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Government of Northwest Territories
Gouvernement des Territoires du Nord-Ouest



2030 NWT CLIMATE CHANGE STRATEGIC FRAMEWORK

CADRE STRATÉGIQUE SUR LE CHANGEMENT CLIMATIQUE DES TNO 2030

Le présent document contient la traduction française du résumé et le message du ministre

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MESSAGE FROM THE PREMIER



Climate change represents serious environmental, economic and social challenges for the Northwest Territories (NWT). During 2016-2017 the Government of the Northwest Territories (GNWT) engaged with community and Indigenous

governments, stakeholders and NWT residents to discuss energy and climate change issues.

NWT residents told us that they have strong interest in solutions that support the transition to a lower carbon economy. However they are also concerned about how this will impact the high cost of living and doing business in the NWT. They are very interested in energy efficiency and developing renewable energy options and we heard that we need to set realistic and achievable emission targets to address climate change. There was a varied view on carbon pricing but general support existed for some carbon revenues to be allocated to improving energy efficiency and renewable energy solutions in communities.

People expressed their concerns about the impacts of climate change, including changing ice conditions and increased risks to human safety, impacts on water quality and quantity, impacts on forest, habitat and wildlife, invasive species, food security and decreased access to country foods, and loss of culturally significant sites and artifacts.

We heard the need for increased research and monitoring, with traditional knowledge highlighted as an important tool in understanding and adapting to climate change. Community and Indigenous governments indicated that they want to be more involved in identifying, planning and undertaking research and monitoring of climate change impacts. We heard that there needs to be better sharing of information and research results with community and Indigenous governments, residents and stakeholders.

The 2030 NWT Climate Change Strategic Framework and 2030 Energy Strategy reflect the priorities of the 18th Legislative Assembly. The GNWT supports the use of energy efficient technologies, increasing the production and transmission of renewable and alternative energy, and the implementation of this strategy to mitigate and adapt to climate change in collaboration with other governments and organizations.

This Framework provides the territory with a strong direction between now and 2030 to act locally, while fulfilling our commitments to Canada and the world. We will continue to work to support the implementation of the Pan-Canadian Framework on Clean Growth and Climate Change, the Canadian Energy Strategy and the development of the Northern Adaptation

Strategy. The actions in these initiatives contribute to Canada's commitment as signatory to the Paris Agreement.

Implementing the 2030 NWT Climate Change Strategic Framework means rolling up our sleeves and putting our words into action. Working together we can transition to a lower carbon economy, build a sustainable energy system and strengthen our understanding of the effects of climate change, while implementing solutions that increase our resiliency and ability to adapt to climate change now and for future generations.

The Honourable Bob McLeod
Premier of the Northwest Territories

MESSAGE FROM THE MINISTER



The 2030 NWT Climate Change Strategic Framework provides the path to address the challenges of climate change to 2030. The vast geography and remote locations of our communities and industry present challenges for

responding to climate change in the NWT. Parts of the territory are warming up to four times faster than global averages, and considerable changes to the natural environment are being experienced by Northerners.

Canada is committed to a 30% reduction in annual greenhouse gas emissions by 2030, and the GNWT has also set this goal for the territory. We must ensure that the economy remains strong and viable while taking concrete actions to transition to a lower carbon economy. We will continue to build on our valuable experience, knowledge and past investments in this area, such as those in energy efficiency and local renewable energy systems, to support this transition. The Framework is directly linked to the 2030 Energy Strategy, which is the primary mechanism that government will be using to reduce greenhouse gas emissions.

As the northern climate continues to change, plans and operations will need to be adjusted to deal with a range of possible future conditions and unanticipated events. Resiliency and adaptation are two interrelated responses to address the various impacts of climate change on individuals, community and Indigenous governments, ecosystems, infrastructure, industry and the economy.

It is understood that climate-related changes create impacts at the local and regional levels. We will continue to work with community and Indigenous governments, and stakeholders to improve research and monitoring, connect them to various funding programs, and build local capacity to support the implementation of the Framework.

I look forward to working with community and Indigenous governments, stakeholders including industry, non-government organizations and others to move towards establishing a lower carbon economy, increasing our knowledge

of climate impacts, and building our resiliency while adapting to a changing climate. By working together, we can support a sustainable future for the NWT.

The Honourable Robert C. McLeod

Minister of Environment and Natural Resources

EXECUTIVE SUMMARY

The residents of the Northwest Territories (NWT), particularly Indigenous people, have a long-standing relationship with the natural environment. Many are concerned about the effects of climate change as the severity of environmental impacts increases, with temperatures warming faster in the North compared to the global average. Such effects include greater coastal erosion, more permafrost thawing, longer ice-free seasons, increasing prevalence of wildland fires and new mammal, bird, insect and fish species moving northward. These effects can have serious implications for the health and safety of residents, culture and heritage, infrastructure and the viability of certain economic activities. Therefore, taking strong action to address climate change in the NWT is imperative.

Recognizing that climate change represents serious and urgent challenges for the NWT, the Priorities of the 18th Legislative Assembly and the Mandate of the Government of the Northwest Territories (GNWT) 2016-2019 reflect the commitment to take action on climate change, beginning with the development of the 2030 NWT Climate Change Strategic Framework (the Framework). The Framework outlines how the territory plans to respond to challenges

and opportunities associated with a changing climate, moving towards an economy that is less dependent on fossil fuels and doing its part to contribute to national and international efforts to address climate change. The Framework was developed at the same time as the 2030 Energy Strategy. The two documents are closely linked and contribute, along with the GNWT's commitment to implementing carbon pricing, to the Pan-Canadian Framework on Clean Growth and Climate Change, which supports Canada in meeting its international commitments to reduce greenhouse gas emissions.

Engagement on the development of the Framework and 2030 Energy Strategy took place during the fall and winter of 2016 and 2017 and included six regional workshops, a public survey and the opportunity to provide written submissions. From December 2017 to January 2018, the draft Framework was released for public review. Throughout the development and review process, valuable input was received from community and Indigenous governments, territorial and federal departments, resource management boards, non-government organizations, academic institutions, industry and the general public, which advanced the Framework's vision, principles and goals.

The vision of the Framework – which states that by 2030, the NWT will enjoy a strong, healthy economy that is less dependent on fossil fuels and will have developed the knowledge, tools and measures needed to increase resilience and adapt to the changing northern climate – rests on several key principles. These principles center on: respecting Aboriginal and Treaty rights; including climate change considerations in planning, decision-making and operational activities; sharing responsibility for taking action on climate change; strengthening collaboration between residents and community, Indigenous, territorial and federal governments; and, recognizing the importance of traditional, local and scientific knowledge in understanding climate impacts and adaptation measures.

To achieve its vision, the NWT is focusing on **three goals**:

- **Goal #1:** Transition to a strong, healthy economy that uses less fossil fuel, thereby reducing greenhouse gas emissions by 30% below 2005 levels by 2030;
- **Goal #2:** Improve knowledge of the climate change impacts occurring in the NWT; and
- **Goal #3:** Build resilience and adapt to a changing climate.

GOAL #1

The focus of the Framework's first goal is transitioning to a lower carbon economy that uses less fossil fuel. To reach this goal, the NWT needs to reduce its annual greenhouse gas emissions to 1,094 kilotonnes (kt) carbon dioxide equivalents (CO₂e) (from a 2005 level of 1,563 kt CO₂e).

Electricity generation, space heating, transportation and industry are the main sectors for fossil fuel use and greenhouse gas emissions tracked in the NWT. The actions needed to achieve Goal #1 are outlined in the 2030 Energy Strategy, which serves as the mechanism for reducing greenhouse gas emissions related to energy supply and consumption. The focus of the 2030 Energy Strategy is on mitigation of emissions, whereas the Framework focuses on tracking and reporting progress on mitigation, and building resilience and adapting to a changing climate.

GOAL #2

Improving knowledge of climate change impacts occurring in the NWT is the second goal of the Framework. To address climate change, there is a need for greater understanding of the impacts to the natural environment, residents' health, safety, culture and heritage, and the territory's infrastructure. The integrated use and management of traditional, local and scientific knowledge to determine knowledge gaps, set and implement research and monitoring requirements, and obtain current and timely information, is essential.

The warming climate is leading to gradual shifts within ecosystems and more extreme events affecting the natural environment. Thawing of permafrost, changes to water quality and quantity, altered forests and tundra vegetation, and impacts on wildlife, fish and marine mammal health and distribution, have been observed for several years and are intensifying.

The effects of climate change on the natural environment can directly impact the health of NWT residents, both physically (such as increases in respiratory problems due to extreme weather) and mentally (such as stress or effects on well-being due to impacts on traditional harvesting sites and activities).

Safety of the general public is also a central concern, from erosion of coastlines leading to building instability, to increased flood risks in certain communities, to less predictable winter travel conditions, all leading to a heightened risk of injury and death.

Effects on the territory's culture and heritage, from risks to heritage resources such as archeological sites due to permafrost thaw and wildland fires, to impacts on traditional economies such as trapping, are evident and will likely continue to intensify. Indigenous people and other residents of the NWT are particularly vulnerable to climate related changes since, for generations, they have depended on the land, water and wildlife for their livelihood and sustenance.

The NWT's infrastructure (buildings, roads, pipelines, transmission lines, etc.) has been and continues to be impacted by climate change. Permafrost thaw and extreme weather events can have significant effects on infrastructure. Coastal erosion is also a concern in the northern parts of the NWT, threatening important infrastructure such as roads and buildings.

Developing a better understanding of current and future impacts and opportunities will support informed decision-making on how to build resilience and adapt to a changing climate.

EXECUTIVE SUMMARY

GOAL #3

Building resilience and adapting to a changing climate is the Framework's third goal. Building resilience focuses on finding ways to withstand the changes that are occurring. For changes that are unavoidable, adaptation efforts are required to find new ways of doing things, such as adjusting plans and operational activities.

Community and Indigenous governments want and need to be involved in adaptation planning to ensure ecosystems, including the people who live in them, remain healthy and diverse. Potential actions to adapt to the impacts of climate change on the natural environment include: increasing capacity at all levels of government (community, Indigenous and territorial governments) to undertake climate change adaptation actions; fostering science-based decision-making tools to assist project planning or development in permafrost regions; using increasingly available satellite imagery and technology to support flood

forecasting; and, considering the harvesting of new non-indigenous species to sustain commercial and subsistence harvests of fish, wildlife and plants.

Potential actions to adapt to the impacts of climate change on human health, public safety, and culture and heritage include: ensuring health facilities and services are able to withstand climate risks, particularly during extreme weather events; assessing and planning for climate change-related hazards in community emergency plans; and strengthening communities from a social and cultural aspect to help build resiliency. This can occur through the documentation and use of traditional and local knowledge and the involvement of youth and elders in on-the-land programming to ensure knowledge is passed on to future generations.

Potential actions to ensure systems for transportation, power and communication, water and sanitation, and other important

infrastructure like health centres, schools and community facilities are adapted to a changing climate include: improving and implementing building standards to take thawing permafrost conditions and extreme weather events into consideration during planning, design, construction and operations; and monitoring and updating risk assessments to understand when it is necessary to mitigate or upgrade some existing infrastructure (like buildings and roads) to handle changing climate conditions not considered when initially designed and constructed.

A warming climate may also provide new opportunities in sectors such as agriculture and forestry. As growing seasons lengthen, producing more food locally could help to address food security concerns, while continuing to increase local biomass use (cordwood and pellets) could provide local solutions and employment in the NWT. Both industries support the reduction of greenhouse gas emissions.

MOVING FORWARD

For each of the Framework's three goals, potential actions to be included in the 2019-2023 Action Plan have been summarized. Requirements for communicating climate change information and building capacity in communities to address impacts have also been outlined. Communicating information, sharing results broadly and involving communities in all aspects of improving knowledge is imperative.

The potential actions identified will serve as the basis for developing and subsequently implementing the 2019-2023 Action Plan. As it is being implemented, annual reports will be produced to track progress and adjust actions as required. The 2019-2023 Action Plan will be reviewed and evaluated after five years, when a second Action Plan (2025-2029) will be developed and implemented.

As reflected in the Framework, significant steps have been taken to address recommendations made by the Office of the Auditor General of Canada in its October 2017 report on climate change in the NWT. The detailed Action Plan that is being developed to implement the Framework will further address specific Auditor General recommendations.

Shared responsibility and partnerships with community and Indigenous governments and

stakeholders will be critical for the successful implementation of the Action Plan. The GNWT's Department of Environment and Natural Resources, as the lead department responsible for climate change, will provide strong leadership on related coordination and communication within the NWT and with other provinces, territories and the federal government.

Through implementation of the Framework, the NWT can respond to the challenges and opportunities associated with climate change, move towards a lower-carbon economy and do its part to contribute to national and international efforts on climate change.

MESSAGE DU PREMIER MINISTRE



Les changements climatiques posent de sérieux défis environnementaux, économiques et sociaux aux Territoires du Nord-Ouest (TNO). En 2016-2017, le gouvernement des Territoires du Nord-Ouest (GTNO) a donc mené des consultations sous le thème de l'énergie et des

changements climatiques auprès des administrations communautaires, des gouvernements autochtones, des résidents et d'autres parties concernées.

Les Téoïos ont manifesté un vif intérêt pour les solutions qui faciliteraient le passage à une économie plus sobre en carbone. Néanmoins, ils craignent qu'elles n'élèvent encore plus le coût de la vie et des affaires aux TNO. S'ils ont à cœur l'efficacité énergétique et le développement des énergies renouvelables, ils ont aussi fait valoir la nécessité d'établir des cibles réalistes de réduction des émissions. Quant à la tarification du carbone, les opinions divergent, mais les Téoïos souscrivent généralement à l'idée d'affecter une partie des recettes ainsi générées à l'amélioration de l'efficacité énergétique et des énergies renouvelables dans les collectivités.

Les intervenants se disent inquiets des effets des changements climatiques, notamment la détérioration de l'état des glaces, l'augmentation des risques pour la population, les répercussions sur les quantités d'eau et sa qualité, ainsi que sur les forêts, les habitats naturels, la faune, les espèces envahissantes et la sécurité alimentaire, la réduction de l'accès aux aliments traditionnels et la perte de sites et d'artefacts à forte valeur culturelle.

Les Téoïos ont souligné qu'il fallait intensifier la recherche et la surveillance, et que le savoir traditionnel nous aiderait grandement à comprendre les changements climatiques et à nous y adapter. Les administrations communautaires et les gouvernements autochtones veulent aussi participer davantage aux travaux entrepris pour connaître, prévoir, étudier et surveiller les effets des changements climatiques. De surcroît, il faudrait mieux communiquer l'information et les résultats des études aux administrations communautaires, aux gouvernements autochtones, aux résidents et aux autres parties concernées.

Le Cadre stratégique sur le changement climatique des TNO pour 2030 et la Stratégie énergétique 2030 reflètent les priorités de la 18^e Assemblée législative. Le GTNO préconise d'utiliser des technologies écoénergétiques, d'accroître la production et le transport d'énergies renouvelables et de remplacement, et de recourir à cette stratégie pour atténuer les effets des changements climatiques et s'y adapter, en collaboration avec d'autres gouvernements et organisations.

Le Cadre donne une orientation claire à l'action que le territoire mènera d'ici 2030 tout en respectant ses engagements nationaux et internationaux. Nous continuerons d'œuvrer à l'exécution du Cadre pancanadien sur la croissance propre et les changements climatiques et de la Stratégie canadienne de l'énergie, et à l'élaboration de la stratégie d'adaptation pour le Nord. Ce travail aide d'ailleurs le Canada à honorer l'engagement pris à la signature de l'Accord de Paris.

Le Cadre stratégique sur le changement climatique des TNO pour 2030 nous demande de retrouver nos manches et de passer de la parole aux actes. Tous ensemble, nous pouvons nous doter d'une économie plus sobre en carbone, bâtir un réseau électrique durable et mieux comprendre les effets des changements climatiques, tout en misant sur des solutions qui amélioreront notre résilience et notre capacité d'adaptation, pour les générations d'aujourd'hui et de demain.

L'honorable Bob McLeod

Premier ministre des Territoires du Nord-Ouest

MESSAGE DU MINISTRE



Le Cadre stratégique sur le changement climatique des TNO pour 2030 montre la voie à suivre pour relever les enjeux liés aux changements climatiques d'ici 2030. En raison de l'immensité du territoire et de l'éloignement des entreprises et des collectivités, la lutte

contre les changements climatiques aux TNO est particulièrement complexe. Dans certaines régions, la vitesse du réchauffement est quatre fois plus élevée que les moyennes mondiales; de surcroît, les Ténos assistent à une transformation radicale de leurs milieux naturels.

Le Canada s'est engagé à réduire de 30 % ses émissions annuelles de gaz à effet de serre d'ici 2030, objectif que s'est aussi fixé le GTNO pour le territoire. Nous devons assurer la vigueur et la viabilité de notre économie tout en prenant des mesures concrètes pour passer à une économie plus sobre en carbone. Afin d'opérer cette transition, nous continuerons de miser sur notre précieuse expérience, nos connaissances et nos investissements passés dans le secteur, par exemple en matière d'efficacité énergétique et de filières d'énergies renouvelables locales. Le Cadre est directement lié à la Stratégie énergétique 2030, principal outil qu'emploiera le gouvernement pour réduire les émissions de gaz à effet de serre.

Vu l'évolution constante du climat nordique, il faudra adapter les plans et les activités à un large éventail de conditions et d'imprévus potentiels. C'est par la résilience et l'adaptation, deux modes d'intervention interreliés, que nous ferons face aux divers effets des changements climatiques sur la population, les administrations communautaires, les gouvernements autochtones, les écosystèmes, les infrastructures, les entreprises et l'économie.

Il va sans dire que les effets des changements climatiques sont ressentis à l'échelle locale et régionale. Nous continuerons donc de collaborer avec les administrations communautaires, les gouvernements autochtones et les autres parties concernées pour leur permettre d'accéder à divers programmes de financement, améliorer la recherche et la surveillance, et accroître les ressources locales liées à l'exécution du Cadre.

Je me réjouis à l'idée de travailler avec les administrations communautaires, les gouvernements autochtones et les autres parties concernées, comme les entreprises et les organisations non gouvernementales, pour que nous puissions passer à une économie plus sobre en carbone, mieux

comprendre les effets des changements climatiques et développer notre résilience tout en nous adaptant à cette évolution du climat. Ensemble, nous pouvons assurer aux TNO un avenir durable.

L'honorable Robert C. McLeod

Ministre de l'Environnement et des ressources naturelles

RÉSUMÉ

Les résidents des Territoires du Nord-Ouest (TNO), particulièrement les peuples autochtones, sont attachés depuis très longtemps aux milieux naturels. Bon nombre d'entre eux se préoccupent des effets des changements climatiques, de plus en plus dommageables pour l'environnement, d'autant plus que les températures augmentent plus rapidement dans le Nord qu'ailleurs en moyenne dans le monde. Les changements climatiques entraînent l'accélération de l'érosion côtière et de la fonte du pergélisol, le prolongement de la période sans glace, l'augmentation du risque de feux de forêt et la migration vers le nord de nouvelles espèces de mammifères, d'oiseaux, d'insectes et de poissons. Ces phénomènes risquent d'avoir de graves conséquences sur la santé et la sécurité de la population, de même que sur la culture, le patrimoine, les infrastructures, et la viabilité de certaines activités économiques. Il est donc primordial de lutter vigoureusement contre les changements climatiques aux TNO.

Les changements climatiques engendrent des problèmes aussi graves qu'urgents aux TNO. Ainsi, les priorités de la 18^e Assemblée législative et le mandat 2016-2019 du gouvernement des Territoires du Nord-Ouest (GTNO) dénotent-ils une volonté de passer à l'action, avec comme première étape la création du Cadre stratégique sur le changement climatique des TNO pour 2030 (le Cadre). Le Cadre définit comment le territoire entend relever les défis inhérents à l'évolution

du climat et en exploiter les potentialités pour développer une économie moins tributaire des combustibles fossiles qui contribue aux efforts nationaux et internationaux de lutte contre les changements climatiques. Il a été élaboré en même temps que la Stratégie énergétique 2030; les deux documents sont étroitement liés et s'inscrivent, tout comme l'intention du GTNO d'imposer une tarification du carbone, dans le Cadre pancanadien sur la croissance propre et les changements climatiques, qui aide le Canada à respecter ses engagements internationaux en matière de réduction des émissions de gaz à effet de serre.

Des consultations sur le Cadre et la Stratégie énergétique 2030 ont eu lieu à l'automne 2016 et à l'hiver 2017; parmi les initiatives alors menées, notons six ateliers régionaux, un sondage auprès de la population et un appel de commentaires écrits. De décembre 2017 à janvier 2018, le public a pu prendre connaissance de la version préliminaire du Cadre. Tout au long du processus d'élaboration et d'évaluation, diverses parties – administrations communautaires, gouvernements autochtones, ministères territoriaux et fédéraux, offices de gestion des ressources, organismes non gouvernementaux, établissements d'enseignement, entreprises, grand public – ont soumis des observations fort utiles qui ont fait progresser la vision, les principes et les objectifs du Cadre.

La vision est que d'ici 2030, les TNO auront une économie saine, forte et moins tributaire des combustibles fossiles, et disposeront du savoir, des outils et des mesures nécessaires pour accroître leur résilience et s'adapter aux changements du climat nordique. Elle s'articule autour de plusieurs grands principes : respecter les droits ancestraux et les droits issus de traités; tenir compte des changements climatiques dans la planification, les décisions et les activités opérationnelles; partager la responsabilité de la lutte contre les changements climatiques; renforcer la collaboration entre les résidents et les administrations communautaires et gouvernements autochtones, territorial et fédéral; et reconnaître l'importance de mobiliser le savoir traditionnel, local et scientifique pour comprendre les effets des changements climatiques et s'y adapter.

Pour concrétiser cette vision, les TNO s'emploient à atteindre **trois objectifs** :

- **Objectif 1** : Se doter d'une économie saine et forte, où l'utilisation des combustibles fossiles sera diminuée de sorte à réduire l'émission de gaz à effet de serre de 30 % d'ici 2030 (par rapport à 2005);
- **Objectif 2** : Mieux comprendre les effets des changements climatiques aux TNO;
- **Objectif 3** : Favoriser la résilience et l'adaptation aux changements climatiques.

OBJECTIF 1

Le premier objectif est, essentiellement, de développer une économie plus sobre en carbone qui utilise moins de combustibles fossiles. Pour parvenir à une réduction de 30 % d'ici 2030, les TNO doivent ramener à 1 094 kilotonnes (kt) d'équivalent dioxyde de carbone (éq. CO₂) leurs émissions annuelles de gaz à effet de serre, qui se chiffraient à 1 563 kt d'éq. CO₂ en 2005.

C'est surtout dans la production d'électricité, le chauffage local, les transports et le secteur industriel que les TNO surveillent l'utilisation des combustibles fossiles et les émissions de gaz à effet de serre. Bon nombre de mesures associées à l'objectif 1 sont décrites dans la Stratégie énergétique 2030, pierre angulaire de la réduction des émissions de gaz à effet de serre attribuables à la production et à la consommation d'énergie. Si cette stratégie vise à réduire les émissions, le Cadre concerne davantage le suivi et la communication des progrès réalisés, la résilience et l'adaptation.

OBJECTIF 2

Le deuxième objectif du Cadre est de mieux comprendre les effets des changements climatiques aux TNO. De fait, pour lutter contre ces changements, il faut d'abord en comprendre

les effets sur les milieux naturels, la santé et la sécurité de la population, la culture et le patrimoine ténois, et les infrastructures du territoire. Par ailleurs, il est essentiel de mobiliser et de maîtriser le savoir traditionnel, local et scientifique pour en relever les lacunes, définir les besoins en recherche et en surveillance et agir en conséquence, et obtenir des informations récentes en temps utile.

Le réchauffement climatique entraîne une mutation des écosystèmes et une multiplication des événements extrêmes altérant les milieux naturels. C'est ainsi qu'on observe depuis plusieurs années des phénomènes qui ne cessent de s'intensifier : fonte du pergélisol, fluctuations des quantités d'eau et de sa qualité, transformation des forêts et de la toundra, et effets sur la santé et la chorologie de la faune, dont les poissons et les mammifères marins.

