




Instrumentation and monitoring

- Manual and Automated Monitoring Solutions
- Geotechnical and In-Ground Instrumentation
- Bespoke monitoring systems
- Environmental Monitoring
- Data visualisation software
- Wireless Tiltmeter solutions
- Hydrostatic Levelling Cells
- Automated Total Stations
- Settlement Monitoring
- ShapeArrays

Monitoring solutions for the construction industry

A black and white photograph of a tunnel interior. The tunnel is lined with concrete and has a series of pipes and cables running along the top. A large, circular, white object, possibly a sensor or light fixture, is mounted on the wall. The perspective is looking down the length of the tunnel, with tracks visible on the floor.

GEO-Instruments is part of the Keller Group plc and specialises in providing instrumentation and monitoring solutions for a wide range of applications.

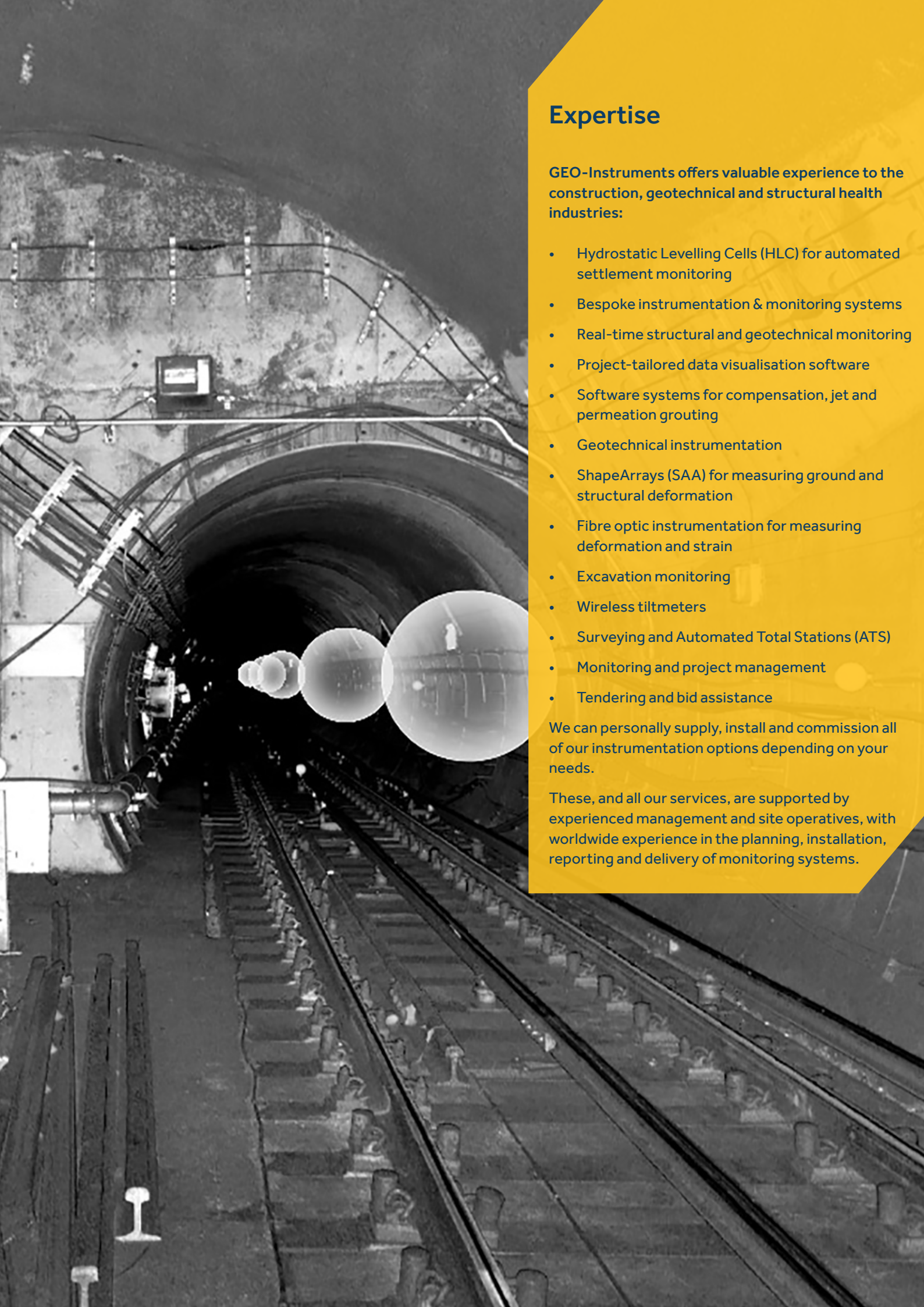
We focus on producing reliable, repeatable data and presenting the results to our clients in the most effective and user-friendly way. Our team designs and installs monitoring systems that provide our clients with the essential information they require to manage their assets or projects.

