

Contents

1	EXECUTIVE SUMMARY	1
1.1	INTRODUCTION.....	1
1.2	REPORT STUCTURE	1
1.3	THEMATIC ISSUES OF IMPORTANCE	2
1.3.1	<i>Human Environment`</i>	2
1.3.2	<i>Cultural Heritage</i>	2
1.3.3	<i>Land and Soils.....</i>	2
1.3.4	<i>Water Resources.....</i>	3
1.3.5	<i>Atmosphere.....</i>	3
1.3.6	<i>Biodiversity and Conservation</i>	3
1.3.7	<i>Environmental Management.....</i>	4
2	A GEOGRAPHICAL OVERVIEW OF EKURHULENI.....	5
2.1	LOCATION AND AREA	5
2.2	CLIMATE	5
2.2.1	<i>Climatic conditions and implications for air quality.....</i>	8
2.3	TOPOGRAPHY AND LAND USE	10
2.3.1	<i>Topography</i>	10
2.3.2	<i>Land use and land cover</i>	10
2.4	SURFACE WATER	16
2.4.1	<i>Catchments and watercourses</i>	16
2.4.2	<i>Dams and pans</i>	18
2.4.3	<i>Wetlands</i>	18
2.5	GEOLOGY	19
2.6	VEGETATION	21
2.7	SOCIO-ECONOMIC CONTEXT	24
2.7.1	<i>Local government.....</i>	24
2.7.2	<i>Socio-economic background</i>	24
2.8	REFERENCES.....	25
3	BACKGROUND AND APPROACH TO STATE OF THE ENVIRONMENT REPORTING	27
3.1	THE BASIS FOR STATE OF THE ENVIRONMENT REPORTING	27
3.1.1	<i>Sustainable Development.....</i>	27
3.1.2	<i>Political and legal framework.....</i>	28
3.1.3	<i>What has been done in South Africa</i>	30
3.2	APPROACH IN EKURHULENI.....	31
3.2.1	<i>Objectives</i>	31
3.2.2	<i>Structure of report</i>	31
3.2.3	<i>Project process.....</i>	35
3.2.4	<i>References.....</i>	44
4	DRIVING FORCES OF ENVIRONMENTAL CHANGE.....	46
4.1	INTRODUCTION.....	46
4.2	EXTERNAL DRIVERS	46
4.2.1	<i>Societal development and related policies.....</i>	46
4.3	INTERNAL DRIVERS.....	48
4.3.1	<i>Societal development (needs, views and values).....</i>	48
4.3.2	<i>Human settlement</i>	49
4.3.3	<i>Mining.....</i>	50

4.3.4	<i>Industry/Manufacturing</i>	52
4.3.5	<i>Wholesale and trade</i>	54
4.3.6	<i>Energy</i>	54
4.3.7	<i>Transport</i>	57
4.3.8	<i>Agriculture</i>	59
4.3.9	<i>Tourism and recreation</i>	60
4.3.10	<i>Informal sector</i>	61
4.3.11	<i>Spatial planning and land reform</i>	62
4.3.12	<i>Waste management</i>	65
4.4	REFERENCES.....	82
5	HUMAN ENVIRONMENT	84
5.1	PRESSURES ON PEOPLE.....	84
5.2	STATE.....	84
5.2.1	<i>Demographic profile</i>	84
5.2.2	<i>Education and literacy</i>	87
5.2.3	<i>Employment</i>	90
5.2.4	<i>Income and expenditure</i>	94
5.2.5	<i>Housing and urban landscape</i>	94
5.2.6	<i>Infrastructure and services</i>	96
5.2.7	<i>Public health</i>	104
5.2.8	<i>Safety and security</i>	112
5.2.9	<i>Leisure, Arts and Culture</i>	114
5.2.10	<i>Societal development</i>	116
5.3	IMPACTS.....	116
5.3.1	<i>Impacts on health and welfare</i>	117
5.3.2	<i>Impacts on safety and security</i>	119
5.3.3	<i>Impacts on living conditions</i>	121
5.3.4	<i>Impacts on human well-being, rights and entitlements</i>	123
5.4	RESPONSES.....	125
5.4.1	<i>Legislation and policy</i>	125
5.4.2	<i>Programmes and initiatives</i>	125
5.5	MONITORING.....	129
5.5.1	<i>Information and data gaps</i>	129
5.5.2	<i>Recommended future indicators</i>	129
5.6	CONCLUSIONS.....	131
5.7	REFERENCES.....	132
6	CULTURAL HERITAGE	133
6.1	PRESSURES ON CULTURAL HERITAGE RESOURCES.....	133
6.2	STATE AND IMPACTS.....	134
6.2.1	<i>Architectural and other urban heritage resources</i>	134
6.2.2	<i>Archaeological resources</i>	136
6.3	IMPACTS.....	136
6.3.1	<i>Development-related factors</i>	138
6.3.2	<i>Social factors</i>	139
6.3.3	<i>Weaknesses in the conservation safety net</i>	139
6.4	RESPONSES.....	140
6.4.1	<i>Policy</i>	140
6.4.2	<i>Legislation</i>	140
6.4.3	<i>Programmes and initiatives</i>	143
6.5	MONITORING.....	143

