

Rancho Seco
Final Status Survey Summary Report
March 18, 2008
Plant Effluent Water Course (SU3)
Survey Unit F1000003

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Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F1000003, Plant Effluent Water Course (SU3)

Survey Unit Description:

Operating History: This area was the release point for liquid effluents released from the plant. The area was impacted by both planned and unplanned liquid releases. Effluents were monitored under the operating RETS/REMP program. Operating records and the HSA document the release of radioactivity in this survey area. The HSA recorded multiple unplanned release events.

Site Characterization: Soil and sediment samples were collected and analyzed for the presence of plant-derived radionuclides. Cs-137 was the predominant nuclide with a mean activity level of 9.2 pCi/g and a maximum value of 48.2 pCi/g. The Characterization data were found to be conservative when compared to the historical information found in the reports referenced in the PDP. Based on the classification procedure (DSIP-0020), the area was determined to be a Class 2 land area.

HSA Events: ODR-740017, 740052, 750046, 760079, 810192, 810193, 810209, 83008, 830023, 830248, 840117, 840118, 840225, 840223, 850299, 850112, 860555, 870764, 870905.

Survey Unit Design Information:

The Survey Unit Design Parameters are presented in Table 1 below. The survey unit and measurement locations are depicted on the maps in Attachment 1. Direct measurement locations were determined using a random-start, fixed grid pattern and 1,180 m² were scanned for approximately 23% coverage. Soil samples were collected at each direct measurement location and analyzed by HPGe detector. The instrumentation used for the survey along with the MDC values are listed in Tables 2-1 and 2-2 in Attachment 2.

Table 1. Survey Unit Design Parameters

| Survey Design Parameter | Value | Comment |
|--|--------------|-----------------------------------|
| Survey Area: | F100 | Plant Effluent Water Course (SU3) |
| Survey Unit: | 0003 | Open Land Area |
| Class: | 2 | LTP Table 5-4 |
| SU Area (m²): | 5,202 | F8000071 |
| Evaluator: | D. Anderson | |
| DCGL for Cs-137 surrogate (pCi/g): | 52.6 | |
| DCGL for Co-60 (pCi/g): | 12.6 | |
| Area Factor: | N/A | Class 2 |
| Design DCGL_{me} (pCi/g): | N/A | Class 2 |
| LBGR (pCi/g): | 27.8 | Adjusted |
| Design Sigma (pCi/g): | 14.7 | DTBD-06-001, Table 5-4A or B |
| Type I Error: | 0.05 | |
| Type II Error: | 0.05 | |
| Sample Area (m²): | 306 | Class 2 |
| Total Area Scanned (m²): | 1,180 | |
| Scan Coverage (%): | 22.7% | Class 2 |
| Z_{1-α}: | 1.645 | |
| Z_{1-β}: | 1.645 | |
| Sign P: | 0.945201 | |
| Calculated Relative Shift: | 1.6 | |
| Relative Shift Used: | 1.6 | Uses 3.0 if Rel Shift >3 |
| N-Value: | 14 | |
| Design N-Value + 20%: | 17 | NUREG-1575 Table 5-5 |
| Grid Spacing L: | 17.5 | Class 2 |

Survey Results:

A total of 21 direct measurements were made in F1000003. The results are shown in Table 2-1. Statistical data including the mean, median, and standard deviation are shown in Table 2-2. All of the direct measurements were less than Unity. None of the scan measurements indicated areas of elevated activity. Soil samples were counted to the MDCs shown in Table 2-1 of Attachment 2.

Table 2-1. Direct Measurement Results
(all activity values in pCi/g)