GEO-Instruments provides expert management and advice to assist your project from the earliest stages of design through to on-site project management.

We are driven to innovate and bring the latest technologies to the instrumentation and monitoring sector. We select our partners carefully to provide the world class service that you would expect from a Keller company.

Although we are a global organisation, our regional structure means that our businesses are close to their customers and can respond to their needs quickly.

Whatever and wherever the project, we are on hand to offer the best quality service.



Expertise

GEO-Instruments offers valuable experience to the construction, geotechnical and structural health industries:

- Hydrostatic Levelling Cells (HLC) for automated settlement monitoring
- Bespoke instrumentation & monitoring systems
- Real-time structural and geotechnical monitoring
- Project-tailored data visualisation software
- Software systems for compensation, jet and permeation grouting
- Geotechnical instrumentation
- ShapeArrays (SAA) for measuring ground and structural deformation
- Fibre optic instrumentation for measuring deformation and strain
- Excavation monitoring
- Wireless tiltmeters
- Surveying and Automated Total Stations (ATS)
- Monitoring and project management
- Tendering and bid assistance

We can personally supply, install and commission all of our instrumentation options depending on your needs.

These, and all our services, are supported by experienced management and site operatives, with worldwide experience in the planning, installation, reporting and delivery of monitoring systems.



Hydrostatic Levelling Cells (HLC)

A Hydrostatic Levelling Cell system allows for accurate real-time measurement of structures for vertical movement, ideal for monitoring for predicted settlement or heave.

Typical applications include monitoring of buildings, excavations, railways, bridges and tunnels. This system is adapted to an environment where conventional survey techniques would not be possible.

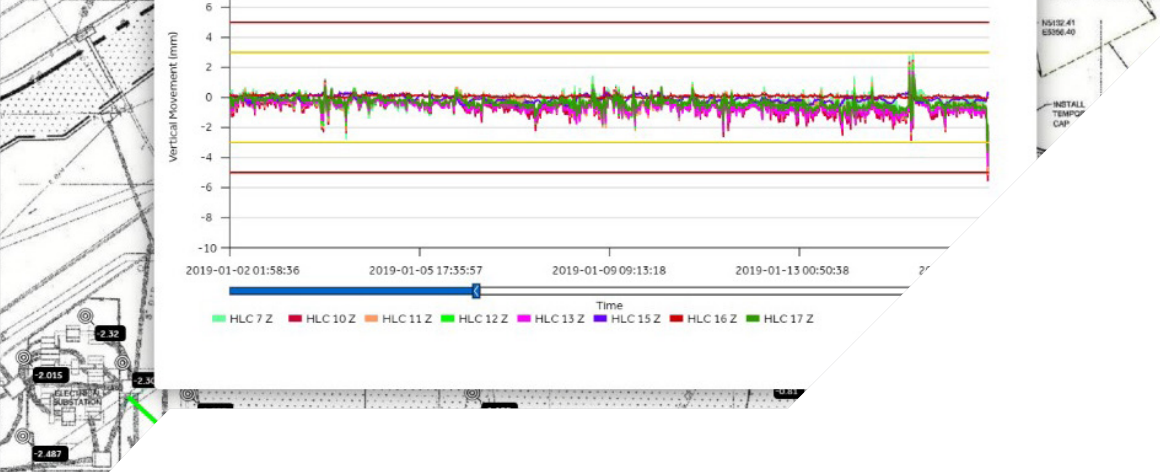
Benefits of the system are the high accuracy, the ability to completely monitor structures on all sides with one system, and reduced need for maintenance. We can also utilise tiltmeters in conjunction with a HLC system to provide a complete settlement and tilt package for structural monitoring purposes.