6.5.1	<i>Information and data gaps</i>	143
6.5.2	<i>Recommended future indicators</i>	143
6.6	CONCLUSIONS.....	144
6.7	REFERENCES.....	145
7	LAND AND SOILS	147
7.1	PRESSURES FACING LAND AND SOIL RESOURCES	147
7.1.1	<i>Human settlement</i>	147
7.1.2	<i>Societal development</i>	147
7.1.3	<i>Mining</i>	147
7.1.4	<i>Industry</i>	148
7.1.5	<i>Energy sector</i>	148
7.1.6	<i>Transport activities</i>	148
7.1.7	<i>Agriculture</i>	148
7.1.8	<i>Tourism and recreation</i>	149
7.1.9	<i>Spatial planning and land reform</i>	149
7.1.10	<i>Policies and uneven distribution of wealth</i>	149
7.1.11	<i>Natural disturbances, natural processes and inherent natural characteristics</i>	150
7.1.12	<i>Economic growth and export</i>	150
7.1.13	<i>Land use</i>	151
7.1.14	<i>Physical location of South Africa</i>	151
7.1.15	<i>Climate</i>	151
7.2	STATE AND IMPACTS.....	151
7.2.1	<i>Soils and soil quality</i>	151
7.2.2	<i>Land condition</i>	158
7.2.3	<i>Land capability, agricultural potential and grazing potential</i>	167
7.2.4	<i>Impacts on soils and land</i>	175
7.3	RESPONSES.....	179
7.3.1	<i>Policy</i>	179
7.3.2	<i>Legislation</i>	181
7.3.3	<i>Programmes and initiatives</i>	183
7.4	MONITORING.....	184
7.4.1	<i>Information and data gaps</i>	184
7.4.2	<i>Recommended future indicators</i>	185
7.5	CONCLUSIONS.....	186
7.5.1	<i>Soil, land and land use constraints within the EMM</i>	186
7.5.2	<i>Worst affected areas in the EMM in with regards to soils and land</i>	187
7.5.3	<i>Future land use development in the EMM</i>	188
7.6	REFERENCES.....	189
8	WATER RESOURCES	191
8.1	PRESSURES ON WATER RESOURCES	191
8.1.1	<i>Introduction</i>	191
8.1.2	<i>Pressures on Water Quality</i>	191
8.2	STATE AND IMPACTS.....	198
8.2.1	<i>State of Water Service Provision</i>	198
8.2.2	<i>Surface Water</i>	201
8.2.3	<i>Groundwater</i>	212
8.3	RESPONSES.....	217
8.3.1	<i>Policy</i>	217
8.3.2	<i>Legislation</i>	218
8.3.3	<i>Programmes and Initiatives</i>	222

