Integrating socio-economic analysis into catchment planning: Insights from the Fitzroy Basin

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Key points

- Integrating socio-economic analysis into water planning improved understanding of catchment pressures, water dependency, and regional development risks across the Fitzroy Basin.
- Spatial and economic analysis identified significant variation in land use, water demand, climate exposure, and development pressures between subcatchments.
- The assessment highlighted increasing competition for water across agriculture, mining, urban growth, environmental flows, and emerging industries.
- Climate variability and rising evaporation are expected to place additional pressure on surface water, groundwater systems, and ecological assets.
- The methodology provides a transferable framework for integrated river and catchment management across Australia's water planning regions

Abstract

The Fitzroy Basin, the largest catchment draining to the Great Barrier Reef, is experiencing increasing pressure from competing water demands, climate variability, and evolving environmental and policy requirements. While water planning frameworks seek to balance economic, environmental, social, and cultural outcomes, socio-economic drivers are often not fully integrated into catchment-scale planning and decision-making.

A comprehensive socio-economic assessment was undertaken using 2021 census data and stakeholder engagement to support the review of the Fitzroy Basin Water Plan and to strengthen the integration of socio-economic considerations into catchment management. The assessment combined demographic, economic, spatial, and stakeholder analysis to evaluate water dependency, development pressures, climate exposure, and catchment dynamics across subcatchments. The study also examined water markets, unallocated water reserves, and infrastructure and development pressures, supported by GIS-based analysis and interactive data visualisation tools.

The analysis identified strong dependence on water across agriculture, mining, and regional communities, alongside significant cultural and environmental values associated with First Nations communities and downstream ecosystems connected to the Great Barrier Reef. Key findings included substantial underutilisation of water allocations, increasing demand from large-scale projects, climate-driven variability in water availability, and growing pressure on groundwater systems and ecological assets.

Outputs included regional socio-economic profiles, spatial datasets, and decision-support tools linking water use, development pressures, and catchment outcomes. The work demonstrated that integrating socio-economic analysis into water planning can improve alignment between water allocation, infrastructure development, environmental management, and regional development objectives. As part of a broader program across eight Queensland water plans, the methodology provides a transferable framework for integrated river and catchment management in complex, multi-user systems.

Keywords

Water planning, catchment management, socio-economic assessment, Fitzroy Basin, water allocation, climate variability, river basin management, Queensland

Introduction

The Fitzroy Basin is Queensland's largest river catchment and one of Australia's most economically significant and environmentally sensitive regions. Extending across approximately 142,000 square kilometres, the basin supports diverse economic activities including agriculture, mining, energy production, manufacturing, and regional urban development. The basin also drains directly into the Great Barrier Reef lagoon, creating a strong connection between upstream water management decisions and downstream environmental outcomes.

