



nashvillenext

Natural Resources & Hazard Adaptation

driving forces report

This report addresses key forces and decisions shaping the future of natural resources, such as Nashville's water and air, and our ability to prepare for natural hazards like flooding and droughts. The contents of this report were developed by NashvilleNext planning staff working with the Natural Resources & Hazard Adaptation Resource Team (members at right) during 2013.

About Driving Forces

Each NashvilleNext Resource Team began its work by identifying a set of Driving Forces — key decisions or outside factors shaping Nashville's future. Each Team considered trends currently affecting Nashville, as well as how different trends and forces interact to affect the future.

This exercise served three primary purposes:

- » Identify key trends & understand how different trends interact
- » Bring different perspectives into the process and understand how they interact
- » Introduce team members to one another prior to beginning the process of making recommendations.

This report contains no direct policy guidance or recommendations. However, its contents did shape the Goals & Policies developed by this Resource Team in early 2014 (available for review by the public in mid-2014).

It is presented here as a record of the process.

See more

See the Driving Forces identified by other Resources Team

- » <http://www.nashville.gov/Government/NashvilleNext/NashvilleNext-Resource-Teams.aspx>

Once available for review, the draft Goals & Policies for all of the Resource Teams will also be available on that page.

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Parts of the Driving Forces

Each Resource Team's work is presented in three parts that together make up the Driving Forces for their element:

- » **Loops:** A high-level summary of the topics and trends discussed by the Resource Team. The loops are the most straightforward way to understand what's involved in each element.
- » **Forces:** A more detailed listing of the forces considered by each Resource Team.
- » **Influence Diagram:** A complex picture representing how the Forces interact. Forces are linked to one another when changes in one Forces are directly or inversely related to one another.

Loops

LAND

The Land Loop describes the interplay of land development, infrastructure choices, and land based natural resources. Population Growth drives the loop, with Infill and Sprawl development offering alternate development patterns. Sprawl drives land consumption, which in turn results in negative effects on natural resources including increased stormwater run-off, and loss of habitat. Infill is supported by transit infrastructure and less dependence on auto use. Infill consumes less land, therefore land based natural resources are more likely to be preserved.

WATER

The Water Loop describes the interplay of water quality, infrastructure choices, climate change, and water based natural resources. As more land is consumed, stormwater run-off increases, resulting in decreased water quality. Nashville's rivers and streams, potable water supply, aquatic habitats, and recreational opportunities all are negatively impacted as a result. Increasing green infrastructure, including low impact develop-

ment, can result in better water quality and preservation of sensitive floodplains. With Climate Change considered a given, storm frequency and intensity is expected to increase, necessitating more stormwater management infrastructure. The additional infrastructure can include green solutions, such as preservation of floodplains, rain gardens, and greyfield development, as well as traditional stormwater/sewer conveyance infrastructure.

AIR

The Air Loop describes the interplay of air quality, infrastructure choices, and climate change. Air pollution is driven by energy generation and auto-use. Increased air pollution results in less active lifestyles, increased poor health, and decreased quality of life for Nashvillians. Increasing transit could decrease auto-use, and reduce localized air pollution from automobiles. Energy generation decisions and climate change are recognized as being driven by federal and global forces. However, if localized air pollution increases unchecked, it could result in a non-attainment status for the region, resulting in decreased economic activity.

ENERGY

The Energy Loop describes the factors and trends affecting energy generation. Water treatment, heat waves, droughts, economic activity, and the built environment energy efficiency are all factors that drive energy generation. If that energy is generated conventionally, increased air and water pollution would result. The extent to which energy is generated conventionally, or via renewable sources, is dictated by federal and global Co2 regulations, supply and demand forces, and technology. While the Energy Loop has broad implications for climate change, it also shows the potential of climate refugees increasing the local population of Nashville.



EQUITY

The Equity Loop describes the interplay of factors and outcomes of equity as they relate to development, infrastructure choices, and pollution. In effect, equity is connected to the other loops and is implicit in them. Equitable outcomes are defined in the loop as access to parks and greenways, to jobs and education, to transit, to active lifestyles, to food, and equitable exposure to pollution. Providing genuine access to these would result in an increased quality of life for Nashvillians regardless of income level or demographic group. The driving factor for achieving these outcomes is the physical siting of infrastructure, transit, parks, facilities and pollution sources in equitable locations. In turn the equitable siting of facilities is driven by the inclusion of disadvantaged populations in policy-making through community involvement and outreach efforts.

Forces

Active and green lifestyle

Active living integrates physical activity into everyday routines, such as walking to the store or biking to work. Green lifestyles takes voluntary opportunities to reduce the environmental impact of daily life, such as reducing water and energy use.

Built Environment Energy Efficiency

The built environment is the space in which people, live, work, and recreate each day consisting of buildings, housing, businesses, estates, cities, and all other things that have been constructed by human beings. Energy efficiency is a way of restraining growth in energy consumption. An more energy efficient built environment uses less energy to provide the same service.

Climate change

Changes to an area's climate, compared to recent centuries. These changes are expected to produce

more and more severe extreme weather events, like floods, heat waves, and droughts. Extreme weather threatens private property, public infrastructure, and the health and safety of Nashvillians.

