DEPARTMENT OF ADMINISTRATION

AGENCY RESILIANCE STRATEGY REPORT

The Department of Administration (DOA) provides a broad range of diverse governmental services to the citizens of North Carolina, including services to approximately 100 State owned buildings in Wake County. Technical and maintenance oversight of building engineering services for the buildings administered by the Department of Administration is provided by the Facilities Management Division within the Department of Administration. The State Construction Office, another division within the Department of Administration, provides engineering services for the downtown Raleigh complex. The effect of climate stressors on the cooling, heating, electrical, and storm water systems at these buildings are the primary concerns to be addressed by the DOA through increased resiliency efforts.

EXTREME HEAT

The Department of Administration, through the Facilities Management Division, provides chilled water to many State-owned buildings in the downtown Raleigh complex, as described above. Chilled water supplied to these buildings is supplied by large chillers located at two primary chilled water plants, plus smaller chillers available at several individual buildings. This chilled water is piped through numerous air handling units in the downtown complex buildings to cool the buildings in spring, summer and fall seasons.

The major climate stressor with respect to chilled water is extreme heat which exceeds the ability of the chilled water system to provide adequate quantities of chilled water. This could lead to loss of building use because the building cannot be maintained within acceptable summer temperatures. Potential consequences of loss or inadequacy of chilled water capacity range from uncomfortably warm buildings to complete loss of building use due to excessive interior heat and/or humidity.

Adequate chilled water system capacity currently exists to handle the summer cooling load in DOA buildings and to maintain current levels of indoor comfort if average summer temperatures increase by no more than one to two degrees Fahrenheit in the foreseeable future. It is important to note that loss of one existing chiller will lead to unacceptably high interior temperatures in DOA buildings under current climate conditions. In connection with the chillers located in the downtown complex, it should be noted that these chillers are powered largely by electricity generated in power plants burning fossil fuels, particularly coal and natural gas.

Funding for additional chiller capacity has been requested to improve system reliability if one or more chillers experience mechanical failure. It is anticipated that additional chiller capacity would be online within two years after funding is appropriated for this additional chiller capacity. Since new equipment can be brought online within two years, the DOA should be able to stay ahead of climate related load changes assuming that funds are appropriated in a timely manner for the necessary equipment.

All the current and anticipated chillers in the downtown Raleigh complex are electrically powered and are therefore dependent on the electrical power grid. Resilience of these electrically driven chillers could be enhanced by replacing one or more existing chillers with steam driven chillers. Steam turbine chillers are commercially available, but a careful engineering study would be necessary to ensure that steam to power these chillers can be met by present and planned boiler systems.

As stated above, fossil fuels provide a major portion of the energy required by the electrically driven chillers in the downtown complex. Therefore, if temperature setpoints inside State owned buildings can be adjusted to allow warmer indoor summer temperatures, the result will be reduced combustion of greenhouse gas fossil fuels.

A major non-climate stressor is the aging infrastructure of the downtown complex chilled water system. Ongoing maintenance of the chilled water infrastructure, principally piping and primary and secondary chilled water pumps, is required to maintain the resilience of the chilled water system.

EXTREME COLD

As the State of North Carolina transitions to an emissions free energy environment eliminating the combustion of fossil fuels, an important resilience issue must be addressed with respect to buildings administered by the Department of Administration. The downtown State Government Complex in Raleigh is heated by four large boilers in the Central Heating Plant near the Albemarle Building. These boilers burn natural gas, a fossil fuel, to produce the steam needed to heat approximately twenty-five major buildings in the Downtown Raleigh Complex including the State Capitol Building, the Legislative Building, the Legislative Office Building, and the Governor's Residence. The steam provided to these buildings not only heats these buildings but also heats potable water and enables all-season humidity control in the buildings.

Since Federal and State directives may begin curtailing the combustion of fossil fuels as early as 2025, it is essential that work begin now to identify alternative means of producing the steam needed for the Downtown Complex. Steam boilers of the scale found at the Central Steam Plant have traditionally burned fossil fuels such as coal, natural gas, and fuel oil. It is not clear that electric steam boilers of the scale of the current natural gas fired boilers exist commercially. If this is the case, work must begin immediately to identify potential manufacturers of very large electric steam boilers and to participate with those manufacturers in the design and production of the electric boilers that will be needed to replace the existing natural gas boilers in the downtown complex.

