

## SOURCES OF INFORMATION FOR THE PREPARATION OF ENGINEERING-GEOLOGICAL MAPS IN THE NETHERLANDS<sup>1</sup>

W. F. J. BURGERS<sup>2</sup>

### ABSTRACT

Burgers, W. F. J. 1980 Sources of information for the preparation of engineering-geological maps in The Netherlands – *Geol. Mijnbouw* 59: 397-403.

The growing interest for engineering-geological maps in The Netherlands has led in recent years to a search for possible sources of engineering-geological information. The object of this paper is to show where the necessary information for the construction of this type of maps is available. The data in this paper were obtained through interviews and by means of an inquiry. The results indicate that the large governmental and semi-official organisations and the geotechnical bureaus are the principal sources of engineering-geological information in The Netherlands.

### INTRODUCTION

The idea of engineering-geological maps is certainly not new, but the interest in this type of maps has been growing steadily over the last ten years. One of the first engineering-geological maps was published in Russia in 1934 (DEARMAN & FOKES, 1974). From that date on many maps were published both in Russia and other Eastern European countries. In those days the Western World still used geological maps for engineering purposes. Since the end of the sixties, however, engineering-geological maps and articles about this type of mapping began to appear in the Western European and American literature.

An engineering-geological map may be defined to be a type of geological map which provides a generalized representation of all those components of a geological environment of significance in land use planning, and in design, construction and maintenance as applied to civil and mining engineering (UNESCO, 1976).

The increasing interest for engineering-geological maps has

resulted from:

- (1) an increasing amount of construction work;
- (2) the need for better and more detailed information on ground conditions as projects became larger and more complex;
- (3) the need to build in areas where the ground conditions are less favourable for construction;
- (4) the increasing demand for underground construction;
- (5) the increasing demand for mineral resources;
- (6) the requirement for more detailed investigations in order to take account of increasingly stringent safety and environmental factors;
- (7) the growing recognition that the suitability of terrains for building purposes and therefore the techniques of construction depend primarily upon the geological conditions;
- (8) the growing range in construction techniques related to different ground properties.

Interest in engineering-geological maps has also been growing in The Netherlands. The 1:600,000 map, dealing with applied geology, published by the Geological Survey of The Netherlands in 1975, may be quoted as an example. The standard 1:50,000 geological maps can be used for engineering purposes in a number of cases (HAGEMAN, 1974). However, at present

<sup>1</sup> Manuscript received: 1980-08-29.

Revised manuscript received and accepted: 1980-10-29.

<sup>2</sup> Rijks Geologische Dienst, Spaarne 17, HAARLEM, The Netherlands.

Table I  
Number of questionnaires sent to various organisations

| Type of organisation                             | Number of questionnaires sent |
|--|-------------------------------|
| Governmental Surveys and Institutes              | 4                             |
| Mining Companies and Affiliates                  | 3                             |
| National and Provincial Public Works Departments | 12                            |
| Watersupply Companies                            | 13                            |
| Polder Authorities                               | 8                             |
| Municipal Authorities                            | 53                            |
| Consultants                                      | 36                            |
| Contractors                                      | 45                            |

specific engineering-geological maps are not concurrently published with those standard-geological maps.

Engineering-geological maps are generally produced by compiling existing geological, geotechnical, geohydrological and geomorphological data (UNESCO, 1976). Should it become necessary to make these maps for The Netherlands, then the data will have to come from various sources. The object of this paper is to indicate where these data are stored and to what extent they are available.

#### METHODS OF INVESTIGATION

The project began in June 1977 with literature research into existing engineering-geological mapping methods, which confirmed that most maps have been produced by using existing geological, geotechnical, geohydrological and geomorphological information. Gathering this existing information, however, presented a considerable problem. The first requirement was to find out who kept useful information. To that end a list was made of organisations in The Netherlands who appeared to be concerned with engineering-geological work.

