Lake Eyre Basin Rivers Monitoring Project

Conceptual Models

DEWNR Technical report 2015/41

Government of South Australia
Department of Environment,
Water and Natural Resources

Funding for these projects has been provided by the Australian Government through the Bioregional Assessment Programme.

Lake Eyre Basin Rivers Monitoring Project

Conceptual Models

Sarah Imgraben[1] and Dale McNeil[2]

[1]Auricht Projects

[2]Department of Environment, Water and Natural Resources

June, 2015

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Government of South Australia
Department of Environment,
Water and Natural Resources

Department of Environment, Water and Natural Resources
25 Grenfell Street, Adelaide
GPO Box 1047, Adelaide SA 5001
Telephone National (08) 8463 6946
International +61 8 8463 6946
Fax National (08) 8463 6999
International +61 8 8463 6999
Website www.environment.sa.gov.au

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ISBN 978-1-925369-17-5

Preferred way to cite this publication

Imgraben, S. and McNeil, D. 2015, *Lake Eyre Basin Rivers Monitoring Project: Conceptual Models,* DEWNR Technical report 2015/41, Government of South Australia, through Department of Environment, Water and Natural Resources, Adelaide

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FOREWORD

The Department of Environment, Water and Natural Resources (DEWNR) is responsible for the management of the State's natural resources, ranging from policy leadership to on-ground delivery in consultation with government, industry and communities.

High-quality science and effective monitoring provides the foundation for the successful management of our environment and natural resources. This is achieved through undertaking appropriate research, investigations, assessments, monitoring and evaluation.

DEWNR's strong partnerships with educational and research institutions, industries, government agencies, Natural Resources Management Boards and the community ensures that there is continual capacity building across the sector, and that the best skills and expertise are used to inform decision making.

Sandy Pitcher
CHIEF EXECUTIVE
DEPARTMENT OF ENVIRONMENT, WATER AND NATURAL RESOURCES

ACKNOWLEDGEMENTS

The authors would like to thank Katie Fels, Hugh Wilson and Glen Scholz for their contribution to the development of the conceptual models and all workshop attendees for their participation. Special thanks to reviewers Andrew Boulton, Edwina Johnson and Moya Tomlinson for valuable comments on a draft report, to Auricht Projects for assistance with editing conceptual models and technical editing and revision, and to Andy Harrison for coordinating production of the final report. Many of the symbols used in the Adobe® Illustrator® pictorial models were developed courtesy of the Integration and Application Network, University of Maryland Centre for Environmental Science.

Funding for this project has been provided by the Australian Government through the Department of the Environment as part of the Bioregional Assessment Programme. See www.bioregionalassessments.gov.au for further information.

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EXECUTIVE SUMMARY

The Lake Eyre Basin River Monitoring (LEBRM) project was developed to collate a baseline of scientific knowledge around the hydrology and ecology of aquatic ecosystems in the LEB and to improve knowledge in regions where coal-bearing deposits are located. The overarching goal of the LEBRM project is to establish an advanced and up-to-date platform of hydrological and ecological knowledge that can form part of the detailed modelling, impact and risk analysis needs of LEB bioregional assessments[1].

The LEBRM Project uses a conceptual modelling approach to illustrate the key aquatic ecosystem types in the Lake Eyre Basin and their potential vulnerability to Coal Seam Gas (CSG) and Large Coal Mining Development (LCM) related activities. Models developed as part of this approach guide the development of indicators and thresholds of potential concern, as well as assisting to evaluate knowledge and data gaps within the LEB.

Two types of models have been developed as part of the LEBRM conceptual modelling task in accordance with the Integrated Science and Management Framework (ISMF) (McNeil and Wilson, 2014) including:

- Hydro-ecological models describing the components and processes attributes of key aquatic ecosystem asset types (consistent with the Ramsar Wetlands Convention, DSE 2005, and National Framework and Guidance for Describing the Ecological Character of Australian Ramsar Wetlands, DEWHA 2008).[2][3]
- Pressure-Stressor (PS) models identifying the impacts specific to key CSG/LCM activities (*pressures) and* the mechanisms through which these pressures cause stress to the environment (*stressor)*.

This report presents the conceptual models developed as part of the LEBRM Project.

An accompanying report, LEBRM Conceptual Modelling Approach (Imgraben and McNeil, 2014) describes the scope of the models and the methodology used to develop the models as part of the LEBRM project.

[1] *The Australian Government is undertaking Bioregional Assessments to elucidate the potential impacts of coal seam gas and coal mining on water resources and related assets. Refer http://www.bioregionalassessments.gov.au/*

[2] *National Guidelines http://www.environment.gov.au/water/wetlands/ramsar/implementing-national-framework*

[3] *See terminology in http://www.ramsar.org/sites/default/files/documents/pdf/res/key_res_ix_01_annexa_e.pdf*

1. HYDRO-ECOLOGICAL MODELS

For a description of the methodology used to develop the hydro-ecological models please refer to accompanying report 'Towards a Conceptual Modelling Approach' (Imgraben and McNeil, 2014).

Flow chart (box and arrow) and pictorial (diagrammatic) Adobe® Illustrator® models have been developed and presented in draft format for the following aquatic ecosystem types:

- Waterholes (during flooding phase)
- In-channel habitats (watercourses) (during flooding phase)
- Connected basin systems
    - Lakes (during flooding phase)
    - Terminal Lakes (during flooding phase)
    - Swamps(during flooding phase)
- Farm dams
- Isolated basin systems
    - Saline lakes
    - Clay pans

1.1. WATERHOLES

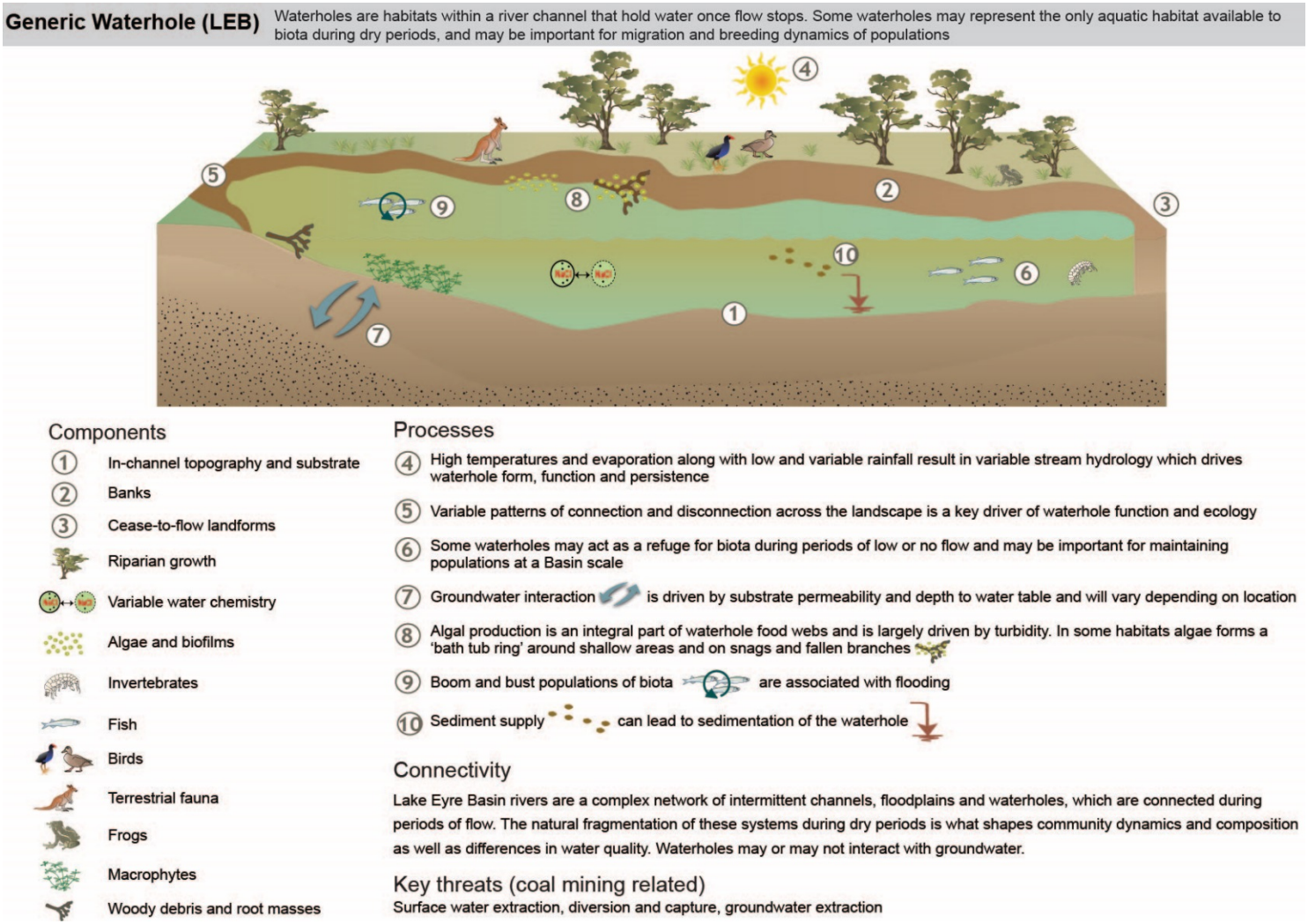

Figure 1: Generic diagrammatic conceptual for waterholes in the Lake Eyre Basin during flooding phase

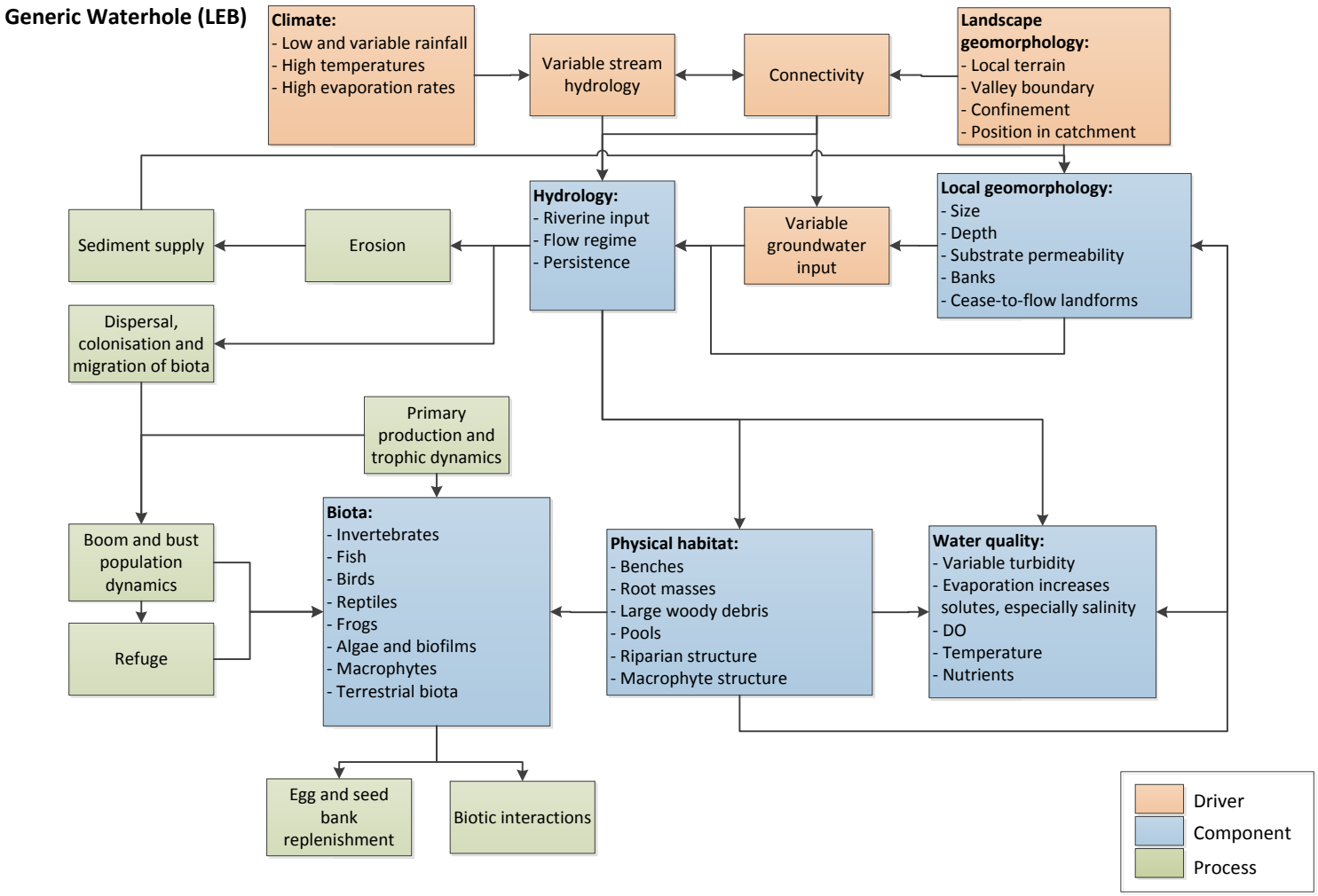

Figure 2: Generic hydro-ecological flow chart model for waterholes in the Lake Eyre Basin

