

Business Case for Making Water Work in the Charters Towers Region

Delivering Greater Regional Benefit from Agricultural Water Supply and Value Chain
Development for the Charters Towers Region



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Executive summary

The Charters Towers Region is building on its economic, social and environmental assets to create a stronger economy. On the back of a broad options assessment, one priority development pathway, the *Making Water Work* initiative, has emerged as a focus for the Region.

The *Making Water Work* initiative will focus effort on the creation of new opportunities in the agricultural production and associated processing sectors. It will do this by improving demand-driven approaches to supply chain analysis, planning and development, whilst monitoring the expected growth and resource use efficiency benefits. The Federal Government's recent commitment of \$54M towards Phase 1 of the Hells Gates Dam Irrigation Project on the upper Burdekin River heralds the arrival of a new era of opportunity for the Region. This large, irrigated agricultural and clean energy project is potentially worth \$5.35B (SMEC Australia Pty Ltd 2018). The first stage will involve the construction of Big Rocks Weir; a major component of the Hells Gate Dam Project. The overall Project aim, however, is to provide long-term water security and hydro-electricity for the Region, and could ultimately facilitate the development of 50,000 hectares of irrigated land for high value crops (SMEC Australia Pty Ltd 2018). This will have a direct and enduring positive impact on the economy of Charters Towers and North Queensland.

The multi-million dollar project will, however, be subject to a comprehensive risk assessment, including proposed new regulatory requirements to protect the Great Barrier Reef (GBR) and to achieve "no net decline" in GBR water quality (Queensland Parliament 2019). At the same time, increasing water prices and declining water availability are driving renewed interest from other irrigation regions in Northern Australia. Recent related supply chain analysis for the Region suggests significant unmet demand for typical agricultural products across key markets, including South East Asia, China and the Middle East. Of relevance to Charters Towers, the analysis identified five priority products, including intensive beef cattle, legumes and pulses, accounting for nearly \$3B of currently unmet demand in global markets. Consequently, the most significant challenge for the development of agriculture will be the effective management of water allocations to enable higher value and much more efficient, low impact agricultural ventures and supply chains; whether large or small in scale.

To assist in this transition, the *Communities in Transition* (CiT) Program, funded by the Department of Environment and Science and supported by CSIRO, James Cook University (JCU), the University of Southern Queensland (USQ) and The Ecoefficiency Group (TEG) have been working with Charters Towers Regional Council and the Region's wider stakeholders to create and to implement the *Making Water Work* initiative. The initiative will explore, scope and strategise the:

- Required agricultural supply chain visions and potential production system models;
- Visionary land use and infrastructure planning that can deliver on this water promise, including innovative road, airport, port and communication solutions;
- Integration with reliable, affordable and low-carbon energy and integrated waste options to service this development;
- Potential for protected cropping, small scale farming and farm services innovation; and
- Next generation sub-catchment approaches and production system practices that will be needed to meet the proposed new GBR regulations.

The Region is central to road, rail and air transport across North Queensland, and is thus well positioned as a goods and services centre underpinned by an enduring and high value supply chain

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with reliable human services, transport and processing industries in agriculture. The city of Charters Towers itself sits at the intersection of major roads going north-south and east-west. Transport by trucks is critical for the on-going viability of several industries, and the location of the city and its airport is also important for climate resilience and disaster management.

These foundational opportunities mean that it is the right time to apply new thinking and technologies to shift towards a more circular economy in this sector. Focusing on strengthening all aspects of the supply and value chain (from production, transport, processing, value adding, retailing and export preparation), the project will deliver greater economic benefits, energy and nutrient use efficiencies, less waste and an improved emissions profile relative to the Region's GDP (CGCC 2019a). This *Making Water Work* pathway and business case will focus a combined Council, community and Industry effort identifying the opportunities, constraints and strategies to achieve this outcome.

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SECTION ONE – STRATEGIC CONTEXT

Options analysis

The *Making Water Work* initiative evolved from the *Communities in Transition* (CiT) Program, an active community development and capacity-building process for strengthening regional resilience and dealing with economic, social and environmental change. The first stage of the program included the development of a *Community Resilience Framework*, from which a community profile was created. Next came a series of deeper community conversations asking stakeholders to describe pressures and opportunities facing their community. A desk-top study, together with information provided by the community conversations led to broader consensus on a set of prioritised transition pathways and options for the future of the Region. These are listed in the third column of Table 1.

Table 1: Linking Regional pressures and opportunities with plausible pathways

Current pressures & future challenges	Current strengths & opportunities for the future	Some options/ideas for broad pathways
Low recognition as an investment destination & small local market	Stable economic base from mining (13.7%); ag. (11.1%); education & training (11.5%); retail (10%); health care (10%)	Making water work: preparing the ground for low impact agriculture
Need to boost economic output by 80% in next 20 years	Opportunities in Big Rock Weir Irrigation Scheme - Ag growth & investment	
Competition from Townsville for residents, investment & recognition	Great natural assets for diverse economic activities - steady water supply, abundant mineral deposits, abundant solar energy;	Tourism & recreation expansion: historic heritage (including mining), Indigenous, nature-based, agritourism
Unemployment DOUBLE Qld rates	Opportunities to explore new sectors e.g. light industry, energy, service industries	Reviving copper string with renewable feed
Low numbers of people in working age groups (20-65) compared with the rest of Qld		Dynamic business ventures: ecobiz and commerce, creative industries, new technologies
Strong dependence on external labour		Effective use of uncluttered airspace: e.g. drones, pilot training
Below average literacy, numeracy & adult learning (QGSO 2018)	Excellent schools & good access to James Cook University; Local Traditional Owners hold key information about country/culture	School to Work: Stronger tech transitions and career paths for the next generation
Townsville-based services are not well coordinated – need more services within the region	Charters Towers' central location	Charters Towers as a supply chain/ transport hub Charters Towers as a human services hub
Many older buildings that are not accessible for elderly or disabled locals and visitors – barrier to retail & tourism	High quality of life for many residents – affordable, safe, friendly; pleasant climate	
Indications of weak connectivity/ communication among key Fed/State governance domains.	High number of retirees – good opportunities to develop community activities that involve older people – e.g. arts and crafts, volunteering in schools, libraries, parks and gardens	
Currently weak links between social & economic development planning efforts.	High proportion of residential rooftop solar panels	
	Strong history of connected leadership & increasingly strong capacity within & across Council planning system. Strong governance associated with catchment & landscape planning.	

Because of its potential to create an early impact, significant economic progress and value-intense industry, one clear priority pathway, *Making Water Work*, became apparent during workshop discussions based on regional pressures, challenges and opportunities for the future. Agreement on this pathway was based on a number of considerations including:

- The recent Federal announcement of \$30M towards the construction of Big Rocks Weir;
- The Federal Government's commitment of \$24M towards a Phase 1 technical design and impact assessment of the wider Hells Gates Dam Irrigation Project on the upper Burdekin River providing long-term water security and hydro-electricity for the Region, and the supply of irrigation water for up to 50,000 hectares of land for high value crops potentially worth \$5.35B (SMEC Australia Pty Ltd 2018);
- Recent related supply chain analysis for the Region suggests significant unmet demand for typical agricultural products across key markets, including South East Asia, China and the Middle East. Of relevance to Charters Towers, the analysis identified five priority products

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including beef cattle, legumes and pulses, accounting for nearly \$3B of currently unmet demand in global markets (KPMG 2019);

- Opportunities to shift towards a more circular economy in the wider agricultural sector (e.g. exploration of new techniques in the design and management of new agricultural lands); and
- The need to meet new and emerging obligations to protect the Great Barrier Reef (GBR) and achieve “no net decline” in GBR water quality under proposed new regulatory arrangements (Queensland Parliament 2019).