Before starting the inquiry, discussions were held with some of the organisations to find out what questions should be posed. From these discussions it appeared that the most relevant questions were the following:

- (1) Does the organisation have engineering-geological activities?
- (2) Does the organisation carry out its own field and interpretation work?
- (3) What type of information is obtained from the field work?
- (4) Does the organisation have an engineering-geological filing system?
- (5) Do the files hold field and/or interpreted data?
- (6) Is there a special file for boreholes?
- (7) Has the organisation a computerized data retrieval system?
- (8) On what conditions is it possible to obtain the information

from the files of the organisation?

- (9) Is the information sent automatically to other organisations?

These questions were sent to the organisations shown in table I.

The response was excellent, for about 80% of the forms dispatched were completed and returned.

The results are presented in the tables II and III. Table II records the replies from governmental organisations, mining companies and affiliates; table III the replies from the other organisations.

#### SOURCES OF INFORMATION

##### *Governmental surveys and institutes (Table II)*

*Rijks Geologische Dienst (Geological Survey of The Netherlands)* – The Survey carries out its own field and interpretational work and receives in addition information from other organisations. The data are of a geological, geomorphological and sometimes of a geotechnical nature. The files contain field and interpreted data; a special boreholes file is present, complete with corresponding location maps. A computerized data retrieval system is in development. The information is usually unclassified. If the work was done at special request of a client, then the information can only be obtained after that client's permission. The Survey sends information on a regular basis to the Rijks Instituut voor Drinkwatervoorziening and on request to the Dienst Grondwaterverkenning TNO, the Waterstaten and the Stichting voor Bodemkartering.

*Topografische Dienst, Dienst van het Kadaster en de Openbare Registers (Topographical Survey, The Land Registry Office)* – The Topographical Survey publishes maps on scales 1:10,000 and smaller, furthermore copies of old topographical maps and air photographs. The Land Registry Office holds plans and air photographs with scales varying between 1:1,000 and 1:10,000, which are available to the public.

*Stichting voor Bodemkartering (Soil Survey of The Netherlands)* – The Survey carries out its own field and interpretational work to depths of about 2 metres. The data are of a geological, geohydrological, geomorphological and sometimes of a geotechnical nature. Its files contain field and interpreted data; a special boreholes file is present, complete with corresponding location maps. A computerized data retrieval system is in development. The information is usually unclassified. If the work was done at special request of a client, then the information can only be obtained after that client's permission.

