

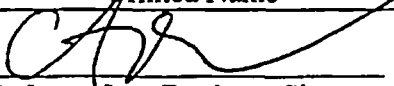
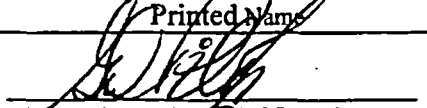



**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-2900 ROADS / RAILROAD
SURVEY UNIT 2**

Prepared By:	 _____ FSS Engineer - Signature <u>G. Madison</u> Printed Name	Date: <u>5/25/05</u>
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**MAINE YANKEE
FINAL STATUS SURVEY RELEASE RECORD
FR-2900 ROADS / RAILROAD
SURVEY UNIT 2**

A. SURVEY UNIT DESCRIPTION

Survey Unit 2 is located in Survey Area FR 2900. The access roads and adjoining parking lots are located North of the Protected Area extending northward to and including Old Ferry Road. The survey unit consisted of gravel and asphalt road surfaces not previously included in FR 2900 Survey Unit 1, with the exception of almost 200 meters of road within the ISFSI boundary. The survey unit is shown in relation to the Maine State Coordinate System (West Zone) NAD 1927 on map FR2900-2 REF in Attachment 1.

The access road served as the primary access for a majority of the site's decommissioning activities. As a result, radioactive materials generated in the restricted area were routinely transferred along the route; including the ISFSI soil/debris pile as a staging area for railcar loading operations for offsite transfer/disposal. The 24,660 m² survey design area encompassed approximately 6845 linear feet of roads plus adjoining parking areas and includes:

- Parking Lot "C"
- East access road from Gate 1 to the FR-2900 Survey Unit 1 boundary
- South road located north of the Restricted Area except the portion included in survey area FR-0111
- Warehouse 2 / 3 parking area
- West access road north of Gate 4 to south ISFSI boundary
- Access roads north of the ISFSI including Old Ferry Road from the east access road to Youngs Brook

The majority of road surfaces within Survey Unit 2 consist of asphalt. The majority of parking lot surfaces are soil. The access road is shown in relation to other major site structures in map FR2900-2 REF. All maps referenced in this release record are provided in Attachment 1 unless otherwise noted. Due to a Maine Yankee commitment, gamma re-scans were performed on 19 selected grid locations inside adjacent FR 1800 Survey Unit 2 (Reference 2). This area was not included in the original survey design area calculation. As a result, an additional 1,020 m² of soils received gamma re-scans outside of the original survey design.

B. SURVEY UNIT DESIGN INFORMATION

The area was designated a Class 3 land survey unit per the LTP (Table 5-1C, R2900, Roads/Railroad Final Verification). There was no remediation of the soil/asphalt surfaces performed prior to the Final Status Survey; however, the east parking lot (Lot "C") was used for staging of clean debris prior to landfill disposal and was removed prior to FSS.

The survey unit design parameters are shown in Table 1. Given an adjusted relative shift of 3.0, it was determined that 14 direct measurements were required for the Sign Test. Fourteen direct measurements were actually performed. Measurement locations were randomly determined and are illustrated on maps FR2900-2DP REF and FR2900-2u through FR2900-2x. Because four of the direct locations (S004, S007, S008, S009) fell on asphalt, *in situ* gamma analysis was performed using High Purity Germanium (HPGe) In Situ Object Characterization System (ISOCS) with the detector located 13 cm from the surface. The remaining ten direct measurements (soil samples) collected from the required locations were analyzed by laboratory gamma spectroscopy instrumentation. The ISOCS direct measurements were converted to a total gross beta dpm/100 cm² by adding the higher (identified or MDA) of the reported Co-60 and Cs-137 components together. The field of view for the ISOCS direct measurement was approximately 531 cm². The soil direct sample results were converted to a total gross beta dpm/100 cm² by adding the higher of the reported Co-60 and Cs-137 components together to calculate a gross beta activity result using an area based on an assumed sample footprint of 929 cm² (12" by 12").

The survey was also designed to include 281 overlapping scans for asphalt or soil surfaces, each of approximately 78.5 m² area (see map FR2900-2 REF). The High Purity Germanium (HPGe) In Situ Object Characterization System (ISOCS) scan setpoint was conservatively set at one-half the DCGL, as shown in Table 2-2 (Attachment 2). The survey design also called for investigation of a scan location with verified positive detection (>MDA) of Co-60. The initial standard ISOCS model used was based on an assumed concrete depth of 5 cm, which was consistent with the concrete depth profile assumed for concrete surfaces and rock ledge for survey units within the Restricted Area (RA). After starting the survey, additional information was obtained from the decommissioning manager that the road surfaces north of the ISFSI and Old Ferry Road had been resurfaced during plant operation. Since the scan locations performed up to that time were only for areas south of the ISFSI, no reanalysis was necessary since the areas scanned had not been paved over. The ISOCS model was revised using the new information obtained from the decommissioning manager that the repaving depth was approximately 7 inches (17.78 cm) of asphalt.

The instruments used in this survey are listed by model and serial number in Attachment 2 (Table 2-1). Scan MDCs are also listed in Attachment 2 (Table 2-2) and are compared to the DCGL and the investigation level. As shown in this table, the scan MDC is less than the scan investigation level in all cases, thus providing high confidence (95% or higher) that an elevated area would be detected in the scanning process.

TABLE 1

SURVEY UNIT DESIGN PARAMETERS

Survey Unit	Design Criteria	Basis
Area	24,660 m ²	Class 3 Unlimited
Number of Direct Measurements Required	14	Based on an adjusted LBGR of 5,894 dpm/100cm ² , Cs-137 sigma ¹ of 1,302 dpm/100 cm ² , and a relative shift of 3.0. Type I = Type II = 0.05
Sample Area	NA	Class 3 Area
Sample Grid Spacing	NA	Class 3 Area
Scan Grid Area	ISOCS scan at 1 meter height for 78.5 m ² field of view	Sec Section B
Area Factor	NA	Only required for Class 1 areas
Scan Survey Area	14,885 m ²	Class 3 – 1-10%
Scan Investigation Level	50% of DCGL	Sec Table 2-2 (Attachment 2)
DCGL	9,800 dpm/100 cm ²	LTP, Revision 4 Table 6-11b for Pavement-Covered Areas use buried piping DCGL
DCGL _{EMC}	NA	Class 3

C. SURVEY RESULTS

Fourteen direct measurements were made in Survey Unit 2. All direct measurements were less than the DCGL. The resulting data are presented in Table 2 below.

¹ Design sigma is based on characterization data, listed in LTP Table 5-1C Bailey House Land Area, R1800, (LTP, Rev. 4). The design sigma was converted to surface activity as follows:

$$\text{Design Sigma pCi/g} \times 2.22 \text{ dpm/pCi} \times \text{Density g/cm}^3 \times \text{Volume cm}^3 / 100 \text{ cm}^2 =$$

$$0.23 \text{ pCi/g} \times 2.22 \text{ dpm/pCi} \times 1.7 \text{ g/cm}^3 \times 100 \text{ cm}^2 (15 \text{ cm}) / 100 \text{ cm}^2 = 1302 \text{ dpm/100 cm}^2$$

TABLE 2
DIRECT MEASUREMENTS

Sample Location	Co-60 dpm/100 cm ²	Cs-137 dpm/100 cm ²	Gross Beta Activity dpm/100 cm ² (Note 3)
FR2900-02-3-S001-SS	< 23	37	59
FR2900-02-3-S002-SS	< 19	< 17	36
FR2900-02-3-S003-SS	< 20	< 20	40
FR2900-02-3-S004-GD	< 834	< 1,190	2,024 (Note 1)
FR2900-02-3-S005-SS	< 22	< 21	42
FR2900-02-3-S006-SS	< 18	< 20	38
FR2900-02-3-S007-GD	< 813	< 1,080	1,893 (Note 1)
FR2900-02-3-S008-GD	< 744	< 1,090	1,834 (Note 1)
FR2900-02-3-S009-GD	< 746	< 1,020	1,766 (Note 1)
FR2900-02-3-S010-SS	< 20	< 20	41
FR2900-02-3-S011-SS	< 20	< 18	38
FR2900-02-3-S012-SS	< 21	< 21	42
FR2900-02-3-S013-SS	< 18	< 16	34
FR2900-02-3-S014-SS	< 17	< 20	37
Mean	238	328	566
Median	21	20	41
Standard Deviation	359	505	864
Sample Range	17 to 834	16 to 1,190	34 to 2,024

NOTES

1. Direct measurements counted for 3600 seconds taken *in situ* using ISOCS with 90 degree collimation (field of view 531 cm²) for asphalt locations.
2. "<" indicates MDA value. Bold indicates positive detection value.
3. Summed results are rounded to the nearest integer.

ISOCS gamma scans were performed at 281 locations using an investigation level of 4900 dpm/100 cm² (Co-60 plus Cs-137) for the 78.5 m² field of view designed to achieve overlapping scan coverage to ensure adequate coverage for the survey unit. The gamma scans were performed for a sufficient count time to achieve a Minimum Detectable Activity of approximately 20 % of the DCGL. All scan activity values were below the investigation level; however, one survey map area (refer to Survey map FR2900-2c) location was re-scanned after adjacent FRAC tank removal, because of positive Co-60 detection (due to FRAC tank source term shine) in several of the initial scans. After the rescans of these areas, an investigation was required on a single location, SC09, because Co-60 was detected above MDA.² An investigation was performed and documented using survey investigation package XR2900-2. Refer to Section D for further discussion of the investigation performed.

² All measurements with residual Co-60 activity greater than MDA were investigated.

D. SURVEY UNIT INVESTIGATIONS PERFORMED AND RESULTS

The scan of grid SC09 resulted in a Co-60 result exceeding the investigation level (positive detection above MDA). The elevated area inside scan grid SC09 corresponded to a portion of the snow removal debris pile located at the edge of the road. To investigate the scan location, ISOCS scans were performed to isolate (bound) the area within the scan grid, using a 19.6 m² field of view at an open collimation height of 0.5-m. The configuration of the first investigation scans is shown on map XR2900-2c (Attachment 1). The scan results indicated that the Co-60 activity was centered within a meter radius of the center of the original elevated scan location because the adjacent north, south, east and west scans centered on the scan field of view radius for point XC09 failed to identify Co-60. Since the SSPA-3 used to identify the highest gross activity in the elevated scan location (XC09) did not identify the area causing the Co-60 activity, (direct sample result for XC09 also did not identify Co-60) a second ISOCS investigation was performed to further investigate and localize the elevated area using a 1.5 m² field of view with 90-degree collimation at a height of 0.7-m.

The second investigation failed to isolate the elevated pocket containing the Co-60 activity, most likely due to reduced detector efficiency from the addition of the 90-degree collimator and a field of view that was too large. The second investigation scan locations are shown on map XR2900-2cX1 (Attachment 1).

The third investigation, successfully identified the elevated pocket of Co-60 activity using a modified open collimation design to narrow the field of view to about 0.8 m² at a height of 0.5-m. The elevated scan location was sectioned in a triangular grid containing a total of 20 scan locations with 30 cm spacing. The third investigation scan locations are shown on map XR2900-2cX2 (Attachment 1). Scan locations S308-S310 and S320 identified Co-60. Since technical review of the gamma spectrums indicated that the Co-60 contamination might be deeper than the assumed depth of 15 cm, two direct samples (one at 0-6" depth, one at 6"-12" depth) were required for scan locations where Co-60 was identified. Of all the direct samples obtained, only one identified Co-60 (20.5 pCi/g) in a 0-6" sample for scan location S310. "As Found" and "As Left" investigation results are presented in Table 3-1 (Attachment 3).

Since the investigation direct sample exceeded the Co-60 DCGL for areas outside the Restricted Area (1.52 pCi/g), in accordance with Reference 1, an area around the elevated sample was reclassified to Class 1. A portion of the investigation scan grid was located in a disturbed area used for piling snow/debris. Because a small strip of area (approximately 0.3 m by 25 m) from FR2900 Survey Unit 2 was located in the footprint of the snow/debris pile, the strip was upgraded in classification to Class 1. The excluded strip includes portions of scan grids SC03, SC04, and SC09 through SC11. The excluded/reclassified section will be included in Class 1 FR 0900 Survey Unit 4 which will be designed to include the area around the snow removal debris pile. The final total scan area for Survey Unit 2 is 14, 877 m², or 60.3% of the total area of the survey unit.

E. SURVEY UNIT DATA ASSESSMENT

An analysis of the direct measurement results, including the mean, median, standard deviation, and sample result range, are provided in Table 2. Positively detected values are bolded in the table. Of the 14 direct measurements obtained, only one identified Cs-137. All other measurement values were below the MDA. No Co-60 activity was identified above the MDA. The mean and median activities were less than the DCGL. Without subtracting background, all direct measurement results were below the DCGL. The maximum direct sample result was equivalent to 2,024 dpm/100 cm².

The mean residual contamination level is 566 dpm/100 cm². This is equivalent to an annual dose of 0.0001 mrem.³

F. ADDITIONAL DATA EVALUATION

Attachment 4 provides additional data evaluation associated with Survey Unit 2, including relevant statistical information. Based on survey unit direct measurement data, this attachment provides the Sign Test Summary, Quantile Plot, Histogram, and Retrospective Power Curve.

1. The Sign Test Summary provides an overall summary of design input (Table 1) and resulting calculated values used to determine the required number (N) of direct measurements (per LTP Section 5.4.2). The Sign Test Summary is a separate statistical analysis that also calculates the mean, median, and standard deviation of the direct measurements.

The critical value and the result of the Sign Test are provided in the Sign Test Summary table, as well as a listing of the key release criteria. As is shown in the table, all of the key release criteria were clearly satisfied for the FSS of this survey unit.

2. The Quantile Plot was generated from direct measurement data listed in Table 2 and indicates general symmetry about the median. Note that there appears to be four outliers in the plot, however, they are from the *in situ* gamma directs of the asphalt surfaces and indicate a much higher MDA than the direct sample results because of matrix, shielding and geometry differences when compared to a direct sample. The data set and plot are consistent with expectations for a Class 3 survey unit. There is no reason to conclude that the data set represents other than random variations in a Class 3 surface survey unit. It also should be noted that the maximum gross beta activity (2,024 dpm/100 cm² at location S004) is well below the DCGL of 9,800 dpm/100 cm².

³ Using the buried pipe dose from LTP Table 6-11, the annual dose is $(566/9800) \times 2.52E-03 = 0.0001$ mrem/yr.

3. A Histogram Plot was also developed based on the direct measurement values. This plot shows that the direct data were essentially a log normal distribution.
4. A Retrospective Power Curve was constructed, based on FSS results. The curve shows that this survey unit having a mean residual activity at a small fraction of the DCGL, has a high probability ("power") of meeting the release criteria. Thus, it can be concluded that the direct measurement data support rejection of the null hypothesis, providing high confidence that the survey unit satisfied the release criteria and that the data quality objectives were met.

G. CHANGES IN INITIAL SURVEY UNIT ASSUMPTIONS ON EXTENT OF RESIDUAL ACTIVITY

The survey was designed as a Class 3 area; the FSS results were consistent with that classification except for one small area of elevated Co-60 activity which was subsequently reclassified. The direct measurement sample standard deviation was less than the design sigma. Thus, a sufficient number of sample measurements were taken.

H. LTP CHANGES SUBSEQUENT TO SURVEY UNIT FSS

The FSS of Survey Unit 2 was designed, performed, and evaluated in the March 2005-May 2005 time frame using the criteria of the LTP Revision 4 (Reference 1). No subsequent LTP changes with potential impact to this survey unit need to be evaluated.

I. CONCLUSION

The FSS of this survey unit was designed based on the LTP designation as a Class 3 area. The survey design parameters are presented in Table 1. The required number of direct measurements was determined for the Sign Test in accordance with the LTP. As presented in Table 2, all direct measurements were less than the DCGL of 9,800 dpm/100 cm².

A Sign Test Summary analysis demonstrated that the Sign Test criteria were satisfied. The direct measurement sigma was determined to be less than that used for design, thus indicating that a sufficient number of samples was taken.

The Retrospective Power Curve shown in Attachment 4 confirmed that sufficient samples were taken to support rejection of the null hypothesis, providing high confidence that the survey unit satisfied the release criteria and the data quality objectives were met. Attachment 4 also revealed that direct measurement data represented essentially a log-normal distribution, with variance consistent with expectations for a Class 3 survey unit.

The scan survey design for this survey unit was developed in accordance with the LTP with significant aspects of the design discussed in Section B and Table 1. ISOCs scans performed at a height of 1 meter in a systematic grid pattern throughout the survey unit using investigation criteria of 50% of the DCGL or positive detection of Co-60 identified only one scan location (SC09) requiring investigation. Refer to Section D for discussion of the resulting investigation performed for scan location SC09 (Co-60 above MDA) and the subsequent reclassification.

It is concluded that FR2900 Survey Unit 2 meets the release criteria of 10CFR20.1402 and the State of Maine enhanced criteria.

