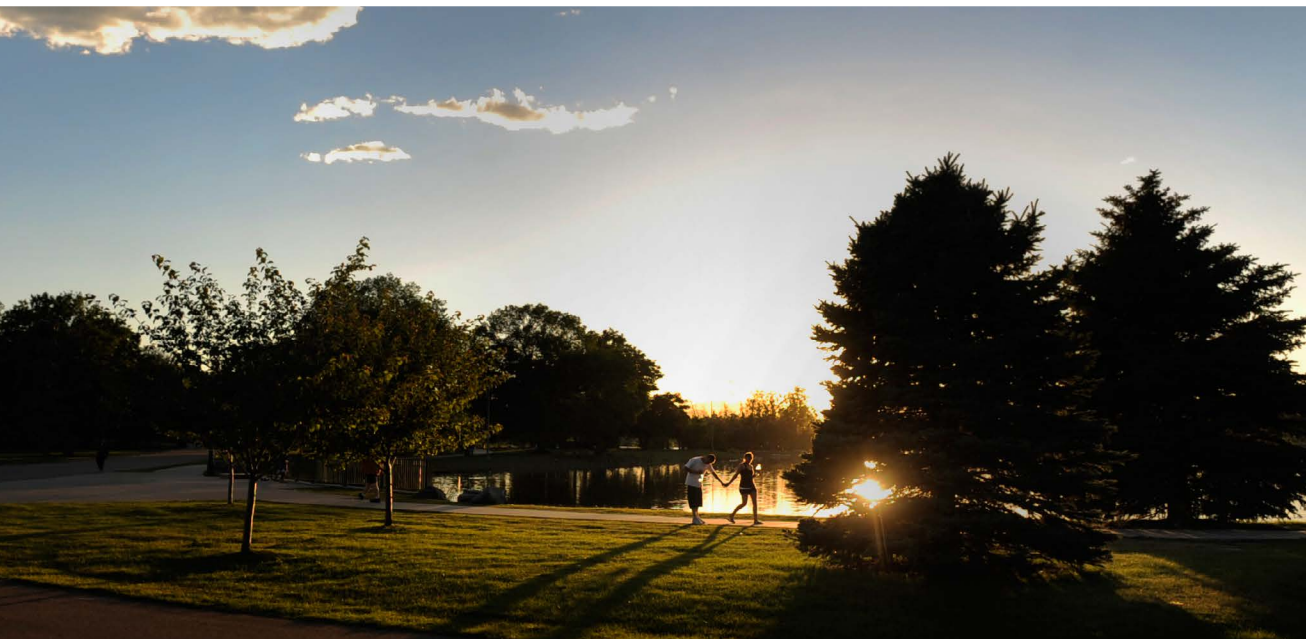


City and County of Denver

2014 Climate Adaptation Plan UPDATE 2015



DENVER
ENVIRONMENTAL HEALTH

2015

INTRODUCTION

Since Denver's Climate Adaptation Plan was released in 2014, several changes in global climate conditions and in policy affecting climate globally, nationally, and locally have occurred. With this update, Denver continues to be committed to tracking the progress of climate adaptation strategies, updating the plan to reflect new climate change science and policy information, and tracking how Denver is adapting to climate change.

Supplementing Denver's Climate Action Plan released in 2015, the 2014 Climate Adaptation Plan offers collaborative strategies to adapt to a future climate with higher temperatures, more extreme weather events, and changes to annual snowpack.

Reducing greenhouse gas (GHG) emissions is integral to mitigating the impacts of climate change. However, Colorado has already experienced an increase in temperature, and even if GHG emissions become stabilized, the climate will continue to be affected by emissions from the past. Climate mitigation and adaptation strategies can be implemented simultaneously, and many strategies that reduce GHG emissions also provide mutual benefits in adapting to a changing climate. Climate adaptation is a vital component of Denver's ongoing efforts to become a city resilient to the effects of climate change.

CURRENT STATE OF THE CLIMATE

The three major GHGs released into Earth's atmosphere, carbon dioxide, methane, and nitrous oxide, all reached record high average atmospheric concentrations in 2014. Accompanying the record high GHG concentrations was the highest annual global surface temperature in at least 135 years of modern record keeping.