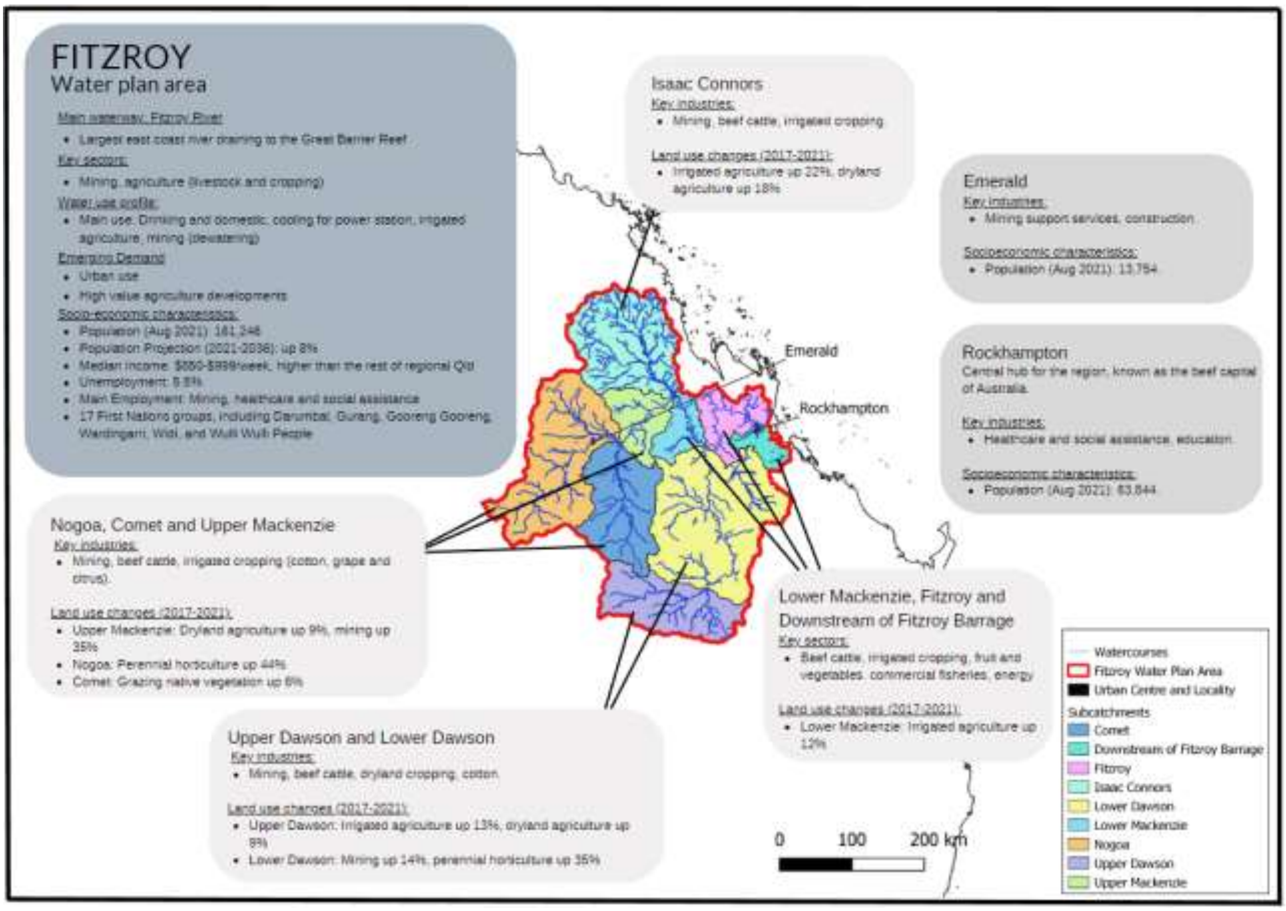

Figure 1 Socio-economic summary of the plan area. Source: BGA Work Product

Over recent decades, increasing competition for water resources, population growth, climate variability, and evolving environmental requirements have intensified pressure on catchment systems. At the same time, water planning frameworks have become increasingly complex, requiring governments to balance economic productivity, environmental sustainability, cultural values, and community expectations.

Historically, water planning processes have focused primarily on hydrological modelling, allocation frameworks, and environmental flow requirements. While these remain critical, there has been comparatively less integration of socio-economic analysis into catchment-scale decision-making. This has limited understanding of how changes in water availability, allocation settings, infrastructure development, and policy reform influence industries, communities, and regional development outcomes.

To address this gap, a comprehensive socio-economic assessment was undertaken to support the review of the Fitzroy Basin Water Plan. The assessment formed part of a broader Queensland Government program involving socio-economic assessments across eight water plan areas. The work aimed to strengthen the evidence base for water planning by improving integration between socio-economic outcomes, infrastructure planning, water allocation decisions, and catchment management objectives.

This paper presents the methodology, findings, and broader implications of the Fitzroy Basin assessment, with particular emphasis on how socio-economic analysis can support more integrated, adaptive, and resilient river and catchment management.

Context and rationale

The Fitzroy Basin supports a highly diverse regional economy and is home to significant water-dependent industries. Agriculture remains a major economic driver, including cattle grazing, irrigated cropping, horticulture, and broadacre farming. At the same time, mining and energy production continue to contribute substantially to regional output and future water demand. The basin contains environmentally sensitive ecosystems and culturally important landscapes, including waterways connected to the Great Barrier Reef and areas of significance for First Nations peoples.

Over recent decades, increasing competition for water resources, climate variability, population growth, and expanding infrastructure and industrial development have intensified pressure on catchment systems. These pressures have increased the complexity of water planning, requiring governments to balance economic productivity, environmental sustainability, cultural values, and long-term community resilience. While water planning frameworks have traditionally focused on hydrological modelling and environmental flow requirements, there has been comparatively limited integration of socio-economic analysis into catchment-scale decision-making. This has constrained understanding of how changes in water availability, allocation settings, infrastructure investment, and policy reform may influence industries, communities, and regional development outcomes across the Basin.

