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EAST AFRICAN STANDARD

Standard guide for set of data elements to describe a ground-water site — Part 3: Usage descriptors

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EAST AFRICAN COMMUNITY

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Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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Introduction

In the preparation of this East African Standard, the following source was consulted extensively:

ASTM D5410:1993(1998), *Standard guide for set of data elements to describe a ground-water site — Part 3: Usage descriptors*

Assistance derived from this source and others inadvertently not mentioned is hereby acknowledged.

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Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part Three—Usage Descriptors[1]

This standard is issued under the fixed designation D 5410; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide is Part Three of three guides to be used in conjunction with Practice D 5254 that delineates the data desirable to describe a ground-water data collection or sampling site. This guide identifies usage descriptors, such as monitoring, for an individual ground-water site. Guide D 5408 describes additional information beyond the minimum set of data elements that may be specified to identify a ground-water site, while Guide D 5409 identifies physical descriptors, such as construction, for a site.

NOTE 1—A ground-water site is defined as any source, location, or sampling station capable of producing water or hydrologic data from a natural stratum from below the surface of the earth. A source or facility can include a well, spring or seep, and drain or tunnel (nearly horizontal in orientation). Other sources, such as excavations, driven devices, boreholes, ponds, lakes, and sinkholes, that can be shown to be hydraulically connected to the ground water, are appropriate for the use intended.

NOTE 2—Guide D 5408 includes data confidence classification descriptor (1 element), geographic location descriptors (4 elements), political regime descriptor (1 element), source identifier descriptors (4 elements), legal descriptors (9 elements), owner descriptors (2 elements), site visit descriptors (3 elements), other identification descriptors (2 elements), other data descriptors (3 elements), and remarks descriptors (3 elements). Guide D 5409 includes individual site characteristics (7 data elements), construction descriptors (56 data elements), lift descriptors (16 data elements), geologic descriptors (26 data elements), hydraulic descriptors (20 data elements), and spring descriptors (11 data elements). For a list of descriptors in this guide, see Section 3.

1.2 These data elements are described in terms used by ground-water hydrologists. Standard references, such as Ref (**1**)[2] and various hydrogeologic professional publications, are used to determine these definitions. Many of the suggested elements and their representative codes are those established by the Water Resources Division of the U.S. Geological Survey and used in the National Water Information Systems computerized data base[3] (**1-21**).

NOTE 3—The purpose of this guide is to suggest data elements that can be collected for ground-water sites. This does not uniquely imply a computer data base, but rather data elements for entry into any type of permanent file.

NOTE 4—Component and code lists given with some of the data elements, for example" method of discharge measurement," are only suggestions. These lists can be modified, expanded, or reduced for the purpose intended by the company or agency maintaining the ground-water data file.

NOTE 5—Use of trade names in this guide is for identification purposes only and does not constitute endorsement by ASTM.

1.3 This guide includes the data elements desirable to document a ground-water site beyond those given in the minimum set of data elements. Some examples of the data elements are water level, discharge, and water-quality sample collection date. No single site will need every data element, for example, a monitoring site may not need a long-term water use record. Each record (group of data elements) for a site has mandatory data elements, such as the date for the water level record. However, these elements are considered necessary only when that specific record is gathered for the site.

1.4 The values stated in both inch-pound and SI units are to be regarded separately as the standard. The values given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all*

[1] This guide is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigations.

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[2] The boldface numbers given in parentheses refer to the list of references at the end of the text.

[3] Guide for the Decommissioning of Ground-Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities (draft); ASTM Subcommittee D18.21.06 on Well Maintenance, Rehabilitation, and Abandonment Section, August 1991.

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2. Referenced Documents

2.1 *ASTM Standards:* [4]

D 653 Terminology Relating to Soil, Rock, and Contained Fluids

D 5254 Practice for Minimum Set of Data Elements to Identify a Ground-Water Site

D 5408 Guide for Set of Data Elements to Describe a Ground-Water Site; Part One—Additional Identification Descriptors

D 5409 Guide for Set of Data Elements to Describe a Ground-Water Site; Part Two—Physical Descriptors

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms applicable to this guide, see Terminology D 653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *code*—a suggested abbreviation for a component, for example, "T" is the code suggested for the "electric tape" component of data element method of measurement.

3.2.2 *component*—a subdivision of a data element, for example, "electric tape" is one of 14 components suggested for data element method of measurement.

3.2.3 *data element*—an individual segment of information about a ground-water site, for example, "method of measurement." The data element is in the water-level record record.

3.2.4 *record*—denotes a set of related data elements that may need to be repeated to fully describe a ground-water site. For example, a ground-water monitoring site where water levels are measured periodically will need more than one water-level record record (the record includes data elements date of measurement, date accuracy, water level, water-level accuracy, status, method of measurement, instrumentation, and statistics method) to fully document the water-level history of the site. However, if only a single water level was measured for the site, the record is utilized once.

3.2.5 *record group*—a set of related records. For example the "monitoring record group" includes the measuring point record, network record, water level record, discharge record, water use record, water quality record, and field water quality record. Some record groups consist of only one record, for example, the "irrigation record group" includes only the irrigation record.

