

# National Research Council Canada

2017–18

## **Departmental Results Report**

Supplementary Information Tables

This supporting document will be published only on NRC's website in HTML format.

## Contents

Departmental Sustainable Development Strategy .....	3
1. Context for the Departmental Sustainable Development Strategy	3
2. Sustainable Development in NRC .....	3
3. Departmental performance highlights .....	4
4. Report on integrating sustainable development .....	5
Details on transfer payment programs of \$5 million or more .....	6
International Astronomical Observatories Program .....	6
TRIUMF .....	9
Industrial Research Assistance Program (IRAP) .....	12
Canada Accelerator and Incubator Program (CAIP) .....	14
Evaluations .....	16
Fees .....	17
Horizontal initiatives .....	17
Internal audits .....	28
Response to parliamentary committees and external audits .....	28
Response to parliamentary committees .....	28
Response to audits conducted by the Auditor General (including to the Commissioner of the Environment and Sustainable Development) .....	28
Response to audits conducted by the Public Service Commission of Canada or the Office of the Commissioner of Official Languages .....	28

## Departmental Sustainable Development Strategy

### 1. Context for the Departmental Sustainable Development Strategy

The [2016–2019 Federal Sustainable Development Strategy](#) (FSDS):

- sets out the Government of Canada’s sustainable development priorities
- establishes goals and targets
- identifies actions to achieve them, as required by the [Federal Sustainable Development Act](#)

in keeping with the objectives of the Act to make environmental decision-making more transparent and accountable to Parliament, NRC supports reporting on the implementation of the FSDS and its Departmental Sustainable Development Strategy, or equivalent document, through the activities described in this supplementary information table.

### 2. Sustainable Development in NRC

NRC’s Departmental Sustainable Development Strategy for 2017 to 2020 describes NRC’s actions in support of achieving the FSDS goal of low-carbon government. This supplementary information table presents available results for NRC’s actions pertinent to this goal. Last year’s supplementary information table is posted on [NRC’s website](#).

In addition to Green Procurement, the NRC will share energy and emission data with the Treasury Board Secretariat Centre for Greening Government, and NRC will develop a strategy to meet the target of 40% reduction in emissions.

### 3. Departmental performance highlights

FSDS goal: low-carbon government

FSDS target	FSDS contributing action	Corresponding departmental actions	Support for UN Sustainable Development Goal target	Starting point(s), target(s) and performance indicator(s) for departmental actions	Results achieved
Reduce greenhouse gas emissions from federal government buildings and fleets by 40% below 2005 levels by 2030, with an aspiration to achieve it by 2025	Support the transition to a low-carbon economy through green procurement	Procurement officers are required to take green procurement training.	12.7	Percent of procurement officers who have received green procurement training: Baseline = 100% on March 31, 2017 Target = 100% by March 31, 2018	100%
		Maintenance contract proposals require proponents to include green considerations as part of their services.	12.7	Percent of janitorial, snow removal and major maintenance contracts having green considerations: Baseline = 80% on March 31, 2017 Target = 90% by March 31, 2018	86%

#### 4. Report on integrating sustainable development

During the 2017–18 reporting cycle, NRC completed no proposals that required a Strategic Environmental Assessment for which a public statement was produced.

.

## Details on transfer payment programs of \$5 million or more

### International Astronomical Observatories Program

#### General information

<b>Name of transfer payment program</b>	International Astronomical Observatories Program
<b>Start date</b>	1978
<b>End date</b>	Ongoing
<b>Type of transfer payment</b>	Contribution
<b>Type of appropriation</b>	Estimates
<b>Fiscal year for terms and conditions</b>	2015-16
<b>Strategic Outcome</b>	SO 2. R&D Infrastructure for an innovative and knowledge-based economy
<b>Link to department's Program Alignment Architecture</b>	Sub-Program 2.1.1: National Science Infrastructure
<b>Description</b>	<p>Astronomy has become a global science. The increasing cost of leading-edge observatories and the scarcity of ideal observation sites have led to a greater focus on international collaboration for large-scale astronomy projects which lead to advances in our knowledge and understanding of the universe.</p> <p>NRC, in collaboration with other international bodies, provides financial contributions to support the management and operations of offshore ground-based observatories and their related facilities, including the Canada-France-Hawaii Telescope (CFHT), the twin telescopes of the Gemini Observatory and the Atacama Large Millimetre/sub-millimetre Array (ALMA). NRC participates in the oversight and direction of these facilities and their research capabilities. NRC also represents Canada in the Square Kilometre Array (SKA) consortium for the pre-construction phase of the telescope. In 2015, Canada joined the international partnership to participate in the Thirty Meter Telescope (TMT). NRC, on behalf of Canada, provides both financial and in-kind contributions.</p> <p>International agreements governing these observatories are long-term commitments that specify contributions to support preconstruction design and development, construction, operation and maintenance, capital improvements (e.g., development of new astronomical instruments and other facility upgrades) and decommissioning of the international ground-based observatories and their related facilities. In addition, they include commitments to support the university-based user communities to ensure a fair and progressive use of these observatories. NRC participates in the governance of these international facilities on behalf of the Canadian astronomy research community and provides appropriate support, including sophisticated data management services and instrumentation. Through NRC's financial and in-kind contributions, the Canadian astronomy community is assured merit-based access to these facilities with appropriate support.</p> <p>Recipients are not required to repay funds obtained under this transfer payment program.</p>