The socio-economic assessment was undertaken to address this gap and strengthen the evidence base supporting the Fitzroy Basin Water Plan review. The work examined how water supports regional economies and communities, the distribution of water-dependent activity across subcatchments, future infrastructure and development pressures, and trade-offs between economic growth, water allocation, and environmental outcomes. The assessment also sought to identify opportunities to improve long-term catchment management through more integrated, evidence-based planning.

Methodology and approach

The study applied a mixed-methods socio-economic assessment framework integrating quantitative analysis, stakeholder engagement, and spatial analysis to evaluate water use, regional dependency, development pressures, and catchment management implications across the Fitzroy Basin.

The assessment combined demographic and economic analysis, water use and allocation assessment, Geographic Information System (GIS)-based spatial analysis, stakeholder consultation, and climate and infrastructure risk evaluation. This integrated approach enabled the assessment of relationships among water availability, economic activity, environmental systems, infrastructure development, and regional growth.

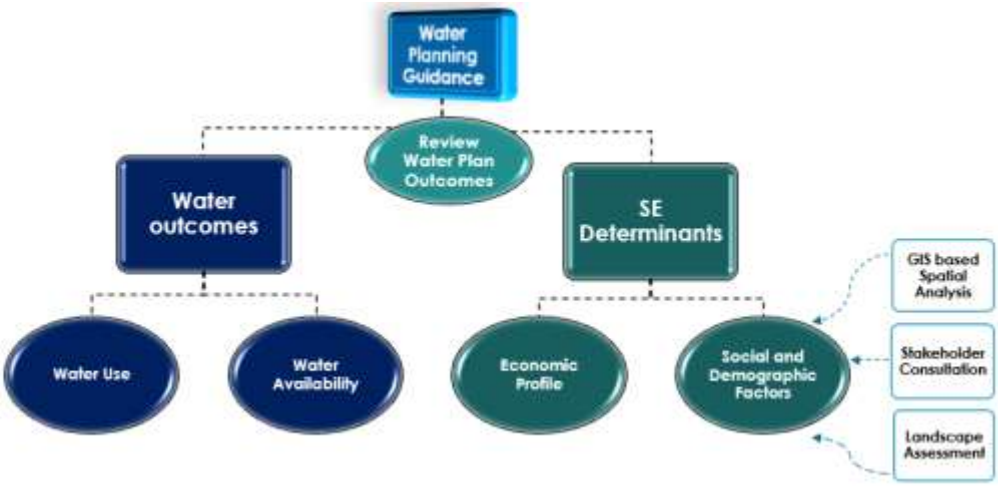

Figure 2 Integrated Socio-economic Assessment Framework

Socio-demographic and economic analysis

Regional demographic and economic analysis was undertaken to understand population trends, employment patterns, industry structure, and economic dependence on water resources.

The assessment examined population growth, labour force characteristics, gross regional product contributions, regional development trends, and the economic significance of water-dependent industries.

Water use and sectorial analysis

The study assessed water use across major sectors including irrigated agriculture, livestock production, mining and energy, urban and industrial use, and environmental water requirements.

The analysis examined existing allocations, entitlement utilisation, water trading activity, and emerging demand pressures. This included assessment of surface water and groundwater use, unallocated water reserves, water reliability, future infrastructure and industrial demand, and potential activation risks associated

Stakeholder engagement

Stakeholder engagement formed a critical component of the assessment. Consultation was undertaken with industry representatives, local governments, community organisations, water users, First Nations stakeholders, and environmental groups.

Engagement provided insights into perceived water management challenges, infrastructure constraints, economic and social impacts of water policy, cultural and environmental concerns, and future development expectations.

Table 1 and Figure 3 illustrate how population dynamics influence socio-economic conditions and future water demand across the Basin.

Table 1 Historical population changes: Fitzroy Water Plan. Source: Queensland Government Statistician's Office(QGSO), BGA Work Product

2011-2021	Change between 2011-2021									Total plan area
	Downstream of Fitzroy Barrage	Fitzroy River	Upper Mackenzie River	Lower Dawson River	Nogoa River	Comet River	Upper Dawson River	Lower Mackenzie River	Isaac-Connors Rivers	
Total population change	1,000	4,766	-427	-387	-425	-285	27	-183	-7	4,079
% Change	1.5	23.8	-5.5	-2.1	-1.9	-11.3	1.0	-21.8	-0.05	2.6

Population growth and demographic change are key drivers of future water demand in urban, industrial, and regional settings.

