ESR
Science for Communities

2017 ANNUAL REPORT

innovate
adapt
deliver

Image courtesy Ian Robertson Photography

Our Purpose

To deliver enhanced scientific and research services to the public health, food safety, security and justice systems and the environmental sector and to contribute to the economic, environmental and social well-being of people and communities.

OUR MISSION

Keeping people and communities safe, healthy and prosperous through smart and sustainable science.

OUR VISION

ESR is a world leader in the science that keeps people safe, healthy and prosperous. Our customers regard us as a critical partner for their work and we are known for our service ethic. They seek us out for our innovative and high quality science solutions and leading edge research. We are a magnet for talented people.

OUR VALUES

- Team spirit
- Quality counts
- Doing the right thing
- Pushing the boundaries

ESR CELEB RATING 25 YEARS

The Institute of Environmental Science and Research was one of ten New Zealand Crown Research Institutes (CRI) established in 1992, after the reorganisation of the Government-owned Department of Scientific and Industrial Research (DSIR) and science units from the Department of Health.

This year, along with the other Crown Research Institutes, we are celebrating ESR's 25 years in existence. Twenty-five years of contributing to the economic, environmental and social well-being of people and communities in New Zealand, and around the world.

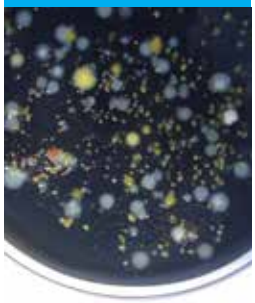
1992 - 1996

- Outbreak of toxic shellfish poisoning
- DNA evidence identifies a murderer
- National DNA Databank established
- EpiSurv goes on stream
- Led the water quality testing after the Mt. Ruapehu eruption

1997 - 2001

- Meningococcal risk factors begin
- Rheumatic fever research project undertaken
- Meningococcal epidemic rages
- Water Information New Zealand database established
- Whooping cough epidemic revealed by EpiSurv
- Social scientists employed
- Human caliciviruses in oysters detected

2002 - 2006



- Helped develop meningococcal vaccine
- Collaborated on drinking water solutions for isolated communities
- Clan Lab deal with a 143% increase in methamphetamine manufacture
- Forensic expertise provided to Thailand after Boxing Day Tsunami
- Nitrate levels in groundwater investigated
- Responded to H5N1 bird flu
- First ever Marsden Fund grant received
- Low Copy Number DNA testing introduced

2007 - 2011

- ZyGEM (DNA extraction product) royalty cheque received
- National Centre for Biosecurity and Infectious Disease opened
- World-leading RNA analysis research operationalised
- National Radiation Laboratory acquired

2012 - 2017

- SHIVERS project to understand flu virus in New Zealand completed
- STRmix™ launched
- CIBR – Biowaste Research Centre established
- Accreditation gained for testing meat products
- Forensics New Zealand documentary series goes to air
- Responded to Hep A in frozen berries
- Responded to Havelock North drinking water contamination
- Drug testing in wastewater research
- Genome sequencing commenced
- One Health NZ established
- Bioreactors for removal of nitrates from drainage water research undertaken

Contents

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ABOUT ESR

We are the stewards of New Zealand's capability in forensic science, human and environmental health.

ABOUT US

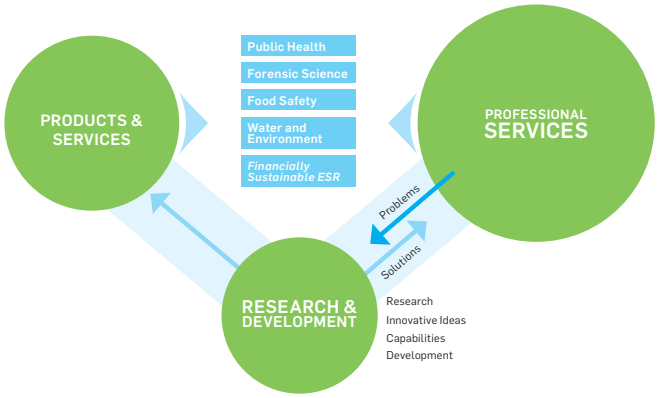
ESR is a New Zealand Crown Research Institute that specialises in science relating to people and communities.

Our science, technology and clinical services, and innovative products help safeguard people's health, protect food-based economies, improve the safety of our fresh water and ground water, reduce land waste and help prevent and solve crime.

Our world-class knowledge, research and laboratory services help our partners and clients solve complex problems and protect people in New Zealand and around the world.

HOW WE WORK

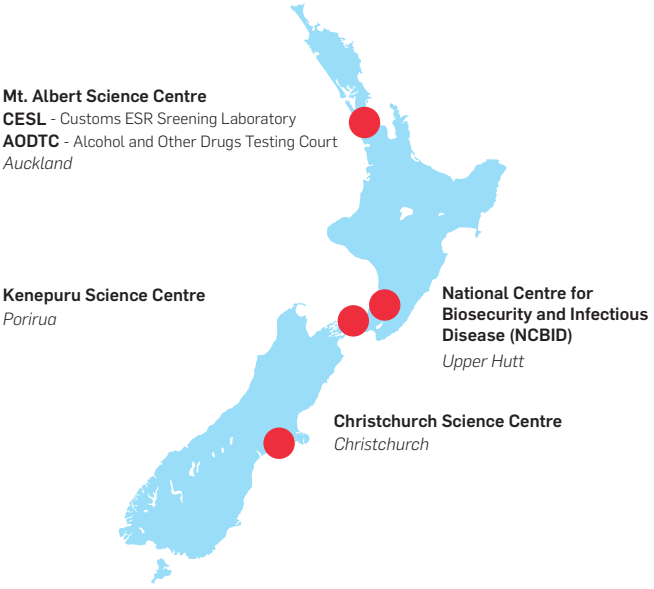
ESR provides high-end, professional scientific and clinical services to a range of clients in the areas of human and environmental health and forensic science. We undertake innovative research to help solve the challenges facing New Zealand today. We then commercialise our new products and services and take them to market.



ESR Platforms:
Human and Environmental Health
Forensic Science

OUR LOCATIONS

We work across six locations in three cities, Auckland, Wellington and Christchurch. We deliver our services worldwide.



OUR PEOPLE

ESR employs over 409 people committed to making a difference to the health, safety and prosperity of New Zealand.

247 Science and Research

75 Corporate

74 Science Support

8 Senior Leadership

5 Senior Science Leadership

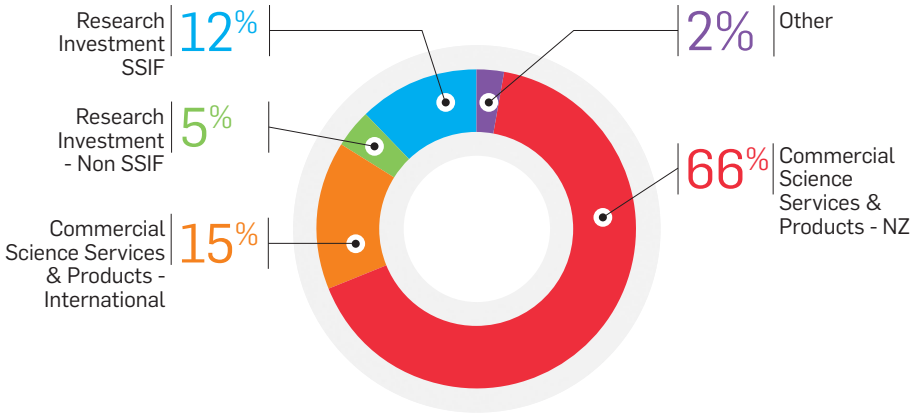
PERFORMANCE HIGHLIGHTS

DELIVERING SUSTAINABLE GROWTH

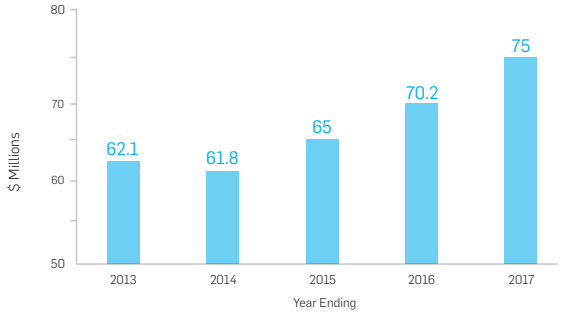
As we deliver professional science services and undertake research for the public good, we are also keenly aware that for us to continue to grow and compete we must keep a sharp commercial focus on our business.

ESR REVENUE SOURCES

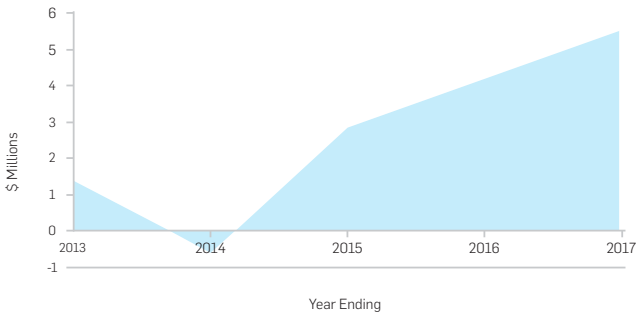
Year Ending June 2017



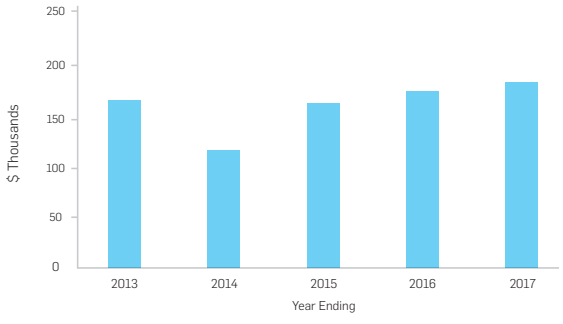
ESR REVENUE



ESR NET PROFIT AFTER TAXATION (NPAT)



REVENUE PER FULL TIME EMPLOYEE



KEY MOMENTS IN OUR YEAR

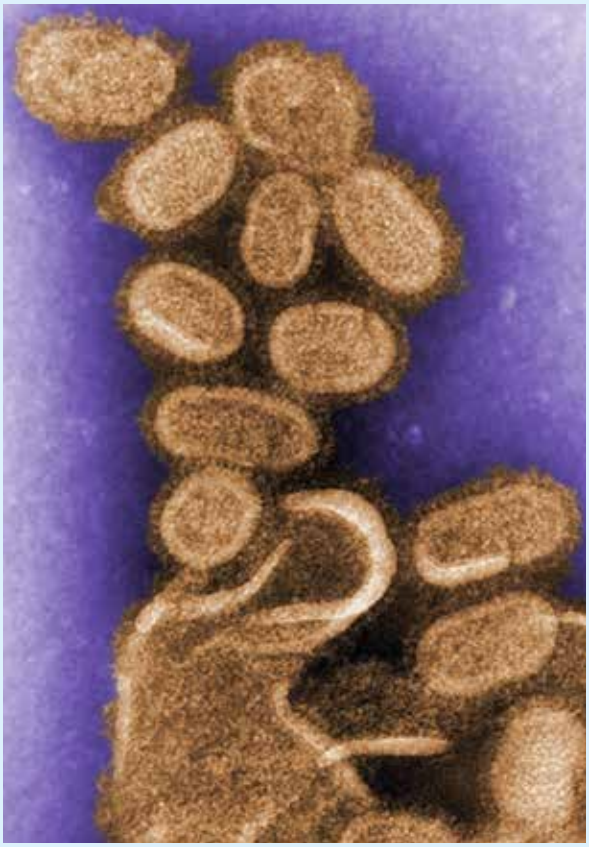
- Tested wastewater for illicit drugs in Auckland and Christchurch. This gives NZ Police valuable intelligence to determine the volume and types of drugs used in New Zealand.
- Increased sales of our ground breaking forensics software, STRmix™.

In 2016-17:

- Reported **16,767** notifiable disease cases
- Tested **3,536** superbugs in our reference laboratory
- **20,121** samples processed by our Health group
- Conducted **23,310** DNA tests
- Linked **75%** of our DNA samples to a person
- Linked **31%** of our DNA samples to other crimes

- Responded to the Havelock North drinking water *Campylobacter* outbreak with a whole-of-ESR response. Our microbiological and genomics expertise proved critical to the management of the event.
- Developed innovative solutions to reduce nitrates in groundwater.
- Invited to lead the development of a new field trial to explore freshwater microbial contaminants of surface water in New Zealand.

- Filed an international patent for our innovative methodology to detect RNA stable regions and biomarkers in the body.
- Established Genomics Aotearoa with our university partners and research institutes. This new body aims to coordinate and oversee the introduction of genomics technology into New Zealand.
- Completed SHIVERS: The Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance research programme. The study investigated the flu over five winter seasons.



- Received a Marsden Fund Grant to research a new approach to study *legionella* mobility and persistence in engineered water systems.
- Sponsored the Australia and New Zealand Forensic Science Society Conference in Auckland. Nine hundred forensic scientists attended from all over the world.
- Posted a strong profit for the second year in a row. This excellent result enables us to invest in our science and infrastructure.

- Signed a Memorandum of Arrangement with the Chinese Research Academy of Environmental Sciences (CRAES) during a visit of Chinese Premier Li Keqiang.
- Continued to compile a baseline library of New Zealand Genomic sequences of human pathogens.
- Set up One Health Aotearoa research centre in collaboration with Massey and Otago Universities, to take an integrated whole-of-society approach to improving human, animal and environmental health.
- Tested over 4,000 samples and 130 food groups for the 2016 Total Diet Study. This study provides information on how safe our food really is.

A YEAR IN REVIEW FROM THE CHAIR AND CHIEF EXECUTIVE

As we look back and celebrate 25 years of ESR serving New Zealand, we also look forward to the future, embracing new technologies and new ways of working – investing in our science, research and people so we can better respond to our customers in New Zealand and beyond. Our vision is to be the leading provider of science services that help people and communities, and to be at the forefront of research that makes this so.

This is the second year we have returned a strong financial result and this gives us the financial sustainability to begin a major investment programme in science and our science infrastructure. Our strategy going forward will be a step change in the way we operate our business.

Our success is as a result of investing in research, successfully commercialising products and services, growing international markets and strengthening and deepening the relationships we have with clients.

Our customer-centric approach, commercial focus and control of costs enables us to be sustainable and to stay relevant to our customers. We know we cannot rest on our laurels. We are actively mapping ESR into the future to ensure we invest in the right science, the right people and the right technology.

A Positive Impact for New Zealand

In public health, we were able to quickly mobilise our health and environmental science staff to be part of a multi-organisational response to the campylobacter contamination in Havelock North's drinking water. Our clinical and environmental microbiological expertise and genomics capability were a critical part of the emergency response which saw nearly one third of the town's population infected by this dangerous bacteria.

The growing threat of the reduced effectiveness of antibiotics to fight infection is of real concern to the health of New Zealanders today. ESR helps improve New Zealand's ability to counter this threat from antimicrobial resistance through building our genomic sequencing capability to identify microorganisms and investigate local outbreaks of infectious disease.

Our services to Police to help solve crime were in high demand this year with our forensic science unit processing a high volume of cases for them. The bedding in of the new Starlims Forensic Laboratory system has improved the efficiency and effectiveness of our service. The increased focus on service delivery has seen a significant improvement in case turnaround times enabling Police to solve crime faster.

Our vision is to be the leading provider of science services that help people and communities, and to be at the forefront of research that makes this so.

A new service testing wastewater for drugs in Auckland and Christchurch was also successful and provided Police and other drug agencies with a clear drug intelligence picture for those areas

To ensure food eaten by New Zealanders is safe, ESR contributed to the Ministry of Primary Industry's 2016 Total Diet Survey by testing fresh food for over 240 contaminants. Through our partnership in the New Zealand Food Safety Science and Research Centre, we are also involved in several research projects to enhance New Zealand's reputation as a quality food producer.

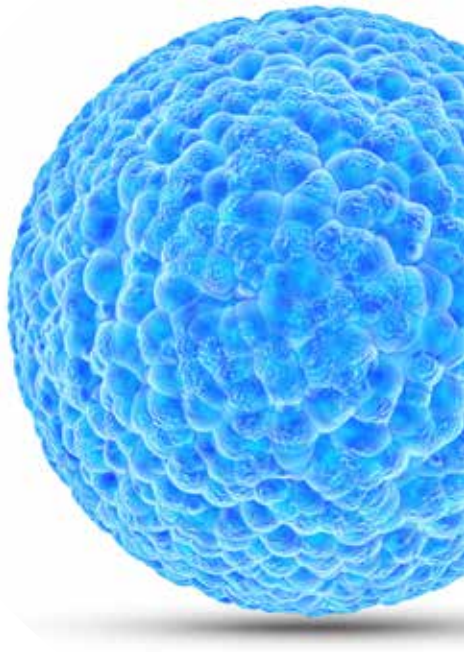
ESR continues its work to help local authorities to improve the quality of New Zealand's waterways and groundwater and to reduce the amount of bio-waste going to landfills by using innovative science and research.

Improving health and wellbeing through an integrated whole-of-society approach to health hazards, underpins a new collaboration of New Zealand's leading infectious diseases researchers. One Health Aotearoa is a partnership between ESR, the University of Otago and Massey University that will bring together those working in the areas of animal, human and environmental health to examine linkages between these areas and tackle significant infectious diseases locally and globally.

Investing in Science, Technology and People

Investment in our genomics and bioinformatics capability has seen the acquisition of the latest technology to provide next generation sequencing capability. Our expertise in this area is growing with capability in metagenomics, RNA, epigenetics, microbiomes and other 'omics. This expertise is applied across the range of all our services and was utilised to great effect in the Havelock North drinking water contamination response.

This year we increased our investment in science research with a 20% increase in MBIE Strategic Science Investment Funding. The increase was targeted at retaining our nationally critical groundwater mitigation capability. We funded 20 research projects in 2016-17, five relating to building ESR's capabilities in genomics and informatics. Another four are aligned to National Science Challenges – Healthier Lives, Our Land and Water, New Zealand's Biological Heritage and the Deep South.



We invested more in our pipeline of new ideas and increased funding to our Pioneer Fund. This seed funding explores 'bright ideas' that will ultimately enhance our science, benefit customers and provide future revenue to ESR.

Working Innovatively

ESR is growing its science products and services, forming new partnerships and attracting new international clients. Revenue from ESR's world leading forensic software STRmix™ is continuing to grow well in existing markets and it is now available in 150 laboratories worldwide. We are now developing additional, complementary products that will make STRmix™ faster and even more effective.

We are developing new technologies, such as DNA synthetic tracers, which will be used in our rivers, streams and groundwater to more effectively find sources of contamination. We are exploring the development of a portable device to allow local authorities to easily determine pathogen contamination in our waterways.

ESR delivers its innovative science services around the world. This includes our work in the Pacific and forensic consulting in the USA. We have also been exploring opportunities in Asia and forming good relationships with our counterparts in these places.

Strenghtening Relationships

ESR has signficant commercial relationships with central and local Government in the areas of justice, security, public health, food safety and the environment. We work closely with them to gain a deep understanding of their needs so we can align our goals to deliver responsive services.

Improving the financial sustainability of contracts with our significant partners remains challenging due to tight financial constraints. ESR works with the Ministry of Health (MoH), New Zealand Police, New Zealand Customs, the Ministry for Primary Industries (MPI) and Ministry of Foreign Affairs and Trade (MFAT) to increase the impact ESR's science has on these partners' strategic goals and the value we bring to their work.

We work collaboratively with a number of research organisations and universities both in New Zealand and overseas. This includes the work we are doing in Pacific countries, particularly relating to water quality and food safety.

Working with Tangata Whenua

The New Zealand Government's *Vision Mātauranga* strategy aims to unlock the potential of Māori knowledge, resources and people. ESR has built on the work of previous years to advance the themes under this strategy, including developing a Māori Economy Strategy. We also have a number of research projects in place under the Vision Mātauranga umbrella.

Developing our People

ESR values diversity and benefits from the knowledge and unique perspectives of a workforce that includes people of New Zealand European, Māori, Pasifika and Asian origin. Women represent two thirds of our employees and work at all levels and in all roles in our organisation. Our gender pay analysis shows that for all levels of our technical and science staff the median hourly earnings for our female staff equalled or was slightly higher than our male staff.

A new staff engagement programme gave our employees an opportunity to voice things that matter to them and allows us to benchmark and measure effectiveness of what we are doing to ensure a capable and engaged workforce. Overall results showed a marked improvement in engagement.

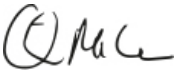
Looking Ahead - Our Strategy

Building on our improved performance, the Board has been reviewing a long term strategy to ensure ESR remains relevant and is positioned to meet New Zealand's challenges.

We plan to be at the forefront of developments in genomics and bioinformatics, providing our clients with better data, evidence and analysis to improve environmental, health and justice outcomes in New Zealand and overseas, increasing international growth of our innovative products and services, developing ESR's next operating model and finalising ESR's property strategy.

Finally we would like to recognise the contribution made to ESR by John O'Hara, Professor Bill Denny and Dr. Andrea Grant, who have stepped down from the Board this year and Professor John Mackenzie who retired from ESR's Strategic Science Advisory Panel.

Denise Church, QSO
Chair



Dr Keith McLea
Chief Executive

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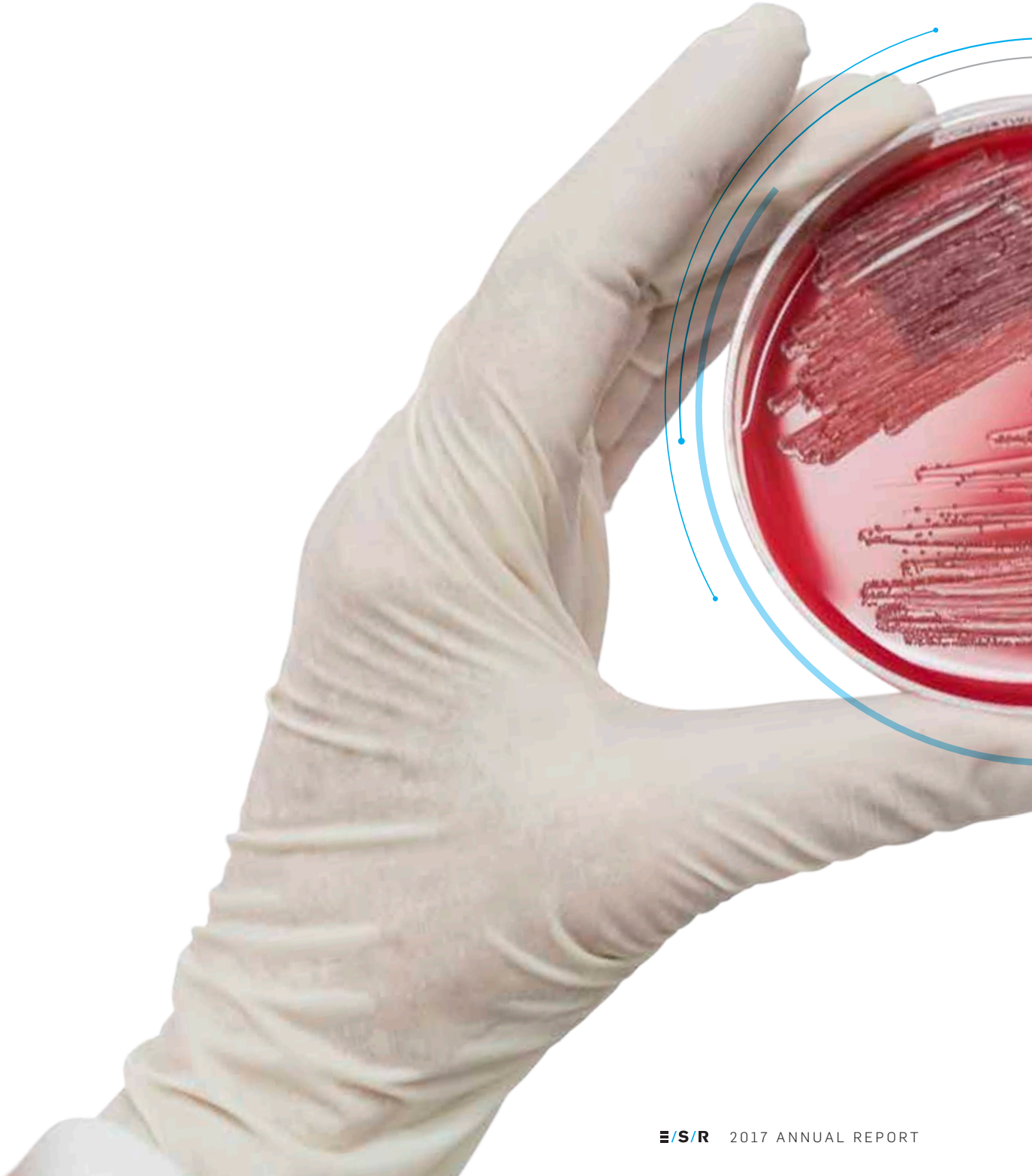
OUR IMPACT



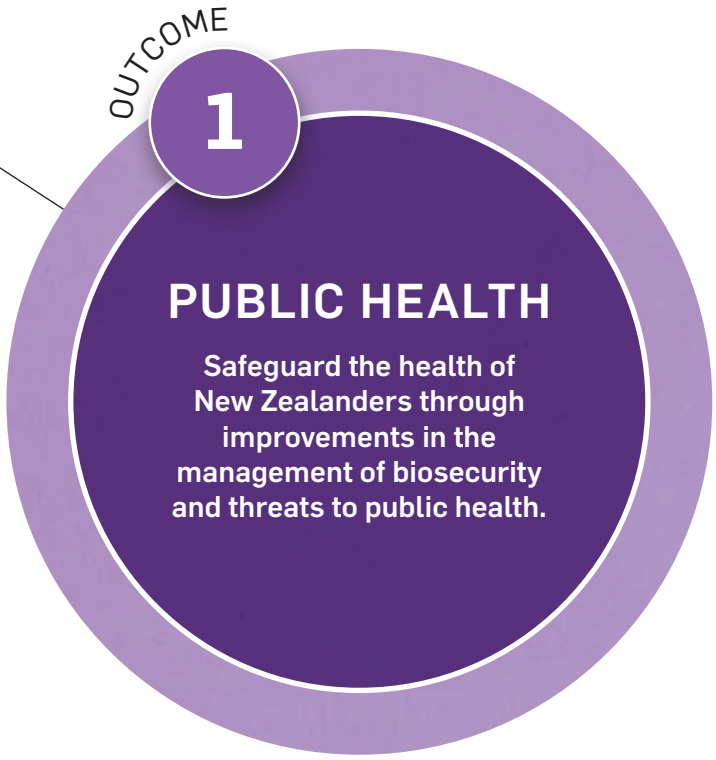
Whether it is sequencing the genome of a disease-causing bacteria, inventing innovative solutions to clean waterways, testing meat to ensure it is safe to eat or making sure justice is served through state of the art processing of crime, everything we do at ESR is for the health, safety and prosperity of New Zealanders.

