

Table 4.5 Sample sites exceeding the TWQR for Irrigated Agriculture Water Use for the Irrigated Agriculture Water Quality Constituents

Sample Site	Constituent/s Exceeding Good Range	Extent of Exceedence	Location of Site
Luvuvhu and Letaba WMA			
B9H003Q01	pH	Purple	Shingwidzi River at Kanniedood Dam/Kruger National Park
Crocodile (West) and Marico WMA			
A2H094Q01	pH	Purple	Bospoort Dam on Hex River: Down Stream Weir
Olifants WMA			
B3H021Q01	EC	Yellow	Elands River at Scherp Arabie
B4H011Q01	pH	Purple	Steelpoort River at Alverton
B7H009Q01	pH	Purple	Olifants River at Finale/Liverpool
Usutu to Mhlatuze WMA			
W3H015Q01	EC; Cl	Yellow; yellow	Hluhluwe River at Valsbaai/St Lucia Inflow
W4H006Q01	pH	Purple	Phongolo River at Ndume Game Reserve
Upper Vaal WMA			
C2H004Q01	EC	Yellow	Suikerbosrand River at Uitvlugt (RW S2)
C2H005Q01	EC	Yellow	Riet Spruit at Kaal Plaats (RW RV2)
Mzimvubu to Keiskamma WMA			
S3H006Q01	pH	Purple	Klaas Smits River at Weltevreden/Queenstown
Upper Orange WMA			
D1H001Q01	pH	Purple	Wonderboom/Stormboom Spruit at Diepkloof/ Burgersdorp
Lower Orange WMA			
D5H021Q01	SAR; EC; pH; Cl	Yellow; red; purple; red	Sak River at De Kruis/Williston
Fish to Tsitsikamma WMA			
K8H001Q01	pH	Red	Kruis River at Farm 508 Pineview
K8H002Q01	pH	Red	Elands River at Kwaai Brand Forest Reserve/ Witelbos
L3R001Q01	EC	Yellow	Beervlei Dam at Windheuveld
L6H001Q01	SAR; EC; Cl	Yellow; red; purple	Heuningklip River at Campherspoort
L7H006Q01	Cl	Yellow	Groot River at Grootrivierspoort
N1H013Q01	SAR; EC; Cl	Yellow; red; purple	Mackiesputs Eye at Graaf-Reinet/Van Reyneveldspas
N2H007Q01	EC; Cl	Red; red	Sundays River at De Draay
N3H002Q01	EC; Cl	Yellow; yellow	Voël River at Rietvley
N4H003Q01	SAR; EC; Cl	Yellow; red; purple	Sundays River at Addo Drift East/Addo Bridge
P1H003Q01	SAR; EC; pH; Cl	Yellow; red; purple; purple	Boesmans River at Donkerhoek/Alicedale
P3H001Q01	SAR; EC; Cl	Yellow; purple; purple	Kariega River at Smithfield/Lower Waterford
P4H001Q01	SAR; EC; Cl	Yellow; red; purple	Kowie River at Bathurst/Wolfscrag
Q2H002Q01	EC; pH	Yellow; purple	Great Fish River at Zoutpansdrift
Q4H013Q01	SAR; EC; pH; Cl	Yellow; red; purple; red	Tarka River at Bridge Farm/Tarka Bridge (New Weir)
Q6H003Q01	EC; pH	Yellow; purple	Baviaans River at Botmansgat/De Klerkdal
Q7H003Q01	EC; pH	Yellow; purple	Great Fish River at Leeuwe Drift
Q8H011Q01	EC; pH; Cl	Yellow; purple; yellow	Little Fish River at Rietfontein/Junction Drift
Q9H001Q01	EC; pH; Cl	Yellow; purple; yellow	Great Fish River at Fort Brown Peninsula
Q9H018Q01	EC; pH; Cl	Yellow; purple; yellow	Great Fish River at Matomela's Reserve/Outspan
Gouritz WMA			
J1H019Q01	SAR; EC; Cl	Yellow; purple; purple	Groot River at Buffelsfontein/Van Wyksdorp
J3H011Q01	SAR; EC; Cl	Red; purple; purple	Olifants River at Warm Water
K2H004Q01	SAR; EC; Cl	Red; purple; purple	Great Brak River at Vishoek
K3H001Q01	pH	Red	Kaaimans River at Upper Barbiers Kraal
K4R002Q01	SAR; EC; Cl	Red; purple; purple	Swart Vlei at Ronde Valley
K7H001Q01	pH	Red	Bloukrans River at Lottering Forest Reserve
Breede WMA			
H5H005Q01	EC; Cl	Yellow; yellow	Bree River at Wagenboomsheuveld/Drew

It would appear that there are sampling sites with constituents of real concern from the constituent set (Table 3.4) from an irrigated agriculture use point of view, especially those sites indicated in Table 4.5.

