Working Copy

DOE/WIPP-13-3501
Volume 1

Waste Isolation Pilot Plant

Geotechnical Analysis Report For July 2011 – June 2012

U.S. Department of Energy

May 2013

This page intentionally left blank

This document has been submitted as required to:

U.S. Department of Energy
Office of Scientific and Technical Information
PO Box 62
Oak Ridge, TN 37831
(865) 576-8401

Additional information about this document may be obtained by calling 1-800-336-9477

Unlimited, publicly available full-text scientific and technical reports produced since 1991 are available online at Information Bridge (www.osti.gov/bridge).

U.S Department of Energy and its contractors may obtain full-text reports produced prior to 1991 in paper form for a processing fee from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
Telephone: (865) 576-8401
Facsimile: (865) 576-5728
E-mail: reports@osti.gov

Available for sale to the public from:

U.S. Department of Commerce
National Technical Information Service
5301 Shawnee Rd
Alexandra, VA 22312
Phone: (800) 553-6847 or (703) 605-6000
Fax: (703) 605-6900
Email: info@ntis.gov

This page intentionally left blank

FOREWORD AND ACKNOWLEDGMENTS

This report contains an assessment of the geotechnical status of the Waste Isolation Pilot Plant (WIPP). During the excavation of the principal underground access and experimental areas, the status was reported quarterly. Since 1987, when the initial construction phase was completed, reports have been published annually. This report presents and analyzes data collected from July 1, 2011, to June 30, 2012.

This Geotechnical Analysis Report (GAR) was written to meet the needs of several audiences. It satisfies requirements contained in the WIPP Hazardous Waste Facility Permit[1] (HWFP) and the Certification of Compliance[2] with Subparts B and C, Title 40 *Code of Federal Regulations* (CFR) Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes." It focuses on the geotechnical performance of the various components of the underground facility, including the shafts, shaft stations, access drifts, and waste disposal areas. The results of investigations of excavation effects and other geotechnical studies are also included.

The report compares the geotechnical performance of the repository to the design criteria. It describes the techniques that were used to acquire the data. The depth and breadth of the evaluation of the different components of the underground facility vary according to the types and quantities of data available and the complexity of the recorded geotechnical responses. Graphic documentation of data and tabular documentation of instrument history can be provided upon request.

This GAR was prepared by Nuclear Waste Partnership LLC (NWP) for the U.S. Department of Energy (DOE), Carlsbad Field Office (CBFO), in Carlsbad, New Mexico. Work was supported by the DOE under Contract No. DE-EM0001971.

[1] New Mexico Environment Department (NMED), 2010, Waste Isolation Pilot Plant Hazardous Waste Facility Permit, NM4890139088-TSDF, Santa Fe, NM

[2] U.S. Environmental Protection Agency, 1998, "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Certification Decision," Federal Register, Vol. 63, No. 95, pp. 27354, May 18, 1998, Washington, DC

This page intentionally left blank

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS 11

1.0 INTRODUCTION 13
1.1 Location and Description 13
1.2 Mission 16
1.3 Development Status 16
1.4 Purpose and Scope of Geomechanical Monitoring Program 17
1.4.1 Instrumentation 18
1.4.2 Data Acquisition 19
1.4.3 Data Evaluation 20
1.4.4 Data Errors 21

2.0 GEOLOGY 21
2.1 Regional Stratigraphy 21
2.1.1 Permian 22
2.1.2 Triassic 23
2.1.3 Quaternary 23
2.2 Underground Facility Stratigraphy 26
2.2.1 Disposal Horizon Stratigraphy of Panels 1, 2, 7, and 8 26
2.2.2 Disposal Horizon Stratigraphy of Panels 3, 4, 5, and 6 29
2.2.3 Northeast Area Stratigraphy 29

3.0 PERFORMANCE OF SHAFTS AND KEYS 31
3.1 Salt Shaft 31
3.1.1 Shaft Observations 33
3.1.2 Instrumentation 33
3.2 Waste Shaft 36
3.2.1 Shaft Observations 38
3.2.2 Instrumentation 38
3.3 Exhaust Shaft 40
3.3.1 Exhaust Shaft Observations 41
3.3.2 Instrumentation 49
3.4 Air Intake Shaft 52
3.4.1 Shaft Performance 52

4.0 PERFORMANCE OF SHAFT STATIONS 54
4.1 Salt Shaft Station 54
4.1.1 Modifications to Excavation and Ground Control Activities 54
4.1.2 Instrumentation 54
4.2 Waste Shaft Station 57
4.2.1 Modifications to Excavation and Ground Control Activities 57
4.2.2 Instrumentation 59
4.3 Air Intake Shaft Station 61
4.3.1 Modifications to Excavation and Ground Control Activities 61
4.3.2 Instrumentation 61

5.0 PERFORMANCE OF ACCESS DRIFTS 61
5.1 Modifications to Excavation and Ground Control Activities 61
5.2 Instrumentation 62
5.2.1 Extensometers 63
5.2.2 Convergence Points 63
5.3 Analysis of Convergence Point and Extensometer Data 64
5.4 Excavation Performance 67

6.0 PERFORMANCE OF WASTE DISPOSAL AREA 68
6.1 History 68
6.2 Modifications to Excavations and Ground Control Activities 69
6.3 Instrumentation 70
6.4 Excavation Performance 73
6.5 Analysis of Extensometer and Convergence Point Data 73

7.0 Performance of the Salt Disposal Investigations and Salt Defense Disposal Investigations Areas 74
7.1 Ground Control Program 74
7.2 Instrumentation 74
7.3 Analysis of Convergence Point Data 74
7.4 Excavation Performance 74

8.0 GEOSCIENCE PROGRAM 74
8.1 Observation Hole Inspections 75
8.2 Fracture Mapping 78

9.0 SUMMARY 79

10.0 REFERENCES 80

LIST OF TABLES

Table 1-1 Geomechanical Instrumentation System 19
Table 4-1 Closure Rates in the Salt Shaft Station 57
Table 4-2 Summary of Roof Extensometers in the Salt Shaft Station 57
Table 4-3 Summary of Roof Extensometers in Waste Shaft Station 59
Table 4-4 Closure Rates in the Waste Shaft Station 59
Table 5-1 Summary of Modifications and Ground Control Activities in the Access Drifts July 1, 2011 to June 30, 2012 62
Table 5-2 New and Replacement Convergence Points Installed in the Access Drifts July 1, 2011 to June 30, 2012 64
Table 5-3 Greater than Twenty Percent Increases in Annual Convergence from July 1, 2011 to June 30, 2012 67
Table 6-1 Summary of Modifications and Ground Control Activities in the Waste Disposal Area July 1, 2011 to June 30, 2012 70
Table 9-1 Comparison of Excavation Performance to System Design Requirements 80

LIST OF FIGURES

Figure 1-1 – WIPP Location 14
Figure 1-2 – Underground Mining and Waste Disposal Configuration as of June 30, 2012 15
Figure 2-1 – Regional Geology 25
Figure 2-2 – Repository Level Stratigraphy of Panels 1, 2, 7, and 8 28
Figure 2-3 – Repository Level Stratigraphy of Panels 3, 4, 5, and 6 30
Figure 3-1 – Salt Shaft Stratigraphy 32
Figure 3-2 – Salt Shaft Instrumentation (Without Shaft Key) 34
Figure 3-3 – Salt Shaft Key Instrumentation 35
Figure 3-4 – Waste Shaft Stratigraphy 37
Figure 3-5 – Waste Shaft Instrumentation (Without Shaft Key) 39
Figure 3-6 – Waste Shaft Key Instrumentation 40
Figure 3-7 – Exhaust Shaft Stratigraphy 43
Figure 3-8 – Sample Intake of Exhaust Shaft Air Monitoring System 44
Figure 3-9 – Diagram of Exhaust Shaft Fixtures and Seepage Zones (Upper 200 ft) ... 45
Figure 3-10 – Location of Interception Wells and Storage Containers 46
Figure 3-11 – Water Removed from the Exhaust Shaft Catch Basin and the Interception Well System 48
Figure 3-12 – Exhaust Shaft Instrumentation (Without Shaft Key) 50
Figure 3-13 – Exhaust Shaft Key Instrumentation 51
Figure 3-14 – Air Intake Shaft Stratigraphy 53
Figure 4-1 – Salt Shaft Station Stratigraphy 55
Figure 4-2 – Salt Shaft Station Instrumentation after Roof Beam Excavation 56
Figure 4-3 – Waste Shaft Station Stratigraphy 58
Figure 4-4 – Waste Shaft Station Instrumentation after Raising the Roof 60
Figure 5-1 – Typical Convergence Point Array Configurations Showing Anchor Designations 66
Figure 6-1 – Location of Panel 6 Geotechnical Instruments 71
Figure 6-2 – Location of Panel 7 Geomechanical Instruments 72
Figure 8-1 – Example of Observation Hole Layout at Lower Horizon 76
Figure 8-2 – Typical Fracture Pattern at Lower Horizon 77
Figure 8-3 – Example Observation Hole Layout at Upper Horizon 77
Figure 8-4 – Typical Fracture Patterns at Upper Horizon 78

ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
bp	before present
bsc	below shaft collar
CAO	Carlsbad Area Office
CBFO	Carlsbad Field Office
CFR	Code of Federal Regulations
CH	contact-handled
cm	centimeter(s)
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	foot (feet)
GAR	Geotechnical Analysis Report
GIS	geomechanical instrumentation system
HWFP	Hazardous Waste Facility Permit
in	inch(es)
km	kilometer(s)
kPa	kilopascal(s)
kVA	kilovolt ampere(s)
LANL	Los Alamos National Laboratory
lb	pound(s)
m	meter(s)
Ma	million years
MB	marker bed
μin	10^{-6} inch(es)
NMED	New Mexico Environment Department
NWP	Nuclear Waste Partnership, LLC
OMB	orange marker bed
psi	pound(s) per square inch

RH	remote-handled
SDI	Salt Disposal Investigation
SDDI	Salt Defense Disposal Investigation
SPDV	Site and Preliminary Design Validation
TRU	transuranic
WIPP	Waste Isolation Pilot Plant
VOC	Volatile Organic Compound
yr(s)	year(s)

1.0 INTRODUCTION

This Geotechnical Analysis Report (GAR) presents and interprets geotechnical data from the underground excavations at the Waste Isolation Pilot Plant (WIPP). The data, which are obtained as part of a regular monitoring program, are used to characterize conditions, to compare actual performance to the design assumptions, and to evaluate and forecast the performance of the underground excavations.

GARs have been available to the public since 1983. During the Site and Preliminary Design Validation (SPDV) Program, the architect/engineer for the project produced these reports quarterly to document the geomechanical performance during and immediately after early excavations of the underground facility. Since completion of the construction phase of the project in 1987, the management and operating contractor for the facility has prepared these reports annually. This report describes the performance and condition of selected areas from July 1, 2011, to June 30, 2012. It is divided into nine chapters.

Chapter 1 provides background information on WIPP, its mission, and the purpose and scope of the geomechanical monitoring program. Chapter 2 describes the local and regional geology of the WIPP site. Chapters 3 and 4 describe the geomechanical instrumentation in the shafts and shaft stations, present the data collected by that instrumentation, and provide interpretation of these data. Chapters 5 and 6 present the results of geomechanical monitoring in the two main portions of the WIPP underground (the access drifts and the waste disposal area). Chapter 7 introduces the Salt Disposal and Salt Defense Disposal Investigation Areas. Chapter 8 discusses the results of the Geoscience Program, which include fracture mapping and observation hole observations. Chapter 9 summarizes the results of geomechanical monitoring and compares the current excavation performance to the design requirements. Chapter 10 lists references.

1.1 Location and Description

WIPP is located in southeastern New Mexico, 26 miles (42 kilometers [km]) east of Carlsbad (Figure 1-1). The surface facilities were built on the flat to gently rolling terrain that is characteristic of the Los Medaños area. The underground facility is being excavated approximately 2,150 feet (ft) (655 meters [m]) beneath the surface in the Salado Formation. Figure 1-2 shows a plan view of the underground configuration of WIPP as of June 30, 2012.

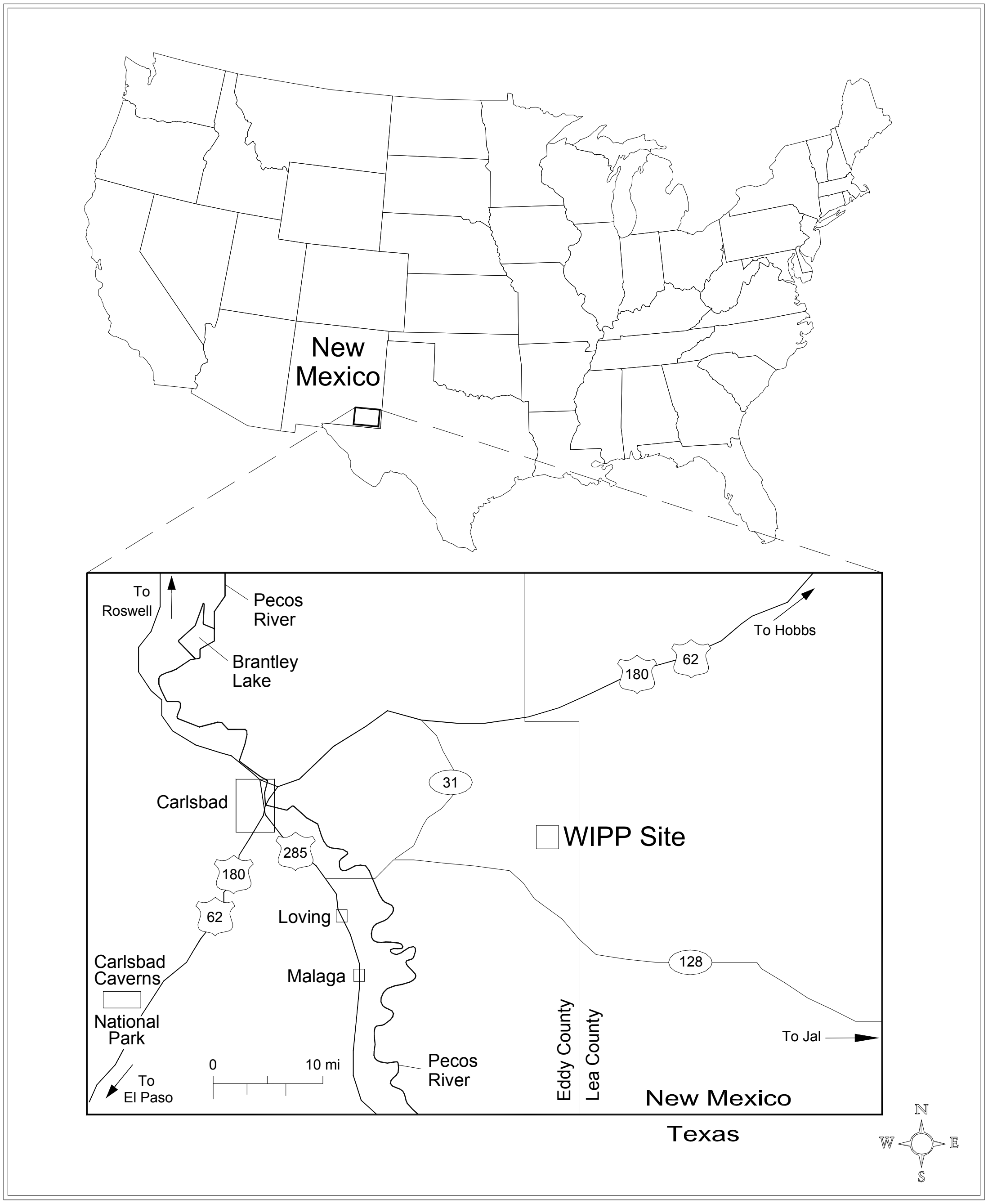


Figure 1-1 – WIPP Location

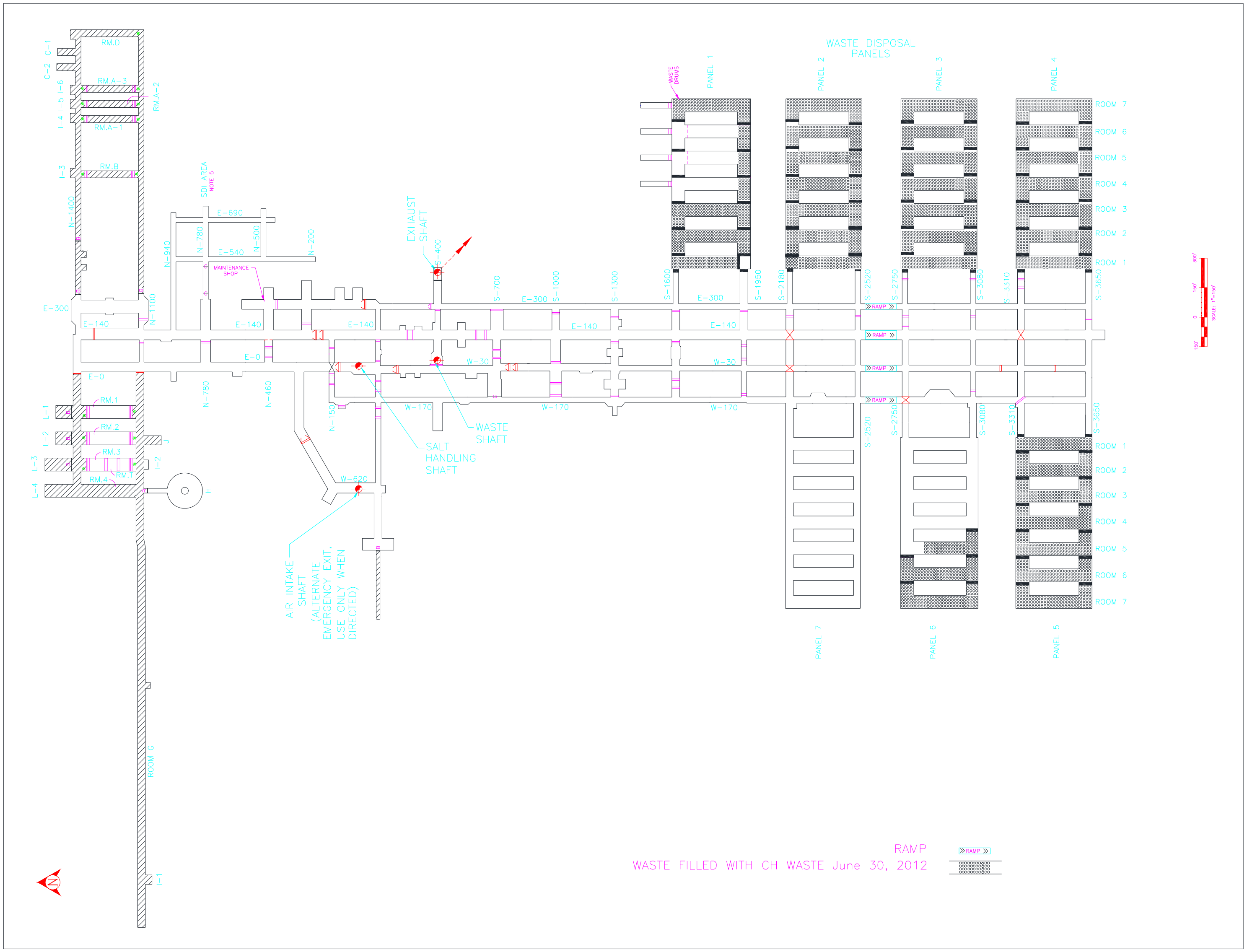


Figure 1-2 – Underground Mining and Waste Disposal Configuration as of June 30, 2012

1.2 Mission

In 1979 Congress authorized WIPP (Public Law 96-164, National Security and Military Applications of Nuclear Energy Authorization Act of 1980) to provide ". . . a research and development facility to demonstrate the safe disposal of radioactive wastes resulting from the defense activities and programs of the United States exempted from regulation by the Nuclear Regulatory Commission." To fulfill this mission, the DOE constructed a full-scale facility to demonstrate both technical and operational principles of the permanent disposal of transuranic (TRU) and TRU mixed wastes. Technical aspects are those concerned with the design, construction, and performance of the subsurface excavations. Operational aspects refer to the receiving, handling, and emplacement of TRU wastes in the facility. The facility was first used for *in situ* studies and experiments without the use of radioactive waste. WIPP now receives handles, and permanently disposes of TRU waste and TRU mixed waste.

1.3 Development Status

To fulfill its mission, the DOE developed WIPP in a phased manner. The goal of the SPDV phase, begun in 1980, was to characterize the site and obtain *in situ* geotechnical data from underground excavations to determine whether site characteristics and in situ conditions were suitable for permanent disposal. During this phase, the Salt Shaft, a ventilation shaft, a drift to the southernmost extent of the proposed waste disposal area, a four-room experimental panel, and access drifts were excavated. Surface-based geological and hydrological investigations were also conducted. The data obtained from the SPDV investigations were reported in the "Summary of the Results of the Evaluation of the WIPP Site and Preliminary Design Validation Program" (DOE, 1983).

Based upon the favorable results of the SPDV investigations, additional activities were initiated in 1983. These included the construction of surface structures, conversion of the ventilation shaft for use as the Waste Shaft, excavation of the Exhaust Shaft, development of additional access drifts to the waste disposal area, excavation of the Air Intake Shaft, and excavation of additional experimental rooms to support research and development. Geotechnical data acquired during this phase were used to evaluate the performance of the excavations in the context of established design criteria (DOE, 1984). Results of these evaluations were reported in Geotechnical Field Data Reports (DOE, 1985; DOE, 1986a) and were summarized in the Design Validation Final Report (DOE, 1986b).

The Design Validation Final Report concluded that the facility, including waste disposal areas, could be developed and operated to fulfill the long-term mission of WIPP (DOE, 1986b). All available information validated the design of underground openings to safely accommodate the permanent disposal of waste under routine operating conditions.

Panel 1 mining began in 1986 and was completed in 1988. Panel 1 was intended to receive waste for an initial operations demonstration and pilot plant phase that was scheduled to start in October 1988; however, the demonstration and pilot plant phase was not put into effect because waste could not be emplaced until permits were acquired.

In October 1996, the DOE submitted to the U.S. Environmental Protection Agency (EPA) a compliance certification application in accordance with 40 CFR Parts 191 and 194, which addressed the long-term (10,000-year) performance criteria for the disposal system. On May 18, 1998, the EPA published the final certification that allowed for the receipt of TRU waste at WIPP. Immediately before this certification, the DOE Carlsbad Area Office (CAO) completed an Operational Readiness Review, which is required by the DOE before the start-up or a process change of any nuclear facility. As a result of the review, the CAO notified the Energy Secretary on April 1, 1998, that WIPP was operationally ready to receive waste. On March 26, 1999, the first shipment of TRU waste was received from Los Alamos National Laboratory (LANL). By the end of June 2011, many additional generator sites had shipped waste to WIPP. The cleanup of several small-quantity generator sites, as well as one large-quantity site (Rocky Flats Environmental Technology Site) is now complete.

Waste disposal in Panels 1, 2, 3, 4 and 5 is complete. Panels 1, 2, and 3 contain only CH waste. The first RH waste shipment arrived January 24, 2007. Panel 4 was the first to receive both CH and RH waste. As of June 30, 2012, waste handling activities included RH disposal in Room 4 of Panel 6 and CH disposal in Room 5 of Panel 6. Mining of Panel 7 began April 24, 2010 and was ongoing as of June 30, 2012.

1.4 Purpose and Scope of Geomechanical Monitoring Program

As specified in the WIPP HWFP (NMED, 2010), the purpose of the geomechanical monitoring program is to obtain *in situ* data to support the continuous assessment of the design for underground facilities.

Specifically, the program provides for:

- Early detection of conditions that could affect operational safety.
- Evaluation of disposal room closure that ensures adequate access.
- Guidance for design modifications and remedial actions.
- Data for interpreting the behavior of underground openings, in comparison with the established design criteria.

Data taken by or input into the geomechanical instrumentation system (GIS) are evaluated and reported in this GAR. This annual report fulfills the requirements set forth in Part 4.6.1.2, Attachment A3, Section A2-5b (2) of the WIPP HWFP (NMED, 2010), and 40 CFR §191.14, "Assurance Requirements," implemented through the certification criteria, 40 CFR Part 194.

The Geomechanical Monitoring Program generates the data for four of the compliance monitoring parameters:

- Creep closure and stresses
- Extent of deformation
- Initiation of brittle deformation
- Displacement of deformation features

The instrumentation system for geomechanical monitoring provides data for routine evaluations of safety, stability, and performance of underground openings. *In situ* data are also used to model long-term disposal system performance. Changes resulting from excavations are monitored by routine inspections of selected observation hole arrays and fracture mapping to detect and quantify occurrences of discontinuities such as fractures and bed separations. Analysis of data indicating areas of potential instability allows timely corrective action before they could become safety issues. Other geoscience activities include geologic mapping and sampling, and seismic monitoring.

The GIS provides data that are collected, processed, and stored for analysis. The following subsections briefly describe the major components of the GIS.

1.4.1 Instrumentation

Instrumentation installed for measuring the geomechanical response of the shafts, drifts, and other underground openings includes convergence points, convergence meters, extensometers, rock bolt load cells, pressure cells, strain gauges, piezometers, and joint meters. Table 1-1 lists a summary of the specifications for geomechanical instrumentation.

Table 1-1 Geomechanical Instrumentation System

Instrument Type	Measures	Range[1]	Resolution[1]
Sonic probe extensometer	Cumulative deformation	0–2 in	0.001 in
Convergence point (tape extensometer)	Cumulative deformation	2–50 ft	0.001 in
Wire convergence meter	Cumulative deformation	0–3.5 ft	0.001 in
Embedded strain gauge	Cumulative strain	0–3000 μin/in	1 μin/in
Spot-welded strain gauge	Cumulative strain	0–2500 μin/in	1 μin/in
Rock bolt load cell	Load	0–50 tons	40 lb
Earth pressure cell	Pressure	0–1000 psi	1 psi
Piezometer	Fluid pressure	0–500 psi	0.5 psi
Joint meter	Cumulative deformation	0–4 in	0.001 in
Vibrating wire extensometer	Cumulative deformation	0–4 in	0.001 in
Wire extensometer	Cumulative deformation	0–20 in	0.001 in
Linear potentiometric extensometer	Cumulative deformation	0–6 in	0.001 in

[1] Manual readout boxes for the instruments were manufactured to render measurements in U.S. customary units. Range and resolution measurement units have not been converted to metric units. Measurements from these instruments have been converted for presentation elsewhere in this report.

1.4.2 Data Acquisition

Geomechanical instruments are read either manually, using portable devices, or remotely by electronically polling the stations from the surface in accordance with approved operating procedures. Remotely read instruments are connected to one of the underground data loggers, and readings are collected by initiating the appropriate polling routine. Upon completion of a verification process, data are transferred to a computer database. Manual readout devices are taken to instrument locations underground. Data are recorded on data sheets and later entered into an electronic database.

The underground data acquisition system consists of instruments, polling devices, and a communications network. Instruments are connected to polling devices that are installed in electrical enclosures near the instrument locations. Polling devices are connected by a data link to a surface computer.

Whether acquired manually or remotely, geomechanical data are entered into the database files of the GIS data processing system. The data processing system consists of computer programs that are used to enter, reduce, and transfer the data to permanent storage files. Additional routines allow access to the permanent storage files for numerical analysis, tabular reporting, and graphical plotting. Copies of the instrumentation database and data plots are available upon request.[3]

[3] Instrumentation data and data plots are presented in "Geotechnical Analysis Report for July 2011-June 2012 Supporting Data" (DOE/WIPP-13-3501 Volume 2).
The document is available upon request from the National Technical Information Service. See page 3 for details and addresses.

1.4.3 Data Evaluation

Rounding and significant digits are used in the data tables of this document. The reference document is American Society for Testing and Materials (ASTM) document ASTM D 6026-06, “Standard Practice for Using Significant Digits in Geotechnical Data."

Closure measurements are acquired manually from convergence point anchors and remotely from convergence meters. Data are presented in plots of closure versus time. Closure rate data are calculated and presented as part of the data analysis. Extensometers provide displacement data from instrumented rods or wires anchored at various depths. Plots show displacement versus time for individual anchors.

Displacement rate data from the hole collar to the deepest anchor are presented in the data analysis.

The annual closure rate is calculated as follows:

$$
\begin{aligned}
&rate(inches/year) = (cfi_2 - cfi_1)/(date_2 - date_1) \times 365.25\, days/year \\
&where\ cfi = the\ change\ from\ the\ initial\ reading\ (inches) \\
&\qquad cfi_1 = cfi\ reading\ closest\ to\ the\ beginning\ of\ the\ reporting\ period \\
&\qquad cfi_2 = cfi\ reading\ closest\ to\ the\ end\ of\ the\ reporting\ period
\end{aligned}
$$

Comparisons between closure rates of the previous and current reporting periods are presented as percent changes in rate and are calculated as follows:

$$percent\ change\ in\ rate = (Rate_{\text{Current Period}} - Rate_{\text{Previous Period}})/(Rate_{\text{Previous Period}}) \times 100\%$$

Rock bolt load cells are used to determine bolt support performance. Plots show load versus time for each instrumented bolt.

Earth pressure cells and strain gauges are used to determine the stresses and deformation in and around the shaft liners. Data are depicted in time-based plots.

Piezometers are used to measure the gauge pressure of groundwater and are installed in the shafts at varying elevations to monitor the hydraulic head acting on the shaft liners. Data are plotted as pressure versus time.

Joint meters, installed perpendicular to a crack, monitor the dilation of the crack with time. Data are presented as displacement versus time.

1.4.4 Data Errors

GIS data are processed through a comprehensive database management system. Whether acquired manually or remotely, GIS data are processed and permanently stored according to approved procedures. On occasion, erroneous readings can occur. There are several possible explanations for erroneous readings, including the following:

- The measuring device was misread.
- The reading was recorded incorrectly.
- The measuring device was not functioning within specifications.

When a reading is believed to be erroneous, the suspect reading is evaluated, and, if necessary, a second reading is collected. If the second reading falls in line with the instrument trend, the first reading is discarded and the second reading is entered in the database. If the second reading and subsequent readings remain out of the instrument trend, the ground conditions in the vicinity of the instrument are assessed to determine the reason for the discrepancy. In addition, the reading frequency may be increased.

2.0 GEOLOGY

This chapter provides a summary of the stratigraphy of the WIPP region and the site. Readers desiring further geologic information may consult the "Geological Characterization Report, WIPP Site, Southeastern New Mexico" (Powers et al., 1978). This report was developed as a source document on the geology of the WIPP site for individuals, groups, or agencies seeking basic information on geologic history, hydrology, geochemistry, or detailed information, such as physical and chemical properties of repository rocks. A more recent survey of WIPP stratigraphy is included in Holt and Powers (1990).

2.1 Regional Stratigraphy

The stratigraphy in the vicinity of the WIPP site includes rocks of Permian (295 to 250 million years [Ma] before present [bp]), Triassic (250 to 203 Ma), and Quaternary (1.75 Ma to present) ages. The descriptions of formations provided in this section are given in order of deposition (oldest to youngest), beginning with the Castile Formation (Figure 2-1).

2.1.1 Permian

The Permian system in southwestern North America is divided into four series. The last of these, the Ochoan Series, contains the host rock in which the WIPP repository is located. The Ochoan Series is of mostly marine origin and consists of four formations: three evaporite formations (the Castile, the Salado, and the Rustler) and one redbeds formation (the Dewey Lake). The Ochoan evaporites overlie marine limestones and sandstones of the Guadalupian Series (Delaware Mountain Group). The younger redbeds represent a transition from the lower evaporite deposition to fluvial deposition on a broad, low-relief, fluvial plain. The Permian rocks are overlain by fluvial deposits of the Triassic and Quaternary periods.

2.1.1.1 Castile Formation

The Castile Formation, lowermost of the four Ochoan formations, is approximately 1,250 ft (380 m) thick in the WIPP vicinity. Lithologically, the Castile is the least complex of the evaporite formations and is composed chiefly of interbedded anhydrite and halite, with limestone present in minor amounts.

2.1.1.2 Salado Formation

The Salado Formation comprises nearly 2,000 ft (610 m) of evaporites, primarily halite. The formation is subdivided into three informal members: the unnamed lower member, the McNutt potash zone, and the unnamed upper member. Each member contains similar amounts of halite, anhydrite, and polyhalite and is differentiated on the basis of soluble potassium- and magnesium-bearing minerals. The WIPP disposal horizon is located within the unnamed lower member, 2,150 ft (655 m) below the surface.

2.1.1.3 Rustler Formation

The Rustler Formation is subdivided into five members, starting from its base: the Los Medaños Member, the Culebra Dolomite Member, the Tamarisk Member, the Magenta Dolomite Member, and the Forty-niner Member.

In the vicinity of the WIPP site, the Rustler is approximately 310 ft (95 m) thick and thickens to the east. The lower portion (Los Medaños Member) contains primarily fine sandstone to mudstone with lesser amounts of anhydrite, polyhalite, and halite. Bedded and burrowed siliciclastic sedimentary rocks with cross-bedding and fossil remains signify the transition from the strongly evaporitic environments of the Salado to the brackish lagoonal environments of the Rustler (Holt and Powers, 1990).

The upper portion of the Rustler contains interbeds of anhydrite, dolomite, and mudstone. The Culebra Dolomite member is generally brown, finely crystalline, and locally argillaceous. The Culebra contains rare to abundant vugs with variable gypsum and anhydrite filling and is the most transmissive hydrologic unit within the Rustler. The

Tamarisk Member consists of lower and upper sulfate units separated by a unit that varies laterally from mudstone to mainly halite. The Magenta Dolomite Member is a gypsiferous dolomite with abundant primary sedimentary structures and well-developed algal features. The Forty-niner Member consists of lower and upper sulfate units separated by a mudstone that displays sedimentary features and bedding. East of the site area, halite correlates with the mudstone. The Culebra and Magenta Dolomite members are persistent and serve as important marker units.

2.1.1.4 Dewey Lake Redbeds

The Dewey Lake Redbeds is the uppermost of the Ochoan Series formations. Within the series, the Dewey Lake represents a transition from the lower marine evaporite deposition to fluvial deposition on a broad, low-relief, fluvial plain. The redbeds, approximately 475 ft (145 m) thick, consist of predominantly reddish-brown interbedded fine-grained sandstone, siltstone, and claystone. This formation is differentiated from others by its lithology and distinctive color (both of which are remarkably uniform), and by sedimentary structures, including horizontal- and cross-laminae and ripple marks. The redbeds also contain locally abundant greenish-gray reduction spots and gypsum-filled fractures. The formation thickens from west to east due to eastward dips and erosion to the west.

2.1.2 Triassic

The only Triassic rocks present in the WIPP region belong to the Dockum Group.

2.1.2.1 Dockum Group

The Dockum Group consists of fine-grained floodplain sediments and coarse alluvial debris of Triassic age. From a pinch-out near the center of the WIPP site it thickens eastward, forming an erosional wedge. Local subdivisions of the Dockum Group are the Santa Rosa Sandstone and the Chinle Formation; however, only the Santa Rosa occurs in the vicinity of the site. It consists primarily of poorly sorted sandstone with conglomerate lenses and thin mudstone partings and contains impressions and remnants of fossils. These rocks have more variegated hues than the underlying uniformly colored Dewey Lake.

2.1.3 Quaternary

Quaternary Period deposits include the Gatuña Formation, Mescalero Caliche, and surficial sediments.

2.1.3.1 Gatuña Formation, Mescalero Caliche, and Surficial Sediments

The Gatuña Formation (ranging in age from approximately 1.3 million to 600,000 years bp) (Powers and Holt, 1993) is a stream-laid deposit overlying the Dockum Group in the WIPP vicinity. At the site center, the formation consists of approximately 13 ft (4 m) of poorly consolidated sand, gravel, and silty clay. The Gatuña Formation is light red and mottled with dark stains. The unit contains abundant calcium carbonate, but is poorly cemented. Sedimentary structures are abundant (Powers and Holt, 1993, 1995).

The Mescalero Caliche (approximately 500,000 years bp) is approximately 4 ft (1.2 m) thick in the WIPP vicinity. The Mescalero is a hard, resistant soil horizon that lies beneath a cover of wind-blown sand. The horizon is petrocalcic (i.e., very strongly cemented with calcium carbonate). Petrocalcic horizons form slowly beneath a stable landscape at the average depth of infiltration of soil moisture and indicate stability and integrity of the land surface. Many of the surface buildings at WIPP are founded on top of the Mescalero Caliche.

Surficial sediments include sandy soils developed from eolian material and active dune areas. The Berino Series (a soil type) covers about 50 percent of the site and consists of deep sandy soils that developed from wind-worked material of mixed origin. Based on sample analyses, the Berino soil from the WIPP site formed 330,000 ± 75,000 years bp.

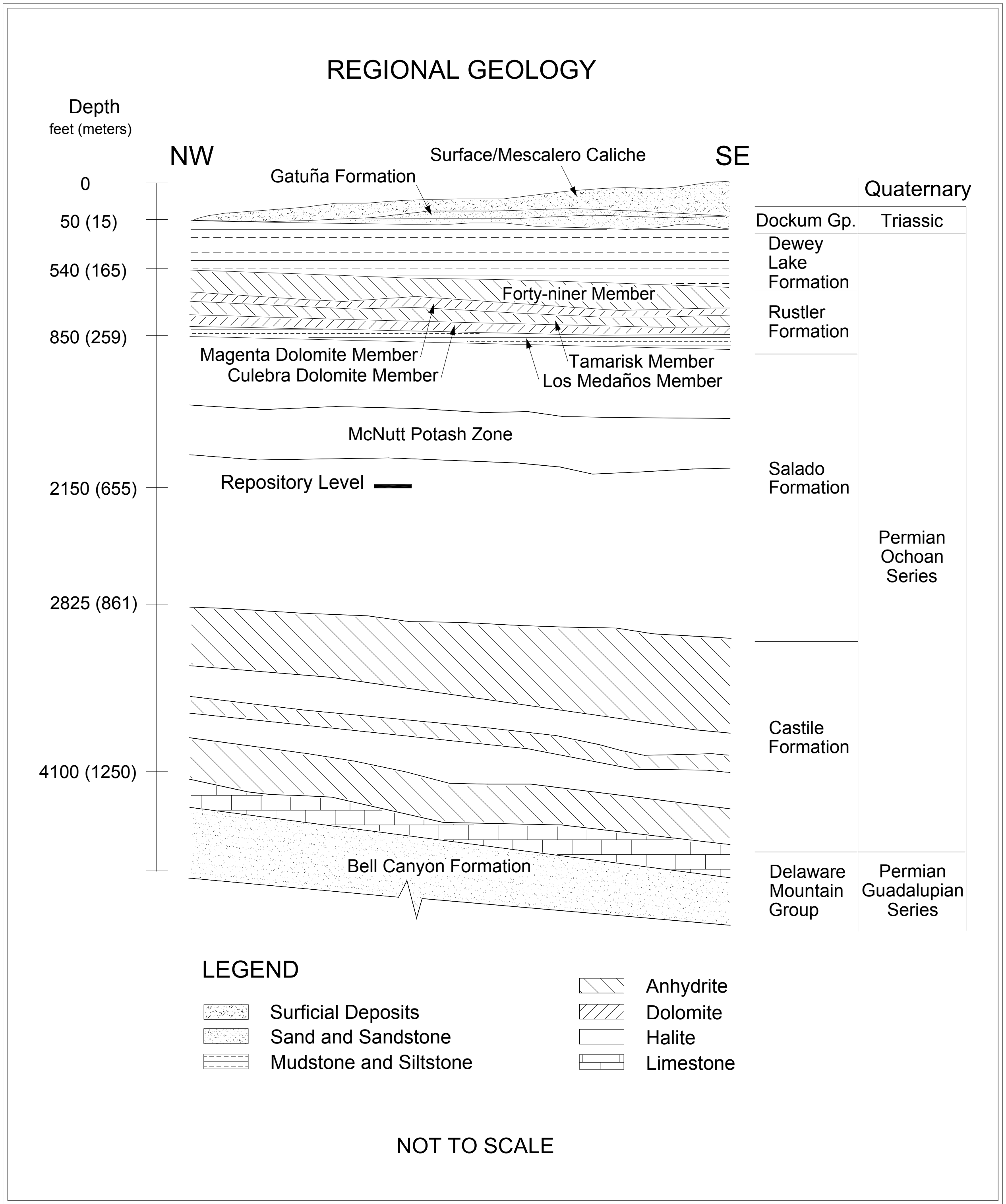


Figure 2-1 – Regional Geology

2.2 Underground Facility Stratigraphy

The WIPP disposal horizon lies near the midpoint of the Salado Formation. The Salado was deposited in a shallow saline lagoon environment, which progressed through numerous inundation and desiccation cycles that are reflected in the formation. An "ideal" cycle progresses upward as follows: a basal layer consisting predominantly of claystone, followed by a layer of sulfate, which is in turn followed by a layer of halite. The entire sequence is capped by a bed of argillaceous (clay-rich) halite accumulated during a period of mainly subaerial exposure.

A regional system used for numbering the more significant sulfate beds within the Salado designates these beds as marker beds (MBs), counted from MB100 near the top of the formation to MB144 near the base. The repository is located between MB138 and MB139 within a sequence of laterally continuous depositional cycles as described above. Within this sequence, layers of clay and anhydrite that are locally designated (as shown) can have a significant impact on the geomechanical performance of the excavations. Clay layers provide surfaces along which slip and separation can occur, whereas anhydrites form brittle layers that do not deform plastically.

In the vicinity of WIPP, the stratigraphy is fairly continuous and uniform. Beds generally dip toward the south-southeast at a slope of approximately 3 percent.

2.2.1 Disposal Horizon Stratigraphy of Panels 1, 2, 7, and 8

This disposal horizon contains Panels 1, 2, 7, and 8, all the shaft areas, the shop areas, the SPDV areas (which are now closed), and all the access drifts north of S-2620. Farther south, the four main entries rise in a ramp that starts at S-2620 and ends at S 2740. Panel 7 is currently being excavated, and Panel 8 has not yet been excavated.

Most underground excavations are located within this disposal horizon (Figure 2-2). In it, the Orange Marker Bed (OMB) lies near the middle of the rib (i.e., the excavation wall). The OMB is a laterally consistent unit of moderate to light reddish-orange translucent halite about 6 inches (in) (15 centimeters [cm]) thick that is used as a point of reference during excavation.

MB139 lies approximately 11.5 ft (3.5 m) below the OMB. MB139 is a 20 to 32 in (50-to-80 cm) thick layer of polyhalitic anhydrite. The top of the anhydrite undulates up to 15 in (38 cm), while the bottom is sub-horizontal and is underlain by Clay E.

Above MB139 is a unit of halite that terminates at the base of the OMB. Within this unit, polyhalite is locally abundant and decreases upward, while argillaceous material increases upward.

Above the OMB, a thin band of argillaceous halite gives way to a thick sequence of clear halite that becomes increasingly argillaceous upward and is capped by Clay F.

This constitutes a thin layer occasionally interrupted by partings and breaks and is readily visible in the upper ribs. Above Clay F, another sequence of halite begins that, as in lower sequences, becomes increasingly argillaceous upward. This sequence terminates at the Clay G/Anhydrite "b" interface, approximately 6.5 ft (2 m) above the roof of most disposal horizon excavations, forming a roof beam that typically acts as a structural unit.

The roof of some disposal horizon excavations (e.g., the E-140 drift between S-1000 and S-1950), has been excavated to the upper contact of Anhydrite "b." In this case, a roof beam is formed by the next depositional sequence beginning with Anhydrite "b" and progressing upward to the Clay H/Anhydrite "a" interface, approximately 6.5 ft (2 m) above the upper contact of Anhydrite "b."

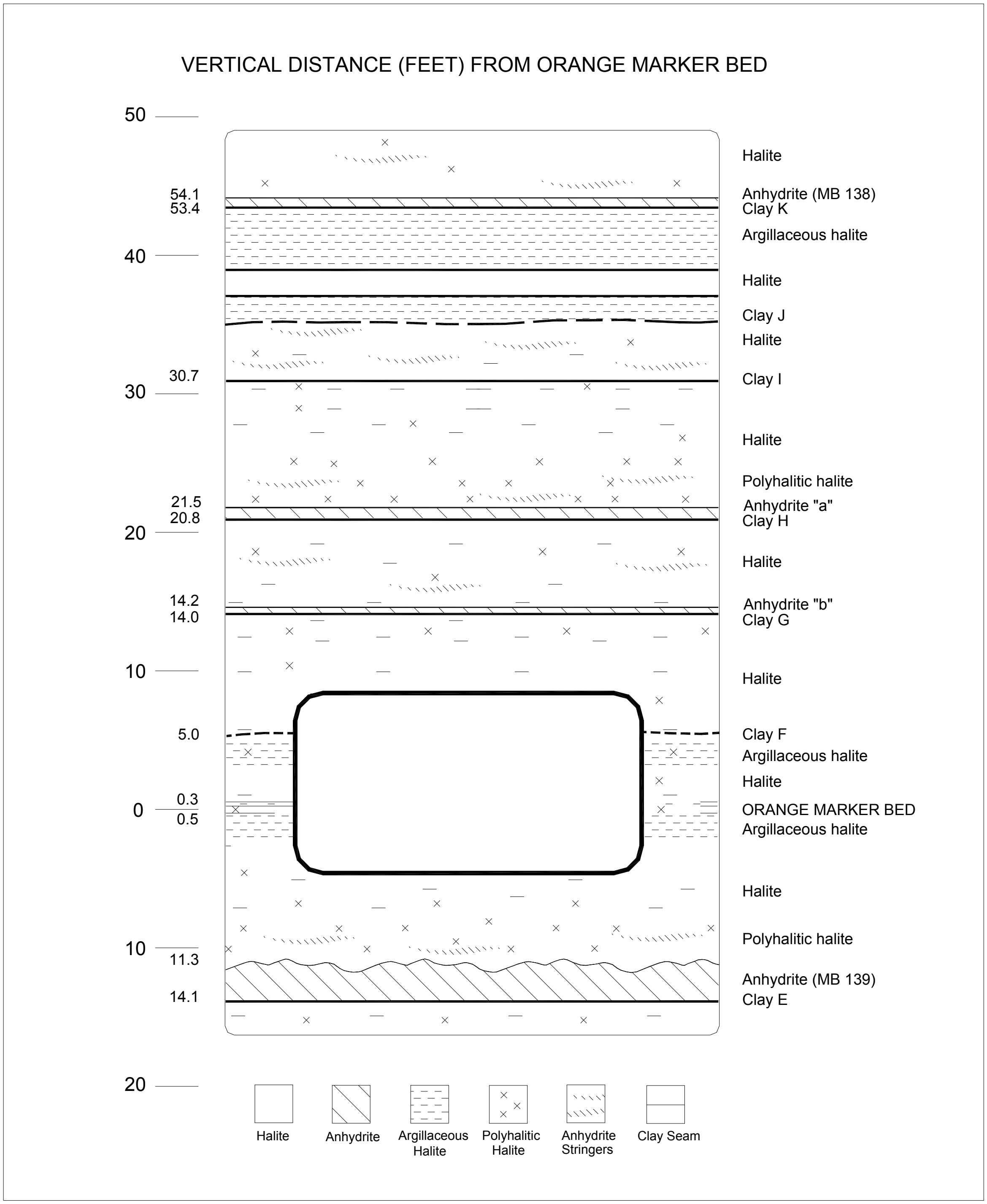


Figure 2-2 – Repository Level Stratigraphy of Panels 1, 2, 7, and 8

2.2.2 Disposal Horizon Stratigraphy of Panels 3, 4, 5, and 6

Field observations and computer modeling indicated that moving the disposal horizon stratigraphically upward (so that the roof was located at Clay G) would improve long-term ground conditions and provide a more stable roof configuration without significantly impacting repository performance. In 2000, the decision was made to implement this change by moving the mining horizon up approximately six feet. Subsequently, in 2000 and 2001, ramps were mined in the W-170, W-30, E-140, and E-300 drifts between S-2620 and S-2750 (Figure 1-2). As a result, the disposal horizon for Panels 3, 4, 5, and 6, and the associated connecting drifts lies above the horizon for the other panels (Figure 2-3).

In this horizon, the OMB lies at or below the floor. MB139 lies about 12 ft (3.7 m) below the floor. The roof lies at or slightly above Anhydrite "b." Clay G/ Anhydrite "b" is used as the mining reference during excavation of this disposal horizon. Locally continuous anhydrite stringers are found within this beam, generally concentrated in the lower portion toward Anhydrite “b”. These effectively divide the roof beam itself into a series of thinner, independent beam.

2.2.3 Northeast Area Stratigraphy

All of the Northeast Area, a former experimental area, is now deactivated and closed to access. These excavations lie at a higher stratigraphic level than the disposal excavations. Floors are at Anhydrite "b." As in the lower units, the halite intervals between the clay seams/anhydrite beds contain relatively pure halite that becomes increasingly argillaceous upward. Above clay I, two more halite intervals complete the underground facility stratigraphy. Clay J, at the top of the first of these intervals, may consist of a distinct seam or merely an argillaceous zone. Clay K tops the second interval and is overlain by MB138.

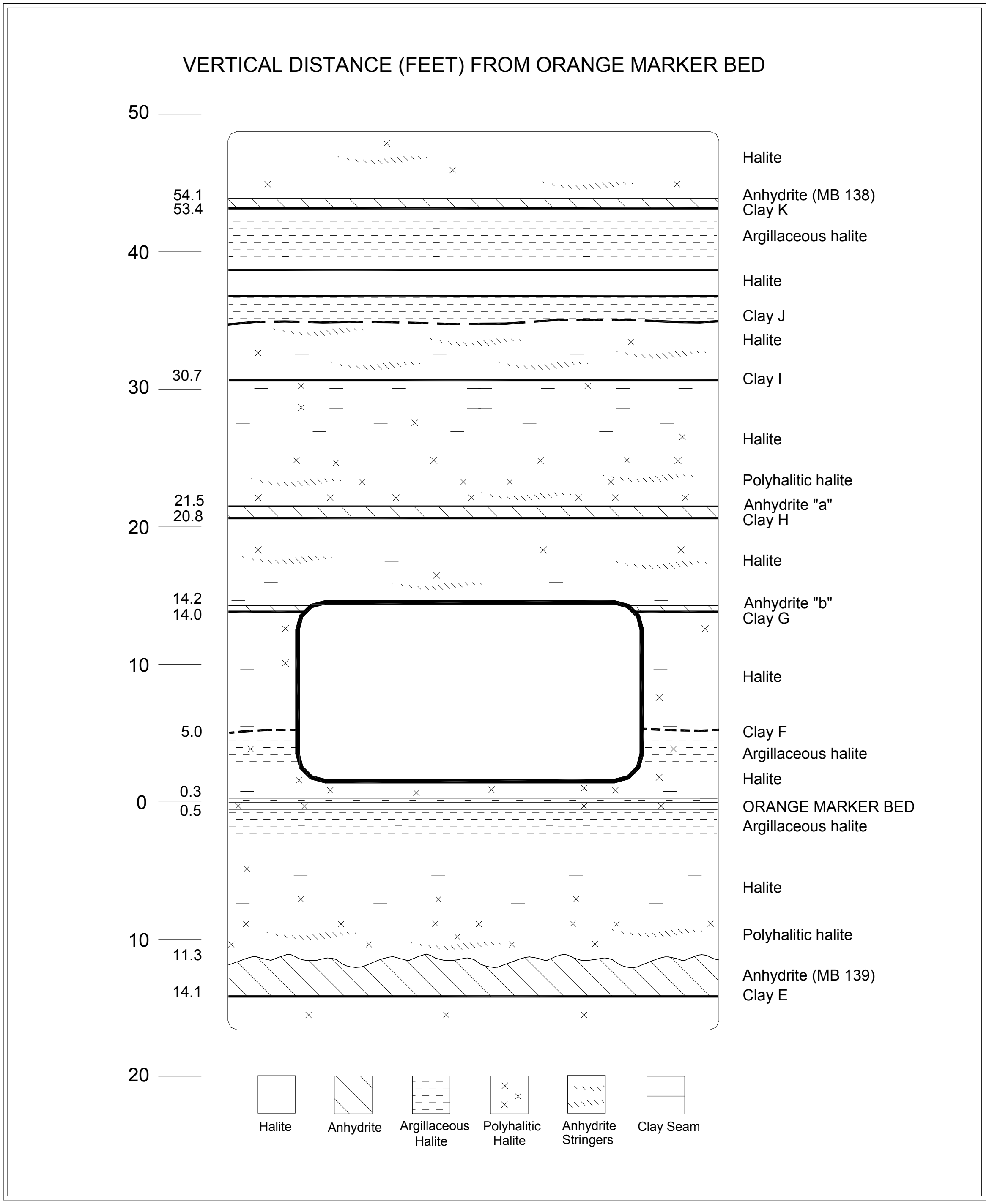


Figure 2-3 – Repository Level Stratigraphy of Panels 3, 4, 5, and 6

3.0 PERFORMANCE OF SHAFTS AND KEYS

Four shafts connect the surface with the underground. They are the Salt Shaft, which is used primarily for removing excavated salt from the underground and for transporting personnel and material; the Waste Shaft, which is used primarily for transporting TRU waste to the underground and for transporting personnel and materials; the Exhaust Shaft, which is used to exhaust the ventilation air from the underground; and the Air Intake Shaft, which is the primary source of fresh air ventilation to the underground. This chapter describes the geomechanical performance of these shafts.

Although through the years much of the instrumentation installed in the shafts has failed, there are no plans to replace it. The project has a good understanding of the expected movements in the shafts. Monitoring results up to the point of instrument failure did not indicate unusual shaft movements or displacements. Continued periodic visual inspections confirm the expected shaft performance and provide necessary observations to evaluate shaft performance. Replacement of failed instrumentation will not provide significant additional information.

3.1 Salt Shaft

The first construction activity undertaken during the SPDV Program was the excavation of the Exploratory Shaft. This shaft was subsequently referred to as the Construction and Salt Shaft and is currently designated the Salt Shaft (see Figure 1-2). The shaft was drilled from July 4 to October 24, 1981, and geologically mapped in the spring of 1982 (DOE, 1983). Figure 3-1 presents the stratigraphy in the shaft.

The Salt Shaft is lined from the surface to 846 ft (258 m) with steel casing having an inside diameter of 10 ft (3-m). The thickness of the steel liner (including external stiffener rings) increases from 0.62 in (1.6 cm) at the top to 1.5 in (3.8 cm) at the key. Cement grout was placed between the liner and the rock face. The 10-ft (3-m) diameter extends through the concrete shaft key to 880 ft (268 m). The shaft key is a 37.5 ft (11.4-m) long, reinforced-concrete structure that begins 3.5 ft (1.07 m) above the bottom of the steel liner. From the key to the bottom at 2,298 ft (700 m), the shaft has a nominal diameter of 12 ft (4 m).

Wire mesh anchored by rock bolts is installed in sections of the lower shaft as a safety screen to contain rock fragments that may become detached. The shaft extends approximately 140 ft (43 m) below the repository horizon in order to accommodate the skip loading equipment and a sump.

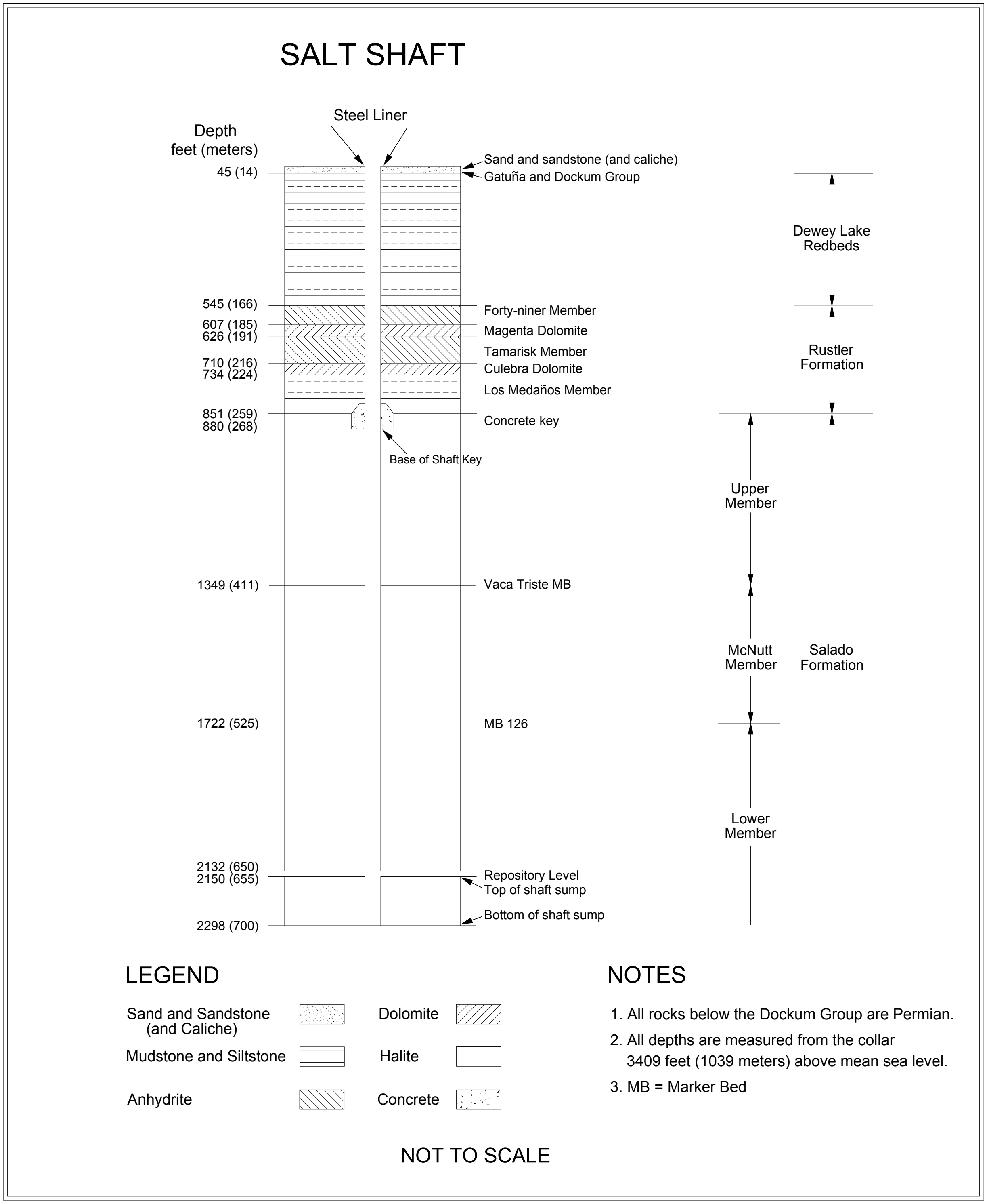


Figure 3-1 – Salt Shaft Stratigraphy

3.1.1 Shaft Observations

Underground operations personnel conduct weekly visual inspections. These inspections are performed principally to assess the condition of the hoisting and mechanical systems, but they also include examining the shaft walls for water seepage, loose rock, or sloughing. Visual inspections during this reporting period found that the shaft remained in satisfactory condition. Only routine ground control activities were required.

3.1.2 Instrumentation

Geomechanical instruments (radial convergence points, extensometers, and piezometers) were installed at various levels in the shaft from April through July of 1982 (Figures 3-2 and 3-3). In the shaft key, instruments included strain gauges, pressure cells, and piezometers. Radial convergence points were installed prior to outfitting. Upon completion of shaft outfitting, no more readings were taken.

Ten of the 12 piezometers continue to provide data. The fluid pressures recorded at the end of this reporting period range from approximately 45 pounds per square inch (psi) (310 kilopascals [kPa]) at the 850-ft (259-m) level in the Los Medaños Member to 151 psi (1041 kPa) at the 620-ft (189-m) level in the Magenta Dolomite Member. The recorded pressures for this reporting period are generally consistent with the readings from the previous reporting period. The fluid pressure on the shaft liner will continue to be monitored on a regular basis.

Four earth pressure cells were installed in the key section during concrete emplacement at the 860-ft (262-m) level. These instruments measure the normal stress between the concrete key and the Salado Formation as salt creep loads up the key structure. Three of the four earth pressure cells continue to provide data. These instruments have indicated essentially no contact pressure since their installation (readings resemble instrument drift at a zero pressure). The maximum contact pressure recorded by the instruments for this reporting period is 4 psi (28 kPa).

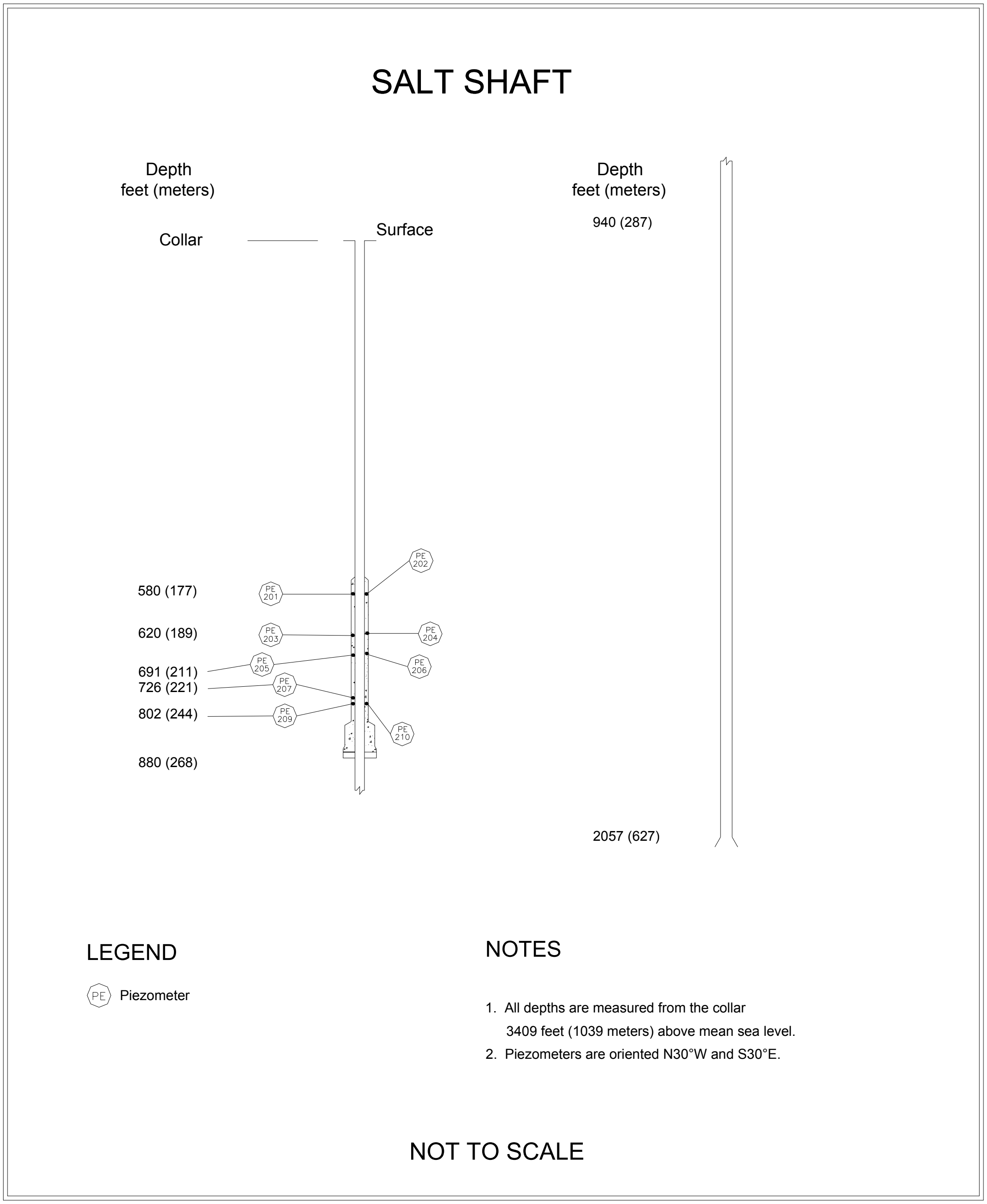


Figure 3-2 – Salt Shaft Instrumentation (Without Shaft Key)

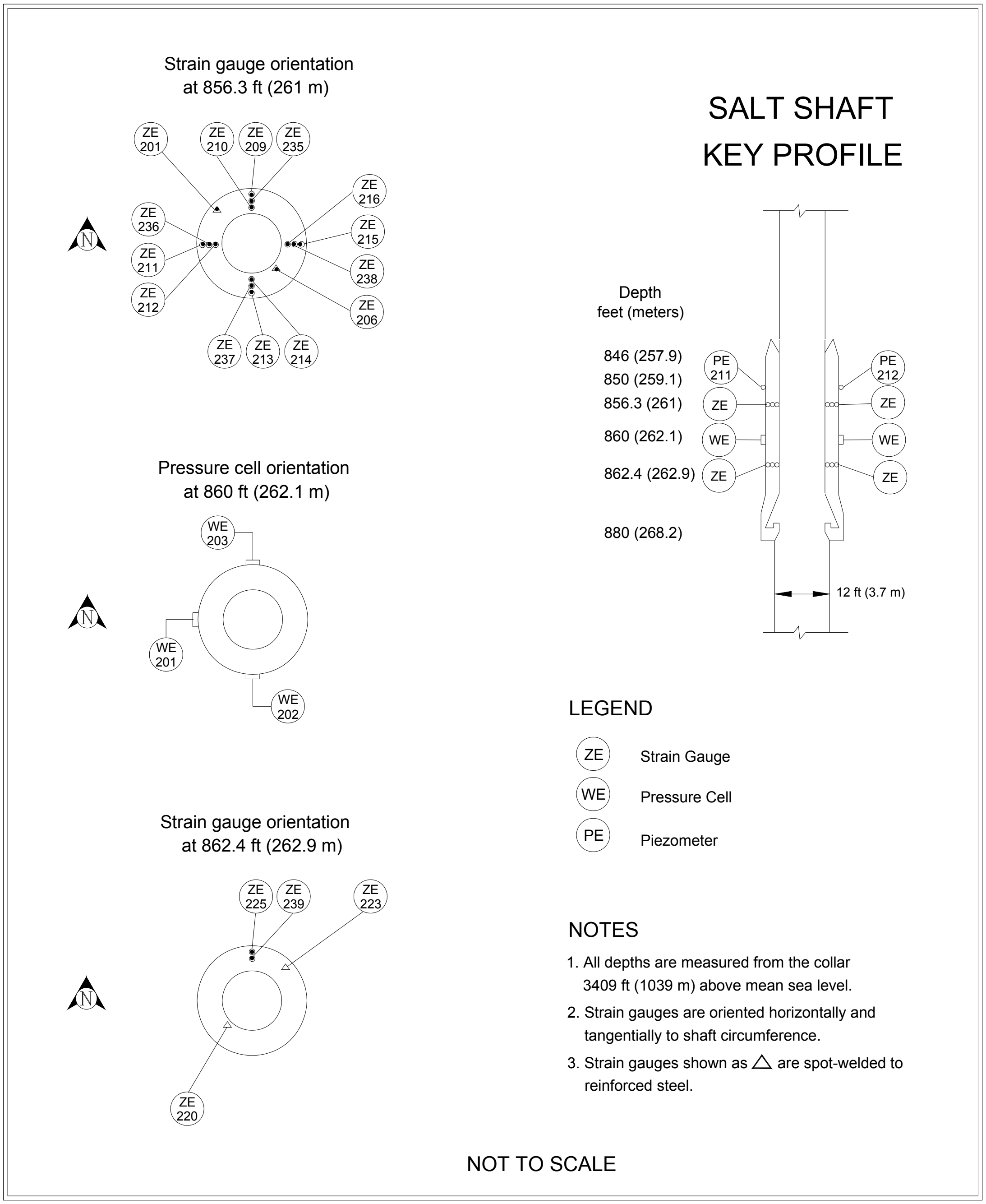


Figure 3-3 – Salt Shaft Key Instrumentation

Sixteen spot-welded and twenty-four embedment strain gauges were installed on and in the shaft key concrete at both the 856.3-ft (261-m) level and at the 862.4-ft (263-m) level. Three spot-welded strain gauges are still functioning at these levels. Strains at the 856.3-ft (261-m) level recorded a maximum strain of 590 microstrain. Strains at the 862.4 ft (263 m) level were 942 and 687 microstrain. Twelve embedment strain gauges are still functioning. The strains at the 856.3-ft (261-m) level ranged from -914 to 970 microstrain. The strains from the two embedment strain gauges at the 862.4 ft (263-m) level were 280 to 397 microstrain. The strains recorded by the spot-welded strain gauges and the embedment strain gauges during this reporting period are very similar to the strains recorded by these instruments at the end of the previous reporting period.

3.2 Waste Shaft

As part of the SPDV Program, a 6-ft (2-m) diameter ventilation shaft, now referred to as the Waste Shaft, was excavated from December 1981 through February 1982 (see Figure 1-2). This shaft, in combination with the Salt Shaft, provided a two-shaft underground air circulation system. From October 11, 1983, to June 11, 1984, the shaft was enlarged to a diameter of 20 to 23 ft (6 to 7 m) and lined above the key. Stratigraphic mapping (Figure 3-4) was conducted during shaft enlargement from December 9, 1983, to June 5, 1984 (Holt and Powers, 1984).

The Waste Shaft is lined with non-reinforced concrete having a 19 ft (6 m) inside diameter from the surface to the top of the key at 837 ft (255 m). Liner thickness increases from 10 in (25 cm) at the surface to 20 in (51 cm) at the key. The key is 63 ft (19 m) long and 4.25 ft (1.3 m) thick and is constructed of reinforced concrete. The bottom of the key is 900 ft (274 m) below the surface. The diameter of the shaft is 20 ft (6 m) at the bottom of the key and increases to 23 ft (7 m) just above the shaft station. The shaft below the key is lined with wire mesh anchored by rock bolts. The diameter of 23 ft (7 m) extends to a depth of approximately 2,286 ft (697 m), with the shaft sump comprising the lower 119 ft (36 m) of that interval.

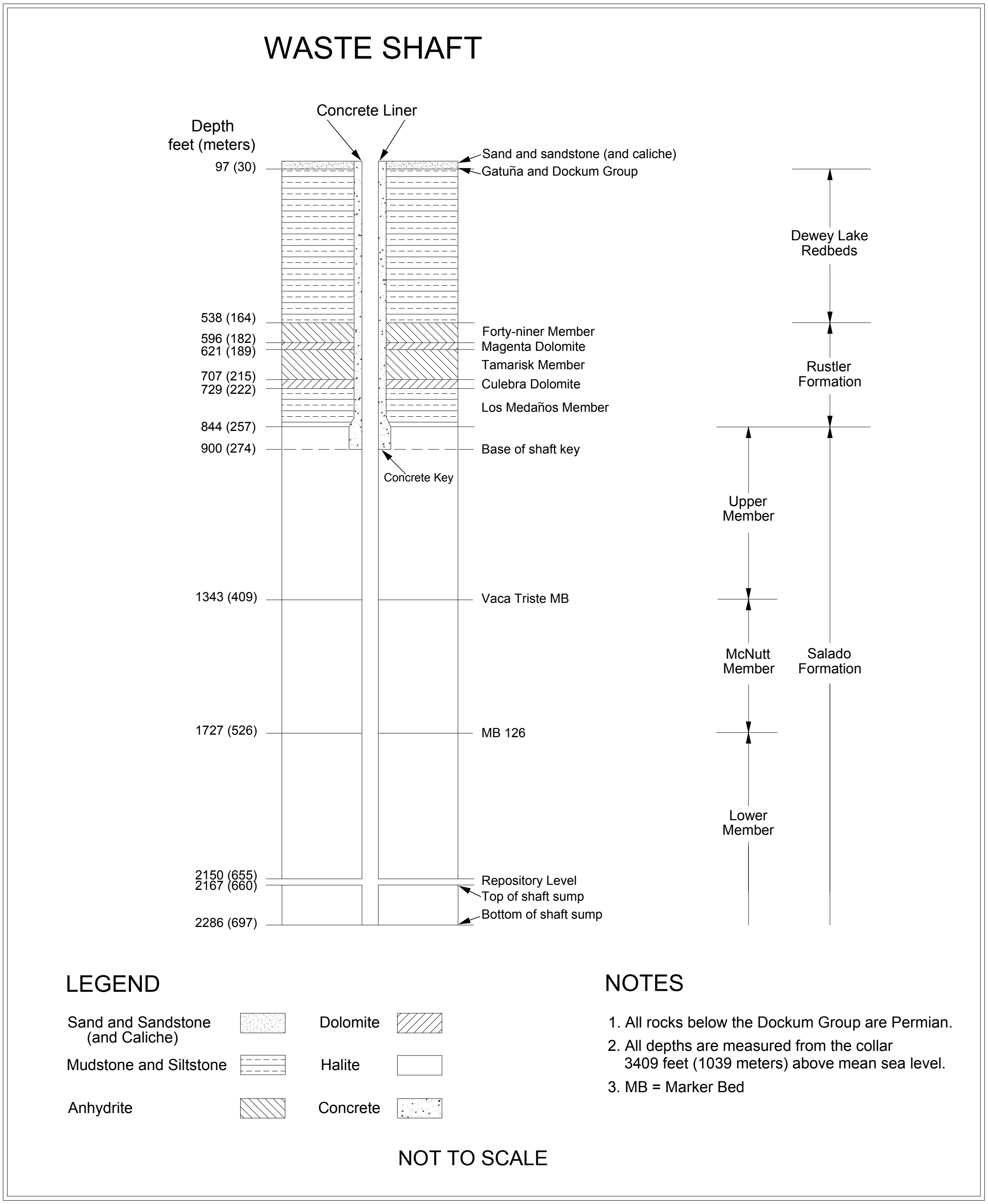


Figure 3-4 – Waste Shaft Stratigraphy

3.2.1 Shaft Observations

Underground operations personnel conduct weekly visual inspections, principally to assess the condition of the hoisting and mechanical systems, but also include observation of the shaft walls for water seepage, loose rock, or sloughing. The visual inspections found that the shaft was in satisfactory condition. No ground control activities other than routine maintenance were required.

3.2.2 Instrumentation

Radial convergence points, extensometers, piezometers, and earth pressure cells were installed in the Waste Shaft between August 27 and September 10, 1984. Radial convergence points were installed prior to the outfitting. Upon completion of shaft outfitting, no more radial convergence readings were taken. Figure 3-5 and Figure 3-6 show the instrument locations.

Nine multi-position extensometers were installed in arrays 1,071 ft (326 m), 1,566 ft (477 m), and 2,059 ft (628 m) below the surface as shown in Figure 3-5. Each array consists of three extensometers. No extensometer data have been collected in recent years due to the malfunction of the data acquisition equipment. Since the type of extensometers installed in the shaft over 27 years ago is no longer manufactured, remote data acquisition equipment for these extensometers is also unavailable.

Twelve piezometers were installed in the lined section of the Waste Shaft on September 7 and 8, 1984, to monitor fluid pressure behind the shaft liner and the key section. As of this reporting period, data is no longer being received from any of the piezometers.

Four earth pressure cells were installed in the key section of the Waste Shaft during concrete emplacement between March 23 and April 3, 1984. One is still working. Earth pressure cells measure the normal stress between the concrete key and the Salado Formation as salt creep loads the key structure. The contact pressure recorded by the instrument during this reporting period was 134 psi (924 kPa) at the 866 ft (264 m) level.

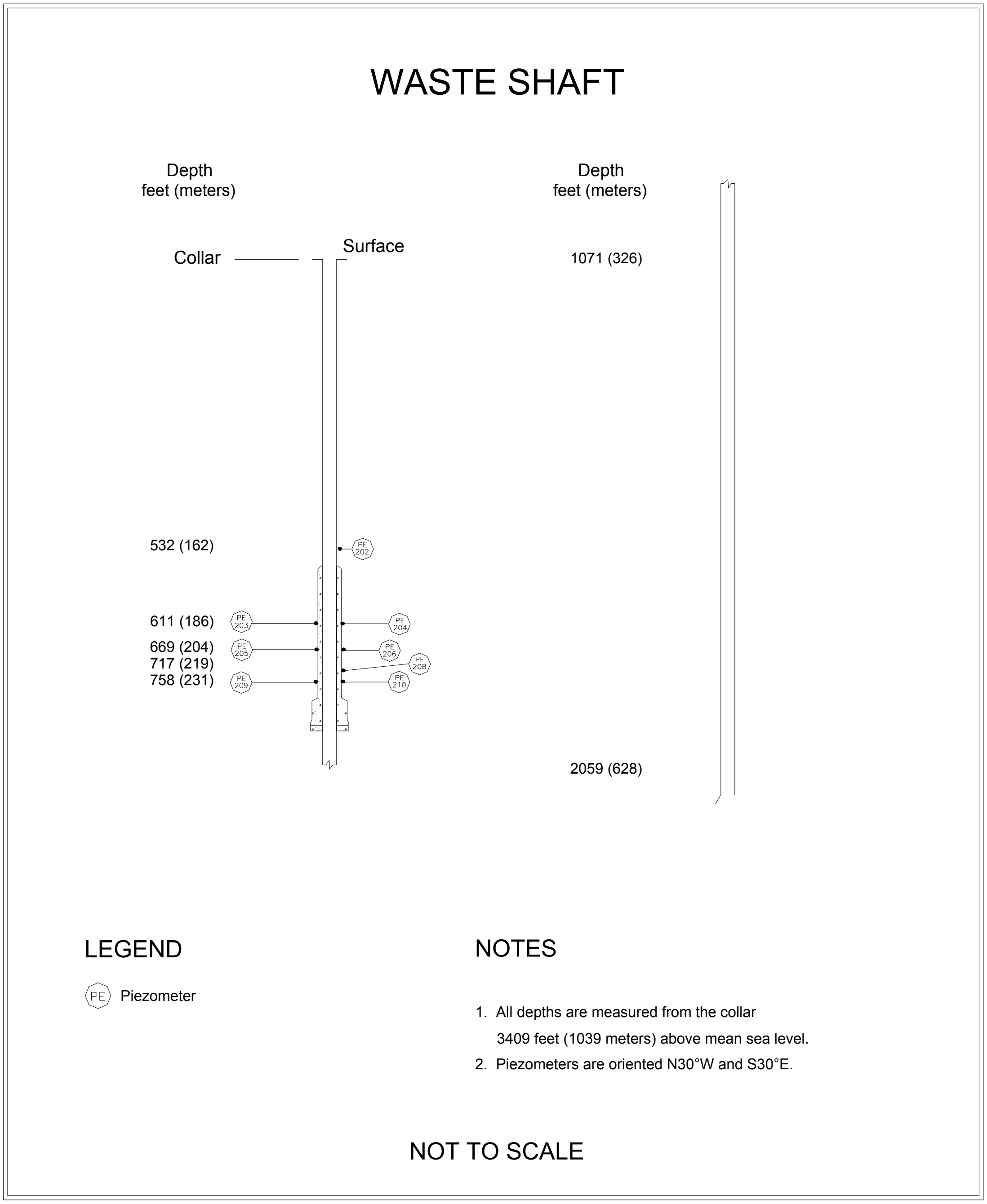


Figure 3-5 – Waste Shaft Instrumentation (Without Shaft Key)

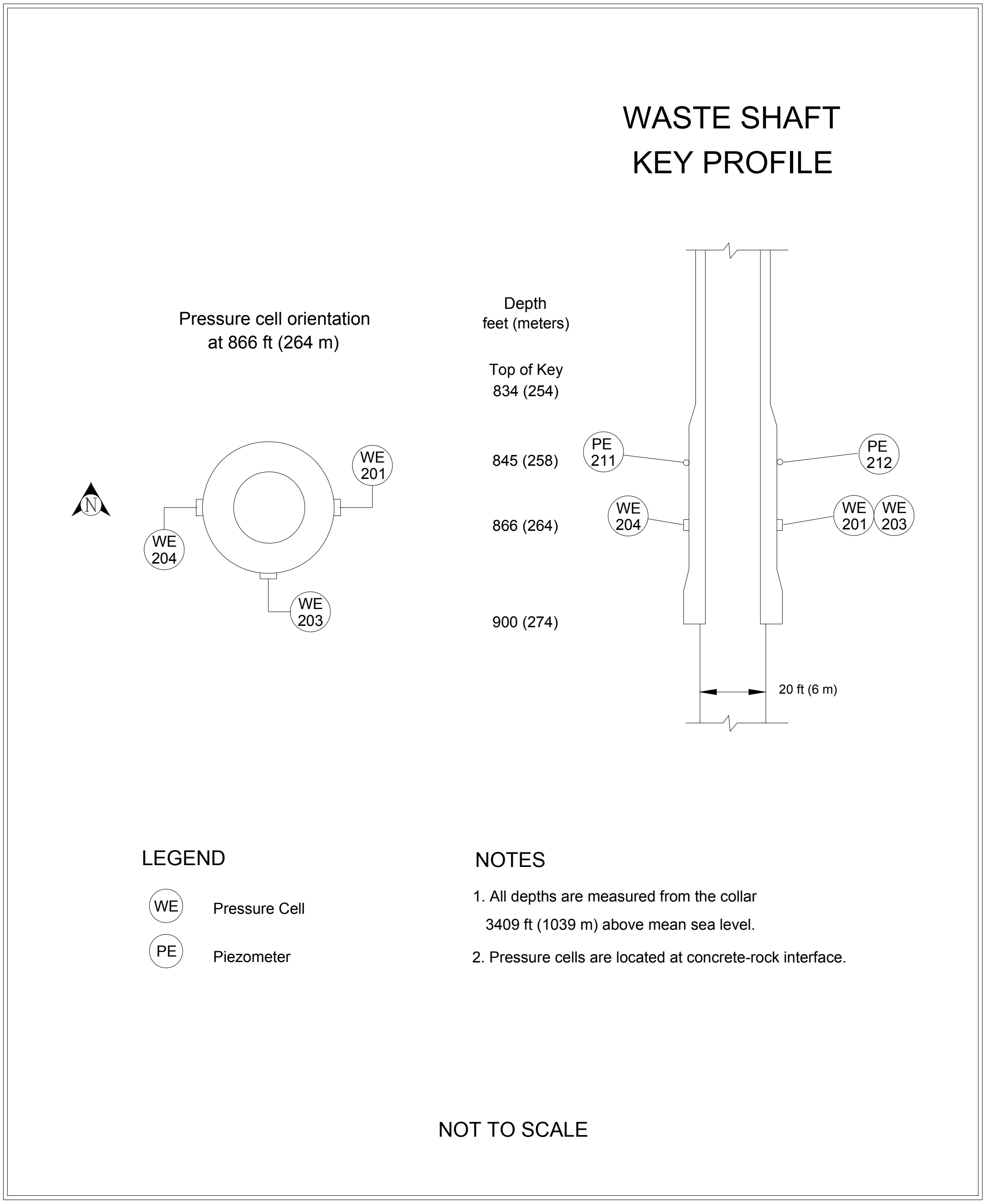


Figure 3-6 – Waste Shaft Key Instrumentation

3.3 Exhaust Shaft

The Exhaust Shaft was drilled from September 22, 1983, to November 29, 1984, to establish a route from the underground to the surface for exhaust air (Figure 1-2). Stratigraphic mapping was conducted from July 16, 1984, to January 18, 1985 (DOE, 1986c). Figure 3-7 illustrates the shaft stratigraphy.

The Exhaust Shaft is lined with non-reinforced concrete from the surface to the top of the shaft key at 844 ft (257 m). The liner thickness increases from 10 to 16 in (25 to 41 cm) over that interval. The key is 63 ft (19 m) long and 3.5 ft (1 m) thick. The shaft diameter below the key is 15 ft (5 m), and the interval below the key is lined with wire mesh anchored by rock bolts. The shaft terminates at the facility horizon, approximately 2,150 ft (655 m) deep. This shaft has no sump.

3.3.1 Exhaust Shaft Observations

Quarterly video inspections were conducted according to approved WIPP procedures. Inspections were performed to evaluate the condition and to verify the integrity of the shaft. The shaft was examined for cracks, corrosion, salt buildup, seeps, and debris. In addition, inspections examined the condition of anchors, brackets, and down-hole equipment. Between July 2011 and June 2012, four quarterly shaft inspections were conducted on August 31, 2011; November 16, 2011; February 29, 2012; and June 12, 2012.

3.3.1.1 Video Camera

Video inspections use a custom-designed vertical-drop color camera in an aerodynamic housing, suspended by a dual-armored cable, with pan, tilt, and zoom capability. The cable contains five copper conductors and two multi-mode optical fibers. It is reeled out by a winch mounted in a control van. Inspections are recorded electronically.

3.3.1.2 Shaft Inspection Observations

Quarterly video inspection observations concentrate on four major areas: air monitoring components, shaft liner, shaft walls, and equipment support and cabling. The air monitoring components consist of one air-velocity and three air-monitoring devices as shown in Figure 3-8. The video inspection includes examination of each device, including the transport assembly, guide tubes, the sample intake, and the support brackets that extend from Station "A" above the shaft to the shaft collar. Air monitoring components extend from the collar 21 ft into the shaft. Video inspections indicate that the air-sampling components can accumulate salt buildup of up to several inches thick.

The Exhaust Shaft liner is examined for cracks, seepage, and general shaft stability. Currently, there are three principal zones of seepage in the shaft. The first is about 50 to 55 ft below the shaft collar (bsc). The second is about 60 to 65 ft bsc. The third is about 75 to 80 ft bsc, as shown in Figure 3-9. Monitoring of seepage horizons started before 1995. Water entering the shaft through these cracks is believed to originate from a perched aquifer at the base of the Santa Rosa Formation that is being recharged as the result of surface modifications at the site. The fluid level in the Santa Rosa near the shaft is about 46 to 47 ft below the surface. Based on examination of inspection videos, the flow rate into the shaft during this reporting period is estimated at about 1 to 1 1/2 gallons per minute, most of which is carried out of the shaft by the exhaust air. Seepage cracks are confined primarily to the eastern side of the shaft wall.

When fluid was detected seeping into the shaft, a catch basin was designed and installed at the base of the Exhaust Shaft to intercept water and prevent it from draining into the Waste Shaft Sump. Fluid was removed from the catch basin from March 1996 through October 2005 as needed. The catch basin was damaged in 2004 by fallen debris, either salt or instrumentation cables or both. A new catch basin was fabricated and installed in December 2004. This basin was damaged in August 2005, most likely the result of fallen debris. An interception well system was installed between November 2005 and March 2006 to replace the catch basin. Interception wells were drilled down-gradient in S-400 between E-140 and E 300 (Figure 3-10). The interception well system initially consisted of four 30-ft deep 9-7/8-in diameter fluid collection holes with a submersible pump and pressure transducer in each. Fluid is pumped from each hole to a series of storage containers in S-550. A data-acquisition system monitors the fluid level in each hole, turning the pump on and off between set limits as needed.

Between February 2 and 6, 2008, two additional fluid collection holes, OH631 and OH632, were drilled in S-400 to improve the total volume of fluid recovered by the interception well system. They replaced OH613 and OH614 which generated little fluid. As with the previous four holes, the additional holes were drilled at 9-7/8-inch diameter to a total depth of 30 feet. Pumps were pulled from OH613 and OH614 and installed in OH631 and OH632. Figure 3-10 shows the location of the interception wells system and the 500-gallons storage containers.

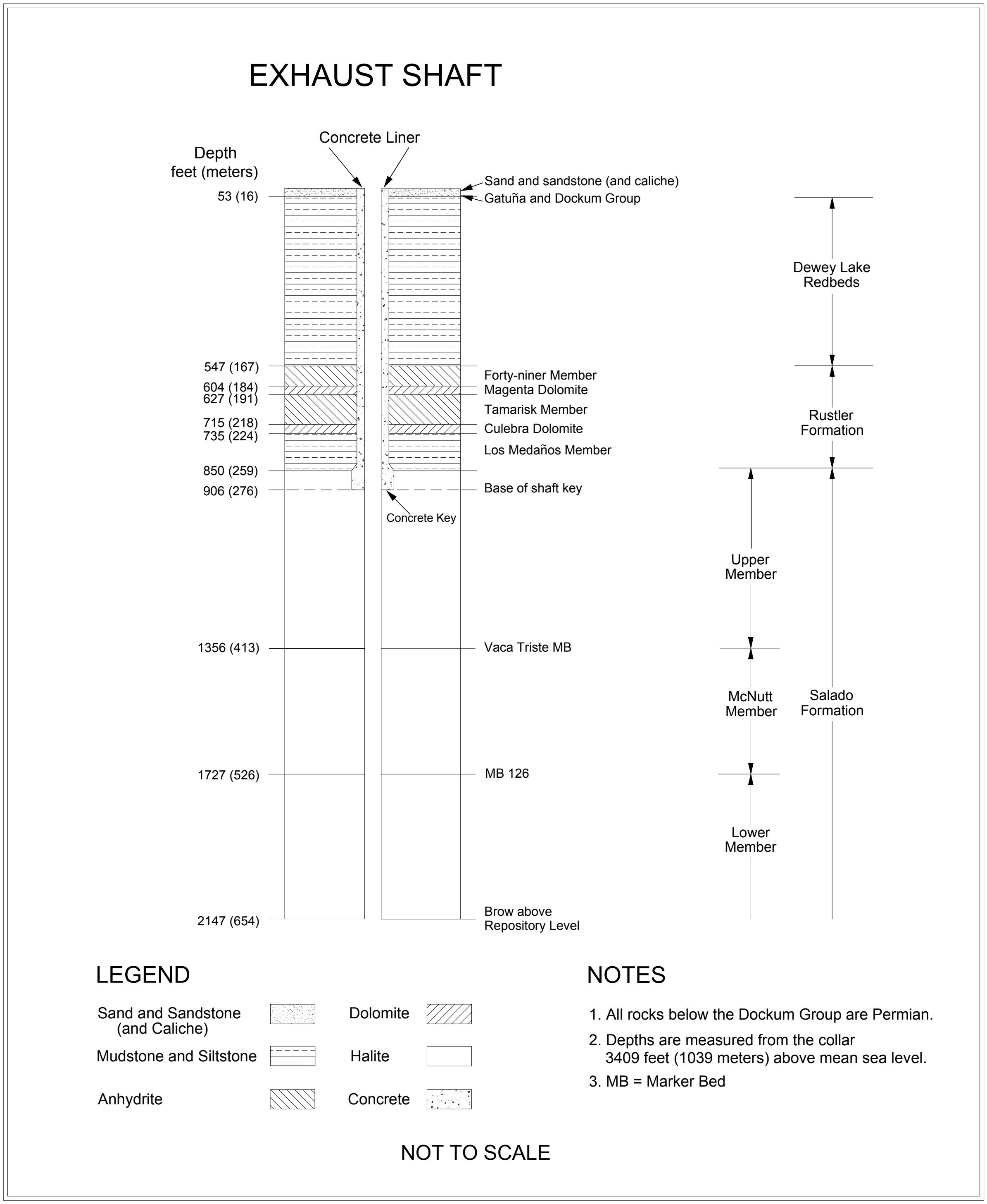


Figure 3-7 – Exhaust Shaft Stratigraphy

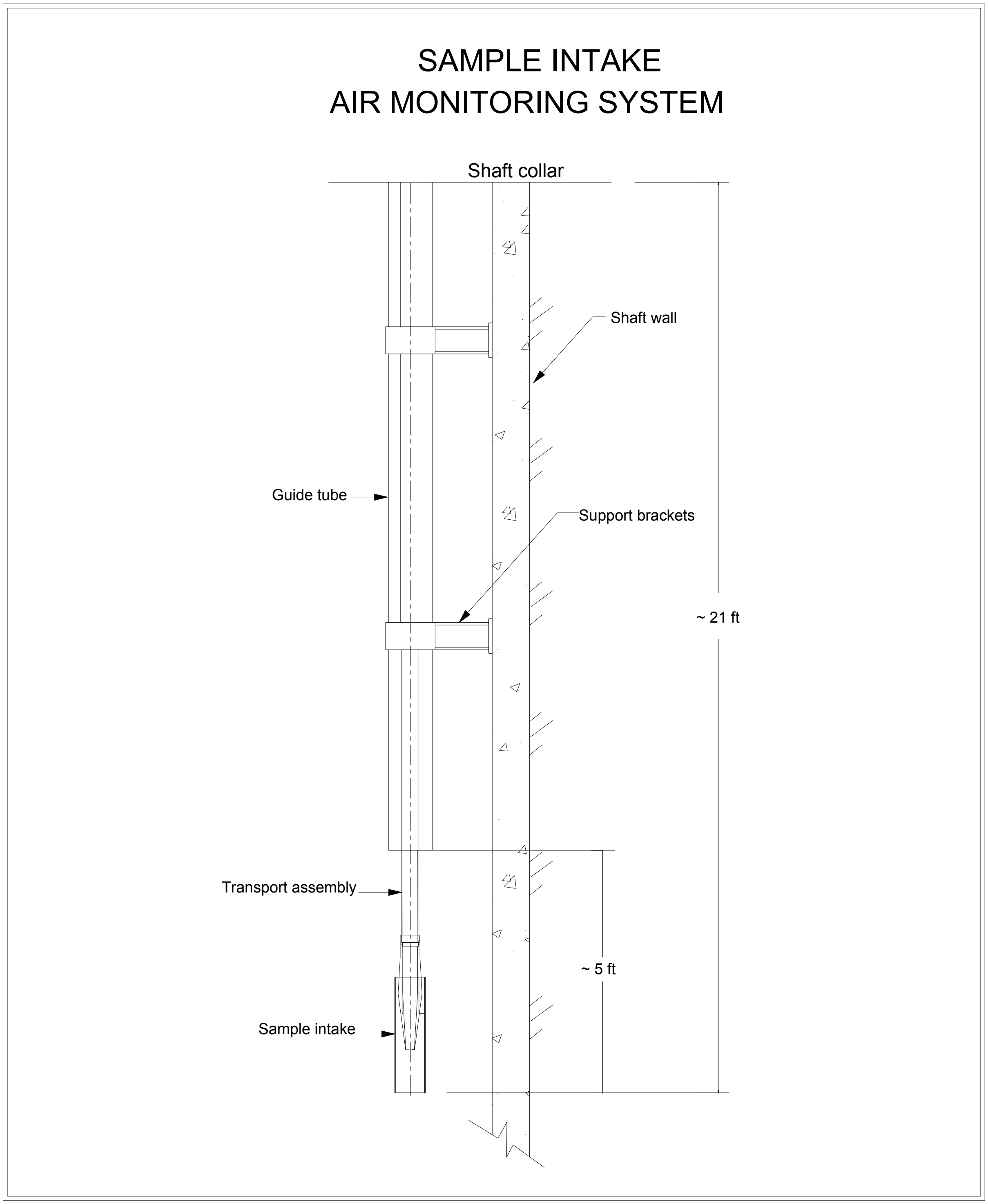


Figure 3-8 – Sample Intake of Exhaust Shaft Air Monitoring System

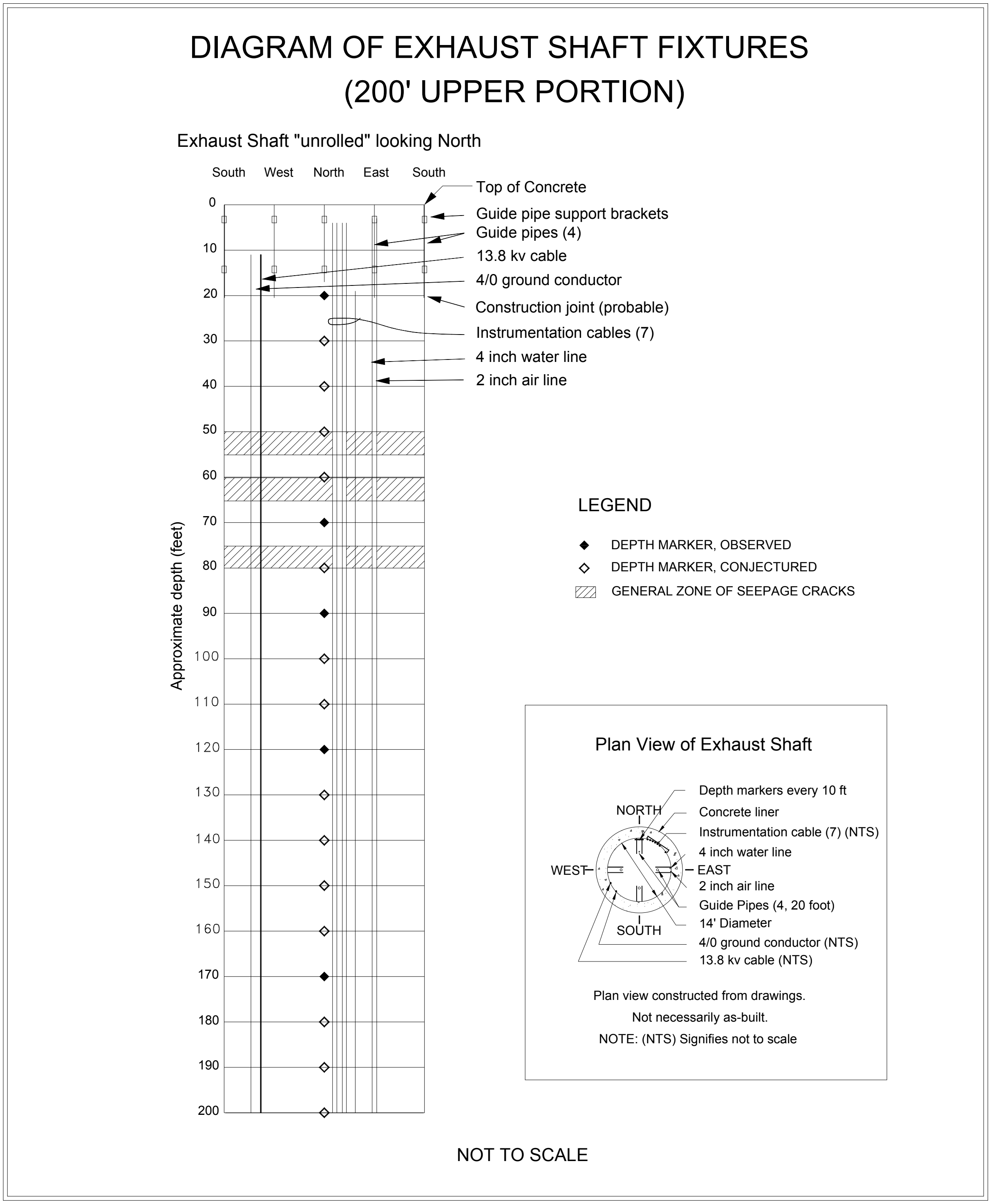


Figure 3-9 – Diagram of Exhaust Shaft Fixtures and Seepage Zones (Upper 200 ft)

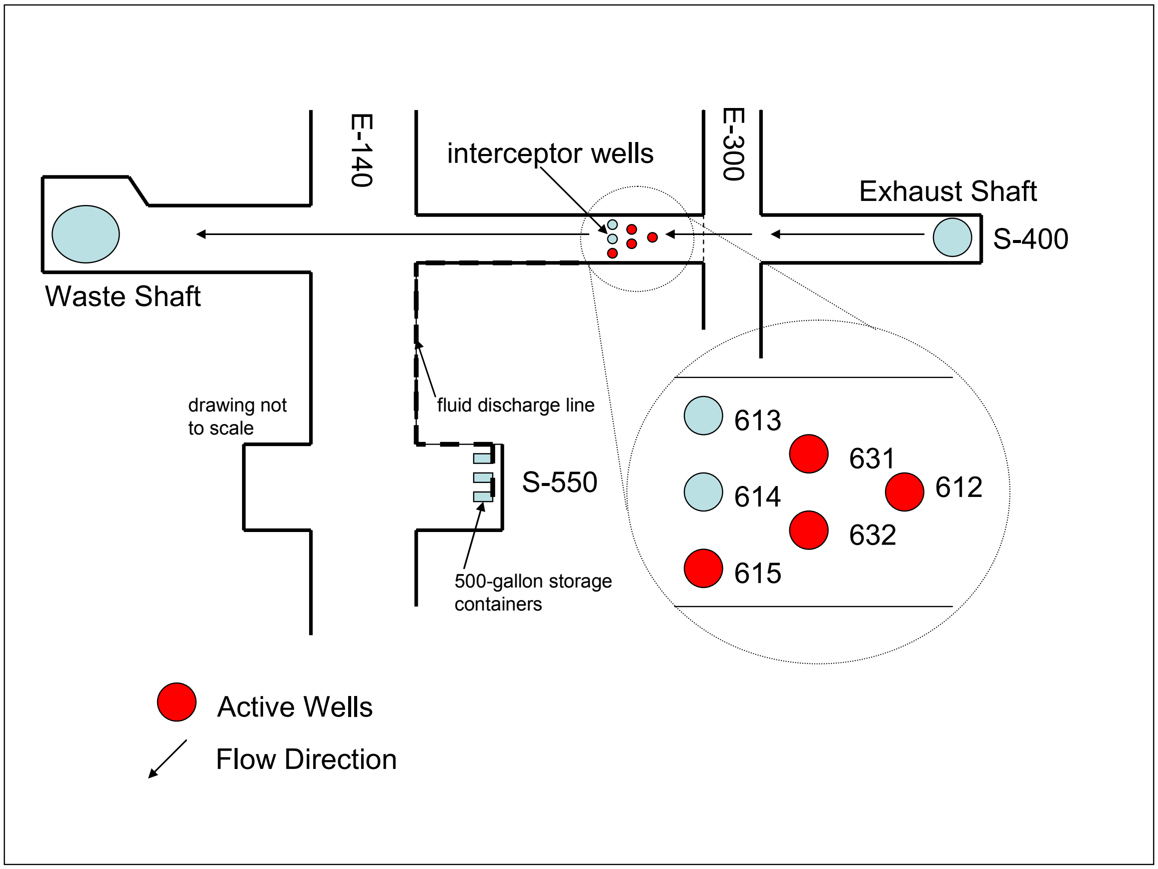


Figure 3-10 – Location of Interception Wells and Storage Containers

Figure **3-11** presents the volume of fluid removed from the catch basin from July 1997 through June 2006, and by the interception well system from July 2006 through June 2012. The largest reported volumes are typically associated with periods of reduced ventilation and increased humidity. For a discussion of the factors affecting the quantity of fluid produced in the Exhaust Shaft, refer to DOE/WIPP-00-2000, *Brine Generation Study*.

The shaft walls were examined for salt buildup, cracks, moisture, and encrustations, with particular attention paid to power cables, instrument cables, air lines and water-lines, and the three water rings at the base of the Magenta and Culebra members of the Rustler Formation and the bottom of the shaft key. The condition of the shaft wall varies depending on airflow, humidity, temperature, and underground mining activities. During this reporting period, significant mining activity continued in Panel 7 and the Salt Disposal Investigation (SDI) area. The principal areas in the shaft with significant salt buildup were the three water rings at the Magenta, the Culebra, and the key, and along upper portions of the shaft generally associated with power cables, support brackets, instrument cables, and the air lines and water-lines.

Though the Magenta and Culebra water rings are encrusted with salt buildup, no water appears to originate from the liner or water rings. Most of the seepage was observed along the east face of the shaft wall near the instrumentation cables and the air lines and water-lines in the upper section of the shaft. Though the presence of water is an inconvenience requiring periodic disposal, at this time it does not appear to have created any hazard or affected the structural integrity of the shaft. However, brine increases the probability of corrosion and deterioration of utility hangers and brackets. There are no visible signs of dissolution of the salt below the key.

The video inspections also focused on the installed utilities and support brackets. These include a 13.8 kVA power cable that is no longer active and the grounding cable on the west wall of the shaft, the instrumentation cables on the northeast wall of the shaft, and the 4 in. air-line and the 2-in. water-line on the east wall of the shaft.

Sporadic salt buildup continues on all cables. The long-term implication of salt buildup is increased loading on cables and cable hangers, accompanied by intermittent falls of debris. The 4-in. compressed air-line and the 2-in. water-line extend from the surface to the bottom of the shaft. At present, neither line is being used. The integrity of the brackets holding the air-line and water-line was difficult to assess because of salt buildup; however, there was no indication that the brackets were broken. Instrumentation cable breaks were observed in the shaft; however, most of these breaks affected abandoned cables, with negligible impact on shaft monitoring and operations.

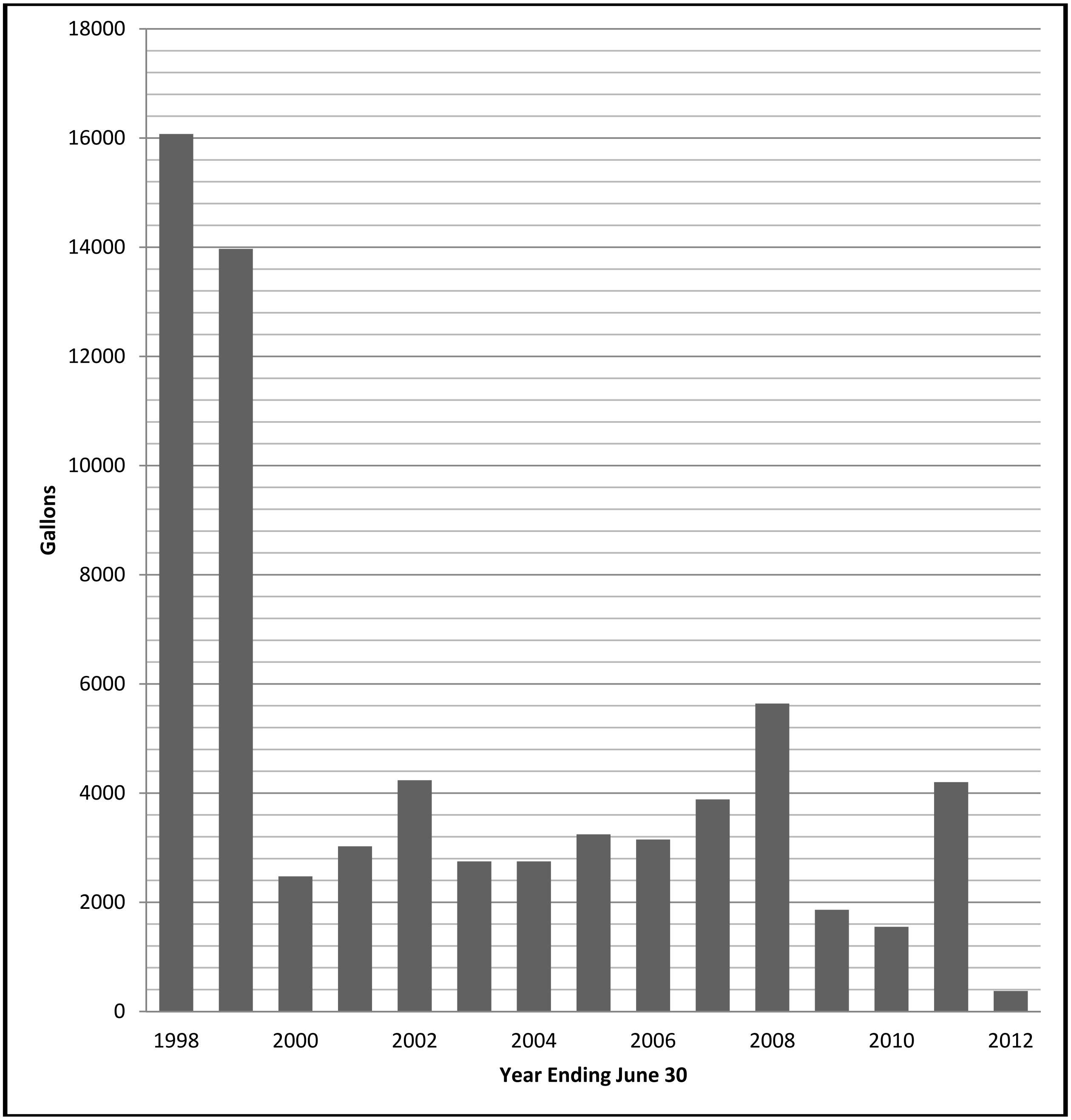


Figure 3-11 – Water Removed from the Exhaust Shaft Catch Basin and the Interception Well System

3.3.2 Instrumentation

The Exhaust Shaft was equipped with geomechanical instrumentation in two stages. Earth pressure cells were installed behind the liner key in November 1984. Piezometers and nine multi-position extensometers were installed during November and December 1985. Figure 3-12 and Figure 3-13 show the instrument locations.

Eight piezometers remained in working condition at the start of this reporting period; none continue to provide data at the end of the period. The fluid pressure readings from the working piezometers during the reporting period range from -2.8 psi (-19 kPa) at 544 ft (166 m) to 141 psi (972 kPa) at 721 ft (220 m). Maximum pressure readings from the working piezometers during this reporting period were consistent with maximum readings from the previous reporting period.

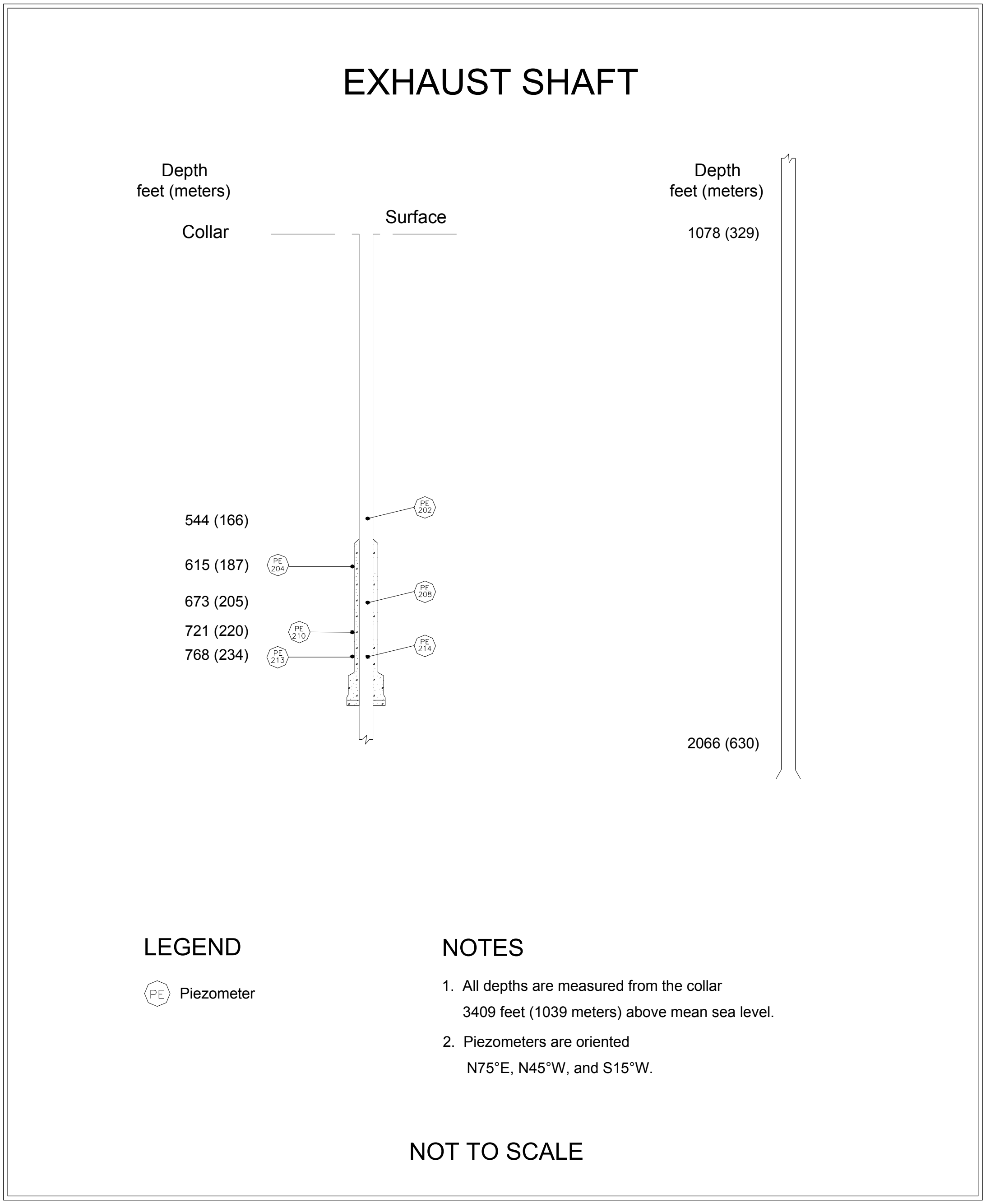


Figure 3-12 – Exhaust Shaft Instrumentation (Without Shaft Key)

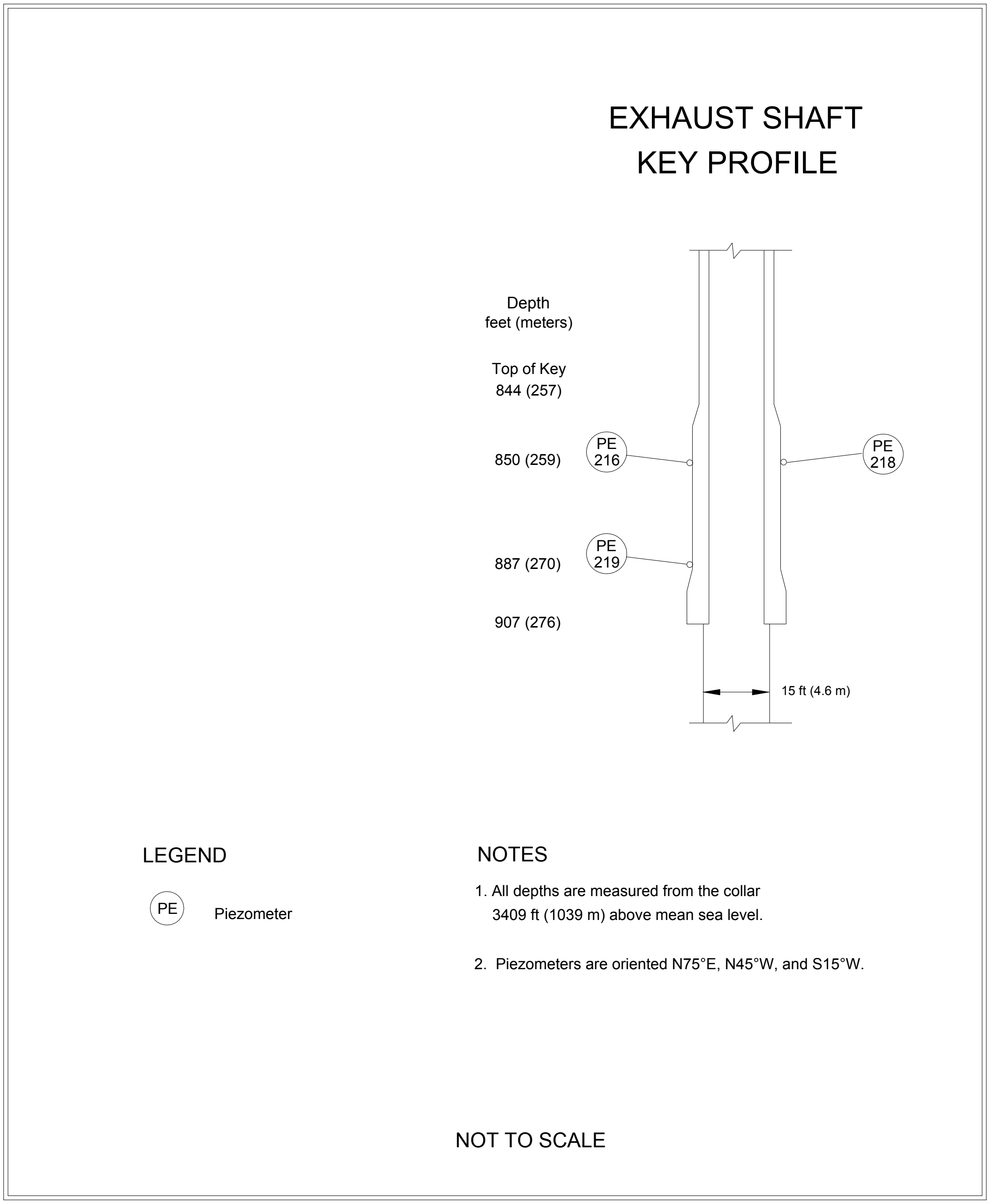


Figure 3-13 – Exhaust Shaft Key Instrumentation

3.4 Air Intake Shaft

The Air Intake Shaft was drilled from December 4, 1987, to August 31, 1988, to establish a primary route for surface air to enter the repository (see Figure 1-2). The stratigraphy was mapped from September 14, 1988, to November 14, 1989 (Holt and Powers, 1990). Figure 3-14 summarizes the shaft stratigraphy.

The Air Intake Shaft is lined with non-reinforced concrete from the surface to the bottom of the shaft key at 903 ft (275 m). The key is 81 ft (25 m) long with an inside diameter of 16 ft (5 m). The shaft diameter below the key is 20 ft (6 m), and the shaft below the key is unlined to the facility horizon at 2,150 ft (655 m). The shaft walls are bolted and meshed from just below the key all the way down to the shaft station. This shaft has no sump.

3.4.1 Shaft Performance

Weekly visual inspections were performed on the Air Intake Shaft during this reporting period, and the shaft was found to be in satisfactory condition. No ground control activities other than routine maintenance were required during this reporting period.

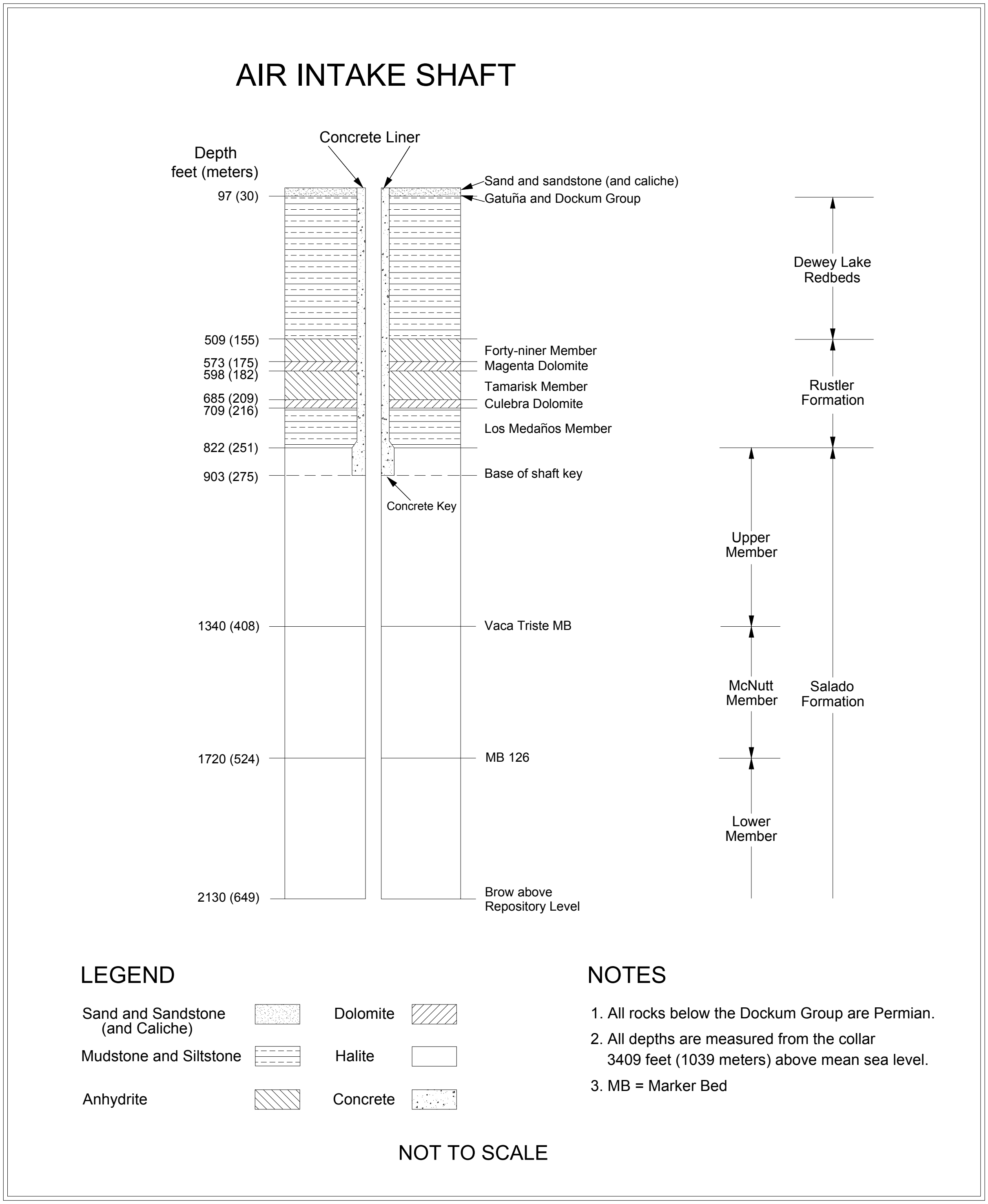


Figure 3-14 – Air Intake Shaft Stratigraphy

4.0 PERFORMANCE OF SHAFT STATIONS

This chapter describes the instrumentation and geomechanical performance of the shaft stations at the base of the Salt Shaft, the Waste Shaft, and the Air Intake Shaft. The Exhaust Shaft does not have an enlarged shaft station; therefore, it is not included in this chapter.

4.1 Salt Shaft Station

The Salt Shaft Station was excavated by drilling and blasting between May 2 and June 3, 1982. In 1987 the station was enlarged by removing the roof beam up to Anhydrite "b" between S-90 and N-20 using a mechanical scaler. In 1995, the remaining roof beam at the north end of the station was also removed up to Anhydrite "b." The station area south of the shaft is 90 ft (27.5 m) long and 32 to 38 ft (10 to 12 m) wide. The height of the station south of the shaft is 18 ft (5.5 m). The station dimensions north of the shaft are approximately 30 ft (9 m) long, 32 to 35 ft (10 to 11 m) wide, and 18 ft (5.5 m) high. The shaft extends approximately 140 ft (43 m) below the facility horizon to accommodate the skip loading equipment and a sump. Figure 4-1 shows a cross section of the station.

4.1.1 Modifications to Excavation and Ground Control Activities

In February 2012, the floor of the salt station was milled in order to accommodate alignment of the station floor to the shaft steel. Ground control activities were limited to routine maintenance.

4.1.2 Instrumentation

Geomechanical instrumentation was installed in the Salt Shaft Station between June 1982 and February 1983, with subsequent re-installation of extensometers and convergence points as necessary. Figure 4-2 shows the instrument locations after the roof beam was taken down.

Five vertical convergence points are currently monitored. Table 4-1 summarizes the vertical closure rates in the Salt Shaft Station from July 2011 through June 2012. Salt Shaft Station vertical closure rates indicate that the rates are higher than during the previous reporting period.

Table 4-2 summarizes the recent history of the roof extensometers in the Salt Shaft Station. Extensometers 51X-GE-01026-2 (S-30) and 51X-GE-01027-2 (S60) are located in the roof of the station.

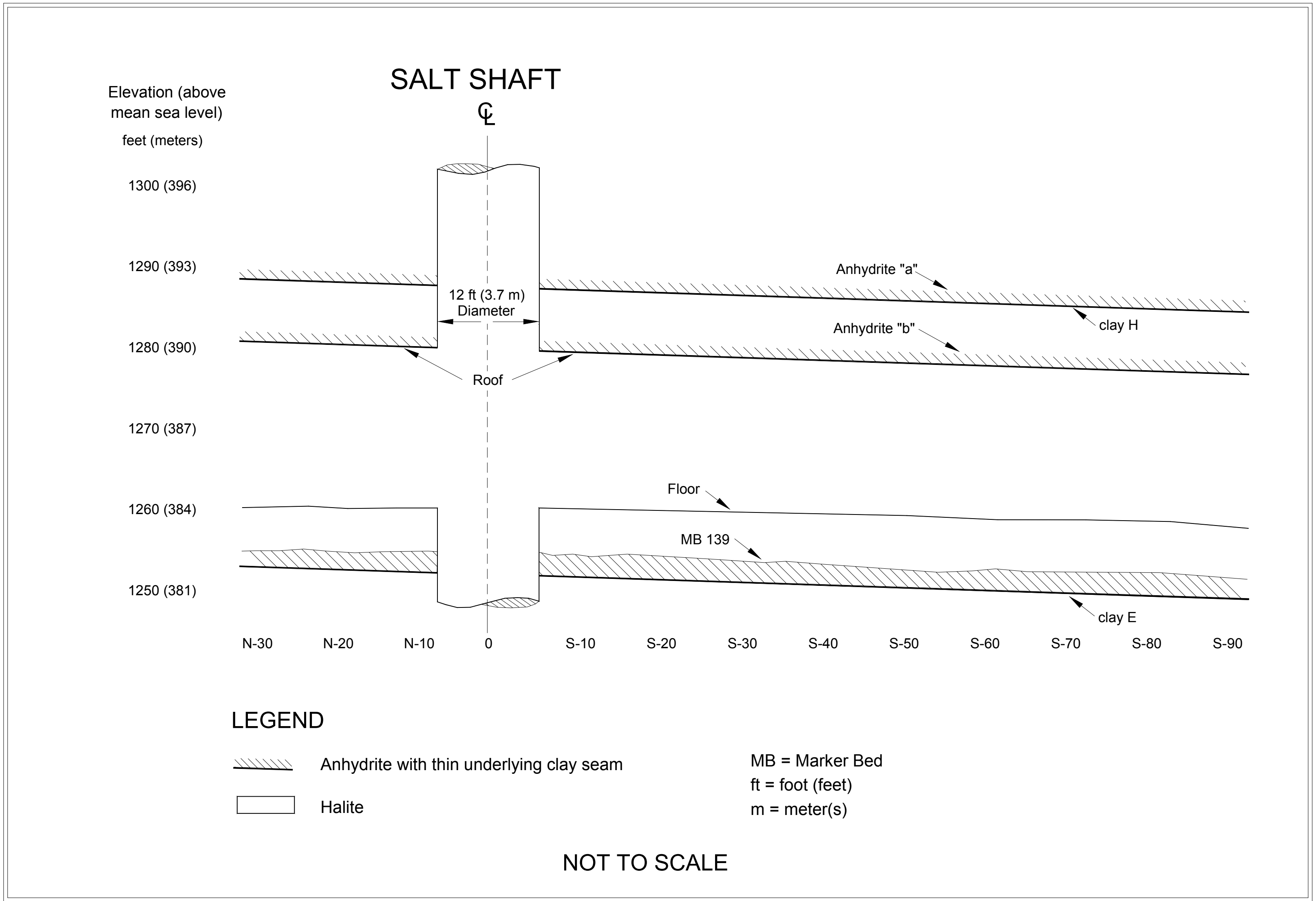


Figure 4-1 – Salt Shaft Station Stratigraphy

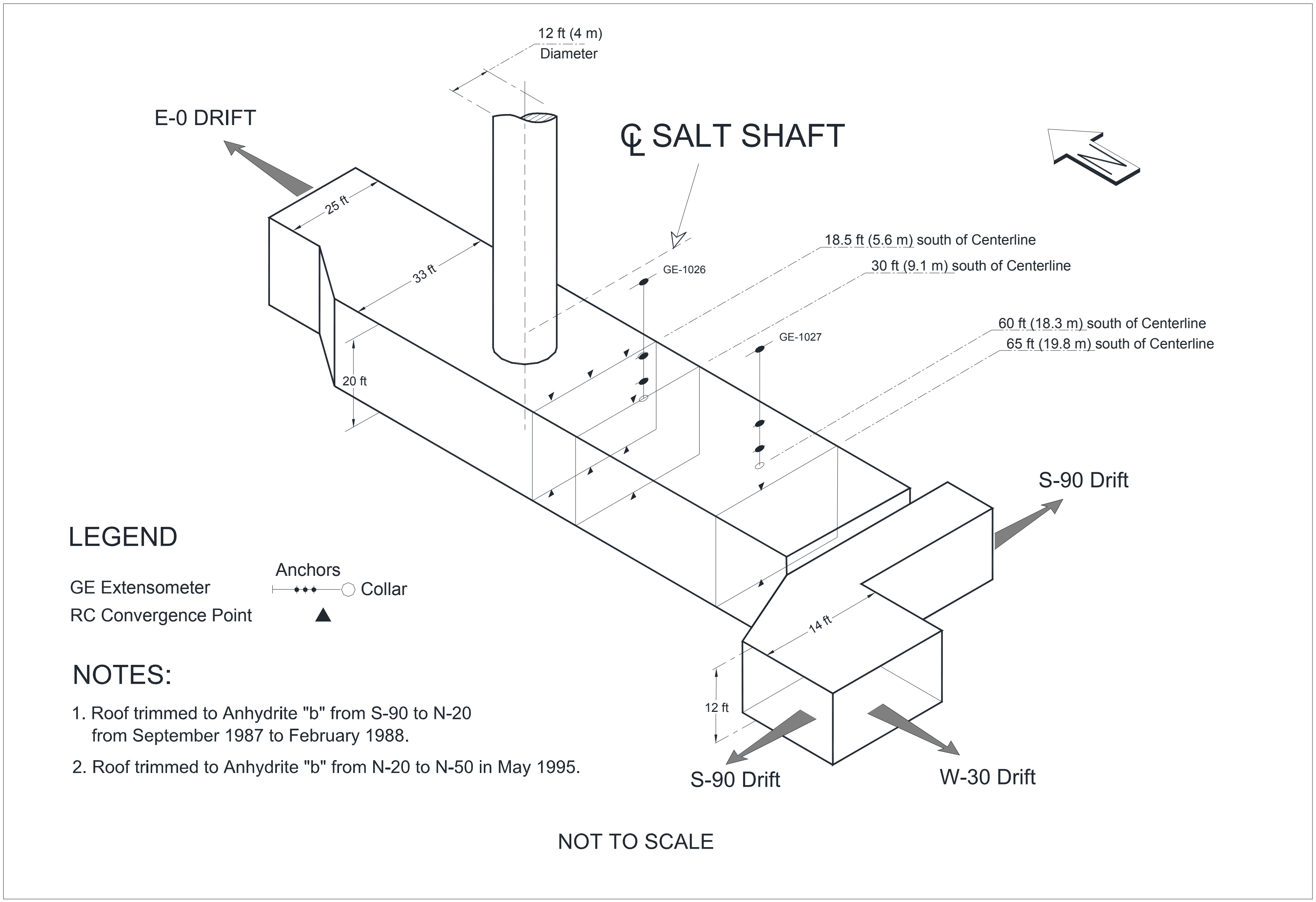


Figure 4-2 – Salt Shaft Station Instrumentation after Roof Beam Excavation

Table 4-1 Closure Rates in the Salt Shaft Station						
Location	Chord[1]	Last Reading	Total Cumulative Displacement in (cm)	Closure Rate 2011-2012 in/yr (cm/yr)	Closure Rate 2010-2011 in/yr (cm/yr)	Rate Percent Change
E0-S18	A-E	6/6/2012	21.749 (55.242)	2.5 (6.4)	1.9 (4.8)	32%
E0-S18	B-D	6/6/2012	23.728 (60.269)	2.6 (6.6)	2 (5.1)	30%
E0-S18	H-F	6/6/2012	14.834 (37.678)	1.5 (3.8)	1.3 (3.3)	15%
E0-S30	A-C	6/6/2012	22.585 (57.366)	2.3 (5.8)	1.9 (4.8)	21%
E0-S65	A-C	6/6/2012	15.726 (39.944)	1.5 (3.8)	1.2 (3)	25%

[1] Chord is defined in Section 5.3

Table 4-2 Summary of Roof Extensometers in the Salt Shaft Station						
Instrument	Location	Last Reading	Displacement Relative to Deepest Anchor in (cm)	Displacement Rate 2011 to 2012 in/yr (cm/yr)	Displacement Rate 2010 to 2011 in/yr (cm/yr)	Rate Change Percent
51X-GE-01026-2	E0-S30	6/6/2012	0.759 (1.928)	0.4 (1.0)	0.4 (1.0)	0%
51X-GE-01027-2	E0-S60	6/6/2012	0.507 (1.288)	0.2 (0.5)	0.2 (0.5)	0%

4.2 Waste Shaft Station

The Waste Shaft Station was initially excavated with a continuous miner as a ventilation connection to a 6-ft (2-m) diameter exhaust shaft in November 1982. In 1984, the station was enlarged to a height of 15 to 20 ft (4.5 to 6 m) and a width of 20 to 30 ft (6 to 9 m). The station is approximately 150 ft (46 m) long. In 1988, the station walls were trimmed, and concrete was placed on the floor. Since 1988, the Waste Shaft Station has undergone five major floor renovations. A 53-ft (16-m)-long section of the reinforced concrete was removed in February 1991, in 1995 an additional 30-ft (9-m) section was removed, and in 2000 floor maintenance included trimming of the floor and reinstallation of the rails supported by segmented concrete panels on a crushed rock backfill. The roof of the Waste Shaft station was mined up to Clay G in December 2008 to assure adequate operational clearance. 12-ft resin-anchored roof bolts and chain link were installed for ground support. Figure 4-3 shows a cross-section of the Waste Shaft Station.

4.2.1 Modifications to Excavation and Ground Control Activities

No modifications were made during this reporting period. Ground control activities were limited to routine maintenance.

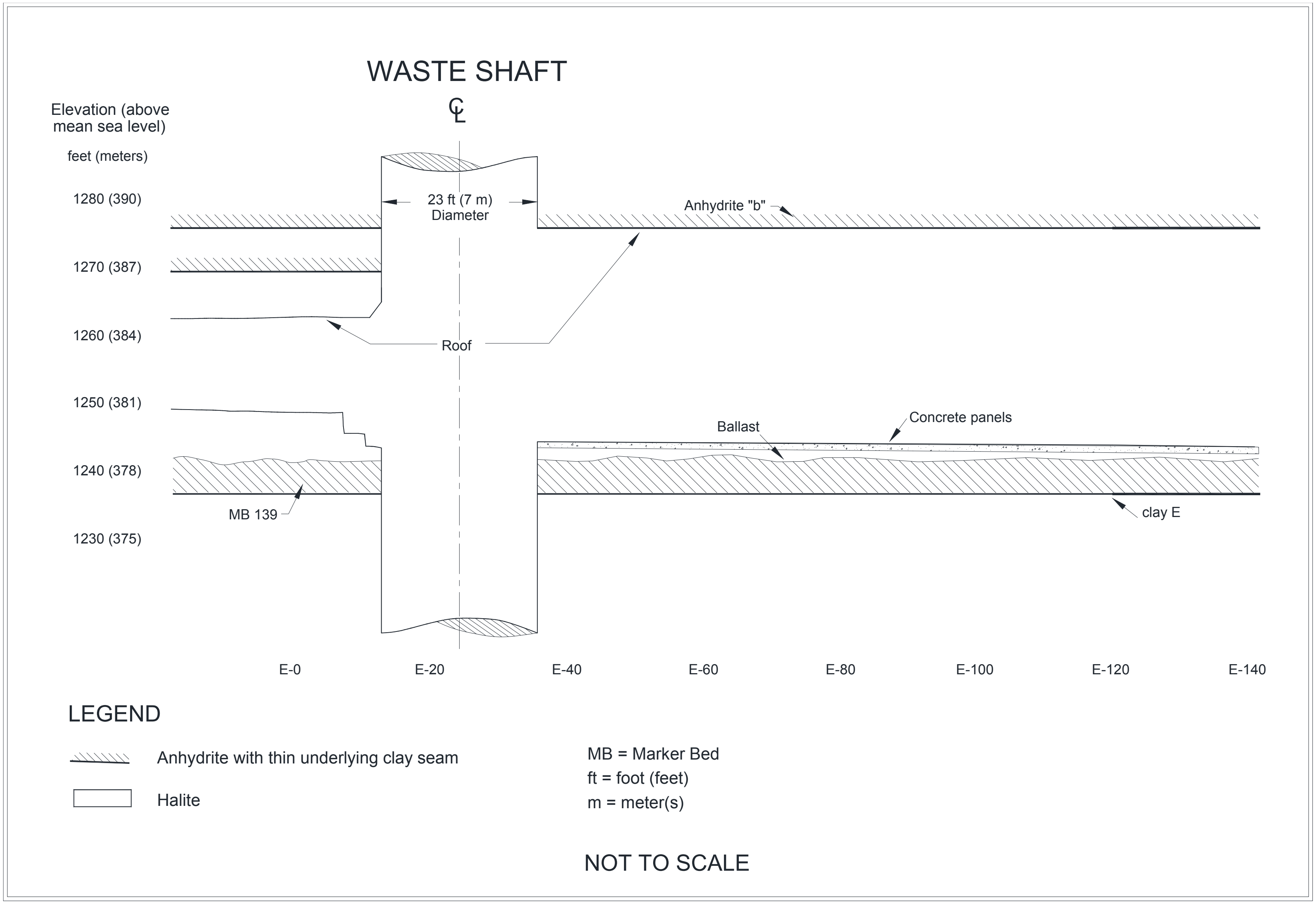


Figure 4-3 – Waste Shaft Station Stratigraphy

4.2.2 Instrumentation

Instruments were initially installed in the Waste Shaft Station between November 12 and December 2, 1982. Figure 4-4 illustrates the locations after enlargement. Two extensometers in the Waste Shaft Station are currently being monitored. In addition, horizontal convergence is being monitored at E-32 and E-85.

Table 4-3 summarizes the recent history of the roof extensometers in the Waste Shaft Station. Extensometer 51X-GE-00404-2 is located at approximately S400-E32.

Table 4-4 summarizes the annual horizontal closure rates calculated from convergence point data for this reporting period. The data indicate that the horizontal closure rates at both E-32 and E-85 have not changed significantly from the previous reporting period.

Table 4-3 Summary of Roof Extensometers in Waste Shaft Station

Instrument	Location	Last Reading	Displacement Relative to Deepest Anchor in (cm)	Displacement Rate 2011 to 2012 in/yr (cm/yr)	Displacement Rate 2010 to 2011 in/yr (cm/yr)	Rate Change Percent
51X-GE-00404-2	Waste Shaft Station	6/28/2012	0.611 (1.552)	0.3 (0.8)	0.3 (0.8)	0%
51X-GE-00268	Waste Shaft Station – W30	6/6/2012	11.003 (27.948)	0.1 (0.3)	0.1 (0.3)	0%

Table 4-4 Closure Rates in the Waste Shaft Station

Location	Chord[1]	Last Reading	Cumulative Displacement in (cm)	Closure Rate 2011 to 2012 in/yr (cm/yr)	Closure Rate 2010-2011 in/yr (cm/yr)	Rate Change Percent
S400-E32	B-D	5/22/2012	4.173 (10.599)	1.2 (3.0)	1.3 (3.3)	-8%
S400-E85	B-D	5/22/2012	4.233 (10.752)	1.2 (3.0)	1.3 (3.3)	-8%

[1] Chord is defined in Section 5.3

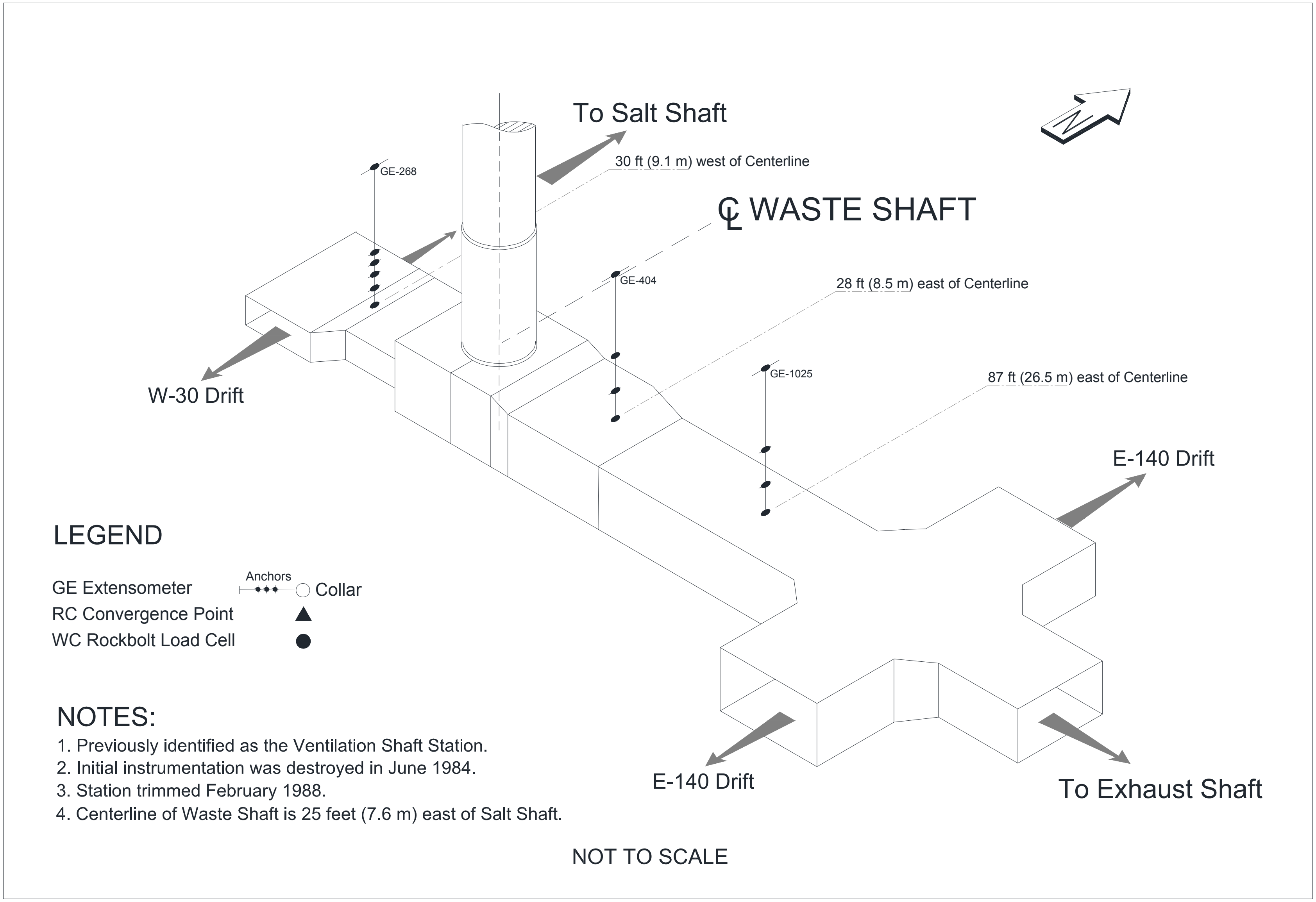


Figure 4-4 – Waste Shaft Station Instrumentation after Raising the Roof

4.3 Air Intake Shaft Station

The Air Intake Shaft Station was excavated in late 1987 and early 1988, using a continuous miner. The Air Intake Shaft is furnished with a work platform and a small cage that can be raised and lowered to perform routine ground maintenance. The principal purpose of that equipment is to provide emergency access.

4.3.1 Modifications to Excavation and Ground Control Activities

The AIS station was not significantly modified during this reporting period. Ground control activities were limited to routine maintenance.

4.3.2 Instrumentation

Radial convergence point and extensometer instrumentation data near the Air Intake Shaft Station are presented in Chapter 5.0 as part of the discussion on the performance of the access drifts. Twenty rock bolt load cells installed in the Air Intake Shaft Station area are monitored regularly.

5.0 PERFORMANCE OF ACCESS DRIFTS

This chapter describes the geomechanical performance of the underground access drifts. The Waste Disposal Area is discussed in Chapter 6.0 and the Salt Disposal Investigation areas are discussed in Chapter 7.0. Four major north-south drifts in the WIPP underground are intersected by shorter east-west cross-drifts. Drift dimensions range from 13 ft (4 m) to 21 ft (6.4 m) high and from 14 ft (4.3 m) to 33 ft (9.2 m) wide.

5.1 Modifications to Excavation and Ground Control Activities

Trimming, scaling, and floor milling activities were performed as necessary in many areas. Table 5-1 summarizes these activities. It also summarizes ground control activities (e.g., rock bolting and installing wire mesh) in various locations in the access drifts.

Table 5-1 Summary of Modifications and Ground Control Activities in the Access Drifts July 1, 2011 to June 30, 2012

Location	Work Activity
E140 from S400 to S3650	Replaced broken 12 ft resin anchored roof bolts
S2750 from E300 to W170	Replaced broken 12 ft resin anchored roof bolts
S1950 from W30 to E140	Installed 4 ft mechanical roof bolts and chainlink mesh on the back, ribs and added 12 ft resin anchored roof bolt supplemental support pattern
E300 Maintenance Shop	Installed 4 ft mechanical roof bolts and chainlink mesh on the back over existing roof bolt pattern
S3080 from E300 to Panel 3 Closure	Installed 4 ft mechanical roof bolts and chainlink mesh on the back, ribs and added 12 ft resin roof bolt supplemental support pattern
W170 from S1600 to S2180 & from S3310 to S3650	Installed 4 ft mechanical bolts and chainlink mesh on ribs, and added 12 ft resin roof bolt supplemental support pattern
E140 from S700 to S1050	Installed 12 ft resin anchored roof bolt pattern
W170 from S2750 to S3080	Replaced broken 12 ft resin anchored bolts with 14 ft resin anchored roof bolts
S1950 from E140 to E300	Replaced broken 12 ft resin anchored roof bolts with 14 ft resin anchored roof bolts
E300 from S400 to S3310	Replaced broken 12 ft resin anchored roof bolts with 14 ft resin anchored roof bolts
S3310 from E140 to E300	Installed 14 ft resin anchored roof bolt pattern
W30 from S2750 to S3080	Replaced broken 12 ft resin anchored roof bolts with 14 ft resin anchored roof bolts
E140 from S2180 to S2520	Installed 18 ft resin anchored roof bolt pattern
Old Core Storage Alcove (W170 –S400)	Installed 14 ft resin anchored roof bolt pattern
E0 from N460 to N780	Installed 14 ft resin anchored roof bolt pattern
S2750 from E140 to E300	Floor trimmed to increase drift height for installation of new airlock
W30 from S2180 to S2520	Trimmed floor heave
W170 from S1950 to S2180	Floor trimmed to increase drift height for installation of con-split bulkhead
S2180 from W100 to W200	Floor trimmed to increase drift height for installation of RADOS bulkhead
S700 from W30 to W170	Floor and rib trimmed to increase drift height and to remove align drift with widened portion in the alternate waste path
E140 from S1950 to S2180	Trimmed floor heave
E140 from S2180 to S2520	Trimmed floor heave
W30 from S760 to S850	Trimmed ribs to widen for installation of new airlock
S700 from W30 to W170	Trimmed floor
W30 from S1950 to S2180	Trimmed floor
W30 from S1300 to S1950	Trimmed floor heave
S2520 from W30 to E140	Trimmed floor to increase drift height for alternate waste transport route
E0 from S90 to the Salt Shaft Station	Trimmed floor

5.2 Instrumentation

This section discusses instrumentation details and locations for each instrumentation type.

5.2.1 Extensometers

Thirty-seven extensometers continue to be monitored at various locations in the access drifts. Where displacement data were available, annual displacement rates were calculated (see Section 1.4.3) for each active installation and compared to the annual displacement rates from the previous reporting period.

Many of the E-140 extensometers indicate movement in the roof beam that may be attributed to shallow fracturing and the effects of anhydrite stringer separations in the roof. Lateral deformation in the roof beam may influence the extensometer readings, causing an increase in the measured displacement. Although the extensometer data indicate continued deformation and breakup of the lower beam, the roof bolt anchorage zone remains competent.

5.2.2 Convergence Points

Convergence point data are obtained by measuring the change in distance between fixed points anchored into the rock across an opening, either from rib to rib or from roof to floor. The measurement end-points constitute a "chord." Figure 5-1 shows typical convergence point array configurations along with typical chord designations.

Extensometer data are obtained by measuring the displacement from the reference head anchor (collar) to each fixed anchor of the extensometer. These measurements are made, at a minimum, every two months throughout the WIPP underground, except when convergence points are not accessible.

Convergence points installed during this reporting period were limited to the replacement of arrays in previously mined areas and the installation of new monitoring arrays in newly mined areas. Replacement convergence points were installed in twenty-three locations throughout the WIPP underground access drifts. Horizontal and vertical convergence point arrays were installed at various locations. Most of these installations were located in E-140 and W-30, where floor trimming activities removed the existing points. Table 5-2 lists the replacement convergence points that were installed during this reporting period.

Where possible, annual closure rates were calculated from convergence point array data gathered in the access drifts. Approximately 370 convergence points are located in the access drifts. A complete tabulation of these convergence point data and calculated closure rates is presented in the supporting data document for this report. Locations with increases in annual vertical closure rates of greater than twenty percent are shown in Table 5-3.

Table 5-2 New and Replacement Convergence Points Installed in the Access Drifts July 1, 2011 to June 30, 2012

Location	New/Replaced	Fieldtag[1]	Chord[2]	Date Installed
E140-S1150	R	E140-S1150-6	B-F	9/14/2011
E140-S1225	R	E140-S1225-4	B-D	1/18/2012
E140-S2007	R	E140-S2007-7	A-C	12/19/2011
E140-S2065	R	E140-S2065-6	A-C	12/19/2011
E140-S2122	R	E140-S2122-5	A-C	12/19/2011
E140-S2275	R	E140-S2275-5	A-C	12/19/2011
E140-S2275	R	E140-S2275-6	A-C	3/8/2012
E140-S2350	R	E140-S2350-6	A-C	12/21/2011
E140-S2425	R	E140-S2425-5	A-C	3/8/2012
S2520-W100	R	S2520-W100-2	A-C	12/7/2011
S2750-E220	R	S2750-E220-2	A-C	12/7/2011
S700-W98	R	S700-W98-3	A-C	3/8/2012
W170-S2060	R	W170-S2060-3	A-C	1/18/2012
W170-S2180	R	W170-S2180-3	A-C	1/18/2012
W170-S2520	R	W170-S2520-2	A-C	12/7/2011
W30-S1775	R	W30-S1775-3	A-C	3/8/2012
W30-S2067	R	W30-S2067-3	A-C	3/8/2012
W30-S2067	R	W30-S2067-4	B-D	3/22/2012
W30-S2275	R	W30-S2275-4	A-C	12/7/2011
W30-S2350	R	W30-S2350-4	A-C	12/7/2011
W30-S2425	R	W30-S2425-4	A-C	12/7/2011
W30-S850	R	W30-S850-4	C-G	3/7/2012
W30-S850	R	W30-S850-5	A-E	3/7/2012

N = New installation.
R = Replacement installation (i.e., instrument replaces older instrument that has failed or has been mined out).
[1] This column is a combination of the convergence point location followed by a "-X," where X represents the reinstallation number, when applicable.
[2] A unique letter is assigned to each convergence array element around a particular opening. Chord refers to a particular array pair. The various array lettering schemes are shown in Figure 5-1.

5.3 Analysis of Convergence Point and Extensometer Data

Vertical loading on mine pillars results in lateral stresses on the roof and floor beams. The composition of those beams, in part, determines how these structures will react to the horizontal stresses. In particular, horizontally continuous anhydrite stringers (see Section 2.2.2) divide the beam itself into a series of smaller independent beams.

Lateral strain on the beam imposed by vertical loading on the pillars is accommodated by vertical displacement over the mined opening. This requires that the horizontally oriented beam separate along the most favorable, or weakest, planes.

Where anhydrite stringers interpose the beam, they constitute a plane of weakness, and delamination occurs. The material is confined in the plane above, so that the roof accommodates the lateral strain by bending convex into the mined opening.

Two distinct results come of this action. First, voids form within the beam as the portions closer to the opening move away from those deeper within the beam. Second, the convex portion of the bended plane is subjected to tensile loading perpendicular to the axis of the drift and superficial tears known as "tensile fractures" develop generally parallel to the axis of the drift.

Where anhydrite stringers are small and discontinuous or not present at all within the beam, horizontal loading is accommodated along shear planes. These develop at angles of approximately 35 degrees with respect to the vertical. In some cases, a plane develops preferentially on one side of the drift, and the bulk of material is pushed into the mined opening on that side. This may be thought of as a cantilevered beam.

Whatever the mechanism, vertical displacement into the mined opening is measured by convergence monitoring. Convergence points consider the displacement between two opposing surfaces: either the roof and floor or the two ribs. Extensometers consider the displacement between one surface (usually the back) and one or more points within the beam. Where a convergence point and an extensometer are adjacent to one another, it is possible to determine the individual displacements of both floor and roof beams.

This data is used to analyze the stability and mechanics of the beam, and in determining what actions may be taken to ensure the safety of personnel and equipment consistent with the safe operation of the facility.

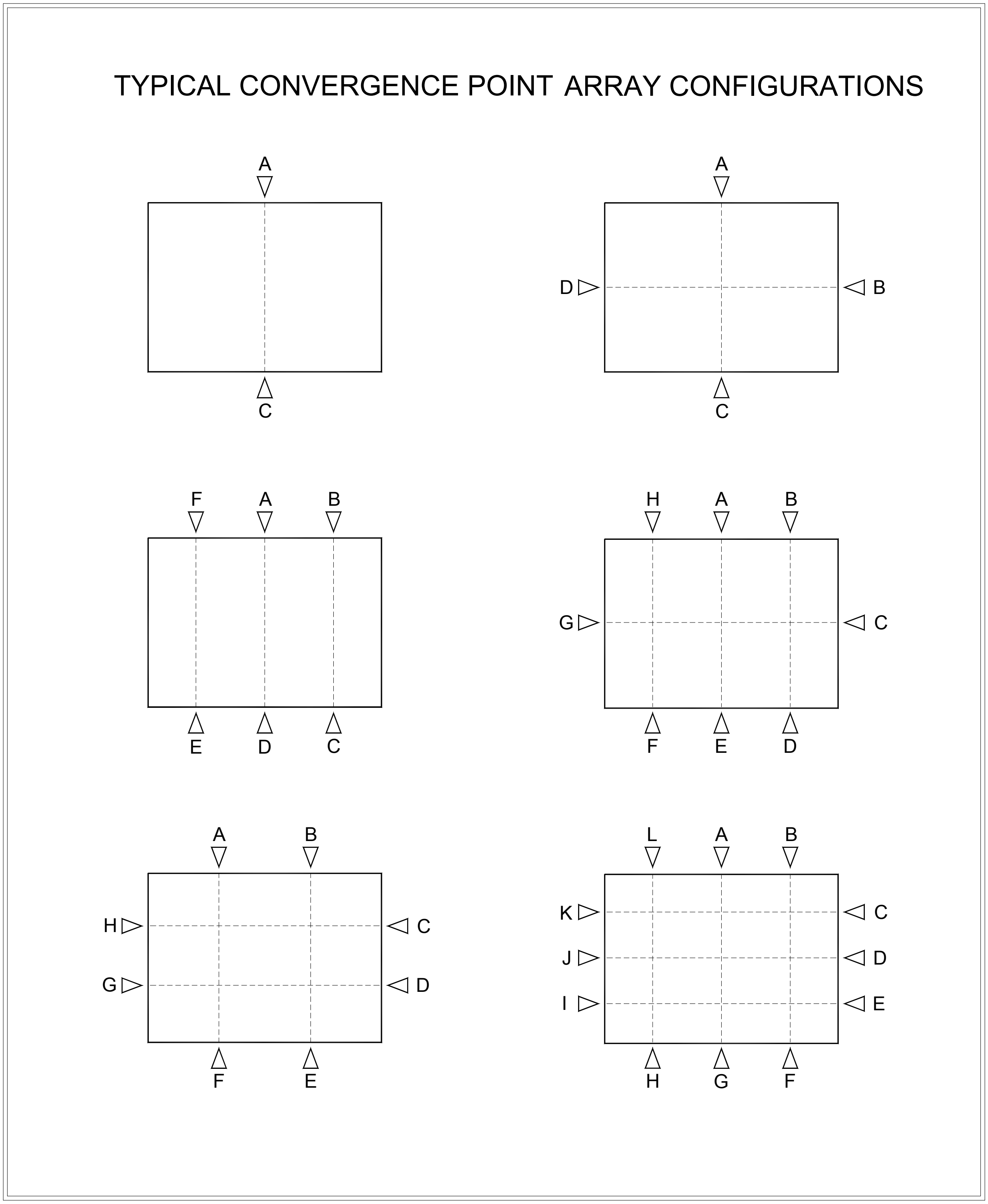


Figure 5-1 – Typical Convergence Point Array Configurations Showing Anchor Designations

Table 5-3 Greater than Twenty Percent Increases in Annual Convergence from July 1, 2011 to June 30, 2012

Location	Chord	Last Reading Date	Cumulative Displacement in (cm)	Closure Rate 2011 to 2012 in/yr (cm/yr)	Closure Rate 2010 to 2011 in/yr (cm/yr)	Rate Percent Change
E0-N626	A-C	6/6/2012	63.012 (160.05)	3.1 (7.9)	2.0 (5.1)	55%
E0-N686	A-C	6/6/2012	24.337 (61.816)	4.0 (10.2)	2.0 (5.1)	100%
E140-N940	A-C	6/12/2012	25.613 (65.057)	4.6 (11.7)	3.6 (9.1)	28%
E140-S1225	B-D	6/19/2012	34.132 (86.695)	3.7 (9.4)	2.5 (6.4)	48%
E140-S1375/1	A-E	6/19/2012	40.707 (103.396)	3.5 (8.9)	2.9 (7.4)	21%
E140-S1375/1	H-F	6/19/2012	43.86 (111.404)	3.8 (9.7)	2.6 (6.6)	46%
E140-S2065	A-C	6/19/2012	49.77 (126.416)	5.5 (14.0)	4.2 (10.7)	31%
N215-W620	A-C	6/13/2012	25.461 (64.671)	1.2 (3.0)	1.0 (2.5)	20%
S2520-W100	A-C	6/11/2012	21.294 (54.087)	3.2 (8.1)	2.5 (6.4)	28%
S2750-E55	A-C	6/11/2012	24.211 (61.496)	4.7 (11.9)	3.1 (7.9)	52%
S3080-E220	A-C	6/11/2012	20.716 (52.619)	3.5 (8.9)	2.8 (7.1)	25%
S3650-E220	A-C	6/11/2012	10.146 (25.771)	2.4 (6.1)	2.0 (5.1)	20%
S3650-E55	A-C	6/11/2012	10.052 (25.532)	2.6 (6.6)	1.8 (4.6)	44%
S3650-W100	A-C	6/11/2012	15.24 (38.71)	4.0 (10.2)	2.6 (6.6)	54%
S700-W98	A-C	6/26/2012	25.161 (63.909)	2.7 (6.9)	1.8 (4.6)	50%
S90-W400	A-C	5/10/2012	18.005 (45.733)	0.6 (1.5)	0.5 (1.3)	20%
S90-W400	B-D	5/10/2012	17.468 (44.369)	0.6 (1.5)	0.5 (1.3)	20%
W170-S1150	C-G	5/8/2012	25.279 (64.209)	1.1 (2.8)	0.9 (2.3)	22%
W170-S5	A-C	5/9/2012	15.263 (38.768)	0.5 (1.3)	0.4 (1.0)	25%
W170-S560	A-C	5/9/2012	13.71 (34.823)	0.8 (2.0)	0.6 (1.5)	33%
W170-S700	A-C	5/9/2012	23.547 (59.809)	1.3 (3.3)	0.6 (1.5)	117%
W170-S850	B-D	5/8/2012	15.241 (38.712)	0.6 (1.5)	0.5 (1.3)	20%
W170-S850	C-G	5/8/2012	22.94 (58.268)	0.9 (2.3)	0.7 (1.8)	29%
W170-S850	H-F	5/8/2012	13.691 (34.775)	0.5 (1.3)	0.4 (1.0)	25%
W30-S2998	A-C	6/18/2012	22.302 (56.647)	5.1 (13.0)	3.9 (9.9)	31%
W30-S3195	A-C	6/4/2012	19.874 (50.48)	3.6 (9.1)	2.4 (6.1)	50%
W30-S850	A-E	6/5/2012	26.859 (68.222)	3.9 (9.9)	3.0 (7.6)	30%

Convergence Rates in the Access Drifts

5.4 Excavation Performance

Approximately 500 readings are collected and assessed regularly from convergence point arrays throughout the WIPP underground. Convergence rates continue to vary seasonally, typically increasing during the warmer summer months and decreasing during the cooler and drier winter months.

The performance of the access drift excavations during this reporting period was within acceptable criteria. "Acceptable criteria" means that a drift remains accessible, and the ground can be controlled by routine maintenance. Standard remedial ground control in some areas was required to maintain the performance of the excavations. The drifts remain stable and controlled. Most of the annualized rates remain steady, indicating stability. In some locations, where the rates are high, nearby mining activity or gradual deterioration of the roof beam along anhydrite stringers is most likely the cause. Where necessary, additional ground control measures have been or will be installed.

6.0 PERFORMANCE OF WASTE DISPOSAL AREA

The Waste Disposal Area as of June 30, 2012, consisted of Panels 1, 2, 3, 4, 5, 6, and 7. Panels 1, 2, 3, and 4 were closed during previous reporting periods. Panel 5 was closed on July 11, 2011 and no geomechanical instrument readings were taken during this reporting period. Waste disposal in Panel 6 was ongoing at the end of this reporting period. Panel 7 mining was under way during this reporting period.

6.1 History

Excavation of Panel 1 began in May 1986 with the mining of the access entries. Initially, the disposal rooms and drifts were developed as pilot drifts that were later excavated to nominal operational dimensions of 13 ft (4 m) high, 33 ft (10 m) wide, and 300 ft (91 m) long. Room 1 was completed to these dimensions in August 1986, and pilot drifts for Rooms 2 and 3 were excavated in January and February 1987. Rooms 2 and 3 were completed in February and March 1988, and Rooms 4 through 7 were completed in May 1988. Four short access drifts designed to lead to smaller test alcoves were excavated north off the S-1600 drift and Rooms 4-7 in June 1989. Only the access drifts to the alcoves were completed; the alcoves themselves were not excavated. Panel 1 waste emplacement (in Rooms 1, 2, 3, 7, adjacent areas of S 1600, and all of S-1950) was completed during a prior reporting period, and the panel is closed to all access. The Panel 1 access entries, S-1600 and S-1950, which extend from the E-300 drift to the isolation walls, remain open, and the instrumentation in this area continues to be maintained and monitored.

Excavation of the Panel 2 waste disposal area began in September 1999 with the mining of access entries. Initially, the disposal rooms and drifts were developed as pilot drifts that were trimmed to finished dimensions. Room 1 was completed in January 2000, and pilot drifts for Rooms 2 and 3 were excavated in February 2000. Pilot drifts were completed for Rooms 4 through 6 in April 2000. The pilot drift for Room 7 was excavated in May 2000. All the rooms were excavated to final dimensions by August 2000. Waste emplacement in Panel 2 was completed during a prior reporting period, and the panel is closed to all access. The Panel 2 access entries, S-2150 and S-2520, which extend from the E-300 drift to the isolation walls, remain open, and the instrumentation in this area continues to be maintained and monitored.

Excavation of Panel 3 waste disposal rooms began in May 2002 with the mining of access entries to Panel 3. As with Panel 2, initially, the disposal rooms and drifts were developed as pilot drifts that were trimmed to finished dimensions. All the rooms were excavated to final dimensions by the end of March 2004. Waste emplacement in Panel 3 was completed in February 2007. Substantial barriers and bulkheads were installed in the exhaust and intake drifts of Panel 3 to prevent access into the panel and to isolate it from the ventilation circuit.

Panel 4 access drift mining began in January 2005. The disposal rooms were initially developed as pilot drifts and were later trimmed to final dimensions. Mining was completed by June 2006. Waste emplacement in Panel 4 was completed in March 2009. Substantial barriers and bulkheads were installed in the exhaust and intake drifts of Panel 4 to prevent access into the panel and to isolate it from the ventilation circuit.

Panel 5 excavation activities began in June 2006. The panel was initially mined to less-than-final dimensions and later trimmed to specification. Mining was complete by February 2008. Waste emplacement was conducted from March 2009 through July 2011. Isolation walls were completed in November 2011. Instrumentation and regular observations will continue in the accessible area up to the isolation walls.

As of the end of this reporting period, CH Waste was being emplaced in Panel 6, Room 5 and RH Waste in Panel 6, Room 4.

Panel 7 mining activities began in April 2010 and were underway as of the end of this reporting period.

6.2 Modifications to Excavations and Ground Control Activities

Routine maintenance and ground control activities in the form of trimming, scaling, rock bolt replacement, and installing wire mesh were performed on ribs, floor, and roof throughout accessible areas of the disposal panels. Of particular note, floor mining in Panel 7 was ongoing at the end of this reporting period. A wide channel was mined through the polyhalite bed and the anhydrite bed beneath it, and is backfilled with run of-mine salt. These beds, being harder than ordinary salt, resist the lateral loading imposed by creep deformation of the pillars and bow upward into the mined openings. The backfilled salt will offer less resistance to the lateral loading and result in a more fluid-like uplift, rather than the severe bowing and eventual fracturing that was experienced with the removed materials.

Table 6-1 summarizes the ground control activities performed in the disposal panels during this reporting period.

6.3 Instrumentation

There were no changes to the Panel 6 instrumentation layout. Convergence monitoring continued in all accessible areas up to the time that the waste stack front passed the instrument location. Remote monitoring of extensometers continues.

Panel 7 instrumentation consists of the following:

- Thirty-nine vertical convergence points, distributed as fourteen each in the intake and exhaust drifts and three in each of the rooms; and

- Eleven wire extensometers, distributed as two in each of the intake and exhaust drifts and one in each of the rooms.

A Schematic of the geomechanical instrumentation layout in Panels 6 and 7 is shown in Figure 6-1 and Figure 6-2**.**

Table 6-1 Summary of Modifications and Ground Control Activities in the Waste Disposal Area July 1, 2011 to June 30, 2012

Location	Work Activity
Panel 7	Installed lanyard system
Panel 7	Installed 4 ft mechanical roof bolts and chainlink mesh on rib/back junction
Panel 7	Began cutting out floor and backfilling with run-of-mill salt to address floor heave in March 2012
Panel 6, Room 1	Expanded existing 3-wide pattern of 12 ft resin anchored roof bolts to 7-wide pattern
Panel 6, S2750 from Room 1 to Room 4	Expanded existing 3-wide pattern of 12 ft resin anchored roof bolts to 7-wide pattern
Panel 6, S3650 From Room 1 to Room 4	Expanded existing 3-wide pattern of 12 ft resin anchored roof bolts to 7-wide pattern
S2750 from W170 to Panel 6, Room 1	Installed 14 ft resin anchored roof bolt pattern
Panel 7, S2180	Replaced broken 12 ft resin anchored roof bolts with 14 ft resin anchored roof bolts
Panel 6, Room 1	Replaced broken 12 ft resin anchored roof bolts with 14 ft resin anchored roof bolts

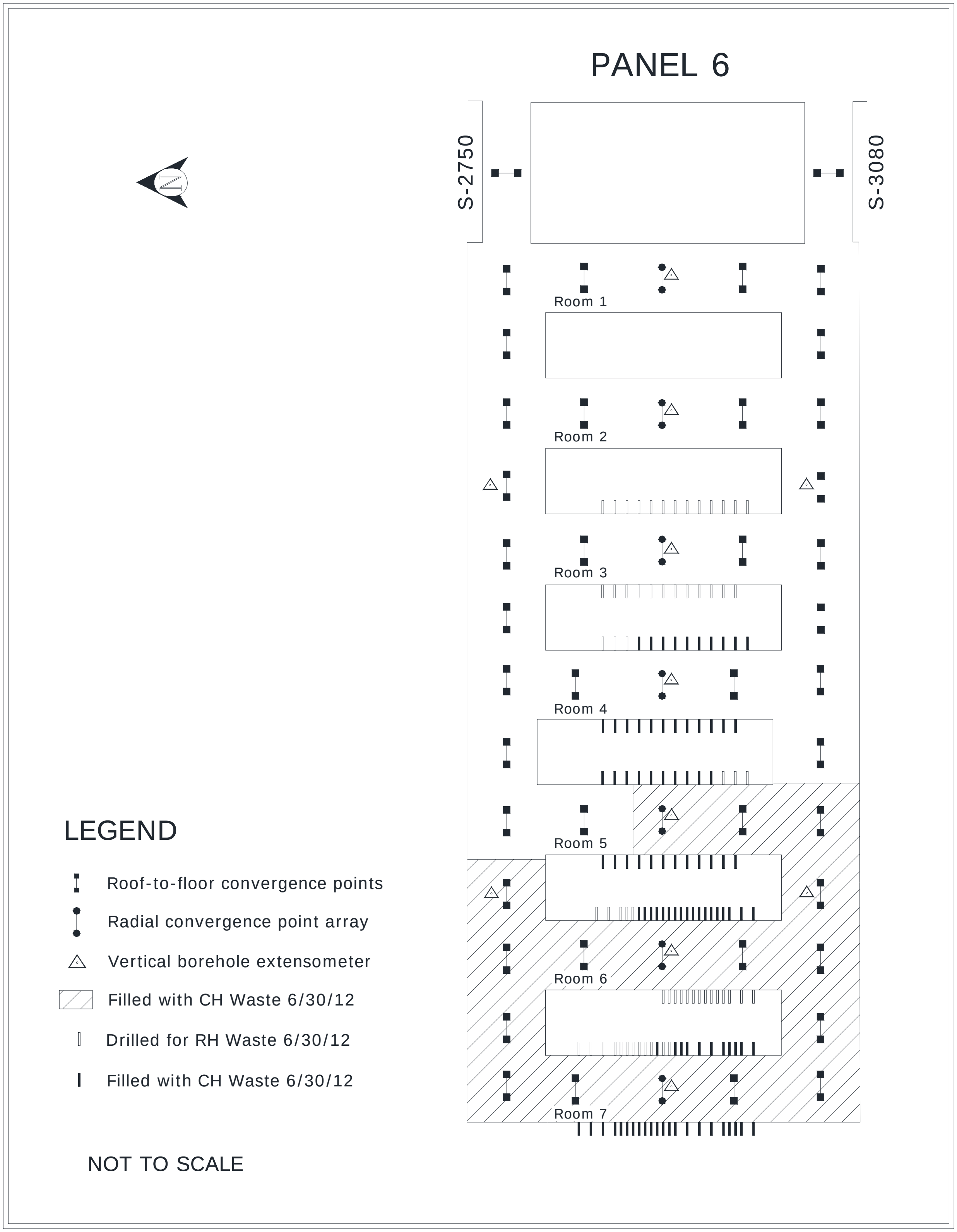


Figure 6-1 – Location of Panel 6 Geomechanical Instruments

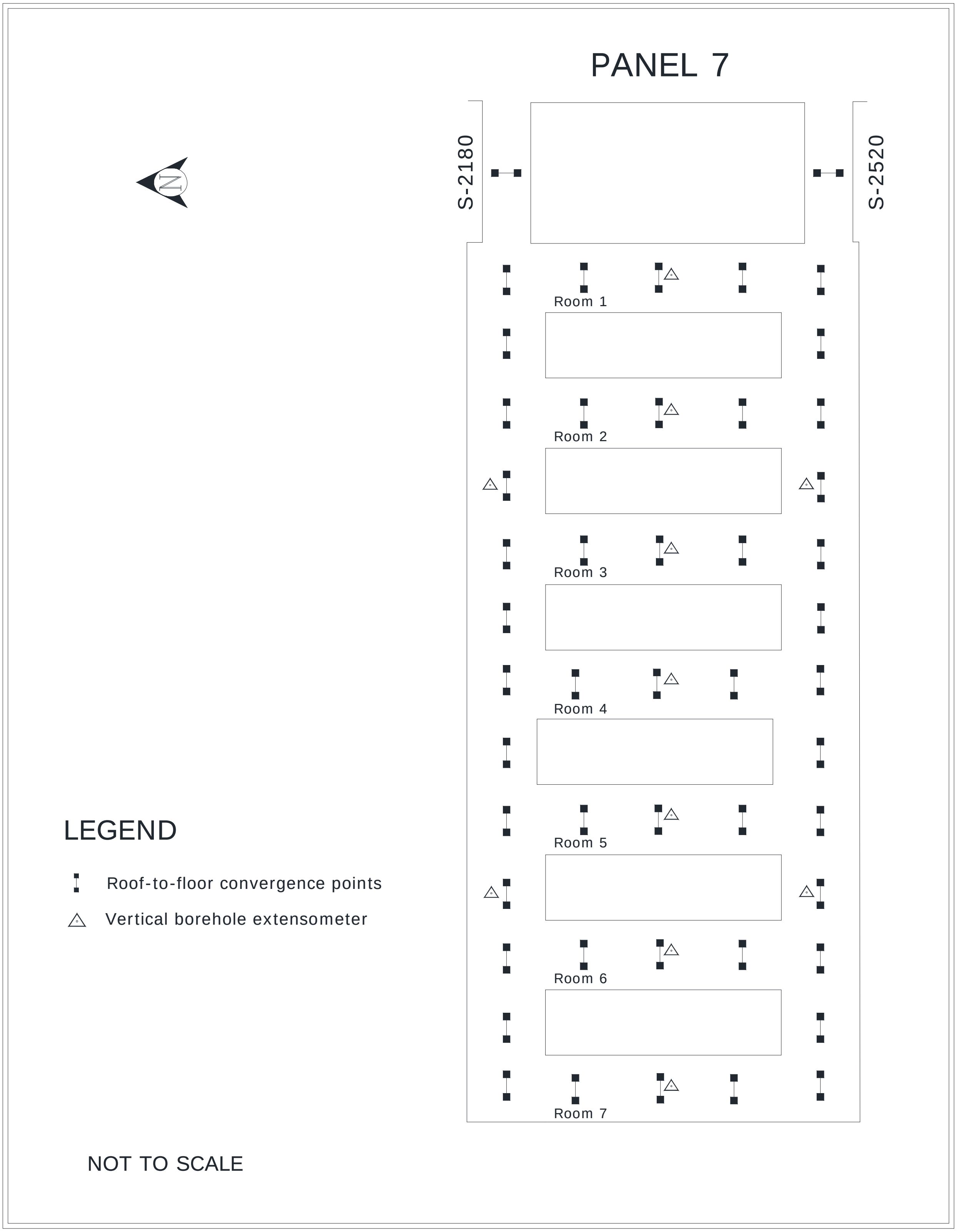


Figure 6-2 – Location of Panel 7 Geomechanical Instruments

6.4 Excavation Performance

Waste handling activities in Panels 1-5 have been completed, and geomechanical monitoring inside these panels has been discontinued.

In accessible underground areas, horizontal and vertical convergence rates, calculated at the center of each of the rooms, were compared between this and the previous reporting period. Generally, convergence rates have declined from initial post-mining levels. Localized increases occur with seasonal creep trends, the presence of continuous anhydrite stringers, and coincident with adjacent mining activities. These increases are addressed, where necessary, with additional ground support selected for conditions prevailing at the specific location of installation.

6.5 Analysis of Extensometer and Convergence Point Data

Geomechanical instrumentation is installed in each disposal room and at select locations in the panel access drifts. As anticipated, these installations showed a general decrease in room closure rate and roof beam deformation with time. At some locations, deformation rates increased as roof sag and roof beam deterioration developed. Supplemental ground control support was installed in these areas and has subsequently reduced the observed rates.

Although Panels 1 through 5 are closed, convergence monitoring continues in the panel entries between E-300 and the explosion isolation walls (Panels 1 and 2) and substantial and isolation barriers (Panels 3 and 4). The exception is the Panel 4 intake drift (S3650) which is closed to access due to elevated volatile organic compound (VOC) levels. Monitoring data indicate generally steady long term trends, with S3650-W285 being the exception. The last reading taken at this location during the reporting period identifies a 45% increase over the past year. This acceleration is largely attributed to creep deformation of the pillars, which results in increasing lateral loading of the roof beam and the growth of separations along anhydrite stringers.

Panel 6 convergence data rates appear to remain elevated after floor trimming, particularly in the northern and eastern portions of the panel. Designed ground support consists of 5 foot-long resin anchored rock bolts, which provide a stiffening effect to the lower portion of the roof beam. Observation holes indicate that larger separations along anhydrite stringers were occurring above the anchorage zone, where the stress has been redirected. Twelve-foot and fourteen-foot resin anchored rock bolts were installed during this reporting period to counter the beam expansion along anhydrite stringers, and convergence monitoring indicates some success with this approach.

Panel 7 mining activities, described in Section 6.2, were underway at the end of this reporting period. Geomechanical monitoring data indicate stable, low rates of roof beam expansion but relatively high rates of vertical convergence. Visual observations confirm that uplifted floor is a significant factor in geomechanical closure of the Panel.

7.0 Performance of the Salt Disposal Investigations and Salt Defense Disposal Investigations Areas

This chapter describes the geomechanical performance of the SDI and SDDI areas (hereafter referred to as SDI). Development of the area began during this reporting period, in January 2012. When completed, most of the area will have nominal dimensions of 13 feet high and 16 feet wide.

7.1 Ground Control Program

Due to the relatively narrow drifts (nominally 16 feet across) and favorable mining horizon, ground control plans in the SDI area are confined to routine maintenance such as spot-bolting where potentially unstable surface features develop. More substantial engineered ground control systems may be applied in the event that ongoing geomechanical monitoring and analysis of the area identify a need.

7.2 Instrumentation

Convergence point data are obtained by measuring the change in distance between fixed points anchored into the rock across an opening, either from rib to rib or from roof to floor. The measurement end-points constitute a "chord." Figure 5-1 shows typical convergence point array configurations along with typical chord designations.

7.3 Analysis of Convergence Point Data

As of this reporting period, thirteen convergence points have produced preliminary data on the behavior of the SDI openings in the immediate post-mining period. As a rule, the area behaves as expected, with relatively high initial rates rapidly decreasing as the stresses redistribute to load the surrounding salt pillars.

7.4 Excavation Performance

One object of the SDI project is to observe the behavior of the salt in response to high-heat sources emplaced within the mined openings. It is expected that the performance of these areas, in particular those nearest the experimental heat sources, will exhibit rapid creep movement. The necessity for ground control has not yet been determined. As the development of the area progresses and as the experiments begin to come on line, geotechnical observations will be closely analyzed for any need of external control.

8.0 GEOSCIENCE PROGRAM

The Geoscience Program confirms the suitability of the site through the collection of various geologic data and excavation characteristics from the underground. These include the inspection of open observation holes for fractures (separations) and offsets (lateral displacements) in roof beams and the mapping of fracture development on roof surfaces. Data collected through these activities support the design and evaluation of ground support systems.

During this reporting period, the following activities were performed:

- Observation hole inspections
- Fracture mapping

Fracture development in the roof is primarily caused by the concentration of compressive stresses in the roof beam and is influenced by the size and shape of the excavation and the stratigraphy in the immediate vicinity of the opening. In a thick roof beam, pillar deformations induce lateral compressive stresses into the immediate roof and floor. With time, the buildup of stress causes differential movement along stratigraphic boundaries. This differential movement is identified as offsets in observation holes and by the bends in failed rock bolts. Large strains associated with lateral movements can induce fracturing in the roof, which is frequently seen near the ribs; however, this process may take a long time (years) to develop.

At the upper repository horizon, clay or anhydrite stringers exert significant influence over the effective thickness of the roof beam. The presence of these stringers causes the roof beam to behave as a series of thin independent beams. Little or no tensile support is provided across the stringer interface. As horizontal end-loading continues, each beam can deflect downward causing a tensile fracture to develop along the bottom of the beam. These tensile fractures can develop in relatively new excavations soon after separation occurs along the stringer interface.

The location and initiation of interface separation is also influenced by the dip of the rock layers. The roofs and floors of the disposal panels are mined level through the sloping beds. At some locations, this may result in a significant difference in roof beam thickness from one side of the excavation to the other. Areas with the thinnest beam are the most likely to develop separations and subsequent fracturing.

8.1 Observation Hole Inspections

Geotechnical observation holes are drilled at various locations throughout the underground facility. A location may contain one or more holes arranged in an array. These holes are drilled to depths that allow the monitoring of fracture development and offsetting and are inspected for the development of those features. Roof observation holes usually extend up past clays G and H (Figure 8-1 and Figure 8-2).

The clay seams nearest the excavation surfaces define the immediate roof beam. The roof beam is bounded by Clay G in most of the access drifts and Panels 1 and 2. Some areas, such as the Salt Shaft Station, portions of the E-0 and E-140 drifts, the south mains south of S-2620, and Panels 3, 4, 5, and 6 are excavated to Clay G and so have roof beams bounded by Clay H.

The offset in an observation hole is determined by visually estimating the degree of occlusion. The direction of offset along clay seams is observed as the movement of the strata nearer to the observer relative to the strata farther away. Typically, the nearer strata move toward the center of the excavation (Figure 8-3 and Figure 8-4). Based on previous observations in the underground, the magnitude of offset is usually greater in holes located near ribs than in those located along excavation centerlines. Offsetting along the clay layers is observable until total offset is reached or visibility is obstructed by intervening offsets at other clay seams or fractures.

Observation holes are inspected for fractures, using an aluminum rod with a flattened steel wire probe attached to one end perpendicular to the rod (referred to as a "scratch rod"). Fractures and clay seams are located by moving the probe along the inside of the hole until it is snagged in one of these features. Depth to each feature is recorded, as is the magnitude of separations encountered. A fiber scope camera is occasionally used in addition to the scratch rod to visually document features of interest in a hole.

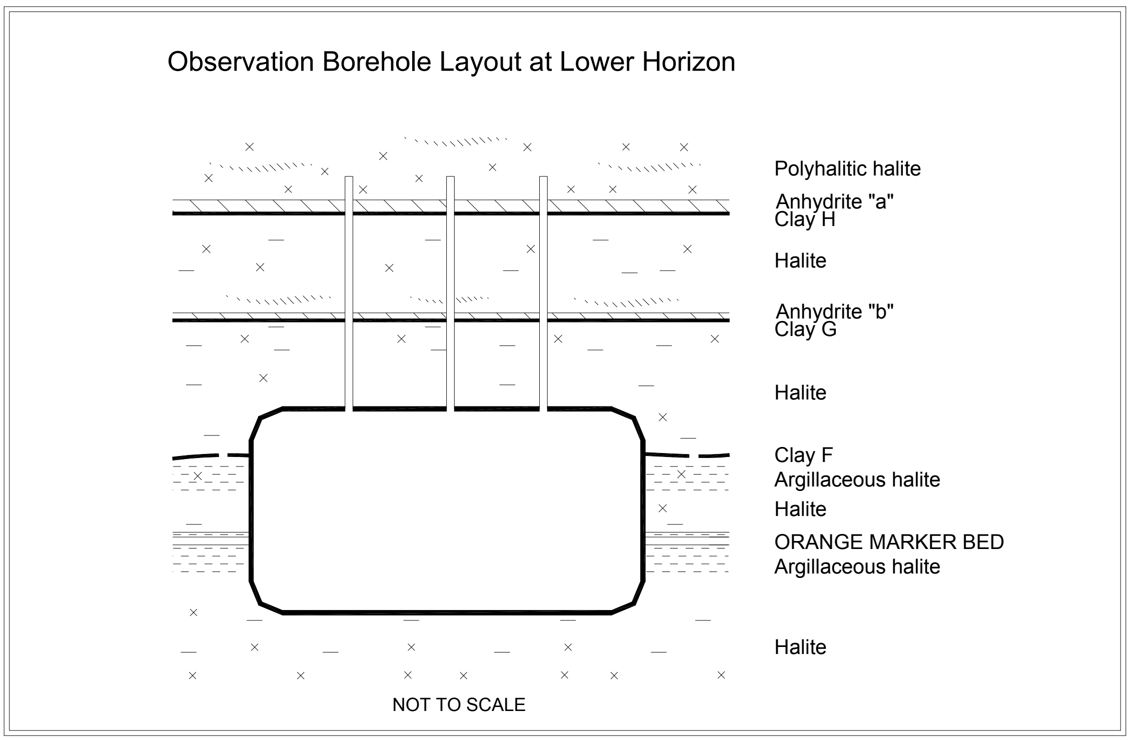


Figure 8-1 – Example of Observation Hole Layout at Lower Horizon

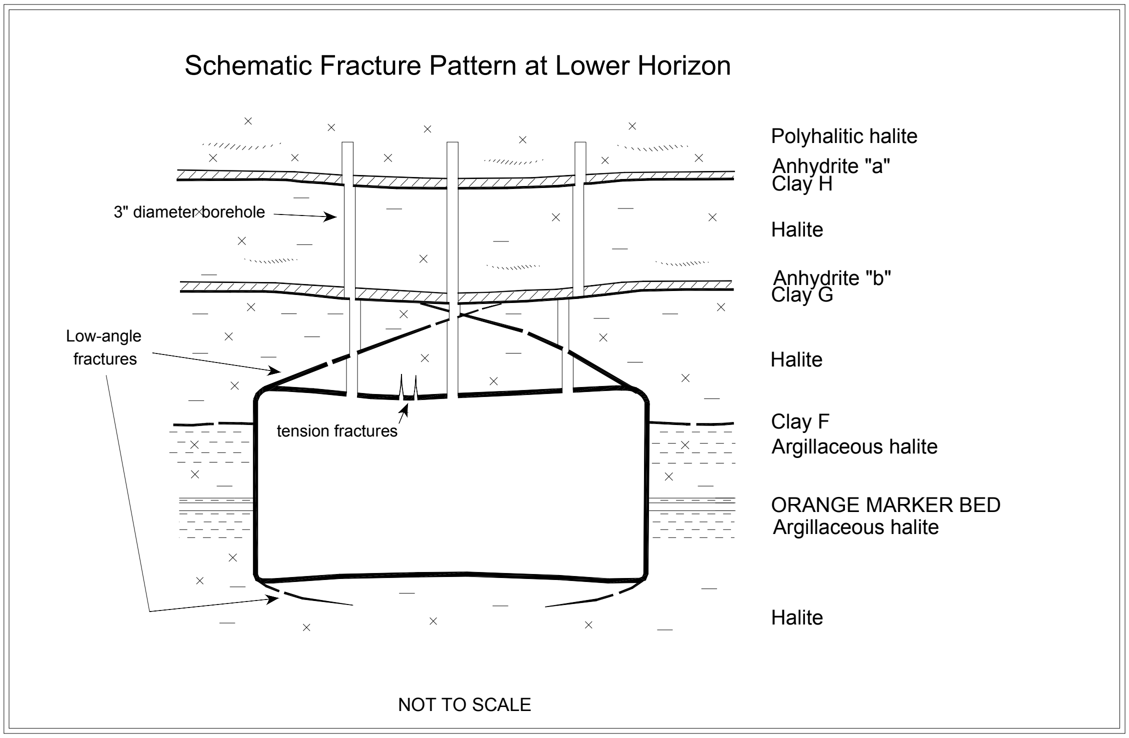


Figure 8-2 – Typical Fracture Pattern at Lower Horizon

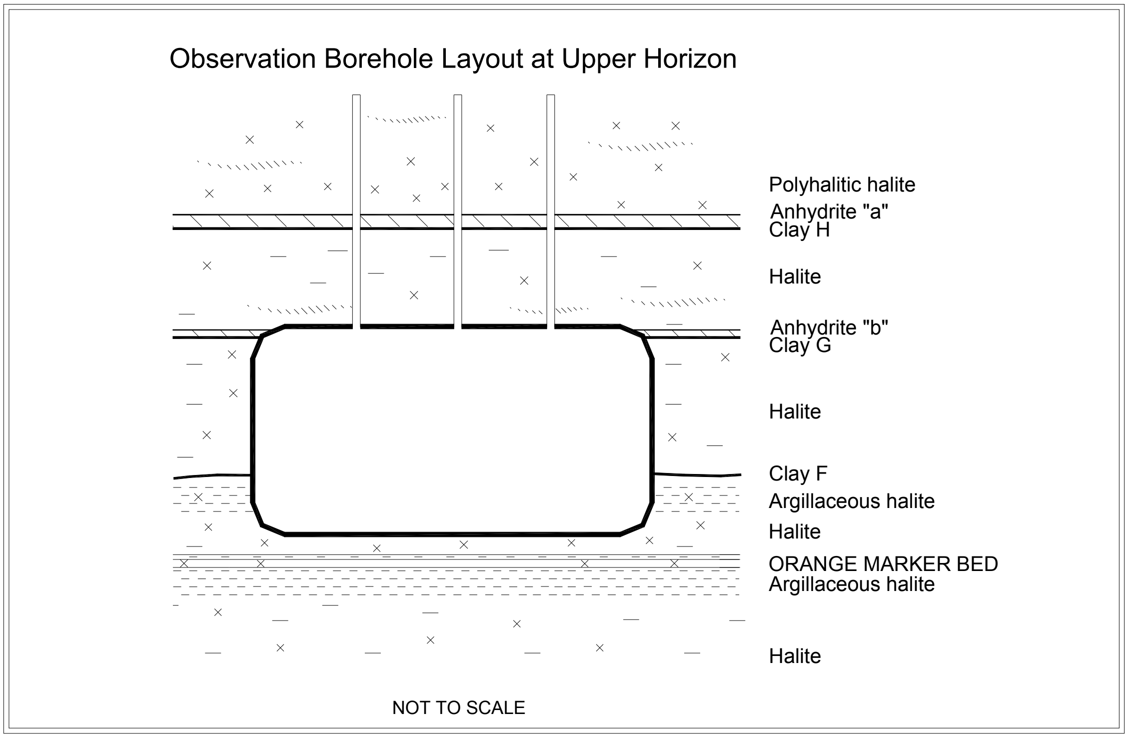


Figure 8-3 – Example Observation Hole Layout at Upper Horizon

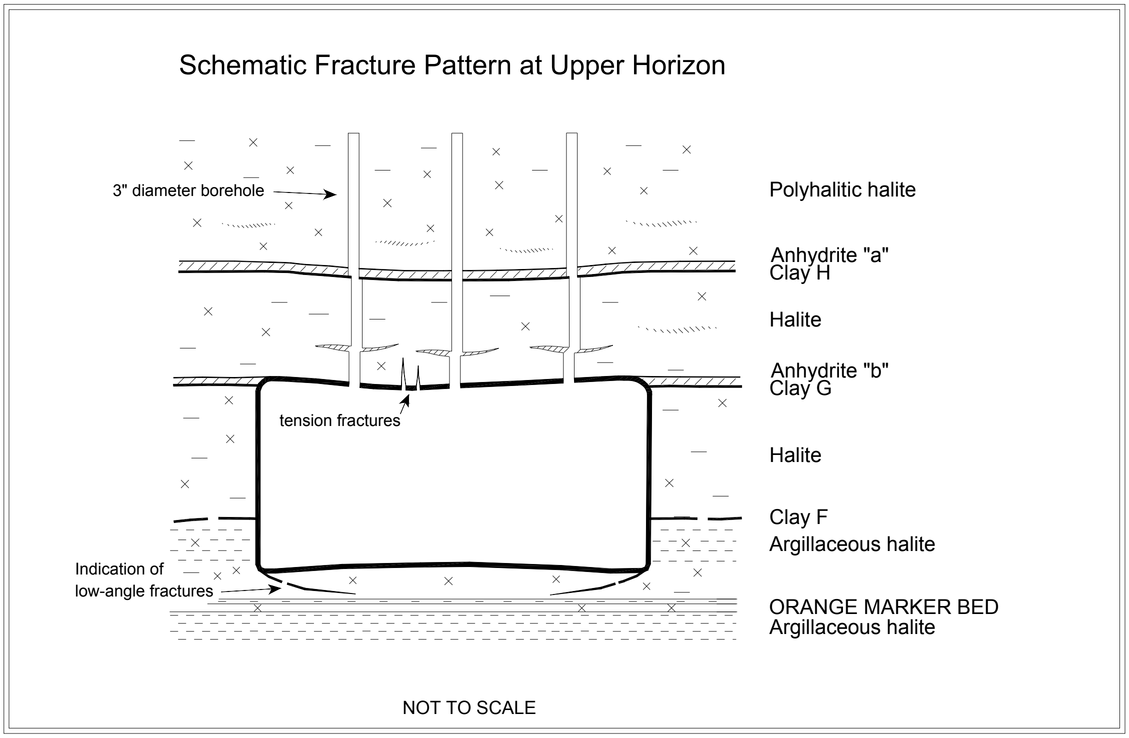


Figure 8-4 – Typical Fracture Patterns at Upper Horizon

The separation and offset data observed in accessible observation holes in the back are presented in the supporting data document for this report. Thirty-five accessible holes were monitored in Panel 6 and forty-seven in Panel 7. In Panel 6, the greatest separations were associated with Clay H and Anhydrite "a." Nineteen holes in Panel 6 had fractures associated with anhydrite stringers in the lower portion (first 3 feet) of the roof beam. Thirty-eight of 47 holes in Panel 6 and sixteen of the 47 holes in Panel 7 showed some offset.

8.2 Fracture Mapping

Routine mapping documents the progression of fractures in the roof exposed on the excavation surfaces of the drifts and rooms in the underground repository. The fracture surveys are generally performed on an annual basis, and the fracture maps are updated. The fracture maps facilitate the analysis of strain in the immediate roof-beam, because they document the development and propagation of fractures through time. The supporting data document contains fracture maps for Panels 6 and 7. During this reporting period, fractures were mapped in Panels 6 and 7.

9.0 SUMMARY

At the inception of WIPP, criteria were developed that address the design requirements (DOE, 1984). They pertained to all aspects of the mined facility and its operation as a pilot plant for the demonstration of technical and operational methods for permanent disposal of contact-handled and remote-handled TRU waste. In 1994, as the WIPP focus moved toward the permanent disposal of TRU waste, these design requirements were reassessed and replaced by a new set of requirements called system design descriptions. Table 9-1 shows the comparison of these design requirements with conditions actually observed in the underground from July 2011 through June 2012.

Normal drift and room maintenance continued during this reporting period with rib, roof, and floor scaling and trimming in various locations, and rock bolts and wire mesh installed as needed. Supplemental ground control systems consisting of resin-anchored bolts were installed in select locations. Some of these supplemental systems also included roof mats.

New geomechanical instrumentation was installed in Panel 7 and its access drifts, as well as in various locations throughout the repository to replace mined-out instruments. Monitoring no longer continues in non-accessible areas. All accessible areas of the underground are connected to data-loggers or are monitored manually.

The *in situ* performance of the excavations generally continues to satisfy the appropriate design criteria, although specific areas are being identified where deterioration resulting from ageing must be addressed through routine maintenance and installation of engineered systems. This deterioration has been identified through the analysis of data acquired from geomechanical instrumentation and the Geoscience Program. If the planned life of some of the openings needs to be extended, changing the geometry of the access drifts (removing unstable roof beam or rib spalls, or milling the floor for added clearance), or additional ground control (roof removal, installing bolts, mesh, or straps) may be necessary. The ground conditions in the waste disposal area and associated waste transport routes continue to slowly deteriorate; however, routine ground control installations and maintenance continue to allow safe access in the underground facility.

In addition to underground instrumentation, qualitative assessments of fracture development are documented through mapping the underground repository and inspecting the observation holes. The information acquired from these programs provides early detection of ground deterioration, contributes to the understanding of the dynamic geomechanical processes in the WIPP underground, and aids in the design of effective ground control and support systems.

Table 9-1 Comparison of Excavation Performance to System Design Requirements

Requirement	Comments
"The lining shall be designed for a hydrostatic pressure. . . ."	Water pressure observed on piezometers located behind the shaft liners remains below design levels.
"The key shall be designed to resist the lateral pressure generated by salt creep."	Geomechanical data from the Waste Shaft indicate that the shaft key is minimally loaded and is structurally stable. Visual inspections of all shaft keys do not indicate any deterioration due to creep loading.
"The key shall be designed to retain the rock formation and will be provided with chemical seal rings and a water collection ring with drains to prevent water from flowing down the unlined shaft from the lining above."	Shaft inspection observations and instrumentation show no indication of instability due to salt dissolution. No water has been observed flowing along the rock-liner interface.
"The underground waste disposal facilities shall be designed to provide space and adequate access for the underground equipment and temporary storage space to support underground operations."	Geomechanical instrument data and visual observations indicate that the current design provides adequate access and storage and disposal space. Ground control maintenance is performed as necessary to maintain access.
"Entries and subentries to the underground disposal area and the experimental areas shall be provided and sized for personnel safety, adequate air flow, and space for equipment."	Deformation of excavation remains within the required limits. Normal periodic maintenance consisting of rock bolting, wire meshing, trimming, and scaling continue throughout the repository. Areas such as the waste transport route undergo periodic floor trims in order to maintain adequate operating height.
"Geomechanical instrumentation shall be provided to measure the cumulative deformation of the rock mass surrounding mined drifts. . . ."	Geomechanical instrumentation is operated and maintained to meet this requirement. This annual report provides a summary and analysis of the geomechanical data.

10.0 REFERENCES

ASTM, 2006, D6026-06, Standard Practice for Using Significant Digits in Geotechnical Data.

Public Law 96-164, Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980.

Title 40 CFR Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes."

Title 40 CFR Part 194, "Criteria for the Certification and Re-certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations."

U.S. Environmental Protection Agency, 1998, "Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Certification Decision," *Federal Register*, Vol. 63, No. 95, pp. 27354, May 18, 1998, Washington, DC

Holt, R. M., and D. W. Powers, 1990, *Geologic Mapping of the Air Intake Shaft at the Waste Isolation Pilot Plant*, DOE/WIPP 90-051, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

Holt, R. M., and D. W. Powers, 1984, *Geotechnical Activities in the Waste Handling Shaft, Waste Isolation Pilot Plant (WIPP) Project, Southeastern New Mexico*, WTSD TME 038, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

New Mexico Environment Department (NMED), 2010, Waste Isolation Pilot Plant Hazardous Waste Facility Permit, NM4890139088-TSDF, Santa Fe, New Mexico.

Powers, D. W., and R. M. Holt, 1993, *The Upper Cenozoic Gatuña Formation of Southeastern New Mexico*, New Mexico Geological Society Guidebook, 44th Field Conference, Carlsbad Region, New Mexico and West Texas, D. W. Love et al., Eds., pp 271–282.

Powers, D. W., and R. M. Holt, 1995, Gatuña Formation (Miocene to Pleistocene) *Geology and Paleohydrology*, prepared for Westinghouse Waste Isolation Division by International Technology Corporation, Albuquerque, New Mexico.

Powers, D. W., S. J. Lambert, S. E. Shaffer, L. R. Hill, and W. D. Weart, Eds.,1978, *Geological Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico*, Vols. I and II, SAND 78 1596; Sandia National Laboratories, Albuquerque, New Mexico.

U.S. Department of Energy (DOE), *2000, Brine Generation Study*, DOE/WIPP 00-2000, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

U.S. Department of Energy (DOE), 1986a, *Interim Geotechnical Field Data Report*, DOE/WIPP 86-012, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

U.S. Department of Energy (DOE), 1986b, *Waste Isolation Pilot Plant Design Validation Final Report*, DOE/WIPP 86-010; Prepared by Bechtel National, Inc., for the U.S. Department of Energy, San Francisco, California.

U.S. Department of Energy (DOE), 1986c, *Geotechnical Activities in the Exhaust Shaft*, DOE/WIPP 86-008, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

U.S. Department of Energy (DOE), 1985, *Quarterly Geotechnical Field Data Report*, DOE/WIPP-221, Waste Isolation Pilot Plant, Carlsbad, New Mexico.

U.S. Department of Energy (DOE), 1984, *Design Criteria, Waste Isolation Pilot Plant (WIPP) Revised Mission Concept-IIA*, DOE/WIPP-071; Waste Isolation Pilot Plant, Carlsbad, New Mexico.

U.S. Department of Energy (DOE), 1983, *Summary of the Results of the Evaluation of the WIPP Site and Preliminary Design Validation Program*, DOE/WIPP-161; Waste Isolation Pilot Plant, Carlsbad, New Mexico.

DOE/WIPP-13-3501
Volume 2

Geotechnical Analysis Report for July 2011 – June 2012

Supporting Data

May 2013

Waste Isolation Pilot Plant

This page was intentionally left blank.

Table of Contents

List of Tables 4

List of Figures 5

1.0 Introduction 23
 1.1 Instrumentation 23
 1.2 Data Plot Explanation 24
 1.3 Report Organization 24

2.0 Instrumentation Summary for Shafts 25

3.0 Instrumentation Summary for Shaft Stations 41

4.0 Instrumentation Summary for the Access Drifts 53

5.0 Instrumentation Summary for the Waste Disposal Area 211

6.0 Instrumentation Summary for the SDI Area 295

7.0 Geoscience Data Summary for the Waste Disposal Area 303

List of Tables

Table 2-1 Salt Handling Shaft Data Analysis.. 26
Table 2-2 Waste Shaft Data Analysis.. 34
Table 2-3 Exhaust Shaft Data Analysis.. 36
Table 3-1 Salt Handling Shaft Station Data A.. 42
Table 3-2 Waste Shaft Station Data Analysis.. 46
Table 3-3 Air Intake Shaft Station Data Analysis.. 49
Table 4-1 Access Drifts Data Analysis.. 54
Table 5-1 Panel 1 Access Drifts Data Analysis.. 212
Table 5-2 Panel 2 Access Drifts Data Analysis.. 220
Table 5-3 Panel 3 Access Drift Data Analysis.. 222
Table 5-4 Panel 4 Access Drift Data Analysis.. 224
Table 5-5 Panel 5 Data Analysis.. 226
Table 5-6 Panel 6 Data Analysis.. 228
Table 5-7 Panel 7 Data Analysis.. 261
Table 5-6 Panel 6 Data Analysis.. 263
Table 6-1 SDI Data Analysis.. 296
Table 7-1 Observation Borehole Fractures and Offset Data Summary.. 304
Table 7-2 Summary of New Boreholes.. 352

List of Figures

Figure	Title	Page No.
SHAFTS AND KEYS		
Salt Handling Shaft		
Figure 2-1	Piezometers 37X-PE-00201 and 37X-PE-00202 Salt Handling Shaft – Level 580 at the Forty-niner Member	28
Figure 2-2	Piezometers 37X-PE-00203 and 37X-PE-00204 Salt Handling Shaft – Level 620 at the Magenta Dolomite Member	28
Figure 2-3	Piezometers 37X-PE-00205 and 37X-PE-00206 Salt Handling Shaft – Level 691 at the Tamarisk Member	29
Figure 2-4	Piezometers 37X-PE-00209 and 37X-PE-00210 Salt Handling Shaft – Level 802 at the Los Medaños Member	29
Figure 2-5	Piezometers 37X-PE-00211 and 37X-PE-00212 Salt Handling Shaft – Level 850 at the Rustler-Salado Contact	30
Figure 2-6	Earth Pressure Cells Behind Shaft Key Salt Handling Shaft Key – Level 860	30
Figure 2-7	Spot-Welded Strain Gages Salt Handling Shaft Key – Level 856.3	31
Figure 2-8	Spot-Welded Strain Gages Salt Handling Shaft Key – Level 862.4	31
Figure 2-9	Embedment Strain Gages Salt Handling Shaft Key – Level 856.3	32
Figure 2-10	Embedment Strain Gage Salt Handling Shaft Key Level 862.4	32
Figure 2-11	Embedment Strain Gages Salt Handling Shaft Key Level 856.3	33
Figure 2-12	Embedment Strain Gages Salt Handling Shaft Key – Level 862	33
Waste Shaft		
Figure 2-13	Earth Pressure Cell 31X-WE-00203 Waste Shaft Key – Level 866	35
Exhaust Shaft		
Figure 2-14	Piezometer 35X-PE-00202 Exhaust Shaft – Level 544 at the Base of Dewey Lake Redbeds	37
Figure 2- 15	Piezometer 35X-PE-00204 Exhaust Shaft – Level 615 at the Magenta Dolomite Member	37
Figure 2-16	Piezometer 35X-PE-00208 Exhaust Shaft – Level 673 at the Tamarisk Member	38
Figure 2-17	Piezometer 35X-PE-00210 Exhaust Shaft – Level 721 at the Culebra Dolomite Member	38
Figure 2-18	Piezometers 35X-PE-00213 and 35X-PE-00214 Exhaust Shaft – Level 768 at the Los Medaños Member	39
Figure 2-19	Piezometer 35X-PE-00218 Exhaust Shaft – Level 850 at the Rustler-Salado Contact	39
Figure 2-20	Piezometer 35X-PE-00219 Exhaust Shaft – Level 887 below the Lower Chemical Seal	40

List of Figures

Figure	Title	Page No.
SHAFT STATIONS		
Salt Handling Shaft Station		
Figure 3-1	Convergence Point Array Salt Handling Shaft Station at S18 – Centerline	43
Figure 3-1a	Convergence Point Array Salt Handling Shaft Station at S18 – Quarter-Points	43
Figure 3-2	Convergence Point Array Salt Handling Shaft Station at S30 – Roof to Floor	44
Figure 3-3	Convergence Point Array Salt Handling Shaft Station at S65 – Roof to Floor	44
Figure 3-4	Extensometer 51X-GE-001026-2 Salt Handling Shaft Station at S30 – Roof	45
Figure 3-5	Extensometer 51X-GE-001027-2 Salt Handling Shaft Station at S60 – Roof	45
Waste Shaft Station		
Figure 3-6	Extensometer 51X-GE-00268 Waste Shaft Station at W30 – Roof	47
Figure 3-7	Extensometer 51X-GE-00404-2 Waste Shaft Station – Roof	47
Figure 3-8	Convergence Point Array Waste Shaft Station at E32 – Rib to Rib	48
Figure 3-9	Convergence Point Array Waste Shaft Station at E85 – Rib to Rib	48
Air Intake Shaft Station		
Figure 3-10	Extensometer 41X-GE-00122 Air Intake Shaft Station at S65 – Roof	**50**
Figure 3-11	Extensometer 41X-GE-00123 Air Intake Shaft Station at N93 – Roof	**50**
Figure 3-12	Rock Bolt Load Cells Air Intake Shaft Station Brow – South Side Roof Bolts Set 1	**51**
Figure 3-13	Rock Bolt Load Cells Air Intake Shaft Station Brow – South Side Roof Bolts Set 2	**51**
Figure 3-14	Rock Bolt Load Cells Air Intake Shaft Station Brow – North Side Roof Bolts Set 1	**52**
Figure 3-15	Rock Bolt Load Cells Air Intake Shaft Station Brow – North Side Roof Bolts Set 2	**52**

List of Figures

Figure **Title** **Page No.**

Access Drifts

Figure 4-1 Extensometer 51X-GE-00355 E0 N300 – Roof 71
Figure 4-2 Extensometer 51X-GE-00353 71
Figure 4-3 Extensometer 51X-GE-00352 E0 N940 – Roof 72
Figure 4-4 Extensometer 51X-GE-00361 E0 N1266 – Roof 72
Figure 4-5 Extensometer 51X-GE-00105-3 – Roof 73
Figure 4-6 Extensometer 51X-GE-00364 E140 S1266 – Roof 73
Figure 4-7 Extensometer 51X-GE-00372 E140 S146 – Roof 74
Figure 4-8 Extensometer 51X-GE-00472 E300 S1000 – Roof 74
Figure 4-9 Extensometer 51X-GE-00464 E300 S1025 – Roof 75
Figure 4-10 Extensometer 51X-GE-00333 E140 S1075 – Roof 75
Figure 4-11 Extensometer 51X-GE-00428-2 E140 S1150 – Roof 76
Figure 4-12 Extensometer 51X-GE-00335 E140 S1300 – Roof 76
Figure 4-13 Extensometer 51X-GE-00429 E140 S1450 – Roof 77
Figure 4-14 Extensometer 51X-GE-00430 E140 S1669 – Roof 77
Figure 4-15 Extensometer 51X-GE-00431 E140 S1775 – Roof 78
Figure 4-16 Extensometer 51X-GE-00432 E140 S1850 – Roof 78
Figure 4-17 Extensometer 51X-GE-00433 / 433-2 E140 S2065 – Roof 79
Figure 4-18 Extensometer 51X-GE-00434 E140 S2265 – Roof 79
Figure 4-19 Extensometer 41X-GE-00435 E140 S2350 – Roof 80
Figure 4-20 Extensometer 41X-GE-00437 E140 S2635 – Roof 80
Figure 4-21 Extensometer 51X-GE-00492 E140 S2750 – Roof 81
Figure 4-22 Extensometers 51X-GE-00367-2 / 51X-GE-00439 E140 S2916 – Roof 81
Figure 4-23 Extensometer 51X-GE-00396 E140 S3493 – Roof 82
Figure 4-24 Extensometer 51X-GE-00374 E300 N1186 – Roof 82
Figure 4-25 Extensometer 51X-GE-00388 E300 N1266 – Roof 83
Figure 4-26 Extensometer 51X-GE-00373 E300 N1341 – Roof 83
Figure 4-27 Extensometer 51X-GE-00474 S1000 E120 – Roof 84
Figure 4-28 Extensometer 51X-GE-00473 S1000 E160 – Roof 84
Figure 4-29 Extensometer 51X-GE-00462 S1300 E120 – Roof 85
Figure 4-30 Extensometer 51X-GE-00463 S1300 E160 – Roof 85
Figure 4-31 Extensometer 51X-GE-00442 S1600 E120 – Roof 86
Figure 4-32 Extensometer 51X-GE-00500 S2750 W93 – Roof 86
Figure 4-33 Extensometer 51X-GE-00415 W170 S2998 – Roof 87
Figure 4-34 Extensometer 51X-GE-00490 W30 S2750 – Roof 87
Figure 4-35 Convergence Point Array Core Storage Library – Roof to Floor 88
Figure 4-36 Convergence Point Array E0 N75 – All Chords 88
Figure 4-37 Convergence Point Array E0 N225 – All Chords 89
Figure 4-38 Convergence Point Array E0 N300 – All Chords 89
Figure 4-39 Convergence Point Array E0 N460 – Roof to Floor 90

List of Figures

Figure	Title	Page No.
Access Drifts (Continued)		
Figure 4-40	Convergence Point Array E0 N562 – All Chords	90
Figure 4-41	Convergence Point Array E0 N626 – Roof to Floor	91
Figure 4-42	Convergence Point Array E0 N686 – All Chords	91
Figure 4-43	Convergence Point Array E0 N780 – Roof to Floor	92
Figure 4-44	Convergence Point Array E0 N940 – Roof to Floor	92
Figure 4-45	Convergence Point Array E0 N1100 – Roof to Floor	93
Figure 4-46	Convergence Point Array E0 N1100 – Roof to Floor	93
Figure 4-47	Convergence Point Array E140 N5 – All Chords	94
Figure 4-48	Convergence Point ArrayE140 N220 – Roof to Floor	94
Figure 4-49	Convergence Point Array E140 N355 – All Chords	95
Figure 4-50	Convergence Point Array E140 N460 – Roof to Floor	95
Figure 4-51	Convergence Point Array E140 N150 – Roof to Floor	96
Figure 4-52	Convergence Point Array E140 N562 – All Chords	96
Figure 4-53	Convergence Point Array E140 N626 – All Chords	97
Figure 4-54	Convergence Point Array E140 N686 – All Chords	97
Figure 4-55	Convergence Point Array E140 N780 – Roof to Floor	98
Figure 4-56	Convergence Point Array E140 N940 – All Chords	98
Figure 4-57	Convergence Point Array E140 N1100 – Roof to Floor	99
Figure 4-58	Convergence Point Array E140 N1266 – All Chords	99
Figure 4-59	Convergence Point Array E140 N1420 – Roof to Floor	100
Figure 4-60	Convergence Point Array E140 S90 – Roof to Floor	100
Figure 4-61	Convergence Point Array E140 S262 – All Chords	101
Figure 4-62	Convergence Point Array E140 S460 – All Chords	101
Figure 4-63	Convergence Point Array E140 S550 – All Chords	102
Figure 4-64	Convergence Point Array E140 S700 – Roof to Floor	102
Figure 4-65	Convergence Point Array E140 S700 – Roof to Floor – East Quarter Point	103
Figure 4-66	Convergence Point Array E140 S700 – Roof to Floor – West Quarter Point	103
Figure 4-67	Convergence Point Array E140 S850 – Roof to Floor	104
Figure 4-68	Convergence Point Array E140 S850 – Rib to Rib	104
Figure 4-69	Convergence Point Array E140 S1000 – Roof to Floor	105
Figure 4-70	Convergence Point Array E140 S1025 – Roof to Floor	105
Figure 4-71	Convergence Point Array E140 S1075 – Roof to Floor – Centerline	106
Figure 4-72	Convergence Point Array E140 S1075 – Roof to Floor – Quarter Points	106
Figure 4-73	Convergence Point Array E140 S1075 – Rib to Rib	107
Figure 4-74	Convergence Point Array E140 S1150 – Roof to Floor – Centerline	107

List of Figures

Figure **Title** **Page No.**

Access Drifts (Continued)

Figure 4-75 Convergence Point Array E140 S1150 – Rib to Rib 108
Figure 4-76 Convergence Point Array E140 S1150 – Roof to Floor – Quarter Points 108
Figure 4-77 Convergence Point Array E140 S1225 – Roof to Floor Centerline / Rib to Rib 109
Figure 4-78 Convergence Point Array E140 S1225 – Roof to Floor – Quarter Points 109
Figure 4-79 Convergence Point Array E140 S1300 – Roof to Floor 110
Figure 4-80 Convergence Point Array E140 S1378 – Roof to Floor – Centerline 110
Figure 4-81 Convergence Point Array E140 S1378 – Roof to Floor – Quarter Points 111
Figure 4-82 Convergence Point Array E140 S1378 – Rib to Rib 111
Figure 4-83 Convergence Point Array E140 S1456/1450 – Roof to Floor – Centerline 112
Figure 4-84 Convergence Point Array E140 S1456/1450 – Roof to Floor – Quarter Points 112
Figure 4-85 Convergence Point Array E140 S1450/1456 – Rib to Rib – Quarter Points 113
Figure 4-86 Convergence Point Array E140 S1456/1450 – Rib to Rib – Mid-Height . 113
Figure 4-87 Convergence Point Array E140 S1525/1534 – Roof to Floor – Centerline and Rib to Rib 114
Figure 4-88 Convergence Point Array E140 S1525/1534 – Roof to Floor – Quarter Points 114
Figure 4-89 Convergence Point Array E140 S1600 – Roof to Floor 115
Figure 4-90 Convergence Point Array E140 S1687 – All Chords 115
Figure 4-91 Convergence Point Array E140 S1775 – All Roof to Floor Chords......... 116
Figure 4-92 Convergence Point Array E140 S1775 – All Rib to Rib Chords............. 116
Figure 4-93 Convergence Point Array E140 S1862 – Roof to Floor – Centerline and Rib to Rib.. 117
Figure 4-94 Convergence Point Array E140 S1862 – Roof to Floor – Quarter Points 117
Figure 4-95 Convergence Point Array E140 S1950 – Roof to Floor 118
Figure 4-96 Convergence Point Array E140 S2007 – Roof to Floor 118
Figure 4-97 Convergence Point Array E140 S2065 – All Chords 119
Figure 4-98 Convergence Point Array E140 S2122 – Roof to Floor 119
Figure 4-99 Convergence Point Array E140 S2275 – All Chords 120
Figure 4-100 Convergence Point Array E140 S2350 – All Chords 120
Figure 4-101 Convergence Point Array E140 S2425 – All Chords 121
Figure 4-102 Convergence Point Array E140 S2520 – Roof to Floor 121

List of Figures

Figure **Title** **Page No.**

Access Drifts (Continued)

Figure 4-103 Convergence Point Array E140 S2634 – All Chords 122
Figure 4-104 Convergence Point Array E140 S2750 – Roof to Floor 122
Figure 4-105 Convergence Point Array E140 S2833 – All Chords 123
Figure 4-106 Convergence Point Array E140 S2915 – All Chords 123
Figure 4-107 Convergence Point Array E140 S2998 – All Chords 124
Figure 4-108 Convergence Point Array E140 S3080 – Roof to Floor 124
Figure 4-109 Convergence Point Array E140 S3195 – All Chords 125
Figure 4-110 Convergence Point Array E140 S3295 – Roof to Floor 125
Figure 4-111 Convergence Point Array E140 S3325 – Roof to Floor 126
Figure 4-112 Convergence Point Array E140 S3395 – All Chords 126
Figure 4-113 Convergence Point Array E140 S3480 – All Chords 127
Figure 4-114 Convergence Point Array E140 S3565 – All Chords 127
Figure 4-115 Convergence Point Array E140 S3650 – Roof to Floor 128
Figure 4-116 Convergence Point Array E300 N45 – All Chords 128
Figure 4-117 Convergence Point Array E300 N170 – All Chords 129
Figure 4-118 Convergence Point Array E300 N250 – Roof to Floor 129
Figure 4-119 Convergence Point Array E300 S45 – All Chords 130
Figure 4-120 Convergence Point Array E300 S90 – Roof to Floor 130
Figure 4-121 Convergence Point Array E300 S250 – All Chords 131
Figure 4-122 Convergence Point Array E300 S700 – Roof to Floor 131
Figure 4-123 Convergence Point Array E300 S850 – All Chords 132
Figure 4-124 Convergence Point Array E300 S1000 – Roof to Floor 132
Figure 4-125 Convergence Point Array E300 S1150 – Roof to Floor 133
Figure 4-126 Convergence Point Array E300 S1150 – Roof to Floor – Quarter Points 133
Figure 4-127 Convergence Point Array E300 S1150 – Rib to Rib 134
Figure 4-128 Convergence Point Array E300 S1300 – Roof to Floor 134
Figure 4-129 Convergence Point Array E300 S1450 – All Chords 135
Figure 4-130 Convergence Point Array E300 S1687 – All Chords 135
Figure 4-131 Convergence Point Array E300 S1775 – All Chords 136
Figure 4-132 Convergence Point Array E300 S1862 – All Chords 136
Figure 4-133 Convergence Point Array E300 S2065 – All Chords 137
Figure 4-134 Convergence Point Array E300 S2275 – All Chords 137
Figure 4-135 Convergence Point Array E300 S2350 – All Chords 138
Figure 4-136 Convergence Point Array E300 S2425 – All Chords 138
Figure 4-137 Convergence Point Array E300 S2634 – All Chords 139
Figure 4-138 Convergence Point Array E300 S2833 – All Chords 139
Figure 4-139 Convergence Point Array E300 S2916 – All Chords 140
Figure 4-140 Convergence Point Array E300 S2998 – All Chords 140
Figure 4-141 Convergence Point Array E300 S3195 – All Chords 141

List of Figures

Figure **Title** **Page No.**

Access Drifts (Continued)

Figure 4-142 Convergence Point Array E300 S3480 – All Chords 141
Figure 4-143 Convergence Point Array N140 E90 – All Chords 142
Figure 4-144 Convergence Point Array N215 W500 – All Chords 142
Figure 4-145 Convergence Point Array N150 W620 – Roof to Floor 143
Figure 4-146 Convergence Point Array N250 E220 – All Chords 143
Figure 4-147 Convergence Point Array N300 W170 – All Chords 144
Figure 4-148 Convergence Point Array N460 E70 – All Chords 144
Figure 4-149 Convergence Point Array N780 E70 – All Chords 145
Figure 4-150 Convergence Point Array S90 W120 – All Chords 145
Figure 4-151 Convergence Point Array S90 W400 – All Chords 146
Figure 4-152 Convergence Point Array S90 W590 – All Chords 146
Figure 4-153 Convergence Point Array S90 W620 – Roof to Floor 147
Figure 4-154 Convergence Point Array S90 W770 – All Chords 147
Figure 4-155 Convergence Point Array S90 W905 – Roof to Floor 148
Figure 4-156 Convergence Point Array S105 W905 – Roof to Floor 148
Figure 4-157 Convergence Point Array S700 E180 – All Chords 149
Figure 4-158 Convergence Point Array S700 E205 – All Chords 149
Figure 4-159 Convergence Point Array S700 E55 – All Chords 150
Figure 4-160 Convergence Point Array S700 W98 – Roof to Floor 150
Figure 4-161 Convergence Point Array S1000 E120 – Roof to Floor 151
Figure 4-162 Convergence Point Array S1000 E160 – Roof to Floor 151
Figure 4-163 Convergence Point Array S1000 E58 – All Chords 152
Figure 4-164 Convergence Point Array S1000 E98 – All Chords 152
Figure 4-165 Convergence Point Array S1300 E120 – Roof to Floor 153
Figure 4-166 Convergence Point Array S1300 E160 – Roof to Floor 153
Figure 4-167 Convergence Point Array S1300 E24 – Roof to Floor 154
Figure 4-168 Convergence Point Array S1300 W100 – Roof to Floor 154
Figure 4-169 Convergence Point Array S1600 E110 – Roof to Floor 155
Figure 4-170 Convergence Point Array S1600 E170 – Roof to Floor 155
Figure 4-171 Convergence Point Array S1950 E113 – Roof to Floor 156
Figure 4-172 Convergence Point Array S1950 E281 – Roof to Floor 156
Figure 4-173 Convergence Point Array S1950 E284 – Roof to Floor 157
Figure 4-174 Convergence Point Array S2180 E220 – All Chords 157
Figure 4-175 Convergence Point Array S2180 E55 – All Chords 158
Figure 4-176 Convergence Point Array S2180 W100 – All Chords 158
Figure 4-177 Convergence Point Array S2520 E220 – All Chords 159
Figure 4-178 Convergence Point Array S2520 W100 – All Chords 159
Figure 4-179 Convergence Point Array S2750 E55 – All Chords 160
Figure 4-180 Convergence Point Array 2750 E220 – All Chords................................ 160
Figure 4-181 Convergence Point Array 2750 E410 – All Chords................................ 161

List of Figures

Figure **Title** **Page No.**

Access Drifts (Continued)

Figure 4-182 Convergence Point Array 2750 W93 – All Chords 161
Figure 4-183 Convergence Point Array S3080 E220 – All Chords 162
Figure 4-184 Convergence Point Array S3080 W100 – All Chords 162
Figure 4-185 Convergence Point Array S3310 E220 – All Chords 163
Figure 4-186 Convergence Point Array S3310 E55 – All Chords 163
Figure 4-187 Convergence Point Array S3310 W100 – All Chords 164
Figure 4-188 Convergence Point Array S3650 E220 – All Chords 164
Figure 4-189 Convergence Point Array S3650 E55 – Roof to Floor 165
Figure 4-190 Convergence Point Array S3650 W100 – All Chords 165
Figure 4-191 Convergence Point Array W30 S120 – Roof to Floor 166
Figure 4-192 Convergence Point Array W30 S250 – All Chords 166
Figure 4-193 Convergence Point Array W30 S400 – Roof to Floor 167
Figure 4-194 Convergence Point Array W30 S500 – All Chords 167
Figure 4-195 Convergence Point Array W30 S700 – Roof to Floor 168
Figure 4-196 Convergence Point Array W30 S850 – Roof to Floor 168
Figure 4-197 Convergence Point Array W30 S850 – Roof to Floor – Quarter Points 169
Figure 4-198 Convergence Point Array W30 S850 – Rib to Rib 169
Figure 4-199 Convergence Point Array W30 S1000 – Roof to Floor 170
Figure 4-200 Convergence Point Array W30 S1150 – Roof to Floor 170
Figure 4-201 Convergence Point Array W30 S1300 – Roof to 171
Figure 4-202 Convergence Point Array W30 S1453 – All Chords 171
Figure 4-203 Convergence Point Array W30 S1600 – Roof to Floor 172
Figure 4-204 Convergence Point Array W30 S1775 – All Chords 172
Figure 4-205 Convergence Point Array W30 S1950 – Roof to Floor 173
Figure 4-206 Convergence Point Array W30 S2067 – All Chords 173
Figure 4-207 Convergence Point Array W30 S2275 – All Chords 174
Figure 4-208 Convergence Point Array W30 S2350 – All Chords 174
Figure 4-209 Convergence Point Array W30 S2425 – All Chords 175
Figure 4-210 Convergence Point Array W30 S2520 – Roof to Floor 175
Figure 4-211 Convergence Point Array W30 S2685 – All Chords 176
Figure 4-212 Convergence Point Array W30 S2750 – Roof to Floor 176
Figure 4-213 Convergence Point Array W30 S2833 – All Chords 177
Figure 4-214 Convergence Point Array W30 S2916 – All Chords 177
Figure 4-215 Convergence Point Array W30 S2998 – All Chords 178
Figure 4-216 Convergence Point Array W30 S3080 – Roof to Floor 178
Figure 4-217 Convergence Point Array W30 S3195 – All Chords 179
Figure 4-218 Convergence Point Array W30 S3310 – Roof to Floor 179
Figure 4-219 Convergence Point Array W30 S3395 – All Chords 180
Figure 4-220 Convergence Point Array W30 S3480 – All Chords 180

List of Figures

Figure **Title** **Page No.**

Access Drifts (Continued)

Figure 4-221 Convergence Point Array W30 S3565 – All Chords 181
Figure 4-222 Convergence Point Array W30 S3650 – Roof to Floor 181
Figure 4-223 Convergence Point Array W170 N150 – Roof to Floor 182
Figure 4-224 Convergence Point Array W170 S5 – All Chords 182
Figure 4-225 Convergence Point Array W170 S90 – Roof to Floor 183
Figure 4-225A Convergence Point Array W170 S232 – All Chords 183
Figure 4-226 Convergence Point Array W170 S400 – Roof to Floor 184
Figure 4-227 Convergence Point Array W170 S560 – All Chords 184
Figure 4-228 Convergence Point Array W170 S700 – Roof to Floor 185
Figure 4-229 Convergence Point Array W170 S850 – Roof to Floor – Centerline 185
Figure 4-230 Convergence Point Array W170 S850 – Roof to Floor – East Quarter Point 186
Figure 4-231 Convergence Point Array W170 S850 – Roof to Floor – West Quarter Point 186
Figure 4-232 Convergence Point Array W170 S850 – Rib to Rib 187
Figure 4-233 Convergence Point Array W170 S1000 – Roof to Floor 187
Figure 4-234 Convergence Point Array W170 S1150 – Roof to Floor 188
Figure 4-235 Convergence Point Array W170 S1150 – Rib to Rib 188
Figure 4-236 Convergence Point Array W170 S1300 – Roof to Floor 189
Figure 4-237 Convergence Point Array W170 S1445 – All Chords 189
Figure 4-238 Convergence Point Array W170 S1600 – Roof to Floor 190
Figure 4-239 Convergence Point Array W170 S1779 – All Chords 190
Figure 4-240 Convergence Point Array W170 S1950 – Roof to Floor 191
Figure 4-241 Convergence Point Array W170 S2060 – All Chords 191
Figure 4-242 Convergence Point Array W170 S2180 – Roof to Floor 192
Figure 4-243 Convergence Point Array W170 S2275 – All Chords 192
Figure 4-244 Convergence Point Array W170 S2350 – All Chords 193
Figure 4-245 Convergence Point Array W170 S2425 – All Chords 193
Figure 4-246 Convergence Point Array W170 S2520 – Roof to Floor 194
Figure 4-247 Convergence Point Array W170 S2685 – All Chords 194
Figure 4-248 Convergence Point Array W170 S2833 – All Chords 195
Figure 4-249 Convergence Point Array W170 S2916 – All Chords 195

Figure 4-249 Convergence Point Array W170 S2916 – All Chords 195

Figure 4-250 Convergence Point Array W170 S2998 – All Chords 196
Figure 4-251 Convergence Point Array W170 S3080 – Roof to Floor 196
Figure 4-252 Convergence Point Array W170 S3195 – All Chords 197
Figure 4-253 Convergence Point Array W170 S3310 – Roof to Floor 197
Figure 4-254 Convergence Point Array W170 S3395 – All Chords 198
Figure 4-255 Convergence Point Array W170 S3480 – All Chords 198

List of Figures

Figure **Title** **Page No.**

Access Drifts (Continued)

Figure 4-256 Convergence Point Array W170 S3565 – All Chords 199
Figure 4-257 Convergence Point Array W170 S3650 – Roof to Floor 199
Figure 4-258 Joint Meter S1950 E300 200
Figure 4-259 Joint Meter E140 S1505 200
Figure 4-260 Joint Meter E140 S1529 201
Figure 4-261 Joint Meter E140 S1545 201
Figure 4-262 Joint Meter E140 S1795 202
Figure 4-263 Joint Meter E140 S2964 202
Figure 4-264 Joint Meter W170-S2678 203
Figure 4-265 Joint Meter W170-S2687 203
Figure 4-266 Joint Meter W170-S2920 204
Figure 4-267 Joint Meter W170-S2932 204
Figure 4-268 Rock Bolt Load Cells, Bolts 1-5 E140 N1266 205
Figure 4-269 Rock Bolt Load Cells, Bolts 6-9 E140 N1266 205
Figure 4-270 Rock Bolt Load Cells E140 S910 206
Figure 4-271 Rock Bolt Load Cells E140 S774 – S1023 206
Figure 4-272 Rock Bolt Load Cell E140 S1550 207
Figure 4-273 Rock Bolt Load Cell E140 S1775 207
Figure 4-274 Rock Bolt Load Cells E140 S2916 208
Figure 4-275 Rock Bolt Load Cells E140 S1300 Brows.. 208
Figure 4-276 Rock Bolt Load Cell E1600 E150 209

Waste Disposal Area Panel 1 Access Drifts

Figure 5-1 Convergence Point Array S1600 E311 – All Chords 213
Figure 5-2 Convergence Point Array S1600 E332 – All Chords 213
Figure 5-3 Convergence Point Array S1600 E357 – All Chords 214
Figure 5-4 Convergence Point Array S1600 E382 – All Chords 214
Figure 5-5 Convergence Point Array S1600 E407 – All Vertical Chords 215
Figure 5-6 Convergence Point Array S1600 E432 – All Chords 215
Figure 5-7 Convergence Point Array S1600 E453 – All Chords 216
Figure 5-8 Convergence Point Array S1950 E311 – All Chords 216
Figure 5-9 Convergence Point Array S1950 E332 – All Chords 217
Figure 5-10 Convergence Point Array S1950 E357 – All Chords 217
Figure 5-11 Convergence Point Array S1950 E382 – All Chords 218
Figure 5-12 Convergence Point Array S1950 E407 – Roof to Floor 218
Figure 5-13 Convergence Point Array S1950 E407 – Rib to Rib 219
Figure 5-14 Convergence Point Array S1950 E432 – All Chords 219

List of Figures

Figure **Title** **Page No.**

Waste Disposal Area Panel 2

Figure 5-15 Convergence Point Array S2180 E410 – All Chords 221
Figure 5-16 Convergence Point Array S2520 E410 – All Chords 221

Waste Disposal Area Panel 3

Figure 5-17 Convergence Point Array S2750 E410 – All Chords 223
Figure 5-18 Convergence Point Array S3080 E410 – All Chords 223

Waste Disposal Area Panel 4

Figure 5-19 Convergence Point Array S3310 E410 – Roof to Floor 225

Waste Disposal Area Panel 5

Figure 5-20 Convergence Point Array S3310 W285 – Roof to Floor 227
Figure 5-21 Convergence Point Array S3650 W285 – Roof to Floor 227

Waste Disposal Area Panel 6

Figure 5-22 Extensometer 51X-GE-00501S2750 W285 – Roof 231
Figure 5-23 Extensometer 51X-GE-00413-2 S2750 W585 – Roof 231
Figure 5-24 Extensometer 51X-GE-00414 S2750 W985 – Roof 232
Figure 5-25 Extensometer 51X-GE-00403 Room 1, Panel 6 at W390 S2916 – Roof... 232
Figure 5-26 Extensometer 51X-GE-00405 Room 2, Panel 6 at W520 S2916 – Room Center – Roof.. 233
Figure 5-27 Extensometer 51X-GE-00406 Room 3, Panel 6 at W660 S2916– Room Center – Roof.. 233
Figure 5-28 Extensometer 51X-GE-00407 Room 4, Panel 6 at W790 S2916 – Room Center – Roof.. 234
Figure 5-29 Extensometer 51X-GE-00408-2 Room 5, Panel 6 at W920 S2916– Room Center – Roof.. 234
Figure 5-30 Extensometer 51X-GE-00409 Room 6, Panel 6 at W1050 S2916– Room Center – Roof.. 235
Figure 5-31 Extensometer 51X-GE-00410 Room 7, Panel 6 at W1190 S2916– Room Center – Roof.. 235
Figure 5-32 Extensometer 51X-GE-00411 S3080 W585 – Roof 236
Figure 5-33 Extensometer 51X-GE-00412 S3080 W985 – Roof 236
Figure 5-34 Convergence Point Array S2750 W285 – Roof to Floor 237

List of Figures

Figure **Title** **Page No.**

Waste Disposal Area Panel 6 (Continued)

Figure 5-35 Convergence Point Array S2750 W390 Intersection (Room 1, Panel 6) – Roof to Floor 237
Figure 5-36 Convergence Point Array S2750 W460 – Roof to Floor 238
Figure 5-37 Convergence Point Array S2750 W520 Intersection (Room 2, Panel 6) – Roof to Floor 238
Figure 5-38 Convergence Point Array S2750 W590 – Roof to Floor 239
Figure 5-39 Convergence Point Array S2750 W660 Intersection (Room 3 Panel 6) – Roof to Floor 239
Figure 5-40 Convergence Point Array S2750 W725 – Roof to Floor 240
Figure 5-41 Convergence Point Array S2750 W790 Intersection (Room 4, Panel 6) – Roof to Floor 240
Figure 5-42 Convergence Point Array S2750 W885 – Roof to Floor 241
Figure 5-43 Convergence Point Array S2750 W920 Intersection (Room 5, Panel 6) – Roof to Floor 241
Figure 5-44 Convergence Point Array S2750 W985 – Roof to Floor 242
Figure 5-45 Convergence Point Array S2750 W1050 Intersection (Room 6, Panel 6) – Roof to Floor 242
Figure 5-46 Convergence Point Array S2750 W1120 – Roof to Floor 243
Figure 5-47 Convergence Point Array S2750 W1190 Intersection (Room 7, Panel 6) – Roof to Floor 243
Figure 5-48 Convergence Point Array Room 1, Panel 6 at W390 W2833 – Roof to Floor 244
Figure 5-49 Convergence Point Array Room 1, Panel 6 at W390 S2916– Room Center – Roof to Floor 244
Figure 5-50 Convergence Point Array Room 1, Panel 6 at W390 S2998 – Roof to Floor 245
Figure 5-51 Convergence Point Array Room 2, Panel 6 at W520 S2833 – Roof to Floor 245
Figure 5-52 Convergence Point Array Room 2, Panel 6 at W520 S2916– Room Center – Roof to Floor 246
Figure 5-53 Convergence Point Array Room 2, Panel 6 at W520 S2998 – Roof to Floor 246
Figure 5-54 Convergence Point Array Room 3, Panel 6 at W660 S2833 – Roof to Floor 247
Figure 5-55 Convergence Point Array Room 3, Panel 6 at W660 S2916– Room Center – All Chords 247
Figure 5-56 Convergence Point Array Room 3, Panel 6 at W660 S2998 – Roof to Floor 248
Figure 5-57 Convergence Point Array Room 4, Panel 6 at W790 S2833 – Roof to Floor 248

List of Figures

Figure	Title	Page No.

Waste Disposal Area Panel 6 (Continued)

Figure 5-58 Convergence Point Array Room 4, Panel 6 at W790 S2916– Room Center – All Chords ... 249
Figure 5-59 Convergence Point Array Room 4, Panel 6 at W790 S2998 – Roof to Floor ... 249
Figure 5-60 Convergence Point Array Room 5, Panel 6 at W920 S2833 – Roof to Floor ... 250
Figure 5-61 Convergence Point Array Room 5, Panel 6 at W920 S2916– Room Center – All Chords ... 250
Figure 5-62 Convergence Point Array Room 5, Panel 6 at W920 S2998 – Roof to Floor ... 251
Figure 5-63 Convergence Point Array Room 6, Panel 6 at W1050 S2833 – Roof to Floor ... 251
Figure 5-64 Convergence Point Array Room 6, Panel 6 at W1050 S2916– Room Center – All Chords ... 252
Figure 5-65 Convergence Point Array Room 6, Panel 6 at W1050 S2998 – Roof to Floor ... 252
Figure 5-66 Convergence Point Array Room 7, Panel 6 at W1190 S2833 – Roof to Floor ... 253
Figure 5-67 Convergence Point Array Room 7, Panel 6 at W1190 S2916– Room Center – All Chords ... 253
Figure 5-68 Convergence Point Array Room 7, Panel 6 at W1190 S2998 – Roof to Floor ... 254
Figure 5-69 Convergence Point Array S3080 W285 – Roof to Floor ... 254
Figure 5-70 Convergence Point Array S3080 W390 Intersection (Room 1, Panel 6) – Roof to Floor ... 255
Figure 5-71 Convergence Point Array S3080 W460 – Roof to Floor ... 255
Figure 5-72 Convergence Point Array S3080 W520 Intersection (Room 2, Panel 6)– Roof to Floor ... 256
Figure 5-73 Convergence Point Array S3080 W585 – Roof to Floor ... 256
Figure 5-74 Convergence Point Array S3080 W660 Intersection (Room 3, Panel 6) – Roof to Floor ... 257
Figure 5-75 Convergence Point Array S3080 W725 – Roof to Floor ... 257
Figure 5-76 Convergence Point Array S3080 W790 Intersection (Room 4, Panel 6) – Roof to Floor ... 258
Figure 5-77 Convergence Point Array S3080 W855 – Roof to Floor ... 258
Figure 5-78 Convergence Point Array S3080 W920 Intersection (Room 5, Panel 6) – Roof to Floor ... 259
Figure 5-79 Convergence Point Array S3080 W985 – Roof to Floor ... 259
Figure 5-80 Convergence Point Array S3080 W1050 Intersection (Room 6, Panel 6) – Roof to Floor ... 260

List of Figures

Figure **Title** **Page No.**

Waste Disposal Area Panel 6 (Continued)

Figure 5-81 Convergence Point Array S3080 W1190 Intersection (Room 7, Panel 6) – Roof to Floor ... 260

Waste Disposal Area Panel 7

Figure 5-82 Extensometer 51X-GE-00416 S2180 W585 – Roof ... 264
Figure 5-83 Extensometer 51X-GE-00417 S2180 W985 – Roof ... 264
Figure 5-84 Extensometer 51X-GE-00425 W390 S2350 – Roof ... 265
Figure 5-85 Extensometer 51X-GE-00426 W520 S2350 – Roof ... 265
Figure 5-86 Extensometer 51X-GE-00418 W660 S2350 – Roof ... 266
Figure 5-87 Extensometer 51X-GE-00419 W790 S2350 – Roof ... 266
Figure 5-88 Extensometer 51X-GE-00421 W1050 S2350 – Roof ... 267
Figure 5-89 Extensometer 51X-GE-00422 W1190 S2350 – Roof ... 267
Figure 5-90 Extensometer 51X-GE-00423 S2520 W585 – Roof ... 268
Figure 5-91 Extensometer 51X-GE-00424 S2520 W985 – Roof ... 268
Figure 5-92 Convergence Point Array S2180 W285 – Roof to Floor ... 269
Figure 5-93 Convergence Point Array S2180 W390 Intersection (Room 1, Panel 7) – Roof to Floor ... 269
Figure 5-94 Convergence Point Array S2180 W460 – Roof to Floor ... 270
Figure 5-95 Convergence Point Array S2180 W520 Intersection (Room 2, Panel 7) – Roof to Floor ... 270
Figure 5-96 Convergence Point Array S2180 W585 – Roof to Floor ... 271
Figure 5-97 Convergence Point Array S2180 W660 Intersection (Room 3 Panel 7) – Roof to Floor ... 271
Figure 5-98 Convergence Point Array S2180 W725 – Roof to Floor ... 272
Figure 5-99 Convergence Point Array S2180 W790 Intersection (Room 4, Panel 7) – Roof to Floor ... 272
Figure 5-100 Convergence Point Array S2180 W885 – Roof to Floor ... 273
Figure 5-101 Convergence Point Array S2180 W920 Intersection (Room 5, Panel 7) – Roof to Floor ... 273
Figure 5-102 Convergence Point Array S2180 W985 – Roof to Floor ... 274
Figure 5-103 Convergence Point Array S2180 W1050 Intersection (Room 6, Panel 7) – Roof to Floor ... 274
Figure 5-104 Convergence Point Array S2180 W1120 – Roof to Floor ... 275
Figure 5-104a Convergence Point Array S2180 W1190 Intersection (Room 7, Panel 7) – Roof to Floor ... 275
Figure 5-105 Convergence Point Array Room 1, Panel 7 at W390 S2275 – Roof to Floor ... 276
Figure 5-106 Convergence Point Array Room 1, Panel 7 at W390 S2350– Room Center – Roof to Floor ... 276

List of Figures

Figure **Title** **Page No.**

Waste Disposal Area Panel 7 (Continued)

Figure 5-107 Convergence Point Array Room 1, Panel 7 at W390 S2425 – Roof to Floor 277
Figure 5-108 Convergence Point Array Room 2, Panel 7 at W520 S2275 – Roof to Floor 277
Figure 5-109 Convergence Point Array Room 2, Panel 7 at W520 S2350– Room Center – Roof to Floor 278
Figure 5-110 Convergence Point Array Room 2, Panel 7 at W520 S2425 – Roof to Floor 278
Figure 5-111 Convergence Point Array Room 3, Panel 7 at W660 S2275 – Roof to Floor 279
Figure 5-112 Convergence Point Array Room 3, Panel 7 at W660 S2350– Room Center – Roof to Floor 279
Figure 5-113 Convergence Point Array Room 3, Panel 7 at W660 S2425 – Roof to Floor 280
Figure 5-114 Convergence Point Array Room 4, Panel 7 at W790 S2275 – Roof to Floor 280
Figure 5-115 Convergence Point Array Room 4, Panel 7 at W790 S2350– Room Center – Roof to Floor 281
Figure 5-116 Convergence Point Array Room 4, Panel 7 at W790 S2425 – Roof to Floor 281
Figure 5-117 Convergence Point Array Room 5, Panel 7 at W920 S2275 – Roof to Floor 282
Figure 5-118 Convergence Point Array Room 5, Panel 7 at W920 S2350– Room Center – Roof to Floor 282
Figure 5-119 Convergence Point Array Room 5, Panel 7 at W920 S2425 – Roof to Floor 283
Figure 5-120 Convergence Point Array Room 6, Panel 7 at W1050 S2275 – Roof to Floor 283
Figure 5-121 Convergence Point Array Room 6, Panel 7 at W1050 S2350– Room Center – Roof to Floor 284
Figure 5-122 Convergence Point Array Room 6, Panel 7 at W1050 S2425 – Roof to Floor 284
Figure 5-123 Convergence Point Array 285
Figure 5-124 Convergence Point Array Room 7, Panel 7 at W1190 S2350– Room Center – Roof to Floor 285
Figure 5-125 Convergence Point Array Room 7, Panel 7 at W1190 S2425 – Roof to Floor 286
Figure 5-126 Convergence Point Array S2520 W285 – Roof to Floor 286
Figure 5-127 Convergence Point Array S2520 W390 Intersection (Room 1, Panel 7) – Roof to Floor 287
Figure 5-128 Convergence Point Array S2520 W455 – Roof to Floor 287

List of Figures

Figure	Title	Page No.

Waste Disposal Area Panel 7 (Continued)

Figure 5-129 Convergence Point Array S2520 W520 Intersection (Room 2, Panel 7) – Roof to Floor 288
Figure 5-130 Convergence Point Array S2520 W585 – Roof to Floor 288
Figure 5-131 Convergence Point Array S2520 W660 Intersection (Room 3, Panel 7) – Roof to Floor 289
Figure 5-132 Convergence Point Array S2520 W725 – Roof to Floor 289
Figure 5-133 Convergence Point Array S2520 W790 Intersection (Room 4, Panel 7) – Roof to Floor 290
Figure 5-134 Convergence Point Array S2520 W855 – Roof to Floor 290
Figure 5-135 Convergence Point Array S2520 W920 Intersection (Room 5, Panel 7) – Roof to Floor 291
Figure 5-136 Convergence Point Array S2520 W985 – Roof to Floor 291
Figure 5-137 Convergence Point Array S2520 W1050 Intersection (Room 6, Panel 7) – Roof to Floor 292
Figure 5-138 Convergence Point Array S2520 W1120 – Roof to Floor 292
Figure 5-139 Convergence Point Array S2520 W1190 Intersection (Room 7, Panel 7) – Roof to Floor 293

Salt Disposal Investigations

Figure 6-1 Convergence Point Array E540 N640 – Roof to Floor 297
Figure 6-2 Convergence Point Array N780 E220 – Roof to Floor 297
Figure 6-3 Convergence Point Array N780 E420 – Roof to Floor 298
Figure 6-4 Convergence Point Array N780 E540 – Roof to Floor 298
Figure 6-5 Convergence Point Array N780 E615 – Roof to Floor 299
Figure 6-6 Convergence Point Array N780 E690 – Roof to Floor 299
Figure 6-7 Convergence Point Array N940 E220 – Roof to Floor 300
Figure 6-8 Convergence Point Array N940 E300 – Roof to Floor 300
Figure 6-9 Convergence Point Array N940 E420 – Roof to Floor 301
Figure 6-10 Convergence Point Array N940 E540 – Roof to Floor 301
Figure 6-11 Convergence Point Array N940 E615 – Roof to Floor 302
Figure 6-12 Convergence Point Array N940 E690 – Roof to Floor 302

Geosciences Program

Figure 7-1 Panel 6 Room 1, S2761-S2861 Roof Fractures 353
Figure 7-2 Panel 6 Room 1, S2861-S2961 Roof Fractures 354
Figure 7-3 Panel 6 Room 1, S2961-S3061 Roof Fractures 355
Figure 7-4 Panel 6 Room 2, S2761-S2861 Roof Fractures 356
Figure 7-5 Panel 6 Room 2, S2861-S2961 Roof Fractures 357
Figure 7-6 Panel 6 Room 2, S2961-S3061 Roof Fractures 358
Figure 7-7 Panel 6 Room 3, S2761-S2861 Roof Fractures 359

List of Figures

Figure	Title	Page No.

Geosciences Program (Continued)

Figure 7-8 Panel 6 Room 3, S2861-S2961 Roof Fractures 360
Figure 7-9 Panel 6 Room 3, S2961-S3061 Roof Fractures 361
Figure 7-10 Panel 6 Room 4, S2761-S2861 Roof Fractures 362
Figure 7-11 Panel 6 Room 4, S2861-S2961 Roof Fractures 363
Figure 7-12 Panel 6 Room 4, S2961-S3061 Roof Fractures 364
Figure 7-13 Panel 6 Room 5, S2761-S2861 Roof Fractures 365
Figure 7-14 Panel 6 Room 5, S2861-S2961 Roof Fractures 366
Figure 7-15 Panel 6 Room 5, S2961-S23061 Roof Fractures 367
Figure 7-16 Panel 6 South 2750, W370-W427 Roof Fractures 368
Figure 7-17 Panel 6 South 2750, W427-W527 Roof Fractures 369
Figure 7-18 Panel 6 South 2750, W527-W627 Roof Fractures 370
Figure 7-19 Panel 6 South 2750, W627-W727 Roof Fractures 371
Figure 7-20 Panel 6 South 2750, W727-W827 Roof Fractures 372
Figure 7-21 Panel 6 South 2750, W827-W927 Roof Fractures 373
Figure 7-22 Panel 6 South 2750, W927-W1027 Roof Fractures 374
Figure 7-23 Panel 6 South 3080, W370-W419 Roof Fractures 375
Figure 7-24 Panel 6 South 3080, W419-W519 Roof Fractures 376
Figure 7-25 Panel 6 South 3080, W519-W619 Roof Fractures 377
Figure 7-26 Panel 6 South 3080, W619-W719 Roof Fractures 378
Figure 7-27 Panel 6 South 3080, W719-W819 Roof Fractures 379
Figure 7-28 Panel 6 South 3080, W819-W919 Roof Fractures 380
Figure 7-29 Panel 6 South 3080, W919-W1019 Roof Fractures 381
Figure 7-30 Panel 7 Room 1, S2201-S2301 Roof Fractures 382
Figure 7-31 Panel 7 Room 1, S2301-S2401 Roof Fractures 383
Figure 7-32 Panel 7 Room 1, S2401-S2505 Roof Fractures 384
Figure 7-33 Panel 7 Room 2, S2201-S2301 Roof Fractures 385
Figure 7-34 Panel 7 Room 2, S2301-S2401 Roof Fractures 386
Figure 7-35 Panel 7 Room 2, S2401-S2505 Roof Fractures 387
Figure 7-36 Panel 7 Room 3, S2201-S2301 Roof Fractures 388
Figure 7-37 Panel 7 Room 3, S2301-S2401 Roof Fractures 389
Figure 7-38 Panel 7 Room 3, S2401-S2505 Roof Fractures 390
Figure 7-39 Panel 7 Room 4, S2201-S2301 Roof Fractures 391
Figure 7-40 Panel 7 Room 4, S2301-S2401 Roof Fractures 392
Figure 7-41 Panel 7 Room 4, S2401-S2505 Roof Fractures 393
Figure 7-42 Panel 7 Room 5, S2201-S2301 Roof Fractures 394
Figure 7-43 Panel 7 Room 5, S2301-S2401 Roof Fractures 395
Figure 7-44 Panel 7 Room 5, S2401-S2505 Roof Fractures 396
Figure 7-45 Panel 7 Room 6, S2201-S2301 Roof Fractures 397
Figure 7-46 Panel 7 Room 6, S2301-S2401 Roof Fractures 398
Figure 7-47 Panel 7 Room 6, S2401-S2505 Roof Fractures 399
Figure 7-48 Panel 7 Room 7, S2401-S2505 Roof Fractures 400

List of Figures

Figure **Title** **Page No.**

Geosciences Program (Continued)

Figure 7-49 Panel 7 Room 7, S2301-S2401 Roof Fractures 401
Figure 7-50 Panel 7 Room 7, S2401-S2505 Roof Fractures 402
Figure 7-51 Panel 7 South 2180, W377-W427 Roof Fractures 403
Figure 7-52 Panel 7 South 2180, W427-W527 Roof Fractures 404
Figure 7-53 Panel 7 South 2180, W527-W627 Roof Fractures 405
Figure 7-54 Panel 7 South 2180, W627-W727 Roof Fractures 406
Figure 7-55 Panel 7 South 2180, W727-W827 Roof Fractures 407
Figure 7-56 Panel 7 South 2180, W827-W927 Roof Fractures 408
Figure 7-57 Panel 7 South 2180, W927-W1027 Roof Fractures 409
Figure 7-58 Panel 7 South 2180, W1027-W1127 Roof Fractures.............................. 410
Figure 7-59 Panel 7 South 2180, W1127-W1210 Roof Fractures.............................. 411
Figure 7-60 Panel 7 South 2520, W370-W419 Roof Fractures 412
Figure 7-61 Panel 7 South 2520, W419-W519 Roof Fractures 413
Figure 7-62 Panel 7 South 2520, W519-W619 Roof Fractures 414
Figure 7-63 Panel 7 South 2520, W619-W719 Roof Fractures 415
Figure 7-64 Panel 7 South 2520, W719-W819 Roof Fractures 416
Figure 7-65 Panel 7 South 2520, W819-W919 Roof Fractures 417
Figure 7-66 Panel 7 South 2520, W919-W1019 Roof Fractures 418
Figure 7-67 Panel 7 South 2520, W1019-W1119 Roof Fractures.............................. 419
Figure 7-68 Panel 7 South 2520, W1119-W1208 Roof Fractures.............................. 420

1.0 Introduction

This report is a compilation of geotechnical data presented as plots for each active instrument installed in the underground at the Waste Isolation Pilot Plant (WIPP) through June 30, 2012. A summary of the geotechnical analyses that were performed using the enclosed data is provided in Volume 1 of the Geotechnical Analysis Report (GAR).

1.1 Instrumentation

Geomechanical instrument data included in this report reflect the measurements of the geomechanical response of the underground and shafts. The instruments consist of convergence points, borehole extensometers, rockbolt load cells, pressure cells, strain gages, piezometers, and joint meters.

Closure measurements are taken at convergence points. Rock displacement is calculated by measuring the distance between two opposing points. Displacement is monitored over time and is plotted as closure versus time. Annual rates of closure are calculated for the convergence data and are compared with annual closure rates from previous reporting periods.

Borehole extensometers are used to determine the absolute movements of the ground around the openings. With these instruments, rods or wires are placed into a hole and anchored at various depths. The displacement at the extensometer head (located near the excavation face) is measured relative to each of the fixed anchors. These data are used in the extensometer *displacement* plots presented here. As part of the post-processing of acquired extensometer data a *relative displacement* value is calculated. The deepest anchor is assumed to be fixed in undisturbed ground and a displacement for the remaining anchors relative to the deepest anchor is calculated. Annual rates of collar displacement are calculated for each extensometer and are compared with the annual displacement rate reported during the previous reporting period.

Rockbolt load cells are used to determine the ground loading and the effectiveness of rockbolts. Plots consist of load versus time for each instrumented bolt.

Earth pressure cells and strain gages are used in and around the shaft liners to determine their loads. These are also depicted in time-based plots. Monitoring of these instruments indicates whether there is any stress buildup in the shaft lining systems.

Piezometers are used to measure the gauge pressure of groundwater. They have been installed in the shafts at varying elevations to monitor the hydraulic head acting on the shaft liners. Plots from piezometers are presented as pressure versus time.

Joint meters are installed perpendicular to a crack and monitor any changes in separation of the crack which may occur over time.

1.2 Data Plot Explanation

Data are presented in graphical form for ease in interpretation. Time-based plots are used in this report. Each plot generally consists of a legend in the upper right-hand corner that gives the array name and specific location of the instrument or point evaluated. The legend ties the graphical cross-sectional representation of the drift or shaft typically presented in the lower right-hand corner to the symbols on the curve in the graph. For extensometers, each anchor is designated with an alpha character "A" closest to the collar and "B," "C," "D," or "E" for the furthest point from the collar (the deepest anchor). For convergence points, the horizontal and vertical sections of the drift are referred to as chords. Breaks in the graph for convergence data and a numeric designator added to the legend typically indicate that the convergence point was lost due to normal mine maintenance activities and later reinstalled.

1.3 Report Organization

Chapter 1.0 provides an introduction to this Supporting Data volume of the GAR. Chapter 2.0 provides instrument data analysis for the Salt Handling Shaft, Waste Shaft, and Exhaust Shaft followed by data plots for the extensometers, piezometers, earth pressure cells, spot welded strain gages, and embedment strain gages installed in the shafts. Chapter 3.0 provides instrument data analysis for the Salt Handling Shaft Station and Waste Shaft Station, an instrument data summary only for the area immediately surrounding the Air Intake Shaft, and data plots for extensometers, convergence points, and rockbolt load cells for all three locations. Chapter 4.0 provides instrument data analysis for the access drifts followed by data plots for the extensometers, convergence points, joint meters and rock bolt load cells. Chapter 5.0 provides instrument data analysis for the Waste Disposal Area followed by data plots for the extensometers, rock bolt load cells and convergence points. Chapter 6.0 provides convergence point instrument data analysis for the Salt Disposal Investigations (SDI) area. Chapter 7.0 provides geologic data collected through the mapping of fractures, stratigraphic mapping and the observed displacements in vertical boreholes.

2.0 Instrumentation Summary for Shafts

Instrumentation data analysis for three of the four shafts at the WIPP follows. Table 2-1 presents data and analysis of the Salt Shaft. Plots of the instrument data are presented as Figures 2-1 through 2-12.

Table 2-2 presents data and analysis of the Waste Shaft. The instrument data plot is presented in Figures 2-13.

Table 2-3 presents data and analysis of the Exhaust Shaft. Plots of the instrument data are presented as Figures 2-14 through 2-20.

