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TECHNOLOGIES LTD
Edinburgh, Scotland

Restoration of Peatland

ENVIRONMENTAL & CRITICAL INFRASTRUCTURE MONITORING SOLUTIONS

ABOUT PEATLANDS:

Peatlands are carbon-rich wetlands which occupy 3% of the global land surface and 12% of UK land area.

- The waterlogged conditions prevent plant material from fully decomposing and ‘peat’ soil is formed by the partially decayed material, which builds up slowly.
- Natural vegetation in Northern Hemisphere peatlands is mainly mosses, sedges and shrubs, while in the tropics they are naturally forested.
- In the UK, there are 3 types of peatland:
    - **Blanket bog – large areas of peat found largely in uplands fed primarily by rainfall.**
    - **Raised bog – localised domes of peat in lowland areas fed primarily by rainfall.**
    - **Fens – fed by mineral-rich groundwater and river water, as well as rainfall.**

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Research information taken from the UK Centre for Ecology & Hydrology.

IMPORTANCE OF PEATLANDS:

Peatlands are among the most carbon-rich ecosystems on Earth. In a natural condition, peatlands have a net cooling effect on climate, reduce flood risk, and support biodiversity. Healthy peatlands can reduce flood risk by slowing the flow of water from the uplands,
and by providing floodplain storage in the lowlands.

They also provide important nesting and feeding grounds for many wading birds, as well as important habitats for rare insects and plants. Due to the unique flora and fauna they support, and their global rarity, blanket bogs have sometimes been referred to as the 'rainforests' of the UK.

Healthy peatlands capture CO_2 from the atmosphere through photosynthesis. Because the plants that grow on peatlands do not fully decompose under wet conditions, they do not release carbon which would otherwise be returned to the atmosphere as CO_2. Peatlands store vast quantities of carbon – 'locking in' an estimated 3.2 billion tonnes in the UK alone.

Research information taken from the UK Centre for Ecology & Hydrology.

THE IMPACT OF DEGRADATION:

Around 80% of UK peatland has been affected due to human activities which are:

- Draining the soil so it is not waterlogged, in order to make it suitable for crop and tree growth leads to the decomposition of plant material and soil shrinkage. This releases carbon into the air and is thereby a source of CO2 emissions into the atmosphere. While it takes 1,000 years for 1m of peat to build up, drainage means the land surface reduces an average of 1cm to 2 cm per year through subsidence due to peat oxidation. Drainage also means large areas of lowland peat, notably in the East Anglian Fens, are now below sea level and at risk from flooding.

- The creation of ditches to enable drainage also provides channels for the rapid flow of water, which may increase flood risk downstream.

- Drying out the peat soil allows shrubby vegetation to grow and makes the land more vulnerable to severe wildfires. Fire (caused by managed burning, accidental spread or arson) also produces CO2; for example a major wildfire on peat in the Scottish Flow Country is thought to have doubled Scotland's greenhouse gas emissions during the six days it was burning.

- The degradation of peatlands has a negative impact on soil health over time, affecting the long-term viability of agriculture in those areas. Peat subsidence due to drainage also increases the need for expensive pumping to maintain conditions suitable for crop growth and increases the risk of flooding.
  Raising water levels could benefit farmers by extending the productive lifetime of the soil, as well as reducing both CO2 emissions and flood risk.

Updated map of the extent of peat in the UK.

Research information taken from the UK Centre for Ecology & Hydrology.

HOW TECHNOLOGY CAN SUPPORT DEGRADATION MONITORING:

Applying technologies to monitor the degradation of peat bogs is key to the restoration and future management.

The solution aims to monitor the effects of the water-level (water table level), soil moisture and air condition in real-time of peatlands in Scotland. Predicting any changes to the land and environment such as fire detection and weather - setting acceptable and unacceptable movement thresholds and alerts.

