Mary River Catchment Coordination Association

Submission on the EIS for the Proposed Traveston Crossing Dam (Stage 1)

January 2008

Integrated Catchment Management

An approach which recognises the catchment or river basin
as the appropriate organising unit
for research on ecosystem processes
for the purpose of managing natural resources
in a context that includes social, economic and political considerations.

Bowden, W. (1999)
from *Integrated catchment management rediscovered: an essential tool for a new millennium*

50 Year Vision for the Communities of the Mary Catchment

By the year 2050, the community will be enjoying the benefits of sustainable agricultural, fishing and recreational activities flowing from a river system, that has healthy natural forests on stable streambanks shading the length of the river and all its creeks, where pools, riffles and snags interplay, to create diverse habitat for a myriad of life forms.

The waterways, whose reflections are as clear as they were when the first explorer gazed upon them, will be as clean as has been recorded in living memory. Major linkages will exist to allow our special fish, turtle, frog and bird species to move freely between conservation reaches.

The flow of water and sediments through the rivers and creeks will sustain the physical and biological needs of the riverine system, as well as the agreed sustainable requirements of the community. The community will be able to see, understand and value the changes, be proud of their role in achieving them, and be committed to restoring the catchment for the next 50 years.

(The agreed result of a series of formal community consultation workshops held throughout the Mary River Catchment during the formulation of the Mary River & Tributaries Rehabilitation Plan – 2001)

Table of Contents

Introduction and overview of MRCCC comments on the Environmental Impact Statement for the Proposed Traveston Crossing Dam

The Mary River Catchment Coordination Association (MRCCA) is a community organisation formed in 1993 as a representative body of community, industry and government interests involved in natural resource management in the Mary River Catchment. The MRCCA is composed of 21 interest sectors from across the Mary River Catchment. Since the formation of larger regional natural resource management groups, the MRCCA has worked closely with the Burnett Mary Regional Group to facilitate community NRM activities in the Mary River Catchment. The Integrated Catchment Management philosophy and community vision of our organisation is summarised on the inside cover of this report.

This submission represents the views of and analysis by the professional staff and the committee of the Mary River Catchment Coordination Association, referred to throughout the document as the Mary River Catchment Coordinating Committee (MRCCC). It restricts its scope to aspects that are directly relevant to the aims of the Association. Lack of comment in this submission on matters in the EIS that are outside this scope does not constitute an endorsement of those aspects of the EIS by the MRCCC. In particular, the MRCCC endorses the formal submissions of the Save The Mary River Coordinating Group and Mr Robert Hales with respect to the social impacts of the proposal (not specifically addressed in the MRCCC submission) which have already affected many of our Sector group members personally.

The MRCCA has produced a Catchment Strategy, endorsed and relied upon by the State Government, which provides strategic direction for Government and community action to improve the sustainability of the Mary River Catchment. In 2000 the MRCCA and the Queensland State Government jointly prepared Australia's first Catchment Rehabilitation Plan, the "Mary River & Tributaries Rehabilitation Plan" which provides the guiding framework for on-ground improvement of river health in the catchment. The Federal and State Governments have made considerable financial investments in supporting the objectives of this plan.

The MRCCA received the Queensland Rivercare award in 1999, 2003 and 2007, the Catchment Landcare award in 2003, and the National Rivercare award in 2004 for the success in implementing these policies in an active partnership with landholders, community, industry and government in the catchment. The MRCCA intends to maintain an ongoing role as a stakeholder body in the management of water resource and river health issues in the Mary River Catchment and seeks to assist in the appropriate assessment of the range of new water infrastructure projects being proposed for South East Queensland with respect to their environmental and economic impacts on the Mary River Catchment.

In evaluating the EIS for the Traveston Crossing Dam proposal the MRCCC looked at the information presented in the EIS and associated data and documents from 3 perspectives:

- Alignment with recognised plans, regulations and policies relating to environmental protection and sustainable water and land use.
- An integrated catchment health appraisal of the predicted impacts of the proposal using the data presented in the EIS and supporting documentation.
- Adequacy of the evaluation of alternatives.

In doing so, we identified the following broad areas of major concern in which the EIS:

1. Fails to demonstrate that the project will provide water security at the lowest cost or in the shortest timeframe;
2. Fails to address climate change adequately;

3. Demonstrates that the project is in conflict with the stated requirements and objectives of many existing laws, plans and policies relating to environmental protection and sustainable water and land use, including the federal Environmental Protection and Biodiversity Conservation Act and the National Water Initiative;
4. Fails to competently quantify the cumulative risks posed by the project to the sustainability of ecosystems in the catchment, the receiving estuary and biodiversity in the region.
5. Does not demonstrate the likely effectiveness of proposed mitigation and/or offset strategies, or quantify the residual risks after implementation;
6. Does not adequately address landscape-scale impacts on groundwater / surface water interactions;
7. Fails to address and quantify flooding and dam failure impacts and risks adequately;
8. Does not adequately evaluate alternatives to the project;
9. Fails to adequately address the irreversible nature of the likely impacts of the project, and the related issue of inter-generational equity;
10. Does not recognise the extensive community efforts towards improving the health of the Mary River over the last 15 years and promotes an action which is in direct conflict with these efforts;
11. Does not conform to accepted professional standards of care and diligence in the preparation of documents and the conduct and interpretation of appropriate analyses.

