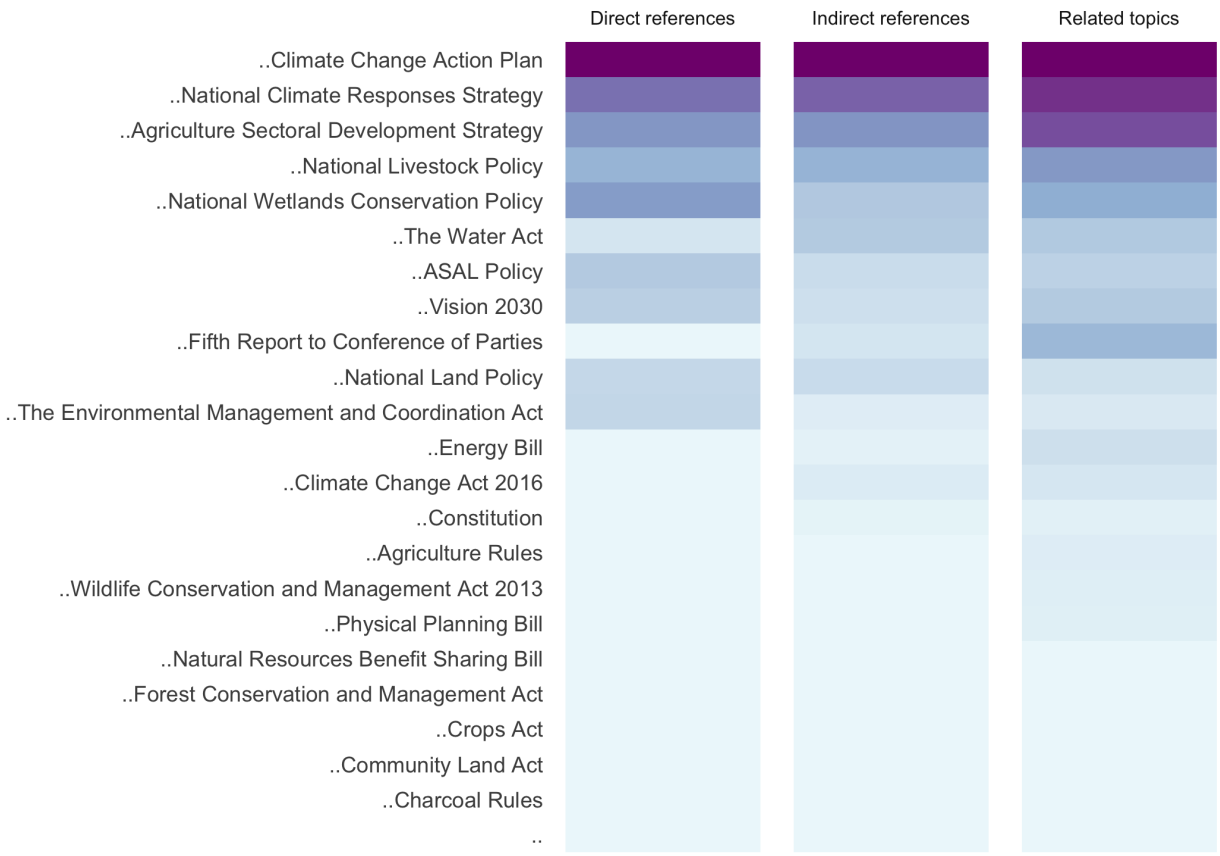
Water risks

Text extracted from Kenya Policy Documents



..Agriculture Sectoral Development Strategy

1. Incidents of flooding are common in areas that receive high rainfall as a result of heavy run-off causing rising siltation and sedimentation of water bodies. Increasing pollution of water bodies by industrial and domestic waste water is threatening the quality of water available for agriculture. In some areas, the quality of groundwater sources is unfit for agricultural use. **71**

2. With the increasing per capita solid and liquid waste generation in the country, the risks to human health are real and call for the design of appropriate agricultural waste management systems. Manpower and financial support shall be provided to obtain more detailed information on how much agricultural waste is produced in the country, the modes of dispersing hazards to humans, animals and crops, and the associated risks. **83**

3. To address these challenges, the environment subsector will implement the following intervention strategies improving environmental conservation improving pollution and waste management enhancing conservation and management of resources implement the national climate change response strategy unsustainable use of natural resources leads to environmental degradation. Indices of degradation include floods, landslides, droughts and desertification. Environmental disasters and their effects are cumulative and long term. **83**

4. The water subsector is developing a national water storage policy to increase water storage from slightly over 183.6 million m3 to 25 billion m3. This will provide enough water to irrigate an additional 800,000

ha above the current irrigation potential of 540,000 ha. It would provide adequate water for livestock, secure water for all uses, raise the standards of the countrys overall water resource management capacity, and ensure a water-secure kenya. Water storage through harvesting flash floods will provide water for irrigation while reducing the damaging effects of flooding in areas such as nyando, lagrangian and kano plains. **73**

5. Pollution and waste are some of the leading environmental health problems in the country affecting both rural and urban populations. Although the quality of air in kenya is not regularly monitored, it is estimated that it is below the who recommended levels. **81**

6. Plant protection and quality assurance services are crucial in increasing productivity and reducing losses along the production trade chains, and in promoting exports. The prevalence of disease outbreaks and incidents of major pests have limited the use of large portions of fertile land for agriculture, increased costs and losses, and prevented trade in plant products. Further, pollution of the environment, misuse and adulteration of agrochemicals and seed are becoming serious concerns for government and the public. **47**

7. The water subsector will enforce the law that requires each irrigation scheme to develop facilities that store water for 90 days for agricultural production. To comply with this law, the government will invest in the development of storage facilities for smallholder and national irrigation schemes. The subsector will also support and encourage water-harvesting activities at household and community levels as an integral part of watershed development for use in irrigation, livestock watering and groundwater recharge. Rehabilitating and protecting water catchments catchment degradation is causing increased run-off, flash flooding, reduced infiltration, erosion and siltation, and is undermining the limited sustainable water resource base in the country. It has invariably affected surface water availability as rivers and reservoirs dry up. The main causes of degradation are poor farming methods, population pressure and cutting down forests for agricultural land and fuelwood. For example, sediment yields from the ewaso giro and tana rivers have increased 115 times since 1970. **74**

8. The quantity and quality of surface and groundwater are important to the irrigation subsector. There is continuous and increasing pressure for sufficient water resources to support irrigation and other economic activities. Well-targeted actions are needed to rehabilitate and manage watersheds or catchments to increase the countrys water resource base. **71**

9. Frameworks, low livestock productivity, and erratic and unpredictable weather conditions which affect the quality and quantity of livestock feed and the water supply. Other constraining factors include the prevalence of transboundary animal and zoophytic diseases and pests coupled with inadequate technical capacity for disease control, weak delivery of extension services, poor access to local and international markets, and unreliable data and information management in the livestock industry. **52**

10. Insufficient water storage infrastructure. The high variability of floods and droughts is likely to increase with global climate change. Water harvesting and storage infrastructure need to be expanded to store the run-off for livestock watering points, irrigated agriculture and fish farming. **42**

11. Hiv and aids, malaria and water-borne diseases pose serious threats to the human population and hence to agricultural labour, and have adverse effects on agricultural development. They consume household savings as a result of high health care costs leading to a decline in household asset base. The diseases cause labour shortages and break up social bonds. Further, there is loss of farm management resources and skills because adults die before passing on their knowledge. **96**

12. Over-abstraction of surface water in some parts of the country, inappropriate land-use practices, soil erosion in catchments and deterioration of riparian lands are causing flash floods and turbidity. Siltation of water courses and storage facilities has led to serious degradation of the quantity and quality of water resources. Poorly controlled discharge of effluent from industry and sewage outflows has also negatively affected the quality of water. The dramatic reduction in the depth of lake baring from over 15in 1921 to an average of 1.8today, is due not only to reduced inflows but also to the increased sediment load from surrounding unprotected and degraded catchments. **74**

