Department of Energy

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OCT 2 4 2002

DOE-0050-03

Mr. James A. Saric, Remedial Project Manager
United States Environmental Protection Agency
Region V-SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

Dear Mr. Saric and Mr. Schneider:

RESPONSES TO THE OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS AND UNITED STATES ENVIRONMENTAL PROTECTION AGENCY DISAPPROVAL OF THE DESIGN FOR REMEDIATION OF THE GREAT MIAMI AQUIFER SOUTH FIELD PHASE II MODULE

References:

1. Letter from J. W. Reising to J. Saric, and T. Schneider, "Transmittal of Design for Remediation of the Great Miami Aquifer; South Field Phase II Module," dated May 16, 2002.

2. Letter from T. Schneider to J. Reising, "Comments South Field Phase II Design for Remediation of the GMA, dated June 18, 2002.

3. Letter from J. Saric to J. W. Reising, United States DOE, "GMA South Field Phase II Module," dated August 1, 2002.

4. Letter from J. W. Reising, United States DOE to J. Saric, EPA and T. Schneider, OEPA, "Transmittal of the Project Specific Plan for Installation of the South Field Phase II Module Extraction/Re-injection Wells and Additional South Field Monitoring Wells," dated June 10, 2002

5. Letter from J. Saric to J. W. Reising, "South Field Phase II Module," undated, but received June 25, 2002.

The purpose of this letter is to submit, for your review and approval, the enclosed subject responses. The design report was transmitted to the agencies via Reference 1. Reference 2 provided the Ohio Environmental Protection Agency (OEPA) comments.

Reference 3 provided the United States Environmental Protection Agency's (USEPA) disapproval of the design. The basis for their disapproval was because the design document did not "describe drilling methods, depths, screen intervals, and well construction details." However, the Department of Energy (DOE) submitted a Project Specific Plan (PSP) (Reference 4) that included the requested well installation information and the USEPA subsequently approved the PSP (Reference 5). Based on the USEPA's approval of the PSP, it appears that these concerns regarding the South Field Phase II Module Design have been addressed.

During the preparation of these responses, the Fernald Environmental Management Project (FEMP) also corrected an inconsistency between Tables 3-1, 3-3, and the text. Tables 3-1 and 3-3, that show the pumping rates and predicted module concentrations, have been revised as explained below.

Table 3-1 contains module pumping rates. It incorrectly identified the pumping periods as occurring from 2001 through 2006 and 2007 through 2011. As stated in the text in Section 3.4.1 on Page 3-5, initial conditions for the transport model were developed from First Quarter 2001 monitoring data and first quarter 2002 direct-push sampling results. Since the first modeling period of six years assumes that Wells EW-15a, EW-30, and EW-31, and EW-32 are pumping, and since these wells are not scheduled to be brought on line until the first half of Calendar Year 2003, the first column of Table 3-1 was changed to read as Years 2003-2009 and the second column was changed to read as Years 2010-2013. As demonstrated by Figure 3-26, concentrations in the aquifer are just above 30 ppb after ten years of operation (e.g., after year 2012 and not 2011 as stated in Section 3.4.3 on Page 3-6). Concentrations fall below 30 ppb before the end of year 2013 (not Year 2012 as stated on the same page).

Table 3-3 was revised to reflect the changes to Table 3-1 and is also enclosed. It now shows module concentrations and pounds of uranium removed by each module from Year 2003 through the end of Year 2013 rather than the end of Year 2011.

Should you have questions regarding this transmittal, please contact Rob Janke (513) 648-3124.

Sincerely,

Johnny W. Reising

FEMP:R.J. Janke

Johnny W. Reising
Fernald Remedial Action
Project Manager

Enclosures: As Stated

cc w/enclosures:
R. J. Janke, OH/FEMP
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T. Schneider, OEPA-Dayton (three copies of enclosure)
G. Jablonowski, USEPA-V, SRF-5J
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W. Hertel, Fluor Fernald, Inc./MS52-5
M. Jewett, Fluor Fernald, Inc./MS52-5
T. Poff, Fluor Fernald, Inc./MS65-2
ECDC, Fluor Fernald, Inc./MS52-7

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ATTACHMENT 1

REVISED TABLES 3-1 AND 3-3

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TABLE 3-1

SOUTH FIELD PHASE II MODULE DESIGN PUMPING RATES

Modeling Well Identification Number	Operations Well Identification Number	Pumping Rates (gpm) (-)=Pumping (+)=Injection Years 2003- 2009	Years 2010- 2013
South Plume 3924	RW-1	-300	0
South Plume 3925	RW-2	-300	0
South Plume 3926	RW-3	-300	0
South Plume 3927	RW-4	0	0
South Plume Opt. 32308	RW-6	-300	0
South Plume Opt. 32309	RW-7	-300	0
		-1500	0
South Field 31565	EW-13	0	0
South Field 31564	EW-14	0	0
South Field 31566	EW-15	0	0
South Field 31567	EW-17	-275	0
South Field 31550	EW-18	-200	0
South Field 31560	EW-19	-200	0
South Field 31561	EW-20	-200	0
South Field 31562	EW-21	-290	0
South Field 32276	EW-22	-300	-300
South Field 32447	EW-23	-300	-300
South Field 32446	EW-24	-300	-300
South Field 33061	EW-25	-300	0
South Field 31	EW-15a	-200	0
South Field 32	EW-30	-300	-300
South Field 33	EW-31	-300	-300
South Field 34	EW-32	-200	-200
		-3365	-1700
WSA 32761	EW-26	-400	-400
WSA 33062	EW-27	-300	-300
WSA 33063	EW-28	-300	-300
WSA 5		0	-100
WSA 6		0	-100
		-1000	-1200
Re-Injection 8A	IW-8a	200	0
Re-Injection 9A	IW-9a	200	0
Re-Injection 10	IW-10	200	0
Re-Injection 10A	IW-10a	200	0
Re-Injection 22240	IW-11	200	0
Re-Injection 22111	IW-12	0	0
South Field 31563	EW-16	200	0
Basin Re-Injection		100	0
South Field Re-Injection 1	IW-29	100	0
		1400	0
Pumping Rate Totals		-4465	-2900

TABLE 3-3

PERFORMANCE MEASURES FOR THE SOUTH FIELD PHASE II MODULE DESIGN

	South Plume Module				South Field Module			
	Gallons Pumped	Module Concentration	Module Mass		Gallons Pumped	Module Concentration	Module Mass	
Year	gpm	μg/L	Annual (pounds)	Cumulative (pounds)	gpm	μg/L	Annual (pounds)	Cumulative (pounds)
2003	1,500	36.0	250.5	250.5	3,365	57.3	1022.0	1022.0
2004	1,500	32.0	223.5	474.0	3,365	44.8	744.1	1766.2
2005	1,500	28.1	197.4	671.4	3,365	35.6	588.5	2354.7
2006	1,500	24.3	172.2	843.6	3,365	28.2	467.6	2822.3
2007	1,500	22.9	155.3	998.9	3,365	22.8	374.5	3196.8
2008	1,500	22.1	148.0	1146.9	3,365	19.0	306.6	3503.4
2009	0	0.0	0.0	1146.9	1,700	15.1	115.1	3618.5
2010	0	0.0	0.0	1146.9	1,700	13.6	106.3	3724.8
2011	0	0.0	0.0	1146.9	1,700	12.1	94.7	3819.5
2012	0	0.0	0.0	1146.9	1,700	10.8	84.5	3904.1
2013	0	0.0	0.0	1146.9	1,700	9.8	76.5	3980.6

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RESPONSES TO OEPA COMMENTS ON THE DESIGN FOR REMEDIATION OF THE GREAT MIAMI AQUIFER SOUTH FIELD PHASE II MODULE

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT

FERNALD, OHIO

OCTOBER 2002

U.S. DEPARTMENT OF ENERGY

RESPONSES TO OEPA COMMENTS ON THE DESIGN FOR REMEDIATION OF THE GREAT MIAMI AQUIFER SOUTH FIELD PHASE II MODULE

1. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
   Section #: 2.0 Pg #: 2-7 Line #: 15 Code: C
   Original Comment #: 1
   Comment: The noted concentration reductions may be, at least partially, a seasonal artifact. The first bullet item should note that locally, higher uranium concentrations may be observed in the future as a result of a higher water table level. As noted in the next bullet and in the cross section discussions, site evidence suggests that uranium desorption from sediments above the current water table may result in increased concentrations under higher water table conditions.
   Response: DOE agrees that the noted concentration reductions may be, at least partially, a seasonal artifact and that higher uranium concentrations may be observed in the future as a result of a higher watertable level. The concern is that uranium contamination may be sorbed to sediments above the present surface of the saturated zone. This concern is noted in the summary of Section 2, along with the recommendation that efforts should be made to keep the water level as high as possible in the SWU area during remediation.
   Action: As stated in response.

2. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
   Section #: 3.0 Pg #: 3-2 Line #: 7 Code: C
   Original Comment #: 2
   Comment: This statement needs the qualification that it is based on the assumption of a linear Kd. The potential for concentration rebound and, therefore, a longer than simulated cleanup time, should be noted.
   Response: DOE agrees with the comment. The groundwater modeling results presented in the report are based on the assumption of a linear equilibrium isotherm with a Kd of 1.78 L/Kg. Uncertainties in this value and the potential for a non-linear isotherm and/or nonequilibrium conditions in the aquifer could result in a significantly different cleanup time than simulated with the transport model. DOE is currently conducting an additional geochemical study in an attempt to reduce the uncertainty in transport modeling results arising from the assumption of a linear equilibrium isotherm. The potential also exists for concentration rebound as stated in the comment and could result in a longer than simulated cleanup time and could require modifications to the aquifer remedy such as pulse pumping.
   Action: As stated in the response.

3. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
   Section #: 3.0 Pg #: Figure 3-3 Line #: 1 Code: C
   Original Comment #: 3
   Comment: Additional details (e.g., specific borings used, geologic descriptions of the low conductivity material versus the surrounding higher conductivity material, evidence obtained from direct excavation versus evidence from borings, etc) regarding the rationale for defining the low conductivity zone, both laterally and vertically, should be provided to document the definition of this zone in the model. How are the 200 ft/day horizontal and 34 ft/day vertical hydraulic conductivity values justified? What sediment samples were used? The term sediment at the site usually denotes unconsolidated material that is transported in surface water and has recently been deposited.
   Response: The lower conductivity designation is based on observations made during surface excavation of the Southern Waste Unit (SWU) area, drilling extraction wells 13, 14, 15, and 17, and operational experience at Extraction Well 15.