Table 2-1
Salt Handling Shaft Data Analysis

Piezometers

Field Tag	Level feet	Figure Number	Date of 2011-2012 Max. Reading	2011-2012 Maximum Pressure Readings (psi)	Date of 2010-2011 Max. Reading	2010-2011 Maximum Pressure Readings (psi)	Change in Maximum Pressure From Previous Year (psi)	Comments
37X-PE-00201	580	2-1	03/05/12	81	08/02/10	79	2	
37X-PE-00202	580	2-1	03/05/12	87	08/02/10	86	1	
37X-PE-00203	620	2-2	03/05/12	151	08/02/10	154	-3	
37X-PE-00204	620	2-2	03/05/12	142	08/02/10	157	-15	
37X-PE-00205	691	2-3	03/05/12	135	06/06/11	188	-53	
37X-PE-00206	691	2-3	03/05/12	132	06/06/11	182	-50	
37X-PE-00209	802	2-4	10/17/11	62	09/07/10	61	1	
37X-PE-00210	802	2-4	10/17/11	63	09/07/10	60	3	
37X-PE-00211	850	2-5	10/17/11	45	06/06/11	91	-46	
37X-PE-00212	850	2-5	03/05/12	57	06/06/11	108	-51	

Earth Pressure Cells

Field Tag	Level feet	Figure Number	Date of 2011-2012 Max. Reading	2011-2012 Maximum Pressure Readings (psi)	Date of 2010-2011 Max. Reading	2010-2011 Maximum Pressure Readings (psi)	Change in Maximum Pressure From Previous Year (psi)	Comments
37X-WE-00201	860	2-6	10/17/11	-9	08/02/10	-7	-2	
37X-WE-00202	860	2-6	10/17/11	-27	08/02/10	-25	-2	
37X-WE-00203	860	2-6	03/05/12	4	04/04/11	7	-3	

Table 2-1
Salt Handling Shaft Data Analysis (Continued)

Spot-Welded Strain Gages

Field Tag	Level Feet	Figure Number	Date of 2011-2012 Max. Reading	2011-2012 Maximum Strain Readings (με)	Date of 2010-2011 Max. Reading	2010-2011 Maximum Strain Readings (με)	Change in Maximum Strain From Previous Year (με)	Comments
37X-ZE-00206	856.3	2-7	10/17/11	590	08/02/10	653	-63	
37X-ZE-00220	862.4	2-8	10/17/11	942	10/04/10	906	36	
37X-ZE-00223	862.4	2-8	10/17/11	687	08/02/10	705	-18	

Embedment Strain Gages

Field Tag	Level feet	Figure Number	Date of 2011-2012 Max. Reading	2011-2012 Maximum Strain Readings (με)	Date of 2010-2011 Max. Reading	2010-2011 Maximum Strain Readings (με)	Change in Maximum Strain From Previous Year (με)	Comments
37X-ZE-00209	856.3	2-9	01/04/12	-543	03/08/11	-540	-3	
37X-ZE-00210	856.3	2-9	10/17/11	970	08/02/10	998	-28	
37X-ZE-00211	856.3	2-9	10/17/11	336	06/06/11	338	-2	
37X-ZE-00212	856.3	2-9	12/05/11	-914	02/07/11	-891	-23	
37X-ZE-00213	856.3	2-9	10/17/11	369	06/06/11	376	-7	
37X-ZE-00214	856.3	2-9	12/05/11	-85	06/06/11	106	-191	
37X-ZE-00215	856.3	2-9	10/17/11	123	06/06/11	131	-8	
37X-ZE-00216	856.3	2-9	10/17/11	618	06/06/11	660	-42	
37X-ZE-00235	856.3	2-10	01/04/12	-414	02/07/11	-413	-1	
37X-ZE-00236	856.3	2-10	12/05/11	-156	02/07/11	-145	-11	
37X-ZE-00237	856.3	2-10	10/17/11	81	06/06/11	124	-43	
37X-ZE-00238	856.3	2-10	10/17/11	522	06/06/11	545	-23	
37X-ZE-00225	862.4	2-11	10/17/11	280	06/06/11	271	9	
37X-ZE-00239	862.4	2-12	10/17/11	397	09/07/10	391	6	

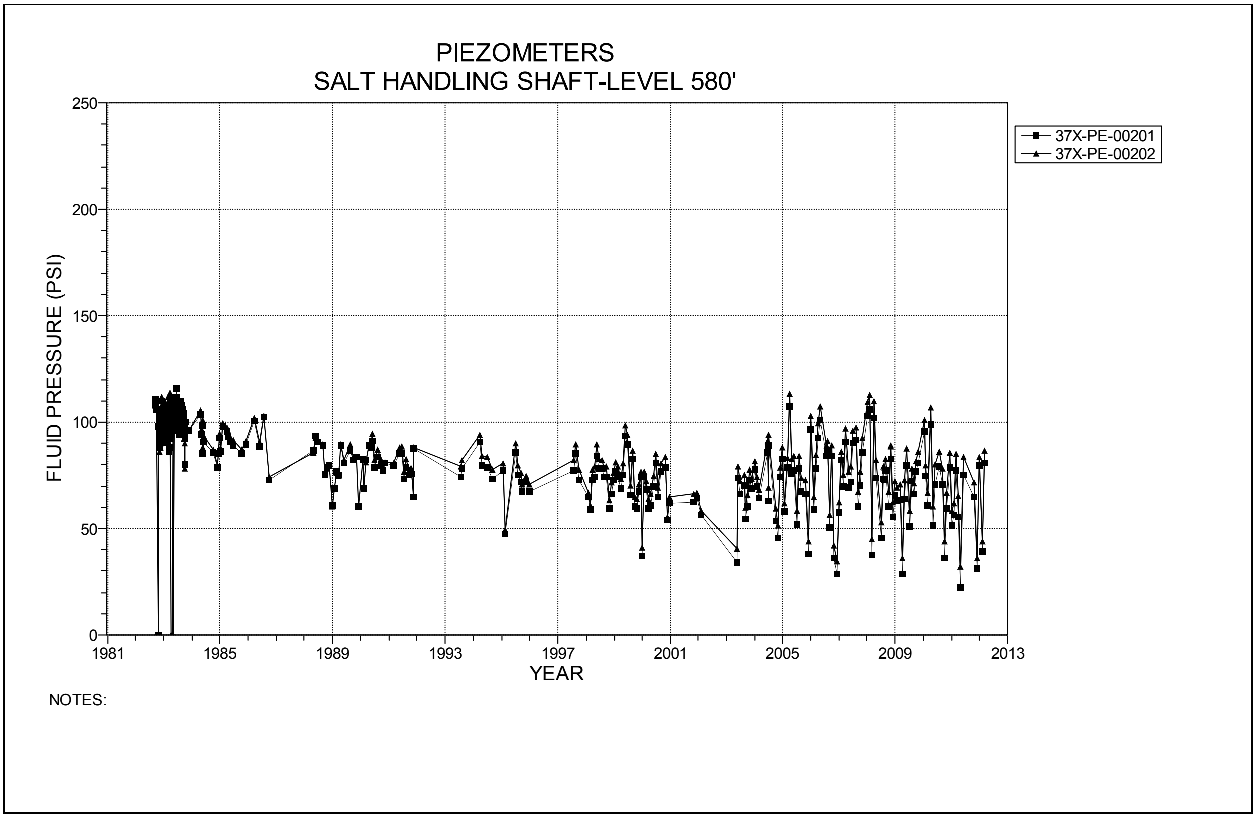


Figure 2-1 Piezometers 37X-PE-00201 and 37X-PE-00202
Salt Handling Shaft – Level 580 at the Forty-niner Member

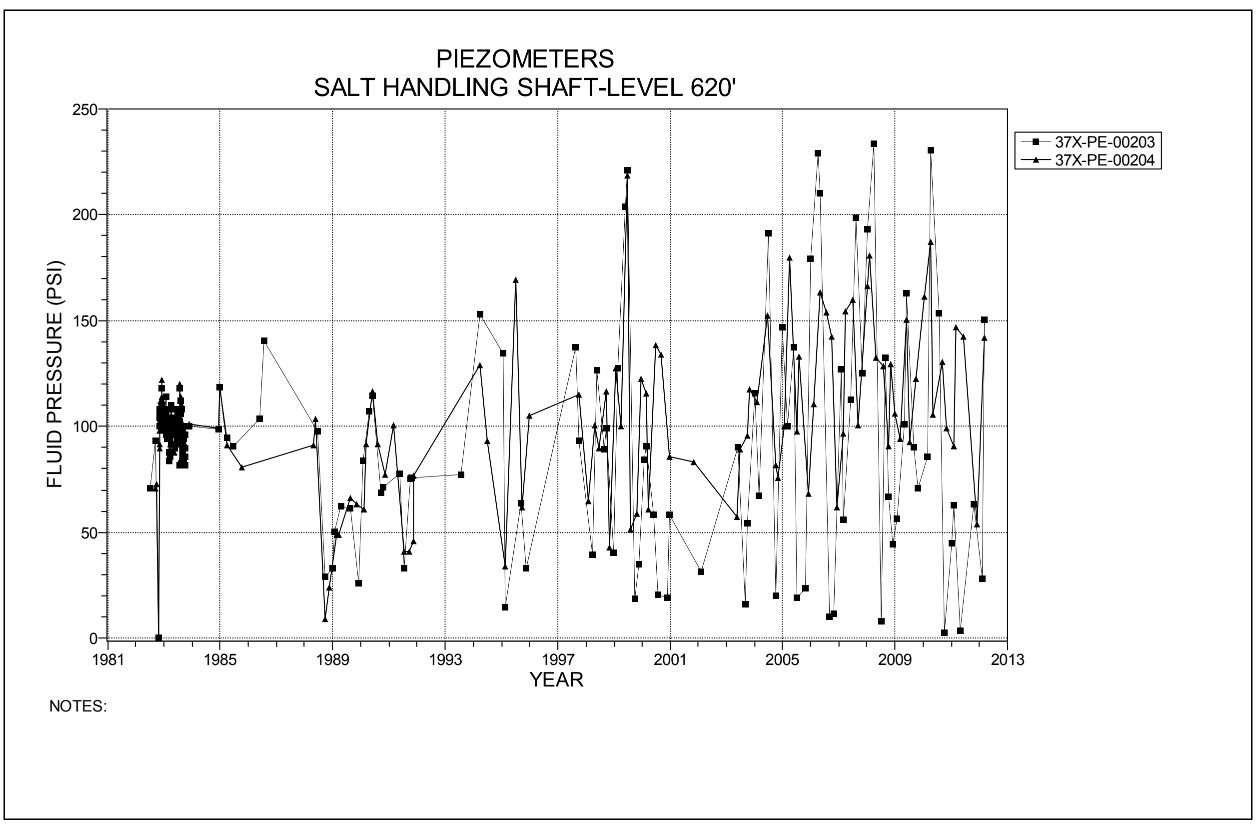


Figure 2-2 Piezometers 37X-PE-00203 and 37X-PE-00204
Salt Handling Shaft – Level 620 at the Magenta Dolomite Member

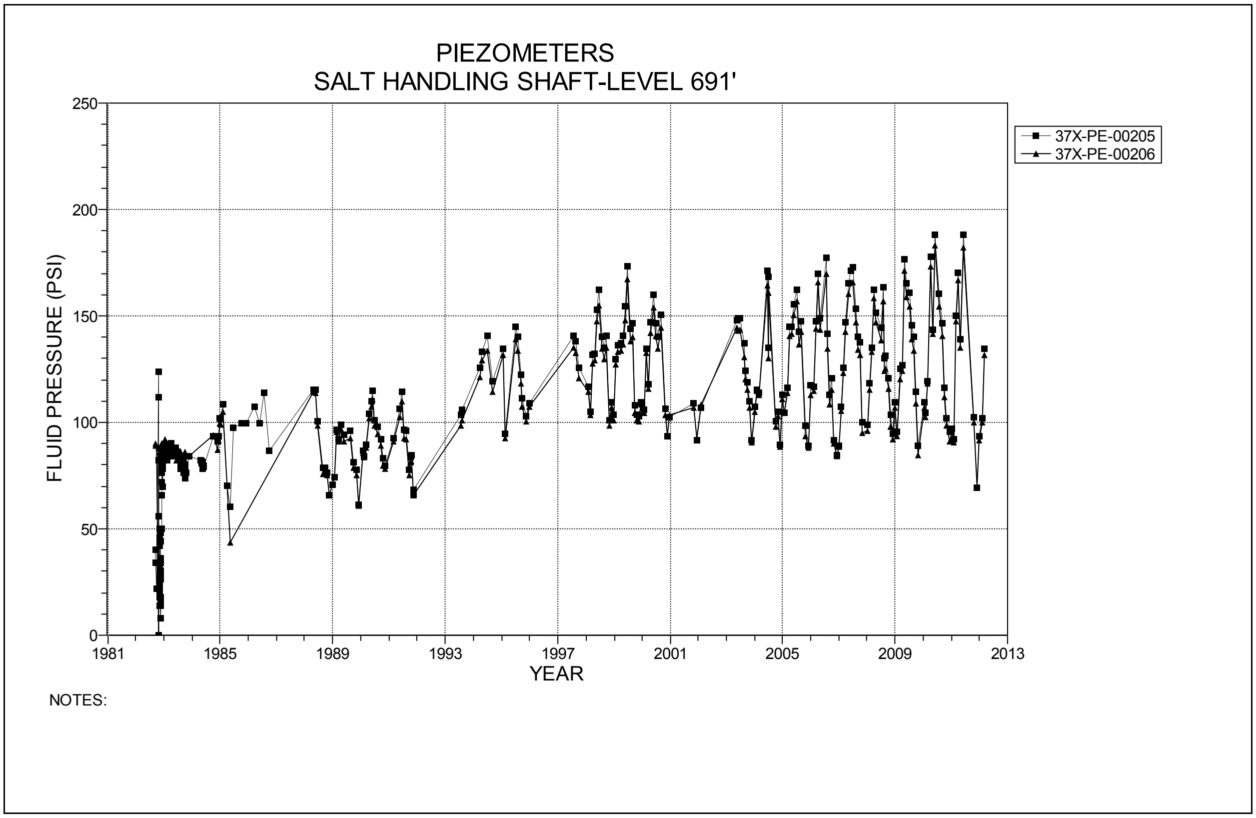


Figure 2-3 Piezometers 37X-PE-00205 and 37X-PE-00206
Salt Handling Shaft – Level 691 at the Tamarisk Member

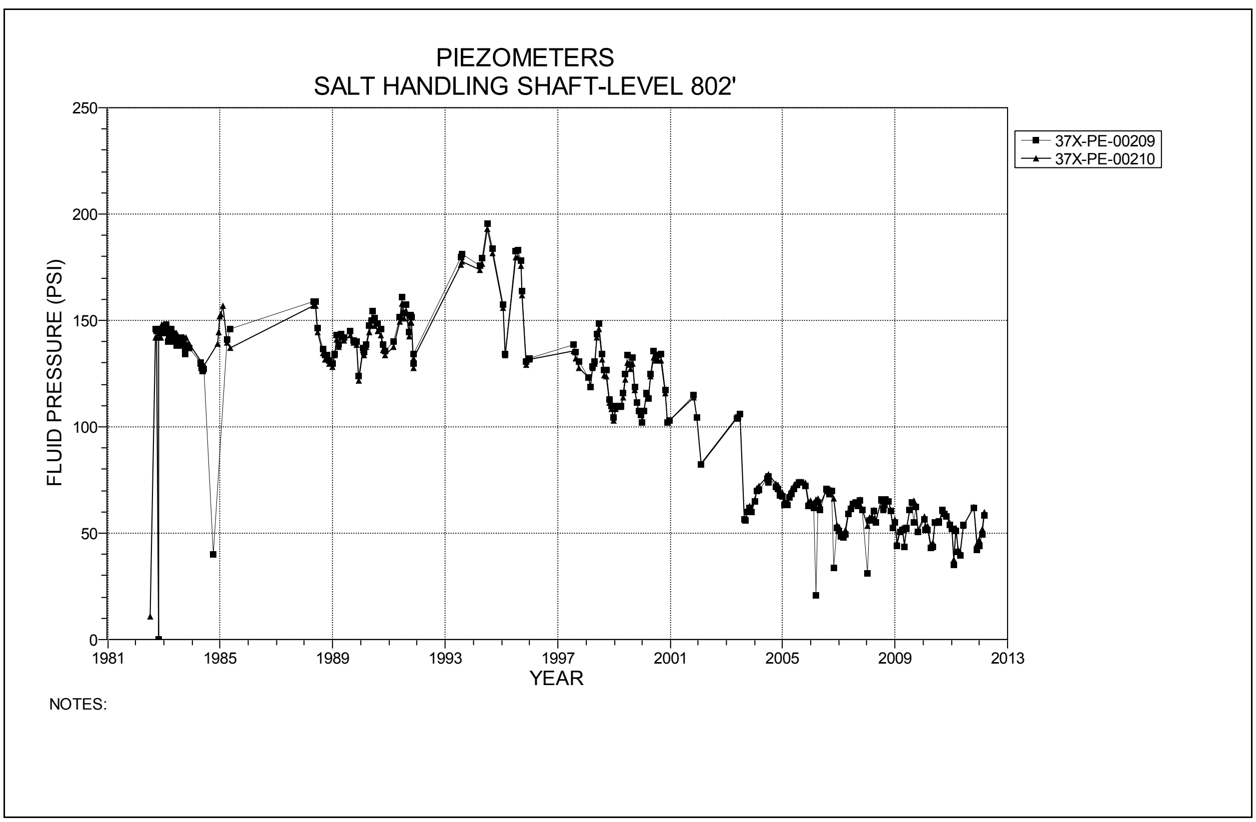


Figure 2-4 Piezometers 37X-PE-00209 and 37X-PE-00210
Salt Handling Shaft – Level 802 at the Los Medaños Member

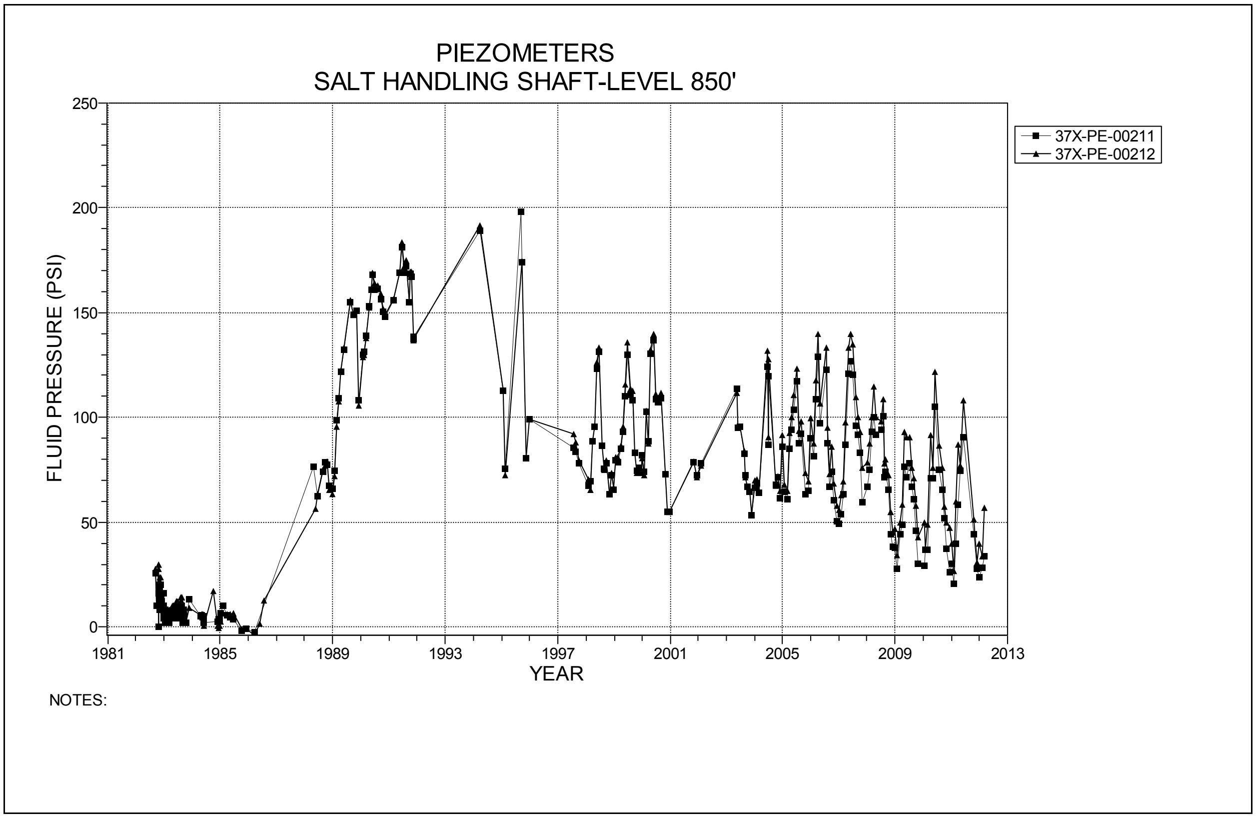


Figure 2-5 Piezometers 37X-PE-00211 and 37X-PE-00212
Salt Handling Shaft – Level 850 at the Rustler-Salado Contact

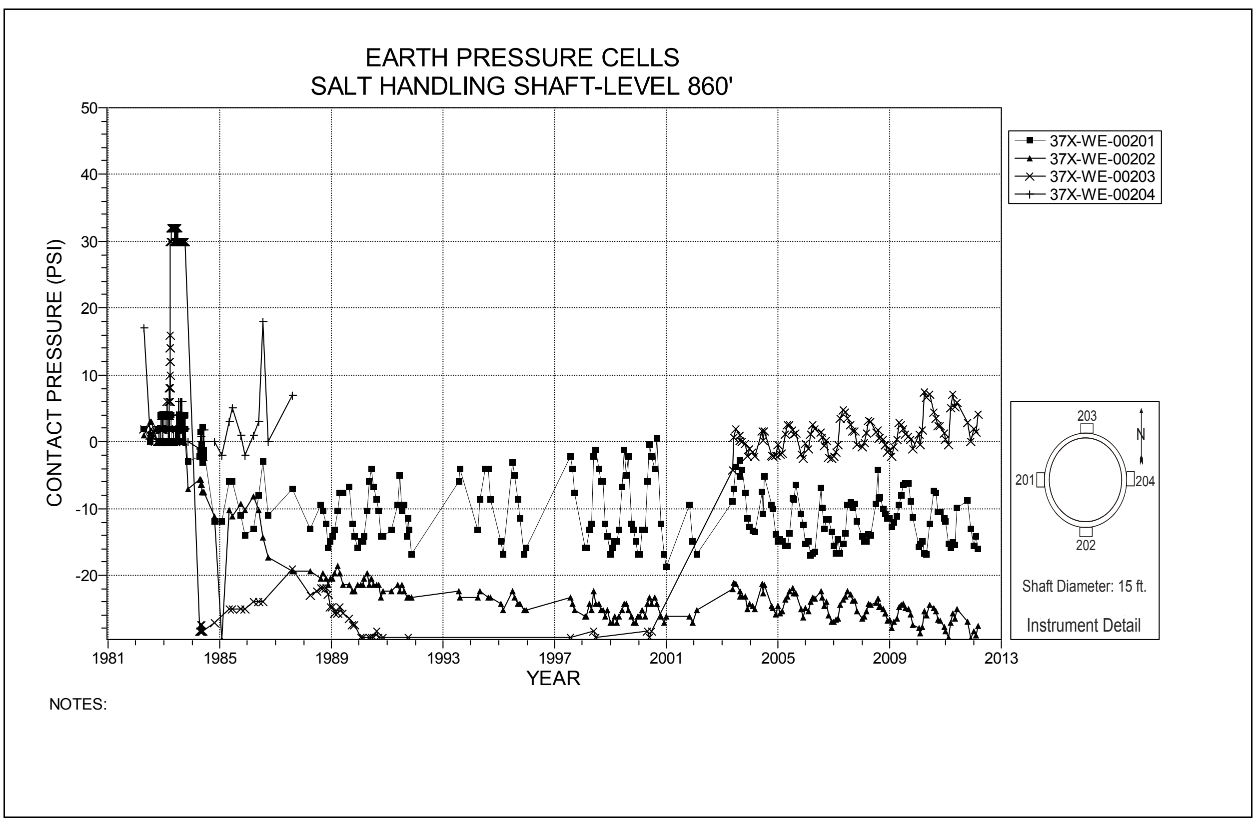


Figure 2-6 Earth Pressure Cells Behind Shaft Key
Salt Handling Shaft Key – Level 860

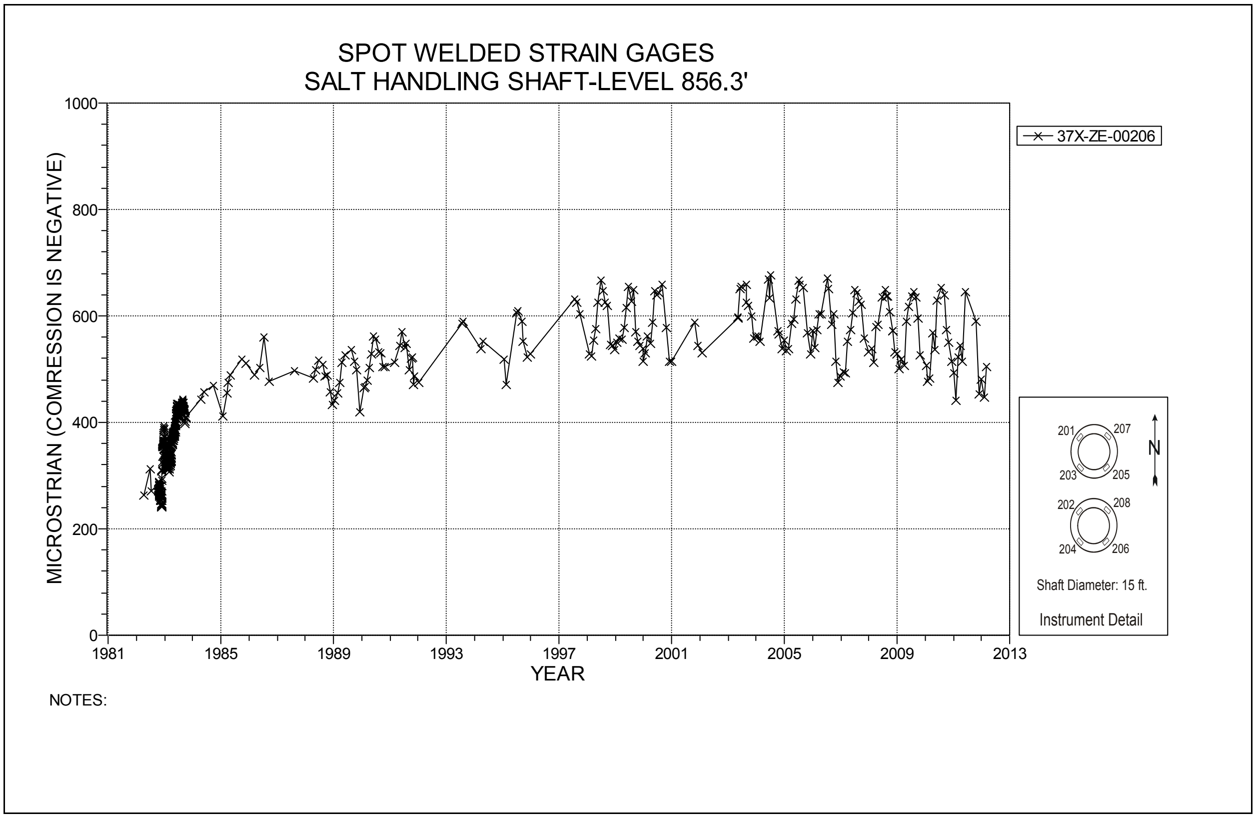


Figure 2-7 Spot-Welded Strain Gages
Salt Handling Shaft Key – Level 856.3

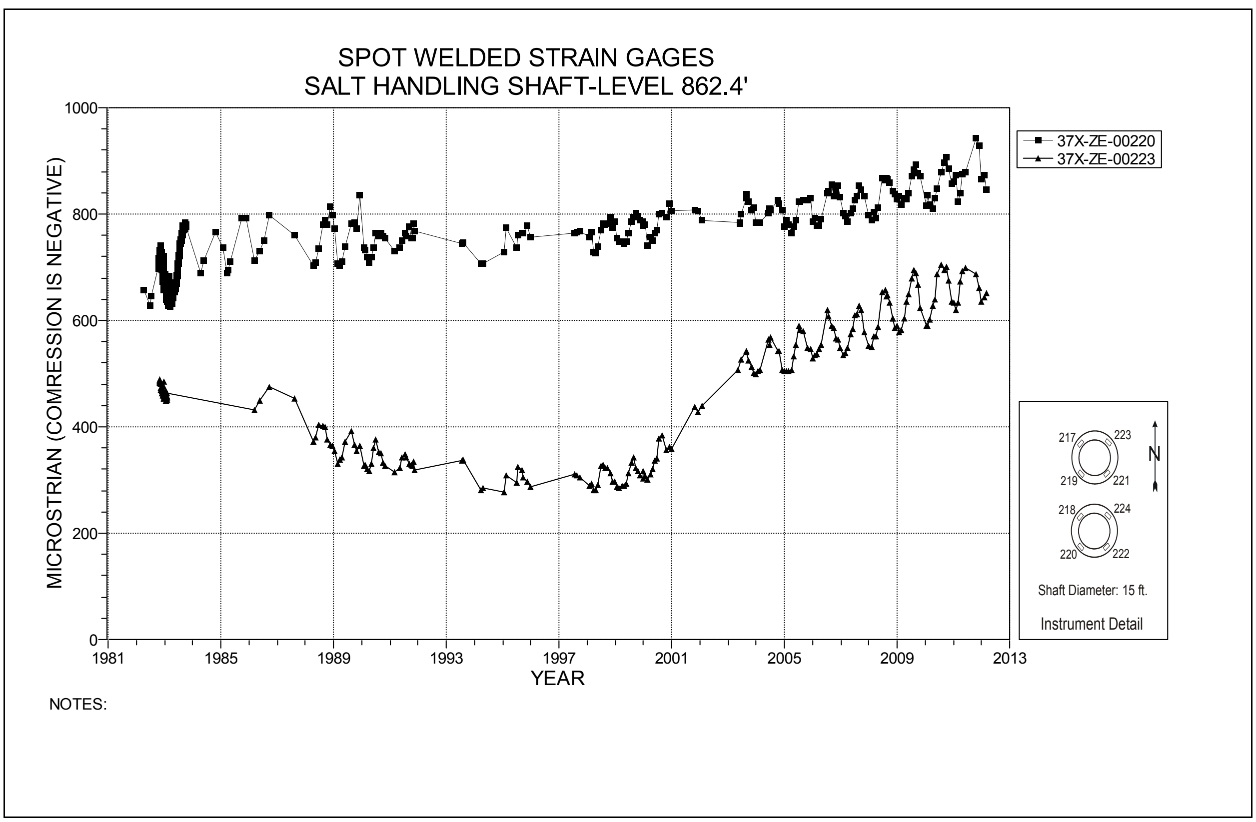


Figure 2-8 Spot-Welded Strain Gages
Salt Handling Shaft Key – Level 862.4

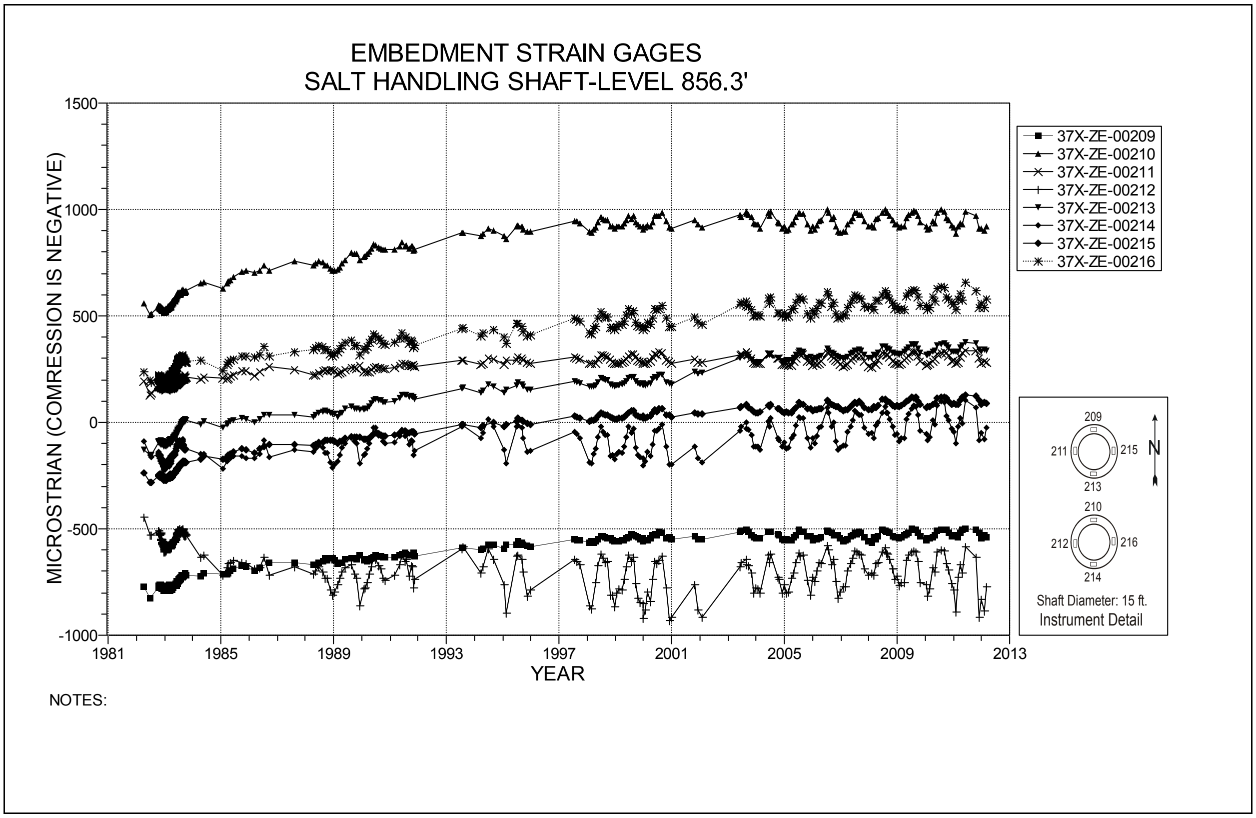


Figure 2-9 Embedment Strain Gages
Salt Handling Shaft Key – Level 856.3

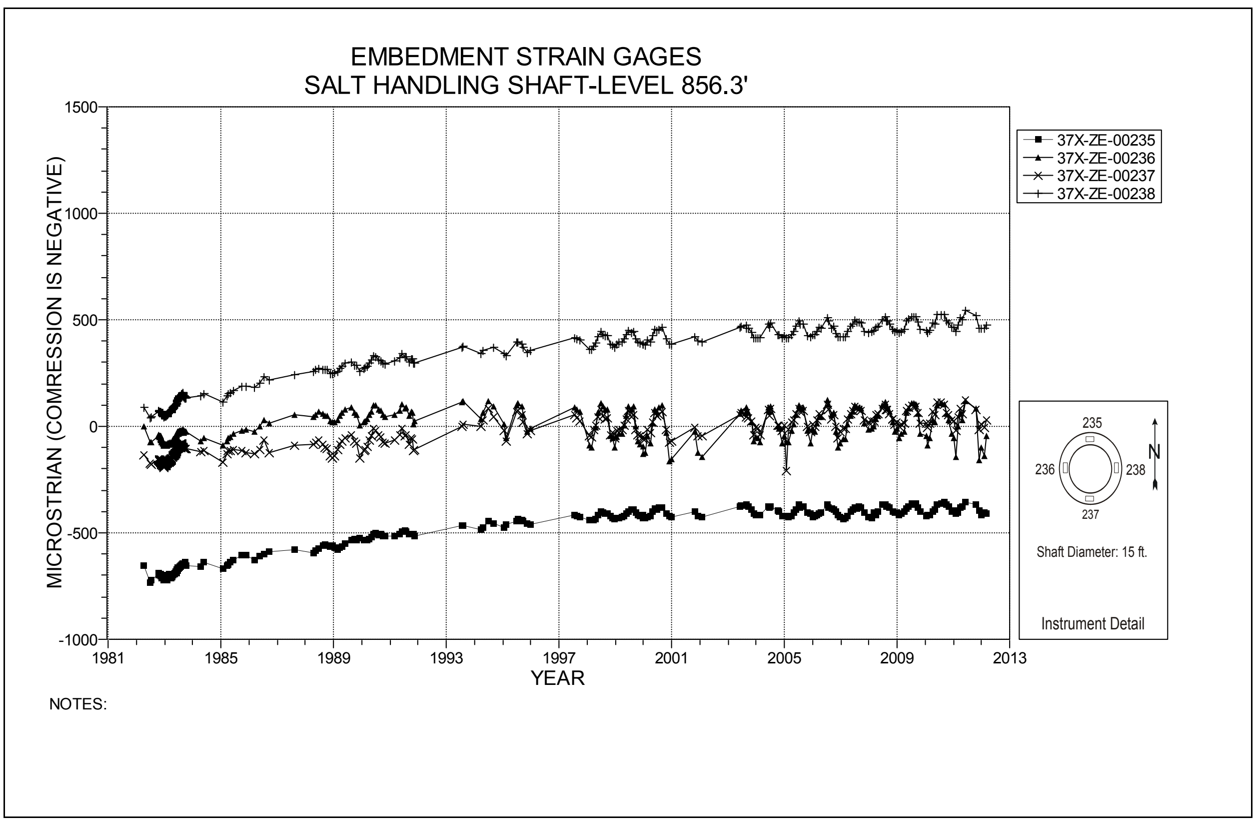


Figure 2-10 Embedment Strain Gage
Salt Handling Shaft Key Level 856.3

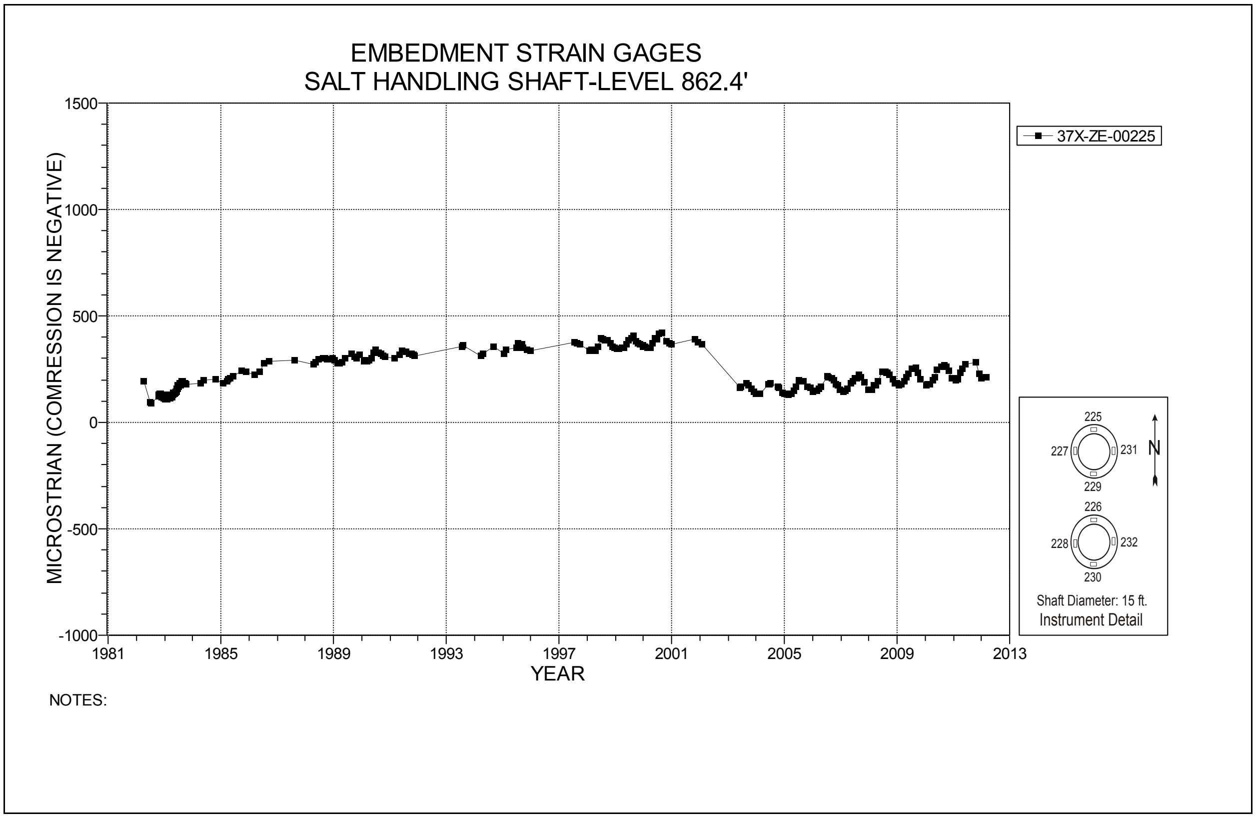


Figure 2-11 Embedment Strain Gages
Salt Handling Shaft Key Level 862.4

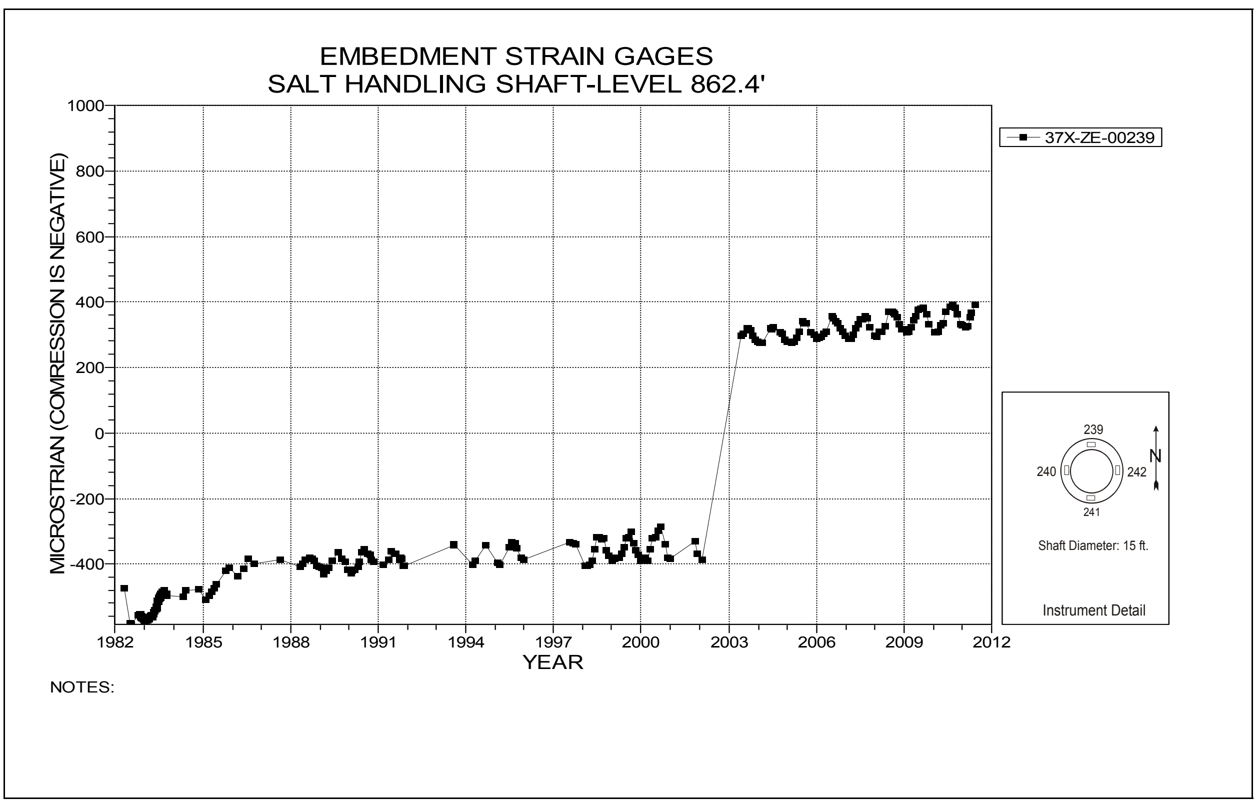
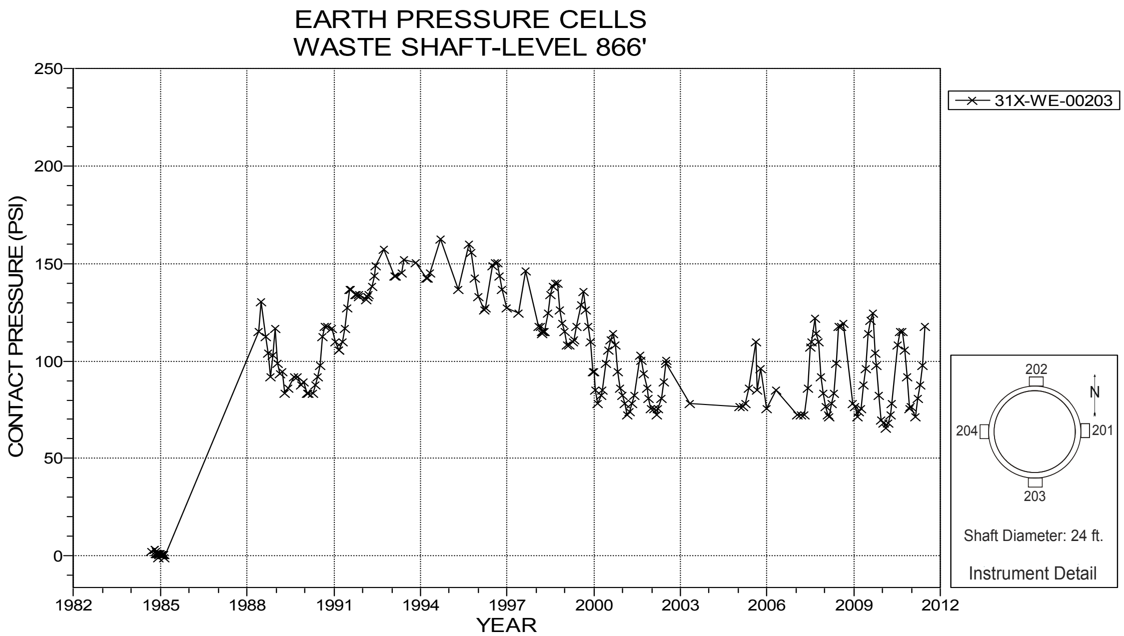


Figure 2-12 Embedment Strain Gage
Salt Handling Shaft Key – Level 862.4

Table 2-2
Waste Shaft Data Analysis

Earth Pressure Cell								
Field Tag	Level feet	Figure Number	Date of 2011-2012 Max. Reading	2011-2012 Maximum Pressure Readings (psi)	Date of 2010-2011 Max. Reading	2010-2011 Maximum Pressure Reading (psi)	Change in Maximum Pressure From Previous Year (psi)	Comments
31X- WE-00203	866	2-13	08/12/11	134	06/16/11	118	16	



NOTES:
1. Excavation date: March 1984.
2. 31X-WE-00201, 202 & 204 are no longer reading, suspect cabling/connection problem.

Figure 2-13 Earth Pressure Cell 31X-WE-00203
Waste Shaft Key – Level 866

Table 2-3
Exhaust Shaft Data Analysis

Piezometers

Field Tag	Level feet	Figure Number	Date of 2011-2012 Max. Reading	2011-2012 Maximum Pressure Readings (psi)	Date of 2010-2011 Max. Reading	2010-20110 Maximum Pressure Readings (psi)	Change in Maximum Pressure From Previous Year (psi)	Comments
35X-PE-00202	544	2-14	05/01/12	1064	06/06/11	-3	1067	
35X-PE-00204	615	2-15	05/01/12	1112	06/06/11	125	987	
35X-PE-00208	673	2-16	10/31/11	6	06/06/11	5	1	
35X-PE-00210	721	2-17	10/10/11	141	06/06/11	141	0	
35X-PE-00213	768	2-18	10/10/11	9	06/06/11	8	1	
35X-PE-00214	768	2-18	10/31/11	6	06/06/11	6	0	
35X-PE-00218	850	2-19	12/05/11	75	05/02/11	46	29	
35X-PE-00219	887	2-20	10/10/11	27	06/06/11	25	2	

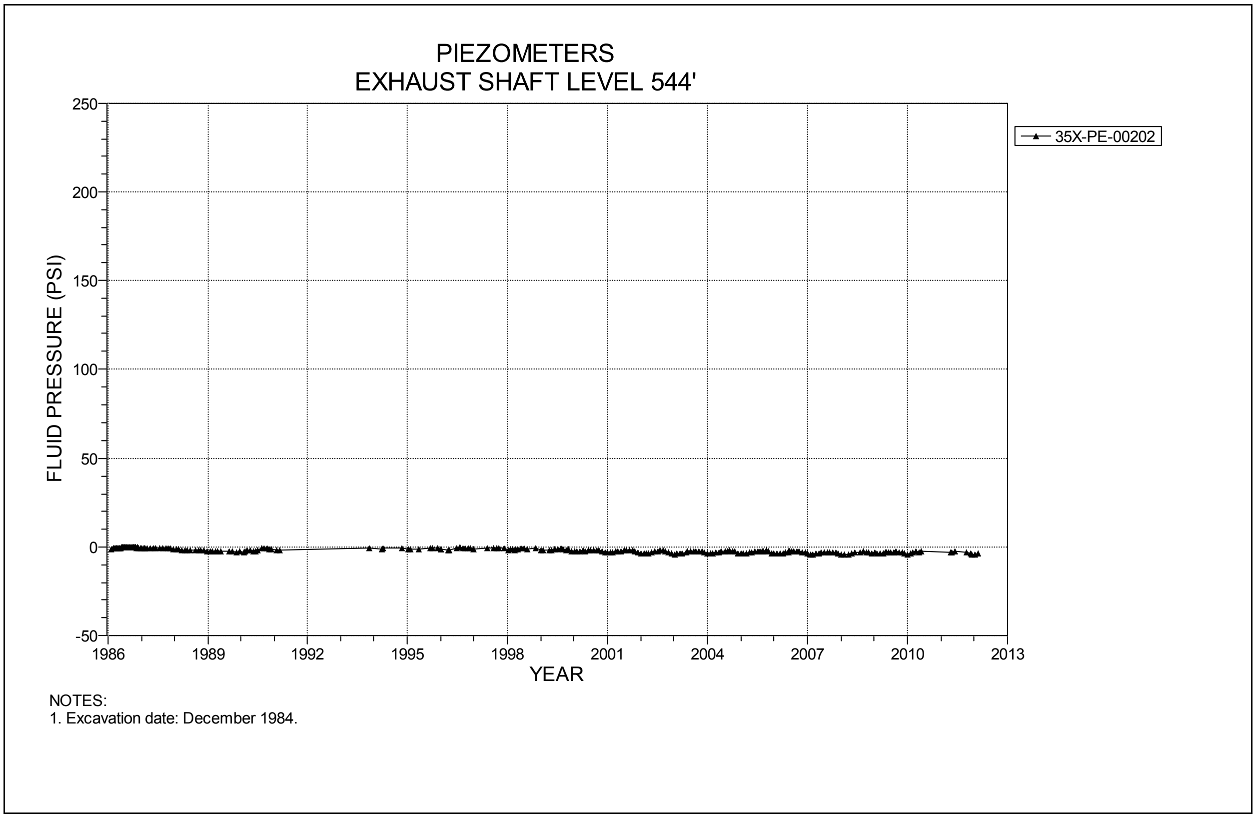


Figure 2-14 Piezometer 35X-PE-00202
Exhaust Shaft – Level 544 at the Base of Dewey Lake Redbeds

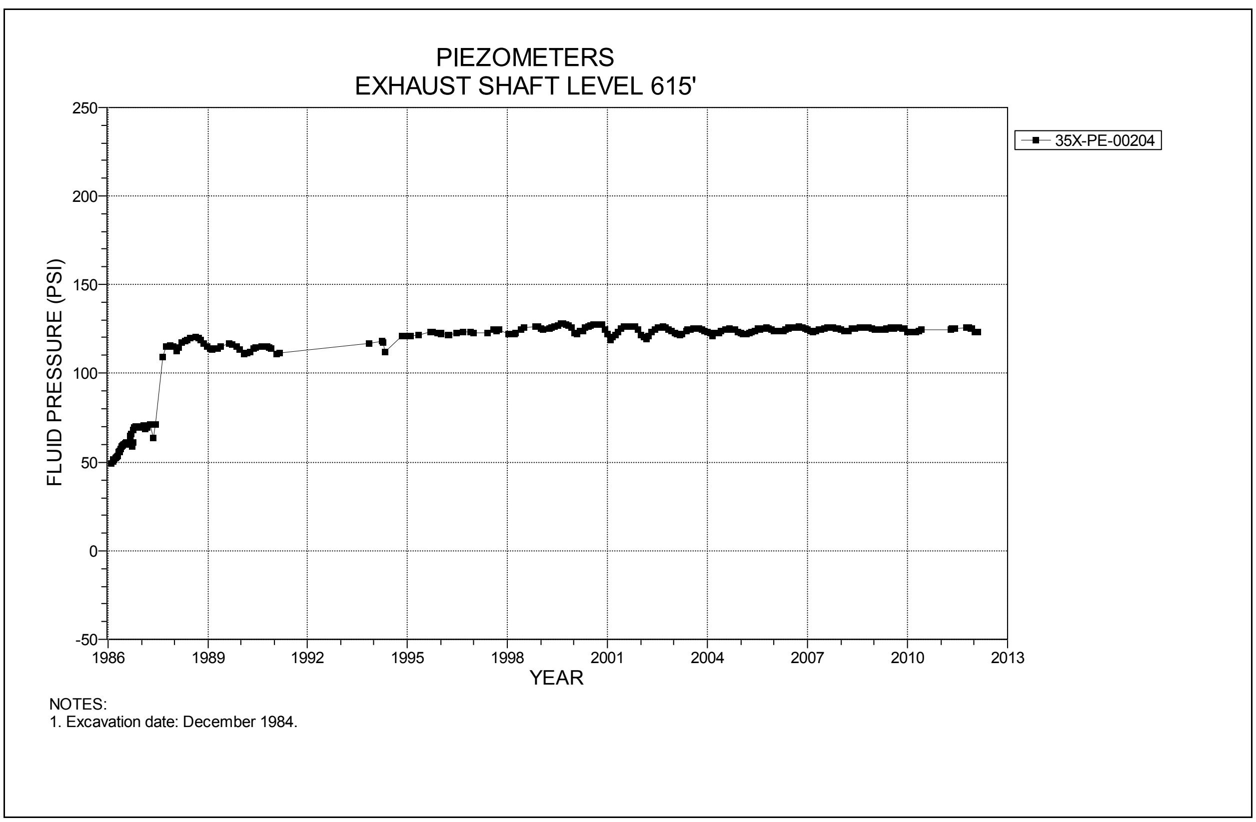


Figure 2- 15 Piezometer 35X-PE-00204
Exhaust Shaft – Level 615 at the Magenta Dolomite Member

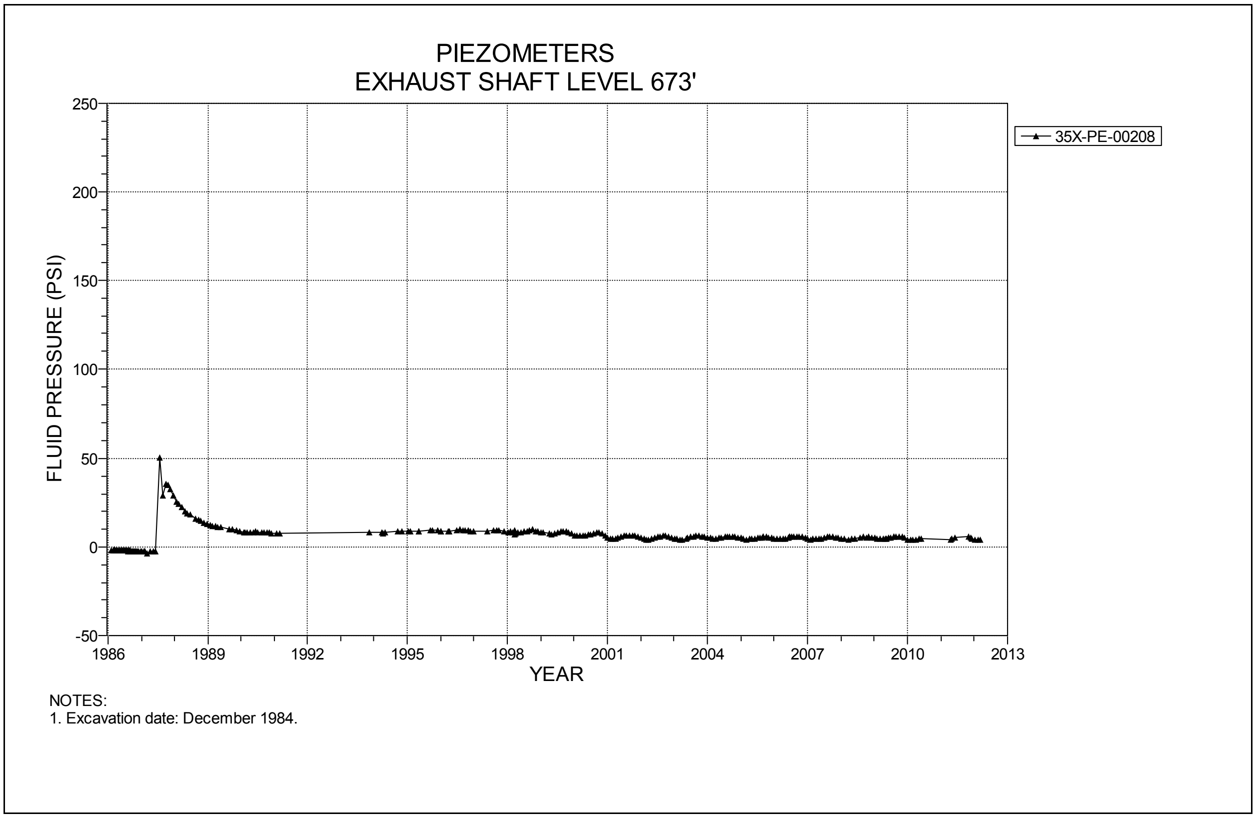


Figure 2-16 Piezometer 35X-PE-00208
Exhaust Shaft – Level 673 at the Tamarisk Member

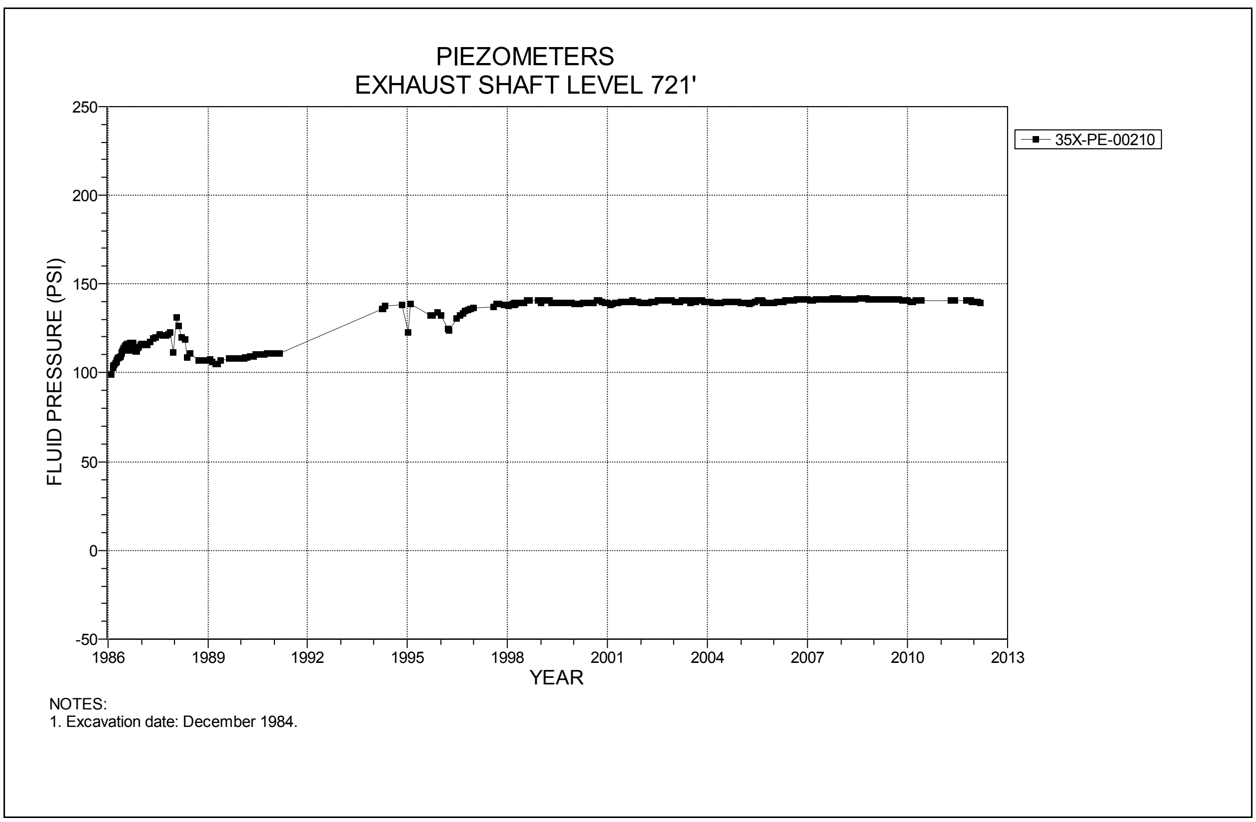


Figure 2-17 Piezometer 35X-PE-00210
Exhaust Shaft – Level 721 at the Culebra Dolomite Member

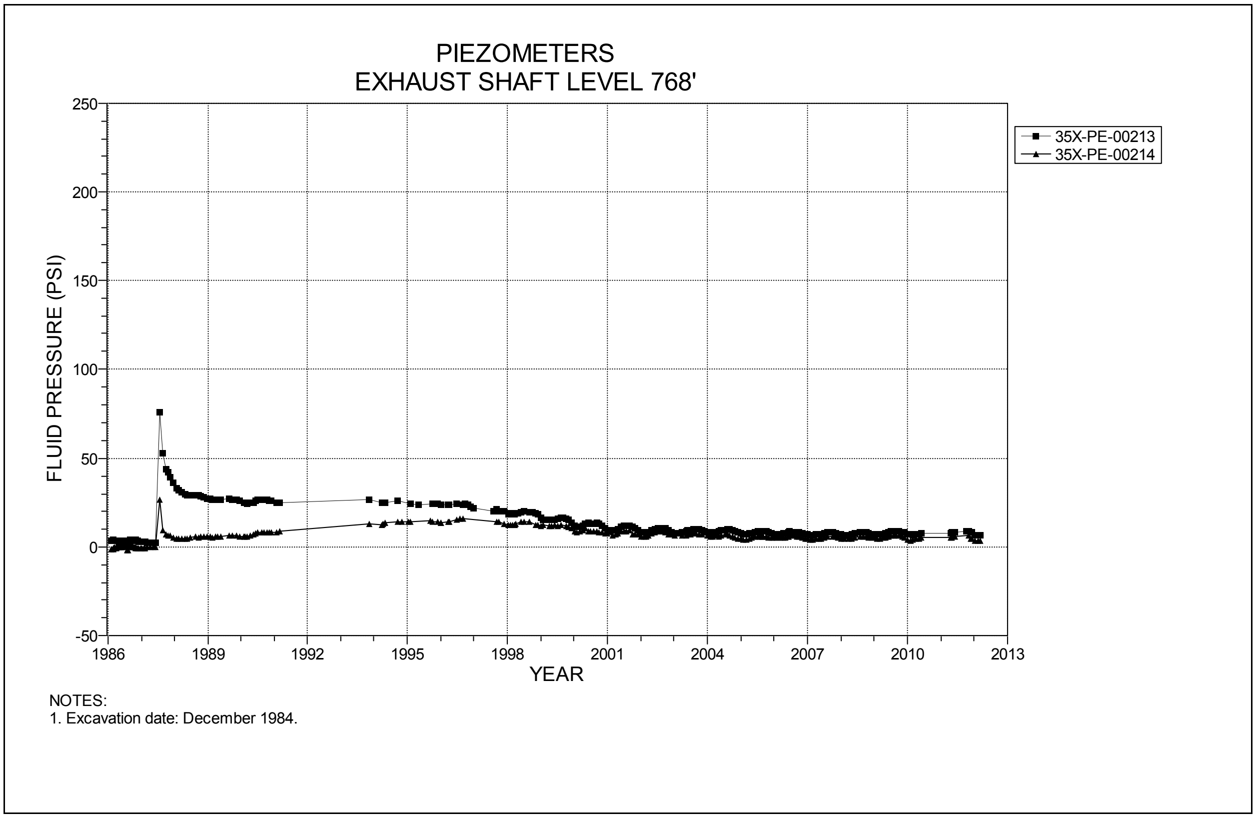


Figure 2-18 Piezometers 35X-PE-00213 and 35X-PE-00214
Exhaust Shaft – Level 768 at the Los Medaños Member

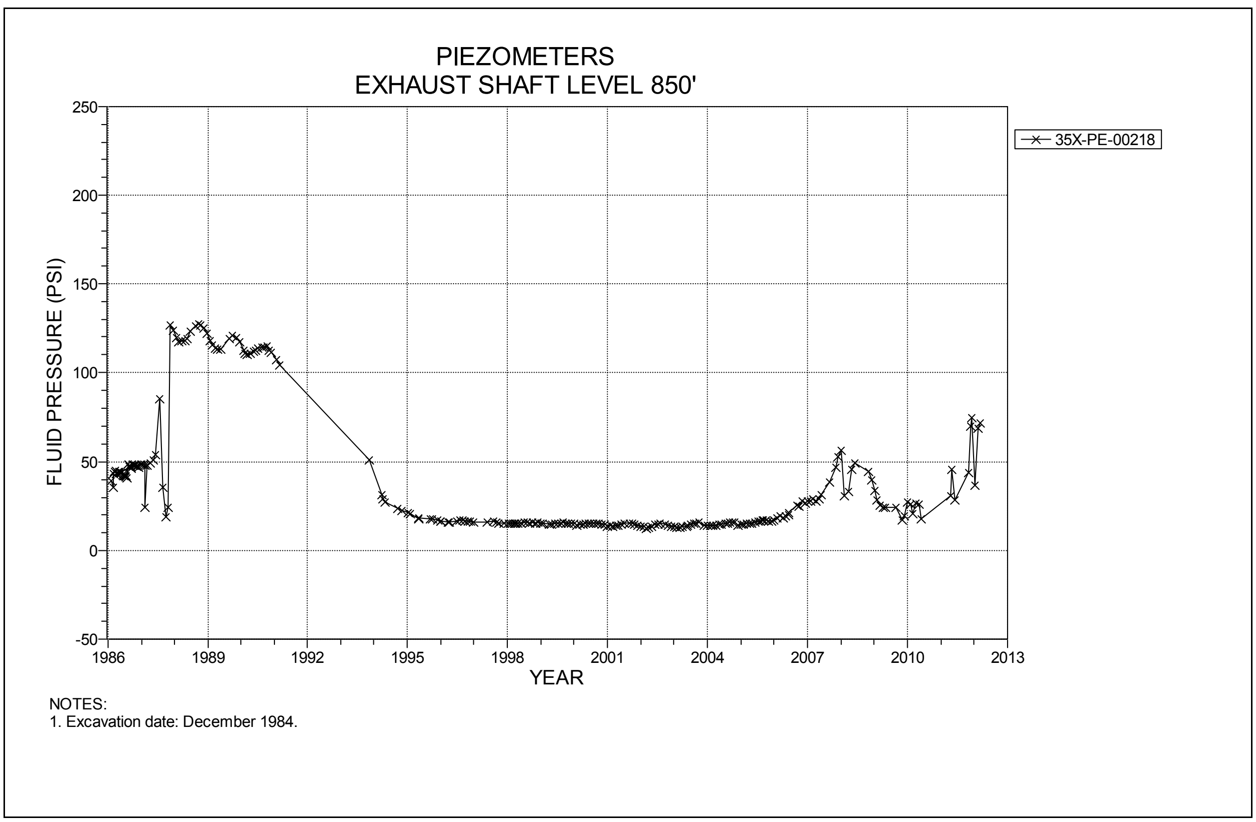


Figure 2-19 Piezometer 35X-PE-00218
Exhaust Shaft – Level 850 at the Rustler-Salado Contact

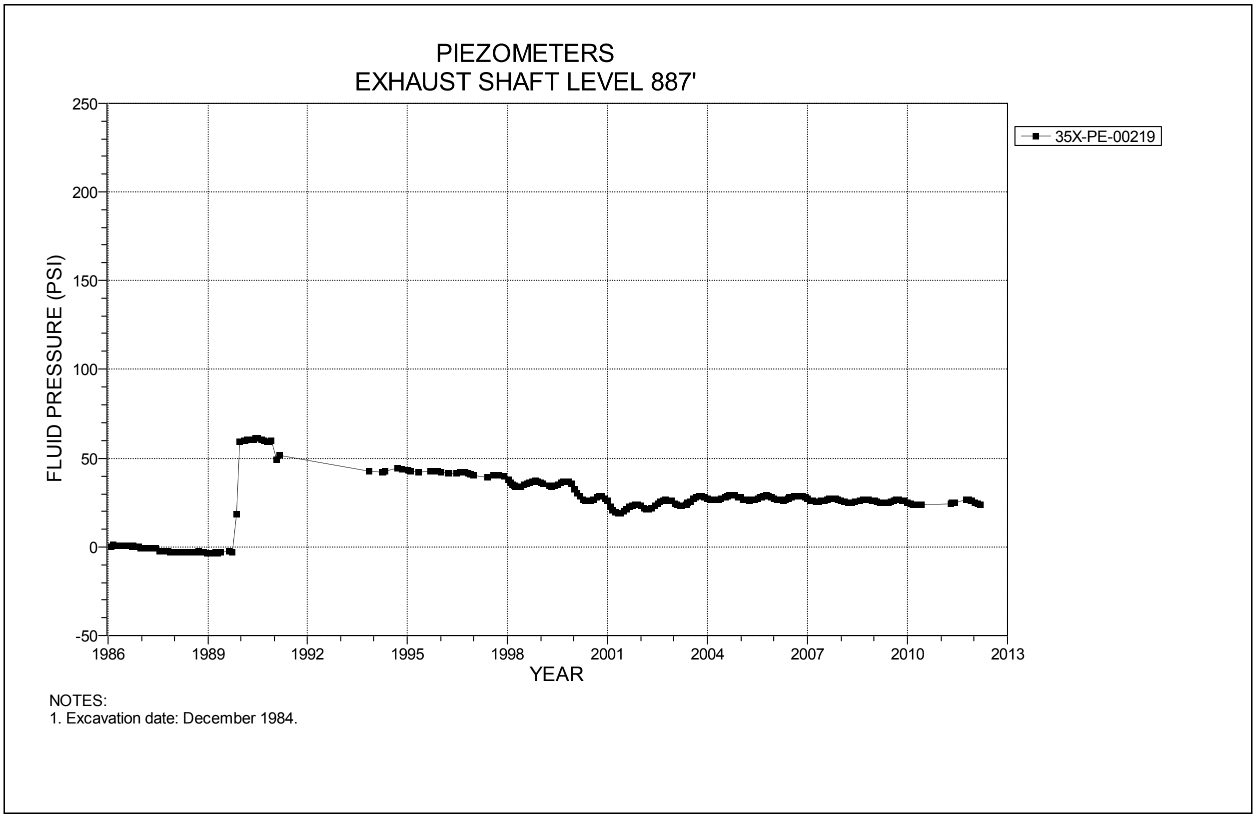


Figure 2-20 Piezometer 35X-PE-00219
Exhaust Shaft – Level 887 below the Lower Chemical Seal

3.0 Instrumentation Summary for Shaft Stations

Instrumentation data analysis for the Salt Handling Shaft Station, Waste Shaft Station, and the area around the Air Intake Shaft follow. Table 3-1 presents data analyses for each of the Salt Handling Shaft Station instruments. Figures 3-1 through 3-5 present plots of the instrumentation data for the Salt Handling Shaft Station.

Table 3-2 presents data and analysis for the Waste Shaft Station. Plots from the instrumentation in the Waste Shaft Station are presented as Figures 3-6 through 3-9.

Table 3-3 and Figures 3-10 through 3-15 present the data from rock bolt load cells and borehole extensometers located in the immediate area around the Air Intake Shaft.

Table 3-1
Salt Handling Shaft Station Data Analysis

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
E0-S18-8 A-E	E0 Drift-S18	3-1	06/06/12	0.597	21.749	2.5	1.9	32%	
E0-S18-6 B-D	E0 Drift-S18	3-1a	06/06/12	0.629	23.728	2.6	2.0	28%	
E0-S18-5 H-F	E0 Drift-S18	3-1a	06/06/12	0.373	14.834	1.5	1.3	22%	
E0-S30-6 A-C	E0 Drift-S30	3-2	06/06/12	0.554	22.585	2.3	1.9	21%	
E0-S65-5 A-C	E0 Drift-S65	3-3	06/06/12	0.366	15.726	1.5	1.2	28%	

Extensometers

Field Tag	Location	Figure Number	Date of Last Reading	Collar Displacement Relative to Deepest Anchor (inches)	Displacement Rate 2011 to 2012 (in/year)	Displacement Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
51X-GE-01026-2	E0-S30 Roof	3-4	06/6/12	0.759	0.4	0.4	0%	
51X-GE-01027-2	E0-S60 Roof	3-5	06/6/12	0.507	0.2	0.2	0%	

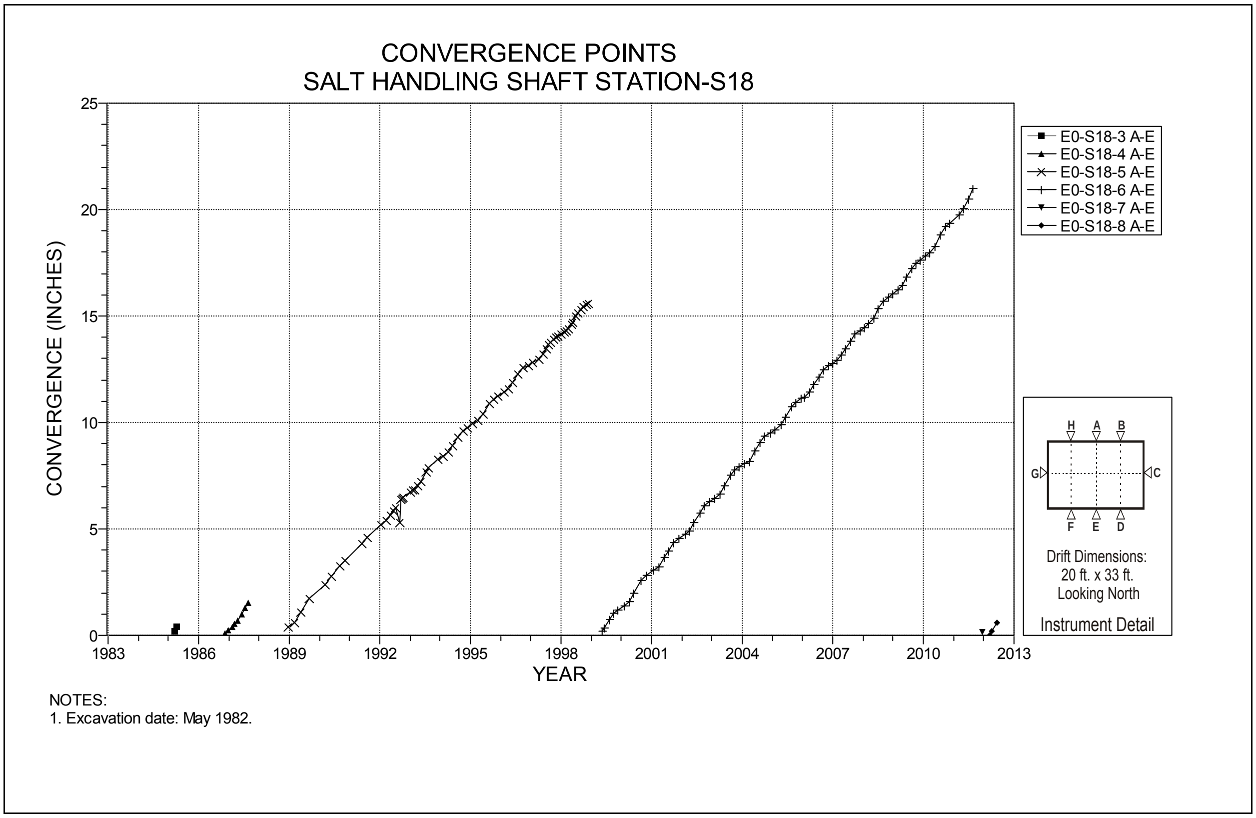


Figure 3-1 Convergence Point Array
Salt Handling Shaft Station at S18 – Centerline

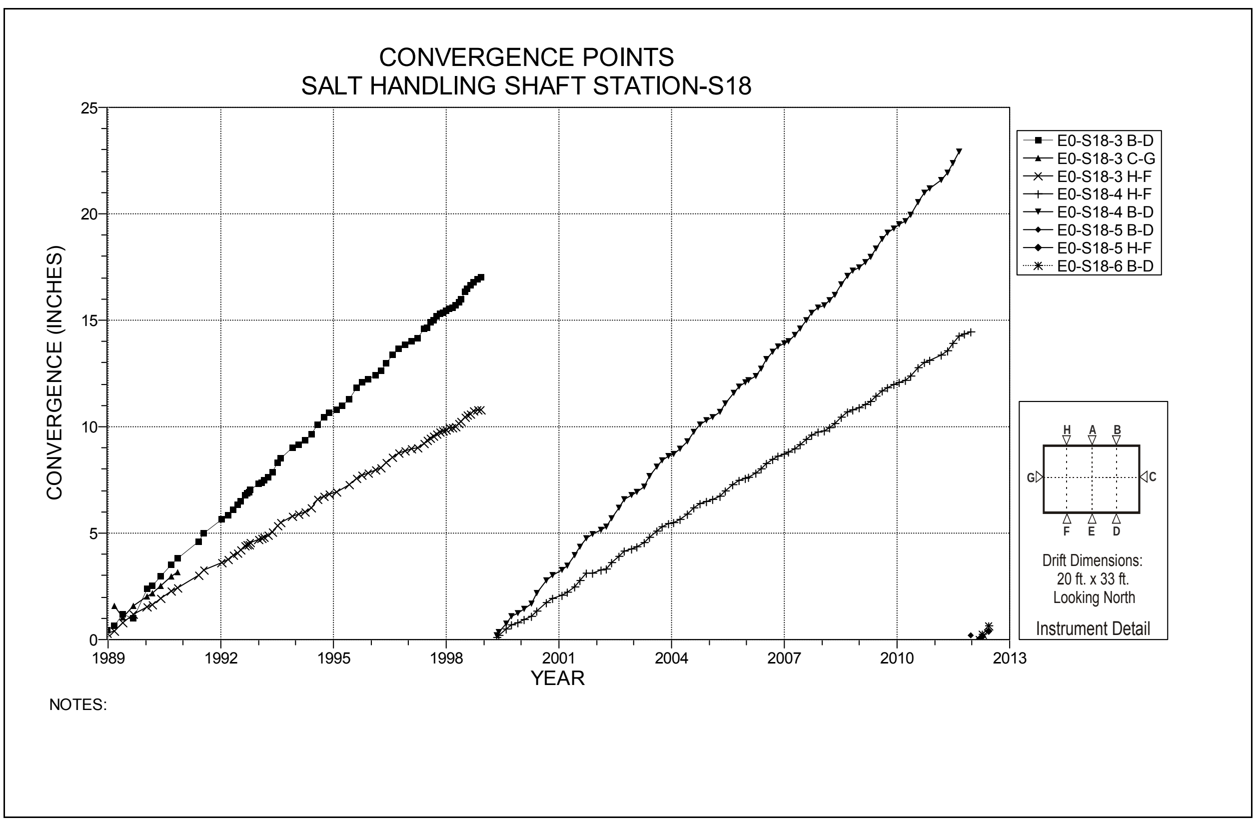


Figure 3-1a Convergence Point Array
Salt Handling Shaft Station at S18 – Quarter-Points

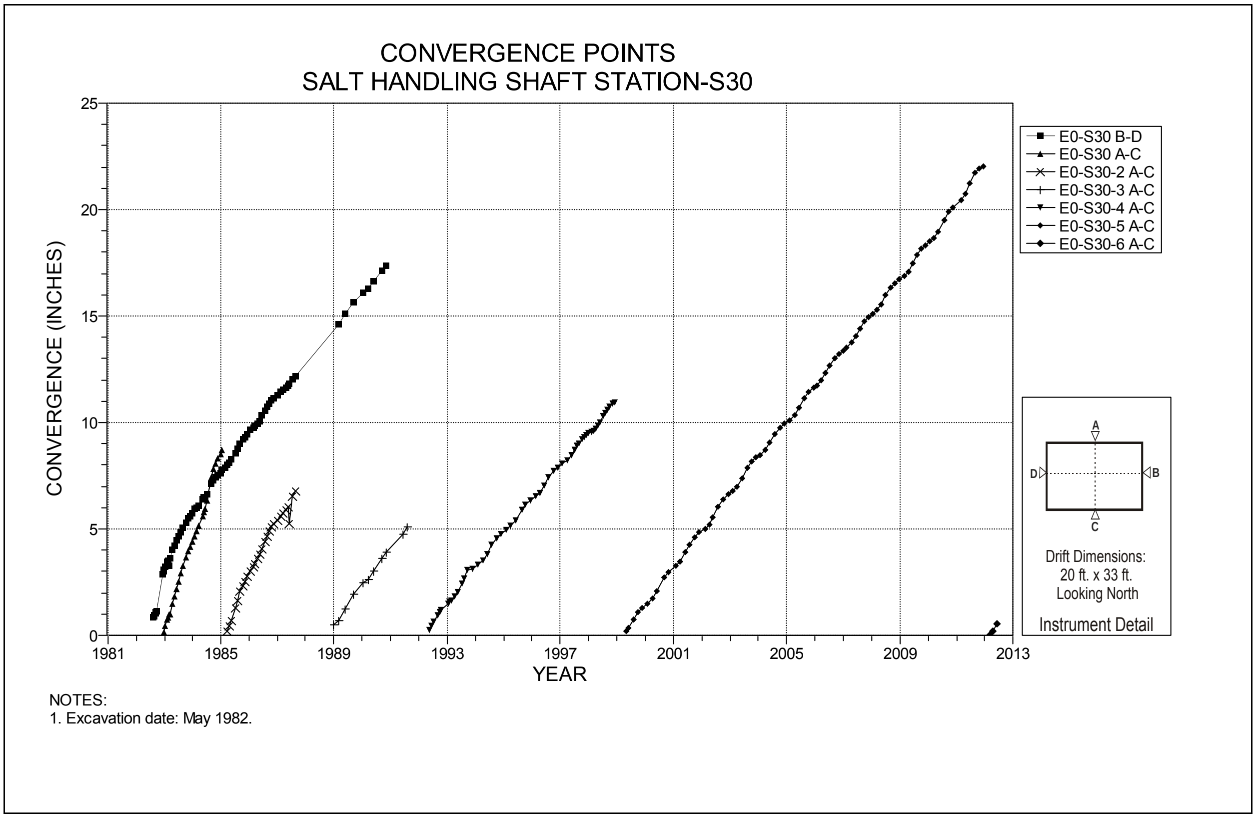


Figure 3-2 Convergence Point Array
Salt Handling Shaft Station at S30 – Roof to Floor

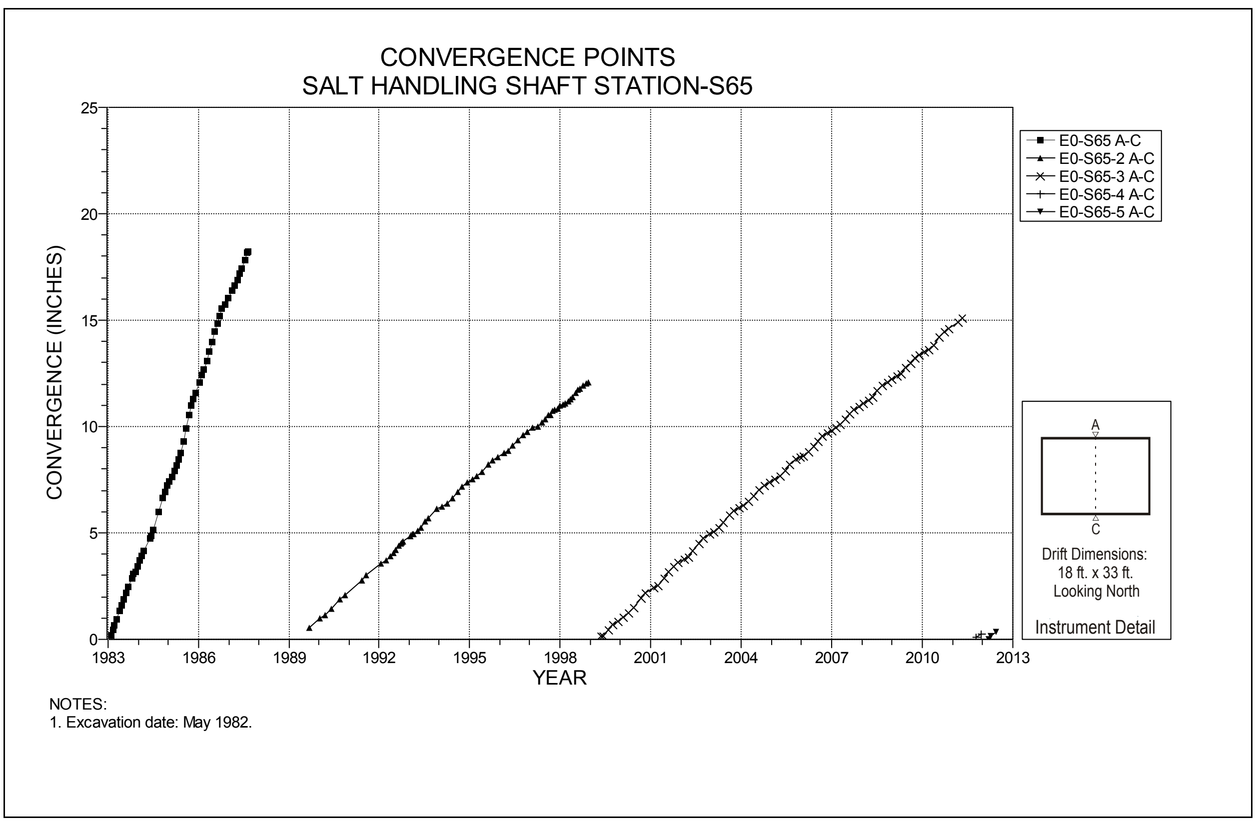


Figure 3-3 Convergence Point Array
Salt Handling Shaft Station at S65 – Roof to Floor

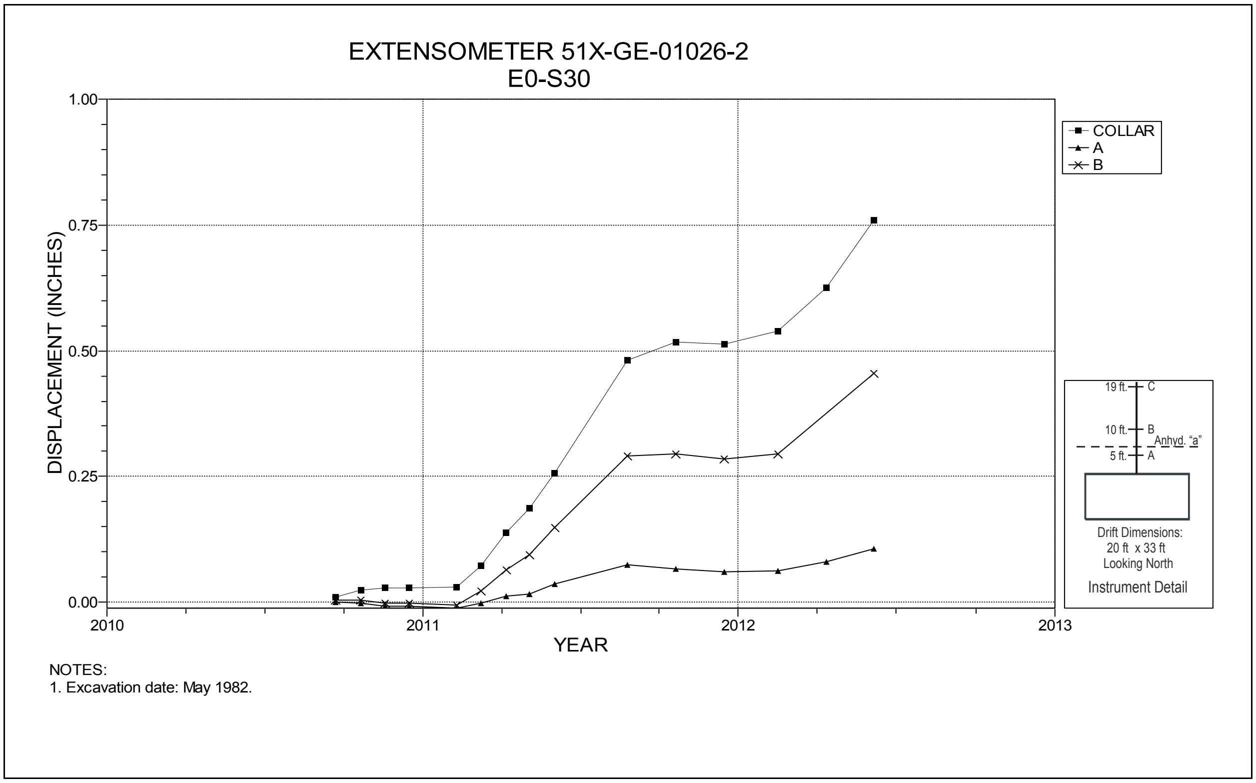


Figure 3-4 Extensometer 51X-GE-001026-2
Salt Handling Shaft Station at S30 – Roof

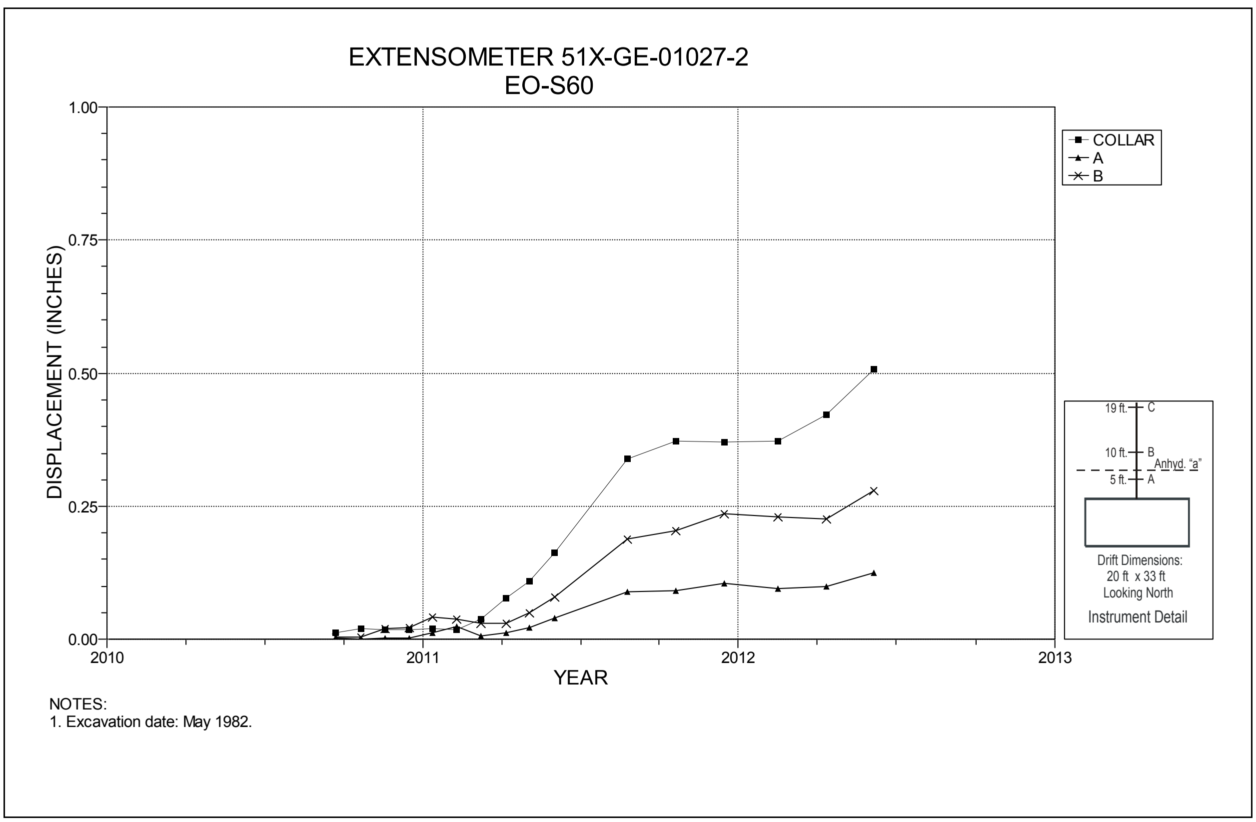


Figure 3-5 Extensometer 51X-GE-001027-2
Salt Handling Shaft Station at S60 – Roof

Table 3-2
Waste Shaft Station Data Analysis

Extensometers

Fieldtag	Location	Figure Number	Date of Last Reading	Collar Displacement Relative to Deepest Anchor (inches)	Displacement Rate 2011 to 2012 (in/year)	Displacement Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
51X-GE-00268	Waste Shaft Station - W30	3-6	06/06/12	11.003	0.1	0.1	0%	
51X-GE-00404-2	Waste Shaft Station	3-7	06/28/12	0.611	0.3	0.3	0%	

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011-2012		Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
			Date	Inches					
S400-E32 B-D	Waste Shaft Station - E32	3-8	5/22/2012	4.173	4.173	1.2	1.2	0%	
S400-E85 B-D	Waste Shaft Station - E85	3-9	5/22/2012	4.233	4.233	1.2	1.3	-8%	

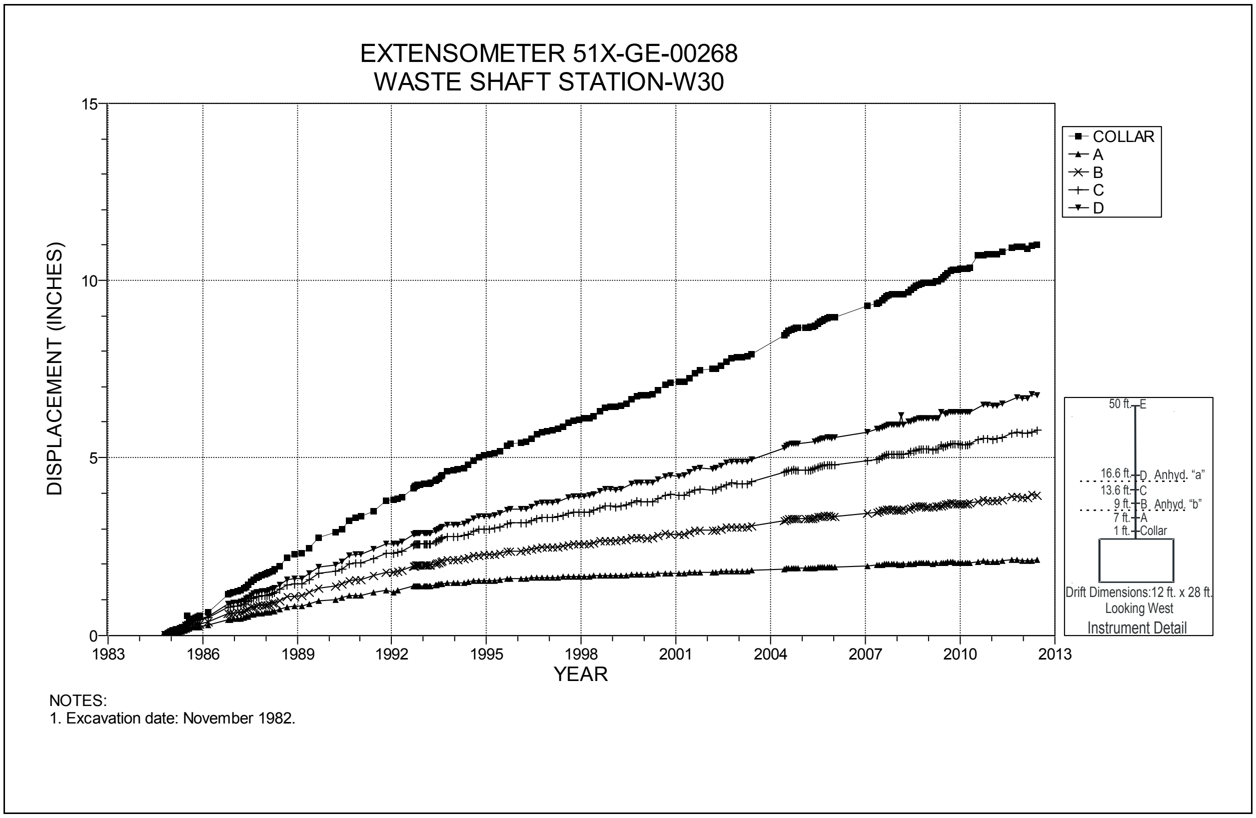


Figure 3-6 Extensometer 51X-GE-00268
Waste Shaft Station at W30 – Roof

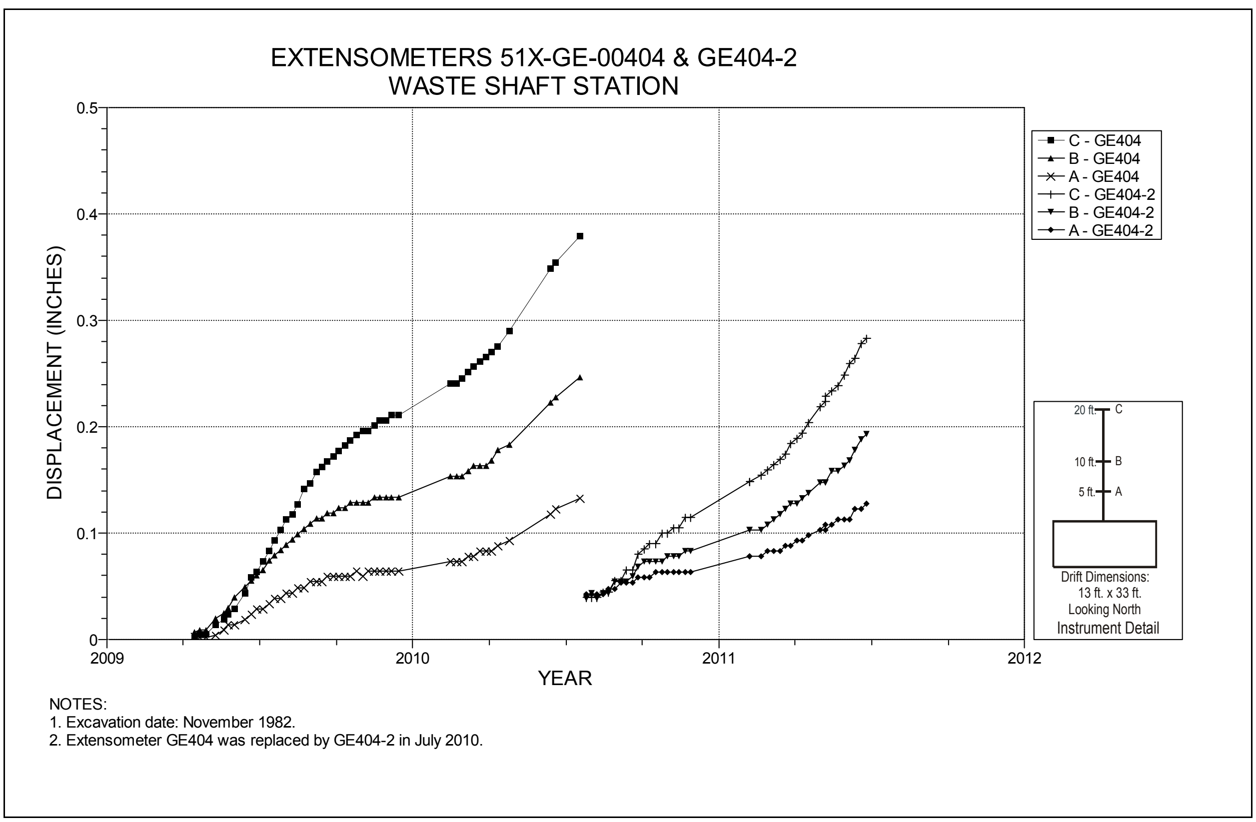


Figure 3-7 Extensometer 51X-GE-00404-2
Waste Shaft Station – Roof

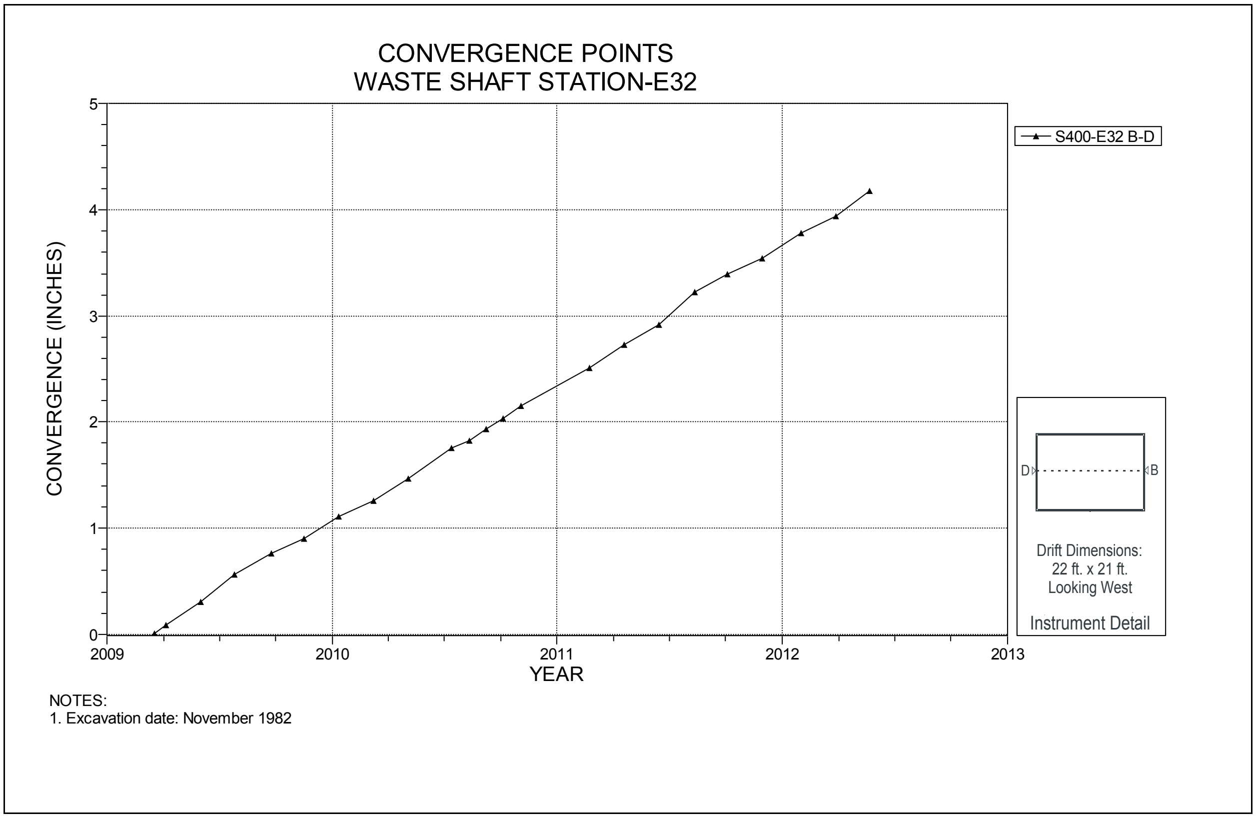


Figure 3-8 Convergence Point Array
Waste Shaft Station at E32 – Rib to Rib

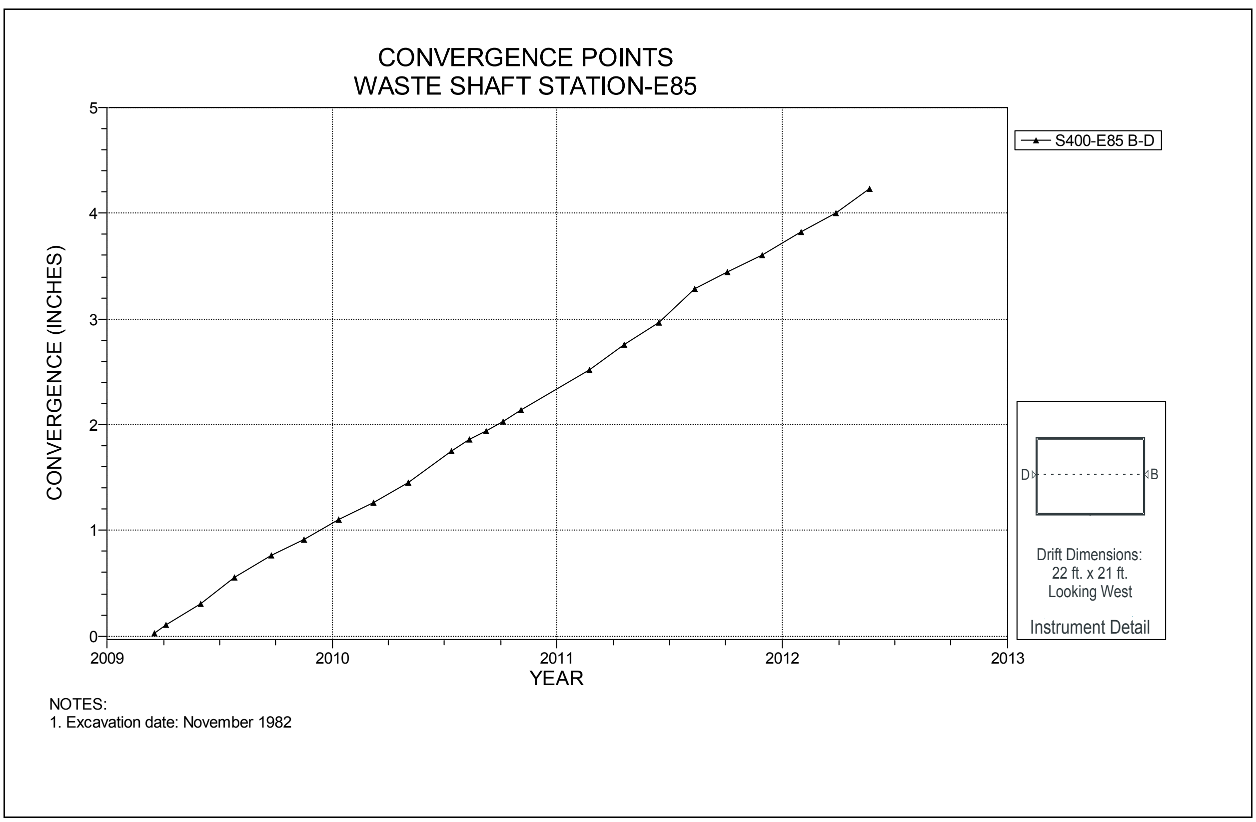


Figure 3-9 Convergence Point Array
Waste Shaft Station at E85 – Rib to Rib

Table 3-3
Air Intake Shaft Station Data Analysis

Extensometers

Field Tag	Location	Figure Number	Date of Last Reading	Collar Displacement Relative to Deepest Anchor (Inches)	Displacement Rate 2011 to 2012 in/year	Displacement Rate 2010 to 2011 in/year	Rate Change Percent	Comments
41X-GE-00122	S65-W620	3-10	03/12/12	3.189	0.20	0.25	-20%	Anchor 'D' has reached its maximum range. Anchor 'B' was used for comparison purposes to 41X-GE-00123.
41X-GE-00123	N93-W620	3-11	03/12/12	4.251	0.22	0.33	-33%	The Collar and 'C' anchors have reached their maximum range. Anchor 'B' readings were used.

Rockbolt Load Cells

Field Tag	Location	Figure Number	Date of Initial Reading	Date of Last Reading	Load (kips)	Comments
51X-WG-00236	AIS Station Brow - South	3-12	01/19/93	03/12/12	64.5	
51X-WG-00237	AIS Station Brow - South	3-12	01/19/93	03/12/12	1.4	
51X-WG-00238	AIS Station Brow - South	3-12	01/19/93	03/12/12	2.2	
51X-WG-00239	AIS Station Brow - South	3-12	01/19/93	03/12/12	30.5	
51X-WG-00240	AIS Station Brow - South	3-12	01/19/93	03/12/12	4.3	
51X-WG-00241	AIS Station Brow - South	3-13	01/19/93	03/12/12	66.5	
51X-WG-00242	AIS Station Brow - South	3-13	01/19/93	03/12/12	17.3	
51X-WG-00243	AIS Station Brow - South	3-13	01/19/93	03/12/12	14.1	
51X-WG-00244	AIS Station Brow - South	3-13	12/24/94	03/12/12	23.7	
51X-WG-00245	AIS Station Brow - South	3-13	01/19/93	03/12/12	0.7	
51X-WG-00246	AIS Station Brow - North	3-14	01/19/93	03/12/12	22.4	
51X-WG-00247	AIS Station Brow - North	3-14	01/19/93	03/12/12	57.9	
51X-WG-00248	AIS Station Brow - North	3-14	01/19/93	03/12/12	9.5	
51X-WG-00249	AIS Station Brow - North	3-14	01/19/93	03/12/12	36.1	
51X-WG-00250	AIS Station Brow - North	3-14	12/24/94	03/12/12	11.3	
51X-WG-00251	AIS Station Brow - North	3-15	01/19/93	03/12/12	28.0	
51X-WG-00252	AIS Station Brow - North	3-15	01/19/93	03/12/12	0.6	
51X-WG-00253	AIS Station Brow - North	3-15	01/19/93	03/12/12	55.4	
51X-WG-00254	AIS Station Brow - North	3-15	01/19/93	03/12/12	9.4	
51X-WG-00255	AIS Station Brow - North	3-15	01/19/93	03/12/12	24.0	

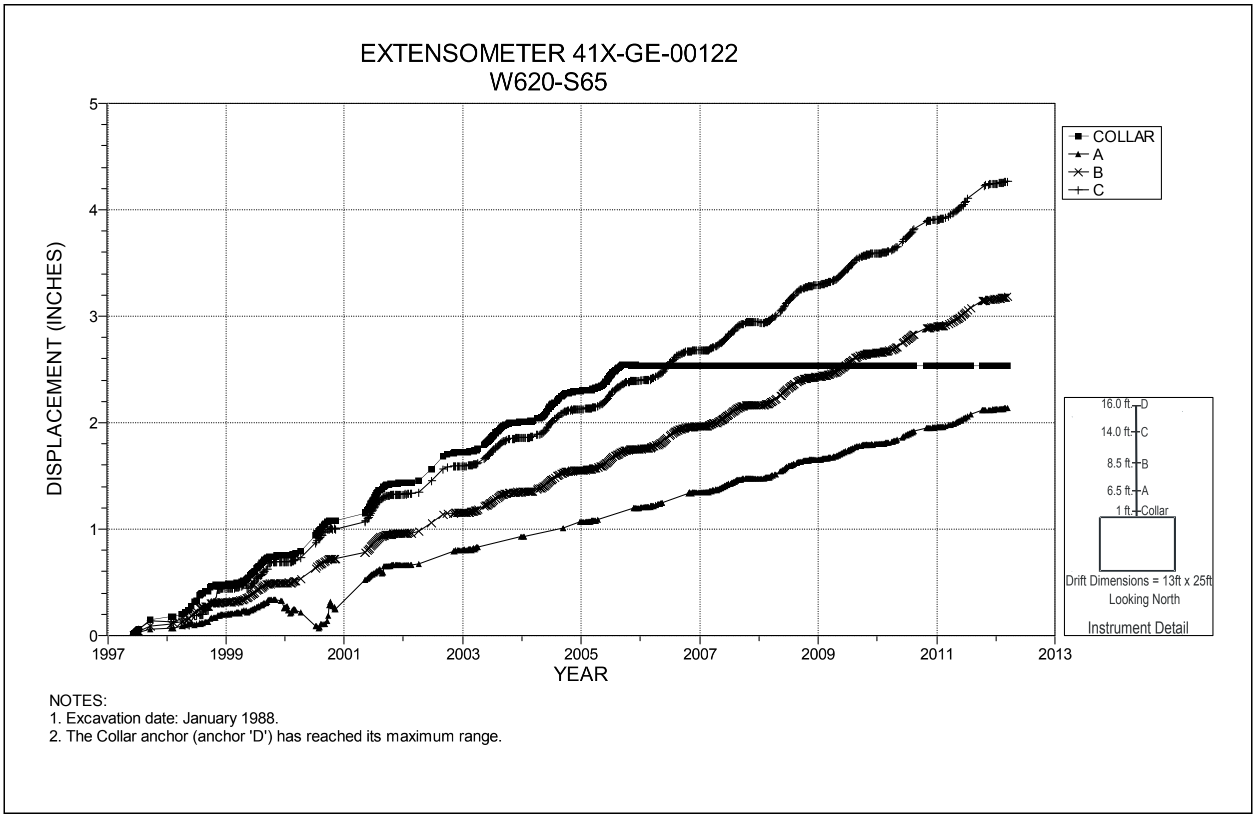


Figure 3-10 Extensometer 41X-GE-00122
Air Intake Shaft Station at S65 – Roof

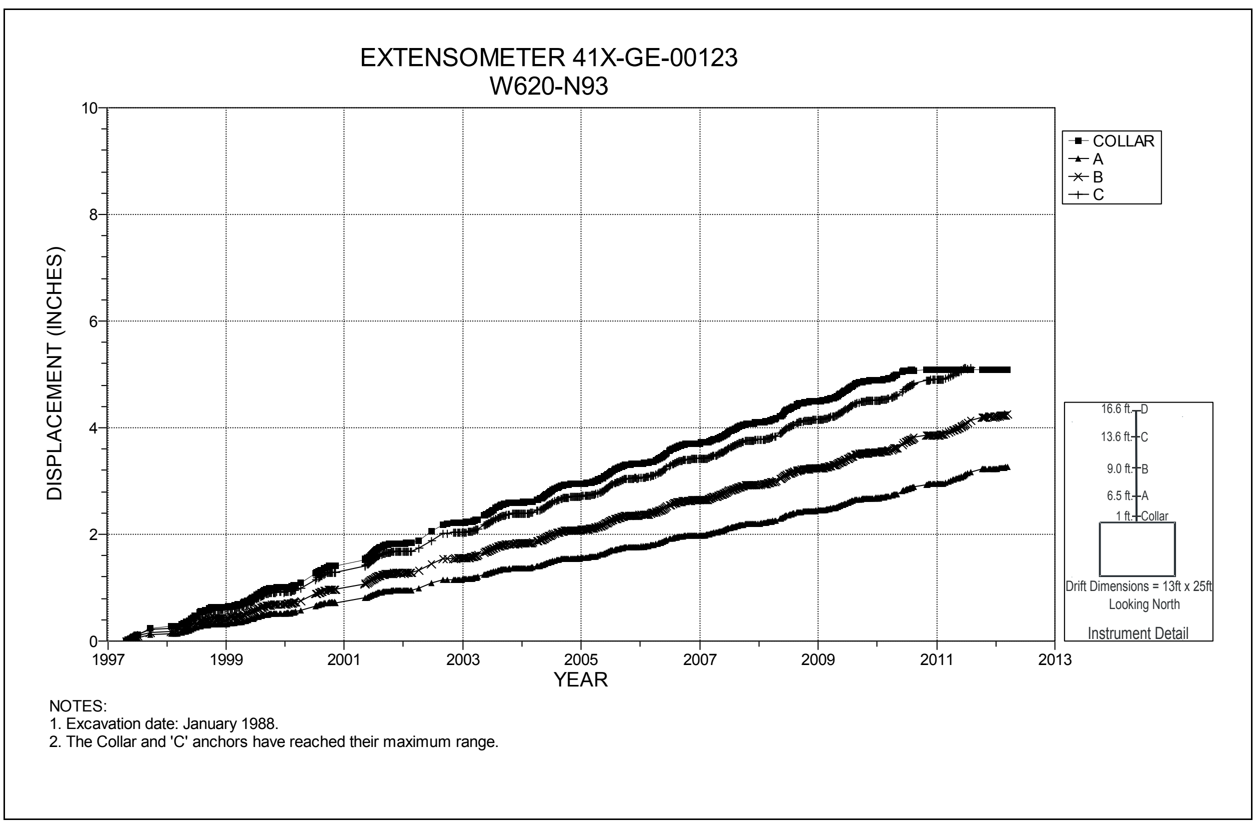


Figure 3-11 Extensometer 41X-GE-00123
Air Intake Shaft Station at N93 – Roof

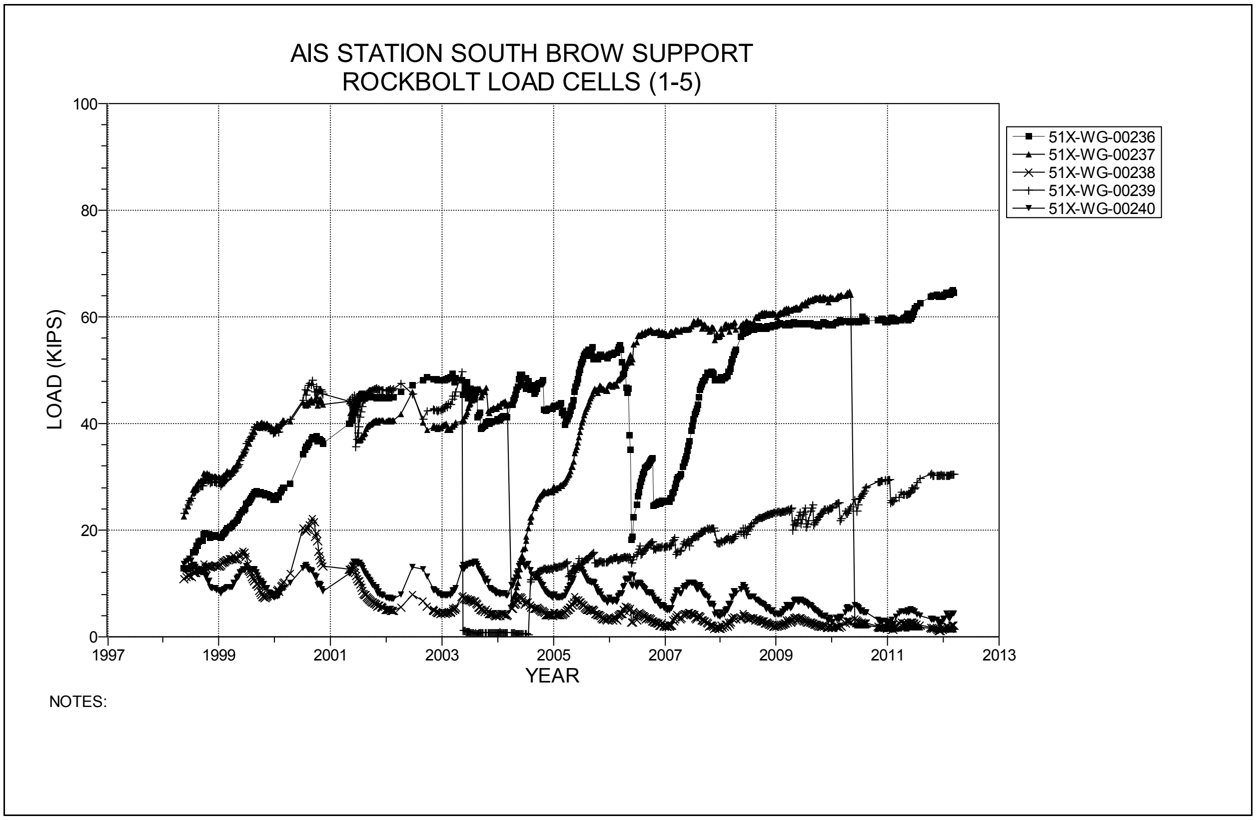


Figure 3-12 Rock Bolt Load Cells
Air Intake Shaft Station Brow – South Side Roof Bolts Set 1

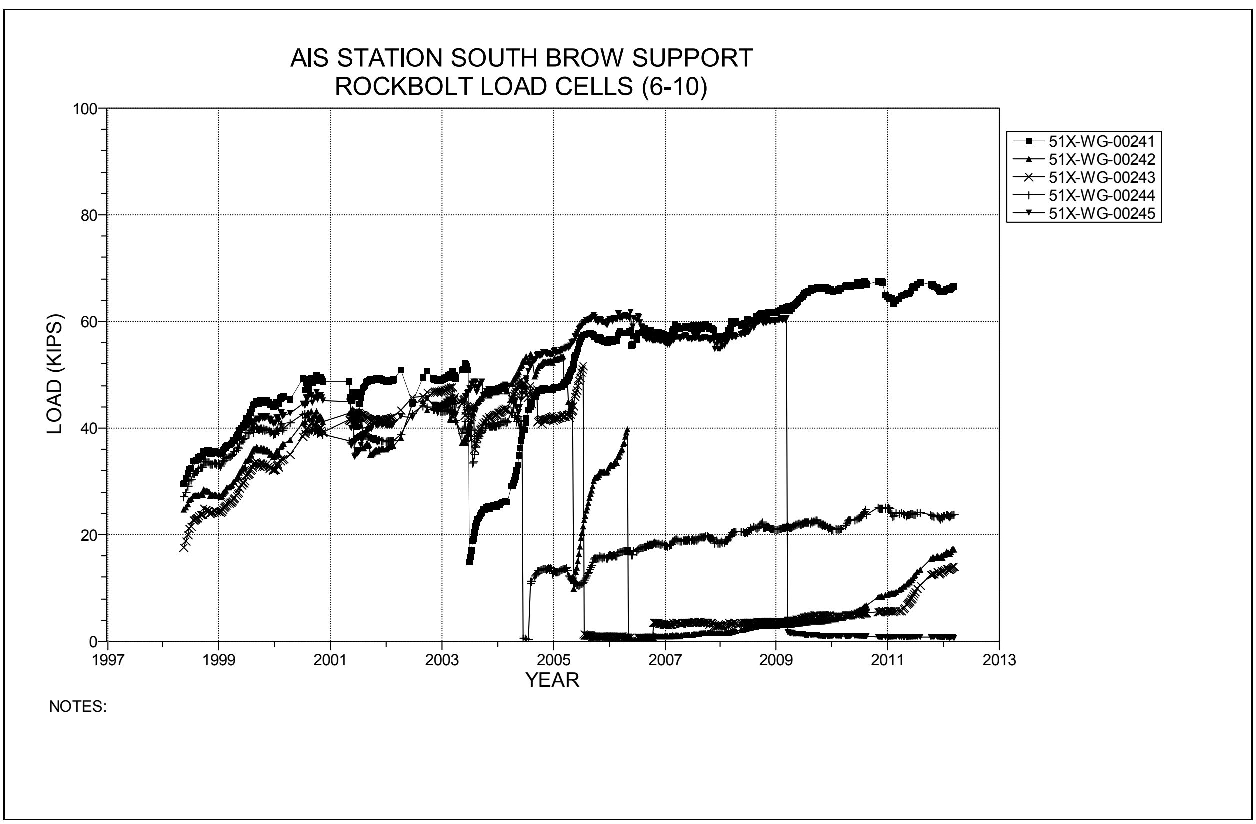


Figure 3-13 Rock Bolt Load Cells
Air Intake Shaft Station Brow – South Side Roof Bolts Set 2

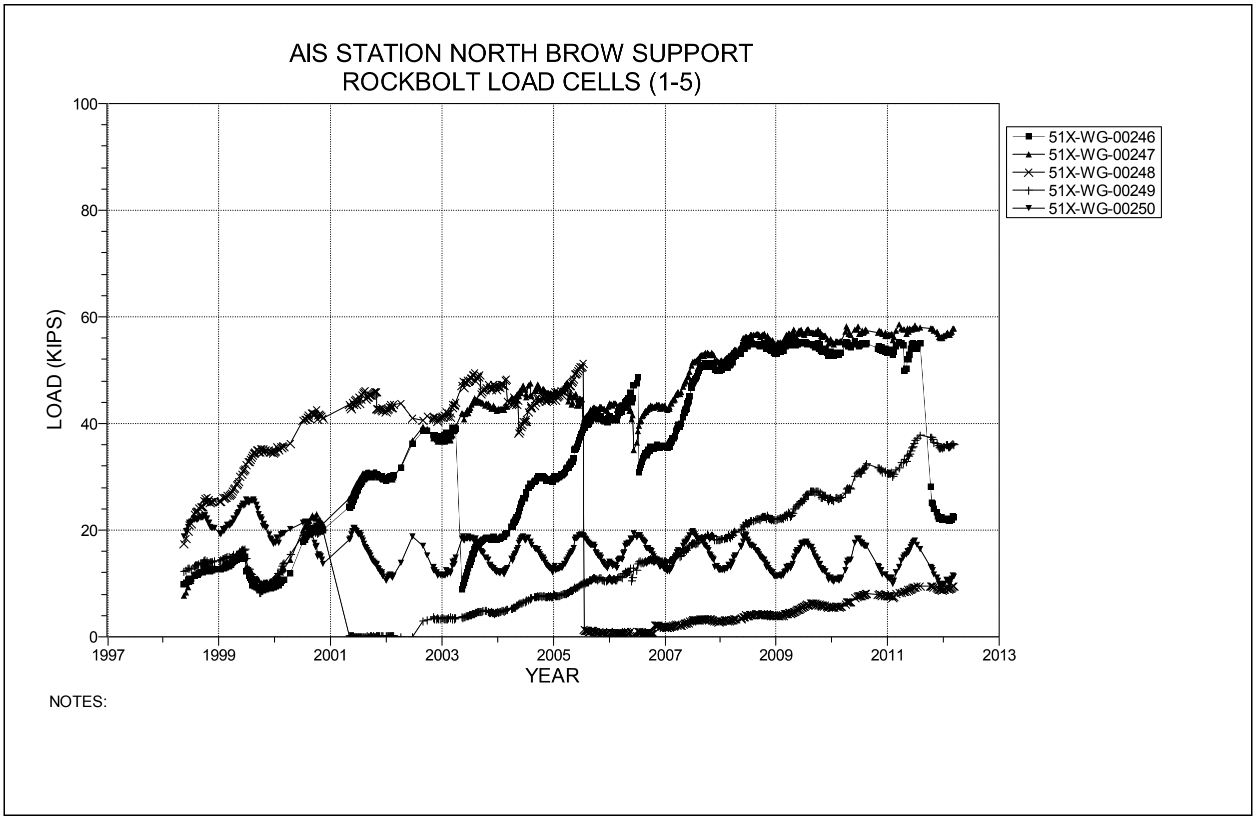


Figure 3-14 Rock Bolt Load Cells
Air Intake Shaft Station Brow – North Side Roof Bolts Set 1

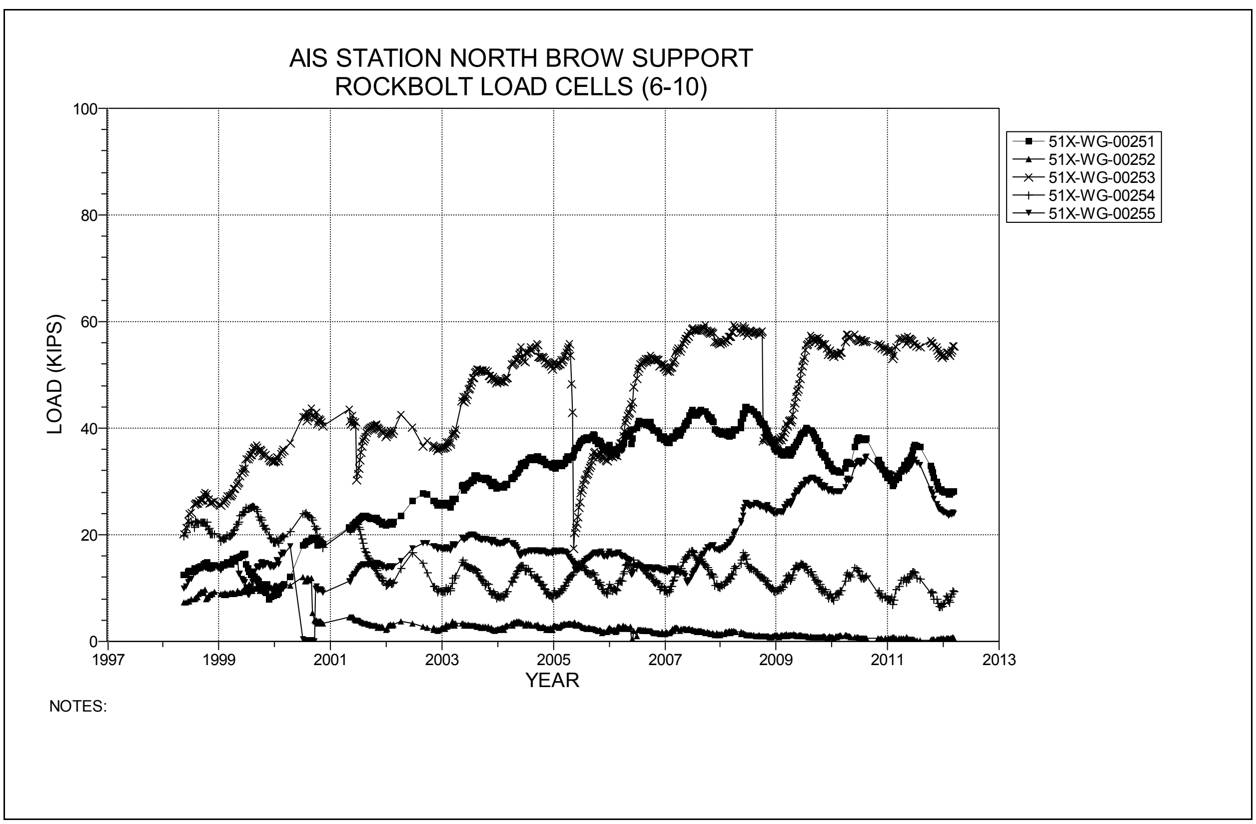


Figure 3-15 Rock Bolt Load Cells
Air Intake Shaft Station Brow – North Side Roof Bolts Set 2

4.0 Instrumentation Summary for the Access Drifts

This chapter presents the instrumentation data and data analyses for the access drifts throughout the WIPP underground. Table 4-1 provides the results of analyses performed on the instrument data including displacement, convergence rates, and rock bolt loading.

Figures 4-1 through 4-34 present data from borehole extensometers installed in the access drifts while Figures 4-35 through 4-257 present the convergence point data.

Figure 4-258 through 4-267 presents data from joint meters installed at the S1950/E300 overcast and the access drifts. Figure 4-268 through 4-276 presents the data from rock bolt load cells installed in the E140 drift, the adjacent brows in E140-S1300 and at the E140-S1300 east brow.

Table 4-1
Access Drifts Data Analysis

Extensometers								
Field Tag	Location	Figure Number	Date of Last Reading	Collar Displacement Relative to Deepest Anchor (inches)	Displacement Rate 2011 to 2012 (in/year)	Displacement Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
51X-GE-00355	E0-N300	4-1	06/28/12	5.297	0.6	0.6	7%	
51X-GE-00353	E0-N626	4-2	06/28/12	6.925	1.9	1.1	74%	
51X-GE-00352	E0-N940	4-3	06/28/12	6.651	1.2	1.4	-18%	
51X-GE-00361	E0-N1266	4-4	06/28/12	10.745	1.5	1.0	57%	
51X-GE-00105-3	E140-N150	4-5	06/13/12	3.829	-0.13	N/A	N/A	
51X-GE-00364	E140-N1266	4-6	06/28/12	5.503	0.57	0.69	-18%	
51X-GE-00372	E140-S146	4-7	06/28/12	3.743	0.36	0.50	-28%	
51X-GE-00472	E140-S1000	4-8	05/22/12	5.670	0.36	0.40	-9%	
51X-GE-00464	E140-S1025	4-9	05/21/12	4.958	0.36	0.40	-10%	
51X-GE-00333	E140-S1075	4-10	06/28/12	6.511	0.00	0.34	-101%	
51X-GE-00428	E140-S1150	4-11	05/02/12	0.881	2.3	N/A	N/A	
51X-GE-00428-2	E140-S1150	4-11	06/25/12	0.342	3.2	N/A	N/A	
51X-GE-00335	E140-S1300	4-12	06/28/12	4.386	0.34	0.34	-2%	
51X-GE-00429	E140-S1450	4-13	06/25/12	1.041	1.9	N/A	N/A	
51X-GE-00430	E140-S1669	4-14	06/25/12	1.116	2.1	N/A	N/A	
51X-GE-00431	E140-S1775	4-15	06/25/12	0.694	1.3	N/A	N/A	
51X-GE-00432	E140-S1850	4-16	06/25/12	1.187	2.2	N/A	N/A	
51X-GE-00433	E140-S2065	4-17	05/02/12	1.202	3.1	N/A	N/A	
51X-GE-00433-2	E140-S2065	4-17	06/25/12	0.477	4.5	N/A	N/A	
51X-GE-00434	E140-S2265	4-18	06/25/12	0.978	2.5	N/A	N/A	
51X-GE-00435	E140-S2350	4-19	06/25/12	1.191	3.5	N/A	N/A	
51X-GE-00437	E140-S2635	4-20	06/25/12	0.144	0.51	N/A	N/A	
51X-GE-00492	E140-S2750	4-21	06/18/12	3.590	0.31	0.34	-7%	
51X-GE-00367-2	E140-S2916	4-22	03/05/12	9.356	1.7	2.1	-16%	
51X-GE-00439	E140-S2916	4-22	06/25/12	0.158	0.9	N/A	N/A	
51X-GE-00396	E140-S3493	4-23	06/28/12	6.847	2.1	1.7	24%	
51X-GE-00374	E300-N1186	4-24	06/28/12	5.288	0.62	0.57	10%	
51X-GE-00388	E300-N1266	4-25	06/28/12	3.462	0.66	0.60	10%	
51X-GE-00373	E300-N1341	4-26	06/28/12	4.653	0.75	1.0	-25%	
51X-GE-00474	S1000-E120	4-27	06/25/12	1.402	0.07	0.08	-5%	

Table 4-1
Access Drifts Data Analysis (Continued)

Extensometers (continued)

Field Tag	Location	Figure Number	Date of Last Reading	Collar Displacement Relative to Deepest Anchor (inches)	Displacement Rate 2011 to 2012 (in/year)	Displacement Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
51X-GE-00473	S1000-E160	4-28	06/25/12	1.206	0.07	0.06	20%	
51X-GE-00462	S1300-E120	4-29	06/26/12	0.810	0.04	0.05	-17%	
51X-GE-00463	S1300-E160	4-30	06/26/12	5.160	0.44	0.56	-22%	
51X-GE-00442	S1600-E120	4-31	06/26/12	1.149	0.06	0.07	-15%	
51X-GE-00500	S2750-W93	4-32	06/18/12	1.941	2.9	N/A	N/A	
51X-GE-00415	W170-S2998	4-33	06/28/12	8.293	4.2	3.5	19%	
51X-GE-00490	W30-S2750	4-34	06/04/12	3.794	0.66	0.67	0%	

[1] N/A – Insufficient data available to perform the calculation. This is usually due to the inability to read the instruments because of activities such as: the temporary removal of an instrument due to floor, rib or back trimming; locations blocked by equipment or waste disposal, etc.

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011-2012		Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
			Date	Inches					
CORE-W10 A-C	Core Storage W10	4-35	05/10/12	22.813	22.813	0.9	0.9	0%	
CORE-W20 A-C	Core Storage W20	4-35	05/10/12	21.632	21.632	0.9	0.9	0%	
CORE-W30 A-C	Core Storage W30	4-35	05/10/12	22.808	22.808	1.0	1.1	-9%	
CORE-W51 A-C	Core Storage W51	4-35	05/10/12	26.465	26.465	1.3	1.4	-7%	
CORE-W62 A-C	Core Storage W62	4-35	05/10/12	27.742	27.742	1.4	1.5	-7%	
CORE-W73 A-C	Core Storage W73	4-35	05/10/12	28.009	28.009	1.4	1.5	-7%	
CORE-W101 A-C	Core Storage W101	4-35	05/10/12	27.008	27.008	1.3	N/A	N/A	
CORE-W117 A-C	Core Storage W117	4-35	05/10/12	24.224	24.224	1.1	1.1	0%	
CORE-W133 A-C	Core Storage W133	4-35	05/10/12	20.247	20.247	0.9	0.9	0%	
E0-N75 A-C	E0-N75	4-36	06/06/12	19.634	19.634	1.8	2.0	-10%	
E0-N75 B-D	E0-N75	4-36	06/06/12	13.703	13.703	1.1	1.4	-21%	
E0-N225-2 A-C	E0-N225	4-37	06/05/12	19.430	19.477	1.7	2.0	-15%	
E0-N225-2 B-D	E0-N225	4-37	06/05/12	2.882	15.187	1.3	1.6	-19%	
E0-N300-6 A-C	E0-N300	4-38	06/05/12	2.993	19.330	1.7	2.8	-39%	Cumulative is from N300 only (N290 not included).

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
E0-N460-3 A-C	E0-N460	4-39	06/05/12	23.014	43.103	2.2	2.4	-8%	
E0-N562 A-C	E0-N562	4-40	06/05/12	17.485	17.485	2.2	2.0	10%	
E0-N562 B-D	E0-N562	4-40	06/05/12	14.815	14.815	1.5	1.6	-6%	
E0-N626-4 A-C	E0-N626	4-41	06/06/12	22.053	63.012	3.1	2.0	55%	
E0-N686 A-C	E0-N686	4-42	06/06/12	24.337	24.337	4.0	2.0	100%	
E0-N686 B-D	E0-N686	4-42	06/06/12	13.743	13.743	1.3	1.3	0%	
E0-N780-2 A-C	E0-N780	4-43	06/06/12	18.928	39.350	2.0	2.3	-13%	
E0-N940-5 A-C	E0-N940	4-44	06/06/12	19.395	67.447	2.4	3.2	-25%	
E0-N1110-5 A-C	E0-N1110	4-45	06/06/12	13.078	47.502	1.4	1.8	-22%	
E0-N1266-4 A-C	E0-N1266	4-46	06/06/12	21.300	58.207	2.1	2.2	-5%	
E140-N5-6 A-C	E140-N5	4-47	06/12/12	13.262	45.104	2.4	2.3	4%	
E140-N5-3 B-D	E140-N5	4-47	06/12/12	17.392	32.633	1.1	1.2	-8%	
E140-N220-3 A-C	E140-N220	4-48	06/12/12	14.580	40.379	2.5	2.5	0%	
E140-N355-2 A-C	E140-N355	4-49	06/12/12	11.910	20.454	2.4	2.2	9%	
E140-N355 B-D	E140-N355	4-49	06/12/12	17.186	17.186	1.6	1.7	-6%	
E140-N460-3 A-C	E140-N460	4-50	06/12/12	21.470	42.301	2.1	2.3	-9%	
E140-N150-4 A-C	E140-N150	4-51	06/12/12	11.066	30.124	1.8	1.7	6%	
E140-N562-2 A-C	E140-N562	4-52	06/12/12	20.739	32.556	2.6	2.5	4%	
E140-N562-2 B-D	E140-N562	4-52	06/12/12	14.714	22.910	1.6	1.7	-6%	
E140-N626-3 A-C	E140-N626	4-53	06/12/12	28.560	61.130	3.8	3.4	12%	
E140-N626-4 B-D	E140-N626	4-53	06/12/12	14.072	35.379	1.5	1.6	-6%	
E140-N686-2 A-C	E140-N686	4-54	06/12/12	22.895	36.034	3.1	2.8	11%	
E140-N686-2 B-D	E140-N686	4-54	06/12/12	14.148	22.982	1.6	1.6	0%	
E140-N780-2 A-C	E140-N780	4-55	06/12/12	27.118	58.875	3.1	2.9	7%	
E140-N940-2 A-C	E140-N940	4-56	06/12/12	25.613	25.613	4.6	3.6	28%	Initial installations were at N952.
E140-N940-2 B-D	E140-N940	4-56	02/22/12	9.278	9.278	1.2	1.3	-8%	
E140-N1100-2 A-C	E140 -N1100	4-57	06/12/12	12.255	36.123	1.7	1.7	0%	

Table 4-1
Access Drifts Data Analysis (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
Convergence Points (Continued)									
E140-N1266-3 A-C	E140-N1266	4-58	06/12/12	19.944	57.699	2.5	2.4	4%	
E140-N1266-4 B-D	E140-N1266	4-58	06/12/12	9.977	31.982	1.3	1.3	0%	
E140-N1420-2 A-C	E140-N1420	4-59	06/13/12	13.529	29.999	1.9	1.7	12%	
E140-S90-4 A-C	E140-S90	4-60	05/22/12	9.246	26.959	1.5	1.6	-6%	
E140-S262-4 A-C	E140-S262	4-61	05/22/12	15.685	36.596	2.1	2.3	-9%	
E140-S262-3 B-D	E140-S262	4-61	05/22/12	20.866	22.219	1.0	1.2	-17%	
E140-S460-6 A-C	E140-S460	4-62	05/22/12	2.731	53.467	2.1	2.2	-5%	
E140-S460-2 B-D	E140-S460	4-62	05/22/12	26.948	32.892	1.2	1.3	-8%	
E140-S550-6 A-C	E140-S550	4-63	05/22/12	2.567	44.534	1.9	2.2	-14%	
E140-S550-4 B-D	E140-S550	4-63	05/22/12	29.418	38.060	1.5	1.7	-12%	
E140-S700-8 A-D	E140-S700	4-64	05/22/12	3.111	33.151	2.2	2.8	-21%	
E140-S700-6 B-C	E140-S700	4-65	05/22/12	5.595	35.627	2.8	2.7	4%	
E140-S700-6 E-F	E140-S700	4-66	05/22/12	3.077	23.074	1.4	1.6	-13%	
E140-S850-9 A-C	E140-S850	4-67	05/22/12	4.942	56.455	2.5	2.6	-4%	
E140-S850-4 B-D	E140-S850	4-68	05/22/12	19.621	35.568	1.3	1.3	0%	
E140-S1000-3 A-C	E140-S1000	4-69	05/22/12	3.565	39.213	1.4	1.9	-26%	
E140-S1025-4 A-C	E140-S1025	4-70	06/19/12	4.137	26.314	2.0	2.0	0%	
E140-S1075-4 A-E	E140-S1075	4-71	06/19/12	5.262	27.492	2.5	2.5	0%	
E140-S1075-4 B-D	E140-S1075	4-72	06/19/12	2.566	21.475	1.2	1.2	0%	
E140-S1075-4 F-H	E140-S1075	4-72	06/19/12	3.585	20.444	1.7	1.7	0%	
E140-S1075-2 C-G	E140-S1075	4-73	06/19/12	18.187	19.009	1.4	1.5	-7%	
E140-S1150-4 A-G	E140-S1150	4-74	06/19/12	8.773	66.803	4.2	4.4	-5%	
E140-S1150-2 D-J	E140-S1150	4-75	06/19/12	19.721	37.642	1.6	1.6	0%	
E140-S1150 C-K	E140-S1150	4-75	06/19/12	18.517	18.517	1.3	1.4	-7%	
E140-S1150-2 E-I	E140-S1150	4-75	06/19/12	17.841	18.702	1.5	1.5	0%	
E140-S1150-6 B-F	E140-S1150	4-76	06/19/12	1.633	31.370	2.1	N/A	N/A	
E140-S1150-5 L-H	E140-S1150	4-76	06/19/12	4.564	24.757	2.1	2.3	-9%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
E140-S1225-4 A-E	E140-S1225	4-77	06/19/12	7.830	34.527	4.0	3.6	11%	
E140-S1225-2 C-G	E140-S1225	4-77	06/19/12	25.601	26.508	2.3	2.4	-4%	
E140-S1225-4 B-D	E140-S1225	4-78	06/19/12	1.531	34.132	3.7	N/A	N/A	
E140-S1225-3 H-F	E140-S1225	4-78	06/19/12	4.661	24.095	2.5	2.3	9%	
E140-S1300-4 A-C	E140-S1300	4-79	06/19/12	20.468	37.051	1.7	1.7	0%	
E140-S1378-3 A-E	E140-S1378	4-80	06/19/12	6.270	40.707	3.5	2.9	21%	
E140-S1378-3 B-D	E140-S1378	4-81	06/19/12	3.490	28.592	1.9	1.7	12%	
E140-S1378-3 H-F	E140-S1378	4-81	06/19/12	6.090	43.860	3.8	2.6	46%	
E140-S1378 C-G	E140-S1378	4-82	06/19/12	22.195	26.365	1.7	1.7	0%	
E140-S1450-5 A-G	E140-S1450	4-83	06/19/12	7.698	79.068	3.8	4.1	-7%	
E140-S1450-3 B-F	E140-S1450	4-84	06/19/12	6.131	46.115	3.2	3.1	3%	
E140-S1450-3 L-H	E140-S1450	4-84	06/19/12	6.036	40.304	3.0	3.2	-6%	
E140-S1456 K-C	E140-S1456	4-85	06/19/12	21.075	21.075	1.5	1.5	0%	
E140-S1450-3 I-E	E140-S1450	4-85	06/19/12	2.654	20.746	1.5	1.5	0%	
E140-S1456-2 D-J	E140-S1456	4-86	06/19/12	23.675	44.970	1.9	2.0	-5%	
E140-S1534-3 A-E	E140-S1534	4-87	06/19/12	5.870	52.033	3.1	3.1	0%	
E140-S1534-2 C-G	E140-S1534	4-87	06/19/12	21.020	22.491	1.7	1.7	0%	
E140-S1534-4 B-D	E140-S1534	4-88	06/19/12	4.593	33.468	2.5	2.3	9%	
E140-S1534-3 H-F	E140-S1534	4-88	06/19/12	4.985	36.544	2.6	2.6	0%	
E140-S1600-6 A-C	E140-S1600	4-89	06/19/12	4.063	40.800	2.1	2.0	5%	
E140-S1687-3 A-E	E140-S1687	4-90	06/19/12	7.148	47.404	3.6	3.8	-5%	
E140-S1687-3 B-D	E140-S1687	4-90	06/19/12	4.725	35.586	2.4	2.5	-4%	
E140-S1687 C-G	E140-S1687	4-90	06/19/12	23.318	23.318	1.9	1.9	0%	
E140-S1687-3 H-F	E140-S1687	4-90	06/19/12	5.344	35.401	2.9	2.6	12%	
E140-S1775-3 A-G	E140-S1775	4-91	06/19/12	8.139	66.197	4.3	4.4	-2%	
E140-S1775-4 B-F	E140-S1775	4-91	06/19/12	7.401	55.489	3.9	4.0	-3%	
E140-S1775-3 L-H	E140-S1775	4-91	06/19/12	4.497	31.480	2.3	2.3	0%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)									
			Last Reading 2011-2012						
Field Tag	Location	Figure Number	Date	Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
E140-S1775 C-K	E140-S1775	4-92	06/19/12	22.317	22.317	1.7	1.7	0%	
E140-S1775-2 D-J	E140-S1775	4-92	06/19/12	23.867	25.118	2.2	2.1	5%	
E140-S1775-3 I-E	E140-S1775	4-92	06/19/12	9.333	23.554	1.9	2.1	-10%	
E140-S1862-3 A-E	E140-S1862	4-93	06/19/12	7.407	51.090	3.9	4.0	-3%	
E140-S1862-3 C-G	E140-S1862	4-93	06/19/12	17.236	23.541	2.2	2.1	5%	
E140-S1862-3 B-D	E140-S1862	4-94	06/19/12	7.517	46.606	4.1	4.0	2%	
E140-S1862-3 H-F	E140-S1862	4-94	06/19/12	3.829	25.288	2.0	2.1	-5%	
E140-S1950-6 A-C	E140-S1950	4-95	06/19/12	6.343	54.527	3.3	3.2	3%	
E140-S2007-7 A-C	E140-S2007	4-96	06/19/12	2.318	41.836	4.6	N/A	N/A	
E140-S2065-6 A-C	E140-S2065	4-97	06/19/12	2.775	49.770	5.5	N/A	N/A	
E140-S2065-2 B-D	E140-S2065	4-97	06/19/12	17.272	23.920	2.2	2.2	0%	
E140-S2122-5 A-C	E140-S2122	4-98	06/19/12	2.499	47.353	5.0	N/A	N/A	
E140-S2275-6 A-C	E140-S2275	4-99	06/18/12	1.987	75.702	7.2	N/A	N/A	
E140-S2275 B-D	E140-S2275	4-99	06/18/12	25.737	25.737	2.4	2.5	-4%	
E140-S2350-6 A-C	E140-S2350	4-100	06/18/12	3.186	79.516	6.5	N/A	N/A	
E140-S2350-2 B-D	E140-S2350	4-100	06/18/12	27.188	34.079	2.6	2.6	0%	
E140-S2425-5 A-C	E140-S2425	4-101	06/18/12	1.340	52.874	4.8	N/A	N/A	
E140-S2425 B-D	E140-S2425	4-101	06/18/12	26.760	26.760	2.6	2.6	0%	
E140-S2520-3 A-C	E140-S2520	4-102	06/18/12	6.965	38.986	3.6	3.7	-3%	
E140-S2634 A-C	E140-S2634	4-103	06/18/12	53.737	53.737	5.8	6.5	-11%	
E140-S2634 B-D	E140-S2634	4-103	06/18/12	20.787	20.787	2.6	2.6	0%	
E140-S2750-3 A-C	E140-S2750	4-104	06/18/12	5.352	24.523	3.1	2.8	11%	
E140-S2833-3 A-C	E140-S2833	4-105	06/18/12	16.073	36.872	5.1	5.0	2%	
E140-S2833 B-D	E140-S2833	4-105	06/18/12	18.305	18.305	2.2	2.3	-4%	
E140-S2915-3 A-C	E140-S2915	4-106	06/18/12	12.195	38.411	3.1	3.6	-14%	
E140-S2915 B-D	E140-S2915	4-106	06/18/12	19.819	19.819	2.4	2.4	0%	
E140-S2998-3 A-C	E140-S2998	4-107	06/18/12	12.581	39.736	3.7	3.9	-5%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
E140-S2998 B-D	E140-S2998	1-107	06/18/12	18.238	18.238	2.1	2.1	0%	
E140-S3080-2 A-C	E140-S3080	4-108	06/18/12	10.984	27.123	3.5	3.3	6%	
E140-S3195-2 A-C	E140-S3195	4-109	06/18/12	13.090	39.345	4.1	3.8	8%	
E140-S3195 B-D	E140-S3195	4-109	06/18/12	18.083	18.083	2.1	2.0	5%	
E140-S3295-2 A-C	E140-S3295	4-110	06/18/12	8.286	15.991	2.5	2.5	0%	
E140-S3325 A-C	E140-S3325	4-111	06/18/12	15.592	15.592	2.4	2.4	0%	
E140-S3395-2 A-C	E140-S3395	4-112	06/18/12	12.438	27.596	3.6	3.7	-3%	
E140-S3395 B-D	E140-S3395	4-112	06/18/12	12.717	12.717	1.7	1.8	-6%	
E140-S3480-2 A-C	E140-S3480	4-113	06/18/12	13.474	27.774	4.2	4.0	5%	
E140-S3480 B-D	E140-S3480	4-113	06/18/12	13.052	13.052	1.8	1.8	0%	
E140-S3565-2 A-C	E140-S3565	4-114	04/23/12	9.409	20.737	3.1	2.9	7%	
E140-S3565 B-D	E140-S3565	4-114	04/23/12	12.047	12.047	1.6	1.8	-11%	
E140-S3650-2 A-C	E140-S3650	4-115	06/11/12	6.873	13.493	1.9	2.1	-10%	
E300-N45 A-E	E300-N45	4-116	05/30/12	31.637	31.637	1.3	1.5	-13%	
E300-N45 H-F	E300-N45	4-116	04/02/12	28.155	28.155	1.2	1.4	-14%	
E300-N45 C-G	E300-N45	4-116	05/30/12	23.468	23.468	1.2	1.3	-8%	
E300-N170-2 A-E	E300-N170	4-117	05/30/12	9.462	31.956	1.7	1.8	-6%	
E300-N170-2 C-G	E300-N170	4-117	05/30/12	10.093	24.937	1.3	1.5	-13%	
E300-N170-2 H-F	E300-N170	4-117	05/30/12	8.732	28.792	1.6	1.7	-6%	
E300-N250-3 A-C	E300-N250	4-118	05/30/12	9.290	38.244	1.6	1.7	-6%	
E300-S45-2 A-E	E300-S45	4-119	05/30/12	25.819	25.819	1.2	1.4	-14%	
E300-S45-2 B-D	E300-S45	4-119	05/30/12	23.465	23.465	1.5	1.7	-12%	
E300-S45 C-G	E300-S45	4-119	05/30/12	19.501	19.501	0.8	1.0	-20%	
E300-S45-2 H-F	E300-S45	4-119	05/30/12	22.190	22.190	1.0	1.1	-9%	
E300-S90 A-C	E300-S90	4-120	06/04/12	18.854	18.854	0.7	0.9	-22%	
E300-S250-2 A-C	E300-S250	4-121	06/04/12	9.202	13.587	0.7	0.7	0%	
E300-S250-2 B-D	E300-S250	4-121	06/04/12	9.847	13.893	0.6	0.7	-14%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
E300-S700-2 A-C	E300-S700	4-122	06/04/12	1.999	21.729	1.4	1.8	-22%	
E300-S850-2 A-E	E300-S850	4-123	06/04/12	1.024	16.106	0.8	0.9	-11%	
E300-S850-2 B-D	E300-S850	4-123	06/04/12	0.876	12.177	0.6	0.6	0%	
E300-S850-2 C-G	E300-S850	4-123	06/04/12	9.115	18.393	0.7	1.0	-30%	
E300-S850-2 H-F	E300-S850	4-123	06/04/12	0.764	11.227	0.5	0.6	-17%	
E300-S1000-2 A-C	E300-S1000	4-124	06/04/12	1.420	20.965	1.0	1.3	-23%	
E300-S1150-4 A-E	E300-S1150	4-125	06/04/12	3.663	20.742	2.5	3.3	-24%	
E300-S1150-4 B-D	E300-S1150-4	4-126	06/04/12	1.119	13.364	0.8	1.0	-20%	
E300-S1150-4 H-F	E300-S1150	4-126	06/04/12	1.259	13.015	0.9	1.1	-18%	
E300-S1150-2 C-G	E300-S1150	4-127	06/04/12	11.168	21.624	1.0	1.4	-29%	
E300-S1300-2 A-C	E300-S1300	4-128	06/04/12	2.633	16.167	1.8	2.5	-28%	
E300-S1450-2 A-C	E300-S1450	4-129	06/04/12	2.595	11.577	1.9	2.1	-10%	
E300-S1450 B-D	E300-S1450	4-129	06/04/12	12.788	12.788	1.3	1.6	-19%	
E300-S1687-2 A-C	E300-S1687	4-130	06/04/12	1.744	11.601	1.3	1.5	-13%	
E300-S1687 B-D	E300-S1687	4-130	06/04/12	12.675	12.675	1.2	1.4	-14%	
E300-S1775-2 A-C	E300-S1775	4-131	06/01/12	2.119	10.914	1.6	1.8	-11%	
E300-S1775 B-D	E300-S1775	4-131	06/01/12	12.898	12.898	1.2	1.5	-20%	
E300-S1862-2 A-C	E300-S1862	4-132	06/01/12	2.681	12.134	2.1	2.4	-13%	
E300-S1862 B-D	E300-S1862	4-132	06/01/12	14.080	14.080	1.4	1.8	-22%	
E300-S2065-2 A-C	E300-S2065	4-133	06/01/12	2.450	13.561	1.9	1.9	0%	
E300-S2065 B-D	E300-S2065	4-133	06/01/12	18.147	18.147	2.0	2.3	-13%	
E300-S2275-2 A-C	E300-S2275	4-134	06/01/12	4.176	17.602	3.1	3.8	-18%	
E300-S2275 B-D	E300-S2275	4-134	06/01/12	21.236	21.236	2.3	2.6	-12%	
E300-S2350-2 A-C	E300-S2350	4-135	06/01/12	5.776	21.340	4.3	5.1	-16%	
E300-S2350 B-D	E300-S2350	4-135	06/01/12	21.802	21.802	2.2	2.6	-15%	
E300-S2425-2 A-C	E300-S2425	4-136	06/01/12	4.767	20.989	3.4	4.4	-23%	
E300-S2425 B-D	E300-S2425	4-136	06/01/12	21.829	21.829	2.1	2.4	-13%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
E300-S2634-2 A-C	E300-S2634	4-137	06/01/12	2.948	16.333	2.3	2.4	-4%	
E300-S2634 B-D	E300-S2634	4-137	06/01/12	16.783	16.783	2.1	2.4	-13%	
E300-S2833-2 A-C	E300-S2833	4-138	06/01/12	2.458	18.750	1.9	2.0	-5%	
E300-S2833 B-D	E300-S2833	4-138	06/01/12	17.444	17.444	2.1	2.4	-13%	
E300-S2916-4 A-C	E300-S2916	4-139	06/01/12	2.978	28.048	2.4	2.2	9%	
E300-S2916 B-D	E300-S2916	4-139	06/01/12	19.430	19.430	2.4	2.5	-4%	
E300-S2998-4 A-C	E300-S2998	4-140	06/01/12	4.224	38.974	3.0	4.5	-33%	
E300-S2998 B-D	E300-S2998	4-140	06/01/12	19.295	19.295	2.7	2.5	8%	
E300-S3195 A-C	E300-S3195	4-141	06/01/12	22.342	22.342	3.4	2.9	17%	
E300-S3195 B-D	E300-S3195	4-141	06/01/12	17.614	17.614	2.0	1.8	11%	
E300-S3480 A-C	E300-S3480	4-142	12/08/11	11.166	11.166	2.2	2.4	-8%	
E300-S3480 B-D	E300-S3480	4-142	12/08/11	8.414	8.414	1.7	1.7	0%	
N140-E90-2 A-C	N140-E90	4-143	06/13/12	3.354	17.491	0.8	0.7	14%	
N140-E90 B-D	N140-E90	4-143	06/13/12	18.856	18.856	0.9	0.9	0%	
N215-W500-2 A-C	N215-W500	4-144	06/13/12	12.204	30.533	1.4	1.3	8%	
N215-W500-2 B-D	N215-W500	4-144	06/13/12	13.013	19.831	0.9	0.9	0%	
N150-W620-2 A-C	N150-W620	4-145	06/13/12	9.243	25.461	1.2	1.0	20%	
N250-E220-2 A-E	N250-E220	4-146	05/30/12	14.477	38.104	2.4	2.6	-8%	
N250-E220-2 B-D	N250-E220	4-146	05/30/12	9.945	34.887	1.6	1.8	-11%	
N250-E220 C-G	N250-E220	4-146	05/30/12	25.940	25.940	1.3	1.6	-19%	
N250-E220-2 H-F	N250-E220	4-146	05/30/12	8.718	27.143	1.5	1.5	0%	
N300-W170-2 A-C	N300-W170	4-147	06/13/12	14.527	36.787	1.7	1.6	6%	
N300-W170-2 B-D	N300-W170	4-147	06/13/12	17.070	25.265	1.3	1.3	0%	
N460-E70-3 A-C	N460-E70	4-148	06/05/12	15.126	31.572	1.6	1.5	7%	
N460-E70-2 B-D	N460-E70	4-148	06/05/12	16.099	27.797	1.4	1.6	-13%	
N780-E70 A-C	N780-E70	4-149	06/06/12	12.897	12.897	1.3	1.4	-7%	
N780-E70 B-D	N780-E70	4-149	02/16/12	12.231	12.231	1.0	1.4	-29%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012		Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
			Date	Inches					
S90-W120 A-C	S90-W120	4-150	05/09/12	8.049	8.049	0.7	0.6	17%	
S90-W120 B-D	S90-W120	4-150	05/07/12	8.580	8.580	0.6	0.7	-14%	
S90-W400-2 A-C	S90-W400	4-151	05/10/12	4.656	18.005	0.6	0.5	20%	
S90-W400-2 B-D	S90-W400	4-151	05/10/12	9.574	17.468	0.6	0.5	20%	
S90-W590-2 A-C	S90-W590	4-152	05/10/12	4.472	13.801	0.6	0.7	-14%	
S90-W590-2 B-D	S90-W590	4-152	05/10/12	9.113	12.920	0.5	0.6	-17%	
S90-W620 A-C	S90-W620	4-153	05/10/12	26.138	26.138	1.1	1.2	-8%	
S90-W770 A-C	S90-W770	4-154	05/10/12	18.154	18.154	0.9	0.9	0%	
S90-W770-3 B-D	S90-W770	4-154	05/10/12	3.303	16.624	0.8	0.9	-11%	
S90-W905 A-C	S90-W905	4-155	05/10/12	14.960	14.960	1.1	1.2	-8%	
S105-W920 A-C	S105-W920	4-156	05/10/12	3.970	3.970	1.0	1.1	-9%	
S700-E180 A-C	S700-E180	4-157	06/26/12	11.837	11.837	2.0	2.0	0%	
S700-E180 B-D	S700-E180	4-157	06/26/12	6.861	6.861	1.1	1.2	-8%	
S700-E205-3 A-C	S700-E205	4-158	06/26/12	11.722	29.151	2.0	2.0	0%	
S700-E55-2 A-C	S700-E55	4-159	06/26/12	4.225	8.359	2.0	2.1	-5%	
S700-E55-2 B-D	S700-E55	4-159	06/26/12	2.721	6.863	1.2	1.4	-14%	
S700-W98-3 A-C	S700-W98	4-160	06/26/12	0.820	25.161	2.7	N/A	N/A	
S1000-E120-3 A-C	S1000-E120	4-161	06/25/12	8.465	16.905	1.2	1.2	0%	
S1000-E160 -3 A-C	S1000-E160	4-162	06/25/12	4.134	4.134	0.9	1.0	-10%	
S1000-E58-4 A-C	S1000-E58	4-163	06/25/12	9.533	24.999	1.4	1.4	0%	
S1000-E58-2 B-D	S1000-E58	4-163	06/25/12	18.757	18.757	1.2	1.2	0%	
S1000-W98-2 A-C	S1000-W98	4-164	06/26/12	15.737	34.485	2.0	2.0	0%	
S1300-E120 A-C	S1300-E120	4-165	06/26/12	15.168	15.168	1.1	1.1	0%	
S1300-E160 A-C	S1300-E160	4-166	06/26/12	23.907	23.907	2.0	2.0	0%	
S1300-E24 A-C	S1300-E24	4-167	06/26/12	22.933	22.933	1.4	1.4	0%	
S1300-W100-3 A-C	S1300-W100	4-168	06/26/12	13.800	37.803	2.5	2.3	9%	
S1600-E110 A-C	S1600-E110	4-169	06/26/12	16.145	16.145	1.1	1.1	0%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012		Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
			Date	Inches					
S1600-E170 A-C	S1600-E170	4-170	06/26/12	17.638	17.638	1.2	1.2	0%	
S1950-E113-4 A-C	S1950-E113	4-171	06/26/12	9.724	13.600	1.3	1.3	0%	
S1950-E281-3 A-C	S1950-E281	4-172	06/28/12	15.560	22.102	1.3	1.3	0%	
S1950-E284-3 A-C	S1950-E284	4-173	06/28/12	15.864	22.476	1.3	1.4	-7%	
S2180-E220 A-C	S2180-E220	4-174	06/14/12	15.947	15.947	1.7	1.6	6%	
S2180-E220 B-D	S2180-E220	4-174	06/14/12	17.520	17.520	1.9	2.0	-5%	
S2180-E55-3 A-C	S2180-E55	4-175	06/12/12	6.699	17.546	2.2	2.1	5%	
S2180-E55 B-D	S2180-E55	4-175	06/12/12	15.783	15.783	1.9	2.0	-5%	
S2180-W100-3 A-C	S2180-W100	4-176	06/12/12	5.554	23.737	3.4	3.1	10%	
S2180-W100-2 B-D	S2180-W100	4-176	06/12/12	14.826	14.967	2.1	2.3	-9%	
S2520-E220 A-C	S2520-E220	4-177	06/14/12	20.502	20.502	1.8	1.8	0%	
S2520-E220 B-D	S2520-E220	4-177	06/14/12	21.210	21.210	2.0	2.1	-5%	
S2520-W100-2 A-C	S2520-W100	4-178	06/11/12	1.614	21.294	3.2	N/A	N/A	
S2520-W100-2 B-D	S2520-W100	4-178	06/11/12	4.464	20.087	2.9	2.6	12%	
S2750-E55-2 A-C	S2750-E55	4-179	06/11/12	7.530	24.211	4.7	3.1	52%	
S2750-E55 B-D	S2750-E55	4-179	06/11/12	17.416	17.416	3.0	2.7	11%	
S2750-E220-2 A-C	S2750-E220	4-180	06/11/12	1.393	22.790	2.6	N/A	N/A	
S2750-E220 B-D	S2750-E220	4-180	06/11/12	15.949	15.949	2.0	2.0	0%	
S2750-E410 A-C	S2750-E410	4-181	06/14/12	25.807	25.807	4.5	4.5	0%	
S2750-E410 B-D	S2750-E410	4-181	06/14/12	17.789	17.789	2.4	2.4	0%	
S2750-W93-2 A-C	S2750-W93	4-182	06/13/12	12.265	30.733	5.7	7.1	-20%	
S2750-W93 B-D	S2750-W93	4-182	06/13/12	14.435	14.435	2.3	2.5	-8%	
S3080-E220-2 A-C	S3080-E220	4-183	06/11/12	18.011	20.716	3.5	2.8	25%	
S3080-E220 B-D	S3080-E220	4-183	06/11/12	15.557	15.557	1.8	1.8	0%	
S3080-W100 A-C	S3080-W100	4-184	06/11/12	25.696	25.696	4.4	4.5	-2%	
S3080-W100 B-D	S3080-W100	4-184	06/11/12	16.068	16.068	2.3	2.2	5%	
S3310-E220 A-C	S3310-E220	4-185	06/14/12	29.145	29.145	6.5	5.8	12%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
S3310-E220 B-D	S3310-E220	4-185	06/14/12	17.576	17.576	1.9	1.9	0%	
S3310-E55 A-C	S3310-E55	4-186	04/16/12	20.467	20.467	2.6	2.3	13%	
S3310-E55 B-D	S3310-E55	4-186	04/16/12	14.985	14.985	1.8	1.8	0%	
S3310-W100-3 A-C	S3310-W100	4-187	06/11/12	18.393	24.671	3.6	3.2	13%	
S3310-W100 B-D	S3310-W100	4-187	06/11/12	15.861	15.861	1.8	1.9	-5%	
S3650-E220-2 A-C	S3650-E220	4-188	06/11/12	6.789	10.146	2.4	2.0	20%	
S3650-E55-2 A-C	S3650-E55	4-189	06/11/12	6.719	10.052	2.6	1.8	44%	
S3650-W100-2 A-C	S3650-W100	4-190	06/11/12	9.223	15.240	4.0	2.6	54%	
S3650-W100 B-D	S3650-W100	4-190	06/11/12	10.627	10.627	1.5	1.7	-12%	
W30-S120-2 A-C	W30-S120	4-191	06/05/12	5.948	25.942	1.0	1.0	0%	
W30-S250-5 A-C	W30-S250	4-192	06/05/12	7.061	33.294	1.1	1.4	-21%	
W30-S250-5 B-D	W30-S250	4-192	06/05/12	17.655	28.609	0.9	1.1	-18%	
W30-S400-2 A-C	W30-S400	4-193	04/10/12	5.621	23.449	0.5	1.2	-58%	
W30-S500-2 A-C	W30-S500	4-194	06/05/12	6.133	28.643	1.1	1.1	0%	
W30-S500 B-D	W30-S500	4-194	06/05/12	27.179	27.179	1.0	1.1	-9%	
W30-S700-5 A-C	W30-S700	4-195	06/05/12	4.298	38.575	1.7	2.2	-23%	
W30-S850-5 A-E	W30-S850	4-196	06/05/12	0.955	26.859	3.9	N/A	N/A	
W30-S850-4 B-D	W30-S850	4-197	06/05/12	3.024	18.854	1.5	1.5	0%	
W30-S850-3 H-F	W30-S850	4-197	06/05/12	4.397	19.965	2.1	2.1	0%	
W30-S850-4 C-G	W30-S850	4-198	06/05/12	0.367	25.844	1.5	N/A	N/A	
W30-S1000-5 A-C	W30-S1000	4-199	06/05/12	3.108	41.287	1.8	2.0	-10%	
W30-S1150-2 A-C	W30-S1150	4-200	06/05/12	6.675	8.176	3.0	3.5	-14%	
W30-S1300-2 A-C	W30-S1300	4-201	06/05/12	4.209	25.447	1.7	2.2	-23%	
W30-S1453-2 A-C	W30-S1453	4-202	06/05/12	5.207	19.274	2.3	2.7	-15%	
W30-S1453-3 B-D	W30-S1453	4-202	06/05/12	3.047	17.009	1.4	1.6	-13%	
W30-S1600-3 A-C	W30-S1600	4-203	06/05/12	4.966	24.096	2.1	2.6	-19%	
W30-S1775-3 A-C	W30-S1775	4-204	06/05/12	0.826	18.072	3.4	N/A	N/A	
W30-S1775-3 B-D	W30-S1775	4-204	06/05/12	3.684	16.360	1.6	2.0	-20%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)									
			Last Reading 2011-2012						
Field Tag	Location	Figure Number	Date	Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
W30-S1950-2 A-C	W30-S1950	4-205	06/05/12	6.406	26.854	2.7	3.4	-21%	
W30-S2067-3 A-C	W30-S2067	4-206	06/05/12	1.046	23.160	4.3	N/A	N/A	
W30-S2067-4 B-D	W30-S2067	4-206	06/05/12	0.423	19.017	2.1	N/A	N/A	
W30-S2275-4 A-C	W30-S2275	4-207	06/05/12	2.145	22.825	4.3	N/A	N/A	
W30-S2275-2 B-D	W30-S2275	4-207	06/05/12	4.481	15.661	2.0	2.6	-23%	
W30-S2350-4 A-C	W30-S2350	4-208	06/05/12	3.072	22.381	6.2	N/A	N/A	
W30-S2350-2 B-D	W30-S2350	4-208	06/05/12	5.012	17.507	2.3	2.7	-15%	
W30-S2425-4 A-C	W30-S2425	4-209	06/05/12	2.126	20.414	4.3	N/A	N/A	
W30-S2425-2 B-D	W30-S2425	4-209	06/05/12	4.984	18.468	2.4	2.8	-14%	
W30-S2520-3 A-C	W30-S2520	4-210	06/05/12	5.920	25.078	3.1	3.1	0%	
W30-S2685-3 A-C	W30-S2685	4-211	06/05/12	4.752	23.642	2.3	2.7	-15%	
W30-S2685-3 B-D	W30-S2685	4-211	06/05/12	4.274	18.544	2.0	2.4	-17%	
W30-S2750-2 A-C	W30-S2750	4-212	06/04/12	4.913	17.263	2.6	2.6	0%	
W30-S2833-3 A-C	W30-S2833	4-213	06/18/12	5.803	21.476	3.7	3.8	-3%	
W30-S2833-2 B-D	W30-S2833	4-213	06/18/12	4.940	16.946	2.6	2.6	0%	
W30-S2916 A-C	W30-S2916	4-214	06/18/12	38.881	38.881	6.2	7.2	-14%	
W30-S2916-2 B-D	W30-S2916	4-214	06/18/12	4.222	14.606	2.2	2.2	0%	
W30-S2998 A-C	W30-S2998	4-215	06/18/12	22.302	22.302	5.1	3.9	31%	
W30-S2998-2 B-D	W30-S2998	4-215	06/18/12	3.684	14.401	2.0	1.9	5%	
W30-S3080 A-C	W30-S3080	4-216	06/04/12	24.005	24.005	2.1	2.2	-5%	
W30-S3195 A-C	W30-S3195	4-217	06/04/12	19.874	19.874	3.6	2.4	50%	
W30-S3195 B-D	W30-S3195	4-217	06/04/12	14.264	14.264	1.6	1.6	0%	
W30-S3310 A-C	W30-S3310	4-218	06/04/12	17.127	17.127	1.8	1.8	0%	
W30-S3395 A-C	W30-S3395	4-219	06/04/12	12.524	12.524	1.8	1.9	-5%	
W30-S3395 B-D	W30-S3395	4-219	06/04/12	10.411	10.411	1.4	1.5	-7%	
W30-S3480 A-C	W30-S3480	4-220	04/09/12	14.721	14.721	2.4	2.7	-11%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (Inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
W30-S3480 B-D	W30-S3480	4-220	06/04/12	10.112	10.112	1.4	1.4	0%	
W30-S3565-2 A-C	W30-S3565	4-221	06/04/12	5.010	10.835	1.7	1.6	6%	
W30-S3565 B-D	W30-S3565	4-221	06/04/12	10.218	10.218	1.5	1.4	7%	
W30-S3650-2 A-C	W30-S3650	4-222	06/11/12	6.555	12.207	2.1	2.0	5%	
W170-N150-3 A-C	W170-N150	4-223	05/09/12	2.629	10.981	0.6	0.7	-14%	
W170-S5 A-C	W170-S5	4-224	05/09/12	15.263	15.263	0.5	0.4	25%	
W170-S5-2 B-D	W170-S5	4-224	05/09/12	9.800	17.566	0.7	0.6	17%	
W170-S90-3 A-C	W170-S90	4-225	05/09/12	9.241	16.443	0.9	0.9	0%	
W170-S232-2 A-C	W170-S232	4-255a	05/09/12	6.880	12.469	0.6	0.6	0%	
W170-S232-2 B-D	W170-S232	4-225a	05/07/12	10.169	12.811	0.6	0.6	0%	
W170-S400 A-C	W170-S400	4-226	05/09/12	15.209	15.209	0.7	0.8	-13%	
W170-S560-4 A-C	W170-S560	4-227	05/09/12	2.891	13.710	0.8	0.6	33%	
W170-S560-3 B-D	W170-S560	4-227	05/07/12	1.885	14.713	0.7	0.7	0%	
W170-S700-2 A-C	W170-S700	4-228	05/09/12	3.754	23.547	1.3	0.6	117%	
W170-S850-7 A-E	W170-S850	4-229	05/08/12	2.860	19.849	0.7	0.6	17%	
W170-S850-6 B-D	W170-S850	4-230	05/08/12	2.501	15.241	0.6	0.5	20%	
W170-S850-7 H-F	W170-S850	4-231	05/08/12	2.070	13.691	0.5	0.4	25%	
W170-S850-3 C-G	W170-S850	4-232	05/08/12	12.127	22.940	0.9	0.7	29%	
W170-S1000-3 A-C	W170-S1000	4-233	05/08/12	4.196	27.109	1.1	1.0	10%	
W170-S1150-4 A-E	W170-S1150	4-234	05/08/12	3.380	23.809	0.8	0.7	14%	
W170-S1150-4 B-D	W170-S1150	4-234	05/08/12	2.748	16.945	0.7	0.6	17%	
W170-S1150-2 H-F	W170-S1150	4-234	05/08/12	2.746	16.152	0.7	0.6	17%	
W170-S1150-2 C-G	W170-S1150	4-235	05/08/12	13.702	25.279	1.1	0.9	22%	
W170-S1300-4 A-C	W170-S1300	4-236	05/08/12	7.677	28.635	1.8	1.7	6%	
W170-S1445-4 A-C	W170-S1445	4-237	05/08/12	6.136	17.428	1.7	1.6	6%	
W170-S1445-2 B-D	W170-S1445	4-237	05/07/12	12.932	15.590	1.1	1.2	-8%	
W170-S1600-4 A-C	W170-S1600	4-238	05/07/12	5.025	19.790	1.7	1.6	6%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Last Reading 2011-2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
W170-S1779-3 A-C	W170-S1779	4-239	05/08/12	6.028	20.999	1.6	1.6	0%	
W170-S1779-2 B-D	W170-S1779	4-239	05/07/12	15.633	18.768	1.4	1.5	-7%	
W170-S1950-3 A-C	W170-S1950	4-240	05/08/12	4.818	17.999	1.5	1.4	7%	
W170-S2060-3 A-C	W170-S2060	4-241	05/08/12	0.454	18.698	1.5	N/A	N/A	
W170-S2060-2 B-D	W170-S2060	4-241	05/07/12	17.215	20.539	2.0	2.0	0%	
W170-S2180-3 A-C	W170-S2180	4-242	06/07/12	0.665	24.229	1.7	N/A	N/A	
W170-S2275 A-C	W170-S2275	4-243	05/08/12	15.259	15.259	1.9	2.0	-5%	
W170-S2275 B-D	W170-S2275	4-243	05/07/12	17.418	17.418	2.5	2.5	0%	
W170-S2350 A-C	W170-S2350	4-244	05/08/12	20.238	20.238	2.6	2.7	-4%	
W170-S2350 B-D	W170-S2350	4-244	05/07/12	17.386	17.386	2.4	2.4	0%	
W170-S2425 A-C	W170-S2425	4-245	06/05/12	17.888	17.888	2.0	2.2	-9%	
W170-S2425 B-D	W170-S2425	4-245	06/05/12	19.608	19.608	2.6	2.7	-4%	
W170-S2520-2 A-C	W170-S2520	4-246	06/05/12	1.882	22.477	3.8	N/A	N/A	
W170-S2685-2 A-C	W170-S2685	4-247	06/05/12	22.186	24.032	2.0	2.1	-5%	
W170-S2685-2 B-D	W170-S2685	4-247	06/05/12	18.197	20.060	2.4	2.5	-4%	
W170-S2833 A-C	W170-S2833	4-248	06/05/12	30.217	30.217	5.5	6.1	-10%	
W170-S2833 B-D	W170-S2833	4-248	06/05/12	17.712	17.712	3.0	3.0	0%	
W170-S2916 A-C	W170-S2916	4-249	06/04/12	27.586	27.586	3.5	3.9	-10%	
W170-S2916 B-D	W170-S2916	4-249	06/04/12	16.603	16.603	2.4	2.6	-8%	
W170-S2998 A-C	W170-S2998	4-250	06/04/12	37.773	37.773	6.6	6.6	0%	
W170-S2998-2 B-D	W170-S2998	4-250	06/04/12	5.563	18.256	3.1	3.1	0%	
W170-S3080 A-C	W170-S3080	4-251	06/04/12	23.552	23.552	3.3	3.6	-8%	
W170-S3195 A-C	W170-S3195	4-252	06/04/12	22.481	22.481	3.0	3.6	-17%	
W170-S3195 B-D	W170-S3195	4-252	06/04/12	15.527	15.527	1.9	2.0	-5%	
W170-S3310 A-C	W170-S3310	4-253	06/04/12	19.793	19.793	1.9	2.3	-17%	
W170-S3395 A-C	W170-S3395	4-254	06/04/12	20.019	20.019	3.6	3.7	-3%	
W170-S3395 B-D	W170-S3395	4-254	06/04/12	12.069	12.069	1.9	1.9	0%	
W170-S3480 A-C	W170-S3480	4-255	06/04/12	21.722	21.722	4.0	3.6	11%	

Table 4-1
Access Drifts Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011-2012 Date	Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
W170-S3480 B-D	W170-S3480	4-255	06/04/12	15.500	15.500	2.3	2.3	0%	
W170-S3565 A-C	W170-S3565	4-256	06/04/12	13.313	13.313	2.2	2.1	5%	
W170-S3565 B-D	W170-S3565	4-256	06/04/12	10.915	10.915	1.5	1.5	0%	
W170-S3650-2 A-C	W170-S3650	4-257	06/11/12	6.233	13.878	1.8	1.9	-5%	

[1] N/A – Insufficient data available to perform the calculation. This is usually due to the inability to read the instruments because of activities such as: the temporary removal of an instrument due to floor, rib or back trimming; locations blocked by equipment or waste disposal, etc.

Joint Meters

Field Tag	Location	Figure Number	Date	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
51X-CG-02706	S1950-E300	4-258	06/20/12	2.011	0.26	0.16	63%	
51X-CG-02707	S1950-E300	4-258	06/20/12	2.052	0.29	0.17	71%	
51X-CG-02876-2	E140-S1505	4-259	05/23/12	0.060	0.00	0.02	-100%	
51X-CG-02883-2	E140-S1529	4-260	05/23/12	0.590	0.26	0.16	63%	
51X-CG-02885-2	E140-S1545	4-261	05/23/12	0.735	0.13	0.29	-55%	
51X-CG-02875-2	E140-S1795	4-262	05/23/12	0.402	0.19	0.13	46%	
51X-CG-02713	E140-S2964	4-263	05/23/12	-0.006	-0.37	-0.26	42%	
51X-CG-02716	W170-S2678	4-264	12/28/11	0.299	0.20	0.15	33%	The W170 and W30 joint meters were removed midway in the reporting period.
51X-CG-02717	W170-S2687	4-265	12/28/11	0.888	0.04	0.28	-86%	
51X-CG-02715-2	W30-S2920	4-266	12/28/11	0.694	0.56	1.1	-49%	
51X-CG-02714-2	W30-S2932	4-267	12/28/11	2.830	2.8	3.5	-20%	

Table 4-1
Access Drifts Data Analysis (Continued)

Rockbolt Load Cells						
Field Tag	Location	Figure Number	Date of Initial Reading	Date of Last Reading	Load (klps)	Comments
51X-WG-00325	E140-N1266	4-268	09/23/10	06/12/12	34.5	
51X-WG-00326	E140-N1266	4-268	09/23/10	06/12/12	30.7	
51X-WG-00327	E140-N1266	4-268	09/23/10	06/12/12	27.7	
51X-WG-00328	E140-N1266	4-268	09/23/10	06/12/12	40.5	
51X-WG-00329	E140-N1266	4-268	09/23/10	06/12/12	24.8	
51X-WG-00330	E140-N1266	4-269	09/23/10	06/12/12	35.2	
51X-WG-00331	E140-N1266	4-269	09/23/10	06/12/12	35.0	
51X-WG-00322	E140-N1266	4-269	09/23/10	06/12/12	31.1	
51X-WG-00333	E140-N1266	4-269	09/23/10	06/12/12	36.1	
51X-WG-00214	E140-S910 East Center	4-270	06/26/97	06/28/12	0.0	
51X-WG-00215-2	E140-S901	4-270	10/21/09	06/28/12	48.3	
51X-WG-00216	E140-S910 East Rib	4-270	06/26/97	06/28/12	13.2	
51X-WG-00217	E140-S910 West Rib	4-270	06/26/97	06/28/12	1.1	
51X-WG-00218	E140-S774	4-271	06/26/97	06/28/12	0.6	
51X-WG-00219	E140-S975	4-271	06/26/97	06/28/12	40.3	
51X-WG-00220	E140-S1023	4-271	10/23/96	06/28/12	9.3	
51X-WG-00293	E140-S1550	4-272	03/17/04	06/20/12	55.3	
51X-WG-00294	E140-S1775	4-273	03/17/04	06/20/12	59.4	
51X-WG-00296-2	E140-S2916	4-274	03/18/10	06/20/12	45.8	
51X-WG-00295-2	E140-S2916	4-274	03/18/10	06/20/12	36.3	
51X-WG-00221	S1300-E120	4-275	10/23/96	06/28/12	5.0	
51X-WG-00222	S1600-E150	4-275	02/18/96	06/18/12	7.1	
51X-WG-00223	S1300-E160	4-276	10/23/96	06/28/12	45.6	

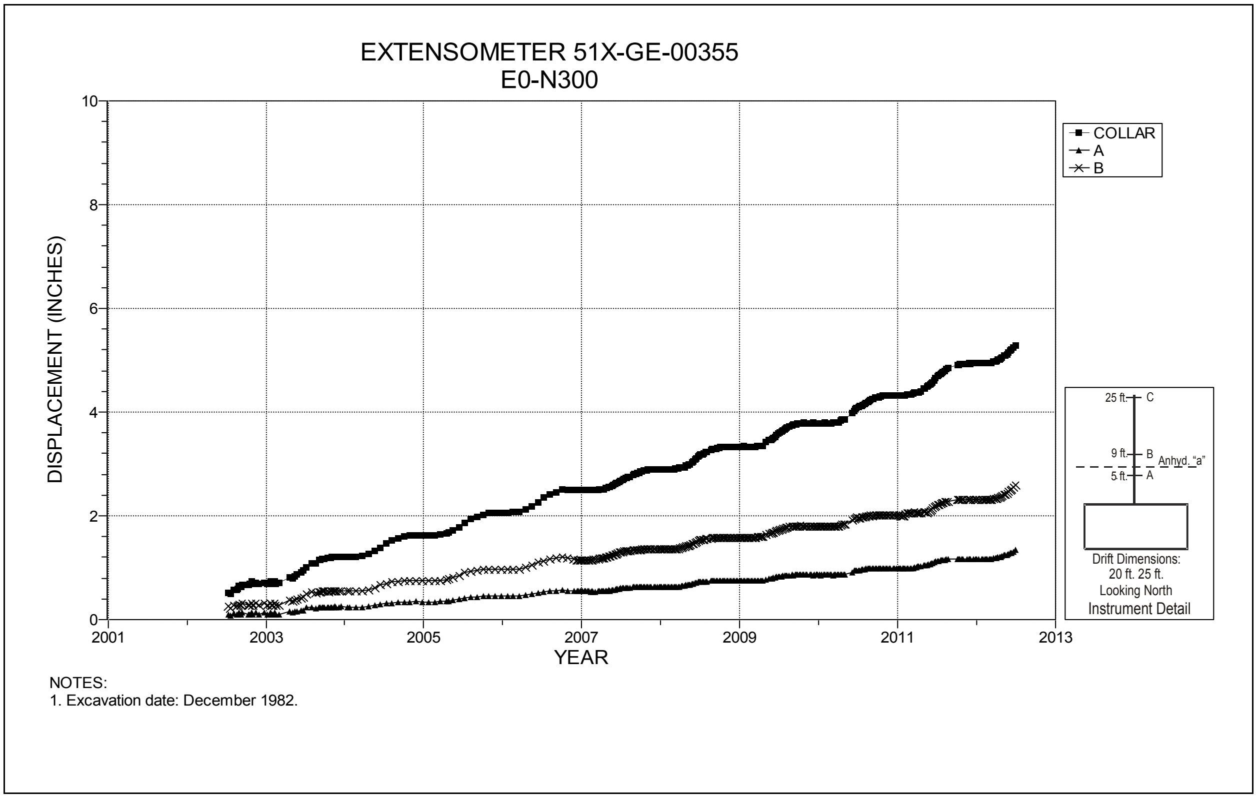


Figure 4-1 Extensometer 51X-GE-00355
E0 N300 – Roof

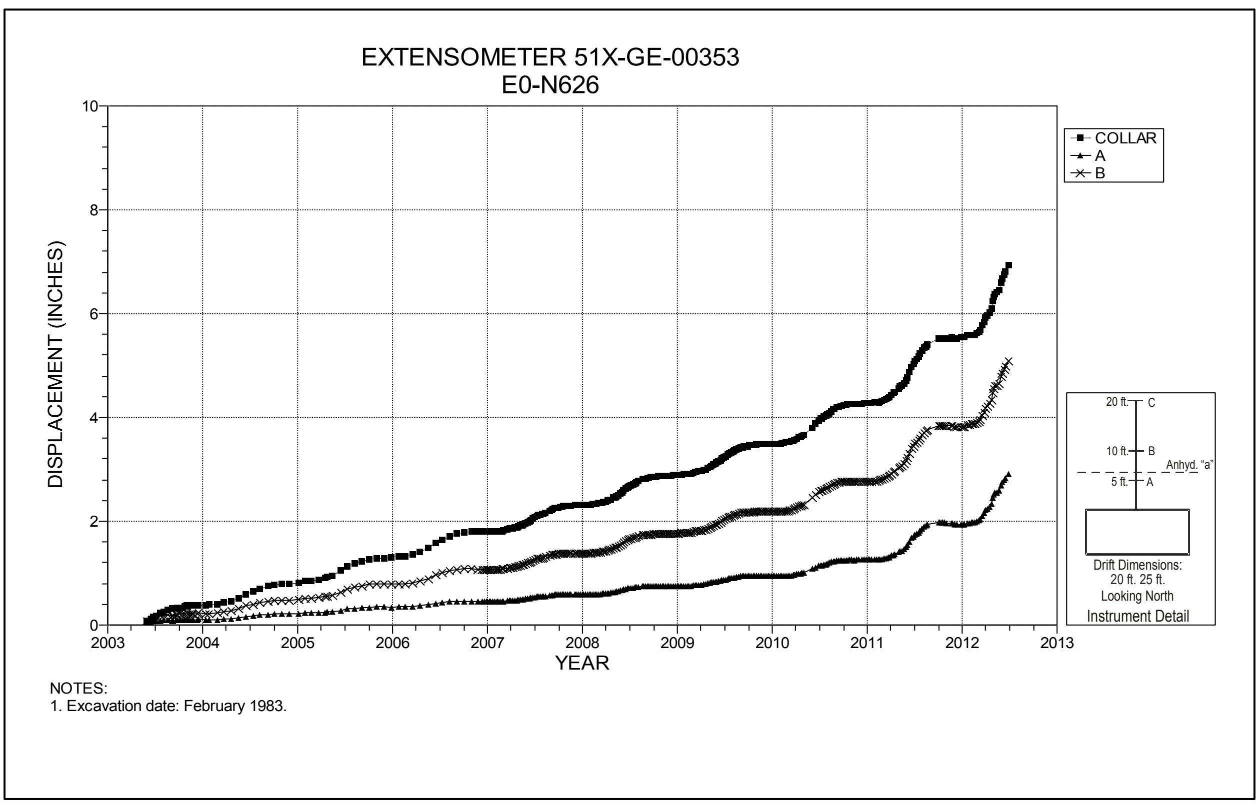


Figure 4-2 Extensometer 51X-GE-00353
E0 N626 – Roof

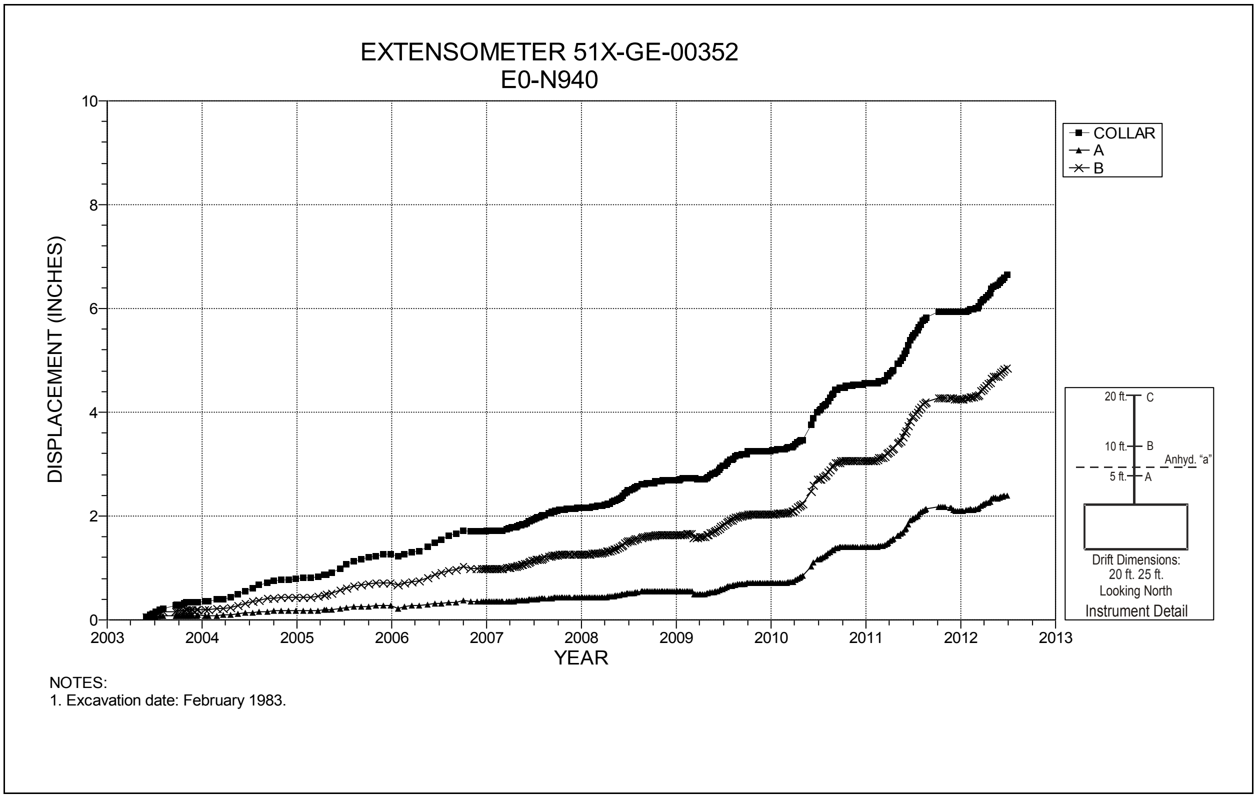


Figure 4-3 Extensometer 51X-GE-00352
E0 N940 – Roof

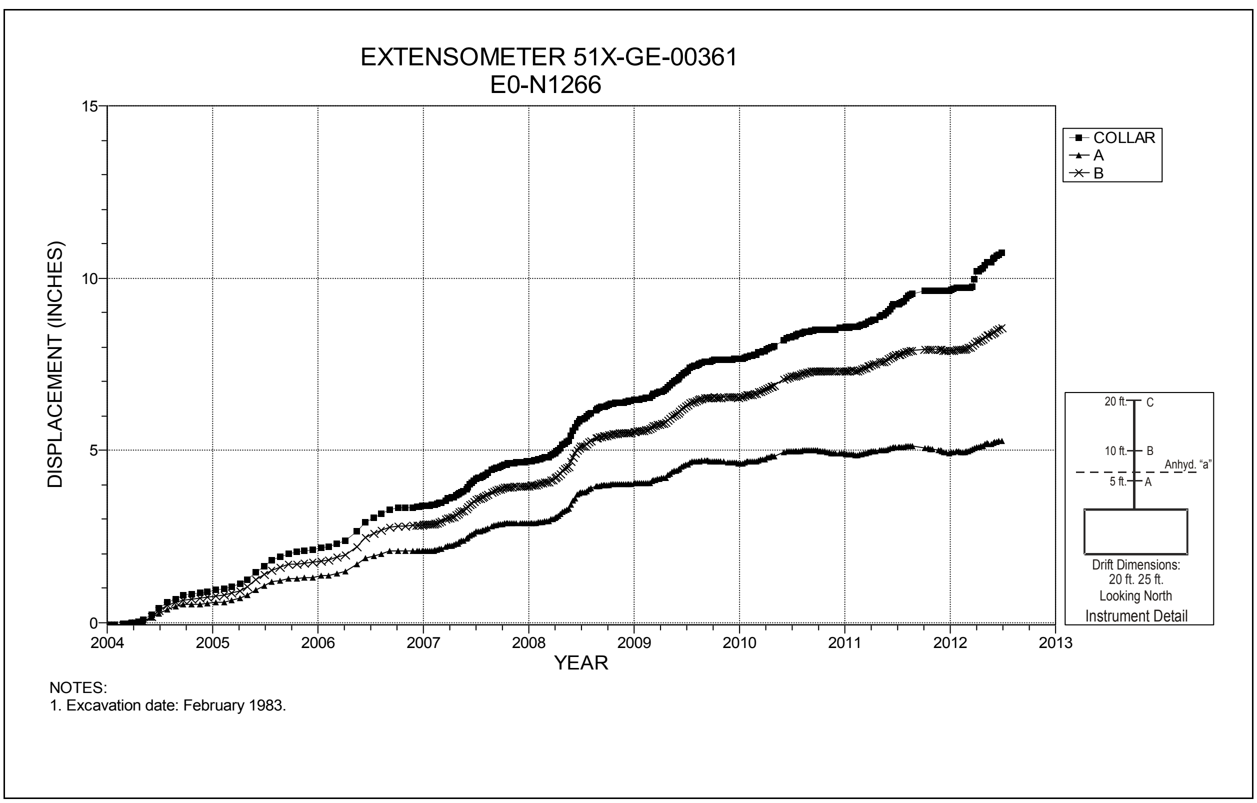


Figure 4-4 Extensometer 51X-GE-00361
E0-N1266 – Roof

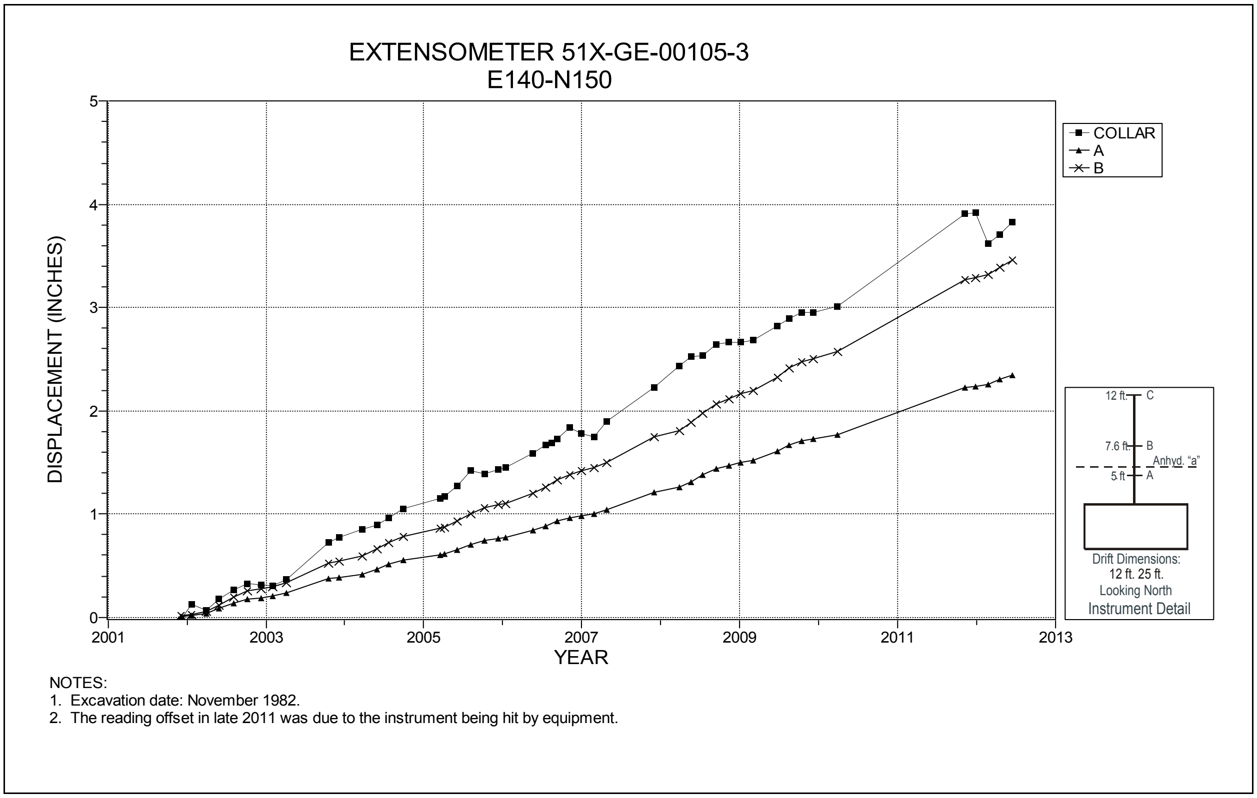


Figure 4-5 Extensometer 51X-GE-00105-3
E140 N150 – Roof

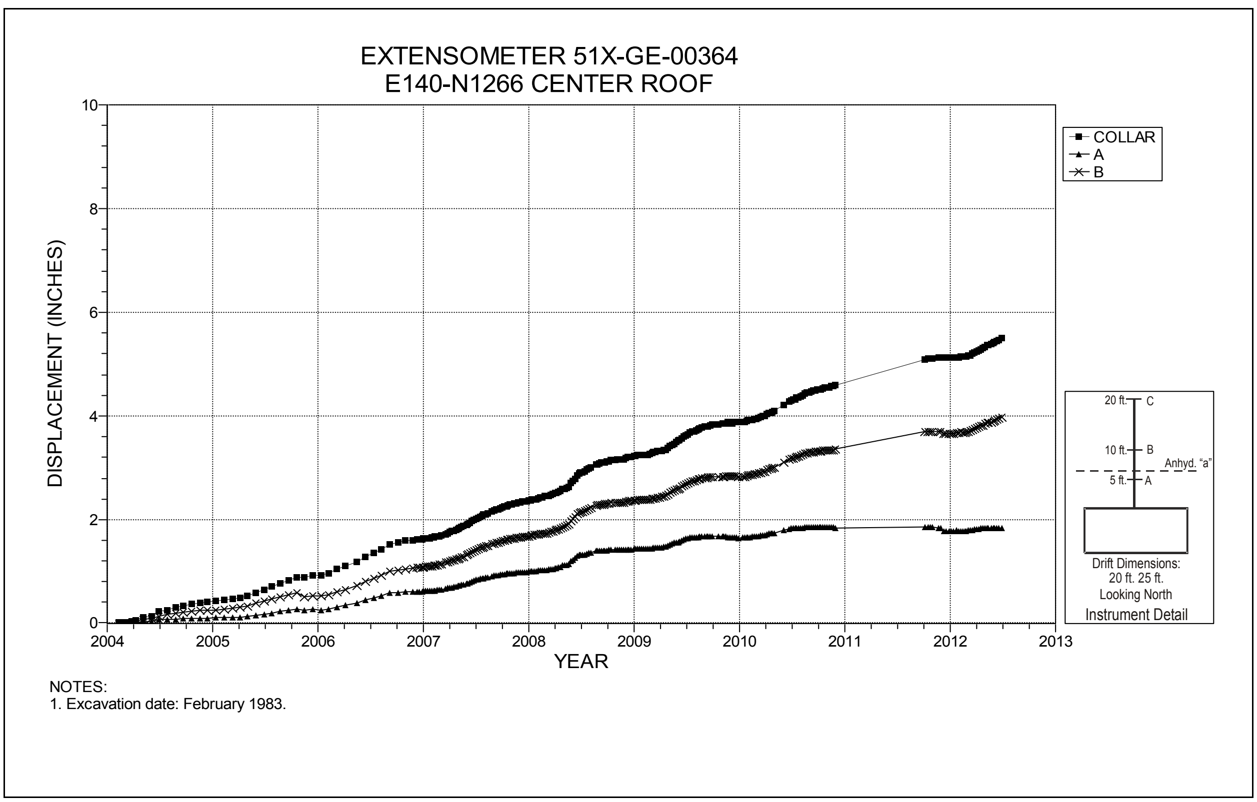


Figure 4-6 Extensometer 51X-GE-00364
E140 N1266 – Roof

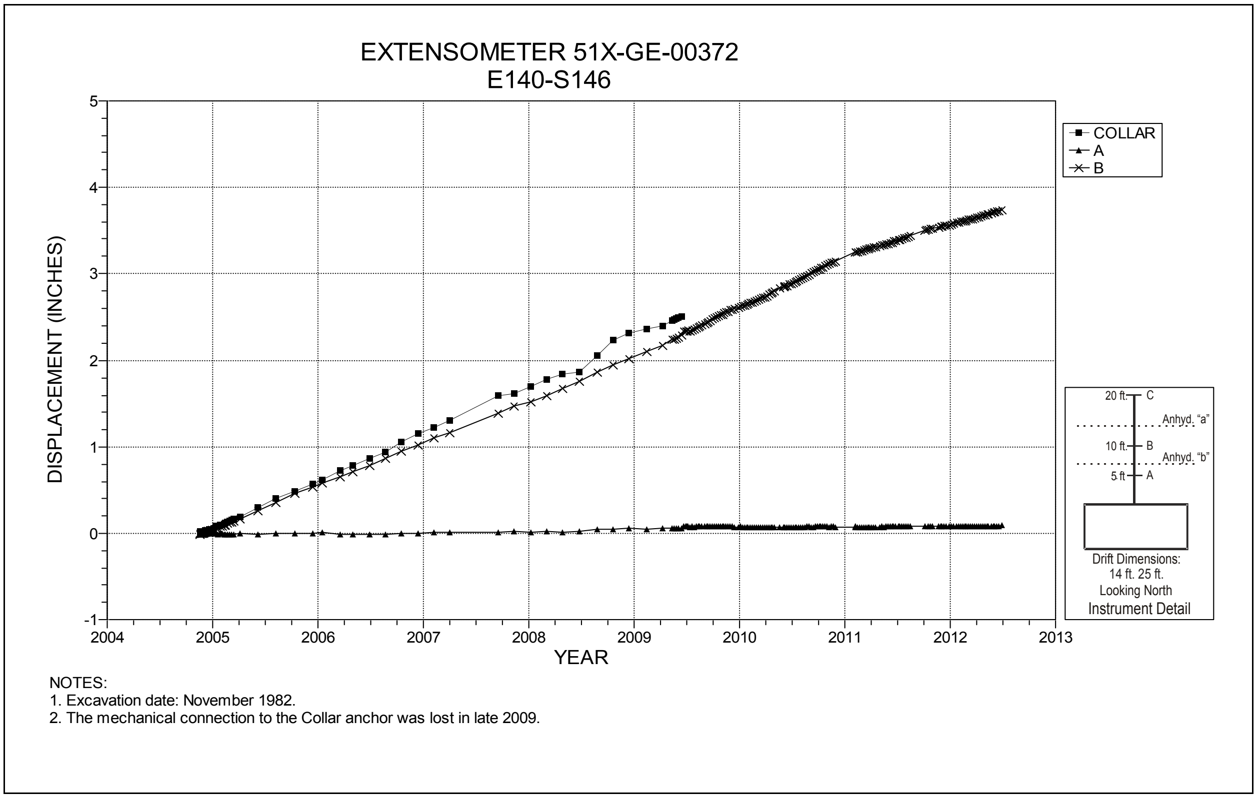


Figure 4-7 Extensometer 51X-GE-00372
E140 S146 – Roof

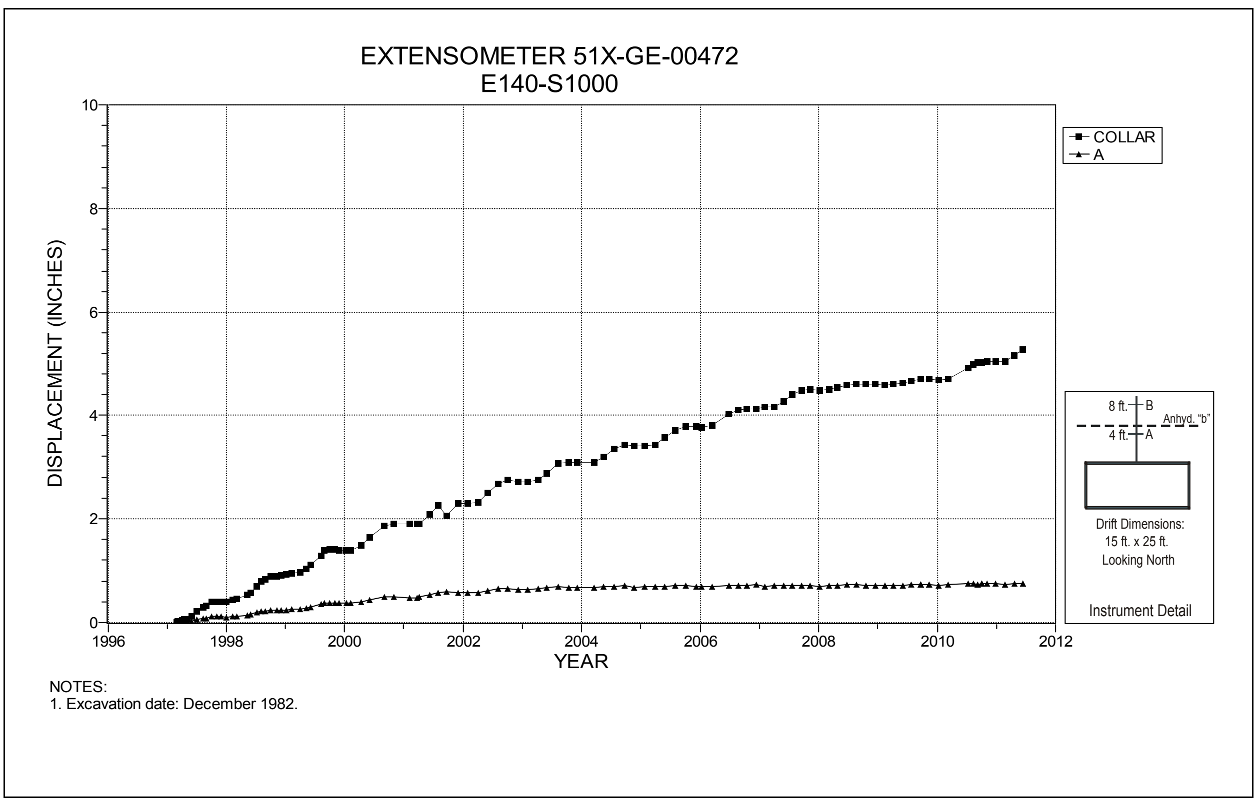


Figure 4-8 Extensometer 51X-GE-00472
E140 S1000 – Roof

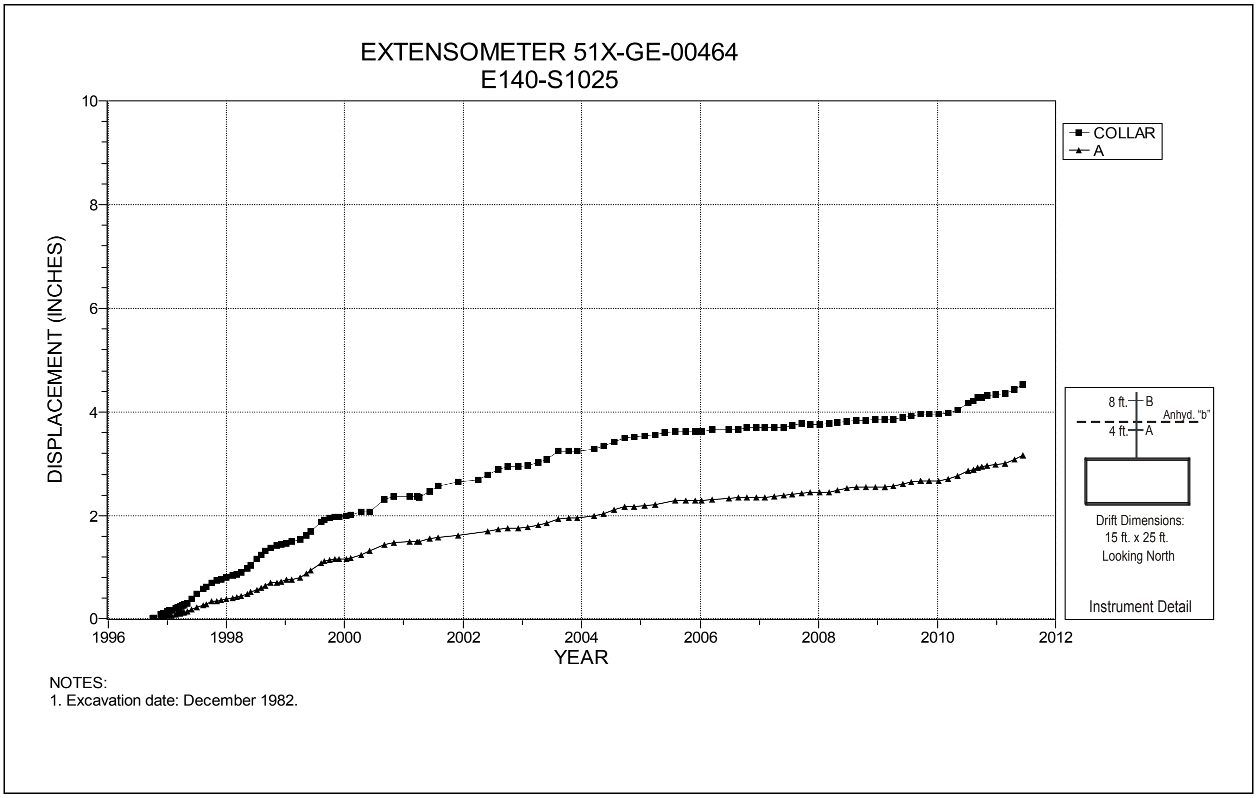


Figure 4-9 Extensometer 51X-GE-00464
E140 S1025 – Roof

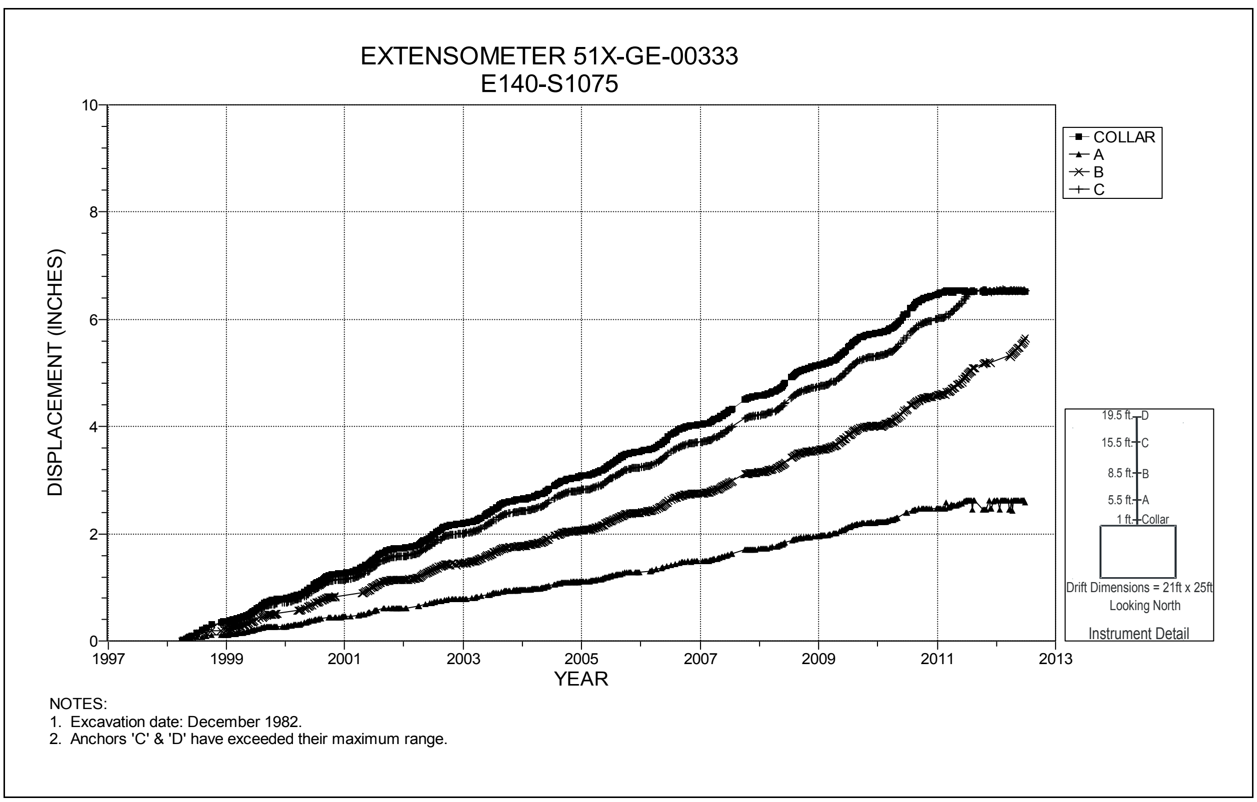


Figure 4-10 Extensometer 51X-GE-00333
E140 S1075 – Roof

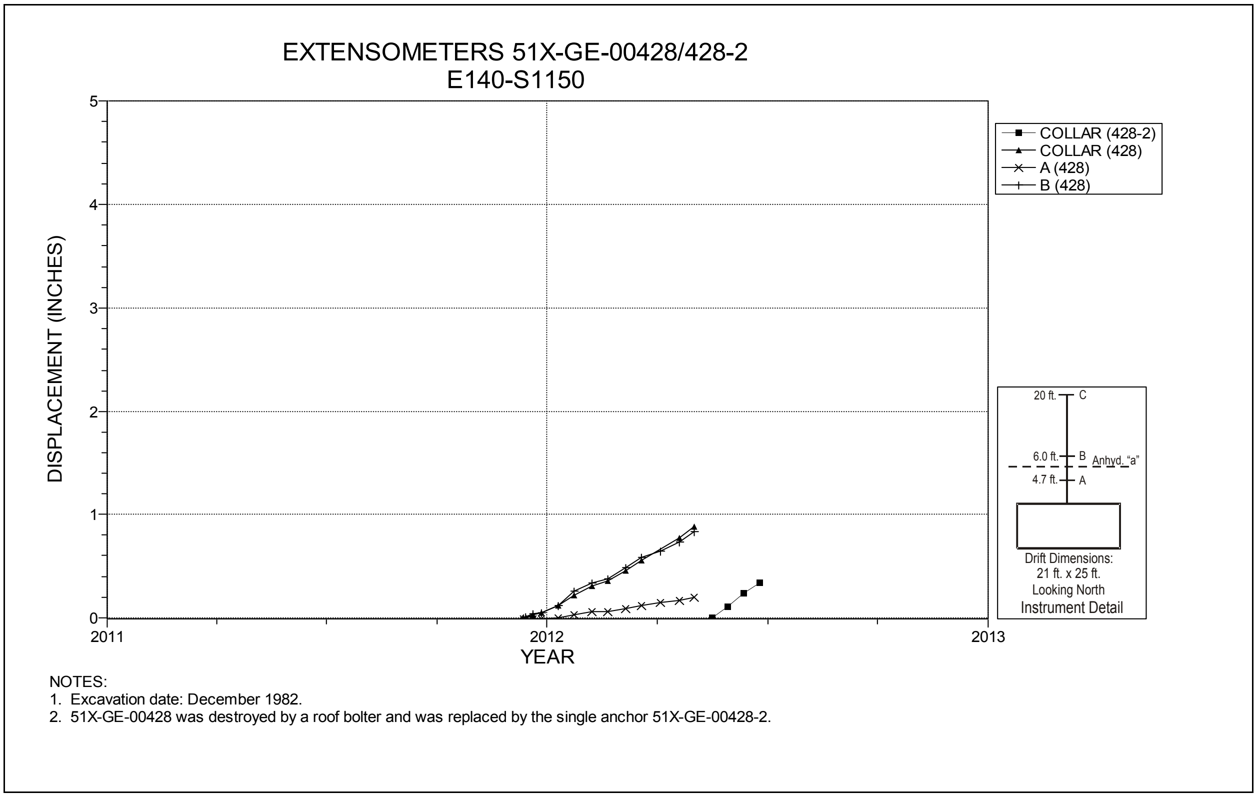


Figure 4-11 Extensometers 51X-GE-00428/428-2
E140 S1150 – Roof

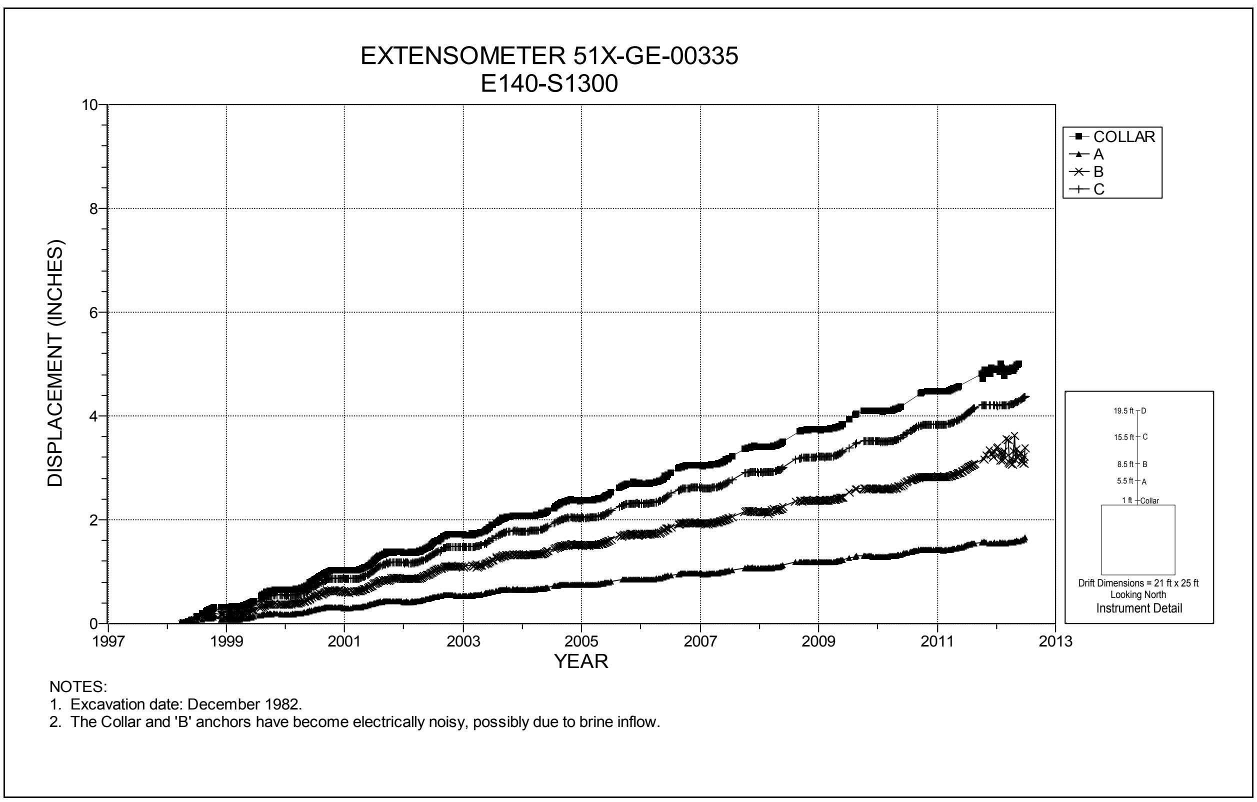


Figure 4-12 Extensometer 51X-GE-00335
E140 S1300 – Roof

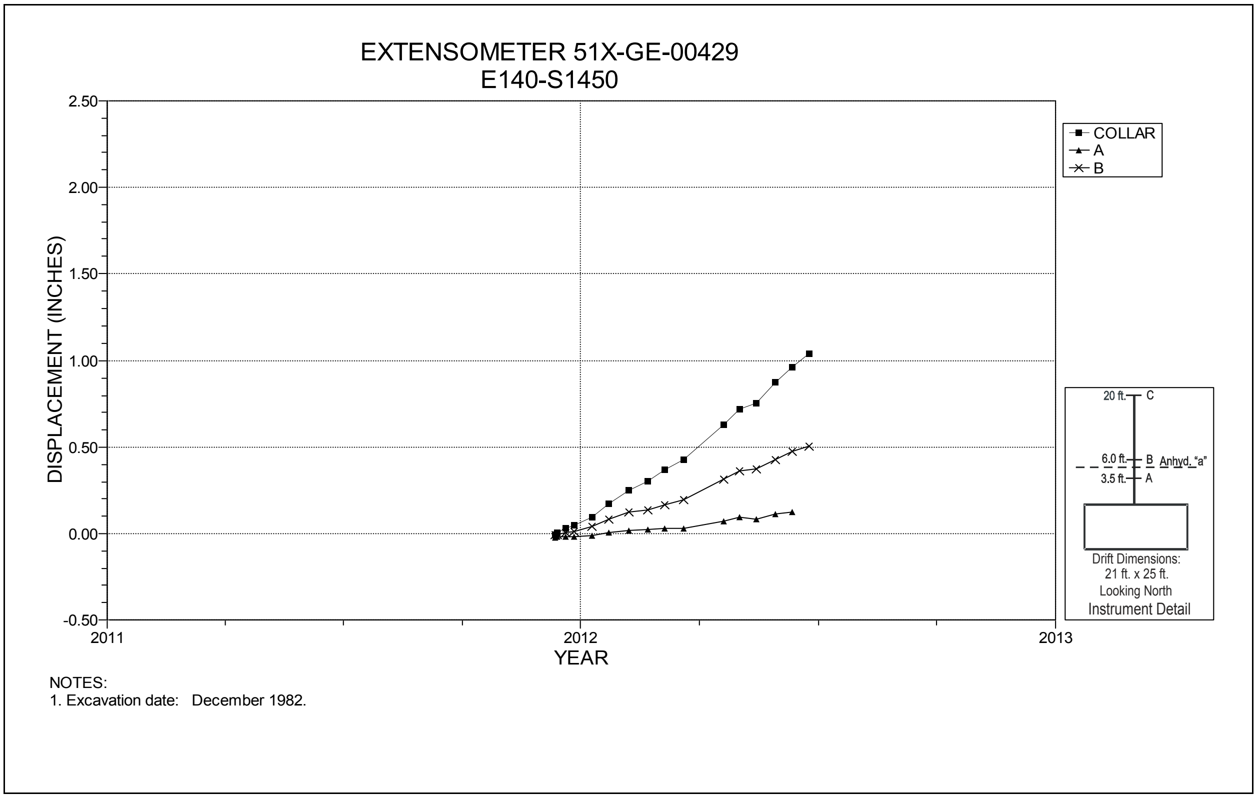


Figure 4-13 Extensometer 51X-GE-00429
E140 S1450 – Roof

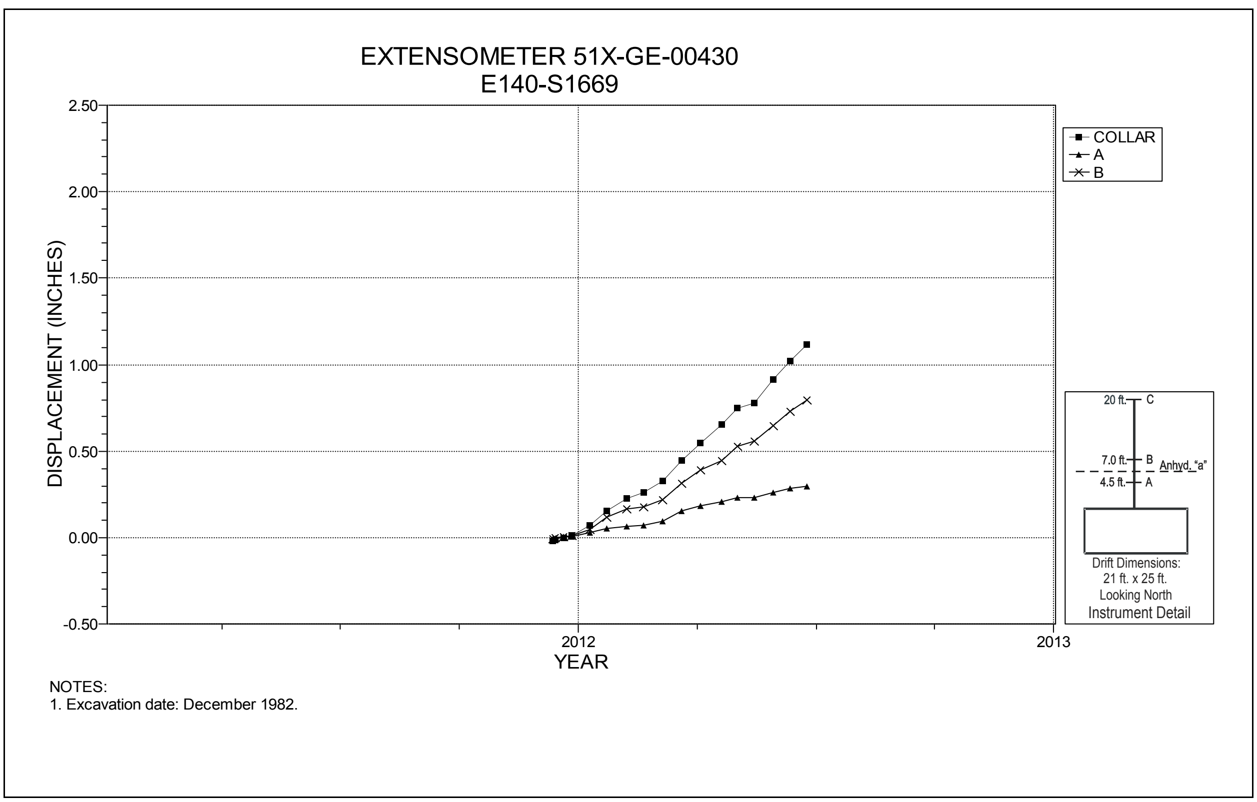


Figure 4-14 Extensometer 51X-GE-00430
E140 S1669 – Roof

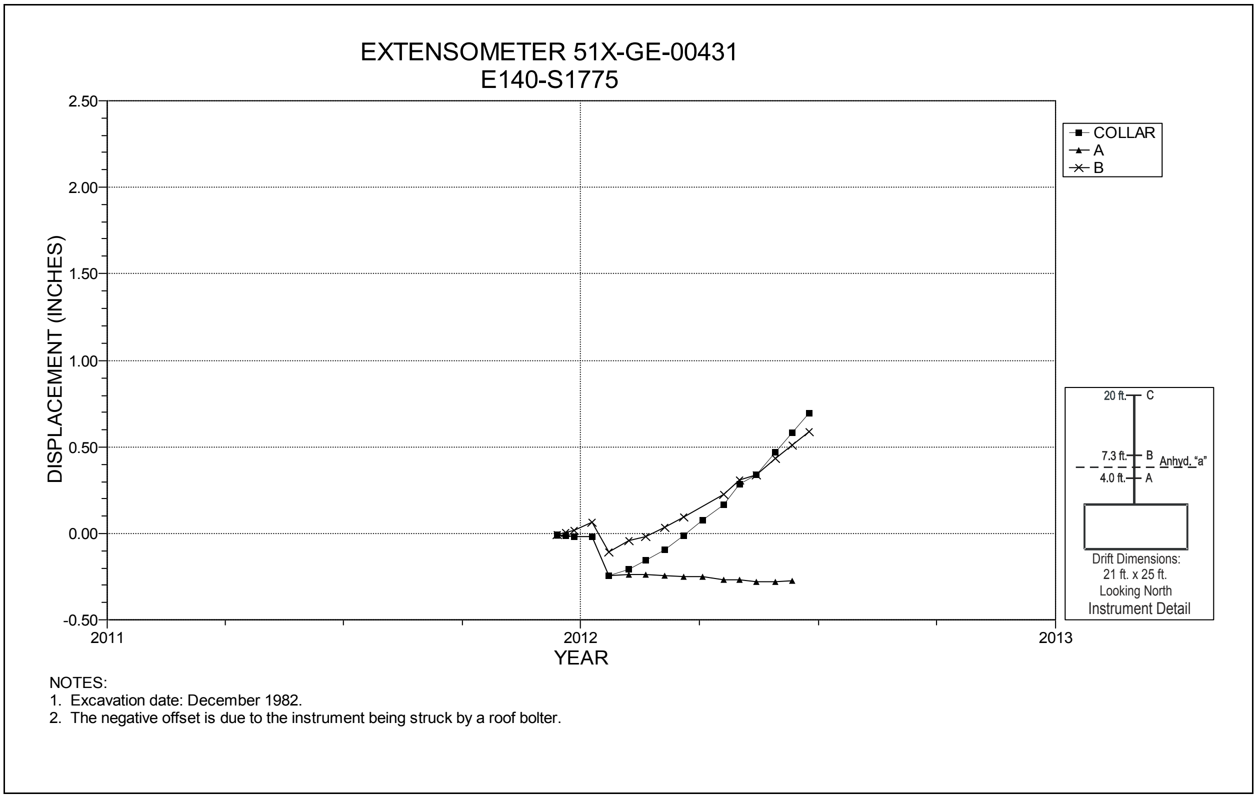


Figure 4-15 Extensometer 51X-GE-00431
E140 S1775 – Roof

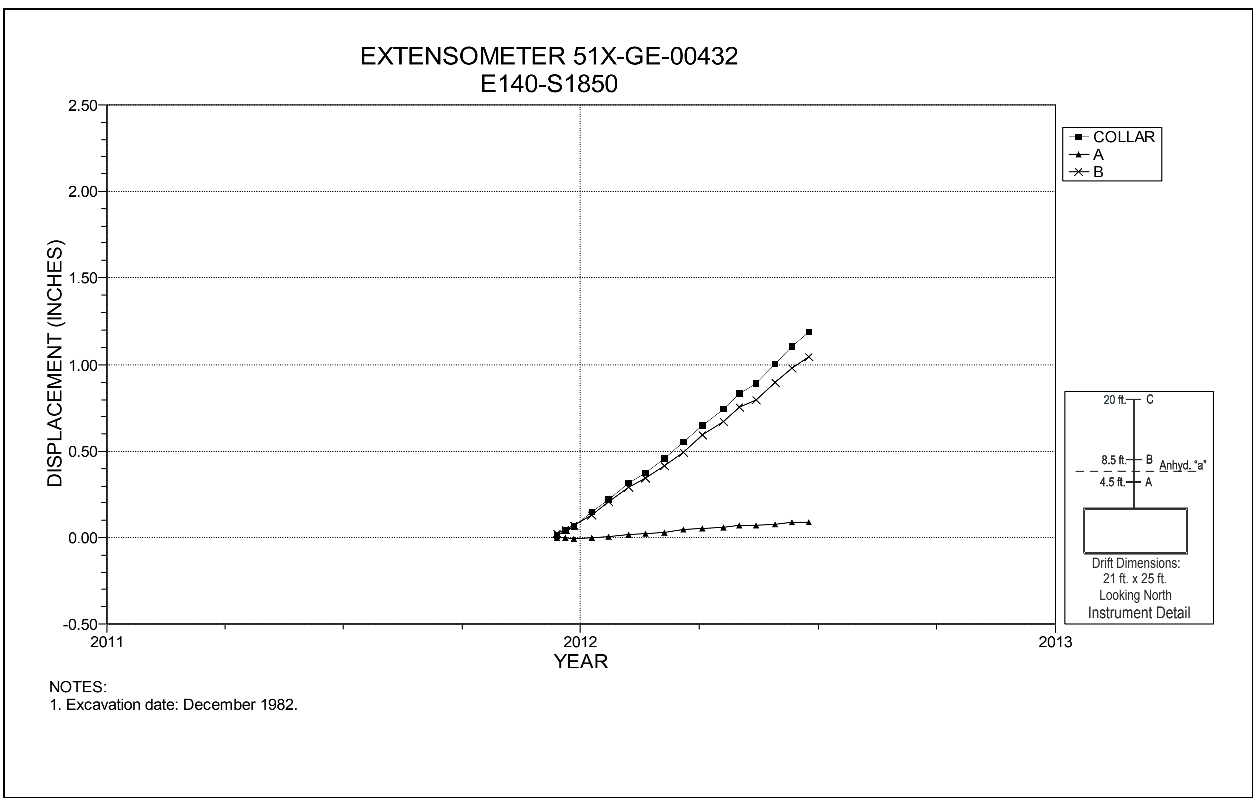


Figure 4-16 Extensometer 51X-GE-00432
E140 S1850 – Roof

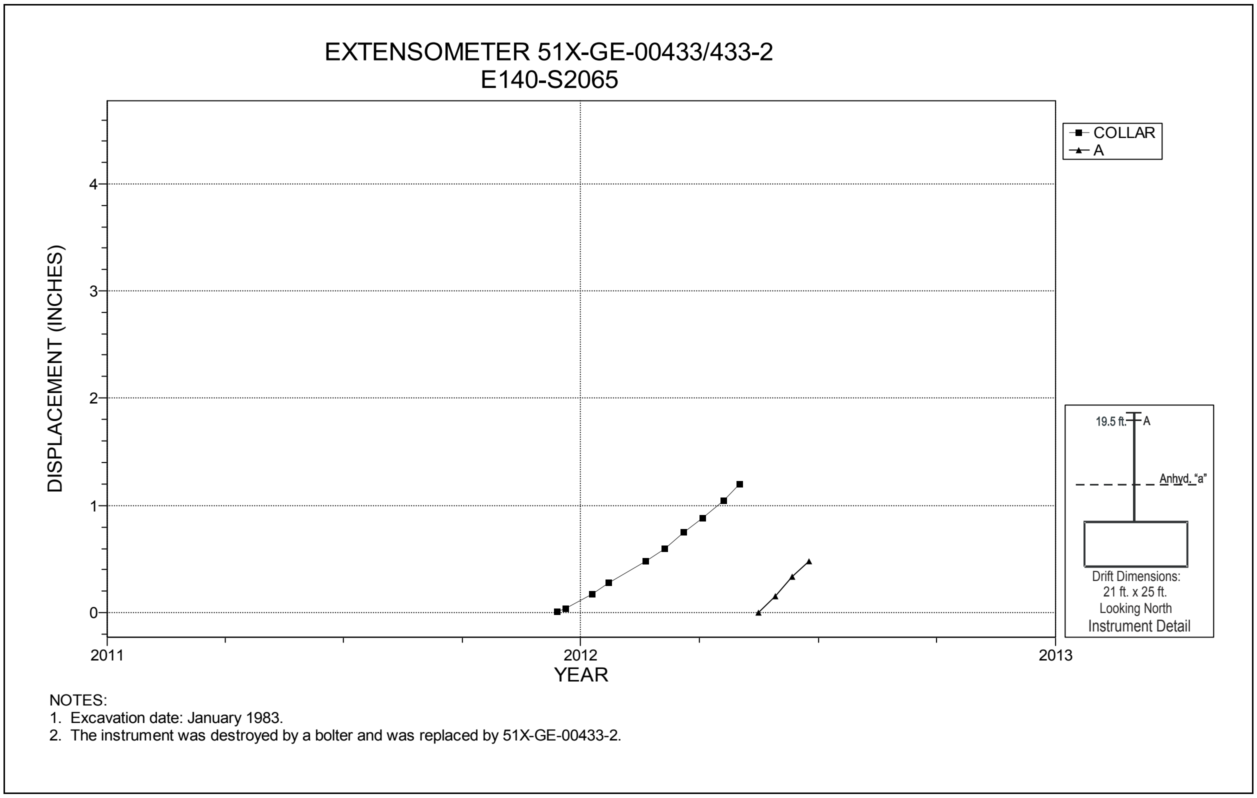


Figure 4-17 Extensometers 51X-GE-00433/433-2
E140 S2065 – Roof

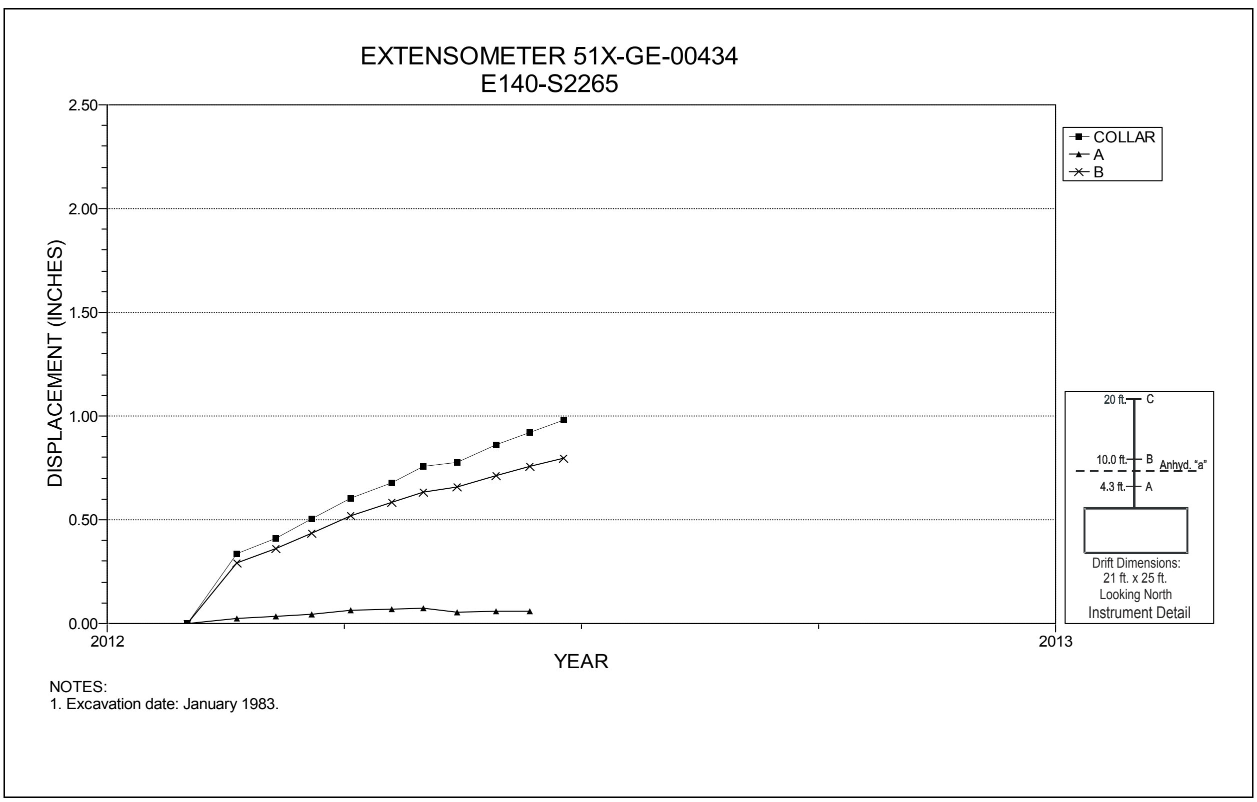


Figure 4-18 Extensometer 51X-GE-00434
E140 S2265 – Roof

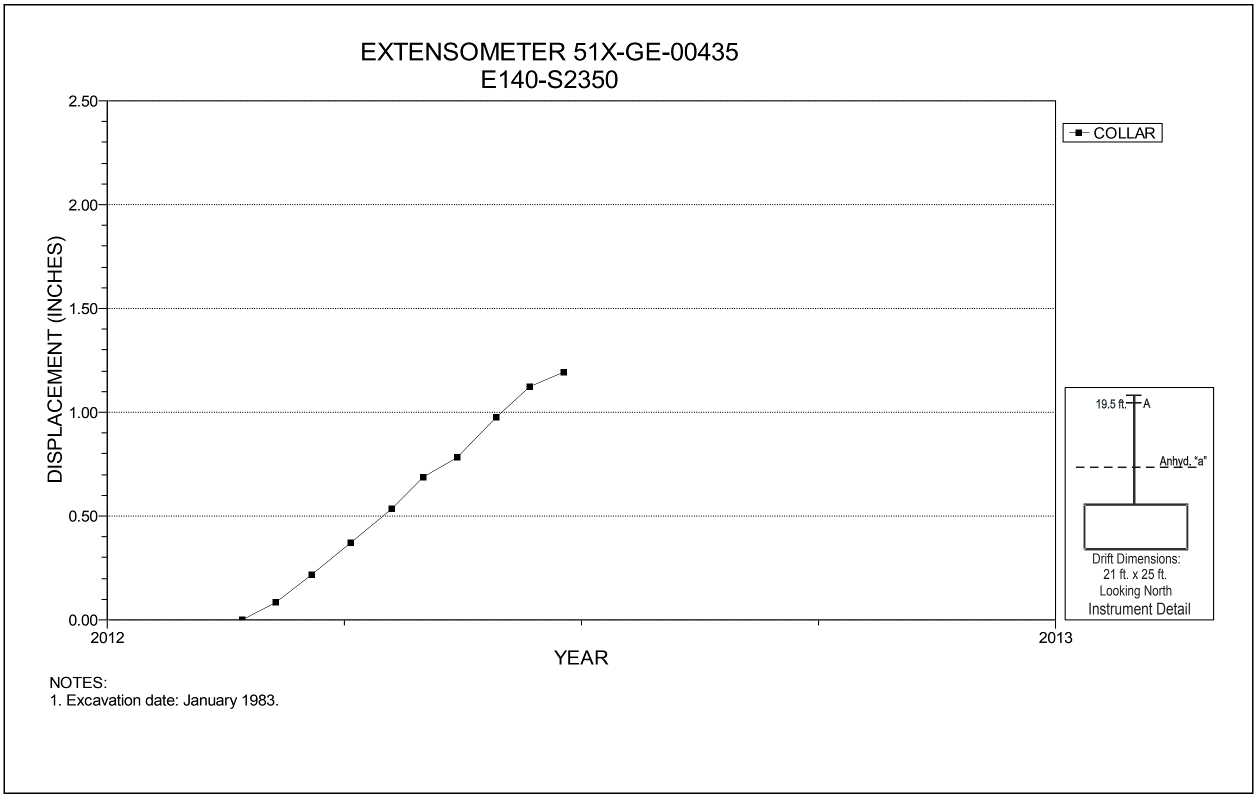


Figure 4-19 Extensometer 41X-GE-00435
E140 S2350 – Roof

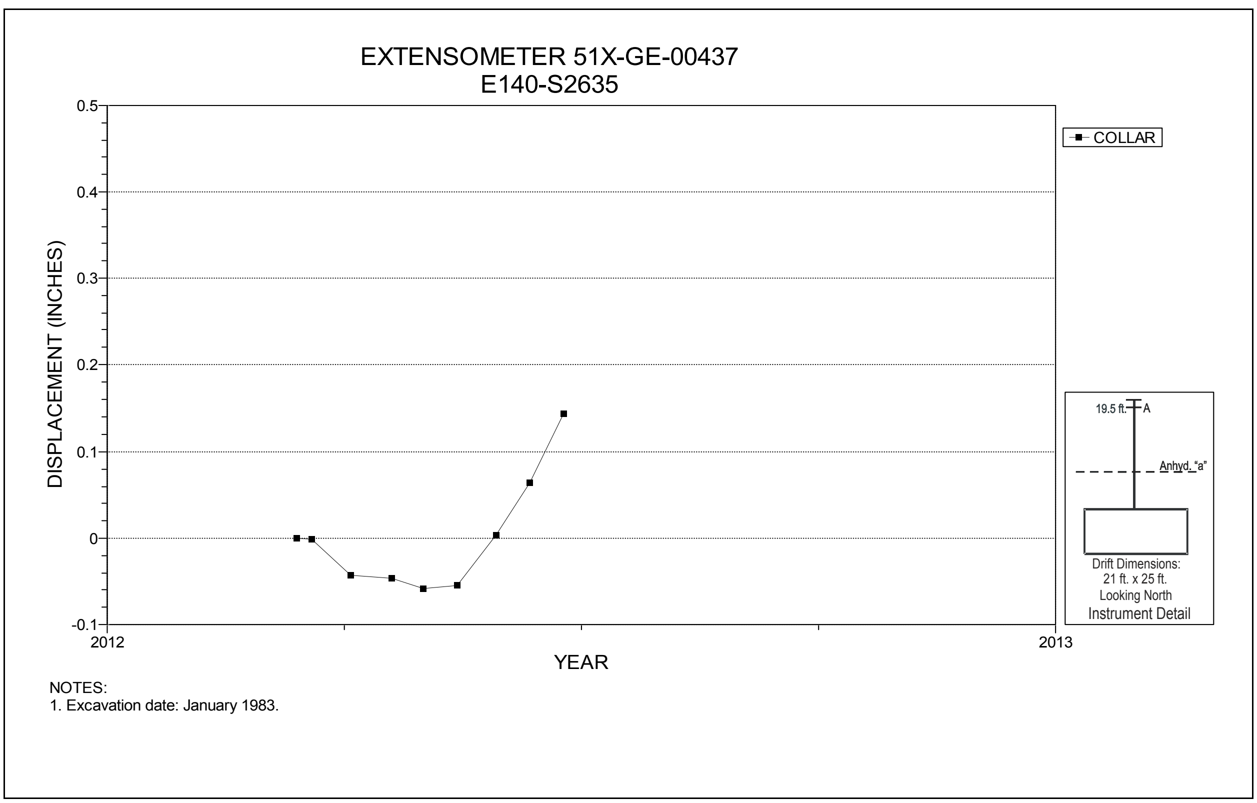
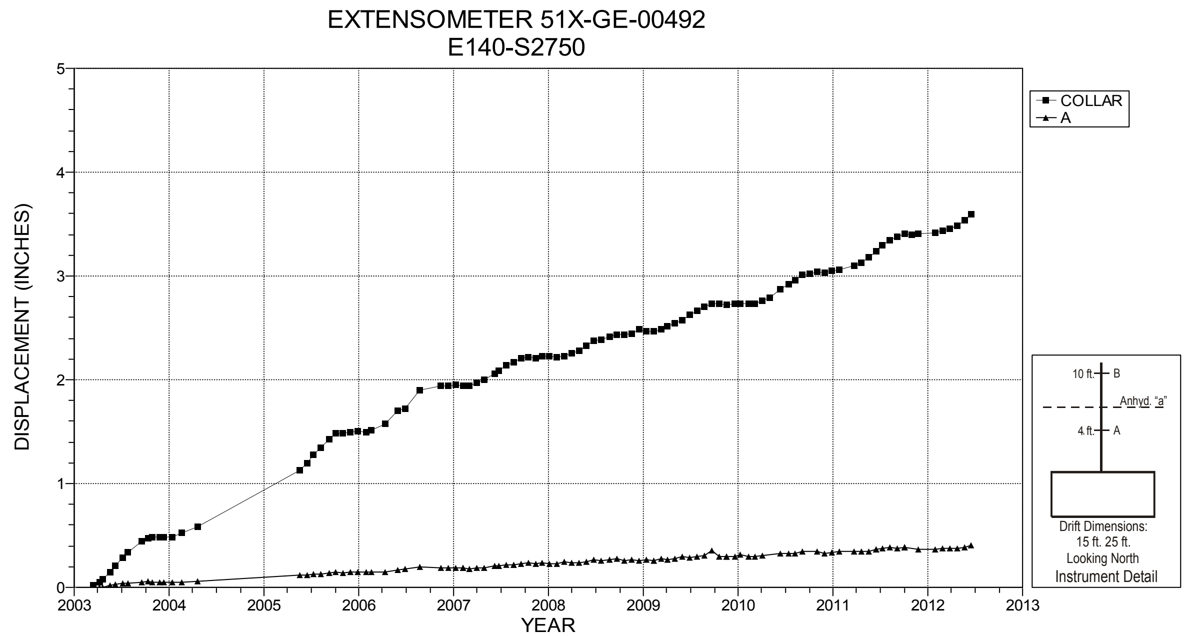
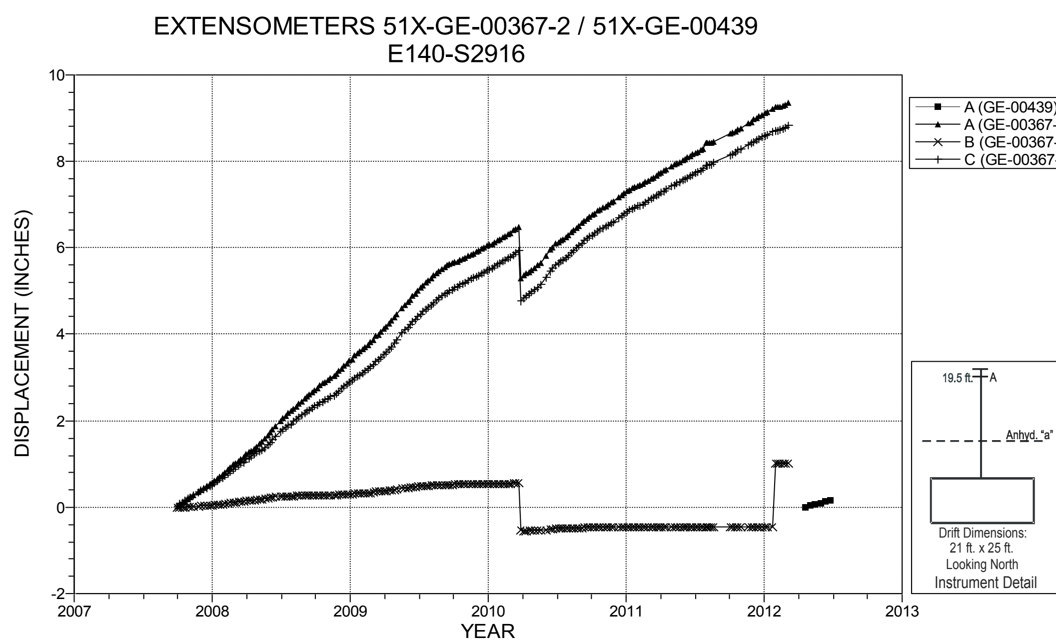


Figure 4-20 Extensometer 41X-GE-00437
E140 S2635 – Roof



NOTES:
1. Excavation date: January 1983.

Figure 4-21 Extensometer 51X-GE-00492
E140 S2750 – Roof



NOTES:
1. Excavation date: January 1983.
2. Data offset that occurred in the first quarter of 2010 was due to the instrument being struck by a bolter.
3. 51X-GE-00439 replaced 51X-GE-00367-2 which was destroyed by a bolter in March 2012.