<p><b>Results achieved</b></p>	<ul style="list-style-type: none"> <li>• The Canadian Astronomy Data Centre (CADC) delivered 170 million files to users (a 50% increase over 2016), 1593 Terabytes of files to approximately 11,000 astronomers. The number of registered users (not all of whom downloaded data) was approximately 8000 in 2017.</li> <li>• The CADC completed a joint project with the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) to unify the Hubble Space Telescope (HST) archive services. This merging of the archive service reduces the staffing burden needed to support the HST archive and prepares the CADC for its role as one of three mirror sites for the James Webb Space Telescope that is expected to be launched in 2021.</li> <li>• 443 scientific papers were published by users based on data obtained using the Canada-France-Hawaii Telescope (CFHT) and the Gemini Observatory. 335 scientific papers were published based on data obtained using the Atacama Large Millimeter Array (ALMA) Observatory.</li> <li>• Demand by astronomers for telescope access continued to exceed the time available by a factor ranging from 2.6 to 7.9, depending on the telescope. This is as a reliable indicator of the relevance of the observatory and of its instrumentation.</li> <li>• \$3.0M in service contracts were signed with industry partners in support of astronomy technology R&amp;D activities.</li> <li>• The Honourable Kirsty Duncan, Minister of Science and of Sport and Persons with Disabilities, inaugurated Canada’s newest and largest radio telescope: the CHIME (Canadian Hydrogen Intensity Mapping Experiment) telescope, located at the NRC’s unique Dominion Radio Astrophysical Observatory (DRAO) site in Penticton, BC. This telescope will allow scientists to measure the expansion of the universe over the period between 7 and 11 billion years ago. Those measurements are expected to explain the properties of dark energy, a poorly-understood source of pressure that is thought to prevent the universe from collapsing under the force of gravity.</li> </ul>
<p><b>Comments on variances</b></p>	<p>The significant variance of \$77,706,320 between the planned spending of \$96,334,149 and actual spending of \$21,903,992 is due primarily to project delays associated with Canada’s participation in the construction of the Thirty Meter Telescope (TMT) that are outside NRC’s control. As a result, NRC has re-profiled \$76,114,850 of its 2017-18 funding related with Canada’s contribution to the TMT to 2018-19.</p>
<p><b>Audits completed or planned</b></p>	<p>Not applicable</p>
<p><b>Evaluations completed or planned</b></p>	<p>Evaluation completed in 2016-17. <a href="#">Evaluation of NRC Herzberg Astronomy and Astrophysics (HAA) Portfolio</a></p>
<p><b>Engagement of applicants and recipients</b></p>	<p>NRC manages observatories established or maintained by the Government of Canada for the benefit of the Canadian astronomy research community, aligning its contributions to the priorities of the community’s Long Range Plan for Astronomy and Astrophysics. NRC participates on the Boards that oversee the observatories to ensure that the science directions and programs of the facilities reflect Canadian strengths and interests. In addition, NRC ensures that these activities increase opportunities for Canadian researchers and firms to develop relevant instrumentation for the observatories. To carry out its roles effectively, NRC provides current information about each observatory to research community-based committees of scientists, which provide expert advice on observatory operations and development. NRC provides extensive support to the user community through numerous services extending from administering the time allocation process for Canadian researchers through to delivery of science-ready data (through its Canadian Astronomy Data Centre).</p>

Performance information (dollars)

Type of Transfer Payment	2015-16 Actual spending	2016–17 Actual spending	2017-18 Planned spending	2017-18 Total authorities available for use	2017-18 Actual spending (authorities used)	Variance (2017-18 actual minus 2017-18 planned)
Total grants	-	-	-	-	-	-
Total contributions	15,406,533	20,991,704	99,610,312	100,734,149	21,903,992	(77,706,320)
Total other types of transfer payments	-	-	-	-	-	-
<b>Total program</b>	15,406,533	20,991,704	99,610,312	100,734,149	21,903,992	(77,706,320)

## TRIUMF

### General information

<b>Name of transfer payment program</b>	TRIUMF(voted)
<b>Start date</b>	1977
<b>End date</b>	Ongoing
<b>Type of transfer payment</b>	Contribution
<b>Type of appropriation</b>	Estimates
<b>Fiscal year for terms and conditions</b>	2014-15
<b>Strategic Outcome</b>	SO 2: R&D Infrastructure for an innovative and knowledge-based economy
<b>Link to department's Program Alignment Architecture</b>	Sub-Program 2.1: Science Infrastructure and Measurement
<b>Description</b>	<a href="#">TRIUMF</a> is Canada's particle accelerator centre. The laboratory is one of Canada's key investments in large-scale research infrastructure. It provides world-class facilities for research in sub-atomic physics, accelerator science, life sciences, and materials science. A consortium of 20 Canadian universities (13 full members and 7 associate members) owns and operates TRIUMF. TRIUMF receives the majority of its federal operating funding through NRC in five-year allocations via a Contribution Agreement. NRC plays an important oversight and stewardship role for TRIUMF on behalf of the Government of Canada. Recipients are not required to repay funds obtained under this transfer payment program.

<p><b>Results achieved</b></p>	<p><b>World-class science and advancement of the ARIEL facility.</b></p> <ul style="list-style-type: none"> <li>• TRIUMF contributed to the publication of 307 manuscripts in scientific journals to advance science and Canada’s reputation on the world stage.</li> <li>• TRIUMF remained on schedule for completing construction of <a href="#">ARIEL</a> by 2023. This new infrastructure will allow for the simultaneous operation of multiple experiments, opening new frontiers in science, medicine and business.</li> <li>• TRIUMF participated in an international collaboration that demonstrated the first ultra-cold neutrons in Canada, achieving a major milestone in understanding fundamental physics measurement including contributing to solving the puzzle of why there is much more matter than antimatter in the universe.</li> </ul> <p><b>New and retained talent, and continued support for international research collaborations and partnerships.</b></p> <ul style="list-style-type: none"> <li>• TRIUMF hosted 875 scientific visitors, students, and users (of which 506 came from international institutions).</li> <li>• TRIUMF trained 251 highly qualified personnel, including undergraduate and graduate students, and post-doctoral researchers.</li> </ul> <p><b>Increased industry and community linkages for increasing the economic and societal benefit delivered to Canada.</b></p> <ul style="list-style-type: none"> <li>• TRIUMF transferred new technology to ARTMS Products for producing a critical medical isotope by enabling its production using hospital-based medical cyclotrons, instead of nuclear reactors. The Canadian spinoff company has commercialized this technology globally. ARTMS received a 2017 BC Technology Association Award for the Most Promising Pre-Commercial Technology.</li> <li>• TRIUMF’s commercialization arm helped secure venture capital funding for two spin-off companies: ARTMS Products and CRM GeoTomography to commercialize technology for production of medical isotopes.</li> </ul> <p><b>Enhanced operational efficiency</b></p> <ul style="list-style-type: none"> <li>• TRIUMF launched a new Project Management Office to improve project governance and strengthen the overall resource planning across all projects in the laboratory.</li> <li>• TRIUMF established weekly management safety walkthroughs and initiated efforts to optimize space utilization and improve work processes.</li> <li>• TRIUMF recruited a Chief Operating Officer to improve operational efficiency.</li> <li>• The laboratory also carried out a comprehensive safety culture assessment led by an independent expert, which ultimately found a mature safety culture in place.</li> </ul>
<p><b>Comments on variances</b></p>	<p>No variances</p>
<p><b>Audits completed or planned</b></p>	<p>Not applicable</p>
<p><b>Evaluations completed or planned</b></p>	<p>Evaluation completed in 2013-14. <a href="#">Evaluation of NRC’s Contribution to TRIUMF</a>. The next evaluation is scheduled for 2018-19.</p>