   The area rests in a flood plain of Paddy's Run. During surface excavation it was clear that this area had been flooded numerous times in the past. Each flood episode brought silt and clay into the area. This silt and clay over the years served to reduce porosity in the sand and gravel matrix of the aquifer. This observation was pointed out to Ohio EPA during visits to the SWU area while surface excavation and source removal was taking place. The clay and silt porosity reduction was marked by a distinct color change in the sediments. Also, water ponded in the area where silt and clay was present, but water readily seeped into the aquifer sand and gravels where the silt and clay was not present.

During the drilling of Extraction Well 15 it was noted that the aquifer sediments in the area of Extraction Well 15 had a finer grain size than the other areas. Table 1 shows a comparison of the sieve results for EW-13, EW-14, EW-15, and EW-17. As Table 1 records, the grain size of the 50% cumulative retained sieve results are smallest overall in EW-15, when compared to the other areas. This raised concern during the completion of EW-15 that the well should possibly be moved. The decision was made to go ahead and complete the well in hopes that heterogeneity in the area would allow communication of this finer area with the coarser grain size areas around it.

Operation of EW-15 re-inforced earlier observations that the area was not in good communication with the surrounding areas due to finer grain size material in the aquifer. The decision was made shortly after putting EW-15 into operation to stop operations at the well in order to avoid pulling the uranium plume into the finer grain area and perhaps creating a recalcitrant zone that would prove difficult to remediate at a later date.

As stated in the text on page 3-3, horizontal and vertical components of hydraulic conductivity in the local area around EW-15 were reduced in the top layers of the zoom model from 638 and 544 ft/day horizontally and 51 and 49.6 ft/day vertically to 200 ft/day horizontally and 34 ft/day vertically. In the absence of specific field data (e.g., slug tests and/or pump tests), these values were chosen to correspond to values in the same area in the lower portions of the aquifer.

The use of the term "sediment" refers to unconsolidated materials, consistent with the definition presented in the _Glossary of Geology, 3d edition_, (Bates and Jackson 1987).

Action: No further action required.

4. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: Figure 3-7 Line #: NA Code: C
Original Comment #: 4

Comment: The solid line on this figure is labeled as "Post-Excavation Limit of Glacial Till." It is unclear what the meaning of this line is south of the zero thickness till contour (i.e., no till was originally present south of the zero contour).

Response: A comparison of Plates 3-2 and 3-3 from the Remedial Investigation Report for Operable Unit 5 (DOE, 1995) shows the zero isopach contour for the glacial overburden varies in elevation from 552 to 554 ft AMSL in the area of the Southern Waste Units excavation. The solid line on Figure 3-7 was taken from a field drawing of the Southern Waste Units excavation and approximates the 552 foot AMSL post-excavation contour. The area where the 552 foot post-excavation contour crosses the zero isopach contour in the direction of increasing thickness indicates areas where glacial overburden has been removed by excavation activities and where modeled infiltration rates were increased. The area where the 552 foot post-excavation contour crosses the zero isopach contour in the direction of decreasing thickness (e.g., south of the zero thickness till contour) implies that any material removed was aquifer material and that no adjustment is required to modeled infiltration rates. The label "Post-Excavation Limit of Glacial Till" in Figure 3-7 was unintentionally misleading in that it applies only to the northern part of the figure as described above.

Action: No further action required.

5. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: 3-4 Line #: 12 Code: C
Original Comment #: 5
Comment: Either the text or Figure 3-9 should note which model layer was used in the comparison.
Response: Elevation contours shown in Figure 3-9 (and in other figures showing groundwater elevation or elevation comparisons) were taken from VAM3D zoom model layer 12. This information will be included in future groundwater modeling reports as appropriate.
Action: As stated in the response.

6. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: 3-4 Line #: 18 Code: C
Original Comment #: 6
Comment: The referenced text discusses the flow model simulation results for the current operational scenario (i.e., existing wells plus the additional re-injection and extraction wells proposed in the South Field Phase II Design). Please include in this report (and in future reports that document modeling activity in support of the groundwater remediation) the model layers and apportioned flows for all existing and proposed extraction and re-injection wells.
Response: The requested information is presented in Tables 2 and 3 that are attached. Table 2 shows the VAM3D zoom model nodes assigned to each pumping/re-injection well along with the pumping/re-injection rates in cubic feet per day and gallons per minute at each node. Pumping/re-injection rates are apportioned to each node based on the screen length in the model layer and on hydraulic conductivity assigned to the model node. The model indices (i, j, k) for each node are also indicated on the table. Table 2 contains the pumping/re-injection rates for 2003 to 2009, and Table 3 contains the same information for 2010 to 2013. DOE will include this type of information in all future reports that document modeling activity in support of the groundwater remediation.
Action: As stated in the response.

7. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: 3-4 Line #: 18 Code: C
Original Comment #: 7
Comment: A useful addition to the report would be a figure showing the un-retarded particle tracking results shown in relation to the total plume footprint. Also, a figure showing the un-retarded particle tracking results for a selected cross section is also recommended. These figures would provide an indication of the overall capture zone for the design. The six-year retarded particle tracks shown on the figures referenced in Section 3.4.3 are potentially misleading because they are subject to uncertainties regarding the proper partitioning coefficient that is appropriate for the cleanup time frame.
Response: Attached Figure 1 shows the non-retarded particle tracking results superimposed onto the total uranium plume footprint as requested in the comment. The particle tracks are taken from Figure 3-10 of the design report and the uranium concentration contours are initial total uranium concentrations in model layer 12 from Figure 3-20 of the design report. Figures 2 and 3 (attached) show non-retarded particle tracking results superimposed with two selected cross sections of the modeled uranium plume sliced at 1983 Northing coordinate of 478,000 in Figure 2 and sliced at 1983 Easting coordinate of 1348550 in Figure 3. The cross section locations are represented on Figure 1 for reference.

DOE agrees that the six-year retarded particle tracks shown on the figures referenced in Section 3.4.3 are potentially misleading in that they represent a 12 to 1 retardation of uranium with respect to groundwater flow. The 12 to 1 ratio is directly related to the linear equilibrium isotherm Kd value of 1.78 L/Kg. A smaller Kd value would give a smaller retardation value resulting in longer retarded particle tracks. Conversely, a larger Kd value would give a higher retardation value and shorter retarded particle tracks.
Action: No further action required.

8. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: 3-5 Line #: 14 Code: C
Original Comment #: 8

Comment: The report should provide discussion and justification for use of the variogram parameters for the current data set. The current concentration data set differs significantly in detail from the data set kriged in the referenced 1994 document because of the addition of the substantial amount of drive point data. The current data set more closely resembles data set evaluated for the conceptual design for groundwater remediation in the waste storage and Plant 6 areas. The variogram ranges for the current analysis differs significantly from those used previously (3000 vs. 500 feet for horizontal; 60 vs. 25 feet for vertical, respectively). The use of the dataset-specific geostatistical analysis for the waste storage and Plant 6 areas design is more appropriate than simply adopting variography previously developed for a more limited site wide data set.

Response: DOE agrees that a semi-variogram range derived from a dataset-specific geostatistical analysis would have been more appropriate to use in Kriging the total uranium data to generate initial conditions for the transport model. However, Kriging results do not appear to be sensitive to the Kriging range if the Kriging range is larger than the semi-variogram range. As demonstrated in the semi-variograms generated from the total uranium data and shown in Figure 4 (attached), the horizontal semi-variogram range appears to be approximately 1000 feet which is smaller than the 3000 foot Kriging range used in the report. The 3000 foot range was used for consistency with the 1994 modeling report. Figures 5 through 9 show the initial conditions for model layers 9 through 13 when the data is Kriged with a 1000/50 foot horizontal/vertical range instead of the 3000/120 foot horizontal/vertical range.

Comparison of these figures with the corresponding Figures 3-17 through 3-21 in the report show no significant differences. Kriging with the shorter range results in a small area of 50 ppb concentration west of Paddys Run and South of Willey Road in model layers 10, 11, and 12 (Figures 6, 7, and 8). There are no input sample data points in this area above 30 ppb to support this result so this area above 50 ppb is an artifact of Kriging with the smaller range and not representative of actual contamination in the aquifer. Regardless of this fact, initial concentrations were generated from these Kriged results as contoured and no attempt was made to edit this small area out.

Figure 10 (attached) shows the final total uranium concentrations in model layer 11 after 10 years of operation using initial conditions generated with the 1000/50 foot horizontal/vertical Kriging range. Comparison of this modeling result with Figure 3-26 shows a slightly larger residual area above 30 ppb (8 acres compared with 4.4 acres in Figure 3-26) but this difference is not considered significant given the general uncertainties inherent in transport model predictions.

Action: No further action required.

9. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: 3-5 Line #: 14 Code: C
Original Comment #: 9

Comment: The report should indicate how the kriging results were assigned to the transport model nodes.

Response: Kriging of the total uranium concentration data was performed with the Mining Visualization System (MVS) developed by C-Tech. The MVS Kriging module is grid centered and outputs a Kriged value at the top, middle, and bottom of each model layer. Since VAM3D is mesh centered, the Kriged values from MVS are averaged across the model interfaces and the average assigned to the model node on the interface. Specifically, for each model node on the interface, the Kriged value from the middle and bottom of the layer above the interface are averaged with the Kriged value from the top of the layer below the interface. Kriged values from the top of the first layer are assigned to the top model nodes and Kriged values from the bottom of the last layer are assigned to the bottom model nodes.

Action: None required.

10. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: 3-5 Line #: 14 Code: C
Original Comment #: 10

Comment: The report should compare the initial dissolved and adsorbed masses computed by kriging versus the mass amounts initialized in the VAM transport model.