Figure 4-22 Extensometers 51X-GE-00367-2/51X-GE-00439
E140 S2916 – Roof

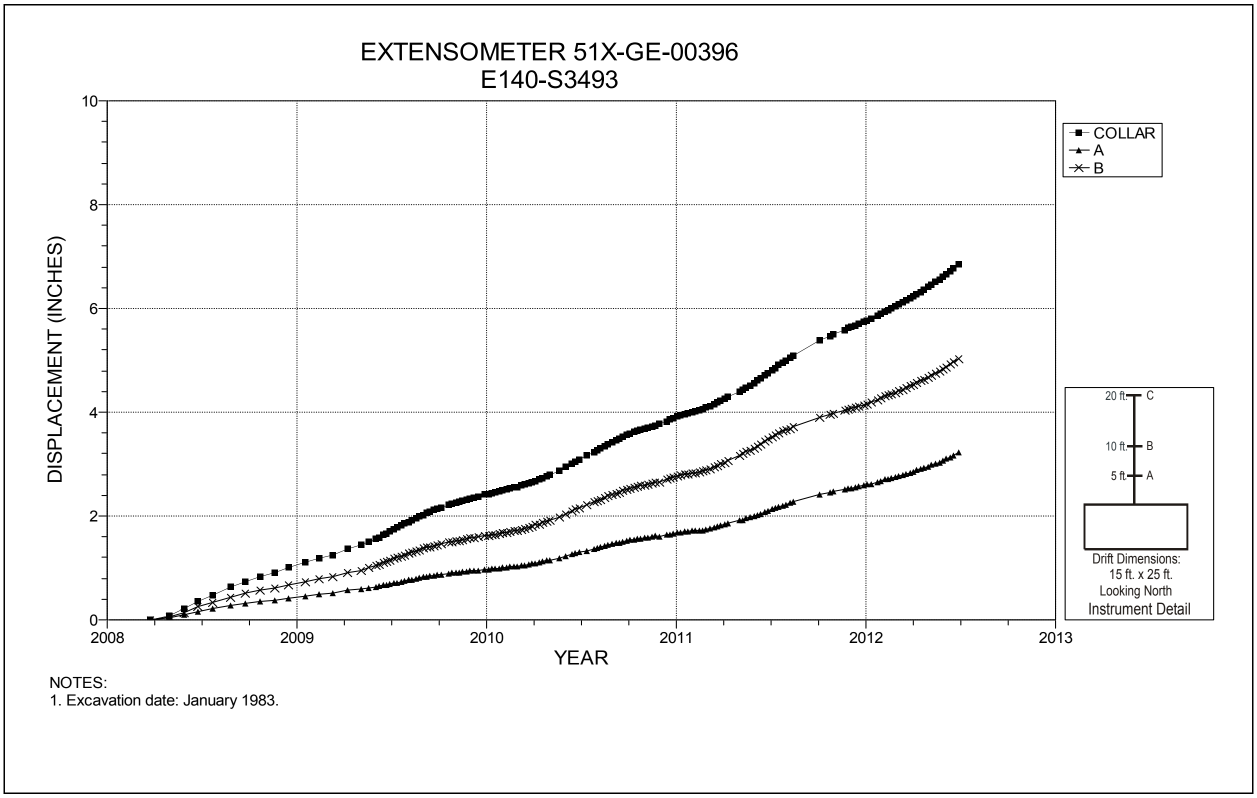


Figure 4-23 Extensometer 51X-GE-00396
E140 S3493 – Roof

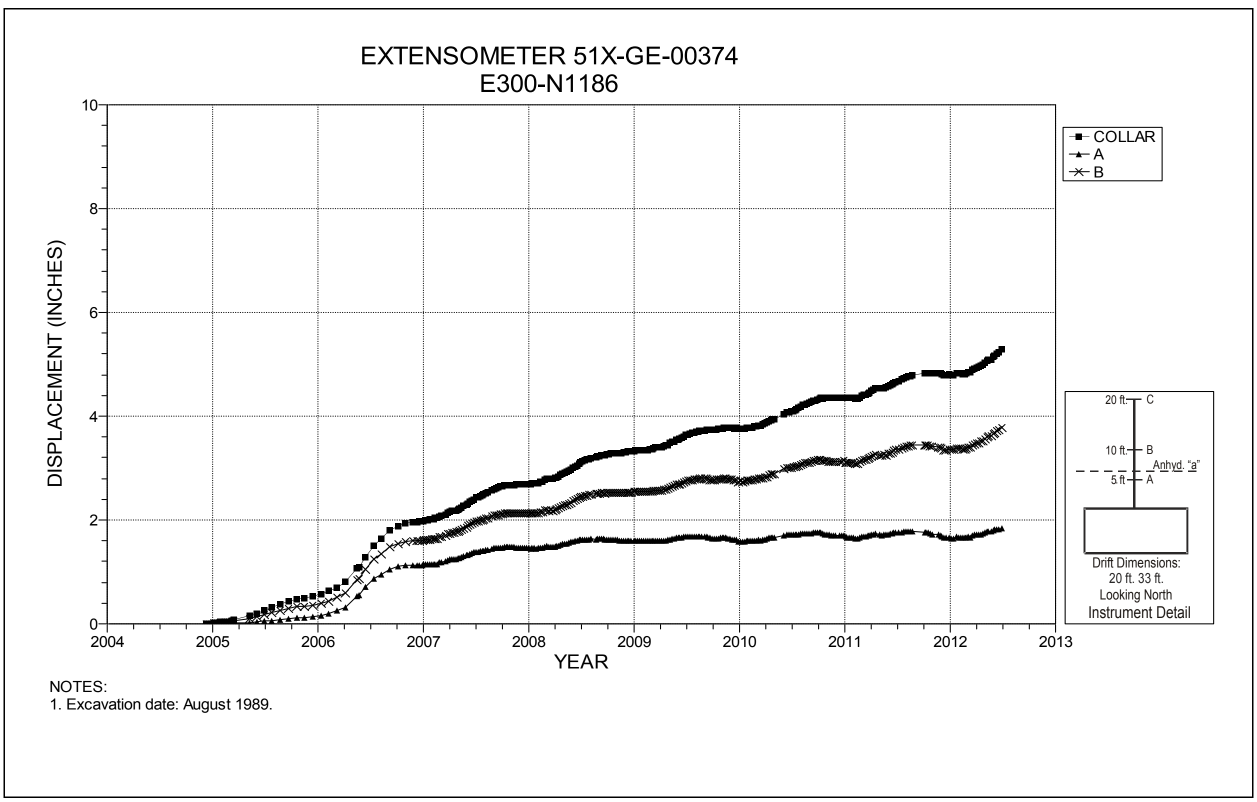


Figure 4-24 Extensometer 51X-GE-00374
E300 N1186 – Roof

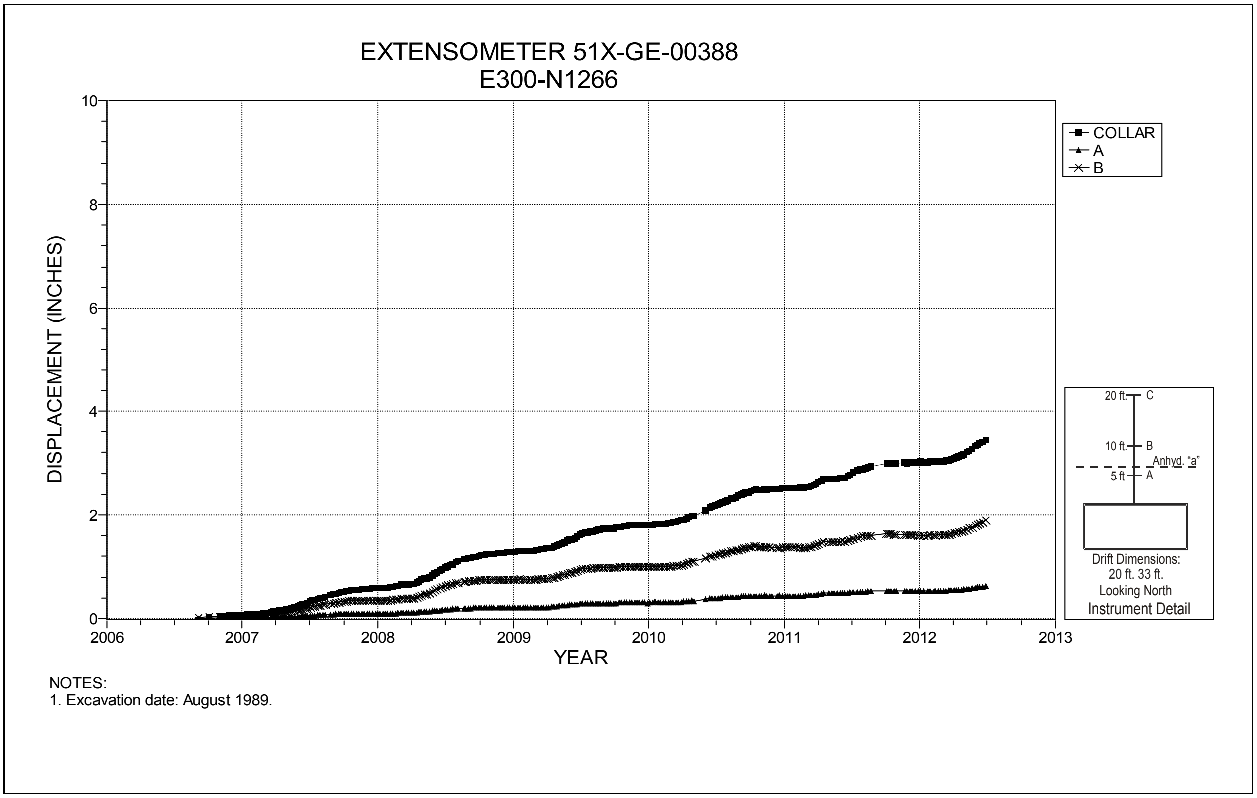


Figure 4-25 Extensometer 51X-GE-00388
E300 N1266 – Roof

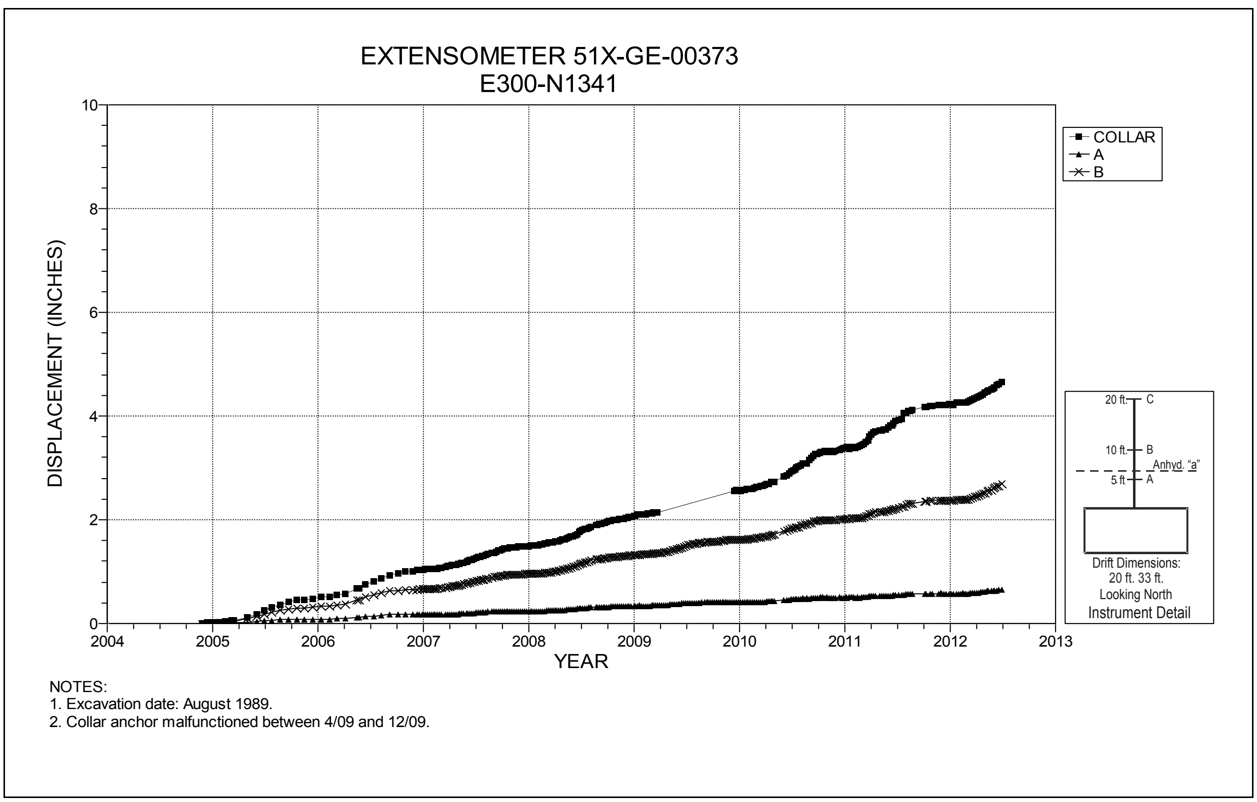


Figure 4-26 Extensometer 51X-GE-00373
E300 N1341 – Roof

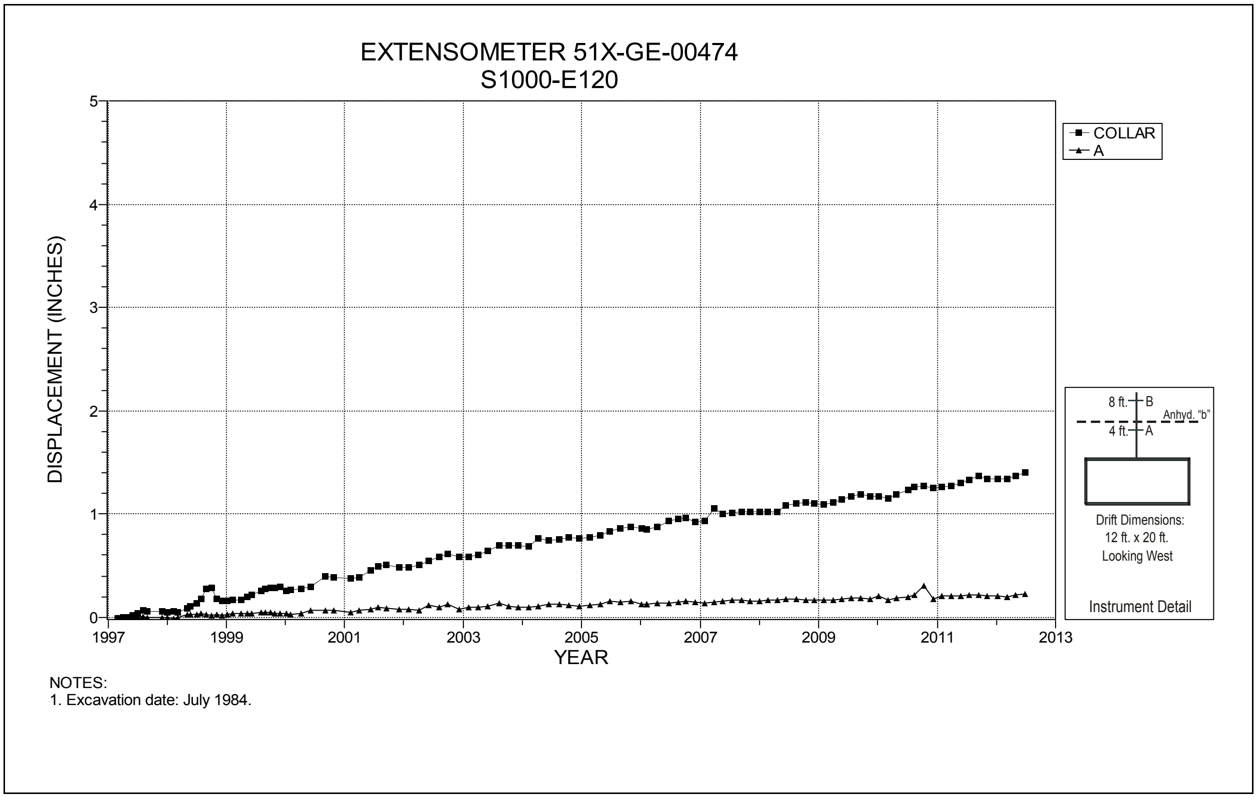


Figure 4-27 Extensometer 51X-GE-00474
S1000 E120 – Roof

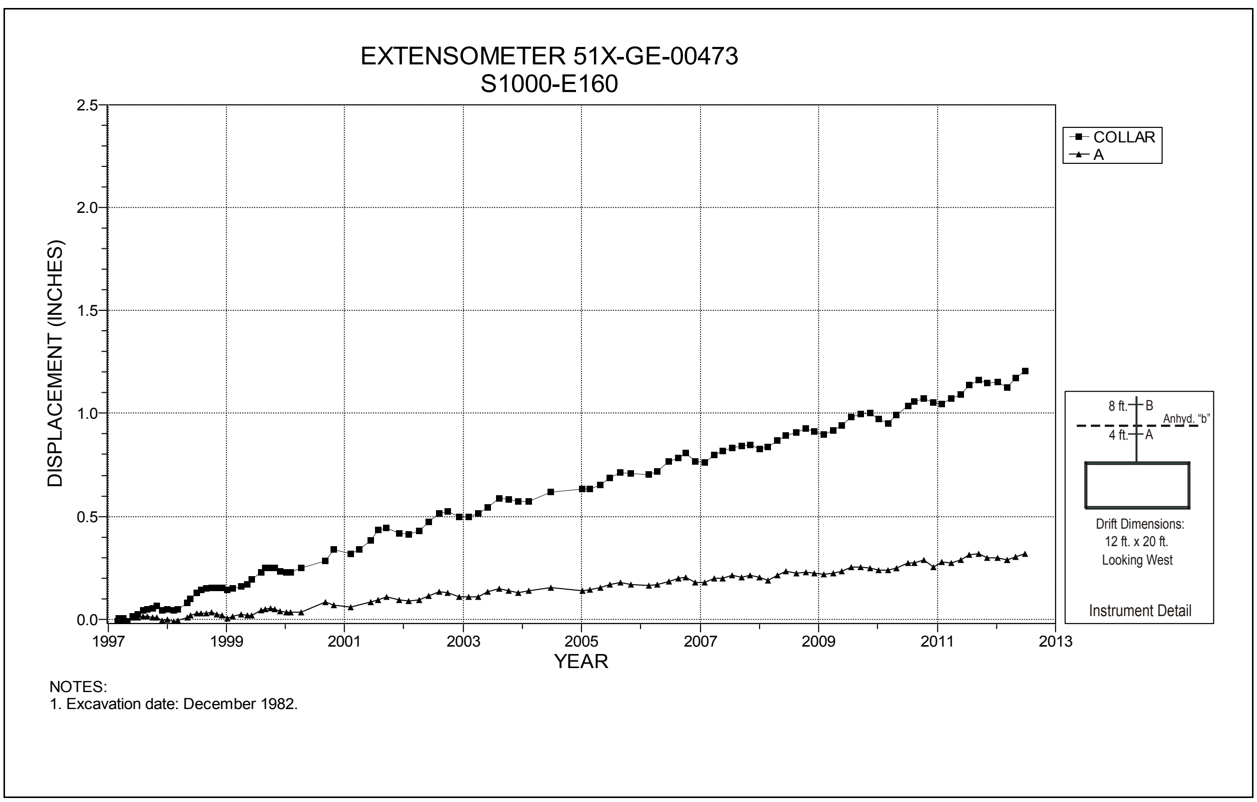


Figure 4-28 Extensometer 51X-GE-00473
S1000 E160 – Roof

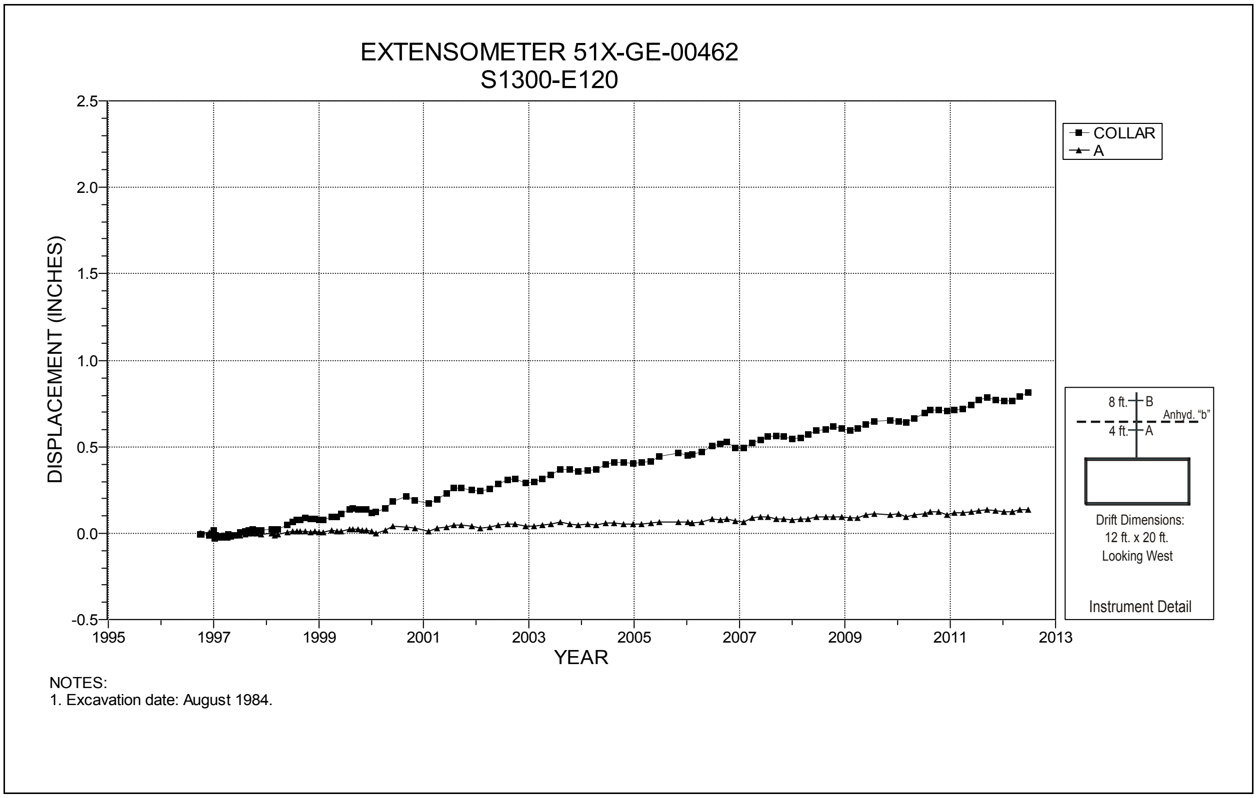


Figure 4-29 Extensometer 51X-GE-00462
S1300 E120 – Roof

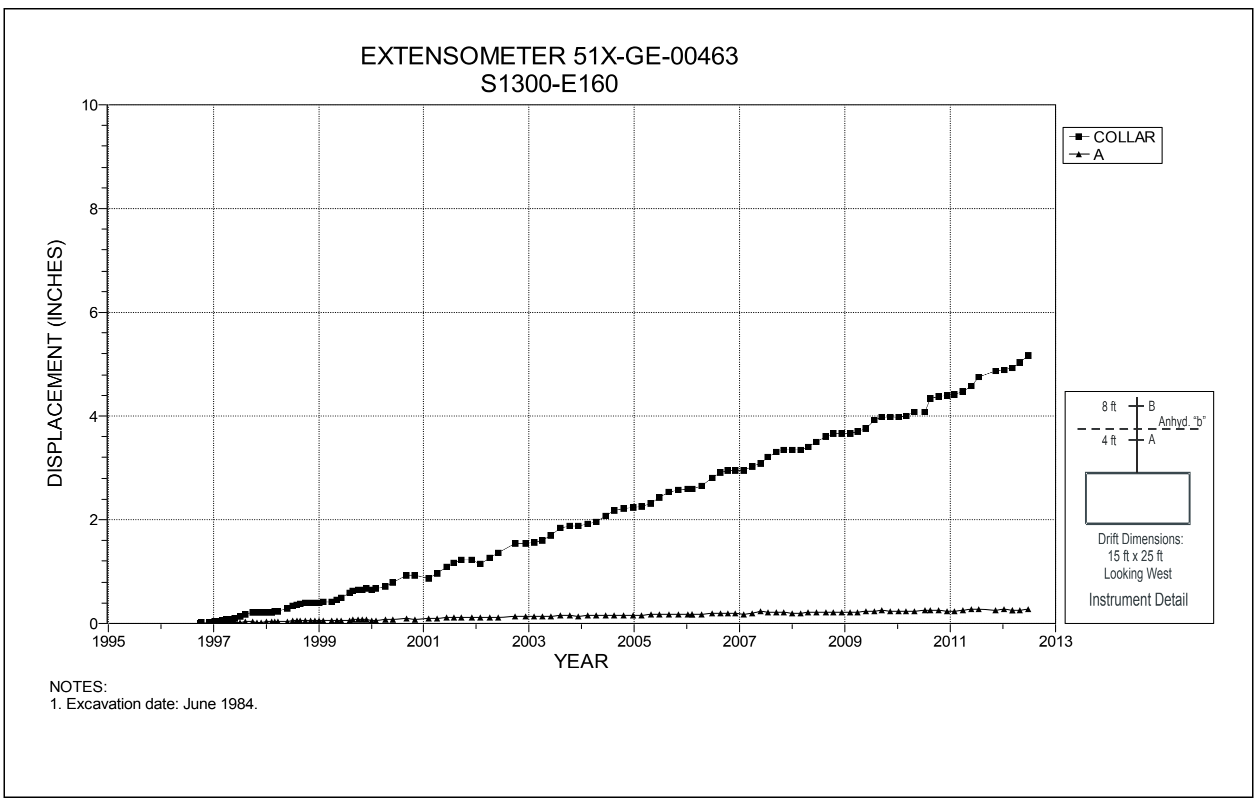


Figure 4-30 Extensometer 51X-GE-00463
S1300 E160 – Roof

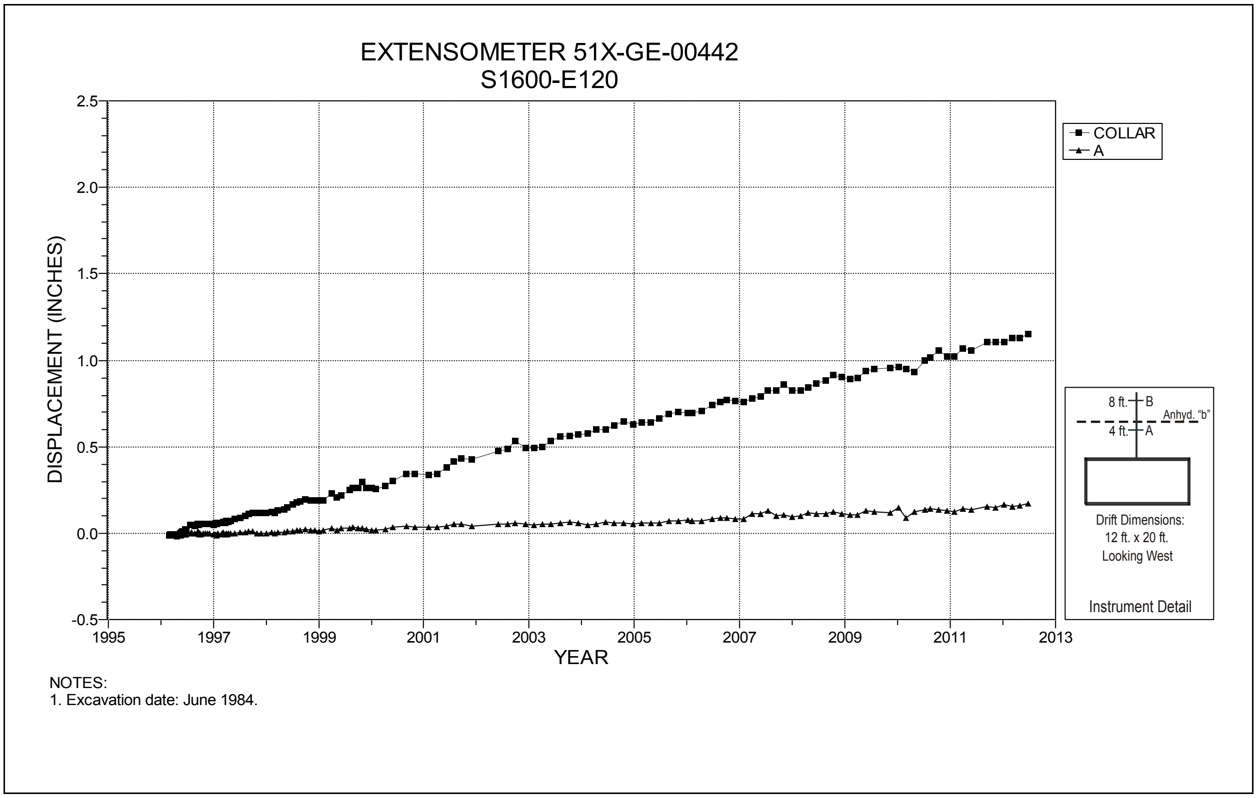


Figure 4-31 Extensometer 51X-GE-00442
S1600 E120 – Roof

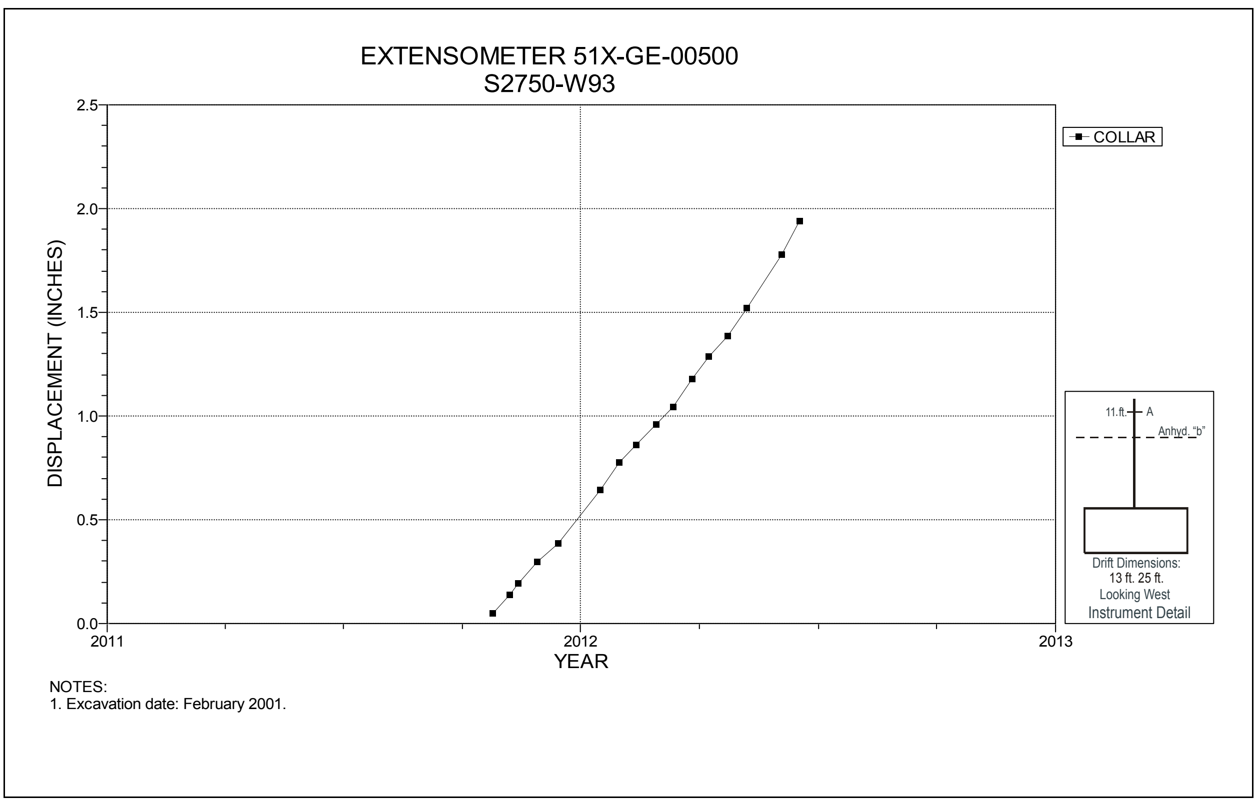


Figure 4-32 Extensometer 51X-GE-00500
S2750 W93 – Roof

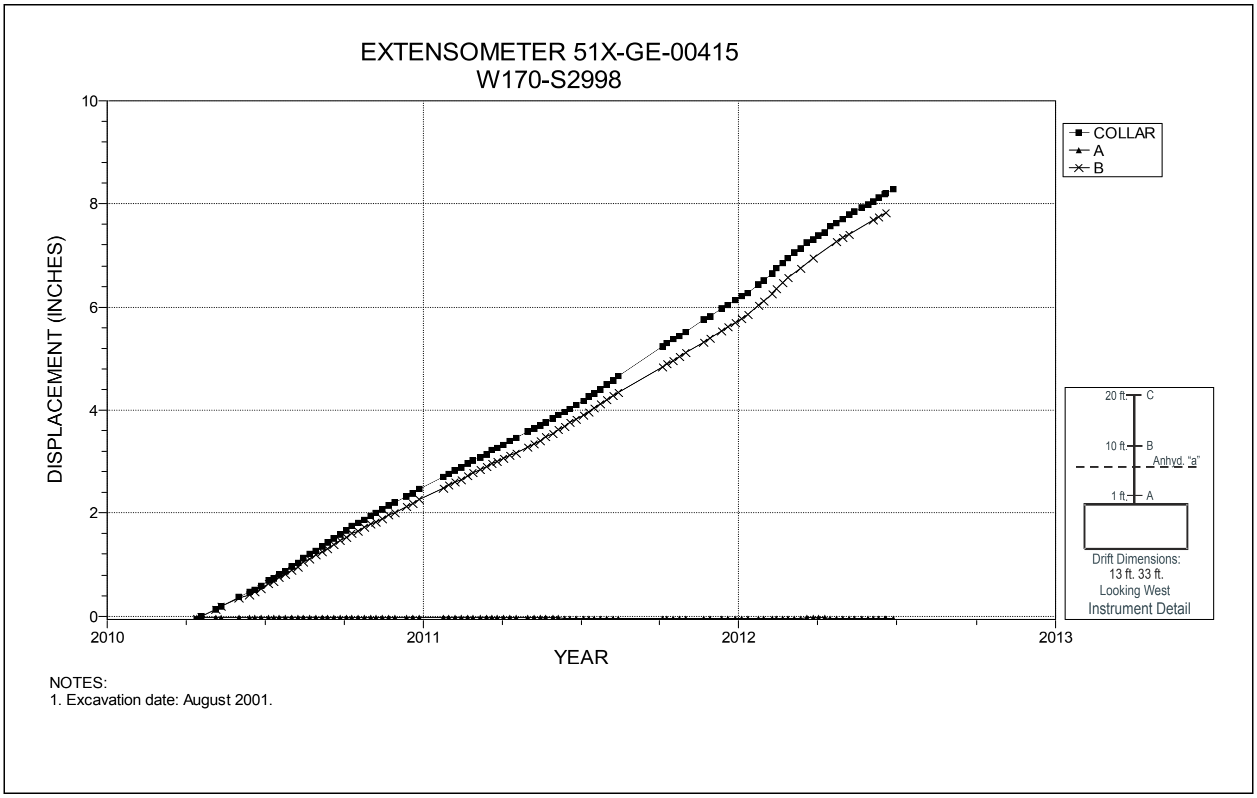


Figure 4-33 Extensometer 51X-GE-00415
W170 S2998 – Roof

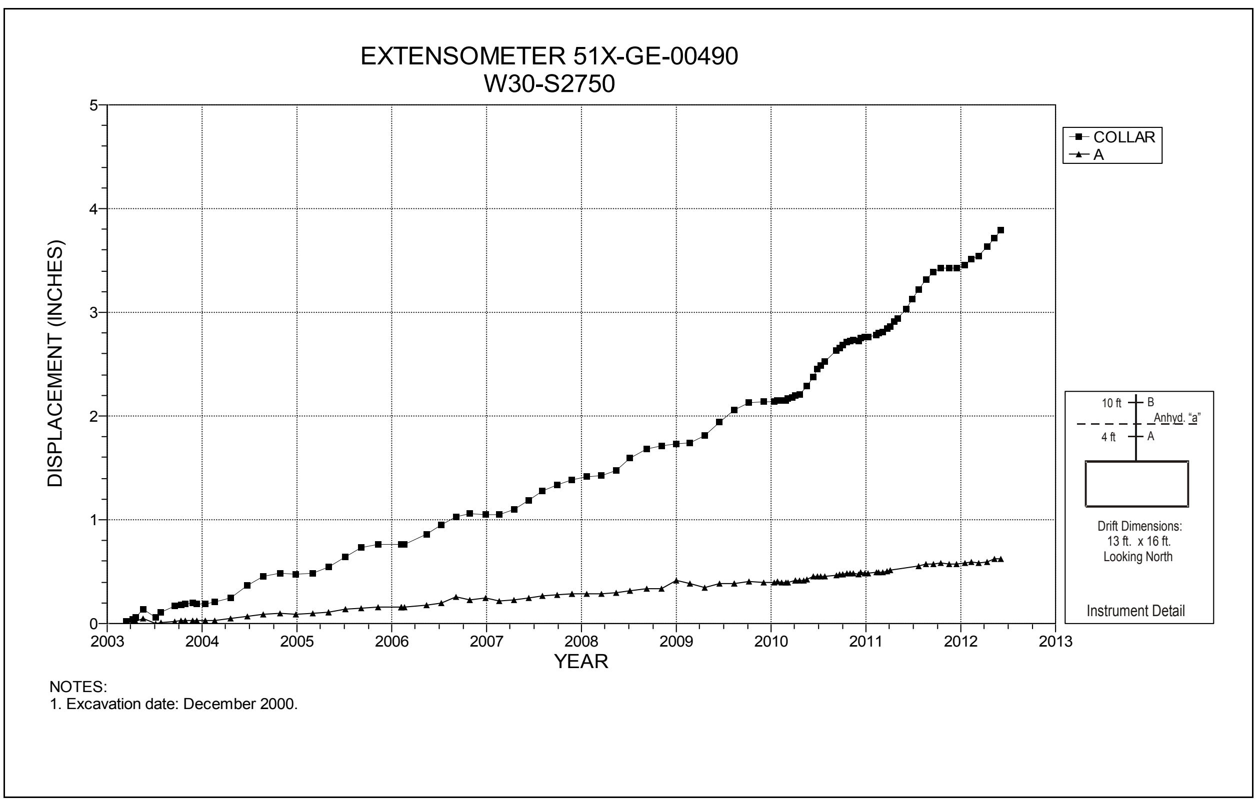


Figure 4-34 Extensometer 51X-GE-00490
W30 S2750 – Roof

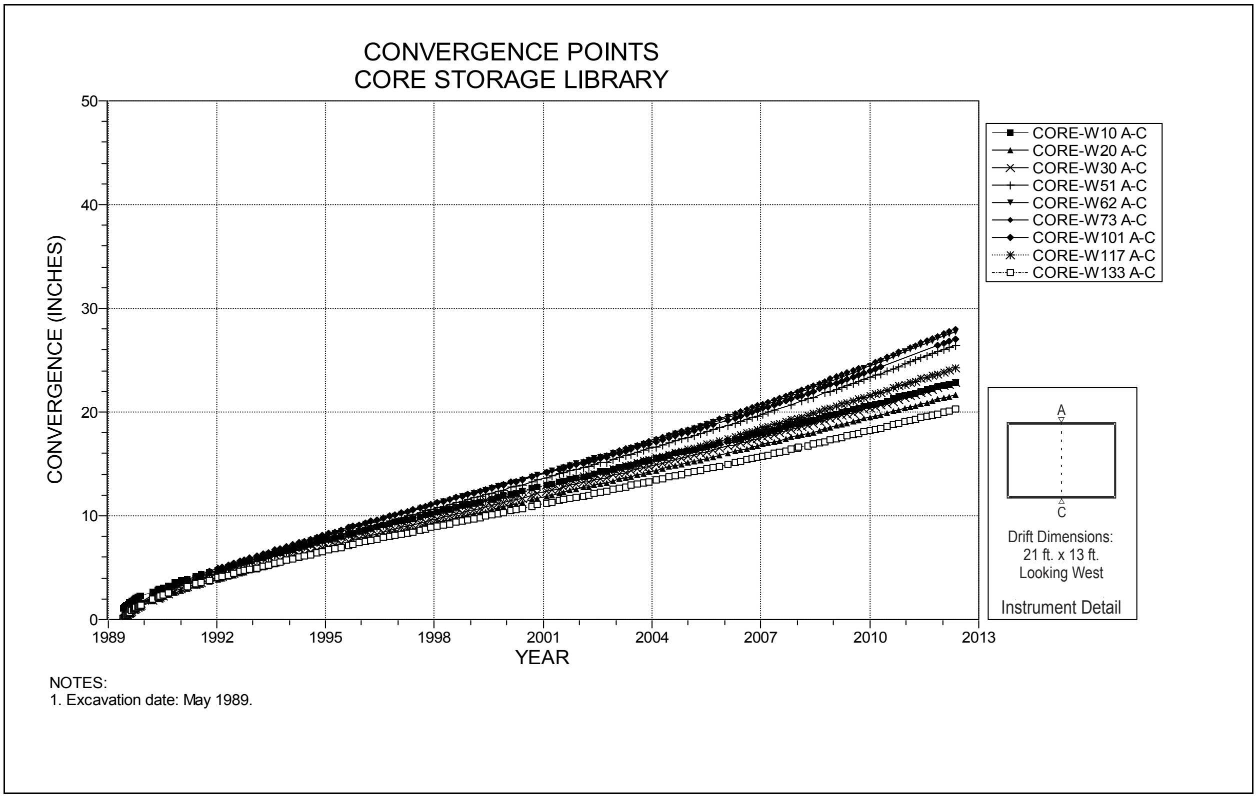


Figure 4-35 Convergence Point Array
Core Storage Library – Roof to Floor

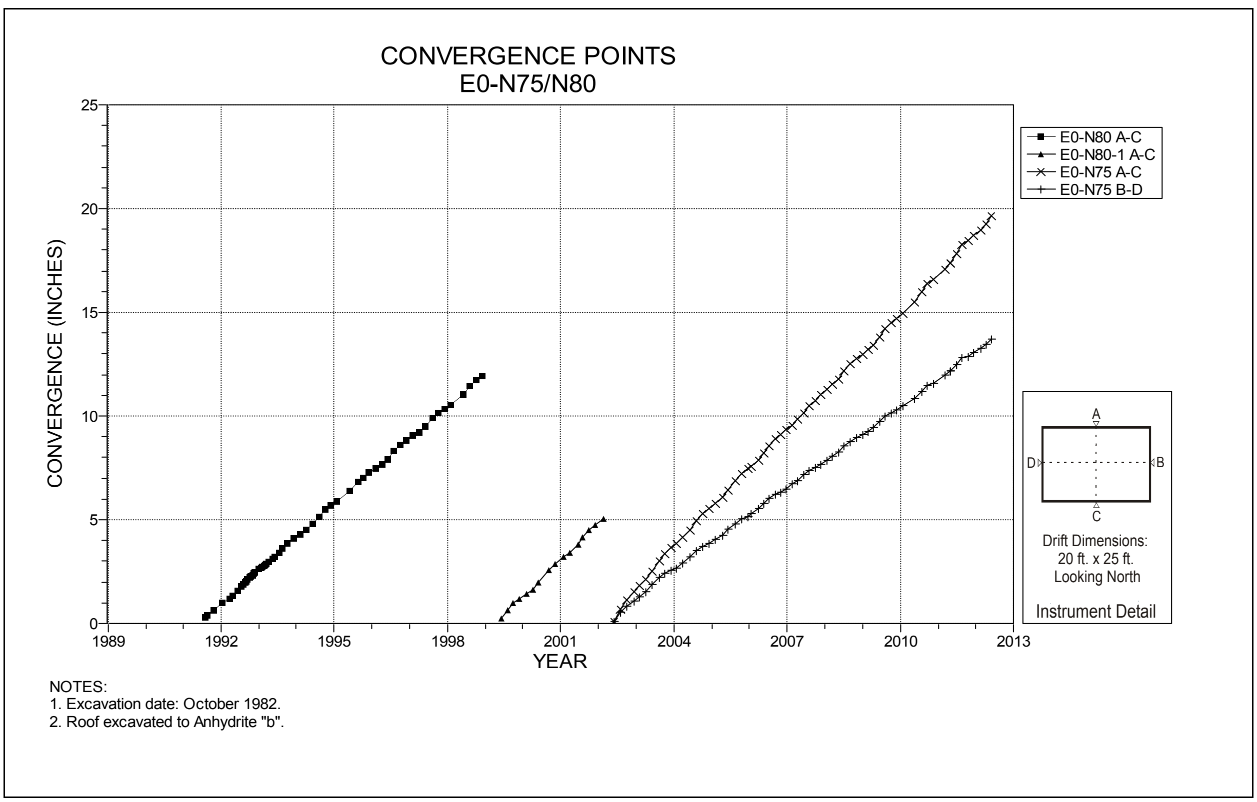


Figure 4-36 Convergence Point Array
E0 N75/N80 – All Chords

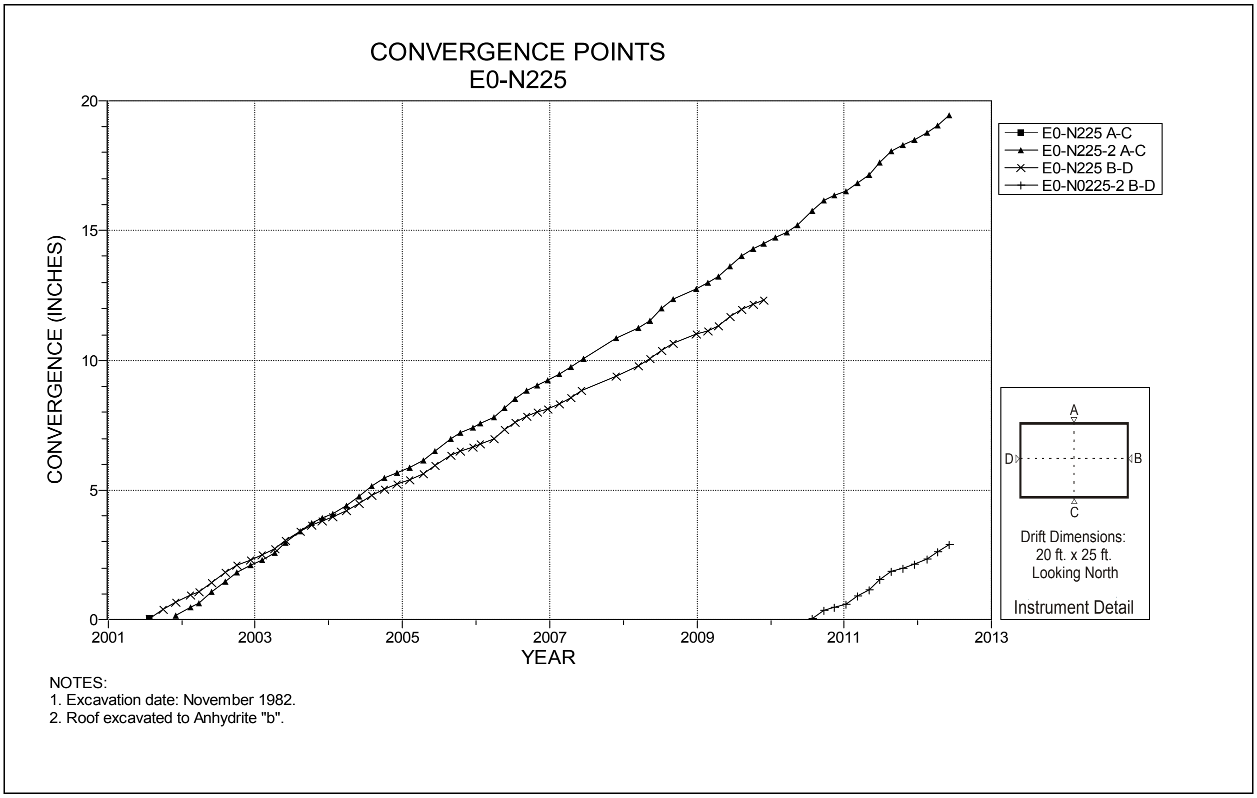


Figure 4-37 Convergence Point Array
E0 N225 – All Chords

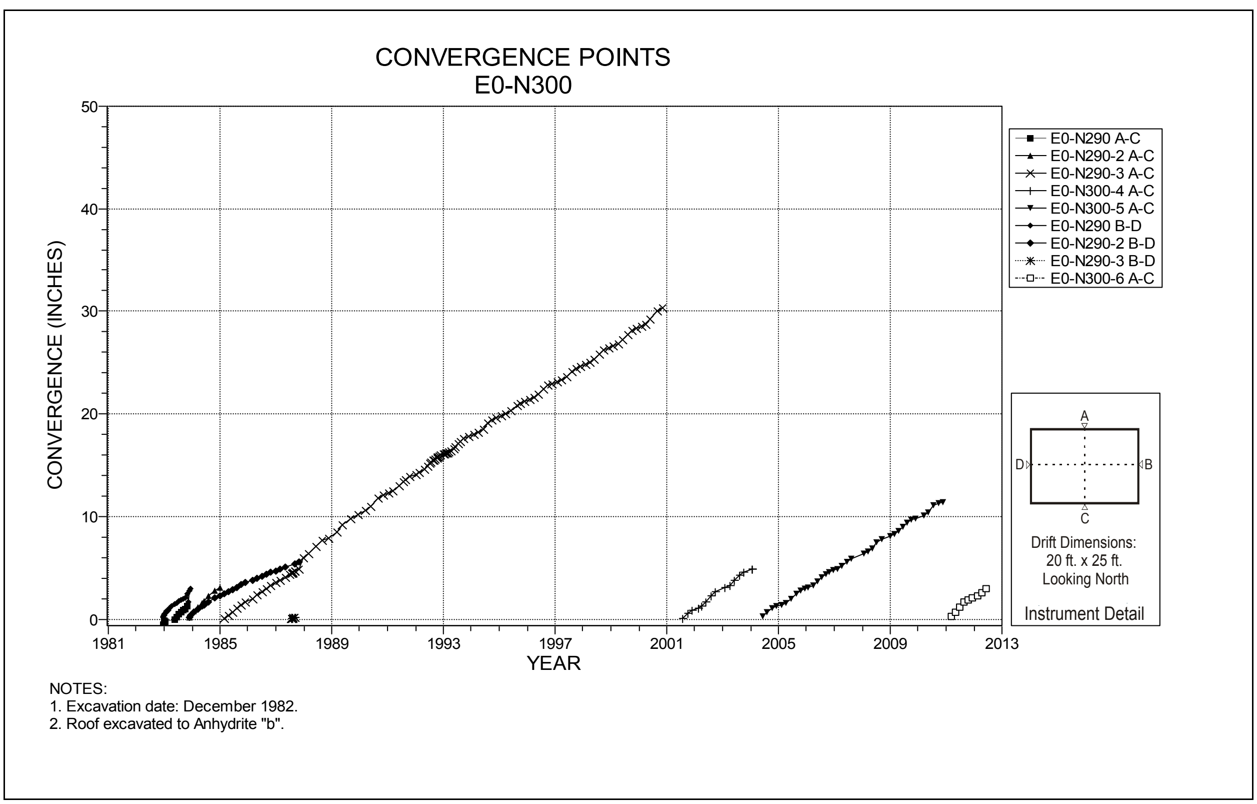


Figure 4-38 Convergence Point Array
E0 N300 – All Chords

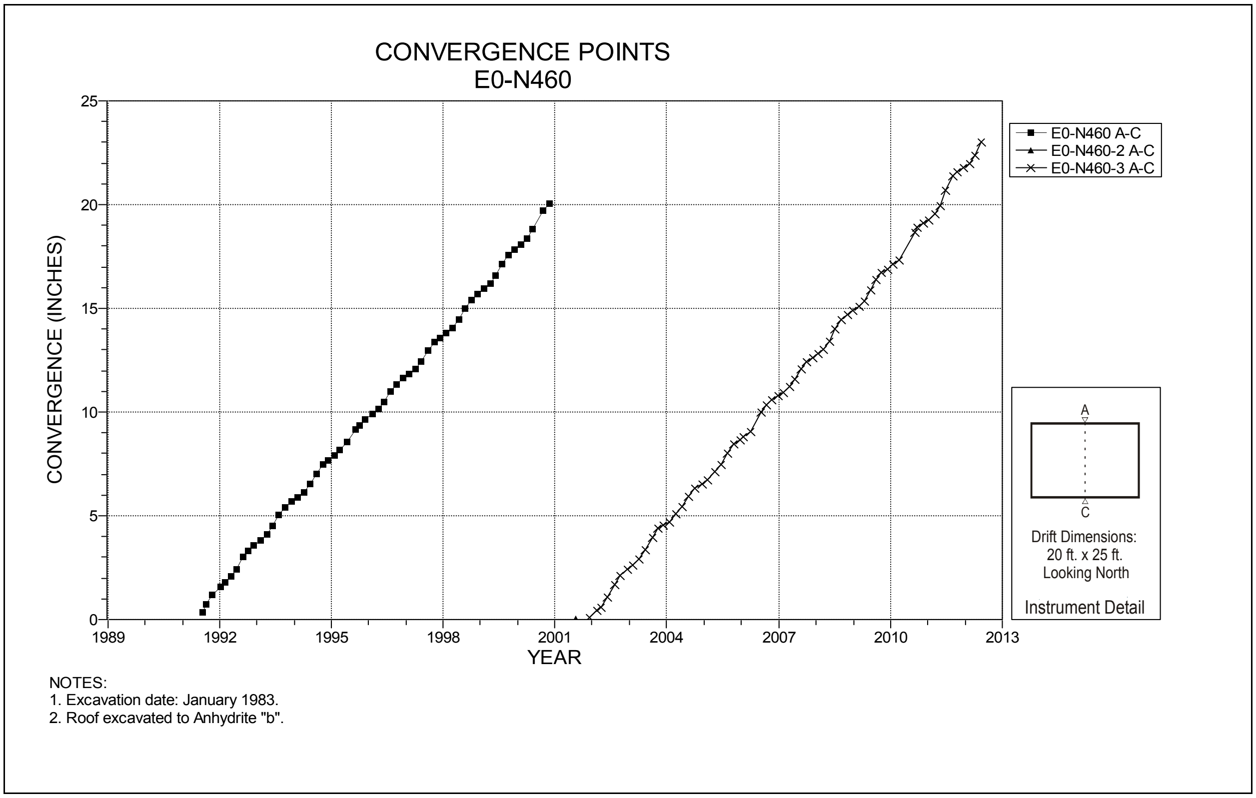


Figure 4-39 Convergence Point Array
E0 N460 – Roof to Floor

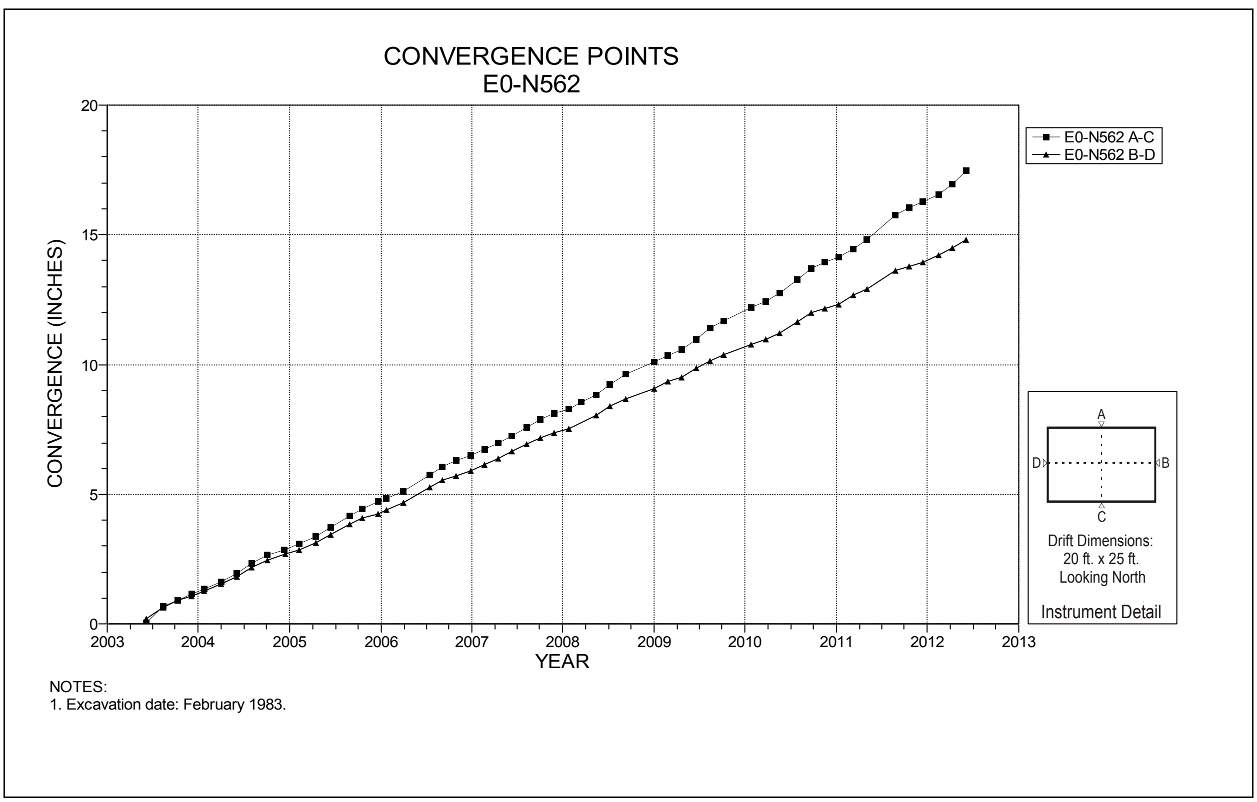


Figure 4-40 Convergence Point Array
E0 N562 – All Chords

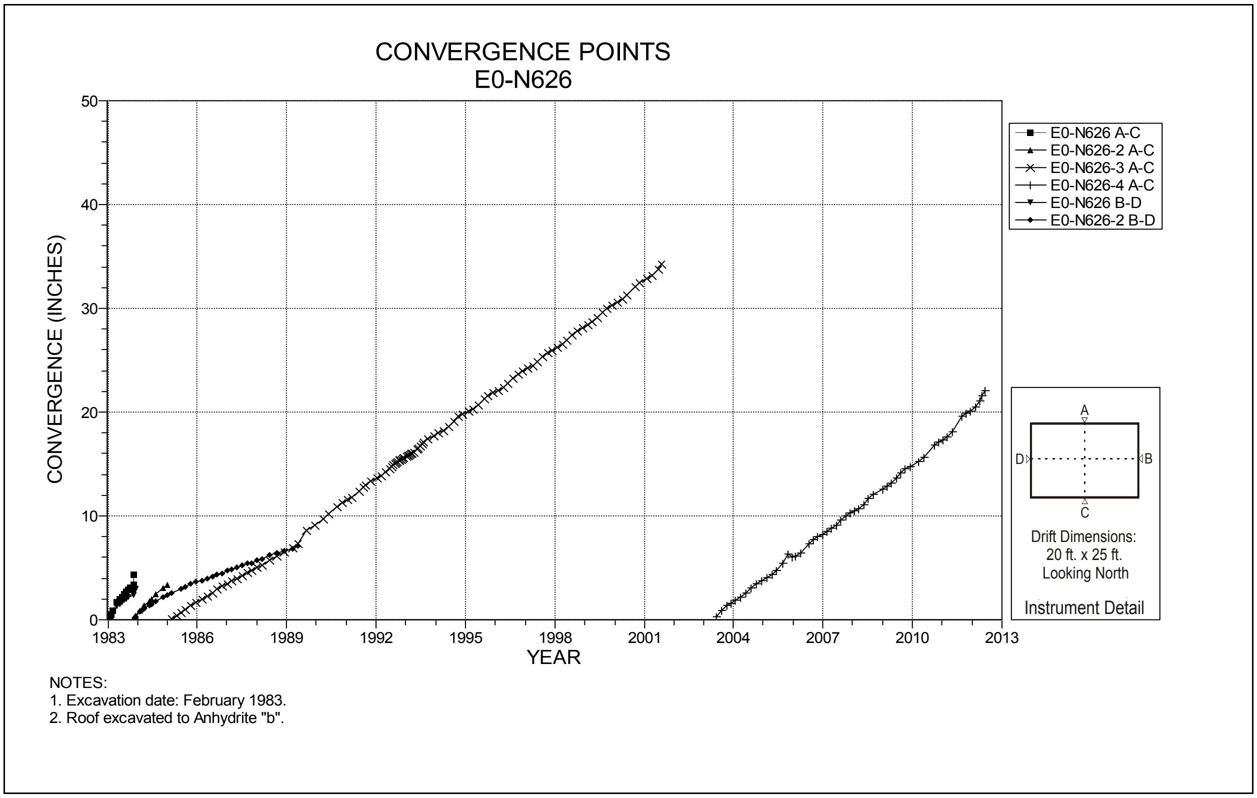


Figure 4-41 Convergence Point Array
E0 N626 – All Chords

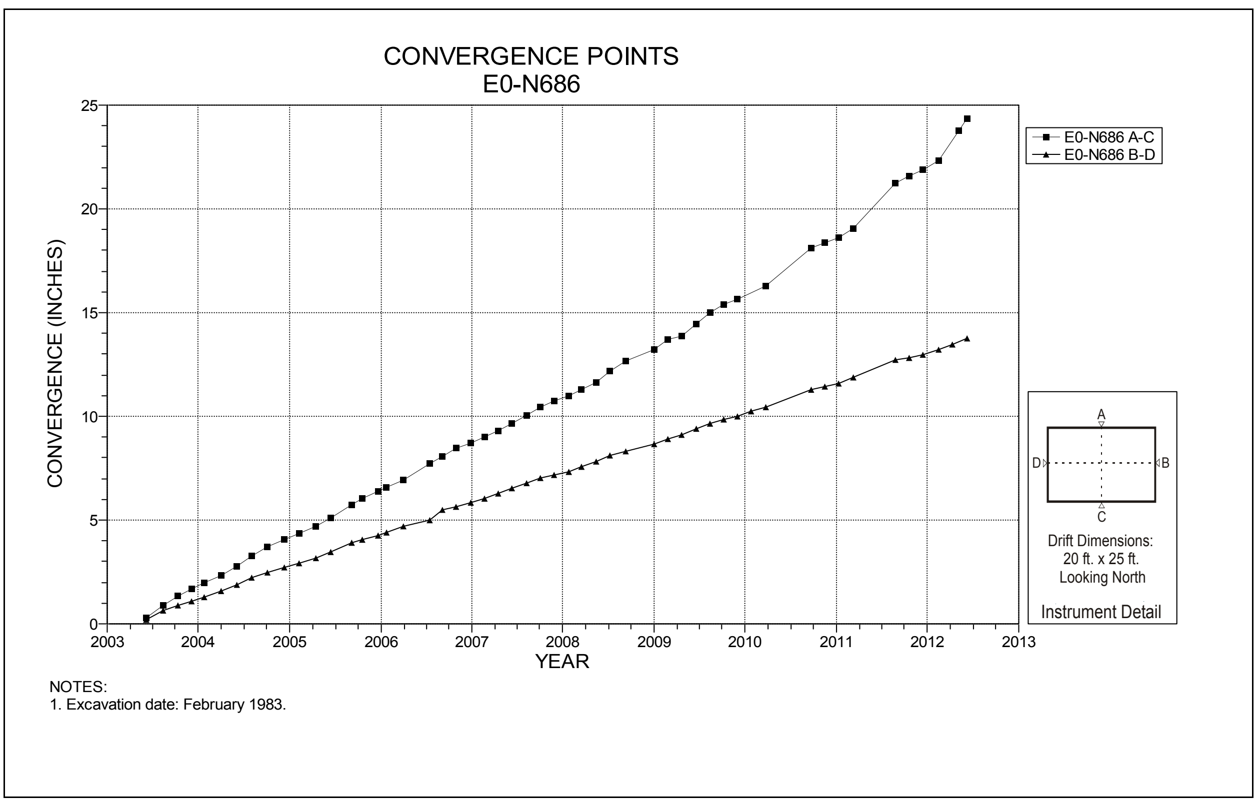


Figure 4-42 Convergence Point Array
E0 N686 – All Chords

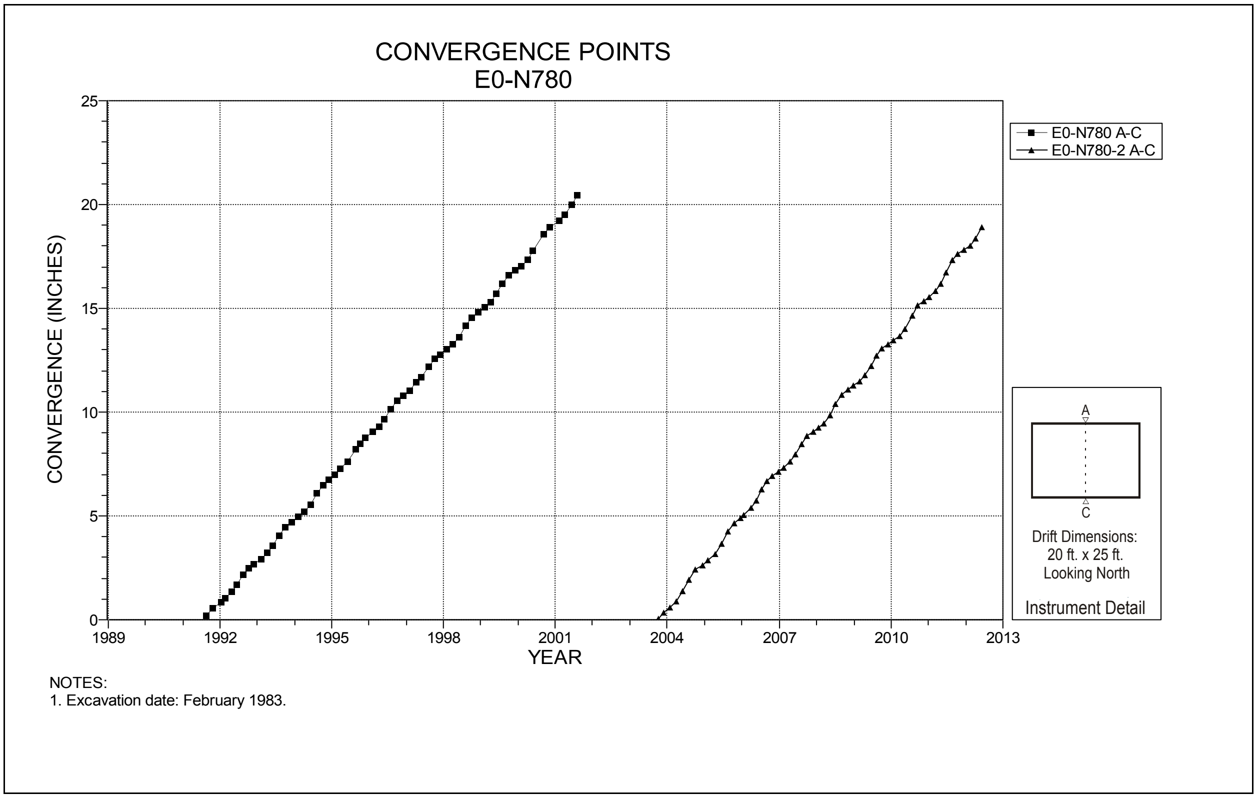


Figure 4-43 Convergence Point Array
E0 N780 – Roof to Floor

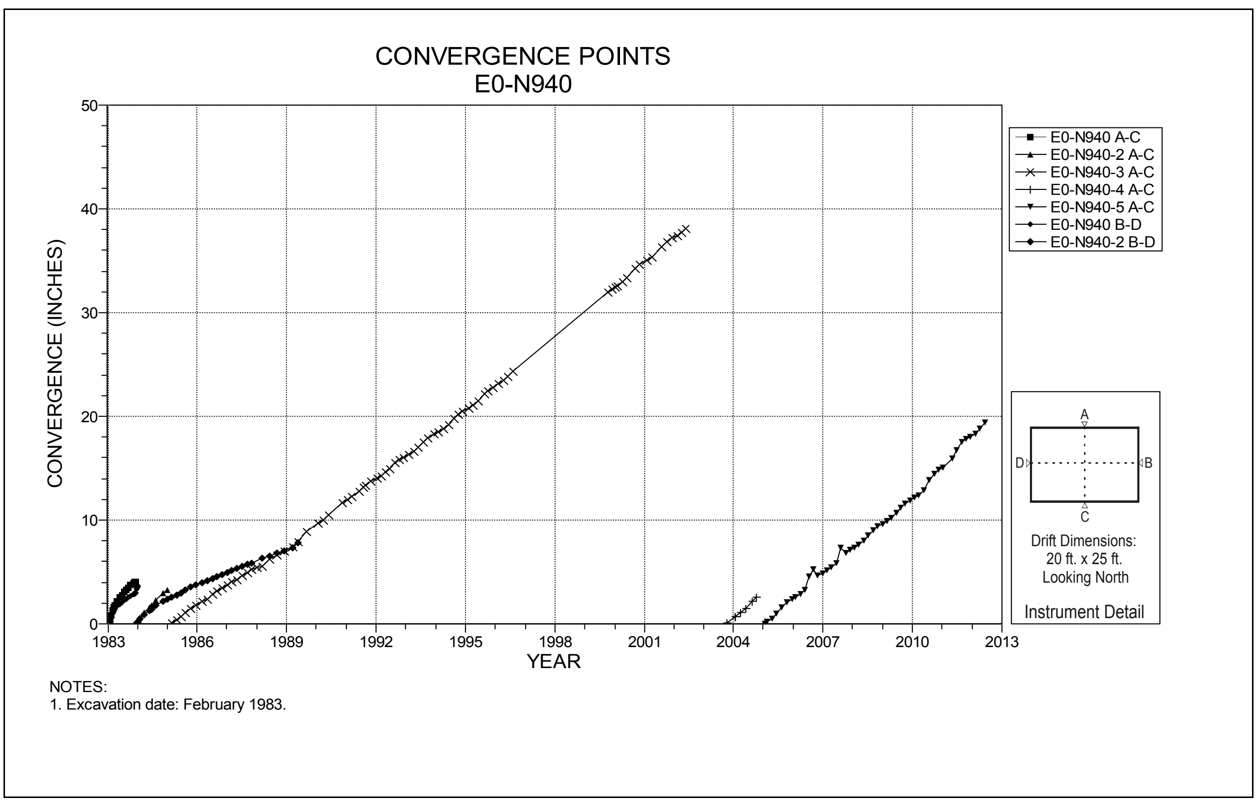


Figure 4-44 Convergence Point Array
E0 N940 – All Chords

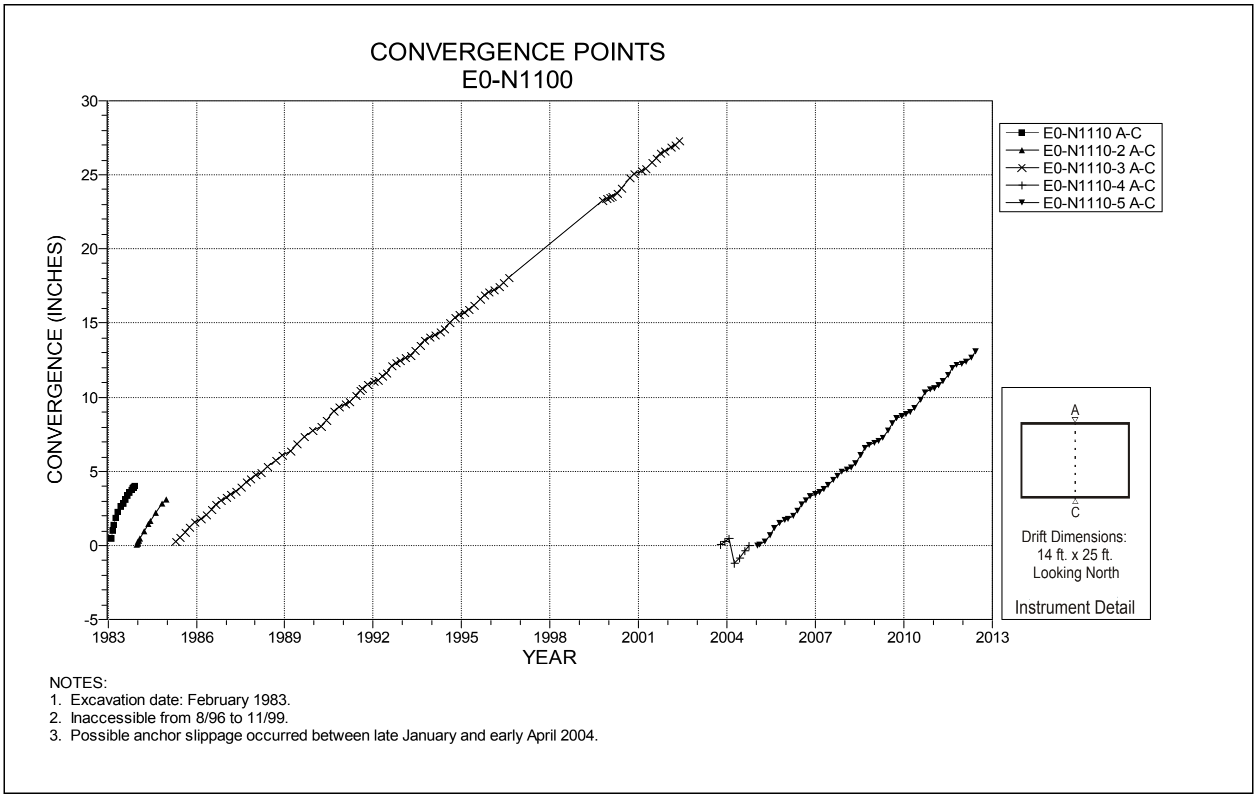


Figure 4-45 Convergence Point Array
E0 N1100 – Roof to Floor

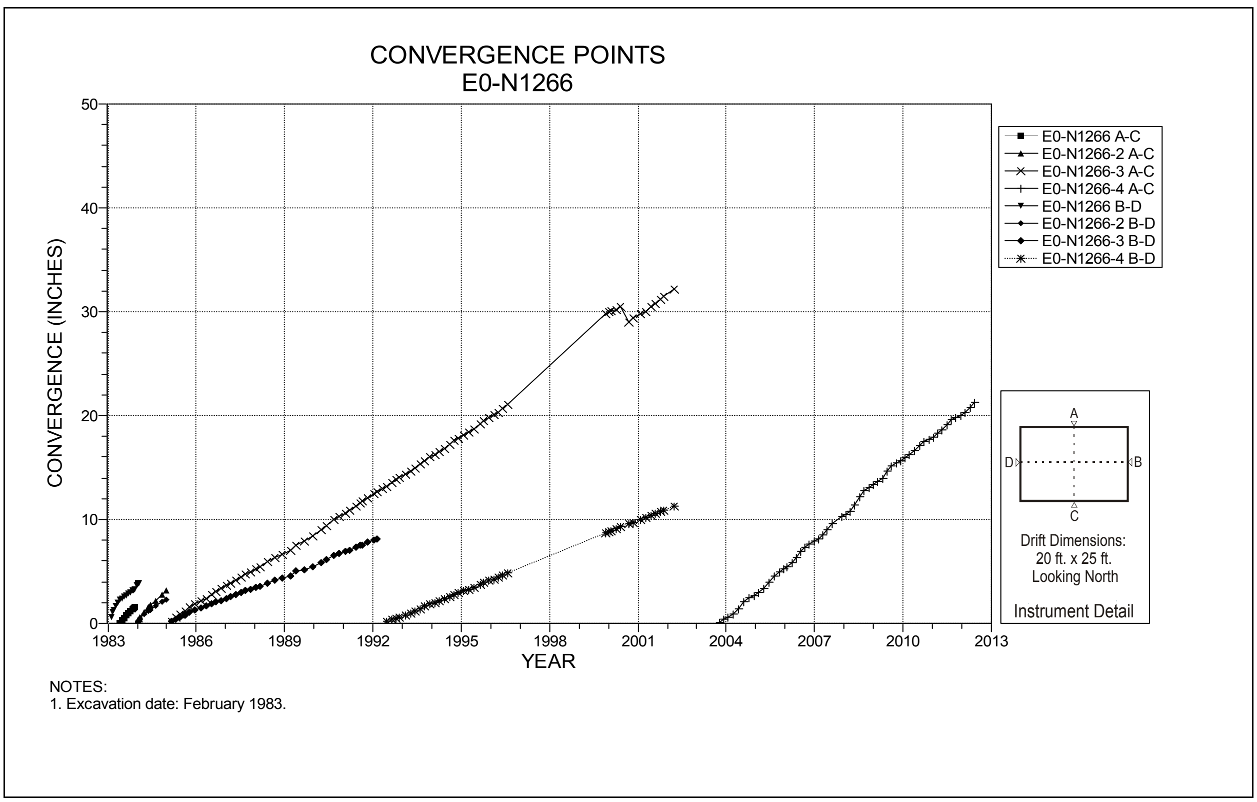


Figure 4-46 Convergence Point Array
E0 N1266 – Roof to Floor

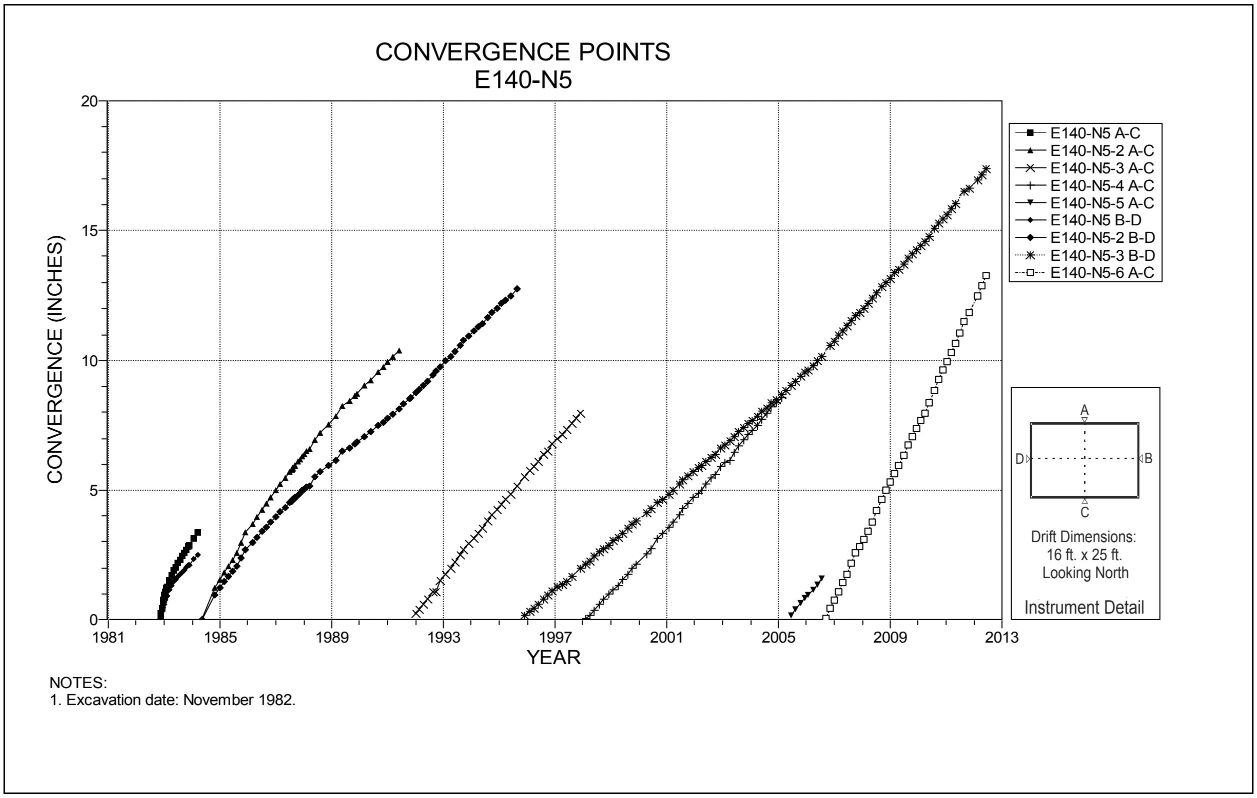


Figure 4-47 Convergence Point Array
E140 N5 – All Chords

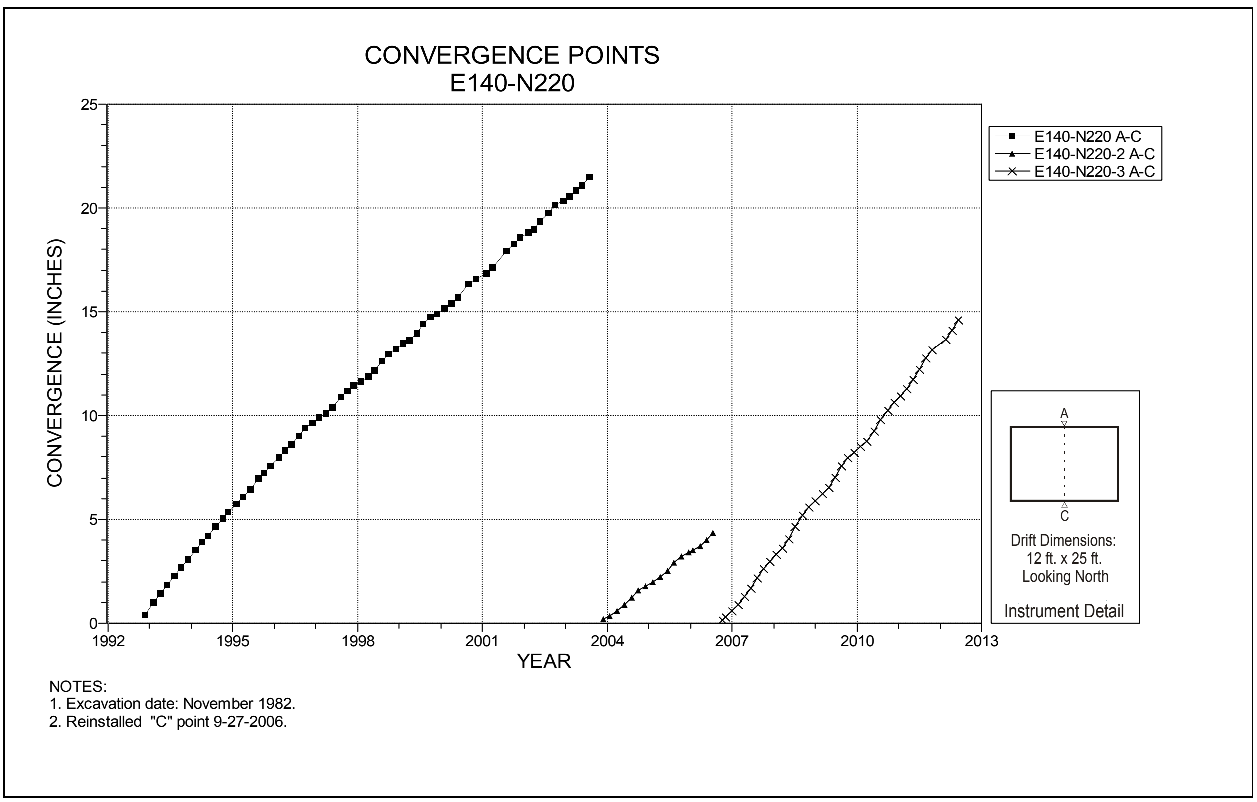


Figure 4-48 Convergence Point Array
E140 N220 – Roof to Floor

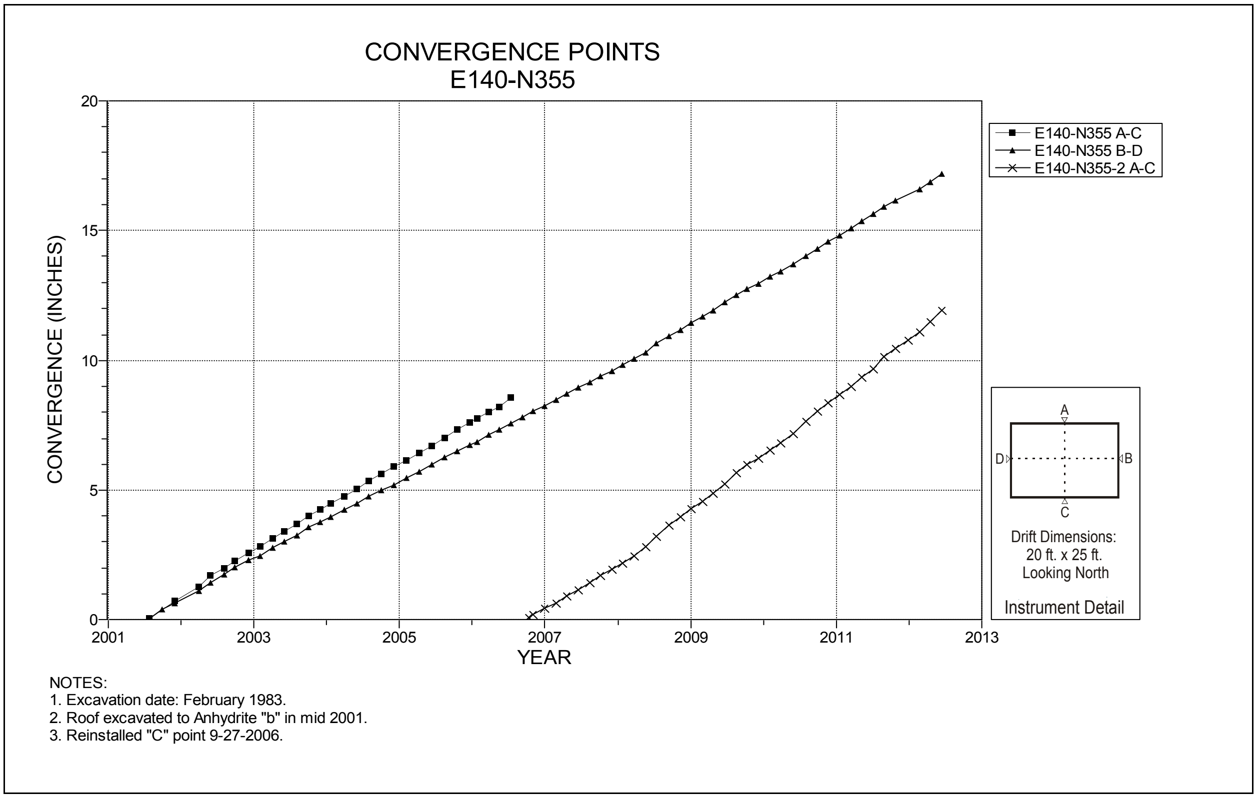


Figure 4-49 Convergence Point Array
E140 N355 – All Chords

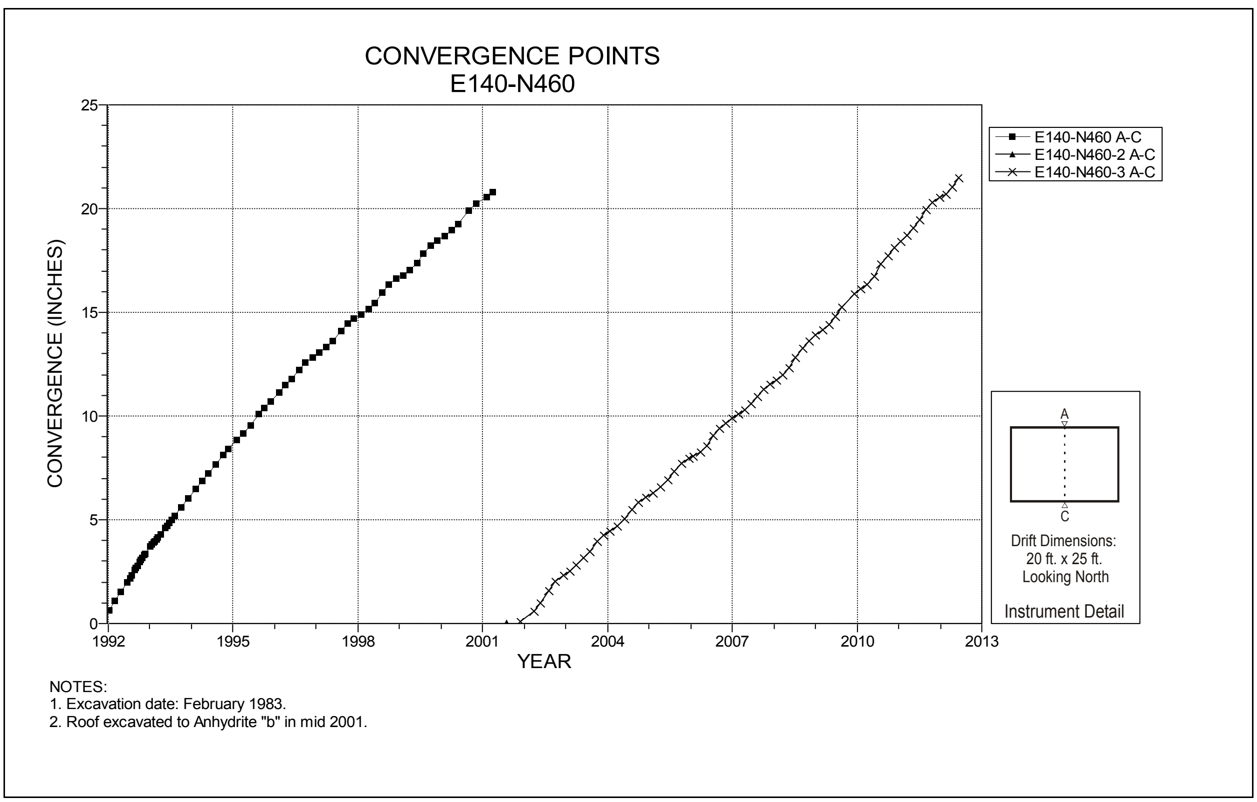


Figure 4-50 Convergence Point Array
E140 N460 – Roof to Floor

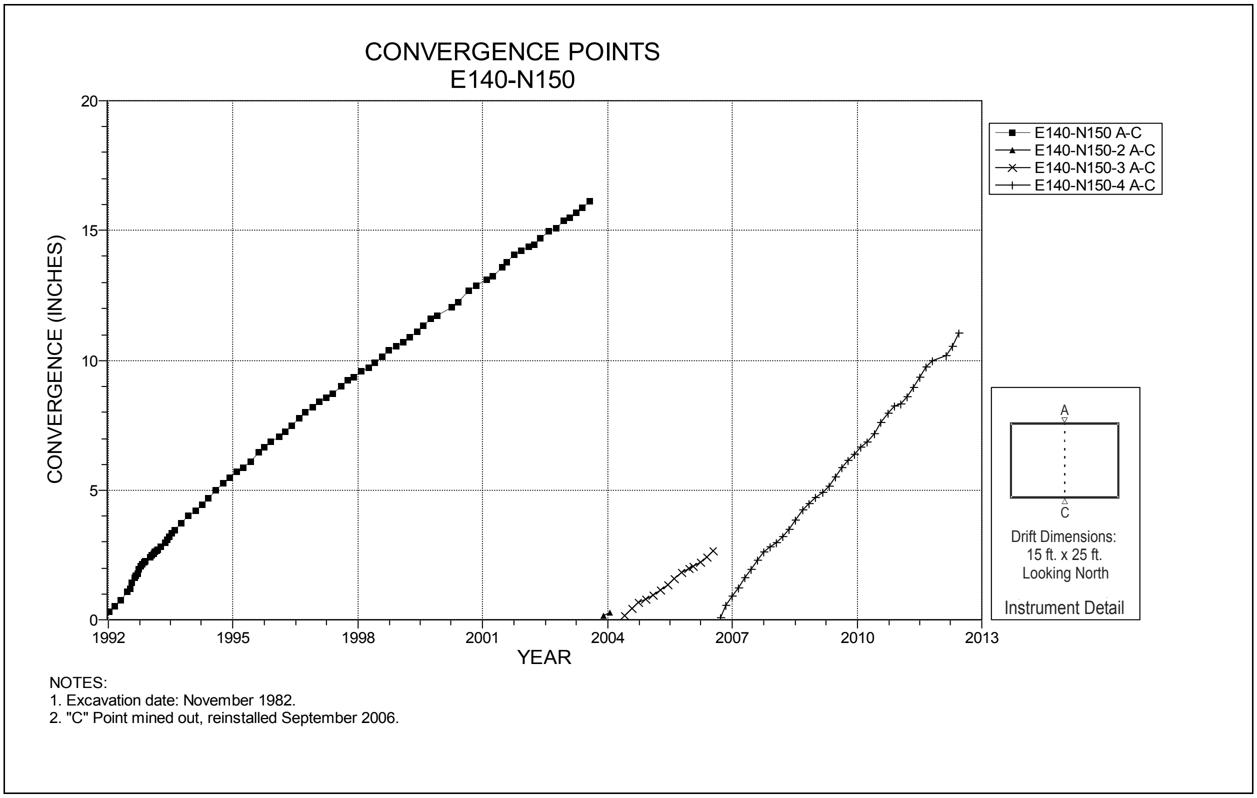


Figure 4-51 Convergence Point Array
E140 N150 – Roof to Floor

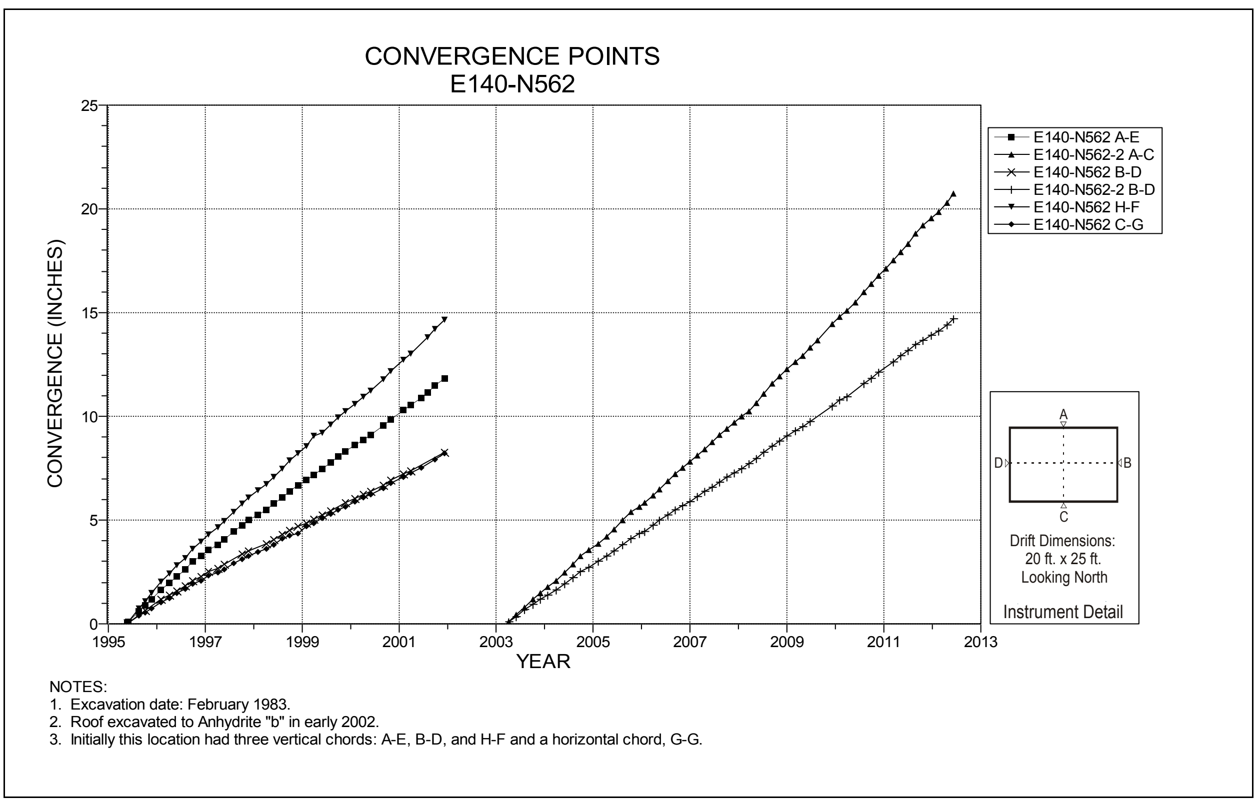


Figure 4-52 Convergence Point Array
E140 N562 – All Chords

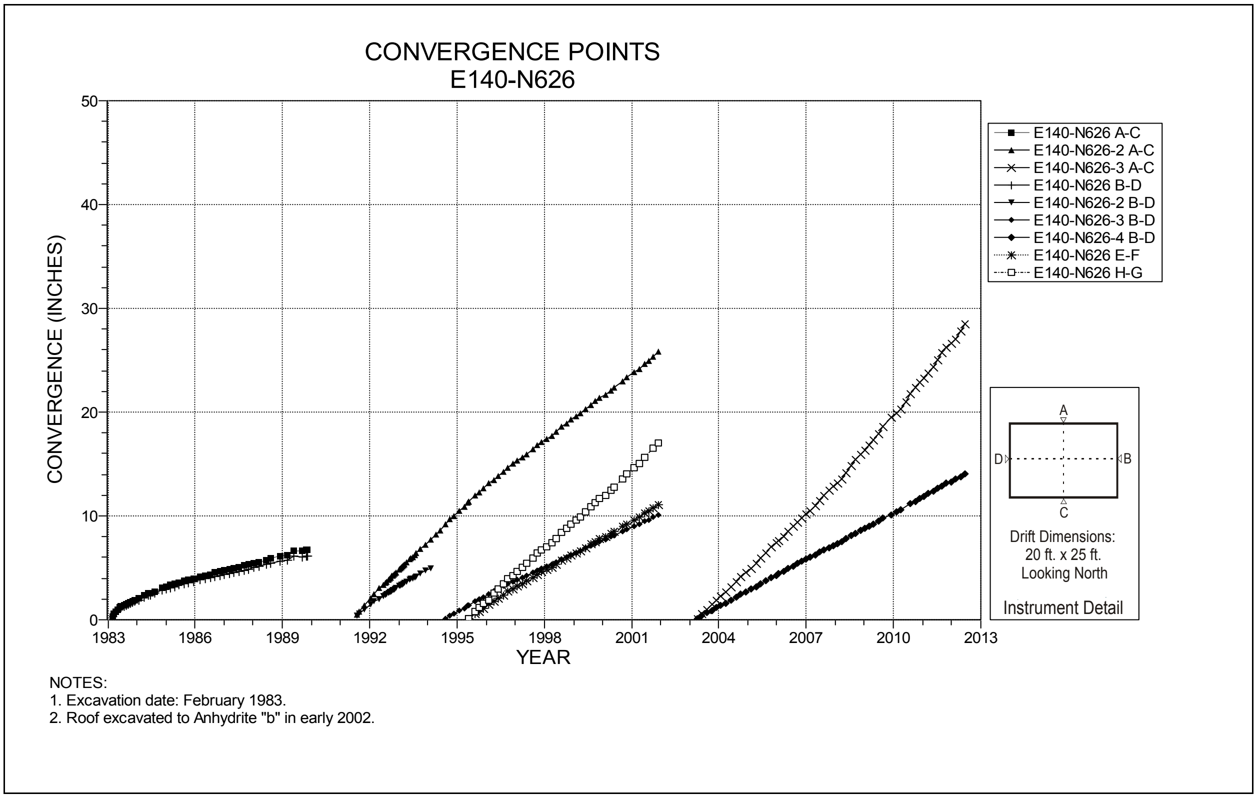


Figure 4-53 Convergence Point Array
E140 N626 – All Chords

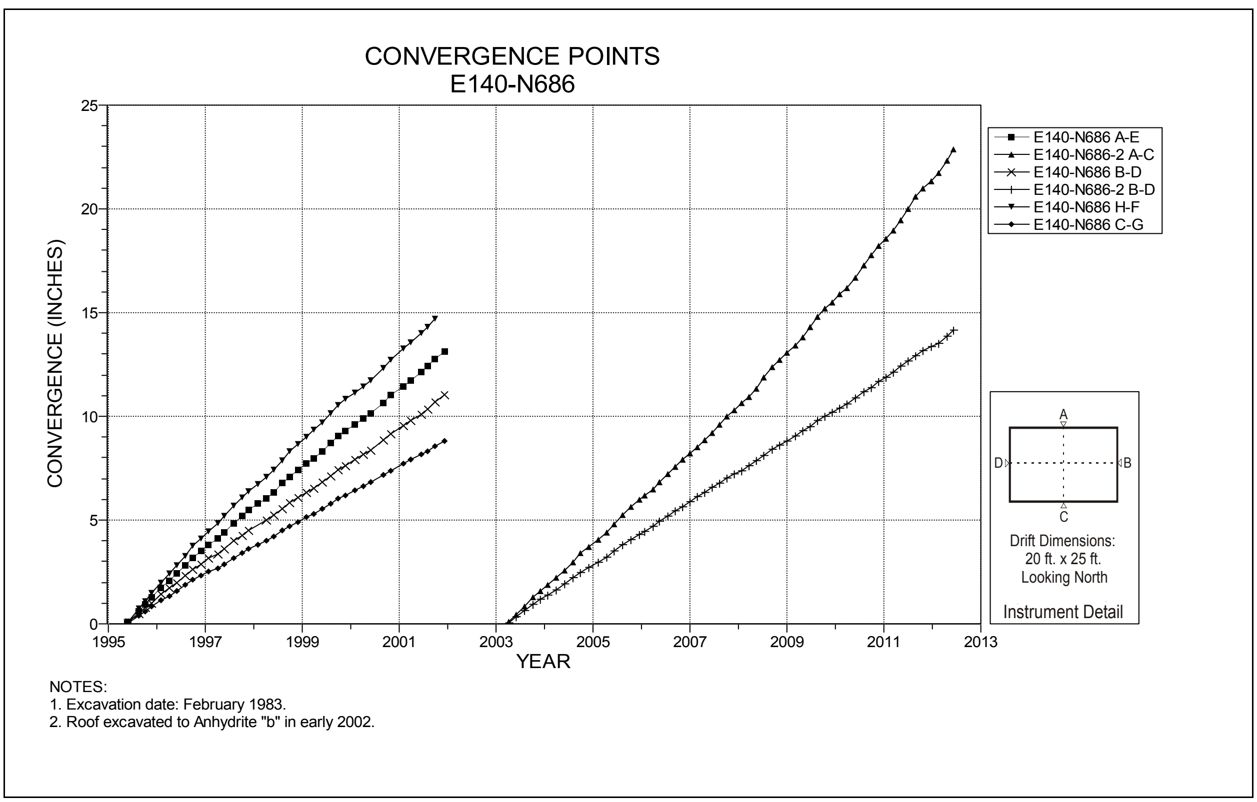


Figure 4-54 Convergence Point Array
E140 N686 – All Chords

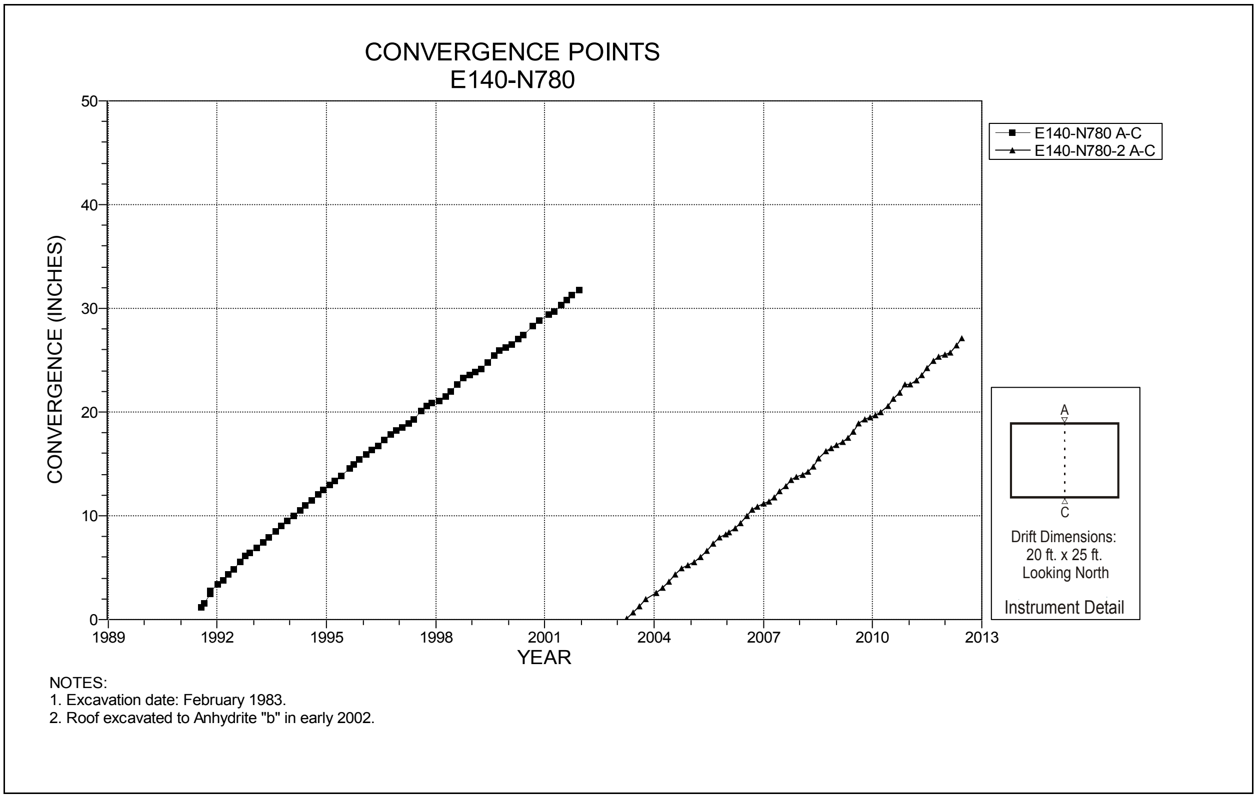


Figure 4-55 Convergence Point Array
E140 N780 – Roof to Floor

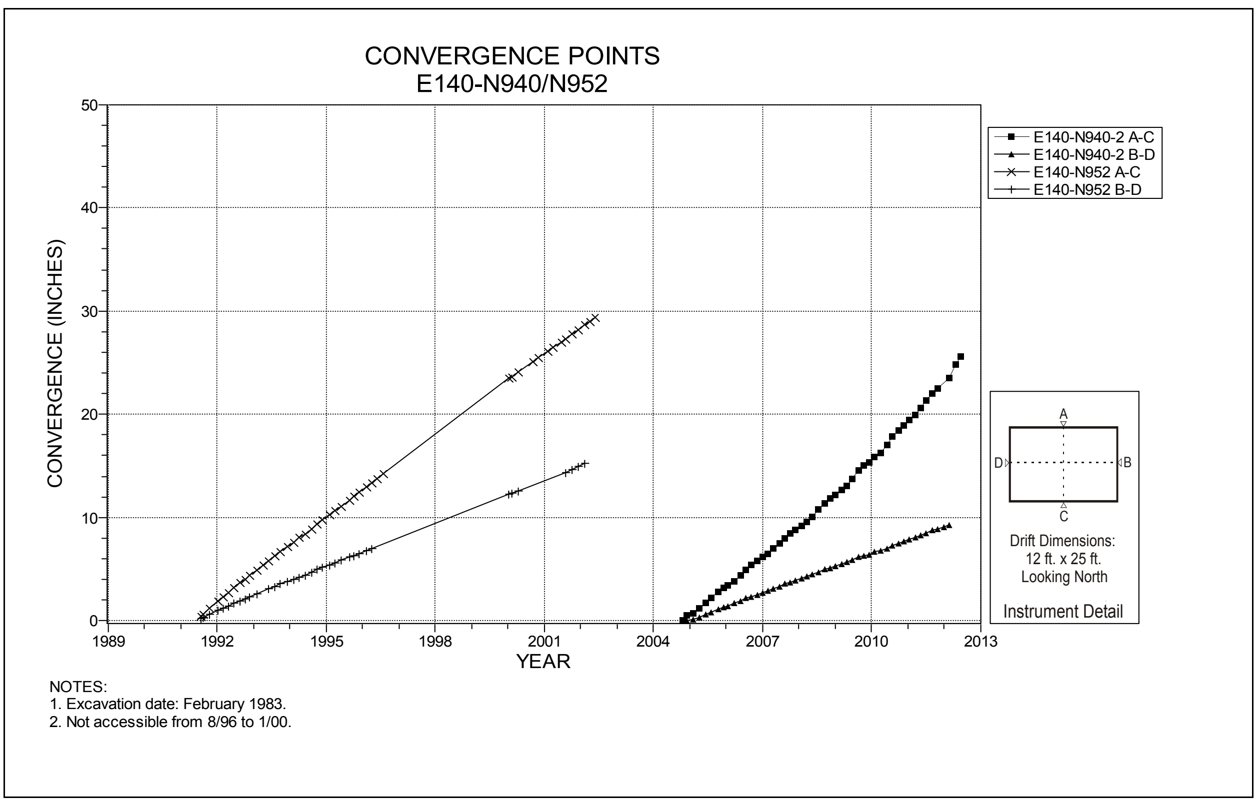


Figure 4-56 Convergence Point Array
E140 N940/N952 – All Chords

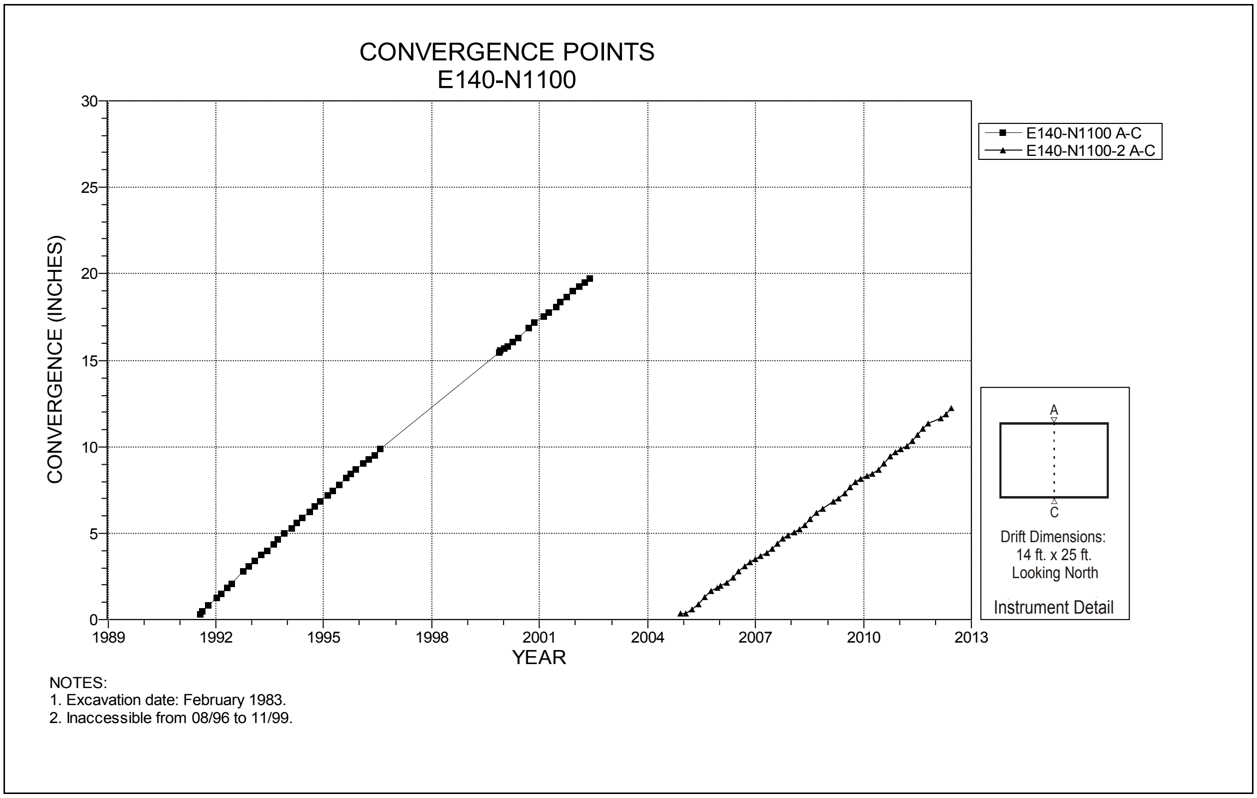


Figure 4-57 Convergence Point Array
E140 N1100 – Roof to Floor

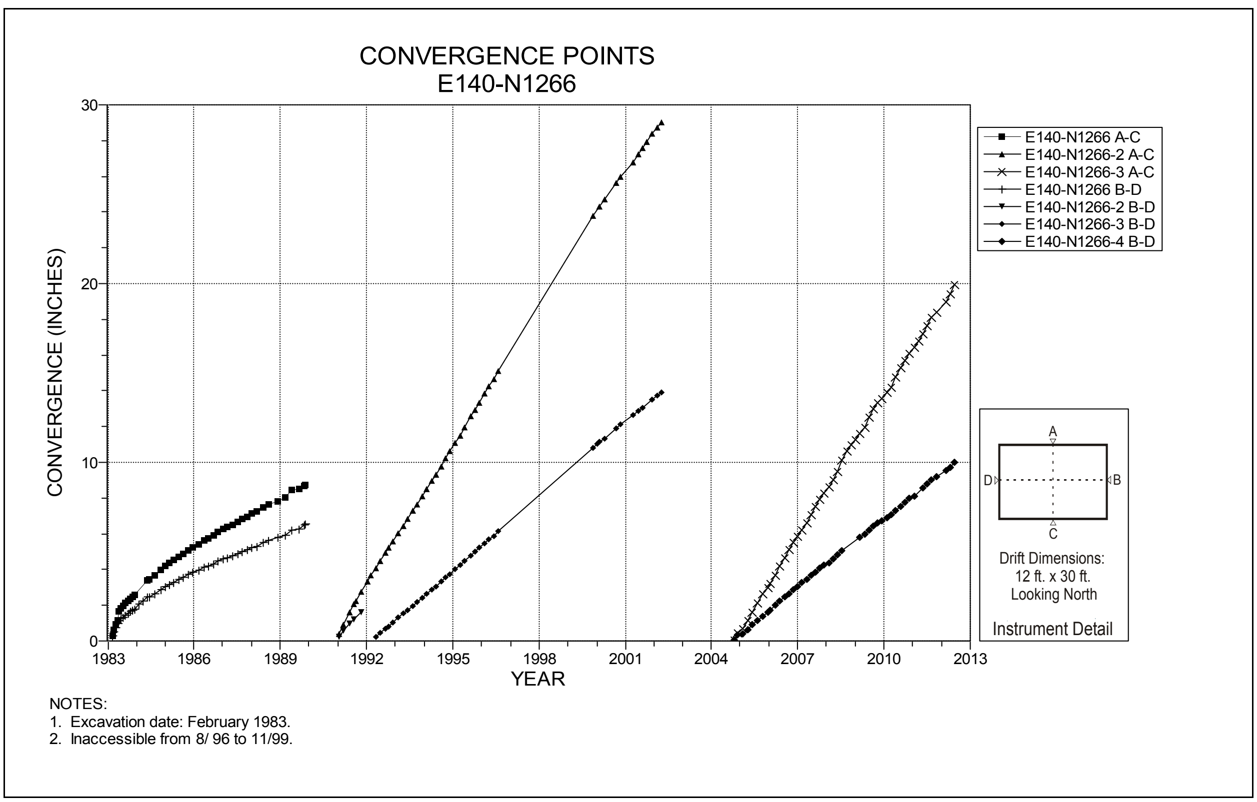
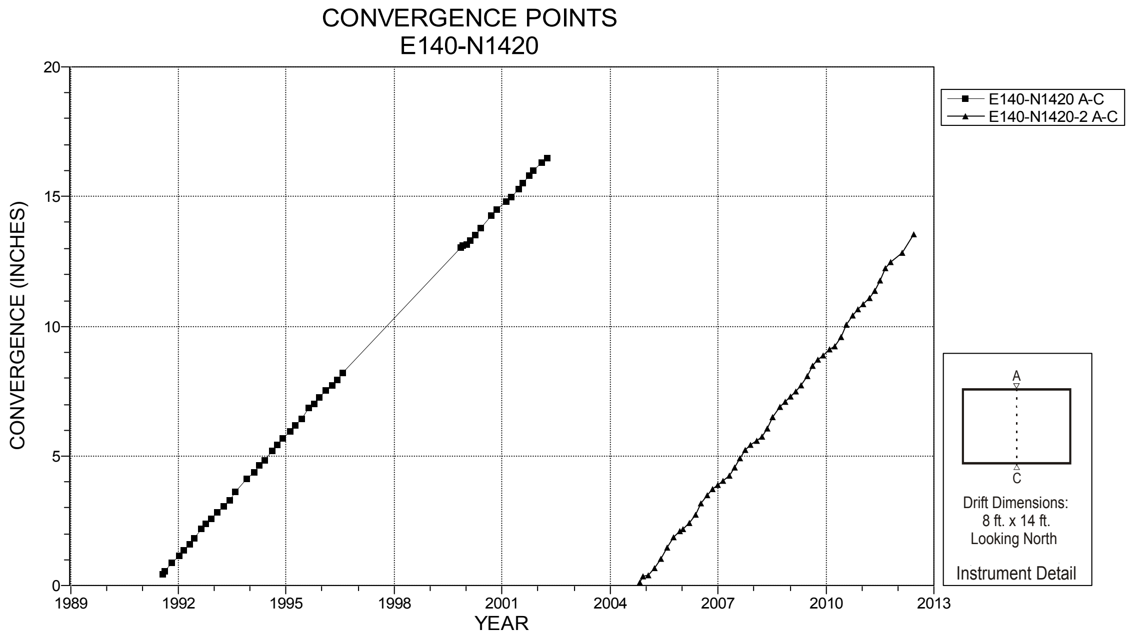
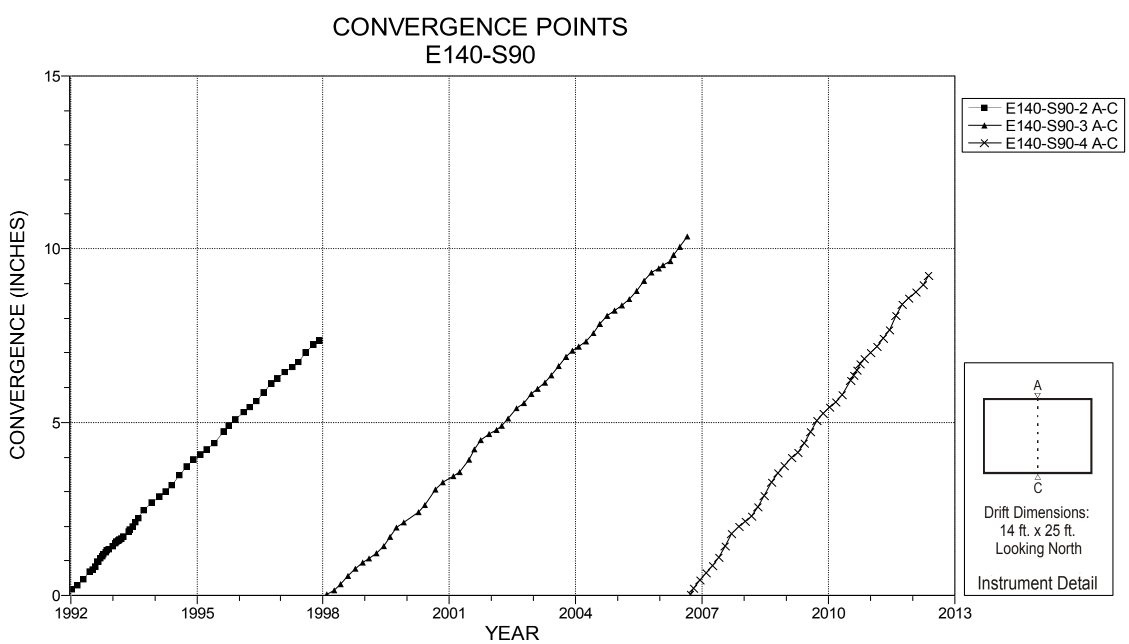


Figure 4-58 Convergence Point Array
E140 N1266 – All Chords



NOTES:
1. Excavation date: February 1983.
2. Inaccessible from August 1996 to November 1999.

Figure 4-59 Convergence Point Array
E140 N1420 – Roof to Floor



NOTES:
1. Excavation date: October 1982.
2. The original installation was never read beyond the inital reading.

Figure 4-60 Convergence Point Array
E140 S90 – Roof to Floor

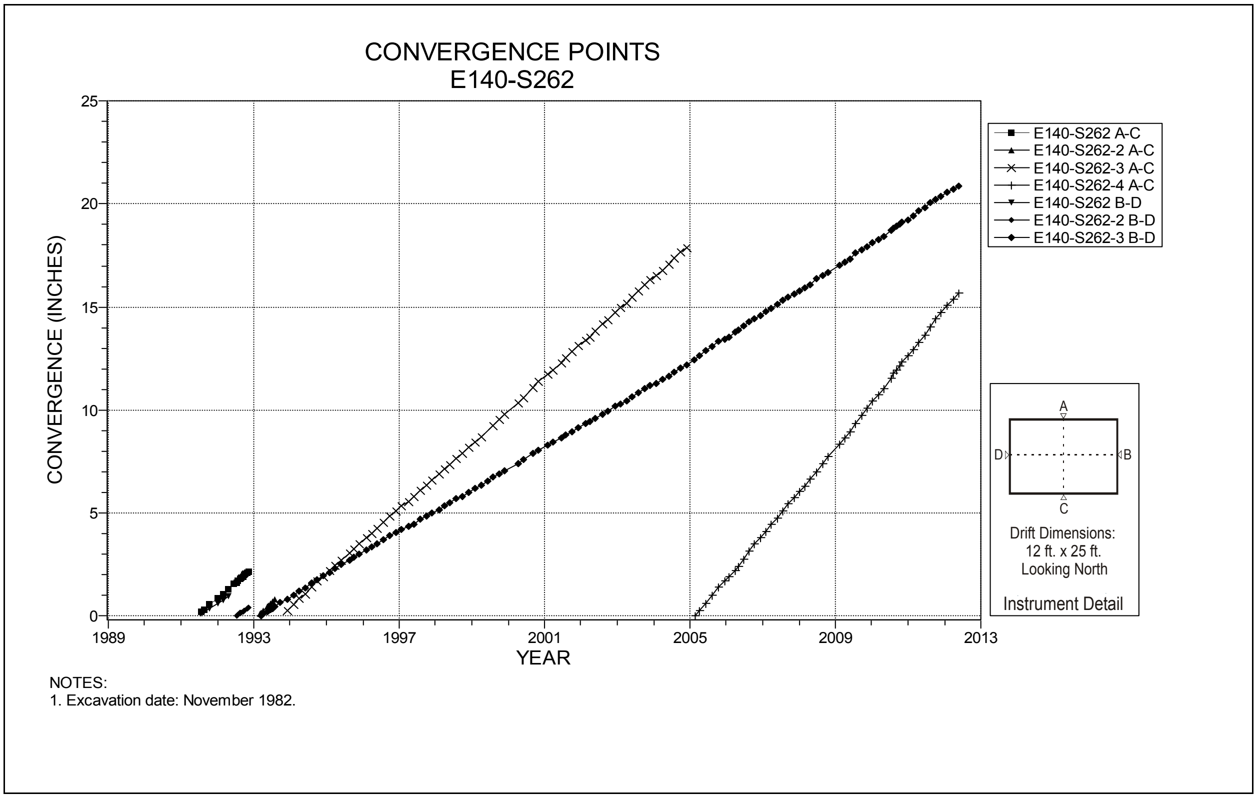


Figure 4-61 Convergence Point Array
E140 S262 – All Chords

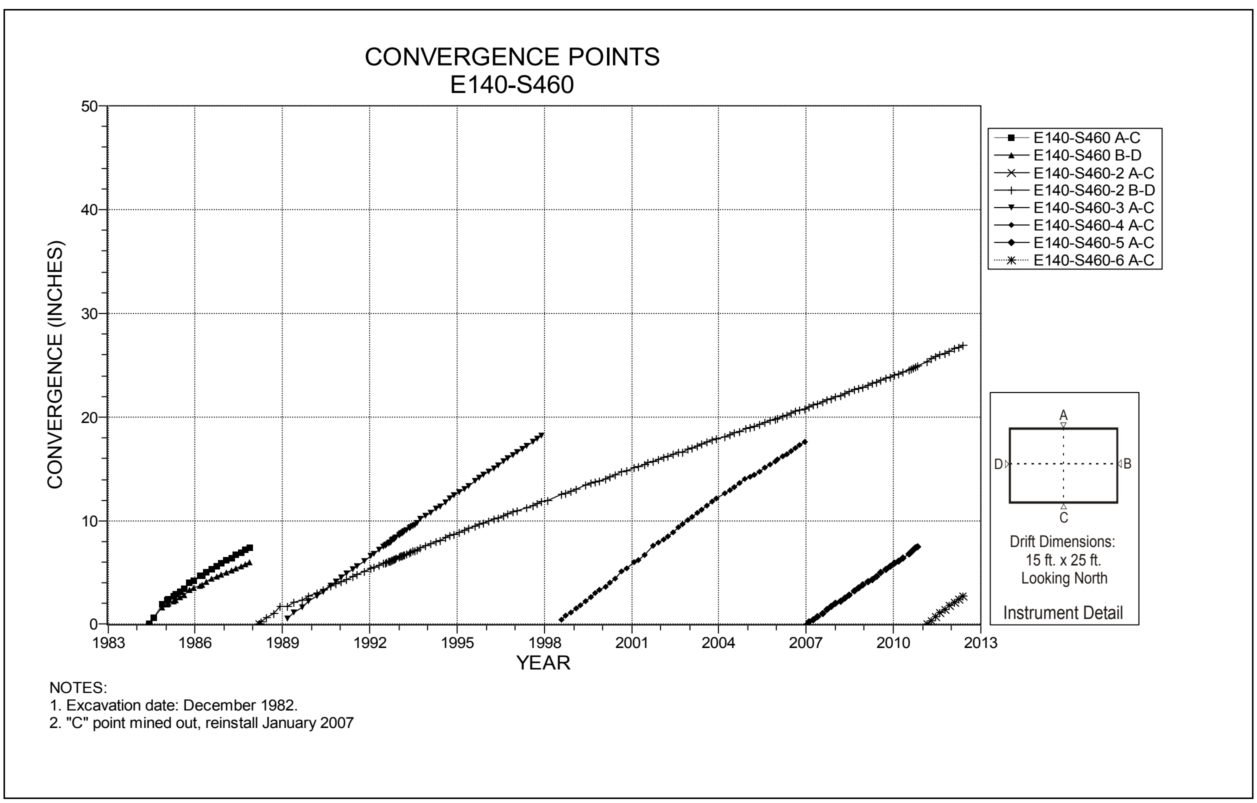


Figure 4-62 Convergence Point Array
E140 S460 – All Chords

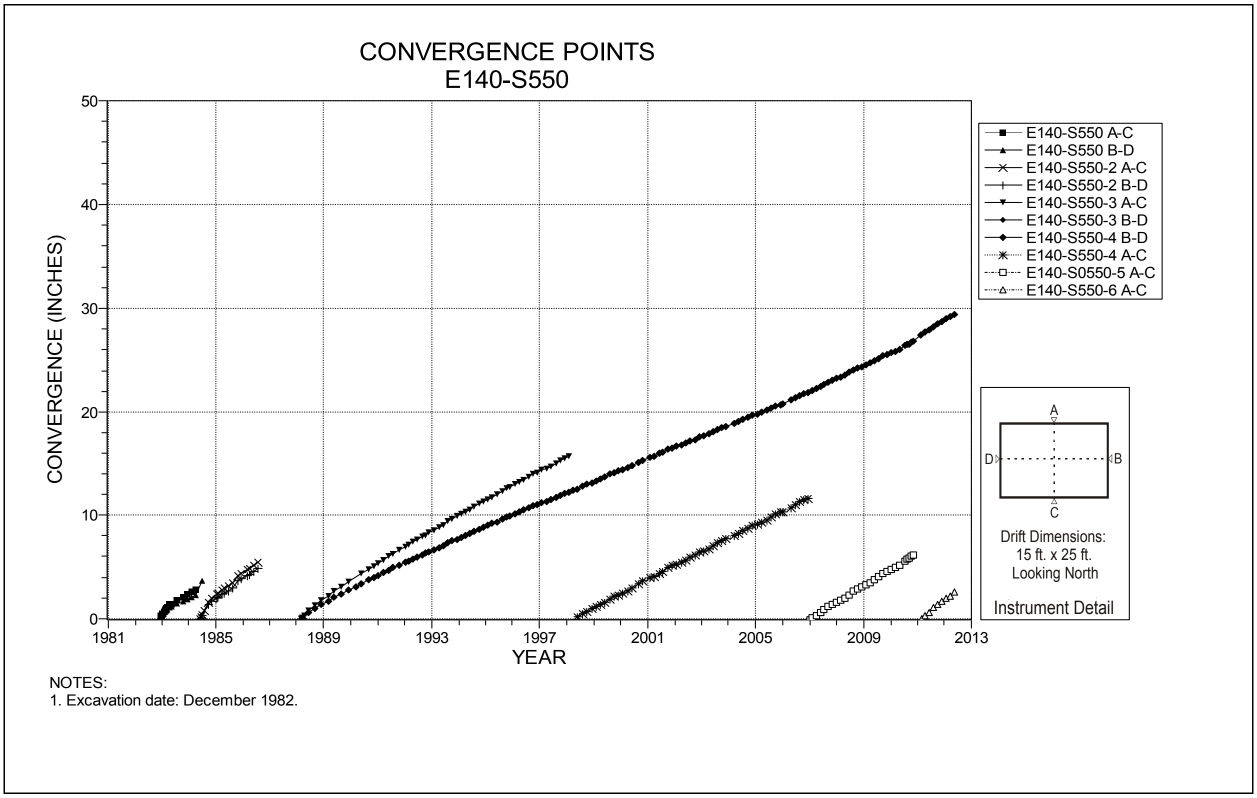


Figure 4-63 Convergence Point Array
E140 S550 – All Chords

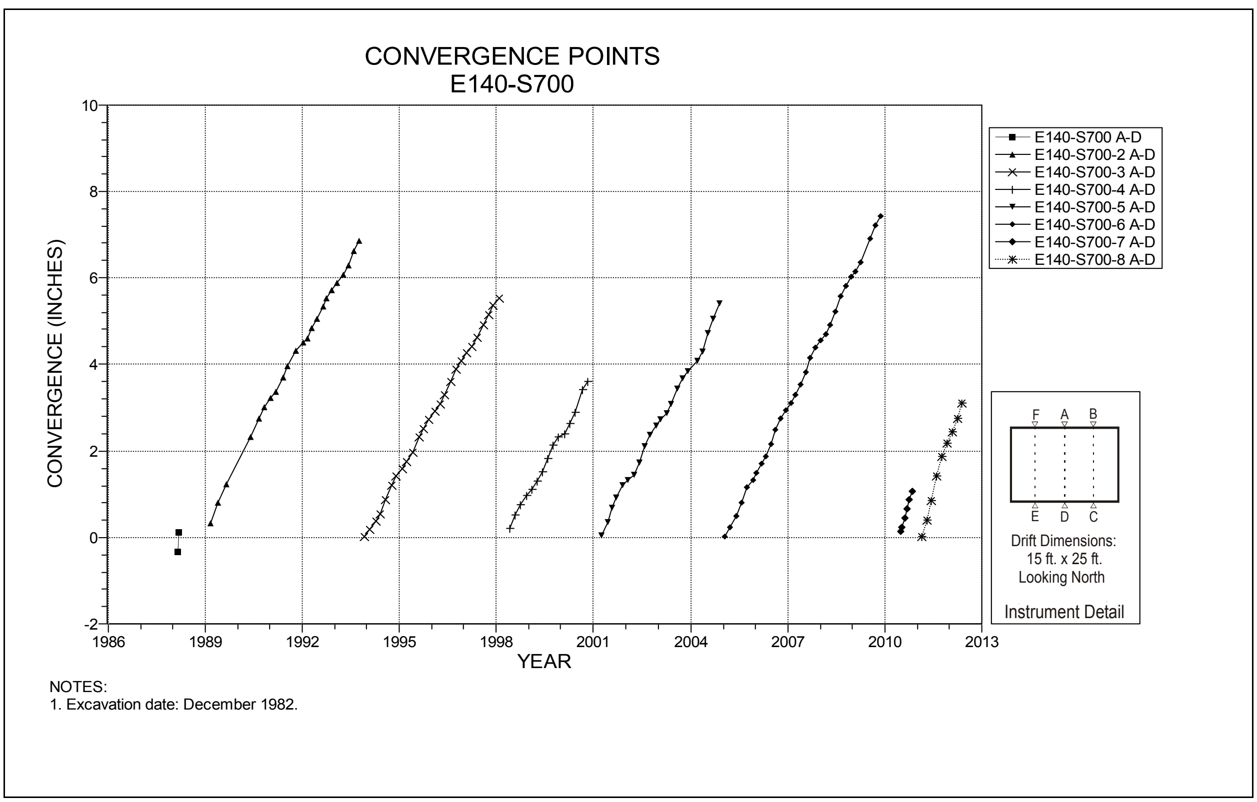


Figure 4-64 Convergence Point Array
E140 S700 – Roof to Floor

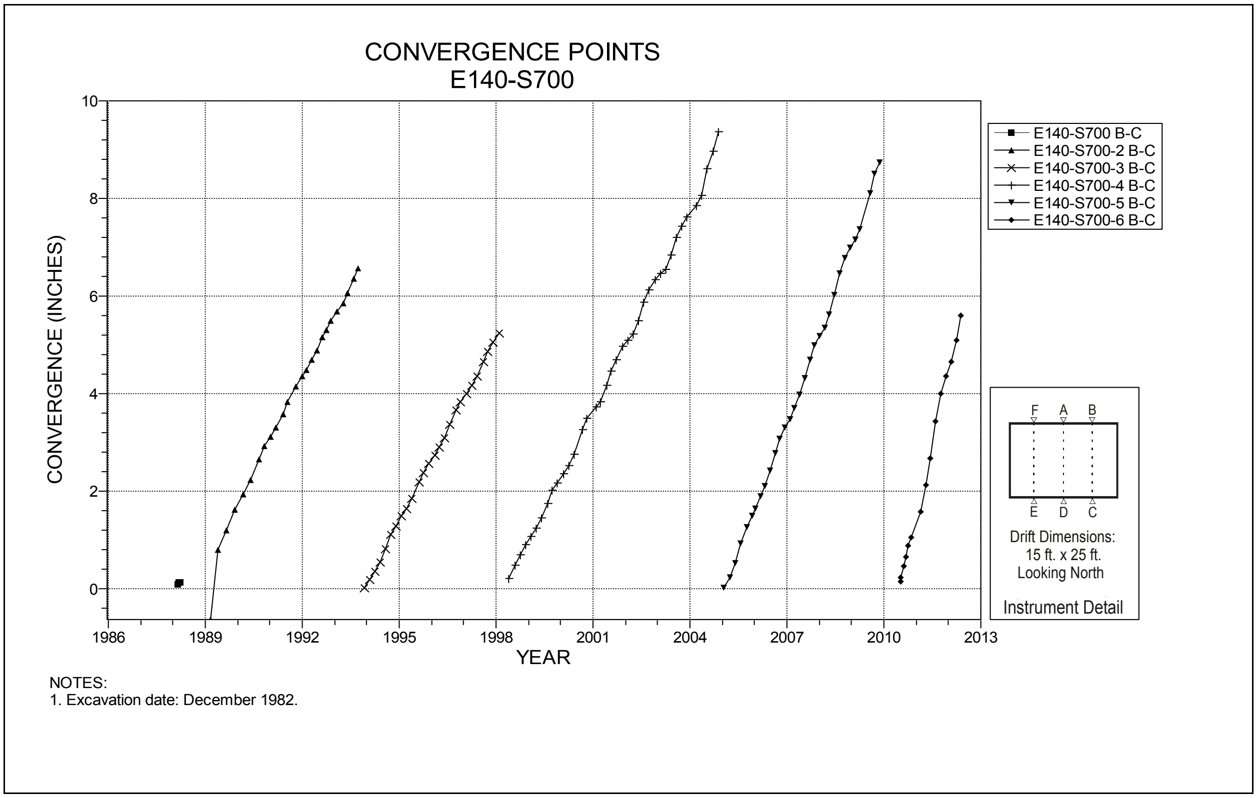


Figure 4-65 Convergence Point Array
E140 S700 – Roof to Floor – East Quarter Point

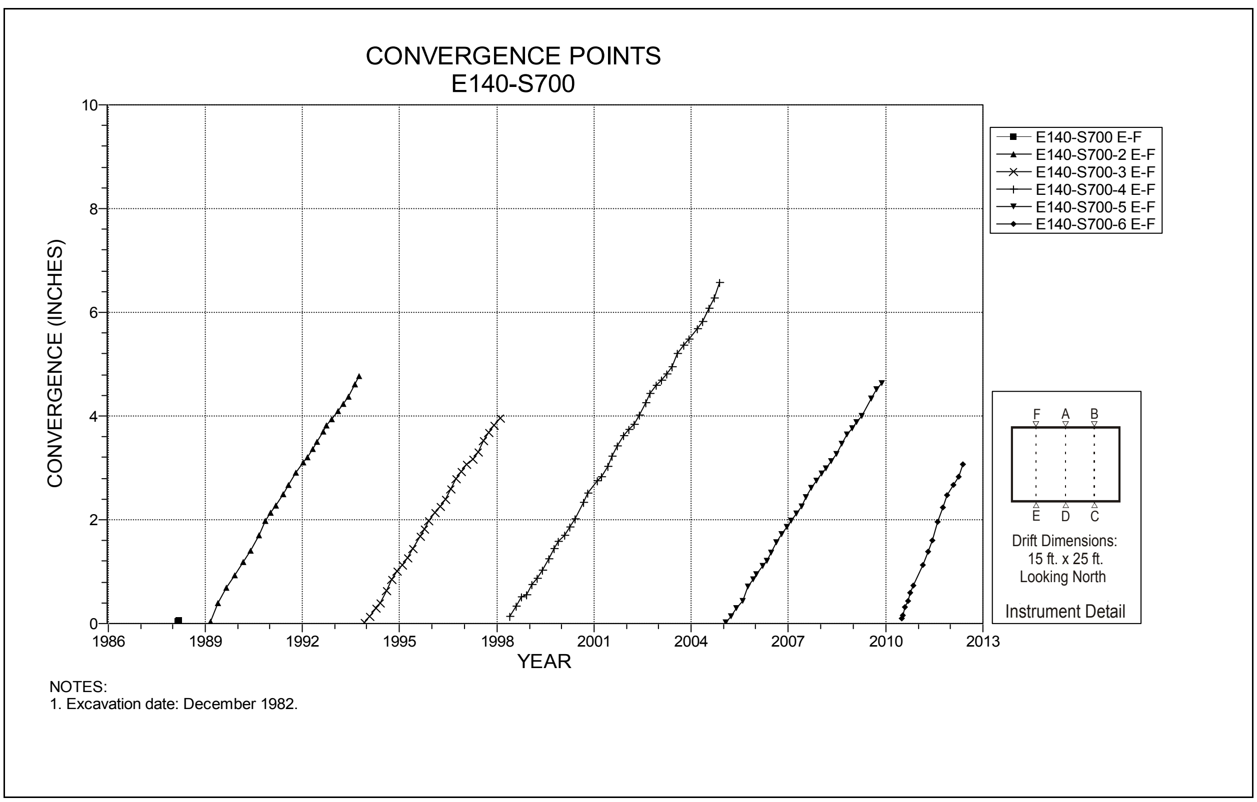


Figure 4-66 Convergence Point Array
E140 S700 – Roof to Floor – West Quarter Point

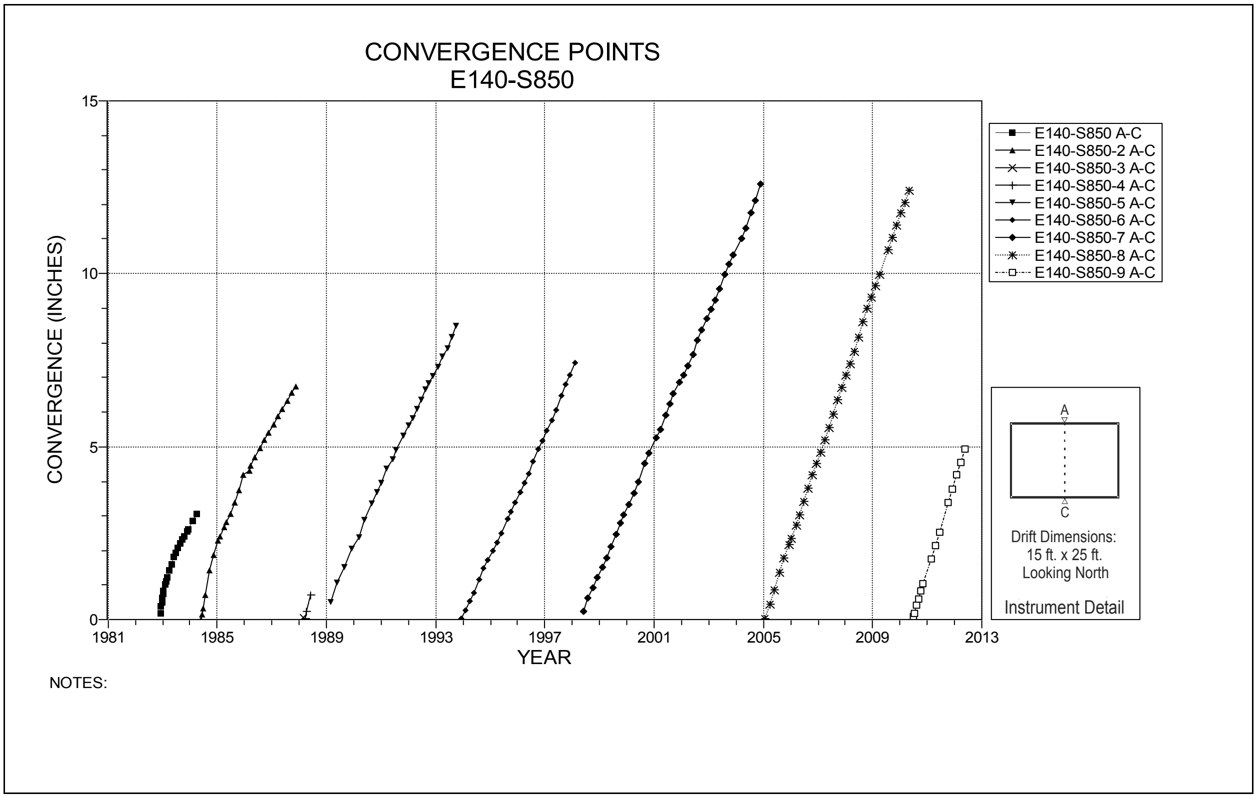


Figure 4-67 Convergence Point Array
E140 S850 – Roof to Floor

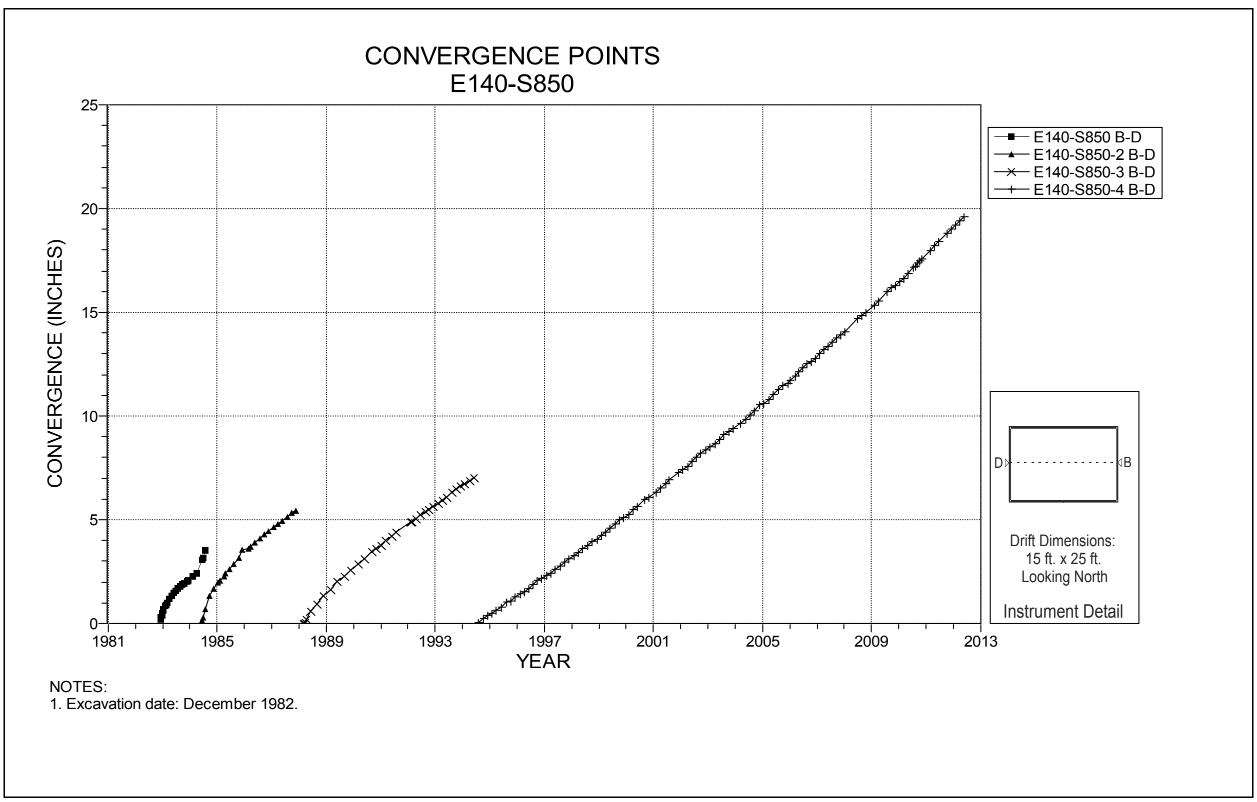


Figure 4-68 Convergence Point Array
E140 S850 – Rib to Rib

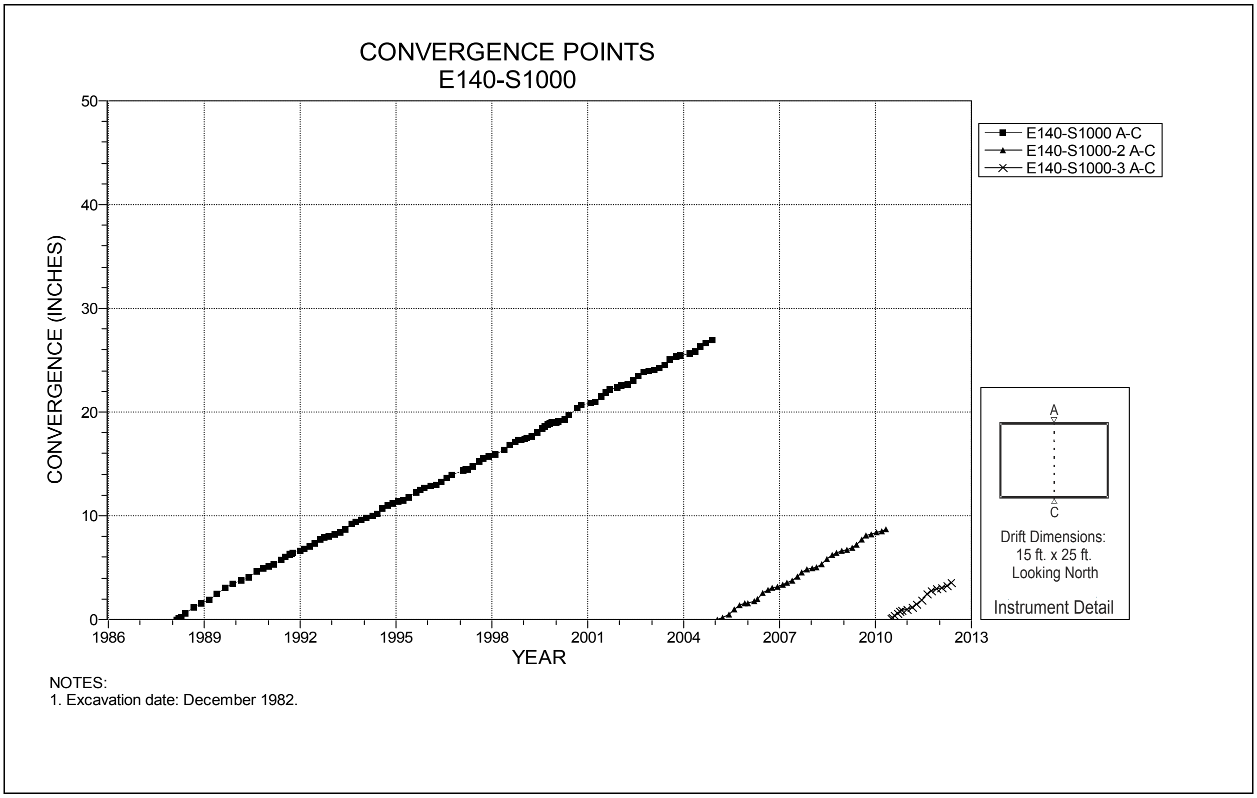


Figure 4-69 Convergence Point Array
E140 S1000 – Roof to Floor

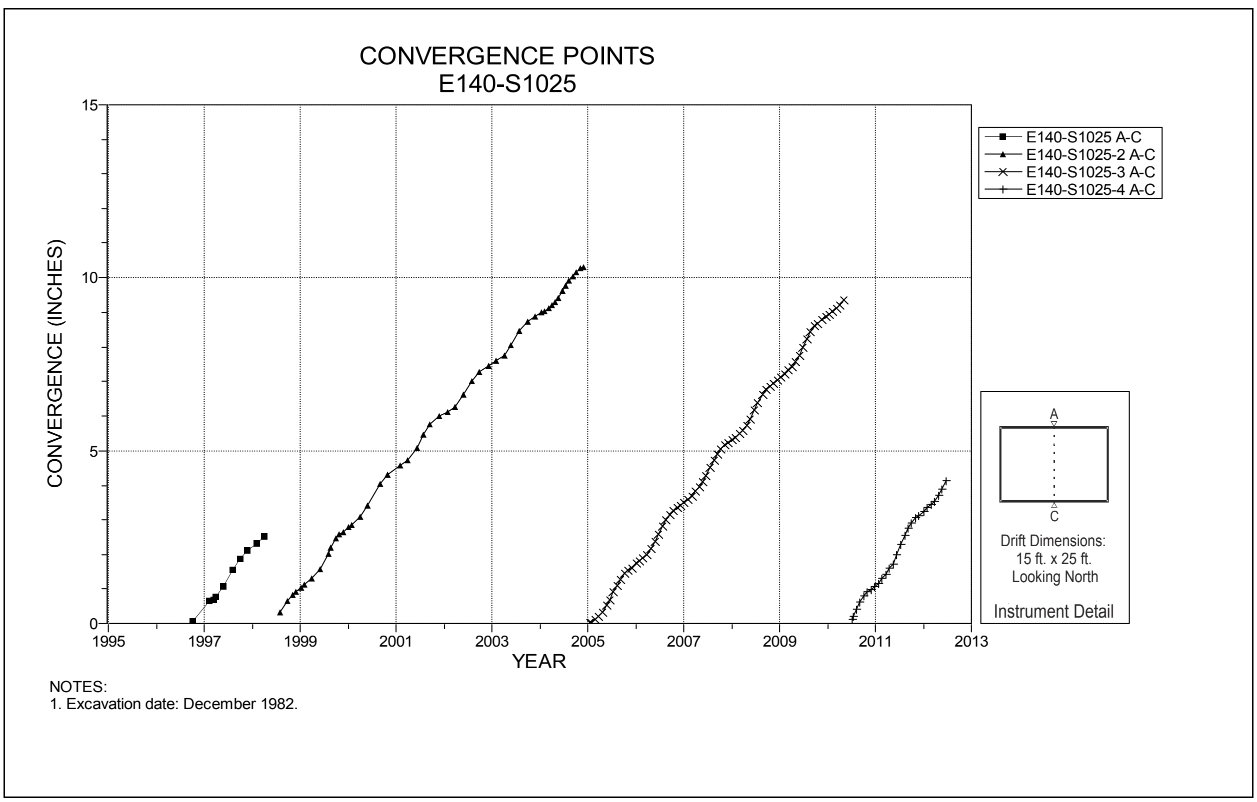


Figure 4-70 Convergence Point Array
E140 S1025 – Roof to Floor

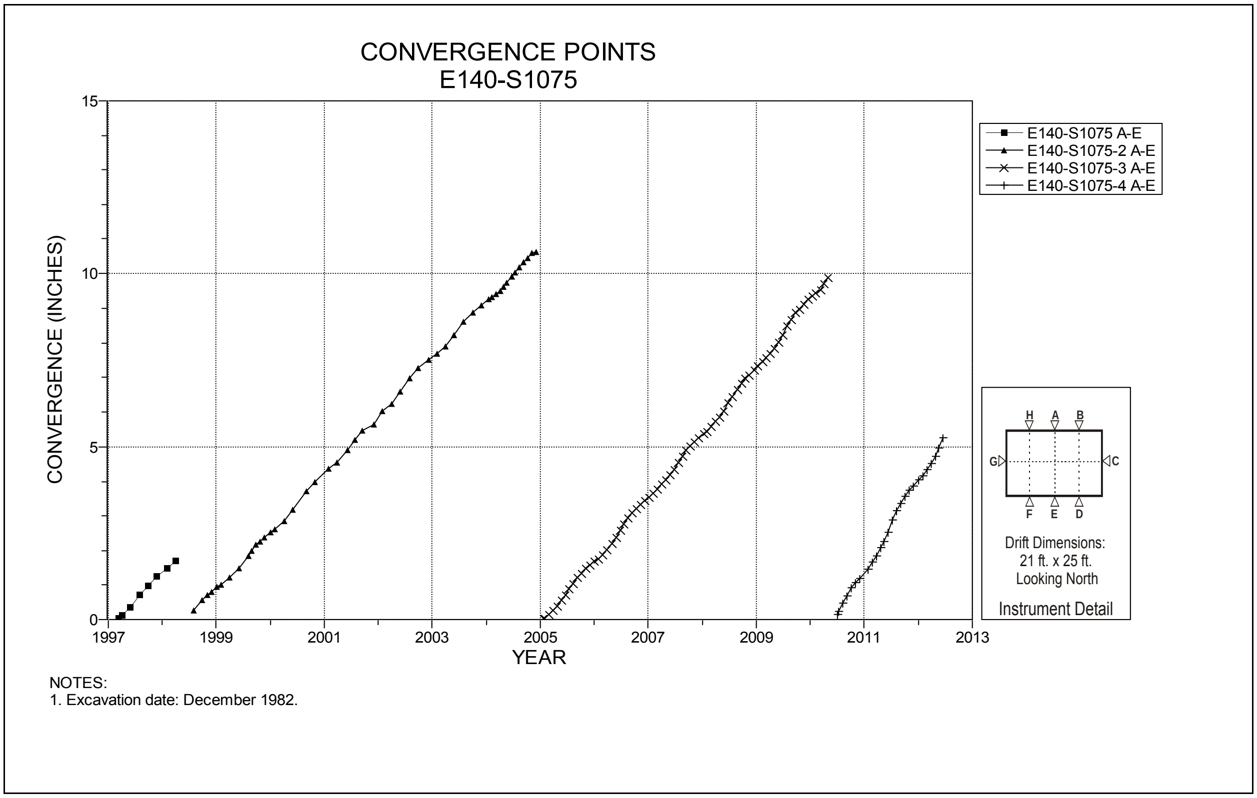


Figure 4-71 Convergence Point Array
E140 S1075 – Roof to Floor – Centerline

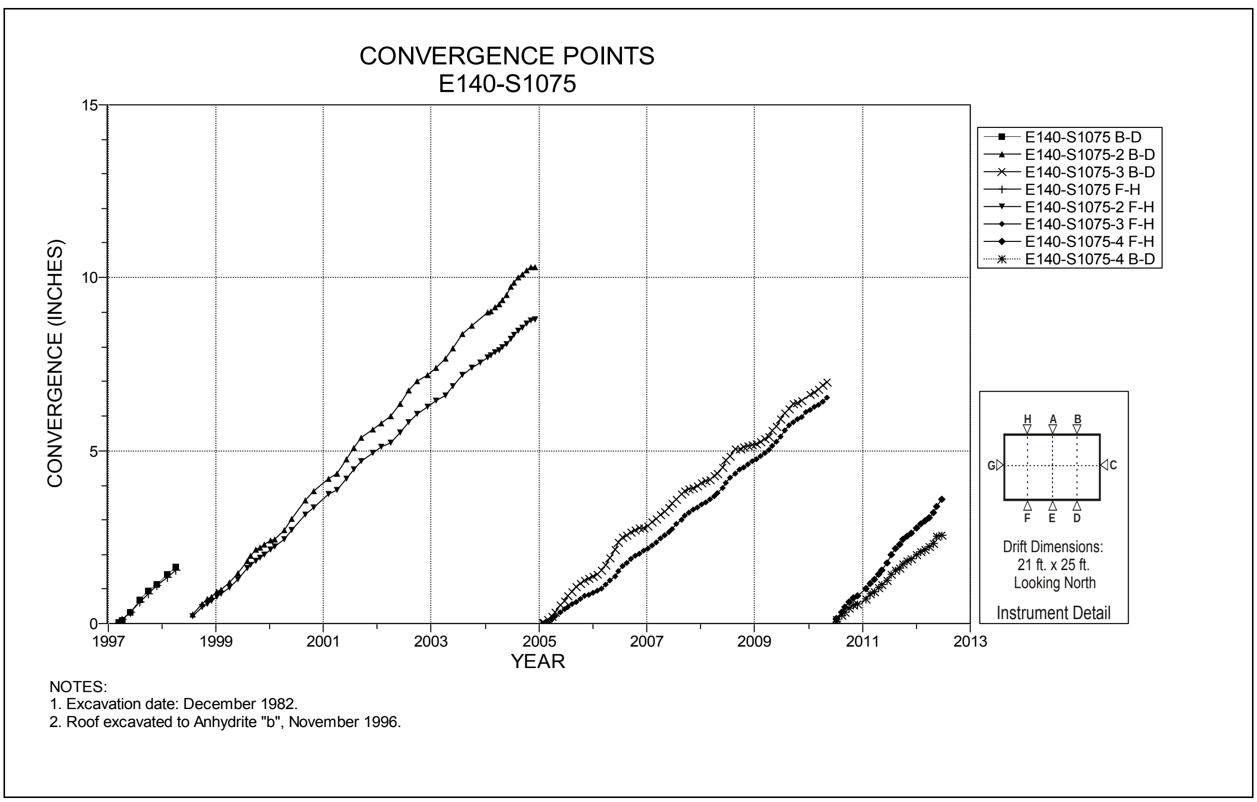


Figure 4-72 Convergence Point Array
E140 S1075 – Roof to Floor – Quarter Points

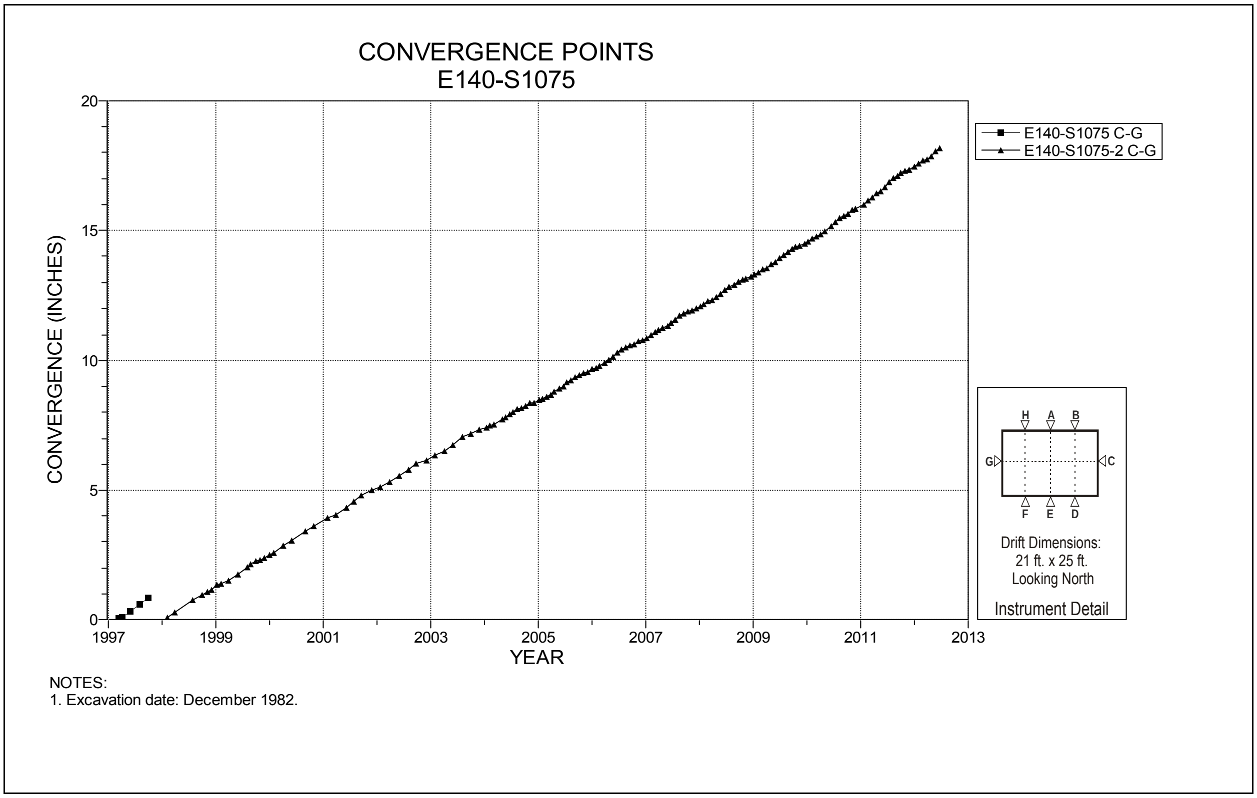


Figure 4-73 Convergence Point Array
E140 S1075 – Rib to Rib

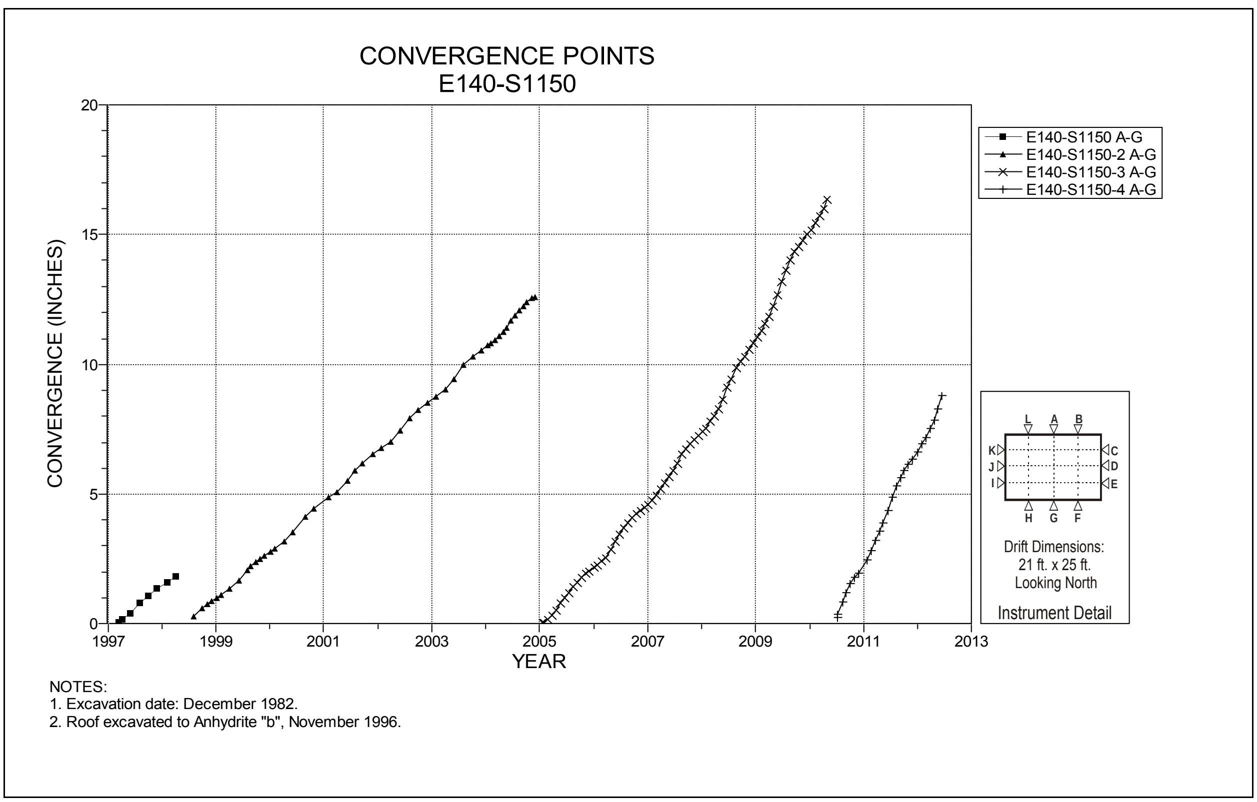


Figure 4-74 Convergence Point Array
E140 S1150 – Roof to Floor – Centerline

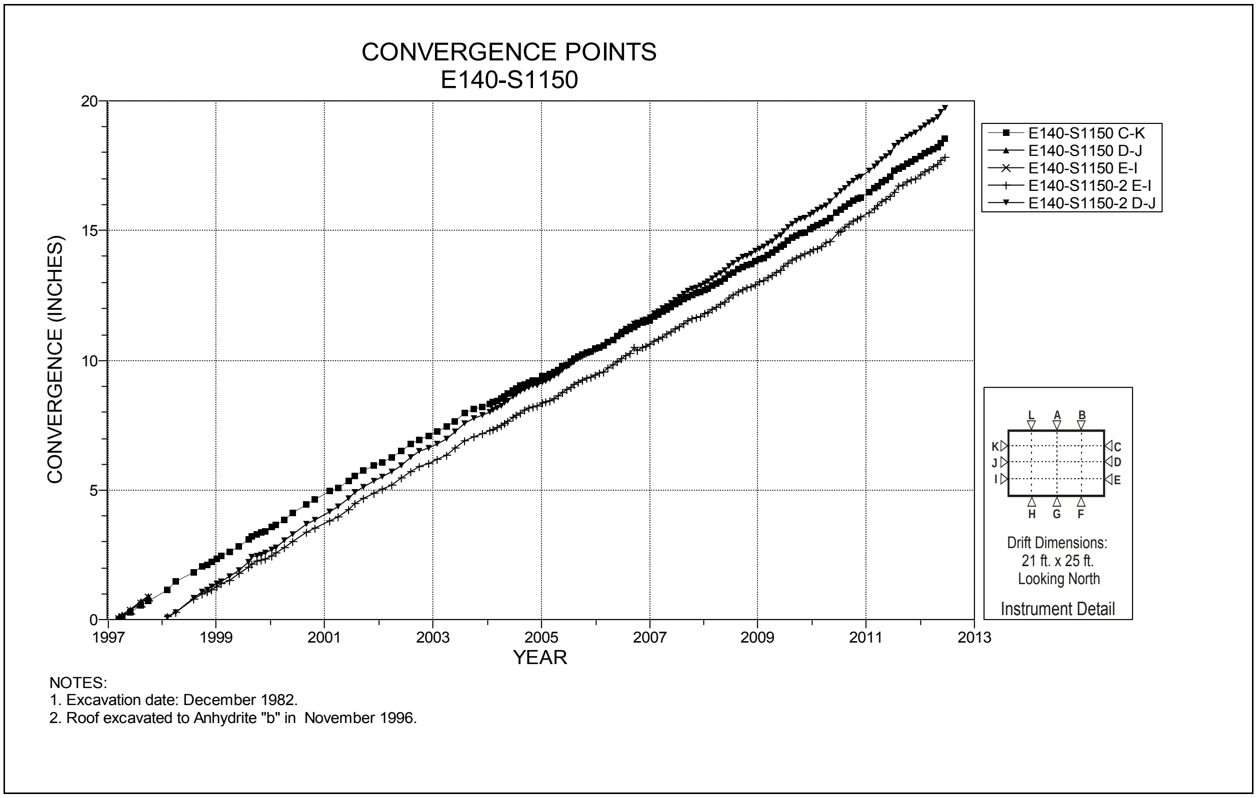


Figure 4-75 Convergence Point Array
E140 S1150 – Rib to Rib

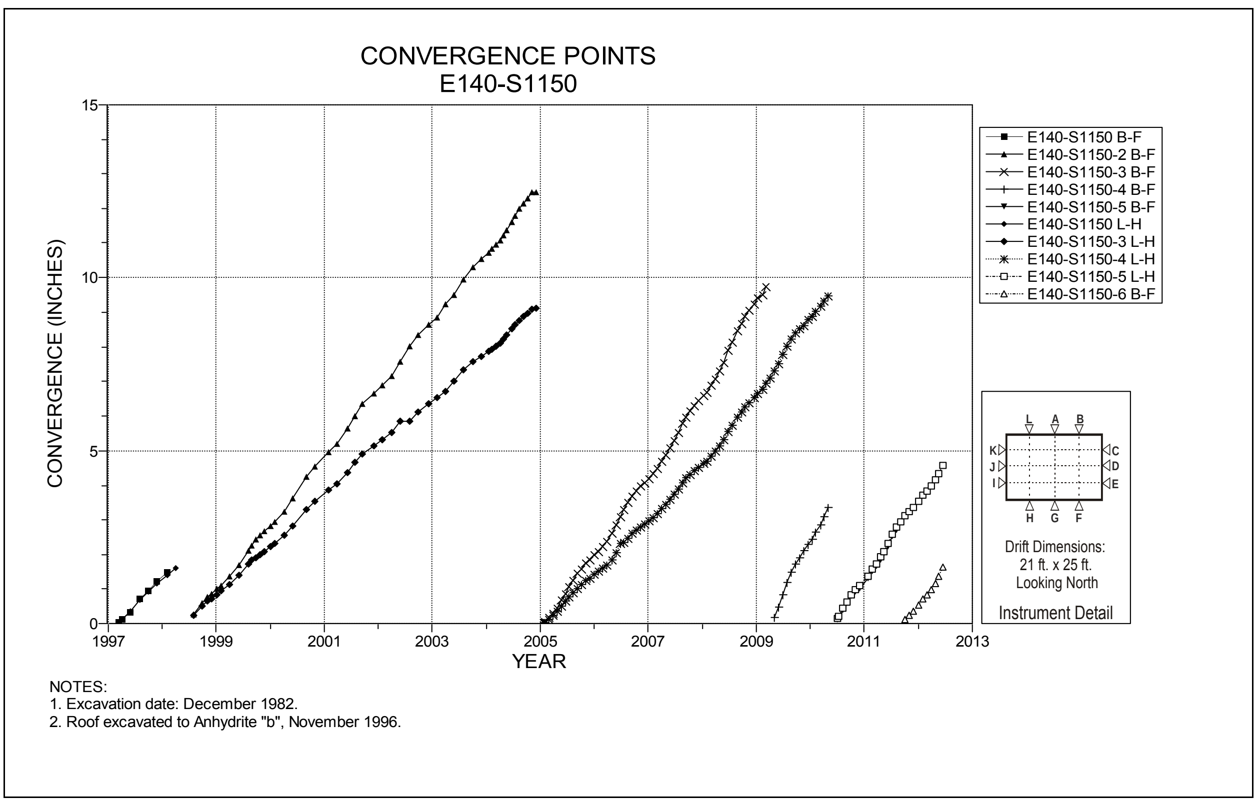


Figure 4-76 Convergence Point Array
E140 S1150 – Roof to Floor – Quarter Points

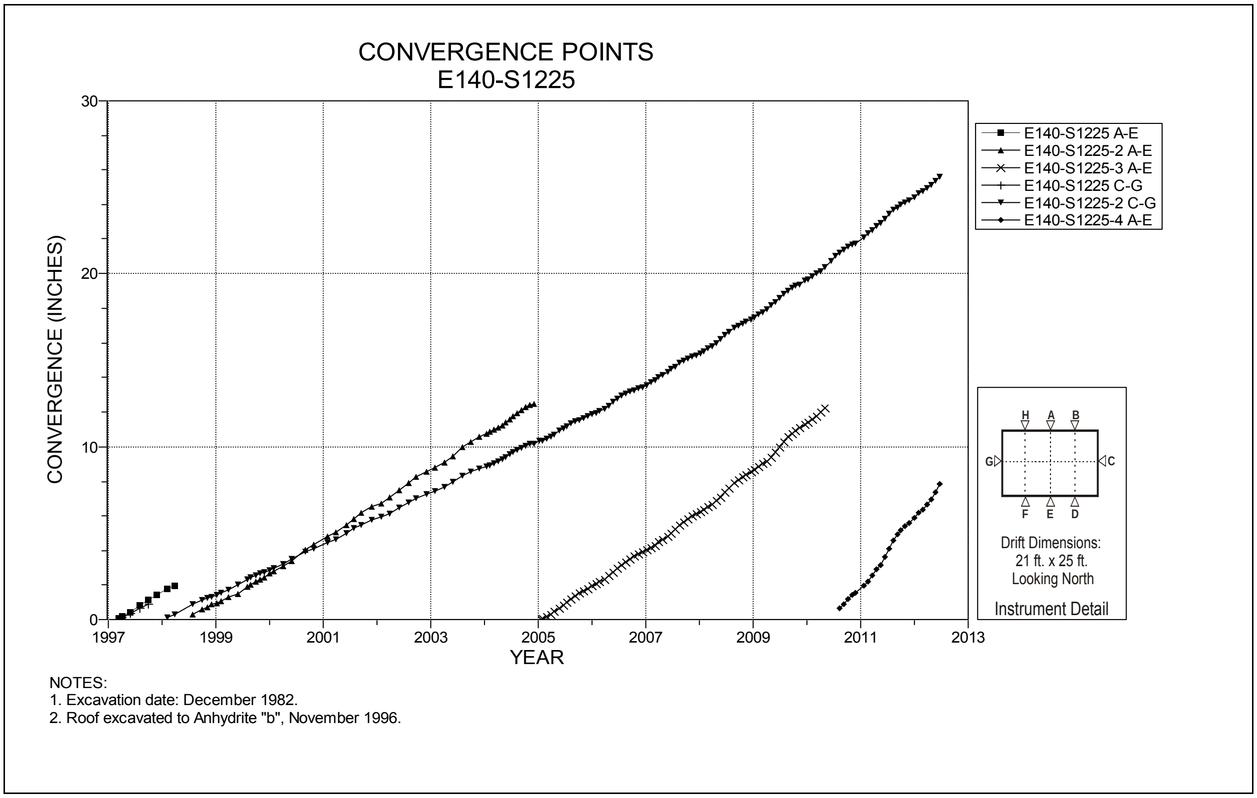


Figure 4-77 Convergence Point Array
E140 S1225 – Roof to Floor Centerline / Rib to Rib

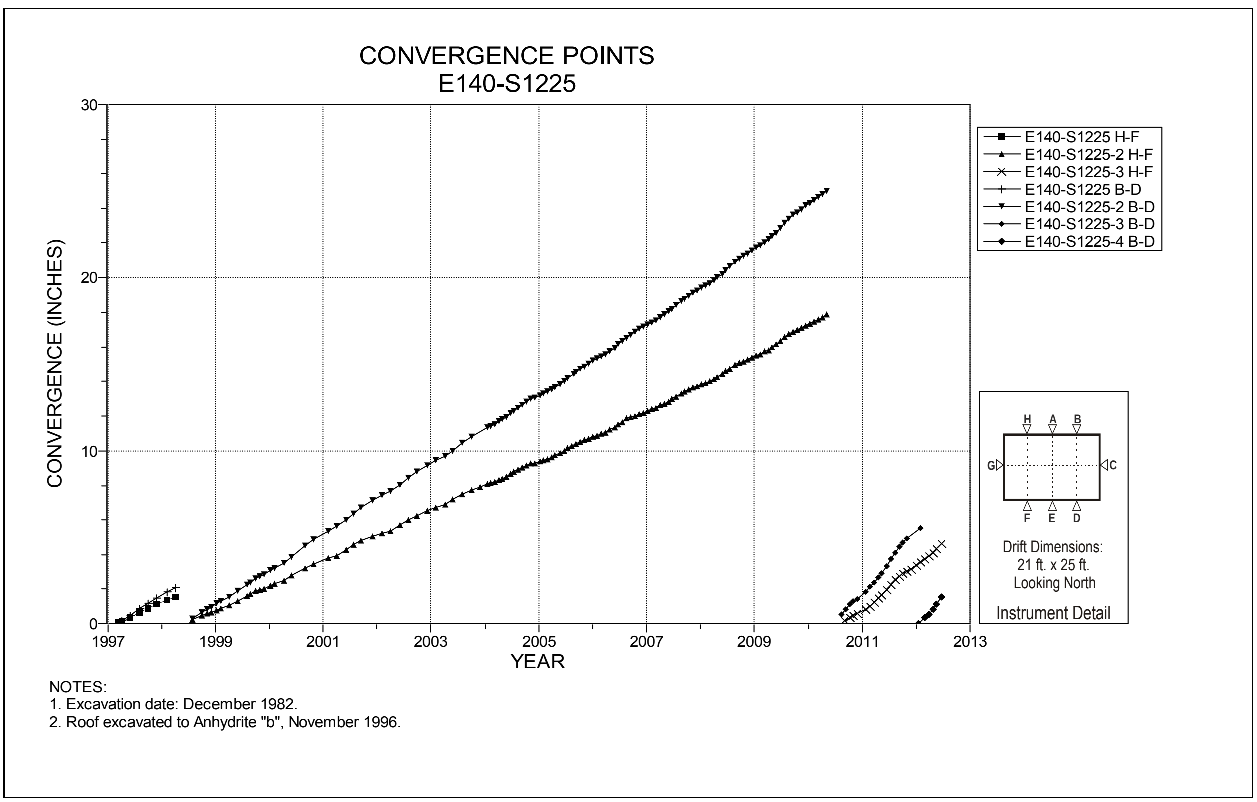


Figure 4-78 Convergence Point Array
E140 S1225 – Roof to Floor – Quarter Points

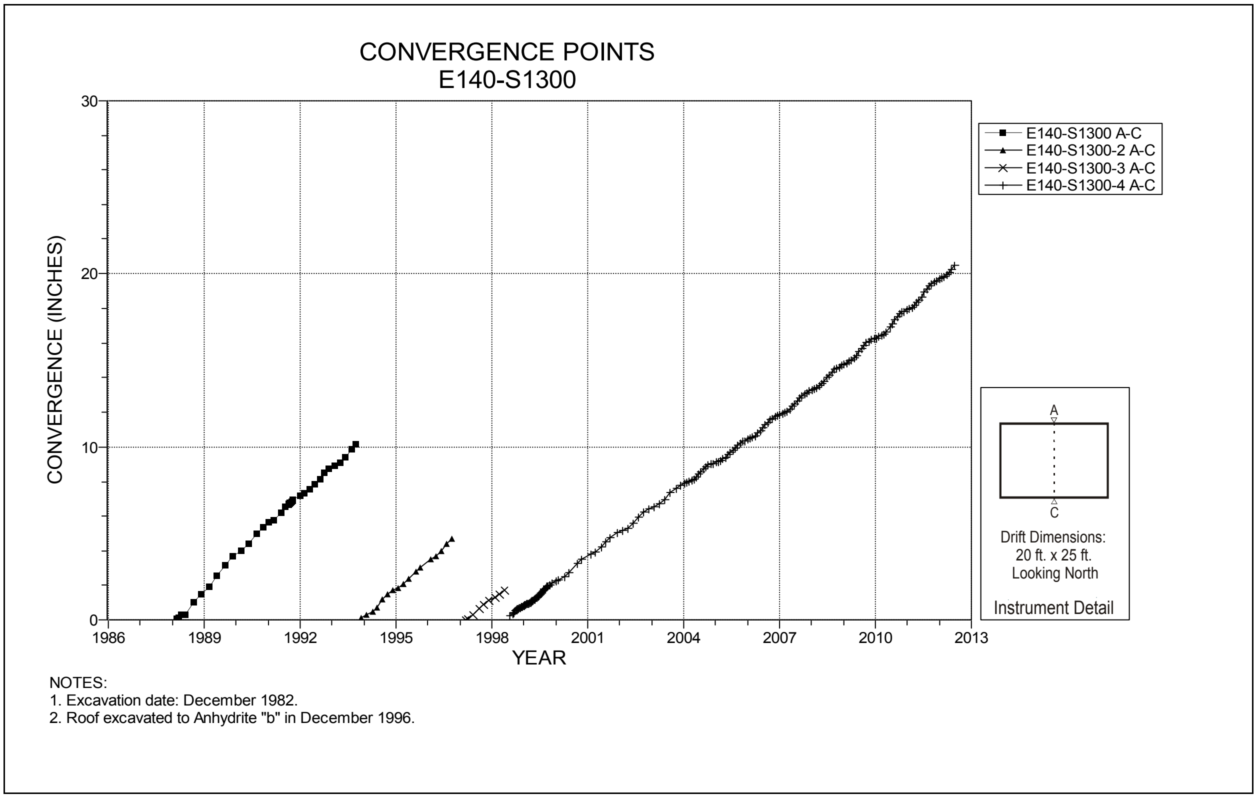


Figure 4-79 Convergence Point Array
E140 S1300 – Roof to Floor

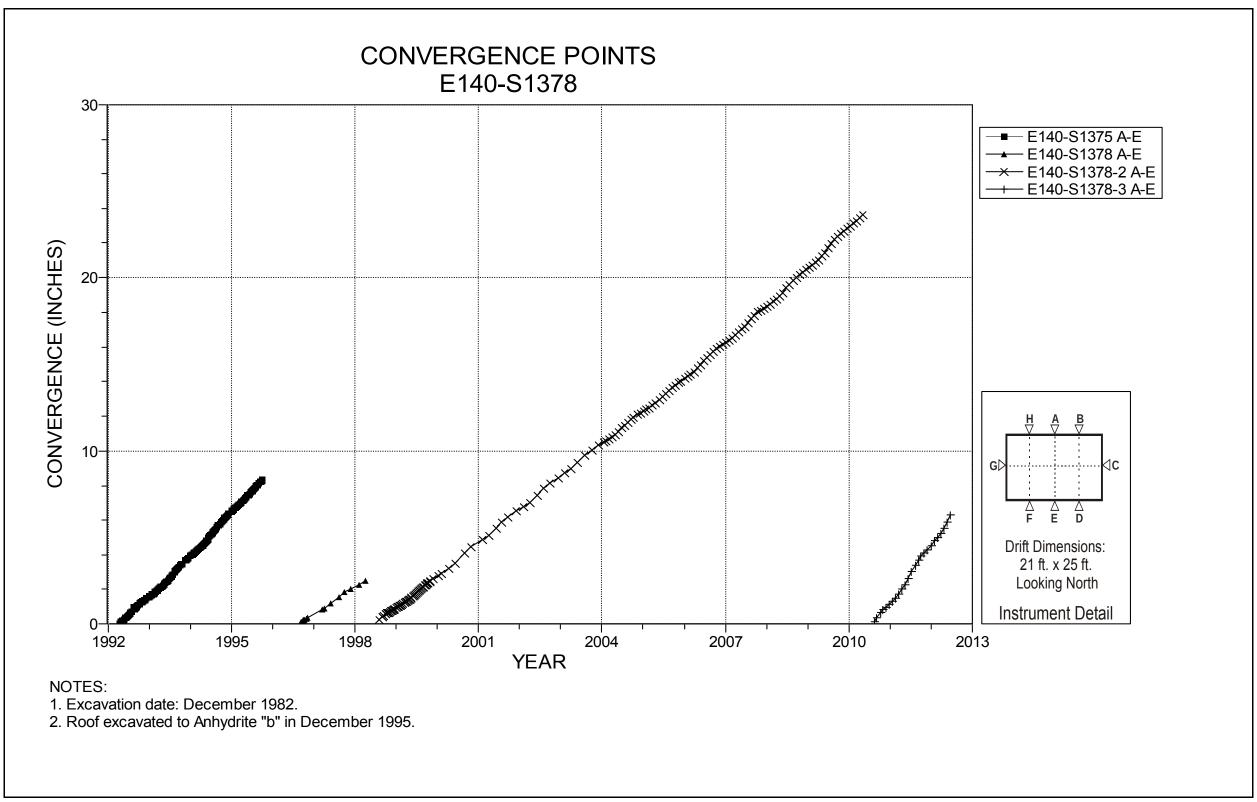


Figure 4-80 Convergence Point Array
E140 S1378 – Roof to Floor – Centerline

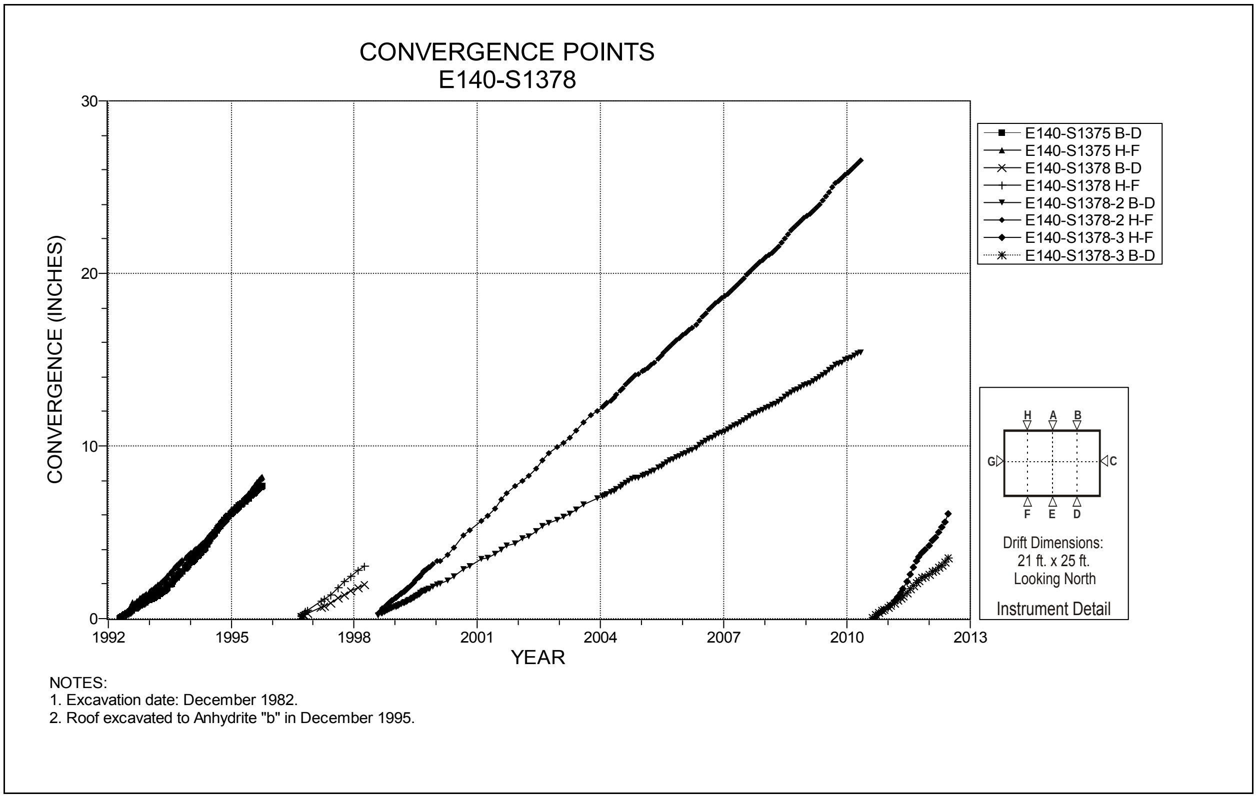


Figure 4-81 Convergence Point Array
E140 S1378 – Roof to Floor – Quarter Points

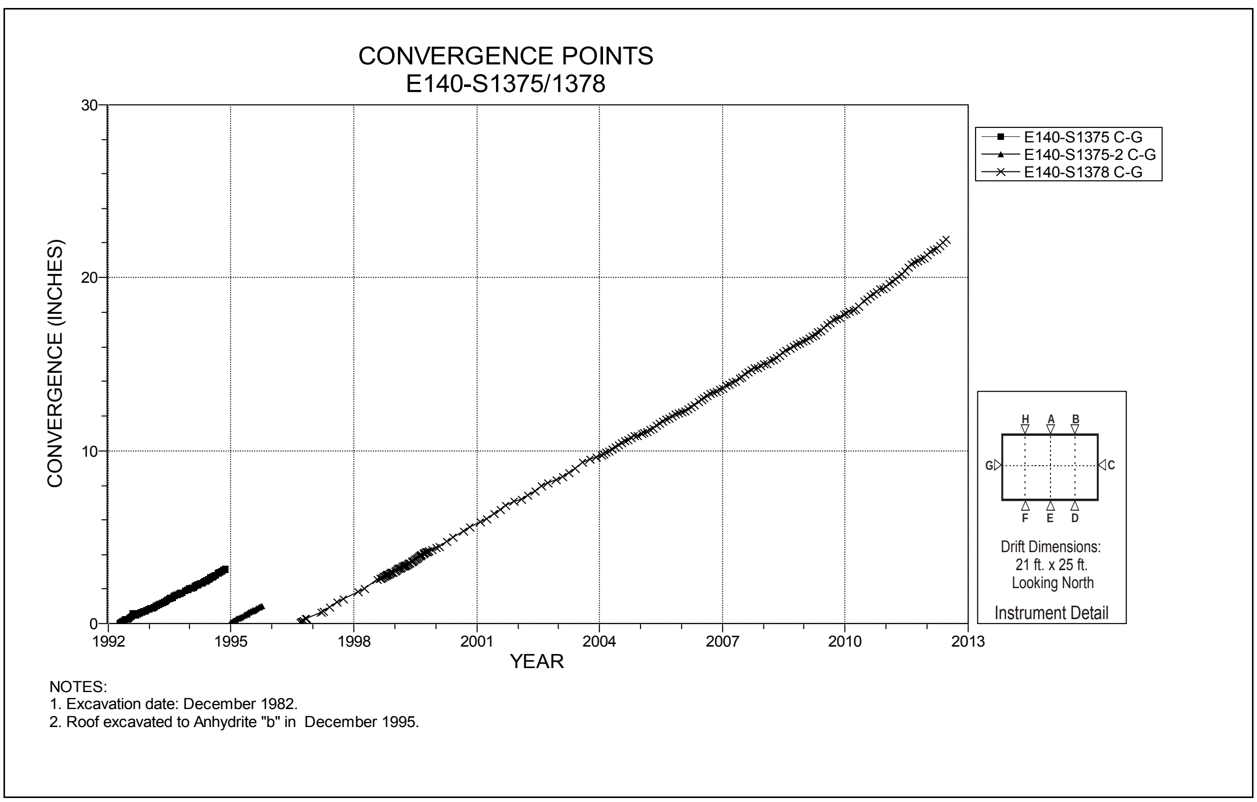


Figure 4-82 Convergence Point Array
E140 S1375/S1378 – Rib to Rib

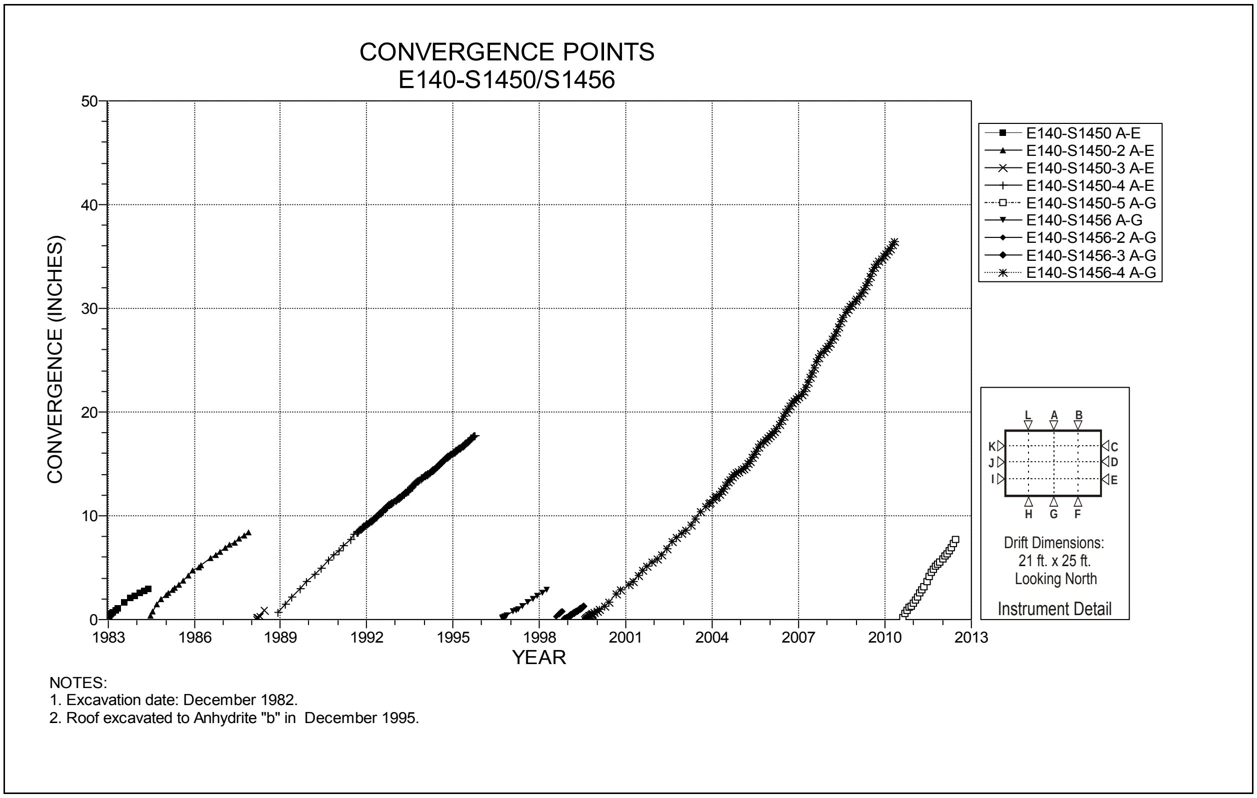


Figure 4-83 Convergence Point Array
E140 S1450/1456 – Roof to Floor – Centerline

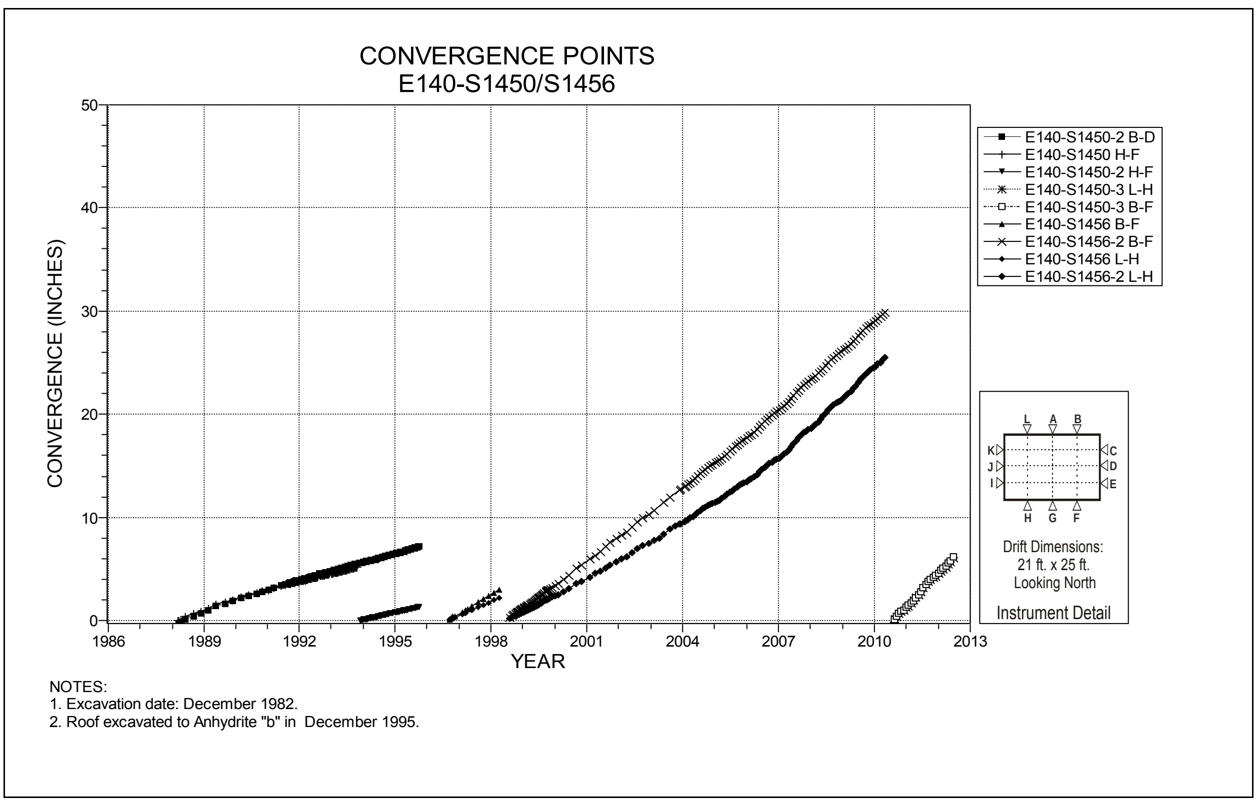


Figure 4-84 Convergence Point Array
E140 S1450/1456 – Roof to Floor – Quarter Points

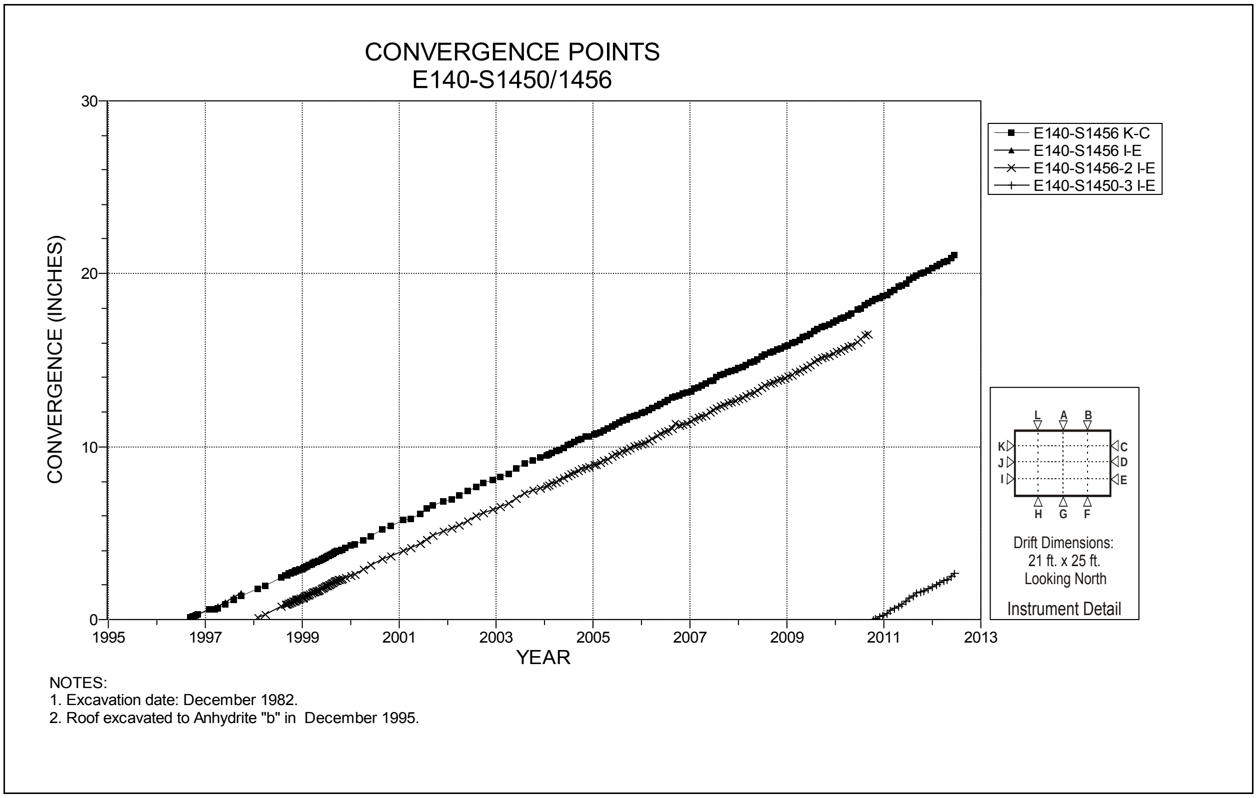


Figure 4-85 Convergence Point Array
E140 S1450/S1456 – Rib to Rib – Quarter Points

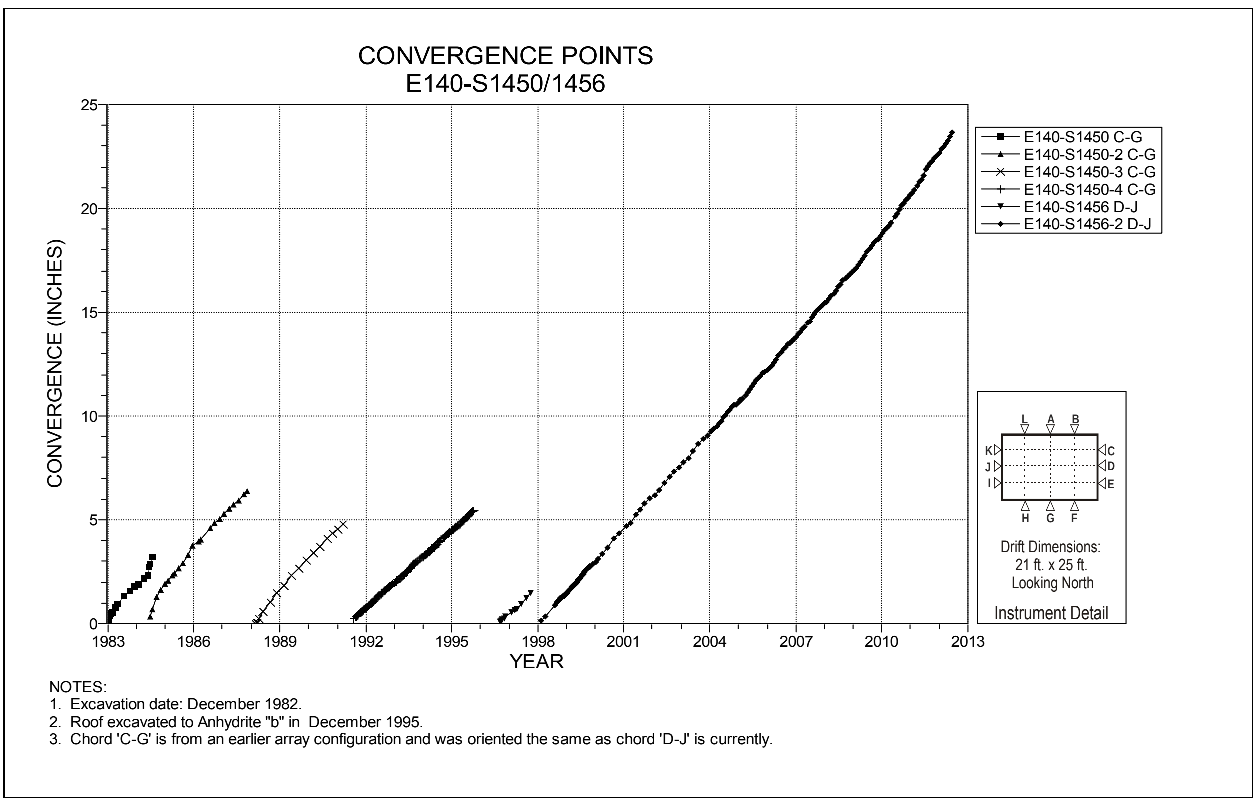


Figure 4-86 Convergence Point Array
E140 S1456/S1450 – Rib to Rib – Mid-Height

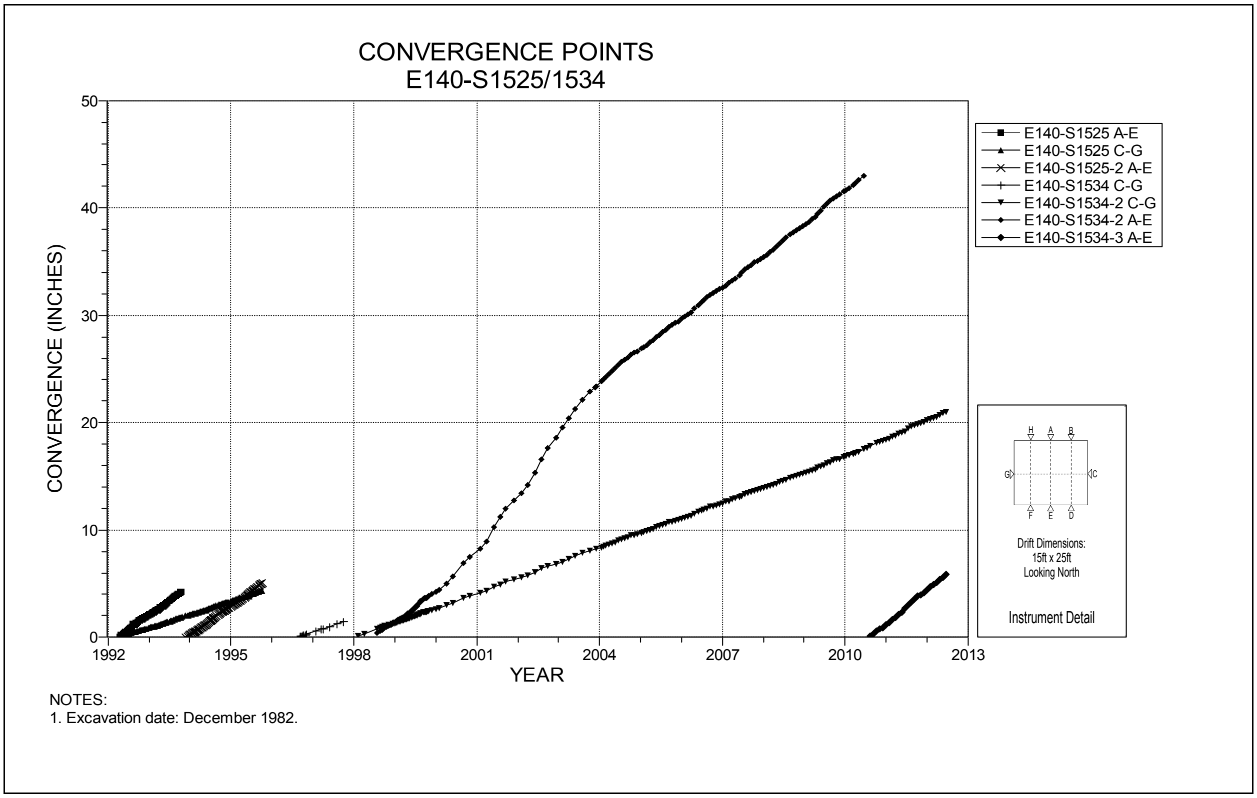


Figure 4-87 Convergence Point Array
E140 S1525/S1534 – Roof to Floor – Centerline and Rib to Rib

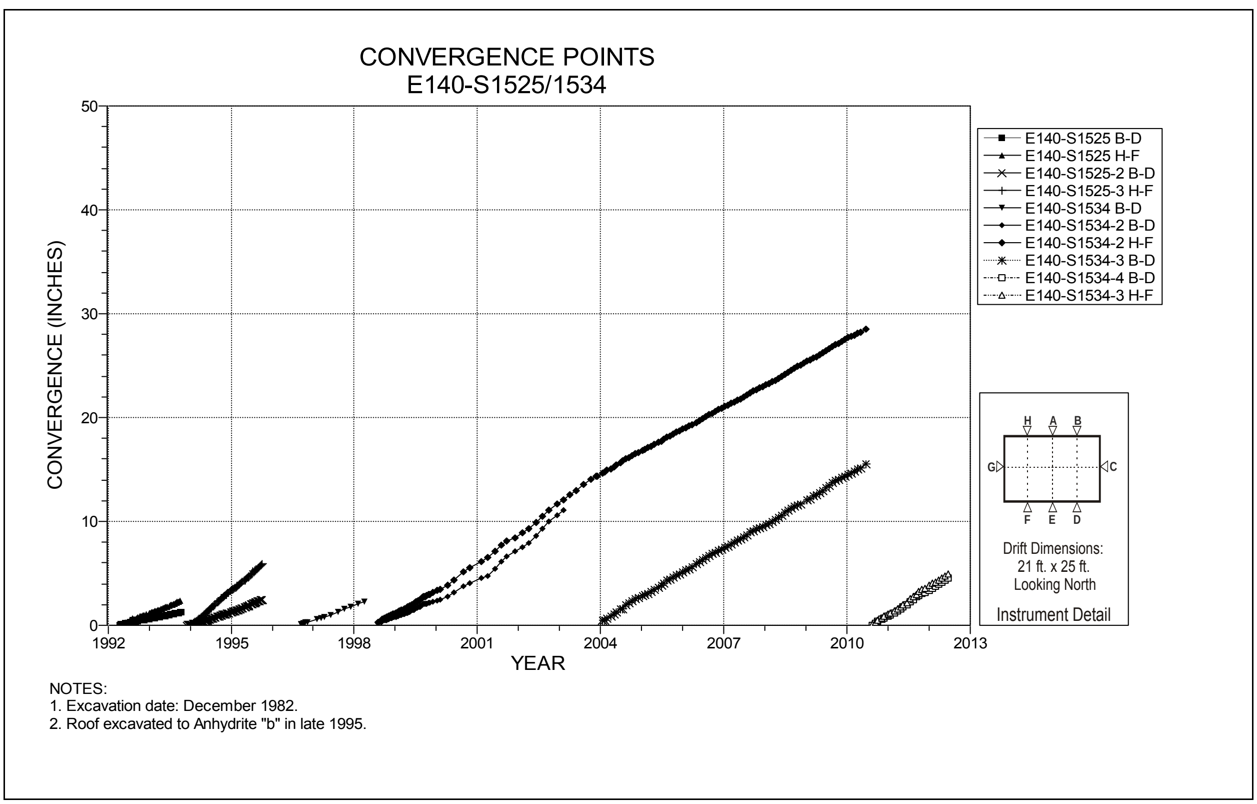


Figure 4-88 Convergence Point Array
E140 S1525/S1534 – Roof to Floor – Quarter Points

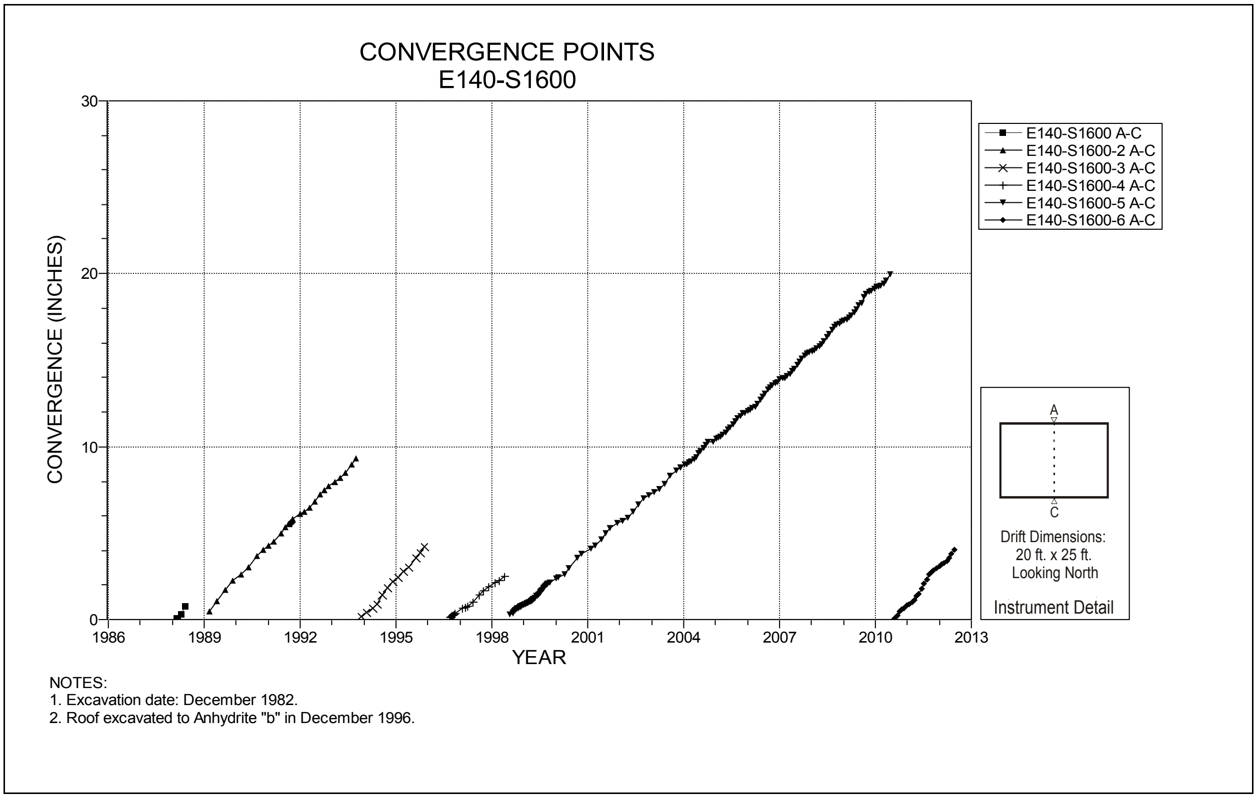


Figure 4-89 Convergence Point Array
E140 S1600 – Roof to Floor

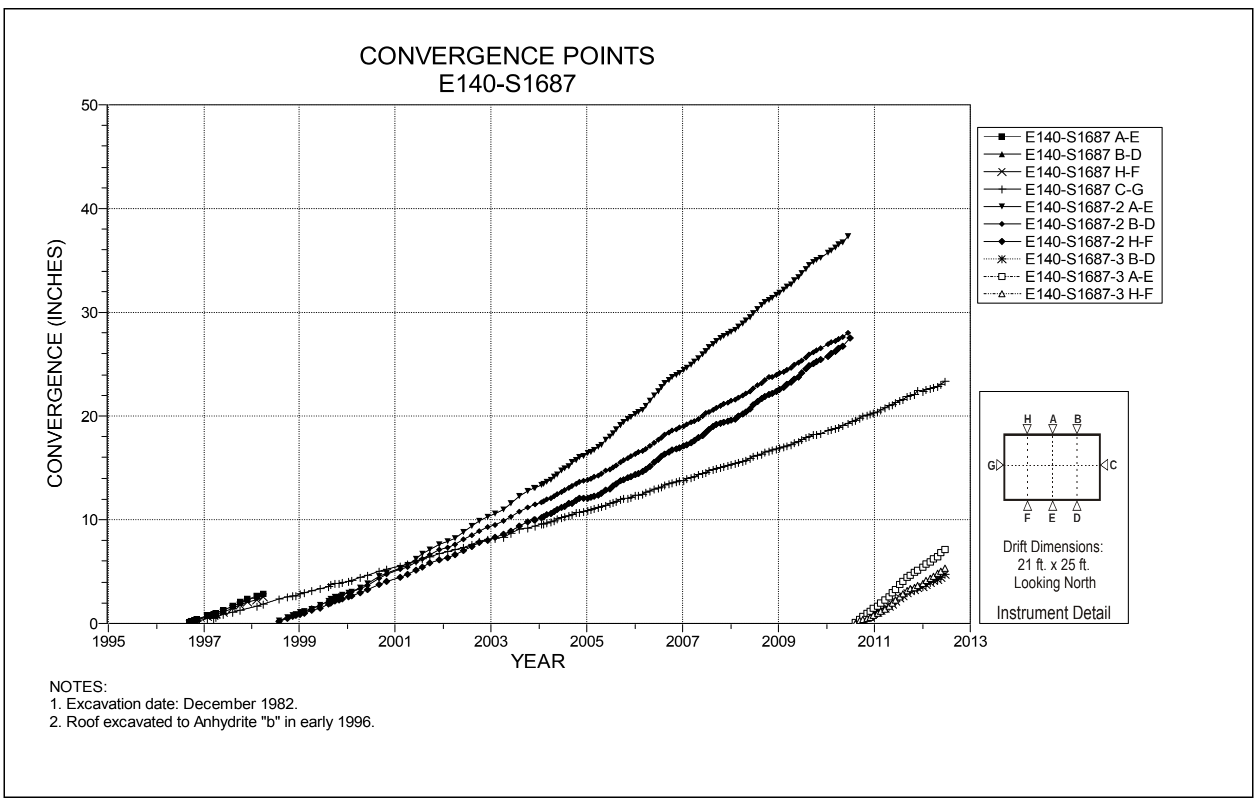


Figure 4-90 Convergence Point Array
E140 S1687 – All Chords

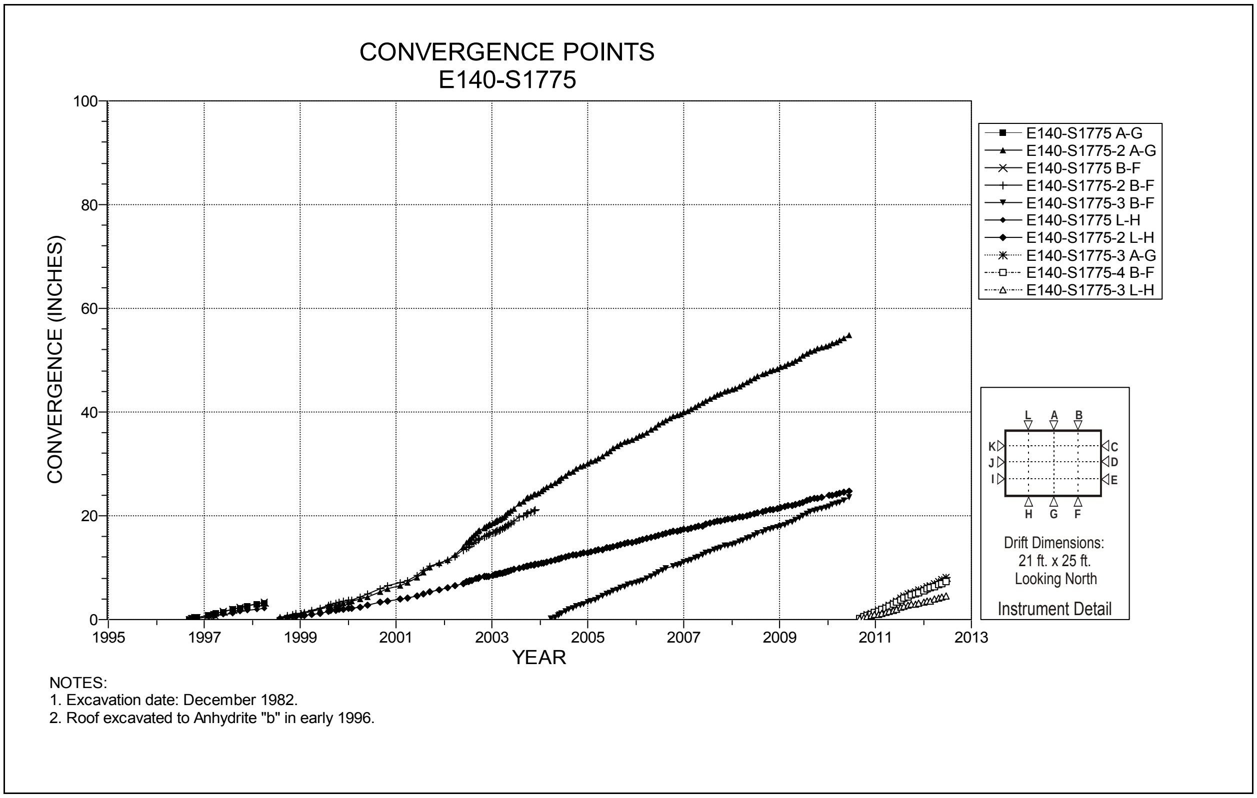


Figure 4-91 Convergence Point Array
E140 S1775 – Roof to Floor

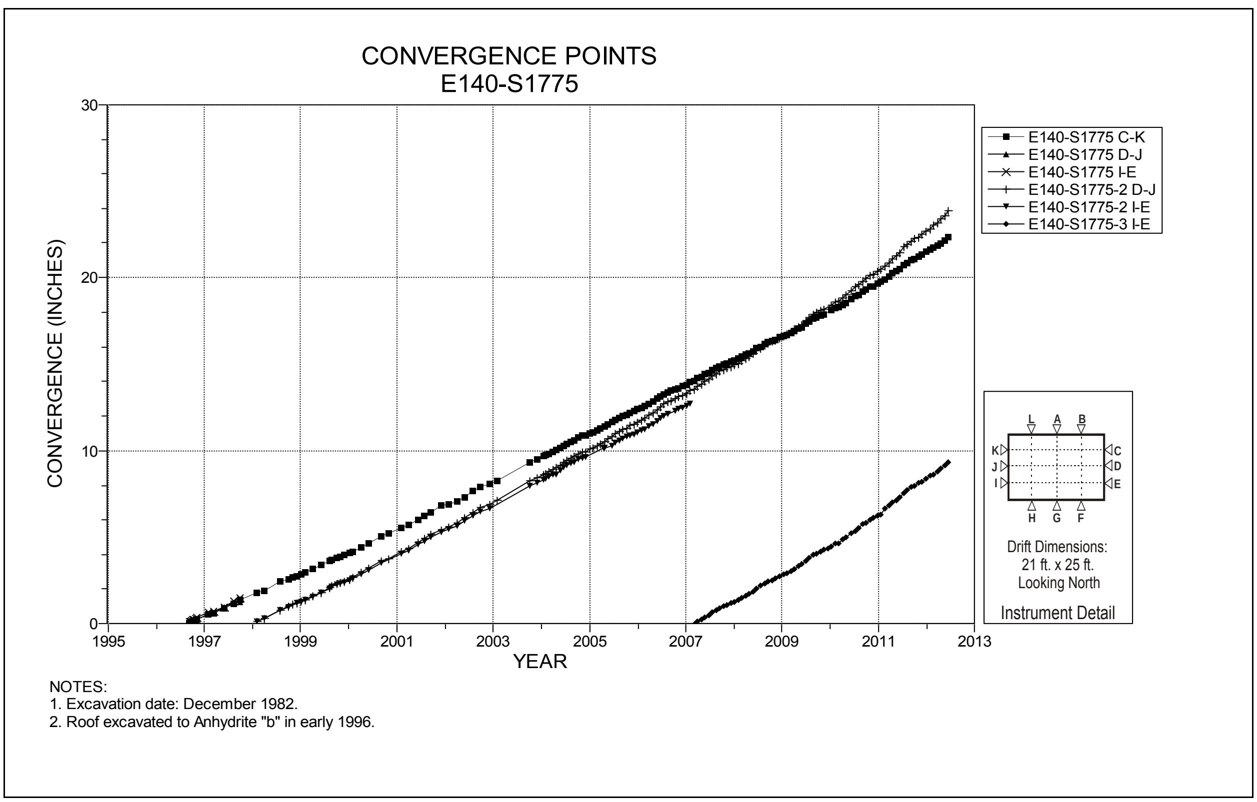


Figure 4-92 Convergence Point Array
E140 S1775 – Rib to Rib

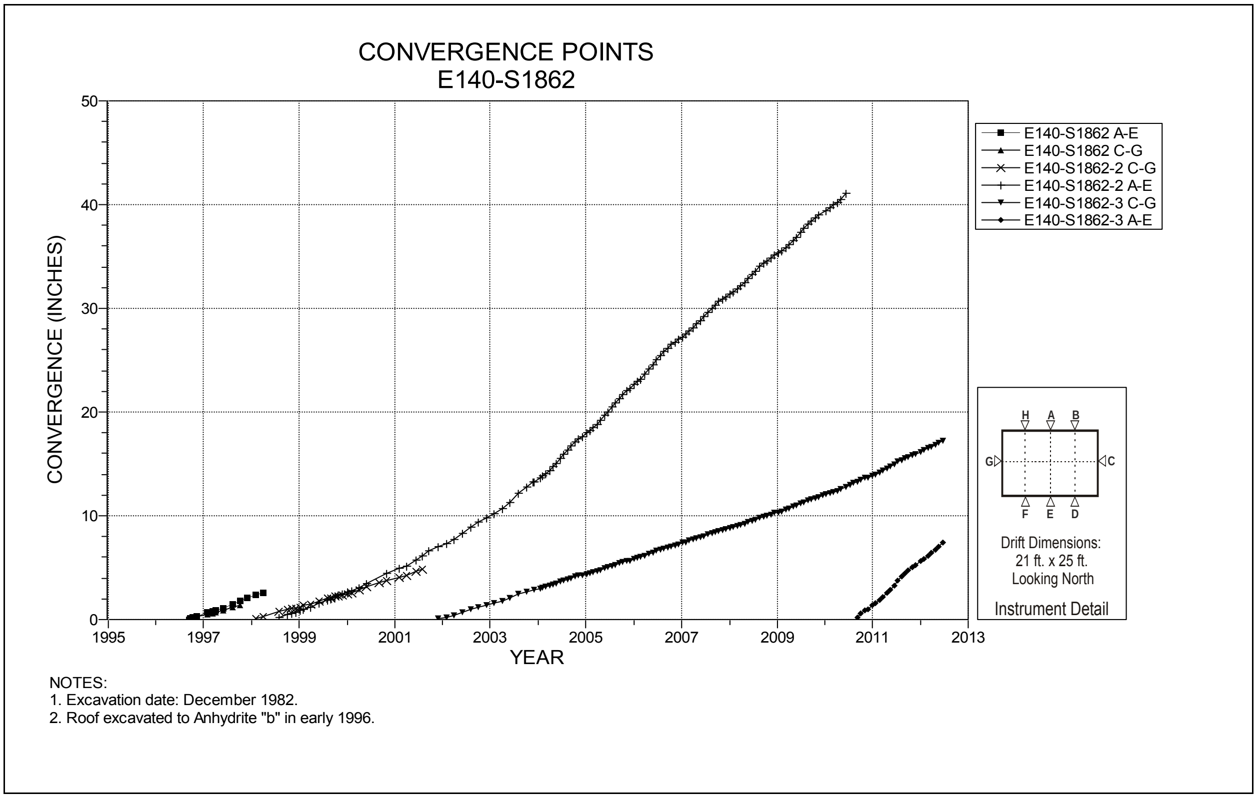


Figure 4-93 Convergence Point Array
E140 S1862 – Roof to Floor – Centerline and Rib to Rib