J. REFERENCES

1. Maine Yankee License Termination Plan, Revision 4, February 28, 2005
2. Form 11 of Maine Yankee Procedure PMP 6.7.4, FSS Survey Unit and Release Record Reconciliation Form for FR 1800 Survey Units 1 and 2, completed 4/27/04
3. Maine Yankee Calculation No. EC-003-04, Use of Canberra In Situ Object Counting System (ISOCS) for FSS Surveys

Attachment 1
Survey Unit Maps

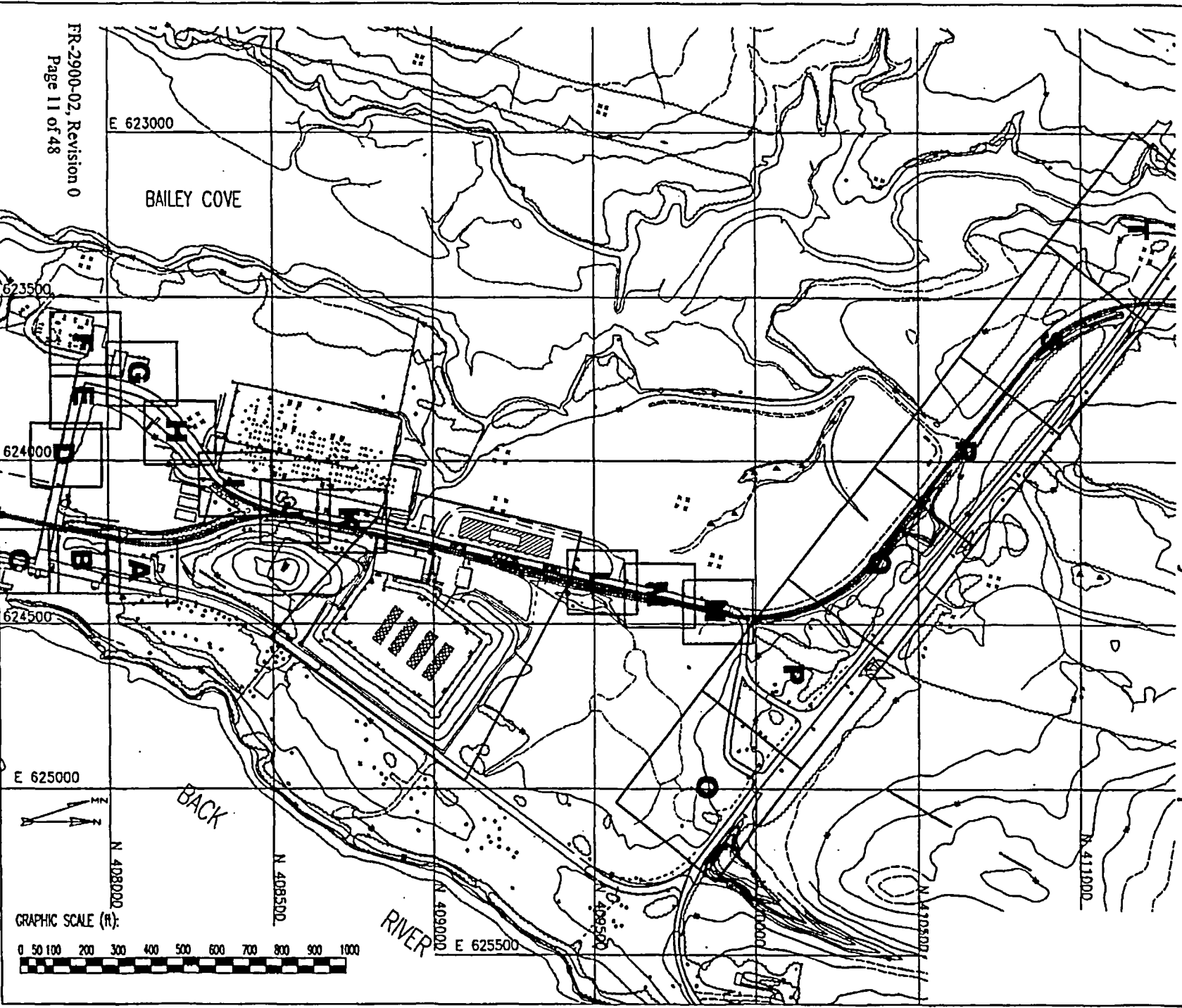
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Maine Yankee Decommissioning Project Survey Form

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Date: 3/28/05

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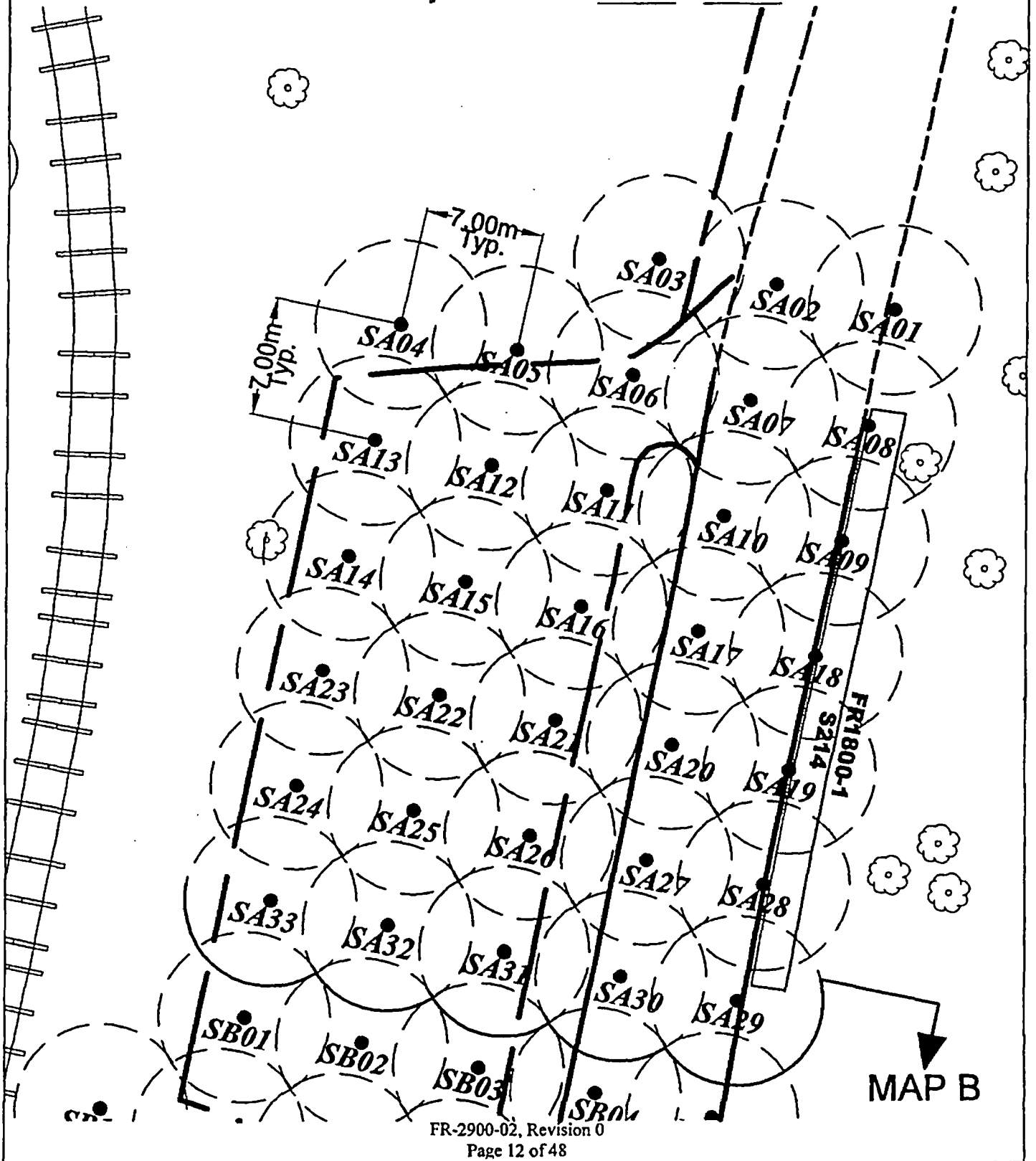
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FR-2900-02, Revision 0
Page 11 of 48

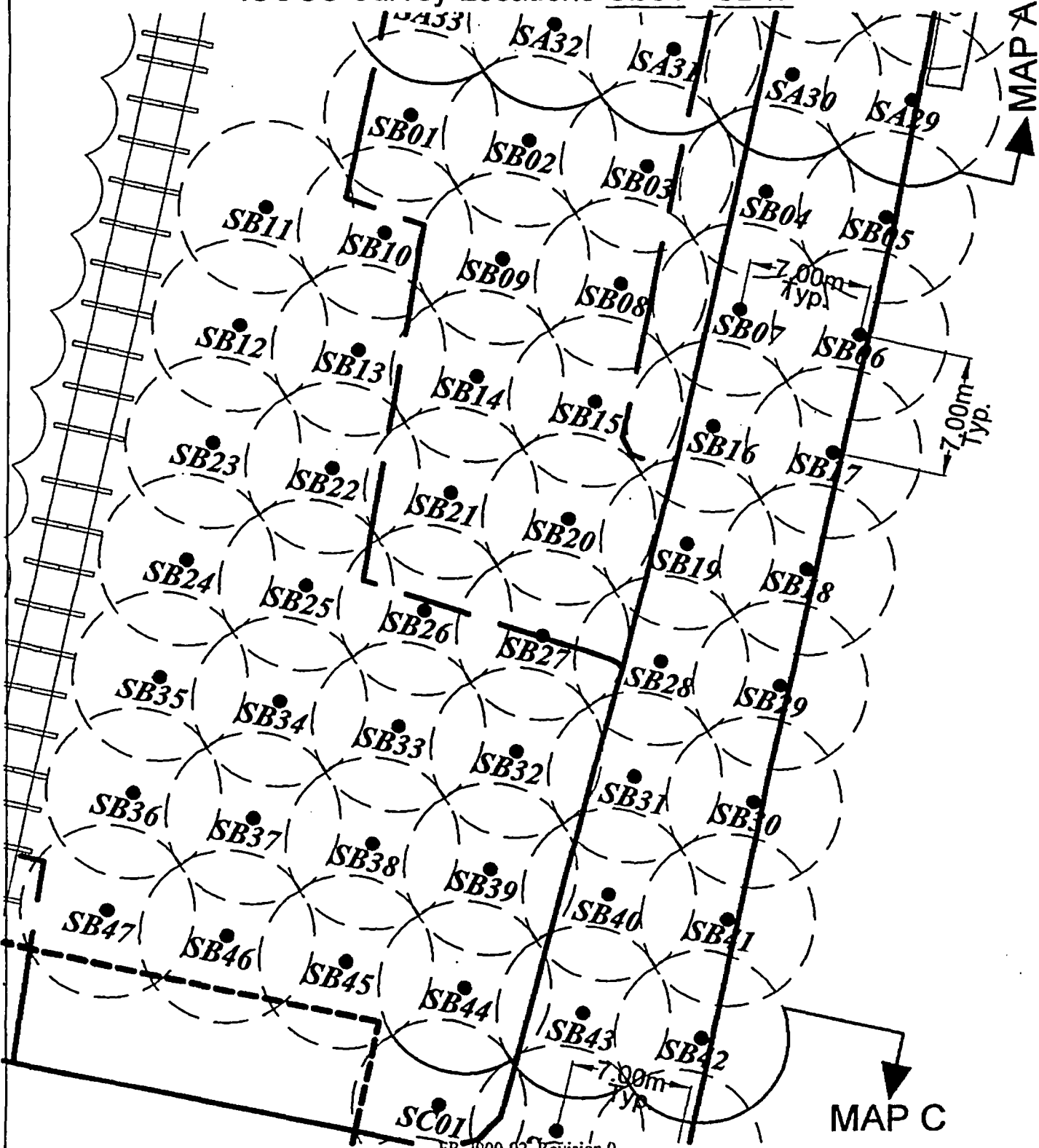
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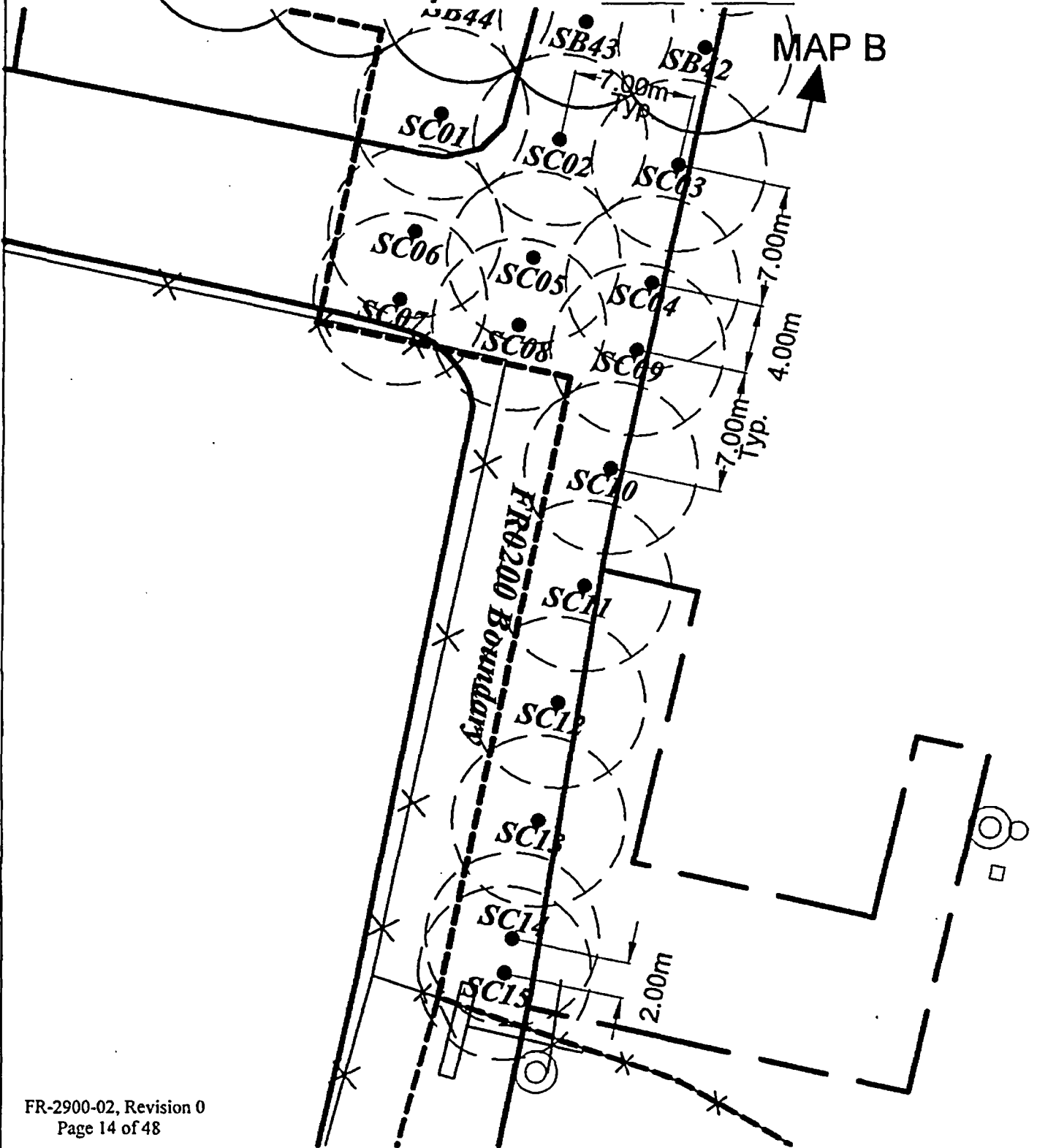
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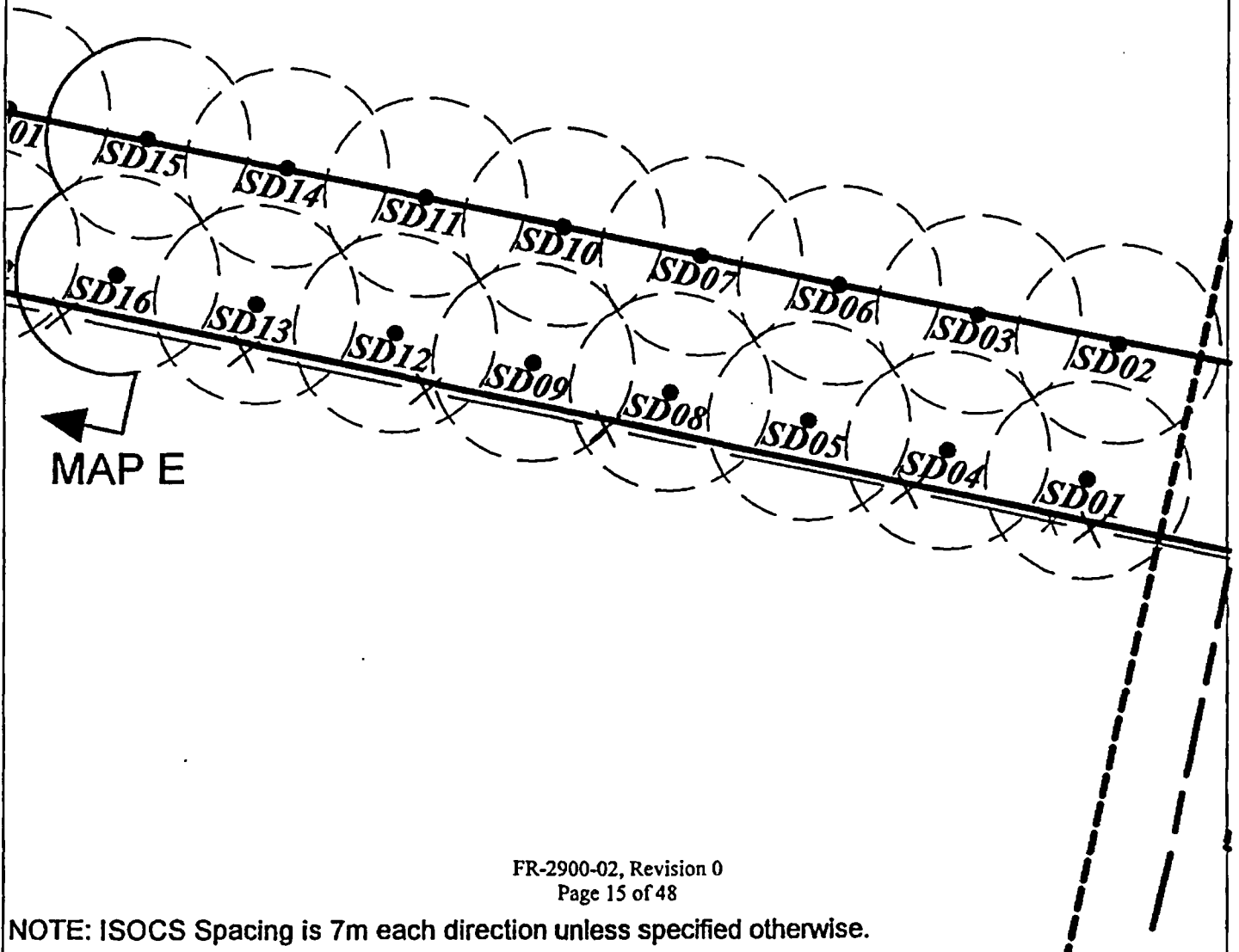
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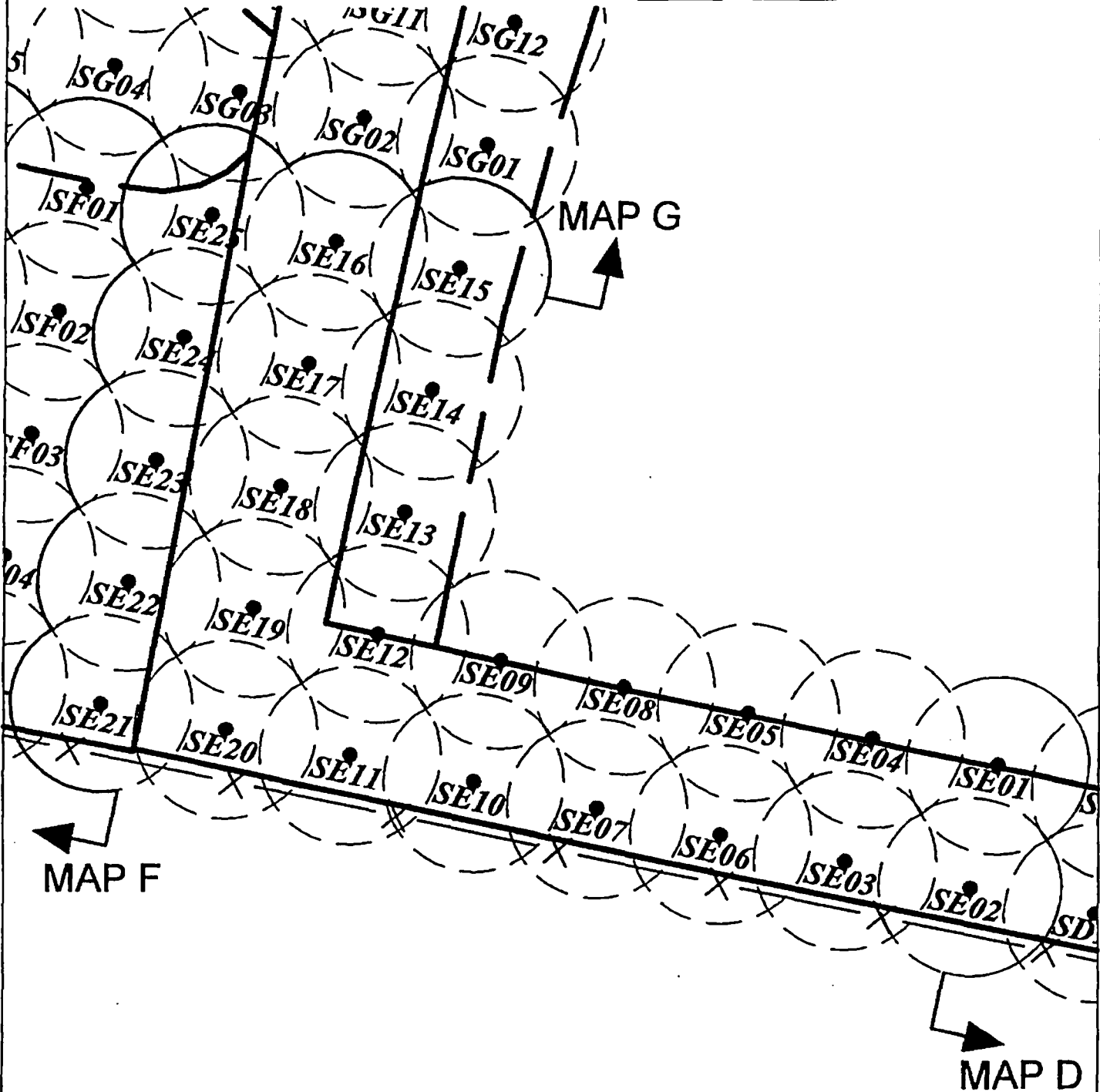
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NOTE: ISOCS Spacing is 7m each direction unless specified otherwise.