The second stage of the program involved an online survey of stakeholders to elicit their preferences and priorities for components within the *Making Water Work* pathway. The prioritisation was completed through a second set of workshop discussions based on options and criteria shown in Appendix A. Further discussions with the Charters Towers Council and other key stakeholders have resulted in the identification of a key concept and components in the *Making Water Work* initiative.

The key concept

The Charters Towers Region is central for road, rail and air transport across North Queensland, and is thus well positioned as a goods and services centre underpinned by an enduring supply chain with reliable human services, transport and processing industries. The city of Charters Towers sits at the intersection of major roads going north-south, and east-west. Transport by trucks is critical for the ongoing viability of several industries, and the location of the city and its airport is also important for disaster management. A recent related supply chain analysis for Townsville suggests significant unmet demand for typical agricultural products across key markets including those in South East Asia, China and the Middle East (KPMG 2019). The *Making Water Work* pathway will focus effort on improving supply chain analysis, planning and improvement while monitoring growth and resource efficiency benefits, particularly in the context of creating new opportunities to expand agricultural production and food processing. The pathway also aims to promote and galvanise Charters Towers as the centre of a viable and more efficient cattle industry which would also have the ability to support grain and fodder handling in the North. Importantly, this could pave the way for investment opportunities, policy and legislation that nurtures sustainable development in the agricultural sector.

The Federal Government’s recent commitment of a total of \$54M towards Phase 1 of the Hells Gates Dam Irrigation Project on the upper Burdekin River heralds the arrival of a new era for the Region. The Project, a large, irrigated agricultural and sustainable power project, is potentially worth \$5.35B (SMEC Australia Pty Ltd 2018). The first stage will be the construction of Big Rocks Weir; a major component of the Hells Gate Dam Project. The Project’s aim is to provide long-term water security and hydro-electricity for the Region, and ultimately facilitate the development of 50,000 hectares of irrigated land for high value crops (SMEC Australia Pty Ltd 2018). This will have a direct and enduring positive impact on the economy of Charters Towers and North Queensland. A new approach, however, is needed as today’s agricultural development comes with a series of previously silent challenges. The Burdekin River and its tributaries contribute to sediment, pesticide, and herbicide levels in the coastal waterways and further out into the GBR lagoon, affecting the distribution and abundance of coral and other marine organisms (Marsden Jacob Associates 2013). Proposed new State regulations for water run-off from farms seeks to achieve no net decline in GBR water quality (Queensland Parliament 2019). Further, there are increasing higher infrastructure costs, higher energy costs and higher general farming input costs, while at the same time, consumers demand increasingly high product standards.

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Consequently, the most significant challenge for the development of agriculture will be the effective management of water allocations to enable higher value and much more efficient, low impact agricultural ventures (both large and small scale). Combined with new supply chain and energy sector thinking, the opportunity exists for the Region to lead the way in new and exciting developments in these approaches. New thinking and technologies present great opportunities to shift towards a more circular economy and integrated and value-rich supply chains in the agricultural sector. These include new techniques in the design and management of new agricultural lands, and the potential for greater integration of feed production, soil enhancement and nutrient reuse.

To create and implement this *Making Water Work* pathway, the *CiT* pilot program has been working with the Charters Towers Regional Council and the Region's wider stakeholders. The pilot program is funded by the Department of Environment and Science and supported by CSIRO, James Cook University (JCU), the University of Southern Queensland (USQ) and The Ecoefficiency Group (TEG).

In effect, the vision for the concept is that new agricultural development incorporate significant environmental efficiencies, highly efficient supply chains, and increasingly integrated and high-worth value chains that deliver improved social and economic resilience. It was considered that the key components needed to drive this vision include:

- Defining demand-led supply chain visions and potential production system models;
- Visionary land use planning, footprint development and design;
- Connected water infrastructure, ownership and water products;
- Integrated infrastructure, communications, services planning and coordination;
- Integrated, reliable, affordable and low impact energy and waste management; and
- Next generation sub-catchment and on farm practices to achieve GBR outcomes.

These are detailed in Section 2 of this business case.

Justification, benefits and risks

There are multiple major justifications underpinning the *Making Water Work* initiative; unpacking the significant benefits and risks to be mitigated by taking such an approach. Consequently, the following key factors underpin the logic for progression of this business case.

1. Unlocking unmet agriculture export and domestic demand

Although Queensland is a very small player on a global scale, more than half of its food production is exported overseas, with producers responding to market trends such as consumer demand for safe, ethical and sustainable produce (QDAF, 2018). Due to Queensland's counter-seasonality to northern hemisphere producers, there is potential for increased exports to consumers wanting access to healthy food all year round. There is also increased overseas demand for:

- Protein-rich products (e.g. beef, seafood, chickpeas);
- Horticultural products (including exotic fruits); and
- Healthy food products from a 'clean green' environment (QDAF 2018).

A further one-fifth of food produced in Queensland is 'exported' to other states of Australia, leaving about one-quarter of Queensland's total food production to supply the nation's agricultural, forestry and fishing produce demand (QDAF, 2018). Recent related supply chain analysis for North Queensland funded by the Collaborative Research Centre for Northern Australia (CRCNA) suggests that demand for products typical of those produced in Central Queensland exists across the usual

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key markets including South East Asia, China and the Middle East. Of most relevance to Charters Towers, this analysis identified several priority products, including intensive beef cattle, legumes and pulses accounting for nearly \$3B of currently unmet demand in global markets (KPMG 2019). This analysis predicted that transitioning land use to the priority products is estimated to provide a positive benefit of between \$26.5 and \$271.1 M NPV and generate numerous jobs; with strong contributing trajectories possible in the Charters Towers Region (KPMG 2019).

Risks of doing nothing

The risks of not preparing for greater involvement in this sector mean the Charters Towers Region would perform poorly in the most significant and resilience building growth opportunities available. If these significant opportunities are to be realized, however, the major climatic and environmental constraints for agricultural development need to be overcome; though these are small compared with other factors such as those associated with finances and investment planning, land tenure and property rights, management, skills and supply chains (Ash & Watson 2018).

2. Taking advantage of new and existing water resources

The Commonwealth Government's North Queensland Water Infrastructure Authority (NQWIA) was established in March 2019 to progress the development of water resource projects (including Big Rocks Weir) in North Queensland through strategic planning and the coordination of information sharing among relevant regulatory authorities and stakeholders (Commonwealth of Australia 2019). The Authority is likely to have a strong presence in Charters Towers.

The Hells Gates Dam feasibility study, funded by the National Water Infrastructure Development Fund, was completed in July 2018. It identified Big Rocks Weir (on the Burdekin River) as a critical first phase element of the development effort. The environmental, cultural heritage and engineering work undertaken as part of the Hells Gates Dam feasibility study established the potential of a 2,110 GL dam that could supply water to up to a 50,000 ha irrigated infrastructure scheme, while also providing long term water security to both Charters Towers and Townsville. The Hells Gates Dam Project and associated infrastructure aims to future-proof the North Queensland economy through bulk agricultural produce, renewable energy, water security and socio-economic development for the Region (SMEC Australia Pty Ltd 2018).