The warming was distributed widely around the globe's land areas. Europe observed its warmest year on record by a large margin, with close to two dozen countries breaking their previous national temperature records; many countries in Asia had annual temperatures among their 10 warmest on record; Africa reported above-average temperatures across most of the continent throughout 2014; Australia saw its third warmest year on record, following record heat there in 2013; Mexico had its warmest year on record; and Argentina and Uruguay each had their second warmest year on record.

Eastern North America was the only major region to observe a below-average annual temperature. However, the oceans drove the record global surface temperature in 2014. The globally averaged sea surface temperature was the highest on record. The June 2015 average global land and ocean temperature was the warmest June since records began in 1880.

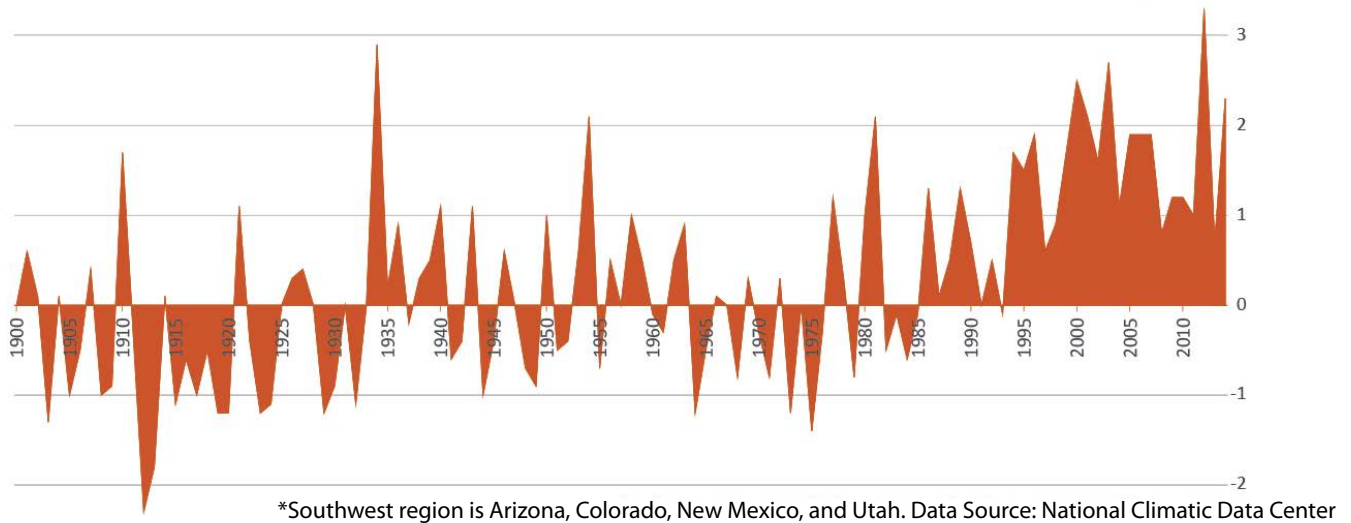
Climate adaptation is a vital component of Denver's ongoing efforts to become a city resilient to the effects of climate change.

The U.S. experienced significant climate anomalies and events reflective of those observed globally in 2015. Alaska experienced warm temperatures contributing to more frequent, higher intensity forest fires and decreased depths of permafrost. The contiguous U.S. saw record warm temperatures in the West, while the Ohio River Valley observed record levels of precipitation. In the Southwest, regional annual average temperatures have increased by more than 1.5°F during the last 110 years, with some cities registering annual average maximum temperature increases of more than 5°F.

CURRENT STATE OF THE CLIMATE (CONT.)

Figure 1 Illustrates trends in temperature anomalies, meaning how much the temperature varies from average, in the Southwest during the last century and first part of this century. It is evident that there is an increasing trend in temperatures 1-3°F above average across the southwest, particularly since approximately 1980.