<b>Engagement of applicants and recipients</b>	<p>NRC provides stewardship to TRIUMF, administering operational funding to the facility and monitoring all matters pertaining to the contribution agreement with the facility. Oversight of TRIUMF operations is provided by the Advisory Committee on TRIUMF (ACOT) which reports to NRC and the Agency Committee on TRIUMF (ACT), comprised of the federal funders of TRIUMF.</p> <p>The Advisory Committee on TRIUMF (ACOT) is composed of international experts within disciplines that cover the research and technology activities of TRIUMF. ACOT reports its findings to NRC twice annually, making recommendations on management issues as well as reporting on the scientific and technological achievements of TRIUMF.</p> <p>Representatives of the National Sciences and Engineering Research Council of Canada (NSERC), the Canadian Institute of Nuclear Physics and the Canadian Institute of Particle Physics are observer members who ensure that TRIUMF's directions are aligned with the research community's needs and that TRIUMF is working with all constituencies of the Canadian sub-atomic physics community.</p> <p>NRC maintains an ex officio presence on TRIUMF's Board of Management and on TRIUMF's Audit Committee. Dialogue is maintained between NRC and the recipient to ensure that investments made by the Government of Canada are optimal, and that NRC meets the needs of its recipient as well as providing a vehicle for feedback on the transfer payment management process.</p> <p>As a magnet for young minds, TRIUMF has designed numerous programs aimed at young people, students, teachers and the general public, to ensure that as many as possible benefit from the scientific program and the excitement that exists within one of Canada's premier laboratories.</p>
--	---

Further information is available from the TRIUMF website at [www.TRIUMF.ca](http://www.TRIUMF.ca) .

Performance information (dollars)

Type of Transfer Payment	2015-16 Actual spending	2016–17 Actual spending	2017-18 Planned spending	2017-18 Total authorities available for use	2017-18 Actual spending (authorities used)	Variance (2017-18 actual minus 2017-18 planned)
Total grants	-	-	-	-	-	-
Total contributions	50,832,000	53,672,000	54,572,800	54,572,800	54,572,800	0
Total other types of transfer payments	-	-	-	-	-	-
<b>Total program</b>	50,832,000	53,672,000	54,572,800	54,572,800	54,572,800	0

## Industrial Research Assistance Program (IRAP)

### General information

<b>Name of transfer payment program</b>	Industrial Research Assistance Program (voted)
<b>Start date</b>	1965
<b>End date</b>	Ongoing
<b>Type of transfer payment</b>	Contribution
<b>Type of appropriation</b>	Estimates
<b>Fiscal year for terms and conditions</b>	2012-13
<b>Strategic Outcome</b>	SO1: Canadian businesses prosper from innovative technologies
<b>Link to department's Program Alignment Architecture</b>	Program 1.2: Industrial Research Assistance Program
<b>Description</b>	<p>The Program contributes to the growth and prosperity of Canadian small and-medium sized enterprises (SMEs) by stimulating innovation, adoption and/or commercialization of technology-based products, services, or processes in Canada. This is done through: 1) technical and related business advice and networking facilitated by a cross-Canada network of field professional staff; 2) cost-shared merit-based contributions; and 3) contributions supporting employment of post-secondary graduates. This Program uses funding from the following transfer payments: Contributions to Firms; Contributions to Organizations; and Youth Employment Program (YEP).</p> <p>NRC IRAP supports the placement of graduates in SMEs through its participation in the delivery of YEP sponsored by Employment and Social Development Canada's Youth Employment Strategy (YES).</p> <p>Recipients are not required to repay funds obtained under this transfer payment program.</p>
<b>Results achieved</b>	Results are described in detail under Program 1.2 Industrial Research Assistance Program in NRC's 2017-18 Departmental Results Report.
<b>Comments on variances</b>	There is a \$15,680,519 variance between the planned spending of \$176,644,000 and actual spending of \$192,324,519. This variance is mainly due to two budget increases received during the fiscal year; \$10,000,000 for Youth Green contributions that was announced in Budget 2016-17 and; a transfer from Employment and Social Development Canada to the Youth Employment Strategy Career Focus Program in the amount of \$10,000,000. This is offset by a several unrealized opportunities including \$2,500,000 in deferred recruiting to Youth Green due to late receipt of funding during the fiscal year.
<b>Audits completed or planned</b>	Audit completed in 2016-17. <a href="#">Audit of Industrial Research Assistance Program (IRAP) - SONAR</a>

<b>Evaluations completed or planned</b>	An evaluation of IRAP was completed in 2017-18. The next evaluation is planned to be completed in 2022-23.
<b>Engagement of applicants and recipients</b>	<p>NRC IRAP is a national program managed on a regional basis with over 240 Industrial Technology Advisors (ITAs) located in approximately 100 communities across the country, who provide customized advice to technologically innovative small and medium-sized enterprises (SMEs). ITAs are engaged with client SMEs throughout the entire contribution management process, from building project proposals through to project completion.</p> <p>At the end of their funded project, recipients are required to complete an online Post-Project Report. This assessment captures information on the recipient's experience with NRC IRAP and, along with published service standards, is used by the program to develop continuous program improvements.</p> <p>NRC IRAP has an Advisory Board composed of 10 to 12 members from the industry sector and industry associations. This Board provides advice to NRC IRAP management and brings an external perspective on the strategic directions and management of the program.</p> <p>NRC IRAP is actively engaged with Treasury Board Secretariat Grants and Contributions Reform. Participation in workshops and constant alignment with recent Treasury Board Secretariat policy and guidelines has enabled the program to steadily move toward principles such as a Recipient Engagement Strategy.</p>

Performance information (dollars)

Type of Transfer Payment	2015-16 Actual spending	2016–17 Actual spending	2017-18 Planned spending	2017-18 Total authorities available for use	2017-18 Actual spending (authorities used)	Variance (2017-18 actual minus 2017-18 planned)
Total grants	-	-	-	-	-	-
Total contributions	205,299,766	242,922,833	176,644,000	196,644,000	192,314,017	15,670,017
Total other types of transfer payments	-	-	-	-	-	-
<b>Total program</b>	205,299,766	242,922,833	176,644,000	196,644,000	192,314,017	15,670,017

