

I. Interview 01 – Climate Change Disturbances in Residential Neighbourhoods

1. Objective [2]: To understand the current climate change disturbances residential neighbourhoods should adapt to in order to thrive.

	Theme	Main Guiding Questions
A	General/Warm-up/Background	<p>1. What is your role and experience in anything related to climate change and residential neighbourhoods/ housing development or planning? <i>[Aiming to understand area of speciality and general views of interviewer]</i></p>
B	<p>Changes in Temperature <i>[Effects of temperature changes on residential neighbourhoods]</i></p>	<p>2. Are temperatures changing in the context of Eswatini? <i>Elaborate.</i> 3. In your field of work as a specialist, what effects/disturbances have you observed in the functioning, development, management, and/or planning of residential neighbourhoods <u>as a result of changes in temperatures</u>? <i>Elaborate. i.e. effects on drainage systems or any infrastructure or building component caused by overheating or very cold weather</i> 4. How have you previously addressed such challenges? <i>i.e. or how have you seen other specialists addressing the problem?</i> 5. Do you foresee any future disturbances caused by future changes in temperature? <i>Elaborate.</i> <i>[Aiming to understand if residential neighbourhoods in the context of Eswatini should adapt to changes in temperature]</i></p>
C	<p>Rainfall patterns & storms <i>[Effects of flooding on residential neighbourhoods]</i></p>	<p>6. Are rainfall patterns changing in the context of Eswatini? <i>Elaborate.</i> 7. Have you observed any disturbances in the functioning, development, management, and/or planning of any residential neighbourhood (infrastructure & buildings) <u>caused by the gradual change in rainfall</u> and storms patterns as a result of climate change in the context of Eswatini? <i>Elaborate. i.e. you may think of the recent cyclone... what were the effects...? Decrease or increase in rainfall?</i> 8. How have you (or other specialists) previously addressed such effects? 9. Do you foresee any future disturbances caused by future changes in rain patterns? <i>Elaborate.</i> <i>[Aiming to get understanding if residential neighbourhoods in the context of Eswatini should adapt to changes in rainfall patterns]</i></p>

D	Wind patterns [Effects caused by strong winds]	<p>10. Are wind patterns changing in the context of Eswatini? Elaborate.</p> <p>11. Are there any disturbances in the functioning and form/structure of residential neighbourhoods you believe were experienced as a result of changes in wind patterns? Elaborate on the observed disturbances. <i>i.e. you may think of utilities, or any infrastructure/building components that may be affected by strong wind</i></p> <p>12. In those events, how was the functioning of the neighbourhood restored by yourself or others? <i>If there was no restoration, what were the challenges?</i></p> <p>13. Do you foresee any future disturbances caused by future changes in wind patterns? Elaborate.</p> <p>[Aiming to identify if residential neighbourhoods in the context of Eswatini should adapt to changes in rainfall patterns]</p>
E	Conclusion	<p>14. Are there any other climate change disturbances you have observed to be affecting the functioning of residential neighbourhoods in Eswatini? Elaborate if any.</p> <p>15. What key climate change disturbances affecting residential neighbourhoods and their residents do you believe should be addressed urgently? Elaborate.</p> <p>16. What other comments do you have concerning climate change disturbances in residential neighbourhoods?</p> <p>[Aiming to find out if there are other climatic changes which residential neighbourhood should adapt to, which have been left out by the researcher]</p>

1. INTERVIEW 01 - 16/06/2021 [1300HRS - 1340HRS]

	Data	Codes
1	<p>Interviewer: My name is Musawenkosi Ndlangamandla, a PhD Architecture student at the University of Pretoria, conducting a research titled <i>Design and Development Strategies of Residential Neighbourhoods towards Climate Change resilience in Eswatini</i>. You have been selected as a participant based on your exposure on issues concerning climate change, and your knowledge about housing issues. So i'd like to just capture your thoughts regarding climate change disturbances in residential neighbourhoods. To start off, kindly elaborate on your role and experience as a specialist in anything related to residential neighbourhood planning/development and/or climate change.</p> <p>Interviewee: I got involved in the Housing Sector when I joined the Eswatini National Housing Board in 2013/2014. There, my involvement with environmental issues was in 2015 when we were working on institutional housing where I did environmental assessments. So my involvement with climate change issues is from the angle of environmental assessments. That's number one. Then my other involvement was when our housing structures were impacted by extreme weather.. mainly storms, more especially in the Matsapha area (Mobeni). I hope this covers your question. My other involvement at the National level - I represent the National Housing Board in climate change action initiatives.</p> <p>Interviewer: Oh okey, so what is happening there (at National level)? Are you also involved in the development of climate change policies?</p> <p>Interviewee: We are developing climate change mitigation and adaptation strategies in the building sector (housing)...</p>	<p>Housing sector [HS] -1</p> <p>Environmental health specialist [EH] Environmental assessment [EA]</p> <p>Climate change mitigation & adaptation strategies [CCMA]</p>

2	<p>Interviewer: Okay, moving forward, what are your observations on the changes of climate in the context of Eswatini? Is it actually changing? If it is, is it becoming too cold or too hot? What is your observation?</p> <p>Interviewee: Oh that's a difficult one because temperature changes over a long period of time. It is difficult to observe within a decade... you see what I mean? But my general observation is that temperatures are becoming more extreme. If it's hot, it's extremely hot, and if it's cold, it's extremely cold. Winters are becoming a little bit warmer. I don't know who I was speaking with to say the winter we are experiencing this year, I last experienced it when I was at primary school. I would say it is becoming extreme, just like it was extremely cold this past few weeks, when it gets warmer, it's again extreme.</p>	<p>Extreme temperatures [ET]</p>
3	<p>Interviewer: So since you believe temperatures are changing, have you observed any effects in the functioning or management or any kind of disturbances depending on your speciality, as a result of changes in climate?</p> <p>Interviewee: Not really. There are no changes I have observed in the functioning of residential neighbourhoods caused by temperature changes.</p> <p>Interviewer: Okay, so what would happen in future, as you mentioned that temperatures are becoming extreme.. What will happen in say 50 years to come if this trend does not change? Like if temperatures reach 40deg today, in future they might reach 60deg. Is that not going to affect housing and infrastructure?</p> <p>Interviewee: It will surely affect infrastructure and housing. You will recall that materials are composed of chemicals, so they would react to extreme heat, the best way they know how. I don't know if I am making sense?</p>	<p>Effect on material [EFM]</p>

	<p>Interviewer: Yah, ofcourse.</p> <p>Interviewee: Like, if we were building in water, the water would expand. So, I know the materials we are using would react the best way they know how. <i>[Assumption]</i></p> <p>Interviewer: So it means there is an effect on materials caused by extreme temperatures even now but we may not be observing them?</p> <p>Interviewee: Yes. Materials will require a certain temperature to visibly expand for instance.</p>	
4	<p>Interviewer: So since you do foresee future disturbances caused by change in temperature, how do you believe these should be addressed? Like, you made an example of materials that would probably expand... so how should this be addressed?</p> <p>Interviewee: That would be exploring alternative technologies that would adapt to changes in temperatures. <i>[Not specific]</i></p>	Adaptive technologies [AT]
5	<p>Interviewer: Moving on to issues of rainfall, as we are talking about climate, rainfall is another component that we need to discuss. How are rainfall patterns changing in the context of Eswatini?</p> <p>Interviewee: Yes they are changing and getting erratic and extreme. When it doesn't rain, it just doesn't rain for long periods. When it rains, it rains heavily and causes damage from storms and flooding.</p>	Erratic [ER] Extreme rainfall [EXR]
6	<p>Interviewer: How does the erratic rainfalls affect residential neighbourhoods?</p>	

	<p>Interviewee: At the initial stages of the project we never project what would happen in future. The Building Act allows for construction about 33m away from the river. Now when there is flooding, this 33m gets smaller, a house initially built about 33m away from the river will be eventually washed away.</p>	Washing away of houses [WAH]
7	<p>Interviewer: The recent cyclone that affected the country is actually a good example of what you are saying. How often are the extreme rainfall events and effects occurring?</p> <p>Interviewee: Now it's 2021 right? In 2019 if I am not mistaken, Mbabane was affected by hailstorm. There was a heavy downfall which affected the Mbabane Mall, Mbabane Spar...it also happened even with the recent Cyclone eloise. I am not sure if it was around 2006 when the Mbabane river started flooding.</p>	Frequent [FR]
8	<p>Interviewer: That's a good observation. So it means they are getting more frequent. So, how have you or other experts addressed the effects of changing rainfall?</p> <p>Interviewee: I am not sure how other experts have addressed it, but as for me.. I am just a tiny drop in the ocean, but through my involvement in the national climate change initiatives, and other town planners, and other policy makers, there are initiatives being crafted to address such issues. I have contributed to the development of Woodlands extension 2, where there is a wetland. I believe I advised well that the plots around the wetland be left undeveloped, and not sold to anyone. Yes, it was expensive.. I think there were about 10 plots which were left out. That way I was increasing the banks of the wetland since once it rains, the wetland becomes alive.</p> <p>Interviewer: If I am right, the organisation you are working for owns property. Has this property been affected before by changes in rainfall?</p>	<p>Policy [POL]</p> <p>Building off wetlands [BOW]</p>

	<p>Interviewee: Not really, but ofcourse it has tested the integrity of the structures.</p>	
9	<p>Interviewer: Are wind patterns changing in the context of Eswatini? What are your observations there?</p> <p>Interviewee: I do not believe the patterns are changing, but instead they are becoming stronger and more extreme. The direction and the path are still the same.</p>	Stronger winds [SW]
10	<p>Interviewer: Are there any disturbances caused by winds in the context of Eswatini ...say in the properties owned by the organisation you are working for?</p> <p>Interviewee: A lot especially in Matsapha (Mobeni), mostly by the wind corridor claimed to be coming from Mankayane, Matsapha through Manzini, towards Sikhuphe area and eventually I think it's blocked by the Lubombo plateau.</p>	
11	<p>Interviewer: How often have the disturbances of these winds been occurring?</p> <p>Interviewee: Very often until we changed the roofings by building parapet walls to hide the roof sheets. Otherwise it was almost certain that between September and November, Matsapha (Mobeni) roofs would be blown away.</p>	<p>Blow away roof coverings [BLR]</p> <p>Parapet walls [PPW]</p>
12	<p>Interviewer: Okay. I think you have already mentioned how you have restored the functioning of the flats. Do you foresee any future disturbances caused by wind changes?</p> <p>Interviewee: I do mainly from the wind pressure.</p>	Future wind pressure

13	<p>Interviewer: Are there any other climate change effects you have observed which affects residential neighbourhoods..looking at your involvement in addressing climate change issues...?</p> <p>Interviewee: It's difficult to isolate climate change to one sector. So, I am aware it affects public roads as well, and when I grew up I used to know that Malaria spreads mainly in the lowveld, but due to the temperature changes they may make other areas like the Middleveld and Highveld to be more conducive to the spread of Malaria. Diseases will spread more easily and that will affect communities. I have also observed climate change effects on food security. On Swazi Nation Land you may be allocated a flood prone area for building and also farming, and this will indirectly affect our livelihoods and further escalate poverty levels.</p>	<p>Effects on roads [EFR]</p> <p>Spread of Diseases [SD]</p> <p>Food security [FS]</p> <p>Poverty [PV]</p>
14	<p>Interviewer: What are the key climate change disturbances to residential neighbourhoods do you believe should be addressed urgently?</p> <p>Interviewee: Flooding leaves more destruction.</p>	
15	<p>Interviewer: Any future climate change disturbances which you foresee?</p> <p>Interviewee: Just what we have discussed and impacts of wind pressure on infrastructure and housing as well as impacts of heavy rainfall which causes flooding.</p>	
16	<p>Interviewer: Do you have any other comments concerning climate change disturbances on residential neighbourhoods:</p> <p>Interviewee: Residential neighbourhoods are heavily regulated in Eswatini. When for instance you want to build a house, you have to get a contractor from the construction industry which is heavily regulated, so the</p>	<p><i>Heavy regulations [HR]</i></p>

	<p>contractor will pass on the subscription fees, and levy fees to the client for instance.. Now if you come and say you want to mitigate climate change issues, maybe through engineering methods, you need to be prepared to pay to be able to do that. Climate change is still taken as a myth. People don't understand why they should design for flooding if it has never occurred before.</p> <p>Interviewer: True. I wonder how this can be solved if it escalates construction fees..</p> <p>Interviewee: It's quite difficult with the heavily regulated industry. Now another comment is the land tenure which is a political issue. Rural areas are not regulated. In rural areas you don't need to conduct an environmental assessment, you don't need to take your plans for approval to local municipalities,</p> <p>Interviewer: So that means even if climate change issues are incorporated in the building regulations, they may not reach rural areas.</p> <p>Interviewee: Yes, yes, just like all the other regulations. Issues of land come with power, so they are difficult to resolve.</p> <p>Interviewer: Good observations. This is going to be very helpful for the study. Thank you very much for setting aside time to participate in this interview. The findings of the study will be shared with you later on.</p> <p>Interviewee: You are welcome. All the best with your dissertation.</p>	<p><i>Myth on climate change [MYT]</i></p> <p><i>Limitation of assessments [LIM]</i></p>
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2. INTERVIEW 02 - 16/06/2021 [1400HRS - 1430HRS]

#	DATA	CODES
1	<p>Interviewer: I am Musawenkosi Ndlangamandla, doing a PhD Architecture at the University of Pretoria. My topic is <i>Design and Development Strategies of Residential Neighbourhoods towards Climate Change Resilience in Eswatini</i>. The aim of the interview is to get your opinion about the changes in climate and establish which climate change disturbances Eswatini should adapt to. My questions are very open so you are free to express yourself for me to get a full understanding of your response. To start off, please elaborate on your role as an expert in anything related to climate change and/or residential neighbourhoods.</p> <p>Interviewee: I am currently with the department of Meteorology. I am a meteorologist by training. I am currently looking at issues concerning climate monitoring. My duties include, amongst others, monitoring and reporting on extreme climate, making climate summaries, annual climate summaries, and things like that. Some of this information is available online at the Eswatini Met website.</p>	<p>Meteorologist [MET] Climate Monitoring [CM]</p>
2	<p>Interviewer: Clearly you do have knowledge on climate change issues. Are average temperatures changing in the context of Eswatini?</p> <p>Interviewee: There is actually one report which is available online, it speaks about the general climate in Eswatini, and looks at the performance last year in terms of climate drivers, climate performance.. but there are also trends which I will just read through to you from this document.. I will start with the rainfall patterns. The trend shows a slight decline in the amount of rainfall. If you break the trends into decades you can see that the rainfall has been dropping from 1981 to 1990, and there was a slight increase from 1991 to 2000, and from 2001 to 2010 followed by a decline again from 2011 to 2020. But the overall trend is a slight decline in rainfall. When it comes to temperatures, we see a slight increase.</p> <p>Interviewer: So in short you are saying in future we foresee a decline in rainfall and increase in temperature?</p>	<p>Erratic rainfall [ER] Decline rainfall [DCL] Extreme temperatures [ET]</p>

	<p>Interviewee: Most of the climate models don't show clearly what will happen, especially with rainfall. Working out the averages does not give a clear picture on the trend but what is clear is that we will have <u>an increase in the number of extreme precipitation events</u> and also longer dry weather. For temperatures we foresee a slight increase in maximum temperatures and longer dry weather. Lower temperatures are showing us the nights are becoming cooler. In the 40 year period analysed, it shows us that the minimum temperatures are also increasing. So there is a slight increase in the maximum and minimum temperatures.</p>	<p>Extreme Rainfall Events [EXE]</p> <p>Long Dry Weather [DW]</p>
3	<p>Interviewer: Are the mentioned changes affecting residential neighbourhoods?</p> <p>Interviewee: Obviously, infact the impacts of climate change will affect a large spectrum of industries especially looking at the extreme climate. Ofcourse the built environment might have to look at issues of cooling since we might have an increase in the number of heat waves, so we need to look at how our buildings will be retrofitted going forward. When we also look and the extreme rainfall and storms we might also look at how to address buildings to adapt to strong wind. We have to look at the strength of structures. So yah, the built environment will be affected.</p>	<p>Overheating [OH]</p> <p>Strong Winds [SW] Q9</p>
4	<p>Interviewer: How else do you believe we should address these challenges? I hear that you are mentioning cooling..</p> <p>Interviewee: Well climate smart buildings are the way to go. When talking about smart buildings I mean when we construct the buildings we should look at the winds of the area, how windows should capture... you get where I am going? Things like that. You need to have climate data before developing buildings and infrastructure. From the planning stages you need to have climate data of the area you are designing for to be able to come up with climate resilient buildings.</p>	<p>Climate smart buildings [CSB]</p> <p>Climate Data [CD]</p>

	<p>Interviewer: What is your take on the costs of developing smart buildings?</p> <p>Interviewee: In the past we used to design these grass huts, where in summer its cool and in winter it's warmer inside. We need to look at how we need to incorporate these indigenous ways of constructing going forward. There are very affordable ways of constructing resilient buildings. Information about this is readily available.</p> <p>Interviewer: True. We tend to ignore the climate data when planning. For instance in Eswatini you can submit drawings to Municipalities for scrutiny and they will pass even when climate issues have been ignored in the design of the building.</p> <p>Interviewee: Ofcourse. We are building on flood plains in Eswatini, yet we have information that tropical cyclones will be intense so we expect an increase in flooding. We also build on wetlands and such areas.. We have to look into such issues.</p>	
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9	<p>Interviewer: You have already addressed questions I have on temperature and rainfall issues. What about wind? Are wind patterns changing or expected to change?</p>	Strong winds [SW]

	Interviewee: We have not been monitoring wind for a long time to be able to determine trends. But since we are already saying we are expecting an increase in high pressure storms, winds are going to be a factor going forward.	
10	Interviewer: So are the wind patterns going to affect buildings? Interviewee: I wouldn't say wind patterns as such, but wind pressure looking at the expected increase in thunderstorms.	
11	-	
12	Addressed in #9	
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14	-	
15	Interviewer: Are there any other expected climate changes apart from those related to winds, rainfall and temperature? Interviewee: The focus is just on the three since they are the ones which will bring more disturbances.	Discussed [Wind, Rainfall & Temperature]
16	Interviewer: Do you have any other comments concerning climate change and impacts to residential buildings? Interviewee: It's quite an interesting topic. We have people dealing with climate change issues in the department who can also share vital information for your research. Interviewer: Thank you very much for your time, and for sharing such useful information.	