Packaged nuclear boilers have been mentioned as a possible alternative to electric steam boilers in the downtown complex. Whether the alternative boilers are electric, nuclear, or possibly involve another technology, it is essential that design work begin now to assure the resilience of the downtown complex buildings.

If electric steam boilers are selected to replace the existing natural gas boilers, very significant enhancement of the downtown Raleigh and possibly regional electrical grids will be necessary to

deliver the power required by the boilers. Budgetary planning should also be done to effectively plan for the higher energy costs that can be anticipated with the conversion from natural gas to less efficient electric boilers.

Additionally, temperature setpoints in State owned buildings served by the downtown energy complex can be lowered to provide reduced indoor winter temperatures, allowing a reduction in fossil fuel consumption for heating purposes.

Other State agencies operate many buildings that are heated with fossil fuels such as natural gas or propane. If fossil fuels are to be discontinued and no longer allowed as part of North Carolina's energy plan, then conversion to alternative heating methods is essential to ensure the resilience of these buildings across the State. Significant funding will be necessary as the State transitions off fossil fuels. Work needs to begin in 2021 to address these important resilience issues and meet Federal and State energy mandates.

ELECTRICAL POWER LOSS

The North Carolina Department of Administration and other agencies occupying buildings administered by the Department of Administration provide a broad range of diverse services to the citizens of North Carolina. Loss of any of the buildings administered by the Department of Administration will result in serious disruption of governmental services.

Electrical power is essential to the proper operation of all buildings. Electric power is necessary, not only for lighting but also for heating, cooling, ventilation, computer & communication systems, and dehumidification in these buildings. Major climate stressors that affect and can shut down building electrical systems are high winds, storm conditions and flooding associated with hurricanes and other high wind events. Electrical system reliability is dependent on the severity and duration of tropical storms. Ice storms and heavy snowfall may also result in loss of electrical power.

Loss of electrical service in any of the downtown complex buildings will necessitate evacuation of the building until the electrical outage is resolved. If the outage is for an extended period, below grade spaces may need pumping if pumps were disabled during the power outage. Additionally, a period may be necessary for cooling, heating, and potable hot water services to stabilize after an extended power loss.

The vulnerability and risk of electrical power loss to the downtown Raleigh complex is considered low to moderate, depending on the severity and duration of the storm or flooding event. There is a low likelihood of extended electrical power loss but a moderate likelihood of temporary electrical power loss. It is likely that electrical power loss in the Raleigh complex will affect much of the downtown area in addition to the State complex of buildings. Although it is not possible to quantify the level of risk, the risk is growing due to increases in frequency and severity of heavy rainfall, storm, and hurricane events in North Carolina.

To address the potential loss of electrical power associated with severe weather events, the loss of main electrical power can possibly be offset by the rental of large trailer mounted electrical generators. This assumes that generators will be available in the quantity and electrical capacity necessary to power key buildings in the downtown Raleigh complex. Rental of temporary generators is a very expensive alternative to hardening the electrical infrastructure serving the downtown complex. Resilience and adaptive capacity can be improved by establishing the necessary temporary electrical hookups, at predetermined locations, at all key buildings if temporary generators need to be brought in. A transfer switch will be needed at each location where a temporary generator is installed. A single point electrical hookup for all State buildings in the downtown complex is not feasible. It should be noted that emergency electrical generators are typically powered by diesel fuel, a fossil fuel that contributes to climate change. Alternatives to engine driven emergency generators, such as large battery banks, should continue to be evaluated.

STORM WATER

Heavy precipitation can cause significant damage to public and private structures and utility services. This, in turn, disrupts provision of government services, often coming during times when government services are critically needed.

The consequences of urban flooding include property damage, as well as damaged infrastructure and utilities, sewer lines and pump stations. When pump stations and sewer lines are inundated important infrastructure must be replaced. Additional investments in storm water resilience are needed to counter the threat of flooding due to climate change.