| Sample ID | Cs137 | | | | Co60 | | | | Unity Total |
|-----------------|----------|-----------|-------------|-------------|----------|-----------|-------------|-------------|-------------|
| | MDA | Activity | Uncertainty | Unity Value | MDA | Activity | Uncertainty | Unity Value | |
| F1000003S0001SS | 7.48E-02 | 1.50E-01 | 5.10E-02 | 0.0029 | 9.46E-02 | <9.46E-02 | | 0.0075 | 0.0104 |
| F1000003S0002SS | 8.17E-02 | 2.01E-01 | 7.72E-02 | 0.0038 | 8.76E-02 | <8.76E-02 | | 0.007 | 0.0108 |
| F1000003S0003SS | 6.48E-02 | 1.29E-01 | 6.41E-02 | 0.0024 | 1.02E-01 | <1.02E-01 | | 0.0081 | 0.0105 |
| F1000003S0004SS | 9.86E-02 | 1.90E00 | 1.86E-01 | 0.0361 | 7.61E-02 | <7.61E-02 | | 0.006 | 0.0421 |
| F1000003S0005SS | 8.16E-02 | 1.50E00 | 1.93E-01 | 0.0285 | 1.12E-01 | <1.12E-01 | | 0.0089 | 0.0374 |
| F1000003S0006SS | 7.67E-02 | 8.25E-01 | 1.34E-01 | 0.0157 | 6.94E-02 | <6.94E-02 | | 0.0055 | 0.0212 |
| F1000003S0007SS | 6.44E-02 | 1.09E-01 | 4.84E-02 | 0.0021 | 1.05E-02 | <1.05E-02 | | 0.0008 | 0.0029 |
| F1000003S0008SS | 9.03E-02 | 3.50E-01 | 8.72E-02 | 0.0067 | 6.68E-02 | <6.68E-02 | | 0.0053 | 0.012 |
| F1000003S0009SS | 5.41E-02 | 2.32E-01 | 7.27E-02 | 0.0044 | 3.80E-02 | <3.80E-02 | | 0.003 | 0.0074 |
| F1000003S0010SS | 1.12E-01 | 2.23E01 | 1.53E00 | 0.4234 | 6.19E-02 | 1.92E-01 | 6.93E-02 | 0.0153 | 0.4386 |
| F1000003S0011SS | 6.75E-02 | 2.56E-01 | 6.50E-02 | 0.0049 | 6.44E-02 | <6.44E-02 | | 0.0051 | 0.01 |
| F1000003S0012SS | 6.37E-02 | 8.95E-02 | 7.04E-02 | 0.0017 | 6.79E-02 | <6.79E-02 | | 0.0054 | 0.0071 |
| F1000003S0013SS | 5.67E-02 | 5.19E-01 | 9.78E-02 | 0.0099 | 5.97E-02 | <5.97E-02 | | 0.0047 | 0.0146 |
| F1000003S0014SS | 6.43E-02 | <6.43E-02 | | 0.0012 | 7.39E-02 | <7.39E-02 | | 0.0059 | 0.0071 |
| F1000003S0015SS | 9.30E-02 | <9.30E-02 | | 0.0018 | 6.30E-02 | <6.30E-02 | | 0.005 | 0.0068 |
| F1000003S0016SS | 5.16E-02 | 6.58E-02 | 6.78E-02 | 0.0013 | 9.05E-02 | <9.05E-02 | | 0.0072 | 0.0084 |
| F1000003S0017SS | 8.29E-02 | <8.29E-02 | | 0.0016 | 7.40E-02 | <7.40E-02 | | 0.0059 | 0.0074 |
| F1000003S0018SS | 5.61E-02 | <5.61E-02 | | 0.0011 | 7.15E-02 | <7.15E-02 | | 0.0057 | 0.0067 |
| F1000003S0019SS | 7.67E-02 | 1.04E-01 | 3.80E-02 | 0.002 | 6.12E-02 | <6.12E-02 | | 0.0049 | 0.0068 |
| F1000003S0020SS | 7.35E-02 | <7.35E-02 | | 0.0014 | 6.08E-02 | <6.08E-02 | | 0.0048 | 0.0062 |
| F1000003S0021SS | 9.45E-02 | <9.45E-02 | | 0.0018 | 7.50E-02 | <7.50E-02 | | 0.006 | 0.0077 |

Table 2-2. Direct Measurements Results Summary

| | Cs137 Activity (pCi/g) | Co60 Activity (pCi/g) | Cs137 Unity | Co60 Unity | Unity Total |
|-------------------------------------|----------------------------------|---------------------------------|--------------------|-------------------|--------------------|
| DCGLw | 52.6 | 12.6 | | | |
| Mean | 1.39E00 | 7.67E-02 | 0.0264 | 0.0061 | 0.0325 |
| Median | 1.29E-01 | 7.15E-02 | 0.0024 | 0.0057 | 0.0084 |
| Standard Deviation | 4.81E00 | 3.40E-02 | 0.0914 | 0.0027 | 0.0936 |
| Cs137 Activity Range (pCi/g) | 5.61E-02 to 2.23E01 | | | | |
| Co60 Activity Range (pCi/g) | 1.05E-02 to 1.92E-01 | | | | |
| Cs137 Unity Range | 0.0011 to 0.4234 | | | | |
| Co60 Unity Range | 0.0008 to 0.0153 | | | | |
| Total Unity Range | 0.0029 to 0.4386 | | | | |
| Sample Count | 21 | | | | |

Survey Unit Data Assessment:

The survey design required 21 direct measurements for the Sign Test. The critical value and the results of the Sign Test are presented in Table 3. The sample mean and median values were less than the DCGL. The sample standard deviation was less than the design standard deviation so no additional samples were required.