	Interviewee: You are welcome. All the best with your research.	
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3. INTERVIEW 03 - 17/06/2021 [1000HRS - 1145HRS]

#	DATA	CODES
1	<p>Interviewer: My name is Musawenkosi Ndlangamandla a PhD Architecture student at the University of Pretoria. I am doing research with an objective of developing design strategies of residential neighbourhoods towards climate change resilience in the context of Eswatini. At the moment I want to establish the current and future climate change disturbances which residential neighbourhoods should adapt to. First of all I'd like to find out about your involvement in anything related to climate change and residential neighbourhoods.</p> <p>Interviewee: I am an employee at the Ministry of Housing and Urban Development. My background training is in Environmental Health and Public Health. We are mostly known as Health inspectors in government. At the Ministry of Housing I am looking into issues involving public health and environment in which climate change issues are also highlighted. I am also participating in stakeholder engagements for climate change. Like recently we were with planners, Ministry of Tourism and Environmental affairs and Meteorological Services in a project addressing global greenhouse gases. In the Ministry we do have engineer's looking at scrutiny of building plans, we also have physical planners who also look into ecological designs. I can say I am the go-between these experts, but I do participate in climate change related issues at the National level. We have also participated in Environmental Authority projects involving waste management, issues of renewable energy and retrofitting were being discussed as well. Recently we were looking at emission reduction under the environment, looking at carbon footprints. Mainly that. I am not a specialist in climate change but I have the application.. I am a generalist.</p> <p>Interviewer: Thank you for that. Based on your involvement, does climate change affect residential neighbourhoods?</p>	<p>Housing Sector [HS] -2</p> <p>Environmental Health [EH]</p> <p>National Level Engagement [NLE]</p>

	<p>Interviewee: Yes they have, because impacts in energy consumption align with the changes occurring, now we have extremes.. sometimes it becomes too cold or rainfall events are intense, such that if residential neighbourhoods are not properly designed, they are unable to cope. More resources are required to mitigate some of the impacts like floods. Sometimes it becomes too cold in houses, such as those designed for Lubombo weather where it is known that it is always hot. Now you can imagine if you have designed your house for such places, now the houses need to consume more energy. Also in our neighbourhoods, we give building and guidance in terms of the Building Regulations of 1968. But people are not properly guided on the kind of buildings that should be built for a particular area. Currently the client has power to guide on what they want their houses to be designed. There are some layouts of cities which resemble certain patterns, just like the capital city of Angola. <i>The city form follows a flower pattern. We can also create special neighbourhood forms which will suit the context and guide the construction in such a way that impacts from changes in climate are minimised.</i></p> <p>There is also a problem where you find that features in the neighbourhood are not complementing each other. Look at the roads into the city of Mbabane... they were designed in times when the climate had lesser rains. Now that the intensity of rains have increased, all the runoffs are led into the city centre. By now we all know that when it heavily rains, superspar and the mall will certainly be flooded. So these are the things which show us that we did not provide for climate changes and they are affecting the neighbourhoods.</p>	<p>Design according to landscape characteristics [DLC]</p> <p>Flooding [FL] - due to poor spatial planning</p>
2	<p>Interviewer: You have already touched a lot to respond to my questions. Are average temperatures changing based on your observations?</p> <p>Interviewee: Yes they are. Initially global targets were recommending that we try by all means to reduce temperatures by 1deg, I am not sure if the target year was 2030 or what. <i>But now glaciers are observed to be melting, and the kind of snow observed is no longer the same as the previous one - before it was more</i></p>	<p>Increased temperatures [IT]</p>

	solid ice, but now due to increased temperatures, it is softer. So I do believe temperatures are increasing and it's global.	
3	<p>Interviewer: How do temperature changes affect residential neighbourhoods?</p> <p>Interviewee: People have been exposed to diseases which they wouldn't have been exposed to if temperatures were not changing, since some diseases are driven by temperature conditions. For instance, the case of Malaria, known to be dominant in tropical climates or very hot areas, will eventually shift to other areas as temperature increases globally because mosquitoes will be breeding easily. Even here we may start to witness diseases which were known to be existing in Northern Africa where it's very hot. Or we start seeing certain species which will now be able to thrive in the changed temperatures. Let me give an example... Your assumption when you design a neighbourhood for the highveld is that snakes are very rare, but now as temperatures are changing we are starting to see snakes around our homesteads. The other one is consumption. Nowadays we always consider installing air conditioners in our homes, yet these components consume a lot of energy. We also decide to use big windows, and we have a decision to make between using artificial ventilation or natural ventilation, and that comes at a cost. There are high costs from municipalities that find themselves dealing with these high demands. Some consumption patterns means you are buying more material, that means more waste, that means more consumption of electricity and water demands. When it's very hot you will bathe many times per day for instance, to cool down. Productivity also declines in the increase of temperature. In cooler weather, it's when productivity increases because people work more outside without being affected by the intensity of the heat. You may notice that now working hours have changed especially in the lowveld. People work in the early morning hours and break early.</p>	<p>Spread of diseases [SD]</p> <p>Invading species [IS]</p> <p>Increased energy consumption [IEC]</p> <p>Increased water consumption [IWC]</p> <p>Productivity Decline [PD]</p>
4	Interviewer: How can these effects be addressed?	Reduced consumption

	<p>Interviewee: We need to understand our contribution to climate change impacts. Where we consume more, we need to reduce the consumption patterns. We also need to choose climate smart materials, like if we still produce our electricity using fossil fuel like coal, we should alternatively prefer renewable sources like the sun as a source. The emissions from using fossil fuels affect the ozone layer.</p>	<p>[RC]</p> <p>Climate smart buildings [CSB] - materials</p>
5	<p>Interviewer: Okay, thank you. Moving to rainfall issues. Do you believe rainfall patterns are changing in the context of Eswatini?</p> <p>Interviewee: Yes they are changing. Evidence to that, you may remember that rains used to start in August which we used to say its rain preparing soil for the ploughing season. Around September we would prepare or start planting. But this has all changed. Now if you plough before november, you run the risk of losing your crops, because the intensity of the sun in November and December might damage your crops. Infact, your crops will be affected by the absence of rain during that time or intense rain that comes with thunderstorms. Those are the two scenarios about rain, and another thing, rains take quite some time to stop raining. If you used to think that rains would stop in February, now its different and that affects harvesting time. All these, indicate that rainfall patterns are changing. Rain is now either absent or very heavy.. or even a mixture of the two. The patterns are unpredictable. Another example... right now its mid winter, but water levels in our dams are very high, yet previously during this time dams would be empty.</p>	<p>Erratic rainfall [ER]</p> <p>Extreme rainfall events [Ex]</p>
6	<p>Interviewer: That's a good observation. How do these changes affect residential neighbourhoods?</p> <p>Interviewee: During heavy rains, the bearing capacity of structures is eroded. Roads are eroded, bridges are swept away by floods, soil just normally fails when it's soaked with too much water such that some structures are destroyed, such as those from stick and mud, some wooden structures, grass structures (maily shacks), such that their wooden trusses require reinforcement. So those are the effects of flooding. Now, in the absence of rain, soils known to hold water are affected, like cracking of clay soils. If you do agriculture in</p>	<p>Flooding [FL]</p> <p>Weaken Structural stability [SS]</p> <p>Effects on roads [EFR]</p>

	<p>such land, your crops are definitely affected. So those are the extremes. Also there is shortage in fresh water supplies in the absence of rain, and we end up exploring boreholes as alternatives where you sometimes find that the yield is not okay, or the quality of the water is not suitable for consumption.</p>	<p>Swept Bridges [SB]</p> <p>Soil failure [SF] Effects on material [EFM]</p> <p>Pollution of Water [PLW]</p>
7	<p>Interviewer: If those effects are not addressed, do you foresee any future disturbances caused by changes in rainfall patterns in Eswatini?</p> <p>Interviewee: Obviously we do, since even the demand is increasing. People are used to paying for everything without looking where its coming from (environment). In the absence of water they look for someone to pay for delivery of water. This will have to change or life will be very expensive. For example, during the times of drought in Eswatini, water was being rationed, and many would have suffered if there was no bottled water in shops. The imported water was helpful during that time, because in the shortage of water supply, what is normally urgent is the water for consumption.</p>	<p>Increased water demand [IWD]</p>
8	<p>Interviewer: How can this be addressed? Or we will have to live by importing water in times of drought?</p> <p>Interviewee: That can be addressed by changing housing design - adopting water harvesting systems, wastewater reuse, and preparing ground water supplies for future consumption. We have very few services providing ground water supply installations and exploration. We are currently unable to use groundwater since it's dirty, or salty. Otherwise there are areas where people are able to use groundwater, where they live. Otherwise we need to reuse waste water in gardens and to irrigate our lawn.</p>	<p>Water harvesting systems [WHS]</p> <p>Wastewater reuse [WWR] Groundwater supplies [GWS]</p>

	<p>Interviewer: What are your thoughts about the high costs of installing boreholes to ensure the use of groundwater? Such services are inaccessible to rural areas mostly.</p> <p>Interviewee: When building say a two bedroom house, you can have an extra structure which will act as a water tank for harvesting rainwater. You know water that can fill a room would be about 60cubic meters, and that amount of water can probably last you for a whole year, mostly since you might only use this water in winter seasons, or just for irrigation. There are projects which were initiated in the Lubombo region where tanks were created using reinforced concrete, that can help in harvesting water. Another thing that needs to be done by authorities and supply services, is that they should reduce leakages. Companies like water service corporations will tell you that 30% of their water supplies are unaccounted for because of leakages. This is because the new and old systems have been combined. The older pipes used asbestos, and when they cracked, pvc pipes would be used to patch these pipes and that causes the leakages. When you observe EWSC valves, you normally find them leaking. So if that water can be saved, that would also save the wasted energy for pumping which is charged to the consumer.</p>	<p>Reduce water leakages [RWL]</p>
9	<p>Interviewer: Are wind patterns changing in the context of Eswatini?</p> <p>Interviewee: Obviously if the climate is changing, wind patterns would change. For instance, the rain we receive is mainly because of winds from the oceans coming towards the country. Sometimes when there is no rain, we may only experience wind only. There are areas where windstorms were not experienced that much. For instance, at Mobeni, Matsapha, the structures were built about 30 years ago, but in the past 3 to 5 years, those structures have been affected by wind more than two times. This means the wind patterns are also changing. If you notice, now the kind of wind pulls out stable trees with their roots, so obviously they are changing.</p> <p>Interviewer: Is it really the patterns or the wind pressure that is changing?</p>	<p>Wind patterns [WP]</p> <p>Wind pressure [WPR]</p>

	Interviewee: What we notice is the intensity of the wind. We used to experience wind in the past but the intensity has increased now. Also the episodes... like we used to know that in December and January, we experience hailstorms but now it comes with strong winds. We used to expect wind in July - August, but now you can't predict it,	
10	<p>Interviewer: How do the changes in winds affect residential neighbourhoods?</p> <p>Interviewee: First of all it disrupts services, with trees falling on roads and destroying infrastructure. Buildings are destroyed, and people are forced to rebuild their houses. When these structures have been impacted by wind, some people would have to relocate to stay in places of safety. Government is forced to increase funds for addressing disasters for those people. Some of these people would have to relocate permanently to other newly established houses built from those funds. Some people are forced to rebuild their houses, because when the winds blow away the roofs, the walls crack and you are forced to rebuild. Some schools for instance, you find that they are built by communities who compromise the standards. That's why some schools are rebuilt because the winds affect even the walls which are unstable and weakened by the wind. It comes at a cost to fix these infrastructure.</p>	<p>Disruption of services [EFS] Destroy houses [DH]</p> <p>Blow away roof coverings [BAR] Cracked walls [CRW]</p>
11	see #11 below	
12	<p>Interviewer: So you are confirming that in future we are seeing more damages caused by changes in winds if they are not addressed?</p> <p>Interviewee: Ofcourse we are seeing more damages, unless we retrofit or redesign or we try to mitigate the effects of climate change. Some people do realise that the way we build is no longer suitable for the kind of climate we are now experiencing. They need to build stronger houses, and need to build stronger roofing.</p>	<p>Increased damages [ID]</p> <p>Retrofitting [RET] Redesign [RED]</p>

	Some who have been using concrete tiles are no longer interested in them since when there is hail storms they are easily affected.	
13	see #15	
14		
15	<p>Interviewer: Are there any other expected changes in climate apart from those discussed already which may affect residential neighbourhoods?</p> <p>Interviewee: I think under temperature and winds, other impacts are from fire. As temperature increases, grass can now burn easily during the day. So fire risks are increasing. When its windy, wild fire easily spreads and can affect residential neighbourhoods. Possibly something else changing are the ecosystems. For instance, there are places where some species of plants were not growing, and you find that some invasive species are now growing because the conditions are becoming more conducive. When you build and used to know that your structure is not affected by certain insects in that area or certain plants, now you find that at the edge of your house apron there is growth of those plants and that affect your building. The soil composition is changing as well as a result of changes in climate. Some areas are becoming more arable and some are more affected.</p>	<p>Wildfire [WF]</p> <p>Ecosystem changes [ECC]</p>
16	<p>Interviewer: Do you have any other comments about the study?</p> <p>Interviewee: The study is going to be useful. What affects us is that as developing countries, infact in Eswatini the problem is that we are a small country with low population, so when you are in between the big brothers, Mozambique and South Africa with large surface areas, you tend to assume that you are not contributing to the impacts. The impacts are assumed to be coming from these neighbouring countries,</p>	

	<p>forgetting that the electricity we are using comes from South Africa. And that you are also responsible for the impacts. So such a research is useful as an eye opener especially to policy decision makers to be aware that we also make contributions to the impacts. Our contribution as a country will also make a positive impact. A lot of these things won't be noticeable until someone documents them. We are also able to inform our targets by knowing what is happening. When it comes to houses, we will be able to know the impacts to infrastructure and what we can do with our neighbourhoods. Especially on issues of efficient buildings and looking at alternative construction methods that can mitigate climate change impacts. We tend to assume that the priority of the country is only Agriculture ignoring that even in agriculture we use infrastructure and shelter, especially now that we practise agriculture under shelter because of the changes in climate. Now you cannot do agriculture in the open because you won't harvest anything. The workers themselves need shelter which should adapt to changes in climate.</p>	
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Interviewer: Well thank you very much. The information shared will be very helpful for the study.

Interviewee: You are welcome.