[4] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Summary of Guide

4.1 This guide includes the following usage descriptor data elements to describe a ground-water site. This guide includes only repeated elements that commonly require several records to fully describe the conditions and history of the site:

Monitoring Record Group:
- *Network Record:*
  - Data Type
  - Date Interval of Network Utilization
  - Source Agency for Network Data
  - Frequency of Data Collection
  - Method of Data Acquisition
  - Power Type of Instruments
  - Network
- *Measuring-Point Record:*
  - Date Interval of Measuring-Point Utilization
  - Height in Reference to Datum
  - Description
- *Water-Level Record:*
  - Measurement Date and Time
  - Water Level
  - Water-Level Accuracy
  - Status
  - Method of Measurement and Instrumentation
  - Instrumentation
  - Source of Data
  - Statistics Method
- *Discharge Record:*
  - Measurement Date and Time
  - Discharge
  - Type of Discharge
  - Source of Data
  - Method of Discharge Measurement
  - Instrumentation
  - Production or Pumping Level
  - Static Level
  - Method of Water-Level Measurement
  - Pumping Period
  - Specific Capacity
  - Drawdown
  - Source of Water-Level Data
- *Water-Use Record:*
  - Date Range of Water-Use Record
  - Data Collection Interval
  - Long-Term Water Use
  - Method Used to Determine Long-Term Water Use
- *Water-Quality Record:*
  - Sample Date and Time
  - Agency That Analyzes Samples
  - Type of Analyses
  - Parameters Requested for Analysis
  - Sample Depth/Interval
  - Water-Quality File Containing Analysis
  - Laboratory Number
  - Laboratory Name
  - Replicate Sequence Number
  - Collecting Agency or Company
  - Agency or Company Code
  - Chain of Custody
  - Sampling Purpose
  - Site Condition
  - Sample Appearance
  - Sample Odor
  - Presence of Immiscible Stratum
  - Thickness of Immiscible Stratum
  - Sensors
  - Sample Preservation Method
  - Sample Filtration Material
  - Pumped Period
  - Casing Volume
  - Amount of Water Purged
  - Sampling Method or Sampler Type
  - Sampler Material
  - Aquifer Sampled
  - Regulating Agency
- *Field Water-Quality Record:*

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Field Sample Date and Time
Parameter Code
Value of Parameter
Unit for Parameter
Instrumentation or Method of Determination
Monitoring Site at Waste-Facility Record:
Date Interval in Service
State Regulatory Agency
State Registration Identification
EPA Registration Identification
Responsible Company
Company's Site Identification
Site Location in Relationship to Waste Facility
Status of Site
Sampled Interval
Irrigation Record Group:
Irrigation Record:
Irrigated Land Area
Allowance for Irrigating
Date Legal Irrigation Begins
Date Legal Irrigation Ends
Decommissioning Record Group:
Decommissioning Record:
Date Decommissioned
Method Used for Decommissioning
Reason for Decommissioning
Plugging Material
Name and Address of Decommissioner
Step-by-Step Procedures
Availability of Decommissioning Report
Regulations Followed, Federal, State, Local

5. Significance and Use

5.1 Data at ground-water sites are gathered for many purposes. Each of these purposes generally requires a specific set of data elements. For example, when the ground-water quality is of concern not only are the minimum set of data elements required for the site, but information concerning the sample collection depth interval, method of collection, and date and time of collection are needed to fully qualify the data. Another group of elements are recommended for each use of the data, such as aquifer characteristics or water-level records. Normally the more information that is gathered about a site by field personnel, the easier it is to understand the ground-water conditions and to reach valid conclusions and interpretations regarding the site.

5.2 The data elements listed in this guide and Guides D 5408 and D 5409 should assist in planning what information can be gathered for a ground-water site and how to document these data.

NOTE 6—Some important data elements may change during the existence of a site. For example, the elevation of the measuring point used for the measurement of water levels may be modified because of repair or replacement of equipment. This frequently occurs when the measuring point is an opening in the pump and the pump is modified or replaced. Because changes cannot always be anticipated. It is preferable to reference the height of the measuring point to a nearby, permanent altitude datum. The measuring point is referenced by being the same altitude (zero correction) or above (negative correction) or below (plus correction) the altitude datum. All appropriate measurements should be corrected in reference to the altitude datum before entry into the permanent file. Care must be exercised to keep the relationship of these data elements consistent throughout the duration of the site.

5.3 Some data elements have an extensive list of components or possible entries. For example the aquifer identification list described in Guide D 5409 has over 5000 entries. Lengthy lists of possible entries are not included in this guide, however, information on where to obtain these components is included with the specific data element.

NOTE 7—This guide identifies sources, lists, etc. of information required to completely document information about any ground-water site.

6. Documentation

6.1 *Introduction*:

6.1.1 Many of the ground-water data elements require multiple records or entries to completely describe a site. Time-related elements, such as water levels, discharge measurements, and water chemistry, may present hundreds or thousands of records for a period of many years that document measurements at a single site. These time-related data help to determine historical trends and serve to establish bench-mark facts for the site.

6.1.2 Other data elements that are not time related, such as casing lengths, spring openings, and an array of geophysical logs, require a sequence of records to thoroughly describe the site. These data are extremely valuable in site characterization, for example, wells for which the construction components are required to understand the source of the water.

6.2 *Monitoring Record Group*:

6.2.1 *Introduction*—The monitoring record group includes records for documenting data elements relating to any type of information gathered at a ground-water site for the purpose of monitoring hydrologic, usage, and water-quality trends.

6.2.2 *Network Record*—The network record includes the data elements that describes a ground-water site as it relates to a node in a hydrologic, usage, or water-quality network (**10**).

NOTE 8—An example of a form (see Fig. 1) for documenting the data elements as described for two records of the monitoring record group is illustrated to show a method of design for this tool. These forms are commonly known as "field forms" or as "coding forms" (for computer entry). This type of form is routinely used for transcribing field data while at the ground-water site and entering nonfield information at the agency's or company's office. It should be noted that each form has the site identification (primary identification as used by the agency or company), date of field visit, and person that recorded the data as the first entries. These three data items are mandatory to ensure correct filing of the information, either in cabinets or in a computer data base, and for quality control.

