Notes on the history of SEED[1]

Introduction

These notes intend to present a brief outline of the history of each of the three divisions that were merged into SEED 2013, i.e. Environmental Strategies Research (FMS), Industrial Ecology (IE) and Land and Water Resources Engineering (LWR). They have three **purposes**: (i) they could serve as a SEED historical reference collection (ii) they could contribute to understanding of each other´s different scientific background and thinking to facilitate cooperation, and (iii) maybe, also some organizational lessons could be learnt from them about how to establish and integrate environmental issues within KTH. It has been written in the context of developing a common vision and strategy of SEED, the so-called "Ämnesutredningen".

The emphasis is on the **early stages** of each division. An approximate back time limit is 2005; thereafter, the history of each division is considered to be rather well described and easily retrieved.

The divisions differ as for their **age**: FMS was founded 1993, IE:s earliest predecessor 1970 and, finally, LWR:s earliest predecessor 1932. It means that the amount of material for each division, on average, varies according to its age. This circumstance is reflected in the different text volume for each division.

The limitations of depicting a long period of past research and education are obvious. I would like to point to a few of them.

(i) **Lack of sources**. I have had good use of the KTH archive management service, and the KTH Library, but there I have, of course, only found the centrally registered documents; locally stored material of each division is scarce, as far as I have experienced. I am grateful to Göran Finnveden, Per Olof Persson and Gert Knutsson who have contributed significantly to the FMS, the IE and the LWR part of the notes.
The lack of good illustrations is a special case. In spite of efforts to find better images, I have had to stop searches and content myself with those found.

(ii) **Unsufficient and uneven coverage** of important activities. This limitation is not only related to (i) lack of sources and the limited time for the study, but also to my necessarily biased choice of themes. This is particularly evident for the LWR history, in which the "post-Kulturteknik" era is very superficially described.

Within these obvious limitations, I have tried to give a chronological and neutral view. The responsibility for remaining deficiencies is mine. However, I hope this document can be a " living document" which can be revised in parts, when new significant historical evidence is found. Therefore, the reader is invited to comment, correct or complement.

Stockholm in September 2015

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Environmental Strategies Research (FMS)

FMS (which is the acronym for the original name in Swedish "Forskningsgruppen för miljöstrategiska studier") started in 1993 as a cooperation between FOI (the Swedish Defence Research Agency) and the Department of Systems Ecology at Stockholm University (SU). The group was from the start co-located with the Stockholm Environment Institute. The founder was Peter Steen who was a Research Director at FOI and an Adjunct Professor at SU. In the beginning the research focused on future studies using backcasting and other scenario methods. One important example is the report "Travels in the future- transports in a sustainable society" (**Figure 1**).

Figure 1. *Färder i framtiden-transporter i ett bärkraftigt samhälle. KFB-Rapport 1997:7*

During the 90's the group grew and became more multi-disciplinary. The focus was a strong sustainability system perspective in policy- relevant technology-society issues. The aim was to develop solutions, knowledge and debate around strategically important environmental issues. The methods came from a number of different fields such as future studies, environmental systems analysis including life-cycle assessment (**Figure 2**), planning, environmental economics, ethnology and systems ecology. The application areas included urban development, transportation, energy, infrastructure, waste management, consumption and resource efficiency.

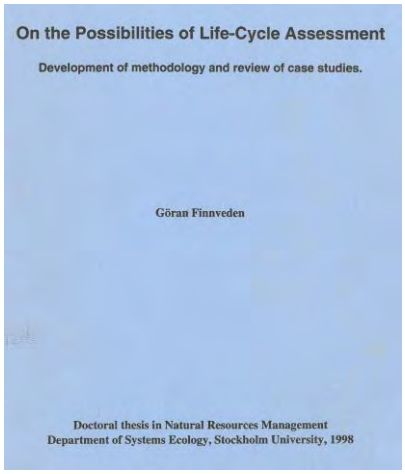

Figure 2. *Front page of the first doctoral thesis from FMS by Göran Finnveden 1998*

In 2003, parts of FMS moved to KTH Royal Institute of Technology and founded the Centre for Environmental Strategies Research. In 2005, the Centre became a division under the Department of Urban Planning and Environment. It continued along similar tracks as before adding competencies and topics growing to approximately 35 people in 2013 when FMS became a division of the Department of Sustainable Development, Environmental Science and Engineering (SEED). During the period FMS became more involved in education, for example in the programs Energy and Environment and Sustainable Urban Planning and Design. Several co-operations in research with other units at KTH also developed for example within the Centre for Sustainable Communication (CESC).