The evidence for each of these assertions is contained in the main body of this submission. The MRCCC maintains that there are considerable doubts concerning the impacts and benefits of the proposal that still remain despite the information presented in the EIS. When there are alternatives available which can provide water security in a shorter time frame, with greater reliability in the face of climate change, at comparable costs, the MRCCC suggests that the precautionary principle should prevail (as required under the principles of Ecologically Sustainable Development) and the project should not be allowed to proceed because the proponent has not clearly demonstrated that the project is likely be ecologically sustainable.

The MRCCC would also like to highlight the close scrutiny that the proposal received during the Senate inquiry conducted in early 2007 by the Standing Committee on Rural and Regional Affairs and Transport, which received extensive submissions from both the proponent and the public. In the final summary report from this inquiry, 6 of the 10 committee members recorded additional comments highly critical of the proposal, recommending that the project not proceed.

The consensus report of the committee made the following formal recommendation regarding ministerial consideration of the evidence received by the Senate:

The (senate) *committee recommends that the Commonwealth Minister for Environment and Water Resources, when exercising authority under the EPBC Act, considers the evidence received* (by the senate) *on the potential environmental impact of the Traveston Dam on the Mary River and the species of the river. The committee also recommends that the Minister reviews the results of the audit on the Paradise Dam approval conditions to mitigate any potential effect on threatened species.*

The MRCCC requests that the serious matters raised in this submission receive full consideration at both the Federal and State levels of assessment. MRCCC personnel are willing to assist by providing local technical knowledge and further clarification of the scientific and technical issues raised. The MRCCC invites the Federal Minister, Coordinator-General and staff involved in the assessment process to visit the Mary River and see first-hand the issues raised in this submission. We believe that there are better solutions for providing long-term water security for both South East Queensland and the communities who live in the Mary River catchment.

Evaluation against existing laws, plans and policies.

Local visions, plans and policies

Mary River &Tributaries Rehabilitation Plan

In 2001 the MRCCC prepared the Mary River & Tributaries Rehabilitation Plan in response to the need to achieve a shared vision for the future of the catchment. The Rehabilitation Plan sets out a long-term strategic framework to protect waterways of conservation value, while rehabilitating and restoring degraded reaches in a more strategic and cost-effective manner than has occurred in the past.

The plan sets out a long-term 'Life-time' vision, and ten year goals. These aim to reverse current trends by motivating and empowering the community to adopt river rehabilitation techniques that are based on a solid understanding of river processes.

The life-time vision was developed in consultation with the Mary River Catchment community in a number of forums to ensure that input was gained from a wide range of community sectors, such as Landcare Groups, primary industry groups, community groups, water advisory groups and local government. The Life Time Vision that was developed directly by the community is"

"In our lifetime the community will be enjoying the natural bounty of sustainable agricultural, fishing, and recreational activities flowing from a healthy river system. Native forests growing on stable streambanks will shade the length of the river and all its creeks, where pools, riffles and snags interplay, to create diverse habitat for a myriad of life forms".

Goals for achievement by 2010 were also developed with a wide variety of stakeholders, with a community capacity building goal of "*An empowered, committed and caring community".*

The goal is "*an enlightened, aware and involved community with a common view for the Mary River Catchment will share an understanding of river processes to enable them to extend their contributions to the planning and implementation of effective and inclusive river restoration and rehabilitation programs"*. In light of the announcement of the Traveston Crossing Dam, the community has effectively highlighted the short-falls of the dam proposal and produced high quality, credible information to provide a balanced view of the dam proposal.

It is interesting to compare the process by which the CSIRO developed their "Vision" for the Mary River Catchment contained within the EIS. The CSIRO vision is not reflective of the Rehabilitation Plan vision or a true representation of the catchment community views. The Rehabilitation Plan vision was actually developed in consultation with the community it affects, with a consensus by the community that the vision and goals accurately depicts their views.

State laws and policies

SDPWO Act - Terms of Reference for the Traveston Crossing Dam stage 1 Environmental Impact Assessment

Throughout the EIS there is considerable non-compliance with the Terms of Reference.

One of the most crucial aspects of the EIS was the requirement for a cost-benefit analysis of the project to be performed. The Terms of Reference expressly requested that a Cost Benefit Analysis (CBA) be produced to identify the distribution of costs and benefits at the local and regional scale.

