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The potential impacts of climate change on water supply in Johannesburg

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1 INTRODUCTION

"Climate change is the defining issue of our era . . . For climate change is upon us, and the problem is here to stay" (Kirby, 2008, 12).

1.1 BACKGROUND TO REPORT

Climate change, due to human-induced global warming, is an existing problem that occurs world-wide. Over the past couple of decades – and especially the past few years – it has become one of the most important and recognised global issues. Climate change affects everyone and everything on earth. There have been worldwide environmental changes and incidences that may be attributed to climate change, for instance an increase in temperatures, and severe and unpredictable disruptions in weather patterns. Consequently, while many climate change-driven impacts are expected to continue occurring in the future, the topic will continue to be debated, with a variety of views and perceptions surfacing on the severity of its potential impacts.

Water is one of the most important resources on earth, for all species. No humans, animals or vegetation can survive without water (Bates et al., 2008). Water supply is controlled by an array of factors that include the earth's temperature, climate, weather and rainfall. South Africa and consequently Johannesburg are currently experiencing water problems, which means water supply is under stress (DEAT, date unknown; Hirji et al., 2002). As South Africa's population continues to grow, and industries in the country expand and develop, our water supply will be placed under increasing pressure. Climate change currently affects and will continue to affect water supply, in terms of availability.

While several studies have been conducted, numerous aspects of the phenomenon of climate change have either not been thoroughly studied and examined, or have been completely overlooked. The impacts of climate change on water supply have not been examined in depth either (Bates et al., 2008). In addition, where the impact of climate change on water supply has been studied

globally, such studies have focused more on the northern hemisphere (Joubert, 2006).

In reference to Johannesburg and the existing climate change research, the City of Johannesburg has produced the Climate Change Strategy and Action Plan and the vulnerability assessment study (City of Johannesburg, 2008a; City of Johannesburg, 2008c). The Climate Change Strategy and Action Plan identifies processes in limiting and dealing with climate change, while the vulnerability assessment study pinpoints susceptible areas and their impacts and possible overall solutions to climate change (City of Johannesburg, 2008c; Golder Associates Africa, 2008). This report aims to investigate the possible future impacts of climate change on water supply in South Africa and Johannesburg, by examining and studying the topic extensively.

1.2 AIM

The research sets out to provide a compilation of existing research and information on the current and potential impacts of climate change on water supply. Subsequently, this knowledge will be applied to South Africa and to Johannesburg in particular. The research seeks out to present the necessary general background, contextual and related information on the issue of climate change. Hence, this information will be used in order to narrow down and relate the focus to Johannesburg.

The research aims to offer a more focused and appropriate inquiry into the possible impacts on water supply or the consequences of climate change that might occur in Johannesburg, South Africa. The intention of this report is to examine climate change and water supply from a planning perspective, by investigating the link between these two aspects and urban planning.

1.3 RATIONALE AND PROBLEM STATEMENT

International research has focused on the current and possible future impacts of climate change. However, this research has been limited in relation to South Africa, and it has not been focused, narrowed down and related to Johannesburg. The rationale for collating this information is to provide a relevant report that inquires and offers insight into the impacts of climate change on planning in respect of sustaining Johannesburg's water supply.

Hence the contribution of this research is to offer a report that conveys and establishes understandable information on climate change, its link with planning and water and consequently relevant and appropriate data for Johannesburg.

The problem that this study addresses, and therefore the problem statement is the question of whether climate change will exacerbate the existing (as identified in the background to report section) water supply problem in Johannesburg.

This report is based on the precautionary principle found in the sustainable literature, that "prevention is better than cure". Planners prepare for the future, and because climate change does and will continue to affect human settlement, expansion and sustainability in the future, planners need knowledge on how cities may develop, and the possible physical limitations of sustaining life in those cities. Therefore this research is necessary because future cities will be shaped by climate change.

1.4 RESEARCH QUESTION AND HYPOTHESIS

Research question:

- What potential impacts will climate change have on water supply in Johannesburg?

Sub-questions:

1. Will the impacts be temporary or permanent?
2. Which aspect (e.g., demand; source; quality) of water supply will primarily be affected or compromised?
3. Will the predicted impacts be positive or negative?

Hypothesis:

- Climate change will exacerbate the existing water supply problem in Johannesburg.

1.5 APPROACH OF RESEARCH REPORT

The approach to climate change that has been utilised in this research report is based on the point of view that climate change has been occurring due to accelerated global warming. Secondly, it is held that human action adds to the severity of climatic changes worldwide. Lastly, as stated in the background to report, water is an important and precious resource, and for this reason Johannesburg's water supply has been selected as theme of this research. This approach has been used as the foundation for gathering, exploring and selecting research and data on climate change, for incorporation and analysis in this report.

1.6 RESEARCH METHOD

The following types of research are included in this report:

- Quantitative in terms of using empirical data;
- Qualitative research;
- Descriptive / exploratory research;
- Fact collection and the examination of existing knowledge and information;
- Instrumental case study and review research.

The exploratory research firstly incorporates studying, evaluating, exploring and examining existing information, knowledge and research on the topic. Secondly, the accumulated information has been assessed, selected and combined to provide a potential future outcome on the topic. Johannesburg has been selected as a case study, in order to focus and narrow down the research to a particular area, with the aid of the vast quantity of international information available on the topic of climate change. Johannesburg has also been selected in order to show a physical example of the potential implications climate change can have for any city Johannesburg is an unusually located city, in that it is not positioned on any major river, and consequently experiences water supply difficulties. In addition Johannesburg is a city that is expanding and growing in size and population, and furthermore, this will contribute to future water problems.