Climate includes patterns and amount of rainfall and average and extreme temperatures. In Tennessee, climate change is likely to include lower levels of rainfall. It will also likely mean longer periods of drought as well as more intense storms. Average temperatures are also expected to rise, including periods of intense heat waves.

Climate refugees

People moving to Nashville (temporarily or permanently) away from places experiencing increased hazards and catastrophes from a changing climate, either elsewhere in the U.S. or internationally.

Conventional Energy Generation

Conventional energy resources are fully developed, nonrenewable resources such as energy obtained through fossil fuels like coal, natural gas, and oil.

Federal regulations on infiltration

The U.S. government sets standards for stormwater run-off from three sources (storm sewer systems, construction sites, and industrial activities). As it moves over ground, particularly in polluted areas, stormwater may collect debris and pollution that it brings to creeks, rivers, and lakes. The EPA is increasingly promoting on-site infiltration, encouraging individual buildings and sites to be designed to soak water into the ground rather than conveying it through stormwater pipes to surface waters.

Food desert

Areas that lack access to healthy food options.



Green Infrastructure

(including Low Impact Development)

Green infrastructure is an approach using environmentally friendly techniques to manage stormwater. Low Impact Development (LID) is an approach to land planning and design that emphasizes preservation and the recreation of natural features so stormwater is managed as close to its source as possible. Examples of green infrastructure used during low impact development designs include green roofs, permeable pavement, bioswales, and rain gardens. Each of these strategies reduce the runoff volume and peak stormwater runoff rate that can damage local streams.

Inclusion in Policy Making

Equity, or the fairness in the way people are treated, is one of the four foundational pillars of the NashvilleNext process. In the past, government processes have not always considered the equitable impacts of policies and regulations. Environmental justice as defined by the EPA is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. The inclusion of all people, specifically minority and lower income populations are explicit concepts to consider when developing policies addressing the local environment.

Infill

Additional development in already developed areas.

Infiltration & Evapotranspiration

Infiltration is the process by which water on the ground surfaces enters the soil. Evapotranspiration is the process by which water is transferred from the land to the atmosphere by evaporation from the soils and other surfaces and by tran-

spiration from plants. Both concepts are used to describe the water cycle in which water circulates between the earth's oceans, atmosphere, and land, involving precipitation, drainage into streams, and return to the atmosphere by evaporation and transpiration.

Natural water cycle

The natural water cycle balances rainfall, infiltration into the ground, evaporation into the air, runoff over land and through ground into surface waters like rivers and lakes. Climate change and urban development interrupts this balance, potentially changing levels of rivers and streams, increasing how often floods occur and how severe they are, and eroding soil from river banks and slopes. Severely interrupting the natural water cycle can reduce the water supply available for use by people. Urban development that promotes infiltration (such as through rain gardens, swales, and detention ponds) can reduce changes in the natural water cycle.

Non-attainment status

An area with air pollution above standards set by the U.S. Clean Air Act. Counties in non-attainment status must have and implement plans to improve air quality or may lose some federal funding, such as transportation spending.

Potable water

Water supply available for drinking. Nashville's water primarily comes from the Cumberland River. As climate change occurs, Middle Tennessee expects more extreme weather years (more years with higher rainfall, as well as more years of drought). More extreme weather makes managing water supplies more difficult.

Renewables and distributed energy sources

Renewable energy sources (such as wind, solar, hydropower, or biomass) generate electricity or



other usable energy without using fossil fuels. Distributed energy sources produce energy without large-scale centralized power facilities. For example, solar panels distributed across many different rooftops, compared with a coal power plant or even several acres devoted exclusively to solar panels.

Sprawl

Conversion of rural and undeveloped land to low- or moderate-density development, typically spreading outward from cities. Developing at the edge of cities uses more land, typically creating more stormwater run-off and increasing energy use and transportation needs.

Urban tree canopy

Trees in developed areas, either in yards or landscaped areas, parks and open space, or as street trees. The urban tree canopy improves quality of life, the pedestrian environment, and beauty; raises property values; reduces the urban heat island effect; and helps soak rainwater into the ground.

Water security conflicts

As population increases and rainfall patterns change, access to water is likely to be an emerging source of conflict between residents, businesses, cities, states, and countries. In terms of quantity, the Cumberland River is likely to remain a stable source of water for the foreseeable future, though threats to quality (such as major discharges of pollution) are possible. The parts of Davidson County and Middle Tennessee that rely on other sources of water may have trouble maintaining supply in the future, particularly in drought years.

Influence Diagram

The influence diagram on the next page shows how the above Forces interact. This is presented as the effects of changes each Force. As one Force changes (increases or decreases), what other Forces also change (either in the same way as the first Force (direct relationship) or opposite to the first Force (inverse relationship)).

-  **Direct relationship** (More X leads to *more* Y)
-  **Inverse relationship** (More X leads to *less* Y)
-  **Metro tax base** (takes contributions *from*)
-  **Metro tax base** (contributes *to*)

Influence diagram

- Direct relationship (More X leads to more Y)
- - - - - Inverse relationship (More X leads to less Y)
- ↔ Metro tax base (takes contributions from)
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