Figure 1. Southwest U.S. Annual Average Temperature Anomalies (In Fahrenheit)



The changes in climate have not escaped notice of world leaders. In the summer of 2015, Pope Francis emphasized the imperative need to address changing climatic conditions in his Encyclical Letter *Laudato Si'* of the Holy Father Francis, he wrote, "Humanity is called to take note of the need for changes in lifestyle and changes in methods of production and consumption to combat this warming." In December 2015, the United Nations Conference on Climate Change was held in Paris. Global leaders discussed strategies to mitigate GHG emissions, as well as to adapt to climate change impacts on the global scale.

"Humanity is called to take note of the need for changes in lifestyle and changes in methods of production and consumption to combat this warming..." - Pope Francis

CURRENT CLIMATE CHANGE POLICY

President Obama and the EPA introduced the Clean Power Plan (CPP), an important step in reducing carbon pollution from power plants that takes real action on climate change, and updated Carbon Pollution Standards in 2015. The CPP establishes interim and final carbon dioxide emission performance rates for steam electric and natural gas fired power plants under the Clean Air Act. The CPP also establishes state-specific goals for each state, based on these limits and each state's mix of power plants. These are the first national standards that address carbon pollution from power plants. By providing states and utilities ample flexibility and the time needed to achieve these pollution cuts, the CPP offers the power sector the ability to optimize pollution reductions while maintaining a reliable and affordable supply of electricity for ratepayers and businesses. Although the Supreme Court has placed a stay on the CPP until legal challenges are resolved, which could delay implementation by up to two years, Colorado is still proceeding with plans to comply and will move forward with taking action on GHG emissions despite the legal challenges.

CURRENT CLIMATE CHANGE POLICY (CONT.)

On the state level, Gov. John Hickenlooper, business and industry leaders, and department directors released the Colorado Climate Plan (CCP) in late 2015. The CCP is a statewide strategy of policy recommendations and actions designed to mitigate GHG emissions. The plan focuses on the areas of water, public health, energy, transportation, agriculture, tourism and recreation, and ecosystems. It is designed to act as a roadmap for state agencies and aims to increase Colorado's level of preparedness for a changing climate.

Denver's 2014 Climate Adaptation Plan recommended short, medium, and long-term activities to adapt to a changing climate based on three defined climate change impacts to Denver:

- An increase in temperature and urban heat island effect
- An increase in frequency of extreme weather events
- Reduced snowpack and earlier snowmelt

Short-term activities were defined as activities to be implemented within one to two years, medium-term to be implemented within two to five years, and long-term to be implemented within five to 10 years.

Short-term activities identified which city agencies will implement the strategies, how they will be incorporated into city plans, and how they will be incorporated into the city's Environmental Management System (EMS) to ensure progress.¹ The EMS utilizes annual plans to document and track agency-specific environmental and climate goals, including their short-term Climate Adaptation goals. The EMS provides a documented location to incorporate and track an agency's progress towards achieving its short-term Climate Adaptation goals. Communication and collaboration with agency EMS representatives ensure annual plan objectives and targets are on track.

Medium and long-term strategies are less specific than the short-term and are not incorporated into city plans or the EMS, but do designate responsible city agencies to carry out the activity.

This update will focus on the status of the short-term activities identified in the 2014 Climate Adaptation Plan. The activities are organized in these sectors: Buildings and Energy, Health and Human Services, Land Use and Transportation, Urban Natural Resources, and Water Consumption. For the short-term activities in each sector, the identified climate impact, vulnerability, EMS adaptation activities, responsible agency, agency plan, and project status are reported. Additionally, climate adaptation accomplishments are briefly highlighted for each sector.

¹ The City and County of Denver's ISO 14001-certified EMS works with all City agencies to identify, manage, track and address environmental aspects/impacts, risks and issues through standardized procedures as a means to continuously improve environmental performance. The EMS is subject to annual audits and recertification every three years by an external, independent ISO Registrar to demonstrate continuing conformance to the ISO 14001 Standard and the City's commitment to continuous improvement.