OUR IMPACT

ESR works across four key areas – public health, forensics, food safety and water, and the environment – to deliver better outcomes for New Zealanders and the communities in which we all live.

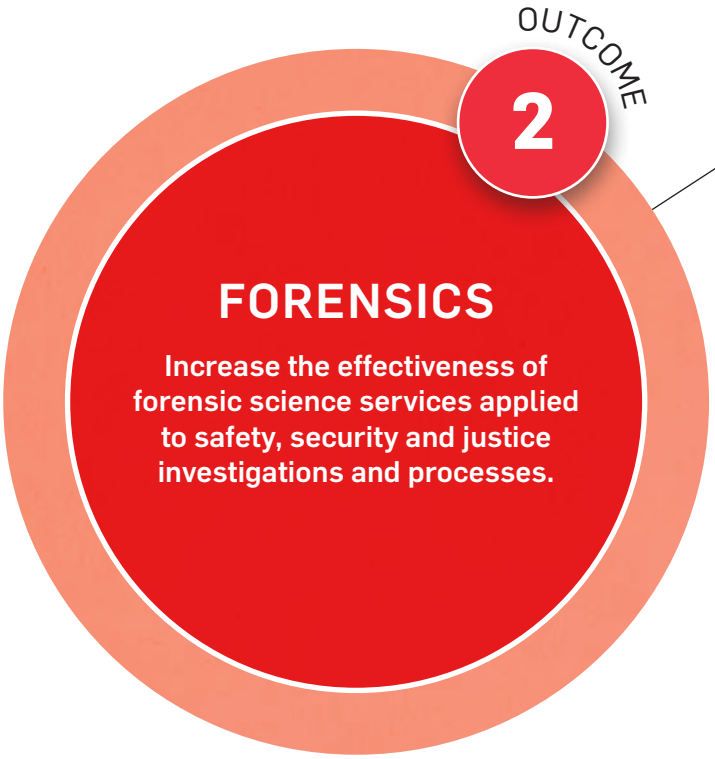
IMPACTS

- Reduced burden of illness and communicable diseases
- Reduced human biosecurity risks
- Reduced risks to human health from radiation
- Timely and proactive response to pandemics
- Safer medicines through pharmaceutical testing
- Proactive informed decisions on complex public and environmental health issues
- Reduced spread of foodborne illness



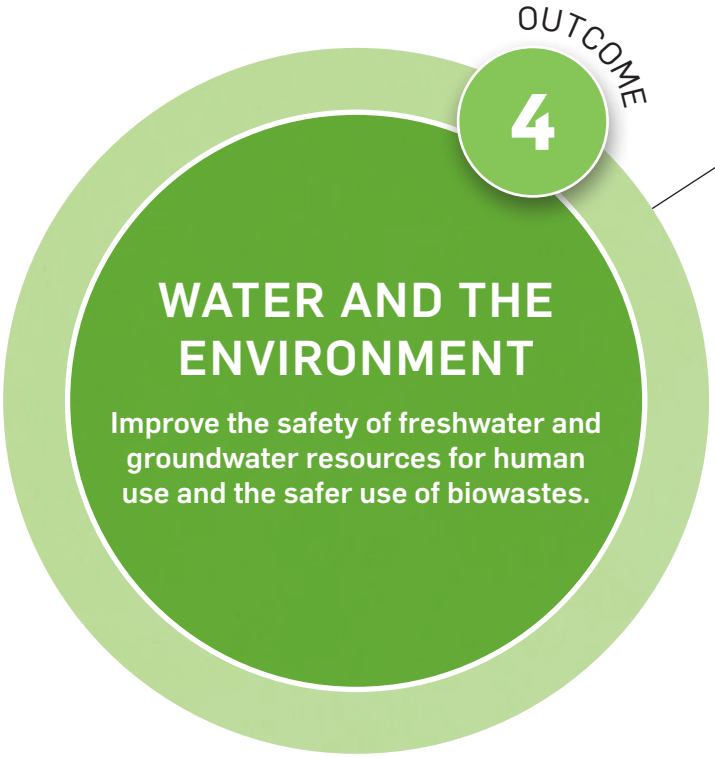
IMPACTS

- Improved integrity and reputation of New Zealand's food exports
- Foodborne illness risks to human health and the financial burden on society are reduced
- Episodes and outbreaks of foodborne illness are diagnosed and mitigated



IMPACTS

- More crime prevented and solved
- Criminal investigations supported by independent, reliable evidence
- Early elimination of the innocent and inclusion of suspects
- Better forensically informed court decisions
- Findings by Coroners are supported by reliable toxicology
- Reduced drug and alcohol dependency of offenders



IMPACTS

- New Zealanders have assurance that drinking water is safe
- Improved water quality in rivers, streams and groundwater
- Safer use of biowastes and reduced waste to landfill
- Reduced threats to human health from chemicals, microbes, radiation and physical contaminants

PUBLIC HEALTH

SAFEGUARDING HUMAN HEALTH

SAFEGUARDING THE HEALTH OF NEW ZEALANDERS THROUGH IMPROVEMENTS IN THE MANAGEMENT OF HUMAN BIOSECURITY AND THREATS TO PUBLIC HEALTH.

ESR's work is a critical contributor to maintaining the health and wellbeing of New Zealanders and their communities. We proactively contribute to, and manage challenges to public health from pathogenic diseases such as influenza, gastroenteritis and campylobacteriosis.

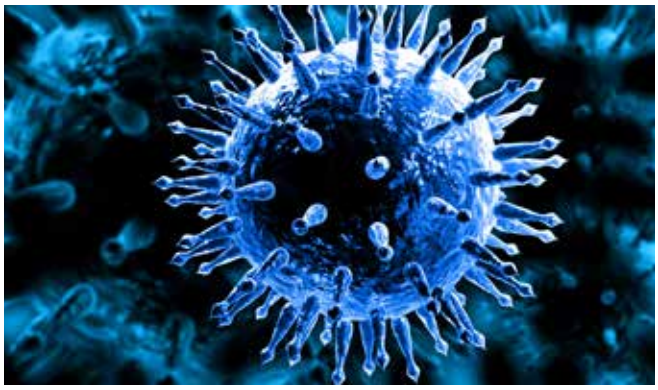
Our extensive disease surveillance activities, scientific, research and clinical expertise allow us to be one step ahead, supporting our health sector partners in proactively responding to – and where possible preventing – risks to public health. We manage New Zealand's notifiable disease surveillance system and gather and analyse data to get a complete picture of the wide range of diseases present in New Zealand. This lets us detect and predict outbreaks and assess the effectiveness of control measures such as vaccines.

We ensure radiation equipment is operated safely and provide advice, training and research on public, occupational and medical exposure to radiation in our role managing the National Centre for Radiation Science. We also provide internationally accredited drug and alcohol testing to prisons and the courts and reduce health and safety risks for the New Zealand workforce through our workplace drug testing service.

ESR's multidisciplinary social systems team contributes to a better understanding of how complex social issues can be tackled using a systems approach. Our work informs policy development and initiatives in public health, environmental policy, community engagement and sustainable development.

As highlights from this last year show, ESR's fundamental research in public health means we are ready to respond to any health crisis that threatens New Zealand.

Fighting the flu



ESR helps fight the flu in New Zealand and internationally. As part of our role monitoring infectious diseases for the Ministry of Health, we collect data on influenza-like illnesses so that we can monitor the spread of the disease and how it affects communities and detect any outbreaks or pandemics.

The faster this data can be collated, the quicker ESR and our partners can take appropriate action. We are developing real-time data and information networks that will enable ESR, Ministry of Health and community health professionals to receive disease information from GPs in real time and feedback disease analysis and clinical advice to the health professionals. With the new and improved electronic reporting system developed by ESR clinicians and scientists, response times have dropped to 24 minutes.

New Zealand's influenza season predicts what might happen in the Northern Hemisphere. New Zealand's predominantly public-funded healthcare system with associated integrated health information systems is a strong asset in conducting population-based research. For the last five years, ESR has led the Southern Hemisphere Influenza and Vaccine Effectiveness Research and Surveillance (SHIVERS) study, funded by the United States Centers for Disease Control and Prevention. SHIVERS provided high quality epidemiologic, virologic and vaccine effectiveness data to share with health agencies around the world and SHIVERS platforms proved to be valuable in supporting seasonal influenza control and pandemic preparedness and responding to other emerging/ endemic respiratory-related infections.

With the five-year study now concluded, ESR is working to fund an extension of the programme. ESR's strength in this area is that we can work across the spectrum – providing technical, scientific, epidemiology, bioinformatics, clinical, analytical and reporting expertise.

Microbial genomics to understand infections

ESR is implementing genomic sequencing to identify microorganisms and investigate local outbreaks of infectious disease with public health implications. ESR continues to build capability to both generate and analyse microbial genomic data, through investment in staff, analysis tools, and equipment.

During the year we continued to establish a New Zealand collection of microbial genomic sequences, which will ultimately be used to understand infectious diseases in New Zealand and inform public health interventions to limit the risks from microbial pathogens. ESR is working closely with key international agencies to ensure that we are using internationally-recognised methods to generate and analyse microbial genomic data.

Healthy people, healthy animals, healthy environments

Improving health and wellbeing through an integrated whole-of-society approach to health hazards underpins a new collaboration of New Zealand's leading infectious diseases researchers.

One Health Aotearoa is a partnership between ESR, the University of Otago and Massey University that will bring together those working in the areas of veterinary, human and environmental health to examine linkages between the areas and tackle important infectious diseases locally and globally.

The Otago University-hosted research centre aims to be the national leader in infectious disease research, education and advocacy and the primary point of contact for international engagement with other One Health partners around the world.

CASE STUDY

READY TO RESPOND TO THE WORLD'S BIGGEST CAMPYLOBACTERIOSIS OUTBREAK

Havelock North's 2016 water contamination crisis both tested and proved the breadth of ESR's expertise and response capability as we worked across disciplines to help tackle a major public health issue.

The Hawke's Bay community was hit hard and suddenly by a severe gastric illness in mid-August 2016, with schools reporting large absences. The worst was confirmed when suspicious results were returned in Hastings District Council's routine water testing.

ESR quickly mobilised a crisis team of scientific, clinical and epidemiological staff as part of a multi-organisational response to the outbreak, working closely with the Ministry of Health, the Hawke's Bay District Health Board, local authorities and Massey University to identify the nature, source and approach to the contamination.

Using our new rapid method for campylobacter typing, developed as part of ongoing research, ESR swiftly confirmed that the organism responsible for the outbreak was present in Havelock North's drinking water. ESR's groundwater team then provided unique modelling capabilities and expertise to understand the transport of the organism in aquifers and groundwater. ESR's research identified ruminants as the likely source of the organism, which helped narrow down the source of the contamination.

ESR's clinical, epidemiological and environmental expertise and genomics work were just as critical in the days and months following the outbreak as the lens was focused on what caused some 5,500 of Havelock North's 14,000 residents to become ill with campylobacteriosis.

The Government Inquiry into the outbreak sought ESR's expertise as the pre-eminent scientific adviser in relation to drinking water safety in New Zealand. ESR's report set out crucial evidence about the source of the pathogen, comparing samples of sheep faeces from paddocks neighbouring the Brookvale Road bore, water and sedimentary matter taken from the bore chambers, and human stool samples taken from victims of the illness. In many cases, these matched, showing a common source of infection. ESR Science Leader Dr. Brent Gilpin was called as an expert witness and was also invited to join the Science Caucus advising the Inquiry Panel.

Dr. Gilpin and the team assisting him from ESR and Massey University produced the ESR Report, dated 17 November 2016, which set out crucial evidence about the source of the pathogen involved in the August 2016 outbreak.

Chris Nokes, one of ESR's environmental health science leaders has been invited to participate in an expert panel to discuss issues arising from the Havelock North gastroenteritis outbreak. Stage two of the inquiry will consider the potential for similar situations to occur in other New Zealand water supplies and the lessons for local and central government agencies with relevant responsibilities, including whether the regulatory regime is operating effectively.

Beyond the science, a retrospective study by ESR has shown the potential value of social media as an early-warning indication of a public health issue.

Social media activity in the early days after the Havelock North contamination showed a possible early warning of the outbreak, a few days before traditional health surveillance picked up on it. Had the social media indicator been used, the boil-water notice could have been issued earlier, which probably would have prevented hundreds of people from getting sick. We are now looking at options for purchasing social media data, school absenteeism data and over the counter medicine purchases to enhance our health surveillance programme.

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FORENSICS

HELPING PREVENT AND SOLVE CRIME

INCREASING THE EFFECTIVENESS OF FORENSIC SCIENCE SERVICES APPLIED TO SAFETY, SECURITY AND JUSTICE INVESTIGATIONS AND PROCESSES.

We use smart science to solve crime. Our expert crime scene scientists, drug chemists, physical evidence specialists, toxicologists and biologists analyse human tissue, crime scene trace evidence, bodily samples and other evidential material. We are working behind the scenes to support New Zealand's justice and security sectors.

ESR's expertise and interpretation of DNA is used across the country and around the world. Combining biological modelling and mathematical processes we have developed innovative new technology that is helping resolve mixed DNA profiles and detect biomarkers to solve crime in the United States, Europe, Asia and the Middle East – and in New Zealand.

We apply the latest advancements in genomics, technology miniaturization, 3D visualisations and DNA analysis to stay at the leading edge of crime science and deliver greater value to clients and the community.

We are the sole forensic science provider to the New Zealand Police and provide services for other government agencies including the New Zealand Customs Service and the New Zealand Defence Force. We manage the National DNA Profile Databank on behalf of the New Zealand Police.

Our trusted and internationally-accredited forensic services provide the Police and lawyers with strong and independent forensic evidence that can be relied on in court – ensuring justice is served and there is less impact on victims.

Crime fighting scientists

Finding out what works to cut crime is behind a new collaboration between ESR, the University of Waikato and the Police.

The concept for evidence-based policing is currently in the process of being set up. It will use data, professional expertise and an evidence-based problem solving approach to identify ways to detect, prevent and disrupt crime. The aim is to efficiently redirect police resources to where they are most needed – ultimately protecting victims and saving lives.

DNA expertise in demand

ESR's internationally renowned expertise in DNA and forensic biology is helping revolutionise forensic science and the investigation of crime worldwide. DNA profiling is routinely used to investigate crimes, identify suspects and exclude the innocent, solve historic cases, assist in the reconstruction of crimes and crime scenes as well as identify human remains.

In New Zealand, our strategic partnership with the Police sees us playing an important and daily role in reducing crime and police investigation time. Our services, which have been in increasing demand over the last 12 months, range from attending and interpreting evidence from crime scenes including clandestine laboratories, analysing DNA samples, trace evidence, toxicology and drugs, and providing expert evidence in court.

Meth testing reduces risk and cost

To help address the growing problem of methamphetamine and the associated health risks to all New Zealanders, ESR has been using its forensic expertise to build a clearer picture of the manufacture and use of the illegal drug.

At the centre of the work is the need to distinguish between methamphetamine manufacture and use in a property. This determines contamination levels and therefore the amount of remediation work required to bring a property back to safe levels. It is of particular value to landlords – including Housing New Zealand – faced with potentially contaminated properties.

The Ministry of Health contracted ESR to review guidelines on the remediation of properties used as labs and those used solely for recreation. Using data sourced from Housing New Zealand, our Forensic Drugs team identified differential markers for contamination of smoking versus cooking and the extent of property remediation required for contaminated houses. ESR's recommendations will help guide clean-up efforts based on an appropriate assessment of risk and will contribute to the country's first national standard for methamphetamine contamination.

Our research in this area has also informed a project underway in partnership with Victoria University of Wellington to develop devices for detecting methamphetamine in contaminated homes and drivers under the influence of drugs.

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Broken glass solves break in

Forensic glass analysis by ESR helped secure a guilty verdict in an attempted burglary in Dunedin last year, after miniscule fragments of broken glass from a ranch slider were found on a suspect.

ESR was asked to analyse the suspect's shirt, trousers and shoes as well as a control sample of glass from the ranch slider to see if there were any fragments of broken glass present on the clothing.

Fifty fragments of glass were found 'backscattered' on the shirt, showing the wearer was close to breaking glass shortly before his clothing was seized. The refractive index of ten of the fragments was then measured and compared to the glass from the broken ranch slider. Nine of the fragments had the same refractive index.

But how common was that type of glass? For this case, the glass was very rare with only 0.03% of New Zealand windows having the same refractive index. Taking into account the large number of glass fragments found on the shirt that could have come from the broken ranch slider, the Forensics team concluded that the glass evidence strongly supported the suggestion that the wearer of the shirt was close to the breaking ranch slider.

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CASE STUDY

DRUGS DOWN THE DRAIN

Knowing where and when drugs are most commonly used is a valuable insight for Police and other agencies to inform and target activity.

Combining a number of ESR's expert capabilities including drug forensics, environmental chemistry and metabolism, and biowastes, ESR was commissioned by the National Drug Investigation Bureau to test sites in Auckland and Christchurch to allow authorities to map drug-use patterns and provide better data than can be achieved through self-reporting or drug arrests. Wastewater analysis is an emerging science and provides a valuable snapshot of the drug flow through cities. It is the first time such a test has been performed in New Zealand by a government agency.

ESR analysed the wastewater in both cities to determine the amount, type and distribution of illicit drug use. Using a robust sampling protocol and a modified and validated extraction method, ESR tested for methamphetamine, heroin, cocaine, alpha PVP (bath salts) and ecstasy (MDMA). Early data has indicated that methamphetamine is the most used drug in both cities followed by cocaine and ecstasy.

The findings have enabled Police and other agencies, such as Customs and the Ministry of Health, to better understand drug-use patterns in the population and will be used as a baseline for future results.

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FOOD SAFETY

PROTECTING NEW ZEALAND'S FOOD

ENHANCING PROTECTION OF NEW ZEALAND'S FOOD-BASED ECONOMY THROUGH THE MANAGEMENT OF FOOD SAFETY RISKS ASSOCIATED WITH TRADED GOODS.

ESR helps ensure food is safe to eat and export. New Zealanders' wellbeing and New Zealand's multi-billion dollar food export industry rely on ESR's checks and balances.

Our experts provide an important service in food safety across every food production sector in New Zealand. Our work across bacterial, viral, chemical, physical and radiological hazards in food provides assurance to food producers and consumers in New Zealand and around the world.

We provide a range of services to the Ministry for Primary Industries, the Ministry of Health and the food industry to avoid, detect, mitigate and respond to foodborne hazards. We have extensive national and international networks and access to a suite of tests accredited against international standards to help find out how, where and when food contamination has happened, and identify the type of contaminant and its source.

Is that safe to eat?

More than 4,000 samples of 130 common food types were tested for 240 agricultural chemical contaminants, contaminant metals and selected nutrients during the year as part of the New Zealand Total Diet Study.

Funded by the Ministry for Primary Industries, this five-yearly study is an important part of New Zealand's food safety system, ensuring we can all have confidence in the food we consume. Total diet surveys are promoted by the World Health Organization as the most cost effective means of assessing dietary risks.

The study involved analysing food samples over the course of the year from across the country. Our analysis estimates the exposure of the New Zealand population to certain agricultural compounds, contaminant elements and nutrients from a range of foods consumed in a typical diet to assess if they pose a health risk.

The findings of the study will be released in late 2017, with the report jointly written by ESR and the Ministry for Primary Industries. Information from the study will inform the ongoing development and review of New Zealand food standards to ensure that food eaten by the average New Zealander continues to be safe.

Campylobacteriosis study to reduce food poisoning

Food poisoning can have a major impact on families and communities. To reduce the risk and control outbreaks, we need to understand the cause and source of food-borne illnesses.

Campylobacter is one of the more common causes of foodborne gastrointestinal illness in New Zealand and has been the focus of government action in recent years. While controls on poultry introduced in 2006 saw a 57% decrease in notified cases of campylobacteriosis in New Zealand, the number of notified cases has remained relatively static since then.

An upcoming Source Attributed Campylobacteriosis in New Zealand (SACNZS) study will provide the Ministry for Primary Industries with detailed and current epidemiology of the disease. ESR is coordinating research across district health boards, public health units, diagnostic laboratories, and poultry and meat companies for the study. In collaboration with Massey University this case-control study will exploit the power of whole-genome sequencing of *Campylobacter* bacteria to identify risk factors, and contribute to interventions to further reduce the incidence of the disease.

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World-leading food safety

A virtual centre is enabling the best scientists from around the country to collaborate to protect and enhance the reputation of food produced in New Zealand and to protect public health.

The New Zealand Food Safety Science and Research Centre was launched in May 2016 as a partnership between government, industry, three Crown Research Institutes (including ESR), three universities and the Cawthron Institute. The Centre was established in response to a key recommendation from the Government inquiry into the suspected contamination of whey protein concentrate with *Clostridium botulinum* in 2013.

ESR is collaborating on several research projects for the Centre, including work on biocides, capability mapping, and a process hygiene index. The Centre is also developing a research programme addressing *Shiga toxin* producing *E. coli (STEC)*, an area in which ESR has considerable expertise.

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New Zealand-China Food Protection Network

In July 2016 Ministry of Business, Innovation and Employment provided funding to establish the New Zealand-China Food Protection Network (NZ-CFPN) of which ESR is a partner.

The partnership is dedicated to developing existing and new collaborations between providers of food safety and security research in New Zealand and China including universities, institutes and academies.

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WATER AND THE ENVIRONMENT

IMPROVING THE SAFETY OF FRESHWATER AND GROUNDWATER RESOURCES FOR HUMAN USE AND THE SAFER USE OF BIOWASTES

SAFE WATER IS FUNDAMENTAL TO A HEALTHY NEW ZEALAND SOCIETY. ESR WORKS TO IMPROVE THE QUALITY OF WATER WE DRINK, USE AND PLAY IN AND ENSURE THE SAFE RE-USE AND DISPOSAL OF WASTEWATER.

We provide scientific advice and expertise on the management of drinking, ground, surface, recreational and wastewater, and biowaste to health authorities, local and central government, industry and communities. Our work includes the surveillance and reporting of drinking water quality, scientific advice on health and environment public policy, research on water-quality issues relating to drinking water and recreational waters and information systems management.

ESR is a valued adviser in the Pacific Islands, supporting local communities and government with water quality, sanitation and hygiene advice to improve water standards in the region.

We lead the Centre for Integrated Biowaste Research, a collaborative multidisciplinary programme delivering innovative solutions for the sustainable re-use of biowastes sent to landfills in New Zealand.

Eradicating a waterborne killer

Engineered water systems such as plumbing, water tanks, cooling towers and spas can harbour *Legionella pneumophila*, a pathogen that can cause severe pneumonia and sometimes death. The bacteria are ubiquitous in natural waters, existing as free cells or in association with biofilms and amoebae. In water treatment plants they are chlorine resistant and can pass through filters to infect engineered water systems where they may lurk, potentially, for a long time.

Contaminated systems have caused numerous outbreaks of Legionnaire's disease worldwide. In the USA, where good surveillance data exists, the bacteria are responsible for most of the drinking waterborne disease outbreaks. Yet combatting the problem is far from easy. Many fundamental scientific questions – such as why *L. pneumophila* bacteria are so difficult to eradicate – remain unanswered as suitable, safe investigation tools are lacking.

Enter Dr. Liping Pang, Science Leader at ESR, who has received a prestigious Marsden grant for a three-year research project into *Legionella* mobility and persistence in engineered water systems. Dr. Pang, along with ESR's Dr. Craig Billington and two Canadian experts, will lead the first study using biocompatible biopolymer micro-particles as pathogen surrogates, a significant advance in synthetic surrogate development.

The novel approach will open new avenues for modelling the mobility and persistence of *L. pneumophila* in water systems. It will reduce reliance on risky, expensive and labour-intensive analyses of actual pathogens and will more accurately model *L. pneumophila* than traditional methods.

The inert surrogate approach has the potential for broader application to other bacterial pathogens in water systems, offering a significant breakthrough in reducing the incidence of waterborne illnesses.

Regular check on water quality

ESR's monitoring and reporting on drinking water quality helps the Ministry of Health, local authorities and public health professionals ensure safe drinking water supplies and effective sanitation in New Zealand.

Each year, ESR prepares an annual report for the Ministry of Health on the quality of drinking water. The report covers drinking water supplies serving communities of more than 100 people. In the 2016-17 report, 97.6% of people received drinking water that met bacteriological standards, which is the most important criteria. Overall 80% of people served received water that met bacteriological, protozoal and chemical standards.

Future thinking to protect our waterways

New DNA-based technology being developed by ESR scientists could help prevent water supply contaminations and enable land owners and local authorities to monitor the quality of rivers and streams in real time.

ESR has been awarded Smart Ideas funding for three years from the Ministry of Innovation, Business and Employment to lead the development of a new environmentally safe tool to quickly, accurately and simultaneously track multiple water contamination sources.

Currently, fluorescent dye and salts are used for water tracing purposes, but are generally limited to one site at a time, which can be time consuming. The novel idea proposed by the team at ESR, led by Dr. Liping Pang, is to use multiple synthetic double-stranded DNA tracers, each with a unique identifier, to concurrently track different contamination sources and pathways.

Synthetic DNA is environmentally safe as it is not derived from the genome of any organism and doesn't have genetic functionality, yet it is extremely sensitive for detection, so only a trace amount is needed. A preliminary study carried out by ESR has shown that for the same water tracing effect, the quantity needed for a DNA tracer is 6-8 times less than those required for dye and salt tracers.

The team will develop two classes of new double-stranded DNA tracers for pollution tracking – encapsulated DNA within food-grade gels for use in wastewater and surface waters, and naked DNA for use in soils and groundwater. The first phase is to develop the tracers while the second phase will involve rigorous laboratory and field testing to ensure the developed tracers and applied methods provide a robust system for tracking water contamination.

If proven successful, the tracer technology could have wide application where tracking of materials or ingredients is important, including food security, protection of high-value goods, forensic, hospital, ecological and environmental investigations.

The research project partners are the University of Canterbury and the University of Calgary. Field experiments will be conducted in collaboration with Environment Canterbury, the CAREX (Canterbury Waterway Rehabilitation Experiment) group and Environment Waikato.

Reducing water pollution with woodchips

Farmers are under increasing regulatory and societal pressure to farm within water quality limits, while still increasing productivity and yield. Research into water contamination from effluent discharge and fertilisers is critical to understanding the environmental impact and to finding cost-effective mitigation measures that can be adopted across the farming sector.

One such measure is being led by ESR's groundwater team which is aiming to harness the natural denitrifying properties of wood to cleanse polluted water. In collaboration with NIWA, the team is piloting an in-stream woodchip denitrifying bioreactor as a method for removing nitrogen in drainage water on agricultural land.

A bioreactor is a buried trench packed with woodchips, through which nitrate-laden drainage water is diverted before it discharges to a natural water course. The woodchips act as a host for bacteria which remove nitrate from water by converting it to harmless atmospheric nitrogen gas.

Denitrifying bioreactors are proving a popular edge-of-field nitrate mitigation measure in United States farming states like Ohio, Iowa and Dakota. The goal of the project is to examine the effectiveness of these engineered systems in a Canterbury setting to assess whether they offer a practical solution for Canterbury farmers – and ultimately farmers across the country.