## Canada Accelerator and Incubator Program (CAIP)

### General information

<b>Name of transfer payment program</b>	Canada Accelerator and Incubator Program (CAIP)
<b>Start date</b>	2013-10-01
<b>End date</b>	2019-03-31
<b>Type of transfer payment</b>	Contribution
<b>Type of appropriation</b>	Estimates
<b>Fiscal year for terms and conditions</b>	2013-14
<b>Strategic Outcome</b>	SO1: Canadian businesses prosper from innovative technologies
<b>Link to department's Program Alignment Architecture</b>	Program 1.2: Industrial Research Assistance Program
<b>Description</b>	The CAIP is a 5-year non-repayable contribution program, aimed at establishing a critical mass of outstanding business incubators and accelerators that can develop innovative, high-growth firms, which themselves represent superior early-stage investment opportunities. The program was structured by Finance Canada and has been delivered by NRC through IRAP.
<b>Results achieved</b>	<p>CAIP funding is expected to contribute to:</p> <ul style="list-style-type: none"> <li>- An expanded range of programs and services by funded accelerators and incubators</li> <li>- Increased investment readiness of early stage firms</li> <li>- Benefits to early stage firms from innovation support resources such as expertise and networks</li> <li>- Wealth creation in Canada</li> </ul> <p>In 2016, a formative evaluation, focusing on design and delivery was conducted. IRAP implemented the evaluation recommendation to strengthen program delivery. A summative evaluation, which assesses the extent to which the program has achieved expected results is currently underway and will be completed by December 2018.</p>
<b>Comments on variances</b>	The variance of (\$2,069,594) between the planned spending and actual spending is within accepted tolerances.
<b>Audits completed or planned</b>	None
<b>Evaluations completed or planned</b>	A Formative evaluation was completed in 2016-17. A Summative evaluation is planned for 2018-19.
<b>Engagement of applicants and recipients</b>	CAIP supports SMEs' access to best-in-class business accelerators and incubators with the goal of helping these organizations expand their overall service offerings. Organizations were selected based on CAIP specific eligibility criteria and selection guidelines. CAIP is a direct result of extensive consultations, undertaken by Finance Canada in 2012, which revealed that, in addition to the availability of venture capital, entrepreneurs also require access to specialized innovation resources to succeed.

Performance information (dollars)

Type of Transfer Payment	2015–16 Actual spending	2016-17 Actual spending	2017-18 Planned spending	2017-18 Total authorities available for use	2017-18 Actual spending (authorities used)	Variance (2017-18 actual minus 2017-18 planned)
Total grants	-	-	-	-	-	-
Total contributions	18,198,272	24,341,747	24,565,885	24,565,885	23,967,946	(597,939)
Total other types of transfer payments	-	-	-	-	-	-
<b>Total program</b>	18,198,272	24,341,747	24,565,885	24,565,885	23,967,946	(597,939)

## Evaluations

Evaluations completed, or planned to be completed, in 2017–18

Title of evaluation	Link to department's programs	Status	Deputy head approval date
Evaluation of the <a href="#">Industrial Research Assistance Program</a>	Industrial Research Assistance Program	Completed	June 2017
Evaluation of NRC <a href="#">Security and Disruptive Technologies</a> Sub-program	Technology Development and Advancement Program	Completed	December 2017
Evaluation of NRC <a href="#">Digital Technologies</a>	Information and Communication Technologies Sub-program	Completed	August 2018 <sup>1</sup>
Evaluation of NRC <a href="#">Energy, Mining and Environment</a> Sub-program	Technology Development and Advancement Program	Completed	July 2018 <sup>2</sup>
Evaluation of the <a href="#">Canadian Accelerator Incubator Program</a>	Industrial Research Assistance Program	In Progress	December 2018 (Planned)
Evaluation of NRC's Contribution to <a href="#">TRIUMF</a>	National Science Infrastructure Program	In Progress	March 2019 (Planned)

<sup>1</sup>To be published by 2018-12-21.

<sup>2</sup>To be published by 2018-11-16.

## Fees

Owing to legislative changes, the fees results for the NRC are available in the [2017-2018 Fees Report](#).

## Horizontal initiatives

### General information

<b>Name of horizontal initiative</b>	Genomics R&D Initiative (GRDI)
<b>Lead departments</b>	National Research Council Canada (NRC)
<b>Federal partner departments</b>	Agriculture and Agri-Food Canada (AAFC), Canadian Food Inspection Agency (CFIA), Fisheries and Oceans Canada (DFO), Environment and Climate Change Canada (ECCC), Health Canada (HC), National Research Council Canada (NRC), Natural Resources Canada (NRCan), Public Health Agency of Canada (PHAC). Canadian Institutes for Health Research (CIHR) received a onetime allocation in 1999-2000.
<b>Non-federal and non-governmental partners</b>	Not applicable
<b>Start date of the horizontal initiative</b>	April 1999, renewed in 2002-03, 2005-06, 2011-12, and 2014-15
<b>End date of the horizontal initiative</b>	March 2019
<b>Description of the horizontal initiative</b>	GRDI supports genomics research inside federal government laboratories. It focuses on mandates and priorities of participating departments and agencies. Research covers areas such as health care, food safety and global food security, sound management of natural resources, a sustainable and competitive agriculture sector, and environmental protection, with collaboration with university and private sectors. Since the implementation of the GRDI in 1999, participating departments and agencies have built a solid genomics research capacity and have gone a long way to deliver on the Initiative's stated objectives, as confirmed by three independent evaluations (2006, 2011, and 2016) and an audit by the Office of the Comptroller General (2012). Additional information may be found on the .
<b>Governance structures</b>	An interdepartmental Assistant Deputy Minister (ADM) Coordinating Committee (CC) oversees collective management and coordination of GRDI. It is responsible for the overall strategic direction for the GRDI and approval of investment priorities.  An Interdepartmental Working Group (WG) supports the work of the committee. It is chaired by the lead agency (NRC) with membership at the Director level from all participating departments/agencies, and Industry Canada. The WG provides recommendations and strategic advice to the ADM CC regarding