Les effets des changements climatiques sur les milieux naturels peuvent influencer directement sur la santé des Ténos, sur le plan tant physique (ex. : multiplication des troubles respiratoires en raison des températures extrêmes) que psychologique (ex. : stress ou dégradation du bien-être en raison des effets sur les sites et activités de récolte traditionnelle).

La sécurité du public est aussi une priorité. Bâtiments fragilisés par l'érosion des côtes, inondations plus probables dans certaines

collectivités, conditions de déplacement hivernales moins prévisibles : ces phénomènes augmentent tous les risques de blessure et de décès.

Les effets des changements climatiques sur la culture et le patrimoine des TNO sont manifestes et devraient continuer de s'aggraver. Mentionnons notamment la dégradation des ressources patrimoniales, comme les sites archéologiques, causée par la fonte du pergélisol et les feux de friches, et les répercussions sur les activités économiques traditionnelles telles que le piégeage. Les peuples autochtones et d'autres résidents sont particulièrement vulnérables, puisque ce sont les terres, l'eau et la faune qui assurent leur subsistance depuis des générations.

Les infrastructures des TNO (bâtiments, routes, pipelines, lignes de transport, etc.) subissent également les contrecoups des changements climatiques. Elles peuvent être durement touchées par la fonte du pergélisol et les phénomènes météorologiques extrêmes. Dans le nord du territoire, l'érosion des côtes est aussi source d'inquiétude, mettant en péril d'importantes infrastructures comme les routes et les bâtiments.

Pour prendre des décisions éclairées sur les moyens de favoriser la résilience et l'adaptation, il faudra mieux comprendre les potentialités et effets actuels et futurs des changements climatiques.

RÉSUMÉ

OBJECTIF 3

Le troisième objectif du Cadre est de favoriser la résilience et l'adaptation aux changements climatiques. Sous l'angle de la résilience, il s'agit de savoir comment faire face aux transformations qui s'opèrent. Dans les cas où l'on ne peut y échapper, il faut alors adapter les façons de faire, comme les plans et les activités opérationnelles.

Les administrations communautaires et les gouvernements autochtones veulent et doivent prendre part à ces efforts d'adaptation pour que les écosystèmes, y compris les populations qui y vivent, demeurent sains et diversifiés. Du côté des milieux naturels, cette adaptation peut prendre diverses formes : accroître, à tous les ordres de gouvernement (administrations communautaires, gouvernements autochtones et territorial), les ressources consacrées à cette mission; recourir à des outils décisionnels scientifiques pour planifier ou mener des projets dans les zones de pergélisol; utiliser l'imagerie satellitaire et les technologies connexes, de plus en plus accessibles, pour mieux prévoir les crues; et exploiter de nouvelles espèces allogènes pour poursuivre les activités de pêche, de chasse et de récolte commerciales et de subsistance.

D'autres mesures potentielles visent plutôt la santé humaine, la sécurité publique, la culture et le patrimoine : protéger les établissements et les services de santé des risques associés aux changements climatiques, surtout en cas de phénomène météorologique extrême; évaluer ces risques et en tenir compte dans les plans d'urgence des collectivités; et accroître la résilience des collectivités en misant sur leur épanouissement culturel et social. Dans cette optique, il faut préserver et utiliser le savoir traditionnel et local, et faire participer les jeunes et les aînés aux programmes d'initiation à la vie dans la nature pour transmettre ce savoir aux générations futures.

En ce qui concerne les transports, l'électricité, les communications, l'eau, les services d'assainissement et d'autres infrastructures importantes telles que les centres de santé, les écoles et les installations communautaires, citons comme éventuelles stratégies d'adaptation : resserrer les normes de construction pour que la fonte du pergélisol et les phénomènes météorologiques extrêmes soient pris en compte à toutes les étapes du projet, y compris la planification, la conception et l'exploitation;

et assurer le suivi et la mise à jour des évaluations des risques pour déterminer s'il faut prendre des mesures d'atténuation ou moderniser les infrastructures (bâtiments, routes) en fonction des nouvelles conditions climatiques.

Le réchauffement climatique recèle néanmoins certaines potentialités dans des secteurs comme l'agriculture et la foresterie. La saison des cultures étant prolongée, une augmentation de la production locale pourrait remédier à des problèmes de sécurité alimentaire. Et en utilisant de plus en plus la biomasse ténnoise (bois de corde et granules), les TNO pourraient se doter de solutions locales et créer des emplois. Ces deux secteurs collaborent à la réduction des émissions de gaz à effet de serre.

PROCHAINES ÉTAPES

Pour chacun des trois objectifs du Cadre, les mesures potentielles à inclure dans le Plan d'action 2019-2023 ont été sommairement définies, tout comme les moyens de communiquer l'information sur les changements climatiques et d'aider les collectivités à y faire face. Il faut à tout prix diffuser largement l'information et mobiliser les collectivités à tous les niveaux de cette quête d'acquisition de nouvelles connaissances.

Les mesures potentielles orienteront l'élaboration, puis l'application du Plan d'action 2019-2023. Tout au long de son exécution, il y aura des rapports annuels sur les progrès réalisés et les ajustements nécessaires. Après cinq ans, le plan sera évalué et remplacé par une nouvelle version (2025-2029).

Comme le montre le Cadre, d'importantes démarches ont été entreprises en réponse aux recommandations formulées par le Bureau du vérificateur général du Canada dans son rapport d'octobre 2017 sur les changements climatiques aux TNO. Le plan d'action détaillé découlant du Cadre traitera plus spécifiquement de ces recommandations.

La réalisation du Plan d'action passera par le partage des responsabilités et la collaboration avec les administrations communautaires, les gouvernements autochtones et les autres parties concernées. Le ministère de l'Environnement et des Ressources naturelles, responsable de la lutte contre les changements climatiques, jouera un rôle prépondérant dans les efforts de concertation tant aux TNO qu'avec les autres territoires, les provinces et le gouvernement fédéral.

En conclusion, les TNO comptent sur le Cadre pour faire face aux défis que présentent les changements climatiques et en exploiter les potentialités, passer à une économie plus sobre en carbone et contribuer aux efforts nationaux et internationaux déployés pour la cause.

1.0

INTRODUCTION – CLIMATE CHANGE



The Northwest Territories (NWT) is a largely undisturbed landscape with unique ecosystems that have supported Indigenous people for millennia. Covering more than one million square kilometres, the NWT is home to approximately 44,000 people who are spread across the territory in 33 communities.

NWT residents have a long-standing relationship with the land. Indigenous people draw their

spiritual and cultural identity from the land and many still practice a traditional lifestyle that includes hunting, fishing, trapping and gathering. Maintaining residents' health, safety and wellness, and cultural practices is critical.

The territory has world-class mineral and petroleum deposits and significant renewable energy resources that offer great potential for development and much needed economic benefit.

Despite abundant renewable and non-renewable resource potential, the NWT economy depends heavily on imported fossil fuels to meet its energy needs. This dependence on fossil fuels results in significant greenhouse gas emissions (GHGs) (on a per-capita basis) and contributes to the high cost of living and doing business in the NWT.

The science is clear that human activities, particularly the burning of fossil fuels, cause climate change and are a major contributor to increasing global average temperatures. Even though the NWT's emissions make up just 0.2% of Canada's total GHG emissions, climate change effects are being acutely experienced across the territory.

Climate change is a long-term shift in weather conditions identified by changes in temperature, precipitation, winds and other indicators. Climate change can involve both changes in average conditions and changes in variability, including, for example, extreme events.

In the northern NWT, average temperatures are warming up to four times faster than global average temperatures while the southern NWT is warming about two times faster. The natural environment, including water, permafrost, vegetation and wildlife, is experiencing changes due to a warming climate. These changes affect the human environment, namely through pressures on health, public safety, infrastructure, food security, and culture and heritage.

The 2030 NWT Climate Change Strategic Framework (the Framework) outlines how the territory as a whole plans to respond to challenges and opportunities associated with climate change, move towards a lower-carbon economy and do its part to contribute to national and international efforts on climate change.

1.1 INTERNATIONAL AND NATIONAL CONTEXT

During the 21st session of the United Nations' Conference of the Parties, held December 2015 in Paris, France, representatives of 195 countries reached agreement on a new global climate change accord known as the Paris Agreement. Key objectives of the Paris Agreement include GHG mitigation, adaptation and financing initiatives to begin in 2020. Specifically, the Paris Agreement aims to strengthen the global response to the threat of climate change by:

- Holding the increase in global average temperature to well below 2°C (above pre-industrial levels) and pursuing efforts to limit the temperature increase to 1.5°C; and
- Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience.

Under the Paris Agreement, Canada is committed to a 30% reduction in annual emissions from 2005 levels, by 2030. To implement this commitment, the federal government, provinces and territories worked together to develop the Pan-Canadian Framework on Clean Growth and Climate Change, which was released in December 2016. It provides broad direction and guidance relevant to all Canadian jurisdictions. The NWT will build upon these efforts to address climate change within our territory.

The Pan-Canadian Framework has four main pillars for addressing climate change:

- Pricing carbon pollution;
- Measures to reduce greenhouse gas emissions;
- Measures to adapt to the impacts of climate change and build resilience; and
- Actions to accelerate innovation, support clean technology and create jobs.

1.2 NWT GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions are increasing average global temperatures and causing climate change. Taking strong action to address emissions is critical, and the need to act is urgent.

Carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride are the six main GHGs. Each of these gases persists for a different length of time in the atmosphere and has a different global warming potential. All GHG emissions are measured as carbon dioxide equivalents (CO₂e) to allow for comparison.

1.0

INTRODUCTION – CLIMATE CHANGE

Figure 1: NWT Historical Greenhouse Gas Emissions (1990-2016)

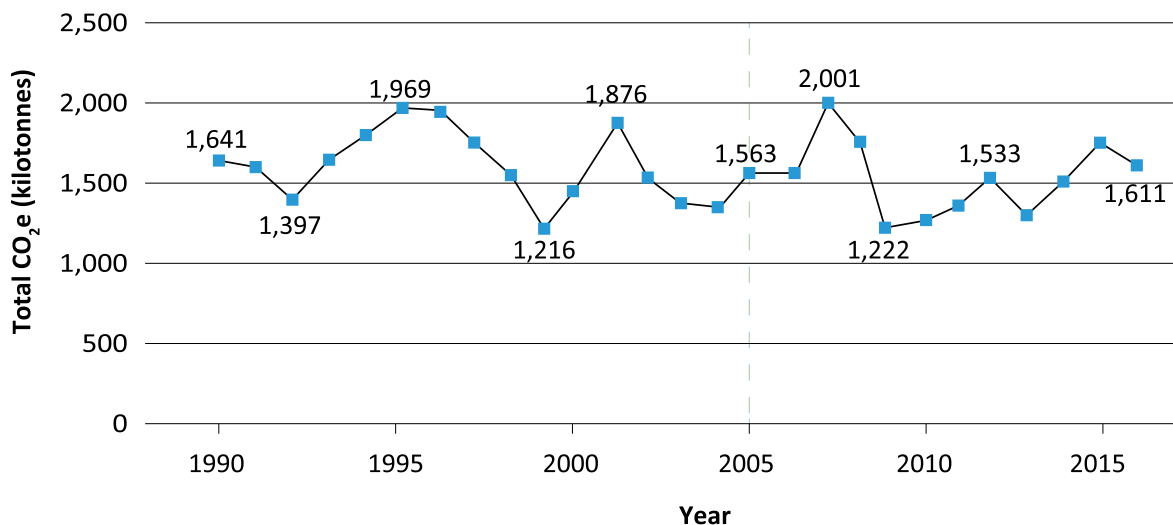


Figure 1 shows the NWT’s total annual GHG emissions, measured from human-caused sources from 1990 to 2016, in kilotonnes (kt) of CO₂e.

Approximately 96% of the NWT’s annual human-caused emissions are due to fossil fuel use. The other 4% comprises emissions from minor sources such as waste and the oil and gas industry.

Each year, the NWT’s annual emissions fluctuate depending on how much fossil fuel is consumed. In turn, the NWT’s annual fossil fuel requirements are driven by the level of economic activity, the climatic conditions experienced and the level of investment in energy efficiency and renewable energy systems.

Natural sources and sinks of GHG emissions in the NWT include lakes, rivers, wetlands, forests and oceans. Forests and oceans are generally considered carbon sinks as they store more GHGs than they release. As permafrost thaws, the carbon stored in the frozen ground is released and more GHG emissions can result. Since there is minimal data on natural sources and sinks of GHGs, they have not been accounted for in the NWT GHG emissions levels presented in the Framework. However, as temperatures continue to rise, research, modeling and monitoring will be necessary to better understand the impacts of thawing permafrost, changing vegetation, lakes, rivers, wetlands and oceans, as well as wildland fires and insect outbreaks, on GHG emissions.

Since 2009, the NWT's total annual GHG emissions from human-caused sources have been relatively stable, varying between 1,220 and 1,720 kt CO₂e, due to annual fluctuations in economic activity and fossil fuel consumption.

In 2016, the most recent year for which data are available, the NWT's GHG emissions were 1,611 kt CO₂e – representing about two-tenths of one percent (0.2%) of Canada's annual GHG emissions. More information on the human-caused sources of NWT GHG emissions is provided in Section 3.0.

While the NWT is not a large contributor to national or global emissions, it is still very important that the NWT economy continues to move from a dependence on imported fossil fuels towards increased use of local and renewable energy sources to reduce the cost of living and build resilient, efficient communities.

1.3 UNDERSTANDING CLIMATE CHANGE

The NWT is situated in a cold arctic and subarctic climate. The plants, wildlife and people that live here have adapted to this cold climate and depend on it to maintain the conditions needed to thrive.

The northern NWT is experiencing rapid average annual temperature increases – up to four times faster than global averages – while the southern NWT is warming about two times faster (see Figure 2). This degree of warming is significant and has serious implications for the NWT.

Over the past 100 years, global average surface temperatures have warmed by about 1°C. In arctic and subarctic regions, average surface temperatures have increased much faster than the global average due to differences in atmospheric conditions and reduced sea ice coverage. This phenomenon is known as arctic amplification.

Computer model projections indicate that without global action to reduce GHG emissions, average annual temperatures in the northern NWT could increase by as much as 8°C to 10°C by 2100. If global efforts to significantly reduce emissions are successful, the northern NWT may experience less severe temperature increases – likely in the range of 4°C to 6°C. The southern NWT is not predicted to exhibit the same level of warming as northern

areas. However, it is still anticipated to experience greater warming than other parts of Canada and much of the world.

While future temperature increases cannot be predicted with certainty, it is clear that warming trends will continue over the long-term, and will be most pronounced during shorter winter seasons, impacting ice quality and travel over ice. The NWT has been experiencing detrimental effects from climate change for decades. The impacts, which are increasing in severity as the warming progresses, include thawing permafrost, shrinking sea ice, coastal erosion, flooding, wildland fire, drought and impacts on vegetation and wildlife. The extent and rate of the changes have serious implications for the NWT, including community and territorial infrastructure, the well-being of residents and the viability of some economic activities.

1.0 INTRODUCTION – CLIMATE CHANGE

Figure 2: Observed Historical Rates of Warming – Hay River and Inuvik (1958-2015)

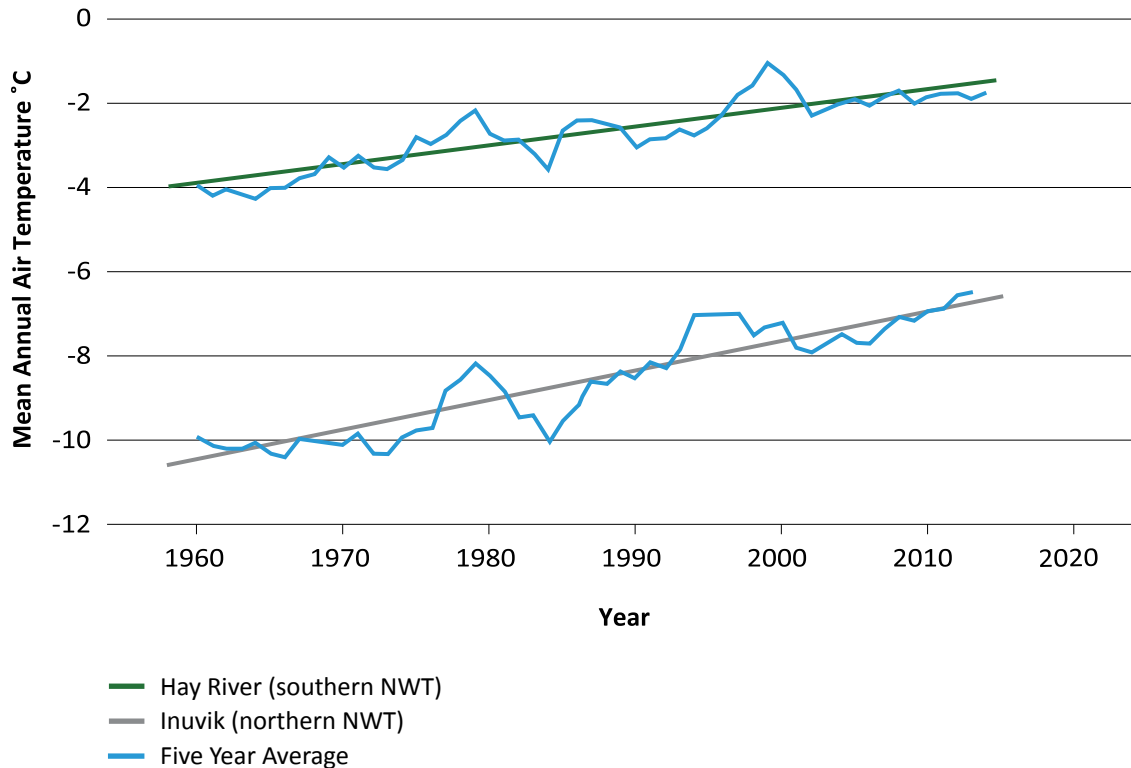


Figure 2 illustrates observed warming in mean annual air temperature at Hay River and Inuvik airports from 1958-2015. The rate of warming is greater in the northern NWT (Inuvik) compared to the southern NWT (Hay River).

1.4 WHY WE NEED A NWT CLIMATE CHANGE STRATEGIC FRAMEWORK

The NWT must address climate change by doing its part to reduce fossil fuel use and GHG emissions. As the northern climate continues to warm, the NWT must prepare to increase the resilience of its communities, and find ways to adapt to the changes already happening or yet to come.

Climate change represents serious and urgent challenges for the NWT. Recognizing this urgency, the 18th Legislative Assembly made mitigating and adapting to climate change a key priority of its term and the Government of the Northwest Territories (GNWT) committed in its mandate to developing a territorial climate change strategy.

Key Climate Change Concepts

- **Mitigation** aims to reduce the causes of climate change.
- **Building resilience** focuses on finding ways to withstand the climate-related changes that are occurring or yet to come.
- **Adaptation** involves modifying decisions, activities and ways of thinking to adjust and respond to a changing climate.

The Framework is the NWT’s roadmap for addressing climate change from 2018 to 2030.

The purpose of the Framework is to comprehensively address the following climate change issues:

- **GHG Emission Targets:** New targets, consistent with the Pan-Canadian Framework on Clean Growth and Climate Change, have been set for the NWT to achieve by 2030. This is necessary to replace the targets from the previous 2011-2015 NWT Greenhouse Gas Strategy (which expired in March 2016) and to indicate how the NWT is contributing to Canada’s objectives under the 2015 Paris Agreement;
- **Resilience and Adaptation:** Describing how the NWT can respond to a warming climate by increasing the resilience of communities and finding ways to adapt to the changes already happening or yet to come; and
- Recommendations from the Office of the Auditor General of Canada’s Climate Change in the NWT audit report, which was tabled in the Legislative Assembly in October 2017.

This Framework sets out a clear vision to guide all GNWT initiatives on how to consider and address climate change. Under each goal in the Framework (Section 2.2), efforts needed to address climate change in the NWT have been identified. During

the development of the 2019-2023 Action Plan to implement the Framework, these efforts will be prioritized and actions for implementation will be defined.

Climate Change Audit

In October 2017, the Office of the Auditor General of Canada submitted its report, *Climate Change in the Northwest Territories*, to the NWT Legislative Assembly. This audit focused on whether the Department of Environment and Natural Resources and the Department of Infrastructure previously took adequate steps to meet their commitments to reduce territorial GHG emissions and to adapt to climate change impacts in the NWT.

Through releasing the 2030 NWT Climate Change Strategic Framework, the Government of the Northwest Territories has taken a significant step towards addressing key recommendations made by the Auditor General. In addition, a detailed Action Plan being developed in 2018 will provide for ongoing assessment and adaptive management as needs evolve. See Appendix A for details on how the Auditor General’s recommendations have been addressed in this Framework.

1.0

INTRODUCTION – CLIMATE CHANGE

For clarity, it should be noted that the Framework does not include detailed information on climate change topics that are dealt with in other GNWT strategies or are still under development. These include:

- **Energy:** The 2030 Energy Strategy is the mechanism for reducing GHG emissions related to energy supply and consumption. The associated Three Year Energy Action Plan (2018-2021) describes the actions and investments required to meet the NWT’s GHG emission targets.
- **Carbon Pricing:** The GNWT intends to honour its carbon pricing commitment under the Pan-Canadian Framework on Clean Growth and Climate Change. The GNWT is working on an approach to implement carbon pricing that encourages carbon conservation and substitution to reduce GHG emissions while minimizing the effect on the local cost of living and the creation of additional barriers to economic development. The GNWT approach to carbon pricing will be announced in a separate document.

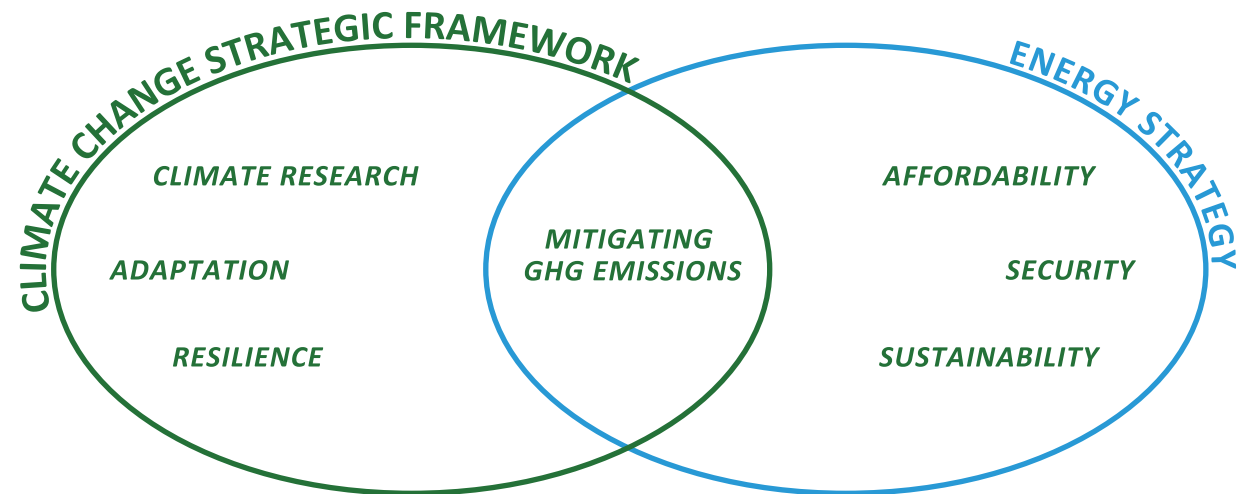
1.5 LINKS WITH OTHER PLANS AND STRATEGIES

Efforts to address climate change in the NWT need to be integrated and aligned with other important goals and considerations in the territory.

The 2030 Energy Strategy and this Framework were developed at the same time and share

common elements in terms of their respective vision statements, goals and objectives, along with GHG emissions reduction targets.