We have years of experience in the effective design, installation, commissioning and long-term maintenance of HLC systems.

The HLC system can work in a broad range of conditions, with a rapid system for acquisition, archiving and visualisation of data.

This makes it an essential system for controlling risk-critical events such as compensation grouting and tunnelling.





QuickView

Powerful, adaptable and easy to use, QuickView is a browser based data visualisation platform at the centre of your monitoring project.

Ideal for the collection and display of all your project's information, QuickView is not just for Instrumentation and Monitoring data.

Weather data, plant telemetry i.e. TBM data, excavation/construction progress, site logs and many other types of information can all be archived and visualised on your project's individual QuickView page.

With a focus on convenience and functionality, QuickView is browser based and optimised for mobile devices, making data accessible at a moment's notice.

We are committed to continuously make QuickView better. In the last year the infrastructure has undergone a complete upgrade, resulting in improved security, versatility and faster data access.

QuickView has a wealth of visualisation options from full site overviews, customisable views, models, graphs and tables. Recorded data can be uploaded automatically or manually from any browser. Users can download data, export graphs and generate reports. Automated reporting functionality can be set up around customisable templates and regular distribution to mailing lists.

Users are able to tailor project displays to show information on maps, uploaded images or CAD files.

The platform allows the client to review historical data and use the journal feature to keep detailed records of key events through the progress of works. Sophisticated alarm/trigger systems can be user defined and adjusted at will, allowing for complete control over exceedance limits, timings and alert recipients.

QuickView is designed to be intuitive and easy to learn, quickly allowing users to analyse, report and discuss monitoring results.



gtcVisual®

Another powerful software solution, gtcVisual® is the first module in a suite of data visualisation programs designed for specialised applications in the construction industry. Supplementary modules include GroutControl®, JetGrout, and ATDS®.

Each module adds specific functionality, such as the ability to calculate and plot grout injection volumes alongside measured ground movements.

gtcVisual® can use a GIS map for complete project overview or a focused look at areas of work and includes a playback function that allows users to review changes over time, alongside the progress of the project. The software is highly customisable, allowing for automatic calculation of user-defined tools such as deflection ratios and rail cant. Monitoring data can also be interpreted using graphs, timeline and cut plot functions.



Manual and Automated Surveying

GEO-Instruments specialise in providing both manual and automated survey solutions to assist with the specific requirements of each of our clients.

Our team of highly experienced surveyors undertake surveys using high quality specialist equipment and software to produce reliable, consistent and accurate data.