While the design remains at feasibility level and requires significant additional field studies, drilling and investigation, there is a technical pathway that includes:

- Immediate development of up to 5,000 ha of annual crops with potential for additional perennial cropping by securing water from Big Rocks Weir;
- Staged infrastructure development to support 50,000 ha of irrigated horticulture, including fruit, vegetables, pulses/legumes, and broad-scale agriculture of perennial and annual crops;
- Consequent upgrades to the road network to handle freight and tourism traffic;
- Value added economic development opportunities in food processing in Charters Towers, Greenvale and the Townsville State Development Area;
- Opportunities for the export of fresh and processed foods via the Port of Townsville;
- The exploration of airport connections to South East Asia and southern Australian cities;
- A pumped hydroelectric scheme of up to 1200 MW;
- A 20 MW solar farm and 15 MW run-of-river hydro facility at the top of the dam;
- Major upgrades to the power network in the Charters Towers Region to allow development of on-farm water pumping and food processing;
- Long-term water security for the City of Townsville post-2035 (from Hells Gates Dam);

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- Long-term water security for Charters Towers Regional Council (from Big Rocks Weir);
- Socio-economic development of the communities around the Hells Gates irrigated scheme and long-term employment for over 4,000 people; and
- Associated recreational (fishing, water sports) and tourism (caravan parks, gourmet foods) activities on a dam that will hold more capacity than the current largest dam in Queensland (Burdekin Falls) within 2.5 hours of Townsville.

Risks of doing nothing

The current Burdekin Water Plan (reviewed in 2019) does not allow for the construction of the Hells Gates Dam, so more detailed planning is required to enable water allocation. Changes to the Water Plan are also needed to include the construction of Big Rocks Weir and other infrastructure associated with the Hells Gates Dam Project. This will require a cohesive economic case and public consultation, and must be considered within the context of other competing interests and options for water resources in the area, as well as any impacts to existing users and the environment (SMEC Australia Pty Ltd 2018). Other potential risks associated with the Project that could be better managed through this *Making Water Work* initiative include:

- Reducing the costs of water likely to restrict the cropping opportunities; and
- Increased capacity of existing markets to absorb significant additional horticultural production (SMEC Australia Pty Ltd 2018).

Further de-risking work of this type is needed before a project proponent could invest confidently, especially given the scale of development, the long term infrastructure investment outlook needed, and the multi-billion-dollar construction cost (SMEC Australia Pty Ltd 2018). While these concepts are being further analysed, without this initiative work to most efficiently match demand to supply and value, there is a risk of creating stranded water assets and under-development.

3. Unlocking Charters Towers' agricultural potential

The agriculture, forestry and fishing sectors of the North Queensland Agricultural Region contributed more than \$1B to North Queensland's GRP of \$15.5B, and according to a recent study (KPMG 2019), there is strong supply side scope to dramatically increase this contribution. The North Queensland Region includes the Local Government Areas of Charters Towers, Townsville, Hinchinbrook, Burdekin and Palm Island. The area's potential is due to the availability and affordability of viable agricultural land and soil resources, new opportunities for irrigation and water storage via the Hells Gates project, access to large domestic and international markets via the Port of Townsville, road and rail links, and airports at Townsville and Charters Towers.

The KPMG (2019) study highlighted the potential for the North Queensland Region to provide international consumers with a reliable and enduring supply of desirable food and fibre products. In particular, the study identified a number of supply-based opportunities that match the previously mentioned unmet demand for particular agricultural products (KPMG 2019). A beef feed-lotting industry of 190 000 head of cattle could be worth \$228M per annum in production value, include \$200M of export value, and provide up to 50 FTE regional jobs. This would require substantial new infrastructure for irrigation and water availability, feedlot development, road and rail transport upgrades, additional processing and cold storage facilities and feed access (KPMG 2019). There are also a range of potential investors in the Queensland beef supply chain, including high net worth individuals, family businesses, intra-industry groups, real estate investment trusts, financial institutions and private equity (EY 2018). If 40,000ha across the Region were converted from existing

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land use to a mix of perennial horticulture and rotational grains and pulses, the Region could see up to \$213M in production value, \$124M of export value and an additional 800 full time jobs. A rotational soybean industry using 36,000ha land could create \$46M in production value and an additional \$18M in export value. KPMG (2019) identified that the infrastructure needed to produce and export avocados, macadamia nuts and soybeans included production equipment, storage capacity (on-farm or regional), processing facilities, temperature controlled facilities and biosecurity facilities (for soybean) (KPMG 2019).

Risks of doing nothing

The Queensland Government's Agricultural Strategy aims to double the value of Queensland's food production by 2040. However, this can only happen if (as envisaged by this *Making Water Work* initiative) the level of analysis and planning for productivity improvements within the sector increases across the whole supply chain (RDAFCW 2018). Therefore, effort must consider:

- Spatial limitations and location of the most productive soils in the Region;
- The potential for early structural decline in the soil resource base, requiring excellent soil identification and management from the outset; and
- The most efficient location of infrastructure requirements relative to production areas.

4. Benefits from building a more circular agricultural economy

A successful circular economy contributes to all three dimensions of sustainable development: economic, environmental and social values (Korhonen, Honkasalo & Seppälä 2018). In agriculture, these shared values focus on improving growing techniques and strengthening the local cluster of supporting suppliers and other institutions in order to increase efficiency, yields, product quality, and sustainability (Porter & Kramer 2011). For example, connecting consumer preference to farm profitability is becoming increasingly important in maintaining farm profitability, as demonstrated by the growing demand for organic food (Perry 2017). Digital technologies have the potential to enable consumers to precisely track food, from the field to the pantry, thus informing decision-making. At the same time, commodity crop farmers will be able to match consumer demand for products and produce a more valuable crop. In the years to come, the essential connection between agricultural practice and consumer preferences will dramatically accelerate the adoption of new sustainable technologies in agriculture (Perry 2017). Key operational principles/options to create a circular economy (Suárez-Eiroa et al., 2019) include:

1. *Adjusting resource inputs to regeneration rates*

- Reduce/eliminate non-renewable resources use;
- Substitute non-renewable with renewable inputs (e.g., renewable energy); and
- Adjust the extraction rate of renewable resources to be within the regeneration rate

2. *Adjusting waste and emission outputs to absorption rates*

- Promote eco-efficiency and eco-effectiveness to reduce wastage and waste

3. *Closing or slowing the material use loops*

- Promote use of renewable resources (e.g. energy);
- Connect waste management with resource recovery; and
- Design products that are durable, repairable, easy to upgrade, and reuse recycle and/or recover

4. *Shifting production and consumption culture*

- Shift business perspectives from producing products with rapid obsolescence; and
- Shift consumer expectations about using disposables and the acquisition of the latest products

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5. Coordinating and collaborating

- Coordinate adjustments throughout the value chain including inputs and outputs;
- Recover material and energy from waste for recirculation;
- Establish new markets and value chains to facilitate transition to a circular economy; and
- Enlist significant policy, regulatory and program support from governments

6. Using digital innovation

- Digital technology such as big data, sensors and 3D printing will make reusing and recovering material energy efficient and effective, thus helping to decouple economic growth from natural resource depletion and environmental degradation (Murray et al., 2017).

Risks of doing nothing

There is significant international evidence suggesting that those economies that adopt more circular approaches to economic development will become much more resource use efficient and highly competitive (Dominish et al., 2017). Not moving in this direction also risks local agriculture not delivering growing market requirements (Kirchherr et al., 2017). While the circular economy concept and its benefits are not widely discussed and accessible to practitioners and the wider public (Merli et al., 2018), the opportunity for the Charters Towers Region to take leadership in this area of thinking will also mean the services that emerge may have increasing global value.