	strategic priority setting and overall management of the GRDI. A Coordination Function, housed at NRC, provides GRDI-wide program coordination, communication, networking and outreach support.
<b>Total federal funding allocated (start to end date) (dollars)</b>	393,300,000
<b>Total federal planned spending to date (dollars)</b>	373,400,000
<b>Total federal actual spending to date (dollars)</b>	372,014,090
<b>Date of last renewal of the horizontal initiative</b>	2014
<b>Total federal funding allocated at the last renewal, and source of funding (dollars)</b>	99,500,000 for 2014 to 2019; Source: Fiscal Framework
<b>Additional federal funding received after the last renewal (dollars)</b>	Not applicable
<b>Funding contributed by non-federal and non-governmental partners</b>	Not applicable
<b>Fiscal year of planned completion of next evaluation</b>	2021-22
<b>Shared outcome of federal partners</b>	<p>The GRDI Horizontal Performance Measurement Strategy was updated for Phase VI. The updated version covers fiscal years 2014-2015 to 2018-2019 and formalizes the roles and responsibilities of the eight departments and agencies involved in the Initiative to support effective monitoring and evaluation activities. It presents three intermediate outcomes:</p> <ol style="list-style-type: none"> <li>1) Federal science departments and agencies are positioned as genomics research leaders;</li> <li>2) Research results are used to inform government regulatory, policy, and/or resource management decisions; and</li> <li>3) Research results are used by stakeholders to support innovation in Canada; contributing to the Government of Canada Outcomes: Healthy Canadians; Strong economic growth; An innovative and knowledge-based economy; and A clean and healthy environment.</li> </ol>
<b>Performance indicators</b>	<p>GDRI is managed using a comprehensive performance measurement framework to gauge progress towards the above 3 shared outcomes. Examples of performance indicators include:</p> <ol style="list-style-type: none"> <li>1) Scientific production and impact in genomics</li> <li>2) Case analysis of examples where risk assessment, regulatory, policy, and resource management decisions have been informed by GRDI research (federal, provincial, municipal)</li> <li>3) Case analysis of examples where innovative tools and</li> </ol>

	processes have been adopted in Canada based upon GRDI research
<b>Targets</b>	Targets for the above examples are: Indicator 1: On par or better than other genomics researchers in Canada Indicator 2 and 3: Positive impact based on qualitative case study analysis
<b>Data source and frequency of monitoring and reporting</b>	The data for the above examples is derived from program Evaluation every 5 years
<b>Results</b>	See results, below.
<b>Expected outcome or result of non-federal and non-governmental partners</b>	Not applicable
<b>Name of theme</b>	Not applicable
<b>Performance highlights</b>	<p>Fiscal 2017–2018 marked the fourth year of Phase VI of the GRDI. The initiative continued to support government genomics research in collaboration with universities, other government levels, and the private sector. It funded 64 research projects within participating departments, including two highly coordinated interdepartmental shared priority projects: the Antimicrobial Resistance (AMR) and Metagenomics Based Ecosystem Biomonitoring (EcoBiomics) projects. Examples of achievements this year include:</p> <ul style="list-style-type: none"> <li>• An analytical tool that predicts antimicrobial resistance phenotypes and the mechanisms of resistance transmission, that provides risk modellers and policy-makers enhanced capacity to assess the risk of the spread of antibiotic resistance genes;</li> <li>• Standardized sampling, nucleic acid extraction, and metagenomics workflows across agencies for the analysis of over 2,300 soil, water, and invertebrate samples collected from across Canada for DNA sequencing. This work will facilitate standardized monitoring of soil and freshwater quality to ensure we deliver evidence-based environmental management and resource development decisions;</li> <li>• Enhanced capacity for the timely detection and identification of microbiological food safety hazards, animal pathogens, plant pests, invasive plants, and plants with novel traits, to support government regulatory actions;</li> <li>• Validated cutting-edge environmental DNA (eDNA) tools to support Fisheries and Oceans Canada (DFO) regulatory decisions;</li> <li>• Assembled genome sequence of Stettler, a popular Canadian wheat variety, for the study of diseases, pests, abiotic stresses and developmental pathways in wheat;</li> <li>• Guidance for the use of genomics in regulatory toxicology, including a guidance project adopted as official guidance for Organisation for Economic Co-operation and Development (OECD) member countries;</li> <li>• A large repository of in vivo gene expression data related to in</li> </ul>

	<p>vivo toxicity of engineered nanomaterials; researchers in Europe are now using the repository to frame evidence-based research and regulatory questions;</p> <ul style="list-style-type: none"> <li>• A new online database and analytical platform that enables investigation of <i>Neisseria meningitidis</i> epidemiology and outbreaks at the local level; and</li> <li>• a national database containing the spectra of rare and under-represented bacterial pathogens, providing fast, accurate and cost-effective identification of those pathogens locally rather than through a reference centre.</li> </ul>
<p><b>Contact information</b></p>	<p>Roman Szumski  Vice-President, Life Sciences  National Research Council Canada  (613) 993-9244</p>

Further information is available from the GRDI website at <http://grdi-irdg.collaboration.gc.ca/eng/index.html>

Performance information

Federal departments	Link to the department's Program Alignment Architecture or Program Inventory	Horizontal initiative activities	Total federal allocation (from start to end date) (dollars)	2017–18 Planned spending (dollars)	2017–18 Actual spending (dollars)	2017–18 Expected results	2017–18 Performance indicators	2017–18 Targets*	2017–18 Actual results
AAFC	Science, Innovation, Adoption and Sustainability	Canadian Crop Genomics Initiative (CCGI)	108,500,000	4,440,000	4,440,000	<a href="#">ER1</a>	<a href="#">PI1</a>	<a href="#">T1</a>	<a href="#">AR1</a>
						<a href="#">ER2</a>		<a href="#">T2</a>	<a href="#">AR2</a>
CFIA	Food Safety Program, Animal Health and Zoonotics Program, Plant Resources Program	GRDI	3,600,000	720,000	720,000	<a href="#">ER3</a>	<a href="#">PI3.1</a> <a href="#">PI3.2</a>	<a href="#">T3</a>	<a href="#">AR3</a>
DFO	Biotechnology and Genomics	National Aquatic Biotechnology and Genomics R&D Strategy	16,495,000	720,000	708,800	<a href="#">ER4</a>	<a href="#">PI4</a>	<a href="#">T4</a>	<a href="#">AR4</a>
ECCC	Climate Change and Clean Air	Strategic Technology Applications of Genomics in the Environment (STAGE)	18,550,000	800,000	800,000	<a href="#">ER5</a>	<a href="#">PI5</a>	<a href="#">T5</a>	<a href="#">AR5</a>
HC	Canadian Health System Policy / Health System Priorities	GRDI	53,123,617	105,904	203,620	<a href="#">ER6</a>	<a href="#">PI6</a>	<a href="#">T6</a>	<a href="#">AR6</a>
	Health Products / Biologics & Radiopharmaceuticals	GRDI	2,136,042	528,601	529,223				
	Food Safety and Nutrition / Food Safety	GRDI	930,461	235,964	186,780				
	Environmental Risks to Health / Health Impacts of Chemicals	GRDI	2,909,880	729,531	710,600				
NRC	Technology Development and Advancement	GRDI	108,500,000	4,440,000	4,440,000	<a href="#">ER1</a>	<a href="#">PI1</a>	<a href="#">T1</a>	<a href="#">AR1</a>
						<a href="#">ER7</a>	<a href="#">PI7.1</a> <a href="#">PI7.2</a>	<a href="#">T7</a>	<a href="#">AR7</a>
		Shared Priorities	28,855,000	3,980,000	3,980,000	<a href="#">ER8</a>	<a href="#">PI7.1</a> <a href="#">PI7.2</a>	<a href="#">T8</a>	<a href="#">AR8</a>
NRCan	Innovation for New Products and Processes	GRDI	36,100,000	1,600,000	1,600,000	<a href="#">ER9</a>	<a href="#">PI9.1</a> <a href="#">PI9.2</a>	<a href="#">T9</a>	<a href="#">AR9</a>
PHAC	Public Health Infrastructure	GRDI	13,100,000	1,600,000	1,600,000	<a href="#">ER10</a>	<a href="#">PI10.1</a>	<a href="#">T10.1</a>	<a href="#">AR10.1</a>
							<a href="#">PI10.2</a>	<a href="#">T10.2</a>	<a href="#">AR10.2</a>
CIHR	Not applicable	Not applicable	500,000	0	0	Not applicable	Not applicable	Not applicable	Not applicable
<b>Total</b>	Not applicable	Not applicable	393,300,000	19,900,000	19,919,023	Not applicable	Not applicable	Not applicable	Not applicable

