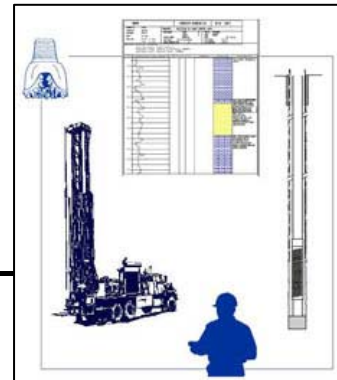


Personal Details

Nationality: British
Email: jma@hydrogeologist.net
Website: www.hydrogeologist.net



Key Qualifications

Specialises in:

- **Integrated water resources assessment and management:** Expert in assessing river basin water resources, water use, reserves and water quality, and then using these data to develop IWRM plans with the aid of GIS.
- **Data organisation:** Excellent computer skills including advanced use of industry-standard software packages such as MS Office, ArcGIS, Manifold, Global Mapper, Modflow, Landsim, Consim, AquiferTest and HecRas. Expert in collating and processing satellite, DTEM, base data and water resources information into databases then utilising these data to create maps for assessment, management, reporting and presentation purposes. Used to working with few or unreliable data and skilled at obtaining missing and representative resources from stakeholders, the internet, field inventories and pilot projects.
- **Environmental Assessment:** Skilled in identifying sources of groundwater contamination and environmental and human receptors via inventories, sampling, monitoring and aquifer tests. Risk analyses of groundwater vulnerability using a variety of techniques (UK Level 1 to 4 procedures, numerical groundwater models or ArcGIS overlay and index methods). Also, skilled at carrying out Flood Risk Assessments for BREEAM Accreditation (Middle-East).
- **Project Design & Management:** He has provided oversight for more than 2000 boreholes worldwide. He brings extensive experience in surface geophysical surveys, deep well design and the testing of production wellfields. He has specialist knowledge of Scavenger and Artesian Wells.

He has been a Manager, Principal Consultant, Team Leader and Technical Advisor for a number of companies and projects and has experience in Afghanistan, Albania, Botswana, Burkina Faso, Cambodia, Canada, Kenya, India, Kosovo, Laos, Nigeria, Oman, Pakistan, Sudan, Thailand, UK, USA and Vietnam.

Education and Professional Status

M.Sc., Hydrogeology, University of London, 1982.

Diploma Hydrogeology, University College London, 1982.

B.Sc. (2:1 Hons.), Environmental Science, Plymouth Polytechnic, 1980.

Member of the International Association of Hydrogeologists.

Other Certificates: United Nations BSAFE, HSHAA, SSAFE, Basic and Advanced Security in the Field. Petroleum Safety Training, H₂S Alive and 1st Aid.

Experience Record

2023. National Rocks for Geological Consultancy (NR), Oman

Between July and September 2023, Mr Ashworth was engaged by NR to carry out a Hydrological Survey and Flood Risk Assessment of a 7 km² solar farm development located near Manah in the Ad Dakhliyah Governorate of Oman. This study provided an assessment of the project's catchment area, its geomorphology, and available meteorology, rainfall and runoff data. This included rainfall and

flood frequency analyses, and the calculation of peak maximum floods (velocity and volume), flood water levels, toppling forces and the advisement of precautionary measures to alleviate flooding.

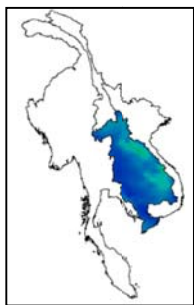
2022 & 2023. Pro Bono Work, Oman

In May 2023, he provided an Expert Opinion on the likely cause of basement-building flooding within Wadi Lansab Police Station compound. Using visual clues, reference to previous reports, historical satellite data and the author's knowledge of the area it was concluded that the source of flooding was two groundwater springs, which were breached during the compound's construction. Remedies to solve this issue were provided.

In August 2022, a groundwater salinity analysis was carried out for a farm located on the Batinah Coastal Plain. This involved collating data from surrounding water-wells and advising on the depth and construction of new wells on the farmer's property, the vulnerability and yield of different crops to variations in likely water quality, and the application of soil-salinity remedial measures.

2022. World Bank, Well and Borehole Specialist

In June 2022 he was tasked with advising on best practices for the siting, design, construction and commissioning of wells and boreholes for World Bank projects. This included a review of Project Appraisal and Operation Manuals of a large groundwater infrastructure project in West Africa, proposals to improve on these and measures to access the risks of future programs.