Response: The dissolved total uranium concentrations as measured by groundwater samples are kriged and assigned to VAM3D model nodes as described in response to comment 9 above. There are no data for adsorbed total uranium mass or concentration, so there are no computed values from Kriging. Contour maps of the Kriged dissolved concentrations and of the initial model concentrations were compared visually to confirm that the Kriged concentrations were faithfully represented in the model. A FORTRAN program was used to read the Kriging output file (an MVS .ucd file) and compute dissolved and adsorbed masses in the model domain assuming a Kd of 1.78 L/Kg, a bulk density of 1.7 gr/cc and an average porosity of 30%. The dissolved mass of Total Uranium computed from the Kriging output file was 840 lbs with a sorbed mass of 5900 lbs. A second FORTRAN program was used to read the VAM3D groundwater model initial condition records (Group 19 records) and compute the dissolved and adsorbed mass assigned as initial conditions. The results from this computation were 890 lbs of Total Uranium dissolved with 6300 lbs adsorbed onto the aquifer material.

Action: None required.

11. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.0 Pg #: 3-6 Line #: 1 Code: C
Original Comment #: 11

Comment: Figures 22 through 26 show the particle tracking results for each model layer. The particle tracks appear to be identical from layer to layer. Some of the extraction wells, however, are not completed in every layer. At least some differences in the tracks, thus, would be expected. Are these figures correct?

Response: There are no particle tracks on Figures 3-22 through 3-26. Presumably, the commentor is referring to Figures 3-17 through 3-21 that show retarded particle tracks around each extraction well and initial total uranium concentrations in model layers 9 through 13 inclusive. Particle tracking is performed with TecPlot, a third party software package from Amtec Engineering. Therefore, particles are not seeded according to model layers since the TecPlot software uses only the VAM3D output velocity field and not model geometry.

The particle tracks in Figures 3-17 through 3-21 are identical in each figure and result from seeding particles at a constant elevation of 510 feet above mean sea level (AMSL) at a radius of 100 feet around each extraction well. Figure 11 attached shows the results of seeding particles at 510, 500, and 490 feet AMSL around each extraction well for comparison. These tracks are not retarded in order to demonstrate that particle paths are relatively insensitive to initial elevation or model layer.

Action: None required.

12. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.4.3 Pg #: 3-6 Line #: 1 Code: C
Original Comment #: 12

Comment: The particle tracks shown in many cases do not capture the entire plume in each layer. Table 3-3 provides an estimation of the amount of mass extracted each year by the South Field and South Plume modules. In addition to these estimates, the report should indicate the cumulative mass balance for the time when the plume is remediated to below the FRL. Specifically, the modeled amounts of mass sorbed on the aquifer grains, dissolved in groundwater, and discharged by offsite groundwater flow should also be provided.

Response: Presumably the first sentence of the comment is referring to the fact the retarded particle tracks shown in Figures 3-17 through 3-21 do not cover the entire plume footprint. As discussed in response to comment 7 above, the length of these tracks is based on the assumption of a linear Kd of 1.78 that results in a retardation factor of 12. As such, these particle tracks represent the distance a given slug of uranium contamination would travel during the time the pumping wells are active.

The current groundwater modeling code (VAM3D) gives a mass balance summary at the end of each iteration showing advective and dispersive flux rates, material accumulation rates and mass balance error. These quantities are not easily interpreted in terms of meaningful quantities such as those suggested in the comment. Although the aquifer remedy is concentration based, DOE agrees that a more meaningful mass balance analysis would be helpful in understanding and analyzing remedy performance. DOE will develop a set of programs to perform these calculations that will show mass balance for the time when the plume is remediated to below the FRL and the modeled amounts of mass sorbed on the aquifer grains, dissolved in groundwater, removed by pumping, and removed from the model by discharge through model boundaries. The results of these calculations will be included in future aquifer remedy design/modification reports once the programs have been developed and tested.

Action: As stated in the response.

13. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 3.4.3 Pg #: 3-10 Line #: NA Code: C
Original Comment #: 13

Comment: The results presented in this table are difficult to interpret. What is meant by the term "Module Concentration" and how was this parameter calculated? Presumably it is a flow-weighted average concentration, but this is not stated in the accompanying text.

Response: The term "Module Concentration" in Table 3-3 refers to a flow-weighted average concentration for all wells in that module as presumed in the comment. Although the modules are not named explicitly, the extraction wells are grouped by module in Table 3-1 on page 3-7. This explanation was inadvertently omitted from the text.

Action: No further action required.

14. Commenting Organization: Ohio EPA Commentor: GeoTrans, Inc.
Section #: 4.0 Pg #: 4-1 Line #: 35 Code: C
Original Comment #: 14

Comment: The text should qualify conclusions regarding the predicted time required to reduce total uranium concentrations to below-FRL levels. The time frame for completion of the remediation may be substantially greater because of distribution coefficient uncertainties.

Response: DOE agrees that the conclusion regarding the predicted time required to reduce total uranium concentrations to below FRL levels should have been better qualified. As EPA points out the time frame for completion of the remediation may be substantially greater because of distribution coefficient uncertainties. This has been pointed out before in earlier reports, i.e., The Baseline Remedial Strategy Report (BRSR). DOE plans on supplementing the BRSR to reflect the new South Field and Waste Storage Area restoration module designs. DOE is also conducting additional studies on how uranium is sorbed onto GMA sediments to get a better handle on how accurate use of a linear equilibrium isotherm with a Kd of 1.78 L/Kg is. This was discussed in response to Comment 2. Rather than revise this design document, DOE would like to further address this issue in the upcoming supplement to the BRSR.

Action: As stated in response.

TABLE 1
COMPARISON OF THE SIEVE RESULTS FOR
EW-13, EW-14, EW-15, AND EW-17

Elevation Feet AMSL	EW-13 50% Cumulative Retained Grain Size 1/1000 inches	EW-14 50% Cumulative Retained Grain Size 1/1000 inches	EW-15 50% Cumulative Retained Grain Size 1/1000 inches	EW-17 50% Cumulative Retained Grain Size 1/1000 inches
511	32			
510				
509		25	50	59
508				
507				
506	> 100			
505				
504		60	40	> 100
503				
502				
501	> 100			
500				
499			28	29
498				
497				
496	57	> 100		
495				
494		23	27	> 100
493				
492				
491				
490				
489		27		
488				
487				
486				
485				
484		66		

TABLE 2
VAM3D ZOOM MODEL PUMPING/RE-INJECTON WELL EXTRACTION RATES BY MODEL NODE
Years 2003 - 2009

Node Number	Model Index I	j	k	Rate (- = extraction, + = re-injection) ft³/day	Rate gpm	Total Rate gpm	Well Name
41847	27	13	9	-181.7	-0.9		
46998	27	13	10	-20467.6	-106.9		
52149	27	13	11	-16265.4	-84.9		
57300	27	13	12	-12684.3	-66.2		
62451	27	13	13	-8151.1	-42.6	-302	S Plume 3924
47051	29	14	10	-19063.6	-99.5		
52202	29	14	11	-18124.2	-94.6		
57353	29	14	12	-17822.9	-93.1		
62504	29	14	13	-2739.3	-14.3	-302	S Plume 3925
47105	32	15	10	-13911.3	-72.6		
52256	32	15	11	-20071.9	-104.8		
57407	32	15	12	-21923.4	-114.5		
62558	32	15	13	-1843.4	-9.6	-302	S Plume 3926
42309	30	22	9	-771.5	-4.0		
47460	30	22	10	-31907.0	-166.6		
52611	30	22	11	-25071.5	-130.9	-302	S Plume Opt 6
47457	27	22	10	-20405.2	-106.5		
52608	27	22	11	-27232.5	-142.2		
57759	27	22	12	-10112.3	-52.8	-302	S Plume Opt 7
43326	27	42	9	3850.0	20.1		
48477	27	42	10	23870.0	124.6		
53628	27	42	11	10780.0	56.3	201	S Field 16
54041	32	50	11	-18544.6	-96.8		
59192	32	50	12	-34392.9	-179.6	-276	S Field 17
53583	33	41	11	-25410.0	-132.7		
58734	33	41	12	-13090.0	-68.3	-201	S Field 18
53788	34	45	11	-25000.0	-130.5		
58939	34	45	12	-13500.0	-70.5	-201	S Field 19
48792	36	48	10	-6600.0	-34.5		
53943	36	48	11	-21040.0	-109.9		
59094	36	48	12	-10860.0	-56.7	-201	S Field 20
48947	38	51	10	-17618.6	-92.0		
54098	38	51	11	-24935.6	-130.2		
59249	38	51	12	-13270.8	-69.3	-291	S Field 21
42974	32	35	9	-7518.2	-39.3		
48125	32	35	10	-19188.5	-100.2		
53276	32	35	11	-20303.9	-106.0		
58427	32	35	12	-10638.4	-55.5	-301	S Field 22
38186	38	42	8	-1749.6	-9.1		
43337	38	42	9	-16798.7	-87.7		
48488	38	42	10	-18103.7	-94.5		
53639	38	42	11	-19988.6	-104.4		
58790	38	42	12	-1109.4	-5.8	-302	S Field 23
43081	37	37	9	-11536.7	-60.2		
48232	37	37	10	-27999.6	-146.2		
53383	37	37	11	-18213.7	-95.1	-302	S Field 24

TABLE 2
(Continued)