In this instance there has been a blatant non-compliance with the Terms of Reference with regards to the section on the evaluation of the costs and benefits of Traveston Crossing Dam at a local and regional scale and the evaluation of alternatives. The authors of the EIS have only completed a detailed 'cost comparison' of Traveston Crossing Dam against a limited range of infrastructure options. A comprehensive cost benefit analysis of Traveston Crossing Dam against a range of alternatives has not been completed. A full assessment of the wide range of alternatives with reference to the principles of ESD, as required by the Terms of Reference, has not been undertaken.

The omission of any assessment at all of the impacts of the construction and operation of the water supply offtake, pumping station and water treatment facilities, is also a serious omission. These facilities are integral to the operation of the project, and will need to be constructed at the same time. Neither the dam project nor the pumping and treatment facilities can perform their stated use independently, and the fact that different proponents may be appointed is irrelevant to the assessment of the impacts of the project. It is particularly concerning that the pump station is proposed to be below the level of the stream bed.

Mary Basin Water Resource Plan (Environmental Flow Objectives)

The MRCCC's analysis of the flow data provided by the proponent suggests that the operation of the proposed dam will be in conflict with at least 2 of the aims defined in section 2 of the WRP, namely:

(ii) to provide a framework for sustainably managing water and the taking of water;

and

(iv) to provide a framework for reversing, where practicable, degradation that has occurred in natural ecosystems;

This is evident in table 6.37, 6.38 and 6.39 of the EIS where it is clear that the proposal is predicted to push the state of the river system further away from complying with environmental flow objectives than it already is.

It is important to note that the Mary Basin Water Resource Plan offers no effective protection for environmental flows downstream of the proposed dam, and compliance with the environmental flow schedules in the WRP does not, of itself, protect the environmental values of the river with respect to increased water extraction from Traveston Crossing. The environmental flow schedules in the Mary Basin WRP were formulated by running various IQQM simulations of large dams of various sizes and spillway characteristics specifically at Traveston Crossing, estimating what the resultant effect on downstream flow regimes would be, and writing environmental flow schedules into the legislation that would specifically allow the desired dam and infrastructure plans to comply with the legislation being drafted. All of this work was being conducted throughout 2005 and early 2006, specifically avoiding consultation with community and non-government stakeholders in the Mary Catchment. Although this sort of behaviour is clearly against the intent of the National Water Initiative with respect to community consultation and setting up environmentally sustainable water allocations systems, the procedure was very well documented in the case of the Mary Basin Water Resource Plan. It is primarily because of this sort of behaviour that the entire Community Reference Panel appointed to the plan formally withdrew their support for the plan before the legislation was enacted.

Therefore, it is an important role of this EIS to examine the specific environmental impacts of the increased level of water extraction attributable to this project and not assume that compliance with the flow schedules in the WRP indicates an environmentally sustainable level of extraction. It is a specific requirement of the WRP that the impacts of allocating water from the strategic reserve and the operation of new infrastructure needs to be specifically assessed, and examples of matters that need to be considered are outlined in Sections 27 and 50 of the legislation.

The use of 'mean' or average flow values is misleading, because this statistic does not show the massive variations in flow conditions of the Mary River. The large periodic flood events which characterise the Mary River have a massive effect on the average flow statistic - a 1 or 2% change to "mean annual flows" at the river mouth can result in years of no-flow in the river, because a 1 in 20 flood will increase the average or mean flow value significantly.

The low flows from Traveston Crossing Dam will be severely attenuated, and will not mimic the current seasonality of flows in the Mary River downstream of the dam wall. The predicted median daily flows downstream of the dam wall in Table 6.12 (pg.6-38) are approximately 100 megalitres per day for every month of the year. The seasonality of flows, especially the summer flows (upwards of 600 megalitres per day) will be severely muted. This is in direct conflict with the Queensland Water Plan 2005 to 2010 under Strategy 1, Action 1.1 which clearly states that a "*secure allocation should be provided to the environment, and that this allocation must be sufficient to maintain the ecological health of aquatic ecosystems and the plants and animals that depend on them, through taking into account river flow regimes-such as volume, timing, seasonality and duration*".

The ANZECC 2000 Guidelines (Chapter 8.2.1.8) states the importance of the establishment of appropriate flow regimes to sustain the ecological values of rivers. ANZECC 2000 recommends six types of methods for obtaining environmental flow regimes for Australian waterways: -

- Range of variability method,
- Habitat assessment methods,
- Expert panel methods,
- Building block methodology,
- Ecological/holistic approaches and
- Decision support systems.

It is not apparent that any of these types of methods were used in the setting of the Mary Basin Water Resource Plan Environmental Flow Objectives, apart from the expert panel process. However, the advice provided by the expert panel was that a large single dam on the main Mary River above Gympie would be disastrous for endangered aquatic species and their ecosystem functioning and the catchment itself (reference R2 scenario of the Mary WRP).

Dam Safety Guidelines

The Save The Mary River coordinating group has published an analysis of flood and dam safety considerations as part of their detailed technical submission. The MRCCC supports their investigation into flooding and dam safety issues, and shares the concerns that no failure impact assessment or dam break analysis was included in the EIS.