4. INTERVIEW 04 - 22/06/2021 [0900HRS - 0945HRS]

#	DATA	CODES
1	<p>Interviewer: Good morning. I had already introduced myself and the study previously, but I can still mention that I am Musawenkosi Ndlangamandla, a PhD Architecture student at the University of Pretoria. I am doing a study titled, <i>Design and Development Strategies of Residential Neighbourhoods for Climate Change Resilience</i>. I am currently collecting data through interviews with the purpose of establishing the current climate change disturbances which residential neighbourhoods should adapt to. May I firstly ask about your role and experience in anything related to climate change and/or residential neighbourhood planning.</p> <p>Interviewee: I am a city planner here at the city council. My role is basically the planning side of land here. We use the Mbabane Town Planning Scheme as a regulatory document that guides us on issues of planning, neighbourhood planning, what must happen where and how. We don't really plan for climate change however, we do expose ourselves to issues of climate change and try to incorporate these in our work.</p> <p>Interviewer: Thank you. Do you believe climate change has effects on residential neighbourhoods? When talking about residential neighbourhoods in this research, we are talking about the housing component and also the infrastructure.</p> <p>Interviewee: Yes definitely, when you look at Mbabane for example, Mbabane is a very steep city. The terrain requires us to plan for climate change. The changes in weather patterns have resulted in flooding in Mbabane so we should be planning for that. So our infrastructure should be responding to such changes in our climate patterns and what our scheme talks about really is stormwater management. The design</p>	<p>City planning [CP]</p> <p>Flooding [FL]</p>

	<p>and houses must include an approach on how the developer will manage water coming from that particular development. So our biggest issue is really stormwater management when it comes to neighbourhood planning and design of houses. We have wetlands also, that are located within residential areas, that's another way of us trying to... certain issues by trying to maintain and managing our wetlands, and keeping them clean or any invasive species so that they are effective when it comes to heavy rainfall.</p>	
2	<p>Interviewer: Based on your observations, are average temperatures changing in the context of Eswatini?</p> <p>Interviewee: This is something we don't really monitor in terms of planning, but what we do check is patterns of effects of rainfall in our neighbourhoods, we don't really check those weather patterns for temperatures. Yah.</p>	
3	<p>Interviewer: We are aware that global temperatures are generally increasing, even though it's not something you are not analysing in the Municipality as earlier mentioned. Just your general thoughts will be helpful. Do you think there are or there will be future disturbances caused by the continuously increasing temperatures in residential neighbourhoods?</p> <p>Interviewee: Yes, we do believe that our neighbourhoods will be affected. That is why we are developing policies that will address that. For instance we have new townships that are emerging but developers never consider planting trees for example, which is one natural response to the increase in temperature. There are those issues that the natural side of things or the environmental side of these are not really looked into and us having certain responses in terms of policy will assist us and in the long run. And then with the architecture as well, we are hoping that atleast our architects, when they do design their concepts, also respond to climate change. However we would not regulate what they do, it depends on us as a local</p>	<p>Planting trees [PT]</p> <p>Policy response [POL]</p>

	authority in ensuring that we make sure that when architectural concepts or designs are submitted to us, they speak to response to climate change.	
4	<p>Interviewer: You have already mentioned how these effects caused by temperatures can be addressed as you have mentioned issues of policies. Is there any other way of addressing such challenges?</p> <p>Interviewee: We need to speak about these issues in different forums. Like right now we have AESAP, that council which registers professional consultants. Such issues must be discussed in these platforms to encourage more creativity when it comes to designing houses and neighbourhoods.</p>	Regulatory body forums [RBF]
5	<p>Interviewer: If issues of temperatures are not addressed, do you foresee any future disturbances caused by increase in temperature?</p> <p>Interviewee: Definitely, we do foresee more flooding, we do foresee a city where we are not able to control pollution and increasing temperatures, especially because the more we cut trees the more we are unable to protect ourselves from the impact of the increase in temperatures. So we will definitely be affected. The capital city also must deal with population increase and increase in vehicles, and all pollution. So if we do not mitigate now, we are definitely going to be affected.</p>	
6	<p>Interviewer: Okey, okey, maybe shifting to rainfall then, do you believe rainfall patterns are changing?</p> <p>Interviewee: Definitely, I do believe they are changing, and I have seen the impacts here in Mbabane as well.</p>	

7	<p>Interviewer: Are there any disturbances you have observed in the functioning of residential neighbourhoods caused by changes in rainfall patterns?</p> <p>Interviewee: We had to deal with issues of flooding, that's the big impact we had to deal with.</p> <p>Interviewer: How does the flooding affect residential neighbourhoods?</p> <p>Interviewee: Flooding relates to our drains. When there is flooding, water goes into people's houses. If people do not have mitigation measures in place when constructing their houses, they are affected. These are the houses in lower lying areas. Otherwise peak areas don't get the same effects. There have been reports of landslides however, in these areas, where people have not constructed properly retaining walls. There have been those effects caused by rainfall.</p>	<p>Flooding [FL]</p> <p>Landslides [LS]</p>
8	<p>Interviewer: How can these effects be addressed?</p> <p>Interviewee: What we don't normally do when designing our neighbourhoods is studying rainfall patterns. That's number one. Two, we don't really look into flood plains. So when you are to construct a house within a flood area, you need to do certain studies to understand how the design of the house should be in the case there is a flood. So such are not included in the submission of plans. As a local authority, maybe it would be looking deeper into those issues to know where to invest more when it comes to stormwater management to minimise the impacts. Yah, that's it.</p> <p>Interviewer: What are your thoughts about the building regulations? Are they addressing issues of climate change? Or you can get away without addressing such issues when submitting a building plan?</p>	<p>Local climate data [CD]</p>

	<p>Interviewee: No they don't. It comes back to our town planning scheme. It does not address or speak into issues of climate change. But as we grow and with experience we realise that we need to be including these issues of climate changes. So we are looking at developing policies to then feed into our legislation. Our legislation is very difficult to change. Our building act is from 1969, and it's currently being reviewed. What I am not sure is if issues of climate change have been included in this review, and if they have not, we need to start speaking to this review so that it includes and speaks to the design, the architectural design, even on the size of the windows on certain areas bringing sunlight and using less electricity would be a great way of incorporating mitigation measures or whatever relates to climate change.</p> <p>Interviewer: So we are still using the 1968 regulations you say?</p> <p>Interviewee: Yes we are using the 1968 regulations. The current one is still under review, and it has been 5 years now, and we are not sure when this exercise will be completed. This is handled by the Ministry of Housing and Urban Development.</p>	Policy Review [POL]
9	<p>Interviewer: Do you foresee any future disturbances in residential neighbourhoods caused by changes in rainfall if these issues are not addressed?</p> <p>Interviewee: Yes. Definitely. The storms we had in January was actually a sign of how bad situations can be in Mbabane, following the flooding that took place from the rains, we realised that there were areas that were neglected before located near flood lines. There was a lot of work that was done to try and minimise effects. There were areas that shouldn't have been affected but they were. That's one issue we are looking at.</p>	Increased flooding events [IFE]
10	<p>Interviewer: Moving to issues of winds as they also relate to climate changes, based on your observations, are wind patterns changing in the context of Eswatini?</p>	

	<p>Interviewee: <u>I think so</u>, in certain parts of the country. We did have reports of houses falling and roofs flying off due to the high winds. However, we do not experience the same amount here (Mbabane) as they do in other areas. Reports we received within Mbabane of houses falling and roofs blown off are mainly in informal areas, where they use temporary building materials to construct their houses. But when it comes to the areas which are more formal and more indepth architecture was used, we have not heard any reports from those areas.</p> <p>Interviewer: So you are saying the more formal neighbourhoods are more stable compared to the informal settlements?</p> <p>Interviewee: Definitely, they are more stable, they are more resilient. So in our informal settlements we have a program that is going on upgrading of these areas inorder for those informal settlements to have cadestria, so that they have plots and are given titled deeds, so they can qualify to construct houses in the requirements of the council. So now they are more informal, so we are not able to give them permission to construct permanent structures</p>	<p>Blow away roof coverings [BAR]</p> <p>Falling houses [FH]</p> <p>Effects on informal settlements [EFI]</p>
11	See #10	
12	<p>Interviewer: I think you have already answered my next question which required your views on disturbances caused by winds. How can these disturbances caused by changes in winds be addressed?</p> <p>Interviewee: I believe it comes back to the construction of houses. If houses can be constructed to be more resilient, that is really the only solution to respond to the natural causes.</p>	<p>Resilient houses [RSH]</p>

	<p>Interviewer: What about the informal settlements? So it means for now you have no control of them until they are formalised?</p> <p>Interviewee: Right now we give them temporal permits, to only use temporal materials to construct, such as stick and mud materials to construct. The current ongoing programme states that these people may need to move, and therefore we cannot give them permanent permits to construct permanent structures. Permanent structures must follow building act regulations and rules. One, you must have a title deed, two you must meet building lines as per the town planning scheme, and three you must build within a specific size that is within your title deed, so without that people cannot be given permission to construct permanently.</p> <p>Interviewer: Have you been previously involved in restorations of affected communities by changes in wind?</p> <p>Interviewee: No, I have not.</p>	
13	<p>Interviewer: Do you foresee any future disturbances on residential neighbourhoods caused by changes in winds if such effects are not addressed?</p> <p>Interviewee: Yes, I foresee that mainly in our upgrading areas.</p>	
14	<p>Interviewer: Are there any other disturbances that we have not addressed?</p> <p>Interviewee: With wind patterns, we have issues of wildfires. The speed of wildfires is normally caused by wind. So there is also that. We have homes burning down, and people are not mitigating. People don't have insurance for housing and they lose things because of that.</p>	Effects of fire [EFF]

15	<p>Interviewer: What key climate change disturbances do you believe should be addressed urgently?</p> <p>Interviewee: Definitely, the storm water management. That is the biggest issue, especially if we can get architects and developers to include such mitigation measures with each of their plans in curbing the issues in the rest of the infrastructure.</p>	Flooding [FL]
16	<p>Interviewer: Do you have any other comments concerning disturbances of residential neighbourhoods caused by changes in climate?</p> <p>Interviewee: No, I do not have any comments.</p> <p>Interviewer: Okay, thank you very much for your time. Your contribution will be beneficial to the study.</p> <p>Interviewee: Thank you Mr. Ndlangamandla. I hope you will be able to share findings of your study, and further start a discussion about these issues in certain professional platforms, like AESAP and other architectural platforms to speak to design for climate change. It would really assist the council a great deal.</p> <p>Interviewer: Definitely, the findings will be shared, and hopefully they will trigger some interventions for designing for climate change. Thank you!</p>	

5. INTERVIEW 05 - 23/06/2021 [0800HRS - 0845HRS]

#	DATA	CODES
1	<p>Interviewer: I had introduced myself that I am Musawenkosi Ndlangamandla, a PhD student at the University of Pretoria. I am conducting a study titled, Design and Development Strategies of Residential Neighbourhoods towards Climate Change Resilience in Eswatini. As much as you are not a climate change specialist, I would still like to get your contribution as an expert in infrastructure development and maintenance based on your observations of how changes in climate affects residential neighbourhoods. First of all, what is your role and experience in anything related to climate change and/or residential neighbourhood planning or development or maintenance?</p> <p>Interviewee: I am in charge of infrastructure maintenance in the entire town. So, we look at construction of new roads, new infrastructure and go on to maintain those roads. Anything which relates to roads. Then we are also in charge of building applications, so we scrutinise the building applications, that is the drawings. People submit drawings to us, then we check if they have used the right standards for construction, do they meet certain specifications. If there is a need for a structural engineer, we suggest that to the applicant.</p> <p>Interviewer: What section of the building plans are you mainly scrutinising as we are aware that there is an office looking at the planning aspect, another looks at the engineering aspect, another the health, and so on...?</p> <p>Interviewee: Okey, number 1, it's the structural integrity of the building you are submitting, that is if you have used proper load bearing walls for instance, and if there are extra supports required. Then some people you find that they are building closer to a river, so we look at how safe they are in terms of flooding</p>	<p>Infrastructure maintenance [IM] Maintenance engineer [ME] Scrutiny of plans [SP]</p>

	and all of that. We look at issues of drainage and if neighbours are safe from such proposed drainages from the plot. We check if there is a public sewer to connect to or a septic tank is required.	
2	<p>Interviewer: Based on your general observations, do you believe average temperatures are changing in the context of Eswatini? And how are they changing if they are changing?</p> <p>Interviewee: Yes. My observations in terms of the weather patterns, we are now getting extremes in everything. We are now receiving high intensive rains, or many storms. In our engineering language we normally categorise these storms. We have a storm which is 1 in 25 years for instance, which tells you about the magnitude of the storm... or 1 in 100. Lets say its a very big storm, we can talk of 1 in 100 years. So now when we design our infrastructure, it should atleast accommodate say 1 in 10years or 1 in 25 years. For a very big storm it means your infrastructure should be very huge to accommodate the rainwater that will come with that storm. So, what happens, you find that the 1 in 25 or 1 in 30 years are now more frequent.</p> <p>Interviewer: Can you clarify again the meaning of the numbers like 1 in 10 years and the others.</p> <p>Interviewee: It means the storm is likely to happen once in ten years. So 1 in 5 years is more frequent. But now the bigger storms are occurring more frequently, and that affects mainly the upgrading areas especially those that are still informal, like Msunduzi and the like. Those are the most distractive storms because we don't have sufficient infrastructure for these areas. But even with areas with infrastructure you can see that they are struggling as may have seen what has happened in the city. To add on issues of temperatures, I can say that they are on their extremes, and that affects our (road) surfacing which is asphalt. The bitumen below the asphalt tends to come above the asphalt which is called bleeding. It separates with the gravel and becomes slippery for vehicles. The bitumen which is a watery mix of the</p>	<p>Extreme storms [EXS] Extreme Rainfall Events [EXE]</p> <p>Effects on Informal Settlements [IFIS]</p> <p>Extreme Temperatures [ET]</p> <p>Bleeding Roads [BR]</p>

	asphalt shifts to the top, and separates with the other components. You might have seen such in roads where you find that the surface material is in a molten stage.	
3	see #2	
4	<p>Interviewer: You have already addressed my question which required the frequency of these disturbances. How can these disturbances be addressed... just like the one you are mentioning of the changes in the road surface?</p> <p>Interviewee: There are allowances in design specifications of roads where it states that in very hot areas, this is the kind of mix which should be used. So that is where we are moving, because in the past we were using a normal mix because we were not experiencing high temperatures. So the mix of the asphalt needs to accommodate the extreme heats in its design.</p> <p>Interviewer: So this confirms that we need to be aware of climate data as designers for the areas we are designing for.</p> <p>Interviewee: Yes. Same applies even for the storm water. When we design we need to be aware of the intensities of the storms like your 1:25, 1:50, 1:100... we shouldn't design for the smaller storms now since we are getting hit from the bigger storms more frequently now. So the storm water drains would be bigger now to handle the bigger storms. That's the norm now.</p>	<p>Understand climate data [CLD]</p> <ul style="list-style-type: none"> - temperature & intensity of storms
5	Interviewer: Do you foresee any future impacts or disturbances in our residential neighbourhoods if these impacts are not addressed?	<p>Future impacts on roads [FIR]</p>

	<p>Interviewee: Yes, definitely. The engineers need to be aware of this. It's a problem, because roads where the asphalt has been affected become accident zones because it becomes very slippery.</p>	
6	<p>Interviewer: Are rainfall patterns changing in the context of Eswatini?</p> <p>Interviewee: Yes, they are changing. We now experience rainfall the entire year, or experience absence of rain the whole year. Or the rainfall period is very shortened compared to previous years.</p>	<p>Erratic Rainfall [ER] - Heavy rain/drought</p>
7	<p>Interviewer: So how are these changes in rainfall patterns affecting residential neighbourhoods?</p> <p>Interviewee: In terms of infrastructure it is best when it's dry because water is the one that affects our infrastructure. I know it's not good for farmers, but the dry season works best for us. If we have long periods of rainfall then we know that the maintenance costs will be very high. Potholes will develop everywhere.. yah so it's a challenge when we experience extreme rains.</p>	<p>Potholes [PH]</p>
8	<p>Interviewer: How can we address these effects such that even when there are extreme rains the infrastructure is not affected?</p> <p>Interviewee: We need to upgrade our networks. Normally you find that some pipes need to be upgraded to handle the amount of water passing through. Green areas are required to reduce the runoffs and relieve pressure to the drainage systems.</p> <p>Interviewer: So your infrastructure is mostly affected by flooding, not the absence of rain?</p> <p>Interviewee: Yes. When there is absence of rain we are happy.</p>	<p>Upgrading networks [UN] Developing green areas [GRA]</p>

9	<p>Interviewer: Do you foresee any future disturbances to the infrastructure caused by flooding if these issues are not addressed?</p> <p>Interviewee: Definitely, a lot of problems. Some of them are manifesting here in Mbabane.. there are a lot of problems we are experiencing because of the increase in rainfall. The roads are being destroyed, you find that the rainwater is diverted away from water drains and move on the asphalt itself, which is not meant to be a drain and that is causing problems for us. So definitely there are a lot of problems coming with the changings in rainfall.</p>	Future impacts on drainages [FID]
10	<p>Interviewer: Do you believe that wind patterns are changing especially in Eswatini?</p> <p>Interviewee: I can't say much about wind. Otherwise wind seems to affect the low lying areas, especially areas in the lowveld. Those are the areas mostly affected by wind. However, we have observed that storms come with intense winds so we can say they have also increased with the storms.</p>	Strong winds [SW]
11	<p>Interviewer: Are there any disturbances in the functioning of residential neighbourhoods caused by changes in wind patterns?</p> <p>Interviewee: Infrastructure is affected. When winds blow down trees, the roads are normally damaged and that affects us in a way. I have noticed that a lot of people now use parapet walls to ensure their roofs are now blown away by winds. I can attest that the winds are much stronger now.</p>	<p>Effects on infrastructure [EFI]</p> <ul style="list-style-type: none"> - trees falling on roads <p>Effects on roofs [EFR]</p> <ul style="list-style-type: none"> - roof cover blown

12	<p>Interviewer: You have already mentioned that the intensity of wind can be addressed through the use of parapet walls in houses, how else can we address these changes for our residential neighbourhoods to adapt to them?</p> <p>Interviewee: I think we need to limit the high trees along the roads. We need trees along the roads instead of just concrete, but they have to be well selected such that the long trees are avoided.</p> <p>Interviewer: We normally see people from the Municipality clearing the sides of the roads, how much space is cleared?</p> <p>Interviewee: It's not specific but in the technical language, the roads have classes and the road reserves align with the class of the road. So there is that standard. Otherwise in town, we clear from the property line across the road to the other property line of a different plot. We try to maintain those spaces. It also depends on the driver's sight distance... a driver should be able to reach quickly when there is something appearing and attempting to cross the road. So for highways, you need a lot of space because traffic travels at high speed.</p>	<p>Parapet walls [PW]</p> <p>Limit tree height [LTH]</p> <p>Plant vegetation [PV]</p>
13	<p>Interviewer: Do you foresee any future disturbances in residential neighbourhoods if we do not address the impacts of wind on them?</p> <p>Interviewee: Yah, well, there are disturbances that may arise because where there are these big trees in some homes, that would affect the homes. The trees may fall on top of the buildings. We need to cub the height of trees.</p>	<p>Trees falling on roofs [TFR]</p>