Industrial Ecology

The Industrial Ecology (IE) division is historically derived from the "Miljövårdscentrum" (MVC). For a long time its only emphasis was on education and information. From the 1970s it was with Land and Water Resources Engineering the only provider of environmental courses at KTH. Its education focus was gradually supplemented by research from about 1995. But how did it start and proceed?

The 1970 environmental committee

On 13 January 1970 the KTH president Göran Borg summoned a meeting on the issue of organization of research and education in "miljövård". Present at this meeting with the president were CEO Eidem, the professors Gustafsson, Hallberg, Lindström, Rasmuson, Reinus and Westermark and a few lecturers. This group confirmed the need for the establishment of a centre for dealing with environmental issues. Consequentlly, on 28 January 1970, an environmental committee chaired by professor Yngve Gustafsson (Department of Land Improvement and Drainage/Kulturteknik) was appointed by the "Konsistoriet" (that era´s Board of KTH). Its task was urgently to investigate the matter of establishing "ett centrum för miljövård". The committee was composed of faculty from KTH´s schools (sektioner), representatives for the students and the Swedish Environmental Institute (IVL). The committee was requested to contact other universities in the Stockholm region in order to create a centre for the whole region. In particular, the committee was asked to determine what is meant with the word "miljö".
In its report, the committee accordingly devoted considerable effort to delimit the focus area, "miljöområdet". There was, according to the committee, a risk that too much of education and research was to be included. It then clarified that the purpose of the centre´s activitities should be limited to "*measures that contribute to positive changes or diminish negative changes which are related to use of land, buildings or facilities that causes water pollution or disturbances through air pollution, noise, vibration, light or similar phenomena*". It also clearly delimited the area to the exterior environment, excluding work environment.
It is interesting to notice that the committee attributed the lack of education and research in environmental issues to the organization. It acknowledged also that it was obvious that too little resources were allocated to coordination and information for interdisciplinary work. It believed, optimistically, that " *with relatively limited measures for co-operation between departments and by organizing courses and inform students, a "not non-essential improvement" (icke oväsentlig förbättring) can be achieved*."

The committee launched a detailed target for what the centre should do in research, education and information, as well as describing its status and organization. Thus, it suggested a board with a chairman and 12 members and an assembly (Kollegium/Referens-grupp) for providing a wider legitimacy. Finally, it suggested that KTH should allocate resources, 130000 SEK, for staffing a secretariat and 40000 SEK for two optional "overview courses" (Orienteringskurser) , common for all KTH students that year.

The 1970s

On 22 April 1970 the "Konsistoriet" decided according to the proposal of the committee. Professor Gustafsson became the first chairman of the Miljövårdscentrum (MVC) board. Its acting secretary was during the first two years Jan Nilsson of the "Kulturteknik" department. From 1972 Lars-Gunnar Lindfors and from late 1974 Per Olof Persson of the Chemical Engineering department was the acting secretary.
During its first decade information about environmental research was spread through annual reports. These "Miljövårdsrapporter" summed up current research in environmental areas at KTH, IVL and other industrial research institutes in Stockholm. In addition, they included a few reports on specific themes like, "Chemical wastewater treatment" and "New processes for wastewater treatment".

The MVC Kompendium "Ecology and Environmental Technology" (Ekologi och miljövårdsteknik) was first published in 1974. It had a broad scope, including not only ecology, water and air pollution and waste handling but also noise, thermal and nuclear pollution, legal and economic aspects. This compendium was later updated and revised many times up to the present. During a couple of decades this textbook (**Figure 3**) became the backbone in university environmental education around Sweden, and a partial income source for MVC. At this time MVC became responsible to provide simple basic one-credit courses in ecology and environmental technology, but gave also doctorate courses in certain areas, for example on surface water problems, environmental economy and practical environmental law.