13. Conserving river banks, water bodies and catchments kenya is a water-scarce country renewable fresh water per capita currently stands at 647 and is expected to fall to 235 m3 by 2025 if supply does not keep up with the population increase. This situation is attributed to several factors among them the destruction of catchment areas through forest destruction, river-bank cultivation and poor landuse practices. The result has seen increased run-off, flash floods, reduced infiltration, soil erosion and siltation of dams and other water reservoirs. Further, the effects of unsustainable human and industrial activities near large water bodies contribute to the decline in the quality of the environment. **87**

14. In kenya, forests provide wood and non-wood products to over 80 per cent of all households. Forests play a key role in supporting other productive sectors including agriculture, industrial energy and, significantly, enhancing the environments ability to withstand disasters such as floods, landslides and drought. **88**

15. Pesticide use in urban and peri-urban production of crops and animals carries serious risks. These households make regular use of highly toxic pesticides not necessarily related to pest type or pest pressure, often near densely populated areas. Urban households are also vulnerable to other contaminants. Farmers take advantage of the nutrients in urban and peri-urban wetlands, sewage disposal areas and dumpsites to plant food crops. These areas contain heavy metals and pathogens, and the air around is generally heavily polluted. **82**

16. Demand for more human food and animal feed, energy for industrial and domestic use, potable water and environmental protection in the river basins and in the country at large require concerted efforts to be met. **88**

17. The national water resources management strategy that was validated in january 2007 stresses that integrated water resources management irma must be elevated and recognized as a national priority that underpins all of kenyas social and economic development. Irma promotes the coordinated development and management of water, land and related resources to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Implementation is on course through various programmes, mechanisms and measures. However, massive investments are required to achieve and sustain this objective, and resources must be mobilized from both internal and external sources. **74**

18. These concerns are addressed by the plant protection services, the kenya plant health inspectorate service, the pesticides control products board, the national environment management authority nema and the kenya bureau of standards kbs. These bodies are expected to control plant pests and diseases, regulate and monitor aspects of plant health services, license the use of agrochemicals, and undertake other quality assurance measures. With so many bodies, there is the risk of inefficiency, duplication of effort and over-regulation of the agricultural sector. This is counterproductive. **47**

19. Inadequate disaster preparedness and response. There is low preparedness, response capacity and coping mechanisms in the event of disasters such as drought, floods, fires, diseases and pests. Early warning and response systems need to be strengthened and widened. **41**

20. Livestock migration has resulted in conflicts over use of pastures and water sources, and in environmental degradation. Ensuring that pastoralists have adequate feed for their livestock will help control movement, especially during times of drought. With the changes in land-use patterns, appropriate interventions must be introduced to enable pastoralists cope with these changes. **56**

21. Since rangelands are characterized by low and erratic rainfall patterns coupled with high evaporation rates, lack of water is one of the major development problems among the pastoral communities. Water availability is a precondition for improving livelihoods and for making use of the natural resource base. However, haphazardly planned and poorly developed water sources and facilities have contributed significantly to land degradation in the pastoral areas. **56**

..ASAL Policy

22. Identifying risks to a project or asset from climate change, and ensuring that those risks are reduced to acceptable levels through changes introduced at different stages in the project cycle. **4**

23. Lack of the basic foundations for development in asals, particularly infrastructure, human capital, and security is deterring investment, undermining productive potential, draining resources into prolonged emergency response, and frustrating local-level initiative. **35**

..Climate Change Act 2016

24. Mainstream and reinforce climate change disaster risk reduction into strategies and actions of public and private entities;mainstream intergenerational and gender equity in all aspects of climate change responses;provide incentives and obligations for private sector contribution in achieving low carbon climate resilient development;promote low carbon technologies, improve efficiency and reduce emissions intensity by facilitating approaches and uptake of technologies that support low carbon, and climate resilient development;facilitate capacity development for public participation in climate change responses through awareness creation, consultation, representation and access to information;mobilize and transparently manage public and other financial resources for climate change response;provide mechanisms for, and facilitate climate change research and development, training and capacity building;mainstream the principle of sustainable development into the planning for and decision making on climate change response; andintegrate climate change into the exercise of power and functions of all levels of governance, and to enhance cooperative climate change governance between the national government and county governments. **7**

..Climate Change Action Plan

25. Water resource management is important for addressing drought, and forests in water catchments are critical for sustaining water availability, which is needed for generation of hydropower, drinking water and water for irrigation. Water resource management is linked to kenyas expected economic and social transformation, and is directly linked to food security, health and GDP growth especially in the asals. **55**

26. Priority adaptation actions to increase climate resilience include improved disease surveillance, including strengthening existing early warning, monitoring and evaluation systems for malaria epidemics. Improved community-level health care and dissemination of information on changing health risks can enhance the response to climate-related diseases. Importantly, increased access to water and sanitation can improve disease vector control. A low carbon action is the use of water filters that provide access to clean water while reducing demand for firewood used to boil water and therefore slowing deforestation. **61**

27. Kenyas forest resources provide important environmental and ecosystem services, and contribute to economic development, rural livelihoods, water availability and climate resilience adaptation benefits. Maintenance of and increased forest cover in water catchments is critical for sustaining water availability and the generation of hydropower. **94**

28. Priority adaptation actions to improve water management include increased domestic water supply and improved sewage systems, enhanced irrigation and drainage to increase agricultural and livestock production, effective trans-boundary water resources management, and flood mitigation schemes. These actions reduce the impact of droughts and floods on crop yields and livelihoods, and more irrigation-based agriculture reduces the reliance of crop production on rainfall. **55**

29. Improved water resources management including increased water retention and storage will contribute to the vision 2030 goal of improved access to water, which views effective water management as a prerequisite to achieving development goals and the countrys transformation to a middle-income status. Improved water resources management will provide opportunities for the asals to achieve food security, improve human health and enable irrigated agriculture. In addition to these socio-economic benefits, water resource management has significant resilience benefits by reducing the impact of droughts and floods, reducing reliance on rain-fed agriculture and improved watershed management. Some mitigation may result from the reduced need to boil water. **170**

30. Our population is vulnerable to climate risks due to the high dependency on natural resources for food, fuel and shelter. Islands report on climate risk and vulnerability in kenya indicates that water availability is especially critical as we live in one of the most water scarce countries in africa.42 access

to this basic resource is likely to become more difficult due to population growth, economic expansion, unsustainable management of water and forest resources, and changes in rainfall patterns. At the same time water is the core input for most economic activities irrigated and rain-fed agriculture, hydroelectric power that constitutes over half the installed capacity of electric power, sanitation and provision of drinking water. **51**

31. The government of kenya has recognised the growing threat of climate-related risk to the achievement of its development goals; and, in response, has improved its capacity to prevent, manage and recover from disasters and to adapt to the impacts of climate change. Kenya has made large technological advances in predicting drought and generating credible early warning information. Yet the challenge of effective response has become more urgent as climate change increases drought vulnerability. The magnitude and severity of drought has increased in the recent past; this is particularly true in the asals that make up more than 89 per cent of kenyas total land mass. Actions to improve climate resilience in the disaster preparedness programme include modernisation of meteorological systems, and an early and appropriate response to emerging drought that includes a well-maintained early warning system. These systems should be backed by a reliable and effective social safety net programme carried out by empowered youth and women. Trained county-level disaster management officers can also help to ensure a timely and effective response. Actions should also address current and anticipated levels of water scarcity, including implementing the water sector investment plan for 2008 to 2030 and water catchment management initiative. Climate-proofed infrastructure development in the asals, investment in sustainable livelihoods that are adaptive to climate change such as crop farming with drought resistant seeds, dry land forestry and community-based livestock systems, and education programmes are priority elements of a climate resilient pathway. **61**