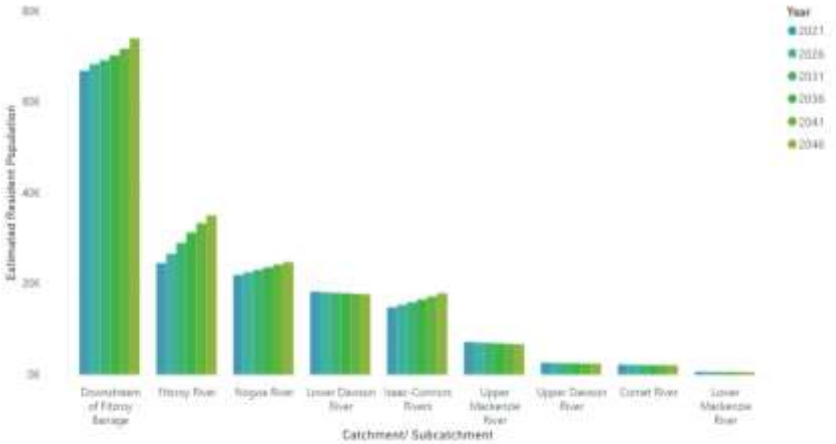

Figure 3 Population projections: Fitzroy Water Plan. Source: QGSO, BGA Work Product

Between 2011 and 2021, population growth across the Basin was uneven, with overall growth of 2.6% concentrated in only three of the nine subcatchments. The Fitzroy River subcatchment recorded the strongest growth (23.8%), while several rural subcatchments experienced population decline.

Population projections to 2046 indicate continued concentration of growth within the Fitzroy River and Downstream of Fitzroy Barrage subcatchments, alongside moderate growth in the Isaac–Connors Rivers associated with mining activity. In contrast, several rural subcatchments are projected to continue declining (Figure 3). These trends suggest increasing pressure on urban water supply, infrastructure, and regional services in growth areas, while declining regions may face reduced economic resilience and changing patterns of water demand.

Key findings

Strong dependence on water across multiple sectors

The assessment identified substantial dependence on water resources across agriculture, mining, regional communities, and infrastructure development. Agriculture remains highly reliant on reliable water access, particularly in irrigated production systems where water availability directly influences productivity, investment, and employment outcomes.

The mining and industrial sectors also represent significant and growing water users, particularly in areas experiencing expansion of energy and resource projects. Spatial analysis highlighted increasing overlap between intensive land use, water demand, and environmentally sensitive areas across several subcatchments (Figure 4). These trends indicate growing competition for water resources between agricultural production, industrial development, urban supply, and environmental flows.

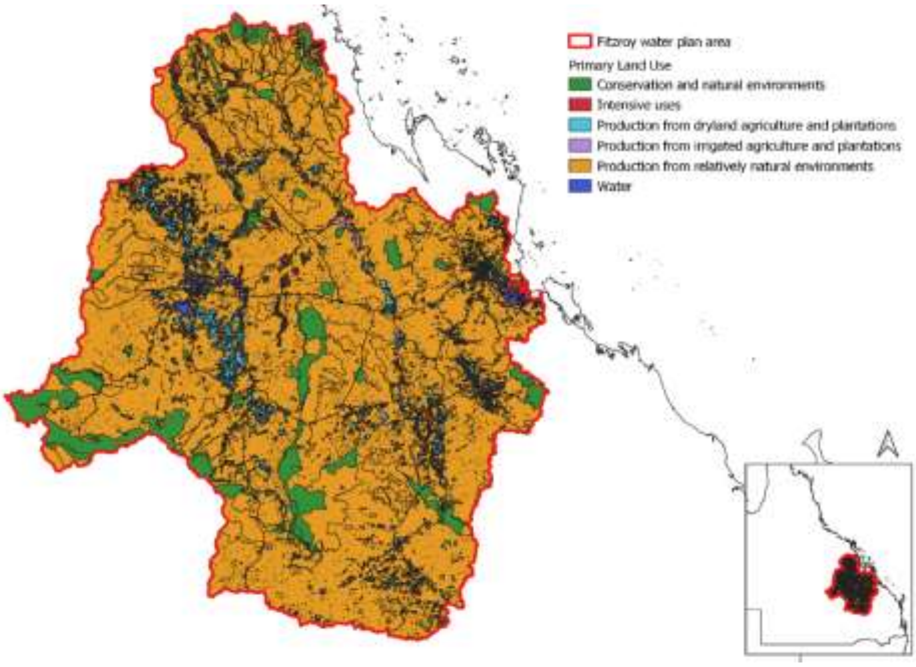

Figure 4 Queensland Land Use Mapping Program (QLUMP) 2021 primary land use classification of the plan area. Source: BGA analysis based on QLUMP, Fitzroy NRM land use mapping (2017)

Underutilised water allocations

The assessment identified substantial underutilisation of supplemented water allocations across parts of the Basin, indicating significant latent demand and future activation risk. Underutilisation occurs where committed water remains unused despite high allocation reliability and the ability to trade entitlements. This may reflect a range of factors, including climatic variability, commodity market conditions, labour constraints, access to alternative water supplies, water market activity, and risk management practices by entitlement holders.

