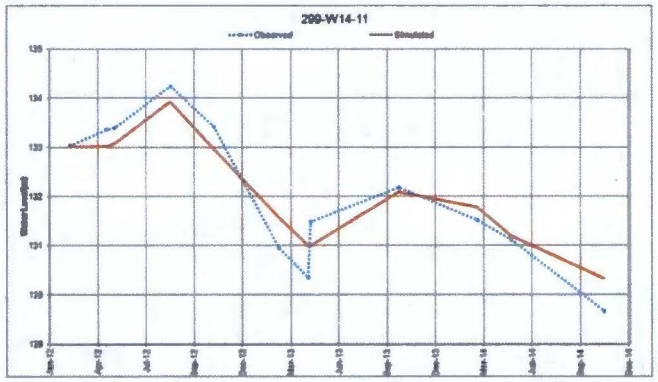
- Developed and initially calibrated during 2008 *(DOE/RL-2008-56)*
- Updated during 2009 *(DOE/RL-2009-38)*
- Additional calibration during 2009 and 2010 and re-issued as the CPGWM
- Version 3.3 released in 2011 *(CP-47631)*:
  - Details model revisions and further calibration
- Has since been used for annual P&T reports:
  - Those ECFs document validation with new data obtained since 200-ZP-1 start-up

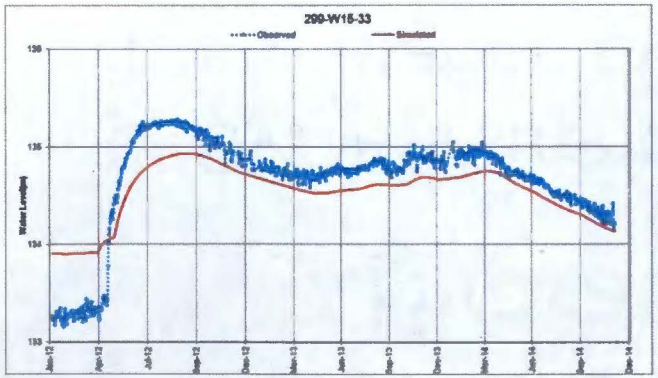
For Discussion Purposes Only

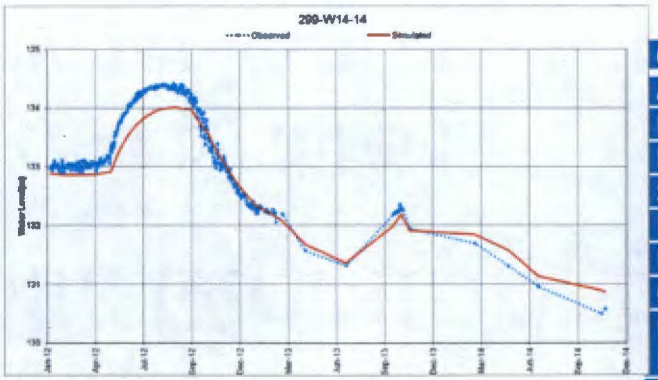
CPGWM Calibration

- Calibrated to data from 1944
- Validated using recent drawdown-mounding









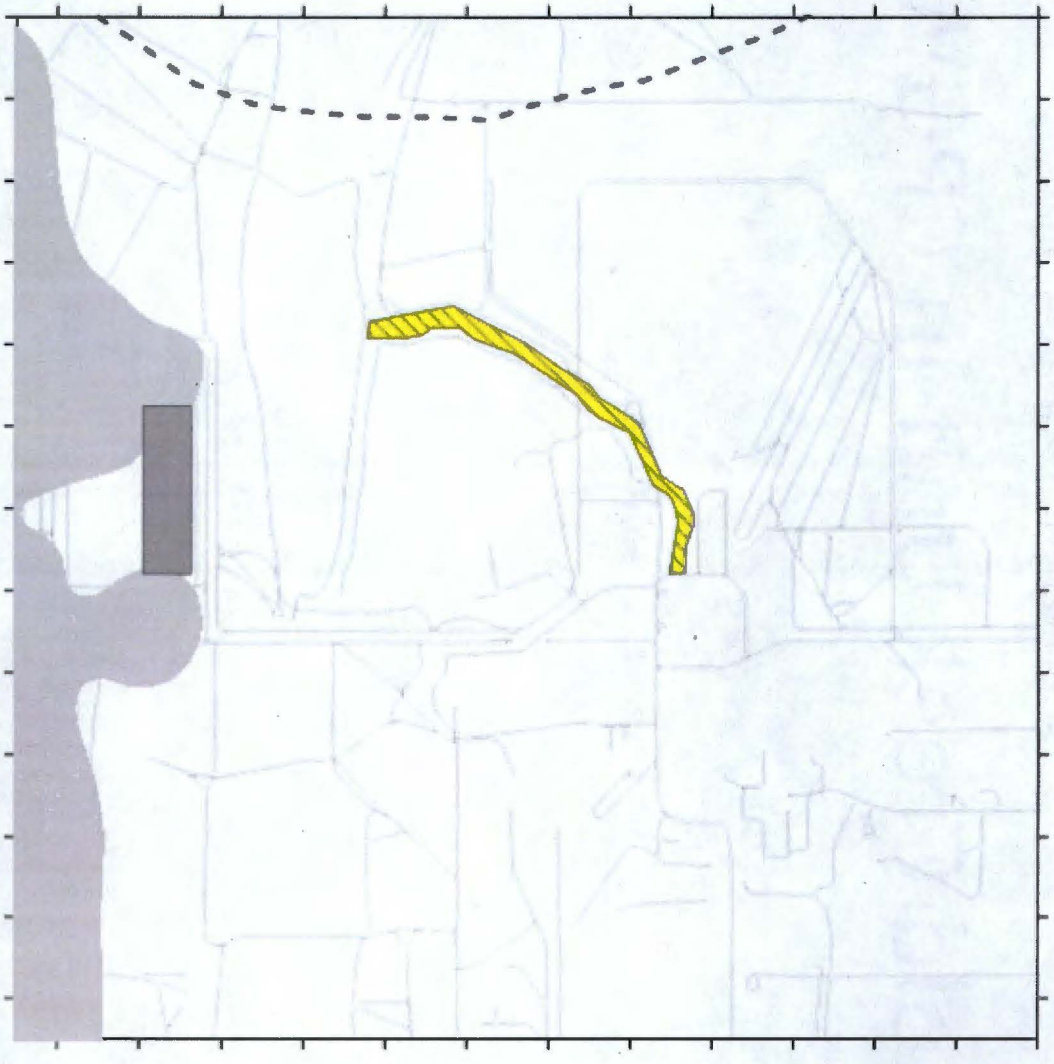
Correlation	0.9914
Avg Residual	-0.08
Max Residual	9.78
Min Residual	-8.36
SSE	1,392
MSE	0.38
RMSE	0.6142
Obs Range	18.989
RMSE/Obs Range	0.0323
R2	0.98

Hydraulic Monitoring

- CPGWM is supported by direct interpretation of water level and pumping data:
  - Construct water level maps
  - Construct flowpath (particle tracking) maps
- Water level mapping can be completed using variety of methods, e.g.:
  - Inverse distance
  - Universal kriging (UK) *(SGW-43209)*