Climate Change Action Plan 2007

The section on the "*Effect of Climate Extremes*" in Section 6 Water Resources & Water Quality (pg.6-26) grossly oversimplifies the consequences of climate change on the potential dam yields.

Statements contained in this section of the EIS are in direct conflict with the Queensland Government Climate Change Action Plan 2007 (ClimateSmart 2050), where the policy document (p.29) states that "*the modelling that underpins water resource planning provides for local assessment of the impacts of climate change scenarios, and enables planned responses*". However the EIS totally contradicts this Qld Government Climate Change Policy statement by stating (pg.6-26) that *"current climate science cannot predict climate variability and future rainfall with any degree of certainty at the scale required for use in the IQQM simulation. Due to this uncertainty, an explicit consideration of future rainfall patterns was not applied to the derivation of the yield for the dam"*.

Because the IQQM simulation computer program cannot incorporate climate variability and climate change should not be an excuse to simply ignore modelling of future rainfall patterns, which is essential to calculate potential future dam yields.

The EIS should conduct a proper assessment of climate variability, predicted rainfall patterns and potential dam yields under a series of climate change scenarios.

Health Guidelines

In chapter 6, the proponent has clearly indicated that both surface water and water in the alluvial aquifers in the project area fall outside of the NHMRC drinking water guidelines and the EPA environmental water quality objectives. The most worrying indication in this respect is related to the presence of high levels of mercury and manganese, and the risks of blue-green algae toxins. The proponent has not assessed or quantified the human health risks associated with these water quality indicators. Because of the geological and mining history of the catchment and the availability of other data that suggests that there may be a risks associated with mercury, this risk is of particular concern. A more detail assessment of the potential risks associated with mercury has been undertaken by the MRCCC, and this report is attached to this submission.

In addition, the proponent has not investigated the risks associated with vector borne disease, which are likely to be heightened by the large increase in suitable mosquito habitat created by the project.

State Planning Policy on Good Quality Agricultural Land

The EIS acknowledges the construction of Traveston Crossing Dam will have a major impact on the supply of Good Quality Agricultural Land (GQAL) (p.5-7) with over 88% of the inundation area classified as "Class A" good quality agricultural land with minor to moderate limitation to agricultural production (p.5-55).

The GQAL Policy Principle 1 states *"good quality agricultural land has a special importance, and should not be built on"*. GQAL Policy Principle 2 states "*the alienation of some productive agricultural land will inevitably occur as a consequence of development, but the Government will not support such alienation when equally viable alternatives exist – particularly where developments that do not have very specific locational requirements are involved*".

The MRCCC contends that equally viable alternative exist for Traveston Crossing Dam, as specified in the Cardno / Institute of Sustainable Futures report on Water Security and Water Planning in SEQ. If these water supply alternatives were implemented instead of constructing Traveston Crossing Dam the loss of over 3000 hectares of "Class A" Good Quality Agricultural Land would not be destroyed forever.

To add further weight to the argument of investigating water supply alternatives, GQAL Planning Principle 4 states "*The preparation of strategic plans should include an evaluation of alternative forms of development, and significant weight should be given to those strategies which minimise the impacts on GQAL"*.

It is obvious that the Traveston Crossing Dam proposal is in direct conflict with State Planning Policy 1/92 for Good Quality Agricultural Land.

State Government Draft Environmental Offsets Policy

Concerns with the use of the Environmental Offsets Policy

The MRCCC has concerns that the Environmental Offsets Policy could be used in the following examples, and recommends that the policy should not be used in the following manner:

1. The offset policy is not clear whether there could be compulsory acquisition of environmental offsets on freehold land within areas where state significant projects under the SDPWO Act are located. For example compulsory acquisition of environmental offsets for the clearing proposed for the Northern Pipeline Interconnector.
2. When a project is staged, such as Traveston Crossing Dam Stage 1 & 2, suitable non remnant vegetation offsets for the clearing in Stage 1 may be located and selected within

land designated for the Stage 2 project area. When Stage 2 is brought on-line the Stage 1 offsets will be destroyed, and new offsets will be required to be found in the area; or worse, if the Stage 1 offsets in the Stage 2 area are still classified as 'non-remnant vegetation', the original intent of the off-sets from Stage 1 could easily be overlooked or challenged.

3. If a Regional Ecosystem is at a threshold level (the 30% remaining "Of Concern" threshold - which relates to approximately half of the RE types in the Burnett Mary) or at a Comprehensive, Adequate, Representative (CAR) 15% threshold, clearing and offsetting should not be allowed to occur.

Mary Water Quality Objectives – EPP & guidelines

The EIS fails to address High Ecological Value waterways within the Great Sandy Strait (including the Mary River estuary) scheduled under the Environment Protection Policy *(Water)*. Information supplied relating to water quality objectives is not consistent with EPA ambient water quality data and inaccurately represents water quality of the lower Mary River and Great Sandy Strait.