Table 3. Data Assessment Results

| Survey Results Parameter | Value | Comment |
|---|--------------|----------------|
| Actual Direct Measurements (N): | 21 | |
| Median (Unity): | 0.008 | |
| Mean (Unity): | 0.032 | |
| Direct Measurement Std Deviation (Unity): | 0.094 | |
| Maximum (Unity): | 0.439 | |
| Sign Test Final N Value: | 21 | |
| S+ Value: | 21 | |
| Critical Value: | 14 | |
| Sufficient Samples Collected: | Yes | |
| Maximum Value < Unitized DCGL: | Yes | |
| Median Value < Unitized DCGL: | Yes | |
| Mean Value < Unitized DCGL: | Yes | |
| Maximum Value < DCGL_{emc} (Unity): | N/A | Class 2 |
| Standard Deviation <= Sigma: | Yes | |
| Pass the Sign Test? | Yes | |
| Reject the Null Hypothesis? | Yes | |
| Does the Survey Unit Pass All Criteria? | Yes | |

Survey Unit Investigations and Results:

No investigations were required for either direct or scan measurements and no investigation results are reported.

ALARA Statement:

As stated in Chapter 4 of the LTP, as long as the residual activity within the survey unit is less than the DCGL (i.e. the survey unit average activity is less than the DCGL and the EMC criterion has been met), the ALARA criterion has been met.

Changes in Initial Survey Unit Assumptions:

The survey unit was designed as a Class 2 land survey and the sample results are consistent with that classification. The variability of the survey results was less than the characterization data used for survey design. No potential areas of elevated activity were detected.

Conclusion:

The FSS of this survey unit was properly designed as a Class 2 survey based on Table 5-4 of the LTP. The required number of direct measurements was made and the scan coverage met the requirement of Table 5-6 of the LTP. All of the direct measurements were less than Unity. No investigations were required.

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.

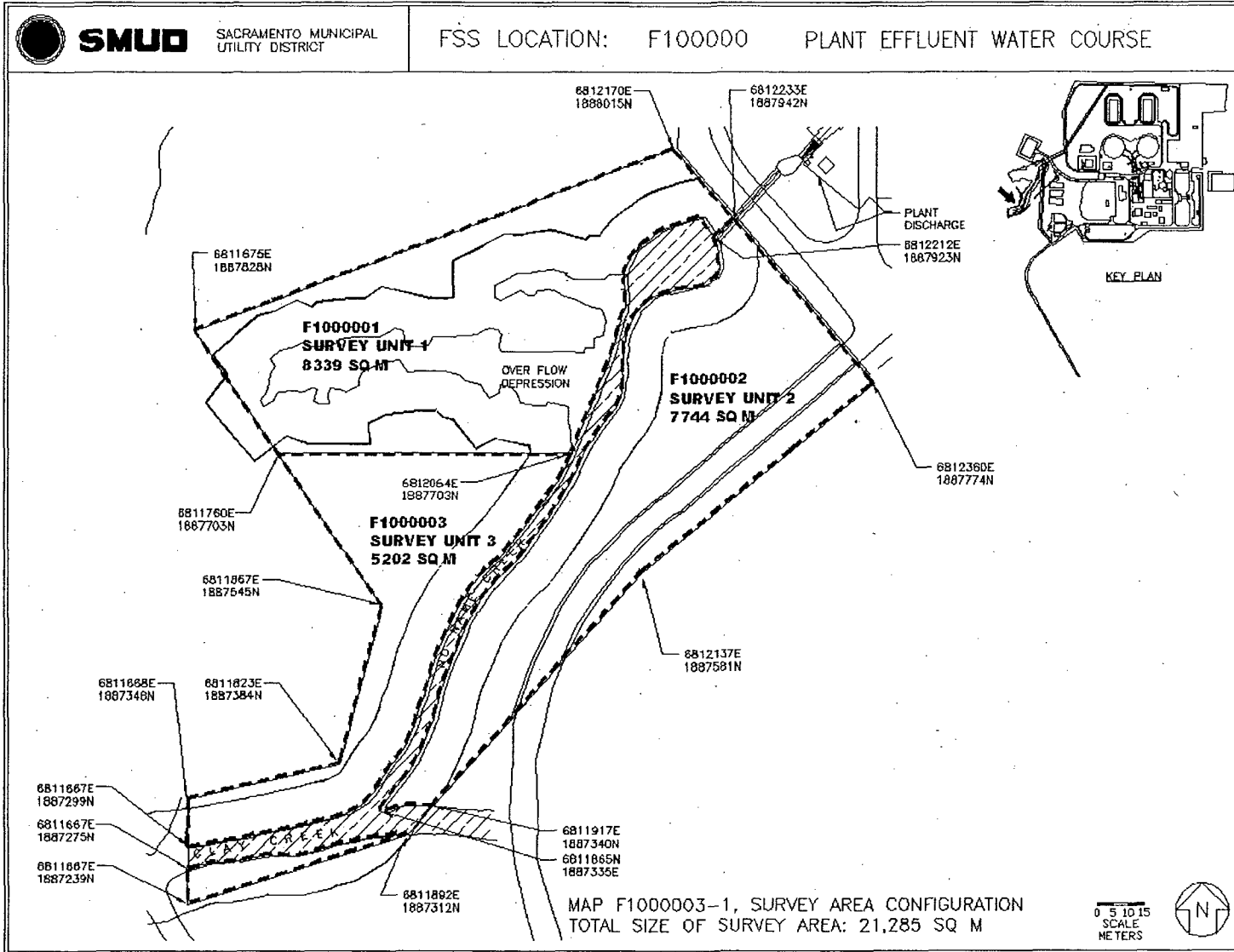
It is concluded that survey unit F1000003 meets the release criteria of 10CFR20.1402.