8.4	MONITORING.....	225
8.4.1	<i>Information and data gaps.....</i>	225
8.4.2	<i>Recommended future indicators.....</i>	227
8.5	CONCLUSIONS.....	230
8.6	REFERENCES.....	231
9	ATMOSPHERE.....	232
9.1	PRESSURES ON THE ATMOSPHERE	232
9.2	SOURCES OF EMISSIONS WITHIN EMM	232
9.2.1	<i>Industry – Scheduled processes (including power generation).....</i>	232
9.2.2	<i>Industry – Non Scheduled Processes, Light Industry</i>	233
9.2.3	<i>Transport.....</i>	233
9.2.4	<i>Domestic Households</i>	234
9.2.5	<i>Agriculture</i>	235
9.2.6	<i>Veld Fires.....</i>	235
9.2.7	<i>Waste Sites</i>	235
9.2.8	<i>Mining.....</i>	236
9.3	STATE	236
9.3.1	<i>Air Quality Monitoring within the EMM.....</i>	236
9.3.2	<i>Status of Air Quality within the EMM: DEAT soiling index and SO₂ monitoring.....</i>	238
9.3.3	<i>Status of Air Quality within the EMM: Airkem Monitoring (Source Airkem Report October 2002)</i>	241
9.4	IMPACTS	244
9.5	RESPONSES.....	245
9.5.1	<i>Policy</i>	245
9.5.2	<i>Legislation</i>	246
9.5.3	<i>Programmes and initiatives</i>	247
9.6	MONITORING.....	248
9.6.1	<i>Information and data gaps.....</i>	248
9.6.2	<i>Recommended future indicators.....</i>	249
9.7	CONCLUSIONS.....	249
9.8	REFERENCES.....	250
10	BIODIVERSITY AND CONSERVATION	251
10.1	PRESSURES ON BIODIVERSITY	251
10.1.1	<i>Human settlements, societal development, informal sector, spatial development plan and land reform</i>	252
10.1.2	<i>Mining.....</i>	253
10.1.3	<i>Industry/Manufacturing.....</i>	254
10.1.4	<i>Energy.....</i>	254
10.1.5	<i>Transport.....</i>	254
10.1.6	<i>Agricultural activities.....</i>	255
10.1.7	<i>Tourism & Recreation.....</i>	256
10.2	STATE AND IMPACTS.....	256
10.2.1	<i>Species diversity</i>	256
10.2.2	<i>Resource value – medicinal plants</i>	278
10.2.3	<i>Aquatic and hydrophilic habitats</i>	282
10.3	RESPONSES.....	287
10.3.1	<i>Policy</i>	287
10.3.2	<i>Legislation</i>	288
10.3.3	<i>Programmes and initiatives</i>	290
10.4	MONITORING.....	291

10.4.1	<i>Information and data gaps</i>	291
10.4.2	<i>Recommended future indicators</i>	292
10.5	CONCLUSIONS.....	293
10.6	REFERENCES.....	293
11	ENVIRONMENTAL MANAGEMENT	296
11.1	INTRODUCTION.....	296
11.2	INDICATORS.....	297
11.2.1	<i>Local policy and by-laws</i>	297
11.2.2	<i>Consideration of environmental issues in planning</i>	297
11.2.3	<i>Staffing</i>	299
11.2.4	<i>Local budget for environmental management</i>	300
11.2.5	<i>Development pressure and environmental applications</i>	301
11.2.6	<i>Voluntary adoption of environmental management systems</i>	302
11.2.7	<i>Co-operative governance</i>	304
11.3	CONCLUSIONS.....	305
11.4	REFERENCES.....	305
12	WAY FORWARD: STRATEGIC PRIORITIES	306
12.1	HUMAN ENVIRONMENT.....	306
12.2	CULTURAL HERITAGE	307
12.3	LAND AND SOILS.....	308
12.4	WATER RESOURCES.....	308
12.5	ATMOSPHERE	309
12.6	BIODIVERSITY AND CONSERVATION.....	309
12.7	ENVIRONMENTAL MANAGEMENT	310