SHORT-TERM CLIMATE ADAPTATION ACTIVITIES 2015 Update



BUILDINGS AND ENERGY

Climate Impact	Vulnerability	Responsible Agency	EMS Adaptation Activities	Agency Plan	Status
Increase in temperature and urban heat island effect	Higher energy consumption and demand in summer months	DGS	Reduce energy use in City facilities by 2.5% per square foot over 2011 baseline	Strategy Initiatives Year End Report	
			Reduce energy use in Facilities Management portfolio by 2.5% per square foot over 2011 baseline		
			Complete 95% of Priority 1 and 2 deficiencies and operational improvements identified in 2013 Facility Condition and Assessment studies within 6 months of project completion		
			Complete Facility Condition and Assessment studies on 8-10 facilities		
Increase in temperature and urban heat island effect	Climate induced in and out migration of workforce populations and businesses	OED	Complete outreach to the top 20 energy companies in Denver	Jumpstart 2013	
		OOS	Begin implementation of the BPS		
Increase in temperature and urban heat island effect	Higher energy demands and use	DEN	Approve and implement DEN Energy Management Program and Energy Team Charter	Energy	

Acronyms: Denver General Services (DGS); Office of Economical Development (OED); Office of Sustainability (OOS); Denver International Airport (DEN); By Product Synergy Network (BPS)



Activity complete



Activity in progress



Activity not completed or not started





ACCOMPLISHMENTS IN BUILDINGS AND ENERGY

Denver government operations have been working to reduce energy use in its facilities to reduce the City's carbon footprint and be more resilient against future climate impacts. Denver General Services (DGS) has had great success in meeting early adaptation goals through various activities.

GOALS: Reduce energy use in City facilities by 2.5 percent per square foot over a 2011 baseline, and reduce energy use in Facilities Management portfolio by 2.5 percent per square foot over a 2011 baseline

The first two goals are part of Mayor Michael B. Hancock's commitment to the Better Buildings Challenge of reducing the City's energy usage by 20 percent over a 2011 baseline by 2020. Yearly goals of 2.5 percent reductions were set starting in 2012 in order to reach a cumulative 20 percent reduction by 2020.

The first goal includes all City facilities, which best reflects the goals of the Better Buildings Challenge. The second includes only facilities that the DGS actively manage. DGS surpassed the yearly goal of 2.5 percent reductions in 2014 and has also surpassed the cumulative goal of 7.5 percent reductions by 2014, with a total reduction of 9 percent over the 2011 baseline. DGS is on track to reach the 20 percent reductions by 2020 as part of the Better Buildings Challenge.

GOALS: Complete 95 percent of Priority 1 and 2 deficiencies, and operational improvements identified in 2013 Facility Condition and Assessment studies within six months of project completion and complete facility condition and assessment studies on 8-10 facilities

General Services Facilities Management (FM) and the Strategic Initiatives division, with Public Works and the Budget Management Office managed a Facilities Commissioning and Assessment Program (FCAP) in 2014. FCAP is a standardized approach for assessing the state, health and efficiency of assets and systems in a building or facility by documenting and tracking the changing conditions. The results of the FCAP enhance the accuracy of budgeting, reporting, forecasting and benchmarking of maintenance and Capital Improvement Program (CIP) expenditures, for individual buildings or across a portfolio. The results of the FCAP were used to address these next two goals. Priority 1 and 2 deficiencies have been identified and progress has been made to improve on them. DGS is on track to reach 95 percent of these deficiencies. Additionally, 12 facilities have been identified to begin the Facility Condition and Assessment studies in 2016.





GOAL: Complete outreach to the top 20 energy companies in Denver

Office of Economic Development (OED) completed the goal by participating in the 2015 Energy Moving Forward conference. The conference brought together energy companies to discuss the future of energy in the U.S. Additionally, OED is collaborating with a master developer, tax equity fund, NREL, and Xcel Energy to develop a financing/pricing model to enable the development of a Net Zero Energy Neighborhood of significant scale.

GOAL: Begin implementation of the By-Product Synergy Network (BPS)

The BPS is a new material reuse program for businesses, organizations, and communities in the Front Range and is intended to result in more sustainable commercial operations for participants. The Front Range Synergy Network (FRSN) will create a closed-loop system in which one organization's waste is another organization's raw material. The BPS is planned to begin operating in 2016.