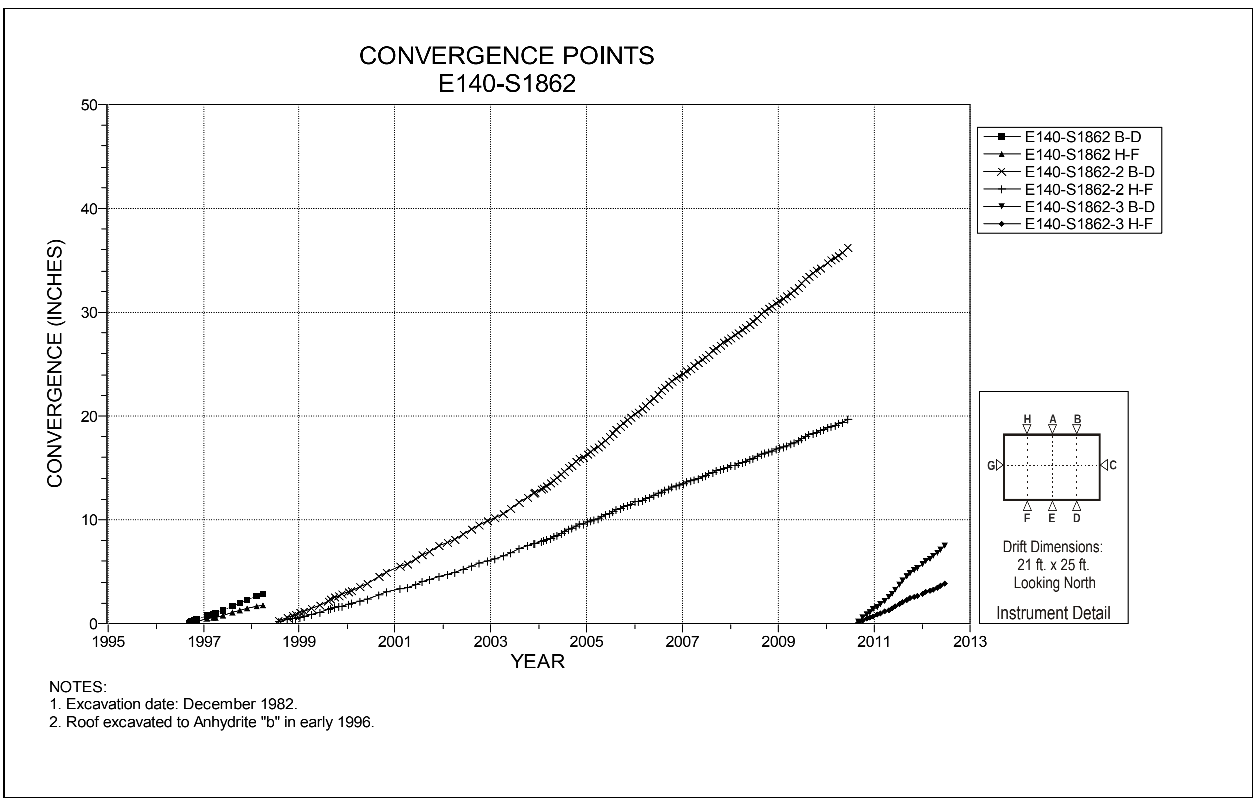


Figure 4-94 Convergence Point Array
E140 S1862 – Roof to Floor – Quarter Points

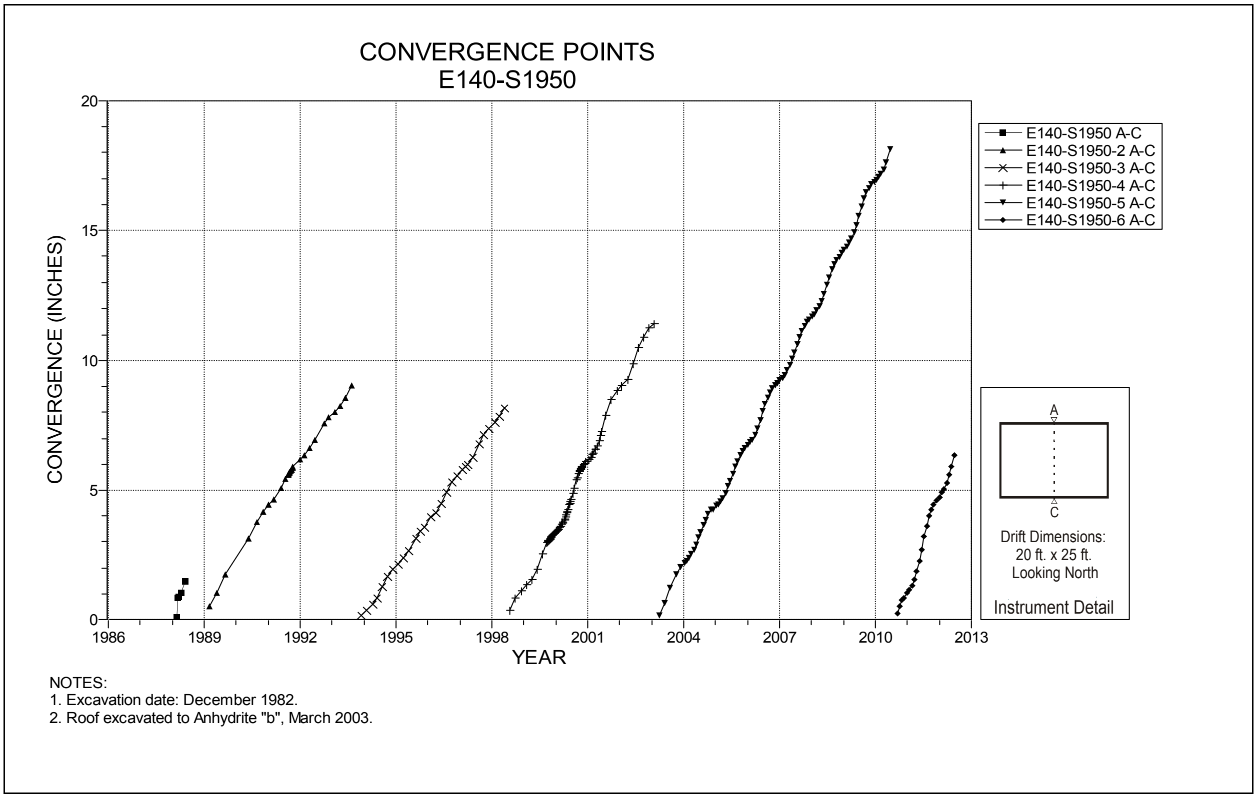


Figure 4-95 Convergence Point Array
E140 S1950 – Roof to Floor

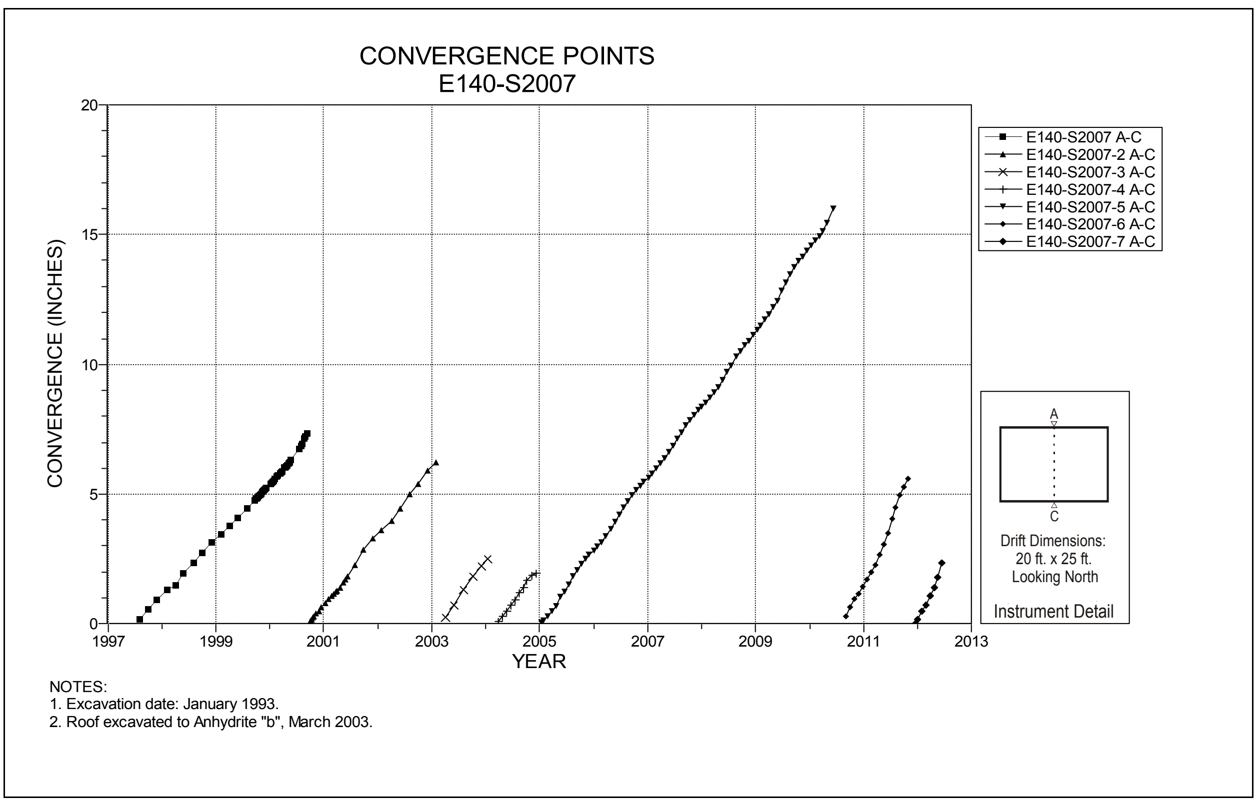


Figure 4-96 Convergence Point Array
E140 S2007 – Roof to Floor

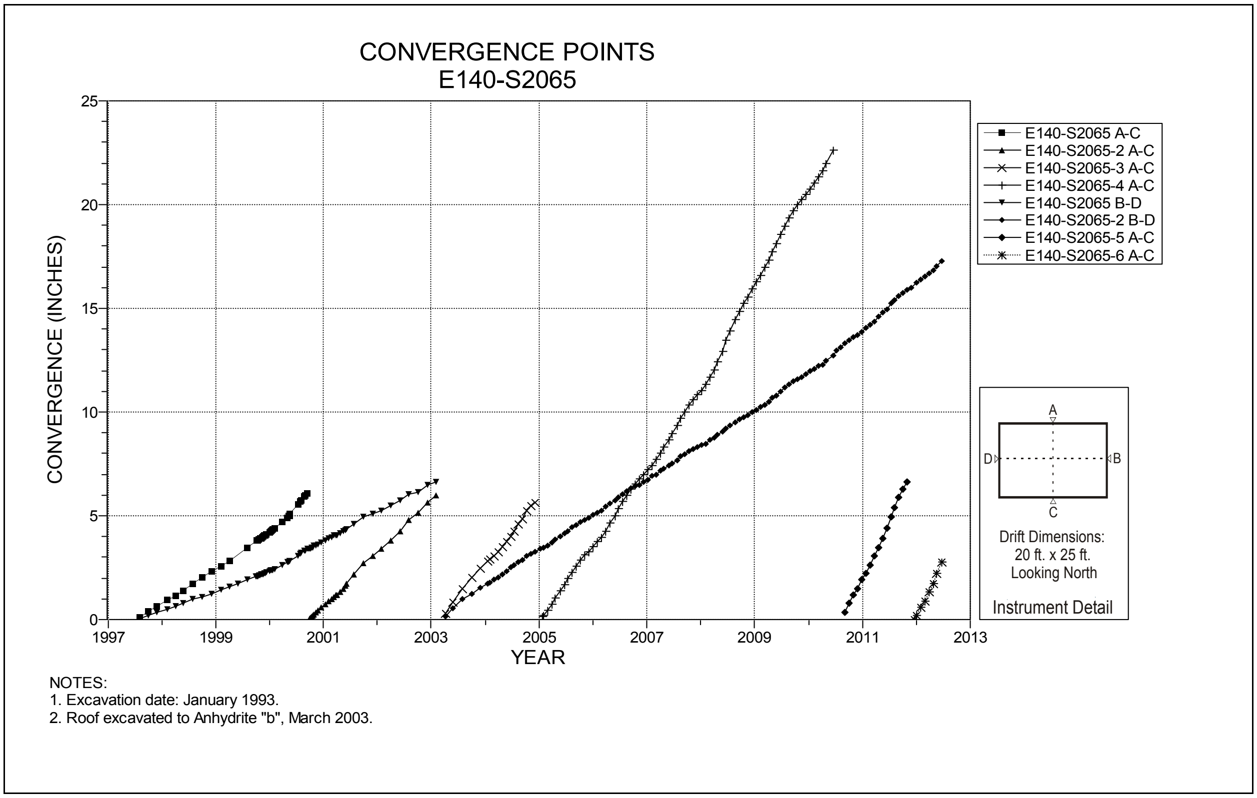


Figure 4-97 Convergence Point Array
E140 S2065 – All Chords

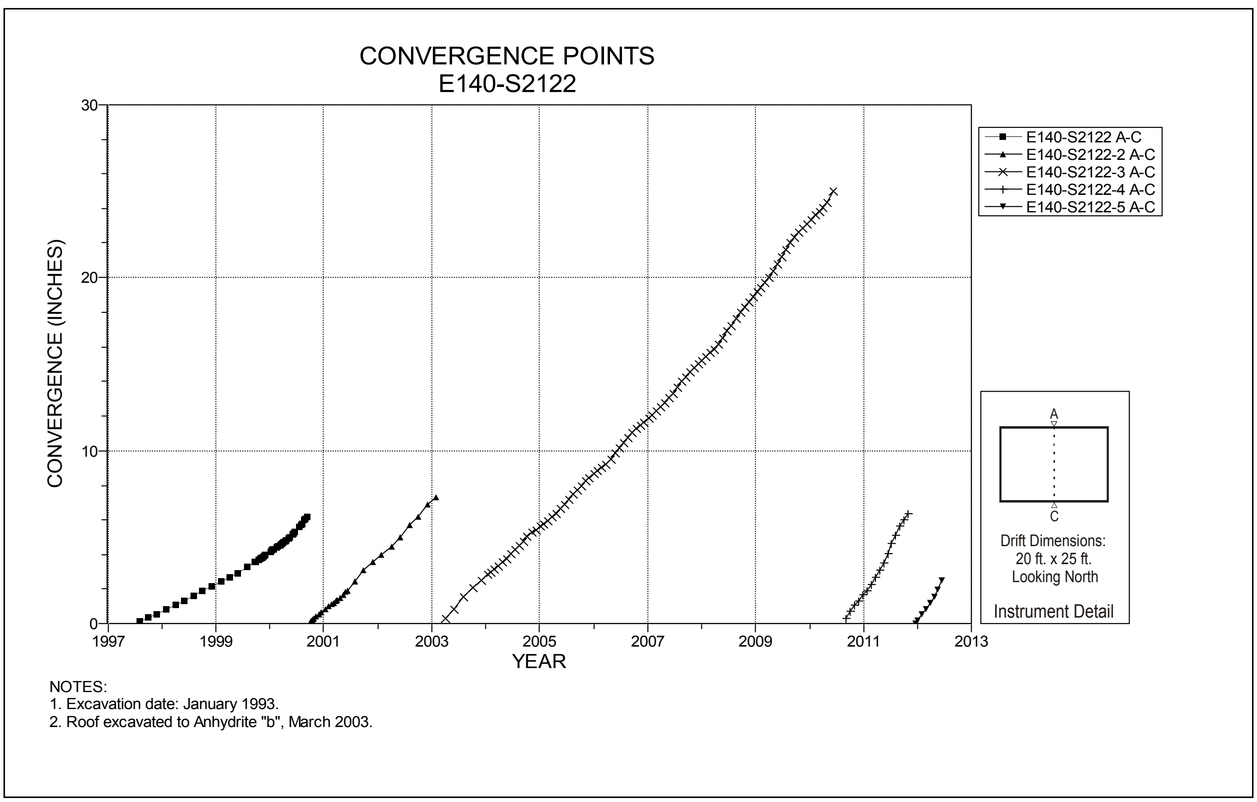


Figure 4-98 Convergence Point Array
E140 S2122 – Roof to Floor

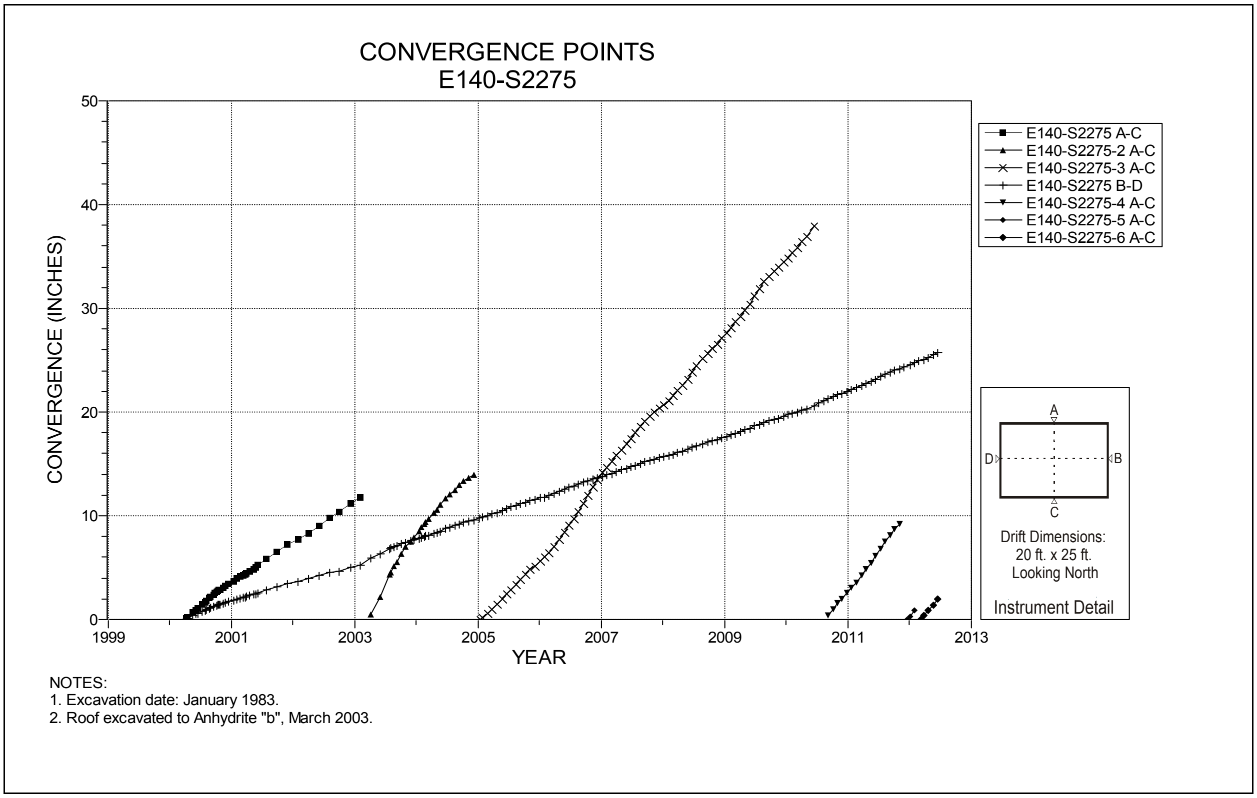


Figure 4-99 Convergence Point Array
E140 S2275 – All Chords

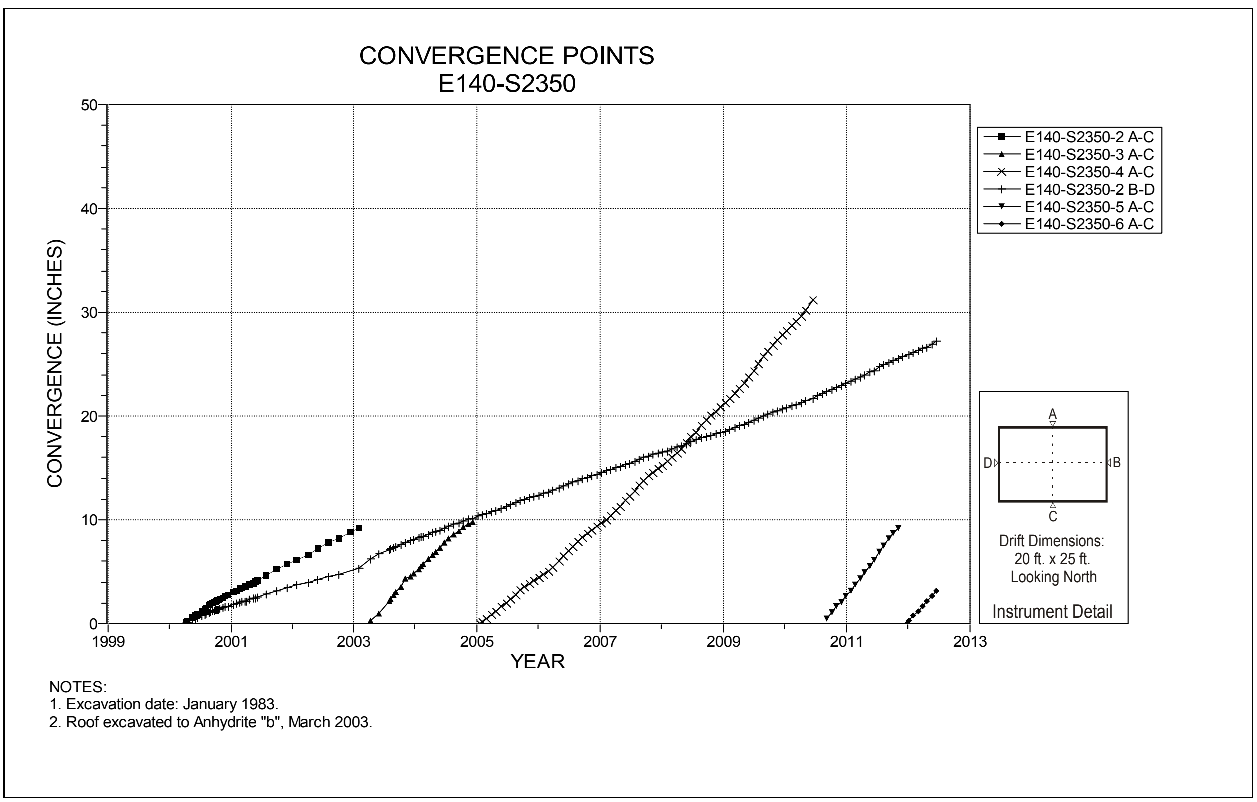


Figure 4-100 Convergence Point Array
E140 S2350 – All Chords

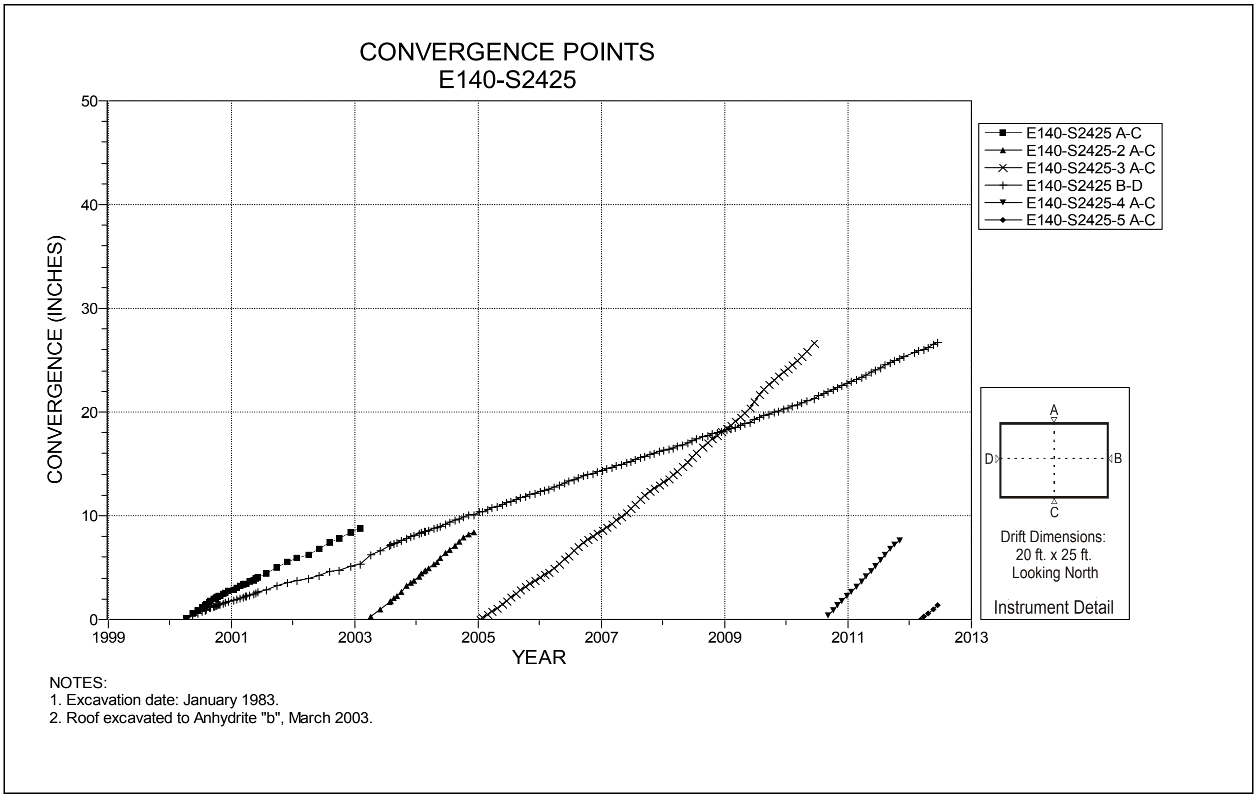


Figure 4-101 Convergence Point Array
E140 S2425 – All Chords

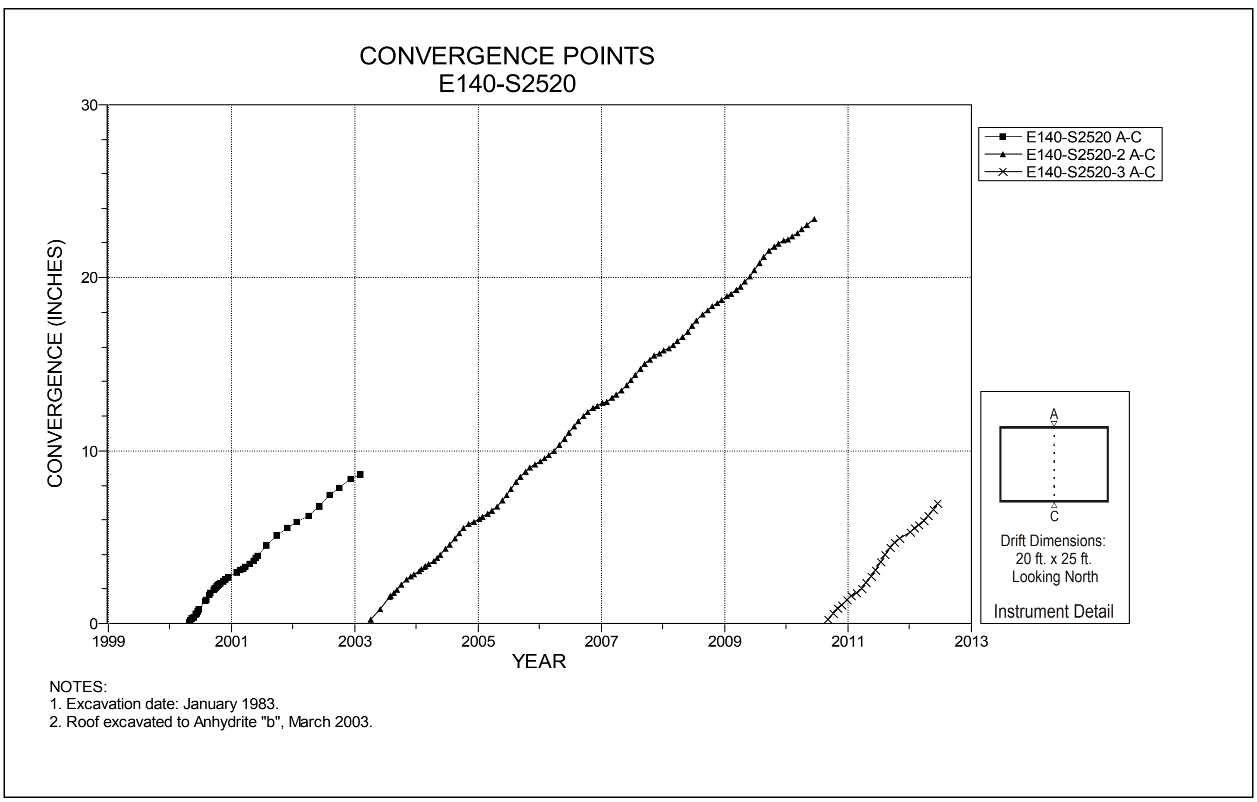


Figure 4-102 Convergence Point Array
E140 S2520 – Roof to Floor

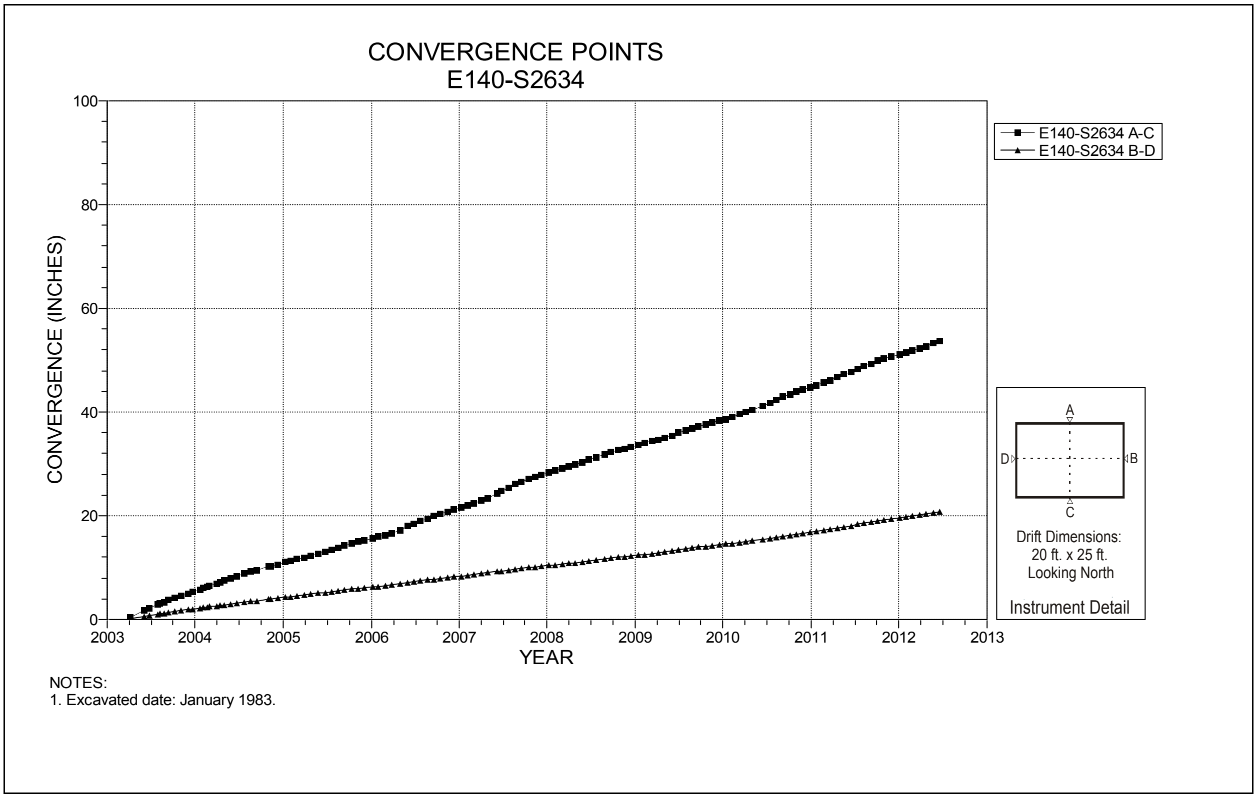


Figure 4-103 Convergence Point Array
E140 S2634 – All Chords

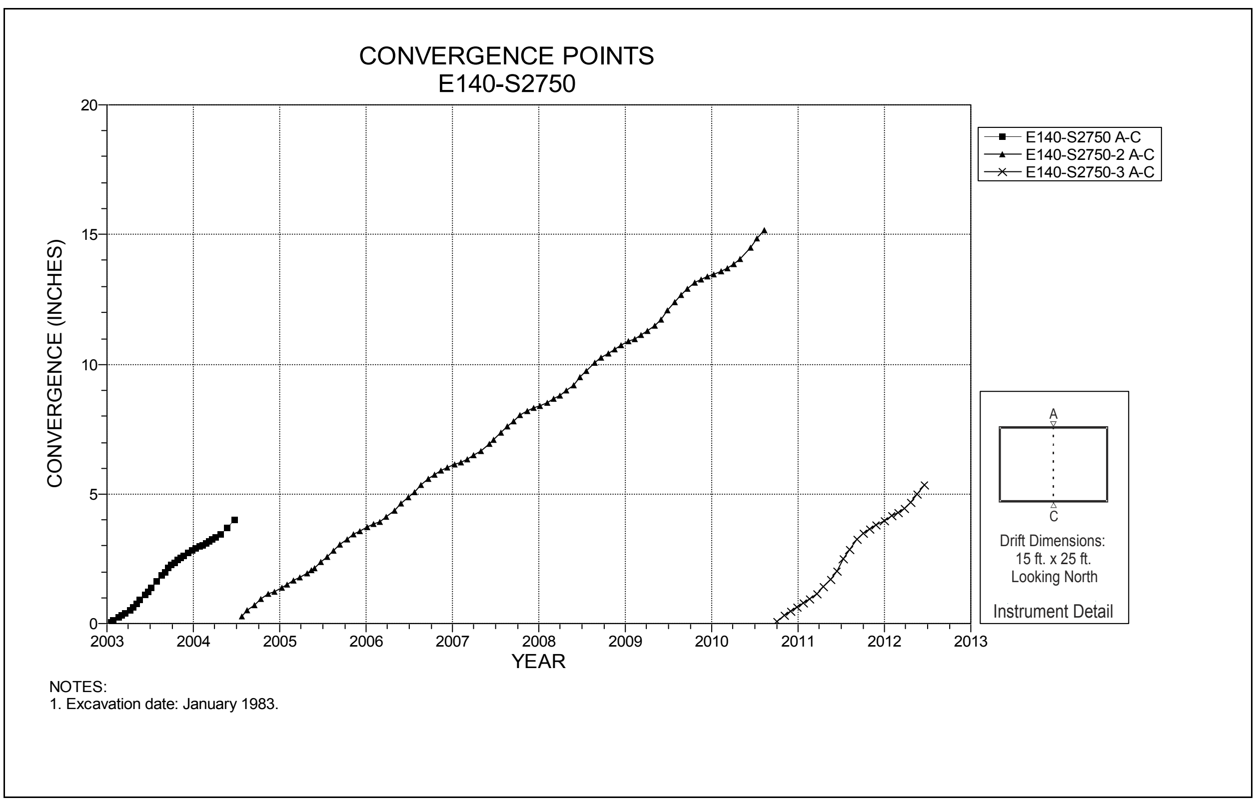


Figure 4-104 Convergence Point Array
E140 S2750 – Roof to Floor

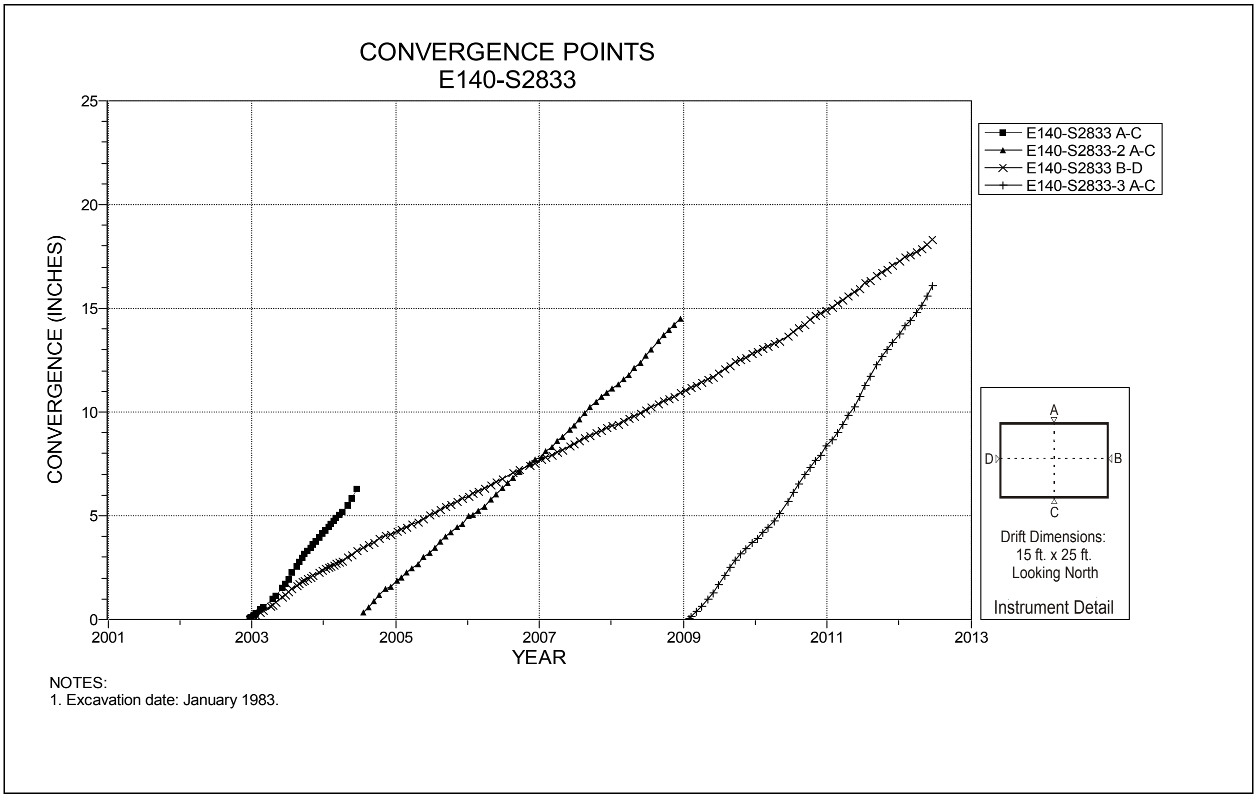


Figure 4-105 Convergence Point Array
E140 S2833 – All Chords

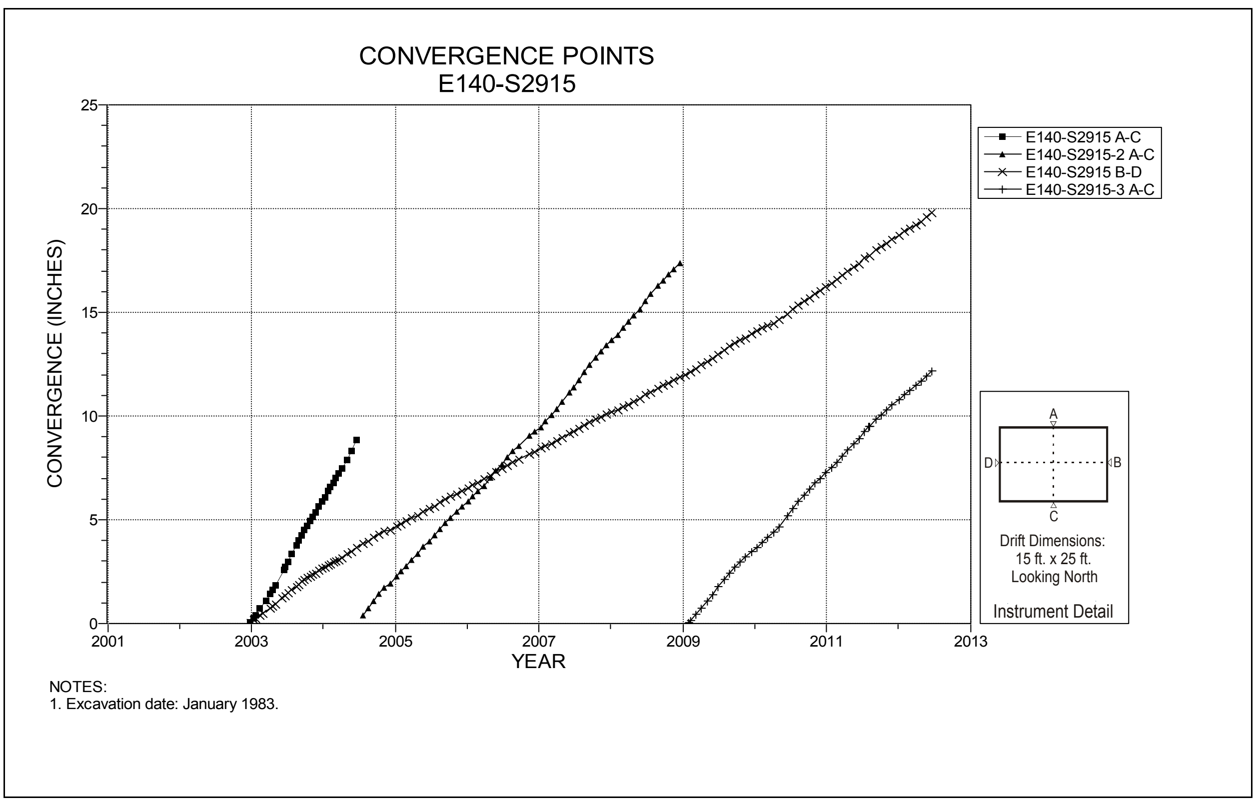


Figure 4-106 Convergence Point Array
E140 S2915 – All Chords

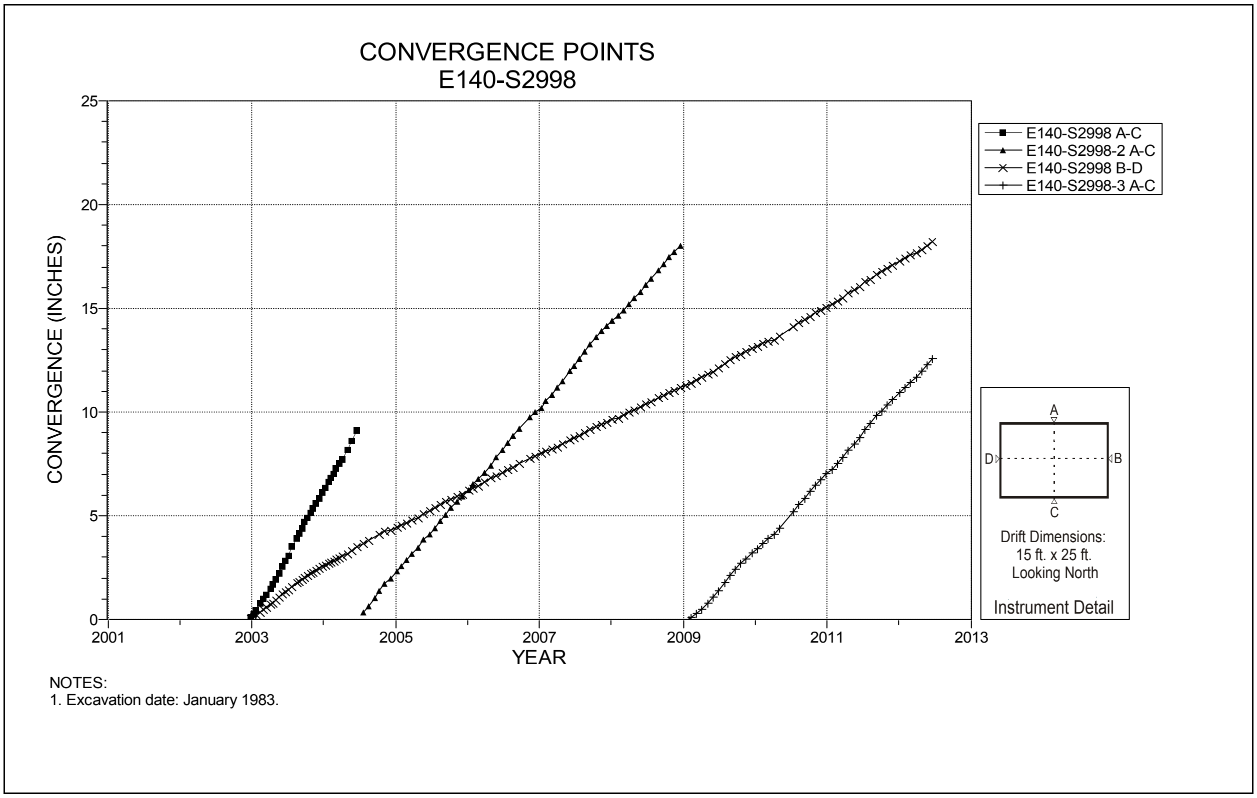


Figure 4-107 Convergence Point Array
E140 S2998 – All Chords

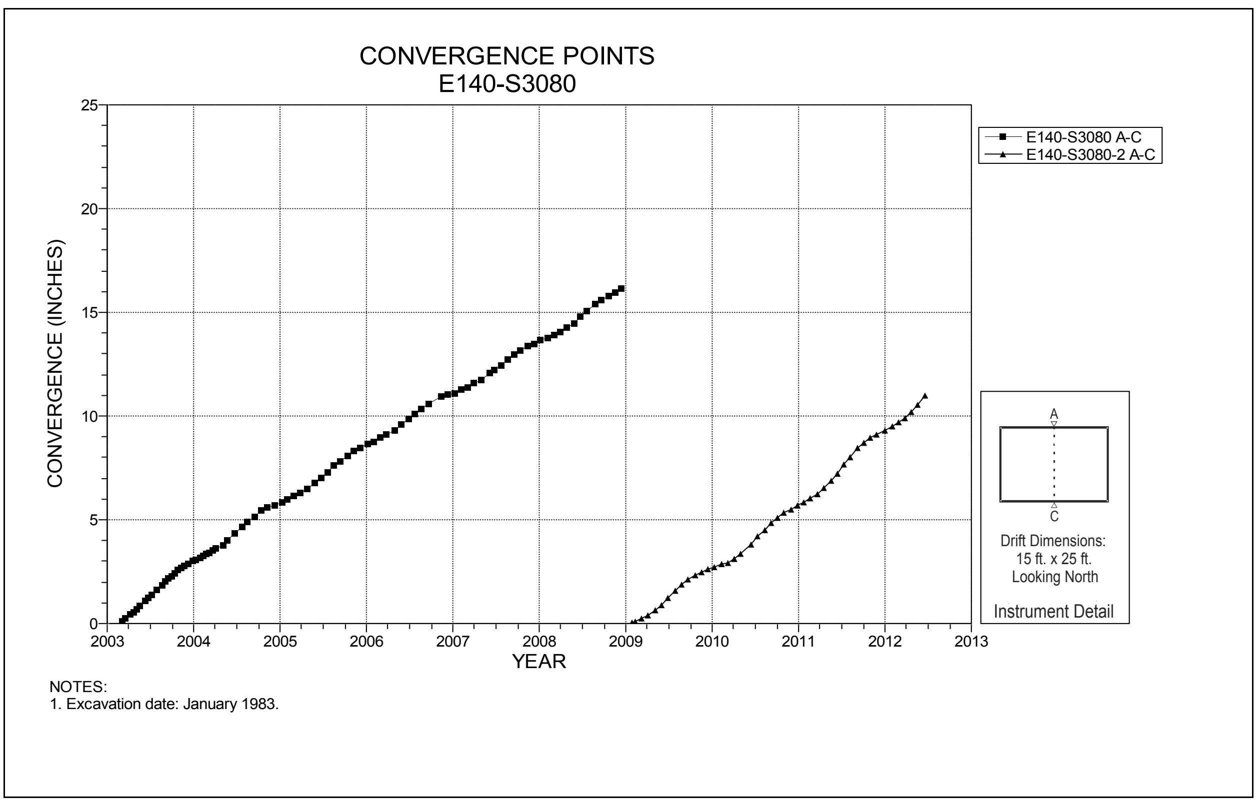


Figure 4-108 Convergence Point Array
E140 S3080 – Roof to Floor

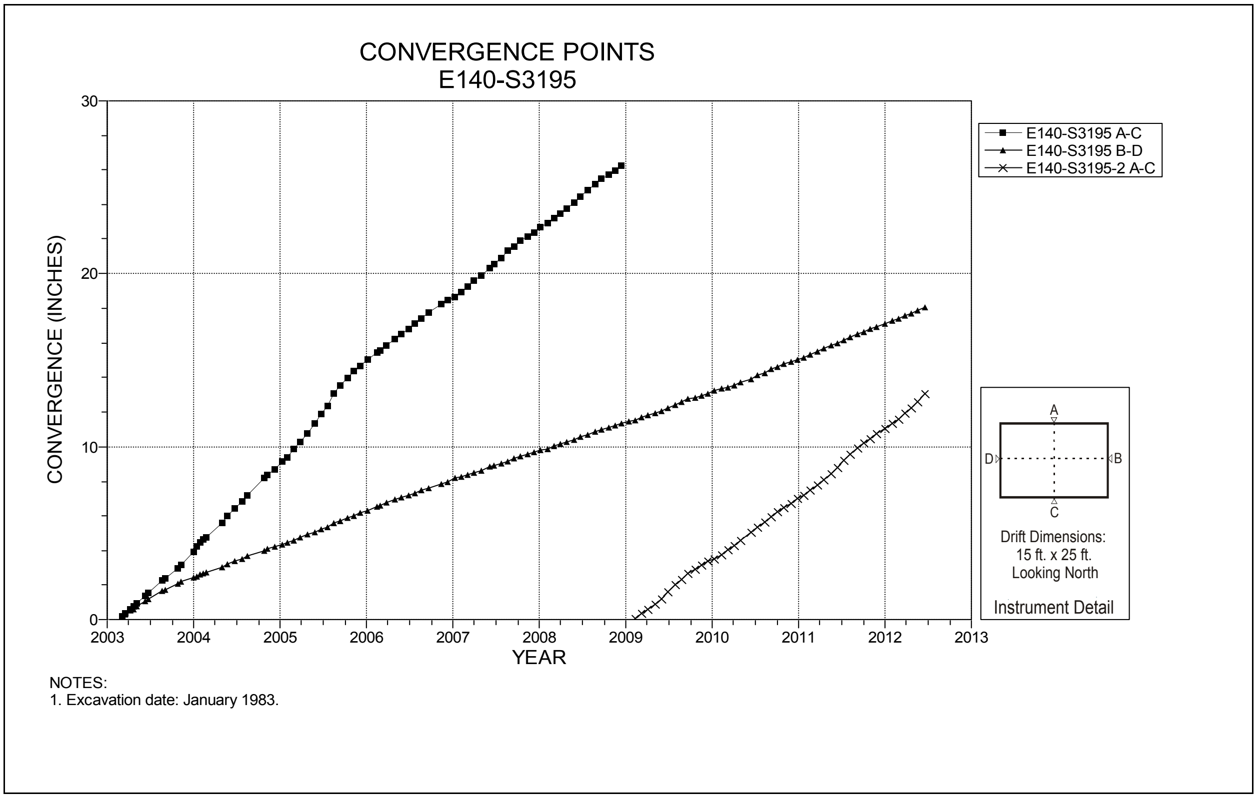


Figure 4-109 Convergence Point Array
E140 S3195 – All Chords

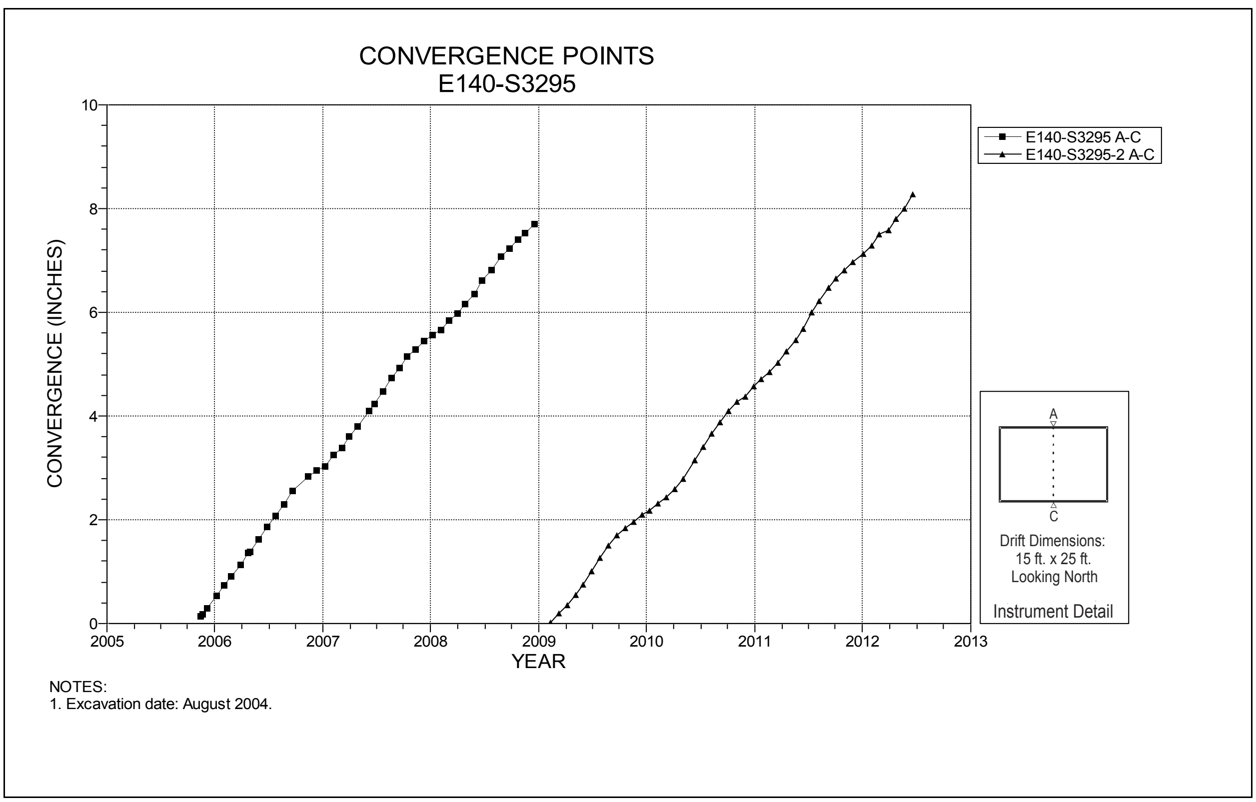


Figure 4-110 Convergence Point Array
E140 S3295 – Roof to Floor

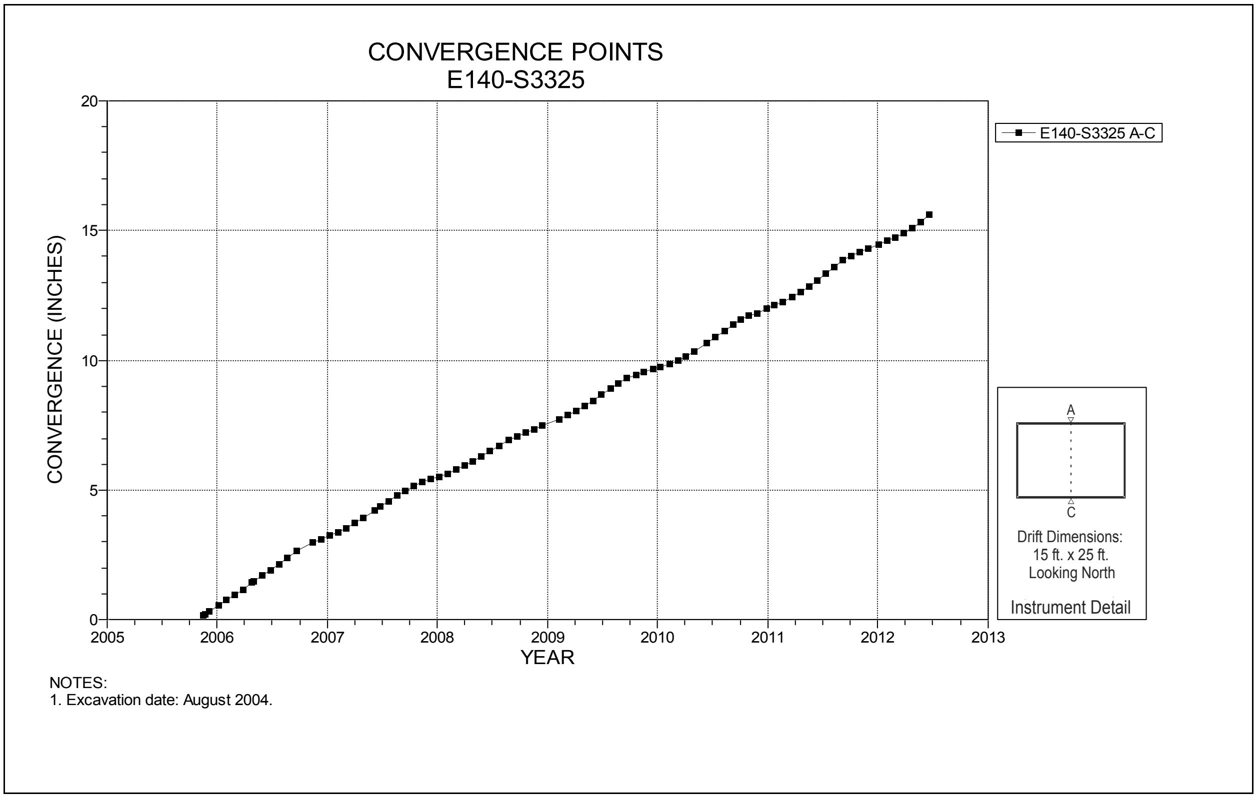


Figure 4-111 Convergence Point Array
E140 S3325 – Roof to Floor

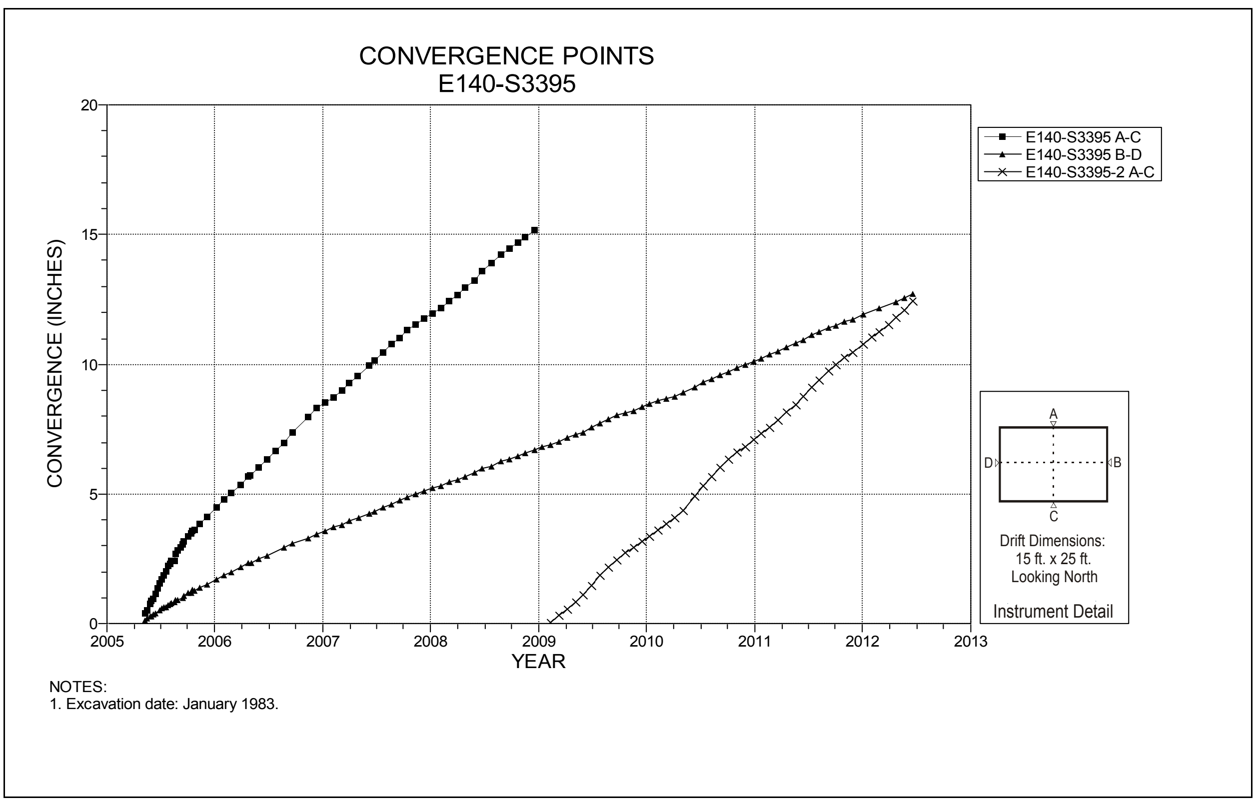


Figure 4-112 Convergence Point Array
E140 S3395 – All Chords

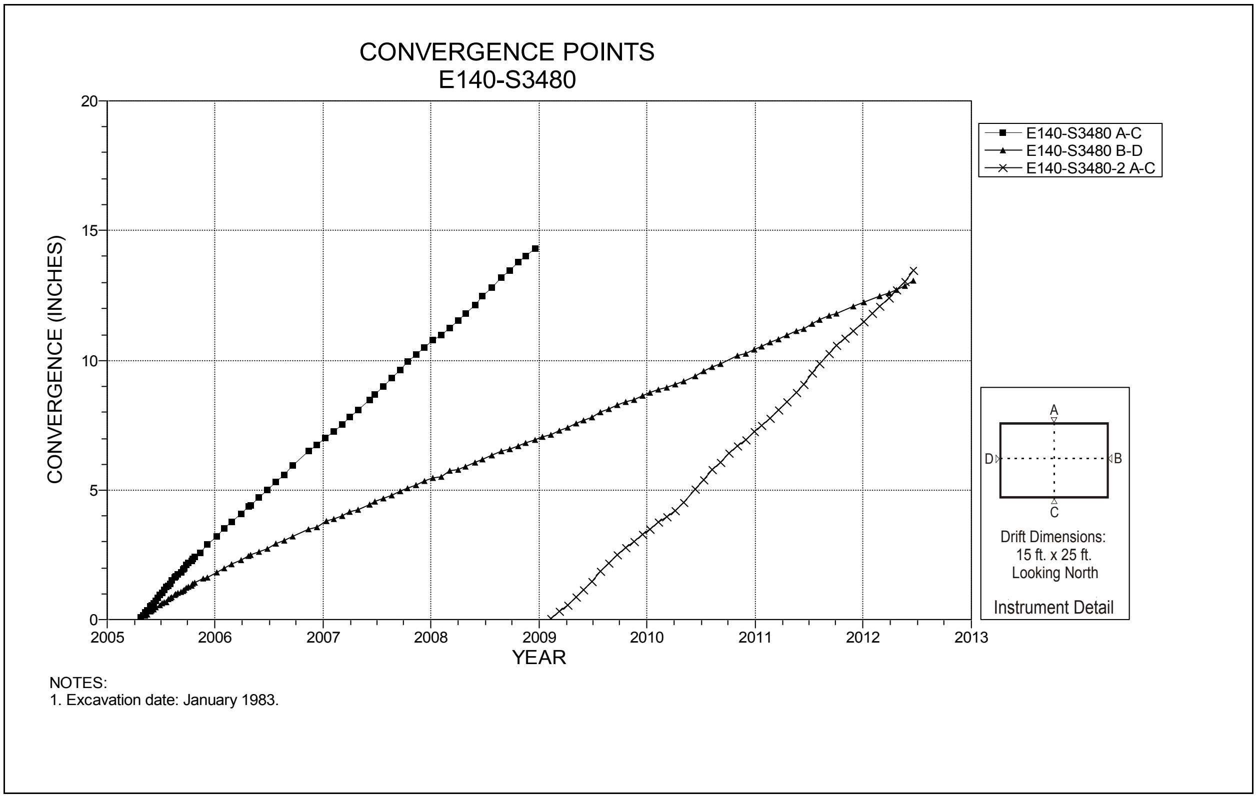


Figure 4-113 Convergence Point Array
E140 S3480 – All Chords

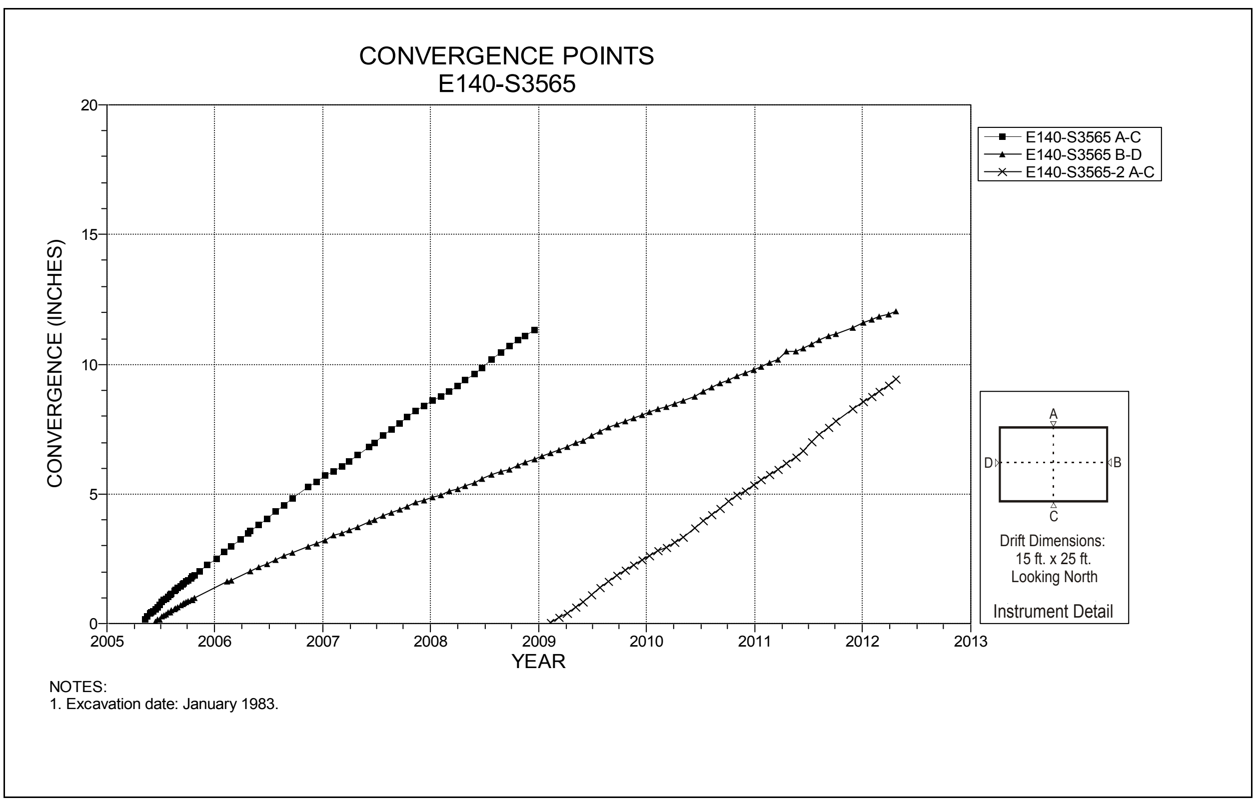


Figure 4-114 Convergence Point Array
E140 S3565 – All Chords

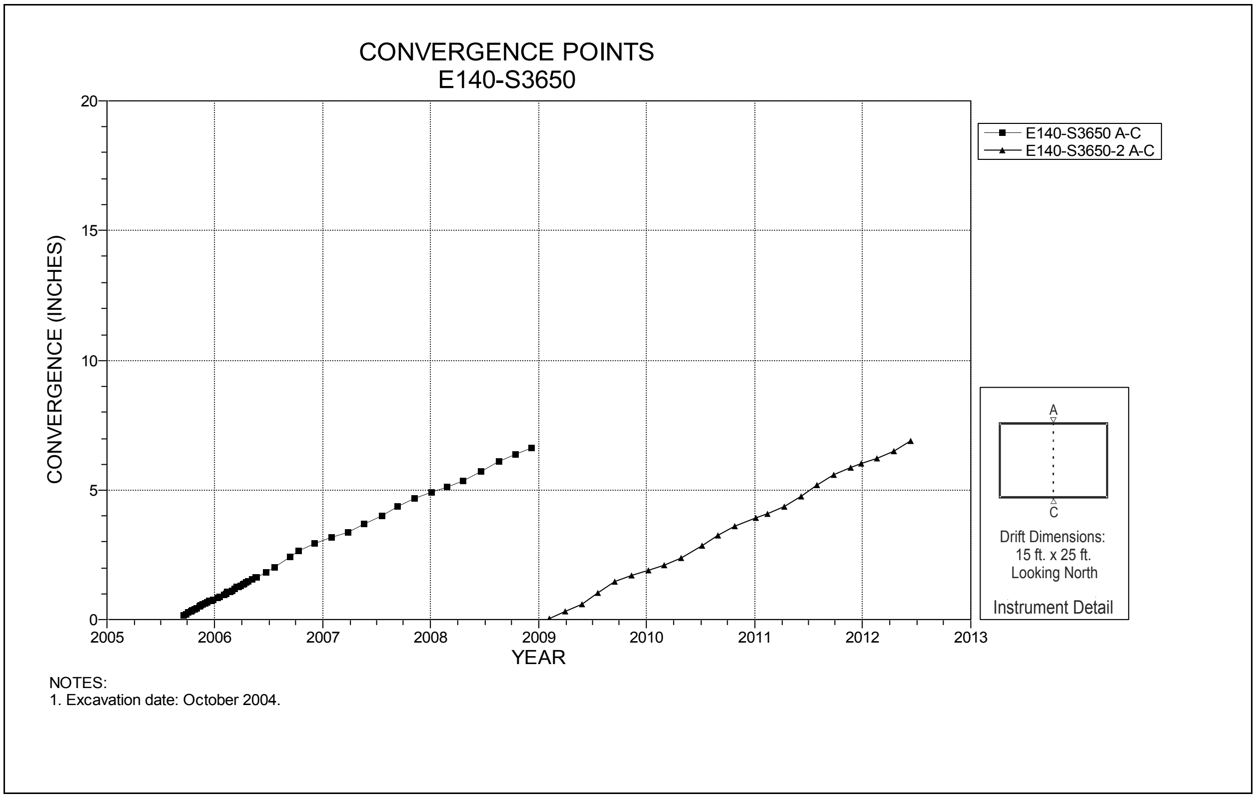


Figure 4-115 Convergence Point Array
E140 S3650 – Roof to Floor

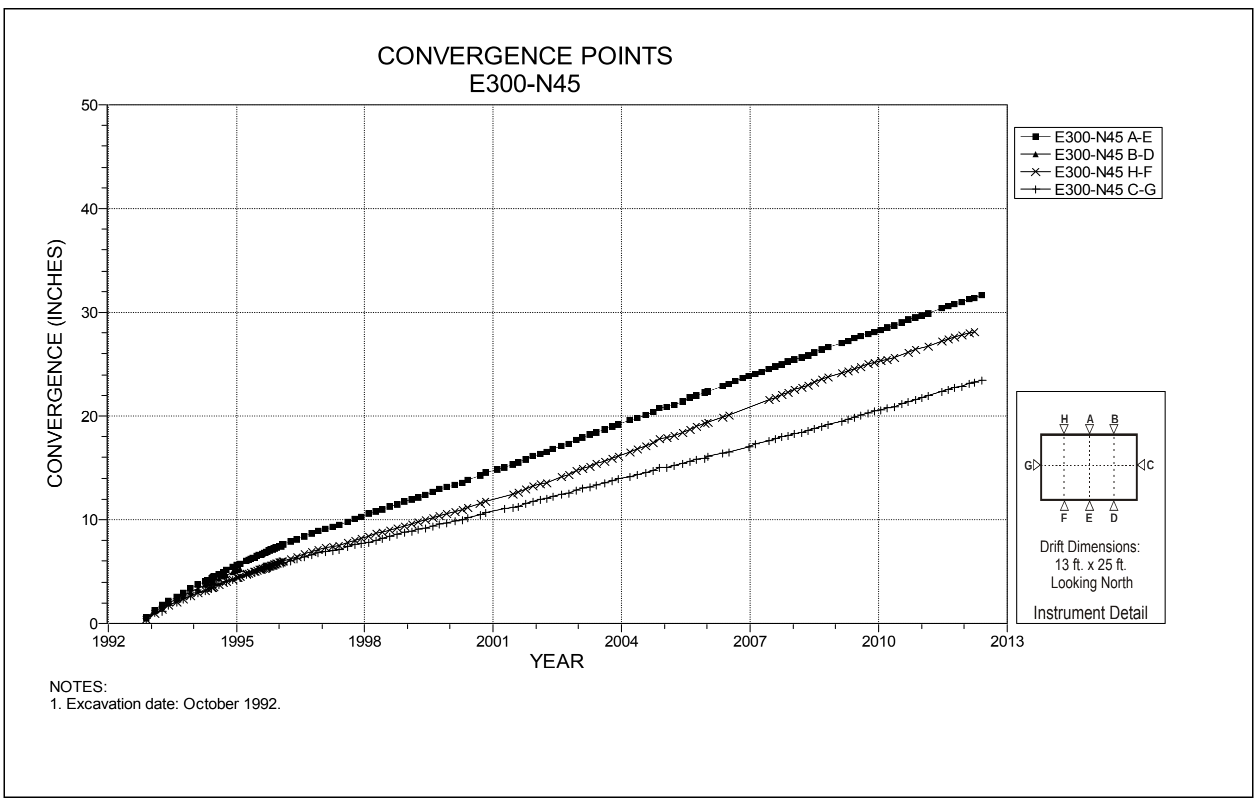


Figure 4-116 Convergence Point Array
E300 N45 – All Chords

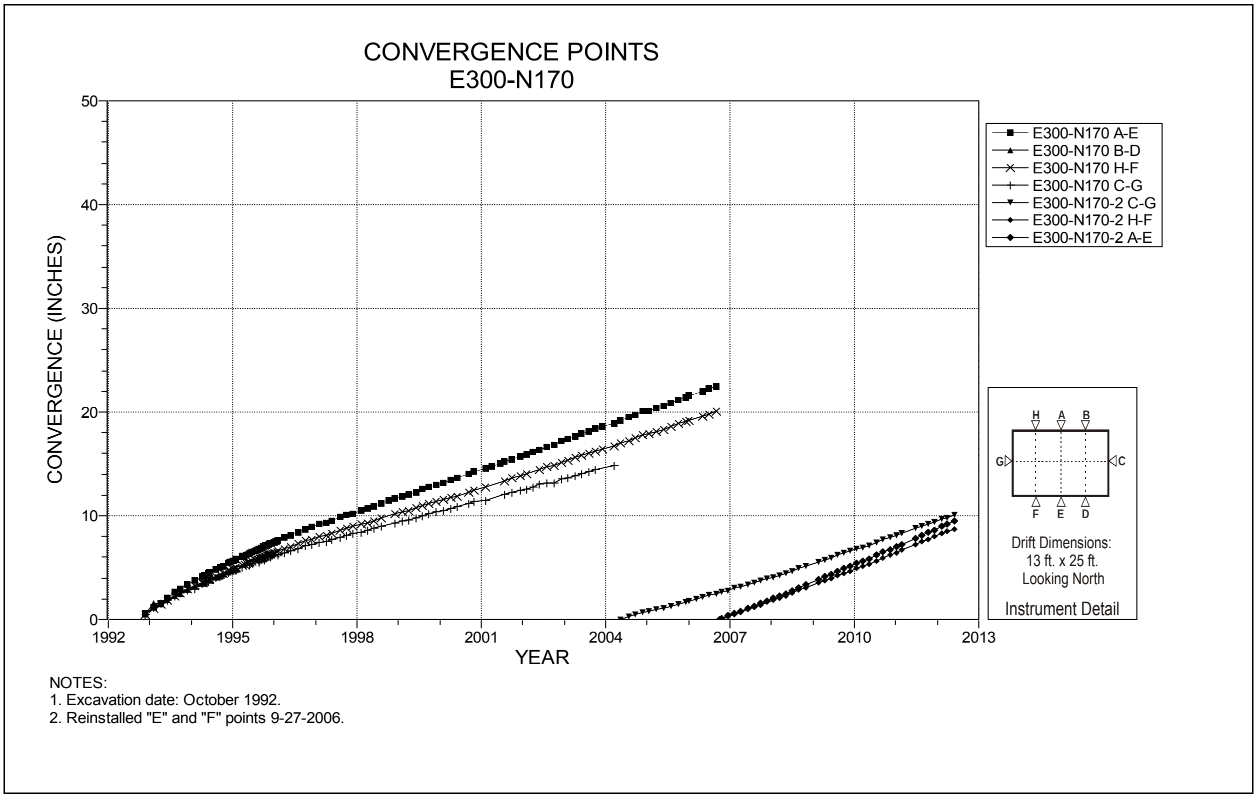


Figure 4-117 Convergence Point Array
E300 N170 – All Chords

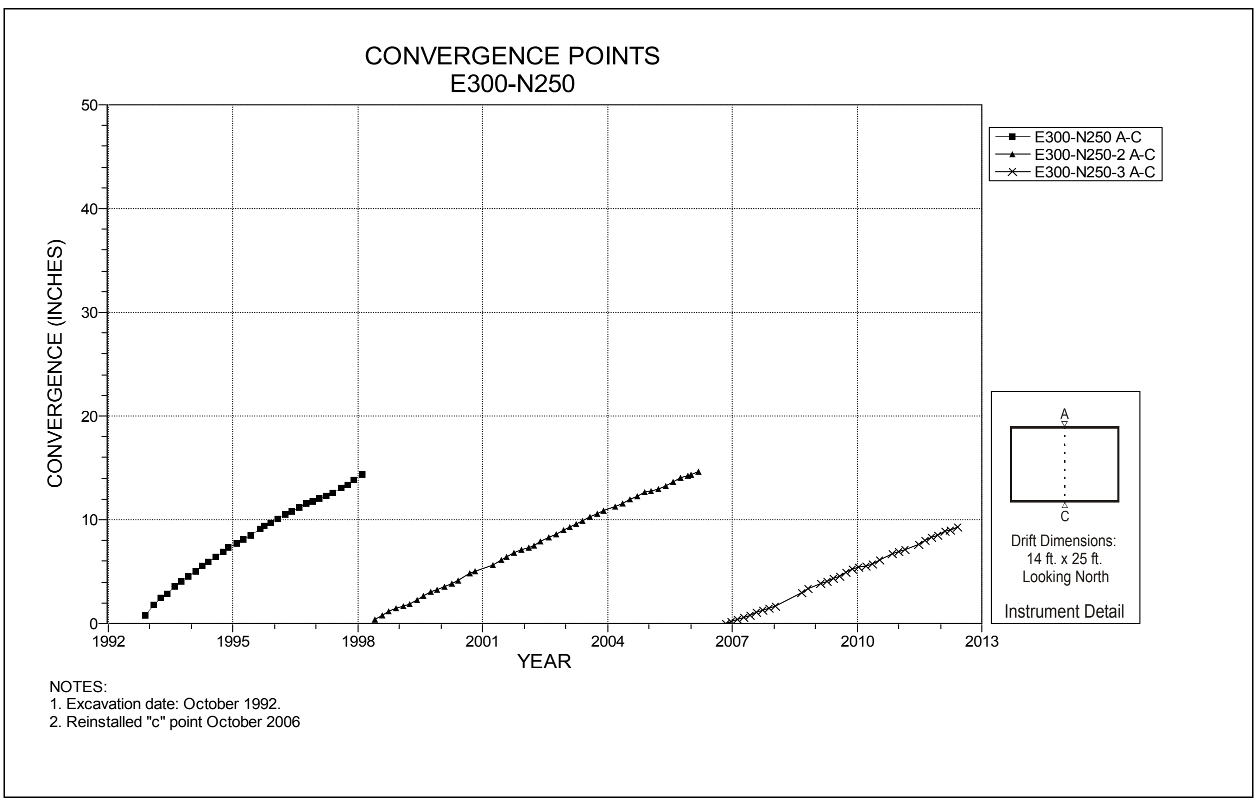


Figure 4-118 Convergence Point Array
E300 N250 – Roof to Floor

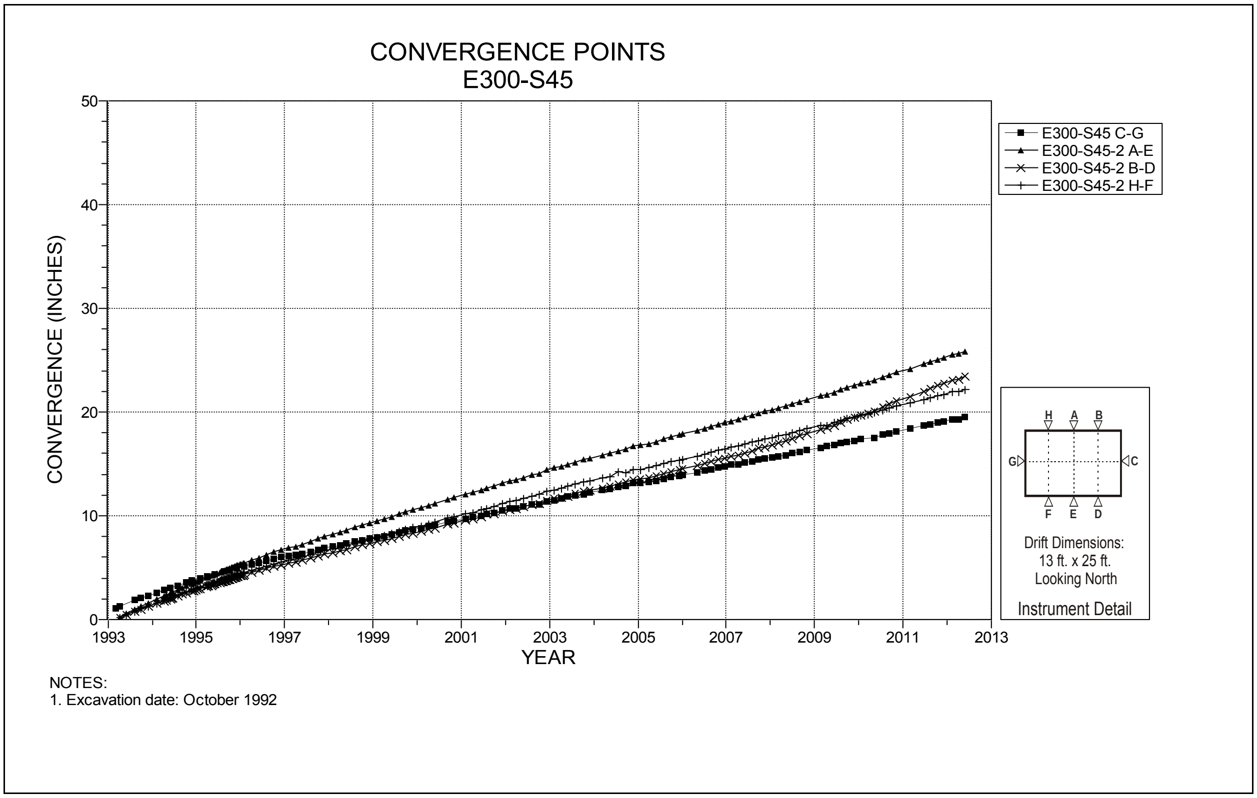


Figure 4-119 Convergence Point Array
E300 S45 – All Chords

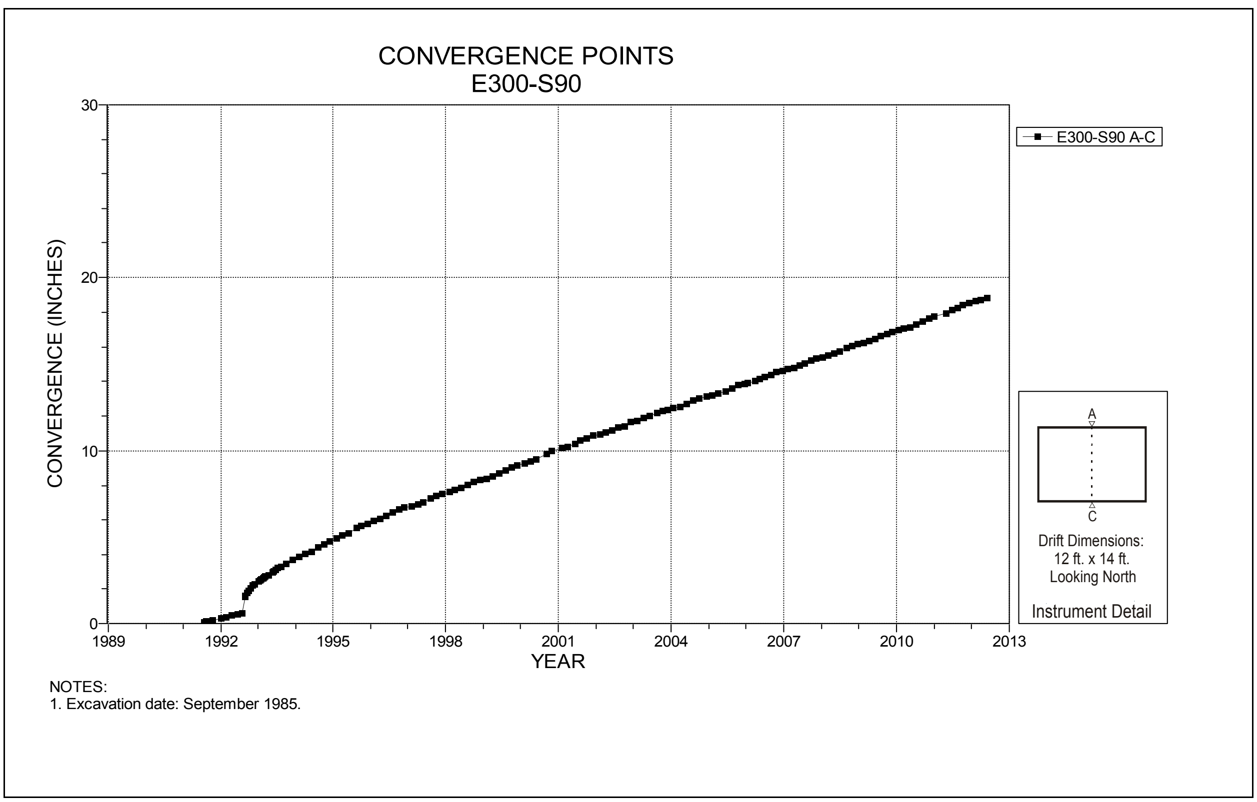


Figure 4-120 Convergence Point Array
E300 S90 – Roof to Floor

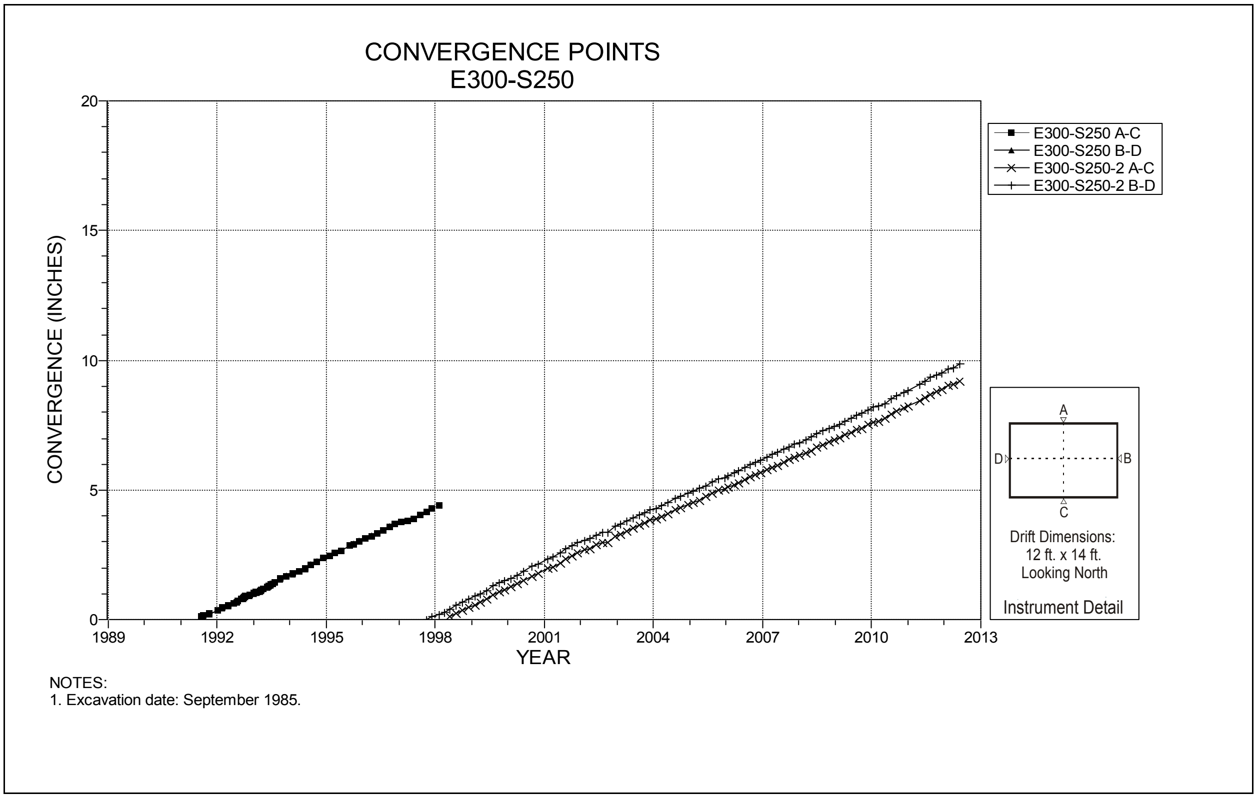


Figure 4-121 Convergence Point Array
E300 S250 – All Chords

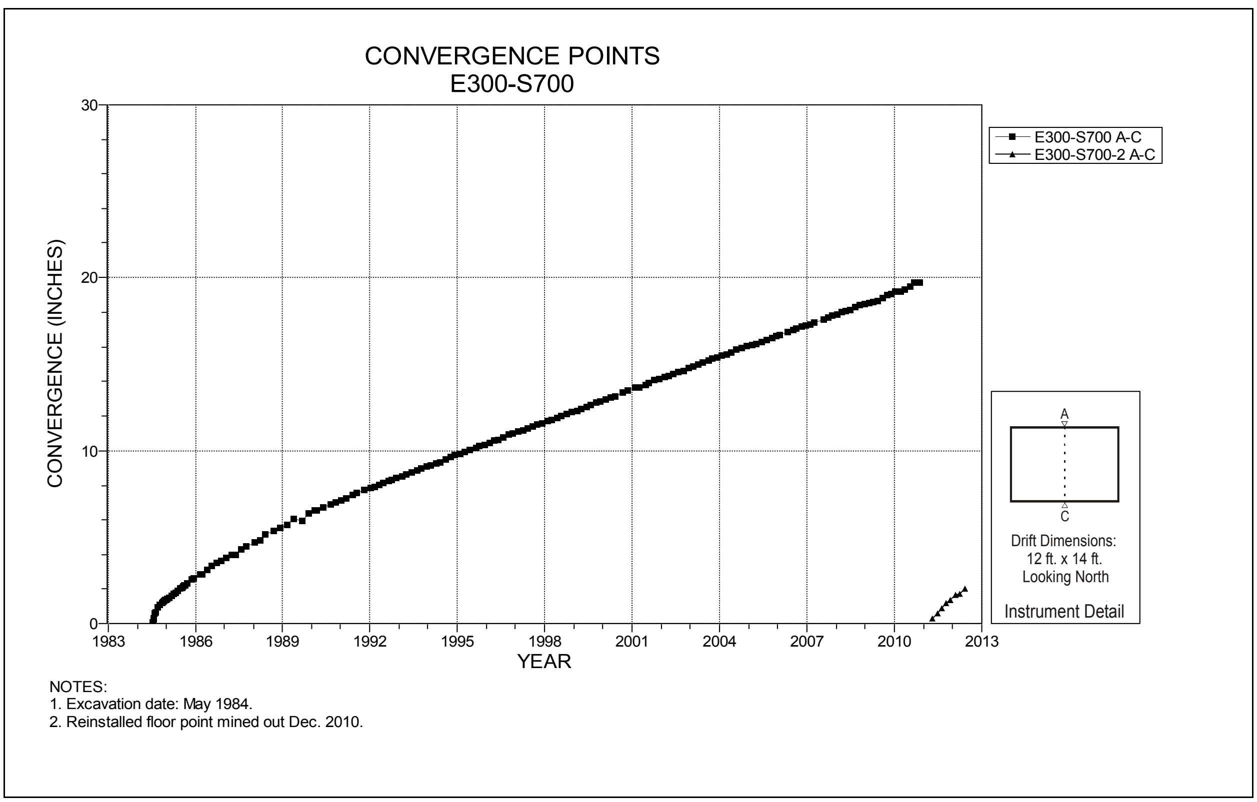


Figure 4-122 Convergence Point Array
E300 S700 – Roof to Floor

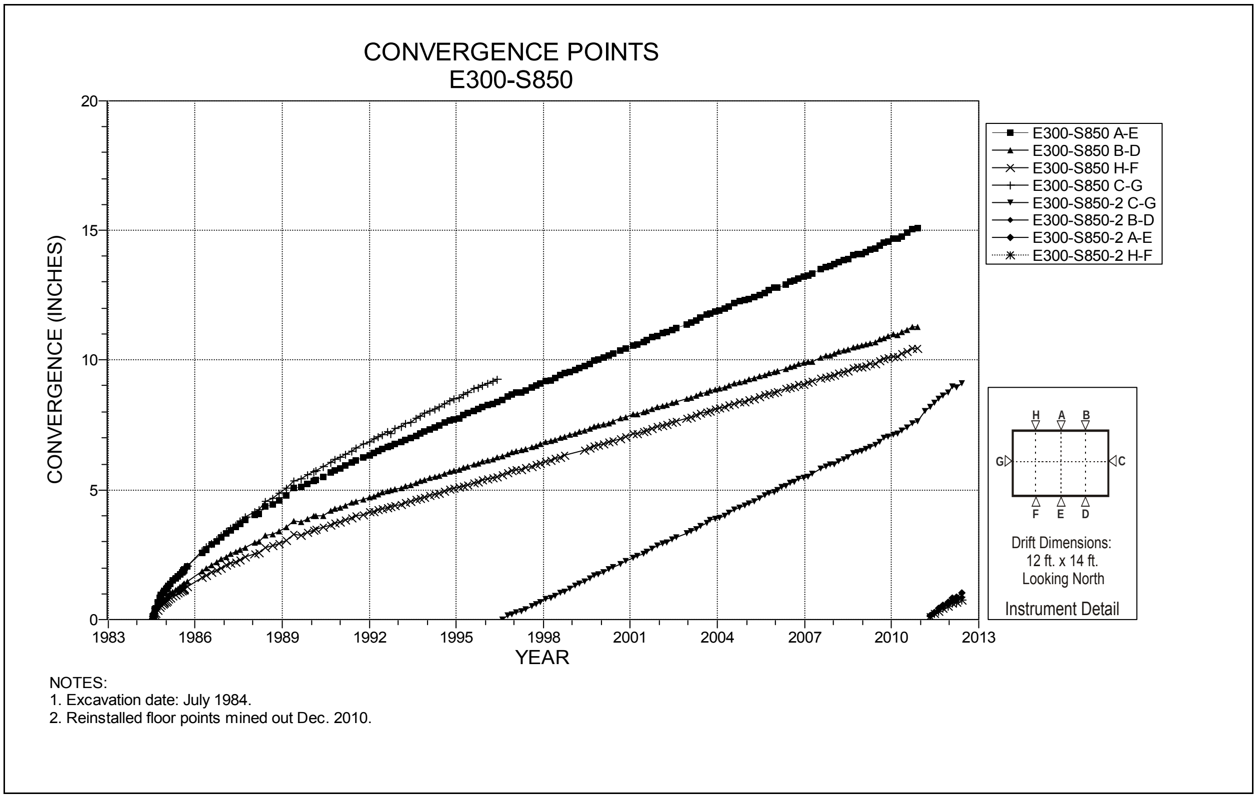


Figure 4-123 Convergence Point Array
E300 S850 – All Chords

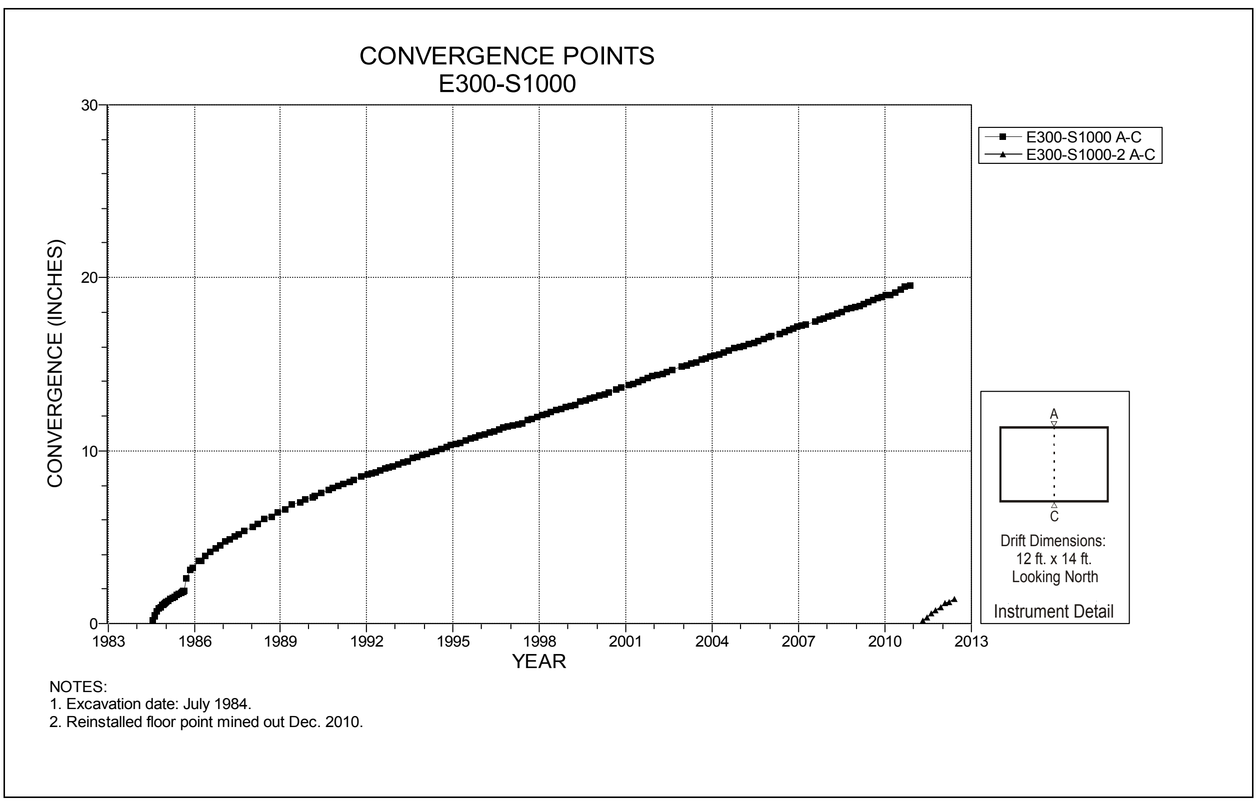


Figure 4-124 Convergence Point Array
E300 S1000 – Roof to Floor

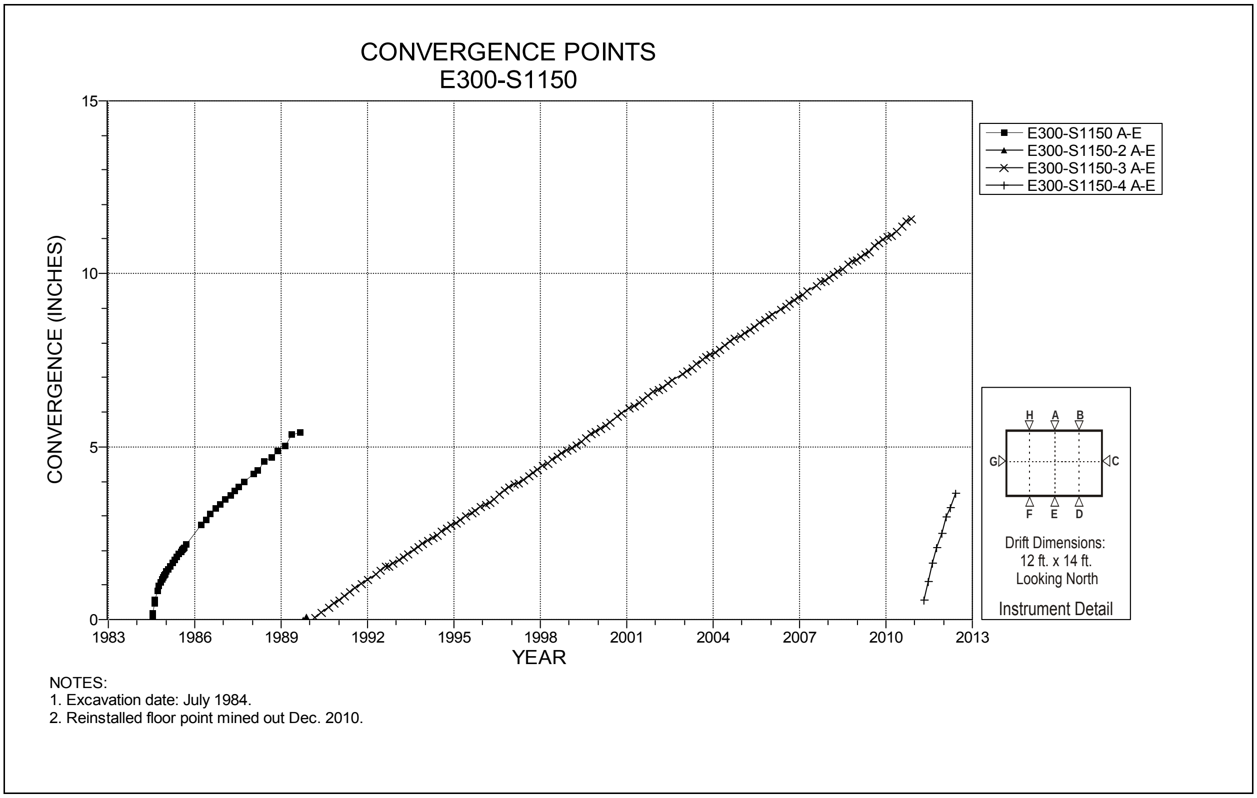


Figure 4-125 Convergence Point Array
E300 S1150 – Roof to Floor

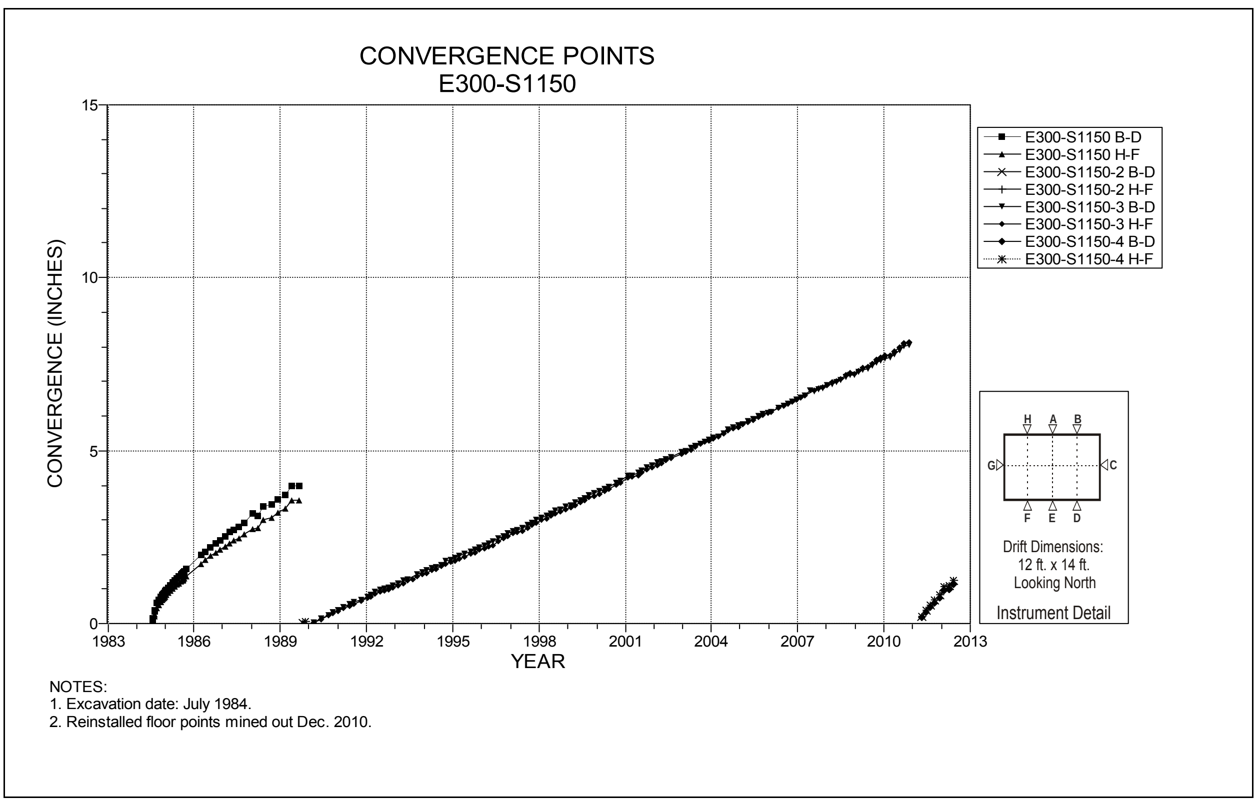


Figure 4-126 Convergence Point Array
E300 S1150 – Roof to Floor – Quarter Points

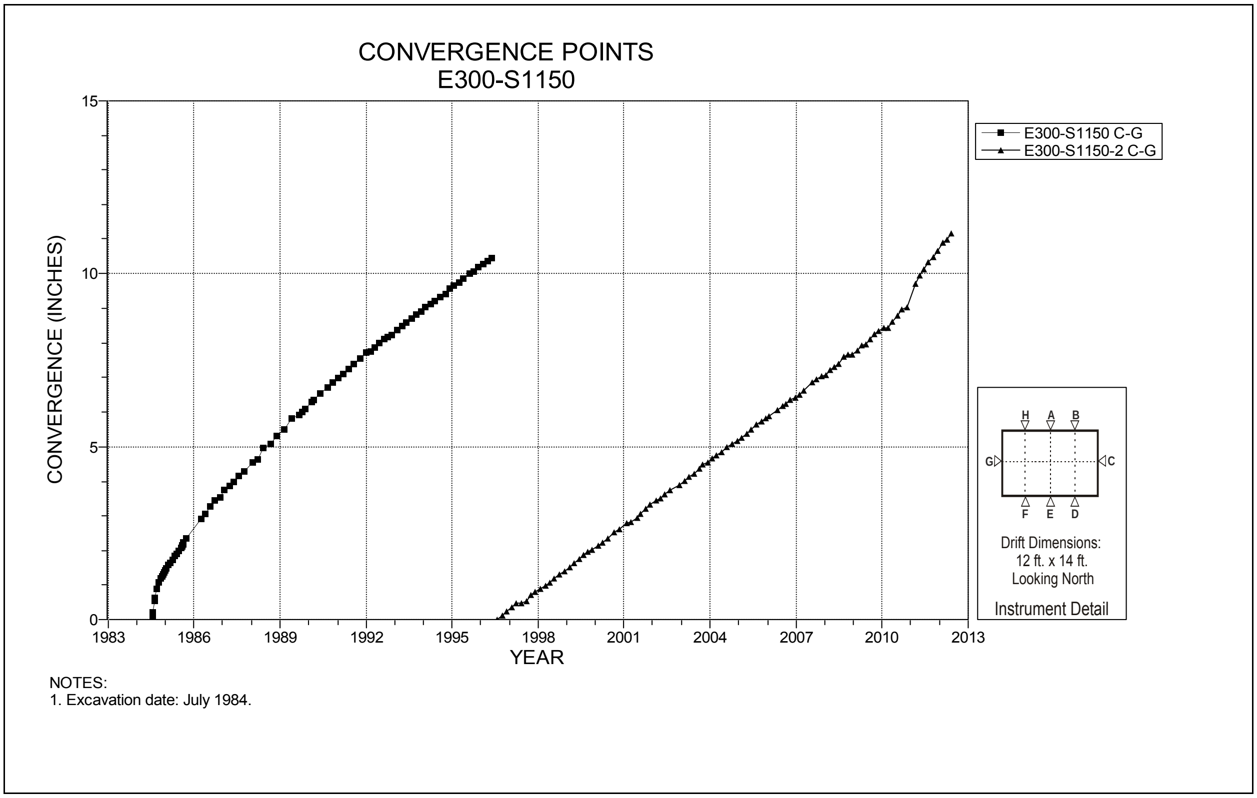


Figure 4-127 Convergence Point Array
E300 S1150 – Rib to Rib

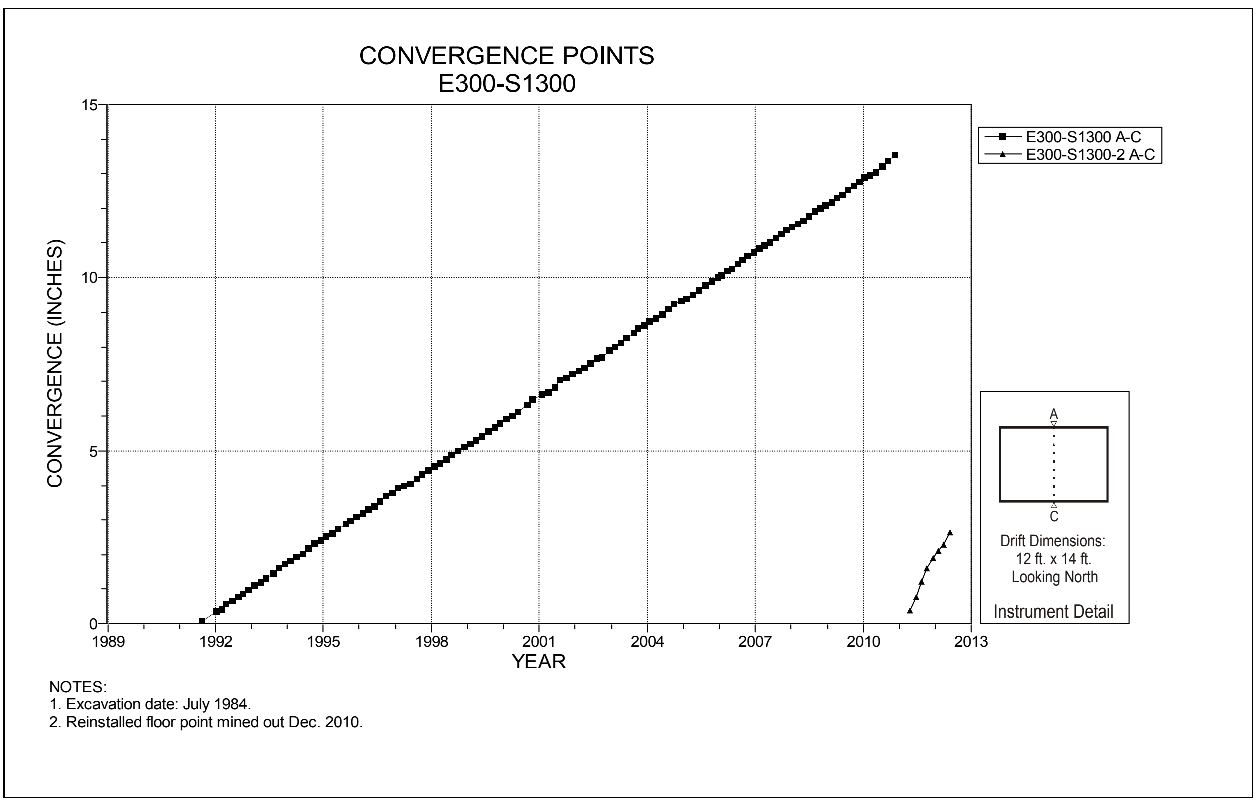


Figure 4-128 Convergence Point Array
E300 S1300 – Roof to Floor

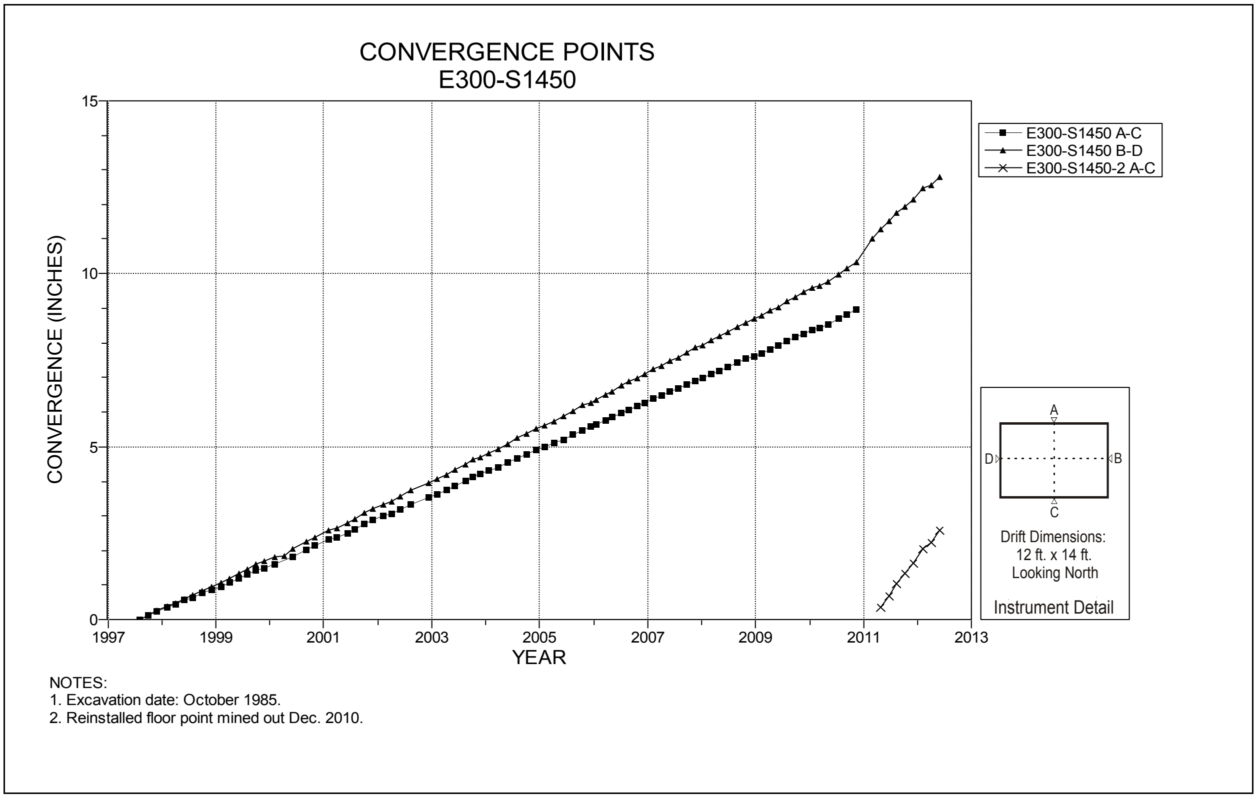


Figure 4-129 Convergence Point Array
E300 S1450 – All Chords

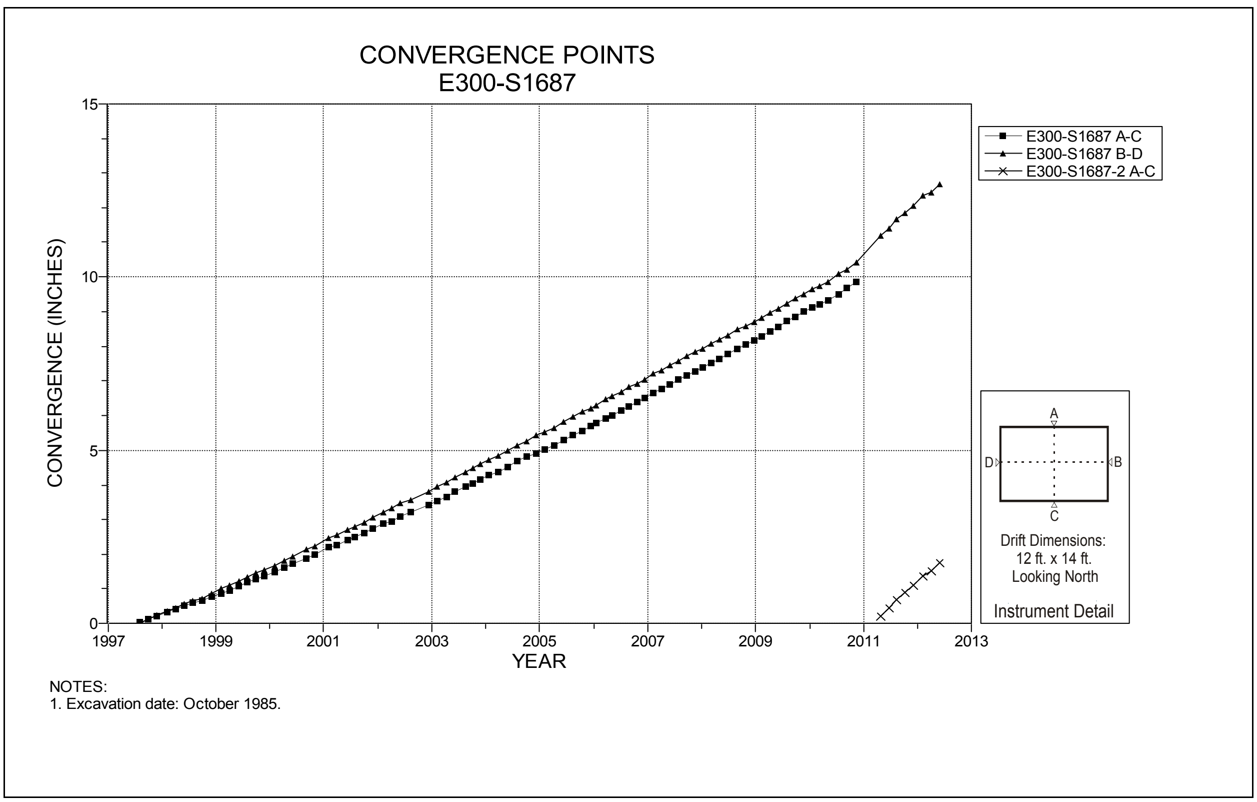


Figure 4-130 Convergence Point Array
E300 S1687 – All Chords

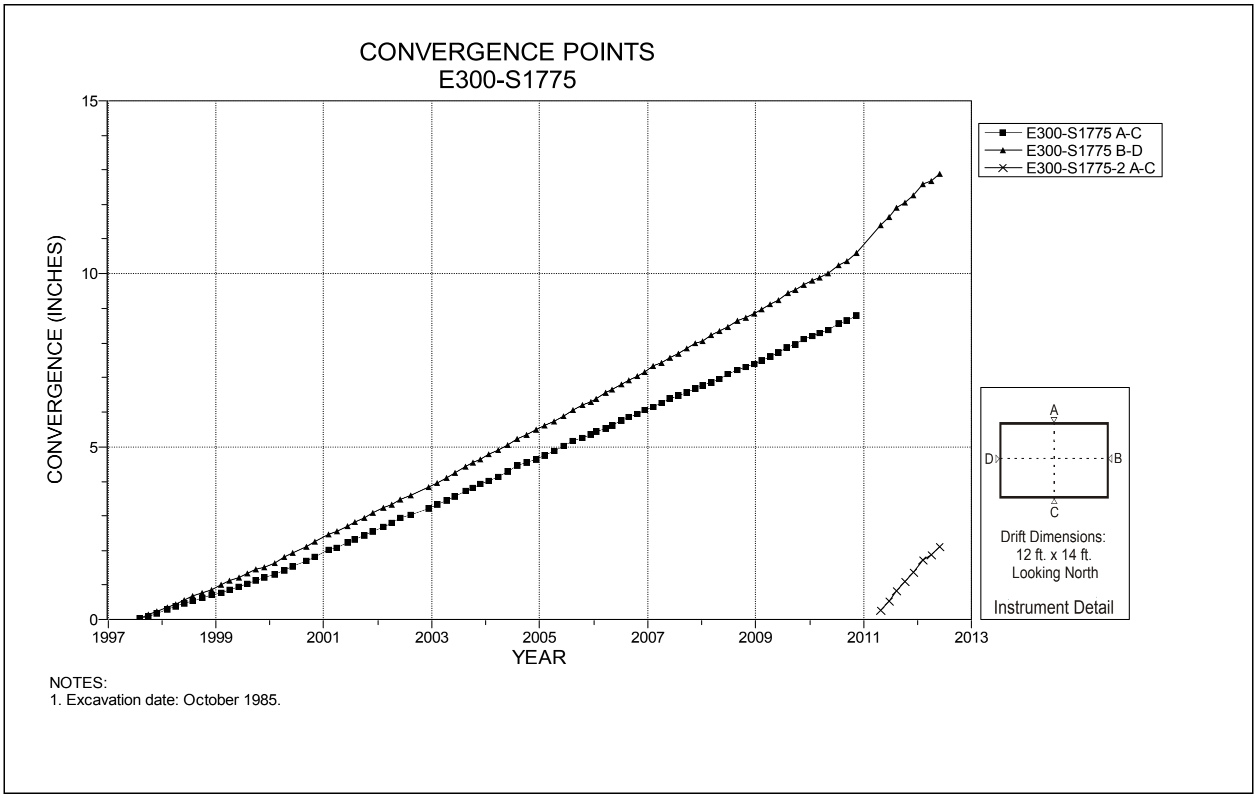


Figure 4-131 Convergence Point Array
E300 S1775 – All Chords

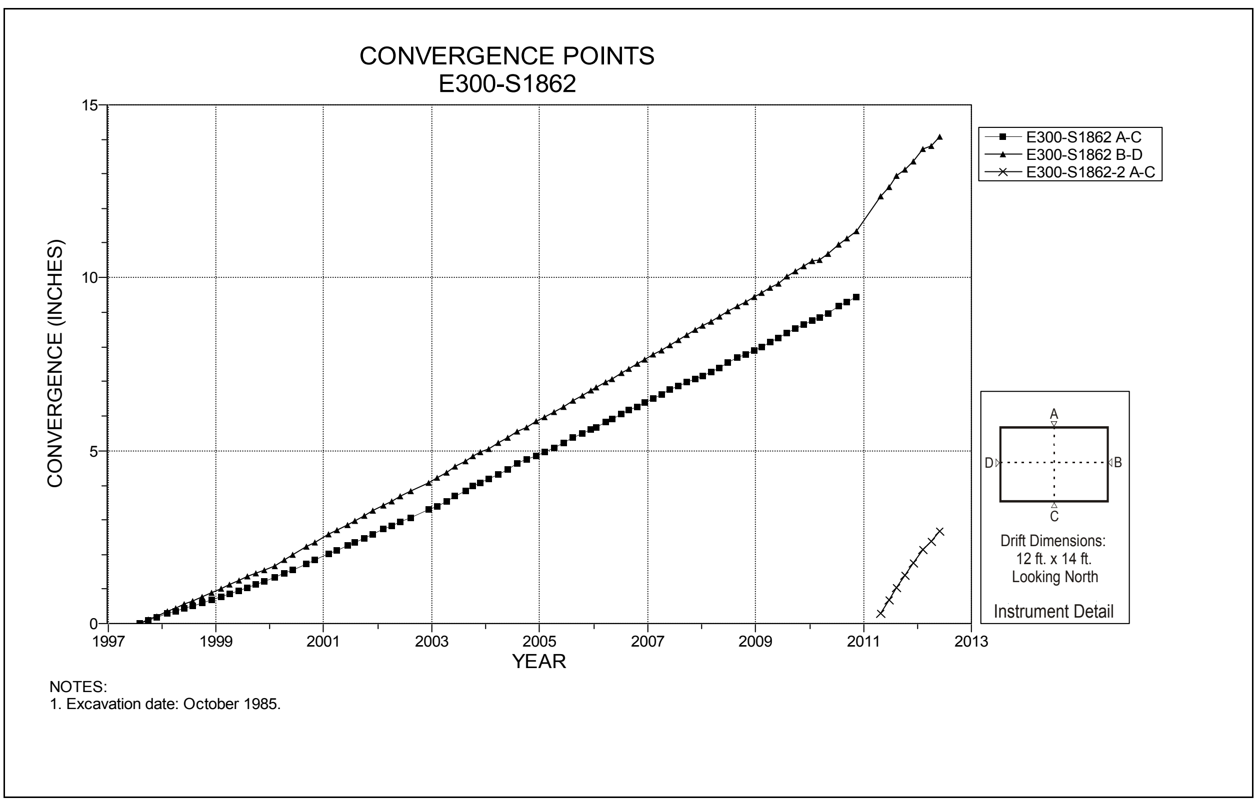


Figure 4-132 Convergence Point Array
E300 S1862 – All Chords

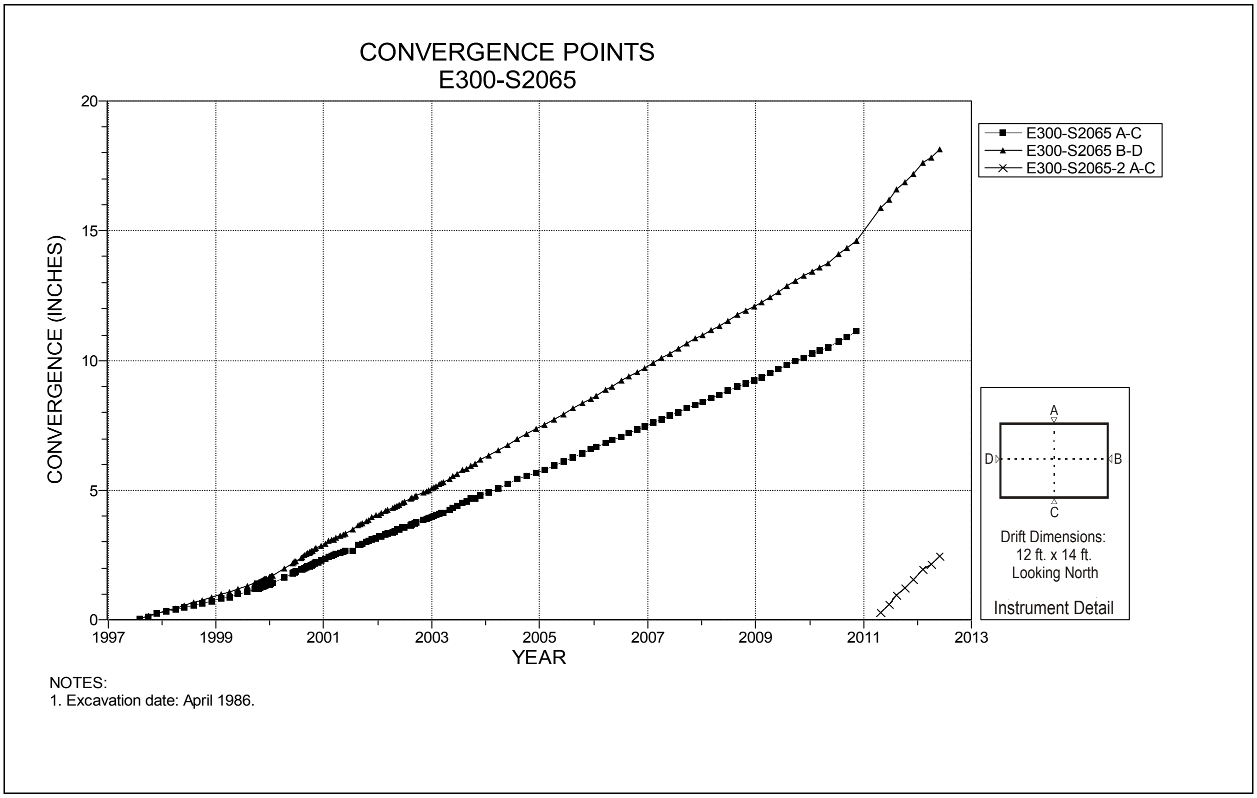


Figure 4-133 Convergence Point Array
E300 S2065 – All Chords

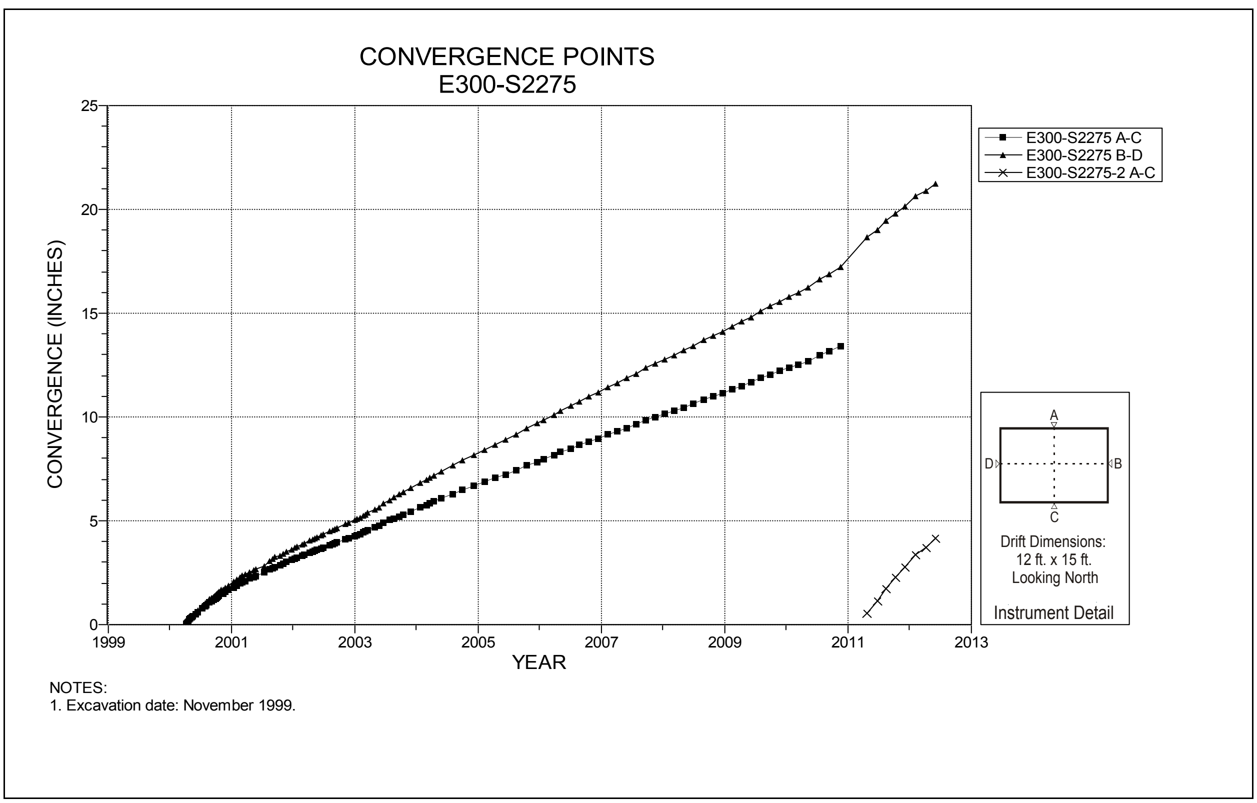


Figure 4-134 Convergence Point Array
E300 S2275 – All Chords

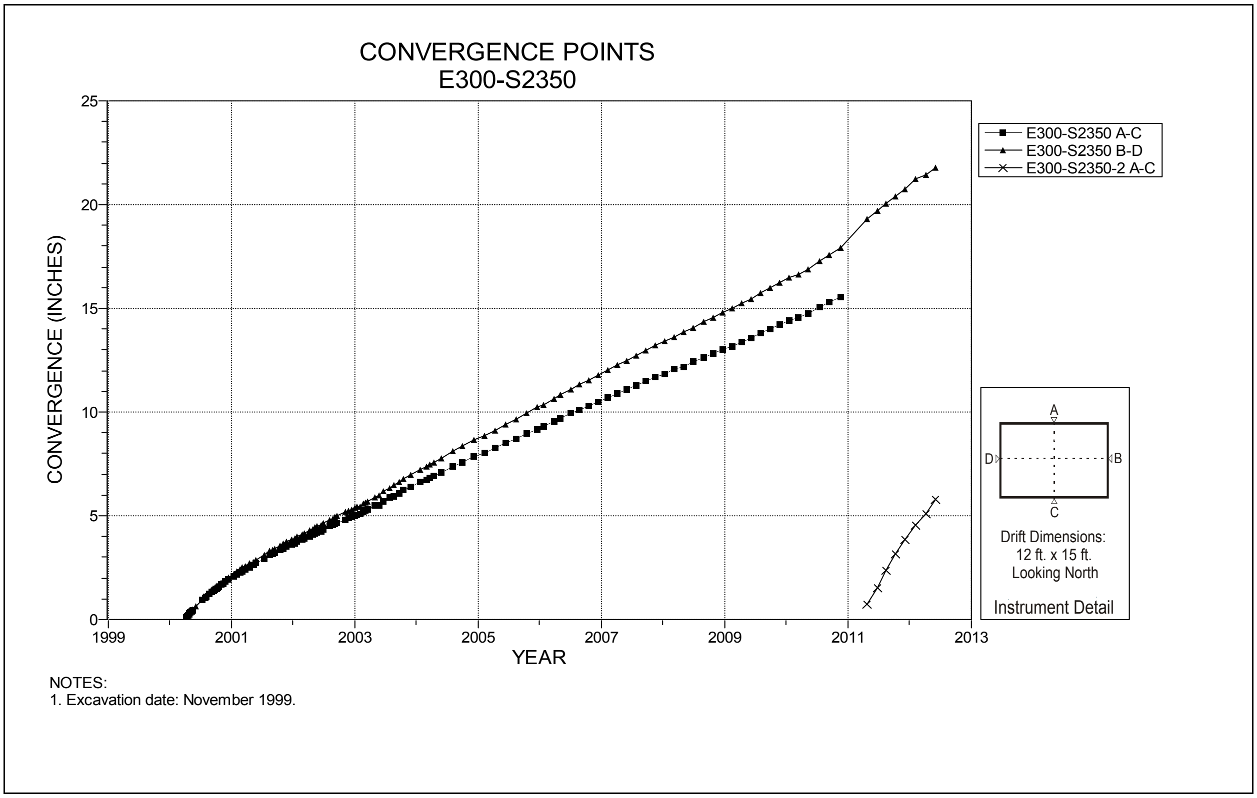


Figure 4-135 Convergence Point Array
E300 S2350 – All Chords

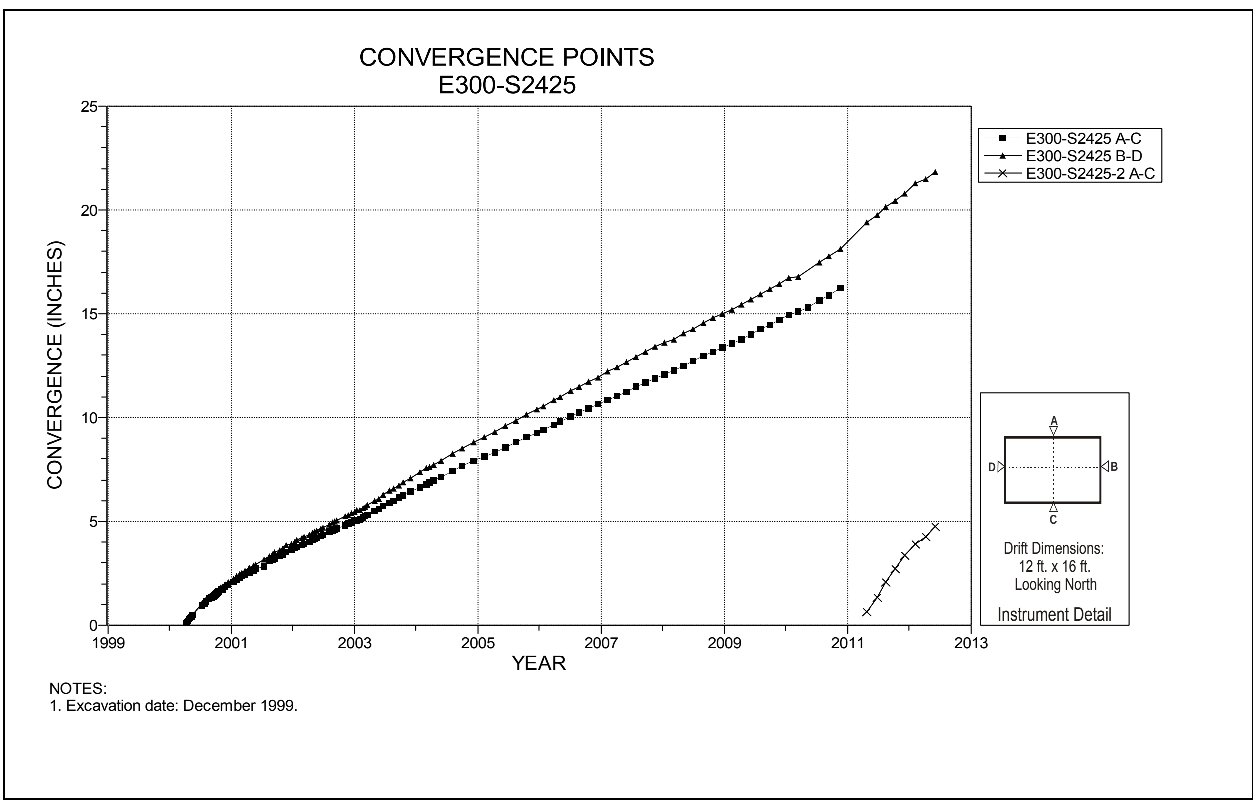


Figure 4-136 Convergence Point Array
E300 S2425 – All Chords

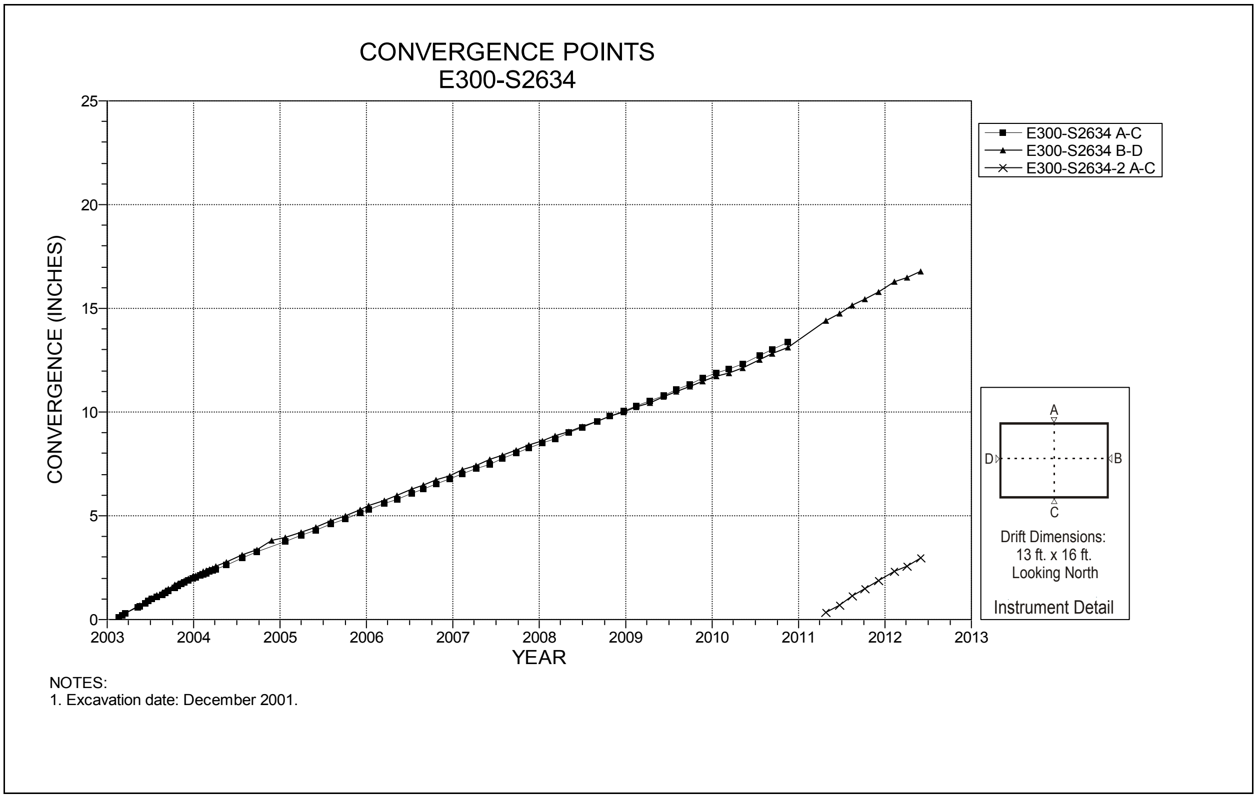


Figure 4-137 Convergence Point Array
E300 S2634 – All Chords

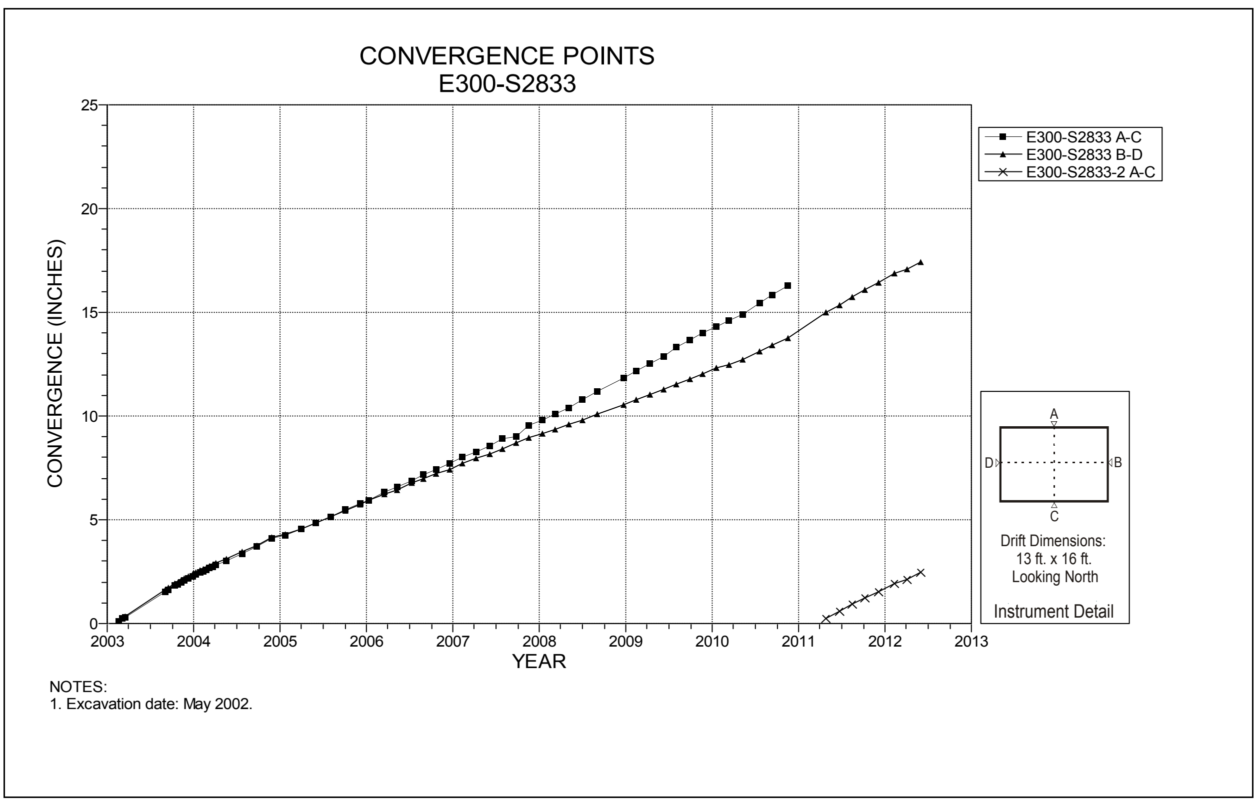


Figure 4-138 Convergence Point Array
E300 S2833 – All Chords

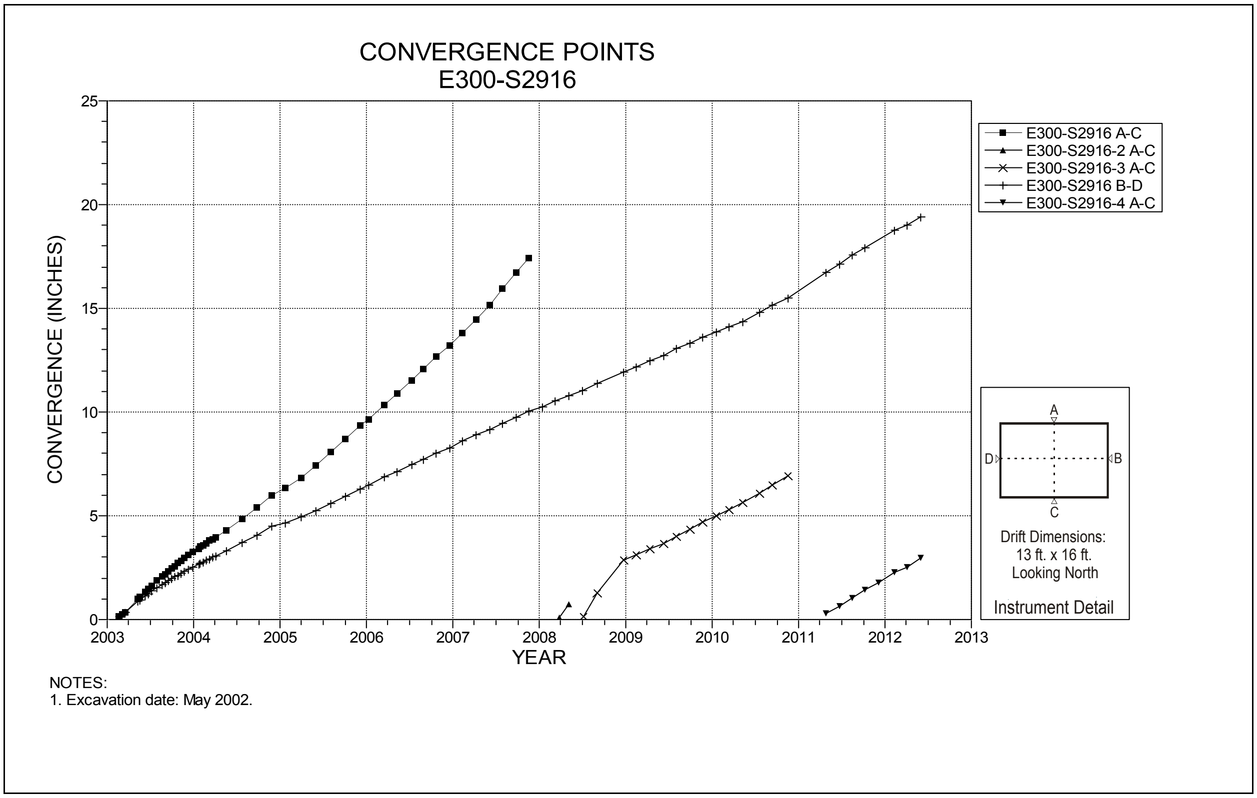


Figure 4-139 Convergence Point Array
E300 S2916 – All Chords

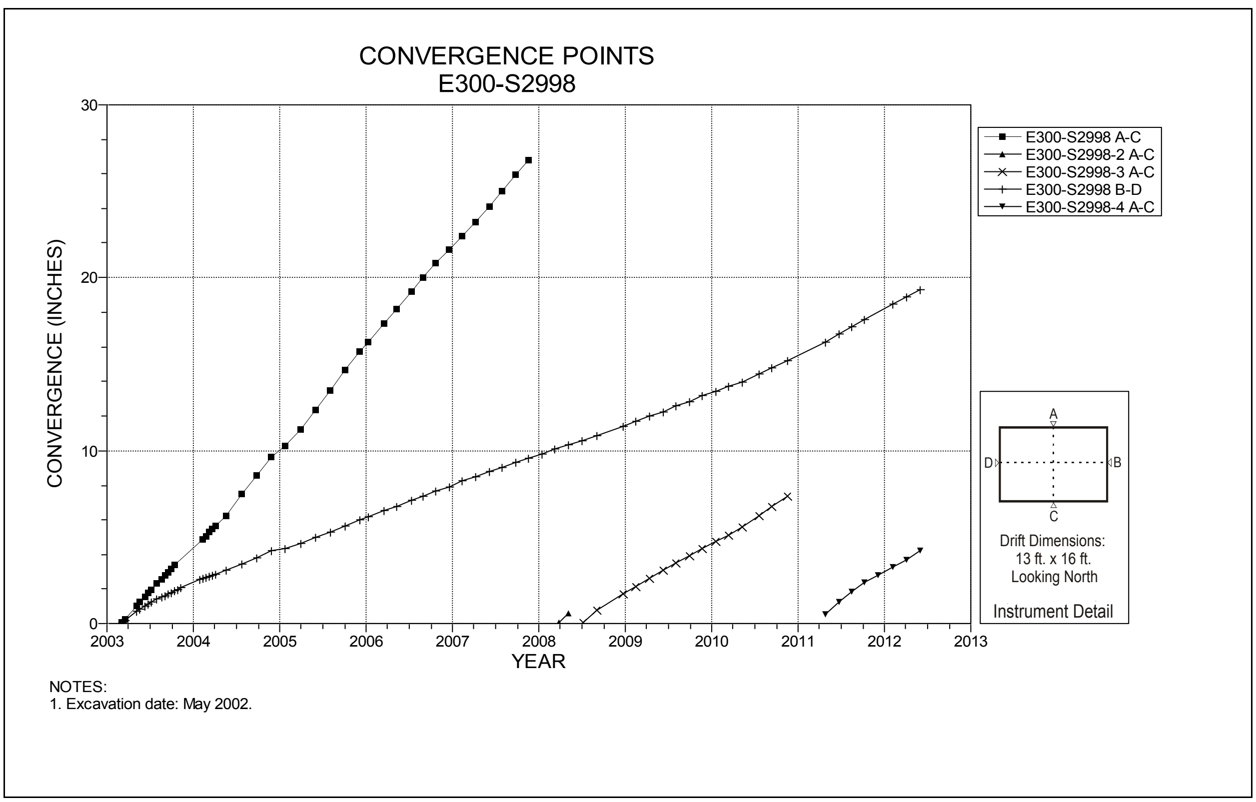


Figure 4-140 Convergence Point Array
E300 S2998 – All Chords

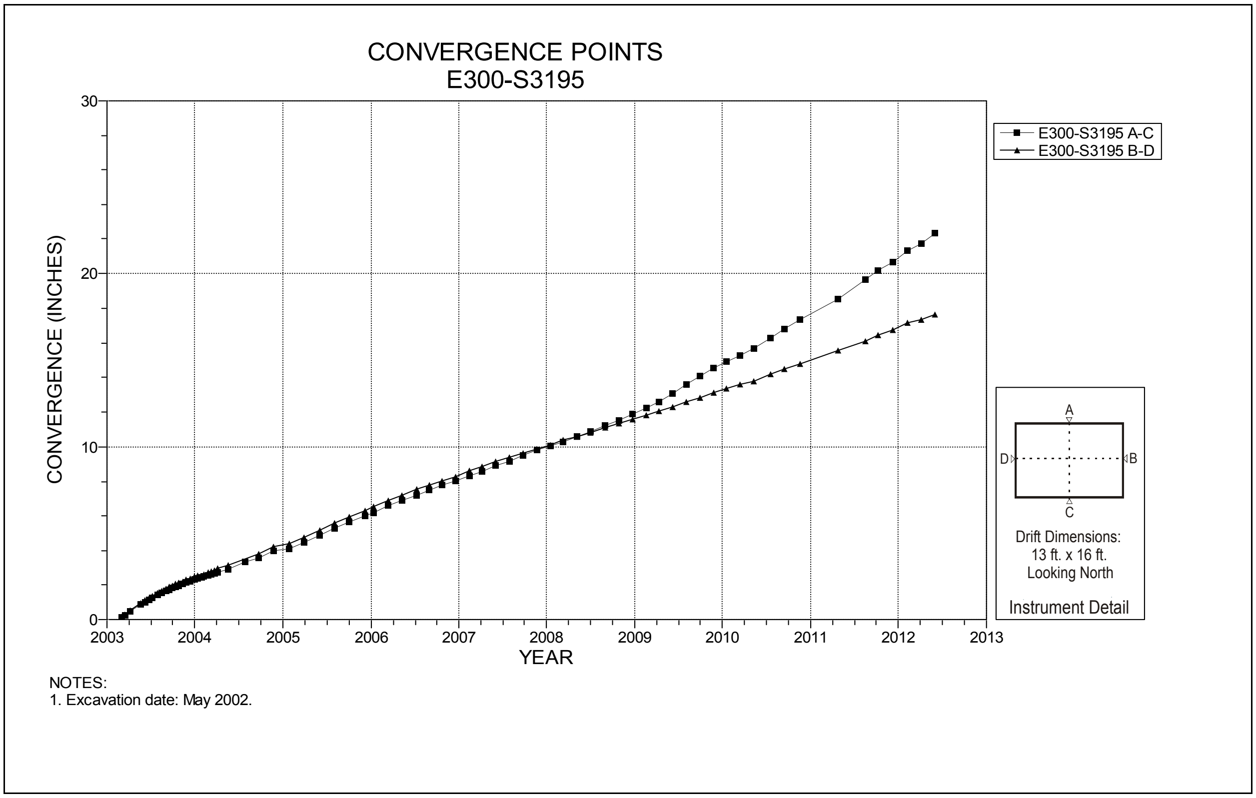


Figure 4-141 Convergence Point Array
E300 S3195 – All Chords

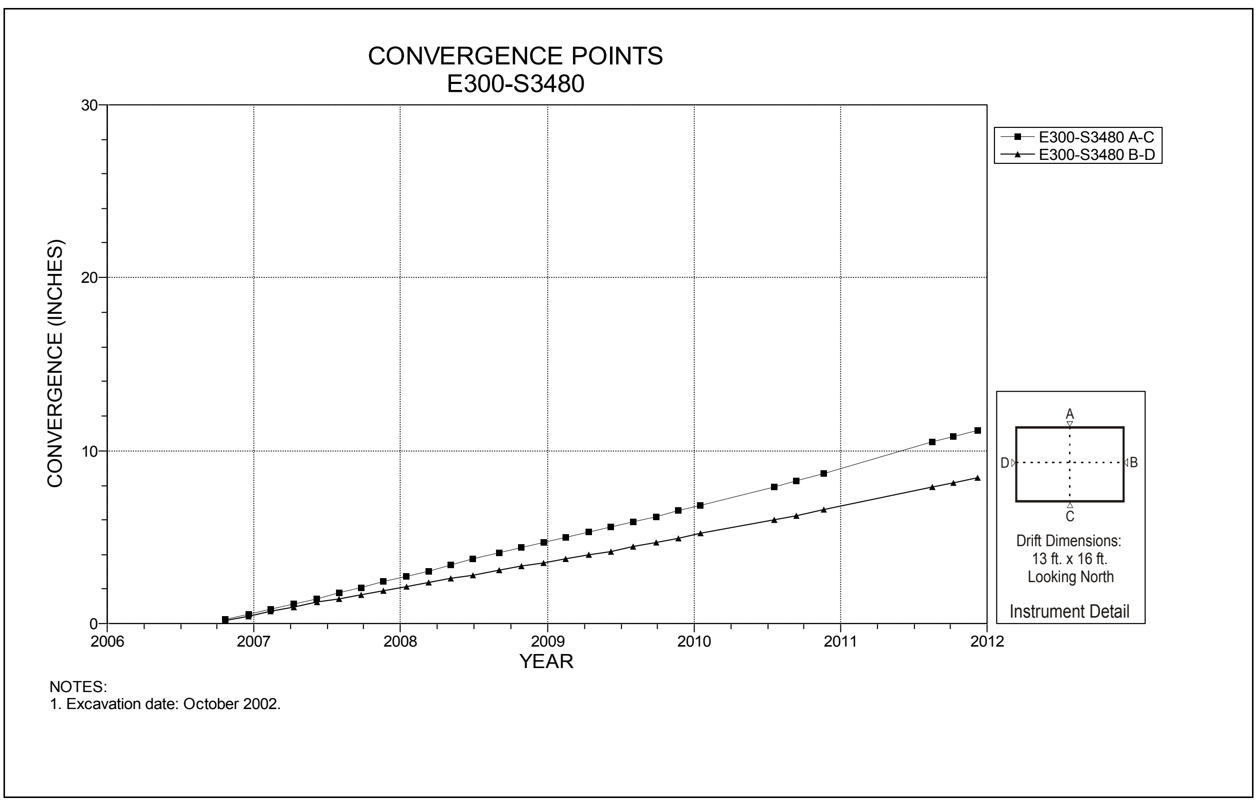
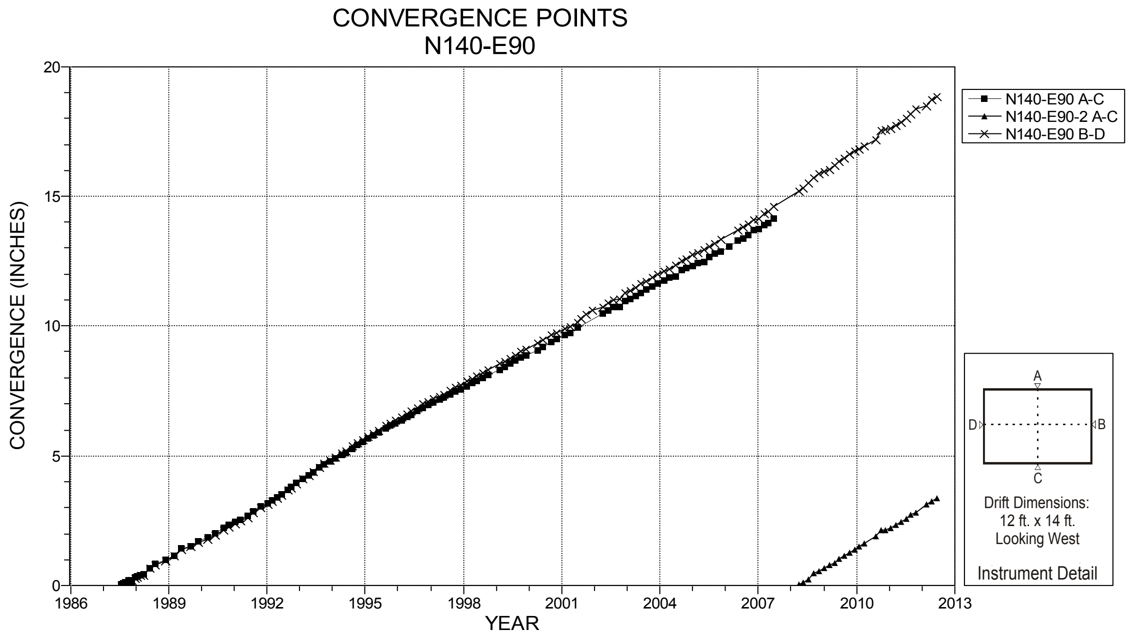
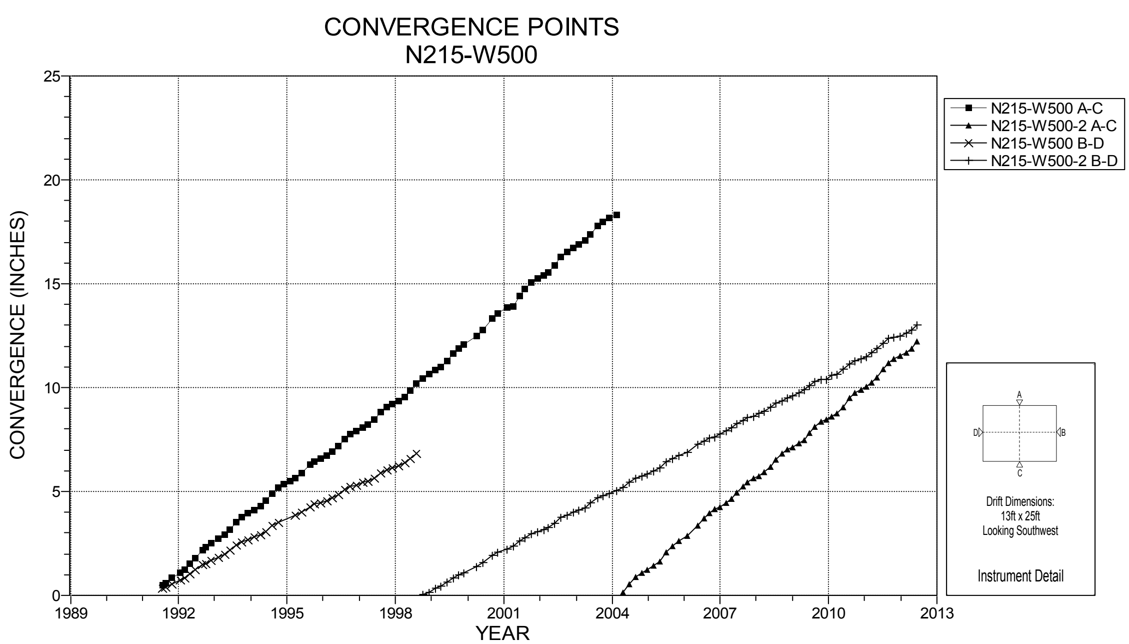


Figure 4-142 Convergence Point Array
E300 S3480 – All Chords



NOTES:
1. Excavation date: November 1982.

Figure 4-143 Convergence Point Array
N140 E90 – All Chords



NOTES:
1. Excavation date: December 1987.

Figure 4-144 Convergence Point Array
N215 W500 – All Chords

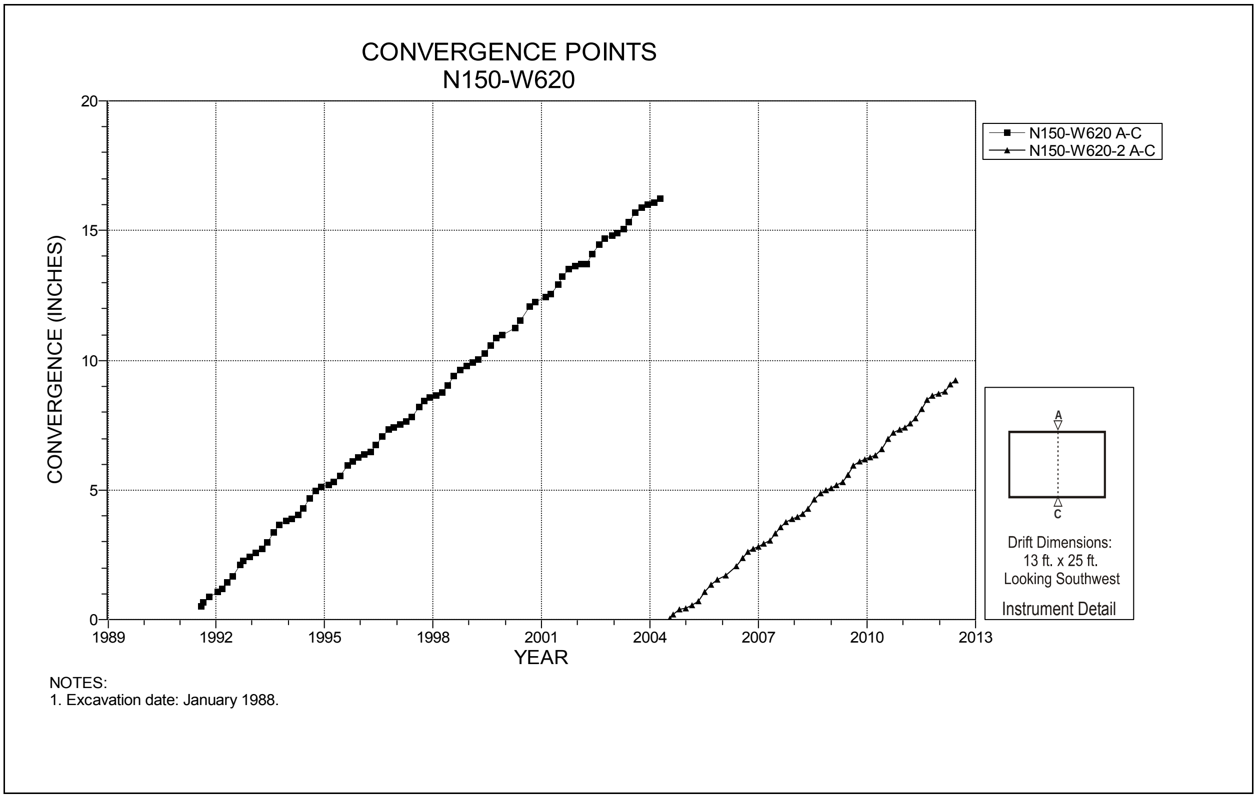


Figure 4-145 Convergence Point Array
N150 W620 – Roof to Floor

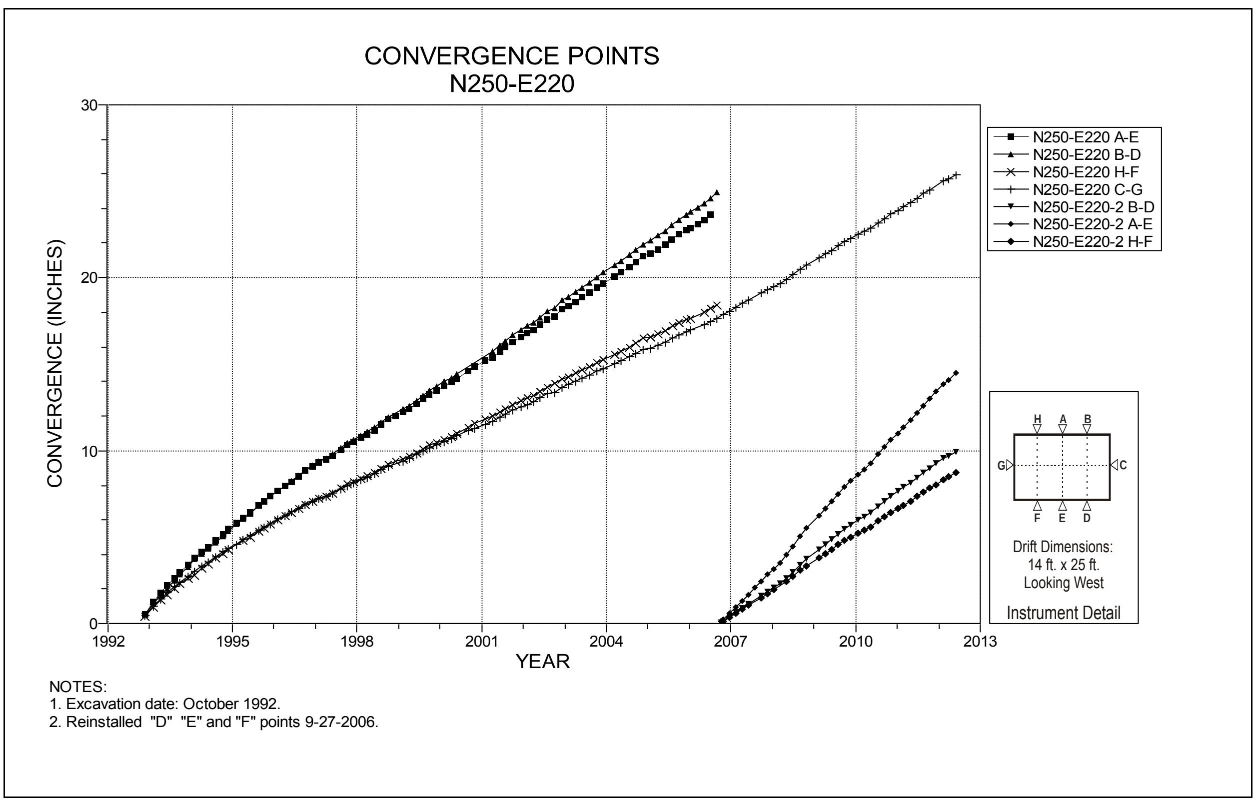


Figure 4-146 Convergence Point Array
N250 E220 – All Chords

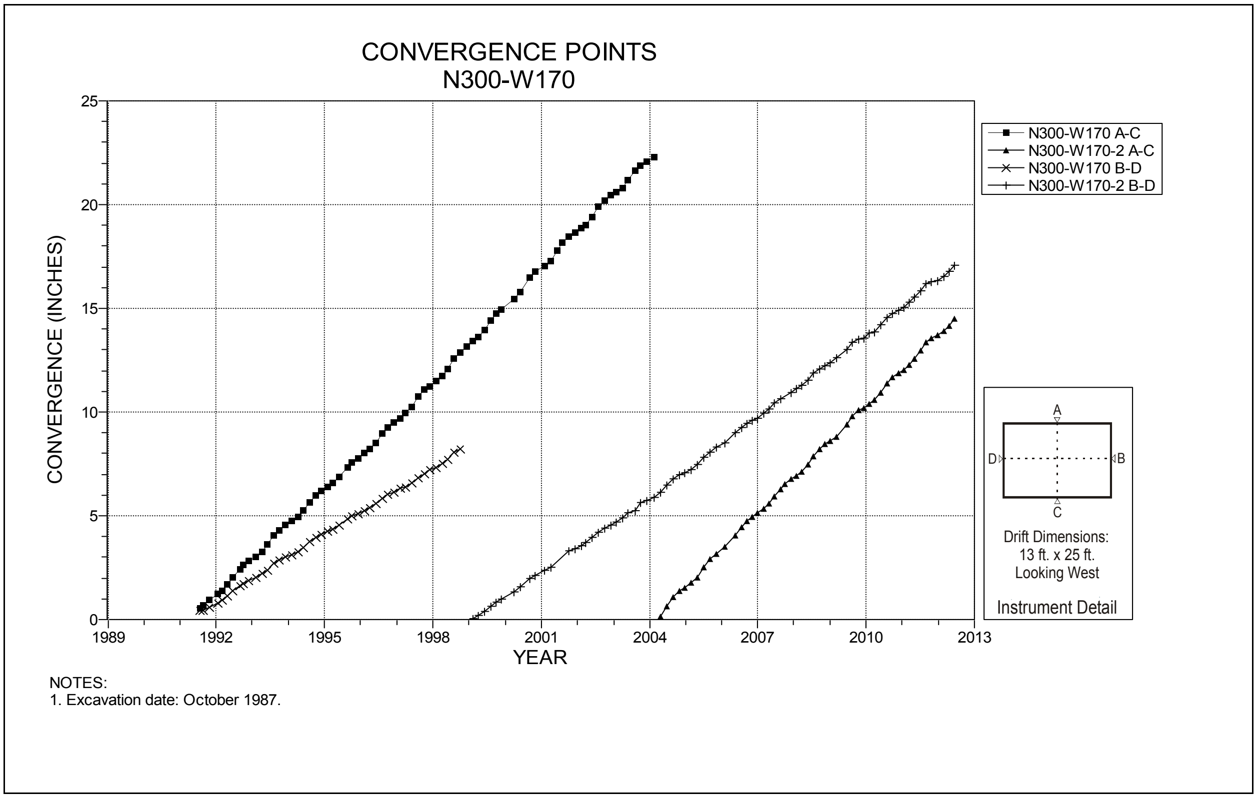


Figure 4-147 Convergence Point Array
N300 W170 – All Chords

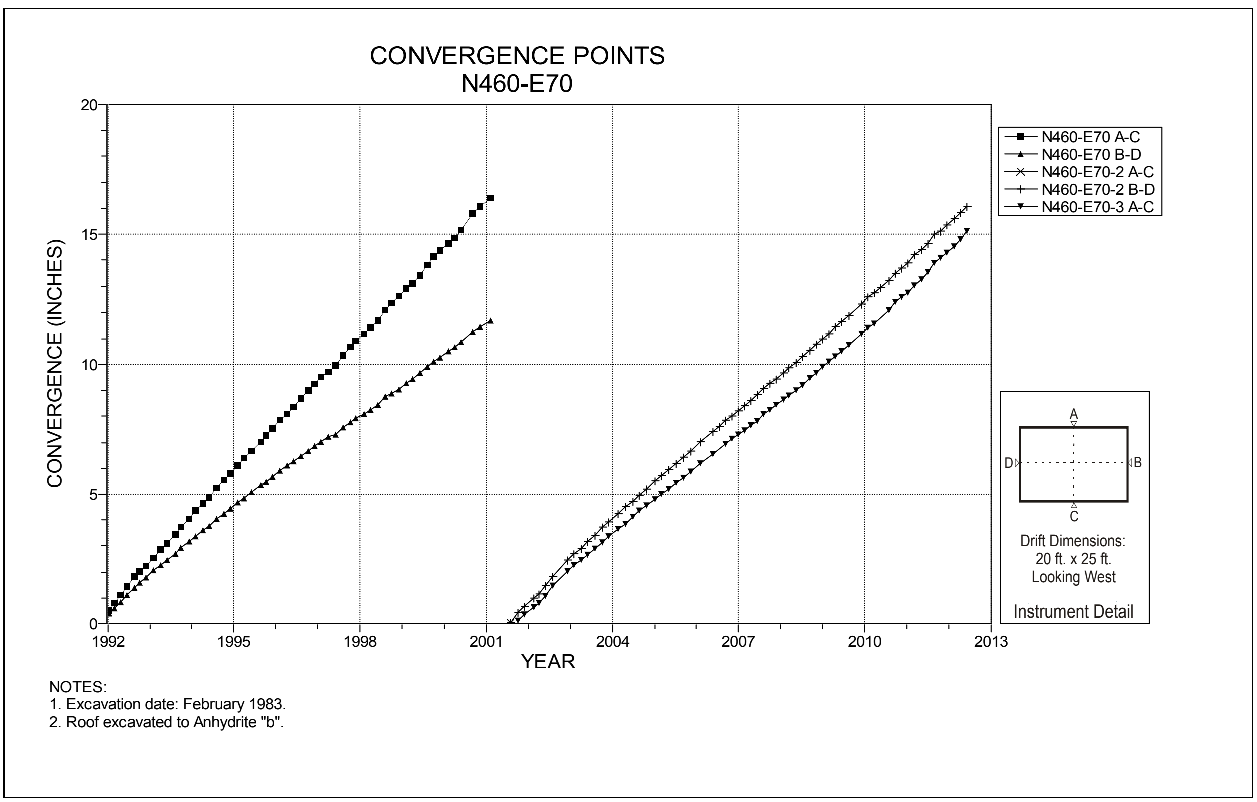


Figure 4-148 Convergence Point Array
N460 E70 – All Chords

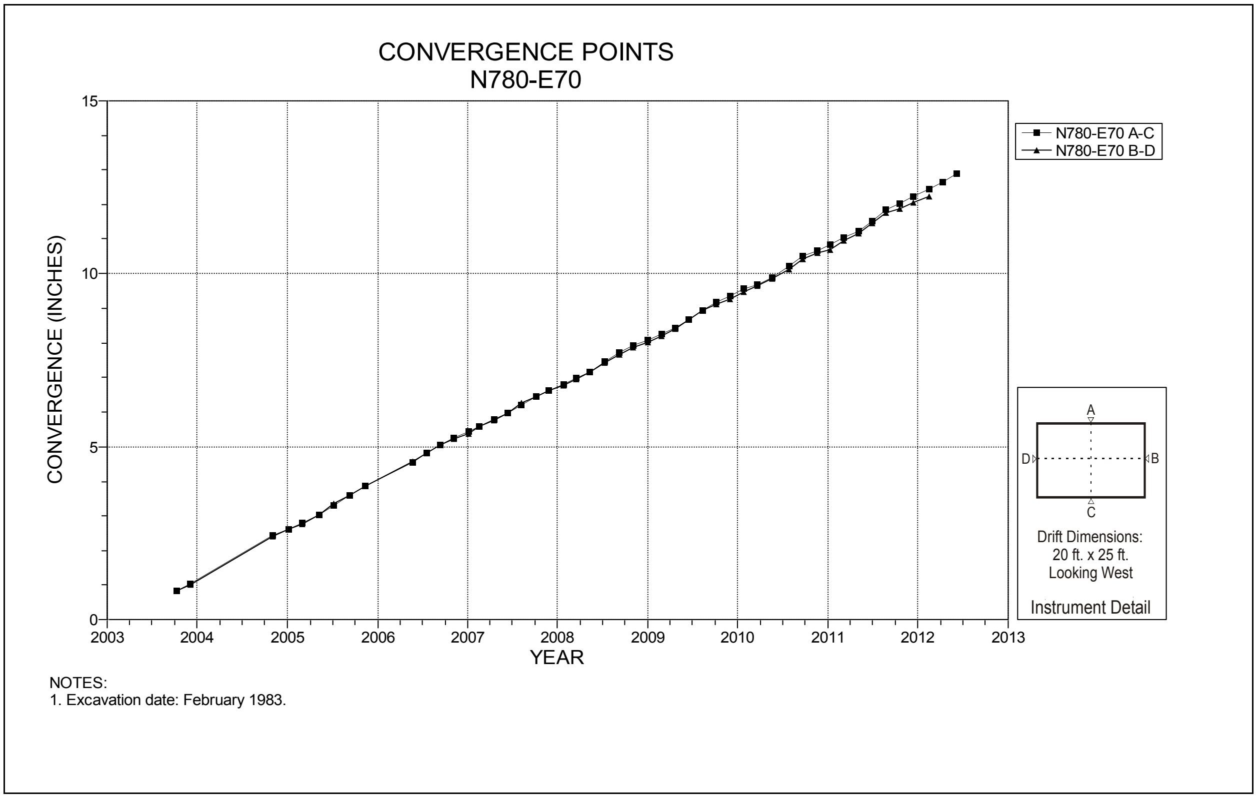


Figure 4-149 Convergence Point Array
N780 E70 – All Chords

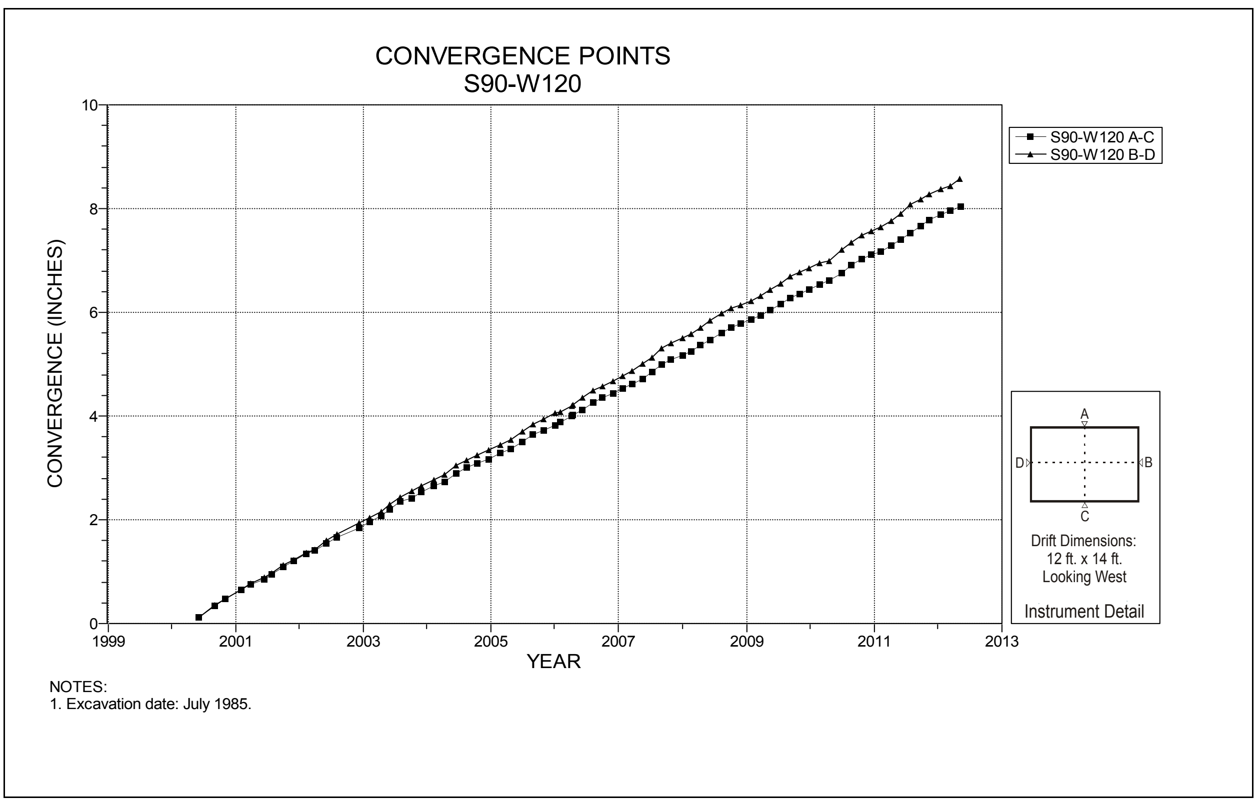


Figure 4-150 Convergence Point Array
S90 W120 – All Chords

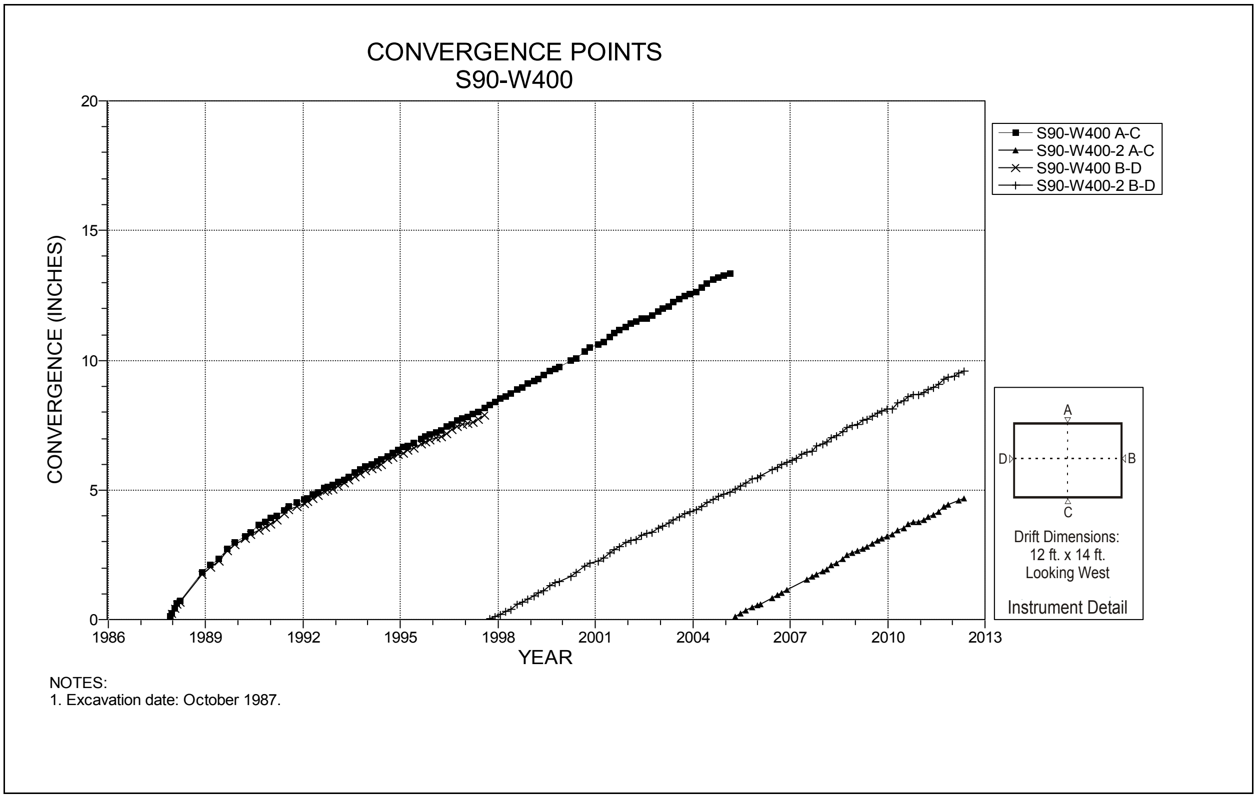


Figure 4-151 Convergence Point Array
S90 W400 – All Chords

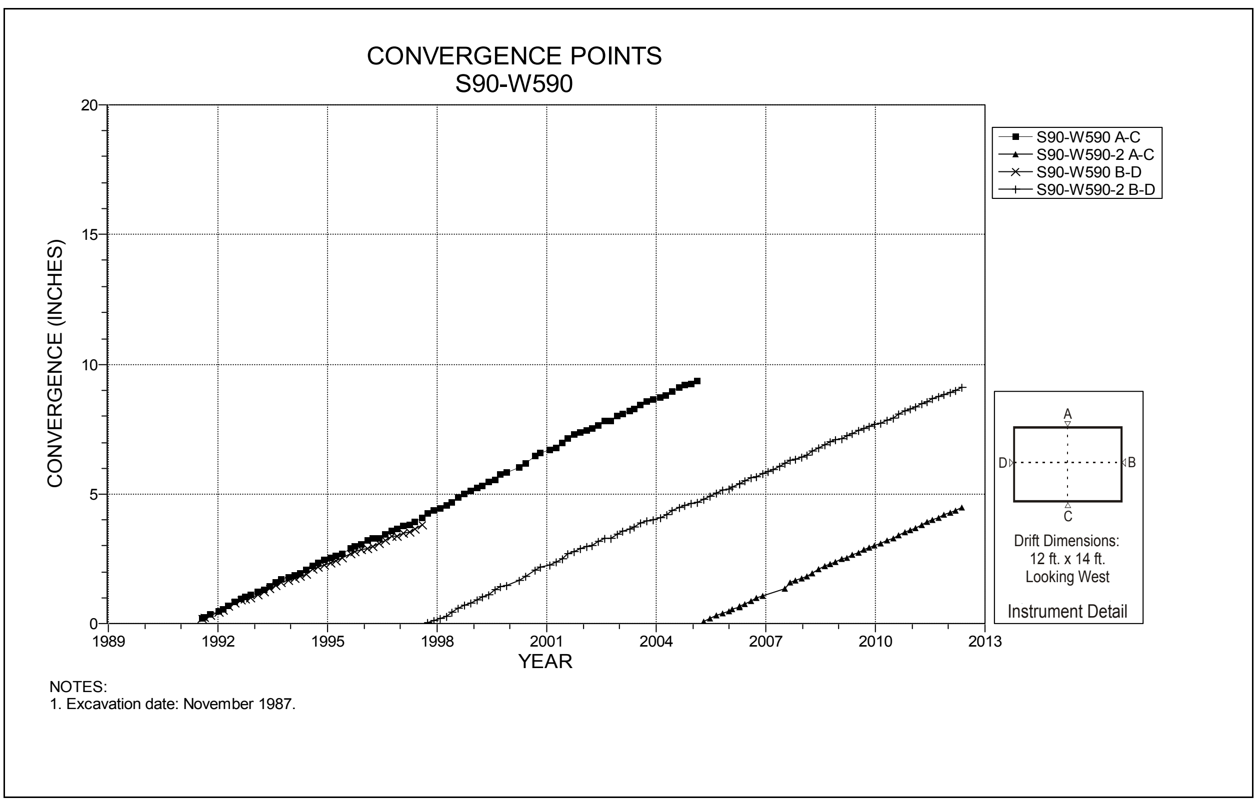


Figure 4-152 Convergence Point Array
S90 W590 – All Chords

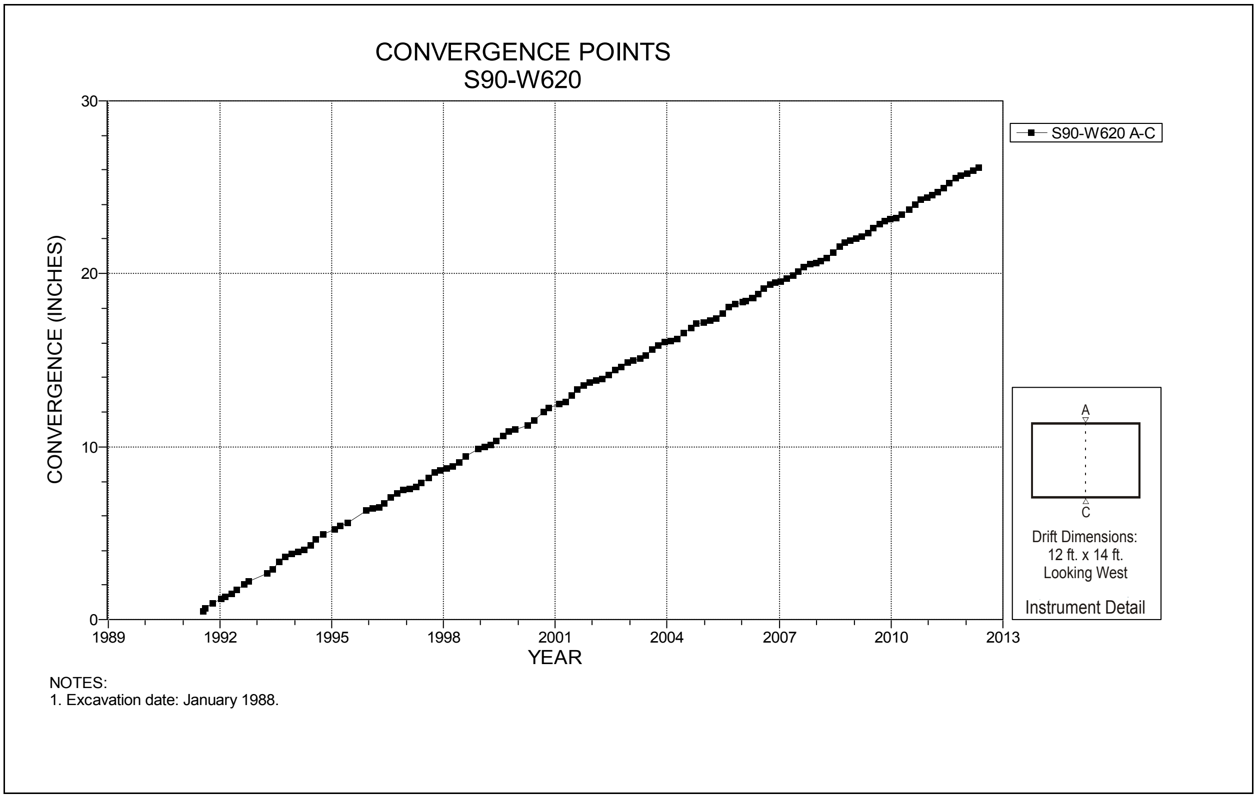


Figure 4-153 Convergence Point Array
S90 W620 – Roof to Floor

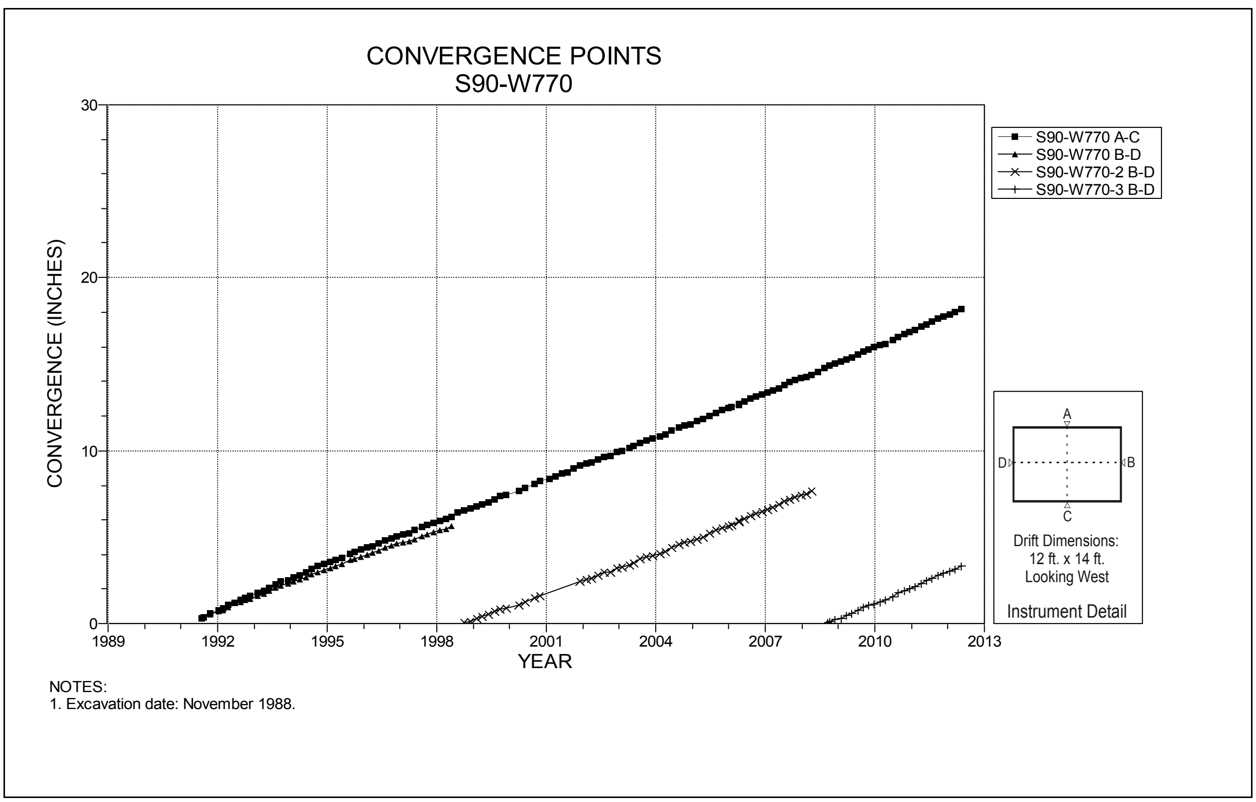
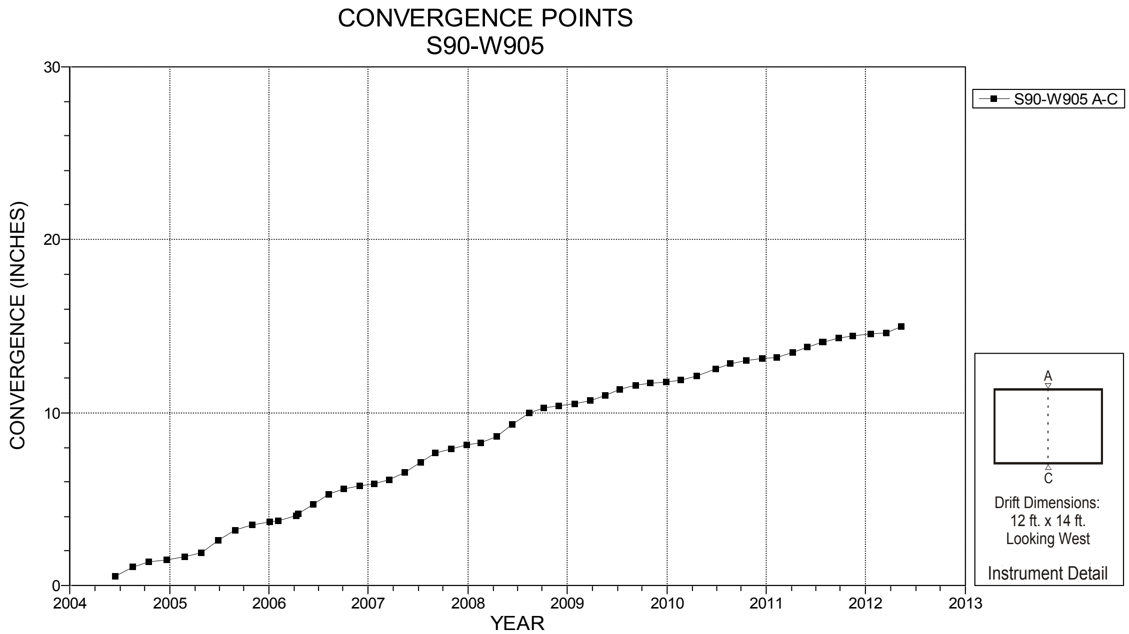
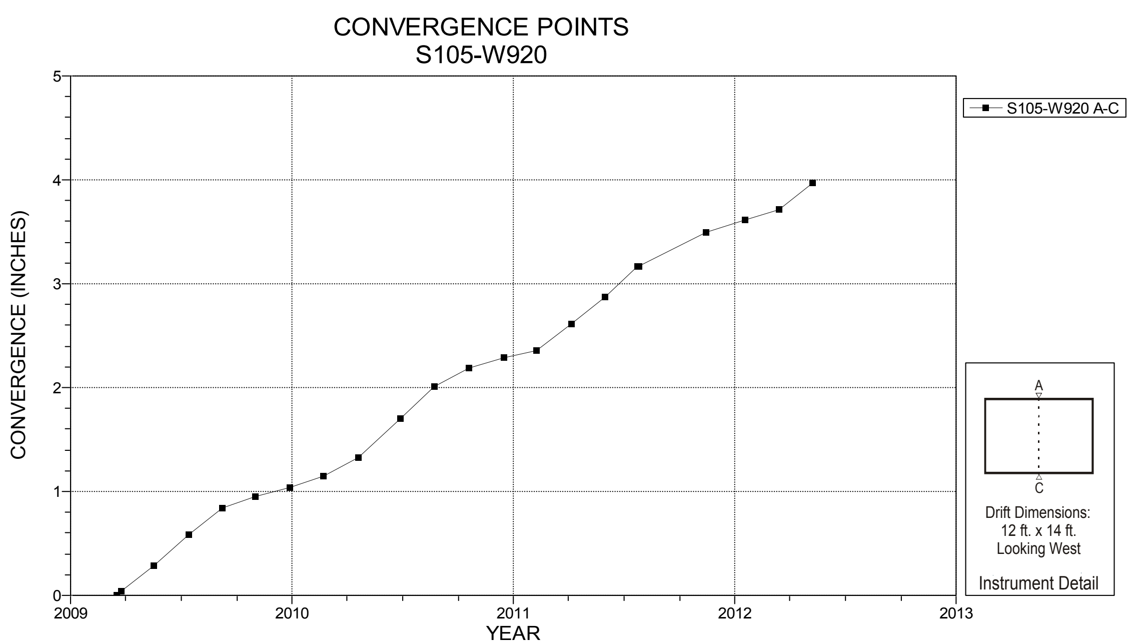


Figure 4-154 Convergence Point Array
S90 W770 – All Chords



NOTES:
1. Excavation date: November 1988.