*Dienst Grondwaterverkenning TNO (Groundwater Survey*

Table II

SUMMARY OF RESULTS FROM INQUIRY FORMS RETURNED BY  
GOVERNMENTAL ORGANISATIONS, MINING COMPANIES AND  
AFFILIATES

|   | Number of forms returned      |  |                | Field work | Information obtained | Type of data stored                |  |            | Accessibility of the information |                             |                               |      | The information is sent automatically to the ..... |                           |                          |                                       |               |                          |   |                                 |                          |                               |  |
|---|-------------------------------|--|----------------|------------|----------------------|------------------------------------|--|------------|----------------------------------|-----------------------------|-------------------------------|------|--|---------------------------|--------------------------|---------------------------------------|---------------|--------------------------|---|---------------------------------|--------------------------|-------------------------------|--|
|   | Active in engineering geology |  |                |            |                      | Interpretation work contracted out | Special files for engineering geological information | Field data | Interpreted data                 | Special files for boreholes | Computerised retrieval system | Free | Against payment                                    | With permission of client | Under special conditions | Only for non commercial organisations | Not available | Rijks Geologische Dienst | Rijksinstituut voor Drinkwatervoorziening | Dienst Grondwaterverkenning TNO | Public Works Departments | Stichting voor Bodemkartering | Instituut voor Cultuurtechniek en Waterhuishouding |
|   | By own department             | By own department down to a depth of about 2 metres only | Contracted out |            |                      |                                    |  |            |                                  |                             |                               |      |  |                           |                          |                                       |               |                          |   |                                 |                          |                               |  |
| Rijks Geologische Dienst ( Geological Survey of the Netherlands )   | 0                             | i  | i              | i          | i                    | i                                  | i  | i          | i                                | i                           | i                             | i    |  |                           |                          |                                       |               |                          |   |                                 |                          |                               |  |
| Stichting voor Bodemkartering ( Soil Survey of the Netherlands )  | 0                             | i  |                | i          |                      | i                                  | i  | i          | i                                | i                           | i                             | i    | i  |                           |                          |                                       |               |                          |   |                                 |                          |                               |  |
| Dienst Grondwaterverkenning TNO ( Groundwater Survey TNO )  | 1                             | 1  |                | 1          | 1                    | 1                                  |  | 1          | 1                                | 1                           | 1                             | 1    | 1  |                           |                          | 1                                     | 1             |                          | 1   | 1                               | 1                        | 1                             |  |
| Rijksinstituut voor Drinkwatervoorziening ( Governmental Institute for Watersupply )  | 0                             | i  | i              | i          |                      | i                                  |  | i          | i                                | i                           | i                             |      |  |                           |                          |                                       |               |                          |   |                                 |                          |                               |  |
| Instituut voor Cultuurtechniek en Waterhuishouding ( Institute of Cultivation techniques and Watermanagement )                  | 1                             | 1  | 1              |            |                      | 1                                  | 1  | 1          | 1                                | 1                           | 1                             |      |  | 1                         |                          | 1                                     | 1             | 1                        | 1   |                                 |                          |                               |  |
| Staatsbosbeheer ( Forestry Commission )   | 1                             | 1  | 1              | 1          | 1                    | 1                                  |  | 1          | 1                                | 1                           | 1                             |      | 1  |                           |                          |                                       |               |                          |   |                                 |                          |                               |  |
| Staatstoezicht op de Mijnen ( State Control of the Mines )  | 1                             | 1  |                |            | 1                    |                                    | 1  | 1          | 1                                | 1                           | 1                             |      |  | 1                         | 1                        |                                       |               |                          |   |                                 |                          |                               |  |
| Petroleum Industry  | 0                             | i  |                | i          |                      | i                                  |  | i          | i                                | i                           | i                             | i    |  |                           |                          | i                                     | i             |                          |   |                                 |                          |                               |  |
| Eerste Nederlandse Cement Industrie NV ( Cement Producing Company )   | 1                             | 1  |                | 1          | 1                    | 1                                  |  | 1          |                                  | 1                           |                               |      |  |                           |                          | 1                                     |               |                          | 1   |                                 |                          |                               |  |
| Stichting Beton Research van de Nederlandse Cement Industrie ( Concrete Research Institute of the Netherlands Cement Industry ) | 1                             | 1  |                |            | 1                    | 1                                  | 1  | 1          | 1                                |                             |                               |      | 1  |                           |                          |                                       |               |                          |   |                                 |                          |                               |  |
| Akzo Zout Chemie Nederland BV ( Salt Mining Company )   | 1                             | 1  | 1              | 1          |                      | 1                                  |  | 1          | 1                                | 1                           | 1                             |      |  |                           |                          | 1                                     |               |                          |   |                                 |                          |                               |  |

Topografische Dienst ( Topographical Survey )

Keeps topographical maps

Dienst van het Kadaster en de Openbare Registers ( Land Registry Office )

Keeps topographical plans

Replies from an inquiry form are indicated with a " 1 "

Replies interpreted from interviews are indicated with an " i ".

*TNO* – The field work for this Survey is generally contracted out. Their own acquisition consists mainly of geoelectrical investigations and geophysical well-logging. The data are of a geological and geohydrological nature. The files store field and interpreted data; a special boreholes file is present, complete with corresponding location maps. There is a computerized retrieval system for groundwater level data, named 'Archief van grondwaterstanden', from which information can be obtained at a small cost. Data from special projects of the Survey can only be obtained with permission of the client. The Survey also supplies information to the Rijks Geologische Dienst, Rijksinstituut voor Drinkwatervoorziening, Waterstaten, Stichting voor Bodemkartering and Instituut voor Cultuurtechniek en Waterhuishouding.