1.2. IN-CHANNEL HABITATS

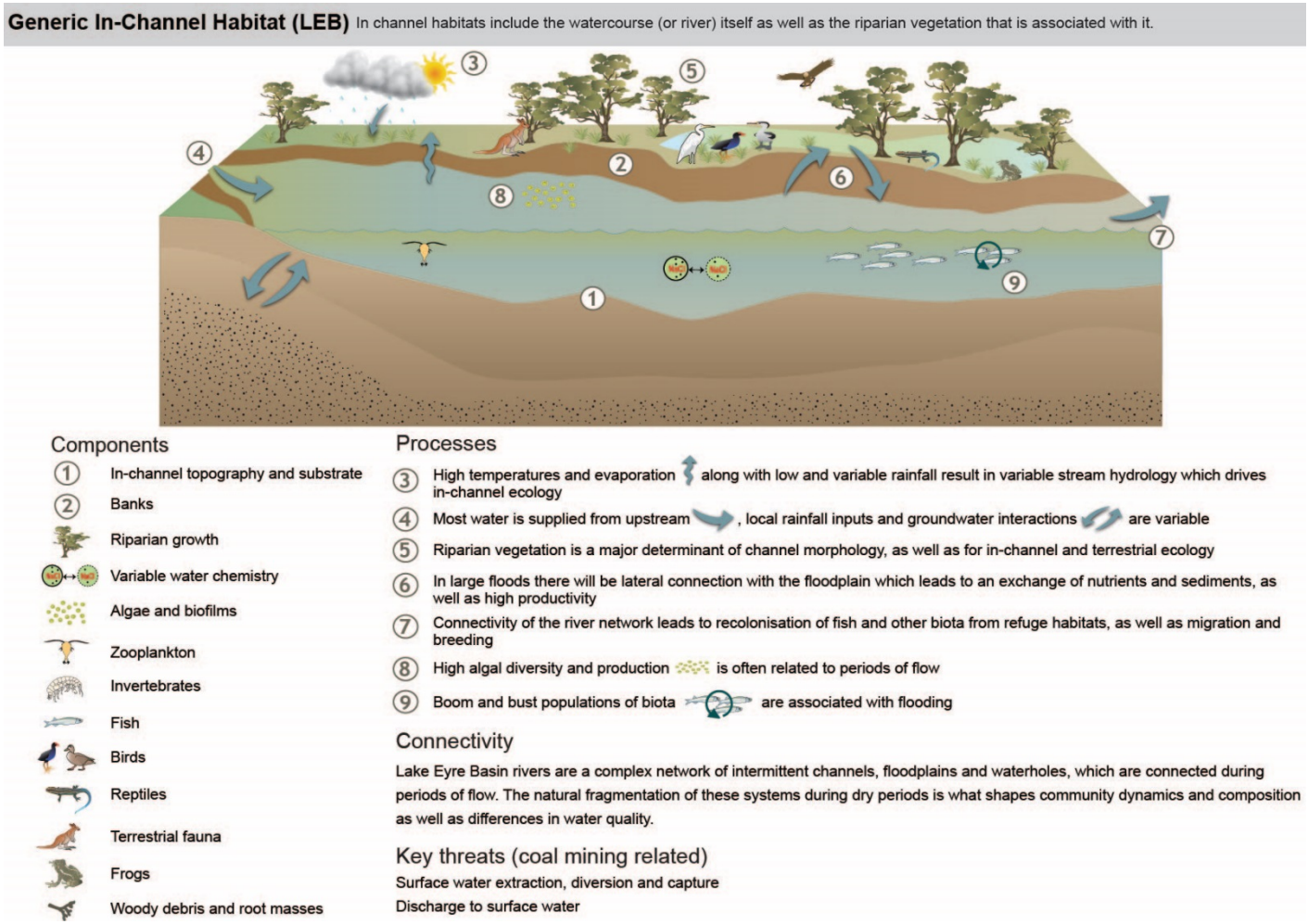

Figure 3: Generic diagrammatic conceptual model for in-channel habitats in the Lake Eyre Basin during flooding phase

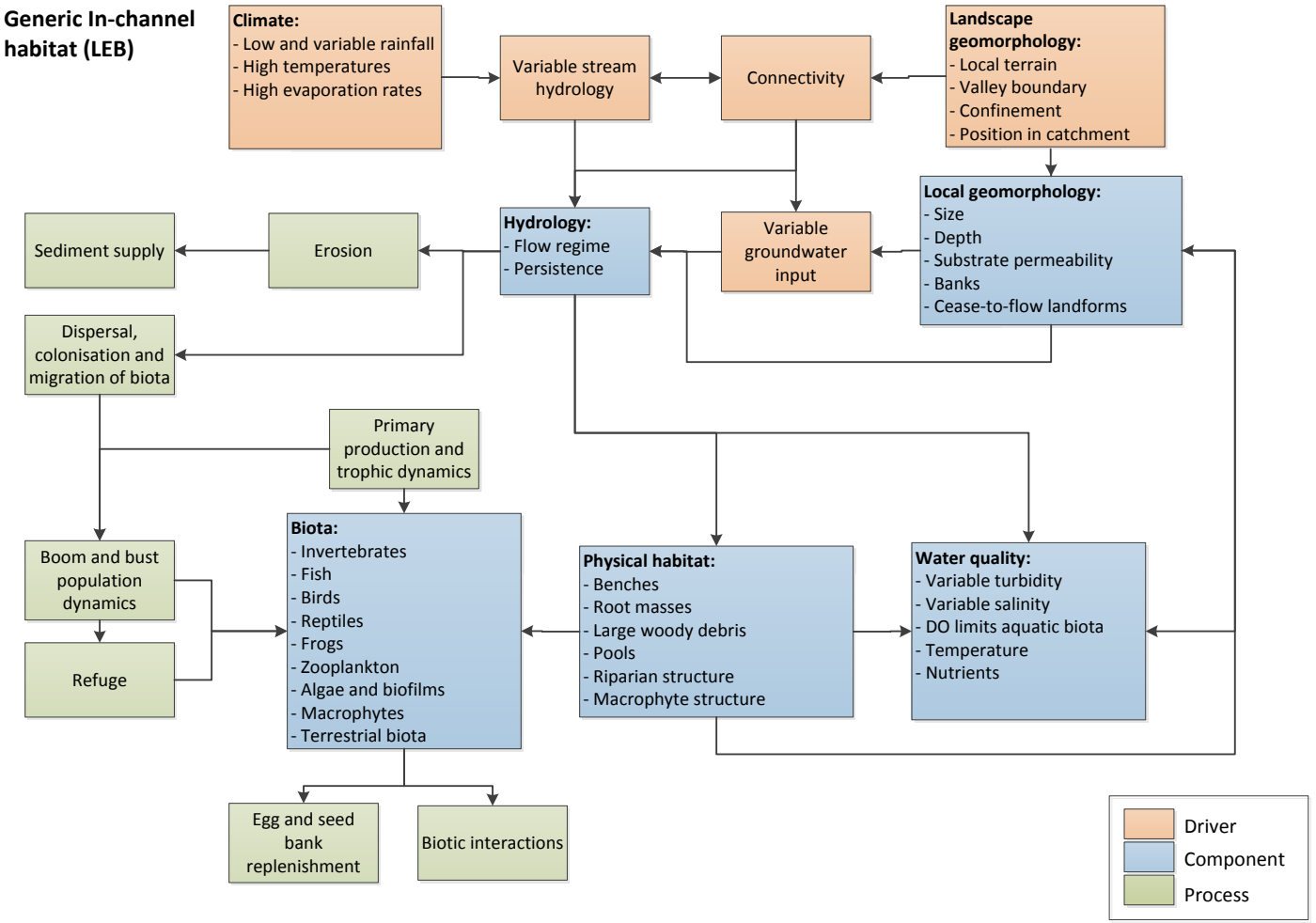

Figure 4: Generic hydro-ecological flow chart for in-channel habitats in the Lake Eyre Basin

1.3. CONNECTED BASIN SYSTEMS

1.3.1. LAKES

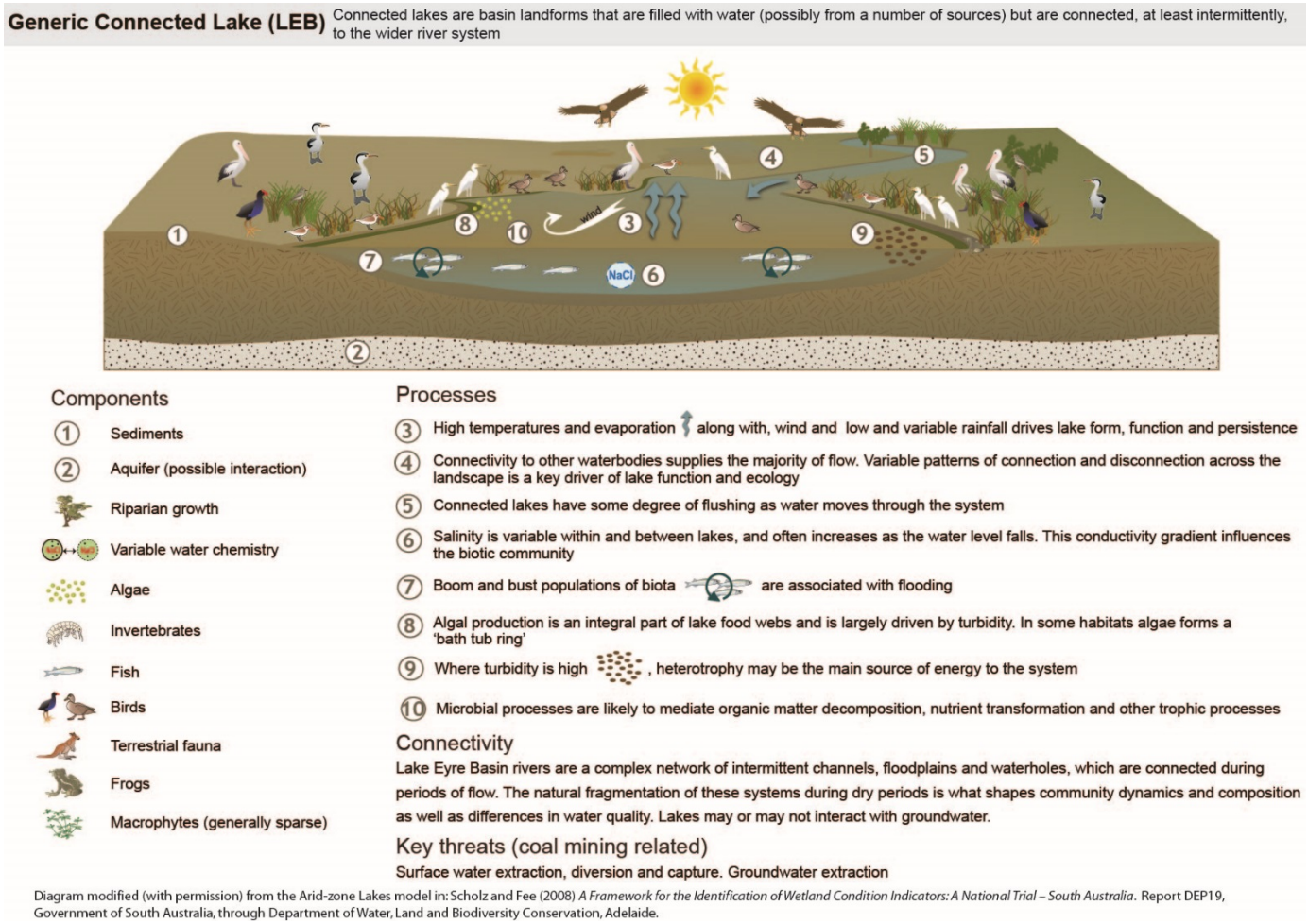

Figure 5: Generic diagrammatic conceptual model for connected lakes in the Lake Eyre Basin during flooding phase