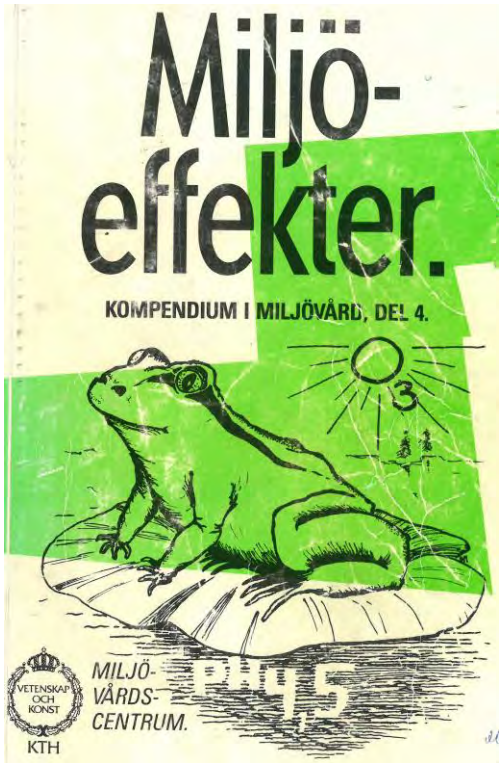

Figure 3. *Front page of part 4 of MVC´s Kompendium i Miljövård. 1990*

MVC´s changing affiliations

From the 1980s MVC was often questioned within KTH, while the environmental issues became gradually inevitable not to address in education and research. MVC tried to persuade programme boards to introduce environmental courses into their education. For example, it arranged 1982 an "intensive course in ecology and environmental protection" for members of KTH programme boards with 12 participants out of 27 invited. As for education it had then grown into a regular department and its organization form as a centre did not fit. In 1985 an internal evaluation committee proposed that it should be a "working unit" (arbetsenhet), with a scientific council. It suggested that environmental issues should be integrated into technology courses and that compulsory courses corresponding to 5 (old) credits should be introduced. Thus, its task was from then and until 1994 only to provide basic education in environmental issues; its earlier task for research and information was eliminated.
In 1988 a new larger proposal "Competence for a better exterior environment" was presented by the MVC scientific council to the KTH President, Janne Carlsson. In the aftermath of this proposal many improvements for MVC took place. The KTH University board decided 1992 that graduates from all engineering programmes must have at least 12 (old) credits of non-technical subjects in their diploma, of which four should comprise "miljövård", with specified contents. From the end of the 1980s MVC expanded and moved into large facilities centrally located at KTH campus, and additional teachers, often with an academic background in biological fields were employed to satisfy this educational need.
A Centrum för Miljövetenskap (CMV) was established 1994 with an ambition to start research besides the dominating education part. CMV was in that period integrated into a department with the acronym IMA (Institutionen för Miljö- och Arbetsvetenskap), in which areas covering external environmental issues and work environment issues were to co-habit. However, in 1997, CMV became a unit directly under the KTH President. Through CMV a research school in Environmental Management, a forum for doctorate students "for sustainability-driven technology and societal development" and a Miljövetenskapligt kollegium (KTH Environmental Assembly) was active from 1998 to 2004. A common KTH-IVL centre for sustainable development existed from 2006 to 2008 as an effort to spur co-operation between KTH and IVL. Organizationally, in 2000, CMV had been moved from the President to the department of Chemical Engineering. During same period the division of Industrial Ecology was created, within the School for Industrial Engineering and Management (ITM) and its first professor, Ronald Wennersten, was appointed. In 2013 Industrial Ecology became a part of SEED.