6.2.2.1 *Data Type*—If applicable, document the type of monitoring conducted or information collected at the ground-water network site. The information identified as continuous are from automatic recording devices, such as water-level recorders. Suggested network data type components and representative codes are as follows:

A—Water quality, analyzed in the laboratory
B—Water quality, analyzed in the field
C—Water levels, continuous
D—Water levels, intermittent
E—Water discharge, continuous
F—Water discharge, intermittent
G—Prediction and detection of earthquakes
H—Land compaction for subsidence
I—Vadose-zone water pressure
Z—Other (describe)

NOTE 9—A ground-water site can be used as a node in a network for monitoring phenomenon other than the common water-quality, water-level, and discharge parameters. For example, in some areas of the country, wells are used indirectly as part of programs to monitor the subsidence of the land surface as a result of collapse or compaction

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GROUND-WATER SITE

MONITORING RECORD

Site Identification _____ Date Prepared _____
Prepared by _____ (Name)

Network Record:
Data Type _____ (See List in Manual)
Date Interval of Network Utilization _____ (Begin) _____ (End)
Source Agency to Network Data _____ (Name)
_____ (Address)
Frequency of Data Collection _____ (See List in Manual)
Method of Data Acquisition _____ (See List in Manual)
Power Type of Instruments _____ (See List in Manual)
Network _____ (See List in Manual)

Measuring-Point Record:
Date Interval of Measuring-Point Utilization _____ (Begin) _____ (End)
Height in Reference to Datum _____ (feet/metre)
Description _____
_____
_____

FIG. 1 Sample Form

resulting from extraction of liquid from the underground material. Wells and springs have been used in past research as monitoring sites to predict and detect earthquakes by chemical changes in the water and by water-level fluctuations.

6.2.2.2 *Date Interval of Network Utilization*—If applicable, document the date interval, in year, month, and day (YYYYMMDD), that the ground-water site was used for network monitoring. If still in use, document the date that the site was put into service.

6.2.2.3 *Source Agency for Network Data*— If applicable, document the name and address of the agency responsible for the collection of the ground-water data at the network monitoring site.

6.2.2.4 *Frequency of Data Collection*—If applicable, document the frequency of data collection at the network monitoring site. Suggested frequency of data collection components and representative codes are as follows:

C—Continuously (analog recorder)
J—Fixed interval (digital recorder) give interval
K—Variable interval (digital recorder) give interval
H—Hourly
D—Daily
W—Weekly
F—Semimonthly (twice a month)
M—Monthly
B—Bimonthly (every two months)
Q—Quarterly
S—Semiannually
A—Annually
2—Biennially (every two years)
3—Every three years
4—Every four years
5—Every five years
X—Every ten years
O—One time only
I—Intermittently or variable time scale
Z—Other (describe)

6.2.2.5 *Method of Data Acquisition*—If applicable, document the method of data collection at the network monitoring site. Suggested method of data collection components and representative codes are as follows:

A—Automated instruments accessed by field personnel
B—Automated instruments accessed by direct line
D—Automated instruments accessed by radio
G—Automated instruments accessed by remote data transmission
F—Periodic field visits by agency or company personnel
C—Calculated from records of owner
E—Estimated from other records
U—Unknown
Z—Other (describe)

6.2.2.6 *Power Type of Instruments*—If applicable, document the power type of permanently mounted data collection instruments at the ground-water monitoring site in the network. A detailed description of the instruments should be included with each specific type of monitoring (for example, digital recorder with water levels). Suggested power type of instrument components and representative codes are as follows:

M—Mechanical
B—Battery operated
S—Spring driven
E—Electrical
R—Solar batteries
Z—Other (describe)

6.2.2.7 *Network*—If applicable, document the areal extent or management level of the network that includes the ground-water monitoring site. Document any additional networks that may include the site. Suggested network data components and representative codes are as follows:

N—National
S—State or Province
R—Regional, multiple state or county
C—County
D—Drainage basin
P—Project
Z—Other (describe)

6.2.3 *Measuring-Point Record*—The measuring point represents a convenient position at a ground-water facility to reference repeated measurements, such as water levels. For some ground-water sites the measuring point is at the same location as the altitude datum (**10**).

NOTE 10—The altitude of the datum is described as one of the

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geographic locational data elements in the "Standard Practice for the Minimum Set of Data Elements to Identify a Ground-Water Site." This record describes the relationship between the measuring point and the datum, thereby linking measurements made at the site to the third dimension, the altitude. The datum normally remains the same for the life of the site; the measuring point can change as the water-withdrawal facilities are modified.

6.2.3.1 *Date Interval of Measuring-Point Utilization*—If applicable, document the date interval, in year, month, and day (YYYYMMDD), that the measuring point was used for conducting measurements at the ground-water site. If still in use, document the date that the measuring point was first used.

NOTE 11—The measuring point can be modified because of changing conditions at the ground-water site, therefore, several different measuring points may be used over the life of the site. These changes must be dated in order to relate to time-significant information, such as ground-water levels, that are collected over the history of the site.

6.2.3.2 *Height in Reference to Datum*—Document the height of the measuring point above or below the datum, in feet or metres. If the position of the measuring point is the same as the datum, the value is 0.0. Document the accuracy or confidence classification for this data element.

6.2.3.3 *Description*—Document a detailed description of the measuring point in relationship to the ground-water withdrawal facilities. A sketch or photograph of the facility and measuring point is valuable as an aid to future identification of the location.

6.2.4 *Water-Level Record*—This record is used to document water-level measurements of ground-water sites. Each water-level record requires most of the following data elements to thoroughly document the event. A single site may have thousands of records (**3-6, 9 and 10, 12, 18 and 19**).

6.2.4.1 *Measurement Date and Time*—Document the date and time of day (standard time and 2400 clock) of the water-level measurement. Many historical measurements do not have the time of day information and are accurate only to the nearest day. Some measurements are only accurate to the nearest year, however are extremely valuable in documenting long-term water-level trends. Unless obvious, document the exactness of the date of measurement. An example is "193800000000" for the year 1938 without the month, day, and time (**2, 13**).

6.2.4.2 *Water Level*—If applicable, document the water level, in feet or metres, in reference to the measuring point, for the ground-water site. For water levels that are above the measuring point (normally artisan wells), precede the value with a minus (–) sign to distinguish those water levels from ones at or below the measuring point. For those events where the condition at the site is dry, plugged, discontinued, certain flowing situations, or the site is destroyed, the water level is not transcribed (see 6.2.4.4). Document the accuracy or confidence classification for this data element (see 6.2.4.3 for suggestions).