For Discussion Purposes Only

216-A-29 Area

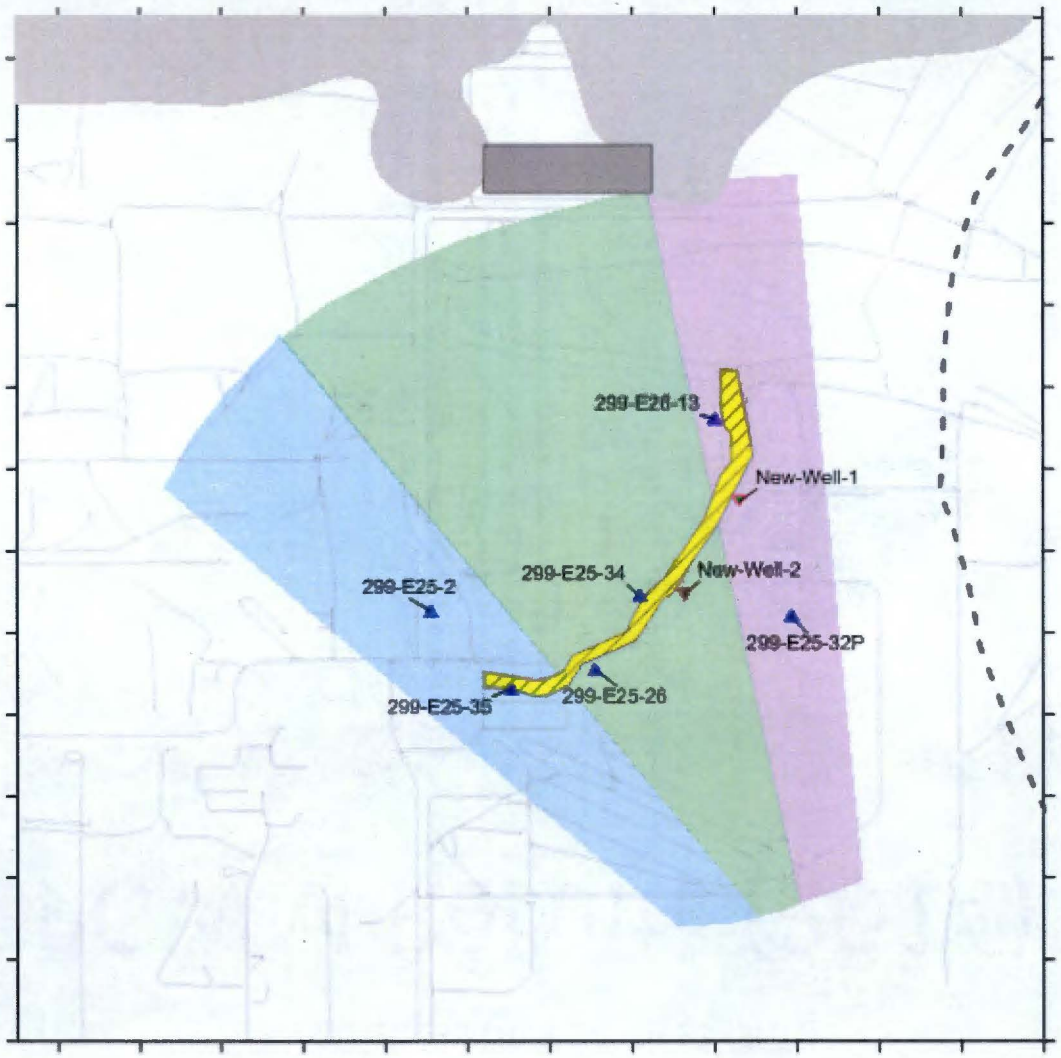


For Discussion Purposes Only

Cold Creek Unit in CPGWM

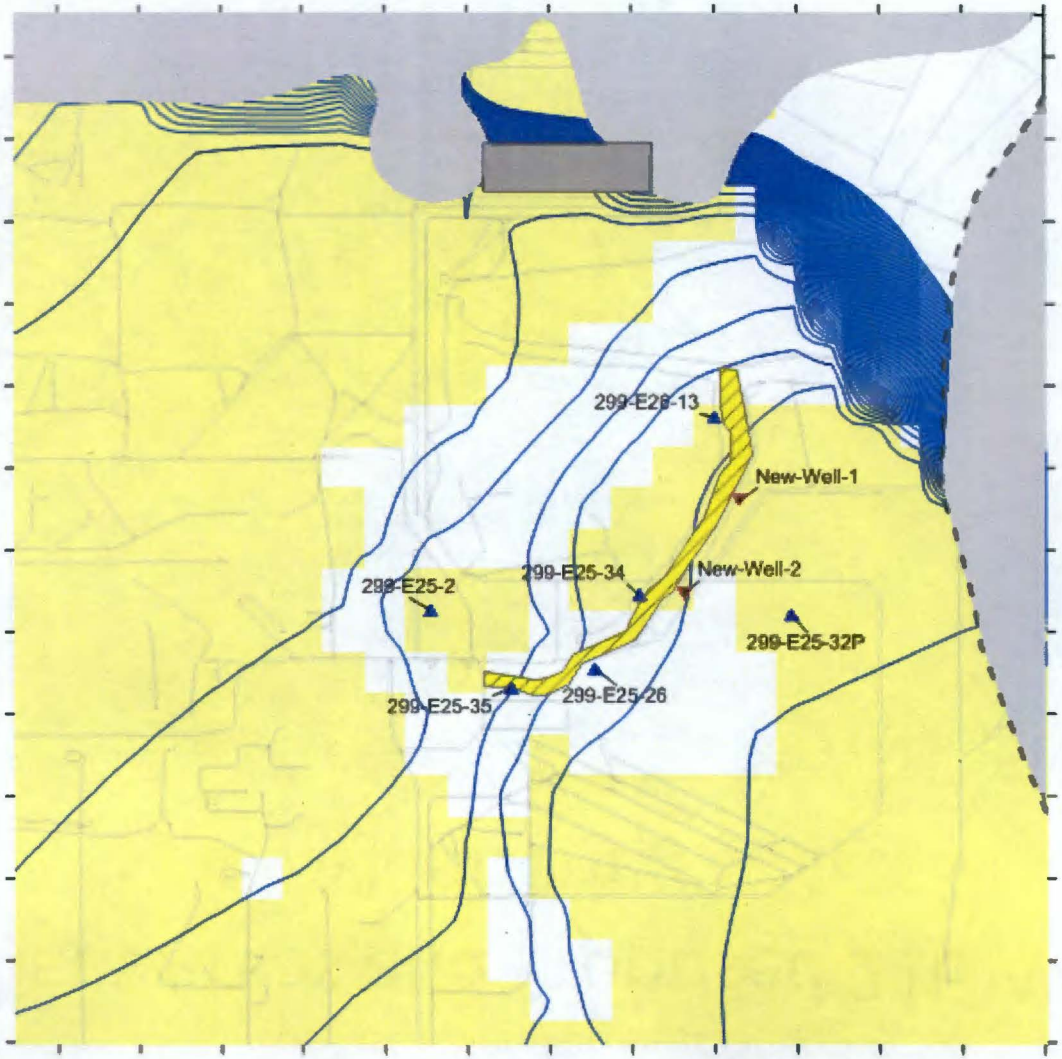
For Discussion Purposes Only

Gradient Areas and Proposed 216-A-29 Monitoring



For Discussion Purposes Only

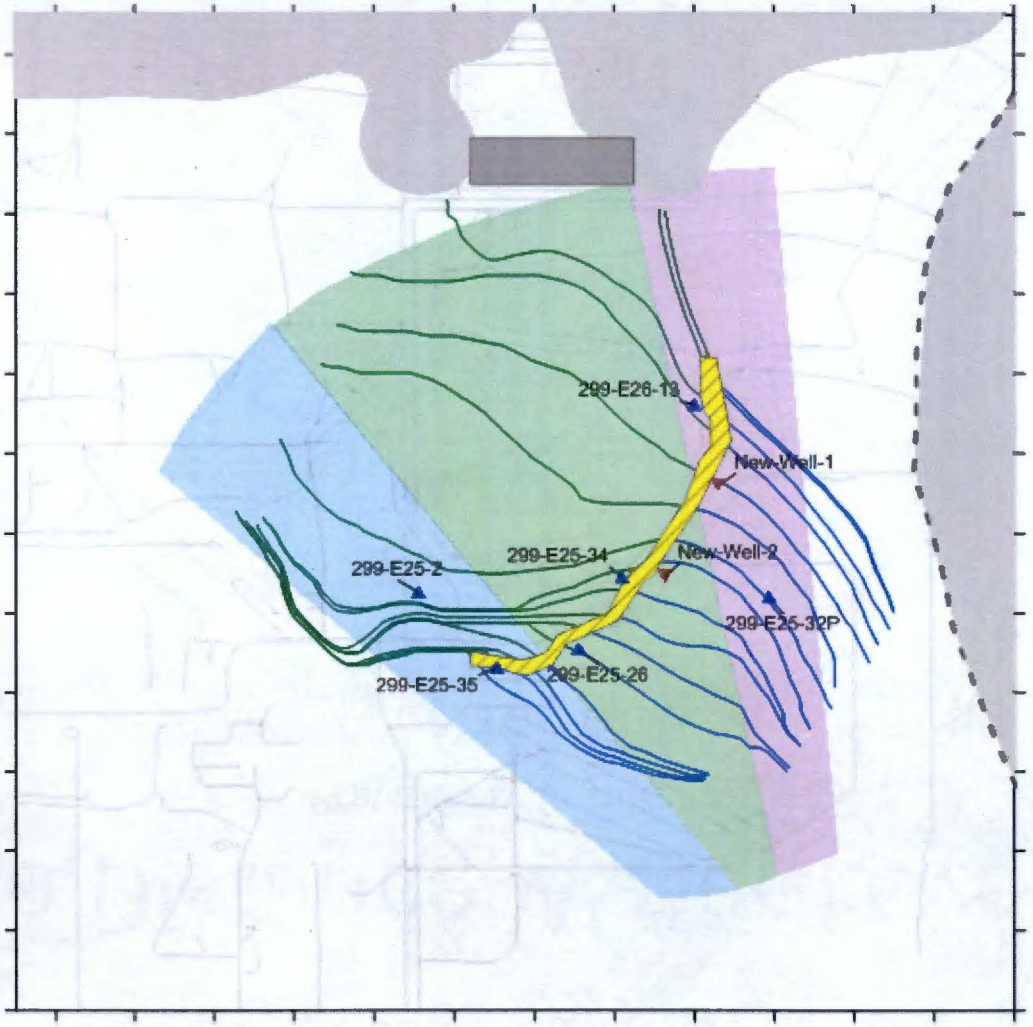
CPGWM Results (2014)



For Discussion Purposes Only

Pathlines - CPGWM

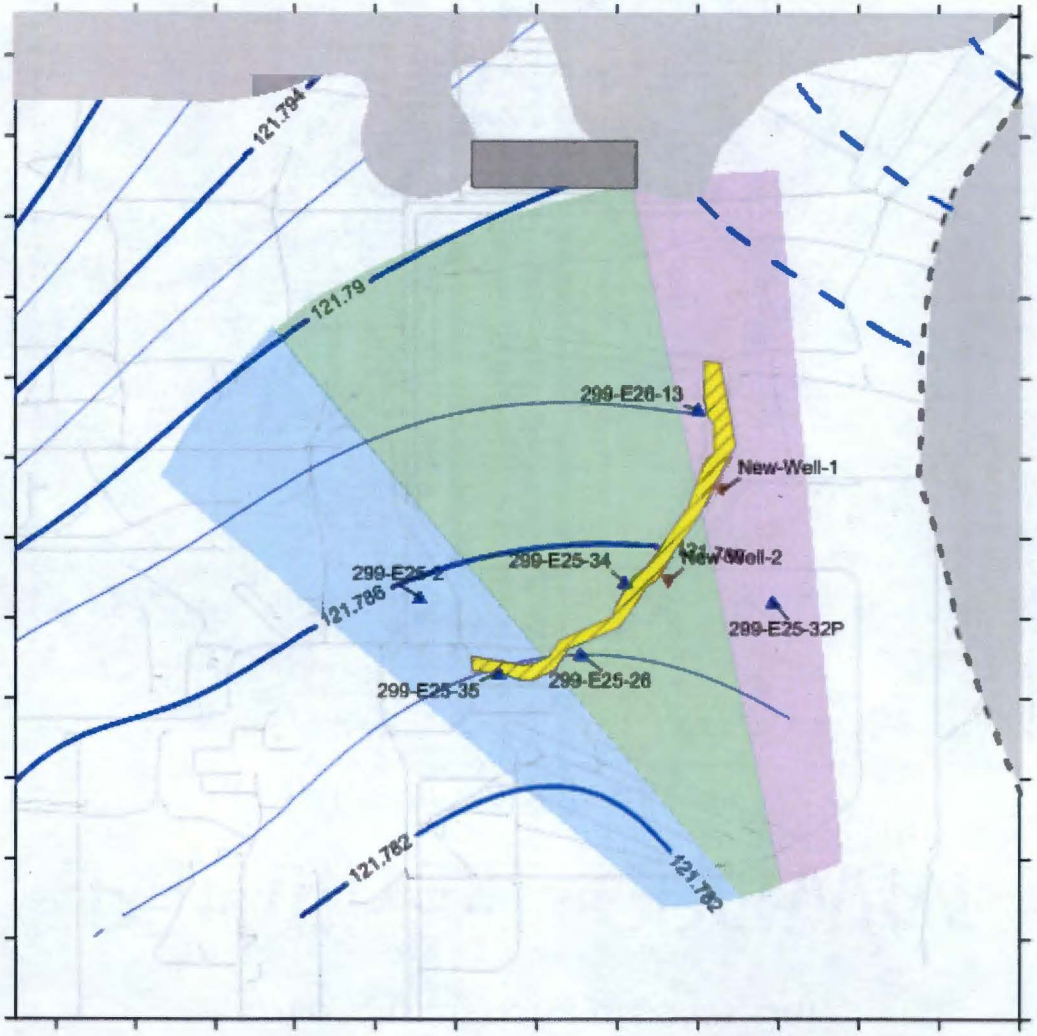
Preliminary Results



For Discussion Purposes Only

Inverse Distance Water Level Map

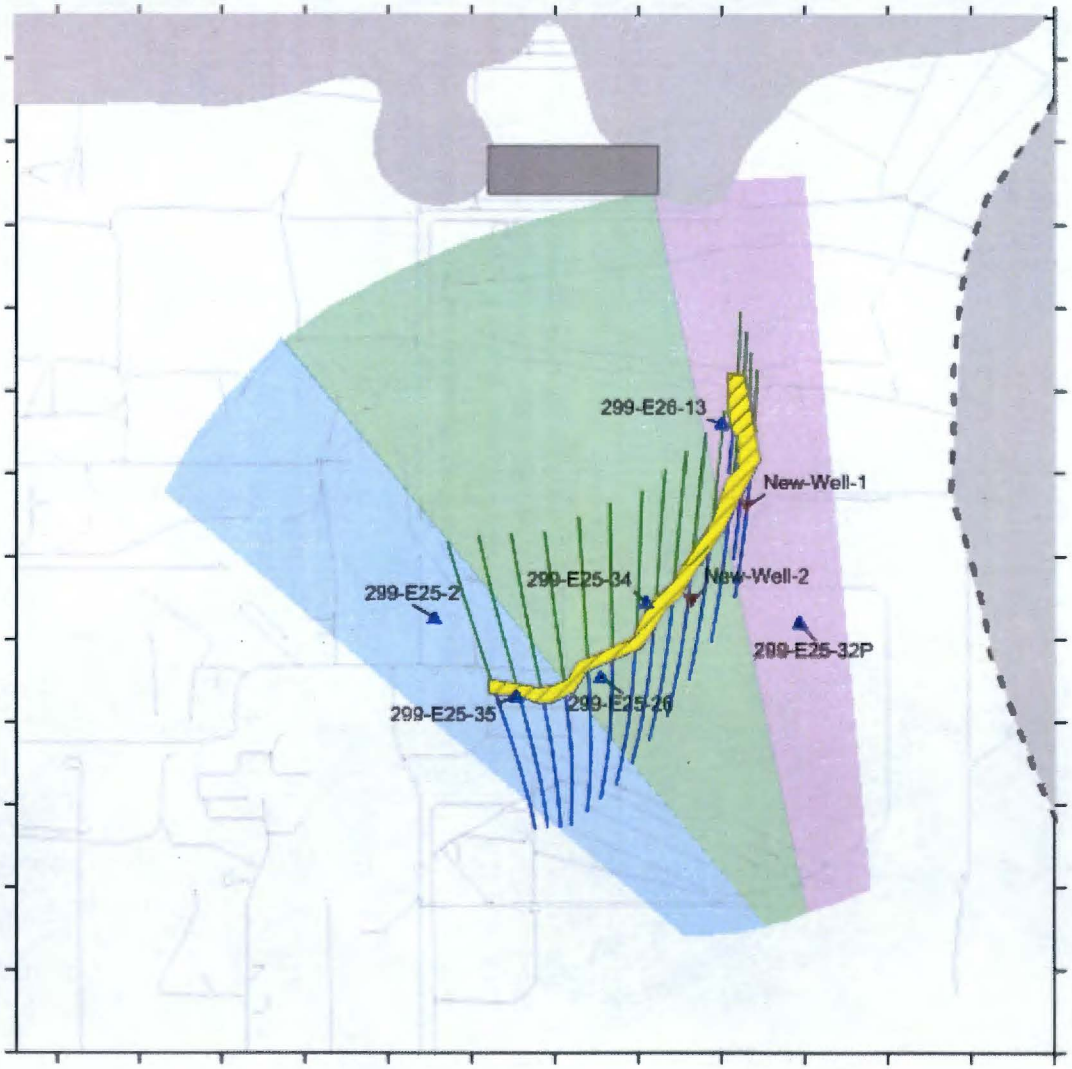
Preliminary Results



For Discussion Purposes Only

Pathlines – Inverse Distance Map

Preliminary Results



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Appendix B

Review of 216-B-3 Monitoring Plan

By Lee Brouillard

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Figures

Tables

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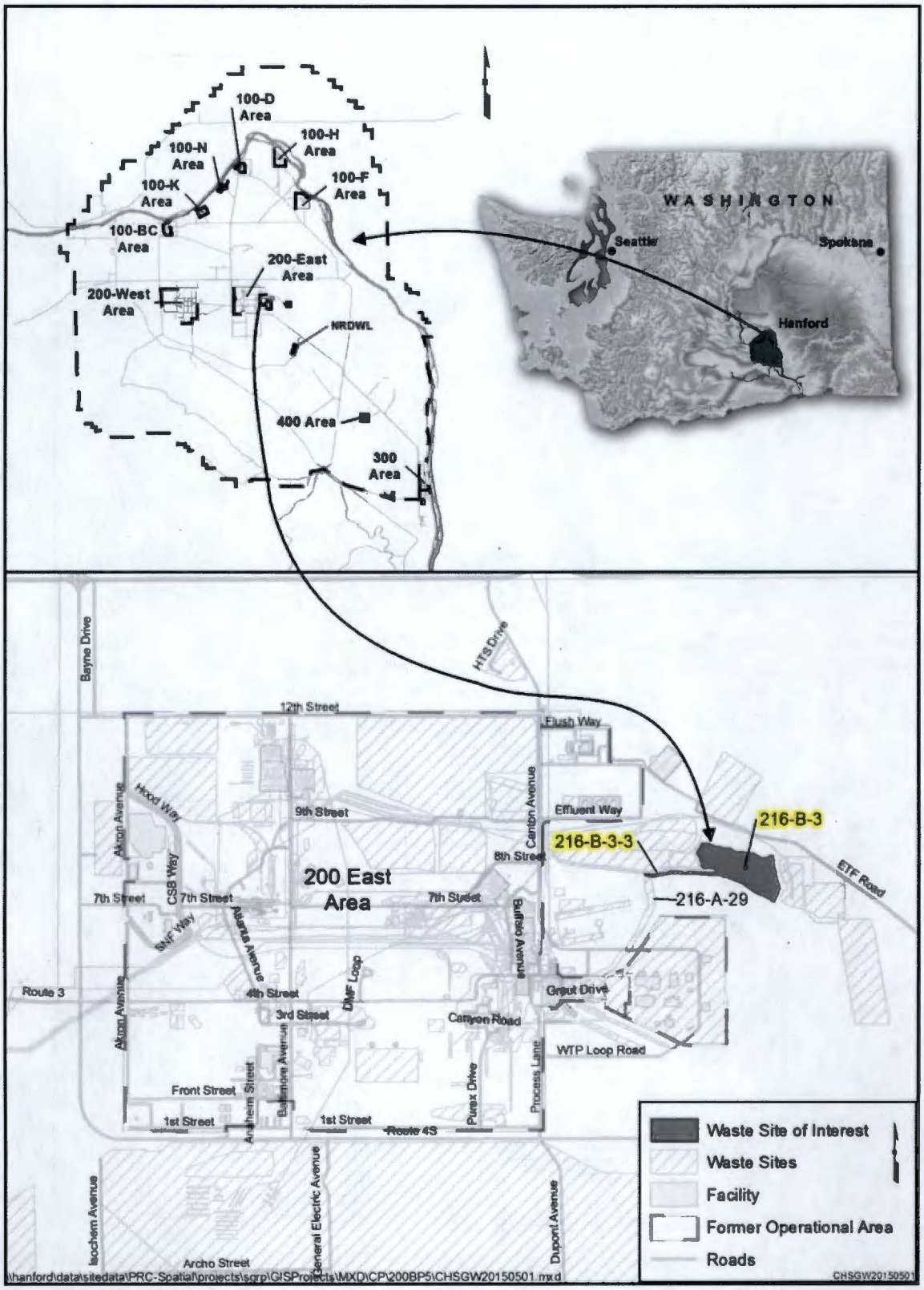