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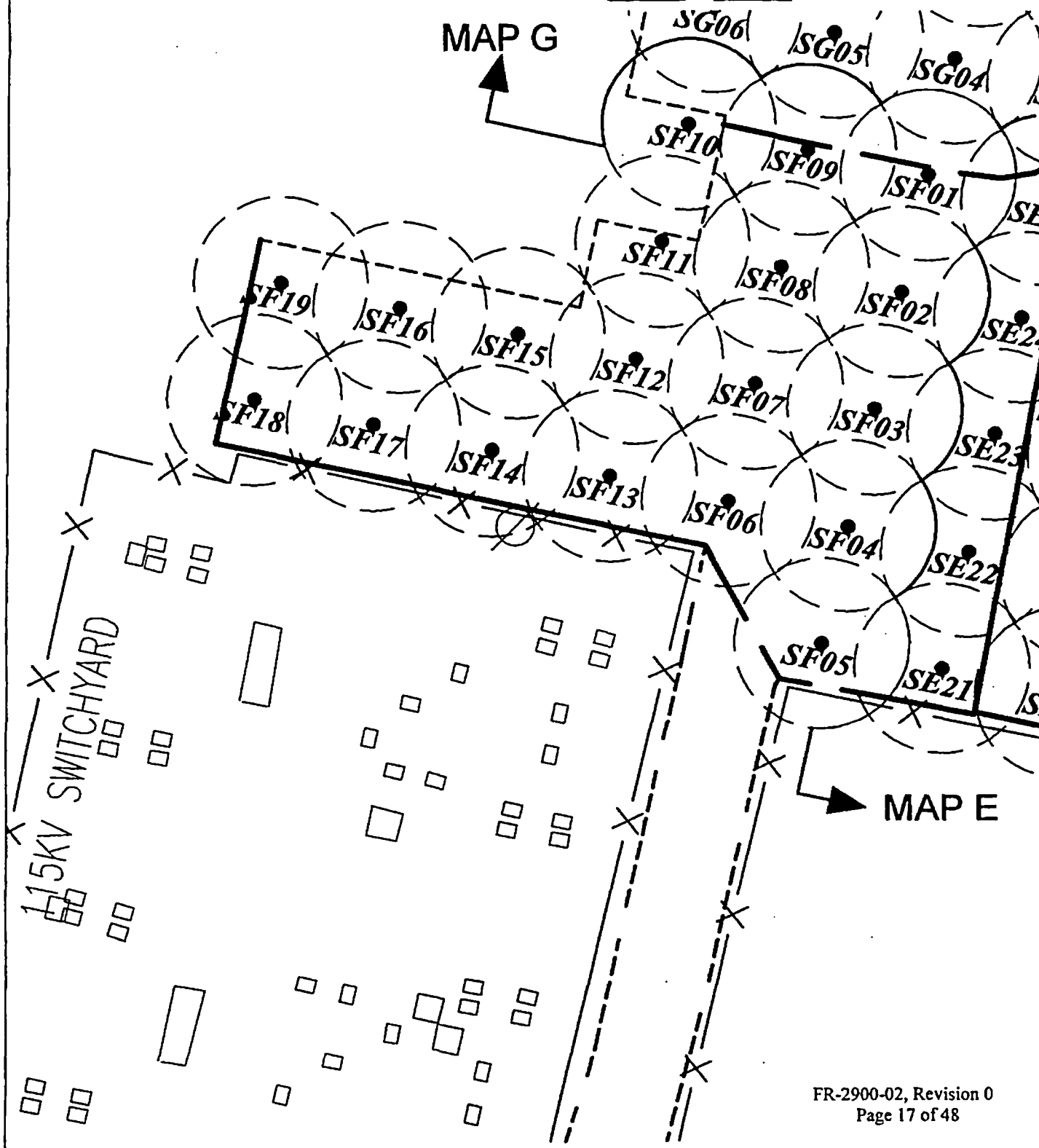
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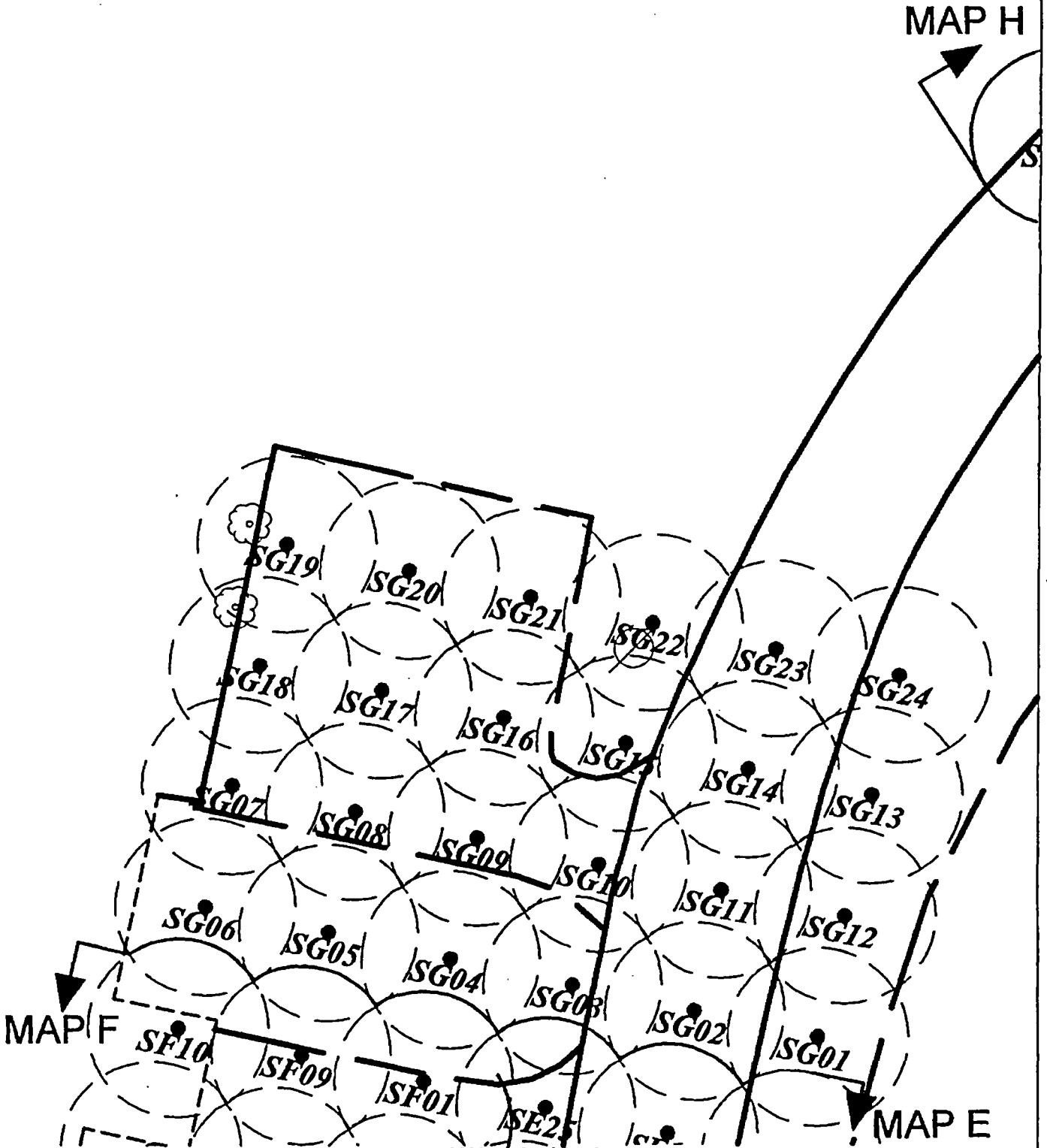
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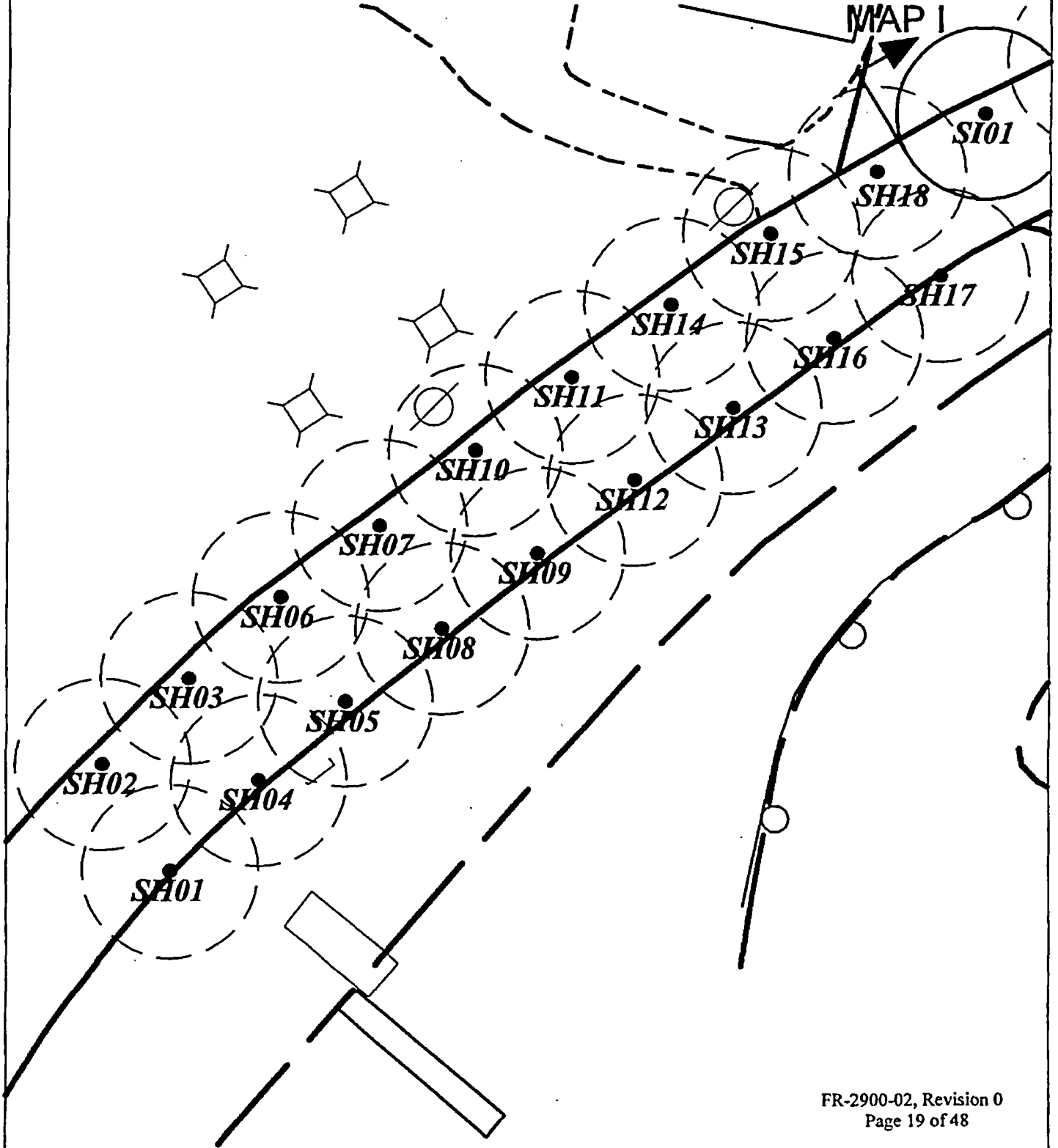
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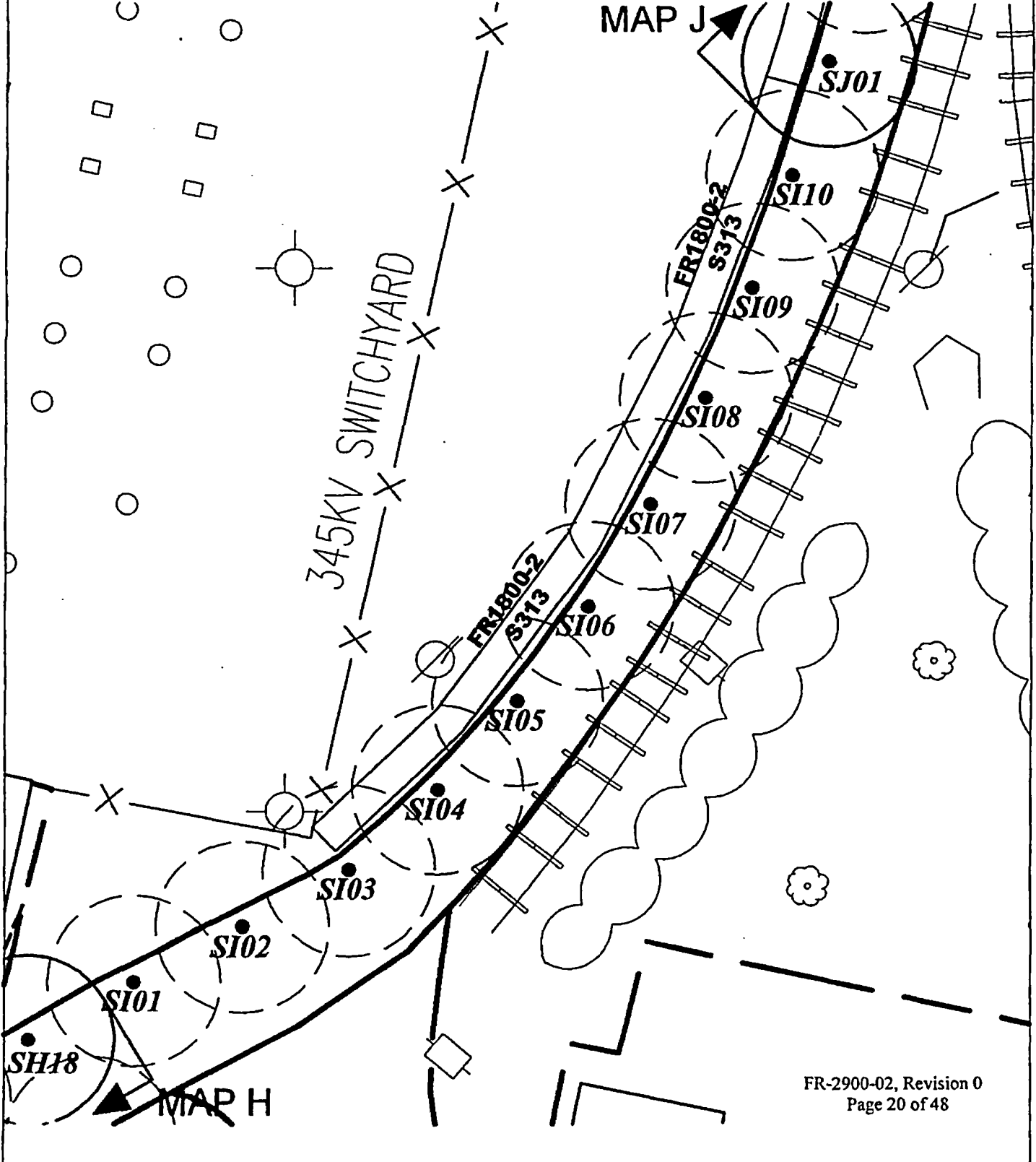
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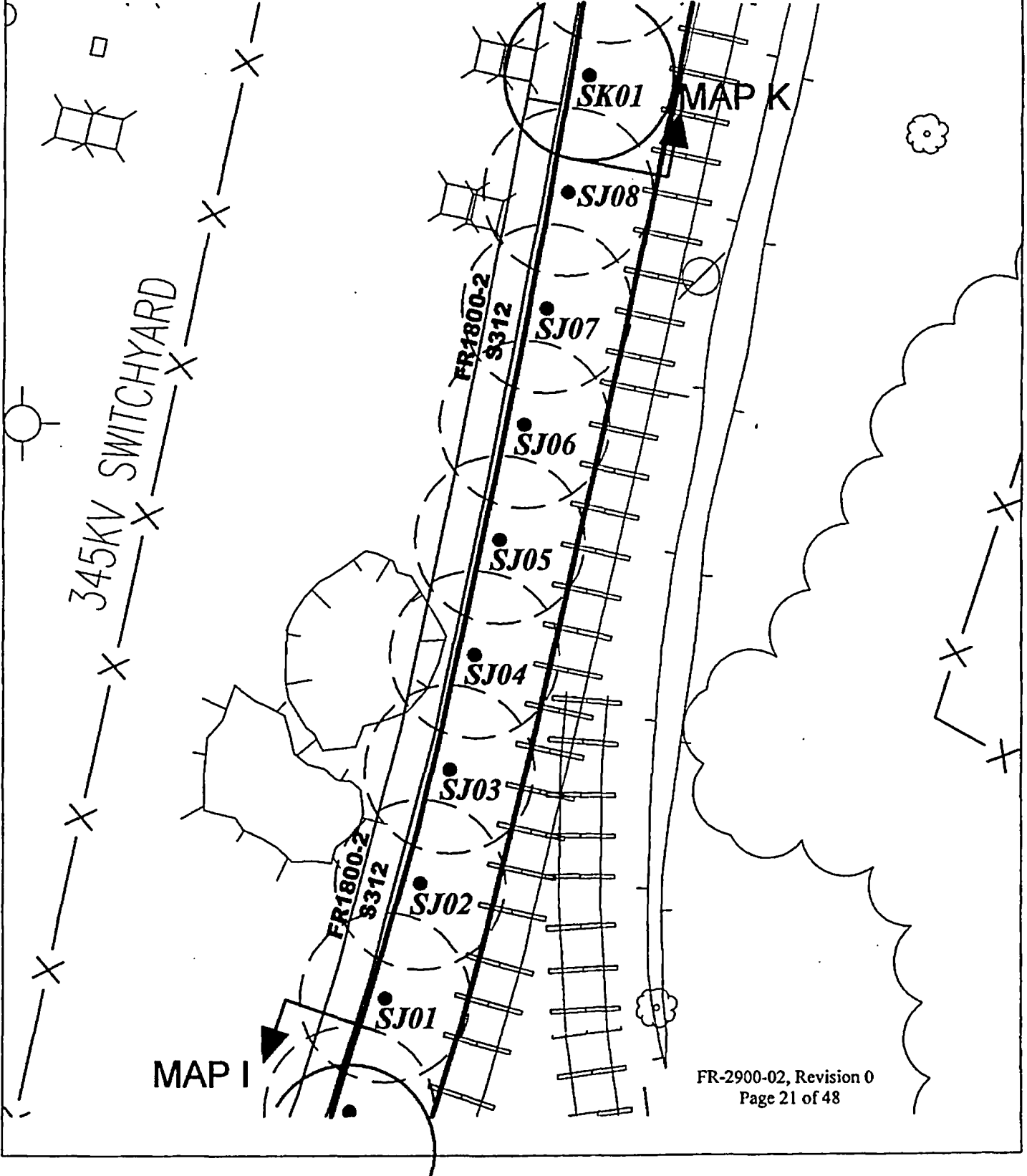
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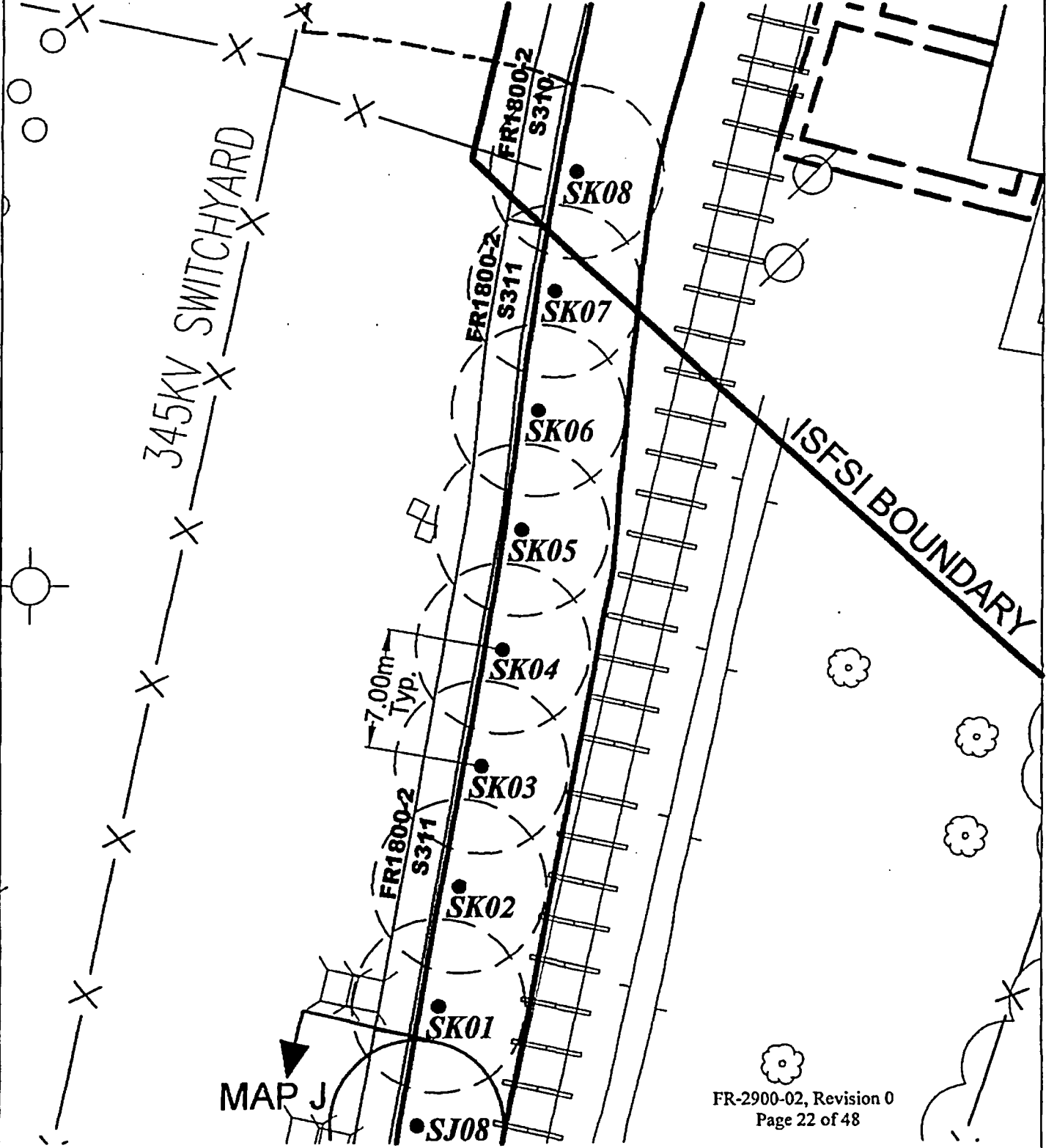