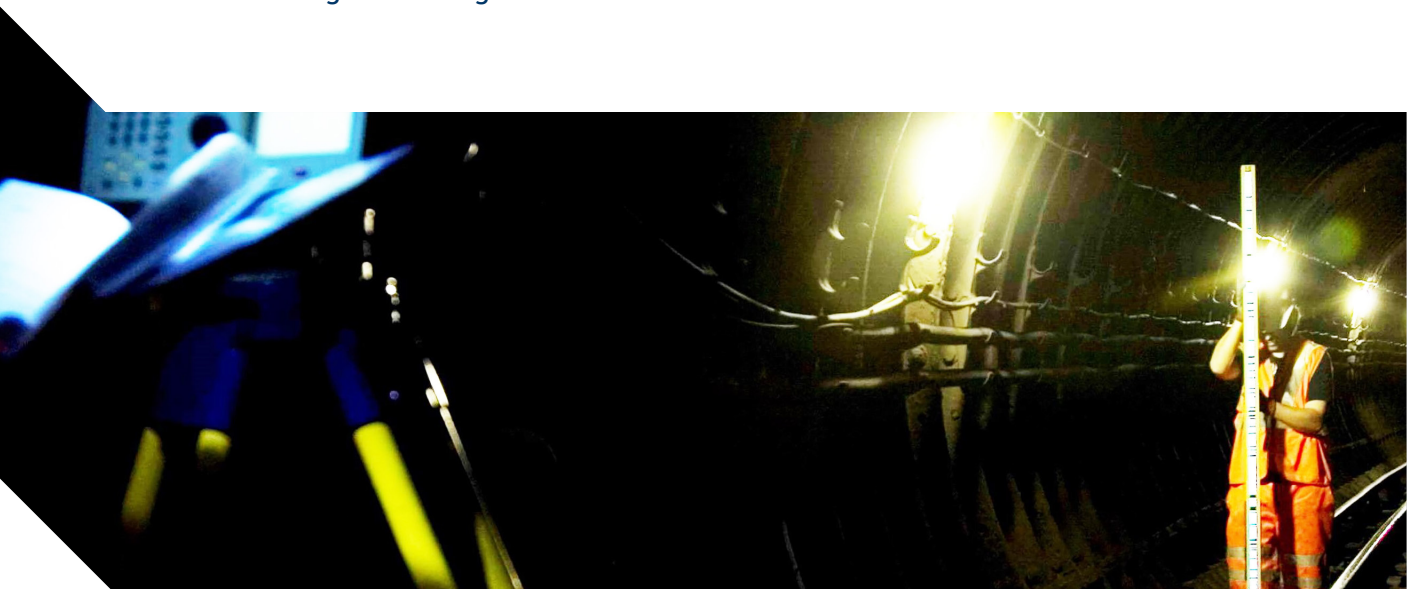
Our range of techniques include:

- Precise levelling
- Manual total station monitoring
- Single or networked Automated Total Stations (ATS)
- Line and level surveys
- Track geometry and clearance surveys
- As-built surveys
- Topographical surveys
- 3D scanning / modelling

Survey data is either automatically or manually uploaded to the GEO-Instruments database. The data can then be visualised in various graphical, visual and tabular formats to provide the flexibility valued by our clients.

We deploy Automated Total Stations (ATS) as either single units or as part of a larger, more complex network to monitor building structures, tunnels, railways and excavations.

We also conduct track surveys to measure track geometry and clearance using an Amberg GRP3000 track trolley.



Geotechnical Instrumentation

GEO-Instruments install a wide range of geotechnical instrumentation.

Our engineers provide the method statements, risk assessments and on-site supervision for the installations.

Where applicable we use accredited drilling companies for groundworks and our own engineers for in ground and structural installations.

GEO-Instruments source, supply and install the following solutions:

- Inclinometers (Manual, Mems IPI and ShapeArray)
- Single and Multi-point Piezometers
- Multi-point Extensometers
- Deep Datums
- Fibre Optic Piezometers and Strain Gauges
- In Pile and Diaphragm Wall instrumentation

- Prop Strain Gauges
- Crack meters
- Tiltmeters

Geotechnical instrumentation and monitoring benefits all phases of a construction project.

In the early stages it can be essential for examining initial site conditions and confirming laboratory testing results.

During advanced construction it is used to enable the site team to guide construction control, enhance communication between contractors and help provide value engineering.

Post construction, the long-term performance of the ground or structure can be monitored and evaluated using Geotechnical I&M.

The data collected is invaluable to designers and engineers for developing more efficient designs and construction methods.



