

Guidelines for Writing Hydrologic Reports



U.S. Department of the Interior—U.S. Geological Survey

INTRODUCTION

The written report is the principal product of the Water Resources Division (WRD) of the U.S. Geological Survey (USGS). Whatever the medium for disseminating and archiving the report—paper copy, diskette, CD-ROM, or online—much of the speed and economy of technological advances will be wasted unless the author's initial efforts result in a technically accurate, clear, and timely document.

The following guidelines are intended to assist WRD authors in the writing phase of reports that document the results of their data collection, hydrologic study, and research activities. They should be considered guidelines only, and, with the exception of a few "rules" regarding report policy, not as rigid doctrine. When given a choice of various ways to approach the preparation of some aspect of a report, strong preference should be given to doing it in a way that conforms to established USGS standards for text and illustrations. The many desktop publishing and illustrations software packages now available allow authors to produce a high-quality manuscript at their own desk, but in some cases the illustrations produced do not strictly conform to established standards. In such cases, authors, illustrators, editors, reviewers, and approving officials need to weigh the effort (in terms of time and cost) that would be required to bring the illustrations into conformance with the USGS standards against the benefits of expedited publication, which would be achieved by allowing minor departures from the standards, that would best serve the USGS and its customers.

Guidelines for the preparation of text, tables, and illustrations in USGS reports are not presented here; those guidelines are contained in four basic source books, listed at the end of this document, that should be available to every employee who is or aspires to be an author. Every author also should have at

hand a general style manual for guidance on issues of proper English usage—grammar, syntax, spelling, punctuation, capitalization, and vocabulary.

The approach taken here is to describe the characteristics of the various parts of a scientific report and their functions within the overall document. This approach is similar to that used by Olcott (1987) in a more detailed paper.

WRITING STYLE

Scientific writing must be accurate, coherent, and concise. The meaning of each word must be clear and unambiguous to the reader. Excessive use of technical jargon detracts from readability. Even complex, highly technical reports should have clearly stated and easily understood objectives, discussions and applications of results, and conclusions. "Write not merely to be understood, but rather so that you cannot possibly be misunderstood." (D.E. Hillier, U.S. Geological Survey, oral commun., 1970).

POLICY

The USGS is obligated to make the results of its scientific and engineering investigations available in a manner that will best serve the whole public. In the preparation of reports, that obligation is met by adhering to the following rules:

- *Maintain impartiality, objectivity, and integrity.*—Do not show bias in data or interpretations. Do not criticize others: agencies, firms, scientists, or members of the public. Do not make statements of what must or should be done. A report may suggest additional data collection, further investigation, or possible study approaches that would help define or assess a hydrologic concern, issue, or problem. A report may state the *relevance* of the information presented to water management or public policy decisions, but should not state what

the proper water-management action or public policy should be.

- *Do not compete with the private sector.*—Avoid site-specific, "consulting-type" reports. Stress the scientific aspects and transfer value of USGS studies.
- *Acknowledge cooperators, all significant assistance, and nonoriginal material.*—Obtain written permission to use copyrighted material and acknowledge its use. Avoid use of company or brand names, if possible, or include a disclaimer statement if names are used.
- *Ensure equal release of information.*—Do not discuss unannounced or pending USGS plans and policies or describe results of studies or data that have not been approved and released.
- *Emphasize the USGS, not its subdivisions.*—Do not refer to Divisions, Branches, Districts, or other organizational units except where necessary for identification.

An additional issue that falls within the scope of USGS report policy is that of authorship. Reports can have multiple authors with the authors' names listed typically in the order of their level of effort in the preparation of the report. To be listed as an author, one should have been substantially involved in that preparation. Participation in a project through data collection, laboratory analysis, data management, or general supervision or advice provided are not, in and of themselves, sufficient basis for inclusion in the list of authors. Listing of more than four authors in a USGS report should be done only rarely and with strong justification. Many people contribute ideas and effort to a study and ultimately to the report. Acknowledgments, and in some cases, reference to written or oral communications, are appropriate forms of recognition for these many contributors.