32. Financial services sector climate change is a potential external shock to the financial services sector, through, for example, exposure to indirect risks to investment portfolios, and retail customers defaulting on loans, and to insurance through increased risks leading to high claim ratios and lower uptake of insurance cover. **71**

33. As kenya realises its development aspirations, there will be gains and risks. A growing population and economy with urbanization will mean increases in greenhouse gas GHG emissions. Resulting environmental and social conditions, including increased competition over resources, could intensify vulnerability to climate risks. Transitioning to a low carbon climate resilient development pathway can address future risks, thereby improving kenyas ability to prosper under a changing climate while reducing the emissions intensity of a growing economy. **47**

34. Low carbon climate resilient pathway includes active planning of industrial development, taking into account energy and water use and scarcity. Climate resilient actions include the generation of data to improve awareness of climate impacts and decision-making in the sector. Support for the growth of insurance markets can help manufacturers have access to a range of insurance products. **59**

35. Therefore, to address the impacts of climate change on the countrys socio-economic growth, proper planning and implementation of actions are necessary. Such measures should include appropriate adaptation to enhance the countrys capacity to cope with the impacts of climate change and build resilience, as well as development choices that minimize carbon emissions. **29**

36. The government of kenya agencies with responsibility for managing climate risks and developing climate change responses are set out in chapter 3. **253**

37. The poor infrastructure in the country also increases the risks and vulnerabilities to climate change. A higher percentage of kenyas roads are earth roads. Floods cut off links and destroy the limited infrastructure. **27**

38. Based on the mitigation actions proposed by sc4 and adaptation actions proposed by sc3, synergies with the greatest potential are increased fuel security from reduced reliance on external imports increased productivity and quality of life from climate resilient electricity generation improved water storage potential of soils from reduced occurrence of grass fires improved human health from improvements in vehicle efficiencies and reduced air pollution improved human health from replacement of kerosene lamps

with renewable lamps in the home reduced vulnerability to floods and storm surges from increased climate change resilience of sanitation improved water storage potential in soils, reduced run off and floods from forestry investments increased carbon sequestration from reforestation, agroforestry and conservation tillage. **159**

39. The forestry sector is an important source of income for many communities in kenya. To ensure that the forests can continue to provide important environmental and ecosystem services, and contribute to economic development, rural livelihoods, water availability and climate resilience benefits, technologies may be required to enhance capacity for sustainable natural resource management in the face of increasing climate uncertainty. Technology will also pave the way for forest-based income-generating activities, which can support adaptation to climate change for those engaged in livelihoods that are particularly sensitive to climate impacts. **145**

40. For livelihoods and biodiversity. In terms of climate resilience benefits, efforts to maintain and increase forest cover will help offset anticipated changes in forest growth patterns due to climate change. Forests are vitally important for water catchment management, for mitigating flooding and landslides, for reducing erosion and sediment discharge and for improving soil health. Restoration of forest lands have the significant mitigation potential of 38.7 mtco232.6+6.1 per year in 2030. **171**

41. The aviation sector is a growing source of GHG emissions, and kenyan airlines that fly into countries of the european union will be expected to offset the emissions associated with this international travel. Research is needed to determine the best way for kenyan airlines to meet or reduce these costs. Low carbon actions can be taken to make refurbished airports as energy efficient as possible; and climate resilience can be improved through up-to-date weather observations systems, which also improves airline safety. Infrastructure for electricity generation is a priority to support kenyas development ambitions. Improved electricity production helps to ensure a stable and secure supply of power which is critical for economic growth and job creation. Increased generation of renewable energy also has the benefit of improved energy security by reducing reliance on fossil fuel imports. A climate resilient pathway includes electricity generating systems and a national grid that can withstand the extreme weather events expected as a result of climate change. **58**

42. Vulnerable to climate variability and change, while providing the increased electricity required for economic growth. As a clean energy source, it has significant mitigation potential of 14.1 mtco2per year by 2030. **170**

43. As for the forestry sector, technologies will pave the way for adaptation to climate change in the water sector. Major technologies which could be applied or scaled-up to enhance water security through the nccap proposed actions include surface run-off water harvesting technology surface runoff water harvesting is the collection, accumulation, treatment or purification and storing of storm-water for its eventual reuse. It can also include other catchment areas from man-made surfaces, such as roads, park gardens and playing fields. The technology involves harnessing surface run-off from ground surfaces and directing the water into a retention earth dam for storage. The water can be used directly for livestock, irrigation or for drinking after appropriate treatment. The main barriers to diffusion and adoption of this technology, which has been limited to date in kenya, are economic and financial, including high initial costs and inadequate access to financial resources; technical insufficient capacity among the local community; environmental, including evaporation, and policy and legal inappropriate land tenure. The enabling actions that are required to promote the adoption, diffusion and transfer of the technology are financial incentives, availability of affordable credit, improvement of appropriate land tenure system, especially in asals, and capacity building. Roof rainwater harvesting technology roof rainwater harvesting involves inducing, collecting, storing and conserving rain water for reuse before it reaches the aquifer. It requires the collection of rainwater in gutters through down-pipes and diversion to containers or tanks. The technology is used more in high potential agricultural areas than in urban areas and asals. The barriers to the use of this technology are high initial costs, lack of suitable roofs, and inadequate rainfall and settlement patterns in asals, among others. Actions required to enable this technology to be adopted and diffused include financial incentives, provision of affordable credit and creation awareness and information. **145**

44. Priority adaptation actions to promote a climate resilient pathway in the population, urbanisation and housing sector include expanded flood management in high-risk areas, including in slums, which need upgrading to increase the resilience of the poor. Also important is the upgrading of building codes to include climate resilience and green building concepts. Climate risk assessments should be undertaken for essential public buildings and emergency services, and priority actions implemented in a timely manner. Research is needed to assess migration as an adjustment or coping mechanism for climate variability, and to identify alternatives to allow people to remain in their communities. This is closely linked to the drought and climate change actions discussed below. **60**

45. The national disaster management policy, 2012 institutionalizes disaster management and mainstreams disaster risk reduction in the countrys development initiatives. The policy aims to increase and sustain resilience of vulnerable communities to hazards. **32**

46. National infrastructure to lower the cost of doing business and increase competitiveness is crucial for development. A low carbon climate resilient pathway means that 1 GHG emissions are as low as possible in the sector recognising that emissions will rise as kenya develops; and 2 infrastructure is climate proofed that is, designed, constructed and operated in a way that accounts for anticipated risks and opportunities that result from climate change, ensuring that infrastructure investments are not compromised in the future. **57**

47. Water resources enforcement andor enactment of laws for efficient water resource management, increasing capture and retention of rainwater, water quality monitoring, de-silting rivers and dams, protecting and conserving water catchment areas, investing in decentralized municipal water recycling facilities, campaigns on water harvesting, developing hydrometric network to monitor river flows and flood warning. **38**

48. Multiple social, economic and environmental challenges can be addressed through the development and transfer of technologies. Exploiting available renewable energy resources can reduce dependence on imported fossil fuels and hydropower which is becoming more insecure with increasing drought while providing a cleaner and healthier environment when technologies are low or carbon neutral. The favourable business environment created by technology adoption will be important to provide incentives to private and public financiers to invest in and support the mitigation and adaptation actions proposed in this nccap. **137**

49. Low carbon climate resilient development pathway is a promising option for kenya. Meeting development goals requires modernisation while increasing ability to manage climate risk. The drivers of our economy are primarily natural resource-based and climatesensitive, and new investments in infrastructure must consider expected changes in temperature and precipitation. Kenya can advance economic growth in ways that reduce climate risk or are less carbon-intensive while seizing opportunities for innovation, such as leapfrogging to the best-available technology. Making the right investments now can prevent technology lock-in and a more costly transition in the future. This development pathway can help to improve competitiveness through a focus on the sustainable use of resources, improved productivity, and decreased vulnerability to variations in climate. **50**