5. Planning now to deliver on Great Barrier Reef outcomes

The Northern Australian development agenda seeks to significantly expand agricultural production in northern Queensland. As much of the State's agricultural land is, however, in GBR catchments, without careful management, agricultural growth and intensification could increase pollutant loads in coastal and marine waterways flowing to the Great Barrier Reef (GBR). Particular activities associated with water pollution in the GBR catchment include suspended sediment from soil erosion, nitrate run-off from fertiliser application on crop lands and herbicide run-off from various land uses (Brodie et al., 2012).

Legislation for natural resource management is in place across all GBR catchments including the *Queensland Vegetation Management Act 1999*, the *Queensland Water Act 2000*, the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, the *Queensland Land Act 1994*, the *Queensland Reef Protection Act 2010*, the *Commonwealth Great Barrier Reef Marine Park Act 1975*, and proposed new regulations in Queensland for land managers to achieve "no net decline" in GBR water quality (Dale et al 2018; Queensland Parliament 2019).

Given the critical role of these legislative instruments in setting the limits for resource use, a clear business case for de-risking agricultural expansion will be needed to include explicit consideration of, and costings due to, environmental regulations. Significant investment is already being applied to improve water quality in the Burdekin Region, (a regulatory requirement under the *GBRMP Act*) and this poses a potentially high risk to the approval of new agricultural activities (NQ Dry Tropics 2016). Area-level approaches to new agricultural development enables serious consideration of individual on-farm activities. These approaches, focussed around new water-based agricultural development areas, have the potential to significantly simplify development approval processes and deliver no net decline in water quality discharging into the GBR lagoon. Key activities would need to include:

- New investors thinking through, committing to and implementing very effective on farm agricultural practices in advance of new agricultural developments;

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- Exploring new approaches to the treatment of water run-off on farm; and
- Exploring more sub-catchment based and collaborative approaches to the capture and treatment of agricultural run-off from new agricultural development areas.

Risks of doing nothing

Existing regulatory arrangements *and* the proposed changes to GBR regulations require landholders to move more urgently from traditional agricultural practices to improved practices. Without early and proactive industry-based thinking about how new agricultural development can be best designed and managed to ensure no net decline in GBR water quality, there is a real risk that new water infrastructure will not be available for the original intended application of agricultural development. Proactive thinking and planning may have the potential to increase profitability in new farming operations as well as maintaining and increasing market access into the future.

SECTION TWO – KEY CONCEPT COMPONENTS

The following unpacks the key jobs and tasks that need to be progressed to secure the best possible and well-defined outcomes from the *Making Water Work* initiative.

1. Defining supply and value chain vision and production system model

What is the current context?

At this current point of time, the proactive supply chain vision building and planning required to drive critical decisions about land use and infrastructure planning to support innovative agricultural development has not yet occurred within the Region. The development of an intensive beef production industry around Charters Towers and North Queensland, for example, is limited by insufficient grain storage, water access, feedlots and processing facilities (KPMG 2019). Further, this sector can have a very long physical supply chain, with individual animals often traveling thousands of kilometers during their life, directly affecting production costs. Currently, there is also limited data sharing between participants, resulting in failure to meet the requirements for particular markets, and limiting processors' abilities to effectively schedule operations.

Queensland graziers have reported that unreliable supply chains are adversely affecting their ability to plan for the future, but they are hopeful that the establishment of more regionalized co-operatives could improve economies of scale and the capacity for planning and investment (EY 2018). Within the Region, horticulture (potentially including avocado and macadamia nut production) is also limited by a lack of planning for temperature controlled infrastructure including storage, drying and processing facilities. Proactive provision of on-farm and/or centralised storage and processing facilities for soybeans would also provide producers with flexibility (risk mitigation) and access to multiple markets. With the required supply chain planning, proactive decision making can progress land use planning, the upgrading of road, rail, port and airport infrastructure, providing all types of producers with diverse channels to establish a range of markets (KPMG 2019).

The key new announcements about Big Rocks and Hells Gates is a critical trigger creating the need for more supply chain oriented planning. Currently, 98.3% of agricultural production in the Charters Towers Region is from beef production, which together with other types of farming, totaled \$242M in 2015-16 (ABS 2017). Although the Region has a relative abundance of arable land and a steady water supply, there are currently few opportunities for irrigation, largely due to a lack of storage and other infrastructure. These limiting factors are now being fundamentally addressed through the \$5B

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Hells Gate Dam Project. The Project includes enabling infrastructure to future-proof the North Queensland economy through bulk agricultural produce, renewable energy and water security (SMEC Australia Pty Ltd 2018). Despite opportunities afforded by the construction of the Big Rocks Weir and wider Hells Gates proposal, the Region has not yet developed a clear vision for its most viable agricultural supply chain models as a basis for planning. A strong model could envision:

- A very clear focus on the development of a key mix of live export and processed product;
- The crop-based feedstock required; and
- A particular combination of horticulture, feedlots and processing facilities.

Obtaining broad support for, and consensus about, the supply and value chain vision and model is a crucial foundation for the next steps required to ensure that the Region really makes water work.

What scope is required?

With significant new water developments coming on line in the Region, the time has now come to ensure that early strategic thinking is in place to deliver new agricultural development that builds upon a very clear, demand-driven *Supply and Value Chain Vision and Plan*. New and significant demand-led thinking is now needed to define the most economically and socially lucrative and environmentally responsible vision of the supply chain. Without much more visionary clarity about how a more demand-led supply and value chain could function, the proactive development of land use planning, infrastructure and servicing required will not be able to emerge. Consequently, the critical tasks and outcomes required include:

Key Tasks	Outcomes
Deeper regional analysis of the most significant and securable agricultural markets.	Regional knowledge to inform proactive land use and infrastructure planning and new agricultural investment.
Based on deeper regional market analysis, building sectoral engagement and collaboration required to forge a shared approach to industry and community-based visioning of the future supply chain possibilities, options and priority strategic directions.	Stronger regional industry and supply chain consensus about priority land use planning and infrastructure investment decision making. Stronger governance arrangements surround critical decision making within the supply chain.
Exploring (quantifying) and envisaging (defining) the potential (demand-led and production enabled) supply and value chains possible to maximize economic and other benefits (from production through to value add and delivery).	Prioritisation of the most viable supply chain options and associated production systems, value-add and distribution system needs (land, infrastructure and servicing), translating into a very clear <i>Agricultural Development Model</i> as a basis for further planning. This vision-based thinking will need to include the development of a view of enterprise diversity possible in the <i>Agricultural Development Model</i> (i.e. a model based on a reasonable mix between larger corporates and small to medium farming enterprises).
Exploring or identifying the key potential investors (or investor types) to lead investment and development in the sector, and prioritising	Key agricultural development investors identified, engaged and supported.

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future engagement and cooperation with those investors (including the potential for co-investment in development infrastructure).	Key investment attraction and investment incentives identified and designed (e.g. linkages to concessional loans under the Clean Energy Finance Corporation (CEFC)).
Exploring potential barriers and enablers in the supply and value chain components.	Key land use planning and infrastructure priorities identified. Steps taken to ensure strong inter-operability between different supply chain options (e.g. between cattle and aquaculture).

Within the context of this work, serious consideration should also be given to the potential role of more protected forms of agriculture within the Region (i.e. glasshouse-based production). If this is a significant opportunity, it is likely that a more diversified agricultural strategy may be possible, with broader scale agriculture and protected cropping not competing heavily for land and water resources, but potentially complimenting each other in terms of airport/port requirements. It is likely that protected cropping would require flood-free land, good access to transport and water infrastructure and exist within 10 kilometers of reasonable services. Protected cropping approaches also present real opportunities in the progression of more circular forms of integrated cropping, particularly if also linked to more broad-scale cropping opportunities. An example of an innovative Australian company that has invested in protected cropping is shown in the case below.