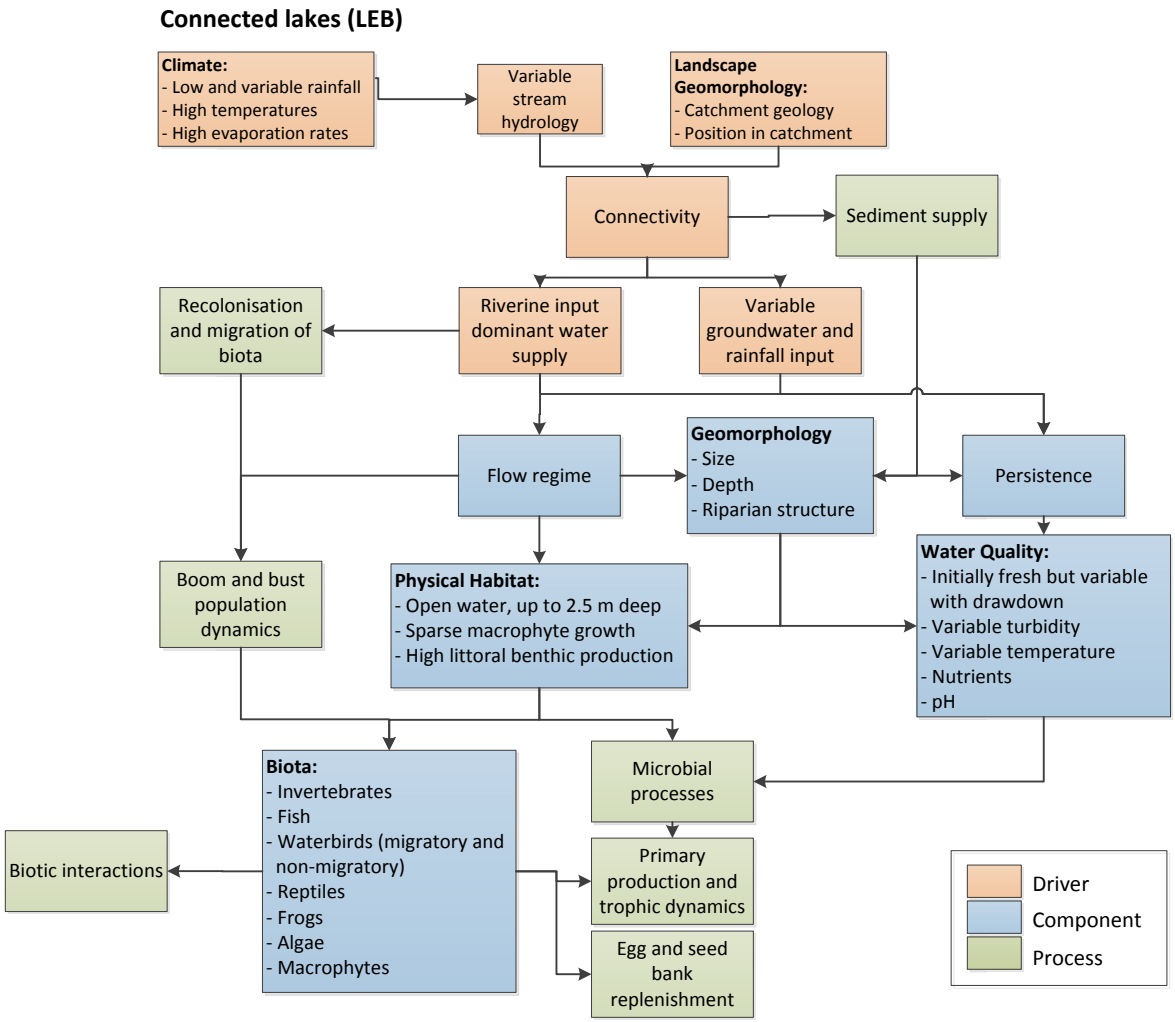

Figure 6: Generic hydro-ecological flow chart for connected lakes in the Lake Eyre Basin

1.3.2. TERMINAL LAKES

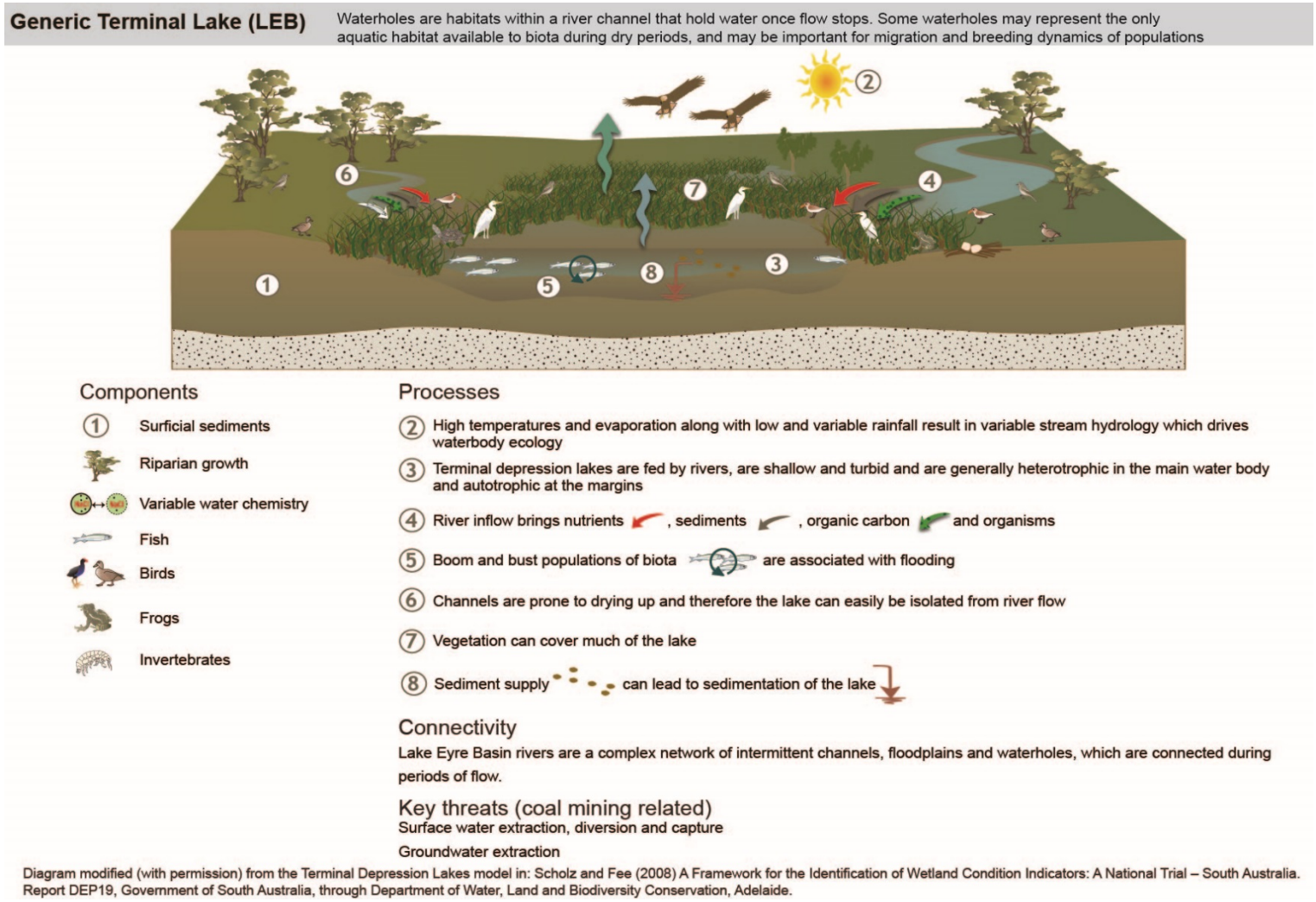

Figure 7: Generic diagrammatic conceptual model for terminal lakes in the Lake Eyre Basin during flooding phase

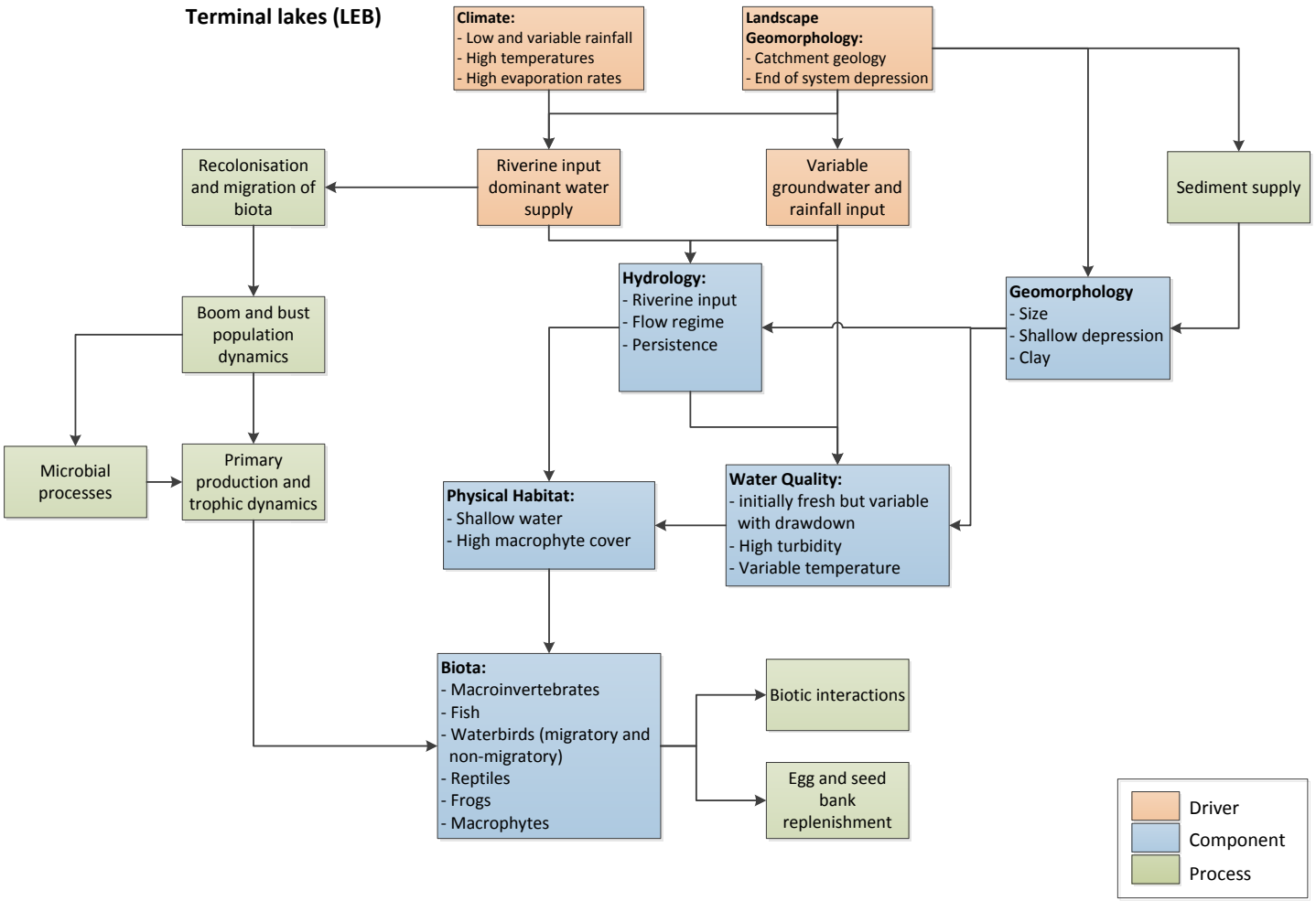

Figure 8: Generic hydro-ecological flow chart for terminal lakes in the Lake Eyre Basin

1.3.3. SWAMPS

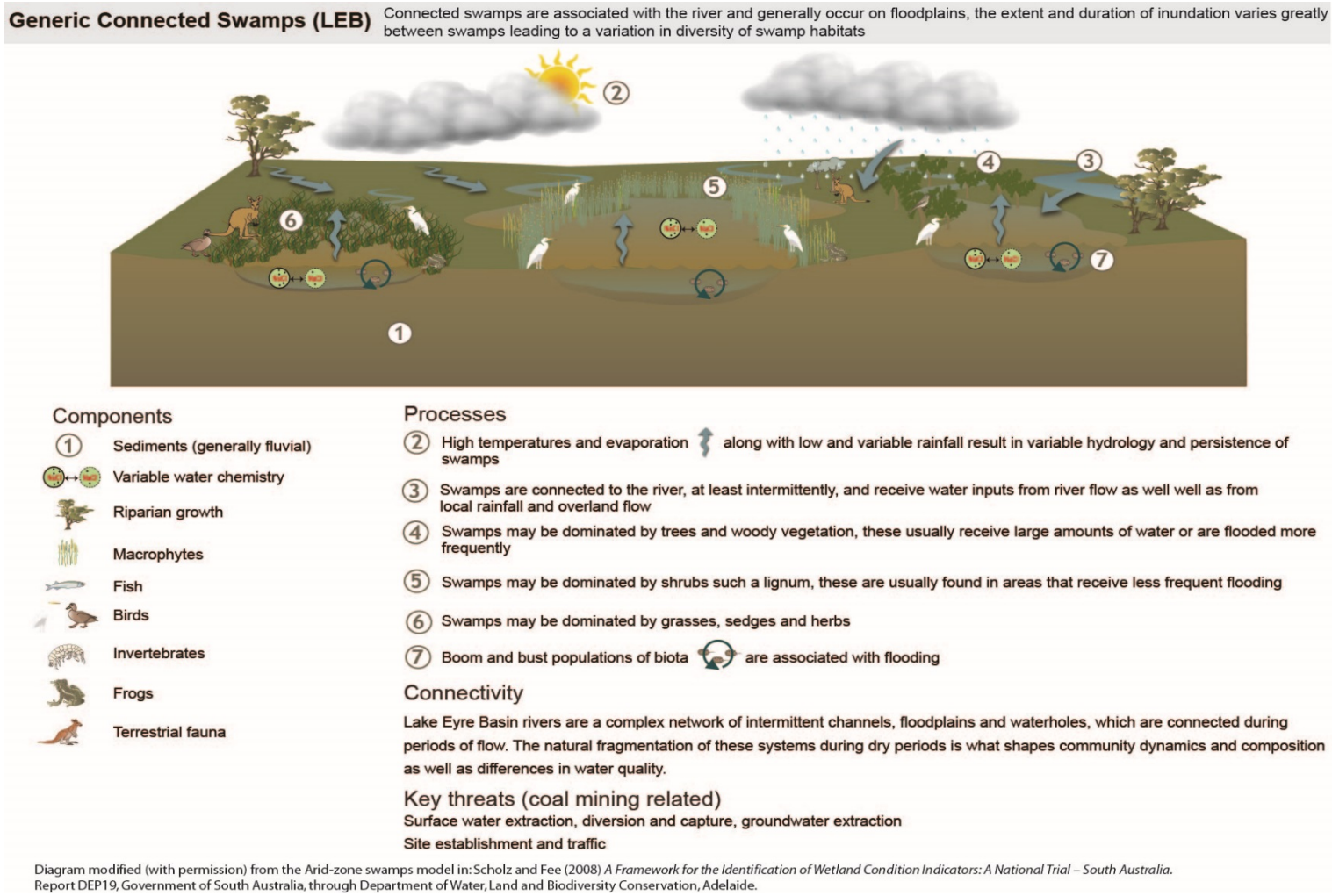

Figure 9: Generic diagrammatic conceptual model for connected swamps in the Lake Eyre Basin during flooding phase