The Framework sets the NWT’s overall approach to addressing climate change. As a cross-cutting issue, climate change considerations affect the objectives and actions of many other strategies and plans, both within and external to the GNWT.



To the greatest extent possible, the development and implementation of the Framework is intended to be consistent with, and supportive of, the following strategies and plans:

- Paris Agreement (2015)
- Pan-Canadian Framework on Clean Growth and Climate Change (2016)
- 2030 Energy Strategy – A Path to More Secure, Affordable and Sustainable Energy in the Northwest Territories (2018)
- Carbon Pricing Approach (under development)
- NWT Petroleum Resources – A Path to Northern Benefits and Energy Security (2018)
- GNWT Knowledge Agenda (2017)
- NWT Water Stewardship Strategy (2010) and Action Plan (2016-2020)
- GNWT Land Use and Sustainability Framework (2014)
- NWT Economic Opportunities Strategy (2013)
- NWT Mineral Development Strategy (2013) and Implementation Plan (2014-2019)
- NWT Agriculture Strategy – The Business of Food: A Food Production Plan (2017-2022)
- Healthy Land, Healthy People – GNWT Priorities for Advancement of Conservation Network Planning (2016-2021)
- Strong Cultures, Strong Territory – GNWT Culture and Heritage Strategic Framework (2015-2025)
- Strategy for Revitalizing the Great Slave Lake Commercial Fishery (2017)
- NWT Geological Survey Strategic Plan (2017-2022)
- Inuit Priorities for Canada’s Climate Strategy (2016) and National Inuit Climate Change Strategy (2018)
- NWT Waste Resource Management Strategy (under development)
- NWT Manufacturing Strategy (under development)
- Northern Adaptation Strategy (under development by Crown-Indigenous Relations and Northern Affairs Canada in collaboration with the GNWT and other northern governments)

2.0

2030 NWT CLIMATE CHANGE STRATEGIC FRAMEWORK



The GNWT understands the implications of climate change and is committed to working with community, Indigenous, territorial, provincial and federal governments, non-government organizations, industry and other stakeholders to address these challenges through the implementation of the Framework.

2.1 WHAT WE HEARD

The GNWT conducted a series of engagement activities during the fall and winter of 2016-2017 in Inuvik, Norman Wells, Fort Simpson, Hay River, Fort Smith and Yellowknife to gather input on both the Framework and the 2030 Energy Strategy. In addition to the workshops, other engagement activities included a public survey, written submissions and public feedback on the draft Framework.

Key input received by the GNWT pertained to the following areas:

- **Setting GHG Emissions Targets:** There was general agreement that the NWT should set emissions reduction targets to demonstrate its commitment to addressing climate change and align with or surpass Canadian targets;
- **Reducing Fossil Fuel Use:** There was a strong interest in energy efficiency and the development of local renewable energy options to reduce fossil fuel use, both in communities and by industry;
- **Implementing Carbon Pricing:** There was a mixed response to carbon pricing. Some respondents expressed concern about potential increases to the already high cost of living and doing business, while others felt it was critical for reducing GHG emissions. Ideas on how the GNWT should use carbon tax revenues included rebates to residents and investments in initiatives that reduce fossil fuel use and/or build resilience to climate change impacts;
- **Increasing Research and Monitoring Efforts:** Respondents expressed concern about numerous climate change impacts. There was a strong interest in additional research and monitoring initiatives to better understand and predict territorial impacts;
- **Respecting Aboriginal and Treaty Rights:** The need for meaningful engagement and consultation where Aboriginal and Treaty rights may be negatively impacted by climate change mitigation and adaptation efforts was highlighted;
- **Involving Communities:** Communities expressed a strong interest in being much more involved in identifying, planning and completing research and monitoring, as well as adaptation activities. Specific suggestions included better partnerships between communities and researchers, and increasing the use of traditional and local knowledge;
- **Building Community Capacity:** Building capacity through training, mentoring and adequate resourcing to facilitate community involvement in research, monitoring and adaptation efforts was highlighted by many;
- **Communication and Outreach:** Respondents stated that regular, consistent and transparent communication and outreach on climate change findings is necessary to ensure communities have access to the best available information to support their participation in relevant decision-making;
- **Building Resilience and Adapting to Changes:** Key areas of concern brought forward included ecosystem and environmental management, better planning for future infrastructure and addressing impacts to people, such as food security, air and water quality, access to the land (e.g. as ice conditions change) and emergency preparedness; and
- **Authority for Climate Change Mitigation and Adaptation:** Many respondents stressed the need for clarity with respect to the authorities of specific GNWT departments in implementing climate change mitigation and adaptation efforts.

This important feedback was carefully reviewed and integrated into the development of the Framework and its vision, guiding principles and goals.

2.0

2030 NWT CLIMATE CHANGE STRATEGIC FRAMEWORK

2.2 VISION, GUIDING PRINCIPLES AND GOALS

Vision

By 2030, the NWT will enjoy a strong, healthy economy that is less dependent on fossil fuels (compared to 2005) and will have developed the knowledge, tools and measures needed to increase resilience and adapt to the changing northern climate.

Guiding Principles

The vision of the Framework is supported by several guiding principles:

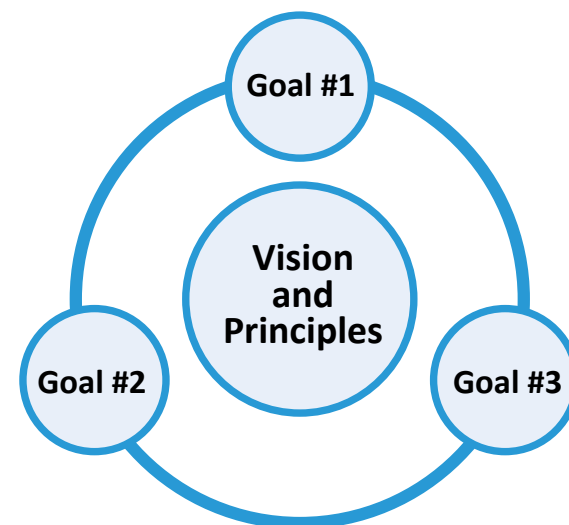
- **Taking Action:** The NWT is experiencing significant climate change impacts and must continue to take immediate action. Climate change considerations need to be included in all relevant planning, decision-making and operations;
- **Meeting Climate Change Commitments:** The NWT has a responsibility to contribute to national and international efforts to address climate change, particularly in reducing fossil fuel use and GHG emissions;

- **Sharing Responsibility:** The responsibility for taking action on climate change is shared by all segments of NWT society, including governments, businesses and residents;
- **Strong Collaboration:** Strengthening the collaboration between governments – including community and Indigenous governments, stakeholders and residents – on mitigation and adaptation actions, based on recognition of rights, respect, cooperation and partnership;
- **Respecting Aboriginal and Treaty Rights:** Climate change mitigation and adaptation decisions respect Aboriginal and Treaty rights, including land, resource and self-government agreements;
- **Traditional, Local and Scientific Knowledge:** Accessing all knowledge types to understand and make decisions related to climate impacts and adaptation measures; and
- **Transparency and Accountability:** Decisions made to implement the Framework are transparent and accountable.

Goals

The NWT is focusing on **three climate change goals** to achieve the vision:

- **Goal #1:** Transition to a strong, healthy economy that uses less fossil fuel, thereby reducing greenhouse gas emissions by 30% below 2005 levels by 2030.
- **Goal #2:** Improve knowledge of the climate change impacts occurring in the NWT; and
- **Goal #3:** Build resilience and adapt to a changing climate.



2030 NWT CLIMATE CHANGE STRATEGIC FRAMEWORK

Under Goal #1, the GNWT is committing the NWT to the same 30% reduction in its annual GHG emissions (compared to 2005) that Canada agreed to under the Paris Agreement (2015).

For Goal #2, numerous research and monitoring projects or programs have been undertaken. However, there is still a need to understand more about the impacts and opportunities associated with a warming climate. Developing a better understanding of current and future impacts and opportunities by 2030 is the NWT's most critical climate change need, and supports Goal #3.

Goal #3 describes the overall outcome that the NWT is striving to achieve over the long-term. While there are resilience and adaptation actions that can and should be implemented today, many of the potential impacts and opportunities from climate change are complex and not yet sufficiently understood. Further progress on Goal #2 is essential to provide the informational foundation needed to build resilience and adapt to a changing climate over time.

2.3 2030 MILESTONE

To achieve the vision of the Framework, the GNWT has selected the year 2030 as a significant milestone for setting targets and measuring progress towards meeting its goals, consistent with the Paris Agreement (2015) and Pan-Canadian Framework on Clean Growth and Climate Change (2016).

For planning and tracking purposes, the timeline to 2030 is divided into several distinct phases:

- 2018:** Release Framework and develop the accompanying 2019-2023 Action Plan
- 2019-2023:** Implement the 2019-2023 Action Plan and complete yearly reviews and adjustments
- 2024:** Complete a comprehensive review of the Framework and 2019-2023 Action Plan, and develop a new five-year Action Plan
- 2025-2029:** Implement the 2025-2029 Action Plan and complete yearly reviews and adjustments
- 2030:** Conduct a second comprehensive review of the Framework and 2025-2029 Action Plan, and update and renew accordingly

Yearly review of the progress made to achieve targets and goals, as well as the need for adjustments, will be reported in an annual report.

These timeframes are utilized in Section 3.1 for reviewing progress and adaptive management related to GHG emissions targets and elaborated upon in Section 8.2.2 to describe the Framework implementation and renewal process.

3.0

GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY



Photo: NT Power Corporation

To achieve Goal #1 by 2030, the NWT economy needs to remain strong and viable while taking concrete actions to gradually reduce GHG emissions. This means growing the economy while at the same time reducing fossil fuel use

and associated emissions. Separating economic growth from fossil fuel consumption will require substantial capital investments in energy efficiency and local supplies of renewable and lower carbon energy sources. In the NWT, 23 of 33 communities

rely on diesel for electricity generation. This is a major challenge and one that requires significant investment in alternative energy solutions to address.

GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY

3.1 NWT ANNUAL GREENHOUSE GAS EMISSIONS TARGETS

Canada is committed to achieving or exceeding a 30% reduction in annual GHG emissions from 2005 levels by 2030.

The NWT's annual GHG emissions are calculated by Environment and Climate Change Canada (ECCC) as part of Canada's National Inventory Report. In 2005, the NWT's total GHG emissions were 1,563 kt CO₂e. To achieve its 30% emissions reduction target, the NWT's total annual GHG emissions need to be reduced to 1,094 kt CO₂e by 2030, as shown in Figure 3.

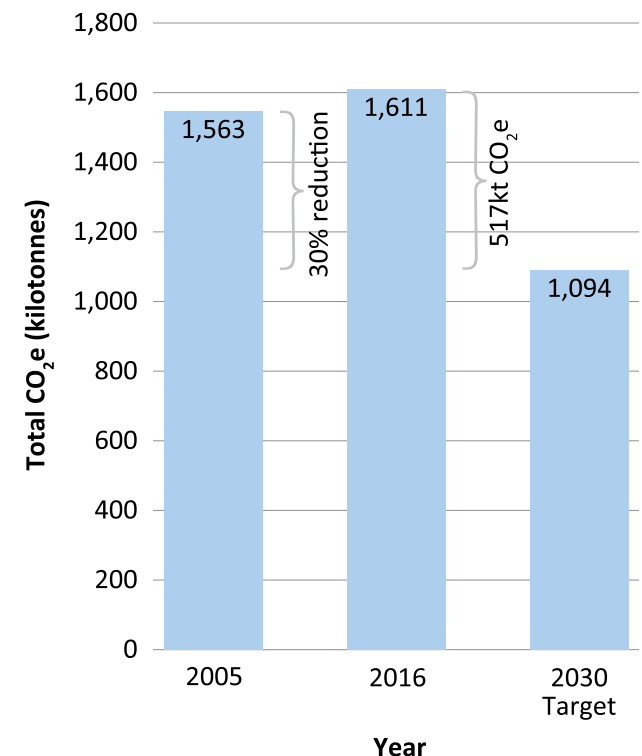
One kilotonne (kt) of GHG emissions, measured in CO₂e, is equivalent to using approximately 376,900 litres of heating oil to heat 151 NWT homes for one year. Replacing heating oil with about 514 tonnes of wood pellets or 642 cords of wood could prevent this kilotonne of emissions.

To provide milestones for measuring progress, total emission targets for the NWT are shown below. The 2020 milestone reflects a modest reduction in emissions, as it is based only on actions that can be taken immediately. The 2025 and 2030 milestones are more ambitious, as these reflect actions that require more time to plan and implement, but result in bigger reductions in emissions:

- 2020 milestone target = 1,550 kt CO₂e (61 kt CO₂e or 3.7% reduction over 4 years from 2016)
- 2025 milestone target = 1,400 kt CO₂e (150 kt CO₂e or 9.7% reduction over 5 years from 2020)
- 2030 final target = 1,094 kt (306 kt CO₂e or 21.9% reduction over 5 years from 2025)

The milestone emissions targets will help to inform the development of successive five-year Action Plans (2019-2023 and 2025-2029) and provide the basis for assessing progress.

Figure 3: NWT's Historical and Target Greenhouse Gas Emissions (2005-2030)



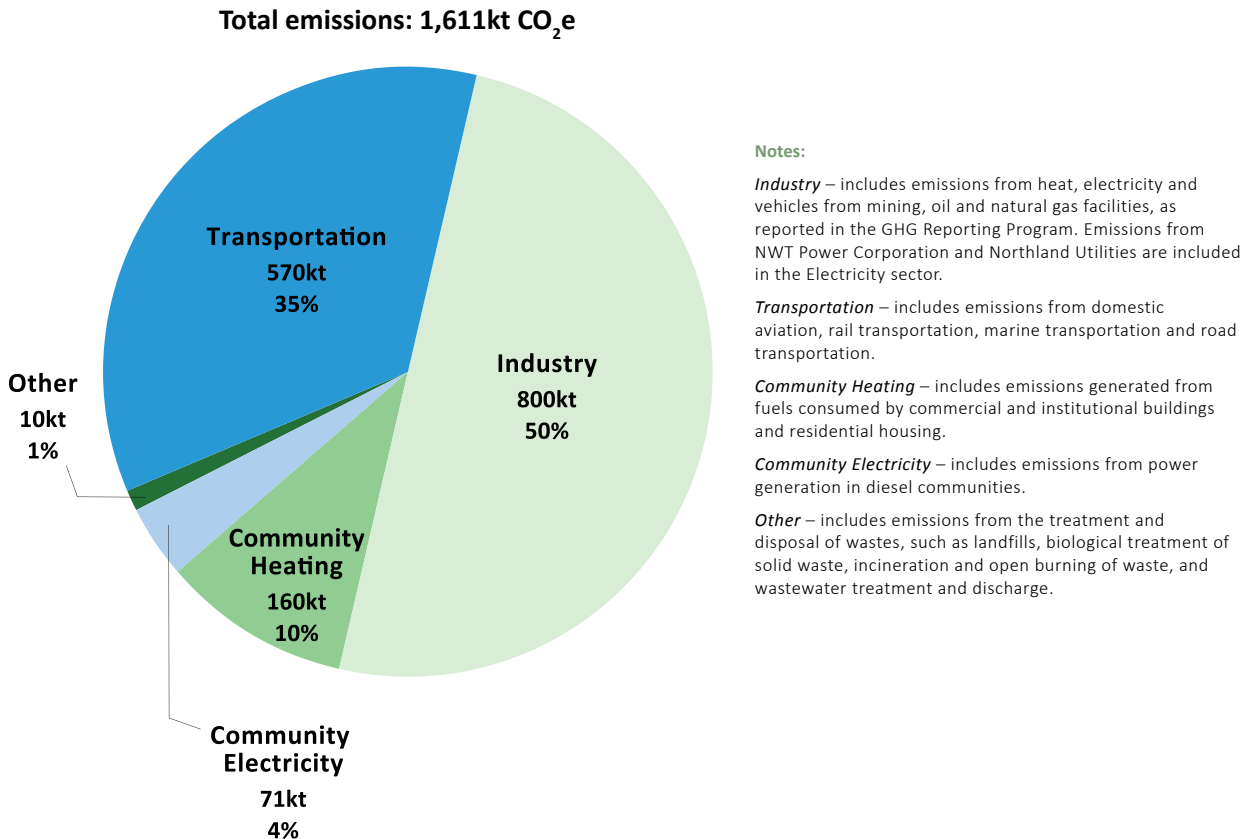
3.0

GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY

3.2 NWT SECTOR-SPECIFIC GHG EMISSIONS

Each year, data from ECCC’s National Inventory Report and GHG Reporting Program are used to estimate the NWT’s sector-specific emissions. Most GHG emissions in the NWT for 2016 are from fossil fuel use for electricity, space heating, transportation and industry as illustrated in Figure 4.

Figure 4: 2016 NWT Sector-specific Greenhouse Gas Emissions



3.3 NWT GREENHOUSE GAS EMISSION REDUCTION EFFORTS

The NWT is a signatory to the Pan-Canadian Framework on Clean Growth and Climate Change and is committed to doing its part to contribute to national and international efforts to reduce GHG emissions.

During 2016 and 2017, the GNWT undertook extensive public engagement and analytical work to develop a draft Framework and a draft 2030 Energy Strategy. This work was based on the understanding that the NWT’s annual emissions in recent years were stable and that reducing emissions by 290 kt CO₂e, to 30% below the 2005 level, was achievable with no major impacts on the NWT economy.

In early 2018, ECCC made changes to the methods used to estimate Canada’s emissions as part of its preparation of the 2018 National Inventory Report. These updates to how emissions are calculated addressed some past errors and changes to modelling methodology. The GNWT will continue to work with ECCC to increase the accuracy of how the NWT’s emissions are estimated and publicly reported.

GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY

The 2018 National Inventory Report indicates that the NWT's current level of emissions, as shown in Figure 4, is higher than previously understood. Therefore, to reach the 2030 target of 1,094 kt CO₂e, the NWT needs to reduce its total annual emissions by 517 kt CO₂e, or 32%, based on current GHG emissions estimates.

It is important to note that, as the NWT's emissions are comparatively small, representing only 0.2% of Canada's total GHG emissions, any significant changes in annual emissions estimates can substantially affect the NWT's ability to meet its emission reduction targets.

Mechanisms available to the NWT to reach its 2030 emissions target are described below.

3.3.1 2030 Energy Strategy

The 2030 Energy Strategy outlines how the NWT can improve its energy systems and reduce emissions. Detailed actions and investments are described in an associated Three Year Energy Action Plan (2018-2021). Together, these two documents address energy efficiency, electricity generation in diesel communities, renewable energy for community heating, energy used for road transportation and industry, and development of the NWT's energy potential.

The 2030 Energy Strategy identifies six Strategic Objectives to achieve the GNWT's vision of a more secure, affordable and sustainable energy system in the NWT.

The Strategic Objectives are:

1. Work together to find solutions through community engagement, participation and empowerment.
2. Reduce GHG emissions from electricity generation in diesel powered communities by an average of 25%.
3. Reduce GHG emissions from transportation by 10% per capita.
4. Increase the share of renewable energy used for space heating to 40%.
5. Increase residential, commercial and government building energy efficiency by 15%.
6. A longer term vision: develop the NWT's energy potential, address industry emissions and do our part to meet national climate change objectives.

The GNWT heard consistently from the public that it should be innovative and do more to address emissions. Innovation, including connecting industry and communities to renewable energy, would significantly reduce NWT emissions and stabilize the cost of living and doing business in the NWT.

One example of an innovative transformative project is to bring renewable energy to industry through the development of the Taltson

hydroelectric project, which has the potential to reduce industrial emissions by about 240 kt. This project, and several others, was identified in the NWT annex in the Pan-Canadian Framework on Clean Growth and Climate Change. To proceed, these projects require federal government support.

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GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY

3.3.2 Carbon Pricing

Under the Pan-Canadian Framework on Clean Growth and Climate Change, all jurisdictions in Canada are required to implement some form of carbon pricing in 2018. While provinces and territories have the flexibility to choose the type of carbon pricing system to implement, the federal government will introduce a carbon price backstop (tax) in jurisdictions that do not meet the federal carbon pricing benchmark. The federal carbon pricing benchmark specifies that jurisdictions must implement carbon pricing systems that are equivalent to \$10 per tonne of emissions in 2018 and increase by \$10 per tonne annually to \$50 per tonne in 2022.

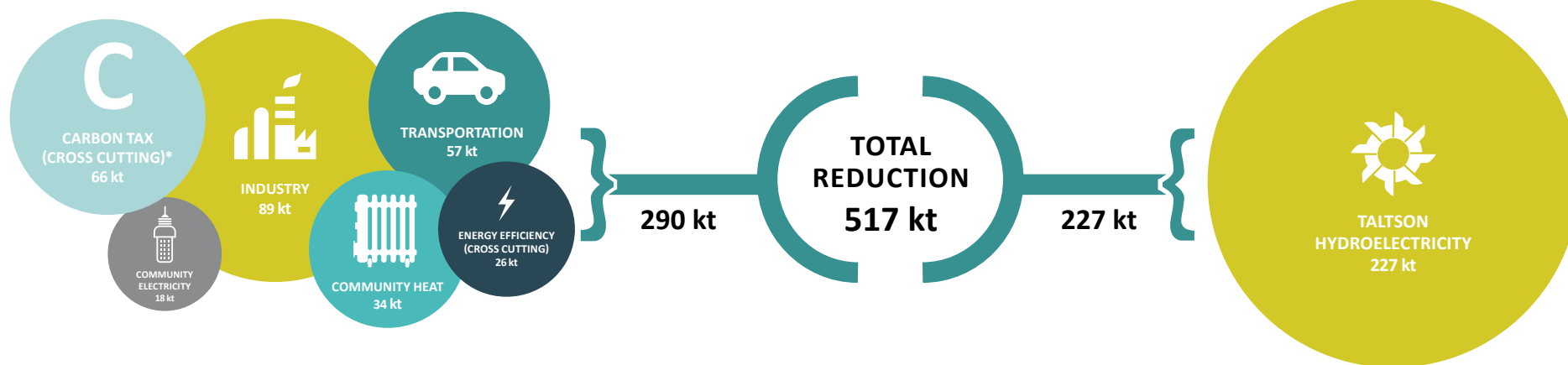
The GNWT must decide between using the federal carbon price backstop and implementing its own carbon pricing system. The GNWT is working on an approach to carbon pricing that encourages carbon conservation and substitution to reduce GHG emissions while minimizing the effects on the local cost of living and additional barriers to economic development. The GNWT approach to carbon pricing will be announced in a separate document.

hydroelectric development and the estimated impact from a \$50 per tonne carbon tax – the estimated GHG emissions reductions that can be achieved on a sector-by-sector basis by 2030 are illustrated below.

It is estimated that the implementation of actions in the 2030 Energy Strategy, as well as carbon pricing, will reduce territorial emissions by 290 kt, with an additional reduction of 227 kt from innovative transformative projects, for a total reduction of 517 kt from 2016 levels, by 2030. This will enable the NWT to meet the Pan-Canadian Framework.

3.3.3 Sector-specific GHG Emission Reduction Targets

Based on the strategic objectives and actions in the 2030 Energy Strategy – including the Taltson



GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY

3.3.4 Other GHG Emission Reduction Initiatives

Other options for reducing GHG emissions that are not energy-related are outlined below:

New Resource Development Projects: In the NWT, proposed resource development projects, along with other large infrastructure projects, are generally evaluated through an environmental impact assessment process administered by either the Mackenzie Valley Environmental Impact Review Board or the Environmental Impact Review Board (Inuvialuit Settlement Region). Once an environmental assessment is complete, the project enters a water licensing and land use permitting phase with the Mackenzie Valley Land and Water Board (or regional panels) or Inuvialuit Water Board.

It is important to ensure that future resource development projects take all reasonable steps to minimize their carbon footprints at the outset. It is also necessary to consider climate change impacts on the environment that could affect the viability and closure of a project. The GNWT will work with relevant boards, key federal agencies and industry to support the incorporation of GHG emissions mitigation and climate change adaptation strategies into environmental assessment, water licensing and land use permitting processes.