50. Health sector climate change is expected to put human health at risk by increasing the magnitude and occurrence of existing impacts, such as heat stress, air pollution, asthma, vector-borne diseases such as malaria, dengue fever, schistosomiasis and tick borne diseases, water-borne and food-borne diseases. According to the world health organisation, increasing temperatures and precipitation patterns arising from a changing climate in the past 30 years already claim over 150,000 lives annually.58 geographic exposure to malaria is predicted to expand into new areas, including the kenyan highlands, due to increasing temperatures and changing distribution of precipitation. Increasing annual temperature is likely to be responsible for increasing prevalence of diarrhoeal disease, particularly among children under 5 years. Extreme events and elnio floods are also likely to lead to increasing outbreaks of other diseases such as cholera and rift valley fever. In coastal areas, toxins from harmful algal blooms can create significant health risks for humans and wide-ranging impacts on marine ecosystems. **72**

51. The myriad of risks and opportunities that come with climate change in kenya require enhanced capacity

to take advantage of the opportunities that may arise and at the same time reduce the associated risks. As with all capacity development efforts, the required capacity development for climate change resides in three different levels, namely,systemic; ii organisational; and iii individual. Capacity development for climate change must focus on those individuals and institutions that are dedicated to climate change and to those that are mainstreaming climate change adaptation or low carbon development into their sectors, organisations and companies. The focus of capacity development at the systemic level is on putting in place enabling environments that encapsulate policy, regulatory and economic frameworks, institutional arrangements and linkages, management and accountability processes, and resource availability and allocation. Chapter 8 has addressed the policy, legal and institutional factors that need to be addressed in kenya and has provided recommendations with regard to a climate change policy, a stand-alone climate law and a miscellaneous amendments bill to remove barriers and provide incentives across the sectors. An institutional arrangement for the governance of climate change has also been proposed. **129**

52. Practices that reduce climate vulnerability also reduce emissions and improve agricultural production potential. Agroforestry, for example, has the potential to abate 4.2 mtco2by 2030, while offering climate resilience benefits of improved soil quality, improved water retention in the soil, reduced erosion, and perennials that are better able to withstand climatic changes. **54**

53. The national policy for the sustainable development of northern kenya and other arid lands focuses on climate resilience requiring government to find solutions to address climate challenges and to come up with measures to manage drought and strengthen livelihoods. The policy also focuses on an enabling environment for accelerated investments in foundations to reduce poverty and build resilience and growth. The establishment of the national drought management authority ndma, the national disaster contingency fund and the council for pastoralists education are provided for in the policy. **32**

54. Impact funding and implementation of actions to restore forests on degraded lands will eventually lead to reduced deforestation and improved forest management and associated cobenefits, such as improved water availability, hydropower generation, reduced flooding and landslides, and sustainable use of forest products such as fuelwood, charcoal and medicines. Many of the areas to be restored will be used for grazing animals and actions could have significant impacts on pastoralists and forest-dependent communities. Free, prior and informed consent will be needed from these communities, and actions will need to consider these trade-offs for example, how to compensate for lost access to grazing land and how to avoid grazing in the protected areas. **182**

55. Climate resilient actions in the infrastructure sector include improved use of weather and climate information in infrastructure development, and research to identify designs and materials that enhance the resilience of infrastructure. Regulations and codes should be revised to account for climate change impacts, and climate risk screening should be undertaken for flagship projects in the infrastructure sector. **58**

56. Impact improved cookstoves can better the lives of individual, particularly women, in rural and urban areas both by reducing time to collect fuelwood and reducing indoor air pollution. The actions may also present cost savings to consumers, depending on the price of alternatives. Increased climate resilience through lower fuelwood demand and reduced deforestation. **188**

57. Agroforestry also contributes to the governments goal of 10 per cent tree cover on farms in addition to benefits of enhanced food security and improved livelihoods of farmers. In regard to livestock, priority low carbon climate resilient actions will be considerate of local cultural practices and include improved management of grazing systems, livestock diversification, and breeding of animals to improve their ability to adapt to climate change and produce lower emissions. Adaptation actions to improve the resilience of livestock are particularly important for the asals. **54**

58. Climate change will affect all sectors of the economy. Agriculture, which accounts for about 20 percent of the gdp43, is very sensitive to climate change, meaning that agricultural systems will need to adapt to ensure provision of adequate food for a growing population and to improve production of export crops. Trade and industry rely on infrastructure and services, such as water, energy and transport, and

are vulnerable to disruptions caused by droughts and heavy rains. Tourism, an important source of foreign exchange earnings, depends on a wide range of environmental resources, such as the abundance and diversity of wildlife, which will be impacted by climate change. **51**

59. Building adaptive capacity kenyas vulnerability to climate change is influenced by the adaptive capacity of its people and institutions, or their ability to take advantage of opportunities or to cope with the consequences of potential damages.39 improving development outcomes such as income, literacy, social networks and access to information and services is critical to building our countrys adaptive capacity. **49**

60. Climate-proofing of improved, expanded, effective and reliable national physical infrastructure is an important and necessary enabler of socio-economic development. For the asals, this means a road network that can stand up to a changing climate, the establishment of strategic multipurpose dams and expanding renewable energy capabilities wind, solar and biogas, both decentralised and connected to the national grid. Developments of the transport sector to meet the needs of the rapidly growing population and economic development will be required to meet kenyas low carbon strategy and will also have to take account of the extreme weather events and flooding. The climate-proofing of infrastructure related to electricity generation will be a priority if the ambitions to ensure a stable and secure supply of power are realised. **171**

61. Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity5. **21**

62. Important adaptation actions to improve climate resilience in the environment sector include improving coastal zone management to rehabilitate and conserve vital coastal ecosystems through the implementation of the integrated coastal zone management plan, the national disaster risk management response plan and national environment action plan. **55**

63. Interventions to develop cost-effective, world-class climate-proofed infrastructure facilities and services in the asals, including construction of priority roads, physical markets and growth poles to promote value addition, mapping of established settlements in arid lands without permanent water, construction of multi-purpose dams, development of mechanisms that ensure timely maintenance of existing water sources, development and expansion of icts capabilities and infrastructure, development of disease control mechanisms and livestock marketing infrastructure, and development and harnessing of energy sources. **77**

64. Environment direct impacts of the drought and indirect impacts from wildfires included environmental losses as a result of damages to plant and animal species, habitats, reduced forest productivity, lower water levels, increased livestock and wildlife mortality rates. **74**

65. Impact increasing the share of geothermal electricity can improve energy security through decreased energy imports and reduce costs of generation. Geothermal power can provide low-cost base load electricity generation, facilitating economic activity and development. It also reduces the current reliance on hydropower thereby improving climate resilience. **184**

66. Low carbon climate resilient pathway in the environment, water and sanitation sector can have important sustainable development benefits and contribute to a clean and healthy environment, which is a fundamental right under kenyas constitution. **55**

67. Tourism sector tourism is a major foreign exchange earner contributing 10 per cent to kenyas gdp.56 climate change may exacerbate the effects of changes in water availability, biodiversity loss and reduced landscape aesthetics, natural hazard frequencies, coastal erosion and inundation, and the incidence of vector-borne diseases on the tourism industry to varying degrees. **71**

68. Improve and strengthen climate change information management systems and enhance awareness creation of climate risk management and opportunities. **82**

69. Drought is the prime recurrent disaster in kenya. In recent times intense droughts have occurred in 199192, 199596, 19982000, 20042005, and 2008-11.63,64,65 each of these events has caused severe crop losses, famine and population displacement in the country. Climate change introduces additional uncertainties into existing vulnerabilities, particularly in the asals.66 increased temperatures and rainfall variability are likely to exacerbate the conditions already experienced and may in the future have a significant impact on water availability and thereby droughts. **74**