GOAL: Approve and implement DEN Energy Management Program and Energy Team Charter

Denver International Airport (DEN) has made significant progress towards the goal of approving and implementing the new energy management program. While the goal is a multi-year effort, an Energy Team Charter has been approved and a Steering Committee and Technical Committee have been established. The Energy Team Charter is working with Xcel's Process Energy program to better understand how energy is being used throughout the facility. Additionally, DEN has made significant progress on efforts to reduce their energy consumption, including:


- The fourth U.S. airport group certified to Airports Council International's Airport Carbon Accreditation standard, the only institutionally-endorsed, carbon management certification standard for airports. In order to qualify for this recognition, DEN completed a GHG inventory, had its carbon reduction targets verified by a third-party auditor, developed a carbon management program, and demonstrated an emissions reduction from 2013 to 2014.
- Replaced 5,400 lightings fixtures in its parking garages with LEDs, which are projected to reduce energy use by 45 percent while improving light quality and decreasing maintenance costs.
- Commissioned two megawatt solar photovoltaic array, bringing the airport's hosted total to ten megawatts across 56 acres of land. This represents one of the most significant investments in renewable energy of any airport in the world, with the arrays designed to generate over 16 million kilowatt-hours of clean electricity each year.
- Currently executing a contract to develop an Energy Master Plan that will consider how the airport will meet its future needs with low-carbon, reliable, resilient, and cost-effective energy sources.


SHORT-TERM CLIMATE ADAPTATION ACTIVITIES 2015 Update

HEALTH AND HUMAN SERVICES

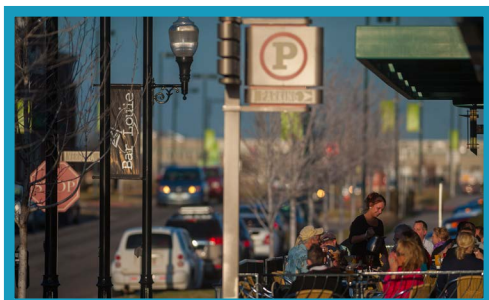
Climate Impact	Vulnerability	Responsible Agency	EMS Adaptation Activities	Agency Plan	Status
Increase in temperature and urban heat island effect	Extreme heat affecting vulnerable populations	DEH	Define extreme heat event	Emergency Operations Plan	
	Increase in vector-borne diseases	DEH	Write a city-wide vector control plan in which both existing and emerging vectors are discussed	Vector Control Plan	
Increase in temperature and urban heat island effect, and extreme weather events	Extreme heat affecting vulnerable populations	OEMHS	Draft an extreme heat annex for the Emergency Operations Plan	Emergency Operations Plan	
			Create and execute an extreme events educational campaign for the public	n/a	
Increase in temperature and urban heat island effect	Extreme heat affecting vulnerable populations	DHS	Specify how DHS will interact/cooperate with other agencies, or OEMHS, during extreme heat events	Emergency Operations Plan	

Acronyms: Denver Environmental Health (DEH); Office of Emergency Management and Homeland Security (OEMHS); Department of Human Services (DHS)

 Activity complete

 Activity in progress

 Activity not completed or not started



Denver's vulnerable citizens will be disproportionately impacted by increasing temperatures, urban heat islands and extreme weather. The activities noted above and detailed below are a start toward Denver's activities protecting vulnerable citizens from negative impacts of climate change.

GOAL: Define extreme heat event

Based on the National Weather Service definition, excessive heat is:

"Excessive heat occurs from a combination of high temperatures (significantly above normal) and high humidity. At certain levels, the human body cannot maintain proper internal temperatures and may experience heat stroke. The 'Heat Index' is a measure of the effect of the combined elements on the body."