Carbon Sinks: NWT forests, tundra vegetation, wetlands, rivers, lakes and oceans store carbon and, as such, are considered carbon sinks. Minimal data exists on natural carbon sinks in the NWT, and so further monitoring, research and modeling will be necessary. Natural occurrences can also cause these carbon sinks to become carbon sources (e.g. wildland fires release stored carbon; methane is released from wetlands). The methodologies for calculating carbon sinks and sources are complex and need to be fully explored to determine the role of these environmental components in reducing GHG emissions.

Composting Organic Waste: In 2015, an estimated 6.3 kt CO₂e were emitted from solid waste in the NWT. These emissions are the result of landfill gas (primarily methane and carbon dioxide), which is created from the anaerobic decomposition of organic wastes in landfills. Diverting organic waste from landfills and into composting programs can decrease these GHG emissions.

Composting results in organic matter that can be used to fertilize gardens to grow food. Rich organic soils are not common in many parts of the NWT, presenting challenges for local agriculture, but the production of compost can enrich soil for local food production. Additionally,

growing food locally can reduce GHGs emissions resulting from the transportation of food from southern provinces and improve food security in the NWT.

A number of schools, communities, businesses and organizations in the NWT have implemented composting projects with support from the GNWT. Continued composting at remote industrial sites and at the community level will help reduce GHG emissions and support increased local food production.

Composting at the Ekati Diamond Mine

Due to the remote nature of industrial developments in the NWT, organic waste has been historically incinerated using diesel as the combustion source. In 2015, Dominion Diamond Ekati Corporation installed an in-vessel composter at the Ekati Diamond Mine and has significantly reduced the volume of waste incinerated. To date, an estimated 299,500 litres of diesel fuel have been saved, equivalent to about 0.84 kt CO₂e.

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GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY

Waste Resource Management Strategy:

The GNWT is developing a Waste Resource Management Strategy for the NWT. This Strategy will provide a 10-year roadmap for improving waste management practices in the territory.

A major focus of the Waste Resource Management Strategy will be shifting away from a disposal model to an integrated waste management approach that emphasizes waste prevention, reuse and recycling. This Strategy will also focus on improving the management of waste sent to landfills to maintain the quality of our land, air and water, as well as the health of wildlife, plants, ecosystems and people living in the NWT.

Recycling in the NWT

Recycling is another way to reduce GHG emissions. As part of the NWT beverage container recycling program, residents diverted 1,233 tonnes of beverage containers from landfills in 2016-2017. The GHG emissions avoided by recycling these materials were equivalent to approximately 2.5 kilotonnes CO₂e – the same as taking 52 cars off NWT roads from 2016 to 2017.

The GNWT is gathering input from community and Indigenous governments, businesses, other stakeholders and the public to inform the development of the Waste Resource Management Strategy, which is targeted for completion in 2019.

3.4 EMISSIONS TRACKING AND REPORTING

Accurate tracking of GHG emissions is an important part of assessing the NWT's environmental performance and measuring progress towards meeting GHG reduction targets. The GNWT and large emitters in the NWT report emissions to various agencies to comply with federal reporting requirements and/or for voluntary reasons.

3.4.1 GNWT Emissions Reporting

The GNWT voluntarily reports its GHG inventory, as it recognizes its role in leading by example to reduce GHG emissions. The Climate Registry is a recognized non-profit organization that designs and operates voluntary and compliance GHG reporting programs globally. Each year since 2011, the GNWT has prepared and submitted a GHG inventory to The Climate Registry. Tracking its emissions allows the GNWT to assess its progress towards achieving its GHG reduction targets.

GNWT Emissions Reductions

From 2011 to 2016, the GNWT's emissions have been reduced by 15%, from 37.4 kt to 31.6 kt CO₂e, due to energy efficiency retrofits and conversions to wood pellet heating systems.

3.4.2 Environment and Climate Change Canada – Greenhouse Gas Emissions Reporting Program

Since 2004, Environment and Climate Change Canada (ECCC) has required facilities that emit 50 kt CO₂e or more per year to submit a report through its GHG Reporting Program. For the 2015 reporting year, five facilities in the NWT submitted annual reports to the GHG Reporting Program:

1. Ekati Diamond Mine – Dominion Diamond Ekati Corporation (216 kt CO₂e)
2. Diavik Diamond Mine – Diavik Diamond Mines Inc. (169 kt CO₂e)
3. Snap Lake Mine – De Beers Canada Inc. (122 kt CO₂e)
4. Norman Wells Central Processing Facility – Imperial Oil Resources N.W.T. Limited (88 kt CO₂e)
5. Jackfish Plant – NWT Power Corporation (56 kt CO₂e)

GOAL #1 – TRANSITION TO A LOWER CARBON ECONOMY

ECCC is in the process of expanding the requirements under the GHG Reporting Program to obtain a more comprehensive picture of emissions by Canadian facilities.

The proposed changes, anticipated to take effect in 2018, will include:

- Lowering the reporting threshold from 50 kt to 10 kt. All facilities that emit 10 kt or more of CO₂e per year will be required to submit a report; and
- Requiring facilities to provide additional data and apply specific quantification methods to determine emissions. These new requirements will be gradually phased in.

When these new reporting requirements are implemented, additional facilities in the NWT will need to track and report their annual emissions. As more information becomes available from ECCC, the GNWT will work to identify and communicate with those NWT facilities that may be affected by these new reporting requirements.

3.4.3 NWT Annual Reporting

Each year the GNWT prepares and releases a NWT GHG Emissions Summary Report. Data in this report comes from ECCC's National Inventory Report, prepared in accordance with international emissions reporting guidelines, and from ECCC's GHG Reporting Program.

The GNWT will continue to work closely with ECCC to improve the accuracy of the NWT annual emissions estimate and will continue to develop and refine its reporting methods to incorporate new emissions data as it becomes available. This work will improve the consistency, accuracy and reliability of the NWT's emissions inventory and deliver a clearer picture of the NWT's emissions by sector.

The NWT's GHG Emissions Summary Report compiles NWT-specific data from the National Inventory Report and outlines the NWT's emissions, by sector. Facility-level reporting from ECCC's GHG Reporting Program is incorporated to summarize emissions from industry. The NWT GHG Emissions Summary Report compares the NWT's annual emissions to emissions targets.

The NWT's annual reporting will provide information on the progress being made to reduce territorial emissions and achieve specific targets, by sector.

3.5 GOAL #1 – PRIORITIES TO BE INCLUDED IN THE ACTION PLAN

Potential actions to be included in the 2019-2023 Action Plan that are focused on transitioning to a lower carbon economy are highlighted below.

Energy Measures

- Support the implementation of the 2030 Energy Strategy and associated actions and investments elaborated upon in the Three Year Energy Action Plan (2019-2021).

Carbon Pricing

- Implement a NWT carbon pricing system in 2019.

New Resource Development Projects

- Work with relevant regulatory boards, key federal agencies and industry to support the incorporation of GHG emissions mitigation and climate change adaptation strategies into environmental assessment, water licensing and land use permitting processes.

GHG Emission Tracking and Reporting

- Improve tracking of GHG emissions and reporting on progress towards the NWT's 2030 emission reduction target.

4.0

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS



The NWT is experiencing numerous changes and increasing impacts to its natural environment, residents' health, public safety, culture and heritage, and infrastructure due to the changing climate. Developing a better understanding of

current and future impacts of climate change is critical. Filling knowledge gaps through research and monitoring will be necessary to define options for building resilience and continuing to adapt to climate change. Goal #2 documents current

impacts, highlights the knowledge gaps and identifies the research and monitoring needed by 2030 to ensure Goal #3, building resilience and adapting to a changing climate, can be met.

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

4.1 CLIMATE CHANGE KNOWLEDGE

Addressing current climate change impacts and predicting future impacts requires increased and well-managed knowledge of changes to the natural environment, human health, public safety, culture and heritage, and infrastructure. The best available information for determining impacts in the NWT includes traditional, local and scientific knowledge.

4.1.1 GNWT Knowledge Agenda

The NWT is experiencing a number of dynamic changes and challenges, including climate change, economic change, sustainable resource development, new technologies, health risks and social change. Decisions required to adapt to these changes should be based on the best available evidence and knowledge as derived from experience, investigation and research.

The GNWT Knowledge Agenda (2017) aims to position the NWT as an active leader, practitioner, partner and promoter of all forms of research, including western science methods, traditional and local knowledge and community-based research.

Understanding the impacts and extent of the climate-related changes occurring in the NWT will require collaboration between research and academic institutions, governments, communities and traditional and local knowledge holders. The

GNWT Knowledge Agenda identifies key themes to focus research to address NWT interests, improve the quality of life of NWT residents and maintain the integrity of NWT cultures, communities and ecosystems. Achieving the goals outlined in the GNWT Knowledge Agenda will require that climate change impacts be considered in research across all themes.

The GNWT Knowledge Agenda Action Plan being developed in 2018 will provide broad direction on how the GNWT will support, organize and communicate research on the potential impacts of climate change on landscapes, resources, people and communities in the NWT. It will apply to research that employs scientific, traditional and local knowledge, as appropriate, to ensure the GNWT has the information it requires for decision-making.

4.1.2 Traditional and Local Knowledge

Traditional knowledge is defined in the GNWT Traditional Knowledge Policy as knowledge and values that have been acquired through experience and observation, from the land or from spiritual teachings, and handed down from one generation to another by Indigenous people.

As outlined in the GNWT Knowledge Agenda and several of the strategies and plans listed in Section 1.5, it is recognized that traditional knowledge and traditional knowledge-based research need to play a key role in identifying and understanding

the changes occurring on the landscape, and the implications of these changes for wildlife, traditional activities and human health and well-being.

As Indigenous people represent about 50% of the NWT's population, traditional knowledge and traditional knowledge-based research need to play a key role in identifying and understanding the changes occurring on the landscape and the implications these changes have for wildlife, traditional activities and human health and well-being.

It is critically important that traditional knowledge be included in collaborative decision-making in appropriate and respectful ways, as agreed upon with traditional knowledge holders and Indigenous governments and organizations.

During the six regional engagement workshops conducted in 2016-2017 to obtain input on the Framework, Indigenous participants offered the following key suggestions regarding the use of traditional knowledge, which will be further underscored in the 2019-2023 Action Plan, as well as in the forthcoming GNWT Knowledge Agenda Action Plan:

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GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

- Researchers should be trained to properly access and include traditional knowledge;
- Research results derived from the use of traditional knowledge should be reported back to the communities involved for their consideration and comment; and
- Traditional knowledge can be used to help establish baselines to determine environmental and health trends and identify research needs.

Local knowledge, like traditional knowledge, is acquired through experience and observation, and can be handed down from one generation to another, but does not include the spiritual connection that Indigenous people have with the land.

Ensuring traditional, local and scientific knowledge is gathered and used appropriately and respectfully when developing and deciding upon climate change research, monitoring, mitigation and adaptation processes and actions will benefit all NWT residents and result in a more robust knowledge base.

4.1.3 Management of Knowledge

The traditional, local and scientific knowledge relevant to climate change that is being acquired through research and monitoring of the environment, human health, public safety, culture and heritage, and infrastructure in the NWT is generating enormous amounts of information in the form of physical samples, data, products and tools.

Key practitioners involved in acquiring and managing this information include community, Indigenous, territorial and federal governments, academic institutions, regulatory and resource management boards, non-government organizations and industry. Each year, numerous environmental programs and projects are undertaken throughout the NWT, but no central authority tracks or coordinates this activity, resulting in challenges related to the storage, management, analysis and sharing of data and information.

As more research and monitoring is required to address climate change-related knowledge gaps, it is clear that steps are needed to improve the capacity to manage and access the knowledge for planning and decision-making. The GNWT will develop a central repository to share knowledge and information on climate change for everyone in the NWT.

4.2 CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS AND RESEARCH AND MONITORING REQUIREMENTS

Continuing warming trends indicate that the NWT will likely experience numerous and significant changes and impacts over the next 50 to 100 years, in addition to what is already happening in the territory (see Figure 5).

The unprecedented pace and extent of the impacts occurring must be better understood to build resilience and find ways to adapt to unavoidable changes. A significant amount of research and monitoring work is taking place in the NWT, ranging from community-based projects to territory-wide investigations. There is a clear need for additional and more extensive research and monitoring, along with focused vulnerability assessments.

A vulnerability assessment is a process for assessing, measuring and characterizing the degree to which the environment, wildlife or humans are susceptible to negative effects of climate change and their capacity to adapt to the impacts.

Input received from the public engagement efforts and subject matter specialists indicates there are many climate change knowledge gaps remaining to be addressed. An overview of climate change impacts, knowledge gaps, and research and monitoring requirements related to: 1) the natural environment, 2) human health, 3) public safety, 4) culture and heritage, and 5) infrastructure, are discussed below and elaborated upon in Appendix B.

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

4.2.1 Natural Environment

The warming climate is causing two different types of changes in the NWT: gradual shifts in the physical landscape and ecosystems (e.g. thawing of permafrost and migration of species) and increased occurrence of more abrupt extreme events (e.g. thaw slumps, floods, droughts and changes to wildland fire regimes). Combined, these changes have serious consequences that need to be better understood due to their environmental and fiscal impacts.

4.2.1.1 Changing Climate and Weather

The rapid warming underway in the North is directly affecting the climate (weather patterns over a long period of time) and weather (day-to-day state of the atmosphere) in the NWT.

Weather is becoming more uncertain and storms are more severe. Winter freeze-up is occurring later, spring thaw is occurring earlier, and traditional and local knowledge indicates that travel on the land, water and ice is becoming more

dangerous and challenging. All of these changes make it increasingly difficult for residents of the NWT to pursue harvesting and trapping activities.

Climate and weather information is essential for understanding the health of ecosystems and climate-related impacts to support sustainable resource management decisions. Climatic information, including trends, is also required to inform adaptation planning, such as the design of new infrastructure (including industrial development) and the maintenance and/or upgrading of existing infrastructure. Future management of legacy contaminated sites needs to consider impacts resulting from changing climate and weather on long-term site structures, as well as closure strategies.

Climate and weather research and monitoring is being undertaken in the NWT by Indigenous, territorial and federal governments, communities, industry and academic institutions. However, improvements need to be made as monitoring stations and programs are lacking, some stations are not ideally located, and coordination of monitoring efforts and access to data is inadequate. Forecasted climatic data required for the design of new infrastructure, many of which will have an expected lifespan in excess of 50 years, is not yet formally published and adopted for use by design professionals.

Figure 5: Projected Future Warming for the NWT to the Year 2100

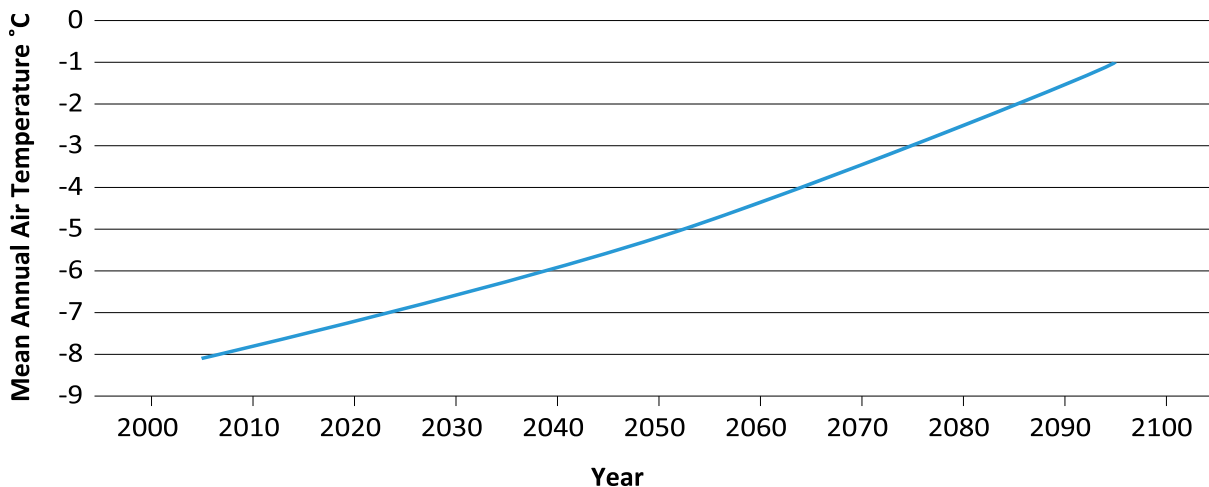


Figure 5 illustrates a climate projection for future warming. The NWT’s mean annual air temperature is projected to increase by approximately 6°C by 2100 if the current emissions pathway does not change. The projection was generated by the University of Alaska Fairbank Scenarios Network for Alaska and Arctic Planning.

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Climate and weather changes directly impact all the natural environment components described below. More detailed information on impacts, knowledge gaps, and research and monitoring requirements pertaining to climate and weather is provided in Appendix B.

4.2.1.2 Changing Permafrost

Permafrost is frozen ground that underlies most of the NWT's communities, infrastructure and natural environment. It can be thought of as the cement that holds northern landscapes together.

Permafrost Thaw

Permafrost thaw in the northwestern NWT has caused the development of very large thaw slumps that can displace millions of cubic metres of sediments, thereby reconfiguring slopes and impacting downstream environments.

In 2015, the growth of one thaw slump near Fort McPherson led to a gradual hillside collapse, resulting in the rapid partial drainage of a small upland lake. The GNWT, Indigenous governments and academic institutions are undertaking research and monitoring on this and other thaw slumps to better understand the development and impacts of thaw slumps on the landscape.

This frozen layer of earth materials can be tens to hundreds of metres thick and contain large volumes of ground ice. Thawing of permafrost and the melting of ground ice causes the ground surface to sink or settle, and reduces the stability of the terrain.

Permafrost thaw is significant to northern communities because it can damage overlying infrastructure, including roads and buildings (see Section 4.2.5), and impact heritage resources and culturally significant sites (see Section 4.2.4). The degradation of permafrost can cause rapid erosion of coasts and shorelines, as well as transform landscapes, impacting wildlife and the quality of water. Thawing of frozen organic materials also releases GHGs that contribute to overall global climate warming.

Long-term permafrost research and monitoring is underway in the NWT; however, due to limited northern capacity, the majority of GNWT activities rely on academic partnerships or collaboration with federal researchers. Northern-based technical capacity is needed to address research and monitoring gaps, support decision-making and provide technical advice to residents, planners, designers, engineers, architects, industry and all levels of government, as stresses on infrastructure, terrestrial and aquatic ecosystems continue to increase due to climate-driven permafrost thaw.

More detailed information on permafrost-related climate change impacts, knowledge gaps, and

The NWT's coasts are being impacted by sea level rise and coastal erosion resulting from thawing permafrost, less ice coverage and more waves. Enhanced monitoring, modeling and projections of coastal erosion and sea level rise are required.

research and monitoring requirements is provided in Appendix B.

4.2.1.3 Changes to Water

The NWT relies on water and aquatic ecosystems for sustenance, transportation, energy production, economic growth, recreation, culture and spirituality. Climate change affects the NWT's water quality and quantity through extreme weather events, changes in flood or drought severity, increased variability in precipitation, thawing of permafrost, and melting of glaciers and polar ice sheets.

Long-term water quality and quantity monitoring is led predominantly by the GNWT and also undertaken by Indigenous and federal governments, communities, industry, academic institutions and non-government organizations. Climate change related impacts include altered water chemistry, varying river and groundwater flows, reduced ice coverage and drying of wetlands. Gaps in the monitoring network will

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

need to be addressed, particularly in areas more vulnerable to the effects of climate change, to further understand climate change impacts.

Changes to Groundwater Systems

Frozen ground acts as a waterproof barrier. However, as permafrost thaws, there is an increase in connections between surface, shallow groundwater and deep groundwater systems. The melting of ground ice in permafrost environments also increases the mobility of groundwater near the surface. Research and monitoring is required to understand the complexity of the changes, as some regions may see an increase in surface water flow, while at other locations drainage of surface water into the ground will occur.

The NWT is the ultimate downstream jurisdiction in the Mackenzie River Basin, in which water flows from Alberta, British Columbia, Yukon and Saskatchewan into the NWT. Consequently, climate impacts and human activity in those jurisdictions can affect aquatic ecosystems, including water quality and quantity, in the NWT. To address the transboundary challenge of climate change, bilateral water management agreements are being negotiated and implemented with

neighbouring jurisdictions. This work will enable collaborative research and monitoring to assist with improved understanding and identification of potential climate change mitigation and adaptation opportunities in the basin.

More detailed information on water related climate change impacts, knowledge gaps and research and monitoring requirements is provided in Appendix B.

4.2.1.4 Changes to Forests and Tundra Vegetation

The NWT contains about 80 million hectares of forested land, representing about 20% of the Canadian boreal forest. It also has a significant tundra ecosystem that includes important plant and lichen species. Residents depend on the forest and tundra as critical habitats for wildlife, as well as for subsistence harvesting, recreation and sustainable resource development. In the boreal forest, natural disturbances such as wildland fires and insect outbreaks, are necessary for forest renewal. For that reason, understanding frequency, severity and distribution of disturbances is essential to recognize abnormal trends that may result from climate change. Climate impacts include shifting vegetation – for example, forests replacing the tundra as the tree line moves northwards – and competition from species moving into the NWT.

Wildland Fire Disturbance

Climate change related impacts to forest and tundra vegetation include increases in wildland fires occurrence and severity (due to dry conditions), compromised forest productivity, and shifts or expansions in ranges of tree and plant species, diseases and pests.

Long-term forest and tundra monitoring in the NWT is undertaken predominantly by the GNWT, but is also conducted by Indigenous and federal governments and academic institutions. The growth response of NWT forests and tundra vegetation to a changing climate remains uncertain due to significant knowledge gaps, meaning long-term monitoring and research is necessary. For example, annual forest health surveys have provided some information on early signs of changes to forest ecosystem conditions and will be needed over the long term to understand how climate change is impacting forest dynamics.

More detailed information on forest and tundra vegetation-related climate change impacts, knowledge gaps and research and monitoring requirements is provided in Appendix B.

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4.2.1.5 Changes to Wildlife

The NWT is one of the few remaining regions in the world with herds of wild ungulates (e.g. caribou and muskoxen), healthy populations of top predators and rich northern biodiversity. NWT residents, including Indigenous people, rely on wildlife to maintain subsistence lifestyles and cultures. Wildlife population numbers, health, distribution and habitat are affected by warming temperatures, increased variability in precipitation, extreme weather events and increases in wildland fires. Existing wildlife may face competition from new, non-indigenous species moving further north into and throughout the NWT (e.g. white-tailed deer). Climate change may also result in a mismatch between the timing of biological events (e.g. a change in phenology, such as plant flowering and the emergence of insects) and key lifecycle stages of species that depend on those events. Although wildlife have evolved and adapted to a variable climate, when combined

Wildlife Challenges

Climate-related stresses on wildlife can lead to changes in the natural ranges of mammals, birds and insects, establishment of new parasites in wildlife and challenges accessing food sources.

with natural fluctuations and other disturbances, the impacts of climate change on most northern species will likely become more severe.

Long-term wildlife monitoring in the NWT is undertaken predominantly by the GNWT, and also by Indigenous and federal governments, wildlife co-management boards, communities, industry and academic institutions. The GNWT addresses the effects of climate change on wildlife at a species level. Knowledge gaps and research and monitoring requirements that need to be addressed include areas and species that may be more vulnerable to the effects of climate change, and monitoring of changes to wildlife health, population numbers and distribution.

Climate change is also a significant threat to several species-at-risk (e.g. boreal caribou, Peary caribou, Dolphin and Union caribou, polar bear, and various bird and plant species). Ongoing monitoring of these and other species-at-risk will be necessary, as their protection is a legislated responsibility through the territorial *Species at Risk (NWT) Act* and federal *Species at Risk Act*.

More detailed information on wildlife related climate change impacts, knowledge gaps and research and monitoring requirements is provided in Appendix B.