List of Figures

Figure 2.1 Locality plan of Ekurhuleni	6
Figure 2.2 Annual wind rose for Johannesburg International Airport for the period January 1996 to December 2002	7
Figure 2.3 Monthly average rainfall for 1960-1991	8
Figure 2.4 Average daily maximum and minimum temperatures for 1960-1991	8
Figure 2.5 Mean annual precipitation in Ekurhuleni	9
Figure 2.6 Topography of Ekurhuleni	11
Figure 2.7 Proportional land use in Ekurhuleni in 2000.....	12
Figure 2.8 Land use in Ekurhuleni in 2000.....	14
Figure 2.9 Land cover in Ekurhuleni in 2000.....	15
Figure 2.10 Surface water in Ekurhuleni	17
Figure 2.11 The geology of Ekurhuleni	20
Figure 2.12 Vegetation types, natural habitats and untransformed grassland	23
Figure 3.1. Example DPSIR framework for the issue of air pollution (modified from DEAT, 2002).....	33
Figure 3.2 Report structure	34
Figure 3.3. A conceptual model of interlinkages between the components of the "environment"	35
Figure 3.4 Flow diagram of the methodology used for SoE reporting	36
Figure 4.1 Waste Profile for South Africa (DWA 1998)	66
Figure 4.2 Waste Composition in different socio-economic levels (Palm 1994)	68
Figure 4.3 Recyclables going to landfills in SA	69
Figure 4.4 Percentage of households receiving refuse removal services	78
Figure 4.5 Location of solid waste sites	81
Figure 4.6 Solid waste volumes handled at waste disposal sites from June 2002 to June 2003.....	82
Figure 5.1 Population groups and population distribution among the towns of the EMM	85
Figure 5.2 Population distribution.....	86
Figure 5.3: Highest education levels attained by over 20 year olds by gender	87
Figure 5.4: Education in Ekurhuleni	89
Figure 5.5: Employment status according to population group	90
Figure 5.6 Unemployment and income levels in Ekurhuleni	92
Figure 5.7: Formal and informal households per population group.....	95
Figure 5.8: Housing backlog within the EMM	96
Figure 5.9 Percentage of households with access to piped water	98
Figure 5.10: Usage of coal and paraffin amongst population groups.....	99
Figure 5.11 Households using coal as a source of heat	100
Figure 5.12: Household refuse disposal services.....	102
Figure 5.13: Mode of travel to school or work and population group	103
Figure 5.14: Household telephone services	104
Figure 5.15: Hospitals, clinics and police stations.....	106
Figure 5.16: Comparison of positive and negative HIV test results.....	108
Figure 5.17: Comparison of male and female HIV positive test results	109
Figure 5.18: Comparison of HIV positive test results per age category	110
Figure 5.19: Disability by population group	112

Figure 5.20: Comparison of 2001 crime statistics for metropolitan areas	113
Figure 5.21: Ekurhuleni Standard of Living Index CDI	116
Figure 5.22: Crime trends in the study area for financial years 1994/1995 to 2002/2003.....	120
Figure 5.23 Noise exposure contours for 2001: JHB International Airport	124
Figure 6.1 Known locations of cultural heritage sites	135
Figure 7.1 Soil and Slope Units in Ekurhuleni	154
Figure 7.2 Potential sources of soil pollution.....	157
Figure 7.3 Land degradation - Combined Degradation Index (CDI).....	160
Figure 7.4 Grass cover and rangeland condition in 2001.....	162
Figure 7.5 Erosion hazard in Ekurhuleni	165
Figure 7.6 Land capability in Ekurhuleni	169
Figure 7.7 General agricultural potential for irrigated crops	173
Figure 7.8 Areas to be reserved for agriculture	176
Figure 8.1 The locations of scheduled industries, tailings dams, rock dumps and quarries.....	193
Figure 8.2 Percentage households with flush toilet facilities	200
Figure 8.3 Surface water and water quality monitoring points	205
Figure 8.4 Electrical conductivity trends and targets in the Klip River.....	206
Figure 8.5 Electrical conductivity trends and target for the Blesbokspruit.....	207
Figure 8.6 Water Monitoring Points Kempton Park Area	208
Figure 9.1: Average long term soiling index trends in CBD areas.....	138
Figure 9.2: Average long term soiling index trends in industrial areas.....	239
Figure 9.3: Average long term soiling index trends in residential areas.....	240
Figure 9.4: Average long term SO ₂ trends in CBD areas.....	240
Figure 9.5: Average long term SO ₂ trends in industrial areas	241
Figure 9.6: Potential zones of air pollution and proposed monitoring stations	243
Figure 10.1 Areas of conservation importance for plants.....	259
Figure 10.2 Areas of conservation importance for birds.....	262
Figure 10.3 Areas of conservation importance for mammals.....	263
Figure 10.4 Areas of conservation importance for invertebrates.....	267
Figure 10.5 Areas of conservation importance for the Giant Bullfrog.....	270
Figure 10.6: Summary of bird data for pans and wetlands in the EMM.	2273
Figure 10.7: Summary of the percentage of the total bird species (species richness) found in EMM that occur protected areas and percentage of total threatened species found in EMM that occur in each of the protected areas.	274
Figure 10.8: Summary of observations of Giant Bullfrogs at Bullfrog pan and specimens collected off nearby roads.....	275
Figure 10.9 Areas of conservation importance and protected areas.....	283
Figure 10.10 Quantifiable threats to pans surveyed in EMM.	285
Figure 11.1 Operating and capital budgets for Ekurhuleni's Environment and Tourism Department.....	300
Figure 11.2 Capital expenditure across metropolitan municipalities for 2002/2003 for (a) Refuse sites, (b) Parks and gardens, recreation sites and museums and art galleries, (c) Land and buildings and (d) Water reservoirs and reticulation.	301