*Rijksinstituut voor Drinkwatervoorziening (Governmental Institute for Watersupply)* – Both field and interpretational work are carried out by the Institute, although in some cases contractors are used for the field work. A substantial amount of information is received from the watersupply companies. The results are of a geological and geohydrological nature. The files contain field and interpreted data; a special boreholes file is present, complete with corresponding location maps. The information is usually unclassified with the exception of information of work carried out by this Institute at the special request of a client, which can only be obtained after that client's permission. Information is sent to the Dienst Grondwaterverkenning TNO and automatically to the Rijks Geologische Dienst.

*Instituut voor Cultuurtechniek en Waterhuishouding (Institute of Cultivation Techniques and Watermanagement)* – Both the field and interpretational work are done by the Institute. The results are of a geological and geohydrological and sometimes of a geomorphological nature. The files store field and interpreted information. There is no special file for boreholes. The information is mostly classified, but can often be obtained on special conditions. In some cases the information is sent to the Rijks Geologische Dienst, Rijksinstituut voor Drinkwatervoorziening, Dienst Grondwaterverkenning TNO and the Waterstaten.

*Staatsbosbeheer (Forestry Commission)* – Both field and interpretational work are usually contracted out. The results are of a geological, geohydrological and geomorphological nature. The files contain field and interpreted information, but there is no special file for boreholes. The information is unclassified.

*Staatstoezicht op de Mijnen (State Control of the Mines)* – Both field and interpretational work are contracted out. The results are of a geotechnical and geohydrological nature. The files store field and interpreted data, together with the corresponding location maps. The information is classified or available to non-commercial organisations only.

#### *Mining companies and affiliates (Table II)*

*Petroleum Industry* – The field work is nearly always contracted out, the interpretational work is usually done by the companies themselves. The results are of a geological nature. The files store field and interpreted data; boreholes files are always present, complete with corresponding location maps. Some companies have a computerized data retrieval system. The information is not, or only on special conditions, available. Information is sent to the Rijks Geologische Dienst and Staatstoezicht op de Mijnen.

*Eerste Nederlandse Cement Industrie N.V. (Cement Producing Company)* – Both field and interpretational work are contracted out. The results are of a geological and geohydrological nature. The files hold interpreted information, which is available on special conditions. Information is sent to the Rijks Geologische Dienst and the Waterstaten.

*Stichting Beton Research van de Nederlandse Cement Industrie (Concrete Research Institute of the Netherlands Cement Industry)* – Both field and interpretational work are contracted out. The results are of a geological, geotechnical and geohydrological nature. The information is readily available.

*Akzo Zout Chemie Nederland B.V. (Salt Mining Company)* – The field work is sometimes contracted out. The interpretation is carried out by the company. The results are of a geological and geohydrological nature. The files hold field and interpreted data. The information, which is obtainable on special conditions, is sent to the Rijks Geologische Dienst.

#### *University departments*

The field work is usually in the form of separate study projects. The data are of a geological, geohydrological and geomorphological nature. The files usually contain field and interpreted data of these projects in report form. The information is readily available.

#### *Other organisations (Table III)*

*Public Works Departments* – The field work is carried out by the departments themselves or contracted out. The interpretational work is generally contracted out. The data are of geological, geotechnical, frequently of a geohydrological and occasionally of a geomorphological nature. The files contain field and sometimes interpreted data. A special boreholes file is sometimes present, complete with corresponding location maps. The information is generally freely available, sometimes at a small compensation, and in some cases the permission of a client is required. The information is sometimes sent to the Rijks Geologische Dienst and occasionally to the Rijksinstituut voor Drinkwatervoorziening and Dienst Grondwaterverkenning TNO.