	<p>Interviewer: We should probably have tree height restrictions just like you limit us on building heights.. I wonder if there is such?</p> <p>Interviewee: Yah, its interesting. I am not too sure if there is such. This is handled by other departments, they look at planting of trees and address trees that are causing problems in the city.</p>	
14	<p>Interviewer: Are there any other climate change disturbances besides those we have discussed?</p> <p>Interviewee: Well, to me of note its what we have discussed. We have discussed the key disturbances.</p>	-
15	<p>Interviewer: Which disturbances do you believe should be addressed urgently?</p> <p>Interviewee: Well, it's what concerns drainages. That's what affects us the most. It causes a lot of problems, but unfortunately, these hit mostly the upgrading areas. Even in terms of building materials, if I may now comment, they use metal sheets as roofing so when temperatures escalate, it gets uncomfortable in the buildings. So if temperatures continue to increase, the internal spaces will be inhabitable. When it comes to flooding, their houses are swiped away, or water enters the houses and all that.</p> <p>Interviewer: It's unfortunate that their building plans are not scrutinised, like the likes of houses in Msunduza. What happens in this regard?</p> <p>Interviewees: Most areas in town are controlled except those that have no tenure. But ofcourse you find that the infrastructure there is substandard.</p>	<p>Temperature & rainfall effects</p> <p>Overheating of internal spaces [OVS]</p> <ul style="list-style-type: none"> - caused by increased temperatures <p>Swiped houses [SH] - uncontrolled self-help housing</p> <p>Flooding of houses [FLH]</p>

16	<p>Interviewer: Do you have any further comments?</p> <p>Interviewee: Maybe if you can focus more on these areas which are more vulnerable to climate changes, like the upgrading areas I have highlighted...and try to bring solutions to that. It would be interesting knowing designs which they can use.</p> <p>Interviewer: That is very helpful and guiding on which part of the city we need to focus mainly. Otherwise thank you very much for your time. It has helped to also get the perspective of an engineer.</p>	<p>Upgrading areas are more vulnerable [UGA]</p>
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6. INTERVIEW 06 - 24/06/2021 [1755HRS - 1845HRS]

#	DATA	CODE
1	<p>Interviewer: I am Musawenkosi Ndlangamandla, as previously introduced. I am a PhD Architecture student at the University of Pretoria. My objective of the study is to develop design and development strategies of residential neighbourhoods for climate change resilience. By residential neighbourhoods we mean the housing and infrastructure components as well as the residents occupying them. So I am basically looking for new ways of designing which will consider climate data. Maybe to start off.. What is your role and experience in anything relating to climate change and/or residential neighbourhood planning and/or development?</p> <p>Interviewee: Okay, one of my biggest roles is to ensure the health and safety of residents of Mbabane. Not only the residents, but anyone that comes to Mbabane. So to what concerns your study, it means I have to ensure the environment they are in is conducive for anything they are doing. Also I ensure preservation or avoiding pollution to any natural resources we have... be it land, water, air, etc. So that is part of my role. Indirectly we do have climate change initiatives, since there are programs which are directed towards climate change. Like we have waste minimization programs.. like we are trying to minimise waste.</p> <p>Interviewer: So, how do you ensure the safety of the people? What is your everyday work to ensure that?</p> <p>Interviewee: We have training we do with different stakeholders on different issues. It can be issues of food. If I can make an example of your topic on climate change, we have issues of stock control. We have issues of food securing, issues of smart gardens.. People should not use fertilizers and the likes, but compost from food wastes. All these issues. We conduct inspections to ensure a building is conducive for occupation.</p>	<p>Municipality [MUN]</p> <p>Environmental & Public Health [EPH]</p> <p>Waste minimization programmes [WMP]</p> <p>Training on health & safety [THS]</p>

	<p>Like we question how you can sleep in a house without ventilation or without light.. So we conduct those physical inspections. We investigate any pollution which may be occurring within the city, be it littering, be it discharge, be it cutting trees illegally, be it the tree itself being a danger to a person. So we need to cut that tree because it endangers someone or infrastructure.</p>	<p>Building Inspection [BI] - to ensure a building is habitable</p> <p>Pollution investigation [POLI]</p>
2	<p>Interviewer: Based on your observations in what you are currently doing, are average temperatures changing in the context of Eswatini?</p> <p>Interviewee: The temperatures are changing. It's actually getting warmer and warmer. The Hhohho region, if I may say, had never experienced Malaria cases because Malaria mosquitoes love the hot conditions, like the Lubonjeni, but what we are now finding is that the Malaria mosquitoes are able to habitat in areas which previously were not suitable habitats for mosquitoes. And one of the major factors is temperature. So if its getting warmer it means they can be able to move from one area to the next and make a new area their habitat that is now causing...if you notice our malaria cases are increasing and when you now start to read the trends you do find that most of the cases are now in Hhohho. One of the reasons is that they have found a new habitat, and unfortunately in these areas we have not been taught to deal or we are not yet combating the malaria mosquitoes. We do not have the programs in these areas. So yah, the temperatures are getting warmer and causing effects. I mean, when it starts raining in Mbabane it pours, and when it stops it just stops. We used to know in the past that this is the rainy season and this was no longer the rainy season.</p>	<p>Increased temperatures [IT]</p> <p>Invasive species [IS]</p> <p>Diseases [Malaria]</p>
3	<p>Interviewer: So since you are saying the temperatures are increasing, what are the effects on residential neighbourhoods.. meaning on housing, infrastructure and people?</p>	

	<p>Interviewee: In this regard, my first case will be the issue of malaria because we are now sleeping with open windows. And our windows do not have screens which can block out the mosquitoes. Also in such cases we are now predators to crimes, because we have made the area accessible to criminals, because if you have left your windows open, someone may be able to take something out (steal). I guess another issue is the design. In low income housing areas or let me say in squatters, the design of most houses you find that when they build a house, they locate the door and windows on the same side. So now there is no air circulation, and it becomes warmer and warmer in the house because air does not move anywhere. Since there is no air circulation a lot of diseases then come up .. sick building syndrome, there can also be heat strokes you know. Nothing cools the house, so when there is no circulation of the air then what cools the house? It makes being in the house uncomfortable, yet that is the safest place one wants to be. Areas that do not have air circulation breeds other diseases. If air is moving in one direction and ends up where, that is where you find flies and then there can be other diseases ofcourse. It goes about that as our climate changes, there are huge issues that... as I mentioned earlier... when it rains in Mbabane it just rains. It used to rain but now it's more often. You know there are people who still live in stick and mud houses, you find that their structures are torn apart because of the weather conditions. So the materials they use, which are the materials we are supposed to be supporting, and say use such natural materials to build your houses, are no longer conducive for the weather.</p>	<p>Malaria [MAL]</p> <p>Safety [SAF]</p> <p>Sick building syndrome [SBS]</p> <p>Heat stroke risk [HS]</p> <p>Materials irrelevant for climate [MI]</p>
4	<p>Interviewer: So how can these issues be addressed, especially the effects caused by increasing temperatures?</p> <p>Interviewee: I think one of the biggest issues is for the country to start educating people in public forums whether its newspapers or radio, to tell people for example that it is conducive to have a window and door on one side and another window on the other side of the house but not on the front side. Currently you find that houses have windows only on one side. If you go to Matsapha for example, you will find that the back side of the houses are actually marking the property boundary, and the window is at the front next to a</p>	<p>Proper Design Awareness [PDA]</p>

	<p>window. Air does not circulate in this setup. So, it's a national issue because people copy these bad habits unknowingly. So issues of designing houses which are able to be cool when it's hot outside, also probably being able to build the houses with materials which will not absorb heat. For instance, roofing sheets, it's not everyone who can afford a ceiling, but using corrugated iron is the only option we have. Can't we go back to using thatched roof? Because corrugated iron absorbs a lot of heat. We can have a mix of the traditional and the modern way of constructing a building. We can probably use concrete bricks, then use the thatched roof to ensure that the house is cool inside when it's hot outside. Also educating people who are not in the urban space would be helpful, since these people self manage construction of their houses. They may ignore components which are actually important such as louvers.</p>	<p>Climate responsive designs [CRD] i.e. cool houses, non heat conductive materials, thatched roof, use of louvers</p>
5	<p>Interviewer: If we do not solve these challenges, do you foresee any future impacts on residential neighbourhoods caused by increase in temperatures?</p> <p>Interviewee: There will be a lot of health issues. As I had mentioned, there will be a lot of diseases which were not supposed to be there previously in those areas. It was not the norm to have such diseases in those areas because we are not used to such heats in different areas. So, I also think it will become an expense for people to change the designs of the houses. So the designs might be right from the beginning because once something becomes in demand.. you know, renovating a house is more expensive than constructing a house. So it will become more expensive to change the structure. Also, I fear that probably, things which we knew were cheap, things which we knew were natural, will become expensive, because now they will be in people's private properties. For instance, I am talking about thatch.. it's not all grass (any type) that you use for thatching your house, but it's a specific type. Once this thing becomes in demand, you will find that it's no longer natural. You don't just go to the mountain and find it, now the mountain will be owned by a person. You will have to buy that thing (thatch).</p>	<p>Increased health risks [IHR] Increased expenses of retrofitting [IER]</p>

6	<p>Interviewer: Concerning rainfall, based on your observations, are rainfall patterns changing in the context of Eswatini?</p> <p>Interviewee: Yah, I'll say they are changing because we are now really facing drought. Farming is no longer practised in a lot of regions across the country. We are now facing water rationing. 2 to 3 years ago there was water rationing in Mbabane. Mbabane was known to be a city with a lot of rainfall and a lot of water, but because of high evaporation rates, because of increased temperatures, we were no longer receiving water. Dams were dry, streams were really non-existent at that time.</p>	Drought [DR]
7	<p>Interviewer: What effects do the changes in rainfall patterns have on residential neighbourhoods?</p> <p>Interviewee: Some impacts are that some residential neighbourhoods do not have storm water drains. So there are issues of flooding. Some neighbourhoods do not have tared or paved roads. So now there are issues of accessibility to properties because the roads are muddy and slippery, so vehicles are not able to reach their destinations. Now you have to leave your car somewhere, and that causes issues of security if you leave your car somewhere and have to walk for another 100 meters to your place because your road is inaccessible. It's not only inaccessible to residents but also to local authorities to get your refuse.. So now when the refuse is not collected, stray animals start scuttering the waste around and that can cause diseases, pollution, so yah, so many of these challenges. Also rainfall destroys infrastructure. It can destroy the roads which are paved and non paved... It can decrease the lifespan of those roads. When it continuously rains, there is surface failure of the roads... the soil beneath the roads becomes very soft and the roads crumble. Also the infrastructure gets damaged. There is also a lot of soil erosion that occurs in arable land. If that land is not farmed, if that land has no vegetation, there is a lot of top soil being washed into the rivers, and when that happens the rivers become shallow which causes flooding of rivers. People who live</p>	<p>Flooding [FL]</p> <p>Inaccessibility [INA] - slippery roads</p> <p>Infrastructure distraction [ID] - road failure</p> <p>Soil erosion [SE]</p> <p>Dredging [DR] - which ruins ecology</p>

	<p>near the rivers get swapped by these rivers because they are shallow. There are costs of dredging those rivers and when it comes to dredging now it means you are ruining the ecology of that particular stream or river.</p>	
8	<p>Interviewer: So how can these effects caused by changes in rainfall patterns be addressed?</p> <p>Interviewee: It's a very difficult thing. But in most cases we tend to look at what others have done and we implement same. I think we need to domesticate our materials for certain locations. Thinking that one solution works for every place is not true. So I think it's wise for us to always take note of these things. and also to involve communities. It's very important to involve communities. In terms of them being the biggest stakeholder, they can be the ones who come up with solutions that will amaze you. We can come with textbook solutions but they will come with practical solutions. You know, in one instance, the government used to construct toilets, but the cholera level in the country was still high, and people had diarrhea. It was not understood why the situation was not changing since toilets were being built. The problem was that the toilets being built were not being used because people would say the these government toilets. You would build a toilet unknowing that in the Swazi culture, a father in law and daughter in law do not use the same toilet for instance. It was only when a participatory approach was used when it was realised that there should be two toilets. So it's best to engage the community to help you to find solutions.</p>	<p>Domesticate materials [DOM]</p> <p>Design participation [DP]</p>
9	<p>Interviewer: If we do not solve these problems, do you foresee any future impacts on residential neighbourhoods that would be caused by changes in rainfall patterns?</p> <p>Interviewee: Yes, yes. I think some of these future impacts.... Some of us live in areas where the property is supposed to appreciate and not depreciate, but different weather conditions can depreciate or temper with the structure of your house, or the material used. For instance, you are using tiles and there are a lot</p>	<p>Depreciation of property [DIP]</p>

	<p>of hailstorms now, so they break your tiles and you keep patching. The value of your house depreciates. It also becomes expensive to maintain. You also have to keep on changing your paints. It also becomes an issue when there is too much rainfall .. You can have issues of the top soil or gardens being ruined by too much rainfall as much as it can be ruined by too much heat. So there are a lot of issues that can arise which we need to adapt to, and if we do not adapt you will be extinct or the operations will seize.</p>	<p>Increased maintenance costs [IRC]</p>
10	<p>Interviewer: Do you believe that wind patterns are changing in the context of Eswatini?</p> <p>Interviewee: The winds will change because of temperature. The warmer it is, it means the quicker the air moves up, and the quicker the cold air replaces the warm air. It means we are having faster winds. Although it's fast, it means its warm wind. Very warm wind. It's no longer soothing to be outside because the wind is too dry.</p>	<p>Faster winds [FW] Dry winds [DW]</p>
11	<p>Interviewer: Are there any disturbances or impacts caused by the changes in wind patterns?</p> <p>Interviewee: Not that I have seen. I haven't seen an impact that has entirely changed a residential neighbourhood. Actually there are. I have seen people changing roofs which were once visible from the side of the road, but they are no longer visible now. I have seen such renovations. The design in that area has changed because of high wind velocities. People have resolved for parapet walls to hide their roofs in windy areas. We do see a lot of townships with houses like that now.</p>	<p>Effects on roofs [EFR] - blown roofs Parapet walls [PW]</p>
12	<p>Interviewer: How can these effects be addressed besides the use of parapet walls as you have pointed out?</p>	

	<p>Interviewee: I think another is to study wind direction. So its data collection in terms of wind direction so that one can be able to place their residential houses in a manner that is normal with no expensive changes. But because of the manner you have positioned your house, it will not be affected by wind.</p>	Study wind direction [SWD]
13	<p>Interviewer: Do you foresee any future disturbances caused by changes in wind patterns if these disturbances are not addressed?</p> <p>Interviewee: Yes, I do because people will start wanting to have trees closer to their houses removed with the fear that they will fall on their houses. Yet this will increase temperatures. Communities without trees are warmer than communities without trees. There is no shade, or cooling of air without the trees in your yard. That's one of the issues I foresee. People will no longer have different houses, but they will be forced to use the same type because of the situation in the area. It also goes back to the materials. You will not want to use materials such as planks or anything like that... materials which can be easily blown away. We will now find ourselves going back to concrete and steel, something which will be very much rigid. It becomes very difficult to go eco friendly when designing your house because most of the materials which are eco friendly will be blown away by high winds. There is an area called Louisiana in the United States, where houses are blown away by winds. If those houses were built of concrete, it wouldn't be a mess like that. So what go for something that can be easily blown away.</p> <p>Interviewer: I like the point that we need to have climate data when designing our houses.</p> <p>Interviewee: Yes, we need to have data. We need to have software which can predict or which has algorithms that can predict how trends will be in future. Actually not just the winds, but the rains, temperatures and so on. We need to have these software that will tell us how the wind is going to be the whole of next year for instance, or 30 years from now. And how we should prepare for 30 years from now now, because we need to start transitioning now to prepare for 30 years from now. Or if we change our</p>	<p>Removal of vegetation [RV]</p> <p>Forced use of non-eco friendly materials [FUEF]</p> <p>Software predicting trends of weather - wind, temperature, rains [SPT]</p>

	behaviour, the algorithms can show that if we are able to change this now, this will not happen in 30 years time.	
14	<p>Interviewer: Now that you are saying, there is one used in the USA which gives information about climate vulnerability of an area you want to construct. Otherwise are there any other climate change disturbances which we did not discuss which comes to mind?</p> <p>Interviewee: Alright, I think there are, like food security. There are issues of food security, issues of farming basically. Like you find that in a family you used to saw maize, but now you saw cotton, since there is no rain to support growing of maize. So I have to grow cotton which requires heat to grow well. So yes there are those issues of climate change. Climate change changes the landscape because everything it does, it does it... I don't know how to put this but where there was no donga today there is a donga because of issues of climate change. The vegetation that used to grow there is no longer able to grow there. So since the vegetation is no longer growing there, the high winds are removing all the top soils and now the rains when they come, they open the pathways because nothing is holding the soil, then walah we have dongas.</p>	<p>Food security [FS]</p> <p>Development of dongas [DV]</p> <p>Change in vegetation [CV]</p>
15	<p>Interviewer: So out of the issues you have discussed, which one requires urgent attention?</p> <p>Interviewee: It's very difficult, but one I would pick are issues affecting shelter. Most of the things we are mentioning forms part of the basic needs of a human being. They are one of the basic needs and shelter is one of them. However, I can be able to get water from a stream, I can be able to get wildberries from a forest or garden..etc, but shelter...!? If I have a house and that house was left by my parents and I don't work and that house is blown by the wind and they are not working, and I can't repair the house it means I am without shelter now. Getting it fixed is not easy and cheap, so I think let's get the shelter right, because if I get it right today and I have built it according to the norms of my area - the wind speeds, the rainfall</p>	<p>Effects on shelter [EFS]</p>

	and I have built it such that when I am inside I will not suffocate or get a heat stroke, I will know everyday that I have a home, and that is where I will cry and say I am hungry.	
16	<p>Interviewer: Do you have any other comments concerning climate change disturbances in residential neighbourhoods?</p> <p>Interviewee: I think, climate change in residential neighbourhoods, is basically changing the way people socialise. When it's too hot, no one wants to be outside. When it's too hot, if you do not have an air conditioner and my neighbour has an air conditioner, my neighbour will not leave the house. The problem with climate change is that those who can't adapt will die, because it will become more and more expensive to adapt to the changes of the climate. We grew up not having air conditioners but opening windows, nowadays all houses should have air conditioners and the windows must be closed and it's cool inside. You know what that is doing, it's increasing the consumption of electricity and now making electricity a demand. And now electricity is no longer affordable to that person we call a helper in the house. Because she will have to buy electricity at the value of her salary so life becomes very difficult. So she will go to the house very miserable because she could not sleep because of the heat. So this brings issues of non equity, non balance in life, it makes the poor more poor. It puts them in the worst condition because as the saying says, adapt or die. Climate change will keep changing and we need to adapt to it. It's going to get too cold in winter now.. you need warm clothes and a warm house. So I am just saying climate change will bring more inequality in the world and in the country where those who do not afford it will really be in a bad position. Their non affordability will get worse with time.</p> <p>Interviewer: Well, thank you very much for your time. I like the health perspective you are bringing to the study.</p>	<p>Social effects - socialising patterns [SP]</p> <p>Increase in energy consumption [IEC]</p> <p>Inequality [INQ]</p>