The information that was needed for this report includes local and international data on:

1. Climate change (existing debates, views and theories, as well as existing and potential impacts from around the world);
2. Water (since this is an important resource, and South Africa and Johannesburg already face water supply problems, the impact that climate change has or will have on water supply needed to be investigated);
3. Johannesburg (climate change and water supply: the related human development, and our understanding of the impacts different phenomena will have on this city);

4. Planning aspects (the effect of climate change on water supply, and consequently on planning).

This report has been approached from a planning perspective, therefore the entire report relates, links and emphasises the notions of climate change and water, to planning. In addition, the information, research and international examples used are related to planning, and to the city of Johannesburg. Therefore, only selective, relevant and necessary information on climate change and water are utilised in this report, and are justified accordingly.

Furthermore, when needed or required, primary data have been utilised in order to obtain unpublished data, research and information from particular personnel who are well versed on the relevant topic. However, only personal correspondence was employed with one key departmental individual (Lisa McNamara from the City of Johannesburg) and an environmental consultant (Herman Wiechers from Dube Ngeleza Wiechers Environmental Consultancy) in this report – in order to acquire documents and information, and therefore no interviews were conducted.

This research has not necessarily referred to or drawn on specific case studies: the information has focused on countries' across the globe, but also on the continent of Africa. This research has primarily utilised existing findings on climate change, garnered from documents, books, the Internet and journals. The research has been based on and obtained from various sources, including the Intergovernmental Panel On Climate Change (IPCC), South African Department of Environmental Affairs and Tourism (DEAT), South African Department of Water Affairs and Forestry (DWAF), South African Cities Network (SACN), City of Johannesburg and the Water Research Commission (WRC), and various organisations active in the field of climate change.

1.7 CONSTRAINTS

The limitations of the research of this report have been the following:

1. The lack of data and information on the relationship between climate change and planning, and consequently the effect on water;
2. The fact that the impact of climate change on water supply has not been a highly researched topic to date;
3. A lack of information on the way in which climate change impacts on the city of Johannesburg;
4. The lack of access to or difficulty in retrieving locally published documents on water and climate change, and difficulty in accessing local personnel associated with water and climate change, for example employees of the DWAF; DEAT and City of Johannesburg;
5. The limitation of the accumulated information possibly being of a speculative nature; and
6. Lastly, the time and length constraints of this research report, therefore limiting the quantity and depth of analysis and presented information.

1.8 ETHICAL CONSIDERATIONS

Personal correspondence with relevant personnel has been utilised in this report in order to attain existing documentation and research, and to acquire information on the availability of documents and their publishing dates. This communication has been conducted by telephone and e-mail, due to problems related to distance, time and accessibility.

This research report has utilised an objective approach in presenting both positive and negative views and debates on the topic of climate change. However, the data utilised in this report has been based on the notion that climate change has resulted from global warming, as has been presented in the approach of research report section. Additionally, it should be taken into consideration, that the authors of all the data and research assembled have

presented their own personal views on climate change. Moreover, the information used in this research report may reflect the approaches of a variety of individuals, institutions or organisations - who may not all be in agreement on various issues.

1.9 OUTLINE OF REPORT

This chapter comprises the introduction and outline of the report, including the background, aim, problem statement and rationale; the research question; the approach of the research; the research method and the structure of the final report.

Chapter two presents and examines the literature review on the planning notions of uncertainty and scenarios, and consequently highlights the relationship between planning and climate change. Definitions have also been included in this chapter. The chapter emphasises the fact that the entire report, with its respective chapters, has been based on and linked to planning.

The third chapter is a literature review that looks at the fundamentals of climate change and water supply, by presenting the relevant debates, views and theories on the topics. This chapter also reflects international and local views on these subjects, as well as the existing problem of water supply in South Africa.

Chapter four puts forward a general overview of existing worldwide climatic changes relating to the aspect of water supply. In addition, the chapter gives an overview of the potential international and predominantly African climate change impacts, before focusing on and relating those impacts to the issue of water supply. This chapter also provides some justification for using the selected research and information on climate change and water supply.

Chapter five provides a broad outline and highlights the context of the situation in South Africa in general, and Johannesburg in particular. It focuses on the general context and planning; the water supply aspect; the available experience and future outlook regarding climate change in South Africa and Johannesburg, and

already existing changes which can be laid at the door of climate change. Furthermore, this chapter offers an explanation as to why the specific international research, summarised in Chapter four, is applicable to Johannesburg.

Chapter six draws on the information from Chapters two to four, and applies this information in predicting the potential climate change impacts on Johannesburg. In addition, Chapter six presents the stated potential climate change scenarios for South Africa and Johannesburg, before outlining and analysing the potential future implications of climate change in Johannesburg from a planning perspective and from other water-related aspects.

Chapter seven, which provides a conclusion to the report, tries to determine whether the main aim of the report has been achieved. In addition, this chapter provides recommendations on essential future research on the topic, and likely planning and other related actions that ought to be taken in order to prevent or limit climatic change in South Africa in general, and Johannesburg in particular. In each chapter, emphasis is placed on linking the research to planning, climate change and water supply.