Greater environmental cooperation between New Zealand and China

A collaboration with China's largest and most comprehensive national environmental research organisation is paving the way towards greater environmental cooperation between New Zealand and China.

A Memorandum of Arrangement between ESR and the Chinese Research Academy of Environmental Sciences (CRAES) was announced during the visit of Premier Li Keqiang of the People's Republic of China to New Zealand in March 2017.

Established in 1978, CRAES is affiliated to China's Ministry of Environmental Protection and engages in scientific activities similar to ESR, especially in the areas of improving the safety of freshwater and groundwater resources for human use and the safer use of bio-wastes.

The agreement will enable both organisations to partner across a wide range of technologies, testing methods and research to improve the environment.

section
03

OUR STRATEGY

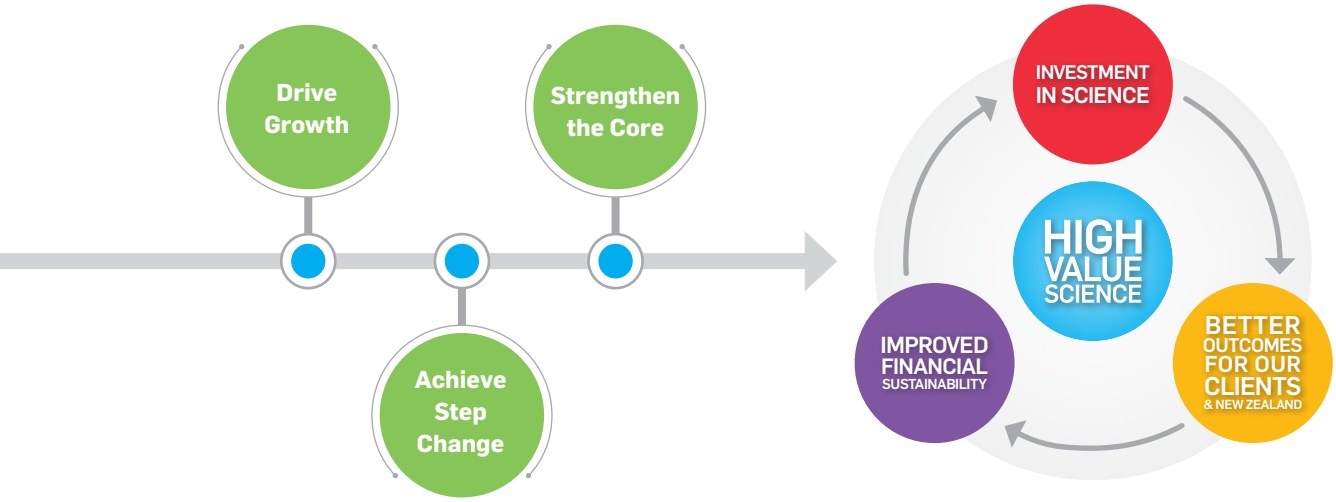
Our strategy lays the foundation for long term sustainability so that we can continue to deliver best value science and innovative research that helps improve the safety, health and prosperity of New Zealanders.

ESR STRATEGY

ESR's strong track record in recent years is proven in our financial results and stakeholder satisfaction. Our long-term strategy, developed to address challenges around revenue and infrastructure and to enable us to grow and become more sustainable, has necessarily evolved over that time.

In 2016-17, we made excellent progress on implementing strategic initiatives identified in our Statement of Corporate Intent 2016–2021 to ensure ESR is fit for the future and that we continue to keep New Zealanders safe, healthy and prosperous.

A refreshed strategy, as set out in our 2016-2021 Statement of Corporate Intent, continues to focus on high value science to deliver better outcomes for New Zealand and improve our financial sustainability. Our three strategic themes centre on driving growth both in New Zealand and abroad, strengthening our core operations and achieving a step change in our science through innovation.



STRATEGIC THEMES	STRATEGIC INITIATIVES 2016-17
Drive growth	→ Enhanced partnership agreement with New Zealand Police → Enhanced partnership agreement with Ministry of Health → Grow STRmix™ → RNA patented science method → Optimising research opportunities → Taking our expertise to the world
Strengthen the core	→ Revised operating model → Property strategy → Health data network development → Develop our people → Drive an engaged, connected culture
Achieve step change	→ Genomics and bioinformatics → Green Channel™

DRIVING GROWTH

In a nutshell, we will engage with our customers so we can provide them with high value science that meets their needs. We will also enhance our commercial focus and grow the business.

Driving growth is a key pillar of our strategy in 2016-17, triggered by the need to turn around flat revenue and secure a sustainable future for the organisation. Our focus on strengthening existing relationships and taking a more commercial – and international – approach to selling our products and services is already seeing results across the breadth of our strategic initiatives.

Aligning our science with customer needs

Our business can only be sustained if we strengthen the relationships we have with key users of our services. We actively engage with them to ensure their strategic priorities and opportunities are captured and realised for the benefit of both organisations, aligning our high value science with their needs.

ESR has significant relationships in the areas of justice, security, public health, environmental protection and food safety. For mutual goals to be attained, we strive to understand our partners current capabilty and infrastructure, their future needs.

Focusing on our customers

Working closely with our major government partners, we actively promote an integrated approach across the agencies responsible for human, animal and environmental health and safety for the benefit of New Zealand.

We continue to gain a deep understanding of the challenges our clients' may face, their fiscal constraints and the outcomes and impacts they aim to achieve through our customer-focused Stakeholder Reference Panel and through our increasingly responsive client management systems.

Meeting regularly with high level representatives including those from Ministries of Health, Primary Industries, Environment, Foreign Affairs and Trade, Justice, the New Zealand Police, New Zealand Customs Service and Corrections, we strengthen our relationships with them and increase the opportunities for collaboration. This enables us to deliver the best possible service that meets their strategic and operational needs.

Working closely with New Zealand Police

Using science to reduce crime is at the core of ESR's partnership with the New Zealand Police. We do this through our work identifying and interpreting evidence from crime scenes, analysing DNA samples, trace evidence, toxicology and drugs, and providing expert evidence in court. This year the relationship was further enhanced with plans progressed

WHAT DRIVES OUR PARTNERS DRIVES ESR

Understanding the goals of our Government Partners is key to delivering science and technology solutions that meet their needs and make a difference to New Zealand communities.

New Zealand Police:

- Keeping communities safe – preventing crime and victimisation, targeting and catching offenders, and delivering a more responsive police service.

"the sooner we can apprehend offenders the better for everybody" – Assistant Commissioner Richard Chambers, National Operations, New Zealand Police.

Ministry of Primary Industries:

- Maximise and increase primary industry export opportunities for New Zealand.
- Protect and enhance New Zealand's reputation as an exporter of high quality food products

"one of the areas that would be of great benefit to MPI is (protecting against) foodborne illnesses" - Martyn Dunne, Chief Executive, Ministry for Primary Industries.

Ministry of Health:

- Helping New Zealanders live longer, healthier and more independent lives.
- Ensuring the health system is cost-effective and supports a productive economy.
- Meeting challenges head on such as disease outbreaks, organisms resistant to multiple antibiotics and the threat of pandemics in an increasingly globalised world.

"big data is going to be really important to us – it's about how can we make the best informed decision about what to do next" - Stewart Jessamine, Director Protection, Regulation and Assurance, Ministry of Health

for an evidence-based policing centre, a strategic partnership between ESR, the Police and Waikato University. The Centre will use the best research evidence and data available to reduce and prevent crime, enabling Police to direct resources where they are needed most.

Enhanced partnership agreement with Ministry of Health

ESR continued to work in partnership with the Ministry of Health to increase the impact of ESR's science on the Ministry's strategic goals, to improve the financial sustainability of contracts and develop new services to Ministry clients.

ESR manages the Notifiable Disease Database and collects information on organisms causing disease through Direct Laboratory Notification and/or other surveillance systems.

Using our nationally significant reference laboratory information, the Notifiable Diseases Database, and the information collected from laboratories, we collect, collate and analyse data and intelligence on a wide range of diseases present in New Zealand.

This work is undertaken under our agreement with the Ministry of Health. It allows us to predict where possible, prepare for, identify and respond to actual and potential human biosecurity and public health threats.

On behalf of the Ministry of Health, we also have the role of collating, checking, analysing and reporting sexually transmitted infections data from participating clinics and laboratories.

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CASE STUDY

STRmix™ SOLVING CRIME

STRmix™'s credibility continues to grow worldwide. In North America, for example, DNA Evidence interpreted with STRmix™ has been successfully used in numerous cases, there have been at least fourteen successful admissibility hearings and the FBI has recently validated this software.

Thirty-nine laboratories worldwide are using STRmix™ for the interpretation of case work data, with another 90 at various stages of installation, validation, and training. Within the United States, STRmix™ is being used by 25 local, state, and federal agencies, including the United States Army Criminal Investigation Laboratory and the California Department of Justice.

STRmix™ is breakthrough forensic software developed by ESR and Forensic Science South Australia that can resolve previously unresolvable mixed DNA profiles using a fully continuous approach for DNA profile interpretation. It has been used to interpret DNA evidence in thousands of cases worldwide since 2012.

The FBI started using STRmix™ in casework in December 2015. Since then it has undertaken extensive validation work to underpin that casework use. The FBI has now confirmed that STRmix™ is sufficiently robust for implementation in forensic laboratories, offering numerous advantages over historical methods of DNA profile analysis.

A recent murder case in Florida has also reaffirmed the reliability of STRmix™ and demonstrated its indispensability in solving crime.

The Manatee County Sheriff's Office submitted evidence taken from a vehicle involved in a 2016 double homicide to a private forensic laboratory that used STRmix™ to help identify a perpetrator in the case, determining that the suspect and three unknown persons had contributed to the mixed DNA profile.

In its decision, the court noted,

> *"The evidence before the court more than adequately convinces it that [probabilistic genotyping and STRmix™] have been accepted by peer review, as well as obtained general acceptance in the relevant community ... Perhaps that is why nearly half of all forensic laboratories in the United States have purchased licenses to use the STRmix™ software..."*

A SUSTAINED COMMERCIAL FOCUS

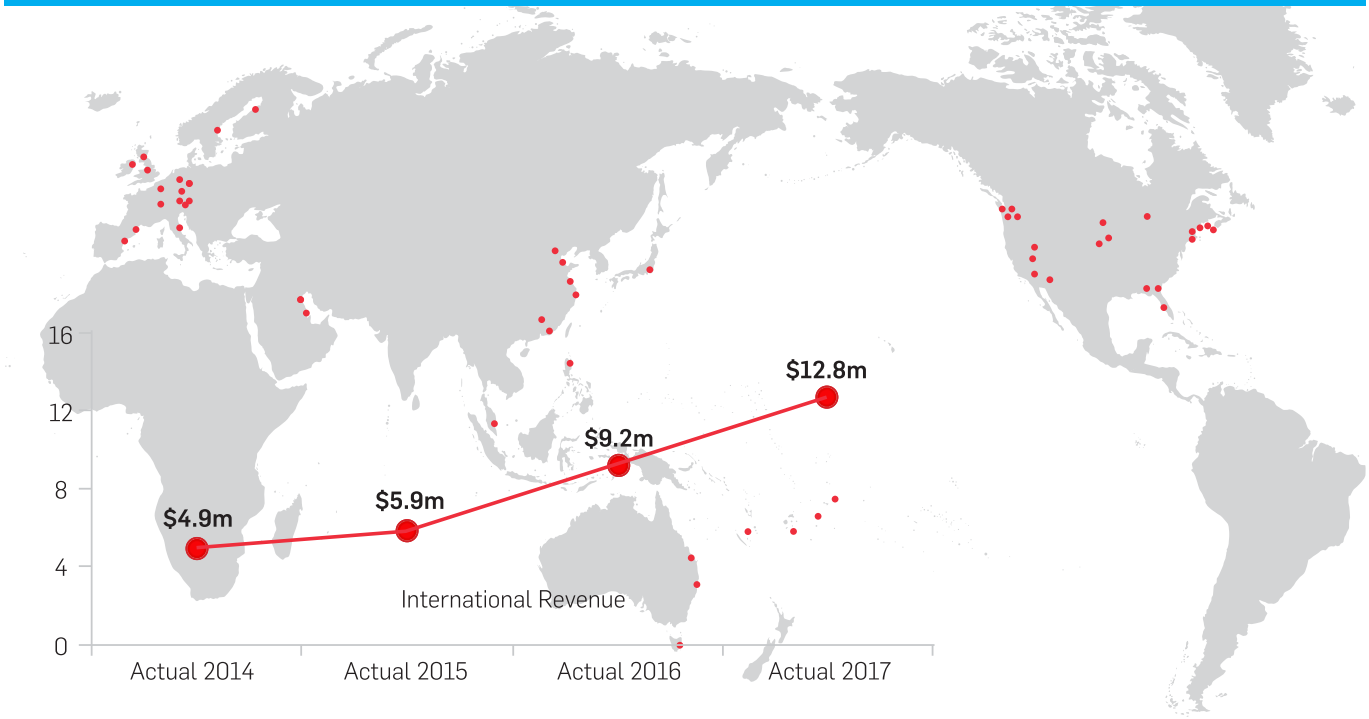
To sustain our business we need to not only strengthen the relationships we have with the core users of our services but continue to adapt and diversify, developing new and innovative science that is turned into products and services that we can bring to market.

For ESR to remain relevant and competitive in the future we need to increase our commercial focus by expanding our business both in New Zealand and internationally.

We are actively growing our existing customer base and in the 2016-17 year our revenue increased from $70 million to $75 million. Domestically we continue to work with our core government partners, local authorities, food producers, iwi, and communities to deliver high quality professional services and products.

Internationally, products, services and research revenue increased by 39% with total international revenue growing to $12.8 million. Sales of our world leading forensic software, STRmix™, increased by 450% since 2015.

TAKING OUR SCIENCE TO THE WORLD



- ESR is growing into an international organisation
- Targeting revenue growth in China, North America, UK and Europe, the Middle East and the Pacific

Grow STRmix™

ESR's world-leading forensic software STRmix™ is a vital part of our international marketing mix and growth strategy. As well as continued strong sales in existing markets – the United States and Europe – ESR achieved our first sale of STRmix™ in Asia to the Hong Kong forensic laboratory and we are in ongoing discussions with Chinese authorities and other Asian jurisdictions.

RNA patented science method

During the year we filed an international patent application for the innovative methodology developed by ESR for detecting RNA stable regions and biomarkers for a body fluid identification panel. ESR's product has huge crime-solving potential as it can identify information not available from DNA alone, including from what cell type any DNA detected in a crime originated. The methodology has garnered a great deal of interest from international partners.

Optimising research opportunities

ESR has enjoyed success in securing new research contracts during the year, enabling us to extend the reach and impact of our expertise and insights. This has included funding from the Marsden Fund, the Health Research Council, and MBIE Smart Ideas for substantial multi-year projects. In Budget 2016 the Government increased ESR's Strategic Science Investment Funding for research into groundwater mitigation.

Among the many research collaborations underway, a new research centre, One Health Aotearoa was established, as a partnership between ESR, the University of Otago and Massey University to improve health and wellbeing through an integrated whole-of-society approach to health hazards. ESR was involved in a number of food safety research projects funded through the recently established New Zealand Food Safety Science and Research Centre, in which ESR is one of seven partners.

Taking our expertise to the world

Opportunities in China were a feature this year. ESR strengthened relationships with key stakeholders including the Ministry of Public Security, and a Memorandum of Arrangement between ESR and the Chinese Research Academy of Environmental Sciences was announced during Chinese Premier Li Keqiang's visit to New Zealand. ESR staff visited China to promote STRmix™ and Green Channel™.

As well as vigorously pursuing commercial opportunities in international markets and leveraging opportunities for cross-border collaboration, ESR continued to support the sustainable development of our Pacific neighbourhood.

As part of this activity, ESR was part of Healthy Tonga Environments study. The MFAT Partnership Fund Activity provided $1.47million to undertake this five year study which aimed at reducing the burden of disease in Tonga caused by preventable environmental exposures.

The World Health Organization's Fiji office also provided ESR with funding to cover ongoing testing for Zika, Dengue and Chikungunya.

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ENGAGING WITH TANGATA WHENUA

ESR wholeheartedly embraces Vision Mātauranga which aims to unlock the innovation potential of Māori knowledge, resources and people to assist New Zealanders to create a better future.

RESEARCH THEMES UNDER VISION MĀTAURANGA

Vision Mātauranga focuses on the distinctive contributions that might arise from the innovation potential of Māori knowledge, resources and people as well as responding to needs and issues that are distinctive to the Māori community.

Our strategy in the 2016-17 year was to increase engagement with the Tangata Whenua by employing a Māori Economy Manager to develop our Māori Economy Strategy. The strategy received overwhelming support for its ongoing development and implementation. It recognises the value to ESR of Māori-focused research, both commercially and from a cultural perspective.

ESR has recently been awarded three research projects under MBIE's Te Pūnaha Hihiko – Vision Mātauranga fund. They are:

In partnership with Ngāi Tahu, this project will develop an environmental risk assessment framework which can be used to determine the sustainability of mahinga kai (recreationally harvested food) for human consumption.

This project measures the benefits of vegetation restoration of Lake Waikare for the area's whānau, hapū, iwi and the lower Waikato communities. It is being developed in partnership with Matahuru Marae/ Nikau Whānau Farm Trust, Te Riu O Waikato Nga Muka Development Trust and Waikato Regional Council. The project will take a multi-generational approach to explore iwi connections and relationships with Lake Waikare in order to develop appropriate monitoring for the assessment of the success of restoration plots.

The project uses systems thinking to inform social investment options for the project partner, Te Rūnanga o Ngāi Tahu. A small team will explore the ways that principles of systems thinking and next generation social investment expertise could contribute to future iwi social development and investment strategies.

ESR is committed to engaging with the Māori economy and Tangata Whenua. Our ability to work with Māori is an important part of our way forward.

STRENGTHENING THE CORE

Investing in the right people, equipment, facilities and information technology for future success.

Ensuring we are future fit means laying the groundwork. Our strategy is to invest in the right mix and calibre of people and to put the best infrastructure, systems and processes around them so they can be their best.

Next operating model

ESR continually reviews the way we operate to ensure we are optimally configured to deliver our innovative science services and adapt to the future needs of our partners and clients. During the year we developed a conceptual operating model and principles that underpin this work.

Property strategy

We explored options for replacing our ageing science facilities at Kenepuru and Christchurch with a focus on efficiency and utility. This included looking at building design and construction options that would give us more adaptable space compared to traditionally built science infrastructure. We also investigated co-locating with other science based organisations and other options in the Wellington region.

Health data network development

ESR has developed a comprehensive network of access to health (and other sector) databases that now provides the basis for collating and coordinating data across health. ESR will continue to expand the scope and utility of these linkages to enable new data sets to be accessed for analysis and provision of new services to new health sector clients.

Bioinfomatics and statistics capability

The acquisition and interpretation of data is ESR's life blood. The ability to create insights and wisdom from data is a valuable commodity and one that our stakeholders expect ESR to provide. We have invested in the capability to collect information from all sources and the skills to manipulate and interpret the data meaningfully. This year we acquired new, specialised bioinformatics IT equipment to support our development in this area.

Develop our people

Our two-yearly review of science capabilities to identify future needs and how we will address them got underway. Based on discussions with stakeholders, we prioritised four areas for capability development: genomics capability, bioinformatics and statistics, social systems science and Vision Mātauranga Capability.

Under our leadership programme we continued to invest in the development of our people managers to ensure they have the skills and mindset to build the capability of their teams, lead our culture, and facilitate growth, change and innovation.

Drive an engaged, connected culture

Staff engagement, wellbeing and performance were the focus of our engagement survey reflecting an upward trend on most factors over the last three years. Staff reported greater pride in ESR, that they cared strongly about ESR's success and had strong alignment with the refreshed organisational values introduced last year.

We launched a new performance, recognition and reward framework and an online performance management system and provided staff with tools and resources to support their wellbeing through an online wellness programme.

INNOVATING FOR CHANGE

A step change in our science through developing innovations that solve big issues for New Zealand.

ESR's future is in innovation and agility. Our broad and in-depth scientific expertise positions us to take a leading role nationally in advancing high value science that will significantly improve health and wellbeing for all New Zealanders. We are also actively pursuing opportunities to contribute to New Zealand's export growth targets and Business Growth Agenda through playing a greater role in food safety and assurance at New Zealand's borders.

Genomics and bioinformatics

Investment in genomics and bioinformatics capability enables the organisation to utilise these skills to deliver new services to clients. The opportunities include improving patient outcomes, improving quality and reducing healthcare costs. During the year we continued to focus on strengthening capability and collaborations in these fields. We established a new health and environmental science sequencing unit which used genome sequencing to track disease outbreaks of *Salmonella*, *Staphylococcus Aureus*, *Campylobacter*, and *Yersinia*. Another example is the support ESR provided to the Havelock North drinking water contamination outbreak, where genomics was a key tool in identifying the source of the contamination.

Opportunities now exist in human genomics. ESR is a founding partner of the MBIE funded Genomics Aotearoa, which is tasked with coordinating genomic technology application across all sectors of the New Zealand economy.

We now need to move from simply developing the capability to utilising this capability to deliver different services to existing clients and new services to new clients.

Green Channel™

We continued to explore opportunities for pre-certification of New Zealand food exports to China, with the aim of reducing the time goods spend on the wharf in China from weeks to days.

INTO THE FUTURE

We will not stand still. To ensure our continued relevance to our clients, and to remain competitive, we need to ensure our organisation is operating in a smart and sustainable way.

That's why we've been doing some serious thinking over the last year about what our future looks like and how we're going to get there. We've reviewed and updated our long-term strategy and are now putting in place an ambitious programme of work to take ESR into the future.

we are ESR. INTO THE FUTURE

Science and technology are transforming at a rapid rate. To maintain relevancy ESR recognises it needs to be agile, future focused and evolutionary. We will continue to focus on maximising our efficiency in the way we work by making the best use of scarce resources, sharing resources across groups, teams and organisations, developing critical masses of capability and realising the benefits from scaling our work.

Our clients say they want us to move from providing data and voluminous analysis, to giving specific answers and 'wisdom'. They want us to furnish the 'so what', to enable them to make the right interventions and decisions.

DRIVERS FOR CHANGE

We know that ESR needs to evolve and encompass continuous change to remain effective and relevant for our clients.

We need to ensure organisational sustainability through investment in our people and supporting resources. ESR into the Future will ensure the organisation is:

Keeping pace with the direction of science

New and emerging technologies that support service delivery to clients will dictate the areas of science and research where we need to prioritise investment to ensure we remain relevant.

Meeting the changing needs of clients

We will provide clients more evidence-based information to support their decisions and provide more of the 'so what' from our science.

Growing commercial success

The long-term financial sustainability of ESR is dependent on generating enough income from our core Government contracts and from the development of products and services to reinvest in people, science and technologies we need.

Improving our operating model to better deliver our services

We need to remove physical and cultural barriers to become a more integrated, connected place to work.

Modernising facilities

Our improved financial position means we can now realistically look at options for modernising our science facilities and provide a great working environment that incorporates modern lab design with spaces to share assets, collaborate and meet with our clients.

The next five years are important for ESR. Over the last few years the organisation has become a more successful commercial enterprise, focused on serving clients and ensuring we deliver outcomes that make a difference. We are committing to a five year programme that articulates our way forward – how we achieve the change required, while working towards ESR's vision.

THE WAY FORWARD

The right science, the right people, the right technology

Into the Future will ensure ESR has the right operating model to meet the challenges of today and tomorrow. The programme is about having the right tools, the right structures, the right skills and the right training and development opportunities to take ESR forward and in the right direction.

PRINCIPLES FOR THE FUTURE

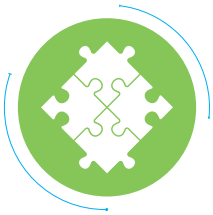
The principles below are those we believe are essential in order for ESR to have an operating model to meet challenges and continue to be successful in the future landscape.

CONVERGENCE

ESR will adapt and adopt technology and science services to drive its next operating model.

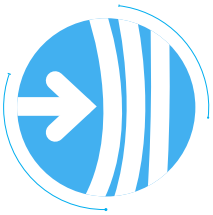
COLLABORATION

ESR's capability will increasingly focus on clients, not a division or scientist. ESR will increase participation with external parties to drive research and service outcomes.



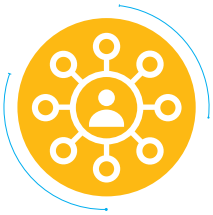
CONSOLIDATION

ESR's operational footrprint will optimise overheads, to support collaboration internally, and leverage assets common to all science domains.



RESILIENCE

ESR will maintain capabilities to support key clients through resilient operating models and partnerships on and off shore, ensuring ESR's essential scientific services are always available in a crisis.



CAPABILITY BUILDING

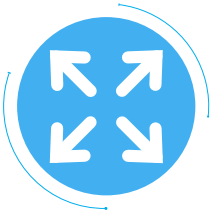
ESR's desire is to build high-value skill sets around collecting, maintaining, manipulating, processing and presenting human data – this will ensure that ESR is a highly attractive service provider or partner to current and future clients.

RESEARCH

Research will grow as a competence reinforcing ESR's reputation. It will also be a key source of growth and remains the underpinning form of the organisation as a CRI.

VIRTUALITY

Location is not a prerequisite of participation. Teams will be bound by objectives, relationships and culture. ESR will become a network-centric organisation.



FLEXIBILITY

ESR will utilise its key scientific and other resources more dynamically and refocus them to meet opportunities.

AGILITY

ESR will become more responsive to clients and market opportunities. This will be evident in the way we work, adopt, adapt and cope with changes and opportunities.

SOLUTION FOCUSSED

ESR will promote and develop science into service opportunities that are ongoing.