ORGANIZATION

Most scientific reports contain a table of contents that summarizes the report content in the form of an outline of section and subsection titles. This outline indicates the organization of the report and thus the logical argument or series of steps used to present the data and observations, to analyze and interpret that information, and to reach a conclusion. The first-order headings in the table of contents should reflect the major concepts or key words in the report title. Second- and third-order headings further subdivide the material under the major headings; words in these subheadings must fit logically under the first-order headings. Headings limit the content of the text that follows, and in USGS reports should describe those contents. Use wording such as “Aquifer Tests,” “Hydraulic Properties of Aquifers,” and “Potential Yields of Aquifers” rather than the nondescriptive headings such as “Methods,” “Results,” and “Discussion,” which are used in many journal papers.

COMPONENTS OF A REPORT

Title

The title is the ultimate abstract of a report. A good title attracts the attention of a potential reader and helps the reader to decide if the report should be obtained. The title uniquely establishes the content of a scientific report and, if pertinent, the geographic location of the study and the dates when data used in the analyses were collected. The title should contain key words that reflect the contents of the report. Avoid abbreviations, acronyms, literature citations, and company or brand names.

Abstract

An abstract is a condensation of the essential information contained in the report. A good abstract helps a potential reader decide if all or part of a report should be read. It is neither a sentence outline of the report nor a summary, but a tersely worded, factual account of the reason for and objective of the work being

reported, the methods used (if new or unusual), the results obtained, and the conclusions reached. The abstract should be informative rather than indicative; it should state what the report “tells,” not what it is about. The abstract should be suitable for publication separate from the entire report. The summary and (or) conclusions section of a report provides the source material for the abstract, which should be written last.

Introduction

As the name implies, this section of the report introduces the reader to the discussion. First and foremost, it presents and explains the problem, issue, or subject that is addressed in the report. Reports that are products of studies made in cooperation with and funding from other agencies must include a statement to that effect. The involvement of the USGS in such studies should be stated in terms of data or analyses provided to understand, explain, or resolve the hydrologic, concern, issue, or problem being addressed. The purpose and scope of the report should be stated. The purpose is that of the report, not of the overall study, and should reflect the title and main section headings. The scope sets limits on what is contained in the report. The introduction also may include background information pertinent to the study, such as climate and physiographic setting of the study area, previous investigations, methods of study, and acknowledgments. Acknowledgments are a courtesy to individuals who have contributed substantially and directly either to the conduct of the study or to the review and preparation of the report.

Body of Report

The body of the report contains the data that were collected to address the problem and the purpose of the study described in the Introduction, and the analyses and interpretation of those data. This section presents, in a logical order, the results of a study in discussions supported as necessary with tables and illustrations.

Summary and (or) Conclusions

The summary and (or) conclusions section(s) draws together and briefly reiterates the main results and conclusions of the study described in the report. At a minimum, this section should address the problem stated in the “Introduction” and ideally provide solutions to the problem. Material not included in the body of the report should not be introduced here. Summaries of long or complex reports should begin with a brief reiteration of the problem and, if important or innovative, the methods of study. Short, simple reports can be adequately summarized by drawing together the conclusions. In either case, conclusions should be as specific, and, if appropriate, as quantitative as possible by using numbers mentioned in the body of the report.

References

In nearly all reports, reference is made to the work of others on the same or related subjects. A reference list at the end of a report enables the reader to locate the literature cited in the text. All cited references must be included in the list, but additional pertinent literature can be included (then termed “Selected References”). References to reports as being “in press” are permissible, but references to manuscripts as “in preparation,” “in review,” or “submitted (to a journal)” are not permitted in USGS reports. References to oral or written communication, which appear in text only, should include an individual’s name, affiliation, and the date the communication was received or written.

Other Report Components

- *Foreword.*—An introductory statement, written by someone other than the author(s), that describes the circumstances and significance of the report.
- *Preface.*—A statement written by the author(s) that presents the main goals of a comprehensive study of regional or national scope and the relation of the following report to that study and (or) to other reports.

- *Appendixes.*—Supplemental information, such as data tables, descriptions of methods of analysis, mathematical derivations, or documentation of computer programs, that would be useful to the reader, but which is not essential to arriving at the conclusions stated in the report.
- *Glossary.*—Definitions of selected technical terms used in the report.