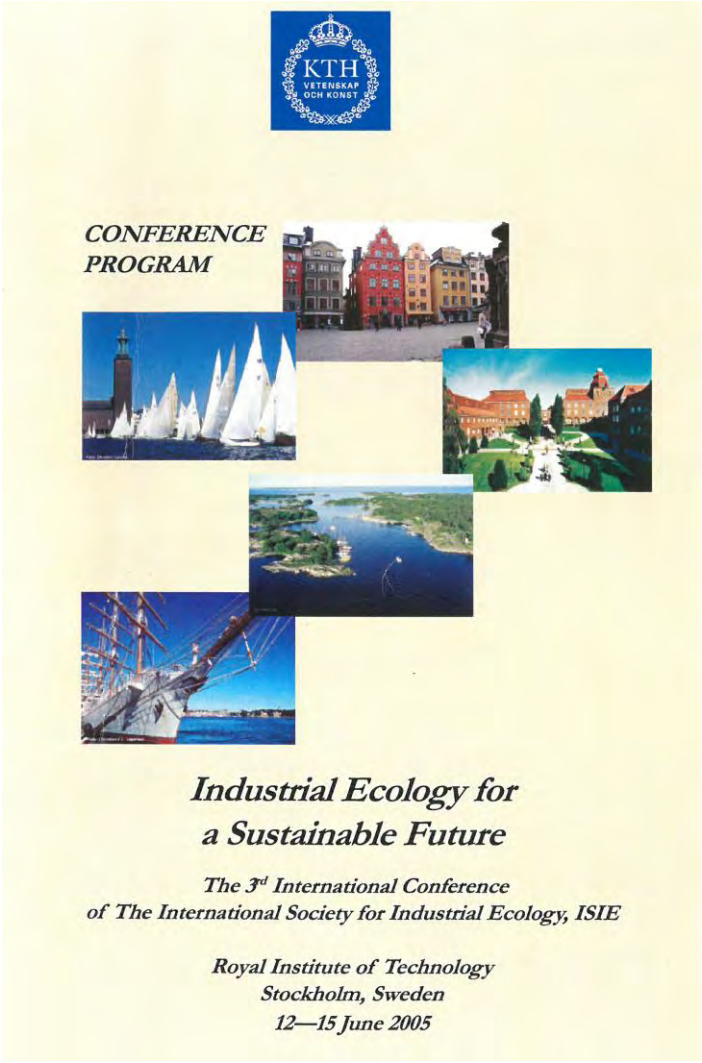

Figure 4. *The Industrial Ecology conference 2005 at KTH.*

Land and Water Resources Engineering (LWR)

The Land and Water Resources Engineering division stems from two old structures of KTH engineering education. One root is derived from the educational programme for surveyors (**Sektion L**). The other root of the division stems from the programme for civil engineers (**Sektion V**).

The chair in "Kulturteknik"

In 1932 the education of surveyors was included among KTH engineering programmes. At that time students could choose between studies for a surveyor diploma or a land improvement and drainage diploma. The education in land improvement and drainage ("Kulturteknik" in Swedish) which dominated the latter programme, aimed at providing

knowledge in the management of technical problems related to rural real estate issues. Now the area was divided into three parts: general construction, house construction and water building.
After several conflicting investigations during the 1940s to shape a professorial chair in the new area, KTHs faculty assembly eventually proposed a programme for the chair in land improvement and drainage. Yngve Gustafsson, then a professor at the Swedish University for Agricultural Sciences in Uppsala, was appointed in 1956.

In fact, Gustafsson had served at KTH since 1942, first as "Speciallärare", and from 1952, as acting professor. Land improvement and drainage concerned how to convert natural land to cultivated land through e.g. clearing, ditching and road building.

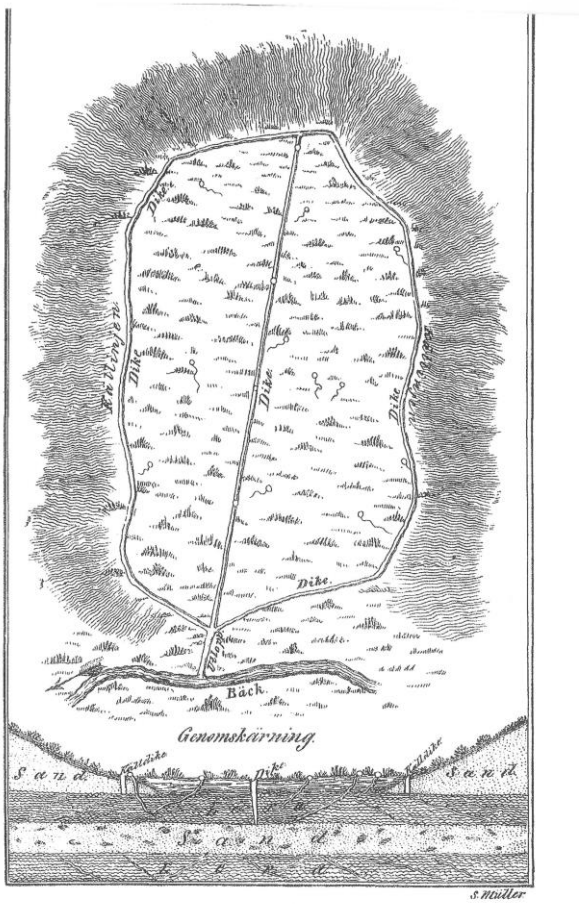

Figure 5. *Plan for ditching by the method of Elkington, applied by George Stephens 1841*.