GOAL: Write a city-wide vector control plan in which both existing and emerging vectors are discussed

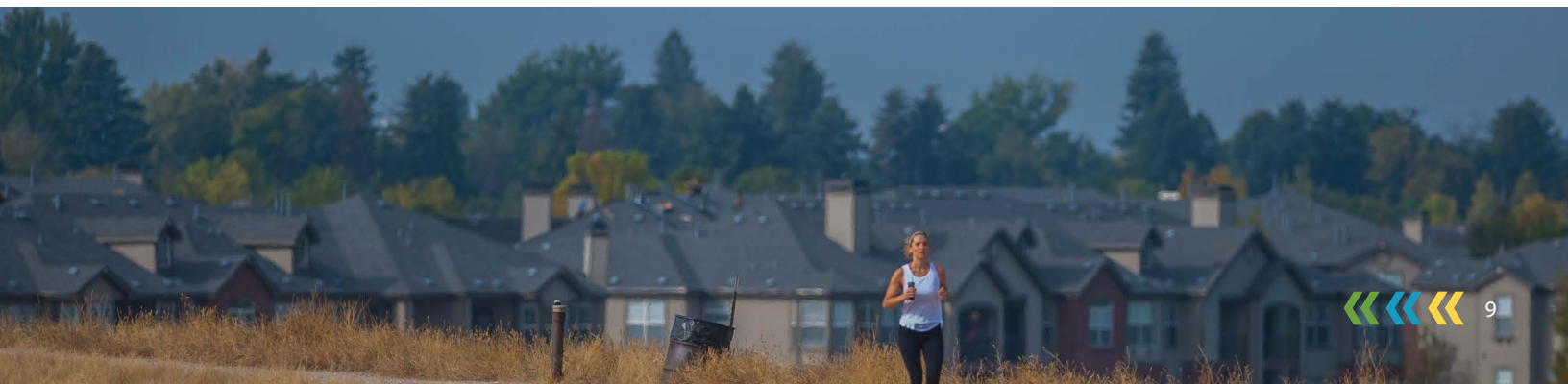
Denver's Department of Environmental Health (DEH) recently completed the City's first Mosquito Control Plan. This plan primarily defines and describes control of mosquitos, which are Denver's most prevalent disease vector. Denver's Mosquito Management Program is designed to reduce public health concerns while providing information and education to residents and business to help them reduce mosquito populations. The program also focuses on minimizing mosquitoes through these activities:

- Survey larval mosquito populations in around 50 sites city-wide, and, either directly or working with our partners, apply larvicide (kill mosquito larvae) when conditions warrant it;
- Trap, separate, count, and test adult mosquitoes to monitor for West Nile Virus; and
- Investigate and respond to citizen complaints



GOALS: Draft an extreme heat annex for the Emergency Operations Plan and specify how DHS will interact and cooperate with other agencies, or OEMHS, during extreme heat events

Denver's Office of Emergency Management and Homeland Security (OEMHS) has drafted an annex to the Emergency Operations Plan detailing how Denver will handle future extreme heat emergencies. Additionally, Denver's Department of Human Services (DHS) will interact and cooperate with other agencies during extreme heat events and has taken steps to adapt to future events through:

- Upgrading city shelters through the addition of generators in order to allow for continued operation during extreme weather events;
- Developing a new five-year plan to address homelessness, with a hard three year check in;
- Changing in zoning code to allow temporary shelters with fewer than 100 residents in any zone as long as the shelter is located in a structure owned by a non-profit or government entity for up to 120 calendar days per year.



LAND USE AND TRANSPORTATION

Climate Impact	Vulnerability	Responsible Agency	EMS Adaptation Activities	Agency Plan	Status
All	Design standards not addressing climate change scenarios	CPD	Address climate change in upcoming Golden Triangle Small Area Plan	Golden Triangle Small Area Plan	
Increase in temperature and urban heat island effect, and extreme weather events	Increased stress on stormwater management	CPD, DPW, and DPR	Begin scoping process and update of Streetscape standards to address climate adaptation	Streetscape Standards	

Acronyms: Community Planning and Development (CPD); Department of Public Works (DPW); Denver Parks and Recreation (DPR)

 Activity complete  Activity in progress  Activity not completed or not started

ACCOMPLISHMENTS IN LAND USE AND TRANSPORTATION

Denver can increase its resilience to climate change impacts by reducing single occupant vehicle travel. Reductions in single occupant vehicle travel can be made through Transit Oriented Development (TOD) planning, walkable neighborhoods, and by promoting multi-modal transportation options. Further, reducing the amount of single occupant vehicles on the road will reduce the amount of smog-forming pollutants that may be increased with warmer temperatures, particularly during the summer months. This will prove beneficial to public health.