\*The planned date to achieve the target was 2018-03-31 in all cases.

## AAFC and NRC

ER1: Using genomics to significantly increase Canada's share of global wheat production.

PI1: Number of scientific outputs generated in the form of scientific papers.

T1: 45 scientific papers through NRC support of the Canadian Wheat Improvement Program in the areas of tolerance to disease and abiotic stress, genomics-assisted breeding, and seed development.

AR1: 46 scientific papers generated compared to 46 in 2015-16.

## AAFC

ER2: Using genomics to improve the value of Canadian crops and agri-products.

T2: GRDI investments at AAFC will focus on the priorities outlined in the Canadian Crop Genomics Initiative, and will be leveraged to enable industry to take advantage of new innovative opportunities. Activities will fall under three broad themes: 1) Biodiversity, gene mining and functional analysis: to develop value-added traits (e.g. seed quality) for the highly competitive marketplace, enhancing the resiliency of Canada's crop production in the face of potentially catastrophic abiotic and biotic stresses and to maximize profitability for the sector. 2) Bioinformatics and physical tools: ensuring that scientists can maximize the opportunities presented by genomics-based research (e.g. identification and characterization of genes coding for desirable traits related to seed quality or disease resistance). 3) Improved access to biological materials and data sets: to enhance the efficiency of plant breeding to lay the scientific foundation for major advances in the development and delivery of priority traits identified by industry (e.g. disease resistance).

AR2: 52 scientific outputs.

## CFIA

ER3: Using genomics for food safety, animal health and plant protection

PI3.1: Number of standard operating procedures/tools developed and/or transferred to end users to support risk management strategies

T3: Funds from GRDI will be targeted to increase the genomics capability within CFIA to support on-site diagnostic tools and surveillance capabilities. Specifically, GRDI activities will focus on three areas: 1) Food Safety: to better support CFIA in the areas of compliance testing, source attribution and risk profiling, enabling enforcement of Health Canada standards. 2) Plant Resources: to enable early detection and rapid response, and inform regulatory decision-making for regulated plant pests and plant commodities within the agricultural and forestry sectors. 3) Animal Health: to support management of public health risks associated with the transmission of zoonotic diseases and reportable and emerging animal diseases.

PI3.2: Number of scientific outputs generated in the form of publications, presentations and contributions to databases to support evidence-based regulatory, policy or resource management decisions.

AR3: CFIA developed 21 new research tools and processes compared to 11 in 2016-17. It transferred 27 Standard Operating Procedures to end users. This more than doubles the 13 reported for 2016-17. During the same period, CFIA developed 85 scientific outputs in the form of publications, presentations and contributions to databases. This compares to 78 reported for 2016-17.

## DFO

ER4: Genomics knowledge and advice for the management of fisheries and oceans

PI4: Percentage of GRDI projects that provided genomics knowledge and advice to decision makers

T4: Genomics-enabled research within DFO will continue to be aligned within the following themes: 1) Protecting fish species and enabling sustainable harvesting: to develop and apply leading-edge genomics tools to accurately identify species, farmed/wild interactions, populations and stocks for fisheries management and the conservation of vulnerable stocks, species at risk and aquatic biodiversity. 2) Safeguarding Canadian fish and seafood products: to develop innovative genomics techniques to detect, monitor and minimize the impact of pathogens (e.g. Infectious Salmon Anemia virus) in order to safeguard the health of Canada's aquatic resources and our export markets for fish and seafood products. 3) Maintaining healthy and productive aquatic ecosystems: to develop and apply new genomics tools to monitor, mitigate and restore aquatic ecosystems.

AR4: 100% of the 5 new DFO projects funded by GRDI in 2017-2018 and 6 previously funded projects delivered genomics knowledge or advice in terms of published scientific papers, invited conference presentations, science advice to management or stakeholders. However, only 29% of client requests were fulfilled at capacity. During 2017-2018, DFO scientists developed new innovations (e.g., novel remote in-field environmental DNA (eDNA) sampling device, genetic tagging system for Pacific salmon hatcheries, panels of thousands of genome-wide functional markers of economically important wild and aquaculture fish). DFO's research in the Arctic expanded greatly with new aquatic biodiversity investigations using eDNA, genomic analysis of the iconic Arctic Charr populations, and the ongoing GRDI Narwhal project. Whole genome sequencing of important fishery species enhanced our ability to assess stock structure and biodiversity associations with changing environments. The knowledge gained by these genomics tools and studies has been transferred through broad reaching networks of international partners (e.g., International Council for the Exploration of the Sea, ICES) and Canadian communities (e.g., First Nations; Northern communities; Provincial Governments). In March 2018, DFO-GRDI scientists and resource management clients participated in a workshop to review a Technical Science Report on 'eDNA and its Applications to DFO' and identify priority research areas that could provide the basis of a DFO eDNA research plan. DFO also actively participated in the EcoBiomics GRDI Shared Priority Project on impacts of human activities on Atlantic Salmon. Out of the 11 research projects, DFO-GRDI researchers produced 20 peer-reviewed papers, 23 contributions to national and international scientific networks this funding year, and 29 research tools and processes.