Elizabeth House

Elizabeth House is a major new mixed-use redevelopment project next to London's Waterloo Station.

The works are near to multiple types of existing infrastructure and it is necessary to monitor adjacent London Underground and Network Rail assets throughout the project.

Included in the monitoring are eight London Underground Tunnels as well as pedestrian passages, including 11 escalators. The monitoring and data collection was automated wherever possible to maintain data frequency

while minimising the need for intervention. Installations and Manual surveys had to take place during limited time in the early morning when services weren't running and stations were closed.

Over the planned five-year lifespan of the project, GEO-Instruments' monitoring system will be providing data 24 hours a day using a mesh network of over 200 triaxial tiltmeters. Further surveys of over 700 prisms, tape-extensometer bolts as well as track trolley geometry surveys and precise levelling are also included.

UCLH Proton Beam Therapy Centre

University College London Hospitals were building a new proton beam therapy cancer treatment centre in central London.

GEO-Instruments deployed a comprehensive structural and environmental monitoring solution for multiple stages of the project. Monitoring was required during demolition of the existing structure and during the excavation and construction of a 4000m², 20m deep basement.

The specification required comprehensive monitoring of noise pollution, tensile strain of excavation props as well as deflection ratios and deformation of adjacent structures. Potential

movements of the surrounding buildings and infrastructure required strict alarm thresholds and immediate notification of invested parties. This allowed the works to be modified accordingly. Comprehensive noise and air quality monitoring was also required due to a large number of residential buildings around the site.

GEO-Instruments' Quickview web viewer was provided, managing the display of data from the various different sources for the project. GEO worked closely with the client to add new features to assist with the reporting requirements.



Viking Wind Farm (pictured)

The Viking Energy Wind Farm on the Shetland Islands began construction in September 2020.

Contributing towards government and global schemes to reduce CO² emissions and increase the usage of renewable energy, the wind farm will consist of 103 wind turbines.

As part of the project, a new dual carriageway is being constructed for site access. During construction works it is necessary to monitor pore pressure in the peat beneath the site. Due to the remoteness of the site, any monitoring solution must collect data automatically with reliable communication

and minimal need for maintenance.

A system of 10 Vibrating Wire Piezometers and 24 settlement plates was designed for the project. The piezometers were installed in an array along the construction area and the data from the piezometers is collected automatically and sent via wireless nodes to a shared gateway where it is sent and uploaded to GEO's web-based software QuickView.

The piezometer data collection will run autonomously for the three-year life of the project using solar power with a deep cycle back-up battery.