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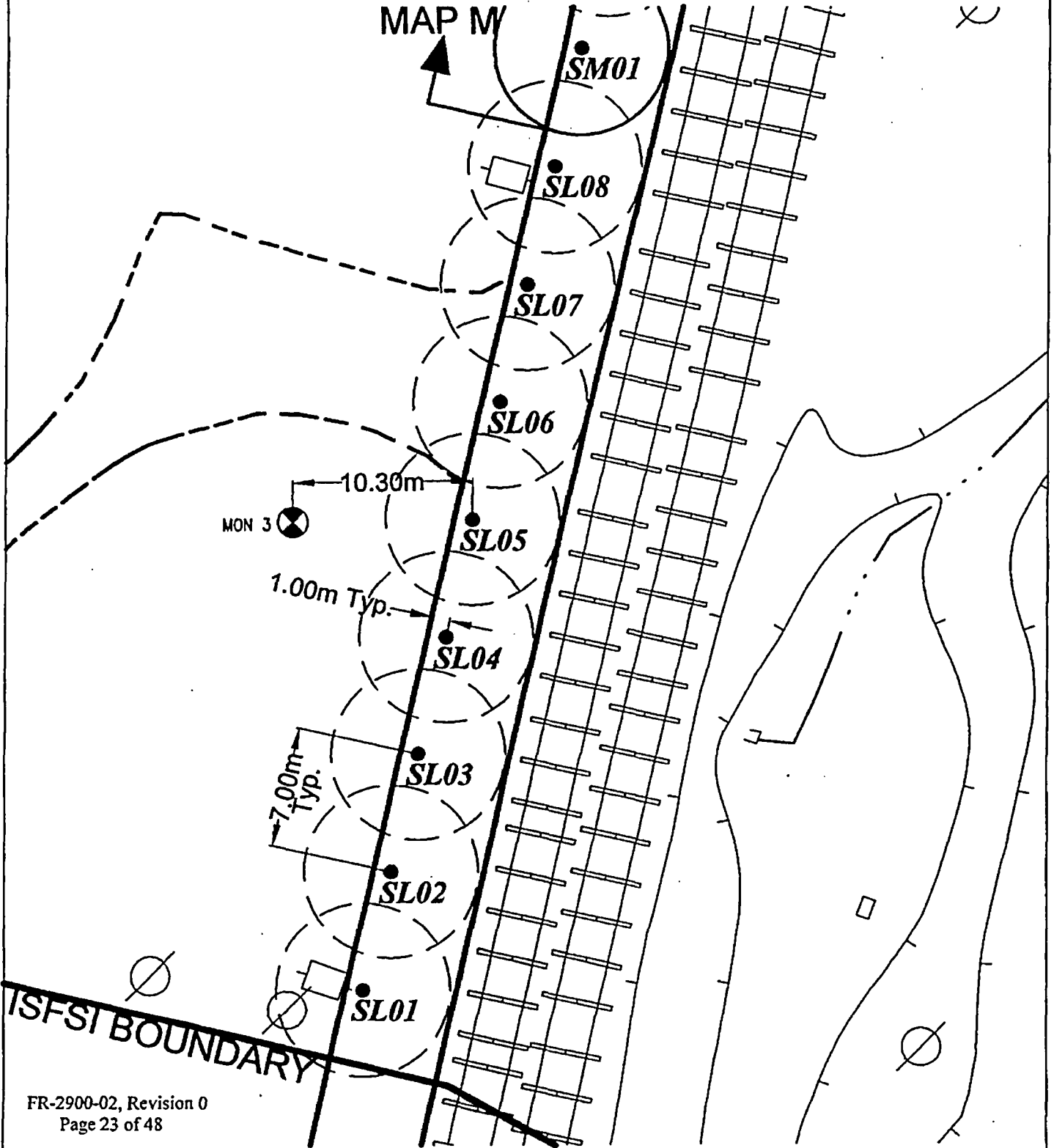
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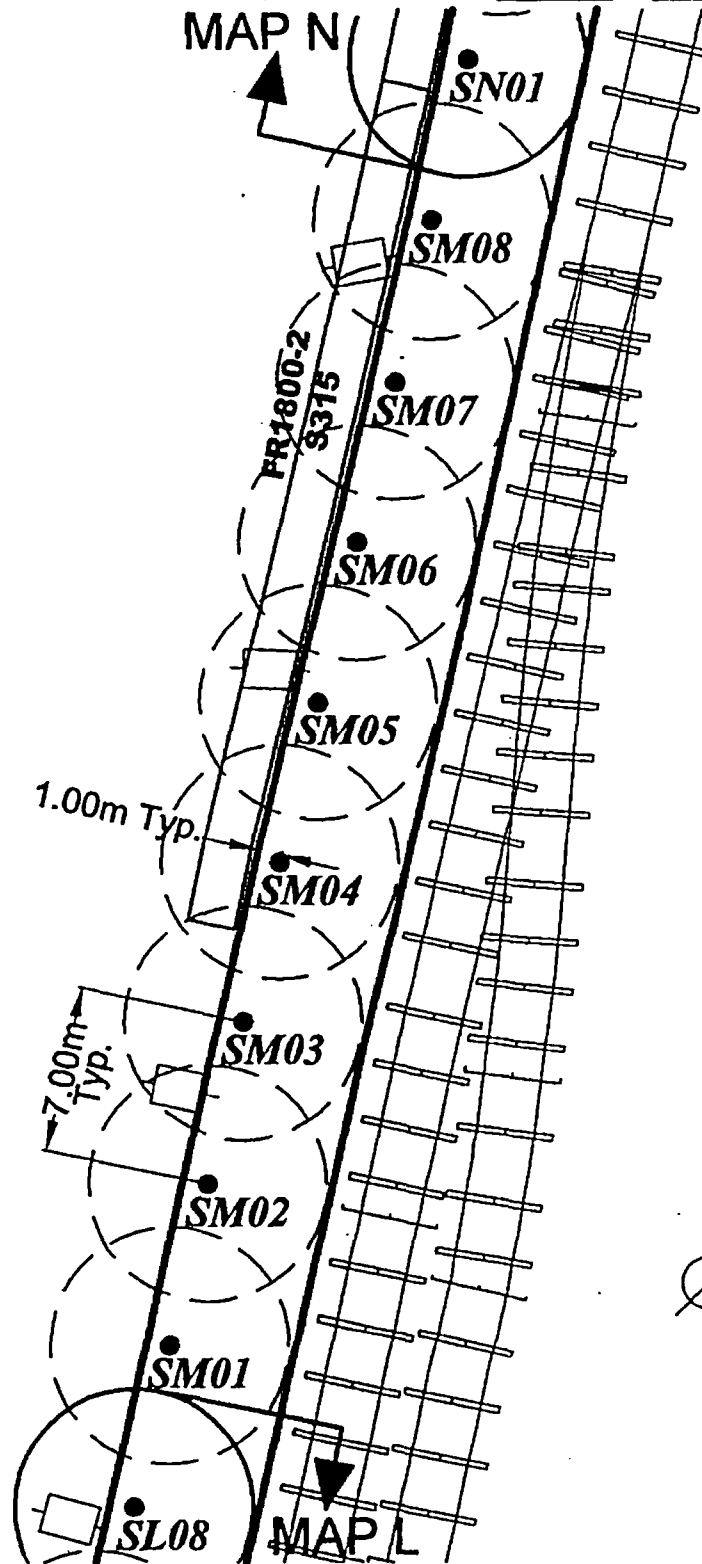
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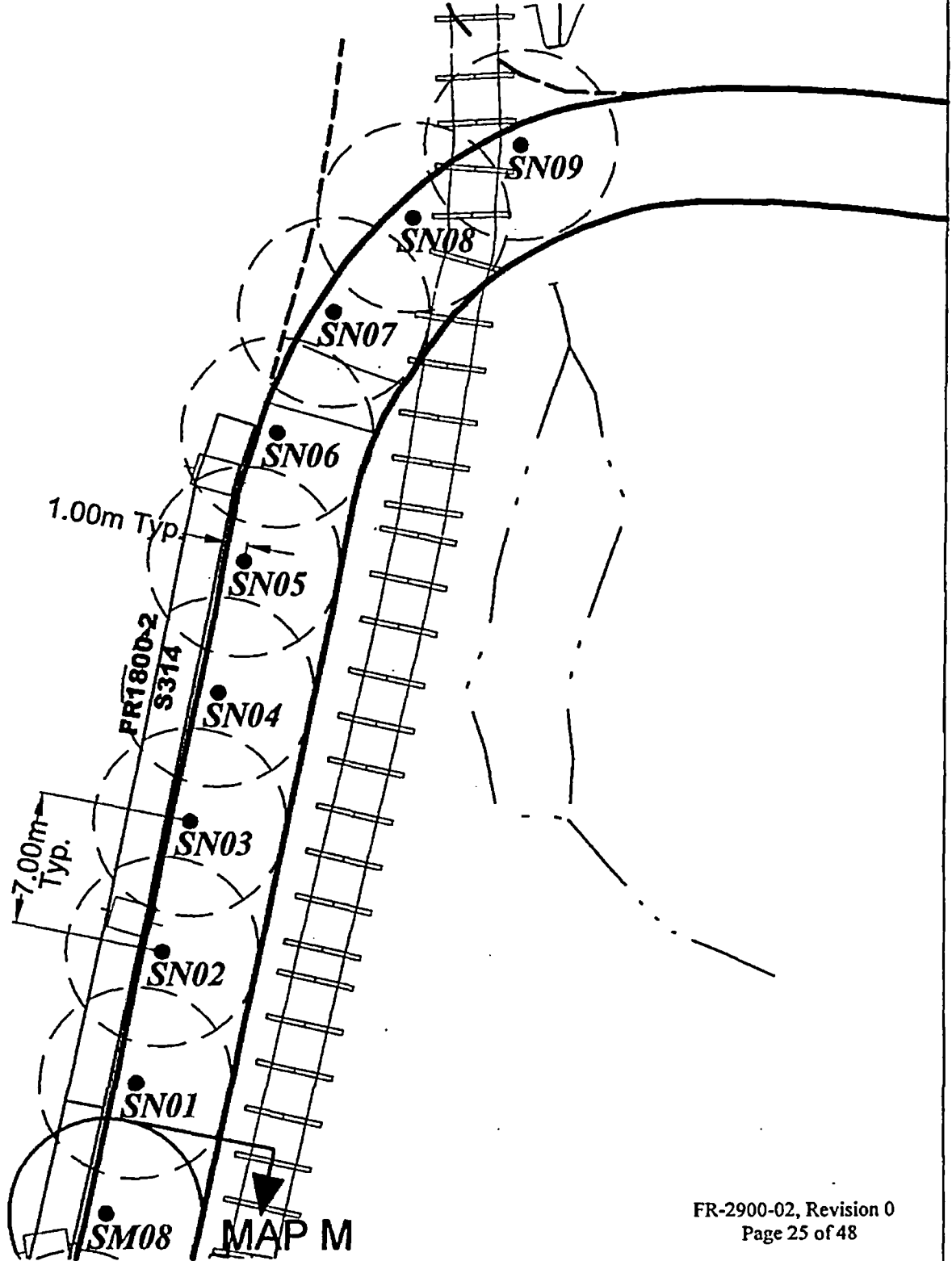
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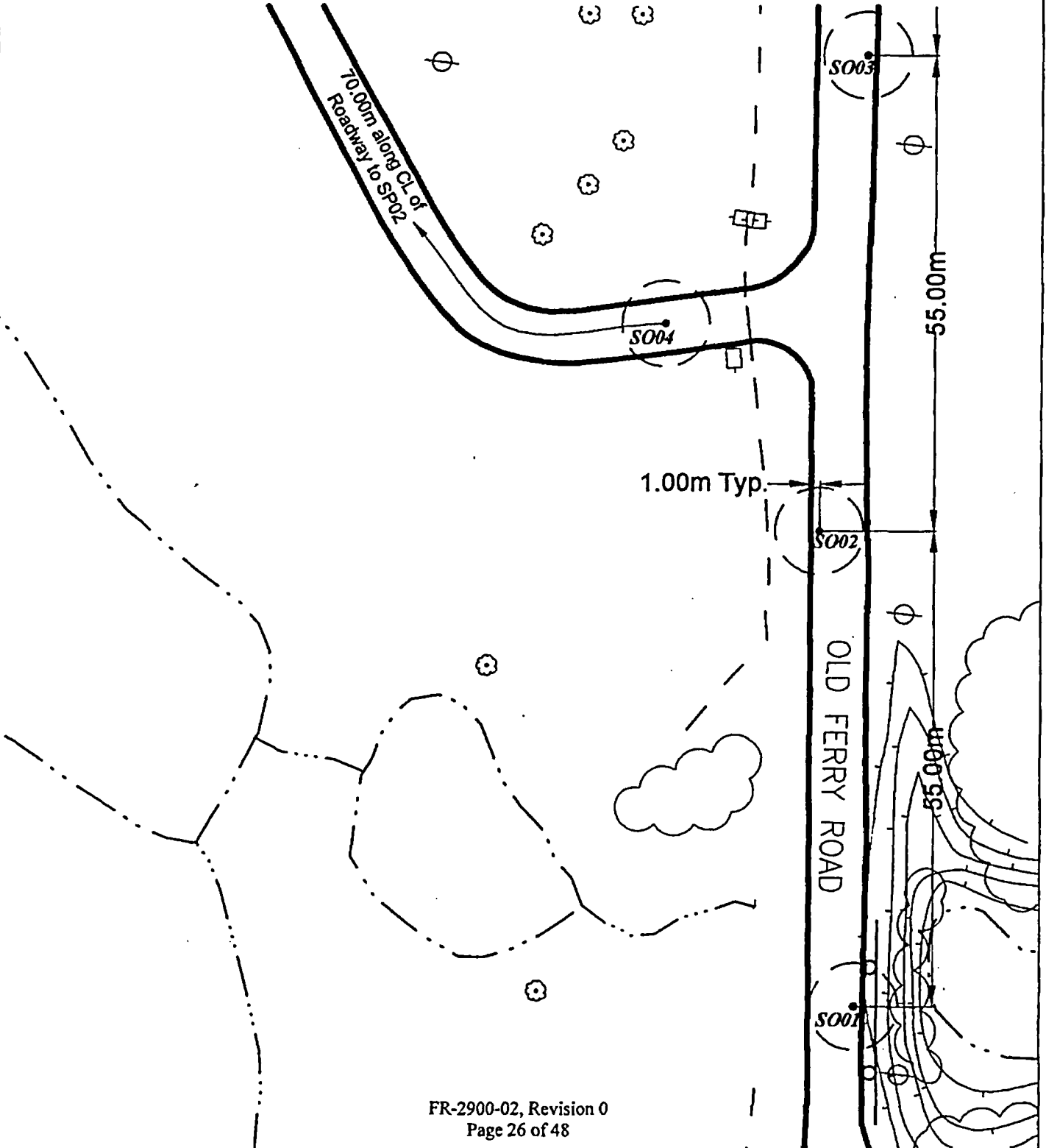
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Final Status Survey: FR2900 SU2 Map N ISOCS Survey Locations SN01 - SN09