There is a legislative requirement under the Water Act 2000 (QLD), that ecological values and water quality of *High Environmental Values* waters scheduled under the Environment Protection Policy *(Water)* be maintained.

Insufficient information is provided to identify impacts on the High Ecological Value waterways of the Great Sandy Strait and Mary River estuary scheduled under Environment Protection Plan *(Water).* The management intent for High Ecological Value waterways is to maintain their values and their existing water quality.

The EIS illustrates that numerous water quality (WQO) guidelines are currently exceeded within the surface waters of the inundation area and downstream, particularly nutrient concentrations. There is also considerable non-compliance of water quality guidelines (WQO) within the groundwater samples at the proposed dam wall.

Nutrient concentrations and electrical conductivity levels within the groundwater are of considerable concern. Within the 1.5km radius of the dam wall, 6 of the 8 bores contain electrical conductivity levels above the water quality guideline (WQO) levels – one bore contains an electrical conductivity level just below that found in the upper / middle Mary River estuary. The EIS postulates that there is a connection between the groundwater and the river baseflows, which is concerning when water quality at present has considerable non-compliance. It is highly probable that water quality conditions are not likely to improve with the proposed low-flows in the EIS, therefore it should be expected that further non-compliance of water quality guidelines (WQO) would occur with the proposed Traveston Crossing Dam. This would severely impact on freshwater ecosystems, and importantly water quality conditions in the HEV receiving waters of the Mary River estuary could not be maintained at current levels. This is in contravention with the EPP (Water).

The EIS does not attempt to predict or model storage nutrient concentrations. The EIS relies solely upon an assessment of river water quality data taken over 4 sampling periods without trying to extrapolate this data to potential storage concentrations. The EIS even states that this data has deficiencies in that "*datasets were not large enough to calculate statistically sound median values as defined by ANZECC & ARMCANZ"* (pg.6-103).

A significant deficiency of the EIS in section 6 is the effect of turbulence at the interface between the confluence of creeks with the proposed impounded waters. This has a major influence on maintaining blue-green algae blooms in impoundments, through re-entrainment of sediment and nutrient mobilisation during large fluctuation in dam levels. This has a high potential to occur in the proposed Traveston Crossing Dam.

The EIS expects stratification of the impoundment to occur (pg.6-142), whereby the dam waters 'turn-over' releasing nutrients and extremely low dissolved oxygen levels from the bottom of the dam to the surface. When a ‘turn-over’ occurs it is devastating for fish and aquatic life, because the water becomes severely depleted of oxygen, whereby large fish-kills occur. Borumba Dam experienced a turn-over event earlier this year. The EIS proposes that a multi-level off-take will resolve the issues with turn-over events, however a multi-level off-take does not prevent this from occurring, it simply allows the dam operators to choose the best water quality level to release from the dam. But after a turn-over event the water is uniform in poor quality so it is pointless using a multi-level off-take when this situation occurs. During these events the dissolved oxygen levels of the water released downstream will not comply with dissolved oxygen WQO’s. There is also no design or operational guidelines contained in the EIS for the multi-level off-take, so there is no way of evaluating whether it will be able to operate at low dam levels where preferential discharge may not be possible.

Federal laws, plans and intergovernmental agreements

Ecologically Sustainable Development

The EIS fails to consider the principles of Ecologically Sustainable Development (ESD), as required by the Terms of Reference, particularly with reference to the consideration of alternatives to Traveston Crossing Dam. The assessment of alternatives is presently focused on costs and the quantity of supply, however there are other considerations (such as ESD) which are not presently taken into account in the EIS, but are stipulated in the Terms of Reference.

The principles of ESD are also enshrined in Section 3A of the EPBC Act, whereby the ‘precautionary principle’ and ‘inter-generational equity’ are fundamental aspects that must be considered when assessing an EPBC triggered project. Throughout the EIS there is no recognition of the ‘pre-cautionary principle’ although we have a serious lack of full scientific certainty, which is the reason provided for the establishment of the Freshwater Ecology Centre the threats to the aquatic ecosystems of the Mary River Catchment have the potential to be serious or have irreversible environmental damage.

National Water Initiative

The EIS has overlooked the potential conflict of the project with the intent of the National Water Initiative. The National Water Initiative mandate is to bring water entitlements back to sustainable levels in over-allocated river catchments (Section 23 iv of the Intergovernment Agreement on a National Water Initiative).

Table 6.37 (pg.6-68) of the EIS illustrates that with the current infrastructure and system of water allocation in the Mary River, flows in July, August and September do not fall within the guidelines outlined in the current Mary Basin Water Resource Plan (WRP) legislation. Further, when the impact of the first stage of Traveston Crossing Dam is added, the seasonal flow patterns are pushed further outside the flow guidelines in the WRP.

The wording of the legislation with respect to these particular guidelines is that any new operations in the river must MINIMIZE THE EXTENT TO WHICH flows do not comply with the guidelines. Schedule 6 of the WRP is very clear in this respect. There is no “Should comply” specification at all in the legislation, and as such, the interpretation in Table 6.73 of EIS is completely misleading.