Figure 1-1. Location Map for the 216-B-3 Ditch

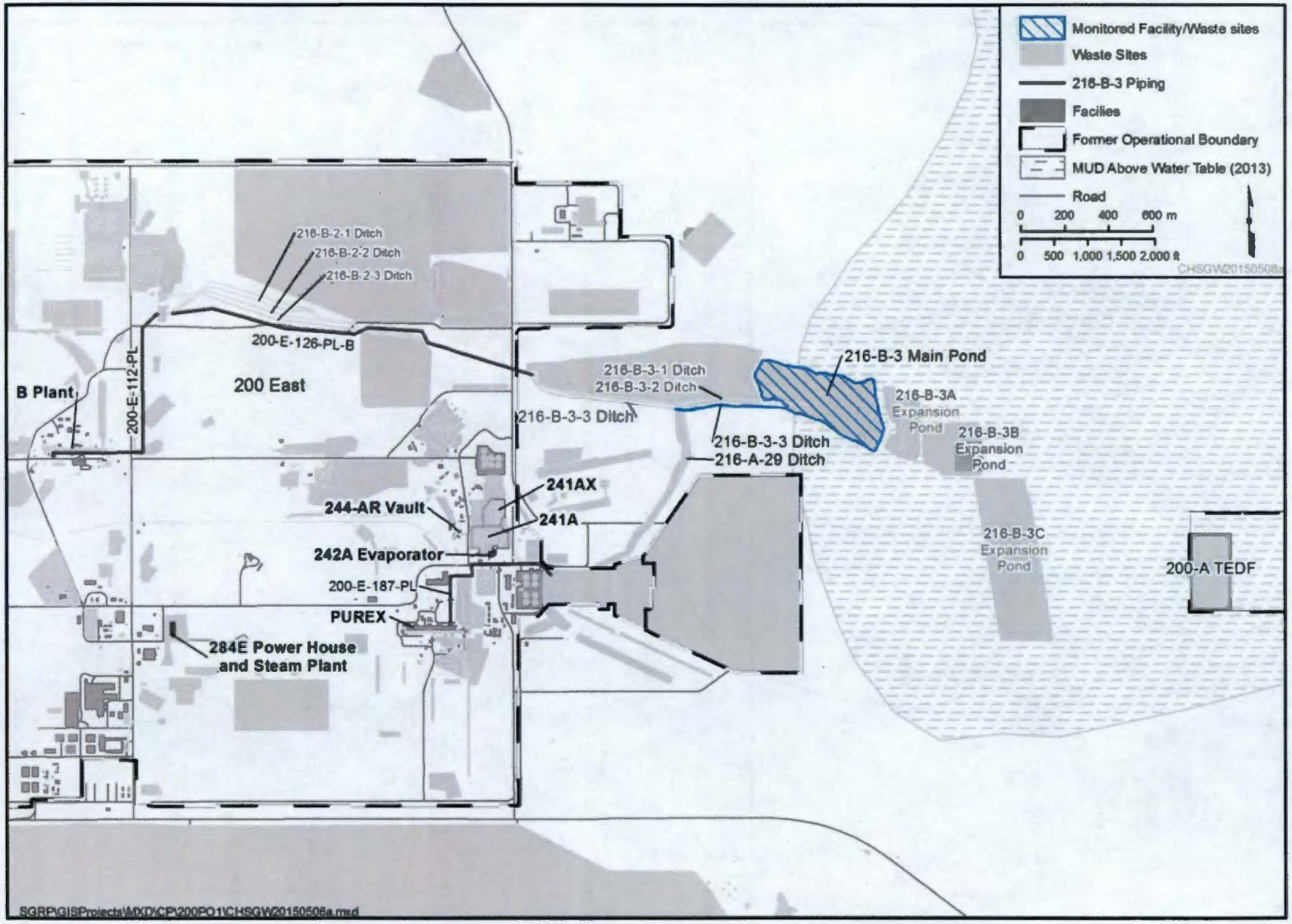

Figure 2-1. Site Map for the 216-A-29 Ditch and Surrounding Facilities

Table 2-1. Dangerous Waste Disposed to 216-B-3 Main Pond and 216-B-3-3 Ditch from RCRA Part A Form

Waste Constituent	Quantity (kg [lb])*	Description
Nitric Acid Sulfuric Acid Sodium Hydroxide Potassium Hydroxide	1,622,500 (3,577,000)	Corrosive and Toxic
Hydrazine	34,900 (77,000)	Listed
Cadmium Nitrate	76,700 (169,000)	Listed
Ammonium Fluoride/Ammonium Nitrate	8,600 (19,000)	Dangerous Waste/Toxic Dangerous Waste

* Quantity includes the water in which the chemicals were discharged.

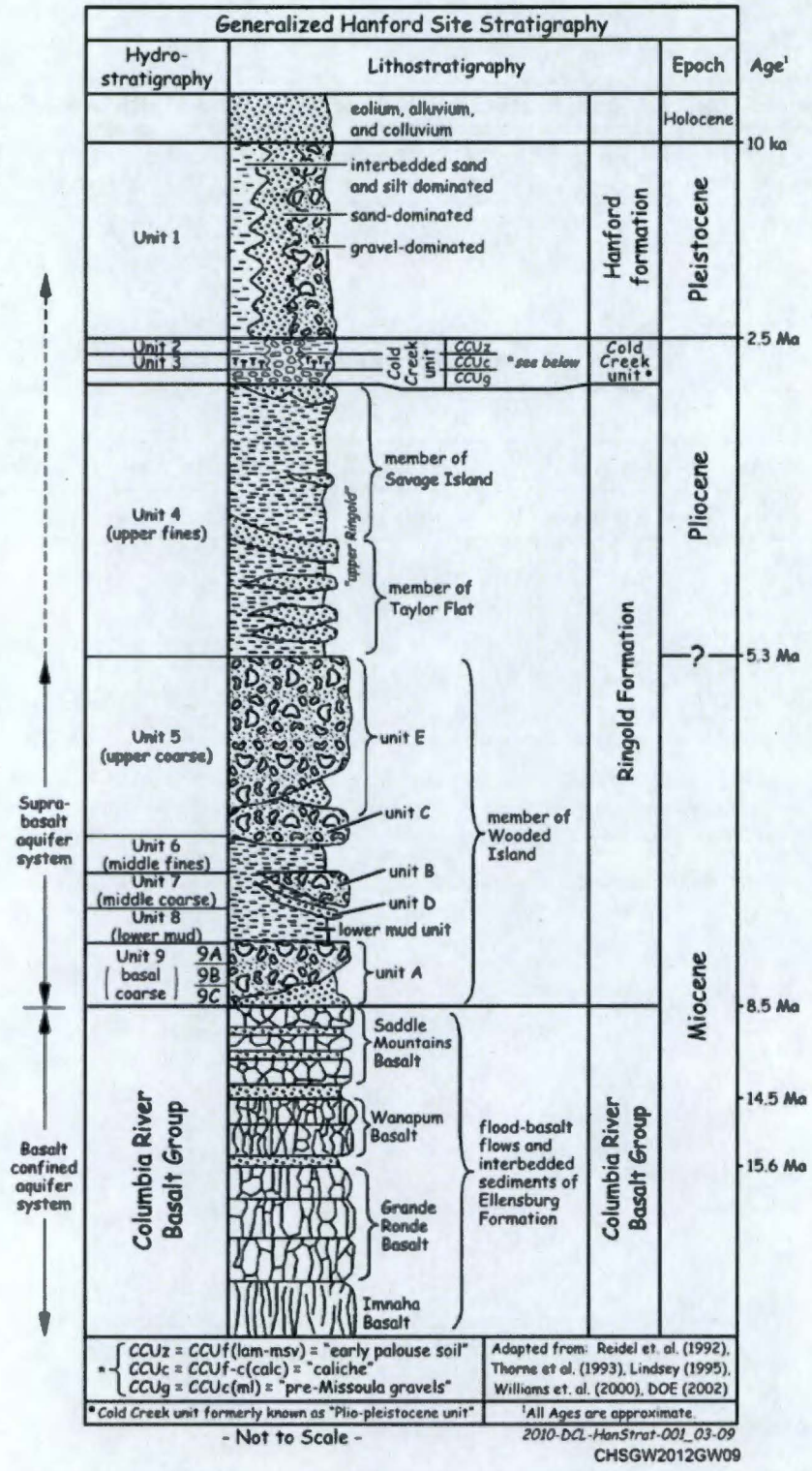

Figure 2-2. General Stratigraphy at the Hanford Site

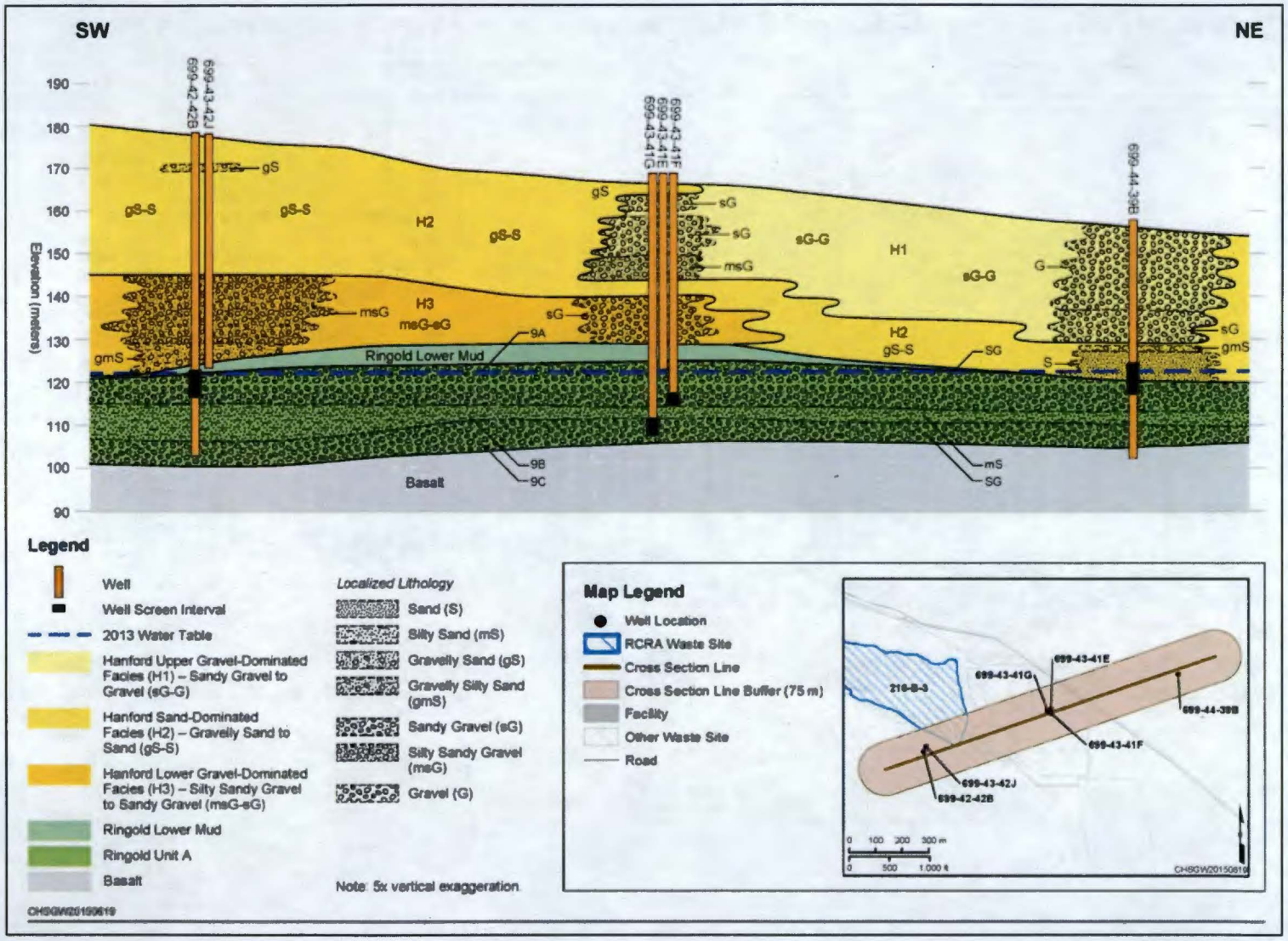

Figure 2-3. Southwest-Northeast Geologic Cross Section Showing the Stratigraphy below the Southeastern Portion of the B Pond (Main Pond)