Attachment 1

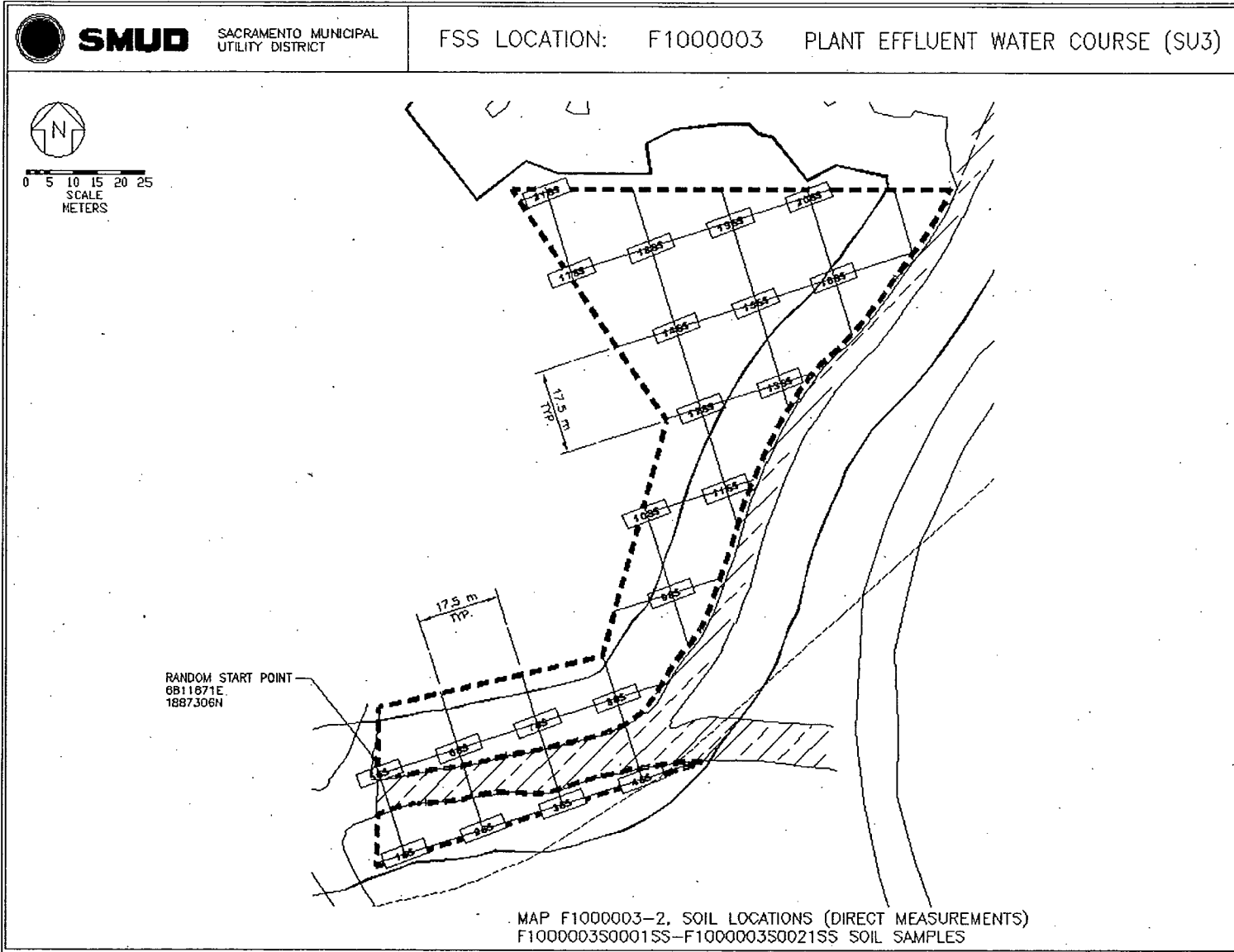
Maps