Analysis of Water Supply Schemes (WSS) showed that the Nogoa Mackenzie WSS recorded the highest volume of underutilised committed water (108,478 ML), while the Fitzroy Barrage WSS recorded the highest proportional underutilisation (56.9%). For the Fitzroy Barrage, a substantial proportion of unused allocations is intentionally retained to improve urban water security for Rockhampton under variable supply conditions (see Table 2).

The findings demonstrate that low current water use does not necessarily indicate surplus water availability. Instead, underutilised allocations represent potential future demand that could place additional pressure on infrastructure capacity, environmental flows, and long-term catchment sustainability if activated. These results reinforce the importance of incorporating latent demand and activation scenarios into water allocation and planning frameworks.

Table 2 Water underutilisation in plan area: Bulk WSS. Source: Department of Natural Resources, Mines and Energy, Natural Resources Inventory (2021)

Water Supply Scheme	Total water storage capacity (ML)	Committed underutilised (ML)	Minimum percent of committed water not used
Collide Valley	151,406	2,624	13.5%
Dawson Valley	66,266	8,363	13.6%
Fitzroy Barrage	81.300	35,234	56.9%
Lower Fitzroy	35,900	8,229	30.3%
Nogoa Mackenzie	1,345,140	108,478	47.5%
GRAND TOTAL	1,680,012	163,019	41%

Climate variability and water security

Climate variability was identified as a major risk affecting water availability, reliability, and long-term catchment resilience across the Basin. Climate projections indicate increasing evapotranspiration and greater variability in rainfall patterns, with implications for water security, ecological health, infrastructure performance, and future development capacity. Figure 5 presents projected changes in potential evapotranspiration (PET) under two climate scenarios: Representative Concentration Pathways (RCP) 4.5 (intermediate emissions) and RCP 8.5 (high emissions). Both scenarios project increasing evaporative demand across the Fitzroy Basin over time, with substantially larger increases under the high-emissions scenario (RCP 8.5).

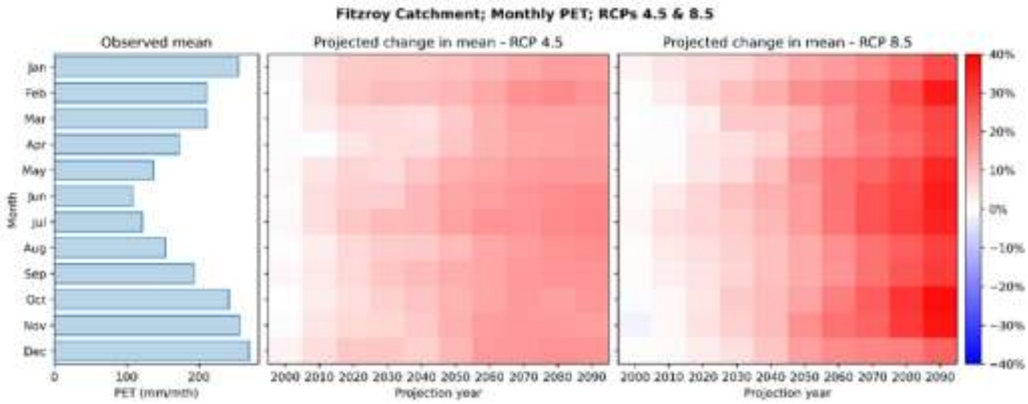

Figure 5 Projected changes in potential evapotranspiration (PET) across the Fitzroy Basin Increasing evaporative demand is projected to place additional pressure on surface water and groundwater systems, particularly during prolonged low-flow periods. Source: Queensland Government climate projections (Department of Regional Development, Manufacturing and Water, 2023)

Stakeholders consistently identified drought risk, supply reliability, and investment uncertainty as key concerns. The findings highlight the need for adaptive allocation frameworks and climate-resilient catchment planning capable of responding to increasing hydrological variability and changing development pressures.