2020. Mekong River Commission (Cambodia, Laos, Thailand & Vietnam)

Over the period July to September 2020, he produced an Inception Report for the Mekong River Commission on 'Sustainable Groundwater Use and Management for Agriculture Projects' in the Lower Mekong River (LMR) Basin. This detailed existing water resources information, provided preliminary water balances and a roadmap for implementing groundwater investigations, water management and sustainable crop-production in two transboundary aquifers in the LMR.

2016 - 2019. GEO-Resources (GRC), Oman

Sporadically, between 2016 and 2019, he was engaged by GRC as an International Consultant to work on the following projects:

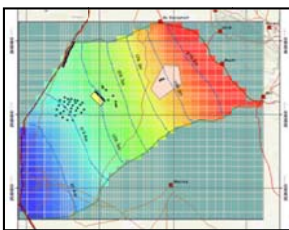
- "Flood Risk Assessment of the Al Irfan Phase One Development". In support of their BREEAM Accreditation application, flood frequency analyses and calculation of Design Flood Peaks were made using: Flood Frequency Curves for Oman (FFCO); Peak over Threshold (POT); Mean Annual Flood Method (MAFM); and, the Rational Method (RM). This study included construction of a Unit Hydrograph from Cyclone Gonu data to calculate Design Flood Volumes, HEC-RAS to visualise the area of flood inundation, and the calculation of water and object tipping forces to make a damage assessment of extreme flood events. Potential changes in flood risk resulting from climate change were also documented.



- "Sector D, Al Mouj Flood Risk Assessment". In support of their BREEAM Accreditation application, a Flood Risk Assessment of this development area was undertaken using a similar methodology adopted for the Al Irfan Project, but with the added complication of including an assessment of flood risks to Muscat International Airport. In 2023, Al Mouj was the first development in Oman to be awarded BREEAM Accreditation.
- An "Aquifer Assessment for Be'ahs Proposed Landfill on the Batinah Plain". This involved the collection and review of data from various government agencies, an assessment of aquifer

characteristics, an analysis of groundwater levels and the groundwater flow system, the existing groundwater quality and risks to downstream users.

- A “Hydrogeological Study Report” for Occidental of Oman Inc. (OXY). This report provides details the results of the pumping tests carried out during the Project. It provides an interpretation of the hydrology, geology, hydrogeology, a water balance and a conceptual model. With the aid of a model, these data were used to estimate the impact of pumping from the OXY wells on nearby farms.
- A “Soil and Groundwater Risk Assessment for HFI’s Concession Area”. This included infiltration tests, soil and groundwater sampling and analysis, and identification of risk to a Wellfield Protection Area using UK Environment Agency guidelines. The software Consim was used to assess probable risk using the “Monte Carlo” approach.
- “Inception and Final Reports” on behalf of the Al Bashayer Meat Company (S.A.O.C), which is planning an Integrated beef stock farm and processing plant in Southern Oman covering 9 km². This project included drilling production wellfield layout, designs, specifications, costs, and an initial assessment of water resources and water quality.



- A “Groundwater Model and Feasibility Study” on behalf of the A’Namaa Poultry Company SAOC, which is planning an Integrated Poultry Project in Northern Oman covering 31 km² that will comprise a poultry farm and centralised processing plant (\$150 million project). This involved developing a regional groundwater model covering 7514 km², using the MODFLOW code (Visual MODFLOW Flex), to evaluate the long-term viability/ sustainability of this project and its impact on existing users.
- A “Soil and Groundwater Risk Assessment for PDO’s Concession Area (Phase-II)”. This included infiltration tests, soil and groundwater sampling and analysis, and identification of probable risk at 15 Production and Fuel Stations using UK Environment Agency guidelines.
- “Inception and Feasibility Reports” on behalf of the O’Sool Poultry Company SAOC, which is planning an Integrated Poultry Project covering 47 km² in Southern Oman. This project included drilling several artesian wells, production wellfield layout, designs, specifications, costs, an assessment of water resources and water quality, and the sustainability of the project over a 30-year time frame.

2019. UHL Associates, Burkina Faso

During September and October 2019 he provided some initial inputs on a USAID-funded program in Burkina Faso (*Resilience in the Sahel Enhanced II (RISE II)*). He was tasked with detailing the status of groundwater knowledge within 15 communes in the Centre North, East and the Sahel Provinces. This included: an overview of institutions and companies engaged in groundwater investigations; detailing existing and missing data sets; noting upcoming projects and investigations; providing a partial water balance with suggestions on how to improve this; detailing GIS mapping that could be carried out; and, proposing groundwater development and capacity building options.