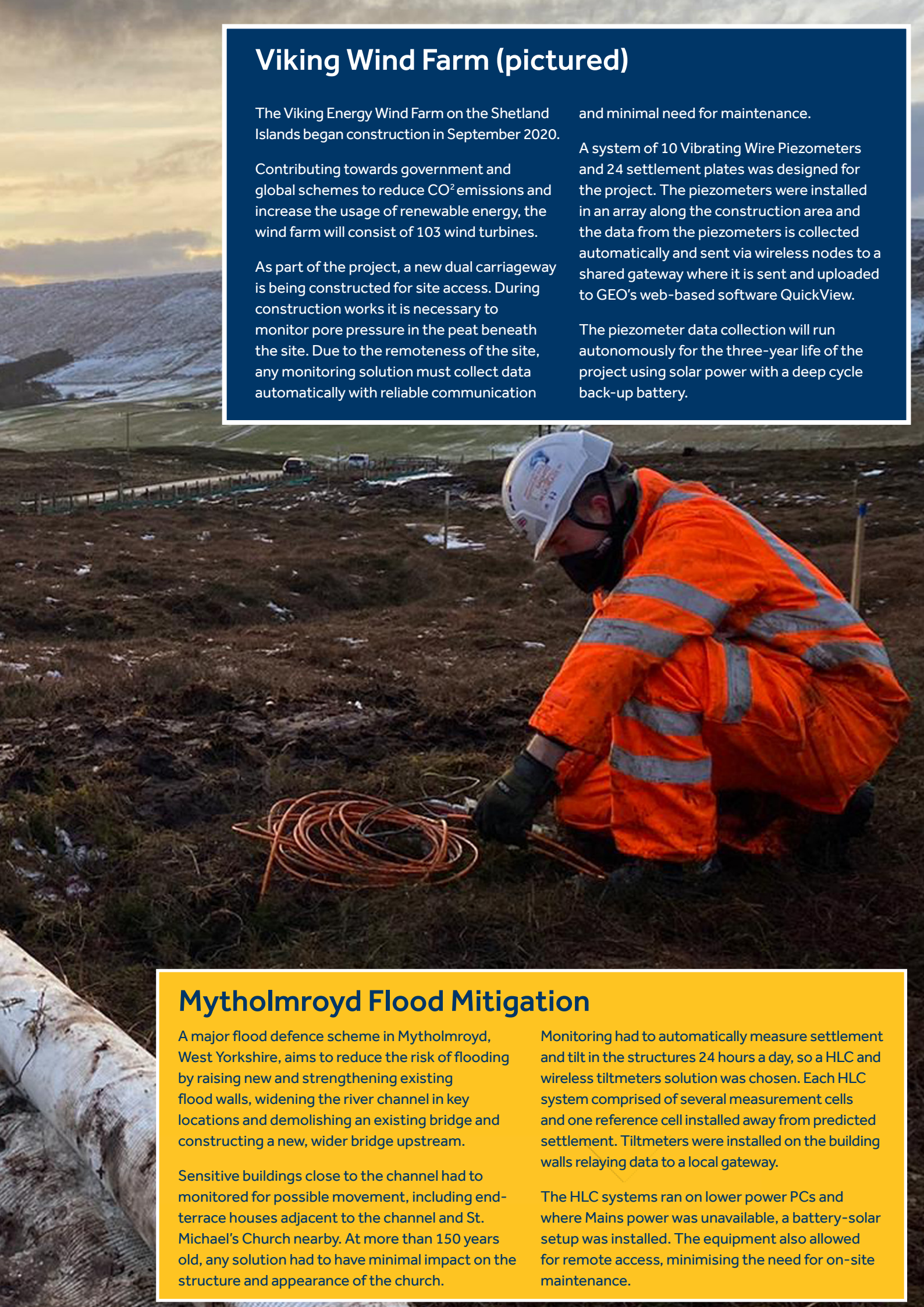
Mytholmroyd Flood Mitigation

A major flood defence scheme in Mytholmroyd, West Yorkshire, aims to reduce the risk of flooding by raising new and strengthening existing flood walls, widening the river channel in key locations and demolishing an existing bridge and constructing a new, wider bridge upstream.

Sensitive buildings close to the channel had to be monitored for possible movement, including end-terrace houses adjacent to the channel and St. Michael's Church nearby. At more than 150 years old, any solution had to have minimal impact on the structure and appearance of the church.

Monitoring had to automatically measure settlement and tilt in the structures 24 hours a day, so a HLC and wireless tiltmeters solution was chosen. Each HLC system comprised of several measurement cells and one reference cell installed away from predicted settlement. Tiltmeters were installed on the building walls relaying data to a local gateway.

The HLC systems ran on lower power PCs and where Mains power was unavailable, a battery-solar setup was installed. The equipment also allowed for remote access, minimising the need for on-site maintenance.