CLIENT FOCUSSED

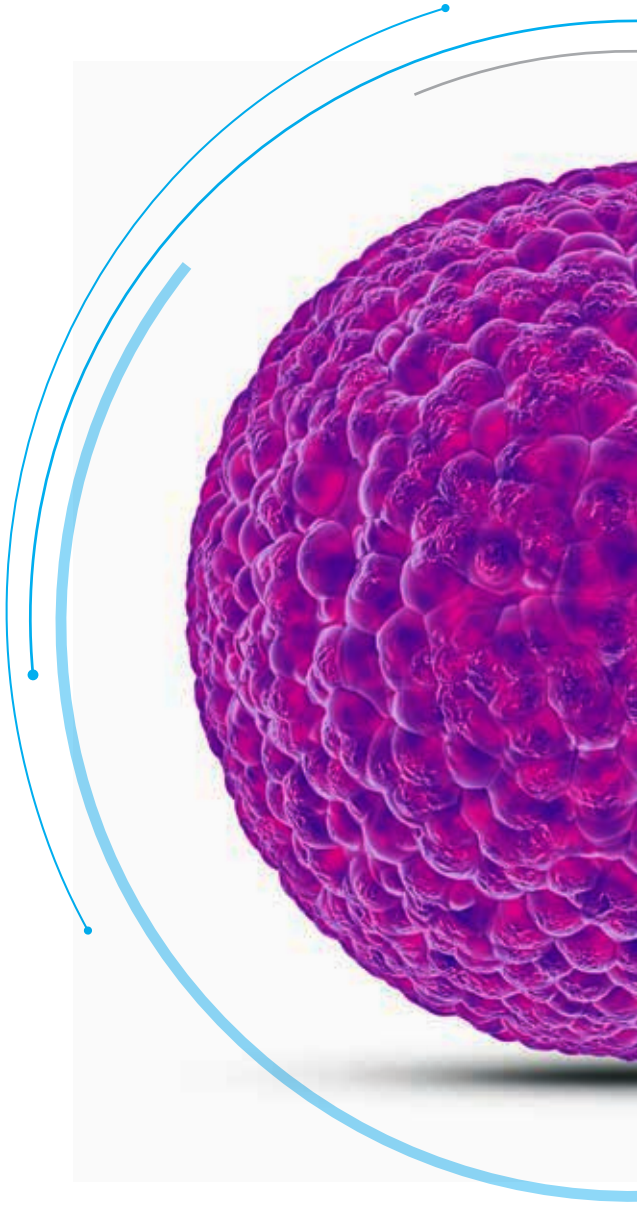
Science will be fit for purpose science and valued by the market. ESR will understand better how the market wants to use its services.

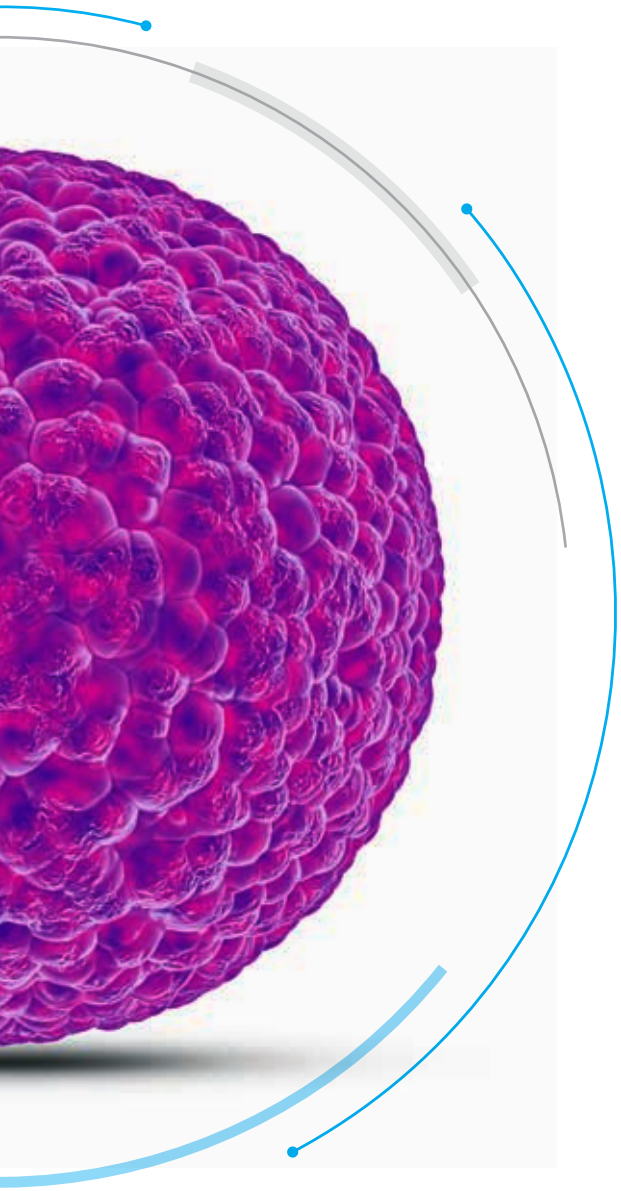
COMMERCIALLY FOCUSSED

ESR will recognise opportunities to develop, market and sell its intellectual property.

section
04

OUR SCIENCE





We push the boundaries of science through innovative research to deliver better outcomes for New Zealand communities.

OUR SCIENCE

ESR uses the power of science to help New Zealand prosper.

Our science lies behind the decisions that safeguard people's health, protect our food-based economy, improve the safety of our water resources and ensure justice is served. Our expertise, experience and networks are trusted to solve complex problems, collect, collate and analyse large amounts of data and manage a range of critical national science assets and facilities for New Zealand.

We have the largest team of forensic, social, radiation, environmental and infectious disease scientists and epidemiologists in the country. Their capabilities are recognised internationally. Their specialist scientific knowledge and clinical skills enable ESR to provide independent, reliable scientific advice and services to clients and partners so they can deliver evidence-based policy and services. ESR scientists regularly collaborate on and contribute to international scientific advancements across health, justice and security, food safety, food integrity, environmental health, and environmental hazards.

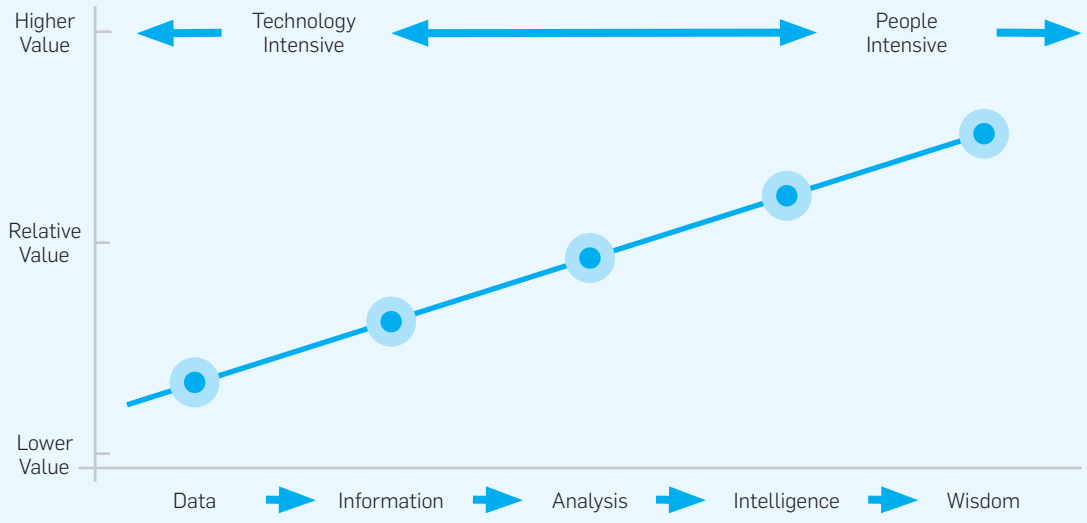
Innovation underpins our science and focuses our work. We apply cutting-edge research and the latest technology and trends, such as genomics and bioinformatics, to address global challenges including violent crime, drug related offending, the threat of pandemics, antimicrobial resistance, food-borne disease outbreaks, waterborne diseases in waterways and nitrate levels in groundwater.

From our internationally acclaimed STRmix™ forensic software which resolves mixed DNA profiles, to our MBiT genotyping technique, offering the world's fastest, cheapest typing system for *Campylobacter*, our science innovations are helping us deliver better outcomes and commercial value to ESR and New Zealand.

Delivering high value science

We not only provide technical data and information to our clients, but our scientists, who are experts in their field, use their knowledge and understanding to evaluate information, taking it to the next level, providing what we call 'wisdom'.

DATA VALUE CHAIN – delivering intelligence, assessment and conclusions



Investing in science research

New knowledge and innovation are fundamental to our work. We invest in scientific research that paves the way for new discoveries.

Our research enables our experts to pioneer new ideas, techniques and technologies and to adapt global scientific advancements to real world needs.

Collaboration with other key players in New Zealand's Science and Innovation System, including other Crown Research Institutes, independent research groups, universities, government agencies and local authorities, as well as international organisations, means our scientific research can deliver impact to New Zealand and globally.

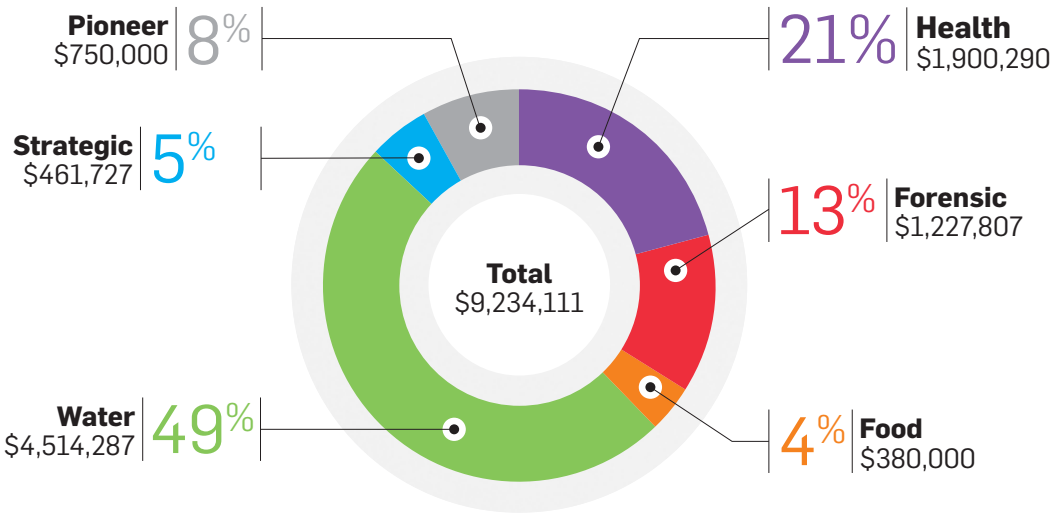
ESR receives various funding to enable us to invest in scientific research and capability.

Our main source of research funding is MBIE's Strategic Science Investment Fund with which we invest in research that contributes to our four outcomes, strategically build our science capabilities and carry out innovative new research.

Our research is also advanced thanks to contestable funding from the Health Research Council of New Zealand, the Marsden Fund, MBIE's Endeavour Fund, Ministry of the Environment's Work Minimisation Fund and local government. International funding, including from the National Institute of Justice and the United States Centers for Disease Control and Prevention, recognises the global impact of our research.

We also carry out collaborative research partnering with local authorities and virtual research centres such as the New Zealand Food Safety Science and Research Centre.

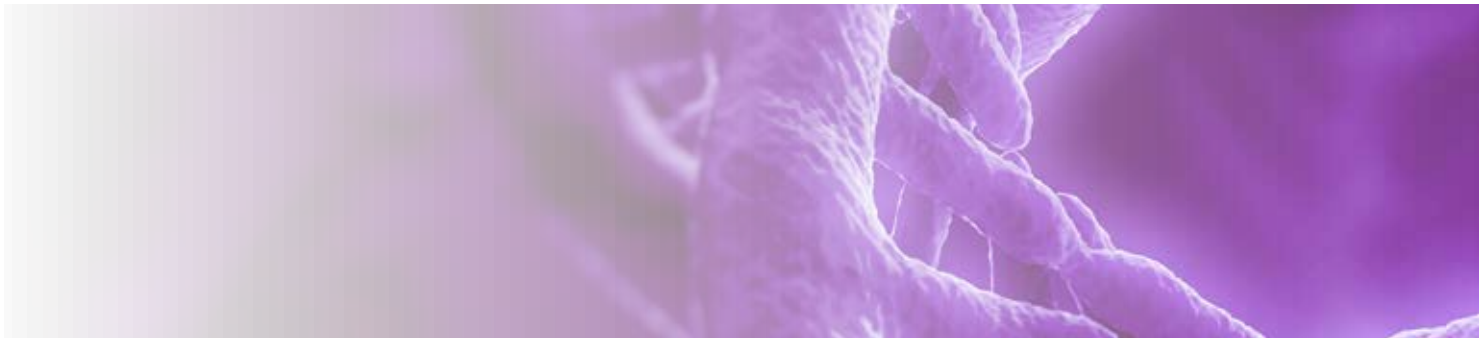
MBIE Strategic Science Investment



All projects are assessed against the following criteria:

- scientific merit (excellence)
- clear demonstration of how the proposal will contribute to ESR's outcomes (impact)
- enhanced collaborations and capability development
- co-funding or commercial opportunities

SCIENCE RESEARCH PROJECTS



This year we invested nearly $13 million, or 17% of our revenue, in our research projects. The majority of this research was funded by MBIE's Strategic Science Investment Fund which increased its funding to ESR by 20%, with an extra $1.5 million targeted at groundwater research. Some of ESR's groundwater research is described below.

A novel tool for assessing groundwater health

The ecosystem present in the groundwater environment has the potential to protect these sources by removing contaminants entering the water from land use practices.

Our research, which also has funding from New Zealand's Biological Heritage National Science Challenge is a collaboration between ESR, NIWA and Waikato University. It aims to establish a better understanding of groundwater ecosystems to help protect waterways in the future. Using state of the art methods, we can identify sentinel organisms that respond to contaminants and highlight potential groundwater quality issues in a timely manner.

By setting up samplers in boreholes in the Canterbury and Southland regions we were able to collect microbial and macro-invertebrates (*Stygofauna*) that inhabit the aquifer system. We then used next generation sequencing to analyse the diversity, metabolic activity and water chemistry and develop a Groundwater Health Index.

This new knowledge will develop our understanding of groundwater ecosystems and the vital role they play in protecting our drinking water. Our research has the potential to identify key organisms that could play a role in remediating groundwater that has been contaminated.

Reducing nitrates in our waterways

The 'Enhanced Mitigation of Nitrate in Groundwater' project is developing new methods for reducing nitrates in groundwater systems, in particular oxygenated, fast flowing, heterogeneous alluvial gravel aquifers. ESR is developing innovative approaches such as Biogas Induced Denitrification in groundwater and denitrifying Permeable Reactive Barriers. These are being coupled with aquifer characterisation using advanced shallow depth geophysics, DNA tracers and groundwater microbial community analysis to enable the effective design, delivery and implementation of these mitigation tools. A third technology being trialled is the use of denitrifying bioreactors to treat nitrate from artificial drains.

Coming clean on water quality

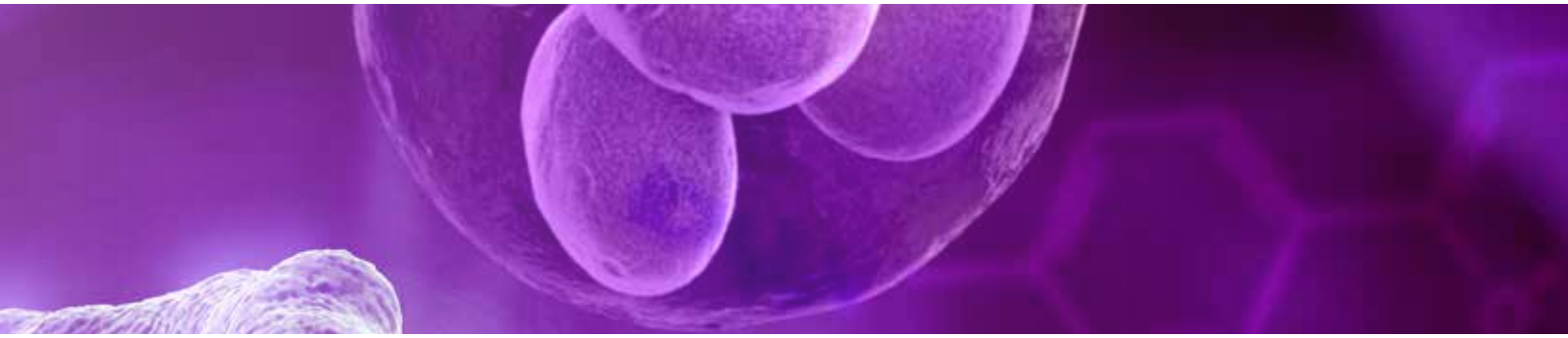
Poor water quality is not only bad for the environment, it can put our health at risk. A collaborative research project with Environment Southland is harnessing ESR's expertise in microbiological and social sciences to build a better understanding of the effects of poor water quality on human health.

The project expands the parameters traditionally examined in water samples to include faecal source tracking and *Campylobacter* using ESR's innovative MBIT tool. The project is also collecting human clinical samples positive for *Campylobacter* in the Southland area. This has allowed for direct comparison of the types of *Campylobacter* isolated in the rivers and in humans to be directly linked for the first time in New Zealand.

The microbial data is being uploaded to a Global Information System to track the movement and change in source and concentration of microbes through a catchment. The latest phase in the research is translating this highly technical scientific knowledge for the community. The team will work with the communities and the Regional Council in Southland to understand the vast amount of information generated and determine ways in which this can be used to improve environmental, water and health outcomes in Southland.

Bacteria hitching a ride

A creative approach to problem solving and an intimate understanding of how contaminants are transported in water and other subsurface media has attracted three prestigious science research awards for ESR Science Leader Dr. Liping Pang.



Her research ranges from an MBIE Smart Idea project tracking water contamination using synthetic DNA tracers to a Marsden-funded study investigating *legionella* mobility and persistence in plumbing systems.

Dr. Pang also received more than $1 million from the Health Research Council of New Zealand to lead a study testing a novel technology for assessing the removal of pathogens in drinking water filtration systems in the hope of preventing outbreaks of gastroenteritis.

Her team – which includes scientists from ESR, the University of Otago and NIWA, and end-users from Canterbury District Health Board and Invercargill City Council – are testing novel surrogate particles that have been modified to mimic the physical and chemical properties of specific pathogens. The particles will be tagged with unique DNA markers or dye to help assess the effectiveness of filters to remove certain pathogens from drinking water supplies.

The new study will target protozoa such as *Cryptosporidium* and viruses like *rotavirus, adenovirus* and *norovirus* – the most frequently detected pathogens in surface waters in New Zealand and overseas.

Business growth for biocontrol

ESR's internationally recognised expertise in biocontrol is being harnessed to grow future revenue for ESR through two key pieces of work. In collaboration with the University of Canterbury's Biomolecular Interactions Centre, we are using our collection of phages (bacterial viruses) to develop lytic enzymes that are able to kill bacterial pathogens in medicine and agriculture. We are also working with researchers in Australia and the United Kingdom to investigate the potential of using phages to reduce levels of *Campylobacter* in poultry.

Strengthening connections between sectors

Research carried out by ESR's Social Systems team examines the ways in which health promoters are working with schools, sports clubs, workplaces, marae and other community settings to create environments which encourage healthy eating and physical activity. Specifically, this research examines the way that Healthy Families Christchurch – part of the Ministry of Health Healthy Families New Zealand– is creating health promoting partnerships. This research will develop new knowledge about what enables or constrains inter-sectorial 'buy in' for health gain, and a toolkit to enhance inter-sectorial action for health gain.

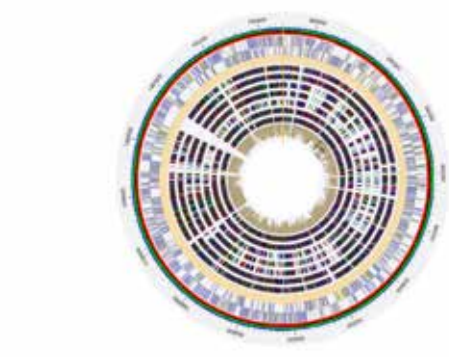
Putting waste to work

ESR leads the Centre for Integrated Biowaste Research (CIBR), a collaborative multidisciplinary programme delivering innovative solutions for the sustainable re-use of biowastes in New Zealand. This virtual centre combines the expertise of eight New Zealand research institutes, universities and research partners including ESR, Scion, Cawthron Institute, Landcare Research, Lincoln University, Lowe Environmental Impact, Northcott Research Consultants Ltd. and Kukupa research.

Over 700,000 tonnes of biowaste is sent to New Zealand landfills each year and this is a complex problem that needs to be addressed by the very best science and innovation. CIBR research focuses on the sustainable management of biowaste – solid and liquid organic, biodegradable waste. Such wastes include sewage sludge, organic industrial waste, agricultural waste, kitchen/food waste, green waste, sewage effluent and greywater.

RESEARCH SNAPSHOTS

Microbial whole genome sequencing



This research supports the implementation of microbial whole genome sequencing to provide an accurate assessment of trends in microbial pathogen spread and informed epidemiological investigations of outbreaks. This will lead to better targeted interventions and faster resolution.

Markers of human disease

This human genomics project studies obesity and type-two diabetes, with a particular focus on the identification and development of new biomarkers that will be of use in clinical settings to help with the diagnosis and prognosis of the disease.

Taking genomics a step further

Genomics and bioinformatics are transforming the way we do our science. This project aims to maximise our understanding of microbial whole genome sequencing. It includes, among other things, how we integrate whole genome sequencing data and epidemiology into our work as well as develop capability in advanced bioinformatics analysis.

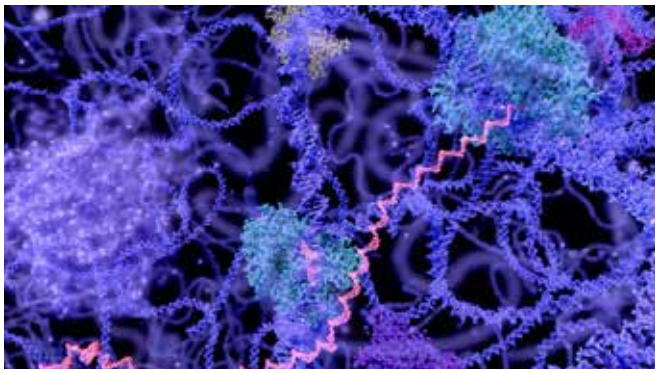
Detecting bugs in sewage

This project builds on the capability we have developed isolating pathogens, including viruses and protozoa from sewage using molecular tools. We have demonstrated that it is possible to isolate from sewage *Campylobacter* of the same genotype as those present in sick people. The outcome of this project will enable early detection of infectious outbreaks of disease as well as an increased capability in the area of sewage epidemiology related to infectious diseases and disease surveillance.

Meta'omics for One Health

This project aims to develop the capability to unlock information on the microbial community composition of a variety of samples by utilising Next Generation Sequencing technologies. For instance, one approach uses meta-'omics to understand how changes in the microbes in raw milk can lead to spoilage of UHT milk. Another approach uses the portable MinION sequencer to detect viruses in wastewater.

RNA technologies platform



RNA is a type of nucleic acid present in cells that differs between cell types and body fluids. This project uses RNA to identify where in the human body a DNA profile came from, an important question in casework. We are using different technology platforms to cover rapid on-site (crime scene) testing through to the laboratory that will result in more efficient analysis of forensic evidence. These technologies build on latest developments and will improve body fluid identification methods that will reduce turn-around-times and costs of delivering results to ESR's clients.

Genomics for forensic science

Our forensic scientists are embracing the genomics era. Their research is providing the underpinning science that enables the transformation of forensic DNA profiling to massively parallel sequencing and as a consequence generate new intelligence for the justice sector. It includes investigating the application of genetic markers for visible characteristics such as hair and eye colour and understanding how DNA mixtures behave. It will enable us to offer effective and efficient forensic DNA science services.

Border to Grave

New psychoactive substances (party pills, legal highs) are proliferating at an unprecedented rate, posing a significant risk to public health, with little ability to track and monitor changing trends. Our new Border to Grave project will build a surveillance framework for the identification of new psychoactive substances across ESR's drug testing activities. The project look at the link between the identification of new drugs at the border, through to their real time use and abuse in the community, including motor vehicle accidents, criminal case work and drug affected patients admitted to emergency departments. Along with our drugs in wastewater work, this will inform the work on psychoactive drug patterns and trends in New Zealand, and be a formative part of a drug early warning system.

BRIGHT IDEAS THROUGH PIONEER FUNDING

The purpose of ESR's Pioneer Fund is to seed fund innovative projects that have potential to increase our impact in public health, forensic science, food safety and water and the environment.

Projects funded this year included:

It's all about Manuka honey

The aim of this project was to see if the levels of various key components in different varieties of honey would enable us to determine if a particular honey was actually Manuka. Manuka honey, being a high value product, is prone to faking, so a less valuable commodity can be passed off as a more expensive genuine product.

Manuka filled socks to clean up the waterways

We tested tubular mesh filter socks filled with manuka mulch to see if they can remove pollutants and bacteria contaminants from water runoff. This could have the potential to improve water quality in rural settings.

Molecular tests for antimicrobial resistance

Information on the detection of genes associated with antimicrobial resistance (AMR) was collated from the scientific literature. This will help inform the AMR component of a test we are developing to more quickly identify thousands of different microbes present in complex samples.

Identifying what lives in the groundwater

We are researching how next generation sequencing can be used to identify macroinvertebrates in groundwater. This will enable us to compare their molecular identification with their taxonomic identification.

How microplastics impact coastal marine animals and then humans

Microplastics are pieces of plastic less than 5mm in size. They have been found to be ingested by all types and sizes of marine animal, from larval fish to whales, and include species frequently eaten by humans. This study investigates the current understanding of marine microplastics around the world, including the gaps in knowledge about pollution levels around New Zealand in order to develop strategies to combat its impacts on humans.

Recycled glass for recycling water

Instead of filling landfill sites with glass, we are investigating the potential for crushed glass to be used as a method for wastewater treatment.

Kava, Kava

Kava is widely consumed by Pacifica people in New Zealand with limited understanding of the impact on driver ability and safety. We have developed new methods for characterising the constituents in kava (called kava lactones) and will be using this as part of a wider study on kava and motor vehicle driver safety.

Measuring THC and CBD

How do we measure the amount of psychoactive substances such as tetrahydrocannabinol (THC) and cannabidiol (CBD) in plants like hemp and cannabis. This research is developing a method to do just that.

RNA in body fluids

Our research has come up with a way to quantify the RNA markers in body fluids such as saliva, blood, vaginal secretions, spermatozoa and seminal fluid.

New app helps Starlims Chain of Custody

Our forensics scientists have built an app that enables mobile Chain of Custody use on iPads within the lab for Starlims forensic exhibits.

Campy killer

The aim is to develop an antimicrobial product to kill *Campylobacter* which could be used either during poultry processing or via incorporation into active product packaging.

Enzymes that destroy viruses in wastewater

We have found enzymes present in wastewater that destroy viruses. We are now investigating what sort of enzymes are present and which organisms produce these enzymes. Once this is identified we have the potential to enhance virus removal in systems such as wastewater and develop treatment options that are low cost and sustainable both here and in the Pacific Region.

OUR SCIENCE AND CLINICAL LEADERS

ESR's senior science and clinical leaders come from a broad range of science and medical backgrounds and have internationally recognised subject matter knowledge and expertise. They are representative of the high calibre of our scientists.

Dr. Phil Carter

is the Chief Scientist and Chair of the Strategic Science Team. Phil is a molecular microbiologist who has worked at ESR for over 16 years. He is responsible for the Research Office, the allocation of strategic funding across ESR science and ESR's scholarships and awards. His research interests include the population genetics of bacterial pathogens including *Neisseria, Campylobacter, E. coli O157* and *Salmonella*.