Figure 4-155 Convergence Point Array
S90 W905 – Roof to Floor



NOTES:
1. Excavation date: November 1988

Figure 4-156 Convergence Point Array
S105 W905 – Roof to Floor

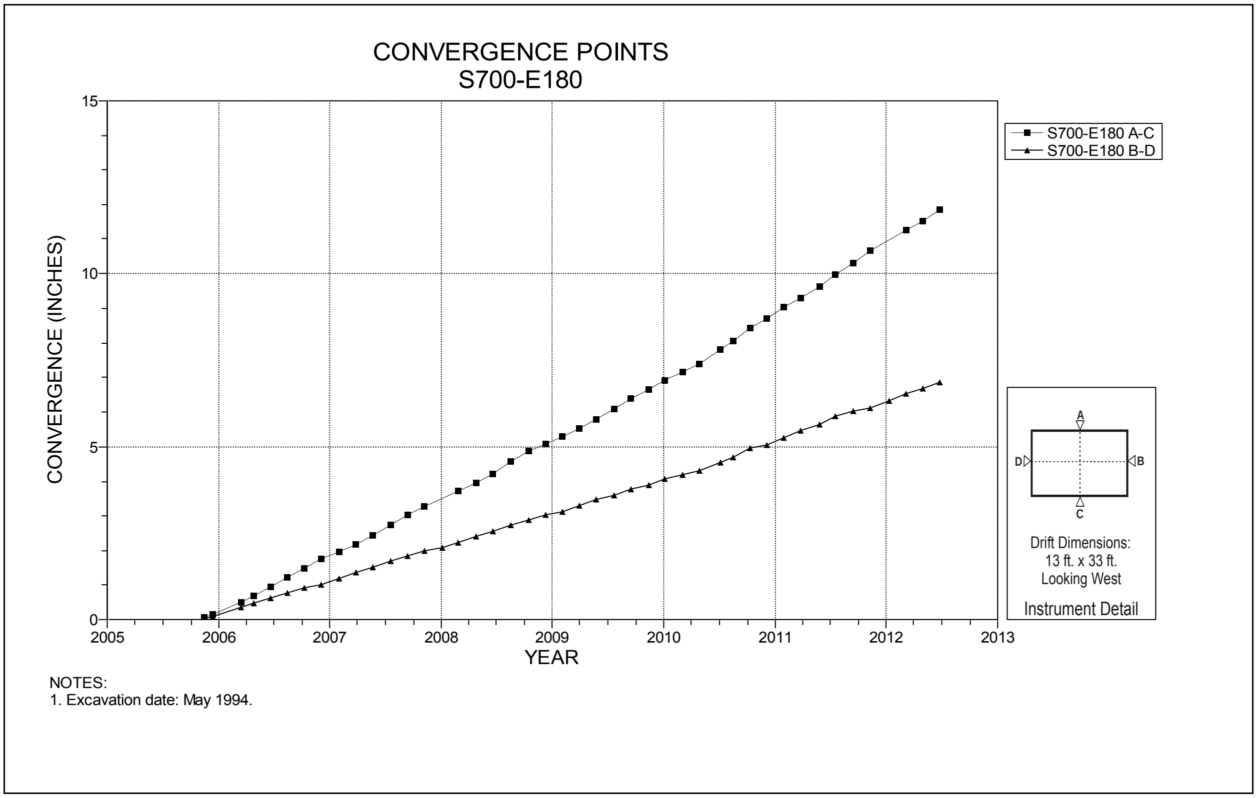


Figure 4-157 Convergence Point Array
S700 E180 – All Chords

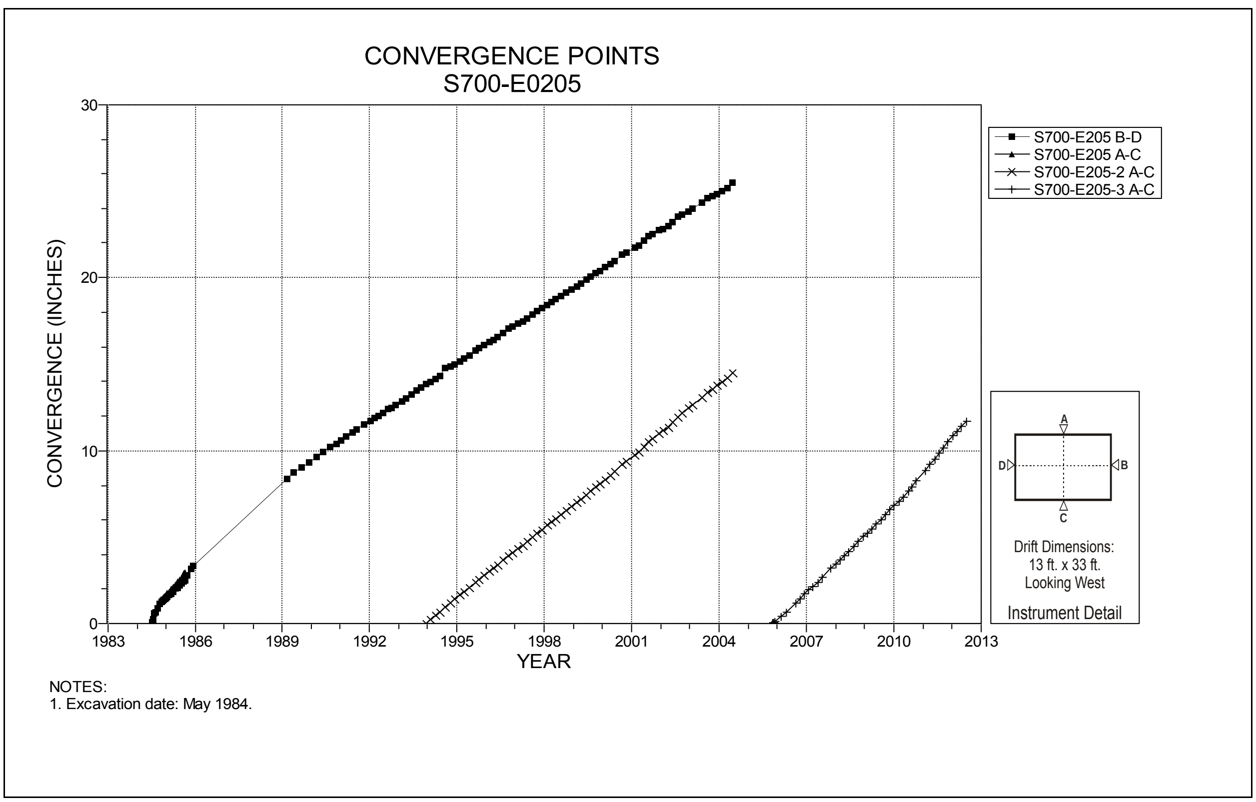


Figure 4-158 Convergence Point Array
S700 E205 – All Chords

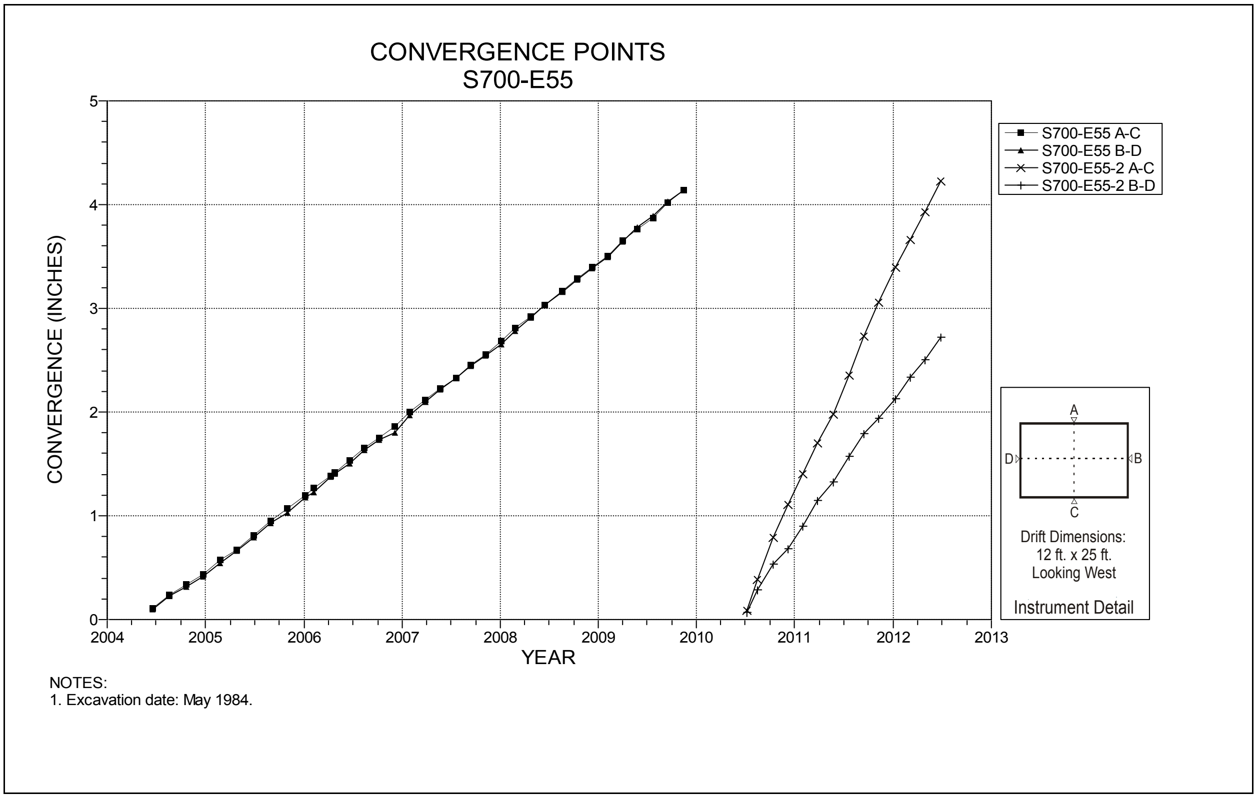


Figure 4-159 Convergence Point Array
S700 E55 – All Chords

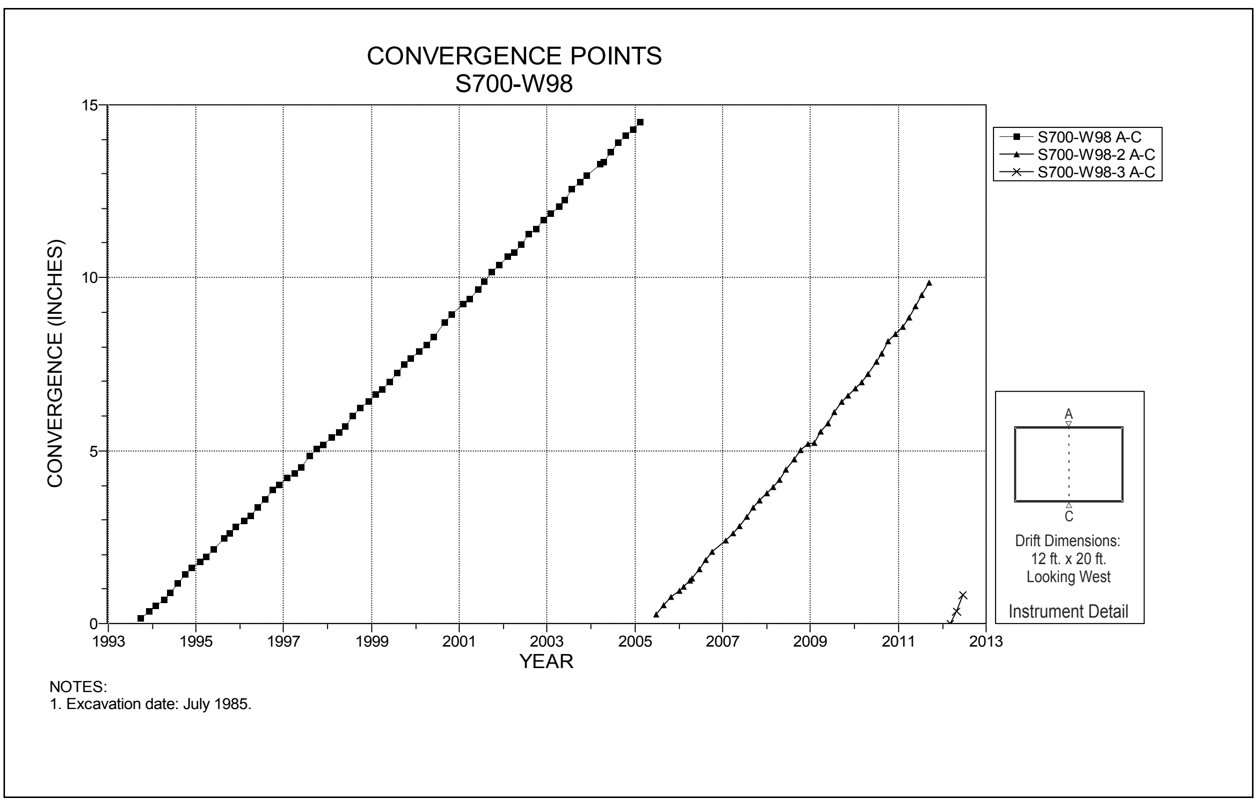


Figure 4-160 Convergence Point Array
S700 W98 – Roof to Floor

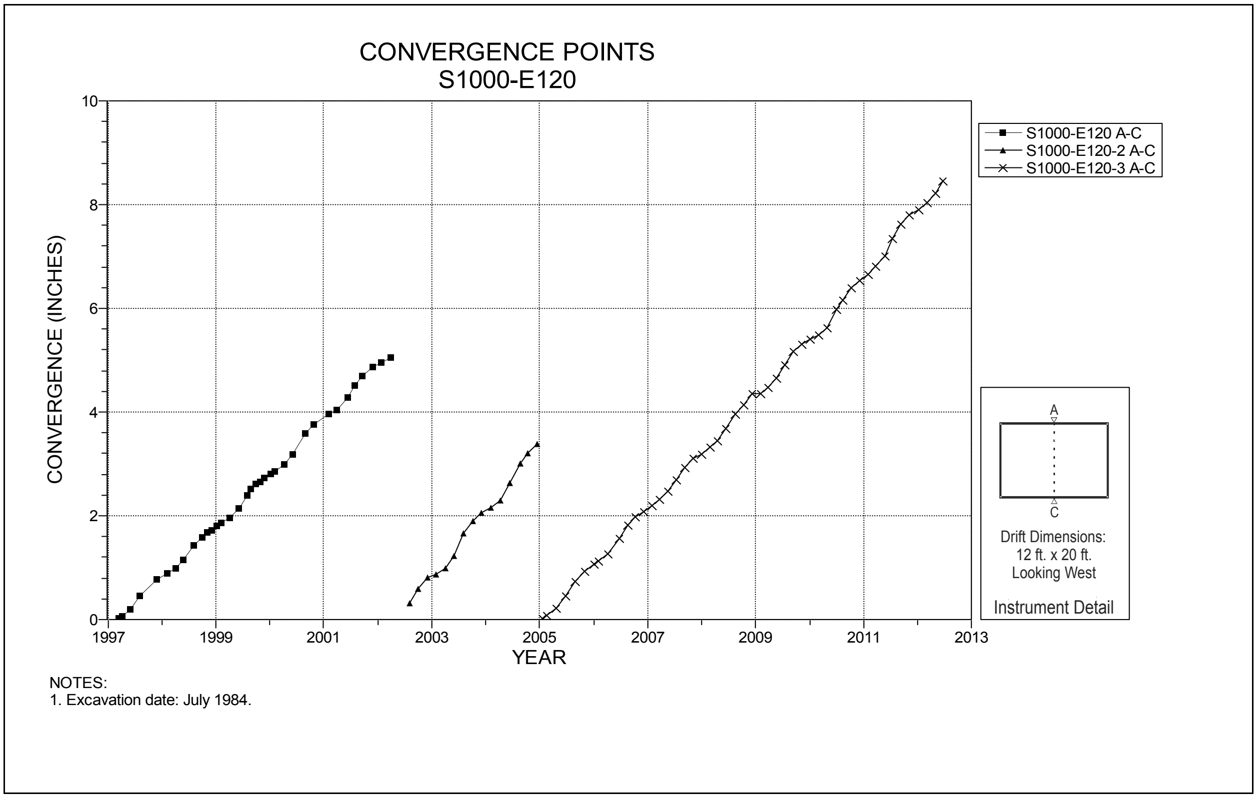


Figure 4-161 Convergence Point Array
S1000 E120 – Roof to Floor

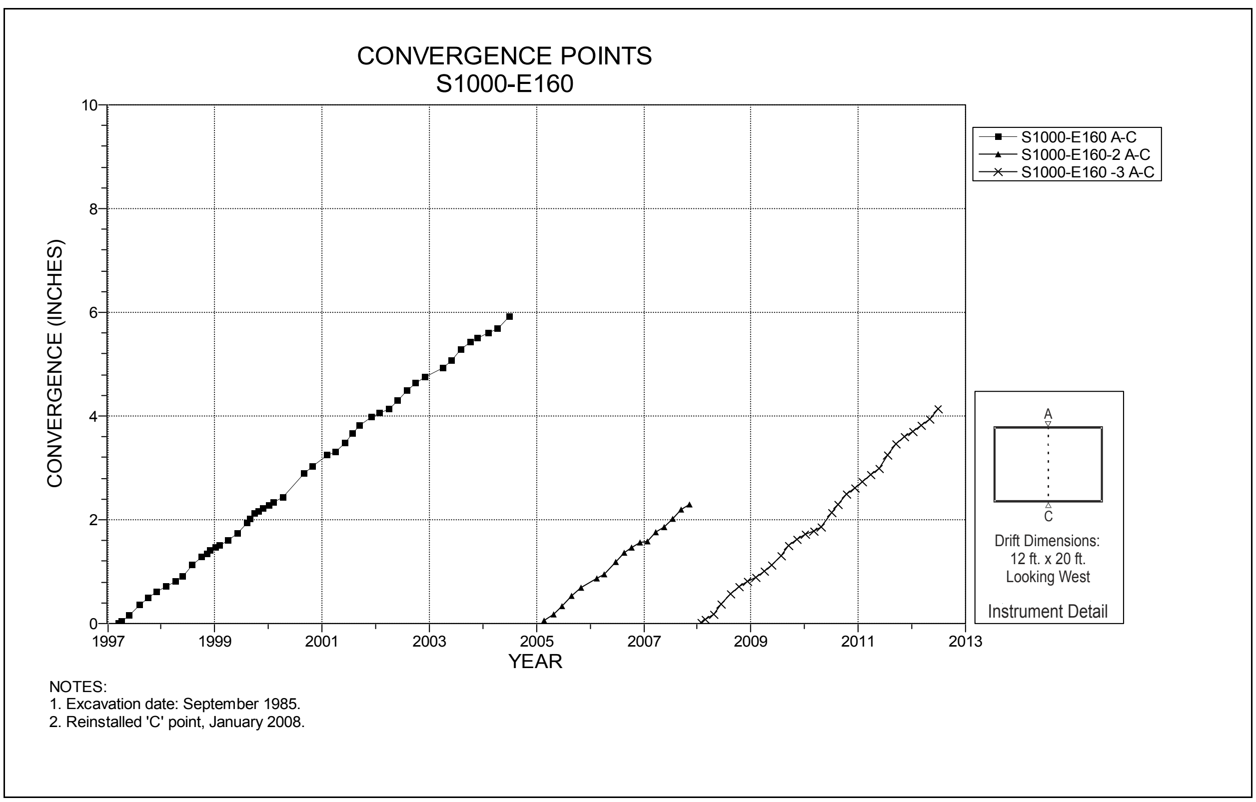


Figure 4-162 Convergence Point Array
S1000 E160 – Roof to Floor

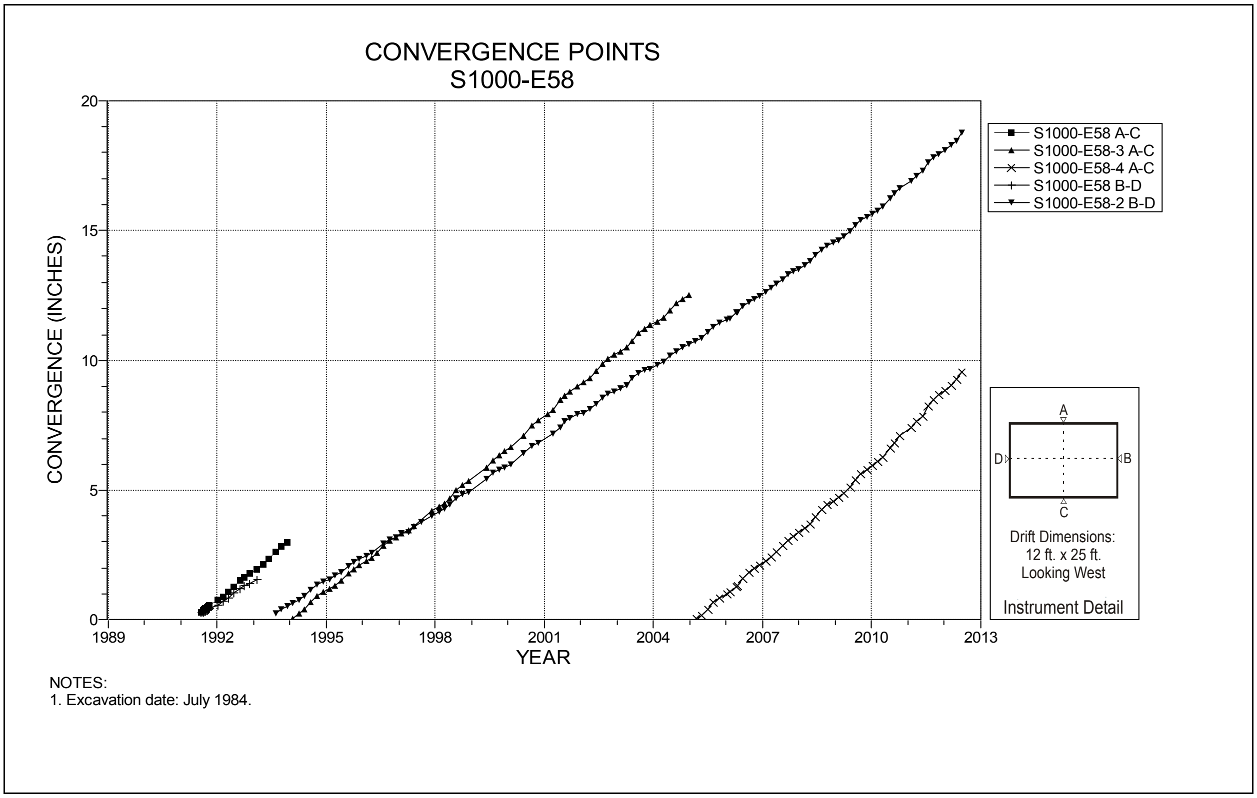


Figure 4-163 Convergence Point Array
S1000 E58 – All Chords

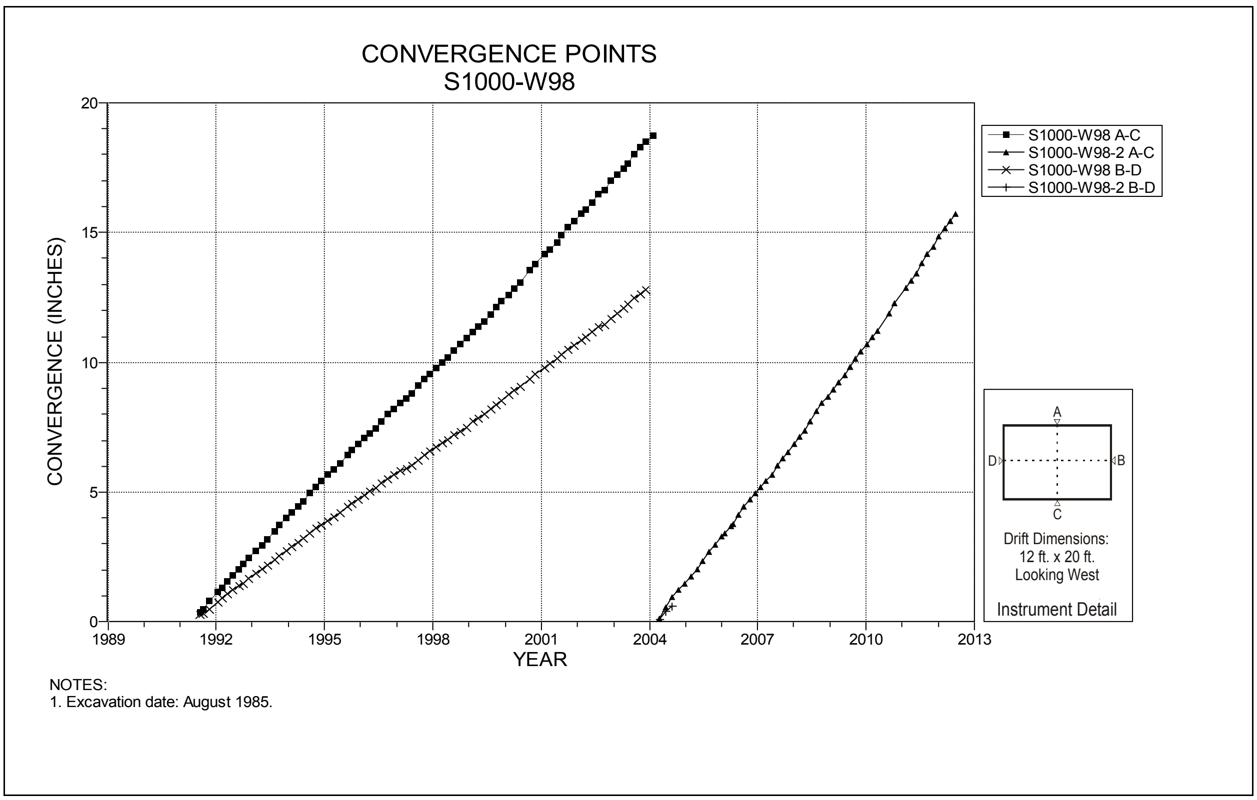


Figure 4-164 Convergence Point Array
S1000 E98 – All Chords

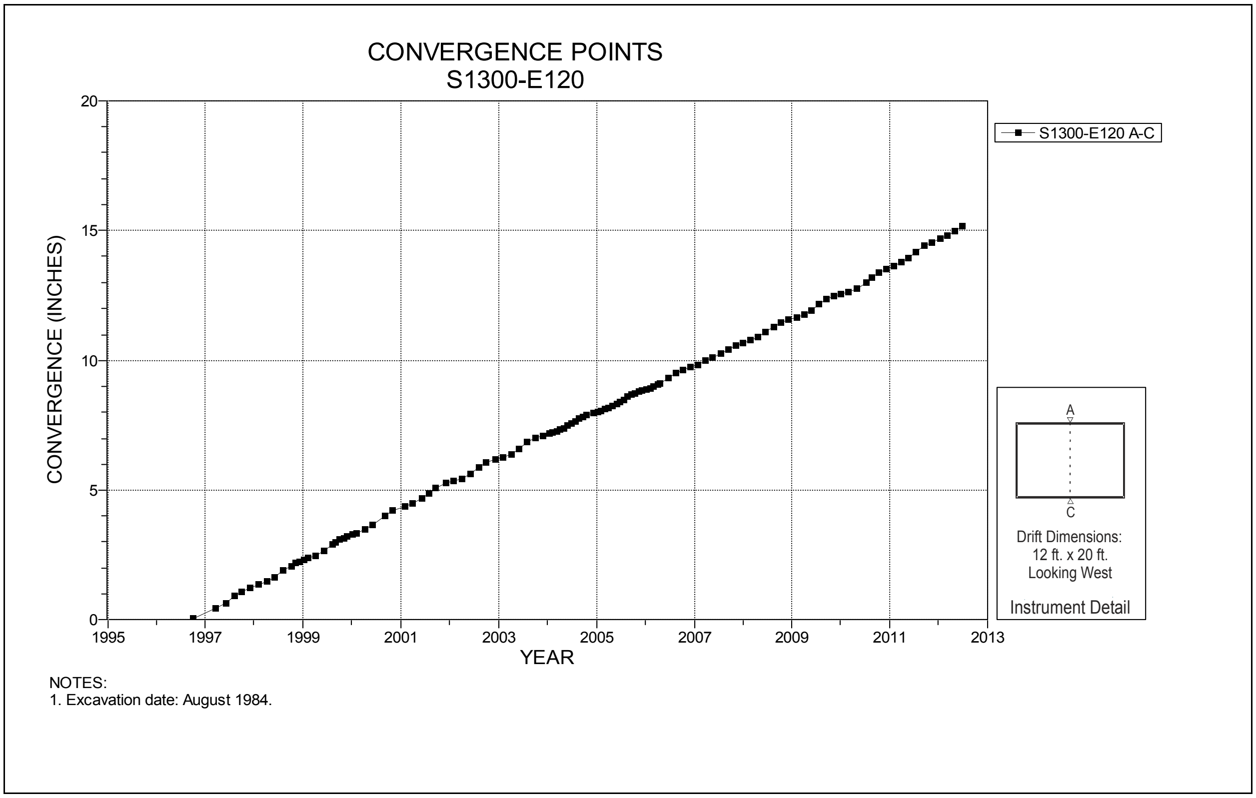


Figure 4-165 Convergence Point Array
S1300 E120 – Roof to Floor

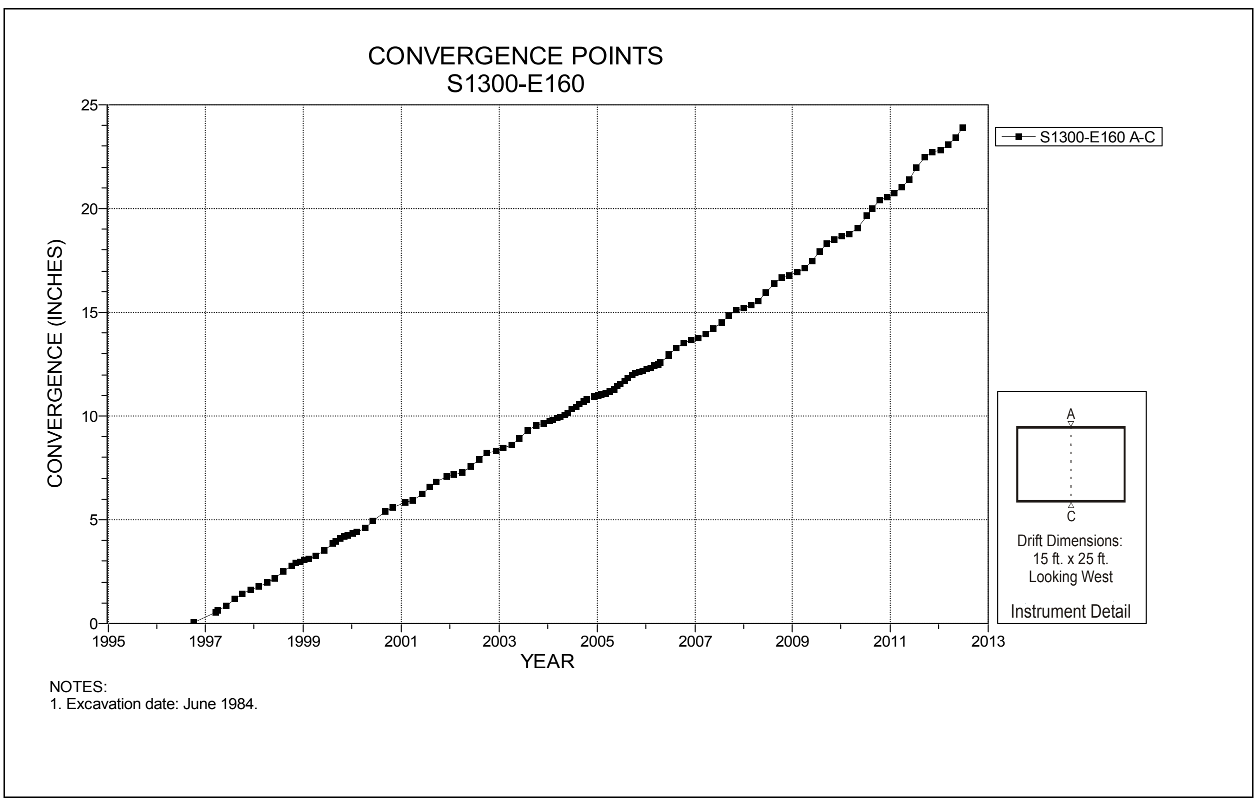


Figure 4-166 Convergence Point Array
S1300 E160 – Roof to Floor

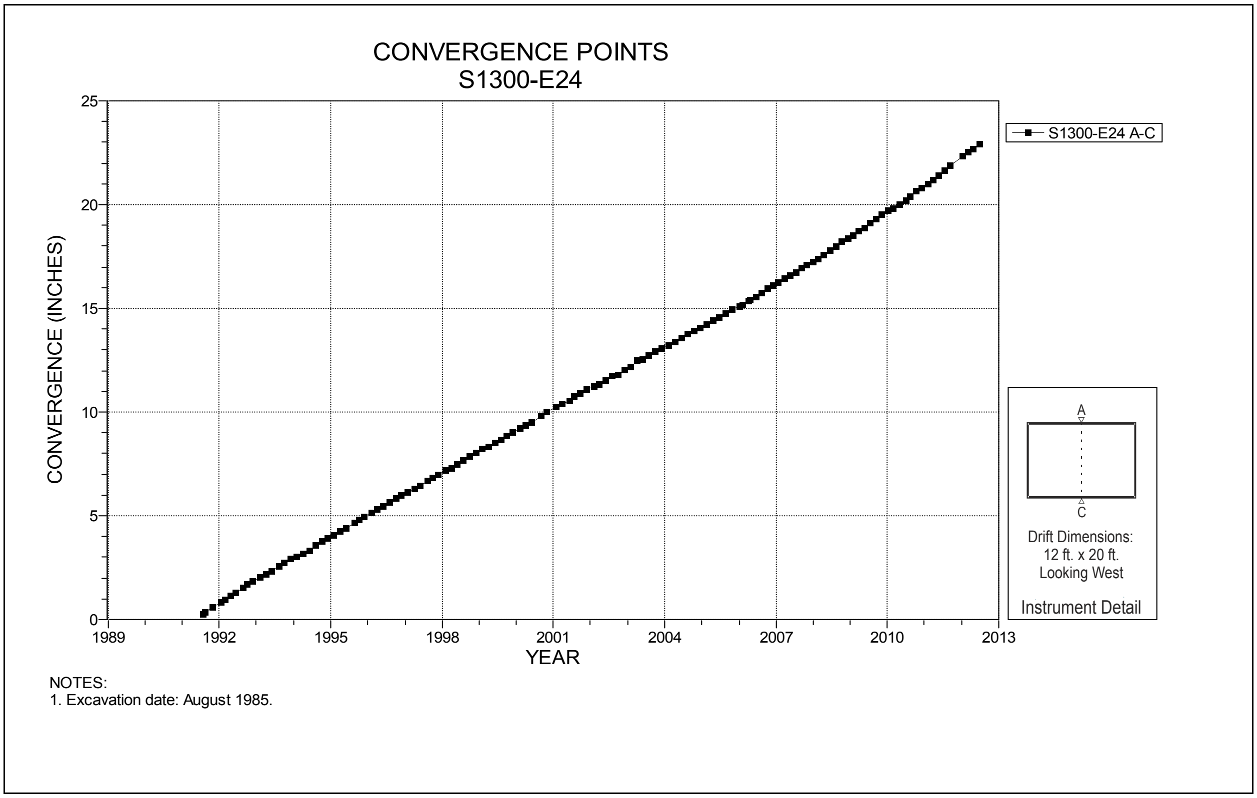


Figure 4-167 Convergence Point Array
S1300 E24 – Roof to Floor

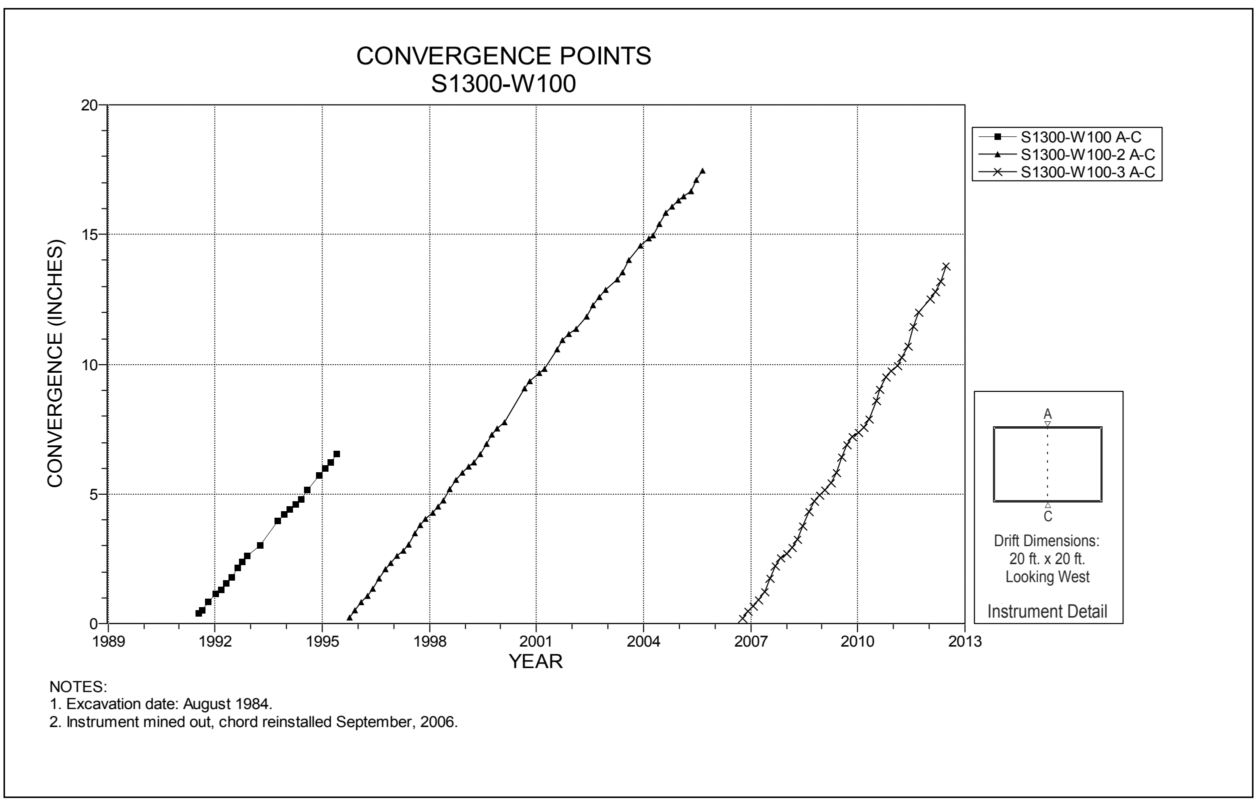


Figure 4-168 Convergence Point Array
S1300 W100 – Roof to Floor

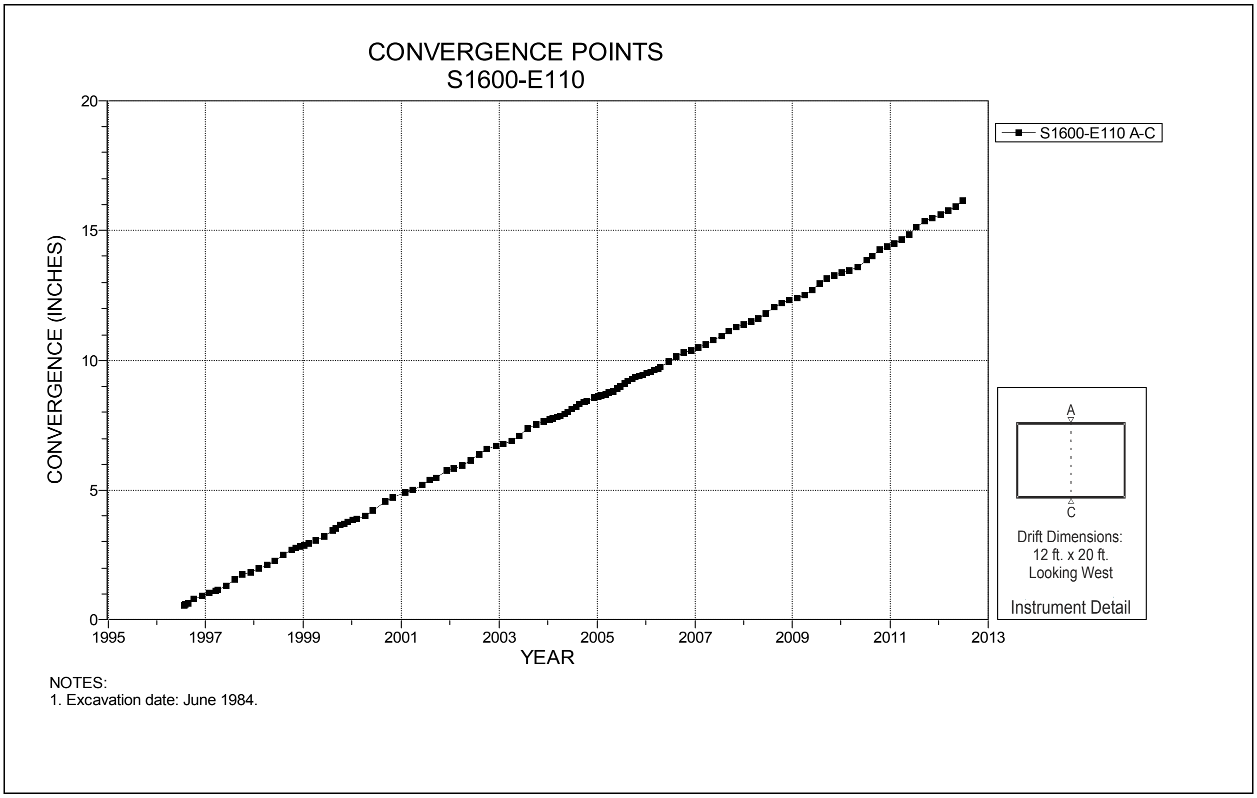


Figure 4-169 Convergence Point Array
S1600 E110 – Roof to Floor

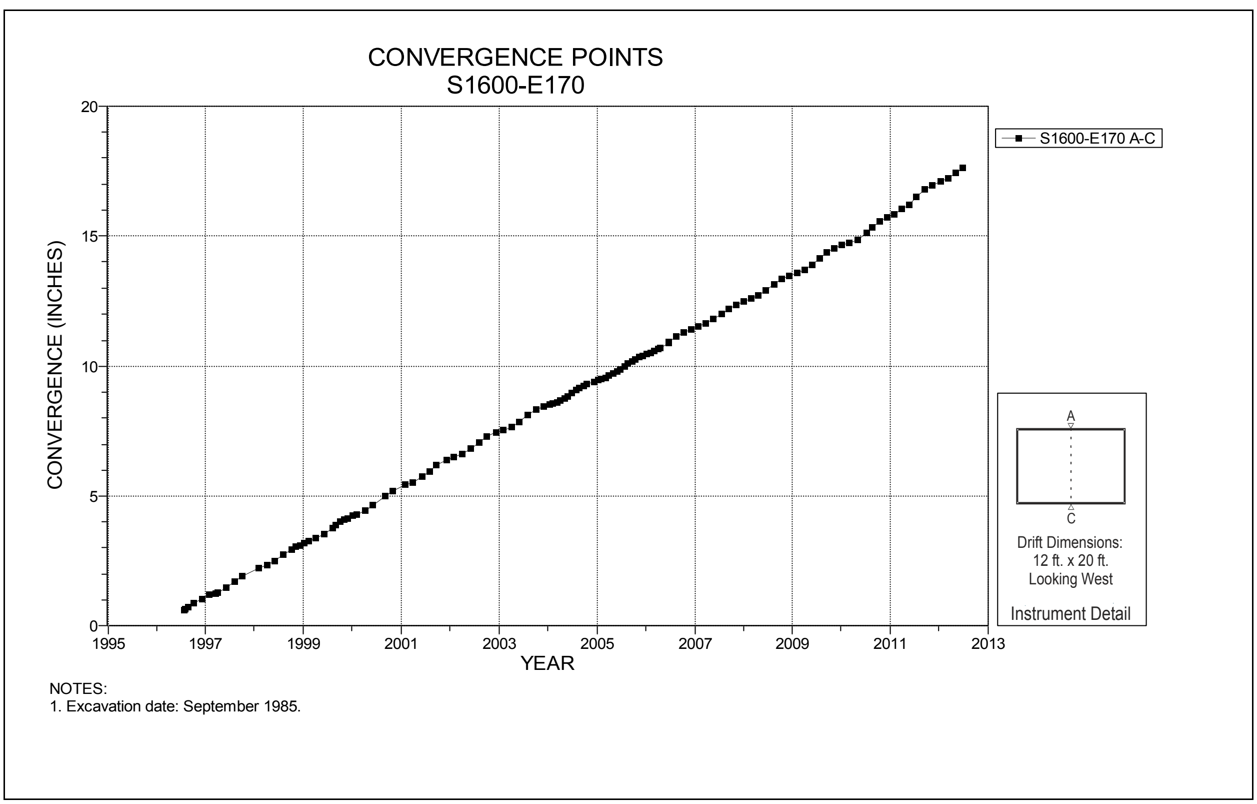


Figure 4-170 Convergence Point Array
S1600 E170 – Roof to Floor

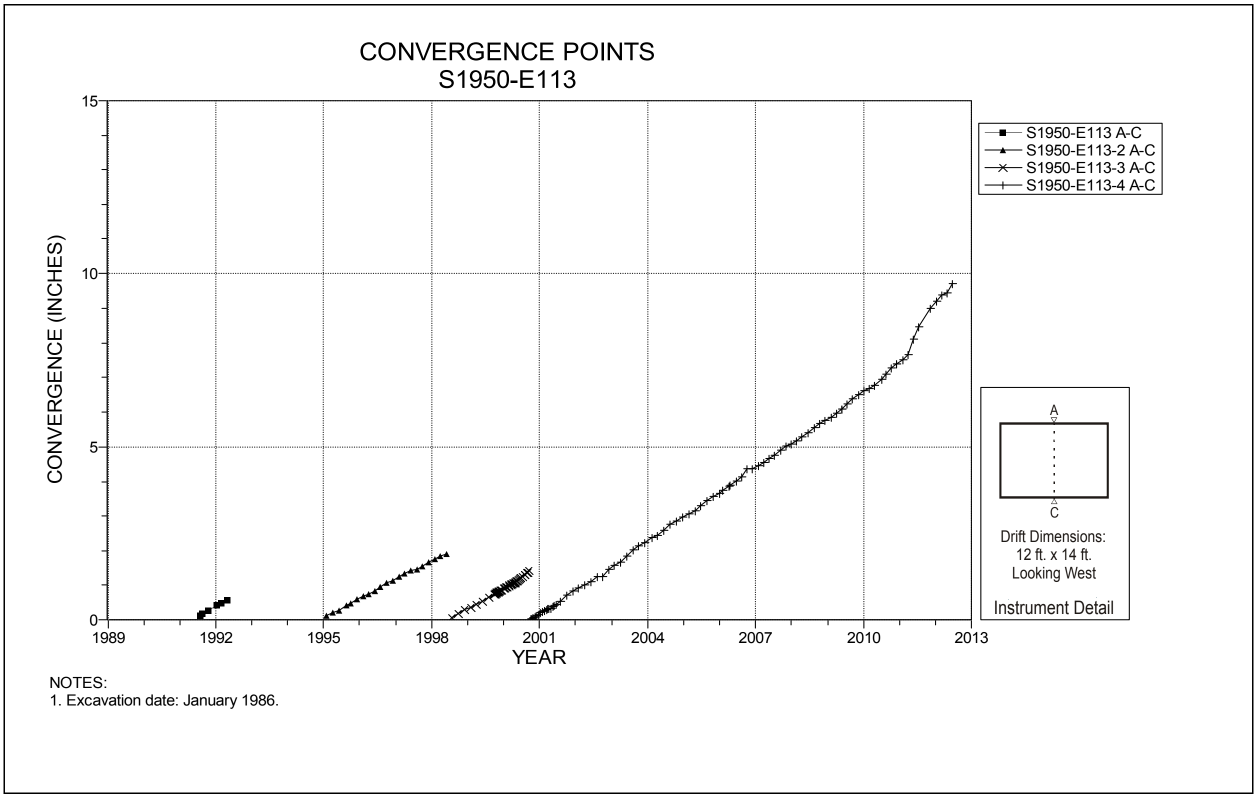


Figure 4-171 Convergence Point Array
S1950 E113 – Roof to Floor

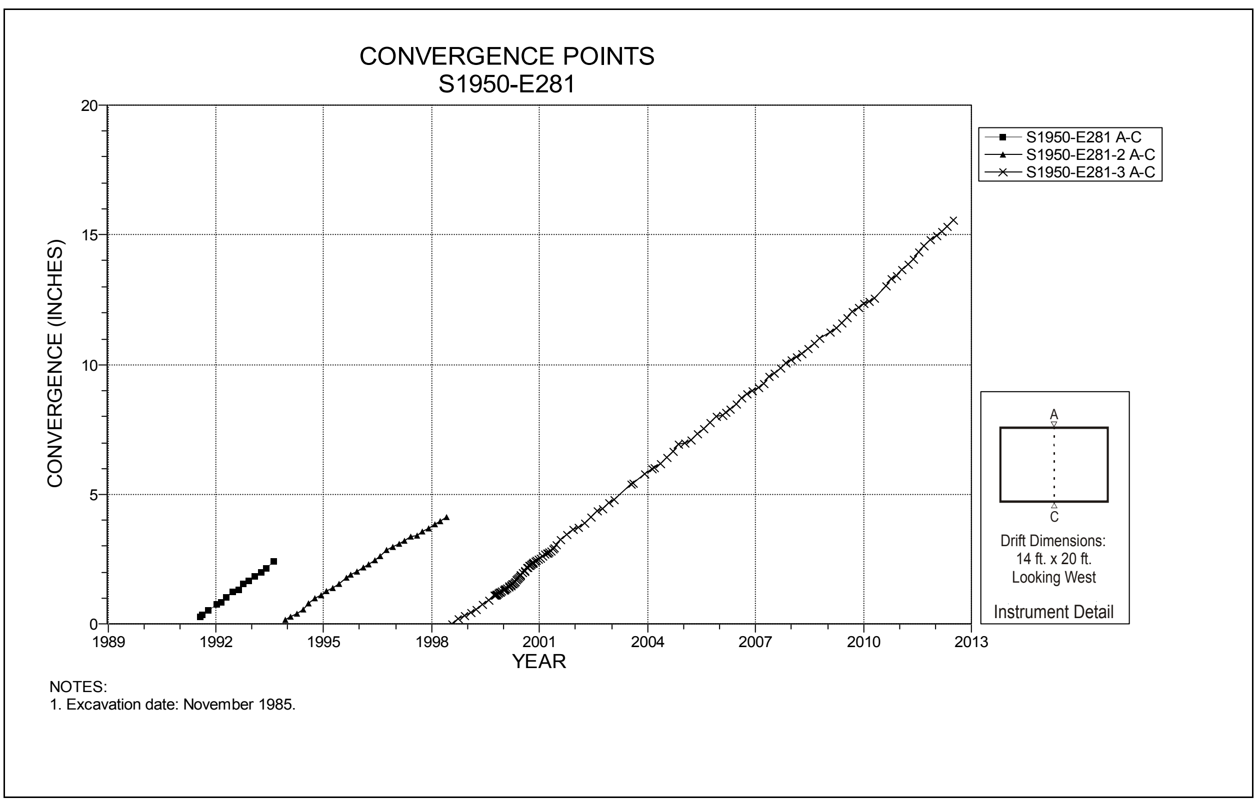


Figure 4-172 Convergence Point Array
S1950 E281 – Roof to Floor

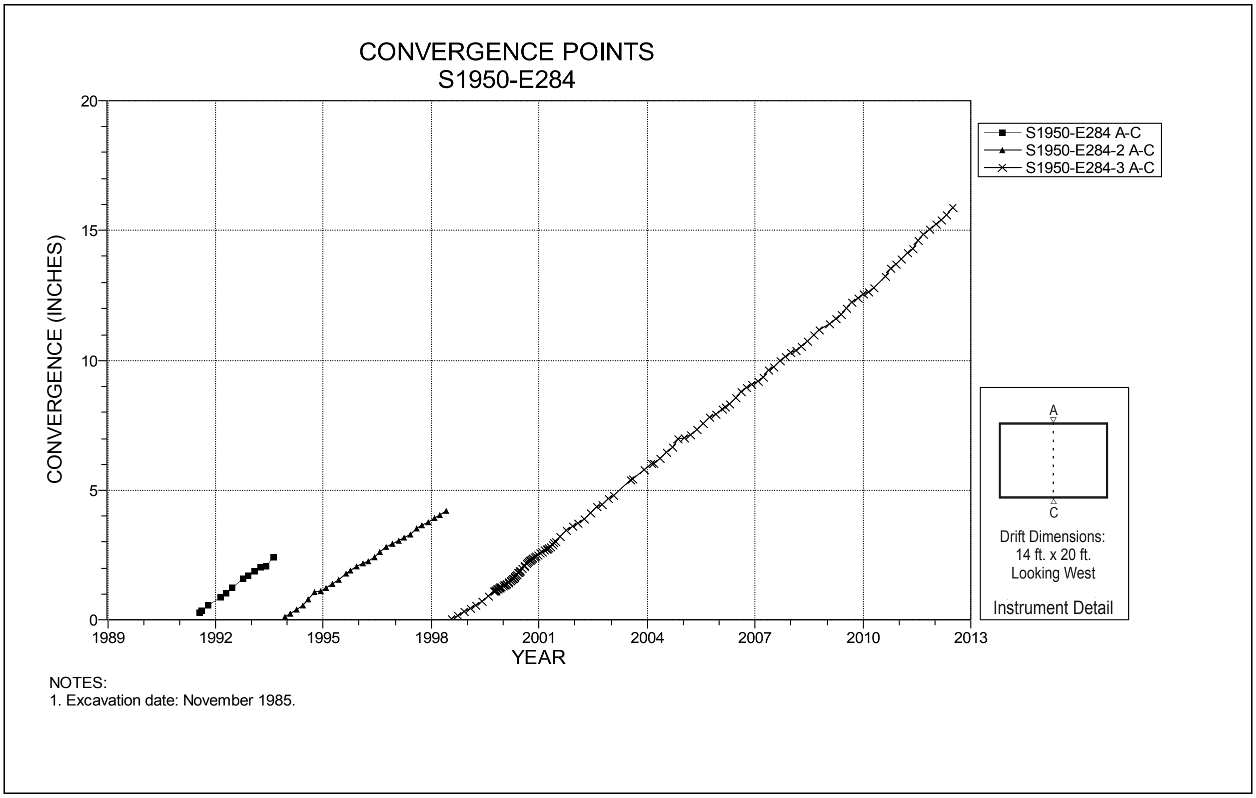


Figure 4-173 Convergence Point Array
S1950 E284 – Roof to Floor

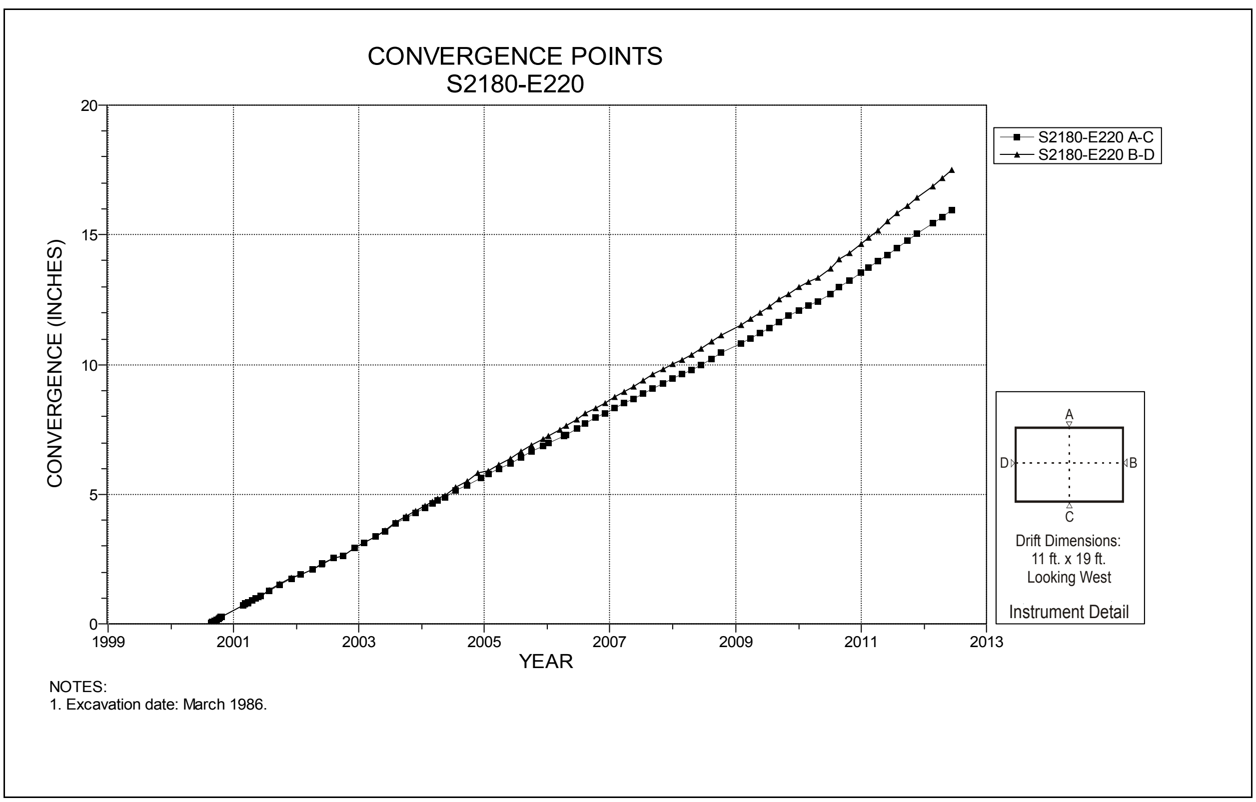


Figure 4-174 Convergence Point Array
S2180 E220 – All Chords

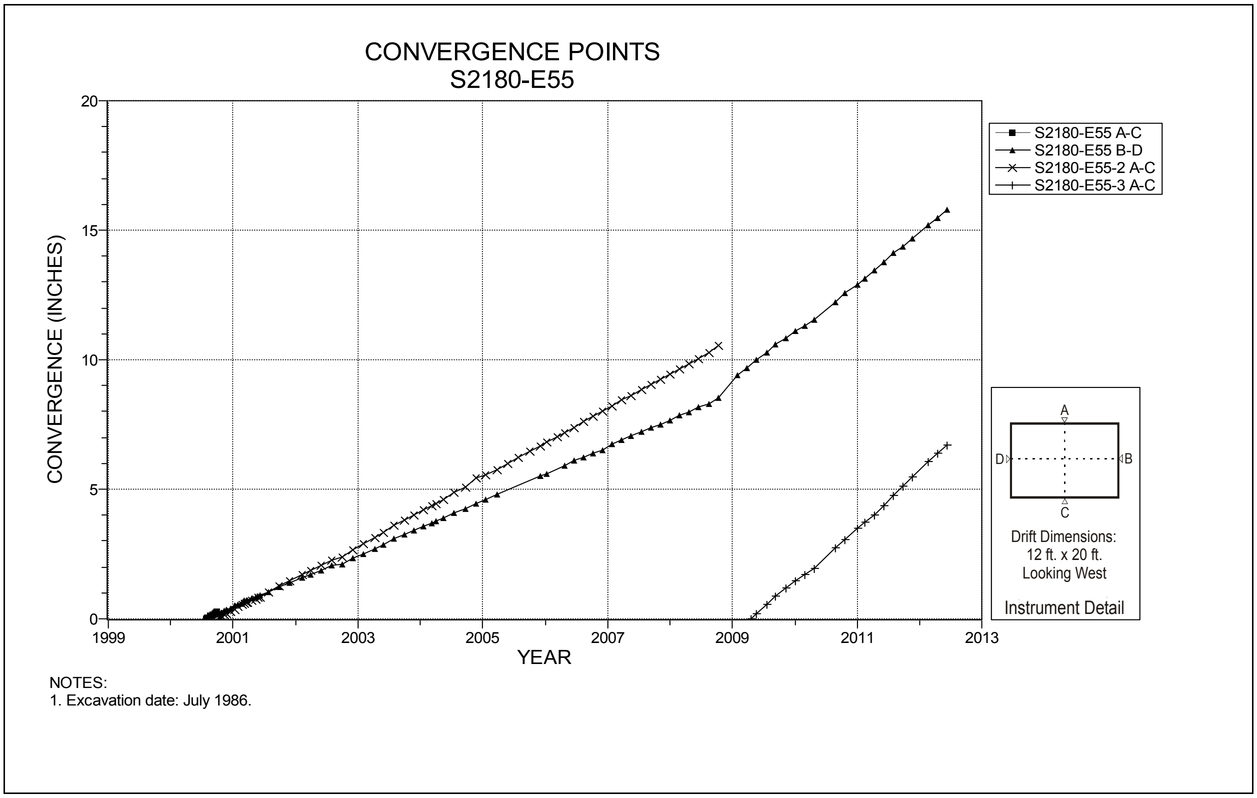


Figure 4-175 Convergence Point Array
S2180 E55 – All Chords

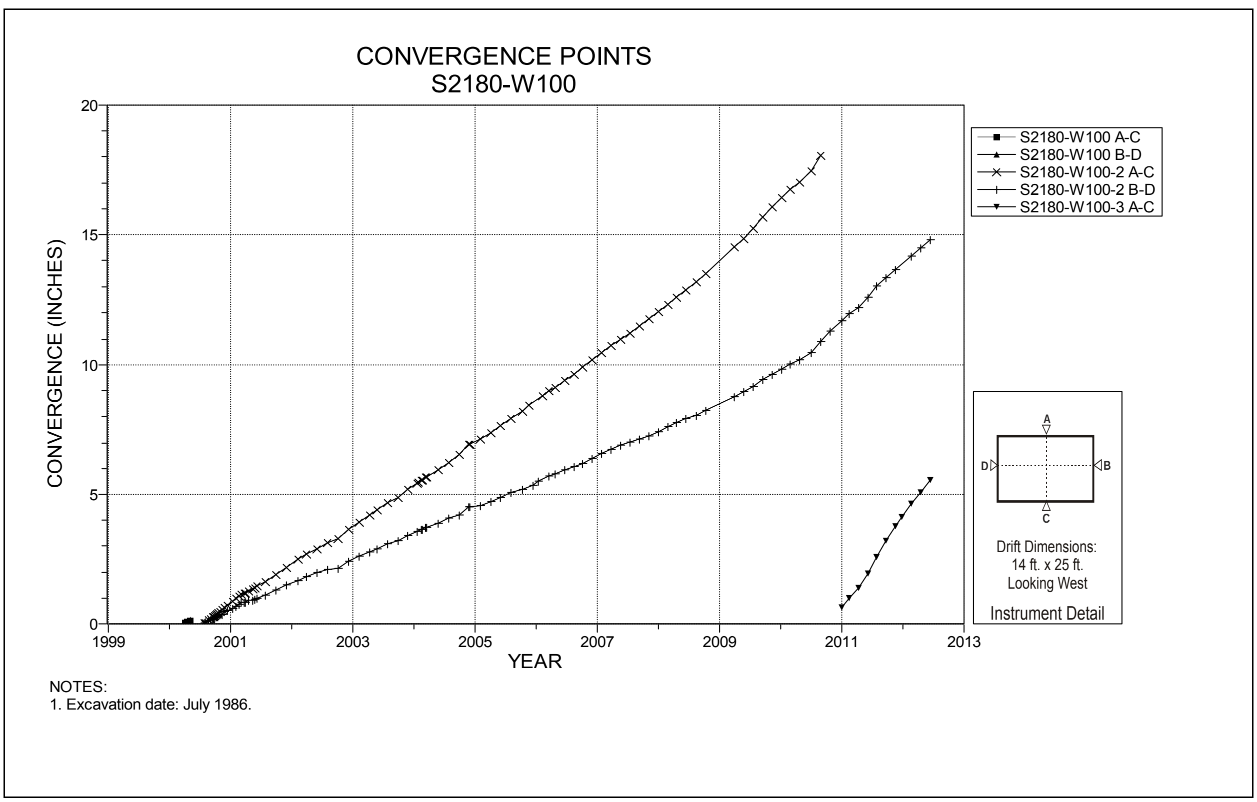


Figure 4-176 Convergence Point Array
S2180 W100 – All Chords

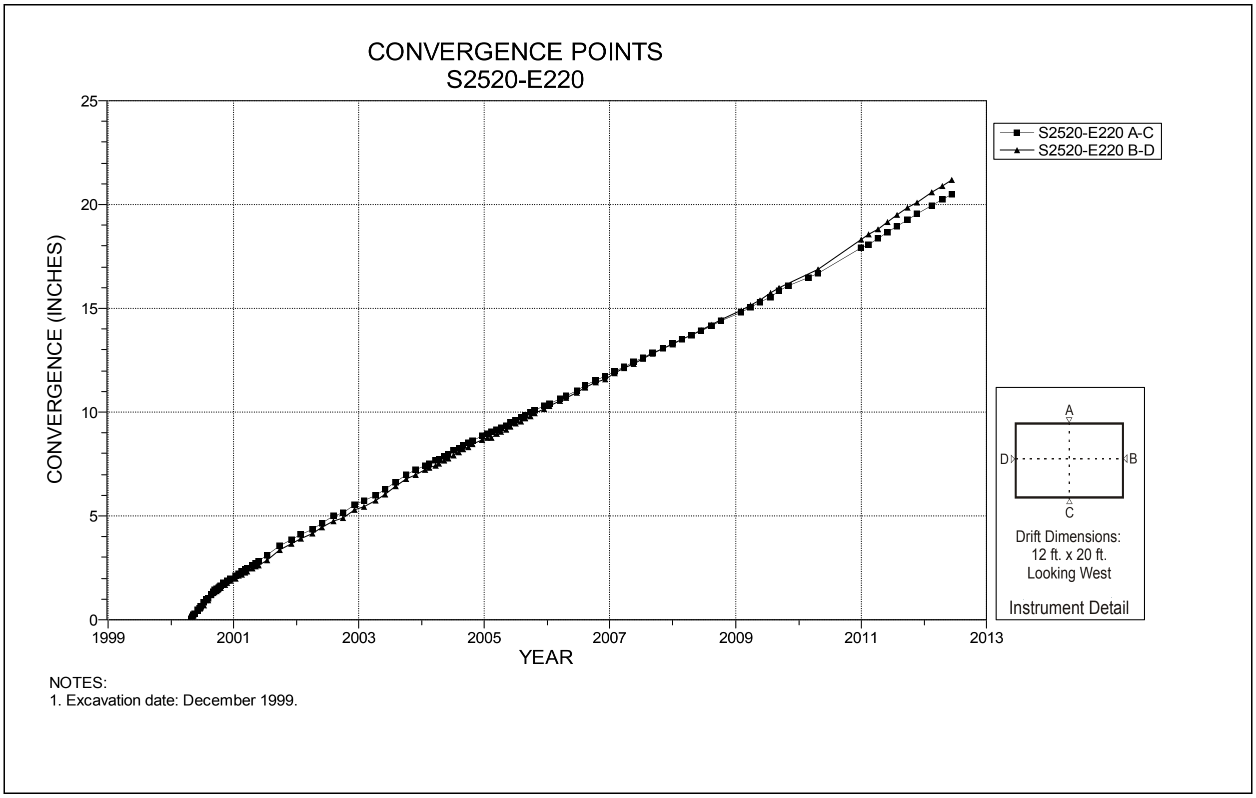


Figure 4-177 Convergence Point Array
S2520 E220 – All Chords

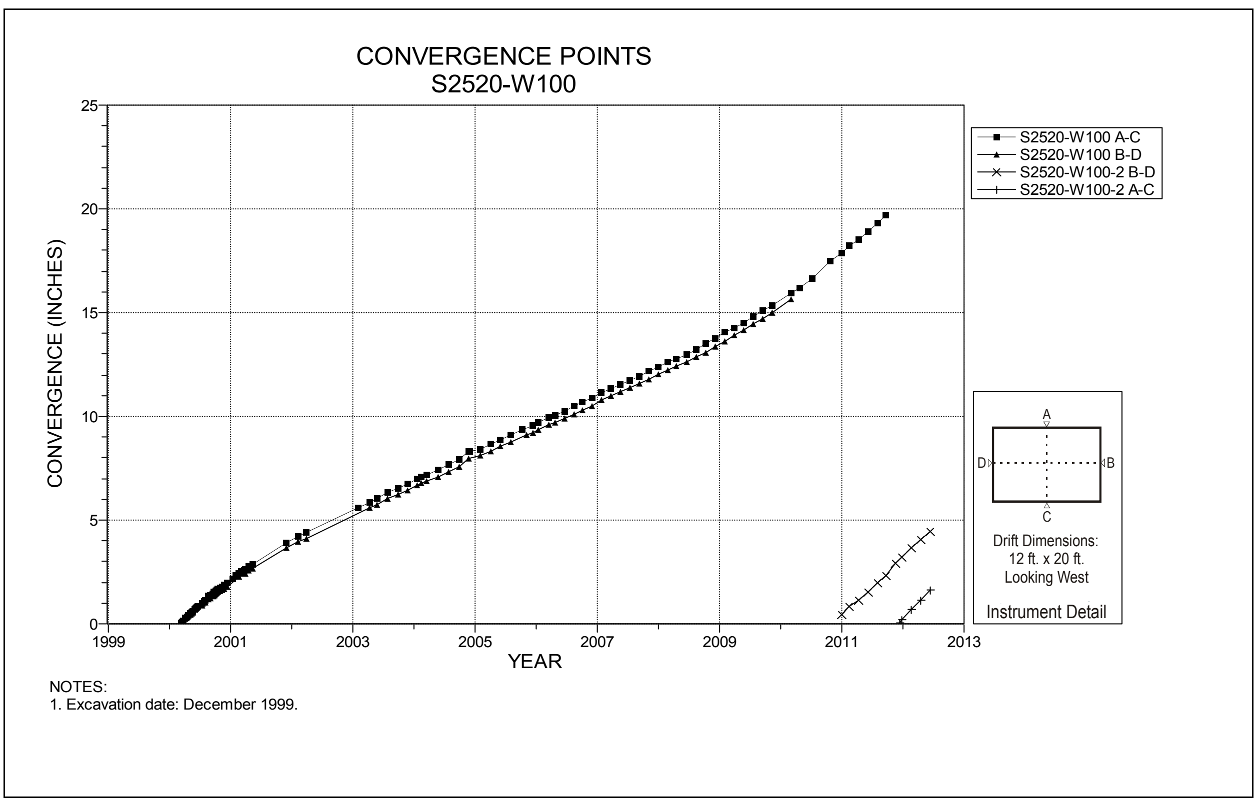


Figure 4-178 Convergence Point Array
S2520 W100 – All Chords

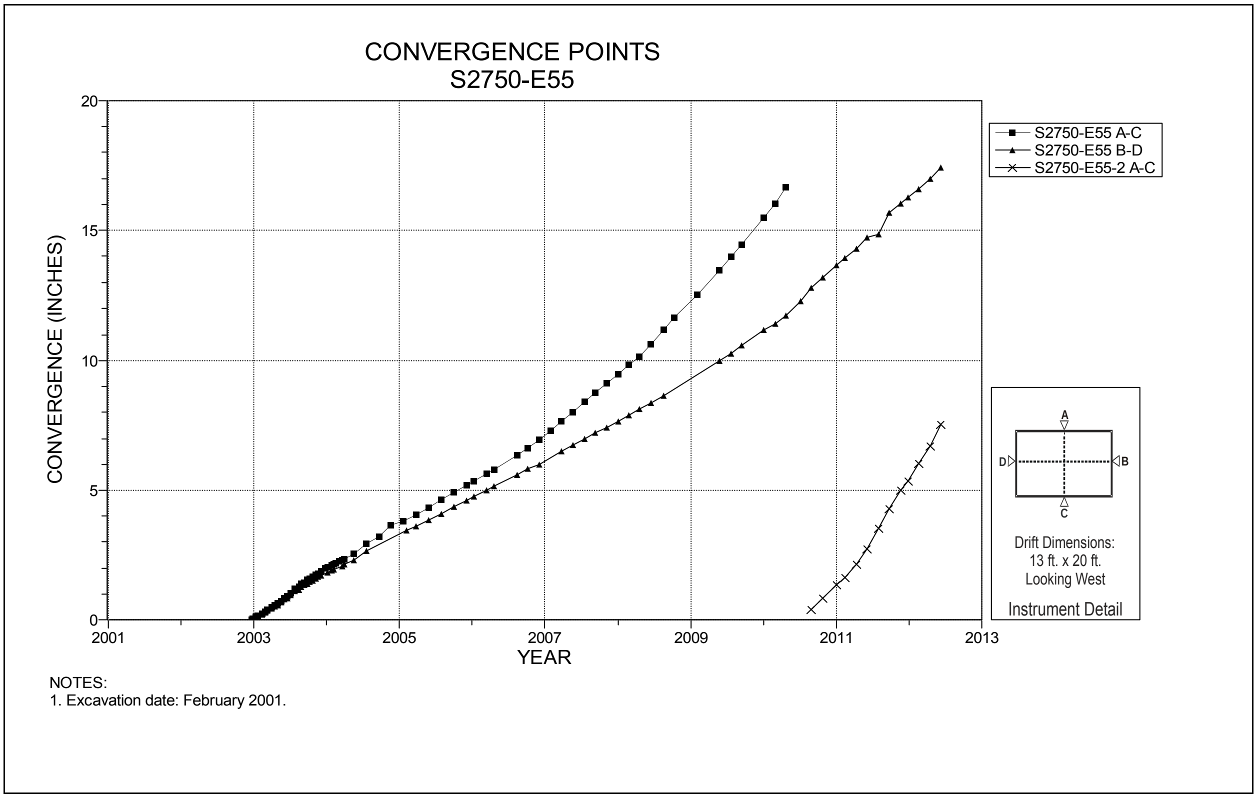


Figure 4-179 Convergence Point Array
S2750 E55 – All Chords

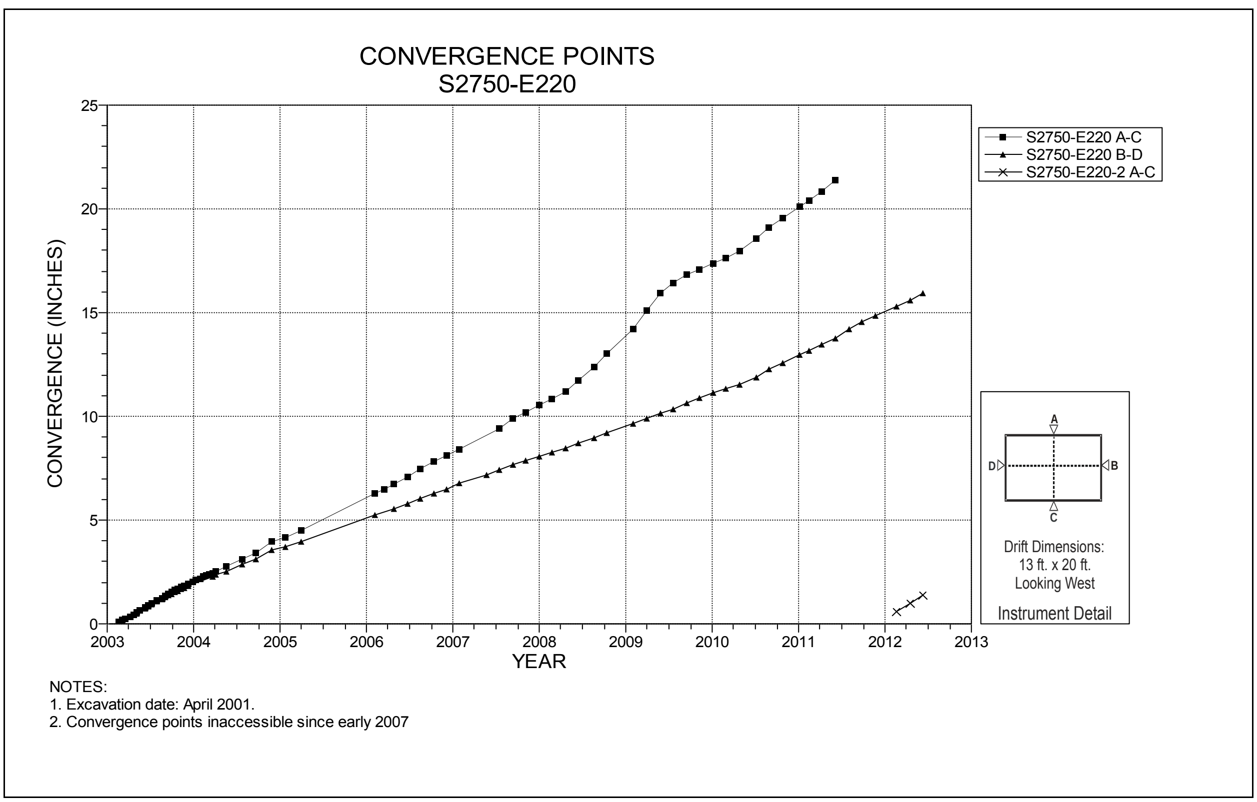


Figure 4-180 Convergence Point Array
S2750 E220 – All Chords

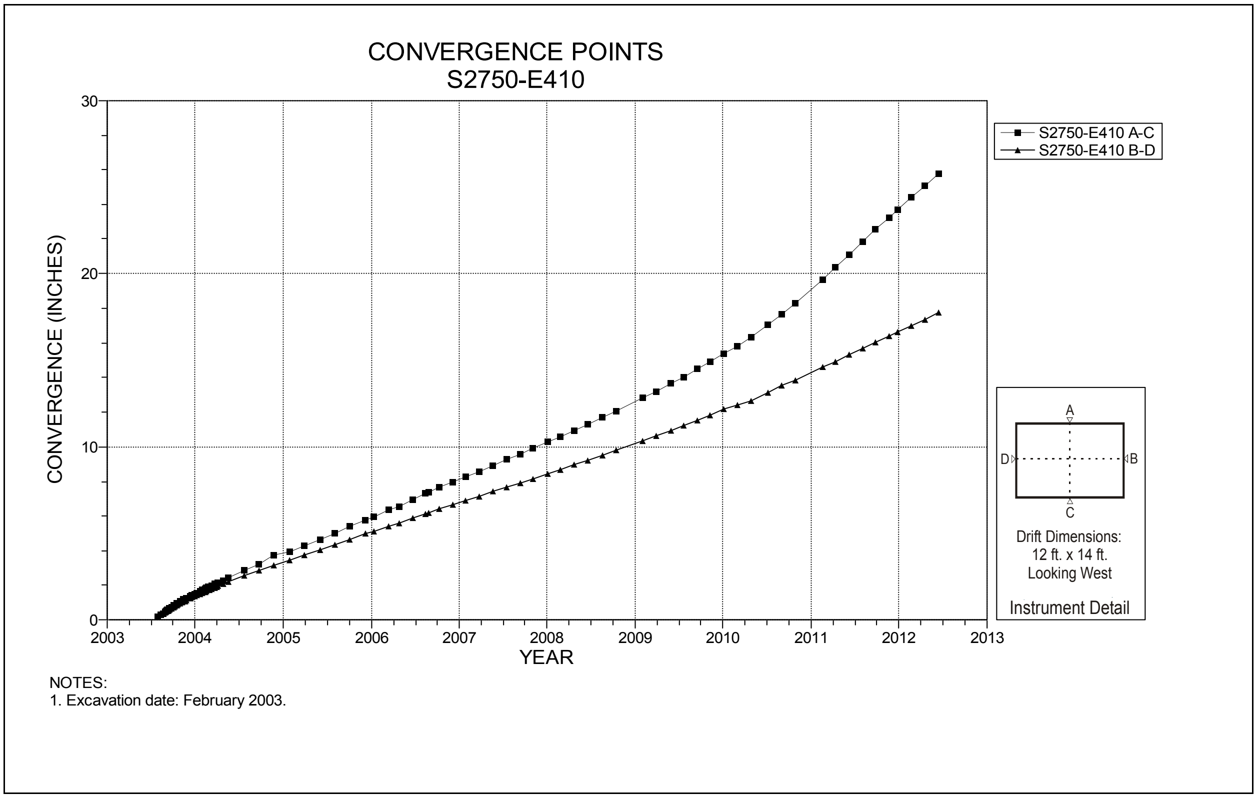


Figure 4-181 Convergence Point Array
S2750 E410 – All Chords

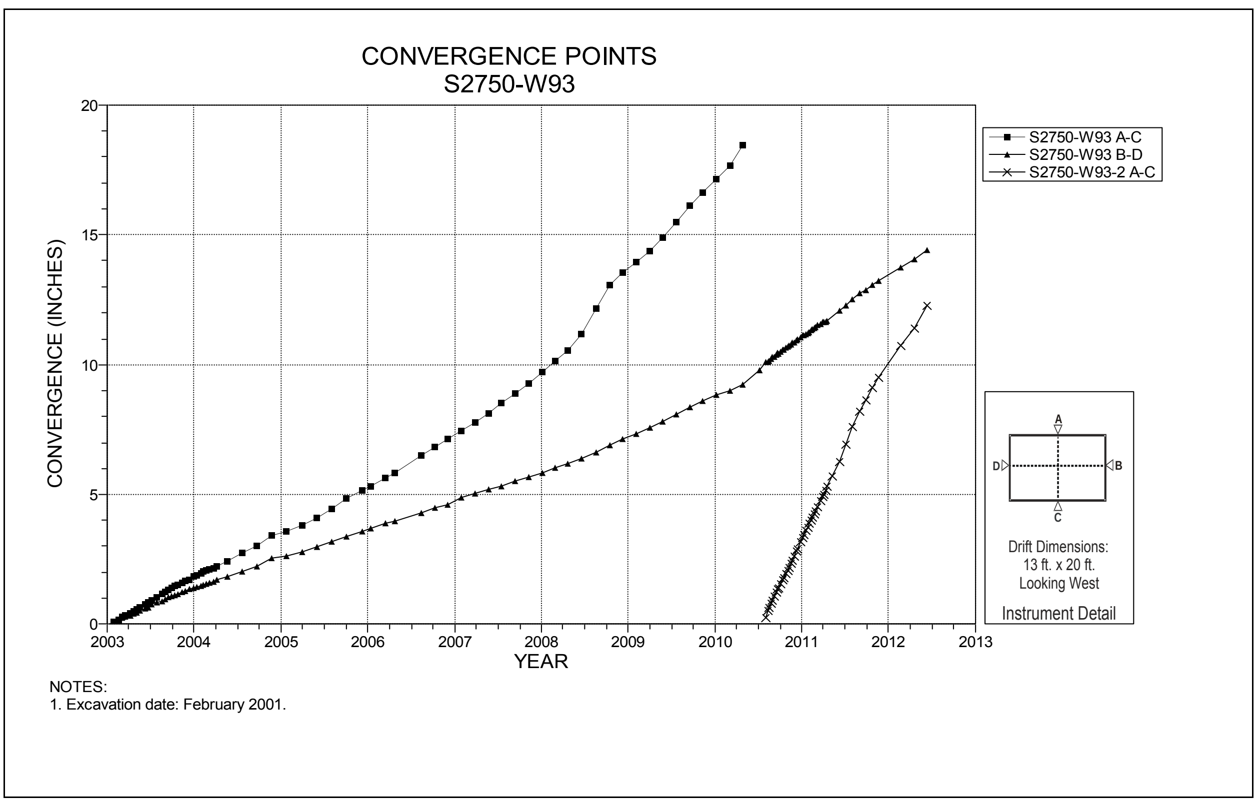


Figure 4-182 Convergence Point Array
S2750 W93 – All Chords

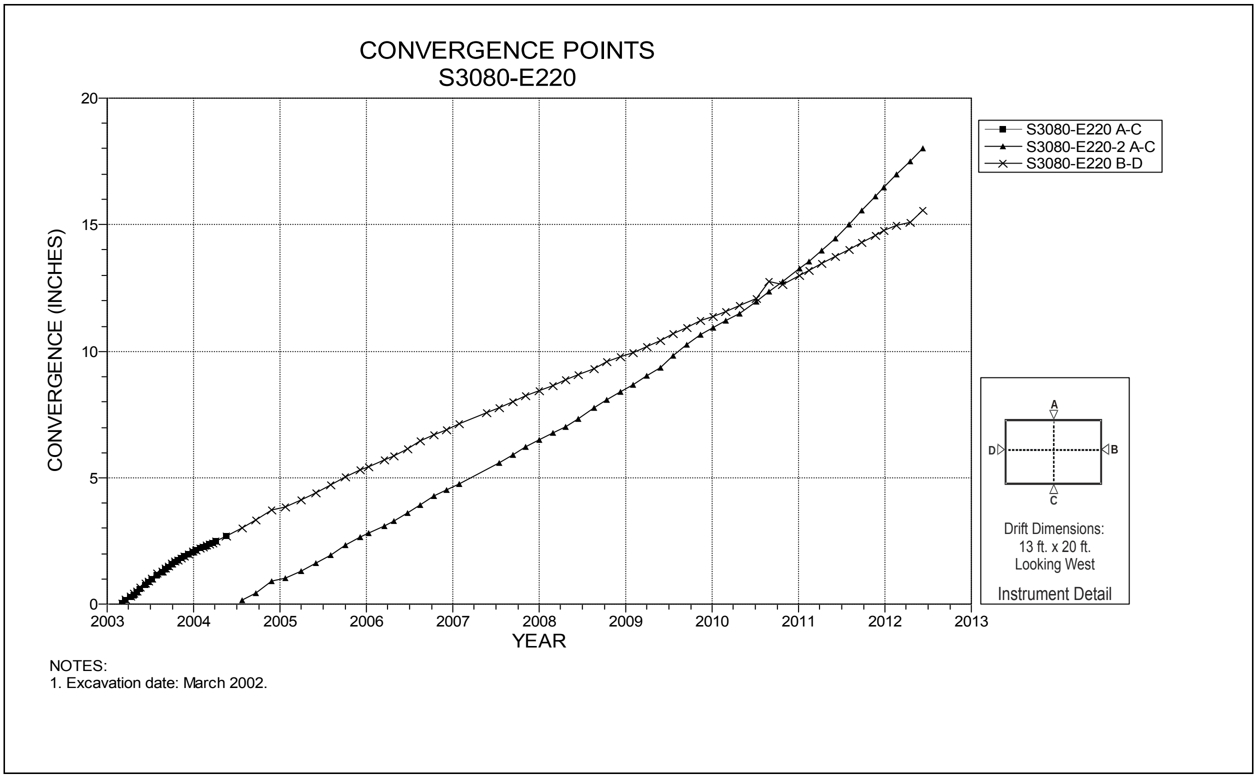


Figure 4-183 Convergence Point Array
S3080 E220 – All Chords

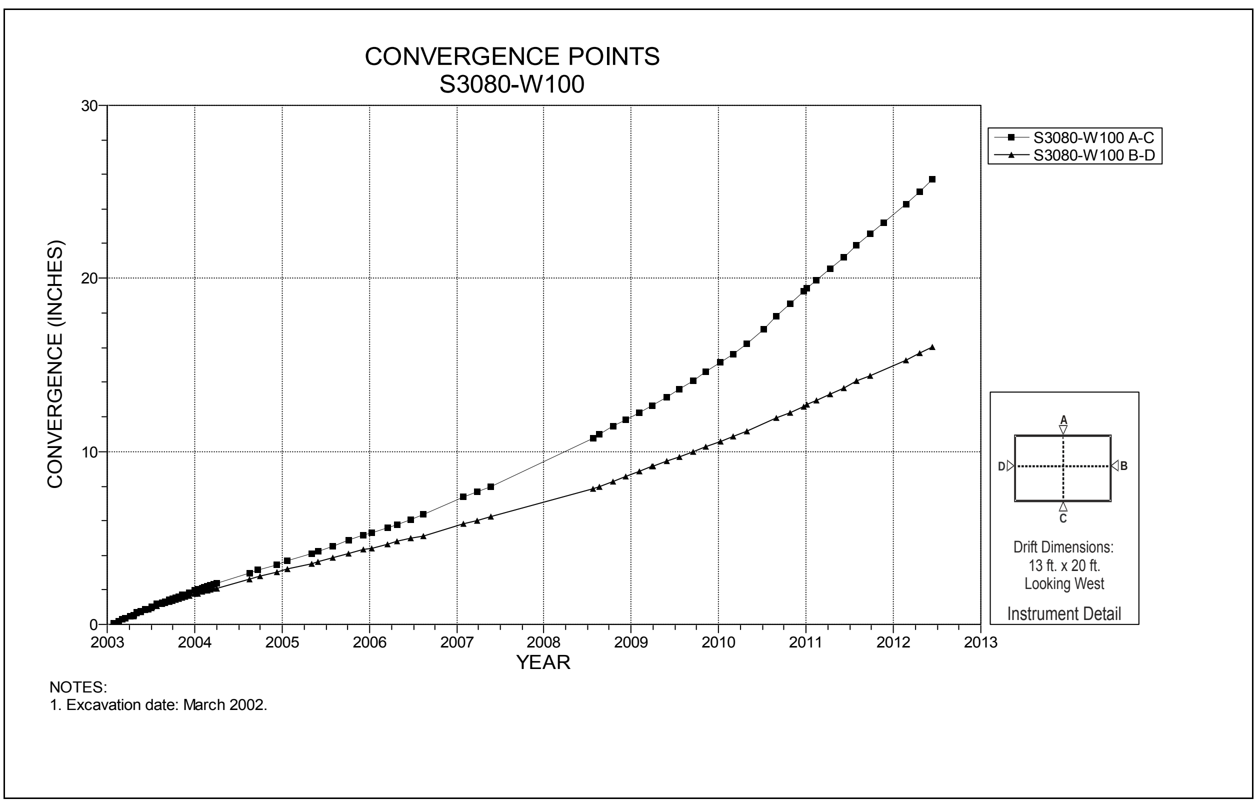


Figure 4-184 Convergence Point Array
S3080 W100 – All Chords

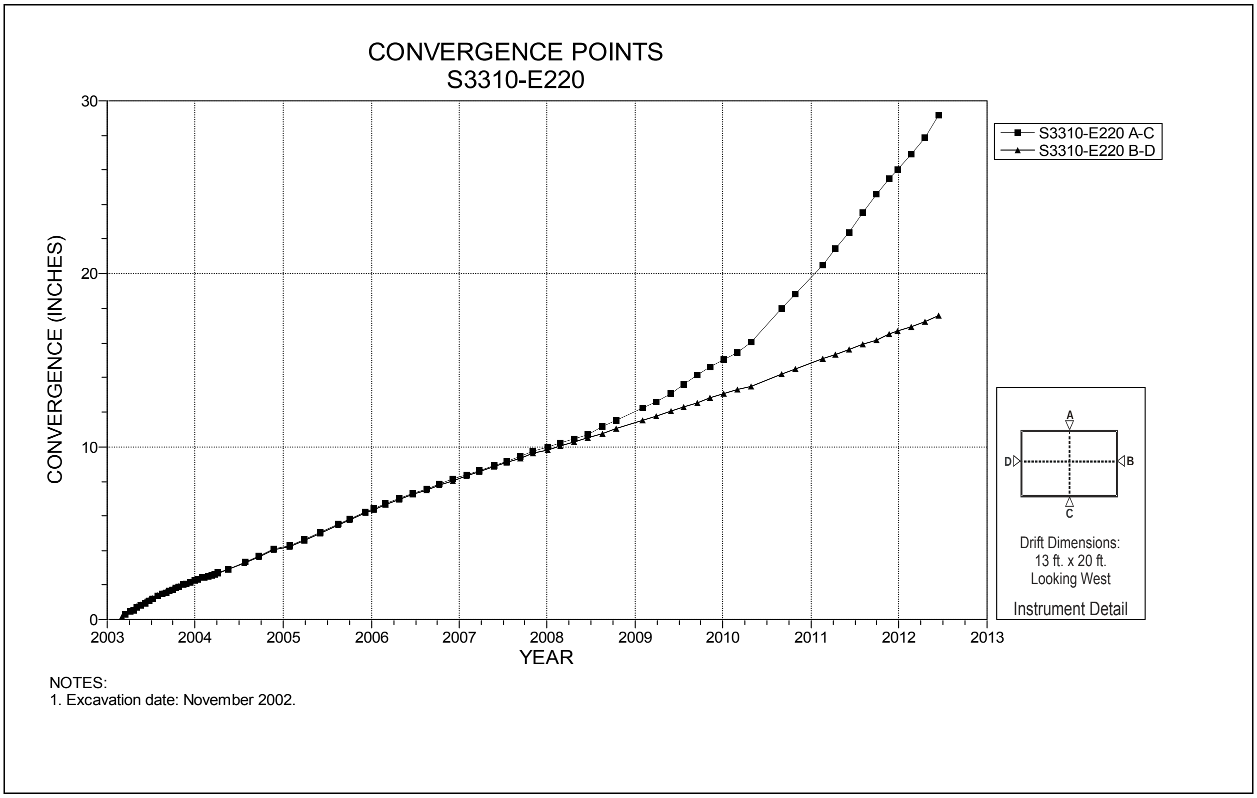


Figure 4-185 Convergence Point Array
S3310 E220 – All Chords

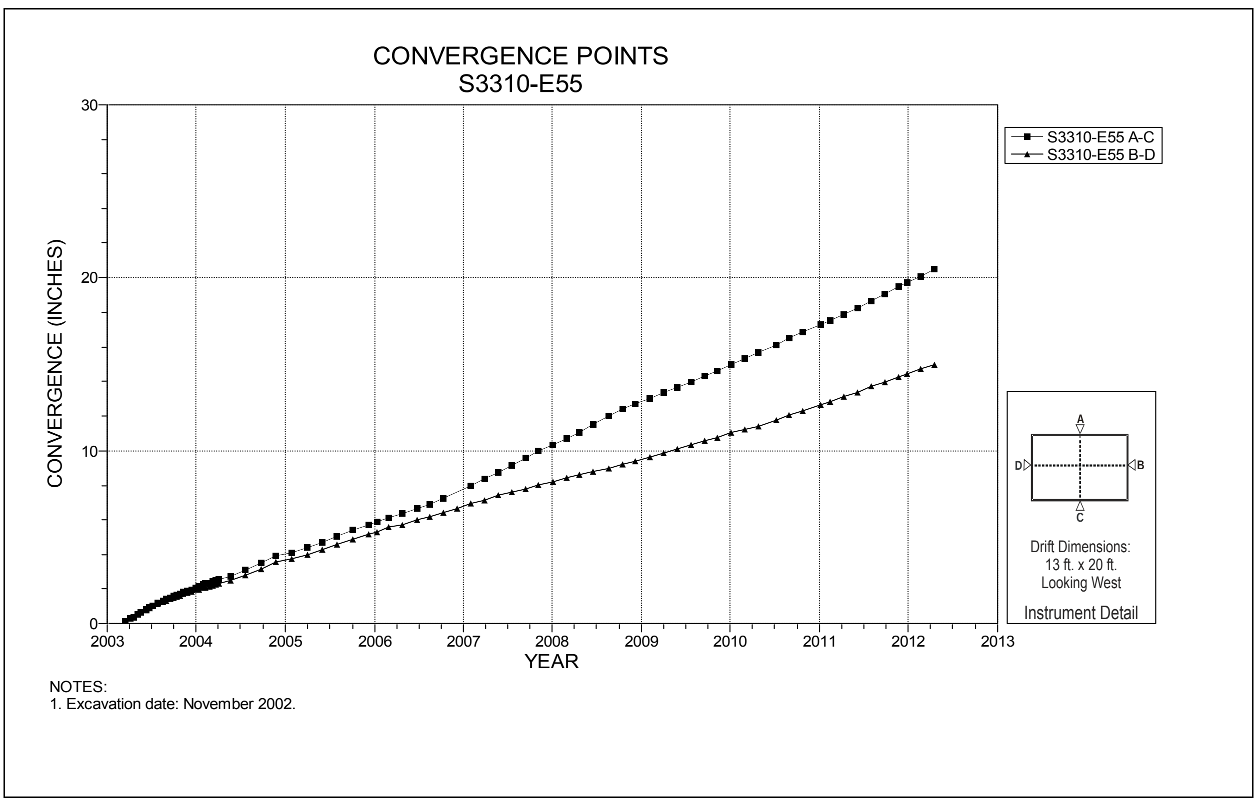


Figure 4-186 Convergence Point Array
S3310 E55 – All Chords

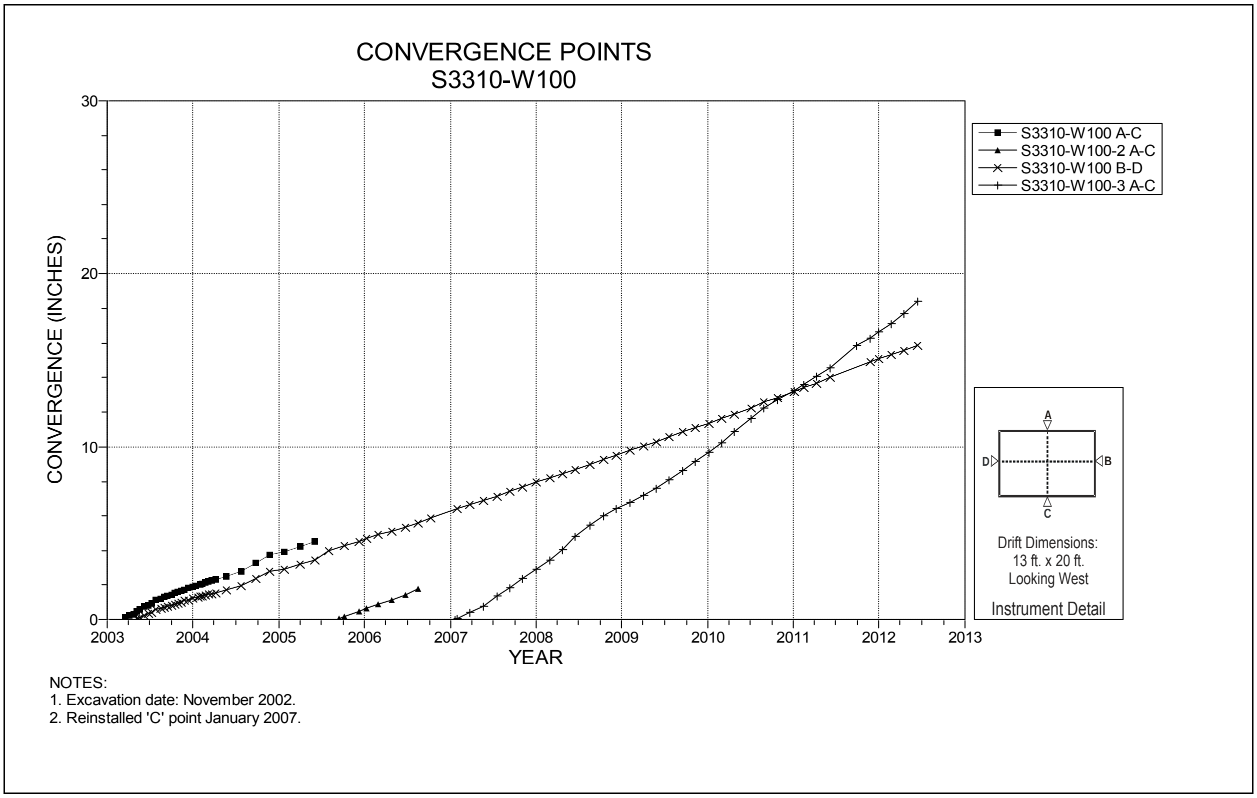


Figure 4-187 Convergence Point Array
S3310 W100 – All Chords

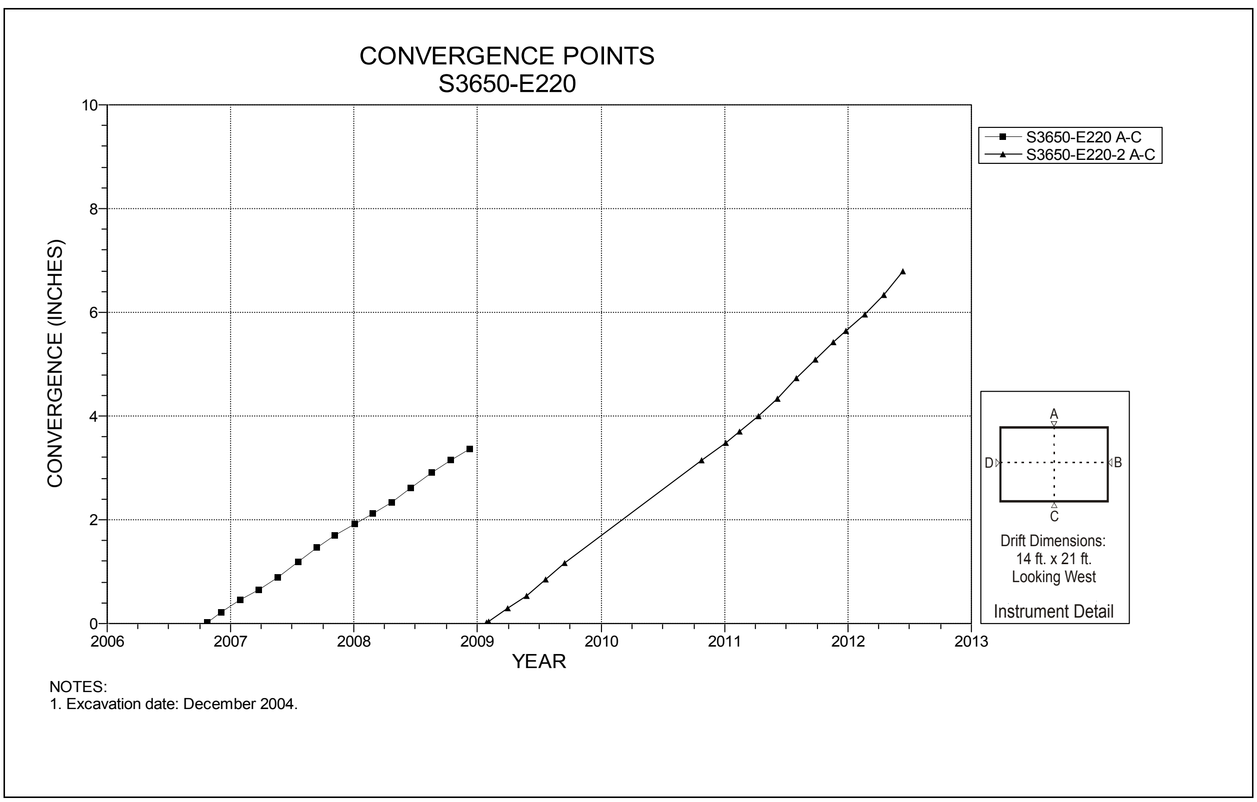


Figure 4-188 Convergence Point Array
S3650 E220 – All Chords

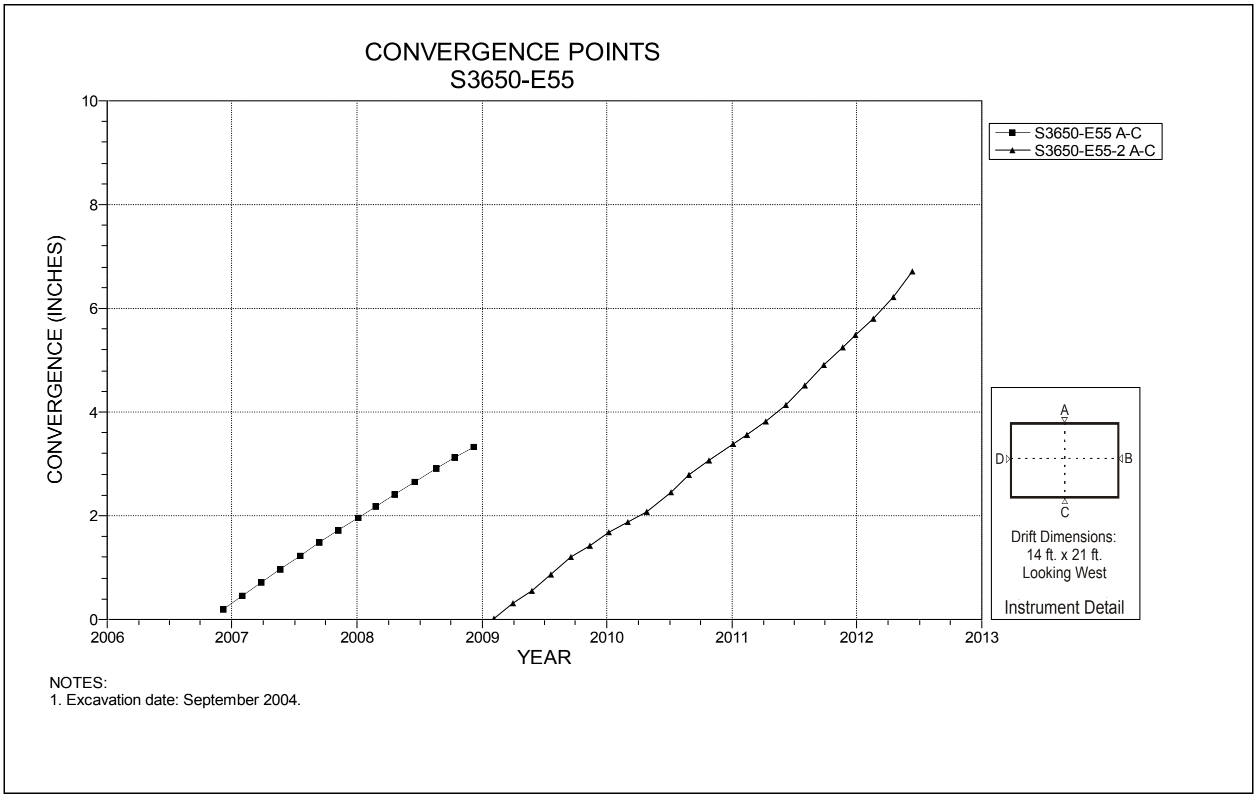


Figure 4-189 Convergence Point Array
S3650 E55 – Roof to Floor

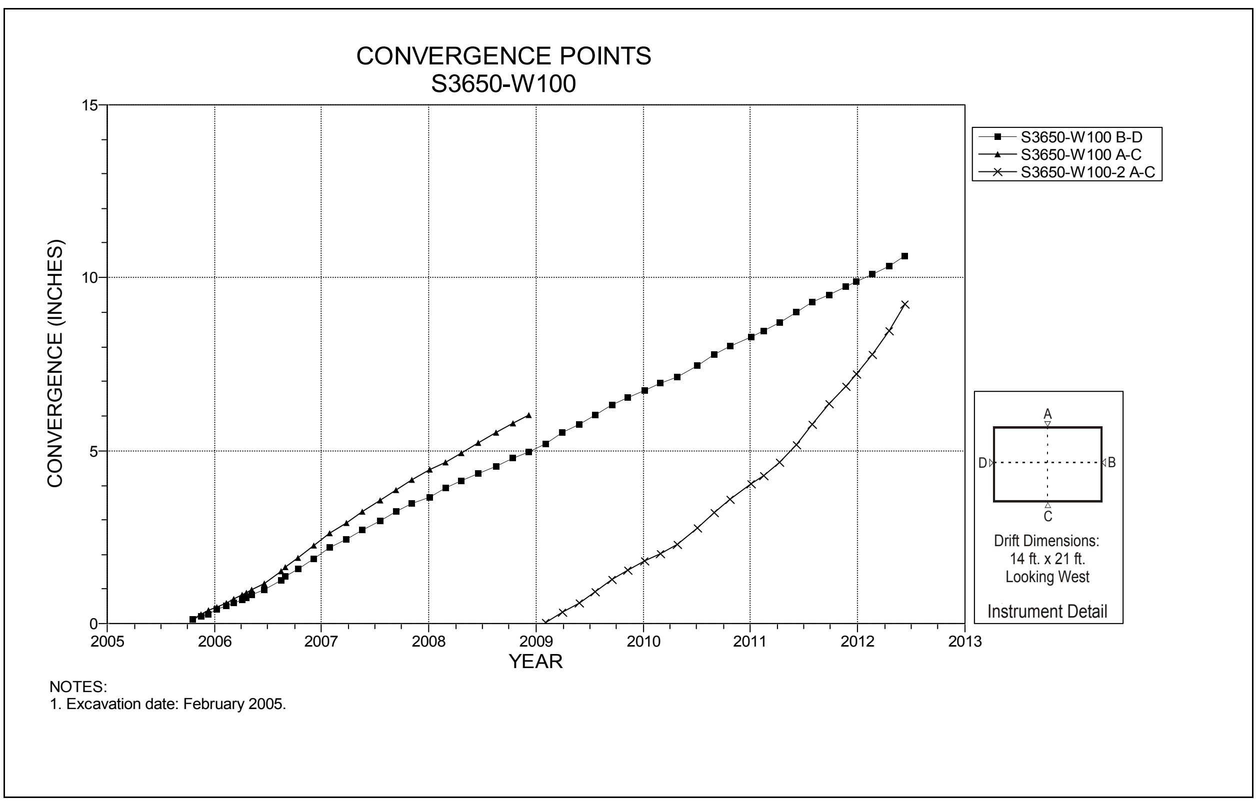


Figure 4-190 Convergence Point Array
S3650 W100 – All Chords

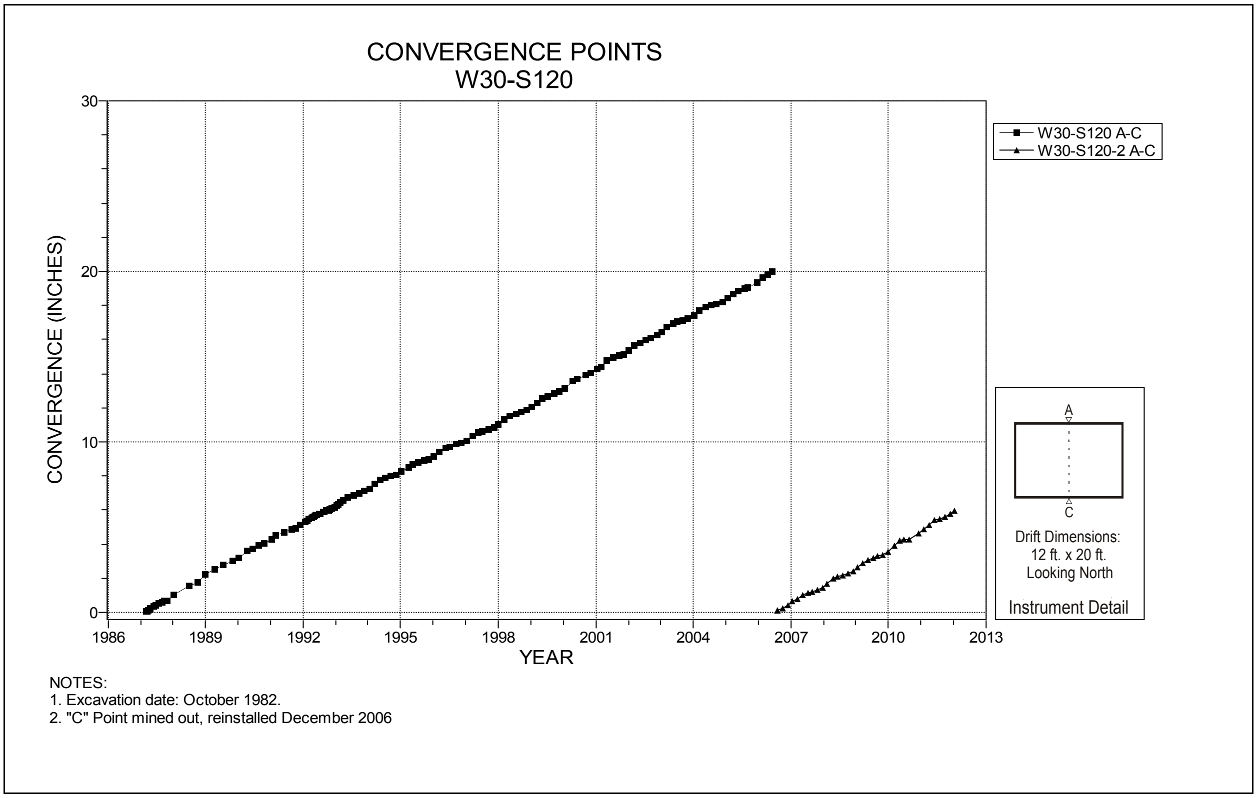


Figure 4-191 Convergence Point Array
W30 S120 – Roof to Floor

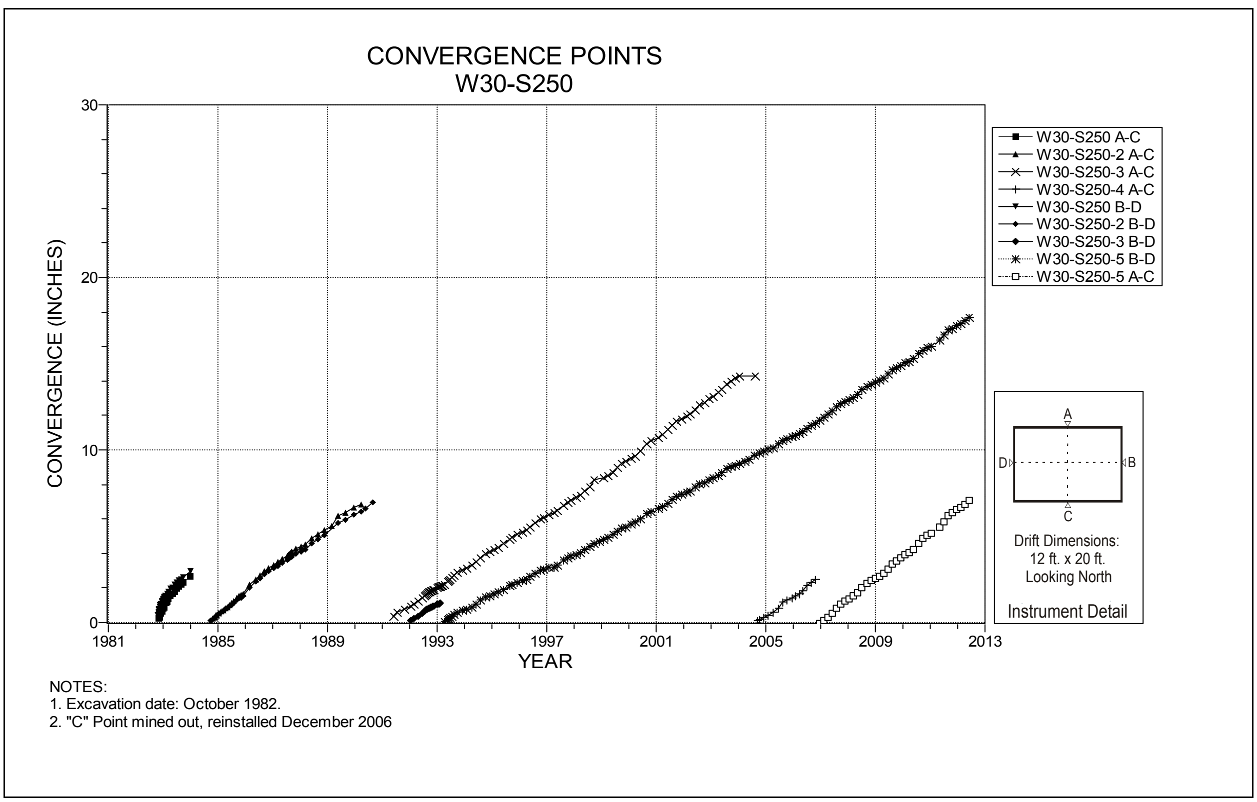


Figure 4-192 Convergence Point Array
W30 S250 – All Chords

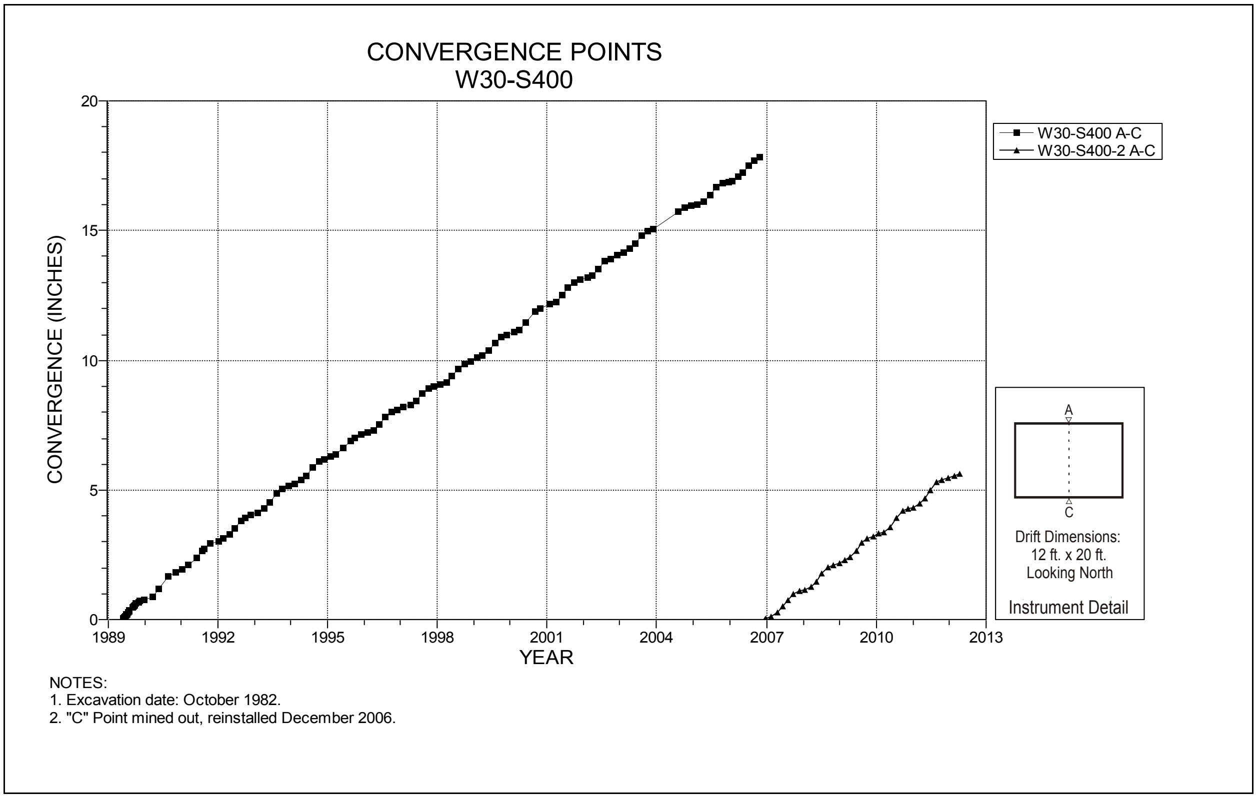


Figure 4-193 Convergence Point Array
W30 S400 – Roof to Floor

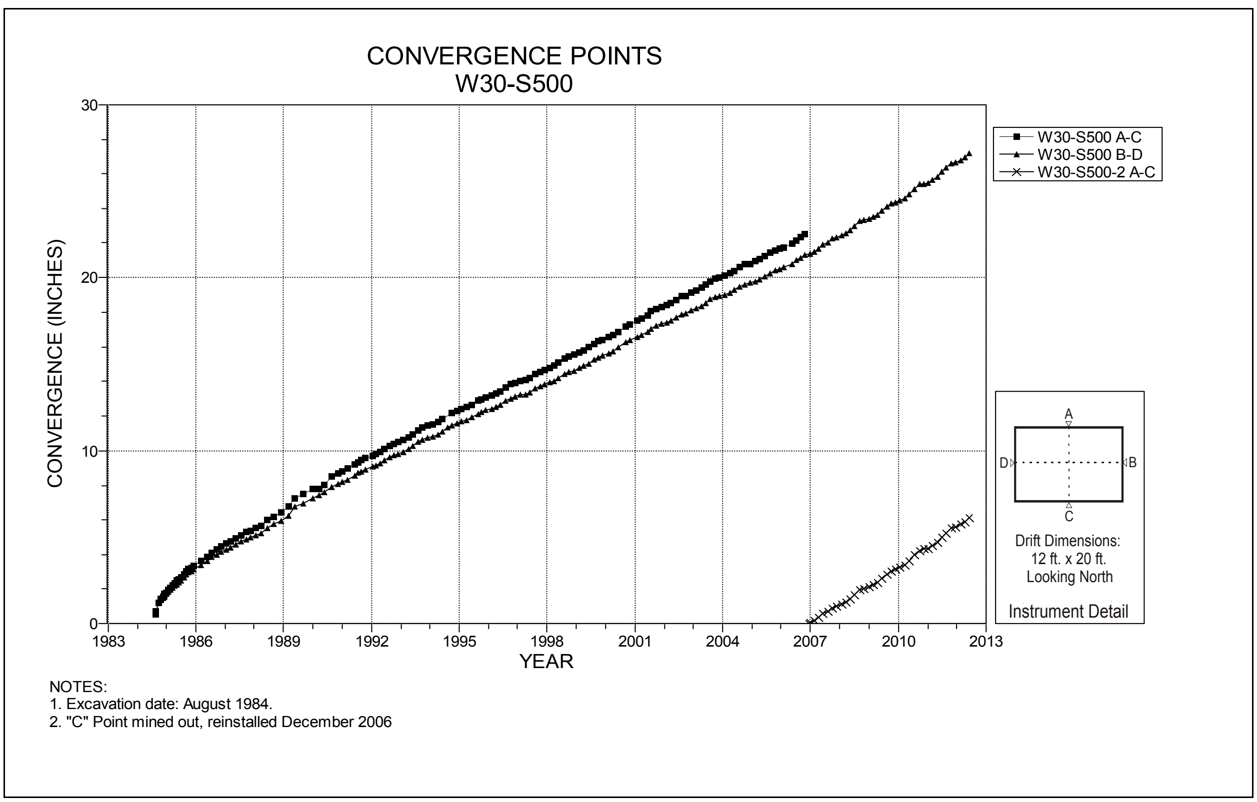


Figure 4-194 Convergence Point Array
W30 S500 – All Chords

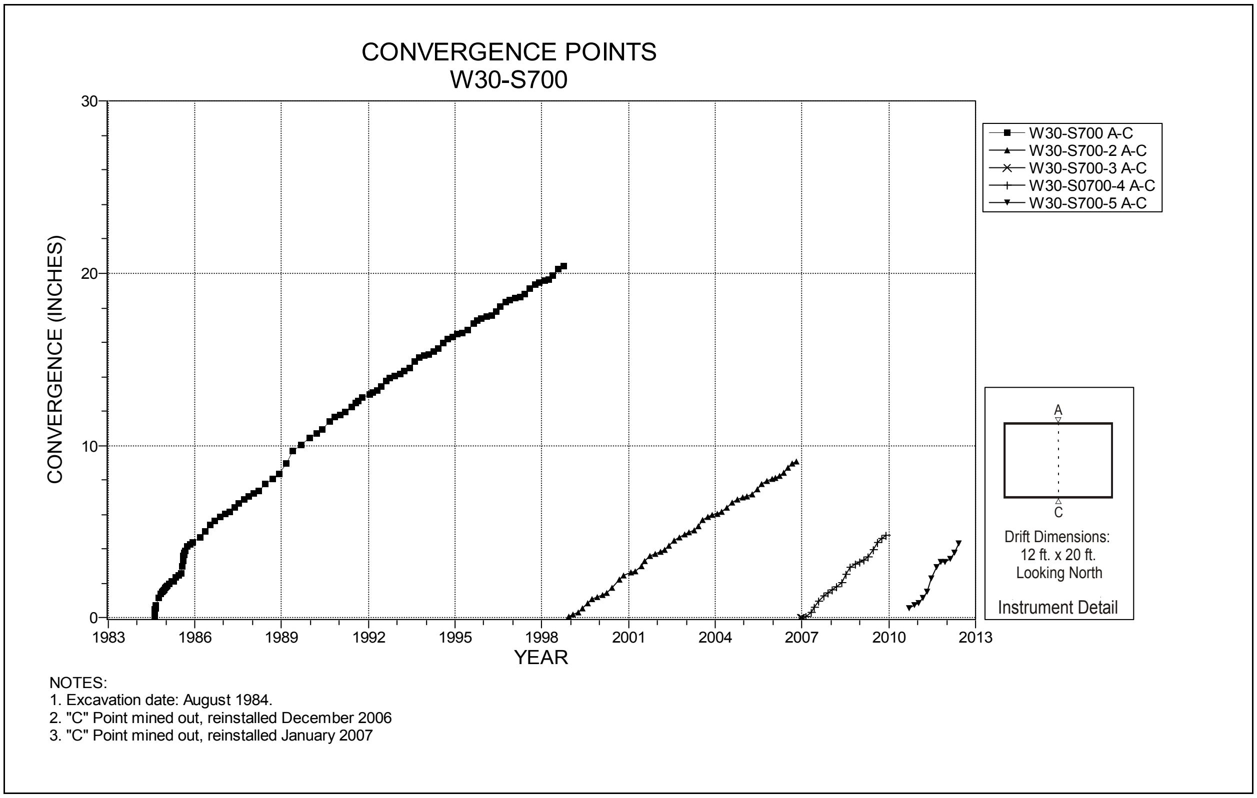


Figure 4-195 Convergence Point Array
W30 S700 – Roof to Floor

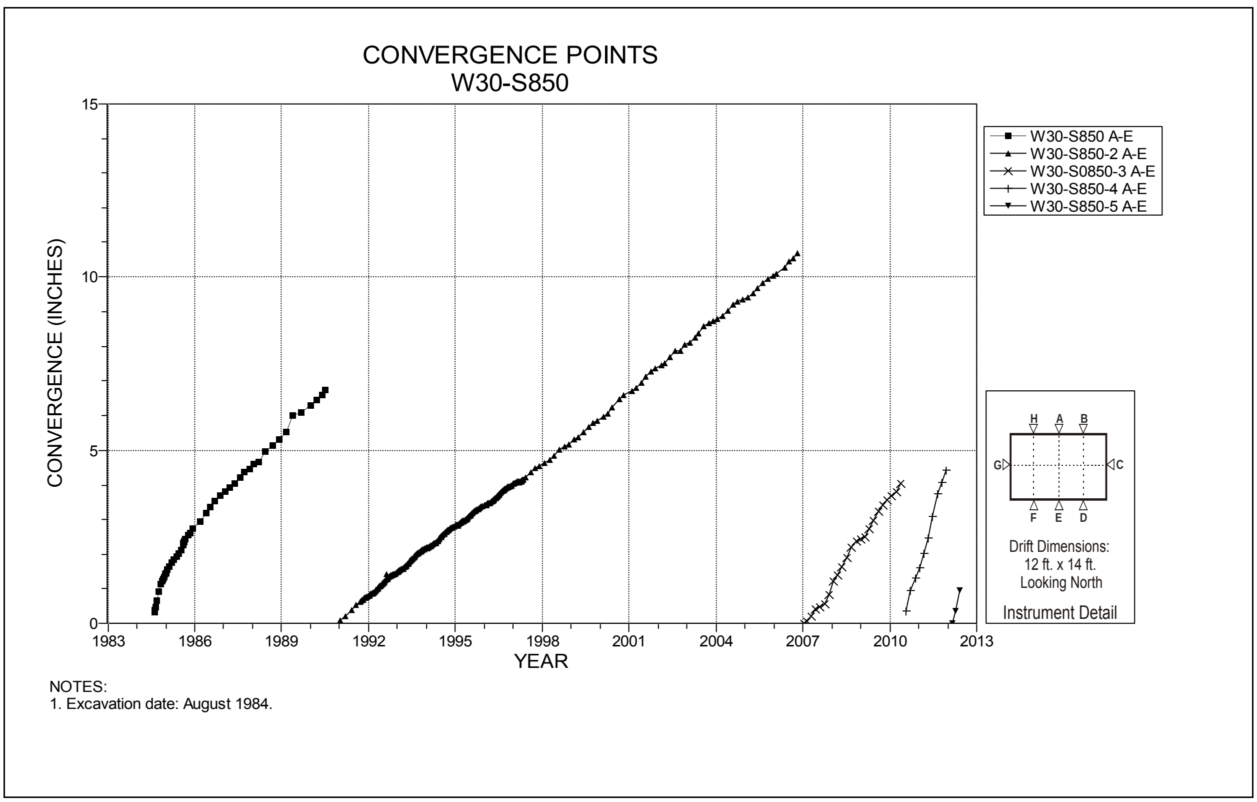


Figure 4-196 Convergence Point Array
W30 S850 – Roof to Floor

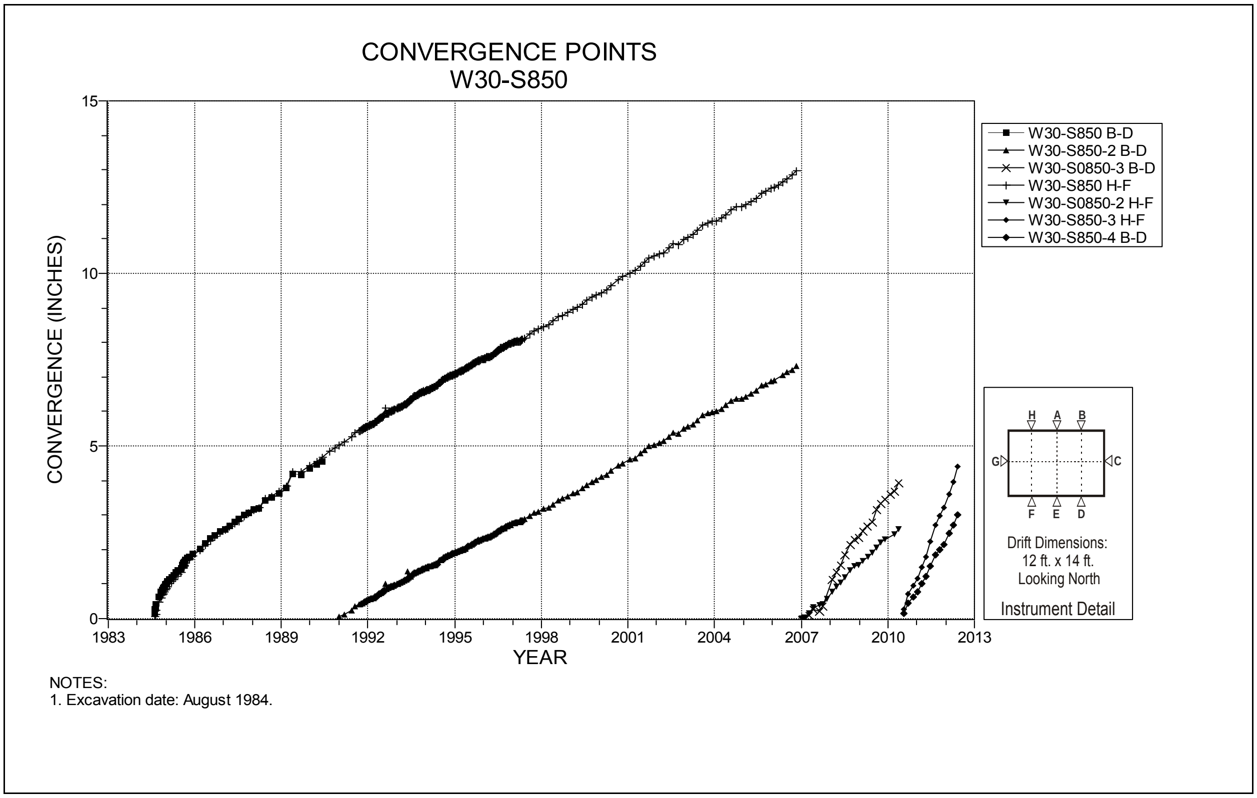


Figure 4-197 Convergence Point Array
W30 S850 – Roof to Floor – Quarter Points

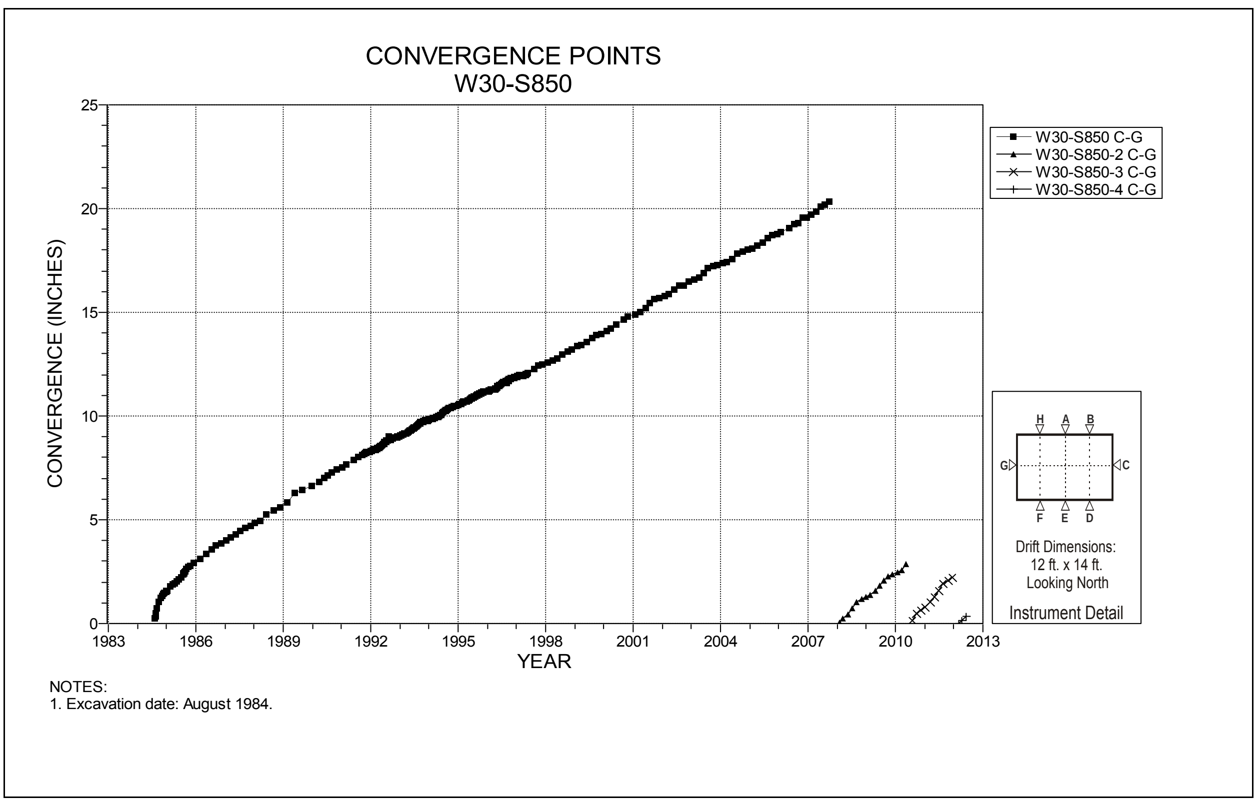


Figure 4-198 Convergence Point Array
W30 S850 – Rib to Rib

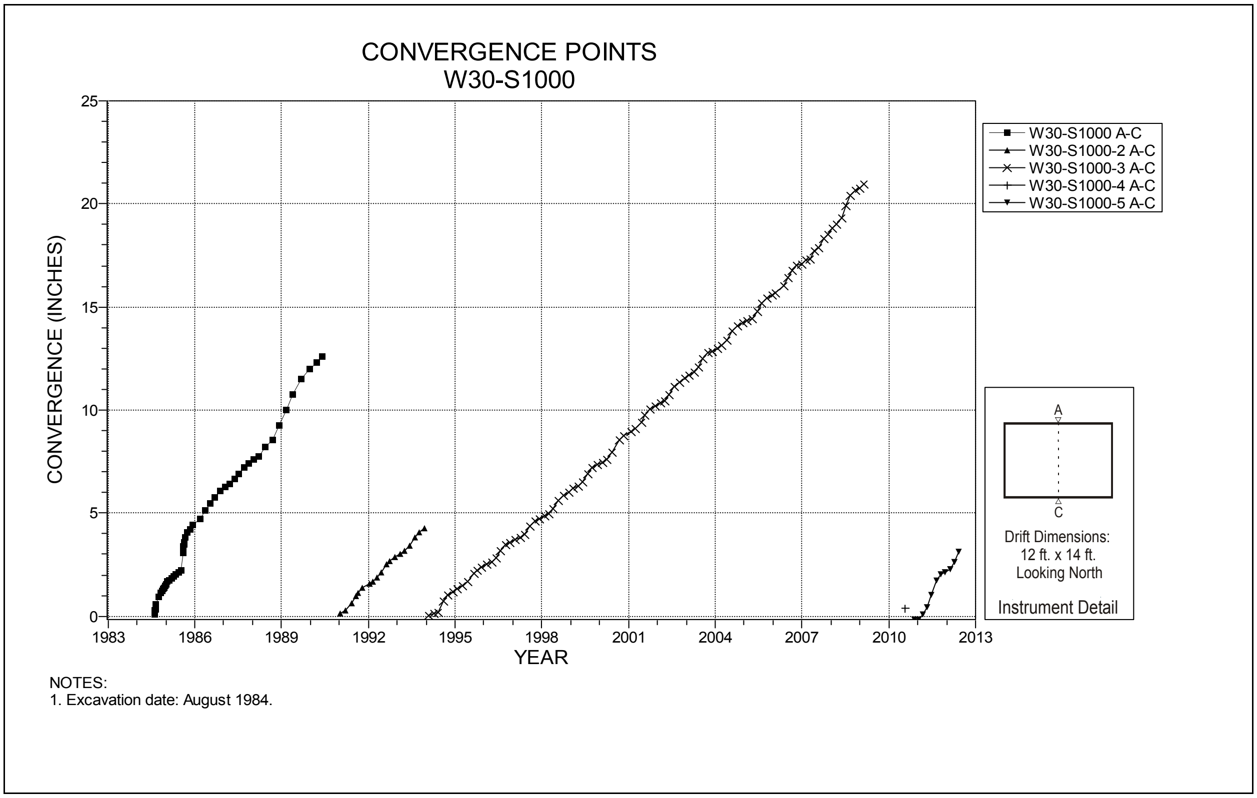


Figure 4-199 Convergence Point Array
W30 S1000 – Roof to Floor

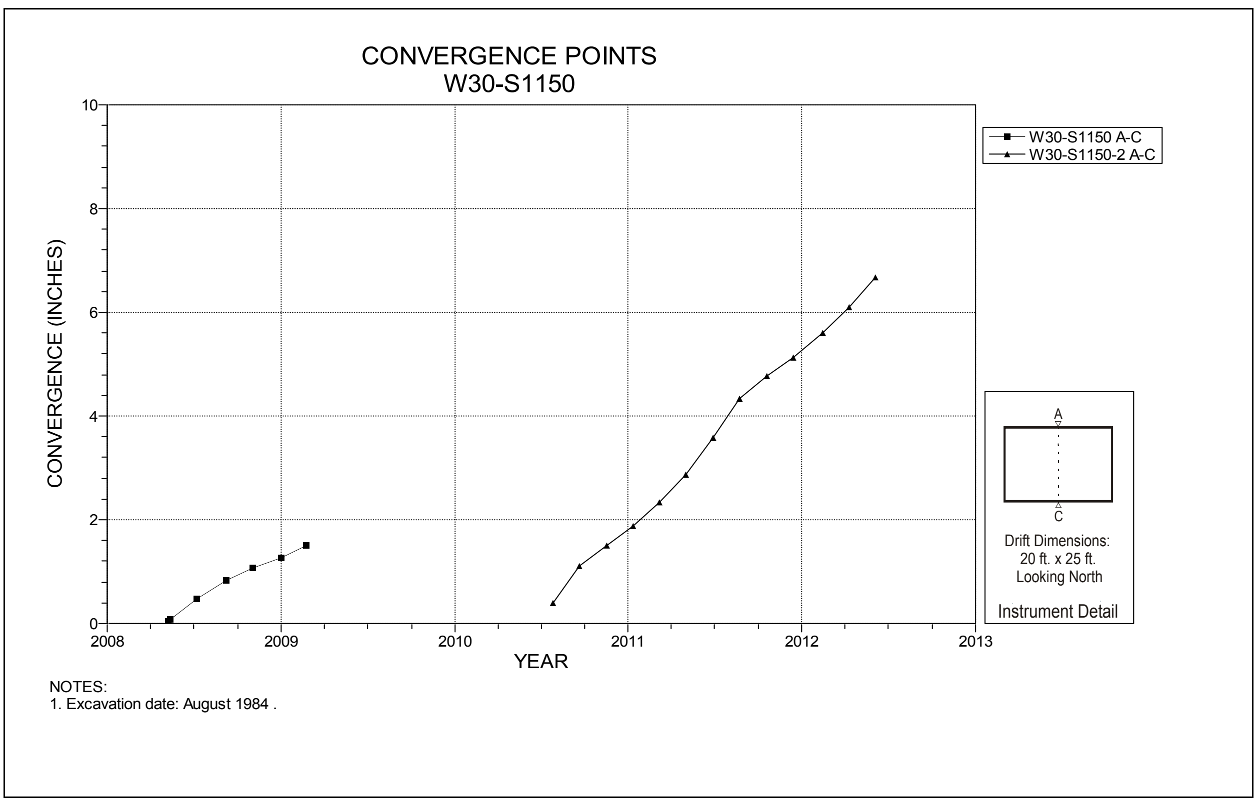


Figure 4-200 Convergence Point Array
W30 S1150 – Roof to Floor

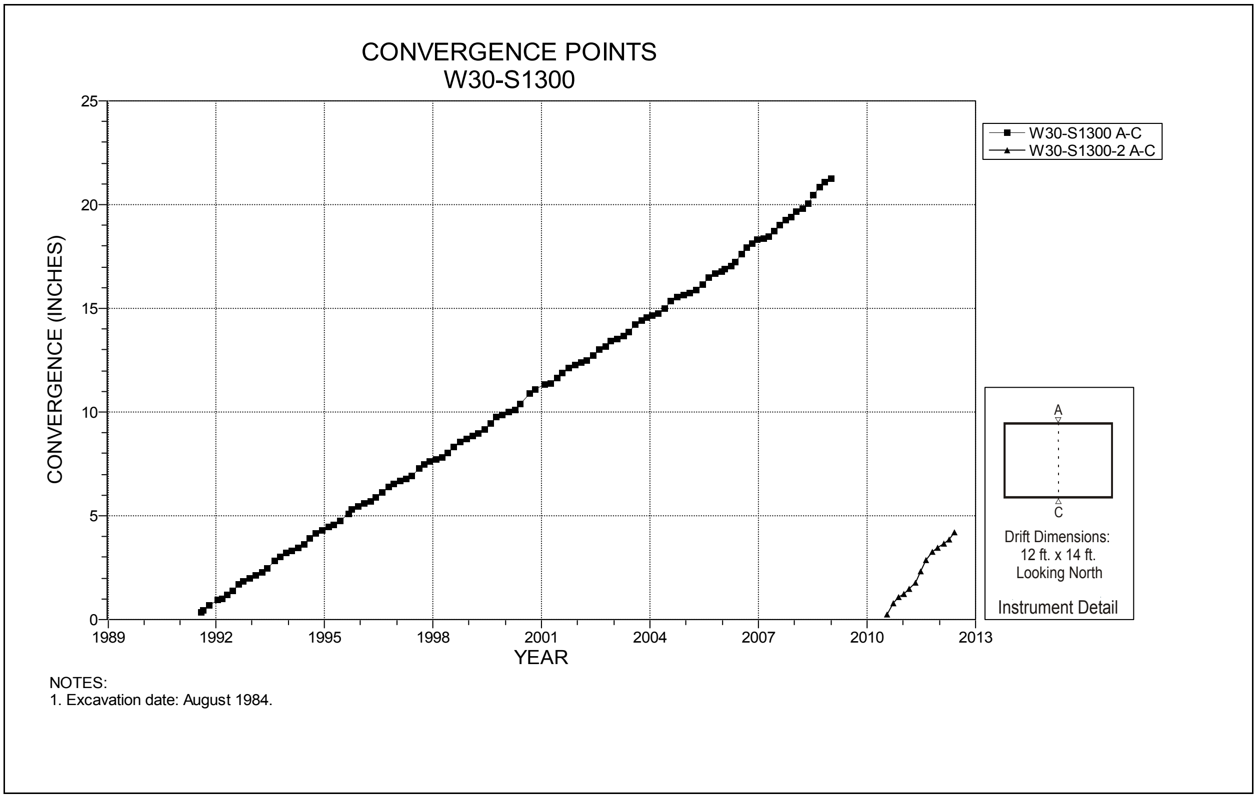


Figure 4-201 Convergence Point Array
W30 S1300 – Roof to Floor

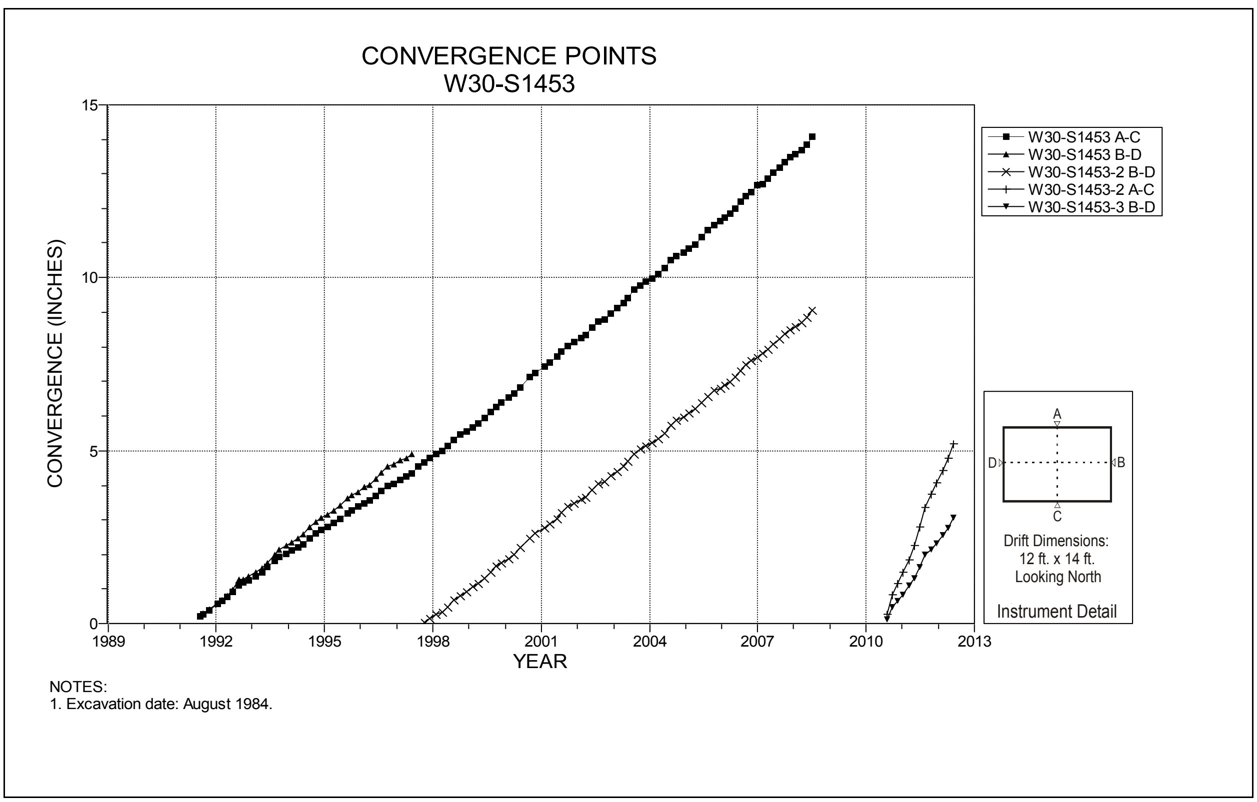


Figure 4-202 Convergence Point Array
W30 S1453 – All Chords

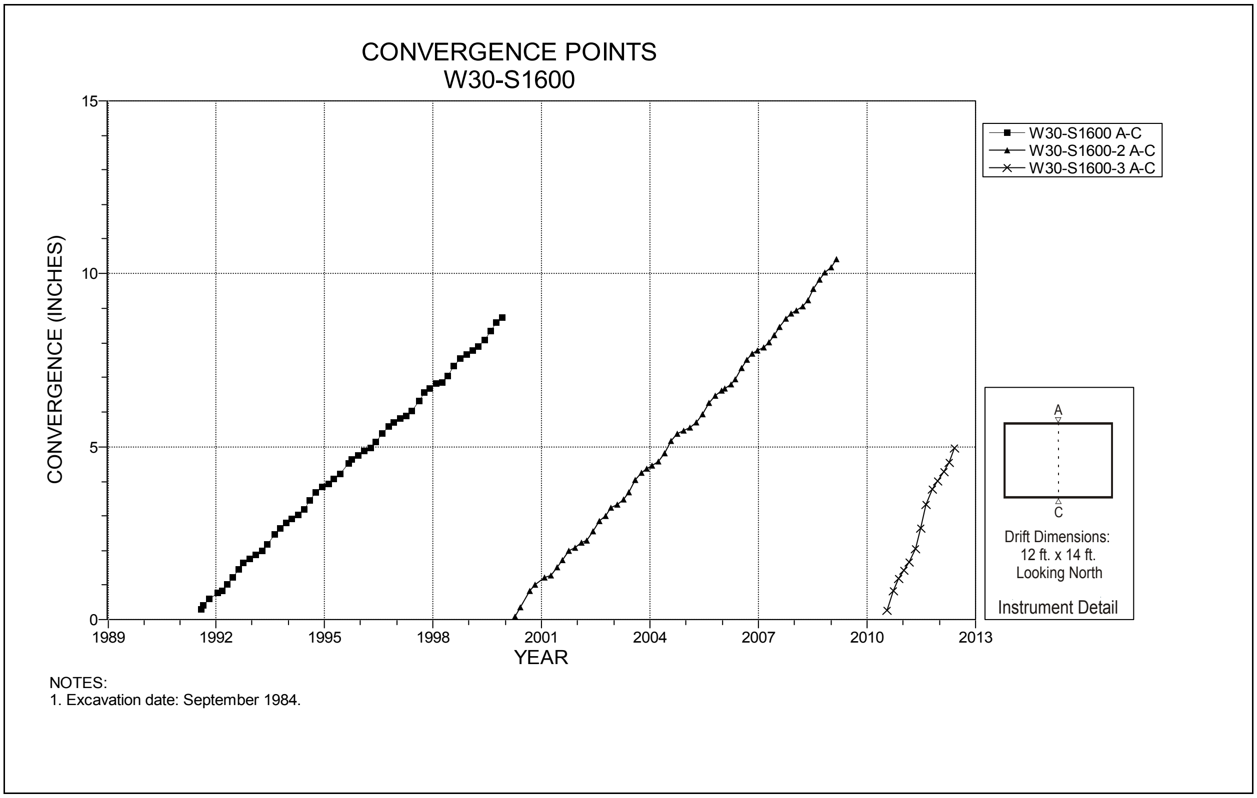


Figure 4-203 Convergence Point Array
W30 S1600 – Roof to Floor

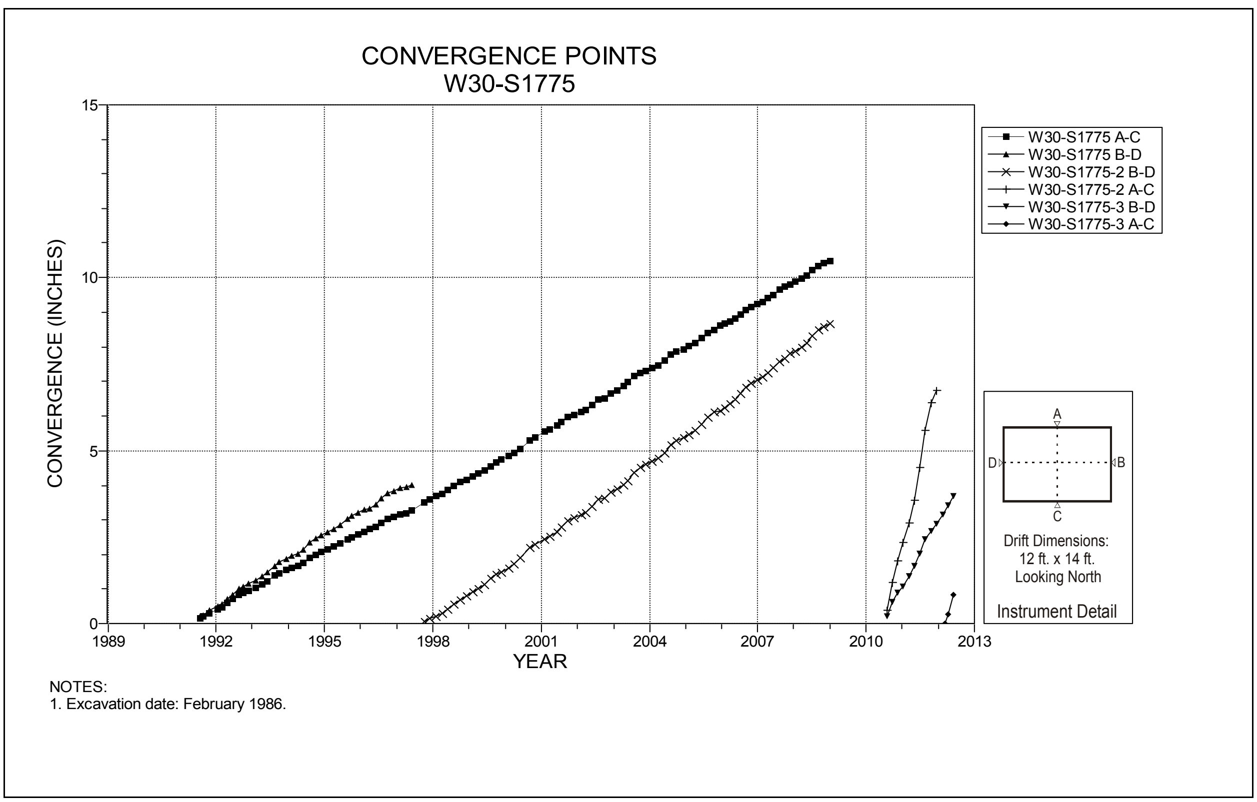


Figure 4-204 Convergence Point Array
W30 S1775 – All Chords

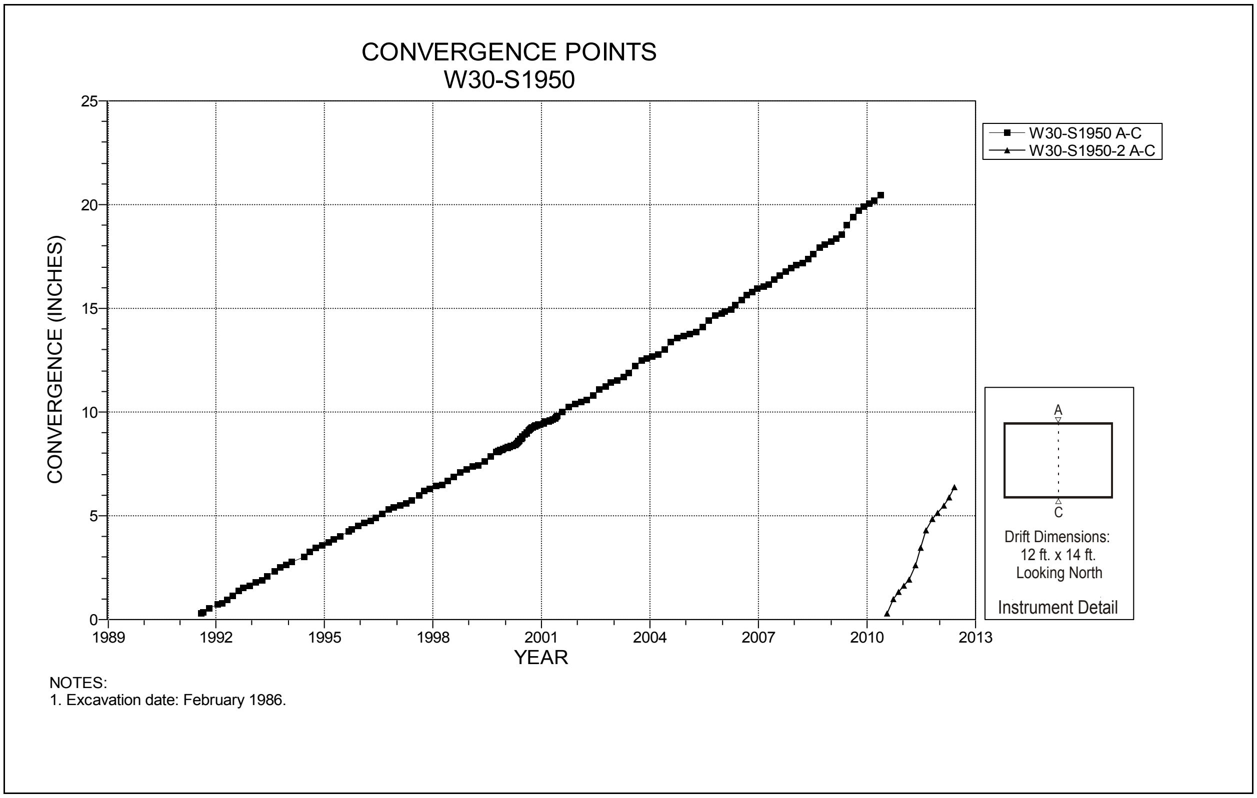


Figure 4-205 Convergence Point Array
W30 S1950 – Roof to Floor

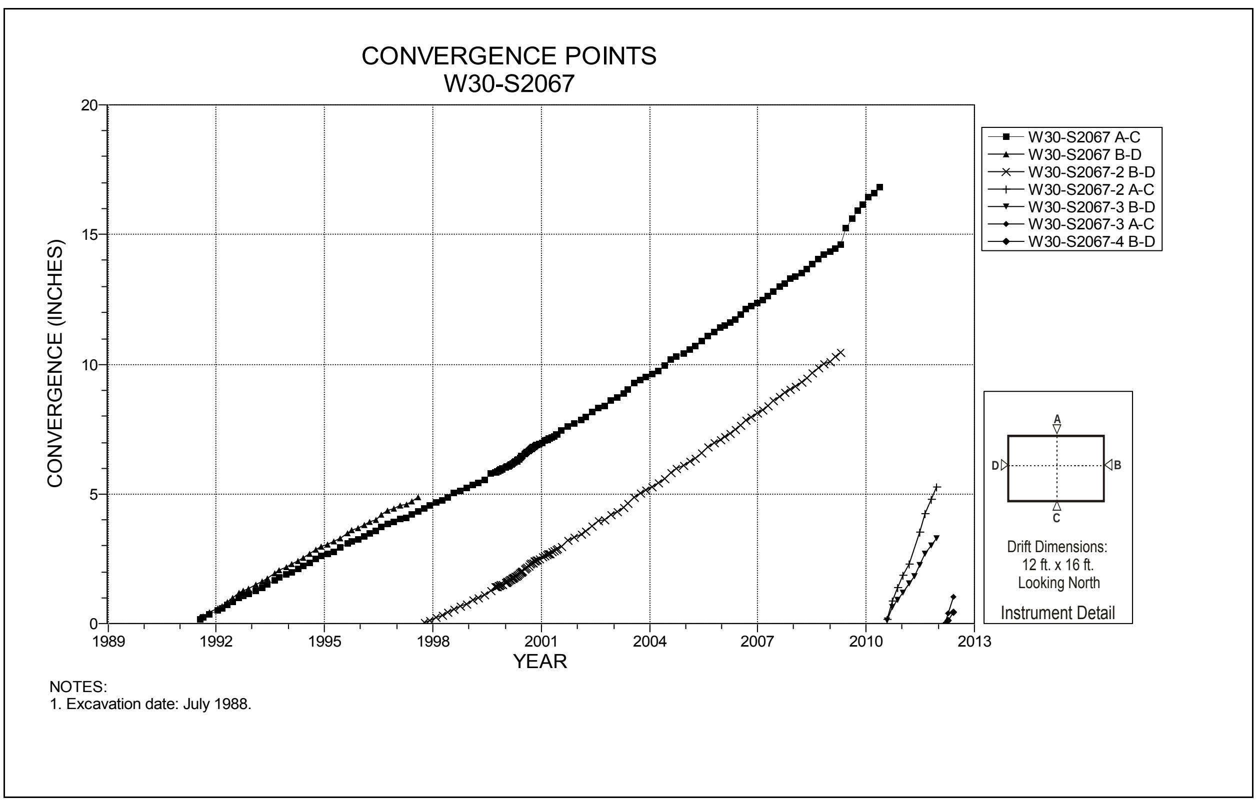


Figure 4-206 Convergence Point Array
W30 S2067 – All Chords

Working Copy

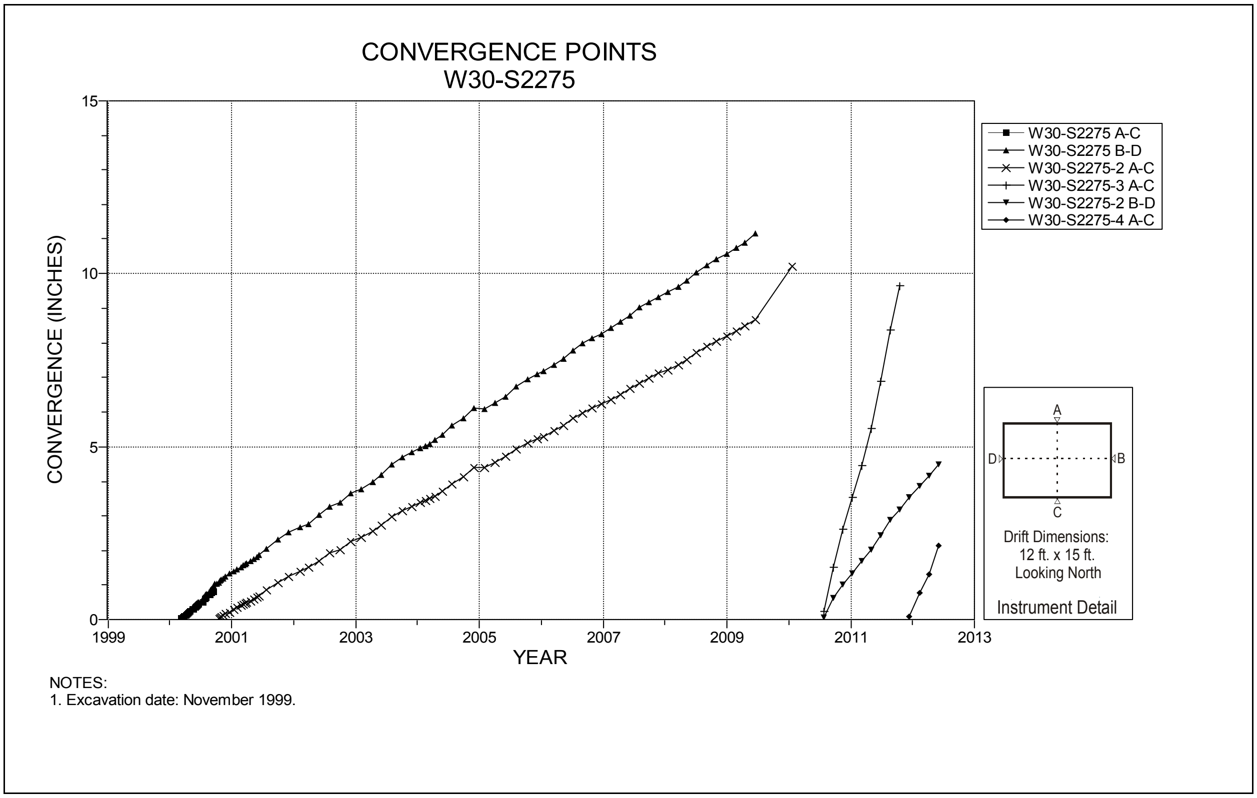


Figure 4-207 Convergence Point Array
W30 S2275 – All Chords

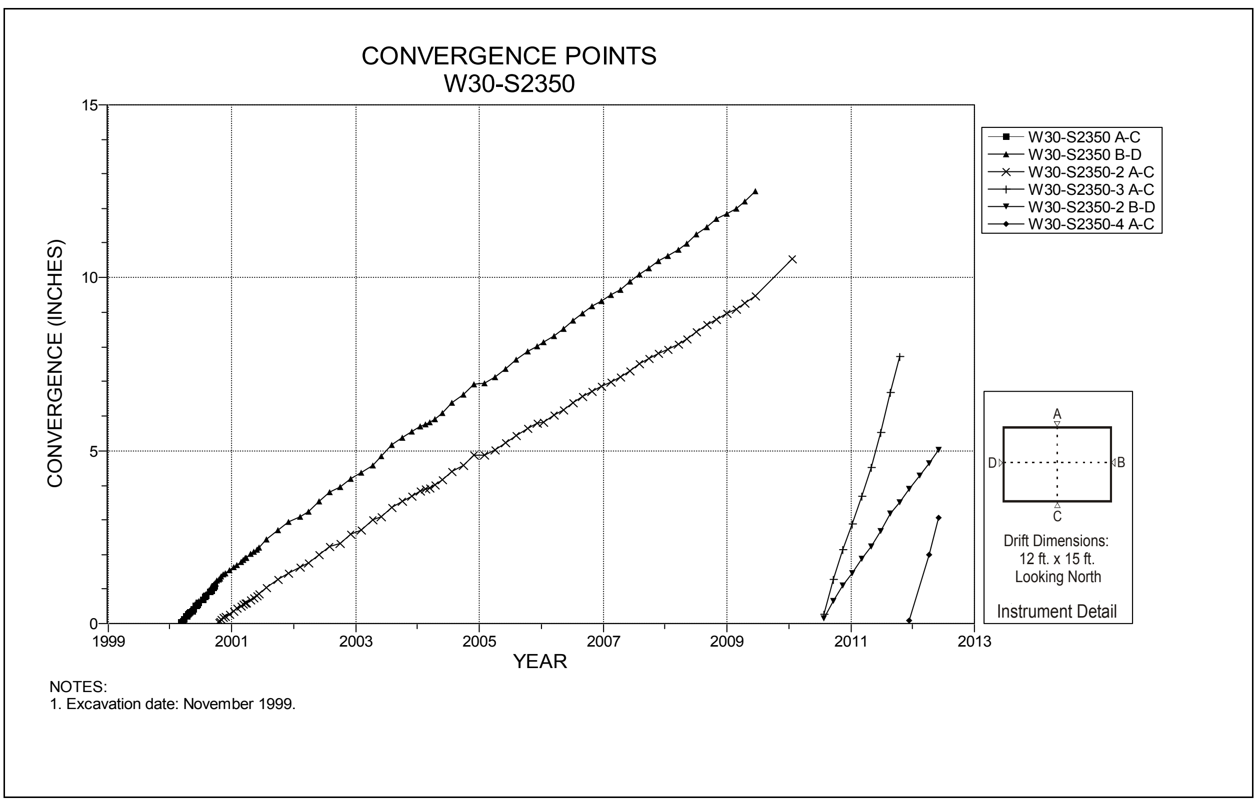


Figure 4-208 Convergence Point Array
W30 S2350 – All Chords

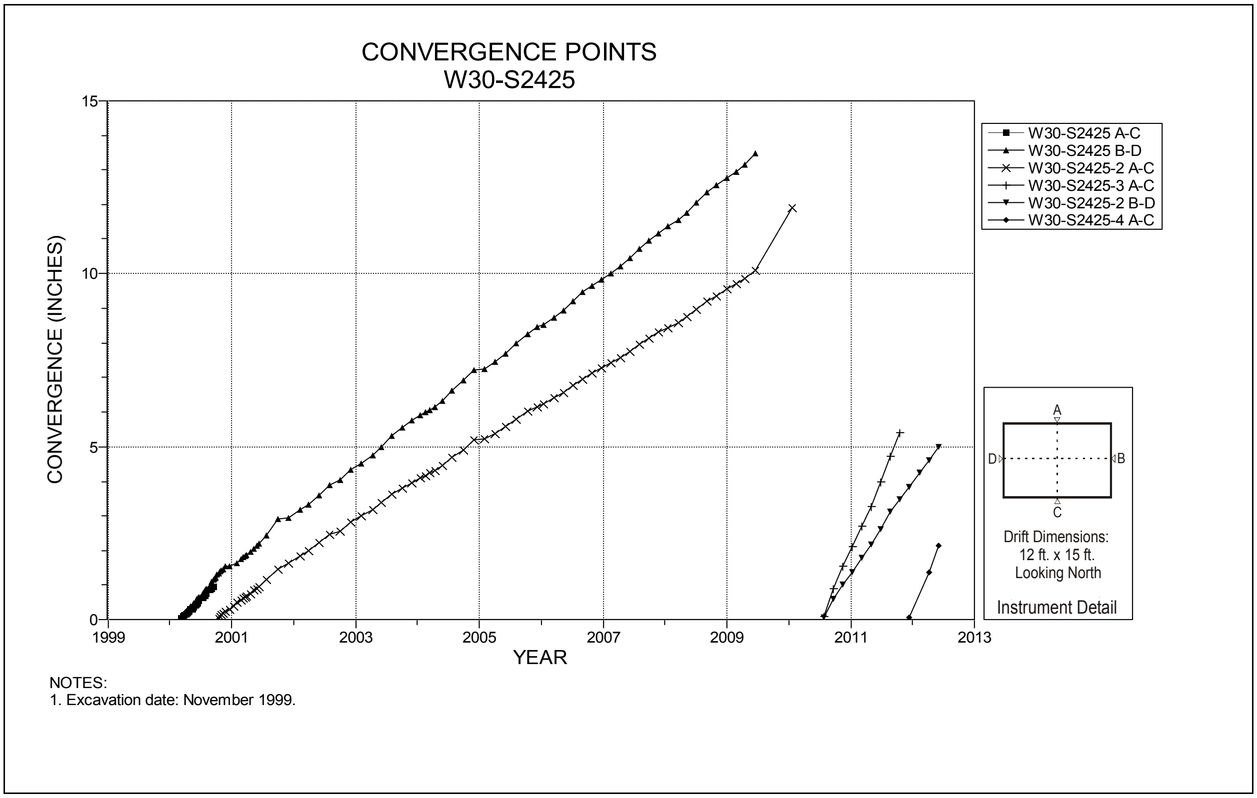


Figure 4-209 Convergence Point Array
W30 S2425 – All Chords

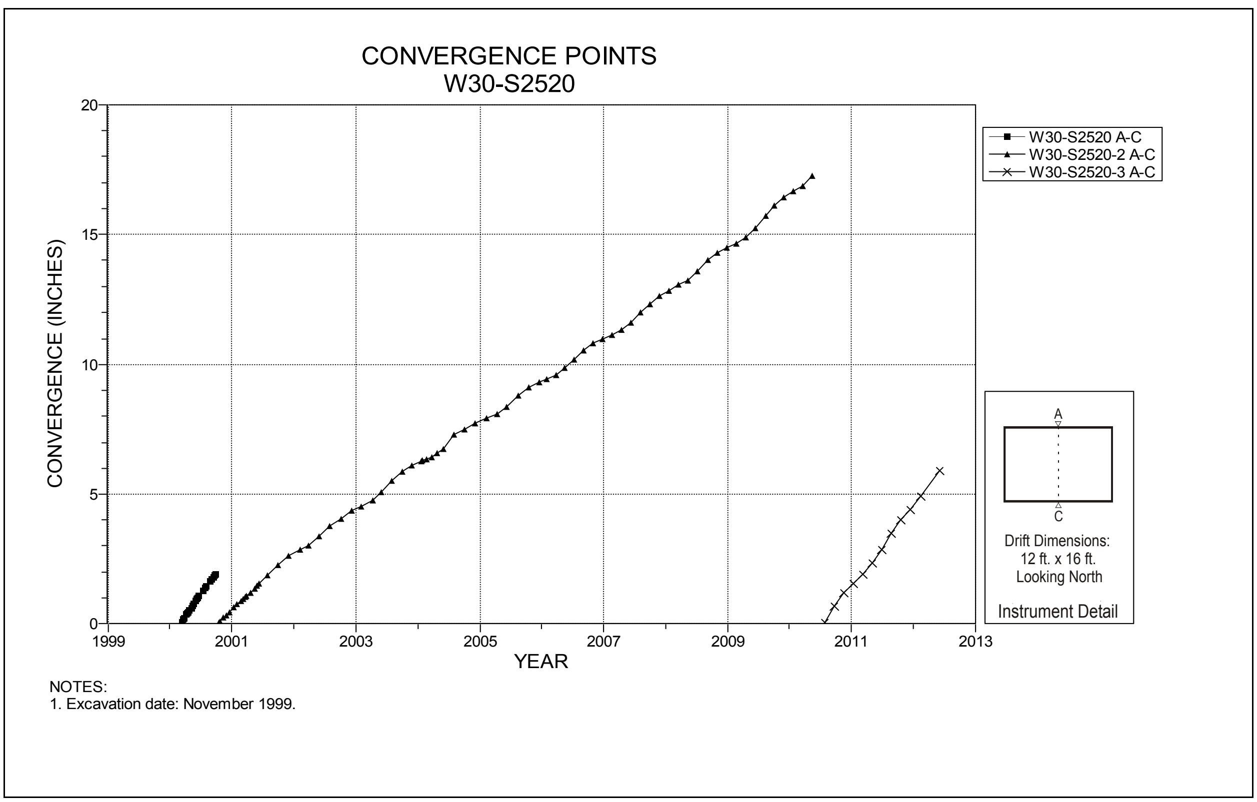


Figure 4-210 Convergence Point Array
W30 S2520 – Roof to Floor

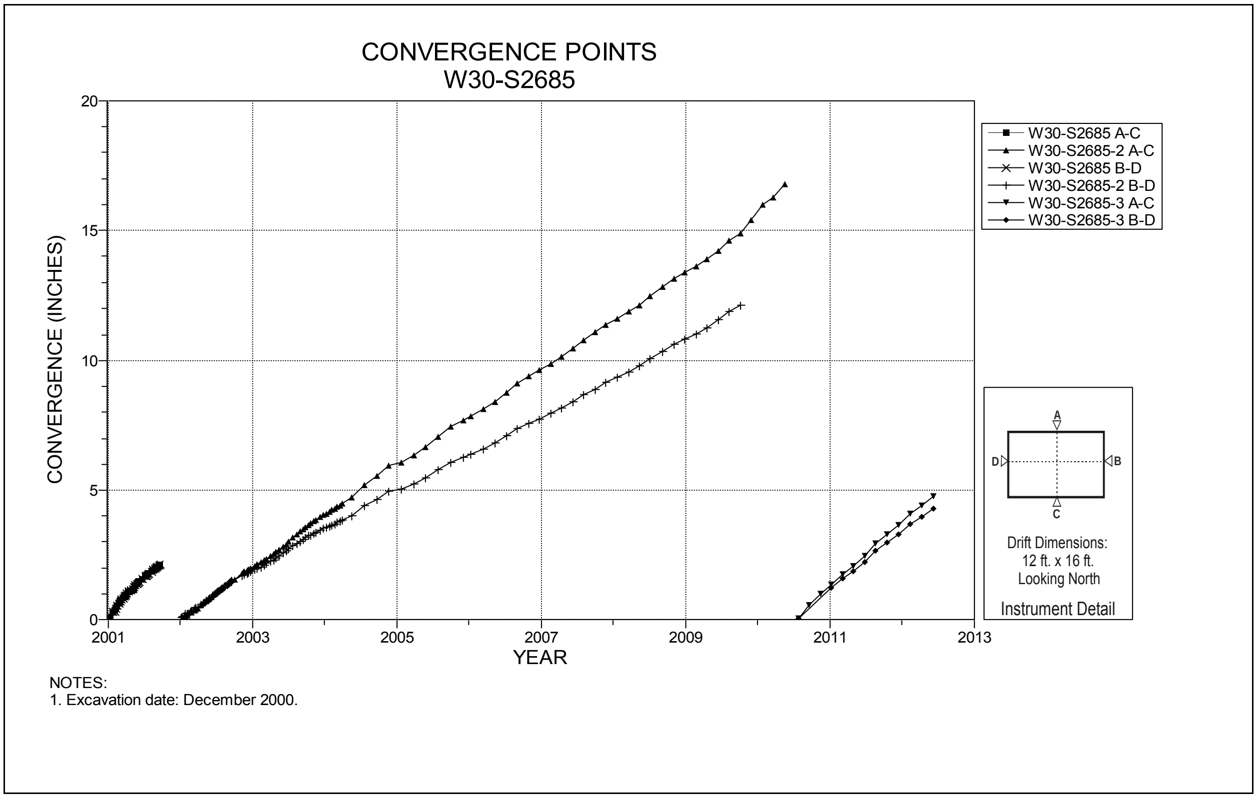


Figure 4-211 Convergence Point Array
W30 S2685 – All Chords

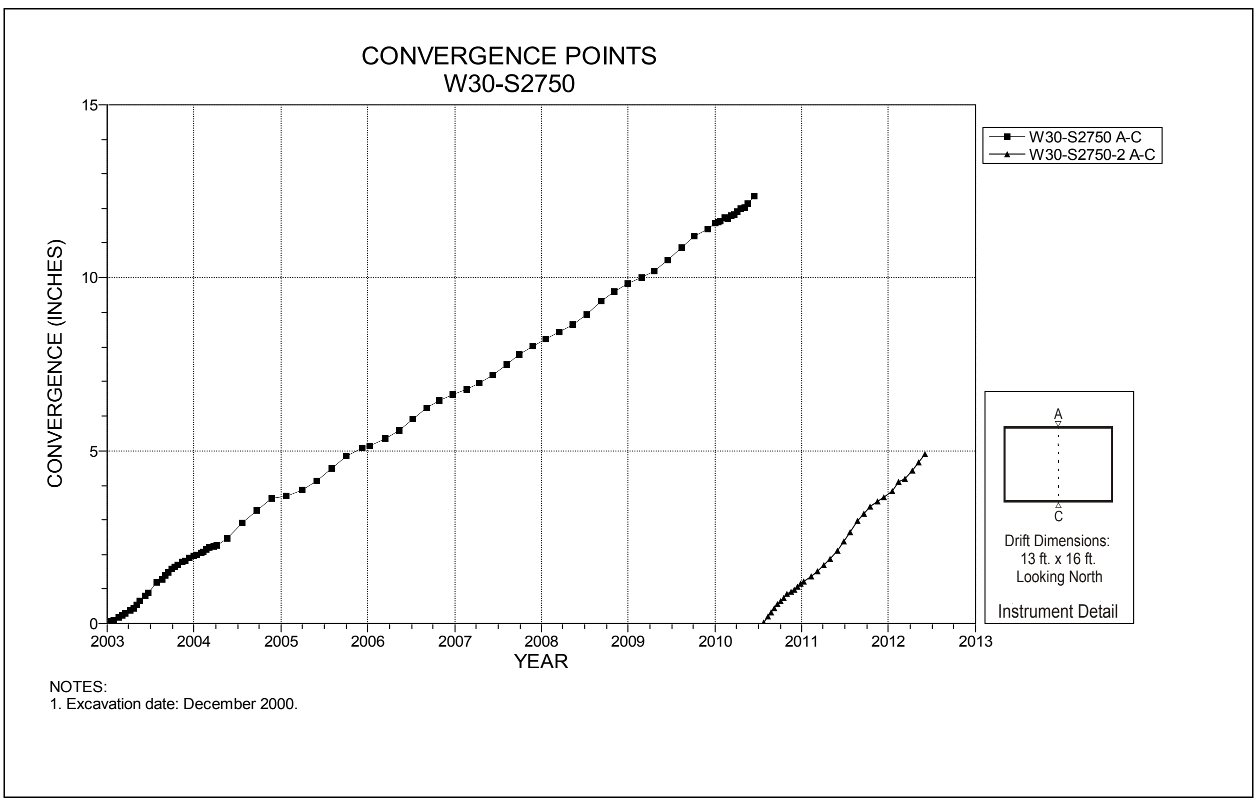


Figure 4-212 Convergence Point Array
W30 S2750 – Roof to Floor

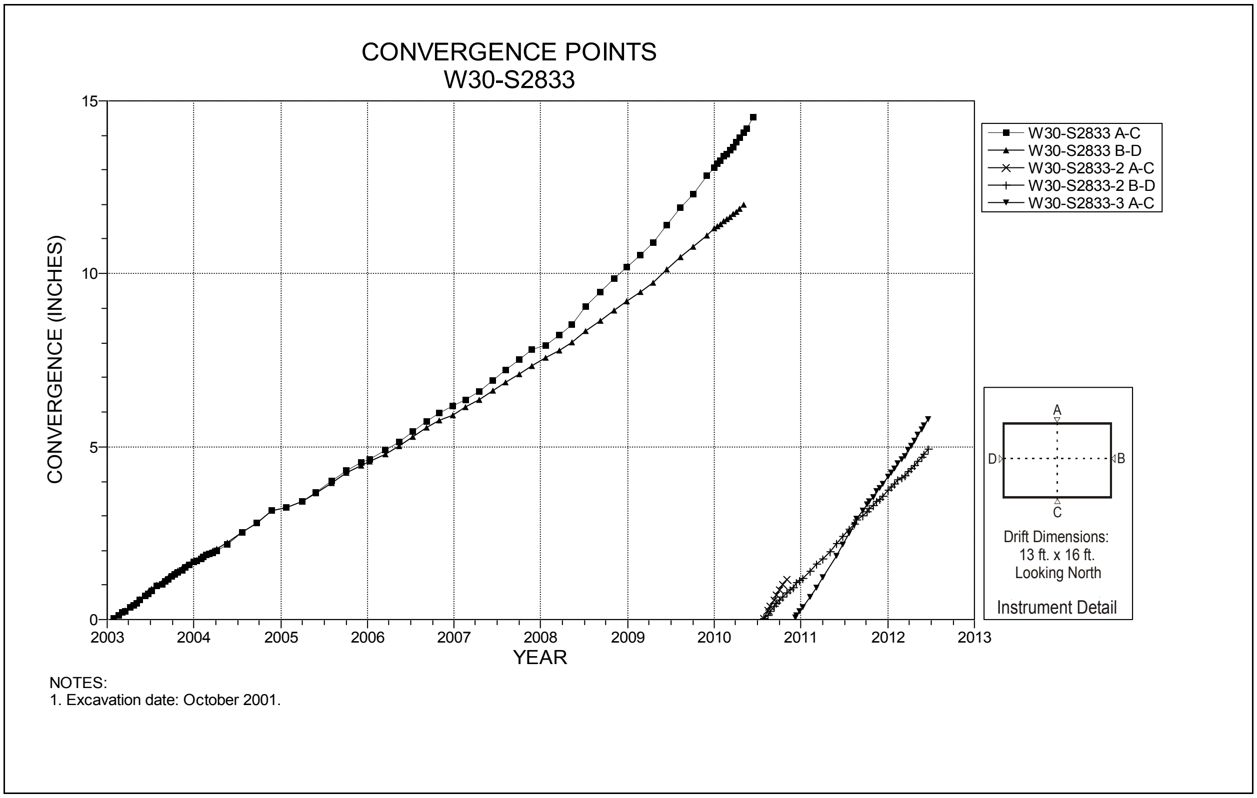


Figure 4-213 Convergence Point Array
W30 S2833 – All Chords

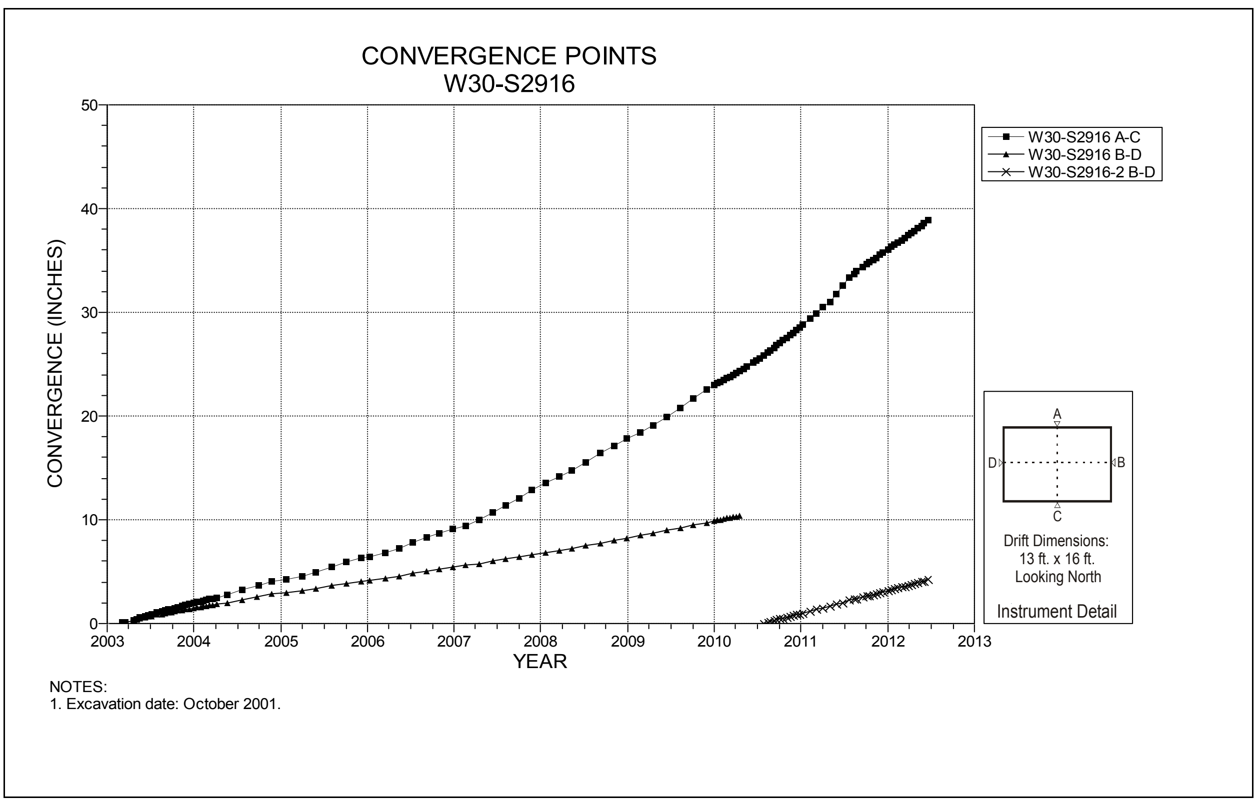


Figure 4-214 Convergence Point Array
W30 S2916 – All Chords

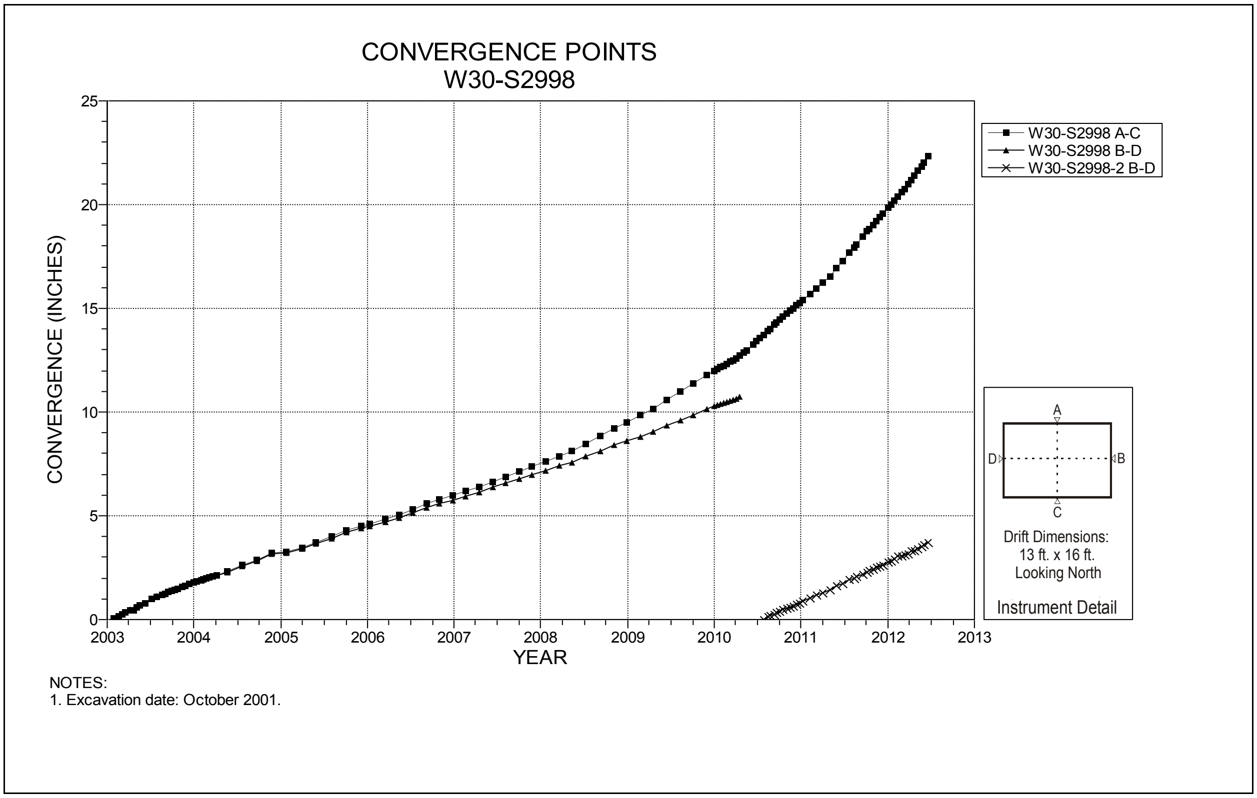


Figure 4-215 Convergence Point Array
W30 S2998 – All Chords

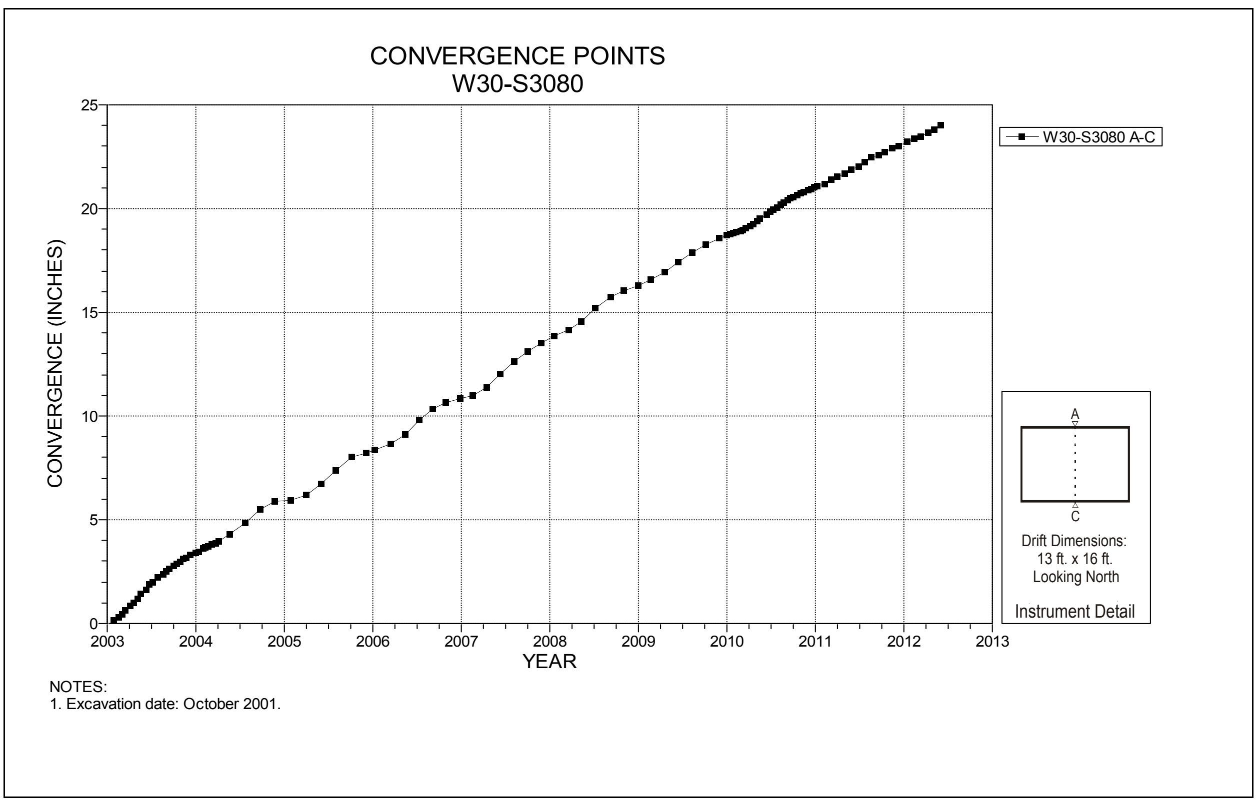


Figure 4-216 Convergence Point Array
W30 S3080 – Roof to Floor

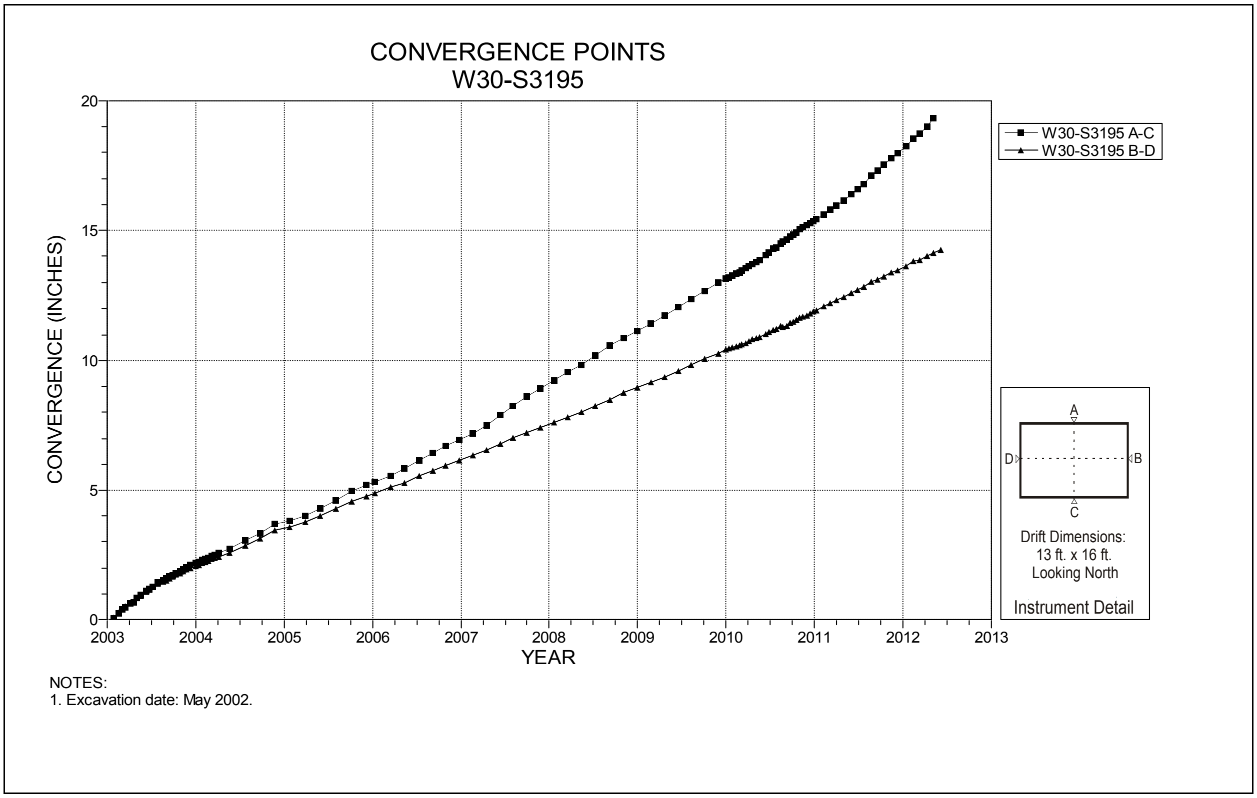


Figure 4-217 Convergence Point Array
W30 S3195 – All Chords

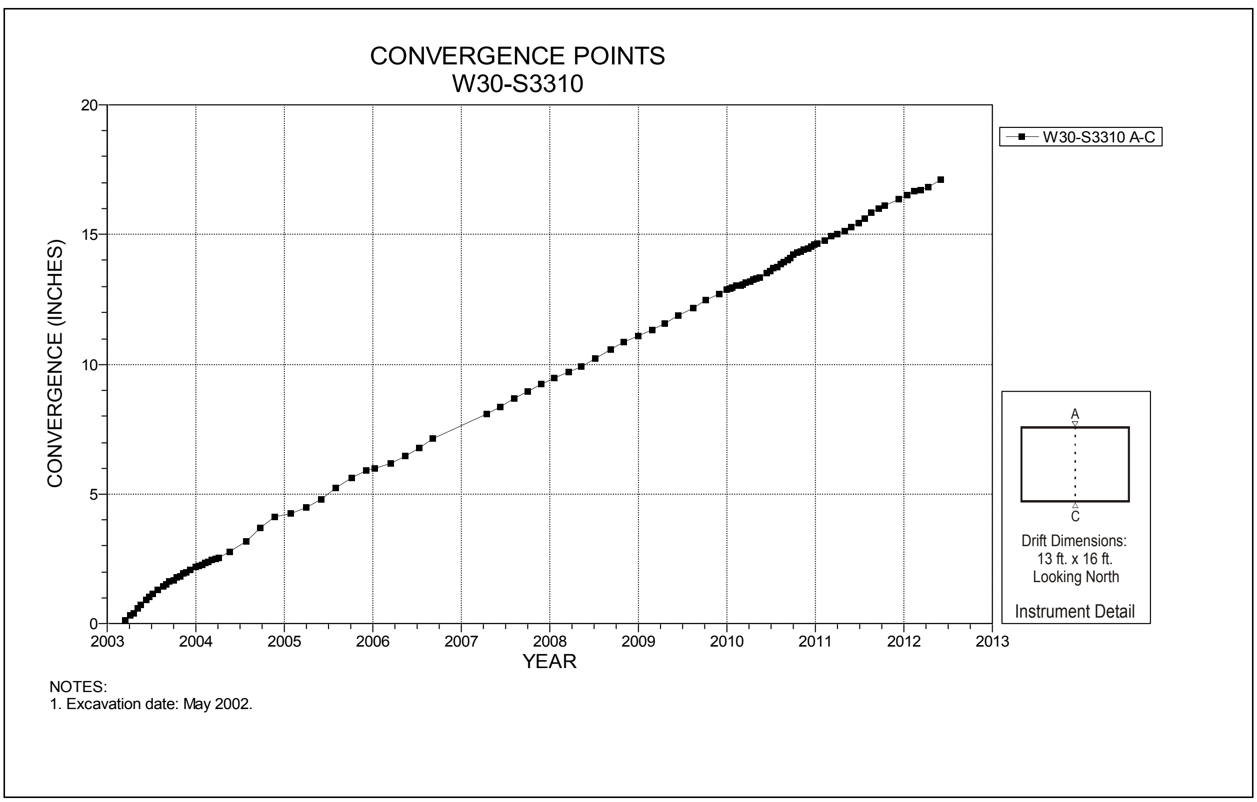


Figure 4-218 Convergence Point Array
W30 S3310 – Roof to Floor

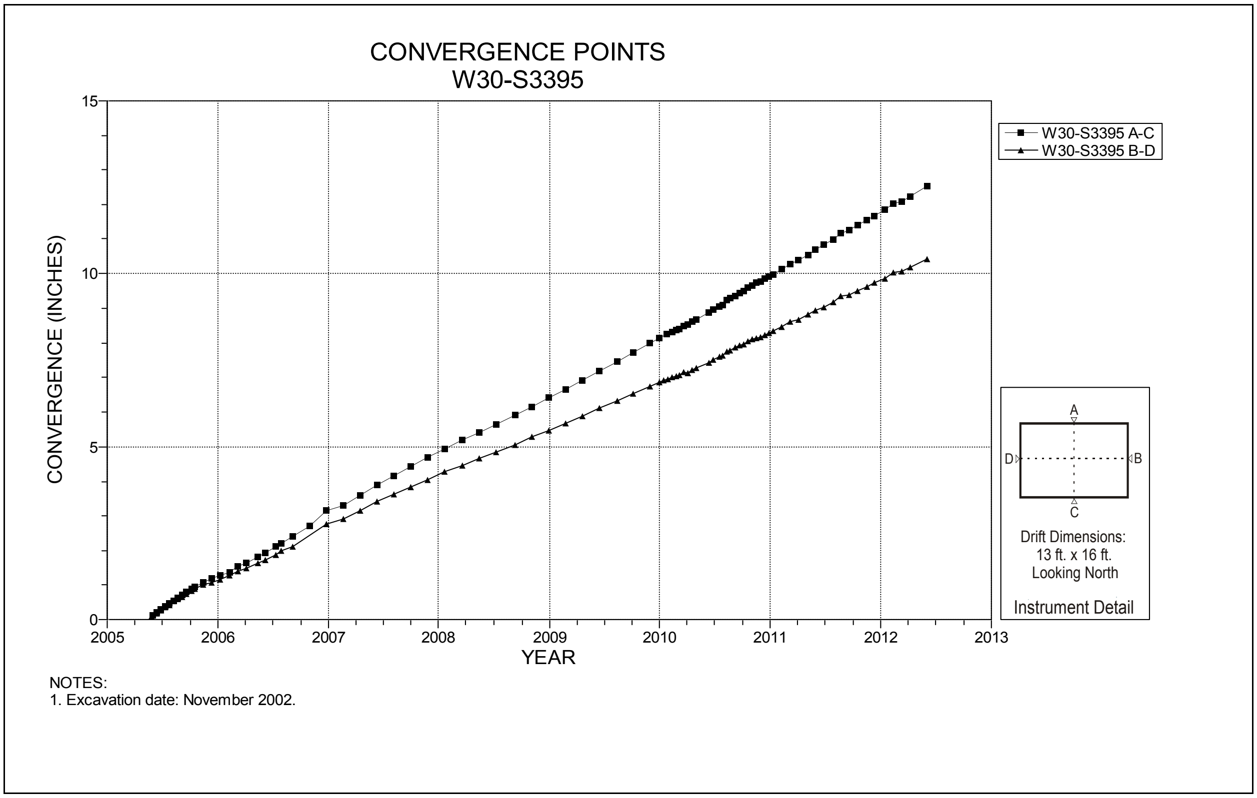


Figure 4-219 Convergence Point Array
W30 S3395 – All Chords

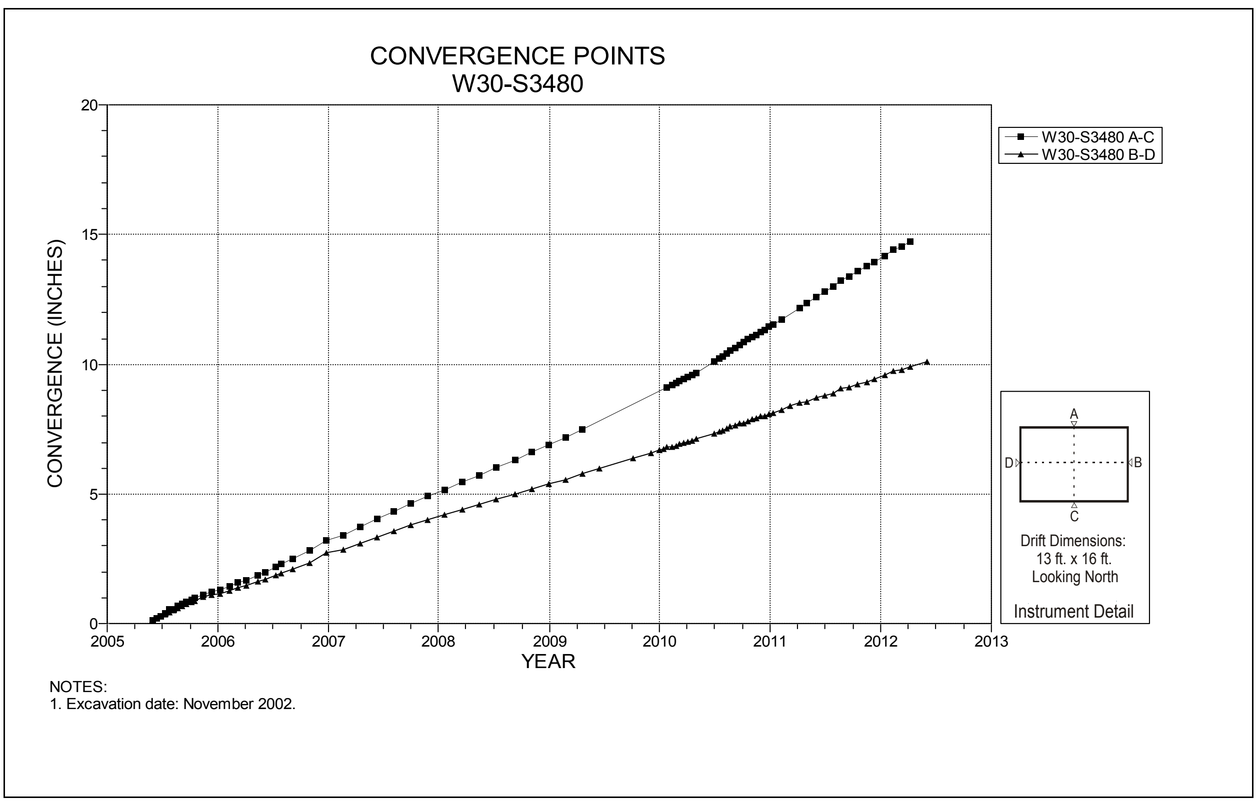


Figure 4-220 Convergence Point Array
W30 S3480 – All Chords

Working Copy

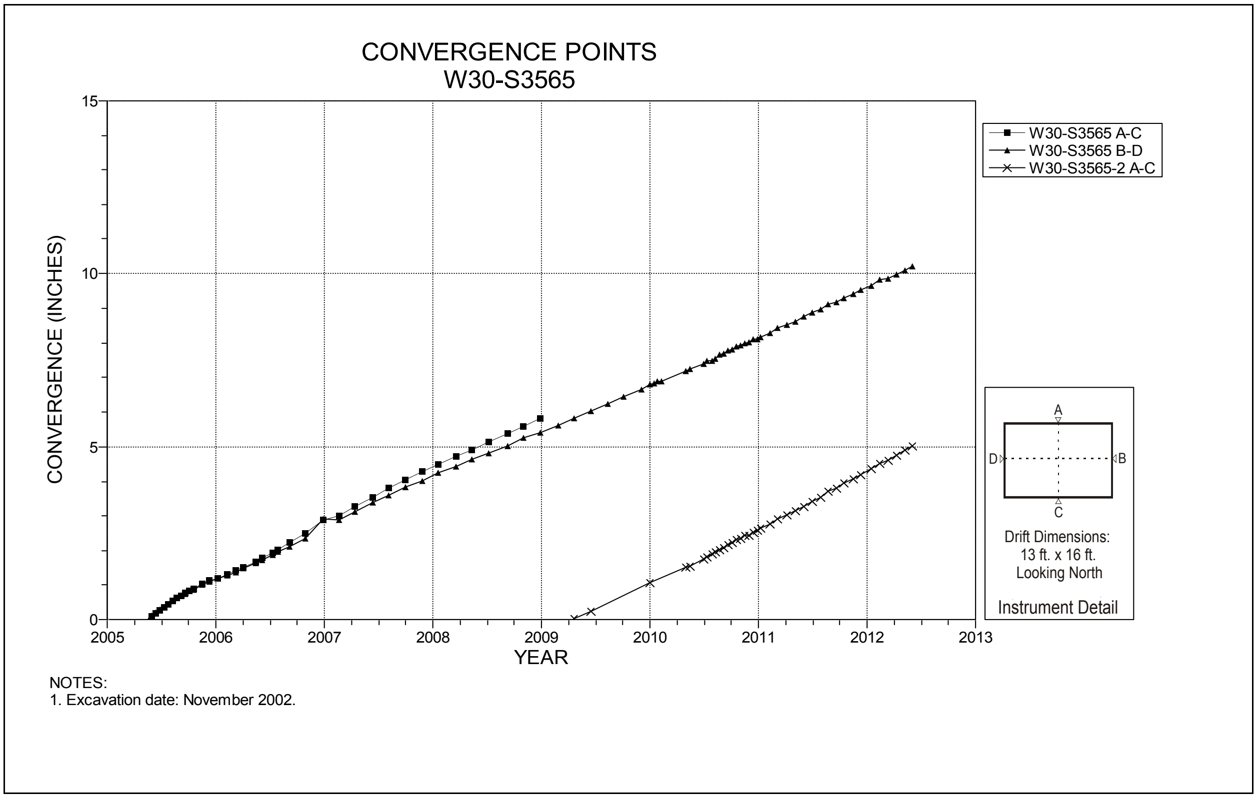


Figure 4-221 Convergence Point Array
W30 S3565 – All Chords

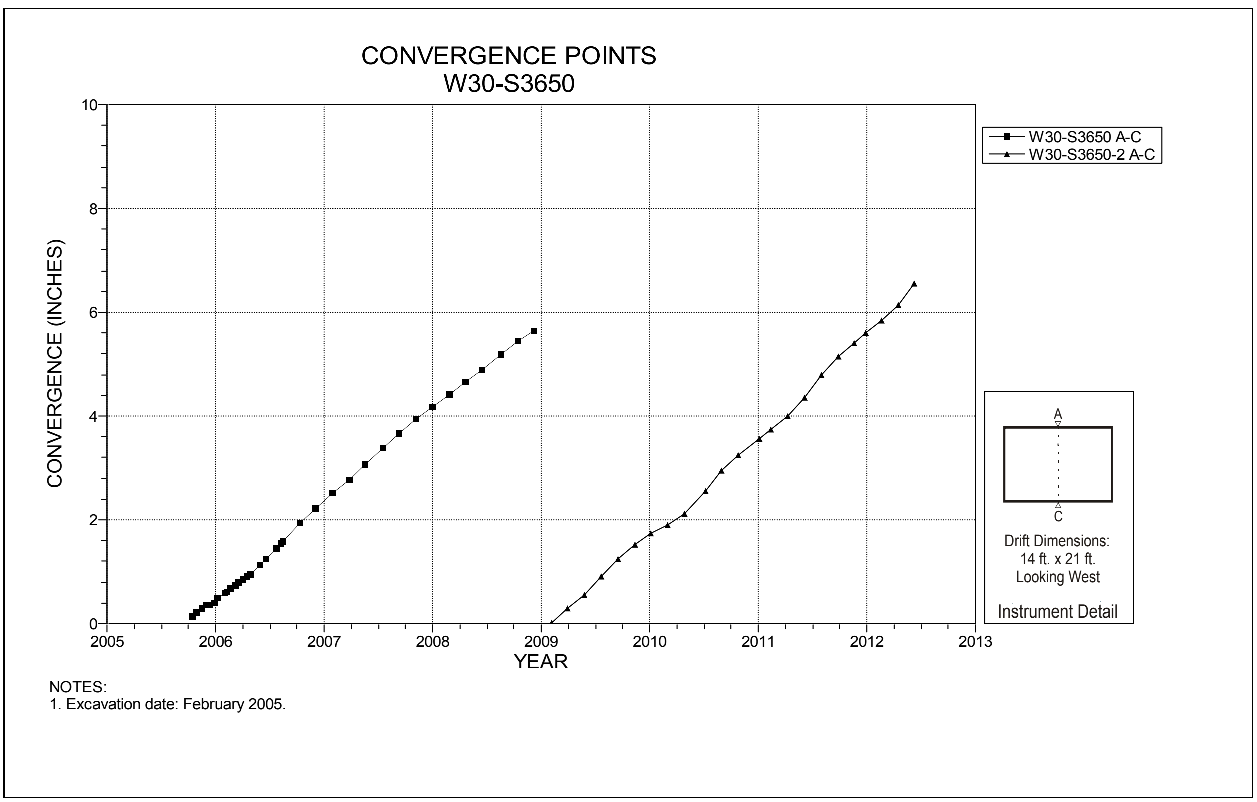


Figure 4-222 Convergence Point Array
W30 S3650 – Roof to Floor

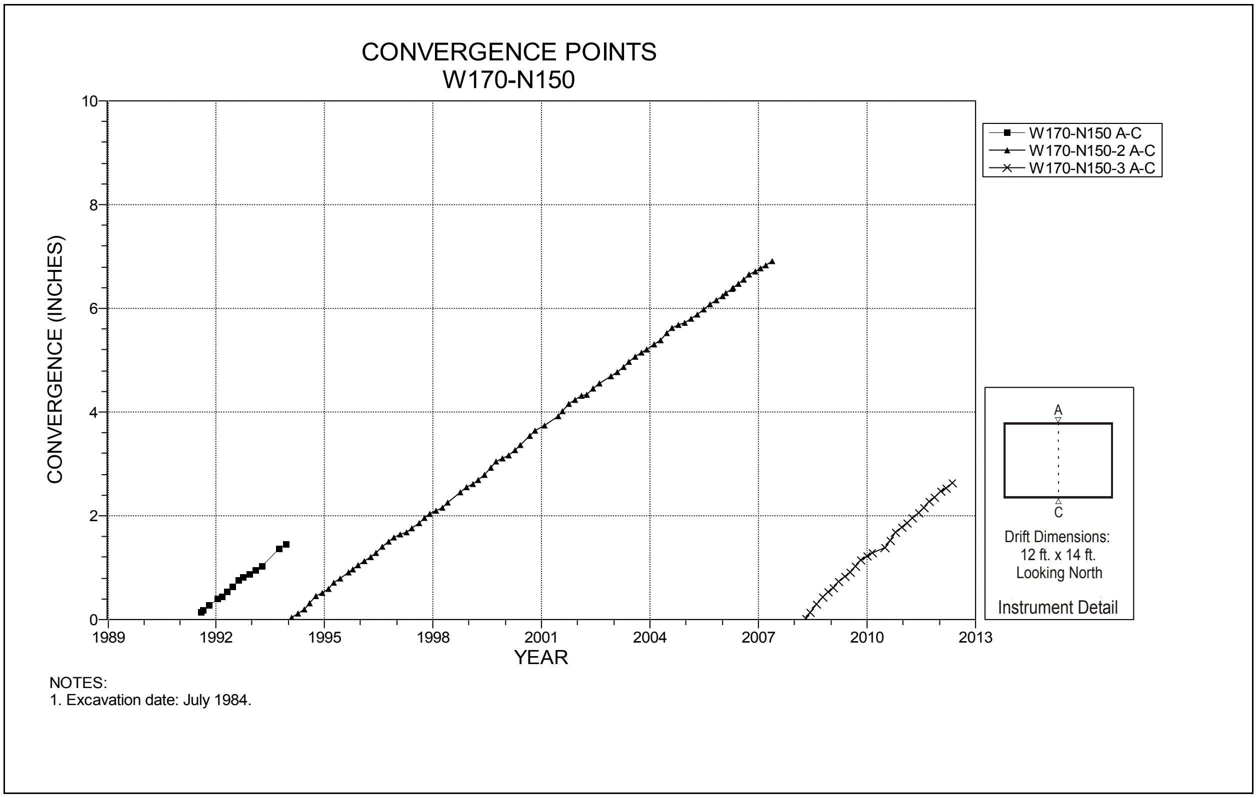


Figure 4-223 Convergence Point Array
W170 N150 – Roof to Floor

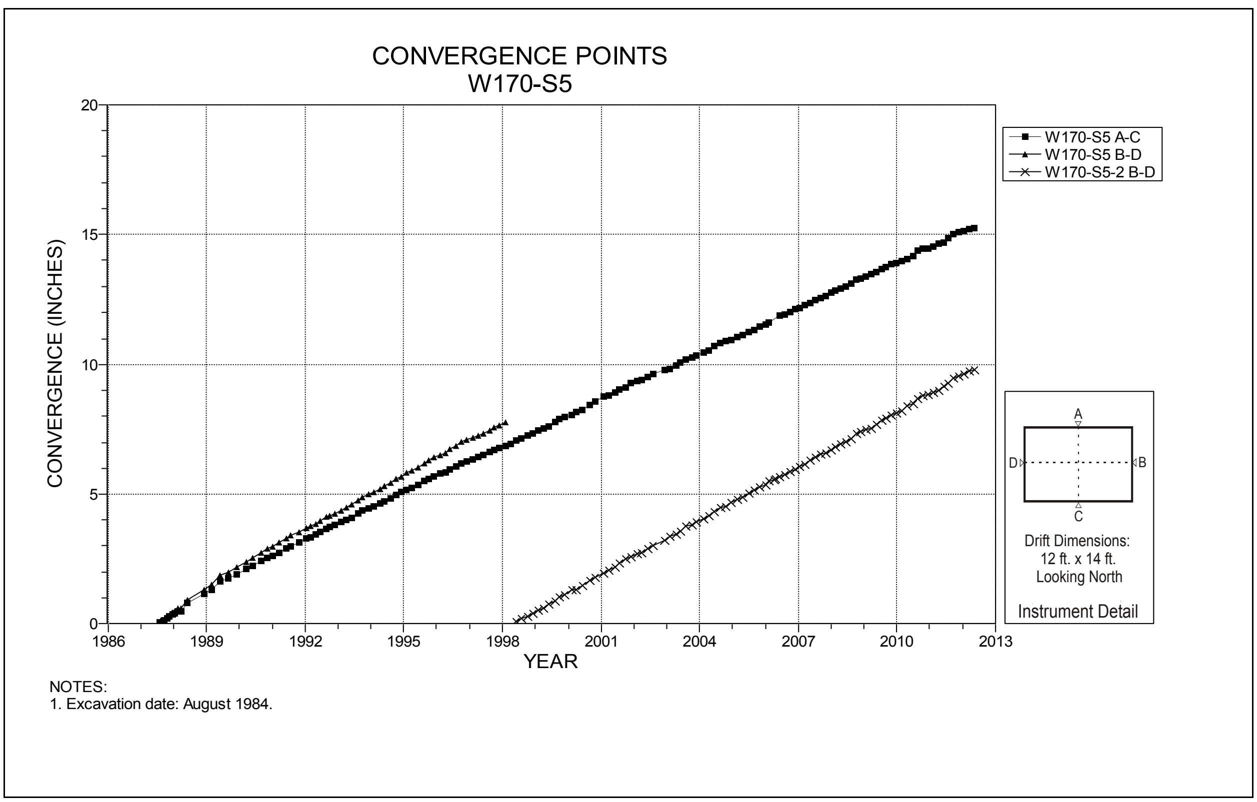


Figure 4-224 Convergence Point Array
W170 S5 – All Chords

Working Copy

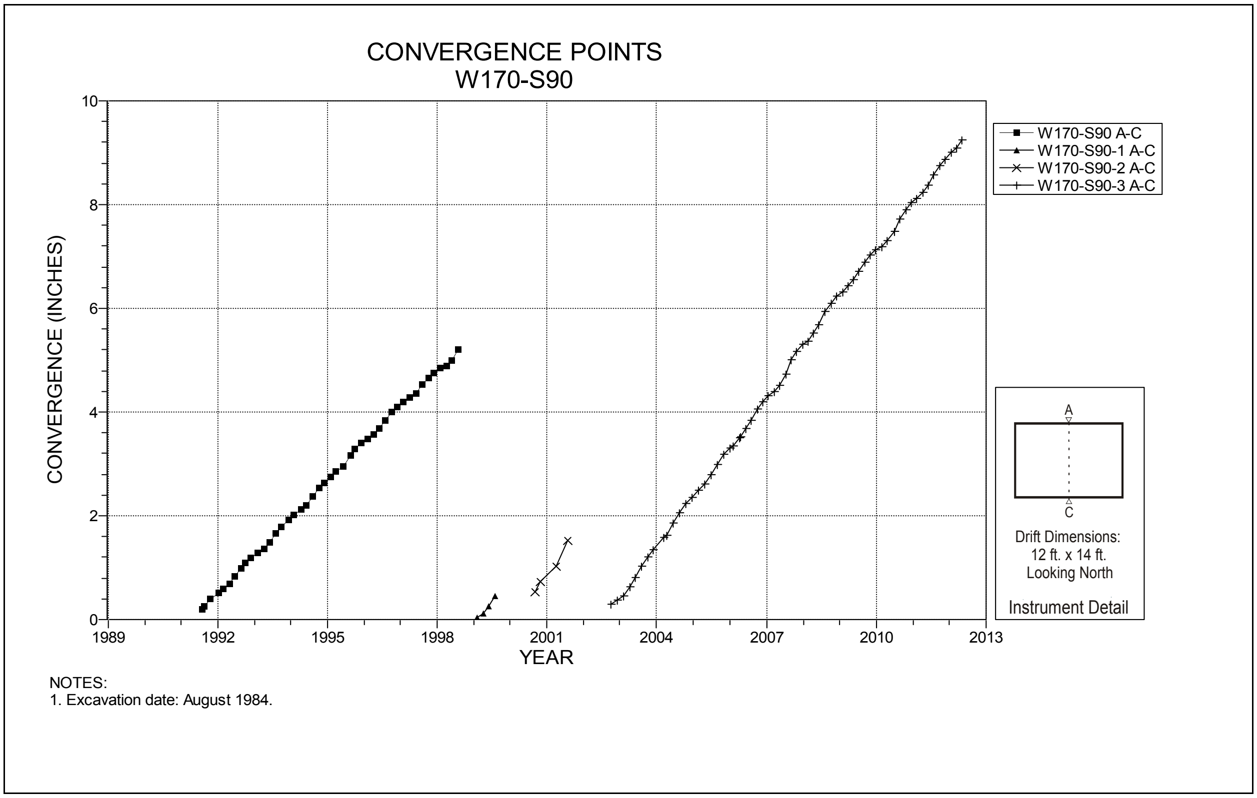


Figure 4-225 Convergence Point Array
W170 S90 – Roof to Floor

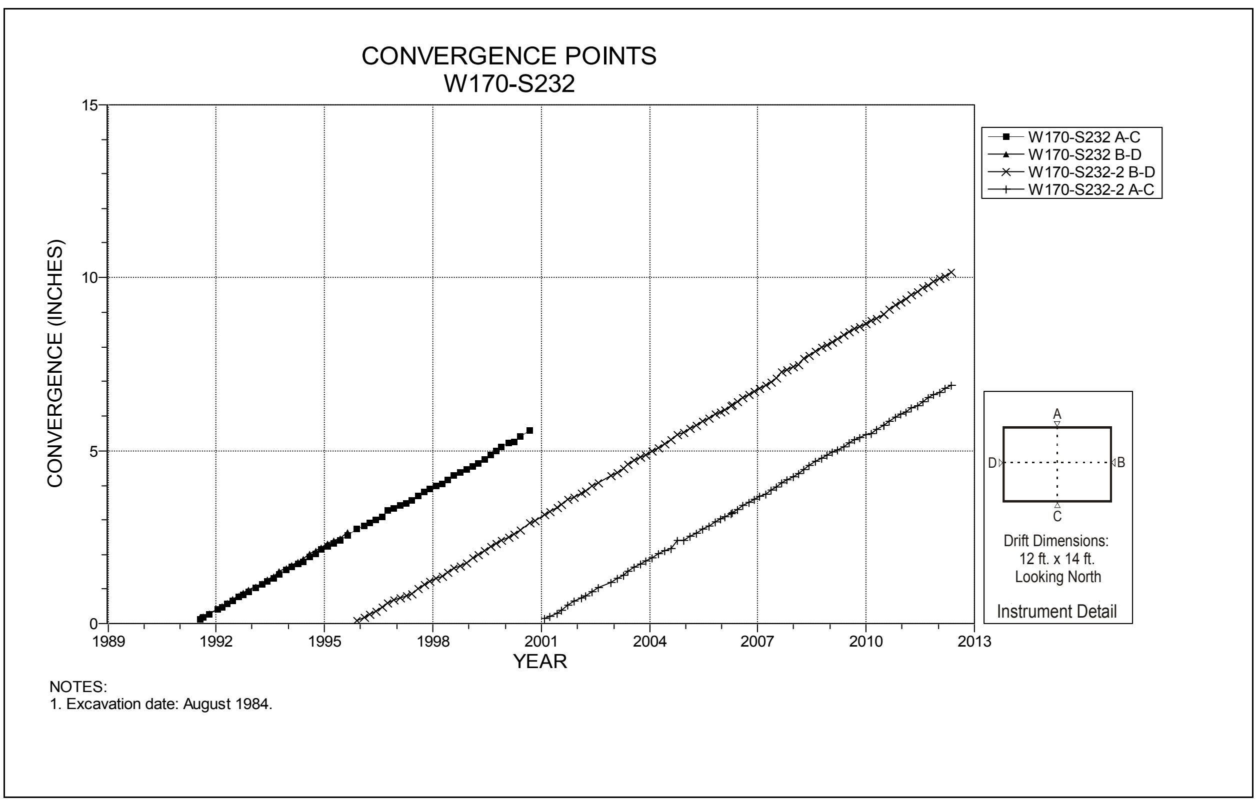


Figure 4-225a Convergence Point Array
W170 S232 – All Chords

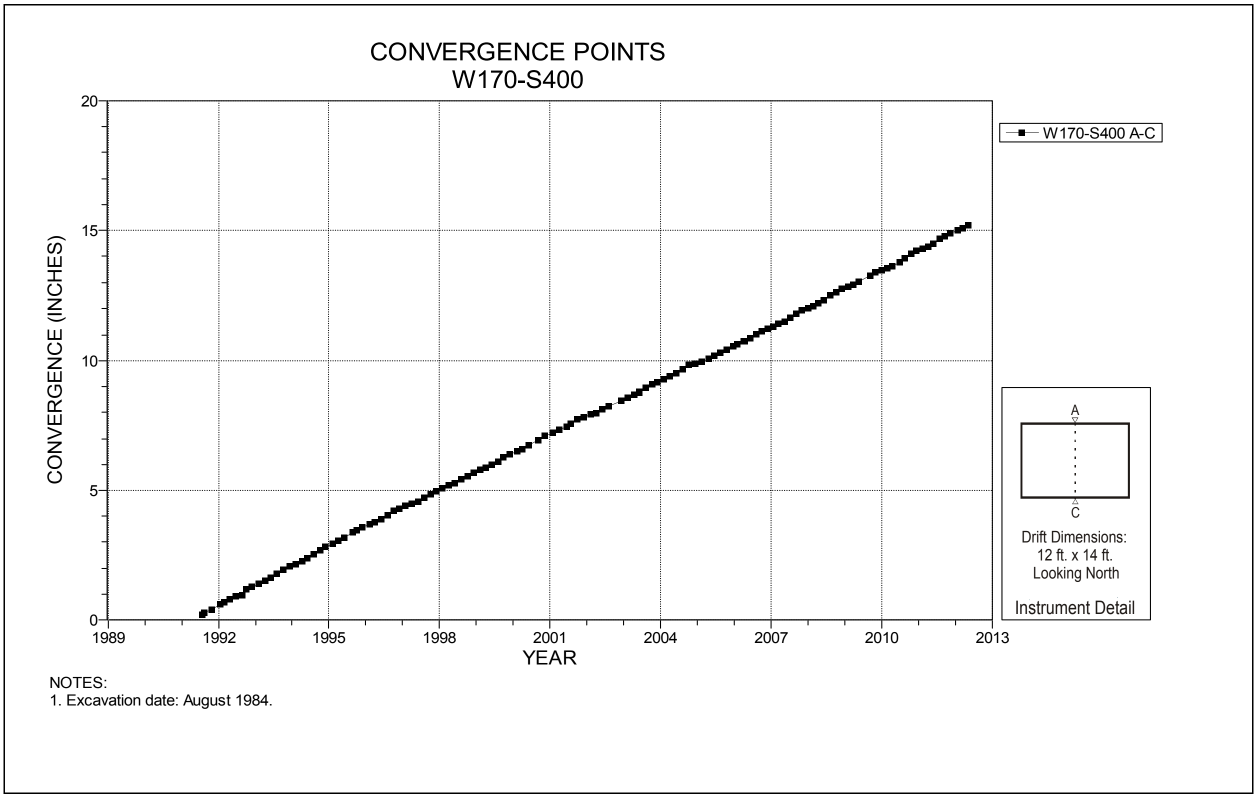


Figure 4-226 Convergence Point Array
W170 S400 – Roof to Floor

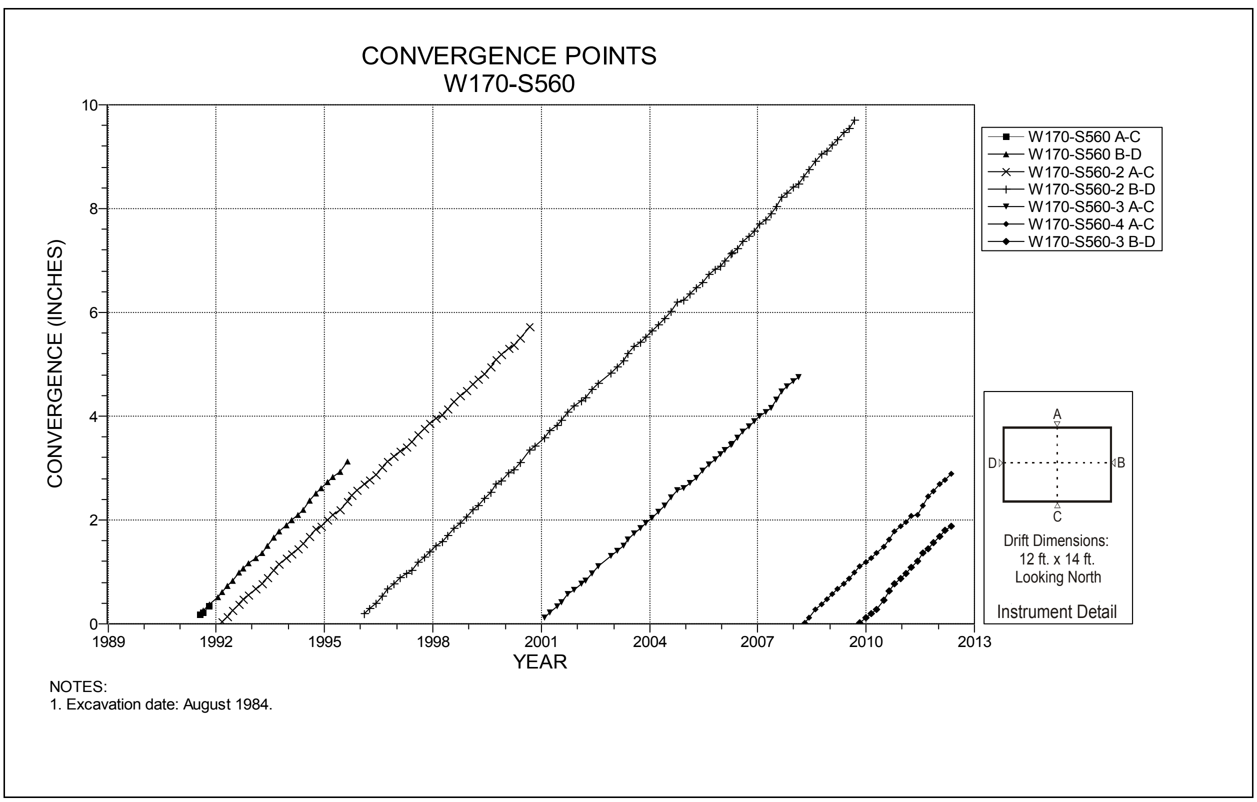


Figure 4-227 Convergence Point Array
W170 S560 – All Chords

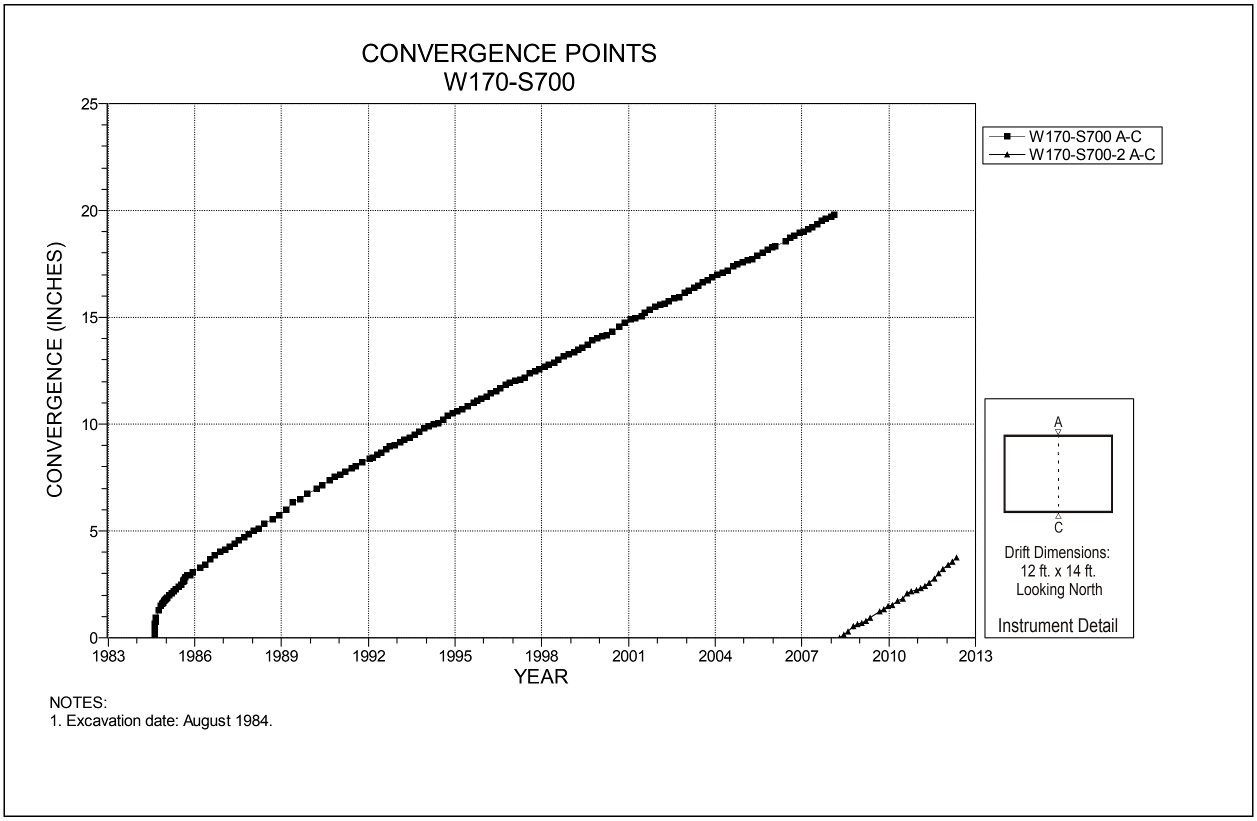


Figure 4-228 Convergence Point Array
W170 S700 – Roof to Floor

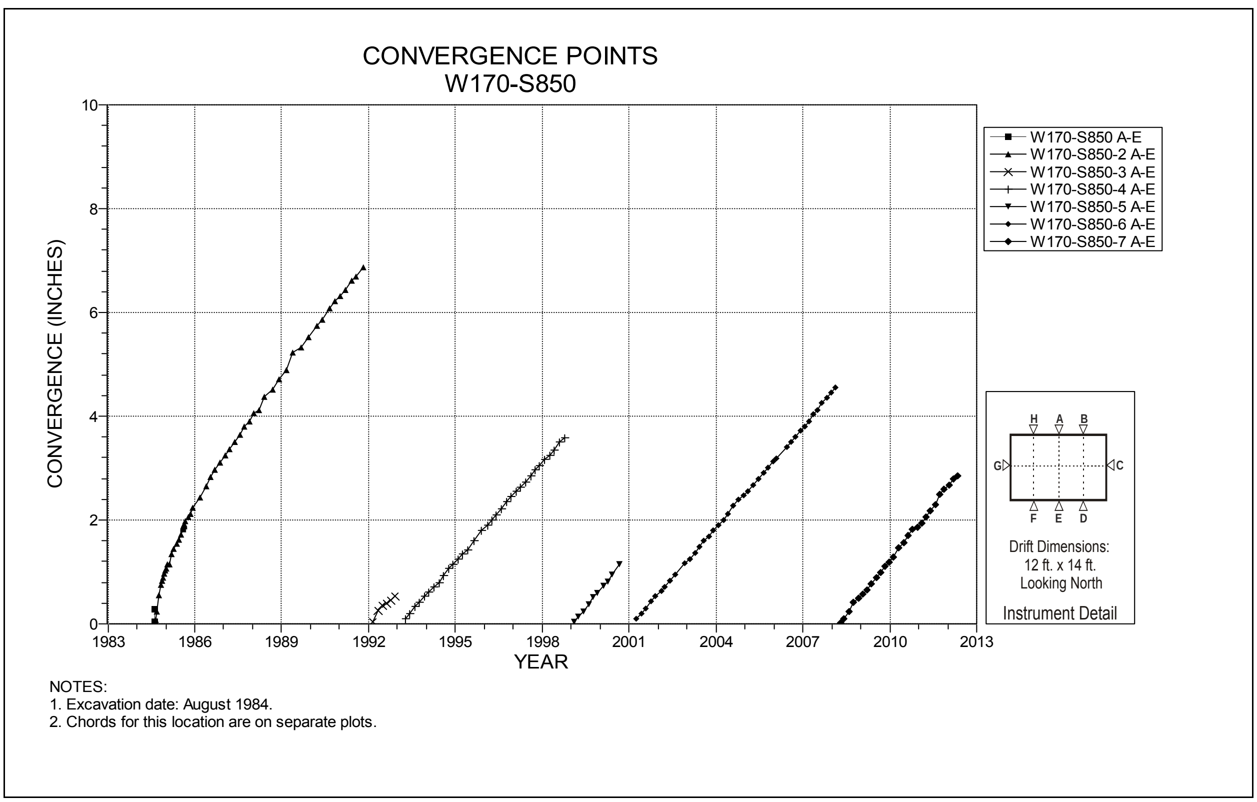


Figure 4-229 Convergence Point Array
W170 S850 – Roof to Floor – Centerline

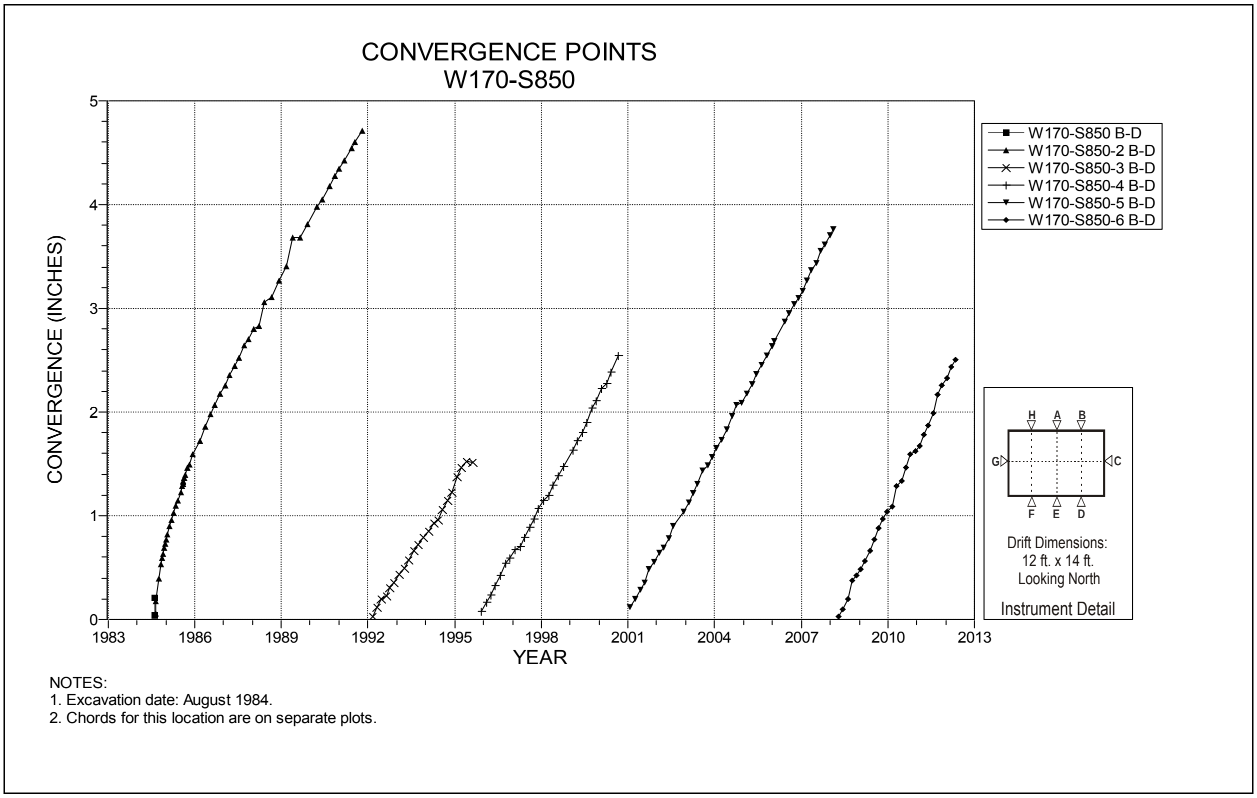


Figure 4-230 Convergence Point Array
W170 S850 – Roof to Floor – East Quarter Point

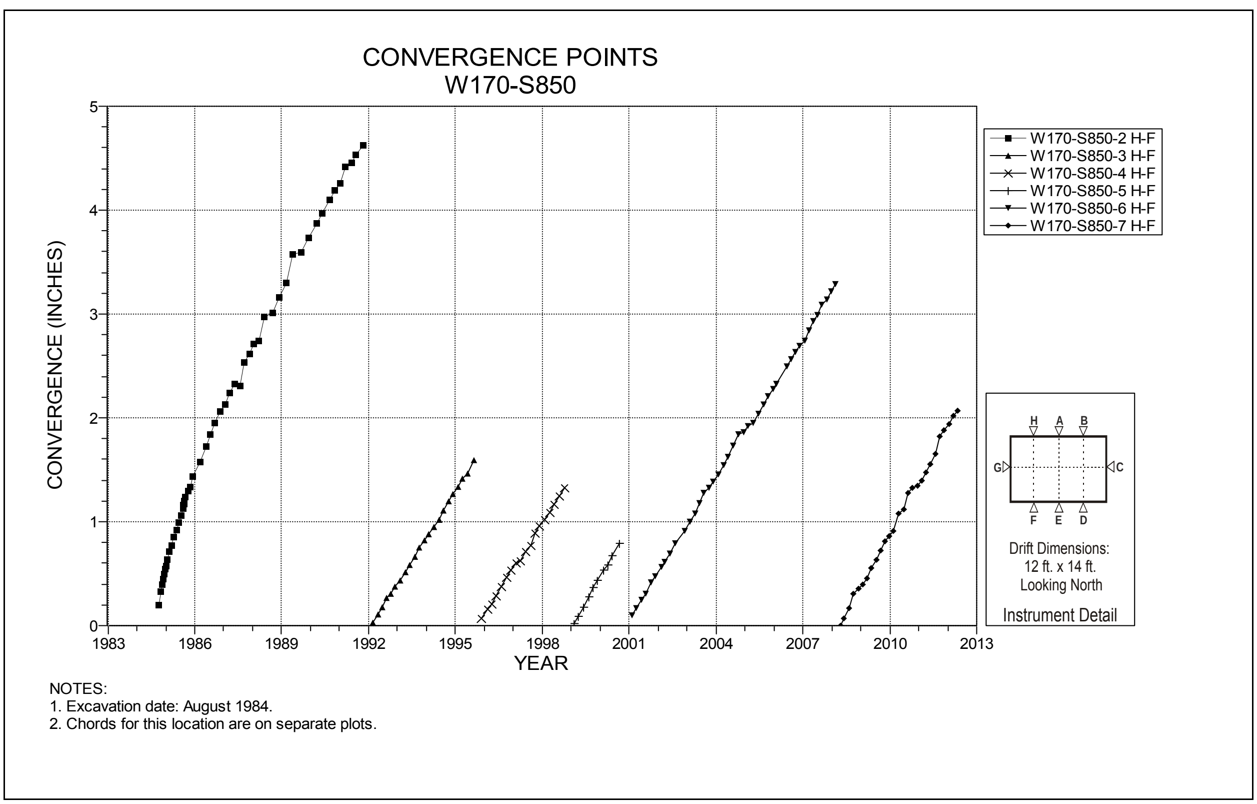


Figure 4-231 Convergence Point Array
W170 S850 – Roof to Floor – West Quarter Point

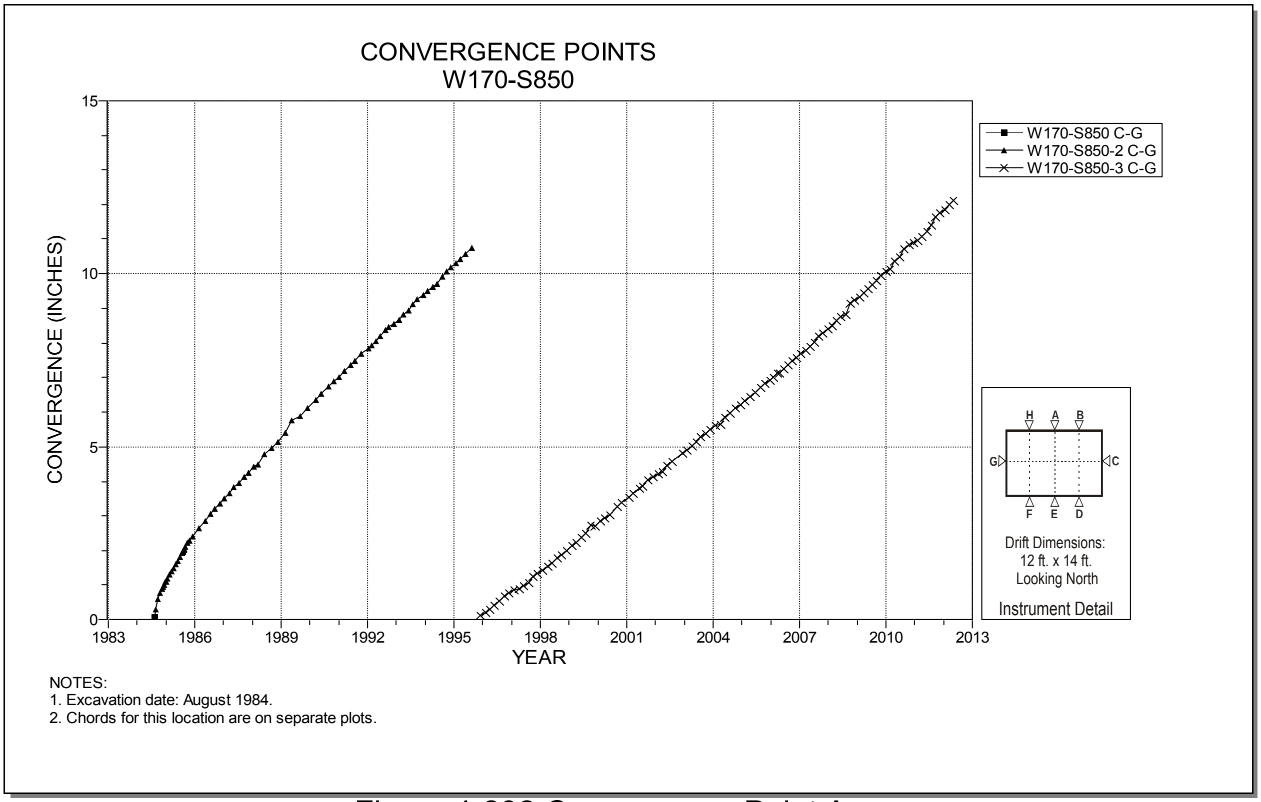


Figure 4-232 Convergence Point Array
W170 S850 – Rib to Rib

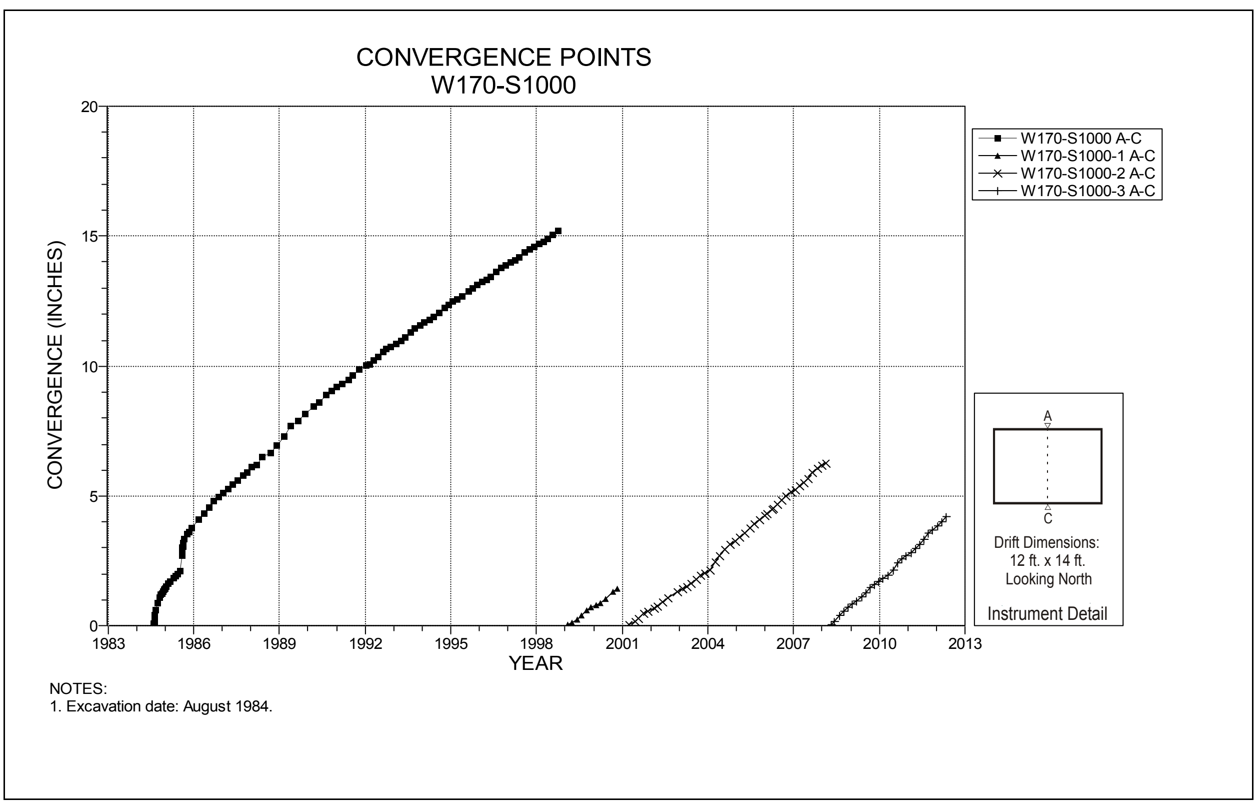
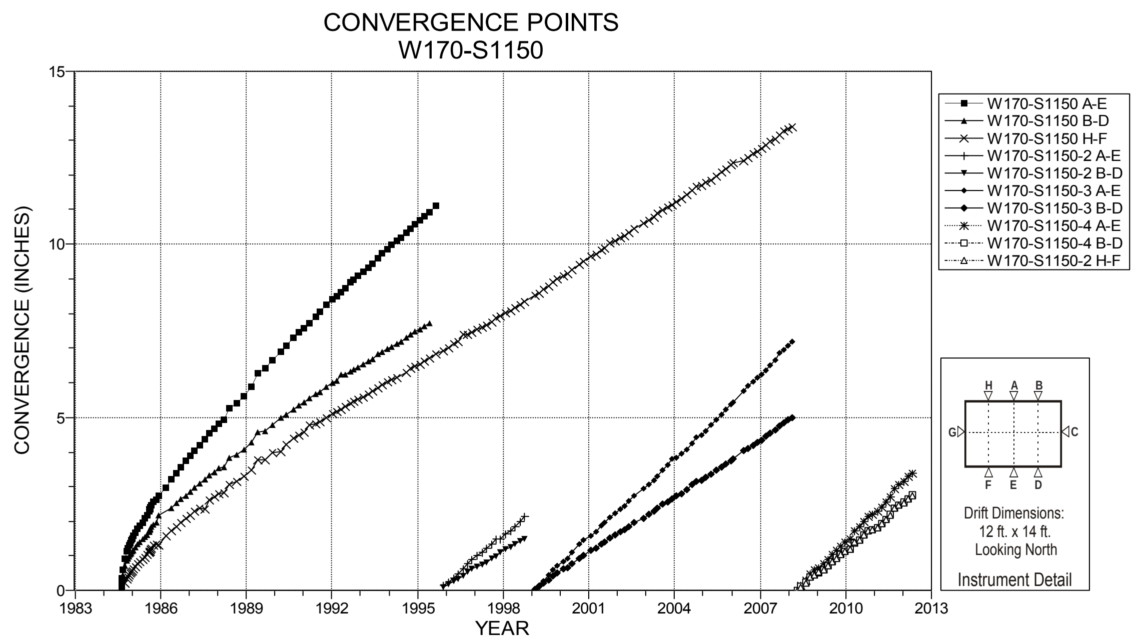
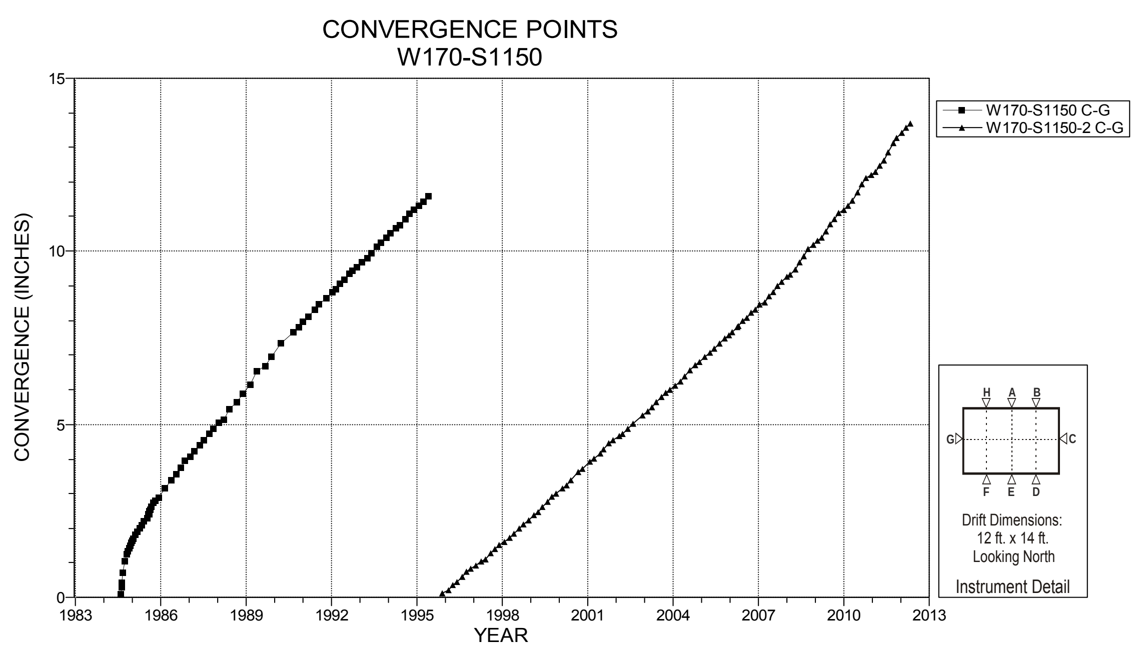


Figure 4-233 Convergence Point Array
W170 S1000 – Roof to Floor



NOTES:
1. Excavation date: August 1984.
2. Horizontal chord is plotted separately.

Figure 4-234 Convergence Point Array
W170 S1150 – Roof to Floor



NOTES:
1. Excavation date: August 1984.
2. Vertical chords are plotted separately.

Figure 4-235 Convergence Point Array
W170 S1150 – Rib to Rib

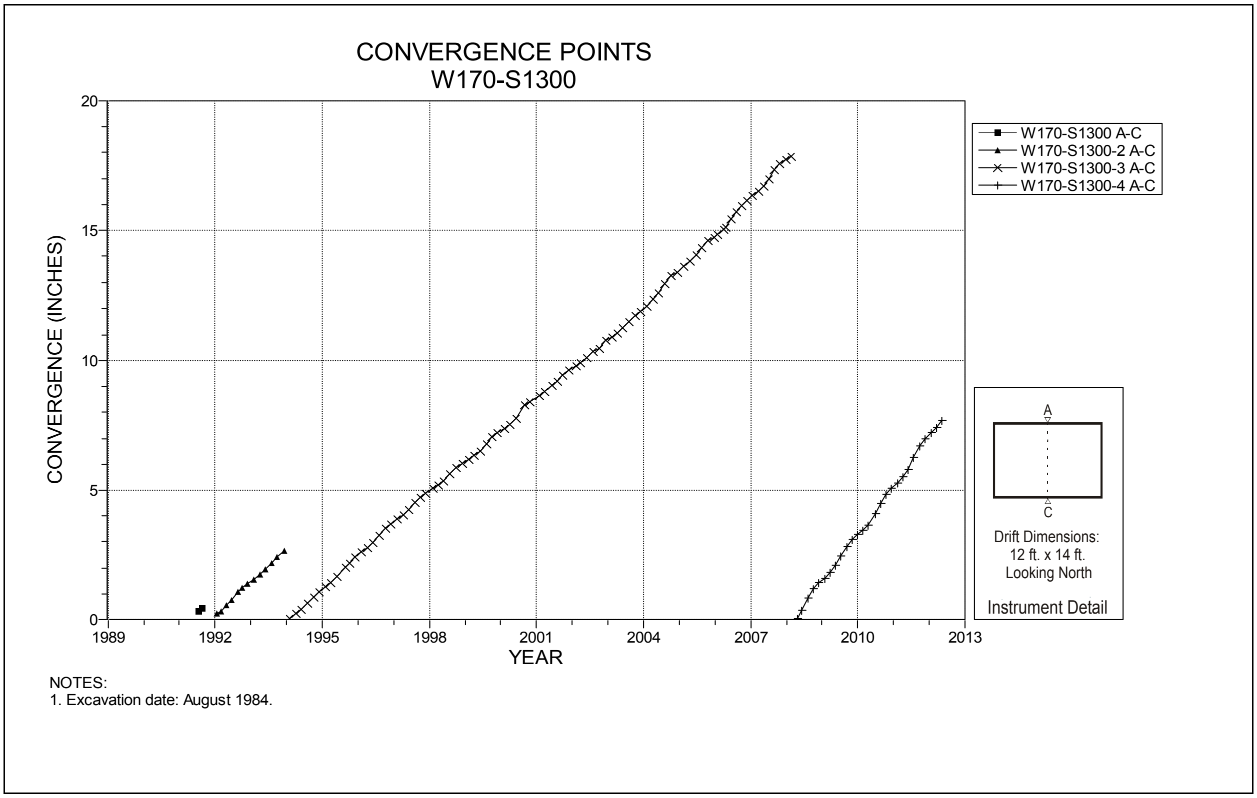


Figure 4-236 Convergence Point Array
W170 S1300 – Roof to Floor

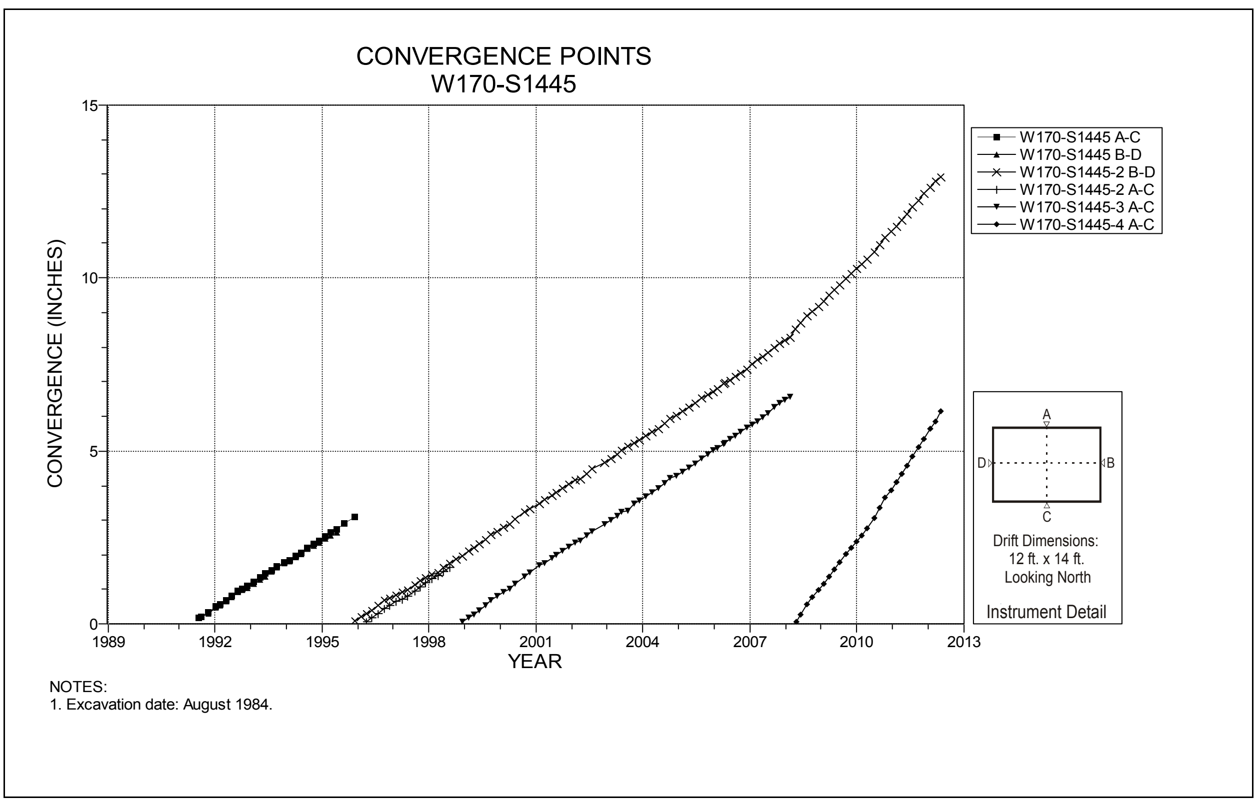


Figure 4-237 Convergence Point Array
W170 S1445 – All Chords

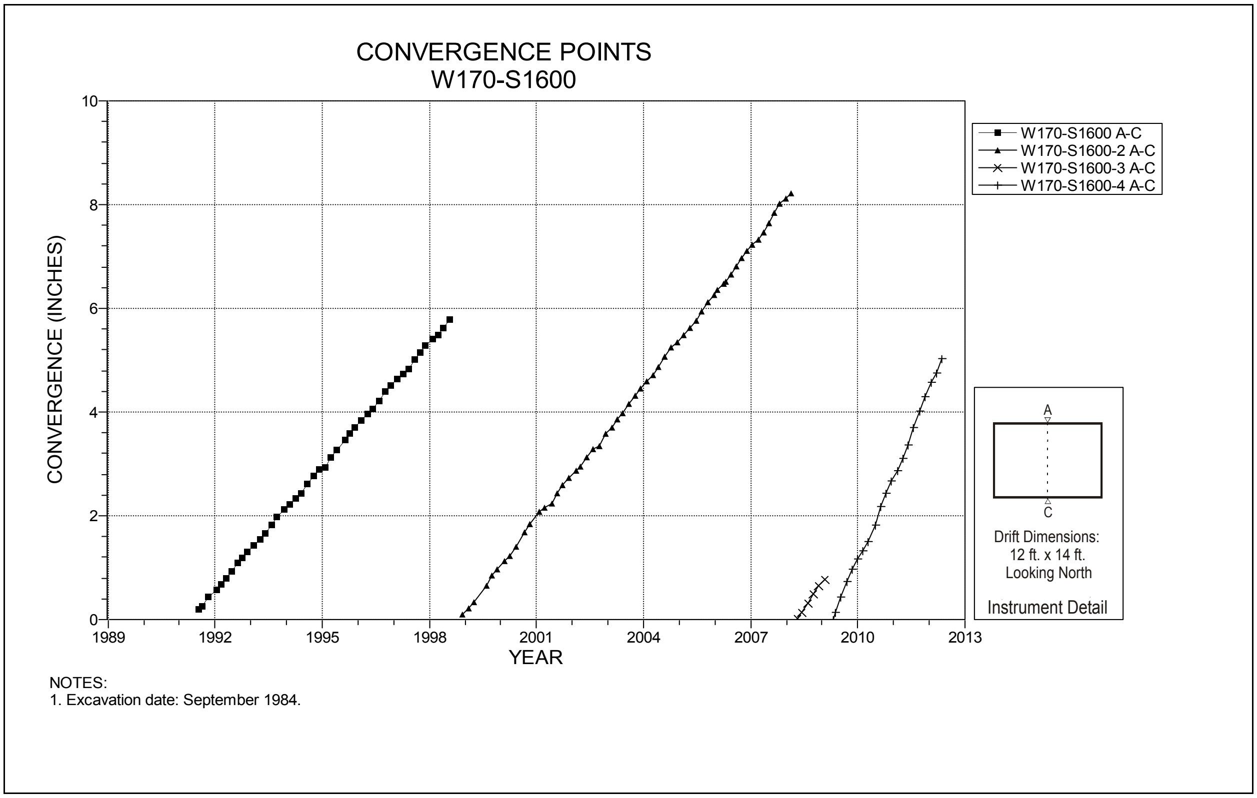


Figure 4-238 Convergence Point Array
W170 S1600 – Roof to Floor

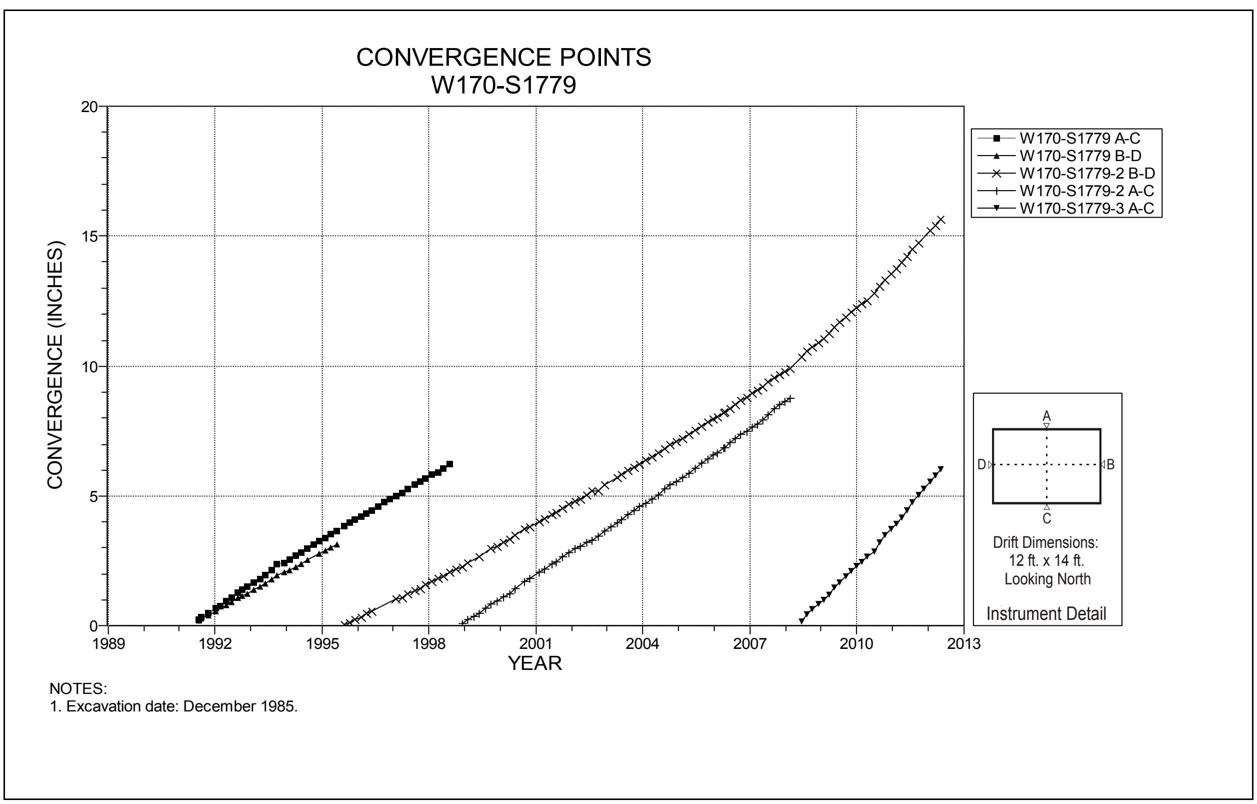


Figure 4-239 Convergence Point Array
W170 S1779 – All Chords

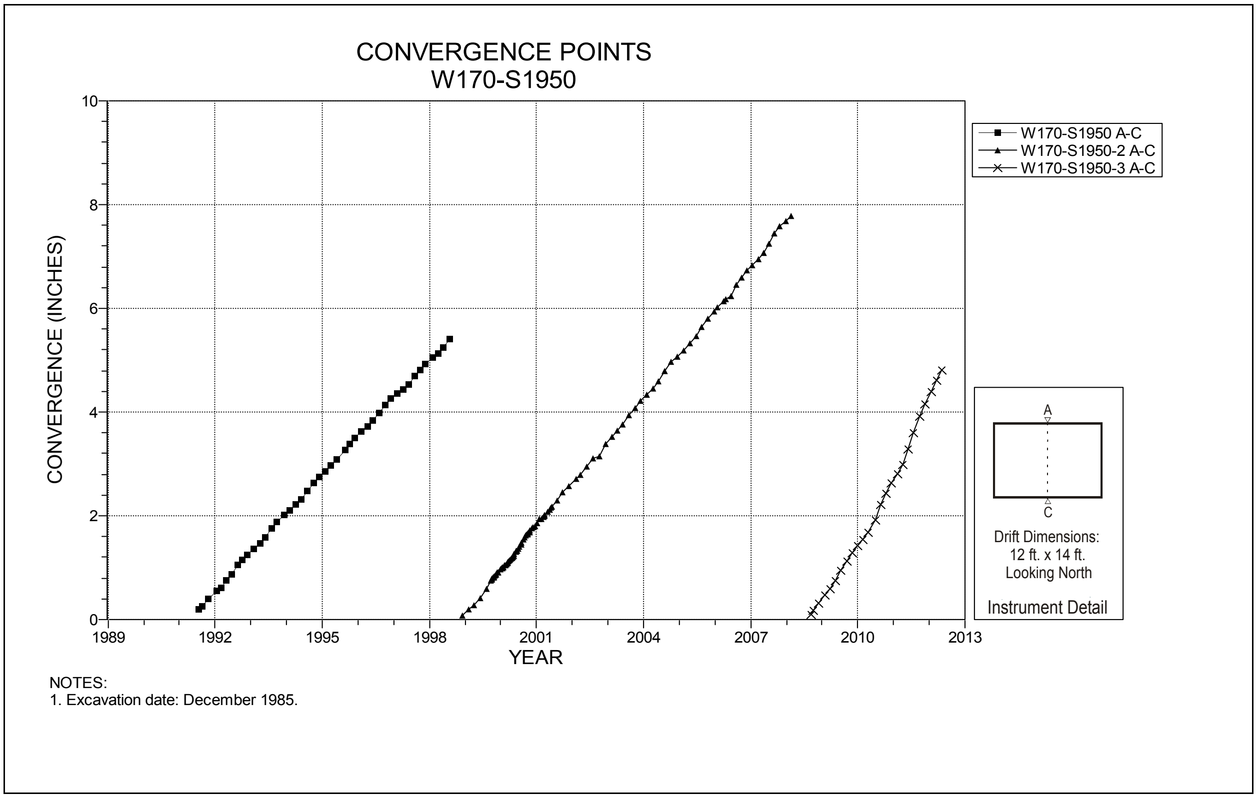


Figure 4-240 Convergence Point Array
W170 S1950 – Roof to Floor

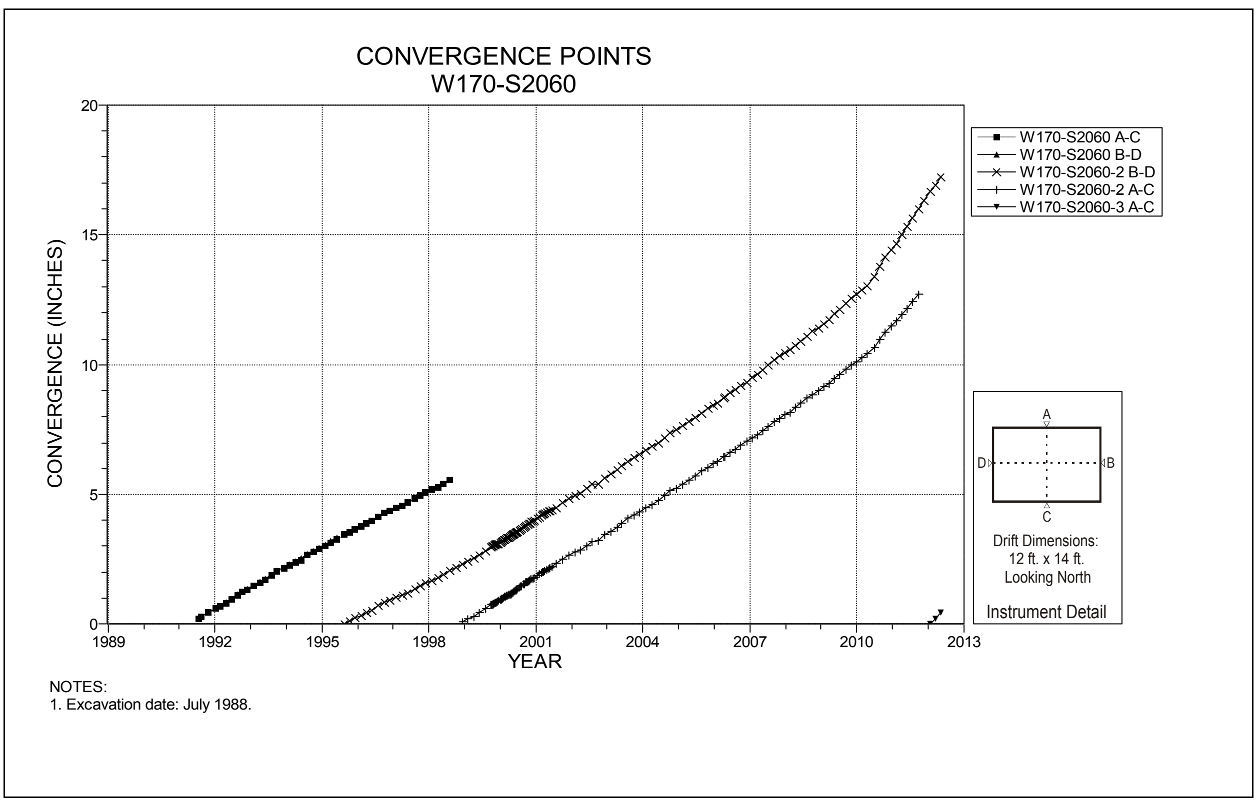


Figure 4-241 Convergence Point Array
W170 S2060 – All Chords

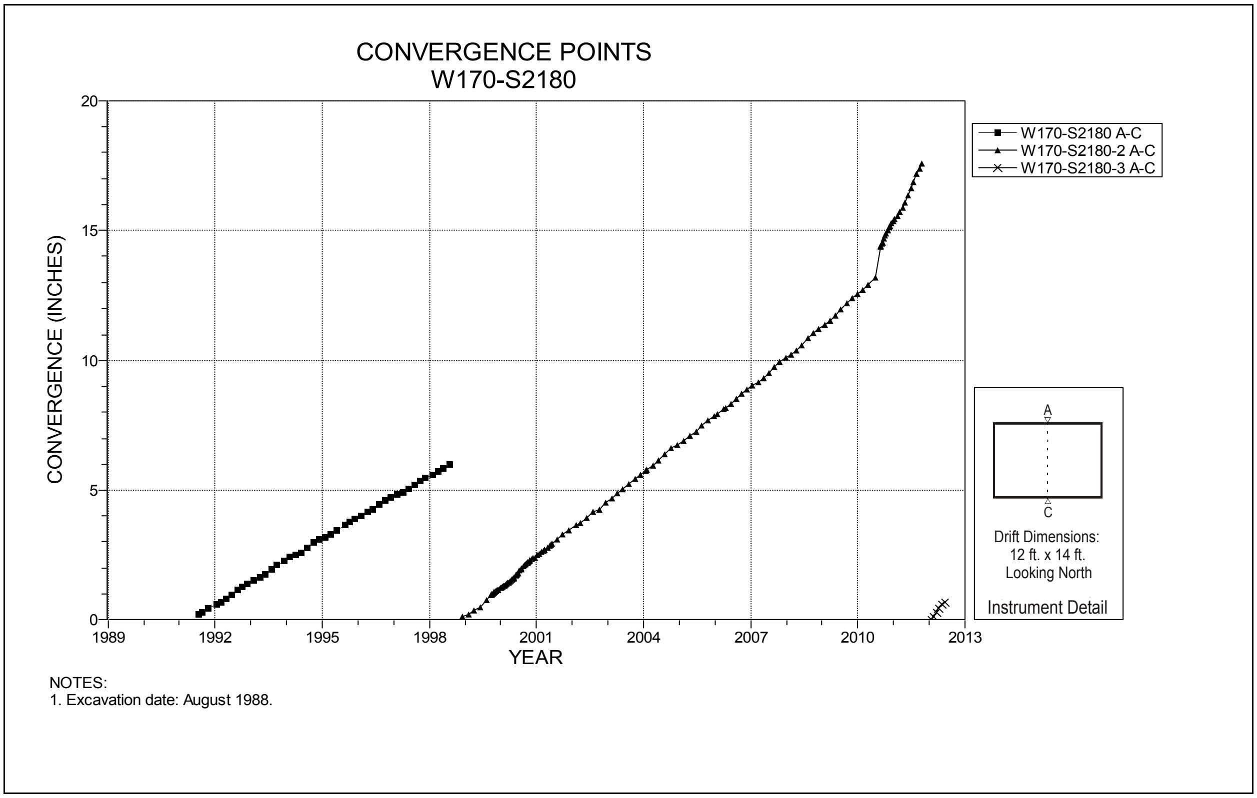


Figure 4-242 Convergence Point Array
W170 S2180 – Roof to Floor

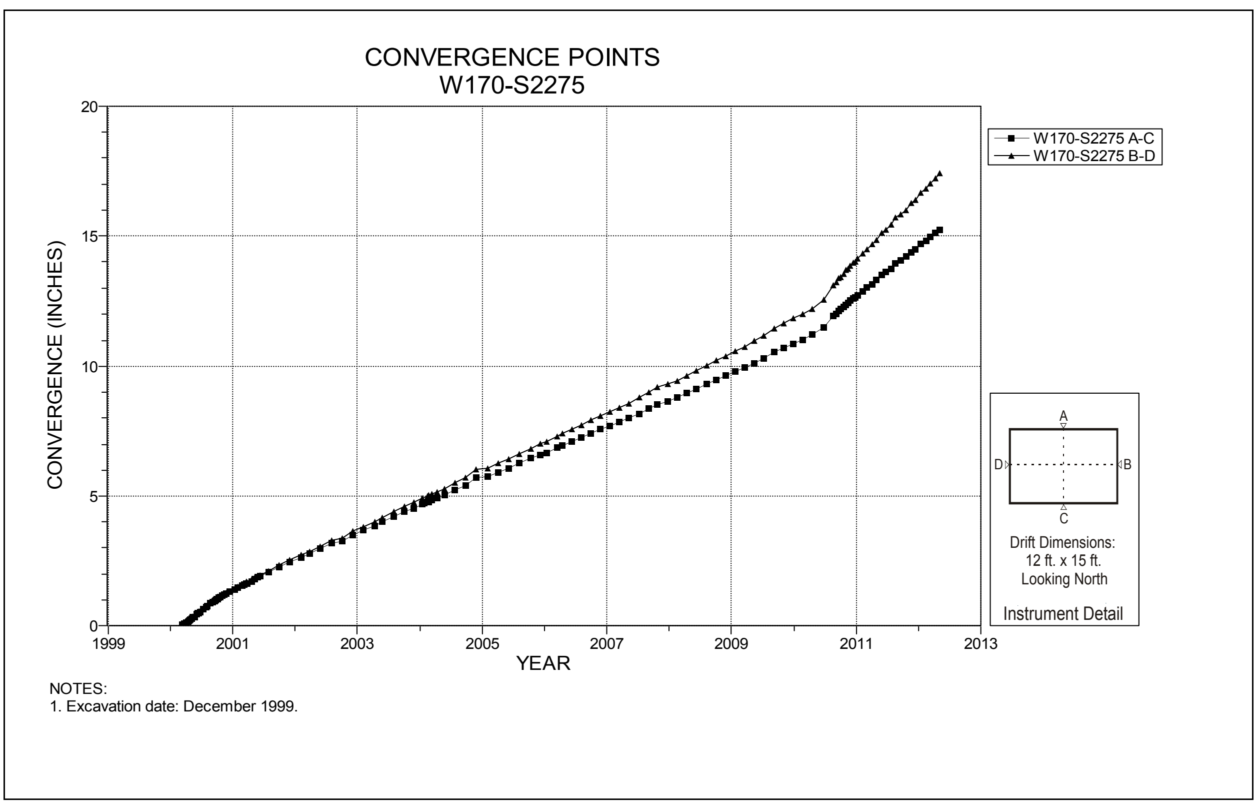


Figure 4-243 Convergence Point Array
W170 S2275 – All Chords

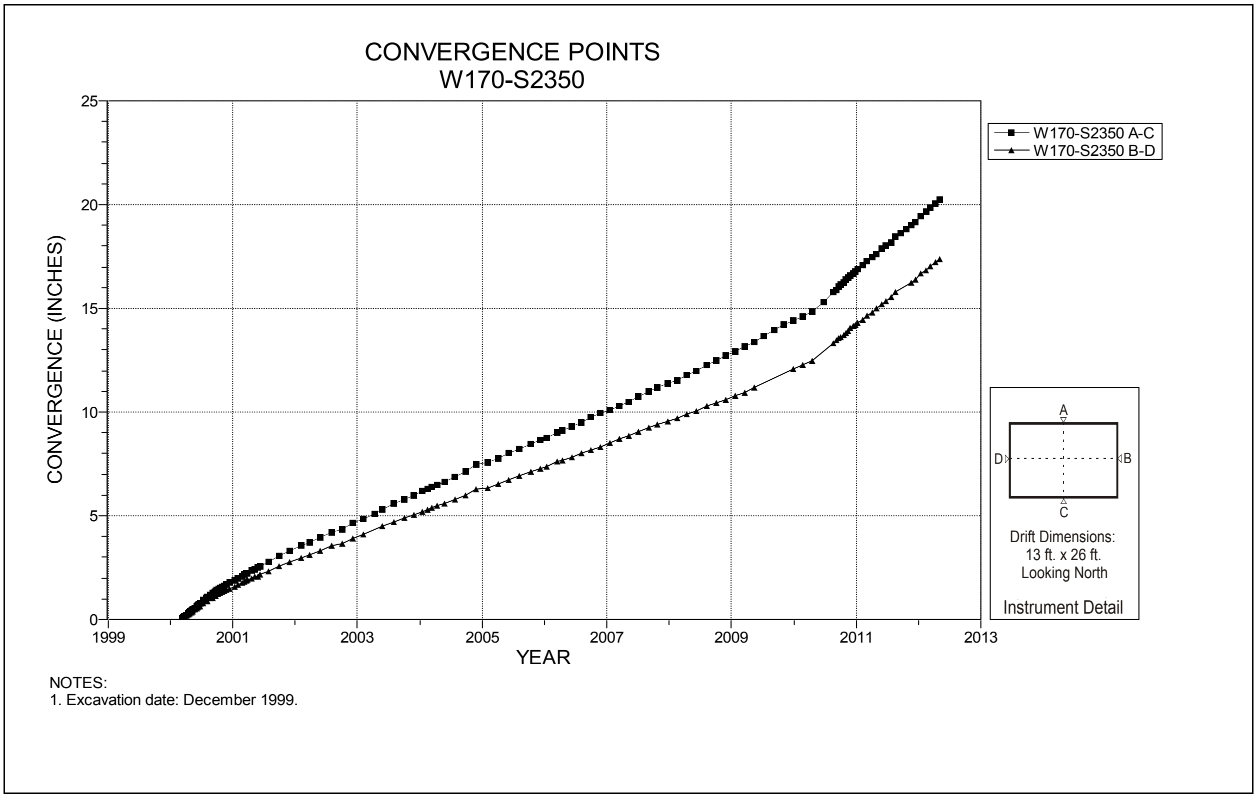


Figure 4-244 Convergence Point Array
W170 S2350 – All Chords

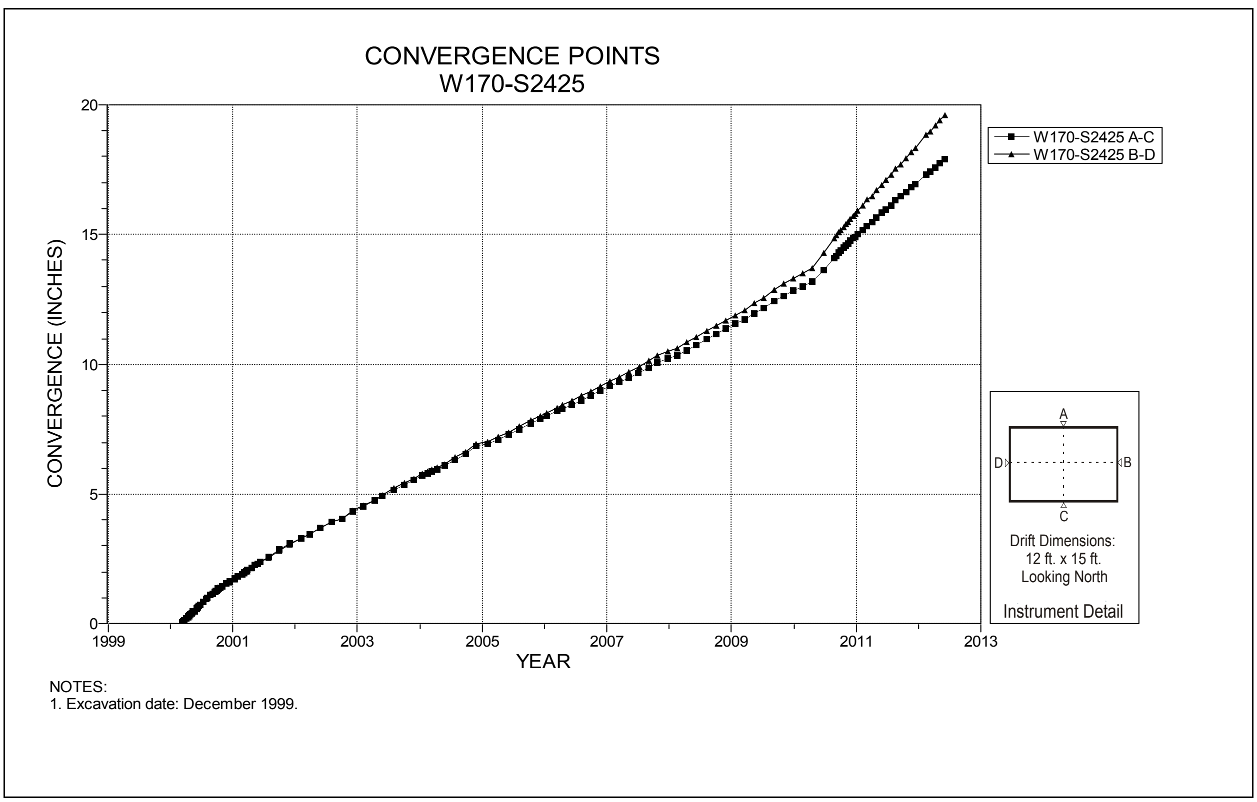


Figure 4-245 Convergence Point Array
W170 S2425 – All Chords

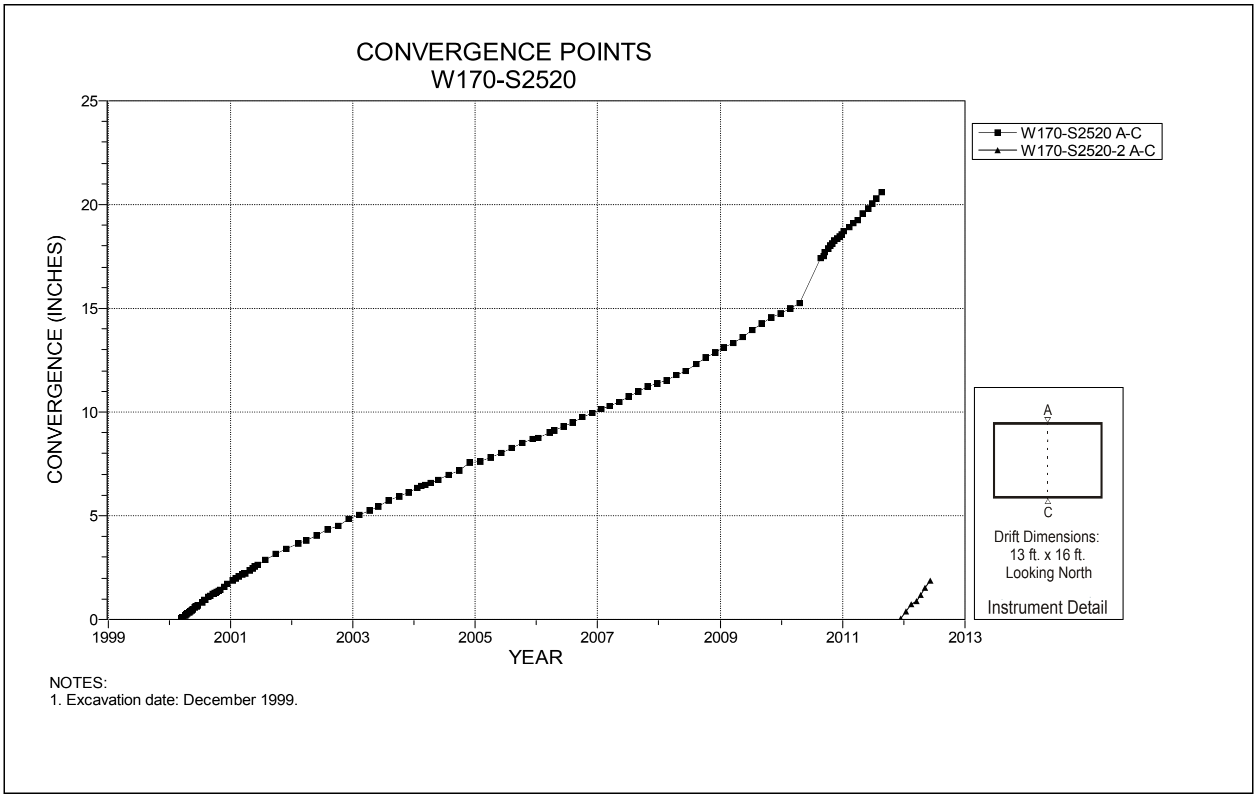


Figure 4-246 Convergence Point Array
W170 S2520 – Roof to Floor

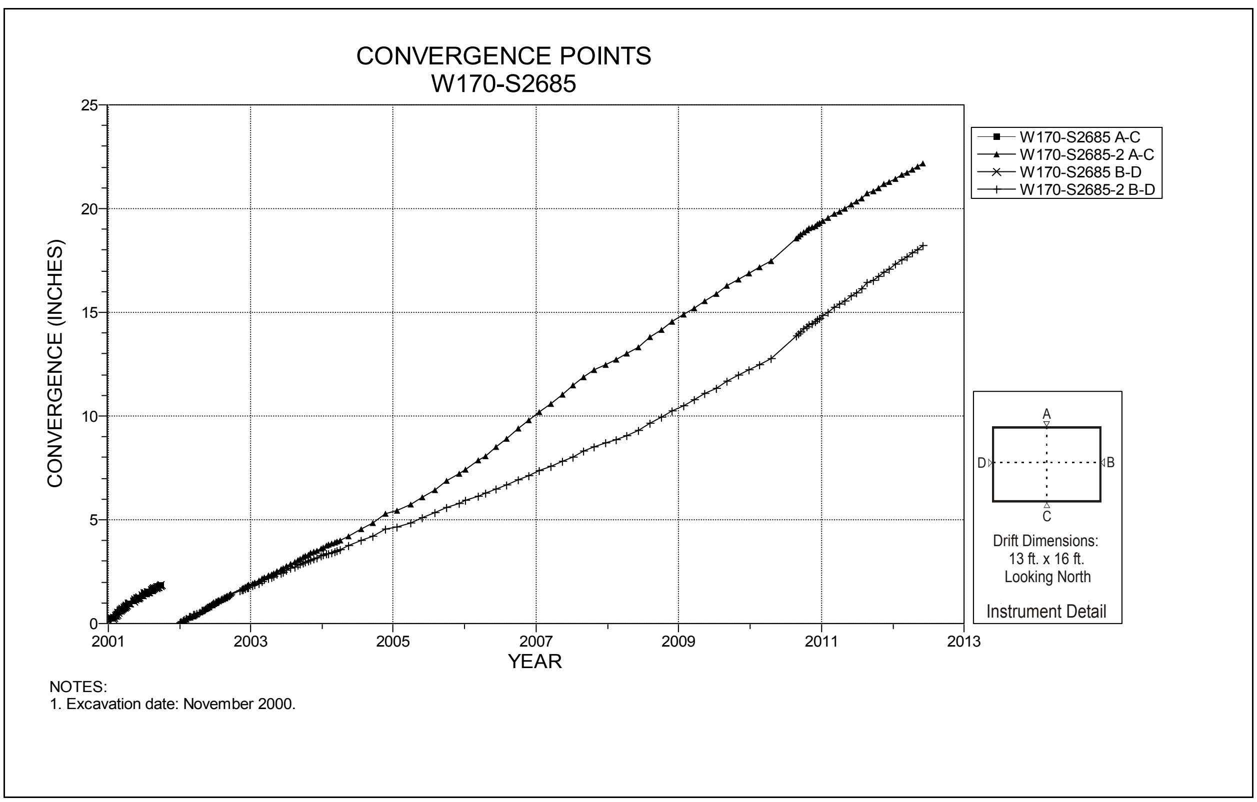


Figure 4-247 Convergence Point Array
W170 S2685 – All Chords

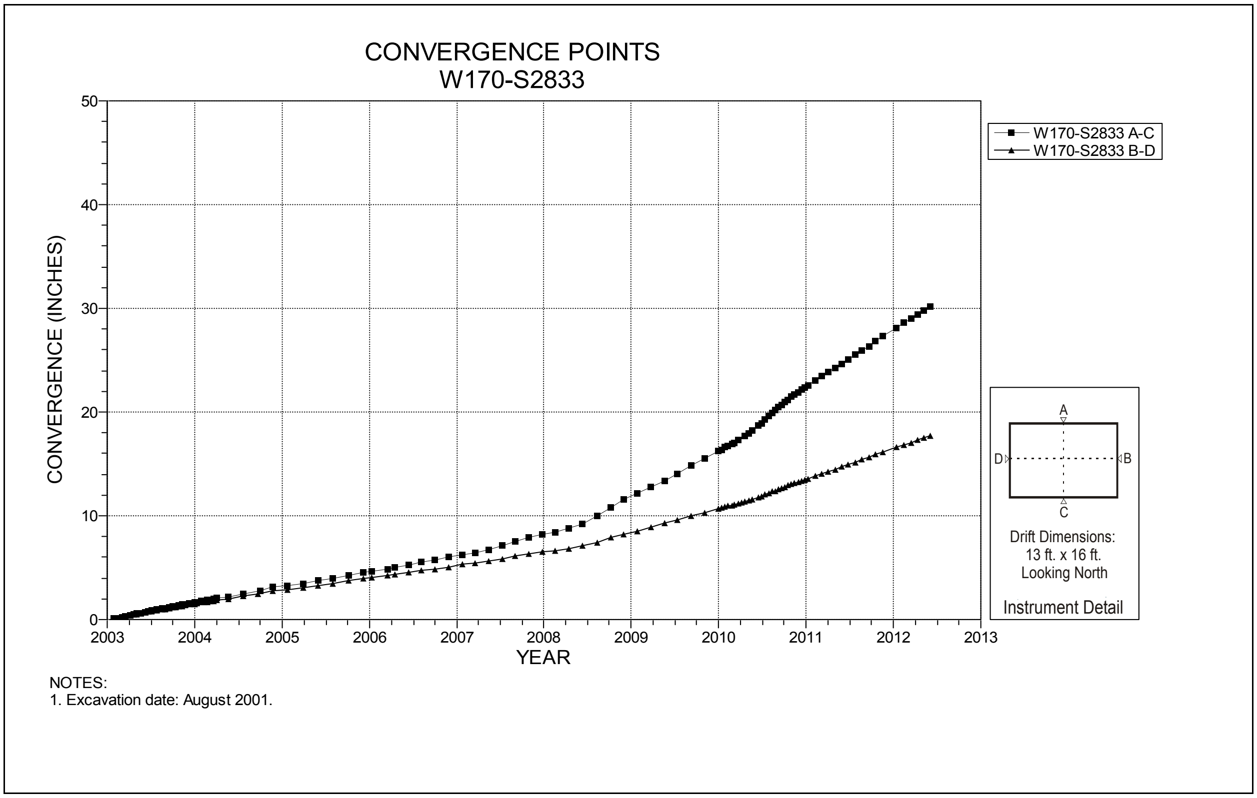


Figure 4-248 Convergence Point Array
W170 S2833 – All Chords

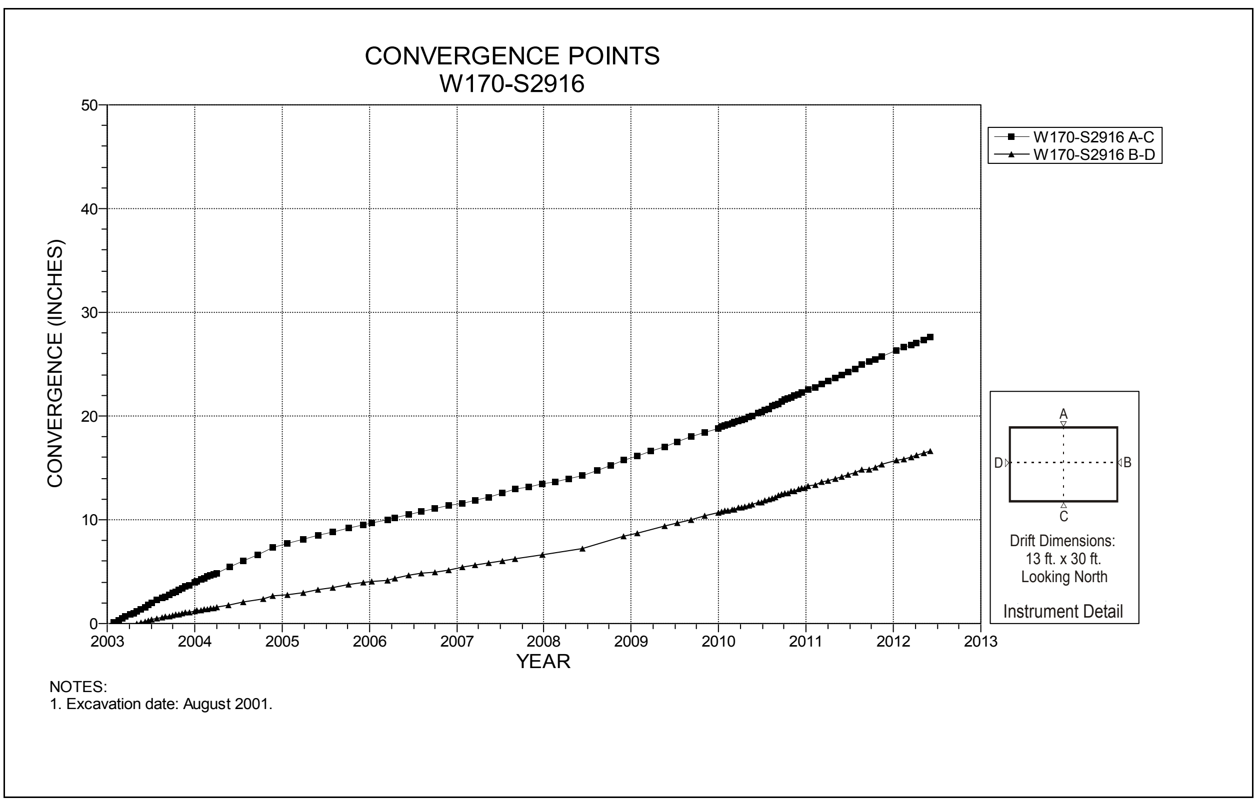


Figure 4-249 Convergence Point Array
W170 S2916 – All Chords

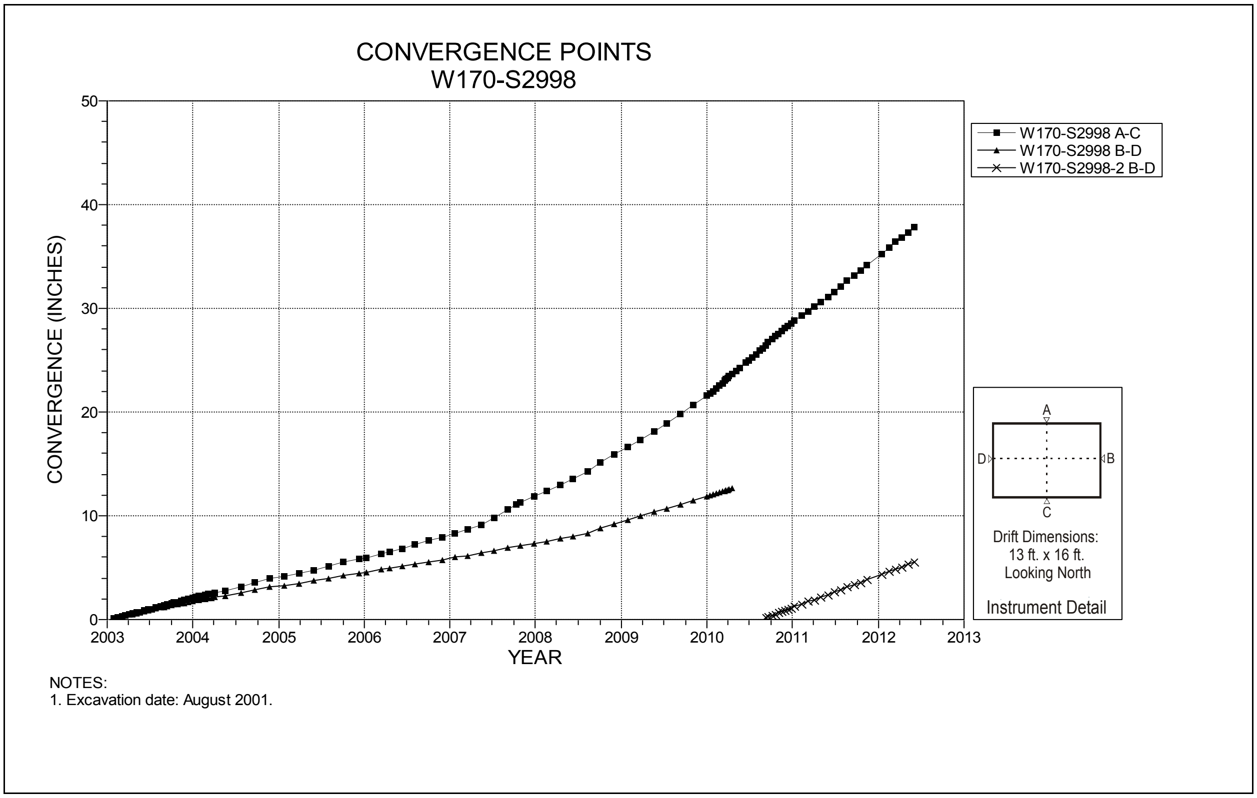


Figure 4-250 Convergence Point Array
W170 S2998 – All Chords

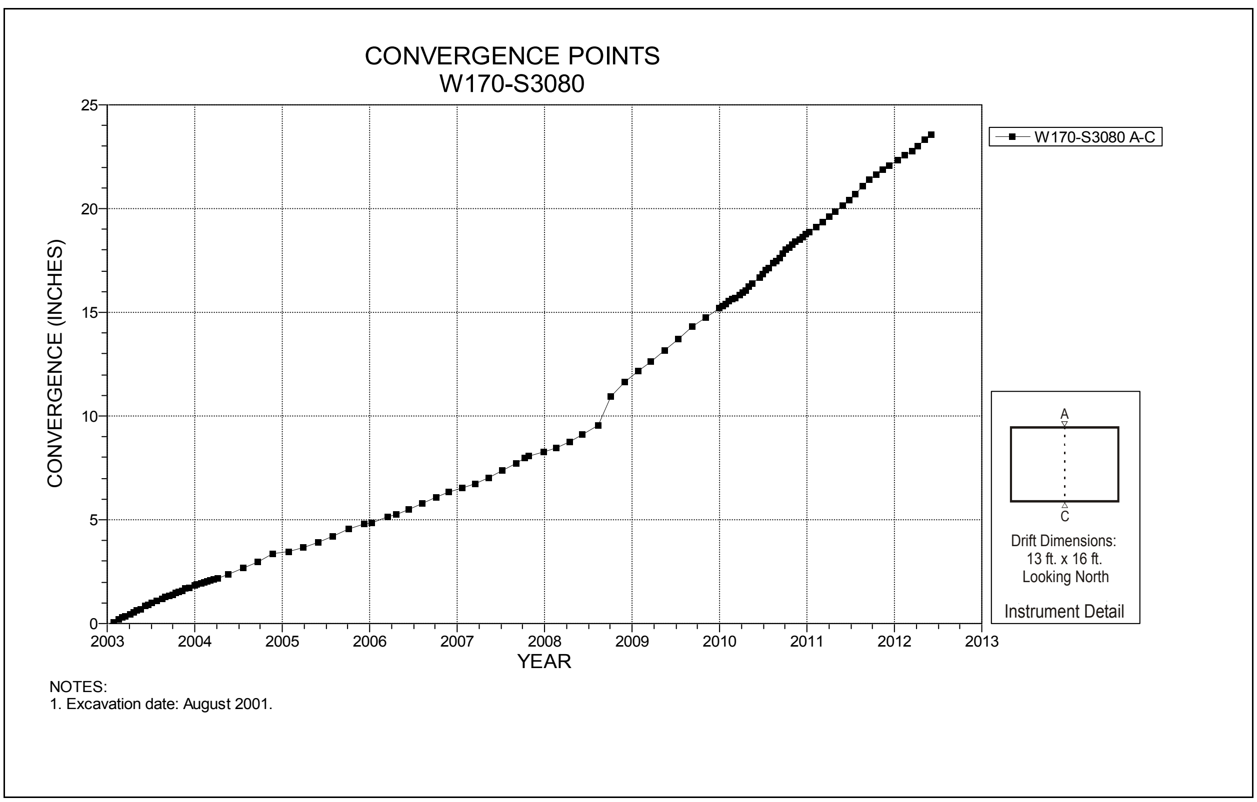


Figure 4-251 Convergence Point Array
W170 S3080 – Roof to Floor

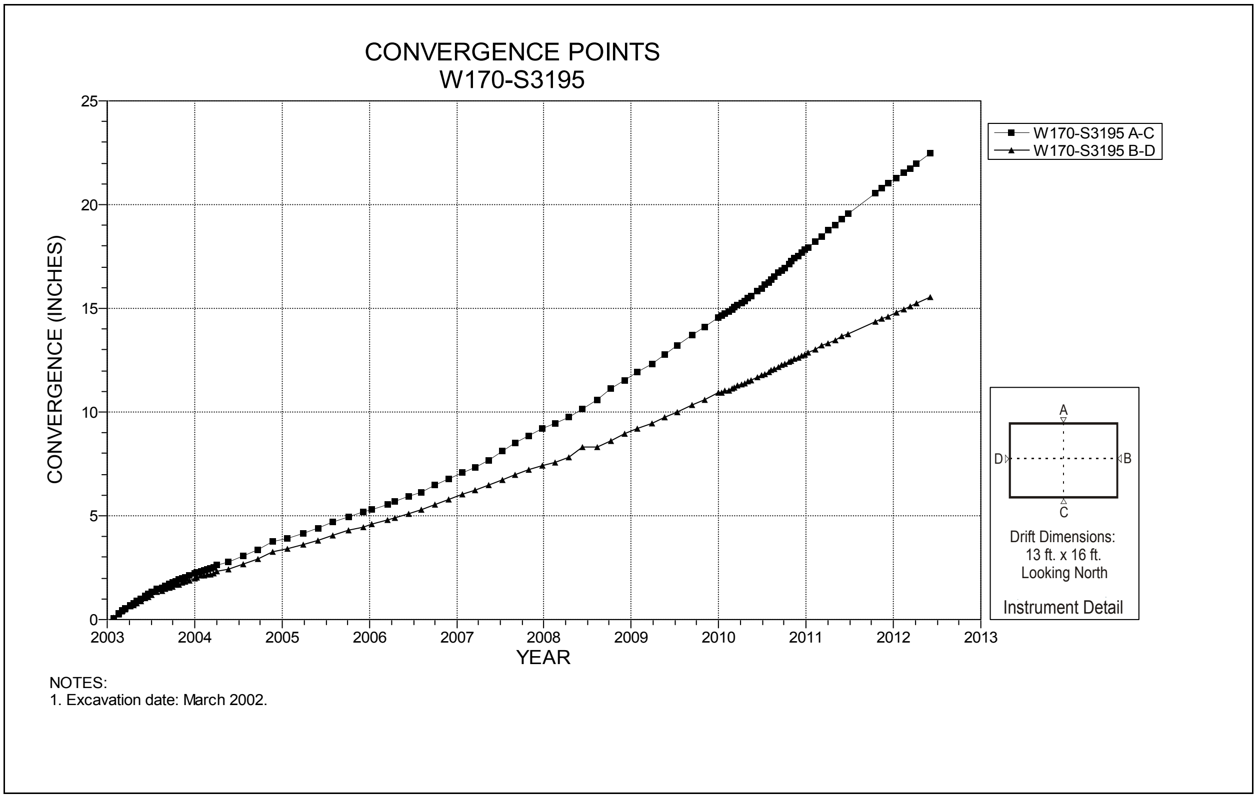


Figure 4-252 Convergence Point Array
W170 S3195 – All Chords

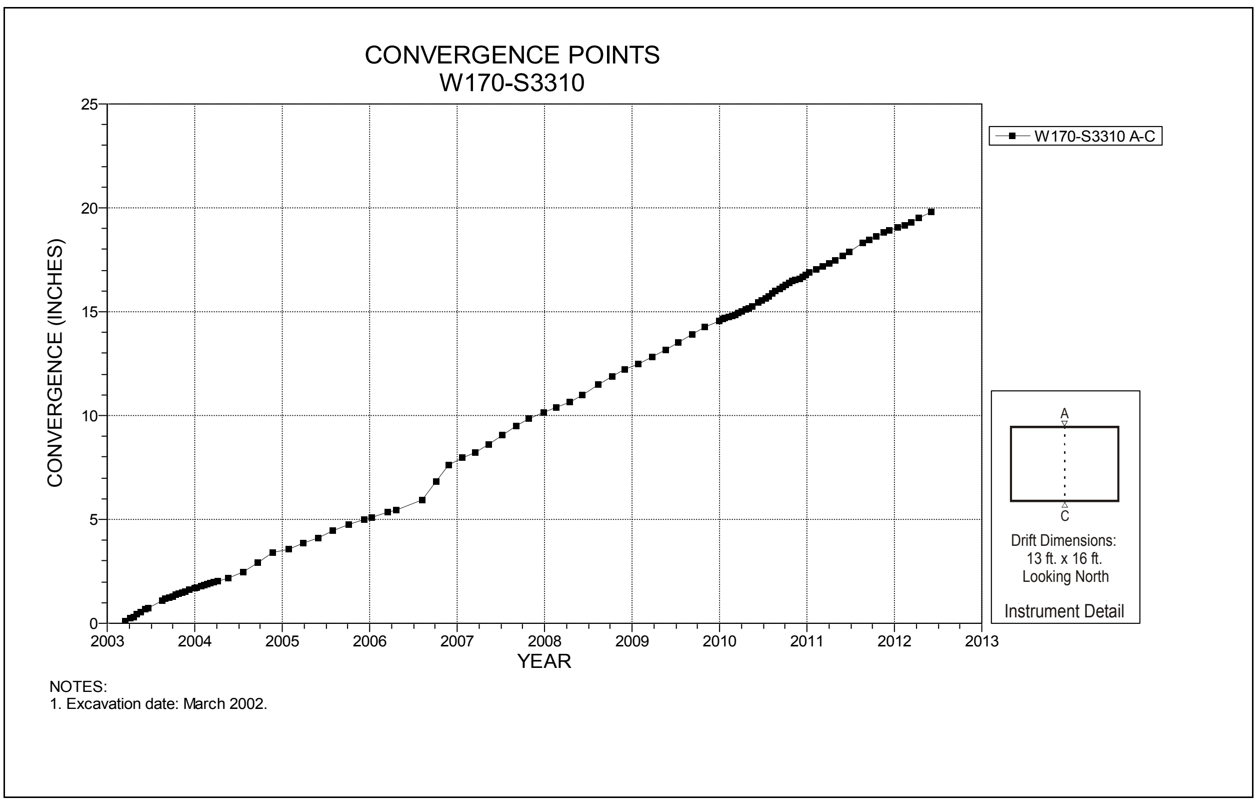


Figure 4-253 Convergence Point Array
W170 S3310 – Roof to Floor

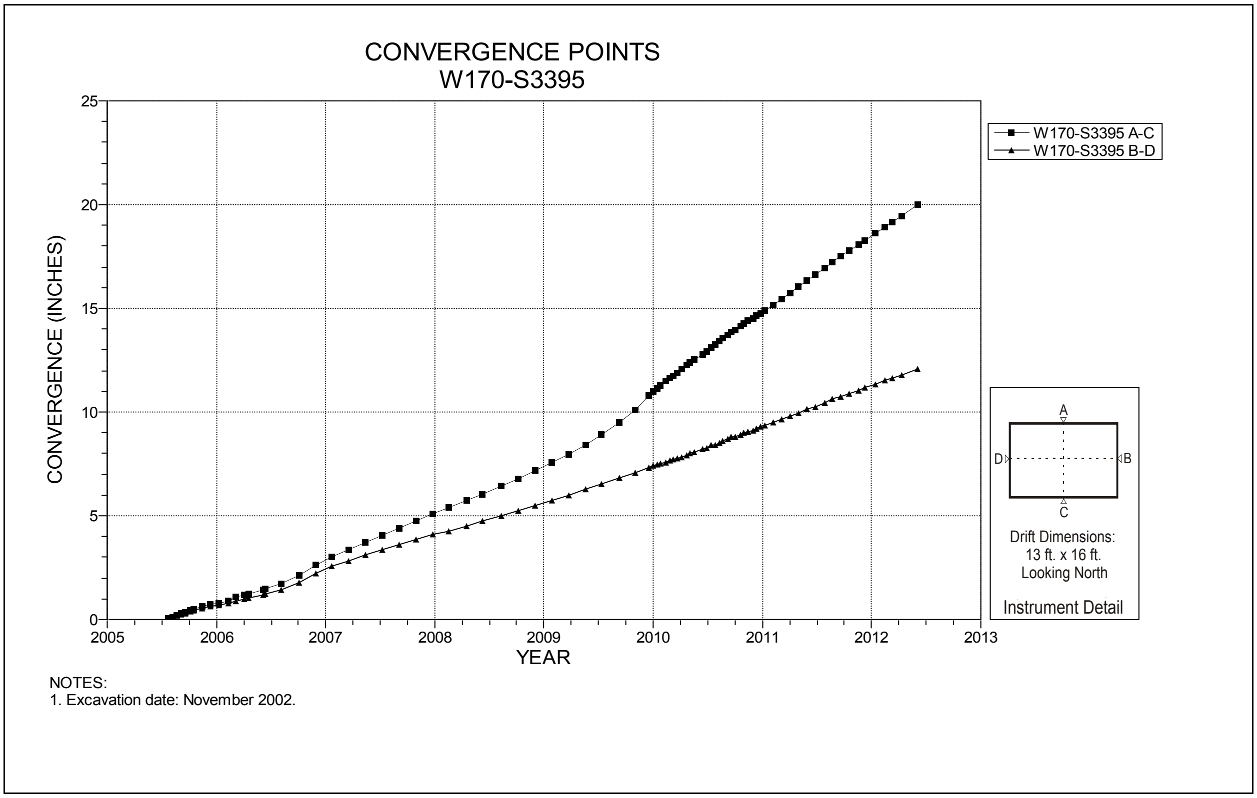


Figure 4-254 Convergence Point Array
W170 S3395 – All Chords

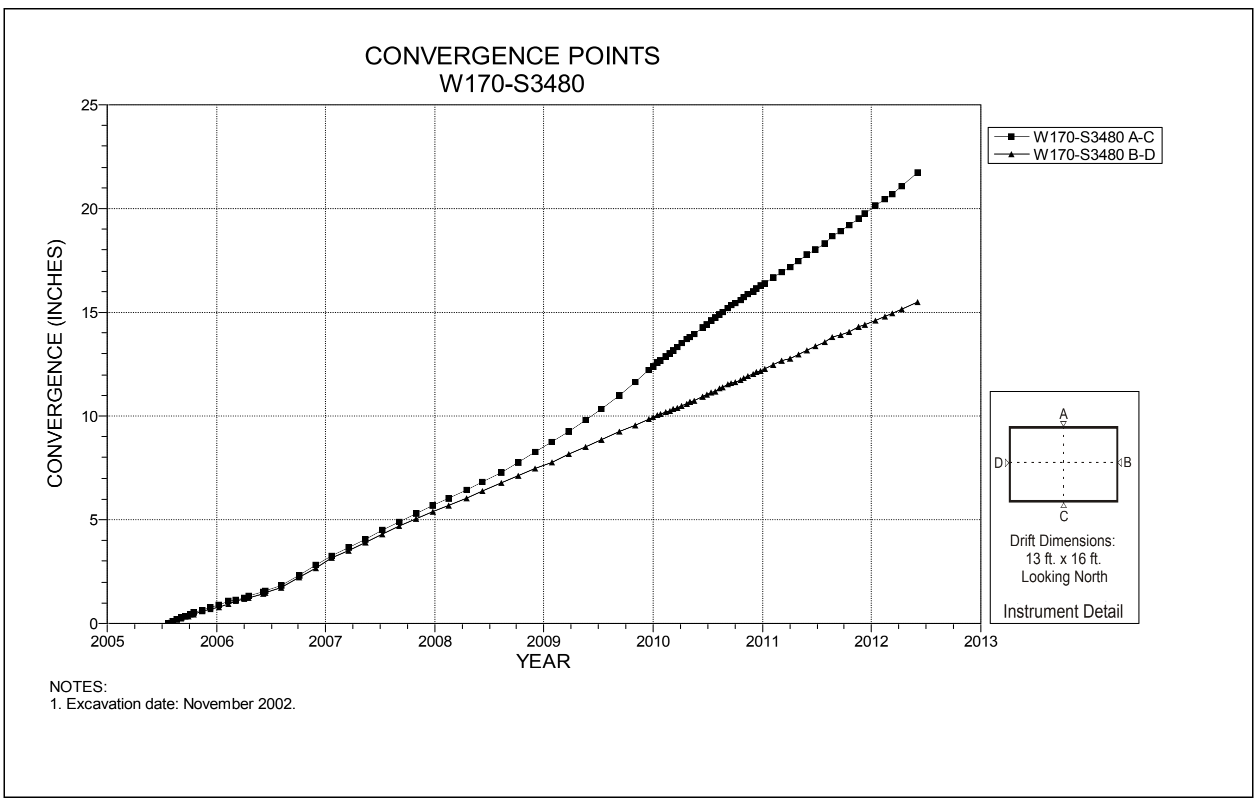


Figure 4-255 Convergence Point Array
W170 S3480 – All Chords

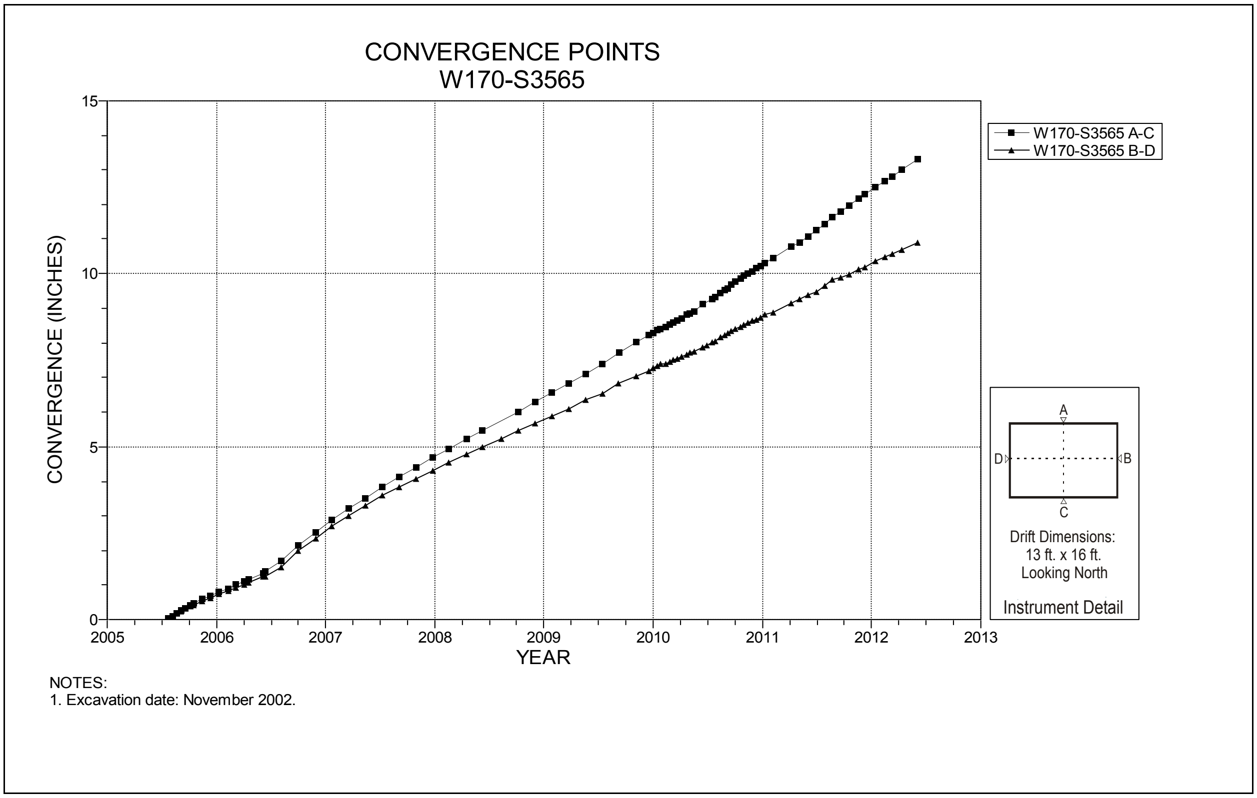


Figure 4-256 Convergence Point Array
W170 S3565 – All Chords

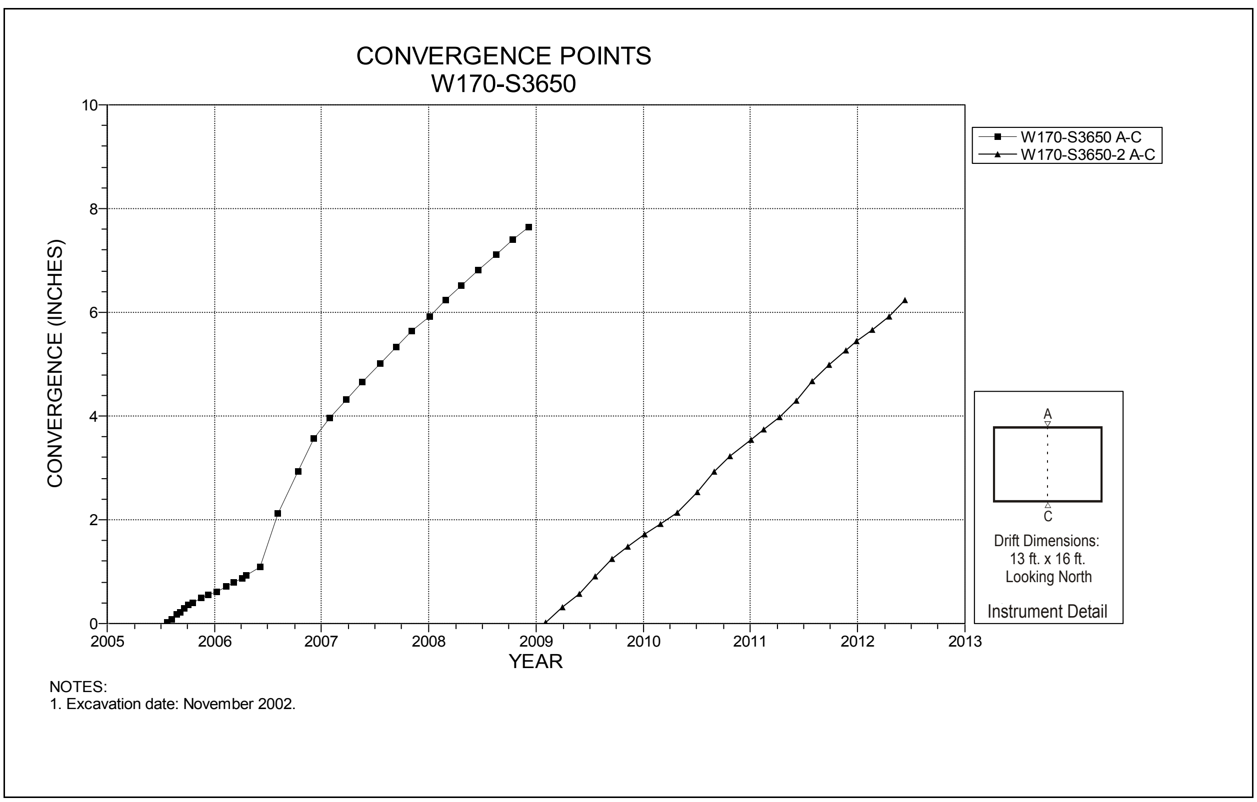


Figure 4-257 Convergence Point Array
W170 S3650 – Roof to Floor

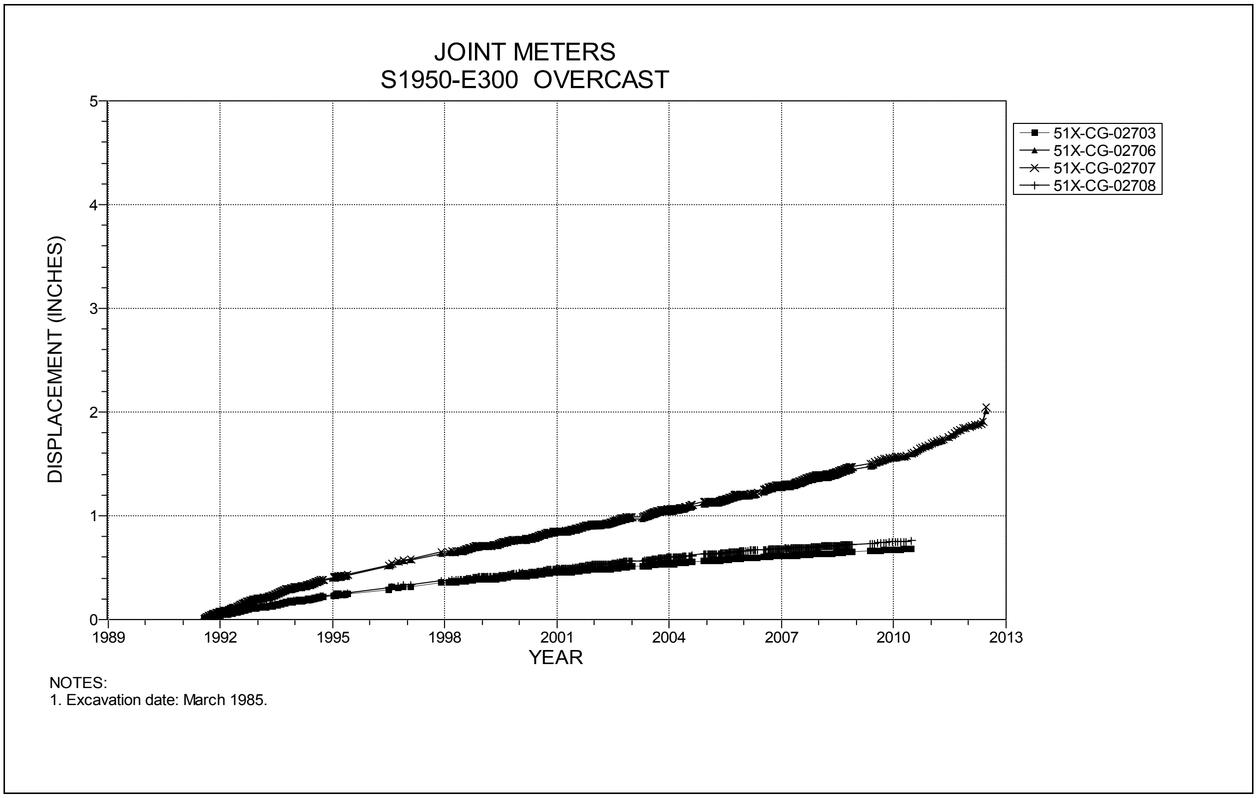


Figure 4-258 Joint Meters
S1950 E300

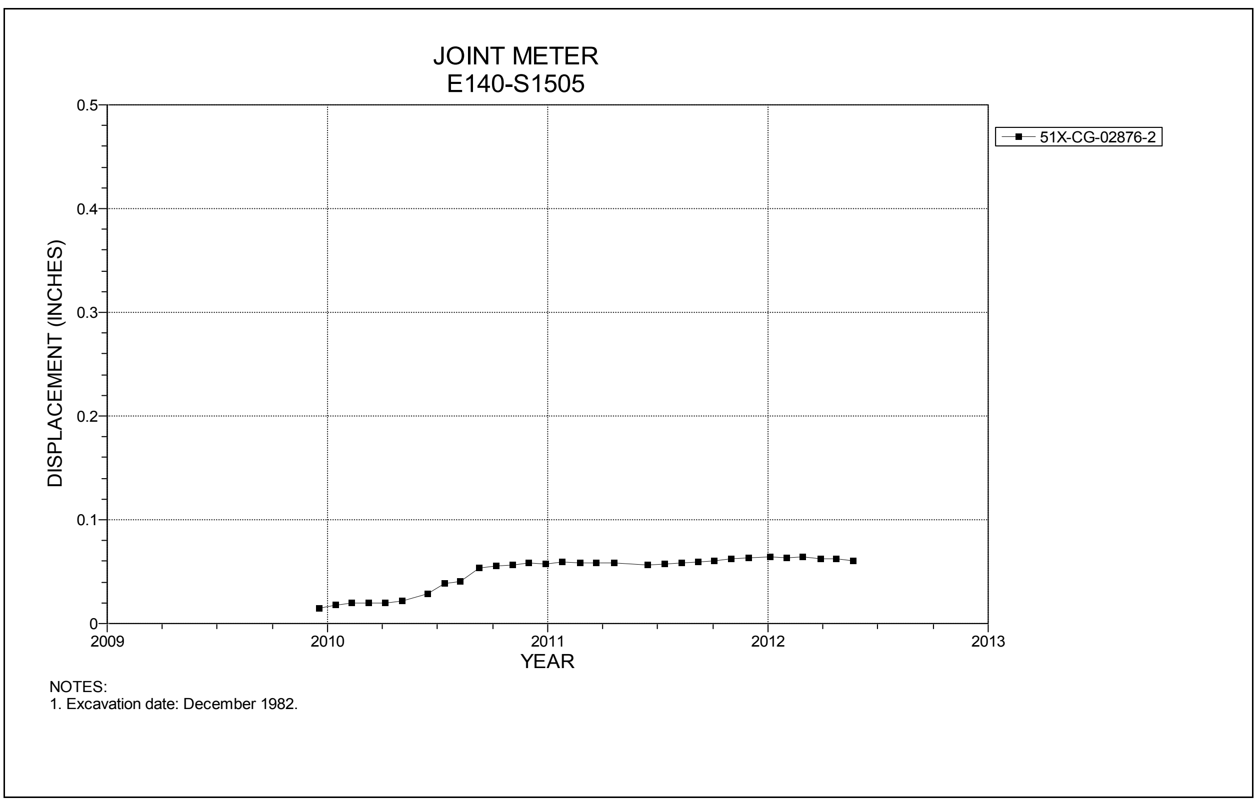


Figure 4-259 Joint Meter
E140 S1505

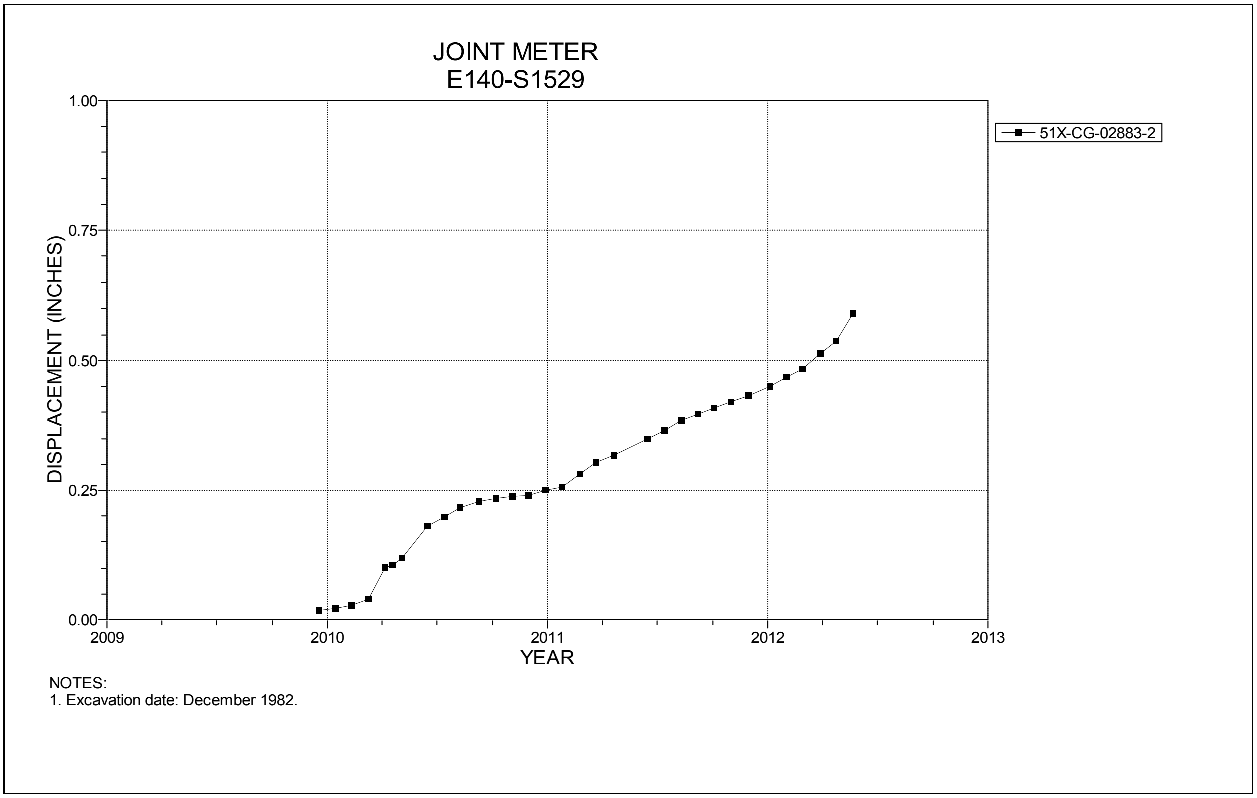


Figure 4-260 Joint Meter
E140 S1529

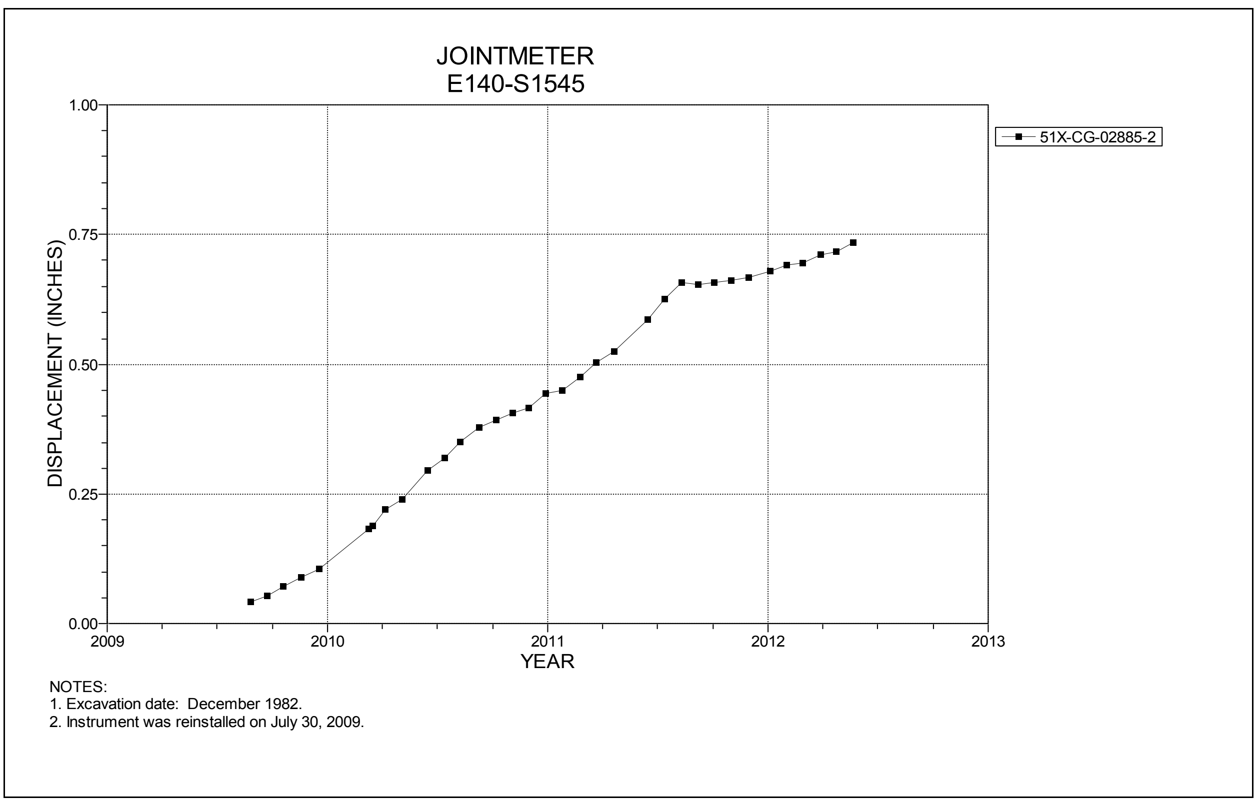


Figure 4-261 Joint Meter
E140 S1545

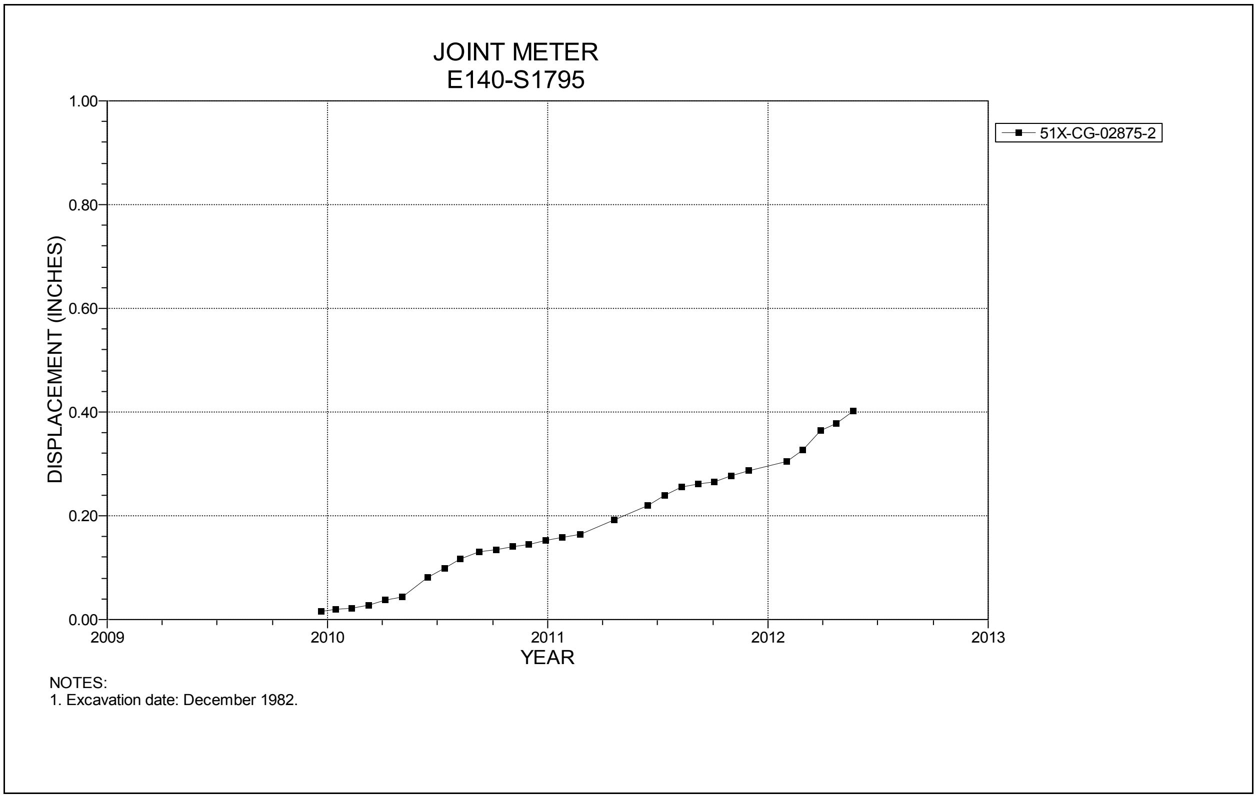


Figure 4-262 Joint Meter
E140 S1795

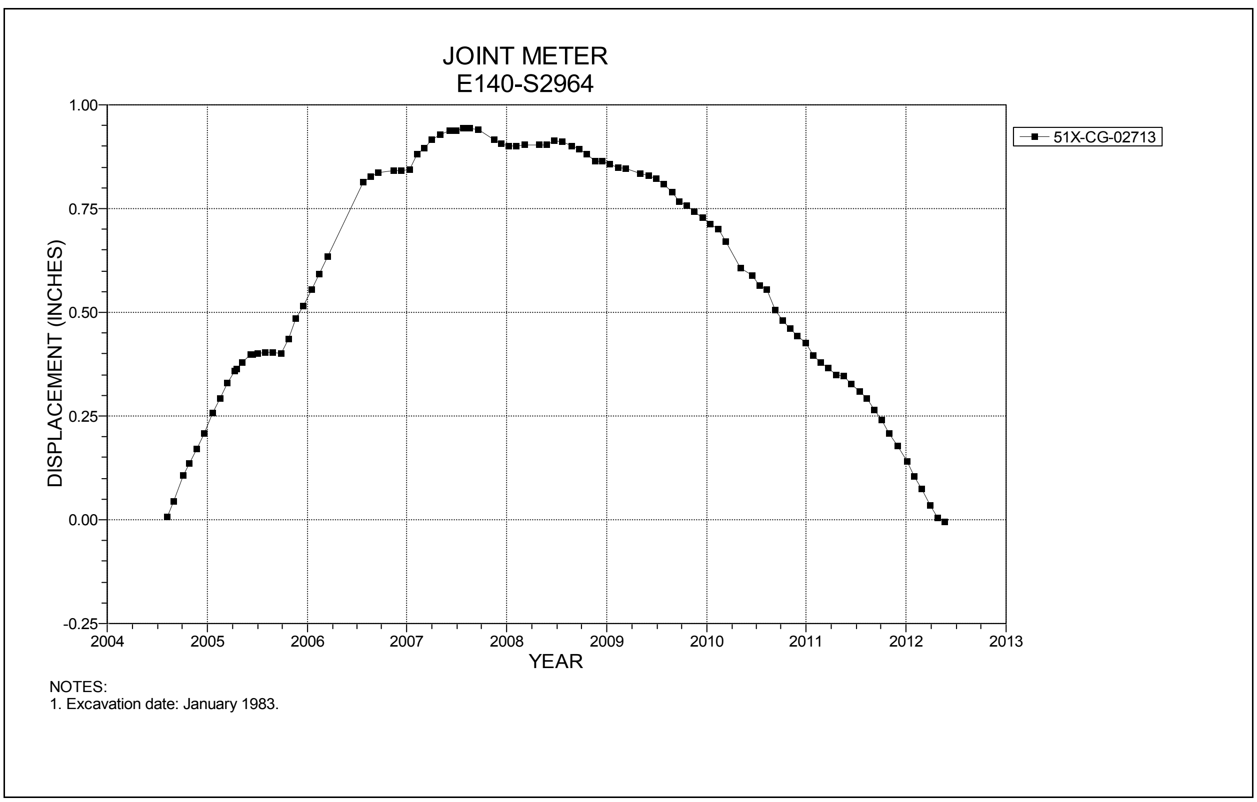


Figure 4-263 Joint Meter
E140 S2964

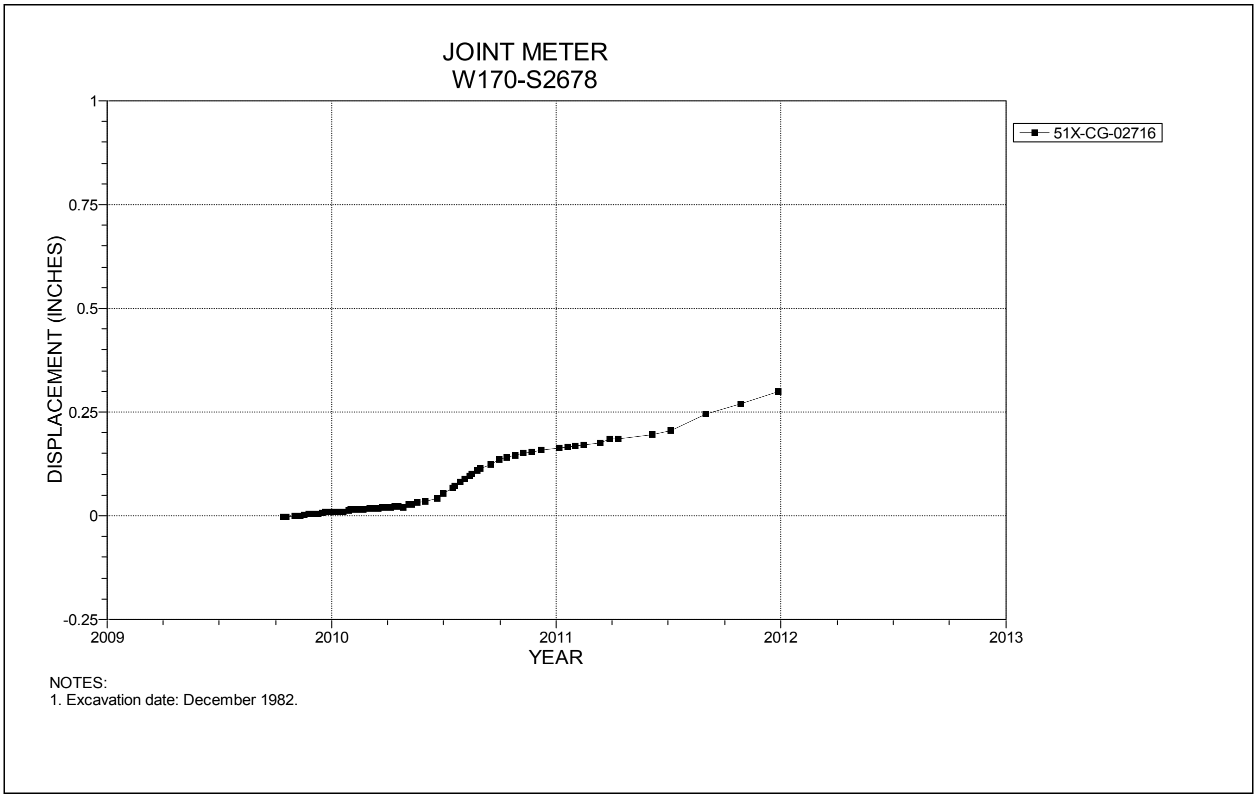


Figure 4-264 Joint Meter
W170-S2678

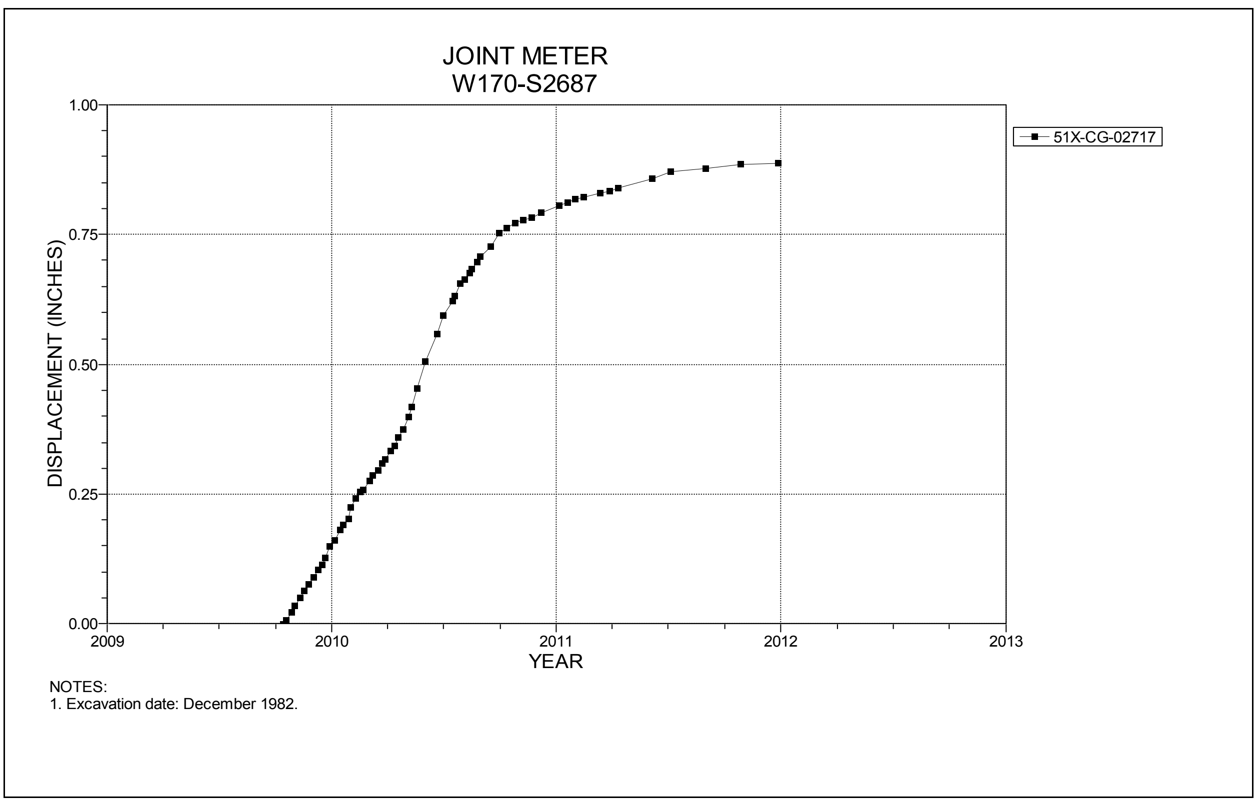


Figure 4-265 Joint Meter
W170-S2687

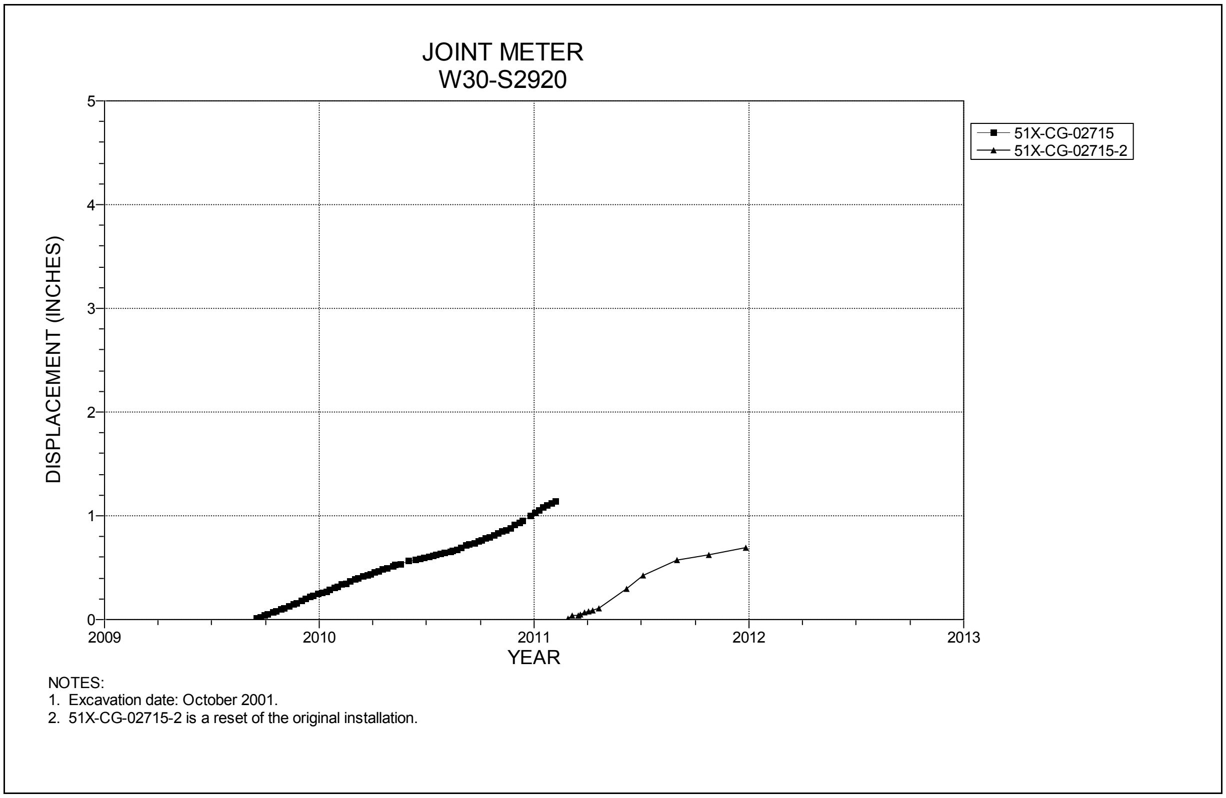


Figure 4-266 Joint Meters
W170-S2920

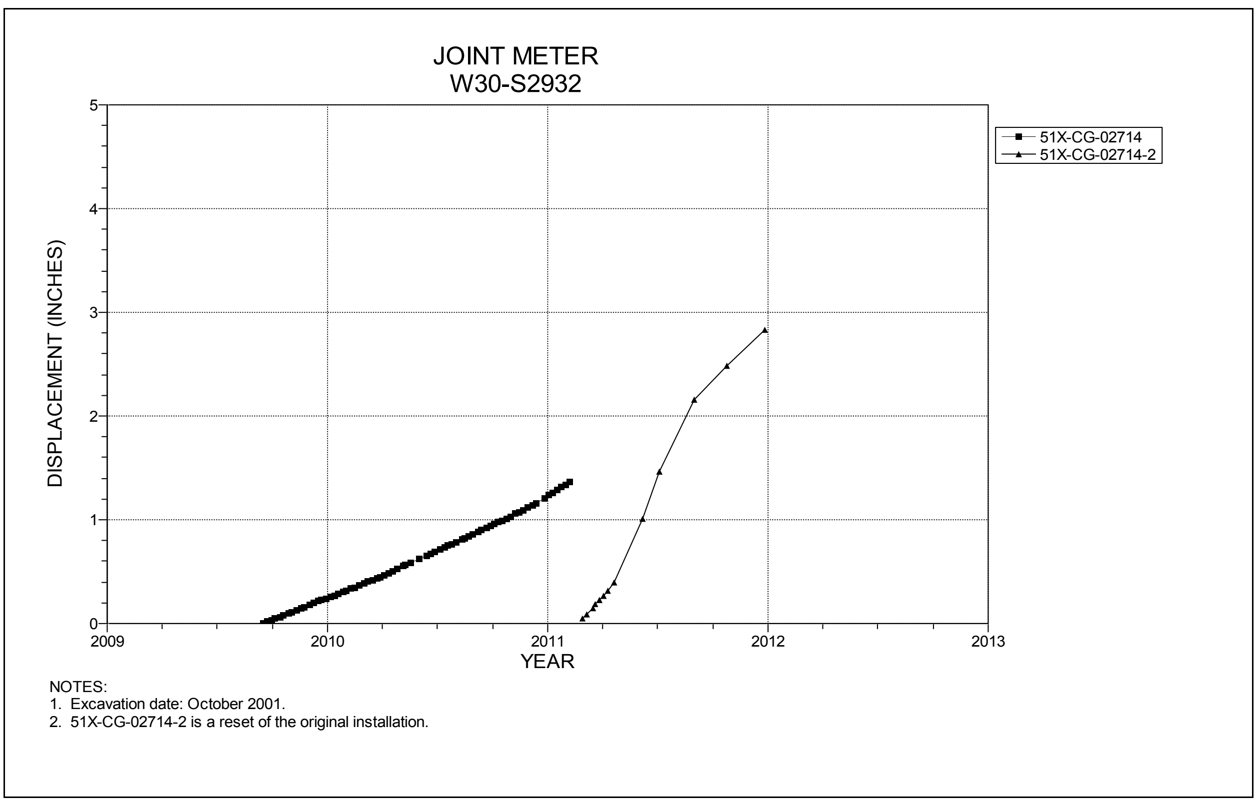


Figure 4-267 Joint Meters
W170-S2932

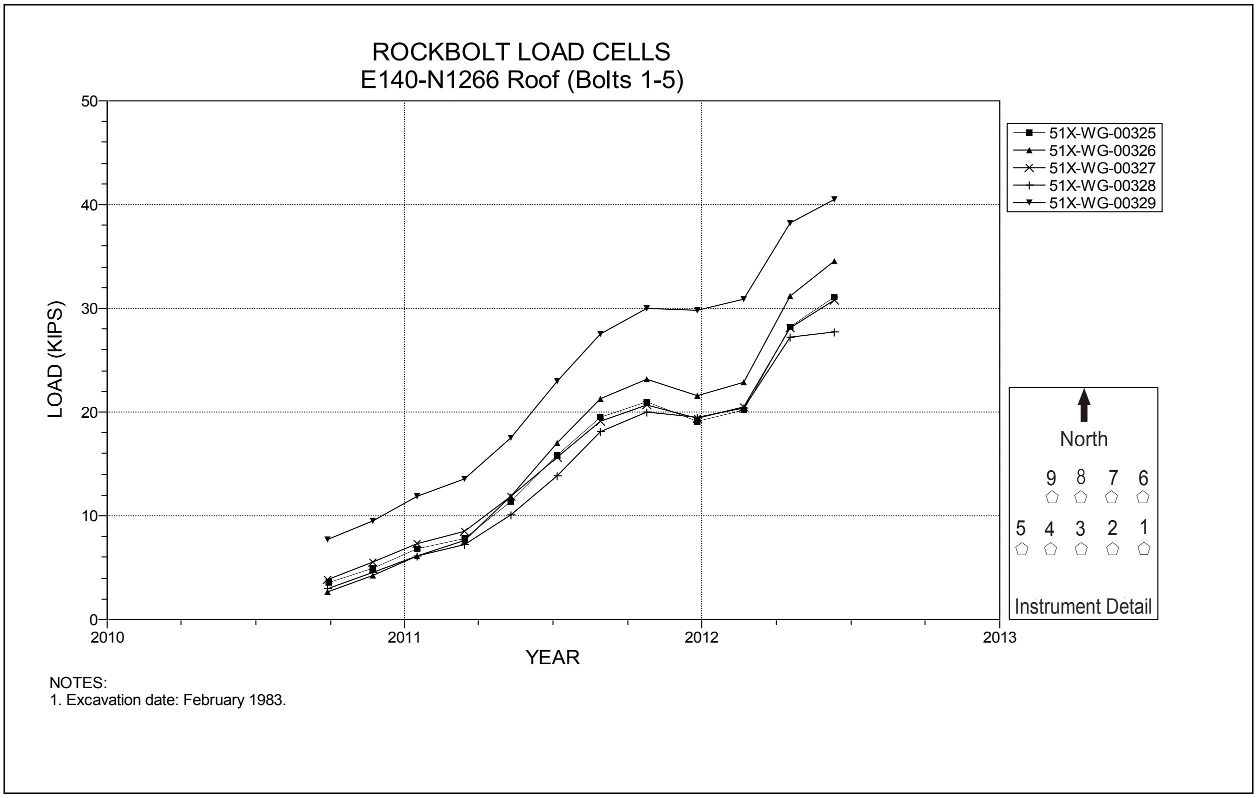


Figure 4-268 Rock Bolt Load Cells, Bolts 1-5
E140 N1266

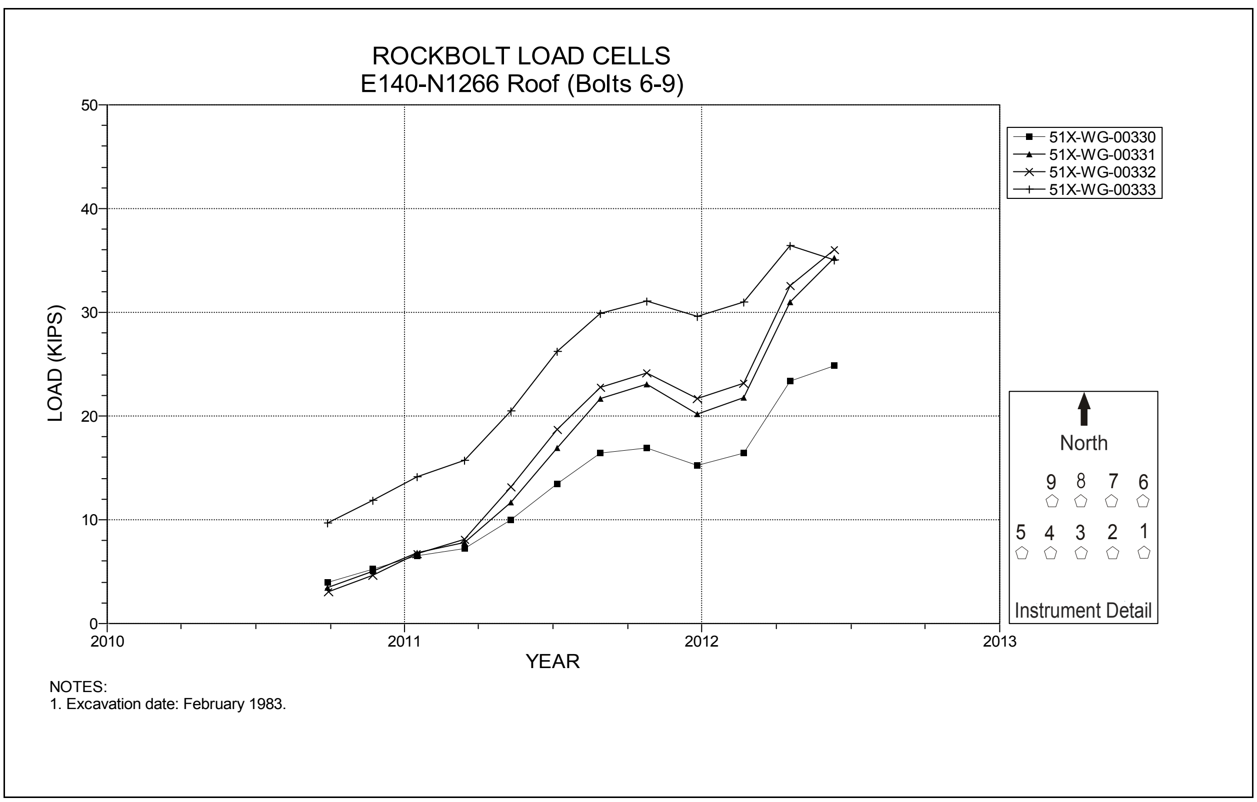


Figure 4-269 Rock Bolt Load Cells, Bolts 6-9
E140 N1266

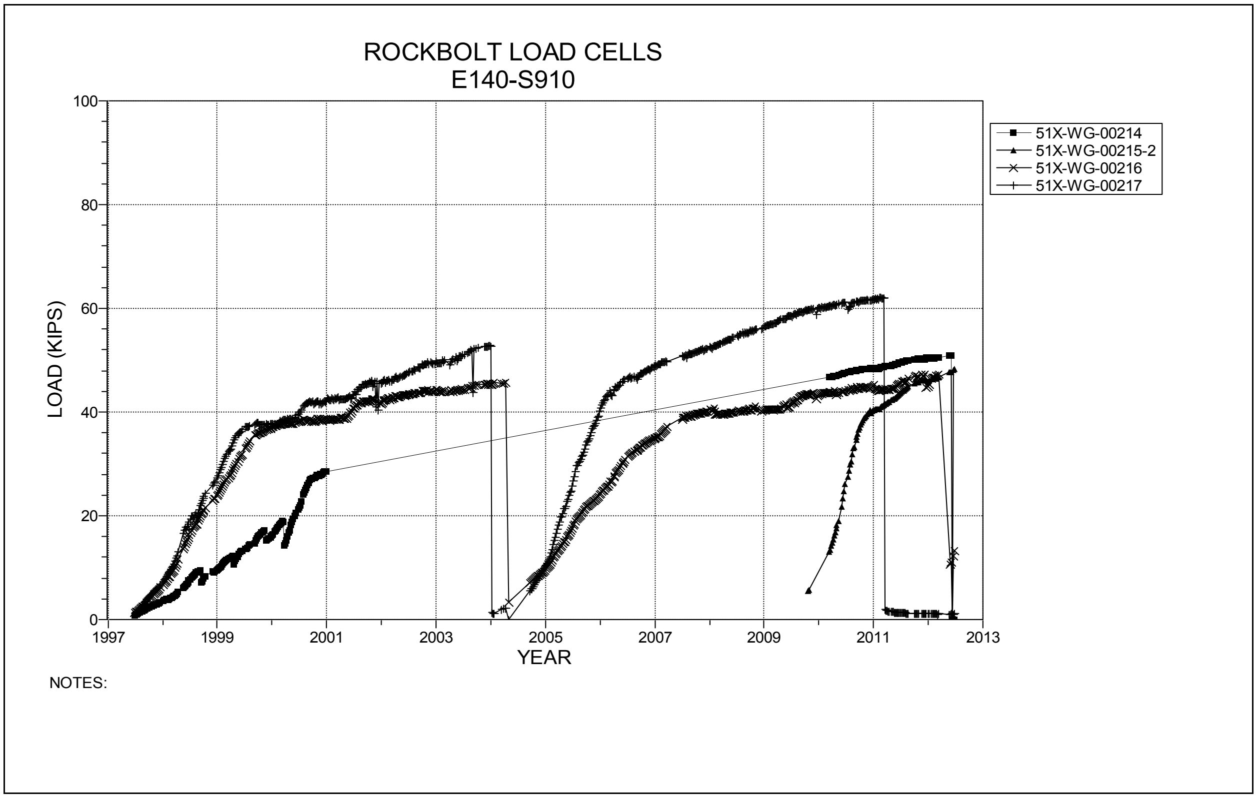


Figure 4-270 Rock Bolt Load Cells
E140 S910

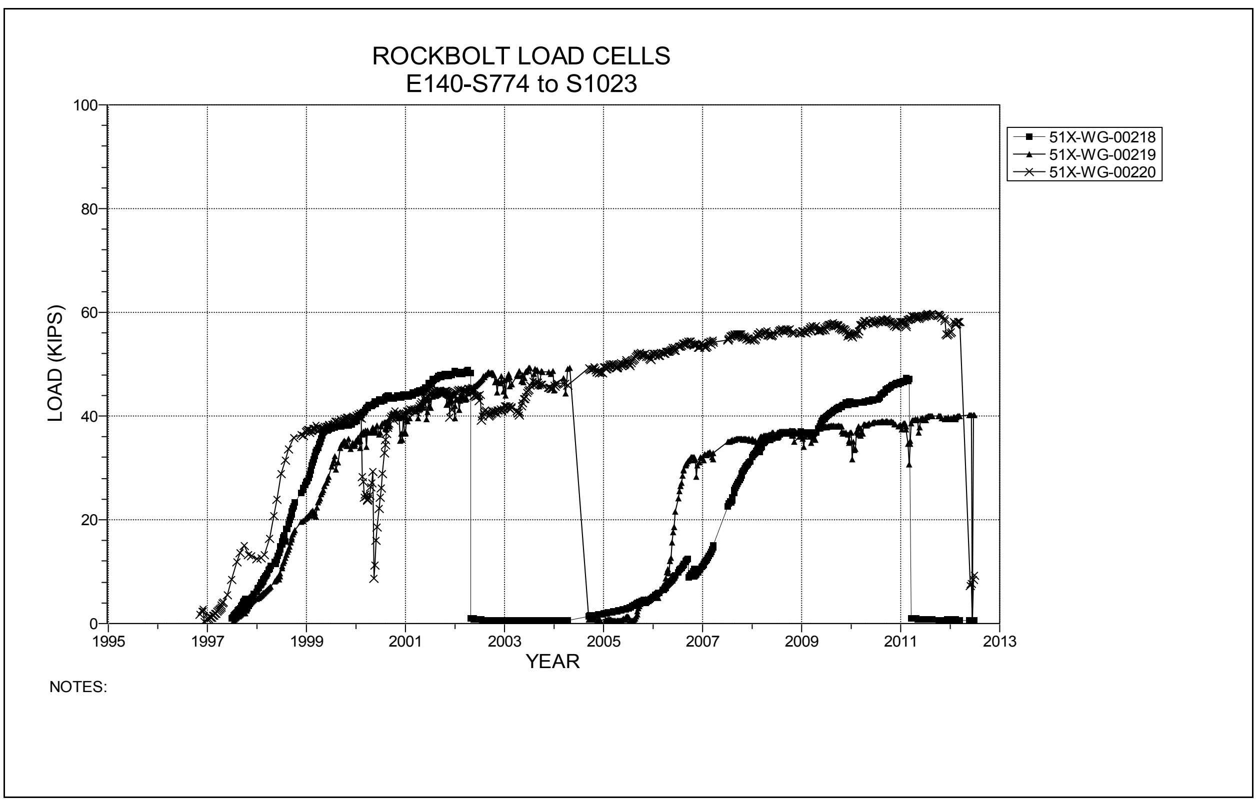


Figure 4-271 Rock Bolt Load Cells
E140 S774 – S1023

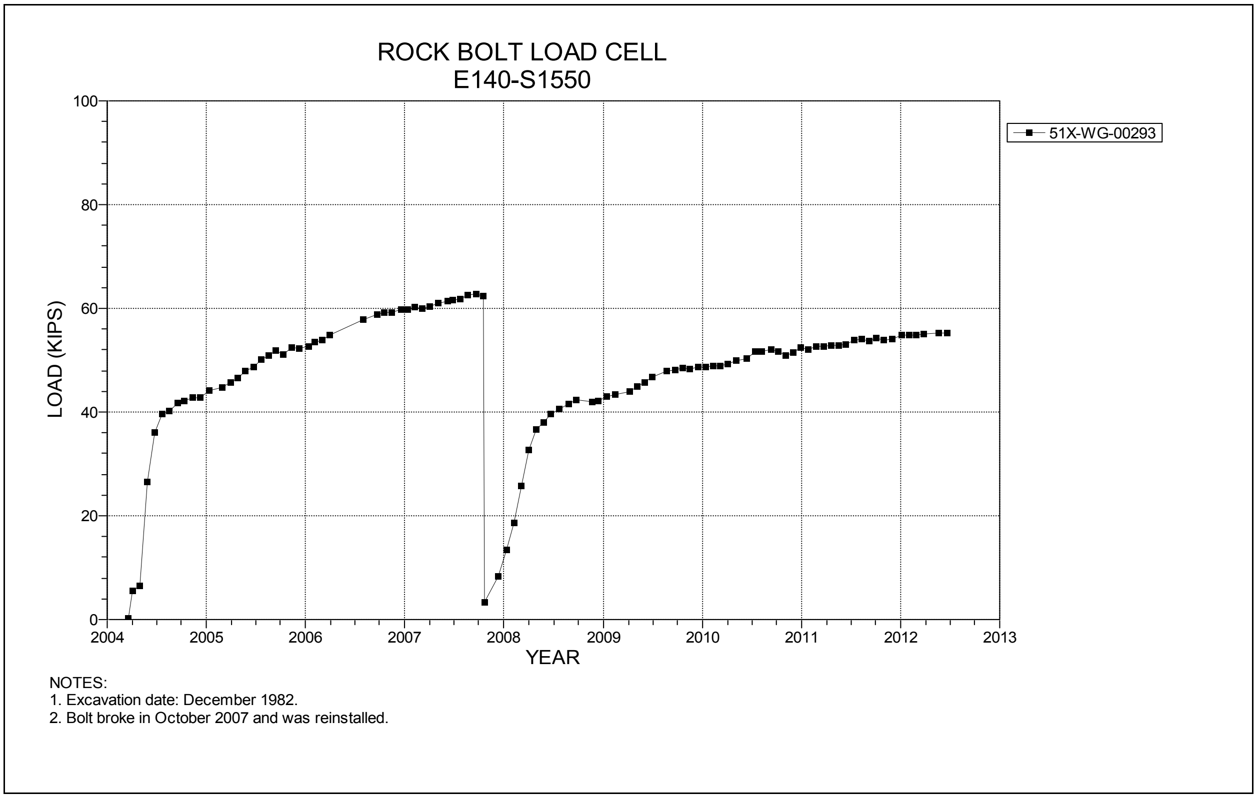


Figure 4-272 Rock Bolt Load Cell
E140 S1550

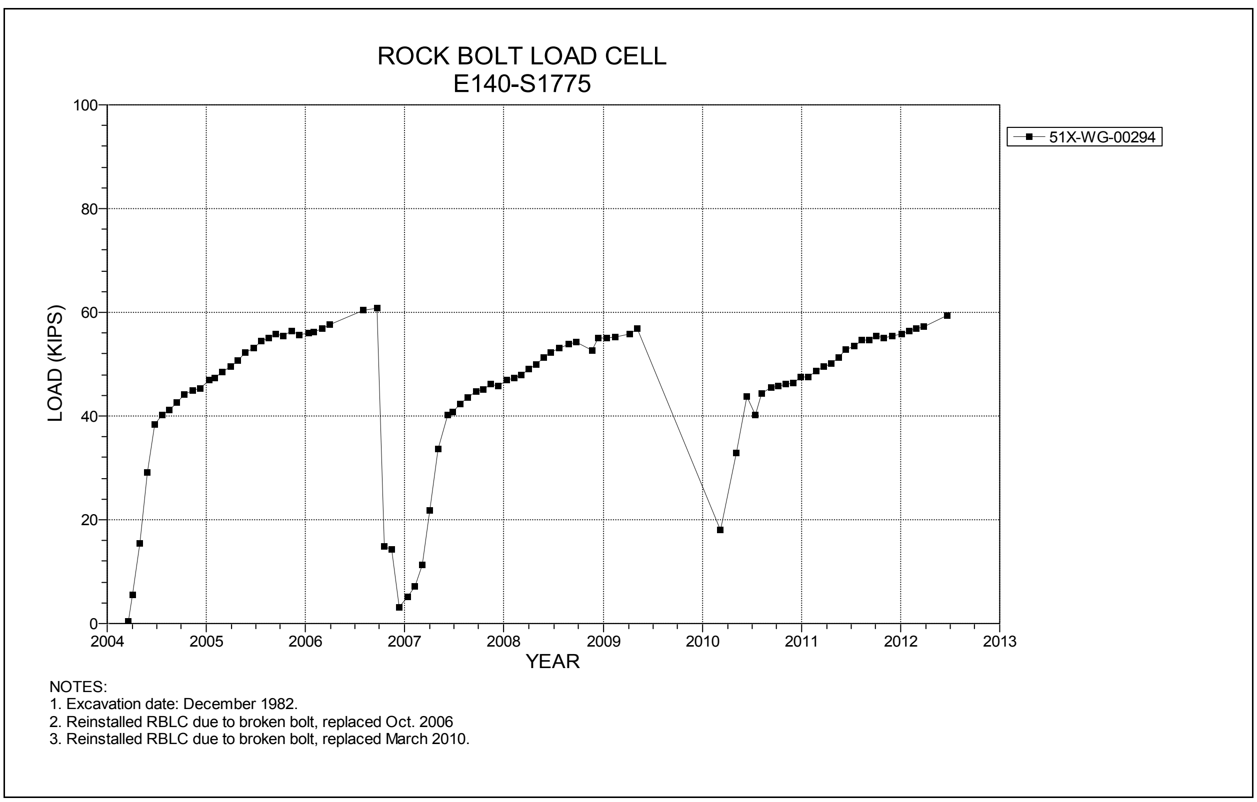
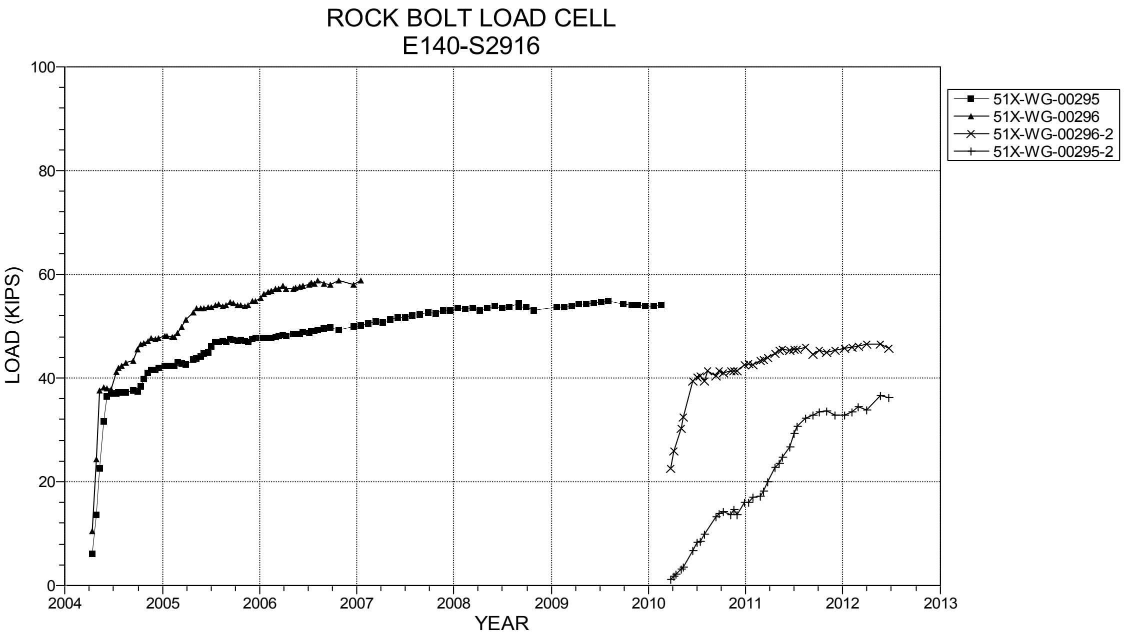
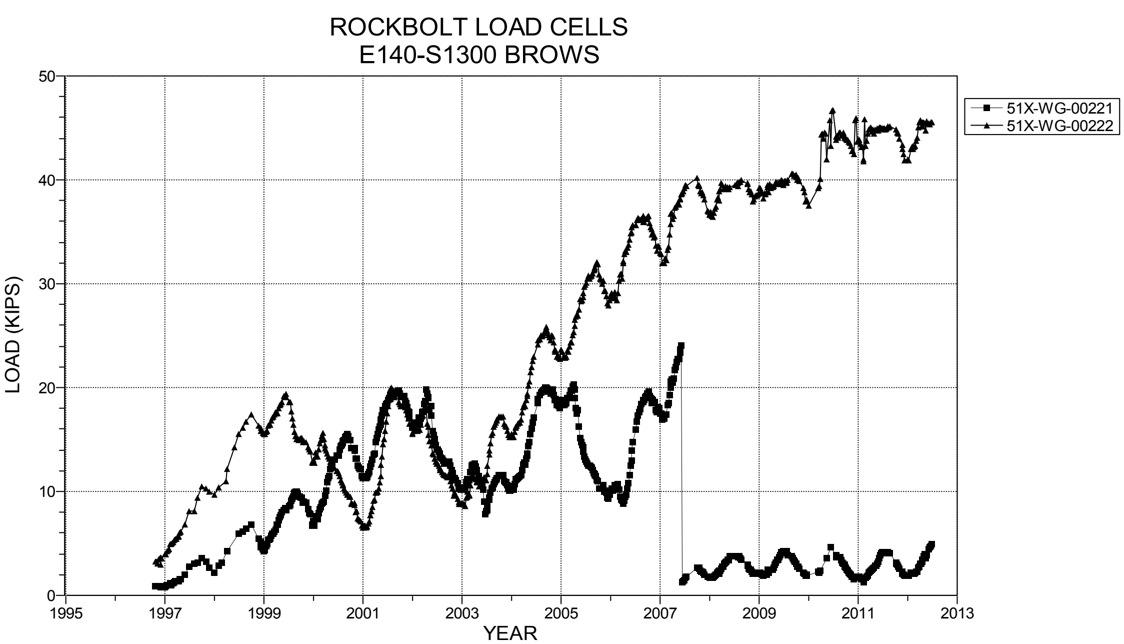


Figure 4-273 Rock Bolt Load Cell
E140 S1775



NOTES:
1. Excavation date: January 1983.
2. 51X-WG-00295-2 installed on replacement bolt 03/2010.
3. 51X-WG-00296-2 installed on replacement bolt 03/2010.

Figure 4-274 Rock Bolt Load Cells
E140 S2916



NOTES:
1. Excavation date: December 1982.
2. 51X-WG-00221 is located on the E120 brow and 51X-WG-00222 is on the E160 brow.

Figure 4-275 Rock Bolt Load Cells
E140 S1300 Brows

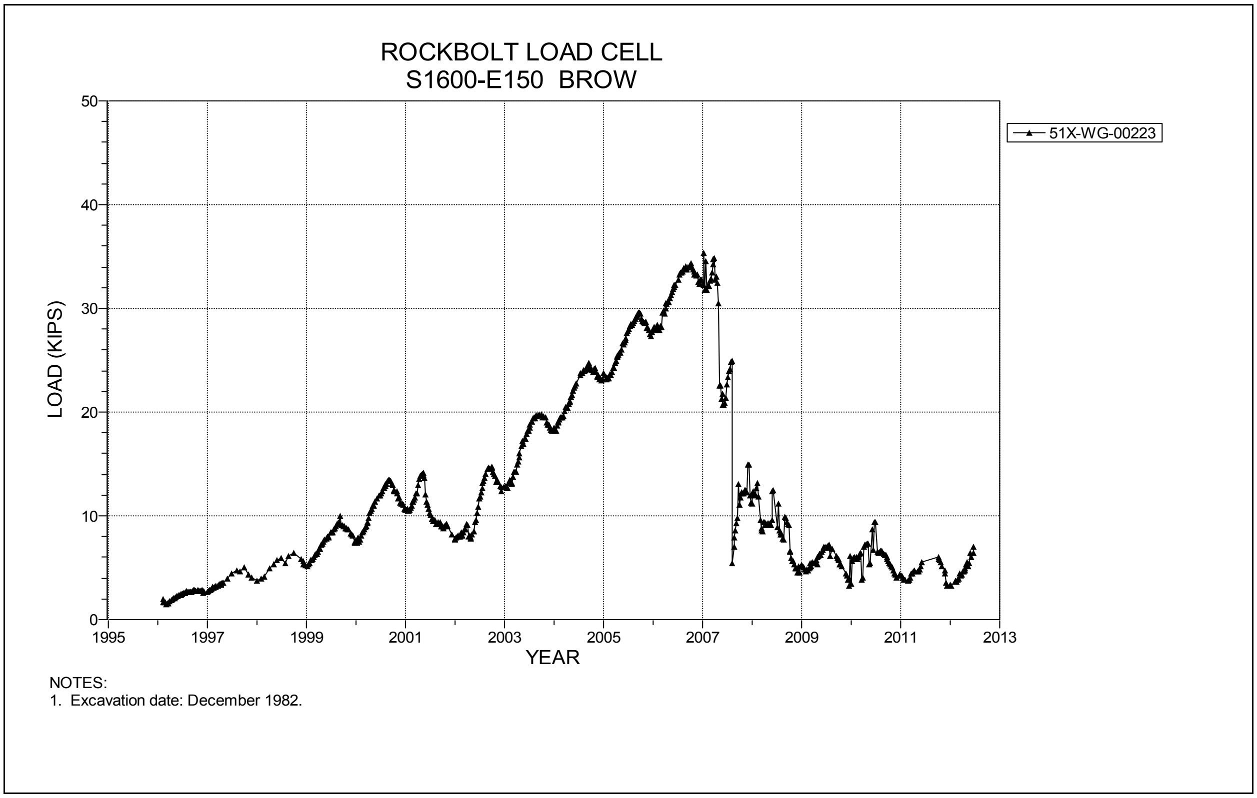


Figure 4-276 Rock Bolt Load Cell
E1600 E150 Brow

.This page was intentionally left blank.

5.0 Instrumentation Summary for the Waste Disposal Area

This chapter presents a summary of the data collected from instruments located in the Waste Disposal Area at the WIPP. Table 5-1 presents data and analysis of the access drifts associated with Panel 1. Plots of the instrument data are presented as Figures 5-1 through 5-14.

Table 5-2 presents data and analysis of the access drifts associated with Panel 2. Plots of the instrument data are presented as Figures 5-15 and 5-16.

Panel 3 data and analysis are presented on Table 5-3. Plots of the instrument data are presented as Figures 5-17 through 5-18.

Table 5-4 presents data and analysis of Panel 4. The instrument data plot is presented as Figure 5-19.

Table 5-5 presents data and analysis of Panel 5. Plots of the instrument data are presented as Figures 5-20 and 5-21.

Table 5-6 presents data and analysis of Panel 6. Plots of the instrument data are presented as Figures 5-22 through 5-81.

Table 5-7 presents data and analysis of Panel 7. Plots of the instrument data are presented as Figures 5-82 through 5-139.

Table 5-1
Panel 1 Access Drifts Data Analysis

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011 to 2012 Date	Last Reading 2011 to 2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
S1600-E311-2 A-C	S1600-E311	5-1	06/28/12	16.827	22.274	0.9	0.8	13%	
S1600-E332-3 A-C	S1600-E332	5-2	06/28/12	16.259	20.686	1.0	0.9	11%	
S1600-E357-2 A-C	S1600-E357	5-3	06/28/12	19.031	24.429	1.3	1.1	18%	
S1600-E382-2 A-C	S1600-E382	5-4	06/28/12	18.724	24.104	1.2	1.0	20%	
S1600-E407-2 A-G	S1600-E407	5-5	06/28/12	20.915	26.357	1.4	1.2	17%	
S1600-E407-2 B-F	S1600-E407	5-5	06/28/12	19.356	24.362	1.3	1.1	18%	
S1600-E407-2 H-L	S1600-E407	5-5	06/28/12	20.317	25.382	1.4	1.3	8%	
S1600-E432-2 A-C	S1600-E432	5-6	06/28/12	24.388	31.147	1.8	1.5	20%	
S1600-E453 A-C	S1600-E453	5-7	06/28/12	5.138	5.138	0.7	0.7	0%	
S1600-E453 B-D	S1600-E453	5-7	06/28/12	4.848	4.848	0.6	0.7	-14%	
S1950-E311-7 A-C	S1950-E311	5-8	06/28/12	2.815	32.206	1.5	1.5	0%	
S1950-E311-3 B-D	S1950-E311	5-8	06/28/12	17.832	30.833	1.4	1.6	-13%	
S1950-E332-4 A-C	S1950-E332	5-9	06/28/12	20.615	39.217	1.9	1.7	12%	
S1950-E332-4 B-D	S1950-E332	5-9	04/30/12	15.776	33.722	1.9	1.8	6%	
S1950-E357-7 A-C	S1950-E357	5-10	06/28/12	26.336	46.500	2.5	2.3	9%	
S1950-E357-4 B-D	S1950-E357	5-10	06/28/12	17.107	35.566	2.0	1.8	11%	
S1950-E382-5 A-C	S1950-E382	5-11	06/28/12	30.913	49.548	2.9	2.7	7%	
S1950-E382-3 B-D	S1950-E382	5-11	06/28/12	23.962	38.344	1.9	2.1	-10%	
S1950-E407-4 A-G	S1950-E407	5-12	06/28/12	30.512	52.336	2.8	2.6	8%	
S1950-E407-3 H-L	S1950-E407	5-12	06/28/12	29.818	50.550	2.5	2.4	4%	
S1950-E407-3 D-J	S1950-E407	5-13	06/28/12	25.024	39.201	2.0	2.0	0%	
S1950-E432-3 A-C	S1950-E432	5-14	06/28/12	30.016	51.811	2.7	2.4	13%	
S1950-E432-3 B-D	S1950-E432	5-14	06/28/12	23.395	37.796	1.9	1.7	12%	

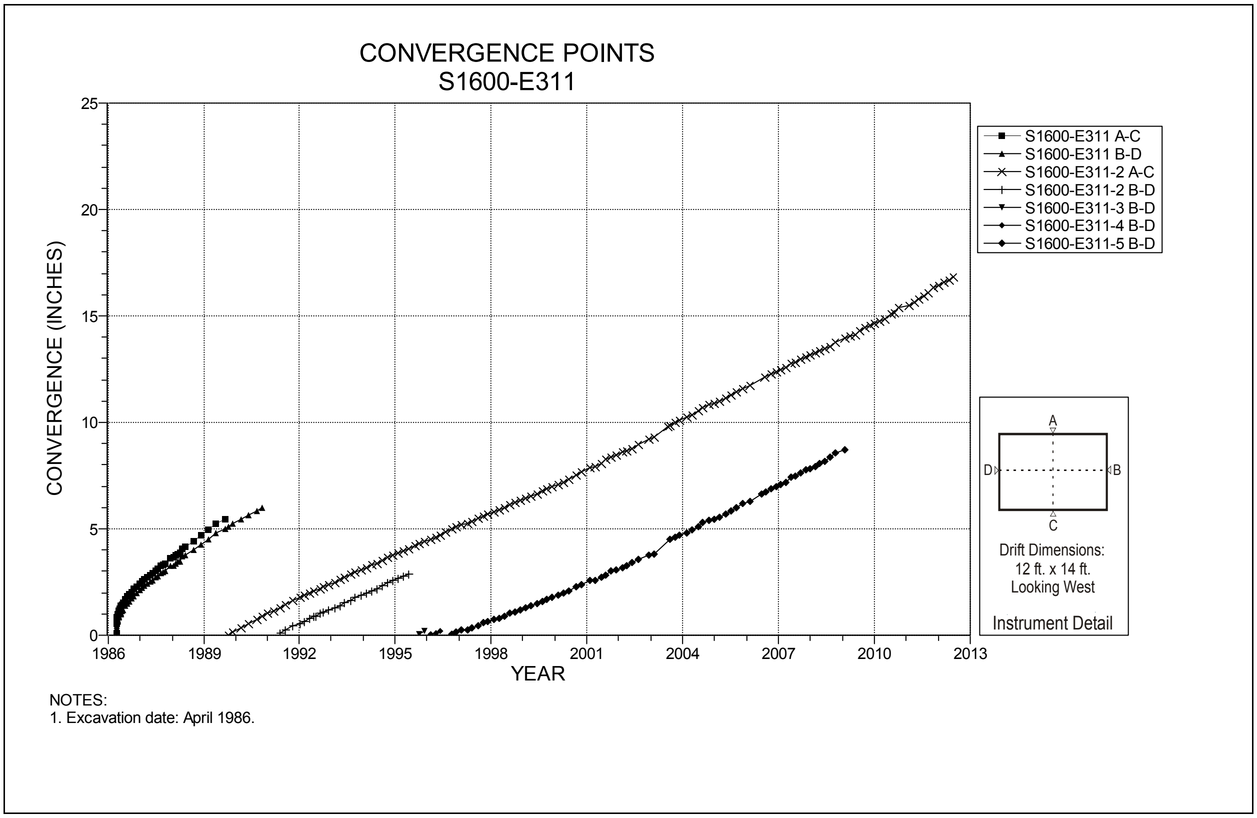


Figure 5-1 Convergence Point Array
S1600 E311 – All Chords

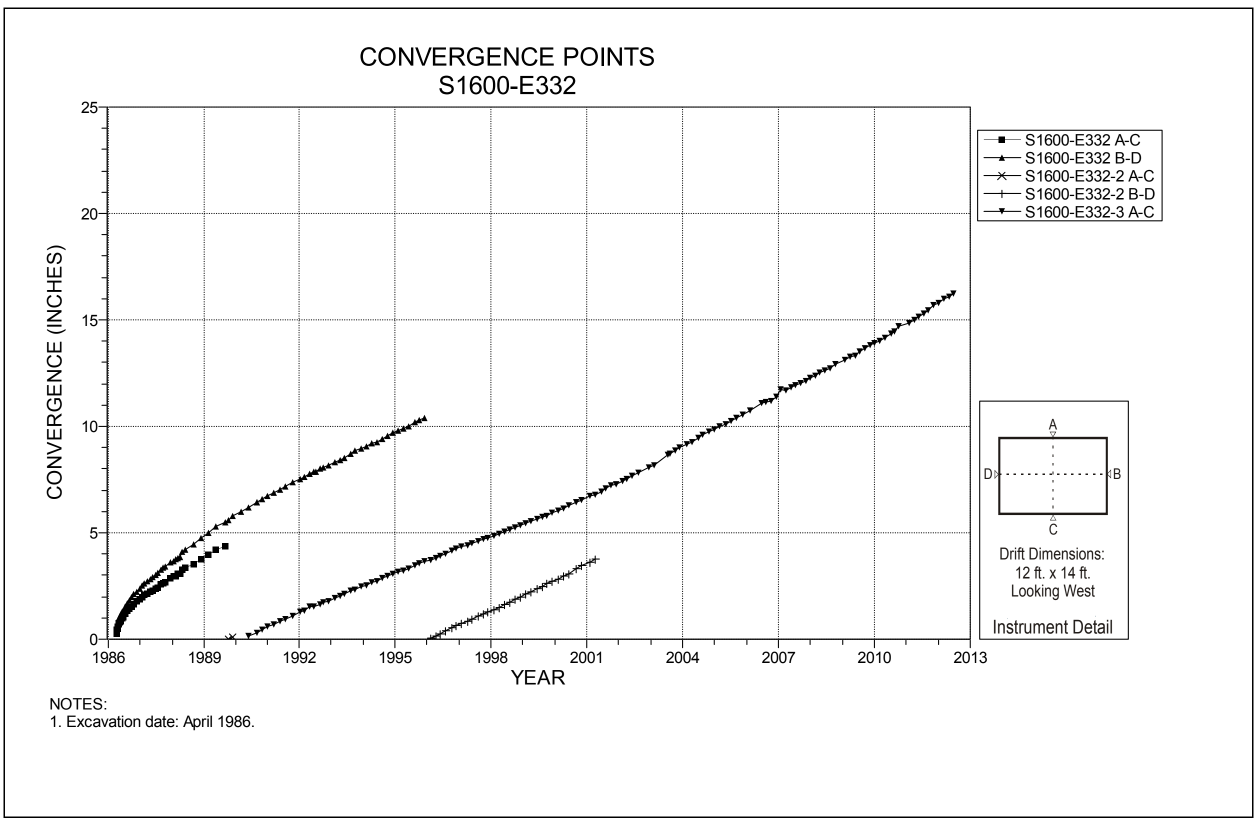


Figure 5-2 Convergence Point Array
S1600 E332 – All Chords

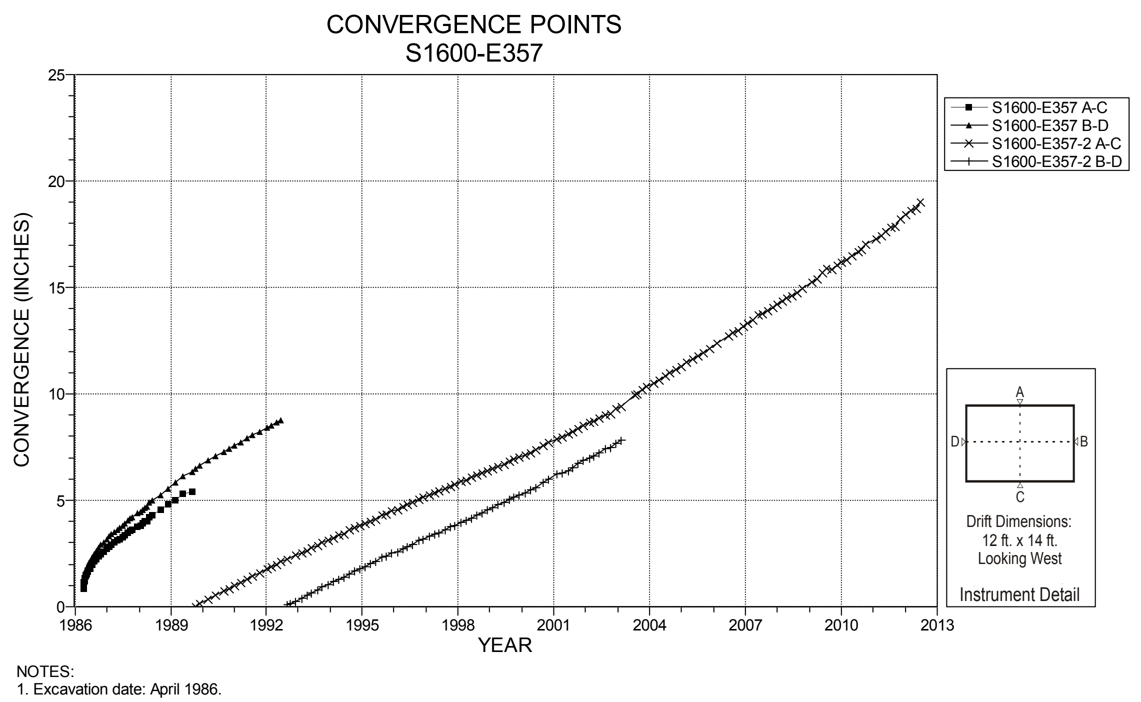


Figure 5-3 Convergence Point Array
S1600 E357 – All Chords

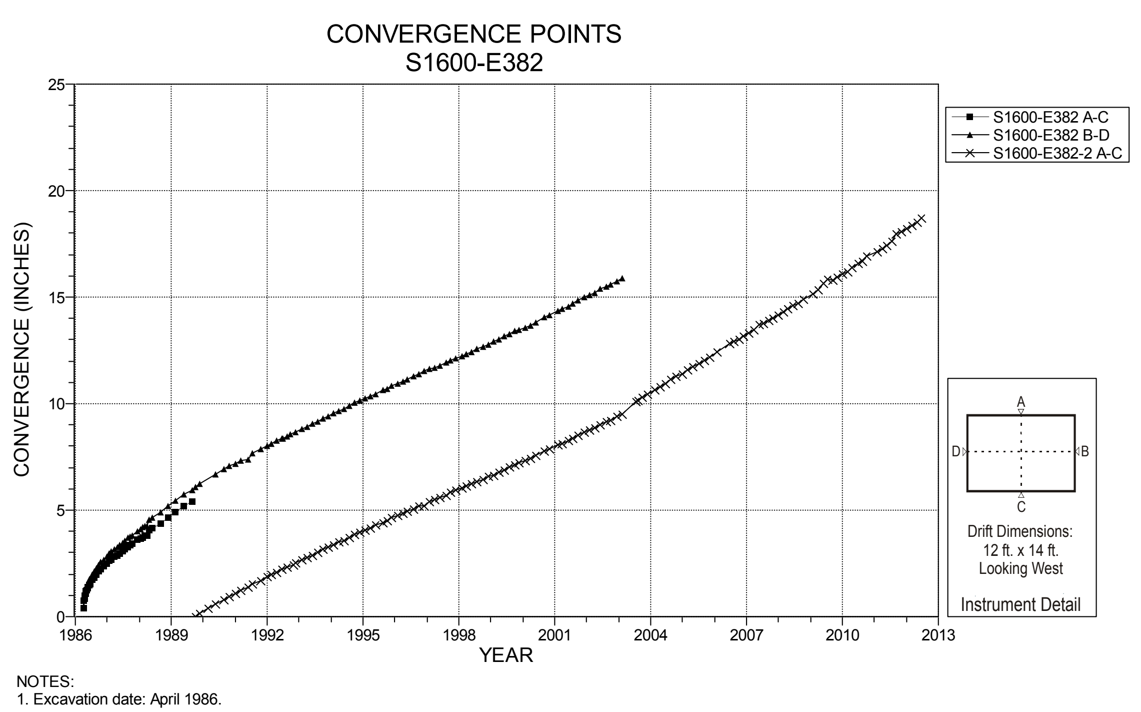


Figure 5-4 Convergence Point Array
S1600 E382 – All Chords

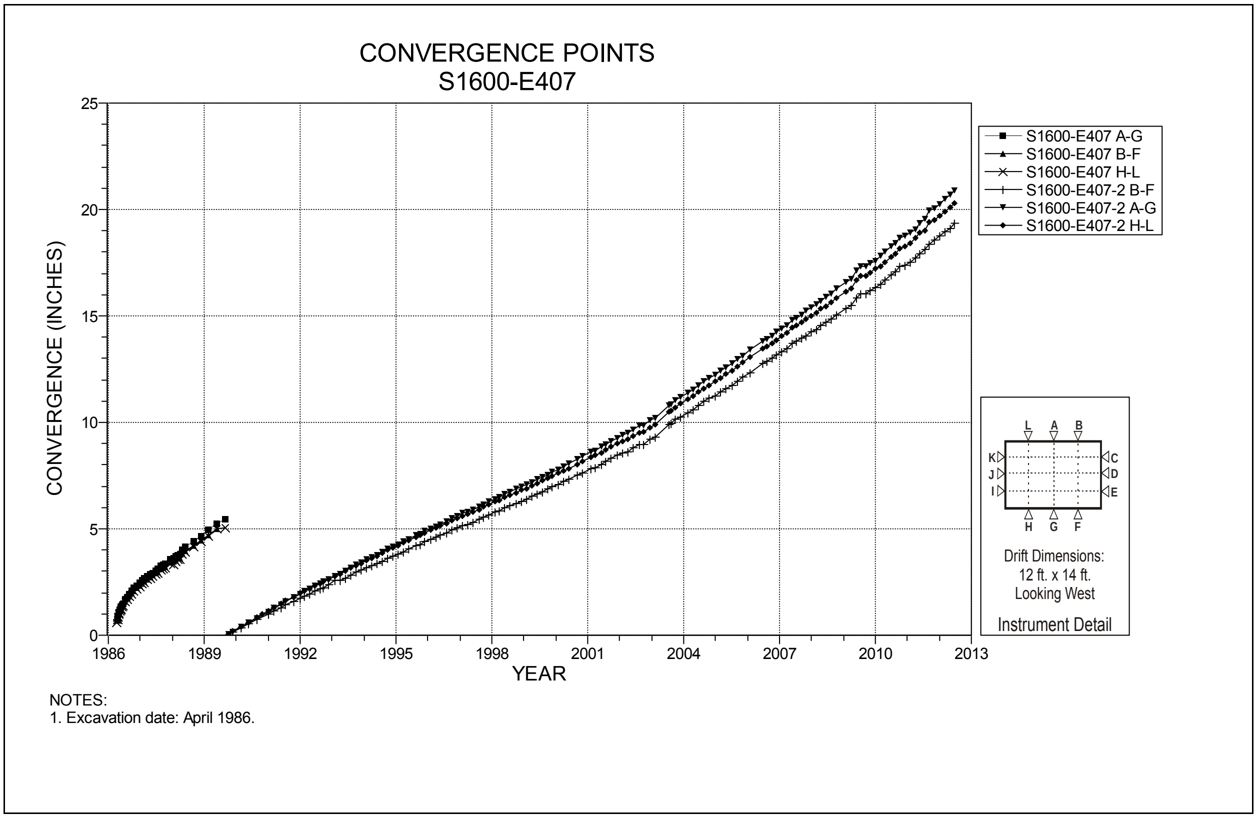


Figure 5-5 Convergence Point Array
S1600 E407 – All Vertical Chords

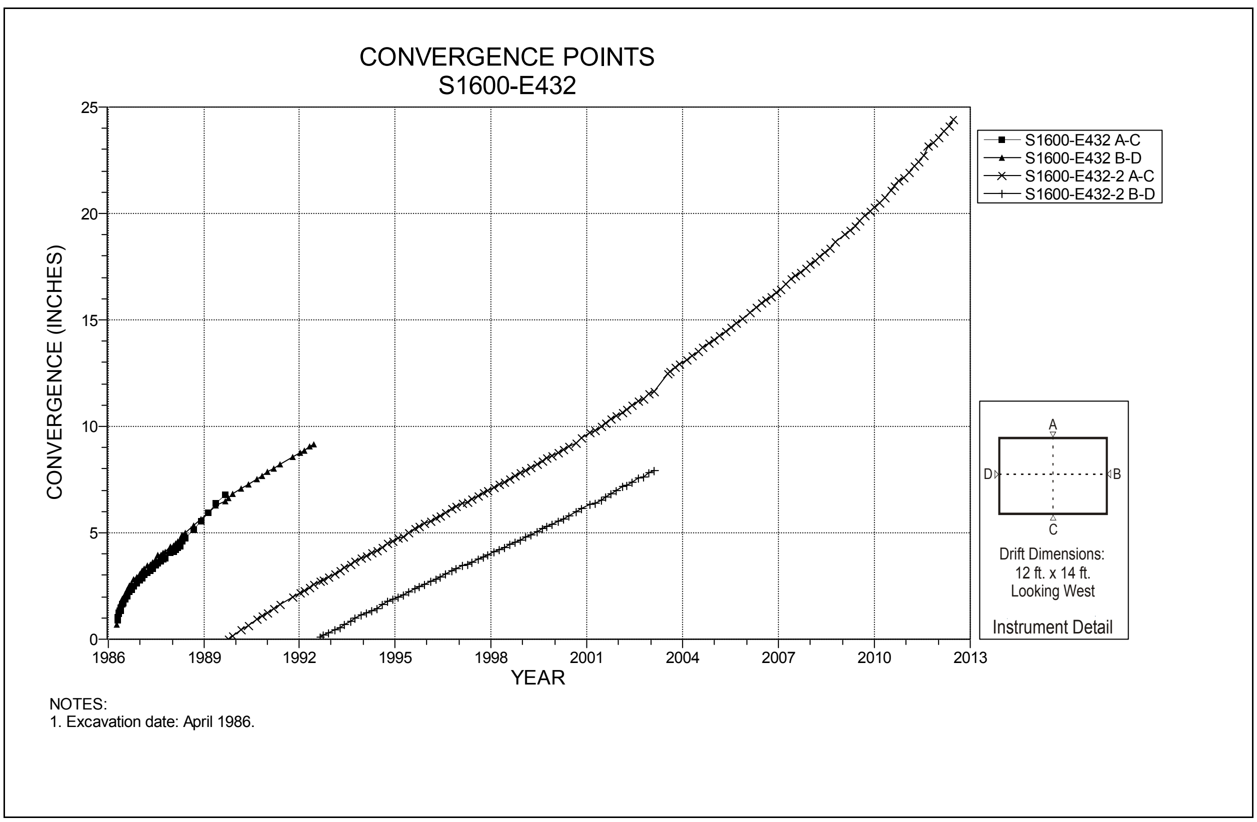


Figure 5-6 Convergence Point Array
S1600 E432 – All Chords

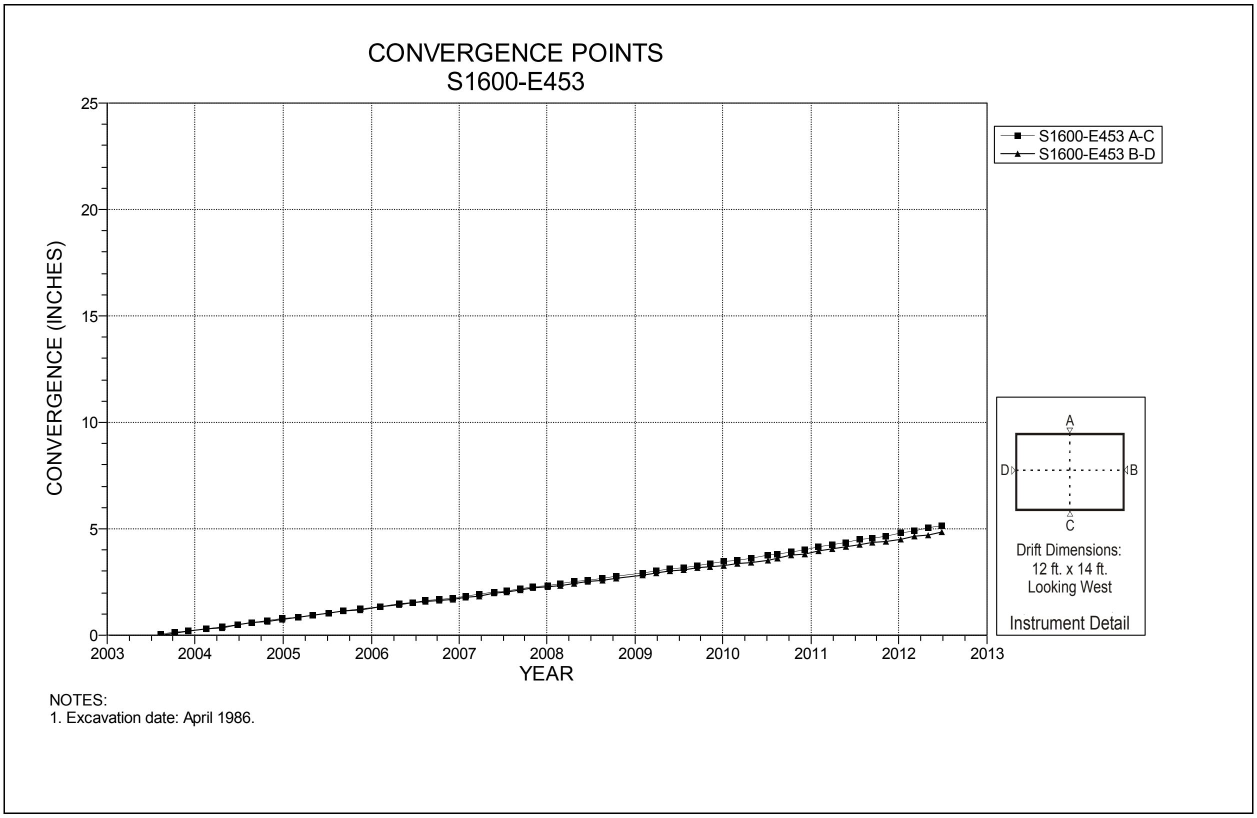


Figure 5-7 Convergence Point Array
S1600 E453 – All Chords

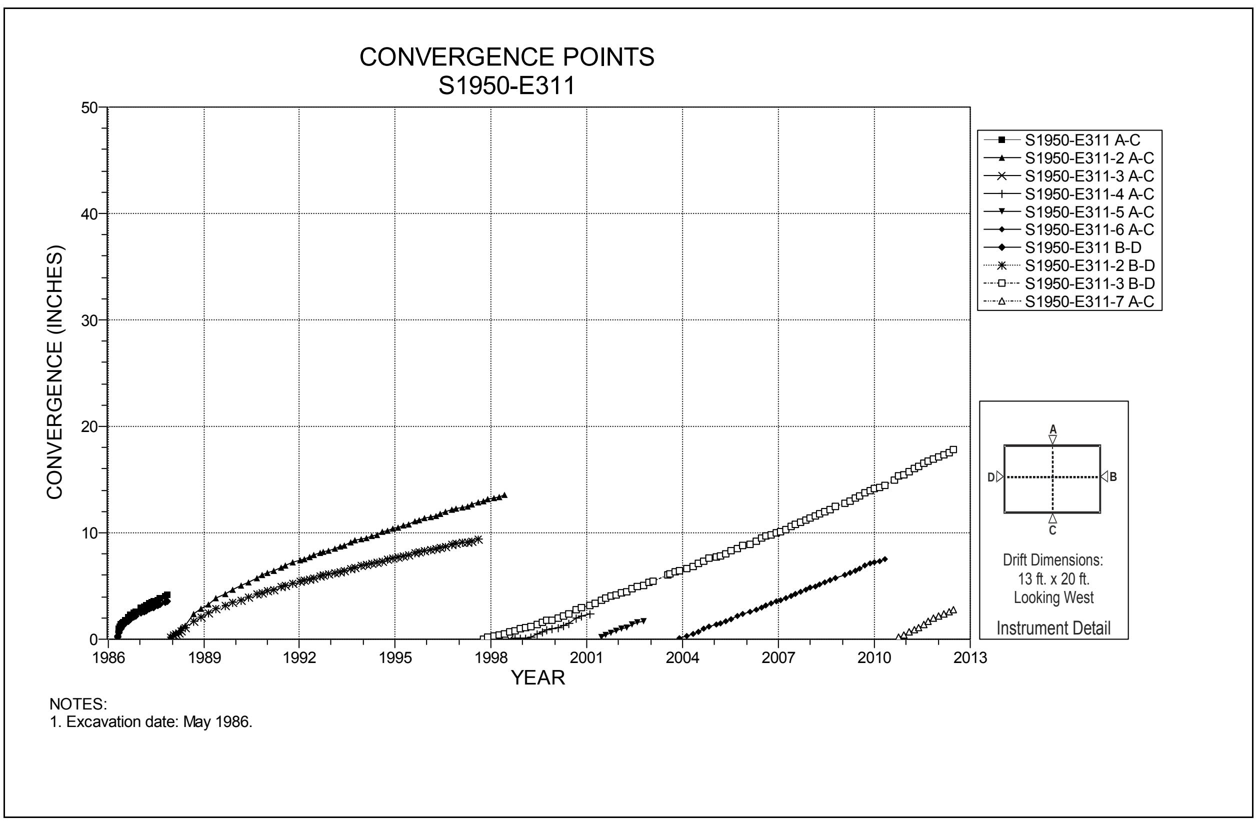


Figure 5-8 Convergence Point Array
S1950 E311 – All Chords

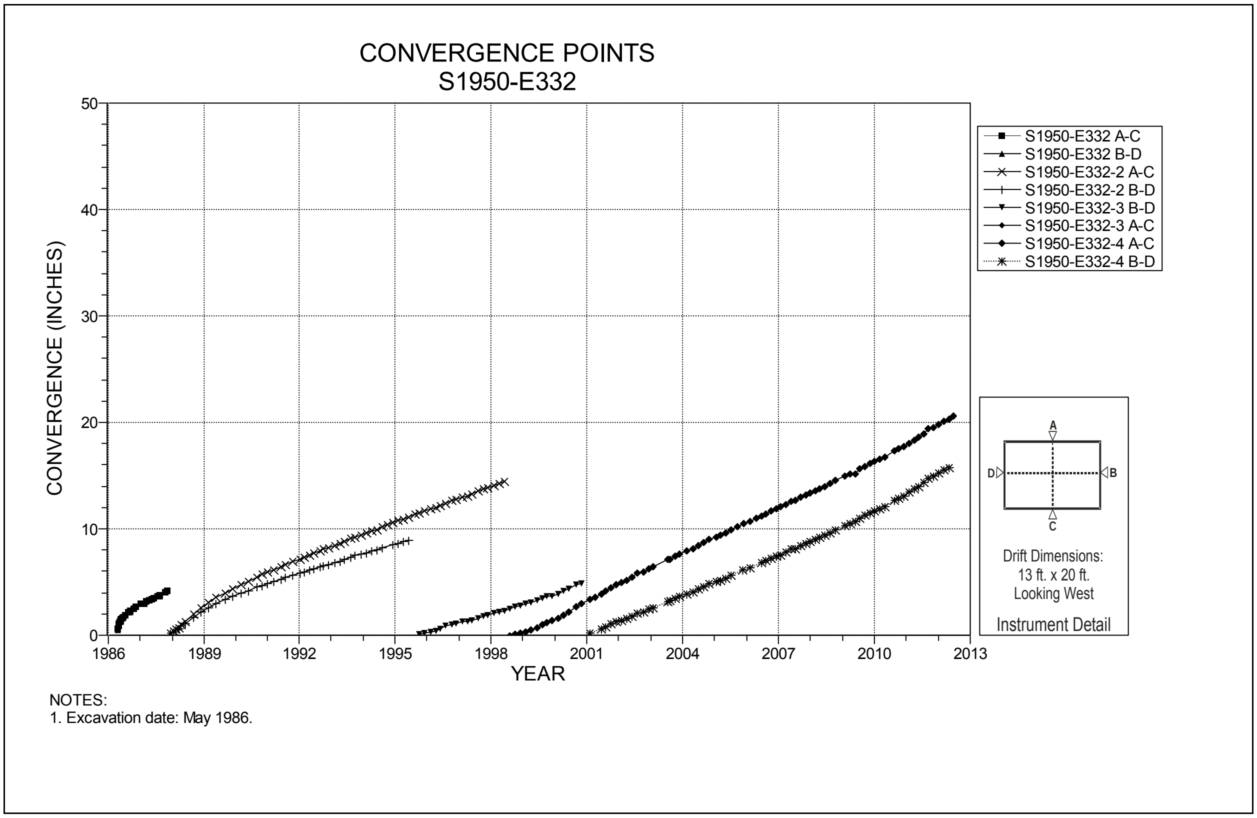


Figure 5-9 Convergence Point Array
S1950 E332 – All Chords

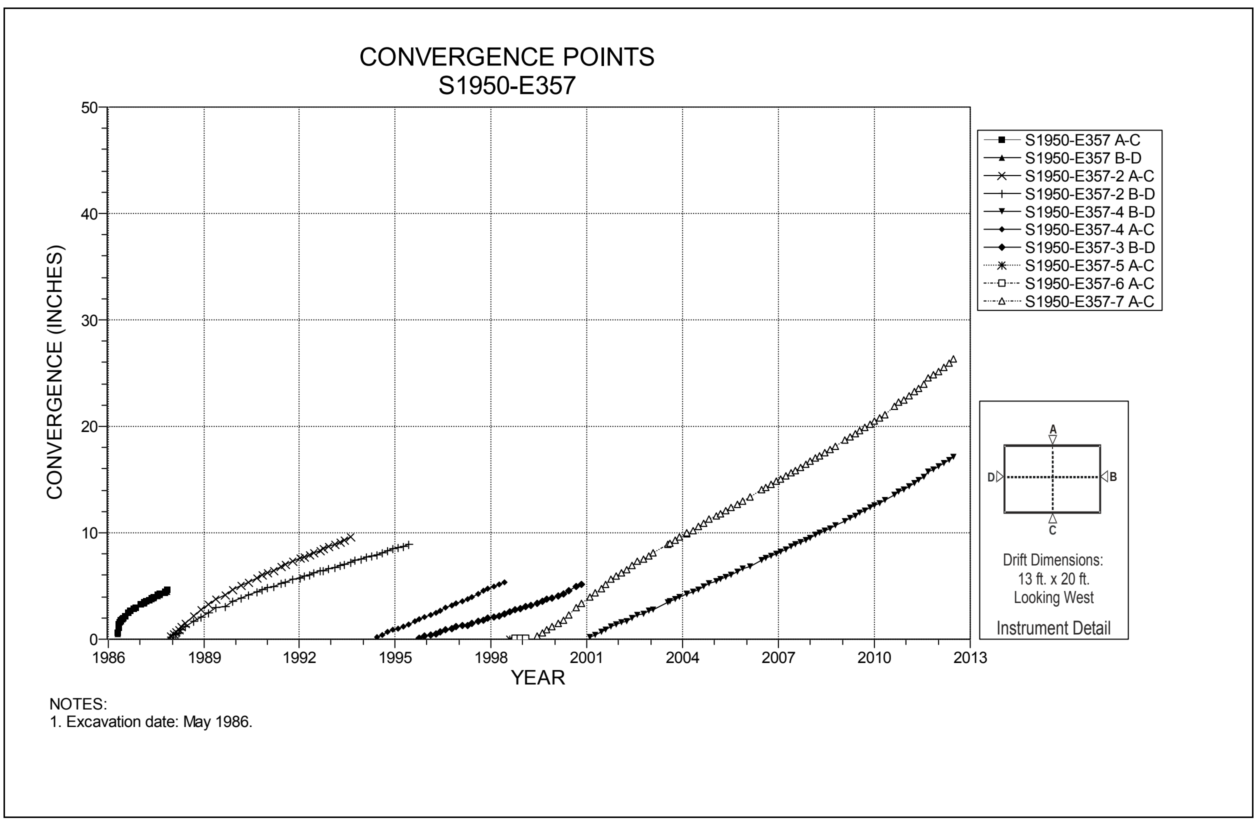


Figure 5-10 Convergence Point Array
S1950 E357 – All Chords

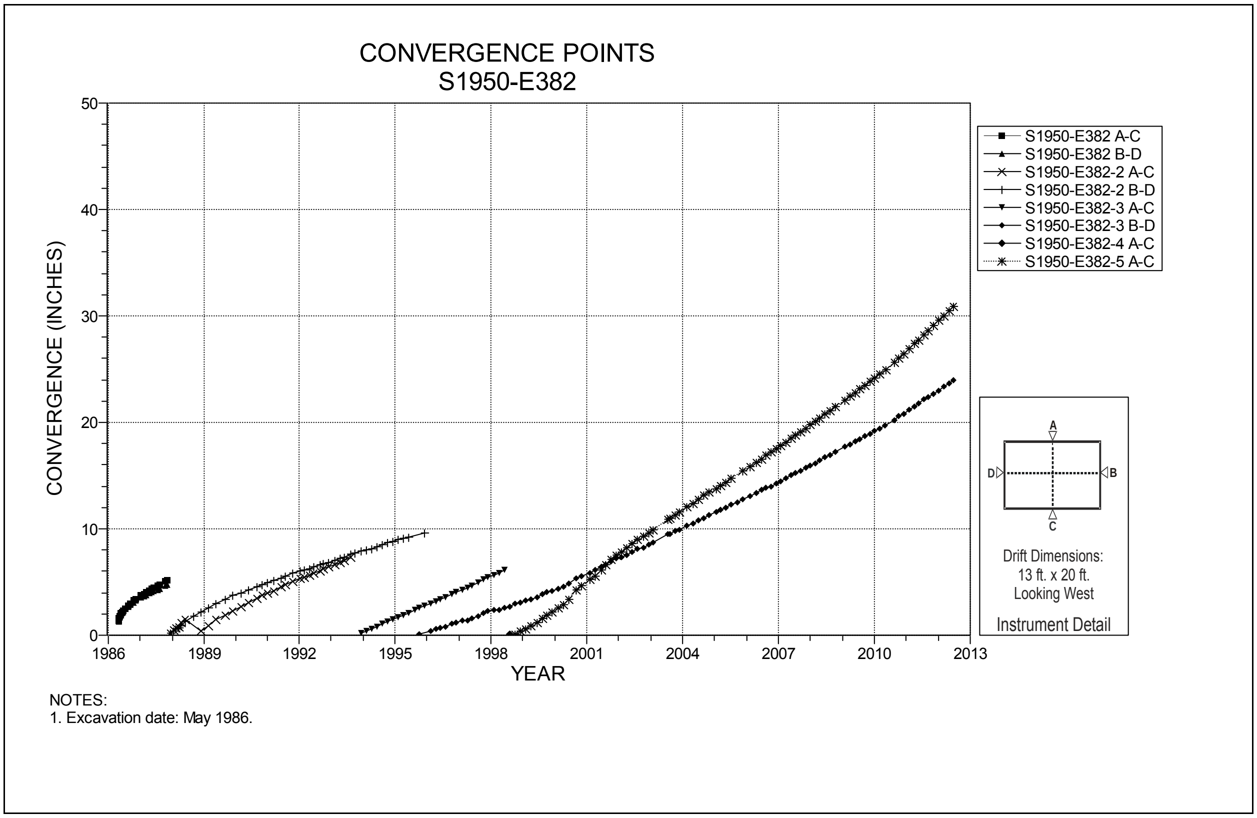


Figure 5-11 Convergence Point Array
S1950 E382 – All Chords

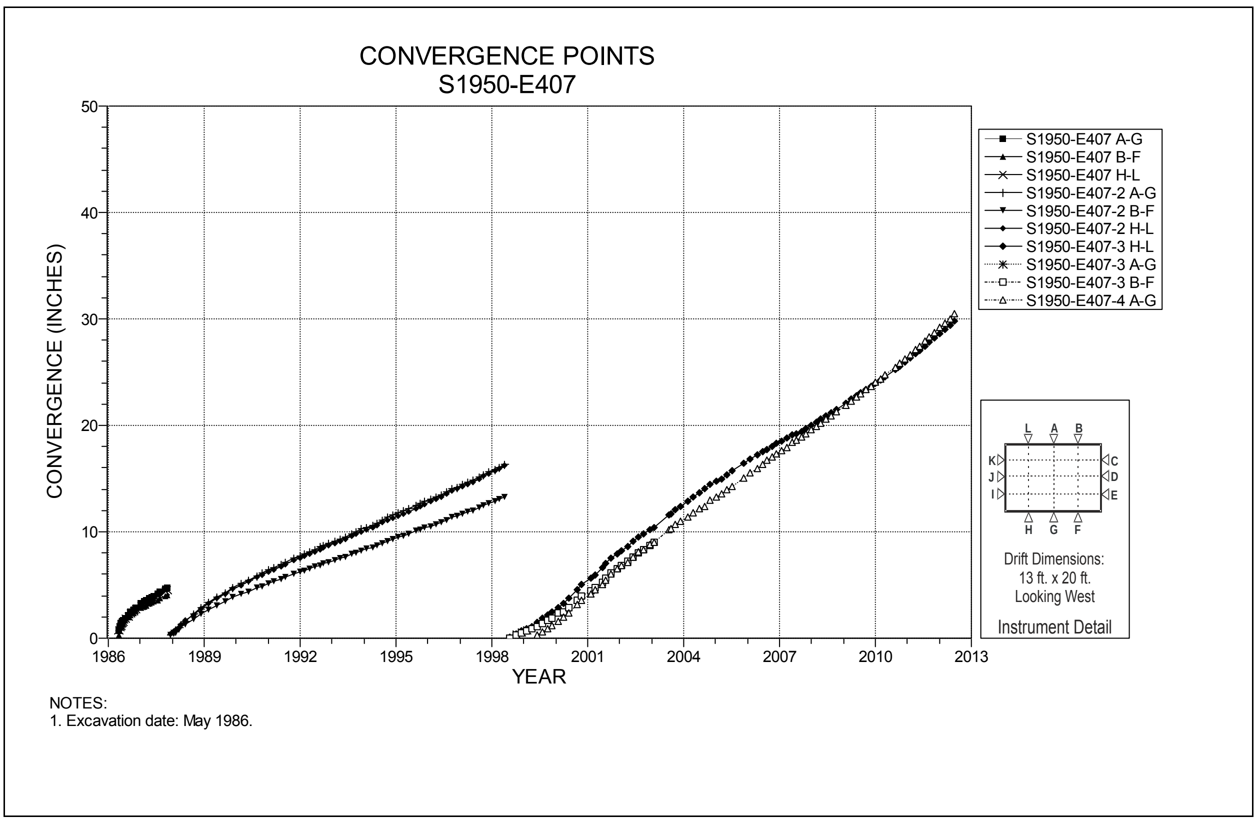


Figure 5-12 Convergence Point Array
S1950 E407 – Roof to Floor

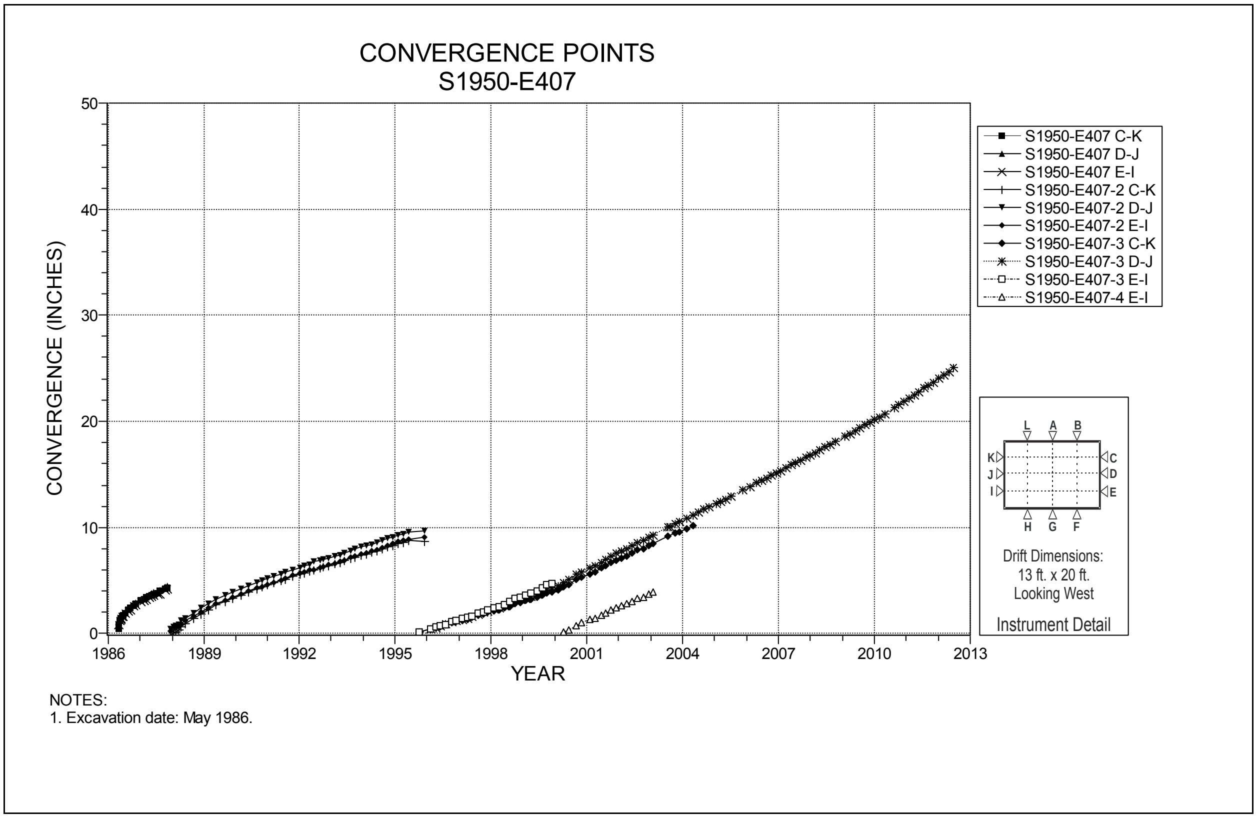


Figure 5-13 Convergence Point Array
S1950 E407 – Rib to Rib

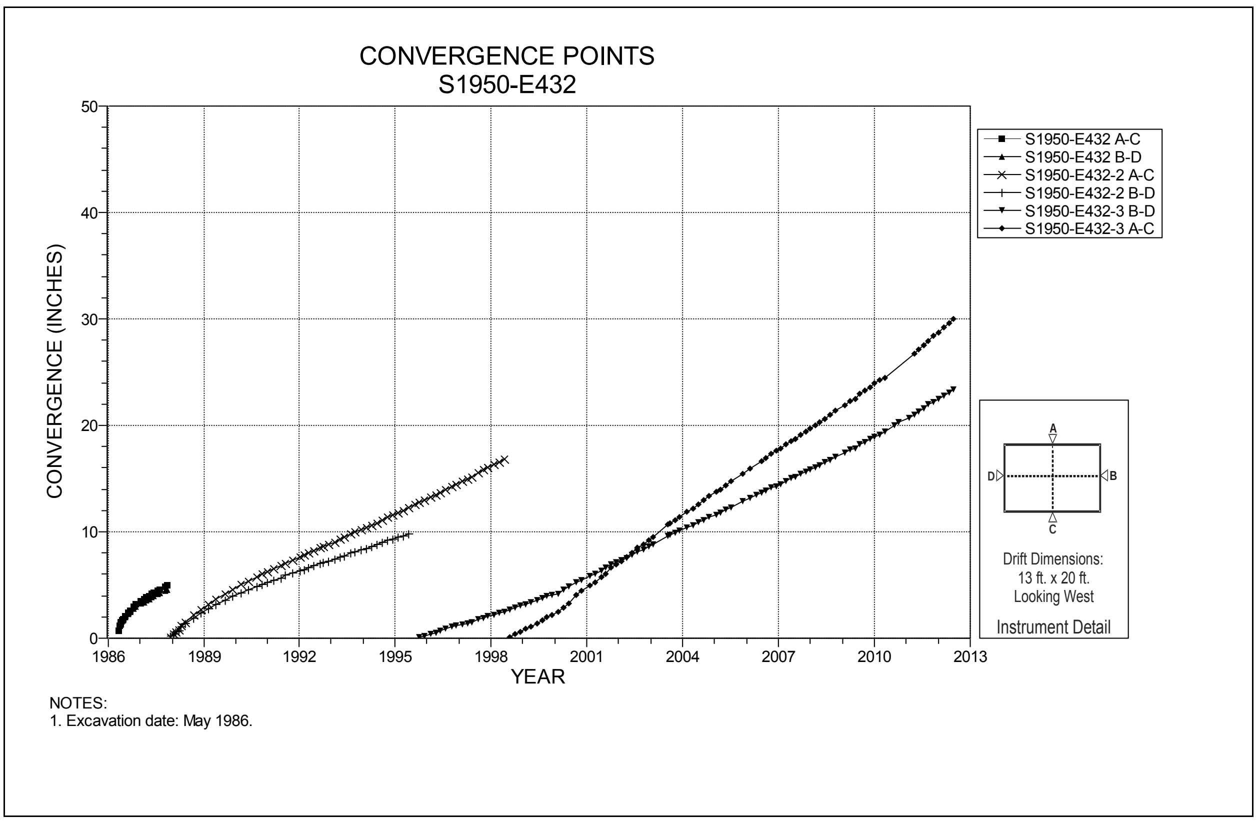


Figure 5-14 Convergence Point Array
S1950 E432 – All Chords

Table 5-2
Panel 2 Access Drifts Data Analysis

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011 to 2012		Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
			Date	Inches					
S2180-E410-2 A-C	S2180-E410	5-15	06/14/12	10.684	15.481	1.5	1.5	0%	
S2180-E410 B-D	S2180-E410	5-15	06/14/12	20.074	20.074	2.3	2.2	5%	
S2520-E410-3 A-C	S2520-E410	5-16	06/11/12	24.310	32.446	3.5	3.5	0%	

Table 5- Panel 2 Access Drifts Data Analysis

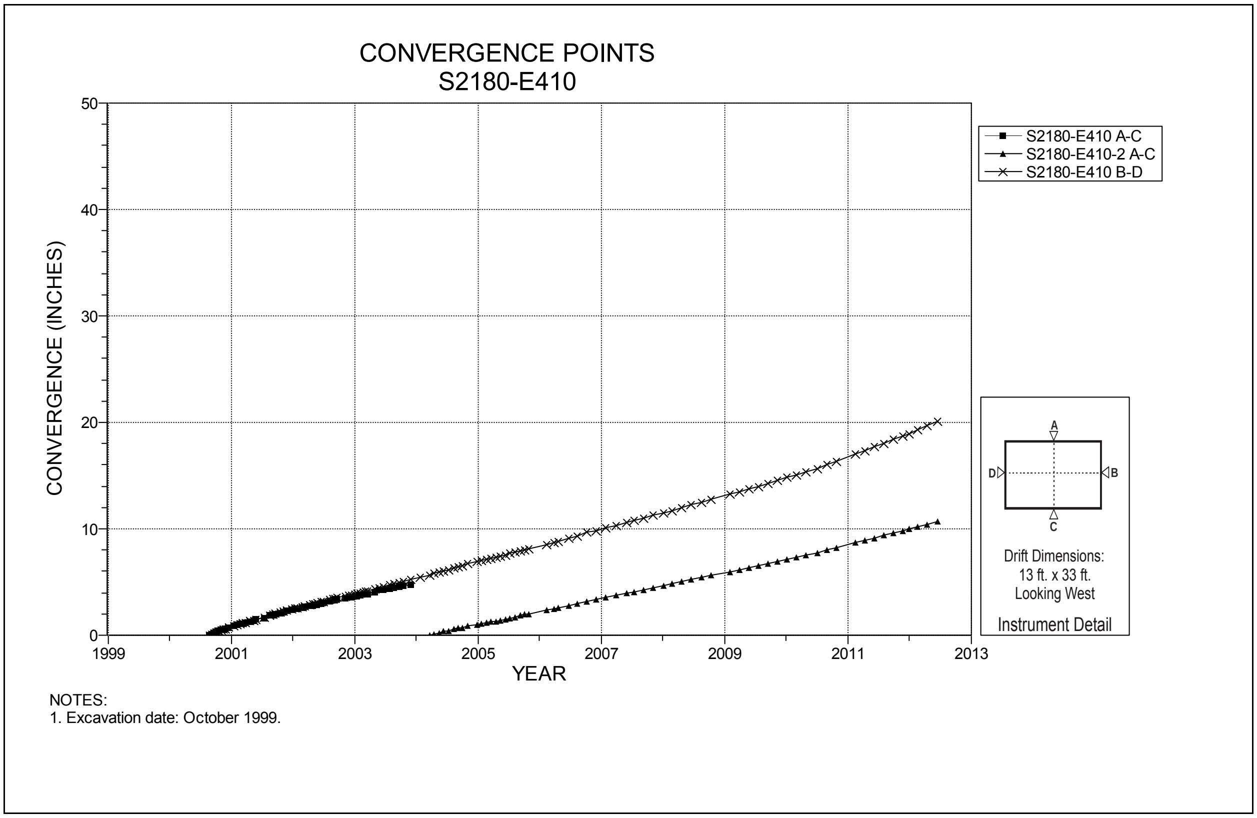


Figure 5-15 Convergence Point Array
S2180 E410 – All Chords

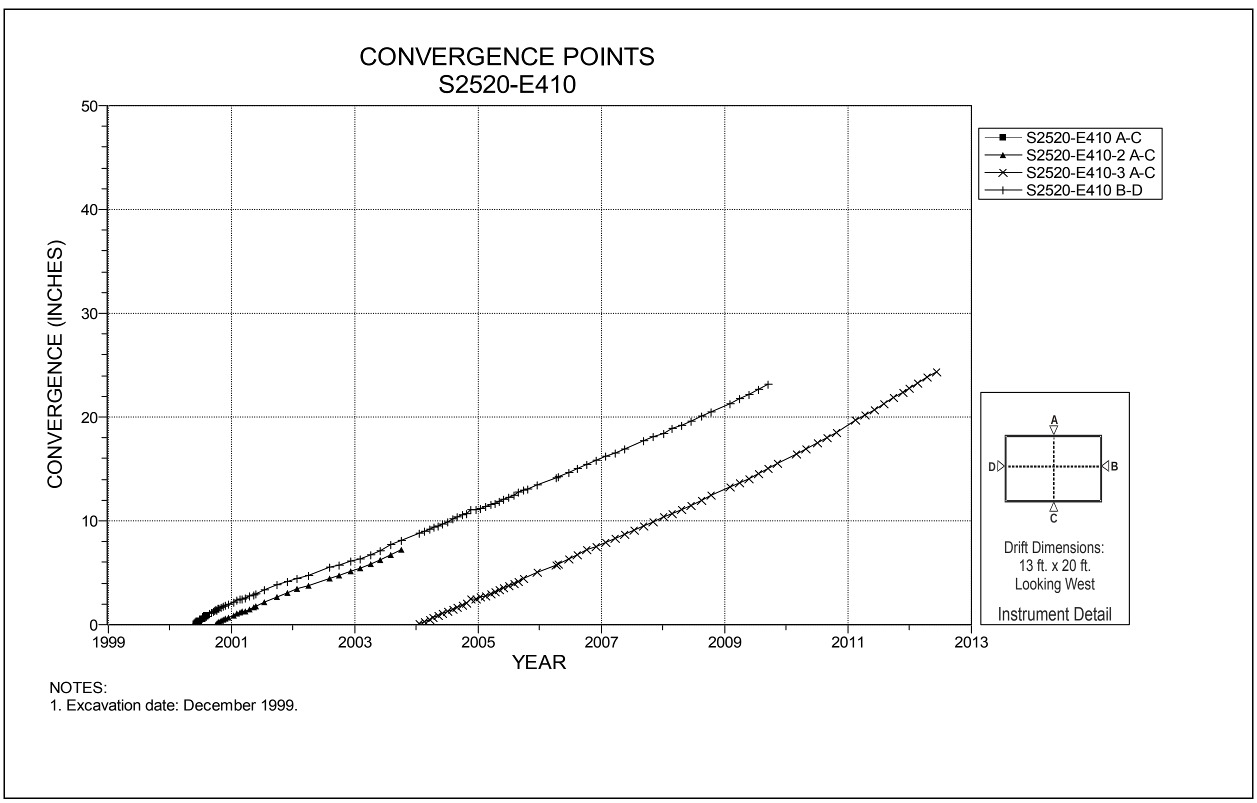


Figure 5-16 Convergence Point Array
S2520 E410 – All Chords

Table 5-3
Panel 3 Access Drift Data Analysis

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011 to 2012 Date	Last Reading 2011 to 2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
S2750-E410 A-C	S2750-E410	5-17	06/14/12	25.807	25.807	4.5	4.5	0%	
S2750-E410 B-D	S2750-E410	5-17	06/14/12	17.789	17.789	2.4	2.4	0%	
S3080-E410-2 A-C	S3080-E410	5-18	06/11/12	26.589	29.102	4.5	4.2	7%	
S3080-E410 B-D	S3080-E410	5-18	06/11/12	20.985	20.985	2.7	2.6	4%	

Working Copy

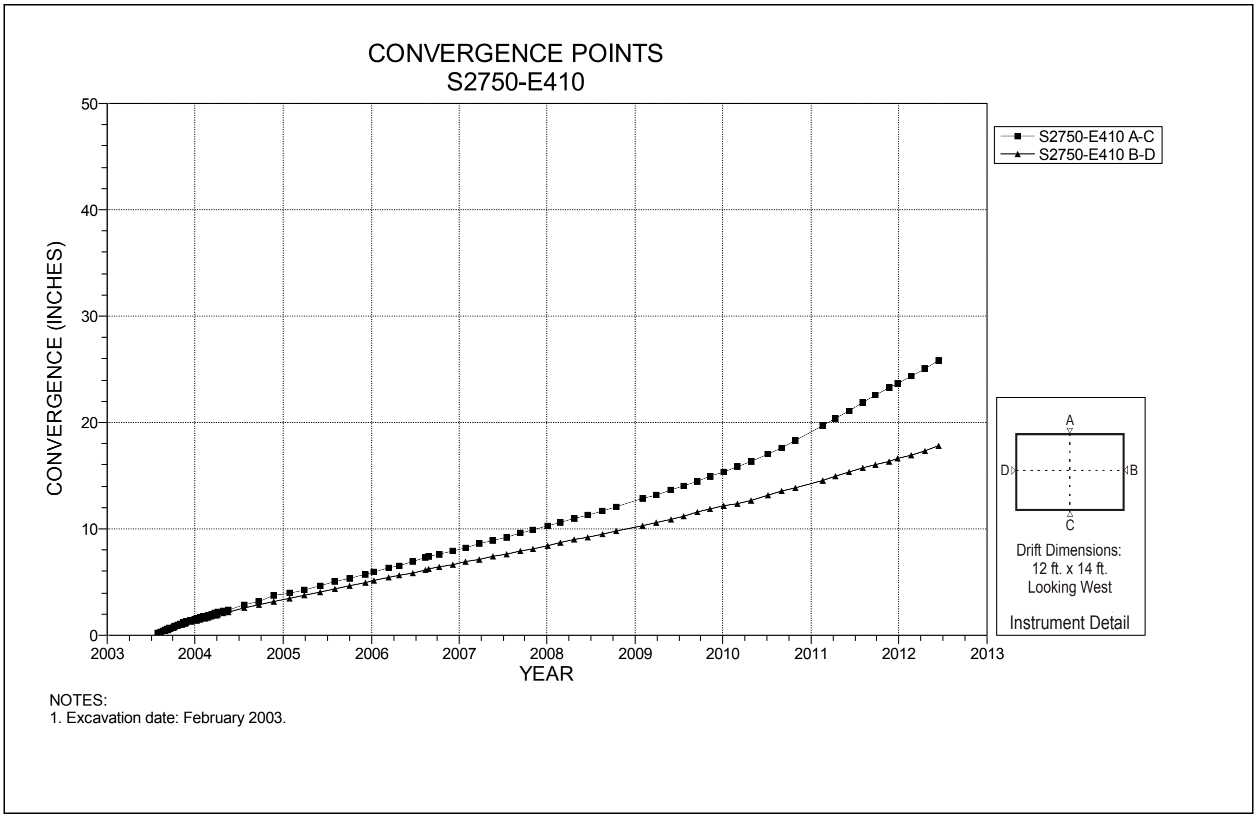


Figure 5-17 Convergence Point Array
S2750 E410 – All Chords

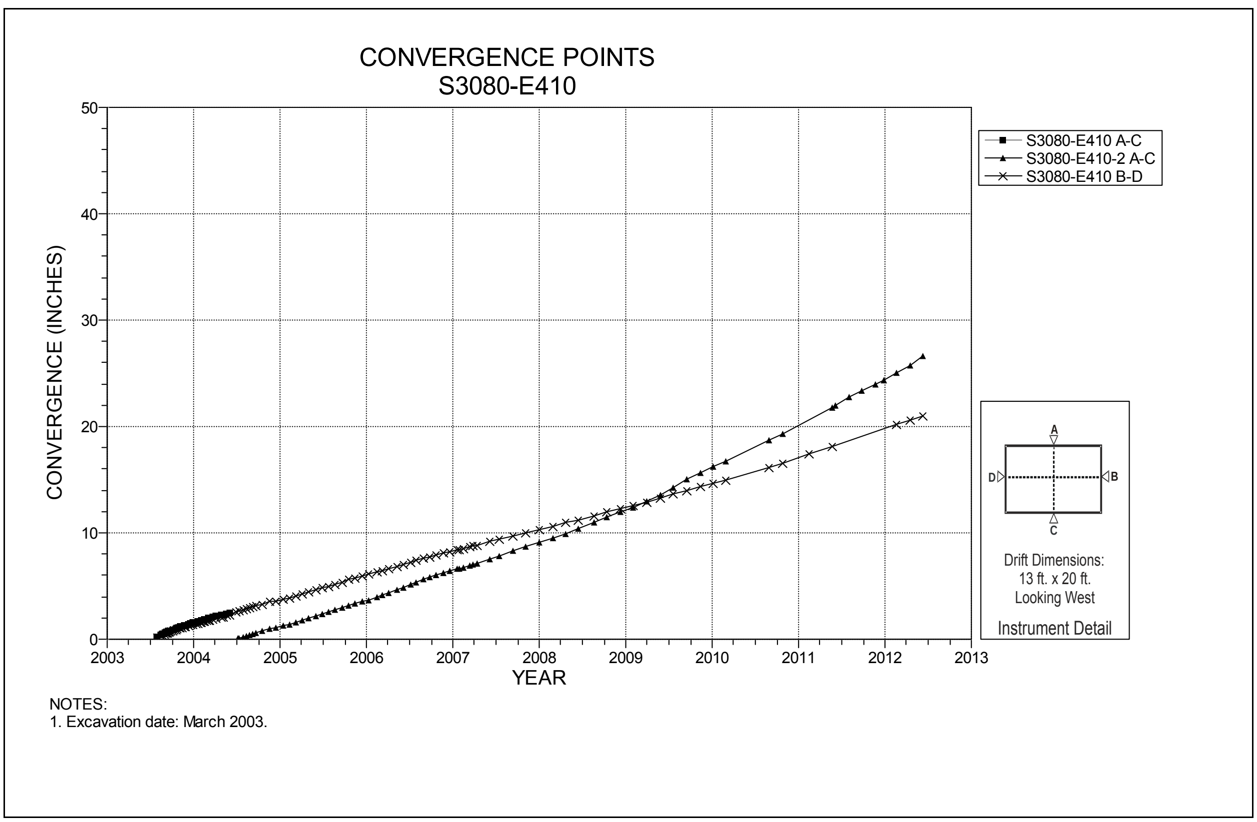
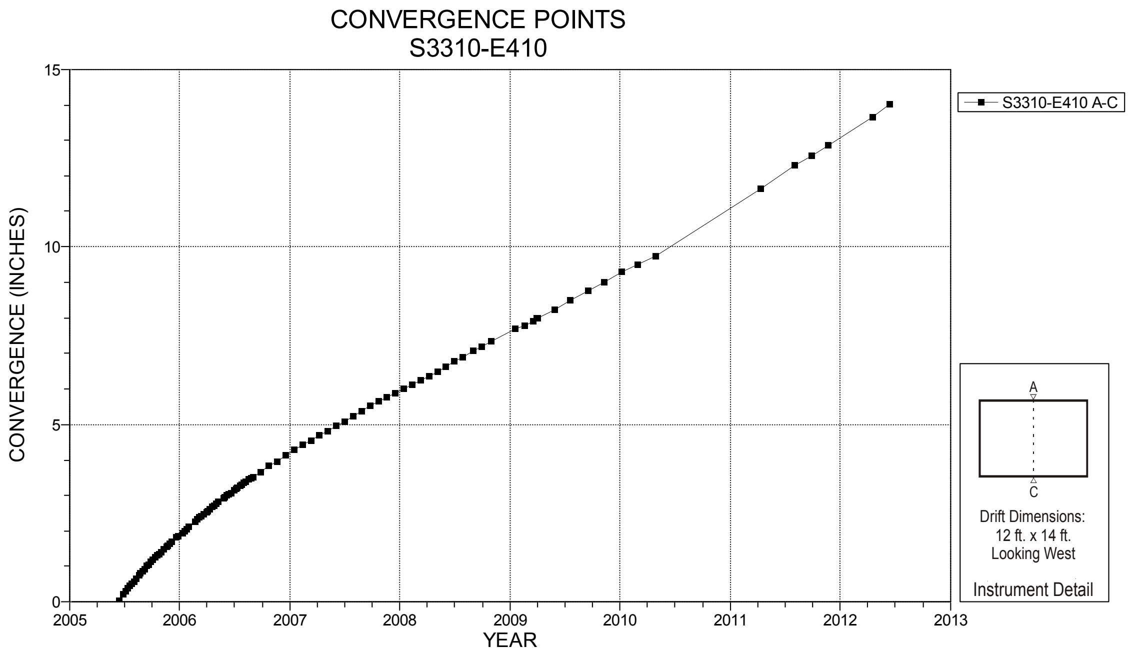


Figure 5-18 Convergence Point Array
S3080 E410 – All Chords

Table 5-4
Panel 4 Access Drift Data Analysis

Convergence Points									
			Last Reading 2011 to 2012						
Field Tag	Location	Figure Number	Date	Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
S3310-E410 A-C	S3310-E410	5-19	6/14/2012	14.027	14.027	2.0	N/A	N/A	One reading during 10’ – 11’ reporting period.