Environmental Monitoring - Vibration, Noise and Dust

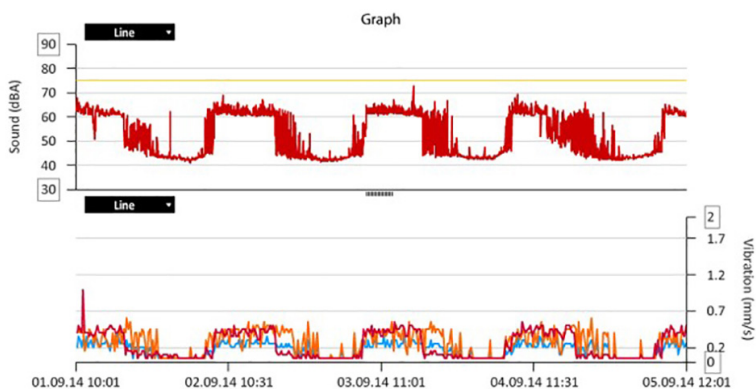
GEO-Instruments are working with manufacturers to provide a complete environmental monitoring package. This includes versatile options for vibration and noise monitoring, automated 24-hour data collection and trigger alerts via text or email. Data can be easily reviewed and reported on our QuickView visualisation software.

The system allows you to conduct continuous, high-resolution measurements in the field with minimal need for maintenance or intervention.

GEO-Instruments engineers provide professional installation and commissioning of on-site equipment and training on the reporting and trigger definitions.

The sensors we supply are able to calculate VDV (Vibration Dose Value) as well as PPV (Peak Particle Velocity) and all European standards can be used.

For Dust and particulate monitoring, GEO-Instruments offers environmental particle monitors that provide long-term, accurate, high frequency recording of PM1, PM2.5 and PM10 levels.



ShapeArray

GEO-Instruments use the ShapeArray for accurately monitoring retaining walls, large slab movements, tunnel and sewer deformation.

ShapeArrays consist of a string of rigid MEMS (Micro-ElectroMechanical Systems) gravity sensors separated by joints that can move in any direction but cannot twist.

Each sensor is capable of measuring tilt in 2D and 3D directions depending on its inclination.

This makes it an ideal tool for measuring drilling orientation inside boreholes or auger stems.

Processors transform the position (e.g. X,Y & Z) of each sensor to produce a cumulative shape and change of shape from a baseline.

The SAA data is then displayed within our



QuickView monitoring platform in a user-friendly section view allowing the user to view data against ground strata profiles, propping information, excavation details and predicted ground movements depicted through design curves.

All this combines to give the user a detailed view of monitoring data alongside site information and designs.





Borehole Surveying

Close collaboration with other Keller divisions has allowed GEO-Instruments to gain detailed experience in efficient and precise surveying of boreholes on site.

With an emphasis on speed and accuracy our teams and equipment can provide essential data on orientation, inclination and deviation of boreholes with minimal interruption to drilling works.

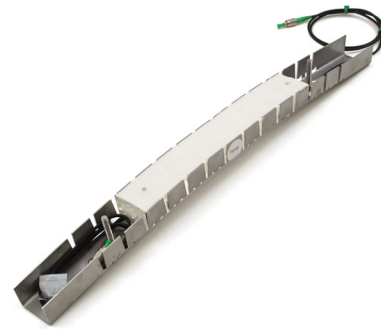
Instrumentation options include a gyroscopic survey system run into and out of installed casings to measure depth and deviation, ideal for as-built surveys of the boreholes.

Continuous surveys allow for a detailed “map” of the borehole showing positions at chosen intervals.

We can also offer rig alignment technology that can be fitted to the drilling rig that gives precise azimuth of the set up over the borehole.

This eliminates the need for other methods of survey and initial azimuth calculation (for example by Total Station).

With robust, reliable equipment and intuitive software our solutions are useful in a wide range of applications.



Fibre Optic Monitoring

We are using Fibre Optic technology in an innovative way to measure strain within structures and geotechnical processes.

GEO-Instruments have partnered with Sylex to provide complete, bespoke designed systems and strain monitoring solutions.

A key advantage of fibre optic instrumentation is being intrinsically safe as well as ATEX rated,

making them especially suitable for tunnel and sewer monitoring. Able to read microstrain directly and in real time, our fibre optic sensors have a long lifespan and don't require individual calibration.