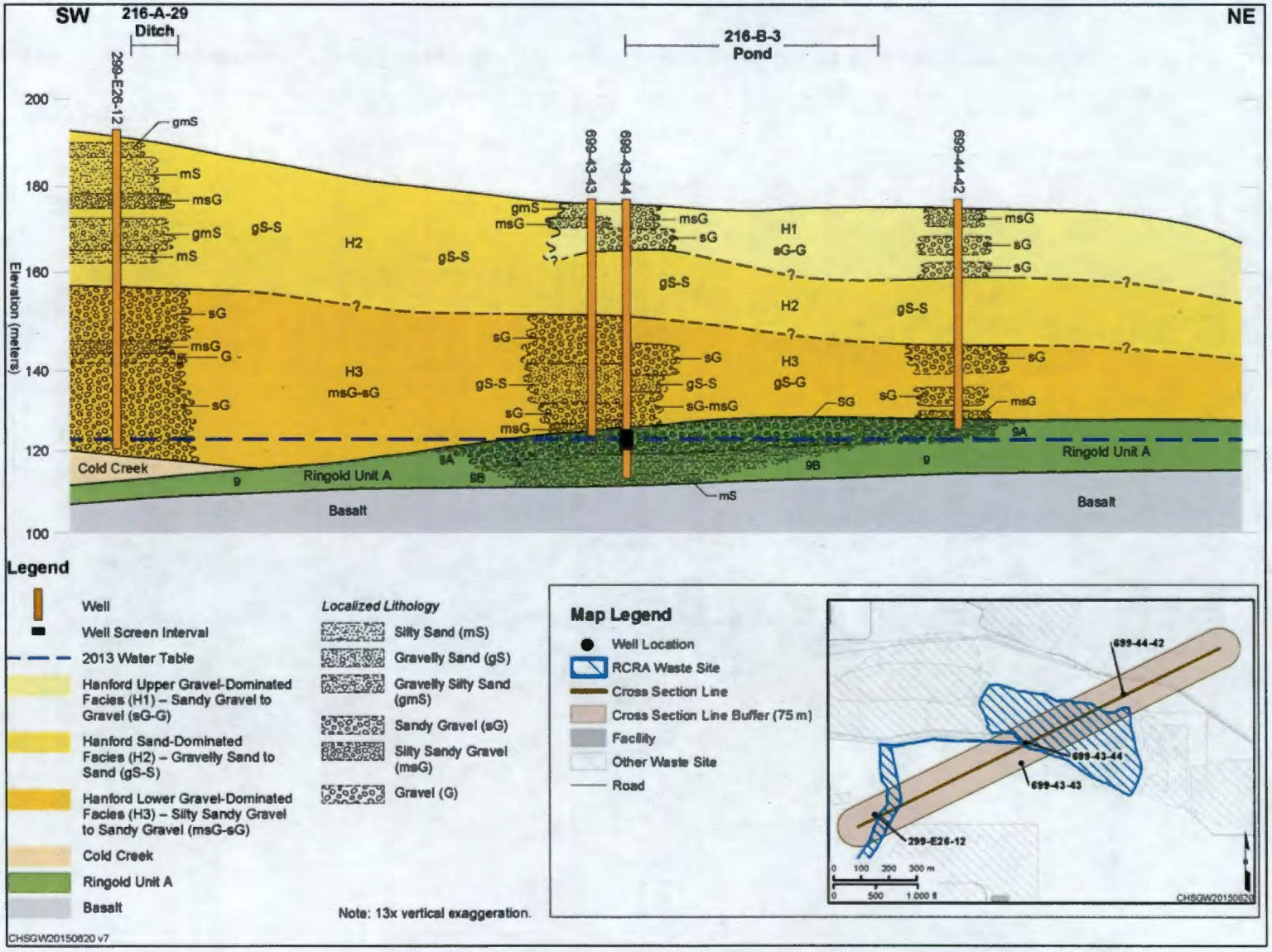

Figure 2-4. Southwest-Northeast Geologic Cross Section Showing the Stratigraphy below the Middle Portion of the B Pond

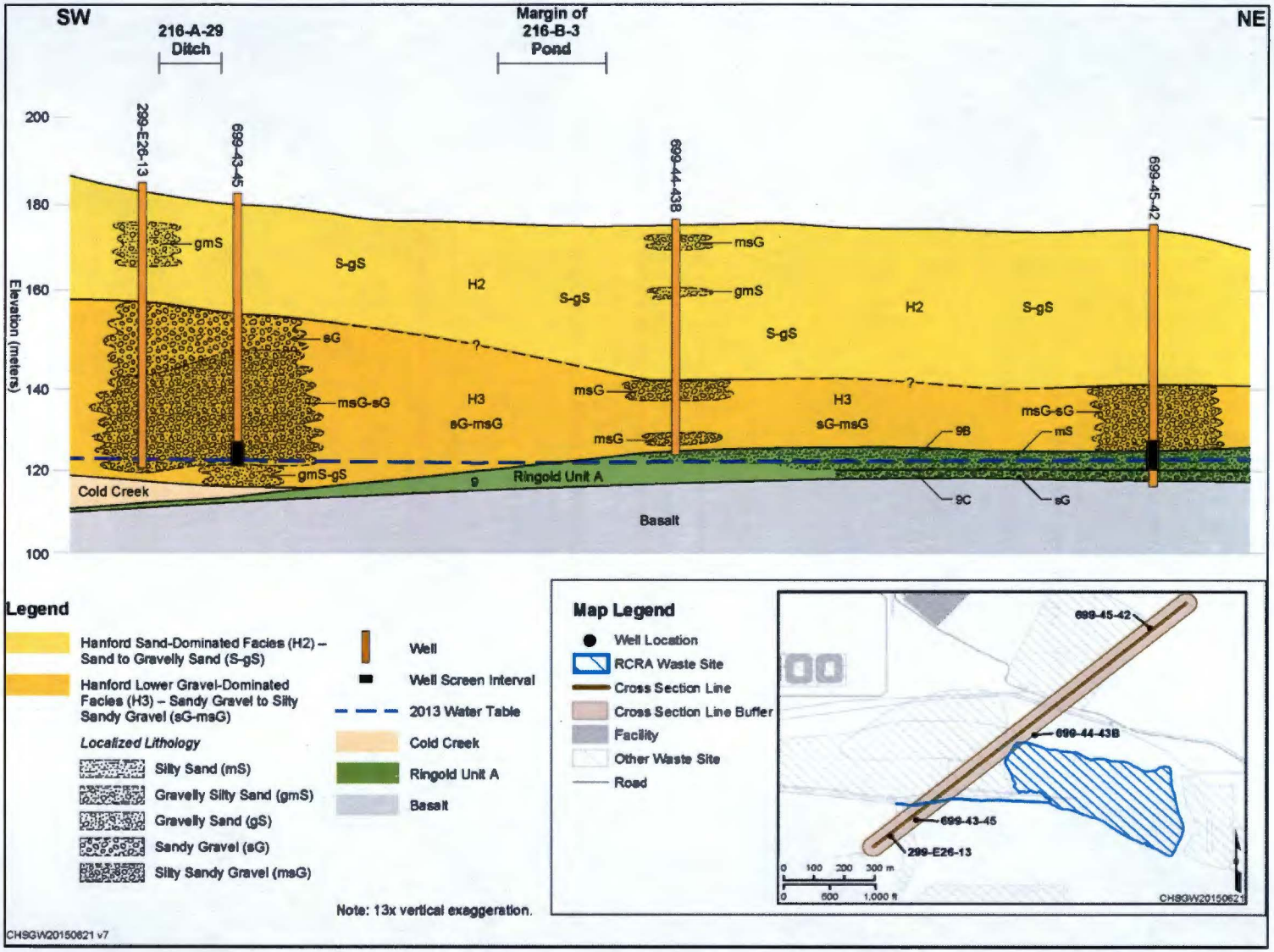

Figure 2-5. Southwest-Northeast Geologic Cross Section Showing the Stratigraphy below the Northwestern Portion of the B Pond

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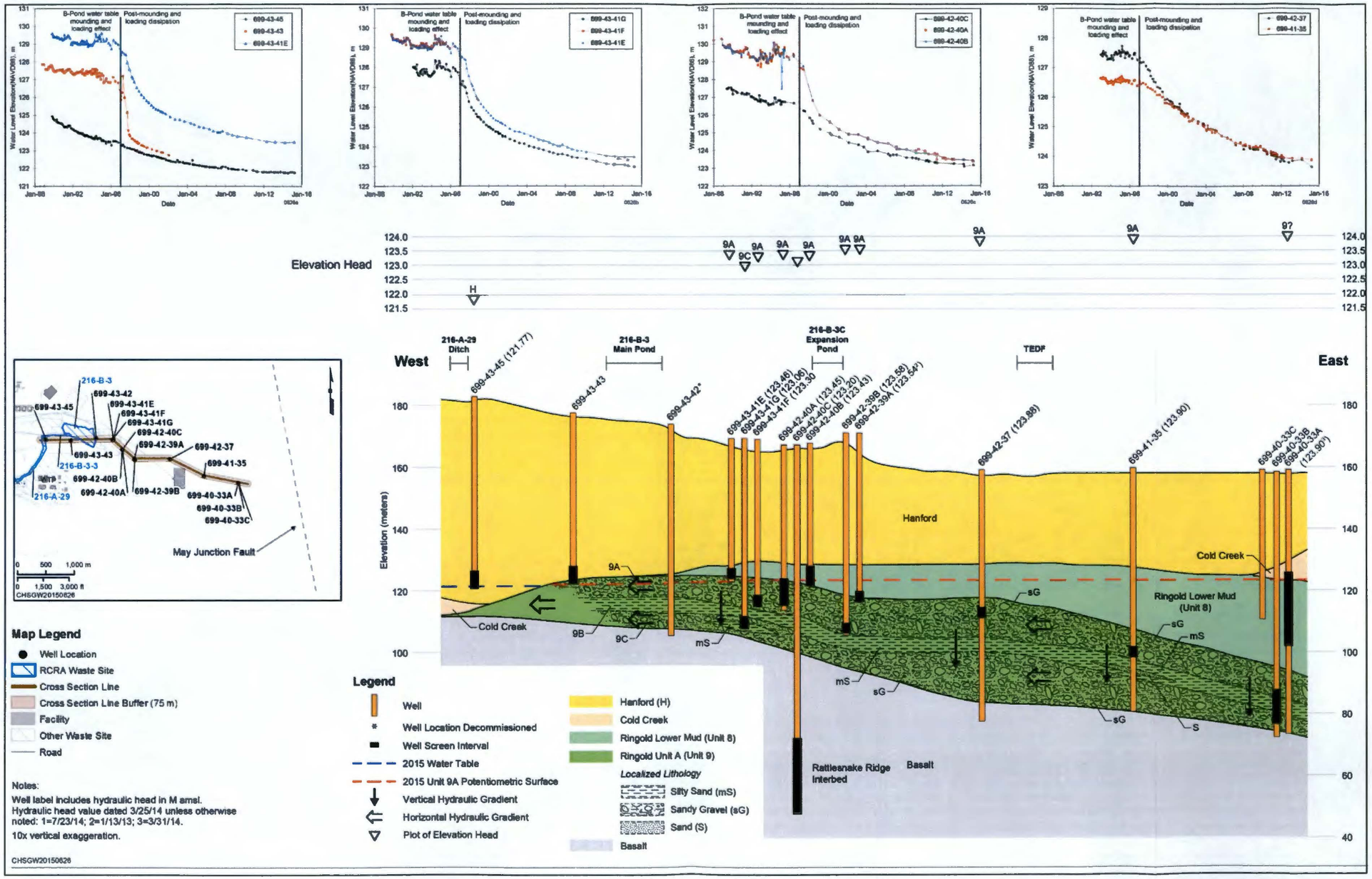
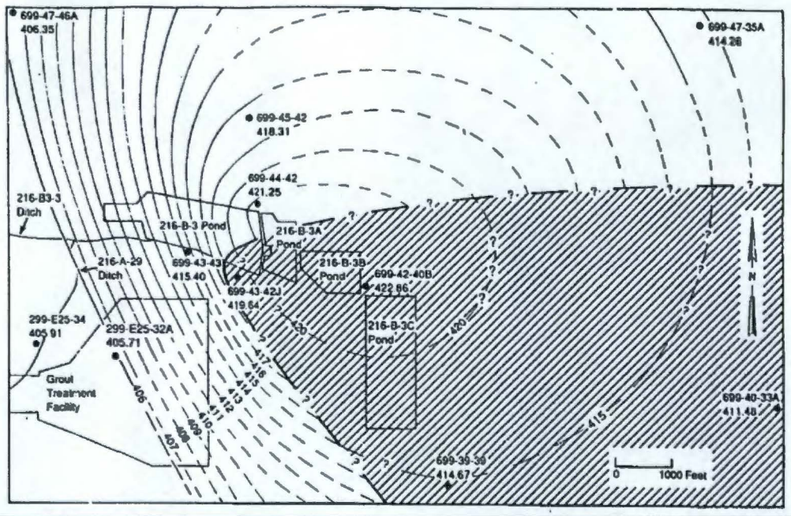
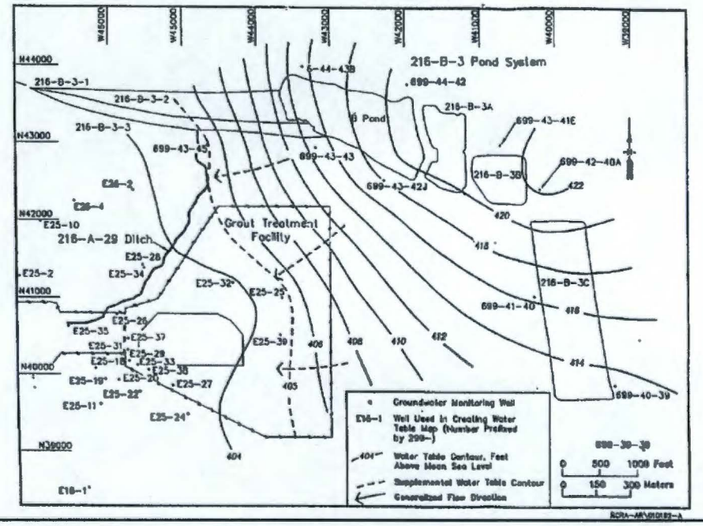


Figure 2-6. Hydrostratigraphy Extending from below B Pond Southeast toward Treated Effluent Disposal Facility

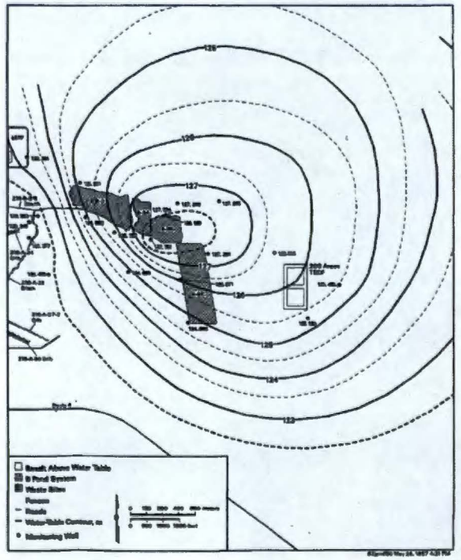
Potentiometric Surface Interpretation May 1989 from WHC-SD-EN-AP-030