70. Increasing tree cover to 10 per cent of total land area is a goal stated in kenyas constitution. Actions to increase forest cover have important climate resilience and low carbon benefits. Forests help to prevent flooding and landslides, and reduce erosion and sediment discharge into rivers. Forests also contribute to water availability by slowing the loss of rainwater from the ecosystem, demonstrating the importance of reforesting and rehabilitating the main water towers and water catchment areas. Moreover, forest conservation can contribute to livelihood improvements and has biodiversity benefits. An important low carbon climate resilient action is the restoration of forests on degraded dry lands, which has a mitigation potential of over 30 mtco2a year in 2030. Other important low carbon climate resilient actions are reforestation and reducing deforestation and forest degradation, with mitigation potentials of 6.1 and 1.6 mtco2 e, respectively. **55**

71. Technology development, transfer and diffusion are required to avoid the adverse effects of climate change and to enable kenya to achieve low carbon climate resilient development. Applying modern technologies to better cope with climate variability is not new to our country and as technology developments have supported kenya to cope with climate variability in the past, new technologies will continue to pave the way for low carbon climate resilient development in the future. Technology developments will improve the investment climate, stimulating sustainable flows of finance needed for long-term action. **137**

72. Achieving long-term sustainable economic growth up to and beyond vision 2030 in the face of climate change is a primary concern. Kenya is already extremely susceptible to climate related events and such events pose a serious threat to the socio-economic development of the country. Droughts and floods in particular have devastating consequences on the environment, society and the wider economy. According to the science of climate change, these impacts are likely to continue to affect the country in the future. Since kenyas contribution to global emissions of greenhouse gases is negligible, it is not responsible for causing this problem. **23**

..Constitution

73. Have reasonable access to water, health services and infrastructure. **37**

..Energy Bill

74. The provision of sufficient regulating capability to meet fluctuations in load occurring within a scheduling interval;the provision of sufficient contingency capacity reserve to maintain power system frequency in the event of network or generation outages;the provision of reactive power support to guard against power system failure through voltage collapse; andthe provision of black start capability to allow restoration of power system operations after a complete failure of the power system or part of the power system; distribution of electrical energy obligations and rights of a distribution licensee. **85**

..Fifth Report to Conference of Parties

75. Loss of habitats is mainly due to poor land use practices, encroachment on protected areas, unplanned and unregulated human settlement and unsustainable agricultural development. A national spatial framework NSF is being developed to address uncoordinated land development. For aquatic and marine environments, declining water quality due to increased pollution and siltation from poorly managed upper catchment and agricultural zones, is a key pressure. In addition, there are insufficient mechanisms to address emerging issues affecting land such as climate change, drought, floods and tsunami and storm surges among others. Inadequate capacity to preserve and conserve natural and cultural heritage within the ecosystems together with inadequate mechanisms for conflict resolution among the various resource users within the ecosystems have led to increased rates of loss of biodiversity. There are now private sector and government efforts to promote strategies to enhance community empowerment

and sustainable livelihoods as well effective communication, education and awareness on landscape management reduce land degradation with associated loss of ecosystem values. **49**

76. Desertification and soil degradation leading to loss of biodiversity and livelihoods, water scarcity regulate river flows and prevent flooding; help recharge ground-water tables; improve soil fertility; reduce soil erosion and sediment loads in river water; help regulate local climate conditions; important as anthropology inc activities human population increase resulting in land use change land tenure change, human settlements, agricultural expansion degradationof the soil, biodiversity y-plants and animals melting of snow on MT kenya, reduction of glaciers unsustainable land practices leading to soil erosion, loss of soil fertility, low productivity, biodiversity loss, landslides environment policy, national land policy, climate strategical egislation, un conventions cbd, , wetland s, cites, ccms, etc. **150**

..National Climate Responses Strategy

77. Together we can tackle climate change rainfall and therefore the quantity of fresh water available for domestic, commercial and industrial use, assessment of watersheds and water resource vulnerability due to hydrological cycle changes, assessment of water quality as it relates to source and receiving waters, storage, treatment, conveyance and demand, in addition to research on adaptation and management practices to protect and manage water quality, assessment of the potential impacts of climate change on water, waste-water and storm-water infrastructure including risk exposure of key infrastructural nodes to weather extremes and the impact of rising sea level on coastal water infrastructure, and assessing the use of cost effective and environmentally friendly water purification methods e.g. Using locally available natural adsorbents to purify water in drought prone asal regions. **82**

78. Conventional universal minimum of 1000 cubic metres. Climate change will aggravate the situation as it affects precipitation. For this reason, certain interventions need to be made in this sector including the following constructing inter-basin and intra-basin water transfers to channel water from areas with excess water to areas with water deficit, investing in decentralised municipal water recycling facilities for both domestic and industrial use to reduce wastage, enforcement andor enactment of laws and regulations required for efficient water resource management, increasing capture and retention of rainwater through the construction of waterways, strategic boreholes and other water harvesting structures to ensure availability of water during dry seasons, developing and maintaining an appropriate stock of water infrastructure dams, water pans, supply lines, building capacity for water quality monitoring including training personnel to protect watersheds and monitor water quality, having a strategic fund to purchase water purification chemicals for disinfection of community wells and shallow boreholes during floods and drought episodes when water quality is most threatened, de-silting rivers and dams to improve carrying capacity, water storage and water quality, protecting and conserving water catchment areas, riverbanks, and water bodies from degradation and contamination e.g., by imposing a water levy to generate funds for investment in conservation of water catchment areas, animal diseases, as well as supporting the improvement and dissemination of such technologies. These inventories are important elements for planning as they provide efficient, appropriate and time tested ways of advising communities affected by climate change, promoting economic diversification among pastoral communities e.g. Cultivation of drought-tolerant crops such as millet, the government, liaising with relevant experts in range dynamics, should enhance the provision of good quality water for both livestock and humans. Construction of dams is recommended to cater for pastoralists water needs during the dry spells, but only after due consideration of a particular regions geologic and hydro logic characteristics, and awareness campaigns among the pastoralist communities on the importance of balancing stocking rates with the available land resources as a way of ensuring sustainable pastoralism. **53**

79. There is inadequate national and local information on how climate change elements e.g. Temperature rise, change in precipitation, extreme weather events, sea level rise and other seasonal shifts will affect phenomena such as floods, drought, water shortages supply and quality, human and domestic health risks, habitat loss, etc. Further, there is limited information regarding the countrys vulnerability to climate change impacts. This is also true regarding the knowledge level of GHG emissions and mitigation capacity carbon-dioxide absorption sequestration capacity of key natural resources such as rangelands, lakes and rivers. This objective will be achieved by identifying key ecosystems for which

such assessments should be carried out. **47**

80. Climate change impacts and GHG emissions monitoring climatic and ecosystem trends there is limited information regarding the status of key natural ecosystems such as major water catchment areas, lakes and major rivers. Further, there is inadequate national and local information on how climate change elements temperature rise, change in precipitation, extreme weather events such as floods and drought, sea level rise and other seasonal shifts will affect these ecosystems and their services e.g. Water supply quantity and quality, air quality, human and domestic health, habitatloss, etc. **73**