Node Number	Model Index I	j	k	Rate (- = extraction, + = re-injection) ft^3/day	gpm	Total Rate gpm	Well Name
48542	41	43	10	-16751.2	-87.5		
53693	41	43	11	-18490.7	-96.5		
58844	41	43	12	-18202.1	-95.0	-279	S Field 32
43596	42	47	9	-5226.9	-27.3		
48747	42	47	10	-16738.8	-87.4		
53898	42	47	11	-18329.0	-95.7		
59049	42	47	12	-17455.2	-91.1	-302	S Field 33
48443	44	41	10	-17333.2	-90.5		
53594	44	41	11	-21166.8	-110.5	-201	S Field 34
49895	17	70	10	-11452.7	-59.8		
55046	17	70	11	-29728.6	-155.2		
60197	17	70	12	-30883.1	-161.3		
65348	17	70	13	-4935.7	-25.8	-402	WSA 1
49953	24	71	10	-12924.6	-67.5		
55104	24	71	11	-21162.7	-110.5		
60255	24	71	12	-19682.9	-102.8		
65406	24	71	13	-3979.8	-20.8	-302	WSA 2
49957	28	71	10	-19557.5	-102.1		
55108	28	71	11	-21783.6	-113.7		
60259	28	71	12	-16409.0	-85.7	-302	WSA 4
53167	25	33	11	21385.5	111.7		
58318	25	33	12	17114.5	89.4	201	Inj Well 8A
53121	30	32	11	23465.2	122.5		
58272	30	32	12	15034.8	78.5	201	Inj Well 9A
53174	32	33	11	24440.8	127.6		
58325	32	33	12	14059.2	73.4	201	Inj Well 10
53227	34	34	11	24440.8	127.6		
58378	34	34	12	14059.2	73.4	201	Inj Well 7
42979	37	35	9	1221.9	6.4		
48130	37	35	10	29270.1	152.8		
53281	37	35	11	8008.0	41.8	201	Inj Well 11
59180	20	50	12	6352.5	33.2		
59231	20	51	12	6352.5	33.2		
59131	22	49	12	6545.0	34.2	101	S Field Basin
54186	24	53	11	9587.1	50.1		
59337	24	53	12	9662.9	50.5	101	S Field Inj 1

TABLE 3
VAM3D ZOOM MODEL PUMPING/RE-INJECTION WELL EXTRACTION RATES BY MODEL NODE
Years 2010 - 2013

Node Number	Model Index I	j	k	Rate (- = extraction, + = re-injection) ft³/day	gpm	Total Rate gpm	Well Name
42974	32	35	9	-7518.2	-39.3		
48125	32	35	10	-19188.5	-100.2		
53276	32	35	11	-20303.9	-106.0		
58427	32	35	12	-10638.4	-55.5	-301	S Field 22
38186	38	42	8	-1749.6	-9.1		
43337	38	42	9	-16798.7	-87.7		
48488	38	42	10	-18103.7	-94.5		
53639	38	42	11	-19988.6	-104.4		
58790	38	42	12	-1109.4	-5.8	-302	S Field 23
43081	37	37	9	-11536.7	-60.2		
48232	37	37	10	-27999.6	-146.2		
53383	37	37	11	-18213.7	-95.1	-302	S Field 24
43391	41	43	9	-4306.0	-22.5		
48542	41	43	10	-16751.2	-87.5		
53693	41	43	11	-18490.7	-96.5		
58844	41	43	12	-18202.1	-95.0	-302	S Field 32
43596	42	47	9	-5226.9	-27.3		
48747	42	47	10	-16738.8	-87.4		
53898	42	47	11	-18329.0	-95.7		
59049	42	47	12	-17455.2	-91.1	-302	S Field 33
48443	44	41	10	-17333.2	-90.5		
53594	44	41	11	-21166.8	-110.5	-201	S Field 34
49895	17	70	10	-11452.7	-59.8		
55046	17	70	11	-29728.6	-155.2		
60197	17	70	12	-30883.1	-161.3		
65348	17	70	13	-4935.7	-25.8	-402	WSA 1
49953	24	71	10	-12924.6	-67.5		
55104	24	71	11	-21162.7	-110.5		
60255	24	71	12	-19682.9	-102.8		
65406	24	71	13	-3979.8	-20.8	-302	WSA 2
49957	28	71	10	-19557.5	-102.1		
55108	28	71	11	-21783.6	-113.7		
60259	28	71	12	-16409.0	-85.7	-302	WSA 4
55455	18	78	11	-19250.0	-100.5	-101	WSA 5
66112	16	85	13	-3465.0	-18.1		
60961	16	85	12	-3465.0	-18.1		
55810	16	85	11	-5414.9	-28.3		
50659	16	85	10	-5414.9	-28.3		
45508	16	85	9	-1490.3	-7.8	-101	WSA 6

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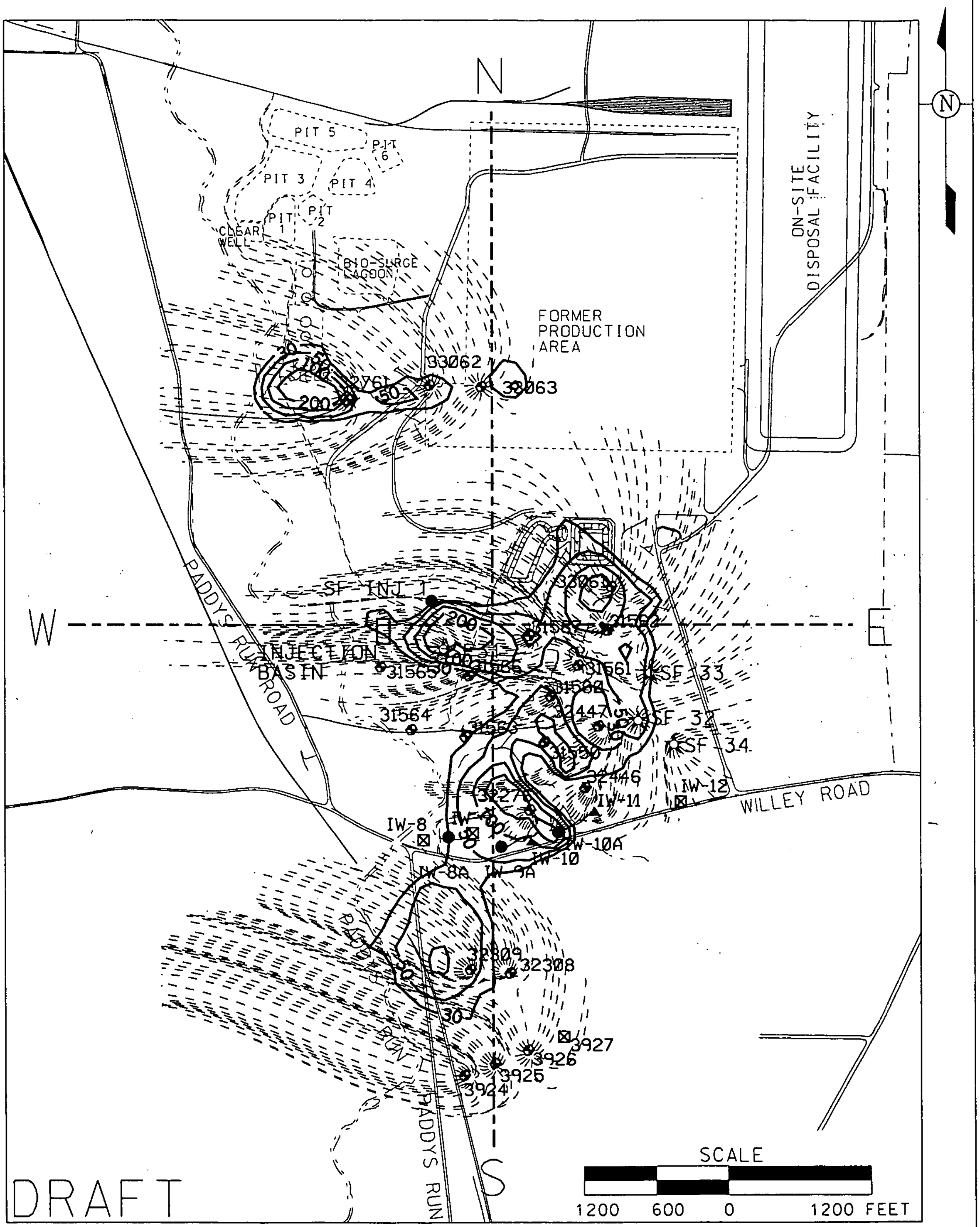
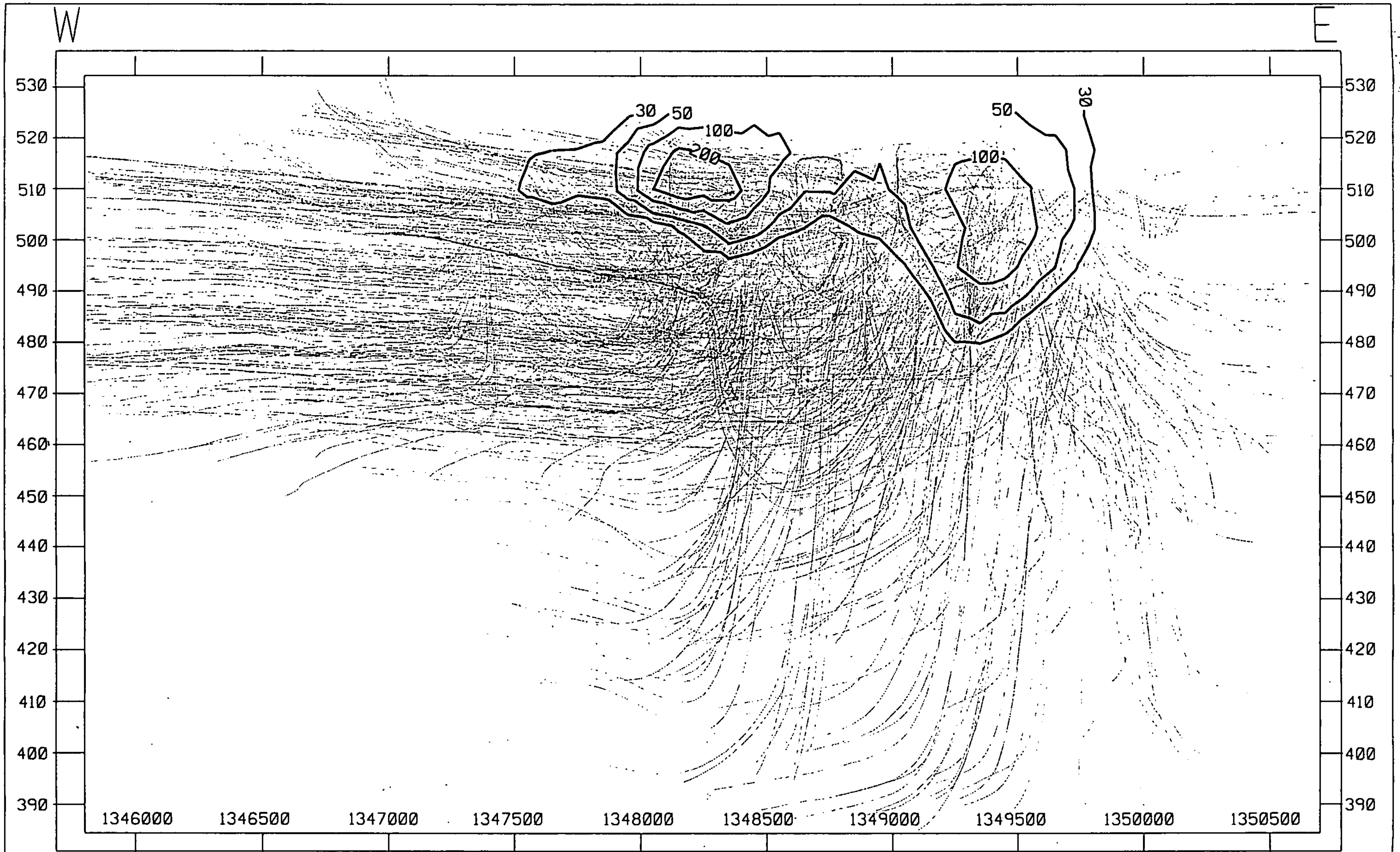