Case Study: Innovative Sundrop Farms Uses Sunlight and Seawater to Grow Tomatoes*

Sundrop Farms in South Australia uses more than 23,000 mirrors to capture sunlight and direct it to a central receiver at the top of a 127-metre "power" tower. All the water used for irrigating the crops is piped from the Spencer Gulf and converted into fresh water using a thermal desalination unit. At its peak it produces 39 megawatts of thermal energy, which is used for electricity, heating and making water. The commercial facility cost about \$200M to build, with private equity firm Kohlberg, Kravis and Roberts (KKR) investing \$100M. The facility produces about 17,000 tonnes of truss tomatoes a year and holds a 10-year supply contract with Coles Australia. See <https://www.sundropfarms.com/innovation/>.

*Information and image source: <https://www.abc.net.au/news/rural/2019-05-15/port-augusta-sundrop-farms-sold-to-investment-fund-morrison-co/11108046>

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Timeframes, investment and costs

The way forward should build strongly on emerging supply chain work currently being progressed through the Collaborative Research Centre on Northern Australia (CRCNA) investment (KPMG 2019), explore the particular relevance of that work to the Charters Towers Region, and facilitate a cohesive cross-sectoral vision for the most viable supply and value chains and required strategic actions.

Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Supply chain visioning and collaboration building		\$150,000	June 2021
Investment Contributors			
Possible State bid		\$150,000	
Australian Government			
TEL			
Council			
CQU/JCU			

Who needs to be involved?

Progress towards wider regional supply chain building is currently being coordinated by Townsville Enterprise Limited (TEL). However, in the Charters Towers context, the Council could be the appropriate project lead to ensure this work is locally coordinated and integrated with other key steps and processes, but it may seek to partner key support from CQU/JCU and the CIT team.

Key players that need to be involved in this work include:

- Key participants in the most prospective agricultural sectors, including growers, financials, suppliers, the real estate industry, agricultural service providers, key infrastructure leaders;
- This work should build on the current TEL work in seeking to understand the collaboration building necessary to build agricultural supply chain cooperatives and key price points along each of the key supply chains. This will help identify clear barriers in the supply chain system. These barriers might include trade access, biosecurity, information barriers, etc.

2. Visionary land use planning footprint and design

What is the current context?

To encourage high quality and high value agricultural development, a far more sophisticated and incentive-focussed land use planning and development approval system will need to be developed, designed and implemented. Not having these arrangements in place in advance of the development front will result in sub-optimal outcomes for the Region and for agricultural development investors alike. It will particularly limit value adding investment opportunities such as food processing and waste management (Benyama, Kinnear & Rolfe 2018).

What scope is required?

With a much clearer vision for the future supply and value chain, and a stronger focus on supply chain efficiency, minimizing environmental harm, maximizing the quality of soils farmed, reducing agricultural runoff and reducing agricultural costs (transport, pumping), a much more refined set of land use planning data layers can be developed, overlaid, analysed and optimized. A good example

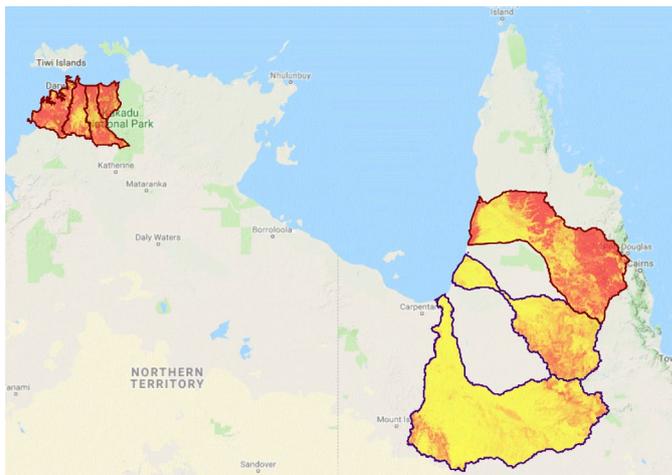
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of the quality of mapping required in this case, as already been developed in Northern Australia and includes the example here.

Case Study: Mapping Water Resources and Suitable Agriculture Use, NAWRA Example

The Northern Australia Water Resource Assessment (NAWRA) provides a comprehensive and integrated evaluation of the feasibility, economic viability and sustainability of water and agricultural development in three priority regions. The Assessment focused on the Fitzroy catchment in Western Australia, the Darwin catchments (Adelaide, Finnis, Mary and Wildman) in the Northern Territory and the Mitchell catchment in Queensland.

The Northern Australia Water Resource Assessment Explorer (NAWRA-explorer) enables the user to simultaneously integrate key datasets generated by the Northern Australia Water Resource Assessment. Datasets consider land suitability, soil type, water storage, surface water availability, groundwater, climate, ecology, Indigenous interests and design hydrology.



Much stronger agricultural area design is required to achieve significantly higher level supply chain and environmental efficiency. Consequently, required tasks and outcomes are:

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Key Tasks	Outcomes
Drawing on the <i>Supply and Production System Vision</i> , the Council needs to further develop the key opportunities and constraints layers for potential and staged agricultural development.	Clearly identified priority areas for agricultural investment and development, including associated value chain opportunities and associated infrastructure corridors/locations. Sufficient planning flexibility to enable alternative supply chain development models to be accommodated if needed. Sufficient planning flexibility to ensure sufficient diversity in the enterprise mix that emerges, enabling an appropriate mix of large and small/medium enterprises, enabling entrepreneurship in enterprise purpose. Sufficient planning effort to optimise required infrastructure development corridors.
Exploring the most appropriate planning instruments and provisions required to help facilitate development and investment in these contexts (e.g. State Development Area, Agricultural Development Precinct, etc.).	A planning and development approval framework that facilitate smooth and high quality development investment, appropriate public-private partnerships and identified suitable investment incentive packages.

Timeframes, investment and costs

The pathways forward on this particular piece of work should build strongly on the foundations mapping overlay work that already exists within the Council. New mapping work can be used to facilitate cohesive cross sector input into the design of the tightest supply and value chains possible.

Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Mapping overlay development, efficiency analytics and plan production			June 2021
Potential Investors	In Kind	Cash	Notes
Possible State bid		\$300,000	
Council	Existing mapping layers within Council		
QDAF			
NQDT			

Who needs to be involved?

Charters Towers Regional Council could be the appropriate project lead to ensure this work is coordinated and integrated with other key steps. Key players that need to be involved include:

- Key participants in the agricultural sectors, including growers, financials, suppliers, the real estate industry, agricultural service providers, key infrastructure leaders;
- Strong skills in relation to the cost analysis of supply chain logistics (e.g. QUT); and
- Stronger designer-skills in the context of more circular agricultural systems.

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3. Connected water infrastructure, ownership and water products

What is the current context?

The city of Charters Towers and the smaller towns of Greenvale and Ravenswood access water from the Charters Towers Weir on the Burdekin River 14 km north of Charters Towers. Pentland is serviced by two bores, located 10 km from the town, which connect to a reliable aquifer (CTRC 2015). In addition to the Weir and the two bores, CTRC also produces and uses recycled water for some schools and the golf club (QDEWS 2016). At present, no irrigated agricultural activity is supplied directly from the Weir, but the total combined annual volume of water licensed for extraction for agriculture and urban use is about 1% of the Burdekin River’s mean annual flow. Most industrial water used for local manufacturing, engineering and other commercial operations is sourced from the Weir, and is accounted for within the total water allocation. Water for the Pajingo Mine is also extracted from the Weir, and is supplied under a private agreement between the Council and the mine. There are a number of other mines in the Charters Towers Region and these do not take water directly from the Weir (QDEWS 2016).