6.2.4.3 *Water-Level Accuracy*—Document the accuracy of the water level as an aid for interpretation. Suggested water-level accuracy components and representative codes are as follows:

0—Accurate to nearest foot or metre
1—Accurate to nearest 1/10th ft or 1 cm
2—Accurate to nearest 1/100th ft or 1 mm
9—Unknown
Z—Other (describe)

6.2.4.4 *Status*—If applicable, document the status of the ground-water site as it relates to the water level. Suggested status components and representative codes are as follows:

A—Static water level (site is in equilibrium)
D—Site dry (no water level recorded)
E—Flowed recently
F—Site flowing (water level could not be measured) (no water level recorded)
G—Nearby site tapping same aquifer was flowing
H—Nearby site tapping same aquifer flowed recently
I—Injector site (recharge water being injected)
J—Injector site monitor (nearby site tapping same aquifer injecting recharge water)
N—Measurements discontinued
O—Obstruction encountered in well above water surface (no water level recorded)
P—Site being pumped
R—Site pumped recently
S—Nearby site tapping same aquifer being pumped
T—Nearby site tapping same aquifer pumped recently
V—Foreign substance present on surface of water
W—Site destroyed
X—Affected by stage in nearby surface-water body
Z—Other conditions affect water level (describe)

6.2.4.5 *Method of Measurement and Instrumentation*—If applicable, document the instruments and method designating the means by which the water level was measured. Suggested method of measurement components and representative codes are as follows:

A—Air line
B—Analog or graphic recorder
C—Calibrated air line
E—Estimated
F—Fiberglass tape
G—Pressure gage, mechanical
H—Calibrated pressure gage
I—Interface probe
L—Interpreted from geophysical logs
M—Manometer
N—Nonrecording gage (for example, staff gage)
P—Pressure transducer with data logger
R—Reported, method not known
Q—Sonar sounder
S—Steel tape
T—Electric tape
V—Calibrated electric tape
Z—Other (describe)

6.2.4.6 *Instrumentation*—If applicable, document the type of all permanently mounted data collection instruments at the ground-water site used for water-level monitoring. Suggested instrument components and representative codes are as follows:

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B—Bubble gage
C—Crest-stage gage
D—Digital recorder (mechanical or electronic)
E—Continuous-record type recorder
G—Graphic or analog recorder
I—In situ, without readout or data logger
M—Data logger
P—Pressure transducer
R—Radio relay
S—Satellite relay
T—Telemetry
Z—Other (describe)

6.2.4.7 *Source of Data*—If applicable, document the source of the discharge data. Suggested source of data components and representative codes are as follows:

A—Government agency
C—Consultant
D—Driller's log or report
L—Personnel of source agency or company
M—Memory (owner, operator, driller)
O—Records by owner
R—Person other than owner, driller, or another government agency
S—Personnel of reporting agency or company
U—University associate
Z—Other source (describe)

6.2.4.8 *Statistics Method*—If applicable, document the method which describes how the measurement was selected from a continuous recorder (for example, analog, digital or micrologger) available for that day. Suggested statistics code components and representative codes are as follows:

M—Water level shown is a daily maximum (for example, deepest water level for the day)
N—Water level shown is a daily minimum (for example, shallowest water level for the day)
A—Water level is 12:00 noon reading
P—Water level is 12:00 midnight reading
N—Mean, daily, monthly, etc. (specify)
O—Other (describe)

6.2.5 *Discharge Record*—This record is used to document instantaneous discharge measurements for ground-water sites. Each discharge record requires most of the following data elements to thoroughly document the measurement. A single site may have many records (**3-6**, **10**, **12**, **18**, **19**).

6.2.5.1 *Measurement Date and Time*—Document the date and time of day (standard time and 2400 clock) of the instantaneous discharge measurement. Many historical measurements do not have the time of day information and are accurate only to the nearest day. Some measurements, accurate to only the nearest year, are extremely valuable in documenting long-term water usage. Unless obvious, document the accuracy of the date of measurement.

6.2.5.2 *Discharge*—Document the discharge value for the ground-water site in gallons per minute, cubic feet (or metres) per second, litres per second or any other standard volume/time unit. This value must correspond to the remainder of the discharge event record for the site. Document the volume/time unit used. Document the accuracy or confidence classification for this data element.

6.2.5.3 *Type of Discharge*—If applicable, document the method of discharge. Suggested type of discharge components and representative codes are as follows:

P—Pumped
F—Flow
Z—Other (describe)

6.2.5.4 *Source of Data*—If applicable, document the source of the discharge and related (water level) data. Suggested source of the data components and representative codes are as follows:

A—Government agency
C—Consultant
D—Driller's log or report
L—Personnel of source agency or company
M—Memory (owner, operator, driller)
O—Records by owner
R—Person other than owner, driller, or another government agency
S—Personnel of reporting agency or company
U—University associate
Z—Other source (describe)

6.2.5.5 *Method of Discharge Measurement*— If applicable, document the method used to measure the discharge. Suggested method of discharge measurement components and representative codes are as follows:

A—Acoustic or sonic meter (transient-time meter)
B—Bailer
C—Current meter; either propeller-type meter in the discharge pipe, or propeller- or cup-type meter in the discharge channel
D—Doppler meter
E—Estimated
F—Flume
M—Totaling meter
O—Orifice
P—Pitot-tube meter, includes Cox meter, Collins meter, and the like
R—Reported, method not known
T—Trajectory method (free-fall method)
U—Venturi meter
V—Volumetric; bucket or barrel and stopwatch
W—Weir
Z—Other (describe)

6.2.5.6 *Instrumentation*—Ground-water sites used for discharge monitoring can have permanently mounted data collection instruments. Document the type and use of all instruments at the site as follows:

D—Digital recorder (mechanical and electronic)
E—Continuous-record type recorder
G—Graphic or analog recorder
M—Data logger
R—Radio relay
S—Satellite relay
T—Telemetry
Z—Other (describe)

6.2.5.7 *Production or Pumping Level*—If applicable, document the water level, in feet or metres in reference to the measuring point, measured while the ground-water site was discharging at the amount transcribed for this discharge record. If the water level is above the measuring point, for example a flowing artesian well, precede the value with a minus (–) sign. Document the accuracy or confidence classification for this data element.