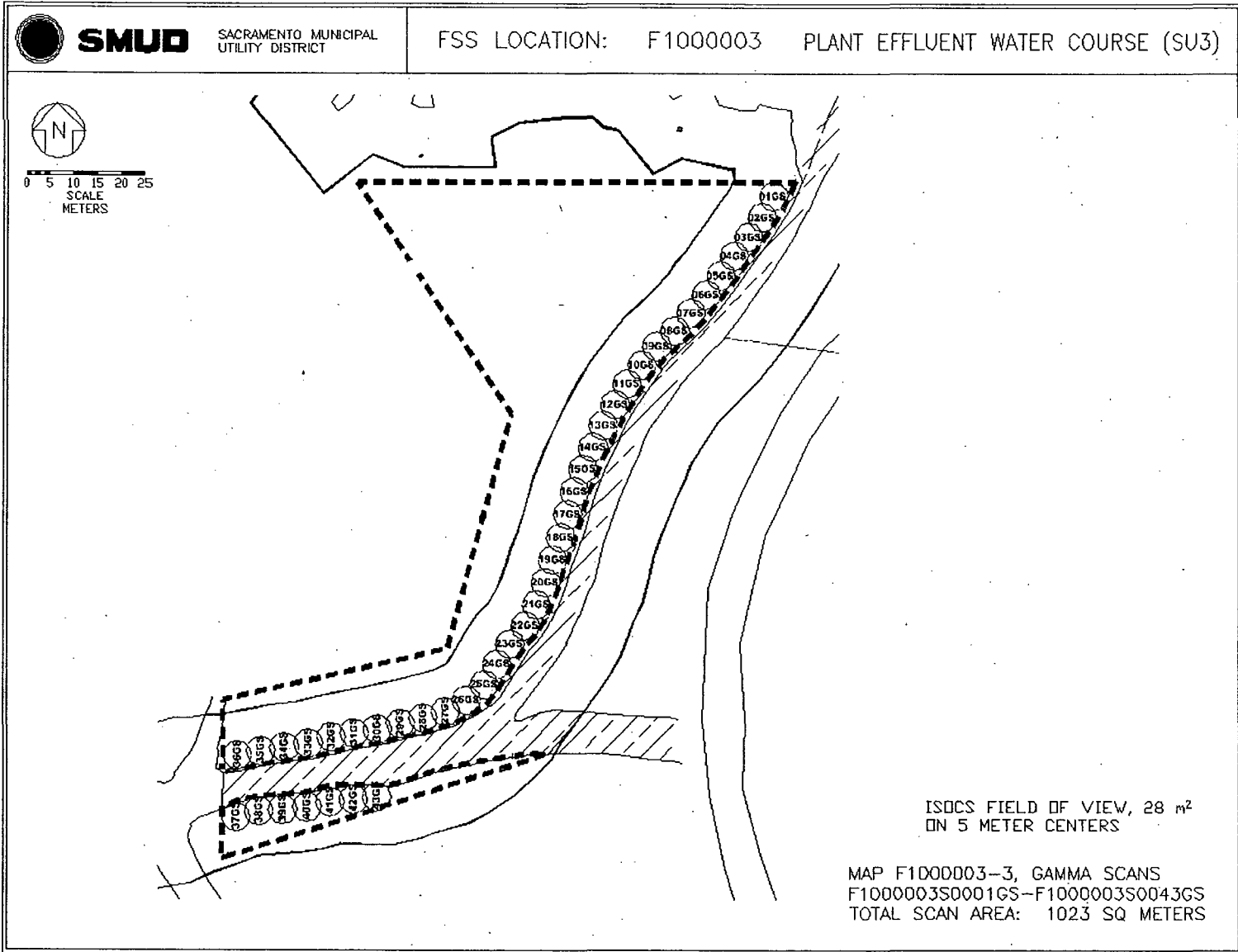
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