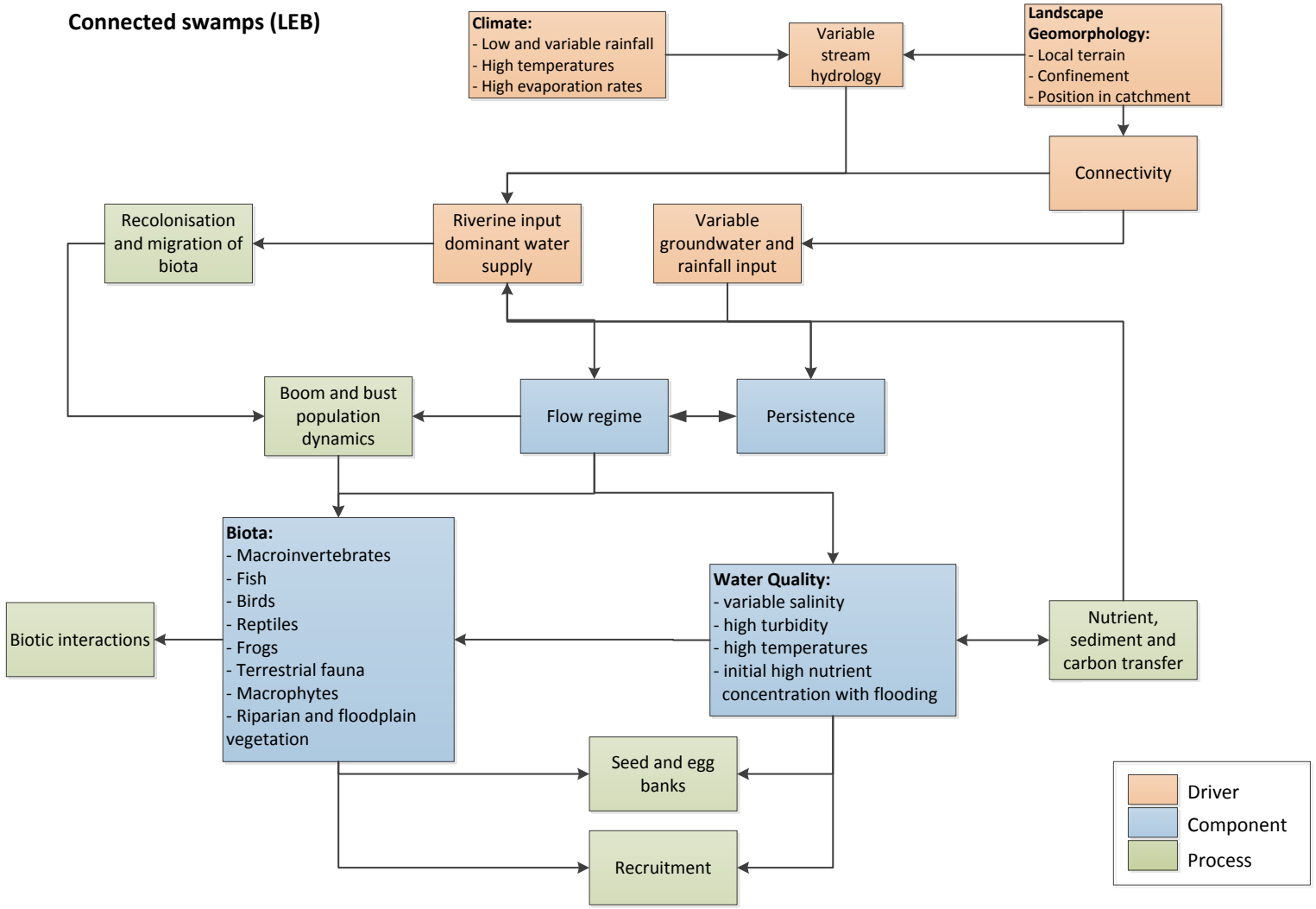

Figure 10: Generic hydro-ecological flow chart for connected swamps in the Lake Eyre Basin

1.4. FARM DAMS

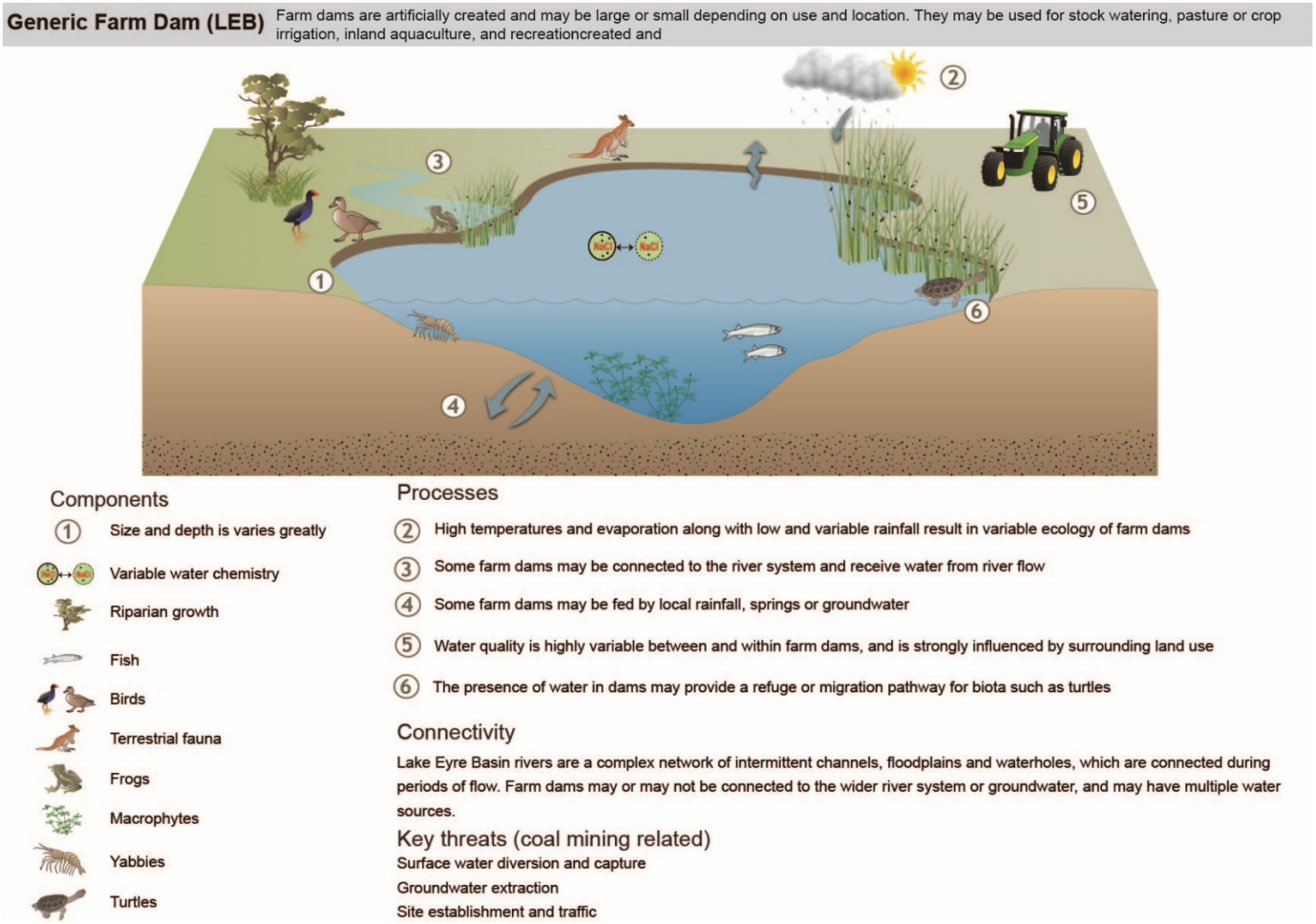

Figure 11: Generic diagrammatic conceptual model for farm dams in the Lake Eyre Basin

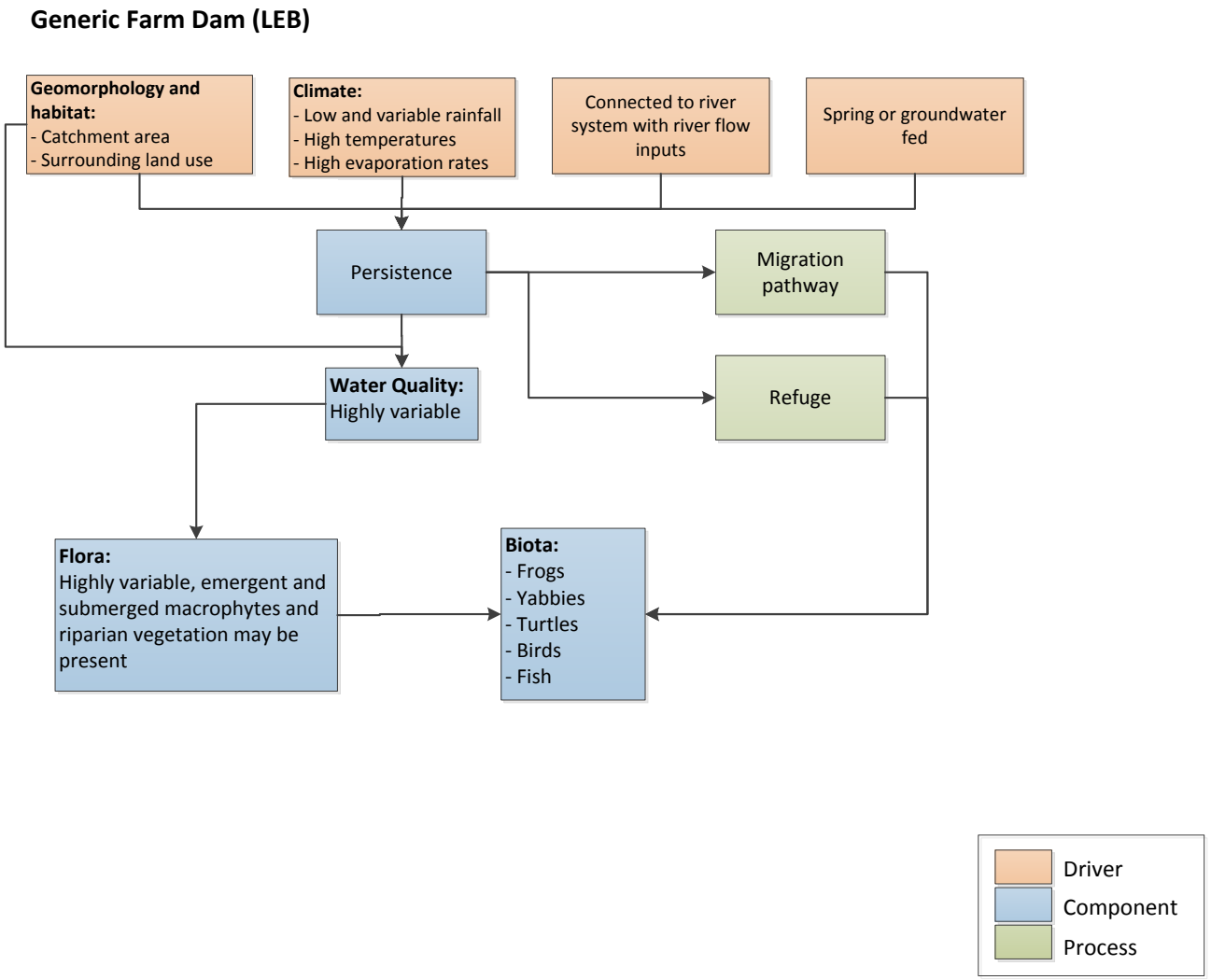

Figure 12**: Generic hydro-ecological flow chart for farm dams in the Lake Eyre Basin**