NOTES:
1. Excavation date: January 2003.
2. Reading frequency has become sporadic due to issues with obtaining access to the area.

Figure 5-19 Convergence Point Array
S3310 E410 – Roof to Floor

Table 5-5 Panel 5 Data Analysis

Convergence Points									
Field Tag	Location	Figure Number	Last Reading 2011 to 2012 Date	Last Reading 2011 to 2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
S3310-W285 A-C	S3310-W285	5-20	6/11/2012	10.489	10.489	2.6	2.2	18%	
S3650-W285-2 A-C	S3650-W285	5-21	6/11/2012	8.966	11.407	3.7	2.6	45%	

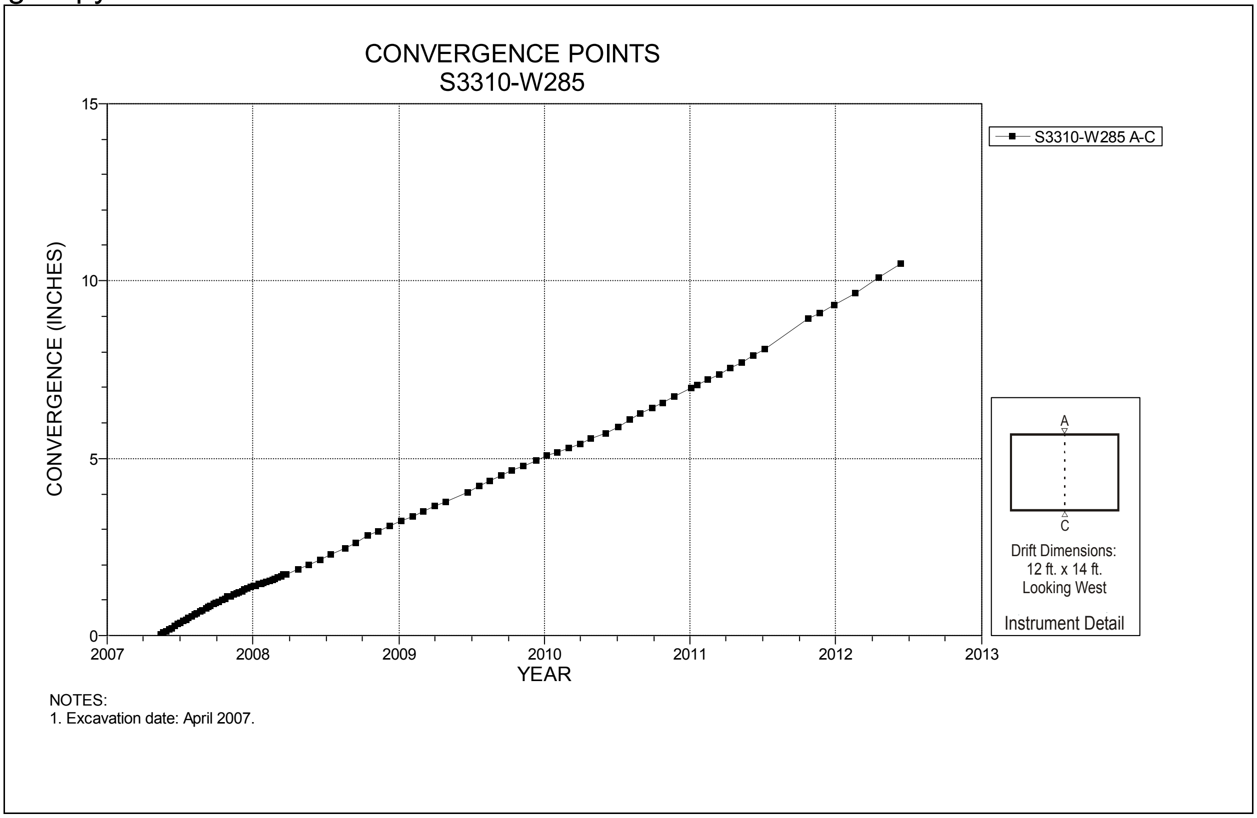


Figure 5-20 Convergence Point Array
S3310 W285 – Roof to Floor

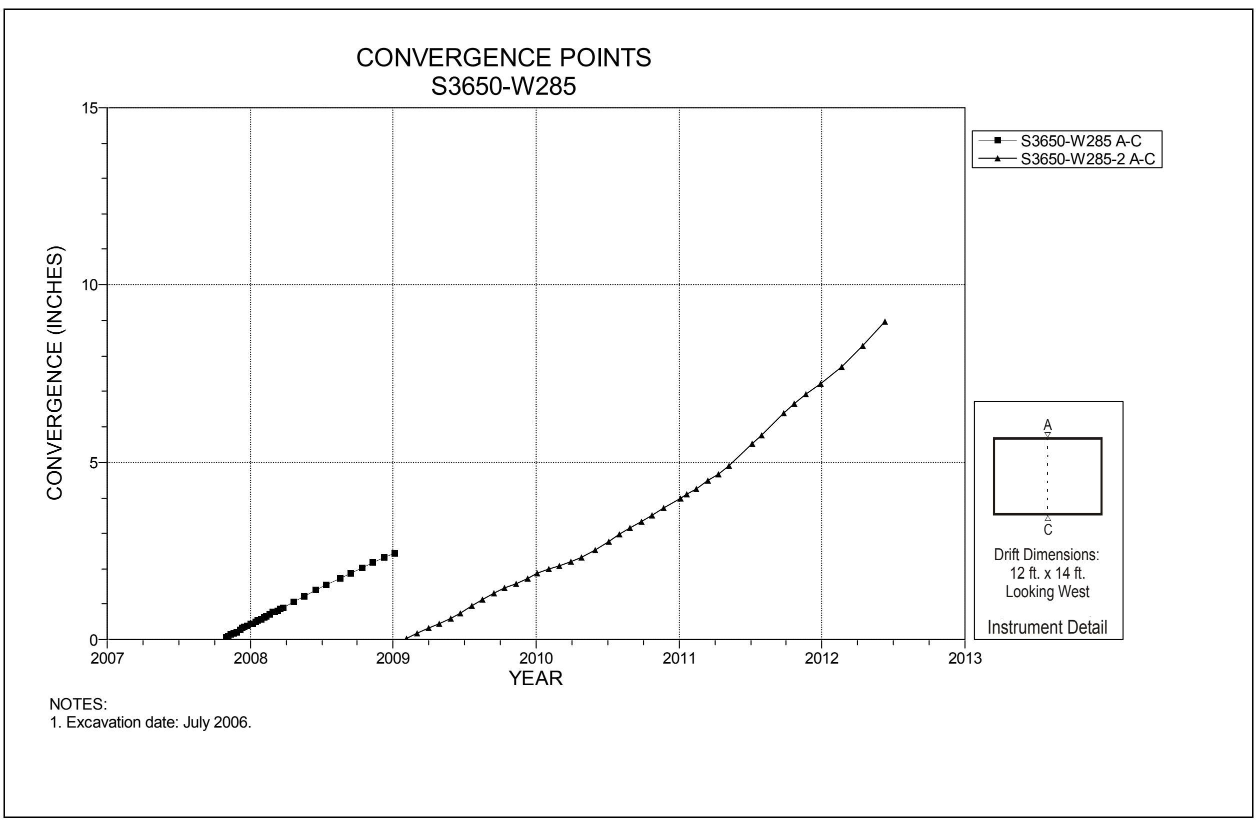


Figure 5-21 Convergence Point Array
S3650 W285 – Roof to Floor

Table 5-6
Panel 6 Data Analysis

Extensometers

Field Tag	Location	Figure Number	Date of Last Reading	Collar Displacement Relative to Deepest Anchor (inches)	Displacement Rate 2011 to 2012 (in/year)	Displacement Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
51X-GE-00501	S2750-W285	5-22	06/25/12	0.548	1.9	N/A	N/A	
51X-GE-00413-2	S2750-W585	5-23	06/28/12	4.328	2.9	3.1	-6%	
51X-GE-00414	S2750-W985	5-24	06/28/12	3.362	1.6	1.6	0%	
51X-GE-00403	W390-S2916	5-25	03/05/12	14.254	4.6	5.7	-19%	
51X-GE-00405	W520-S2916	5-26	06/28/12	12.087	5.1	3.8	34%	
51X-GE-00406	W660-S2916	5-27	06/28/12	8.098	3.5	2.5	40%	
51X-GE-00407	W790-S2916	5-28	06/28/12	5.664	1.7	2.0	-15%	
51X-GE-00408-2	W920-S2916	5-29	06/28/12	2.530	1.3	1.3	0%	Anchor “B” was used (anchor “C” has failed).
51X-GE-00409	W1050-S2916	5-30	06/28/12	4.802	1.7	1.9	-11%	
51X-GE-00410	W1190-S2916	5-31	06/28/12	3.794	1.5	1.7	-12%	
51X-GE-00411	S3080-W585	5-32	06/28/12	8.826	3.8	4.1	-7%	
51X-GE-00412	S3080-W985	5-33	06/28/12	3.889	1.6	1.8	-11%	

[1] N/A – Insufficient data available to perform the calculation. This is usually due to the inability to read the instruments because of activities such as: the temporary removal of an instrument due to floor, rib or back trimming; locations blocked by equipment or waste disposal, etc.

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011 to 2012		Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
			Date	Inches					
S2750-W285-2 A-C	S2750-W285	5-34	06/25/12	14.438	19.119	7.6	6.4	19%	
S2750-W390-2 A-C	S2750-W390	5-35	06/25/12	11.552	18.678	5.1	6.0	-15%	
S2750-W460-2 A-C	S2750-W460	5-36	06/25/12	15.682	21.708	6.8	8.4	-19%	
S2750-W520-2 A-C	S2750-W520	5-37	06/25/12	11.990	18.706	5.0	6.6	-24%	
S2750-W590-2 A-C	S2750-W590	5-38	06/25/12	13.469	17.171	5.7	7.4	-23%	
S2750-W660-2 A-C	S2750-W660	5-39	06/25/12	12.205	16.295	4.9	7.0	-30%	
S2750-W725-2 A-C	S2750-W725	5-40	06/25/12	12.482	16.762	5.1	7.1	-28%	
S2750-W790-2 A-C	S2750-W790	5-41	06/25/12	11.847	16.300	4.7	6.7	-30%	
S2750-W855-2 A-C	S2750-W855	5-42	06/25/12	12.117	13.802	5.6	6.3	-11%	
S2750-W920-2 A-C	S2750-W920	5-43	06/25/12	12.054	13.978	5.5	6.3	-13%	

Table 5-6
Panel 6 Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011 to 2012 Date	Last Reading 2011 to 2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
S2750-W985-2 A-C	S2750-W985	5-44	04/03/12	8.462	10.372	4.2	5.1	-18%	
S2750-W1050-2 A-C	S2750-W1050	5-45	03/05/12	7.996	9.979	3.9	5.1	-24%	
S2750-W1120-2 A-C	S2750-W1120	5-46	09/13/11	5.342	5.958	4.0	4.2	-5%	
S2750-W1190-2 A-C	S2750-W1190	5-47	09/13/11	5.679	6.702	3.5	3.5	0%	
W390-S2833-2 A-C	W390-S2833	5-48	06/25/12	18.233	25.762	8.2	9.3	-12%	
W390-S2916-2 A-C	W390-S2916	5-49	06/25/12	15.910	25.123	6.7	8.5	-21%	
W390-S2916 B-D	W390-S2916	5-49	06/25/12	3.870	3.870	3.3	4.0	-18%	
W390-S2998-2 A-C	W390-S2998	5-50	06/25/12	11.015	20.068	4.6	5.9	-22%	
W520-S2833-2 A-C	W520-S2833	5-51	06/25/12	10.432	16.440	4.9	5.1	-4%	
W520-S2916-2 A-C	W520-S2916	5-52	06/25/12	14.170	20.273	7.1	6.6	8%	
W520-S2916 B-D	W520-S2916	5-52	06/25/12	5.178	5.178	3.2	3.5	-9%	
W520-S2998-2 A-C	W520-S2998	5-53	06/25/12	9.929	15.639	4.7	4.8	-2%	
W660-S2833-2 A-C	W660-S2833	5-54	06/25/12	11.080	15.374	5.3	5.6	-5%	
W660-S2916-2 A-C	W660-S2916	5-55	06/25/12	11.599	16.661	5.9	5.5	7%	
W660-S2916 B-D	W660-S2916	5-55	06/25/12	5.740	5.740	3.6	3.7	-3%	
W660-S2998-2 A-C	W660-S2998	5-56	06/25/12	10.714	15.504	5.2	5.3	-2%	
W790-S2833-2 A-C	W790-S2833	5-57	05/29/12	10.126	15.434	4.7	5.5	-15%	
W790-S2916-2 A-C	W790-S2916	5-58	06/25/12	9.518	14.782	4.2	5.1	-18%	
W790-S2916 B-D	W790-S2916	5-58	06/25/12	5.668	5.668	3.3	3.7	-11%	
W790-S2998-2 A-C	W790-S2998	5-59	06/25/12	8.700	13.806	3.8	4.7	-19%	
W920-S2833-2 A-C	W920-S2833	5-60	05/31/12	8.703	12.389	4.1	4.7	-13%	
W920-S2916-2 A-C	W920-S2916	5-61	05/31/12	8.686	12.463	4.1	4.7	-13%	
W920-S2916 B-D	W920-S2916	5-61	05/31/12	5.100	5.100	3.1	3.5	-11%	
W920-S2998-2 A-C	W920-S2998	5-62	05/02/12	7.081	10.666	3.3	4.1	-20%	
W1050-S2833-2 A-C	W1050-S2833	5-63	03/05/12	6.336	7.278	2.7	3.9	-31%	
W1050-S2916-2 A-C	W1050-S2916	5-64	01/12/12	7.395	8.437	3.6	4.9	-27%	
W1050-S2916 B-D	W1050-22916	5-64	01/12/12	4.160	4.160	2.6	3.8	-32%	
W1050-S2998-2 A-C	W1050-S2998	5-65	11/07/11	5.313	6.259	3.4	3.9	-13%	

Table 5-6
Panel 6 Data Analysis (Continued)

Convergence Points (Continued)									
Field Tag	Location	Figure Number	Last Reading 2011 to 2012 Date	Last Reading 2011 to 2012 Inches	Cumulative Displacement (inches)	Closure Rate[1] 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
W1190-S2833-2 A-C	W1190-S2833	5-66	09/13/11	6.825	8.253	3.8	4.1	-7%	
W1190-S2916-2 A-C	W1190-S2916	5-67	08/15/11	5.234	6.764	4.3	4.5	-4%	
W1190-S2916 B-D	W1190-S2916	5-67	08/15/11	2.601	2.601	3.1	3.3	-6%	
W1190-S2998-2 A-C	W1190-S2998	5-68	08/15/11	4.734	6.259	3.5	4.2	-17%	
S3080-W285-2 A-C	S3080-W285	5-69	06/25/12	5.795	9.762	2.8	2.8	0%	
S3080-W390-2 A-C	S3080-W390	5-70	06/25/12	8.661	16.859	3.5	4.8	-27%	
S3080-W460-2 A-C	S3080-W460	5-71	06/25/12	10.516	18.55	4.6	5.7	-19%	
S3080-W520-2 A-C	S3080-W520	5-72	06/25/12	11.25	19.721	4.8	6.0	-20%	
S3080-W585-2 A-C	S3080-W585	5-73	06/25/12	13.143	22.321	5.7	7.0	-19%	
S3080-W660-2 A-C	S3080-W660	5-74	06/25/12	11.225	18.349	4.7	6.1	-23%	
S3080-W725-2 A-C	S3080-W725	5-75	06/25/12	11.185	11.185	5.1	5.7	-11%	
S3080-W790-2 A-C	S3080-W790	5-76	06/25/12	11.693	17.43	5.1	6.2	-18%	
S3080-W855-2 A-C	S3080-W855	5-77	04/03/12	10.191	13.451	5.8	5.7	2%	
S3080-W920-2 A-C	S3080-W920	5-78	05/02/12	9.127	12.906	4.5	5.5	-18%	
S3080-W985-2 A-C	S3080-W985	5-79	10/11/11	6.095	8.113	4.7	4.7	0%	
S3080-W1050-2 A-C	S3080-W1050	5-80	11/07/11	6.014	7.612	3.8	4.3	-12%	
S3080-W1190-2 A-C	S3080-W1190	5-81	07/19/11	3.425	4.653	N/A	3.2	N/A	

[1] N/A – Insufficient data available to perform the calculation. This is usually due to the inability to read the instruments because of activities such as: the temporary removal of an instrument due to floor, rib or back trimming; locations blocked by equipment or waste disposal, etc.

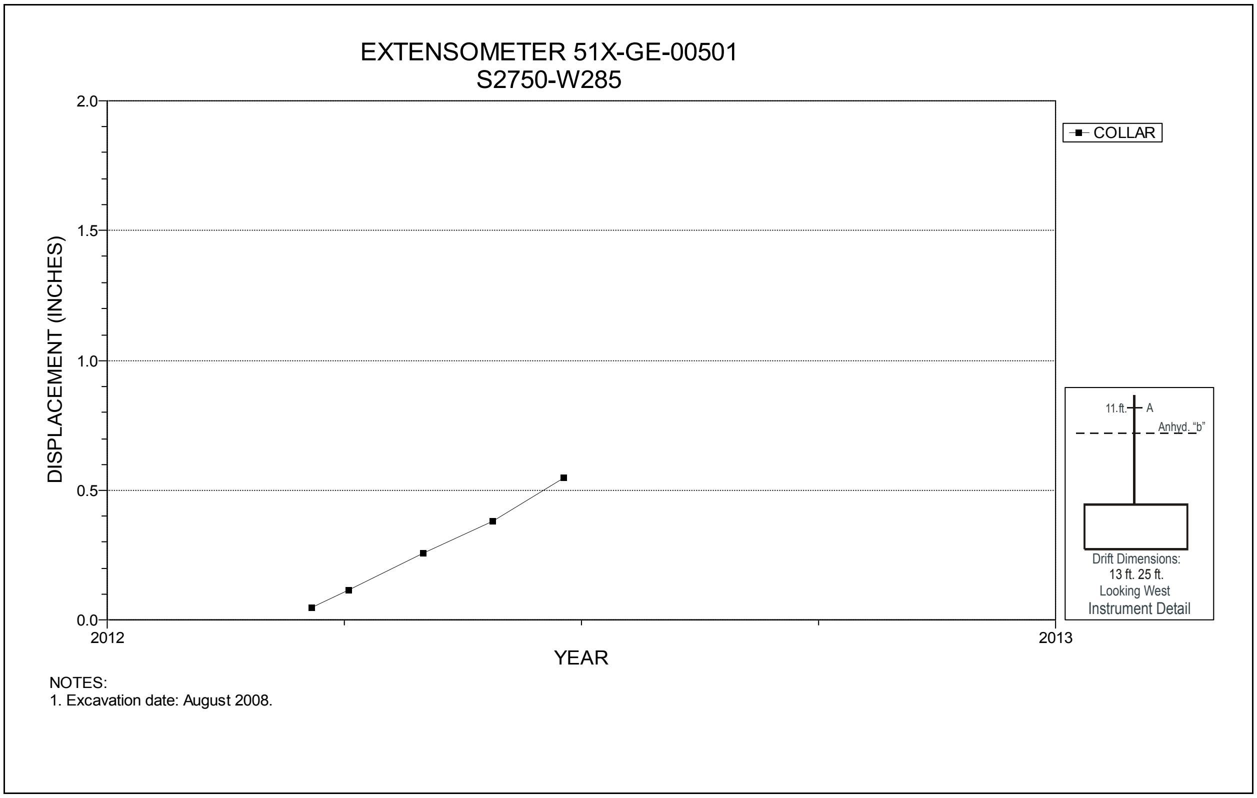


Figure 5-22 Extensometer 51X-GE-00501
S2750 W285 – Roof

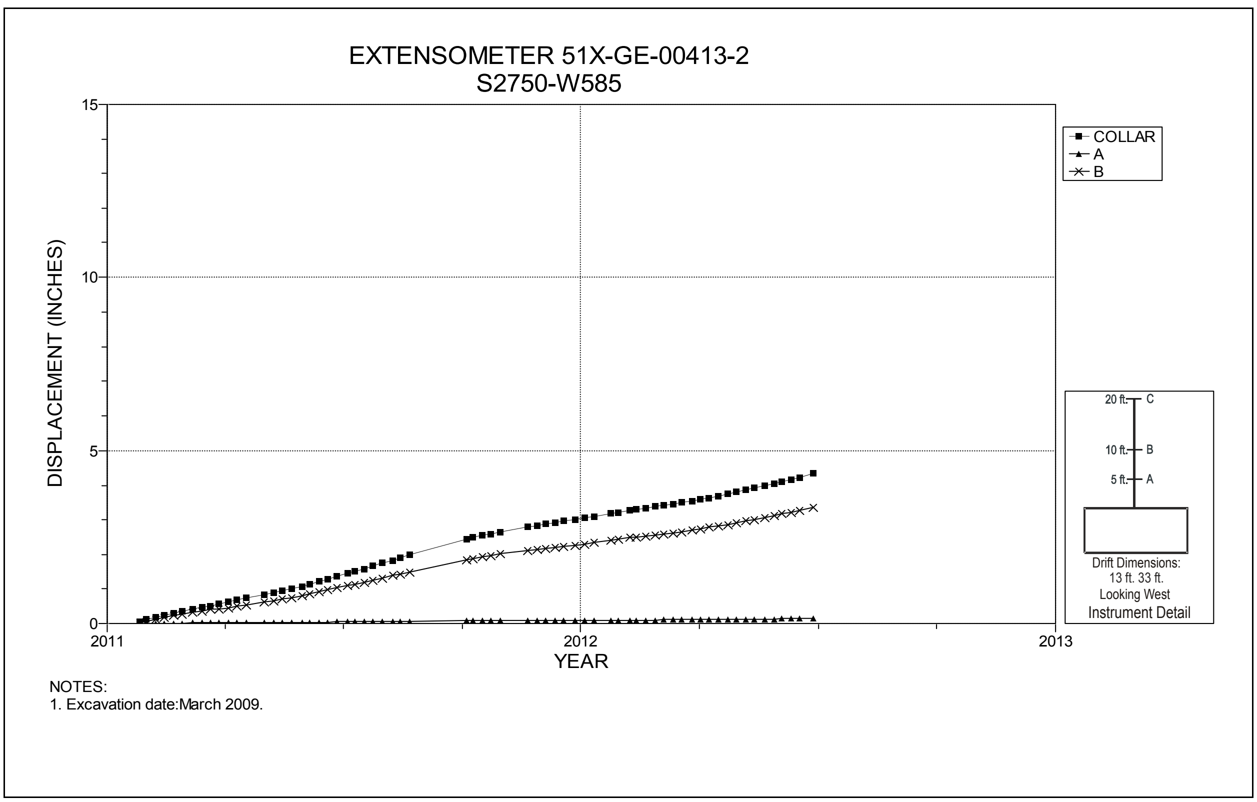


Figure 5-23 Extensometer 51X-GE-00413-2
S2750 W585 – Roof

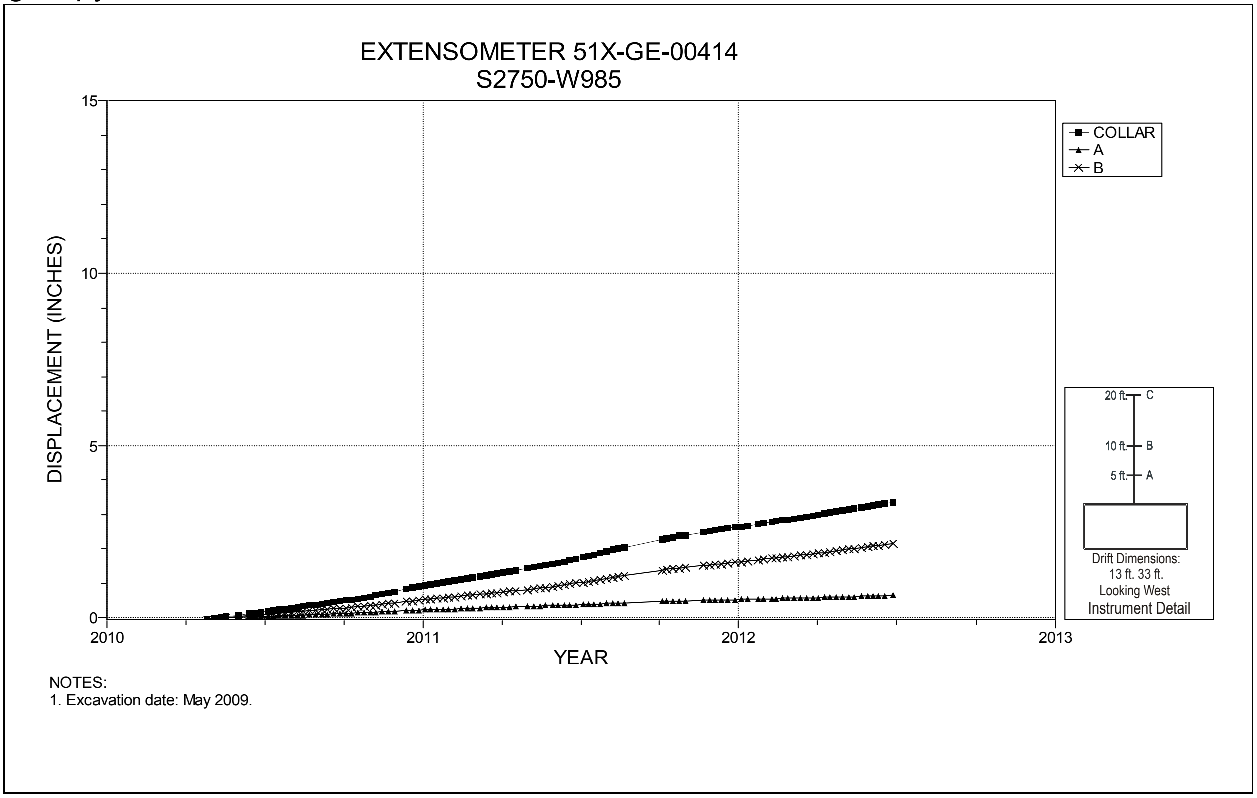


Figure 5-24 Extensometer 51X-GE-00414
S2750 W985 – Roof

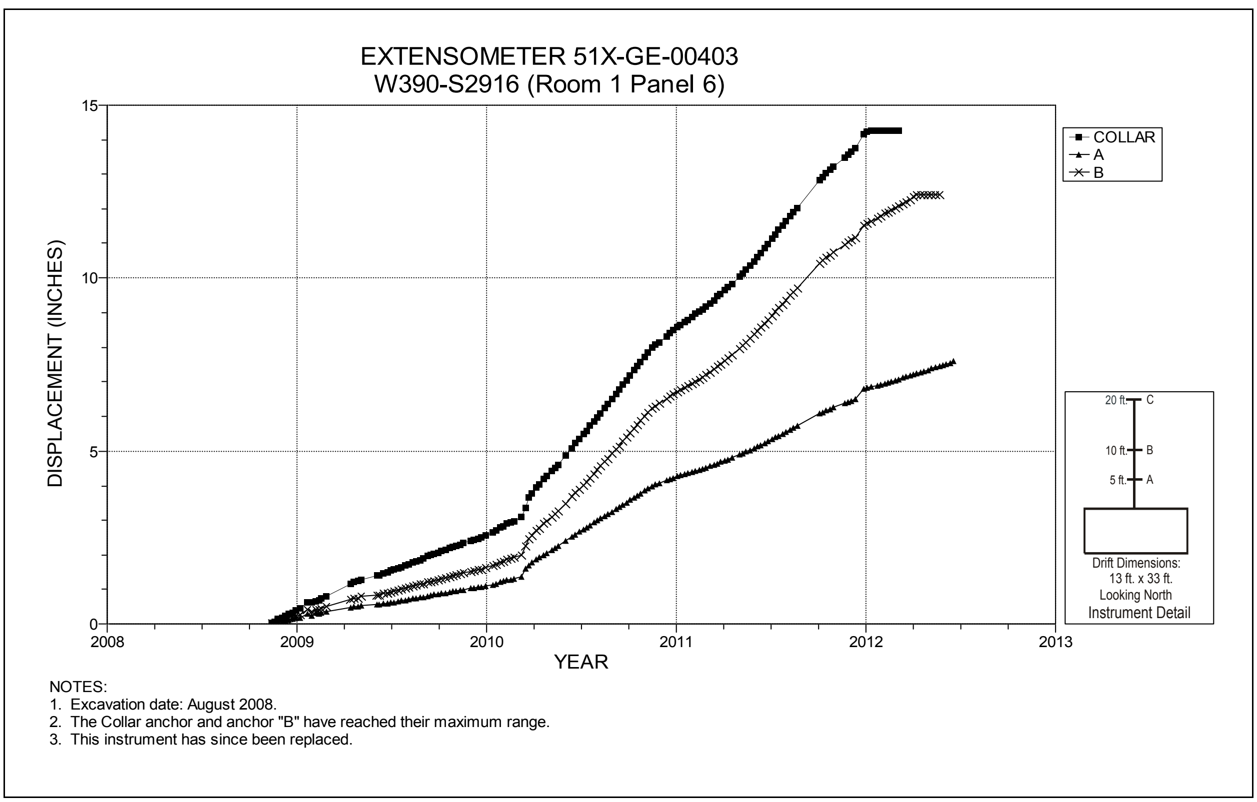


Figure 5-25 Extensometer 51X-GE-00403
Room 1, Panel 6 at W390 S2916 – Roof

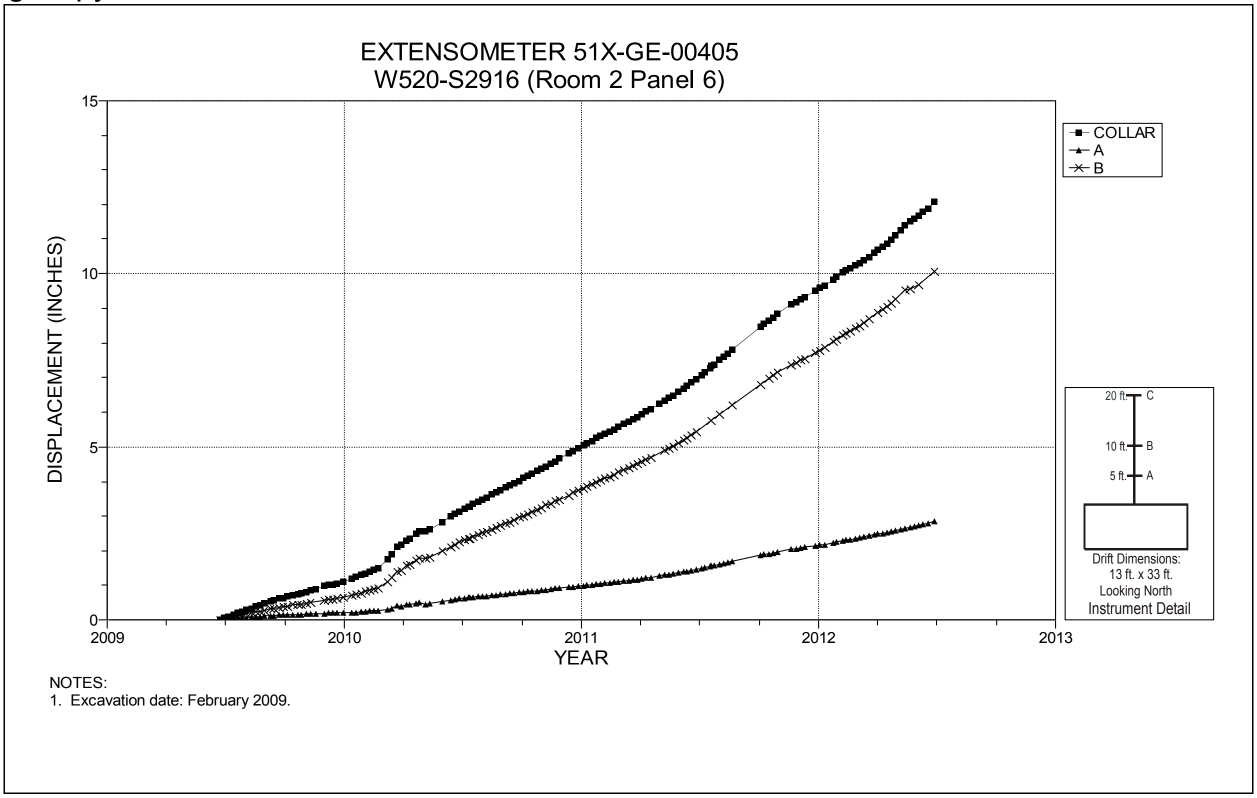


Figure 5-26 Extensometer 51X-GE-00405
Room 2, Panel 6 at W520 S2916 – Room Center – Roof

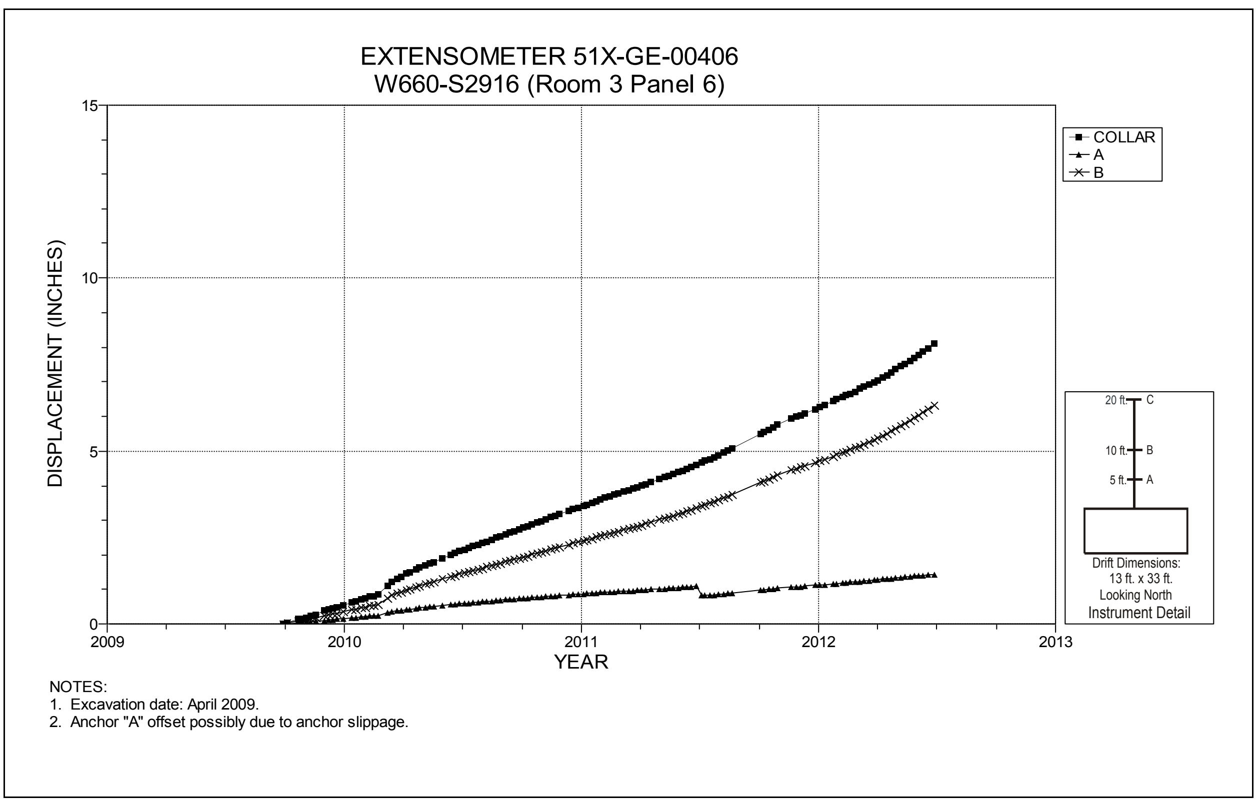


Figure 5-27 Extensometer 51X-GE-00406
Room 3, Panel 6 at W660 S2916– Room Center – Roof

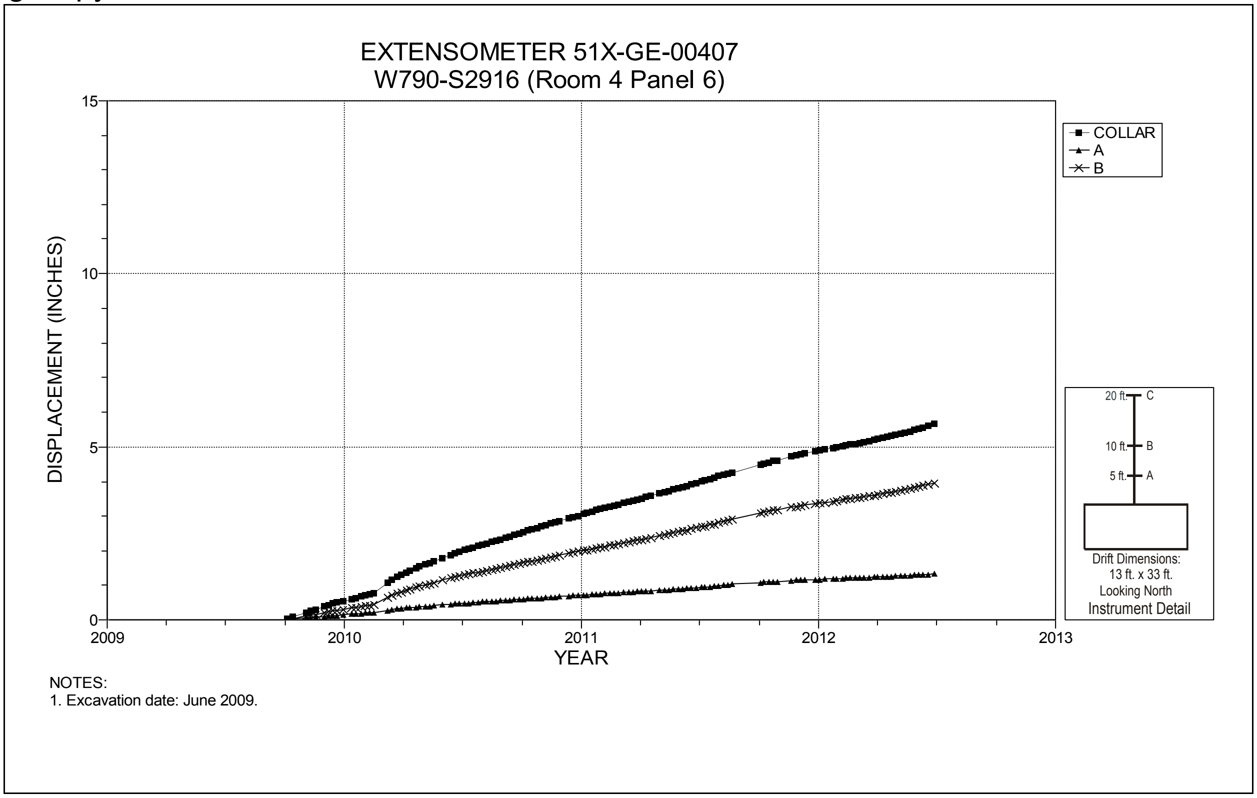


Figure 5-28 Extensometer 51X-GE-00407
Room 4, Panel 6 at W790 S2916 – Room Center – Roof

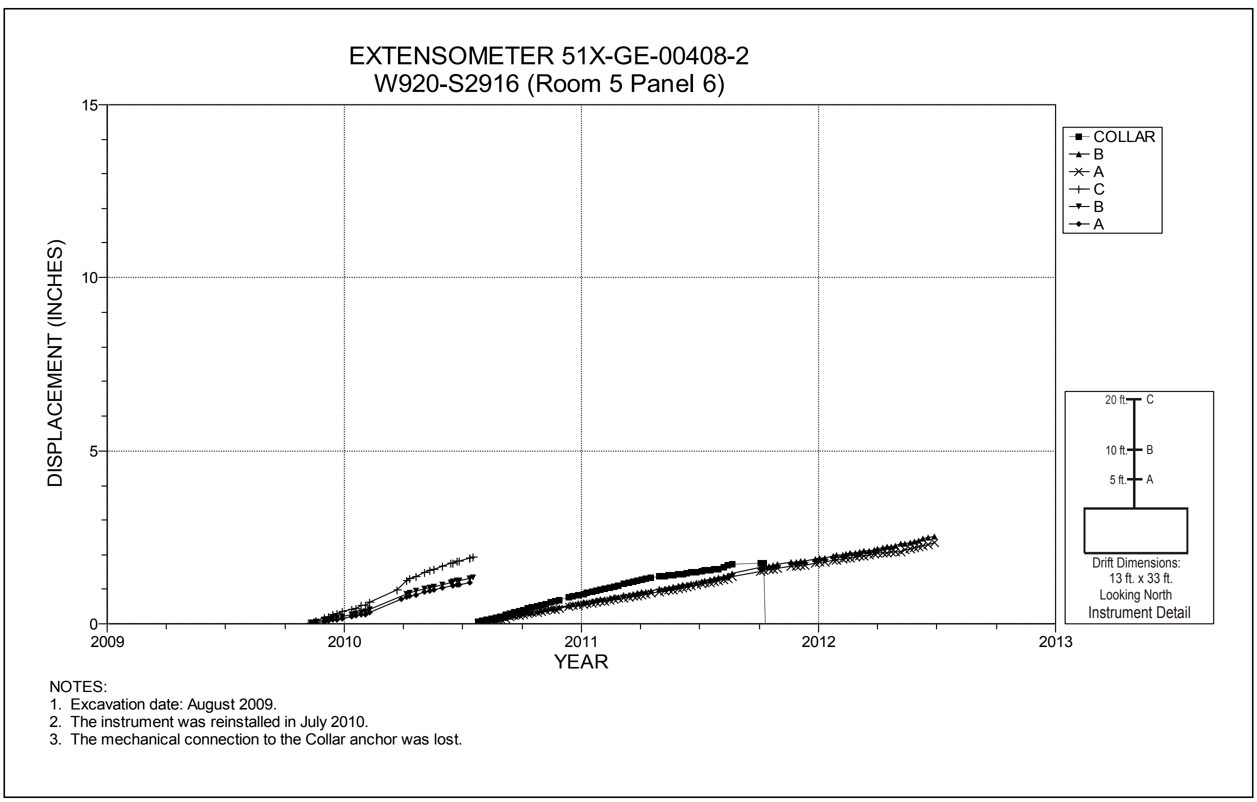


Figure 5-29 Extensometer 51X-GE-00408-2
Room 5, Panel 6 at W920 S2916– Room Center – Roof

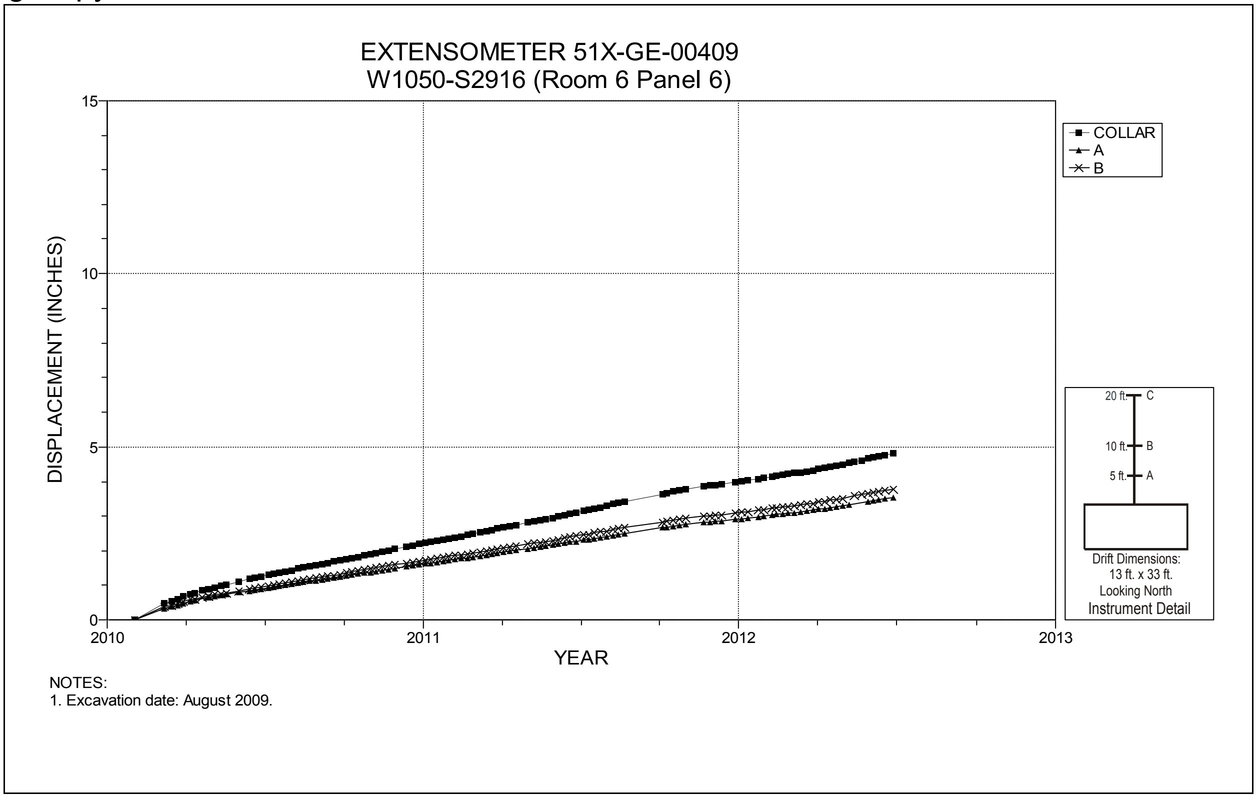


Figure 5-30 Extensometer 51X-GE-00409
Room 6, Panel 6 at W1050 S2916– Room Center – Roof

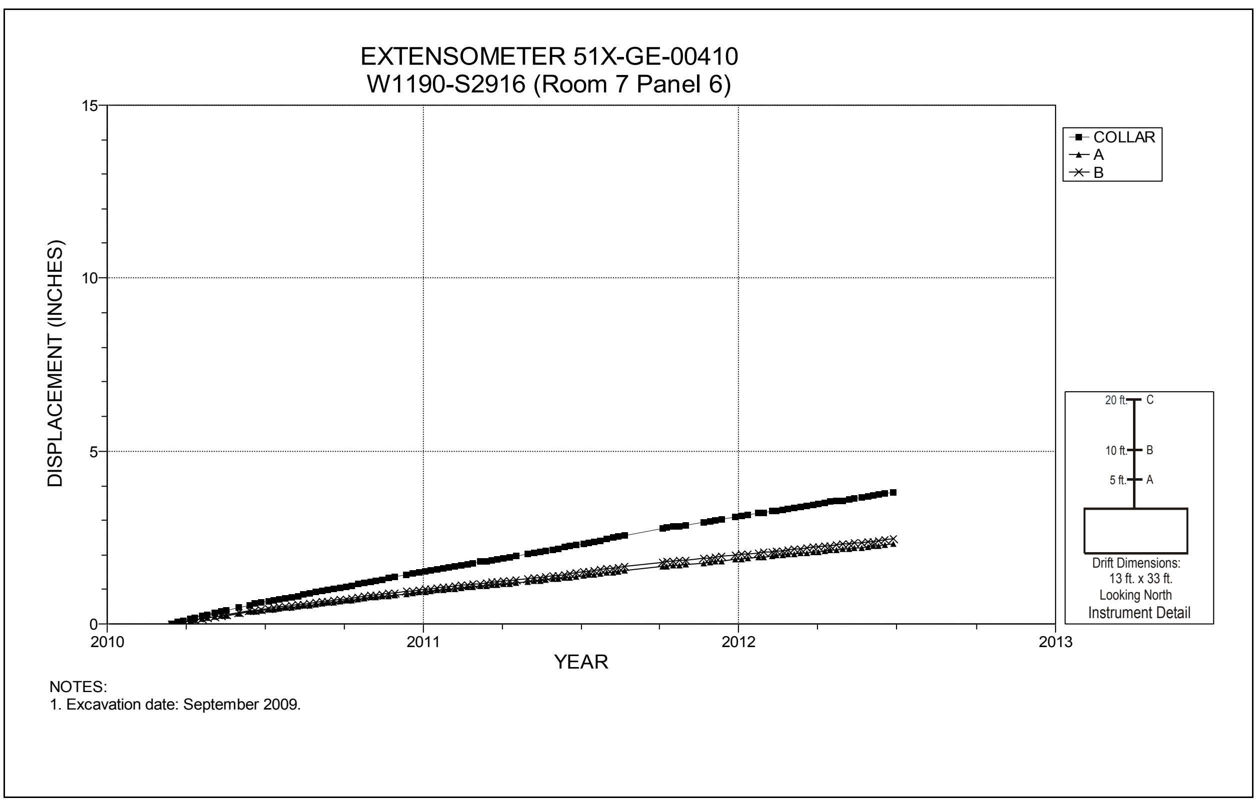


Figure 5-31 Extensometer 51X-GE-00410
Room 7, Panel 6 at W1190 S2916– Room Center – Roof

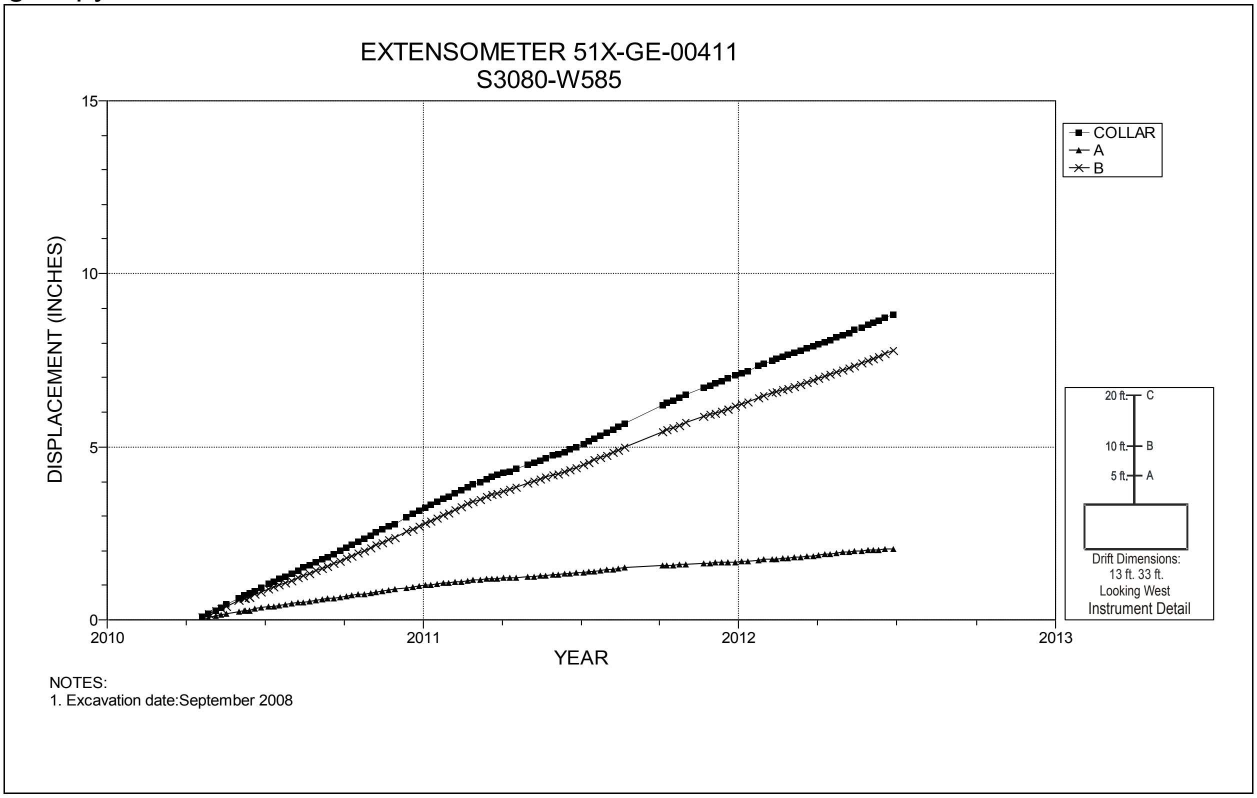


Figure 5-32 Extensometer 51X-GE-00411
S3080 W585 – Roof

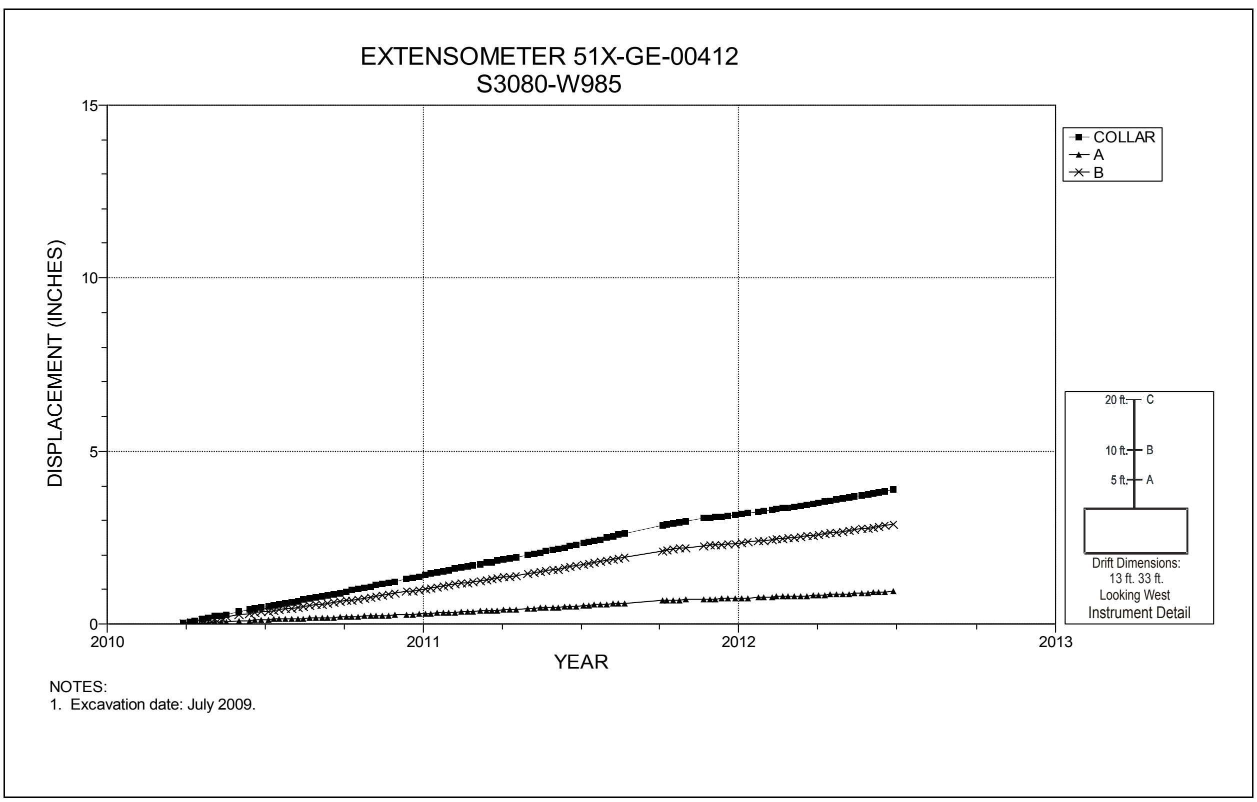


Figure 5-33 Extensometer 51X-GE-00412
S3080 W985 – Roof

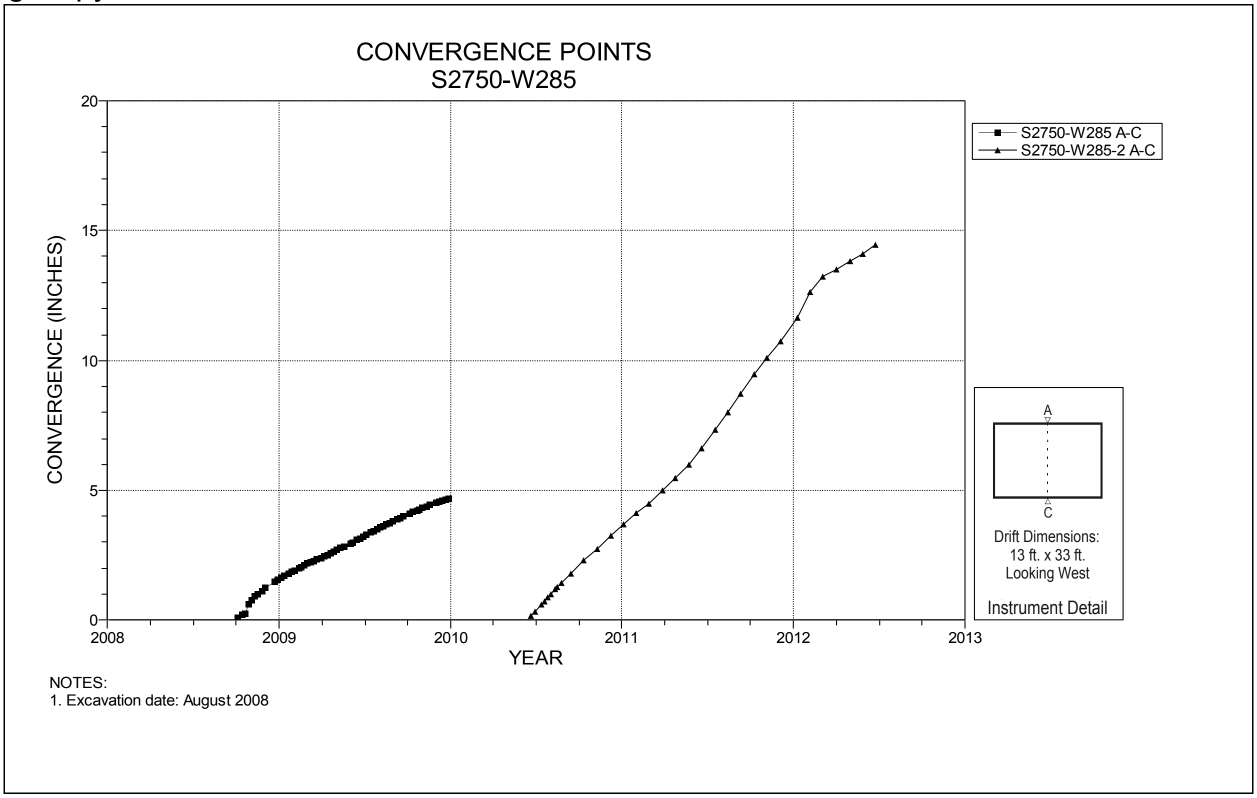


Figure 5-34 Convergence Point Array
S2750 W285 – Roof to Floor

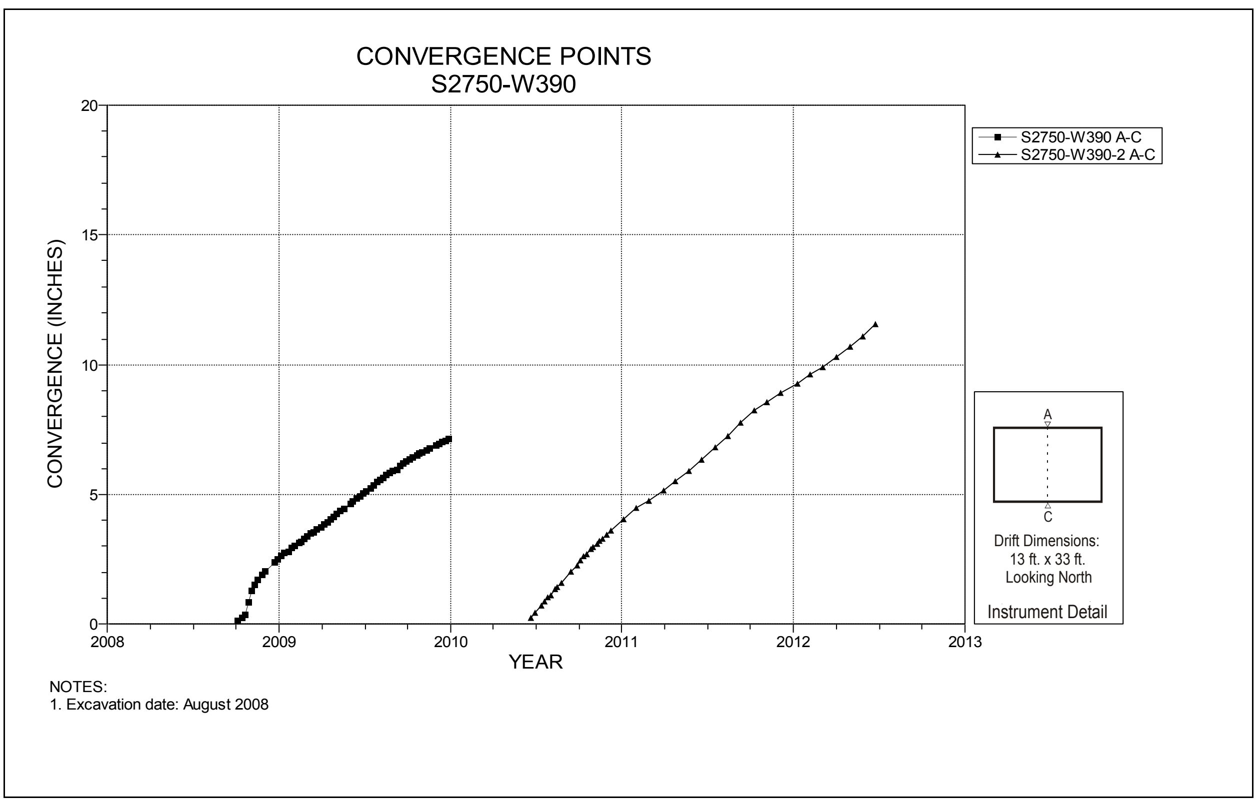


Figure 5-35 Convergence Point Array
S2750 W390 Intersection (Room 1, Panel 6) – Roof to Floor

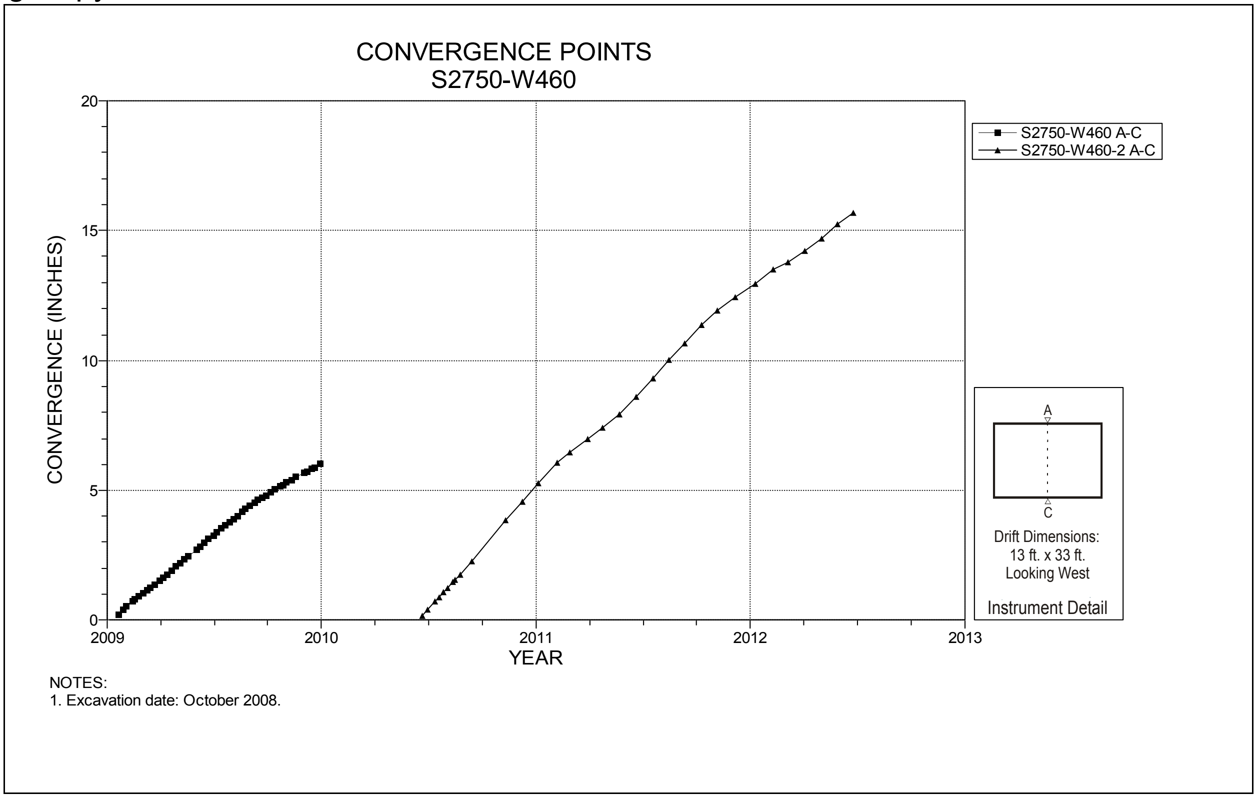


Figure 5-36 Convergence Point Array
S2750 W460 – Roof to Floor

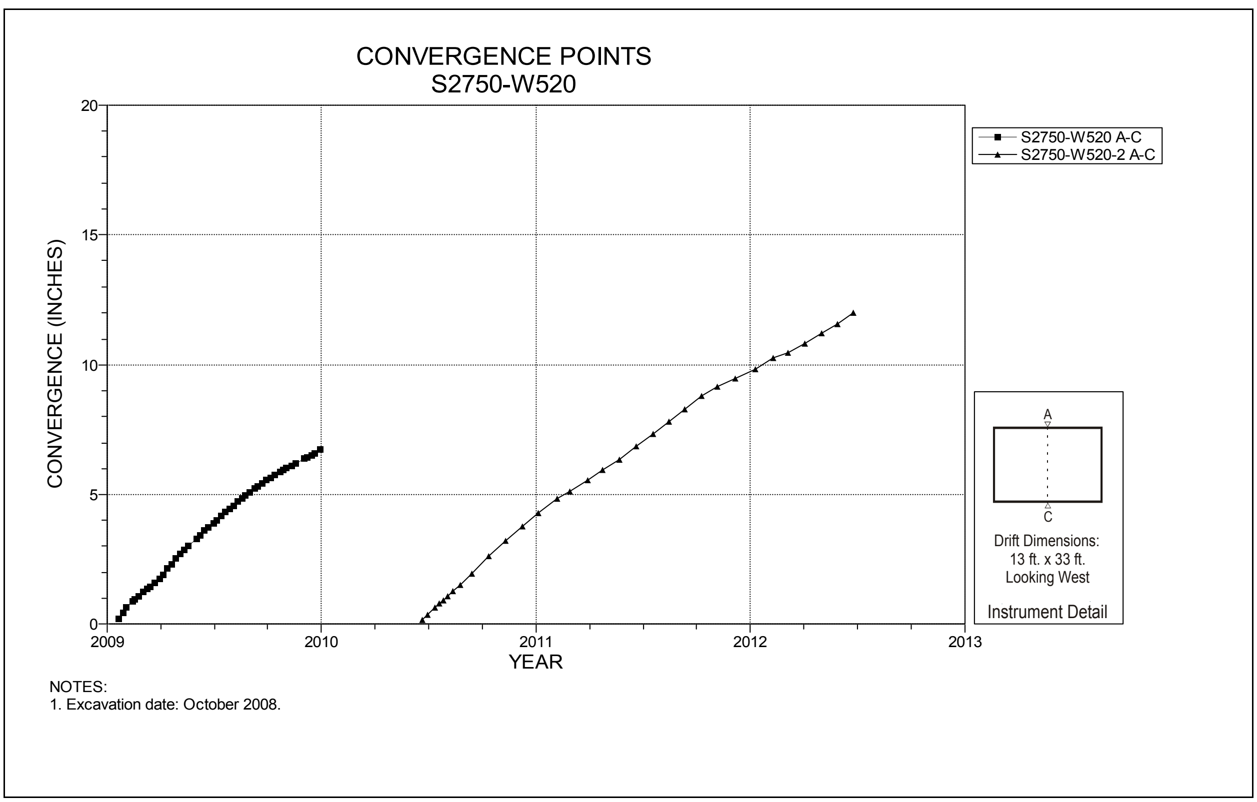


Figure 5-37 Convergence Point Array
S2750 W520 Intersection (Room 2, Panel 6) – Roof to Floor

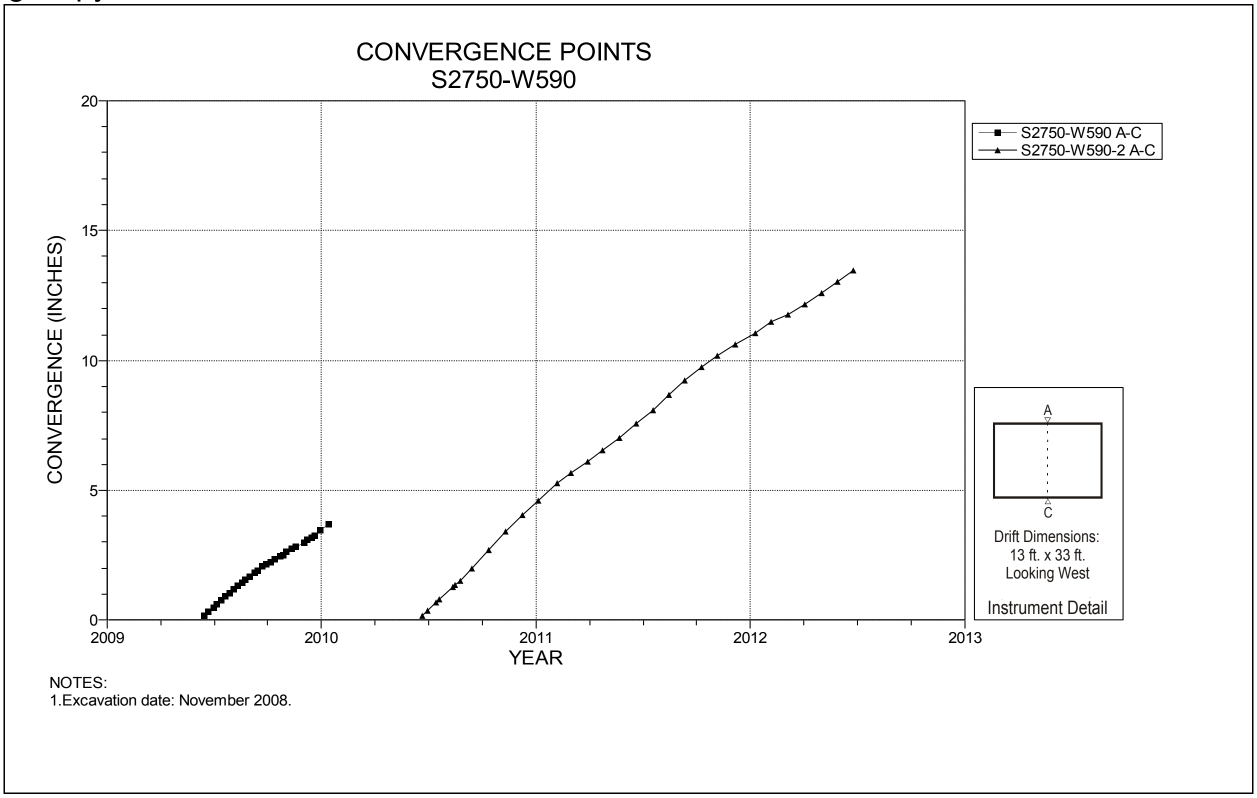


Figure 5-38 Convergence Point Array
S2750 W590 – Roof to Floor

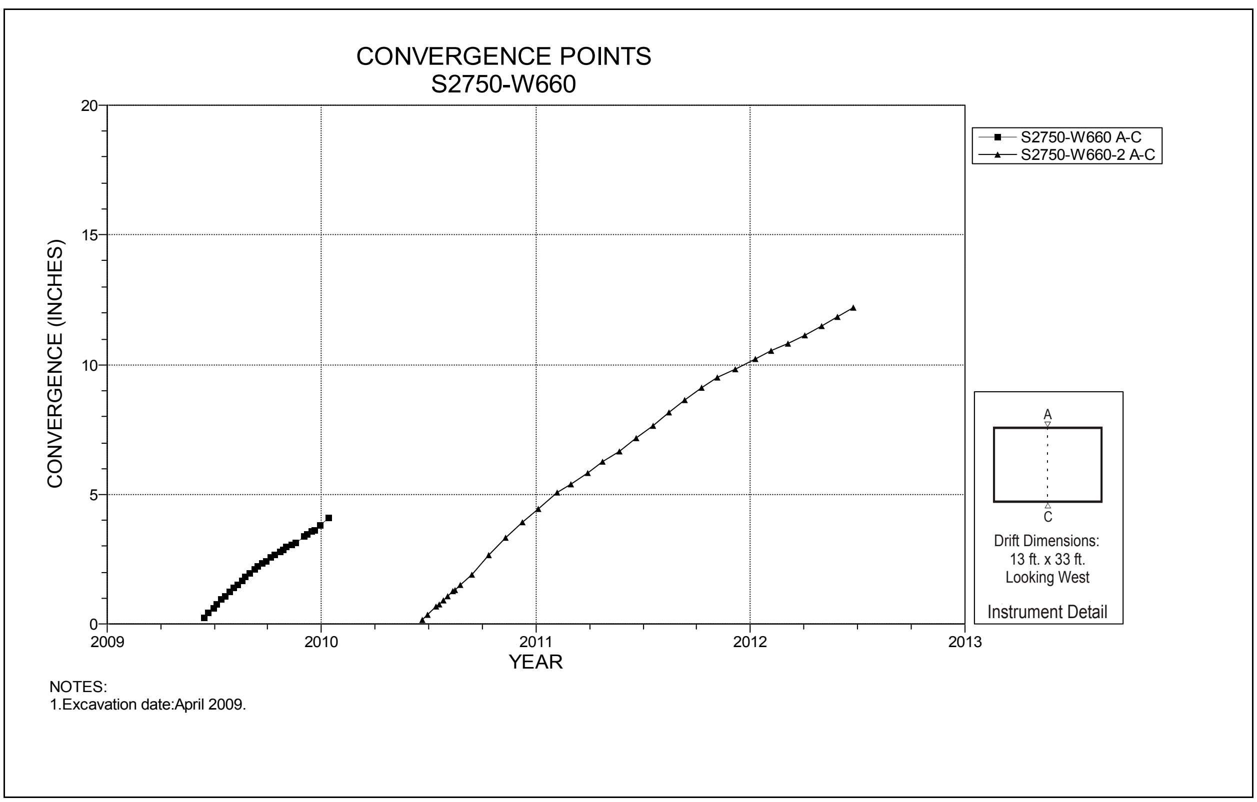


Figure 5-39 Convergence Point Array
S2750 W660 Intersection (Room 3, Panel 6) – Roof to Floor

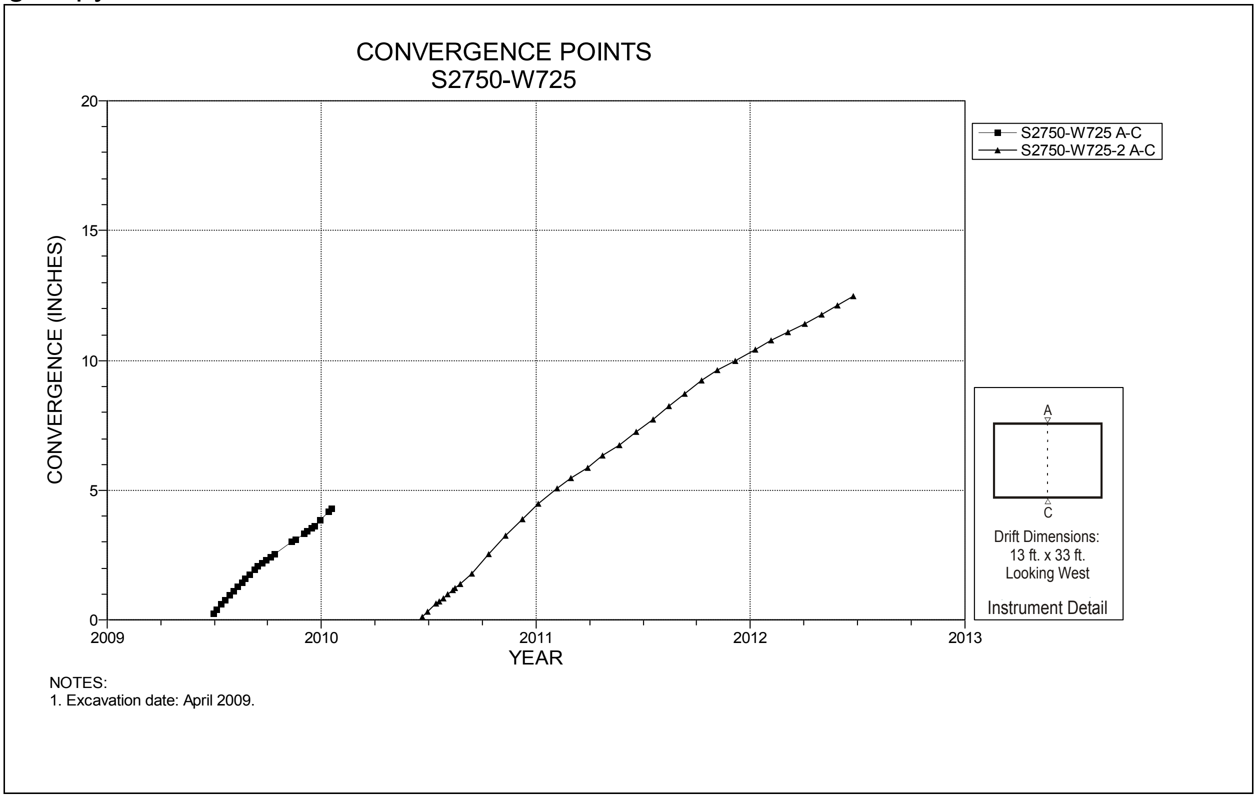


Figure 5-40 Convergence Point Array
S2750 W725 – Roof to Floor

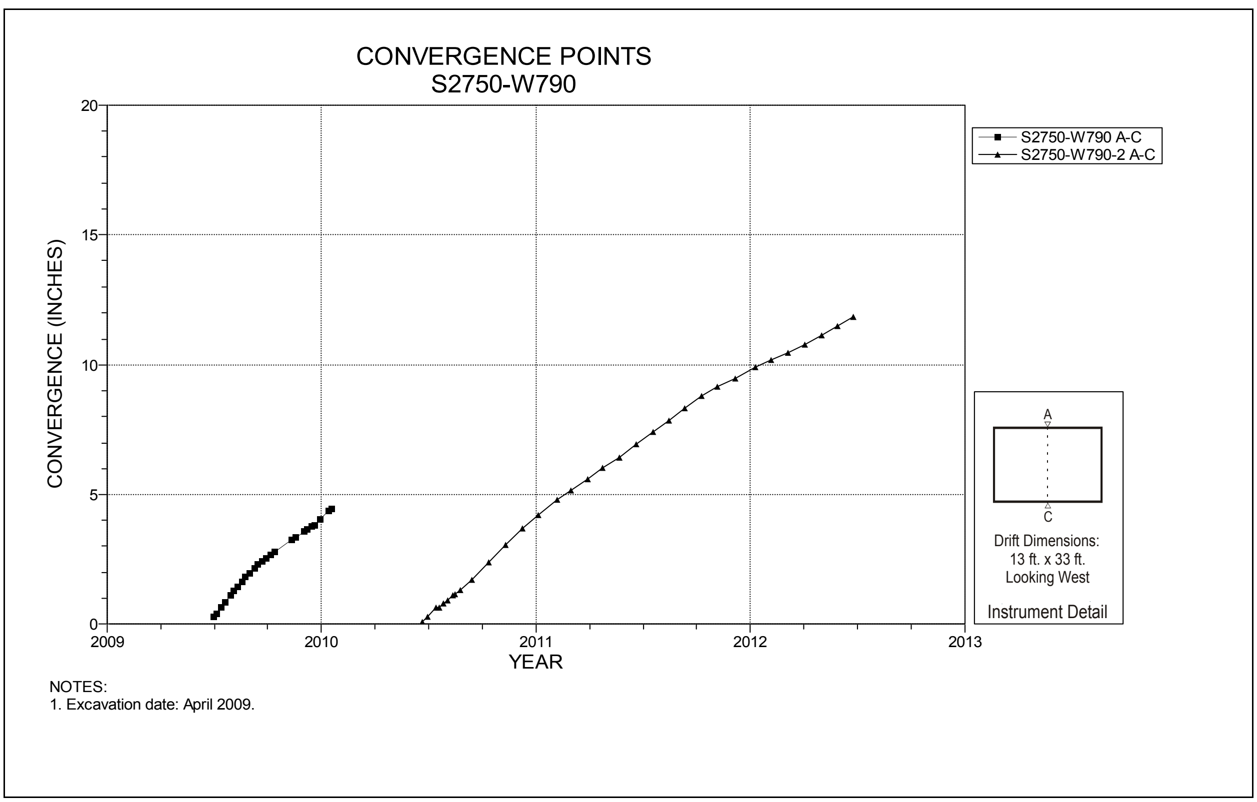


Figure 5-41 Convergence Point Array
S2750 W790 Intersection (Room 4, Panel 6) – Roof to Floor

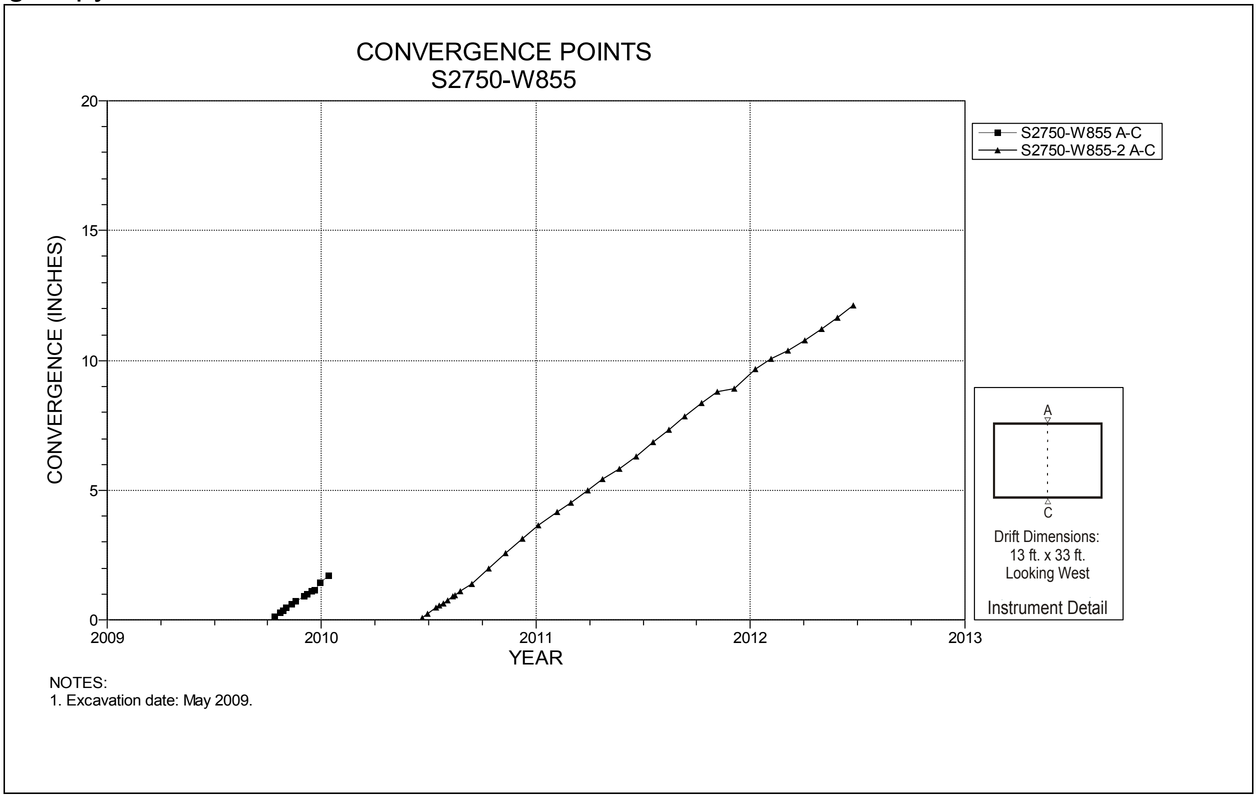


Figure 5-42 Convergence Point Array
S2750 W885 – Roof to Floor

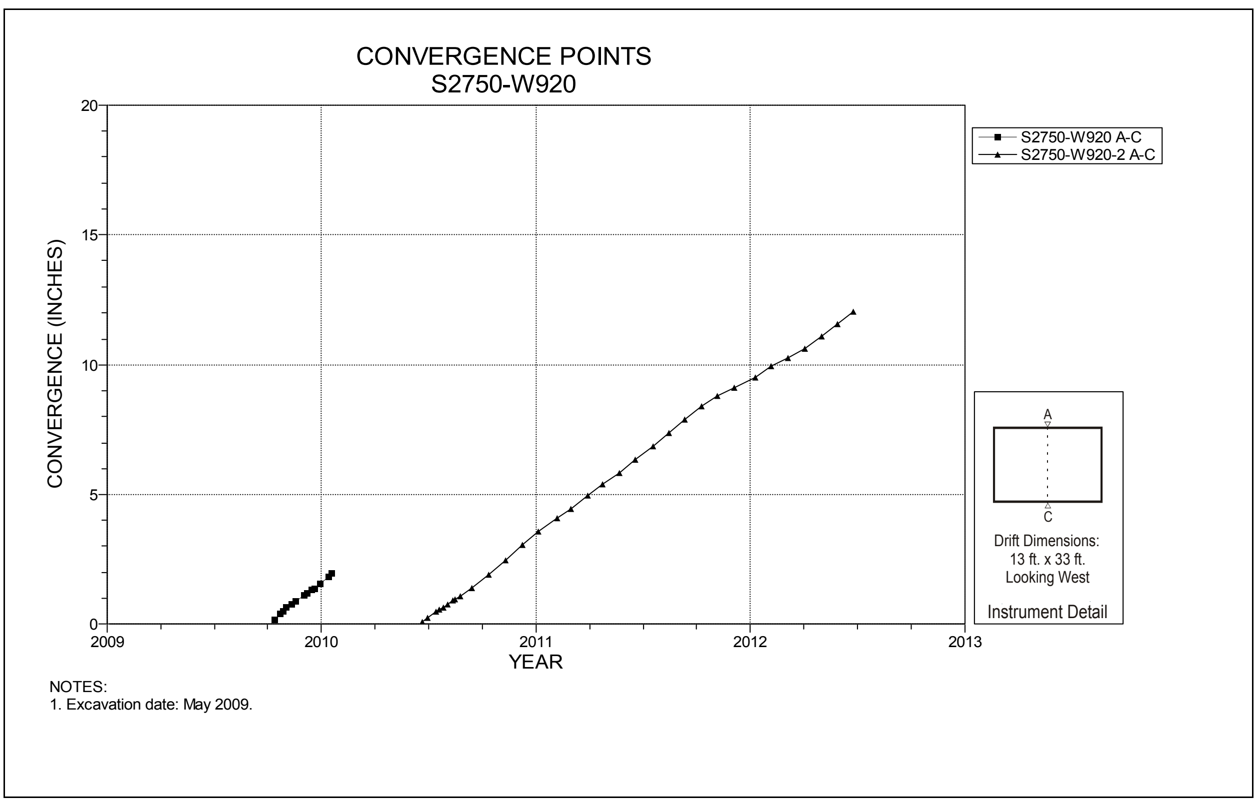


Figure 5-43 Convergence Point Array
S2750 W920 Intersection (Room 5, Panel 6) – Roof to Floor

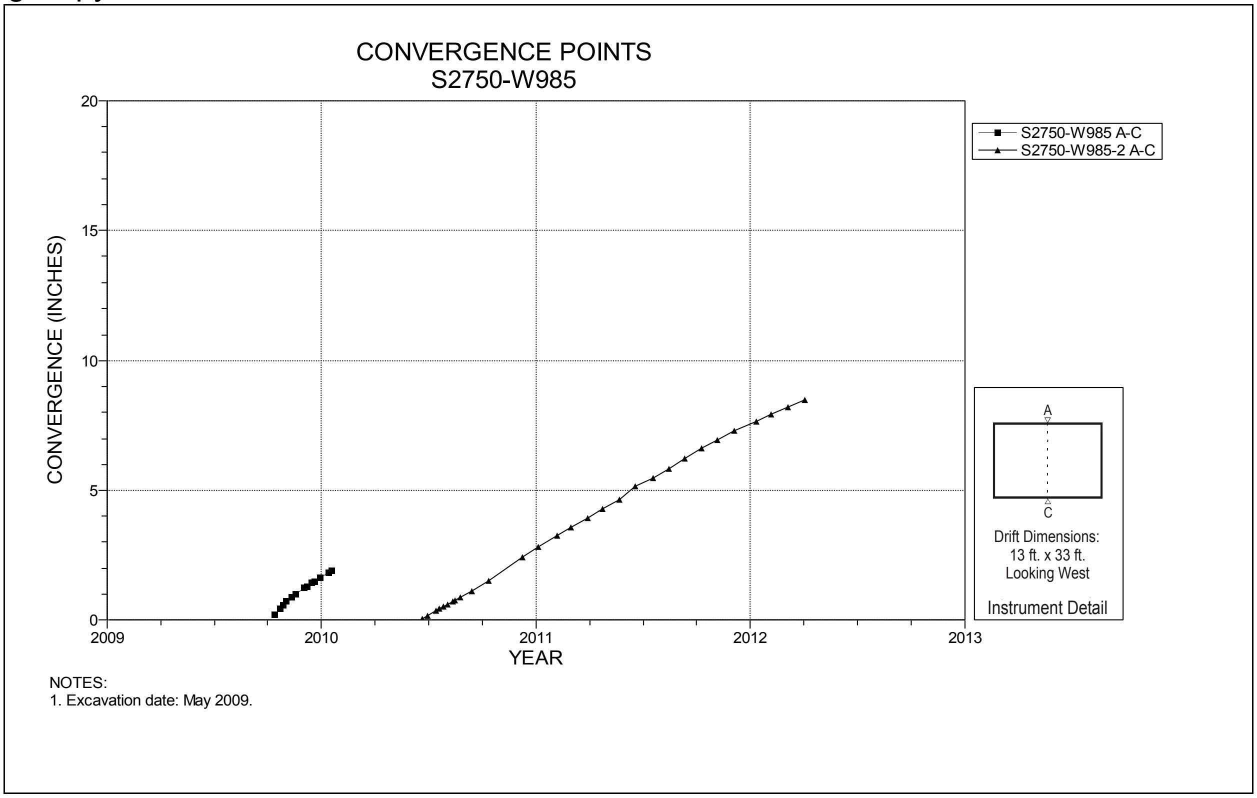


Figure 5-44 Convergence Point Array
S2750 W985 – Roof to Floor

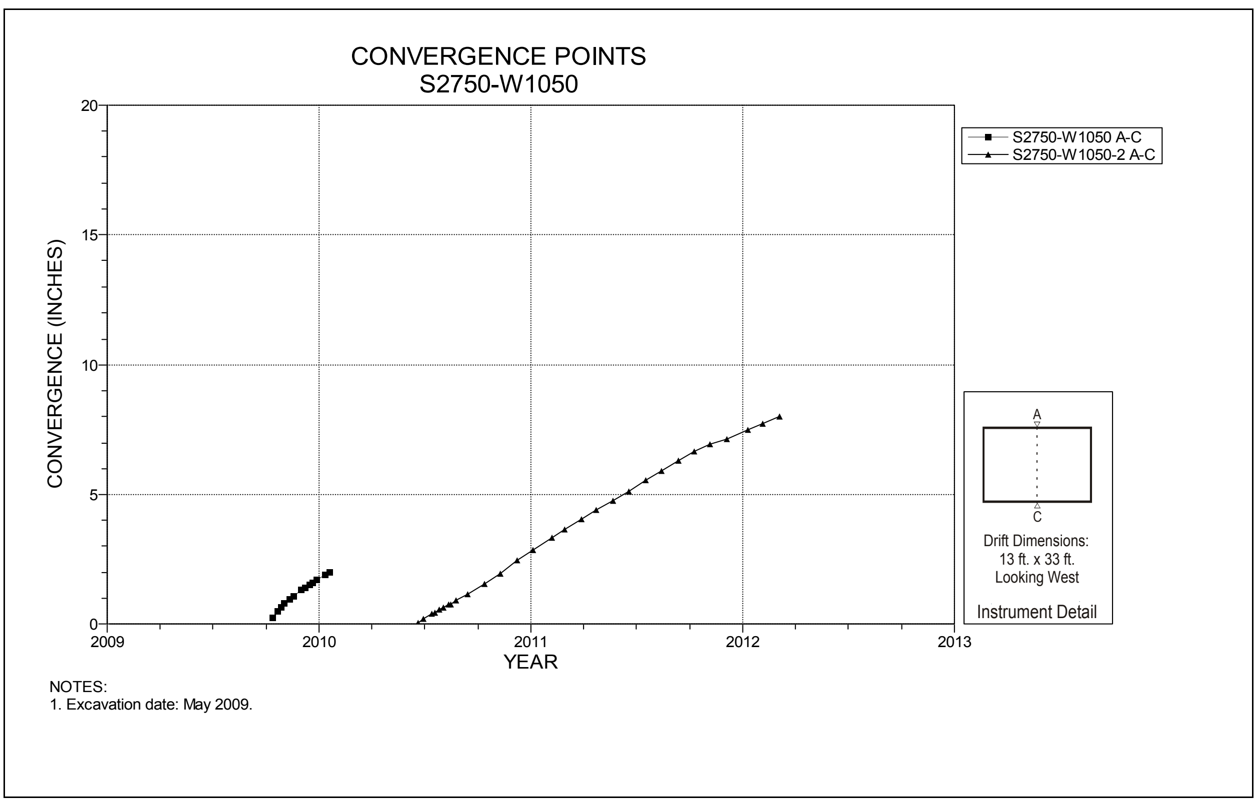


Figure 5-45 Convergence Point Array
S2750 W1050 Intersection (Room 6, Panel 6) – Roof to Floor

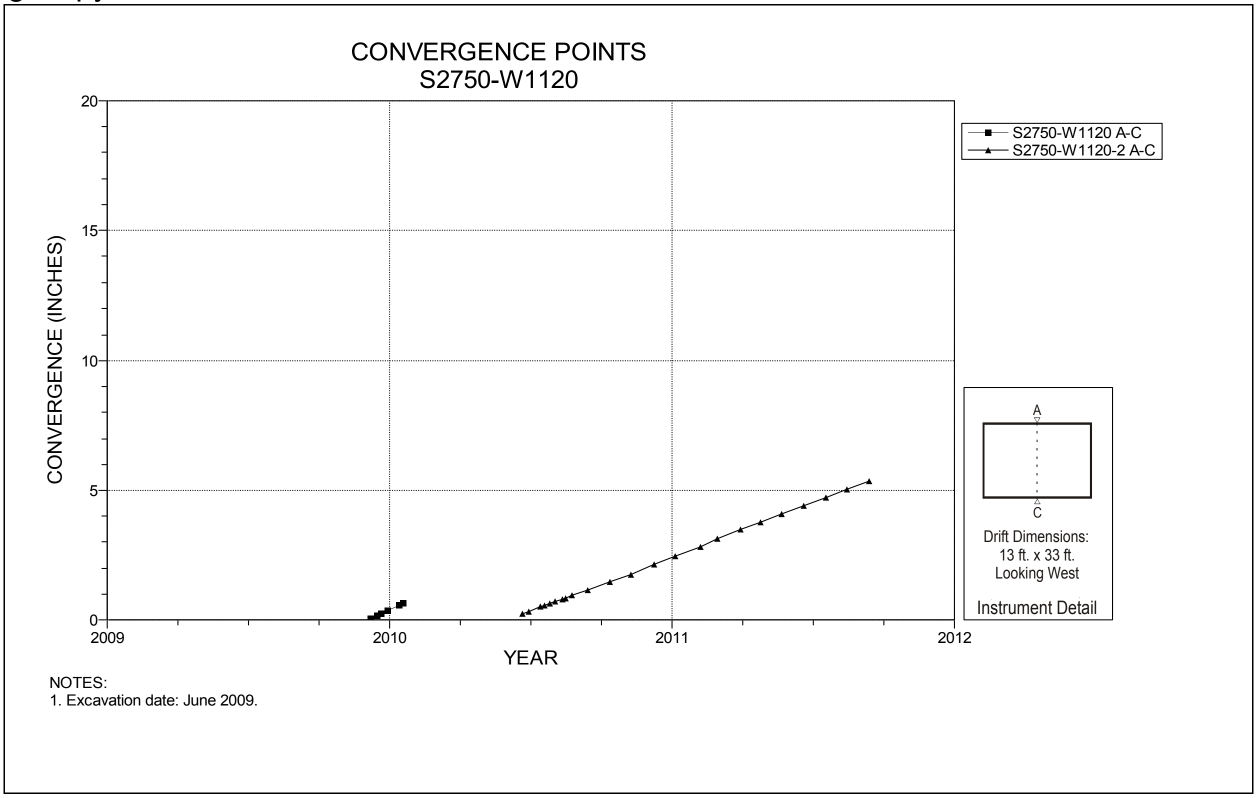


Figure 5-46 Convergence Point Array
S2750 W1120 – Roof to Floor

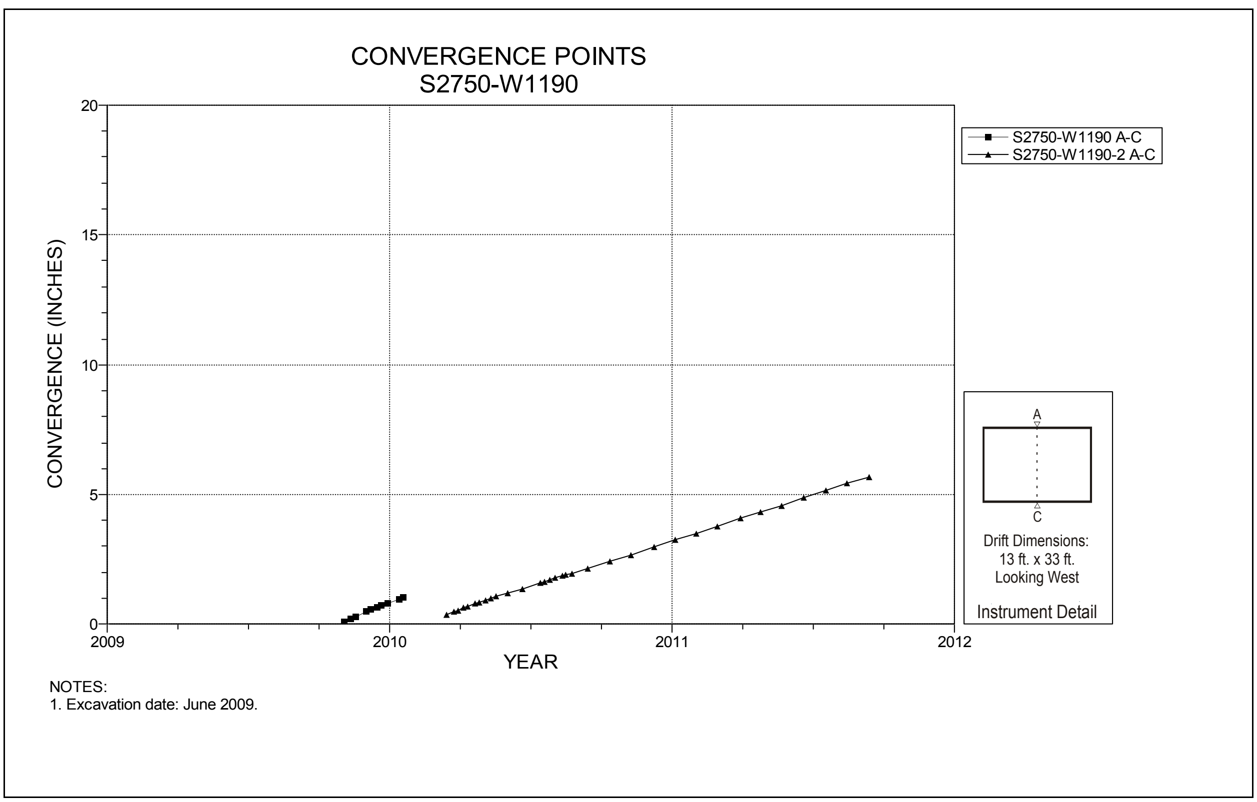


Figure 5-47 Convergence Point Array
S2750 W1190 Intersection (Room 7, Panel 6) – Roof to Floor

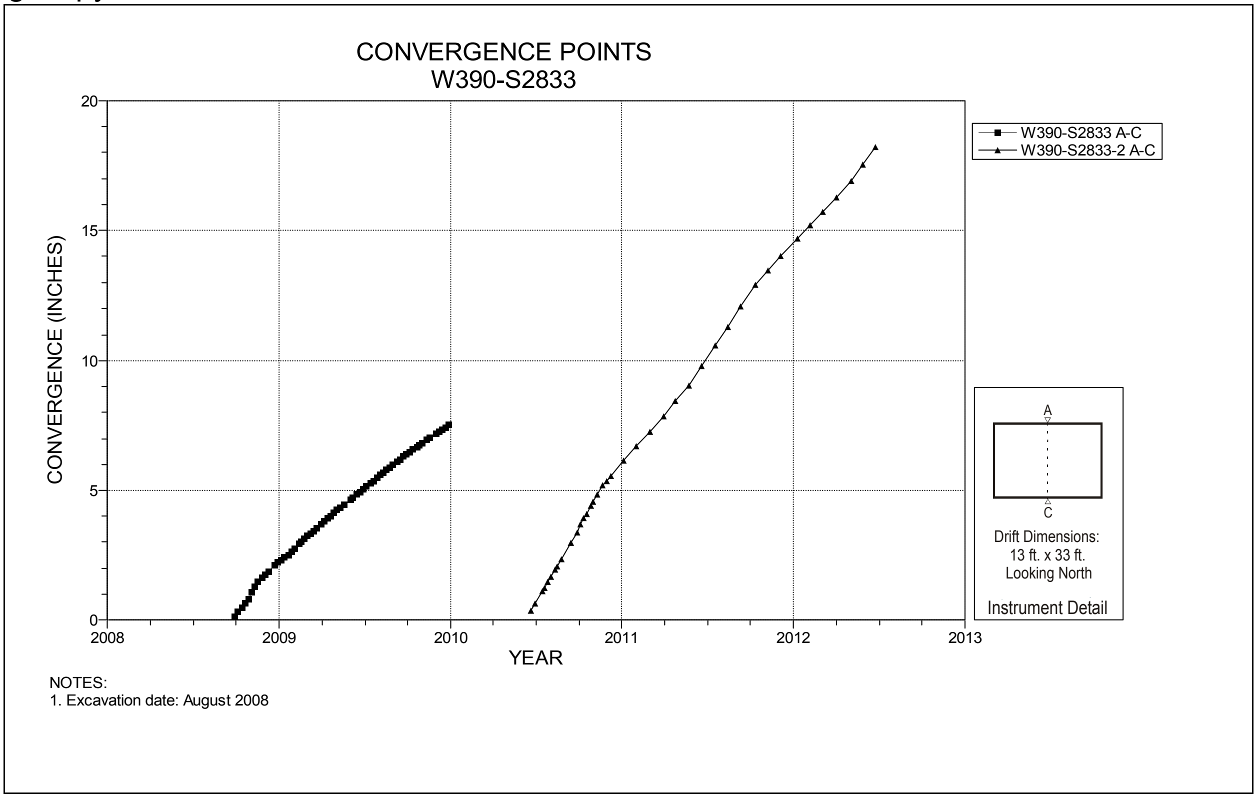


Figure 5-48 Convergence Point Array
Room 1, Panel 6 at W390 W2833 – Roof to Floor

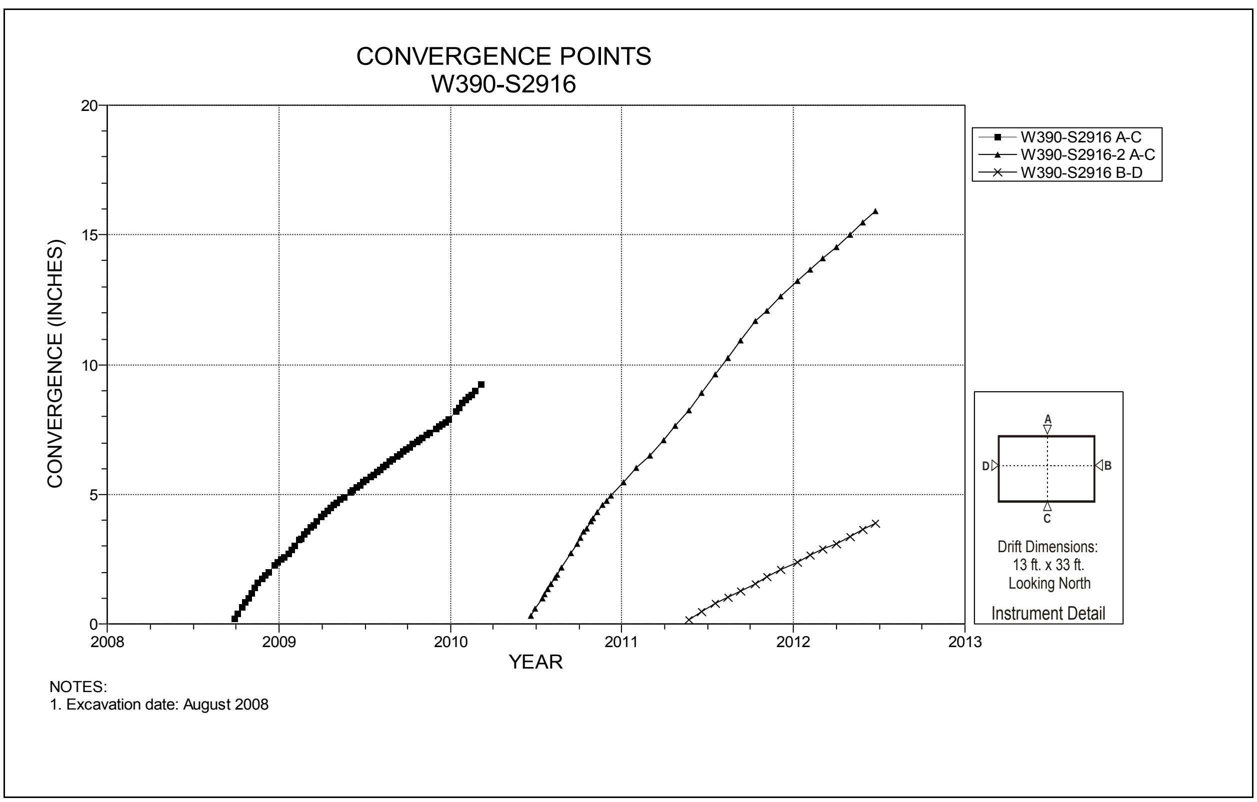


Figure 5-49 Convergence Point Array
Room 1, Panel 6 at W390 S2916– Room Center – All Chords

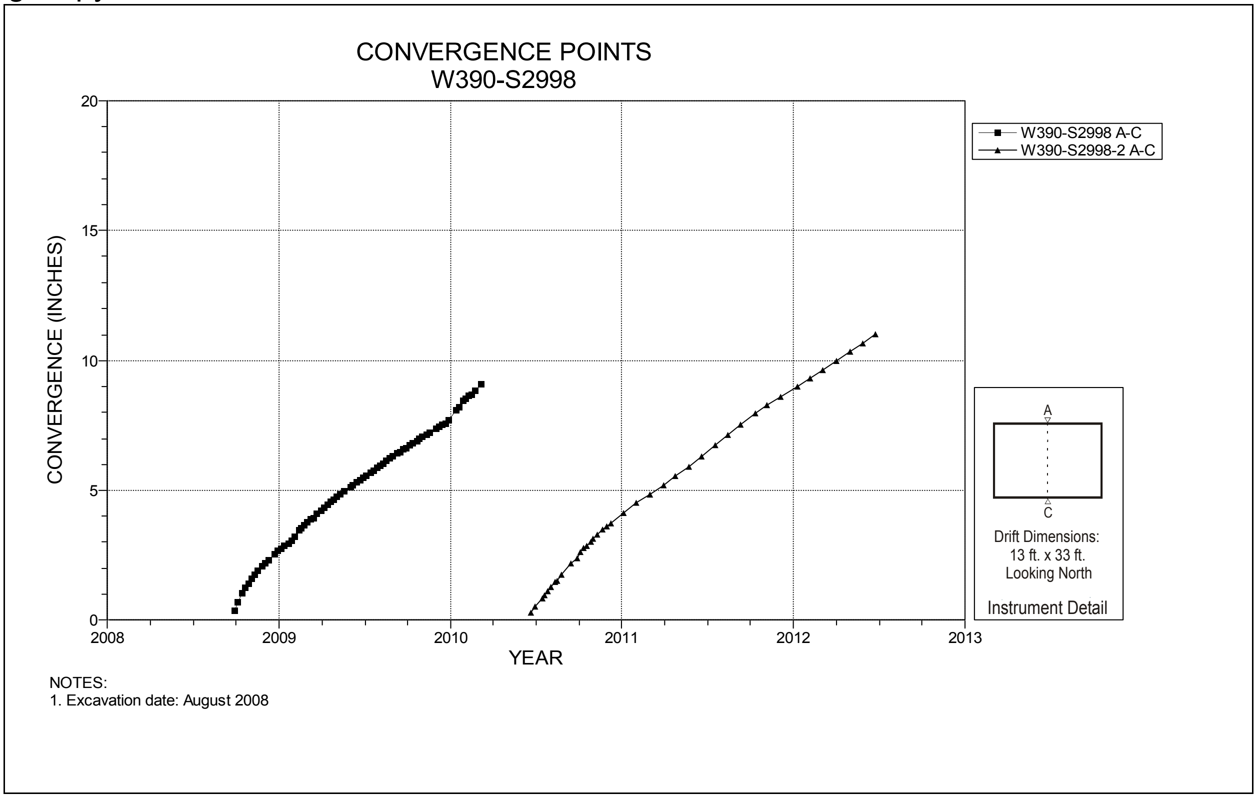


Figure 5-50 Convergence Point Array
Room 1, Panel 6 at W390 S2998 – Roof to Floor

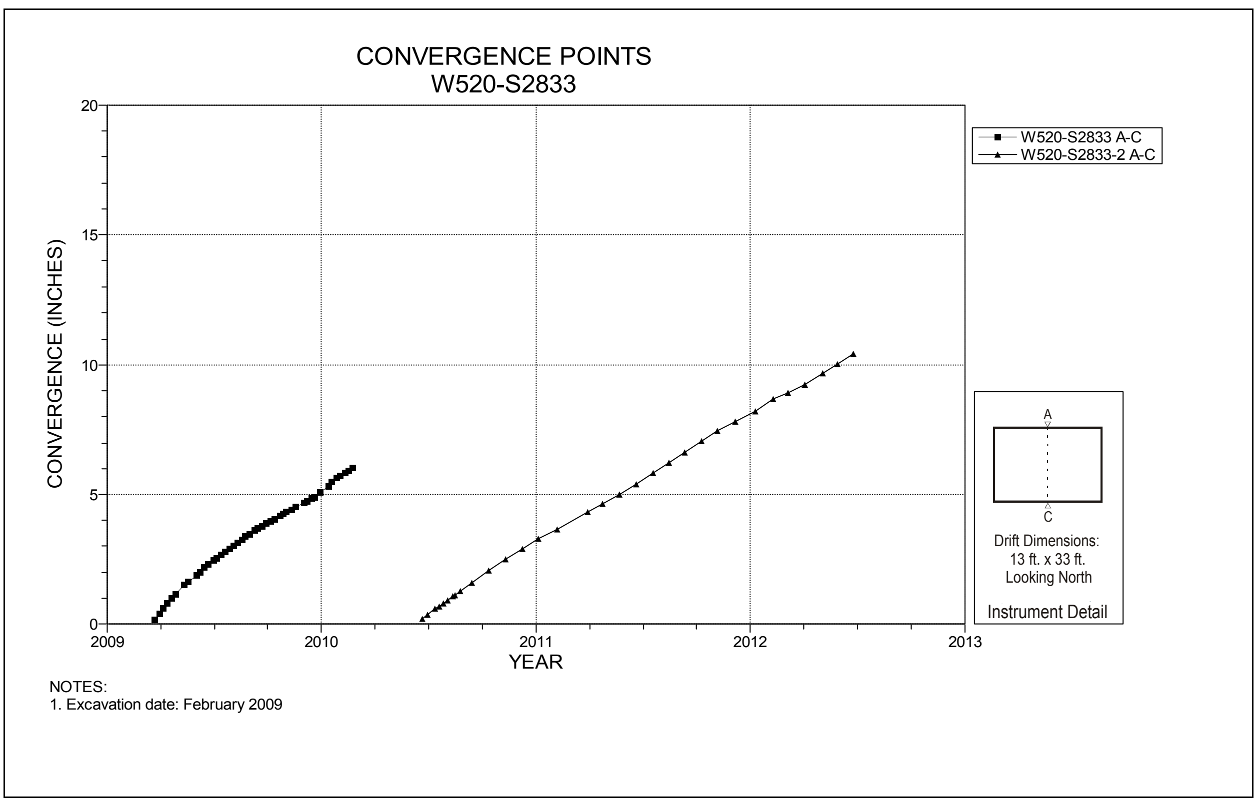


Figure 5-51 Convergence Point Array
Room 2, Panel 6 at W520 S2833 – Roof to Floor

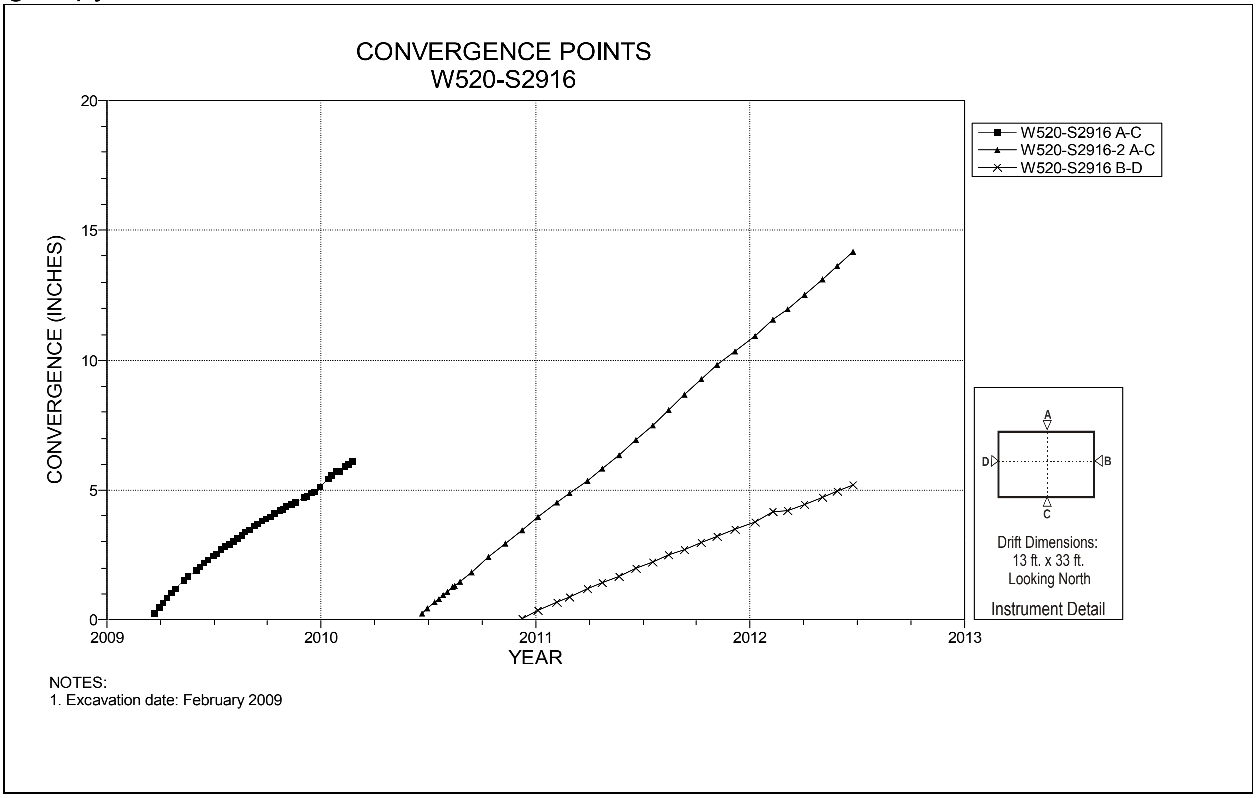


Figure 5-52 Convergence Point Array
Room 2, Panel 6 at W520 S2916– Room Center – All Chords

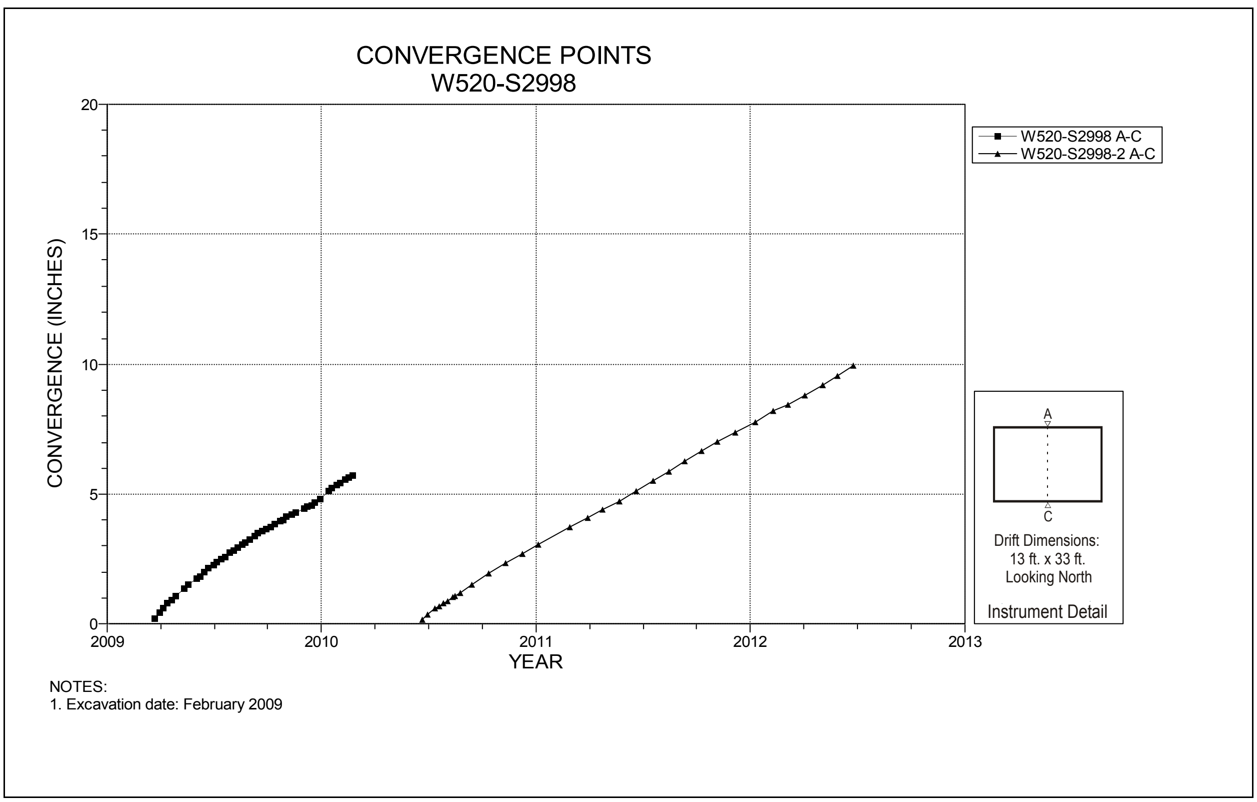


Figure 5-53 Convergence Point Array
Room 2, Panel 6 at W520 S2998 – Roof to Floor

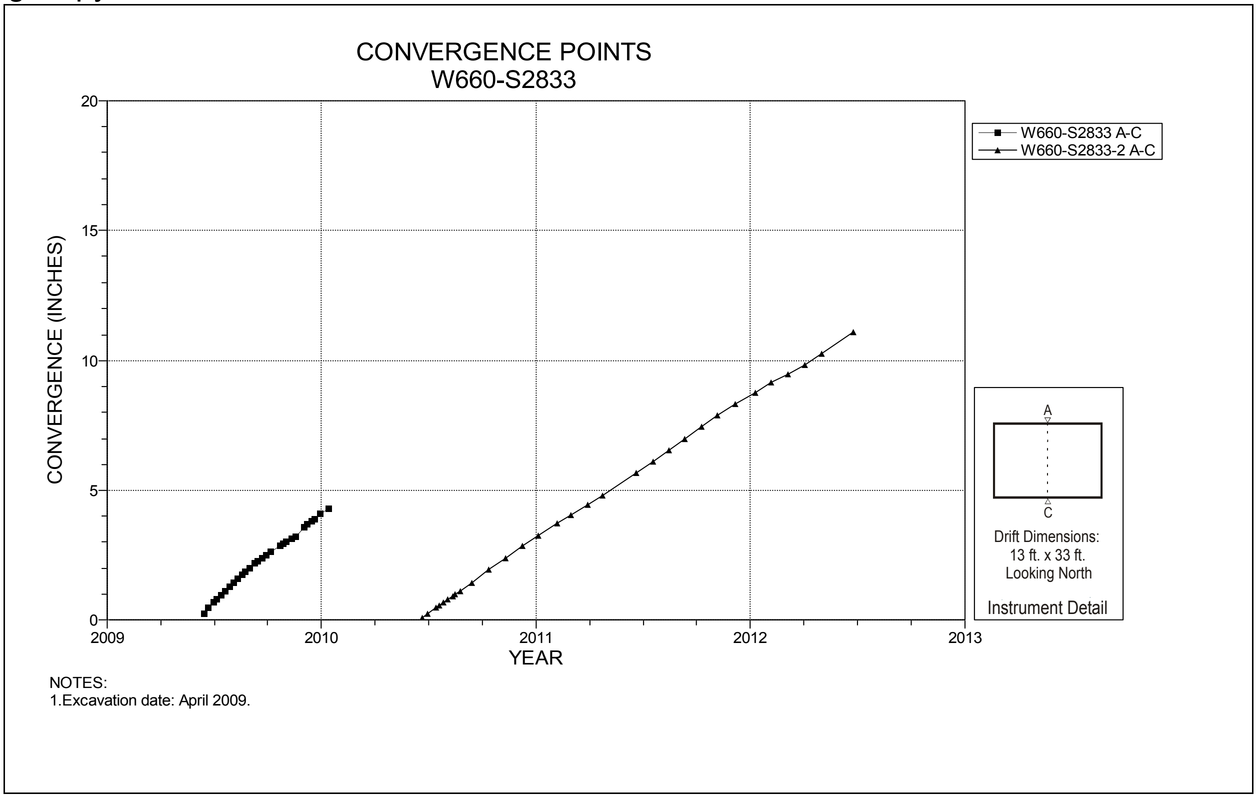


Figure 5-54 Convergence Point Array
Room 3, Panel 6 at W660 S2833 – Roof to Floor

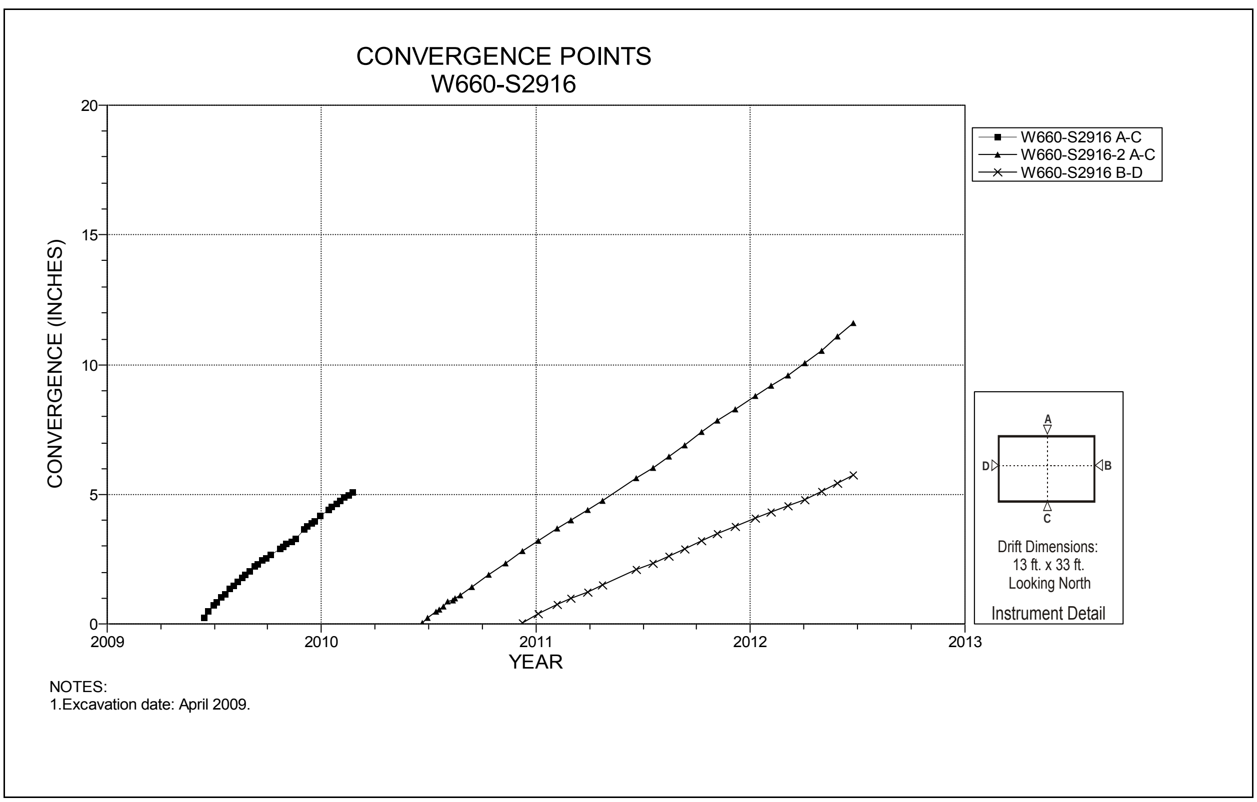


Figure 5-55 Convergence Point Array
Room 3, Panel 6 at W660 S2916– Room Center – All Chords

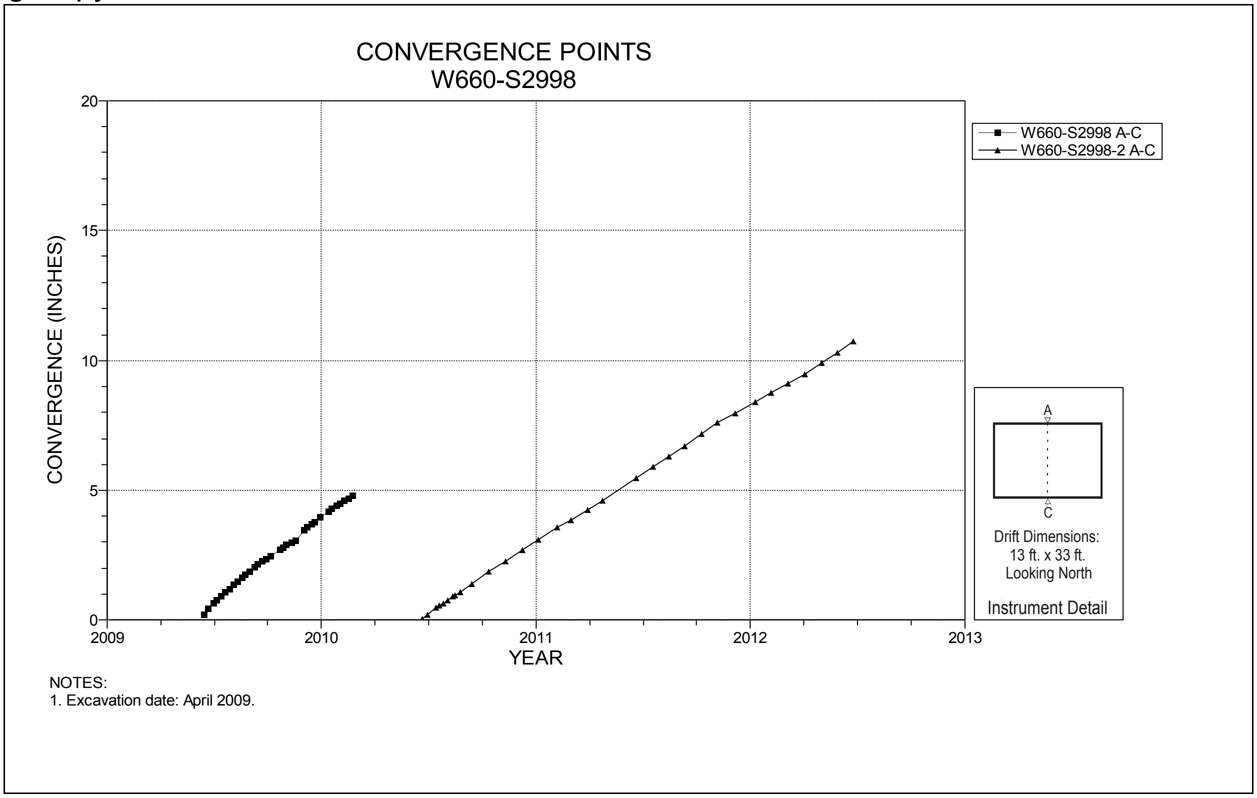


Figure 5-56 Convergence Point Array
Room 3, Panel 6 at W660 S2998 – Roof to Floor

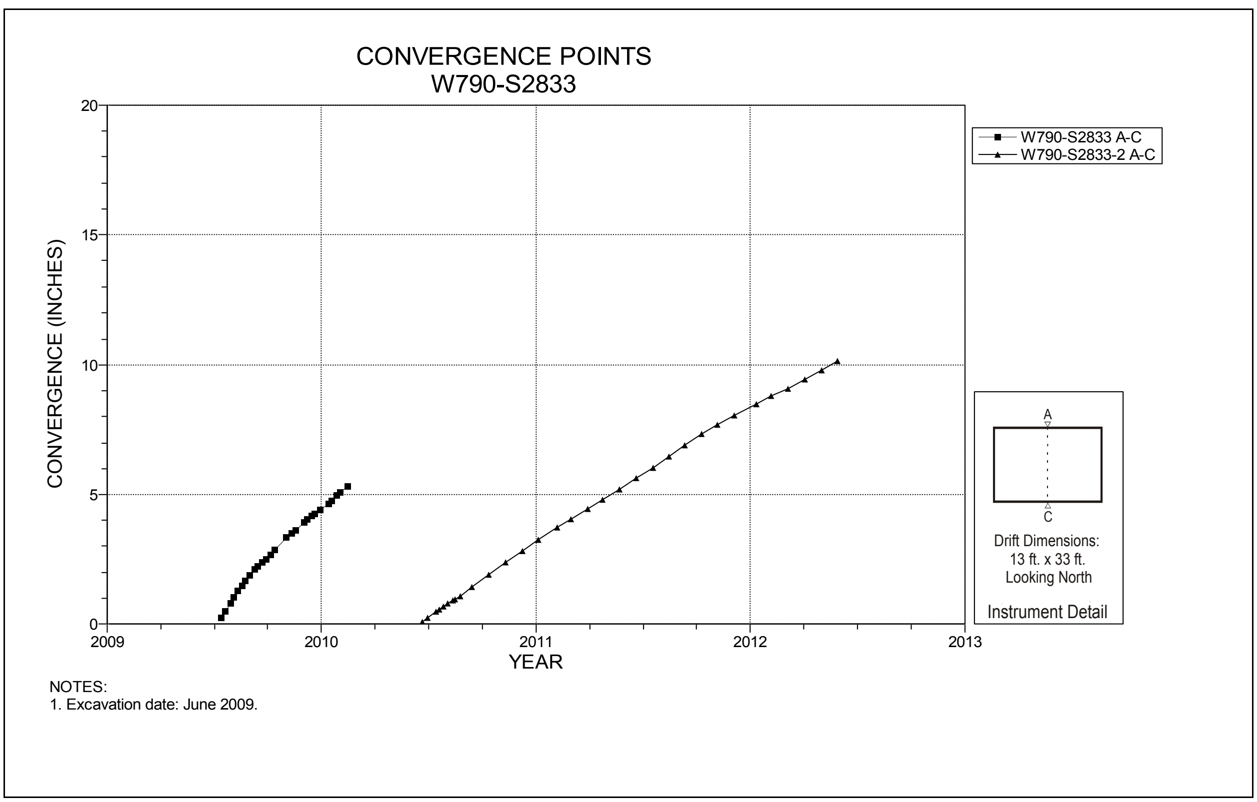


Figure 5-57 Convergence Point Array
Room 4, Panel 6 at W790 S2833 – Roof to Floor

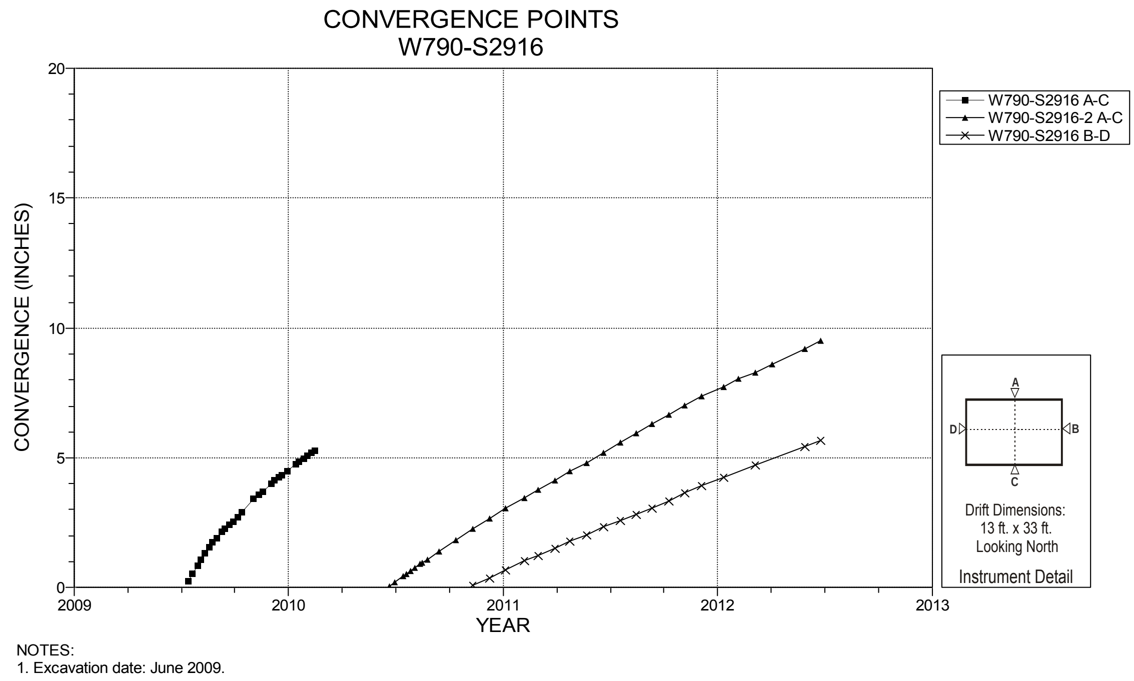


Figure 5-58 Convergence Point Array
Room 4, Panel 6 at W790 S2916– Room Center – All Chords

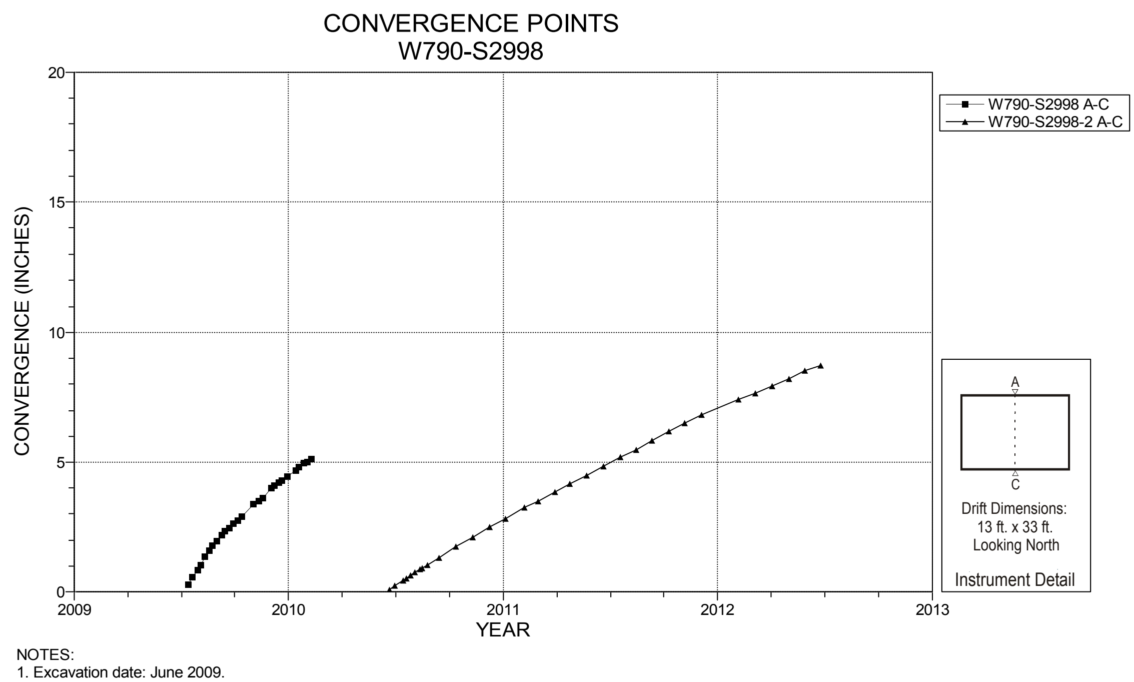


Figure 5-59 Convergence Point Array
Room 4, Panel 6 at W790 S2998 – Roof to Floor

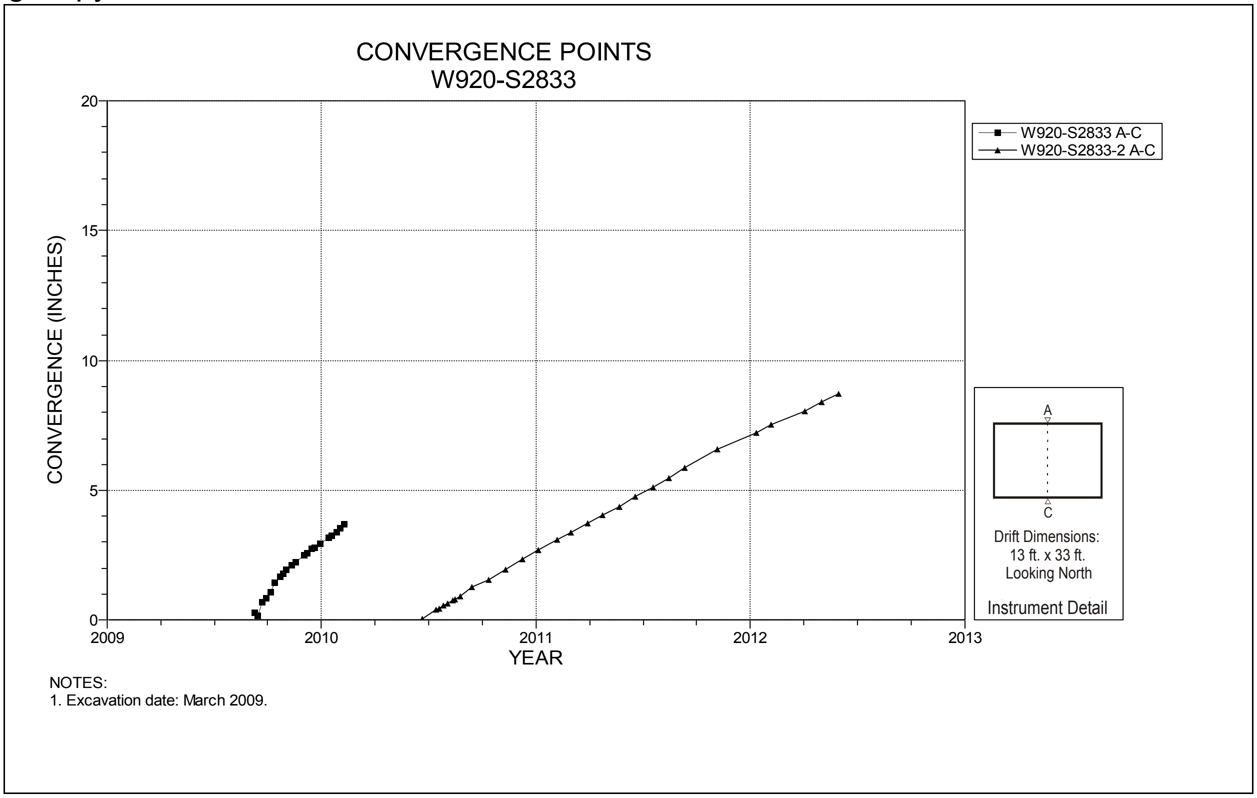


Figure 5-60 Convergence Point Array
Room 5, Panel 6 at W920 S2833 – Roof to Floor

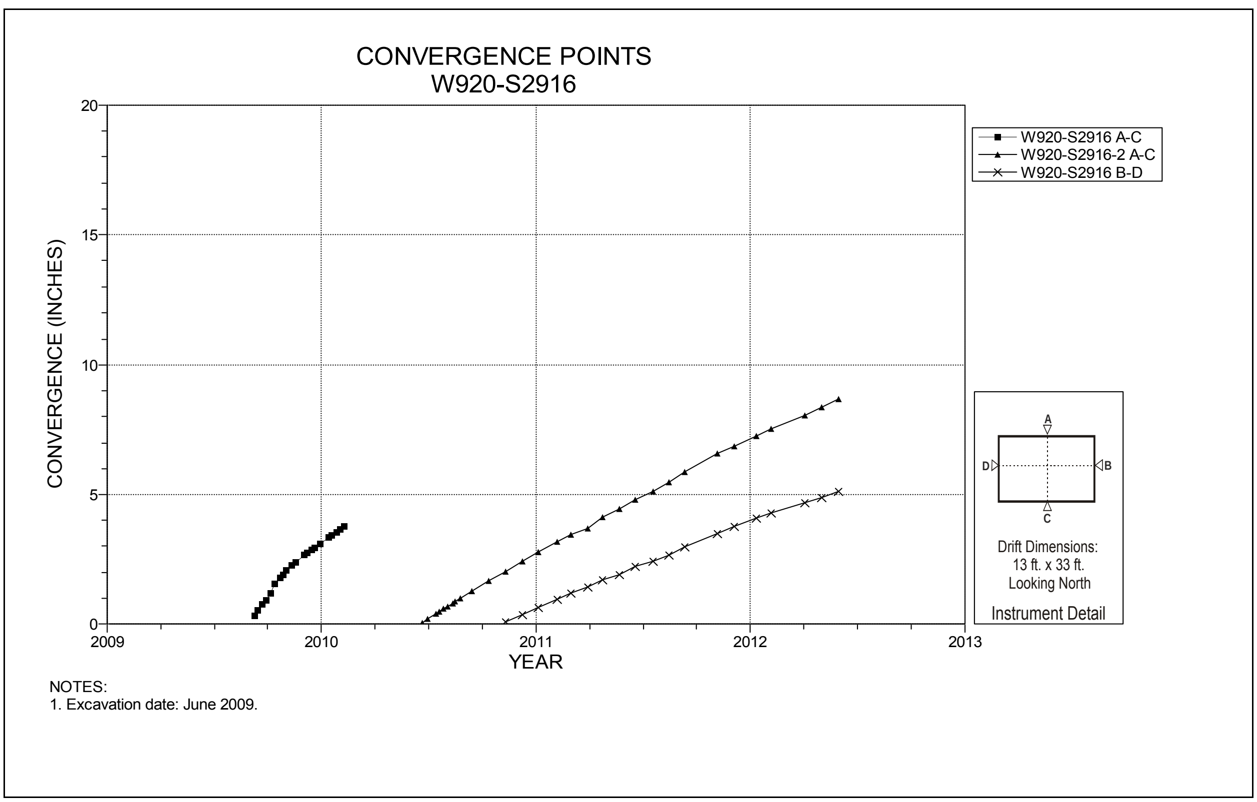


Figure 5-61 Convergence Point Array
Room 5, Panel 6 at W920 S2916– Room Center – All Chords

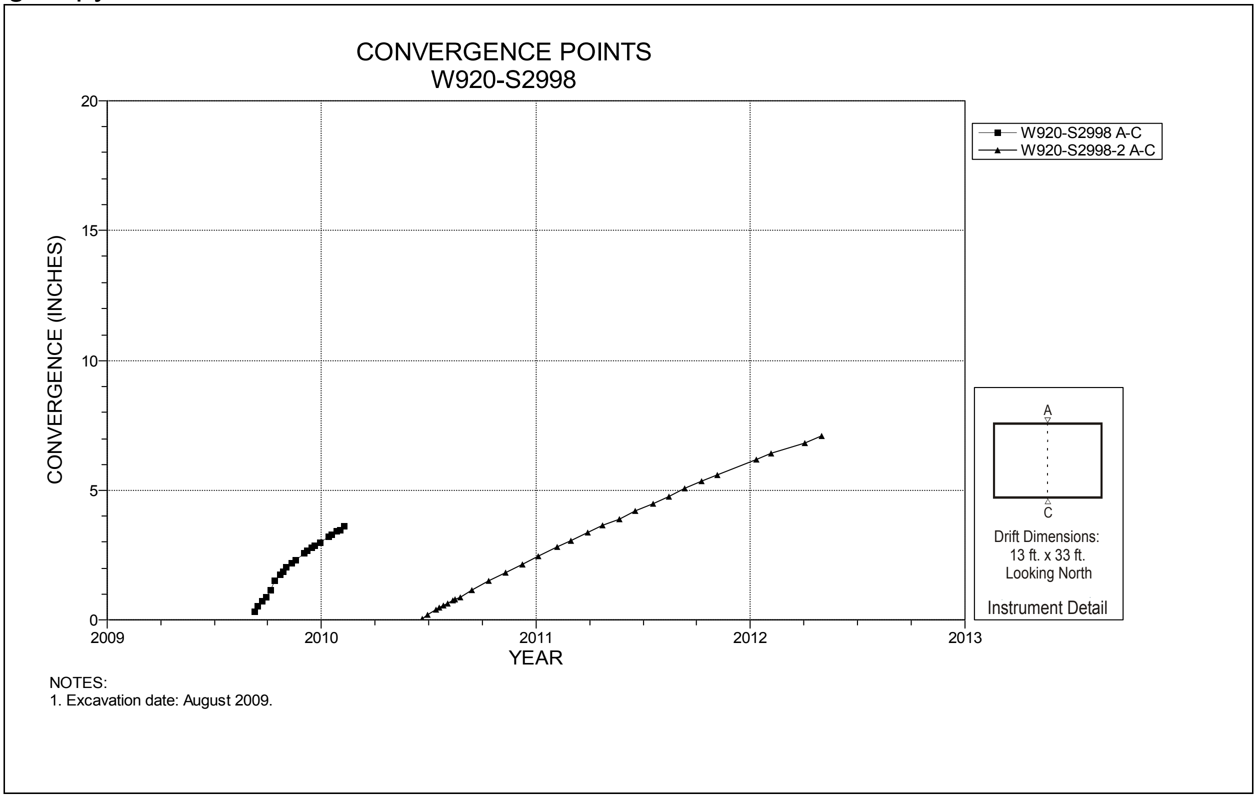


Figure 5-62 Convergence Point Array
Room 5, Panel 6 at W920 S2998 – Roof to Floor

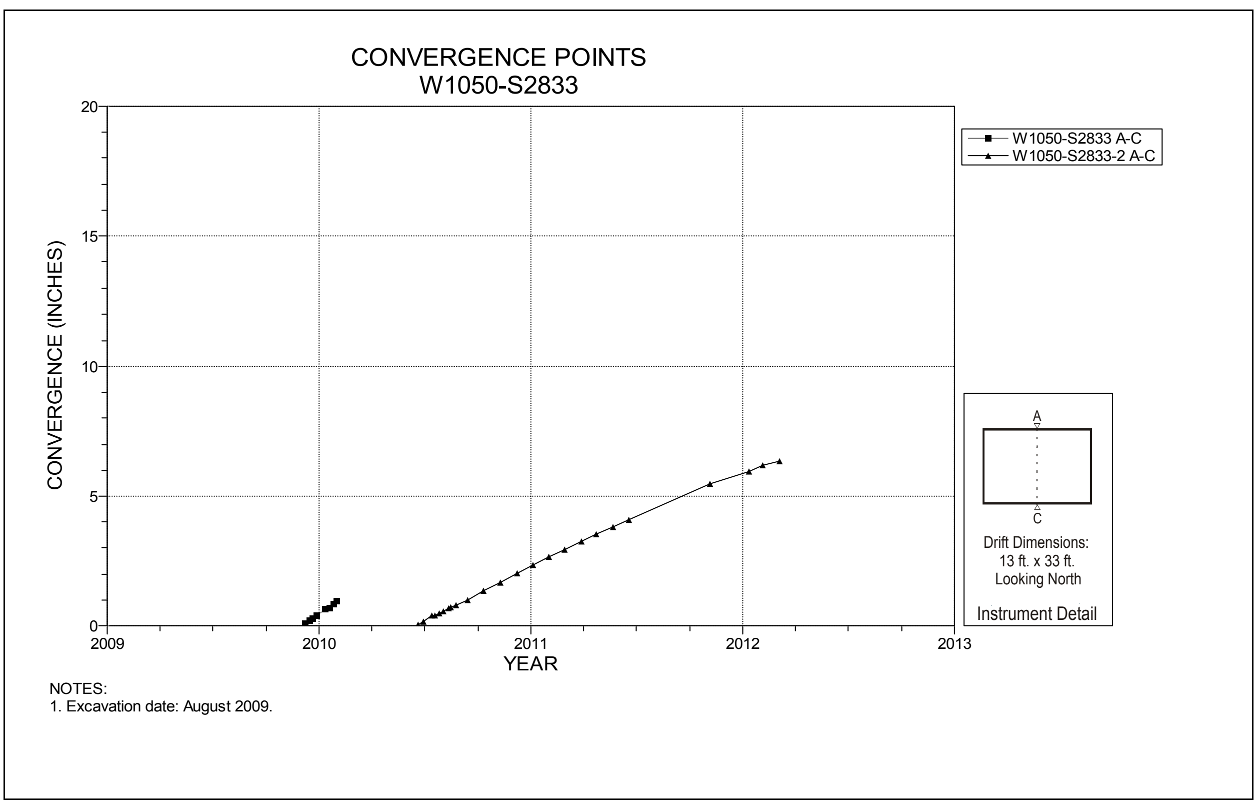


Figure 5-63 Convergence Point Array
Room 6, Panel 6 at W1050 S2833 – Roof to Floor

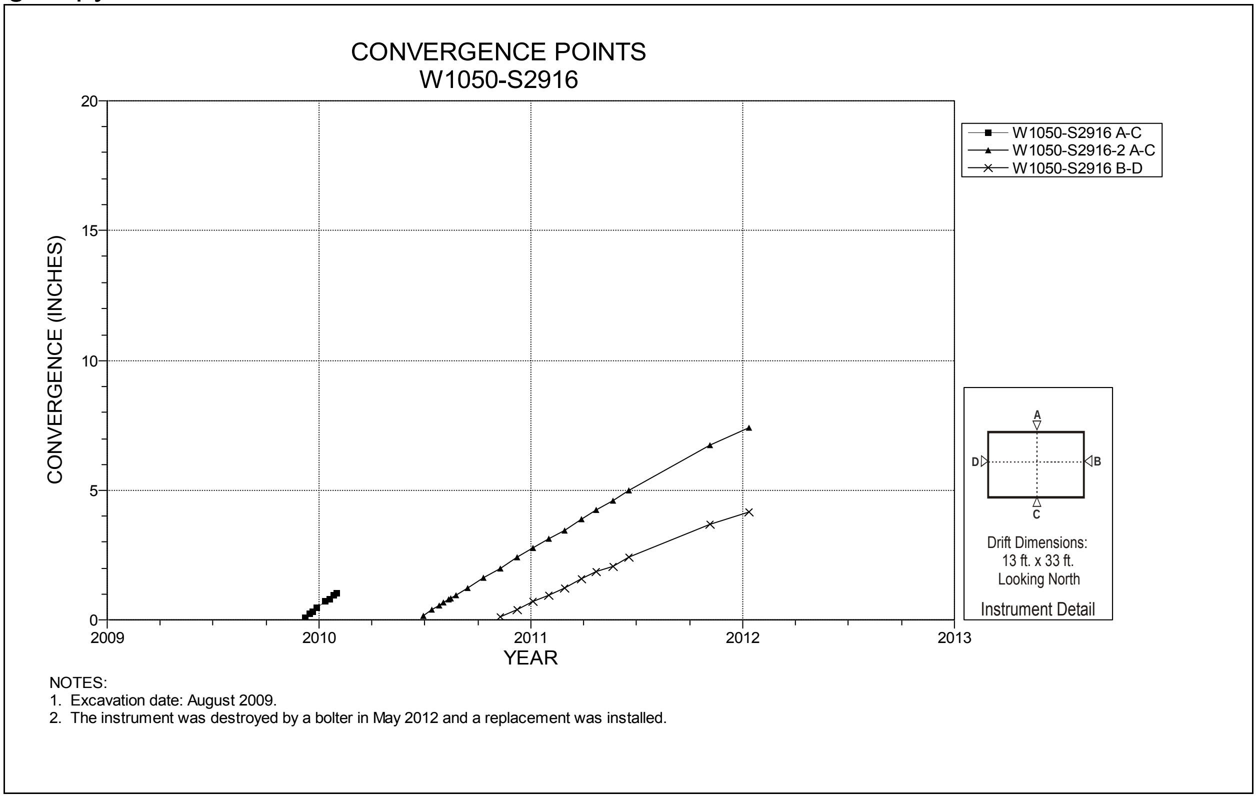


Figure 5-64 Convergence Point Array
Room 6, Panel 6 at W1050 S2916– Room Center – All Chords

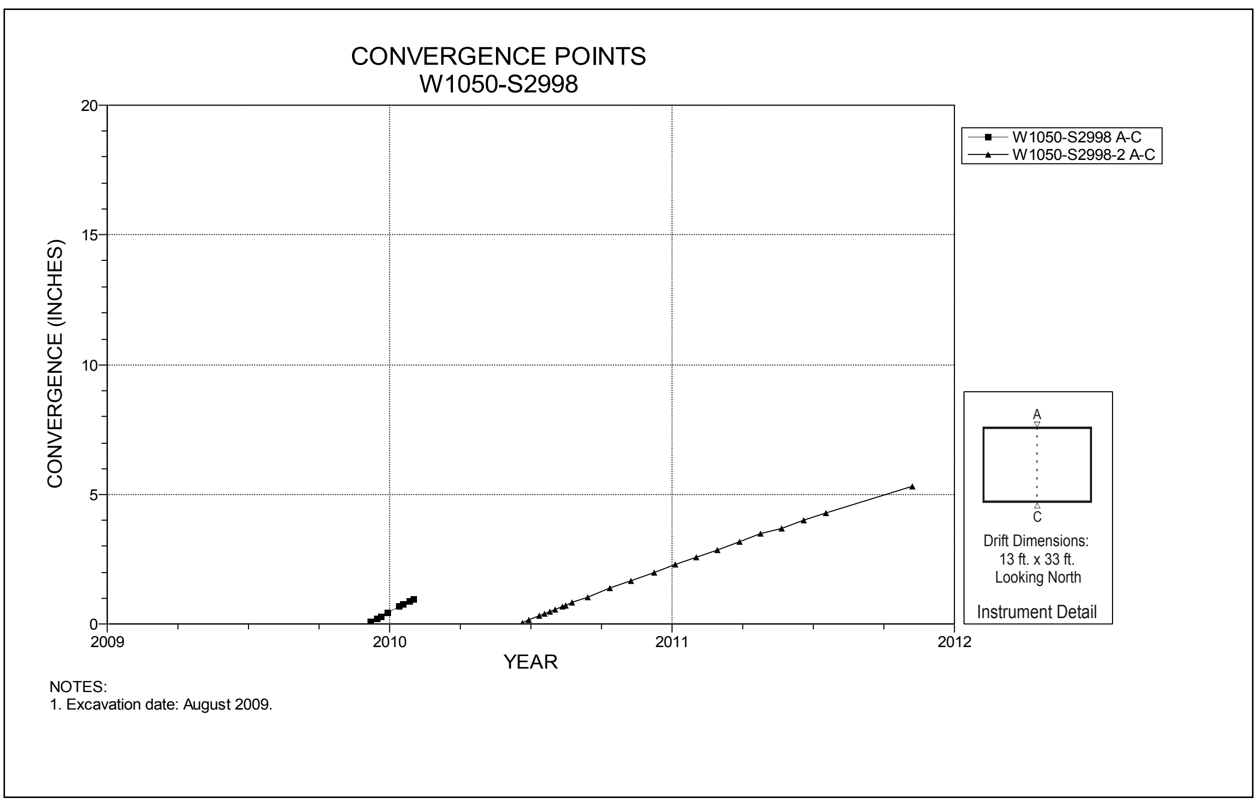


Figure 5-65 Convergence Point Array
Room 6, Panel 6 at W1050 S2998 – Roof to Floor

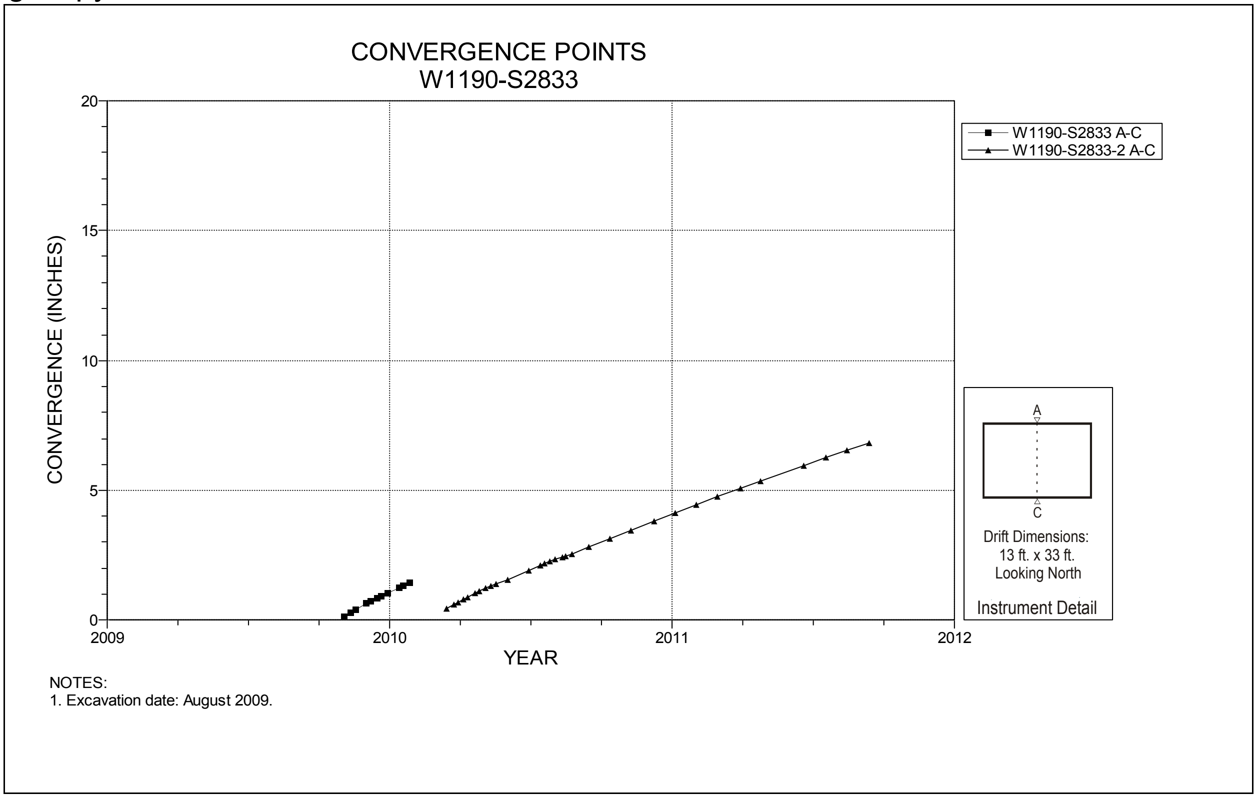


Figure 5-66 Convergence Point Array
Room 7, Panel 6 at W1190 S2833 – Roof to Floor

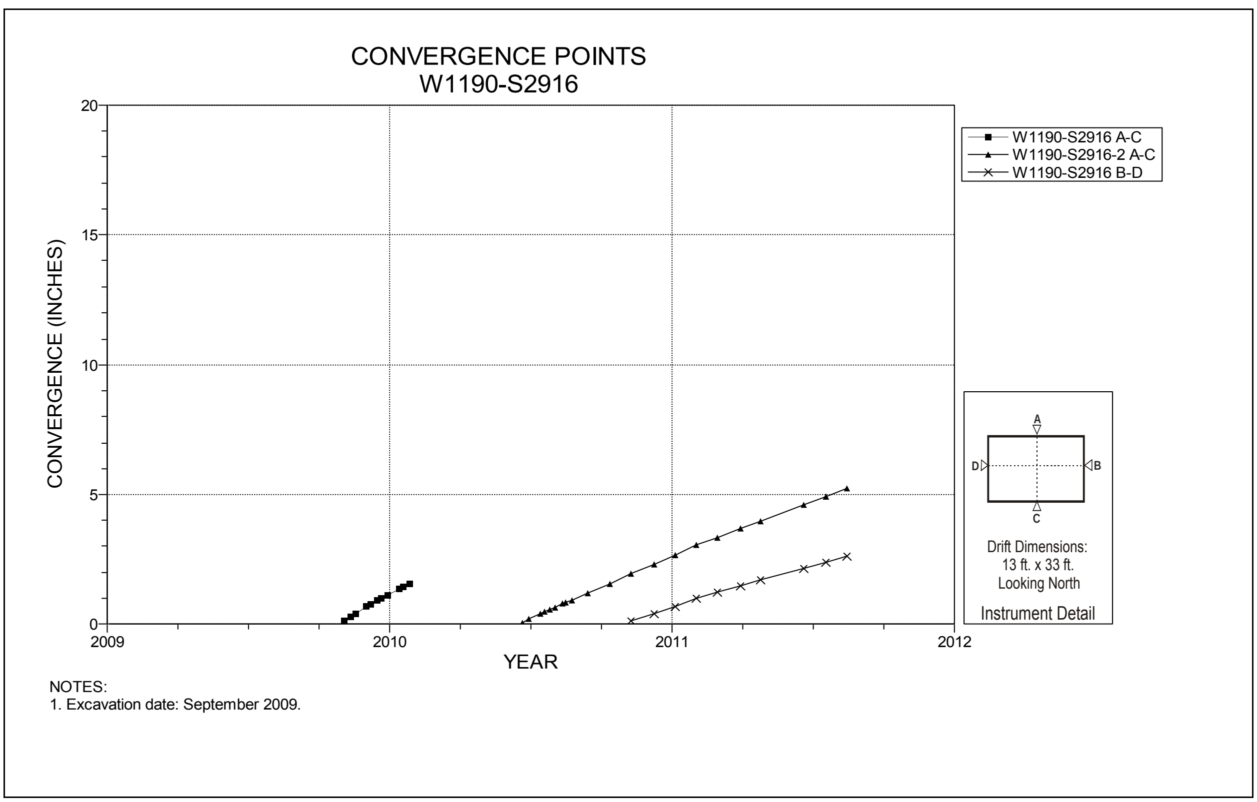
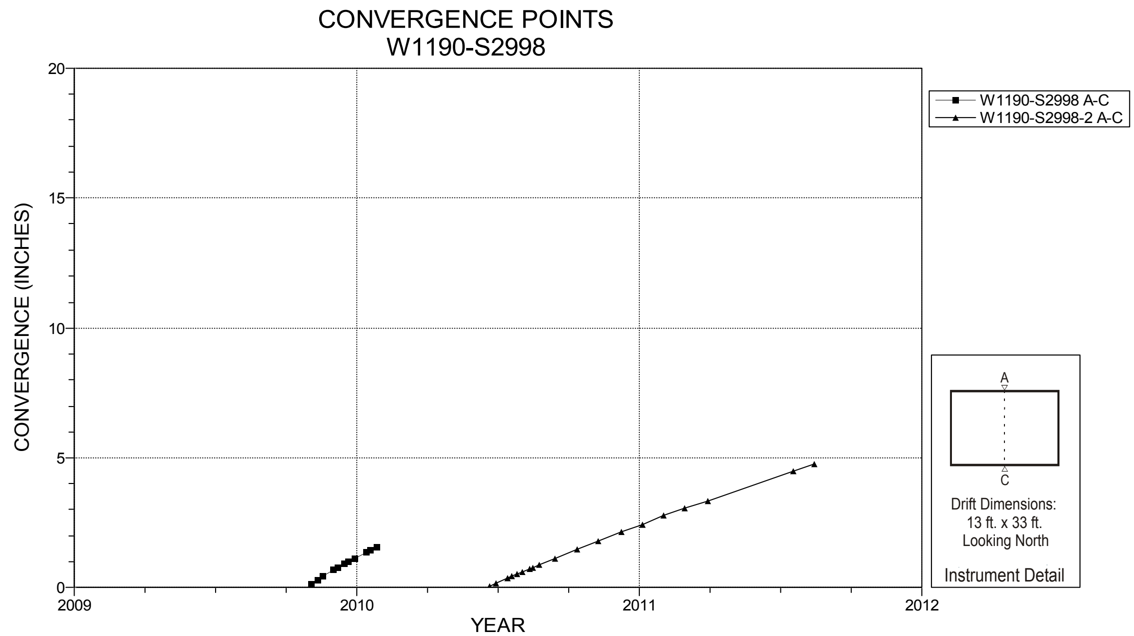
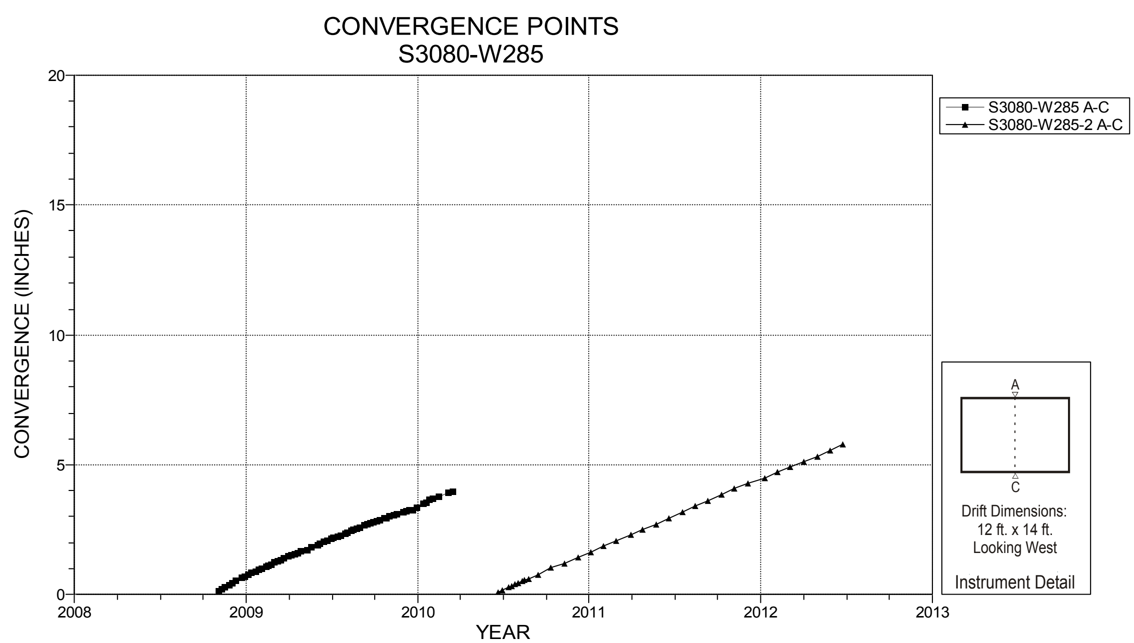


Figure 5-67 Convergence Point Array
Room 7, Panel 6 at W1190 S2916– Room Center – All Chords



NOTES:
1. Excavation date: September 2009.

Figure 5-68 Convergence Point Array
Room 7, Panel 6 at W1190 S2998 – Roof to Floor



NOTES:
1. Excavation date: September 2008

Figure 5-69 Convergence Point Array
S3080 W285 – Roof to Floor

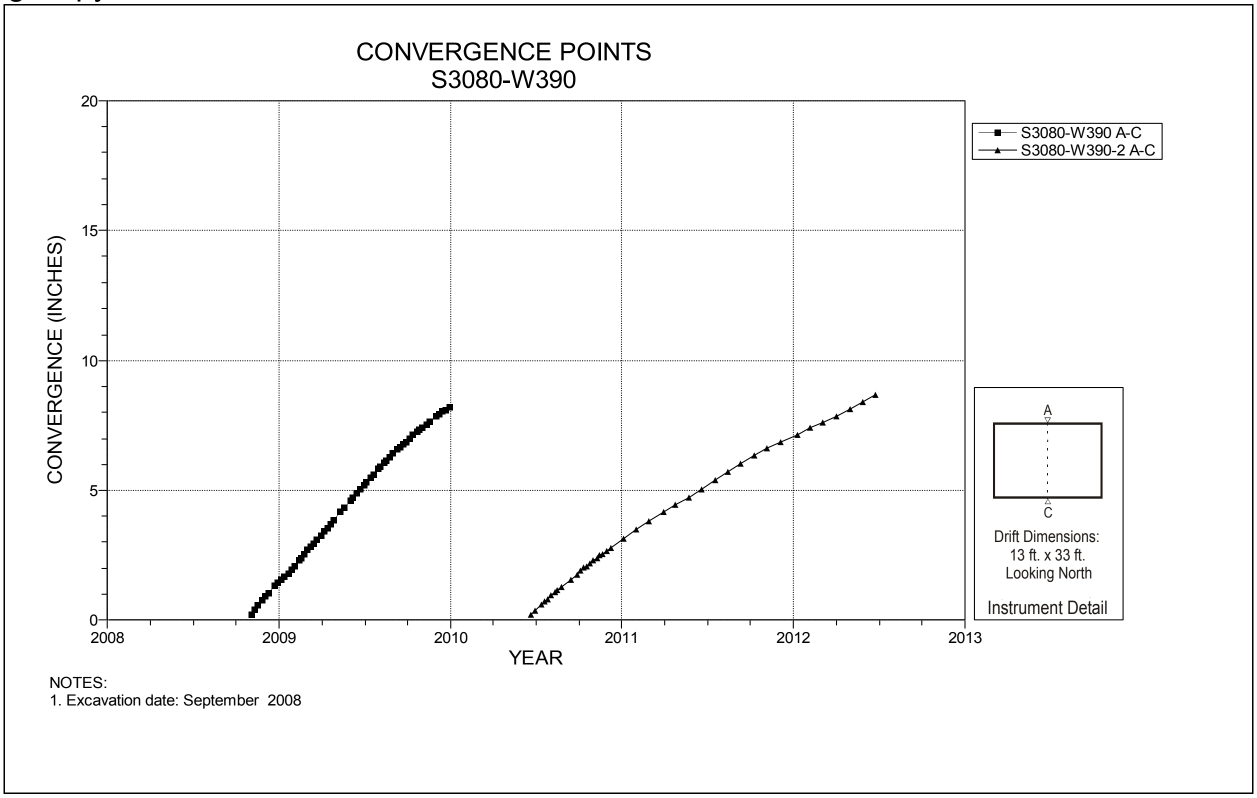


Figure 5-70 Convergence Point Array
S3080 W390 Intersection (Room 1, Panel 6) – Roof to Floor

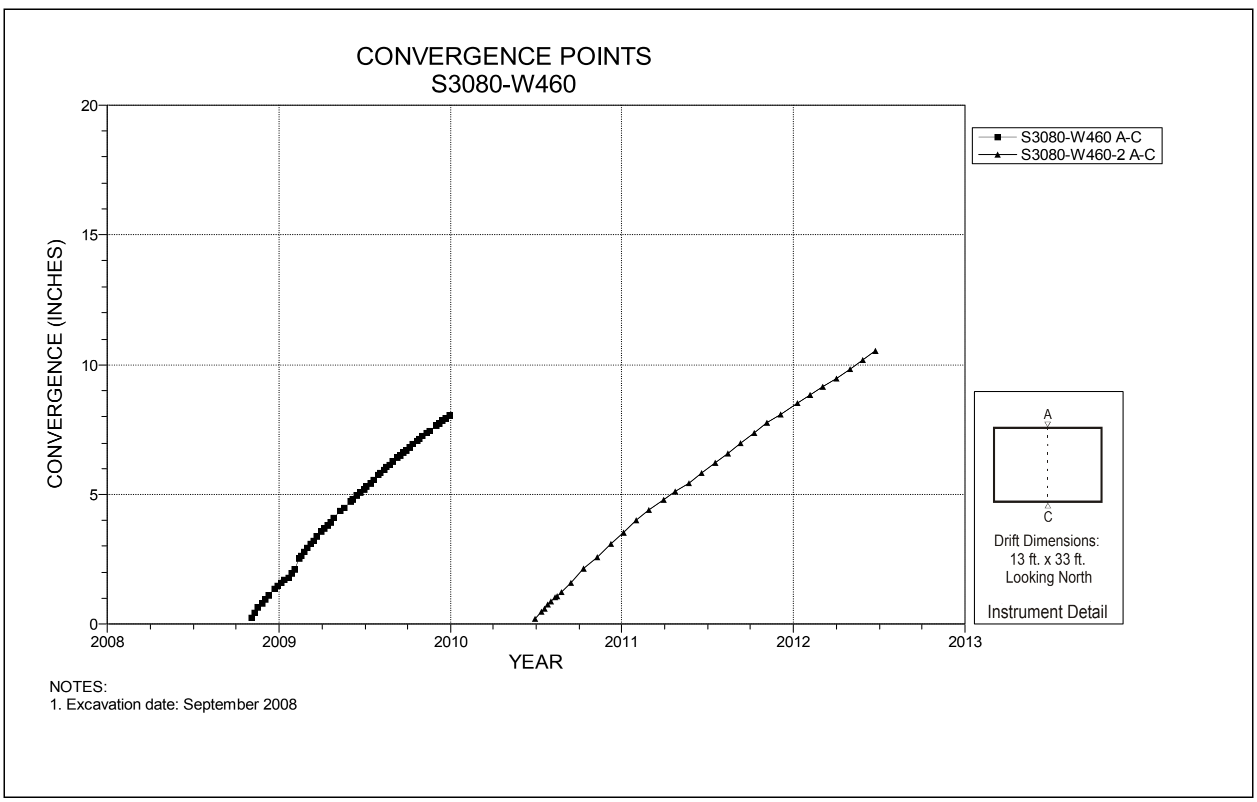


Figure 5-71 Convergence Point Array
S3080 W460 – Roof to Floor

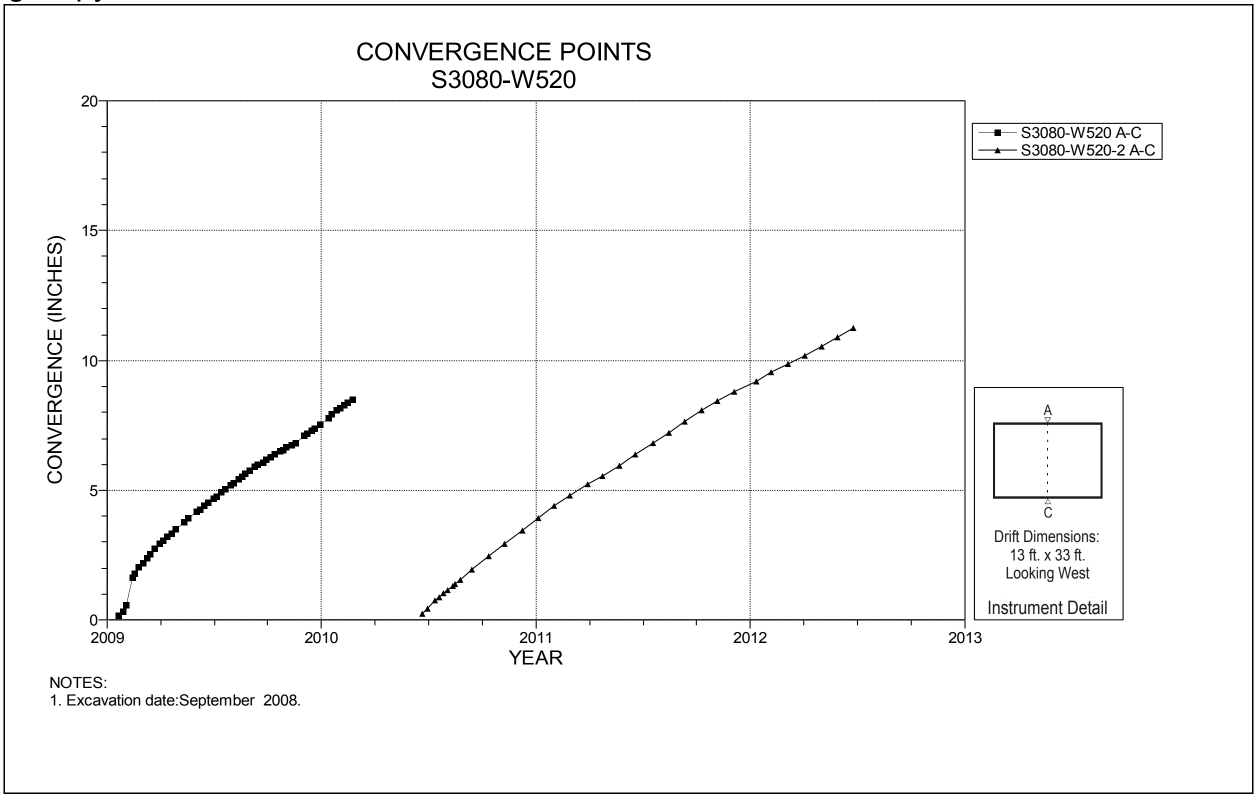


Figure 5-72 Convergence Point Array
S3080 W520 Intersection (Room 2, Panel 6) – Roof to Floor

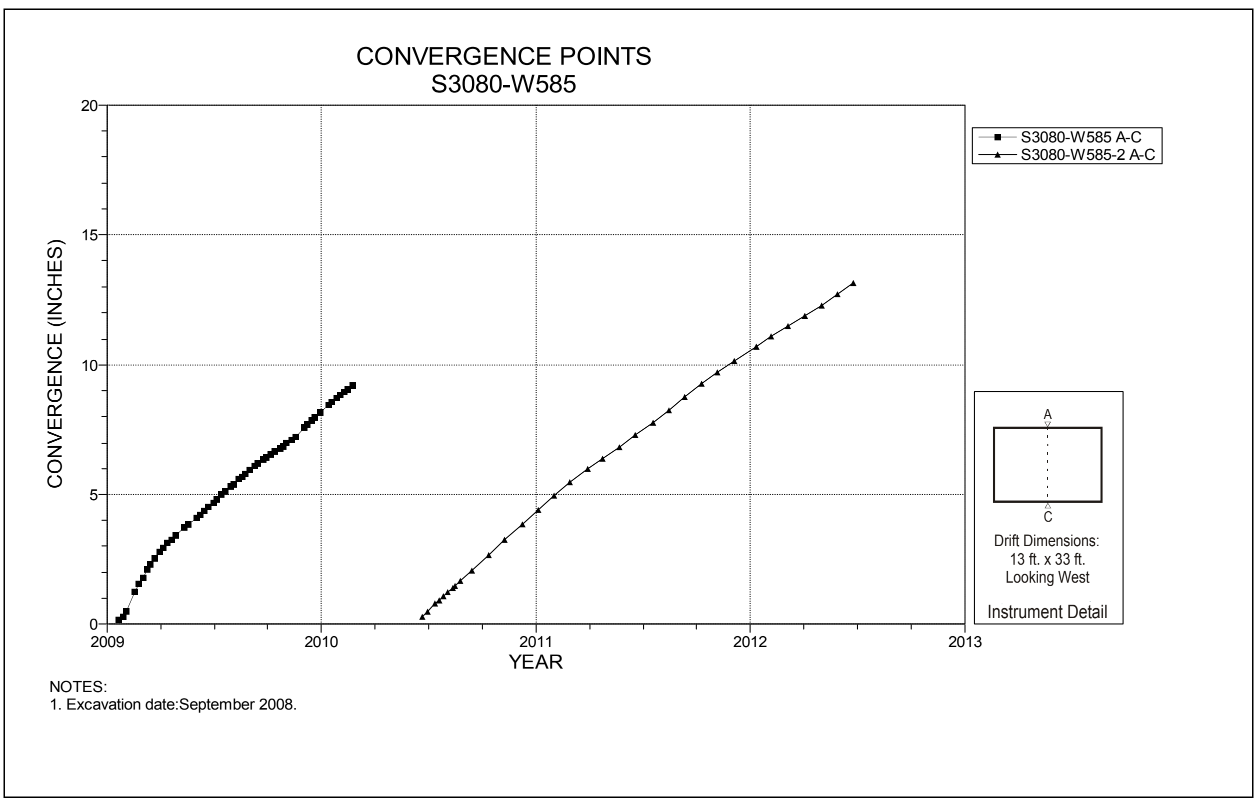


Figure 5-73 Convergence Point Array
S3080 W585 – Roof to Floor

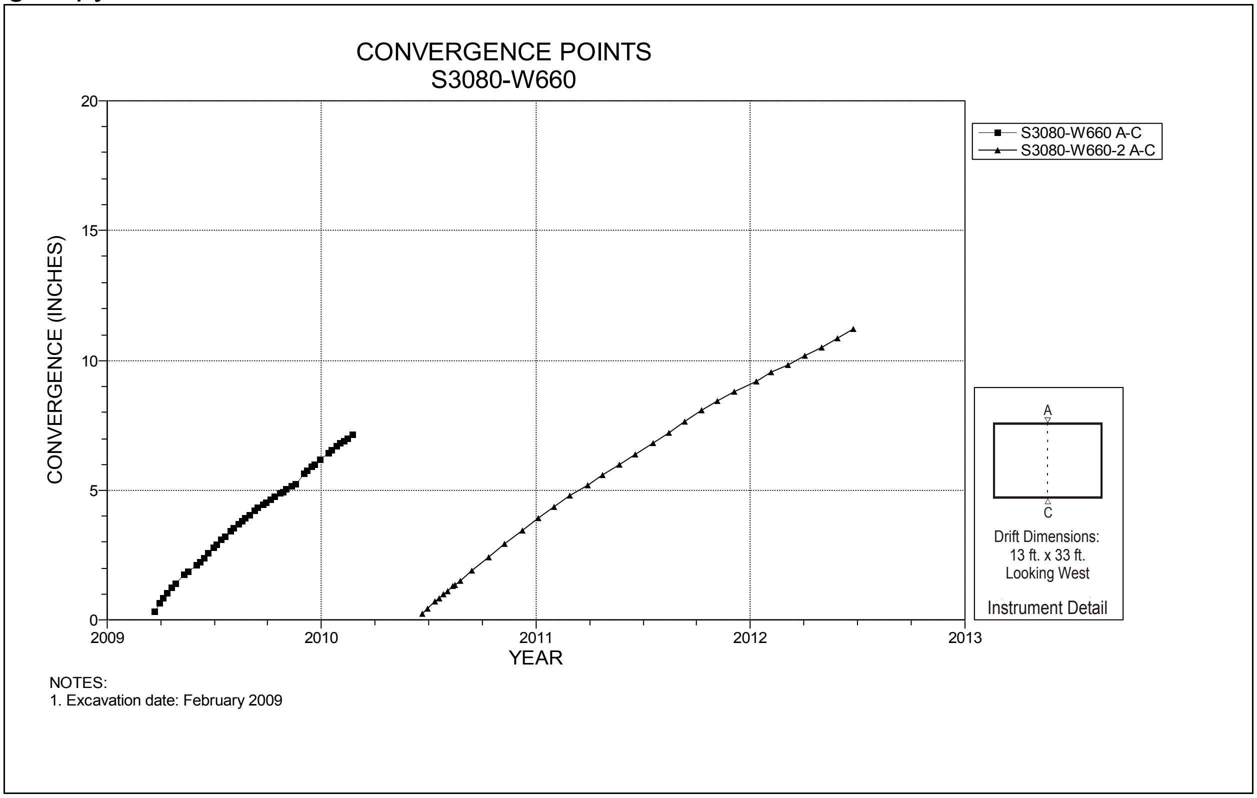


Figure 5-74 Convergence Point Array
S3080 W660 Intersection (Room 3, Panel 6) – Roof to Floor

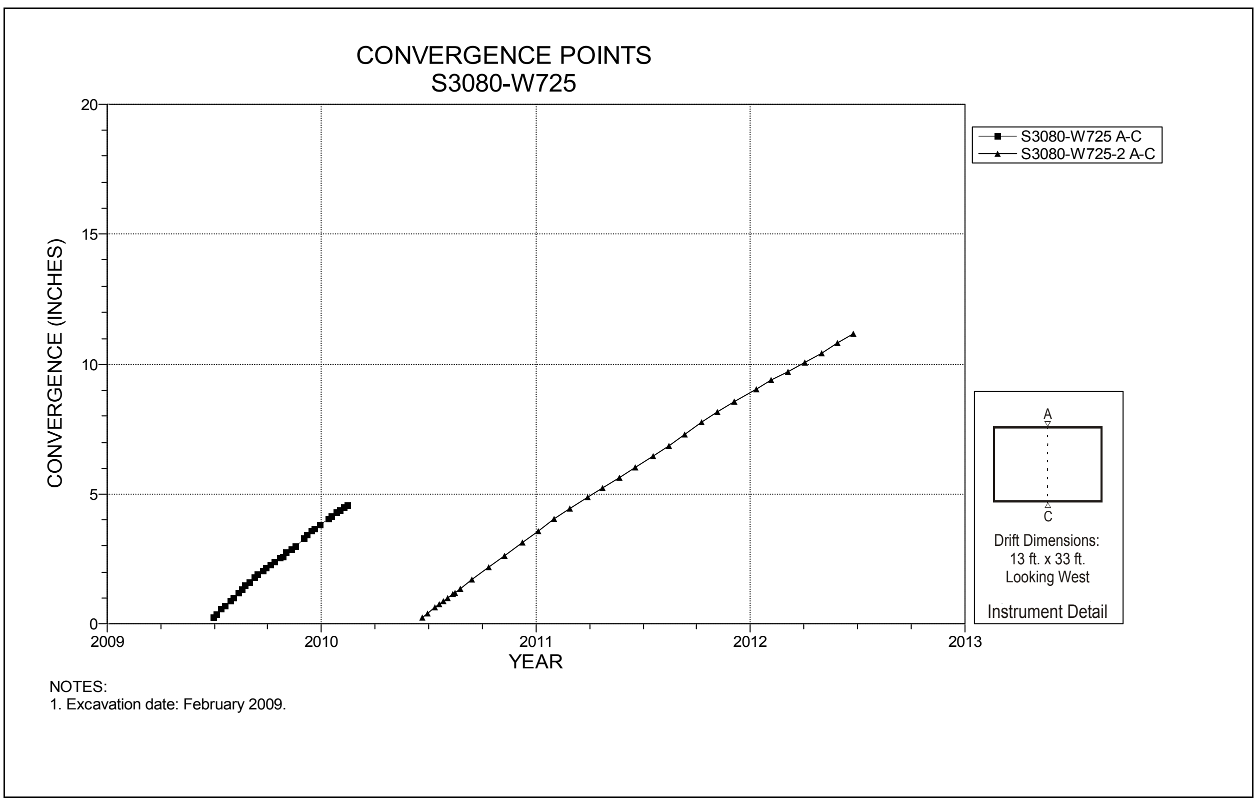


Figure 5-75 Convergence Point Array
S3080 W725 – Roof to Floor

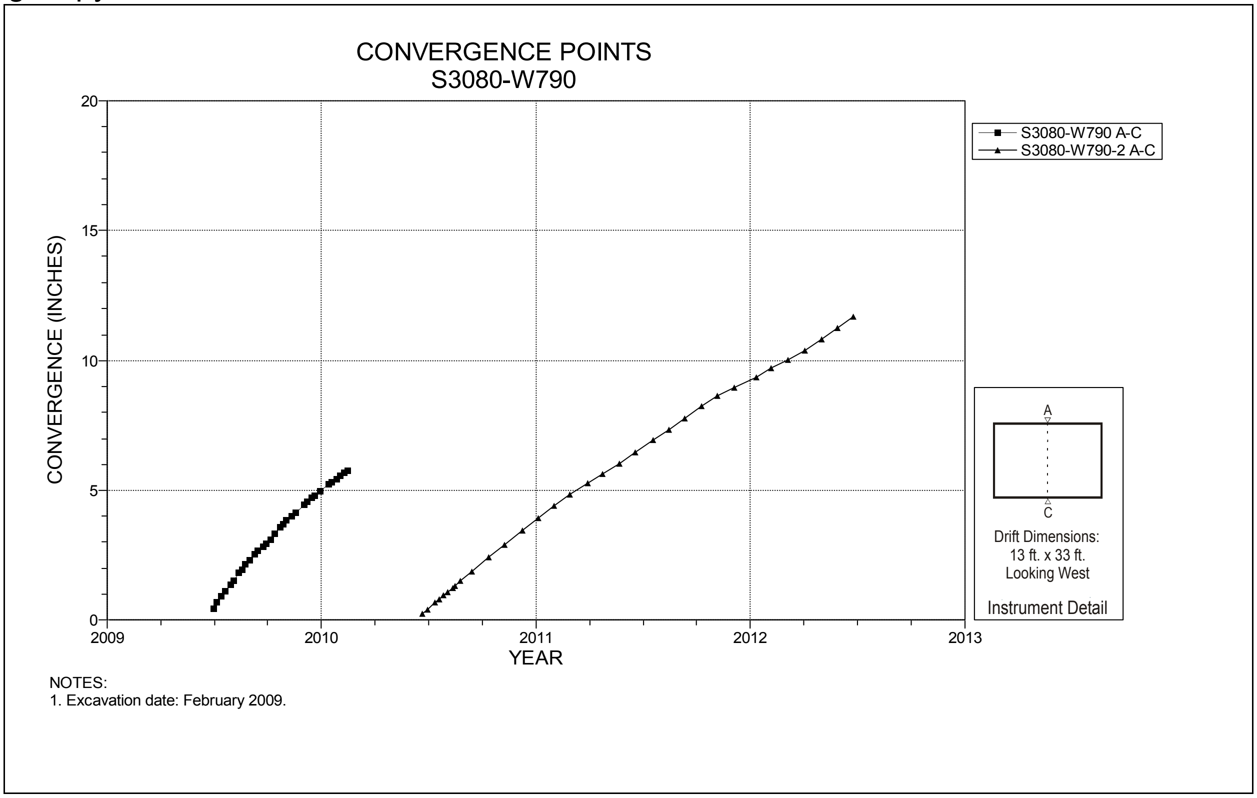


Figure 5-76 Convergence Point Array
S3080 W790 Intersection (Room 4, Panel 6) – Roof to Floor

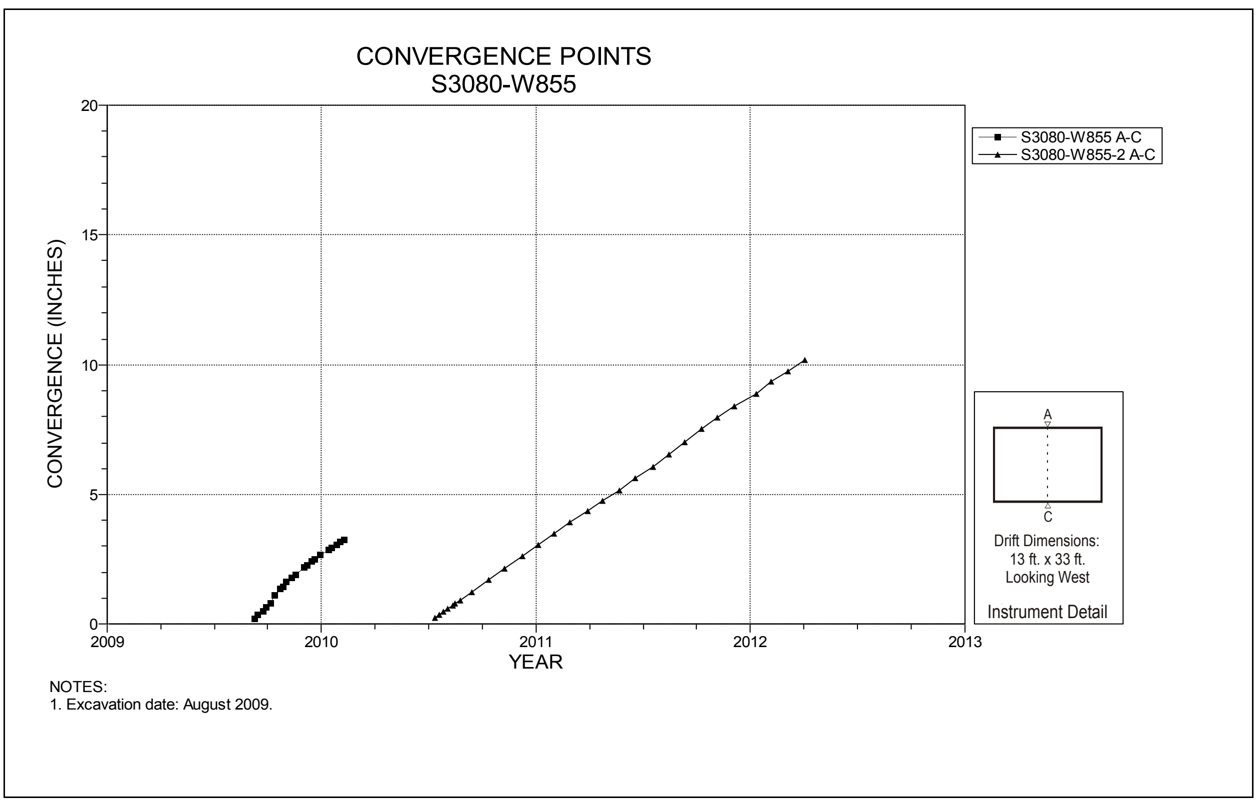


Figure 5-77 Convergence Point Array
S3080 W855 – Roof to Floor

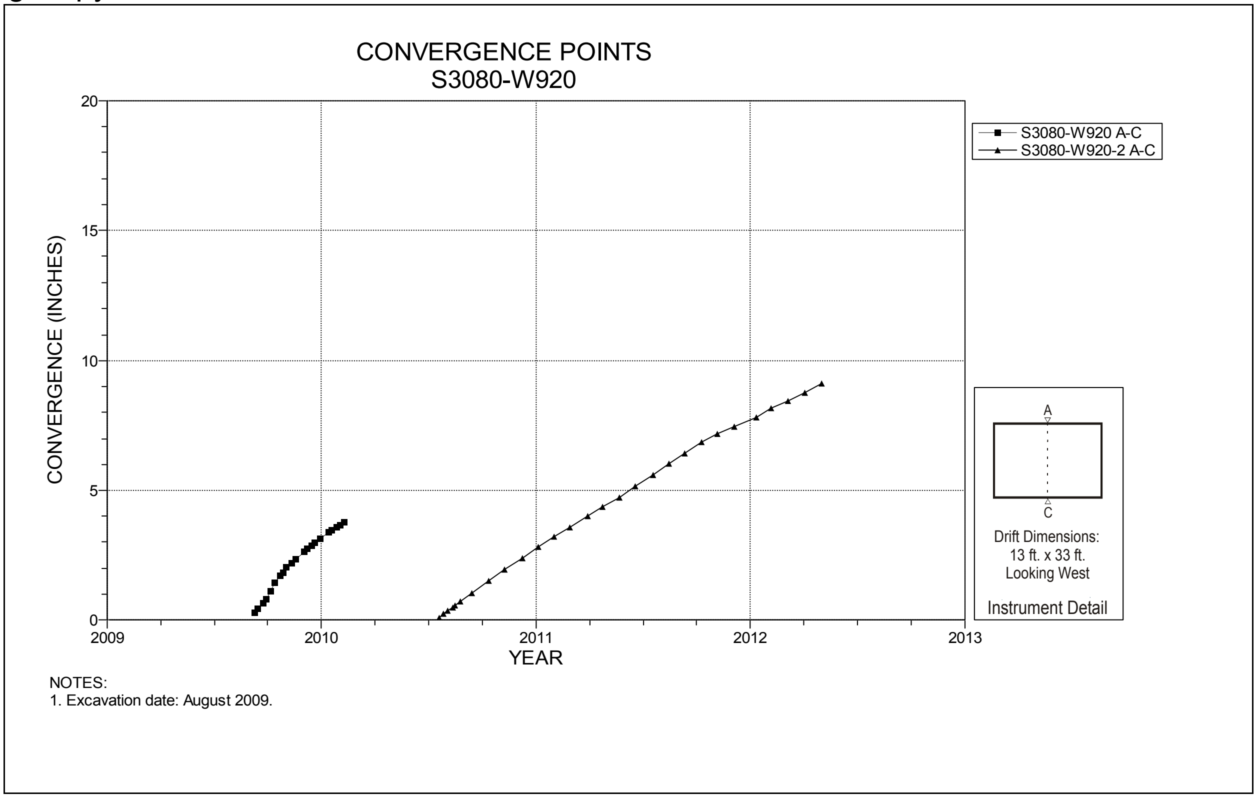


Figure 5-78 Convergence Point Array
S3080 W920 Intersection (Room 5, Panel 6) – Roof to Floor

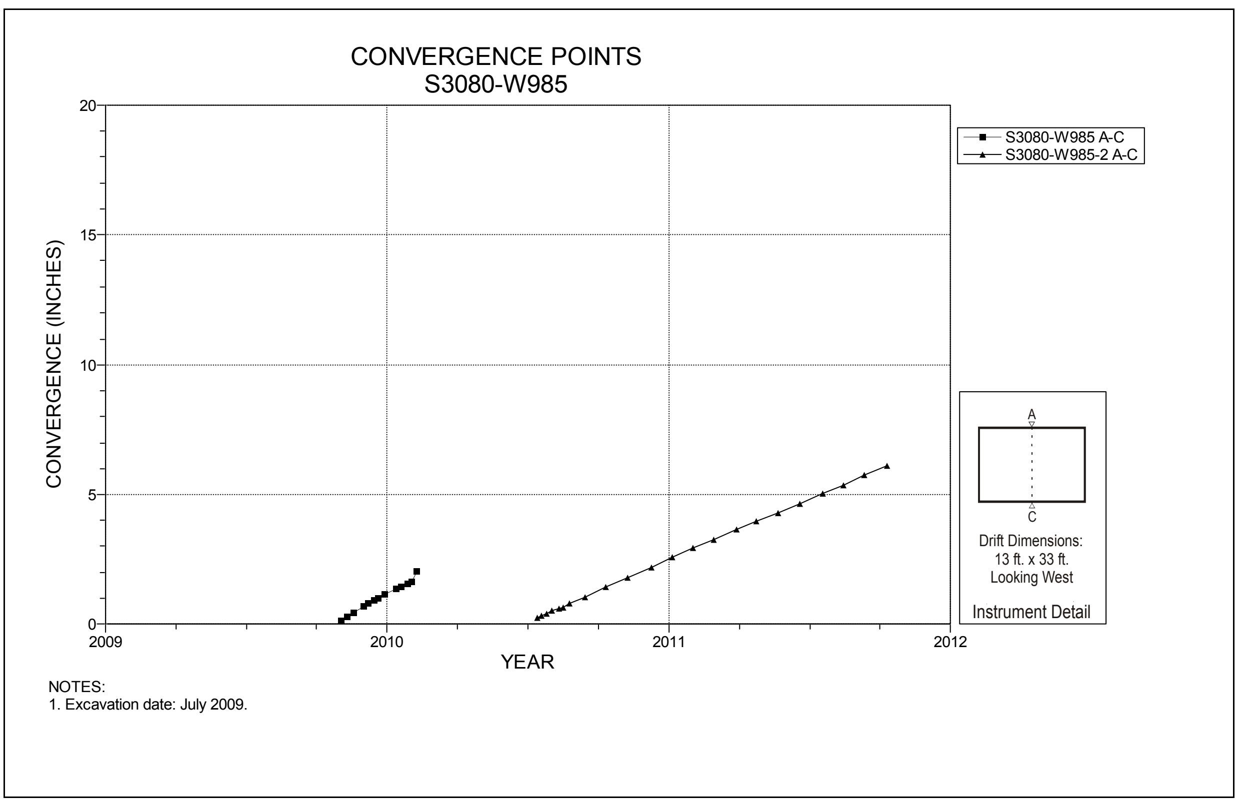


Figure 5-79 Convergence Point Array
S3080 W985 – Roof to Floor

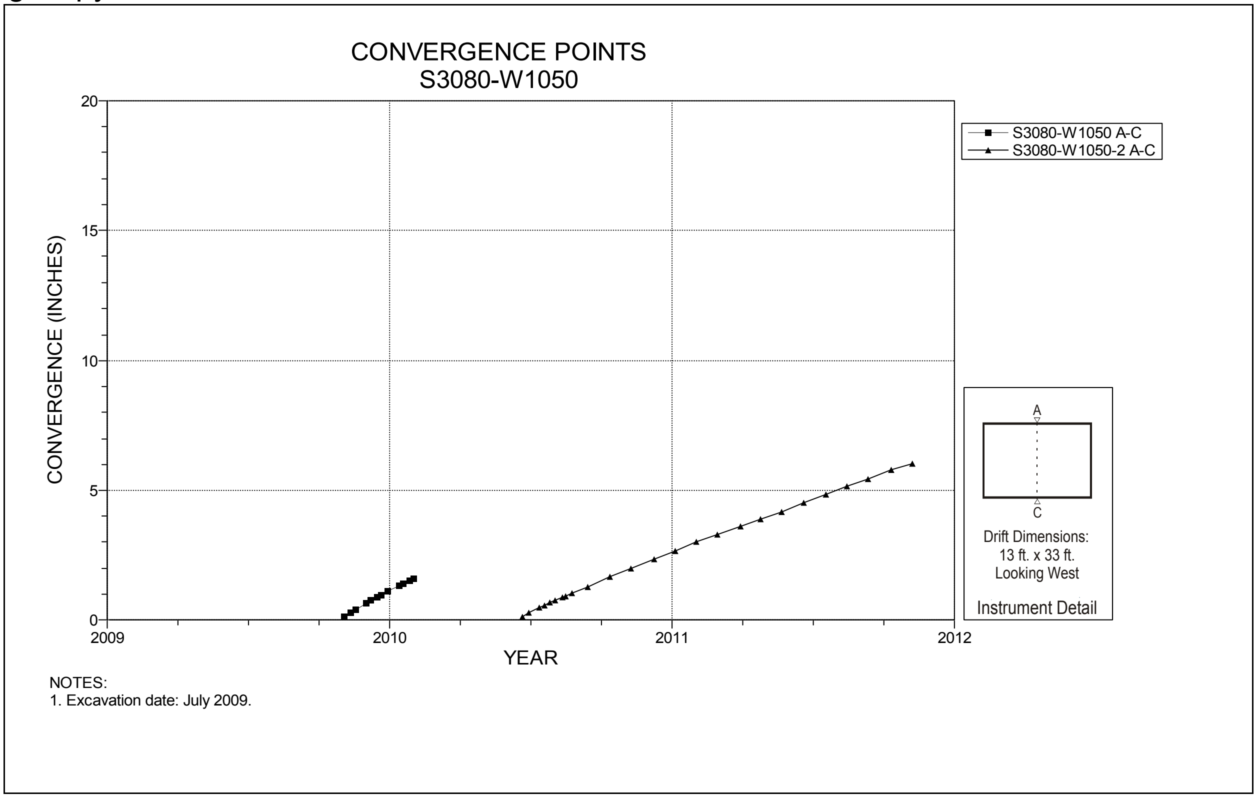


Figure 5-80 Convergence Point Array
S3080 W1050 Intersection (Room 6, Panel 6) – Roof to Floor

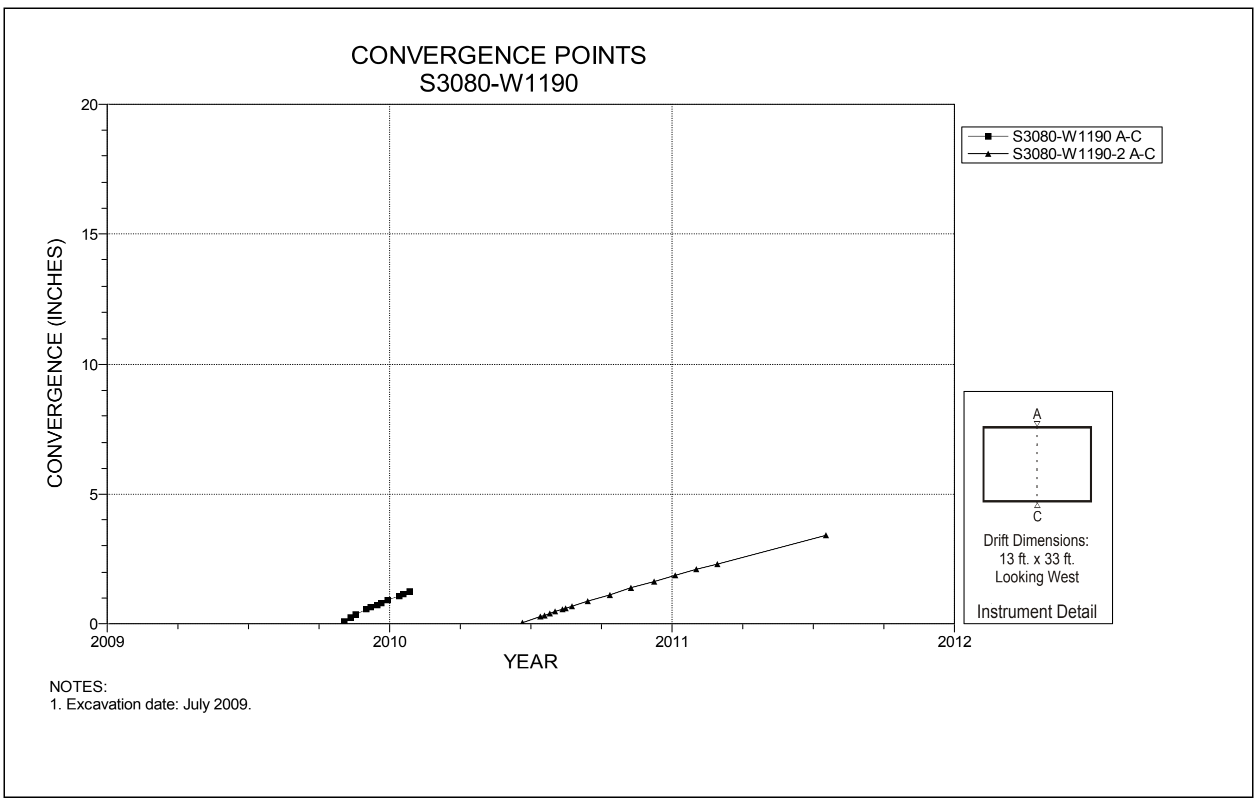


Figure 5-81 Convergence Point Array
S3080 W1190 Intersection (Room 7, Panel 6) – Roof to Floor

Table 5-7
Panel 7 Data Analysis

Field Tag	Location	Figure Number	Date of Last Reading	Collar Displacement Relative to Deepest Anchor (inches)	Displacement Rate 2011 to 2012 (in/year)	Displacement Rate 2010 to 2011 (in/year)	Rate Change Percent	Comments
Extensometers								
51X-GE-00416	S2180-W585	5-82	04/25/12	0.937	1.4	N/A	N/A	The Panel 7 extensometers were installed after the 10’-11’ interval.
51X-GE-00417	S2180-W985	5-83	04/25/12	1.036	1.6	N/A	N/A	
51X-GE-00425	W390-S2350	5-84	02/15/12	0.433	1.2	N/A	N/A	
51X-GE-00426	W520-S2350	5-85	04/25/12	0.767	1.4	N/A	N/A	
51X-GE-00418	W660-S2350	5-86	04/25/12	0.941	1.6	N/A	N/A	
51X-GE-00419	W790-S2350	5-87	04/25/12	0.397	1.4	N/A	N/A	
51X-GE-00421	W1050-S2350	5-88	04/25/12	0.910	1.4	N/A	N/A	
51X-GE-00422	W1190-S2350	5-89	04/25/12	1.071	1.6	N/A	N/A	
51X-GE-00423	S2520-W585	5-90	04/25/12	0.840	1.5	N/A	N/A	
51X-GE-00424	S2520-W985	5-91	04/25/12	0.802	1.5	N/A	N/A	

Table 5-7
Panel 7 Data Analysis (Continued)

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011 to 2012 Date	Last Reading 2011 to 2012 Inches	Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)[1]	Rate Change Percent[1]	Comments
S2180-W285-2 A-C	S2180-W285	5-92	04/25/12	1.860	2.306	2.1	2.6	-19%	
S2180-W390-2 A-C	S2180-W390	5-93	04/25/12	4.769	5.700	5.4	N/A	N/A	
S2180-W460-2 A-C	S2180-W460	5-94	04/25/12	7.102	8.224	8.1	10.2	-21%	
S2180-W520-2 A-C	S2180-W520	5-95	04/25/12	9.408	10.910	10.6	13.2	-20%	
S2180-W585-3 A-C	S2180-W585	5-96	04/25/12	3.530	9.977	7.1	N/A	N/A	
S2180-W660-3 A-C	S2180-W660	5-97	04/25/12	5.099	9.409	8.2	N/A	N/A	
S2180-W725-3 A-C	S2180-W725	5-98	04/25/12	5.679	7.419	7.7	N/A	N/A	
S2180-W790-2 A-C	S2180-W790	5-99	04/25/12	9.266	10.572	10.4	13.9	-25%	
S2180-W855-2 A-C	S2180-W855	5-100	04/25/12	9.017	10.374	9.8	17.6	-44%	
S2180-W920-2 A-C	S2180-W920	5-101	04/25/12	8.378	9.881	9.2	16.7	-45%	
S2180-W985-3 A-C	S2180-W985	5-102	04/25/12	7.373	16.046	14.0	N/A	N/A	
S2180-W1050 A-C	S2180-W1050	5-103	04/25/12	8.573	8.573	9.1	22.9	-60%	
S2180-W1120-2 A-C	S2180-W1120	5-104	04/25/12	2.053	9.249	8.1	N/A	N/A	
S2180-W1190-2 A-C	S2180-W1190	5-104a	04/25/12	4.864	6.218	5.9	N/A	N/A	
W390-S2275-2 A-C	W390-S2275	5-105	02/15/12	3.059	7.934	9.1	N/A	N/A	
W390-S2350-2 A-C	W390-S2350	5-106	02/15/12	1.680	6.564	5.9	N/A	N/A	
W390-S2425-2 A-C	W390-S2425	5-107	02/15/12	3.680	10.067	10.8	N/A	N/A	
W520-S2275-2 A-C	W520-S2275	5-108	04/25/12	3.684	8.452	7.3	N/A	N/A	
W520-S2350-2 A-C	W520-S2350	5-109	04/25/12	7.757	12.869	15.2	N/A	N/A	
W520-S2425-2 A-C	W520-S2425	5-110	04/25/12	3.980	9.282	7.8	N/A	N/A	
W660-S2275-2 A-C	W660-S2275	5-111	04/25/12	3.948	9.016	7.8	N/A	N/A	
W660-S2350-2 A-C	W660-S2350	5-112	04/25/12	11.345	16.729	22.8	N/A	N/A	
W660-S2425-2 A-C	W660-S2425	5-113	04/25/12	7.024	12.554	14.0	N/A	N/A	
W790-S2275-2 A-C	W790-S2275	5-114	04/25/12	2.042	4.604	7.6	N/A	N/A	
W790-S2350-2 A-C	W790-S2350	5-115	04/25/12	1.950	4.291	7.3	N/A	N/A	
W790-S2425 A-C	W790-S2425	5-116	07/11/11	2.299	2.299	7.8	6.5	20%	
W920-S2275-2 A-C	W920-S2275	5-117	08/08/11	0.693	3.068	18.1	N/A	N/A	
W920-S2350-2 A-C	W920-S2350	5-118	08/08/11	0.740	3.016	19.2	N/A	N/A	
W920-S2425-2 A-C	W920-S2425	5-119	08/08/11	0.538	2.843	13.0	N/A	N/A	

Table 5-7
Panel 7 Data Analysis (Continued)

Convergence Points (Continued)

Field Tag	Location	Figure Number	Last Reading 2011 to 2012		Cumulative Displacement (inches)	Closure Rate 2011 to 2012 (in/year)	Closure Rate 2010 to 2011 (in/year)[1]	Rate Change Percent[1]	Comments
			Date	Inches					
W1050-S2275-2 A-C	W1050-S2275	5-120	04/25/12	7.495	9.629	9.7	N/A	N/A	
W1050-S2350-2 A-C	W1050-S2350	5-121	04/25/12	5.891	8.031	7.5	N/A	N/A	
W1050-S2425-2 A-C	W1050-S2425	5-122	04/25/12	7.380	9.521	9.4	N/A	N/A	
W1190-S2275-2 A-C	W1190-S2275	5-123	04/25/12	8.358	10.030	10.1	N/A	N/A	
W1190-S2350-3 A-C	W1190-S2350	5-124	04/25/12	1.800	3.714	7.1	N/A	N/A	
W1190-S2425-3 A-C	W1190-S2425	5-125	04/25/12	1.522	3.537	6.0	N/A	N/A	
S2520-W285-3 A-C	S2520-W285	5-126	02/13/12	2.380	4.975	7.2	N/A	N/A	
S2520-W390-2 A-C	S2520-W390	5-127	02/13/12	2.753	7.283	8.2	N/A	N/A	
S2520-W455-2 A-C	S2520-W455	5-128	02/13/12	2.591	7.690	7.9	N/A	N/A	
S2520-W520-2 A-C	S2520-W520	5-129	04/25/12	4.695	12.778	8.9	N/A	N/A	
S2520-W585-3 A-C	S2520-W585	5-130	01/30/12	1.830	7.666	95.5	N/A	N/A	
S2520-W660-2 A-C	S2520-W660	5-131	04/25/12	7.482	13.434	14.3	N/A	N/A	
S2520-W725-4 A-C	S2520-W725	5-132	04/25/12	2.027	8.951	8.0	N/A	N/A	
S2520-W790-2 A-C	S2520-W790	5-133	04/25/12	5.601	8.101	9.0	N/A	N/A	
S2520-W855-2 A-C	S2520-W855	5-134	04/25/12	11.466	13.933	18.7	N/A	N/A	
S2520-W920-3 A-C	S2520-W920	5-135	04/25/12	4.033	9.369	7.7	N/A	N/A	
S2520-W985-2 A-C	S2520-W985	5-136	04/25/12	7.840	10.214	10.1	N/A	N/A	
S2520-W1050-3 A-C	S2520-W1050	5-137	04/25/12	4.153	8.513	7.9	N/A	N/A	
S2520-W1120-3 A-C	S2520-W1120	5-138	04/25/12	4.473	15.072	17.6	N/A	N/A	
S2520-W1190-2 A-C	S2520-W1190	5-139	04/25/12	5.563	7.200	6.7	N/A	N/A	

[1] N/A – Insufficient data available to perform the calculation. This is usually due to the inability to read the instruments because of activities such as: the temporary removal of an instrument due to floor, rib or back trimming; locations blocked by equipment or waste disposal, etc.

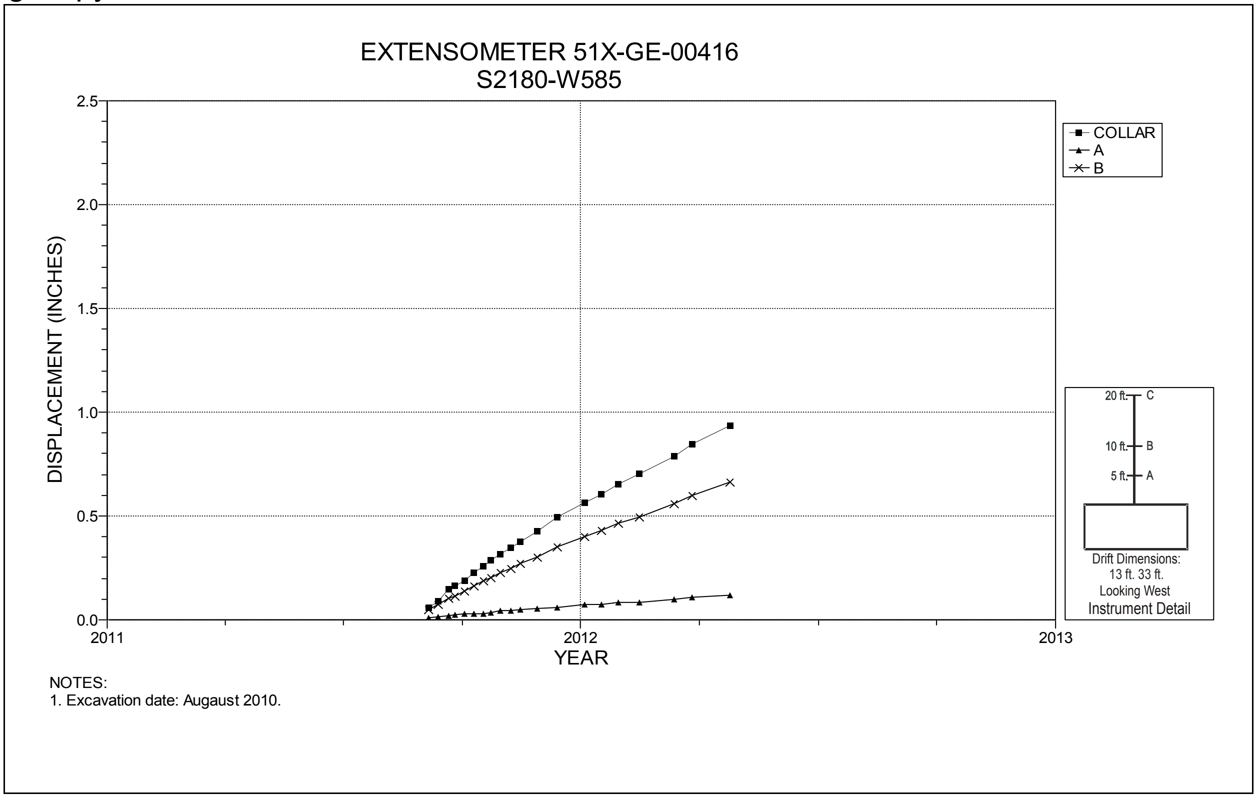


Figure 5-82 Extensometer 51X-GE-00416
S2180 W585 – Roof

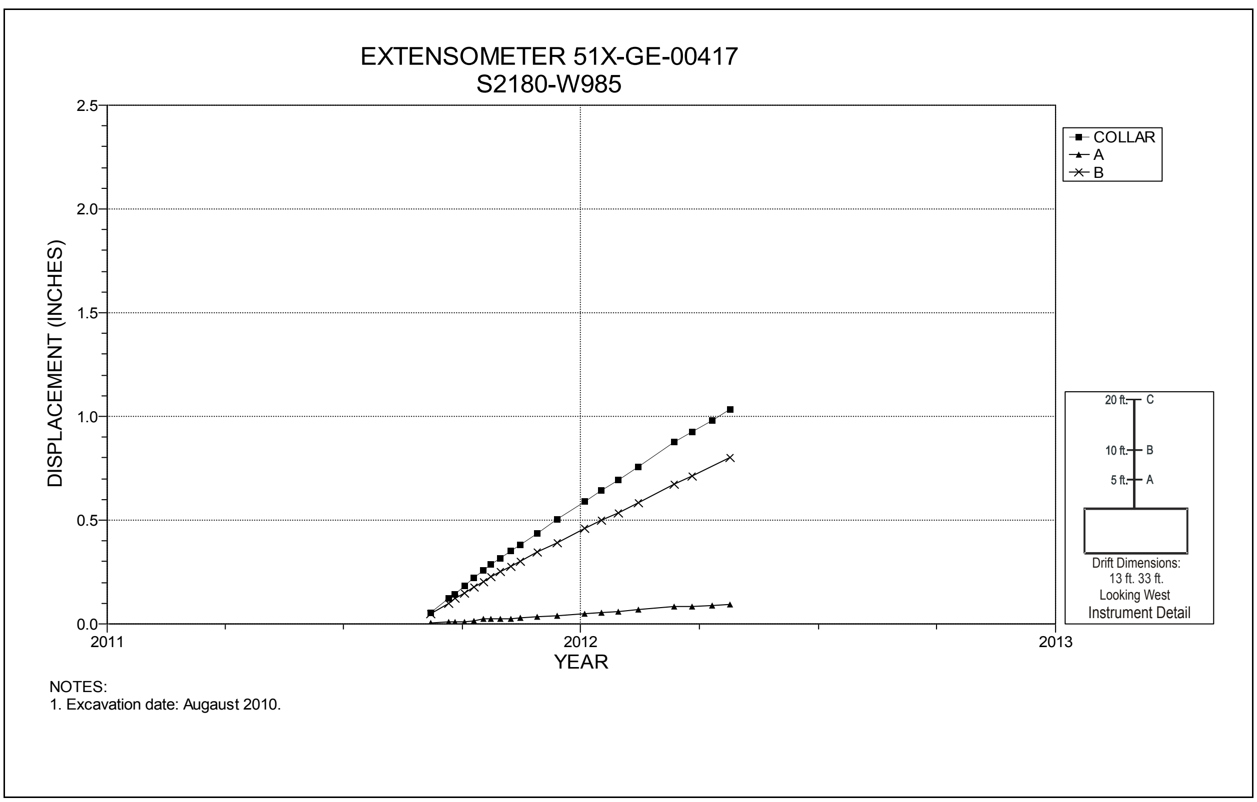


Figure 5-83 Extensometer 51X-GE-00417
S2180 W985 – Roof

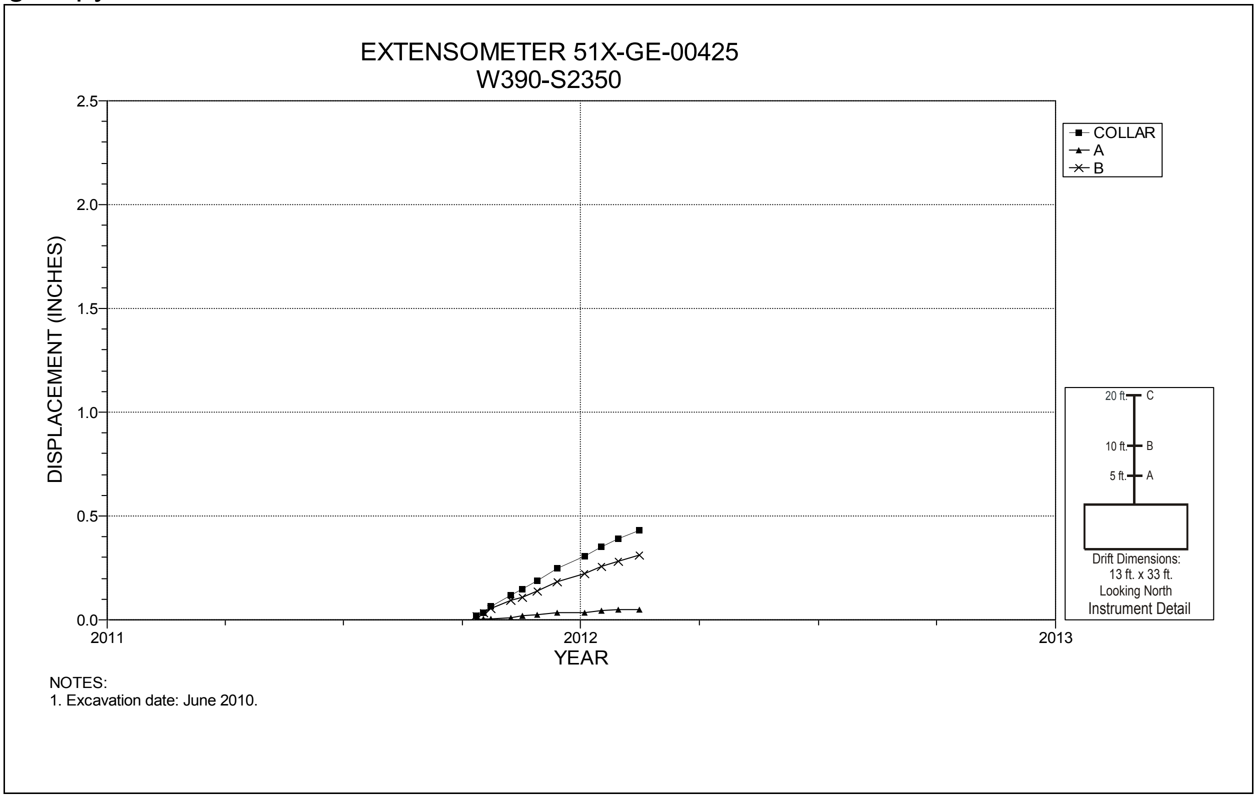


Figure 5-84 Extensometer 51X-GE-00425
W390 S2350 – Roof

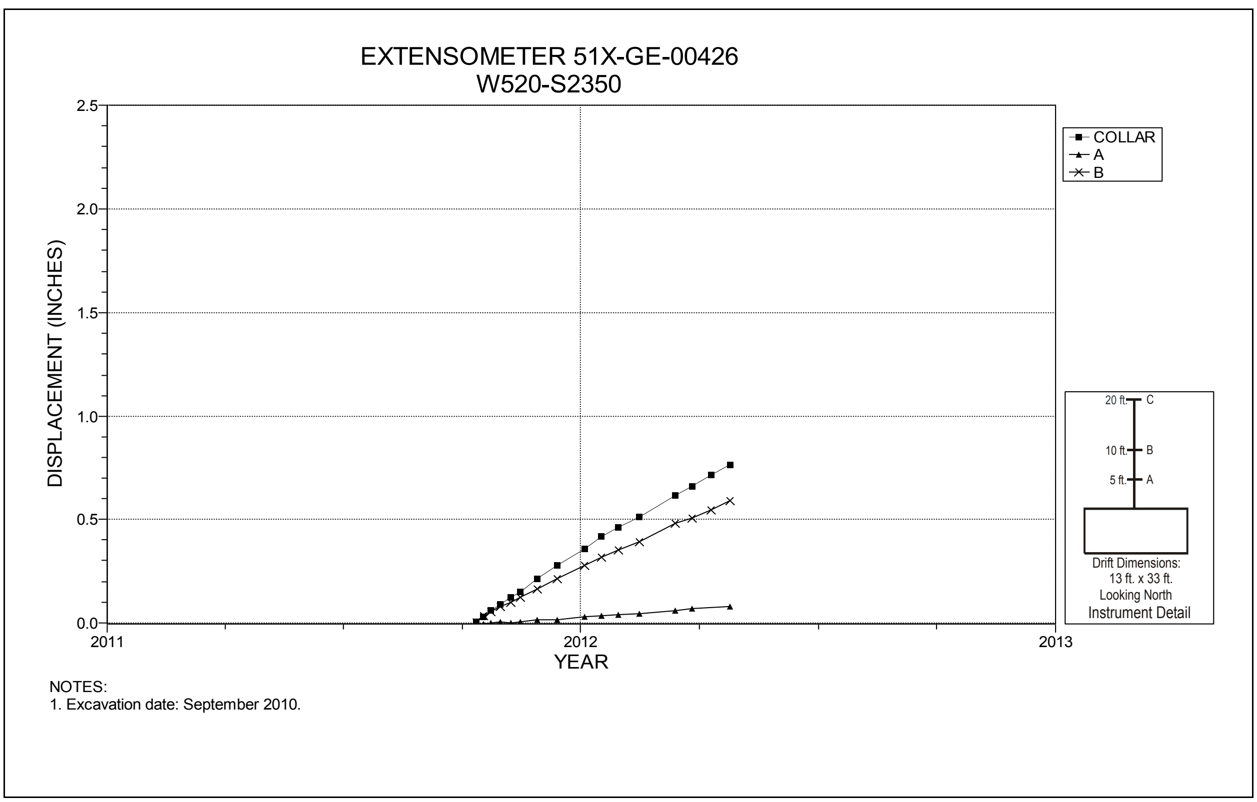


Figure 5-85 Extensometer 51X-GE-00426
W520 S2350 – Roof

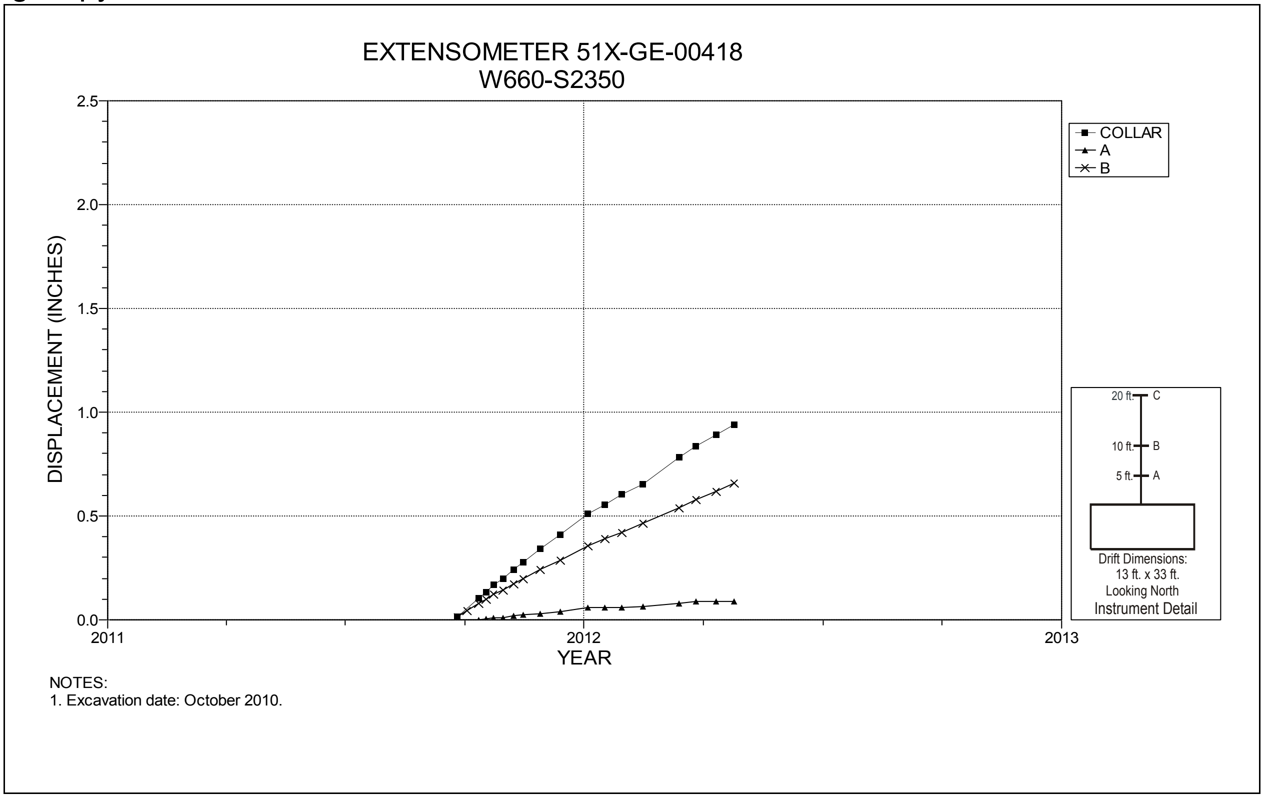


Figure 5-86 Extensometer 51X-GE-00418
W660 S2350 – Roof

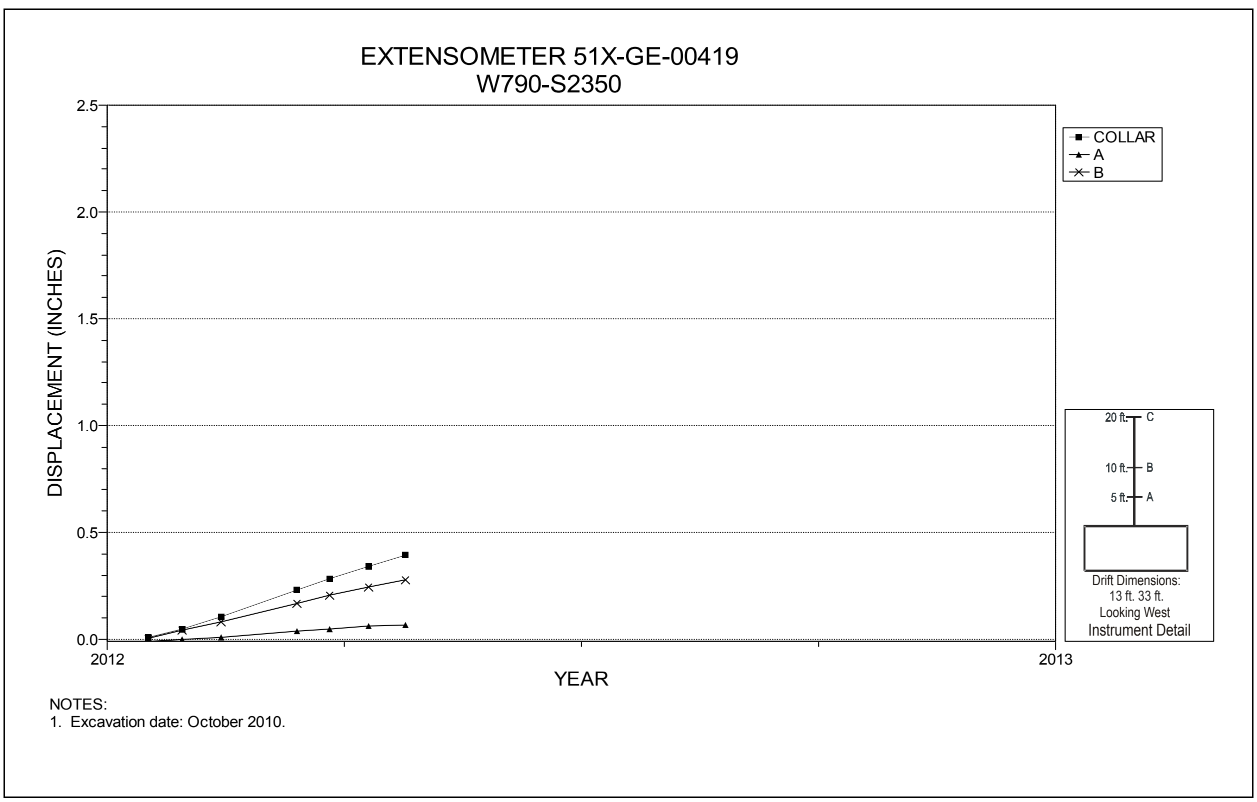


Figure 5-87 Extensometer 51X-GE-00419
W790 S2350 – Roof

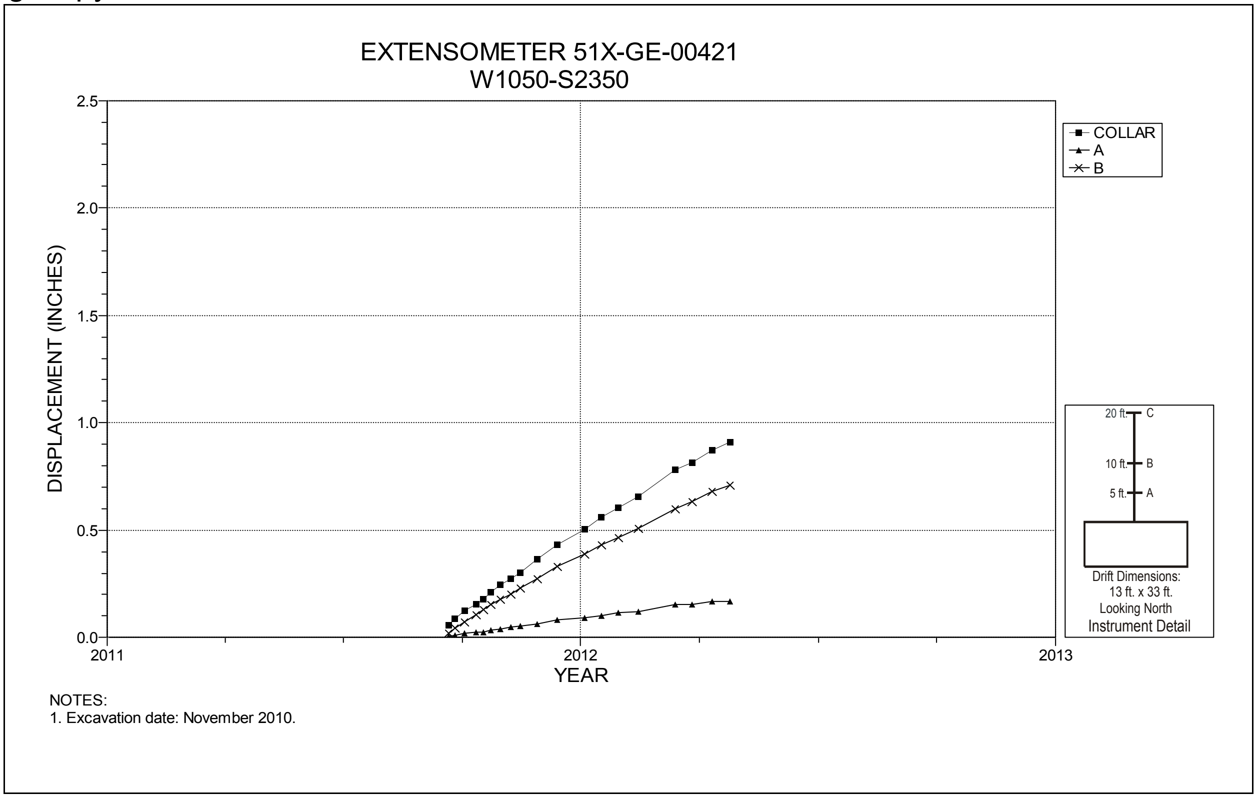


Figure 5-88 Extensometer 51X-GE-00421
W1050 S2350 – Roof

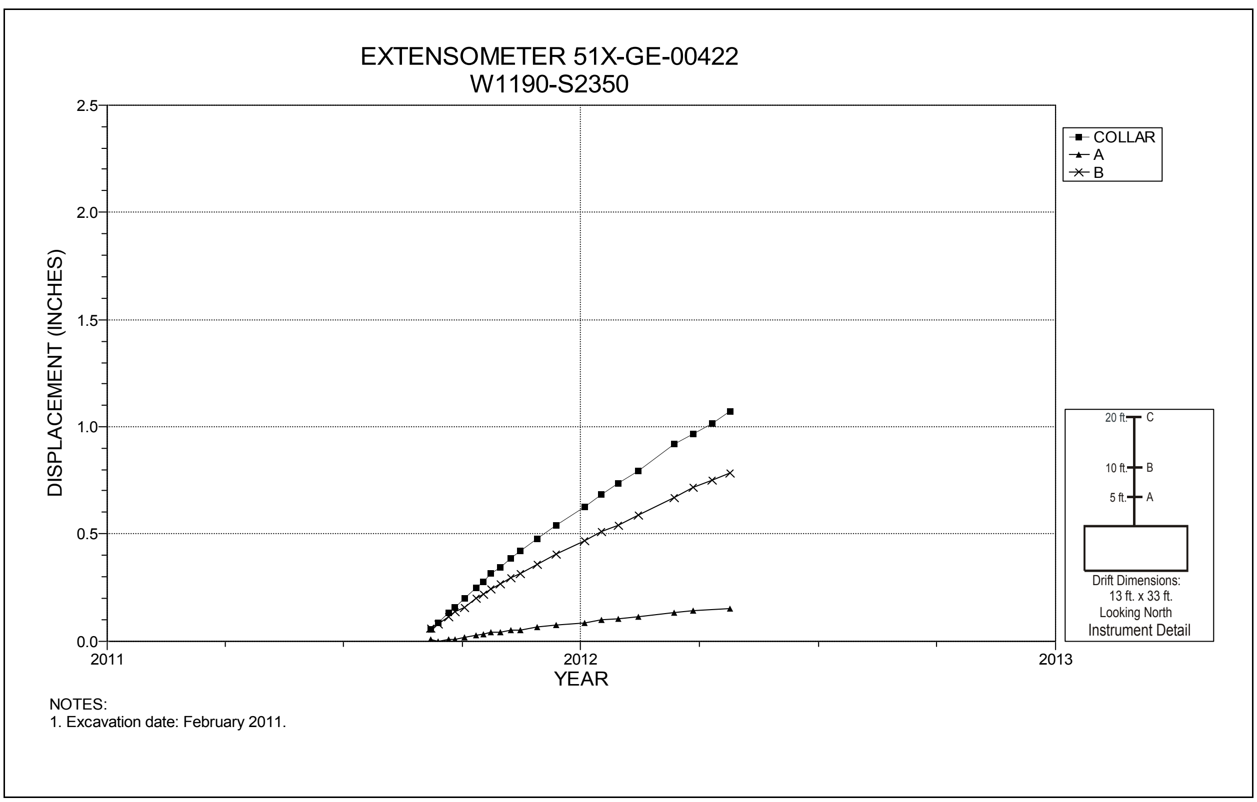


Figure 5-89 Extensometer 51X-GE-00422
W1190 S2350 – Roof

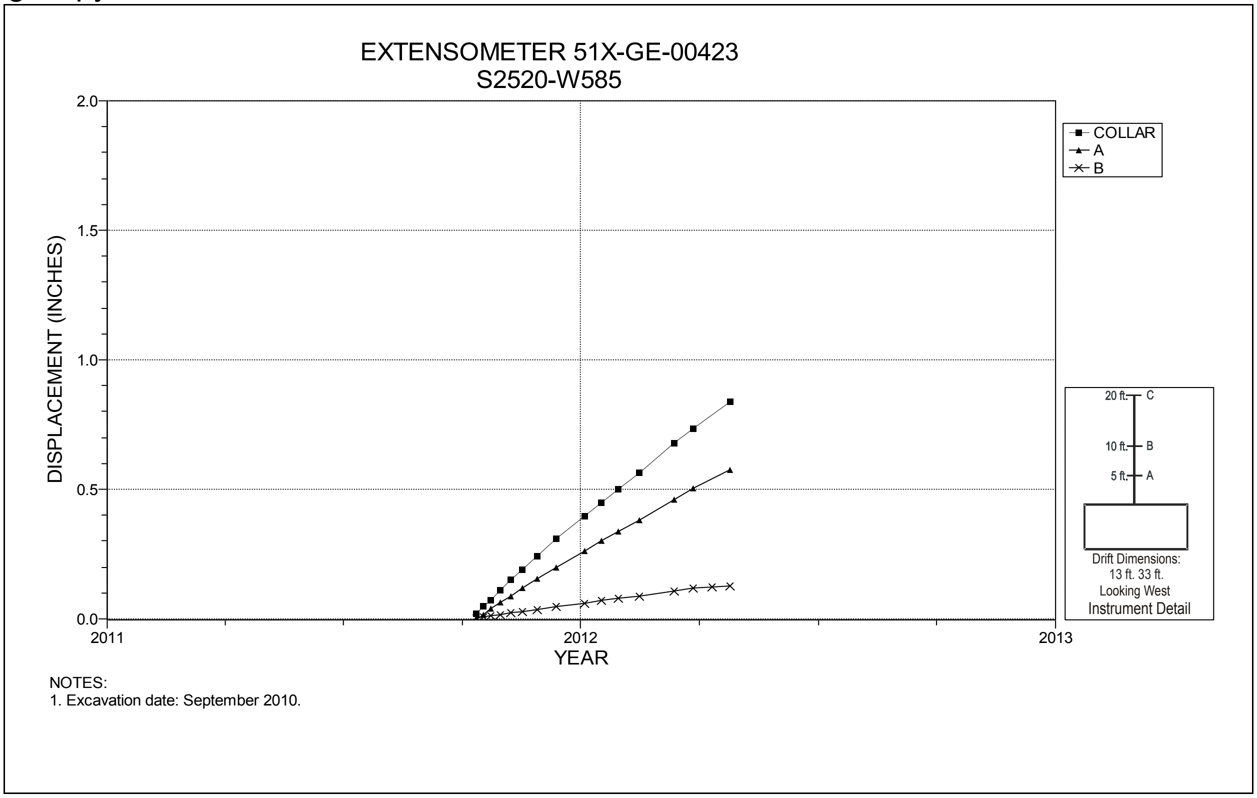


Figure 5-90 Extensometer 51X-GE-00423
S2520 W585 – Roof

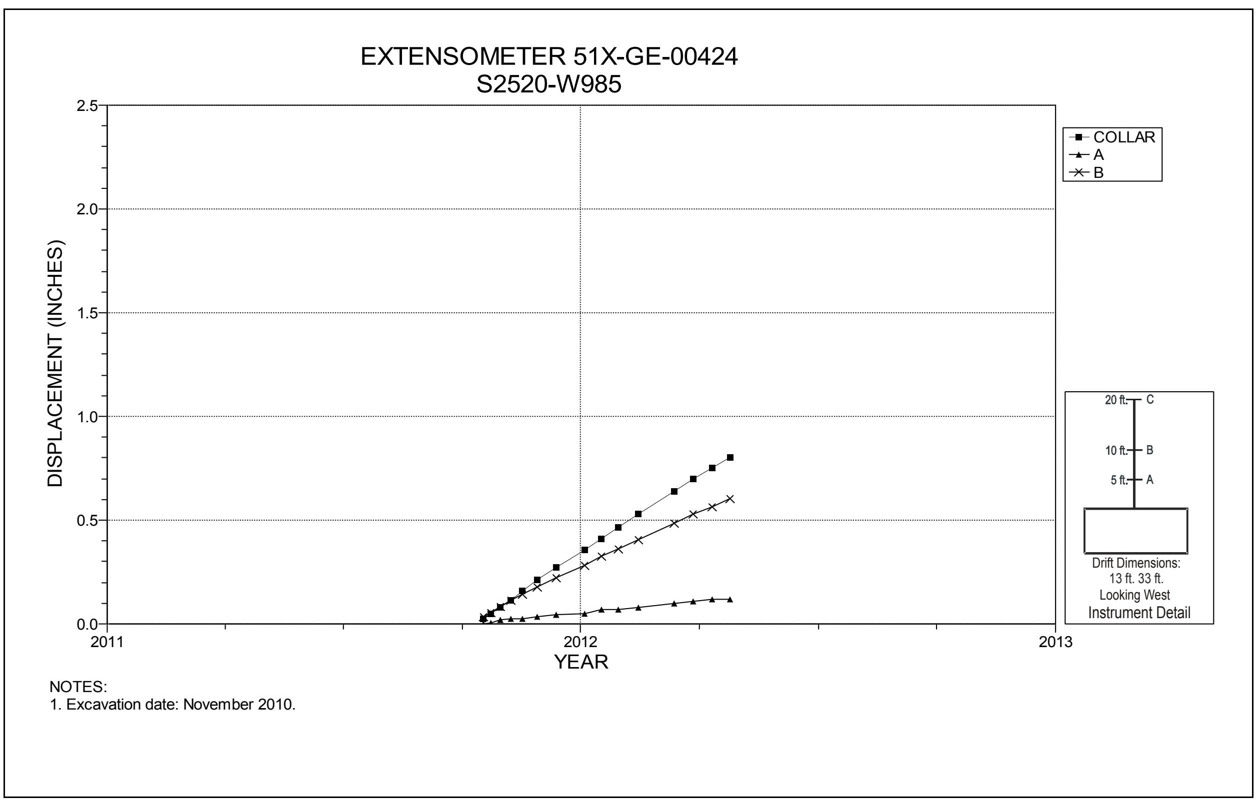
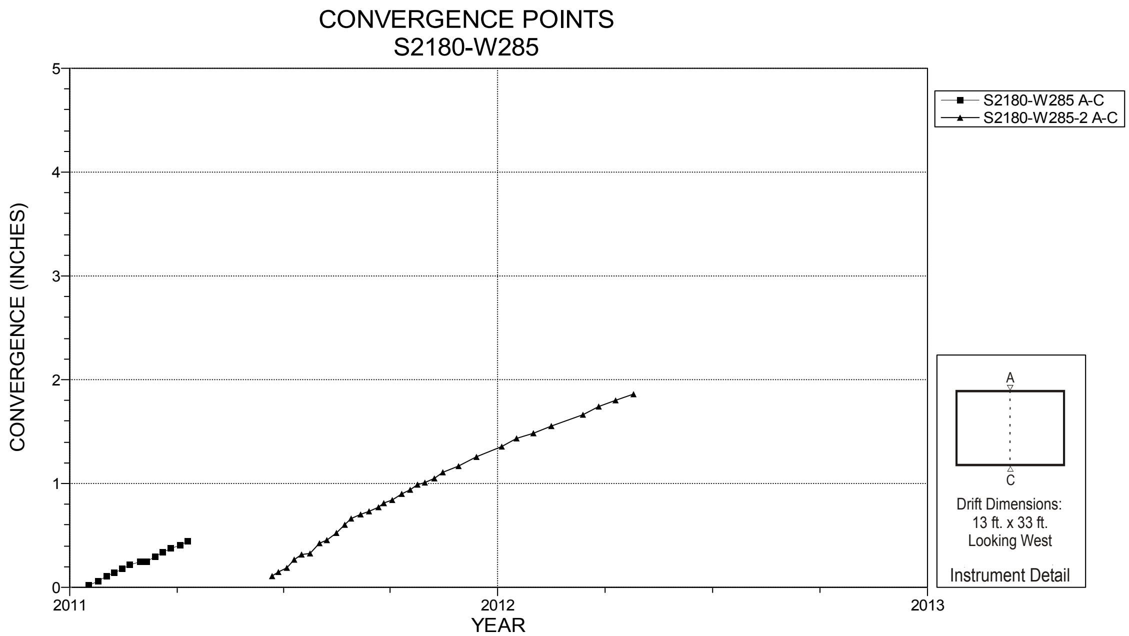
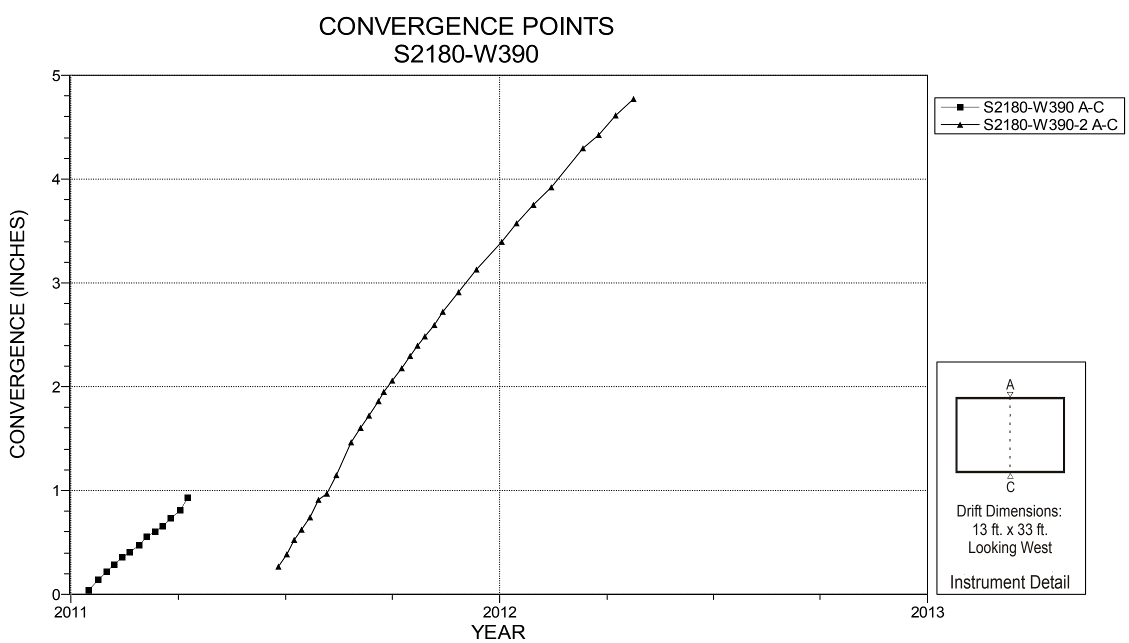


Figure 5-91 Extensometer 51X-GE-00424
S2520 W985 – Roof



NOTES:
1. Excavation date: July 2010.

Figure 5-92 Convergence Point Array
S2180 W285 – Roof to Floor



NOTES:
1. Excavation date: July 2010.