The volume of the Weir represents 0.12% of the average annual flow of the river (CTRC 2015). The Weir relies on seasonal filling cycles and continual inflows from the Burdekin River. Seasonal inflows are generally sufficient for around six or seven months, after which time the Weir level is slowly reduced through a combination of water use, evaporation and natural seepage losses. Late wet seasons and low yielding wet seasons pose a risk to supply security (QDEWS 2016). The Weir has no recorded water supply shortfalls since it was raised in 1996, though water levels have fallen to low levels several times since then (QDEWS 2016). Water restrictions are introduced across the Region in response to drought or other temporary water shortage events (Level 1- 4 restrictions) and lifted when conditions return to normal (CTRC 2015).

What scope is required?

With Big Rocks Weir now planned for construction, significant effort is needed to define the emerging model of agricultural development which will, in itself, define the scope and type of water products and delivery systems that will need to be made available. Irrigation distribution systems and their ability to contribute to the emergence of a more circular economy are also yet to be determined and designed. Finally, issues of various aspects of scheme ownership, and associated governance are yet to be determined. Consequently, required tasks and outcomes are:

Key Tasks	Outcomes
Feasibility of the preferred water products and distribution system developed, and full costings driven by the project planning.	A significant interplay between supply chain visioning, innovative land use planning and the final design, costing, funding and delivery of distribution systems. More cohesive distribution systems and innovative investment sharing principles. Opportunities for market arrangements that explore and enhance the potential for using existing under-used water systems/allocations.
Early consideration of the most appropriate governance arrangements and ownership options need to be agreed to between Sunwater, the Council and Industry.	Once established, there may be potential value in improving operability of the market. The current market is constrained by the trading rules and also needs some refinement. New

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	approaches being explored in the MDIA may be worth exploring and adopting.
Identify and finalize any requirements to update the current Queensland Government Burdekin Water Management (WMP).	All water allocations scientifically tested and legitimately allocated to enable security.

Timeframes, investment and costs

Given the amount of work still needed to determine design efficiency, it is unlikely that the Big Rocks Project will begin within the next twelve months. This work will include significant field investigations and design development, extensive documentation of the site's social and cultural heritage and environmental (EIS) values, extensive geological surveys and commercial modelling. To date, there has been no consideration of the pumped hydro project beyond a desktop assessment. As a result, no costings for a large scale pumped hydro project have been included in economic assessments. Refinements to the original proposal in light of this work could positively or negatively affect the economic outcomes and viability of the project (SMEC Australia Pty Ltd 2018).

Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Consideration of water governance, ownership, distribution, water products and market arrangements.			
Potential Investors	In Kind	Cash	Notes
Possible State bid		\$100,000	
Council			
TEL/SMEC			
NRM&E			
Sunwater			

Who needs to be involved?

The *Charters Towers Regional Council* would be the appropriate project lead to ensure this work is coordinated and integrated with other key steps, but the work would need to be developed in strong partnership with the current impact assessment process being run by TEL/SMEC and by Sunwater and the Queensland Department of Natural Resources and Mines (QDNR&M).

Key players that need to be involved in this work include:

- Key participants in the agricultural sectors, including growers, financials, suppliers, the real estate industry, agricultural service providers, key infrastructure leaders;
- Council, TEL, SMEC, Sunwater and QDNR&E will need to work closely together in partnership with industry; and
- Stronger designer-skills in new water product opportunities, power generation in water distribution and market trading skills will be required.

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4. Integrated infrastructure, communications and services planning and coordination

What is the current context?

To facilitate effective agricultural investment, more cohesive infrastructure and services planning will be required alongside water infrastructure planning and development. With Big Rocks coming on line, there are emerging changes in the infrastructure and communication systems needed in the Region, and there will be a stronger need to ensure good telecommunications access, and a fresh look at the integrated infrastructure needs of a more intensive/circular agricultural system.

What scope is required?

Given the importance of infrastructure, communications and services in ensuring a tight and value-rich supply chain that enables integrated linkages between sectors, it is essential that innovative infrastructure and services design follows through in advance of the development front. In this context, there will be a need for a focus on roads, the airport, port linkages and communications. At the same time, this work flags the implications for human and commercial services linkages; though these will tend to be lagging rather than leading requirements.

While there should be a strong focus on the telecommunications aspects of this work, it is understood that there are no major constraints in the trunk system. As such, service support behind big data management in the supply chain will again tend to be a lagging versus leading part of that thinking, though early approaches to big-data service innovators in the agricultural space will be important within this process to build and strengthen the agricultural support opportunity. Consequently, required tasks and outcomes are:

Key Tasks	Outcomes
Reframing of the key infrastructure, communications and services requirements to deliver on the emerging supply chain vision and visionary land use planning.	Strong co-design in establishing a much tighter supply and value chain and greater circular economy opportunities. A clear understanding of the lagging human and commercial service requirements emerging from the proposed development trajectory. Facilitation and brokering of staged workforce development planning and coordinated response (linked to the <i>Dynamic Business and Sector Development</i> initiative).
The coordinated design and prosecution of appropriate, coordinated and staged budgetary and investment responses for infrastructure (across Federal, State, Local and private sector requirements).	Timely delivery of infrastructure to secure high quality agricultural investment. Active facilitation of the required big data service supports to keep pace with emerging agricultural development.

Timeframes, investment and costs

The pathways forward on this particular piece of work should build strongly on the foundational mapping and supply chain vision building and visionary land use planning work undertaken by the Council. This will be needed to facilitate cohesive sector wide input into the design of the tightest and most effective infrastructure planning and investment priorities possible.

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Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Planning and strategic infrastructure, communications and services to service agricultural development			June 2021
Potential Investors	In Kind	Cash	Notes
Possible State bid		\$300,000	
Council			
TMR			
TEL			
NBNCo/Telstra			

Who needs to be involved?

Charters Towers Regional Council would be the appropriate project lead to ensure this work is coordinated and integrated with other key steps, but the work would need to be developed in strong partnership with the Department of Transport and Main Roads (TMR), the Townsville Port, both the Charters Towers and Townsville Airports, Telstra and the National Broadband Network Company (NBN Co). Key players that need to be involved in this work include:

- Key participants in the agricultural sectors, including growers, financiers, suppliers, the real estate industry, agricultural service providers, data service providers, JCU, CQU and key infrastructure leaders;
- Council, TMR, Airport Corporation, Townsville Port Authority, Telstra and NBN Co will need to work closely in partnership with industry;
- Strong linkages to emerging Defence developments in the Region are also needed; and
- A stronger co-design approach is required that can deliver tighter supply and value chain outcomes and stronger circular economy principles.

5. Integrated, reliable, affordable and low impact energy and waste management

What is the current context?

Despite policy instability over the last decade, a more stable national and state-wide policy framework is now emerging, seeking to achieve energy security, affordability (via enhanced generation investment) and transition (AER 2018). This means that, as a new agriculture development area, the Region has the chance to rethink the design of the right energy mix to service new agricultural development in advance of the development front, and in ways that achieve significant advances in all three energy-related objectives (security, affordability and transition).

Additional energy priorities for Queensland (QDEWS 2017b) include:

- Assessment of options for deploying hydro and pumped storage;
- Increased supply of gas into the Australian market;
- Reviewed costs of energy storage and demand management (Arenawire 2019);
- Increased assessment of energy investment trends in Distributed Energy Resources (DER) and Virtual Power Plants (VPPs);
- Strengthening future power systems by addressing technical issues
- Improved access to climate and extreme weather information for the electricity sector; and
- Tri-sector integration of electricity, gas, and transport in AEMO’s co-optimisation model, based on the “zero emission vehicle” roadmap (AEMO 2019).