1.5. ISOLATED BASIN SYSTEMS

1.5.1. SALINE LAKES

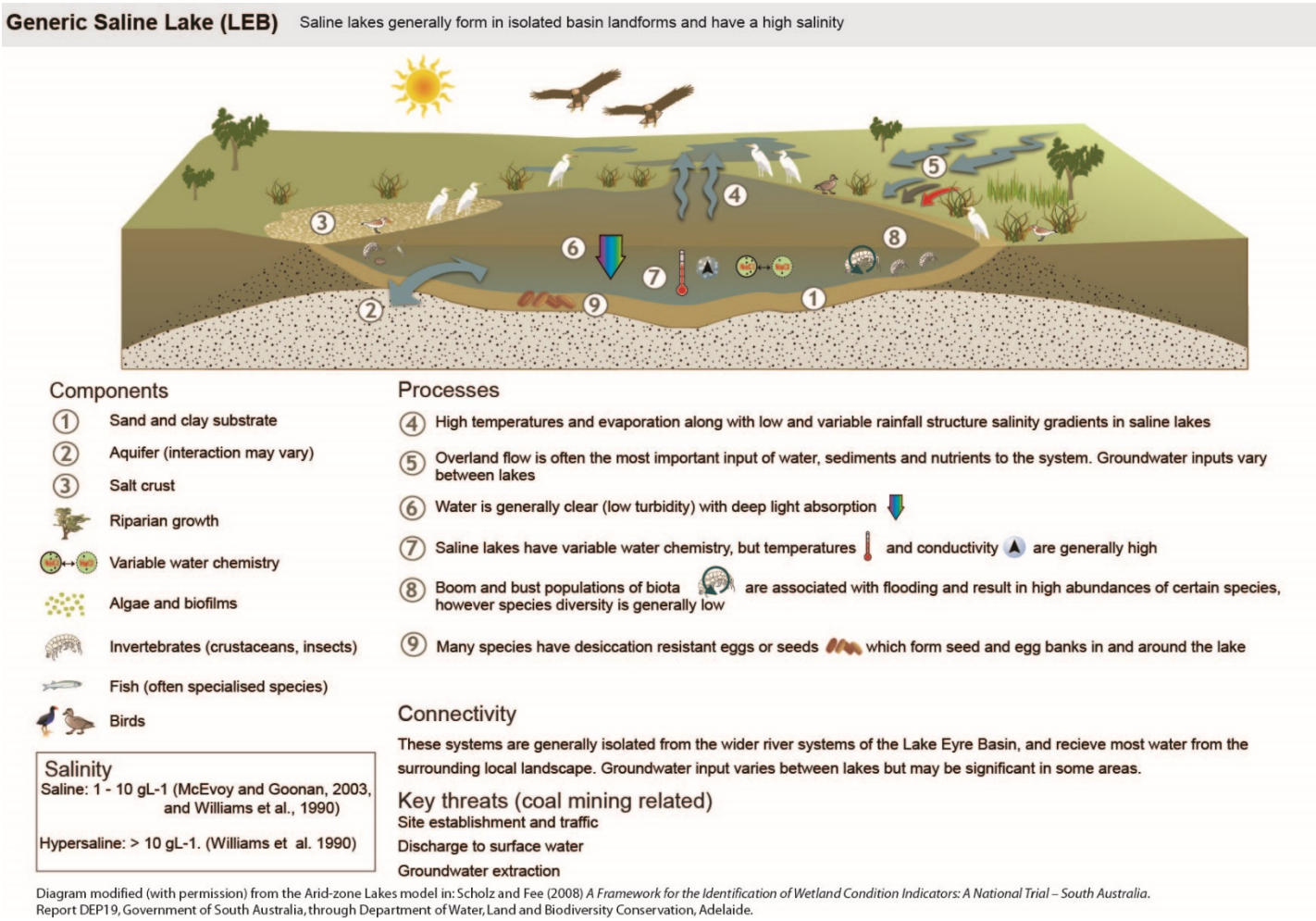

Figure 13: Generic diagrammatic conceptual model for saline lakes in the Lake Eyre Basin during flooding phase

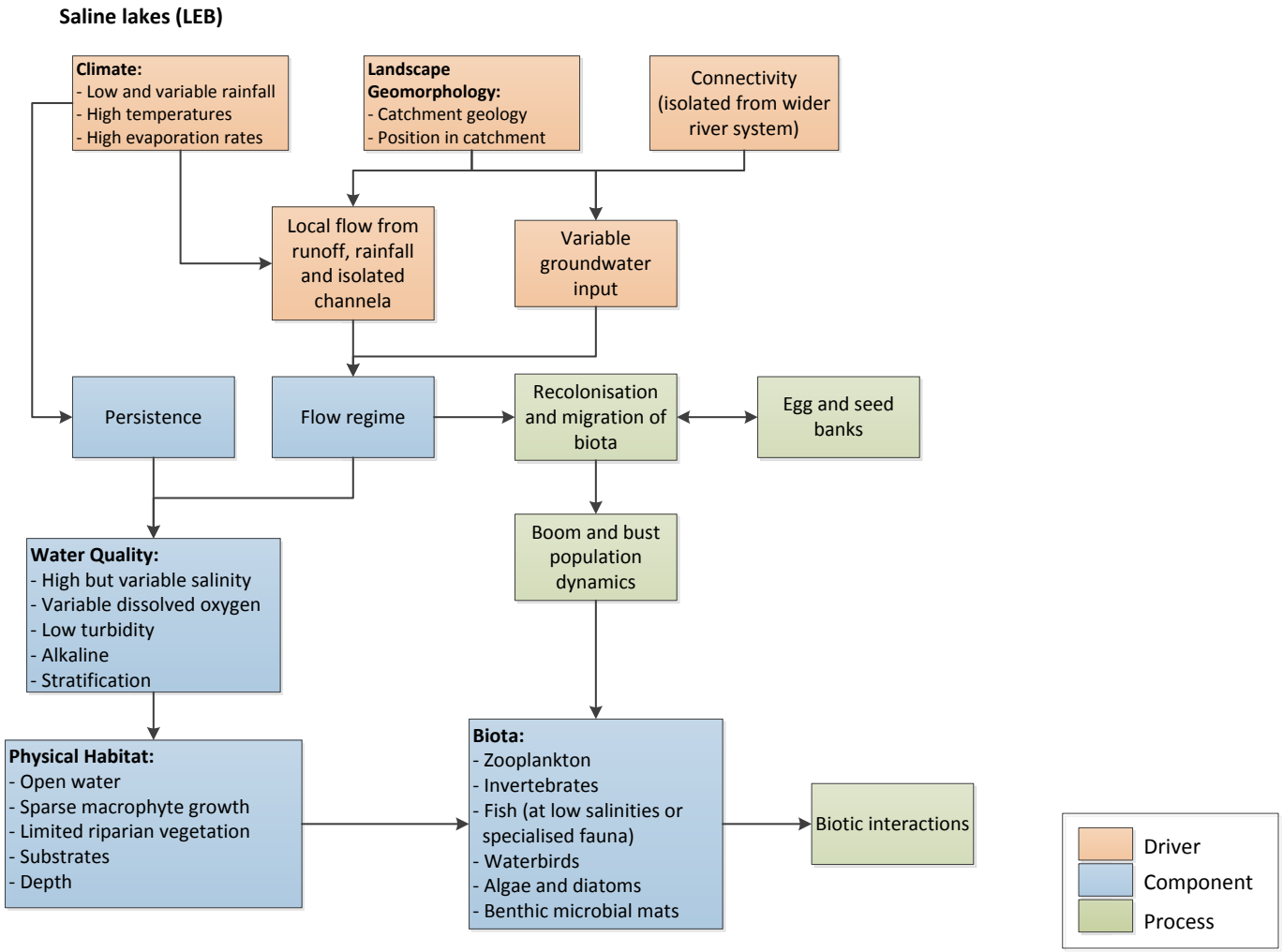

Figure 14: Generic hydro-ecological flow chart saline lakes in the Lake Eyre Basin

1.5.2. CLAY PANS

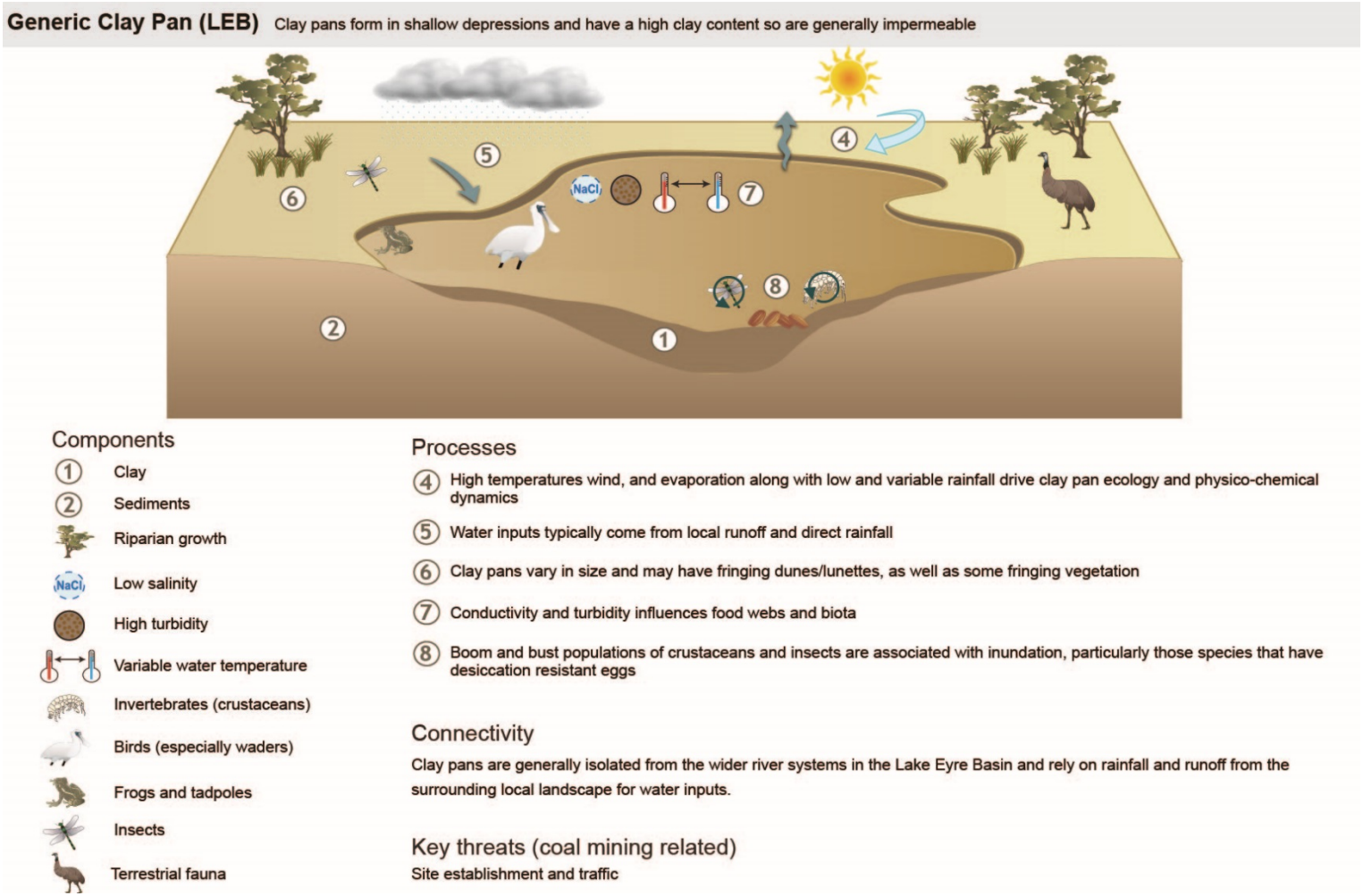

Figure 15: Generic diagrammatic conceptual model for clay pans in the Lake Eyre Basin