These efforts can be implemented through citywide community and neighborhood plans. Although not addressed in the Golden Triangle Small Area Plan, other more comprehensive plans are being revised to address land use and transportation in the face of climate change. The 2004 Downtown Streetscape Plan, for example, will be updated and will incorporate climate adaptation measures accordingly. Additionally, the 2002 Blueprint Denver, Denver's integrated land use and transportation plan, calls for a balanced, multi-modal transportation system, land use that accommodates future growth, and open space throughout the city. A majority of the actions identified in Blueprint Denver have been completely or partially implemented, including the adoption of a new context and form-based zoning code in 2010 that rezoned 80 percent of the city, numerous station area plans, and several citywide planning efforts. Blueprint Denver is being updated with climate adaptation strategies.



SHORT-TERM CLIMATE ADAPTATION ACTIVITIES 2015 Update



URBAN NATURAL RESOURCES

Climate Impact	Vulnerability	Responsible Agency	EMS Adaptation Activities	Agency Plan	Status
Increase in temperature and urban heat island effect	Stress on trees and urban landscaping	DPR	Publish and begin the outreach of the Metro Denver Urban Forest Assessment	Metro Denver Urban Forest Assessment	
			Initiate a contract to inventory existing trees within the City in preparation for a Tree and Shade Master Plan	Tree and Shade Master Plan	
			Update the right-of-way tree list that focuses on trees that can thrive in future climates	Right-of-Way Tree List	
Higher frequency of extreme weather events	Stormwater management and flood control	DPW	Include a discussion section on climate adaptation and mitigation in the Storm Drainage Master Plan documentation update currently underway by DPW planning staff	Storm Drainage Master Plan	
	Contaminant loading from increased flooding and heavy rain spells		Include climate adaptation and mitigation in discussion and documentation related to 6 year Water Quality Strategic Implementation Plan currently underway by DPW planning staff	Water Quality Strategic Implementation Plan	

Acronyms: Denver Parks and Recreation (DPR); Department of Public Works (DPW)



Activity complete



Activity in progress



Activity not completed or not started





ACCOMPLISHMENTS IN URBAN NATURAL RESOURCES

The Denver Parks and Recreation (DPR) has made significant progress in efforts to protect Denver's tree and urban landscapes against the effects of increasing temperatures and urban heat island effects.

For example, DPR completed a Metro Denver Urban Forest Assessment by inventorying existing trees and updating the right-of-way tree list. Additionally, DPR is examining species distributions of trees that are more likely to thrive in future climates. DPR has hired additional employees to complete the street tree inventory, which is expected to be complete by Spring of 2016. The community has also been involved in the urban tree canopy through a partnership between DPR and the Park People, through the Community Forester Program. The Community Forester Program empowers individuals to lead tree planting and care activities within the community.



WATER CONSUMPTION

Climate Impact	Vulnerability	Responsible Agency	EMS Adaptation Activities	Agency Plan	Status
Reduced snowpack and earlier snowmelt	Reduced amount of water available from independent ditch water supplies for irrigation	DPR	Implement Phase II of the Central Control Master Plan	Central Control Master Plan	
	High water demands and consumption in summer months		Require xeric planting or low water use landscape plantings in the urban design standards and guidelines for Cherry Creek East	Cherry Creek North Urban Design Standards and Guidelines	

Acronyms: Denver Parks and Recreation (DPR)