6.2.5.8 *Static Level*—Document the water level, in feet or metres in reference to the measuring point, that relates to the remainder of the even record at the ground-water site. The measurement should be made before production begins or after the production has been stopped and the water level has reached equilibrium. For those water levels that are above the measuring point (normally flowing artesian wells), precede the value with a minus (–) sign to distinguish those water levels from one at or below the measuring point. Document the accuracy or confidence classification for this data element.

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6.2.5.9 *Method of Water-Level Measurement*— If applicable, document the method indicating how the water level was measured. Suggested method of water-level measurement components and representative codes are as follows:

A—Airline
B—Analog or graphic recorder
C—Calibrated airline
E—Estimated
G—Pressure gage
H—Calibrated pressure gage
L—Interpreted from geophysical logs
M—Manometer
N—Nonrecording gage
R—Reported, method not known
S—Steel tape
T—Electric tape
V—Calibrated electric tape
Z—Other (describe)

6.2.5.10 *Pumping Period*—If applicable, document length of time, in hours and minutes, that the ground-water site was pumped or allowed to flow prior to the measurement of the production water level. Document the accuracy or confidence classification for this data element.

6.2.5.11 *Specific Capacity*—If applicable, document the specific capacity of the ground-water site. The value is computed by dividing the yield of the well in gallons per minute by the drawdown in feet ((yield)/(production water level–static water level)). Document the time of test if different than pumping period and the accuracy or confidence classification for this data element.

6.2.5.12 *Drawdown*—If applicable, document the drawdown, in feet or metres, of the water level of the pumping or flowing ground-water site. The drawdown is equal to the production level minus the static level. Document the accuracy or confidence classification for this data element.

6.2.5.13 *Source of Water-Level Data*—If applicable, document the source of the water-level data. Suggested source of data components and representative codes are as follows:

A—Government agency
C—Consultant
D—Driller's log or report
L—Personnel of source agency or company
M—Memory (owner, operator, driller)
O—Records by owner
R—Person other than owner, driller, or another government agency
S—Personnel of reporting agency or company
U—University associate
Z—Other source (describe)

6.2.6 *Water-Use Record*—The water-use record is used to document a history of long-term water withdrawals from a ground-water site. These withdrawals are usually reported daily, monthly, quarterly, or yearly (**10**, **20**).

6.2.6.1 *Date Range of Water-Use Record*— If applicable, document the date interval, in year, month, and day (YYYYMMDD), that the water-use data were gathered for the ground-water site.

6.2.6.2 *Data Collection Interval*—If applicable, document the data collection interval for the cumulative long-term water use for the ground-water site. Suggested time-increment components and representative codes are as follows:

D—Daily
M—Monthly
Q—Quarterly
R—Seasonal
S—Semiannually
Y—Yearly
Z—Other (describe)

6.2.6.3 *Long-Term Water Use*—If applicable, document the cumulative long-term water use, in gallons or litres (for large amounts, use units of thousands, millions, or acre-feet), for the ground-water site. This value can be stated in volume per day, month, quarter, year, etc. If other volume units are used, identify the unit. Document the accuracy or confidence classification for this data element.

6.2.6.4 *Method Used to Determine Long-Term Water Use*—If applicable, document the method used to determine the long-term water use. Suggested method used to determine long-term water use components and representative codes are as follows:

E—Estimated from Periodic Measurements
M—Totaling Meter
O—Owners Meter Records
P—Estimated from Power Records
R—Reported, Method Not Known
Z—Other (describe)

6.2.7 *Water-Quality Record*—The process of collecting and analyzing water-quality samples requires that complete information be gathered to confirm that the sample meets quality assurance procedures that may be required by law. The following data elements may be used to document the water samples (**3**, **4**, **10**, **14**, **15**, **18**).

6.2.7.1 *Sample Date and Time*—If applicable, document the date (year, month, and day) and time of day (standard time and 2400 clock) that the sample was collected at the ground-water site. Many historical samples do not have the time of day information and are accurate only to the nearest day. Some measurements, accurate to only the nearest year, are extremely valuable in documenting long-term water-quality trends. Unless obvious, document the accuracy of the date of measurement (**2**, **13**).

6.2.7.2 *Agency That Analyzes Samples*—If applicable, document the name and address of the agency that performed the quality analyses on the water sample collected for the monitoring site.

6.2.7.3 *Type of Analyses*—If applicable, document the type of quality analyses conducted on the water collected at the monitoring site. Suggested type of analyses components and representative codes are as follows:

A—Physical properties
B—Common ions (major cations and anions)
C—Trace elements
D—Pesticides
E—Nutrients
F—Sanitary analysis (organisms)
H—Herbicides
R—Radioactive
T—Biological taxa
V—Volatile organic compounds
Z—Other (describe)

NOTE 12—The Environmental Protection Agency (EPA) has compiled

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lists of components required to fulfill the needs of various federal regulations. These lists are available through EPA publications (**16**).

6.2.7.4 *Parameters Requested for Analysis*— If applicable, document the EPA's five-digit STORET or chemical name or symbol for those parameters requested for analysis. Normally, the results of the analyses will be stored in a related and separate file, for example, EPA's STORET data base.[5]

6.2.7.5 *Sample Depth/Interval*—If applicable, document the maximum depth or preferably, interval, in feet or metres below the datum, to specify the zone of origin of the water sample at the ground-water site. Document the accuracy or confidence classification for this data element.

6.2.7.6 *Water-Quality File Containing Analysis*—If applicable, document the location of the file that contains the final water-quality analysis. If stored in a computer data base, identify the file (for example, STORET). If stored in file cabinets or published, identify the file type or publication.