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Final Status Survey: FR2900 SU2 Map O ISOCS Survey Locations S001 - S004



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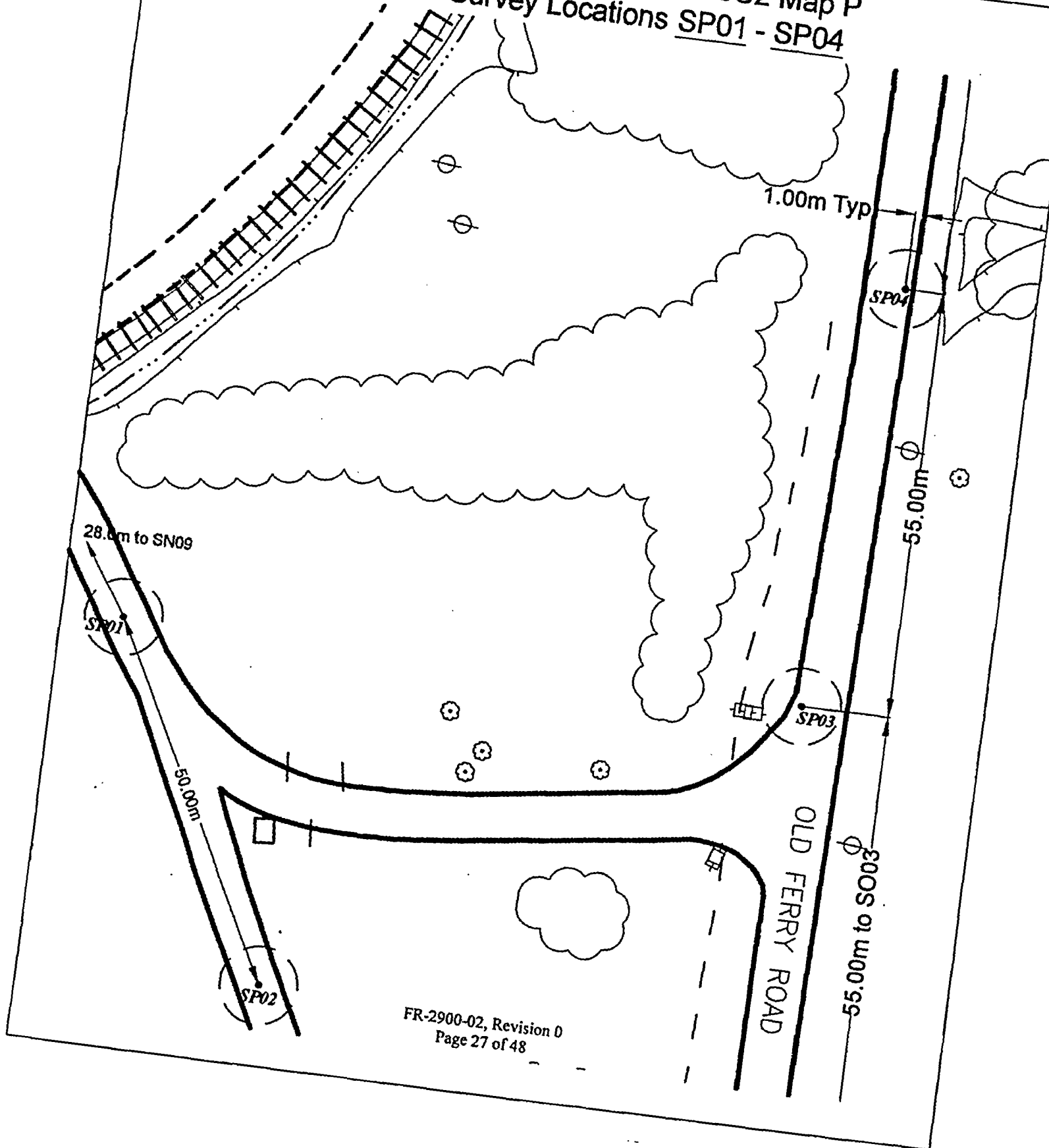
Maine Yankee Decommissioning Project Survey Form