TABLES

Tables are essential to many scientific reports because some information is presented most effectively in tabular format. However, a table should supplement, not duplicate, information given in the text. The essence of a table is the logical arrangement of information. Because a table must be able to stand alone, it should have a brief, descriptive title that contains no acronyms or abbreviations. Each column has a descriptive heading and units (if applicable). No vertical rules (lines) are used between columns. A bracketed headnote below the title provides information that applies to the entire table; all abbreviations, acronyms, and symbols used in the table are spelled out or defined in the headnote. Footnotes are used to provide additional information about column headings and individual entries.

ILLUSTRATIONS

All illustrations in a scientific report must be accurate, must clearly convey the author's meaning, and must be consistent within the report. Illustrations that portray similar information, such as discharge hydrographs for several streams in the study area, should be in the same format. Each illustration in a report should have a purpose—either to give the reader a visual impression of the data or the relation between different types or sets of data or to clarify or emphasize something said in the text. In addition to meeting these general criteria, illustrations in USGS reports should include, at a minimum, the elements and (or) characteristics indicated in the subsections below.

Maps

A base map is the background on which all other information, such as data points, contours, and patterns, is superimposed. It should be selected early in a project on the basis of anticipated density of data and the degree of background detail needed. All similar maps in a report, such as a series of maps that show ground-water levels at various times, should be compiled on the same base.

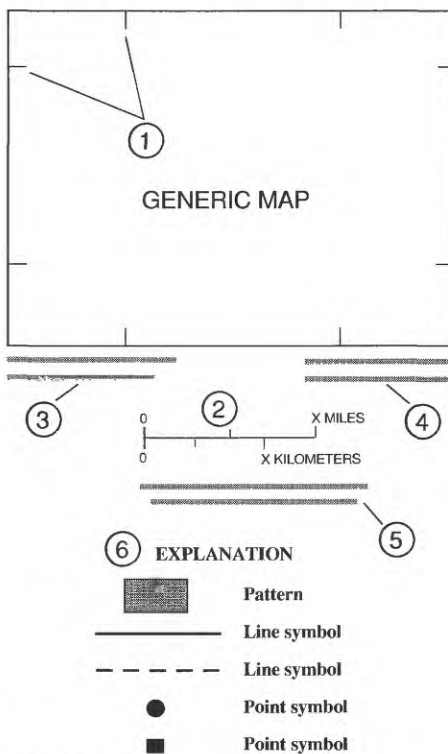


Figure 1. _____

The basic elements of a map include the following (keyed to the sketch above):

1. *Latitude and longitude.*—Show location of study area.
2. *Bar or rake scale.*—In inch-pound and metric units; units used in the report on top.
3. *Base credit.*—Provides the source for a non-original map.
4. *Mapping credit.*—Provides sources for the geology and hydrology depicted if not original by the author.
5. *Topographic data.*—Indicates contour interval(s) and datum if contours are shown.
6. *Explanation.*—Defines or explains all patterns, line symbols, and point

symbols that are not part of the base map.

7. *Caption.*—Describes briefly what the map shows. Avoid paragraph-long captions in USGS reports.

Graphs

Graphs are an effective means to illustrate the relation between two (or more) factors or sets of data (such as stream stage and water level in a nearby well) or how a factor or condition (such as ground-water levels or concentrations of dissolved oxygen in a stream) varies with time.

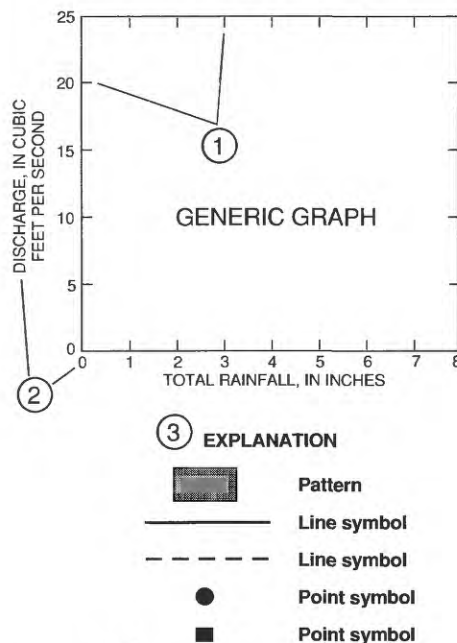


Figure 1. _____

The basic elements of a graph include the following (keyed to the sketch above):

1. *Format.*—Boxed in with tick marks on all four sides.
2. *Axis labels and values.*—Shown on left and bottom, although right vertical axis may be divided and labeled for multivariable, multiscale graphs.
3. *Explanation.*—Defines or explains all patterns, line symbols, and point symbols that are not defined or labeled on the graph.
4. *Caption.*—Describes briefly what the graph shows. Include geographic location if not obvious from entries or labels on graph.