6.2.7.7 *Laboratory Number*—If applicable, document the number assigned by the analyzing laboratory to the water sample.

6.2.7.8 *Laboratory Name*—If applicable, document the name and address of the laboratory that analyzed the water sample.

6.2.7.9 *Replicate Sequence Number*—If applicable, document the sequence number for the replicate sample.

6.2.7.10 *Collecting Agency or Company*—If applicable, document the name and address of the agency or company that collected the sample.

6.2.7.11 *Agency or Company Code*—If applicable, document the code of the agency or company that collected the sample. This code is assigned by EPA's STORET User Assistance staff and is required before entry of the ground-water site data into EPA's computerized Water Quality File (WQF).[5]

6.2.7.12 *Chain of Custody*—If applicable, document the names of the people and agency or company that signed the chain of custody form and the dates signed.

6.2.7.13 *Sampling Purpose*—If applicable, document the purpose or reason for collecting the sample. Suggested sampling purpose components and representative codes are as follows:

B—Research
C—CERCLA
R—RCRA
D—Drinking water regulations
E—Exploration (water)
L—Local ordinance
S—State regulations, other than CERCLA or RCRA
F—Federal regulations, other than CERCLA or RCRA
H—Hydrologic benchmark
I—Environmental issues
J—Judicial/litigation
M—Mining regulations
N—Natural resources exploration
U—Unknown
Z—Other (describe)

6.2.7.14 *Site Condition*—If applicable, document the condition of the ground-water site at the time the sample was collected. Suggested sampling condition components and representative codes are as follows:

P—Pond—fenced, but open to atmosphere
U—Pond—unprotected
S—Spring or tunnel—protected
V—Spring or tunnel—unprotected
W—Well—sealed
Y—Well—open casing
Z—Other (describe)

6.2.7.15 *Sample Appearance*—If applicable, document the appearance of the sample at the time of collection as to color and turbidity. Suggested sample appearance components and representative codes are as follows:

A—Clear or colorless
C—Colored, not turbid (give color)
S—Turbid, suspended matter, particles visible (give color)
T—Turbid, suspended matter, particles not visible (give color)
U—Unknown
Z—Other (describe)

6.2.7.16 *Sample Odor*—If applicable, document the odor given off by the ground water during the collection of the sample. Suggested sample odor components and representative codes are as follows:

C—Chemical, unknown
D—Chlorine
H—Hydrogen sulfide
M—Methane
N—None
P—Petroleum
Z—Other (describe)

6.2.7.17 *Presence of Immiscible Stratum*—If applicable, document the presence of an immiscible stratum that may be at the top or bottom of the water column at the time of sample collection. Suggested presence of immiscible stratum components and representative codes are as follows:

T—Top presence of immiscible stratum
B—Bottom presence of immiscible stratum
I—Indeterminable
M—Mixed as globules in water
N—None
S—Sheen
U—Unknown
Z—Other (describe)

6.2.7.18 *Thickness of Immiscible Stratum*— If applicable, document the thickness in inches or millimetres of an immiscible stratum that may be at the top or bottom of the water column at the time of sample collection.

6.2.7.19 *Sensors*—If applicable, document the type of sensors, manufacturer, and model numbers of sensors at the ground-water site used for sensing of water-quality parameters. Suggested sensor components and representative codes are as follows:

E—Electrical
I—Ion specific
O—Sensors, using fiber optics
U—Unknown
Z—Other (describe)

6.2.7.20 *Sample Preservation Method*—If applicable, document the method used to preserve the sample. Several methods of preservation may be used that depend upon the parameter analyzed. Each method should be documented. Suggested sample preservation method components and representative codes are as follows:

[5] STORET Users Assistance, USEPA, Mail Code PM-2180, 401 M Street, S.W., Washington, DC 20406.

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C—Cooled or iced
H—Hydrochloric acid
P—Hydrogen peroxide
N—Nitric acid
R—Phosphoric acid
S—Sulfuric acid
X—None
Z—Other (describe)

6.2.7.21 *Sample Filtration Material*—If applicable, document the filter size and sample filtration material used in-line or in the field following the sample collection. If more than one filter is used, document each material and filter size. Suggested sample filtration material components and representative codes are as follows:

D—Cellulose acetate
C—Cellulose nitrate
G—Glass
E—Polycarbonate
T—Teflon
X—None
Z—Other (describe)

6.2.7.22 *Pumped Period*—If applicable, document length of time, in hours and minutes, that the ground-water site was pumped or allowed to flow prior to the collection of the water sample. Document the accuracy or confidence classification for this data element.

6.2.7.23 *Casing Volume*—If applicable, document the amount of water that needs to be pumped to purge the casing one time, in gallons, cubic feet (or metres), litres, or any other standard volume/time unit. Document the volume unit used. For example, the amount of water needed to purge the system is in the well casing above the screen or open area. Document the accuracy or confidence classification for this data element.

6.2.7.24 *Amount Water Purged*—If applicable, document the amount of water that was pumped or allowed to flow before the water sample was collected at the ground-water site, in gallons per minute, cubic feet (or metres) per second, litres per second, or any other standard volume/time unit. Document the volume/time unit used. Document the accuracy or confidence classification for this data element.