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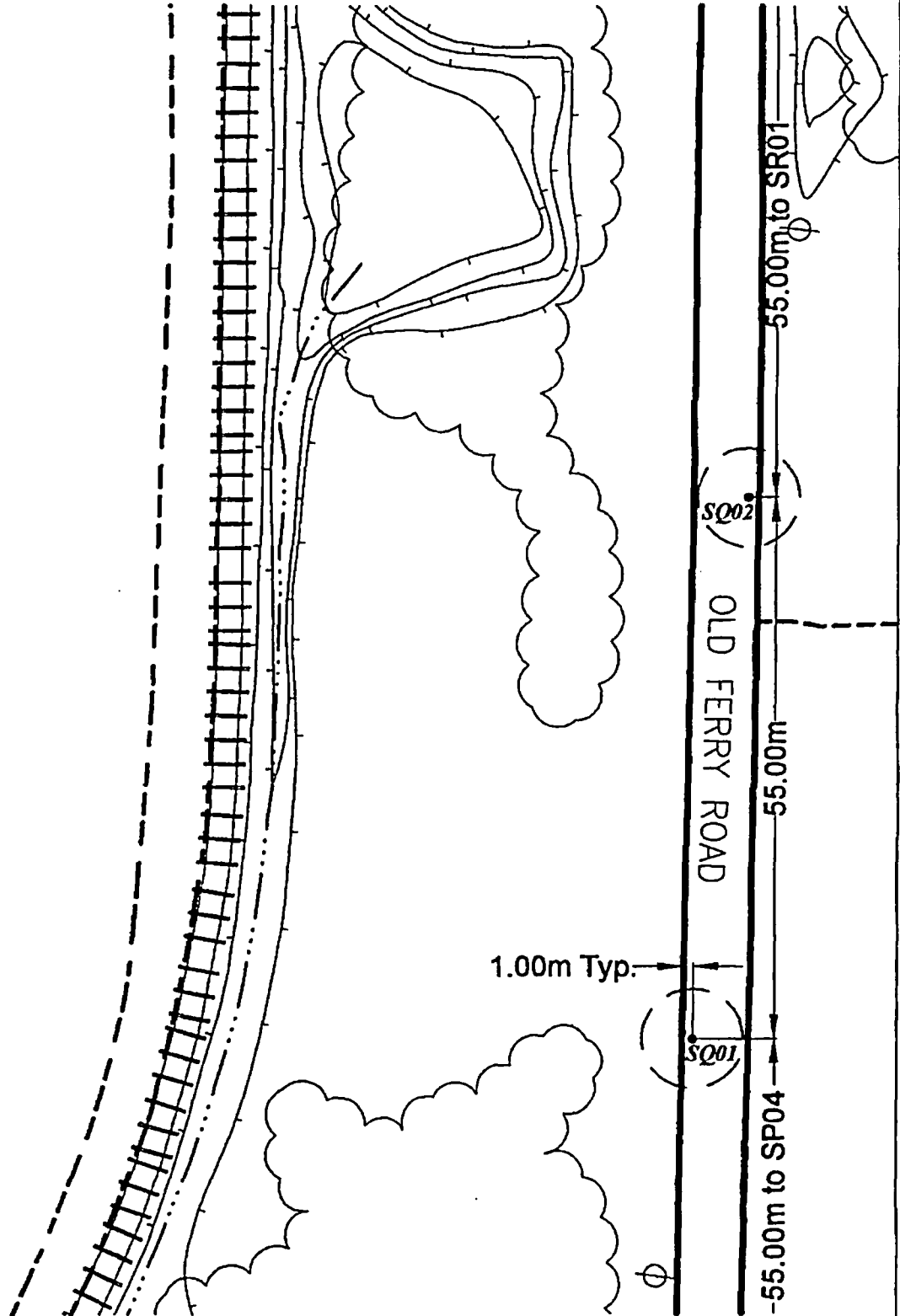
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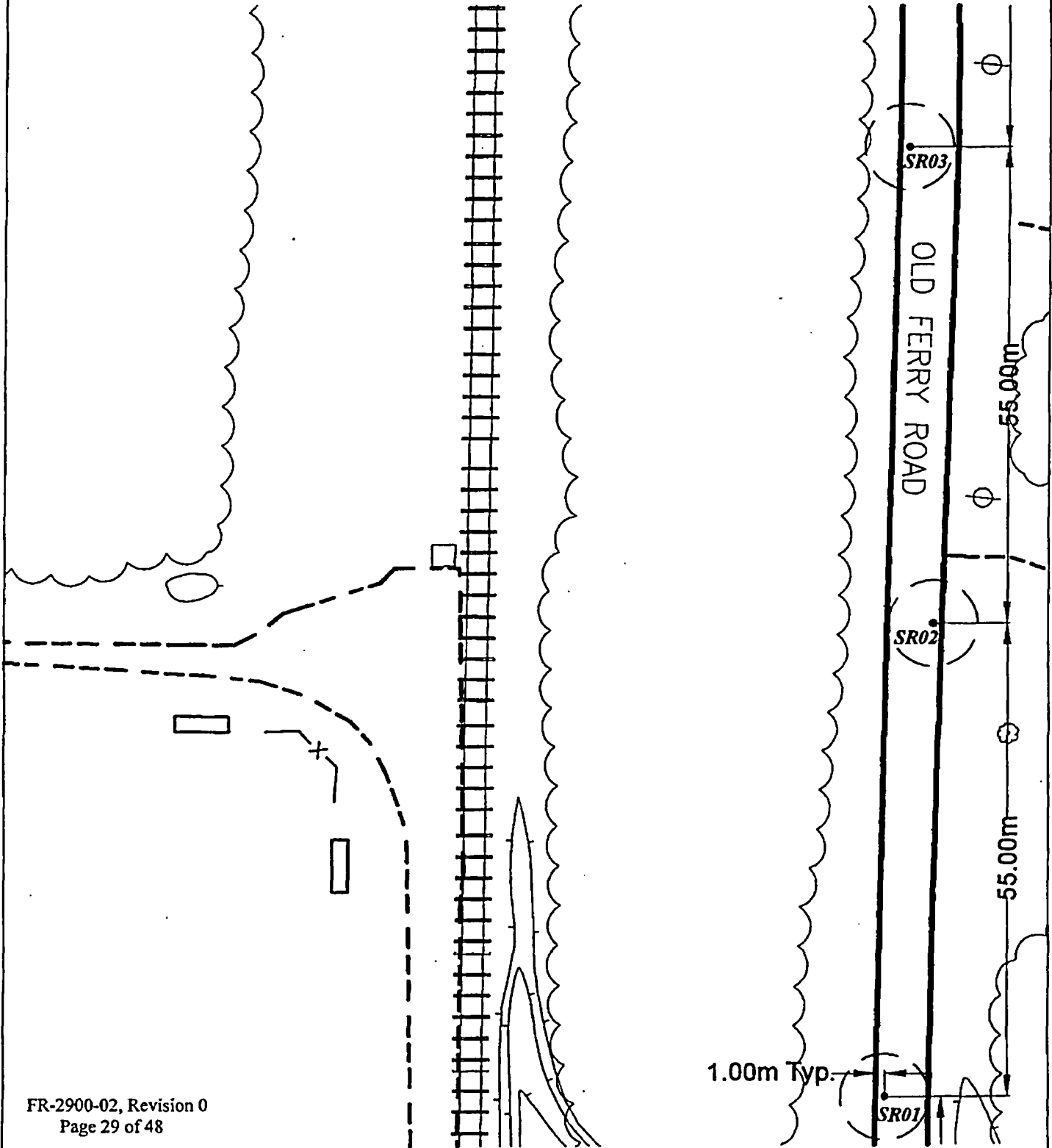
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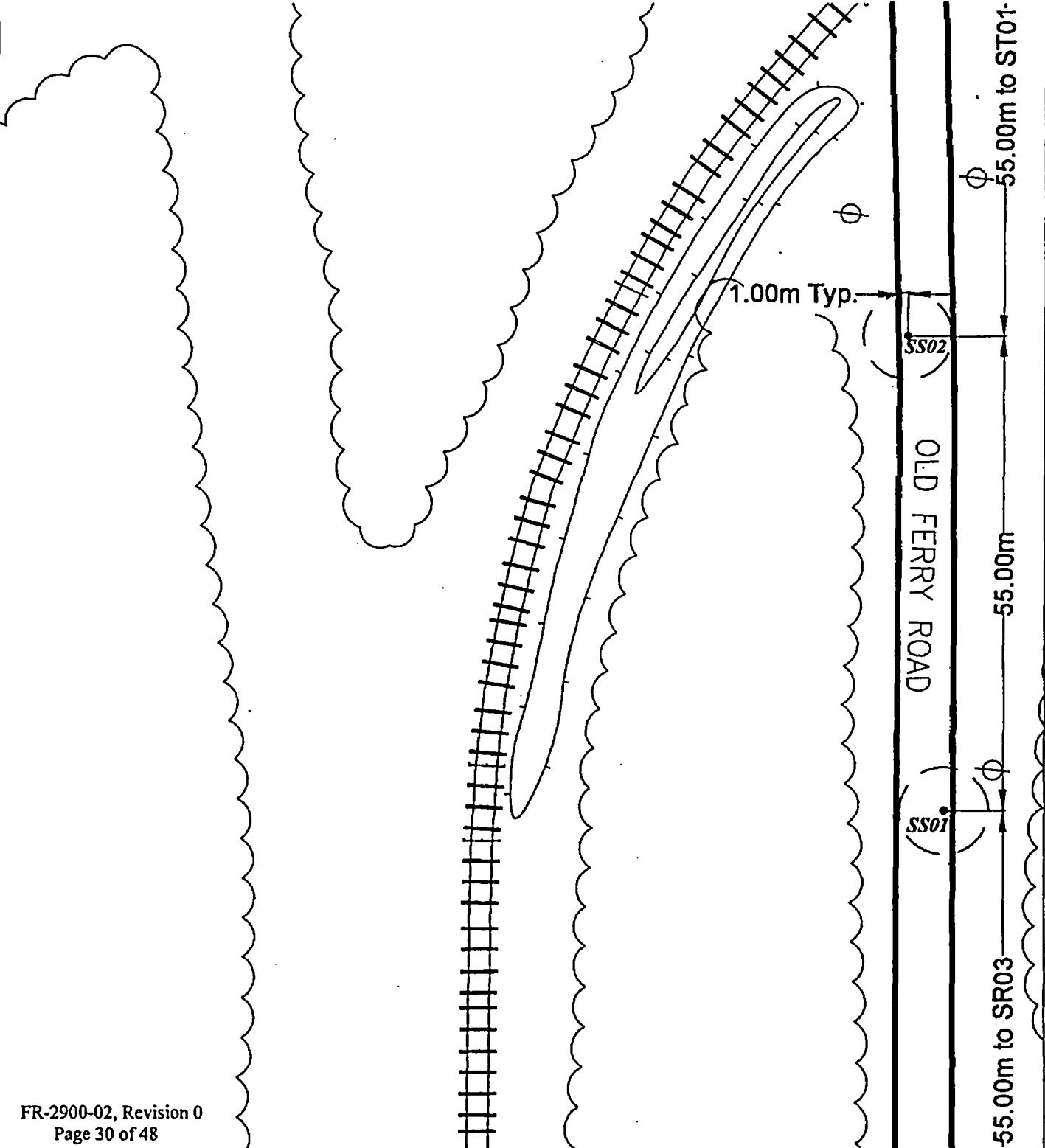
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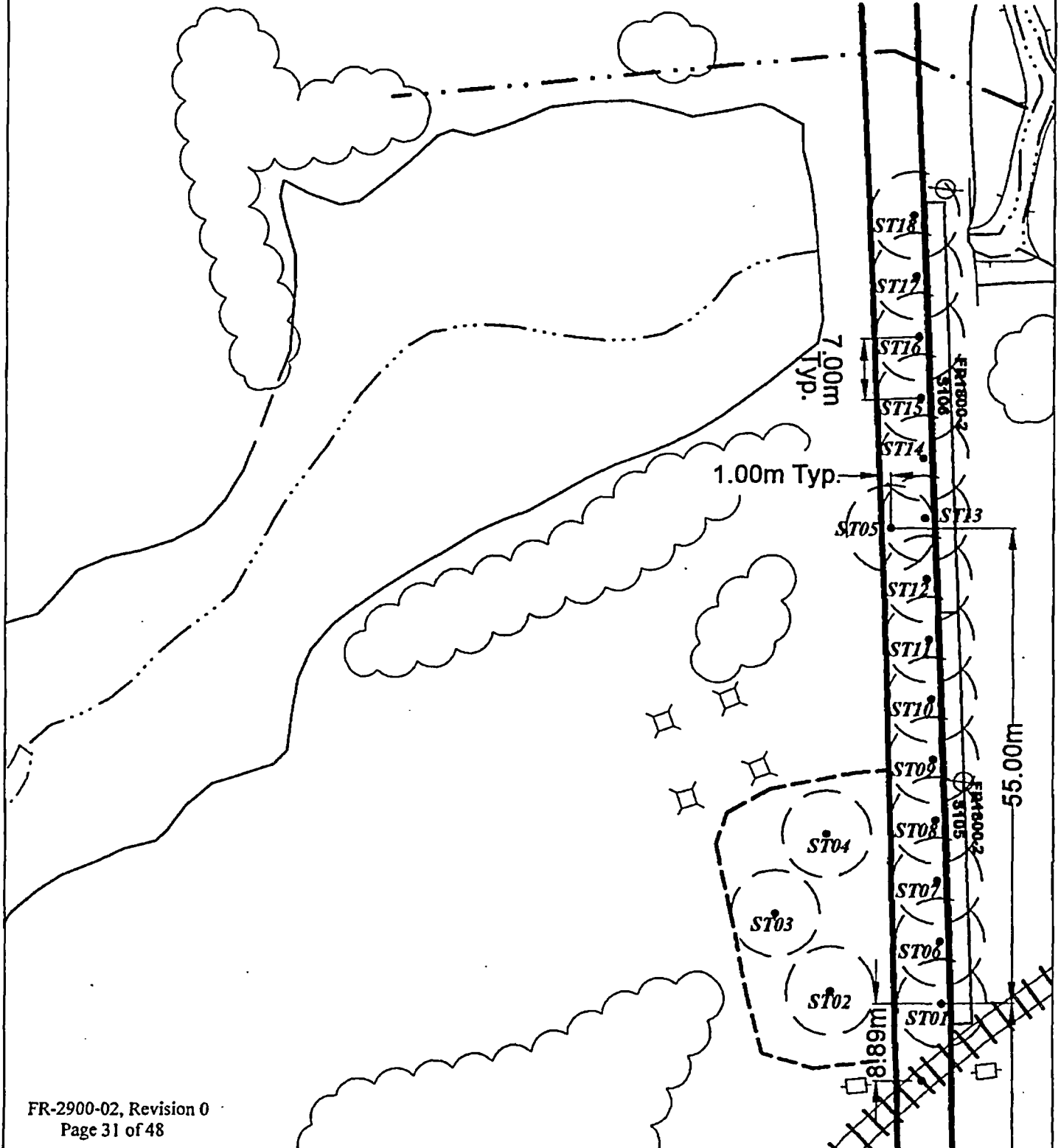
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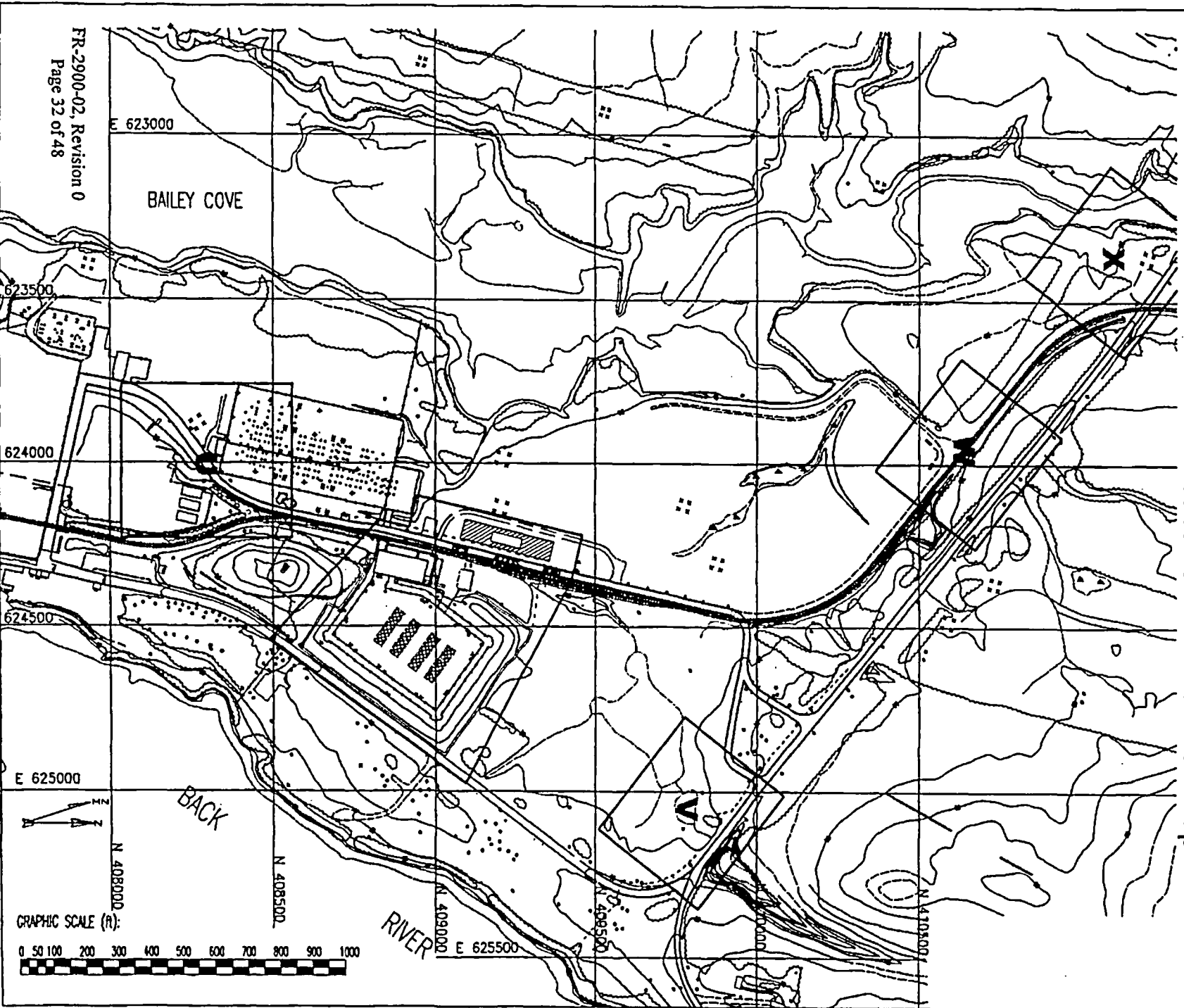
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Maine Yankee Decommissioning Project Survey Form

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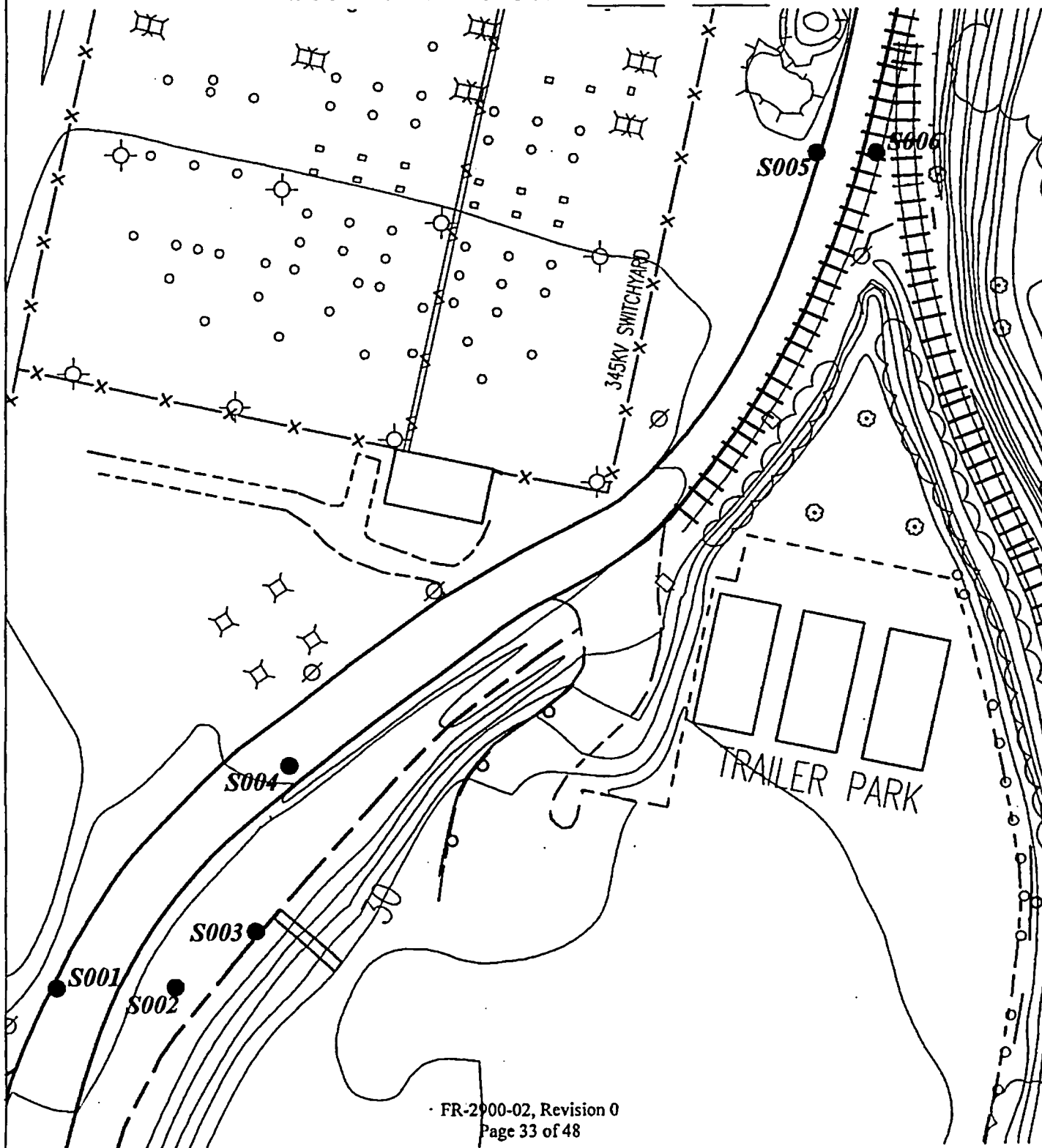
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FR-2900-02, Revision 0
Page 32 of 48