7. INTERVIEW 07 - 24/06/2021 [1830HRS - 1930HRS]

#	DATA	CODES
1	<p>Interviewer: I had already introduced myself that I am Musawenkosi Ndlangamandla. I am doing a PhD Architecture at the University of Pretoria. I am doing a study titled, Design and Development Strategies of Residential Neighbourhoods for Climate Change Resilience in Eswatini. Briefly, I aim to come up with design and development strategies of residential neighbourhoods, meaning the housing and infrastructure, in such a way that they adapt to the changes in climate. This comes looking at the rigid designs of residential neighbourhoods which are not changing with the changes in climate. I am currently creating the base of the study by investigating the current condition of residential neighbourhoods in Eswatini through observations, and identifying the climate change disturbances which our neighbourhoods should adapt to. This should be achieved through the interviews. So to start, what is your role and experience in anything which relates to climate change and residential neighbourhoods?</p> <p>Interviewee: Well, in the organisation I am working for... you actually know the role my organisation has as a coordinating body for disaster risk reduction. Now you can't speak of climate change and divorce it from DRR (disaster risk reduction). In order for you to mitigate and adapt, there are disaster risk reduction that have to be done as well. So I work closely with the climate change team, and we try to create awareness. In as much as we will talk of disaster risk reduction when we go to the communities and our stakeholders, the element of climate change you can't divorce it, because what we see in the communities you can observe that things are not the way they were when we grew up. So there is a lot that is changing and there is a lot of adaptation that we try to preach to our communities as well, that they should adapt to the changes that you see.. that is what we try to do. We create awareness, try as much as possible to be a part of... as for myself the climate change team invites me a lot mainly in the forums they have to try and inform policy. Establishing what needs to be done. Otherwise in a nutshell, that is what we try to do. Like I</p>	<p>Creating awareness [CA] Disaster risk reduction [DRR]</p> <p>Inform policy [IP]</p>

<p>am saying you can't divorce climate change with DRR. You can't do one and overlook the other. When you talk of mitigation and adaptation of climate, you actually talk of things we are busy with in our organisation as well.</p> <p>Interviewer: Maybe I can further ask about your organisation, to get a holistic view of what you do. Generally, what is your organisation all about?</p> <p>Interviewee: The organisation coordinates all disaster risk reduction activities in the country. Activities of disaster risk reduction are pre and post disaster. So pre disaster, you have preparedness, you have mitigation, and for post disaster you have response and rehabilitation. There is prevention and preparedness in pre-disaster, and then mitigation is overarching... it's both pre and post. So, we coordinate stakeholders in all that relates to addressing disasters. We work with government ministries, we work with parastatals, we work with NGOs, we work using a sector approach.. like what has been adapted in the world. Like we work through sectors, through health, that is why Covid came to us. But obviously pre disaster, what normally happens is, you will have all your contingencies in place. There has to be a sector meeting which we hold maybe quarterly just to observe the situation. Now when there is a threat of some sort, that is when you will start having more of the meetings. Like now, covid was declared, so you need to meet every now and then, to see if the contingencies which were done pre disaster, what is happening now? How can you play around, or adapt because covid was a new thing. It was a completely new thing that through us it threw a curveball, luckily we do have a multi hazard contingency plan. It was taken from infectious diseases, but now there will be a plan looking at the flues, but not to say there wasn't.</p> <p>Interviewer: So you get into all sectors depending on which direction a disaster may come?</p> <p>Interviewee: Yes. Like I am saying, there are nine sectors... We have agriculture & food and security, we have water sanitation and hygiene, we have health and social protection issues, we have the environment...</p>	<p>Climate mitigation & adaptation [CMA]</p> <p>Coordinate stakeholders [CS] Sector approach [SA]</p>
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	<p>but yah they should be nine altogether. ICT is part of them, like when you talk of covid you are talking about messages that have to be impactful. This sector has to be activated. When you talk about covid, it has affected social protection issues. People have been at home. Gender based violence increased. So it's all mixed. What I need to clarify is that when disaster has not been declared, it will be the ministry responsible that will lead everything. Ours will be coordinated. Coordinating resources, coordinating.. you know.. yes.</p>	
2	<p>Interviewee: Thank you for that clarity. So moving on to issues of climate change... Based on your general observations, your involvement in national climate change interventions, Are average temperatures changing in the context of Eswatini?</p> <p>Interviewer: I believe so. I believe they are, and science is confirming that things are changing a bit.</p>	
3	<p>Interviewer: So, what effects do these changes have on residential neighbourhoods?</p> <p>Interviewee: Okay. Uhm.. with regards to temperature, I wouldn't say.. You know when you look at Eswatini we look at it in the context of rural and urban.. so with urban areas, the infrastructure will try to adapt to high temperatures.. like glazing up the windows, and all that. And that people will move from having small windows to bigger windows to bring in I think cooler air. But it's in the rural areas where we can talk more about. People are shifting away from what we know as cooler houses and cooler roofing - from thatch to corrugated iron. Uhm, thatch moderates temperature.. So with the houses that are being built, we are moving more into houses where you find that they trap more heat yet it's hot even outside. The traditional houses which used thatch... well it's actually getting even more difficult to get thatch grass because there are a lot of these fires, and our ecosystem is changing. People are building where they shouldn't. So its affecting a lot of how people access materials which we used to know in the past that when you enter such a house on a hot day, you cool down. Now we move into corrugated iron, into clay tiles, which for me, traps the heat. Now even these stick and mud houses are roofed with corrugated iron.</p>	<p>Forced use of heat absorbing materials [FHM]</p>

4	<p>Interviewer: With your organisation, have you addressed issues concerning increased temperatures?</p> <p>Interviewee: It hasn't been addressed per se, but there has been an observation that we are building houses out of brick and use metal sheets. And you find that people do not use these houses because the houses in the hotter areas, like Lavumisa, are quite hot. So you find that they prefer to stay in their houses which are falling apart, and only use the newly constructed houses when the situation is worsening. We have looked at it as a problem. It came up in one meeting we had as a team... There was a suggestion made that we need to sit down and think about how we are going to accommodate people living in the hotter areas of the country.</p>	Brick and metal sheets [BMS]
5		
6	<p>Interviewer: So that confirms that you do need housing which adapts to high temperatures. So going on to rainfall, are rainfall patterns changing in the context of Eswatini?</p> <p>Interviewee: Yes they are. Evident that ploughing times have changed. Now we start ploughing in late November when it used to be early October.</p> <p>Interviewer: How are the rainfall patterns changing if I may ask?</p> <p>Interviewee: There are episodes where you find that the rain is just normal, and there are episodes where you find that it's below the normal of those areas. Sometimes you find that rainfall will last for a week and then the other week there is nothing. But in those 2 weeks you get the normal of that area. Then there are</p>	<p>Shifting rainfall time [SRT]</p> <p>Erratic rainfall [ER] - not predictable</p>

	<p>times just like 2017, Dineo and now Eloise. There are episodes where it just rains you know, and there is more rainfall than we normally have. Most especially in our work we are always on alert for these rains and strong winds even though I am getting to another question. Starting from July, August, September for the wind. But then the rain and the hail, we expect it at the beginning of December, that is when we start being on the alert.. November so.. up until February. We actually include February because of the incidents where you find that in February it starts raining heavily. I think it's because of the system that comes from the ocean, that of tropical cyclones because it's normally beyond January. Now we find ourselves responding even going to April because of rain and hail even in April! This year for instance, was just another year... which is something we did not expect. It's unusual what was happening, because the rain took long to stop falling, and when we expected the rain to stop, it came with hail in May, which is something we are not familiar with. We normally expect hailstorms in October, November, December and maybe January... in February we do not expect it to be that bad you know.</p>	Strong rains episodes [SR]
7	<p>Interviewer: How have these changes you are mentioning affected residential neighbourhoods?</p> <p>Interviewee: It's bad I am telling you my brother! It was really bad. This thing (cyclone) did now want any mud house. You see. It did not want a house that is built of mud bricks, one; a house built of stick & mud. You know these two are different. I am not referring to the compressed mud bricks.. but those using soil without any compression or anything of that sort. I am still talking about the Hhohho region only where we had about 500 houses reported to have been destroyed/affected. What was worse.. the houses that were worse are those that had not been patched (maintained) for quite a long time, because we know as Emaswati that we have means of strengthening our houses. For the houses which were found not to have a slab, the houses were sinking, the houses were collapsing. So the house would either be sinking or collapsing. There will be walls collapsing, if it's not walls it's the whole house. As for the concrete block houses... Only a few were not leaking through the metal roof sheets since it was raining for the whole night,</p>	<p>Effects on mud houses [EFM] Effects on stick & mud houses [EFSM] - destroyed/affected</p> <p>Sinking houses [SH] Collapsing houses [CH] Collapsing walls [CW] Leaking metal roofs [LMR]</p> <p>Moisture absorption [MA] - of unpainted houses</p>

<p>from Sunday to Tuesday. Some houses which were not painted had absorbed the moisture.. you could actually tell... There is this woman who complained that there was water coming through her floor slab, because some may build on land unknowing that there is water underneath (close water table). So you would see the house as stable from outside, but when you enter the house you find a hole inside, and the slab has sunk into the ground, then cracks develop. Even the houses built of concrete blocks, you find that the house itself underneath, has no slab, nothing. People would report water coming from the floors. The challenge you could see that emanates from the rapid urbanisation as people would settle in places where they tell you that this used to be a well. But since you did not find the well you insist in building your house, then you find your house being within a river bank.</p> <p>Interviewer: Which areas were mostly affected by these cyclones?</p> <p>Interviewee: It's the highveld. It's mainly the highveld where you find that the rainfall is normally higher. Otherwise for us, areas which gave serious challenges were in Nkhamba, Mbabane at Msunduzi, Makholokholo, going to Motshane, Maphalaleni, and then there was Madlangemphisi. Here like I said earlier, it's where we found the house already tilted, you know. Otherwise it was mainly in the highveld where it rained the most.</p> <p>Interviewer: Concerning Makholokholo (middle class sort of neighbourhood), was it the areas with stick and mud houses?</p> <p>Interviewee: Yes. Otherwise for the modern houses, you would mainly find that it's an issue of a retaining wall which fell. For some, you would find that there was a failure of soil beneath the house, and the house is hanging. You know that Mbabane is high (altitude). One area that challenged us was Mpolonjeni where the mountain itself was falling, because people cut the mountain to build. So you find that the hanging soil falls and pushes the houses.</p>	<p>Cracking houses [CRK]</p> <p>Water seeping through floors [WSF] - houses possibly built on flood plains or close water table</p> <p>Falling wall fence [FWF] Soil failure beneath house [SF] Land sliding (pushing houses) - [LS]</p>
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8	<p>Interviewer: How have you previously addressed such challenges as the one you have narrated?</p> <p>Interviewee: With the urban area, there has been consultations with the Municipalities, because unfortunately, there are laws governing the operations of municipalities. Now it was sitting and talking... actually we are still communicating since this is something that occurred this February. We are still going to work... we will sit down and talk. Because if another cyclone could happen, if these things are not addressed, and there are no new guidelines for building, addressing drainages and stuff, the problem will worsen. And this time around, where the houses were left hanging, now they will be moved because in some of these areas the house would tilt, or a whole wall would move. So, with the municipalities, there is that engagement going forward, to look at how these people can be assisted. For some you find that the processes are quite slow. And for some it's the laws that maybe they do not have tenure or they have not been allocated, so when someone does not have a plot with his/her name, they won't be able to use concrete blocks (considered to be a strong material). So there are those challenges about tenure so it's difficult to help those people. So for now you can only get permission to build another temporal structure which will be destroyed again.</p>	<p>Regulations barrier [RB]</p> <p>Lack of building guidelines [LBG]</p> <p>Tenure challenges [ENC]</p> <p>Building of temporal structures [BTS]</p>
9	<p>Interviewer: If these problems are not addressed, do we foresee any future challenges caused by the changes in rainfall patterns?</p> <p>Interviewee: Well, if the problems are not addressed, we will have the same situations or even worse because... have you been in Msunduzi? Mncitsini area mainly.. because the challenge there is that the people have been living there for the longest time, and some bought the plots some time back. After buying these plots, they built rental houses. <u>Most of the people who were affected there were the tenants. You find that the houses they rent are not fit... even me as a layman in construction I can see</u></p>	<p>Worsening due to urbanisation</p>

	<p>that the houses are not fit for occupancy. So I think it can actually be worse, mostly since more and more people are coming into the city looking for jobs, and more and more people are building these structures which are not strong enough. Maybe we are limited by resources to get to the place where you would say we are like Rwanda... building for everyone proper buildings. A solution here would be that type of scheme like they have in Brazil where you find that the community... there is that building of houses for each other using proper material. If we do not afford the concrete blocks, there are always the compressed clay bricks. There are houses at Piggs Peak that have been standing for the longest time built of compressed clay bricks. These bricks are cheap even though they use a bit of cement to add to its strength. With one bag of cement you may get 100 of these bricks.</p>	<p>Housing schemes [HS]</p> <p>Compressed clay bricks [CCB]</p>
10	<p>Interviewer: What about wind patterns? Are they changing in Eswatini?</p> <p>Interviewee: Even though I have been with this organisation for 5 years, in that 5 year period there have been instances where the wind has been terrible. 2016 in Hhohho was very bad... It was a very bad year for us. Yes, each year has an episode where you find that it's windy, and there are years where it's worse than others. Last year or the other year was also bad.</p>	<p>Strong wind episodes [SW]</p>
11	<p>Interviewer: How do changes in winds affect residential neighbourhoods?</p> <p>Interviewee: My brother! If your paper advocates... I would say this weak metal sheet which is shiny should never be used. They should actually be banned. Something else that affects the houses is that they (roofing) are not tied well. The problem is that in rural areas you can pick anyone to build your house, while in urban areas there will be someone guiding you on how to build your house. In the rural areas we just build anyhow even when we see how the patterns are changing. We do not even plant shelterbelts to protect our homes. In some houses you could see that it was an issue of poor roof installation, so wind</p>	<p>Weak roofing material destroyed (0.3mm corrugated iron sheets) [WR]</p> <p>Poor construction technique [PCT]</p>

	would blow away the whole roofing. These other shiny sheets... When there is hail, they are cut into pieces like there was someone on the roof intentionally cutting the sheets with an axe.	Poor roof installation [PRI]
12	<p>Interviewer: How have you addressed such issues?</p> <p>Interviewee: With wind.. remember that we cannot construct for everyone. When you talk about rehabilitation, you talk about help that goes to the people that are the most vulnerable in society. So when it comes to rehabilitation, there are assessments that are done... we do not just build for everyone. And what we do is... <u>like those who build in wetlands...</u> we advocate that they should relocate to a different area. And we plead with the community and tell them that we cannot waste government funds and build in the wetland for that person. What we normally do in these campaigns or when we have been called by communities, we seriously advocate for shelter belts. We ask for people to plant trees. We have identified areas which are prone to windstorms. So even when we go to these communities, we advise people to plant trees. But sometimes you are asked by these people where they should get these trees, you see. Fortunately the Ministry of Tourism has this campaign of planting a million or is it 10millino trees..? We had planned on riding on it last year, that these houses in wind prone areas should get part of the trees.. but then covid happened and everything stalled. But we are still looking at this to work with the ministry. There are these areas which are problematic.</p> <p>Interviewer: Do you have an idea of areas mostly affected by wind?</p> <p>Interviewee: We have areas in Shiselweni and Lubombo. In Manzini region its Mahlangatsha, and in Hhohho its Mhlangatane, Madlangephisi, Nkhaba... the true highveld areas. Otherwise mostly it's the belt of Timphisini, Mayiwane, Madlangephisi and Mhlangatane.</p>	<p>Building in wetlands [BWL] Relocation [RLC] Shelterbelts [SB] Campaigns [CMP]</p>