LEGEND:

- FEMP BOUNDARY
- URANIUM CONTOUR
- PARTICLE TRACK (6 YEARS)
- EXTRACTION WELL
- RE-INJECTION WELL
- PROPOSED RE-INJECTION WELL
- PROPOSED ABANDONMENT LOCATION
- CROSS SECTION

FIGURE 1. NON-RETARDED PARTICLE TRACKS SEEDED AT 510 FEET AMSL WITH INITIAL TOTAL URANIUM CONCENTRATIONS IN VAM3D ZOOM MODEL LAYER 12



LEGEND:

TOTAL URANIUM CONCENTRATION (μg/L)
SLICED AT NORTHING = 478,000

PARTICLE TRACKS LOOKING NORTH

19

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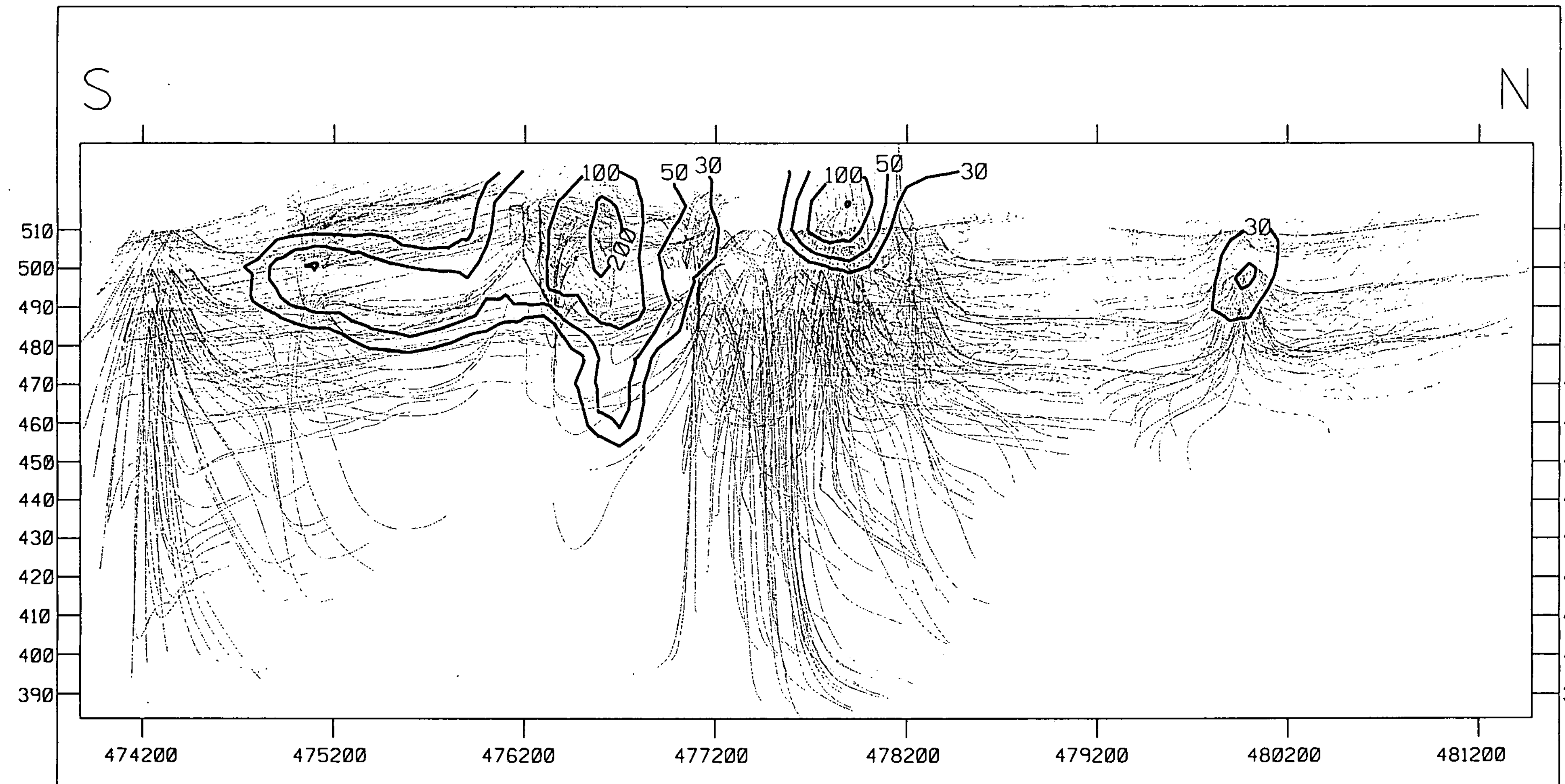
FIGURE 2. VERTICAL EAST-WEST CROSS SECTION SHOWING NON-RETARDED PARTICLE TRACKS AND INITIAL TOTAL URANIUM CONCENTRATIONS IN VAM3D ZOOM MODEL



LEGEND:

TOTAL URANIUM CONCENTRATION (μg/L)
SLICED AT EASTING = 1,348,550

PARTICLE TRACKS LOOKING WEST

20

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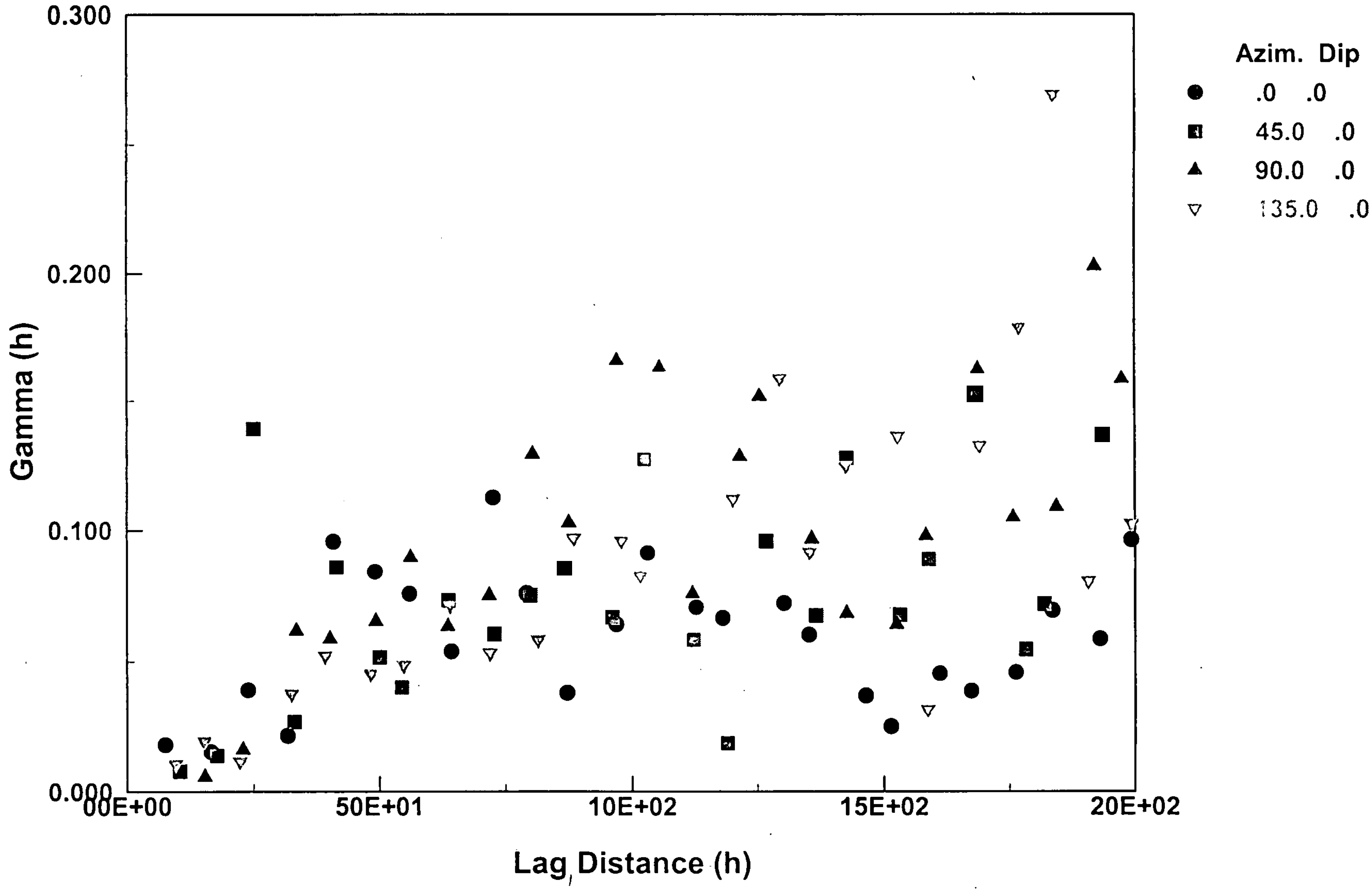
FIGURE 3. VERTICAL NORTH-SOUTH CROSS SECTION SHOWING NON-RETARDED PARTICLE TRACKS AND INITIAL TOTAL URANIUM CONCENTRATIONS IN VAM3D ZOOM MODEL