Monitoring Technologies, Communications & Reporting;

- **Reports and alerts accessible from anywhere, on any device, at any time.**
- **Data accessible through a visualization secure dashboard in virtually real-time.**
- **Data into a single unified management platform in near to real-time.**
- **Resilient satellite communications.**
- **Low Power Wide Area network (LPWan) technologies.**
- **Renewable power sources.**

The following table explains in depth the parameters and frequencies of the real-time alarms and alerts.

PARAMETERS AND FREQUENCIES FOR MONITORING PEATLANDS:

PEATLAND'S CONDITION	POSSIBLE MONITORING PARAMETERS	SUGGESTED MINIMUM FREQUENCY	FOR CLIMATE REPORTING, INDICATOR OF:
All peatlands	Area of peat	Annually	Potential GHG emissions
	Local climate and altitude	Rainfall regimes seasonally	Potential for GHG emissions
	Socio-economic factors	Annually	Sustainability of action
	Peat depth	Once	Carbon storage and potential duration of emissions
Peatlands in temperate and boreal regions	Fertility	Once at different peat depths	Potential for GHG emissions
Temperate peatlands	Vegetation	Regularly, e.g. every five or ten years	Proxy for GHG emissions
Pristine peatlands	Potential land cover or land use change	Annually	Need for preventive action
	Drainage-free land uses	Twice a year	Sustainability of action
	GWL (also through canal water depth)	Seasonally	Adaptive capacity
	Soil moisture	Seasonally	Fire risk in case of reduced moisture
	Fire risk and fire detection during dry periods	Daily	GHG emissions, haze and associated health, economic and political issues
Drained peatlands	Area of each drained peatland hydrological unit or area	Twice a year	GHG emissions
	Land cover change or development of drainage canals or ditches, logging tracks and roads (expansion of network)	Twice a year	Changes in above and below-ground carbon stock; Need for preventive action
	Surface level: subsidence and peat depth	Four times a year	GHG and other carbon loss
	Soil moisture and GWL	Seasonally, twice a year	Fire risk, disaster risk reduction
	Fire risk and frequency of fires	Daily during dry periods	GHG emissions, disaster risk reduction
	Area of burnt peat and frequency of fires	After the dry season	GHG emissions, disaster risk reduction
Restored peatlands	Land cover change: Return of native peatland species	Annually	Success indicator
	Management: Wet peatland uses	Annually	Sustainability of action
	Profitability and gender equity of wet livelihood options	Annually	Sustainability of action
	Fully rewetted area with the entire drainage system blocked	Twice a year	Avoided GHG emissions
	Location and status of dams and other restoration efforts (e.g. blocking of canals and ditches)	Twice a year	Success indicator
	Surface level: subsidence and peat depth	Four times a year	GHG emissions and success indicator
	Soil moisture and GWL (also through canal water depth)	Twice a year	Avoided GHG emissions; disaster risk reduction
	Fire risk and frequency of fires	Daily during dry season	GHG emissions; disaster risk reduction
	Area of burnt peat	After the dry season	GHG emissions, disaster risk reduction

Research information from the Food and Agriculture Organization of the United Nations.

IMPLEMENTING A LOW POWER WIDE AREA NETWORK:

THE COMPLETE SOLUTION EYCOSYSTEM

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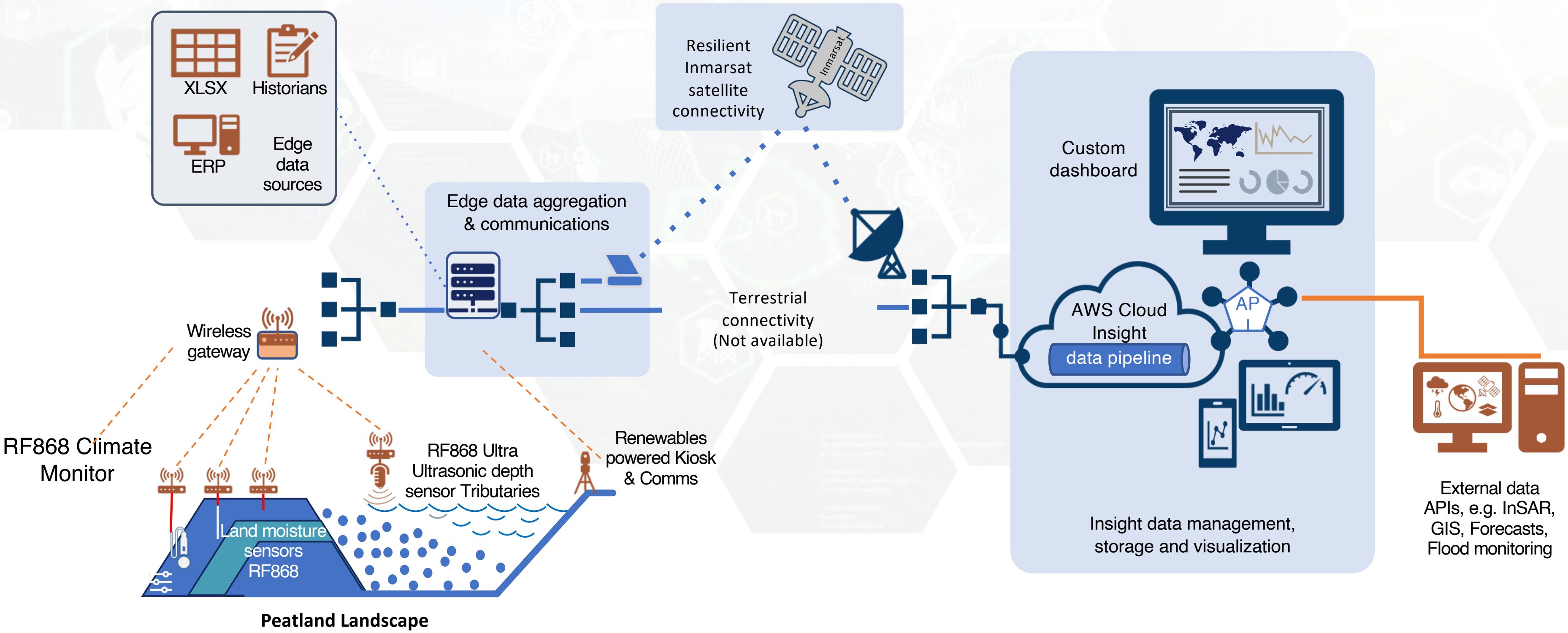

- Sensors Data Ingestions / Processing.
- Information extension to mobile / web platforms.
- Real-time notifications and alerts.
- Analytical and BI toolset integration.
- AI algorithms to predict future data sets and alerts.
- ERP system integration.

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HARDWARE;
EDGE & COMMUNICATION:

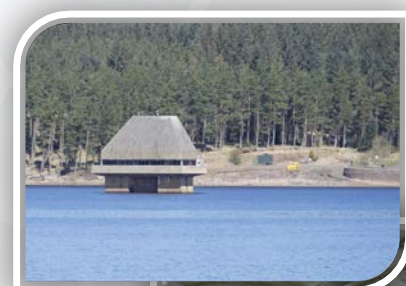
MConnected Gateways are designed to be used continuously in some of the harshest environments in the world. MConnected adapt the hardware required for specific use cases:

- **Test and entry level solution where we supply power, packaging, cables and an Inmarsat ISatData Pro modem.**
- **Complete self-contained, self-powered kit ready to deploy.**
- **Complete self contained solution with 2-day UPS**
- **Complete self contained hybrid cellular + satellite solution with 2-day UPS .**

Remote LoRaWan and satellite kiosk.