2018 - 2019. ADB and SAMES, India

Intermittently, between September 2018 and August 2019, he worked on the Asian Development Bank (ADB) funded Ara Canal Water Productivity Improvement Project for both SAMES PTY LTD and ADB. He was responsible for providing advice on the design, spacing and location of tube wells for conjunctive use, and reviewing the design and findings of a groundwater model.

2018 - 2019. FAO, Afghanistan

Intermittently, between July 2018 and April 2019, he worked for the Food and Agricultural Organization (FAO) on a groundwater monitoring and water resources assessment in Afghanistan. He was tasked with writing specifications for groundwater monitoring networks (5 cities), writing

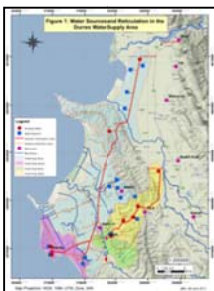
Water Resources Assessment Reports for the Cities of Kabul and Kandahar and training the Ministry of Energy and Water's counterpart staff.

2013 - 2016. GEO-Resources, Oman

Between September 2013 and December 2016 he was employed by GRC as the Manager/ Principal Consultant responsible for the Water Resources, Geology and Surveying Department. Work included client liaison, writing and editing proposals and reports, directing and co-ordinating the efforts of personnel in GRC. Over a 3-year period he was responsible for provision of ~140 proposals and ~70 project deliverables. Technical work included site selection (using ERT and TDEM surveys) and design of beach and water supply wells, the introduction of impact assessment procedures (EA Level 1 to 3 techniques) for slurry pits, landfills and evaporation ponds (Landsim and Consim), groundwater modelling (Modflow), mining projects (geological mapping, physical and chemical tests, and reserve estimation for Manganese, Chromite, Limestone, Marble and Gabbro operations), geotechnical investigations (slope stability), and technologies for topographic surveys (combined land and UAV surveys).

2012 - 2013. GEO-Resources, Oman

Between February 2012 and February 2013 he was engaged as Consultant for GRC and worked on a joint Diwan of Royal Court/ Ministry of Regional Municipalities and Water Resources project to investigate groundwater resources to irrigate date palms in the Al-Dhahirah Governorate of the Sultanate of Oman. This Phase-2 project formed part of a series of investigations intended to plant 1 million date palms. Ashworth's responsibilities included drilling and aquifer test scheduling, site selection, technical advice, catchment and water resource assessment with aid of GIS, preparation of a date farm development plan, and reporting.



2011. COWI AS, Albania

Intermittently between July and November 2011 he provided services for a World Bank project in Albania ("Feasibility Study & Preparation of Preliminary & Detailed Design for Bulk Water Supply Line to Durres Region"). For this mission he was tasked with confirming yield/quality of water abstractions from proposed well fields, the design of new abstraction facilities, assessment of groundwater potential with the aid of a groundwater model, and assistance with the preparation of inception and preliminary design reports.

2011 - 2012. Lahmeyer International, Pakistan

Intermittently between March 2011 and January 2012 he worked on an ADB project ("Groundwater Monitoring, Modelling & Management of the Lower Bari Doab Canal Irrigation Project") that provided services to evaluate deteriorating groundwater conditions, characterised by falling water tables and deteriorating water quality. Team Leader responsibilities included provision of technical advice, team management, client liaison, setting up a GIS database, a groundwater model (GMS), provision of additional monitoring points, reporting, logistics, procurement, project expenditure and accounting.

2010 - 2011. Egis BCEOM International, Kenya

Intermittently, between October 2010 and January 2011 he provided an assessment of the groundwater resources and development potential for a World Bank and AFD financed project entitled "Feasibility Study and Master Plan for Developing New Water Sources for Nairobi and Satellite Towns". This included contributions to the Project's Inception Report and cost estimates for drilling deep boreholes.

2010. Lahmeyer International, Sudan

Between April and July 2010 he worked on the “Roseires Dam Heightening Project” on the Blue Nile in Sudan. His tasks included supervision of the construction of pressure relief wells, local geologists, documentation, and the assessment of dewatering proposals for dam embankment construction.