Dr. Virginia Hope, MNZM

is our Medical Director and leads our growing team of medical specialists. She is a public health medicine specialist and medical administrator. Virginia has 30 years' experience in medical practice and has worked as an occupational medicine specialist, a Medical Officer of Health specialising in environmental health and as a Senior Lecturer in Environmental Health and Health Protection at the University of Auckland. Virginia has publications in water quality, giardiasis, outbreak and pandemic investigations, health risk assessment and environmental risk factors for infectious disease.

Dr. John Buckleton

is a Principal Scientist in the Commercial Group. He has an international reputation based on his extensive publication record and contributions to forensic science, particularly in evidence interpretation. He has made a notable contribution in forensic DNA statistics and interpretation. Dr Buckleton has published more than 150 peer-reviewed scientific papers and co-authored five books, in addition to his experience as a forensic case-working scientist. His contribution to leading-edge thinking in forensic science was recognised by the award of a Doctor of Science degree from the University of Auckland in 2010. His innovations have contributed significantly to four series of patents relating to enhanced DNA techniques.

Dr. Murray Close

is a Principal Scientist and Senior Science Leader and leads the Groundwater Contamination research team. He has over 38 years' experience and a wide knowledge of groundwater conditions and processes throughout New Zealand. His current interests include pesticide contamination of groundwater, measurement and modelling of attenuation of contaminants in groundwater, unsaturated (vadose) zone processes, regional and national groundwater quality assessment, remediation of contaminated groundwater, groundwater ecosystems, and land use impacts on groundwater quality.

Dr. Jo-Anne Bright

is a Senior Science Leader in the Commercial Group. Jo's research interests involve developing new methods for forensic DNA profile interpretation. Jo has a PhD in Forensic Science from the University of Auckland and has co-authored numerous papers in this area. She has presented at a number of workshops and conferences in Australia, Asia, United States and Europe. She is one of the co-developers of STRmix™, expert software for the interpretation of forensic DNA profiles. The STRmix™ team was shortlisted for the 2017 Kiwinet awards.

Dr. SallyAnn Harbison

is a Senior Science Leader, a member of the Strategic Science Team and the DNA Technical Leader in Forensic Biology. SallyAnn's background is in forensic crime scene and evidence examination. She specialises in forensic DNA and RNA analysis leading, the implementation of Y STR profiling and RNA analysis. Her current research is focused on integrating new generation DNA sequencing technologies into forensic science for identification and intelligence based applications

Dr. Brent Gilpin

is a Science Leader and a member of ESR's Strategic Science Team. Brent is a molecular biologist whose primary research interests include the application of genetic analysis techniques to understanding foodborne and waterborne outbreaks and disease. This includes microbial contamination of water, the importance of different indicators and pathogens in water, tools for tracking sources of contamination of water, assessment of health risks, and the use of whole genome sequencing and metagenomics analysis.

Dr. Sue Huang

is a Senior Science Leader. Sue is a virologist and the director of the World Health Organization (WHO) accredited National Influenza Centre and WHO National Poliovirus Reference Laboratory at ESR. She has a PhD in virology from the University of Pennsylvania in Philadelphia. Her area of expertise is infectious and pathogenic human viruses, particularly influenza, other respiratory viruses, polio and other enteroviruses, including studying aetiological agents, diagnostic methods, routes and modes of transmission, viral pathogenesis and host immune responses, disease burden and related risk factors, vaccine effectiveness, viral ecology and evolution.

Contributing to the World of Science

ESR employs some of the brightest minds in New Zealand. Our staff are passionate about science and the impact we have on the safety, health and prosperity of New Zealanders.

Dr. Liping Pang

received a prestigious Marsden Grant to lead research into a new approach to study how the disease causing bacteria, *Legionella*, can survive in man-made water systems such as household plumbing. This is the third Marsden Grant Dr. Pang has won. She was also awarded an Health Research Council grant to study protozoa and virus removal in water filtration systems typically used in New Zealand, as well as an MBIE Endeavour Fund for her "Smart Idea" proposal for concurrently tracking multiple sources and pathways of water contamination using synthetic DNA tracers.

Dr. Brent Gilpin

an internationally recognised scientist, was commended for his part in ESR's response to the Havelock North drinking water contamination and his support to the inquiry by the Chair of the Government Inquiry into Havelock North Drinking Water. ESR pulled out all stops to respond to this national emergency with staff working around the clock. Our ability to work across the spectrum of health, environment, forensic and radiation sciences means we can offer a seamless, joined up approach when responding to critical national crisis situations.

Dr. Donia Macartney-Coxson

a genetics/epigenetics expert, is leading research into the human genome. Her research on biomarkers, and the power of DNA methylation (a chemical process which can change gene expression) to distinguish between different types of fat tissue, will help in the understanding of how obesity, weight-loss and diabetes works. Her paper on this subject was published in the highly regarded journal, Clinical Epigenetics and to date has been downloaded 500 times, putting it in the top 25% of research accessed as measured on the Altmetric score.

Dr. Keith Bedford

was awarded Life Membership of the Australia and New Zealand Forensic Science Society. Dr. Bedford recently retired from ESR after 40 years of service. He was instrumental in developing what today is ESR's formidable and ground-breaking forensic capability.

Recognising their expertise, each year ESR scientists are invited to sit on committees both in New Zealand and internationally. The following appointments were made this year.

Dr. Jill Vintiner

has been appointed to the New Zealand MBIE Science Board. She is considered one of New Zealand's foremost experts in forensic science. Dr Vintiner also serves on the University of Auckland, Forensic Science Board of Studies and the Australia New Zealand Policing Advisory Committee and the Australia New Zealand Forensic Executive Committee.

Dr. John Buckleton

was appointed to the Organization of Scientific Area Committees for Forensic Science: Biological Data Interpretation and Reporting Sub-Committee in the United States.

Dr. Libby Harrison

was nominated to the judging panel to select the Prime Minister's Macdiarmid Emerging Scientist Prize.

Dr. Virgina Hope

now sits on the Scientific Committee of the Asthma and Respiratory Foundation, New Zealand as well as the Gillies McIndoe Research Institute, Wellington. She is also a Lead Educator for the Royal Australasian College of Medical Administrators Lead Educators in Melbourne.

Dr. Nikoklaus (Klaus) Hermansphan

has been made Task Leader for the Comprehensive Nuclear-Test-Ban Treaty Organization Working Group in Vienna Austria. He is one of New Zealand's foremost experts in Radiation Science and recently participated in an International Atomic Energy Agency sampling mission in Fukushima, Japan.

Dr. Craig Billington

an expert in biological control technologies, has been invited to join the Academic Committee of the International Phage Research Centre in Nanjing China. He is also a member of the New Zealand-China Food Protection Network and the Biomolecular Interactions Centre, University of Canterbury. Dr Billington is a lead collaborator on Dr. Pang's groundwater research project.

Dr. Cris Ardouin

a radiation scientist, has been appointed to the International Atomic Energy Agency (IAEA) Emergency Preparedness and Response Committee in Vienna. He is also part of the IAEA Asia Pacific Transport Safety Network.

Dr. Murray Close

has been appointed to the Engineering and Interdisciplinary Sciences panel for the Marsden Fund. Dr. Close is also leading a significant research project aimed at reducing nitrogen levels in groundwater.

Angela Brounts

has been appointed to the Board of the Pacific Paramedical Training Centre.

Virginia Baker

has been made a member of the New Zealand Qualifications Authority STEM Taupulega Fono, as well as sitting on the Ministry of Primary Industries Sector Roadmap Advisory Panel.

Dr. Louise Weaver

has been appointed to the Water New Zealand Technical Committee in Wellington.

Recognising Excellence

ESR's culture of excellence is encouraged through an internal awards programme designed to motivate and inspire our staff. These are the awards made this year.

Chairman's Supreme Award

to the entire Forensic Biology Team for their team spirit in delivering outstanding service in meeting the needs of their customers.

ESR Smart Science Award

to Mark Connor, David Neale, Jayshree Patel, Susan Vintiner, Nigel Lee, Rosy Moar, Glenn Rowlands, Sally Coulson, Angus Newton, Rian Morgan Smith, Sarah Cockerton, Amelia Gamblin, Gary Gillespie, Melanie LeCompte, Lisa Melia and Tim Power for their work on Operation Concord, the 1080 infant milk formula scare.

ESR Smart Science Award

David Wood, Barry Mattingley and Jacqui Ritchie were highly commended for their contribution towards the annual survey of New Zealand drinking water supplies and the publication of the Annual Report on Drinking-water Quality.

ESR Smart Science Award

Mehnaz Adnan and Donald Peterkin were highly commended for their contribution towards the implementation of data transfer systems that leverage the international HL7 messaging standard for data of public health importance.

ESR Vision Award: PhD Scholarships

- Alessandra Santana, PhD student from Brazil, was awarded an ESR Vision Award to work with renowned ESR health scientist, Dr. Donia Macartney-Coxson. He will examine genomic data science and how data is integrated, analysed and visualised in human health genomics.
- Alex Liu also won a PhD scholarship to work on bioinformatic tools for the analysis and interpretation of forensic sequencing data. This project is led by one of ESR's foremost forensic experts, Dr. Sally Ann Harbison.

ESR Vision Award for Best Paper in a peer-reviewed journal

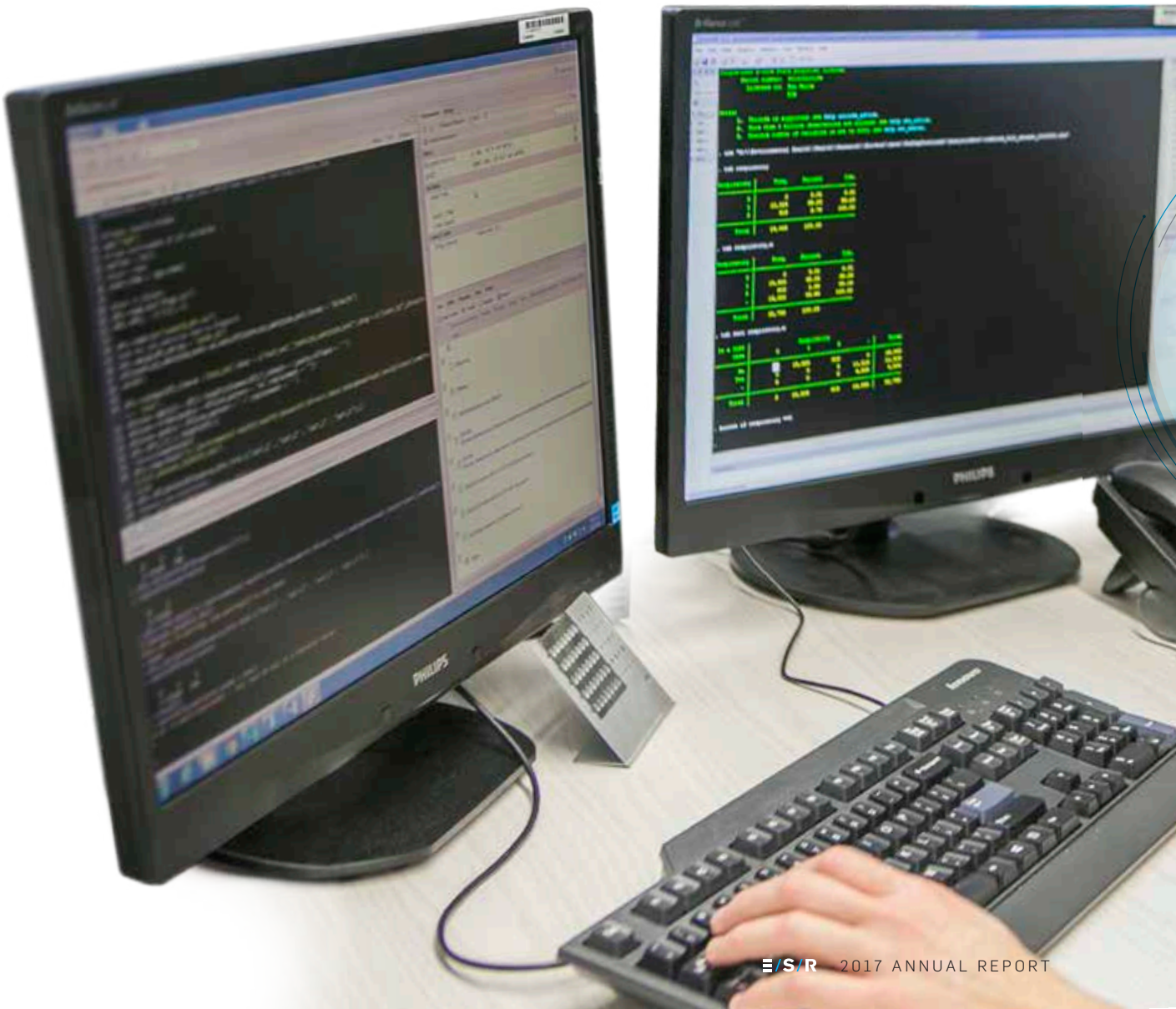
- Mehnaz Adnan, Donald Peterkin and Liza Lopez won this award for their paper on how they developed and rolled out the pilot to improve the GPs reporting system for the flu. The new system, which has now been rolled out nationally, improves the time it takes for ESR to compile influenza statistics in New Zealand enabling faster responses to outbreaks.

Our Scientists also made a splash at scientific conferences this year with the following awards.

- Dr SallyAnn Harbison and Rachel Fleming, ESR Forensic Scientists were awarded Best Literature Review by the National Institute of Forensic Science Australia and New Zealand (ANZFSS).
- Nicholas Curnow was highly commended for his presentation at the ANZFSS symposium in September 2016. His talk was titled *Taking mixed DNA samples further than ever before: successes of mixed sample database searching.*
- Patricia Albani, an ESR PhD student, was highly commended for her presentation on *Background levels of Y DNA in female intimate samples* at the ANZFSS symposium.
- Ravishka Arthur was highly commended for his presentation on *Bloodstain Pattern Analysis* at the ANZFSS symposium in September 2016.
- Barry Mattingley, David Wood and Chris Nokes presented the paper *Failing the Drinking-water Standards – Insights from the Annual Surve*y to the 2016 Water New Zealand's Annual Conference. The team won the Silver 2016 Hynds Paper of the Year Award which recognises the best technical papers submitted to the conference.

section 05

OUR PEOPLE



ESR people are the core of our success. They are expert at what they do and committed to making a difference to the lives of New Zealanders.

OUR PEOPLE

Keeping people safe and healthy through science is only possible when we put our people at the centre of what we do.

To meet the science needs of New Zealand, deliver to our customers and increase revenue, we work to attract, retain and develop a capable high performing workforce. We want to ensure our people have the right tools, structures, skills, training and development opportunities to advance their capabilities, develop their careers, and grow their professional and personal skill base.

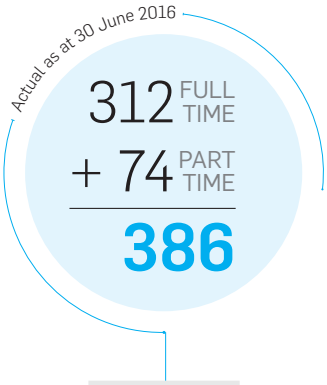
Workforce profile

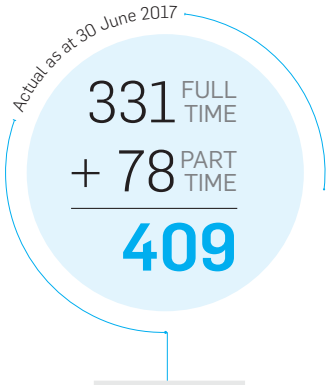
ESR employs more than 400 expert minds whose independent scientific advice and services help improve the collective economic and social wellbeing of New Zealanders.

The majority of our staff (82%) are employed in science or science support roles. We value diversity and benefit from the knowledge and unique perspectives of a workforce that includes people of New Zealand European, Māori, Pasifika and Asian origin. Women represent two thirds of our employees and work at all levels and in all roles in our organisation.

We have a high performance culture but encourage work-life balance and enable flexible work practices. Just under 20 percent of our staff work part-time. Our workforce turnover for the year ending 30 June 2017 was just 7%.

Workforce statistics





% staff engaged in science	82%	82%
% female staff	67%	66%
% male staff	33%	34%
% aged 20-40 years	36%	37%
% aged 41-60 years	56%	54%
% aged 60+	8%	9%
Disability profile	<1%	<1%

Ethnicity profile

NZ European	233	246
Asian	48	52
Pacific peoples	5	7
Māori	8	7
Other European	88	93
MELAA*	4	4

*Middle Eastern, Latin American and African.

Being a good employer

This year we continued to demonstrate our commitment to being a good employer and advocating organisation-wide equal employment opportunity (EEO) practices relating to the recruitment and selection, development, management and retention of all staff. We achieved a full compliance rating of 100% from the New Zealand Human Rights Commission for our good employer and EEO New Zealand programmes.

The table below outlines our achievements against the seven key elements of being a good employer, as set out by the New Zealand Human Rights Commission.

Good employer key elements	What we delivered 2016-2017
Leadership, accountability and culture	→ We held targeted leadership workshops and coaching for people managers and future leaders, with a focus on strengthening the capability of leaders to effectively champion a high-performing, customer-centred culture. → Our leadership team communicates the strategic direction and organisational goals to staff at all levels. → Our performance management and development process is designed to build a high-performance culture through clear accountability, defined work outputs and alignment to organisational goals and business plans. → This year's staff survey results reflected an upward trend on most factors over the last three years, with staff reporting greater pride in ESR, strongly caring about ESR's success and strong alignment with organisational values. Teams have undertaken action planning to address opportunities for improvement identified in the survey. → Our awards scheme encourages leadership and accountability and is aligned with our values.
Recruitment, selection and induction	→ Recruitment and selection processes are in place to foster EEO principles. Recruitment is focused on competencies, values, skills and experience and backed by appropriate assessment and selection tools to ensure the best candidate is selected in a fair and equitable manner. → Our new employees receive a thorough induction programme that includes familiarisation with key policies and processes. → We have continued to systemise our recruitment practices and approvals in order to increase consistency across the organisation.
Employee development, promotion and exit	→ Our performance management and development system encourages employee development by providing clear and achievable progression through building technical skills and behavioural competencies. We offer on-the-job opportunities, internal secondments, and attendance at national and international science conferences. → Our new performance management framework and online system has embedded well and resulted in a more efficient process, greater transparency, and more meaningful performance discussions. → Our annual science promotions process supports career progression for our employees. → Employees who leave ESR are offered the opportunity to participate in either an online or face-to-face exit interview. The feedback is consolidated and used to determine how we can build on areas of strength and improve our working environment.

Good employer key elements	What we delivered 2016-2017
Flexibility and work design	→ We promote flexible working arrangements with flexible hours, extended flexitime, and other flexible working arrangement polices, which are outlined in our Employee Handbook. We support parents returning to work by offering part-time and gradual return to full-time work arrangements. As at 30 June 2017, 19% of our employees work part-time. → This year we introduced a paid volunteering day for staff which aims to support staff who wish to contribute to the wider community through volunteer work.
Remuneration, recognition and conditions	→ Our terms and conditions of employment are consistent with the good employer philosophy, with a range of benefits valued by employees. → We reward people fairly and equitably on the basis of contribution, regardless of gender, age or ethnicity. Our performance management and remuneration framework ensures staff feel valued, recognised and appropriately rewarded for their contribution to help nurture a high-performance culture. → This year we conducted a gender pay analysis for all levels of our technical and science staff. This analysis showed that for every level the median hourly earnings for our female staff equaled or was slightly higher than our male staff. → We have annual Staff Awards that recognise and celebrate individuals or teams for their achievements.
Harassment and bullying prevention	→ Our Acceptable Behaviour Policy sets out the standards of behaviour expected of all our people, how to deal with unacceptable behaviour including harassment and bullying, and where to access further information and support if required, including the Employee Assistance Programme (EAP). → New employees are introduced to this policy and given training as part of their induction. The policy is reviewed regularly and will be supported by the upcoming launch of a new Code of Conduct. → We align our approaches with the bullying-prevention guidelines produced by Worksafe to ensure we are following best practice.
Safe and healthy environment	→ Our health and safety policies and procedures were comprehensively reviewed this year. We are now implementing recommendations based on an external review with the oversight of our Board. We have also implemented an improved electronic reporting platform. → Employees are given comprehensive training, guidelines and supervision to ensure everyone's safety, health and wellbeing at work. → We participate in the ACC Workplace Safety Management Practices programme and hold tertiary-level accreditation, the highest level achievable. → This year we introduced a new online wellness platform focused on promoting the overall health and wellbeing of staff. This builds on our wellness programme which already includes flu vaccinations, counselling, annual wellness checks and workstation assessments. → EAP has been extended to include a trauma support programme providing tailored support to assist staff in dealing with the physical or psychological symptoms that are associated with exposure to traumatic events, unpleasant information or ongoing traumatic experiences as part of their roles.

Everyone on an equal footing

ESR is committed to a diverse and inclusive workplace where all staff have equal opportunities to fulfil their potential and make their contribution. All our policies and practices are based on the principles of fairness, equity and non-discrimination and are regularly reviewed and refreshed to ensure they remain relevant and fit for purpose.

Partnership for quality

We continued to work closely with the Public Service Association (PSA) to ensure our employees have a channel where they can communicate recommendations or suggestions to policies, practices and programmes to ESR management. Our Partnership for Quality forum is offered jointly with the PSA and is a way for people to discuss issues affecting staff, feel listened to and validated.

Engaged people

A new staff engagement programme implemented this year gave our people an opportunity to voice things that matter to them, while providing valuable insights into their views on the organisation including culture, leadership, performance and recognition. It allows us to benchmark and measure effectiveness of what we are doing to ensure a capable and engaged workforce.

Over 85% of staff responded to the survey and we enjoyed improvements across most measures. Overall results showed that 53% of staff were engaged with the organisation, and the number of disengaged staff had decreased markedly from 28% in 2013 to 9% this year.

Health and safety

At ESR health and safety is not one person's job it is everybody's responsibility. To this end, ESR is committed to continual improvement and excellence in the management of health and safety in the workplace. Our aim is to provide and maintain a healthy and safe working environment for all employees, contractors and visitors.

The nature of our work means that staff can be exposed to physical, chemical, psychological and biological hazards. In response we have developed a strong health and safety culture with all employees given comprehensive training, guidelines, mentoring and supervision and with all policies aligned with Health and Safety at Work Act 2015.

Our total recordable injury frequency rate of 3.6 per 100 full-time equivalents and our tertiary-level accreditation in the ACC Workplace Safety Management Practices programme is evidence of ESR's commitment to health and safety.

Keeping our people well and safe

At ESR, health and wellness of both our people and our families is really important. Our Wellness programme provides a range of options, including staff-led initiatives, to ensure our own healthy futures. Some examples of ESR's wellness initiatives include on-site health check-ups with a nurse, flu vaccinations, and workplace assessments.

This year the ESR wellness programme was enhanced with the introduction of a new online wellness platform providing staff with the tools and resources to support their wellbeing.

OUR SENIOR LEADERS

The ESR Senior Leadership team

Left to right →

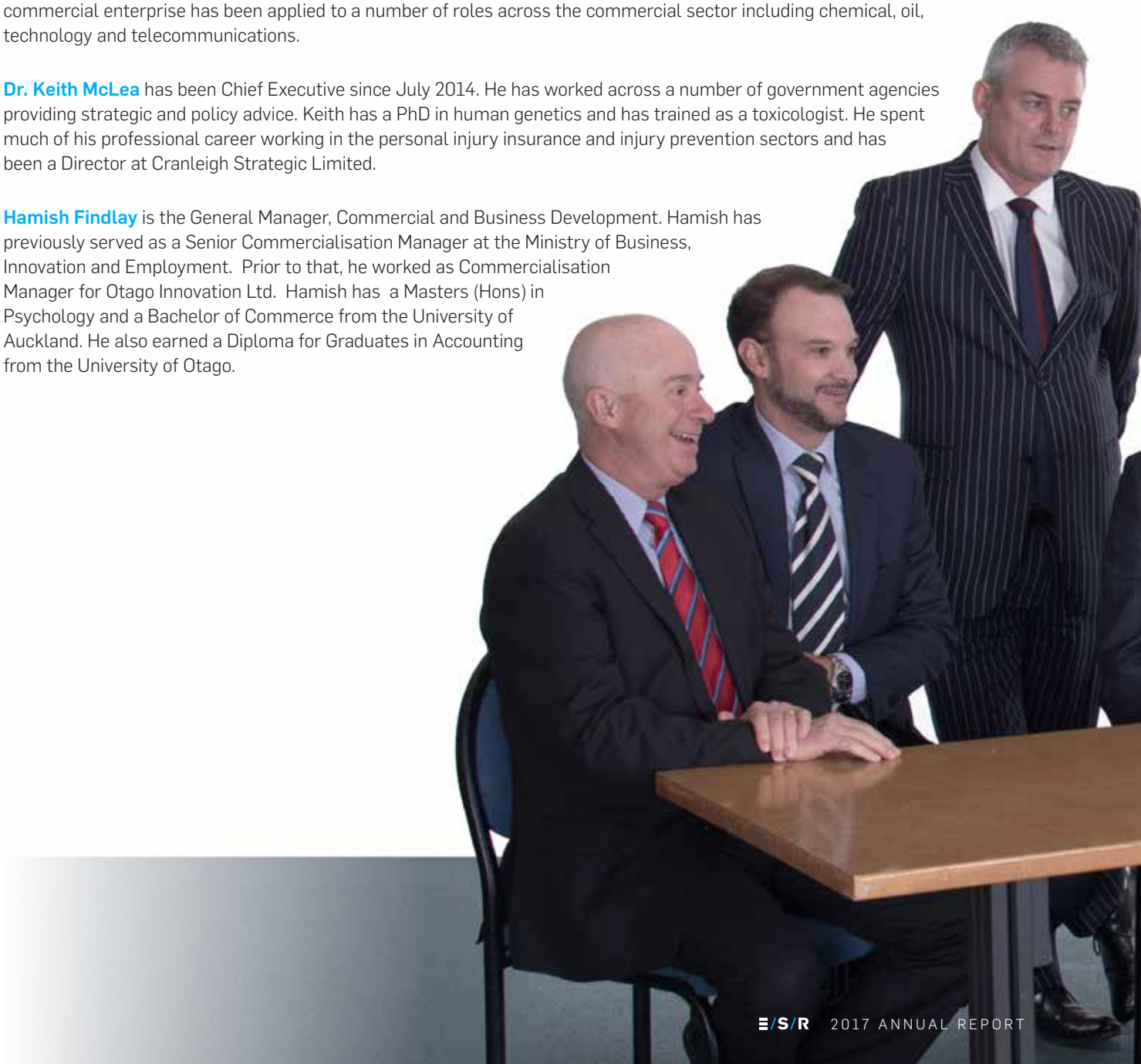
Dr. Graeme Benny is General Manager, Health. Having worked in executive roles in both the private and public sectors, Graeme brings strong management skills and a proven track record to the organisation. Before coming to ESR, Graeme was the Chief Executive of Health Workforce New Zealand. Graeme earned his PhD in clinical biochemistry from the University of Auckland.