4.2.1.6 Changes to Freshwater Fish and Marine Mammals

Freshwater fish and marine mammals are both important ecosystem components and vital country food sources for residents of the NWT. As part of subsistence, commercial and recreational fisheries, fish such as lake trout, Arctic char, lake whitefish, Northern pike, pickerel and burbot are harvested in numerous lakes and rivers across the territory. Marine mammals, such as ringed seal and beluga, are harvested in the Beaufort Sea.

Healthy and abundant freshwater fisheries are critical to sustaining the NWT's economy, as evidenced by an active Great Slave Lake commercial fishery and outfitters that host tourists for recreational and trophy fishing. Climate change can affect fish and marine mammal health, habitat, food sources, growth, spawning and reproduction schedules, prey-predator relationships, distribution and seasonal migration, due to altered water quality and quantity, changes in water temperature, ocean acidification and extreme weather events.

Long-term fish and marine mammal monitoring in the NWT is the jurisdiction of the federal government, and is supported by the GNWT and Indigenous governments, wildlife co-management boards and academic institutions. There are knowledge, research and monitoring gaps that need to be addressed, particularly for species more vulnerable and sensitive to the

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

effects of climate change. For example, in some areas, non-indigenous species may threaten indigenous species and affect traditional harvests. In addition, invasive species may also become more widely established as a result of human actions associated with climate change. Further, contaminant concentrations in certain fish and marine mammals (e.g. from thawing permafrost or warmer water temperatures) could increase and potentially impact subsistence consumption.

Climate change is also a significant threat to several fish and marine mammal species-at-risk (e.g. grey whale, bull trout and Dolly Varden). Ongoing monitoring of these and other species-at-risk will be necessary as their protection is a legislated responsibility through the *Species at Risk (NWT) Act* and federal *Species at Risk Act*.

More detailed information on fish and marine mammal-related climate change impacts, knowledge gaps, and research and monitoring requirements is provided in Appendix B.

4.2.2 Human Health

The health of NWT residents is integrally linked to the health of water, wildlife, vegetation and air. Climate change-related impacts – such as changing weather, water and ice conditions, increases in wildland fires and associated smoke, increases in invasive species, altered wildlife, fish and marine mammal ranges, increased types and levels of

contaminants, and changes in the distribution, prevalence and impact of infectious diseases and parasites – can impact the health and general well-being of NWT residents.

Impacts being observed include those that affect physical human health, such as the risks from possible exposure to Lyme disease as it moves northward, or injuries sustained from falling through unusually thin ice. Negative impacts on food security can result from declines in specific wildlife, fish and marine mammal species, consumption guidelines due to contaminant levels or altered ranges in species distribution, which can lead to decreased harvesting opportunities. Additionally, changes to mental, social and cultural well-being, due to limited ability to travel safely along traditional routes to access these vital country foods and spend time with family and community on the land, can occur as climate change impacts the land and water.

Food security means having reliable access to affordable, sufficient and nutritious food. In the NWT, food security may decrease for Indigenous people who can no longer safely access country food sources due to increasingly unpredictable lake and river ice conditions.

Long-term monitoring of the health of NWT residents is led predominantly by the GNWT and is also undertaken by Indigenous and federal governments and academic institutions. There are, however, gaps in knowledge, research and monitoring that need to be addressed to better understand the implications for human health, particularly in populations more vulnerable to the effects of climate change, like Indigenous people who depend on the natural environment for their livelihood and sustenance.

More detailed information on human health-related climate change impacts, knowledge gaps, and research and monitoring requirements is provided in Appendix B.

4.2.3 Public Safety

Public safety is a key consideration in the context of climate change. As conditions change, harvesters are experiencing increasing difficulties and taking on greater risks in accessing country foods and pursuing traditional economies and activities, particularly due to changing ice conditions. In communities or built environments, infrastructure may be at risk due to thawing of permafrost, wildland fires or flooding, causing public safety concerns.

4.0

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

The built environment refers to human-made structures, features and facilities that exist within communities, on the landscape and at remote locations.

The monitoring of risks and promotion of emergency preparedness and safety to the public is led predominantly by the GNWT and also undertaken by Indigenous and federal governments and academic institutions. It is therefore important that gaps in knowledge, research and monitoring for these high hazards, as well as other hazards, be addressed, particularly for communities that are increasingly vulnerable to the effects of climate change.

In 2014, the GNWT released the NWT Hazard Identification Risk Assessment Report, which considered climate change impacts when assessing hazards. Floods and wildland fires were deemed very high hazards in the NWT.

More detailed information on public safety-related climate change impacts, knowledge gaps, and research and monitoring requirements is provided in Appendix B.

4.2.4 Culture and Heritage

Culture is the living and evolving expression of values. Heritage encompasses things from the present and the past that people wish to bring to the future. Together, culture and heritage are vitally important to Indigenous people and all residents of the NWT. The numerous climate-related changes occurring on the landscape are a threat to important heritage resources, artifacts and cultural practices. Impacts range from challenges accessing traditional hunting and trapping grounds that lead to decreases in traditional economies (e.g. sale of wild furs), to losses of cultural and heritage resources due to changes in the natural environment, such as coastal erosion, permafrost thaw slumping and wildland fires.

Long-term monitoring of the culture and heritage of NWT residents is led predominantly by the GNWT and also undertaken by Indigenous and federal governments and academic institutions. There are, however, gaps in knowledge, research and monitoring that need to be addressed to ensure that resiliency is strengthened to sustain Indigenous peoples' culture and heritage in light of the effects of climate change.

More detailed information on culture and heritage-related climate change impacts, knowledge gaps, and research and monitoring requirements is provided in Appendix B.

4.2.5 Infrastructure

The NWT's built infrastructure, including buildings, houses, airports, roads, bridges, pipelines, power transmission lines and marine transportation systems, is being impacted by the many alterations to the environment resulting from climatic change, such as permafrost thaw, extreme weather events, increasing snow loads, changing water levels, changing water courses and coastal erosion.

Permafrost thaw and extreme weather events, particularly in northern NWT, has resulted in damage to infrastructure, including buildings, runways and highways.

Thawing permafrost is a significant concern as it underlies much of the NWT's infrastructure, both within communities and on the broader landscape, and can lead to potential adverse impacts on commercial and residential building foundations, damage to runways, highways and bridges, and the possible movement or failure of pipelines and utilidors, resulting in spills. These risks could result in significant infrastructure damage.

Increased snow loads are also a potential issue in relation to the structural integrity of existing, aging buildings whose design and construction is not able to withstand current climate change impacts.

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

If these facilities are not monitored and assessed regularly, there is a potential for increased snow loads to result in damage and failures on buildings with limited structural capacity.

Reliable permafrost data and analysis is of key importance to designing, building and maintaining infrastructure in the North. Knowledge of ground temperature and permafrost properties is required to ensure the long-term stability of infrastructure is not at risk as the climate changes.

Monitoring of impacts on infrastructure is led predominantly by the GNWT and also undertaken by community, Indigenous and federal governments, industry and academic institutions. There are gaps in knowledge and research and monitoring requirements that need to be addressed, particularly in regions and communities that are more vulnerable to the effects of climate change. Conducting research and monitoring and filling current knowledge gaps on infrastructure will allow for the development of standards, tools and predictive models to adapt and build resilience in the NWT.

More detailed information on climate change impacts to infrastructure, along with knowledge gaps and research and monitoring requirements, is provided in Appendix B.

4.2.6 General Requirements – Linkages and Cumulative Impacts

Sections 4.2.1 to 4.2.5 describe various impacts, knowledge gaps, and research and monitoring requirements related to the natural environment, human health, public safety, culture and heritage, and infrastructure. In addition to these specific impacts and requirements, it is also important to consider related linkages and interconnections to different processes and impacts.

Two general requirements that need to be addressed include:

1. Determining and understanding the feedbacks, linkages and interactions among ecological processes (including terrestrial, aquatic, marine and air) and the effects of climate-related changes; and
2. Determining what the cumulative impacts of all these changes are on human and community health, cultural and heritage resources, and the built environment within the NWT.

The GNWT, Indigenous and federal governments, communities, industry and academic institutions conduct or contribute to a variety of monitoring and research focused on these requirements. For example, the NWT Cumulative Impact Monitoring Program coordinates, conducts and funds the collection, analysis and reporting of information related to environmental conditions in the NWT, using scientific, traditional and local knowledge. This territorial program is guided by a steering committee of Indigenous, territorial and federal government representatives. By furthering an understanding of cumulative impacts, the program aims to support sustainable resource management.

Currently the focus of the program is on caribou, water and fish, and there is an increasing awareness of the climate change-related impacts to these ecosystem components (e.g. habitat suitability, permafrost thaw slumps and wildland fires). As cumulative impact monitoring and assessment continues to evolve in the NWT, the impacts from climate change will continue to be monitored and included in cumulative impacts assessments.

4.0

GOAL #2 – IMPROVE KNOWLEDGE OF CLIMATE CHANGE IMPACTS

4.3 GOAL #2 – ACTION PLAN RESEARCH AND MONITORING REQUIREMENTS

Research and monitoring requirements to be included in the 2019-2023 Action Plan are highlighted below. A more comprehensive list can be found in Appendix B, which will serve as the basis for the further development of research and monitoring actions in the 2019-2023 Action Plan to improve knowledge of climate change impacts.

Management of Information

- Develop a central repository to share and access climate change knowledge and information.
- Ensure traditional, local and scientific knowledge is gathered and managed appropriately when developing climate change research, monitoring, mitigation and adaptation processes and actions.

Natural Environment

- Enhance the availability of climate and environmental information by providing data, along with products such as summaries of data trends and variability, and projections of future climate.

- Collect and provide permafrost baseline data to support infrastructure planning, community decision-making and ecosystem management.
- Complete vulnerability assessments of aquatic ecosystems at greater risk of climate change impacts, and expand monitoring networks where necessary and possible.
- Complete vulnerability assessments that integrate research, monitoring and traditional knowledge to develop effective adaptation measures for specified forests and tundra areas of value and interest.
- Complete climate change vulnerability assessments for all species-at-risk.
- Further research and monitor country food sources, including their health, abundance and distribution, to determine availability and quality of food sources.

Human Health, Public Safety, and Culture and Heritage

- Complete flood zone and fire risk mapping for vulnerable communities.
- Assess risks to human health arising from air quality issues, floods, increases in invasive species and other climate change impacts.

- Conduct research to understand where heritage resources, such as archeological sites, are at greatest risk of impact due to coastal erosion, thawing permafrost, melting alpine ice and wildland fires.

Infrastructure

- Obtain accurate climate data sets for all regions in the NWT that account for regional variability to inform new infrastructure design and risk assessments for existing infrastructure.
- Develop a climate projection model to use for infrastructure design and risk assessments.
- Understand the vulnerability of existing and future infrastructure.
- Understand how aged infrastructure is responding to the effects of climate change.
- Continue research and development to assist in improving construction standards for different types of infrastructure that take into account a changing climate.

GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE



Integrating or “mainstreaming” climate change considerations into plans, policies, operational practices and management functions is vitally important.

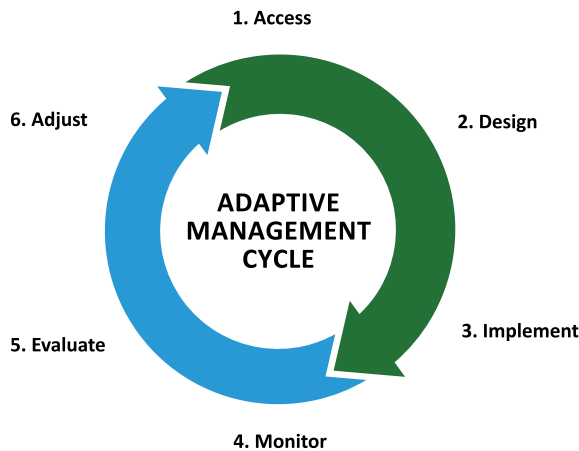
As the northern climate continues to change, decision-makers will need to adjust plans and operations to deal with a wide range of possible future conditions and unanticipated events.

To address the degree of uncertainty related to how climate changes may affect the NWT, an adaptive management cycle, as shown on the right, will be implemented so that adjustments can be made as required. This is necessary to ensure current and future climate change considerations are incorporated into management and decision-making.

Efforts to increase resilience and understand the processes of adaptation are required in four broad areas: sustainability of ecosystems; the natural environment and its components; human health, public safety, and culture and heritage; and infrastructure.

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GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE



5.1 SUSTAINABILITY OF ECOSYSTEMS

The NWT already has numerous processes and plans in place that govern and support the management of ecosystems and natural resources. Over time, it is anticipated that many of these will need to be updated to better account for climate change-related impacts and opportunities.

Ensuring that ecosystems remain healthy and diverse is a priority for the NWT, as food security and traditional economies rely on the maintenance of biodiversity. There are several integral components that make up the NWT’s overall ecosystem and sustainable resource management regime, including conservation network planning through Healthy Land, Healthy People: GNWT Priorities for Advancement of

Conservation Network Planning (2016-2021), the GNWT Land Use and Sustainability Framework and regional land use planning. Each contributes to improving ecological, social and economic resilience and adaptation to climate change. Additional information on these contributions is provided in Appendix C.

5.2 NATURAL ENVIRONMENT

As discussed under Goal #2, numerous impacts to the natural environment resulting from climate change have been identified, ranging from gradual shifts in the physical landscape and ecosystems, to increased occurrence of more abrupt extreme events. For many of these impacts, resilience and adaptation measures will be required.

As research and monitoring continues to 2030, important knowledge gaps will be filled to better understand the NWT’s natural environment and results will be integrated into climate change planning and adaptation.

5.2.1 Climate and Weather

With more extreme weather conditions and changes in climate over time, the NWT will need to build resilience and work towards adapting to these changes. Key efforts will include enhanced climate monitoring, undertaking vulnerability assessments and using climate modeling to

predict future climatic conditions, including extreme weather events. These projections will also be integral to allow for the assessment of new opportunities, such as those resulting from a longer growing season. Current and potential adaptation efforts to address impacts related to climate and weather are provided in Appendix D.

5.2.2 Permafrost

Residents and wildlife will depend on the territory’s ability to adapt to changes in permafrost. To support the NWT’s efforts in adapting to thawing permafrost conditions due to climate change, improved monitoring and assessment and the fostering of science-based decision-making are needed. Current and potential adaptation efforts to address climate change-related impacts to permafrost are provided in Appendix D.

5.2.3 Water Quality and Quantity

Residents, wildlife and fish will depend on the ability to adapt to changes in water quality and quantity, in all its forms, due to the likely increased frequency of natural events such as wildland fires, permafrost thaw slumps, extreme weather events, frequency and severity of droughts and floods, and increased water temperatures.

GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE

The NWT Water Stewardship Strategy's Action Plan 2016-2020 outlines actions that consider the effects of climate change and assess the vulnerability of watersheds to climate change, to ensure the waters of the NWT remain clean, abundant and productive for all time, as per the Strategy's vision. Current and potential adaptation efforts to address climate change impacts to water quality and quantity are provided in Appendix D.

5.2.4 Forest and Tundra Vegetation

Residents and wildlife depend on the NWT's ability to adapt to changes to forests and tundra due to the likely increased frequency of natural events such as wildland fires, droughts, extreme weather events, and insect and disease disturbances.

The effects of climate change on NWT forests and tundra are currently difficult to predict due to knowledge gaps and uncertainties about the extent and direction of changes. Several integrated management approaches to address climate change adaptation need to be employed. Current and potential adaptation efforts to address climate change-related impacts to forest and tundra vegetation are provided in Appendix D.

5.2.5 Wildlife

The NWT's wildlife is typical of arctic and subarctic ecosystems and has adapted to a northern climate. However, with more extreme weather

conditions and accelerated changes in climate, it is difficult to predict how wildlife will be able to continually adapt to more frequent wildland fires, changes in water quality and quantity, increased temperatures, landscape changes due to thawing permafrost, changes in species distribution (including invasive species) and potential increases in diseases and parasites.

Maintaining healthy and resilient wildlife populations in the NWT for ongoing biodiversity conservation, to meet food security needs and to preserve traditional economies (e.g. trapping for the harvest of wild furs) is important from an economic and cultural standpoint. Current and potential adaptation efforts to address climate change-related impacts to wildlife are provided in Appendix D.

5.2.6 Freshwater Fish and Marine Mammals

A warming climate is contributing to changing water temperatures, levels, quality and quantity in the NWT, which in turn affects fish and marine mammals. It is important to maintain healthy and resilient fish and marine mammal populations in the territory for ongoing biodiversity, as vital country foods and as valuable sources of income. Current and potential adaptation efforts related to fish and marine mammals are provided in Appendix D.

5.3 HUMAN HEALTH, PUBLIC SAFETY, AND CULTURE AND HERITAGE

Protection of people and culture is of paramount importance. This responsibility is shared by community, Indigenous, territorial and federal governments and NWT residents. As the climate changes, various levels of government must be able to anticipate, address and minimize emerging risks and associated impacts to human health, public safety, and culture and heritage. Climate change is resulting in increased unpredictability in seasonal weather, affecting decision-making in many aspects of northerners' lives, including determining whether or not travelling on the land for subsistence harvesting is safe.

Current and emerging climate change risks and impacts to human health, public safety, and culture and heritage will need to be anticipated and addressed in order to adapt to a changing climate.

NWT communities are generally more vulnerable to climate change effects than southern Canadian communities. This is due to a lack of back-up infrastructure and systems, remoteness, socio-

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GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE

economic challenges and limited local capacity. On the other hand, residents of the NWT also have advantages to overcoming impacts from natural hazards or disasters, as they are self-reliant and used to extreme weather conditions and related disruptions. Building resilience and adapting to climate change impacts will be critically important for NWT residents.

5.3.1 Human Health

Health adaptation is action taken by health sector officials, in collaboration with other sectors, to understand, assess, prepare for and help to prevent the health impacts of climate change, particularly on the most vulnerable in society.

In the NWT, current and emerging human health risks resulting from climate change include food safety and security, air quality concerns, exposure to environmental contaminants, spread of infectious diseases and outbreaks, and deterioration of physical and mental health. Current and potential adaptation efforts to address climate change-related impacts to human health are provided in Appendix D.

5.3.2 Public Safety

Abrupt extreme events, such as flooding and wildland fires, may increase in severity and frequency due to climate change and necessitate changes to the NWT's approach to emergency management. The identification of flooding and wildland fires as very high hazards in the 2014 NWT Hazard Identification Risk Assessment Report is a driving factor behind ongoing updates to the NWT Emergency Management System. Numerous other hazards, such as extreme weather (including increasing snow loads), critical infrastructure failure, drought (due to low water levels), human disease and permafrost degradation, along with the level of changing risk, need to be understood and considered to inform adaptation planning. Current and potential adaptation efforts to address climate change-related impacts to public safety are provided in Appendix D.

FireSmart is an initiative that lowers the fire risk around homes and communities by reducing the amount of woody material (e.g. trees, shrubs and leaves) that can burn in a wildland fire.

5.3.3 Culture and Heritage

Culture and heritage is tied to the land. The GNWT works with communities to preserve, research and showcase culture and heritage for future generations. The effects of climate change create additional urgency and challenges for protecting culturally significant places, preserving heritage objects and records, supporting the preservation of traditional skills and practices, and engaging in culture and heritage research.

The GNWT's Culture and Heritage Strategic Framework (2015-2025) identifies goals and priorities to help protect and support the NWT's rich heritage and diverse cultural practices. of the goals – safeguarding heritage – is particularly relevant in the context of a rapidly warming climate and the numerous changes occurring on the landscape. Current and potential adaptation efforts to address climate change-related impacts to culture and heritage are provided in Appendix D.

GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE

5.4 INFRASTRUCTURE

Infrastructure, such as houses, public buildings, roads, airports, marine transportation systems, pipelines, bulk fuel storage tank farms, power generation plants and transmission lines, water sanitation systems and other important facilities that exist within communities, on the landscape and at remote locations, can be referred to as the built environment. These assets provide services as part of daily life, such as transportation, shelter, health, education and other essential services, including economic and social activities.

The need to carefully consider climate change, including impacts on permafrost, when determining suitable sites for buildings and facilities in the NWT is critical. This is highlighted in the GNWT's Good Building Practice for Northern Facilities.

In the NWT, the replacement value for the built environment is roughly estimated to be \$8 to \$10 billion.

Some of the infrastructure in the NWT is relatively new. However, much of it was designed and

built in previous decades based on engineering practices, building codes and standards of the day that did not consider the need to adapt to a changing environment over extended service timelines.

The Standards Council of Canada leads the Northern Infrastructure Standardization Initiative to address unique circumstances in Canada's North, such as its vulnerability to the impacts of climate change, to develop standards for northern infrastructure.

Current critical areas of focus include:

- Moderating the effects of permafrost degradation on existing building foundations;
- Managing changing snow load risks for buildings;
- Community drainage system planning, design and maintenance;
- Planning, design, operation and maintenance of wastewater treatment using lagoon and wetland systems;
- Selection of foundation types and sites for buildings in permafrost;
- Fire resilient building designs and materials;
- Techniques for dealing with high winds for northern infrastructure; and
- Erosion protection in permafrost.

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GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE

As the NWT continues to warm and experience significant climate changes (i.e. increasing snow loads, permafrost instability, coastal erosion, potential flooding, increased rainfall and high wind events), two distinct challenges with respect to its built environment have emerged:

1. A need to upgrade some of the aged infrastructure and facilities to handle emerging conditions never contemplated when originally designed and constructed; and
2. A need to establish appropriate design standards and practices when designing and constructing new infrastructure with a service life in excess of 50 years. This is challenging because uncertainty about the range and extent of climate impacts that may occur in future decades creates further uncertainty about appropriate design parameters.

Ongoing monitoring and potential upgrading will occur on an as-required basis for existing infrastructure and facilities. With regards to planning, design and construction of some new institutional buildings, the GNWT and other jurisdictions are moving towards specifying a service life in excess of 40 years. Pile foundation resiliency has been improved by extending foundation pile depths to reach colder and more thaw-stable permafrost soils. These types of changes are the result of incorporating best

available knowledge and resilient design standards to adapt to a changing climate.

Adapting the NWT's built environment to be resilient to current and future climate change impacts is a major technical and economic challenge that all levels of government, professional associations, industry and the private sector must work together to address.

While it is a significant challenge, it is not new to the NWT. Professionals such as architects, engineers, capital planners, builders and maintainers are well aware of the challenges and have already been taking steps to address climate change issues for nearly 20 years.

5.4.1 Transportation System

The NWT's transportation system is made up of all-weather roads, seasonal winter roads, airports, rail transportation, ferry crossings and marine transportation systems. Climate-related changes, particularly thawing permafrost, winter ice conditions and variable water levels, are impacting how the transportation system is planned, operated and maintained.

The GNWT has completed a considerable amount of work in recent years to identify emerging issues and potential adaptation actions. Efforts are focused on planning, replacing winter roads with all-season roads and updating aging infrastructure. Current and potential adaptation efforts are provided in Appendix D.

5.4.2 Community and Public Infrastructure

NWT communities are responsible for infrastructure that may be vulnerable to, or affected by, climate change impacts. This includes roads, recreational facilities and other municipal buildings, water supply systems and waste management systems. Current and potential adaptation efforts to help communities address climate change-related impacts affecting infrastructure, such as thawing permafrost, flooding, wildland fire risks and coastal erosion, are provided in Appendix D.

5.4.3 Utilities and Other Infrastructure

Within the NWT, there are different types of linear infrastructure that span the landscape (e.g. telecommunications, power transmission lines and pipelines) or are situated on the landscape (e.g. hydroelectric generating stations, mining, oil and gas facilities, monitoring stations, legacy contaminated sites and drilling mud sumps).

This vital infrastructure is also vulnerable to climate change impacts, particularly risks of wildland fire, thawing permafrost or flooding, depending on where the infrastructure is located. Responsibility for the care and maintenance of such infrastructure lies with the owner (e.g. the GNWT, the federal government or the private sector). Impacts to this infrastructure in

GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE

remote parts of the NWT could adversely affect communities, residents and businesses, as well as the natural environment. Therefore, it is necessary to ensure infrastructure is resilient or can be adapted to the effects of a changing climate. Related current and potential adaptation efforts are provided in Appendix D.