|                          | Number of forms returned      |    | Field work        |  |                |                                    | Information obtained |              |                 |                  | Type of data stored                                  |            |                  |                             | Accessibility of the information |      |                 |                           | The information is sent automatically to the ..... |                                       |               |                          |   |                                 |                          |                               |  |
|--------------------------|-------------------------------|----|-------------------|--|----------------|------------------------------------|----------------------|--------------|-----------------|------------------|--|------------|------------------|-----------------------------|----------------------------------|------|-----------------|---------------------------|--|---------------------------------------|---------------|--------------------------|---|---------------------------------|--------------------------|-------------------------------|--|
|                          | Active in engineering geology |    | By own department | By own department down to a depth of about 2 metres only | Contracted out | Interpretation work contracted out | Geological           | Geotechnical | Geohydrological | Geomorphological | Special files for engineering geological information | Field data | Interpreted data | Special files for boreholes | Computerised retrieval system    | Free | Against payment | With permission of client | Under special conditions                           | Only for non commercial organisations | Not available | Rijks Geologische Dienst | Rijksinstituut voor Drinkwatervoorziening | Dienst Grondwaterverkenning TNO | Public Works Departments | Stichting voor Bodemkartering | Instituut voor Cultuurtechniek en Waterhuishouding |
| Public Works Departments | 11                            | 11 | 9                 | 1  | 10             | 7                                  | 10                   | 9            | 8               | 4                | 10   | 9          | 6                | 5                           |                                  | 7    | 3               | 3                         | 1  | 3                                     | 1             | 5                        | 4   | 4                               | 2                        | 2                             | 1  |
| Watersupply Companies    | 13                            | 13 | 8                 | 1  | 12             | 10                                 | 13                   | 5            | 12              |                  | 11   | 12         | 10               | 7                           | 2                                | 5    | 1               |                           | 6  | 1                                     | 2             | 12                       | 11  | 12                              | 1                        |                               |  |
| Polder Authorities       | 8                             | 5  | 1                 | 2  | 4              | 3                                  | 4                    | 5            | 4               | 1                | 5  | 3          | 3                | 1                           |                                  | 3    |                 | 1                         | 1  |                                       |               |                          |   | 1                               |                          |                               |  |
| Municipal Authorities    | 48                            | 45 | 6                 | 16   | 43             | 27                                 | 32                   | 45           | 29              | 2                | 41   | 38         | 17               | 13                          |                                  | 19   | 11              | 11                        | 7  | 4                                     | 13            |                          | 1   | 12                              | 3                        |                               | 1  |
| Building Consultants     | 21                            | 21 | 3                 | 10   | 19             | 12                                 | 12                   | 18           | 18              | 2                | 19   | 17         | 8                | 5                           |                                  | 3    | 2               | 13                        | 3  | 1                                     | 4             | 1                        |   |                                 |                          |                               | 1  |
| Geotechnical Consultants | 7                             | 7  | 7                 |  | 4              | 1                                  | 6                    | 7            | 7               | 4                | 7  | 7          | 7                | 3                           |                                  |      | 1               | 5                         | 1  | 1                                     | 1             | 2                        |   | 1                               |                          |                               |  |
| Building Contractors     | 23                            | 23 | 6                 | 4  | 15             | 13                                 | 4                    | 22           | 15              |                  | 11   | 11         | 1                | 1                           |                                  | 5    | 1               | 4                         | 2  |                                       | 4             | 1                        |   |                                 |                          |                               |  |
| Dredging Contractors     | 11                            | 11 | 6                 |  | 11             | 9                                  | 11                   | 11           | 5               | 2                | 10   | 10         | 5                | 4                           |                                  | 3    | 1               | 2                         | 7  | 2                                     | 1             |                          |   | 1                               |                          |                               |  |
| Drilling Contractors     | 3                             | 3  | 3                 |  |                |                                    | 3                    | 2            | 3               |                  | 3  | 3          | 1                | 2                           |                                  |      | 1               | 2                         | 1  |                                       |               | 1                        | 3   | 1                               | 1                        |                               |  |

Table III  
Summary of results from inquiry forms returned by other organizations.