Sodium Adsorption Ratio (SAR)

Sodium-sensitive crops can be expected to absorb toxic levels of sodium through the roots at the median SAR values at the Sak River at De Kruis (Lower Orange WMA), Groot River at Buffelsfontein (Gouritz WMA), Heuningklip River at Campherspoort, Mackiesputs Eye at Graaf-Reinet, Sundays River at Addo Drift East, Boesmans River at Donkerhoek, Kariega River at Smithfield, Kowie River at Bathurst and Tarka River at Bridge Farm (all in the Fish to Tsitsikamma WMA).

All sodium-sensitive crops absorb toxic levels of sodium through root uptake (while a number of economically important crops can be irrigated without sodium toxicity developing) at the Olifants River at Warm Water, Great Brak River at Vishoek and Swart Vlei at Ronde Valley (all in the Gouritz WMA).

Electrical Conductivity (EC)

According to median electrical conductivity values, a 90 % relative yield of moderately salt-tolerant crops can be maintained by using a low frequency irrigation system at the Elands River at Scherp Arabie (Olifants WMA), Suikerbosrand River at Uitvlugt, Riet Spruit at Kaal Plaats (both in the Upper Vaal WMA), Bree River at Wagenboomsheuvel (Breede WMA), Beervlei Dam at Windheuvel, Groot River at Grootrivierspoort, Voël River at Rietvley, Great Fish River at Zoutpansdrift, Baviaans River at Botmansgat, Great Fish River at Leeuwe Drift, Little Fish River at Rietfontein, Great Fish River at Fort Brown Peninsula, Great Fish River at Matomela's Reserve (all in the Fish to Tsitsikamma WMA) and Hluhluwe River at Valsbaai (Usutu to Mhlatuze WMA).

An 80 % relative yield of moderately salt-tolerant crops can be maintained by using a low frequency irrigation system at the Sak River at De Kruis (Lower Orange WMA), Heuningklip River at Campherspoort, Mackiesputs Eye at Graaf-Reinet, Sundays River at De Draay, Sundays River at Addo Drift East, Boesmans River at Donkerhoek, Kowie River at Bathurst and Tarka River at Bridge Farm (all in the Fish to Tsitsikamma WMA).

The water with median electrical conductivity values recorded at the following sites can still be used for irrigation of selected crops provided that sound irrigation management is practised and yield decreases are acceptable: the Groot River at Buffelsfontein, Olifants River at Warm Water, Great Brak River at Vishoek, Swart Vlei at Ronde Valley (all in the Gouritz WMA) and Kariega River at Smithfield (Fish to Tsitsikamma WMA).

pH

Due to the nature of the pH range, an undesirable value can be one that is lower or higher than the *Very Good* range.

The median pH was not *Very Good* (too acid) and results in increasing problems of foliar damage at the Kaaimans River at Upper Barbiers Kraal, Bloukrans River at Lottering Forest Reserve (both in the Gouritz WMA), Kruis River at Farm 508 Pineview and Elands River at Kwaai Brand Forest Reserve (both in the Fish to Tsitsikamma WMA).

The median pH was not *Very Good* (too alkaline) and also results in increasing problems with foliar damage at the Bospoort Dam on Hex River (Crocodile West and Marico WMA), Steelpoort River at Alverton, Olifants River at Finale (both in the Olifants WMA), Shingwidzi River at Kanniedood Dam (Luvuvhu and Letaba WMA), Wonderboom/ Stormboom Spruit at Diepkloof (Upper Orange WMA), Sak River at De Kruis (Lower Orange WMA), Boesmans River at Donkerhoek, Great Fish River at Zoutpansdrift, Tarka River at Bridge Farm, Baviaans River at Botmansgat, Great Fish River at Leeuwe Drift, Little Fish River at Rietfontein, Great

Fish River at Fort Brown Peninsula, Great Fish River at Matomela's Reserve (all in the Fish to Tsitsikamma WMA), Klaas Smits River at Weltevreden (Mzimvubu to Keiskamma WMA) and Phongolo River at Ndume Game Reserve (Usutu to Mhlatuze WMA).