81. Strategies, e.g. Building or enhancing systems for conveying climate information to rural populations. The government and development partners need to provide support to the KMDS early warning system to facilitate the timely dissemination of projected and downscaled weather information to farmers. This will enhance farmers resilience to the impacts of climate change, e.g. Through altering the timing of planting dates to adapt to changing conditions, enhanced financial and technical support to the orphan crops programme so that indigenous and more drought tolerant food crops like cassava, millet, sorghum sweet potatoes can be re-introduced into the farming systems, promoting irrigated agriculture by developing irrigation schemes along river basins, construction of water basins and pans, but also reconfiguring irrigated production systems to use water more efficiently and to accommodate the use of marginal quality water, addressing land degradation by building soil and stone bunds, creating grass strips and contour levelling as well as incorporating trees or hedgerows. These measures will increase rain-water infiltration, reduce run-off during floods, reduce soil erosion, and help trap sediments including dead plant matter, promoting conservation agriculture ca, whose aim is to achieve sustainable and profitable agriculture and ultimately improve farmers livelihoods through the application of the three ca principles minimal soil disturbance, permanent soil cover and crop rotations, 4.1 adaptation interventions adaptation to global warming covers all actions aimed at coping with climatic changes that cannot be avoided and at reducing their negative effects. Adaptation measures include the prevention, tolerance or sharing of losses, changes in land use or activities, changes of location, and restoration. The primary reason for adaptation is that the GHGS already present in the atmosphere are enough to cause significant climate change, irrespective of if all emissions were stopped today. Anthropogenic climate change is already occuring glaciers are melting, sea levels are rising, and hurricanes are increasing in intensity. With rising carbon dioxide levels, climate change is likely to worsen. For these reasons, the world must prepare for and adapt to the effects of global warming through adaptation actions and policies that are designed to tackle both current and future climate change threats. **51**

82. Providing special livestock insurance schemes to spread and transfer risks from climate change. **8**

83. Kenyas ability to cope with the impacts of climate change is compounded by many factors including poverty, weak institutions, poor infrastructure, lack of information, poor access to financial resources, low management capabilities, armed conflicts due to a scramble for diminishing environmental resources and high interest rates. It is vital that policies and measures for adaptation to climate change are put in place across all the economic sectors after a consultative process in order to minimise the impending climate change catastrophe. **45**

84. 1 agriculture and food security climate change affects the four components of food security - food availability, food accessibility, food utilization and food system stability - in various direct and indirect ways. As a result of climate change, there will be increased frequency and intensity of extreme weather events like droughts and floods, which will lead to losses of productive assets, personal possessions and even life. This has already been observed, but will intensify in the future if efforts are not raised to stop global warming. **35**

85. There is inadequate national and local information on how climate change elements temperature rise, change in precipitation, extreme weather events, sea level rise and other seasonal shifts will affect phenomena such as floods, drought, water shortages supply and quality, air quality, human health, and habitat loss. A thorough nationwide assessment of how these changes will affect human population, infrastructure, the environment, the economy and society as a whole. In parallel, it is important to conduct climate change scenarios and develop corresponding policy responses. **9**

86. Wind intensities on windmills benny and others, 2007 as well as measures to deal with such impacts. Considering infrastructural development funds, a maintenance component should be factored in to take care of the damage caused to the infrastructure by extreme weather events such as floods that sweep away roads and bridges, carrying out geotechnical site investigations sis to determine areas that are appropriate andor inappropriate for infrastructural development, e.g. Sis will help identify flood landslide prone areas on which roads, railways and other infrastructure should not be constructed, and accommodation, which involves the continued use of the affected areas through measures practicable under the new prevailing conditions e.g. **59**

87. Although chapter 2 of this strategy has attempted to discuss kenyas vulnerability to climate change impacts, the level of knowledge about kenyas current vulnerability is still more or less general. It is accepted that kenya is vulnerable to climate change because most of her people depend on climate sensitive natural resources for their livelihoods. However, how vulnerability varies across the country is something that is yet to be determined. An appropriate approach to coping with climate change impacts requires proper knowledge of the vulnerable nature of communities, groups and sectors. This will then inform the measures that need to be taken in order to minimise the negative impacts of climate change, and exploit the beneficial ones. Vulnerability assessments can address these needs and should therefore be carried out. This will involve assessing past and projected climate change evidence and impacts in the country and identifying sectors as well as regions that are most vulnerable, and therefore in high need of remedial interventions. **73**

88. How vulnerability varies across kenya is something that is yet to be determined. An appropriate approach to coping with climate change impacts requires proper knowledge of the vulnerable nature of communities, groups and sectors. This will then inform the measures that need to be taken in order to minimise the negative impacts of climate change, and exploit the beneficial ones. **73**

89. Together we can tackle climate change preparedness and management in regions prone to such climatic disasters, developing climate change awareness programmes involving all stakeholders, proper planning of urban settlements which takes into consideration the expected high growth rate of urban population due to climate-induced migration from rural areas to urban centres. This will require urban planners and real-estate industry players to accordingly implement proper and adequate housing structures, waste disposal as well as piped water infrastructure, establishing insurance schemes to make reparations in regions affected by climatic disasters, diversifying economic activities to improve resilience to rural communities dependent on climate-sensitive sectors such as agriculture and livestock rearing, encouraging the formation of resident associations that can respond to emergencies, and involving them in key decision making, and expanding the consolidated social development fund and women enterprise fund to address the following social and gender-based response strategies - disburse self-help grants for boosting existing enterprises or establishment of new income generating activities by poor rural and urban women and men, e.g. Making energy saving sickos accessible and affordable to all families and individuals, particularly women; planting of crops used as alternative sources of income, e.g. Aloe-vera, neem, and mangrove trees, - provide food rations to the hungry at times of need during drought and flood disasters, - disburse grants to self-help groups in support of environmental conservation projects such as tree nurseries development, afforestation, riverbank protection, construction installation of rain water harvesting tanks, spring protection, - train gender focal points, women and men self-help groups in rural areas and urban poor in environmental management, and - disseminate climate change information in local language through the use of field-based gender officers, women groups, participatory education theatre pet and music groups. **58**

90. According to the national environmental management authority nema state of environment report of 20062007, major floods periodically afflict lake victoria basin, the lower tana basin and the coastal region occurring at least six times in the past 50 years. In these areas, higher turbidity, siltation, and sedimentation occur. Floods carry fertiliser and pesticide residues into water bodies resulting in eutrophication, which has detrimental impacts on water quality and aquatic life. Until recently, such episodes were assumed to represent natural climate variability but now scientific evidence points to climate change as the driving force behind the frequency and intensity of these events. **34**

91. 5 forest products the asals are subject to recurring droughts, which when coupled with overexploitation of resources, result in high vulnerability to land degradation and desertification. This not only increases levels of GHG emissions, but simultaneously threatens livelihoods. **38**

92. Population displacement and migration from climate disaster-prone areas e.g. Drought prone northern kenya and sea-level rise in the coastal region are expected to increase. It is expected that most of those on the move from rural areas will head towards urban agglomerations where assistance, income opportunities and infrastructure may be perceived to be more accessible and readily available. This will create an enormous social, health, infrastructure and management challenge for cities, subjecting them to unplanned population growth. **42**

93. In order to address the shortage of climate change specialists in the areas of science, policy, adaptation, mitigation and carbon markets, it is imperative that a comprehensive national capacity building framework in strategic climate change areas be developed. This objective will be achieved by identifying sectoral capacity needs and will be complemented by successful models applied internationally. In addition, the countrys capacity to respond to natural disasters has been stretched due to climatic events such as drought and floods. This objective will further seek to strengthen institutions involved in disaster risk reduction DRR to enable them cope with climate disasters. **47**

94. Moreover, because there are few climate change specialists in the areas of science, policy, adaptation, mitigation and carbon finance and markets it is important to put in place a targeted capacity-building framework. Building the capacity of local communities to help them adapt to the adverse impacts of climate change as well as take opportunities such as those offered by the reduced emissions from deforestation and degradation redd mechanisms is also important. Kenya will undertake various interventions to address its capacity needs by strengthening vulnerability analysis and food security monitoring, supporting the modernisation of the kenya meteorological department, strengthening institutions in charge of disaster risk reduction drr, the national designated authority dna amongst other interventions discussed further in chapter 6. **10**