2009 - 2010. GFA Consulting Group, Kosovo

Between March 2009 and January 2010 he worked for GFA as a Consultant on an EU-funded river basin management project. This project provided institutional support to the Ministry of Environment and Spatial Planning (MESP), and River Basin Authorities in Kosovo. Mr Ashworth was tasked (KE-3) with implementing the EU Water Framework Directive’s (WFD) rules and procedures for groundwater in Drini River Basin. Main responsibilities included the delineation and characterisation of groundwater bodies, the execution of plans for creating a monitoring network (for groundwater levels and water quality), and the introduction of procedures and tools to characterize the quantitative and chemical status of groundwater. These activities were aided by training programs and a groundwater pilot project.

**2007 - 2008. GEO-Resources, Oman**

Between June 2007 and May 2008 he worked for GRC, on behalf of the Ministry of Regional Municipalities and Water Resources (MRMWR), on a project designed to investigate groundwater resources for irrigated agriculture and settlements in Tertiary to Cambrian aged aquifers in the Dhofar Governorate. He was employed to collate existing and new (90 project boreholes) hydrological and hydrogeological information, to collate these data onto GIS databases and write a report detailing the water balance, water quality and groundwater resources of Dhofar. Interesting technologies employed on this project included the analysis of ^{14}C , oxygen ($^{16}\text{O}/^{18}\text{O}$), deuterium (^2H) and strontium ($^{87}\text{Sr}/^{86}\text{Sr}$) isotope data.

2006 - 2007. BCEOM, Oman

Intermittently between November 2006 and May 2007 he worked for BCEOM as a Consultant on a project designed to investigate the feasibility of abstracting large volumes ($9000\text{ m}^3/\text{hr}$) of groundwater from beach wells for a desalination plant located in Sur. This project was funded by Veolia Water. His responsibilities included the preparation of specifications and contract documents for drilling and testing these wells. He selected contractors, liaised with government agencies, implementing the award of these contracts, and assisting BCEOM in the investigation, testing and development of these resources.

2005 - 2006. GEO-Resources, Oman

Between September 2005 and August 2006 he worked on three exploration drilling and aquifer testing projects in Northern Oman for GRC on behalf of MRMEWR. The main objectives of these Projects were to evaluate the extent of brackish and fresh groundwater resources in the Massarat, Batinah and Musandam Regions of Oman with a view to using this water for agriculture and town water supplies. He collated existing borehole data, remote sensing and surface geophysics (TDEM) onto a GIS maps and identified exploration areas. His other responsibilities included: providing borehole designs; supervising the collation, analysis and reporting of all drilling and testing data; liaison and supervision of the MRMEWR field teams; training; and, preparation of Final Water Resource and Management Reports.

**2005. PCI Asia, Afghanistan**

In July and August 2005, Mr Ashworth visited Mazar-e Sharif and made a preliminary assessment of the groundwater resources in the lower sections of the Balkh and Khulm watersheds for an ADB



Emergency Infrastructure, Rehabilitation and Reconstruction Project.

Existing hydrogeological data were collated onto GIS-linked databases, historic hand-drawn USSR maps were geo-referenced and the hydrogeology of the area was reviewed and examined with the aid of GIS generated maps. Plans, tender documents and cost estimates were then prepared for a well inventory, a surface geophysical survey (resistivity imaging and TDEM soundings) and a drilling and aquifer testing program.

2003 - 2005. GEO-Resources, Oman

Between August 2003 and June 2005, he provided hydrogeological advice for a groundwater



exploration project in the Rub al Khali Desert, in Oman. The main objectives of this project were to delineate and quantify fresh and useable brackish water resources, and determine locations for potential wellfields. Drilling targets were aquifers located in the Tertiary-aged Dammam, Rus and Umm er Radhuma Formations (UER). Overflowing artesian conditions (e.g. 92 L/sec at 4 bar) in the UER provided challenging drilling conditions. Formations, aquifers and thief zones were identified with the aid of foraminifera, lithological descriptions and downhole geophysics. Non-target aquifers and thief zones were cemented off with multiple steel casings to avoid run-away flows, head and flow losses, and deterioration of water quality.

2001 - 2003. Water Resources Consultants, Botswana

Between April 2001 and August 2003, he was the Team Leader of the Maun Groundwater



Development Project (Phase 2). The goal of this Project was to develop production wellfields capable of meeting the year 2015 projected water demand, of 5 Mm³/yr, for the town of Maun and associated localities. The Project entailed exploration, quantification and development of groundwater resources in the lower Okavango Delta (2,500 km²). Responsibilities included provision of technical advice, team management (29 staff), client liaison, reporting, logistics, procurement, Project expenditure, billing and accounting. Interesting technologies employed on the Project included the use of AEM, TDEM and NMR geophysical surveys, installation of jetted piezometers, analysis of delta inflows and outflows, and the development of ArcGIS databases and groundwater models. 30 production boreholes were constructed to meet Project objectives.