Figure 4. Total Uranium Data - Semi-Variograms



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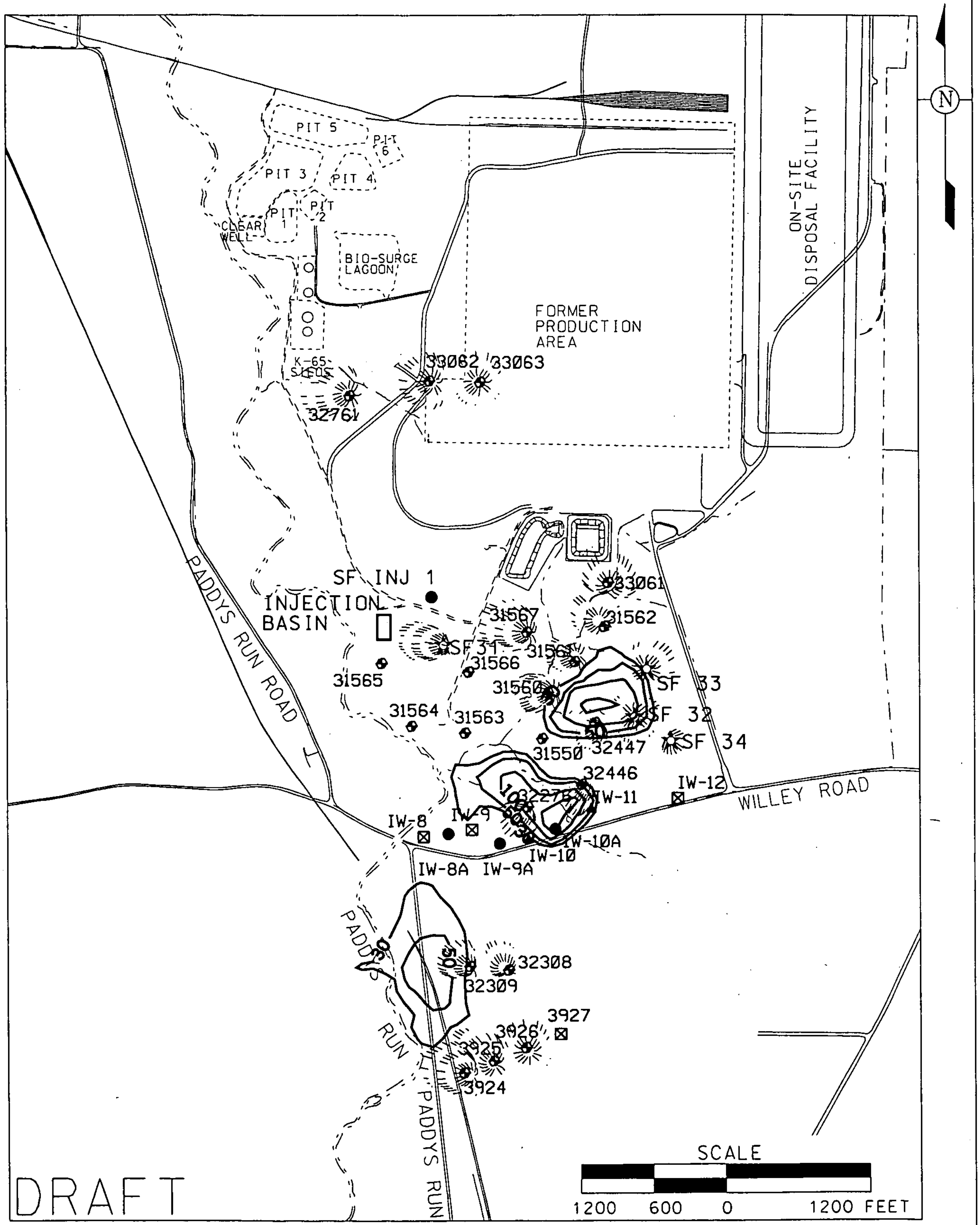

LEGEND:

- FEMP BOUNDARY
- URANIUM CONTOUR
- PARTICLE TRACK (6 YEARS RETARDED)
- EXTRACTION WELL
- RE-INJECTION WELL
- PROPOSED RE-INJECTION WELL
- PROPOSED PLUGGING AND ABANDONMENT LOCATION
- PROPOSED EXTRACTION WELL
- PROPOSED BASIN RE-INJECTION

FIGURE 5. INITIAL CONDITIONS FOR TOTAL URANIUM IN MODEL LAYER 9 WITH KRIGING RANGE OF 1000 FEET

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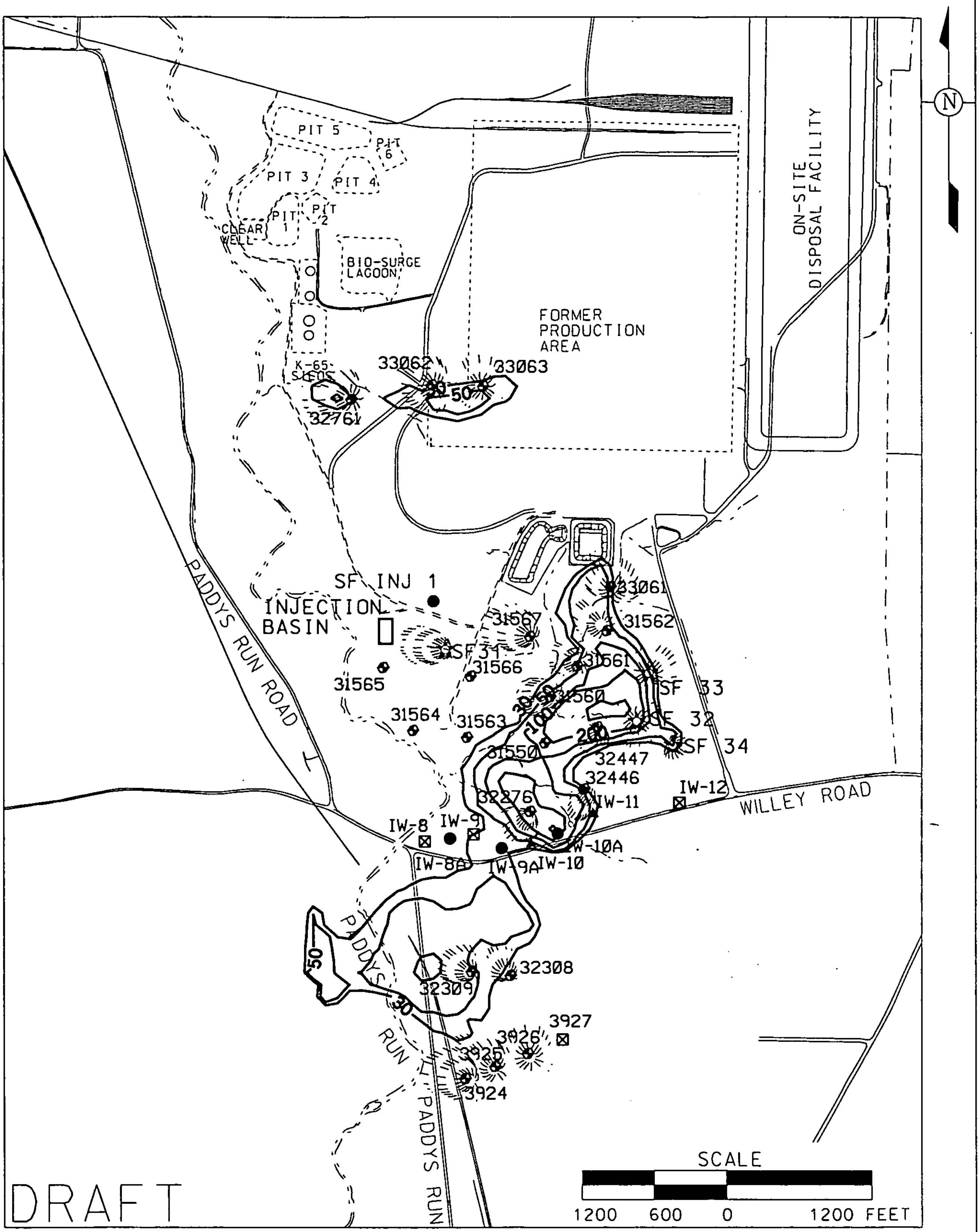
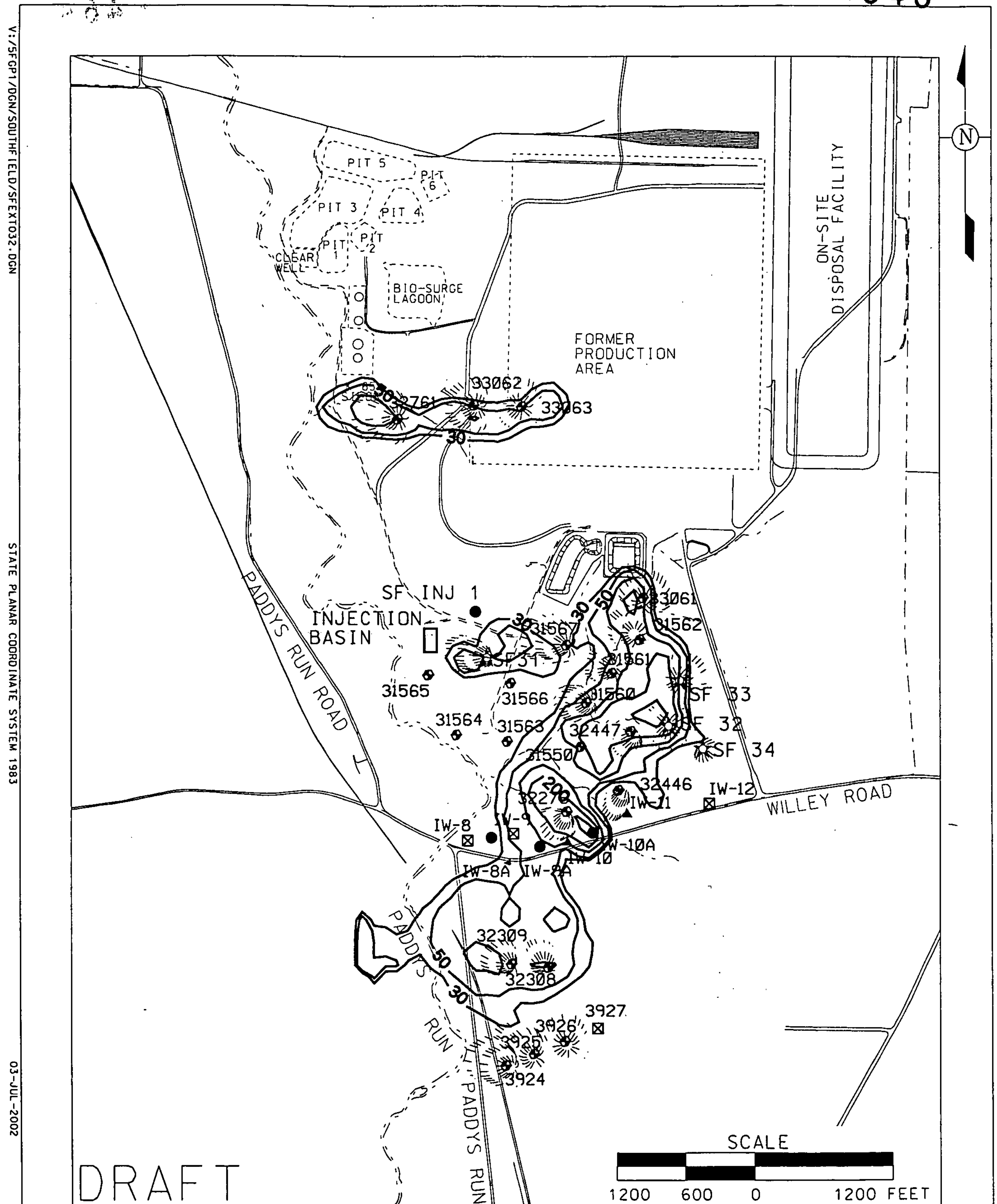