It is very difficult to comprehend how the Traveston Crossing Dam proposal, which clearly demonstrates further non-compliance of the legislated WRP guidelines (than at present) is minimizing the level of non-compliance. Non-compliance with the guidelines in the WRP is evidence of an existing unsustainable level of extraction, hence of an over-allocated system (as legally defined under the National Water Initiative). The Mary Basin Water Resource Plan is a regulatory instrument of the National Water Initiative – part of Queensland’s Bi-lateral agreement. Creating a situation where a system is currently in an over-allocated state to a more over-allocated state is directly in conflict with one of the principal objectives of the National Water Initiative.

National Action Plan for Salinity & Water Quality

Community consultation is one of the four 'cornerstones' of this action plan. Considerable effort has already been invested into the Mary River under this plan, with exemplary examples of very effective cooperation between the Government and community in the past

However, it is clear that the communities of the Mary River catchment are in strong opposition to this particular proposal. To date there has been no sign of a consultative approach being taken by on this issue to develop viable alternatives that would win back community support. It is also clear from the data provided by the proponent that water quality is likely to decline in the catchment if this proposal goes ahead, which is in direct conflict with the aims of this National Plan, and partly responsible for the community opposition.

Mary River Cod Recovery Plan

The EIS (page 8-59) recognises that core Mary River Cod habitat is located at:

- Obi Obi Creek – downstream of Baroon Pocket Dam
- Six Mile Creek – downstream of Lake Macdonald
- Western Mary Sub-catchments (Widgee, Munna Creeks)

However the EIS significantly understates the potential impact to Mary River Cod populations of water resource development in the future when Traveston Crossing Dam is placed in the context of large interbasin transfers (full entitlements) from Baroon Pocket Dam (Northern Pipeline Inteconnector Stage 1) and Lake Macdonald (Northern Pipeline Interconnector Stage 2), which is unprecedented since the construction of these dams. If the full entitlements are taken from these dams (and transferred out of the Mary Catchment) it has been predicted by the Technical Advisory Panel for the Mary Basin WRP that significant degradation of the Mary River Cod habitats downstream will occur.

Coupled with this dire prediction for Mary River Cod habitat in the Obi Obi and Six Mile Creeks, is the significant drought that is currently occurring in the Western Mary Sub-catchments (Widgee and Munna Creeks) which have historically been good Mary River Cod habitat. At present significant waterholes that once contained Mary River Cod are drying up, with locals reporting not seeing Mary River Cod of late.

The mitigation strategies for the Mary River Cod (and Lungfish) (page 9-91) are fundamentally flawed, particularly the strategies involving retention or revegetation of riparian vegetation within 1.5 metres elevation of Full Supply Level (FSL). This assumes that the dam will continually be within 1.5 metres of FSL, which is obviously not achievable if the dam is intended to supply bulk water to Brisbane. The critical time of the year for Mary River Cod breeding is August – September, which is also the time when the dam will be optimised to provide water to Brisbane, and it is expected that water will not be within the critical habitats (1.5 metres elevation of FSL) required for spawning.

It is also questionable whether the dam temperature will significantly alter during the spawning period (August – September) which is a critical cue to Mary River Cod for breeding (Simpson & Jackson).

The EIS assumes that Mary River Cod broodstock will always be available for hatchery purposes (p.9-92). Broodstock must be continually replaced with wild stock to ensure adequate (optimal) genetic material. But if existing habitat is lost, or degraded either by the proposed Traveston Crossing Dam or the Northern Pipeline Interconnector/s, the potential to obtain broodstock from the wild will decrease dramatically.

The Mary River Cod Recovery Plan precautions against relying on raised broodstock from hatcheries to supplement wild cod populations because '*hatchery operators report that wild cod* *broodstock have become increasingly difficult to catch in recent years, and a significant increase in broodstock numbers above current levels would be both difficult to achieve and potentially damaging to already depleted wild populations'* (Simpson & Jackson, page 27).

The EIS does not address the issue of genetic diversity in hatchery reared Cod fingerlings adequately. To ensure adequate genetic material for broodstock, "Mary River Cod Conservation Areas" within tributaries known to have good Cod populations must be implemented, over and above the conservation areas on Coondoo and Obi Obi Creek. Within these "Mary River Cod Conservation Areas" optimal conditions to ensure the survival of the species is required, such as optimal environmental flows (including flushing flows), excellent water quality and crucial habitat features are maintained.