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In this Region, the \$330M Kidston solar hydro project is expected to be completed by 2021. It sits within the Etheridge Shire Council, but its infrastructure corridor cuts across the Charters Towers Region near Greenvale. The project will allow energy to be stored and harnessed on demand (QDSDMIP 2019). With respect to this development, the Charters Towers Regional Council considers that a second power line should be provided (rather than just one proposed) so that potential solar farms and wind generators in the Charters Towers Region can also feed into the line.

While these broad settings are emerging, there remains no clear energy planning in advance of new proposed agricultural development. Strategic thinking in this context will also need to account for:

- New opportunities for agricultural-based waste to energy technologies that might also significantly contribute to circular economies and tighter supply chains;
- Integration between power generation options and regional waste management; and
- New emerging opportunities for hydrogen-based power options.

Similar to energy, the new agricultural development front presents an opportunity to rethink regional and more sustainable and cost effective approaches to waste management. Given several new policy and technology developments, there is a fresh opportunity to explore the linkages between agriculture and waste management. These include: (i) the recent introduction of the waste level system; (ii) new thinking about regional organic waste management supporting agricultural production (being undertaken by Central Queensland University in the Lakeland area); and (iii) the Growcom agricultural waste utilization trial being developed by CSIRO. In respect to the Growcom-based work in the Townsville context, the Food Waste CRC is currently starting a 20 week process for engaging in opportunities for new approaches to food waste processing. In emerging agricultural domains, this might involve the development of a significant value add opportunity for agricultural products. The approach has the potential to be built in a modular model for expansion or duplication. In this context, the Charters Towers Region could have an appropriate horticultural mix all year round. This emerging approach suggests that there is significant global investment interest in area-based food manufacturing models (by combining the skills of local entrepreneurs and attracting investors).

What scope is required?

With respect to energy's pivotal role in agricultural development, to achieve genuine affordability, security and transition outcomes, a unique opportunity exists to ensure every effort is taken to fully explore and compare the range of locally-based options now available, to enable regional decisions about the best options possible, and to progress planning and implementation. These opportunities may contribute to the design of a more circular economy in the context of the new agricultural developments at Big Rocks and associated future water developments. As such, a structured approach to the conceptualization, comparison and more targeted design of the most effective energy and waste management options should at least include the following tasks and outcomes:

Key Tasks	Outcomes
Criteria based assessment and refinement of a range of possible energy generation and supply options, or a combined set of options that deliver significantly improved energy security, affordability and transition in the region in the	Full exploration of: (i) property-based solutions (solar or biomass) that feed additional energy back into the grid; (ii) the potential contribution of innovative hydro-power within or from the distribution system; (iii) a regional approach to

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context of emerging new agricultural developments.	biomass powered sub-regional micro-grids, resulting in multiple circular economy products (e.g. oil/syngas, biochar); (iv) potential regional waste to energy options; (v) potential hydrogen-based solutions (e.g. water plus power to create hydrogen with overflow power to reduce marginal cost); or (vi) an appropriate combination of these and other options.
Criteria-based assessment and refinement of the options possible, or a combined set of options that deliver significantly improved waste and pollution reduction, together with increased supply chains and value chain opportunities.	Full exploration of options that include: (i) management of municipal waste; (ii) agricultural waste biomass contributions to energy production; (iii) regional approaches to organic waste for compost production; and (iv) greater consideration of potential wood waste and other value adding options and processes. Integrated consideration of biological waste and nutrient pollution reduction emerging from new agricultural developments. Full review of the potential waste and pollution reduction technologies that could be applied in the agricultural development context and their associated benefits and product streams.
Progression of the most appropriate options into a fully integrated area-based design concept and associated investment strategies for implementation.	Strongly positive and investment ready business cases for regionally agreed solutions.

While energy and waste management security, affordability and transition are the key objectives, additional benefits such as multiple product streams contributing to a more circular system need to be considered, as do additional value-added products that the Region may be able to grow economically (e.g. power, biochar, etc.).

Timeframes, Investments and Costs

The pathways forward on this particular piece of work should again all build on the foundation supply chain and land use planning work previously outlined.

Package Item	Total In Kind	Total Cash Cost	Completion Timelines
Circular integrated energy supply and waste management option comparisons and preliminary designs.			June 2021
Possible Investors	In Kind	Cash	Notes
Proposed State bid		\$250,000	
Council			
Energy Queensland			

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DES and Queensland waste levy			
NRM&E			
Growcom			
Pacific Bio			
Industry partners			
CQU/JCU/CSIRO			

Who needs to be involved?

Charters Towers Regional Council would be the appropriate project lead to ensure this work is coordinated and integrated with other key steps, but the work would need to be developed in strong partnership with Energy Queensland, DES and DNR&M. The Council’s waste management team would be involved to ensure that this work is coordinated and integrated with other key steps, but the work would need to be developed in strong partnership with groups like Pacific Bio, Growcom and research institutions (JCU, CSIRO and CQU). Linkages would also need to be made to the NQ Regional Organization of Councils Waste Management Strategy.

This work would be led by the Council through the integrated governance arrangements, but would need to involve key players that include:

- Key participants in the agricultural sectors, including growers, financials, suppliers, the real estate industry, agricultural service providers, key infrastructure leaders;
- Council, SMEC, Energy Queensland, DES and DNR&E will need to work closely in partnership with Industry; and
- Strong designer-skills in new energy generation, waste management and their integrated contribution to circular economy development opportunities.

6. Achieving regulated water quality outcomes for the Great Barrier Reef

What is the current context?

Since the early 2000s, there has been significant and ongoing investment in improving water quality in the Burdekin catchment. Best management practice options for most land uses in the Region (but particularly for agriculture) are well developed and there is good evidence of the water quality benefits associated with these practices. Nevertheless, further significant improvements in practice are required across the catchment and the Region (NQ Dry Tropics 2016).

The bilaterally agreed *Reef 2050 Plan* sets a clear strategy for improving water quality outcomes for the GBR World Heritage Area. In this national context, the Queensland Government introduced a Bill to Parliament in February 2019 to strengthen existing Reef protection regulations. The proposed regulations under the *Environmental Protection (Great Barrier Reef Protection Measures) and Other Legislation Amendment Bill 2019* aims to reduce water pollution (nutrients and sediment) from agricultural and industrial land uses entering Reef waters, while maintaining productivity and profitability through improved land management (Queensland Parliament 2019). Once passed by Parliament, the amended legislation will support the staged roll-out of strengthened GBR protection regulations to apply to all commercially produced sugar cane, bananas, horticulture, grains and grazing as well as to direct sources of pollution from industrial land uses (for example, sewage and water treatment plants, intensive animal industries etc.) across all GBR regions. This, for the first time, will include requirements to ensure that new agricultural development does not contribute further to declines in the quality of water running into the GBR lagoon. This has major significance

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for any new agricultural development in the Charters Towers Region. While there has been major progress in improving existing practices in the Region, there has to date been no cohesive attempt to conceptualise and design how new agricultural development will meet the “no net increase” in pollution requirements. This detailed thinking is better managed on an area-based approach, rather than leaving every new farming enterprise to design a “no net decline” approach property by property. Additionally, some actions (particularly water treatment) are actually better planned at multi-property (e.g. combined water reuse) or sub-catchment (e.g. sub catchment monitoring) scale. Across the globe, there are significant examples to be drawn upon. The newly developed *Reef Credit Scheme* has the potential to be an innovative, market-based solution offering a new way to improve GBR water quality. It will enable farmers and graziers to gain ‘Reef Credits’, through changes in land management, which can then be traded; providing an additional income stream. A Reef Credit represents a quantifiable volume of nutrient, pesticide or sediment prevented from entering the GBR Catchment (NQ Dry Tropics 2019).