LEGEND:

- FEMP BOUNDARY
- URANIUM CONTOUR
- PARTICLE TRACK (6 YEARS RETARDED)
- EXTRACTION WELL
- RE-INJECTION WELL
- PROPOSED RE-INJECTION WELL
- PROPOSED PLUGGING AND ABANDONMENT LOCATION
- PROPOSED EXTRACTION WELL
- PROPOSED BASIN RE-INJECTION

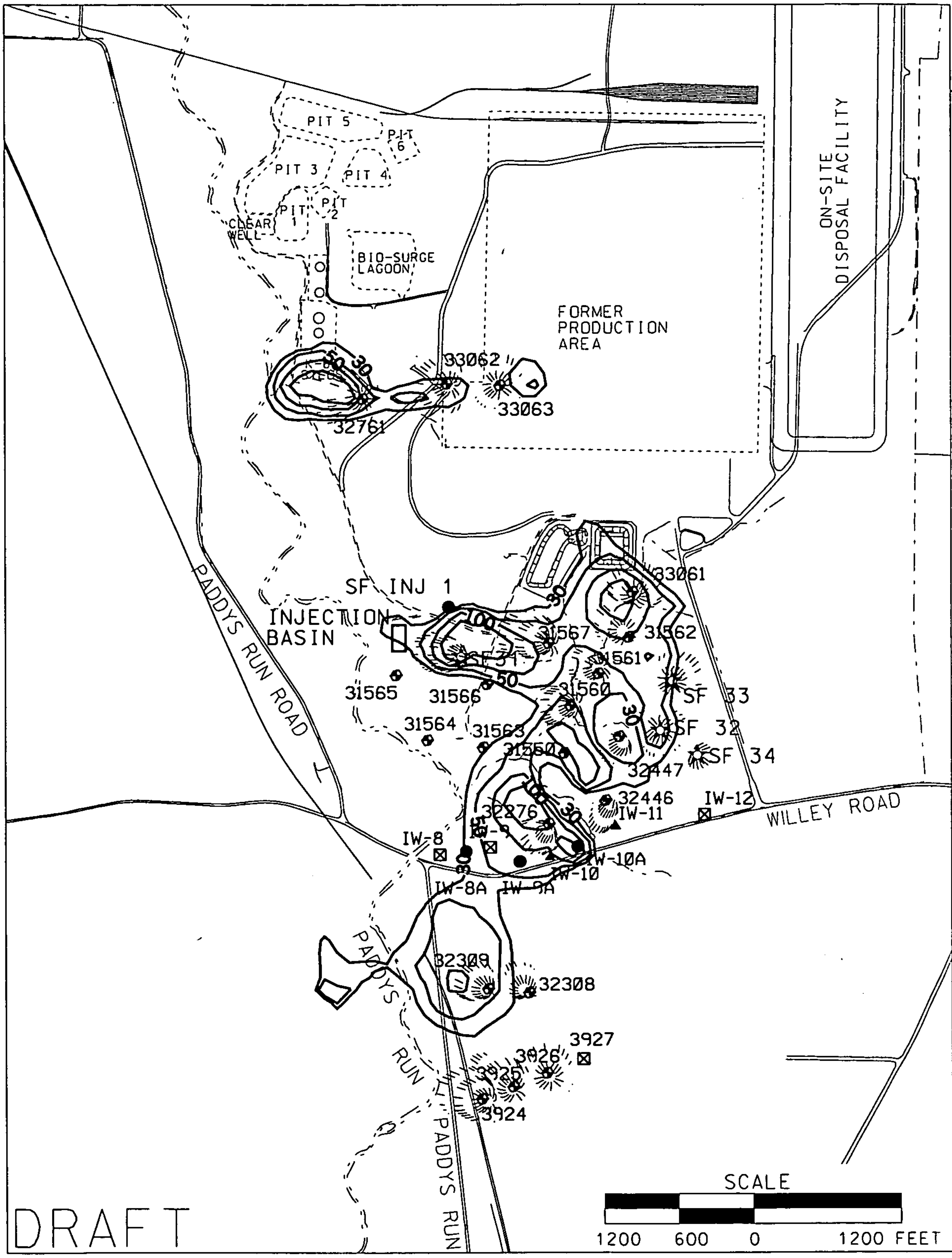
FIGURE 6. INITIAL CONDITIONS FOR TOTAL URANIUM IN MODEL LAYER 10 WITH KRIGING RANGE OF 1000 FEET



LEGEND:

- FEMP BOUNDARY
- URANIUM CONTOUR
- PARTICLE TRACK (6 YEARS RETARDED)
- EXTRACTION WELL
- RE-INJECTION WELL
- PROPOSED RE-INJECTION WELL
- PROPOSED PLUGGING AND ABANDONMENT LOCATION
- PROPOSED EXTRACTION WELL
- PROPOSED BASIN RE-INJECTION

FIGURE 7. INITIAL CONDITIONS FOR TOTAL URANIUM IN MODEL LAYER 11 WITH KRIGING RANGE OF 1000 FEET



LEGEND:

- FEMP BOUNDARY
- URANIUM CONTOUR
- PARTICLE TRACK (6 YEARS RETARDED)
- EXTRACTION WELL
- RE-INJECTION WELL
- PROPOSED RE-INJECTION WELL
- PROPOSED PLUGGING AND ABANDONMENT LOCATION
- PROPOSED EXTRACTION WELL
- PROPOSED BASIN RE-INJECTION

FIGURE 8. INITIAL CONDITIONS FOR TOTAL URANIUM IN MODEL LAYER 12 WITH KRIGING RANGE OF 1000 FEET

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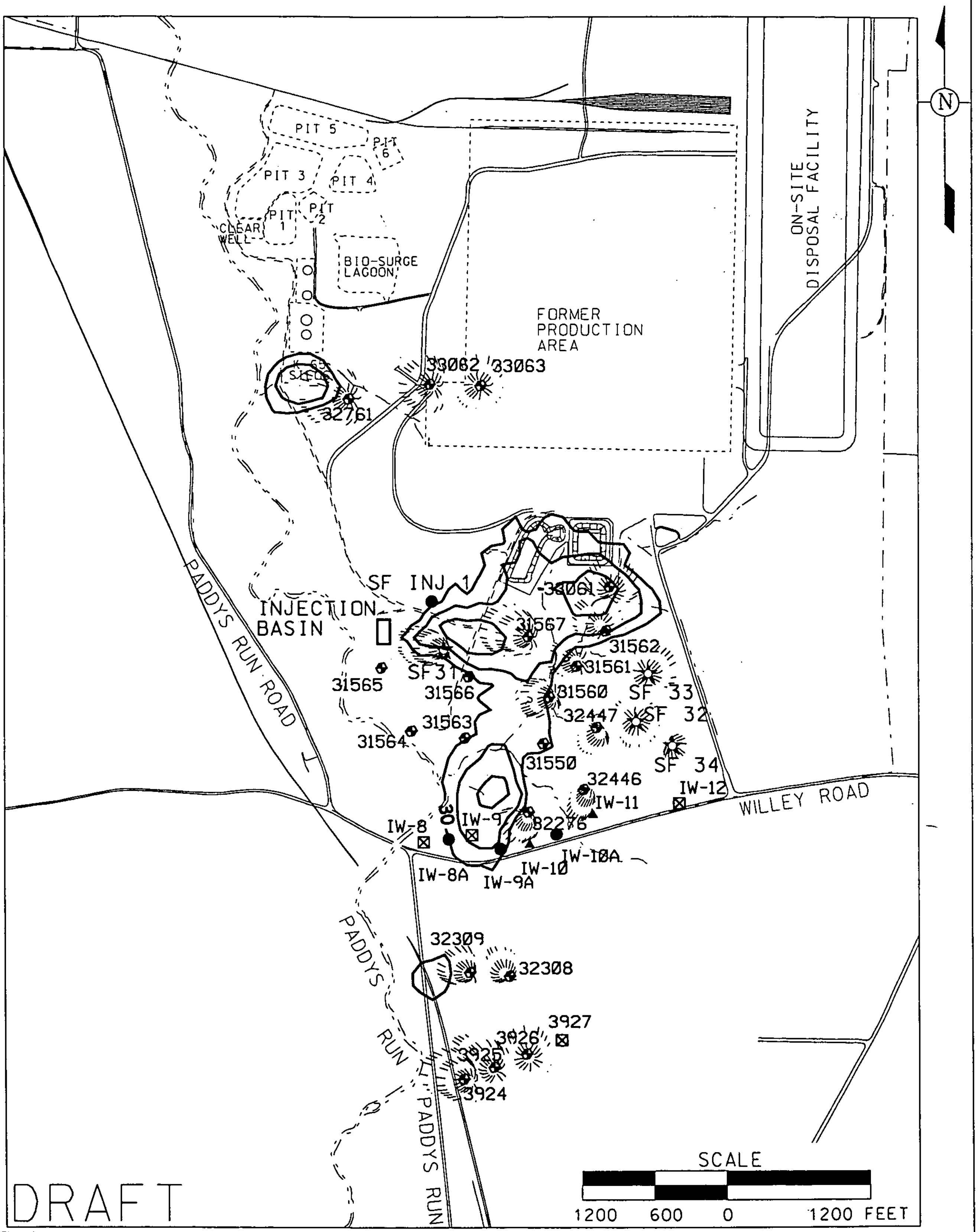