EPBC Act Species Profile and Threats Database - Lungfish Listing

Inundation of current breeding areas

It is widely accepted that one of the main breeding requirements of the Australian Lungfish (*Neoceratodus forsteri)* is the provision of Vallisneria or Ribbon-plant beds (particularly) in shallow moving water. Inundation of such sites will cause the disappearance of these Vallisneria beds and they will be replaced by aquatic or emergent macrophyte species that are adapted to still waters, both deep and shallow. While it has been found that lungfish have on occasion laid eggs on emergent macrophytes this is a very uncommon occurrence and the survival of the eggs and hatchlings from these sites is unknown. Macrophyte beds (Vallisneria) in flowing waters provide many conditions for the eggs, larvae and juveniles including the following:

- High and constant oxygen levels to maintain viability of the eggs (not expected in still waters with abundant waterweeds)
- Low sediment adherence probability. Sediment can smother eggs in slow moving or still waters and this will kill the eggs.
- Adequate refuge and protection from predators for young. Lungfish have adapted to utilise this type of macrophyte and their ability to successfully reach adulthood amongst different macrophyte species in the wild is unknown.

So very little is known about the ecology of hatchlings and juveniles and their utilisation of their natural habitat, that any conclusions regarding successful utilisation of a different habitat have to be ill founded. Occasional success does not ensure a sustainable population.

Current evidence from the Burnett River suggests that breeding rarely in occurs in the deep, steep-sided pools created by dams and weirs (Brooks and Kind 2002). Successful utilisation of replacement habitats by eggs and young lungfish in the Paradise Dam impoundment has not been observed, therefore there is no basis for assuming that there will be successful breeding in the Traveston Dam impoundment.

Reduction in flow of downstream areas

Reduced flows in downstream sections of the Mary River will initially affect the shallower areas, which are the breeding locations for *N. forsteri*. Currently the long glides that provide the best conditions for Vallisneria growth, and consequently breeding and feeding habitat for the lungfish, are located at sites where flow is guaranteed even during drier periods. Water releases from Bourumba Dam help to ensure this is so in sections downstream of the Yabba confluence. Environmental flows from Bourumba Dam will be incorporated into the inundation area and will be lost to downstream flow. Minor flushes are not likely to reach downstream sections of the river.

The consequences of downstream drying are that the Vallisneria beds will be temporarily or permanently exposed and the plants will die. It takes some time of low, stable flow to re-establish macrophyte beds. Oxygenated water may be available during high flow periods but these occasions usually occur after the major breeding season (early Spring to early-summer) has finished.

Temporary water flows will be of no value due to the lack of macrophytes and the likely high velocity of these flows. lungfish breeding habitat is highly susceptible to flow changes.

Adult habitat issues

Inundation area

While adults are known to utilise impounded areas, such habitats provide less variability of habitat such as is provided by the typical pool/riffle systems of the Mary River. Juvenile fish that have left the refuge of the macrophyte beds are particularly cryptic and their requirements are very poorly understood. It is therefore unknown whether impoundment habitats provide the requirements for juveniles to grow to maturity. It is probable that the populations that survive in other impoundments are static and not being replaced by successful breeding.

The expected bloom in waterweed growth during the warmer months is likely to result in regular fish kills, as has been experienced in recent times in long deep pools on the main trunk of the Mary River due to excessive growth of *Egeria densa*. The effects of these kills on the food webs is unknown so that, while lungfish can survive the low dissolved oxygen levels, their prey items may not and a lower carrying capacity may result.

Downstream habitats

Lower flows downstream will cause isolation of fish from each other, from breeding sites and from foraging areas. It will reduce the size of deep pools, reduce oxygen levels in the pools, reduce the downstream flow of energy through nutrients and organisms and therefore reduce the carrying capacity of the river as a whole.

Macrophyte beds provide a major foraging area for both juveniles and adults and their loss (as discussed above) will have immediate effects on both refuge and feeding opportunity.

Populations of lungfish in the middle/lower Mary River are phenotypically different to those both of the upper reaches and the Burnett River. They present as shorter fish with a greater girth relative to body length. These populations could provide important research opportunities into genetic expression and may reflect environmental conditions not well understood at this time. Such conditions may be altered by a changed flow regime and may even reduce the survival of these populations.

Effects of barrier

The dam wall will be an impassable barrier isolating upstream and downstream populations and causing damage to individuals that pass over. A fish passage structure of this magnitude is unlikely to succeed given past performance at other locations.

The barrier will also prevent underground flows which are likely to be essential to recharge of the downstream river sections. The effects of underground flows are poorly understood, therefore the effects of their blockage cannot be predicted. The effects on lungfish and other aquatic life are therefore also poorly understood. Precautionary principal must apply.

The lungfish in the Mary River have been researched to a very limited extent. Many years of extensive research is needed prior to an impoundment being built to determine the habitat requirements and population dynamics of the lungfish in this river system.

SEQ Stream Frogs Recovery Plan

The Mary River is currently one of the main strongholds for the Giant barred frog (pers comm. Harry Hines, EPA 2007) following frog declines and disappearances in the 1970’s and 80’s in upland areas in SEQ and throughout its range in NSW in more recent times. In the Mary River Catchment declines were experienced in the Conondale and Blackall Ranges (headwaters of the Mary River Catchment). The Chytrid fungus deemed responsible for the declines (which is the major given reason for the Giant barred frog being listed as Endangered under the EPBC Act), operates more effectively at high altitudes where temperatures are lower than lowland areas. Therefore the populations remaining at higher altitudes continue to be at risk and population levels have still not returned to 'pre-frog decline' levels. With upland genetic mixing thus compromised it is even more essential to maintain pathways for downstream genetic mixing.