Figure 5-93 Convergence Point Array
S2180 W390 Intersection (Room 1, Panel 7) – Roof to Floor

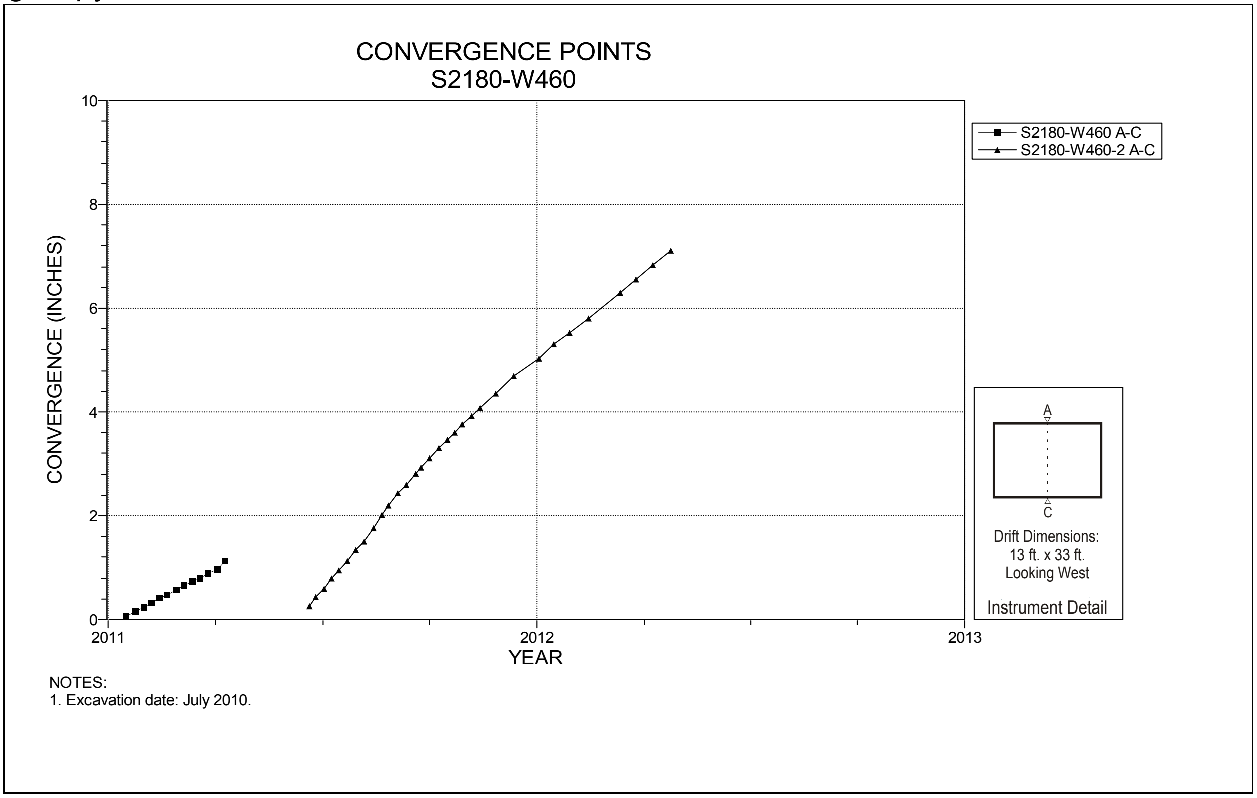


Figure 5-94 Convergence Point Array
S2180 W460 – Roof to Floor

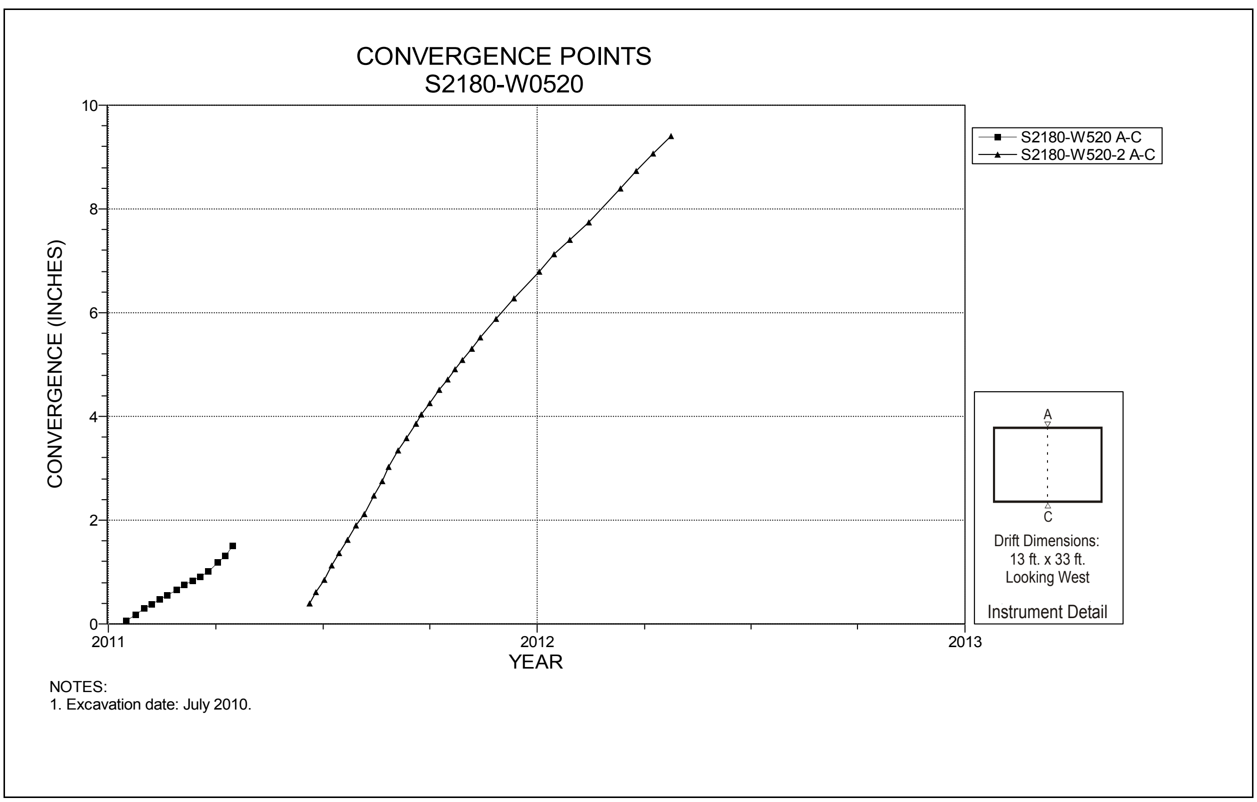


Figure 5-95 Convergence Point Array
S2180 W520 Intersection (Room 2, Panel 7) – Roof to Floor

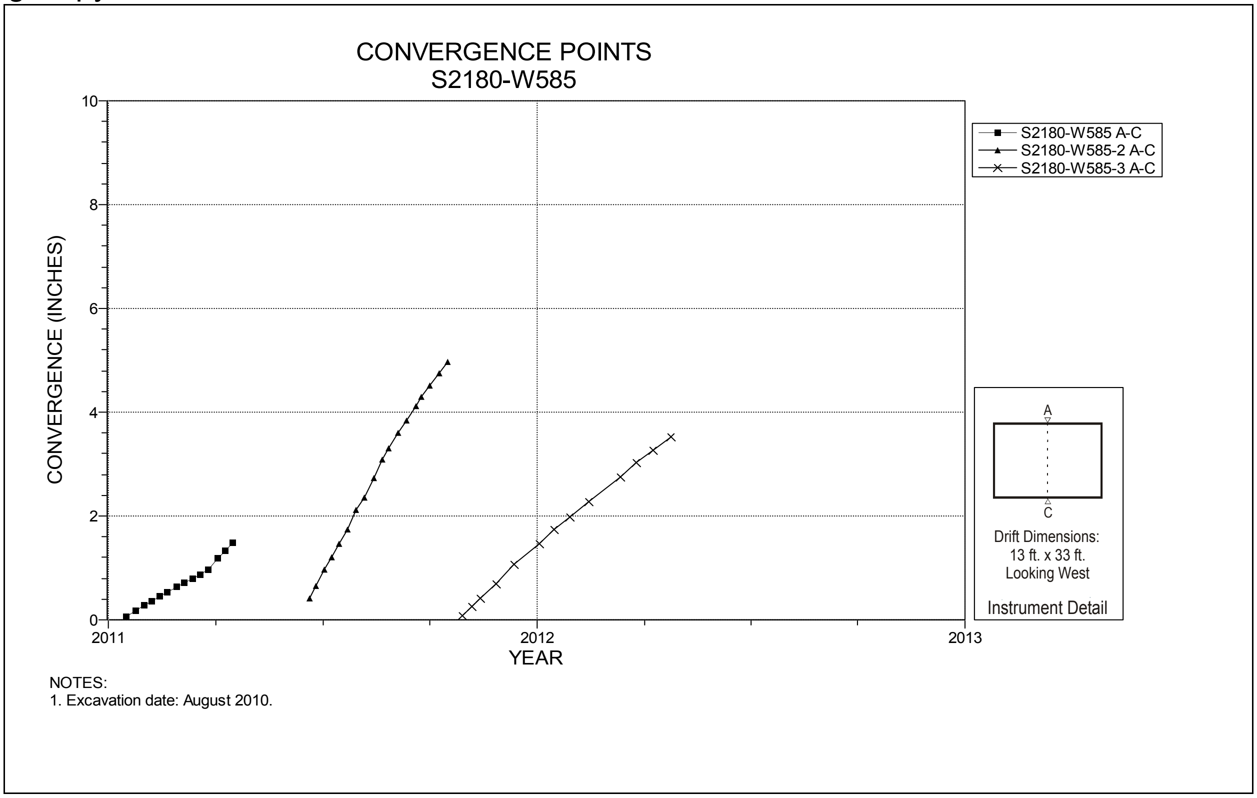


Figure 5-96 Convergence Point Array
S2180 W585 – Roof to Floor

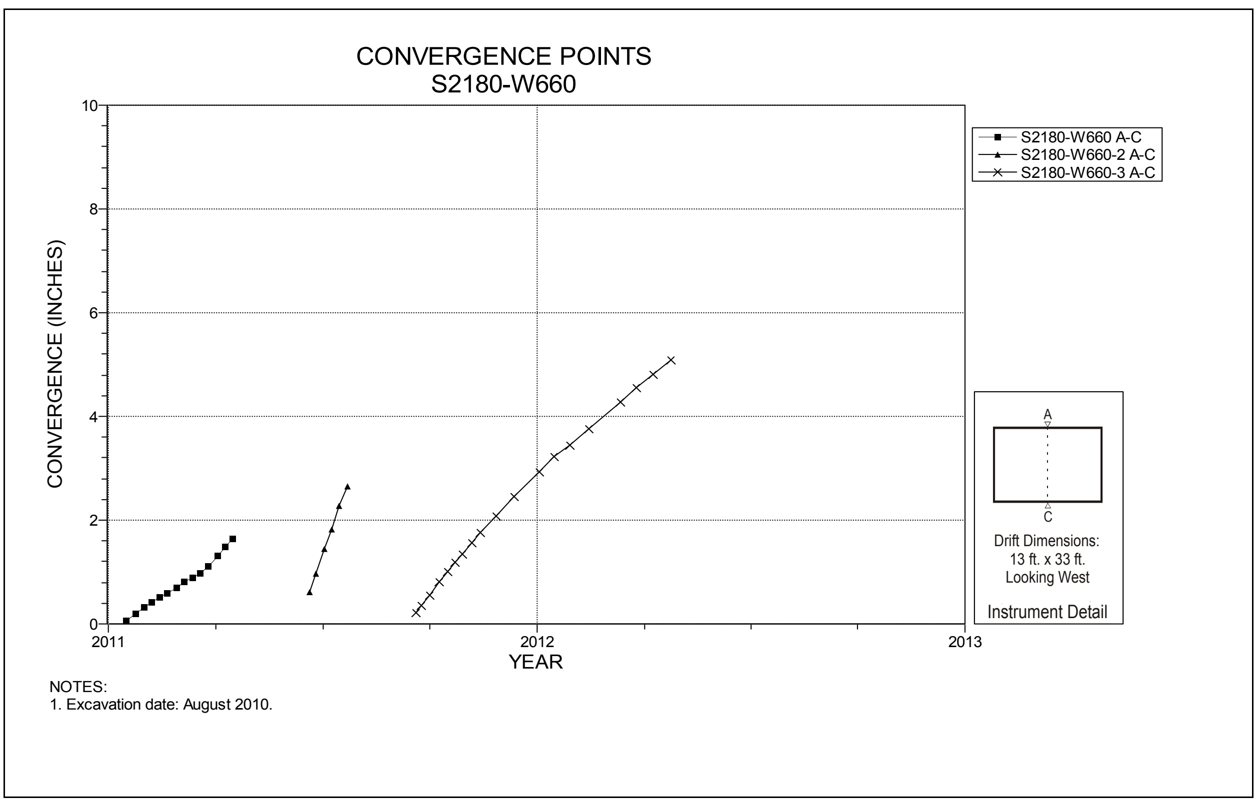


Figure 5-97 Convergence Point Array
S2180 W660 Intersection (Room 3 Panel 7) – Roof to Floor

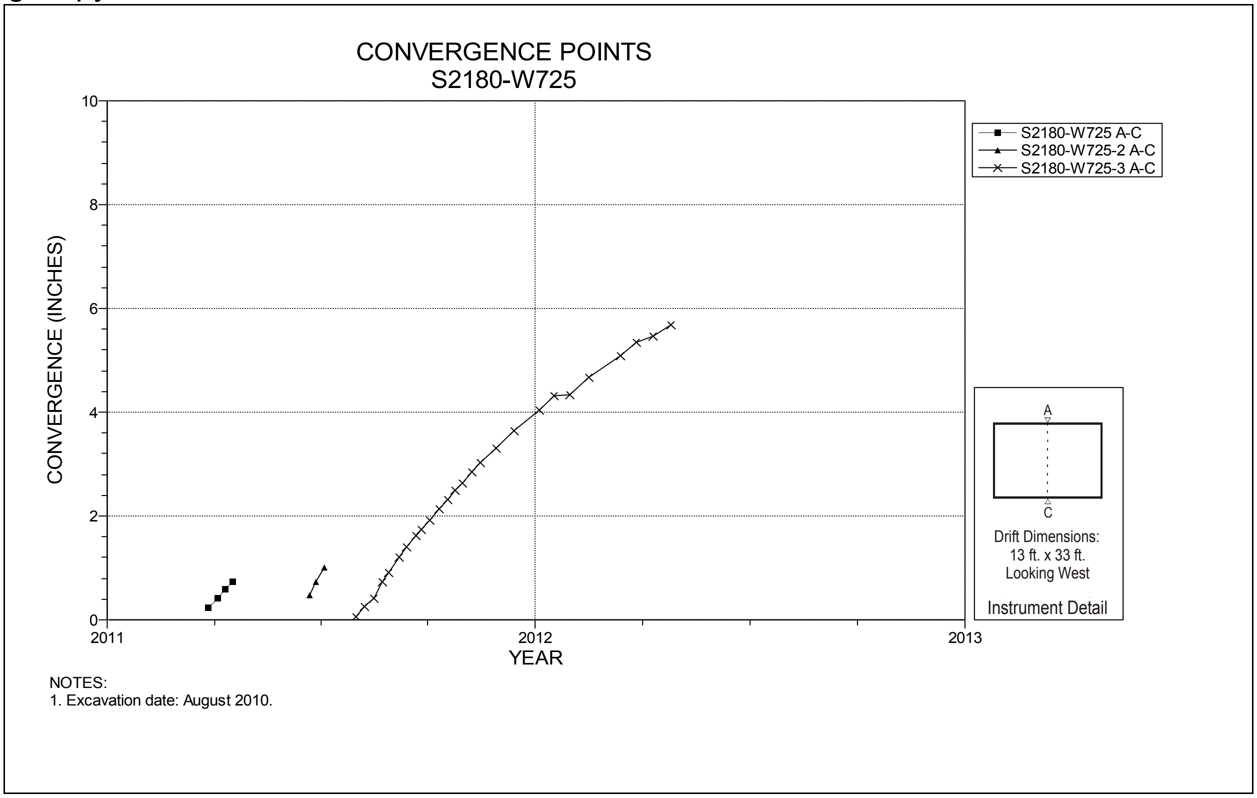


Figure 5-98 Convergence Point Array
S2180 W725 – Roof to Floor

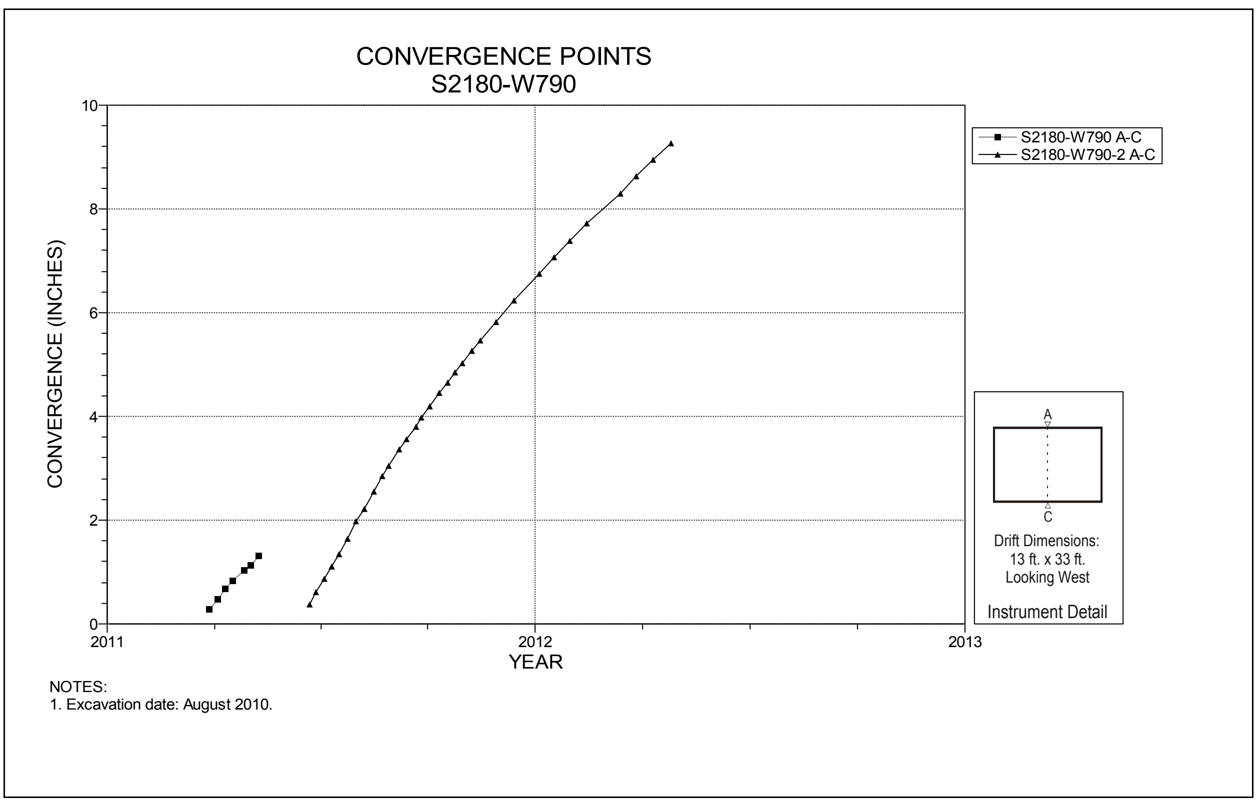


Figure 5-99 Convergence Point Array
S2180 W790 Intersection (Room 4, Panel 7) – Roof to Floor

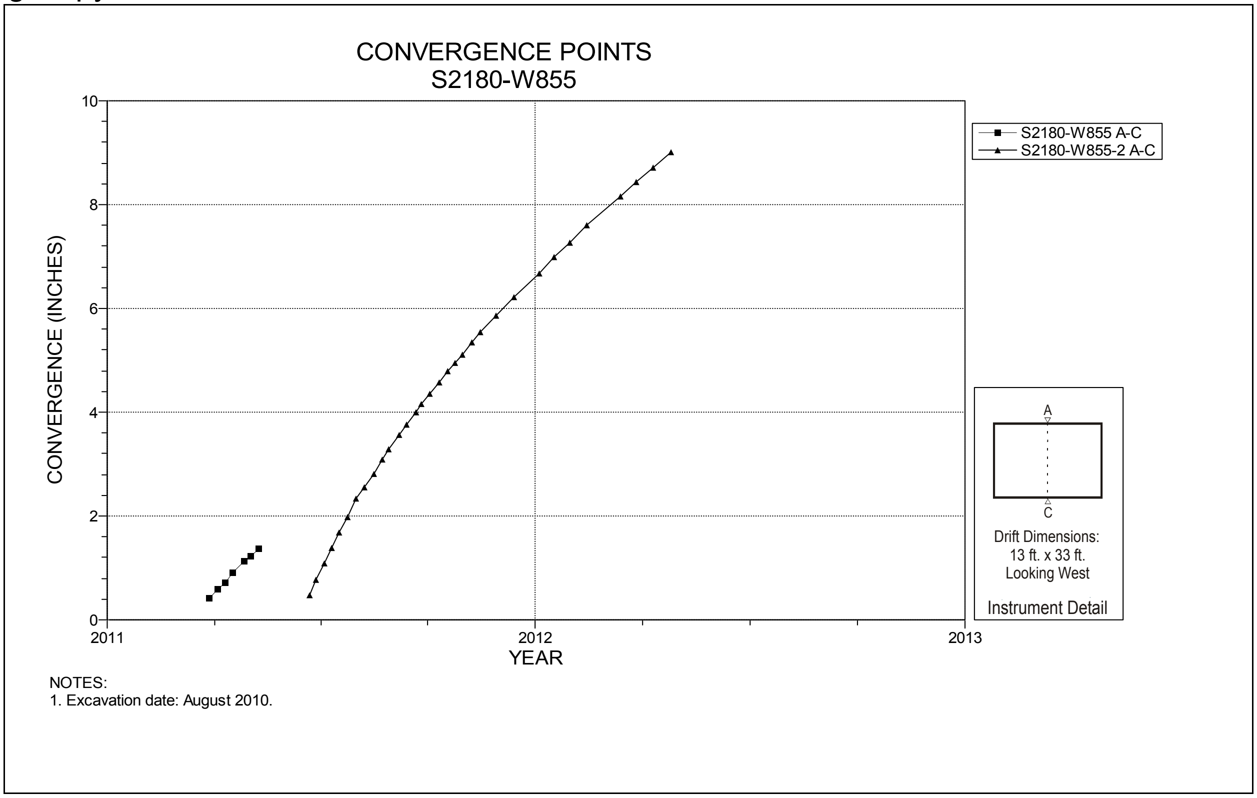


Figure 5-100 Convergence Point Array
S2180 W885 – Roof to Floor

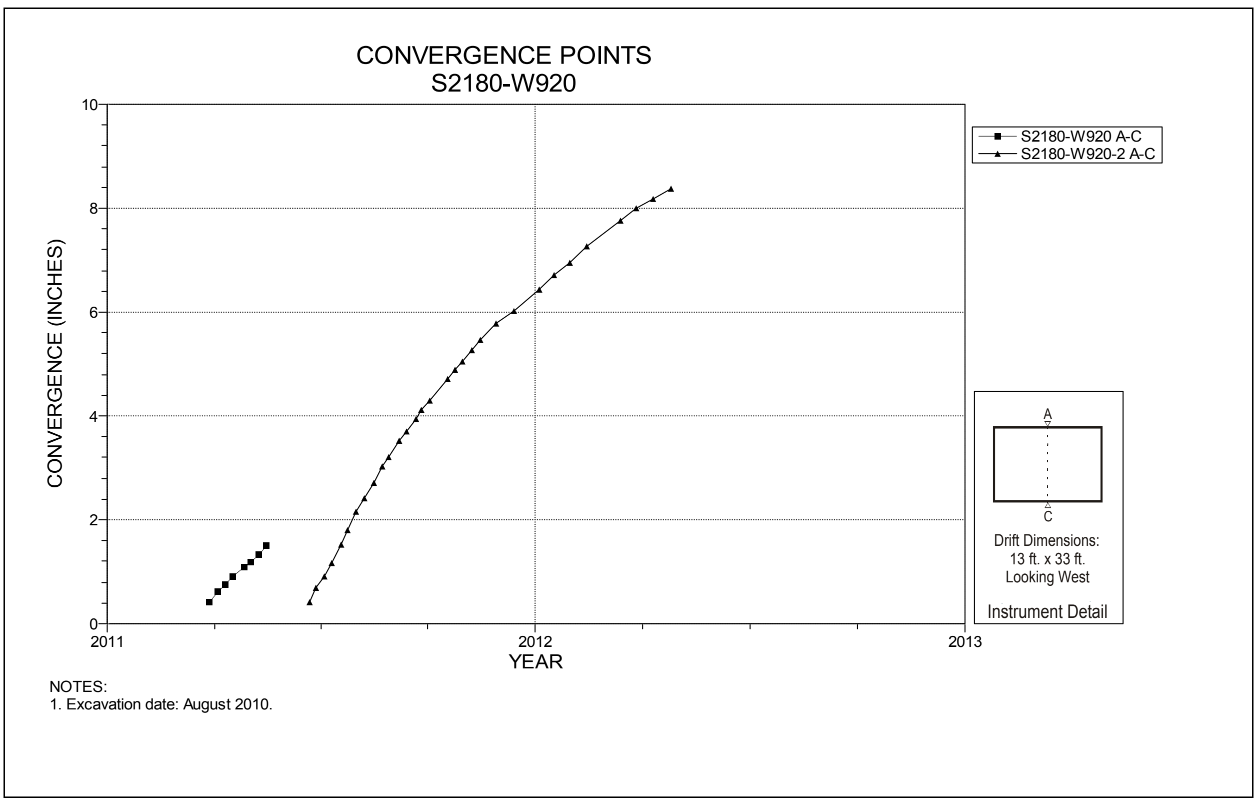


Figure 5-101 Convergence Point Array
S2180 W920 Intersection (Room 5, Panel 7) – Roof to Floor

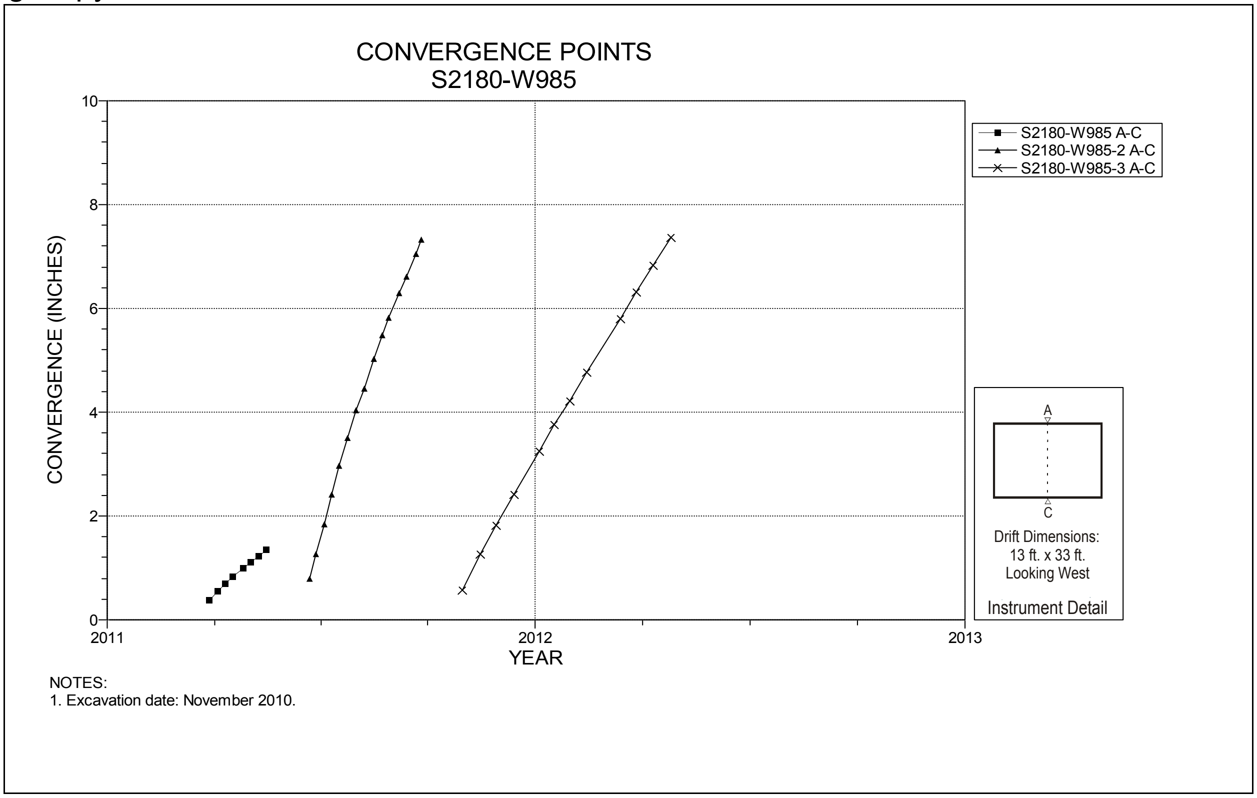


Figure 5-102 Convergence Point Array
S2180 W985 – Roof to Floor

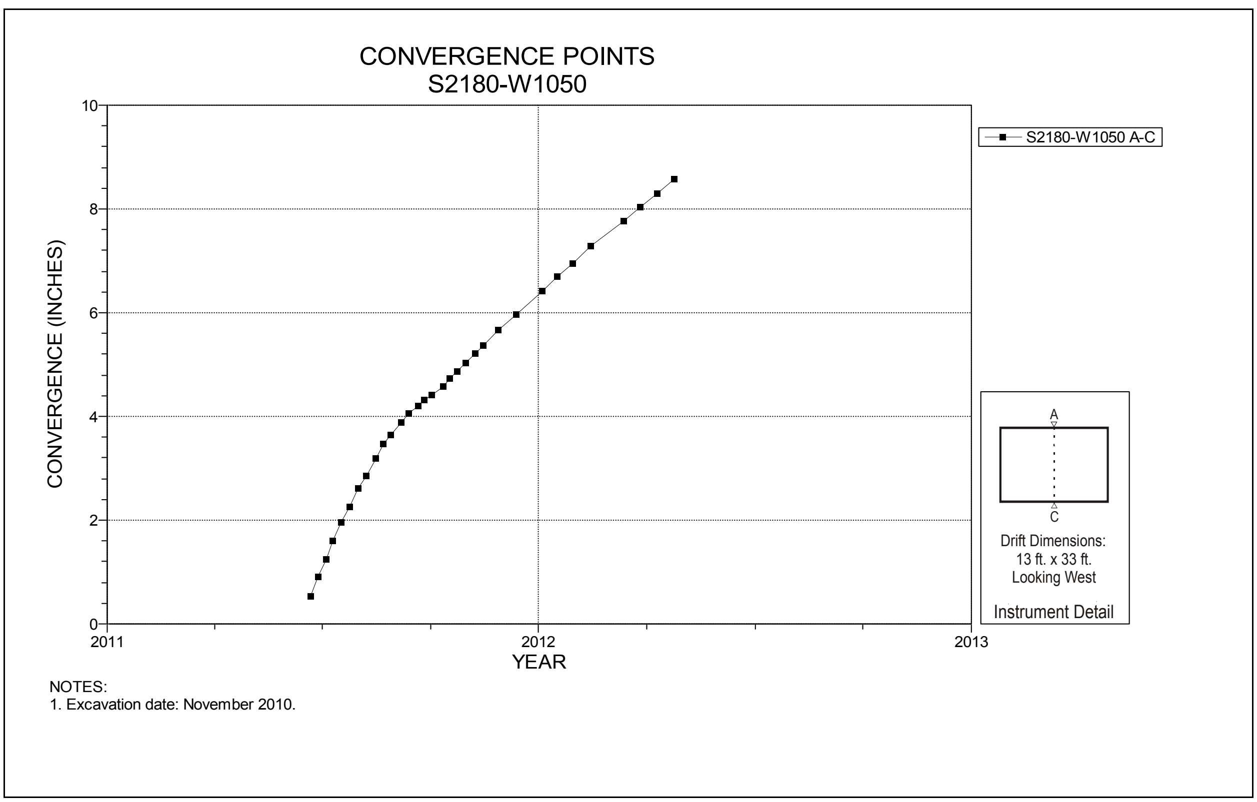


Figure 5-103 Convergence Point Array
S2180 W1050 Intersection (Room 6, Panel 7) – Roof to Floor

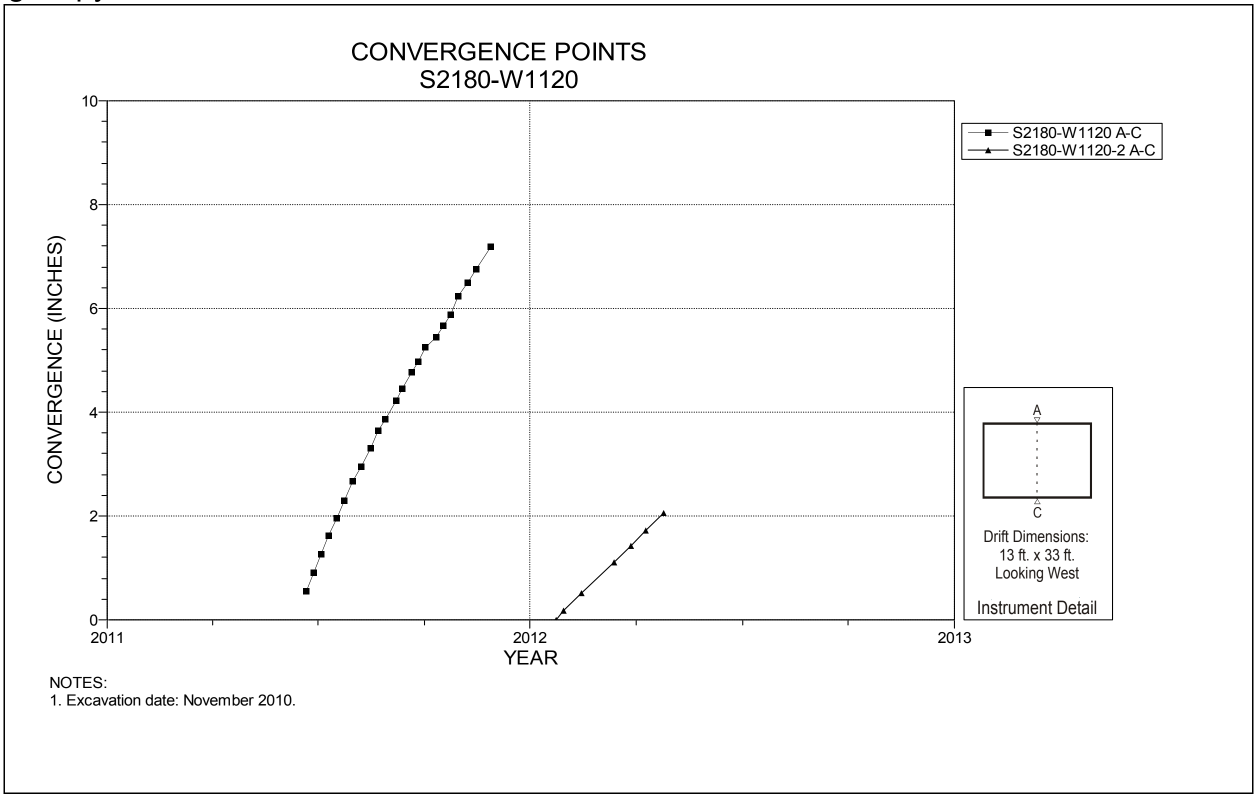


Figure 5-104 Convergence Point Array
S2180 W1120 – Roof to Floor

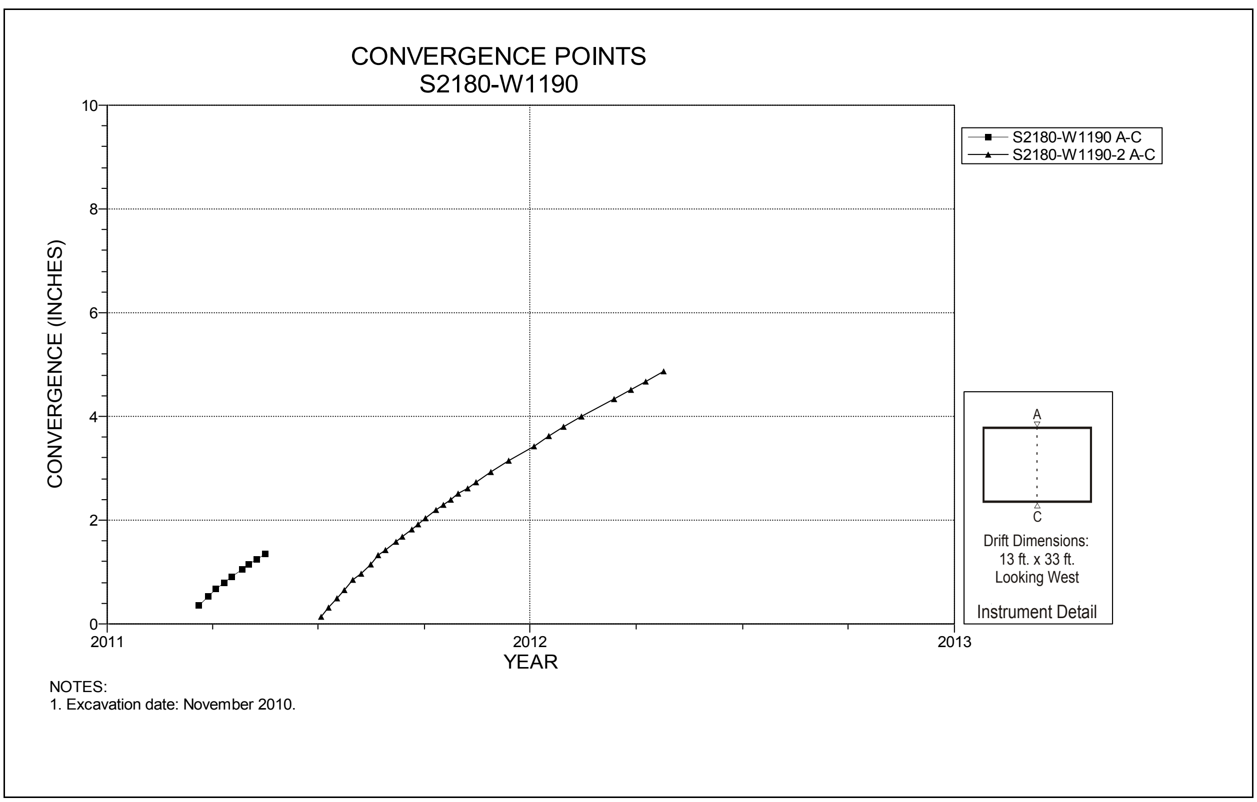


Figure 5-104a Convergence Point Array
S2180 W1190 Intersection (Room 7, Panel 7) – Roof to Floor

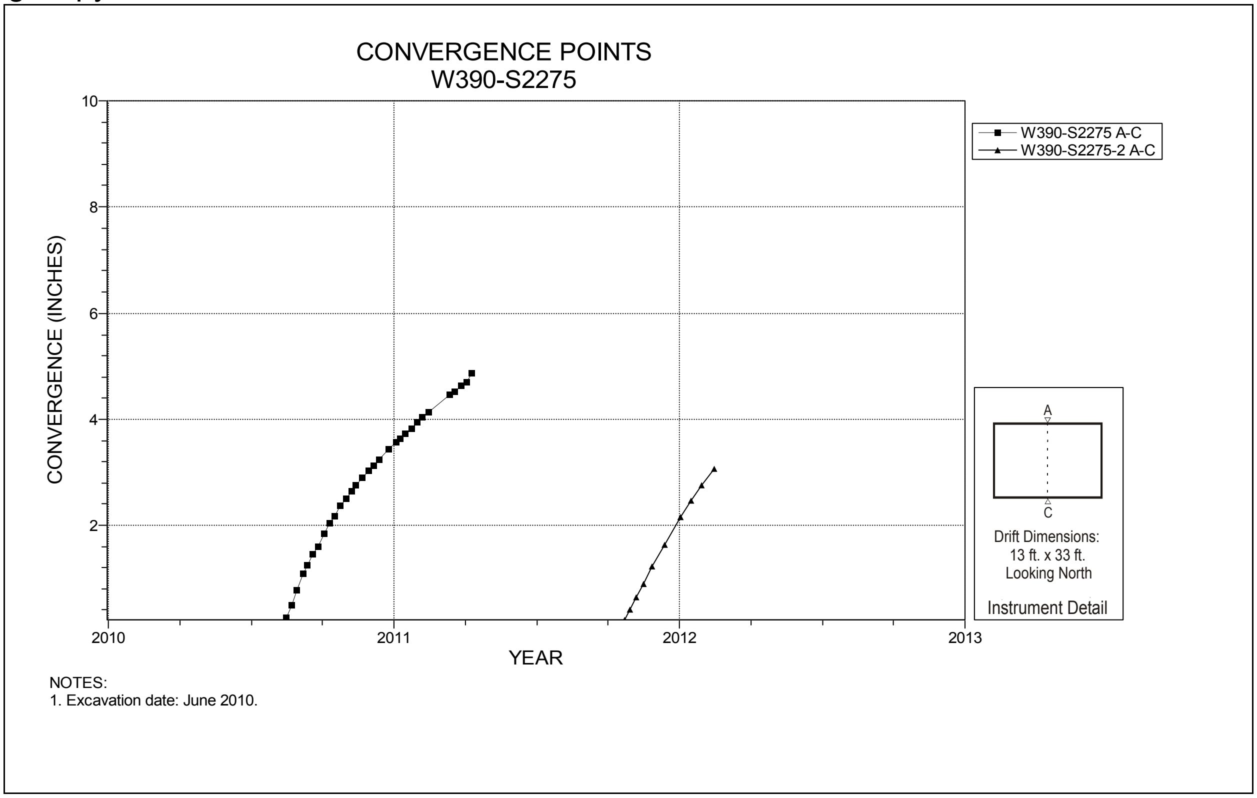


Figure 5-105 Convergence Point Array
Room 1, Panel 7 at W390 S2275 – Roof to Floor

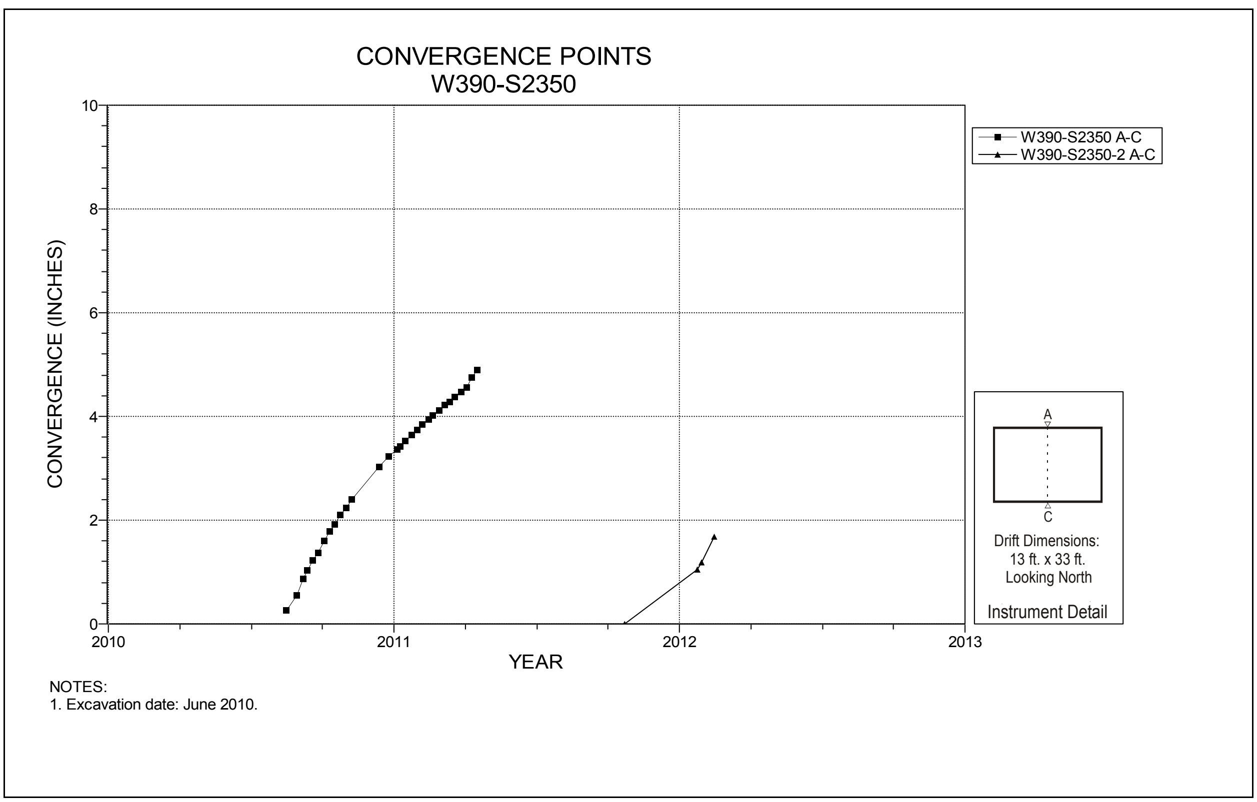


Figure 5-106 Convergence Point Array
Room 1, Panel 7 at W390 S2350– Room Center – Roof to Floor

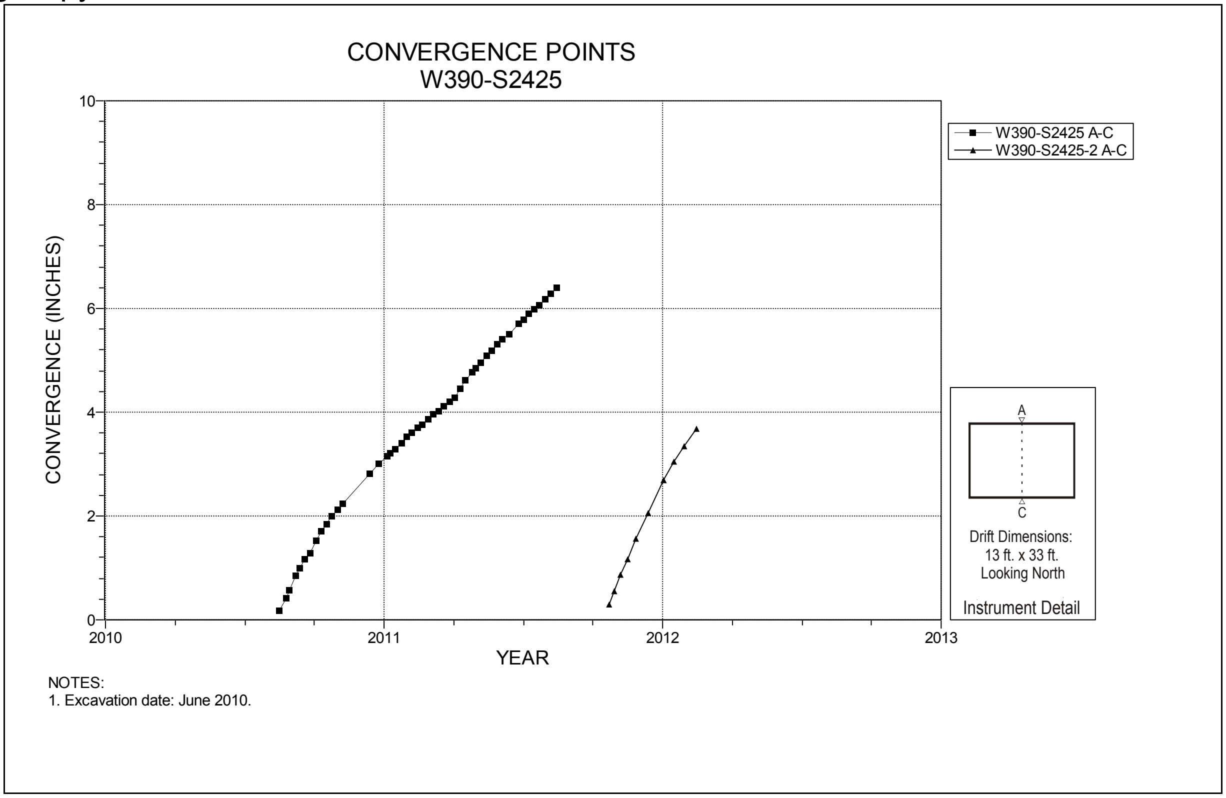


Figure 5-107 Convergence Point Array
Room 1, Panel 7 at W390 S2425 – Roof to Floor

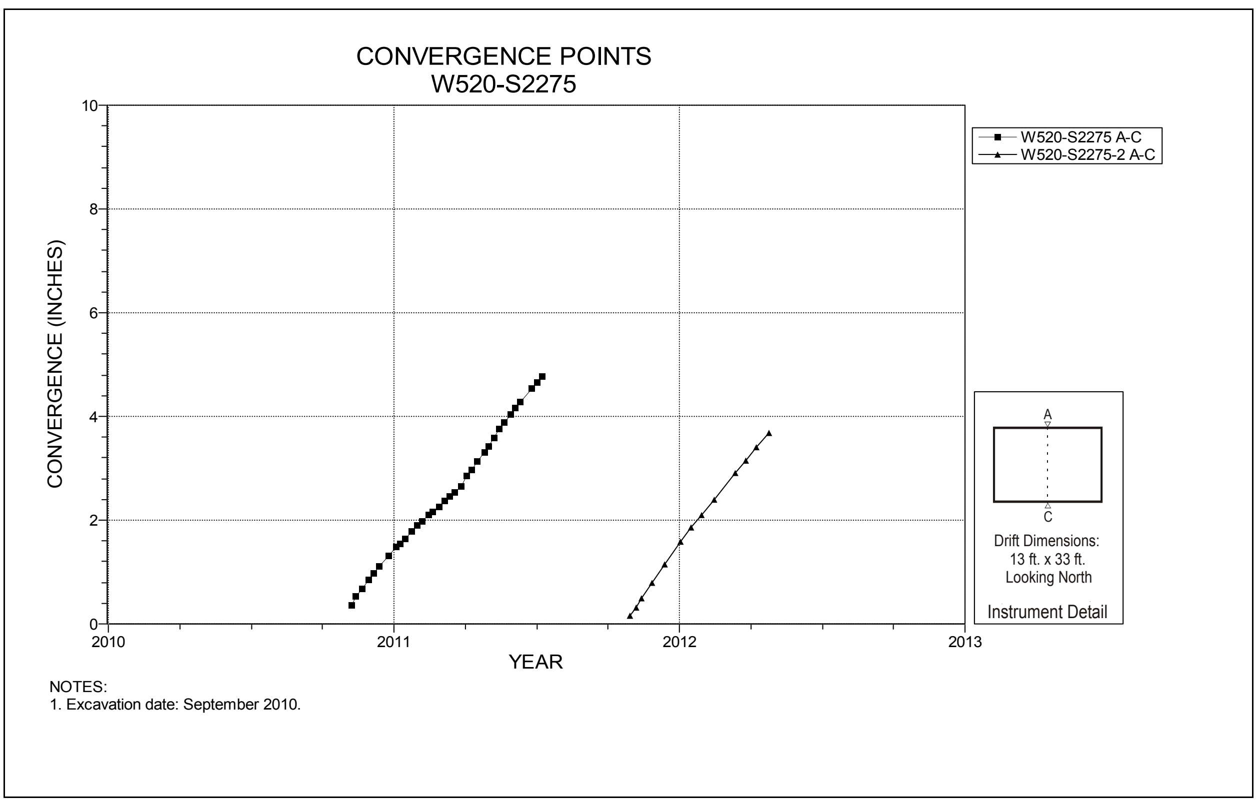


Figure 5-108 Convergence Point Array
Room 2, Panel 7 at W520 S2275 – Roof to Floor

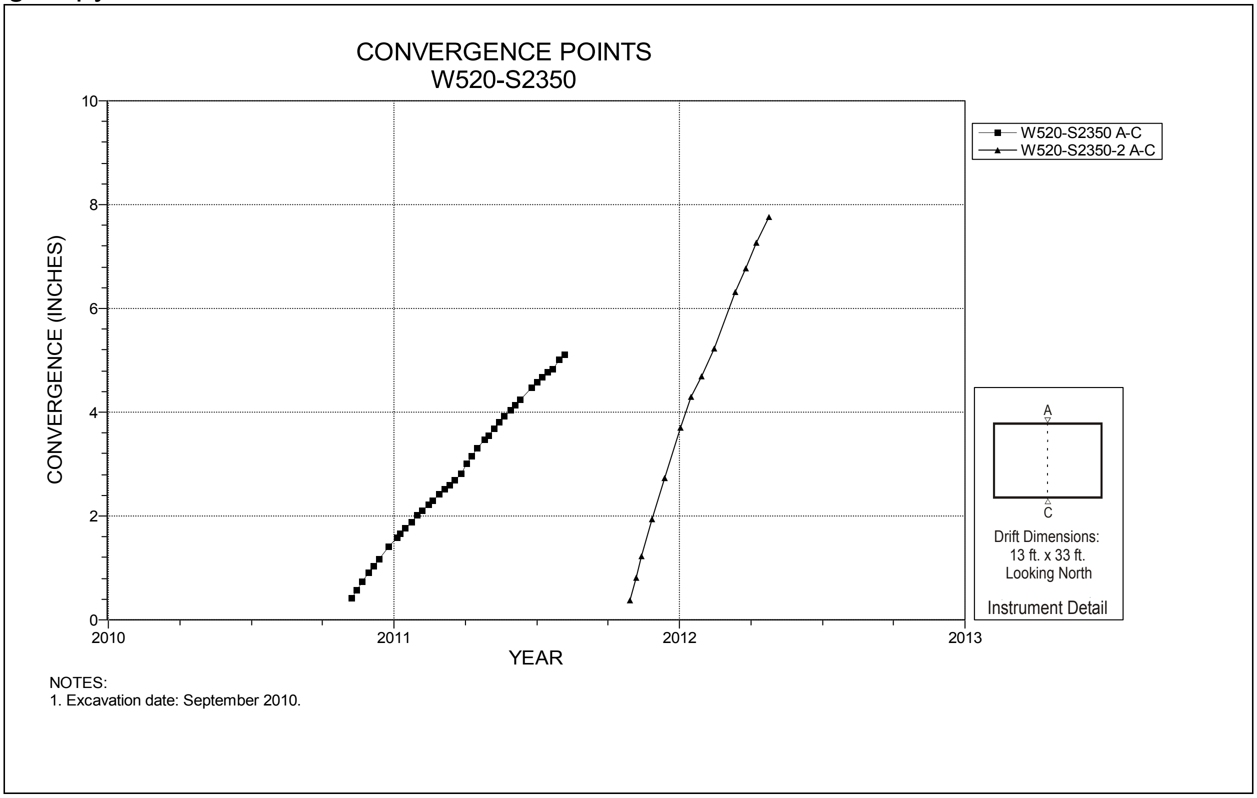


Figure 5-109 Convergence Point Array
Room 2, Panel 7 at W520 S2350– Room Center – Roof to Floor

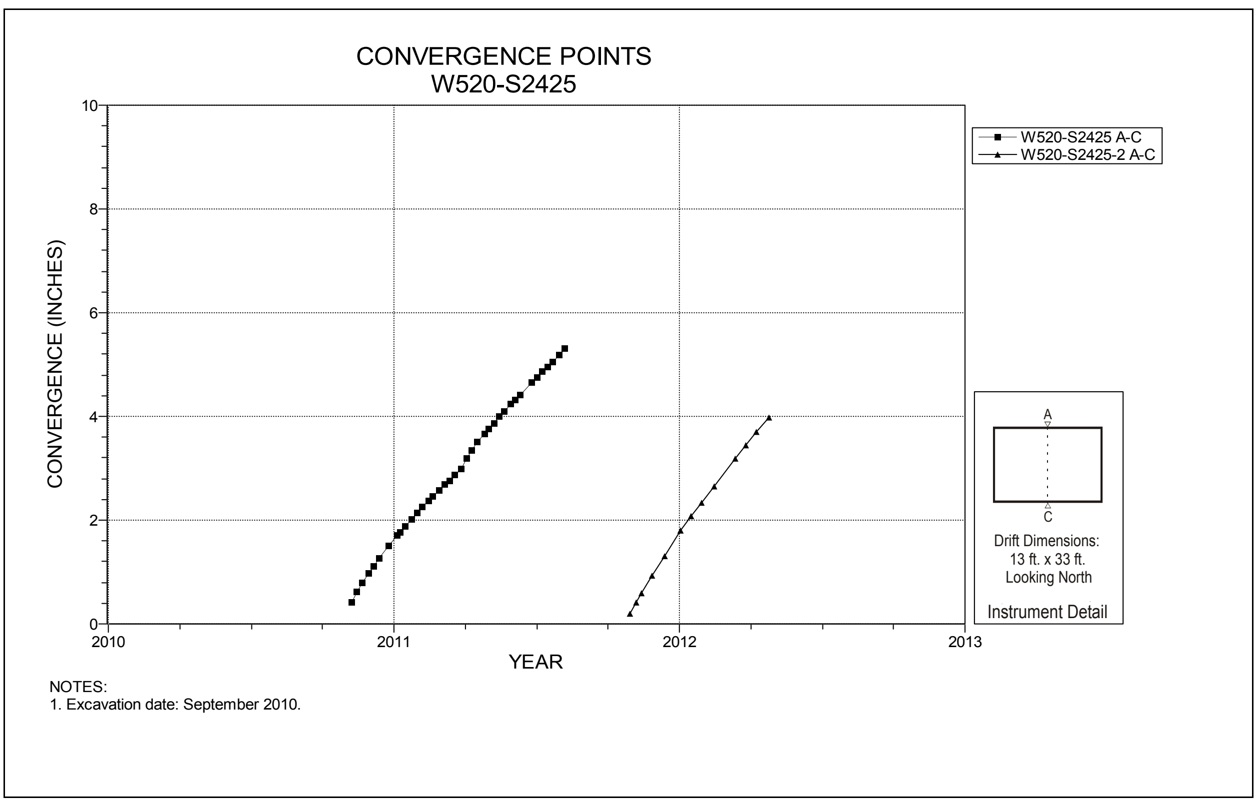


Figure 5-110 Convergence Point Array
Room 2, Panel 7 at W520 S2425 – Roof to Floor

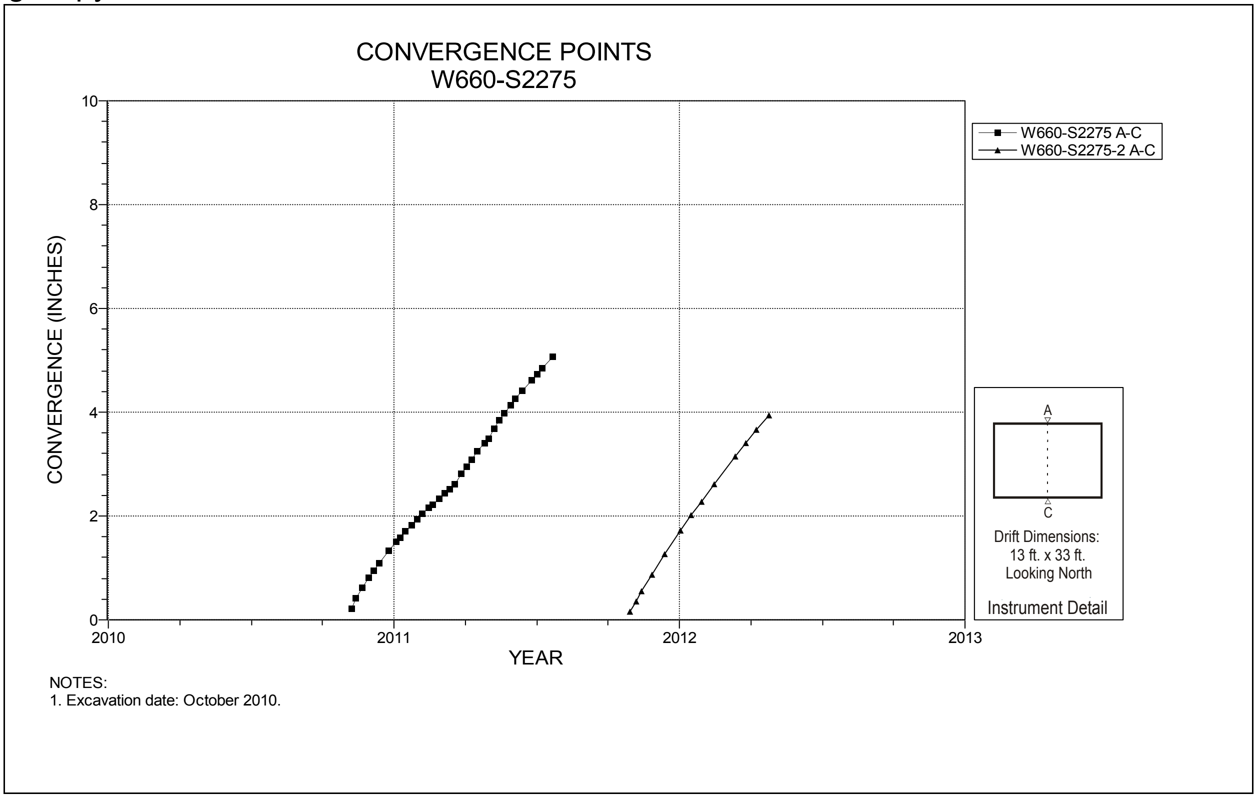


Figure 5-111 Convergence Point Array
Room 3, Panel 7 at W660 S2275 – Roof to Floor

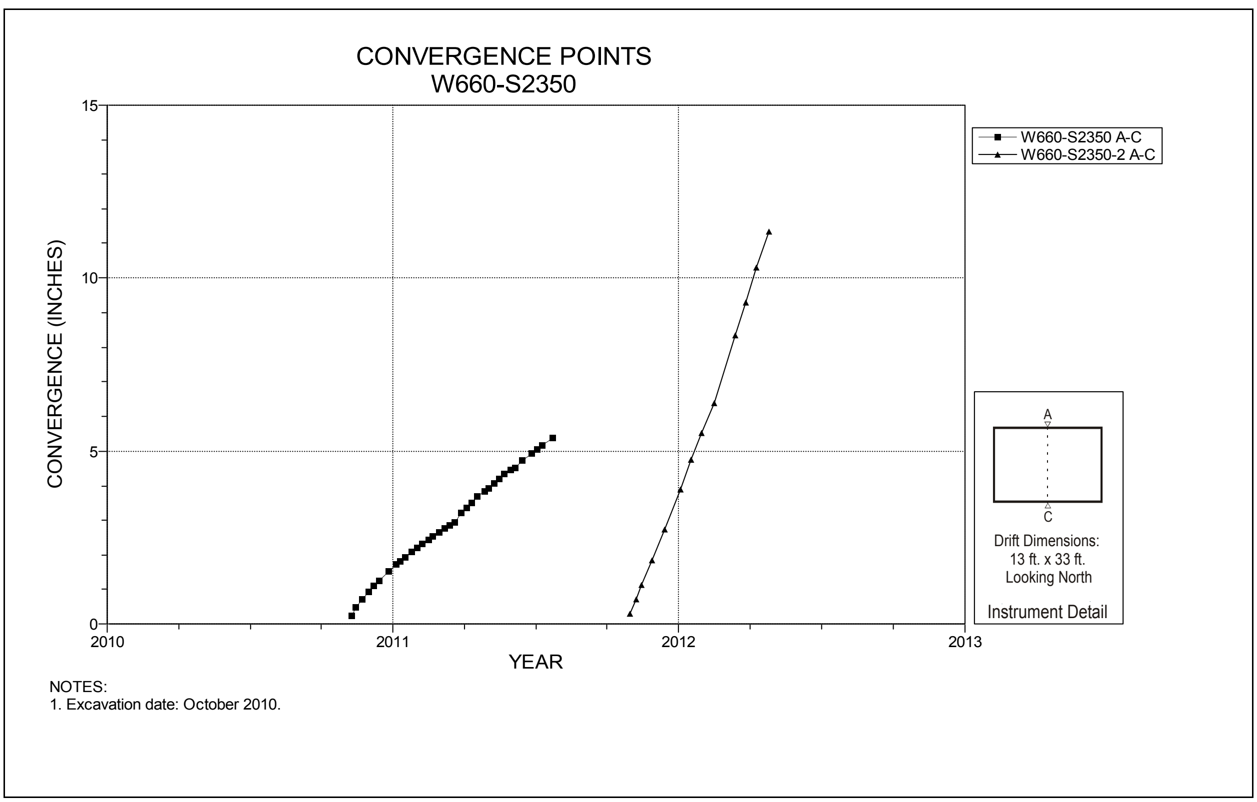


Figure 5-112 Convergence Point Array
Room 3, Panel 7 at W660 S2350– Room Center – Roof to Floor

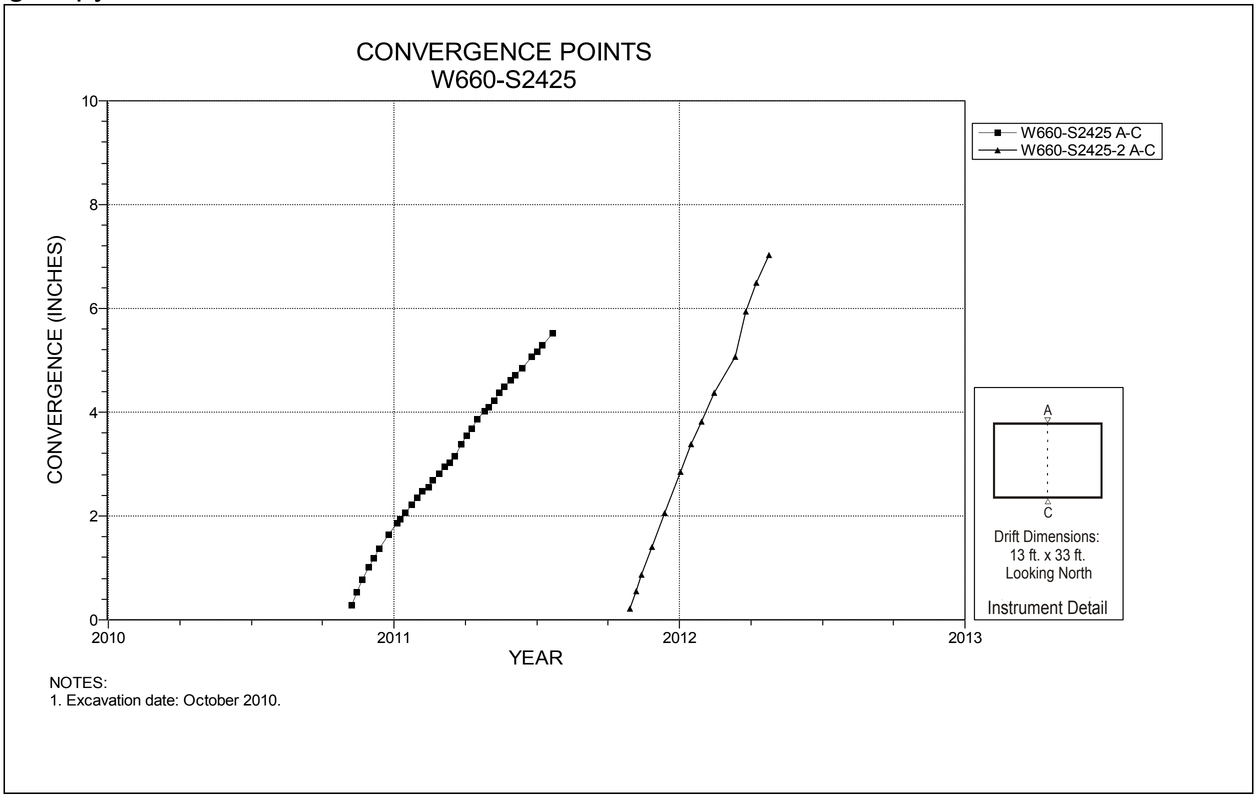


Figure 5-113 Convergence Point Array
Room 3, Panel 7 at W660 S2425 – Roof to Floor

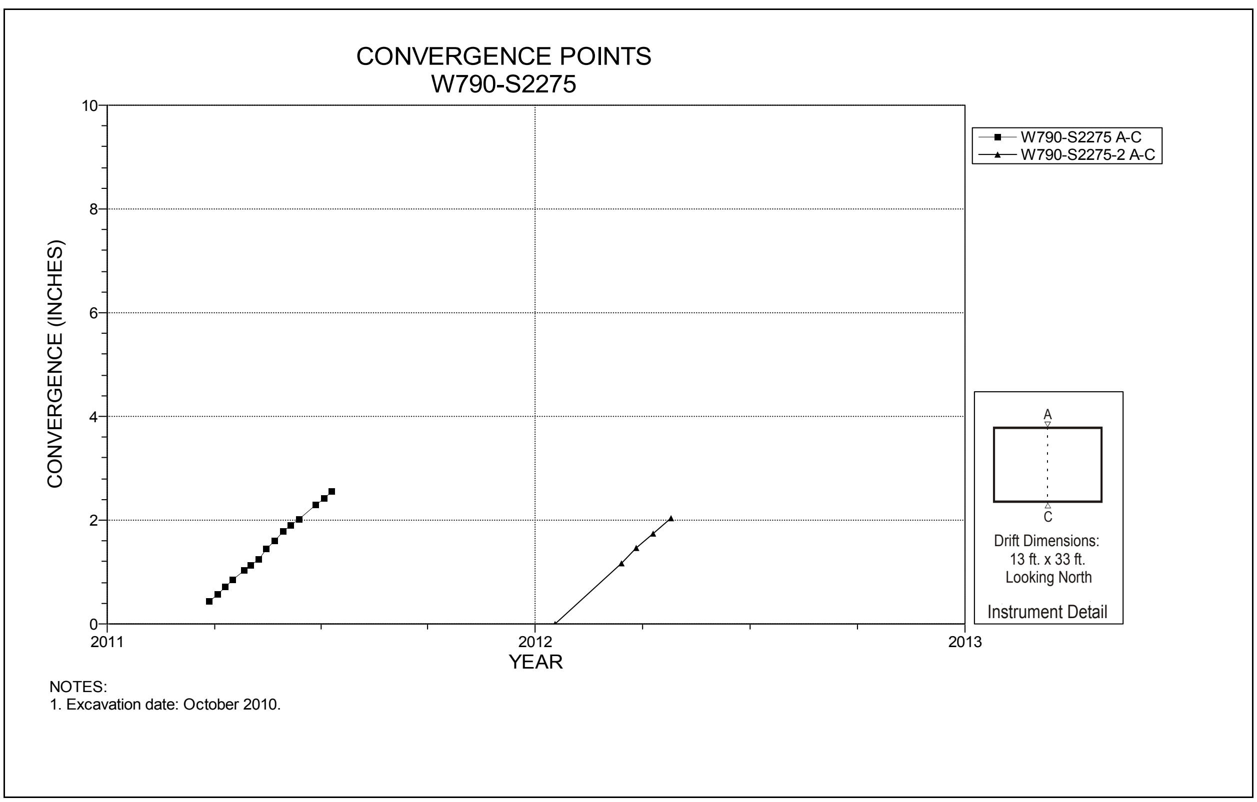


Figure 5-114 Convergence Point Array
Room 4, Panel 7 at W790 S2275 – Roof to Floor

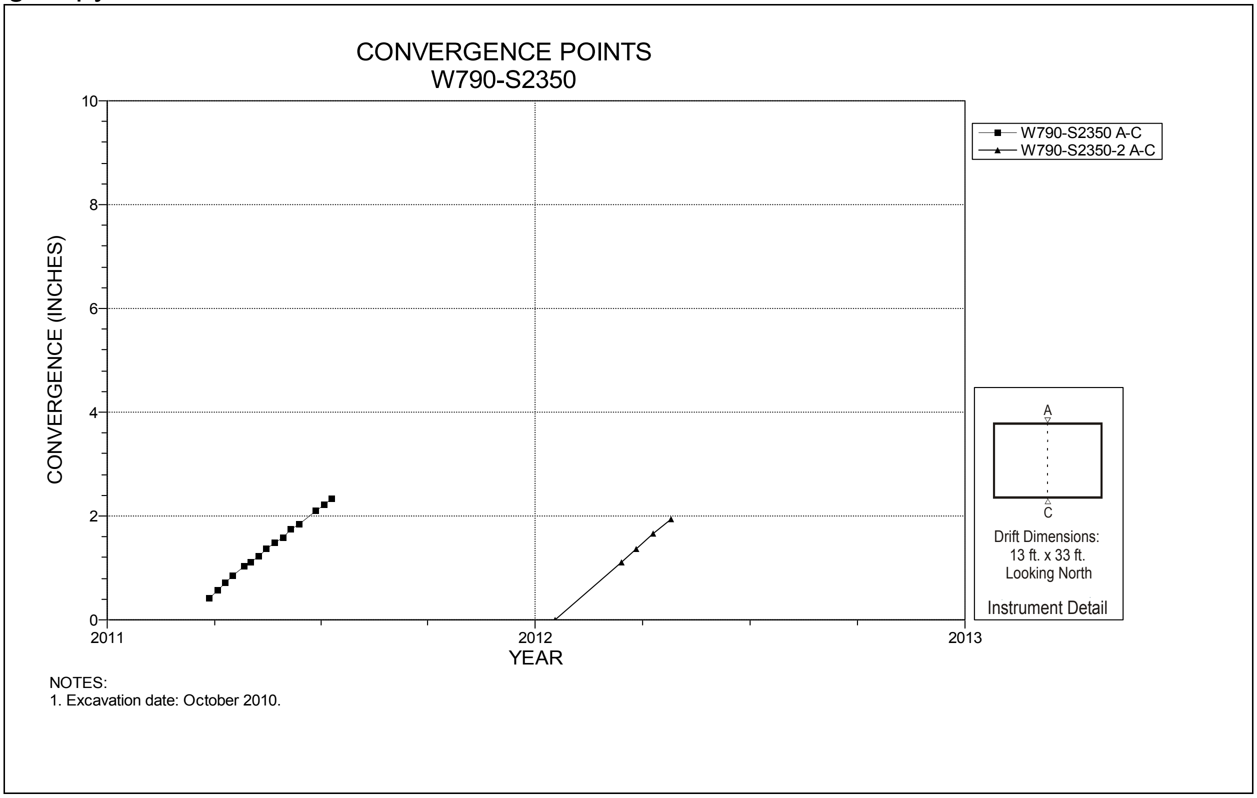


Figure 5-115 Convergence Point Array
Room 4, Panel 7 at W790 S2350– Room Center – Roof to Floor

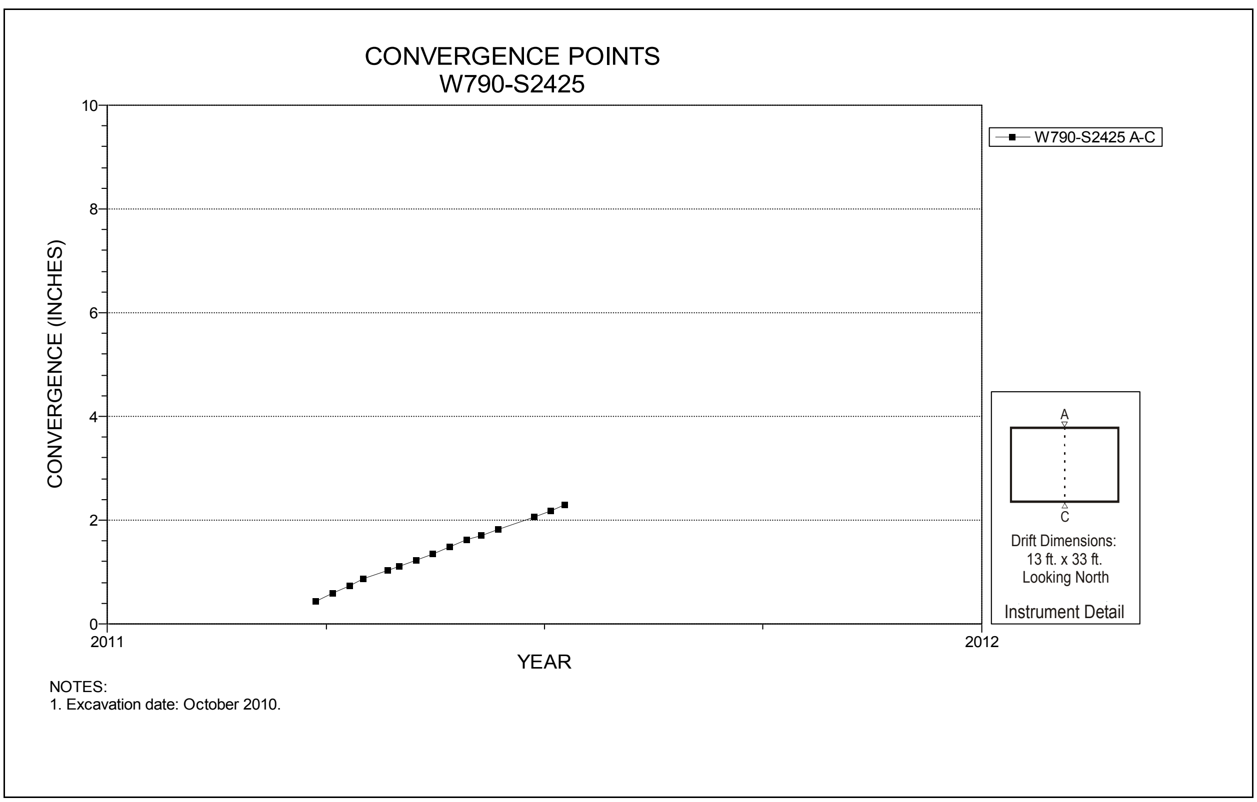


Figure 5-116 Convergence Point Array
Room 4, Panel 7 at W790 S2425 – Roof to Floor

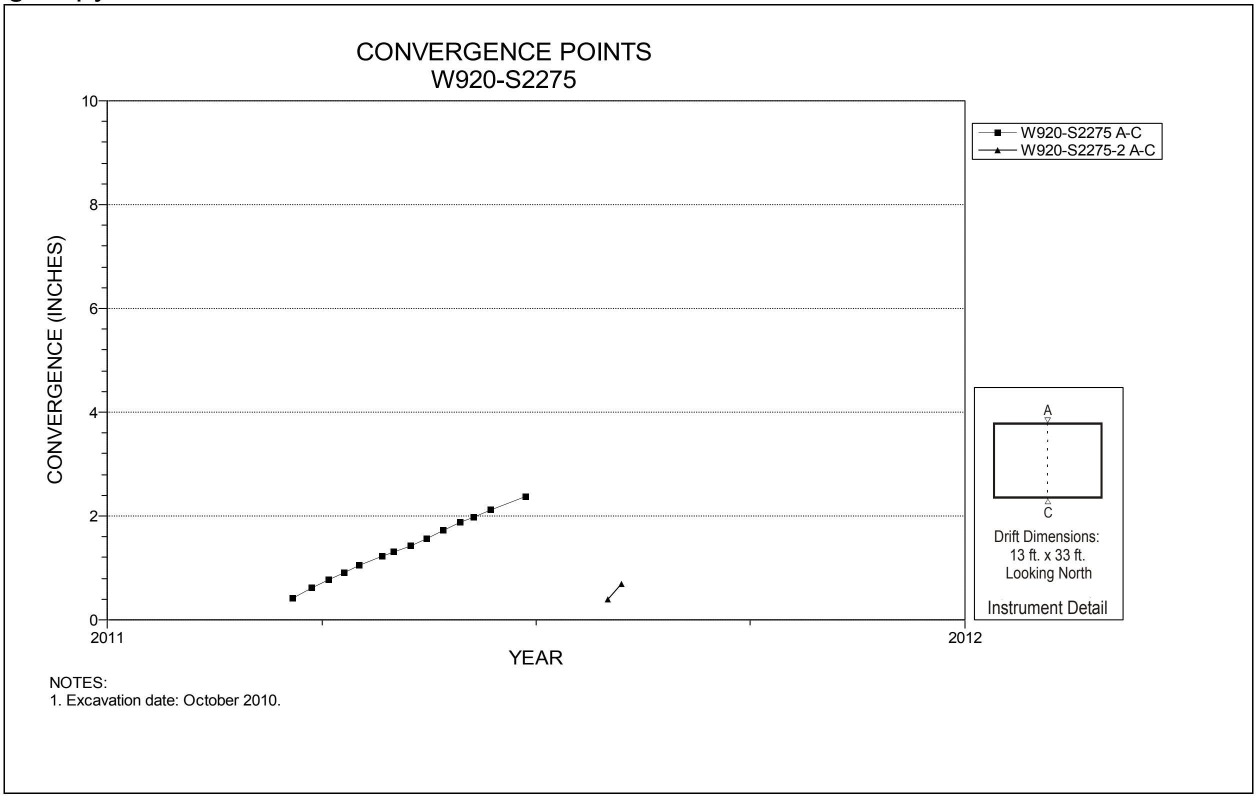


Figure 5-117 Convergence Point Array
Room 5, Panel 7 at W920 S2275 – Roof to Floor

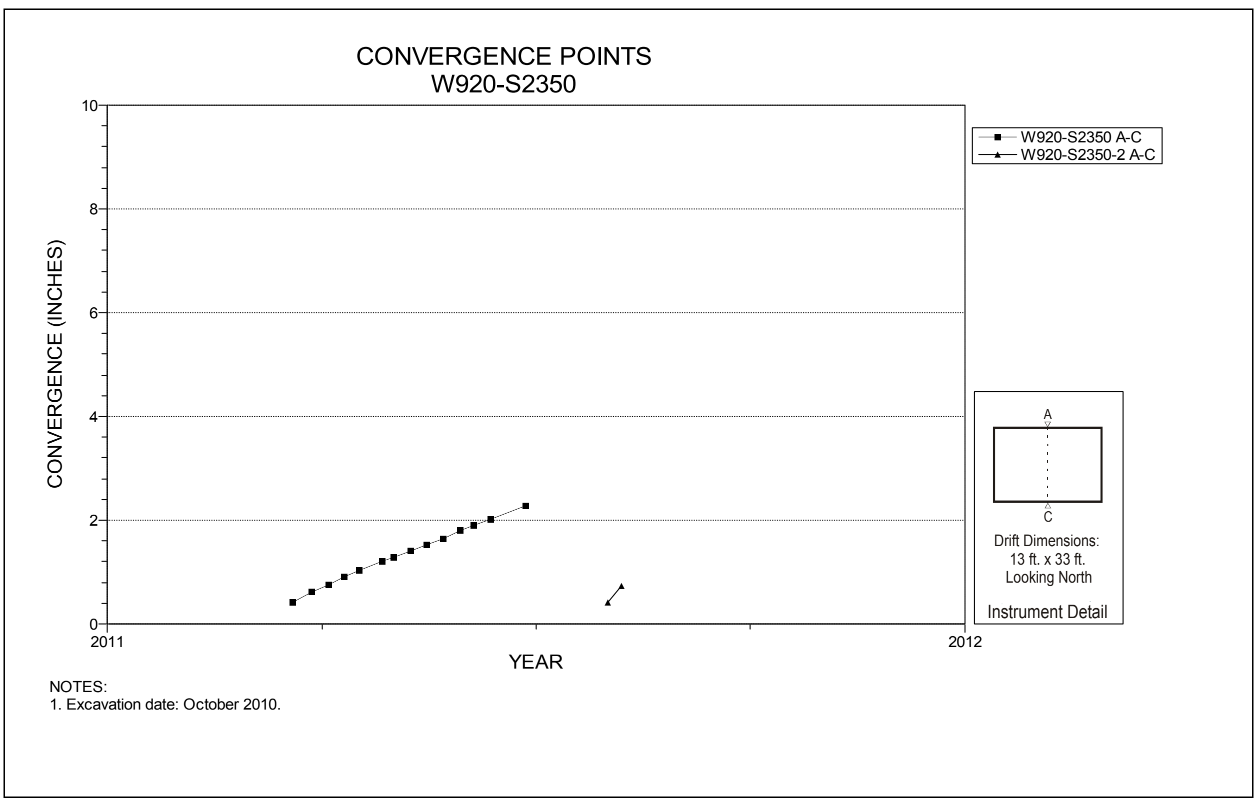


Figure 5-118 Convergence Point Array
Room 5, Panel 7 at W920 S2350– Room Center – Roof to Floor

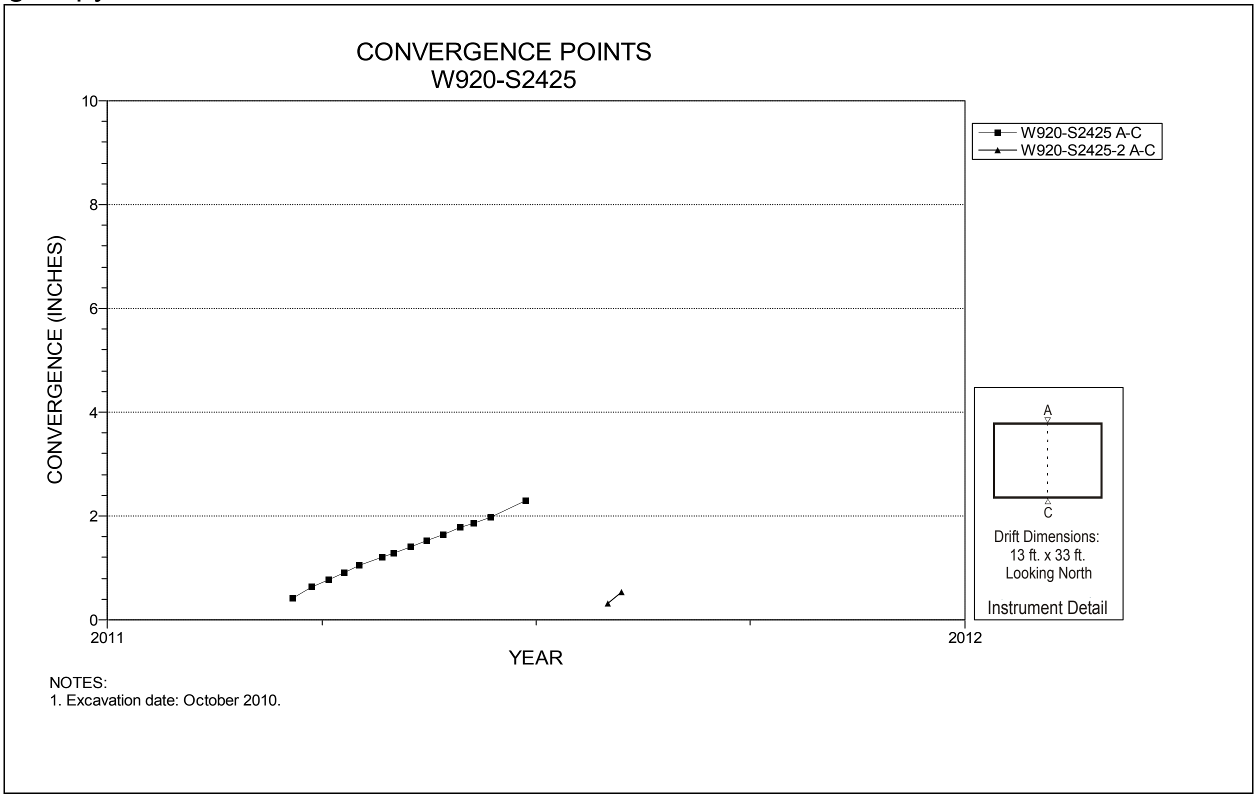


Figure 5-119 Convergence Point Array
Room 5, Panel 7 at W920 S2425 – Roof to Floor

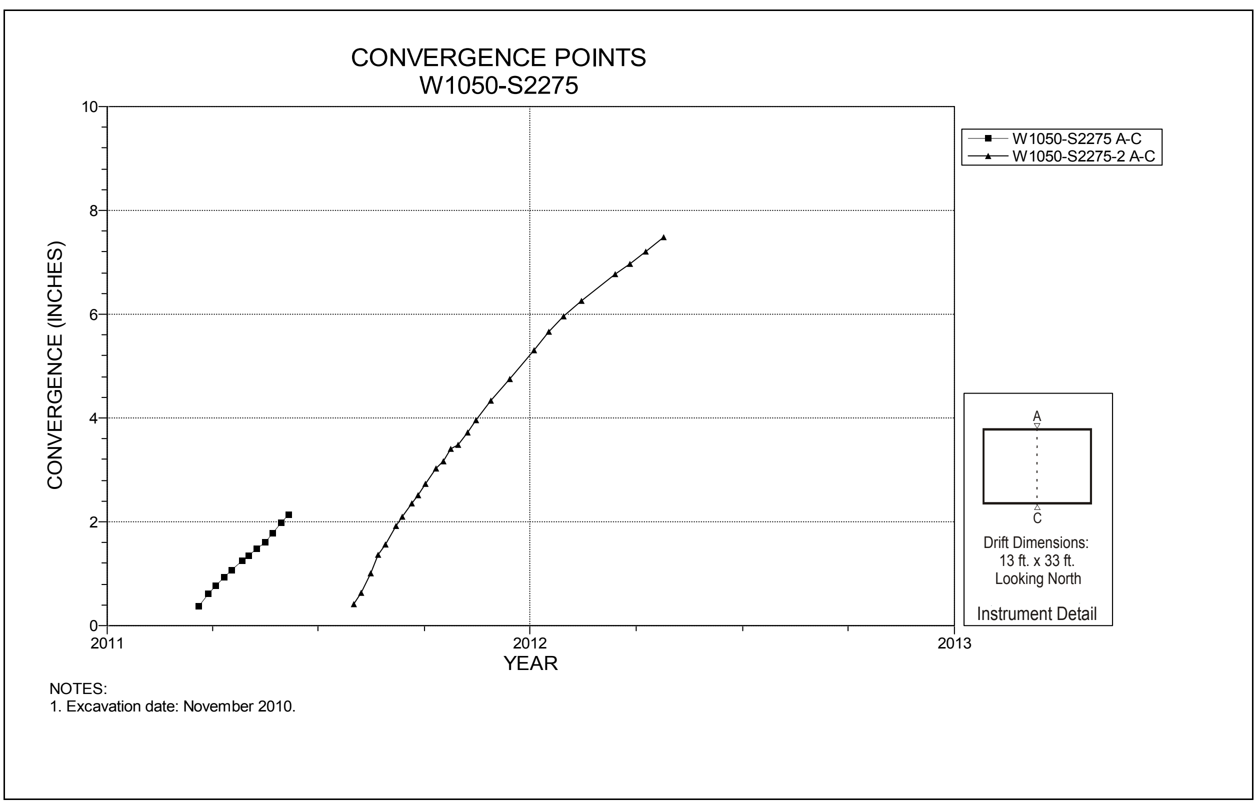


Figure 5-120 Convergence Point Array
Room 6, Panel 7 at W1050 S2275 – Roof to Floor

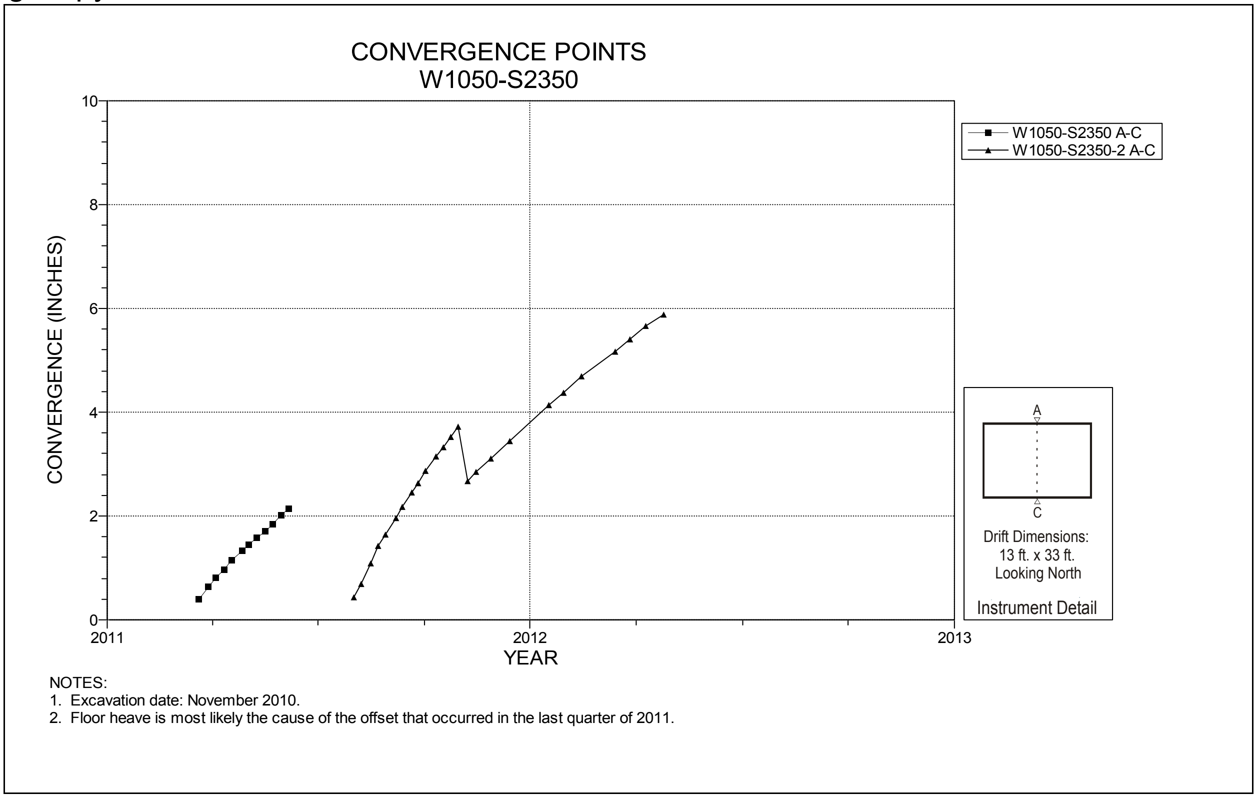


Figure 5-121 Convergence Point Array
Room 6, Panel 7 at W1050 S2350– Room Center – Roof to Floor

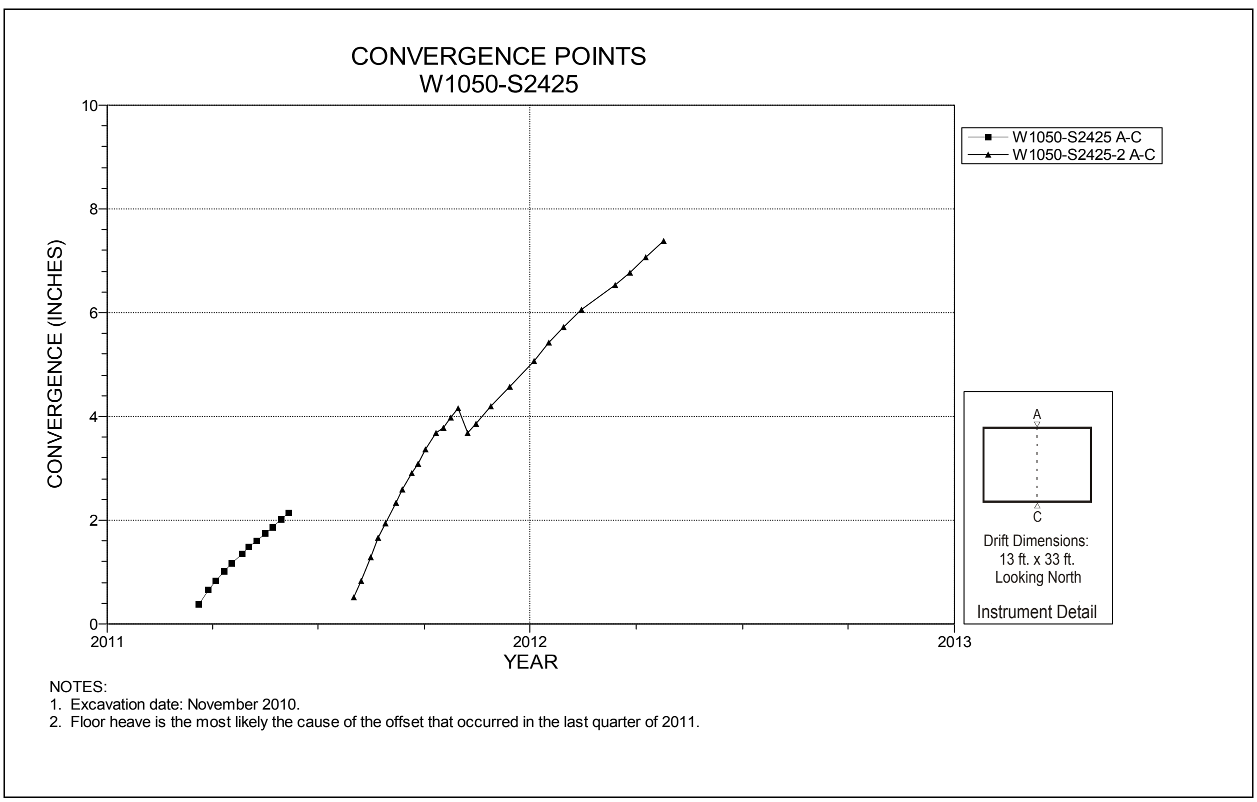


Figure 5-122 Convergence Point Array
Room 6, Panel 7 at W1050 S2425 – Roof to Floor

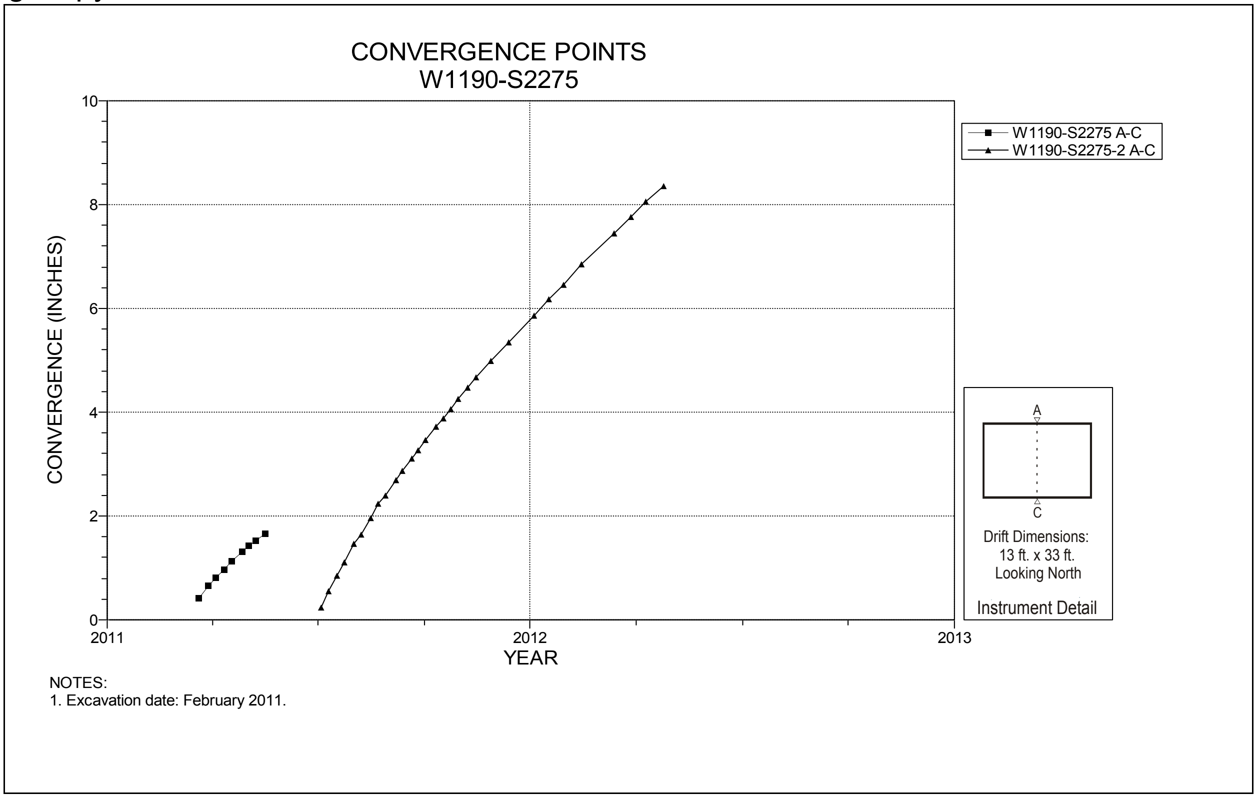


Figure 5-123 Convergence Point Array
Room 7, Panel 7 at W1190 S2275 – Roof to Floor

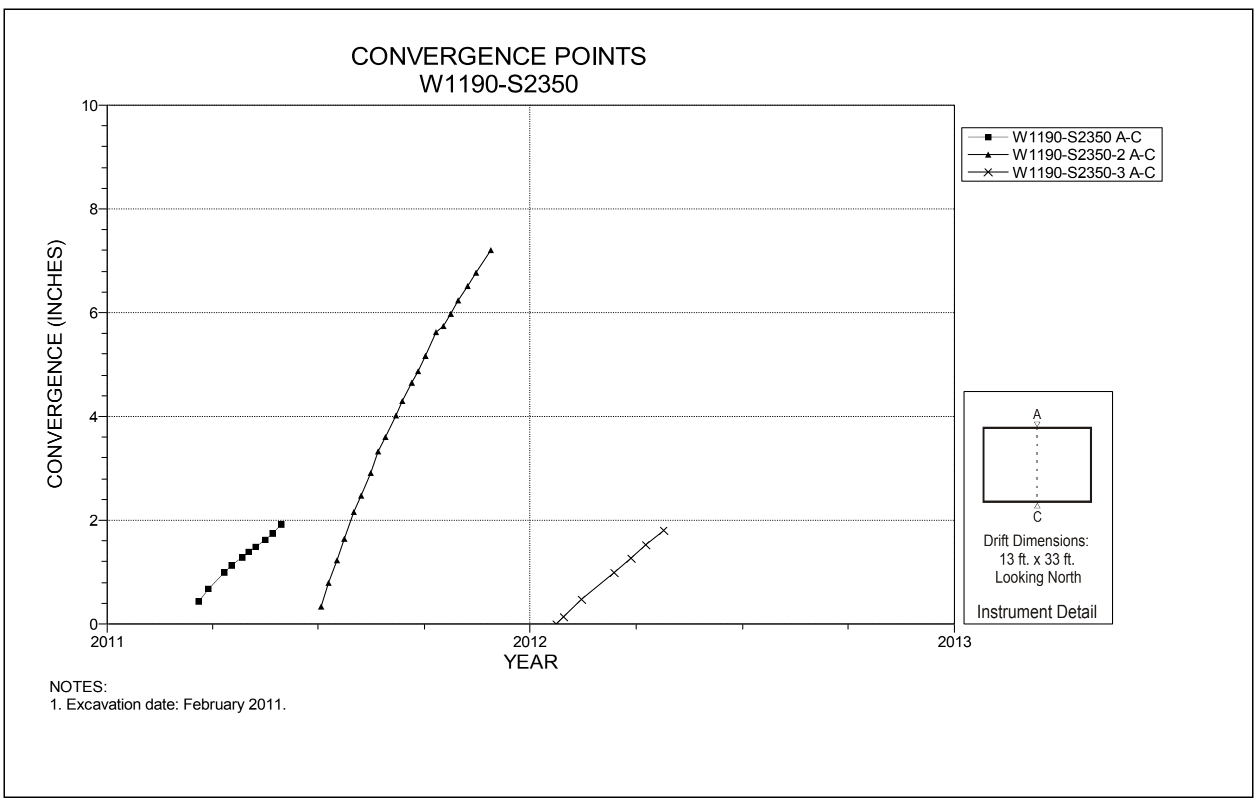


Figure 5-124 Convergence Point Array
Room 7, Panel 7 at W1190 S2350– Room Center – Roof to Floor

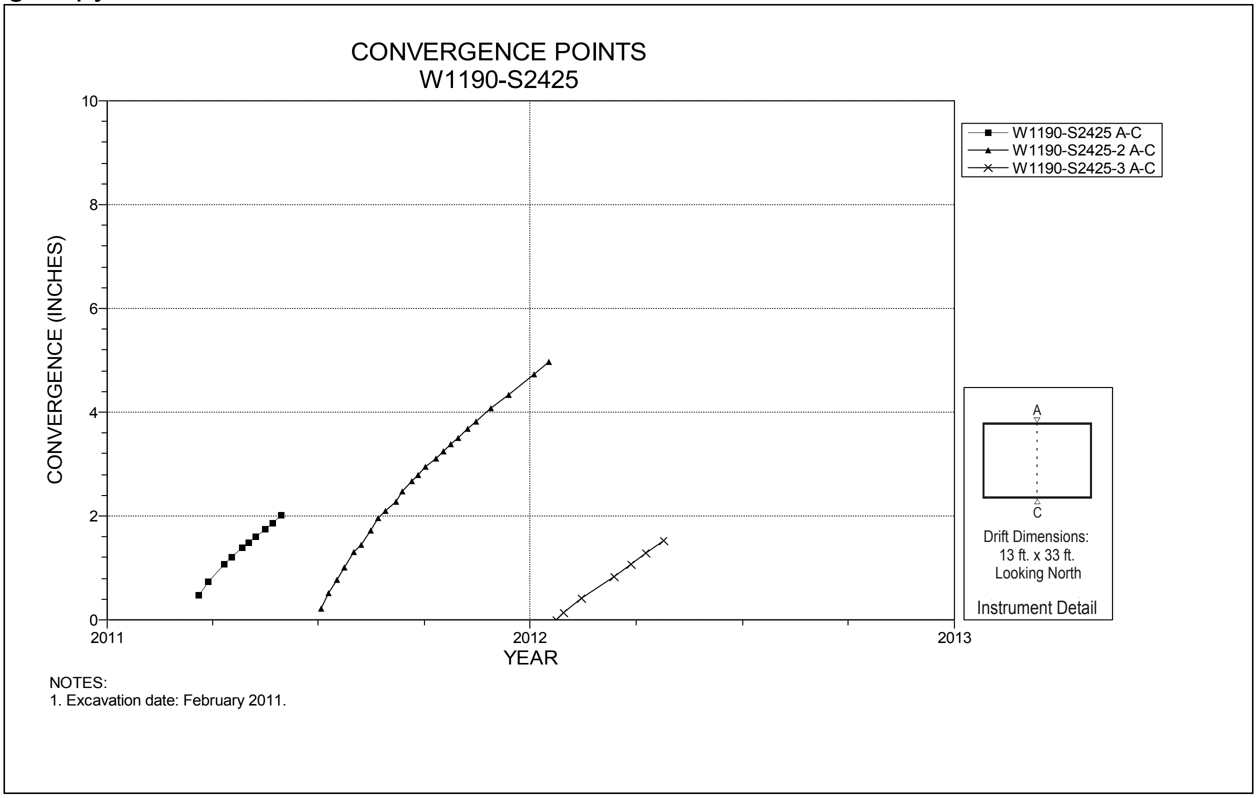


Figure 5-125 Convergence Point Array
Room 7, Panel 7 at W1190 S2425 – Roof to Floor

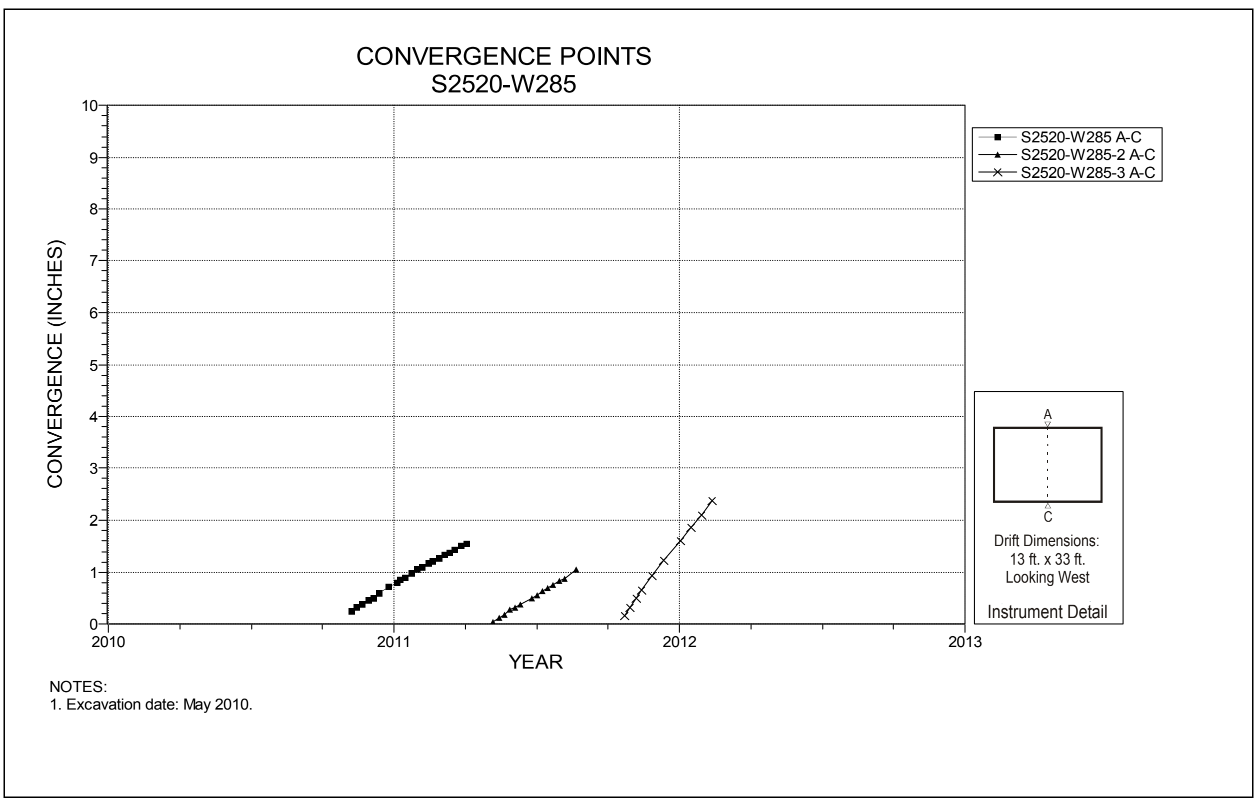


Figure 5-126 Convergence Point Array
S2520 W285 – Roof to Floor

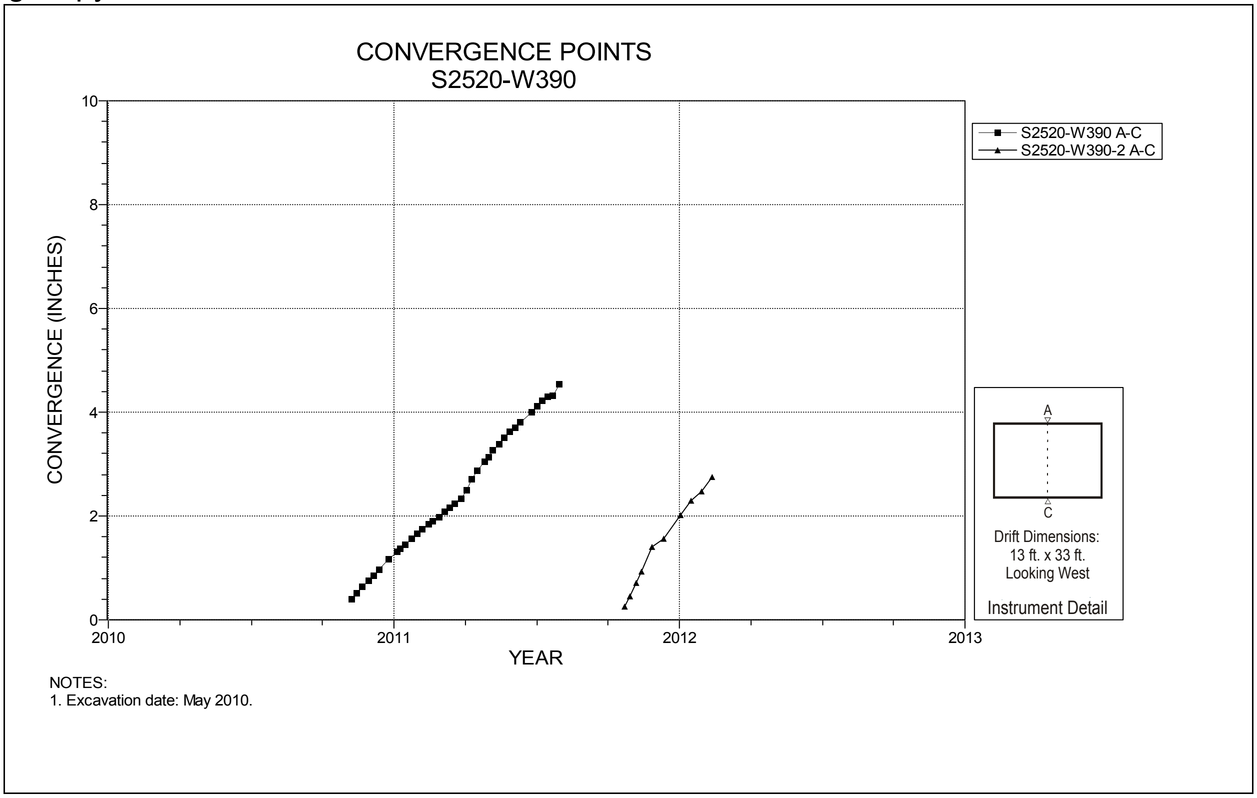


Figure 5-127 Convergence Point Array
S2520 W390 Intersection (Room 1, Panel 7) – Roof to Floor

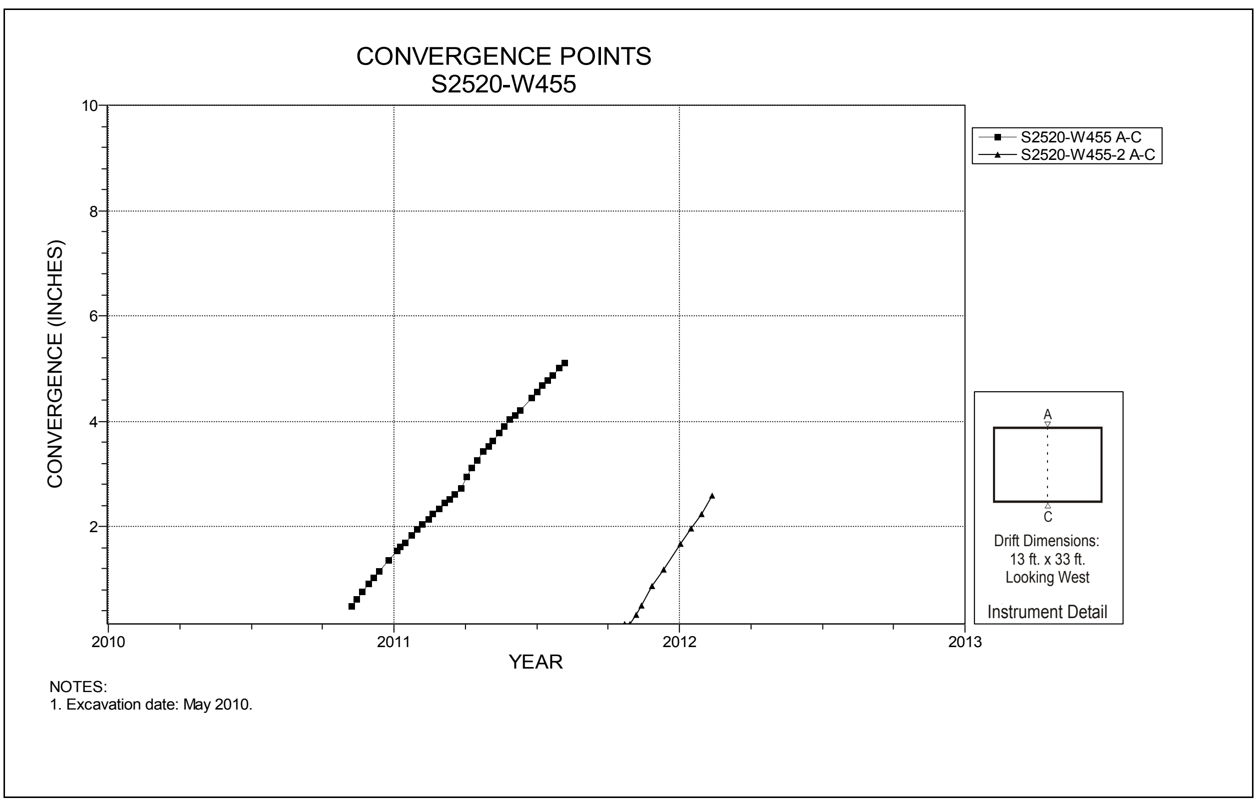


Figure 5-128 Convergence Point Array
S2520 W455 – Roof to Floor

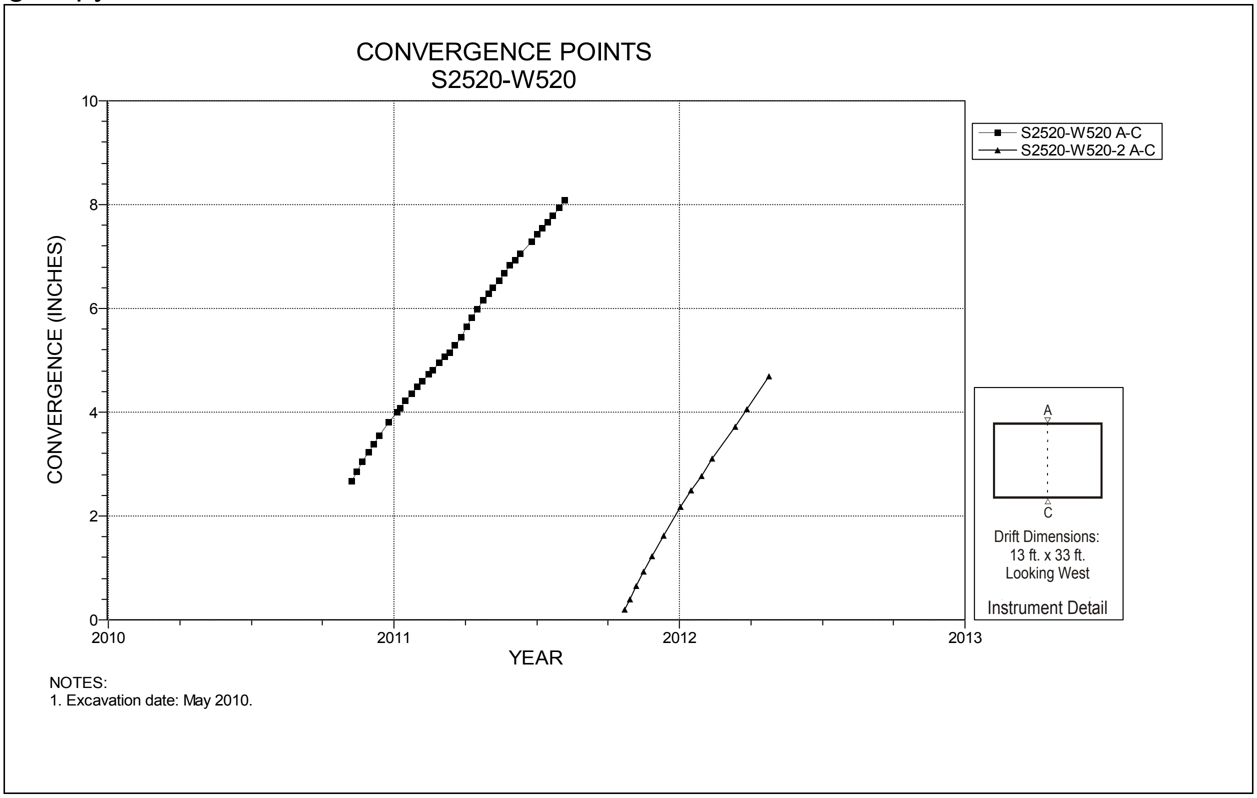


Figure 5-129 Convergence Point Array
S2520 W520 Intersection (Room 2, Panel 7) – Roof to Floor

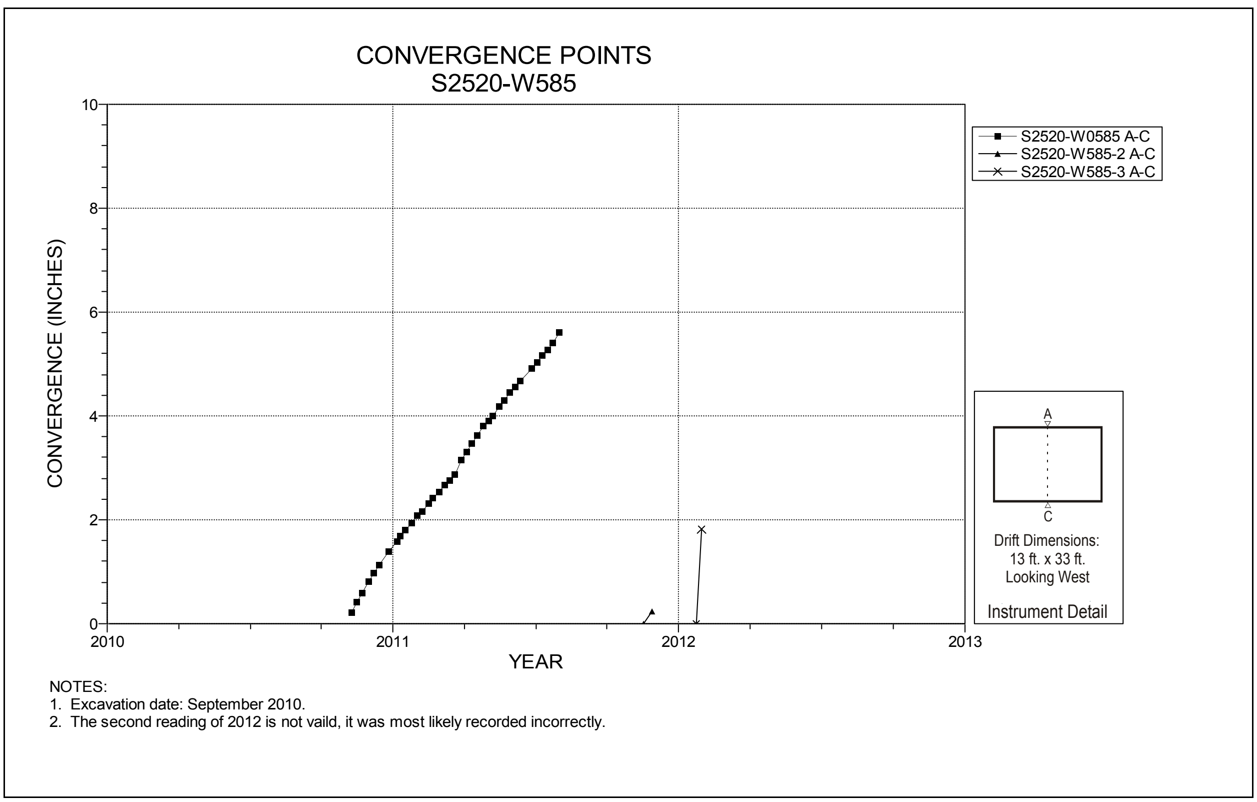


Figure 5-130 Convergence Point Array
S2520 W585 – Roof to Floor

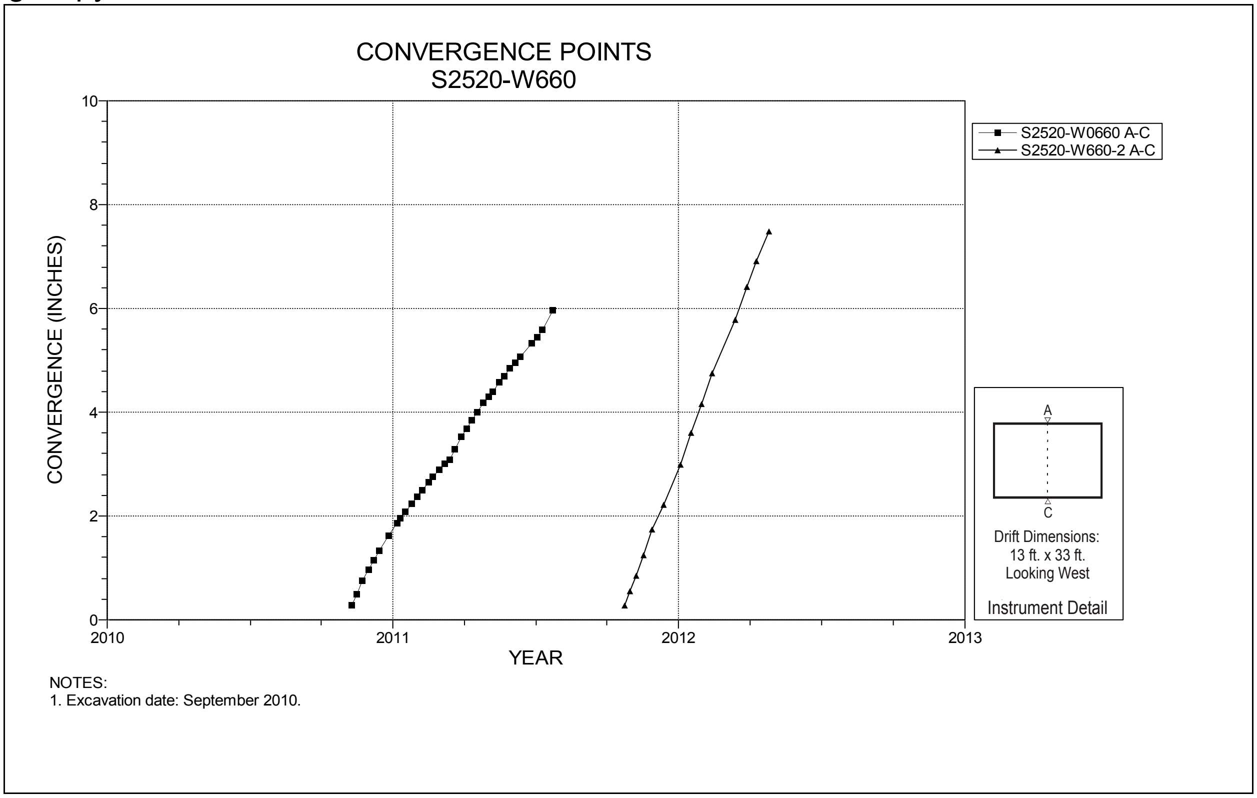


Figure 5-131 Convergence Point Array
S2520 W660 Intersection (Room 3, Panel 7) – Roof to Floor

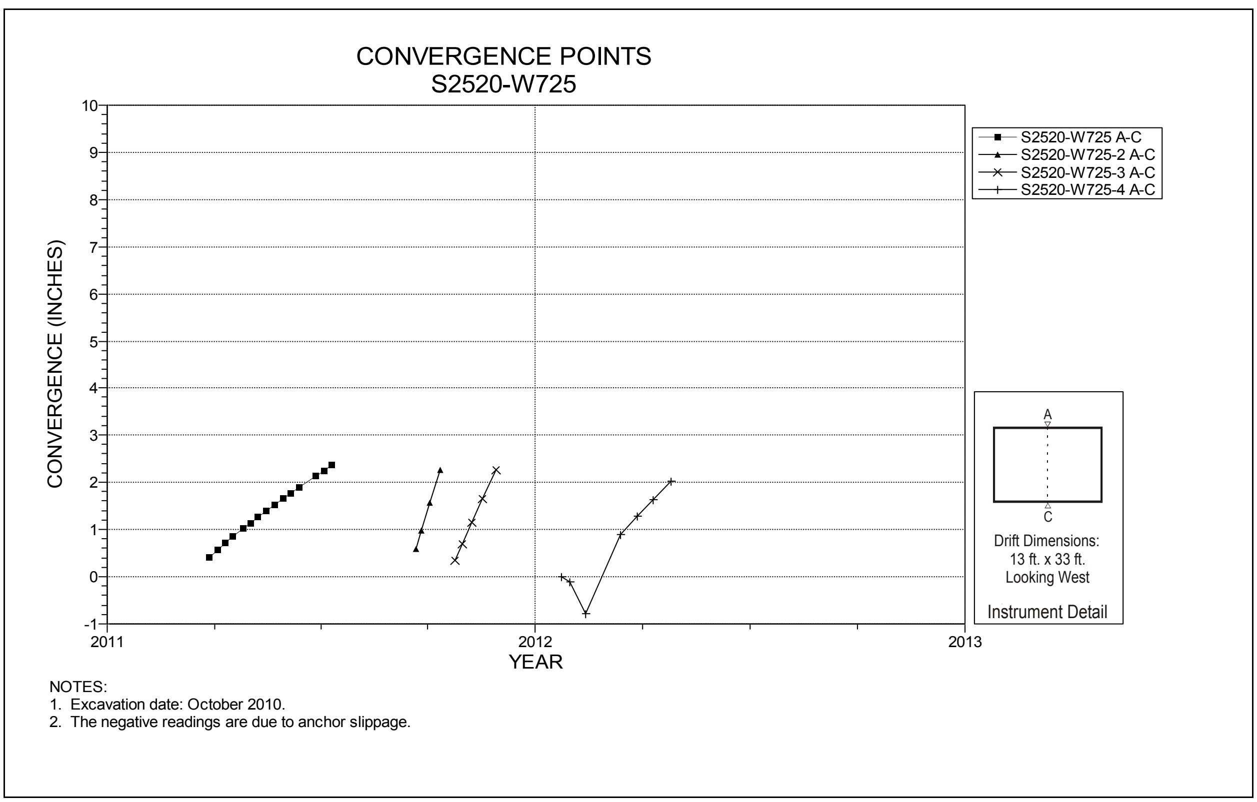


Figure 5-132 Convergence Point Array
S2520 W725 – Roof to Floor

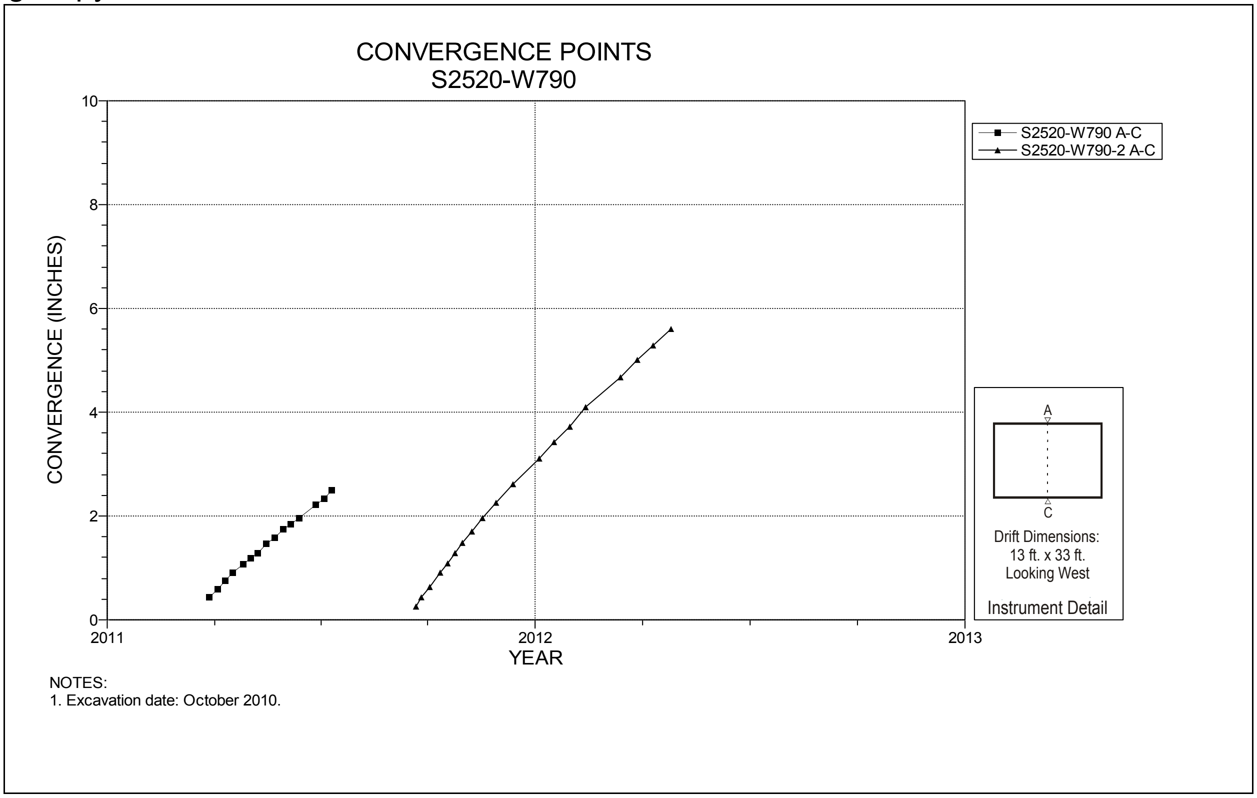


Figure 5-133 Convergence Point Array
S2520 W790 Intersection (Room 4, Panel 7) – Roof to Floor

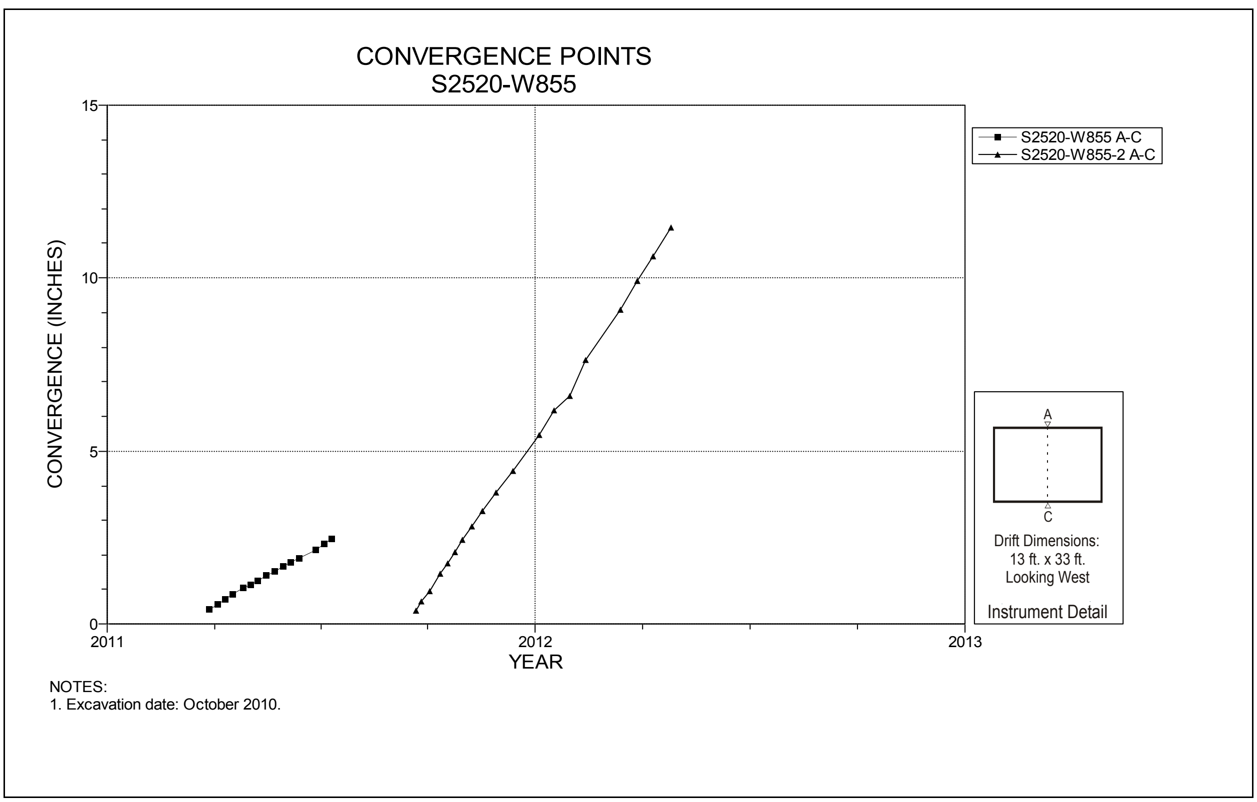


Figure 5-134 Convergence Point Array
S2520 W855 – Roof to Floor

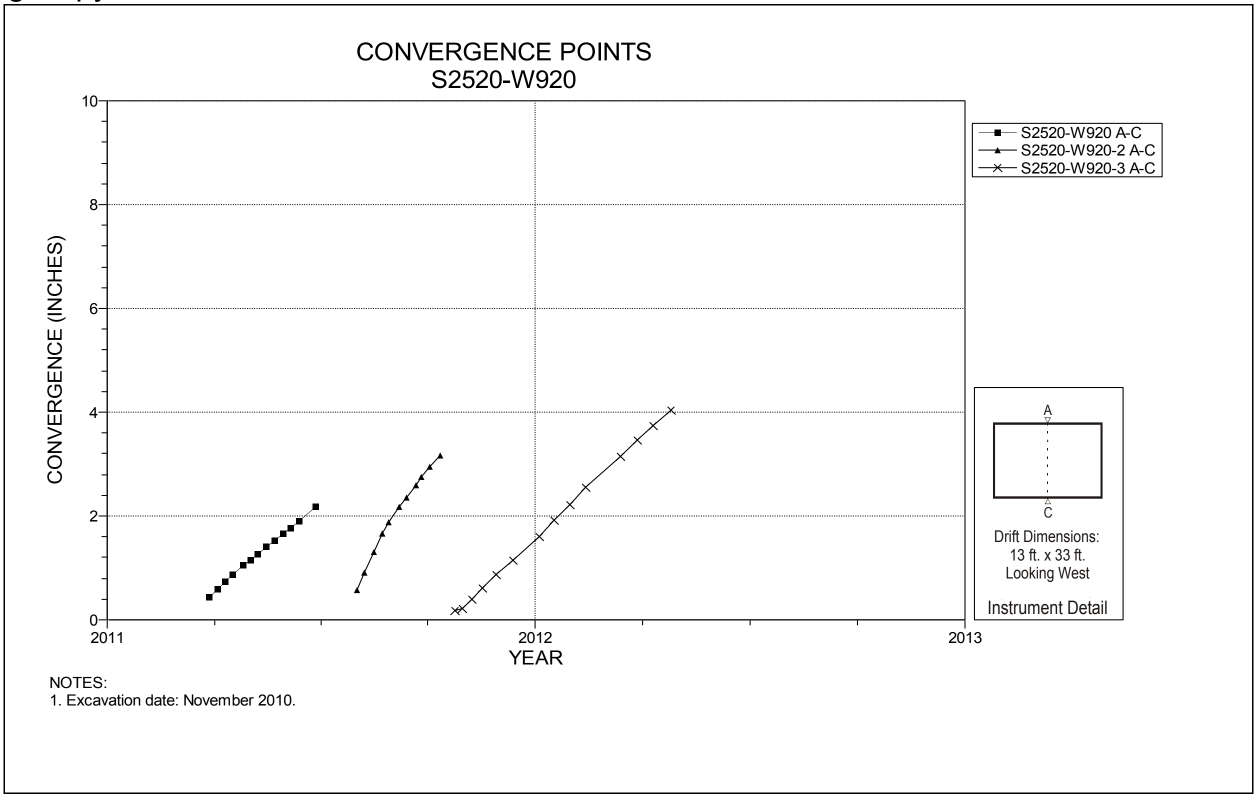


Figure 5-135 Convergence Point Array
S2520 W920 Intersection (Room 5, Panel 7) – Roof to Floor

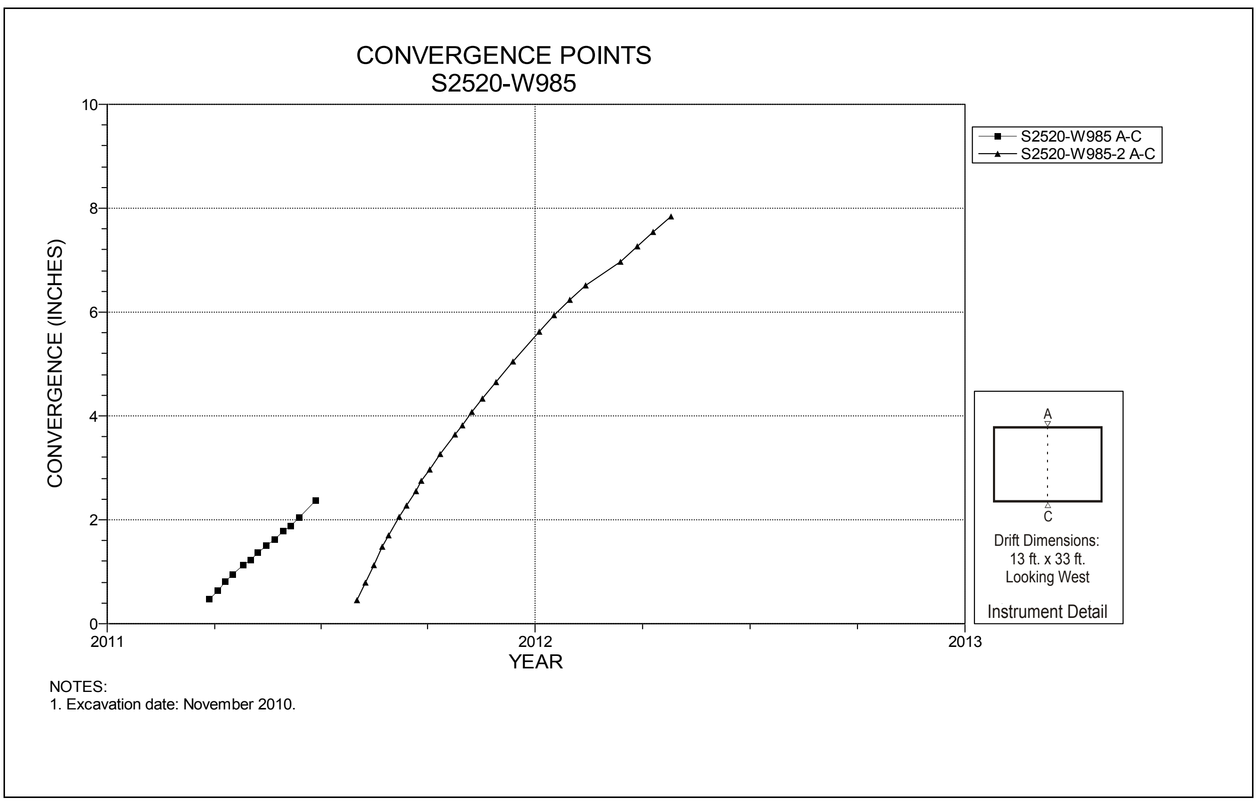


Figure 5-136 Convergence Point Array
S2520 W985 – Roof to Floor

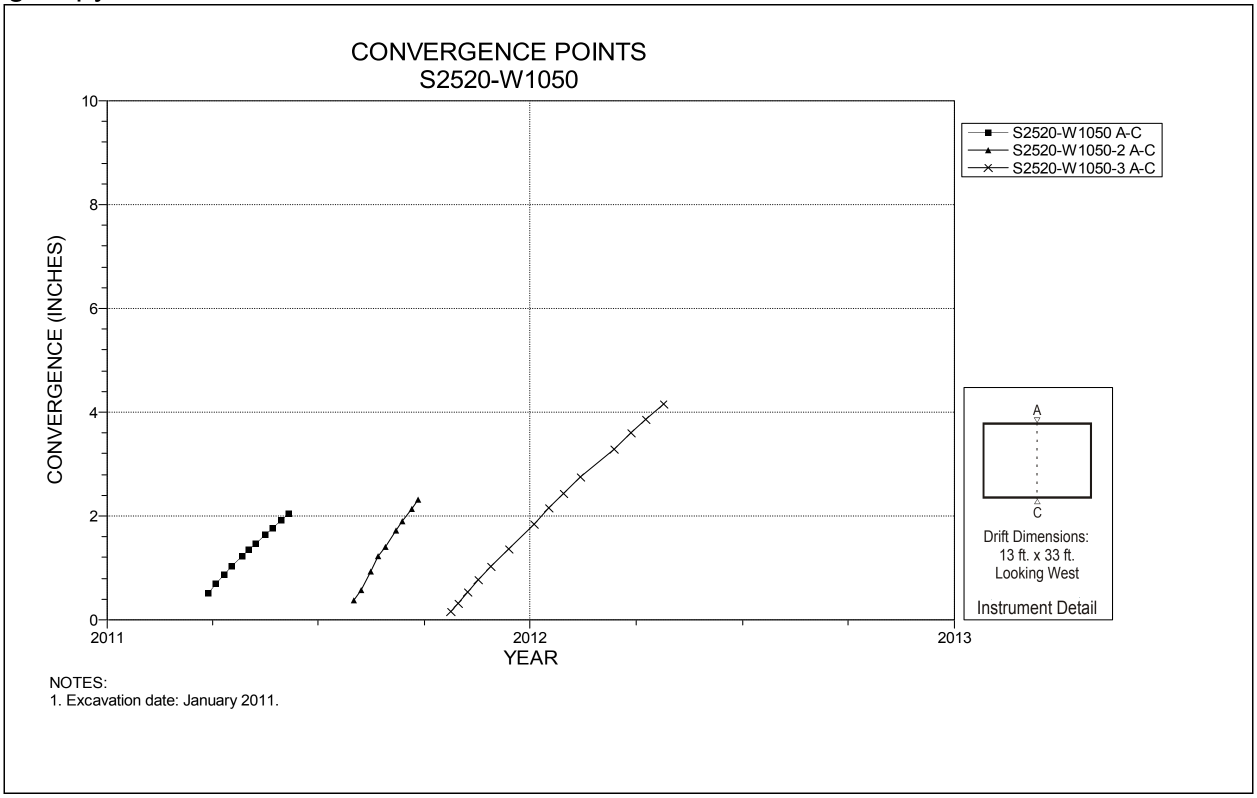


Figure 5-137 Convergence Point Array
S2520 W1050 Intersection (Room 6, Panel 7) – Roof to Floor

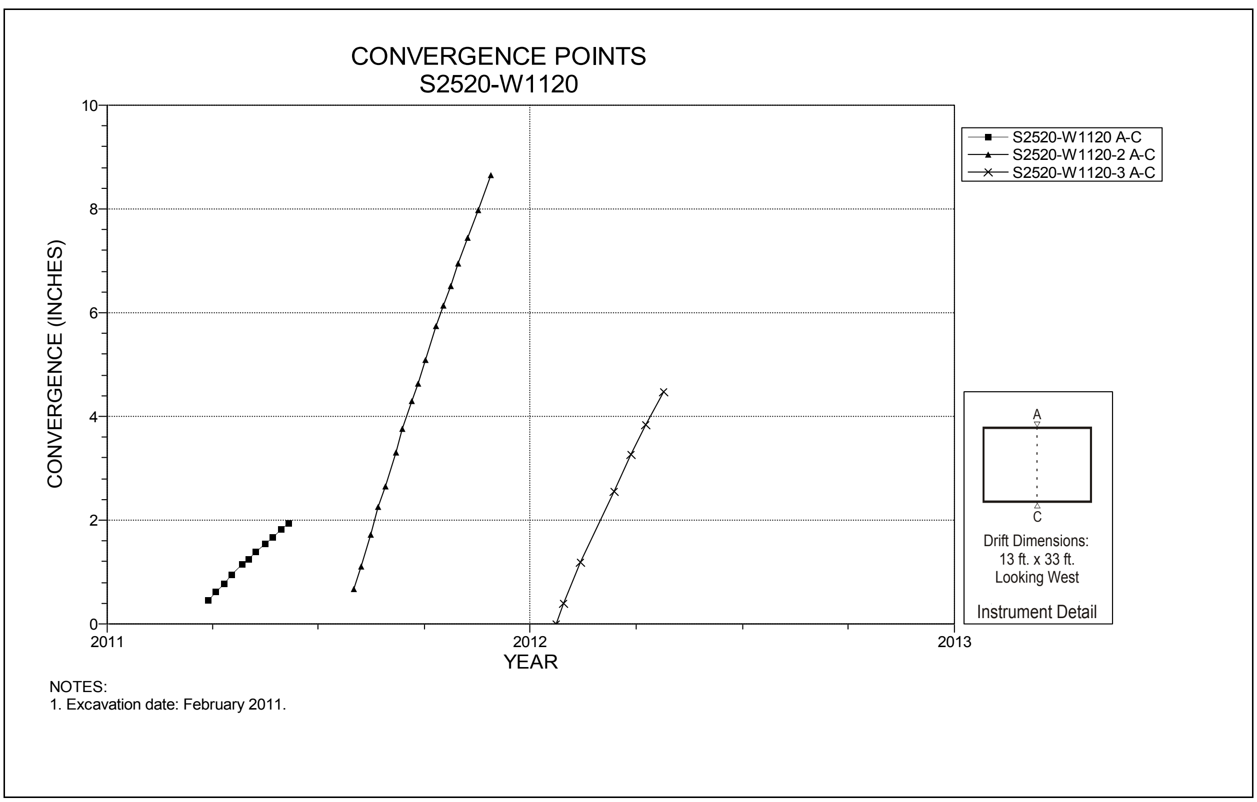


Figure 5-138 Convergence Point Array
S2520 W1120 – Roof to Floor

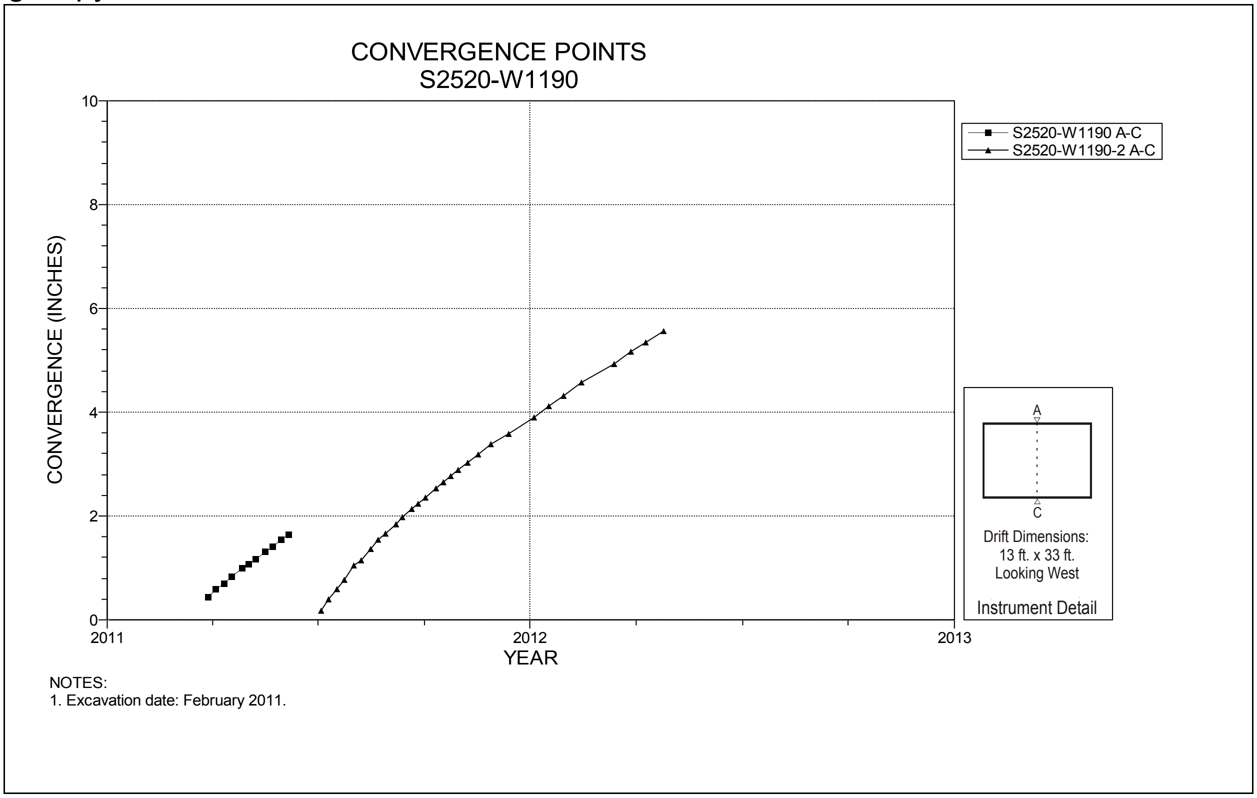


Figure 5-139 Convergence Point Array
S2520 W1190 Intersection (Room 7, Panel 7) – Roof to Floor

This page was intentionally left blank.

6.0 Instrumentation Summary for the SDI Area

This chapter presents a summary of the data collected from radial convergence points located in the Storage Disposal Investigations (SDI) area at the WIPP. Table 6-1 presents data and analysis of the access drifts associated with the SDI area. Plots of the instrument data are presented as Figures 6-1 through 6-12.

Radial convergence points have been installed at the pillar midpoints, quarter points and drift intersections. The SDI area is still being mined. Hence, at times, access to many of the instruments may not be possible. Therefore, there will be intervals on some of the data plots void of any readings. Readings are resumed once access has been restored.

Table 6-1
SDI Data Analysis

Convergence Points

Field Tag	Location	Figure Number	Last Reading 2011 to 2012 Date	Last Reading 2011 to 2012 Inches	Cumulative Displacement (inches)	Closure Rate[1] 2011 to 2012 (in/year)	Closure Rate[1] 2010 to 2011 (in/year)	Rate Change Percent[1]	Comments
E540-N350 A-C	E540-N350	Not plotted.	06/28/12	0.000	0.000	N/A	N/A	N/A	Only an initial reading this period.
E540-N500 A-C	E540-N500	Not plotted.	06/28/12	0.000	0.000	N/A	N/A	N/A	Only an initial reading this period
E540-N640 A-C	E540-N640	6-1	06/26/12	1.215	1.215	4.6	N/A	N/A	
E690-N640 A-C	E690-N640	Not plotted.	06/28/12	0.000	0.000	N/A	N/A	N/A	Only an initial reading this period
N780-E220-2 A-C	N780-E220	6-2	06/12/12	2.827	13.285	2.3	N/A	N/A	
N780-E420 A-C	N780-E420	6-3	05/07/12	2.417	2.417	6.4	N/A	N/A	
N780-E540 A-C	N780-E540	6-4	04/30/12	4.420	4.420	15.4	N/A	N/A	
N780-E615 A-C	N780-E615	6-5	06/26/12	2.105	2.105	5.5	N/A	N/A	
N780-E690 A-C	N780-E690	6-6	06/26/12	3.436	3.436	9.0	N/A	N/A	
N940-E220 A-C	N940-E220	6-7	06/26/12	0.675	0.675	3.2	N/A	N/A	
N940-E300 A-C	N940-E300	6-8	06/26/12	0.829	0.829	3.9	N/A	N/A	
N940-E420 A-C	N940-E420	6-9	06/26/12	1.238	1.238	5.9	N/A	N/A	
N940-E540 A-C	N940-E540	6-10	06/26/12	1.477	1.477	7.0	N/A	N/A	
N940-E615 A-C	N940-E615	6-11	06/26/12	1.511	1.511	7.8	N/A	N/A	
N940-E690-2 A-C	N940-E690	6-12	06/26/12	0.590	0.917	5.5	N/A	N/A	

[1] N/A – The convergence points above were installed after the 2010-2011 reporting period.

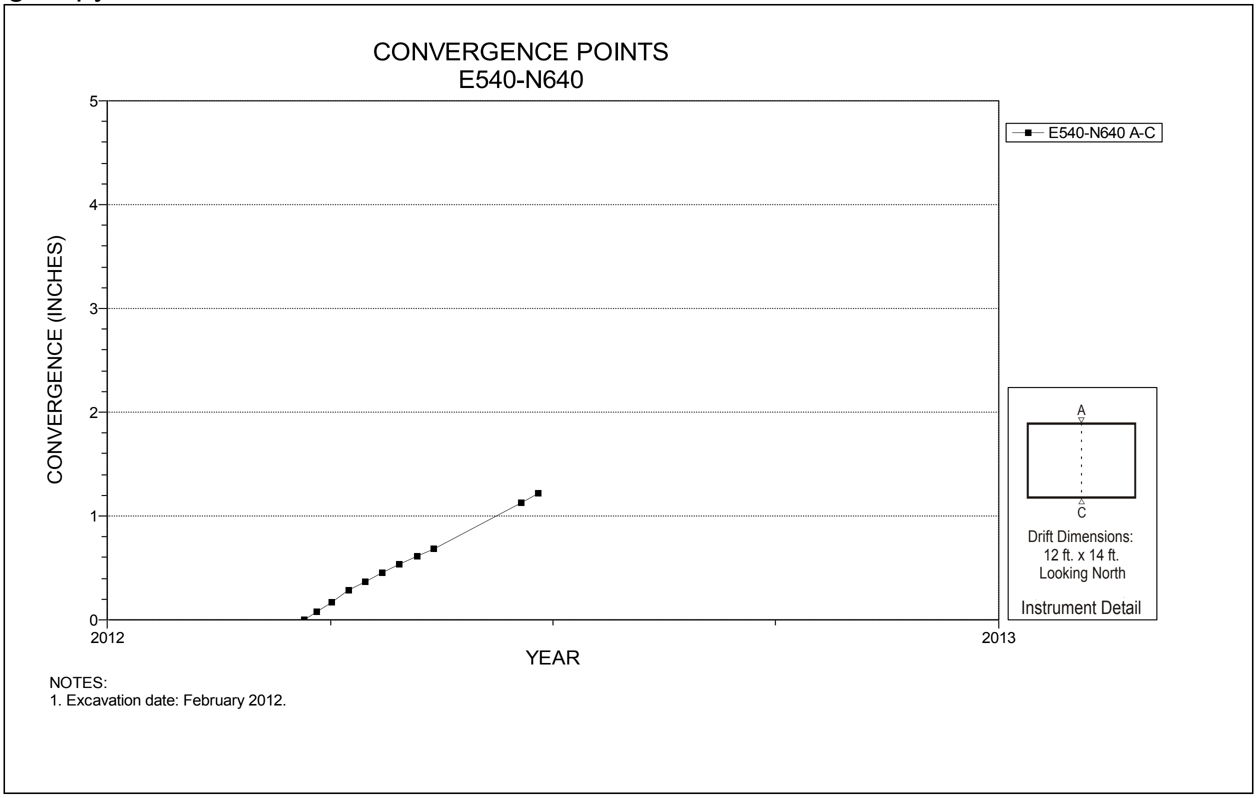


Figure 6-1 Convergence Point Array
E540 N640 – Roof to Floor

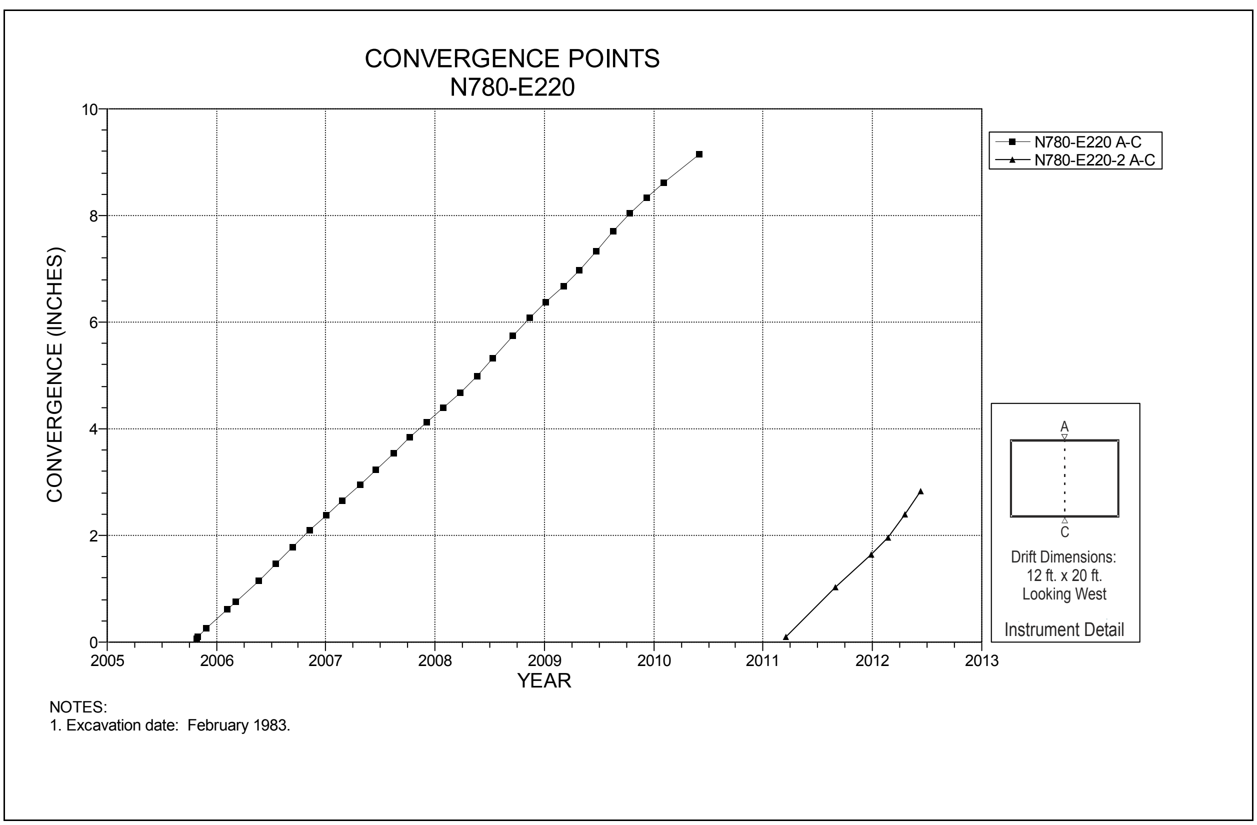


Figure 6-2 Convergence Point Array
N780 E220 – Roof to Floor

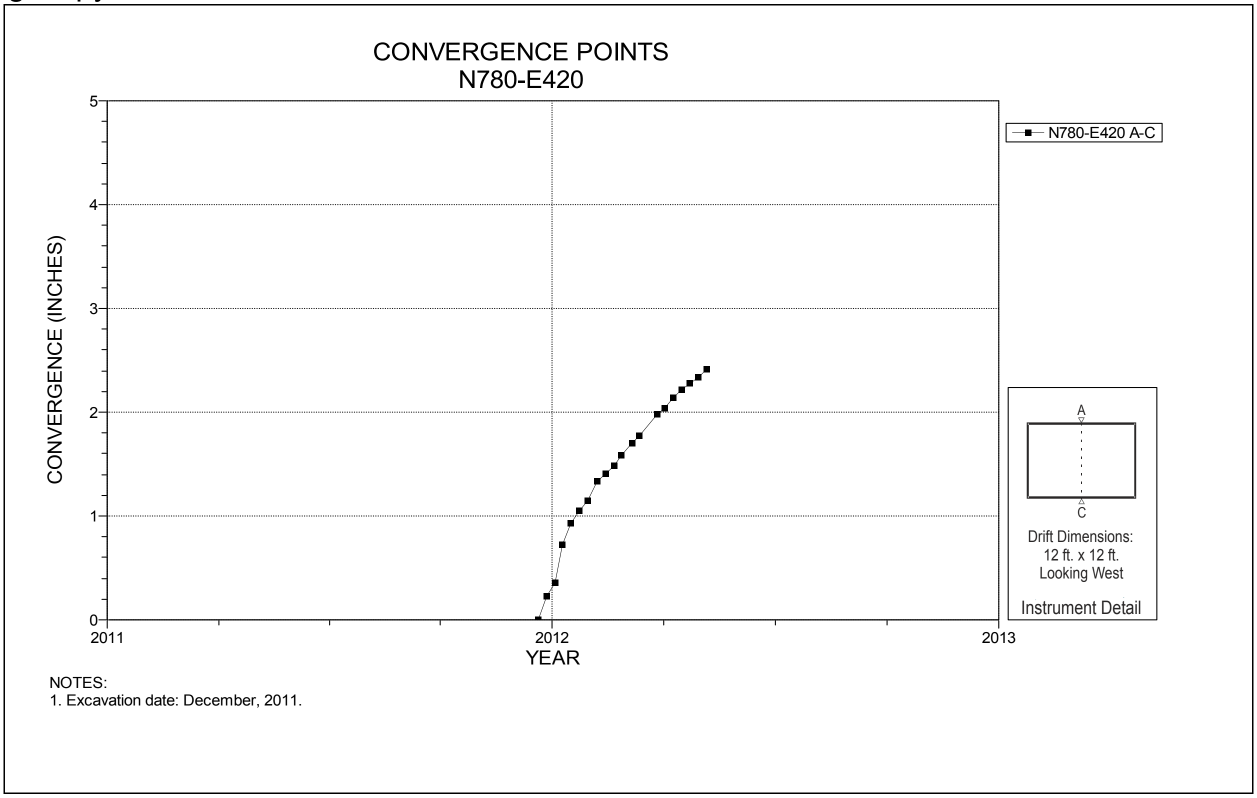


Figure 6-3 Convergence Point Array
N780 E420 – Roof to Floor

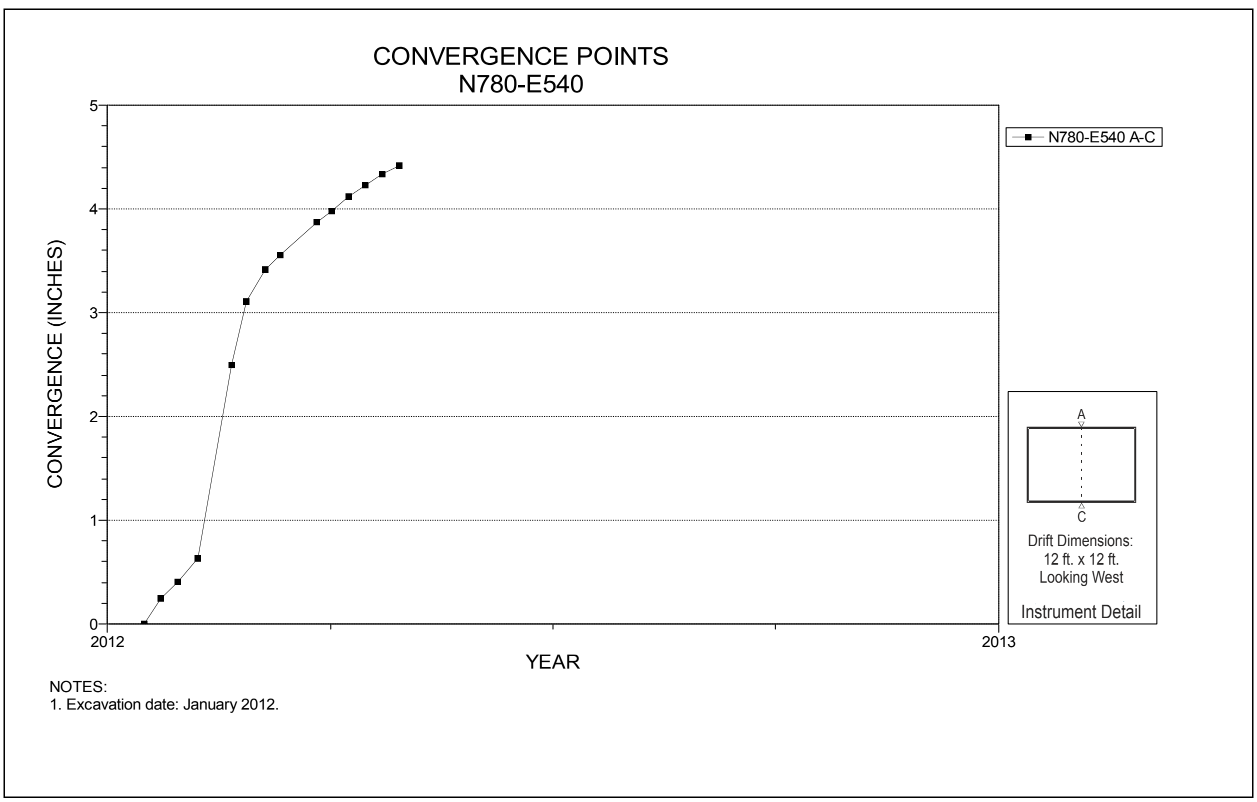


Figure 6-4 Convergence Point Array
N780 E540 – Roof to Floor

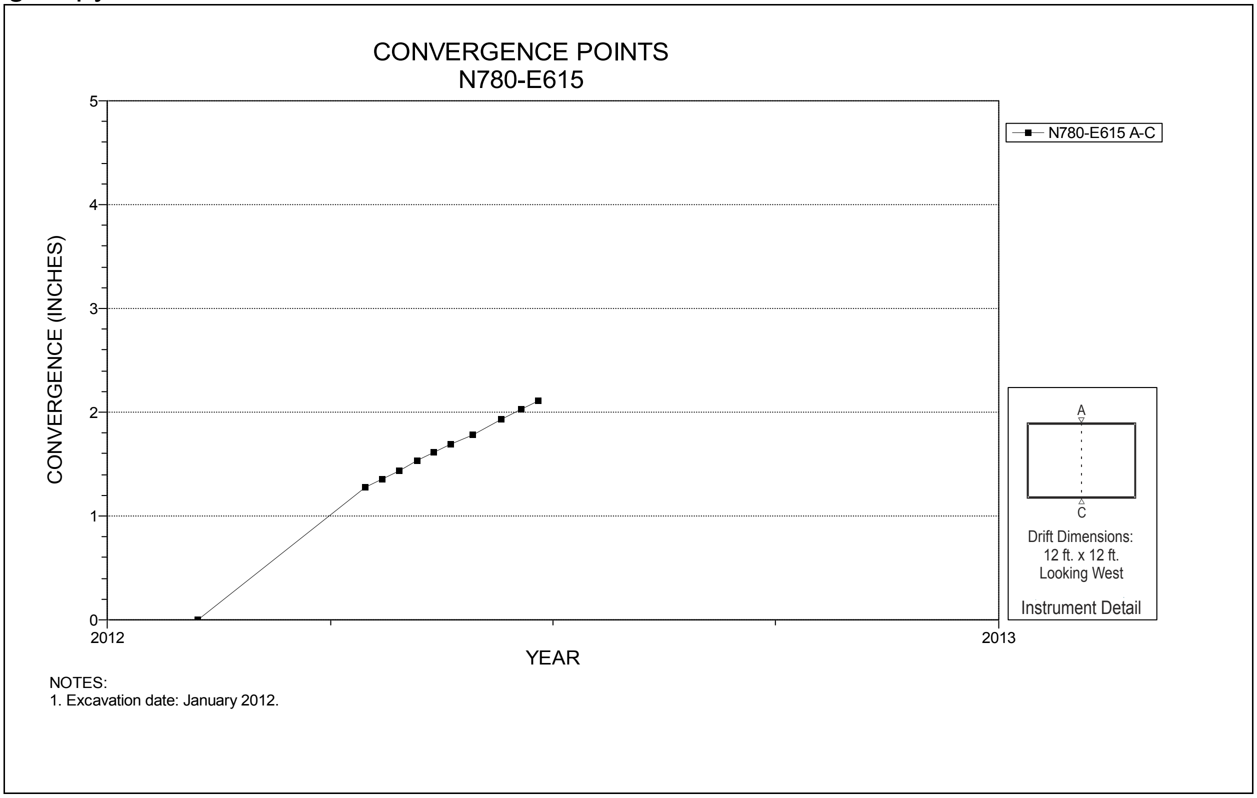


Figure 6-5 Convergence Point Array
N780 E615 – Roof to Floor

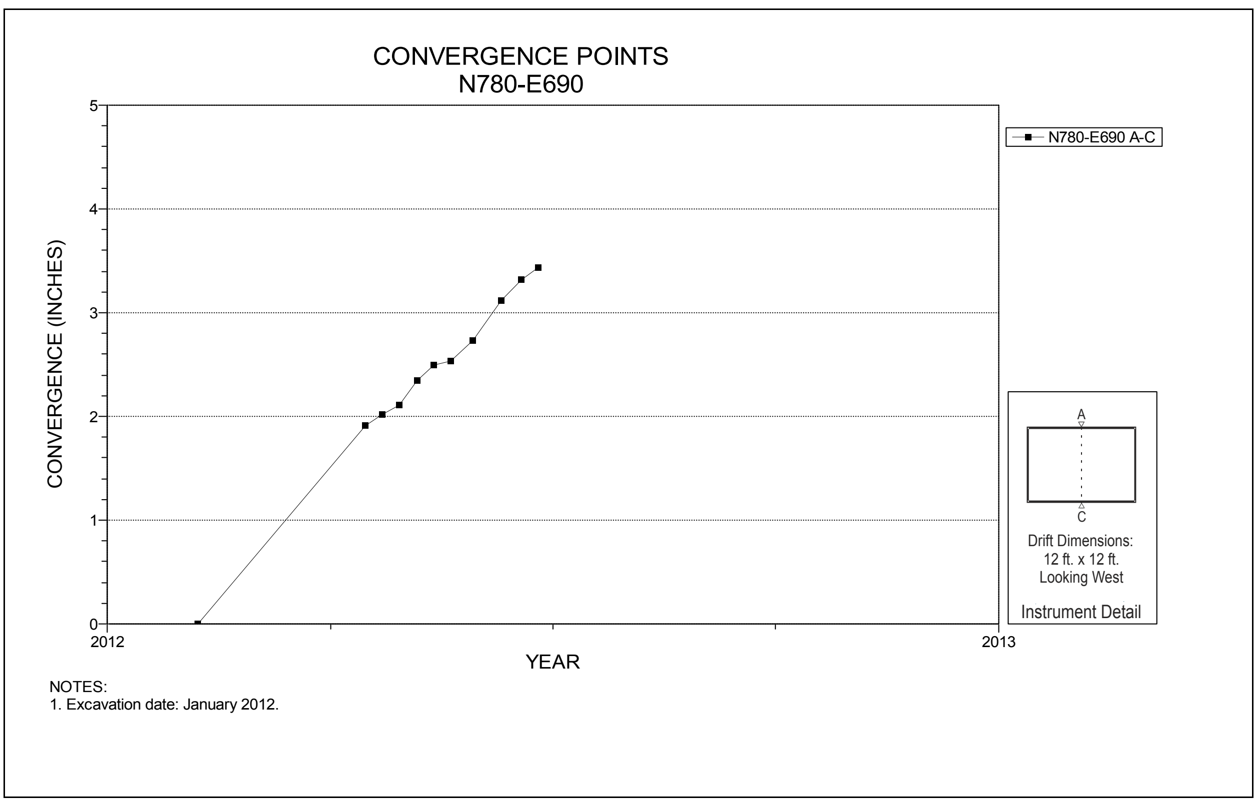


Figure 6-6 Convergence Point Array
N780 E690 – Roof to Floor

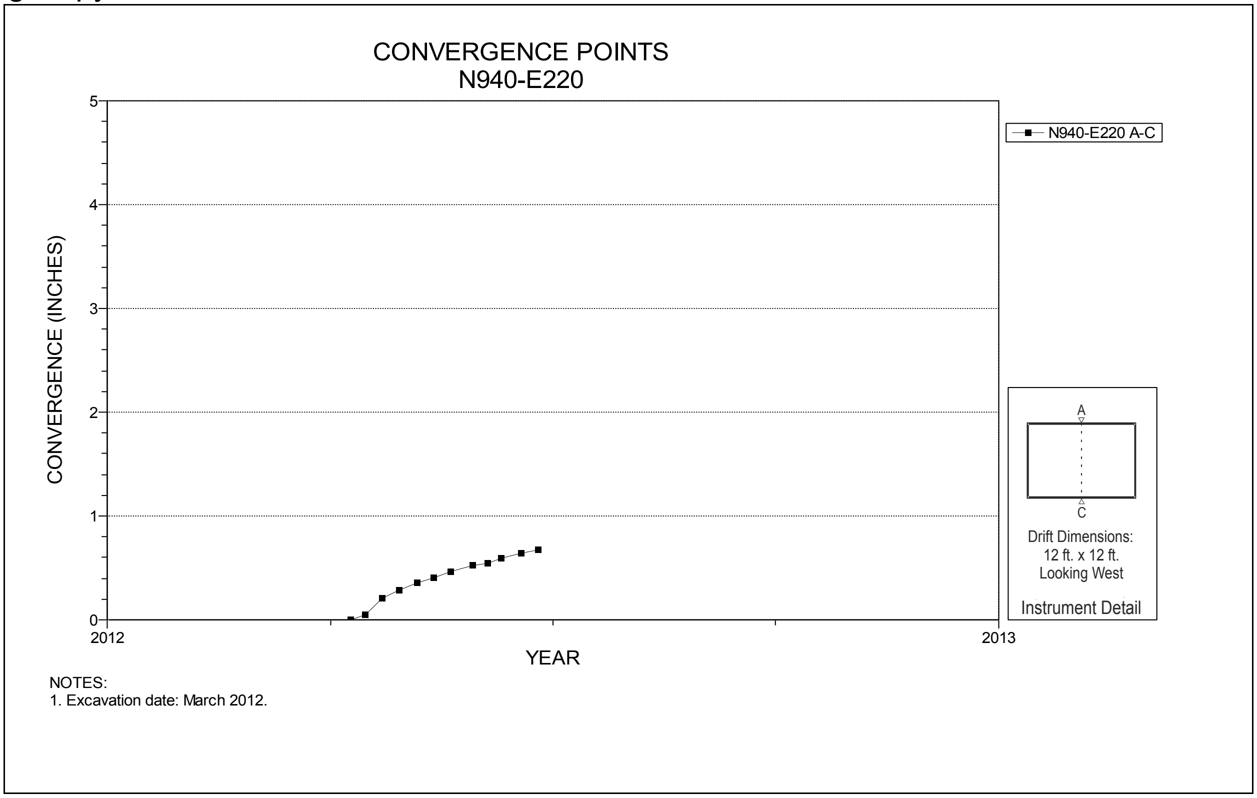


Figure 6-7 Convergence Point Array
N940 E220 – Roof to Floor

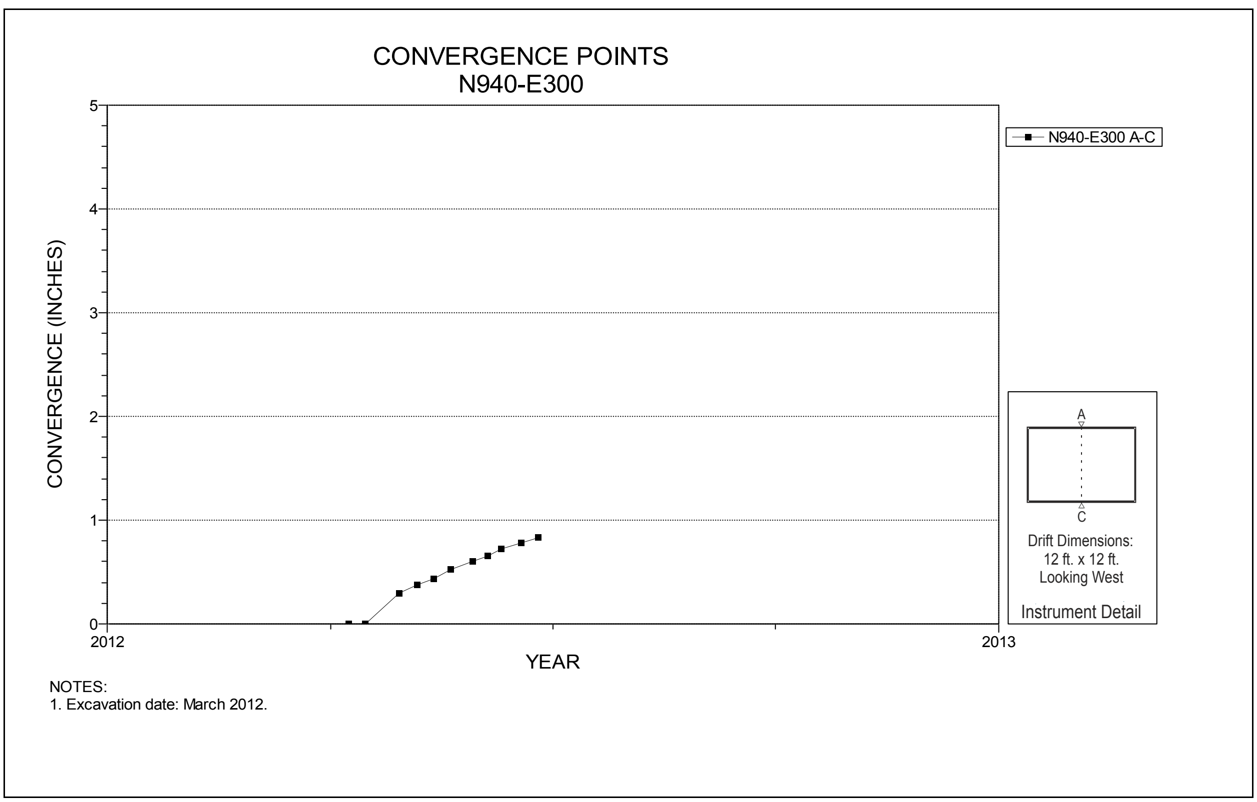


Figure 6-8 Convergence Point Array
N940 E300 – Roof to Floor

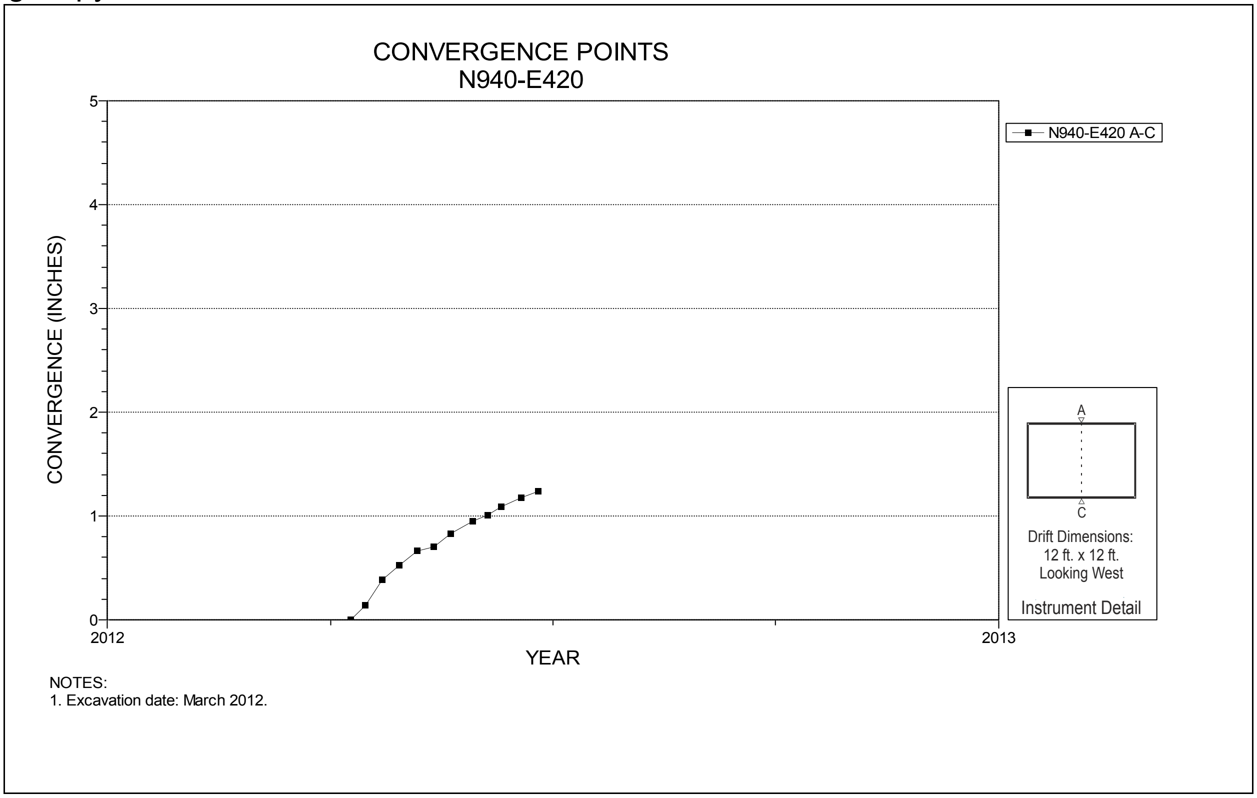


Figure 6-9 Convergence Point Array
N940 E420 – Roof to Floor

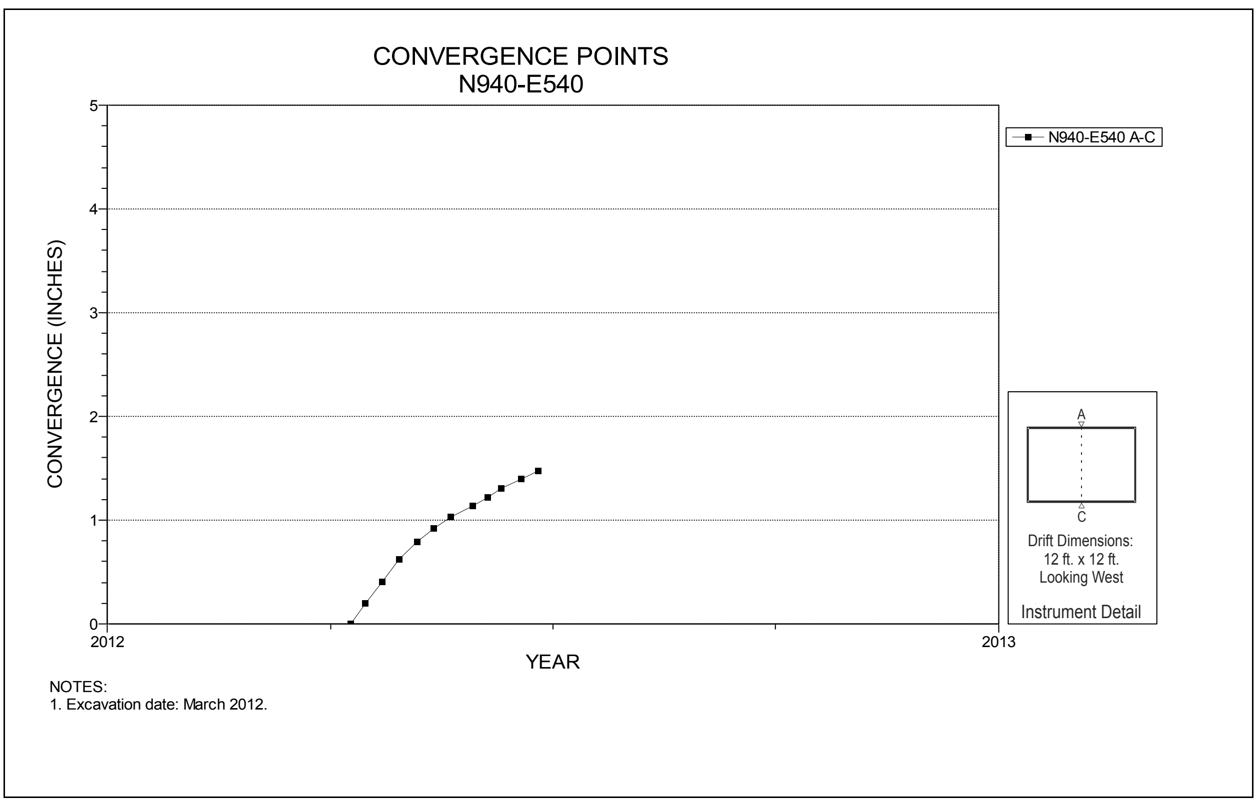


Figure 6-10 Convergence Point Array
N940 E540 – Roof to Floor

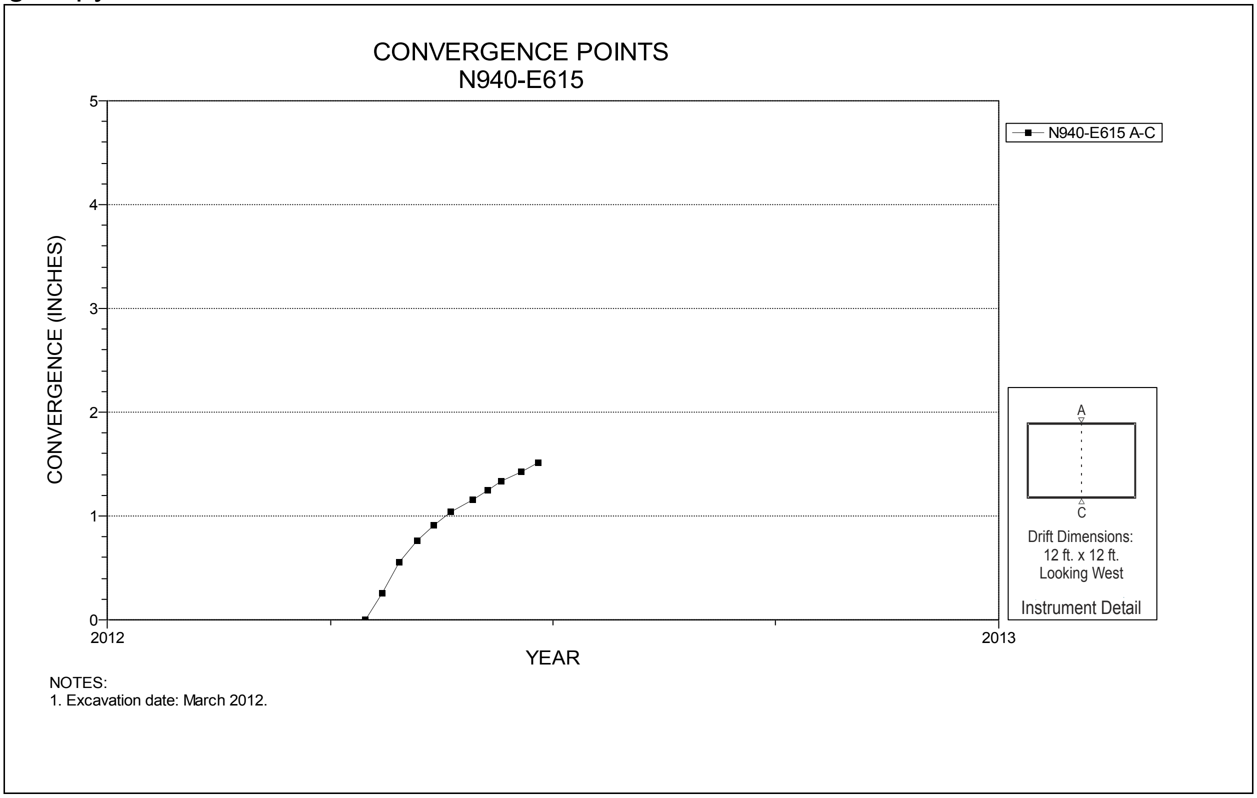


Figure 6-11 Convergence Point Array
N940 E615 – Roof to Floor

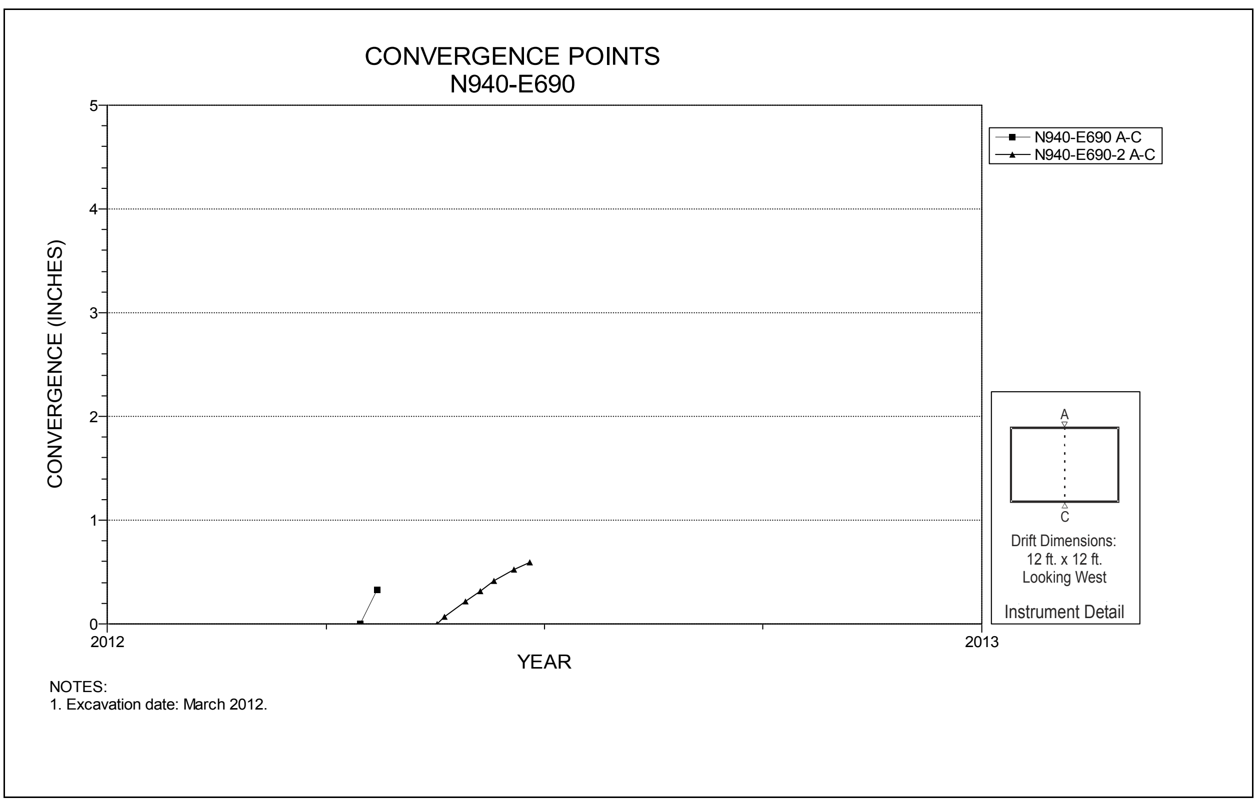


Figure 6-12 Convergence Point Array
N940 E690 – Roof to Floor

7.0 Geoscience Data Summary for the Waste Disposal Area

This chapter presents supporting data acquired as part of the Geoscience Program. It includes observations of clay seam displacements and other features in vertical observation holes, and fracture maps of excavation surfaces.

Borehole Inspections

This section presents a summary of the clay seam displacements (offsets) and fracture densities measured in observation boreholes located through the WIPP underground facility. Relative lateral displacement of rock strata above and below a clay layer is measured as offset within a borehole. Fracture density is a calculated parameter based on the number of fractures (separations) and fracture zones observed in an observation borehole. Fracture density is calculated to be the number of fractures plus twice the number of fracture zones in a roof beam divided by the thickness of the beam (in feet). Table 7-1 presents the observed offset data for boreholes, the observed fractures and fracture zones, and the calculated fracture densities. Table 7-2 is a summary of new boreholes drilled during this reporting period.

Fracture Mapping

This section presents graphical results of the fracture mapping done in Panel 6 and Panel 7 of the Waste Disposal Area. Figures 7-1 through 7-68 are plan view fracture maps for the roof.

Table 7-1 Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH485	E140-N1400	1/7/2004	12/20/2011				Separation		1.70	0.1250	0.0000		0	0.00
OH485	E140-N1400	1/7/2004	12/20/2011	1	0	6.60	Separation	0.15	6.60	0.1250	1.7500	S	58	0.22
OH485	E140-N1400	1/7/2004	12/20/2011				Hangup		16.10	0.0000	0.0000		0	0.00
OH485	E140-N1400	1/7/2004	12/20/2011				BOH		20.30	0.0000	0.0000		0	0.00
OH484	E140-N1265	1/7/2004	12/30/2011				Separation		1.60	0.5000	0.2500	W	8	0.03
OH484	E140-N1265	1/7/2004	12/30/2011				Separation		5.60	0.1250	0.0000		0	0.00
OH484	E140-N1265	1/7/2004	12/30/2011				Separation		5.90	0.1250	0.2500	W	8	0.03
OH484	E140-N1265	1/7/2004	12/30/2011	3	0	6.60	Separation	0.45	6.60	0.1250	0.0000		0	0.00
OH484	E140-N1265	1/7/2004	12/30/2011				BOH		20.50	0.0000	0.0000		0	0.00
OH483	E140-N940	1/7/2004	12/30/2011				Separation		1.40	0.3750	1.0000	W	33	0.13
OH483	E140-N940	1/7/2004	12/30/2011				Separation		1.90	0.3750	0.0625	W	2	0.01
OH483	E140-N940	1/7/2004	12/30/2011				Separation		2.70	0.1250	0.1250	W	4	0.02
OH483	E140-N940	1/7/2004	12/30/2011				Separation		5.30	0.1250	0.0000		0	0.00
OH483	E140-N940	1/7/2004	12/30/2011				Separation		6.40	0.1250	0.0000		0	0.00
OH483	E140-N940	1/7/2004	12/30/2011				Separation		6.80	0.1250	0.0000		0	0.00
OH483	E140-N940	1/7/2004	12/30/2011	6	0	7.00	Separation	0.86	7.00	0.1250	1.2500	W	42	0.16
OH483	E140-N940	1/7/2004	12/30/2011				BOH		17.00	0.0000	0.0000		0	0.00
OH492	E140-N790	1/9/2004	12/30/2011	0	0	6.80	Separation	0.00	6.80	0.1250	0.1250	W	4	0.02
OH492	E140-N790	1/9/2004	12/30/2011				BOH		20.40	0.0000	0.0000		0	0.00
OH521	E140-N40	11/22/2004	12/20/2011	0	0	6.80	Separation	0.00	6.80	0.2500	0.2500	E	8	0.04
OH521	E140-N40	11/22/2004	12/20/2011				Separation		8.30	0.1250	0.3750	S	13	0.05
OH521	E140-N40	11/22/2004	12/20/2011				Separation		9.00	0.1250	0.2500	S	8	0.04
OH521	E140-N40	11/22/2004	12/20/2011				BOH		20.30	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH523	E140-S164	11/22/2004	12/20/2011	0	0	5.50	Separation	0.00	5.50	0.1250	1.7500	E	58	0.25
OH523	E140-S164	11/22/2004	12/20/2011				Separation		6.60	0.1250	0.3750	W	13	0.05
OH523	E140-S164	11/22/2004	12/20/2011				Separation		6.90	0.1250	0.3750	E	13	0.05
OH523	E140-S164	11/22/2004	12/20/2011				Separation		7.10	0.1250	0.3750	E	13	0.05
OH523	E140-S164	11/22/2004	12/20/2011				Separation		7.40	0.1250	0.0000		0	0.00
OH523	E140-S164	11/22/2004	12/20/2011				Separation		8.10	0.1250	0.0000		0	0.00
OH523	E140-S164	11/22/2004	12/20/2011				Separation		8.40	0.1250	0.0000		0	0.00
OH523	E140-S164	11/22/2004	12/20/2011				Separation		8.70	0.1250	0.0000		0	0.00
OH523	E140-S164	11/22/2004	12/20/2011				BOH		20.30	0.0000	0.0000		0	0.00
OH498-1	E140-S415	3/2/2009	3/12/2012				BOH		8.00	0.0000	0.0000		0	0.00
OH499-1	E140-S520	3/2/2009	3/12/2012				BOH		12.50	0.0000	0.0000		0	0.00
OH620	E140-S700	11/17/2005	5/22/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH620	E140-S700	11/17/2005	5/22/2012	1	0	5.80	Separation	0.17	5.80	0.1250	0.0000		0	0.00
OH620	E140-S700	11/17/2005	5/22/2012				Separation		5.90	0.1250	0.0000		0	0.00
OH620	E140-S700	11/17/2005	5/22/2012				BOH		16.80	0.0000	0.0000		0	0.00
OH750	E140-S773	9/29/2011	5/22/2012				Separation		4.10	0.1250	0.3750	E	13	0.58
OH750	E140-S773	9/29/2011	5/22/2012				Separation		4.20	0.2500	0.2500	E	8	0.39
OH750	E140-S773	9/29/2011	5/22/2012	2	0	6.60	Separation	0.30	6.60	0.1250	0.1250	W	4	0.19
OH750	E140-S773	9/29/2011	5/22/2012				BOH		20.70	0.0000	0.0000		0	0.00
OH874-1	E140-S850	9/29/2011	3/12/2012	0	0	5.80	Separation	0.00	5.80	3.0000	0.5000	W	17	1.11
OH874-1	E140-S850	9/29/2011	3/12/2012				Separation		6.10	0.2500	0.0000		0	0.00
OH874-1	E140-S850	9/29/2011	3/12/2012				Separation		6.90	0.1250	0.0000		0	0.00
OH874-1	E140-S850	9/29/2011	3/12/2012				BOH		20.10	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH751	E140-S920	9/29/2011	5/22/2012				Separation		3.50	0.1250	0.0000		0	0.00
OH751	E140-S920	9/29/2011	5/22/2012	1	0	4.70	Separation	0.21	4.70	2.0000	1.0000	W	33	1.55
OH751	E140-S920	9/29/2011	5/22/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH751	E140-S920	9/29/2011	5/22/2012				Separation		5.40	0.1250	0.0000		0	0.00
OH751	E140-S920	9/29/2011	5/22/2012				Separation		6.20	0.2500	0.0000		0	0.00
OH751	E140-S920	9/29/2011	5/22/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH575-1	E140-S1000	9/29/2011	5/22/2012				Separation		3.30	0.1250	0.0000		0	0.00
OH575-1	E140-S1000	9/29/2011	5/22/2012				Separation		3.60	0.1250	0.0000		0	0.00
OH575-1	E140-S1000	9/29/2011	5/22/2012	2	0	4.30	Separation	0.47	4.30	0.5000	0.2500	E	8	0.39
OH575-1	E140-S1000	9/29/2011	5/22/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH575-1	E140-S1000	9/29/2011	5/22/2012				Separation		5.60	0.1250	0.0000		0	0.00
OH575-1	E140-S1000	9/29/2011	5/22/2012				Rough Spot		5.90	0.0000	0.0000		0	0.00
OH575-1	E140-S1000	9/29/2011	5/22/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH752	E140-S1070	9/29/2011	5/22/2012				Separation		0.50	0.1250	0.0000		0	0.00
OH752	E140-S1070	9/29/2011	5/22/2012				Separation		0.90	0.1250	0.0000		0	0.00
OH752	E140-S1070	9/29/2011	5/22/2012	2	0	5.60	Separation	0.36	5.60	0.1250	0.0000		0	0.00
OH752	E140-S1070	9/29/2011	5/22/2012				Separation		6.50	0.1250	0.0000		0	0.00
OH752	E140-S1070	9/29/2011	5/22/2012				BOH		20.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH873-1	E140-S1145	9/29/2011	5/22/2012				Separation		4.00	1.0000	0.0000		0	0.00
OH873-1	E140-S1145	9/29/2011	5/22/2012				Separation		4.90	0.2500	0.0000		0	0.00
OH873-1	E140-S1145	9/29/2011	5/22/2012				Separation		5.40	0.7500	0.0000		0	0.00
OH873-1	E140-S1145	9/29/2011	5/22/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH873-1	E140-S1145	9/29/2011	5/22/2012				Separation		6.20	0.1250	0.0000		0	0.00
OH873-1	E140-S1145	9/29/2011	5/22/2012	5	0	6.30	Separation	0.79	6.30	0.2500	1.2500	E	42	1.93
OH873-1	E140-S1145	9/29/2011	5/22/2012				Separation		6.50	0.2500	0.0000		0	0.00
OH873-1	E140-S1145	9/29/2011	5/22/2012				Separation		7.50	0.1250	0.0000		0	0.00
OH873-1	E140-S1145	9/29/2011	5/22/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH753	E140-S1226	9/29/2011	5/22/2012				Separation		1.40	0.5000	0.0000		0	0.00
OH753	E140-S1226	9/29/2011	5/22/2012				Separation		3.90	0.1250	0.0000		0	0.00
OH753	E140-S1226	9/29/2011	5/22/2012				Separation		4.40	0.1250	0.0000		0	0.00
OH753	E140-S1226	9/29/2011	5/22/2012				Separation		4.70	0.7500	0.0000		0	0.00
OH753	E140-S1226	9/29/2011	5/22/2012	4	0	5.00	Separation	0.80	5.00	0.1250	0.1875	E	6	0.29
OH753	E140-S1226	9/29/2011	5/22/2012				Separation		5.30	0.3750	0.1250	E	4	0.19
OH753	E140-S1226	9/29/2011	5/22/2012				Separation		7.20	0.1250	0.0000		0	0.00
OH753	E140-S1226	9/29/2011	5/22/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH578	E140-S1300	6/16/2005	5/22/2012				Separation		4.90	0.1250	0.0000		0	0.00
OH578	E140-S1300	6/16/2005	5/22/2012	1	0	6.00	Separation	0.17	6.00	0.1250	0.0000		0	0.00
OH578	E140-S1300	6/16/2005	5/22/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH872-1	E140-S1390	9/29/2011	5/22/2012				Separation		0.50	0.1250	0.0000		0	0.00
OH872-1	E140-S1390	9/29/2011	5/22/2012				Separation		2.90	0.1250	0.0000		0	0.00
OH872-1	E140-S1390	9/29/2011	5/22/2012				Separation		4.40	0.1250	0.0000		0	0.00
OH872-1	E140-S1390	9/29/2011	5/22/2012	3	0	5.50	Separation	0.55	5.50	0.5000	0.1250	E	4	0.19
OH872-1	E140-S1390	9/29/2011	5/22/2012				Separation		6.50	0.1250	0.0000		0	0.00
OH872-1	E140-S1390	9/29/2011	5/22/2012				BOH		20.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		3.80	0.3750	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		4.10	2.0000	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		4.50	2.5000	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		5.00	3.5000	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		6.40	0.1250	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		7.20	0.1250	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012	6	0	7.40	Separation	0.81	7.40	2.0000	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		7.50	0.1250	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				Separation		8.00	0.1250	0.0000		0	0.00
OH580-2	E140-S1463	9/29/2011	5/22/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH754	E140-S1526	9/29/2011	5/22/2012				Separation		1.00	1.5000	0.3750	E	13	0.58
OH754	E140-S1526	9/29/2011	5/22/2012				Separation		1.80	1.5000	0.2500	E	8	0.39
OH754	E140-S1526	9/29/2011	5/22/2012				Separation		2.80	6.0000	0.3750	E	13	0.58
OH754	E140-S1526	9/29/2011	5/22/2012				Separation		4.60	0.1250	0.0000		0	0.00
OH754	E140-S1526	9/29/2011	5/22/2012				Separation		6.20	0.1250	0.0000		0	0.00
OH754	E140-S1526	9/29/2011	5/22/2012	5	0	6.80	Separation	0.74	6.80	5.0000	1.2500	E	42	1.93
OH754	E140-S1526	9/29/2011	5/22/2012				Separation		7.40	0.2500	0.0000		0	0.00
OH754	E140-S1526	9/29/2011	5/22/2012				Separation		8.00	4.0000	0.0000		0	0.00
OH754	E140-S1526	9/29/2011	5/22/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH582	E140-S1600	6/16/2005	5/22/2012	0	0	6.30	Separation	0.00	6.30	0.1250	0.0000		0	0.00
OH582	E140-S1600	6/16/2005	5/22/2012				Separation		6.40	0.1250	0.0000		0	0.00
OH582	E140-S1600	6/16/2005	5/22/2012				Separation		6.80	0.1250	0.0000		0	0.00
OH582	E140-S1600	6/16/2005	5/22/2012				BOH		20.40	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		1.60	2.0000	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		2.80	1.5000	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		4.00	0.2500	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		5.00	1.0000	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012	4	0	5.90	Separation	0.68	5.90	6.0000	1.5000	W	50	2.17
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		6.80	0.1250	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		6.90	0.1250	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		7.10	0.1250	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012				Separation		7.60	0.1250	0.0000		0	0.00
OH871-1	E140-S1680	9/29/2011	6/7/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		0.80	1.0000	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		2.50	0.2500	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		3.30	0.2500	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		3.70	1.0000	0.5000	W	17	1.11
OH143-4	E140-S1784	9/26/2011	3/8/2012				Rough Spot		4.10	0.0000	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		4.60	2.0000	1.0000	W	33	2.23
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		5.20	1.0000	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012	7	0	5.70	Separation	1.23	5.70	4.0000	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		7.70	0.5000	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				Separation		8.60	1.0000	0.0000		0	0.00
OH143-4	E140-S1784	9/26/2011	3/8/2012				BOH		20.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		0.80	0.1250	0.0000		0	0.00
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		1.40	0.1250	0.0000		0	0.00
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		2.50	2.5000	0.0000		0	0.00
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		2.70	0.2500	0.0000		0	0.00
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		4.50	12.0000	0.3750	W	13	0.54
OH146-4	E140-S1854	9/26/2011	6/7/2012	5	0	7.40	Separation	0.68	7.40	3.0000	2.0000	W	67	2.86
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		8.00	0.1250	0.0000		0	0.00
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		8.20	0.1250	0.0000		0	0.00
OH146-4	E140-S1854	9/26/2011	6/7/2012				Separation		8.30	0.1250	0.0000		0	0.00
OH146-4	E140-S1854	9/26/2011	6/7/2012				BOH		20.70	0.0000	0.0000		0	0.00
OH583	E140-S1950	6/16/2005	6/7/2012				Separation		2.00	0.1250	0.3750	E	13	0.05
OH583	E140-S1950	6/16/2005	6/7/2012				Separation		5.10	0.1250	0.1875	E	6	0.03
OH583	E140-S1950	6/16/2005	6/7/2012				Rough Spot		5.20	0.0000	0.1875	W	6	0.03
OH583	E140-S1950	6/16/2005	6/7/2012	3	0	5.60	Separation	0.54	5.60	3.5000	1.5000	E	50	0.21
OH583	E140-S1950	6/16/2005	6/7/2012				Separation		6.50	0.1250	0.0000		0	0.00
OH583	E140-S1950	6/16/2005	6/7/2012				Separation		6.80	0.1250	0.0000		0	0.00
OH583	E140-S1950	6/16/2005	6/7/2012				BOH		20.80	0.0000	0.0000		0	0.00
OH472-2	E140-S2167	6/1/2009	6/7/2012				Separation		4.90	0.1250	0.0000		0	0.00
OH472-2	E140-S2167	6/1/2009	6/7/2012				Separation		5.00	0.1250	0.0000		0	0.00
OH472-2	E140-S2167	6/1/2009	6/7/2012				Separation		5.30	0.7500	0.0000		0	0.00
OH472-2	E140-S2167	6/1/2009	6/7/2012				Separation		5.70	0.1250	0.0000		0	0.00
OH472-2	E140-S2167	6/1/2009	6/7/2012	4	0	6.00	Separation	0.67	6.00	0.5000	0.1875	SE	6	0.06
OH472-2	E140-S2167	6/1/2009	6/7/2012				Separation		6.30	0.2500	0.0000		0	0.00
OH472-2	E140-S2167	6/1/2009	6/7/2012				Separation		6.60	0.1250	0.0000		0	0.00
OH472-2	E140-S2167	6/1/2009	6/7/2012				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH471-2	E140-S2300	9/26/2011	6/7/2012				Separation		1.30	0.5000	1.0000	E	33	1.43
OH471-2	E140-S2300	9/26/2011	6/7/2012				Separation		2.30	0.7500	1.2500	E	42	1.79
OH471-2	E140-S2300	9/26/2011	6/7/2012				Separation		3.50	3.2500	0.0000		0	0.00
OH471-2	E140-S2300	9/26/2011	6/7/2012				Separation		4.70	1.5000	0.0000		0	0.00
OH471-2	E140-S2300	9/26/2011	6/7/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH471-2	E140-S2300	9/26/2011	6/7/2012				Separation		5.40	0.1250	0.0000		0	0.00
OH471-2	E140-S2300	9/26/2011	6/7/2012				Separation		5.60	0.0000	0.0000		0	0.00
OH471-2	E140-S2300	9/26/2011	6/7/2012	7	0	6.20	BOH	1.13	6.20	4.0000	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		1.90	1.0000	0.3750	E	13	1.73
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		2.90	4.0000	0.1875	E	6	0.87
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		4.50	0.1250	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		5.20	2.0000	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		5.50	7.0000	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		6.10	0.1250	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		6.80	2.5000	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		7.00	0.1250	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011	8	0	7.20	Separation	1.11	7.20	6.0000	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		8.30	5.5000	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		9.00	0.1250	0.0000		0	0.00
OH586-2	E140-S2358	9/26/2011	12/14/2011				Separation		20.90	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH870	E140-S2456	6/1/2009	6/11/2012				Separation		1.20	0.2500	0.0000		0	0.00
OH870	E140-S2456	6/1/2009	6/11/2012				Separation		1.60	0.1250	0.0000		0	0.00
OH870	E140-S2456	6/1/2009	6/11/2012				Separation		2.50	1.2500	0.0000		0	0.00
OH870	E140-S2456	6/1/2009	6/11/2012				Separation		4.60	12.0000	1.0000	E	33	0.33
OH870	E140-S2456	6/1/2009	6/11/2012				Separation		5.70	0.1250	0.0000		0	0.00
OH870	E140-S2456	6/1/2009	6/11/2012				Separation		6.60	0.1250	0.5000	W	17	0.17
OH870	E140-S2456	6/1/2009	6/11/2012				Separation		7.10	0.1250	0.0000		0	0.00
OH870	E140-S2456	6/1/2009	6/11/2012	7	0	7.30	Rubble Zone	0.96	7.30	2.0000	0.3750	W	13	0.12
OH870	E140-S2456	6/1/2009	6/11/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH588-1	E140-S2520	9/26/2011	6/11/2012				Separation		1.50	0.5000	0.0000		0	0.00
OH588-1	E140-S2520	9/26/2011	6/11/2012	1	0	5.30	Separation	0.19	5.30	2.5000	0.7500	E	25	1.06
OH588-1	E140-S2520	9/26/2011	6/11/2012				Separation		6.40	0.5000	0.0000		0	0.00
OH588-1	E140-S2520	9/26/2011	6/11/2012				BOH		20.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		0.90	1.0000	0.1250	E	4	0.18
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		1.70	2.5000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		2.00	0.2500	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		2.10	2.0000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		2.40	3.0000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		4.50	2.5000	1.0000	E	33	1.41
OH468-2	E140-S2640	9/26/2011	6/11/2012				Hangup		6.00	0.0000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		6.70	0.5000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012	8	0	7.10	Separation	1.13	7.10	3.0000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		7.70	0.2500	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		7.80	1.0000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		9.00	0.1250	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Hangup		9.20	0.0000	0.0000		0	0.00
OH468-2	E140-S2640	9/26/2011	6/11/2012				Separation		20.40	0.0000	0.0000		0	0.00
OH589-1	E140-S2750	6/1/2009	6/11/2012				Separation		5.60	0.2500	0.0000		0	0.00
OH589-1	E140-S2750	6/1/2009	6/11/2012				Separation		6.80	0.2500	0.0000		0	0.00
OH589-1	E140-S2750	6/1/2009	6/11/2012				Separation		7.90	1.0000	0.0000		0	0.00
OH589-1	E140-S2750	6/1/2009	6/11/2012				BOH		20.30	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		0.90	2.0000	0.1250	W	4	0.18
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		1.90	0.2500	0.1250	W	4	0.18
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		2.00	1.0000	0.0000		0	0.00
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		4.70	0.2500	0.0000		0	0.00
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		4.90	0.2500	0.0000		0	0.00
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		5.30	1.5000	0.0000		0	0.00
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		5.70	1.0000	0.0000		0	0.00
OH500-2	E140-S2920	9/26/2011	6/11/2012	7	0	6.10	Separation	1.15	6.10	5.0000	0.0000		0	0.00
OH500-2	E140-S2920	9/26/2011	6/11/2012				Separation		7.70	2.5000	0.0000		0	0.00
OH500-2	E140-S2920	9/26/2011	6/11/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		0.80	1.0000	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		1.70	3.2500	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		5.00	0.1250	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		5.50	0.2500	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012	4	0	5.60	Separation	0.71	5.60	0.1250	1.7500	E	58	2.47
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		5.70	0.1250	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		5.90	2.0000	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		6.20	0.3750	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		6.60	1.0000	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		7.30	0.5000	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		7.80	3.0000	0.0000		0	0.00
OH501-2	E140-S2935	9/26/2011	6/11/2012				Separation		20.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH590-1	E140-S3080	6/1/2009	5/21/2012				Separation		1.50	0.3750	0.2500	S	8	0.08
OH590-1	E140-S3080	6/1/2009	5/21/2012				Separation		5.40	0.5000	0.5000	E	17	0.17
OH590-1	E140-S3080	6/1/2009	5/21/2012				Separation		5.90	0.3750	0.0000		0	0.00
OH590-1	E140-S3080	6/1/2009	5/21/2012				Separation		6.10	0.2500	0.0000		0	0.00
OH590-1	E140-S3080	6/1/2009	5/21/2012				Separation		6.50	0.1250	0.0000		0	0.00
OH590-1	E140-S3080	6/1/2009	5/21/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		0.90	4.0000	0.2500	NW	8	0.38
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		2.00	0.1250	0.0000		0	0.00
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		2.30	0.1250	0.0675	W	2	0.10
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		2.50	1.0000	0.0000		0	0.00
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		5.10	0.1250	0.5000	W	17	0.77
OH493-2	E140-S3199	9/26/2011	5/21/2012	5	0	5.50	Separation	0.91	5.50	2.5000	0.3750	W	13	0.58
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		5.90	0.5000	0.0000		0	0.00
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		6.10	2.0000	0.0000		0	0.00
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		6.50	0.3750	0.0000		0	0.00
OH493-2	E140-S3199	9/26/2011	5/21/2012				Separation		7.90	0.3750	0.0000		0	0.00
OH493-2	E140-S3199	9/26/2011	5/21/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH605-2	E140-S3394	9/26/2011	5/21/2012				Separation		1.30	0.7500	0.1250	E	4	0.19
OH605-2	E140-S3394	9/26/2011	5/21/2012				Separation		2.20	0.1250	0.1250	E	4	0.19
OH605-2	E140-S3394	9/26/2011	5/21/2012				Separation		5.10	4.0000	0.1250	E	4	0.19
OH605-2	E140-S3394	9/26/2011	5/21/2012	3	0	5.60	Separation	0.54	5.60	4.0000	1.7500	E	58	2.68
OH605-2	E140-S3394	9/26/2011	5/21/2012				Separation		6.20	1.5000	0.0000		0	0.00
OH605-2	E140-S3394	9/26/2011	5/21/2012				Separation		6.50	0.1250	0.0000		0	0.00
OH605-2	E140-S3394	9/26/2011	5/21/2012				Hangup		6.70	0.0000	0.0000		0	0.00
OH605-2	E140-S3394	9/26/2011	5/21/2012				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		0.40	0.1250	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		1.60	0.1250	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		4.40	0.7500	1.5000	W	50	2.30
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		5.20	1.0000	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012	5	0	5.60	Separation	0.89	5.60	1.0000	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		5.70	0.1250	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		6.50	0.1250	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				Separation		7.10	0.5000	0.0000		0	0.00
OH606-2	E140-S3480	9/26/2011	5/21/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH571-1	E140-S3527	9/26/2011	2/22/2012				Separation		4.20	0.1250	0.2500	W	8	0.61
OH571-1	E140-S3527	9/26/2011	2/22/2012				Separation		4.30	0.1250	0.2500	W	8	0.61
OH571-1	E140-S3527	9/26/2011	2/22/2012				Separation		4.80	0.5000	0.0000		0	0.00
OH571-1	E140-S3527	9/26/2011	2/22/2012	3	0	5.10	Separation	0.59	5.10	3.0000	0.0000		0	0.00
OH571-1	E140-S3527	9/26/2011	2/22/2012				Separation		6.90	0.2500	0.0000		0	0.00
OH571-1	E140-S3527	9/26/2011	2/22/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH607-1	E140-S3580	9/26/2011	2/22/2012				Separation		0.90	0.2500	0.0000		0	0.00
OH607-1	E140-S3580	9/26/2011	2/22/2012	1	0	4.70	Separation	0.21	4.70	0.2500	0.0000		0	0.00
OH607-1	E140-S3580	9/26/2011	2/22/2012				Separation		7.10	1.5000	0.0000		0	0.00
OH607-1	E140-S3580	9/26/2011	2/22/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH567-1	E140-S3650	9/26/2011	5/21/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH567-1	E140-S3650	9/26/2011	5/21/2012	1	0	6.70	Separation	0.15	6.70	0.2500	0.0000		0	0.00
OH567-1	E140-S3650	9/26/2011	5/21/2012				Separation		8.20	0.2500	0.0000		0	0.00
OH567-1	E140-S3650	9/26/2011	5/21/2012				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH901-2	W395-S2832	5/15/2012	5/15/2012				Separation		1.00	0.1250	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012				Separation		1.80	0.5000	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012				Separation		2.00	0.1250	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012				Separation		4.20	0.5000	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012				Separation		4.70	1.0000	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012				Separation		5.20	2.0000	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012	6		5.50	Separation	1.09	5.50	5.0000	0.2500	N	8	N/A
OH901-2		5/15/2012	5/15/2012				Separation		6.10	2.5000	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012				Separation		7.80	1.5000	0.0000		0	N/A
OH901-2		5/15/2012	5/15/2012				BOH		20.10	0.0000	0.0000		0	N/A
OH902-2	W393-S2912	5/15/2012	5/15/2012				Separation		1.30	0.2500	0.0000		0	N/A
OH902-2		5/15/2012	5/15/2012				Separation		2.20	0.2500	0.0000		0	N/A
OH902-2		5/15/2012	5/15/2012				Separation		4.90	0.1250	0.0000		0	N/A
OH902-2		5/15/2012	5/15/2012				Separation		5.00	0.1250	0.1250	W	4	N/A
OH902-2		5/15/2012	5/15/2012	4	0	5.20	Separation	0.77	5.20	1.2500	0.0000		0	N/A
OH902-2		5/15/2012	5/15/2012				Hangup		6.50	0.0000	0.1250	W	4	N/A
OH902-2		5/15/2012	5/15/2012				BOH		20.10	0.0000	0.0000		0	N/A

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH903-2	W393-S2994	5/15/2012	5/15/2012				Separation		0.50	0.3750	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012				Separation		1.10	0.1250	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012				Separation		4.20	0.2500	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012				Separation		4.80	2.0000	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012	2	0	5.10	Separation	0.39	5.10	2.0000	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012				Separation		5.20	0.1250	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012				Rough Spot		5.30	0.0000	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012				Separation		5.50	2.5000	0.0000		0	N/A
OH903-2	W393-S2994	5/15/2012	5/15/2012				BOH		20.20	0.0000	0.0000		0	N/A
OH904	W525-S2843	12/16/2008	6/11/2012				Separation		1.00	0.5000	0.0000		0	0.00
OH904	W525-S2843	12/16/2008	6/11/2012				Separation		4.80	2.0000	0.2500	SE	8	0.07
OH904	W525-S2843	12/16/2008	6/11/2012	2	0	5.40	Separation	0.37	5.40	2.5000	0.2500	SE	8	0.07
OH904	W525-S2843	12/16/2008	6/11/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH905-1	W525-S2912	5/15/2012	5/15/2012				Separation		0.50	0.2500	0.0000		0	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012				Separation		2.90	0.1250	0.0000		0	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012	2	0	5.10	Separation	0.39	5.10	0.5000	0.0000		0	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012				Separation		5.40	0.1250	0.0000		0	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012				Separation		5.70	0.3750	0.0000		0	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012				Separation		5.80	0.3750	0.0000		0	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012				Separation		6.10	5.0000	0.1250	E	4	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012				Separation		6.80	0.2500	0.0000		0	N/A
OH905-1	W525-S2912	5/15/2012	5/15/2012				BOH		20.00	0.0000	0.0000		0	N/A

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH906-1	W525-S2994	5/15/2012	5/15/2012				Separation		1.10	0.2500	0.0000		0	N/A
OH906-1	W525-S2994	5/15/2012	5/15/2012				Separation		4.80	0.1250	0.0000		0	N/A
OH906-1	W525-S2994	5/15/2012	5/15/2012	2	0	5.30	Separation	0.38	5.30	4.0000	0.0000		0	N/A
OH906-1	W525-S2994	5/15/2012	5/15/2012				BOH		20.00	0.0000	0.0000		0	N/A
OH907	W656-S2800	6/5/2009	3/8/2012				Separation		1.00	0.2500	1.0000	E	33	0.36
OH907	W656-S2800	6/5/2009	3/8/2012	1	0	5.30	Separation	0.19	5.30	2.0000	1.5000	E	50	0.54
OH907	W656-S2800	6/5/2009	3/8/2012				BOH		21.00	0.0000	0.0000		0	0.00
OH908	W656-S2895	6/5/2009	3/8/2012				Separation		0.80	0.1250	0.0000		0	0.00
OH908	W656-S2895	6/5/2009	3/8/2012				Separation		0.90	0.1250	0.0000		0	0.00
OH908	W656-S2895	6/5/2009	3/8/2012	2	0	5.00	Separation	0.40	5.00	4.0000	1.5000	E	50	0.54
OH908	W656-S2895	6/5/2009	3/8/2012				Separation		5.90	0.1250	0.0000		0	0.00
OH908	W656-S2895	6/5/2009	3/8/2012				BOH		21.00	0.0000	0.0000		0	0.00
OH909	W656-S3000	6/5/2009	3/8/2012				Separation		1.80	0.1250	0.5000	E	17	0.18
OH909	W656-S3000	6/5/2009	3/8/2012				Separation		5.00	0.2500	0.0000		0	0.00
OH909	W656-S3000	6/5/2009	3/8/2012				Separation		5.40	0.2500	0.0000		0	0.00
OH909	W656-S3000	6/5/2009	3/8/2012	3	0	5.90	Separation	0.51	5.90	3.0000	2.5000	E	83	0.91
OH909	W656-S3000	6/5/2009	3/8/2012				BOH		21.00	0.0000	0.0000		0	0.00
OH910	W790-S2800	9/17/2009	12/13/2011				Separation		5.00	0.1250	0.0000		0	0.00
OH910	W790-S2800	9/17/2009	12/13/2011				Separation		5.10	0.1250	0.0000		0	0.00
OH910	W790-S2800	9/17/2009	12/13/2011	2	0	5.50	Separation	0.36	5.50	1.2500	1.0000	E	33	0.45
OH910	W790-S2800	9/17/2009	12/13/2011				Separation		5.70	0.1250	0.0000		0	0.00
OH910	W790-S2800	9/17/2009	12/13/2011				Separation		5.80	2.0000	0.0000		0	0.00
OH910	W790-S2800	9/17/2009	12/13/2011				BOH		20.60	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH911	W790-S2895	9/17/2009	12/13/2011				Separation		4.70	0.1250	0.0000		0	0.00
OH911	W790-S2895	9/17/2009	12/13/2011				Separation		4.90	0.1250	0.0000		0	0.00
OH911	W790-S2895	9/17/2009	12/13/2011	2	0	5.50	Separation	0.36	5.50	1.5000	0.7500	E	25	0.34
OH911	W790-S2895	9/17/2009	12/13/2011				BOH		20.50	0.0000	0.0000		0	0.00
OH912	W790-S3000	9/17/2009	12/13/2011				Separation		5.10	0.3750	0.0000		0	0.00
OH912	W790-S3000	9/17/2009	12/13/2011	1	0	5.50	Separation	0.18	5.50	1.2500	0.3750	E	13	0.17
OH912	W790-S3000	9/17/2009	12/13/2011				BOH		20.70	0.0000	0.0000		0	0.00
OH913	W920-S2800	9/17/2009	9/14/2011				Separation		4.50	0.7500	0.1250	E	4	0.06
OH913	W920-S2800	9/17/2009	9/14/2011	1	0	5.20	Separation	0.19	5.20	1.0000	0.0000		0	0.00
OH913	W920-S2800	9/17/2009	9/14/2011				BOH		20.50	0.0000	0.0000		0	0.00
OH914	W920-S2895	9/17/2009	9/14/2011				Separation		4.70	0.1250	0.0000		0	0.00
OH914	W920-S2895	9/17/2009	9/14/2011	1	0	5.20	Separation	0.19	5.20	1.5000	0.0000		0	0.00
OH914	W920-S2895	9/17/2009	9/14/2011				BOH		20.50	0.0000	0.0000		0	0.00
OH915	W920-S3000	9/17/2009	9/14/2011				Separation		4.00	0.1250	0.0625	E	2	0.03
OH915	W920-S3000	9/17/2009	9/14/2011				Separation		4.40	0.1250	0.0000		0	0.00
OH915	W920-S3000	9/17/2009	9/14/2011	2	0	4.90	Separation	0.41	4.90	0.1250	1.0000	E	33	0.50
OH915	W920-S3000	9/17/2009	9/14/2011				Separation		5.40	0.1250	0.0625	W	2	0.03
OH915	W920-S3000	9/17/2009	9/14/2011				BOH		20.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH922-1	S2750-W394	2/11/2011	5/23/2012				Separation		1.00	0.5000	0.1875	S	6	0.15
OH922-1	S2750-W394	2/11/2011	5/23/2012				Separation		4.50	1.2500	0.2500	N	8	0.20
OH922-1	S2750-W394	2/11/2011	5/23/2012	2	0	5.40	Separation	0.37	5.40	2.0000	0.1250	N	4	0.10
OH922-1	S2750-W394	2/11/2011	5/23/2012				Separation		5.80	0.5000	0.3750	S	13	0.29
OH922-1	S2750-W394	2/11/2011	5/23/2012				Separation		7.30	0.5000	0.0000		0	0.00
OH922-1	S2750-W394	2/11/2011	5/23/2012				Separation		9.00	0.1250	0.0000		0	0.00
OH922-1	S2750-W394	2/11/2011	5/23/2012				Hangup		10.10	0.0000	0.0000		0	0.00
OH922-1	S2750-W394	2/11/2011	5/23/2012				Hangup		15.20	0.0000	0.0000		0	0.00
OH922-1	S2750-W394	2/11/2011	5/23/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		1.20	0.3750	0.7500	S	25	0.59
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		1.30	0.1250	0.0000		0	0.00
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		2.20	0.1250	0.1250	S	4	0.10
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		2.70	0.1250	0.1250	S	4	0.10
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		2.80	0.3750	0.1250	S	4	0.10
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		4.00	0.2500	0.0000		0	0.00
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH923-1	S2750-W461	2/11/2011	5/23/2012	7	0	5.50	Separation	1.27	5.50	6.0000	2.5000	S	83	1.95
OH923-1	S2750-W461	2/11/2011	5/23/2012				Separation		6.40	3.5000	0.0000		0	0.00
OH923-1	S2750-W461	2/11/2011	5/23/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH924-1	S2750-W528	2/11/2011	5/23/2012				Separation		1.00	0.2500	0.2500	S	8	0.20
OH924-1	S2750-W528	2/11/2011	5/23/2012				Separation		4.30	0.1250	0.0000		0	0.00
OH924-1	S2750-W528	2/11/2011	5/23/2012				Separation		5.20	1.5000	0.7500	S	25	0.59
OH924-1	S2750-W528	2/11/2011	5/23/2012	3	0	5.80	Separation	0.52	5.80	4.0000	0.1875	S	6	0.15
OH924-1	S2750-W528	2/11/2011	5/23/2012				BOH		20.40	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH925-1	S2750-W618	2/11/2011	5/23/2012				Separation		4.50	0.2500	0.0000		0	0.00
OH925-1	S2750-W618	2/11/2011	5/23/2012				Separation		4.80	1.5000	0.0000		0	0.00
OH925-1	S2750-W618	2/11/2011	5/23/2012	2	0	5.20	Separation	0.38	5.20	4.0000	2.5000	S	83	1.95
OH925-1	S2750-W618	2/11/2011	5/23/2012				Separation		6.50	0.2500	0.0000		0	0.00
OH925-1	S2750-W618	2/11/2011	5/23/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH926-1	S2750-W656	2/11/2011	5/23/2012				Separation		1.20	0.1250	0.1250	S	4	0.10
OH926-1	S2750-W656	2/11/2011	5/23/2012				Separation		4.90	0.1250	0.0000		0	0.00
OH926-1	S2750-W656	2/11/2011	5/23/2012	2	0	5.60	Separation	0.36	5.60	4.5000	1.7500	S	58	1.37
OH926-1	S2750-W656	2/11/2011	5/23/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH927-1	S2750-W725	2/11/2011	5/23/2012				Separation		1.00	0.1250	0.1875	S	6	0.15
OH927-1	S2750-W725	2/11/2011	5/23/2012				Separation		4.20	0.1250	0.0000		0	0.00
OH927-1	S2750-W725	2/11/2011	5/23/2012				Separation		4.40	0.1250	0.0000		0	0.00
OH927-1	S2750-W725	2/11/2011	5/23/2012				Separation		4.80	0.5000	0.0000		0	0.00
OH927-1	S2750-W725	2/11/2011	5/23/2012				Separation		5.10	0.1250	0.0000		0	0.00
OH927-1	S2750-W725	2/11/2011	5/23/2012	5	0	5.30	Separation	0.94	5.30	3.0000	0.1875	S	6	0.15
OH927-1	S2750-W725	2/11/2011	5/23/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH928-1	S2750-W790	2/11/2011	12/13/2011				Separation		1.10	0.1250	0.0000		0	0.00
OH928-1	S2750-W790	2/11/2011	12/13/2011				Separation		5.30	0.5000	0.1250	S	4	0.15
OH928-1	S2750-W790	2/11/2011	12/13/2011	2	0	5.80	Separation	0.34	5.80	2.0000	0.0625	S	2	0.07
OH928-1	S2750-W790	2/11/2011	12/13/2011				Separation		7.30	0.1250	0.0000		0	0.00
OH928-1	S2750-W790	2/11/2011	12/13/2011				BOH		20.10	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH929-1	S2750-W860	2/11/2011	12/13/2011				Separation		4.10	0.1250	0.0000		0	0.00
OH929-1	S2750-W860	2/11/2011	12/13/2011				Separation		4.50	0.1250	0.0000		0	0.00
OH929-1	S2750-W860	2/11/2011	12/13/2011				Separation		5.10	0.2500	0.0000		0	0.00
OH929-1	S2750-W860	2/11/2011	12/13/2011				Separation		5.30	0.1250	0.0000		0	0.00
OH929-1	S2750-W860	2/11/2011	12/13/2011	4	0	5.50	Separation	0.73	5.50	1.5000	0.0000		0	0.00
OH929-1	S2750-W860	2/11/2011	12/13/2011				BOH		20.40	0.0000	0.0000		0	0.00
OH930-1	S2750-W920	2/11/2011	9/14/2011				Separation		1.10	0.3750	0.0625	S	2	0.11
OH930-1	S2750-W920	2/11/2011	9/14/2011	1	0	5.20	Separation		5.20	1.0000	0.1875	N	6	0.32
OH930-1	S2750-W920	2/11/2011	9/14/2011				Separation		5.40	0.1250	0.1250	S	4	0.21
OH930-1	S2750-W920	2/11/2011	9/14/2011				Separation		5.90	0.1250	0.0000		0	0.00
OH930-1	S2750-W920	2/11/2011	9/14/2011				Separation		7.00	0.3750	0.1250	S	4	0.21
OH930-1	S2750-W920	2/11/2011	9/14/2011				BOH		20.10	0.0000	0.0000		0	0.00
OH931-1	S2750-W985	2/11/2011	9/14/2011				Separation		4.80	0.1250	0.0000		0	0.00
OH931-1	S2750-W985	2/11/2011	9/14/2011				Separation		5.80	1.2500	0.0000		0	0.00
OH931-1	S2750-W985	2/11/2011	9/14/2011				BOH		20.10	0.0000	0.0000		0	0.00
OH935-1	S3080-W395	2/11/2011	3/12/2012				Separation		4.90	0.1250	0.0000		0	0.00
OH935-1	S3080-W395	2/11/2011	3/12/2012				Separation		5.40	0.2500	0.1250	N	4	0.12
OH935-1	S3080-W395	2/11/2011	3/12/2012	2	0	5.70	Separation	0.35	5.70	4.0000	0.3750	N	13	0.35
OH935-1	S3080-W395	2/11/2011	3/12/2012				BOH		20.00	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		1.00	2.0000	0.7500	S	25	0.56
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		1.90	1.0000	0.1250	N	4	0.09
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		5.00	0.2500	0.0000		0	0.00
OH936-1	S3080-W463	2/11/2011	6/11/2012	4	0	5.20	Separation	0.77	5.20	3.0000	0.0000		0	0.00
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		5.50	1.5000	0.0000		0	0.00
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		5.70	0.5000	0.0000		0	0.00
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		5.90	2.0000	0.0000		0	0.00
OH936-1	S3080-W463	2/11/2011	6/11/2012				Separation		6.30	2.0000	0.0000		0	0.00
OH936-1	S3080-W463	2/11/2011	6/11/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH937-1	S3080-W529	2/11/2011	6/11/2012				Separation		1.20	0.1250	0.1250	S	4	0.09
OH937-1	S3080-W529	2/11/2011	6/11/2012				Separation		4.90	0.2500	0.0000		0	0.00
OH937-1	S3080-W529	2/11/2011	6/11/2012	2	0	5.40	Separation	0.37	5.40	5.0000	0.7500	N	25	0.56
OH937-1	S3080-W529	2/11/2011	6/11/2012				Separation		6.10	0.7500	0.0000		0	0.00
OH937-1	S3080-W529	2/11/2011	6/11/2012				Separation		7.30	0.1250	0.0000		0	0.00
OH937-1	S3080-W529	2/11/2011	6/11/2012				Separation		16.20	0.1250	0.0000		0	0.00
OH937-1	S3080-W529	2/11/2011	6/11/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH938-1	S3080-W592	2/11/2011	6/11/2012				Separation		1.00	0.2500	0.0000		0	0.00
OH938-1	S3080-W592	2/11/2011	6/11/2012				Separation		4.70	0.5000	0.0000		0	0.00
OH938-1	S3080-W592	2/11/2011	6/11/2012	2	0	5.10	Separation	0.39	5.10	2.0000	0.5000	S	17	0.38
OH938-1	S3080-W592	2/11/2011	6/11/2012				Separation		5.50	1.0000	0.0000		0	0.00
OH938-1	S3080-W592	2/11/2011	6/11/2012				Separation		6.00	7.0000	0.0000		0	0.00
OH938-1	S3080-W592	2/11/2011	6/11/2012				BOH		20.30	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH939-1	S3080-W662	2/11/2011	6/11/2012				Separation		1.30	0.2500	0.1250	N	4	0.09
OH939-1	S3080-W662	2/11/2011	6/11/2012				Separation		4.90	0.2500	1.2500	N	42	0.94
OH939-1	S3080-W662	2/11/2011	6/11/2012	2	0	5.40	Separation	0.37	5.40	5.0000	0.0000		0	0.00
OH939-1	S3080-W662	2/11/2011	6/11/2012				Separation		5.90	0.2500	0.0000		0	0.00
OH939-1	S3080-W662	2/11/2011	6/11/2012				Hangup		16.00	0.0000	0.0000		0	0.00
OH939-1	S3080-W662	2/11/2011	6/11/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH940-1	S3080-W725	2/11/2011	3/12/2012				Separation		1.60	0.1250	0.0675	S	2	0.06
OH940-1	S3080-W725	2/11/2011	3/12/2012	1	0	5.00	Separation	0.20	5.00	1.2500	0.5000	S	17	0.46
OH940-1	S3080-W725	2/11/2011	3/12/2012				Separation		5.70	0.5000	0.2500	S	8	0.23
OH940-1	S3080-W725	2/11/2011	3/12/2012				Separation		6.00	2.5000	0.1250	E	4	0.12
OH940-1	S3080-W725	2/11/2011	3/12/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH941-1	S3080-W795	2/11/2011	12/19/2011				Separation		0.90	0.1250	0.0000		0	0.00
OH941-1	S3080-W795	2/11/2011	12/19/2011	1	0	4.80	Separation	0.21	4.80	2.5000	0.3750	S	13	0.44
OH941-1	S3080-W795	2/11/2011	12/19/2011				Separation		5.40	0.2500	0.0000		0	0.00
OH941-1	S3080-W795	2/11/2011	12/19/2011				Separation		5.50	0.1250	0.0000		0	0.00
OH941-1	S3080-W795	2/11/2011	12/19/2011				Separation		5.70	0.2500	0.0000		0	0.00
OH941-1	S3080-W795	2/11/2011	12/19/2011				Separation		5.90	0.7500	0.0000		0	0.00
OH941-1	S3080-W795	2/11/2011	12/19/2011				Separation		6.80	0.1250	0.0000		0	0.00
OH941-1	S3080-W795	2/11/2011	12/19/2011				Separation		7.00	1.0000	0.1250	S	4	0.15
OH941-1	S3080-W795	2/11/2011	12/19/2011				BOH		20.10	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH942-1	S3080-W860	2/11/2011	12/19/2011				Separation		0.90	0.1250	0.0000		0	0.00
OH942-1	S3080-W860	2/11/2011	12/19/2011				Separation		1.70	0.1250	0.0000		0	0.00
OH942-1	S3080-W860	2/11/2011	12/19/2011				Separation		4.10	1.5000	1.0000	N	33	1.17
OH942-1	S3080-W860	2/11/2011	12/19/2011				Separation		5.00	1.0000	0.0000		0	0.00
OH942-1	S3080-W860	2/11/2011	12/19/2011	4	0	5.30	Separation	0.75	5.30	2.0000	0.7500	E	25	0.88
OH942-1	S3080-W860	2/11/2011	12/19/2011				Separation		5.70	0.1250	0.0000		0	0.00
OH942-1	S3080-W860	2/11/2011	12/19/2011				BOH		20.30	0.0000	0.0000		0	0.00
OH943	S3080-W920	9/19/2009	9/15/2011				Separation		0.90	0.1250	0.0000		0	0.00
OH943	S3080-W920	9/19/2009	9/15/2011	1	0	5.00	Separation	0.20	5.00	3.5000	0.5000	N	17	0.25
OH943	S3080-W920	9/19/2009	9/15/2011				Separation		5.70	0.2500	0.0000		0	0.00
OH943	S3080-W920	9/19/2009	9/15/2011				BOH		20.00	0.0000	0.0000		0	0.00
OH944	S3080-W980	9/18/2009	9/15/2011				Separation		5.30	1.5000	0.0000		0	0.00
OH944	S3080-W980	9/18/2009	9/15/2011				BOH		20.30	0.0000	0.0000		0	0.00
OH1001	W390-S2271	9/23/2010	6/25/2012				Hole Closed		0.00	0.0000	0.0000		0	0.00
OH1002	W390-S2350	9/23/2010	6/25/2012	0	0	8.70	Separation	0.00	8.70	0.1250	0.0000		0	0.00
OH1002	W390-S2350	9/23/2010	6/25/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH1003	W390-S2422	9/23/2010	6/25/2012	0	0	7.90	Hangup	0.00	7.90	0.0000	0.0000		0	0.00
OH1003	W390-S2422	9/23/2010	6/25/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH1004	W520-S2271	9/14/2010	6/4/2012				Separation		1.20	0.1250	0.0675	W	2	0.04
OH1004	W520-S2271	9/14/2010	6/4/2012				Separation		3.00	0.1250	0.1250	W	4	0.07
OH1004	W520-S2271	9/14/2010	6/4/2012				Separation		6.00	0.1250	0.0000		0	0.00
OH1004	W520-S2271	9/14/2010	6/4/2012	3	0	8.10	Hangup	0.37	8.10	0.0000	0.0000		0	0.00
OH1004	W520-S2271	9/14/2010	6/4/2012				BOH		20.60	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH1005	W520-S2350	9/14/2010	6/4/2012	0	0	8.80	Rough Spot	0.00	8.80	0.0000	0.1250	E	4	0.07
OH1005	W520-S2350	9/14/2010	6/4/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH1006	W520-S2422	9/14/2010	6/4/2012				Separation		0.50	0.2500	0.1250	W	4	0.07
OH1006	W520-S2422	9/14/2010	6/4/2012	0	0	7.90	Rough Spot	0.00	7.90	0.0000	0.0000		0	0.00
OH1006	W520-S2422	9/14/2010	6/4/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH1007	W660-S2271	11/15/2010	6/4/2012	0	0	8.30	Separation	0.00	8.30	0.1250	0.0000		0	0.00
OH1007	W660-S2271	11/15/2010	6/4/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1008	W660-S2350	11/15/2010	6/4/2012	0	0	7.60	Separation	0.00	7.60	0.1250	0.0000		0	0.00
OH1008	W660-S2350	11/15/2010	6/4/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1009	W660-S2422	11/15/2010	6/4/2012	0	0	8.00	Hangup	0.00	8.00	0.0000	0.0000		0	0.00
OH1009	W660-S2422	11/15/2010	6/4/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1010	W790-S2271	11/15/2010	6/4/2012	0	0	8.00	Hangup	0.00	8.00	0.0000	0.3750	E	13	0.24
OH1010	W790-S2271	11/15/2010	6/4/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH1011	W790-S2350	11/15/2010	6/4/2012				Separation		6.10	0.1250	0.1250	E	4	0.08
OH1011	W790-S2350	11/15/2010	6/4/2012	0	0	7.50	Hangup	0.00	7.50	0.0000	0.2500	E	8	0.16
OH1011	W790-S2350	11/15/2010	6/4/2012				Hangup		13.50	0.0000	0.1875	W	6	0.12
OH1011	W790-S2350	11/15/2010	6/4/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH1012	W790-S2422	12/21/2010	12/30/2011	0	0	6.60	Separation	0.00	6.60	0.1250	0.2500	E	8	0.24
OH1012	W790-S2422	12/21/2010	12/30/2011				BOH		20.50	0.0000	0.0000		0	0.00
OH1013	W920-S2271	3/1/2011	6/4/2012	0	0	7.30	Hangup	0.00	7.30	0.0000	0.0000		0	0.00
OH1013	W920-S2271	3/1/2011	6/4/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1014	W920-S2350	3/1/2011	6/4/2012	0	0	7.50	Separation	0.00	7.50	0.1250	0.0000		0	0.00
OH1014	W920-S2350	3/1/2011	6/4/2012				BOH		20.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR+ 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH1015	W920-S2422	3/1/2011	6/4/2012	0	0	7.20	Hangup	0.00	7.20	0.0000	0.0000		0	0.00
OH1015	W920-S2422	3/1/2011	6/4/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1016	W1050-S2271	3/1/2011	5/31/2012	0	0	7.80	Separation	0.00	7.80	0.2500	0.2500	E	8	0.20
OH1016	W1050-S2271	3/1/2011	5/31/2012				Separation		8.90	0.2500	0.0000		0	0.00
OH1016	W1050-S2271	3/1/2011	5/31/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH1017	W1050-S2350	3/1/2011	6/4/2012	0	0	8.00	Hangup	0.00	8.00	0.0000	0.0000		0	0.00
OH1017	W1050-S2350	3/1/2011	6/4/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH1018	W1050-S2422	3/1/2011	6/4/2012	0	0	7.70	Hangup	0.00	7.70	0.0000	0.0000		0	0.00
OH1018	W1050-S2422	3/1/2011	6/4/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH1019	W1190-S2271	3/21/2011	5/31/2012				Separation		6.80	0.1250	0.0000		0	0.00
OH1019	W1190-S2271	3/21/2011	5/31/2012	0	0	7.90	Separation	0.00	7.90	0.1250	0.0000		0	0.00
OH1019	W1190-S2271	3/21/2011	5/31/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH1020	W1190-S2350	3/21/2011	5/31/2012	0	0	7.60	Separation	0.00	7.60	0.1250	0.0000		0	0.00
OH1020	W1190-S2350	3/21/2011	5/31/2012				Separation		7.90	0.1250	0.0000		0	0.00
OH1020	W1190-S2350	3/21/2011	5/31/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1021	W1190-S2422	3/21/2011	5/31/2012	0	0	7.10	Separation	0.00	7.10	0.1250	0.0000		0	0.00
OH1021	W1190-S2422	3/21/2011	5/31/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1022	W390-S2180	9/14/2010	2/28/2012	0	0	8.40	Separation	0.00	8.40	0.2500	1.2500	S	42	0.86
OH1022	W390-S2180	9/14/2010	2/28/2012				Hangup		14.70	0.0000	0.0000		0	0.00
OH1022	W390-S2180	9/14/2010	2/28/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH1023	W455-S2180	9/14/2010	2/28/2012	0	0	8.50	Separation	0.00	8.50	0.2500	0.5000	N	17	0.34
OH1023	W455-S2180	9/14/2010	2/28/2012				BOH		20.40	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH1024	W520-S2180	9/14/2010	5/30/2012				Separation		0.70	0.1250	0.1250	S	4	0.07
OH1024	W520-S2180	9/14/2010	5/30/2012	0	0	8.50	Separation	0.00	8.50	0.1250	1.0000	S	33	0.58
OH1024	W520-S2180	9/14/2010	5/30/2012				Separation		14.80	0.1250	1.0000	S	33	0.58
OH1024	W520-S2180	9/14/2010	5/30/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1025	W590-S2180	9/14/2010	5/30/2012				Separation		6.20	0.1250	0.2500	N	8	0.15
OH1025	W590-S2180	9/14/2010	5/30/2012	0	0	8.70	Separation	0.00	8.70	0.1250	0.1250	N	4	0.07
OH1025	W590-S2180	9/14/2010	5/30/2012				Hangup		15.00	0.0000	0.0000		0	0.00
OH1025	W590-S2180	9/14/2010	5/30/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1026	W660-S2180	9/14/2010	5/30/2012	0	0	8.10	Separation	0.00	8.10	0.1250	1.2500	S	42	0.73
OH1026	W660-S2180	9/14/2010	5/30/2012				Separation		14.30	0.1250	0.7500	S	25	0.44
OH1026	W660-S2180	9/14/2010	5/30/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH1027	W725-S2180	9/14/2010	5/30/2012				Separation		6.40	0.1250	0.0000		0	0.00
OH1027	W725-S2180	9/14/2010	5/30/2012				Separation		7.80	0.1250	0.0000		0	0.00
OH1027	W725-S2180	9/14/2010	5/30/2012	2	0	8.00	Separation	0.25	8.00	0.1250	1.5000	N	50	0.88
OH1027	W725-S2180	9/14/2010	5/30/2012				Hangup		14.40	0.0000	0.0000		0	0.00
OH1027	W725-S2180	9/14/2010	5/30/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH1028	W790-S2180	9/14/2010	5/30/2012				Separation		2.30	0.1250	0.0000		0	0.00
OH1028	W790-S2180	9/14/2010	5/30/2012	0	0	8.20	Separation	0.00	8.20	0.1250	1.0000	S	33	0.58
OH1028	W790-S2180	9/14/2010	5/30/2012				Separation		14.40	0.0000	1.0000	S	33	0.58
OH1028	W790-S2180	9/14/2010	5/30/2012				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH1029	W855-S2180	9/14/2010	5/30/2012				Separation		5.60	0.1250	0.0000		0	0.00
OH1029	W855-S2180	9/14/2010	5/30/2012				Separation		5.90	0.1250	0.0000		0	0.00
OH1029	W855-S2180	9/14/2010	5/30/2012				Separation		6.30	0.1250	0.0000		0	0.00
OH1029	W855-S2180	9/14/2010	5/30/2012				Rough Spot		7.30	0.0000	0.0000		0	0.00
OH1029	W855-S2180	9/14/2010	5/30/2012	4	0	8.30	Separation	0.48	8.30	0.1250	2.2500	N	75	1.32
OH1029	W855-S2180	9/14/2010	5/30/2012				Hangup		14.30	0.0000	0.0000		0	0.00
OH1029	W855-S2180	9/14/2010	5/30/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH1030	W920-S2180	9/14/2010	5/30/2012	0	0	8.30	Separation	0.00	8.30	0.1250	1.2500	S	42	0.73
OH1030	W920-S2180	9/14/2010	5/30/2012				Hangup		14.60	0.0000	0.1875	S	6	0.11
OH1030	W920-S2180	9/14/2010	5/30/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH1031	W985-S2180	9/14/2010	5/30/2012				Separation		7.30	0.1250	0.0000		0	0.00
OH1031	W985-S2180	9/14/2010	5/30/2012				Separation		7.70	0.1250	0.0000		0	0.00
OH1031	W985-S2180	9/14/2010	5/30/2012	2	0	8.10	Separation	0.25	8.10	0.1250	0.0000		0	0.00
OH1031	W985-S2180	9/14/2010	5/30/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH1032	W1050-S2180	9/14/2010	5/30/2012				Separation		6.60	0.1250	0.0000		0	0.00
OH1032	W1050-S2180	9/14/2010	5/30/2012	1	0	7.30	Separation	0.14	7.30	0.1250	1.0000	S	33	0.58
OH1032	W1050-S2180	9/14/2010	5/30/2012				Separation		13.80	0.1250	1.0000	S	33	0.58
OH1032	W1050-S2180	9/14/2010	5/30/2012				BOH		20.70	0.0000	0.0000		0	0.00
OH1033	W1120-S2180	3/1/2011	5/30/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH1033	W1120-S2180	3/1/2011	5/30/2012				Separation		6.10	0.1250	0.0000		0	0.00
OH1033	W1120-S2180	3/1/2011	5/30/2012				Separation		6.80	0.1250	0.0000		0	0.00
OH1033	W1120-S2180	3/1/2011	5/30/2012				Separation		6.90	0.1250	0.0000		0	0.00
OH1033	W1120-S2180	3/1/2011	5/30/2012	4	0	7.00	Separation	0.57	7.00	0.1250	0.0000		0	0.00
OH1033	W1120-S2180	3/1/2011	5/30/2012				BOH		20.40	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH1034	W1190-S2180	3/21/2011	5/30/2012	1	0	6.90	Separation	0.14	6.90	0.1250	1.2500	SE	42	1.05
OH1034	W1190-S2180	3/21/2011	5/30/2012				Separation		12.30	0.1250	0.3750	E	13	0.31
OH1034	W1190-S2180	3/21/2011	5/30/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH1035	W390-S2520	9/10/2010	6/25/2012	0	0	7.80	Separation	0.00	7.80	0.1250	0.0000		0	0.00
OH1035	W390-S2520	9/10/2010	6/25/2012				Hangup		13.80	0.0000	1.2500	N	42	0.70
OH1035	W390-S2520	9/10/2010	6/25/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH1036	W455-S2520	9/10/2010	2/28/2012				BOH		19.60	0.0000	0.0000		0	0.00
OH1037	W520-S2520	11/15/2010	5/31/2012	0	0	7.80	Separation	0.00	7.80	0.1250	1.2500	N	42	0.81
OH1037	W520-S2520	11/15/2010	5/31/2012				Separation		13.90	0.1250	1.2500	N	42	0.81
OH1037	W520-S2520	11/15/2010	5/31/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH1038	W590-S2520	11/15/2010	5/31/2012				Rough Spot		6.40	0.0000	0.0000		0	0.00
OH1038	W590-S2520	11/15/2010	5/31/2012	0	0	8.00	Separation	0.00	8.10	0.1250	0.1250	SE	4	0.08
OH1038	W590-S2520	11/15/2010	5/31/2012				Hangup		14.30	0.0000	0.1250	SE	4	0.08
OH1038	W590-S2520	11/15/2010	5/31/2012				BOH		21.80	0.0000	0.0000		0	0.00
OH1039	W660-S2520	11/15/2010	5/31/2012	0	0	7.70	Separation	0.00	7.70	0.1250	0.7500	N	25	0.49
OH1039	W660-S2520	11/15/2010	5/31/2012				Separation		13.70	0.1250	0.5000	N	17	0.32
OH1039	W660-S2520	11/15/2010	5/31/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH1040	W725-S2520	11/15/2010	5/31/2012	0	0	7.20	Separation	0.00	7.20	0.1250	0.0625	N	2	0.04
OH1040	W725-S2520	11/15/2010	5/31/2012				Separation		7.30	0.1250	0.0000		0	0.00
OH1040	W725-S2520	11/15/2010	5/31/2012				Hangup		13.80	0.0000	0.1250	N	4	0.08
OH1040	W725-S2520	11/15/2010	5/31/2012				BOH		20.40	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH1041	W790-S2520	11/15/2010	5/31/2012				Separation		2.20	0.1250	0.1250	N	4	0.08
OH1041	W790-S2520	11/15/2010	5/31/2012	1	0	7.80	Separation	0.13	7.80	0.1250	1.7500	N	58	1.13
OH1041	W790-S2520	11/15/2010	5/31/2012				Separation		7.90	0.1250	0.0000		0	0.00
OH1041	W790-S2520	11/15/2010	5/31/2012				Hangup		14.20	0.0000	1.5000	N	50	0.97
OH1041	W790-S2520	11/15/2010	5/31/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH1042	W855-S2520	11/15/2010	5/31/2012				Separation		6.50	0.1250	0.1250	N	4	0.08
OH1042	W855-S2520	11/15/2010	5/31/2012				Separation		6.60	0.1250	0.0000		0	0.00
OH1042	W855-S2520	11/15/2010	5/31/2012				Separation		6.80	0.1250	0.0000		0	0.00
OH1042	W855-S2520	11/15/2010	5/31/2012	3	0	7.00	Separation	0.43	7.00	0.1250	0.3750	N	13	0.24
OH1042	W855-S2520	11/15/2010	5/31/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1043	W920-S2520	3/1/2011	5/31/2012	0	0	8.00	Separation	0.00	8.00	0.1250	2.0000	N	67	1.60
OH1043	W920-S2520	3/1/2011	5/31/2012				Hangup		14.50	0.0000	0.2500	W	8	0.20
OH1043	W920-S2520	3/1/2011	5/31/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH1044	W985-S2520	3/1/2011	5/31/2012	0	0	7.40	Separation	0.00	7.40	0.1250	0.0675	N	2	0.05
OH1044	W985-S2520	3/1/2011	5/31/2012				Rough Spot		13.50	0.0000	0.0000		0	0.00
OH1044	W985-S2520	3/1/2011	5/31/2012				BOH		20.40	0.0000	0.0000		0	0.00
OH1045	W1050-S2520	3/1/2011	5/31/2012	0	0	7.50	Separation	0.00	7.50	0.1250	2.0000	N	67	1.60
OH1045	W1050-S2520	3/1/2011	5/31/2012				Hangup		13.90	0.0000	1.0000	N	33	0.80
OH1045	W1050-S2520	3/1/2011	5/31/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH1046	W1120-S2520	3/21/2011	5/31/2012				BOH		0.00	0.0000	0.0000		0	0.00
OH1046	W1120-S2520	3/21/2011	5/31/2012				Hangup		7.50	0.0000	0.0675	N	2	0.06
OH1047	W1190-S2520	3/21/2011	5/31/2012	0	0	7.30	Separation	0.00	7.30	0.2500	1.2500	NE	42	1.04
OH1047	W1190-S2520	3/21/2011	5/31/2012				Hangup		13.50	0.0000	0.0000		0	0.00
OH1047	W1190-S2520	3/21/2011	5/31/2012				BOH		20.30	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH860	0E-N1266	3/8/2009	12/20/2011				Separation		1.60	1.5000	0.0000		0	0.00
OH860	0E-N1266	3/8/2009	12/20/2011				Separation		3.10	2.5000	0.0625	W	2	0.02
OH860	0E-N1266	3/8/2009	12/20/2011				Separation		5.80	0.1250	0.0000		0	0.00
OH860	0E-N1266	3/8/2009	12/20/2011	3	0	6.20	Separation	0.48	6.20	0.1250	0.0000		0	0.00
OH860	0E-N1266	3/8/2009	12/20/2011				Separation		6.80	0.1250	0.0000		0	0.00
OH860	0E-N1266	3/8/2009	12/20/2011				Separation		7.20	0.3750	0.0000		0	0.00
OH860	0E-N1266	3/8/2009	12/20/2011				BOH		20.20	0.0000	0.0000		0	0.00
OH488	E0-N1100	1/7/2004	5/18/2012				Separation		1.10	0.5000	0.0000		0	0.00
OH488	E0-N1100	1/7/2004	5/18/2012	1	0	6.20	Separation	0.16	6.20	0.3750	0.1250	W	4	0.01
OH488	E0-N1100	1/7/2004	5/18/2012				Separation		6.60	0.1250	0.1875	W	6	0.02
OH488	E0-N1100	1/7/2004	5/18/2012				BOH		20.30	0.0000	0.0000		0	0.00
OH859	0E-N920	3/8/2009	12/27/2011				Separation		1.10	0.5000	0.0000		0	0.00
OH859	0E-N920	3/8/2009	12/27/2011				Separation		5.30	0.1250	0.0000		0	0.00
OH859	0E-N920	3/8/2009	12/27/2011	2	0	6.10	Separation	0.33	6.10	0.1250	0.0000		0	0.00
OH859	0E-N920	3/8/2009	12/27/2011				Separation		6.40	0.3750	0.0000		0	0.00
OH859	0E-N920	3/8/2009	12/27/2011				BOH		20.20	0.0000	0.0000		0	0.00
OH490	E0-N780	1/9/2004	5/18/2012				Separation		1.30	0.1250	0.0000		0	0.00
OH490	E0-N780	1/9/2004	5/18/2012				Separation		2.10	0.2500	0.0000		0	0.00
OH490	E0-N780	1/9/2004	5/18/2012	2	0	6.60	Separation	0.30	6.60	0.1250	2.5000	E	83	0.30
OH490	E0-N780	1/9/2004	5/18/2012				Hangup		16.30	0.0000	0.0000		0	0.00
OH490	E0-N780	1/9/2004	5/18/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH491-1	E0-N620	5/18/2012	5/18/2012				Separation		1.50	2.0000	0.0000		0	N/A
OH491-1	E0-N620	5/18/2012	5/18/2012				Separation		2.60	0.1250	0.0000		0	N/A
OH491-1	E0-N620	5/18/2012	5/18/2012	2	0	6.50	Separation	0.31	6.50	0.1250	1.7500	W	58	N/A
OH491-1	E0-N620	5/18/2012	5/18/2012				Separation		6.80	0.1250	0.0000		0	N/A
OH491-1	E0-N620	5/18/2012	5/18/2012				BOH		19.90	0.0000	0.0000		0	N/A

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH888	W30-S700	3/8/2009	5/17/2012				Separation		6.50	0.1250	0.1250	W	4	0.04
OH888	W30-S700	3/8/2009	5/17/2012	1	0	8.50	Separation	0.12	8.50	0.1250	0.0000		0	0.00
OH888	W30-S700	3/8/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH887	W30-S850	3/10/2009	5/17/2012	0	0	8.60	Hangup	0.00	8.60	0.0000	0.1875	W	6	0.06
OH887	W30-S850	3/10/2009	5/17/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH886	W30-S1000	3/3/2009	5/17/2012	0	0	8.00	Separation	0.00	8.00	0.1250	0.1875	S	6	0.06
OH886	W30-S1000	3/3/2009	5/17/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH885	W30-S1150	3/3/2009	5/17/2012				Separation		0.50	0.1250	0.0000		0	0.00
OH885	W30-S1150	3/3/2009	5/17/2012				Separation		0.70	0.1250	0.2500	W	8	0.08
OH885	W30-S1150	3/3/2009	5/17/2012				Separation		1.00	0.1250	0.2500	W	8	0.08
OH885	W30-S1150	3/3/2009	5/17/2012				Separation		1.60	0.1250	0.1875	W	6	0.06
OH885	W30-S1150	3/3/2009	5/17/2012				Separation		2.00	0.1250	0.1250	W	4	0.04
OH885	W30-S1150	3/3/2009	5/17/2012				Separation		6.20	0.1250	0.7500	W	25	0.23
OH885	W30-S1150	3/3/2009	5/17/2012	6	0	8.30	Separation	0.72	8.30	0.1250	0.2500	W	8	0.08
OH885	W30-S1150	3/3/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH884	W30-S1300	3/3/2009	5/17/2012				Separation		0.80	0.1250	0.0000		0	0.00
OH884	W30-S1300	3/3/2009	5/17/2012	1	0	8.30	Separation	0.12	8.30	0.1250	0.7500	NW	25	0.23
OH884	W30-S1300	3/3/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH883	W30-S1485	3/3/2009	5/17/2012	1	0	8.60	Separation	0.12	8.60	0.1250	0.0000		0	0.00
OH883	W30-S1485	3/3/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH882	W30-S1600	3/3/2009	5/17/2012				Separation		0.50	0.1250	0.0000		0	0.00
OH882	W30-S1600	3/3/2009	5/17/2012	1	0	7.60	Separation	0.13	7.60	0.1250	0.0000		0	0.00
OH882	W30-S1600	3/3/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH881	W30-S1780	3/3/2009	5/17/2012	0	0	8.30	Separation	0.00	8.30	0.1250	0.0000		0	0.00
OH881	W30-S1780	3/3/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH880	W30-S1950	3/3/2009	5/17/2012	0	0	8.30	Separation	0.00	8.30	0.1250	0.0000		0	0.00
OH880	W30-S1950	3/3/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH879	W30-S2060	3/3/2009	5/17/2012	0	0	7.60	Separation	0.00	7.60	0.1250	0.0000		0	0.00
OH879	W30-S2060	3/3/2009	5/17/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH877	W30-S2350	3/11/2009	5/17/2012				Separation		0.90	0.1250	0.0000		0	0.00
OH877	W30-S2350	3/11/2009	5/17/2012	1	0	7.90	Separation	0.13	7.90	0.1250	0.0000		0	0.00
OH877	W30-S2350	3/11/2009	5/17/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH876	W30-S2520	3/3/2009	5/17/2012				Separation		0.80	0.1250	0.0000		0	0.00
OH876	W30-S2520	3/3/2009	5/17/2012				Separation		2.60	0.1250	0.0000		0	0.00
OH876	W30-S2520	3/3/2009	5/17/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH876	W30-S2520	3/3/2009	5/17/2012				Separation		7.20	0.1250	0.0000		0	0.00
OH876	W30-S2520	3/3/2009	5/17/2012	4	0	7.50	Separation	0.53	7.50	0.1250	0.0000		0	0.00
OH876	W30-S2520	3/3/2009	5/17/2012				BOH		17.90	0.0000	0.0000		0	0.00
OH875	W30-S2750	3/3/2009	5/17/2012	0	0	5.50	Separation	0.00	5.50	0.1250	0.2500	W	8	0.08
OH875	W30-S2750	3/3/2009	5/17/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH875	W30-S2750	3/3/2009	5/17/2012				Separation		6.30	0.1250	0.0000		0	0.00
OH875	W30-S2750	3/3/2009	5/17/2012				Separation		6.50	0.3750	0.3750	N	13	0.12
OH875	W30-S2750	3/3/2009	5/17/2012				Separation		6.80	0.1250	0.0000		0	0.00
OH875	W30-S2750	3/3/2009	5/17/2012				BOH		20.30	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH899	W170-S1000	3/24/2009	5/18/2012				Separation		0.90	0.1250	0.0000		0	0.00
OH899	W170-S1000	3/24/2009	5/18/2012	1	0	9.20	Hangup	0.11	9.20	0.0000	0.5000	E	17	0.16
OH899	W170-S1000	3/24/2009	5/18/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH898	W170-S1150	3/24/2009	5/18/2012	0	0	8.90	Rough Spot	0.00	8.90	0.0000	0.0000		0	0.00
OH898	W170-S1150	3/24/2009	5/18/2012				BOH		21.10	0.0000	0.0000		0	0.00
OH897	W170-S1300	6/8/2009	5/18/2012	0	0	8.40	Separation	0.00	8.40	0.1250	0.0000		0	0.00
OH897	W170-S1300	6/8/2009	5/18/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH896	W170-S1482	6/8/2009	5/18/2012	0	0	7.20	Separation	0.00	7.20	0.2500	0.1250	W	4	0.04
OH896	W170-S1482	6/8/2009	5/18/2012				Hangup		15.00	0.0000	0.0000		0	0.00
OH896	W170-S1482	6/8/2009	5/18/2012				BOH		17.30	0.0000	0.0000		0	0.00
OH895	W170-S1600	6/8/2009	5/18/2012	0	0	8.60	Separation	0.00	8.60	0.1250	0.0000		0	0.00
OH895	W170-S1600	6/8/2009	5/18/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH894	W170-S1780	6/8/2009	5/18/2012	0	0	9.50	Separation	0.00	9.50	0.2500	0.2500	E	8	0.08
OH894	W170-S1780	6/8/2009	5/18/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH893	W170-S1950	6/8/2009	5/18/2012	0	0	8.40	Separation	0.00	8.40	0.1250	0.1875	W	6	0.06
OH893	W170-S1950	6/8/2009	5/18/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH892	W170-S2055	6/8/2009	6/12/2012				Separation		1.10	0.1250	0.0000		0	0.00
OH892	W170-S2055	6/8/2009	6/12/2012				Separation		1.70	0.1250	0.0000		0	0.00
OH892	W170-S2055	6/8/2009	6/12/2012	2	0	7.80	Separation	0.26	7.80	0.1250	0.0000		0	0.00
OH892	W170-S2055	6/8/2009	6/12/2012				BOH		19.60	0.0000	0.0000		0	0.00
OH891	W170-S2180	6/8/2009	6/12/2012	0	0	7.70	Separation	0.00	7.70	0.1250	0.1875	E	6	0.06
OH891	W170-S2180	6/8/2009	6/12/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH890	W170-S2345	3/11/2009	6/12/2012	0	0	7.90	Hangup	0.00	7.90	0.0000	0.3750	E	13	0.12
OH890	W170-S2345	3/11/2009	6/12/2012				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH889	W170-S2520	3/11/2009	6/12/2012				Separation		1.70	0.1250	0.0000		0	0.00
OH889	W170-S2520	3/11/2009	6/12/2012				Rough Spot		2.70	0.0000	0.0000		0	0.00
OH889	W170-S2520	3/11/2009	6/12/2012	2	0	8.00	Separation	0.25	8.00	0.1250	0.1875	E	6	0.06
OH889	W170-S2520	3/11/2009	6/12/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH900	W170-S2635	3/17/2010	6/12/2012				Separation		2.70	0.1250	0.0000		0	0.00
OH900	W170-S2635	3/17/2010	6/12/2012				Separation		3.20	0.2500	0.0000		0	0.00
OH900	W170-S2635	3/17/2010	6/12/2012				Separation		4.00	3.5000	2.7500	W	92	1.23
OH900	W170-S2635	3/17/2010	6/12/2012				BOH		4.30	0.0000	0.0000		0	0.00
OH855	S90-W380	3/4/2009	5/18/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH856	S90-W620	3/4/2009	5/18/2012				Separation		1.10	0.1250	0.0000		0	0.00
OH856	S90-W620	3/4/2009	5/18/2012				Separation		1.20	0.1250	0.0000		0	0.00
OH856	S90-W620	3/4/2009	5/18/2012	2	0	9.00	Separation	0.22	9.00	0.1250	0.0000		0	0.00
OH856	S90-W620	3/4/2009	5/18/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH857	S90-W880	3/4/2009	5/18/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH850	N300-W80	3/8/2009	5/18/2012				Separation		4.30	0.1250	0.0000		0	0.00
OH850	N300-W80	3/8/2009	5/18/2012	1	0	7.00	Separation	0.14	7.00	0.1250	1.2500	S	42	0.39
OH850	N300-W80	3/8/2009	5/18/2012				Separation		8.00	0.1250	0.0000		0	0.00
OH850	N300-W80	3/8/2009	5/18/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH858	W469-N216	3/11/2009	5/18/2012				Separation		5.60	0.1250	0.0000		0	0.00
OH858	W469-N216	3/11/2009	5/18/2012	1	0	8.50	Separation	0.12	8.50	0.1250	0.3750	S	13	0.12
OH858	W469-N216	3/11/2009	5/18/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH852	N785-E195	6/8/2009	12/30/2011				Separation		6.10	0.1250	0.0000		0	0.00
OH852	N785-E195	6/8/2009	12/30/2011				Separation		6.20	0.1250	0.0000		0	0.00
OH852	N785-E195	6/8/2009	12/30/2011	2	0	6.40	Separation	0.31	6.40	0.1250	1.2500	S	42	0.49
OH852	N785-E195	6/8/2009	12/30/2011				Separation		7.10	0.1250	0.0000		0	0.00
OH852	N785-E195	6/8/2009	12/30/2011				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH869	E300-S1430	6/15/2009	6/28/2012	0	0	8.20	Hangup	0.00	8.20	0.0000	0.0000		0	0.00
OH869	E300-S1430	6/15/2009	6/28/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH868	E300-S1780	6/15/2009	6/28/2012				Separation		1.30	0.1250	0.0000		0	0.00
OH868	E300-S1780	6/15/2009	6/28/2012	1	0	7.80	Hangup	0.13	7.80	0.0000	0.0000		0	0.00
OH868	E300-S1780	6/15/2009	6/28/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH867	E300-S2060	6/15/2009	6/25/2012	0	0	8.70	Separation	0.00	8.70	0.3750	0.0000		0	0.00
OH867	E300-S2060	6/15/2009	6/25/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH866	E300-S2340	6/15/2009	6/11/2012				Separation		1.30	0.1250	0.1250	W	4	0.04
OH866	E300-S2340	6/15/2009	6/11/2012	1	0	8.40	Rough Spot	0.12	8.40	0.0000	0.0000		0	0.00
OH866	E300-S2340	6/15/2009	6/11/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH865	E300-S2630	6/15/2009	6/11/2012				BOH		4.00	0.0000	0.0000		0	0.00
OH422	E300-S2825	8/6/2003	6/12/2012				Separation		1.50	0.1250	1.2500	W	42	0.14
OH422	E300-S2825	8/6/2003	6/12/2012				Separation		2.40	3.2500	1.2500	W	42	0.14
OH422	E300-S2825	8/6/2003	6/12/2012				Separation		3.00	0.1250	0.0000		0	0.00
OH422	E300-S2825	8/6/2003	6/12/2012				Separation		4.00	0.1250	0.0000		0	0.00
OH422	E300-S2825	8/6/2003	6/12/2012				Separation		4.40	0.1250	0.0000		0	0.00
OH422	E300-S2825	8/6/2003	6/12/2012				Separation		5.40	0.1250	0.0000		0	0.00
OH422	E300-S2825	8/6/2003	6/12/2012				Separation		5.60	0.1250	0.0000		0	0.00
OH422	E300-S2825	8/6/2003	6/12/2012	7	0	5.70	Rubbly	1.23	5.70	0.0000	0.0000		0	0.00
OH423	E300-S2890	8/6/2003	6/11/2012				Separation		1.00	0.1250	0.0000		0	0.00
OH423	E300-S2890	8/6/2003	6/11/2012				Separation		1.70	1.5000	1.0000	E	33	0.11
OH423	E300-S2890	8/6/2003	6/11/2012				Separation		1.80	0.2500	0.1875	E	6	0.02
OH423	E300-S2890	8/6/2003	6/11/2012				Rough Spot		4.90	0.0000	0.0000		0	0.00
OH423	E300-S2890	8/6/2003	6/11/2012	4	0	5.50	Separation	0.73	5.50	0.0000	3.0000	W	100	0.34

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH424	E300-S2950	8/6/2003	6/11/2012				BOH		2.00	0.0000	0.0000		0	0.00
OH425	E300-S3020	8/6/2003	6/11/2012				Separation		1.60	0.1250	0.0000		0	0.00
OH425	E300-S3020	8/6/2003	6/11/2012				Separation		1.70	0.1250	0.1250	E	4	0.01
OH425	E300-S3020	8/6/2003	6/11/2012				Separation		1.90	0.1250	0.0000		0	0.00
OH425	E300-S3020	8/6/2003	6/11/2012				Separation		2.40	2.0000	0.1250	N	4	0.01
OH425	E300-S3020	8/6/2003	6/11/2012				Separation		3.00	4.0000	0.0000		0	0.00
OH425	E300-S3020	8/6/2003	6/11/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH425	E300-S3020	8/6/2003	6/11/2012	6	0	5.90	Separation	1.02	5.90	0.1250	1.5000	E	50	0.17
OH425	E300-S3020	8/6/2003	6/11/2012				Separation		6.30	0.1250	0.0000		0	0.00
OH425	E300-S3020	8/6/2003	6/11/2012				BOH		20.10	0.0000	0.0000		0	0.00
OH457	E300-S3260	8/28/2003	6/18/2012				Separation		0.70	0.1250	0.0000		0	0.00
OH457	E300-S3260	8/28/2003	6/18/2012				Separation		1.00	0.1250	0.1250	E	4	0.01
OH457	E300-S3260	8/28/2003	6/18/2012				Separation		1.20	0.3750	0.0000		0	0.00
OH457	E300-S3260	8/28/2003	6/18/2012				Rough Spot		4.70	0.0000	0.0000		0	0.00
OH457	E300-S3260	8/28/2003	6/18/2012				Separation		4.90	0.1250	0.0000		0	0.00
OH457	E300-S3260	8/28/2003	6/18/2012				Separation		5.10	0.1250	0.0000		0	0.00
OH457	E300-S3260	8/28/2003	6/18/2012				Separation		5.50	0.2500	0.0000		0	0.00
OH457	E300-S3260	8/28/2003	6/18/2012	7	0	6.10	Separation	1.15	6.10	0.1250	0.3750	W	13	0.04
OH457	E300-S3260	8/28/2003	6/18/2012				BOH		21.10	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH458	E300-S3295	8/28/2003	6/18/2012				Separation		1.60	1.0000	0.1875	E	6	0.02
OH458	E300-S3295	8/28/2003	6/18/2012				Rough Spot		4.70	0.0000	0.0000		0	0.00
OH458	E300-S3295	8/28/2003	6/18/2012				Rough Spot		4.80	0.0000	0.0000		0	0.00
OH458	E300-S3295	8/28/2003	6/18/2012				Separation		5.20	0.2500	0.0000		0	0.00
OH458	E300-S3295	8/28/2003	6/18/2012	4	0	5.90	Hangup	0.68	5.90	0.0000	0.3750	E	13	0.04
OH458	E300-S3295	8/28/2003	6/18/2012				Hangup		6.20	0.0000	0.0000		0	0.00
OH458	E300-S3295	8/28/2003	6/18/2012				BOH		20.70	0.0000	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Separation		1.00	0.1250	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Separation		1.50	0.2500	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Separation		4.60	0.1250	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Separation		4.90	0.1250	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Separation		5.10	0.1250	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Rough Spot		5.30	0.0000	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012	6	0	5.60	Separation	1.07	5.60	0.1250	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				Rough Spot		5.90	0.0000	0.0000		0	0.00
OH459	E300-S3140	8/28/2003	6/18/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH453	E300-S3310	8/18/2003	6/18/2012				Separation		5.10	0.1250	0.0000		0	0.00
OH453	E300-S3310	8/18/2003	6/18/2012	1	0	6.10	Separation	0.16	6.10	0.2500	1.5000	S	50	0.17
OH453	E300-S3310	8/18/2003	6/18/2012				Separation		6.40	0.1250	0.0000		0	0.00
OH453	E300-S3310	8/18/2003	6/18/2012				Separation		6.70	0.1250	0.0000		0	0.00
OH453	E300-S3310	8/18/2003	6/18/2012				Rough Spot		7.80	0.0000	1.0000	S	33	0.11
OH453	E300-S3310	8/18/2003	6/18/2012				BOH		21.00	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH622	E300-S3400	6/15/2006	6/25/2012				Separation		1.30	0.2500	1.0000	E	33	0.17
OH622	E300-S3400	6/15/2006	6/25/2012				Hangup		4.40	0.0000	0.0000		0	0.00
OH622	E300-S3400	6/15/2006	6/25/2012				Hangup		4.60	0.0000	0.0000		0	0.00
OH622	E300-S3400	6/15/2006	6/25/2012				Separation		5.20	0.1250	0.0000		0	0.00
OH622	E300-S3400	6/15/2006	6/25/2012	4	0	5.60	Separation	0.71	5.60	0.1250	0.0000		0	0.00
OH622	E300-S3400	6/15/2006	6/25/2012				BOH		20.70	0.0000	0.0000		0	0.00
OH623	E300-S3450	6/15/2006	6/25/2012				Separation		1.30	0.1250	0.3750	E	13	0.06
OH623	E300-S3450	6/15/2006	6/25/2012				Separation		4.30	0.1250	0.0000		0	0.00
OH623	E300-S3450	6/15/2006	6/25/2012				Separation		4.60	0.1250	0.0000		0	0.00
OH623	E300-S3450	6/15/2006	6/25/2012	3	0	5.60	Separation	0.54	5.60	0.1250	0.2500	E	8	0.04
OH623	E300-S3450	6/15/2006	6/25/2012				BOH		20.60	0.0000	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012				Separation		1.20	0.7500	2.5000	E	83	0.36
OH604	E300-S3480	7/18/2005	6/25/2012				Hangup		4.00	0.0000	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012				Separation		4.20	0.1250	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012				Hangup		4.80	0.0000	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012				Hangup		5.10	0.0000	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012				Hangup		5.30	0.0000	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012	2	0	5.40	Separation	0.37	5.40	0.1250	0.3750	E	13	0.05
OH604	E300-S3480	7/18/2005	6/25/2012				Separation		5.70	0.1250	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH604	E300-S3480	7/18/2005	6/25/2012				Separation		6.20	0.1250	0.3750	E	13	0.05
OH604	E300-S3480	7/18/2005	6/25/2012				BOH		20.80	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH624	E300-S3550	6/15/2006	6/25/2012				Separation		4.50	0.1250	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				Hangup		4.70	0.0000	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				Hangup		4.90	0.0000	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				Separation		5.10	0.1250	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				Separation		5.20	0.1250	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				Separation		5.60	0.1250	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012	5	0	6.00	Hangup	0.83	6.00	0.0000	0.2500	E	8	0.04
OH624	E300-S3550	6/15/2006	6/25/2012				Separation		6.30	0.1250	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				Rough Spot		16.60	0.0000	0.0000		0	0.00
OH624	E300-S3550	6/15/2006	6/25/2012				BOH		20.70	0.0000	0.0000		0	0.00
OH573	S3650-W170	4/14/2005	6/25/2012	0	0	5.10	Separation	0.00	5.10	0.2500	0.0000		0	0.00
OH573	S3650-W170	4/14/2005	6/25/2012				Surveyed to		50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		1.30	1.0000	1.0000	S	33	0.14
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		2.20	2.0000	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Hangup		3.00	0.0000	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		3.50	1.0000	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		3.90	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		4.00	1.0000	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		4.10	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		4.30	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		4.50	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		4.80	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		4.90	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		5.00	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		5.40	0.1250	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012	14	0	5.60	Separation	2.50	5.60	0.2500	0.0000		0	0.00
OH564	S3650-W90	4/20/2005	6/25/2012				Separation		6.00	0.2500	0.0000		0	0.00
OH565	S3650-W30	2/23/2005	6/25/2012				Separation		1.40	0.2500	0.0000		0	0.00
OH565	S3650-W30	2/23/2005	6/25/2012				Separation		5.10	0.2500	0.0000		0	0.00
OH565	S3650-W30	2/23/2005	6/25/2012				Separation		5.60	0.2500	2.0000	N	67	0.27
OH565	S3650-W30	2/23/2005	6/25/2012				Hangup		7.30	0.0000	0.0000		0	0.00
OH565	S3650-W30	2/23/2005	6/25/2012				Hangup		16.20	0.0000	0.0000		0	0.00
OH565	S3650-W30	2/23/2005	6/25/2012				BOH		20.70	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH566	S3650-E50	4/20/2005	12/21/2011				Separation		1.40	0.2500	0.0000		0	0.00
OH566	S3650-E50	4/20/2005	12/21/2011				Separation		3.80	0.2500	0.5000	S	17	0.07
OH566	S3650-E50	4/20/2005	12/21/2011	2	0	6.30	Separation	0.32	6.30	0.1250	0.0000		0	0.00
OH566	S3650-E50	4/20/2005	12/21/2011				BOH		20.90	0.0000	0.0000		0	0.00
OH567-1	S3650-E140	9/26/2011	5/21/2012	0	0	4.70	Separation	0.00	4.70	0.1250	0.0000		0	0.00
OH567-1	S3650-E140	9/26/2011	5/21/2012				Separation		6.70	0.2500	0.0000		0	0.00
OH567-1	S3650-E140	9/26/2011	5/21/2012				Separation		8.20	0.2500	0.0000		0	0.00
OH567-1	S3650-E140	9/26/2011	5/21/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH568	S3650-E235	4/20/2005	6/25/2012				BOH		20.80	0.0000	0.0000		0	0.00
OH569	S3650-E300	4/20/2005	6/25/2012	0	0	5.10	Separation	0.00	5.10	0.5000	0.7500	N	25	0.10
OH569	S3650-E300	4/20/2005	6/25/2012				Separation		5.70	0.1250	0.0000		0	0.00
OH569	S3650-E300	4/20/2005	6/25/2012				Separation		5.80	0.2500	0.0000		0	0.00
OH569	S3650-E300	4/20/2005	6/25/2012				BOH		20.80	0.0000	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		0.20	0.1250	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		1.30	1.5000	1.2500	S	42	0.16
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		2.30	0.3750	0.1250	S	4	0.02
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		3.70	0.3750	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		3.80	0.1250	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		4.10	0.1250	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		4.40	0.1250	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		4.90	0.1250	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011	8	0	5.30	Separation	1.51	5.30	0.1250	0.2500	S	8	0.03
OH503	S3080-E230	4/12/2004	12/30/2011				Separation		5.80	0.1250	0.0000		0	0.00
OH503	S3080-E230	4/12/2004	12/30/2011				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH452	S3310-E230	8/18/2003	12/30/2011				Separation		1.30	4.5000	2.2500	S	75	0.27
OH452	S3310-E230	8/18/2003	12/30/2011				Separation		2.70	0.2500	0.0000		0	0.00
OH452	S3310-E230	8/18/2003	12/30/2011				Separation		5.90	0.1250	0.0000		0	0.00
OH452	S3310-E230	8/18/2003	12/30/2011	3	0	6.10	Separation	0.49	6.10	0.1250	1.0000	N	33	0.12
OH452	S3310-E230	8/18/2003	12/30/2011				Separation		6.20	0.1250	0.0000		0	0.00
OH452	S3310-E230	8/18/2003	12/30/2011				Separation		6.80	0.1250	0.0000		0	0.00
OH452	S3310-E230	8/18/2003	12/30/2011				BOH		20.80	0.0000	0.0000		0	0.00
OH450	S3310-E65	8/18/2003	6/25/2012				Hangup		4.40	0.0000	0.5000	S	17	0.06
OH450	S3310-E65	8/18/2003	6/25/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH450	S3310-E65	8/18/2003	6/25/2012				Hangup		4.90	0.0000	0.0000		0	0.00
OH450	S3310-E65	8/18/2003	6/25/2012				Hangup		5.20	0.0000	0.0000		0	0.00
OH450	S3310-E65	8/18/2003	6/25/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH450	S3310-E65	8/18/2003	6/25/2012	5	0	5.40	Separation	0.93	5.40	0.1250	2.0000	S	67	0.23
OH450	S3310-E65	8/18/2003	6/25/2012				BOH		5.70	0.0000	0.0000		0	0.00
OH450	S3310-E65	8/18/2003	6/25/2012				Separation		5.70	0.2500	0.0000		0	0.00
OH514-1	W30-S3400	6/5/2009	12/21/2011	1	0	5.20	Separation	0.19	1.30	0.2500	0.5000	S	17	0.20
OH514-1	W30-S3400	6/5/2009	12/21/2011				BOH		22.00	0.0000	0.0000		0	0.00
OH515-1	W30-S3490	6/5/2009	6/25/2012				Separation		1.40	0.5000	0.0000		0	0.00
OH515-1	W30-S3490	6/5/2009	6/25/2012	1	0	5.30	Separation	0.19	5.30	0.2500	0.2500	E	8	0.08
OH515-1	W30-S3490	6/5/2009	6/25/2012				Separation		5.40	0.1250	0.0000		0	0.00
OH515-1	W30-S3490	6/5/2009	6/25/2012				Separation		6.10	0.1250	0.0000		0	0.00
OH515-1	W30-S3490	6/5/2009	6/25/2012				BOH		20.30	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH526-1	W30-S3583	6/5/2009	6/25/2012				Separation		1.40	0.2500	0.2500	E	8	0.08
OH526-1	W30-S3583	6/5/2009	6/25/2012				Hangup		4.40	0.0000	0.0000		0	0.00
OH526-1	W30-S3583	6/5/2009	6/25/2012	2	0	5.50	Separation	0.36	5.50	0.2500	0.0000		0	0.00
OH526-1	W30-S3583	6/5/2009	6/25/2012				Separation		5.90	0.5000	0.0000		0	0.00
OH526-1	W30-S3583	6/5/2009	6/25/2012				BOH		20.20	0.0000	0.0000		0	0.00
OH608-1	W170-S3395	6/10/2009	6/25/2012				Separation		0.50	0.1250	1.0000	E	33	0.33
OH608-1	W170-S3395	6/10/2009	6/25/2012				Separation		1.00	0.1250	0.5000	E	17	0.16
OH608-1	W170-S3395	6/10/2009	6/25/2012				Separation		1.10	0.1250	0.0000		0	0.00
OH608-1	W170-S3395	6/10/2009	6/25/2012				Separation		2.00	4.0000	0.5000	E	17	0.16
OH608-1	W170-S3395	6/10/2009	6/25/2012				Separation		2.30	0.1250	0.0000		0	0.00
OH608-1	W170-S3395	6/10/2009	6/25/2012	4	0	5.10	Separation	0.78	5.10	0.1250	0.0000		0	0.00
OH608-1	W170-S3395	6/10/2009	6/25/2012				Separation		6.30	0.1250	0.0000		0	0.00
OH608-1	W170-S3395	6/10/2009	6/25/2012				BOH		20.70	0.0000	0.0000		0	0.00
OH609-1	W170-S3485	6/10/2009	6/25/2012				Separation		1.10	0.2500	0.0000		0	0.00
OH609-1	W170-S3485	6/10/2009	6/25/2012				Hangup		2.10	0.0000	0.0000		0	0.00
OH609-1	W170-S3485	6/10/2009	6/25/2012				Hangup		2.40	0.0000	0.0000		0	0.00
OH609-1	W170-S3485	6/10/2009	6/25/2012	1	0	5.40	Separation	0.19	5.40	0.1250	0.0000		0	0.00
OH609-1	W170-S3485	6/10/2009	6/25/2012				Rubble Zone		6.90	1.0000	0.0000		0	0.00
OH609-1	W170-S3485	6/10/2009	6/25/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH610-1	W170-S3580	6/10/2009	6/25/2012				Separation		1.30	0.1250	0.0000		0	0.00
OH610-1	W170-S3580	6/10/2009	6/25/2012	1	0	5.60	Separation	0.18	5.60	0.1250	0.0000		0	0.00
OH610-1	W170-S3580	6/10/2009	6/25/2012				BOH		20.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH455	W30-S2850	8/28/2003	12/21/2011				Separation		1.70	1.0000	0.5000	W	17	0.06
OH455	W30-S2850	8/28/2003	12/21/2011				Separation		4.60	0.1250	0.0000		0	0.00
OH455	W30-S2850	8/28/2003	12/21/2011	2	0	5.70	Separation	0.35	5.70	0.2500	0.0000		0	0.00
OH455	W30-S2850	8/28/2003	12/21/2011				BOH		19.00	0.0000	0.0000		0	0.00
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		1.30	0.1250	0.0000		0	0.00
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		1.80	0.1250	1.0000	W	33	0.11
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		2.70	3.5000	1.0000	W	33	0.11
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		4.30	0.1250	0.0000		0	0.00
OH456	W30-S2950	8/28/2003	5/21/2012	4	0	4.70	Separation	0.85	4.70	0.1250	1.0000	W	33	0.11
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		5.00	0.1250	0.0000		0	0.00
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		6.20	0.1250	0.0000		0	0.00
OH456	W30-S2950	8/28/2003	5/21/2012				Separation		6.80	3.0000	0.0000		0	0.00
OH456	W30-S2950	8/28/2003	5/21/2012				BOH		20.50	0.0000	0.0000		0	0.00
OH463	W30-S3080	9/3/2003	6/12/2012				Separation		1.50	5.0000	2.0000	E	67	0.23
OH463	W30-S3080	9/3/2003	6/12/2012				Separation		3.80	0.1250	2.0000	E	67	0.23
OH463	W30-S3080	9/3/2003	6/12/2012				Separation		5.20	0.2500	0.0000		0	0.00
OH463	W30-S3080	9/3/2003	6/12/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH463	W30-S3080	9/3/2003	6/12/2012	4	0	6.00	Separation	0.67	6.00	0.2500	0.0000		0	0.00
OH463	W30-S3080	9/3/2003	6/12/2012				Separation		6.20	0.2500	0.0000		0	0.00
OH463	W30-S3080	9/3/2003	6/12/2012				Separation		6.60	0.1250	0.0000		0	0.00
OH463	W30-S3080	9/3/2003	6/12/2012				Separation		7.70	0.1250	0.0000		0	0.00
OH463	W30-S3080	9/3/2003	6/12/2012				BOH		21.40	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		1.00	0.2500	1.2500	E	42	0.14
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		2.40	0.3750	0.5000	E	17	0.06
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		2.50	0.7500	0.1250	E	4	0.01
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		5.10	0.1250	0.0000		0	0.00
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		5.30	0.1250	0.0000		0	0.00
OH465	W30-S3200	9/3/2003	6/12/2012	5	0	5.50	Separation	0.91	5.50	0.1250	0.0000		0	0.00
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		5.60	0.1250	0.0000		0	0.00
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		6.00	0.1250	0.0000		0	0.00
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		16.80	0.0000	0.0000		0	0.00
OH465	W30-S3200	9/3/2003	6/12/2012				Separation		22.80	0.0000	0.0000		0	0.00
OH449	W30-S3310	8/18/2003	6/25/2012				Separation		5.00	0.1250	0.0000		0	0.00
OH449	W30-S3310	8/18/2003	6/25/2012				Separation		5.70	0.1250	0.0000		0	0.00
OH449	W30-S3310	8/18/2003	6/25/2012	2	0	6.00	Separation	0.33	6.00	0.2500	0.2500		8	0.03
OH449	W30-S3310	8/18/2003	6/25/2012				Separation		6.50	0.1250	0.0000		0	0.00
OH449	W30-S3310	8/18/2003	6/25/2012				BOH		21.70	0.0000	0.0000		0	0.00
OH460	S2750-W100	9/3/2003	6/12/2012				Separation		1.60	1.2500	0.7500	S	25	0.09
OH460	S2750-W100	9/3/2003	6/12/2012				Separation		2.70	8.0000	0.7500	S	25	0.09
OH460	S2750-W100	9/3/2003	6/12/2012				Separation		5.00	0.1250	0.0000		0	0.00
OH460	S2750-W100	9/3/2003	6/12/2012				Separation		5.40	0.2500	0.0000		0	0.00
OH460	S2750-W100	9/3/2003	6/12/2012	4	0	7.10	Separation	0.56	7.10	3.5000	0.0000		0	0.00
OH460	S2750-W100	9/3/2003	6/12/2012				BOH		10.20	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		1.30	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		1.60	0.1250	0.3750	S	13	0.04
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		1.80	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		2.60	0.7500	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		4.00	3.2500	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		4.30	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		4.50	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		4.70	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		5.00	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		5.20	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		5.50	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		5.80	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		5.90	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012				Separation		6.10	0.1250	0.0000		0	0.00
OH462	S3080-W100	9/3/2003	6/12/2012	14	0	6.30	BOH	2.22	6.30	0.1250	3.0000	N	100	0.34
OH442	W170-S2820	8/18/2003	1/23/2012				Separation		1.50	0.1250	1.2500	W	42	0.15
OH442	W170-S2820	8/18/2003	1/23/2012				Separation		2.40	3.5000	1.2500	W	42	0.15
OH442	W170-S2820	8/18/2003	1/23/2012				Separation		3.00	0.1250	0.0000		0	0.00
OH442	W170-S2820	8/18/2003	1/23/2012				Separation		4.70	0.5000	0.0000		0	0.00
OH442	W170-S2820	8/18/2003	1/23/2012	4	0	5.20	Separation	0.77	5.20	0.1250	0.0000		0	0.00
OH442	W170-S2820	8/18/2003	1/23/2012				BOH		13.50	0.0000	0.0000		0	0.00