Sections

A hydrogeologic (or geologic) section is a representation of the hydrologic (or geologic) features or conditions at and beneath the land surface along a vertical plane. Sections portrayed as representing actual or "to scale" conditions must include adequate control points (wells) to establish their accuracy. Distances between control points in sections and along the section trace shown on a map must coincide. The same principles apply to cross sections, which show conditions or features within water bodies, such as streams, lakes, or estuaries.

The basic elements of a hydrogeologic or geologic section include the following (keyed to the sketch below):

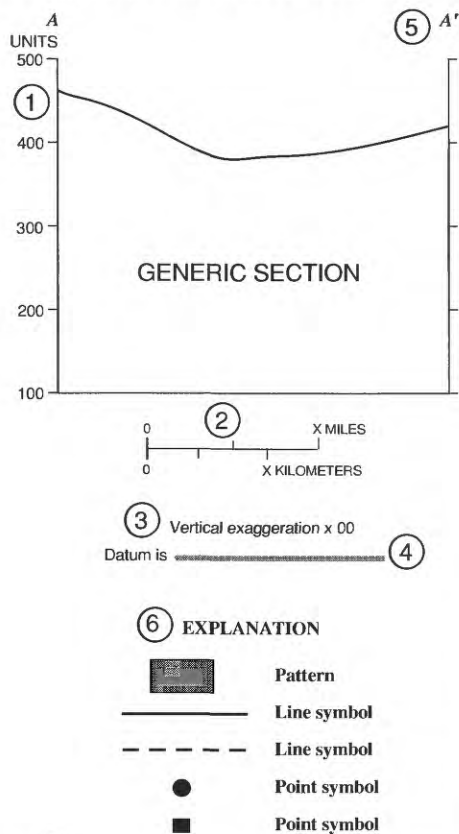


Figure 1.

1. *Units of vertical axis.*—Numerical values for tick marks are shown on left axis, optional on ticks on right axis.
2. *Scale.*—In inch-pound and metric units; units used in the report on top.
3. *Vertical exaggeration.*—If more than 10, use VERTICAL SCALE GREATLY EXAGGERATED.
4. *Datum note.*—Needed if datum (usually sea level) is not labeled on vertical axis.
5. *Designation of line or trace of section.*—For "to scale" sections, letter designations are used (A-A' shown here) and shown on a map. For diagrammatic or generalized sections, compass directions are sufficient, for example EAST and WEST.
6. *Explanation.*—Defines or explains all patterns, lines, and symbols not defined or labeled on the section.
7. *Caption.*—Describes what section shows. Include the geographic location, if not obvious from labels or names at land surface of section, and indicate on which illustration (map) in report the trace is shown.

Photographs

Photographs that are sharply focused and have good contrast are most effective. Photographs that show unique conditions of stream channels or banks, flood extent, or stratigraphy are appropriate, but photographs of standard laboratory or field equipment or field installations (observation wells or stream-gaging stations) are not recommended. Because the printing of color photographs can greatly increase the cost of a report, black-and-white photographs should be used wherever possible.

REFERENCE AND SOURCE BOOKS

- Alt, D.F., and Iseri, K.T., 1986, Publications policy and text preparation guide; v. 1 of WRD publications guide, U.S. Geological Survey, Water Resources Division, 429 p.
- Hansen, W.R. ed., 1991, Suggestions to authors of the reports of the United States Geological Survey (7th ed.): U.S. Government Printing Office, 289 p.
- Miller, R.A. and Balthrop, B.H., compilers, 1995, Standards for illustrations in reports of the U.S. Geological Survey, Water Resources Division: U.S. Geological Survey Open-File Report 95-415, 239 p.
- Olcott, P.G., 1987, Reflections on writing hydrologic reports: U.S. Geological Survey Open-File Report 87-398, 8 p.
- U. S. Government Printing Office, Style manual 1984: Washington, D.C., 479 p.

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