5.5 COMMUNITY ADAPTATION PLANNING

Community governments in the NWT are responsible for providing a wide range of programs and services. Adaptation planning and action at a local level is urgently required to help community and Indigenous governments address the impacts of climate change and identify options and opportunities to ensure community well-being. Community governments require support to develop and implement adaptation plans.

Key aspects of community adaptation planning typically include hazard mapping (e.g. flood zone mapping), a thorough evaluation of all community infrastructure, the identification of potential impacts to community health and well-being (e.g. food security), and a review of all municipal policies, plans and operations that may be affected by climate change. As noted in Section 5.3.2, the NWT Hazard Identification Risk Assessment identified numerous hazards that can be strongly

affected by climate change that need to be considered by communities.

The following initiatives are aimed at helping communities build resilience and find ways to adapt to the impacts of climate change:

Federal Government Initiatives

- Indigenous and Northern Affairs Canada's Climate Change Preparedness in the North program (2016-2021) helps communities undertake risk and vulnerability assessments, develop hazard maps, identify adaptation options and develop adaptation plans;
- Health Canada's Climate Change and Health Adaptation Program for Northern First Nations and Inuit Communities funds community-led research projects aimed at addressing anticipated health-related impacts of climate change; and
- Public Safety Canada's National Disaster Mitigation Program funds communities to undertake mitigation work (e.g. studies, plans and small projects). While the current program focus is on flood mitigation, it is broadening to include all hazards. A Disaster Mitigation and Adaptation Program focused on large-scale structural mitigation projects is also under development by the federal government.

GNWT Adaptation Initiative

- In 2018-2019, the GNWT will implement a new Community Climate Change Adaptation initiative investing in projects that support community adaptation to climate change impacts. Projects will be completed through partnerships between community, territorial and federal governments, academic institutions, non-government organizations and others.

5.6 COST OF INACTION

Sections 5.1 to 5.4 outline a number of wide-ranging issues and potential responses that the NWT could take to address climate change concerns and opportunities. In the future, all community, Indigenous, territorial and federal governments, businesses, industry, academic institutions, non-government organizations and NWT residents will need to make a number of decisions about their priorities for allocating resources to address the impacts of climate change.

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GOAL #3 – BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE

To inform the NWT’s overall efforts to address climate change impacts and opportunities, the GNWT will undertake a comprehensive assessment of the projected economic impacts of climate change in the NWT over the next 20 years. This study will attempt to estimate the overall cost of the combined impacts that may occur due to climate change, if no action is taken. Understanding the cost of inaction is critically important for providing context for funding decisions and resource allocations.

5.7 GOAL #3 – SUMMARY OF EFFORTS REQUIRED TO BUILD RESILIENCE AND ADAPT TO A CHANGING CLIMATE

A summary of efforts with a focus on building resilience and adapting to climate change is highlighted below. A more comprehensive list of current and potential adaptation efforts found in Appendix D will serve as the basis for prioritizing and developing the adaptation actions to be further elaborated upon in the 2019-2023 Action Plan.

Natural Environment

- Incorporate climate change considerations into conservation network planning and the establishment of existing candidate areas as protected areas.

- Undertake flood forecasting for communities at risk.
- Develop predictions on landscape, ecosystem and water quality changes that will likely result from permafrost thaw to inform environmental management and decision-making.
- Increase the resilience of wildlife populations to climate change by mitigating other impacts and stressors.

Human Health, Public Safety, and Culture and Heritage

- Assess the impacts of climate change on health and social services to ensure the capacity needed to withstand climate risks and provide essential services, particularly during extreme weather events or situations arising from climate change-related events, is understood.
- Implement a modernized NWT Emergency Plan.
- Improve wildland fire suppression planning and adoption of FireSmart principles in communities.
- Strengthen communities socially and culturally to help build resilience to impacts from climate change.

Infrastructure

- Monitor, inspect and report on existing infrastructure for climate-related impacts.
- Adapt existing infrastructure to climate change impacts through regular maintenance and upgrades.
- Evaluate adaptation efforts to improve resiliency in existing and future infrastructure.

Community Adaptation Planning

- Support community and Indigenous governments in the development and implementation of adaptation plans.

Cost of Inaction

- Undertake a comprehensive assessment of the projected economic impacts of climate change in the NWT over the next 20 years.

PUBLIC AWARENESS, CAPACITY BUILDING AND COMMUNITY INVOLVEMENT



The impacts of climate change represent serious environmental, economic and social challenges for all residents. Outreach and communication activities, along with community involvement, are

GNWT priorities that will promote awareness and build capacity to respond to climate change across the NWT. Improving and increasing awareness and capacity building will support the strong

partnerships needed to decrease the territory's dependency on fossil fuels and develop the knowledge, tools and measures required to adapt to the changing climate.

6.0

PUBLIC AWARENESS, CAPACITY BUILDING AND COMMUNITY INVOLVEMENT

6.1 COMMUNICATION AND OUTREACH

There is a clear need for enhanced knowledge sharing to build awareness about climate change in the NWT, which will require increased access to understandable climate change-related information, like results from research and monitoring on the natural environment, human health, public safety, culture and heritage, and infrastructure. A knowledgeable public will be better equipped to do its part to contribute to territorial efforts on climate change.

As the Framework is implemented, communication and outreach activities will be completed by reaching out to, and working in collaboration with, all levels of government (community, Indigenous, territorial and federal), academic institutions, industry, businesses, non-government

organizations and residents, to develop best practices and innovative ways to share knowledge and information. Examples of knowledge sharing mechanisms include websites, webinars, social media, radio, databases, meetings, workshops, public talks, school visits, on-the-land programs and training. Regular, consistent and transparent communication and outreach will provide a way for the GNWT, community and Indigenous governments, and stakeholders to demonstrate accountability through coordinated reporting.

Specific information needs of different regions, community and Indigenous governments, and stakeholders will be solicited by the GNWT as part of the development of the 2019-2023 Action Plan. As different information needs become better understood, the GNWT will develop a central repository to share knowledge and information on climate change.

6.2 COMMUNITY INVOLVEMENT AND CAPACITY BUILDING

The engagement process for the development of the Framework highlighted that community and Indigenous governments want to be more involved in the identification, planning and completion of efforts to address climate change. Because impacts occurring in the NWT are experienced to the greatest extent at the local or regional level, efforts to address such impacts require local leadership and involvement. To ensure they have the capacity to make informed decisions on climate change efforts in a meaningful way, training, research and monitoring must be fully supported to understand and implement climate change actions. It is also important to emphasize that increased capacity is needed at all levels of governments, as well as in academic institutions and other organizations, to realize climate change mitigation and adaptation actions.

PUBLIC AWARENESS, CAPACITY BUILDING AND COMMUNITY INVOLVEMENT

A great deal of climate change-related research and monitoring information is being generated. Increasing traditional, local and scientific knowledge capacity will allow for enhanced and more frequent climate change related research and monitoring (See Section 4.1 for more details). This is essential for informing planning and decision-making at the community level, from adaptations that will protect infrastructure from the effects of permafrost thaw, to mapping flood zones and fire risks in vulnerable communities.

Training and education will need to incorporate climate change knowledge, as climate change issues affect all disciplines and areas of society. The demand for training and education in the environmental, human health, public safety, culture and heritage, and infrastructure fields related to climate change is increasing. Coordinated training and educational programs will be required to address the growing list of climate change impacts and future mitigation and adaptation strategies.

6.3 OUTREACH PRIORITIES FOR ACTION PLAN

Priority actions for the 2019-2023 Action Plan that focus on public awareness, capacity building and community involvement are highlighted below and will be elaborated upon in the Action Plan.

Communication and Outreach

- Develop an outreach and communication plan to support the Framework's vision and goals.
- Develop accessible tools and resources (e.g. community permafrost maps) for use by community and Indigenous governments.
- Work with GNWT staff to incorporate climate change into existing and future outreach programming.

Community Involvement and Capacity Building

- Implement coordinated training and educational programs to address the growing list of climate change impacts and future mitigation and adaptation actions.
- Enhance community-based capacity to monitor and assess climate change impacts and inform necessary adaptations.
- Increase capacity at all levels of government (community, Indigenous, territorial and federal) to undertake climate change mitigation and adaptation actions.

Community Workshop Feedback 2017

During the six regional engagement workshops and as part of the public feedback received on the draft Framework, communities made a number of specific requests related to their role in research and monitoring:

- Establish better partnerships between communities and researchers;
- Lead research and monitoring based on local/regional climate change priorities;
- Participate at the outset of research projects to identify community concerns and make sure the intended results address community interests;
- Receive training and support to build community capacity that will allow community residents to participate in and lead research and monitoring work;
- Integrate schools and youth in research and monitoring;
- Increase the use of traditional and local knowledge;
- Improve communications and outreach on findings and trends; and
- Ensure access to climate change knowledge.

7.0

ECONOMIC DEVELOPMENT OPPORTUNITIES



While the NWT is facing many risks and vulnerabilities due to a changing climate, there may also be opportunities that could result in economic benefits.

ECONOMIC DEVELOPMENT OPPORTUNITIES

Some of the actions the NWT must implement to reduce GHG emissions have tangible economic benefits. Examples include:

- **Energy Efficiency and Renewable Energy Projects:** Retrofitting existing homes and buildings or installing local biomass and renewable energy projects helps to stimulate local economies through the purchase of equipment, building materials and the hiring of engineers, contractors and skilled labour;
- **Biomass Supply:** Continuing to increase the use of biomass energy for space heating and, potentially, power generation will increase the demand for biomass supplies in NWT communities. The harvesting, storage and distribution of biomass (cordwood and pellets) provides local business and employment opportunities;
- **Hydroelectric Projects and/or Transmission Lines:** Such projects are capital-intensive and require professional support at all stages, including planning, design, permitting, construction, operation and maintenance;
- **Resource Development Projects:** Finding ways to reduce fossil fuel consumption at remote sites can help reduce GHG emissions and energy costs, which can in turn lower overall operating costs and improve the economic viability of resource development projects;
- **Local Natural Gas Supply:** The development of locally available natural gas resources for power generation and space heating may offer a lower-cost and lower-emissions alternative to importing diesel fuel and natural gas from southern Canada;
- **Knowledge Economy:** The climate change challenges that need to be addressed represent opportunities for research, development and innovation. Identifying and implementing practical adaptive measures for communities and industry will contribute to the NWT's knowledge economy. It may also be possible to generate economic opportunities emerging from the NWT's collective experience in building resilience and adapting to climate change; and
- **Agriculture:** Building a relevant and viable agricultural industry and contributing to the sustainability of NWT communities are goals of the territory's first agriculture strategy, *The Business of Food: A Food Production Plan 2017-2022*. As growing seasons lengthen, producing more food locally can begin to address food security concerns, reduce food costs for residents and decrease GHG emissions resulting from the transportation of food from the south.

As more information becomes available on climate projections, assessments of new opportunities will be conducted in these, and potentially other, sectors.

8.0 IMPLEMENTATION



Photo: Natural Resources Canada

To achieve the Framework’s three goals by 2030, the GNWT, in collaboration with community and Indigenous governments and key stakeholders, will develop and implement two Action Plans – the 2019-2023 Action Plan and 2025-2029 Action Plan – which will be reviewed yearly, as

well as comprehensively every five years. Shared responsibility and strong partnerships will be critical to the successful implementation of the Action Plans. Governance and coordination structures will be established to strengthen collaborative working relationships within the

GNWT and with community, Indigenous and federal governments, industry, non-government organizations and other stakeholders. Ongoing tracking, annual reporting and formal evaluations will ensure the Action Plans and the Framework can be adapted, as required.

8.1 SHARED RESPONSIBILITY AND PARTNERSHIPS

The Pan-Canadian Framework on Clean Growth and Climate Change is Canada's collective plan to address climate change and grow a clean economy. The Pan-Canadian Framework provides broad direction and guidance that is relevant to the development and implementation of the NWT's Framework.

The Government of Canada is implementing several significant funding programs and initiatives to support the four main focus areas of the Pan-Canadian Framework. The GNWT will work closely with the federal government, community and Indigenous governments, and stakeholders to deliver specific funding programs and initiatives of particular interest to the NWT, including:

- **Low Carbon Economy Fund** – will support a variety of actions to reduce GHG emissions;
- **Green Infrastructure Fund** – will support projects involving GHG emissions reductions, along with clean water, wastewater and electricity systems;
- **Arctic Energy Fund** – will focus on addressing energy security for communities north of the 60th Parallel;
- **Resilience and Adaptation Measures** – will support Indigenous and northern communities' use of traditional knowledge

to understand and prepare for climate change, improve emergency management and enhance resilience in northern communities; and

- **Canadian Centre for Climate Services** – this newly-created organization will focus on supporting the provision of climate-related training, data, information and tools to support adaptation decision-making and climate resiliency.

As information on the various funding opportunities becomes available, the GNWT will work collaboratively with community and Indigenous governments, non-government organizations and the private sector to identify and scope out potential projects and actions that can be supported using federal funds. Collaborations will lead to the strong partnerships necessary to adapt to climate change impacts well into the future.

8.2 2019-2023 ACTION PLAN AND FRAMEWORK RENEWAL

The GNWT recognizes that climate change is an urgent concern and that there are numerous programs and initiatives already underway, or required, at the community, regional and territorial levels that rely on the involvement and support of community, Indigenous and federal governments and stakeholders.

To manage the work that will be funded through various programs and initiatives, and to report on progress, the GNWT will lead the development of a comprehensive 2019-2023 Action Plan.

8.2.1 2019-2023 Action Plan

The goals, knowledge requirements, adaptation efforts and other action items described in this Framework are the basis for the 2019-2023 Action Plan.

The process for developing and implementing the Action Plan will include additional engagement to identify research and monitoring requirements and current and potential adaptation efforts (preliminary lists are provided in Appendices B and D). For each identified action, efforts will be made to determine key partners, estimated costs, available resources, expected timelines and anticipated results.

Engagement on the development of the 2019-2023 Action Plan will be undertaken with:

- GNWT departments and agencies;
- Indigenous governments and organizations;
- Community governments and other local organizations;
- Regulatory and resource management boards;
- Non-government organizations; and
- Industry, the private sector and the public.

8.0 IMPLEMENTATION

The GNWT is committed to developing the 2019-2023 Action Plan before the end of 2018. Once finalized, key elements of the 2019-2023 Action Plan will include:

- A summary of the roles and responsibilities of all community, Indigenous, territorial and federal governments, organizations, industry and others involved in climate change emissions mitigation and adaptation;
- A comprehensive list of current and potential actions, organized by goals and priorities;
- An estimate of the annual funding available and resources needed to implement the identified actions;
- Direction on how overall collaboration, coordination and communication on climate change activities can be improved; and
- Details on key indicators to be used to measure progress and report annually.

8.2.2 Framework Implementation and Renewal

The following is a general planning timeline for the implementation of the Framework and development of Action Plans from 2018 to 2030, based on an adaptive management approach:

- 2018:** Develop a comprehensive 2019-2023 Action Plan for the NWT
- 2019-2023:** Implement the 2019-2023 Action Plan, and track and report on results annually
- 2024:** Complete a formal independent review of the Framework and 2019-2023 Action Plan. Any revisions to the Framework and the development of a new Action Plan for 2025 to 2029 will be based on the results of the 2024 Evaluation Plan review along with emerging issues and new opportunities, technologies and information
- 2025-2029:** Implement the 2025-2029 Action Plan, and track and report on results annually
- 2030:** Conduct a second independent review of the Framework and 2025-2029 Action Plan and use the results to update and renew accordingly

8.3 GOVERNANCE AND COORDINATION

The GNWT recognizes that it needs to play a leadership role in the governance and coordination of all the priorities, knowledge requirements, adaptation efforts and other actions contained in the Framework.

Within the GNWT, three different committees are in place to support the overall governance and coordination of climate change-related programs and projects across departments and manage linkages with other relevant initiatives, such as the 2030 Energy Strategy. These are:

- Assistant Deputy Minister Energy and Climate Change Committee
- Deputy Minister Energy and Climate Change Committee
- Energy and Climate Change Committee of Cabinet

The Department of Environment and Natural Resources (ENR) serves as the lead GNWT department for climate change. ENR fulfills several roles that support information-sharing and coordination of climate change efforts within the NWT, including:

- Tracking and reporting on GHG emissions and the NWT's progress on climate change resiliency and adaptation;
- Identifying emerging issues;
- Sharing information on climate change trends and topics;
- Providing technical expertise;
- Building partnerships (within the GNWT and externally) to support cross-cutting initiatives;
- Distributing adaptation funding; and
- Representing the NWT at national and international meetings and forums.

One recommendation from the Office of the Auditor General report, *Climate Change in the Northwest Territories*, focused on the need for ENR to provide stronger leadership and communication within the NWT on climate change.

To respond, ENR will:

- Establish a GNWT Working Group including membership from each department at a Director level. ENR and the Department of Infrastructure will serve as co-chairs and provide leadership and secretariat support. This working group will focus on government efforts to implement and report on the Framework and Action Plans. The GNWT Working Group will report to the Assistant Deputy Minister Energy and Climate Change Committee.
- Explore mechanisms to improve coordination and communication with community and Indigenous governments, industry, the NWT Association of Communities, non-government organizations, stakeholders and the public. Ensuring mechanisms are in place to provide input into the implementation of the Framework and Action Plan will support the identification of needs and interests; confirm priorities, knowledge requirements,

adaptation efforts and other actions; provide guidance on program or project development; and support communications and capacity building.

8.4 FINANCIAL AND RESOURCES

As noted in Section 8.2.1, the development of the 2019-2023 Action Plan will determine the costs and funding requirements, including resources required for actions. As part of this process, existing programs and funding will be examined to determine where additional support, capacity and collaboration are required.

With this information in hand, the GNWT will be in a position to consider what level of funding support may be available from the Government of Canada, and other potential sources, to support the Action Plan. Forming partnerships and collaborations will be necessary to ensure adequate resources to implement the Action Plan.

8.5 TRACKING AND REPORTING

Each year, the GNWT will produce and distribute an annual report on the progress made to address climate change. Each annual report will summarize activities and accomplishments, report on outputs and outcomes, and identify challenges and options to overcome them.

The annual reports will communicate Framework and Action Plan successes to community and Indigenous governments, GNWT departments, Members of the Legislative Assembly, the GNWT Financial Management Board Secretariat and stakeholders, including industry, non-government organizations and the general public. Information and results contained in the annual reports will enable adjustments to be made to the Action Plan and support the evaluation of the Framework in 2024.

A template for the annual report will be developed in 2018 in tandem with the development of the 2019-2023 Action Plan and the 2024 Evaluation Plan.

9.0

LOOKING FORWARD



The NWT's climate is expected to continue to change in the coming decades. This trend will continue to influence and change ecosystems, wildlife, water, infrastructure, human health, public safety, and culture and heritage in the NWT. Residents and communities need to prepare for these changes by undertaking mitigation actions, building resilience and finding ways to adapt, when necessary.

9.0

LOOKING FORWARD

The Framework will guide the implementation of the 2019-2023 Action Plan, setting the stage for the NWT to respond to the challenges and opportunities associated with climate change, move towards a lower-carbon economy and do its part to contribute to national and international efforts on climate change.

Despite its small population, the NWT has the potential to leverage emissions reductions nationally and internationally as an advocate for the magnitude of climate change impacts felt in the North. Even though the NWT is a small jurisdiction, by broadly sharing its powerful accounts of climate change impacts – and the challenges faced in mitigating and adapting to these impacts – it could strongly influence global action on climate change.

Collaborative efforts and partnerships will be the key to achieving the vision and goals outlined in the Framework by 2030. Community, Indigenous, territorial and federal governments, industry, businesses, academic institutions, regulatory and resource management boards, non-government organizations and residents all have a vital role in reducing GHG emissions and adapting to current and future changes.

The 2030 Energy Strategy is the primary mechanism for GHG reduction from energy in the NWT. The Three Year Energy Action Plan (2018-2021) will set out investments in actions and initiatives to improve energy efficiency and reduce emissions from electricity generation, transportation, space heating and industry. Together, GHG reductions achieved through the 2030 Energy Strategy and Energy Action Plan, carbon pricing and efforts from industry will put the NWT on a solid path to meeting its 30% reduction target for GHG emissions by 2030 (compared to 2005 levels).

The priorities, knowledge requirements, adaptation efforts and other actions outlined in the Framework will serve as the basis for developing and subsequently implementing the 2019-2023 Action Plan. As it is implemented, annual reports will be produced to track progress. Following a review and evaluation of the 2019-2023 Action Plan, a second Action Plan (2025-2029) will be developed and implemented.

By working together, we can address climate change and ensure a safe and prosperous future for the NWT.

APPENDIX A

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES AND DEPARTMENT OF INFRASTRUCTURE RESPONSES TO THE AUDITOR GENERAL OF CANADA REPORT, CLIMATE CHANGE IN THE NORTHWEST TERRITORIES

The Government of the Northwest Territories (GNWT) Department of Environment and Natural Resources (ENR) and Department of Infrastructure (INF) committed to addressing recommendations outlined in the Office of the Auditor General of

Canada’s October 2017 report, *Climate Change in the Northwest Territories*.

As outlined below, in releasing the 2030 NWT Climate Change Strategic Framework (the

Framework), ENR has taken a significant step towards fulfilling this commitment, with remaining portions of the six recommendations to be fully addressed in the 2019-2023 Action Plan.

Auditor General of Canada Recommendations	Additions to the 2030 NWT Climate Change Strategic Framework
<p>1. ENR should develop and implement a strategy outlining how the NWT will adapt to climate change, including: a territory-wide assessment of climate change risks; input from GNWT departments and residents; taking into account regional diversity, current adaptation efforts and existing knowledge of climate change impacts; and a clear implementation plan with indicators to track adaptation progress, and provision for ongoing assessment and updates as adaptation needs evolve.</p>	<p>ENR has developed the Framework to outline its approach to climate change adaptation. The following responses to the Auditor General’s recommendation are reflected in the Framework. Specifically:</p> <ul style="list-style-type: none"> • Section 4.3 highlights several action plan requirements focused on addressing research and monitoring gaps, and Section 5.7 highlights requirements to be included in the Action Plan focused on addressing current and potential adaptation efforts. These requirements center on the assessment of climate change risk on the natural environment, human health, public safety, culture and heritage, and infrastructure. These, and other potential actions, are reflected in Appendices B and D, respectively, and will be elaborated upon in the 2019-2023 Action Plan and subsequent 2025-2029 Action Plan. • Section 2.1 highlights the extensive engagement carried out to develop the Framework (see Recommendation 4 below). • Section 6.1 notes that different regions will have different information needs, reflecting regional diversity. • Existing knowledge of climate change impacts (Section 4 and Appendix B) and current adaptations needs (Section 5 and Appendix D) are described throughout the Framework. • Section 8.2.2 lays out the implementation plan for the Framework and Section 8.5 highlights the tracking and reporting that will be required annually as the Action Plans are implemented. Annual review and formal evaluations every five years will provide for ongoing assessment and updates as adaptation needs evolve. Section 8.2.1 states the 2019-2023 Action Plan will include details on key indicators to be used to measure progress and report on annually.

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Auditor General of Canada Recommendations	Additions to the 2030 NWT Climate Change Strategic Framework
<p>2. To better support climate change information needs and adaptation decisions, ENR should: identify the climate change information needs of GNWT departments and communities; provide departments and others with access to relevant information to support informed adaptation decisions; and monitor implementation of the GNWT Knowledge Agenda.</p>	<p>ENR recognizes the importance of identifying climate change needs and access to information to support adaptation decisions. Specifically:</p> <ul style="list-style-type: none"> • Section 4.1.3 has been drafted to address the management of traditional, local and scientific knowledge information. The need to improve the capacity to manage information and be able to use the knowledge generated for decision-making is stressed. • Section 4.3 highlights the development of a central repository to share and access climate change knowledge and information as a 2019-2023 Action Plan requirement. • Section 4.3 highlights the need to gather, include and manage traditional, local and scientific knowledge appropriately when developing climate change research, monitoring, mitigation and adaptation processes and actions, as a 2019-2023 Action Plan requirement. • Section 4.1.1 discusses the GNWT Knowledge Agenda, the need to consider climate change impacts across all themes, and the importance of transferring resulting knowledge to the public. • Section 8.1 highlights the collaboration and partnerships with community, Indigenous, territorial and federal governments required to develop and implement the 2019-2023 Action Plan. Strengthening ongoing partnerships with federal departments will also be critical to delivering specific funding programs and initiatives to mitigate and adapt to climate change.