Environmental and cultural values

The analysis reinforced the importance of integrating environmental and cultural values into water planning. The Fitzroy Basin supports Reef-connected ecosystems and culturally significant waterways for First Nations peoples, creating important trade-offs between development, water extraction, and ecological protection. These findings highlight the need for catchment management approaches that better integrate economic development with long-term environmental and cultural outcomes.

Infrastructure and development pressures

The study identified increasing infrastructure and development pressures across multiple subcatchments. Large-scale industrial projects, agricultural expansion, urban growth, and emerging industries, including hydrogen and biofuel developments, are expected to increase pressure on water systems and supporting infrastructure over time.

The interaction between expanding water-intensive industries, climate variability, and population growth is likely to intensify competition between consumptive use, environmental flows, and long-term water security objectives. These findings reinforce the importance of integrating water planning with broader infrastructure, regional development, and catchment management strategies.

Outputs and decision-support tools

The key outputs of the project included a regional socio-economic profile report and an interactive Power BI dashboard developed to support water planning and catchment management across the Fitzroy Basin.

The socio-economic profile consolidated demographic, economic, land-use, climate, infrastructure, and water-use information to provide an integrated assessment of regional dependence on water resources and emerging catchment pressures across subcatchments. The Power BI dashboard enabled interactive visualisation of socio-economic and water-related datasets, improving accessibility of information for government agencies and stakeholders.

These outputs enabled improved identification of areas experiencing overlapping pressures from agricultural expansion, industrial development, population growth, climate variability, and environmental sensitivity. The tools also strengthened the evidence base for water allocation decisions, infrastructure planning, and long-term catchment management by improving integration between socio-economic conditions, water availability, and environmental considerations.

Implications for river catchment management

The assessment demonstrated that effective river and catchment management requires integrating socio-economic analysis alongside hydrological and environmental assessments. While hydrological modelling and environmental flow analysis remain essential, the Fitzroy Basin assessment showed that socio-economic drivers strongly influence water demand, infrastructure investment, regional resilience, and long-term development pressures.

Integrating socio-economic, spatial, and stakeholder analysis improved understanding of trade-offs between economic development, water allocation, infrastructure growth, and environmental sustainability across subcatchments. The findings also highlighted the importance of adaptive planning approaches capable of responding to climate variability, latent water demand, and evolving industry and community needs.

The study further demonstrated the value of spatial analysis and interactive decision-support tools in identifying overlapping pressures associated with agricultural expansion, industrial development, environmental sensitivity, and population growth. These tools strengthened the evidence base supporting water allocation decisions, infrastructure planning, and long-term catchment management. Importantly, the methodology is transferable to other catchments experiencing increasing pressure from climate variability, infrastructure demand, environmental constraints, and competing water uses.

Table 3 Key catchment pressures and planning implications

Key pressure	Key findings	Catchment management implications
Climate variability	Increasing rainfall variability and evaporation risk	Reduced water reliability and increased ecosystem stress
Growing water demand	Mining, agriculture, urban growth, and emerging industries increasing demand	Greater competition for allocations and infrastructure pressure
Underutilised allocations	Significant latent water demand identified across subcatchments	Need for improved allocation flexibility and adaptive planning
Land use change	Expansion in irrigated agriculture and industrial activity	Increased pressure on water quality and catchment systems
Environmental sensitivity	Strong ecological and Reef-connected environmental values	Greater need for integrated environmental and water planning
Infrastructure and development pressures	Large-scale projects increasing future water requirements	Need for coordinated infrastructure and long-term planning

Conclusions

The Fitzroy Basin socio-economic assessment strengthened the evidence base for water planning and catchment management by integrating socio-economic, spatial, and stakeholder analysis into decision-making processes. The assessment highlighted the strong dependence of regional economies, communities, and water-intensive industries on reliable water access, while also identifying increasing pressures associated with climate variability, infrastructure development, environmental sustainability, and future water demand.

The findings demonstrated that integrating socio-economic analysis into catchment planning improves understanding of trade-offs between economic development, water allocation, infrastructure growth, and environmental outcomes. Spatial analysis and decision-support tools further improved the identification of overlapping pressures across subcatchments, supporting more adaptive, evidence-based planning approaches.

As part of a broader program across eight Queensland water plans, the methodology provides a scalable and transferable framework for integrated river and catchment management in complex, multi-user systems. Future water planning frameworks will increasingly require approaches capable of balancing economic productivity, environmental sustainability, cultural values, and long-term regional resilience under changing climatic and development conditions.

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