Steven Pyne is Chief Information Officer. He has worked at the nexus of science and ICT support for a number of government and corporate organisations, including his previous role as CIO for the Science and Innovation Group at the Ministry of Business, Innovation and Employment.

John Bone is the General Manager, Forensics. John's passion for technical innovation, customer relationships and commercial enterprise has been applied to a number of roles across the commercial sector including chemical, oil, technology and telecommunications.

Dr. Keith McLea has been Chief Executive since July 2014. He has worked across a number of government agencies providing strategic and policy advice. Keith has a PhD in human genetics and has trained as a toxicologist. He spent much of his professional career working in the personal injury insurance and injury prevention sectors and has been a Director at Cranleigh Strategic Limited.

Hamish Findlay is the General Manager, Commercial and Business Development. Hamish has previously served as a Senior Commercialisation Manager at the Ministry of Business, Innovation and Employment. Prior to that, he worked as Commercialisation Manager for Otago Innovation Ltd. Hamish has a Masters (Hons) in Psychology and a Bachelor of Commerce from the University of Auckland. He also earned a Diploma for Graduates in Accounting from the University of Otago.



Celia Wellington is the General Manager, People and Communications. She has a background as an industrial psychologist over twenty years' experience in organisational development. Celia has delivered consultancy services at both an operational and strategic level, to a wide range of public and private sector organisations in New Zealand.

Dr. Phil Carter is Chief Scientist and Chair of the Strategic Science Team. Phil is a molecular microbiologist who has worked at ESR for over 16 years. He is responsible for the Research Office, the allocation of strategic funding across ESR science and ESR's scholarships and awards. His research interests include the population genetics of bacterial pathogens including *Neisseria, Campylobacter, E. coli O157* and *Salmonella*.

Dr. Libby Harrison is General Manager, Environmental Science. Before coming to ESR, Libby held a number of consulting and senior executive roles including General Manager at Landcare Research and the Environmental Protection Authority and Deputy Secretary at the Ministry for the Environment. Originally from the United Kingdom, Libby has a Masters and PhD in insect pest control from the University of London.

Bryan Lau Young is General Manager, Business Services and Chief Financial Officer at ESR. Bryan has 20 years experience across a broad range of industries having held senior financial and commercial roles in consulting, telecommunication, financial services and aviation with a focus on lifting organisational financial performance. Prior to joining ESR, Bryan was head of Finance at Airways NZ where he was responsible for commercial relationships with airlines and airports, structuring international growth and acquisition initiatives and leading the newly formed finance, property and procurement team.

PERFORMANCE INDICATORS

Outcome performance indicators

	ACTUAL	TARGET
Public health		
Time-critical turnaround times are met	100%	100%
Positive customer survey results from the Ministry of Health	Very Good	Good
Ministry of Health's project brief milestones and deliverables consistently met	97%	95%
Forensic science		
DNA samples linked to a person	75%	70%
DNA samples linked to other crimes	31%	33%
Fulfilment of contractual obligations under the service level agreement	SLA now met (turnaround times improved throughout the year)	SLA obligations fulfilled
Police satisfaction with ESR's timeliness and quality of service	>80%	90%
Food safety		
Stakeholder satisfaction with turnaround time for test results and advice on contamination of food for export (will vary by food type and incident)	91% average stakeholder satisfaction (surveyed biennially)	
Export radiation certificates issued within required timeframes for export	100%	100%
Meet MPI project milestones and deliverables	All projects met time and quality expectations	All projects met time and quality expectations
Water and the environment		
Met agreed milestones in the Ministry of Health environmental health contract	Milestones met	Milestones met
Increased project work related to environmental health in the Pacific	6 new contracts in place	Two new contracts signed
Provide water quality advice and advanced analytical services to regional and unitary councils each year to help improve recreational water quality	85% of councils	At least 80% of councils
Increase iwi/hapū participation in ESR's water related projects	33% of projects involve iwi/hapū participation	At least 25% of projects involve iwi/hapū participation

Generic CRI performance indicators

		ACTUAL	TARGET
End user collaboration	Revenue from commercial and other sources per FTE	$171,200	$152,300
Research collaboration	Publications with collaborators	53	65
Technology and knowledge transfer	Commercial reports per scientist FTE	0.36	0.45
Science quality	Impact of science publications (measured using Web of Science citations for the preceding financial year)	3.1	3.4
Financial indicators	Revenue per FTE	$206,600	$192,800
	Commercial and other services revenue	$62.6m	$57.5m

Financial performance indicators

	YEAR ENDING JUNE		
	ACTUAL 2017	TARGET 2017	ACTUAL 2016
Revenue	$75.5m	$70.2m	$70.1m
Operating margin[1]	16.3%	13.5%	15.5%
Return (NPAT) on equity[2]	10.5%	5.7%	8.9%
Return (EBIT) on assets[3]	10.1%	5.8%	8.6%
Profit volatility	28.2%	N/A	22.5%
Acid test ratio	2.7	1.5	1.7
Equity ratio	70.7%	76%	71.3%
Gearing	0.6	0.4	1.1
Annualised operating margin per FTE	$33,700	$25,100	$30.500

[1] Earnings before interest, tax, depreciation and amortisation to revenue.
[2] Net Profit After Tax.
[3] Earnings Before Interest and Tax.

section
06

OUR GOVERNANCE

Our Board is passionate about science, focused on the future and determined to keep ESR on a sustainable path.

CORPORATE GOVERNANCE

The Institute of Environmental Science and Research Limited is a Crown Research Institute (CRI) incorporated as a Company in 1992. Ownership is held equally between two Shareholding Ministers appointed by the Government: the Minister of Science and Innovation and the Minister of Finance.

Statement of Core Purpose

ESR's shareholders' expectations are set out in the Statement of Core Purpose that defines our purpose, expected outcomes, areas of operation, and operating principles.

ESR's purpose is to deliver enhanced scientific and research services to the public health, food safety, security and justice systems, and the environmental sector to improve the safety of, and contribute to the economic, environmental and social well-being of people and communities in New Zealand.

Statement of Corporate Intent

The Statement of Corporate Intent (SCI) sets out ESR's five year strategy for delivering against the core purpose. It includes the future operating environment, the activities and strategic initiatives that will be undertaken, the outcomes ESR aims to achieve and how performance is measured. It is reviewed annually.

ESR's latest SCI can be found on the ESR website.

Governance structure

As the owner of the CRIs, the Crown acts to protect its investment on behalf of New Zealand.

Each CRI has two Shareholding Ministers: the Minister of Science and Innovation and the Minister of Finance. Each Minister has a 50 percent shareholding, with the Minister of Science and Innovation as the Responsible Minister.

ESR has its own constitution and complies with the operating framework issued annually by its shareholders.

Shareholding Ministers appoint a Board of Directors to oversee the management of ESR and to appoint the chief executive in accordance with the Companies Act and its constitution. The Crown also appoints the Chair and Deputy Chair.

The Ministry of Business, Innovation and Employment (MBIE) is the primary monitoring agency for ESR.

Legal obligations

ESR complies with all legislation including the following:

- Companies Act 1993
- Crown Research Institutes Act 1992
- Crown Entities Act 2004
- Health and Safety at Work Act 2015
- Official Information Act 1982
- Public Audit Act 2001
- Public Finance Act 1989
- State Sector and Public Finance Reform Act 2012

Board of Directors

The Board of Directors is accountable to the Minister of Science and Innovation and the Minister of Finance and is ultimately responsible for the strategic direction, legal obligations and operational performance of the Institute. The Board delegates responsibility for the management of the organisation to the Chief Executive.

The ESR Board meets eleven times each year at one of three ESR locations in Auckland, Wellington and Christchurch.

ESR Board Composition for 2016-17 was:

Denise Church, QSO
Chair

Marion Cowden
Deputy Chair

Helen Darling

Prof. Bill Denny, NZOM
(retired June 2017)

Quentin Hix

Richard Gill

Dr Andrea Grant
(resigned April 2017)

John O'Hara
(retired June 2017)

Significant focus has been placed on updating ESR's governance and corporate policies during the year.

Key policies reviewed include:

- Health and Safety
- Anti-Fraud and Corruption
- Protected Disclosure
- Media/Social Media
- Delegated Financial Authorities
- Procurement
- Capital Expenditure
- Sensitive Expenditure and Gifts
- Privacy
- Information Management
- Scientific Publishing
- Contract Management

Board Committees

There are two Board Committees operating under the direction of the Board Chair.

People, Performance and Remuneration Committee

The objective of this Committee is to assist the Board in discharging its responsibilities in relation to the oversight of ESR's people strategies, principles and frameworks that support a high performance culture.

Members are:

- Helen Darling (Chair)
- Denise Church
- Richard Gill

Audit and Risk Committee

The objective of this Committee is to assist the Board in discharging its responsibilities in relation to the oversight of risk, control and compliance framework and its external accountability responsibilities.

Members are:

- Marion Cowden (Chair)
- Quentin Hix
- Denise Church
- Bill Denny (retired June 2017)

Strategic Science Advisory Panel

The Board receives advice from the Institute's independent Strategic Science Advisory Panel.

The panel provides independent, expert advice to the Board on research, development and future science initiatives that are aligned to ESR's core purpose.

Members of the Strategic Science Advisory Panel are:

- Dr. Ian Elsum, Australian National University
- Professor Bruce Weir, University of Washington
- Dr. Liz Jawinska, RMIT
- Professor John Mackenzie (retired 2017)

Profiles of the Strategic Science Advisory Panel can be found on page 77 of this report.

Managing risk effectively

ESR has in place a risk management framework and associated procedures for effective identification and management of ESR's financial and business risks, including fraud.

Risk management is integrated into a number of other corporate processes including business planning, internal audit and health and safety. Strategic risks are monitored by the senior leadership team, and assessed and reported quarterly to ESR's Audit and Risk Committee and the Board.

Code of Conduct and Ethics

As a publicly-funded organisation, we have a responsibility to maintain the highest standards of integrity, discretion and ethical conduct in order to maintain and enhance the public's trust and confidence in ESR.

Our Code of Conduct which was redeveloped in 2016-17 reinforces our values and sets out common standards of behaviour that we expect of our staff. It provides a framework that reinforces our commitment to legal requirements and policies, standards and principles.

Board of Directors

Denise Church, QSO was appointed as Chair of the ESR Board in July 2015. She is a Director of Leadership Matters Ltd, a Wellington based strategy and leadership consulting practice. She has extensive governance experience including as Chair of Karori Sanctuary Trust, WWF New Zealand, and the Wellington Zoo Trust. Her other Board roles have included the National Executive Committee Scouts, New Zealand, the National Health IT Board, Ako Aotearoa, Landcare Research, and the Foundation for Research, Science and Technology. Denise was previously Chief Executive of the Ministry for the Environment.

Marion Cowden is Deputy Chair of the ESR Board and Chair of the Audit and Risk Committee. Marion is a fellow of the Institute of Chartered Accountants of New Zealand and holds a BSc and BCom from University of Auckland and an MBA (with Distinction) from Massey University. She is currently part-time Executive Officer for Age Concern and has held senior roles in finance and corporate services in New Zealand and Australian public services and with the Commonwealth Secretariat based in London. Her current governance roles include Board Member and Chair of the Audit Committee of the Real Estate Agents Authority, Trustee, Nazareth Care and St John of God Hauora Trust.

Quentin Hix has many years' experience in governance roles across a broad range of sectors. He is currently a director of Ngāi Tahu Holdings Limited, one of the South Island's larger investment companies. He is also a member of the main governance board for Ngāi Tahu, chairs Ngāti Manawa Development Limited and is a board member for Presbyterian Support South Canterbury. Previous roles include chairing Westland Holdings Limited and Trust Aoraki Limited and being a director of Hunter Downs Water Limited; as well as holding a ministerial appointment to the South Canterbury District Health Board. Quentin is a lawyer with experience in most areas of the law. He currently practices mostly in the field of criminal law.

Dr. Andrea Grant has over 16 years of international, executive leadership experience in the pharmaceutical, biotech and healthcare sectors in United Kingdom, Europe, United States and New Zealand, combined with 10 years of governance experience as an appointed Director on commercial and not for profit boards. She has a particular expertise and interest in commercialisation of scientific innovations and ensuring organisations develop strategically to create economic benefit from their research activities. Dr. Grant is currently a Director of the Accreditation Council and Youthtown Inc.

Dr. Helen Darling graduated with a PhD in Public Health from the Dunedin School of Medicine, University of Otago and has founded two companies that work in the area of food integrity. Dr. Darling continues to work in the area of commercialisation of food integrity services and is particularly interested in the application of technology to enhance global food supply chains. In addition to industry and business knowledge, she has over 20 years' governance experience. She is the Chair of the People, Performance and Remuneration Committee.

Richard Gill is a creative engineer with a passion for leveraging leading-edge technologies to drive key improvements in human safety and organisational performance. Richard has a number of notable technology start-ups under his belt and is currently a Founder and CEO of mobile technology company Blerter (previously CLOUD M). He is also an advisor on ICT, strategy and innovation to a number of organisations.

Professor Bill Denny, NZOM is a graduate of University of Auckland, and trained there and at the University of Oxford as a medicinal chemist. He is currently Director of the Auckland Cancer Society Research Centre in the University of Auckland's School of Medical Sciences, where he has been closely involved in the development of eight drugs from the Centre into clinical trials, in collaboration with different industrial partners. He is a principal investigator in the Maurice Wilkins Centre (one of the national Centres of Research Excellence), and is co-chair of the University's Biopharma Research Initiative. He is a scientific co-founder of the biotech companies Proacta Inc and Pathway Therapeutics, and a scientific advisory board member of the Australian Research Centre for Cancer Therapeutics. He is also a co-author of 600 scientific papers and 100 patent applications in the area of drug design and development, a Rutherford Medallist of the Royal Society of New Zealand, and an Officer of the New Zealand Order of Merit.

John O'Hara has over 25 years' experience in commercialising innovation for high tech companies and government agencies. John founded and led three companies – one was sold privately, one publicly listed in New Zealand and one listed on NASDAQ. He is an angel investor in 16 New Zealand startup companies. John has extensive governance experience and is Chair of Ask Nicely Ltd and a Director of Spidertracks Ltd. Before he retired from the Board, he was Chair of the People, Performance and Remuneration Committee.

ESR Strategic Science Advisory Panel

Dr. Ian Elsum (BSc (Hons), PhD) is Principal Adviser in CSIRO's Science Strategy and Investment Group with responsibilities in research planning and science assessment across the organisation. He represents CSIRO within the Industrial Research Institute where he has co-chaired Research-on-Research Subcommittees investigating radical innovation and management of high-uncertainty R&D projects. Dr Elsum joined CSIRO in 1984 following research fellowships at the Australian National University and Harvard University and has extensive experience in research management, particularly strategic planning and assessment of applications-oriented research. He has been a member of a number of boards and management and advisory committees including, the Board of the Cooperative Research Centre for Advanced Computational Systems; Austrade's Export Advisory Panel – Communications; and, the Board of NPSC Ltd (a start-up company in computer communications). He has also been a regular participant in forums for the development of industry and innovation policy. He is currently Visiting Fellow in the School of Management at the Australian National University, carrying out research into the management of innovation, with an emphasis on high-uncertainty areas.

Professor Bruce Weir (BSc (Hons), PhD) is Professor and Chair of the Department of Biostatistics and Adjunct Professor, Department of Genome Sciences, University of Washington, Seattle. He has a BSc (Hons) with First Class Honours in Mathematics from the University of Canterbury and a PhD in Statistics, with a minor in Genetics, from North Carolina State University. He is a Fellow of the American Association for the Advancement of Science, the American Academy of Forensic Sciences, the American Statistical Association, and an Honorary Fellow of the Royal Society of New Zealand.

Professor Weir has held numerous editorial positions with journals in genetics, statistics, biometrics, heredity and epidemiology. He has supervised more than 30 PhD students. He is Chair of the 8th International Conference on Forensic Inference and Statistics. His research interests range across bioinformatics, genetics, statistical analysis, allelic association mapping, optimal testing strategies, analytical power, genetic relatedness, Bayesian networks for paternity case analysis, quality control in GWAS studies, and many more. He has published 210 peer-reviewed journal articles, which have gathered about 16,000 citations. He has an H-index of 47.

Dr. Elizabeth Jazwinska (BSc (Hons), PhD, MBA) has more than 25 years' experience in research and development management and business development. She has held senior positions in academia, industry and government in Australia, New Zealand, United Kingdom and Singapore. This has included being Executive Director of the Australian Research Council, Deputy Chief Executive for the Ministry of Science and Innovation and Director, Research Engagement in A*Star. She is currently Director, Research Engagement and Business Development at RMIT University where she leads a cross functional research engagement team responsible for identifying and managing industry partnerships for RMIT researchers. She is also Chair of the Governance Board of the Australian Phenomics.

During her academic career, her research team was supported by competitive funding from government, public agencies and industry and she authored 62 publications in peer-reviewed journals. She has a substantial network of contacts with academic groups, biotechnology and pharmaceutical companies, government agencies and venture capital groups world-wide.

Dr.Jazwinska is qualified in both science (she completed her BSc (Hons) at Aberdeen University and her PhD at Edinburgh University) and business (she completed her MBA at the Australian Graduate School of Management). She is also a graduate of the Australian Institute of Company Directors.

Professor John Mackenzie (BSc, PhD, FASM) retired from the Strategic Science Advisory Panel in 2017. He is a scientist with an outstanding international reputation in the field of microbiology and its impacts on public health. He is a recipient of the Western Australian Premier's Research Fellowship, was awarded an Order of Australia in 2002 for service to microbiology research, led the World Health Organization mission into China seeking information on SARS in 2003 and was involved in the global response to Avian Flu in 2004. His research interests extend across the spectrum of infectious disease emergence, especially the areas of zoonotic and vector-borne viral diseases, and the establishment of national and international surveillance systems to detect, monitor and verify such disease outbreaks. Examples include novel virus diseases such as *Hendra virus, Australian bat lyssavirus*, animal reservoirs for diseases such as SARS, and the spread of mosquito-borne diseases, such as Japanese encephalitis virus. He has published 241 peer-reviewed papers, with 5201 citations and an H-index of 36.

section
07

OUR FINANCES

Our strong financial performance enables us to invest in our future growth.

FINANCIAL STATEMENTS

Institute of Environmental Science and Research Limited

For the Year Ended 30 June 2017

Contents

Statement of Responsibility

We certify that the Company has operated in accordance with the principles of the Crown Research Institutes Act 1992 and Companies Act 1993. The Company has also complied with all statutory environmental regulations.

We acknowledge responsibility for the preparation of these financial statements and for the judgements used therein.

Internal control procedures are considered to be sufficient to provide a reasonable assurance as to the integrity and reliability of the financial reports.

In our opinion these financial statements fairly reflect the financial position and operations of the Institute of Environmental Science and Research Limited (ESR) for the year ended 30 June 2017.

Denise Church
Chair

Marion Cowden
Deputy Chair

REPORT FROM THE CHIEF FINANCIAL OFFICER

ESR has achieved a record financial result in 2017 with Net Profit after Tax (NPAT) of $5.0m. This follows the previous highest reported NPAT of $3.8m in 2016 and significantly exceeds the Statement of Corporate Intent target of $2.5m.

The strong financial result was driven by an ongoing focus on revenue growth, margins and the realisation of efficiencies and cost savings across ESR's business and corporate functions.

Year on year revenue growth of $5.4m (8%) was achieved with higher international revenues of $12.8m (up from $9.2m in 2016), increased success in attracting external research funding, supported by additional services provided to New Zealand Police. The international revenue increase was driven by the continued growth in sales of STRmix™ software. New research contracts this year include funding from Marsden, Health Research Council, and MBIE Smart Ideas, for substantial multi-year projects.

Investing in the future

This is the third year of sound financial results for ESR since 2014, rewarding the organisation's commitment to the growth strategy implemented in 2015.

This ongoing success has ESR well placed to continue its programme of investing in growth through investing in our staff, application of strategic science investment funding and targeted capital expenditure.

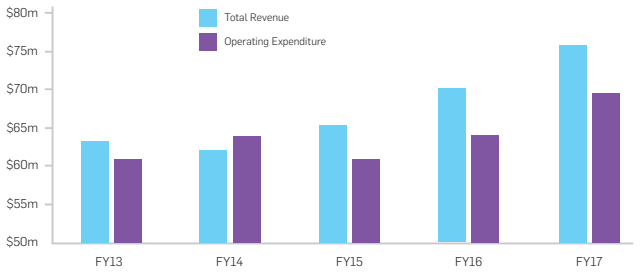
In addition to the Health Research Council, Marsden and MBIE Smart Ideas projects, in 2017 ESR increased resourcing and investment in research and growth across the areas of genomics and informatics, human disease, forensic modelling, groundwater health and groundwater modelling. ESR invested $750,000 on targeted research projects that test ideas, prove concepts, develop prototypes or new products and services.

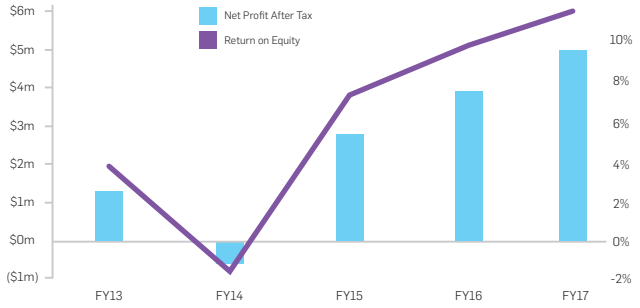
ESR made significant capital investment during 2017 on enhancements to STRmix™ software, next generation sequencing for health and forensic applications, bioinformatics infrastructure, forensic robotics and a Fourier Transform Infrared Spectrometer for food science applications.

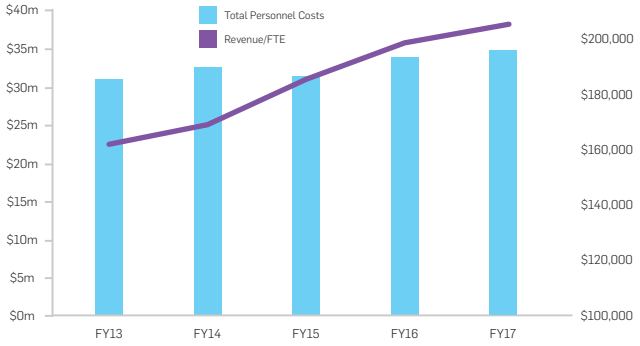
Strong operating cash flows have enabled ESR to make significant progress towards building the cash reserves required to address the issue of science facilities approaching end-of-useful-life.

Financial performance

$000	Actual 2017	SCI Target	Actual 2016
Revenue	75,511	70,163	70,082
Operating margin	6,783	3,421	5,318
NPAT	5,009	2,538	3,842
Return on equity	10.5%	5.7%	8.9%







Five year trends

	2013	2014	2015	2016	2017
Revenue	$62.1m	$ 61.8m	$65.0m	$70.1m	$75.5m
Operating margin[1]	11.7%	8.1%	13.9%	15.5%	16.3%
Return on equity[2]	3.3%	-1.4%	6.5%	8.9%	10.5%
Return on assets[3]	2.9%	-1.3%	6.0%	8.6%	10.1%
Acid test ratio	1.4	1.3	1.5	1.7	2.7
Equity ratio	66.4%	67.8%	67.3%	71.3%	70.7%
Operating margin per FTE	$19,060	$13,230	$25,600	$30,500	$33,700

[1] Earnings before interest, tax, depreciation and amortisation to revenue
[2] Net profit after tax to average equity
[3] Earnings before interest and tax to average total assets

Cash flow

	2013	2014	2015	2016	2017
Net cash inflow from operating activities	$5.3m	$4.6m	$12.0m	$10.1m	$13.9m
Net cash outflow from investing activities[3]	($10.0m)	($4.5m)	($6.0m)	($5.2m)	($3.2m)
Closing cash, cash equivalents and investment cash	$2.1m	$1.9m	$7.7m	$12.4m	$22.8

[3] Excluding investment in bank term deposits

Capital expenditure

	2013	2014	2015	2016	2017
Investment in:					
Property, plant and equipment	$6.8m	$2.3m	$2.1m	$3.8m	$2.5m
Intangible assets	$3.0m	$2.2m	$3.9m	$1.3m	$0.7m
Investments	$0.2m	$0.03m	-	-	-
Total capital expenditure	$10.0m	$4.6m	$6.0m	$5.1m	$3.2m

Capital structure

	2013	2014	2015	2016	2017
Equity	$39.1m	$38.6m	$41.1m	$45.0m	$50.0m
Total assets	$56.9m	$57.7m	$60.8m	$63.1m	$70.7m
Shareholders funds to total assets	66.4%	67.8%	67.3%	71.3%	70.7%

Bryan Lau Young
Chief Financial Officer

Report of the Directors

The directors present the Annual Report and audited financial statements of the Institute of Environmental Science and Research (ESR) for the year ended 30 June 2017.

The Auditor-General is the statutory auditor pursuant to section 21 of the Crown Research Institutes Act 1992. The Auditor-General has appointed Chris Ussher with the assistance of PricewaterhouseCoopers to audit the financial statements and to express an opinion on them.

Principal activity

ESR is a Crown Research Institute that provides specialist scientific services and research, particularly to the health and justice sectors. Its purpose is to deliver enhanced scientific and research services to the public health, food safety, security and justice systems, and the environmental sector to improve the safety and contribute to the economic, environmental and social wellbeing of people and communities in New Zealand.

Dividends

No dividends have been declared or paid in respect of the 2017 financial year.

Directors' indemnity

ESR has arranged for directors and officers insurance for any act or omission in their capacity as a director of the Company.

Directors' use of information

No member of the Board of ESR, or any subsidiary, issued a notice requesting to use information received in their capacity as directors that would not otherwise have been available to them.

Donations

No donations were made during the year.