6.2.7.25 *Sampling Method or Sampler Type*— If applicable, document the sampling method or sampler type used to collect the water sample at the ground-water site. Numerous sampling devices have been and are being developed. The following list was patterned after a draft USEPA reference guide (**4**). Also see Note 5. Suggested type of sampling method or sampler type components and representative codes are as follows:

Portable Grab/Depth Specific Samplers
O—Open bailer
P—Point-source bailer
B—Bucket
S—Syringe sampler
W—Westbay sampler
K—Kemmerer/Van Dorn sampler
C—Collwasa sampler
T—Stratified thief sampler
A—Swabbing
D—Packer pumps
Portable Positive Displacement (Submersible) Samplers
E—Bladder pump
G—Grundfos centrifugal pump
F—Other centrifual pump
H—Helical rotor pump
I—Gas-drive piston pump
J—Gear-drive pump
L—Submersible rod pump
Other Portable Samplers
M—Peristaltic suction lift
N—Centrifugal suction
Q—Gas-drive/displacement
R—Inertial pump
V—Gas-lift pump
Y—Jet pump
Portable In Situ Samplers
1—Hydropunch
2—BAT sampler
3—Other cone penetrometer samplers
4—Other in situ samplers
Other or Unknown Methods
X—Natural flowing, spring or well
U—Unknown
Z—Other (describe)

6.2.7.26 *Sampler Material*—If applicable, document the material used in construction of the sampler. Suggested sampler material components and representative codes are as follows:

A—Aluminum
B—ABS (Plastic)
C—Copper
G—Galvanized iron
L—Steel
N—Nylon
O—Polypropylene
P—Polyvinyl chloride (PVC)
Q—Polyalkene
R—Rubber
S—Stainless steel
T—Teflon
W—Wood
U—Unknown
Z—Other (describe)

6.2.7.27 *Aquifer Sampled*—If applicable, document the identification of the aquifer or aquifers from where the water was obtained at the ground-water site. A convenient and systematic method of coding aquifer and geologic units is used

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by the U.S. Geological Survey in a national file (Catalog of Aquifer Names and Geologic Unit Codes used by the Water Resources Division) (for example, Edwards Limestone of Texas is coded 218EDRD). Information needed to obtain an ordered list of aquifers and related codes is available (**10**):[6]

6.2.7.28 *Regulating Agency*—If applicable, document the name and address of the agency that regulates water quality at the ground-water site, for example, State Health Department.

6.2.8 *Field Water-Quality Record*—The field water-quality data denote those constituents or characteristics where the final values are determined in other than the laboratory. Many of the values for these parameters, such as temperature and pH, only can be measured at the time of sample collection because of rapidly changing conditions in the water upon removal from the natural environment. Properly measured, these parameters are extremely valuable in determining the true hydrologic conditions in the aquifer at the ground-water site (**3**, **7**, **10**, **14**, **15**).

NOTE 13—Many of the supporting data elements listed under the water-quality record also apply and can be used for documenting the field water-quality record. Normally, field water-quality characteristics (for example, temperature, pH) are determined during the same site visit that water-quality samples are collected for laboratory analysis. Therefore, when samples are collected for laboratory analysis, those supporting data elements (for example, sample depth/interval, site condition, aquifer sampled) need not be repeated for the field water-quality record.

6.2.8.1 *Field Sample Date and Time*—Document the date (year, month, and day) and time of day (standard time and 2400 clock) that the water-quality characteristic was determined at the ground-water site. Many historical determinations do not have the time of day information and are accurate only to the nearest day. Some measurements, accurate to only the nearest year, are extremely valuable in documenting long-term water-quality trends. Unless obvious, document the accuracy of the date of measurement (**2**, **13**).

6.2.8.2 *Parameter Code*—Document the EPA's five-digit STORET number, CAS number, or chemical name or symbol for those water-quality parameters analyzed or measured in the field. The following are some of the common field-determined water-quality characteristics and the corresponding STORET number code:

00010—Temperature, water (°C)
00095—Specific conductance (microsiemens/cm at 25°C)
00300—Oxygen, dissolved (DO), milligrams per litre (mg/L)
00400—pH (standard units)
00405—Carbon dioxide, dissolved (mg/L as CO_2)
00410—Alkalinity, water, whole, total, field, as $CaCO_3$, mg/L
00430—Alkalinity, carbonate (mg/L as $CaCO_3$)
00440—Bicarbonate, water, whole, total, field, as HCO_3, mg/L
00445—Carbonate, water, whole, total, field, as CO_3, mg/L
00900—Hardness, total (mg/L as $CaCO_3$)
00940—Chloride, dissolved (mg/L as Cl)
00945—Sulfate, dissolved (mg/L as SO_4
00950—Fluoride, dissolved (mg/L as F)
01045—Iron, total (micrograms per litre (µg/L) as Fe)
31501—Coliform, membrane filter, immediate M-endo medium (colonies/100 mL)
31625—Coliform, fecal, 0.7µ m membrane filter (UM-MF) (colonies/100 mL)
31673—Streptococci, fecal, membrane filter, KF agar (colonies/100 mL)
71820—Density—grams per millilitre (g/mL) at 20°C
71830—Hydroxide, water, whole, total, field, as OH, mg/L

6.2.8.3 *Value of Parameter*—Document the value for the field determined water-quality constituent or characteristic. Document the accuracy or confidence classification for this water-quality parameter.

6.2.8.4 *Unit for Parameter*—Include with each water-quality constituent or characteristic the unit used for recording the value, for example, degrees celsius for temperature, micromhos (or microsiemens) per centimetre at 25° (25° is the laboratory standard) celsius for specific conductance or milligrams per litre (mg/L) for chloride.

6.2.8.5 *Instrumentation or Method of Determination*—Document the method or function, manufacturer, model, and accuracy of the instruments used to obtain field water-quality characteristics at the ground-water site. A number of instruments are currently available to measure these data. Some generic examples of the more common field instruments are as follows (**17**, **19**):

pH meter
Thermometer
Specific-conductance meter
Dissolved-oxygen metre
Kits for field measurement of constituent values
Kits for field determination of biological values

NOTE 14—New apparatus become available daily and many instruments of laboratory quality have become portable and are suitable for use in the field. Whether the field-determined chemical analyses can be classed as laboratory equivalent depends upon the quality control maintained on the instruments used for the measurement.

6.2.9 *Monitoring Site at Waste-Facility Record*—The monitoring site at waste-facility record includes the documentation of data elements of ground-water sites that were constructed for the primary purpose of monitoring the pollutants and hydraulics at hazardous and solid-waste facilities (**11**, **19**).