After a long period of reclamation of land to support an increasing population in the 19th century (**Figure 5**) and the beginning of the 20th, land improvement and drainage was then limited to improve and sustain arable land.

Figure 6. *Professor Yngve Gustafsson at an excursion to Bälinge mossar 1959.*

The department moved 1958 into new buildings at Drottning Kristinas väg 30 (**Figure 7**) in which it co-habited with other L-section departments: Geodesy, Photogrammetry and Real Estate Planning and Real Estate Economics.

Research and education profiles

Two large research projects belonged to the International Hydrological Decade (IHD) initiated by UNESCO: The Verkaå-project in southern Upland and the Ko Mosse-project in Småland. Several scientists and doctoral students took part in these projects in basic hydrology. Some other scientists and doctoral students worked in the so called STEGA-project. The aim of this project was to show the need of broad knowledge in geology, geotechnology and hydrology for planning and realizing of new building areas to large cities. The study areas were new suburbs in Stockholm and Gothenburg.

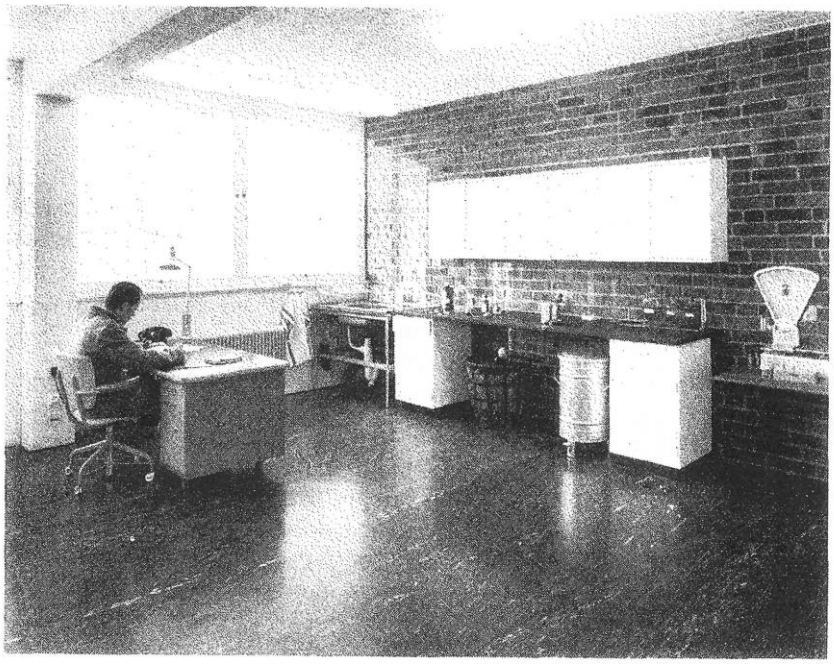

Fig. 4. Interiör av laboratorierum för finare arbeten.

Figure 7. *New lab at Land Improvement and Drainage in the new buildings at Drottning Kristinas väg 30 (1958).*

The department devoted much research on water circulation and ground water. It also gave courses in water supply and sewage treatment. These areas became increasingly important due to the environmental pollution debate triggered by, for example, Carson´s Silent spring (1962). From 1969 special units for Environmental Pollution Control (Miljövårdsteknik) and Ecology and Natural Resources (Naturresurslära) were established within the department.
The education in land improvement and drainage from the time of Gustafsson´s appointment consisted of two courses: Land improvement and drainage (I), which comprised hydraulics, hydrology and road construction and Land improvement and drainage II with water and wastewater handling. Another important area of surveyors´education at that time was "Soil and geology". At that period units for Geotechnology (Geoteknik), Water Supply and Sewage (Vattenförsörjningsteknik), Geology and Water Chemistry were also established within the department of Civil Engineering.