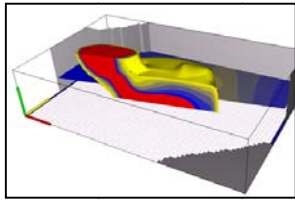
2000 - 2001. Komex International, Canada

Between December 2000 and March 2001 he was engaged to support the following activities:

- Groundwater source assessments at Lewis and Meadow Creek (Petro-Canada Oil & Gas leases), Fort McMurray. Exploratory drilling, pumping test analyses and aquifer modelling were carried out to examine the feasibility of providing water for the extraction of bitumen from oil-sands using Steam-Assisted Gravity Drainage recovery techniques (SAGD).
- Hydrogeological assessment of Isadore Lake. Exploratory drilling, pumping test analyses and aquifer modelling were carried out to examine the feasibility of injecting disposal water, from Albion Oils (Shells) operations, into a Cretaceous aquifer.
- Environmental impact assessment of Imperial Oil's activities in Devon, Alberta. This investigation included an assessment of lithology, groundwater flow, water quality (major ions, dissolved metals and organic compounds [phenols, naphthenic acids, BTEX, TVH, TEH, PAH]) and attenuation.



2000. Komex H₂O Science, USA



Between July and December 2000, he worked in California to assist with the following:

- Assessment of water quality impacts of selected oilfields in the Santa Maria River Basin.
- Preliminary environmental assessment of Hull Middle School Torrance.
- Conceptual & numerical groundwater model for Murrieta County Water District.
- Proposal to evaluate techniques to assess groundwater vulnerability to methyl tertiary-butyl ether (MTBE).
- Proposal to assess the impact of alkylphenol ethoxylates (endocrine disruptors) on Chinook salmon reproduction.
- Supplemental Hydrogeologic Site Investigations: Jefferson Middle School No. 1, Los Angeles. Investigation of primary hexavalent chrome (Cr⁺⁶) and trichloroethene (TCE) contamination.

1999 - 2000. Resources Services, Botswana



Between June 1999 and April 2000, he was engaged as the Team Leader of a study to evaluate the groundwater resources and potential of providing reticulated supplies to three villages on the edge of the Kalahari Desert. Responsibilities included managing a team of 24 staff, reporting, logistics, procurement, Project expenditure, billing and accounting. Leading edge technologies employed on the Project included: a helicopter-borne FDEM survey; the installation of a combined meteorological and groundwater monitoring station; use of chloride mass balances, groundwater recession analyses, and real-time remote sensing data to estimate the variability of recharge; sampling and analyses of Br, Cl, B and Li to determine the origin of various brines; and, ¹⁴C, ¹⁸O and ²H sampling and analyses to determine the age and origin of recharge.

1991 – 1999. Ministry of Water Resources, Sultanate of Oman (Hydrogeology Expert)

Initially, in 1991, he worked for the Recharge Section of the Ministry of Water Resources (MWR) to help evaluate existing and proposed recharge schemes in Oman. These evaluations included an assessment of a catchment's water balance, with and without scheme, using groundwater modelling and "accounting" techniques. In 1993 he became the Acting Project Manager for the Nejd Desert Assessment Programme, assigned creating a groundwater archive, installing a groundwater monitoring network, and estimating the volume of reserves and recoverable groundwater contained within aquifers of the Hadhramaut Group. In 1994 he joined the Technical Secretariat, which was tasked with writing and editing technical reports, developing assessment methodologies, evaluating external reports and providing assistance and advice to the D.G. In 1996 he was the Project Manager for the Wahaybah Sands Assessment Programme - the largest drilling/aquifer-testing contract ever undertaken by MWR. Mr Ashworth was responsible for running the Project, running a Regional Office, logistics and training, and was the main author of Project Reports. At the end of 1997 he was posted to Muscat to write a series of reports for the National Water Resources Master Plan.



1991. M J Carter Associates (Senior Hydrogeologist)

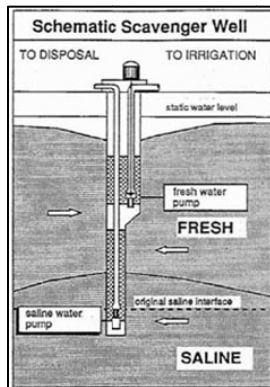
He assessed the impact on groundwater resources of proposed mineral extractions and landfill sites and helped evaluate the environmental liabilities of 37 landfill sites belonging to Biffa, in the U.K.