Activity complete



Activity in progress



Activity not completed or not started



ACCOMPLISHMENTS IN WATER CONSUMPTION

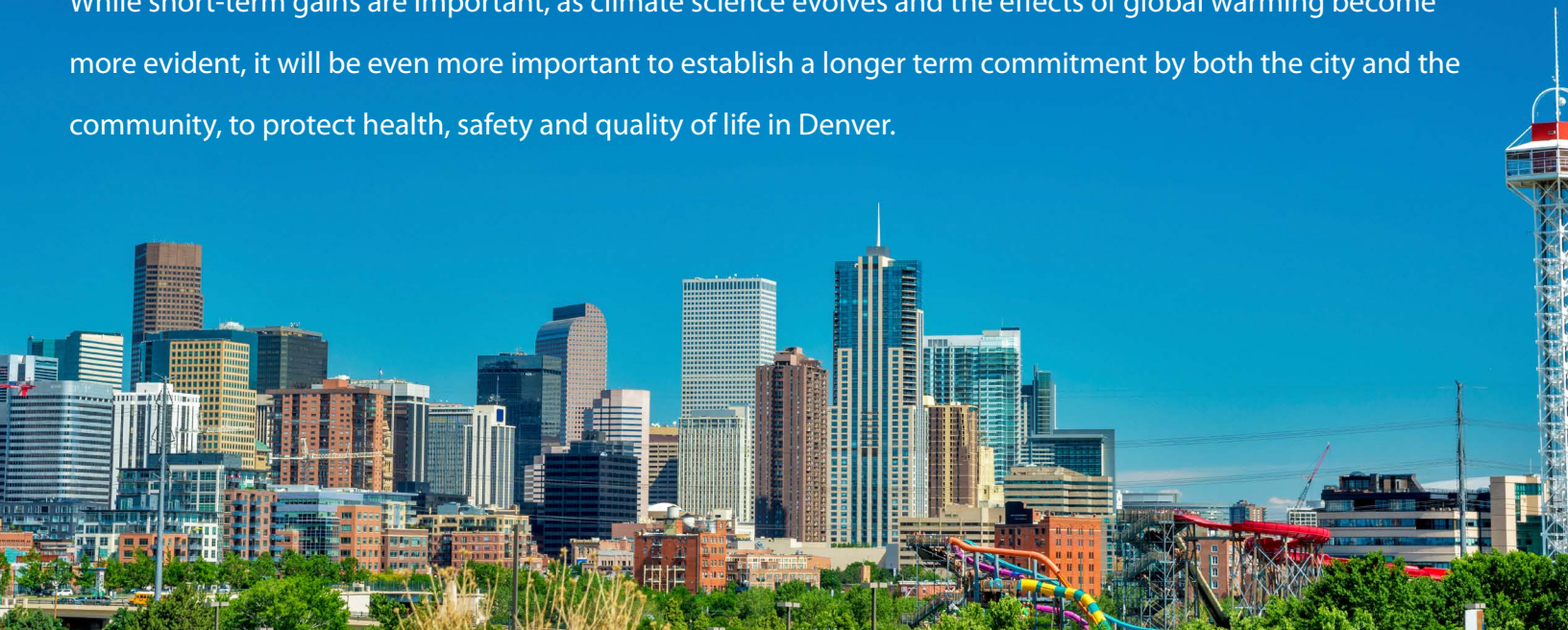
Water conservation is a key component of climate adaptation planning, as Denver's population and demand grows, and warmer temperatures and changes in snowpack threaten supplies. DPR and Community Planning and Development (CPD) have made great efforts in promoting water conservation and reducing water consumption.

DPR has successfully reduced water use for park irrigation and landscaped areas since 2014. Much of these efficiencies are a direct result of irrigation infrastructure. DPR expanded water reuse with the Montbello, Cheesman and Congress Parks reuse conversions and central control build-out in the north east district in 2013. DPR also completed irrigation improvements in Washington Park and Harvard Gulch, and will make additional improvements in Chaffee Park, and Mestizo Curtis Park. DPR is awaiting City Council approval of the Denver Water/ Parks intergovernmental agreement (IGA) regarding additional central control build-out, raw water conversions at Harvard Gulch, a Water Conservation Plan update, and additional future reuse conversions.

NEXT STEPS

It's exciting that just a year after releasing Denver's first Climate Adaptation Plan, the City has already made significant progress on the short-term adaptation activities. By incorporating climate change adaptation activities into city plans and the EMS, agencies can easily track and measure progress.

While short-term gains are important, as climate science evolves and the effects of global warming become more evident, it will be even more important to establish a longer term commitment by both the city and the community, to protect health, safety and quality of life in Denver.



Protect health, safety and quality of life in Denver

REFERENCES

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