Remuneration of Directors

The directors who held office in the period of this report and their total remuneration and other benefits were:

Denise Church (Chair)	$47,032
Marion Cowden (Deputy Chair)	$29,395
Dr Helen Darling	$23,516
Professor William Denny (retired June 2017)	$23,516
Richard Gill	$23,516
Andrea Grant (appointed September 2016, resigned April 2017)	$11,672
Quentin Hix (appointed September 2016)	$19,683
John O'Hara (retired June 2017)	$23,516
	$201,846

Disclosure of interests by Directors

As at 30 June 2017 the following directors had made the following general disclosures:

Denise Church (Chair)

Chair, Karori Sanctuary Trust
Trustee, Scout Youth Federation
Director and Shareholder, Leadership Matters Limited
Member, National Executive Committee, Scouts New Zealand
Member, Advisory Board, Centre for Space Science and Technology

Marion Cowden (Deputy Chair)

Board Member, St John of God Hauora Trust
Trustee, Nazareth Care Charitable Trust
National Council Member, Student Job Search, Aotearoa
Part-time Executive Officer, Age Concern (Wellington)
Member, Real Estate Agents Authority
Director and Shareholder, Muriell Olaghair Properties Limited

Dr Helen Darling

Director and Shareholder, Sumfood Limited
Director and Shareholder, Darling and Associates
Director and Shareholder, Cherry Futures Limited
Director and Shareholder, Asia Pacific Centre for Food Integrity
Expert Committee, United States Pharmacopeial Convention, Food Ingredients
Expert Panel, United States Pharmacopeial Convention, Food Adulteration

Professor William Denny

Director, Auckland Cancer Society Research Centre, University of Auckland
Head, Scientific Advisory Committee, Australian Cancer Research Foundation Drug Discovery Centre, Sydney
Member, Scientific Advisory Group, Australian Cooperative Research Centre for Cancer Therapeutics, Melbourne
Member, Ministry of Health/Health Research Council Steering Committee for Cancer Research Partnership
Member, Management Group, Maurice Wilkins Centre for Molecular Bioscience, University of Auckland
Member, Senior Management Team, Cancer Society Auckland
Member, National Science Challenge Panel
Board Member, NZ Genomics Limited

Richard Gill

Director, Shareholder and CEO, Cloud M Limited
Director and Shareholder, Richard Gill Limited
Director, Richard Gill Trustees Limited
Director and Shareholder, Sumfood Limited

Quentin Hix

Board Member, Te Runanga O Ngāi Tahu
Director, Ngāi Tahu Holdings Corporation Limited
Director, Chair, Ngāti Manawa Development Limited
Director, Aoraki Management Services Limited
Director, Aoraki Investments Limited
Director, Aoraki Trust Management Limited
Trustee, Hunter Downs Irrigation Trust
Director, Quentin Hix Legal Limited
Trustee, Q C S & K L Hix Family Trust
Trustee, The T A A H R K Hix Family Trust
Opus Approved RMA Commissioner and Chair
Director, Murupara Motors Limited
Director, DGH GP Limited
Board Member, Presbyterian Support South Canterbury
Director, Aoraki Environmental Consultancy Limited
Director, One to One Corporate Trustees Limited
Director, One to One Corporate Trustees 2011 Limited

John O'Hara

Director, Spidertracks Limited
Chair and Lead Investor, Ask Nicely Limited
Shareholder, Tekron International Limited
Consultant, SnapComms Ltd
Director, John O'Hara Limited
Director and Shareholder, Sport Aircraft Limited
Governance Board External Advisor, Airways Corporation

Directors' interests

No director held any interest in the shares of the Institute. The Institute has funding contracts with the Marsden Fund and the Ministry of Business, Innovation, and Employment, which are negotiated at arm's length with appropriate director's interest being declared. Except for these contracts no material contracts involving director's interests were entered into during, or subsequent to, the period covered by this report.

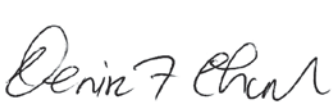
Remuneration

Total remuneration in respect of employees paid above $100,000 was as follows:

Remuneration Range	No. of Staff
$100,000 - $109,999	26
$110,000 - $119,999	17
$120,000 - $129,999	10
$130,000 - $139,999	9
$140,000 - $149,999	2
$150,000 - $159,999	2
$160,000 - $169,999	5
$170,000 - $179,999	1
$180,000 - $189,999	1
$200,000 - $209,999	1
$210,000 - $210,999	3
$220,000 - $229,999	3
$230,000 - $239,999	1
$240,000 - $249,999	1
$410,000 - $419,999	1

Events subsequent to balance date

The directors are not aware of any matter or circumstance since the end of the financial year that has significantly affected, or may significantly affect, the operation of the Institute.



Denise Church
Chair

Marion Cowden
Deputy Chair

Independent auditor's report

To the readers of the Institute of Environmental Science and Research Limited's Group financial statements for the year ended 30 June 2017.

The Auditor-General is the auditor of the Institute of Environmental Science and Research Limited and its subsidiary (the Group). The Auditor-General has appointed me, Chris Ussher, using the staff and resources of PricewaterhouseCoopers, to carry out the audit of the financial statements of the Group on his behalf.

Opinion

We have audited the financial statements of the Group on pages 91 to 111, that comprise the statement of financial position as at 30 June 2017, the statement of profit or loss and other comprehensive income, statement of changes in equity and statement of cash flows for the year ended on that date and the notes to the financial statements that include the statement of significant accounting policies and other explanatory information.

In our opinion, the financial statements of the Group:

- present fairly, in all material respects:
  - its financial position as at 30 June 2017;
  - its financial performance and cash flows for the year then ended; and
- comply with generally accepted accounting practice in New Zealand in accordance with New Zealand equivalents to International Financial Reporting Standards and International Financial Reporting Standards.

Our audit was completed on 22 August 2017. This is the date at which our opinion is expressed.

The basis for our opinion is explained below. In addition, we outline the responsibilities of the Board of Directors and our responsibilities relating to the financial statements, we comment on other information, and we explain our independence.

Basis for our opinion

We carried out our audit in accordance with the Auditor-General's Auditing Standards, which incorporate the Professional and Ethical Standards and the International Standards on Auditing (New Zealand) issued by the New Zealand Auditing and Assurance Standards Board. Our responsibilities under those standards are further described in the Responsibilities of the auditor section of our report.

We have fulfilled our responsibilities in accordance with the Auditor-General's Auditing Standards.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Responsibilities of the Board of Directors for the financial statements

The Board of Directors is responsible on behalf of the Group for preparing financial statements that are fairly presented and that comply with generally accepted accounting practice in New Zealand.

The Board of Directors is responsible for such internal control as it determines is necessary to enable it to prepare financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Board of Directors is responsible on behalf of the Group for assessing the Group's ability to continue as a going concern. The Board of Directors is also responsible for disclosing, as applicable, matters related to going concern and using the going concern basis of accounting, unless the Board of Directors has to cease operations, or has no realistic alternative but to do so.

The Board of Directors' responsibilities arise from the Crown Research Institutes Act 1992.

Responsibilities of the auditor for the audit of the financial statements

Our objectives are to obtain reasonable assurance about whether the financial statements, as a whole, are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance, but it is not a guarantee that an audit carried out in accordance with the Auditor-General's Auditing Standards will always detect a material misstatement when it exists. Misstatements are differences or omissions of amounts or disclosures and can arise from fraud or error. Misstatements are considered material if, individually or in the aggregate, they could reasonably be expected to influence the decisions of readers taken on the basis of these financial statements.

For the budget information reported in the financial statements, our procedures were limited to checking that the information agreed to the Group's statement of corporate intent.

We did not evaluate the security and controls over the electronic publication of the financial statements.

As part of an audit in accordance with the Auditor-General's Auditing Standards, we exercise professional judgement and maintain professional scepticism throughout the audit. Also:

- We identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

- We obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances but not for the purpose of expressing an opinion on the effectiveness of the Group's internal control.
- We evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by the Board of Directors.
- We conclude on the appropriateness of the use of the going concern basis of accounting by the Board of Directors and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to continue as a going concern.
- We evaluate the overall presentation, structure and content of the financial statements, including the disclosures and whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.
- We obtain sufficient appropriate audit evidence regarding the financial statements of the entities or business activities within the Group to express an opinion on the consolidated financial statements. We are responsible for the direction, supervision and performance of the Group audit. We remain solely responsible for our audit opinion.

We communicate with the Board of Directors regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Our responsibilities arise from the Public Audit Act 2001.

Other Information

The Board of Directors is responsible for the other information. Our opinion on the financial statements does not cover the other information and we do not, and will not, express any form of audit opinion or assurance conclusion thereon. At the time of our audit, there was no other information available to us.

In connection with our audit of the financial statements, our responsibility is to read the other information. In doing so, we consider whether the other information is materially inconsistent with the financial statements or our knowledge obtained in the audit, or otherwise appears to be materially misstated. If, based on our work on the other information that we obtained prior to the date of our auditor's report, we conclude that there is a material misstatement of this other information, we are required to report that fact.

Independence

We are independent of the Group in accordance with the independence requirements of the Auditor-General's Auditing Standards, which incorporate the independence requirements of Professional and Ethical Standard 1 (Revised): Code of Ethics for Assurance Practitioners issued by the New Zealand Auditing and Assurance Standards Board.

In addition to the audit we have carried out engagements in the areas of other assurance services and taxation compliance and advice. Other than the audit and these engagements, we have no relationship with or interests in the Group.

Chris Ussher
On behalf of the Auditor-General
Wellington, New Zealand

PricewaterhouseCoopers

Statement of Profit or Loss and Other Comprehensive Income

for the year ended 30 June 2017

Group	Note	Actual 2017 $'000s	Budget 2017 (unaudited) $'000s	Actual 2016 $'000s
Operating revenue				
Revenue from rendering of services		66,277	62,440	62,359
Strategic science investment funding		9,234	7,723	7,723
		75,511	**70,163**	**70,082**
Operating expenses				
Scientific materials		5,799	5,664	5,755
Subcontracting expenses, commissions and royalties		8,610	7,596	7,142
Personnel expense		34,950	33,690	33,820
Depreciation and amortisation expense	**4/5**	5,525	6,049	5,519
Other expenses	**2**	13,844	13,743	12,528
		68,728	**66,742**	**64,764**
Operating profit		**6,783**	**3,421**	**5,318**
Interest income		336	232	163
Finance expense		(38)	(15)	(24)
Net finance income		**298**	**217**	**139**
Profit before income tax expense		**7,081**	**3,638**	**5,457**
Income tax expense	**3**	2,072	1,100	1,615
Profit for the period attributable to the Institute's shareholders		**5,009**	**2,538**	**3,842**
Other comprehensive income		-	-	-
Total profit and other comprehensive income for the period attributable to the Institute's shareholders		**5,009**	**2,538**	**3,842**

The accompanying notes form an integral part of these financial statements.

Statement of Changes in Equity

for the year ended 30 June 2017

Group	Share capital $'000s	Retained Earnings $'000s	Total Equity $'000s
Balance at 30 June 2015	**8,494**	**32,654**	**41,148**
Profit for the period	-	3,842	3,842
Other comprehensive income	-	-	-
Total comprehensive income	-	**3,842**	**3,842**
Transactions with owners:			
Dividend	-	-	-
Balance at 30 June 2016	**8,494**	**36,496**	**44,990**
Balance at 30 June 2016	**8,494**	**36,496**	**44,990**
Profit for the period	-	5,009	5,009
Other comprehensive income	-	-	-
Total comprehensive income	-	**5,009**	**5,009**
Transactions with owners:			
Dividend	-	-	-
Balance at 30 June 2017	**8,494**	**41,505**	**49,999**

The accompanying notes form an integral part of these financial statements.

Statement of Financial Position

as at 30 June 2017

Group	Note	Actual 2017 $'000s	Budget 2017 (unaudited) $'000s	Actual 2016 $'000s
Non-current assets				
Property, plant and equipment	4	29,544	34,191	30,784
Investment		30	30	30
Intangible assets	5	9,800	10,183	11,044
		39,374	**44,404**	**41,858**
Current assets				
Cash and cash equivalents		6,773	9,127	12,364
Investment cash		16,000	-	-
Trade and other receivables	6	7,658	5,605	7,888
Derivative financial instruments		68	-	134
Inventories – scientific materials and consumables		869	802	875
		31,368	**15,534**	**21,261**
Current liabilities				
Trade and other payables	7	11,440	6,408	8,999
Employee benefits	8	3,222	2,613	2,925
Finance lease liabilities	9	234	104	258
Income tax payable	10	620	311	730
		15,516	**9,436**	**12,912**
Net current assets		**15,852**	**6,098**	**8,349**
Non-current liabilities				
Employee benefits	8	1,292	765	1,194
Finance lease liabilities	9	50	80	250
Deferred taxation	11	3,885	3,583	3,773
		5,227	**4,428**	**5,217**
Net assets		**49,999**	**46,074**	**44,990**
Equity				
Share capital	13	8,494	8,494	8,494
Retained earnings		41,505	37,580	36,496
Total equity		**49,999**	**46,074**	**44,990**

The Board of Directors of the Institute of Environmental Science and Research Limited authorised these financial statements for issue on 22 August 2017.

On behalf of the Board:

Denise Church
Chair

Marion Cowden
Deputy Chair

Dated 22 August 2017

The accompanying notes form an integral part of these financial statements.

Statement of Cash Flows

for the year ended 30 June 2017

Group	Note	Actual 2017 $'000s	Budget 2017 (unaudited) $'000s	Actual 2016 $'000s
Cash flows from/(used in) operating activities				
Cash was provided from:				
Customers and strategic science investment funding		78,821	70,563	69,276
Interest received		233	232	163
		79,054	70,795	69,439
Cash was applied to:				
Suppliers and employees		(63,037)	(60,750)	(58,278)
Interest paid		(8)	(15)	(10)
Income tax paid	**10**	(2,070)	(1,083)	(1,045)
		(65,115)	(61,848)	(59,333)
Net cash inflow from operating activities	**14**	**13,939**	**8,947**	**10,106**
Cash flows from/(used in) investing activities				
Cash was provided from:				
Proceeds from sale of property, plant and equipment		4	-	2
Term deposit maturities		10,000		
		10,004	-	2
Cash was applied to:				
Purchase of property, plant and equipment	**4**	(2,542)	(6,594)	(3,810)
Purchase of intangible assets	**5**	(680)	(1,098)	(1,345)
Investment in term deposits		(26,000)	-	-
		(29,222)	(7,692)	(5,155)
Net cash outflow from investing activities		**(19,218)**	**(7,692)**	**(5,153)**
Cash flows (used in) financing activities				
Cash was (applied to):				
Repayment of finance lease liabilities		(312)	(300)	(291)
Net cash outflow from financing activities		**(312)**	**(300)**	**(291)**
Net increase in cash held		**(5,591)**	**955**	**4,662**
Cash and cash equivalents at the beginning of the period		12,364	8,172	7,702
Cash and cash equivalents at the end of the period		**6,773**	**9,127**	**12,364**

The accompanying notes form an integral part of these financial statements.

Notes to the Financial Statements

1. Statement of significant accounting policies

Reporting entity

These financial statements of the Institute of Environmental Science and Research Limited and its subsidiary ("ESR" and the "Group") are for the year ended 30 June 2017.

ESR is a Crown Entity incorporated and based in New Zealand. Its registered office is 34 Kenepuru Drive, Porirua.

ESR is a Crown Research Institute that provides specialist scientific services and research to the public health, food safety, security and justice systems, and the environmental sector.

Statement of compliance

The financial statements have been prepared in accordance with the requirements of the Crown Entities Act 2004, the Crown Research Institutes Act 1992, the Companies Act 1993 and the Financial Reporting Act 2013.

These financial statements have been prepared in accordance with Generally Accepted Accounting Practice in New Zealand (NZ GAAP). They comply with International Financial Reporting Standards (IFRS) and other applicable financial reporting standards as appropriate for for-profit entities.

The Group has adopted External Reporting Board Standard A1 Accounting Standards Framework (For-profit Entities Update) (XRB A1). XRB A1 establishes a for-profit tier structure and outlines which suite of accounting standards entities in different tiers must follow. The Group is a Tier 1 entity.

Basis of preparation

The financial statements are prepared on the basis of historical cost, except for financial instruments, certain leased assets and long service leave as identified in the specific accounting policies and accompanying notes.

The financial statements are presented in New Zealand dollars and all values are rounded to the nearest thousand dollars ($000).

The budget and target figures presented in these financial statements are unaudited.

Changes in accounting policies

Accounting policies have been applied on a basis consistent with the prior year.

Critical accounting estimates and judgements

The preparation of financial statements requires judgements, estimates and assumptions that affect the application of policies and reported amounts of assets and liabilities, income and expenses. The estimates and associated assumptions are based on historical experience and various other factors that are believed to be reasonable under the circumstances. Actual results may differ from these estimates. The estimates and assumptions are reviewed on an on-going basis.

The judgements that have the most significant effect on amounts recognised in the financial statements are applied in the determination of revenue.

Revenue

The Group uses the stage of completion method in accounting for its fixed price contracts to deliver scientific services.

The use of the stage of completion method requires management to estimate the services performed to date as a proportion of the total services to be performed. The stage of completion is calculated and reviewed monthly, and significant variances are investigated to ensure that the stage of completion estimate is reasonable, in line with the overall project plan, estimated completion date and prior measurements of progress.

Principles of consolidation

Subsidiaries

The consolidated financial statements incorporate the assets and liabilities of all subsidiaries of ESR as at 30 June 2017 and the results of the operations of all subsidiaries for the year then ended.

Subsidiaries are those entities controlled, directly or indirectly, by the Parent. Subsidiaries are consolidated from the date on which control is transferred to ESR. They are de-consolidated from the date that control ceases.

The acquisition method of accounting is used to account for the acquisition of businesses by the Group. The cost of an acquisition is measured as the fair value of the assets given, equity instruments issued and liabilities incurred or assumed at the date of exchange. Identifiable assets acquired and liabilities and contingent liabilities assumed in a business combination are measured initially at their fair values at the acquisition date, irrespective of the extent of any non-controlling interest. The excess of the cost over the fair value of the Group's share of the identifiable net assets acquired is recorded as goodwill. If the cost of acquisition is less than the Group's share of the fair value of the identifiable net assets of the subsidiary acquired the difference is recognised directly in the statement of profit or loss and other comprehensive income.

Property, plant and equipment

Items of property, plant and equipment are initially recorded at cost and subsequently at cost less accumulated depreciation and impairment. The cost of property, plant and equipment includes the value of consideration given to acquire the assets and the value of other directly attributable costs that have been incurred in bringing the assets to the location and condition necessary for their intended use.

The carrying amounts of property, plant and equipment are reviewed at least annually to determine if there is any indication of impairment. Where an asset's recoverable amount is less than its carrying amount, it will be reported at its recoverable amount and an impairment loss will be recognised.

Losses resulting from impairment are reported in the statement of profit or loss and other comprehensive income.

Realised gains and losses arising from the disposal of property, plant and equipment are recognised in the statement of profit or loss and other comprehensive income in the periods in which the transactions occur.

Depreciation is charged on a straight-line basis at rates calculated to allocate the cost of an item of property, plant and equipment, less any estimated residual value, over its estimated useful life, as follows:

Type of Asset	Estimated useful life
Land	Not depreciated
Freehold buildings	20 - 50 years
Leasehold improvements	10 years
Plant, equipment and vehicles	3 - 10 years
IT equipment and internal software	3 - 12 years

Intangible assets

Computer software

Items of computer software that do not comprise an integral part of the related hardware are treated as intangible assets with finite lives. Intangible assets with finite lives are recorded at cost, and subsequently recorded at cost less any accumulated amortisation and impairment losses. Amortisation is charged to the statement of profit or loss and other comprehensive income on a straight-line basis over the useful life of the asset (between 3 and 12 years).

Customer contracts

The intangible asset customer contracts represents the fair value of future revenue streams from customer contracts acquired under business combinations. Initial recognition of the intangible asset is stated at fair value. Subsequent to initial recognition, acquired intangible assets are stated at initially recognised amounts less accumulated amortisation and any impairment. Amortisation of acquired intangible assets is made according to the straight-line method over their estimated useful life, not exceeding ten years.

Research and development costs – internally generated intangible assets

Expenditure on research is expensed when it is incurred.

Development expenditure incurred on an individual project is capitalised if the process is technically and commercially feasible, future economic benefits are probable and ESR intends to and has sufficient resources to complete development and to use or sell the asset.

Any expenditure capitalised is amortised over the period of expected future sales from the related project from the point the asset is ready for use.

Impairment of non-financial assets

Assets that are subject to amortisation are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount may not be recoverable. An impairment loss is recognised for the amount by which the asset's carrying amount exceeds its recoverable amount. The recoverable amount is the higher of an asset's fair value less costs to sell and value in use. For the purposes of assessing impairment, assets are grouped at the lowest levels for which there are separately identifiable cash flows (cash-generating units).

Taxation

Current tax

Current tax is calculated with reference to the current period's taxable profit or loss calculated using tax rates and tax laws that have been enacted or substantially enacted by reporting date. Current tax for the current and prior periods is recognised as a liability (or asset) to the extent that it is unpaid (or refundable).

Deferred tax

Deferred tax is calculated using the comprehensive balance sheet liability method in respect of temporary differences arising from differences between the carrying amount of assets and liabilities in the financial statements and the tax base for those items.

Deferred tax assets and liabilities are not recognised if the temporary differences giving rise to them from the initial recognition of assets and liabilities (other than as a result of a business combination) affects neither taxable income nor accounting profit.

Deferred tax assets are recognised for deductible temporary differences and unused tax losses only if it is probable that future taxable amounts will be available against which deductible temporary differences or unused tax losses and tax offsets can be utilised.

Deferred tax assets and liabilities are measured at the tax rates expected to apply when the assets are recovered or liabilities settled using tax rates and tax laws that have been enacted or substantially enacted by reporting date.

Cash and cash equivalents

Cash means cash on hand, demand deposits and other highly liquid investments in which ESR has invested as part of its day-to-day cash management. The following definitions are used in the statement of cash flows:

- Investing activities are those activities relating to the acquisition, holding and disposal of fixed assets and investments.
- Financing activities are those activities that result in changes in the size and composition of the capital structure of ESR and this includes both equity and debt not falling within the definition of cash. Dividends paid in relation to the capital structure are included in financing activities.
- Operating activities are the principal revenue producing activities and other activities that are not investing or financing activities.

Investment cash

Investment cash represents cash held in bank deposits with original maturities of between 3 and 12 months. Investment cash movements are included in investing activities in the statement of cash flows.

Trade and other receivables

Trade receivables are stated at their estimated realisable value after providing against debts where collection is doubtful. An estimate of the value of doubtful debts is made based on a review of debts at year end. Bad debts are written off in the period in which they are identified.

Inventories

Stocks of consumables and work in progress are stated at the lower of cost and net realisable value. Cost is determined on a first in, first out basis.

Trade and other payables

These amounts represent the best estimate of the expenditure required to settle an obligation arising from goods or services provided to ESR prior to period end. These amounts are unsecured and are usually paid within 30 days of recognition. Liabilities and provisions to be settled beyond 12 months are recorded at their present value.

Employee benefits

Wages, salaries and annual leave

Liabilities for wages and salaries including annual leave that are expected to be settled within 12 months of the reporting date are recognised in respect of employees' services up to the reporting date and are measured at the amounts expected to be paid when the liabilities are settled.

Obligations for contributions to defined contribution retirement plans are recognised in the statement of profit or loss and other comprehensive income as they fall due.

Long service leave and retirement leave

Liabilities for long service and retirement leave are recognised as employee benefit liabilities and measured as the present value of expected future payments to be made in respect of services provided by employees up to the reporting date. Consideration is given to the expected future salary levels, experience of employee departures and periods of service. Expected future payments are discounted using market yields at the reporting date for Government bonds with terms to maturity and currency that match, as closely as possible, the estimated future cash outflows.

Leases

Finance leases transfer to ESR, as lessee, substantially all the risks and rewards incidental to ownership of a leased asset. Initial recognition of a finance lease results in an asset and liability being recognised at amounts equal to the lower of the fair value of the leased asset or the present value of the minimum lease payments. Each lease payment is allocated between the liability and finance charges so as to achieve a constant rate of finance charge over the term of the lease. Property, plant and equipment acquired under a finance lease is depreciated over the shorter of the useful life and lease term of the asset.

Leases in which a significant portion of the risks and rewards of ownership are retained by the lessor are classified as operating leases. Payments made under operating leases (net of any incentives received from the lessor) are charged to the statement of profit or loss and other comprehensive income on a straight-line basis over the period of the lease.

Share capital

Ordinary shares are classified as equity. Incremental costs directly attributable to the issue of new shares or options are shown as appropriate in equity as a deduction, net of tax, from the proceeds.

Revenue

Sales of goods and services

Revenue is earned by ESR in exchange for the provision of outputs (services) to third parties.

Revenue from the supply of services is measured at the fair value of consideration received. Revenue from the supply of services is recognised in the accounting period in which the services are rendered, by reference to the stage of completion of the specific transaction assessed on the basis of the actual service provided as a proportion of the total services to be provided.

Any revenue for which services have not been supplied as at the reporting date but for which payment has been received is deferred within the statement of financial position as revenue in advance.

Strategic science investment funding

ESR receives strategic science investment funding from the government in order to perform scientific research activities. Strategic science investment funding is recognised in the statement of profit or loss and other comprehensive income when the requirements under the funding agreement have been met.

Interest income

Interest income is recognised in the statement of profit or loss and other comprehensive income on a time proportion basis, using the effective interest rate method.

Foreign currency

Items included in the financial statements of each of the Group's entities are measured using the currency of the primary economic environment in which the entity operates. The Group financial statements are presented in New Zealand dollars, which is ESR's functional currency.

Foreign currency transactions are recorded at the foreign exchange rates in effect at the dates of the transactions. Monetary assets and monetary liabilities denominated in foreign currencies are translated at the rates of exchange ruling at the end of each reporting period. Non-monetary assets and non-monetary liabilities denominated in foreign currencies that are measured at fair value are translated to the functional currency at the exchange rate at the date that the fair value was determined.

Goods and services tax

Items in the statement of profit or loss and other comprehensive income and statement of cash flows are disclosed net of Goods and Services Tax (GST). All items in the statement of financial position are stated net of GST with the exception of receivables and payables, which include GST invoiced.

Dividends

A provision is made for the amount of any dividend declared on or before the end of the financial year but not distributed at balance date.

Financial instruments

The designation of financial assets and financial liabilities by ESR into instrument categories is determined by the business purposes of the financial instruments, policies and practices of management, the relationship with other instruments and the reporting costs and benefits associated with each designation. The designations applied by ESR are reflected in the financial statements.

Financial assets

The Group classifies its financial assets as loans and receivables and at fair value through profit and loss. Management determines the classification of its financial assets at initial recognition.

Loans and receivables are non-derivative financial assets with fixed or determinable payments that are not quoted in an active market. They are included in current assets, except for maturities greater than 12 months after the reporting date, which are classified as non-current assets. ESR's loans and receivables comprise trade and other receivables, investment cash and cash and cash equivalents in the statement of financial position.

Regular purchases and sales of financial assets are recognised on the trade-date – the date on which the Group commits to purchase or sell the asset. Financial assets are derecognised when the rights to receive cash flows from the investments have expired or have been transferred and the Group has transferred substantially all risks and rewards of ownership. Loans and receivables are carried at amortised cost using the effective interest method.

The Group assesses at each reporting date whether there is objective evidence that a financial asset or a group of financial assets is impaired.

Financial liabilities

Financial liabilities held by ESR include trade and other payables, employee benefits and finance lease liabilities.

Such financial liabilities are recognised initially at fair value less transaction costs and subsequently measured at amortised cost using the effective interest rate method. Financial liabilities entered into with durations less than 12 months are recognised at their nominal value.

Derivatives

Derivative financial instruments are recognised both initially and subsequently at fair value. They are reported as either assets or liabilities depending on whether the derivative is in a net gain or net loss position. ESR does not use hedge accounting and as such derivatives are classified as held-for-trading financial instruments with fair value gains or losses recognised in the statement of profit or loss and other comprehensive income. Such derivatives are entered into for risk management purposes.