List of Tables

Table 2.1 Description of watercourses in the EMM.....	16
Table 2.2 Biodiversity status of the grassland biome.....	21
Table 3.1 State of the Environment Reports available on the internet.....	30
Table 3.2 DPSIR framework component definitions.....	32
Table 3.3 Priority Issues identified for Ekurhuleni.....	38
Table 4.1 Firm survey results by Manufacturing Sub-sector.....	53
Table 4.2 Energy or fuel for lighting, heating and cooking for households in the EMM.....	55
Table 4.3 Travel mode used for work trips.....	58
Table 4.4 Waste Generation per capita/day.....	67
Table 4.5 Refuse densities in developing areas of Ekurhuleni.....	68
Table 4.6 Hazardous Waste Disposed of in Gauteng.....	71
Table 4.7 Industrial Hazardous Waste Generation in Gauteng.....	71
Table 4.8 Waste Movements by Waste Management Operators in the East Rand Region.....	74
Table 4.9 Summary of Waste Stream Production According to Hazard Group.....	75
Table 4.10 Mini-waste sites and landfills per service delivery centre.....	79
Table 4.11 Status of Landfill Sites in EMM.....	80
Table 5.1 Population structure in terms of age and gender.....	87
Table 5.2 Education institutions being attended by persons aged 5 to 24 years.....	87
Table 5.3 Schools, learners, teachers and number of classes in the EMM.....	88
Table 5.4 Labour force per industry and population group.....	90
Table 5.5 Employment by profession.....	91
Table 5.6 A summary of the EMM informal sector.....	93
Table 5.7 Annual household income by population group.....	94
Table 5.8 Individual monthly income by population group.....	94
Table 5.9 Type of dwelling and population group of the household head (derived).....	95
Table 5.10 Derived source of water and population group of head of household (2001).....	97
Table 5.11 Toilet facilities and population head of household.....	101
Table 5.12: Health facilities within the EMM.....	104
Table 5.13 Total attendance of all services.....	107
Table 5.14: Comparison of HIV positive results – July 2001 to June 2002.....	108
Table 5.15 Expanded programme on immunisation.....	110
Table 5.16 Reproductive health information.....	111
Table 5.17 Integrated management of childhood illnesses.....	111
Table 5.18 Existing sport and recreation resources.....	114
Table 5.19 EMM Human Development Index 2001.....	115
Table 5.20 Recommended cumulative exposure land use compatibility standards.....	122
Table 5.21 Indicators of sustainable development: UN CSD methodology.....	131
Table 6.1 The National Estate (National Heritage Resources Act 25 of 1999).....	142
Table 7.1 Land use change between 1995 and 2000.....	158
Table 7.2 Rangeland Condition in Ekurhuleni.....	161
Table 7.3 Erosion hazard in Ekurhuleni.....	164
Table 7.4 Area of land capability classes in the EMM.....	168
Table 7.5 Resulting Agricultural Potential.....	172
Table 8.1 Major pressures of urbanisation on surface water systems.....	196
Table 8.2 Greywater pollution in dense informal settlements (WRC 2000).....	197