13	<p>Interviewer: Do you foresee any future impacts to residential neighbourhoods caused by changes in wind patterns if these issues are not addressed?</p> <p>Interviewee: The problems will be there. And we will find ourselves... There is a saying we have with our colleagues that.. we will find ourselves going back and responding to houses that we have built, if some of these things are not addressed. Because some places you see that it's not only a matter of strengthening the house. There are other measures that should take place as well. Our solutions should be comprehensive.</p> <p>Interviewer: Does it happen that you revisit a place twice to sort the same problem?</p> <p>Interviewee: Yah you do find that we go back to the same area but to the same houses. If we have given you the material... You know what we give is really strong... and when you get a good bricklayer, you will find that the surroundings are affected but not your house. But still trees should be planted (to break wind) or put on a facia board which we also recommend. We also tell people that if the overhang of the roof sheets is too long, they should be cut short to avoid a risk of being pushed by wind.</p>	<p>Facia boards [FCB] Short overhangs [SO]</p>
14	<p>Interviewer: Besides the effects of cyclones, flooding, winds, are there any other effects you have previously experienced or observed which affect residential neighbourhoods?</p> <p>Interviewee: It's hail, and there are houses burnt by lightning.</p>	<p>Hail [HL] Lightning [LTN]</p>
15	<p>Interviewer: Which effects do you think should be addressed urgently from what we have discussed and other?</p> <p>Interviewee: In a normal year it's the wind.</p>	<p>Wind [W]</p>

16	<p>Interviewer: Do you have any other comments?</p> <p>Interviewee: Our residential neighbourhoods have to adapt to climate change otherwise there will be dire consequences if there is no adaptation happening. Sometimes modern is nice, but there was good in the materials we used to use in the past. We also need to find materials that are relatively inexpensive but durable, especially to the people who are less privileged. Because we have realised that the materials which they use... the stick and mud... yes its resources that are there, but if there could be an alternative that could be provided that this is the alternative. Or maybe if you are building, there has to be proper education that when building a house you do not just extrude it... these are the things we need to talk about. People lack that knowledge, they think building a house is just taking a house and putting it on a site and then you occupy it.</p> <p>Interviewer: How do you think the study can assist your organisation?</p> <p>Interviewee: The findings can assist because we need to diversify. Yes, our mindate is not to build people's houses, but to respond to those who have been affected by disasters. Yes we are doing what we term climate smart structures but more insight would be helpful in trying to adapt to those climate smart structures in the different regions because we cant be doing a blanket approach.</p> <p>Interviewer: Thank you very much for sacrificing your time to assist me. This is going to be very helpful, more because you have actually experienced what you are talking about.</p> <p>Interviewee: Thank you for trusting us to contribute to your study. All the best, hey.</p>	<p>Climate Responsive Designs [CRD]</p> <p>Alternative affordable materials [AAM]</p> <p>Education [ED]</p> <p>Avoid blanket approach [ABA]</p>
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8. INTERVIEW 08 - [1251 HRS - 1318 HRS]

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1	<p>Interviewer: Im Musawenkosi Ndlangamandla, a PhD student at the University of Pretoria. I am doing a study titled, Design and Development strategies of residential neighbourhoods towards climate change resilience in Eswatini. I am trying to come up with new ways of designing residential neighbourhoods in such a way that it adapts to the changes in climate.</p> <p>Interviewee: Oh wow, this is very interesting for me personally as well because I have a civil engineering background, and now I am working in the climate change field, and the building sector and health sector are not really looking much into climate change issues seriously. We are not really experienced in that sector and these sectors cannot be left behind so your research is very good and very relevant to the times. Once you have the results of this study please keep in touch with me so I include you in our workshops so that people can learn from what you have.</p> <p>Interviewer: I have also noticed that this sector has not been included in the adaptation strategies the climate change team is working on.</p> <p>Interviewee: Actually in the revised NDA we have included it, but we need to know if it is adequately included, what else needs to be included and so on. So yah, we are in the process but we need people like you to help us.</p> <p>Interviewer: That would be great. So yah, I just have a few questions to ask. Firstly, what is your experience and role in anything related to climate change and/or residential neighbourhoods?</p>	

<p>Interviewee: Okay, in general, I worked as a civil engineer previously in Lesotho in Rural water supply, and have worked as a lecturer in the same country at the university of x, then I moved to environmental Science because I realised that environment is my passion. So I started doing some work in that. I did some work in water pollution and then I moved to Malawi. There I was working at an NGO where I was doing climate adaptation work. That time it was mostly livelihood, agriculture, ecosystem services, land use change. From there we moved to Eswatini in 2015 where I do consultancy. I did consultancy for the Ministry of Tourism and Environmental Affairs, for UNDP, for NDMA, for SADC and for the South African Government. So it was more on climate change, different things. The first thing I did for Eswatini was the Technology Needs Assessment on climate change adaptation, and we looked at three sectors - agriculture, water and forest and diversity. So we were looking at what technology Eswatini needs and the stakeholders prioritised those technologies for climate change adaptation. Then for SADC I was one of the authors that wrote the climate change year book for SADC. So it covered 15 countries in SADC. It was the first year book so we went far back as much as we could - 15 years and some 10 years. We were working in teams and looked at issues which concerned climate change. Then after that I did a post doctorate at Rhodes University. There I looked at provisional ecosystem services in forest and how it helps reduce poverty, and we published a book on that, and a number of other publications because post doctorate is all about publications. Then I came back here (Eswatini). For NDMA I was a consultant for them to write proposals for them to get funding. One proposal that got funding of 1 million dollars focuses on climate resilience. But it focuses on WASH - water sanitation and hygiene, because water will also be affected by climate change and also covid 19... you need to have hygiene as a response to covid 19. So we also wrote a proposal on that and it got funding. We also wrote a proposal about drones - technical assistance to utilize drones to look at food security issues, like if there are any dry... which affects crops and so on because NDMA is interested in vulnerabilities. So that one also got funded. Then we also wrote a proposal directly related to the infrastructure in the building sector. We call it SURE - Strengthening Urban Resilience in Eswatini. And that is amongst four projects which have been shortlisted on the Green Climate Fund Eswatini Country Program. Which means it is now eligible to apply for a green climate fund. But the green climate</p>	<p> Civil engineering [CE] Rural water supply [RWS] Lecturer [LEC] Environmental health [EH] Water pollution [WP] Climate change consultant [CCC] Climate change adaptation [CCA] Technology Needs Assessment [TNA] </p> <p> Author [AUT] </p> <p> Proposals for funding [PF] </p>
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<p>fund takes time, so we are still at the concept stage. We need an international accreditation entity to assess that fund...so we got UNIDO - United Nation Industrial Development Organisation. Their offices are in Austria, so they are working to develop our concept. That one was inspired by the floods we had, not just the recent cyclone because even before that we had a flash flooding. You remember how the malls got flooded. So that was the time we were developing this proposal and we were like everyone is writing about Rural Areas, Agriculture, but we also need to remember urban areas are also vulnerable to climate change. And in climate change you will find more flash floods, more cyclones and heavy rainfalls that can damage infrastructure. So this project looks at climate proofing urban infrastructure. And it also looks at the enabling framework, like the construction industry council, the Municipalities, bylaws and all. What kind of regulations and legislations can ensure that when we are building in Eswatini, we include climate change into..uhm right at the design stage. And one of the things that came out from that was that even our procurement we don't include these issues. We choose the cheapest tender. So if we want to build schools and hospitals, for example, we ask for tenders and choose the cheapest tender and we award. We do not ask them if they have considered that now we will have more floods, we will have more heat waves. Is your design considering that..? We do not ask that. Procurement is where we should start. I have been thinking about that for a very long time but I am still not sure how to get it rolling. If you are trying to change the procurement act, it really takes a long time. But luckily now I am coordinating the Nationally Determined Contribution for Eswatini, which is the climate action plan for the country and part of the Paris action plan agreement. So as part of this NDC process, Eswatini received a number of technical assistance in the form of consultants and advise. So we got an economic advisor. He is now based in the Ministry of Economic Planning and Development. So I told him about the procurement that we have to start there and he was convinced. He can write an advisory directive to the Minister. So he was convinced and wrote an advisory on how we can do that. So yah. Revising the procurement act, and how to integrate climate change issues, when doing a tender you should have a table where you evaluate, and in that you should have columns where you articulate how climate change adaptation is included and so on, and the projections that should be included as well. So we are slowly moving towards that direction, and yah there</p>	<p>Nationally Determined Contribution for Eswatini Coordinator (climate change action plan for Eswatini) - [NDC]</p>
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	<p>is a lot that needs to be done. In the NDC we have added more sectors. So the infrastructure sector is now included. And we have included in our workshops the Ministry of Housing and Urban Development, Housing Board, Municipalities, CIC and some contractors we also invited</p> <p>Interviewer: Interesting. What an experience. So you are currently based in Eswatini?</p> <p>Interviewee: Yes, this is my 6th year. We are quite happy here, and we hope we can stay longer. So yah, we are here and want to contribute to the country.</p>	
2	<p>Interviewer: Okay. Moving on, based on your observations, how are temperatures changing in the context of Eswatini? 13:24</p> <p>Interviewee: Temperatures are definitely rising. It shows in an analysis from I think 2010 that temperatures have risen by almost 1deg, and it keeps increasing. And then in terms of rainfall, although annual rainfall is not decreasing dramatically, the trend is generally downward, and that is true almost all over the world. But this is misleading because you might think that we are going to get the same rainfall. No. Cyclones are changing. You might get the same overall rainfall but you might get huge intense rainfall episodes. Rainfall you would get in months you find that you get in a week, which is very bad for agriculture and infrastructure. So saying that annual rainfall is the same, doesnt really... is actually misleading. In terms of projections for the future, Eswatini will continue to get warmer. Mean temperature is expected to increase. There will be an increase in the number of hot days, and rainfall will become uncertain and difficult to predict. This will affect almost all sectors.</p>	<p>Increasing MEan Temperatures [IT] Slight decreasing annual rainfall [DR] Erratic Rainfall [ER] Huge Rainfall Episodes [RE] Increase in number of hot days [INHD]</p>
3	<p>Interviewer: So how are the changes in temperatures affecting residential neighbourhoods?</p>	

<p>Interviewee: Buildings have been built based on how things are usually. So when you build without considering that there could be days where the temperature will be 9 deg or 50deg celsius etc, imagine the demand of air conditioning that will come as a result of that. Yah. If you have not designed your buildings with air ventilation that keeps the inside cool enough but you got glass and fancy looking things for aesthetics which actually increase the greenhouse gases inside the building making the buildings really too hot to inhabit. That can affect human health. Heatwaves will affect the building sector. And then we are building our cities, we are building roads, we are building malls and the paving is everywhere. We are cutting down trees. You need to have more green spaces, you need to have more trees. There are people who are working outside, when temperatures are too high, this will affect them. This is not only true for the built environment but also for agriculture. Like if you are farming sugarcane, you need places with trees where you can get refuge when it gets too hot. Yah. And the materials that we use for building, are they good for that high temperature? Such high variations. Have we thought of that? Are we sure that the materials will last long? It will not crack, it will not melt? You know, there can be all kinds of impacts. So we need to look at that. And that is just to look at human health and human comfort angles. Also about climate change, you may also know about urban heat island effects. So if cities are not having some form of cooling systems in the form of wetlands and planting trees and shade... and pavements which increase heat radiation. If they are not designed properly you will find the urban heat island is very very uncomfortable. And some of these interventions may serve you money. Why are we using normal concrete? It actually costs more. Concrete is made of aggregate, water and cement. There is another form of concrete. When you have used it in a carpark, when it rains water can seep through and you can have a reservoir under your carpark, and you can actually keep it there. It will cool the concrete because there is water below. And you can actually reuse that water, divert it to water tanks, treat it and use for hand washing facilities, flushing toilets, etc. And that is climate change adaptation because in climate change we need to harvest water and control the usage of water. So the building sector has really a lot of opportunities to adapt and mitigate against climate change, and even with the use of material, if you use recycled material, you are reducing carbon emission. The building sector, they call it a <u>mitigation heavy</u></p>	<p>Air conditioning demand [ACD] Increase internal greenhouse gases [IIGG] Inhabitable buildings [IB] (human comfort) Effect on Human Health [EHH] Heatwaves [HW] Effects on Agriculture [EFA] Effects on materials - melting, cracking [EFM] Urban Heat Effects [UHE] (Wetlands [WT] Planting Trees [PT]) Cooling reservoirs [CR] Porous concrete [PC] Water Harvesting [WH] Water usage control [WUC] Recycled material [RM]</p>
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	<p><u>weight</u>. If you just target a few projects, you can say you have reduced huge amounts of kilograms of carbon or even tons of carbon emissions. So yah, we haven't really tapped into it that much.</p>	
4	<p>Interviewer: Thanks for the suggestions. They will also be helpful for the study. If we do not address these issues, do you foresee any future disturbances in residential neighbourhoods caused by the changes in temperature?</p> <p>Interviewee: Absolutely. If you look at what happened with the recent cyclone, buildings that were not strong enough were destroyed. And if you look at climate change, you will see that there will be heavy rainfall episodes, which means if you build on low lying areas, your structures will be flooded. And the frequency of flooding will increase with climate change. So the losses that you have in your business will multiply.. they will increase. When you design you need to think 30 years from now, 50years from now. What are the climate issues? what are the hazards and then you design your building accordingly. You also need to look at cyclones with strong winds, then you also have hailstorms. So are the buildings strong enough to withstand that. Otherwise we will have to keep repairing our buildings. So climate change needs to be taken seriously in the building sector and critical infrastructure. Infrastructure that locks up people, such infrastructure needs to be retrofitted not only for climate but also for disaster risk reduction, because the two go hand in hand.</p>	<p>Destroyed buildings [DB]</p> <p>Increased flooding frequency [FF]</p> <p>Design for future climate [DFC]</p> <p>Analyse climate data [ACD]</p> <p>Retrofitting infrastructure [RI]</p>
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7	<p>Interviewer: Okay thank you for that. I also have a set of questions about rainfall but you have already responded about your observations on how climate is changing in the context of Eswatini. So what are the effects caused by the changes of rainfall on the infrastructure and housing?</p>	

	<p>Interviewee: So, I had mentioned that rainfall will increase and we will have the same amount of rainfall annually but the intensity will increase. We will experience heavy storms, more rainfall in a short period of time. So you have designed your drains, your roads, your gutters based on your normal rainfall and now you will experience say 3 times more in a short period of time. So your gutters can get damaged from hails, etc. So you have to design these things based on future projections of climate.</p>	<p>Heavy storms [HS]</p> <p>Damage gutters [DG]</p>
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9		
10	<p>Interviewer: Okay. What about winds? Are wind patterns changing in the context of Eswatini?</p> <p>Interviewee: I do not know if wind patterns are changing. But definitely storms, cyclones and other storms are increasing in frequency in the region. There is no study particularly for Eswatini on that but in the African region we are expecting an increase in frequency of storms. And they are linked with the wind. The cyclones come with winds. So our roofs need to be retrofitted to withstand strong winds.</p>	<p>Increased storm frequency [ISF]</p> <p>Retrofit roofs [RR]</p>
11	<p>Interviewer: So you are saying changes in winds mainly affect the roofings?</p> <p>Interviewee: You need to see if your roof is well secure, do you have windbreaks around the house.. all those things affect how vulnerable your house is. And of course it's the roof that gets blown off by strong winds. So you need to design that properly.</p>	<p>Establish windbreaks [WB]</p> <p>Blown roof [BR]</p>
12		
13		

14	<p>Interviewer: Besides the changes in temperature, rainfall and winds, how else do changes in climate affect residential neighbourhoods?</p> <p>Interviewee: Climate change effects mainly come from changes in temperature and precipitation change. Those are the two main components. And from that comes the impacts..high temperatures, heat waves have damages to material, damages to your agriculture, and also human health. And then from rainfall the impact will be the floods, and overflowing drainage and so on. And that affects your roads, and buildings and causes economic losses to humans. So that is how you see the impacts. So basically you look at temperature and rainfall. Those are the two parameters you have to look at.</p>	<p>Temperature impacts: heat waves damage material, agriculture, human health</p> <p>Precipitation change: flooding, overflowing drainage, affecting roads & buildings</p> <p>Economic losses [EL]</p>
15	<p>Interviewer: Which effects are more urgent - impacts from changes in rainfall or from changes in temperature?</p> <p>Interviewee: That is very difficult to say because both are important and they are both connected. So one other impact can be drought or flood so they are actually connected. You can't choose one over another, you have to look at them holistically.</p>	<p>All Drought [DR]</p>
16	<p>Interviewer: Lastly, do you have any comments concerning climate change impacts on residential neighbourhoods?</p> <p>Interviewee: Yah. You also need to look at the utilities within the building - water reuse etc. They are all connected. With climate change we will experience water scarcity. You need to start designing your houses with technology that uses less water, which will use water treatment systems, use grey water.. shower</p>	<p>Water scarcity [WS] Water conservation technology [WCT]</p>

<p>installations, all of that should be considered not to waste water. So within the building sector there is a lot that one can do to address climate change. So we need to look at that as well.</p> <p>Interviewer: Thank you very much for your time. For now I only have those questions which you have responded to.</p> <p>Interviewee: Alright. This is also my area of interest. As part of our climate action, now with Covid 19 we had a covid economic recovery plan that the government was pushing which mainly they are focusing on job creation but we should not forget the environment, we should not forget climate change. So now whatever recovery we do, it should be a green recovery. It should create jobs, but it should create green jobs and not polluting jobs. And in that aspect, the infrastructure and building sector is very important because there are many opportunities for creating green jobs. Designing in such a way that the buildings are more energy efficient. YOu do not need to push air conditioners everywhere. We really need to address that.</p> <p>Interviewer: Interesting. Thank you very much.</p> <p>Interviewee: You are welcome. We will keep in touch.</p>	<p>Water treatment systems [WTS]</p> <p>Green recovery [GR] Green jobs [GJ]</p>
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9. INTERVIEW 09 - [1445 HRS - 1530 HRS]