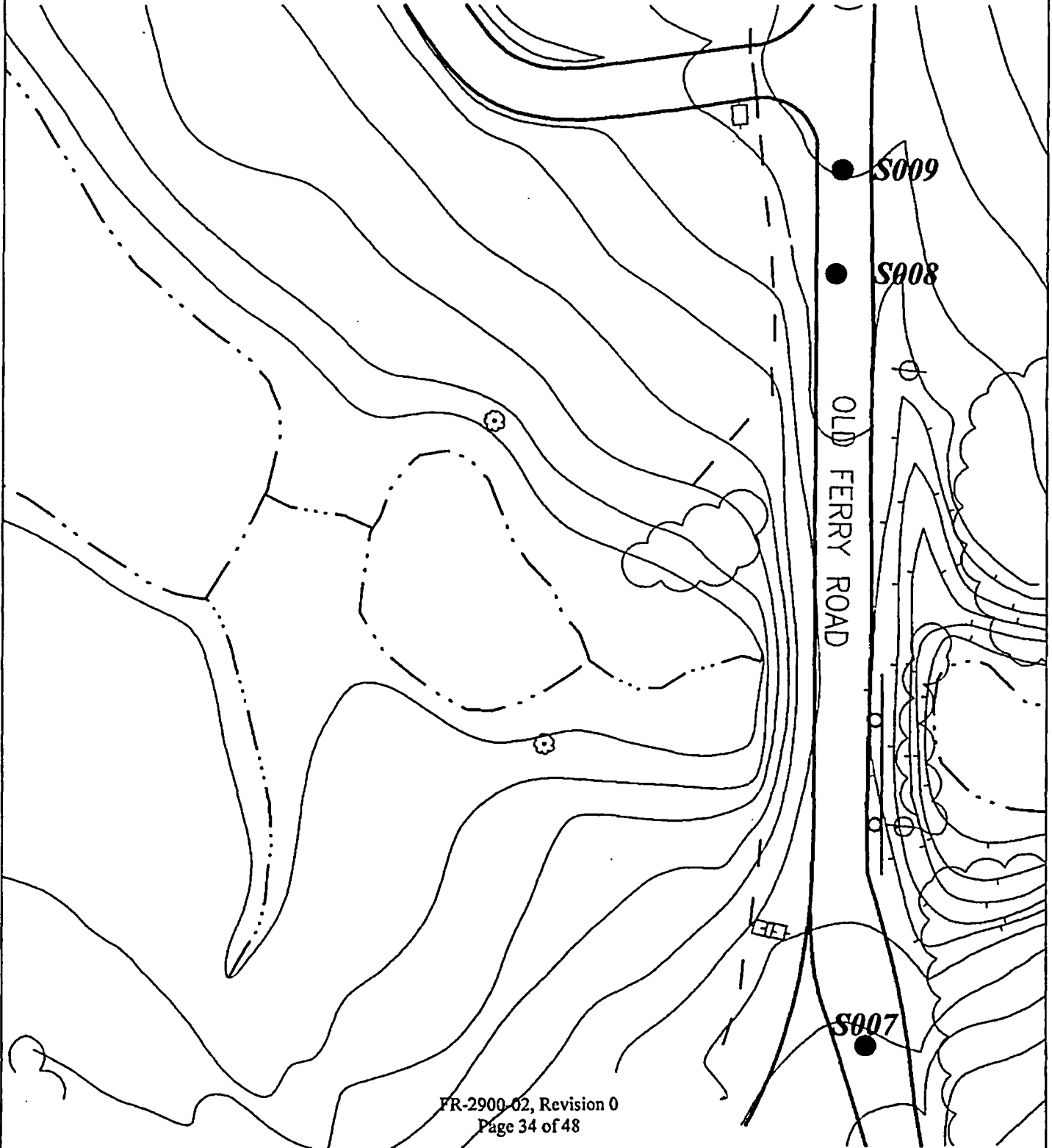
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Final Status Survey: FR2900 SU2 Map U Direct Point Locations S001 - S006



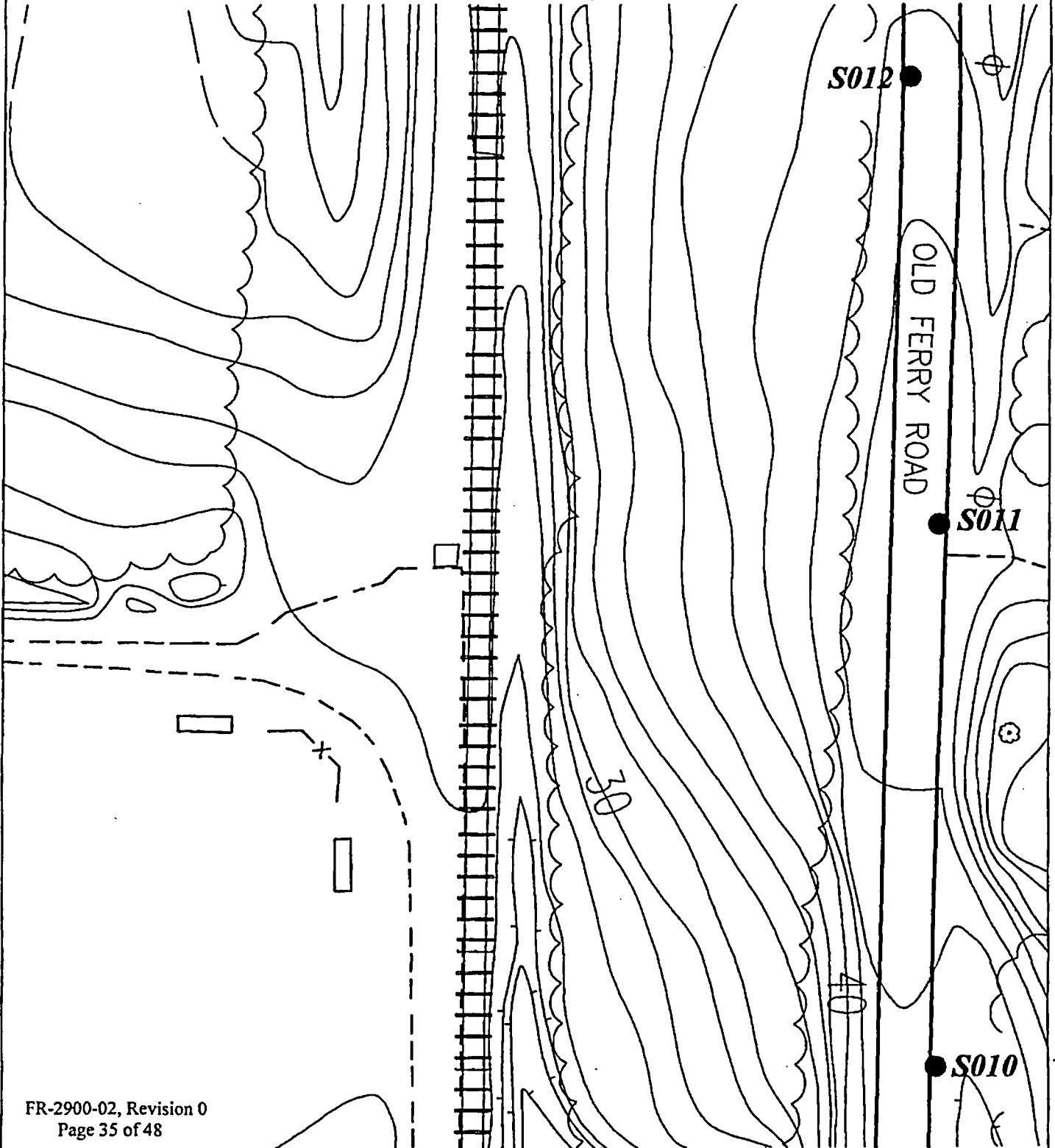
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Final Status Survey: FR2900 SU2 Map V
Direct Point Locations S007 - S009



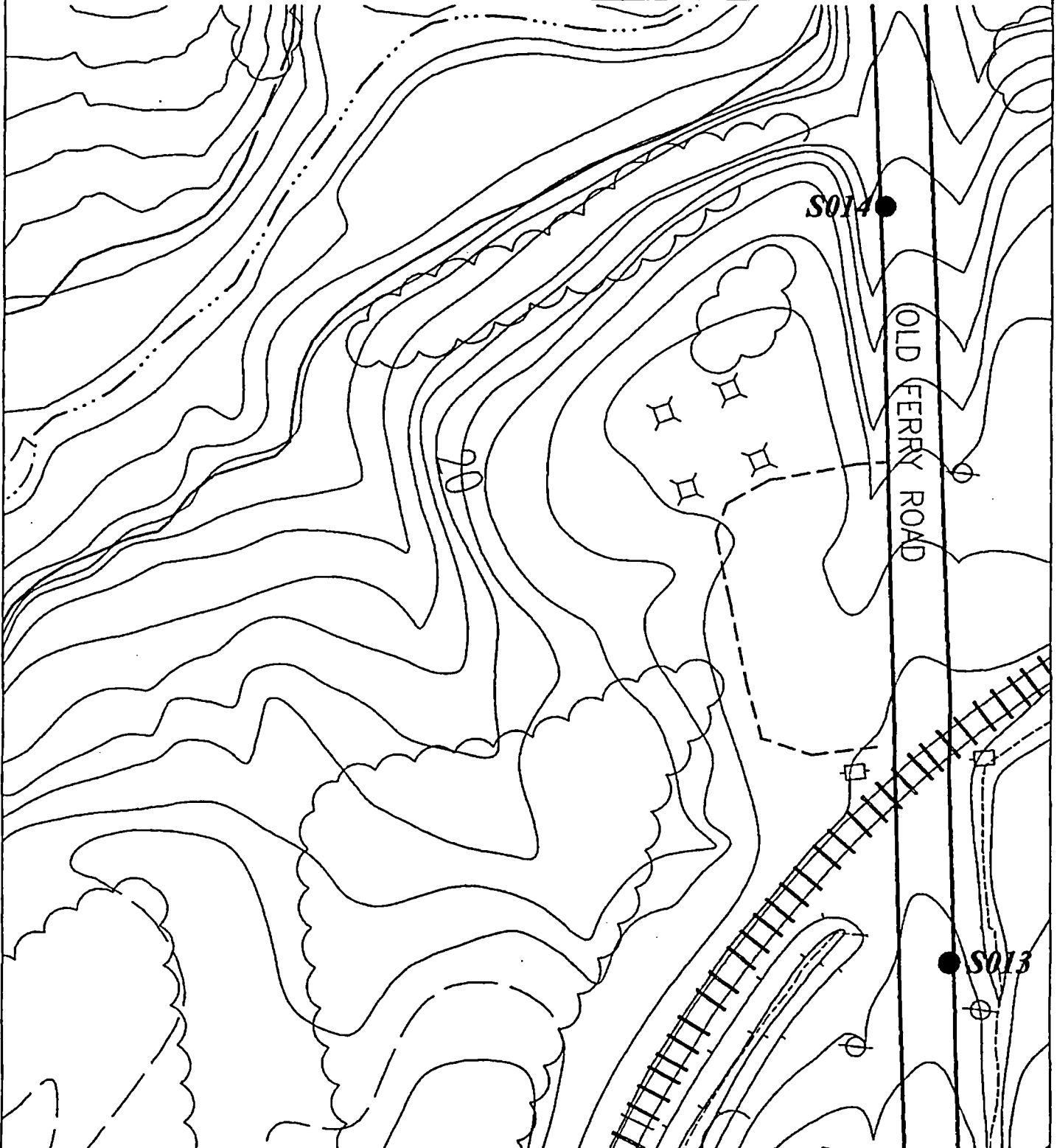
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Final Status Survey: FR2900 SU2 Map W
Direct Point Locations S010 - S012



Survey Type: Characterization Turnover Final Status Survey | Survey Area Name: Roads and Rails

Final Status Survey: FR2900 SU2 Map X
Direct Point Locations S013 - S014



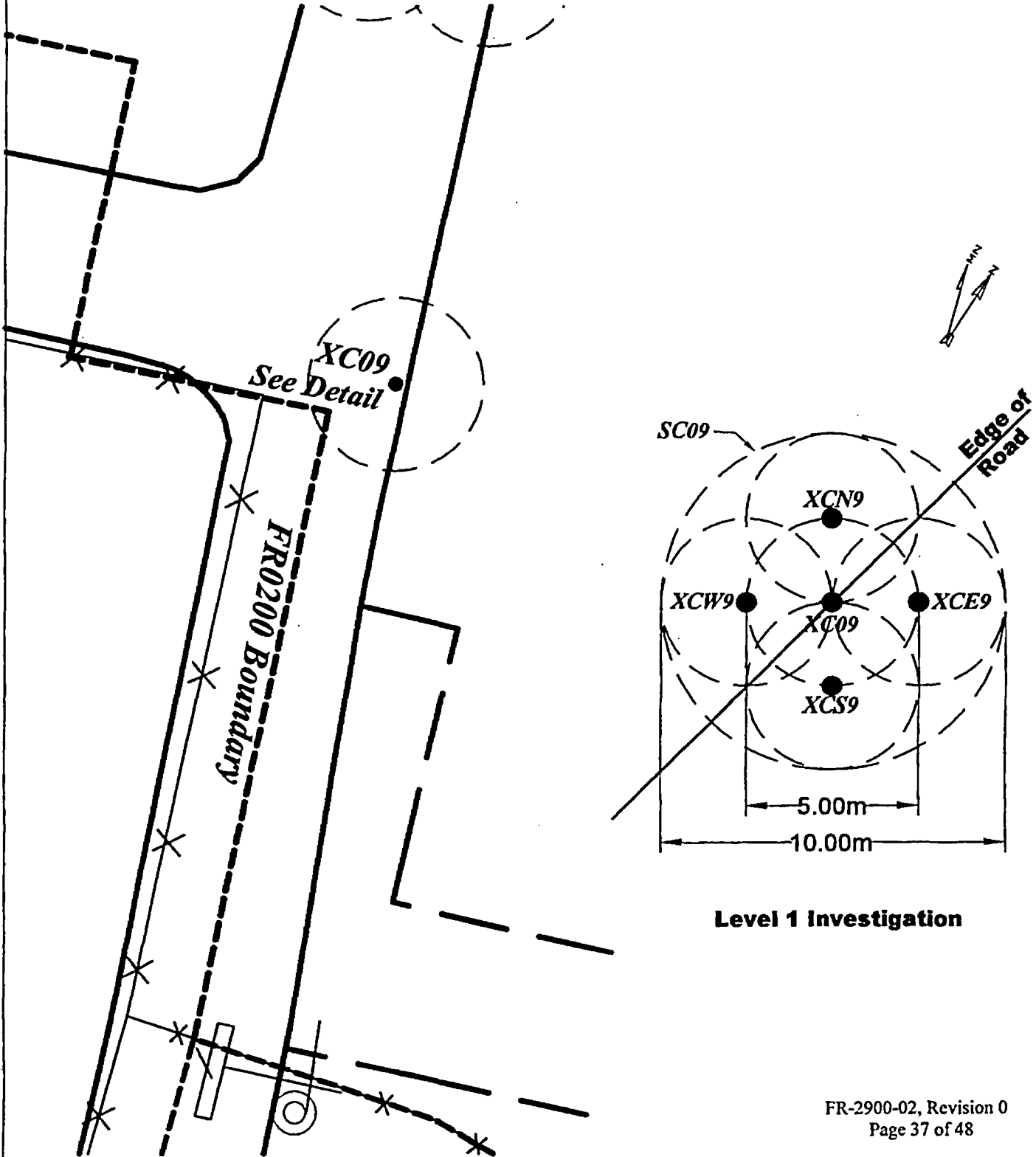
Survey Type: Investigation

Turnover

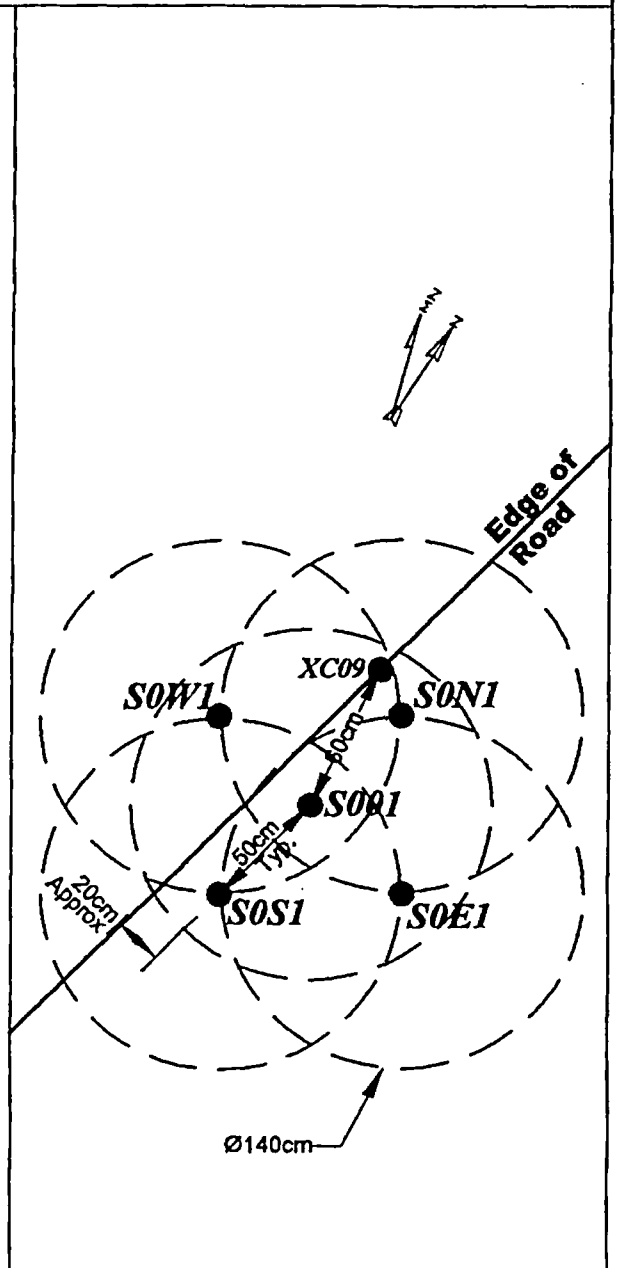
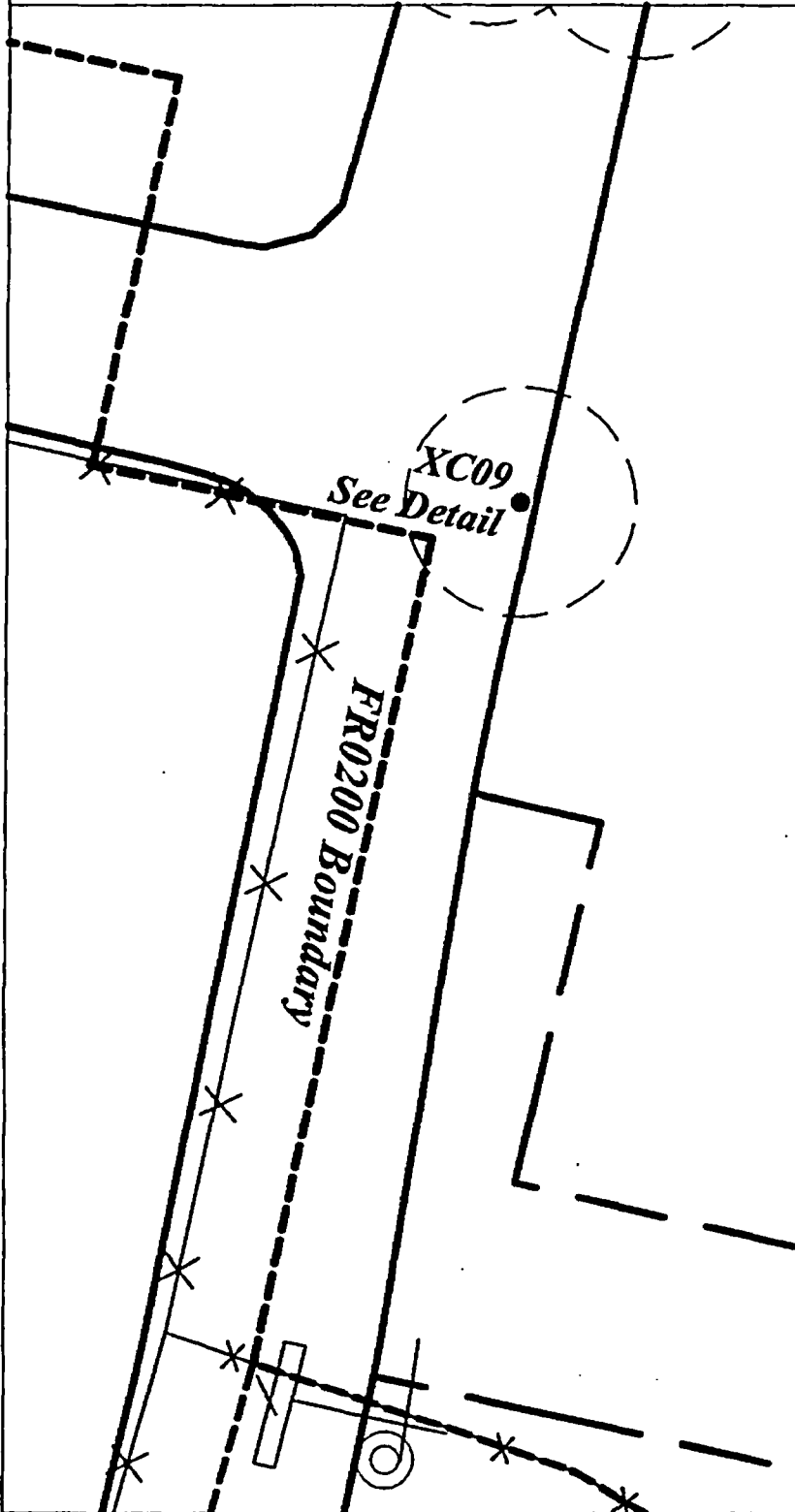
Final Status Survey