95. These changing temperature and rainfall patterns have profound impacts on kenyas socio-economic sectors, most of which are climate-sensitive. Based on the contributions of stakeholders during the national and regional national climate change response strategy NCCRS workshops as well as literature review, both observed and potential impacts of climate change on kenyas key sectors and land use systems were assessed. These key sectors include agriculture; rangelands which are the backbone of kenyas pastoralism, wildlife and tourism sectors; forestry; water resources; aquatic and marine resources; health; as well as physical and social infrastructure. A key finding of this assessment is that climate change is already ravaging kenya as shown for instance by the increase in the incidence and geographical spread of diseases like malaria as well as more frequent and more intense droughts, and erratic rainfall patterns. These impacts and others portend an increasingly worsening and worrying situation in the future if global and national efforts are not enhanced to reverse atmospheric GHG emissions which accelerate global warming. **8**

96. These effects of climatic change occur at all levels local, regional and global and have the potential to disrupt the earths ecological systems with serious negative consequences on agricultural production, forests, water supply, health systems and overall human development. The recognises these consequences and in article 2 has called on the worlds governments to take action aimed at reducing and stabilising concentrations of GHGS in the atmosphere at a level that would avoid dangerous anthropogenic interference with the climate system. **24**

97. Heightened awareness campaigns to underscore the importance of sustainable use of water resources, e.g. Through the promotion of water harvesting techniques such as harvesting water from roof catchment at household level, developing artificial re-charging of groundwater for threatened aquifers, protecting flood plains through construction of dykes and river dredging, putting in place adequate hydrometric network to monitor river flows and flood warning telemetric systems, and introducing financial instruments such as subsidies to promote technologies that use water efficiently. **54**

98. Physical infrastructure kenyas infrastructure continues to be built based on the assumption that the

climate will remain unchanged in the future. Such an assumption is misguided, considering that climate change is already threatening vital infrastructure such as road and rail networks as well as water and energy systems. Lower annual rainfall in kenya has reduced the power supply capacity of hydroelectric dams while temperature rise and glacial melt is causing sea level rise. Flooding of coastal and adjacent inland areas is exacerbating due to periodic torrential rainfall, thereby posing a risk to maritime, road, rail and air networks. **58**

..National Land Policy

99. Environmental management principles 128. Kenya faces a number of environmental problems including the degradation of natural resources such as forests, wildlife, water, marine and coastal resources as well as soil erosion and the pollution of air, water and land. **39**

100. To address urban environmental problems the following measures shall be implemented a prohibit discharge of untreated solid and liquid waste into rivers, lakes and the ocean by providing appropriate waste management methods;encourage and require waste segregation and labelling for easier management;regulate all quarrying and excavation activities;encourage urban waste re-use and recycling; anddevelop a framework for rehabilitation of dumping sites and land that has been subjected to environmental degradation. 3.4.3.4 environmental assessment and audit as land management tools 141. To promote environmental impact assessment and audit as tools for land management, the government shall implement the following principles a ensure that environmental impact assessments and audits are carried out on all proposed projects, programmes and activities on land that have a likelihood to degrade the environment;monitor urban and rural environmental degradation regularly;encourage public participation in the monitoring and protection of the environment; andinstitute enforcement mechanisms such as the polluter pays principle, and provide incentives to promote cleaner production and prevent pollution of soil, water and air. 3.4.4 sectoral and cross-sectoral land use 142. Effective land management requires coordination and cooperation among different sectors. This policy should be understood and implemented taking into account all related sectors such as agriculture, livestock, water, energy, human settlement, industry, tourism, wildlife, forestry and fisheries. **42**

101. Provide legal and institutional frameworks for restitution; andsupport their resource management systems to ensure sustainability of land and land based resources. 3.6.7 disaster management 200. Kenya experiences disasters that should be managed in order to avoid the loss of human and animal life, the negative impacts on agriculture, the natural environment and the destruction of property. Such disasters include floods, earthquakes and landslides. There are no legal, policy and institutional frameworks for the prevention and management of land-related disasters. There is also a dearth of appropriate technologies and financial resources to deal with these disasters. 201. The government shall a establish legal, policy and institutional frameworks for the prevention and management of land-related disasters; andestablish a suitable legal and administrative framework for resettlement in the event of natural disasters. 3.6.8 refugees and internally displaced persons 3.6.8.1 refugees 202. Kenya hosts a large number of refugees as a result of civil strife in neighbouring countries. 203. Due to the unpredictable nature of refugee influxes, resources such as land, fuel wood, water and pasture are overstretched in already stressed environments. Widespread underdevelopment of infrastructure in the affected areas exacerbates the situation. 204. The location of refugee camps in fragile ecosystems causes systematic ecological degradation. **56**

..National Livestock Policy

102. Early warning and emergency preparedness is necessary for averting impacts of drought, floods and disease related disasters. Currently, the country does not have an integrated information data bank on food and nutrition security. This particular weakness limits efforts of the government and other service providers to identify and profile key characteristics of the vulnerable groups and, hence, mitigates against the ability to facilitate in the design of appropriate interventionist programmes, and the necessary resource mobilization allocation mechanism. To overcome this challenge, the government will strengthen capacity of the existing early warning systems prevalent in various institutions and ensure that the operations of such systems are well coordinated to cover all disaster vulnerable areas adequately. Further, medium and long-term plans for emergency preparedness will also be established. **32**

103. Cross- 3.10.1 land, water and environment land is a key asset and the basis for the development of different enterprises in the agricultural sector, including the livestock industry. Some of the practices employed in the cultivation of crops and raising of the different types of livestock species, including continuous land sub-division, have resulted in land degradation. The depletion of vegetation cover affects water quality and its availability, while exacerbating soil erosion and land degradation. Sustainable livestock development requires guaranteed water availability at all times. However, the limited access to water, for both human and animal use, is a major cause of conflict, especially during the dry season. Further, increased industrial activities, the growth of agro-chemicals use, and domestic waste disposal continue to have a significant negative impact on the environment, thus adversely affecting production of livestock and livestock products. In seeking a solution to these problems, the government will set appropriate policies on optimal land sizes and use. In liaison with the relevant experts in range dynamics, mechanisms for promoting efficient management of water resources will be set up to enhance the provision of adequate and good quality water, for both livestock and human use. To ameliorate negative environmental impacts, the government will liaise with relevant authorities to enforce adherence to the stipulated environmental management assessment guidelines, standards and provisions, as well as encouraging appropriate use and disposal of parricides and other pesticides. **33**

104. In order to adequately address the infrastructural challenges facing the livestock industry, the government in collaboration with other stakeholders, will explore ways and means of ensuring adequate investment in livestock infrastructure to enhance livestock production and marketing. The necessary measures will also be taken to promote public security and minimize conflict in asal areas. **34**

105. Mastitis, scours, zoophytic and tick borne diseases that affect large number of livestock in the country and which need sustained vigilance and surveillance in order to control. In order to address these challenges, the government will take the necessary steps to allocate adequate funds to the relevant departments for the control of notifiable diseases and for compensation of farmers where stamping out programmes are done. Towards this end, the animal diseases act cap 364 will be reviewed to accommodate interventions such as establishment of disease free zones which is the ministry flagship for vision 2030 where financial allocation will be on the basis of the sub sector challenges such as disease burden and compensation for farmer losses . The ministry shall establish a livestock emergency fund to handle livestock related disasters. **23**

106. Due to the limited public sector capacity in the provision of veterinary services, the main focus of animal disease control has been on cattle. To address this limitation, public and stakeholder resources will be harnessed to facilitate expansion of focus to include control of animal diseases and pests affecting other species of livestock. In addition the government will address the sub sector needs to enable it address essential services by availing material and fiscal resources. **24**

107. Kenya has expansive and porous borders with its neighbors; in addition, there is little coordination and collaboration with the neighbors on disease control across the borders, making control of trans-boundary diseases a major challenge. To mitigate against this challenge, the government will seek collaboration with neighboring states to strengthen both national and regional disease surveillance, monitoring and control, as well as providing rapid response to check the effects of disease outbreaks. 3.4.12 it is estimated that livestock reproductive diseases account for substantial economic losses to livestock farmers. Such losses arise from infertility, embryonic deaths and abortions. To address this weakness, the government will enhance the capacity of the VS and encourage more players in the private sector to participate in the management of animal reproductive health. **25**