Chloride (Cl)

According to median chloride concentrations, crops moderately sensitive to foliar absorption accumulate toxic levels of chloride when foliage is wetted at the Bree River at Wagenboomsheuvel (Breede WMA), Groot River at Grootrivierspoort, Voël River at Rietvley, Little Fish River at Rietfontein, Great Fish River at Fort Brown Peninsula, Great Fish River at Matomela's Reserve (all in the Fish to Tsitsikamma WMA) and Hluhluwe River at Valsbaai (Usutu to Mhlatuze WMA).

Crops moderately sensitive to foliar absorption increasingly accumulate toxic levels of chloride when foliage is wetted at the Sak River at De Kruis (Lower Orange WMA) and Tarka River at Bridge Farm (Fish to Tsitsikamma WMA).

Crops tolerant to foliar absorption increasingly accumulate toxic levels of chloride when foliage is wetted at the Groot River at Buffelsfontein, Olifants River at Warm Water, Great Brak River at Vishoek, Swart Vlei at Ronde Valley (all in the Gouritz WMA), Heuningklip River at Campherspoort, Mackiesputs Eye at Graaf-Reinet, Sundays River at Addo Drift East, Boesmans River at Donkerhoek, Kariega River at Smithfield and Kowie River at Bathurst (all in the Fish to Tsitsikamma WMA).

Boron (B)

No sites had elevated boron levels, but it must be said that boron was sampled at very few sites and this, therefore, does not indicate that there are no locations where boron was elevated.

Link to land cover

Refer to Table 3.5 and Map 1 and the location of the sites above for an explanation.

Sodium Adsorption Ratio (SAR)

The land cover at the sites with elevated sodium adsorption ratio values is as follows: shrub at the Sak River at De Kruis; shrub at the Groot River at Buffelsfontein; shrub and bush at the Heuningklip River at Campherspoort; bush, grass, urban and cultivated land at the Mackiesputs Eye at Graaf-Reinet; bush, shrub and cultivated land at the Sundays River at Addo Drift East; bush, grass, shrub and cultivated land at the Boesmans River at Donkerhoek; bush, grass and forest at the Kariega River at Smithfield; bush, grass and cultivated land at the Kowie River at Bathurst; and shrub, grass and cultivated land at the Tarka River at Bridge Farm.

The land cover at the sites with more elevated sodium adsorption ratio values is as follows: shrub, cultivated land and plantation at the Olifants River at Warm Water; and bush, plantation and cultivated land at the Swart Vlei at Ronde Valley.

Electrical Conductivity (EC)

The land cover at the sites with elevated electrical conductivity values resulting in a 90 % relative yield of moderately salt tolerant crops is as follows: cultivated land at the Elands River at Scherp Arabie; cultivated land, grass and urban at the Suikerbosrand River at Uitvlugt; cultivated land, urban and grass at the Riet Spruit at Kaal Plaats; cultivated land and shrub at the Bree River at Wagenboomsheuvel; shrub and degraded land at the Beervlei Dam at Windheuvel; shrub, bush and cultivated land at the Groot River at Grootrivierspoort; shrub and bush at the Voël River at Rietvley; shrub and cultivated land at the Great Fish River at Zoutpansdrift; shrub, bush and cultivated land at the Baviaans River at Botmansgat; shrub, cultivated land and forest at the Great Fish River at Leeuwe Drift; shrub and bush at the Little Fish River at Rietfontein; bush and shrub at the Great Fish River at Fort Brown Peninsula; shrub, bush and cultivated land at the Great Fish River at Matomela's Reserve; and bush, plantation and cultivated land at the Hluhluwe River at Valsbaai.

The land cover at the sites with elevated electrical conductivity values resulting in an 80 % relative yield of moderately salt tolerant crops is as follows: shrub at the Sak River at De Kruis; shrub and bush at the Heuningklip River at Campherspoort; bush, grass, urban and cultivated land at the Mackiesputs Eye at Graaf-Reinet; shrub at the Sundays River at De Draay; bush, shrub and cultivated land at the Sundays River at Addo Drift East; bush, grass, shrub and cultivated land at the Boesmans River at Donkerhoek; bush, grass and cultivated land at the Kowie River at Bathurst; and shrub, grass and cultivated land at the Tarka River at Bridge Farm.