[6] Geologic Names Unit, U.S. Geological Survey, 439 National Center, Reston, VA 22092.

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NOTE 15—Many of the other records listed under the monitoring record group and other standards describing ground-water data components also apply and can be used for documenting the ground-water sites at waste facilities.

6.2.9.1 *Date Interval in Service*—If applicable, document the date interval, in year, month, and day (YYYYMMDD), that the ground-water site was in service at the waste facility. If still in use, document the date that the site was put into service.

6.2.9.2 *State Regulatory Agency*—If applicable, document the name and address of the state regulatory agency that has jurisdiction over the site.

6.2.9.3 *State Registration Identification*— If applicable, document the number or identification assigned to the site by the state regulatory agency.

6.2.9.4 *EPA Registration Identification*— If applicable, document the number or identification assigned to the site by the U.S. Environmental Protection Agency.

6.2.9.5 *Responsible Company*—If applicable, document the name and address of the company or agency that owns or has control of the ground-water site.

6.2.9.6 *Company's Site Identification*— If applicable, document the company or agency number or identification of the ground-water site.

6.2.9.7 *Site Location in Relationship to Waste Facility*—If applicable, document the relative location of the ground-water site at the waste facility. Common site locations in relationship to the ground-water hydraulic gradient and waste facility and representative codes are as follows:

A—Upgradient
D—Downgradient
S—Side
W—Within boundaries
U—Unknown
Z—Other (describe)

6.2.9.8 *Status of Site*—If applicable, document the status of the ground-water site at the waste facility. Suggested status components and representative codes are as follows:

A—Active
D—Destroyed
E—Damaged
I—Inactive
U—Unknown
Z—Other (describe)

6.2.9.9 *Sampled Interval*—If applicable, document the monitored interval, in feet or metres. Document the accuracy or confidence classification for this data element.

NOTE 16—For example, the interval might be 15 to 18 ft (4.57 to 5.49 m) below the measuring point. The measuring point is defined under the measuring-point record and is related to the altitude, therefore, if the supporting records are utilized, the sampled interval can be converted to altitude values.

6.3 *Irrigation Record Group*:

6.3.1 *Introduction*—The irrigation record group includes the record for documenting the data elements pertaining to irrigation at a ground-water site.

6.3.2 *Irrigation Record*—The irrigation record includes data elements that relate to the withdrawal of water to be used for irrigation at the ground-water site (**10**).

6.3.2.1 *Irrigated Land Area*—If applicable, document the land area, in acres or hectares, that is irrigated by water from the ground-water site.

6.3.2.2 *Allowance for Irrigating*—If applicable, document the maximum amount of water, in acre-feet per year or another unit, that is allocated for withdrawal from the ground-water site. Document the measurement unit and accuracy or confidence classification for this data element.

6.3.2.3 *Date Legal Irrigation Begins*—If applicable, document the date, in year, month, and day (YYYYMMDD), that irrigation can begin in the spring or at the start of the irrigation season (for example, 19870301).

6.3.2.4 *Date Legal Irrigation Ends*—If applicable, document the date, in year, month, and day (YYYYMMDD), that irrigation ends in the fall or at the end of the irrigation season (for example, 19871001).

6.4 *Decommissioning Record Group*:

6.4.1 *Introduction*—The decommissioning record group includes the record for documenting data elements that pertain to the permanent decommissioning or closure of a ground-water site.

6.4.2 *Decommissioning Record*—The decommissioning record includes data elements that pertain to permanent closure of a ground-water site. Although the decommissioning normally applies to sites at solid or hazardous waste facilities, the record can be used for any ground-water site, such as a public supply well[3] (**18**).

6.4.2.1 *Date Decommissioned*—If applicable, document the date, in year, month, and day (YYYYMMDD), that the ground-water site was decommissioned or closed.

6.4.2.2 *Method Used for Decommissioning*— If applicable, document the method used to decommission or close the ground-water site. Suggested method used for decommissioning components and representative codes are as follows:

L—Casing left in place and plugged
R—Casing removed and hole plugged
U—Unknown
Z—Other (describe)

6.4.2.3 *Reason for Decommissioning*—If applicable, document the reason for decommissioning or closing the ground-water site. Suggested reason for decommissioning components and representative codes are as follows:

C—Remove chance of unauthorized use
P—Prevent migration of contaminants
M—Reduce chance of vertical or horizontal migration
N—No longer required
F—Failed or damaged
R—Regulatory requirement
U—Unknown
Z—Other (describe)

6.4.2.4 *Plugging Material*—If applicable, document the material used to fill the opening, for example the borehole opening. Suggested generic plugging material components and representative codes are as follows:

P—Portland cement (describe)
E—Expansive cement (describe)
A—API cement (describe)
B—Other cement (describe)
D—Gypsum cement (describe)
F—Epoxy resin cement (describe)
C—Clay (describe)
G—Coarse-grained material (describe)
U—Unknown
Z—Other (describe)

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NOTE 17—Plugging materials, such as Portland cement, have a number of different types. In addition, each type can have a number of possible additives that are used for extenders, accelerators, retarders, density improver, fluid loss controllers, and friction reducers. The various materials and additives should be described.

6.4.2.5 *Name and Address of Decommissioner*— If applicable, document the company or agency name and address of the decommissioner of the ground-water site.

6.4.2.6 *Step-by-Step Procedures*—If applicable, document the step-by-step procedure used to decommission the ground-water site.

6.4.2.7 *Availability of Decommissioning Report*—If applicable, document the availability of the decommissioning report. Include the name and address of the source of the report.

6.4.2.8 *Regulations Followed, Federal, State, Local*—If applicable, document the regulations followed in decommissioning the ground-water site. Include the name and address of the regulator.

7. Keywords

7.1 confidence classification; decommissioning of ground-water site; field water-quality sample; ground water; ground-water site; irrigation; monitoring network; regulatory agency; site identification; waste facility; water-quality sample; water use

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