What scope is required?

Any planned expansion of agriculture must meet these new regulatory standards. Additionally, however, there is real scope to apply highly innovative and collaborative thinking in advance of the agricultural development curve, improving development approval and new development outcomes.

Case Study: Innovative Agritech, InFarm, Goondiwindi

Goondiwindi based company, InFarm, is pioneering the development of ground breaking drone-to-tractor weed identification technology that is enabling large farms in south west Queensland to achieve savings of up to 95% in herbicide use on farm. The process uses drones to capture high definition images of the paddock. The images are uploaded into InFarm's processing platform, where a unique weed-identifying algorithm is applied. The result is a file that pinpoints the exact location of the weeds. The file is uploaded into a standard variable rate tractor via a USB and the data is used to control spray nozzles; turning them on and off depending on the presence of weeds. See <https://www.infarm.io/>.

Consequently, required tasks and outcomes are:

Key Tasks	Outcomes
Building a strong and evidence-based collaborative alliance between, industry, researchers and NQ Dry Tropics to co-design an area-based approach in association with the <i>Supply Chain Vision Building</i> and <i>Visionary Land Use Planning</i> phases.	All responsibilities for implementation are clearly defined and strong pathways in place to secure the investment required to implement. Highly innovative cross-sectoral, area-based approaches are explored and assessed along with traditional practice-based approaches.
Building strong collaborative governance arrangements to ensure standards are maintained and continuously improved.	Whole of area monitoring alliances and outcomes established from the beginning of the development cycle to minimize investment risk. Targeted concessional finance arrangements identified and linked to new agriculture developments, meeting scheme requirements.

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Timeframes, investment and costs

The pathways forward on this particular piece of work should build strongly on the foundational mapping of supply chain vision and visionary land use planning work undertaken by Council. It should also facilitate a cohesive sector wide input into the design of systems that might be able to attract significant concession finances for compliant agricultural development opportunities.

Package Item	Total In Kind	Total Cash	Completion Timelines
Establishing innovation and delivery systems for meeting no net decline water quality outcomes in the GBR			June 2021
Potential Investors	In Kind	Cash	Notes
GBRF		\$300,000	
OGBR			
Council			
NQDT			
Industry partners			
CQU/JCU/CSIRO			
Clean Energy Finance Corporation			

Who needs to be involved?

NQDT (in collaboration with Council) could be the appropriate project lead to ensure this work is coordinated and integrated with other key steps, but the work would need to be developed in strong partnership with Industry and investors.

Key players that need to be involved in this work include:

- Key participants in the most prospective agricultural sectors, including growers, financials, suppliers, agricultural service providers and data service providers;
- Council, GBRMPA, NQ Dry Tropics, CEFC and the water service provider; and
- A stronger co-design approach at area scale is required to deliver an area-based and cross-sectoral approach to achieving “no net decline” in water quality.

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SECTION THREE – GOVERNANCE, MANAGEMENT AND CAPACITY

Total project costs, return on investment and future leverage

The following outlines the foundational and incomplete ROI case behind the proposed \$1.4M State budget investment in this proposal envisaged over a five year period starting July 2020. The table below outlines the estimated returns and the assumptions underpinning these returns.

Project Impact Category	Assumptions For Additional Impact	Total Investment Return
Project Cash Leverage	<ul style="list-style-type: none"> TBA following initiative budget finalization. 	\$
Increased regional sector growth or business turnover	<ul style="list-style-type: none"> Assume current Gross Regional Product from agriculture is \$70.6 Assume project growth in agriculture from proposed new water development over 30 years Assume this investment delivers 25% of the value of the growth in that agricultural GRP over 30 years. 	\$
New consequent and attributable private and public sector investment in Region	<ul style="list-style-type: none"> Target of \$500,000 Year 1 and \$1.5M in each subsequent year to Year 5. 	\$6,500,000
Total State Investment	Preliminary Total Investment Return	Total ROI
\$1.4M	\$6.5M	4.6:1

Governing for integrated effort and success

Project Governance Arrangements

Strong governance arrangements will be the key to the success of this initiative, particularly those that are locally led, regionally coordinated and State supported. These would include:

- Some form of strong area-based governing structure that is inclusive of key partners;
- Strong stable and longer-term initiative leadership based within the CTRC;
- Strong project-focused delivery coordination (preferably third-party facilitated) involving CTRC, the CiT team, the private sector and the State);
- Ongoing support partnerships with the original CiT partners and the Regional Economies Centre of Excellence (RECoE); and
- Ongoing formal networking across-CiT regions, potentially including the strategic consideration of shared appointments and procurement approaches.

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Integrated Project Linkages

Key integrated linkages from this initiative and others will need to include:

- Integrated links and cooperation between the wider *Making Water Work* Queensland budget bid (Cook Shire, Charters Towers, Rockhampton and Barcaldine);
- Strong linkages to the planning of the recently established Federal NQ Water Infrastructure Development Authority;
- Strategic links to key Queensland policy initiatives, including the new Innovation Strategy, Just Transition Strategy, Zero Net Emissions, the Agricultural Strategy Paper, etc.;
- Strategic linkages to the Office of the Great Barrier Reef (OGBR), the Great Barrier Reef Foundation (GBRF) and the Great Barrier Reef Marine Park Authority (GBRMPA); and
- Key research investments and linkages should be considered and maintained, including: (i) the Advanced Manufacturing Growth Centre; (ii) the CRC Northern Australia; (iii) the new Future Food Systems CRC; and the NESP Tropical Water Quality Hub (RRRC).

Monitoring for Success

A strong monitoring program should be established from the outset to ensure that the key outcomes and projected ROI are achieved. This approach sets up the process for key partners to jointly monitor both the health of the partnerships and the progress of implementation. It also establishes a basis for monitoring the achievement of the predicted cost benefits as the project unfolds and becomes a reality.

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Appendix A: Criteria Sheet – Key options for Making Water Work

Select **ONE** Option and consider it when you answer the questions in the table.

1. **Best Management Practices**, Regional Composts and Credentialing in Nutrient Management and Monitoring
2. New Forms of **Zero Emission Aquaculture**, including macro algae to treat waste water
3. New Forms of Local, Secure, Affordable, Dispatchable and **Low Carbon Energy** to Drive Agricultural Growth
4. Visionary **Land Use and Infrastructure Planning** to Reduce Costs and Impacts and Strengthen Supply Chains
5. More **Effective Water Trading** and Local Management
6. Stronger Digital **Data Hubs and Value Chain** Resilience and Innovation
7. **Next Generation Skills** for a Circular Economy
8. New **Protected Cropping Systems** for Agriculture (e.g. greenhouses, shade structures)
9. **Engineering Solutions**, New Water Infrastructure and Enabling Substantive Water Recycling

Intervention Option Name:	Not sure	No	Yes	Comments
1. Is it essential for the pathway?	N S	N	Y	
2. Is it essential, but difficult to implement - i.e. lots of barriers	N S	N	Y	
3. Might the option foreclose other options?	N S	N	Y	
4. Might it open/benefit other options?	N S	N	Y	
5. Could it lead to irreversible negative changes?	N S	N	Y	
6. Will it be robust? (long-lasting & durable)	N S	N	Y	
7. Is it 'no regrets'?	N S	N	Y	
8. Other considerations				