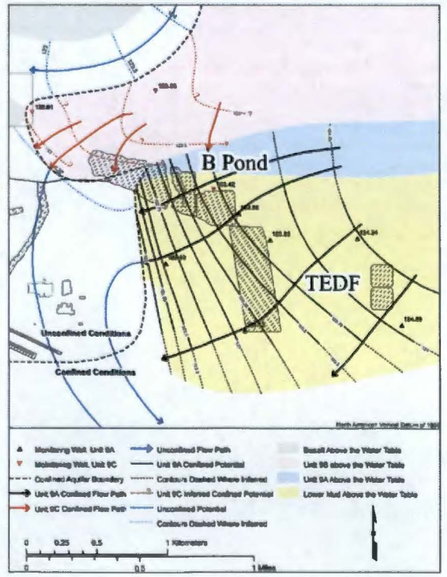
Potentiometric Surface Interpretation June 1991 from ECN-166756 (WHC-SD-EN-AP-030)



Potentiometric Surface Interpretation January 1997 from PNNL-11604



Potentiometric Surface and Flow Direction Interpretation March 2004 from DOE/RL-2008-59



CHSGW20150807

Figure 2-7. Historic Potentiometric Surface and Groundwater Flow Pattern Interpretations in the B Pond Area 1989, 1991, 1997, and 2004

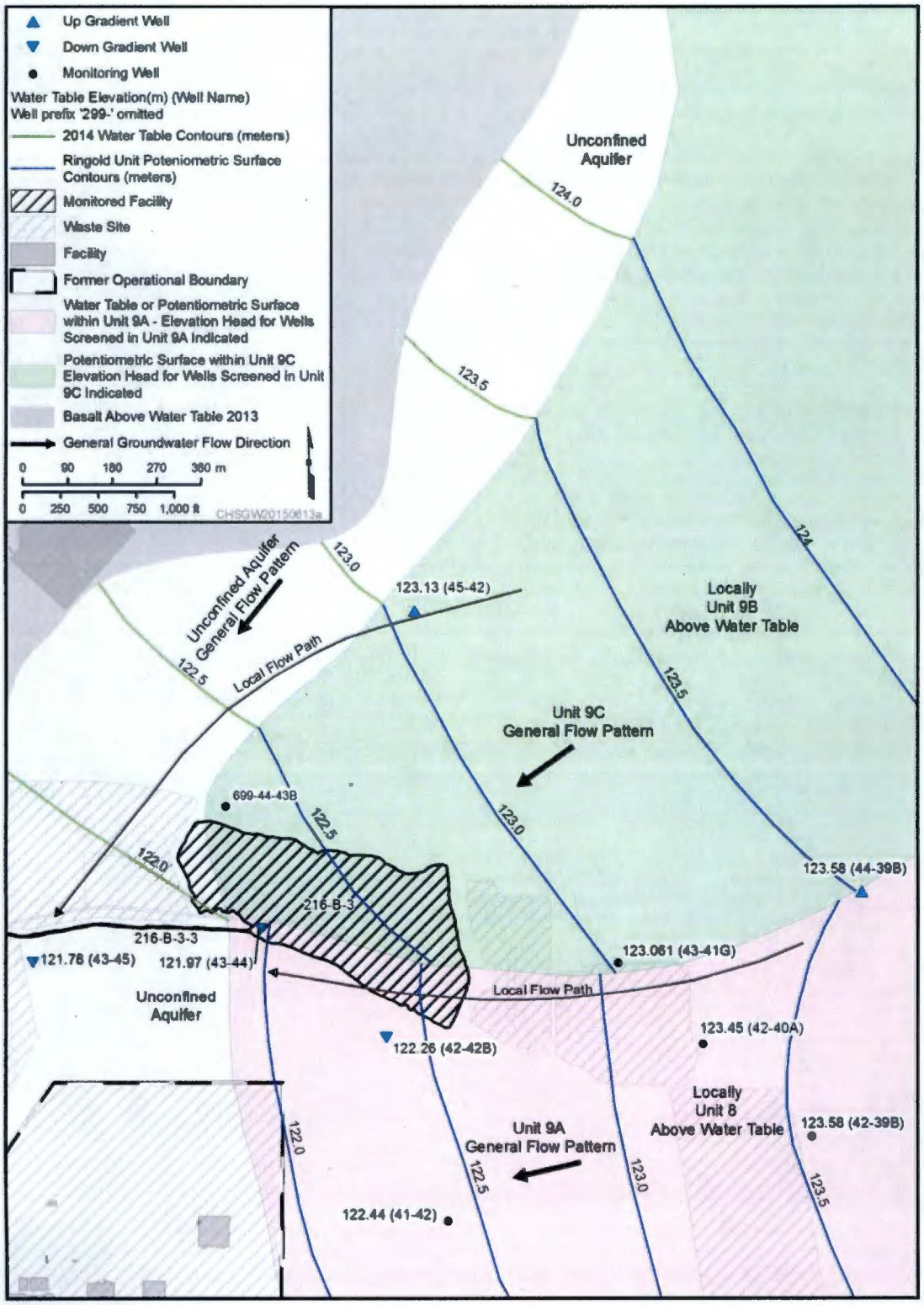


Figure 2-8. Groundwater Flow near B Pond in 2014

Table 2-2. Previous Monitoring Plans

Document	Date Issued	Monitoring Program*
Preliminary Closure/Post-Closure Plan 216-B-3 Pond (DOE, 1987)	1987	Indicator Evaluation Program
Interim-Status Groundwater Monitoring Plan for the 216-B-3 Pond (WHC-SD-EN-AP-013, Rev. 0)	1989	Indicator Evaluation Program
Groundwater Quality Assessment Plan for the 216-B-3 Pond System (WHC-SD-EN-AP-030, Rev. 0)	1990	Groundwater Quality Assessment Plan
WHC-SD-EN-AP-030 (ECN 166756)	1992	Groundwater Quality Assessment Plan
WHC-SD-EN-AP-013, Rev. 1	1995	Indicator Evaluation Program
Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility (PNNL-13367)	2000	Indicator Evaluation Program
PNNL-13367-ICN-1	2002	Indicator Evaluation Program
Groundwater Monitoring Plan for the Hanford Site 216-B-3 Pond RCRA Facility (PNNL-15479)	2005	Indicator Evaluation Program
Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond (DOE/RL-2008-59, Rev. 0)	2010	Indicator Evaluation Program

* The indicator evaluation program satisfies the requirements of 40 CFR 265.92(b)(2), (b)(3), (d)(1), (d)(2), and (e), "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Sampling and Analysis." The groundwater quality assessment program's first determination satisfies the requirements of 40 CFR 265.93(d)(4) and (d)(6), "Preparation, Evaluation, and Response."

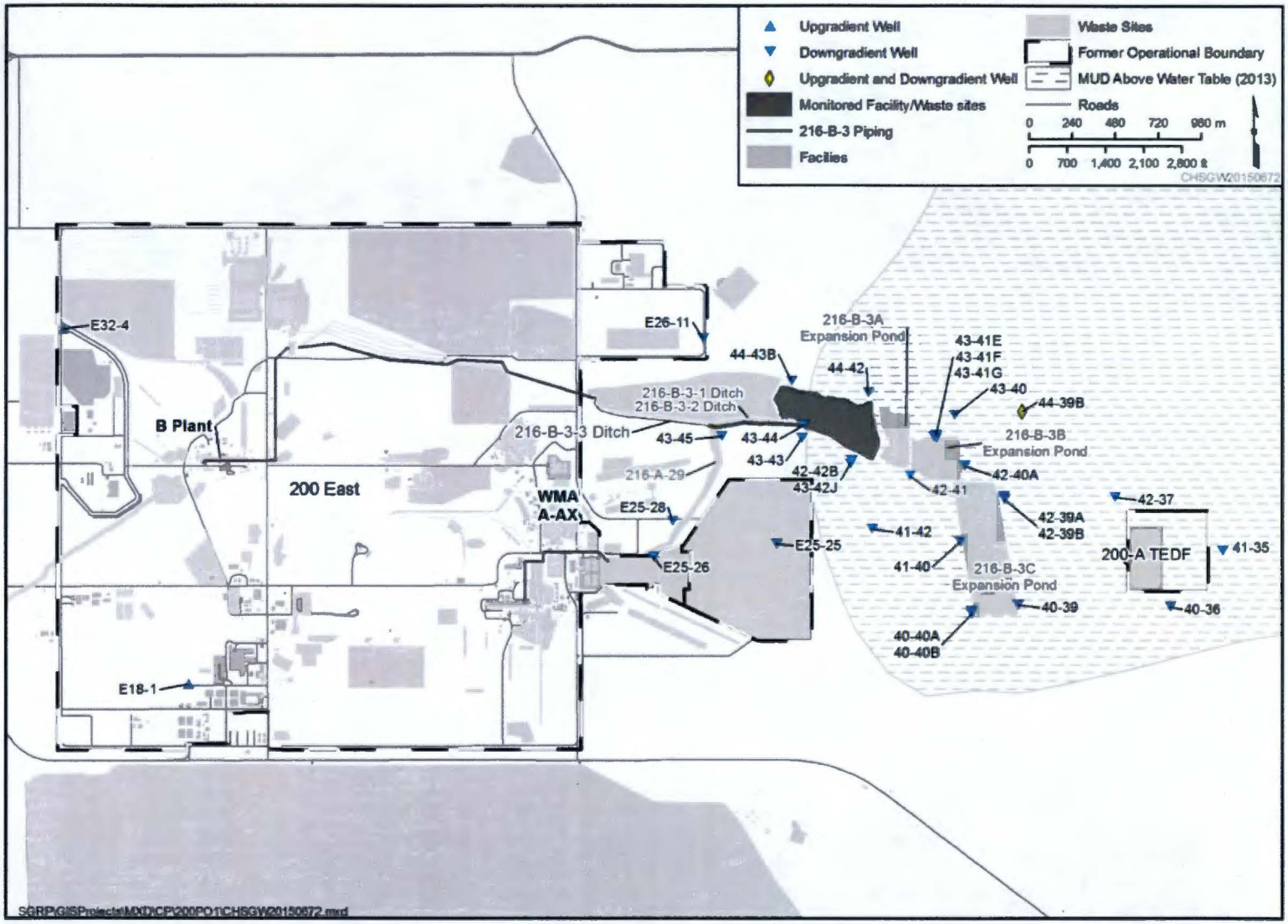


Figure 2-9. Historical RCRA Groundwater Network Wells Used to Monitor the B Pond System

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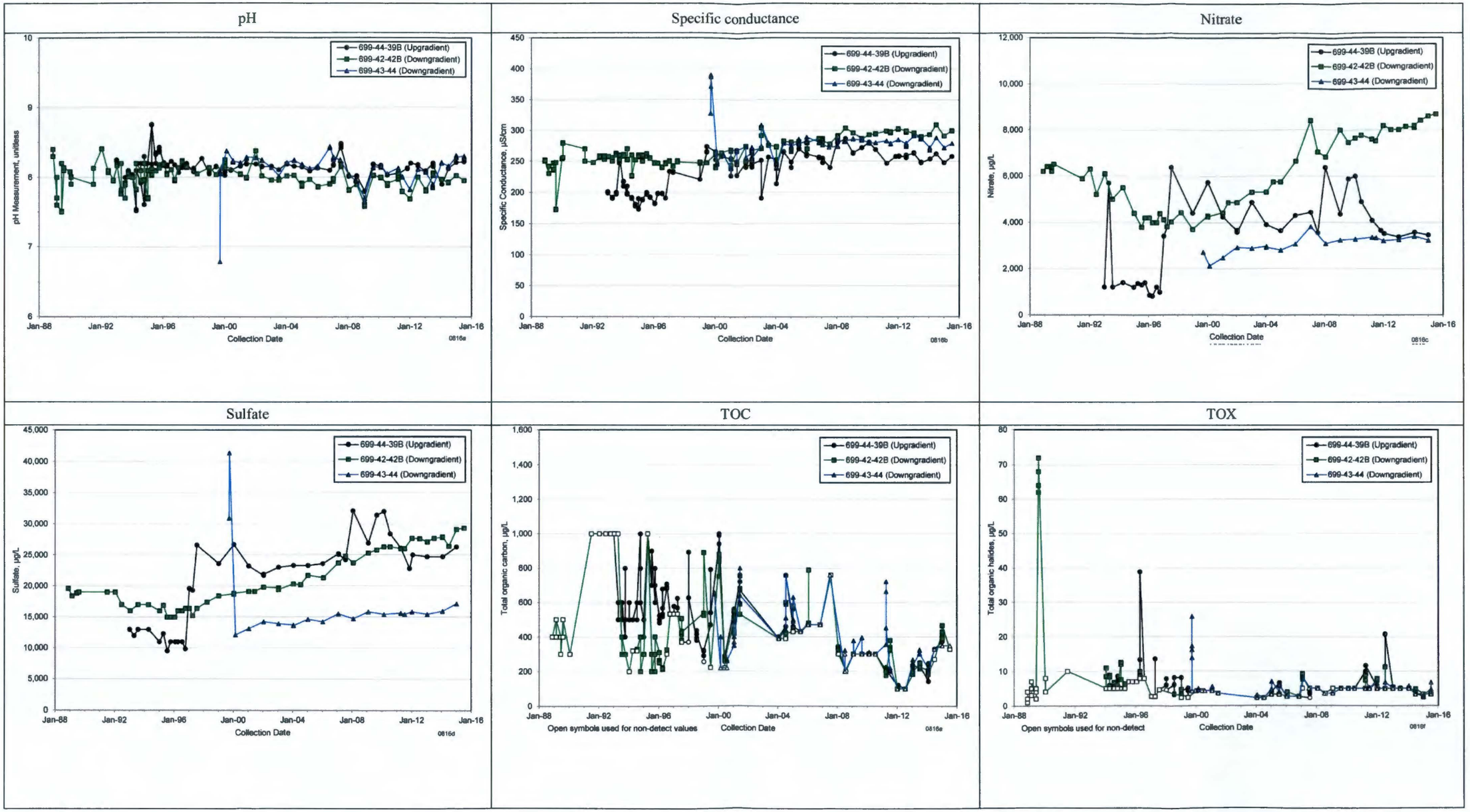
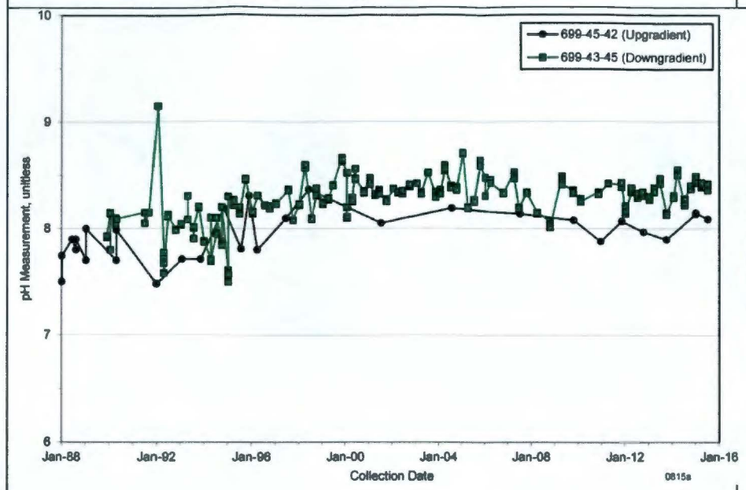
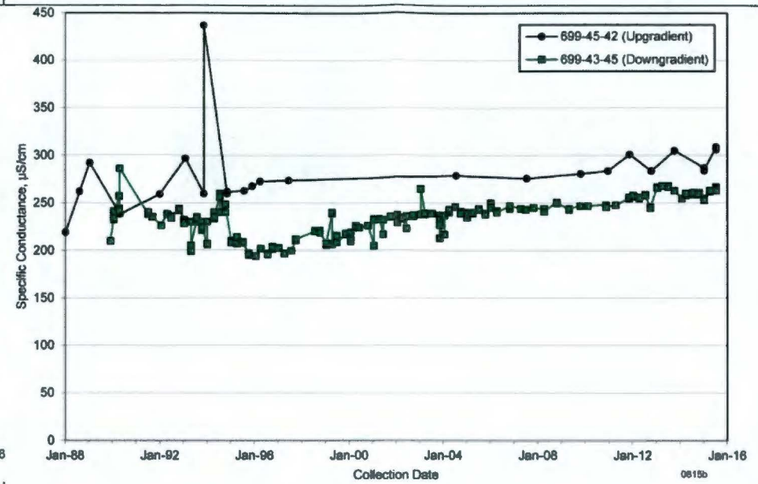