*Watersupply companies* – The field work is nearly always contracted out, but they often maintain the direct supervision. The interpretational work is often contracted out. The data are of a geological, geohydrological and occasionally of a geotechnical nature. The files contain field data and frequently interpreted data. A special boreholes file is sometimes present, complete with corresponding location maps. There is rarely a computerized data retrieval system. The information is either freely available or with certain restrictions. It is sent to the Rijks Geologische Dienst, Rijksinstituut voor Drinkwatervoorziening and Dienst Grondwaterverkenning TNO.

*Polder authorities* – They partake in engineering-geological activities. The field work is generally contracted out. However, shallow investigations up to about 2 m are sometimes carried out under their own direction. The interpretational work is generally contracted out. The data are of a geological, geotechnical and geohydrological nature. The files store both field and interpreted data, but there usually are no special files for boreholes. The information generally is unclassified.

*Municipal authorities* – In most cases the field work is contracted out. Shallow investigations up to about 2 m are occasionally carried out under their own direction. The interpretational work is often contracted out. The data are of a geotechnical and frequently of a geological and geohydrological nature. The files contain generally field and occasionally

interpreted data. Sometimes a special boreholes file is present, complete with corresponding location maps. The information is generally classified, but may be obtained on special conditions. It is occasionally sent to the Dienst Grondwaterverkenning TNO.

*Consultants* – Two major groups of consultants may be distinguished:

(1) Building consultants: the field work is mostly contracted out. Shallow investigations up to about 2 m are sometimes carried out under their own direction. The interpretational work is often contracted out. The data are of a geotechnical, geohydrological and sometimes of a geological nature. The files contain field and occasionally interpreted data. A special boreholes file is not present. The information is mostly classified, but can often be obtained with client's permission.

(2) Geotechnical consultants: in most cases the field work is carried out under their own direction. The data are of a geological, geotechnical, geohydrological and sometimes of a geomorphological nature. The files contain field and interpreted data. A special boreholes file is occasionally present, complete with corresponding location maps. The information is classified, but can be obtained if permission is given by the client. It is occasionally sent to the Rijks Geologische Dienst.

*Contractors* – Three major groups of contractors are present:

(1) Building contractors: the field work is generally contrac-

ted out and the interpretational work often. The field data are of geotechnical and frequently of a geohydrological nature. Sometimes they are stored in special files. The information is generally classified, but may sometimes be obtained on special conditions.

(2) Dredging contractors: both field and interpretational work are nearly always contracted out. The results are of a geological, geotechnical and sometimes of a geohydrological nature. The files contain field and sometimes interpreted data. A special boreholes file is occasionally present, complete with corresponding location maps. The information is classified, but may often be obtained on special conditions.

(3) Drilling contractors: the data are of a geological, geohydrological and frequently of a geotechnical nature. The files contain field and occasionally interpreted data. A special boreholes file is sometimes present, complete with the corresponding location maps. The information is classified, but may often be obtained with permission of the client. It is sent to the Rijksinstituut voor Drinkwatervoorziening and occasionally to the Rijks Geologische Dienst, Dienst Grondwaterverkenning TNO and the Waterstaten.

## SUMMARY OF RESULTS

### *General*

From the answers in the questionnaire one can easily derive the importance of an organisation for the information needed in the preparation of engineering-geological maps. This importance was measured by the following standards:

- (1) The amount and kind of the geological activities carried out by the organisation;
- (2) The amount and type of data contained in the files of the organisation;
- (3) The accessibility of the files of the organisation.

The value of the information in the different organisations will be judged below with respect to geology, geotechnics, geohydrology and geomorphology.

### *Geology*

The Rijks Geologische Dienst is the most important source of geological information, as they receive large quantities of data from their own field work as well as from other organisations. The data are stored in large and well organized files and are mostly unclassified.

A substantial amount of geological information can be retrieved from the geotechnical consultants and drilling contractors, who do their own field work. The data are, however, mostly classified, but may be obtained after the client's permission.