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1	<p>Interviewee: Good day, welcome. I will just start by telling you briefly what we do here. So we ensure that we collect waste from residential and commercial establishments. We collect it on a daily basis, transport it and deposit it off in a landfill in Matsapha because we do not have a landfill here (Ezulwini). The department is divided into two sections - public health and environment. So the public health has more to do with inspections of shops, more especially supermarkets just to make sure that the food that we sell to the public is wholesome food. Also the public health side also includes disease management, covid 19.. that's the public health side. Like rabies, so we do campaigns... any disease existing in the town to make sure that we combat it. Then we do civic education. So we also do occupational health and safety on the public health side. We inspect all new establishments, check issues of fire management.. basically that's public health. Where there is a human being.. we protect.</p> <p>Then there is environmental management, where there is nature.. we protect the environment. Including waste management, managing rubble in construction sites, we do water tests to check our streams if there are no chemical discharges. Long and short of it. Issues of climate change are addressed on the environmental side. Otherwise how do I further help you?</p> <p>Interviewer: Thanks for that. As I had previously introduced myself, I am a PhD Architecture student at the University of Pretoria. So looking at the way climate is changing and the kind of structures we have in Eswatini, I decided to do a study with the aim of developing design strategies of residential neighbourhoods towards climate change resilience. So I am conducting this interview to identify the impacts on the residential neighbourhoods which the designs should adapt to. You had already started addressing my first</p>	

<p>research question.. What is your role and engagement in anything related to climate change and/residential neighbourhoods?</p> <p>Interviewee: This is how the Municipality works. In every town there is a planner who plans for the town/city. The role of the planner is to decide on how the town should be structured. So we start with the town planning scheme, which is the highest document when it comes to planning. Of course it has some alignments because there are national town planning documents, of course there are specific relevant terms for those documents. So at Ezulwini there is a town planning scheme which was developed which guides that for instance in this area we are going to have commercial areas, in this area we will have strictly residential areas. The reason I am starting here is because when a developer applies for construction of a residential house, my engagement there is that I do a scrutiny of the plans. We scrutinise building plans and check the location of the building, but it starts with the town planner who checks if the house is built according to the town planning scheme. Or, where you want to build the area was zoned for residential but you want to build an office. Do we even allow that sort of small scale commercial development in that area? If it is not permitted, this is where special consent issues come in. Meaning that this is what is allowed in this zone by which I am applying to build this which is currently not allowed. I believe you are clear with this process. So that's where the process of the town planner starts, then all of us are supporting that town planning scheme. So in our public health and environment department, we receive the building plans as well after it has passed the town planners desk. It also goes to the engineer who looks at the structural system of the building and I look at the public health and safety issues, like your ventilations, drainage that is residential and all of that. If it's a commercial building, we will get in and talk of issues like drainages and that touches on climate change. Because look if you do not address such... look at cyclone eloise which caught us with our pants down. So that is where we look at drainages... are they functional? Your weep holes in terms of integrity, your boundary holes.. do they even have weep holes to discharge water? ... so when we receive heavy rainfalls they do not collapse. First of all that is where a little bit of climate change is introduced... when scrutinising the building plans. Then during the</p>	<p>Scrutiny of plans [SP]</p> <p>Public & environmental health [PEH]</p> <p>Ventilations, Drainages, Weep holes</p>
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<p>construction of that house or construction of that commercial area, we do get in and inspect if you are following the approved plan. If you do not have these things in place.. say you do not have the weep holes on boundary walls, rain will come as we have seen boundary walls collapsed because there was too much water and the soil could not carry the walls so they collapsed. We do advise them to reapply so the drawings are scrutinised until this passes. So that's the first part. We also encourage greening as you have appreciated in the ICC. They could have chosen to pave outside.. but we do encourage greening especially in commercial establishments. <u>There is no policy though to force developers to plant vegetation.</u> That's a gap. But we see it happening especially with the newly completed clinic that even though they have paved, they tried to include small elements of urban gardens here and there. In terms of climate change that's what we do - the part of drainage, the part... if it's too hot how are you going to manage ventilation. We do inspections to check the structural integrity in the areas we own. Unfortunately the municipality does not own a lot of areas. But in the public market we own we do inspect the walls and predict how they could be affected in the case of disasters. So we attend that through our works department.</p> <p>Interviewer: At national level are not involved in anything related to climate change?</p> <p>Interviewee: Yes and no. Yes in the sense that first of all I sit in the technical working group of the National Disaster Management Agency, but in bits and pieces. We sit in the steering committees. For instance, the National Disaster Management Agency wants all towns on a national scale to have disaster risk management plans. So we did not have that. We have a draft now which was issued on Monday, so we are doing that as a requirement that every town should have disaster management. In Fact I wanted to mention that after you have planned the city, the town planning scheme is an important document, but the next important document is the Disaster Risk Management Plan of a town. Because you want to say now there is SRA who did... I like what they did actually, there was a wetland in their site and they accommodated that wetland in their plans. They even constructed a man made wetland to go with the natural one. So that's what we are encouraging. Because you can buy land and the Municipality cannot</p>	<p>Technical working group of NDMA</p>
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	<p>say no dont sell this piece there is a wetland..! If you have already bought such land we encourage that you build around the wetland. Your architecture should consider that there is a wetland. These are systems which help us in the issues of climate change because they buffers in case we get excessive rain. Also the national disaster plan is important for all towns because you are able to say these are the hazards the town has. Maybe it's a town prone to lightning and striking. So disaster management plans are very critical because they tell you that here are the hazards and they are this side, and this is the history of the town in terms of hazards. It can be field fires, floods.. depending on the geography of that area.. air pollution, water pollution, severe winds depending on where you are.. I am just reading the hazards for our city (Ezulwini).</p> <p>Interviewer: So are you going to change the town planning scheme to accommodate that?</p> <p>Interviewee: Unfortunately not. because as I say.. It's a chicken and hen type of situation. Ideally if we were to start afresh we were going to start with the disaster plans so that now the town planning scheme will follow that there might be a disaster here, and probably some of the land wouldn't be sold. I think it's important to marry the two now going forward, 2021 going forward and remember that in this place this is what is prone. We may not eliminate but it's an issue of managing now, that guys the rainy and summer season, where you have built is a waterway which can charge anything, do this, do this, do that, because it's already very late.</p>	<p>Nature responsible architecture [NRA]</p> <p>Site analysis [SA]</p> <p>Limitation of town planning scheme [LTPS]</p>
2	<p>Interviewer: Based on your general observations and involvements, are temperatures changing in the context of Eswatini?</p> <p>Interviewee: Yes. Temperatures have increased. There is a beautiful study done by a certain Dr. from the University of Eswatini, Kwaluseni Campus. He mapped what is prone in all the four regions of Eswatini. From him I was surprised because I actually thought that global temperatures have increased by plus 1</p>	<p>Increased temperatures [IT]</p>

	<p>degrees. That's what they have been saying. But he mentioned that in Eswatini they have increased by plus 2 -3 degrees. It's even higher because of the quick development of towns. As we construct them, we have these urban heat islands, so due to that exposure I know that it might not be just plus 1 degrees because of what we have built. In towns there are a lot of pavements, a lot of tarred roads, all of these things are causing dramatic increases in temperature. So definitely they are changing. When it comes to rainfall patterns, no one is able to predict, it's raining now but it's July. It was raining the other day, so the rainfall patterns were easily predictable in the past. Our grandparents were able to predict that now it's about to rain, now it's winter and so on but now we can't do that. Even when it does rain, it becomes erratic. We are unable to predict, it's now rain which causes damage. Wind, I used to know that in July it was the windy times but now it has changed. So all of those show that the climate has changed. It no longer happens in the time period we knew before, and when it does happen it's extreme. When it's hot, it's extremely hot and when it's cold it's extremely cold, and rainfall is damaging now, it's no longer normal rain.</p>	<p>Erratic rainfall [ER]</p> <p>Unpredictable wind times [UWT]</p> <p>Extreme temperatures</p> <p>Damaging rainfall [DR]</p>
3	<p>Interviewer: How does changes in temperature affect residential neighbourhoods?</p> <p>Interviewee: What I have noticed is that on the roads... I do not want to believe that you would stick to the same materials. We have seen tar melting when it's too hot. So now it talks to the material that you are now using. You cannot just use any material. It should accommodate that one day when it's too hot what do you do? There is more engineering involved in terms of infrastructure. In terms of building, it's no longer that you will just build an office.. An office will rely on natural sunlight and windows only. That's not enough. We learnt at school that we need to promote natural light and natural ventilation but now it's no longer enough because sitting here now I feel cold. I need to have the aircon on. Even on a hot day, you need to have mechanical means of warming and cooling the buildings. The mechanical means are now required to assist the natural means.</p>	<p>Melting tar [MT]</p> <p>Increased energy demand [IED]</p>

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7	<p>Interviewer: Since you have also mentioned that rainfalls are also extreme, how do they affect residential neighbourhoods?</p> <p>Interviewee: I think it's the same thing with rainfalls. We have noticed in Ezulwini that there are roads that we need to start over because drainage systems were not properly planned. All drained water has previously gone to a certain residential property and destroyed a wall, and we were forced to pay for rebuilding that wall. Now when you build you need to think about the extremes. If I were to get the heaviest rain, would this road take it? Where does the water go knowing that water takes the shortest route. Is the infrastructure enough? That's why I said to you it starts with the town planner, to the public health to engineering. At the end of the day we need to ask ourselves that when it rains, what is going to happen? So we ask ourselves those questions. You talk to the integrity of the building itself. You want to use material that you know would withstand heavy rain, and will withstand winds as well. So that is how it is affecting the town.</p> <p>Interviewer: So you confirm that when designing residential neighbourhoods we should be aware of the climate data? In the past the current infrastructure and house might have been relevant but as climate change we now see that no no we missed something.</p> <p>Interviewee: Ofcourse, what I forgot to mention on the environmental management side of the department is the urban gardens. We are in the process of promoting urban gardens because they are sponges on their own. We want everyone to at least have minimal space for an urban garden, at the same</p>	<p>Drainage failure [DF]</p> <p>Effects on neighbouring properties [ENP]</p> <p>Urban gardens [UG]</p>

	<p>time you get to eat those products. At the same time it is like a sponge. Water can be trapped in the case of excessive rainfall.</p> <p>Interviewer: Is it that difficult to change the town planning scheme and just incorporate all the ideas you are talking about? If it's not documented anywhere you may find that implementation is difficult. Why are you not changing the town planning scheme?</p> <p>Interviewee: It's not an easy one since it's gazetted in parliament. It's a high level document. Changing a town planning scheme would mean that my house is now redundant and I have to demolish it. At what expense. I think we would rather climate proof what is already existing than to start afresh, but now regulate the newer buildings going forward. We have people who came quite some time back and we are struggling to provide them with certain infrastructure. They have septic tanks and are not connected to the public sewer... you struggle with the older buildings. You may however amend, but the town planner would have responded better on whether it's easy to change a town planning scheme.</p>	Climate proof [CP]
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10	<p>Interviewer: You have highlighted something about winds already, are they changing in the context of Eswatini? Did you respond to that?</p> <p>Interviewee: Where are the winds now because it's July? We expect a windy July. From what I know since I was young, in July it used to be very windy. You would even have teary eyes. The winds have now changed.</p>	

11	<p>Interviewer: Do those changes affect residential neighbourhoods?</p> <p>Interviewee: It does. <i>If your building has a compromised structural integrity. On a windy day it will fall.</i> It does affect to a large extent just like rain. Just that rain is more common because it's on your face, you know. And for wind it's once in a while. Actually in most cases this happens at the same time where you find that there is windy rain.</p>	Falling buildings [FB]
12	<p>Interviewer: If we do not address these impacts, do you foresee future disturbances caused by the changes in climate?</p> <p>Interviewee: Definitely. I don't know if you have experienced Mbabane on a good rainy day? That's what is going to happen. I can share with you a bit of our experience here, where we had one road which was not draining properly. Ezulwini urban area is surrounded by the peri-urban area, there is Lobamba this side, we have Mvutshini this side, we are literally inside. If you do not have a proper drainage system here in town, <i>the water flows to these peri urban areas</i>. Right now we are in talks with a community, Inshakabili, where water because of construction of a road, flows to be received by someone at the far end of this community, passing through people's homes. <i>This causes erosion which is extremely bad. There are gullies now.</i> When there is such erosion there is a risk of introducing invasive species. Because what happens is that everything is being washed from the upper stream including seedlings, and all plantations on the upper side... Sedimentations, <i>pollution of rivers</i>.. so invasive species are migrated from the town to communities just because of a poor drainage system. On a normal day everything is fine, but climate change is approaching.. The rainfall is now unpredictable, the wind is unpredictable.. washed down everything. The Dr. i was talking about also mentioned that invasive species have covered about 90% of land and you know how dangerous that is, I wont get there. Sedimentation is introduced to streams where there is fish and other normal biodiversity that is there is at risk. So water is polluted which is also used as drinking water. What am I living behind? Costs as well. <i>The costs of fixing this thing, the damages, is more</i></p>	<p><i>Water from town flows to neighbouring peri urban areas</i> Soil erosion [SE] Invasive species [IS] <i>River pollution [RP]</i></p>

	<p>costly. The costs of fixing the damages if more costly than the costs of preventing like building a good designed road with a drain channeling water to deposit water safely to a river. So now fixing this is costly since you find that you are compensating a lot of homes. That's a bit of a disaster. Here is a tourist town. When we receive floods this would affect the economy. We get a lot of foreign exchange here when we receive tourists. Livelihoods would be affected just because we could not control floods. Let me summarise it this way.</p>	<p>Increased renovation costs [IRC]</p> <p>Effects on Economy [EFE]</p>
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16	<p>Interviewer: What are your general comments on issues of climate change and residential neighbourhoods?</p> <p>Interviewee: I think the study is well and good. I appreciate that. But we need to do more. Where are the policies? What forces me to design in a certain manner? I own the land, I have a title, so no one can tell me what to do with my property. People still don't understand that when a stream passes your property it's not yours. You need permits to touch that stream. So we really need policies. I am happy there is a wetland policy now. I think the policy is very important. The legislative framework of climate change is not there. I do not know one that is strictly talking to climate change that this is what should go in the built environment. Because you are in this area you need to build in this manner because there is a national scheme. As long as there are no policies people will do as they please.</p> <p>Interviewer: Alright, thank you very much. This is going to be very helpful.</p>	<p>Need of climate change legislative framework</p>

10.INTERVIEW 10 - [1100 HRS - 1200 HRS]

#	DATA	CODES
1	<p>Interviewer: I am Musawenkosi Ndlangamandla. I am doing a PhD Architecture at the University of Pretoria. My study is titled Design and Development Strategies of Residential Neighbourhoods towards Climate Change Resilience in Eswatini. The aim of the study is to come up with new ways of designing residential neighbourhoods such that they are resilient to climate change. I am conducting this interview mainly to identify climate change impacts which the designs should adapt to. I will get to my first question right away. What is your role or experience in anything related to climate change or residential neighbourhood development?</p> <p>Interviewee: I am working for NDMA in the Shiselweni region. By title I am a Disaster Risk Manager. In a nutshell, I will keep it in a DRL continuum to say, my work is how to prevent risks, how to prepare the region for any impending disaster, how to coordinate any kind of a response to any disaster that has occurred, and how I coordinate recovery ultimately. We can break this down into a lot of things per responsibility, but in a nutshell I work with all stakeholders in this region (Shiselweni). So I work with the Regional Emergency Task Team comprising, security cluster, agriculture, and some NGOs. I work with the RRT which is in the pandemics and epidemics with Health. I work with Tinkhundla on disaster response at Tinkhundla level. I work with World Vision, the Forest guys on how to prevent forest fires. Its a whole lot of things. Just anything that relates to disasters. I further work with Municipalities, Nhlengano, Lavumisa, Hlathikulu, I work with water services on how to manage water schemes and provide water where there is none. I work with works where we rehabilitate bridges whereby they have been affected by rainfall - that's the recovery aspect. Uhm, I work on food response during droughts, and now it happens yearly. I work with the Red Cross on cash transfers, I work with World Vision. So I will probably say its a whole spectrum of things, because as an organisation we are sort of in the middle. We coordinate</p>	<p>Disaster Risk Manager [DRM] Risk Prevention [RP] Coordinating Recovery [CR]</p> <p>Rehabilitate bridges [RB] Food response [FR]</p>

everything. So when the partner does the work, once it touches on protection and reduction of risk, then we come and work with them. So I only do that in my region, and then of course there are linkages to the HQ in Mbabane. But when it comes to the region of Shiselweni, that is what I try to manage. Yah.

Interviewer: So your work is not specific to a certain sector but you address disasters from any sector?

Interviewee: Yah. Of Course now it's now more climate induced hazards and disasters but we are not confined to that. The Disaster Management Act is broad. It includes even the civil unrest which happened. It's very broad in its nature.

Interviewer: Specifically to what relates to climate change, what are you involved in?