Survey Area Name: Roads and Rails

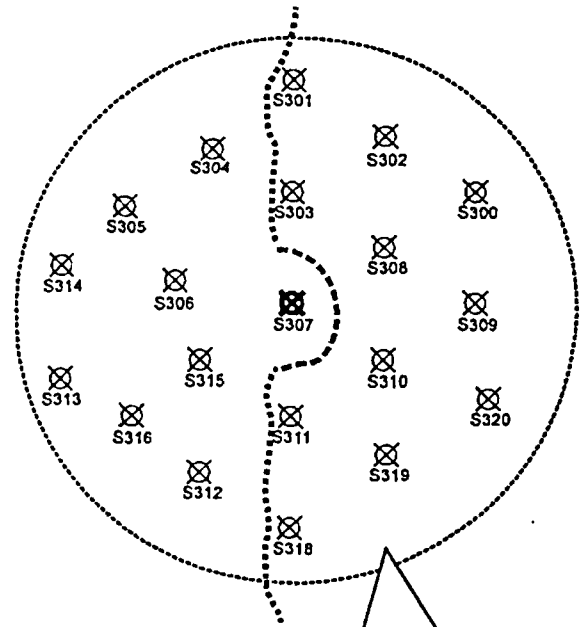
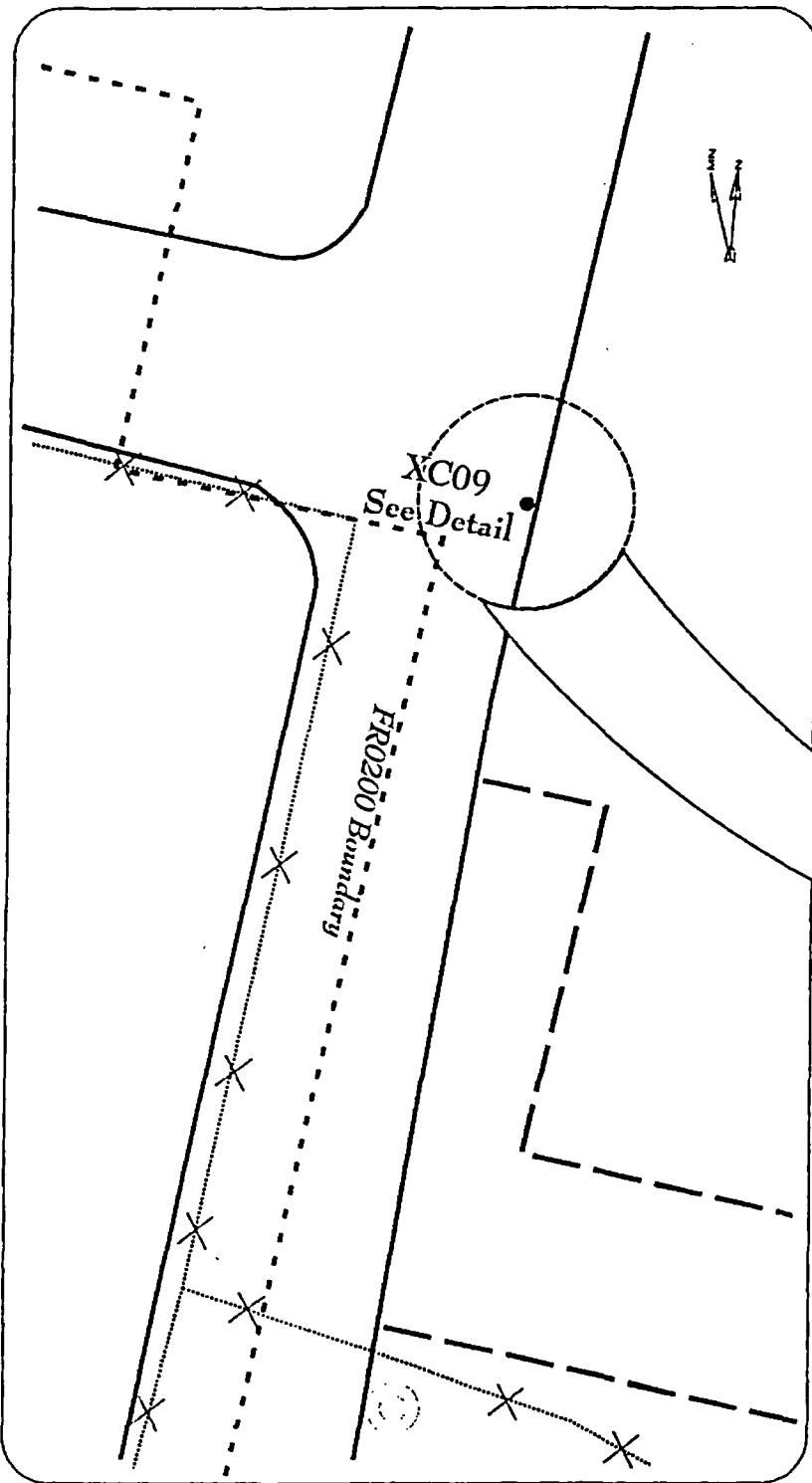
Final Status Survey: XR2900 SU2 Map C
ISOCS Survey Location XC09



Final Status Survey: XR2900 SU2 Map CX1
ISOCS Survey Location S001



Level 1 Investigation



Attachment 2
Survey Unit Instrumentation

TABLE 2-1

INSTRUMENT INFORMATION

HPGe Detectors

(Laboratory Sample Analysis)

Detector No.	MDC
FSS1	0.04 to 0.06 (pCi/g)
FSS2	0.04 to 0.06 (pCi/g)

ISOCS Detectors (Field Scan Measurements)

Detector No.	MDC
7605	181 to 1,190 dpm/100 cm ² (Notes 1 and 2)

TABLE 2-2

**INSTRUMENT SCAN MDC, DCGL,
AND INVESTIGATION LEVEL**

Parameter	Instrument: ISOCS	Comments
Scan MDC	181 to 778 dpm/100 cm ² Co-60 307 to 1,190 dpm/100 cm ² Cs-137	Design MDC specified to be 980 dpm/100 cm ² (Co-60 plus Cs-137)
DCGL (dpm/100 cm ²)	9,800 dpm/100 cm ² (Co-60 plus Cs-137)	Gross Beta dpm/100 cm ² LTP Rev 4 Table 6.11b (Reference 1)
Investigation Level (ISOCS @ 1m)	4,900 dpm/100 cm ² (Co-60 plus Cs-137) (Note 2)	50% DCGL (Reference 1)

NOTES

1. ISOCS Detector 7605 used for direct locations on asphalt road surfaces with the 90 degree collimator at 13 cm perpendicular from surface for a 531 cm² field of view.
2. ISOCS Detector 7605 used for 180 degree open collimation at 1 m perpendicular from surface for a 78.5 m² field of view. Any positive detection of Co-60 was investigated

Attachment 3
Investigation Table

TABLE 3-1

INVESTIGATION TABLE

INITIAL SURVEY				INVESTIGATION				
Scan Grid Location	Nuclide	ISOCS Scan @ 1m performed 5/14/05 (dpm/m ²)	Total Beta dpm/100 cm ² (Note 1)	SSPA-3 Scaler Highest Value (kcpm)	Highest Soil Sample results (pCi/g)	Total Beta dpm/100 cm ² (Note 2)	"As Left" ISOCS Scan @ 1m performed 5/20/05 (dpm/m ²)	"As Left" Total Beta dpm/100 cm ² (Note 1)
SC09	Co-60	22,270	653	<30	20.5 (Note 3)	7,012	<26,700	473
	Cs-137	<43,000			<0.17		20,575	

NOTES

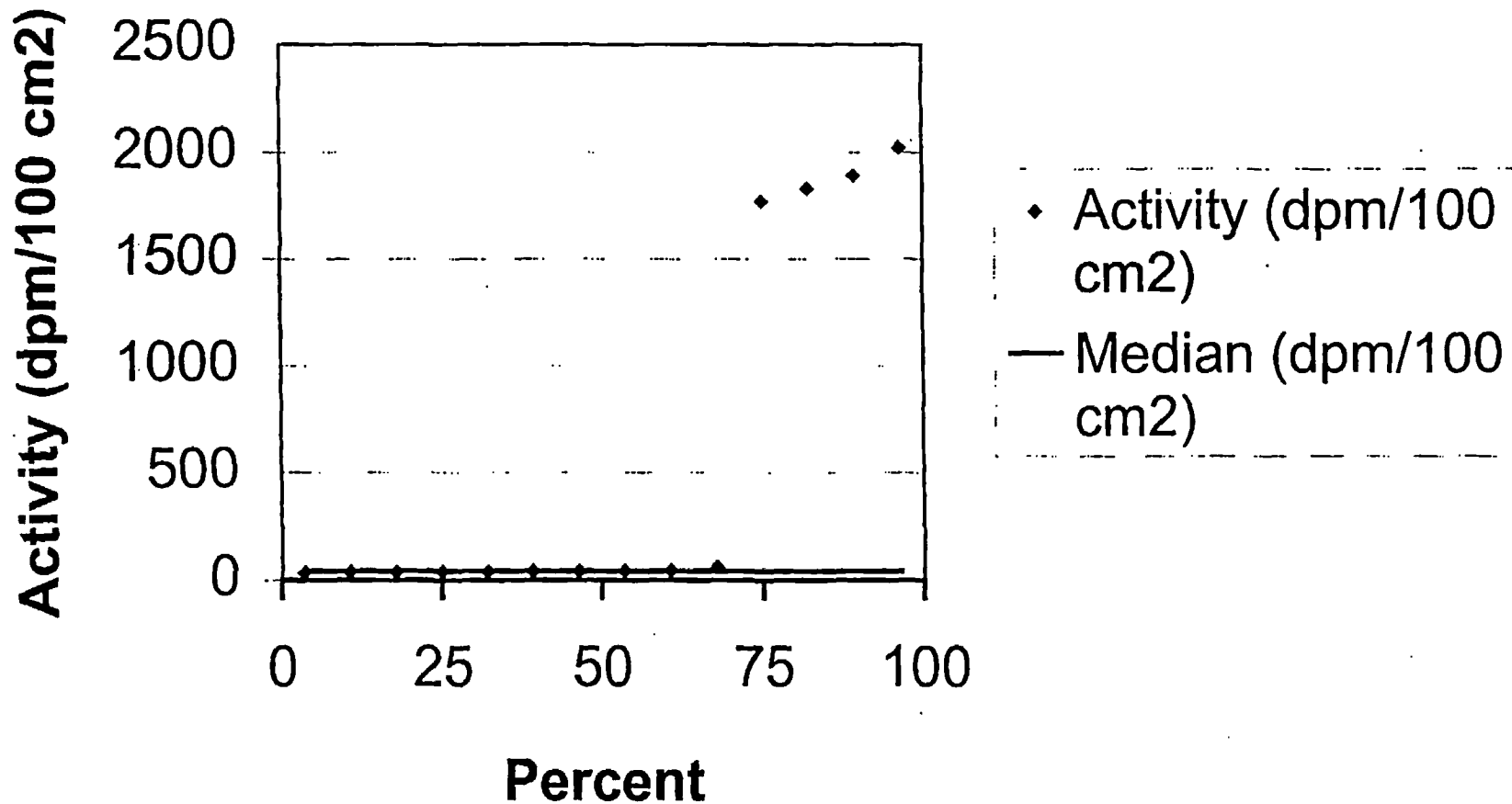
1. Total Beta dpm/100 cm² equals ISOCS scan values (Co-60 dpm/m²+ Cs-137 dpm/m²)* m²/(100 cm)²*(100 cm²/100 cm²).
2. Total Beta dpm/100 cm² equals direct soil sample values (Co-60 pCi/g+ Cs-137 pCi/g)*2.22 dpm/pCi*sample weight (g)/sample area (cm²)*(100 cm²/100 cm²). Sample weight was 1417 g and the sample area was 929 cm² (12" by 12"). No Co-60 was detected in any other direct sample.
3. The activity in the soil sample was determined to be a discrete Co-60 particle of 0.02 μ Ci.

Attachment 4
Statistical Data

Survey Package FR2900 Unit 2 Surface Sign Test Summary

Survey Package:	FR2900	Roads
Survey Unit:	02	
Evaluator:	G. Madison	
DCGL _w :	9,800	dpm/100cm2 Gross Beta DCGL
DCGL _{emc} :	N/A	NA for Class 3 Areas
LBGR:	4,900	dpm/100cm2
Sigma:	1,302	dpm/100cm2
Type I error:	0.05	
Type II error:	0.05	
Total Instrument Efficiency:	100.0%	data adjusted for various effs.
Detector Area (cm ²):	100	
Material Type:	N/A	Choosing 'N/A' sets material background to "0"
Z _{1-α} :	1.645	
Z _{1-β} :	1.645	
Sign p:	0.99865	
Calculated Relative Shift:	3.7	
Relative Shift Used:	3.0	Uses 3.0 if Relative Shift >3
N-Value:	11	
N-Value+20%:	14	
Number of Samples:	14	
Median:	41	dpm/100cm2
Mean:	566	dpm/100cm2
Net Static Data Standard Deviation:	864	dpm/100cm2
Total Standard Deviation:	864	SRSS
Maximum:	2,024	dpm/100cm2
Adjusted N Value:	14	
S+ Value:	14	
Critical Value:	10	
Sufficient samples collected:	Pass	
Maximum value <DCGL _w :	Pass	
Median value <DCGL _w :	Pass	
Mean value <DCGL _w :	Pass	
Maximum value <DCGL _{emc} :	Pass	
Total Standard Deviation <=Sigma:	Pass	SU passes
Sign test results:	Pass	
The survey unit passes all conditions:	Pass	SU Passes

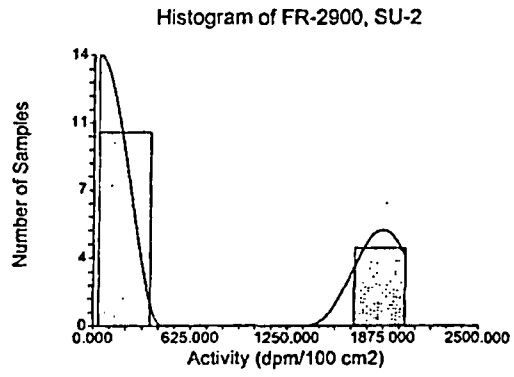
FR2900 SU-2 Quantile Plot



One-Sample T-Test Report

Page/Date/Time 2 5/2/05 12:45:31 PM
Database
Variable C2

Plots Section



One-Sample T-Test Power Analysis

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Chart Section