A moderate amount of geological information is available from:

- (1) Stichting voor Bodemkartering, which obtains a vast

quantity of shallow geological data up to depth of about 2 m;

- (2) Dienst Grondwaterverkenning TNO;
- (3) Rijksinstituut voor Drinkwatervoorziening, which sends all its borehole information to the Rijks Geologische Dienst;
- (4) Public Works Departments;
- (5) Municipal Authorities, who receive a great deal of information from organisations who have worked in their municipality.

Further geological information is available from the Instituut voor Cultuurtechniek en Waterhuishouding, Staatsbosbeheer, Eerste Nederlandse Cementindustrie N.V., Stichting Beton Research van de Nederlandse Cement Industrie, Akzo Zout Chemie, watersupply companies, polder authorities, building consultants, dredging contractors and university departments.

### *Geotechnics*

The geotechnical consultants (such as the Laboratorium voor Grondmechanica) are the best sources of geotechnical data, as they do their own field work and interpretation. The information is, however, more difficult to obtain, as it is classified and spread over many consultants. It may be obtained after the client's permission.

A substantial quantity of geotechnical data can be recovered from:

- (1) drilling contractors, who carry out the geotechnical field work but who leave the interpretation mostly to others;
- (2) municipal authorities, who receive a great deal of information from organisations who have worked in their municipality;
- (3) Public Works departments;
- (4) Rijks Geologische Dienst.

Further geotechnical information is available from the building consultants, dredging contractors, building contractors, Staatstoezicht op de Mijnen, polder authorities, Stichting Beton Research van de Nederlandse Cement Industrie and Stichting voor Bodemkartering.

### *Geohydrology*

The best sources of geohydrological information are the:

- (1) Dienst Grondwaterverkenning TNO, which is mainly specialized in physical groundwater data. This survey keeps large files, such as the 'Archief van Grondwaterstanden', which has a computerized data retrieval system;
- (2) Rijksinstituut voor Drinkwatervoorziening, which is mainly specialized in the quantity and chemical quality of the groundwater for water supply. The institute keeps large files and receives a great deal of information from other organisations.

A substantial amount of geohydrological information is available from the:

- (1) Rijks Geologische Dienst;
- (2) Instituut voor Cultuurtechniek en Waterhuishouding, which cares for the availability and quality of groundwater for agricultural purposes;
- (3) drilling contractors;
- (4) geotechnical consultants;
- (5) Public Works departments, who obtain, besides information regarding their own projects, a great deal of information about the surface waterlevels;
- (6) municipal authorities, who receive a great deal of information from organisations who have worked in their municipality.

Further geohydrological information is available from the building consultants, Stichting voor Bodemkartering, water-supply companies, polder authorities, Staatsbosbeheer, Staatstoezicht op de Mijnen, Eerste Nederlandse Cement Industrie N.V., Stichting Beton Research van de Nederlandse Cement Industrie, Akzo Zout Chemie, building contractors, dredging contractors and university departments.

### *Geomorphology*

The best sources of geomorphological information are the Rijks Geologische Dienst and the Stichting voor Bodemkartering, who co-operate in this field. Other sources of geo-

morphological information are the geotechnical consultants, Instituut voor Cultuurtechniek en Waterhuishouding, Staatsbosbeheer, Public Works departments and university departments.

### ACKNOWLEDGEMENTS

This investigation was made possible by those who were prepared to fill out and return the questionnaire and particularly by those who were prepared to spend their time in an interview. The comments of D. G. Price B.Sc (lector in engineering geology at the T.H. Delft) and of the director of the Rijks Geologische Dienst Ir. B. P. Hageman on drafts of this manuscript are highly appreciated.

### REFERENCES

- Dearman, W. R. & P. G. Fookes 1974 Engineering geological mapping for civil practise in the United Kingdom – Q. J. Eng. Geol. 7: 223-256.
- Hageman, B. P. 1974 Usage of geological maps for civil engineering purposes in Quaternary and Holocene areas – Bull. Int. Ass. Eng. Geol. 10: 13-14.
- Unesco 1976 Engineering geological maps, a guide to their preparation – Unesco Press 15: 80 pp.