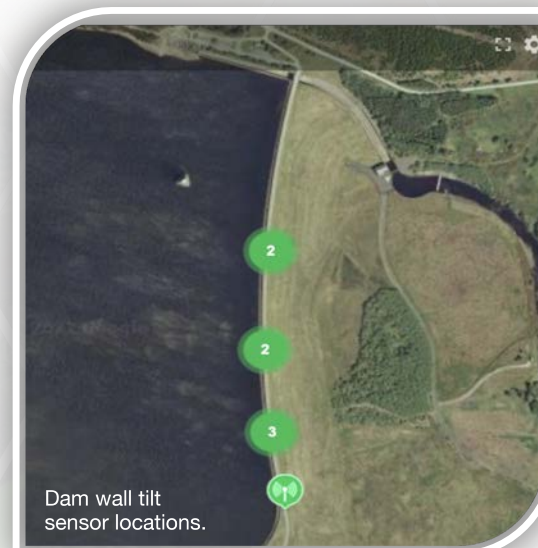
TECHNOLOGY & REMOTE MONITORING: KIELDER DAM & RESERVOIR, A CURRENT LIVE PILOT

ENVIRONMENTAL & CRITICAL INFRASTRUCTURE MONITORING SOLUTIONS



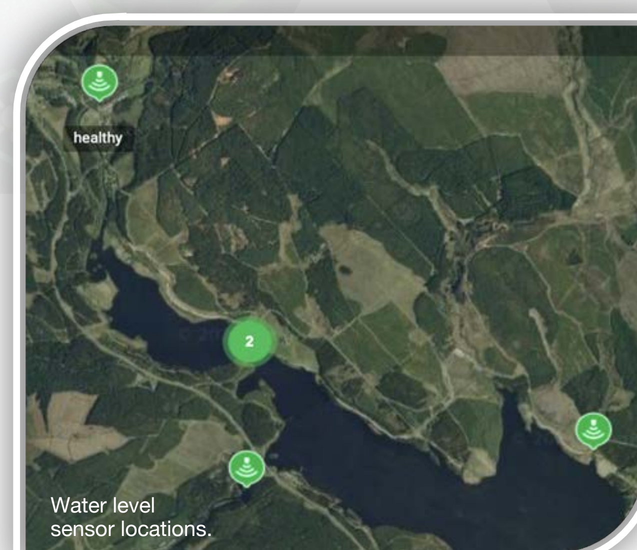
Kiosk 2; Valve tower Access tunnel 70m below reservoir.

Kiosk 2; Valve tower installation.



Dam wall tilt sensor locations.

Kiosk 1; Bakethin installation.



Water level sensor locations.

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TECHNOLOGY & REMOTE MONITORING:

KIELDER DAM & RESERVOIR, A CURRENT LIVE PILOT

ENVIRONMENTAL & CRITICAL INFRASTRUCTURE MONITORING SOLUTIONS

Ultrasonic water level sensor – North Tyne

Kielder Dam wall

Edge device: Dam Wall Tilt Sensor

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ABOUT
MCONNECTED TECHNOLOGIES LTD:

MConnected Technologies Ltd excel's in several verticals, which we recognize are essential in achieving Digital Transformation targets over the next 10 years in environmental scenarios.
MConnected Technologies Ltd specialist team are seasoned professionals in;

- **Climate & Environmental Analysis & Impact.**
- **Critical Infrastructure Monitoring.**
- **Digital Transformation.**
- **Space Technologies.**
- **Corporate Governance & Funding.**

MConnected Technologies Ltd is uniquely placed to support government and businesses projects within these important sectors.

MConnected Smart Projects to date:

- Smart Ship: Personnel Accountability on a Warship –HMS Queen Elizabeth. Royal Navy.
- Tracking exam papers: Globally and alerting tamper- Pearson Publishing.
- Logistics: Digital Manifest for a global sporting events- DHL / RedBull
- Smart Rail: Predictive IoT and Maintenance on Rail - OnTrac / Tracsis Plc.
- Smart Port: Connecting one of the UK's largest industrial ports.
- Disaster Relief: Personnel Accountability: Digitally recording personnel during a disaster- Nice Airport & French Coast Guard
- Smart Forest Project: Carbon Monitoring - Inmarsat/ European Space Agency("ESA").
- Critical Infrastructure and dam monitoring: UK Space Agency and NWL. Predictive dam "flex" in relation to reservoir volume-NWL & Kielder Development Trust
- Connected Forest: Tracking Lone workers in Europe's largest Forest. Forestry England and Inmarsat
- Authentication of high Value Wines & Spirits: Embedded technologies to protect against counterfeit product.

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