## ECCC

ER5: Genomics-based tools and technologies for responsible decision-making

PI5: Increased awareness and understanding of the five Strategic Technology Applications of Genomics in the Environment (STAGE) research priorities.

T5: ECCC will continue to deliver its GRDI funding under the STAGE program, in the following areas: 1) Chemical and biological risk assessment: to establish toxicology end points for microorganisms, chemicals of concern, and emerging stressor; and to predict the mode of action of chemicals of concern and their effects on organisms; 2) Wildlife conservation: to understand how genes are interacting in flora and fauna in response to environmental conditions and to track disease in wildlife; 3) Environmental monitoring: to develop indicators (e.g., gene expression profiles for key species) of ecosystem health in priority ecosystems (e.g., Great Lakes and St. Lawrence) and to track pathogen sources; and 4) Compliance and Enforcement: to analyze flora and fauna for individual species identification, parentage determination and ascertaining geographic origin. This work will enable the delivery of EC's obligation under the Fisheries Act and the Canadian Environmental Protection Act, and programs including the Chemicals Management Plan.

AR5: Genomics research increased ECCC's awareness related to the following three priorities:

- 1) The monitoring of ecosystem health to support regulations to conserve and manage the environment through data collection of biodiversity information using metabarcoding techniques.
- 2) Determining the effects of new industrial chemical products for environmental risk assessment. A new genomic technique was developed to determine the effects of complex mixtures on the

double-crested cormorant and rhinoceros auklets in order to inform risk assessment and decision-making. The United States Environmental Protection Agency and the United States Fish and Wildlife Services are also using these genomic techniques to predict the sensitivity of avian species to dioxin-like chemicals in order to guide environmental risk assessments and to define future research needs.

3) The assessment of water quality through the use of metagenomics profiling in order to protect watersheds. Results are being used by Parks Canada and the City of Toronto for water quality monitoring in the Rouge River watershed. These results are also being used to assess associated storm water outfalls to support improved water quality and to reduce beach closures in the Great Lakes Area of Concern.

## HC

### ER6: Genomic knowledge for the Canadian health regulatory system

PI6: Percentage of targeted knowledge transfer activities accomplished related to genomic research (e.g., client meetings, poster/conference presentations, and peer-reviewed publications)

T6: Genomics research will continue to focus on four priority investment areas to strengthen HC's regulatory role: 1) Supporting regulatory knowledge on therapeutics and biologics: to inform and support regulatory decisions throughout the biotherapeutic product life-cycle. Specifically, HC will continue with research projects on vaccines and emerging stem cell based projects. During the 2017-18 fiscal year, HC stem cell research will identify molecules that can be used to monitor the safety and effectiveness of mesenchymal stem cell based products. In addition, vaccine research projects will be developing a list of immune cell markers that can be used to improve current methods for monitoring the efficacy and safety of Respiratory Syncytial Virus vaccines. 2) Supporting regulatory knowledge on food safety and nutrition: enabling detection and characterization of food-borne micro-organisms; characterization of health effects of food contaminants, allergens, nutrients, novel foods/food ingredients, and pre- and pro-biotics; and development of markers of health status and disease (e.g. cancer, diabetes, obesity, allergies and cardiovascular disease) in the context of nutrition, micro-organisms, allergens and food contaminant exposure. 3) Protecting human health from potential adverse effects of environmental contaminants, radiation, consumer products and pesticides. 4) Research on socio-ethical impacts of genomics technologies, outputs and products: approaches for responsible integration of genomics for societal benefit, taking into account ethical, legal and socio-economic considerations.

AR6: HC met its new 100% target in terms of knowledge transfer activities relating to genomics research. Out of a total of 8 research projects, one study was completed; and a total of 56 presentations, and 21 peer reviewed papers were produced nationally and internationally.

Genomics research supported knowledge development for the assessment and regulation of environmental contaminants. For HC environmental contaminants research, further biological characterization was carried out to better understand the health impact of nanomaterials as more than 20 individual nanomaterials were investigated. Following the development of a whole genome sequencing method to characterize mutations in the DNA of sperm, whole genomes of mice demonstrated an increase in mutations in the offspring of males exposed to the environmental contaminant benzo(a)pyrene. The result supported the utility of the method to investigate the potential transmission of hazardous effects from parents to their offspring and is now being applied to human families. HC continued to collaborate with the Health and Environmental Sciences Institute's Genomics Technical Committee to validate and qualify a genomic biomarker that identified genome-damaging agents, and demonstrated regulatory application. Health Canada generated genomics knowledge for the Canadian health regulatory system by conducting stem cells and vaccines research projects. 100% of the translation of genomics research into decision-making data for regulatory toxicology proceeded in Bureau of Chemical Safety. Three manuscripts (of the 21 above) were completed in which genomic analyses were integrated into traditional, dose-response modelling studies, with the goal of bridging emerging and existing science in toxicology.

## NRC

ER7: Commercially-relevant advances in genomics R&D related to human health.

PI7.1: Technology deployment (client commitments to exploit NRC innovations)

T7: GRDI investments in NRC will be made in program areas that require genomics to help industry and government tackle strategic national priorities (e.g. strong economic growth, healthy Canadians, innovative and knowledge-based economy)

PI7.2: Client/stakeholder feedback on benefits: jobs, sales, R&D: This performance indicator has been retired. An updated performance measurement framework will be operational for 2018-19. Client feedback for the higher-level Technology Development and Advancement Program (TD&A), to which GRDI contributes, indicates a high degree of satisfaction and meaningful impacts as detailed in the main body of NRC's 2017-18 Departmental Results Report.