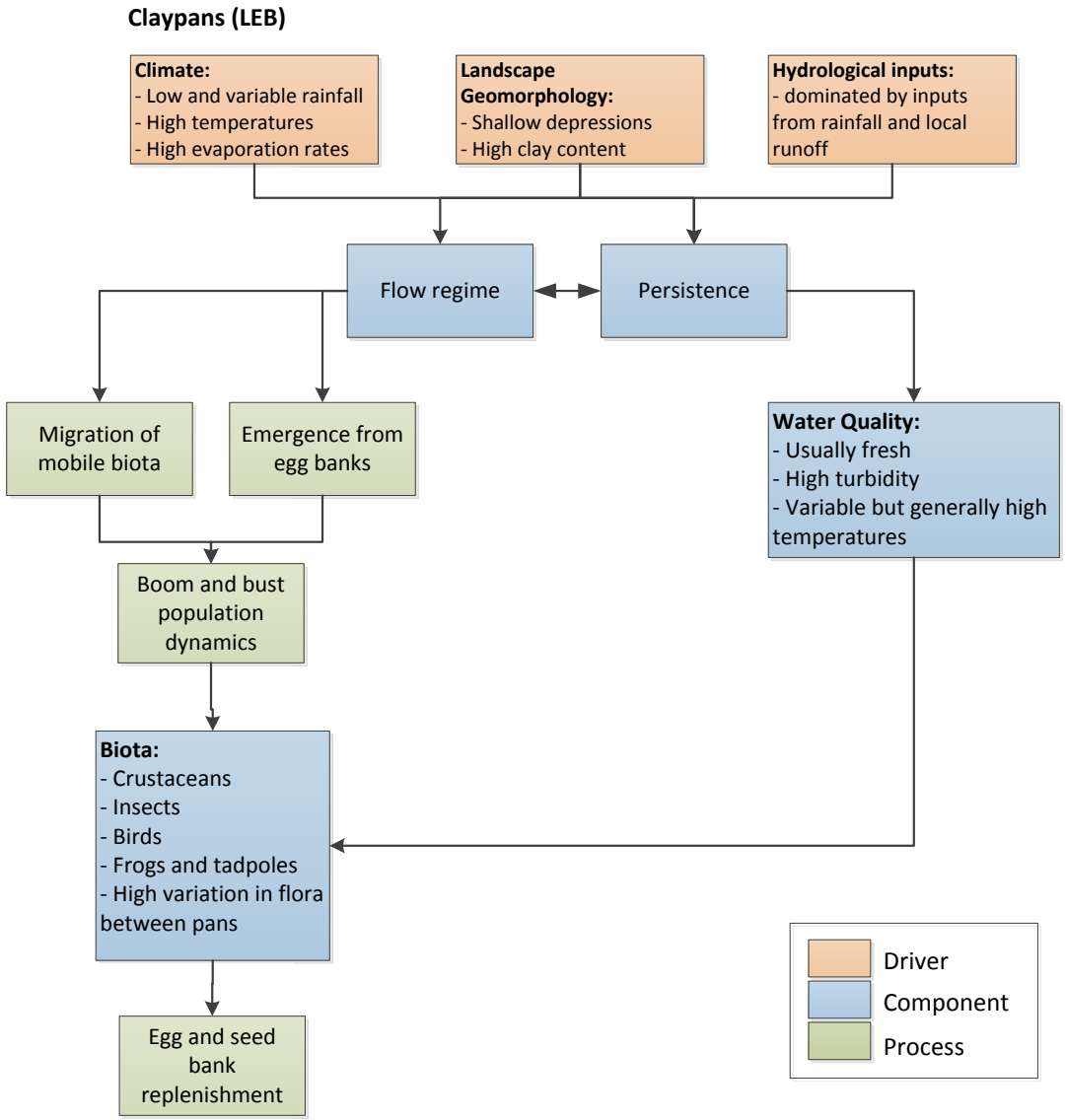

Figure 16: Generic hydro-ecological flow chart clay pans in the Lake Eyre Basin

2. PRESSURE-STRESSOR MODELS

For a description of the methodology used to develop the PS models, please refer to Conceptual Modelling Approach.

Flow chart conceptual models have been developed and presented for the following CSG and LCM development related pressures:

- Surface water extraction
- Surface water diversion
- Surface water capture
- Discharge to surface water
- Groundwater extraction
- Evaporation ponds
- Tailings dams
- Overburden management
- Site establishment and traffic

2.1. SURFACE WATER EXTRACTION

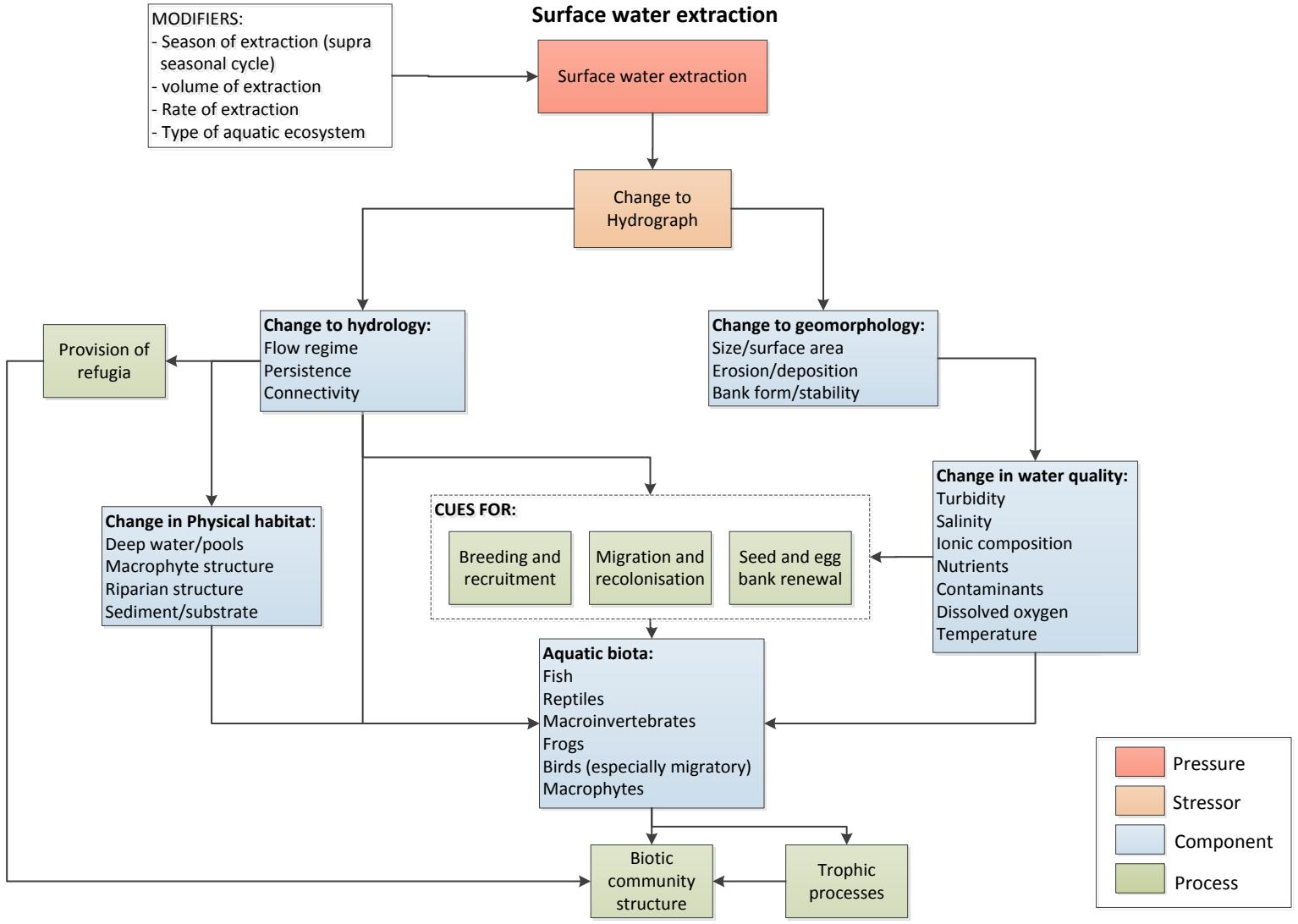

Figure 17: Generic PS flow chart for surface water extraction in the Lake Eyre Basin

2.2. SURFACE WATER DIVERSION

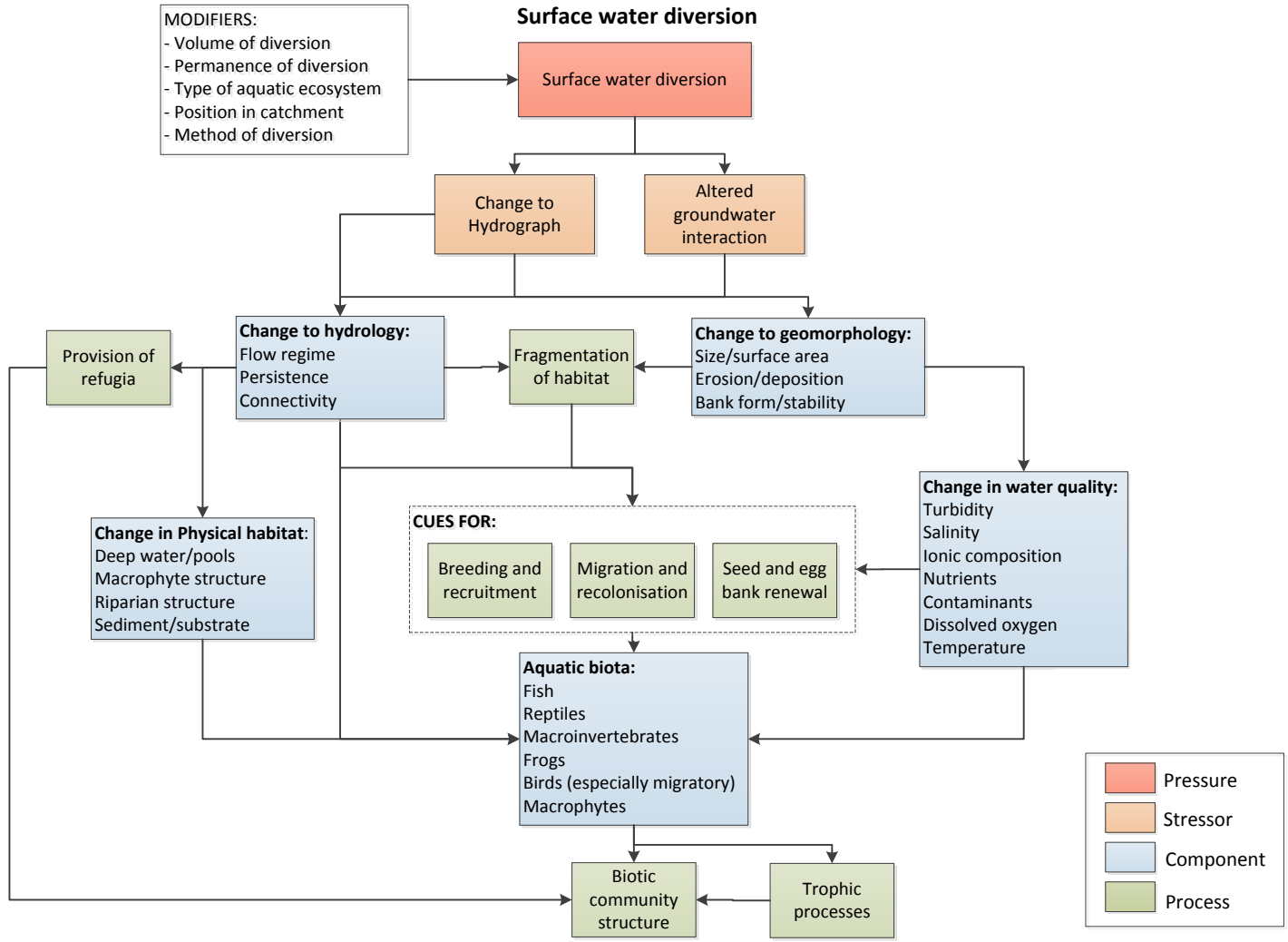

Figure 18: Generic PS flow chart for surface water diversion in the Lake Eyre Basin