Figure 2-10. pH, Specific Conductance, Nitrate, Sulfate, TOC, and TOX Time Series Trend Plots Showing Concentrations for Upgradient Well 699-44-39B versus Downgradient Wells 699-42-42B and 699-43-44

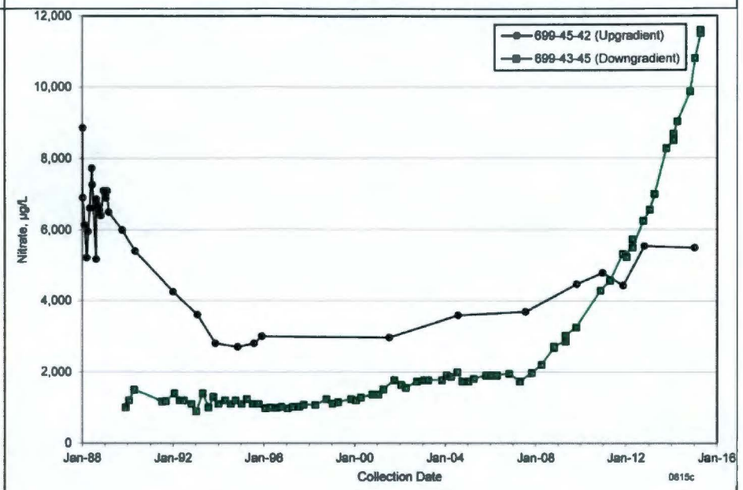
pH



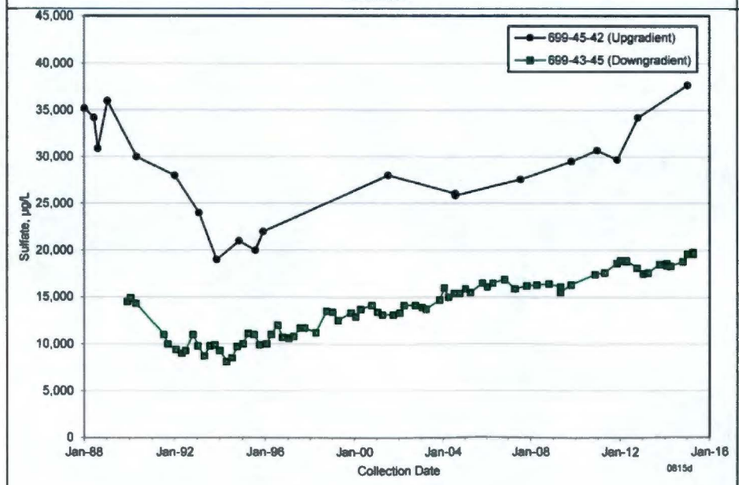
Specific conductance



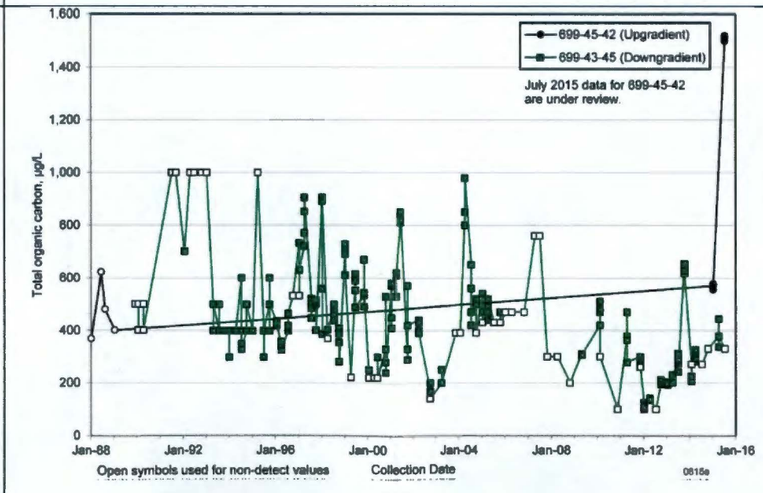
Nitrate



Sulfate



TOC



TOX

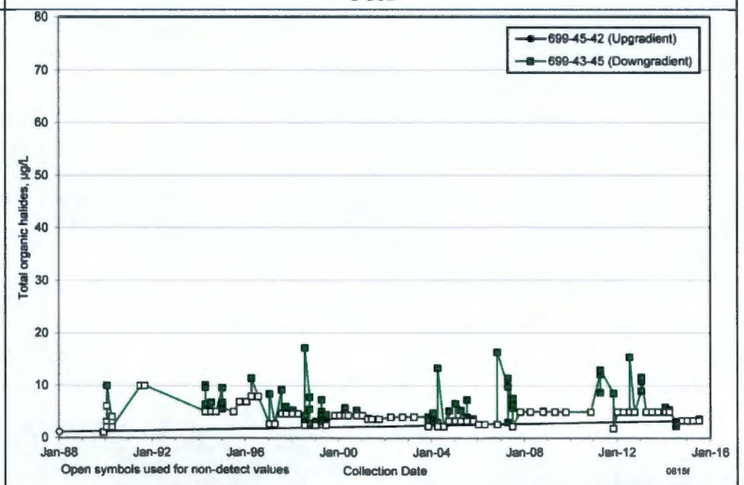


Figure 2-11. pH, Specific Conductance, Nitrate, Sulfate, TOC, and TOX Time Series Trend Plots Showing Concentrations for Upgradient Well 699-45-42 versus Downgradient Well 699-43-45

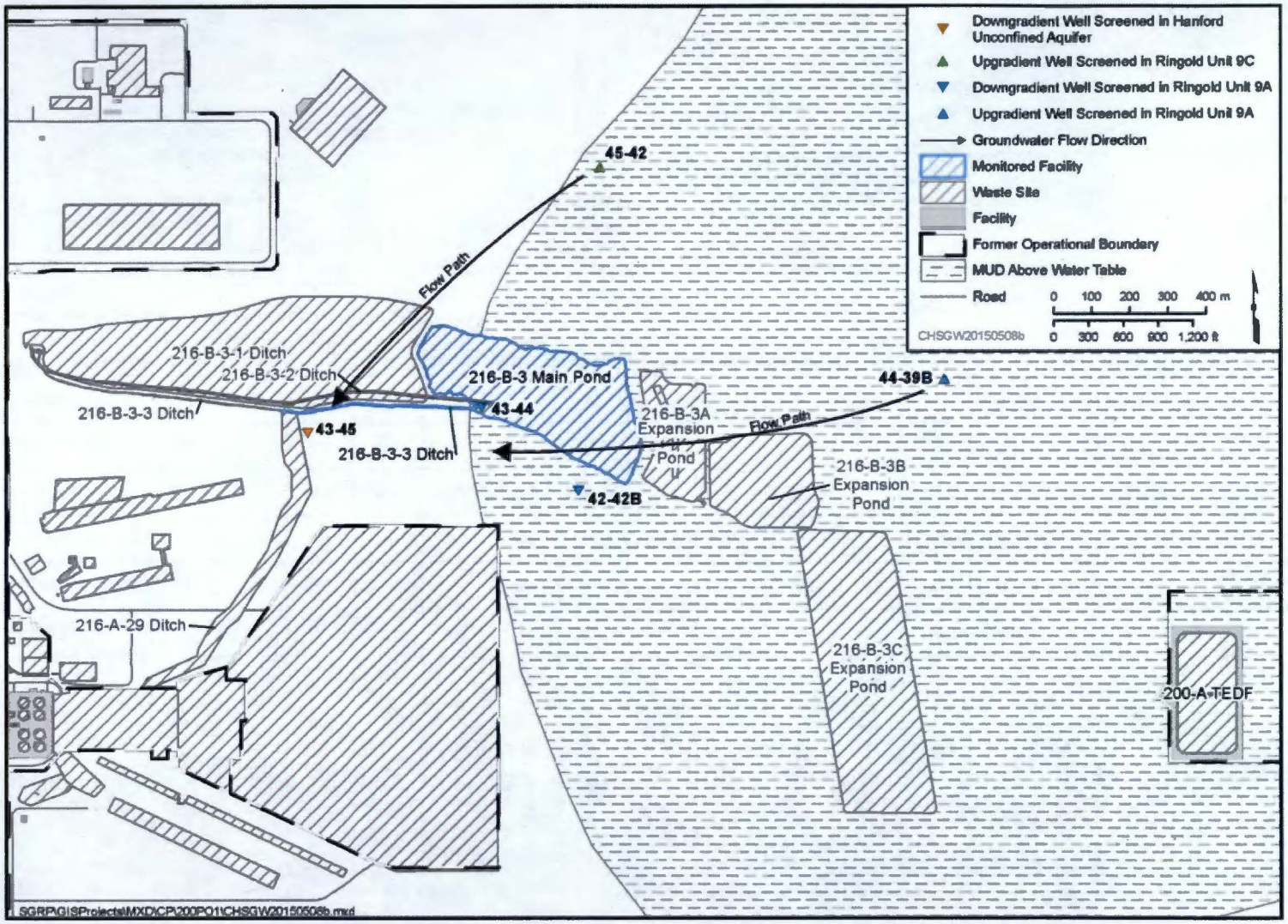


Figure 3-1. 216-B-3 Pond RCRA Monitoring Network

Table 3-1. Monitoring Well Network for B Pond

Well Name	Purpose	WAC Compliant	RCRA-Required Parameters[a]											Site-Specific Constituents[b]					
				Contamination Indicator Parameters				Groundwater Quality Parameters											
			Water Level	pH[c]	Specific Conductance[c]	Total Organic Carbon	Total Organic Halogen	Chloride	Iron (F/UF)	Manganese (F/UF)	Phenols	Sodium (F/UF)	Sulfate	Arsenic (F/UF)	Nitrate	Temperature[c]	Turbidity and Dissolved Oxygen[c]	Alkalinity	Metals[d] (F/UF)
699-42-42B	Downgradient	Y	S	S4	S4	S4	S4	A	A	A	A	A	A	A	A	S	S	A	A
699-43-44	Downgradient	Y	S	S4	S4	S4	S4	A	A	A	A	A	A	A	A	S	S	A	A
699-43-45	Downgradient	Y	S	S4	S4	S4	S4	A	A	A	A	A	A	A	A	S	S	A	A
699-44-39B	Upgradient	Y	S	S4	S4	S4	S4	A	A	A	A	A	A	A	A	S	S	A	A
699-45-42[e]	Upgradient	N	Q	Q4	Q4	Q4	Q4	A	A	A	A	A	A	A	A	Q	Q	A	A
699-45-42[f]	Upgradient	N	S	S4	S4	S4	S4	A	A	A	A	A	A	A	A	S	S	A	A

a. Constituents and parameters required by 40 CFR 265.92, "Interim Status Standards for Owners of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Sampling and Analysis."
b. Constituents not required by RCRA but needed to support interpretation.
c. Field measurement.
d. Metals; analytes include, but are not limited to, the following common soil minerals for charge-balance computations: calcium, magnesium, and potassium.
e. Constituents and sampling frequency for Well 699-45-42 only for first year of monitoring.
f. Constituents and sampling frequency for Well 699-45-42 after first year of monitoring.