AR7: NRC leveraged GRDI support to advance multiple projects, with the overall objective of improving cancer treatment. This multi-pronged approach is grouped into three activity thrusts:

1. Better cancer diagnosis and prognosis: NRC scientists have developed a software tool, eTumourMonitor, which is able to predict key personalized cancer-driver genes for the early detection of tumors. This tool is being applied to pediatric leukemia in collaboration with clinicians and scientists at the CHU Ste-Justine in the context of the new Innovation Center in Applied Micro-Analytics for Pediatric Medicine (I-CAMP), which was announced in July 2017.
2. Developing novel, biologics-based therapeutic modalities: NRC continues to improve its cancer target selection and prioritization, using multiple bioinformatic and experimental approaches to identify the most promising candidates. NRC is partnering these assets with Canadian SMEs once they have completed *in vivo* validation. This development pipeline has yielded one therapeutic that has reached the human clinical trial stage (anti-Clusterin antibody, Alethia Biotherapeutics). A second candidate was licensed in 2017 by Formation Biologics, with clinical trials being targeted for summer 2018.
3. Optimization of NRC's proprietary biologics expression platform: Genomic technologies are being used by NRC scientists to continuously improve our proprietary protein production platforms, which are widely used for work with NRC clients and collaborators as well as for internal R&D.

### IP & Licensing

- pTT protein expression system licences: 18 total (16 foreign, 2 Canadian)
- 1 new antibody asset patent filed
- 1 new technology asset (site-specific conjugation) patent filed
- 1 licence signed for new therapeutic asset

ER8: Concerted interdepartmental research along shared priorities and common goals on issues that are beyond the mandates of single departments.

T8: Two shared priority projects will continue their activities in 2017-2018.

AR8: : Phase VI shared priority projects continued to implement their approved Project Management Plans and Science Plans. 1) The Antimicrobial Resistance project is a collaborative effort by five departments and agencies (AAFC, CFIA, HC, NRC, and PHAC). The project developed an analytical tool that can predict antimicrobial resistance phenotype as well as the mechanisms of transmission associated with the resistance, as well as a comprehensive database of closed plasmid genomes. Together, this will provide risk modellers and policy-makers enhanced capacity to assess the risk of spread of antibiotic resistance genes.

Enterococci associated with antimicrobial resistance were found to clearly differ between humans and cattle. The use of antimicrobials in poultry was shown to clearly increase antimicrobial resistant bacteria in poultry litter, some of which could pose a risk to human health. On the other hand, plant bioactives were shown to have the potential to reduce antimicrobial resistance in poultry. Isolates were also collected from swine to determine the impact of production practices on antimicrobial resistance. 2) The shared priority project Metagenomics-Based Ecosystem

Biomonitoring project is a collaborative effort by seven Federal departments and agencies (AAFC, CFIA, DFO, ECCC, NRC, NRCan and PHAC). The project standardized sampling, nucleic acid extraction, and metagenomics workflows across departments. Over 2,300 soil, water, and invertebrate samples were collected across Canada for DNA sequencing. A total of 47 sequencing runs were processed by the NRC's sequencing facility on the Illumina MiSeq (metabarcoding) and HiSeq (metagenomics) platforms. Bioinformatics training was provided to over 80 project participants. Discussions on protocols for implementing genomic monitoring and selection of candidate genomic observatories continued in collaboration with end-user groups such as ECCC's National Water Quality Monitoring Program, and the Canadian Aquatic Biomonitoring Network (CABIN).

## **NRCan**

ER9: Genomic knowledge for forest generation and protection Genomic knowledge for forest generation and protection

PI9.1: Number of new products and processes resulting from NRCan information.

T9: The Canadian Forest Service of NRCan will focus on accelerating the translation of accumulated genomics knowledge into applications in support of Canada's forest sector competitiveness, including: 1) Forest generation: the development of innovative genomic applications will result in accelerated production of higher quality fibre, translating into economic and environmental benefits for Canada. 2) Forest protection: the development of innovative genomic diagnostic tools will enable rapid detection and management of invasive insects and diseases which threaten the health and ecological integrity of Canadian forests, the forest sector and forest communities.

AR9: NRCan produced 19 new products and tools based on genomic knowledge. NRCan research has contributed to knowledge and applied genomic tools to significantly enhance conventional breeding programs and accelerate the development and deployment of genomics-improved spruce stock. Early detection and rapid response are critical to mitigating the risk of introduction and establishment of unwanted insects and pathogens into Canada's forests. NRCan researchers generated DNA libraries and reference databases and developed new bioinformatics software for the analysis of metabarcoding sequences, to help more quickly identify insects caught in traps. Researchers also used novel molecular methods to identify candidate receptor proteins for pheromones, a crucial step for faster development of surveillance tools for three species of longhorn beetle, an economically important insect pest. NRCan researchers validated a suite of assays for the detection of fungal pathogens responsible of the white pine blister rust and the butternut canker. The suite of genomic and analytic tools being developed will increase confidence in Canada's phytosanitary certification processes and will help maintain Canada's access to international markets, both for forest products and for all export industries that use wood packing materials. Researchers discovered limber pine seed families originating in Canada with major gene resistance and elucidated a molecular mechanism underlying resistance mechanisms in whitebark pine. Identifying genomic variation contributing to host resistance can contribute to breeding and genetic conservation programs. NRCan researchers developed improved molecular techniques, for example, better techniques for extracting DNA from deadwood that will contribute to improved data for forest integrity assessments helping to assess the sustainability of forest management practices.

PI9.2: R&D expenditures in natural resource sectors, specifically total intramural R&D expenditures in energy, mining and forest sectors. (This performance indicator has been retired given that it no longer represents outcomes of genomics work at NRCan. An updated performance measurement framework will be operational for 2018-19.)

## **PHAC**

ER10: Genomics knowledge to strengthen public health programs and activities related to infectious and chronic disease

PI10.1: Percent of clients indicating overall satisfaction with laboratory reference services as “satisfied” or “very satisfied”

T10.1: 90%

AR10.1: 98% of clients responding to the satisfaction survey were “satisfied” or “very satisfied” with the laboratory reference services received.

PI10.2: Number of citations to agency laboratory research publications to demonstrate knowledge transfer uptake

T10.2: 1800

AR10.2: 4343 citations of PHAC’s National Microbiology Laboratory publications were recorded.

## Internal audits

Internal audit engagements completed in 2017-18

Title of internal audit	Completion date
Audit of Talent Management – Workforce Planning and Succession Management	Completed in 2017-18
Audit of Industrial Research Assistance Program (IRAP) - SONAR information management system	Completed in 2017-18

## Response to parliamentary committees and external audits

### Response to parliamentary committees

There were no parliamentary committee reports requiring a response in 2017–18.

### Response to audits conducted by the Auditor General (including to the Commissioner of the Environment and Sustainable Development)

There were no audits in 2017–18 requiring a response.

### Response to audits conducted by the Public Service Commission of Canada or the Office of the Commissioner of Official Languages

There were no audits in 2017–18 requiring a response.