Interviewee: How we work as NDMA, we work within nine sectors. So one of those sectors is environment and climate change. So within this sector we have the players that we work with, like SEA, the likes of SNCT, the University of Swaziland.. just a couple of people, but what we mostly do there, we mostly work on climate induced hazards. That is your drought, that is your cyclones, that is your flash flooding, that is your windstorms, those are the types of climate induced hazards we work on. But when it comes to prevention and preparedness, that is where we spend a lot of resources. **So we support initiatives of other organisations when it comes to how do we prepare, how do you prevent issues... implications of drought for example. That is where we even find ourselves digging boreholes, working on water schemes for communities. It's part of the prevention part.** So it depends on what we are working on at the particular time. I will make an example of these guys working on forests. You find that you see the likelihood of fires increasing almost every year you see. And then when you dig down into it and try to understand the problems, they are not the socioeconomic problems perse, but the likelihood of the spontaneous fires out of the blue because if becomes dry this year and more drier the following year, the

	fuel load is even higher the following year, so that doesn't happen on its own. The drier it becomes is the more likely we experience fires.	
2	<p>Interviewer: Interesting. Based on your observations as you have narrated your involvement on issues which concerns climate change, are temperatures changing in the context of Eswatini?</p> <p>Interviewee: Definitely. Either you are seeing more of something or less of something. Whenever it happens it's on the extremes. I will make an example of ... probably I will start with the heavy rains and strong winds because that happens almost every year such that we now have a standing budget for it. When we started it was something a little bit more spontaneous when you know that probably in December, October, November, maybe even January... <u>maybe we will spend a few millions on rehabilitation and reconstruction for people who have been affected. But as the time goes by, we are spending even more on that.</u> So that is one part. The same has happened on drought mitigations. We have one declared drought probably.. if you look at the return period of droughts, you say its 1992, 1997, and as you go closer you are looking at 2005, 2007, and then you have 2008, then 2015.. so all of a sudden they are more title packed now, the return period has reduced in such a way that even if you do not have a declared drought, its still localised in some areas in such a way that every year you deal with areas that have experienced drought. This did not happen previously, the situation has changed drastically. Even in terms of fires as a whole, not just forest fires. Like right now that is June, July, August, September, October, which is the fire season. <u>The fire season you used to find that for my region, you are looking at 200 house cases, maybe 210.. but now in the worst case scenario you find that you are looking at 400 cases, 450 cases reported on forest fires, household fires.</u> And then we have forest fires which happen yearly. This year we are expecting even more because of the fuel load. So, I will probably say it's tilting towards the extremes. If there are no rains there are seriously no rains, if there are rains there are a lot of rains. It's no longer a case of saying it's just in the middle.</p>	<p>Extreme Temperatures [EXT]</p> <p>Overall extreme weather changes [OEW]</p>

3	<p>Interviewer: How do the changes in temperature affect residential neighbourhoods? What have you observed?</p> <p>Interviewee: One of our mindate is to build back better, so if you were affected during a certain hazard, we have to assist you by saying building for you if your structure was completely destroyed in such a way that you just have something where you can hide. So when I started here at NDMA, <u>the plan that we were using became a hazard even on itself because it was more prone to the disasters. YOu would find that the same house we have built for someone has been blown away again the following year. And then we changed it and went for some consultants in 2016 - 2017, they gave us a new plan which is a little bit climate smart. I will say climate smart in terms of saying its a little bit more wind proof. Not necessarily to say it has less concrete, etc you know. So more windproof in a way. Even now during our cyclones, some of these houses were damaged. Not because of poor workmanship, but because they are no longer suitable to the intensity of the rainfall we have now. Some of the winds are just too strong for some of these houses.</u> We had to change the way we do our work. Fortunately I am also joining the municipalities in the planning and approval of some houses. So one of the aspects we incorporate is the issue of trying to build something suitable for that region/area, because the <u>'one size fits all' does not work for us.</u> Uhm, we are trying to change as NDMA. We are looking at the areas which have high temperatures like in the lowveld. <u>We are trying to build houses which have less concrete because they become a little bit too hot in summer when it's hot.</u> We look at how we can modify these in terms of ventilation, in terms of coolness in summer. And probably have the concrete ones in the Highveld side. But of course the climate is forcing us to try to adapt as quickly as we can because some of the interventions we are proposing turn out to be not suitable for that place in 2 years time or so because of the climate. But in most of the work that we have done, i think we have just recently concluded building a certain school in the Shiselweni region with the help of CIC. We tried to be flexible of what was needed in that type of locality. What kind of housing structure can we experiment to see if it could work here. That is in our case anyway, I wouldn't know about others.</p>	<p>Strong Winds [SW]</p> <p>Inhabitable Buildings [IB]</p>
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	<p>Interviewer: You mention that you are engaged in the scrutiny of plans, what aspect are you checking in the plans?</p> <p>Interviewee: Not necessarily being engaged on specific plans but when the municipality plans on what to do, what they want to implement, what kind of infrastructure they want, we are also part of that team. For the Nhlanguano municipality, I am the one who has been involved in trying to craft the disaster management plan for them. So it becomes very important to stick to the disaster management plan we have crafted together, not being willy nilly on what we want, not taking consideration of the prevention aspects. Some of the towns we have, I will make an example with Nhlanguano, we have a lot of drainage flooding which happens around here during the summer when there are heavy rains. That is what we consider when we craft the disaster management plan. It goes back to what type of housing is where, why? I think we have a good relationship. It's not only here in Shiselweni, but the whole country, because the Matsapha management plan was fully crafted by us. So it has to do with what we do together on what could be allowed and what could not be allowed, where, when it comes to the risk aspect of it.</p>	Flooding drainages [FD]
4	<p>Interviewer: Do you address disasters induced by increasing temperatures or do you address mainly rainfall related disasters?</p> <p>Interviewee: I'd probably say from issues of flooding. In terms of heatwave, I'd say no. We do not necessarily..we only have dry spells. Prolonged dry spells. For those ones because they are slow inset disasters, we are able to plan for them you know. but the immediate onset ones like the heavy rains, the cyclons and the heavy rains, those ones are a little bit tricky because they happen quickly and you have to... you do plan for them but it's difficult during the response phase. I will make an example of the cyclone, the biggest challenge was accessibility. It doesn't matter who you are. If you can't get there, you can't get there. So it becomes a problem because overnight I can't access certain areas. so once you can't</p>	<p>Dry spells [DS]</p> <p>Accessibility [AC]</p>

	access certain areas the response is delayed. But in terms of the rainfall and heatwaves, I'd say rainfall is the one that takes more of our time and the responsibility and resources go towards disasters and hazards induced by rainfall.	
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7	<p>Interviewer: Concerning the access, are the places inaccessible because the roads are slippery or the roads are blocked by trees which have fallen or what? Specifically what disturbs the accessibility?</p> <p>Interviewee: It can be damaged bridges, it can be slippery roads, it can be blockages or roads distorted completely. There is one road towards Mhlosheni which was completely washed away. Dongas were formed, so a different route had to be used. So its cases like those but mostly like the cyclones, it would be crossing to the other side of a river because the bridges have overflowed.</p> <p>Interviewer: Concerning the housing, how does the flooding affect the houses?</p> <p>Interviewee: It depends on the house. In most cases than not, before the intensity of the rainfalls reach the level where they are now, your thatched house would just last you a lifetime. Now you can still do that but the problem is that the kind of infrastructure can't withstand persistent rainfall over a period of time. So, mud walls would be saturated with water and eventually fall. Then you have cases like at the Highveld where the stone structure is very loose and a bit porous compared to the lowveld areas so when someone has cleared his land, the embankment just falls. For us... is it partially destroyed, or completely destroyed, is the main house? How many people are in the household in terms of gender disabrigation? do they need another house because they can't be in the same house, the men and women. So we look at a wide range... is there someone disabled? Are there special needs cases here? So we then use our</p>	<p>Damaged Bridges [DB] Slippery Roads [SR] Damaged roads [DR] Washed away roads [WR]</p> <p>Mud walls saturation [MWS]</p> <p>Falling embankments [FE]</p>

	rapid assessment forms to try and fish out who exactly needs to be prioritised. And then we get that, we mobilise our own resources. We get the army, we get the police, we get correctional who go and build for these people.	
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11	<p>Interviewer: Are there any impacts caused by changes in winds?</p> <p>Interviewee: Probably I would say it's rare when it comes to strong winds but it happens. It's just that in most cases than not, the winds are accompanied by rainfall. When you report that you sort of labby that with heavy rainfall. But, there are cases where you have strong winds. They are localised in most cases. In some areas like what happened in Maseyisini, they would tell you that 55 homes were affected by winds in just an hour's time. And mind you, I was just here in Nhlangano and nothing was happening here. It's more localised. It's just quick and then gone like that.</p> <p>Interviewer: What was being affected specifically?</p> <p>Interviewee: Mainly the roof.</p>	Localised winds [LW]
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15	<p>Interviewer: If these climate induced issues are not addressed, what would happen in future? Do you foresee any further disturbances and say these issues were not addressed.</p> <p>Interviewee: Definitely, especially if NDMA was not there. A lot of people rely on the kind service we offer. Most importantly what is missing are plans which are climate smart, resilient, climate proof but very affordable and can be easily implemented by people using local resources they have. NDMA can sustain what is currently happening. There is just no way this could be sustained over a long period of time considering the financial situation of the country. So how can we find a way to use what is already locally available but have a structure.... at least NDMA should just come with just a few incentives or a few materials to complete what the person already has. But at the end the house should be disaster proof and climate smart you know. <u>so i think that is where for us we are missing, we are having a gap and I think that is where you guys can come in and say look, this is what is currently available.</u> Even if the shelf life of the household could be 3, 5 years, I'd probably say it would be much better than the stick and mud that we are currently seeing. The stick and mud doesn't work at all in the kind of rainfall we have now.</p> <p>Interviewer: The question is how do we get to the rural areas? It's easier where there is the municipality which controls development in urban areas, but what about the rural areas?</p> <p>Interviewee: At Least be in a position to pilot something like that. Then you have the NGOs that are working at community levels like world vision. Those are the people who can implement these things because what we do as NDMA is that in that home where we were going to respond with a full structure, let's go and pilot it and see if it's not going to work. We can support that, wide scale over the country because in any case it replaces a house we were going to construct using blocks. For example, between February and today, we had 45 houses for my region.. for me at a very significant cost which I know moving forward we won't be able to do at this scale. We need to try some other methods. There was someone who wanted to give us interlocking bricks. We wanted to try that. Let's try interlocking bricks</p>	<p>Affordable climate smart buildings [ACSB]</p> <p>Locally available materials [LM]</p>
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	<p>and see if they can work. Let's try mud bricks and see if they can work. Lets try mud bricks mixed with something else if they will be more sustainable than what we are currently doing. So we are 100 percent willing to do that.</p> <p>Interviewer: That's interesting. Maybe before the last question.. so as NDMA, the service you render to affected homes if mainly reconstruction of their affected houses?</p> <p>Interviewee: Yah, depending on the situation. We build for them, we give them food, we give them temporary shelter if there is need for that. We do not go as far as.. how can we establish livelihoods.. How can we return our livelihoods back? Those ones fall with the world vision and the likes. But we try to make sure that within the recovery phase of the disaster itself, there is temporary shelter, there is food and then long term there is permanent shelter.</p>	
16	<p>Interviewer: Do you have any other comments even though you have made a few comments already? Anything to add concerning impacts of climate change to residential neighbourhoods?</p> <p>Interviewee: Probably if you can come up with solutions to what I have just mentioned, it would be very helpful. It doesn't need to be the whole infrastructure which is affordable, it could even be just the roofing type. What kind of roofing can we implement? That is a little bit innovative. Something we can try and see if it works. We have places where we end up leaving before the rainy season starts, give people wires to tie their roofing sheets you know. I do not like that thing. I feel like it's not what we need to do. I feel like we need to try to implement something new, something that we can try to cascade. Something we can try to seek funding for and try to implement on a large scale. THat is what I think as NDMA we</p>	

	<p>should do. Not this thing. If part of the results you bring are at least pointing us towards that direction, we would appreciate that one.</p> <p>Interviewer: Thank you very much for sharing your experience in issues related to climate change. This is going to be very helpful for the study. Results will be shared with your organisation as we all seek for a lasting solution.</p>	
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11.INTERVIEW 11 - [1100 HRS - 1200 HRS]

#	DATA	CODES
1	<p>Interviewer: I am Musawenkosi Ndlangamandla, a PhD student at the University of Pretoria. I am doing a study with the aim of developing design strategies of residential neighbourhoods to adapt to changes in climate. Currently, I am conducting the interviews to establish the climate impacts which the designs should adapt to. I am trying to get different experts from different organisations involved in climate change related issues such as yourself to respond to the questions.</p> <p>The first question, what is your role and experience in anything related to climate change?</p> <p>Interviewee: Okay. Some of the things we do is to respond to hazards or disasters which are mostly related or induced by climate change. That responds to blown houses, houses which are degrading, places which are a threat in communities like when there is a developed donga. Also, besides the response, as the region we want to move into a phase where our communities will be ready to face any adversity which may occur or prone hazards in each community. We are currently teaching communities on how they can prepare for the most common hazards, like storms, heavy rainfalls, fire in winter, etc. We are trying to get the residents to be prepared. Our role mainly is to capacitate communities about the disasters and how they can prepare for them, rather than waiting for the government to assist them. It may be ways of preventing disasters from damaging or else prepare to ensure less damages in the unpreventable disasters.</p>	Disaster Risk management [RM]
2	<p>Interviewer: Based on your general observations, are temperatures changing in the context of Eswatini?</p> <p>Interviewee: Temperatures are changing. Like last year, our meteorological department mentioned that we recorded the highest temperatures ever in the country which shows that temperatures are changing.</p>	Increased daily temperatures [IT]

3	<p>Interviewer: How does the increasing temperatures affect residential neighbourhoods?</p> <p>Interviewee: I wouldn't say there are many effects. But in the long term it may be issues of contraction and expansion of infrastructure and tend to reduce the lifespan of infrastructure. We have seen in some places where roads would melt because of extreme heat. Otherwise, increases in temperatures do not have that much effects.</p>	<p>Reaction with materials [RM]</p>
4	<p>Interviewer: Are rainfall patterns changing in the context of Eswatini?</p> <p>Interviewee: Yes, they are. They are changing drastically in so many ways. We were used to having rainfalls from August, September, October to February or so, that was our norm when we were growing up. Now, they start late and when they start they are more intense within a very short period of time. That's where we are observing a great change, and it's affecting a lot especially structures and agriculture.</p>	<p>Rainfall season [RS]</p> <p>Intense rainfall events [RE]</p>
5	<p>Interviewer: Based on your experience, as I believe that you do address the impacts, what have you observed in the buildings? What kind of effects were you observing?</p> <p>Interviewee: It's in two ways. The rainfall may be very extreme and cause impacts, and the status of some of the structures is not good. A properly built structure can withstand the disasters but the problem is that the structures are vulnerable hence the impacts. Another thing I can say is that it's also where people have built. There was once a cyclone, but there was no data recorded in terms of water levels. People build where there used to be floodplains. The stick and mud are more vulnerable. People now tend to build closer to river banks. What mostly affects us is the rainfall. For me, my analysis, it's the vulnerability of people. It's about affordability. People build using cheap materi*-als without considering all the risks that may occur at that time.</p>	<p>Structural impacts on weak structures [SI]</p>

6	<p>Interviewer: If I may ask, which areas have you responded to in the Manzini region, which were affected by the changes in climate?</p> <p>Interviewee: Everywhere. You cannot pick one area. Our assessment showed that the whole of Manzini is affected by cyclones. I used to think that the most vulnerable areas were Mahlangatsha, Mankayane, but now it isn't the case. Our response may be food, or we build houses for a few selected. In the recent cyclone about 400 households were affected, but it was impossible to help all because of limitations in resources. From the 400 we may end up assisting 50 of them.</p>	
7	<p>Interviewer: Do you foresee any future disturbances in residential neighbourhoods if the impacts are not addressed?</p> <p>Interviewee: It goes without saying. That's what we are all about. Let's sit and plan. We have been receiving rainfall with more intensity, with intense storms, it shows that it will be worse than before. There will still be more distractions from just rainfall alone. Until we take all risk factors when we plan development, we are bound to have more impacts.</p>	
8	<p>Interviewer: Do you believe wind patterns are changing in the context of Eswatini?</p> <p>Interviewee: They are. What we are noting is that disasters are still to increase. Winds are getting worse in terms of speed. The US at some point noted that they recorded the highest speed. So that's what we are expecting as well. Winds will still be more severe in terms of speed and in terms of duration. Now within 20 minutes the wind will be over but the distraction will be huge. So the change is observed in many ways. Sometimes the wind will take very long time. It comes unexpected.</p>	<p>Increased wind speed [IWS] Unexpected winds [UW]</p>
9	<p>Interviewer: How do they affect the residential neighbourhoods?</p> <p>Interviewee: Some houses fall, some it's just the roofing which is blown away.</p>	<p>Falling houses [FH]</p>

		Blown roofing [BR]
10	<p>Interviewer: If the wind impacts are not addressed, do you foresee any further destruction?</p> <p>Interviewee: Yes ofcourse. That's why we are trying to address these issues with the communities. The main challenge is that they are not prepared for this. We foresee more and more people suffering if there won't be changes.</p>	
11	<p>Interviewer: Do you have any other comments concerning any impacts of climate to residential neighbourhoods?</p> <p>Interviewee: Yes. As a country we need to address this thing. Currently when I want to build my house at home, I just do as I wish. That affects the government directly because once that structure has been damaged, we have to come in to assist. There should be regulations for constructing even in rural areas. There should be standards. The buildings should atleast meet certain standards, atleast meeting requirements to address local challenges. I hope one day we will get there. It's a long shot but worth doing.</p>	<p>Need for regulations [LR]</p> <p>Improve building standards</p>
12	<p>Interviewer: Do you have a risk analysis of the country showing local disturbances common in that particular area?</p> <p>Interviewee: No we don't, but we already know the disturbances in each and every area. We however experience the same disturbances across the whole country, but you find that in Manzini it occurred on Monday, but in Lubombo it's another day. The differences are not much or not there at all from region to region.</p>	