A = to be sampled annually
CFR = *Code of Federal Regulations*
F/UF = filtered and unfiltered
N = well is not constructed as a resource protection well (WAC 173-160, "Minimum Standard for Construction and Maintenance of Wells")
Q = to be sampled quarterly
Q4 = to be sampled quarterly, with quadruplicate samples collected during each event
RCRA = *Resource Conservation and Recovery Act of 1976*
S = to be sampled semiannually
S4 = to be sampled semiannually, with quadruplicate samples collected during each event
TSD = treatment, storage, and disposal
WAC = *Washington Administrative Code*
Y = well is constructed as a resource protection well (WAC 173-160)

Table 3-2. Attributes for Wells in the B Pond Groundwater Monitoring Network

Well Name	Completion Date	Easting (m)	Northing (m)	Screened Unit	Screen Top (m [ft] bgs)	Screen Bottom (m [ft] bgs)	Water Depth (m [ft] bgs)	Remaining Water Column (m [ft] bgs)	Water Level Date
699-42-42B	1988	576998.10	136433.92	Ringold 9A	55.9 (183.5)	62.0 (203.5)	55.3 (181.5)	6.7 (22.1)	7/14/2015
699-43-44	1999	576744.71	136652.85	Ringold 9A	52.1 (171.0)	58.2 (191.0)	54.7 (179.3)	3.6 (11.7)	7/14/2015
699-43-45	1989	576283.82	136585.73	Hanford	55.8 (183.0)	62.0 (203.3)	60.5 (198.4)	1.5 (5.0)	7/14/2015
699-44-39B	1992	577960.62	136727.39	Hanford/ Ringold 9A	30.1 (98.9)	37.0 (121.4)	32.9 (107.9)	4.1 (13.5)	7/14/2015
699-45-42	1948	577055.09	137286.37	Ringold 9C	48.2 (158.0)	54.9 (180.0)	53.5 (175.4)	1.4 (4.6)	7/14/2015

Note: Coordinates are in Washington Coordinate System of NAD83, *North American Datum of 1983*, South Zone/1991 Adjustment.

bgs = below ground surface

Table 3-3. Main Differences between This Plan and Previous Plan

Type of Change	Previous Plan*	Current Plan	Justification Summary
Constituents	Indicator parameters, groundwater quality parameters, and water chemistry	Same	
	Supporting constituents	Same	
	Site-specific constituents – arsenic, cadmium, and nitrate	Site-specific constituents – arsenic and nitrate	Cadmium is removed as a site-specific constituent. Cadmium has been analyzed since 1989, but generally it is not detected.
Sampling Frequency	Indicator parameters – semiannual	Indicator parameters – same	
	Groundwater quality parameters – annual	Groundwater quality parameters – same	
	Supporting constituents – semiannual/annual	Supporting constituents – same	
	Contaminants of interest – annual	Site-specific constituents – annual	
		First-year monitoring for Well 699-45-42 – quarterly	Well 699-45-42 is added to the monitoring network and requires quarterly first-year monitoring frequency.
	Water level measurements – every sampling event	Water level measurements – same	
Well Network	One upgradient, three downgradient wells	Two upgradient, three downgradient	Additional upgradient monitoring well (699-45-42) added to provide better representation of upgradient hydrogeology and constituent concentrations impacting the site.
Groundwater Flow Direction	West to southwest	Same	No change.
Type of Groundwater Monitoring Program	Interim status indicator evaluation program	Same	No change.
Background Arithmetic Mean Recalculated	Calculated annually using one upgradient well	Calculated annually using two upgradient wells	Two wells provide better representation of hydrogeologic and constituent variability upgradient of the site.

Table 3-3. Main Differences between This Plan and Previous Plan

Type of Change	Previous Plan*	Current Plan	Justification Summary
Groundwater Quality Assessment Plan Outline	None	Chapter 5	Update outline to current norms.

* DOE/RL-2008-59, Rev. 0, *Interim Status Groundwater Monitoring Plan for the 216-B-3 Pond.*

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Appendix C

LLWMA-2 Waste Burial Trenches Discussion

By Greg Thomas

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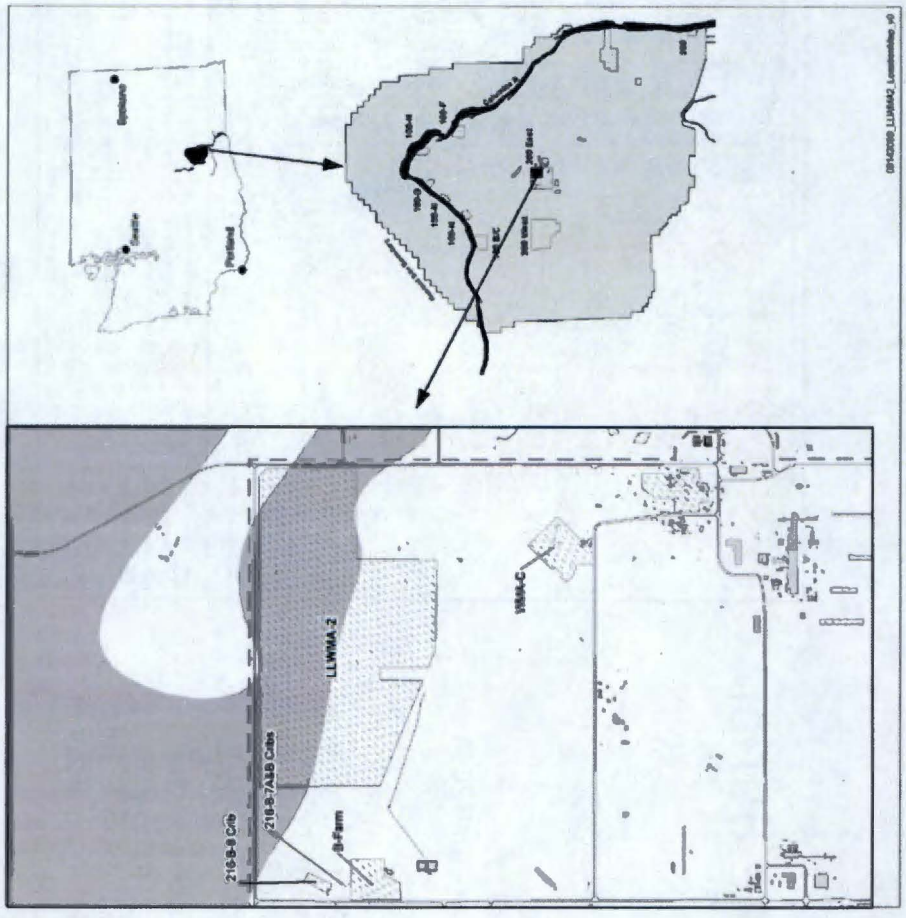
LLWMA-2



LLWMA-2 Waste Burial Trenches

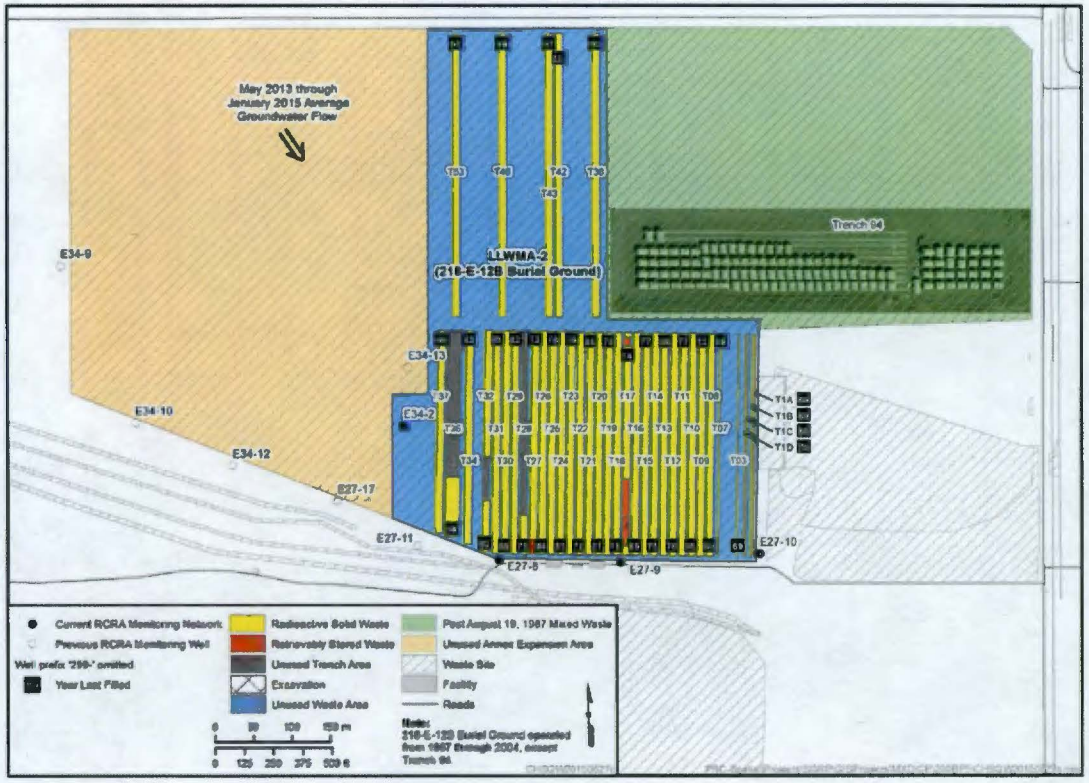
Placed in service in 1967

Covers 173 ac

39 n-s trending unlined trenches received radiological and transuranic waste until 2004 and occupy 54 ac

39 trenches vary in length between 944-1250' and received approximately 2 M ft^3 of waste generally from the 200 East Area, but also included 100 Area, 300 Area, and Richland Landfill material, and sludge from B-2 Ditches.

Trench 94 is still active and contains reactor compartments which is an integrated waste form providing containment of the waste. This trench remains uncovered and the containment packages are mounted on concrete blocks.



Vadose zone

There is 195-240' of Hanford vadose zone sediments underlying the buried waste

The vadose zone consists entirely of Hanford sediments. The depiction of the facies was based on sieve results as documented in PNL-6820.

The lower gravels contain the aquifer and consist of sandy gravels to silty sandy gravels. Silt content ranged mainly between 4 and 8 percent. Hydraulic conductivity values range from 1500 to >2400 ft/d.

The middle facies is the sand-dominated facies which is mainly a gravelly sand with other local subordinant lithologies. Silt content is generally below 8 percent, however, higher silt content is occasionally observed near the top of the graded gravelly sand and sand sequences. Clay clumps to clay balls have been described in the higher silt zones. These finer-grained lenses can be continuous to distances of several hundred meters and are capable of generating perched water horizons and described by Lindsey.

The upper gravels contain a gravel content of 33 to over 50 percent. Silt content is also present from 5 to 13 percent and perched water horizons have been reported in the past within this zone. Calcium carbonate levels are generally only a few percent.

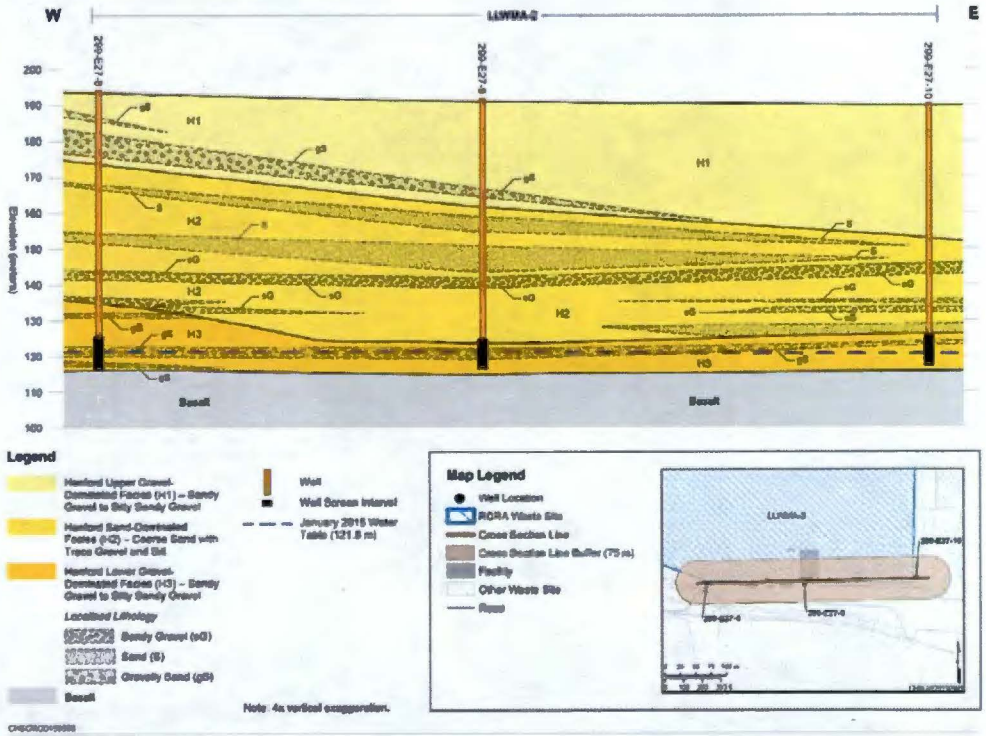
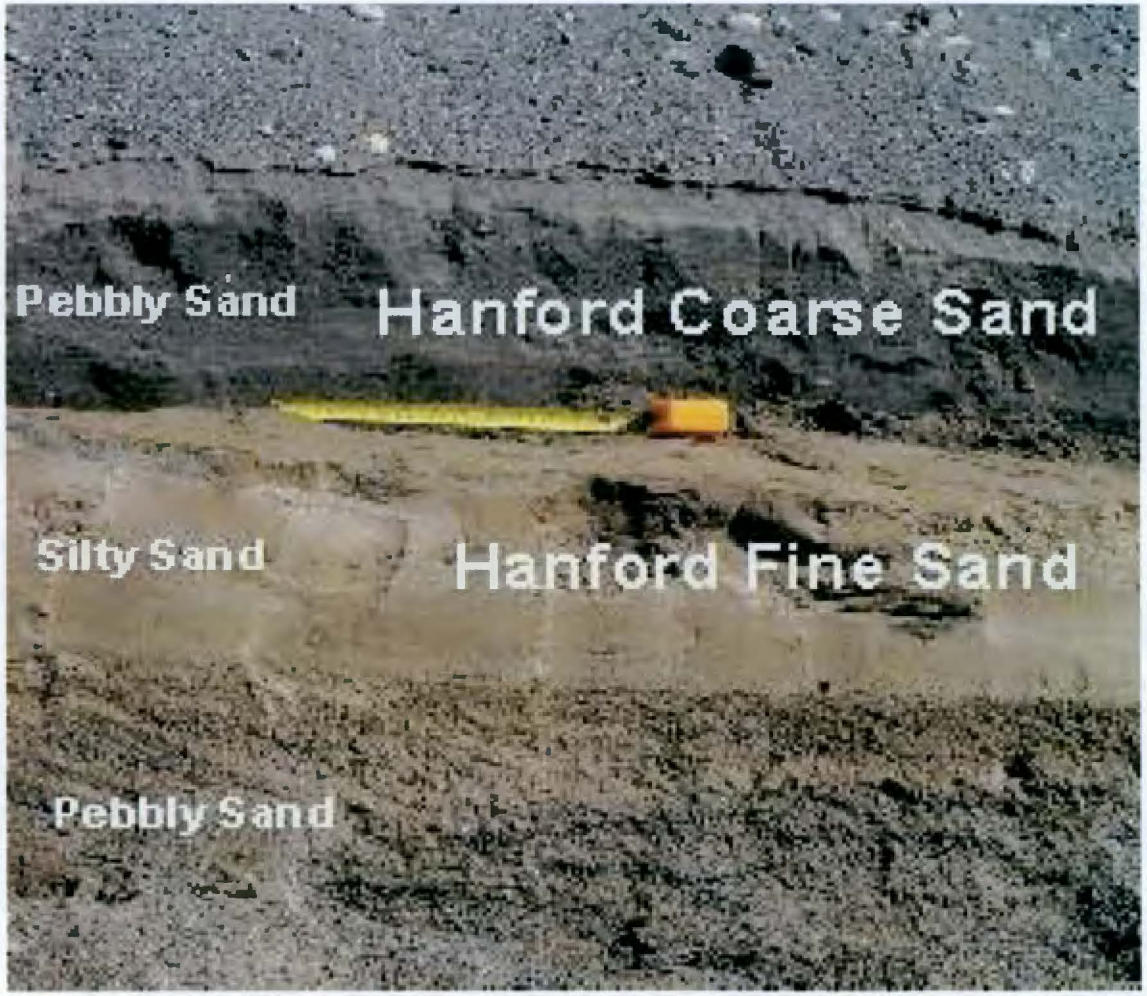
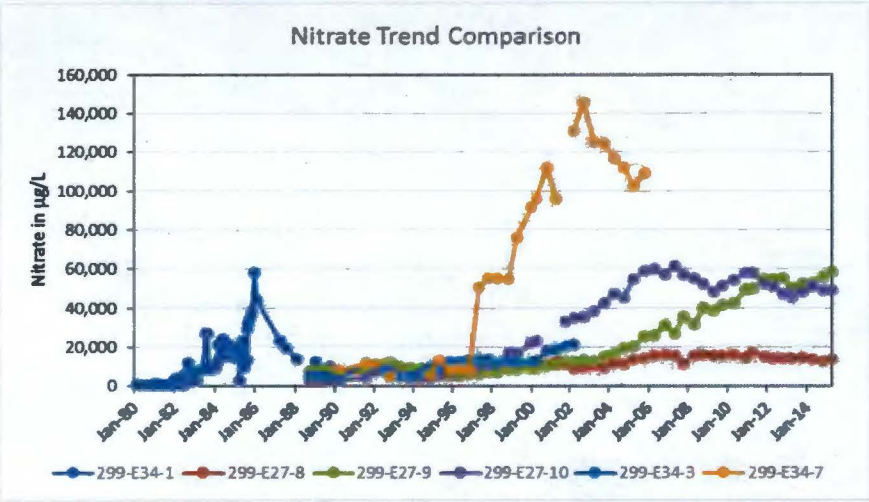