Fibre optic sensor strings can be installed over relatively long distances with no loss in signal strength. The flexibility of these solutions has seen them used in diverse applications including measurement of pipelines, props, tunnels, sewers, bridges, railway beds and roads.

Wireless Tilt Sensors

Networks of wireless tiltmeters are versatile monitoring solutions that are relatively easy to deploy, making them a popular option for tunnel and infrastructure monitoring.

These systems boast high accuracy, consistency and longevity with batteries that can last several years. The need for maintenance over the course of a project is minimal.

We work with wide range of industry-leading suppliers to enable us to adapt our solutions to best match the needs of the project.

We also offer wired tiltmeter options for applications where battery life is a concern.

Tiltmeters combined with other automated instrumentation options like settlement cells (HLCs) can help monitor three-dimensional deformation of assets where other 3D monitoring solutions are not feasible. Combining inclination and settlement monitoring in this way gives a more complete picture of structural movement has allowed us to collect vital information on many successful projects.



Keller Group plc - Who we are

Every day, people around the world live, work and play on ground prepared by Keller, the number one geotechnical specialist contractor worldwide.



North America

- North-East
- South-East
- Florida
- Mid-West
- Central
- West
- Canada
- Specialty Services
- Moretrench Industrial
- Suncoast

Europe

- Central Europe
- French-Speaking Countries
- Iberia
- North-East Europe
- UK
- South-East Europe and Nordics

AMEA

(Asia-Pacific, Middle East and Africa)

- ASEAN
- Austral
- India
- Keller Australia
- Middle East and Africa

Solutions specialist

Used alone or in combination, our techniques solve a wide range of geotechnical challenges across the entire construction sector – from industrial, commercial and housing projects to infrastructure construction for dams, tunnels, transportation and water treatment, as well as projects to address environmental challenges.

Global strength and local focus

We are unique in that we combine global strength and knowledge with our local presence and focus. Our knowledge of local markets and ground conditions means we're ideally placed to understand and respond to a particular local engineering challenge. Our global knowledge

base then allows us to tap into a wealth of experience, and the brightest minds in the industry, to find the optimum solution.

With 9,000 employees and operations across six continents, we have the people, expertise, experience and financial stability to respond quickly, get the job done and see it through safely.

By connecting global resources and local knowledge, we can tackle some of the largest and most demanding projects around the world but the everyday work we do is just as important and, in total, we handle an unrivalled 6,000 projects every year.



Keller at a glance

 Established in 1860	 6k contracts executed a year
 40 countries	 9,000 employees

Helping create infrastructure that improves the world's communities

-  Ground improvement
-  Grouting
-  Heavy foundations
-  Earth retention
-  Instrumentation and monitoring

Our Projects

GEO-Instruments are proud to have partnered with industry leading contractors and suppliers on a wide array of projects across the globe.

- Crossrail C300 /C410 Western Running Tunnels, Bond Street and Tottenham Court Road Station, London – Full Instrumentation, Monitoring and Software package including Project Management.
- UCLH Proton Beam Therapy Centre – Settlement, Structural and Environmental Monitoring.
- Seaton Ground Investigation, Devon - Automated ground settlement monitoring for ground preparation works.
- Southbank Place, London – Automated and manual deformation and settlement monitoring (tunnels). Geotechnical and Environmental monitoring (surface).
- Thames Tideway, Central London – Embankment and sewer monitoring including Hydrostatic Levelling Cells (settlement), Tiltmeters (inclination) and Fibre Optics (strain).
- Royal Mansour Hotel, Casablanca – Structural, Excavation and Environmental monitoring including Tiltmeters (inclination), ShapeArray (excavation) and Vibration sensors.

If you would like to know more about our experience or discuss your upcoming projects we are here to answer your questions.

GEO-Instruments

Instrumentation and monitoring

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