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Auditor General of Canada Recommendations	Additions to the 2030 NWT Climate Change Strategic Framework
<p>3. ENR should develop a new greenhouse gas (GHG) strategy for the NWT that includes: concrete actions for addressing GHG emissions, how the actions will address emissions and the specific steps for their implementation; and actively monitor the commitments in its new GHG strategy and publicly report on progress made and results achieved on an ongoing basis.</p>	<p>The following responses to the Auditor General’s recommendation are reflected in the Framework. Specifically:</p> <ul style="list-style-type: none"> • Section 1.4 and Section 1.5 detail the relationship between the Framework and the 2030 Energy Strategy, stating the 2030 Energy Strategy is the primary mechanism for reducing GHG emissions related to energy supply and consumption. The associated Three Year Energy Action Plan (2018-2021) describes the actions and investments required to meet the NWT’s GHG emission targets. • Section 3.3 reflects actions for reducing GHG emissions in the NWT that are outside the scope of the 2030 Energy Strategy. Concrete actions and specific steps for implementation will be elaborated upon in the 2019-2023 and 2025-2029 Action Plans. • Sections 8.2.1 and 8.5 highlight that annual progress measuring and reporting on Action Plans will be undertaken and publicly released, and that a template for the annual report will be developed in tandem with the 2019-2023 Action Plan.
<p>4. In developing and implementing its strategy, ENR should engage with stakeholders, including industry, to clearly identify commitments to address GHG emissions in each sector across the NWT.</p>	<p>ENR has engaged extensively with community and Indigenous governments, community organizations, industry, non-government organizations, other interested groups and the public on the development of the Framework. Specifically:</p> <ul style="list-style-type: none"> • Section 2.1 outlines the areas for which key input was received during regional engagement workshops, a public survey, written submissions and public feedback on the draft Framework. These were reflected in the Framework. • Section 8.2.1 highlights the engagement with all interested community and Indigenous governments and stakeholders that will be required to develop and implement the 2019-2023 and 2025-2029 Action Plans.

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Auditor General of Canada Recommendations	Additions to the 2030 NWT Climate Change Strategic Framework
<p>5. ENR should consider options for how best to fulfill its responsibilities as the lead for climate change in the GNWT, including: considering what authority is needed; and identifying the resources needed to fulfill its responsibilities.</p>	<p>ENR is committed to continuing to make improvements to support its leadership role on climate change, as reflected in the Framework. Specifically:</p> <ul style="list-style-type: none"> • Section 8.3 highlights that ENR is the lead GNWT department for climate change, and lists several roles that it undertakes. To help support a leadership role, the establishment of a GNWT Working Group has been proposed. The Working Group will focus on government efforts to implement and report on the Framework and subsequent action plans. ENR will also explore mechanisms to improve coordination and communication with community and Indigenous governments, industry, the NWT Association of Communities, non-government organizations, stakeholders and the public, to support the implementation of the Framework and Action Plans. As the 2019-2023 Action Plan is developed, ENR will continue to review its authority, roles and responsibilities, and the resources required to effectively implement the Framework.

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Auditor General of Canada Recommendations	Additions to the 2030 NWT Climate Change Strategic Framework
<p>6. ENR should identify and implement wildlife management actions to adequately adapt to climate change, including: conducting an assessment of risk for its overall wildlife management strategy to ensure all climate change risks to wildlife have been identified; collecting information to understand impacts on wildlife; taking action to address the risks identified; and working to fulfill existing commitments to address climate change impacts on wildlife.</p>	<p>ENR recognizes climate change as an important factor affecting the NWT’s wildlife, as reflected throughout the Framework. Specifically:</p> <ul style="list-style-type: none">• Section 4.2.1 states the GNWT generally addresses the effects of climate change on wildlife at a species level. Under this approach, all factors that affect a species, including climate change, are considered in order to assess their cumulative impact on the health and resilience of species.• Section 4.3 highlights the completion of climate change vulnerability assessments for all species-at-risk as an Action Plan priority to better understand climate change impacts on individual species and inform wildlife management decisions and actions.• Numerous climate change research and monitoring requirements (Appendix B) and current and potential adaptation efforts (Appendix D) that collect information on impacts to wildlife, take action to address identified risks, and work to fulfill existing initiatives to address climate change impacts on wildlife are listed in the Framework and will be implemented through the Action Plans.

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INF has committed to the following actions to address the Office of the Auditor General of Canada recommendations on assessments, research, inspections, monitoring and reporting on climate change for key infrastructure, which are summarized below.

Auditor General of Canada Recommendations	Department of Infrastructure Responses
<p>1. INF should consistently carry out those operational practices that it committed to in order to manage the impacts of climate change on roads, in particular for the management of small culverts and ice roads.</p>	<ul style="list-style-type: none"> • INF will reinforce the current inspection system to include minor infrastructure (small culverts and ice crossings); • INF will implement an integrated system (including the Bridge Management System, Highway Surface Management System, webworks and highways inspections reports); <ul style="list-style-type: none"> • The generation of monthly reports to measure performance with semi-annual summaries; • Missing inspections flagged monthly; and • Follow-up action reported and prioritized monthly. • INF will conduct a major risk assessment on transportation infrastructure in the presence of climate change, updating the 2013 version and again every two years based on current weather predictions; and • INF will continue to work with other jurisdictions to lead and reinforce research and development in infrastructure and climate change, reinforcing the current research and development sites on Highway 3 and Highway 10.

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Auditor General of Canada Recommendations	Department of Infrastructure Responses
<p>2. INF should consistently carry out those operational practices that it committed to in order to manage the impacts of climate change on public buildings.</p>	<ul style="list-style-type: none">• INF will reinforce the current inspection system for buildings as follows:<ul style="list-style-type: none">• Integrate our systems for inspections, monitoring and responses to climate change risks from snow loads, wind loads, permafrost degradation of foundation systems including adfreeze steel and timber piles, thermosyphons and other types of foundations within the maintenance management system;• The generation of regular monthly reports to measure performance with semi-annual summaries;• Missing inspections flagged monthly; and• Follow-up action reported and prioritized monthly.• INF will conduct a major risk assessment on the public infrastructure in the presence of climate change, updating the 2004 version and updating/reviewing every two years; and• INF will continue working with other northern jurisdictions to lead and reinforce research and development in climate change adaptation for infrastructure and permafrost.

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

To improve knowledge of climate change impacts, as per Goal #2 of the 2030 NWT Climate Change Strategic Framework, the specific impacts of climate change on the natural environment, human health, public safety, culture and heritage, and infrastructure must be documented to highlight knowledge gaps and determine future research and monitoring requirements.

Impacts of rising temperatures, changing ice cover duration, coastal erosion, thawing permafrost and extreme weather events are easier to measure than impacts to biology, ecology and productivity. The latter impacts tend to be indirect (i.e. seen in secondary factors), take longer to occur and can be the result of many interacting factors, including climate change. All of these factors need to be considered when implementing Goal #2.

The table below outlines important climate change impacts, knowledge gaps and research and monitoring requirements for the natural environment, human health, public safety, culture and heritage, and infrastructure. These knowledge gaps and research and monitoring requirements will help inform the development of the 2019-2023 Action Plan, as well as the Action Plan for the GNWT Knowledge Agenda.

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Overarching	<p>To address climate change impacts, knowledge gaps, and research and monitoring requirements on the natural environment, human health, public safety, culture and heritage, and infrastructure, it will be necessary to develop NWT-based capacity.</p> <p>Building capacity will increase the NWT's overall ability to fill the gaps and partner in a meaningful way with funding agencies, as well as formulate important partnerships with community, Indigenous, territorial and federal governments, academic institutions and other organizations to undertake necessary climate change research and monitoring.</p>
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APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Natural Environment	
Changes to Climate and Weather	<p>Impacts:</p> <ul style="list-style-type: none">• Storms are becoming more severe;• Precipitation is increasingly unpredictable;• Winter freeze-up dates are occurring later, and spring thaw is occurring earlier;• Extreme events, such as drought, are more frequent; and• Increasing snow loads can lead to increased spring run-off and flood risks, as well as impede the movement of people and wildlife on the land. <p>Knowledge Gaps and Research and Monitoring Requirements:</p> <ul style="list-style-type: none">• Improving the existing monitoring network by increasing the number of stations, particularly in areas more vulnerable to the effects of climate change;• Increasing snow monitoring and winter climate monitoring;• Improving knowledge of extreme climatic events;• Improving knowledge of climate-induced sea level rise on coastal erosion;• Coordinating monitoring efforts between territorial, federal and other partners; and• Collecting and managing data to be easily compared and readily accessible to inform decision-making.

Natural Environment	
Thawing Permafrost	<p>Impacts:</p> <ul style="list-style-type: none"> • Thawing permafrost can result in coastal and shoreline erosion, ground subsidence, landslides, thaw slumps and landscape change; • The structural integrity of much of the NWT’s built environment, which relies on frozen ground as a foundation, will be increasingly vulnerable in future decades. The cost of maintaining infrastructure and mitigating impacts can be expected to increase significantly with the acceleration of climate-driven permafrost thaw; • Water quality can be greatly impacted by thawing permafrost as sediment, soluble materials (including metals) and organic carbon are released into nearby water bodies, potentially affecting the surrounding ecosystem and traditional uses; • Thawing permafrost can transform landscapes and overlying ecosystems, most notably in expansive peat plateau woodlands, which are converted to wetlands or fens following thaw. Thaw slumping and transfer of large volumes of sediments downslope is reconfiguring landscapes across the northwestern NWT. Downstream effects may include shifts in water quality and changes in aquatic ecology; • Legacy contaminated sites, drilling mud sumps, tailings and impoundment structures (including waste water lagoons) that utilize permafrost as a containment medium will be increasingly at risk with climate-driven permafrost thaw; and • Preservation of cultural heritage is at risk as thawing permafrost affects heritage resources and culturally significant sites, particularly near coasts and shorelines.

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Natural Environment	
Thawing Permafrost continued	Knowledge Gaps and Research and Monitoring Requirements: <ul style="list-style-type: none">• Collecting and providing permafrost baseline data to support infrastructure planning, community decision-making and ecosystem management;• Further developing a permafrost monitoring network that integrates new data collection and management methods, modeling and remote sensing;• Developing a database of likely landscape, ecosystem and water quality changes resulting from permafrost thaw to inform environmental management and decision making;• Developing a permafrost data management system to manage GNWT and partner generated information, and the capacity to support the system;• Supporting mapping initiatives, modeling and monitoring that can evaluate landscape and ecosystem change and geohazards (e.g. coastal erosion and vertical land movement along the coast);• Developing requirements to ensure the consideration of permafrost thaw in all development and adaptation planning for NWT infrastructure; and• Developing key research topics and climate change research corridors (e.g. Dempster Highway and the new Highway 10 from Inuvik to Tuktoyaktuk) to guide internal and external research efforts to meet NWT needs.

Natural Environment	
Changes to Water Quality and Quantity	<p>Impacts:</p> <ul style="list-style-type: none"> • Water quality can change as water chemistry is altered due to the release of nutrients, metals and other contaminants resulting from wildland fires, erosion and permafrost thaw; • Changes in water quality can affect drinking water sources and harvesting practices; • Changes in water quantity can lead to low water levels in some areas, which can impact wetlands, fishing areas and marine transportation; • Changes in water quantity can lead to flooding in some areas, which can affect the safety and well-being of residents, as well as surrounding ecosystems; • Increases in groundwater flow due to thawing permafrost in certain regions can lead to increased winter flow and changes in water chemistry, while other locations may experience drainage of surface water into the ground; • Reduced ice coverage, duration and thickness on many lakes and rivers can affect the viability of winter roads and traditional harvesting practices; and • Changes in water quality and quantity can impact the aquatic ecosystem as a whole, including invertebrates, which form a critical part of the food chain. <p>Knowledge Gaps and Research and Monitoring Requirements:</p> <ul style="list-style-type: none"> • Expanding water quality and quantity monitoring in areas more vulnerable to the effects of climate change; • Continuing ongoing water monitoring, including community-based monitoring by Indigenous governments and organizations, to answer community questions and determine if stressors such as climate change are affecting water; • Considering climate change in ongoing community source water protection planning; • Determining appropriate biological indicators for aquatic ecosystem health monitoring to provide early warnings of changes that may be related to climate change;

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Natural Environment	
Changes to Water Quality and Quantity continued	Knowledge Gaps and Research and Monitoring Requirements (continued): <ul style="list-style-type: none">• Completing vulnerability assessments for aquatic ecosystems at greater risk of climate change impacts, and expanding monitoring as necessary;• Assessing the cumulative impacts to water from multiple stressors, including climate change, as reflected in the NWT Water Stewardship Strategy Action Plan 2016-2020;• Understanding impacts of climate change on water quality and quantity for mining, oil and gas, hydroelectric and other developments;• Understanding impacts of climate change on water quality and quantity for legacy contaminated sites or industrial developments undergoing reclamation, as certain site management approaches are based on temperatures remaining cold enough (e.g. frozen core dams), or water levels and/or quality remaining relatively constant;• Understanding the implications of flooding on communities and aquatic ecosystems;• Understanding the impacts of thawing permafrost on near-surface groundwater quantity and quality;• Ongoing monitoring of water quantity, snow and ice conditions to provide important planning information for marine transport (river and lake barges), land transport (all-season and winter roads) and for residents undertaking traditional and recreational activities on the land and water;• Understanding climate change impacts on wetlands (remote sensing can be used to provide a baseline for assessing changes to wetlands);• Understanding the important role of wetlands in storing carbon (as carbon dioxide), while also determining the significance of methane release;• Understanding the potential impacts of GHG release from lakes and rivers; and• Determining how the NWT and neighbouring jurisdictions can account for the effects of climate change in setting and monitoring transboundary objectives and conducting research and monitoring as part of current and future transboundary bilateral water management agreements.

Natural Environment	
Changes to Forests and Tundra Vegetation	<p>Impacts:</p> <ul style="list-style-type: none"> • Forest ecosystems in the NWT have been experiencing unprecedented changes in natural disturbance regimes, particularly in the last 10 years, likely due to changing climate. Warming temperatures, changing precipitation patterns, flooding and thawing permafrost are all factors impacting forests; • Changes in natural disturbance regimes and weather patterns are affecting forest productivity, composition and distribution, increasing the frequency and severity of wildland fires, and increasing the prevalence of insect and disease disturbances; • Changes in wildland fire regimes are creating challenges for fire management and community protection, in addition to impacting water, permafrost, wildlife and traditional activities; • Changes in forest insect and disease regimes, such as northern shifts in pest ranges, changes in pest behaviour and increased occurrence of non-indigenous and invasive species (e.g. alfalfa), are causing damage to previously unaffected forest ecosystems; • Changes in tundra vegetation include an increase in shrubs observed near the tree line and the tundra becoming greener, with more growth in vascular vegetation (green leaf plants) but less growth in lichen-dominated areas; and • Drying of tundra vegetation is occurring due to longer warm periods, increasing the risk of tundra fires that can, in turn, leave the surfaces of pingos (unique permafrost formations) vulnerable to erosion. <p>Knowledge Gaps and Research and Monitoring Requirements:</p> <ul style="list-style-type: none"> • Completing vulnerability assessments that integrate research, monitoring and traditional knowledge to develop effective adaptation measures in specified forest and tundra areas of interest; • Understanding the changing wildland fire regime and potential implications for NWT residents and communities; • Understanding forest and tundra vegetation renewal and growth dynamics after natural and human-caused disturbances in a changing climate;

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Natural Environment	
Changes to Forests and Tundra Vegetation continued	Knowledge Gaps and Research and Monitoring Requirements (continued): <ul style="list-style-type: none">• Understanding carbon storage and fluxes in vegetation, soil, wetlands and peat;• Enhanced monitoring of changes in forest productivity, condition and carbon dynamics as climate change progresses (e.g. annual forest health surveys and network of permanent sample plots);• Mapping permafrost extent and characteristics in forested ecosystems to help understand the implications of permafrost thaw;• Enhanced monitoring of changes in tundra vegetation condition as climate change progresses;• Utilizing remote sensing techniques to assist with informed decision-making across the NWT's vegetated land mass;• Creating a baseline vegetation classification scheme for the entire NWT (including forested, tundra and wetland areas);• Completing forest inventories to provide detailed information on vegetation composition and structure at specific areas/times to serve as a baseline for key conditions that can be measured against as climate change progresses;• Assessing long-term impacts resulting from range shifts of domestic pests and presence of invasive and non-indigenous plant and wildlife species; and• Enhancing trials where tree species from different locations are planted at new locations and their growth monitored in relation to the climate.

Natural Environment	
Changes to Wildlife	<p>Impacts:</p> <ul style="list-style-type: none"> • New, non-indigenous species are moving northward into the NWT as the climate continues to warm. Other species are experiencing changes in their ranges within the NWT and some have more limited ranges; • Changes in migrations and movements of wildlife due to extreme weather events or wildland fires are apparent; • New diseases and parasites have been observed that might become established in resident wildlife species; • Changes in the types and distribution of wildlife parasites as well as the frequency, intensity and rate of development of infections are a concern, as wildlife parasites are strongly influenced by relatively subtle changes in climate. There is also evidence that host-pathogen interactions for species already present in the NWT are changing in such a way that may lead to unprecedented host population declines; • Shifting of the timing of insect hatch has resulted in some bird species arriving on their breeding grounds too late to take advantage of the peak in insects. Over time, this will likely lead to population declines for some boreal birds, insectivores and shorebirds; • The ability of wildlife to adapt to natural processes such as wildland fires will likely be compromised as these processes increase in intensity due to climate change; • The ability of caribou to forage for winter food sources has been and could continue to be affected by increased snowfall in regions of the NWT; and • Changes in permafrost and resulting altered habitat are impacting wildlife that prefers lichens, forested areas, bogs and wetlands. The scale of these changes is uncertain, but some evidence shows that it is significant in the Taiga Plains region of the NWT.

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Natural Environment	
Changes to Wildlife continued	Knowledge Gaps and Research and Monitoring Requirements: <ul style="list-style-type: none">• Undertaking climate change vulnerability assessments for all species-at-risk to inform better wildlife management decisions;• Tracking trends and changes in wildlife populations, health and distribution to determine impacts of climate change;• Continuing research and monitoring on changes to caribou food sources in the NWT and circumpolar countries based on a suite of climatic indicators;• Applying a suite of climatic indicators relevant to caribou to other species that are vulnerable to climate change to better predict population changes, inform management actions and alleviate other human-caused threats;• Conducting monitoring, particularly community-based monitoring, to track and manage non-indigenous and invasive species (e.g. mammals, birds, insects, amphibians and plants) that can pose a threat to wildlife and biodiversity as they extend their ranges and become established in the NWT;• Determining whether or not wildlife is adapting to changes, such as increases in parasites;• Completing NWT landscape monitoring at regular intervals (every 10 to 15 years) to assess changes to baseline conditions and help predict potential impacts to wildlife;• Continuing ongoing use of remote sensing techniques to assess wildlife habitat and impacts due to climate change (e.g. landscape change resulting from increased wildland fires);• Updating the 2006 NWT Biodiversity Action Plan with a new gap analysis to ensure actions for maintaining biodiversity in light of a changing climate are in place; and• Understanding cumulative impacts of climate change, industrial development and other stressors on wildlife species.

Natural Environment	
<p>Changes to Freshwater Fish and Marine Mammals</p>	<p>Impacts:</p> <ul style="list-style-type: none"> • Non-indigenous fish and marine mammal species are being observed more frequently by residents and researchers as their ranges expand. Colonization and invasion by non-indigenous species may threaten indigenous species due to increased competition for habitat and food; • Changes in ice cover duration may influence the growth, mortality, reproduction and seasonal migration of fish and marine mammals; • Variable lake and river levels influenced by climate change may threaten fish habitat and reproduction; • Declines in sea ice can lead to reduced birthing habitat and increase mortality for young seals, likely impacting their populations; • Ocean acidification is happening faster in the Beaufort Sea than predicted. Acidification (as a result of global increases in carbon dioxide in the atmosphere) will result in profound changes to marine ecosystem productivity, including fish and marine mammals; • Increases in water temperature impact the overwintering habitat and health of fish and marine mammals, including changes to spawning and rearing habitat, food availability and predators; • Increases in contaminant loads in fish and marine mammals from long-range and local contaminant sources could occur; • Impacts to contaminant loads in fish and marine mammals could occur due to the release of naturally occurring elements and contaminants from the frozen ground as permafrost thaws; • Lower levels of dissolved oxygen in lakes in winter due to climate change can negatively impact the survival of overwintering fish populations; and • Increases in predation risk, disease and parasitism, have the potential to affect the abundance and distribution of indigenous fishes.

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Natural Environment	
Changes to Freshwater Fish and Marine Mammals continued	Knowledge Gaps and Research and Monitoring Requirements: <ul style="list-style-type: none">• Improving baseline information to better understand the impacts of climate change on fish species, health and distribution in the North (as highlighted in Fisheries and Oceans Canada’s Climate Change and Arctic Fisheries Research Program);• Ongoing monitoring of temperature-dependent contaminants (e.g. mercury) in ringed seal, beluga and subsistence fish species such as lake trout, burbot and lake whitefish;• Ongoing monitoring of non-indigenous fish and marine mammal species and associated diseases or parasites;• Monitoring vulnerable fish and marine mammal populations to develop conservation strategies;• Understanding the impacts of ocean acidification and oxygen depletion on fish and marine mammals;• Monitoring marine mammal population dynamics in the Beaufort Sea, as sea ice declines in extent, duration and thickness, negatively affecting habitat for some species and potentially expanding ranges for others;• Understanding climate change impacts on aquatic ecosystems and fisheries for Great Slave and Great Bear Lakes (e.g. temperature profile changes being observed in Great Bear Lake);• Addressing knowledge gaps on the cumulative impacts of multiple stressors, including climate change, on fish and marine mammals;• Determining appropriate biological indicators to assess vulnerability, resilience and adaptation of fish and marine mammal populations and providing early warnings of climate-induced changes; and• Determining changes in contaminants in fish and marine mammals over time and the implications as food sources for wildlife and humans.

Human Health, Public Safety, and Culture and Heritage

Human Health

Impacts:

1. *Potential Negative Impacts on Physical Human Health:*

- Zoonotic infectious diseases (transmitted from wildlife to humans) or outbreaks may spread northward. These could include Lyme disease, West Nile virus, Hantavirus and Rocky Mountain spotted fever, among others. In the past, human diseases or reservoir species might not have survived in the cold temperatures, but as the region warms, new diseases could emerge. These may be food or waterborne, transmitted by insects, ticks and rodents, or the result of exposure to wildlife through hunting. Re-emergence of other diseases no longer common in the NWT is also likely (e.g. brucellosis and anthrax);
- Risk of illness or death in people with heart and respiratory problems due to higher temperatures, extreme weather, wildland fires and smoke may increase;
- Increased human exposure and associated health risks (e.g. sunburns, skin cancers, cataracts and eye damage) due to elevated ultraviolet radiation levels from stratospheric ozone depletion may occur;
- Increases in eye, nose and throat irritation, shortness of breath, exacerbation of respiratory conditions and allergies, chronic obstructive pulmonary disease and asthma, due to negative impacts of wildland fires on air quality could occur;
- The increased production of pollens and spores by plants may lead to more frequent and heightened allergic reactions due to longer growing seasons;
- Increased health impacts resulting from source drinking water contamination could increase due to extreme weather events, floods or wildland fires leading to source water contamination;
- Concerns with food safety and potential health impacts resulting from increases in contaminant loads (e.g. from long-range and from local climate-related sources) in country foods due to climate change. Contaminants such as mercury and persistent organic pollutants pose risks to human health; and
- Concerns with country food safety resulting from increases in wildlife diseases or parasites which, in turn, impact human health.