Adoption status of relevant new financial reporting standards and interpretations

The Group has elected not to early adopt any of the new standards and amendments to existing standards which have been issued as at 30 June 2017 but not yet effective. It is not anticipated that standards not yet effective will significantly impact the financial statements of the Group with the exception of NZ IFRS 15 and NZ IFRS 16.

NZ IFRS 15, Revenue from contracts with customers (effective for annual periods beginning on or after 1 January 2018)

NZ IFRS 15 addresses recognition of revenue from contracts with customers. It replaces the current revenue recognition guidance in NZ IAS 18 Revenue and NZ IAS 11 Construction Contracts and is applicable to all entities with revenue. It sets out a 5 step model for revenue recognition to depict the transfer of promised goods or services to customers in an amount that reflects the consideration to which the entity expects to be entitled in exchange for those goods or services. The Group has yet to assess the full impact of NZ IFRS 15. The Group will apply this standard from 1 July 2018.

NZ IFRS 16, Leases (effective for annual periods beginning on or after 1 January 2019)

NZ IFRS 16 introduces a single lessee accounting model and requires a lessee to recognise right-of-use assets and liabilities for all leases with a term of more than 12 months, unless the underlying asset is of low value. The Group has yet to assess the full impact of NZ IFRS 15. The Group will apply this standard from 1 July 2019.

2. Other expenses

Group	Note	2017 $'000s	2016 $'000s
Fees paid to PricewaterhouseCoopers for:			
- the audit of the statutory financial statements		112	112
- the SHIVERS Project Uniform Guidance audit		28	26
Total audit related fees paid to the auditors		140	138
- taxation compliance and advice		53	31
- benchmarking advice		-	34
Total fees paid to auditors		**193**	**203**
Directors' fees	**17**	202	178
Directors' expenses		55	59
Communication costs (including network charges)		604	667
IT systems maintenance and licence costs		1,376	1,300
Legal and consultancy fees		1,791	1,417
Impairment of receivables (loans and advances)		-	15
Fair value loss/(gain) on forward exchange contract		66	(134)
Office and administration		1,561	1,675
Occupancy and insurance		2,777	2,886
Rental and operating lease costs		689	771
Travel		2,121	1,927
Outsourced costs		2,083	1,093
Other operating costs		326	471
Other expenses		**13,844**	**12,528**

Given the nature of ESR's principal business activities, research comprises part of ESR's everyday business operations. As such, expenses relating to research are not separately identified. The cost of research to ESR is distributed between the relevant expense items, for example employee benefits and scientific materials used.

3. Taxation

Group	Note	2017 $'000s	2016 $'000s
The taxation charge has been calculated as follows:			
Profit/(loss) before income tax expense		**7,081**	**5,457**
Prima facie taxation at 28%		1,983	1,528
Plus taxation effect of:			
Net prior years under / (over) estimation		(1)	-
Non-deductible items		90	87
Tax expense for the year		**2,072**	**1,615**
The tax expense for the year is represented by:			
Current taxation	**10**	2,000	1,466
Deferred taxation	**11**	72	149
		2,072	**1,615**

4. Property, plant and equipment

Group	Freehold land $'000s	Buildings and leasehold improvements $'000s	IT equipment $'000s	Plant, equipment and vehicles $'000s	Assets under construction $'000s	Total $'000s
At 1 July 2015						
Cost	476	29,667	8,811	32,788	44	71,786
Accumulated depreciation	-	(7,732)	(7,641)	(26,165)	-	(41,538)
Net book value at the beginning of the year	**476**	**21,935**	**1,170**	**6,623**	**44**	**30,248**
Year ended 30 June 2016						
Net book value at the beginning of the year	476	21,935	1,170	6,623	44	30,248
Additions	-	86	1,172	1,274	1,941	4,473
Transfers from assets under construction	-	618	-	266	(884)	-
Disposals	-	(59)	-	(67)	-	(126)
Depreciation for the year	-	(922)	(870)	(2,019)	-	(3,811)
Net book value at the end of the year	**476**	**21,658**	**1,472**	**6,077**	**1,101**	**30,784**
At 30 June 2016						
Cost	476	30,278	7,935	33,343	1,101	73,133
Accumulated depreciation	-	(8,620)	(6,463)	(27,266)	-	(42,349)
Net book value at the end of the year	**476**	**21,658**	**1,472**	**6,077**	**1,101**	**30,784**
Year ended 30 June 2017						
Net book value at the beginning of the year	476	21,658	1,472	6,077	1,101	30,784
Additions	-	338	657	1,548	40	2,583
Transfers from assets under construction	-	883	-	67	(950)	-
Reclassification to intangible assets		-	-	-	(151)	(151)
Disposals	-	-	-	(71)	-	(71)
Depreciation for the year	-	(988)	(806)	(1,807)	-	(3,601)
Net book value at the end of the year	**476**	**21,891**	**1,323**	**5,814**	**40**	**29,544**
At 30 June 2017						
Cost	476	31,499	7,583	34,533	40	74,131
Accumulated depreciation	-	(9,608)	(6,260)	(28,719)	-	(44,587)
Net book value at the end of the year	**476**	**21,891**	**1,323**	**5,814**	**40**	**29,544**

IT equipment recognised under finance leases (where ESR is a lessee) included in the above table, has the following values.

Group	2017 $'000s	2016 $'000s
Cost - capitalised finance lease assets	859	1,661
Accumulated depreciation	(589)	(1,153)
Net book value at the end of the year	**270**	**508**

ESR does not have any property, plant and equipment used as security for liabilities.

Restriction on Title

In relation to the transfer of land owned by ESR shareholding ministers shall have regard to the principles of the Treaty of Waitangi in accordance with section 10 of the Crown Research Institutes Act 1992. Properties owned by ESR in Christchurch, Wellington and Auckland have caveats on the land as required by section 31 of the Crown Research Institutes Act 1992, which maintains the general provisions of the Public Works Act 1981. ESR complies with section 31 of the Crown Research Institutes Act 1992.

5. Intangible assets

Group	Computer software - externally purchased $'000s	Computer software - internally generated $'000s	Customer contracts $'000s	Assets under construction $'000s	Total $'000s
At 1 July 2016					
Cost	8,547	8,881	1,338	4,109	22,875
Accumulated amortisation	(6,804)	(3,865)	(799)	-	(11,468)
Net book value at the end of the year	**1,743**	**5,016**	**539**	**4,109**	**11,407**
Year ended 30 June 2016					
Net book value at the beginning of the year	1,743	5,016	539	4,109	11,407
Additions	284	-	-	1,061	1,345
Transfers from assets under construction	101	4,698	-	(4,799)	-
Amortisation for the year	(573)	(912)	(223)	-	(1,708)
Net book value at the end of the year	**1,555**	**8,802**	**316**	**371**	**11,044**
At 30 June 2016					
Cost	8,284	13,465	1,338	371	23,458
Accumulated amortisation and impairment losses	(6,729)	(4,663)	(1,022)	-	(12,414)
Net book value at the end of the year	**1,555**	**8,802**	**316**	**371**	**11,044**
Year ended 30 June 2017					
Net book value at the beginning of the year	1,555	8,802	316	371	11,044
Additions	226	57	-	246	529
Transfers from assets under construction	-	314	-	(314)	-
Reclassification from property plant and equipment				151	151
Amortisation for the year	(566)	(1,135)	(223)	-	(1,924)
Net Book Value at the End of the Year	**1,215**	**8,038**	**93**	**454**	**9,800**
At 30 June 2017					
Cost	8,503	13,836	1,338	454	24,131
Accumulated amortisation and impairment losses	(7,288)	(5,798)	(1,245)	-	(14,331)
Net book value at the end of the year	**1,215**	**8,038**	**93**	**454**	**9,800**

ESR does not have any intangible assets whose title is restricted or used as security for liabilities.
Intangible assets include ESR's laboratory operating system with a net book value of $7,700,000 (2016; $8,784,000). The laboratory operating system has an estimated remaining useful life of 7 years.

6. Trade and other receivables

Group	2017 $'000s	2016 $'000s
Trade debtors	6,648	6,968
Provision for doubtful debts	(68)	(75)
	6,580	6,893
Prepayments	1,078	995
	7,658	**7,888**

As at 30 June 2017, trade receivables of $204,000 (2016: $316,000) were past due but not impaired. These relate to a number of customers for whom there is no recent history of default. The ageing analysis of these trade receivables is as follows:

Past due 1 - 30 days	86	125
Past due 31 - 60 days	29	72
Past due > 61 days	89	119
	204	**316**

7. Trade and other payables

Group	2017 $'000s	2016 $'000s
Accrued expenses	2,621	2,485
GST payable	12	180
Revenue in advance	4,591	1,563
Trade payables	4,216	4,771
	11,440	**8,999**

Accrued expenses in 2016 included a provision for $196,000 for the disposal of a Cobalt 60 source (2017: nil).

8. Employee benefits

Group	2017 $'000s	2016 $'000s
Annual leave accrual	2,972	2,681
Service leave accrual	237	234
Other	13	10
Current liabilities	**3,222**	**2,925**
Service leave accrual	1,220	1,107
Retirement leave accrual	72	84
Other	-	3
Non-current liabilities	**1,292**	**1,194**

9. Finance lease liabilities

Future minimum lease payments are as follows:

Group	2017 $'000s	2016 $'000s
Not later than one year	244	300
Later than one year and not later than five years	52	249
Total minimum lease payments	**296**	**549**
Future finance charges on finance leases	(12)	(41)
Present value of finance lease liabilities	**284**	**508**

The finance leases relates to IT equipment. Upon termination of the initial lease period, ESR can either choose to extend the term further, or return the leased assets to the lessor. There is no option to purchase the leased assets upon termination of the lease.

The present value of finance lease liabilities are as follows:

Group	2017 $'000s	2016 $'000s
Not later than one year	234	258
Later than one year and not later than five years	50	250
	284	**508**

10. Income tax payable

Group	2017 $'000s	2016 $'000s
Balance payable at the beginning of the year	730	359
Current year charge	2,000	1,466
Prior period adjustment	(40)	(50)
Provisional taxation payments	(2,070)	(1,045)
Balance at the end of the year	**620**	**730**

11. Deferred taxation

Deferred tax liabilities/(assets) are attributed to the following:

Group	2017 $'000s	2016 $'000s
Balance at the beginning of the year	3,773	3,574
Transfer from current tax	40	50
Charge to statement of profit or loss and other comprehensive income	72	149
Balance at the end of the year	**3,885**	**3,773**

	Accelerated tax depreciation $'000s	Employee benefits $'000s	Provisions and other items $'000s	Total $'000s
Year ended 30 June 2016				
Balance at the beginning of the year	4,697	(1,033)	(90)	3,574
Over provision in prior years	-	50	-	50
Current year charge / (credit) to statement of profit or loss and other comprehensive income	431	(206)	(76)	149
Balance at the end of the year	**5,128**	**(1,189)**	**(166)**	**3,773**
Year ended 30 June 2017				
Balance at the beginning of the year	5,128	(1,189)	(166)	3,773
Over provision in prior years	-	40	-	40
Current year charge / (credit) to statement of profit or loss and other comprehensive income	148	(166)	90	72
Balance at the end of the year	**5,276**	**(1,315)**	**(76)**	**3,885**

There are no unrecognised deferred tax assets or liabilities.

12. Borrowings

The multi-option credit facility with Westpac Banking Corporation was cancelled during the year (2016 facility: $3,000,000). The facility was not used during the year.

13. Equity

Share capital

Group	2017 $'000s	2016 $'000s
8,494,000 Ordinary $1 Shares (issued and fully paid)	**8,494**	**8,494**

All ordinary shares rank equally with one vote attached to each fully paid ordinary share.
No dividends were proposed or declared for the 30 June 2017 year (2016: nil).

14. Reconciliation of profit/(loss) after taxation to cash flows from operating activities

Group	Note	2017 $'000s	2016 $'000s
Profit for the year after taxation		**5,009**	**3,842**
Non-cash items:			
Depreciation and amortisation expense	**4, 5**	5,525	5,519
Increase in provisions		-	37
Increase in provision for doubtful debts	**2**	-	15
Increase in deferred tax liability	**11**	112	149
Fair value loss / (gain) on derivative financial instruments	**2**	66	(134)
		5,703	**5,586**
Changes in working capital:			
Decrease / (increase) in trade and other receivables		230	2,904
Decrease / (increase) in inventories		6	(247)
(Decrease) / increase in trade and other payables		2,441	(2,807)
(Decrease) / increase in income tax payable		(110)	371
(Decrease) / increase in employment benefits		395	693
(Decrease) / increase in financial liabilities		-	(161)
		2,962	**753**
Items classified as investing and financing activities:			
Profit / loss on disposal of property, plant and equipment		(1)	62
Decrease / (increase) in trade payables related to property, plant and equipment		252	(151)
Finance charge on leases		14	14
		265	**(75)**
Net cash inflow from operating activities		**13,939**	**10,106**

15. Investments

Subsidiary companies

ESR has one wholly owned, non-trading, subsidiary company:

Name	Balance Date	Country of Incorporation
ESR Limited	30 June	New Zealand

The subsidiary has remained non-trading during the period.
At balance date the investment in the subsidiary had a nil carrying value.

Investments

ESR holds 18 shares in Kiwi Innovation Network Limited and the investment has a carrying value of $30,000 (2016: $30,000)

16. Commitments

Capital commitments

Group	2017 $'000s	2016 $'000s
Property, plant and equipment	1,193	431
Intangible assets - software	73	58
Total capital commitments	**1,266**	**489**

Operating lease commitments

The future aggregate minimum lease payments under non-cancellable operating leases are as follows:

Group	2017 $'000s	2016 $'000s
Not later than one year	33	58
Later than one year and not later than five years	54	1
Total operating commitments	**87**	**59**

ESR leases land, buildings, equipment and vehicles. These are renewal options in respect of the land and building leases. There are no renewal options or options to purchase in respect of vehicles held under operating leases.

ESR has a number of standard operational agreements for the purchase of materials and consumables that have both fixed and variable components, some of which extend beyond one year.

17. Related party transactions and key management personnel

Related party transactions

ESR is a wholly owned entity of the Crown. ESR enters into transactions with other Crown entities and Government departments.

Related parties include the entities disclosed in note 15. There have been no transactions with these related parties in the year ended 30 June 2017 (30 June 2016: nil).

The following transactions were carried out with related parties:

- Fees paid to Directors during the year were $201,846 (30 June 2016: $178,250). There were no Directors' fees payable at balance date (30 June 2016: $7,667).

No provision has been required, nor any expense recognised, for impairment of receivables from related parties.

Key management personnel compensation

Key management personnel comprise the Chief Executive Officer, members of the Senior Leadership Team and the Directors. Key management personnel compensation is disclosed below.

Group	2017 $'000s	2016 $'000s
Salaries and other short-term employee benefits	1,950	1,877
Other long-term employee benefits	16	16
Directors' fees	202	178
Total key management personnel compensation	**2,168**	**2,071**

18. Financial instruments by category

Group		Loans and receivables $'000s	Fair value through profit or loss $'000s	Total $'000s
30 June 2016				
Assets as per balance sheet				
Trade and other receivables excluding prepayments		6,893	-	6,893
Derivative financial instruments		-	134	134
Cash and cash equivalents		12,364	-	12,364
Total		**19,257**	**134**	**19,391**

		Financial liabilities at amortised cost $'000s	Fair value through profit or loss $'000s	Total $'000s
Liabilities as per balance sheet				
Finance lease liabilities		508	-	508
Employee benefits		4,119	-	4,119
Trade payables and accrued expenses		7,256	-	7,256
Total		**11,883**	**-**	**11,883**

		Loans and receivables $'000s	Fair value through profit or loss $'000s	Total $'000s
30 June 2017				
Assets as per balance sheet				
Trade and other receivables excluding prepayments	6	6,580	-	6,580
Derivative financial instruments		-	68	68
Cash and cash equivalents		6,773	-	6,773
Investment cash		16,000	-	16,000
Total		**29,353**	**68**	**29,421**

		Financial liabilities at amortised cost $'000s	Fair value through profit or loss $'000s	Total $'000s
Liabilities as per balance sheet				
Finance lease liabilities	9	284	-	284
Employee benefits		4,514	-	4,514
Trade payables and accrued expenses	7	6,837	-	6,837
Total		**11,635**	**-**	**11,635**

19. Financial risk management

ESR's activities are exposed to a variety of financial risks: market risk, credit risk, liquidity risk, cash flow risk and fair value interest-rate risk. ESR's overall risk management programme focuses on the unpredictability of financial markets and seeks to minimise potential adverse effects on ESR's financial performance. The policies approved and financial instruments being utilised at balance date are outlined below.

a) Market risk

In accordance with its Treasury Management Policy, ESR uses derivative financial instruments to economically hedge its exposure to foreign exchange risks from its operational, financing and investment activities. These derivatives are classified at fair value through profit or loss, and gains and losses are recognised in the statement of profit or loss and other comprehensive income.

i) Foreign exchange risk

Foreign exchange risk occurs as a result of transactions denominated in a currency other than ESR's functional currency of New Zealand dollars. Currencies commonly transacted in, and giving rise to foreign exchange risk include the United States dollar, Australian dollar, euro and the pound sterling. ESR is subject to foreign currency risk through its trade receivables and trade payables balances.

Where a material foreign currency balance is entered into (exposures equivalent to greater than New Zealand dollar $100,000), ESR is required by the Treasury Management Policy to hedge its exposure to the currency through the use of forward exchange contracts.

ESR held one forward exchange contract of US $363,000 at 30 June 2017 (30 June 2016: US $1,111,000).

The carrying amounts of the Group's trade and other receivables denominated in foreign currencies are:

Group	2017 $'000s	2016 $'000s
US dollar	1,478	984
Euro	110	111
Australian dollar	5	71
Pound sterling	25	51
	1,618	**1,217**

The carrying amounts of the Group's trade and other payables denominated in foreign currencies are:

Group	2016 $'000s	2015 $'000s
US dollar	134	32
Euro	36	14
Australian dollar	28	128
Pound sterling	14	-
Others	4	3
	216	**177**

ii) Interest rate risk

As at reporting date, ESR is subject to interest rate risk through the holding of cash and cash equivalents and investment cash. ESR uses a mixture of call and short-term deposit investment accounts to hold excess funds. Available interest rates are monitored to ensure the best return on cash.

iii) Market risk sensitivity analysis

ESR is exposed to market risk through the holding of the following financial instruments: cash, trade receivables and trade payables. ESR management has analysed the below sensitivities in market risk factors over a 12 month period:

- proportional foreign exchange rate movement of -10% (depreciation of New Zealand dollar) and +10% (appreciation of New Zealand dollar) against foreign currencies; and
- a parallel shift of +1%/-1% in market interest rates in New Zealand.

If these movements were to occur (all other variables held constant), the impact on ESR's reported net profit after tax for the year ended 30 June 2017 would be:

- foreign currency $683,000 (30 June 2016: $237,000)
- interest rate $65,000 (30 June 2016: $108,000)

b) Credit risk

Credit risk refers to the risk that a counterparty will default on its contractual obligations, resulting in financial loss to ESR. The financial instruments which expose ESR to credit risk are, principally, cash and cash equivalents, investment cash and trade receivables.

Bank balances and short-term investments (comprising cash and cash equivalents and investment cash) are held with New Zealand registered banks in accordance with ESR's Treasury Management Policy.

The majority of high value trade receivables comprise government entities and therefore the potential risk of default is low. ESR has a Contracts Policy which requires assessment of credit worthiness of potential clients, where the value of the contract is material as defined in the policy.

A provision for doubtful debts is maintained in respect of trade receivables and this is reassessed on a regular basis. No collateral is held by ESR in respect of cash and cash equivalents, investment cash and trade receivables as at 30 June 2017 (30 June 2016: nil).

The carrying amount of financial assets recognised in the statement of financial position best represents ESR's maximum exposure to credit risk at the reporting date.

As at 30 June 2017 the trade receivables balance included $2,079,000 (30 June 2016: $4,610,000) owed by entities within, or owned by, the New Zealand Government. It is not believed that there is any material risk of loss with these receivables.

c) Liquidity risk

Prudent liquidity risk management implies the availability of funding through adequate levels of committed credit facilities. Liquidity risk is monitored through the forecasting of cash flows, and ensuring that the committed credit lines in place remain adequate for requirements.

The contractual undiscounted maturity analysis of financial liabilities is presented below:

Group	2017					2016				
	Carrying value $'000s	Less than 1 year $'000s	1-2 years $'000s	2-5 years $'000s	Greater than 5 years $'000s	Carrying value $'000s	Less than 1 year $'000s	1-2 years $'000s	2-5 years $'000s	Greater than 5 years $'000s
Trade payables	6,837	6,837	-	-	-	7,256	7,256	-	-	-
Employee benefits	4,514	3,222	68	37	1,187	4,119	2,925	59	45	1,090
Finance lease liabilities	284	234	50	-	-	508	255	224	26	-
	11,635	**10,293**	**118**	**37**	**1,187**	**11,883**	**10,439**	**283**	**71**	**1,090**

d) Fair values

The carrying value of financial assets and liabilities recorded in the financial statements approximate their fair values.

Fair value is generally based on the contracted amount payable/receivable of financial assets and financial liabilities, being the amount for which the financial instrument is to be exchanged. Fair value includes the impact of any assessed impairment of the financial instruments – please refer to the statement of significant accounting policies for details of each financial instrument and their recognition criteria.

e) Capital risk management

ESR's objectives when managing capital are to maintain financial stability, achieve sustainable growth and to realise its strategic goals and targets, all within the risk appetite of its shareholders and management.

In line with government requirements, ESR monitors its capital structure through the return on equity and gearing ratios. Government provides ESR with guidelines with the expectation that an appropriate average return is achieved over time, rather than requiring that ESR meet the specified targets annually.

Each year ESR internally sets return on equity and gearing ratio targets, bearing in mind the overall results expected by Government. The ratios are reported in the Statement of Corporate Intent.

The return on equity and gearing ratios as at 30 June 2017, and 30 June 2016 were as follows, along with the relevant annual targets set by ESR.

Group **Return on equity ratio**	**2017** **$'000s**	**2016** **$'000s**
Profit/(loss) for the year	5,009	3,842
Average equity	**47,495**	**43,069**
Actual ratio	**10.5%**	**8.9%**
Target ratio	**5.7%**	**5.5%**
Gearing ratio		
Net debt		
Finance lease liabilities - current	234	258
Finance lease liabilities - non current	50	250
	284	**508**
Equity	**49,999**	**44,990**
Actual ratio	**0.6%**	**1.1%**
Target ratio	**0.4%**	**0.5%**

20. Contingent liabilities

The directors are satisfied that there are no claims outstanding that would have a material impact on ESR's financial position as at 30 June 2017 (30 June 2016: Nil).

21. Subsequent events

There were no events subsequent to reporting date that require disclosure in the financial statements.

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ANZ Bank New Zealand Limited

Solicitor

Buddle Findlay

Presented to the House of Representatives pursuant to Section 44 of the Public Finance Act 1989.

The Institute of Environmental Science and Research Limited (ESR) is a Crown research institute. It was incorporated in July 1992 and is wholly owned by the New Zealand Government. The two shareholding ministers appoint a Board of Directors to govern the organisation. ESR has science centres in Auckland, Wellington (Porirua and Wallaceville) and Christchurch.

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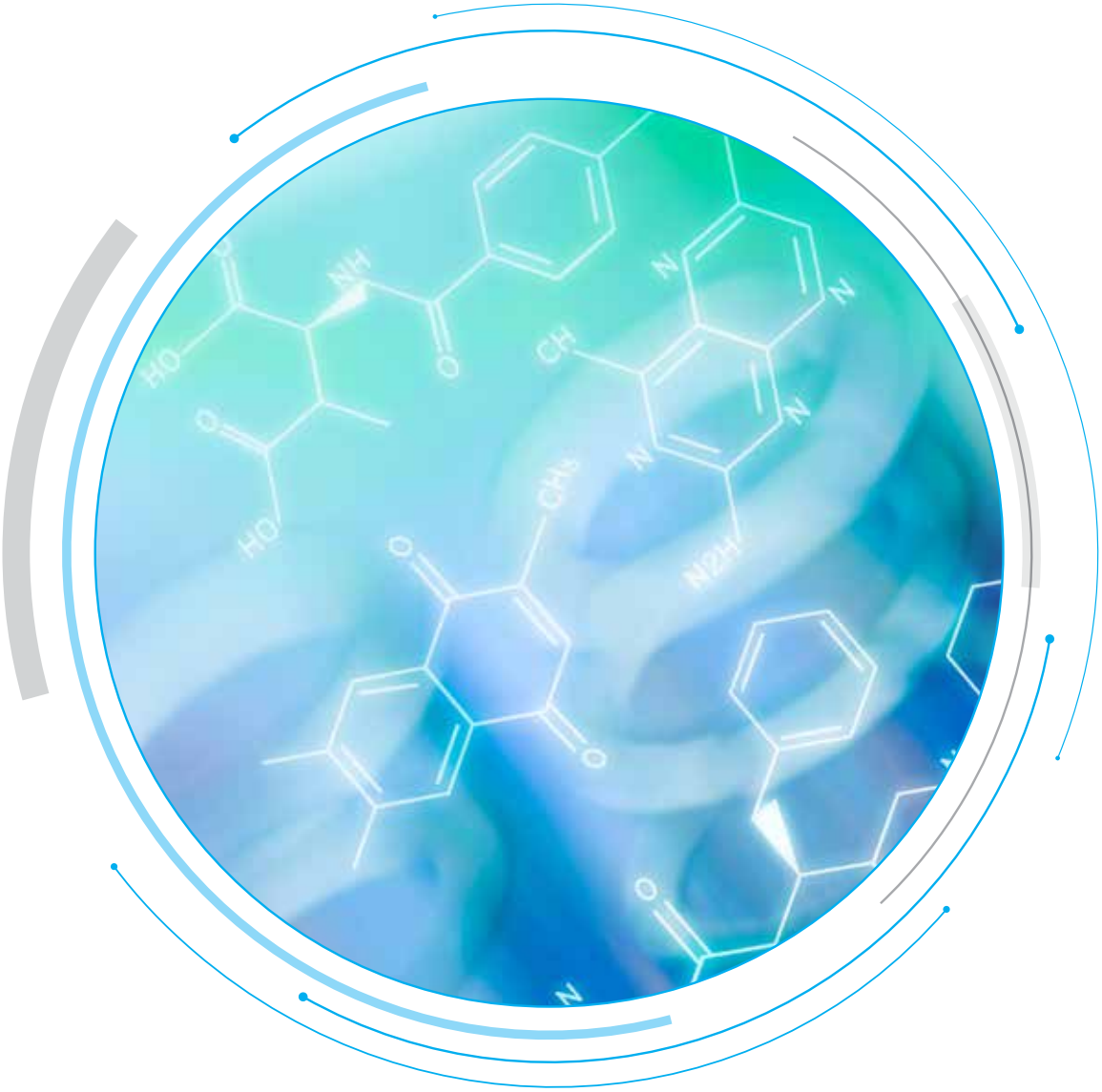

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