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Geomorphology of the lower Balonne River, southern Queensland, Australia

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The floodplain of the lower Balonne River is in the upper reaches of the Murray Darling Basin and has significant agricultural value as cotton irrigation and cattle grazing land. The area faces water allocation issues and there have been reports of recent salinity hazards occurring in this heavily irrigated area. Consequently the region has undergone extensive and ongoing geoscientific investigations by many agencies. Groundwater flow systems and the presence of salinity hazards in the area are determined by regolith materials and their architecture at the surface and at depth.

Landform, regolith and geomorphic mapping relied heavily on remotely sensed data, including Landsat TM, airborne gamma-ray radiometrics, aerial photography, Aster imagery, and digital elevation models (DEM). Mapping was carried out at 1:100,000 and 1:250,000 scale and individual units were validated. The Regolith Landform Map has 22 detailed units based on regolith materials and form, while the Geomorphic map is divided into the 8 major units based on landform and the geomorphic processes responsible for their formation. The Regolith Landform Map is useful for surface detail, especially in terms of salinity hazard identification and for assessing which data sources were most appropriate in its construction. For information on landscape evolution and for sub-surface interpretation, the more regional Geomorphic Units were considered.

The landscape has a complex evolutionary history. Bedrock consists of the Griman Creek Formation, deposited as marine sediment in the Cretaceous. This unit has been slightly deformed and extensively weathered to form silcrete and ferricrete in varying amounts. The weathering profile is believed to strongly influence the groundwater characteristics in the area by forming an aquiclude for the overlying alluvial sedi-

ments. Coincident with the erosion and weathering quartz gravels were deposited and are now extensively duricrusted and preserved as remnants forming zones of inverted relief. These are inferred to be Early Tertiary in age. Much of the present landscape consists of a series of juxtaposed depositional surfaces. These are the surface expression of an incised and infilled valley succession formed from the Pliocene onwards by the palaeo-Balonne, Moonie, Maranoa and Condamine Rivers. The oldest of the depositional surfaces is the Maranoa surface. At present there is little active channel flow on the surface and it now has a slightly weathered and eroded form. The Maranoa surface is Pliocene – Early Pleistocene in age. At some point following the deposition of this feature, the Balonne River was diverted to its present course between two low rises upstream from the township of St George. After it changed course, the Balonne River flowed to the east of its present course. At the same time the Moonie River was bringing material from further east and presumably because it was blocked by sediments from the Balonne River, turned to the south to take up its present course. These changes in sedimentation patterns on the fluvial plain formed a series of different depositional surfaces. The Modern Balonne River system consists of a number of easily recognised segments. In the north, the modern Balonne River channel is deep and well established. To the south the modern channel opens out onto an anastomosing plain with branching and reconnecting small-scale channels. Source bordering dunes have also formed along the western and eastern sides of the modern Balonne River and are prominent in large dunes in the south along the present Moonie River. However, they are not apparent in older landscape elements.

The surface distribution of regolith materials on most geomorphic units is a fair indication of the complexity of regolith materials at depth. Regolith distribution patterns of former channels in the major alluvial geomorphic units can be described, even if their actual location can not be predicted. Surface mapping unfortunately does little to characterise the sub-surface character of the Griman Creek formation which is present at depth throughout the study area and is a crucial factor in the ground water flow systems. Overall, however, knowledge of the surface distribution of regolith materials, their boundary character, and the processes that are responsible for that distribution, can be used as part of the input into models of the 3D regolith architecture, and of the evolution of the Lower Balonne landscape. Areas that may be a salinity hazard have also been identified through this study of the regolith and landforms of the Lower Balonne area. Predominantly these are located along the eastern boundary of the Maranoa surface. These are areas of concern because of their sodic soils, the potentially active seepage of saline water that the geomorphic evidence indicates to be going on in the area, and their proximity to the current Balonne River, which may receive some of the saline efflux.