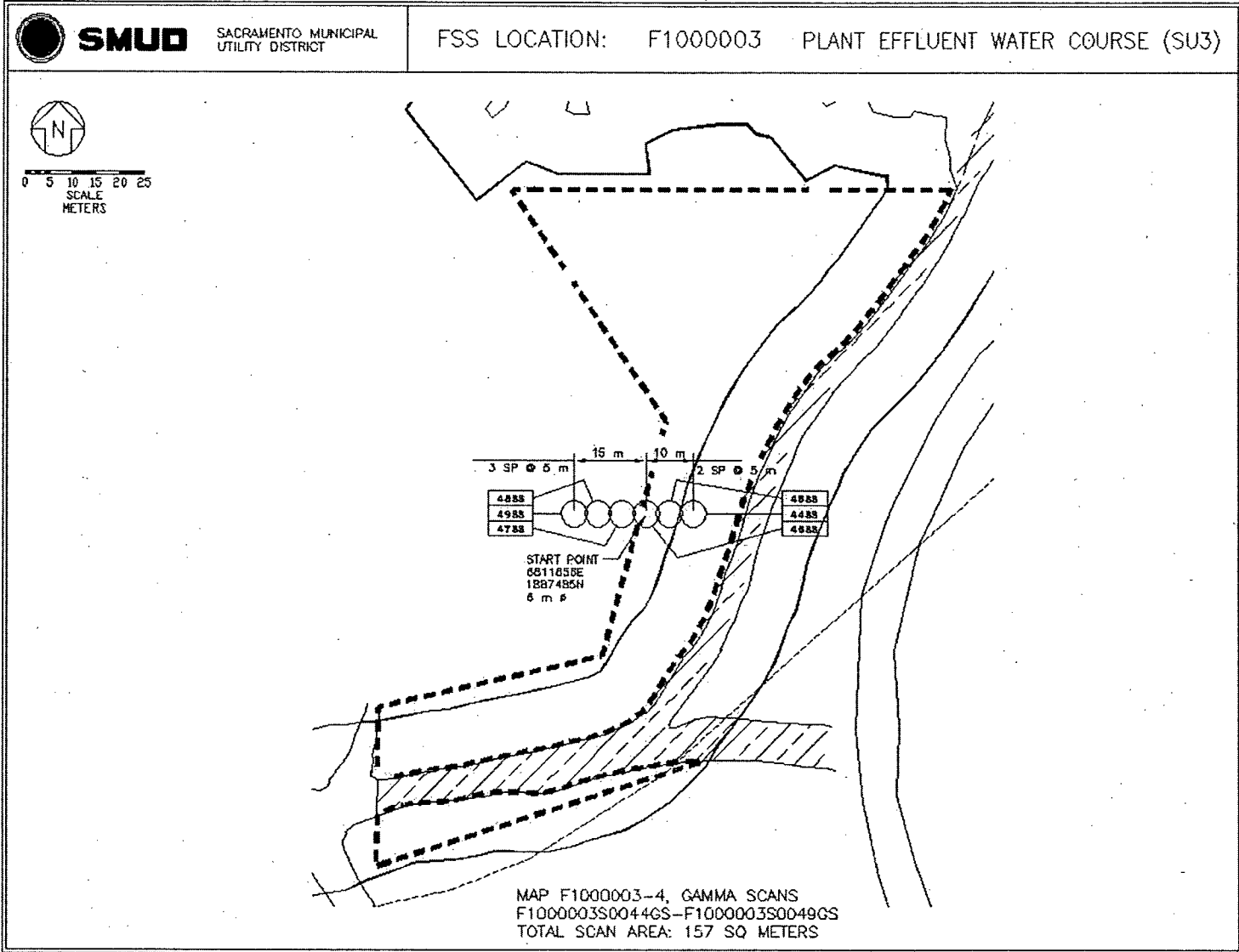
Survey Unit F1000003