2.3. SURFACE WATER CAPTURE

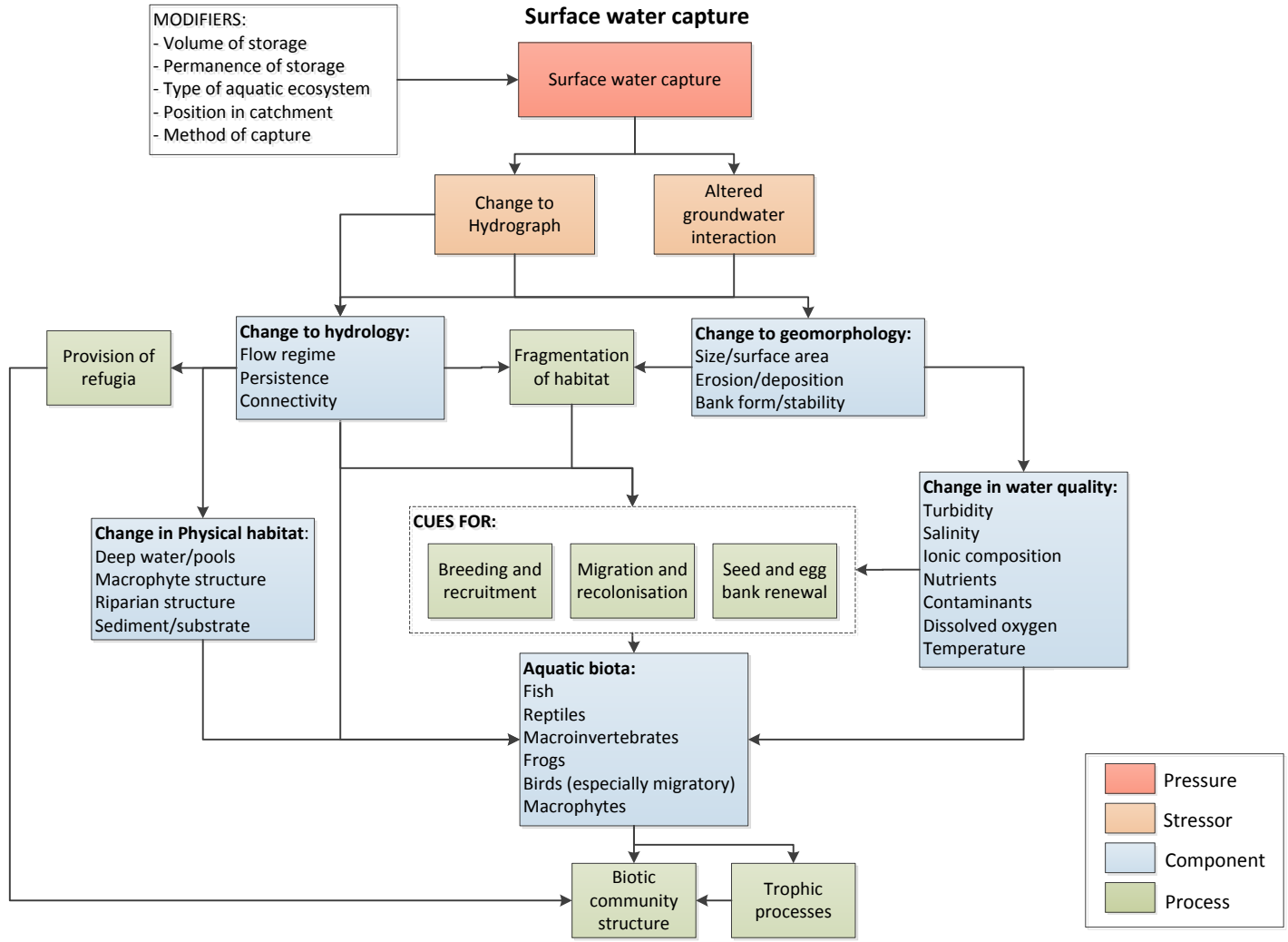

Figure 19: Generic PS flow chart for surface water capture in the Lake Eyre Basin

2.4. DISCHARGE TO SURFACE WATER

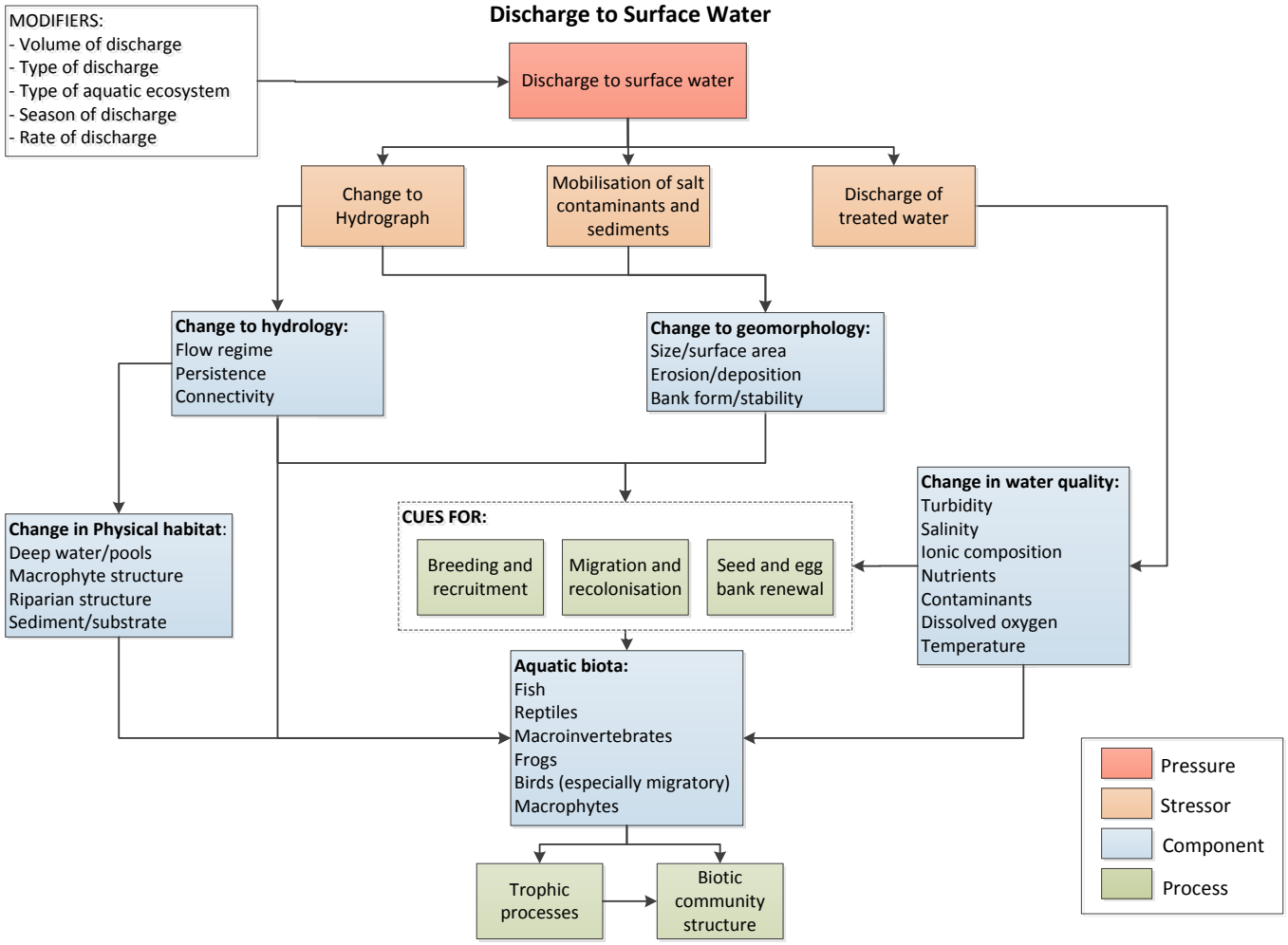

Figure 20: Generic PS flow chart for discharge to surface water in the Lake Eyre Basin

2.5. GROUNDWATER EXTRACTION

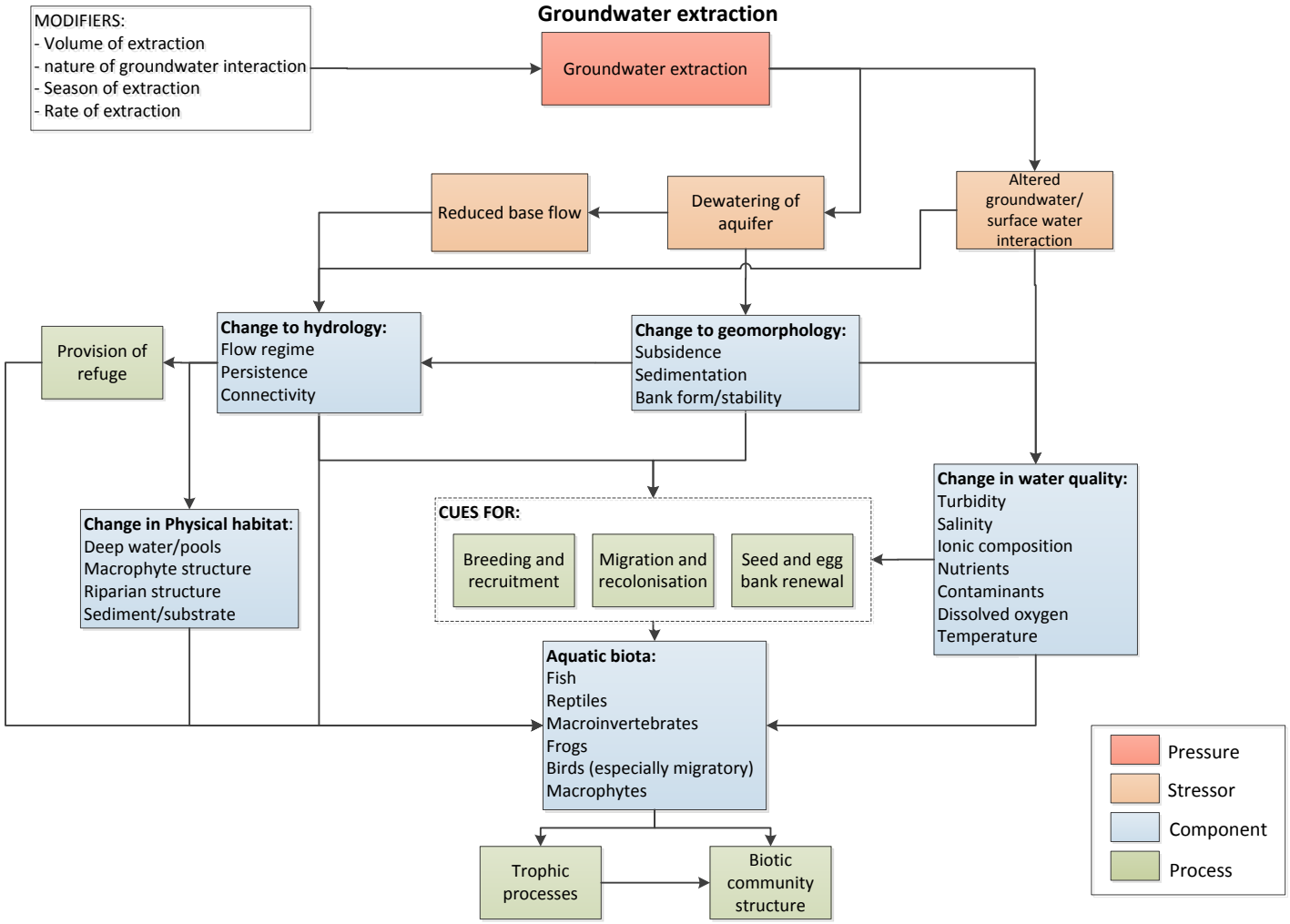

Figure 21: Generic PS flow chart for groundwater extraction in the Lake Eyre Basin