1984 – 1990. Mott MacDonald International (formerly Sir M. MacDonald & Partners Ltd.)**1988 – 1990. Oman - various projects (Resident Hydrogeologist)**

Based in the Muscat Office, he was responsible for groundwater investigations conducted by MMI in Oman. Responsibilities included project management, making proposals, preparing tender documents, tender analyses, and writing preliminary, feasibility and final reports for a variety of studies. These studies included: investigation of groundwater recharge schemes; the design of small recharge and impoundment dams; well improvement works; investigations for the development of irrigated agriculture; and, the development of a new wellfield for Muscat.

1987 – 1988. MMI, Pakistan Scavenger Well Studies (Hydrogeologist)

This Overseas Development Administration (ODA) financed project was designed to test the feasibility of separating groundwater of different salinities. It involved the construction of wells and multiple piezometers to study the pressure distribution and water quality movements within variable density aquifers. Novel technologies used during this Project included the design and construction of asymmetrical wells, and the procurement of twin, variable-speed impellers, designed to run off a single pumping shaft. Responsible for field supervision of all aspects of the Project. This Project showed that the continuous abstraction of two different quality waters is practical from single or multiple wells, and that Scavenger Wells can be used to lower water levels, reduce soil salinity, and separate fresh and brackish water.

**1986 – 1987. MMI, Cambridge (Hydrogeologist)**

At head office he participated in the preparation of borehole specifications for a water supply project in Malaysia, specifications for a pumping plant in East Anglia, pump selection criteria for Scavenger Well, and the training of a Malaysian consultant.

1986. MMI, Geophysical Survey, Benue State, Nigeria (Hydrogeologist)

A geophysical survey, in basement rocks, was carried out to help locate new production boreholes for two large towns in Benue State. A geophysical survey of a proposed dam site was also undertaken. This Project involved use of the combined EMT/VES method of geophysical surveying.

1984 – 1986. MMI, Kano State Water Supply, Nigeria (Hydrogeologist)

This World Bank Project for the Kano State Agricultural and Rural Development Authority established 1,100 village boreholes, for the installation of hand pumps, in Northern Nigeria. Mr. Ashworth was a member of the team responsible for the hydrogeological investigations, the supervision of the drilling, and the testing of production boreholes. Geophysical surveys included vertical electric soundings using an ABEM Terrameter and traversing using a Geonics EM 34. A major technical innovation was the interpretation and development of the combined EMT/VES method of geophysical surveying.

**1984. MMI, Fort William Alluvium Investigations, Scotland (Hydrogeologist)**

He supervised the investigations for the abstraction of 100 l/s of groundwater from alluvial deposits near Fort William. Work included the preparation of the report and general contract administration including checks of work measurement.

1984. MMI, River Spey Alluvium Investigations, Scotland (Hydrogeologist)

He was involved in the chemical analysis of water samples, surveying and carrying out experiments on test columns for the removal of colour from water from the River Spey at Fochabers intake works.

1984. Wimpey Laboratories, Geoconsult U.K Ltd. (Hydrogeologist)

He assessed the dewatering requirements for the construction of deep underground foundations for a proposed nuclear power station in Dorset. He supervised the construction of a large diameter

borehole and a number of multiple piezometers in the Cretaceous Chalk in Essex, subsequent pumping tests and their analysis.

1982 - 1983. Isles of Scilly Council (Hydrogeologist)



This EEC-financed water resource survey of the Isles of Scilly included an assessment of saline intrusion, and nitrate and leachate contamination on the Islands of St. Mary's, St Agnes, Bryher and St. Martin's. It involved surface geophysical surveys, the installation of piezometers, pumping and slug-tests. The assessment of Hugh Town's water supply included an analysis of the hydraulic and aquifer properties of the alluvial aquifer, the geometry of the leachate plume, and a risk assessment of contaminating water supply wells. The later included groundwater sampling for typically key contaminants found in landfills taking domestic/ commercial wastes (NH₄, Fe, Mn), common PHEs (Cu, Pb, Zn, As, Cd) and coliforms.

1981. Comshare (Network Operator)

After completing his 1st degree, Mr. Ashworth worked for a year as a Network Operator on mainframe Honeywell computer systems. Responsibilities included tracing faulty network links for large institutions and banks, data storage and other IT work. After this he studied for his Master's degree in Hydrogeology.