The land cover at the sites with even more elevated electrical conductivity values is as follows: shrub at the Groot River at Buffelsfontein; shrub, cultivated land and plantation at the Olifants River at Warm Water; shrub at the Great Brak River at Vishoek; bush, plantation and cultivated land at the Swart Vlei at Ronde Valley; and bush, grass and forest at the Kariega River at Smithfield.

The range of land cover types seen in each class indicates that there is not a strong correlation between land cover and the electrical conductivity value.

pH

Land cover types where the water was too acid: bush and plantation at the Kaaimans River at Upper Barbiers Kraal; forest, plantation and bush at the Bloukrans River at Lottering Forest Reserve; cultivated land and bush at the Kruis River at Farm 508 Pineview; and cultivated land, bush and urban at the Kwaai Brand Forest Reserve.

Land cover types where the water was too alkaline: bush at the Bospoort Dam on the Hex River; bush and cultivated land at the Steelpoort River at Alverton; cultivated land, degraded land and bush at the Olifants River at Finale; bush at the Shingwidzi River at Kanniedood Dam; shrub and bush at the Wonderboom/Stormboom Spruit at Diepkloof; shrub at the Sak River at De Kruis; bush, grass, shrub and cultivated land at the Boesmans River at Donkerhoek; shrub and cultivated land at the Great Fish River at Zoutpansdrift; shrub, grass and cultivated land at the Tarka River at Bridge Farm; shrub, bush and cultivated land at the Baviaans River at Botmansgat; shrub, cultivated land and forest at the Great Fish River at Leeuwe Drift; shrub and bush at the Little Fish River at Rietfontein; bush and shrub at the Great Fish River at Fort Brown Peninsula; shrub, bush and cultivated land at the Great Fish River at Matomela's Reserve; grass, bush and degraded land at the Klaas Smits River at Weltevreden; and forest, bush and cultivated land at the Phongolo River at Ndume Game Reserve.

Chloride (Cl)

The land cover at sites where crops moderately sensitive to foliar absorption accumulate toxic levels of chloride when foliage is wetted are as follows: cultivated land and shrub at the Bree River at Wagenboomsheugel; shrub, bush and cultivated land at the Groot River at Grootrivierspoort; shrub and bush at the Voël River at Rietvley; shrub and bush at the Little Fish River at Rietfontein; bush and shrub at the Great Fish River at Fort Brown Peninsula; shrub, bush and cultivated land at the Great Fish River at Matomela's Reserve; bush, plantation and cultivated land at the Hluhluwe River at Valsbaai.

The land cover at sites where crops moderately sensitive to foliar absorption increasingly accumulate toxic levels of chloride when foliage is wetted are as follows: shrub at the Sak River at De Kruis; and shrub, bush and cultivated land at the Tarka River at Bridge Farm.

The land cover at sites where crops tolerant to foliar absorption increasingly accumulate toxic levels of chloride when foliage is wetted are as follows: shrub at the Groot River at Buffelsfontein; shrub, cultivated land and plantation at the Olifants River at Warm Water; shrub at the Great Brak River at Vishoek; bush, plantation and cultivated land at the Swart Vlei at Ronde Valley; shrub and bush at the Heuningklip River at Campherspoort; bush, grass, urban and cultivated land at the Mackiesput Eye at Graaf-Reinet; bush, shrub and cultivated land at the Sundays River at Addo Drift East; bush, grass, shrub and cultivated land at the Boesmans River at Donkerhoek; bush, grass and forest at the Kariega River at Smithfield; and bush, grass and cultivated land at the Kowie River at Bathurst.

“Hot Spot” Information from Additional WMA Sites

Refer to Map 10 and Table 4.6 for the location of the “hot spots” as they relate to irrigated agriculture. They are the sites from the individual WMAs (and the national assessment sample site set) that exceed the Target Water Quality Range for the selected variables and fitness-for-use for irrigated agriculture.

Map 10 Water quality effects on Irrigated Agriculture Use reported at the “hot spot” sample sites