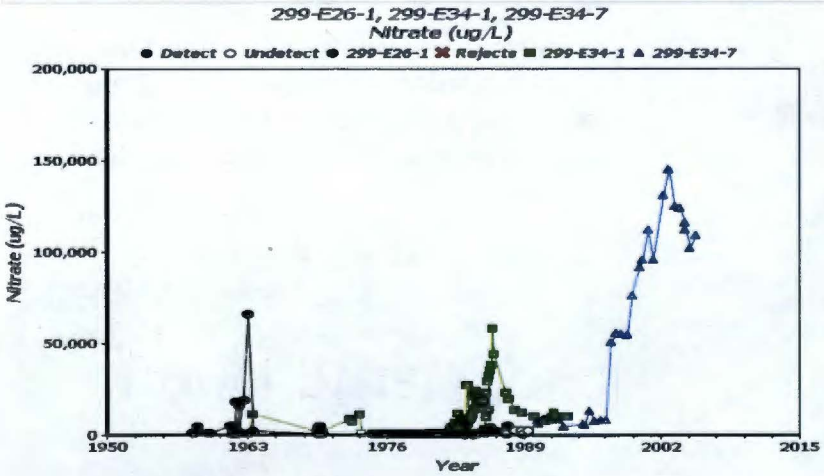
Photo of silty sand in upper Hanford gravels

These layers have the extent and capacity to create perch water horizons for hundreds of meters



Groundwater





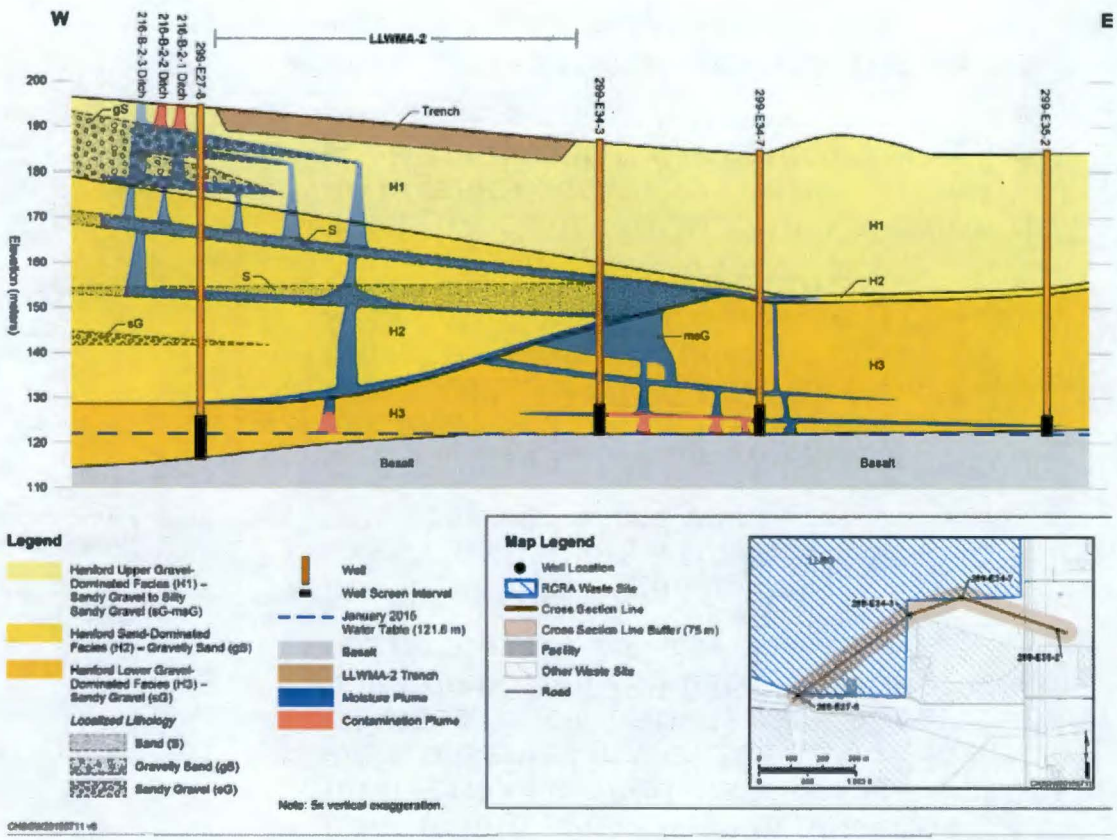
- Flow was to the west until early in the new millennium.
- Prior to implementation of detection monitoring elevated nitrate concentrations were observed in well 299-E34-1. However, elevated concentrations were not present in upgradient well 299-E26-1 shortly preceding the increase at 299-E34-1.
- In 1997 nitrate began increasing in well 299-E34-7. In addition, a similar increase in TOC was observed in this well.
- Characterization of the well began in 2000 and extended semiannually until 2005, when well 299-E34-7 became sample dry. Characterization included 40 CRFR 264 Appendix IX and other analysis (TPH-G&-D, oil & grease, coliform bacteria).
- It was concluded in 2005 annual report that no organic constituents were detected consistently and those detected were false positives.
- PNNL also concluded that the TOC plume was migrating southward.

Conceptual Model

Soil geochemistry of the site favors sorption or retardation of many heavy metals.

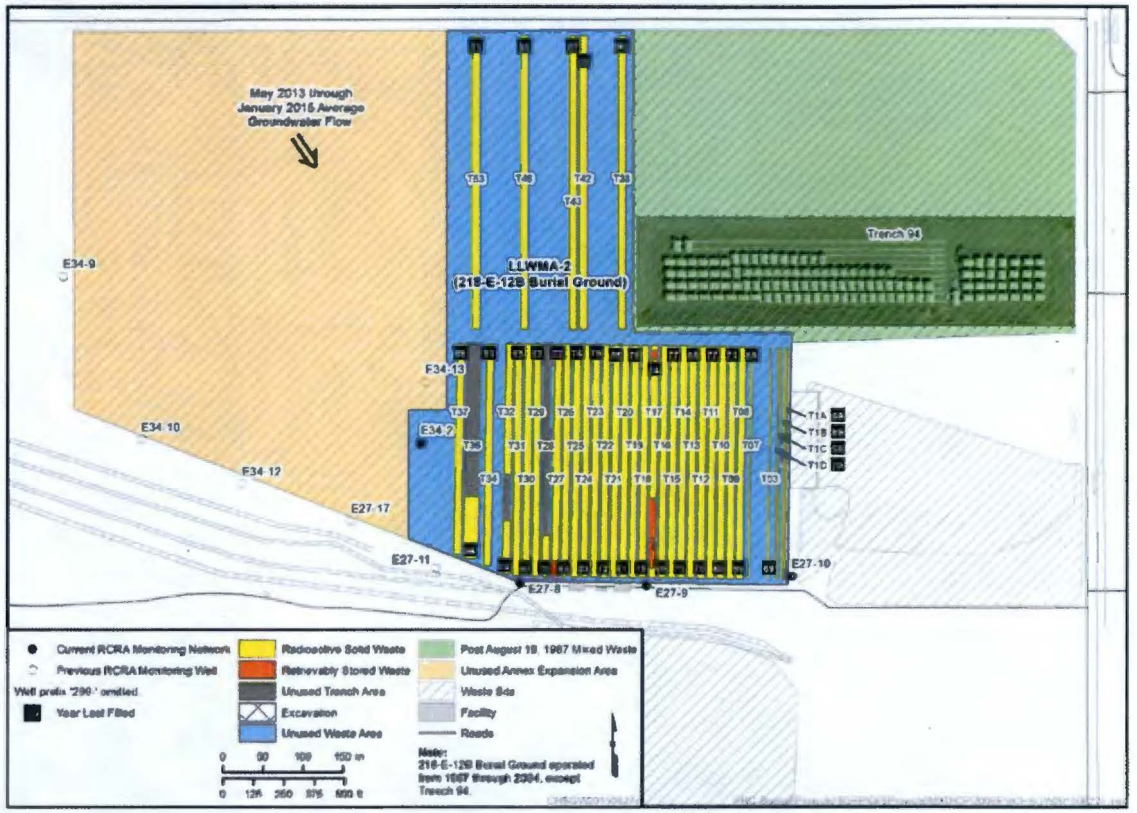
Although contamination indicator parameters have periodically exceeded critical mean values, exceedances in downgradient wells have been explained by laboratory errors, sample collection errors, or migrating plumes from other sources.

Past, unplanned releases of liquid waste from adjacent facilities appear to have caused increased concentrations of nitrate and total organic carbon in some monitoring wells.



Monitoring Network

The monitoring well network was selected based on the location of the buried waste with respect to the groundwater flow direction currently beneath LLWMA-2. The upgradient well is 299-E34-2. The down gradient wells are 299-E27-8, -9, and -10.



Sampling

Deleted alkalinity

Changed frequency of site specific constituent and groundwater quality parameters from semiannual to annual

Changed network monitoring network to align with the groundwater flow direction change

Groundwater flow direction changed from west-southwest to southward

Table 3-3. Main Differences between This Plan and Previous Plan

Type of Change	Previous Plan*	Current Plan	Justification Summary
Constituents	Contamination indicator parameters Groundwater quality parameters Supporting constituents; alkalinity, anions (fluoride, nitrate, and nitrite), metals (calcium, chromium, and potassium)	Contamination indicator parameters Groundwater quality parameters Site-specific constituents; anions (fluoride, nitrate, and nitrite), metals (calcium, chromium, and potassium)	Alkalinity no longer sampled as it is not required by 40 CFR 265, Subpart F.
Sampling Frequency	Contamination indicator parameters-semiannual Groundwater quality parameters and site specific parameters-semiannual Phenols – annual	Contamination indicator Parameters – semiannual Groundwater quality parameters and site-specific parameters (including phenols) – annual	Frequency for groundwater quality parameters and site-specific constituents reduced to frequency called out in Subpart F of 40 CFR 265.
Well Network	One upgradient well Eight downgradient wells	One upgradient well Three downgradient wells	Network change based on groundwater flow direction change
Groundwater Flow Direction	West-Southwest	Southeast	Groundwater flow direction change is the result of diminished anthropogenic liquid discharges to ground and returning to original groundwater conditions.
Type of Groundwater Monitoring Program	Indicator Parameter Evaluation Program	Indicator Parameter Evaluation Program	No change
Background Arithmetic Mean Recalculated	Generally recalculated every year.	Recalculate every year.	Calculated annually using EPA 530/R-09-007, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance.
Groundwater Quality Assessment Plan Outline	None	Outline added in Chapter 5	Update outline to current norms.

* DOE/RL-2009-76, Rev. 0, Interim Status Groundwater Monitoring Plan for the LLBG WMA-2.