2.6. EVAPORATION PONDS

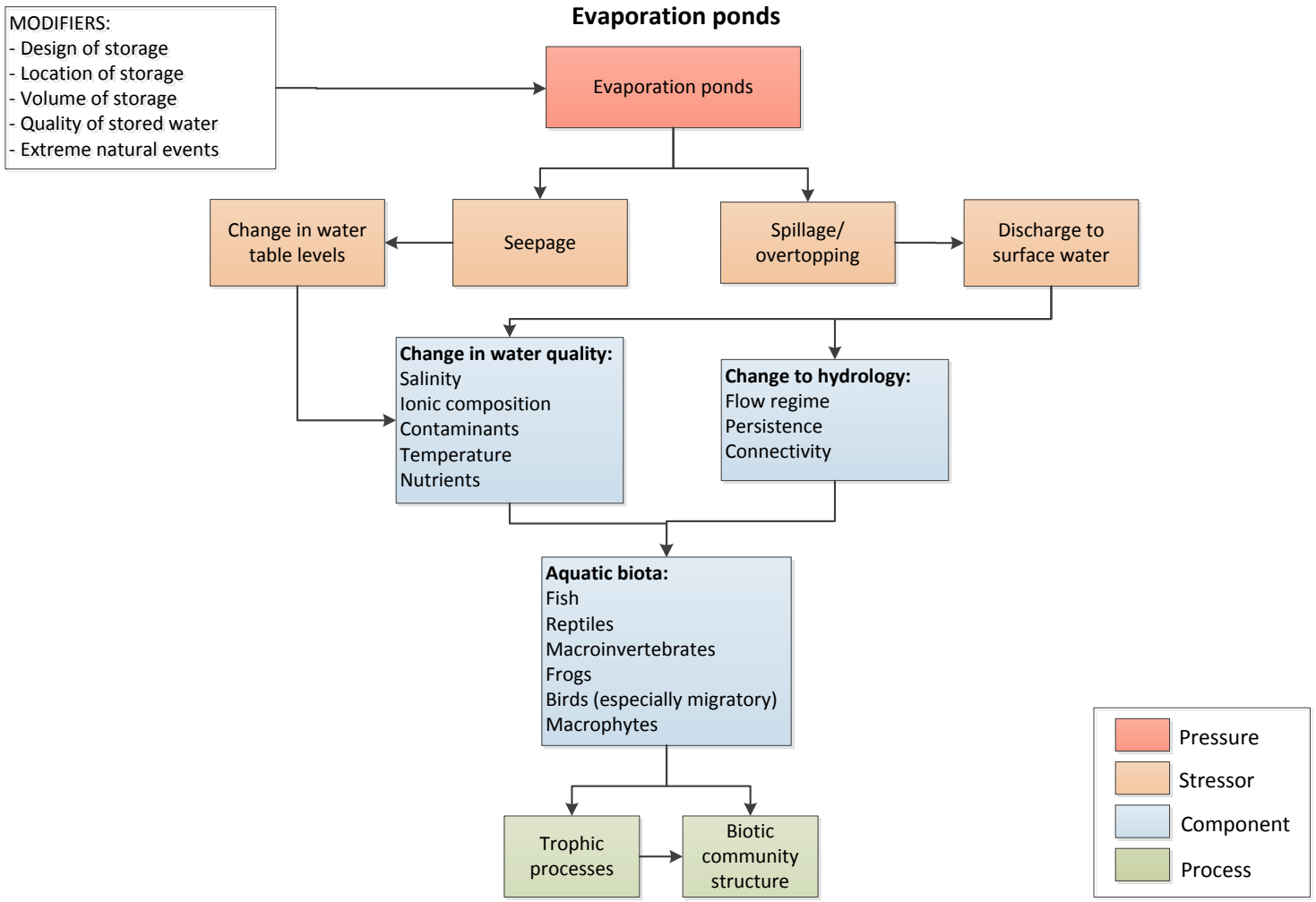

Figure 22: Generic PS flow chart for evaporation ponds in the Lake Eyre Basin

2.7. TAILINGS DAMS

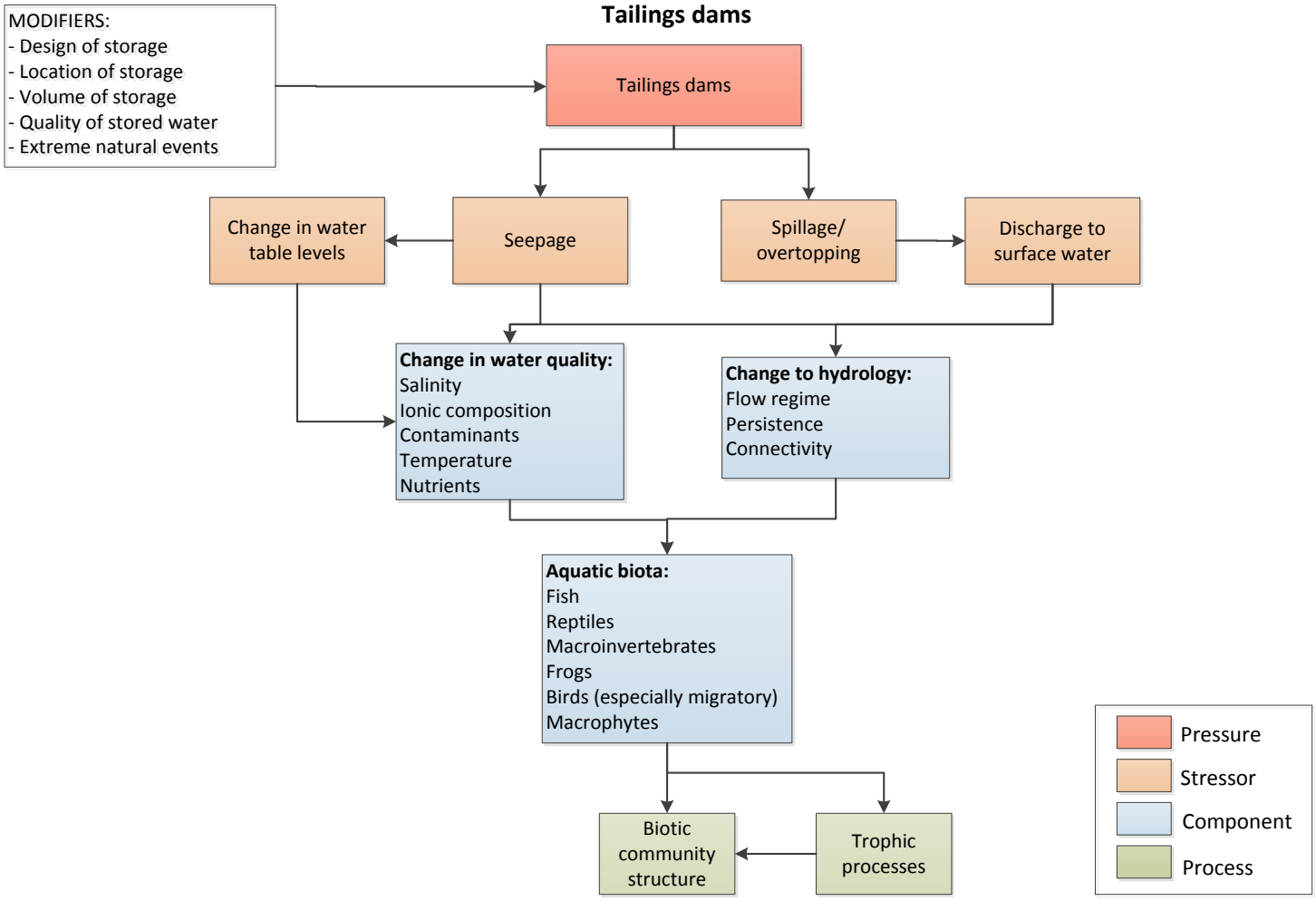

Figure 23: Generic PS flow chart for tailings dams in the Lake Eyre Basin

2.8. OVERBURDEN MANAGEMENT

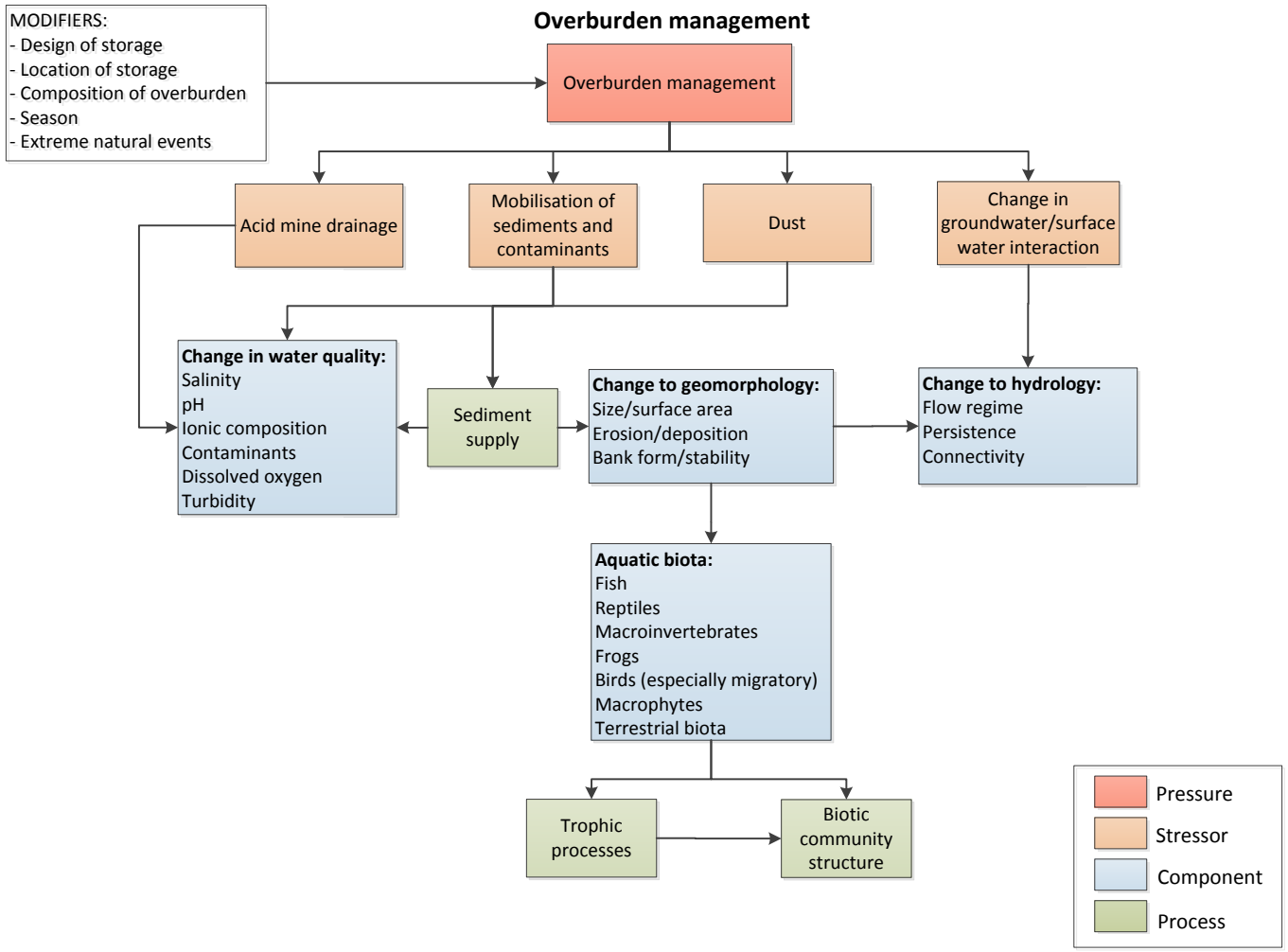

Figure 24: Generic PS flow chart for overburden management in the Lake Eyre Basin

2.9. SITE ESTABLISHMENT AND TRAFFIC

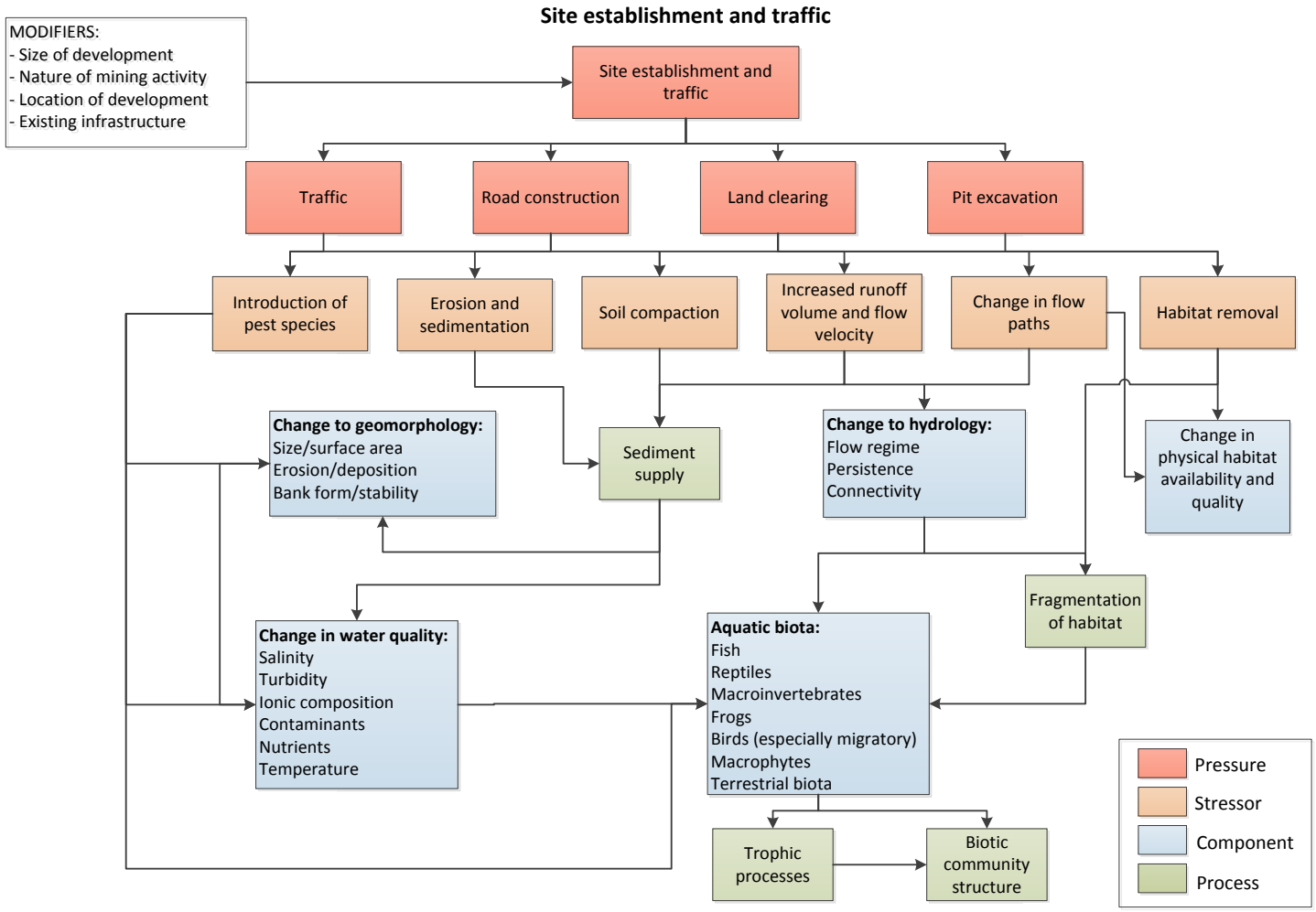

Figure 25: Generic PS flow chart for site establishment in the Lake Eyre Basin

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