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Human Health, Public Safety, and Culture and Heritage

Human Health continued

Impacts (continued):

2. Negative Impacts on Food Security and Mental, Social and Cultural Well-being:

- Limitations to traditional harvesting and cultural/land-based activities, leading to altered lifestyles, which have negative impacts on mental health (e.g. lack of social and cultural activities) and well-being (e.g. decreased physical activity and greater reliance on store bought food);
- Decreased food security due to changes in wildlife, fish and plant habitat and health affecting the availability of country foods, which is of utmost importance to Indigenous peoples who have depended on these food sources for generations; and
- Psychological health effects including mental health problems and stress-related illnesses.

3. Potentially New Opportunities for Growing Local Food:

- A positive impact could be an increase in some food sources, such as cultivated crops in community gardens as a result of longer growing seasons, and opportunities for new agriculture sectors in the NWT.

Knowledge Gaps and Research and Monitoring Requirements:

- Further research and monitoring of country food sources, including their health, abundance and distribution, to determine availability and quality of food sources for generations to come;
- Surveillance systems that enhance the ability to support predictions of species distribution changes and associated public health impacts (e.g. appearance of species carrying diseases that can be transmitted to humans, and new and re-emerging infectious diseases) associated with climate change are needed;
- An improved understanding of environmental toxicology and greater risk communications capacity to address human health implications associated with long-range and local environmental contaminants, particularly as it relates to changing climate;
- Continued source water protection planning for NWT communities, including linkages with the monitoring of drinking water quality and safety of water supplies in reservoirs; and

Human Health, Public Safety, and Culture and Heritage	
<p>Human Health continued</p>	<p>Knowledge Gaps and Research and Monitoring Requirements (continued):</p> <ul style="list-style-type: none"> • Assessments of risks to human health arising from air quality issues related to wildland fires, as well as flood and heat event prediction, assessment of land cover changes, and associated implications for the safety and security of local food and water resources for communities.
<p>Public Safety</p>	<p>Impacts:</p> <ul style="list-style-type: none"> • Physical injuries, illnesses and deaths from extreme weather events, floods, wildland fires, erosion, permafrost thaw slumps, critical infrastructure failure and transportation accidents; • New risks to the people, property, environment and economy of the NWT could arise as new opportunities and commercial activity potentially increase; • Increased erosion has led to the removal and closure of buildings close to shorelines (ocean and river) and greater risk to infrastructure; • Adverse impacts to transportation infrastructure, such as roads, bridges and airstrips, as well as changes to navigable waters and air space; • Evacuation of communities, damage to property and infrastructure, contamination of surrounding water and disruption of essential services can all result from significant hazards such as wildland fires and floods; • Food insecurity is a cross-cutting concern that impacts the safety of residents and wildlife; and • Drought can impact the production of hydroelectricity, water navigation, food availability and wildlife distribution patterns.

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Human Health, Public Safety, and Culture and Heritage	
<p>Public Safety continued</p>	<p>Knowledge Gaps and Research and Monitoring Requirements:</p> <ul style="list-style-type: none"> • The NWT Hazard Identification Risk Assessment Report (2014) considered climate change in its assessment of current hazards, projecting which hazards could occur more frequently or become more extreme in the future. Two hazards – floods and wildland fires – were deemed top hazards in the NWT, and are a priority for research and monitoring to ensure public safety; • Expanding the ability to predict and monitor flood activity; and • Ongoing research and monitoring of other hazards identified in the NWT Hazard Identification Risk Assessment Report, such as extreme weather, coastal erosion, thawing permafrost, invasive species, etc., to support planning for public safety.
<p>Culture and Heritage</p>	<p>Impacts:</p> <ul style="list-style-type: none"> • Challenges related to unpredictable weather and ice conditions when traveling on the land for hunting, fishing, trapping and camp access may impact the traditional and cultural activities and economies (e.g. sale of wild furs) of Indigenous people; • Less predictable weather and ice conditions may impact the wide variety of on-the-land cultural, recreational and spiritual activities of NWT residents; • Stresses to country food sources due to climate change and related impacts on cultural activities (e.g. harvesting activities may be affected by decreased wildlife or fish populations); • Heritage resources (e.g. archaeological sites) are at risk from processes such as coastal erosion, landscape disturbances caused by thawing permafrost, melting alpine ice and wildland fires; and • As local climates change, the ability of traditional and local knowledge holders to utilize their knowledge on the land may be affected.

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Human Health, Public Safety, and Culture and Heritage

Culture and Heritage continued

Knowledge Gaps and Research and Monitoring Requirements:

- Understanding the impacts of climate change on the traditional lifestyles and practices of Indigenous and local people; and
- Understanding where heritage resources are at greatest risk from climate change-related disturbances.

Infrastructure

Impacts:

- Several NWT communities have infrastructure subject to potential structural failure due to degrading permafrost and additional snow load effects;
- Certain communities may be subject to extended loss of power due to transmission line failures caused by extreme weather events arising from climate change;
- Potential loss of infrastructure and buildings in the four NWT coastal communities along the Beaufort Sea could occur due to coastal erosion;
- Several NWT communities are subject to flood risk from river flooding due to ice jams or sea level rise, both of which may increase as a result of climate change;
- Compromised ability to generate hydroelectricity due to droughts;
- Lack of sufficient water flow for the passage of river barges and ferries;
- Warmer winters resulting in shorter winter road seasons, compromising the long-term viability of winter roads and increasing risks; and

APPENDIX B

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Infrastructure	
	<p>Impacts (continued):</p> <ul style="list-style-type: none">• Linear infrastructure such as highways, airports and transmission lines, and isolated infrastructure such as mines, hydroelectric facilities and radio/microwave transmission towers, are potentially at risk from climate change impacts such as extreme weather events, thawing permafrost and increased frequency and severity of wildland fires.
	<p>Knowledge Gaps and Research and Monitoring Requirements:</p> <ul style="list-style-type: none">• Increased monitoring of key environmental components, including microclimate effects like precipitation, air temperature, permafrost, forest composition and water levels, to better understand potential impacts on infrastructure and buildings;• Long-term monitoring and forecasting of infrastructure stability in NWT communities;• Long-term monitoring, analysis and forecasting of impacts of climate change on linear infrastructure (e.g. the new all-season Highway 10 from Inuvik to Tuktoyaktuk);• Long-term monitoring and forecasting of impacts of climate change on infrastructure that support essential services;• Undertaking research and development and test projects with various experts to improve knowledge and allow for the development of new designs and measures to mitigate or adapt to climate change impacts for a wide range of northern infrastructure;• Continuing to work with other jurisdictions on research, development and best practices;• Updating climate change risk assessments for major infrastructure;• Continuing to explore the potential for remote sensing and other technology to acquire settlement and movement data as part of a monitoring program for buildings and other critical infrastructure; and• Continuing to work with other jurisdictions to lead and reinforce research and development, including the current research and development sites on Highway 3 and Highway 10.

APPENDIX C

SUSTAINABILITY OF ECOSYSTEMS AS A RESPONSE TO CLIMATE CHANGE

Numerous planning processes govern and support the management of NWT ecosystems and natural resources. These can contribute to improving ecological, social and economic resilience and adaptation to climate change and will likely need to be updated in the future to better account for ongoing climate change-related impacts and opportunities.

Three examples are provided below.

CONSERVATION NETWORK PLANNING

Northern ecosystems are diverse and particularly sensitive to climate change. Conservation network planning involves the protection of biodiversity through the establishment and management of protected and conservation areas, while recognizing the relationship between social well-being, ecological health, sustainable livelihoods and economic prosperity. A conservation network

ensures that protected areas fall within a broader land management framework that includes land use planning, regulatory requirements, monitoring activities and best practices, to ensure they do not become isolated and less resilient to change.

The inclusion of healthy populations and ecosystems, ecological representation, enduring landscape features and traditional knowledge in protected areas is important to conservation network planning. These aspects can help maintain and build both ecological and social resilience to a changing climate. Connectivity of certain protected and conservation areas can support the adaptation and survival of species in the face of climate change by facilitating their movement to more suitable environments.

The protection of biodiversity ensures the continuation of vital ecosystem services, such as clean water and climate stabilization. It also protects cultural and spiritual pursuits, increases social well-being, provides food provisioning services, cultural and eco-tourism business

opportunities and commercial renewable resource harvesting opportunities, and contributes to the arts and crafts industry and the traditional economy.

Healthy Land, Healthy People outlines the GNWT's priorities for the advancement of conservation network planning from 2016 to 2021, based on the principles and objectives of the GNWT Land Use and Sustainability Framework. Continuing to incorporate climate change considerations based on the best traditional, local and scientific knowledge into conservation network planning is imperative, and will support the establishment of existing candidate areas and the identification of new potential protected and conservation areas.

Integrating climate change considerations will be undertaken through careful adaptive management and the monitoring of protected and conservation areas to detect impending changes in ecosystems, in order to adjust flexibly as new knowledge becomes available.

APPENDIX C

SUSTAINABILITY OF ECOSYSTEMS AS A RESPONSE TO CLIMATE CHANGE

GNWT LAND USE AND SUSTAINABILITY FRAMEWORK

Northern Lands, Northern Leadership: The GNWT Land Use and Sustainability Framework sets out a vision, guiding principles and land interests to guide how the GNWT manages land and resources. It seeks to balance economic, environmental and cultural interests in land and resource management decisions.

In support of the vision set out in the Land Use and Sustainability Framework, the GNWT is developing a suite of government-wide land use and sustainability objectives to be incorporated into government decision processes that will ensure a consistent GNWT-wide approach to implementing the Land Use and Sustainability Framework. Including climate change considerations in all land and resource decision-making will be central to adapting to the changing climate.

REGIONAL LAND USE PLANNING

Regional land use planning is an ongoing process in the NWT. Regional land use plans define where and how certain land use activities can take place. Land use plans are statutory requirements in the Gwich'in and Sahtu Settlement Areas, flowing from comprehensive land and resources agreements. Pursuant to these agreements and as set out in the Mackenzie Valley Resource Management Act, land use planning is a shared responsibility in the NWT. The GNWT, along with Indigenous and federal governments, have authorities respecting the approval of regional land use plans. For example, the Tłı̄chǫ Wenek'e - Tłı̄chǫ Land Use Plan (2012) states that when new information related to climate change is found, an amendment to the land use plan may be considered, including strategies relating to adaptation and mitigation. Other settled and unsettled land claim regions have or are pursuing land use planning initiatives.

Climate change is changing the way land is used. Conversely, the way land is used has an impact on GHG emissions and climate change. Land use plans are an important policy tool to respond to climate change. Climate change considerations can be incorporated into the vision and objectives of a plan and built into legally binding conformity requirements, which can assist with climate change adaptation on a regional level.

APPENDIX D

CURRENT AND POTENTIAL ADAPTATION EFFORTS TO ADDRESS CLIMATE CHANGE IMPACTS

Resilience and adaptation measures will be required for many of the impacts to the natural environment, human health, public safety, culture and heritage, and infrastructure identified in Appendix B.

The numerous current and potential adaptation efforts listed below will serve as a starting point to inform the development of the 2019-2023 Action Plan to implement the 2030 NWT Climate Change Strategic Framework.

Further engagement with community, Indigenous, territorial and federal governments, industry, non-government organizations, academic institutions, regulatory and resource management boards, stakeholders and the public will take place in 2018 to seek input on the implementation of these and other identified actions.

CLIMATE CHANGE IMPACTS, KNOWLEDGE GAPS, AND RESEARCH AND MONITORING REQUIREMENTS

Natural Environment	
Climate and Weather	<ul style="list-style-type: none">• Enhancing community-based monitoring and management to better inform communities and gain an understanding of potential adaptations required due to climate change;• Enhancing land-based climate monitoring to better inform climate change adaptation decision-making;• Completing vulnerability assessments to identify NWT locations susceptible to extreme weather or other natural hazards;• Enhancing marine climate monitoring in the Beaufort Sea, Great Bear Lake and Great Slave Lake using weather buoys;• Projecting sea level rise for the NWT due to climate change;• Enhancing weather warnings for extreme conditions, including air quality;• Undertaking predictive climate modeling to allow planning for extreme weather events, such as drought;• Enhancing climate data and predictive information for the current and future climate to inform decision-making for adaptation;

APPENDIX D

CURRENT AND POTENTIAL ADAPTATION EFFORTS TO ADDRESS CLIMATE CHANGE IMPACTS

Natural Environment	
Climate and Weather continued	<ul style="list-style-type: none">• Developing projections of future climate for the NWT that can be expected with increased levels of GHGs; and• Adjusting community services as a result of increasing extreme or variable weather events (e.g. ensuring equipment and staff are in place to deal with greater snowfalls).
Permafrost	<ul style="list-style-type: none">• Enhancing community-based monitoring and management to better inform communities and gain an understanding of potential adaptations required due to climate change;• Increasing the NWT's capacity with respect to permafrost research, science, engineering and infrastructure to adapt to quickly changing conditions resulting from permafrost thaw;• Developing a permafrost data management system to inform planning, adaptation and mitigation related to permafrost thaw;• Fostering science-based decision-making tools to assist with project planning and development in permafrost regions;• Improving and implementing building standards so that thawing permafrost conditions are adequately taken into consideration for all infrastructure design and construction;• Considering the effects of climate change in planning for industrial development (both infrastructure and closure and reclamation) by fully integrating impacts of permafrost thaw and climate change into project planning and environmental assessment, water licensing and land use permitting processes;• Considering impacts to traditional harvesting and cultural and heritage resources and determining adaptations accordingly; and• Developing methodologies and technologies to maintain and enhance permafrost on the landscape as long as climatically possible.

Natural Environment	
Water Quality and Quantity	<ul style="list-style-type: none"> • Enhancing community-based monitoring and management to better inform communities and gain an understanding of potential adaptation required due to climate change; • Potential adjustments to harvesting practices due to changes in water level and ice quality (e.g. fishing or trapping in safer areas or for different periods of time throughout the year); • Infrastructure planning to ensure local water treatment plants can provide safe and adequate supplies of drinking water where changes to water quality and quantity have a negative impact on source water; • Continued source water protection planning for NWT communities, including linkages with the monitoring of drinking water quality and safety of water supplies in reservoirs, in light of climate change; • Flood forecasting in communities at risk, due to potential impacts of flooding to infrastructure, public safety, human and wildlife health, and drinking water quality; • Using available satellite imagery and technology to monitor ice cover to support flood forecasting, spring breakup predictions and sediment loads in rivers, providing valuable information for traditional and recreational land-users; • Modifying transportation methods and infrastructure due to shorter or non-existent winter transportation seasons and changes to freeze-up/breakup patterns; • Monitoring groundwater flow changes due to thawing permafrost to determine required adaptations; • Infrastructure and emergency planning to address potential flooding; • Increasing water flow and level monitoring to inform future hydroelectric development planning and flood forecasting; • Water conservation and drought management planning; • Ensuring wetlands are maintained, as they help buffer against the effects of climate change by storing carbon; and • Considering predicted changes due to climate change when setting terms and conditions in water licences.

APPENDIX D

CURRENT AND POTENTIAL ADAPTATION EFFORTS TO ADDRESS CLIMATE CHANGE IMPACTS

Natural Environment	
Forests and Tundra Vegetation	<ul style="list-style-type: none">• Enhancing community-based monitoring and management to better inform communities and gain an understanding of potential adaptations required due to climate change;• Undertaking forest health monitoring across the NWT to serve as an early detection system for rapid changes occurring on the forested landscape, in order to facilitate adaptive management;• Utilizing remote sensing techniques to track changes in vegetation, hydrology, land cover and other factors over large areas to identify landscape-level changes and inform decisions related to adaptation; and• Collaborating with community, Indigenous and federal governments, academic institutions and others to conduct research into fire regimes, forest recovery patterns and the effects of permafrost and hydrology changes to inform decisions related to adaptation.

Natural Environment	
Wildlife	<ul style="list-style-type: none"> • Enhancing community-based monitoring and management, particularly through wildlife co-management boards and systems in place in unsettled land claim areas, to better inform communities and gain an understanding of potential adaptations required due to climate change; • Supporting wildlife through the establishment and management of strategic plans (e.g. a NWT barren-ground caribou management strategy is being updated with monitoring and managing activities for cumulative effects, including climate change effects); • Sustainable management of wildlife species by the GNWT, Indigenous governments and wildlife co-management boards; • Undertaking a new gap analysis for the NWT Biodiversity Action Plan with a focus on climate change impacts, and potential adaptations; • Ongoing dissemination of current and new information on the health and distribution of wildlife, including diseases and parasites, so that harvesters and residents can adapt to possible changes in wildlife due to warming temperatures; • Developing strategies to assess and potentially adapt to invasive species that could negatively affect wildlife; • Facilitating the adaptation of residents and non-residents to climate-related changes in wildlife (e.g. restrictions in hunting certain species may be needed, while species that are expanding their ranges could be harvested instead, providing a new food source to residents); • Planning for the enhanced resilience of wildlife populations by better understanding impacts and stressors and the effects of climate change on mitigation measures; and • Assessing the impacts on wildlife of all new projects related to climate change adaptation (e.g. all-weather roads, assisted species migration and agriculture).

APPENDIX D

CURRENT AND POTENTIAL ADAPTATION EFFORTS TO ADDRESS CLIMATE CHANGE IMPACTS

Natural Environment	
Freshwater Fish and Marine Mammals	<ul style="list-style-type: none">• Enhancing community-based capacity for monitoring and assessment of climate change impacts to inform necessary adaptation;• Developing consumption advisories as needed, due to potential increases in contaminants in fish and marine mammals. Advisories could require residents to adapt by making changes to their diets, carefully considering consumption of alternative fish species and other food sources, or fishing from water bodies with lower contaminant concentrations in fish;• Considering harvesting non-indigenous species to sustain commercial and subsistence harvest, should the abundance of indigenous fish species decrease in some areas;• Developing strategies to assess and potentially adapt to invasive species in freshwater and marine environments;• Developing research programs to better understand the impacts of climate change, and including adaptation tools and strategies into fisheries management plan considerations (e.g. through Fisheries and Oceans Canada’s Aquatic Climate Change Adaptation Services Program); and• Developing research programs on the evaluation of ecosystem-based adaptive management strategies for some northern aquatic ecosystems. This work will allow researchers to integrate traditional, local and scientific knowledge and international practices into modeling frameworks to better understand the effects of climate change on NWT fish and marine mammal population production, leading to the development of adaptation tools for sustainable management of fisheries.

Human Health, Public Safety, and Culture and Heritage

<p>Human Health</p>	<ul style="list-style-type: none"> • Developing the capacity of the health and social services workforce to address climate risks by supporting capacity building through setting of norms and standards, technical guidance and training courses, and integrating climate change and health topics into clinical, public health and social services training; • Enhancing health information systems, analytics tools and capacity to support timely analysis and surveillance of emerging infectious diseases; • Supporting research that examines improved risk assessment and response to protect human health from the effects of climate change; • Assessing the impacts of climate change on health and social services to ensure the capacity needed to withstand climate risks and provide essential services, particularly during extreme weather events or situations arising from climate change-related events, is developed; • Strengthening the management of environmental determinants of health, climate-informed health programming and emergency preparedness; • Planning for wildland fire suppression and adopting FireSmart principles (strategies and planning measures to help reduce the risk and minimize the unwanted effects of wildland fires) in communities to help adapt to negative impacts of wildland fires, such as air quality; • Developing a reliable system for determining and releasing health alerts and advisories to minimize impacts on human health; • Improving geo-mapping to identify and communicate trends in potential contaminants to better support the dissemination of public health advisories on the consumption of traditional foods with elevated contaminants; • Developing and delivering educational and public outreach materials to support communities in building resilience and adapting to human health concerns; • Supporting access to country foods where access has become limited due to climate change impacts; and • Addressing food insecurity by increasing local food production (e.g. community gardens and raising animals such as chickens and goats) to take advantage of a lengthier growing season and develop new agricultural sectors in the NWT.
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APPENDIX D

CURRENT AND POTENTIAL ADAPTATION EFFORTS TO ADDRESS CLIMATE CHANGE IMPACTS

Human Health, Public Safety, and Culture and Heritage	
Public Safety	<ul style="list-style-type: none">• Ensuring community emergency plans include approaches for assessing climate change-related hazards and adapting to the increase in frequency and severity of such hazards. The GNWT supports communities with this planning by providing guidance and a template for community emergency plans. When a need is identified, the GNWT provides community emergency planning workshops that include assessment of risks;• For the very high hazard of wildland fire, implementing strategies such as adopting FireSmart principles and considering the use of FireSmart programs for all communities. Creating wildland fires education training and awareness sessions for first responders and the public and implementing fire prevention practices are also possible adaptations;• For the very high hazard of flooding, developing flood plain hazard maps to support land use and building bylaws to minimize flooding and subsequent erosion on infrastructure. The establishment of flood watch committees to monitor changing ice breakup or flooding conditions is a specific adaptation to be better prepared for floods; and• Ensuring residents, first responders, communities and the GNWT are better prepared to deal with the impacts of all hazards, ranging from low through to very high risks. Examples of adaptation approaches include the development of educational resources, training, capacity building and preparedness programs and plans.
Culture and Heritage	<ul style="list-style-type: none">• Conducting research to understand where heritage resources are at greatest risk of impact from processes, such as coastal erosion, landscape disturbances caused by thawing permafrost, melting alpine ice and wildland fires, will assist in prioritizing resources to mitigate impacts on heritage resources;• Prioritizing the collection of information from heritage resources at greatest risk of impact from climate change;• Supporting traditional economies, such as trapping for the harvest of wild furs; and• Strengthening communities socially and culturally to help build resiliency through the documentation and use of traditional knowledge. Involving youth and elders in on-the-land programming to ensure local and traditional knowledge and Indigenous languages are passed on to future generations.

APPENDIX D

CURRENT AND POTENTIAL ADAPTATION EFFORTS TO ADDRESS CLIMATE CHANGE IMPACTS

Infrastructure	
Transportation System	<ul style="list-style-type: none">• Continuing to pursue opportunities for installation of permanent bridges to replace ferry crossings (where vulnerable to fluctuating water levels);• Continuing to pursue opportunities for installation of permanent bridges to extend winter road seasons;• Construction of all-season roads to replace winter roads;• Implementing measures to address permafrost instability under highways and airport runways; and• Ongoing research and development on NWT transportation networks to develop better engineering and construction processes, as well as mitigation measures to address the real and potential effects of climate change.

APPENDIX D

CURRENT AND POTENTIAL ADAPTATION EFFORTS TO ADDRESS CLIMATE CHANGE IMPACTS

Infrastructure	
<p>Community and Public Infrastructure</p>	<ul style="list-style-type: none"> • Enhancing building codes and standards, including energy (existing and new); • Enhancing bridge codes and standards (existing and new); • Enhancing geometric design guidelines (existing and new); • Enhancing requirements of the GNWTs technical reference handbook, Good Building Practice for Northern Facilities; • Mandating that all designs incorporate the applicable requirements of the <i>Northern Infrastructure Standardization Initiative</i>; • Implementing measures to mitigate permafrost instability affecting community and public infrastructure by improving surface water management; • Enhancing water intake, water treatment, sewage systems and lagoons and waste management systems to be resilient to emerging climatic conditions; • Ensuring that private sector investments (businesses and housing) are resilient to emerging climatic conditions; • Supporting emergency preparedness and developing enhanced community emergency response plans; and • Enhancing infrastructure capacity and readiness (e.g. adequate community emergency shelters for climate change-related events and facilities with the capability to offer indoor clean air shelters for sustained wildland fire smoke events).
<p>Utilities and Other Infrastructure</p>	<ul style="list-style-type: none"> • Enhancing codes and standards for infrastructure, such as hydroelectric, mining, and oil and gas facilities; • Enhancing codes and standards for linear infrastructure, such as transmission lines; and • Long-term planning for the management of climate change impacts on the remediation of legacy contaminated sites.