Table 8.3 Source of water available to households in Ekurhuleni (Census 2001)	199
Table 8.4 Sanitation facilities of households in Ekurhuleni (Census 2001)	199
Table 8.5 Areas of concern with regards to stormwater	201
Table 8.6 The ecological status of the Klip River, Natalspruit and Blesbokspruit	203
Table 8.7 Water quality trends for the Klip River (1998-2003)	206
Table 8.8 Water quality trend for the Blesbokspruit (2000-2003)	206
Table 8.9 Water Quality Monitoring Data for Kempton Park Area (Ekurhuleni Municipality)	209
Table 8.10 Ekurhuleni Municipality Springs Service Area Water Quality Monitoring (January 2002).....	210
Table 8.11 Ekurhuleni Municipality Nigel Service Area Water Quality Monitoring (January 2003).....	211
Table 8.12 Groundwater quality of the Basement Complex Granite-Gneisses	213
Table 8.13 Groundwater quality of the West Rand and Central Rand Groups of the Witwatersrand Supergroup Geological formations	214
Table 8.14 Water quality of the Klipriviersberg Group.....	215
Table 8.15 Groundwater quality in the Chuniespoort Dolomites	215
Table 8.16 Groundwater quality of the Vryheid Formation.....	216
Table 8.17 Groundwater use by households in Ekurhuleni (Census 2001)	216
Table 8.18 Summary of the National Water Act, Act No. 36 of 1998	219
Table 8.19 Activities Carried Out by the EMM, Nature and Response	224
Table 9.1 Estimated of emissions of priority pollutants emitted by scheduled process.....	233
Table 9.2 Travel mode used for work trips	234
Table 9.3 Energy or fuel for lighting, heating and cooking for households in the EMM	234
Table 9.4 Summary of estimated contributions to air emissions by source type in the Southern SDR.....	236
Table 9.5 Summary of monitoring locations within the Airkem network	237
Table 9.6 Summary Status of smoke and SO ₂ monitoring sites	237
Table 9.7 Summary of important international agreements relating to air quality management ...	246
Table 9.8 Summary of monitoring requirements and indicators for climate change and air quality monitoring.....	249
Table 10.1 Species values for Ekurhuleni per taxonomic group	256
Table 10.2: Threatened plant species occurring in Ekurhuleni	258
Table 10.3: Threatened bird species within the EMM (shaded cells indicate bird species considered to be vagrants to EMM – C. Whittington-Jones <i>pers.comm.</i>).....	260
Table 10.4: Invertebrate species within the EMM that are rare, of conservation concern or threatened.....	264
Table 10.5: Frog species recorded at Bullfrog Pan during the period 1991–2003	268
Table 10.6: Threatened waterbird species abundance at the 20 pans and wetlands forming part of the waterbird count surveys.....	271
Table 10.7 Area of each map class calculated from the north & south exotic woody vegetation product	278
Table 10.8: Exotic invasive species identified within the quarternary catchments within the EMM	278
Table 10.9: PRECIS list of medicinal plants in the EMM area. Species shown in bold are threatened according to IUCN 2002.	279
Table 10.10: Percentage of pans surveyed in the EMM that have been impacted by human activities.	285
Table 10.11: Ecological state of the Klip River, Natalspruit and Blesbokspruit	286

Table 11.1 Evaluation of the EMM IDP June Review 2003.....	298
Table 11.2. Authority environmental staff involved in Ekurhuleni (Aucamp, Olivier, Scheepers, <i>pers comm</i>).....	299
Table 11.3 Environmental applications commented on by EMM officials	302
Table 11.4 Businesses in the EMM with certified SABS ISO 14001/SANS 14001 Environmental Management Systems	303

Appendices

- Appendix A: Land use and land cover change between 1995 and 2000
- Appendix B: Site description of the Blesbokspruit RAMSAR Site
- Appendix C: Records of stakeholder involvement process
- Appendix D: Metadata for spatial data
- Appendix E: Collated List of State of Environment Indicators
- Appendix F: Summary of Known Arts, Culture and Heritage sites in Ekurhuleni
- Appendix G: Plants traded medicinally in Ekurhuleni