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Attachment 2

Instrumentation

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Table 2-1. Survey Unit Instrumentation

| Instrument | Detector Model No. | Detector Serial No. | MDC |
|-------------------|---------------------------|----------------------------|---|
| HPGe | N/A | 9987008 | Soil – 1.12E-01 pCi/g Cs-137 Soil – 1.12E-01 pCi/g Co-60 |
| HPGe | N/A | 05047773 | Soil – 9.86E-02 pCi/g Cs-137 Soil – 8.76E-02 pCi/g Co-60 |
| ISOCS | N/A | 2983947 | Soil – 2.98E-01 pCi/g Cs-137 Soil – 2.45E-01 pCi/g Co-60 |

Table 2-2. Investigation Criteria and DCGL

| Instrument | Parameter | Value |
|-------------------|-------------------------------|---------------------------|
| ISOCS | Investigation Criteria - Scan | Soil – 20 pCi/g Cs-137 |
| All | DCGL _w | 52.6 Cs-137 12.6 Co-60 |
| All | DCGL _{EMC} | N/A |

Attachment 3

Investigation

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(none required)

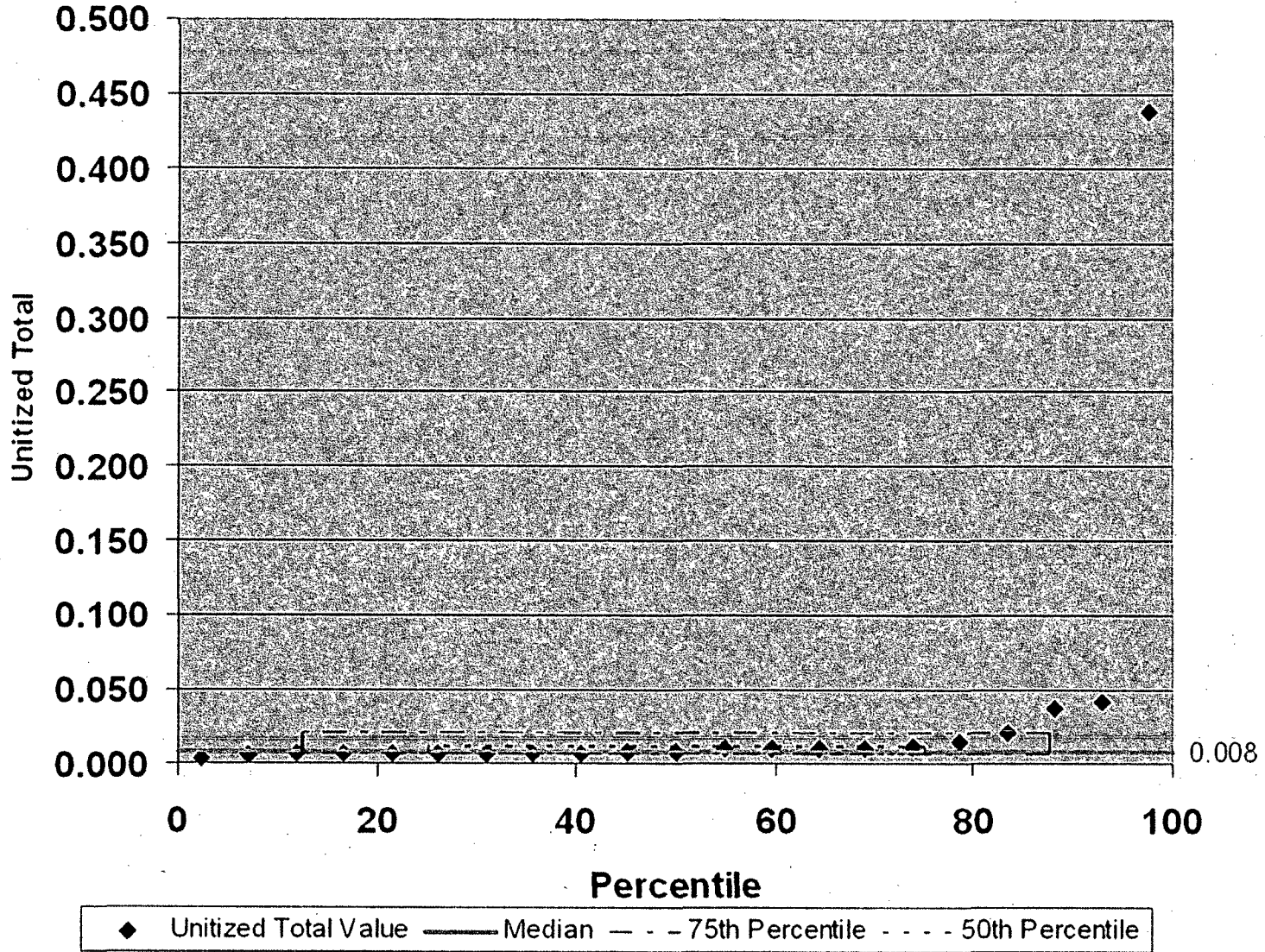
Attachment 4

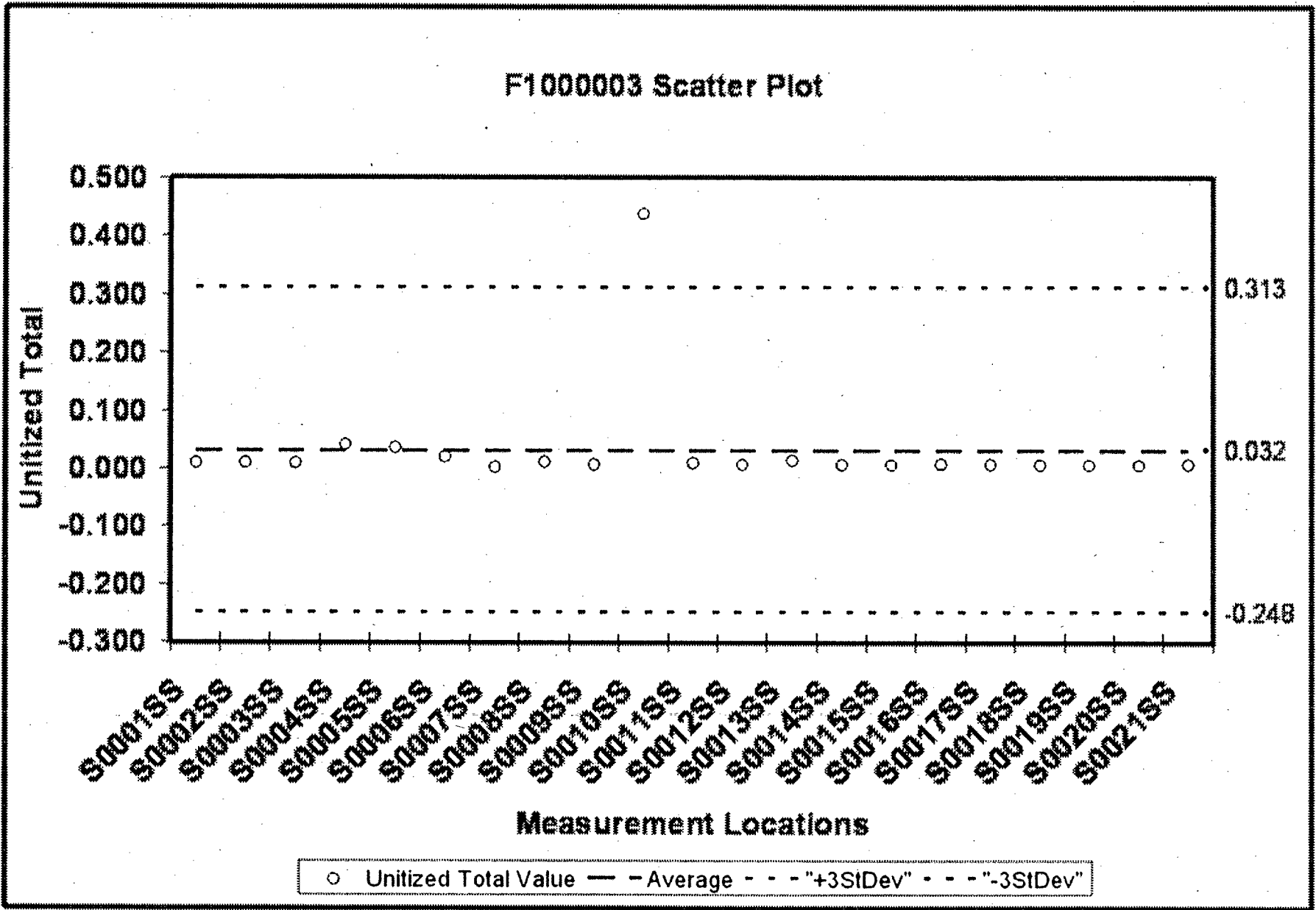
Data Assessment

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Survey Unit F1000003

F1000003 Quantile Plot





F1000003 Frequency Plot