108. However, in the arid and semi-arid areas, livestock input suppliers are rare and poorly distributed. The prevailing relatively poor infrastructure in such areas increases transportation and storage costs for livestock inputs, placing the prices of livestock inputs beyond the reach of most farmers. Currently, the farmers are meeting all the costs of inputs with the exception of compulsory vaccinations that are administered during major disease outbreaks, where the government meets much of the cost. In order to address the various challenges arising from these shortcomings, the government will work closely with other stakeholders to build the capacity of the private sector, including farmer organizations, to undertake production and distribution of livestock inputs more cost effectively. The government will

also develop the necessary infrastructure to facilitate efficient production, distribution and storage of livestock inputs. To minimize shortages of vaccines supply, will be supported to enhance its efficiency in management and vaccine production for public good. **22**

..National Wetlands Conservation Policy

109. Policy statement 2 promote bio-control mechanisms to mitigate the impacts of vectors causing water borne and water related diseases. **21**

110. Pollution, eutrophication and salinization of wetlands the quality of many water sources in kenya is declining as a result of municipal, agricultural and industrial wastes discharges. These have negatively impacted water quality and biodiversity within the wetland ecosystems thereby reducing their values. Increased nutrient loads have led to eutrophication which leads to algal blooms. In certain areas excessive abstraction of fresh waters, diversions, and catchment degradation, have led to increased salinity. In this regard, the government shall policy statement 1 support and promote enforcement of relevant regulations and laws related to environmental pollution. . Policy statement 2enhance public awareness on proper management of waste including reduction, reuse and recycling will be promoted. **14**

111. Wetlands contribute significantly to the socio-economic development of kenya.theyhowever face diverse and severe threats including unsustainable human activities within the wetland catchment area and in the wetlands, lack of coordinated and holistic policy guidelines, and climate change. The threats have induced changes that have eroded the ecological and socio-economic values and services derived from wetlands. The underlying threat remains lack of recognition of the importance of wetlands and the roles they play in both the national economy and community livelihoods. **13**

..The Environmental Management and Coordination Act

112. Drinking water; ii water for industrial iii water for agricultural purposes; iv water for recreational purposes;water for fisheries and wildlife; and vi for any other prescribed water use;analyse conditions for the discharge of effluents;issue guidelines regulations for preservation of fishing areas, aquatic areas, water sources and reservoirs and other areas, where water may need special protection;recommend measures necessary for the treatment of effluents before being discharged into the sewerage system; and 0 make any recommendation necessary for the and control pollution. Other that may be monitoring of water amendment of section 74 of no. 8 of 1999. **27**

..The Water Act

113. Every person abstracting ground water by means of a well shall, in order to prevent contamination or pollution of the water- **106**

114. Treatlnent waste water ori-sinating from centralized and decentralized systems but shall not include household sanitation faxi ties ; “spring” means water emerging from beneath the surface of the ground other than as a result of drilling or excavation operations ; “state organ” has the meaning assigned in article 260 of the constitution “stream” means the water contained in a watercourse, and includes a river “supply of water in bulk” means a supply of water to a licensee for distribution by or on behalf of the licensee taking the supply; “swamp” means any shallow depression in which water collects either intermittently or permanently and where there is a small depth of surface water or a shallow depth of ground water and a slight range of fluctuation either in the surface level of the water or of the ground water level so as to permit the growth of aquatic vegetation; “transboundary waters” means water resources shared between kenya and another state; “urban water services” means services provided in urban areas as shall be defined by the regulatory board from time to time “use of water”, in relation to a water resource includes, without any limitation to- **14**

115. Water works for bulk distribution and provision of water services; no. 6 of 2012.inter-basin water transfer facilities; andreservoirs for impounding surface run-off and for regulating stream flows to synchronize them with water demand patterns which are of strategic or national importance. **17**

116. - ownership of resources. 6-regulation of the management and use of water 7-rights to water resources.

8-national public water works. 9 - administration of national water resources. 10-national water resource strategy. **3**

117. “reserve”. In relation to a water resource. Means that quantity and quality of water required- **12**

118. Water no.43the use or potential for use of the water resource for inter-basin transfersecological functions of the water resource andvulnerability to degradation or depletion and other related factors. **23**

119. Community level initiatives for the sustainable management of water resources;development of water services in rural areas considered not to be commercially viable for provision of water services by licensees;development of water services in the under-served poor urban areas; andresearch activities in the area of water resources management and water services, sewerage and sanitation. **66**

120. Water a manage the resources of the fund;mobilize additional resources for the fund;formulate and implement principles, regulations and procedures in consultation with the national government and county governments for financing projects, including efficiency and effectiveness of funds;implement measures to ensure the efficient and equitable sharing of the resources of the fund giving priority to resource allocation uni rural and urban areas where access to basic water services is below the national average; and ii rural areas which are vulnerable to the degradation or depletion of water resources;monitor the implementation of projects;maintain and make public available information on the projects financed and impact of such projects;receive grants for onward lending to water services providers, counties, and registered community schemes towards water services and water resources management projects for the underserved areas and urban poor;establish and manage subsidiary funds as may be necessary for sustainable financing towards water services and water resource management; andin collaboration with relevant institutions develop incentive programmes for water resources management including disaster management, climate change adaptation and mitigation. **67**

121. “licence” nearness a licence in force under this act; “licensee” leanne a water sen ice proi,‘ider licensed by the regulatory board under this act’ “limits of supply”, in relation to a $,ater undertaking, means the limits within which the licensee is for the time being authorised to supply water; “management board” means the board of the authority established under section l4; “management of water resources” means the no l2.f 2016 development, augmentation, conservation or protection of a water resource “peri-urban water services” means services provided in peri-urban areas as shall be defined by the regulatory board from time to time; “permit” means a permit for the time being in force under this acyl “person” includes a company, association or other body of persons whether incorporated or unincorporated “pollution”, in relation to a water resource, means any direct or indirect alteration of the physical, thermal. Chemical or biological properties of the water resource so as to make it- **12**

..Vision 2030

122. Other risks include un-anticipated geo-political developments which could include increased international oil prices, negative effects of climate change, and external and internal security risks. The government will implement strategies to mitigate against these risks. **21**

123. The three most critical foundations for drought resilience are security, infrastructure and human capital.competition between communities over natural resources increases insecurity within kenya and across its borders. Insecurity in turn increases vulnerability to drought, by impeding migration, curtailing access to services and resources, destroying assets, and damaging inter-communal relations. Poor infrastructure increases vulnerability to drought by reducing access to markets and basic services and by deterring the investment needed to expand and diversify the economy. Educated and healthy people can draw on greater reserves of capital to withstand shocks such as drought. **56**

124. These include climate-related extreme weather events such as droughts, FL pods and landslides; increased waste generation and unsustainable disposal particularly in urban areas; degradation of water catchments due to human settlement, agricultural activities and encroachments; unsustainable land management practices that threatens the quality of the environment goods and services; increased human wildlife con FL icts affecting conservation and community livelihoods; poaching and trade in wildlife trophies; increased competition and con FL icts of natural resources; inappropriate disposal of

e-waste; over reliance on non-renewable source of energy; and low levels of research and development and funding. Strengthening environmental governance this will entail harmonisation of sectoral policies, legislation, regulations and strengthening of institutions. **98**

125. Sanitation the development of water supplies and water distribution networks has not been matched by a corresponding increase in facilities for sanitary disposal of wastewater. The policy framework for implementing sanitation and hygiene activities in rural and urban areas is provided in the national environmental sanitation and hygiene policy. The policy places emphasis on sanitation components in both rural and urban water supply for all projects. **97**