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		1.00	0.1250	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		1.50	1.0000	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		1.60	0.1250	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		2.30	6.0000	0.3750	S	13	1.42
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		3.30	0.2500	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		4.50	0.1250	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012	6	0	4.70	Separation	1.28	4.70	5.0000	0.0000		0	0.00
OH445-1	W170-S3000	6/12/2012	6/12/2012				Separation		0.50	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Hangup		1.10	0.0000	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		5.10	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012	3	0	5.20	Separation	0.58	5.20	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		5.30	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		5.50	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		6.60	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				BOH		22.00	0.0000	0.0000		0	N/A

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-1
Observation Borehole Fractures and Offset Data Summary

Hole	Location	Initial Inspection Date	Recent Inspection Date	FR[1]	FZ[2]	Beam Height (ft)	Feature	Fracture Density	Feature Depth (ft)	Separation (in)	Offset (in)	Compass	Hole Closure (%)	Offset Rate (in/yr)
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		1.00	0.1250	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		1.50	1.0000	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		1.60	0.1250	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		2.30	6.0000	0.3750	S	13	1.42
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		3.30	0.2500	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012				Separation		4.50	0.1250	0.0000		0	0.00
OH444	W170-S3000	8/18/2003	6/12/2012	6	0	4.70	Separation	1.28	4.70	5.0000	0.0000		0	0.00
OH445-1	W170-S3000	6/12/2012	6/12/2012				Separation		0.50	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Hangup		1.10	0.0000	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		5.10	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012	3	0	5.20	Separation	0.58	5.20	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		5.30	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		5.50	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				Separation		6.60	0.1250	0.0000		0	N/A
OH445-1	W170-S3080	6/12/2012	6/12/2012				BOH		22.00	0.0000	0.0000		0	N/A

[1] Number of fractures (FR) in immediate roof beam

[2] Number of fracture zones (FZ) in immediate roof beam

[3] Fracture Density = (FR + 2 FZ)/Beam Height

Table 7-2 Summary of New Boreholes

Hole	Location	Northing	Easting	Drill Date	Depth (ft)	Diameter (in)	Purpose
OH750	E140-S773	8914	7035	9/29/2011	20.5	3	Observation
OH874-1	E140-S850	8837	7035	9/29/2011	20.0	3	Observation
OH751	E140-S920	8767	7035	9/29/2011	20.5	3	Observation
OH575-1	E140-S1000	8687	7035	9/29/2011	20.7	3	Observation
OH752	E140-S1070	8617	7035	9/29/2011	20.5	3	Observation
OH873-1	E140-S1145	8542	7035	9/29/2011	20.5	3	Observation
OH753	E140-S1226	8461	7035	9/29/2011	20.1	3	Observation
OH872-1	E140-S1390	8297	7035	9/29/2011	20.4	3	Observation
OH580-2	E140-S1463	8224	7035	9/29/2011	20.4	3	Observation
OH754	E140-S1526	8161	7035	9/29/2011	20.5	3	Observation
OH871-1	E140-S1680	8007	7035	9/29/2011	20.5	3	Observation
OH143-4	E140-S1784	7905	7035	9/26/2011	20.7	3	Observation
OH143-4	E140-S1784	7833	7035	9/26/2011	20.1	3	Observation
OH473-3	E140-S2091	7596	7035	9/26/2011	20.5	3	Observation
OH471-2	E140-S2300	7342	7035	9/26/2011	20.1	3	Observation
OH586-2	E140-S2358	7329	7035	9/26/2011	20.6	3	Observation
OH588-1	E140-S2520	7167	7035	9/26/2011	20.4	3	Observation
OH468-2	E140-S2640	7053	7035	9/26/2011	20.2	3	Observation
OH500-2	E140-S2920	6767	7035	9/26/2011	20.1	3	Observation
OH501-2	E140-S2935	6703	7035	9/26/2011	20.4	3	Observation
OH493-2	E140-S3199	6507	7035	9/26/2011	20.1	3	Observation
OH605-2	E140-S3394	6307	7044	9/26/2011	20.0	3	Observation
OH606-2	E140-S3480	6207	7035	9/26/2011	20.1	3	Observation
OH571-1	E140-S3527	6160	7035	9/26/2011	20.1	3	Observation
OH607-1	E140-S3580	6107	7044	9/26/2011	20.2	3	Observation
OH567-1	E140-S3650	6039	7035	9/26/2011	20.2	3	Observation
OH901-2	W395-S2832	6855	6500	5/15/2012	20.1	3	Observation
OH902-2	W393-S2912	6775	6500	5/15/2012	20.1	3	Observation
OH903-2	W393-S2994	6693	6500	5/15/2012	20.2	3	Observation
OH905-1	W525-S2912	6775	6370	5/15/2012	20.0	3	Observation
OH906-1	W525-S2994	6693	6370	5/15/2012	20.0	3	Observation
OH950	E0-N460	6895	10307	5/18/2012	20.1	3	Observation

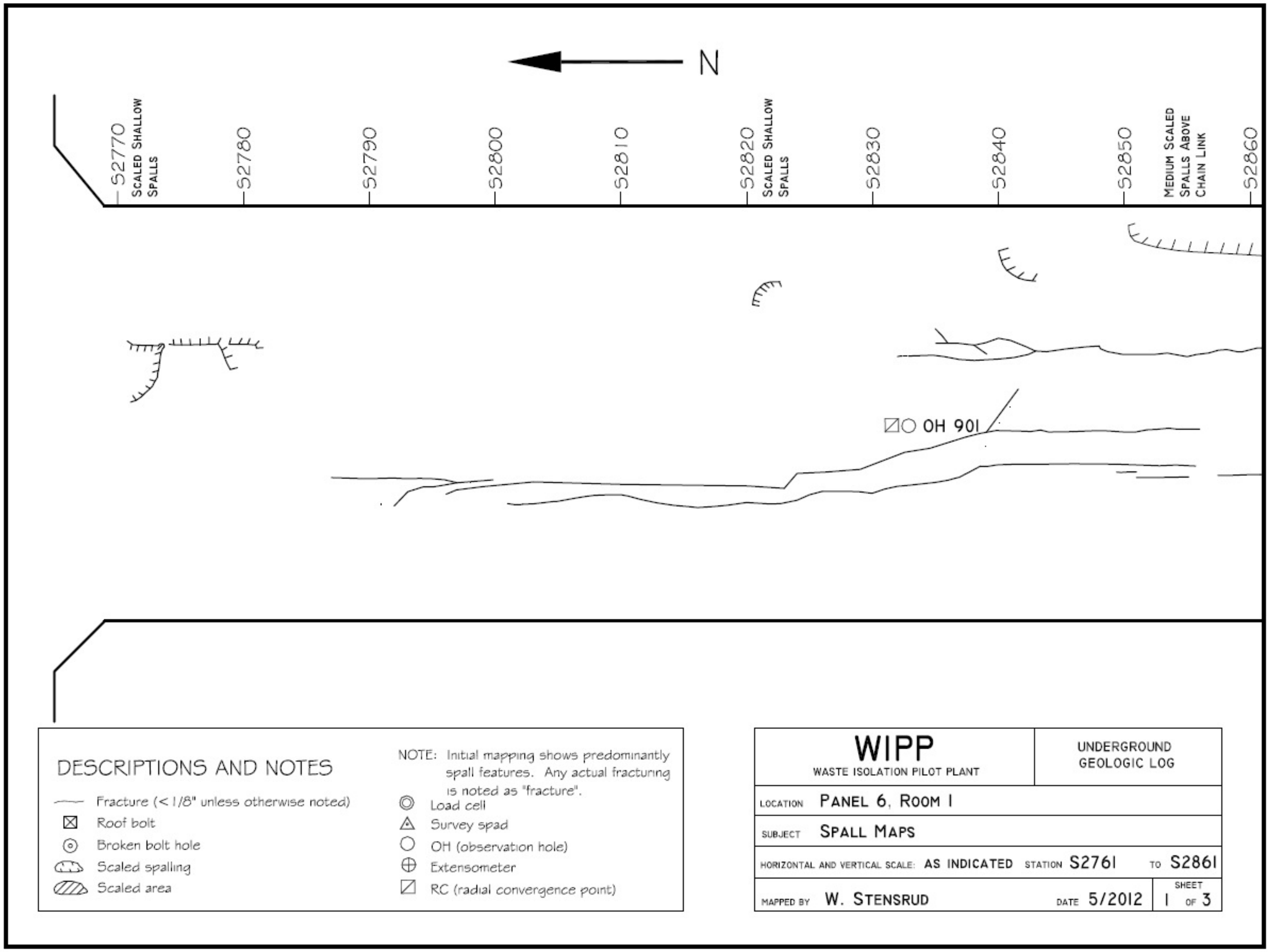


Figure 7-1
Panel 6 Room 1, S2761-S2861 Roof Fractures

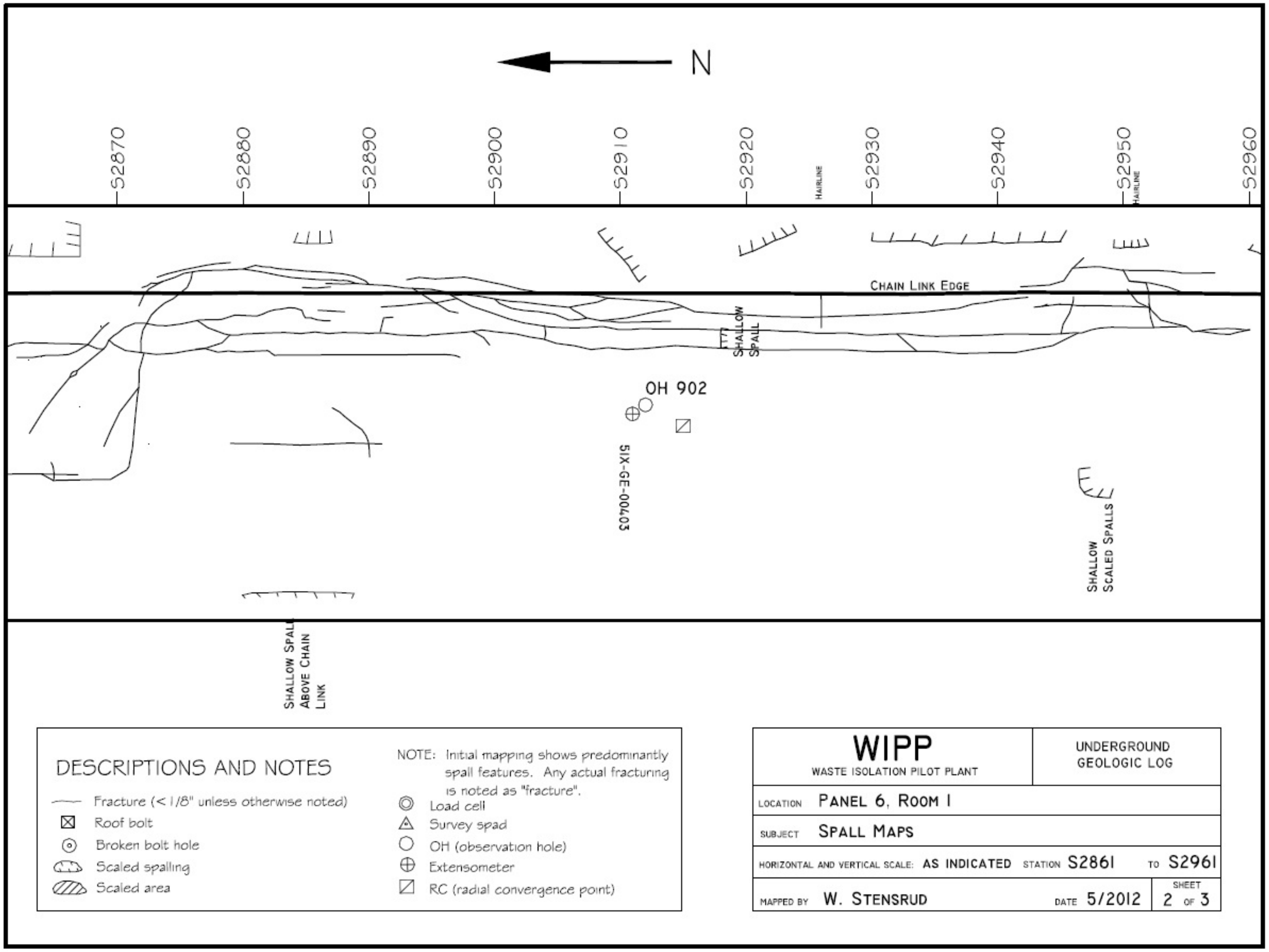


Figure 7-2
Panel 6, Room 1, S2861-S2961 Roof Fractures

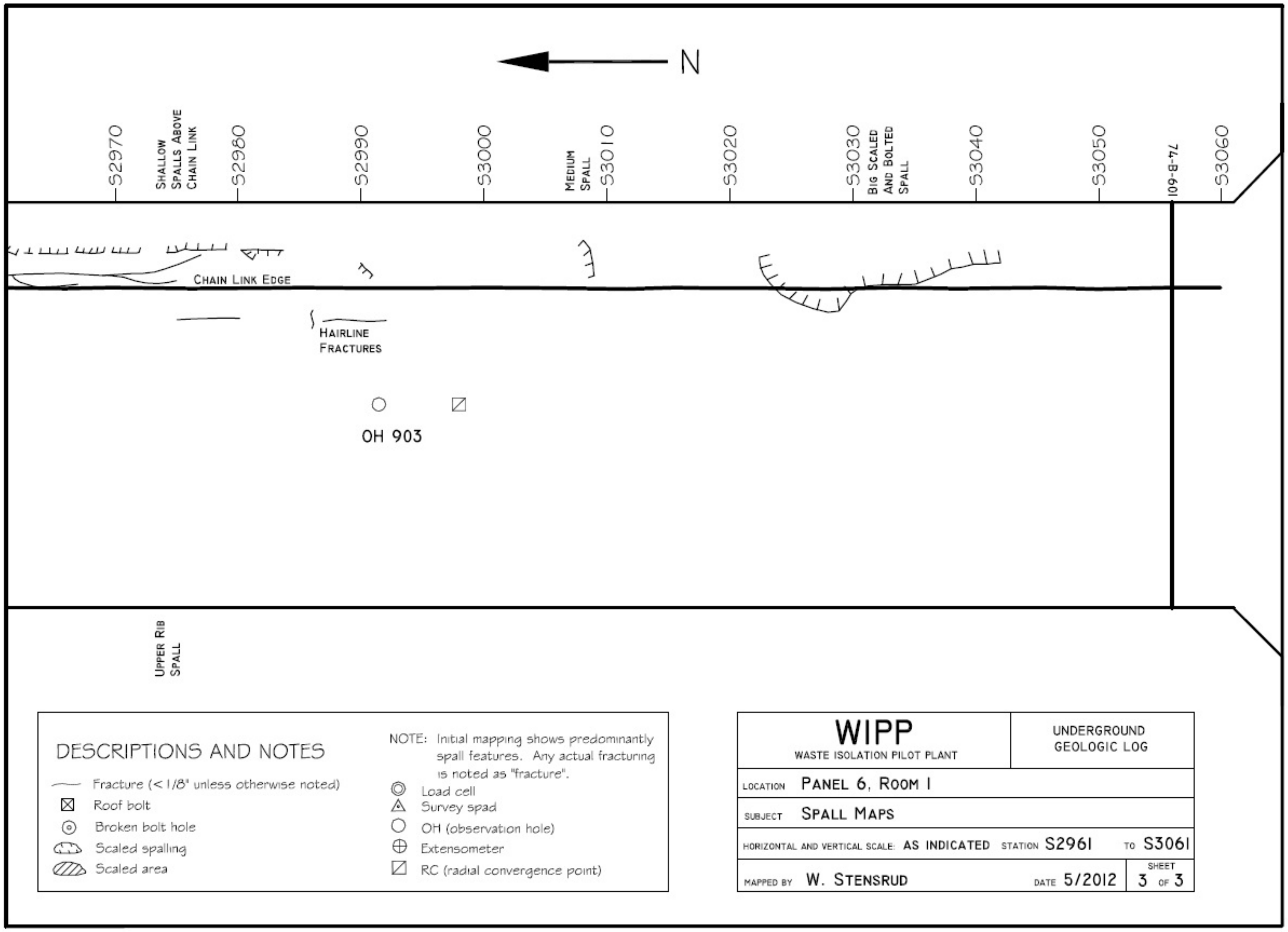


Figure 7-3
Panel 6 Room 1, S2961-S3061 Roof Fractures

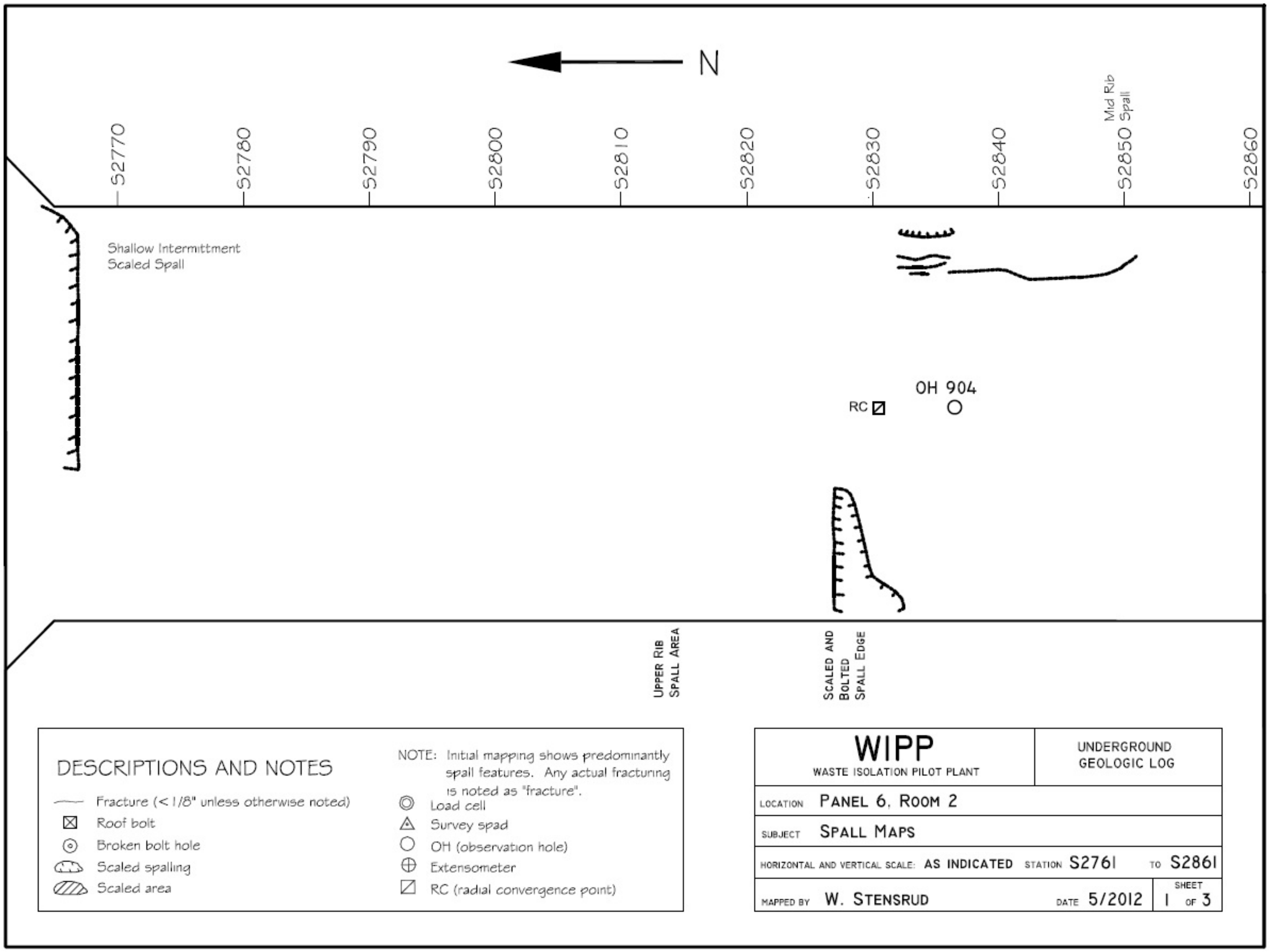


Figure 7-4
Panel 6 Room 2, S2761-S2861 Roof Fractures

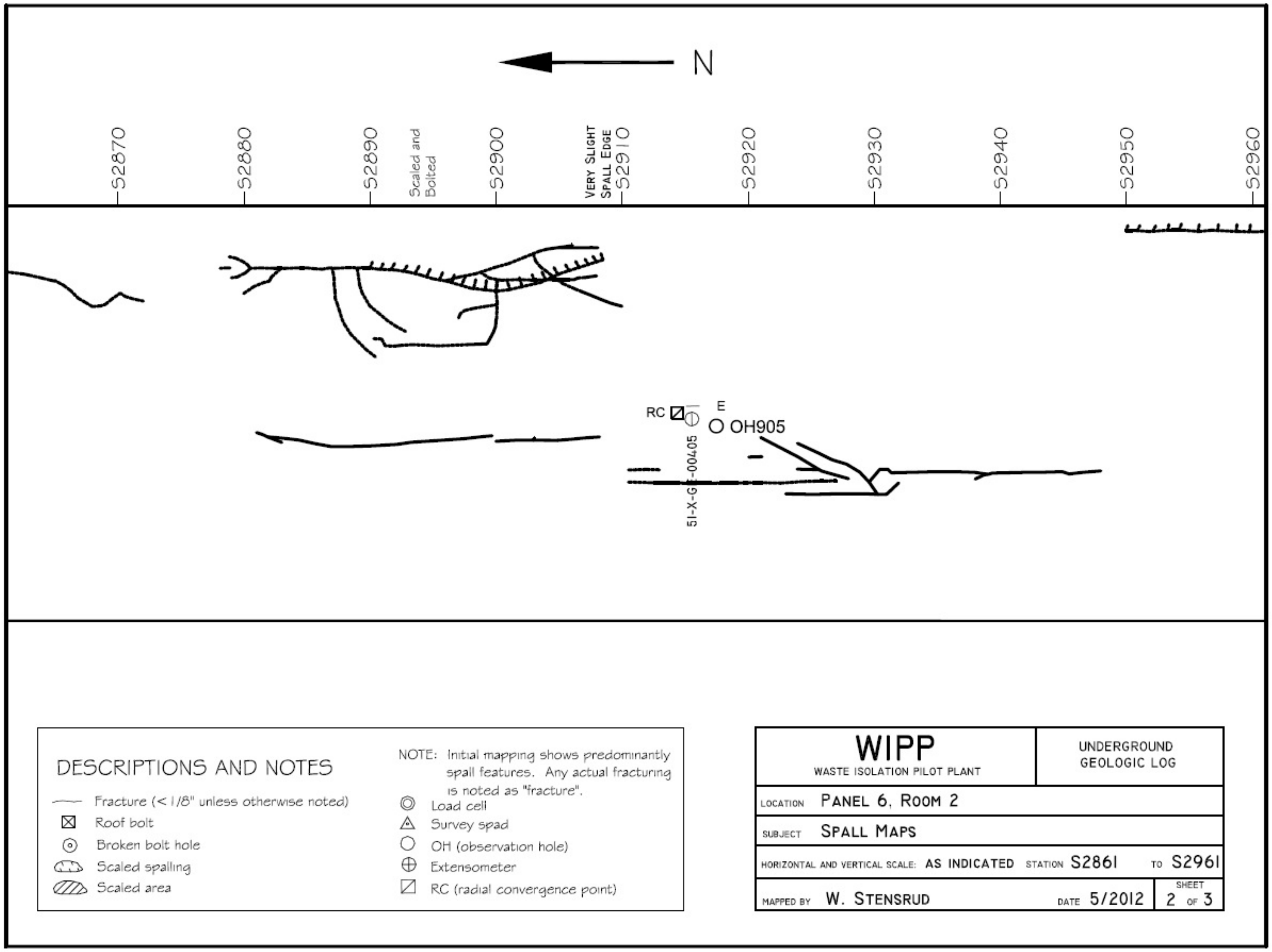


Figure 7-5
Panel 6 Room 2, S2861-S2961 Roof Fractures

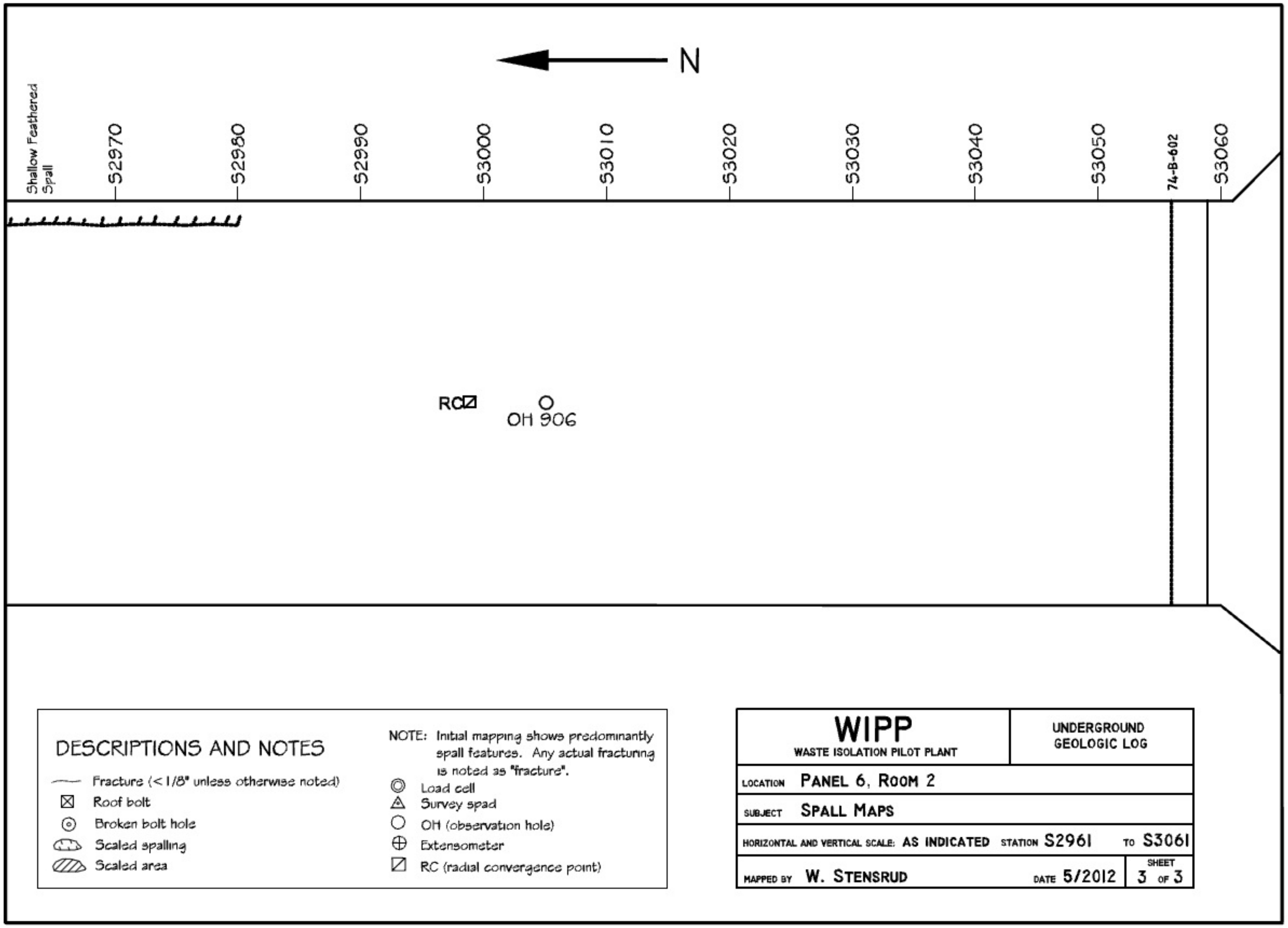


Figure 7-6
Panel 6 Room 2, S2961-S3061 Roof Fractures

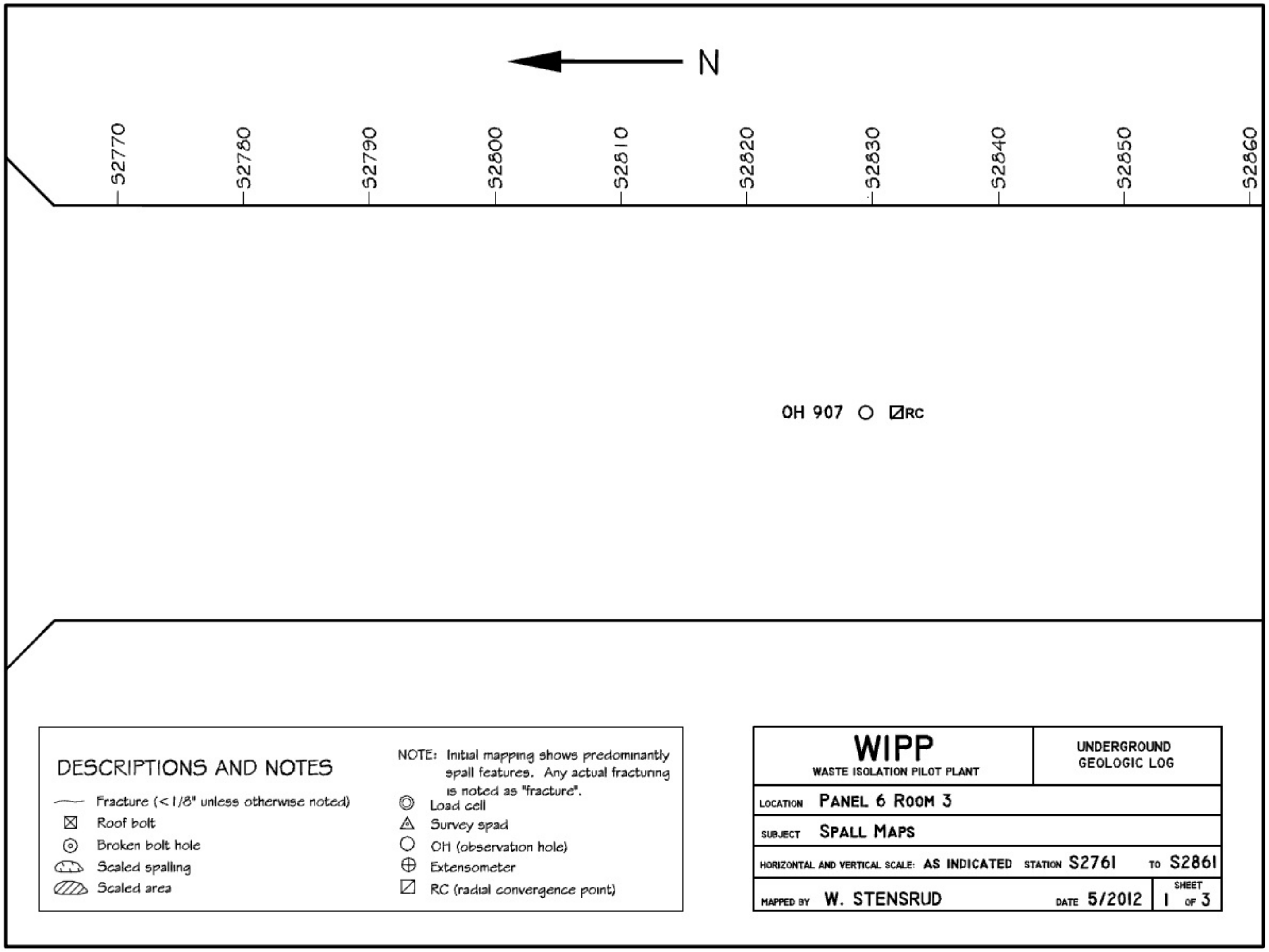


Figure 7-7
Panel 6 Room 3, S2761-S2861 Roof Fractures

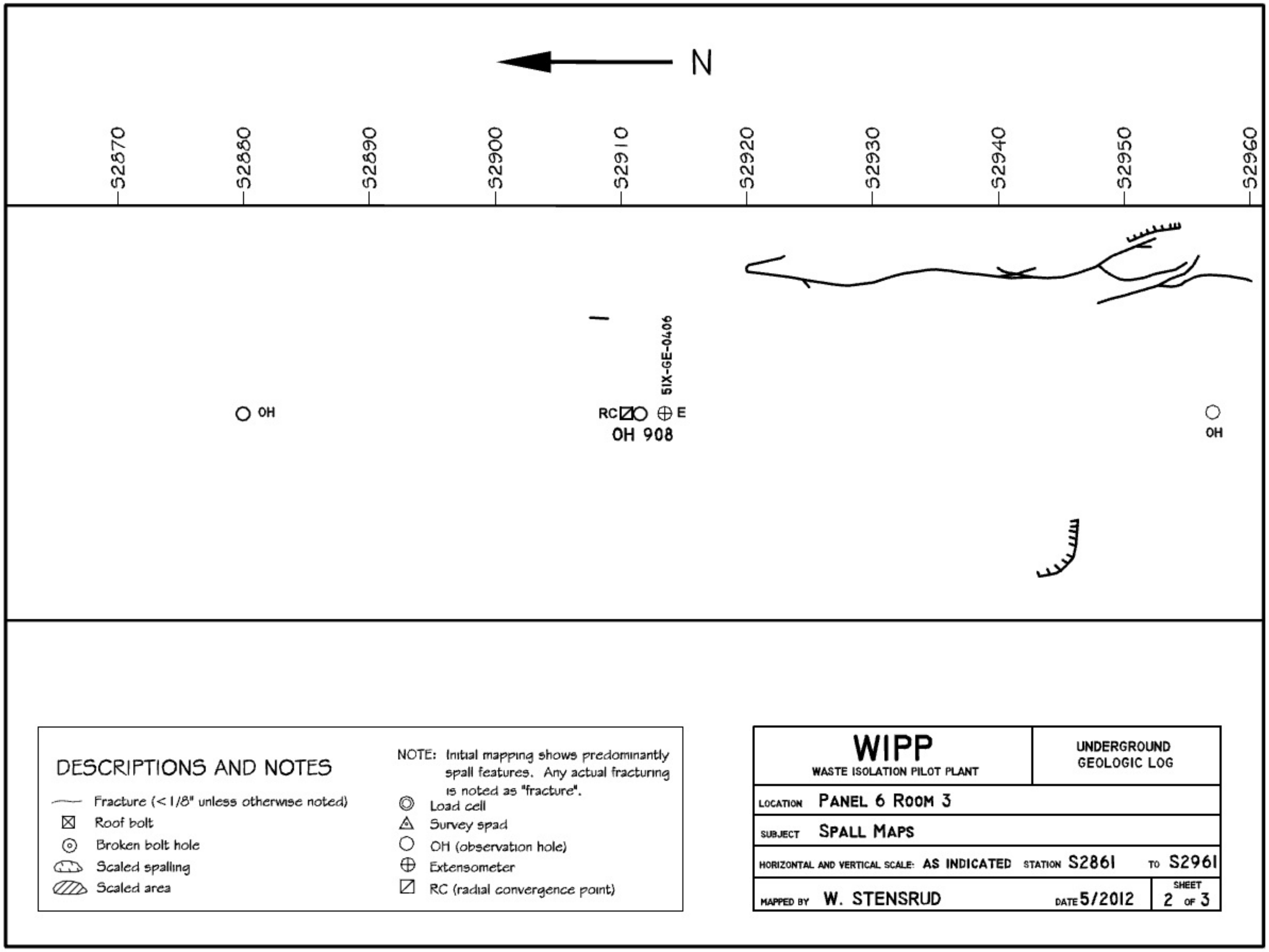


Figure 7-8
Panel 6 Room 3, S2861-S2961 Roof Fractures

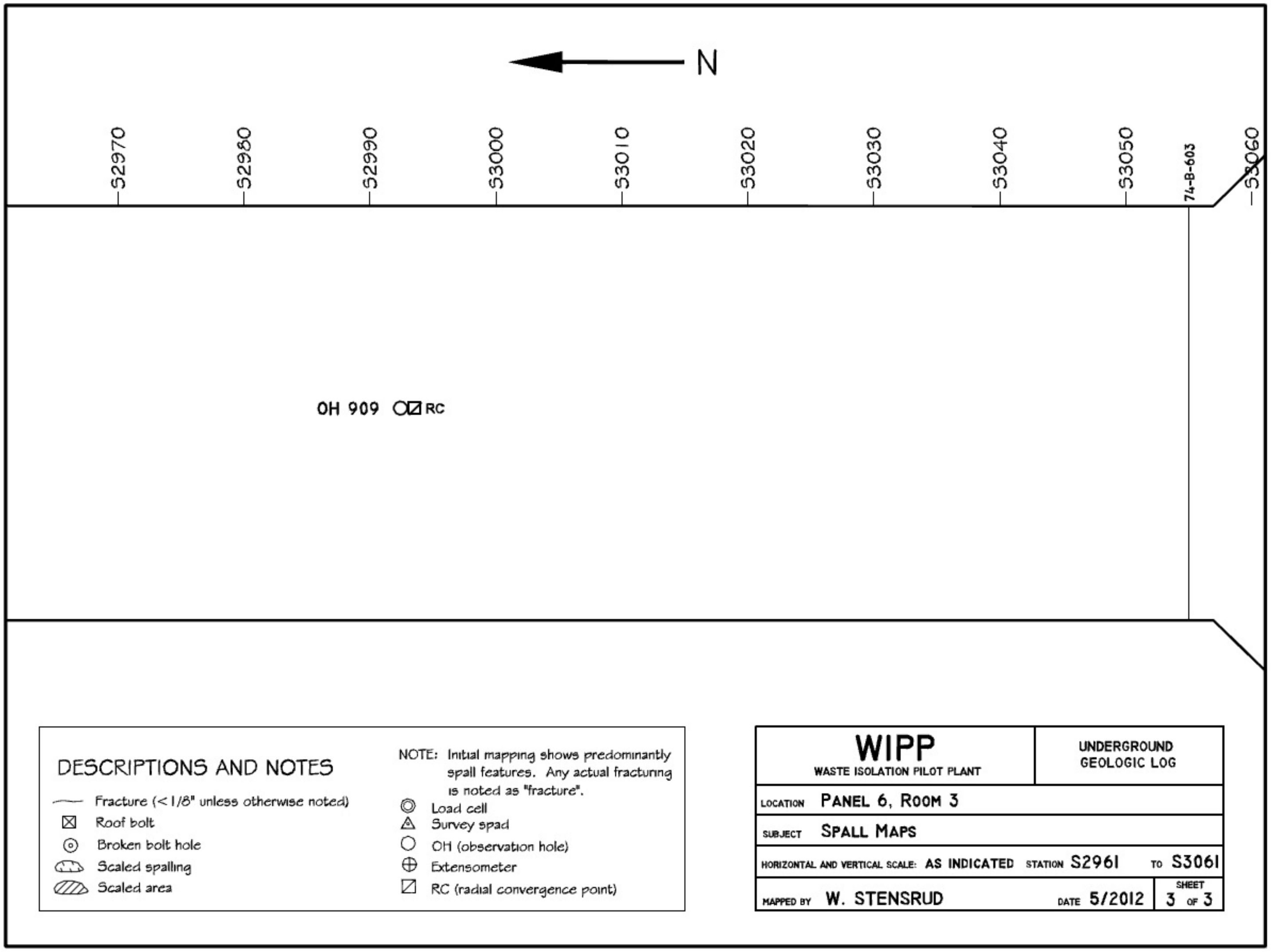


Figure 7-9
Panel 6 Room 3, S2961-S3061 Roof Fractures

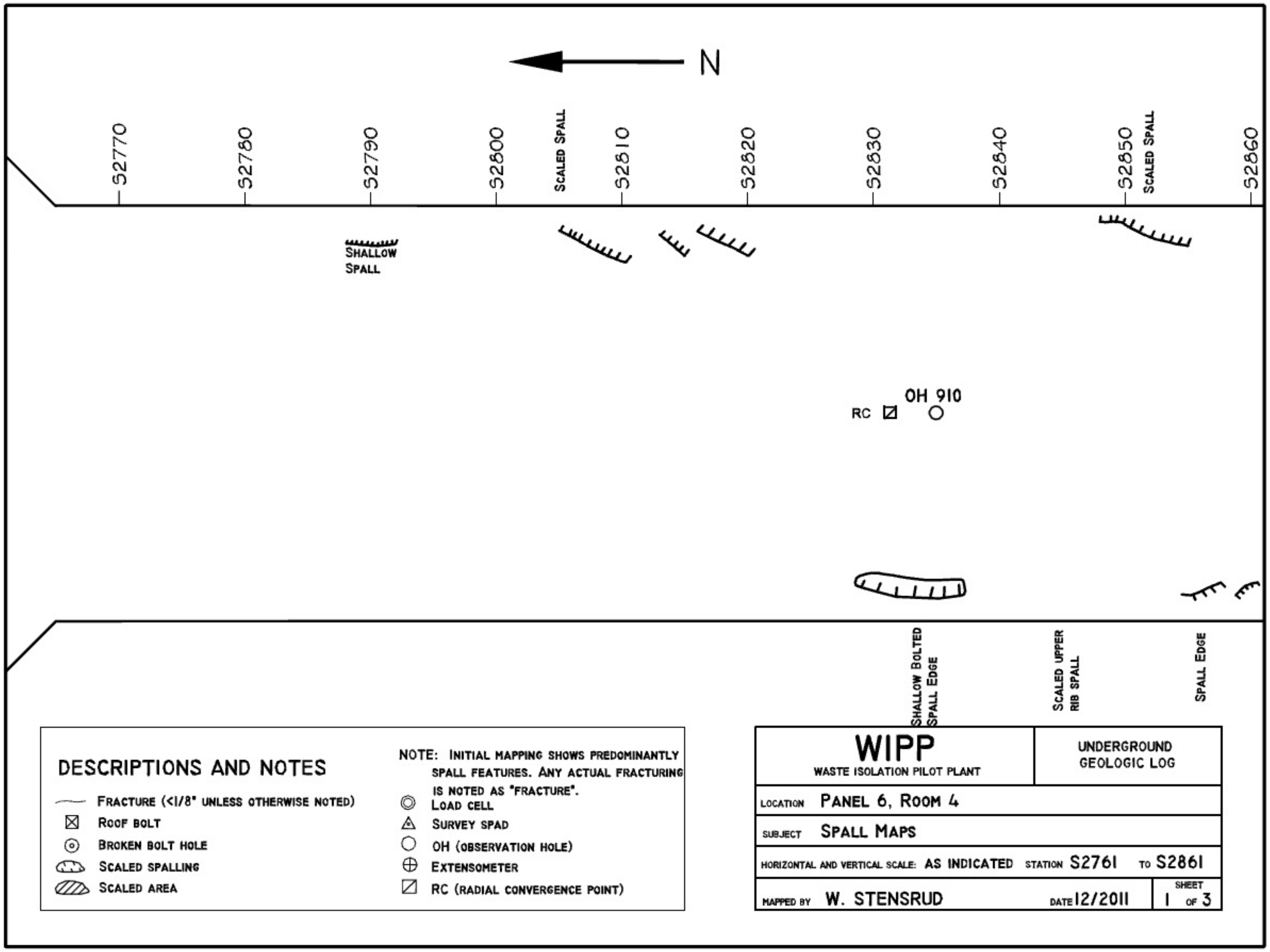


Figure 7-10
Panel 6 Room 4, S2761-S2861 Roof Fractures

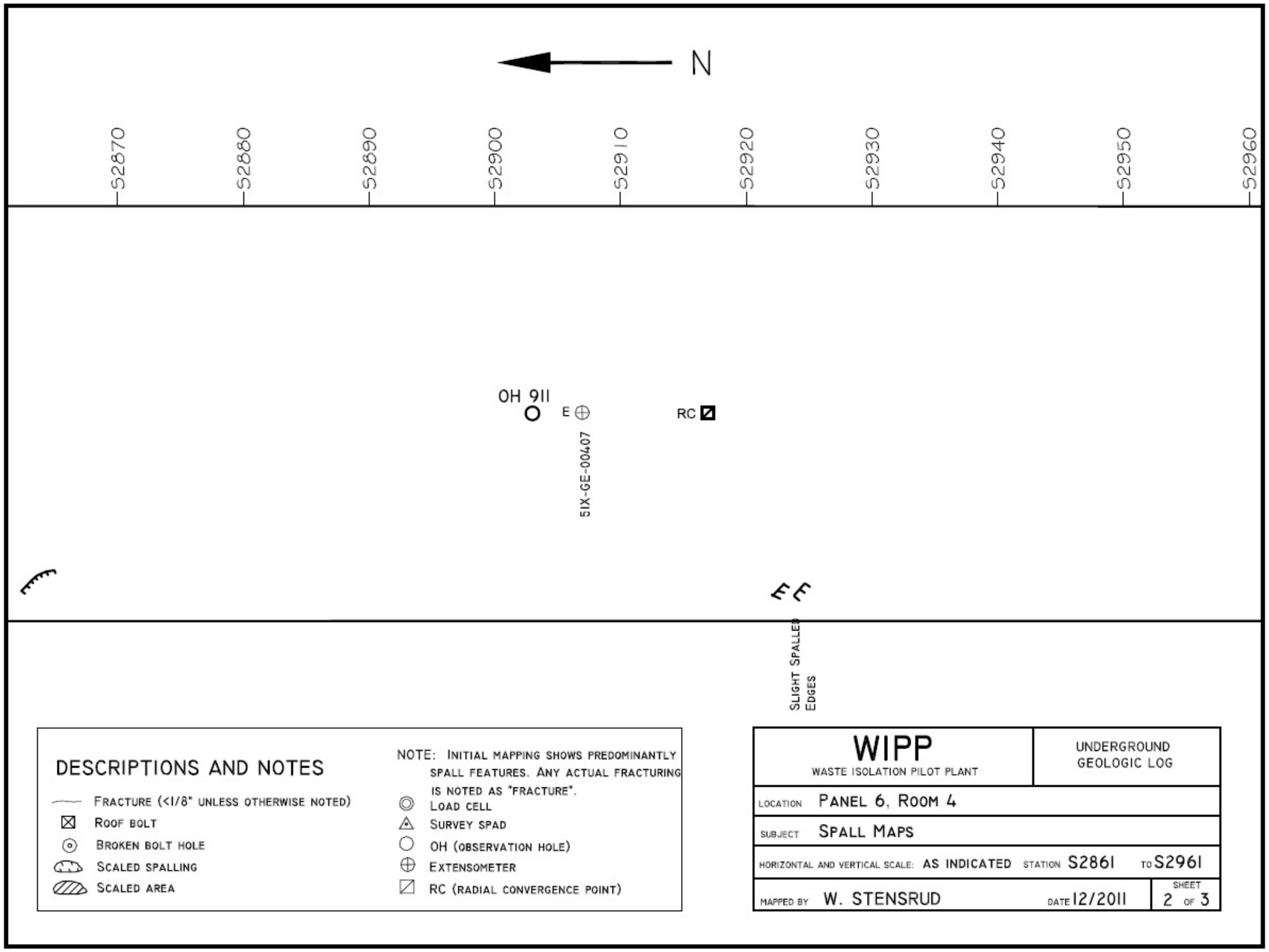


Figure 7-11
Panel 6 Room 4, S2861-S2961 Roof Fractures

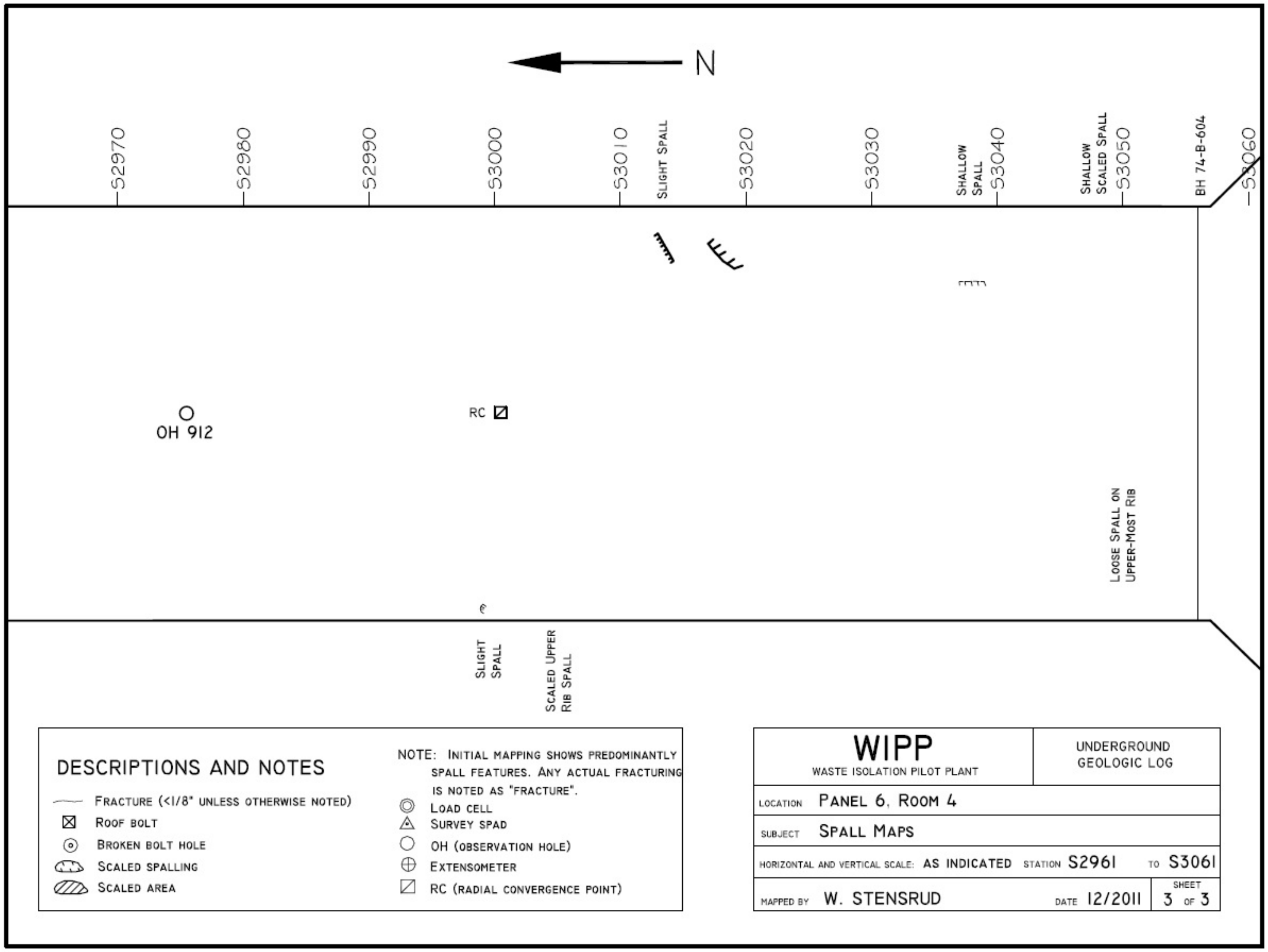


Figure 7-12
Panel 6 Room 4, S2961-S3061 Roof Fractures

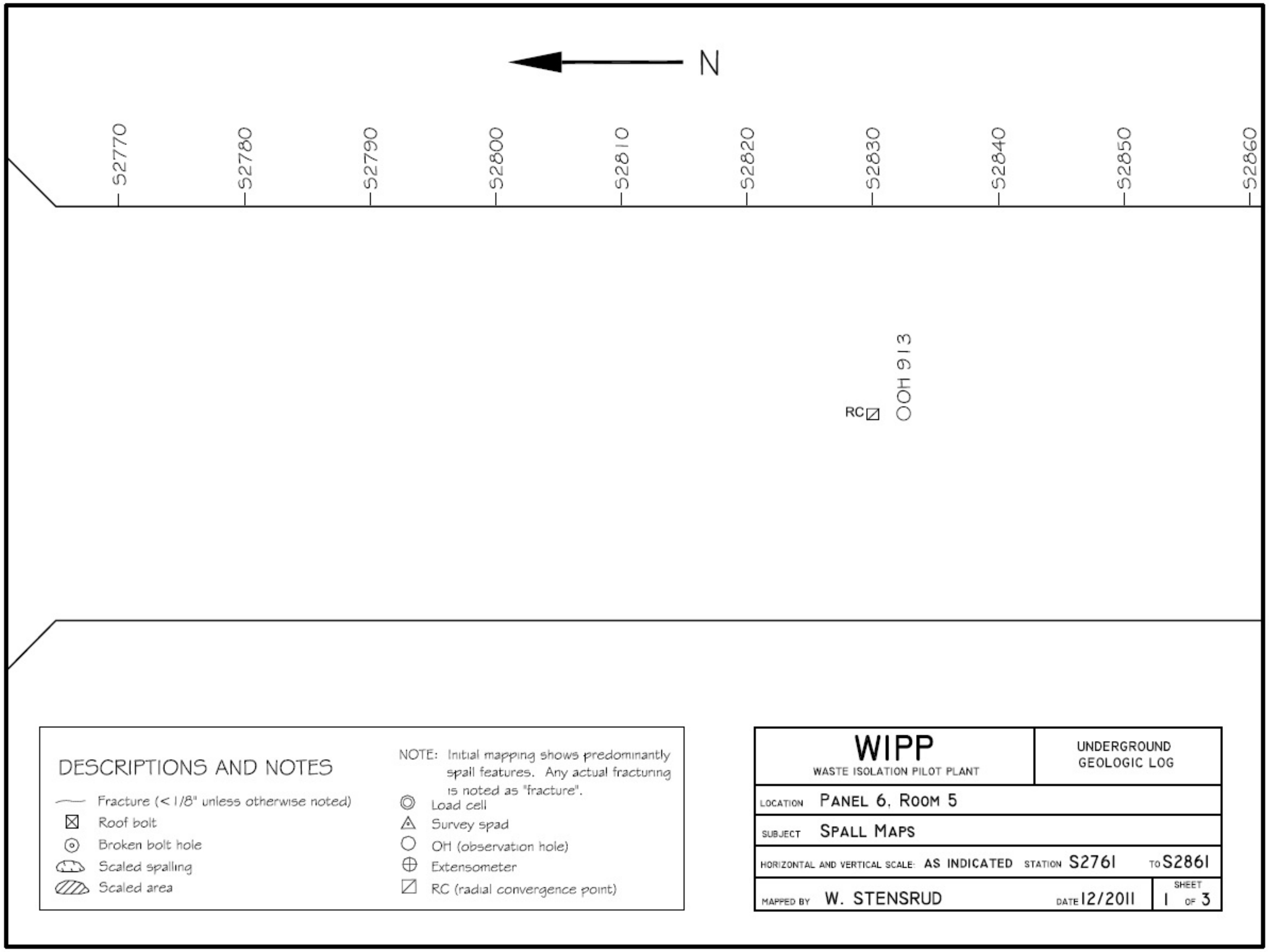


Figure 7-13
Panel 6 Room 5, S2761-S2861 Roof Fractures

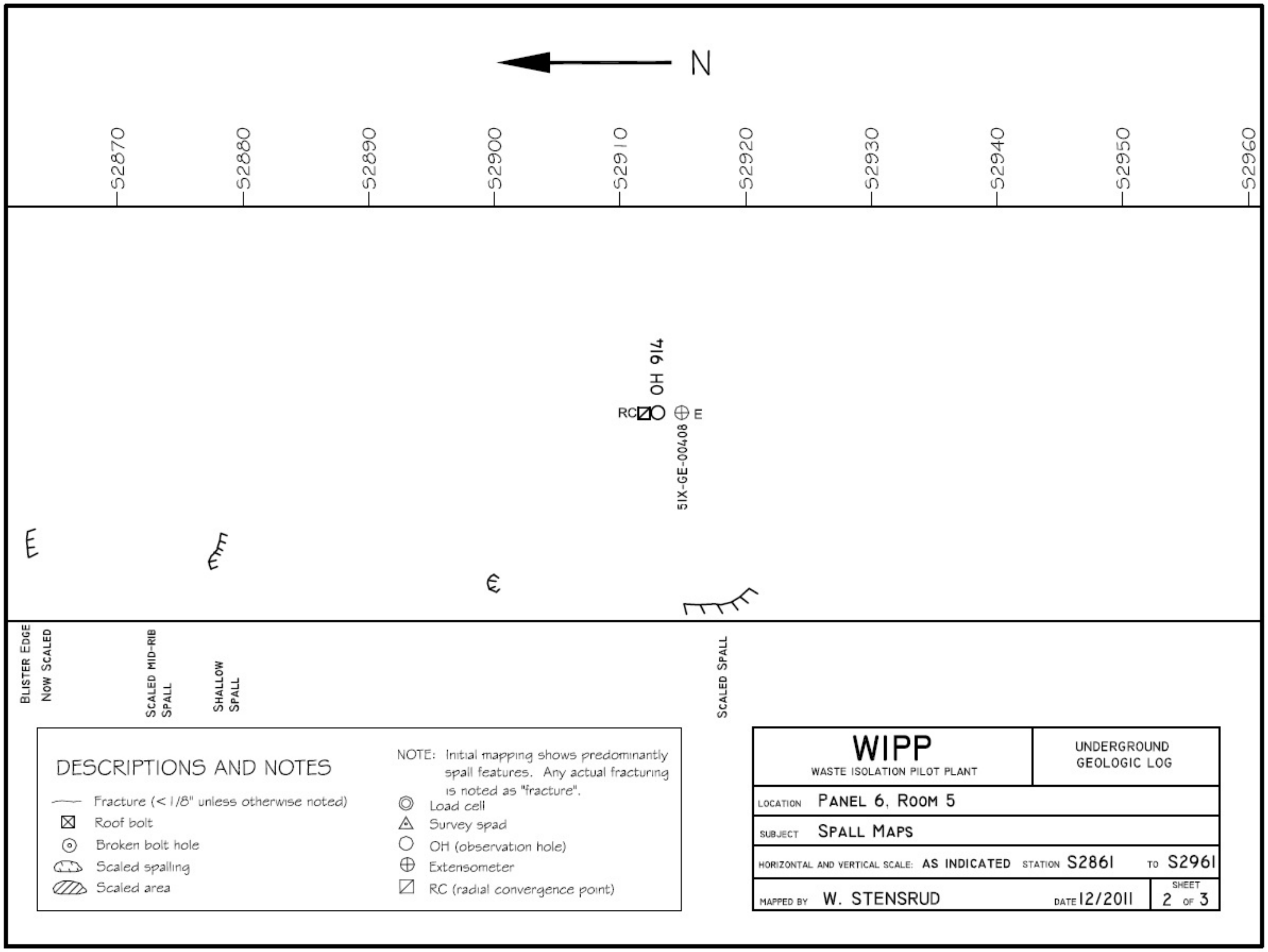


Figure 7-14
Panel 6 Room 5, S2861-S2961 Roof Fractures

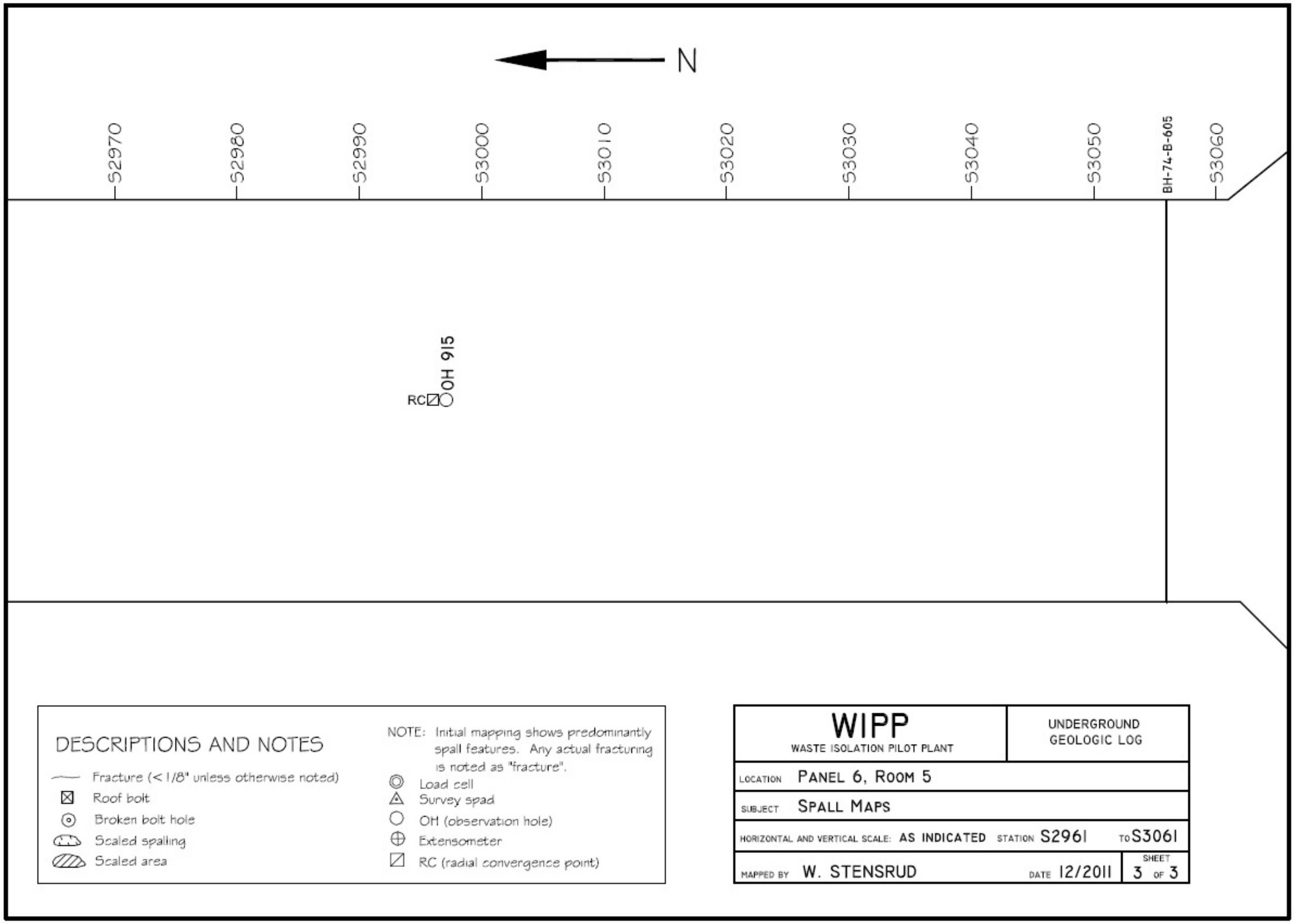


Figure 7-15
Panel 6 Room 5, S2961-S3061 Roof Fractures

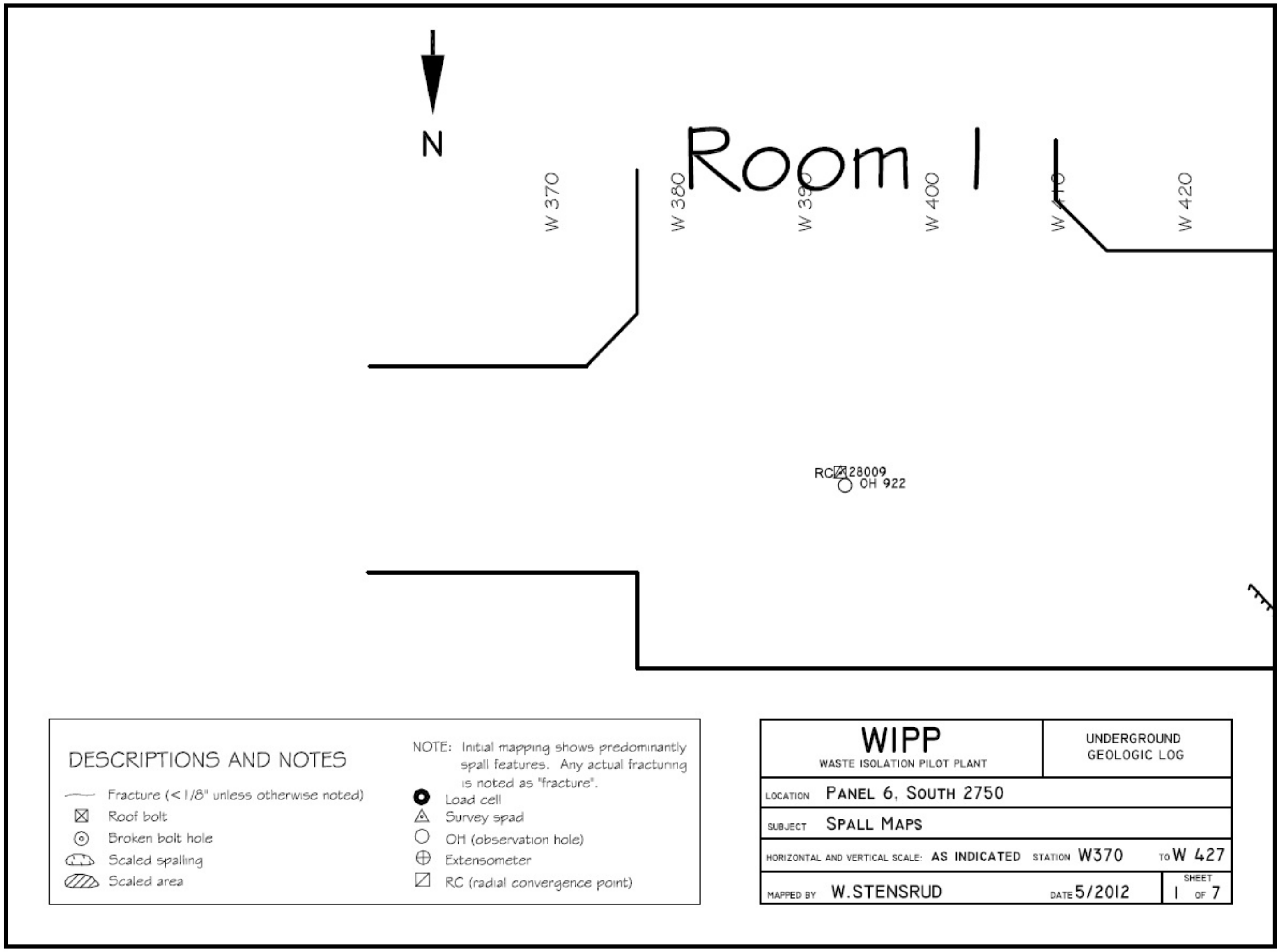


Figure 7-16
Panel 6 South 2750, W370-W427 Roof Fractures

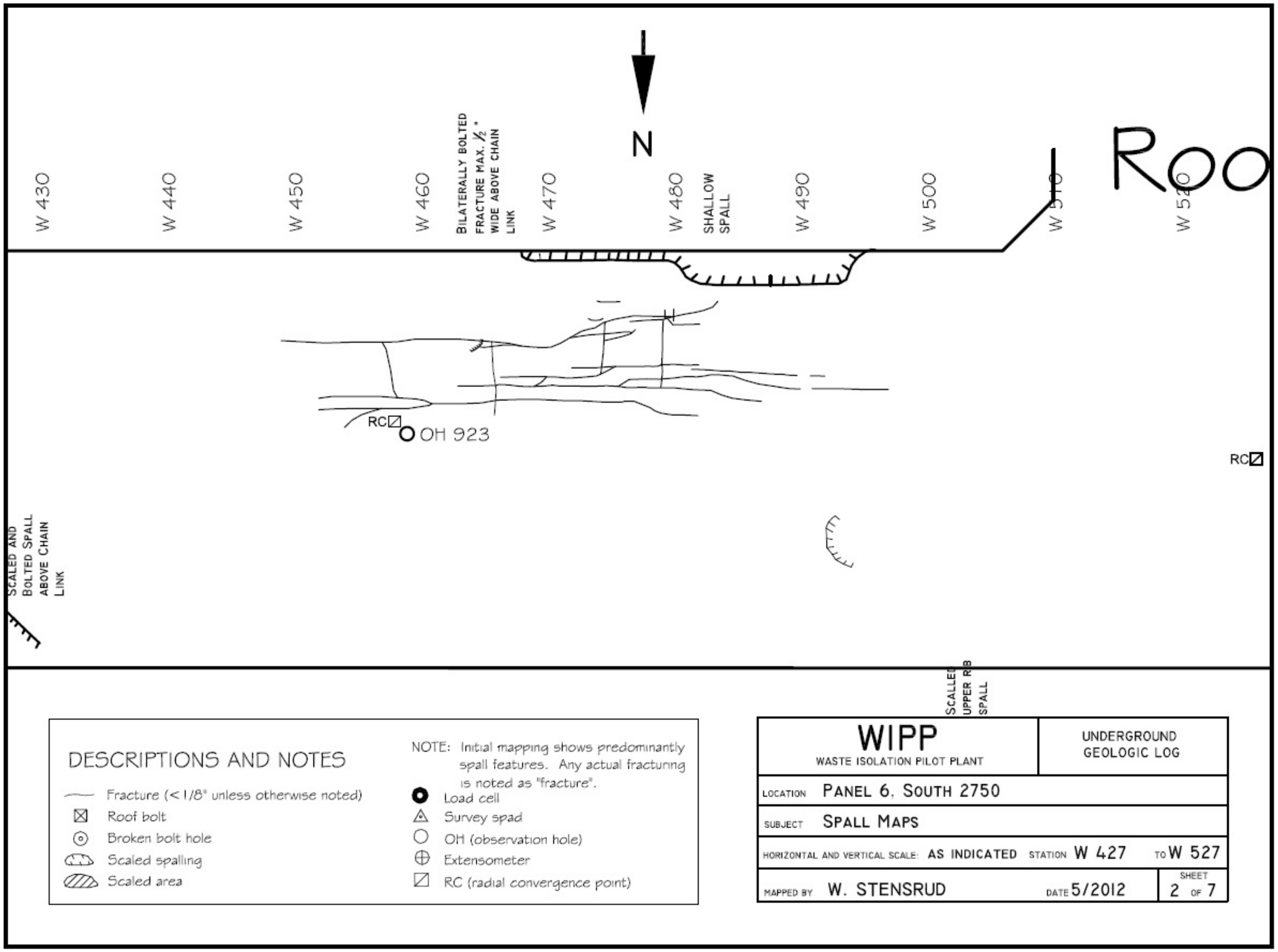


Figure 7-17
Panel 6 South 2750, W427-W527 Roof Fractures

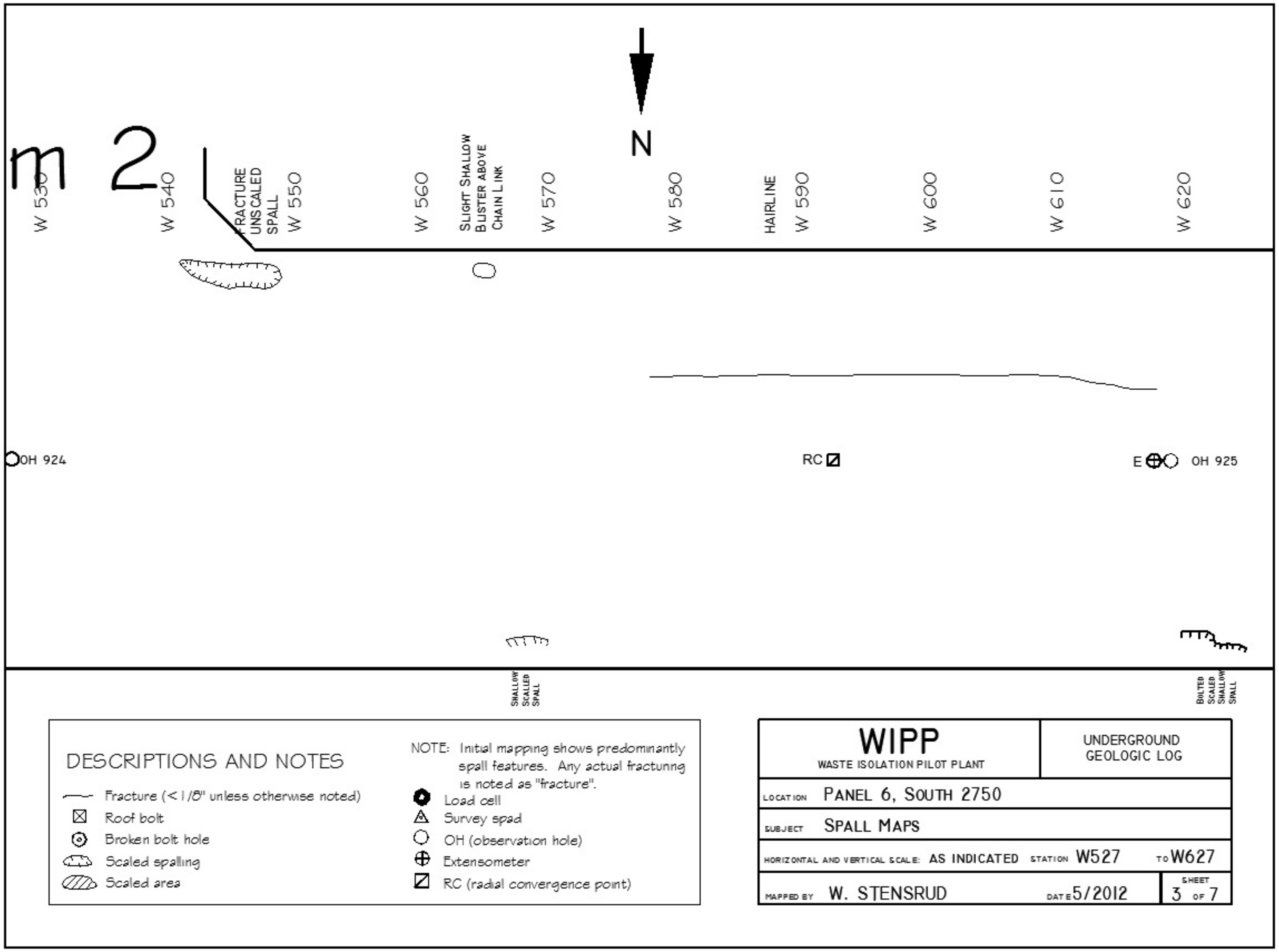


Figure 7-18
Panel 6 South 2750, W527-W627 Roof Fractures

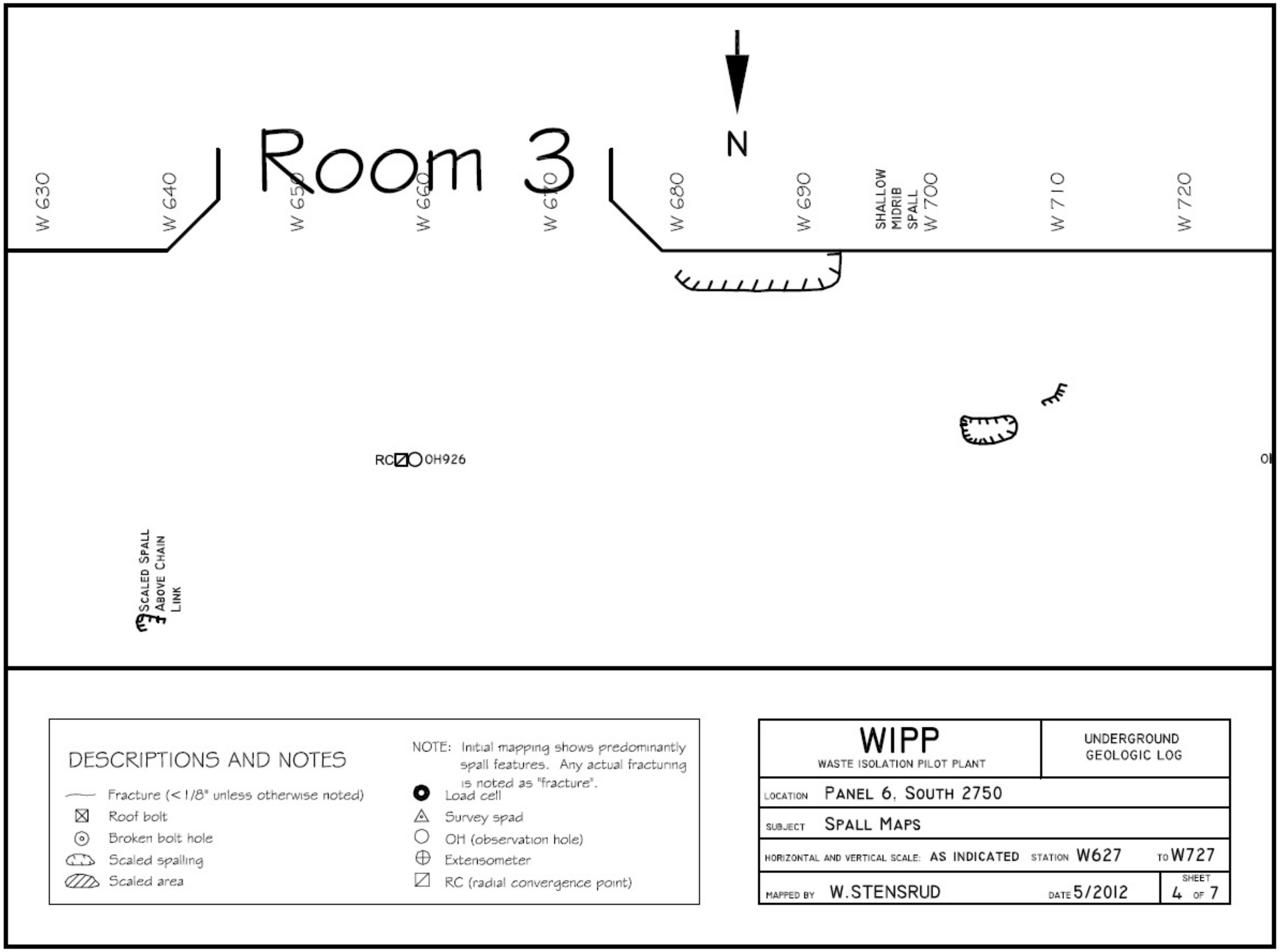


Figure 7-19
Panel 6 South 2750, W627-W727 Roof Fractures

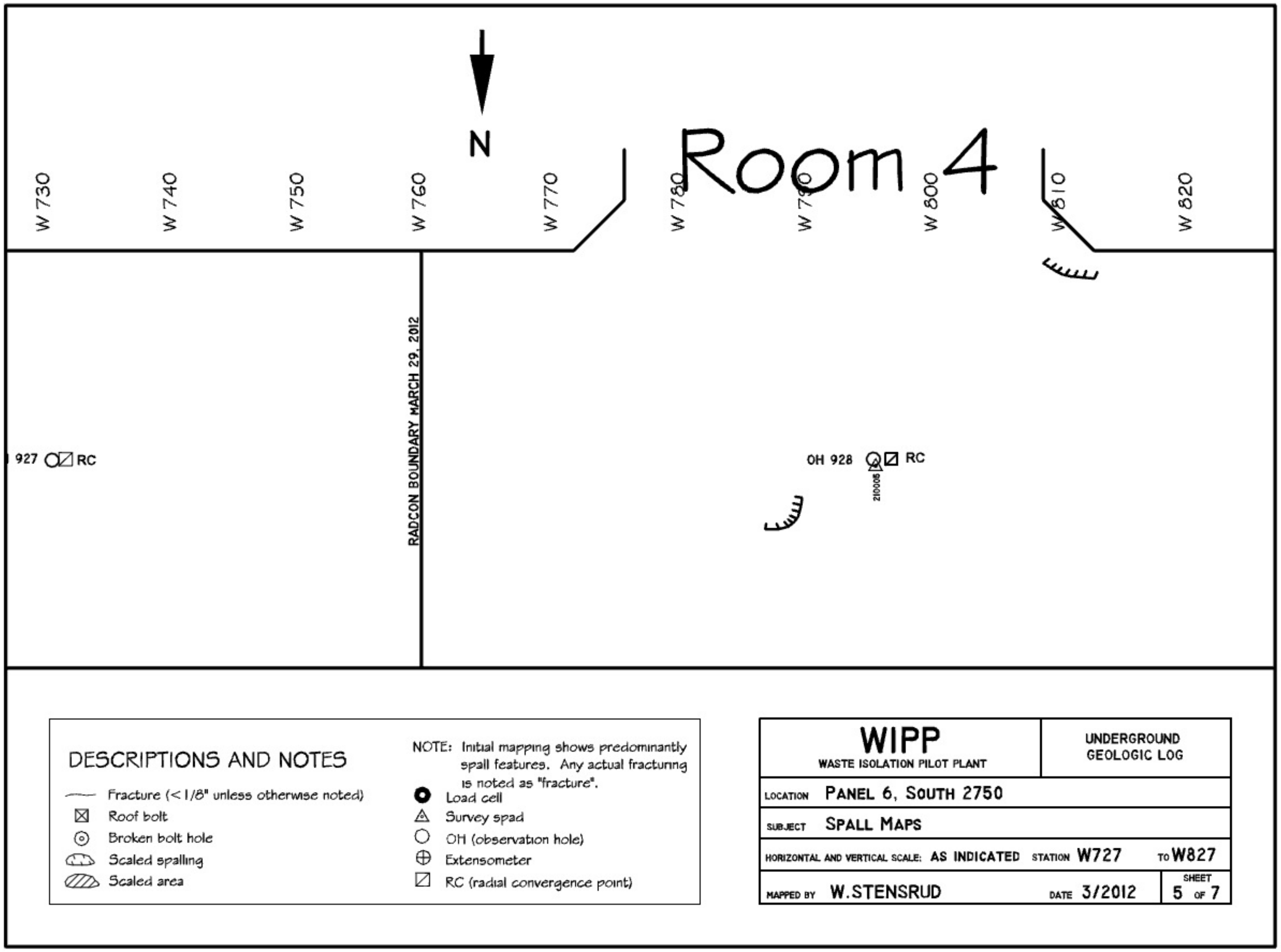


Figure 7-20
Panel 6 South 2750, W727-W827 Roof Fractures

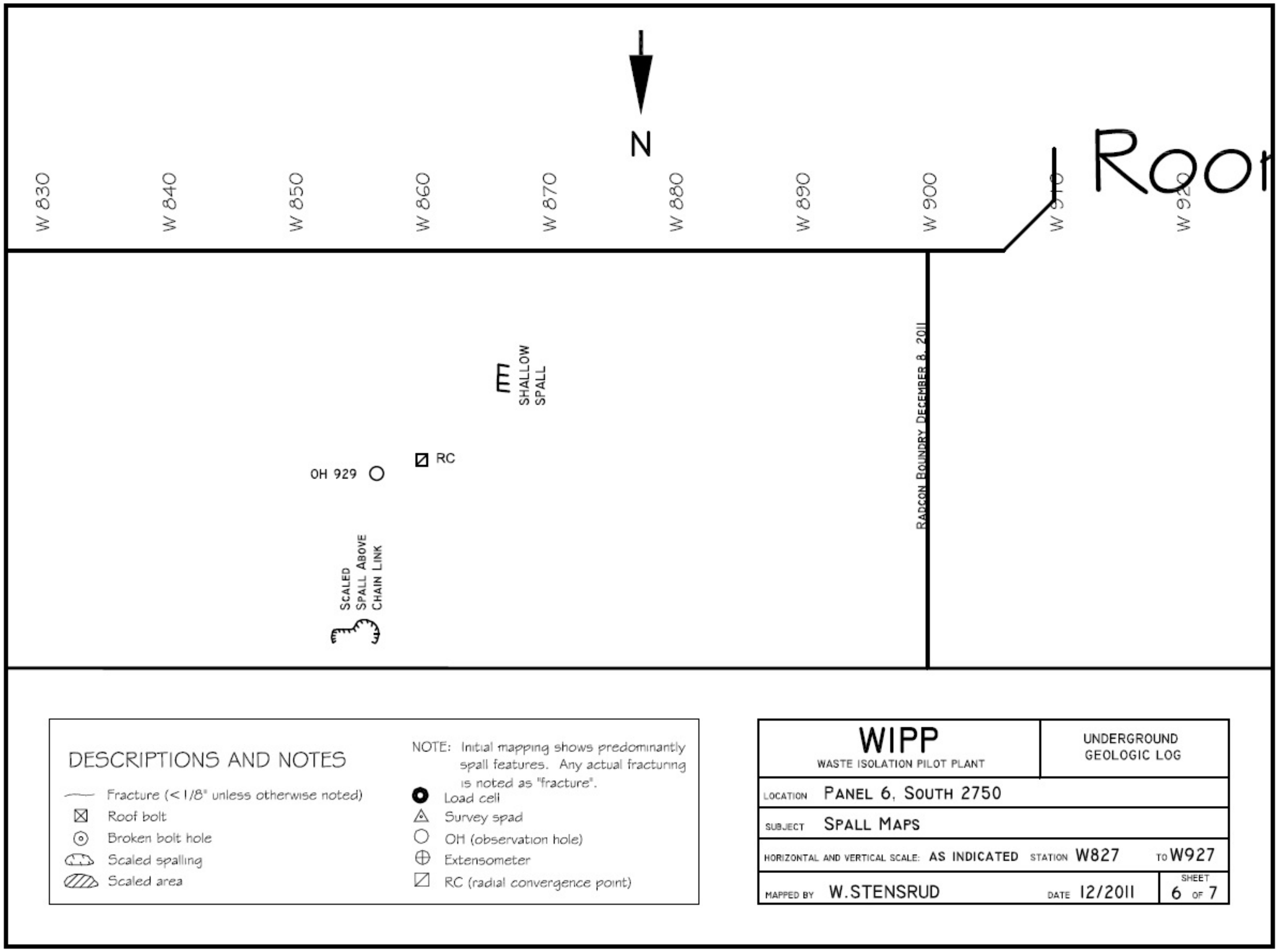


Figure 7-21
Panel 6 South 2750, W827-W927 Roof Fractures

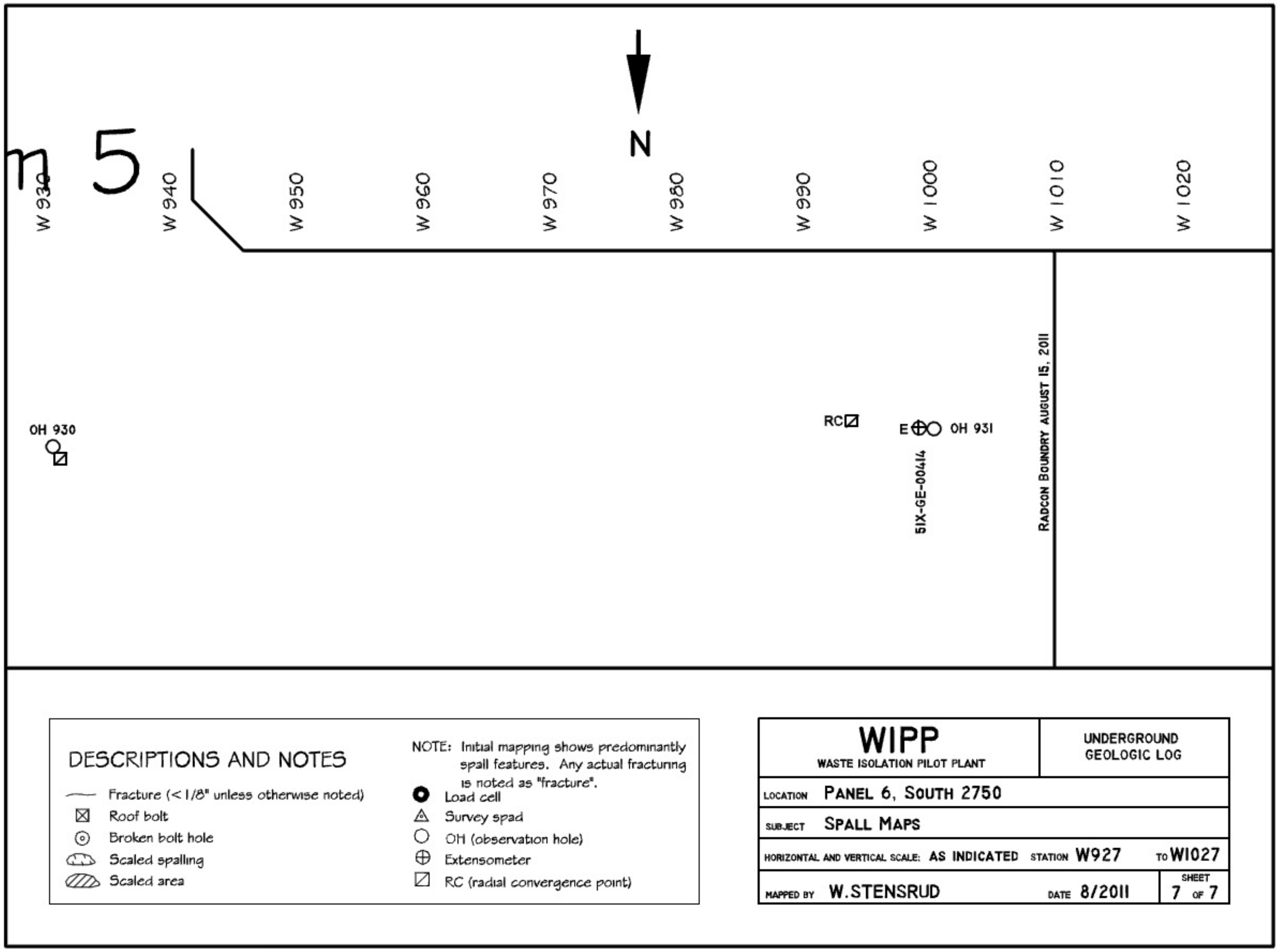


Figure 7-22
Panel 6 South 2750, W927-W1027 Roof Fractures

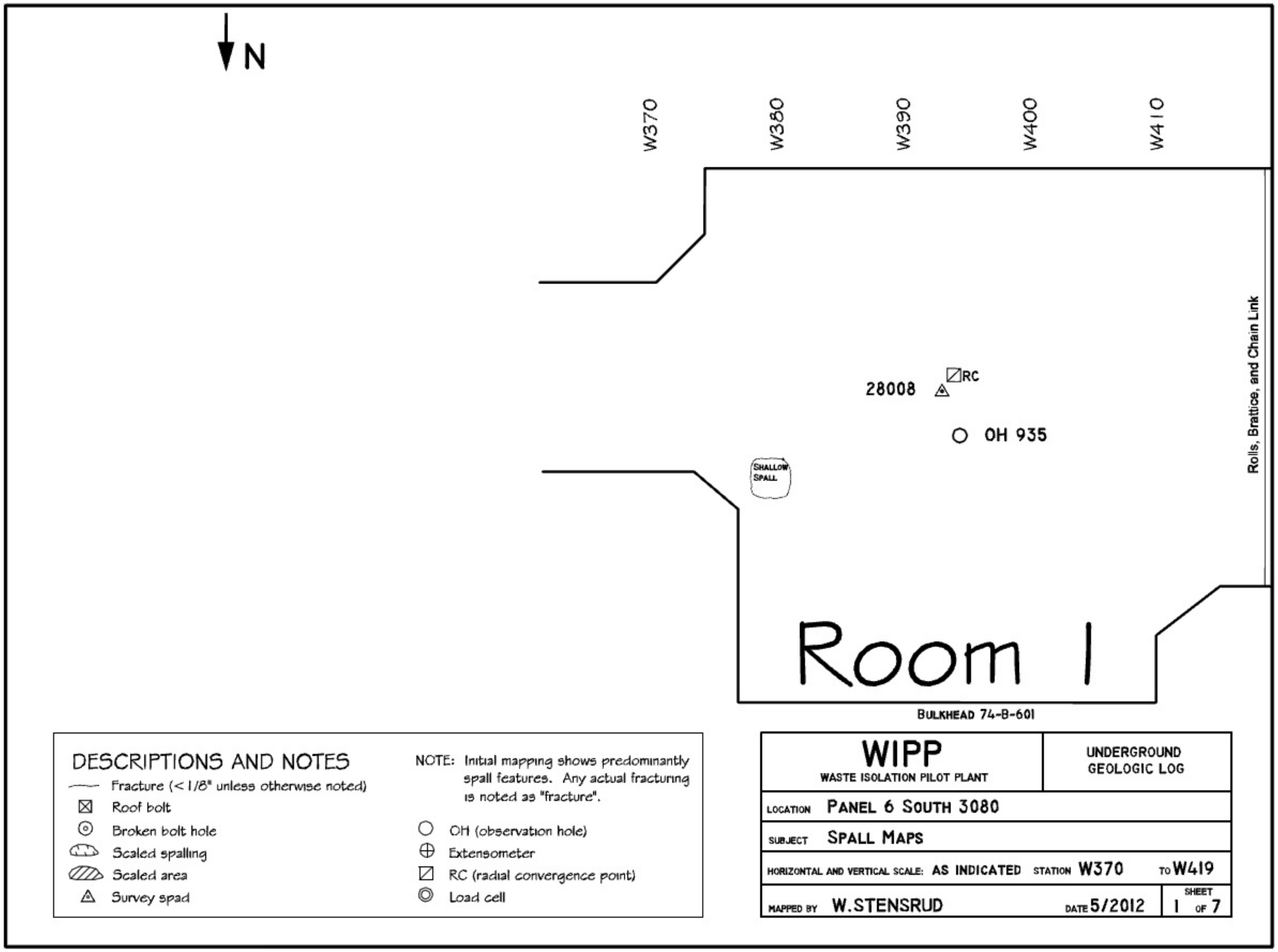


Figure 7-23
Panel 6 South 3080, W370-W419 Roof Fractures

Working Copy

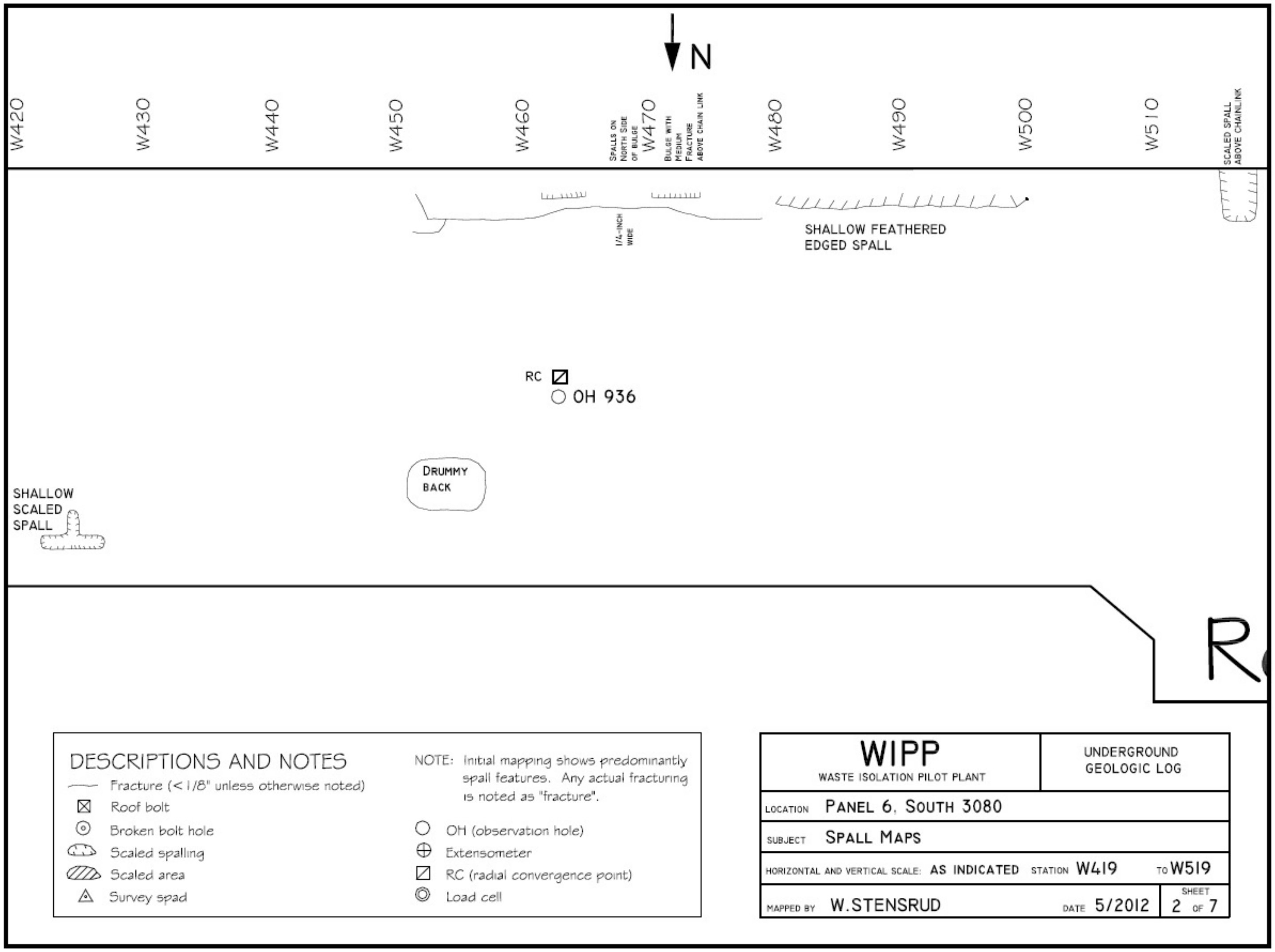


Figure 7-24
Panel 6 South 3080, W419-W519 Roof Fractures

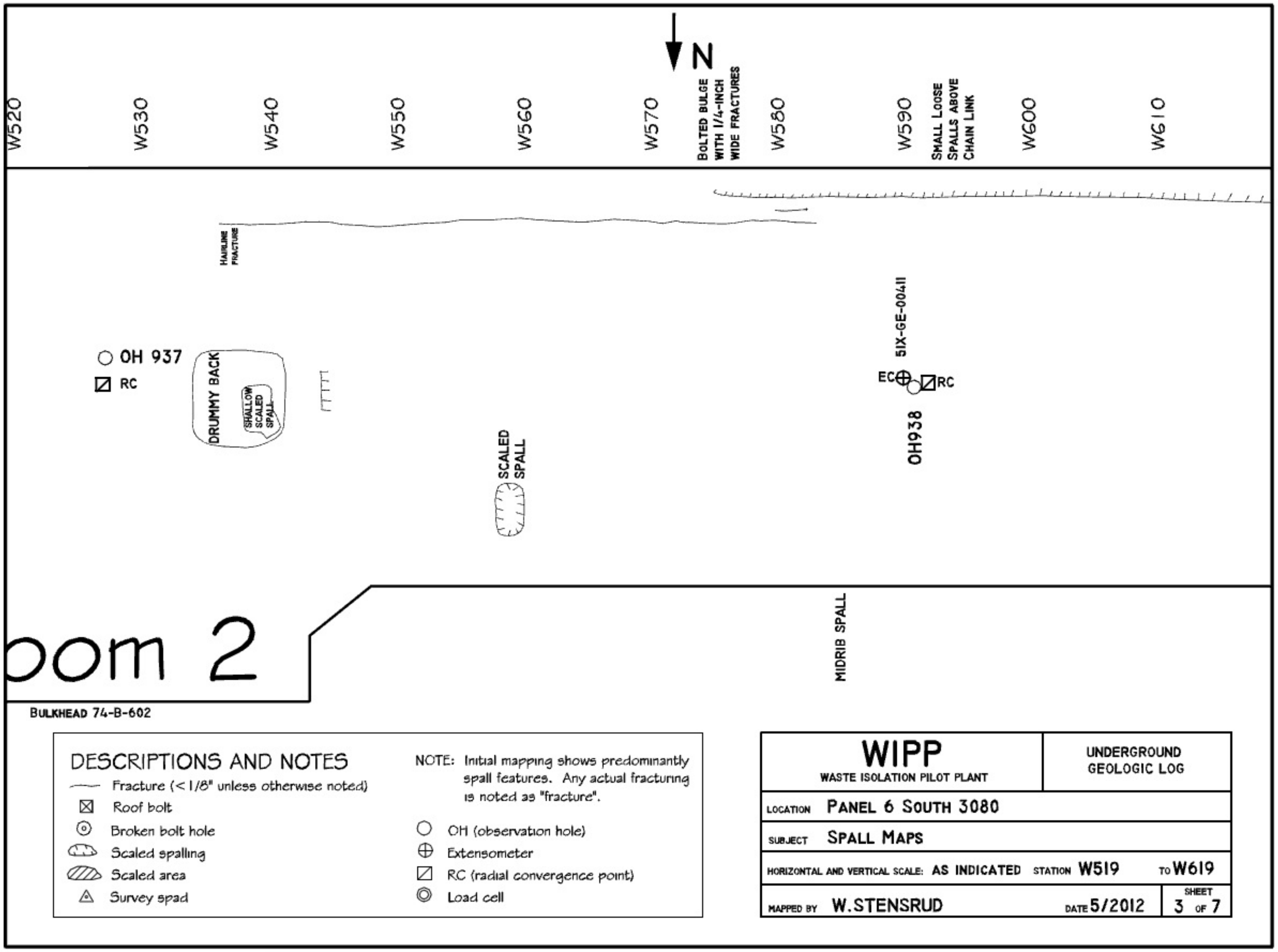


Figure 7-25
Panel 6 South 3080, W519-W619 Roof Fractures

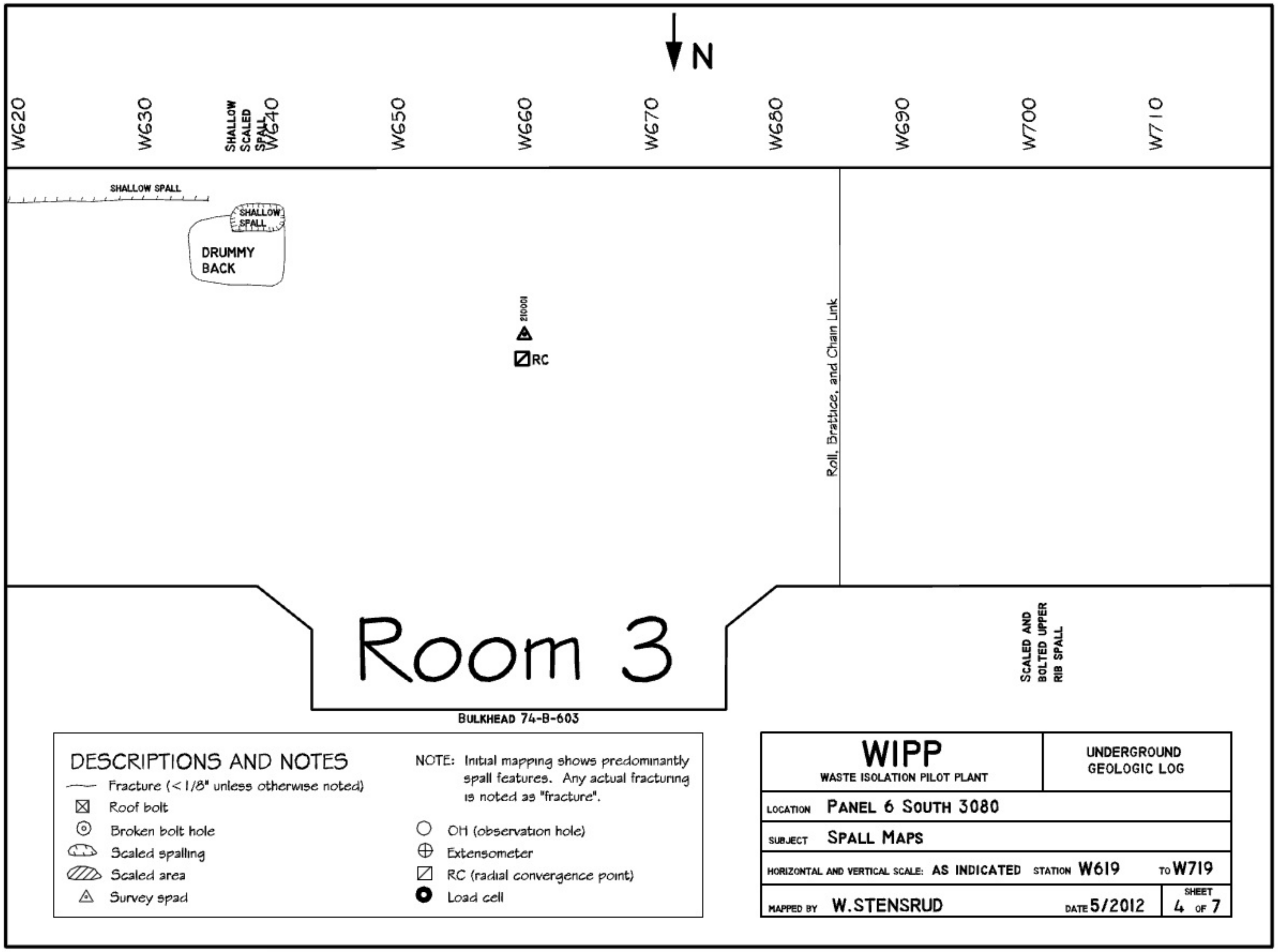


Figure 7-26
Panel 6 South 3080, W619-W719 Roof Fractures

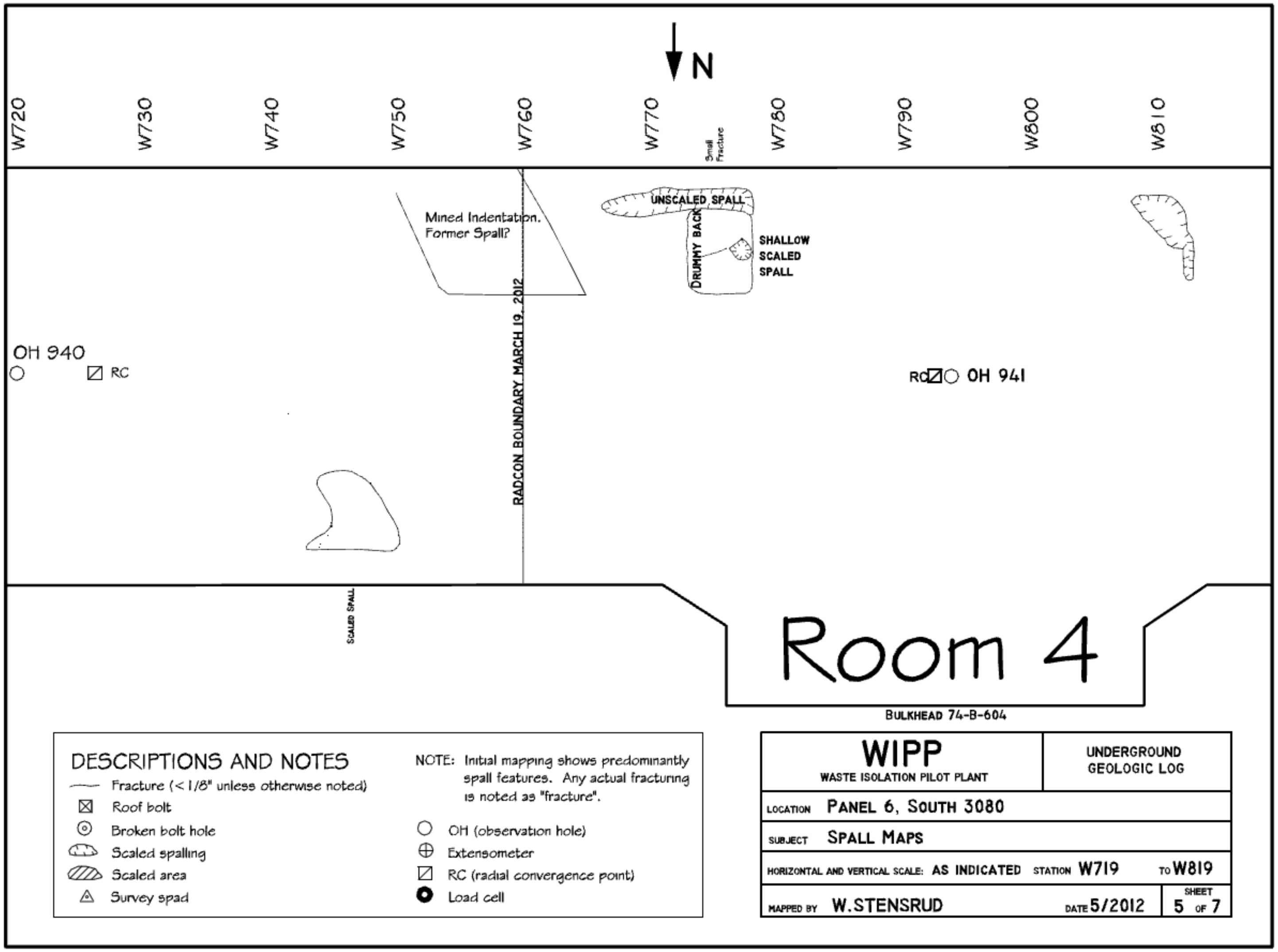


Figure 7-27
Panel 6 South 3080, W719-W819 Roof Fractures

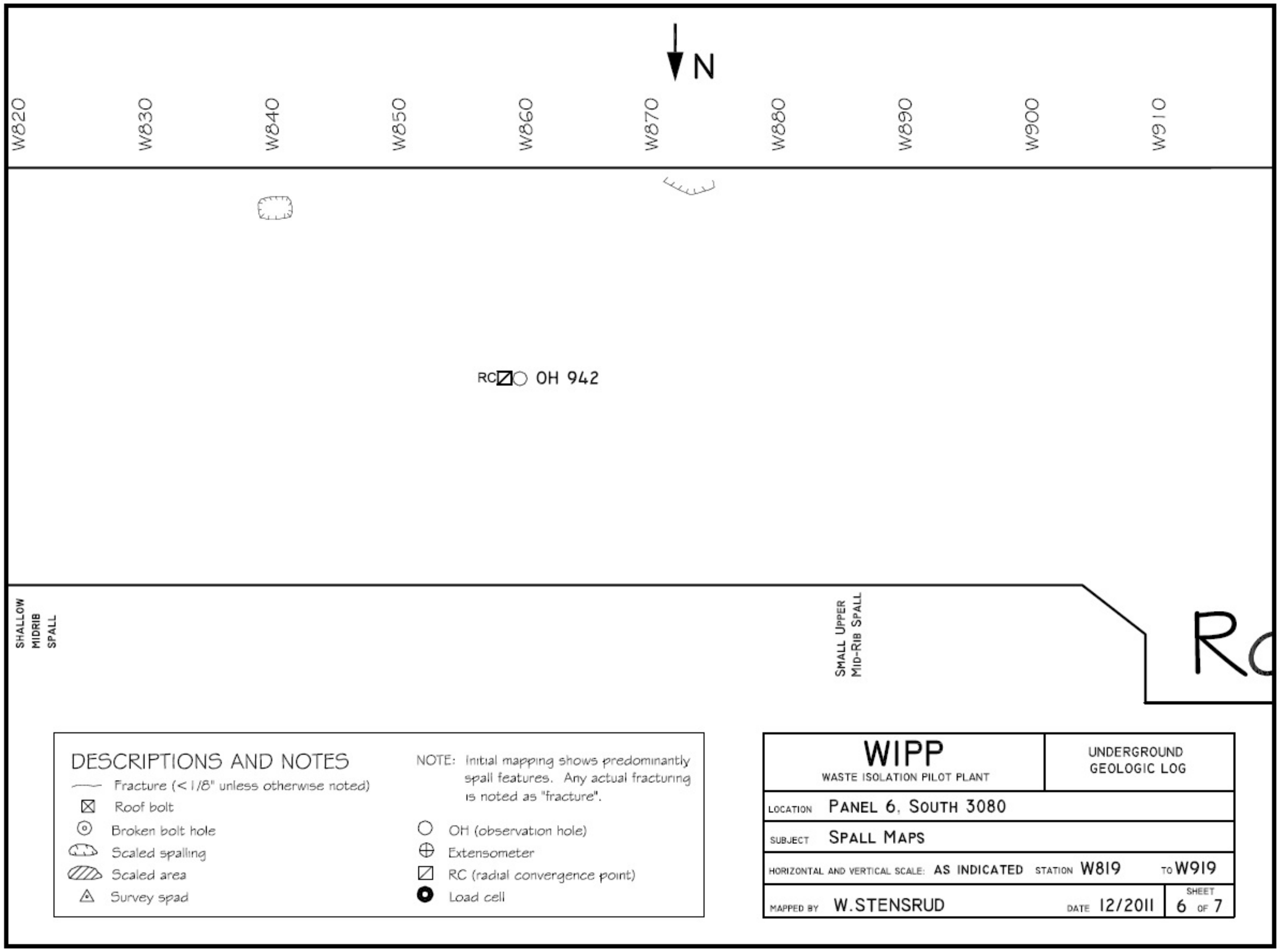


Figure 7-28
Panel 6 South 3080, W819-W919 Roof Fractures

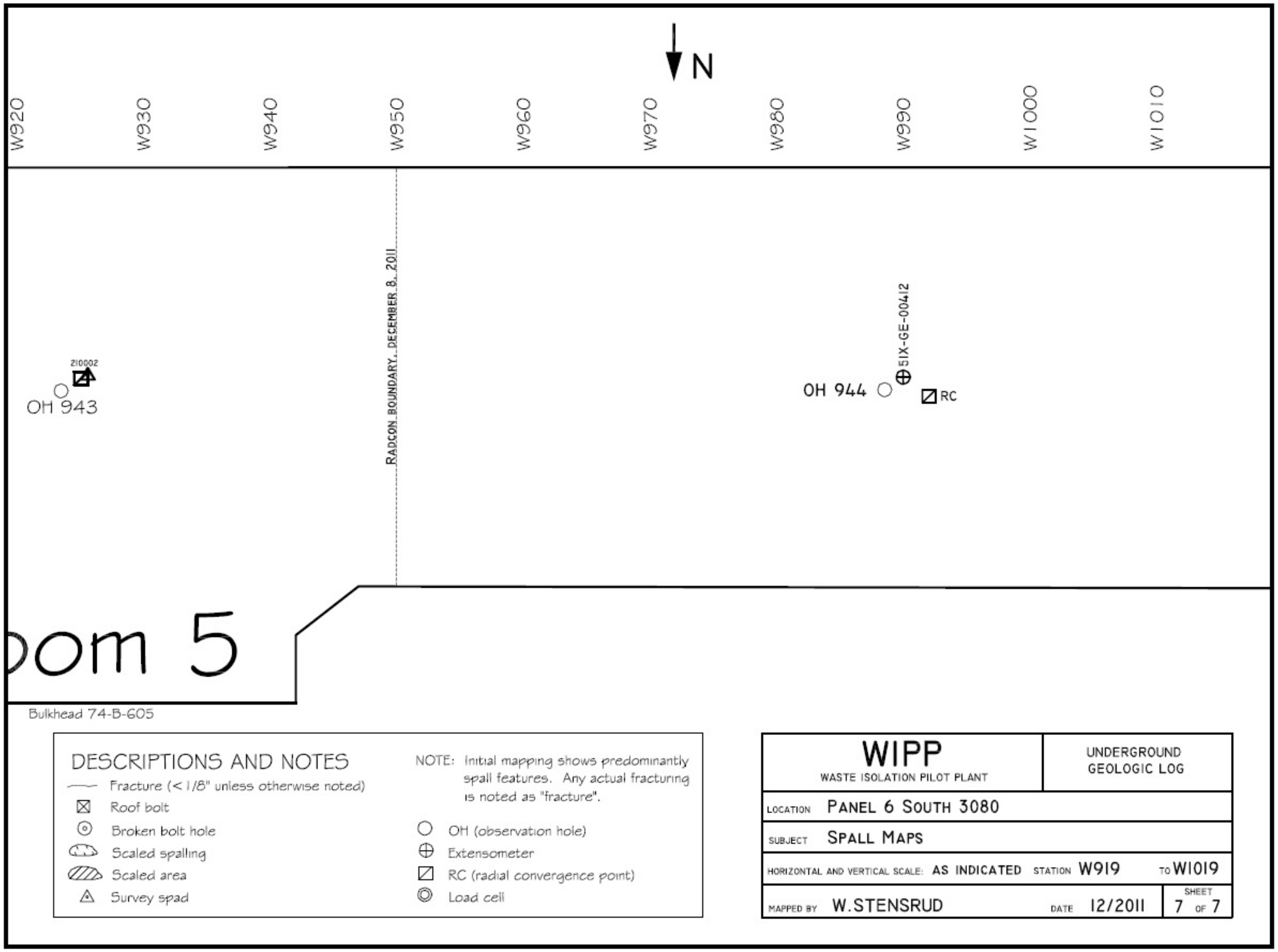


Figure 7-29
Panel 6 South 3080, W919-W1019 Roof Fractures

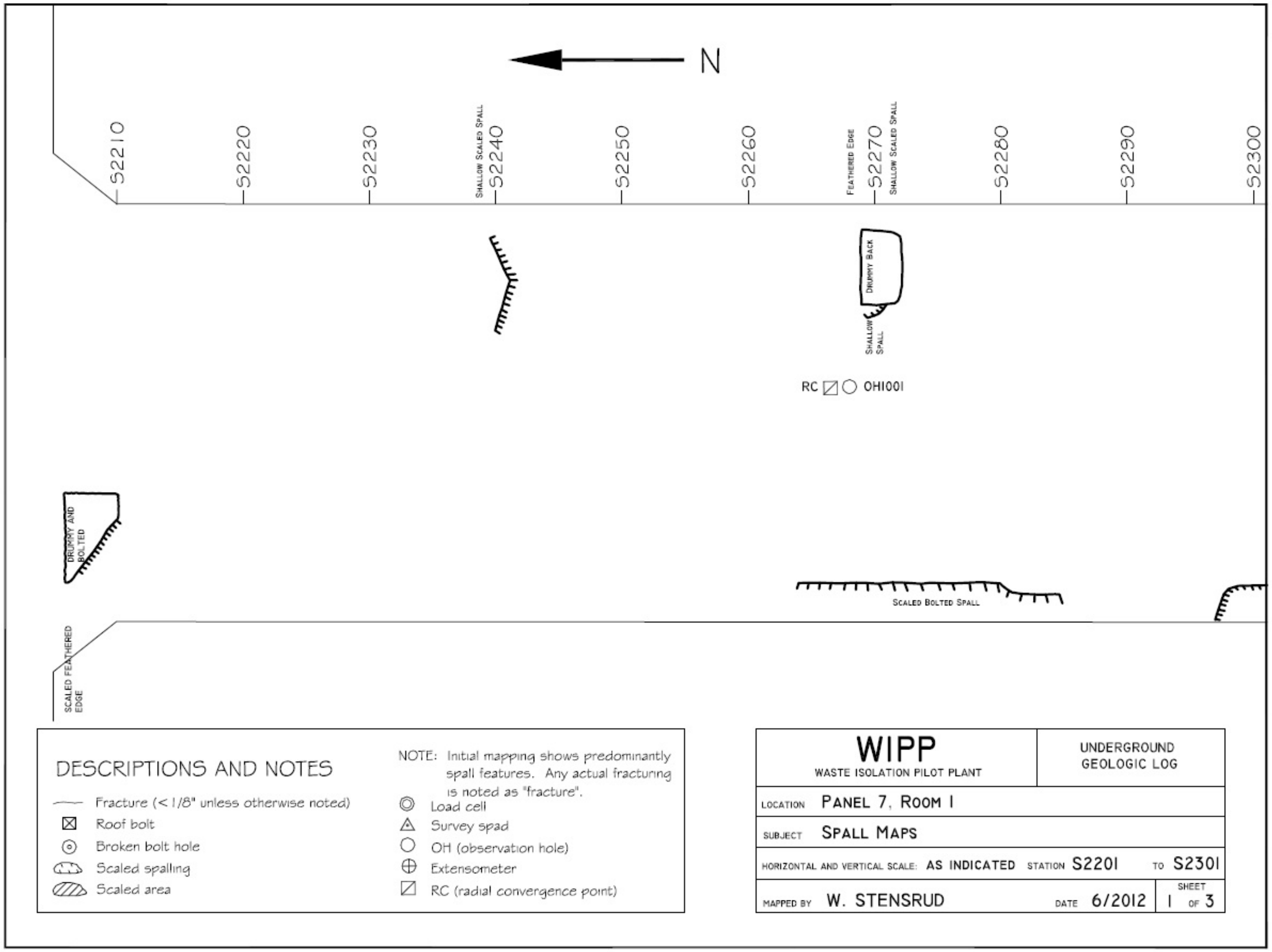


Figure 7-30
Panel 7 Room 1, S2201-S2301 Roof Fractures

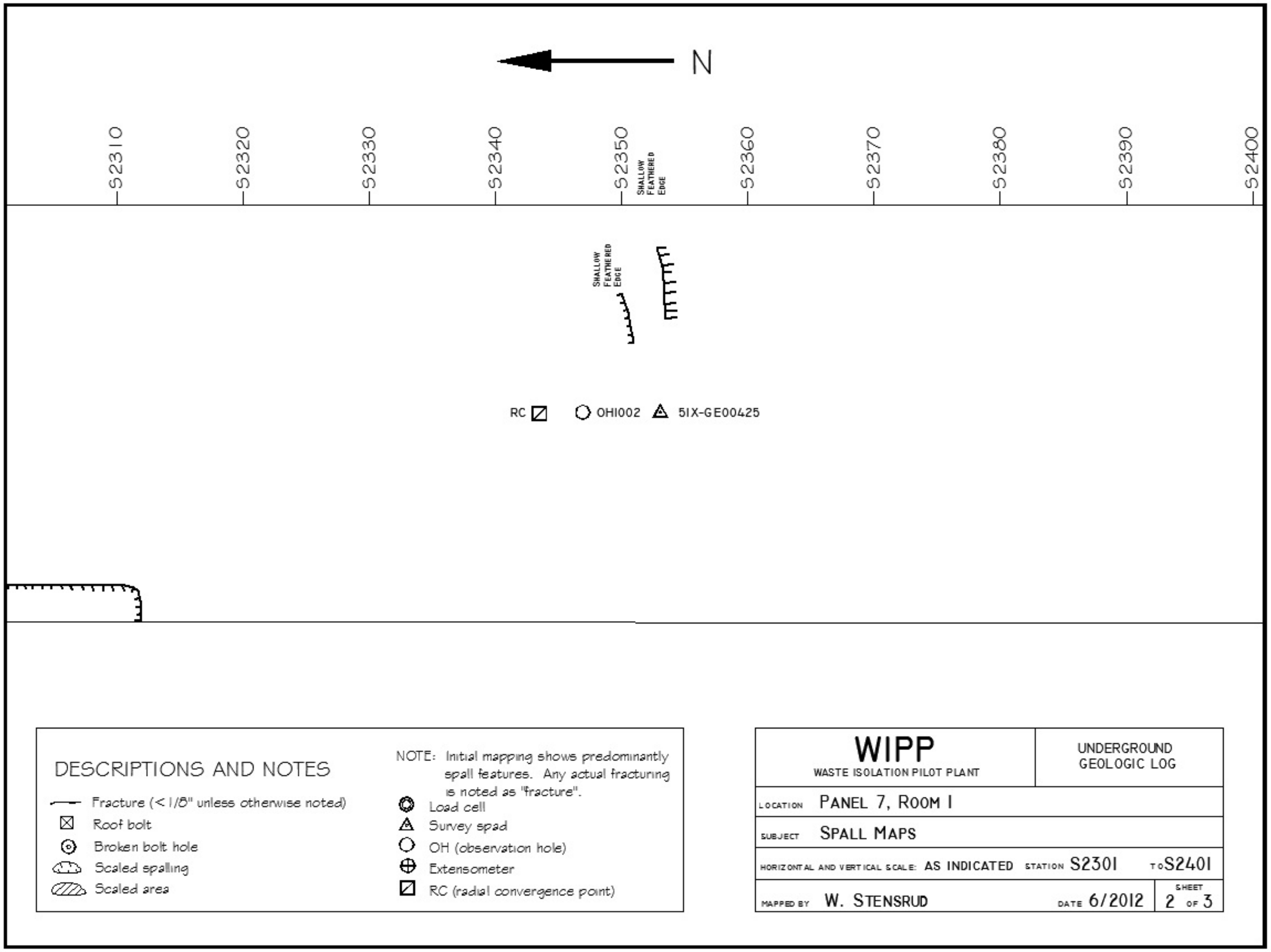


Figure 7-31
Panel 7 Room 1, S2301-S2401 Roof Fractures

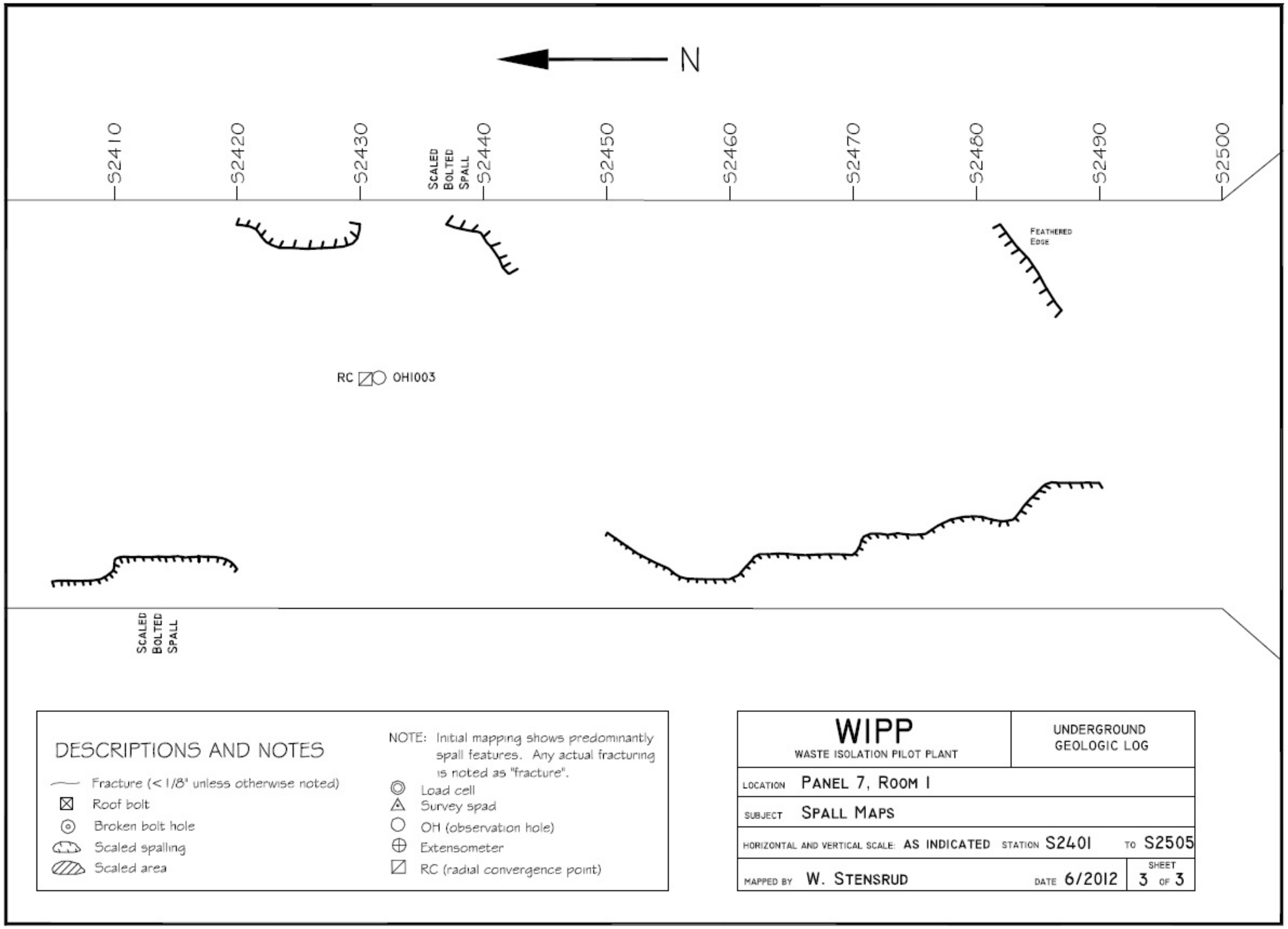


Figure 7-32
Panel 7 Room 1, S2401-S2505 Roof Fractures

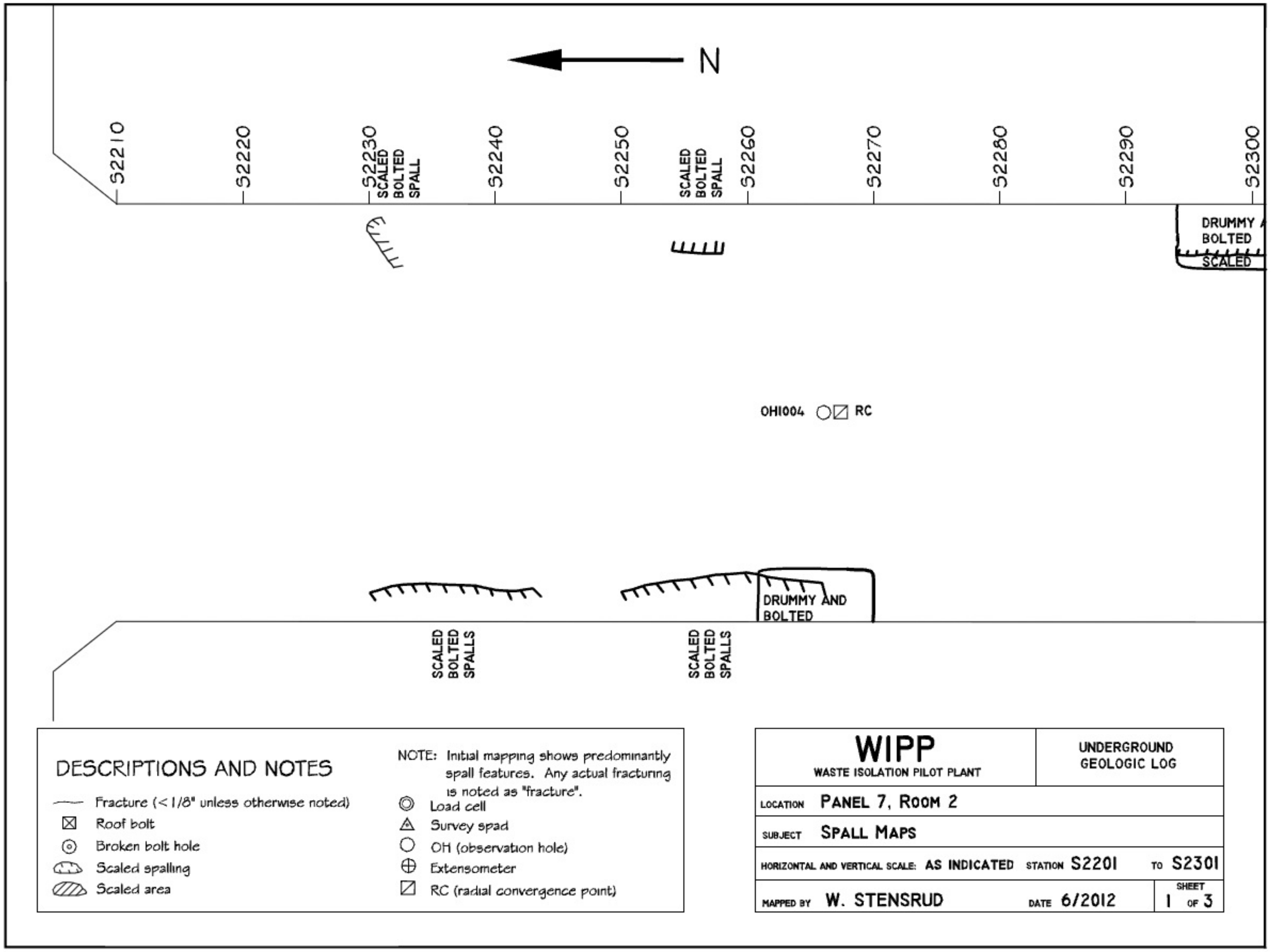


Figure 7-33
Panel 7 Room 2, S2201-S2301 Roof Fractures

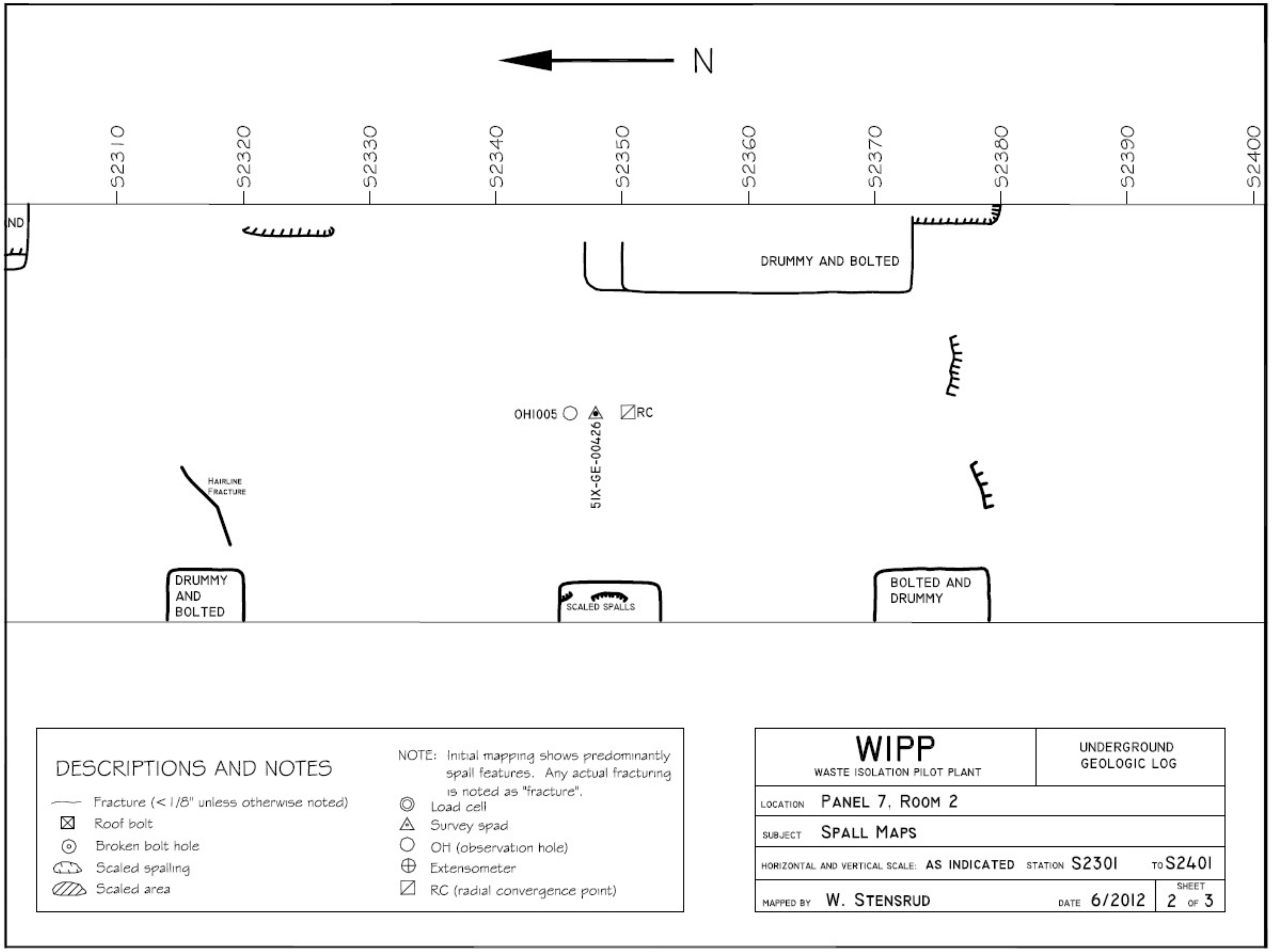


Figure 7-34
Panel 7 Room 2, S2301-S2401 Roof Fractures

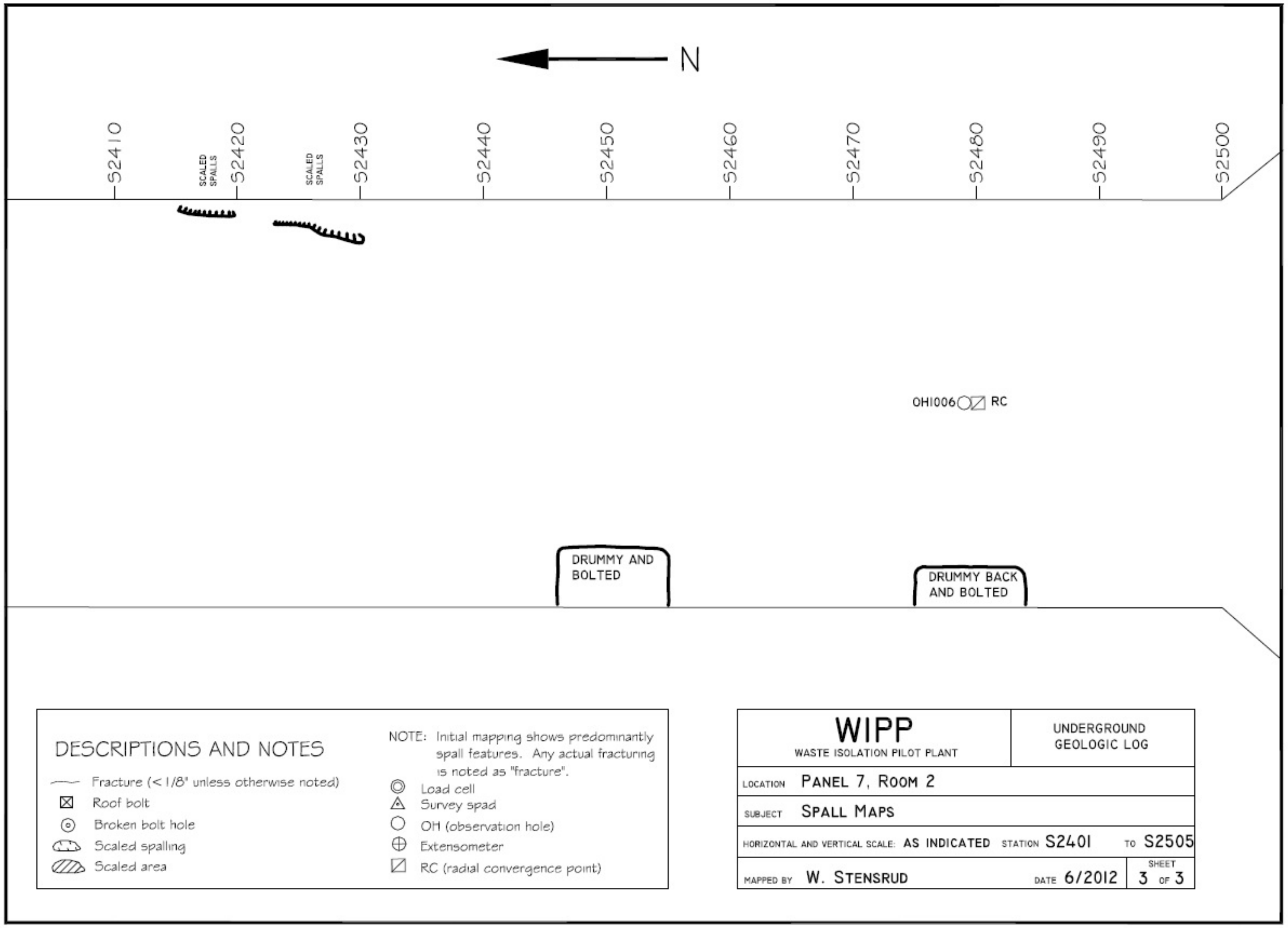


Figure 7-35
Panel 7 Room 2, S2401-S2505 Roof Fractures

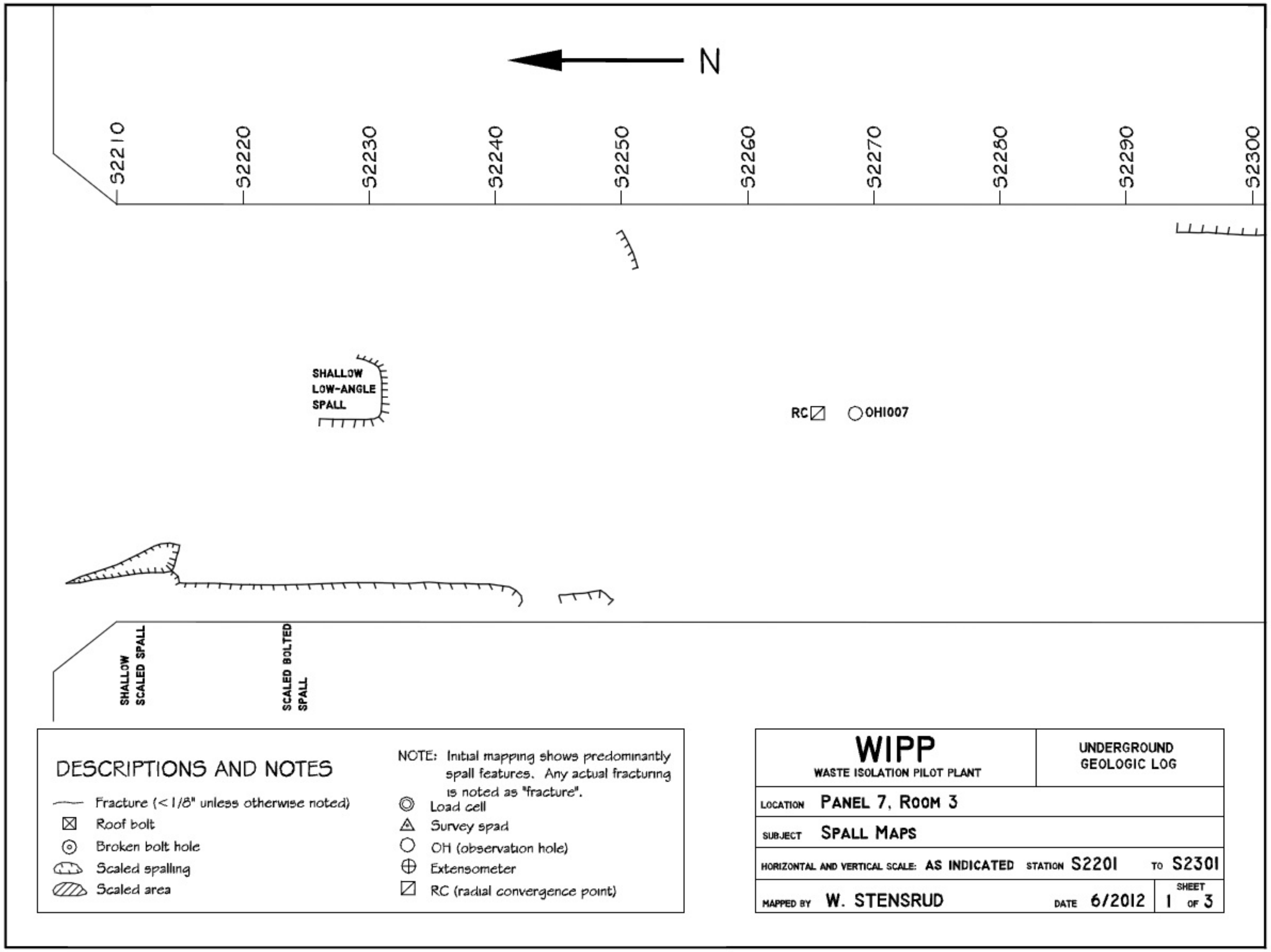


Figure 7-36
Panel 7 Room 3, S2201-S2301 Roof Fractures

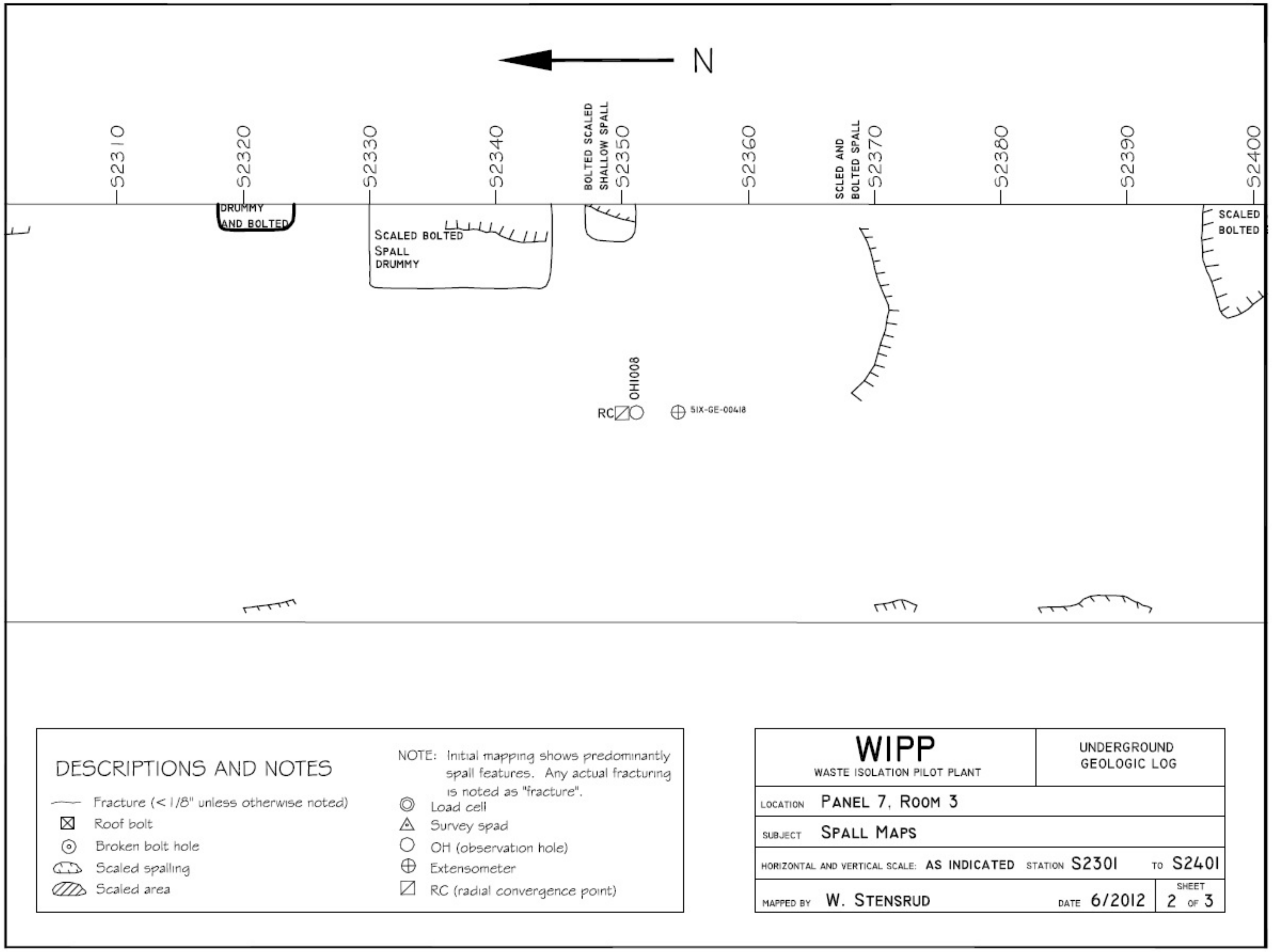


Figure 7-37
Panel 7 Room 3, S2301-S2401 Roof Fractures

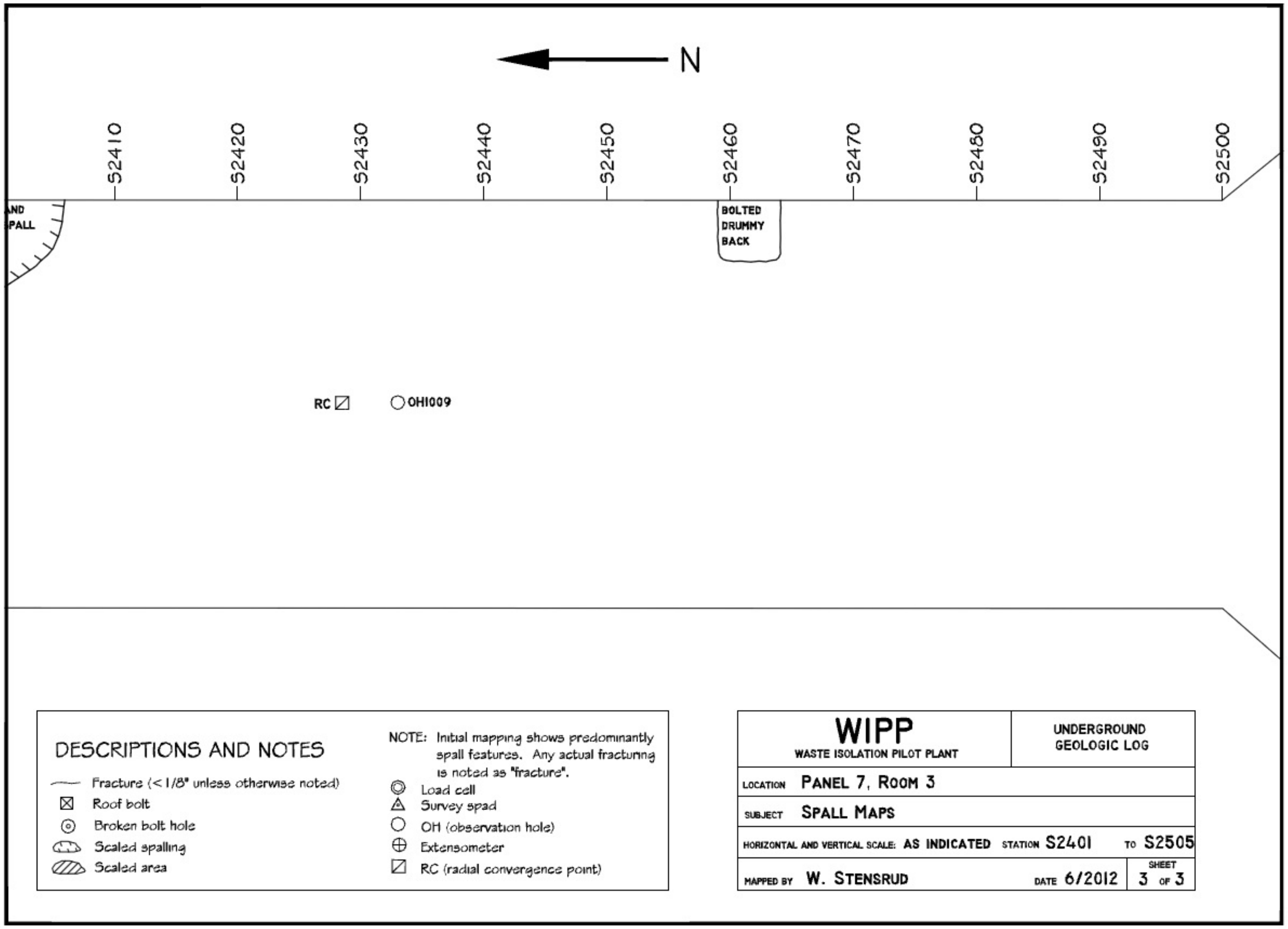


Figure 7-38
Panel 7 Room 3, S2401-S2505 Roof Fractures

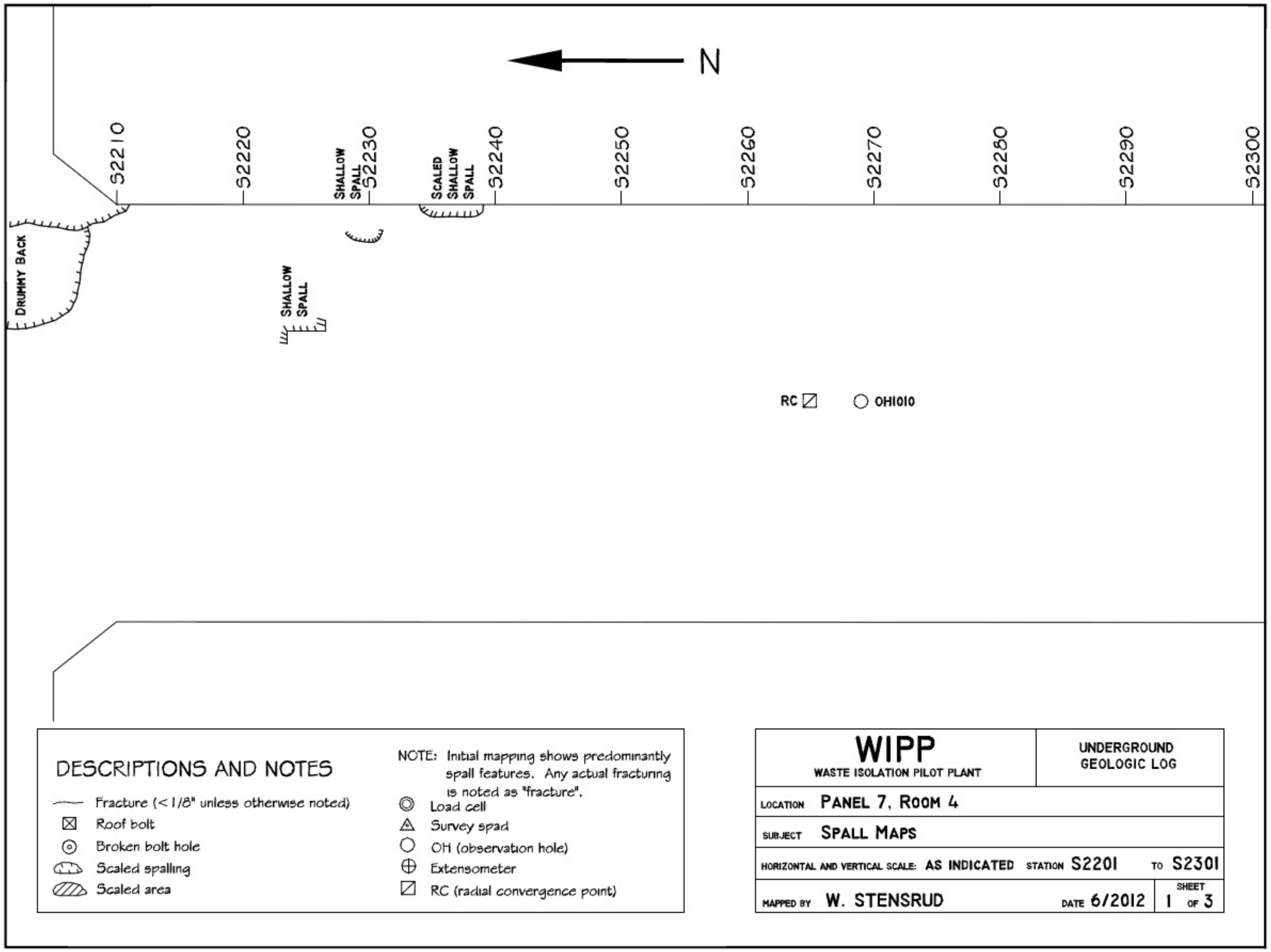


Figure 7-39
Panel 7 Room 4, S2201-S2301 Roof Fractures

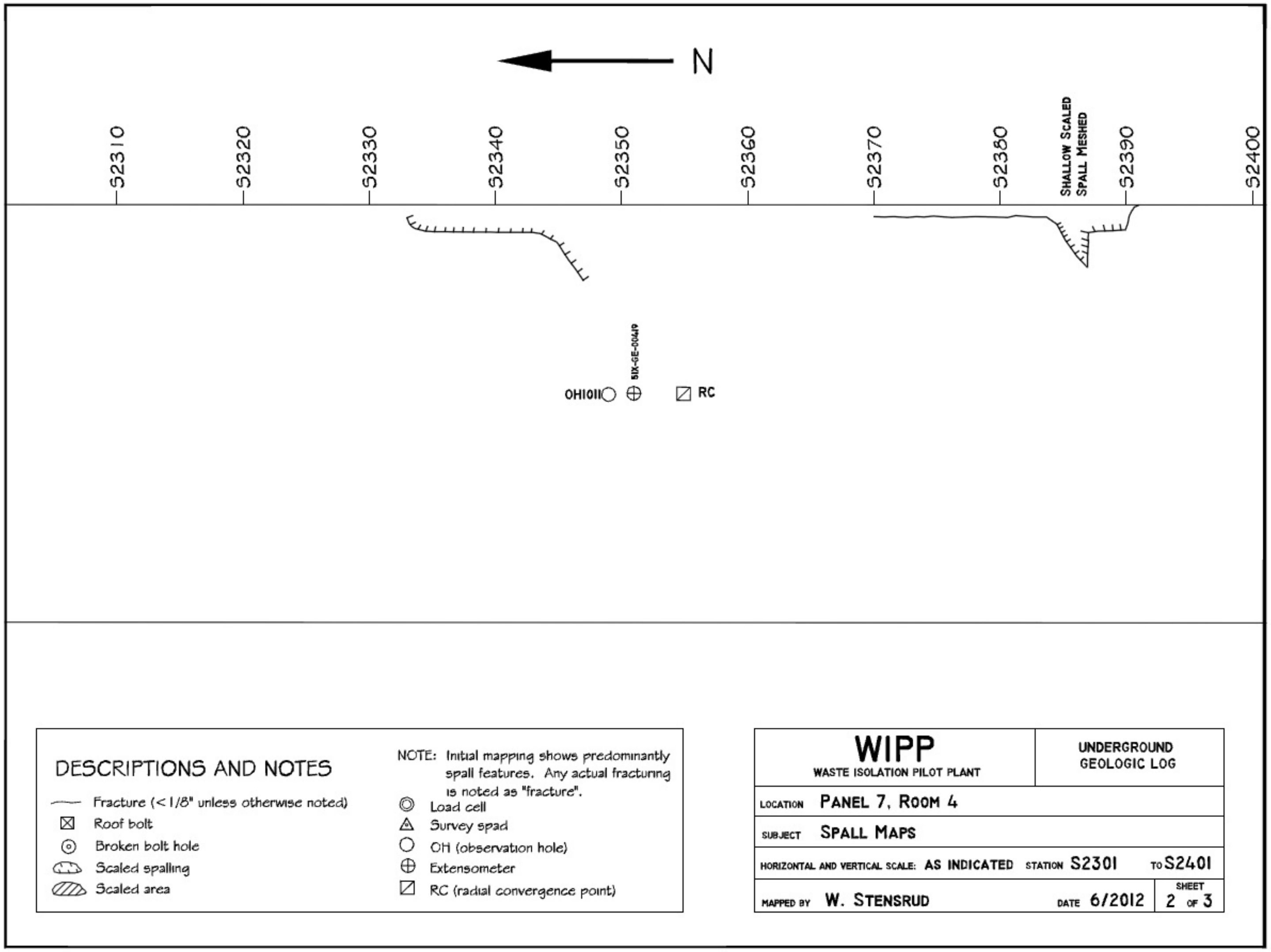


Figure 7-40
Panel 7 Room 4, S2301-S2401 Roof Fractures

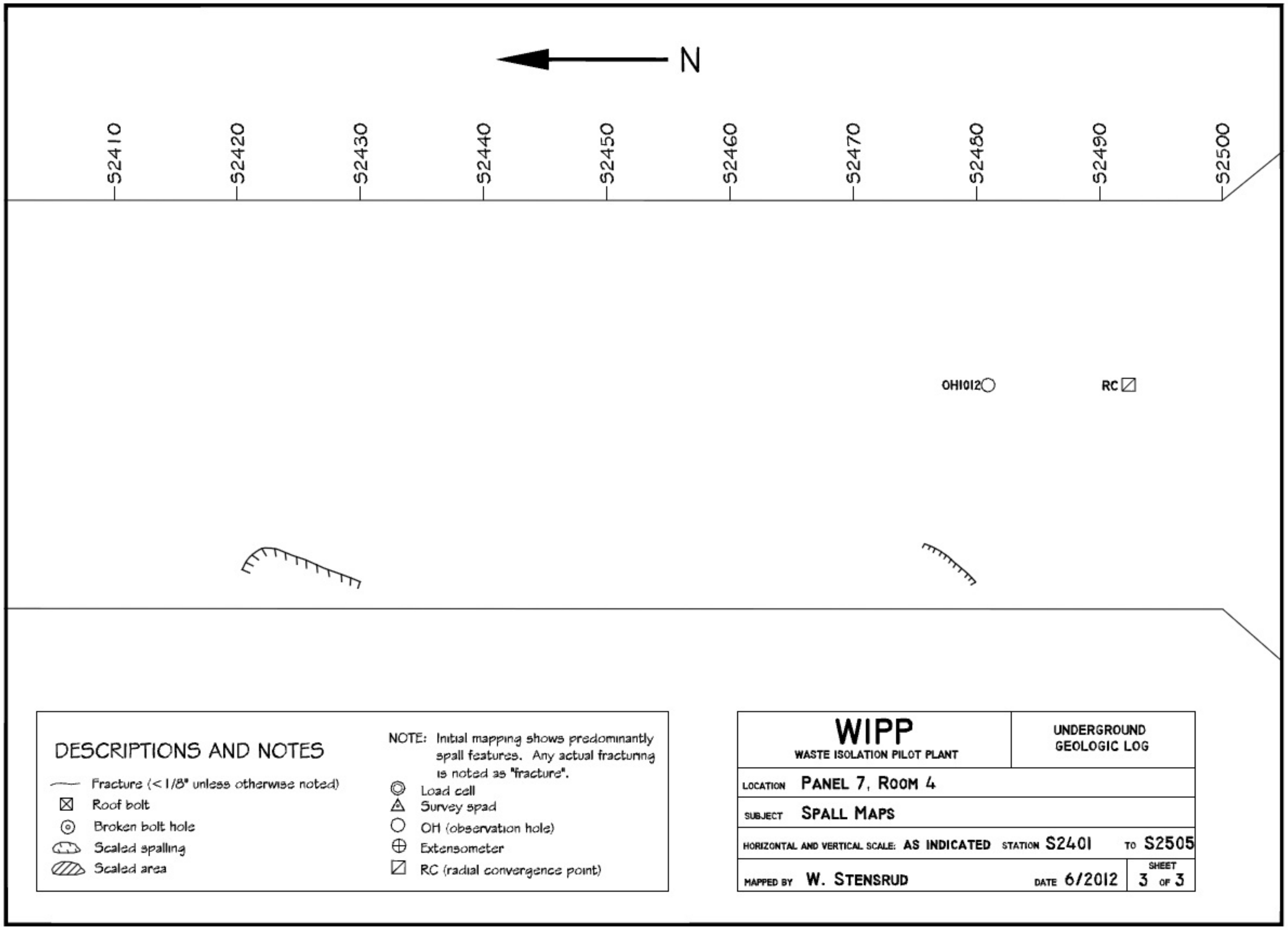


Figure 7-41
Panel 7 Room 4, S2401-S2505 Roof Fractures

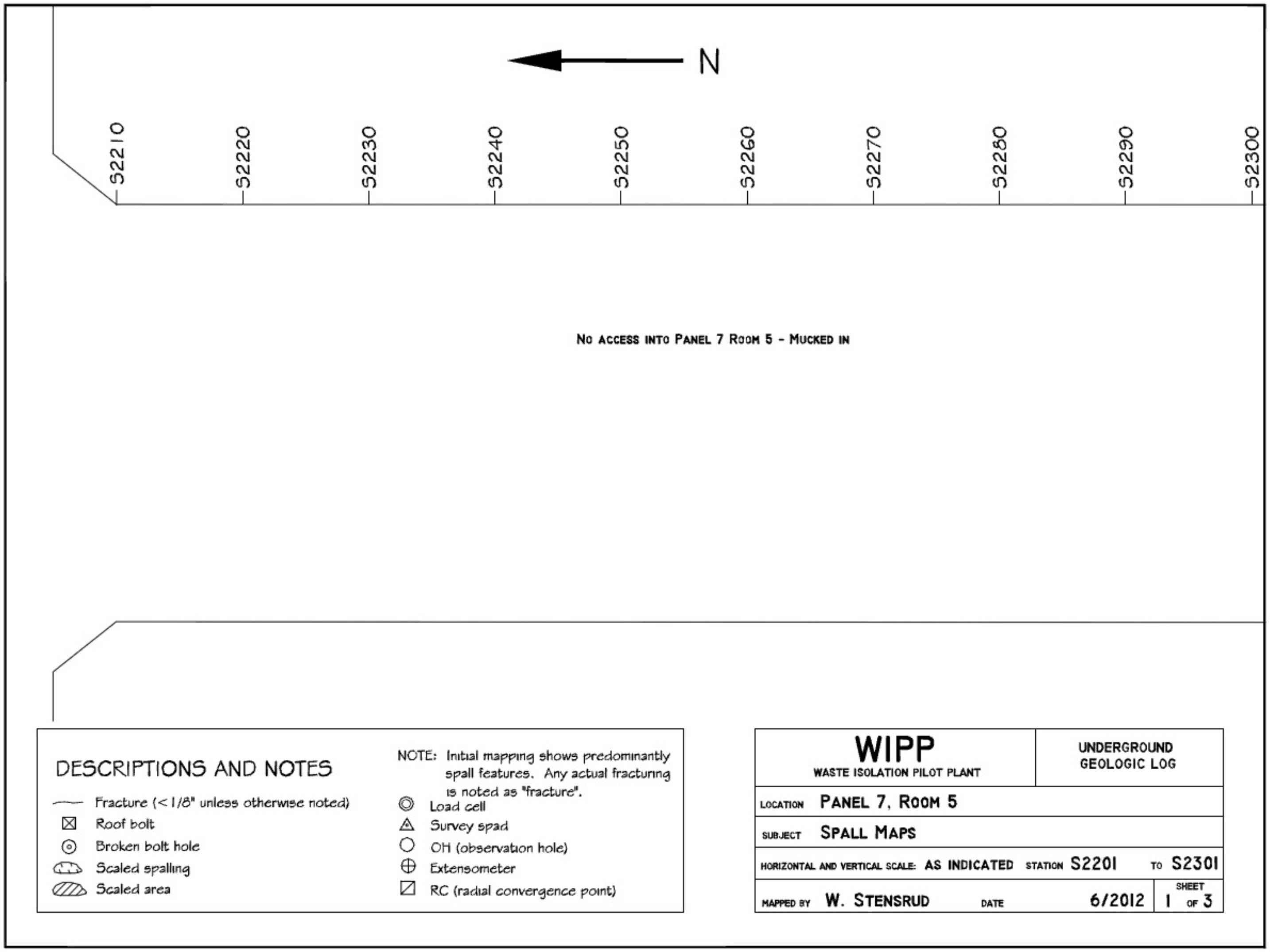


Figure 7-42
Panel 7 Room 5, S2201-S2301 Roof Fractures

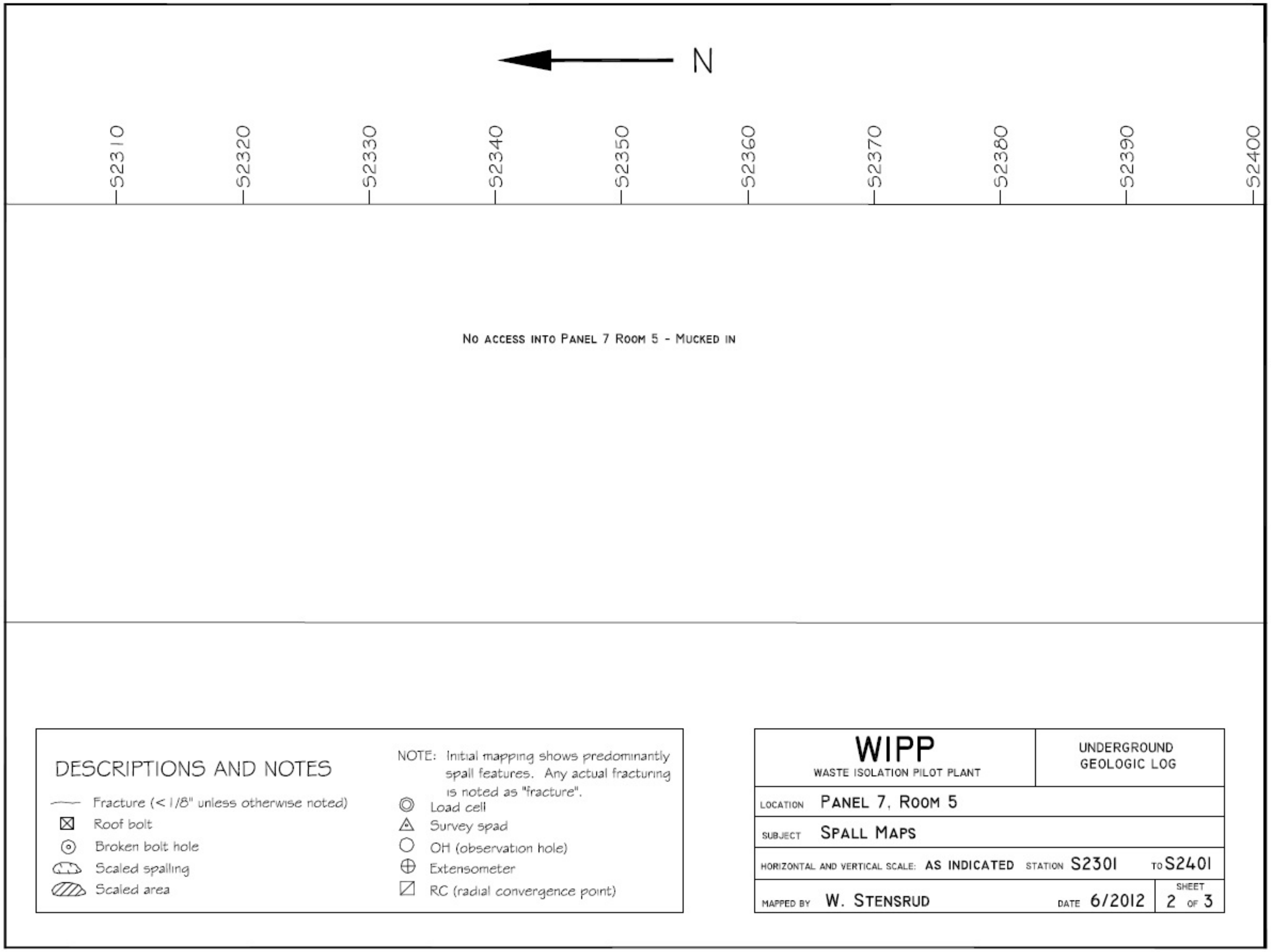


Figure 7-43
Panel 7 Room 5, S2301-S2401 Roof Fractures

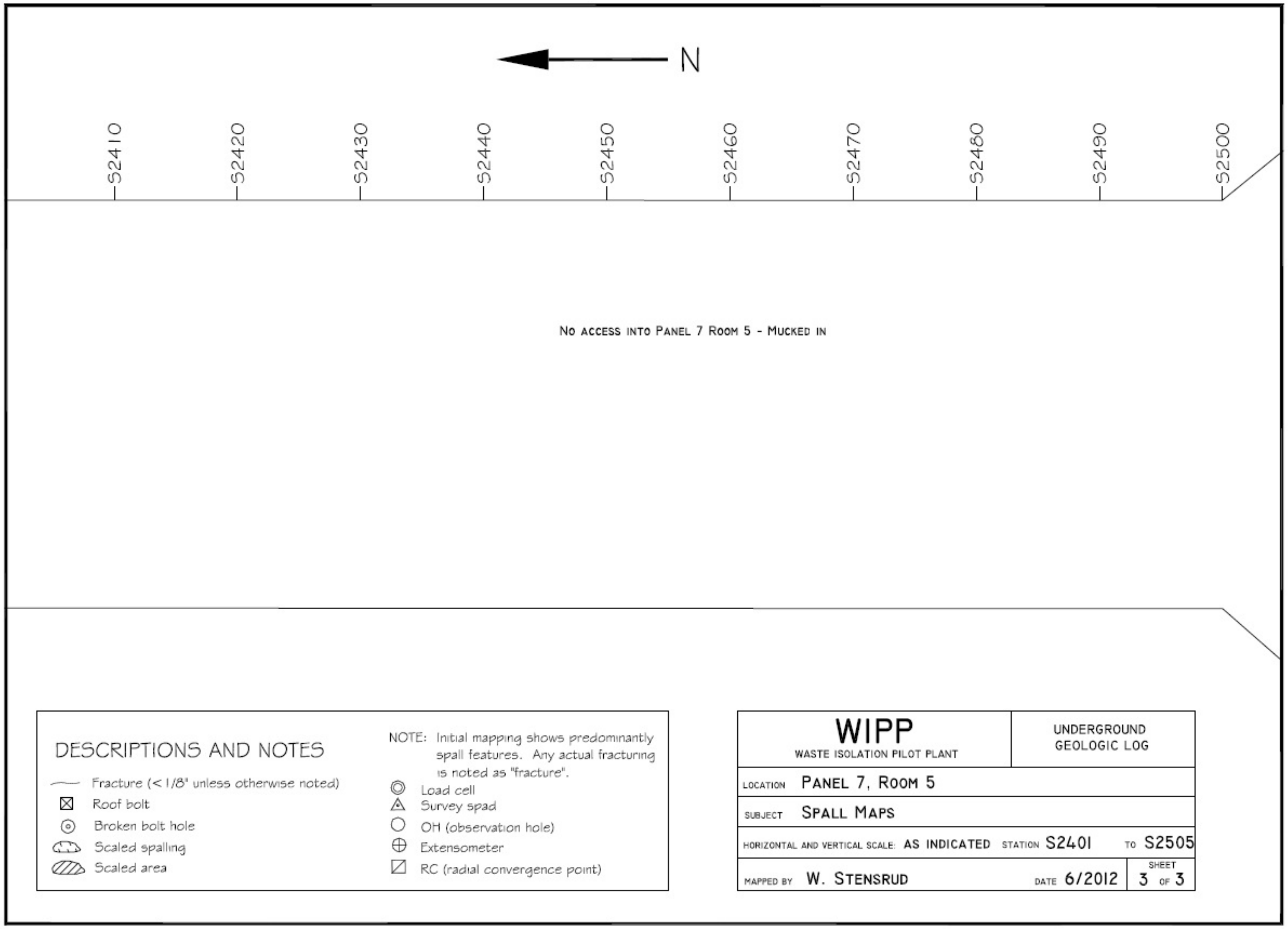


Figure 7-44
Panel 7 Room 5, S2401-S2505 Roof Fractures

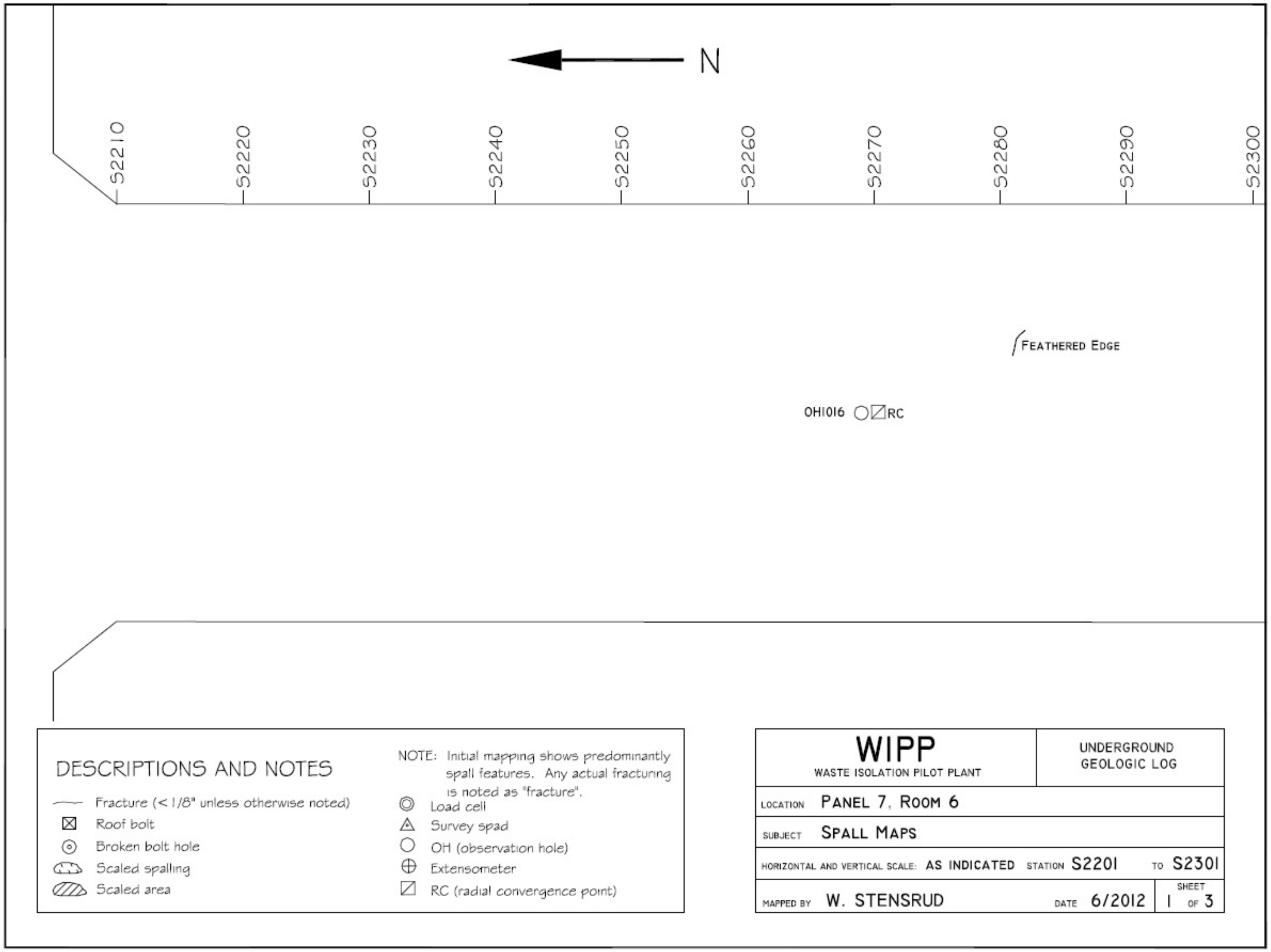


Figure 7-45
Panel 7 Room 6, S2201-S2301 Roof Fractures

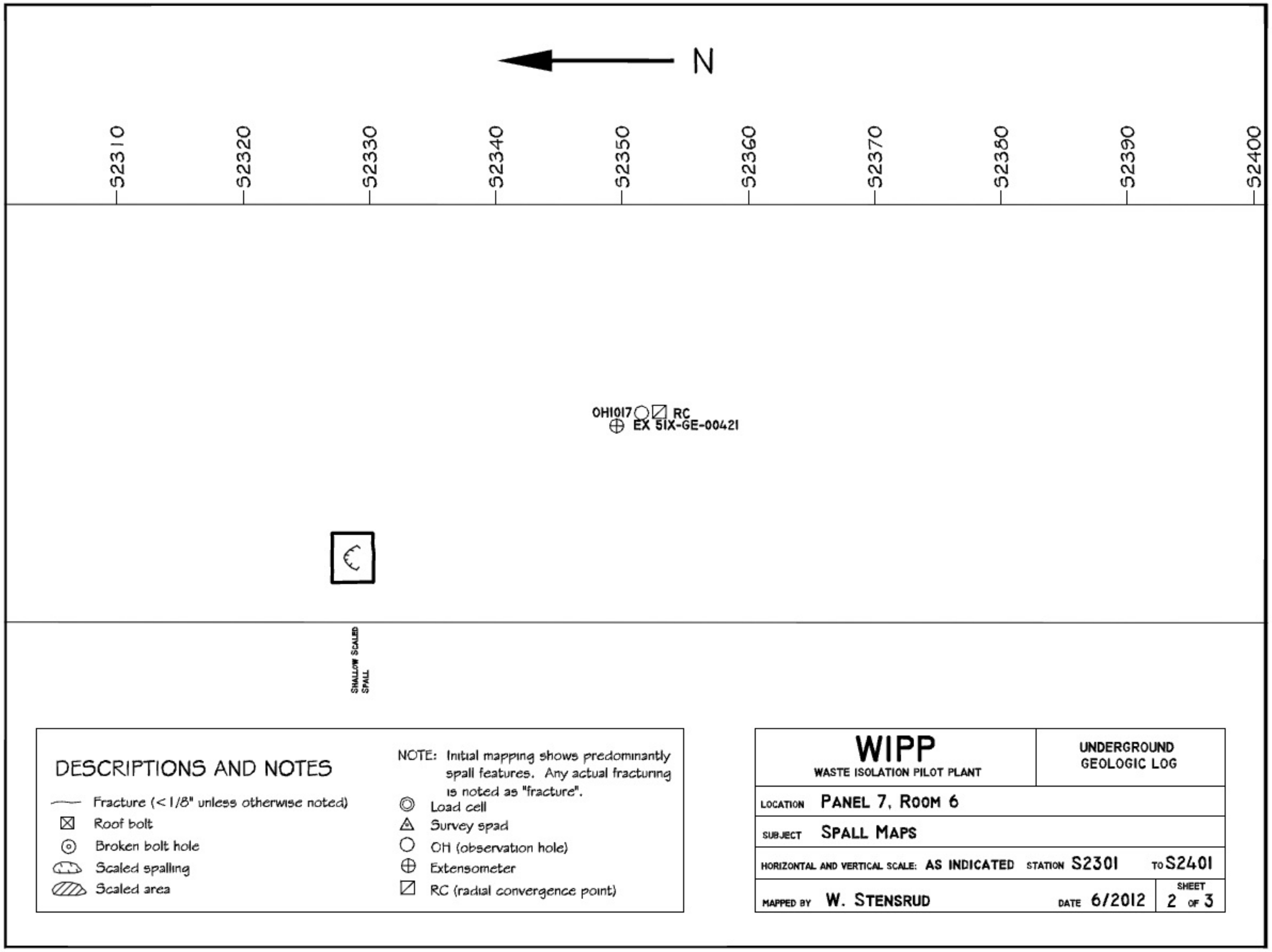


Figure 7-46
Panel 7 Room 6, S2301-S2401 Roof Fractures

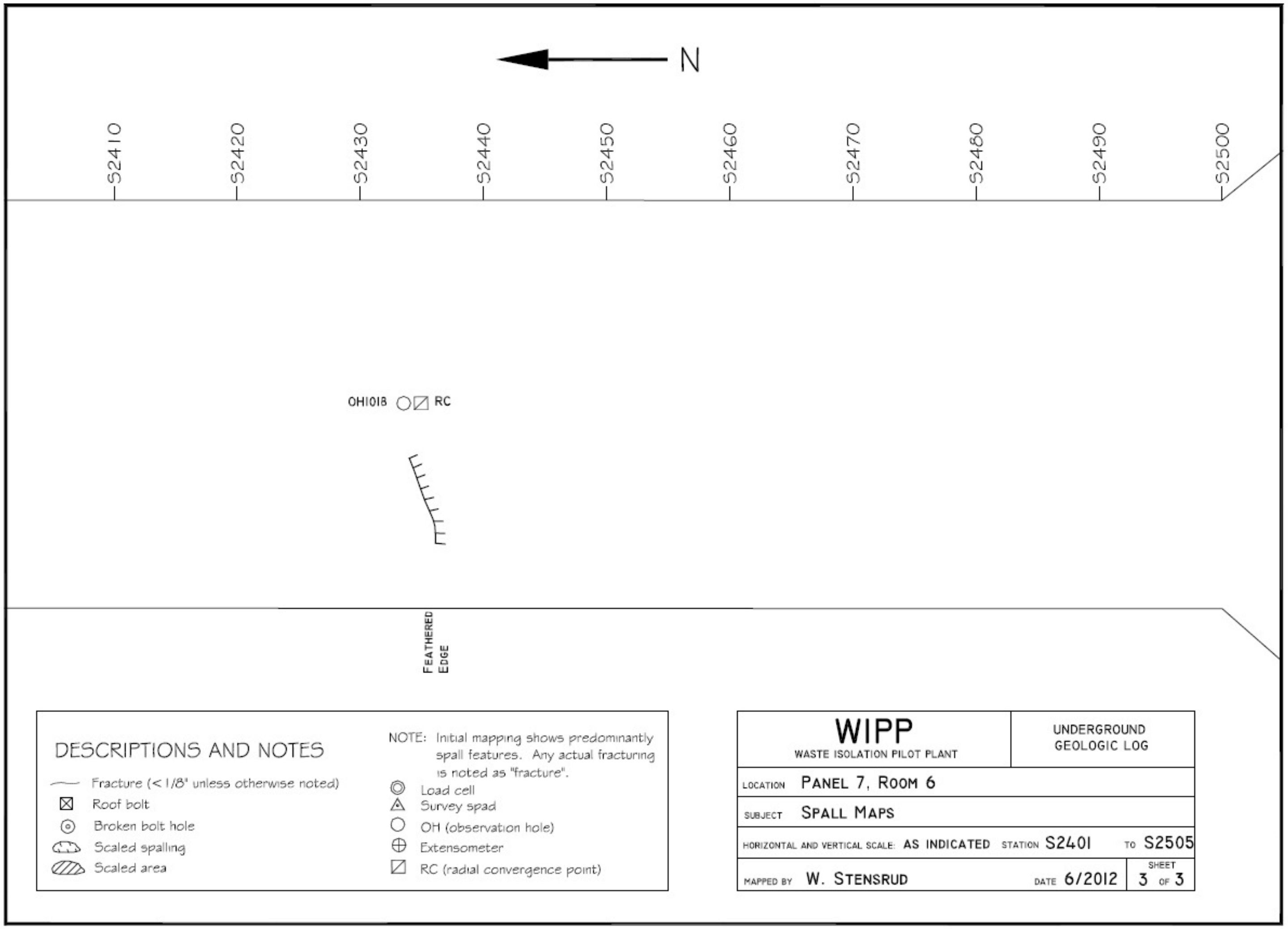


Figure 7-47
Panel 7 Room 6, S2401-S2505 Roof Fractures

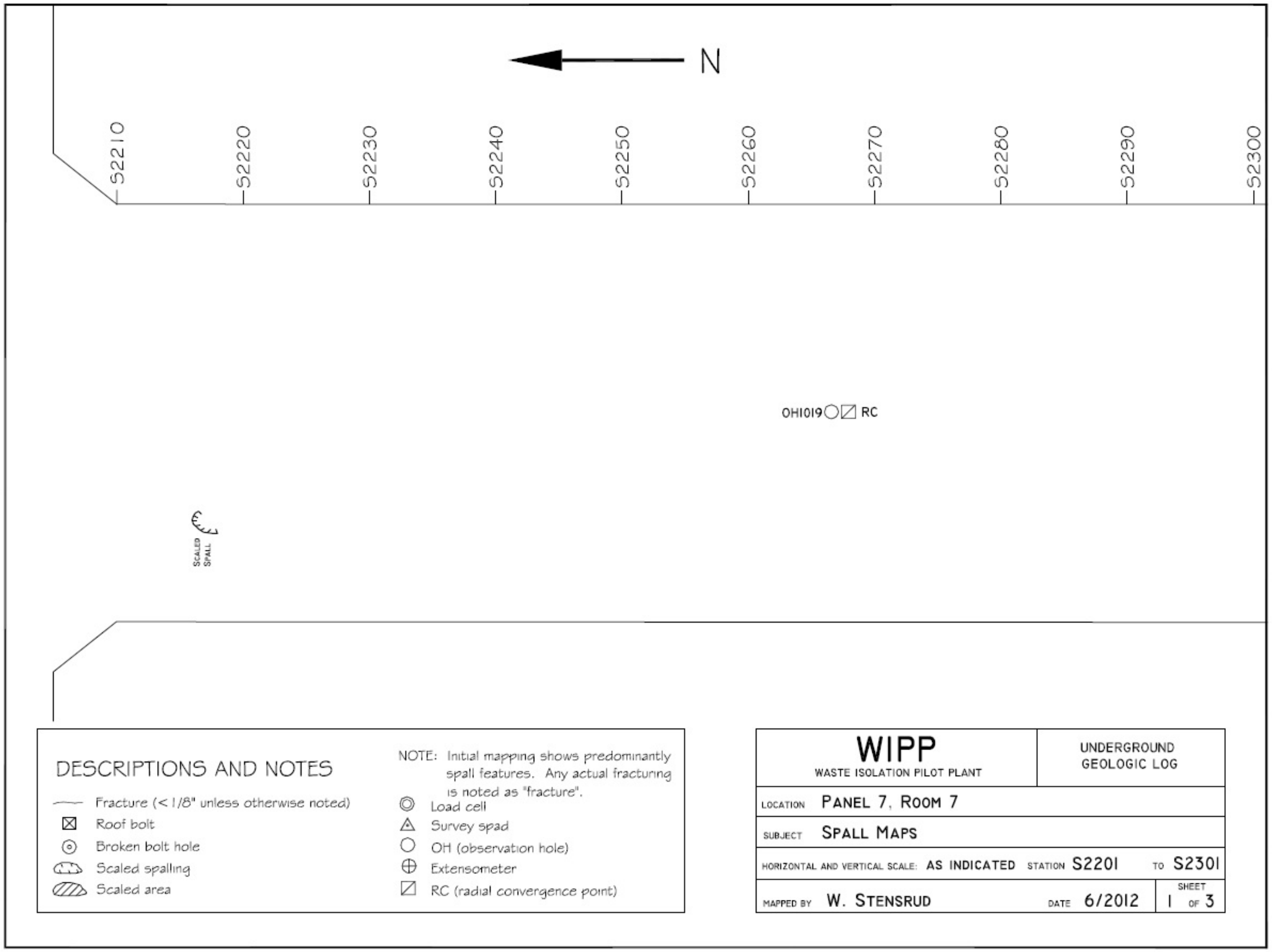


Figure 7-48
Panel 7 Room 7, S2201-S2301 Roof Fractures

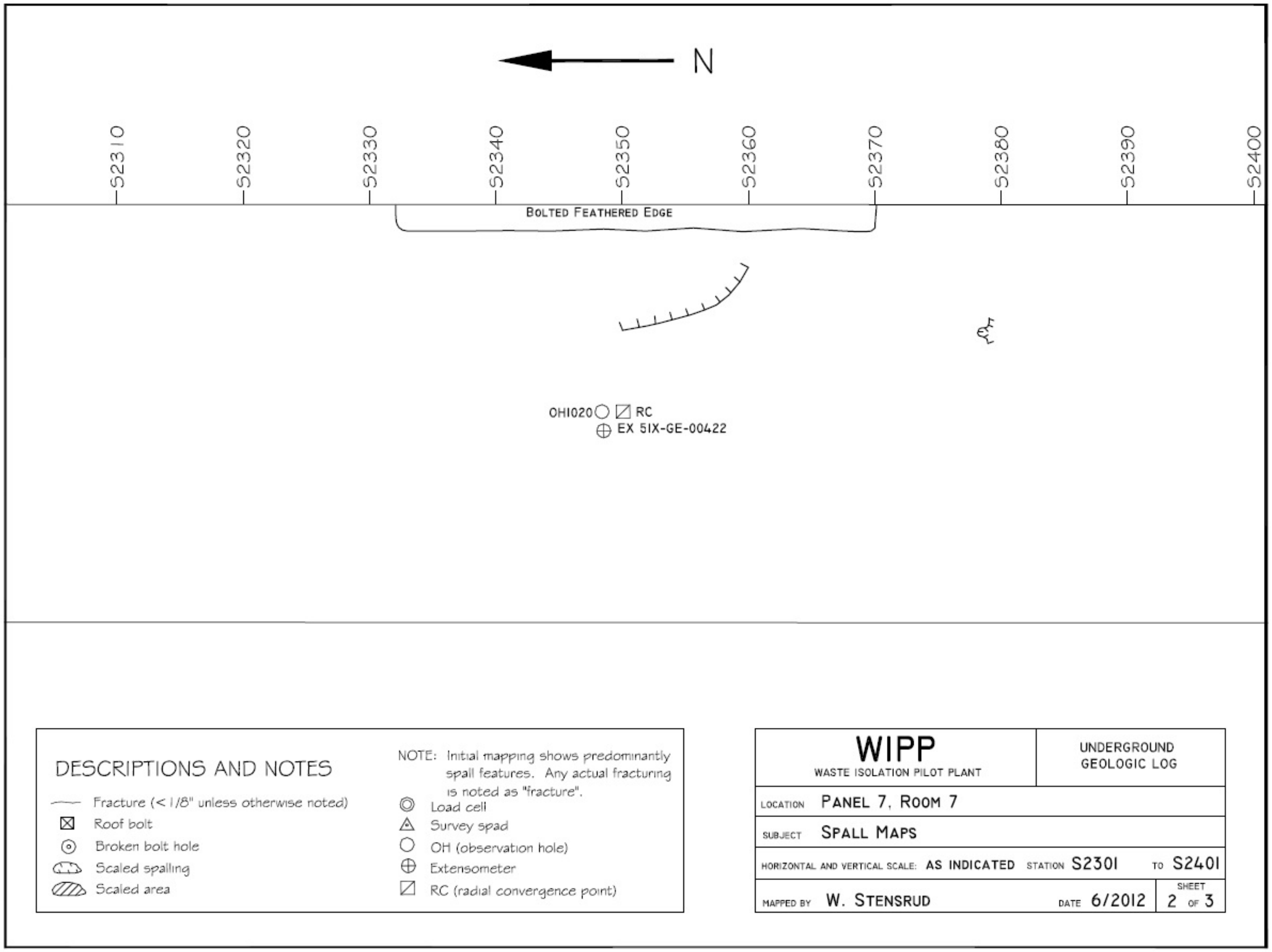


Figure 7-49
Panel 7 Room 7, S2301-S2401 Roof Fractures

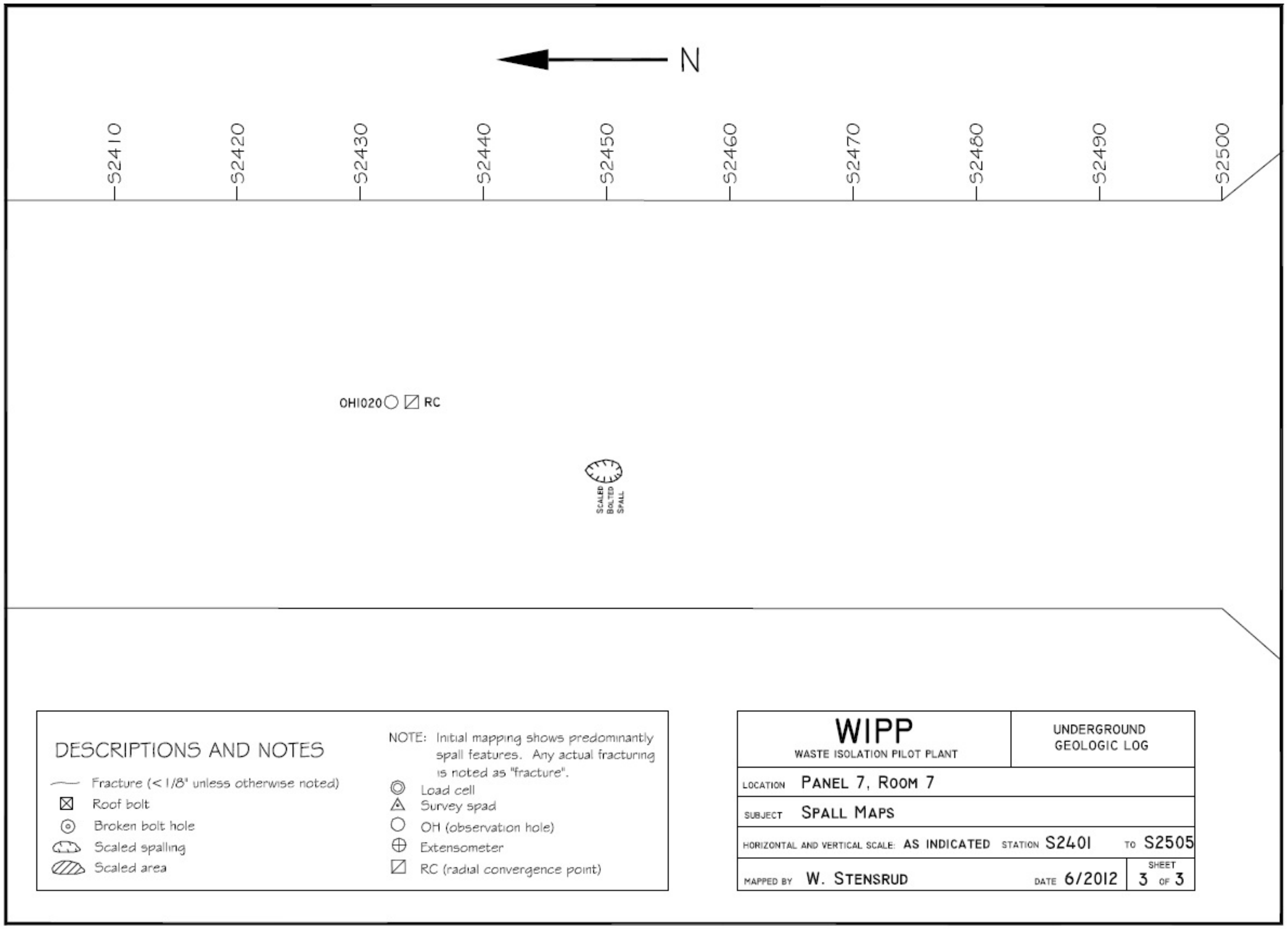


Figure 7-50
Panel 7 Room 7, S2401-S2505 Roof Fractures

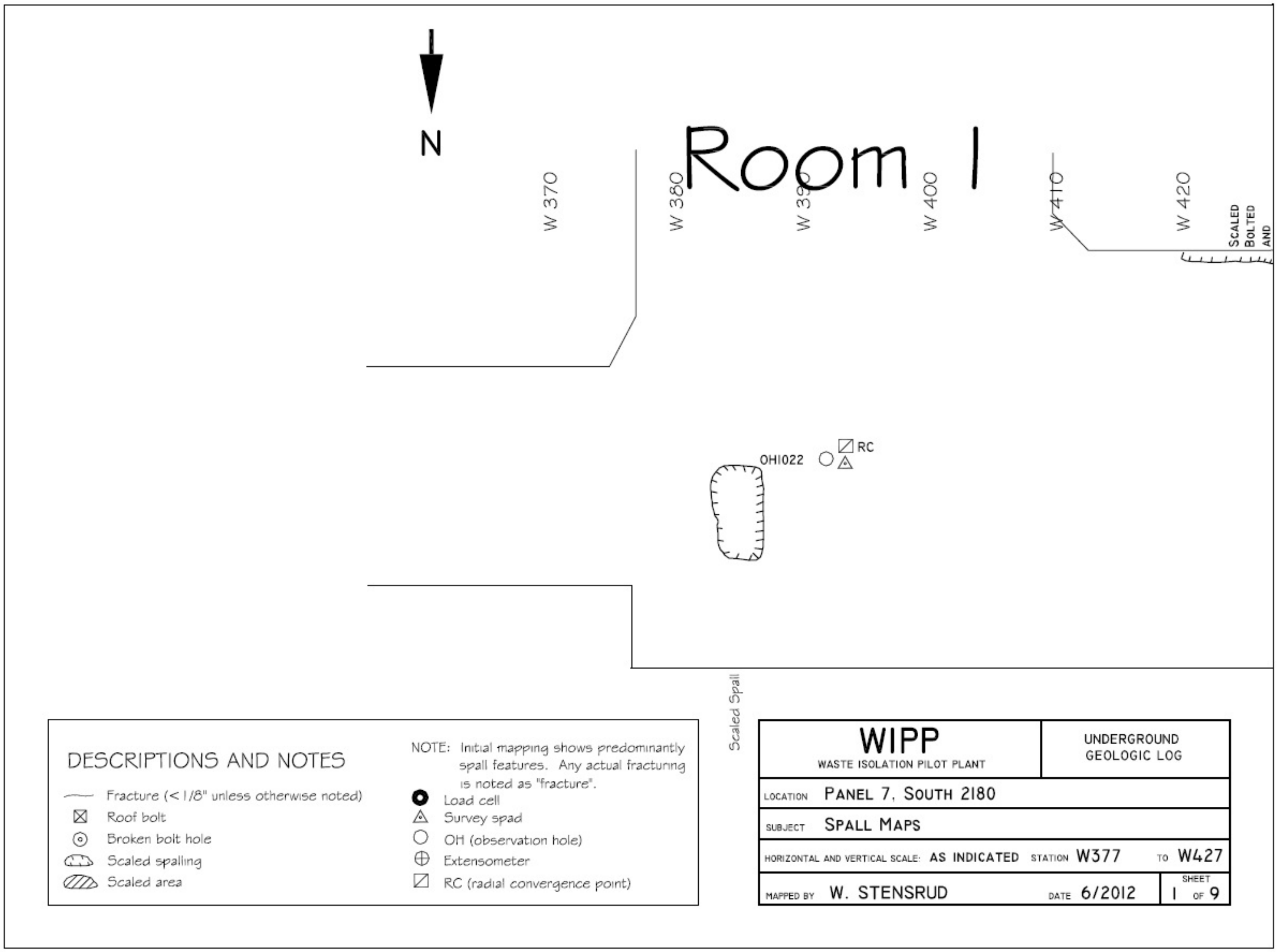


Figure 7-51
Panel 7 South 2180, W377-W427 Roof Fractures

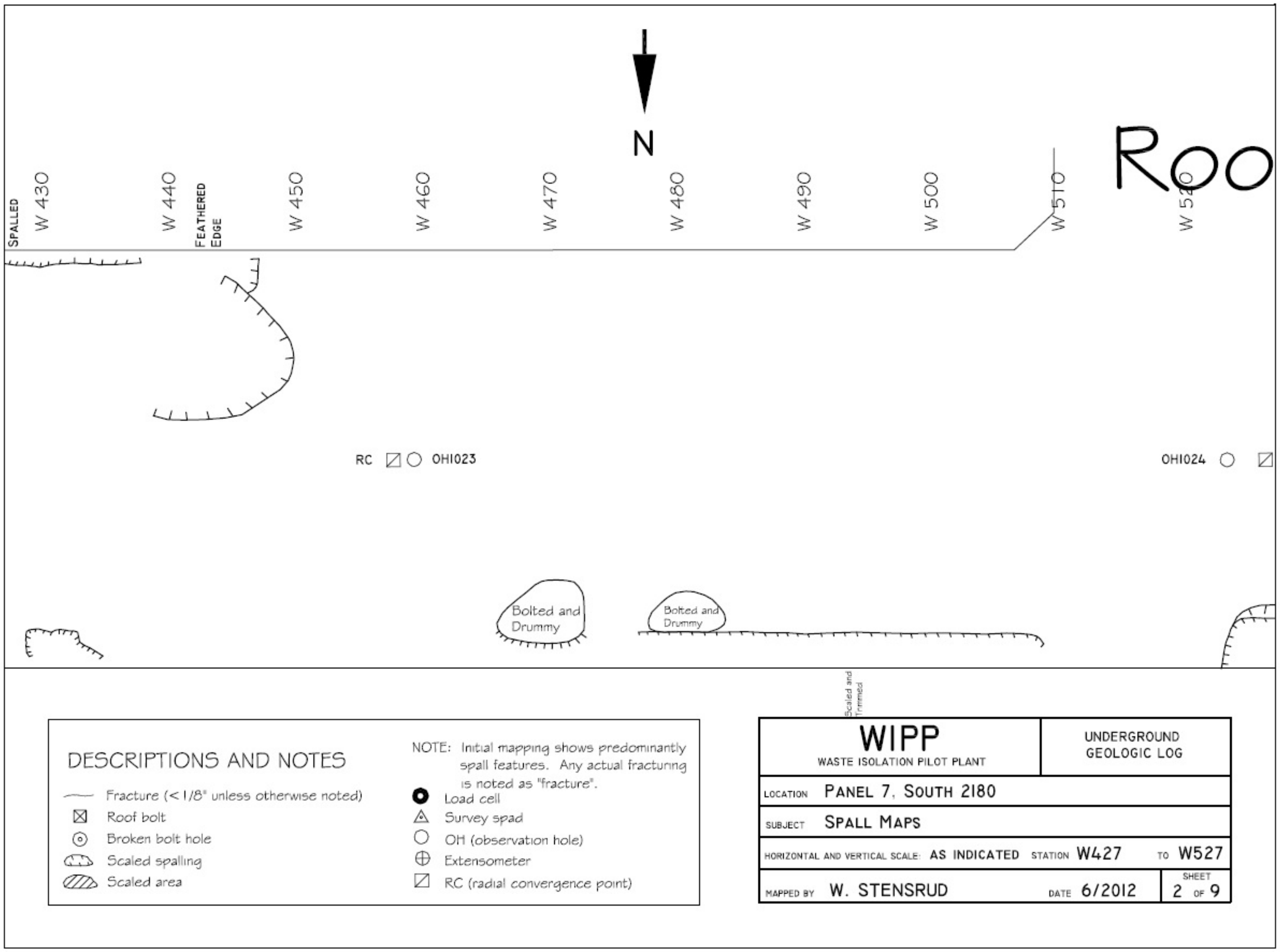


Figure 7-52
Panel 7 South 2180, W427-W527 Roof Fractures

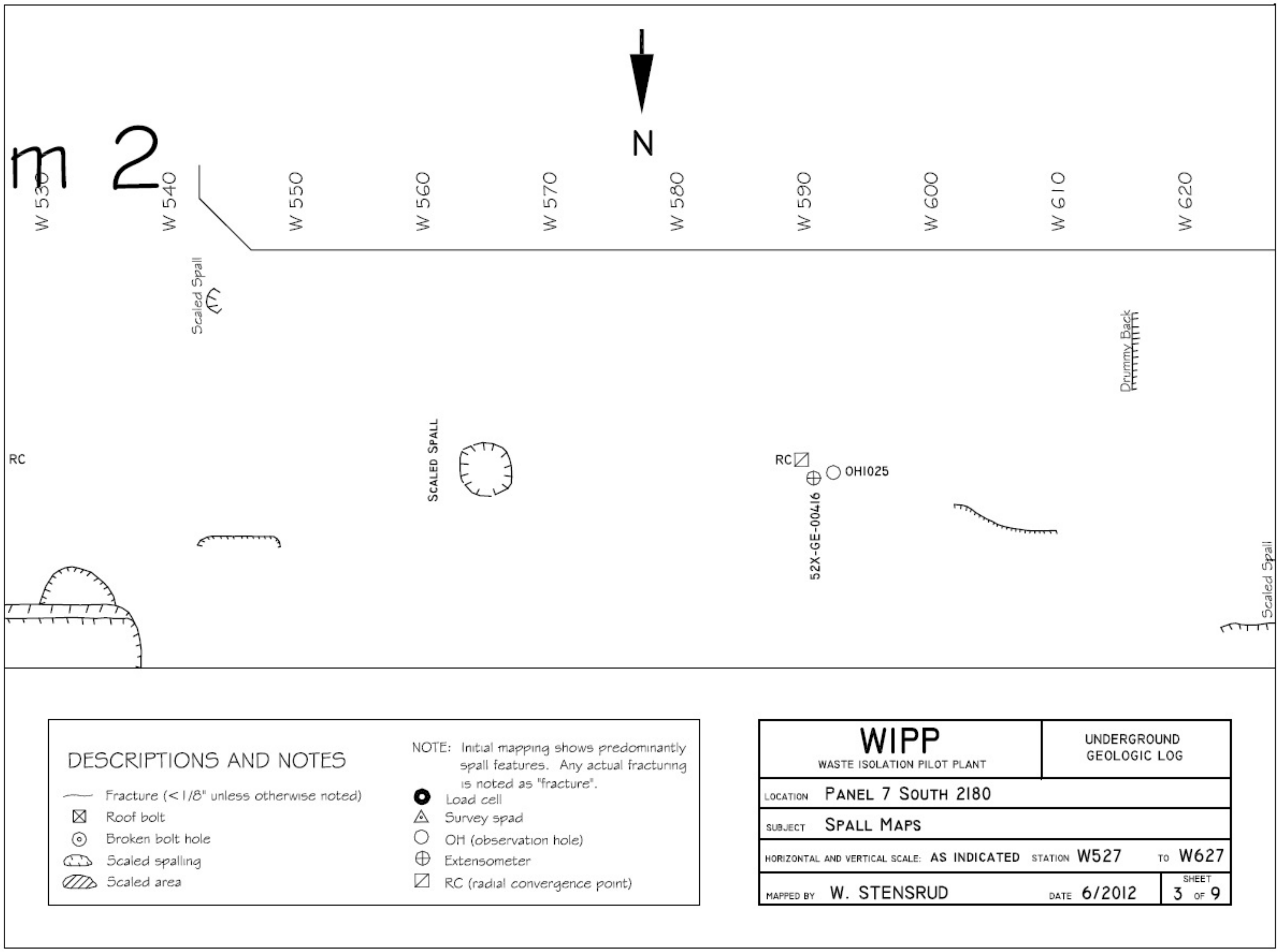


Figure 7-53
Panel 7 South 2180, W527-W627 Roof Fractures

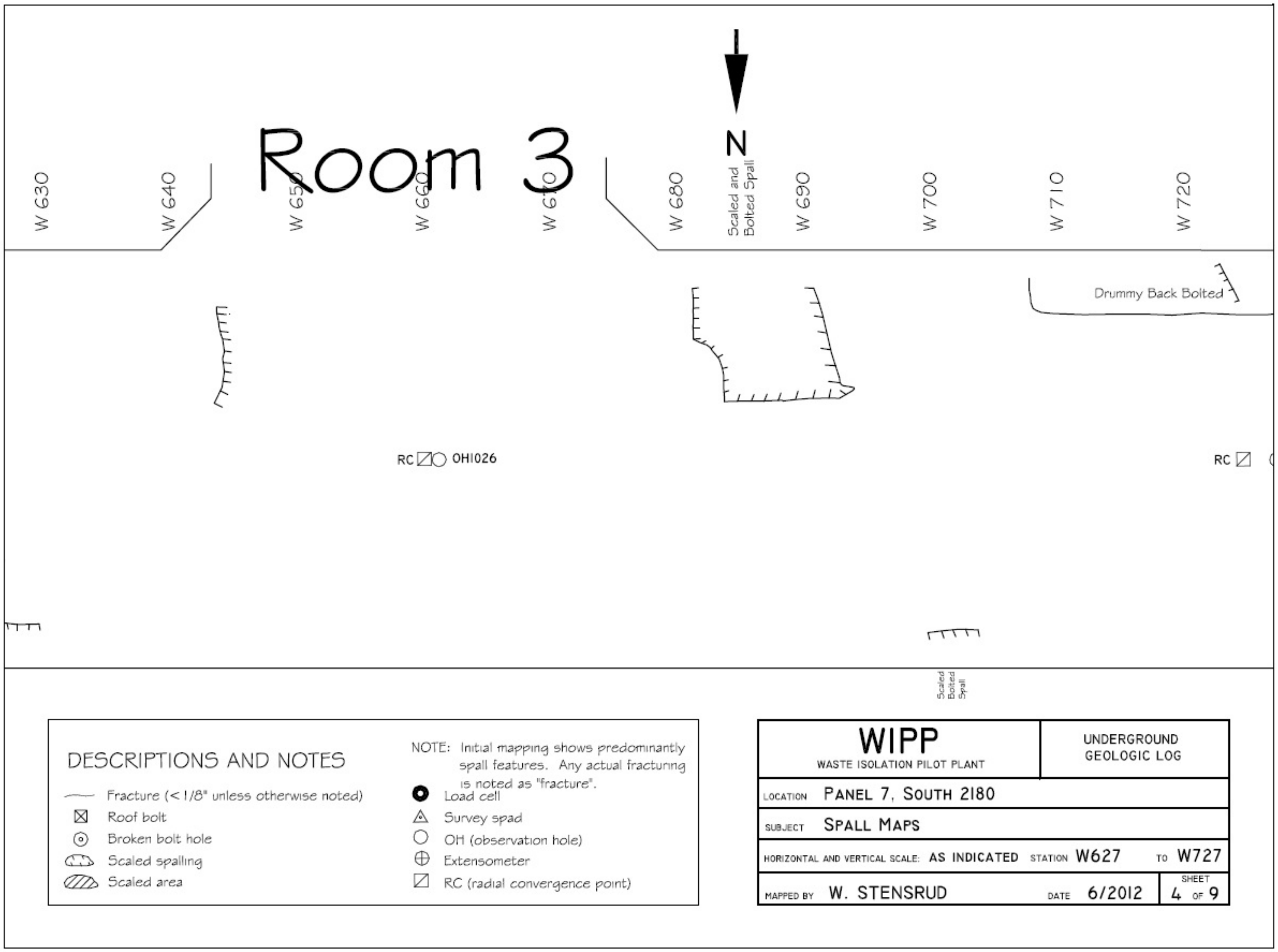


Figure 7-54
Panel 7 South 2180, W627-W727 Roof Fractures

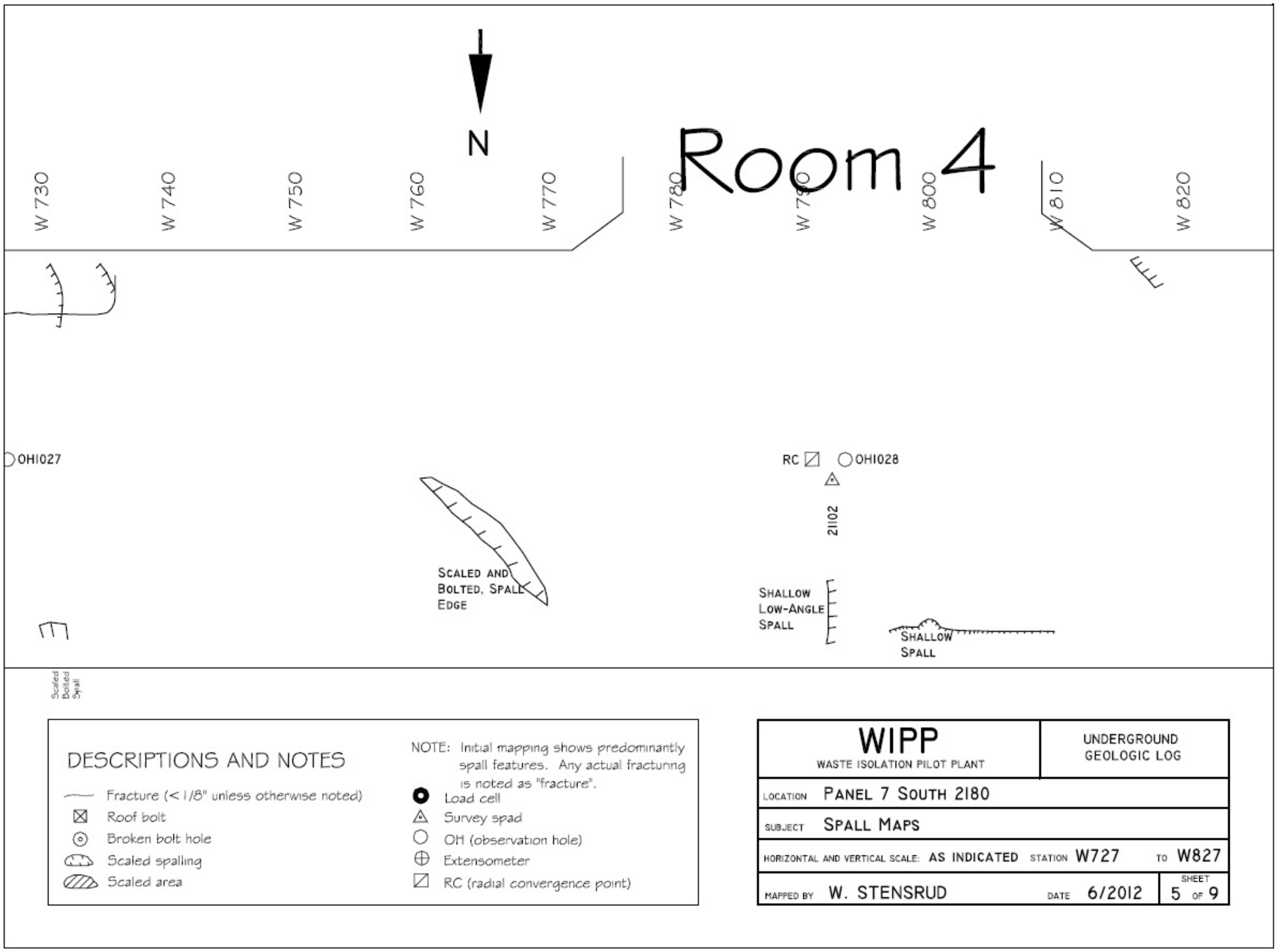


Figure 7-55
Panel 7 South 2180, W727-W827 Roof Fractures

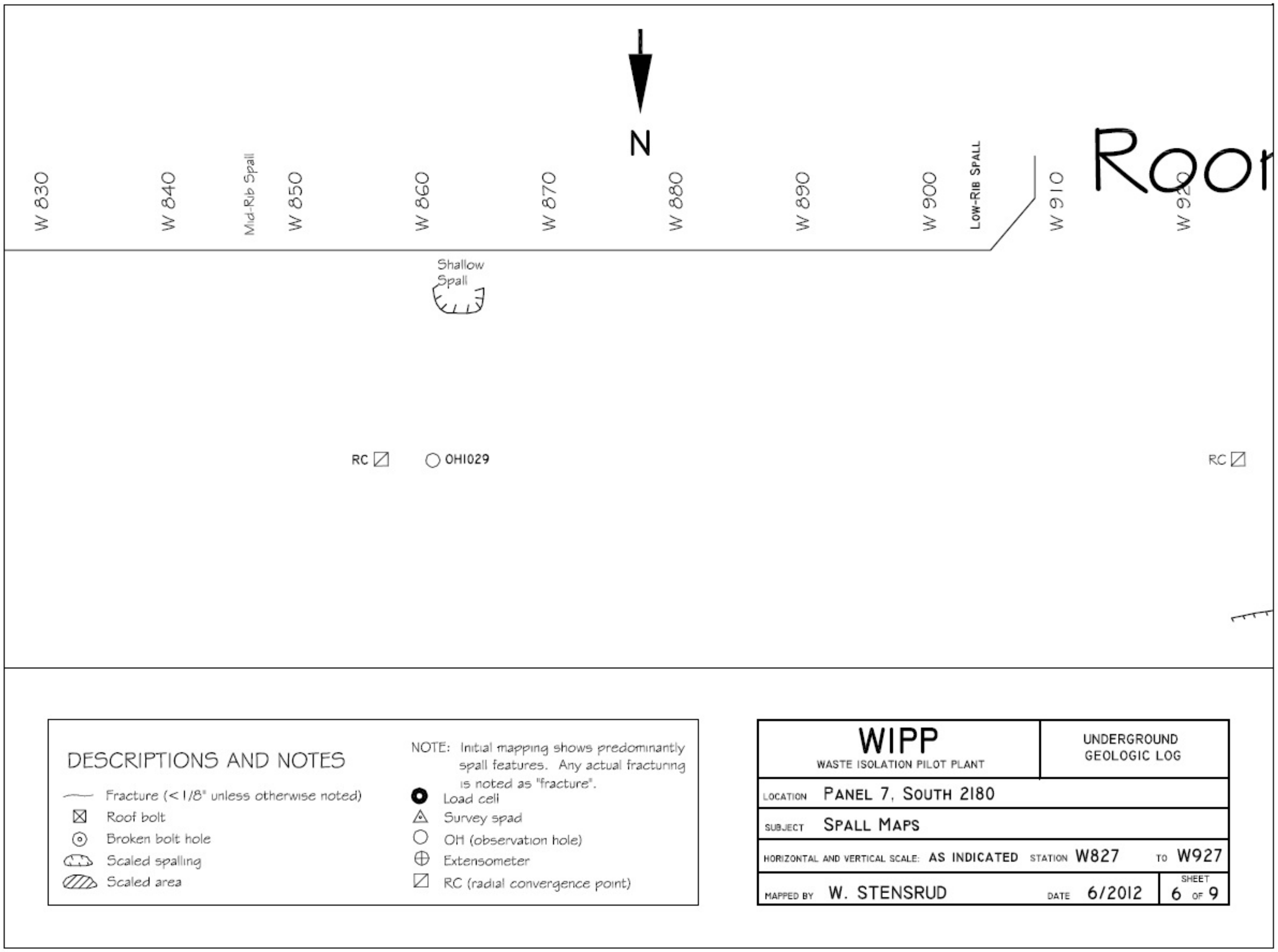


Figure 7-56
Panel 7 South 2180, W827-W927 Roof Fractures

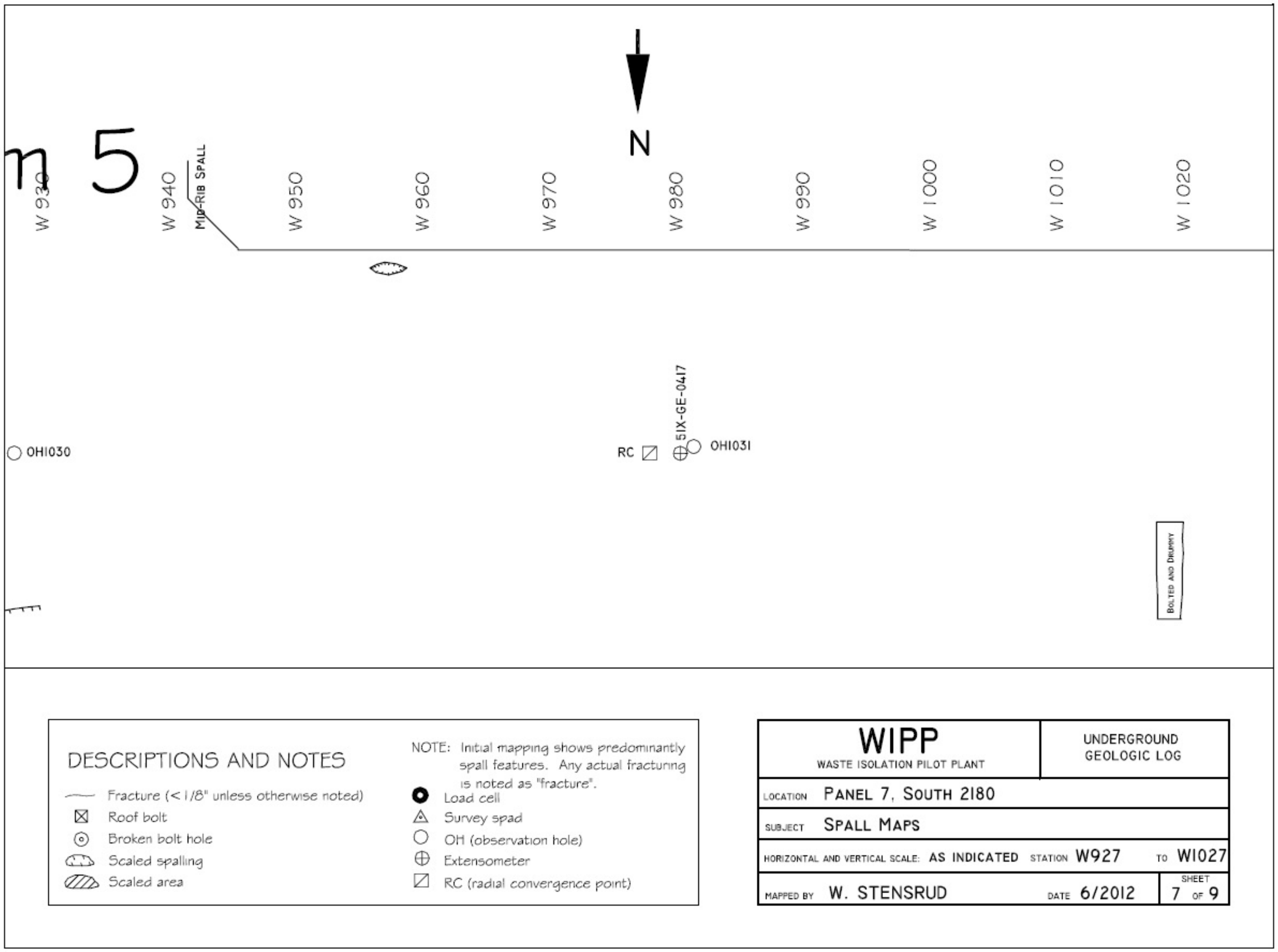


Figure 7-57
Panel 7 South 2180, W927-W1027 Roof Fractures

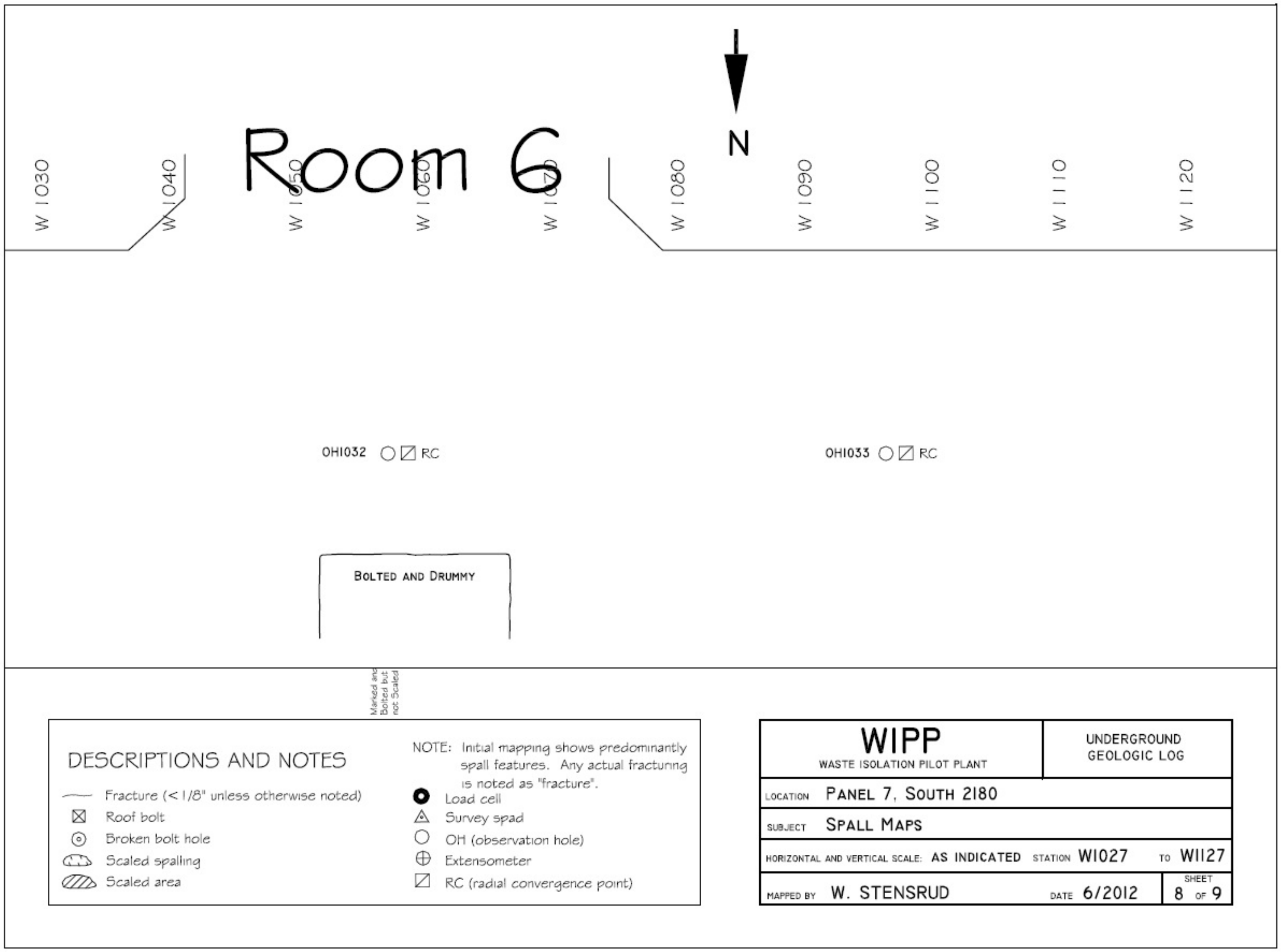


Figure 7-58
Panel 7 South 2180, W1027-W1127 Roof Fractures

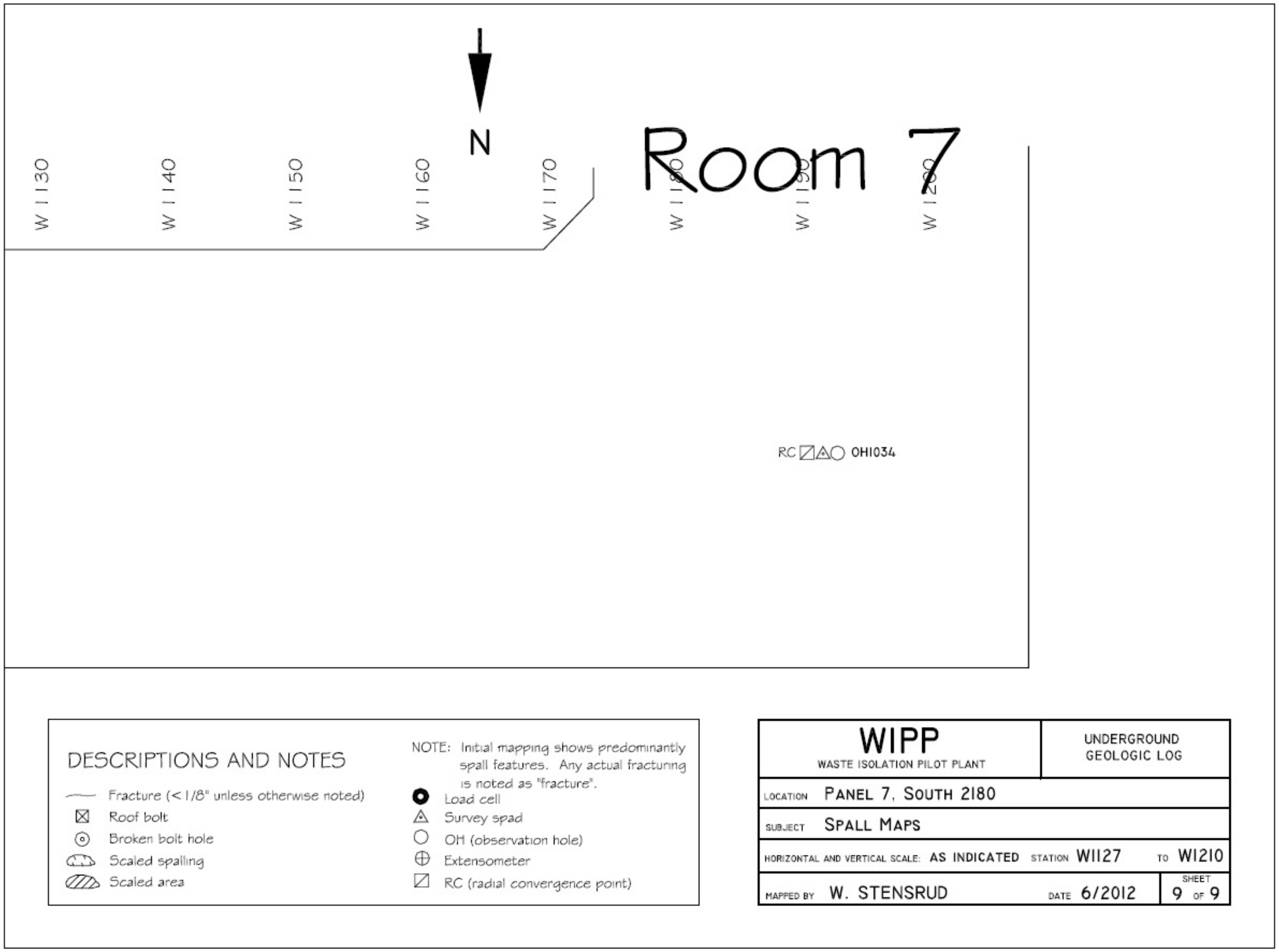


Figure 7-59
Panel 7 South 2180, W1127-W1210 Roof Fractures

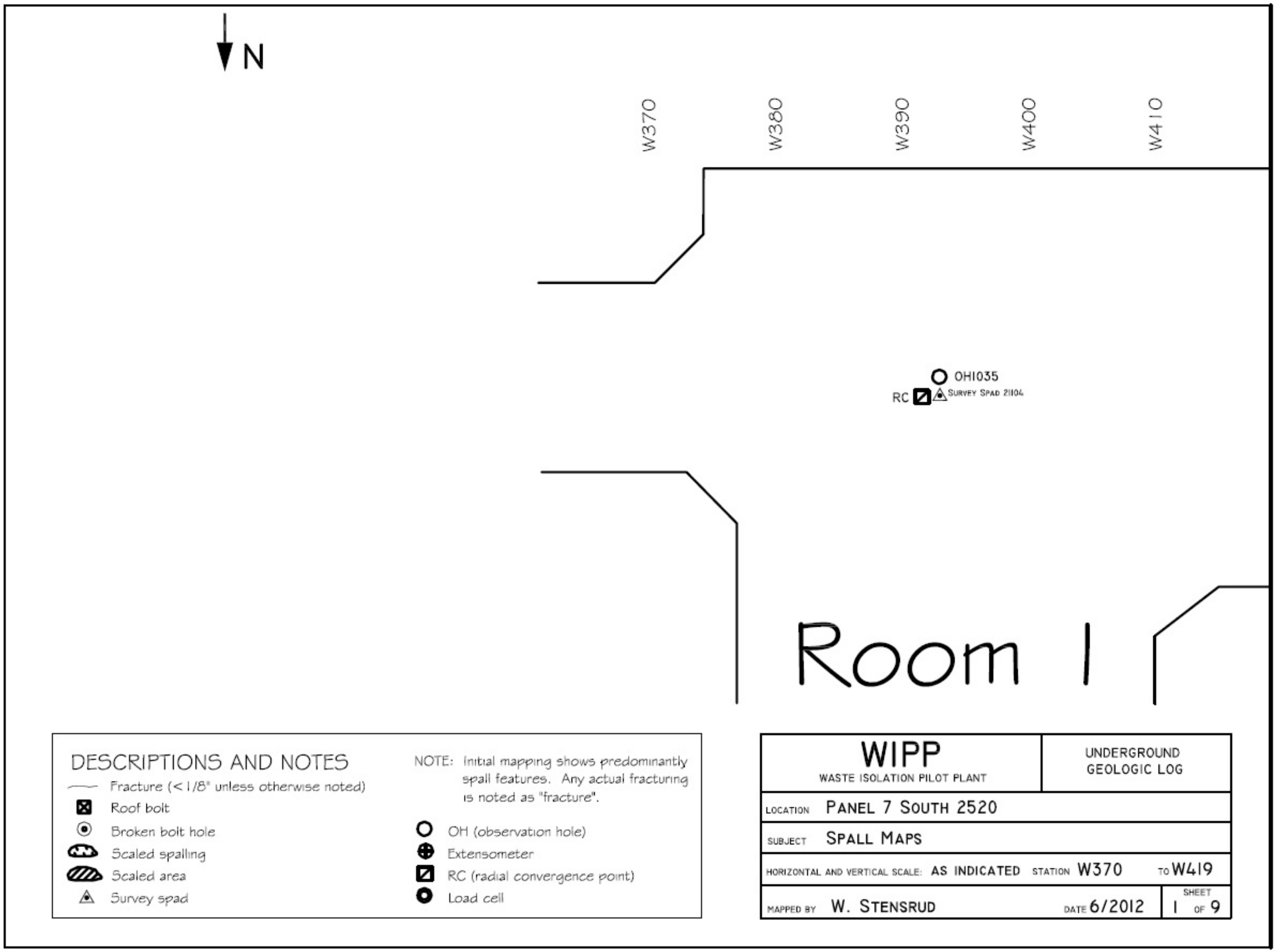


Figure 7-60
Panel 7 South 2520, W370-W419 Roof Fractures

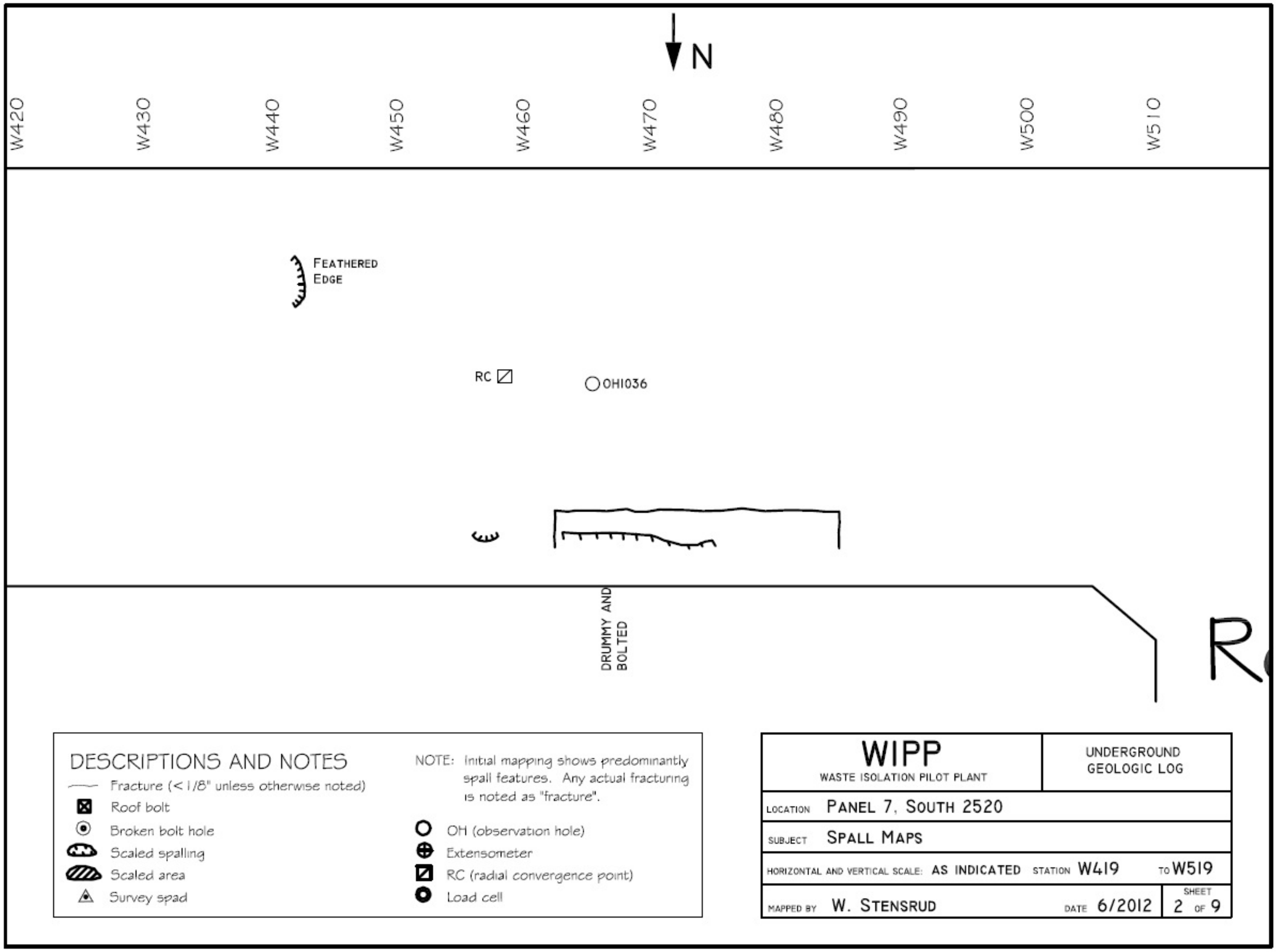


Figure 7-61
Panel 7 South 2520, W419-W519 Roof Fractures

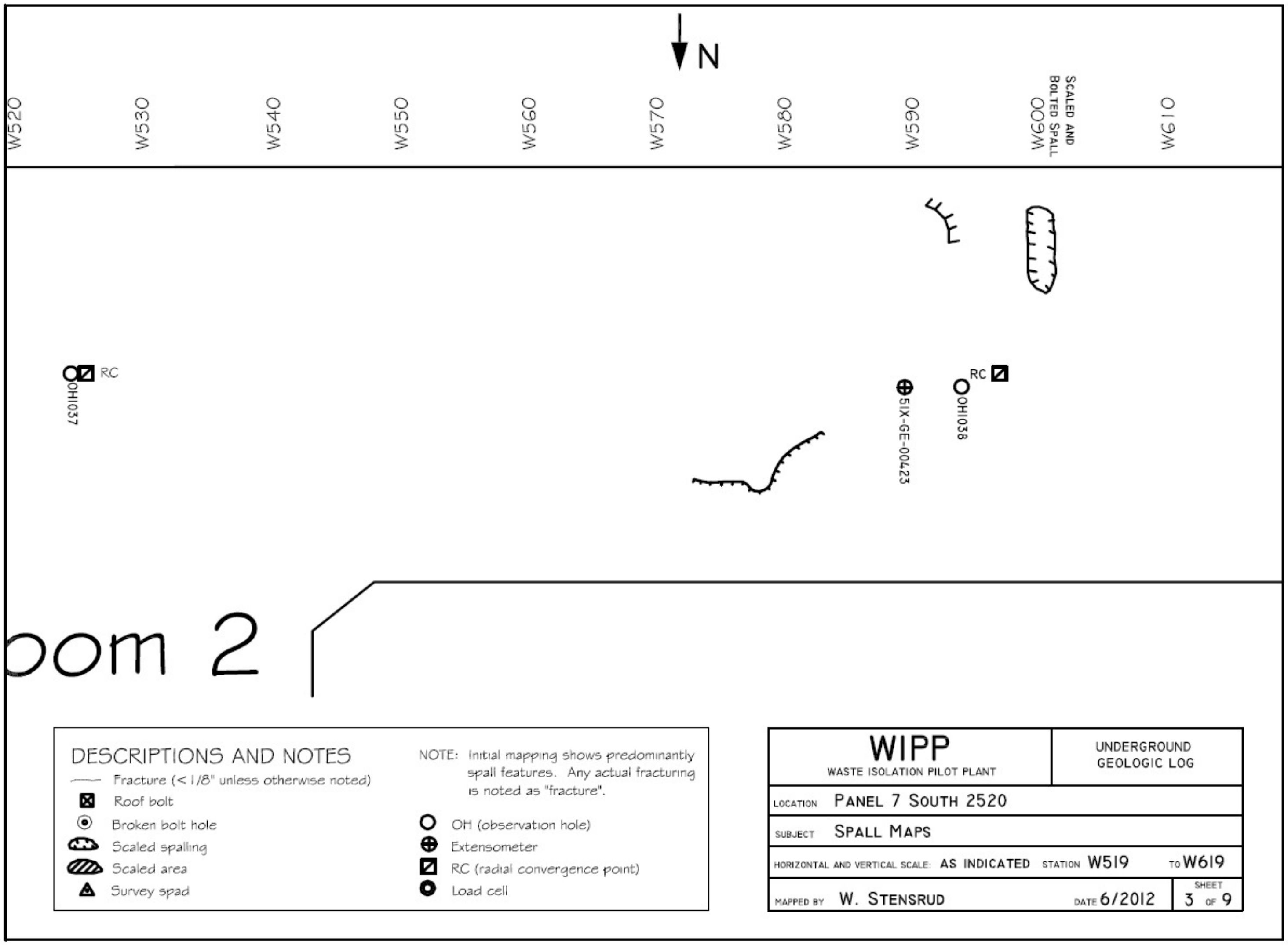


Figure 7-62
Panel 7 South 2520, W519-W619 Roof Fractures

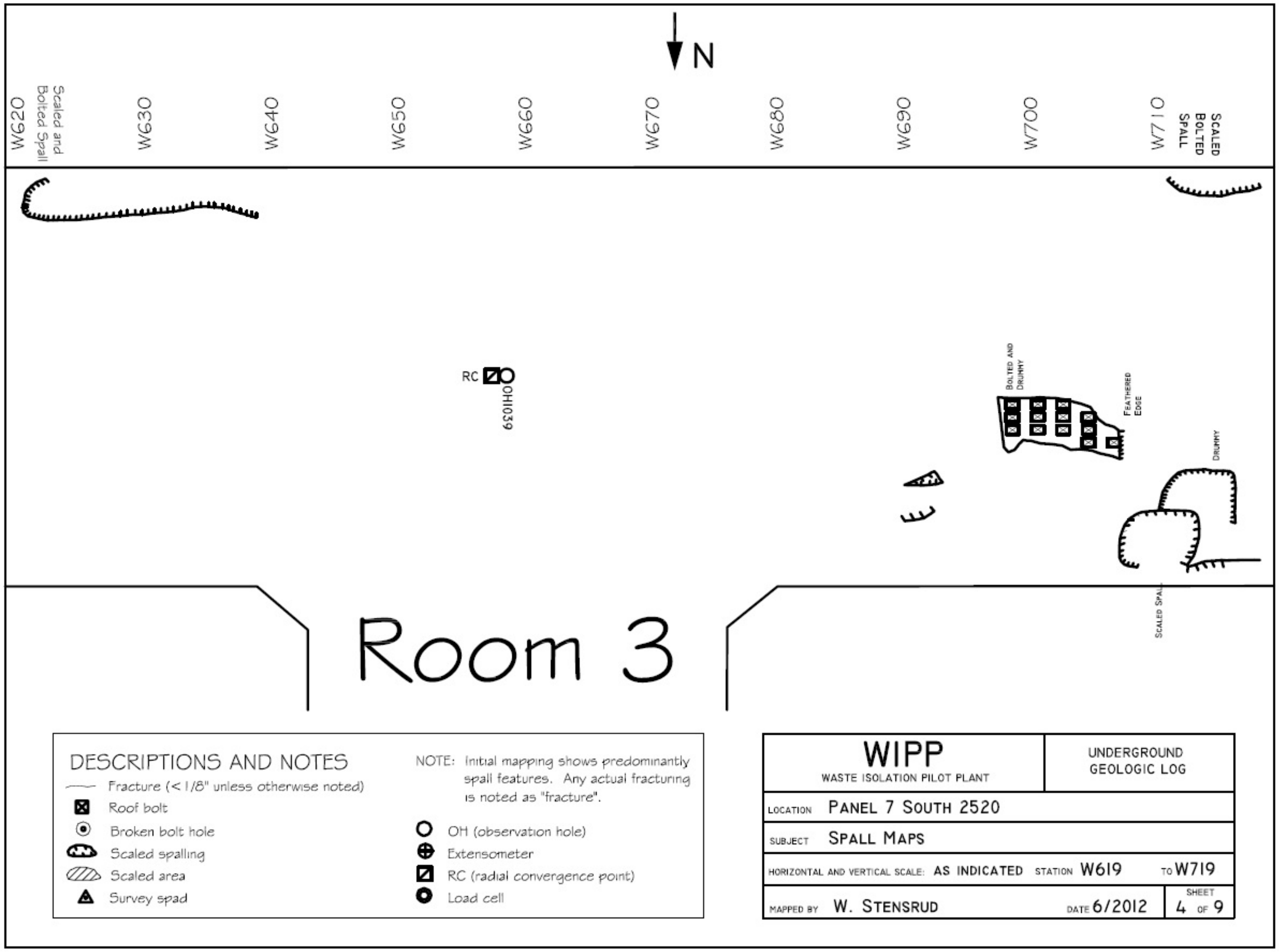


Figure 7-63
Panel 7 South 2520, W619-W719 Roof Fractures

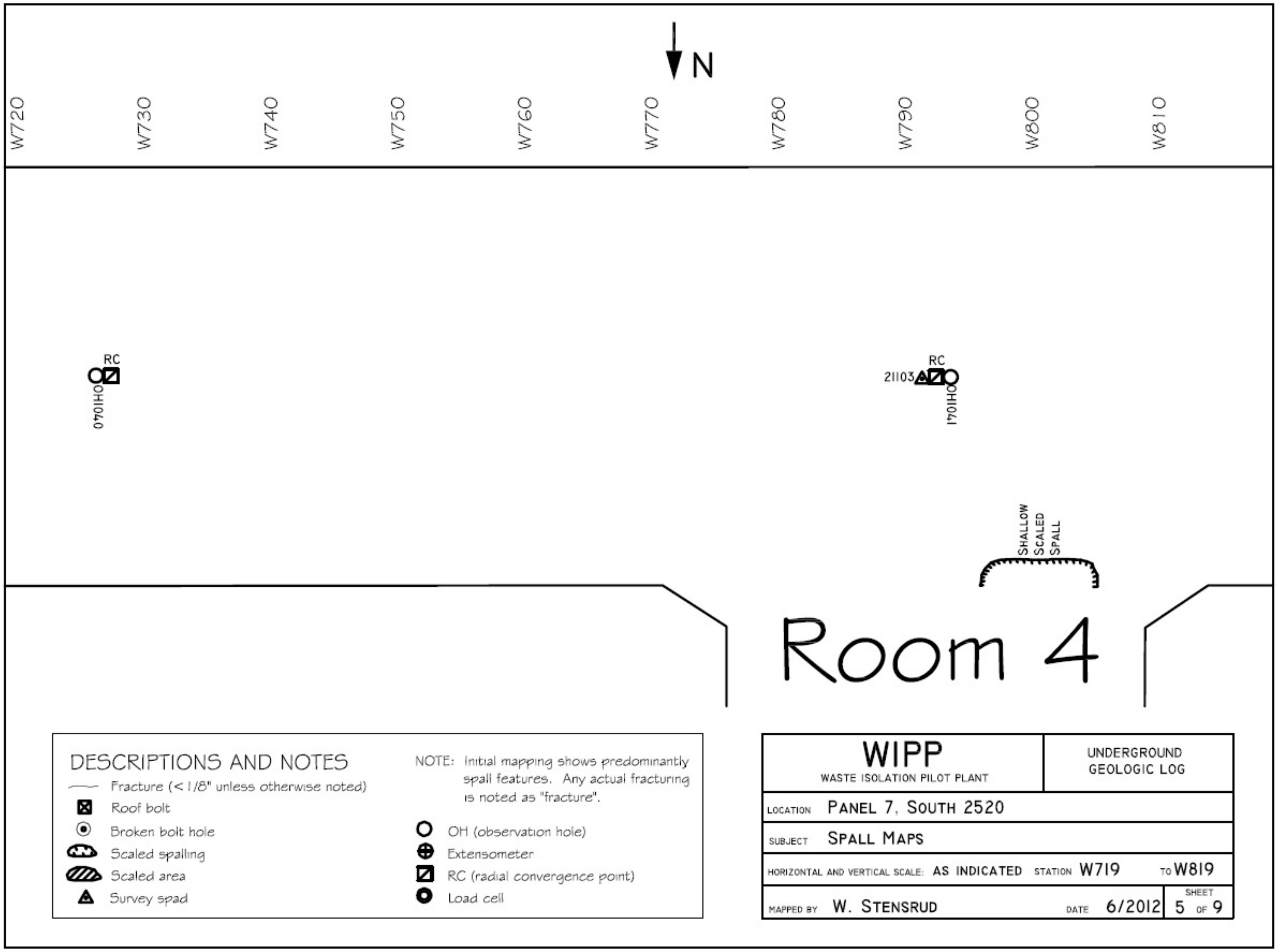


Figure 7-64
Panel 7 South 2520, W719-W819 Roof Fractures

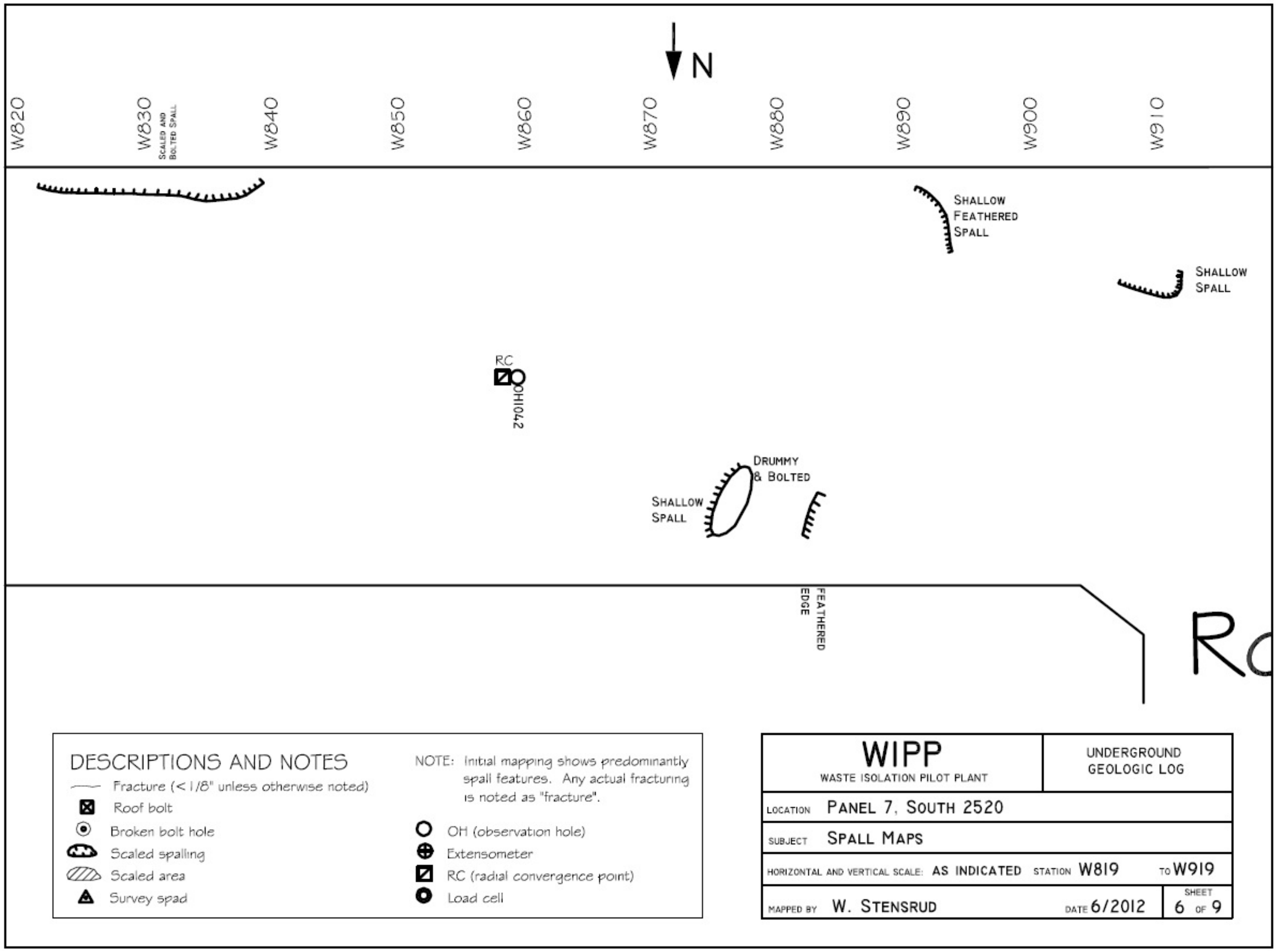


Figure 7-65
Panel 7 South 2520, W819-W919 Roof Fractures

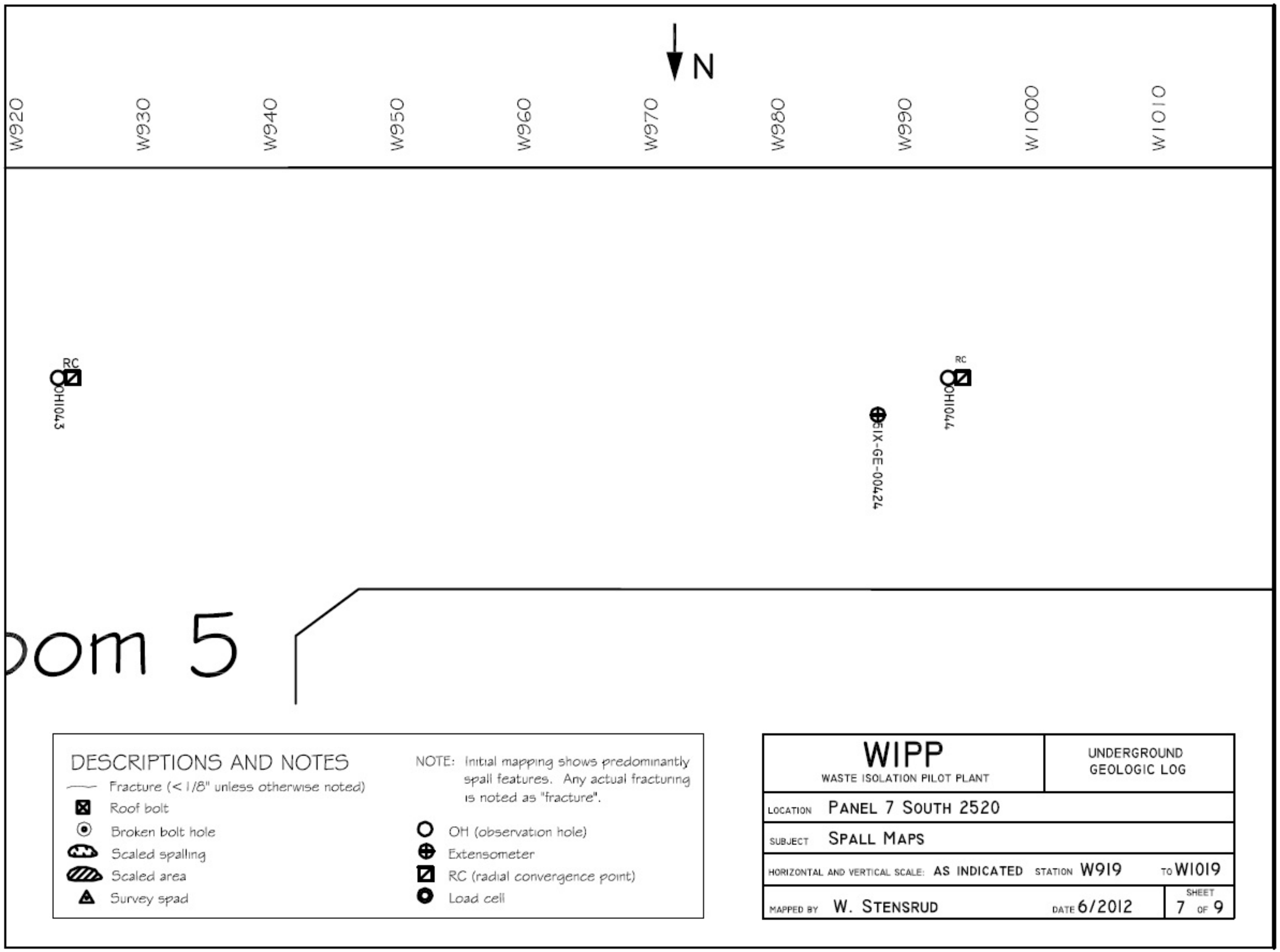


Figure 7-66
Panel 7 South 2520, W919-W1019 Roof Fractures

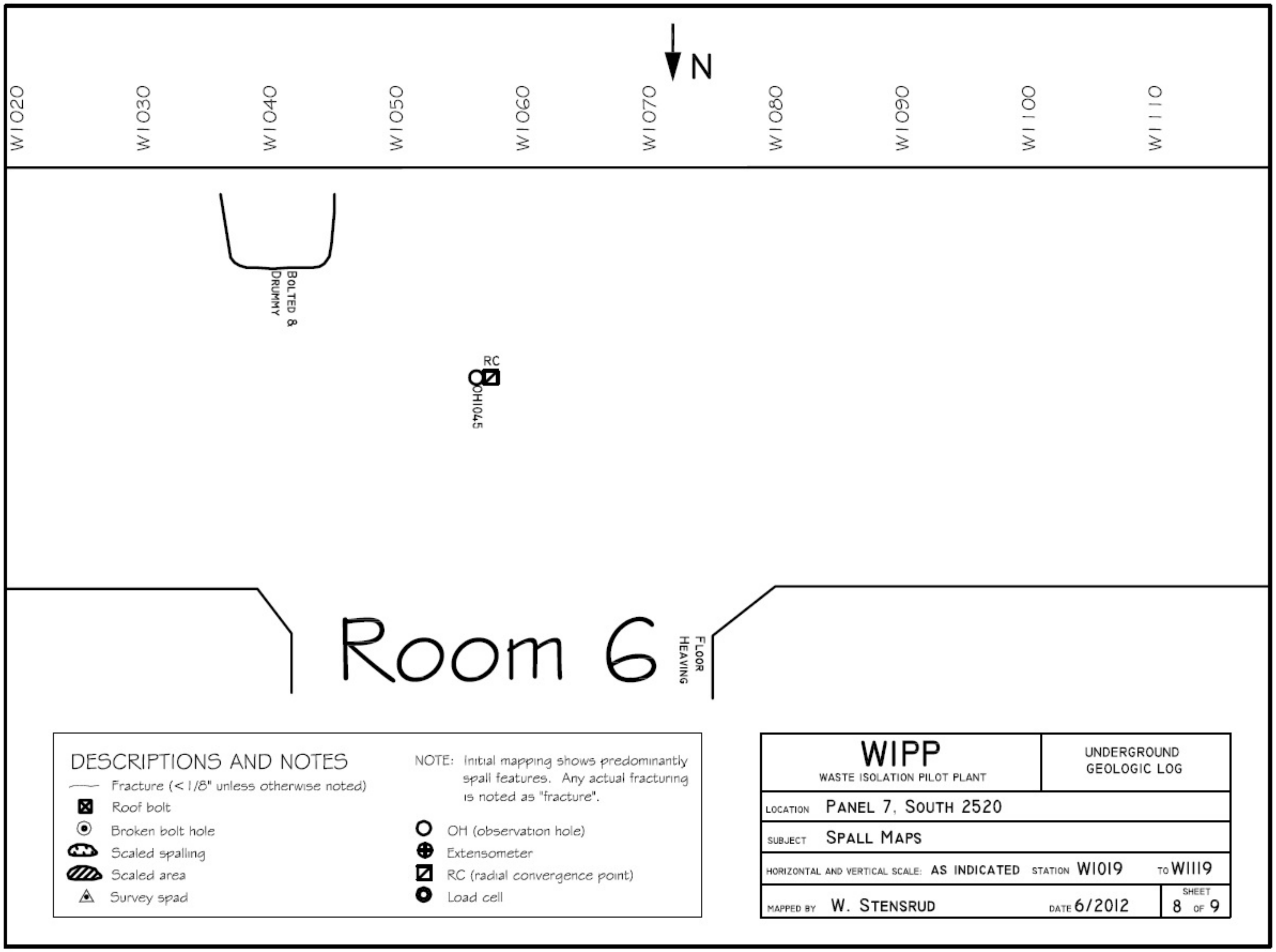


Figure 7-67
Panel 7 South 2520, W1019-W1119 Roof Fractures

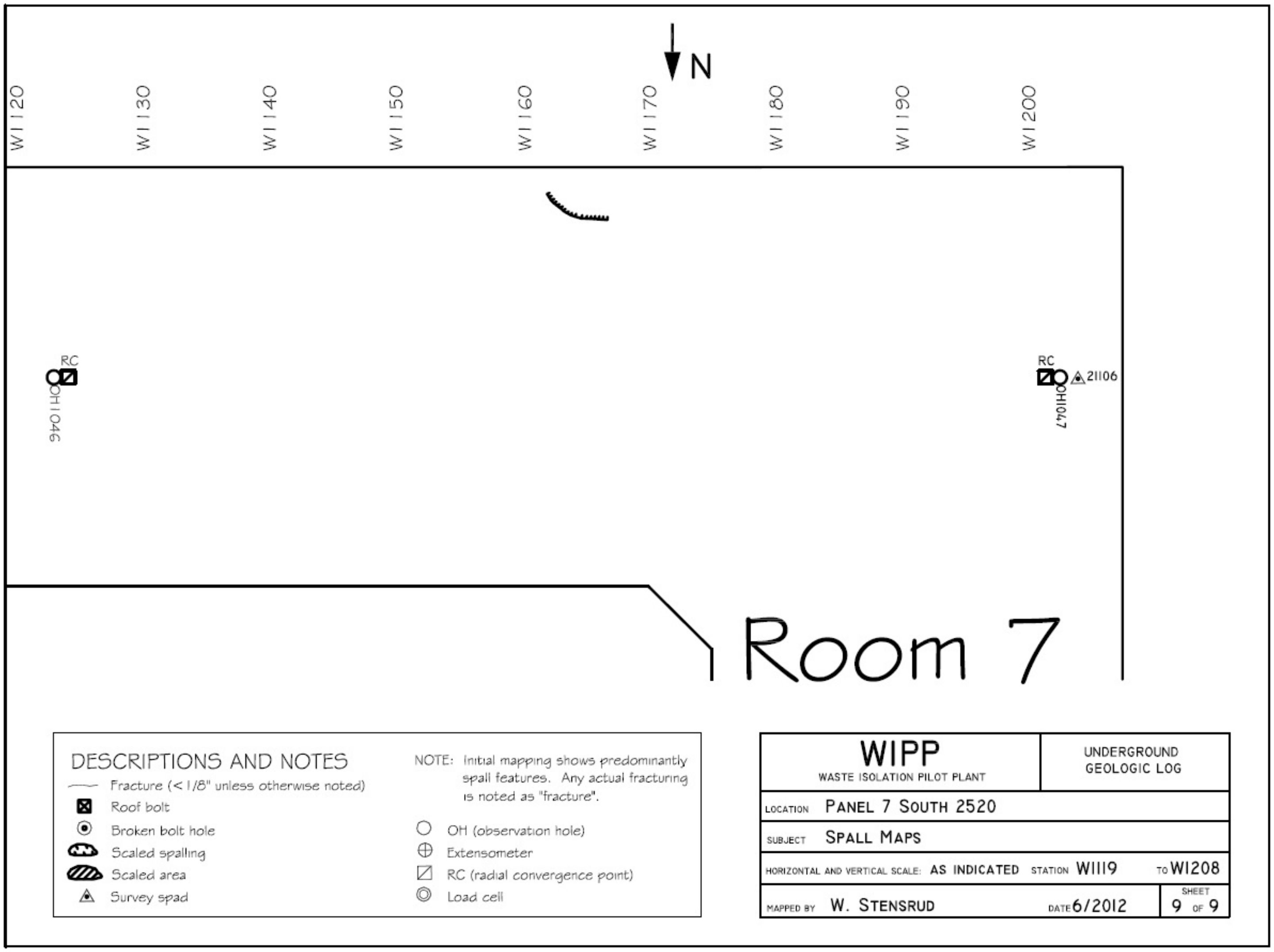


Figure 7-68
Panel 7 South 2520, W1119-W1208 Roof Fractures