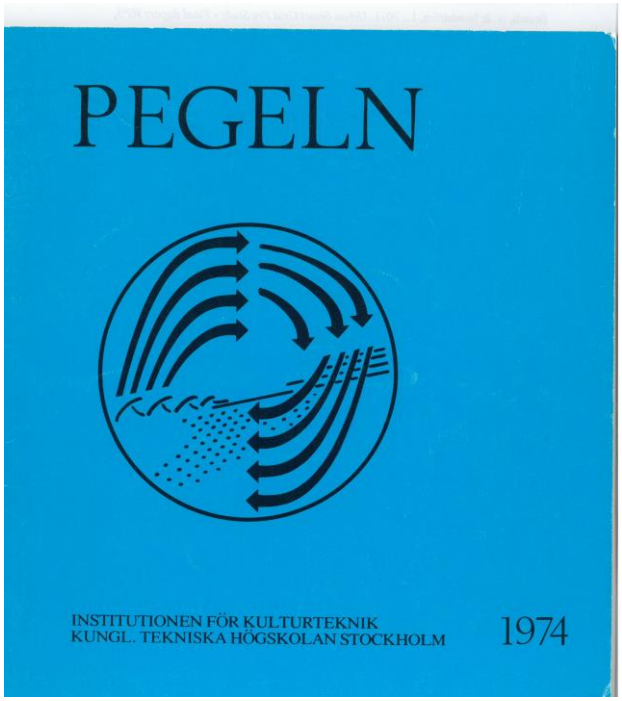

Figure 8. *Pegeln- The annual report 1974 of Land Improvement and Drainage (Kulturteknik).*

As said, the other root of the division stems from the educational programme for civil engineers (**Sektion V**). The department of "Väg- och vattenbyggnadskonst" existed 1877-1903. It was reorganized i.a. under the labels of Vattenbyggnadskonst (1903-1910), Vattenbyggnadslära (1911-1939) and Vattenbyggnad (Civil Engineering) 1939-1993. During 1954-1966 Vattenförsörjnings och avloppsteknik (Water Supply and Wastewater Technology) became a division of "Vattenbyggnad", and 1976-1993 "Vattenvårdsteknik" (Water Resource Engineering) and 1974-1993 Jord- och bergmekanik (Geotechnics) was a part of Vattenbyggnad.

International developments

Gert Knutsson was appointed as professor in Land Improvement and Drainage (Kulturteknik) 1979 and was acting until his retirement 1999, when Per-Erik Jansson was appointed as professor in Land and Water Resources Science. A professorship in Groundwater Chemistry was created in 1983 and Gunnar Jacks became its holder 1986. In the beginning of the 21th century another professorships in related fields within the department were established.

The research at the department mainly addressed problems concerning groundwater recharge, groundwater flow in hard rocks, hydrochemistry and environmental problems. Acidification of soil and water was an increasing problem, so a large project concerning acidification of groundwater was running during the 1980`s with several scientists from the department involved as well as from other departments.

Several scientists from the department took part as experts in water supply projects in developing countries, especially India, sponsored by SIDA (Swedish International Cooperation Agency) and SAREC (Swedish Agency for Research Cooperation with Developing Countries). The name of the department was changed 1988 to the Department of Land and Water Resources (Institutionen för

Mark- och vattenresurser) and became a division of the Department of Civil and Environmental Engineering 1993.

In 1987 a new graduate programme ”Management of Natural Resources” (”Naturresurshushållning”) was formed with two parallel study majors: Environmental Engineering and Sustainable Infrastructure (EESI). The scope of the programme was international and multicultural. It was recommended to students, who wanted to work with management of engineering and planning issues in industrialized as well as developing countries. One half of the students were from foreign countries and the other half were from Sweden. The education was given in English. A special course on”Acidification of soil and groundwater” was also carried out. Advanced courses on an international level were also held in cooperation with other organizations e.g. ”Groundwater in hard rocks” sponsored by SIDA and UNESCO.
In addition to these developments, the department´s research groups were in the 1990s building and consolidating specific LWR competencies in other fields. A sample of such fields and examples of themes in research and education are:

- Environmental modelling (e.g. studies of leaching, retention and tracement of pollutants).
- Wastewater, sludge and waste technology(e.g. recovery of phosphorous from sludge and ashes; small-scale wastewater treatment and ecotechnology; remediation of groundwater).
- Environmental impact, risk assessment and management (for example applied to governance and management of e.g. information, bio-diversity, energy systems, road maintenance and operation, dam security and erosion).
- Environmental geochemistry (e.g. metal binding in soils; arsenic in ground water).
- Applied geology and hydrology (e.g. geotechnical engineering, hydraulic engineering, water resource development).

In 1993 the large department ”Anläggning och miljö” (Civil and Environmental Engineering) was formed. The Department of Land and Water Resources (“Mark- och Vattenresurser”) was then one of its divisions. Finally, from 2001 until the decision to form SEED 2013, it has been an independent department named Land and Water Resources Engineering (Mark- och vattenteknik).

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