LEGEND:

- FEMP BOUNDARY
- URANIUM CONTOUR
- PARTICLE TRACK (6 YEARS RETARDED)
- EXTRACTION WELL
- RE-INJECTION WELL
- PROPOSED RE-INJECTION WELL
- PROPOSED PLUGGING AND ABANDONMENT LOCATION
- PROPOSED EXTRACTION WELL
- PROPOSED BASIN RE-INJECTION

FIGURE 9. INITIAL CONDITIONS FOR TOTAL URANIUM PLUME IN MODEL LAYER 13 WITH KRIGING RANGE OF 1000 FEET

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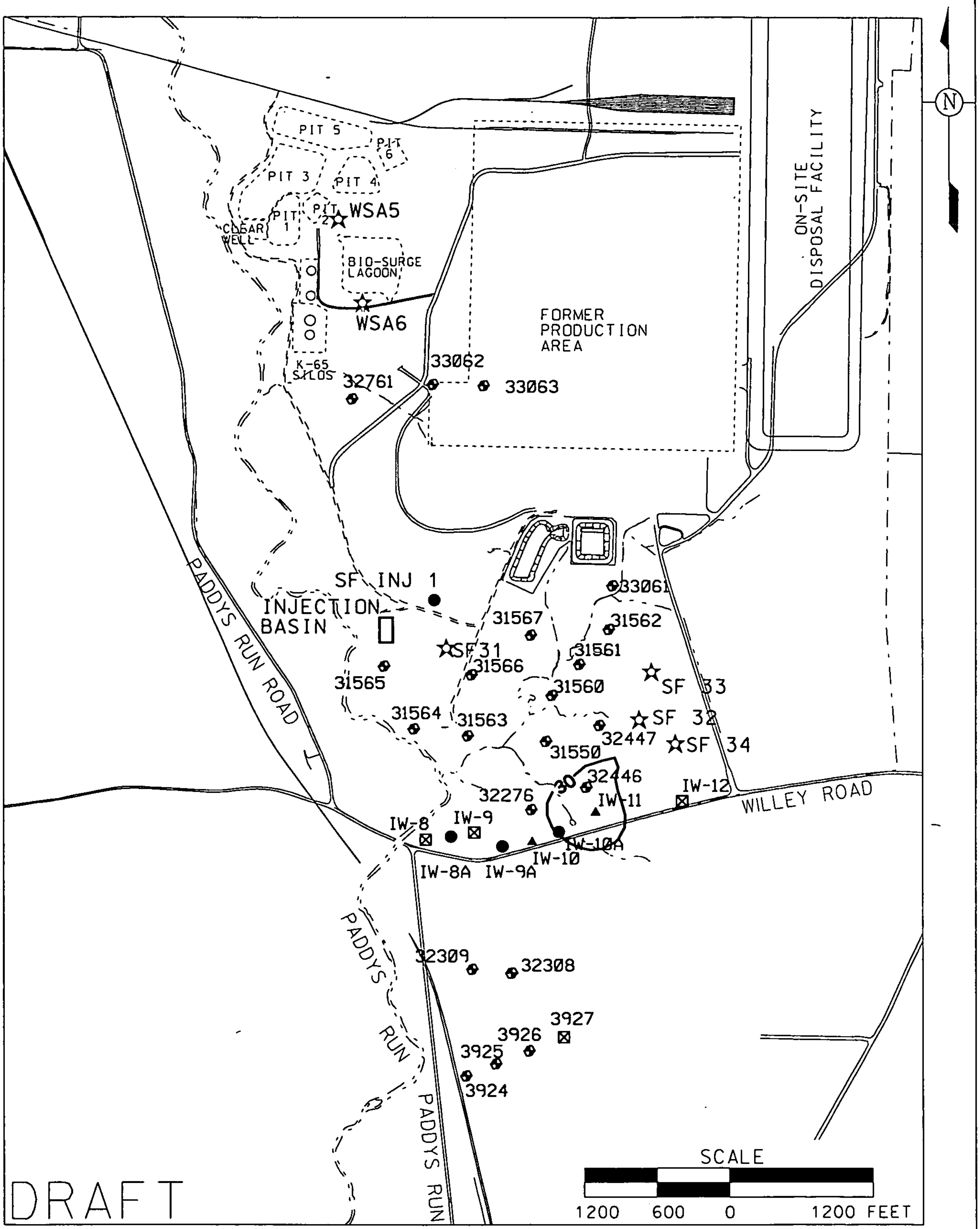

LEGEND:

- — · — · — FEMP BOUNDARY
- ——— URANIUM CONTOUR
- EXTRACTION WELL
- ▲ RE-INJECTION WELL
- ● PROPOSED RE-INJECTION WELL
- ⊠ PROPOSED PLUGGING AND ABANDONMENT LOCATION
- ☆ PROPOSED EXTRACTION WELL
- □ PROPOSED BASIN RE-INJECTION

FIGURE 10. PREDICTED TOTAL URANIUM PLUME IN MODEL LAYER 11 AFTER 10 YEARS OPERATION WITH NOMINAL BOUNDARY CONDITIONS

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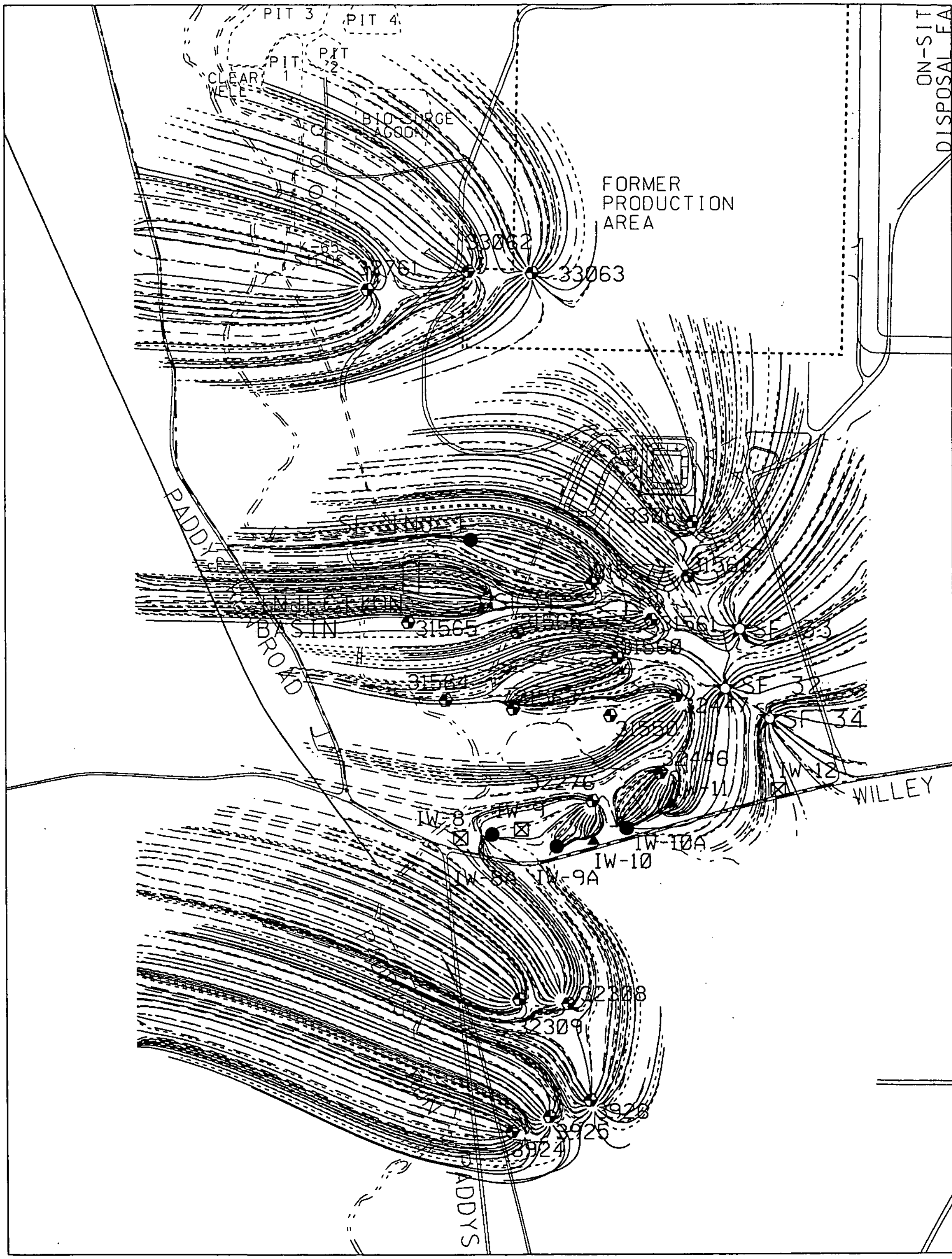

LEGEND:

- FEMP BOUNDARY
- 490 FEET AMSL
- 500 FEET AMSL
- 510 FEET AMSL

SCALE

1000 500 0 1000 FEET

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FIGURE 11. NON-RETARDED 6 YEAR PARTICLE TRACKS SEEDED AROUND EXTRACTION WELLS AT DIFFERENT INITIAL DEPTHS