Giant barred frogs show a preference for 3rd, 4th and 5th order streams (Hughes, 2005) and rarely if ever venture into areas where the stream becomes ephemeral.

The main tributaries that carry significant populations of Giant barred frog throughout the whole Mary Catchment, and consequently also within the inundation area (with the exception of Six Mile Creek), are the Belli/Cedar/Blackfellow, Happy Jack, Skyring, Coonoon Gibber and Six Mile Creek systems.

Blackfellow, Happy Jack and Skyring Creeks all rise from the Black Mountain region; an area that is relatively dry and supports drier Eucalypt dominated vegetation. MRCCC searches in the headwaters of these systems have not located Giant barred frogs in the past. Belli and Cedar Creeks rise in the Mapleton National Park, which is a moister area, but where the creek styles do not provide habitat for Giant barred frogs.

Streams dry for much of the year in these locations, and canopy cover can be sparse and of a composition that is not similar to their preferred habitat of vine forest and gallery rainforest. Traversing from one sub-catchment to another is therefore very unlikely.

The upper reaches of the Coonoon Gibber lie along the northern extent of the Blackall Range and genetic mixing via this route may be more likely, however has not been investigated through surveys.

We conclude that during pre-European times in the project area, genetic mixing was more likely to occur along the main trunk of the Mary River via gradual movement along vegetation corridors and via minor and major flood events. Upland mixing in the upland areas of moist habitat found in the Conondale and Blackall Ranges would have complimented lowland interactions.

Further investigation of the sub-catchment sources for suitable habitat and suitability for frog passage is essential before this means of genetic mixing is relied upon. Revegetation of the main trunk of the Mary River should be supported to enhance its function as a conduit for genetic material.

Page 87, para 1 of the EIS states that '*Belli Creek does not support permanent above ground flow*.' This statement is incorrect as the whole length of Belli Creek from Belli Crossing No. 1 to the confluence contains permanent water that flows for much of the year. Belli Creek is likely to support greater numbers of *L. pearsoniana* than are known at this time as might Blackfellow Creek.

- '*it is also possible that the species currently does not occur in the inundation area at all.*' Is incorrect (see above comments).

'***Significance of Inundation Area for Species***

The statement that *"Only a very small part of the inundation area represents potential habitat for the species and it is currently unclear whether the species actually occurs in that area. It is not envisaged that the species utilises the inundation area downstream of potential habitat areas for dispersion or other movements as these represent extensive unsuitable habitat areas*.' is untrue.

L. pearsoniana does occur in the inundation area and it is likely that the Mary River serves as a conduit for genetic mixing especially during minor and major flood events as tadpoles are dispersed.

Pg 91, 9.2.4 Occurrence in the inundation area - Last paragraph – '*It is unclear whether there is movement of individuals between tributaries although this is likely to happen at least occasionally over time and may be important for maintaining genetic diversity within the overall population and reinforcing local extinctions. It is expected that any contemporary movements between tributaries* *are likely to occur by traversing upper catchment areas where larger continuous tracts of forest persist, rather than via the Mary River riparian corridor*.'

There are major knowledge gaps in the Mary River Catchment north of Gympie to Doongul Creek in the Burrum River system. There are no known Giant barred frog records in this area. Tinana Creek to the east, which joins the Mary River in the tidal section near Maryborough, has Giant barred frogs in the mid reaches east of Gympie. Habitat preference would make it unlikely that Giant barred frogs would occur in the drier sub-catchments to the west of the Mary River north of Gympie. This makes the populations within the inundation area even more significant.

General comment on distribution:

Conclusions about the distribution of M. iteratus along the Mary River and tributaries should not be based on the 2006/07 survey effort as this was a time of particularly poor breeding conditions and males were not very vocal compared to other years. More effort along the Mary River is required before the following conclusion can be made: '*it does not appear that the Southern Barred Frog occurs along the entire length of the Mary River within the inundation area'* (9.5.3.2). Further survey effort along Yabba and Kandanga Creeks is also required under better breeding conditions.

Comment on inundation area effects on populations

Giant barred frogs do not occur in all apparently suitable habitats therefore, while it is relatively easy to predict the general ecosystem that they are likely to occur in, to recreate the exact habitat of preference is difficult. The main components of preferred habitat are deep, slow moving water, undercut banks, closed canopy cover, abundant leaf litter. But given all these criteria does not guarantee presence of the frogs. It therefore follows that there are micro-habitat preferences that are unknown to us at this present time. The assumption that ideal conditions can be recreated in areas where these ecosystems and micro-habitat conditions do not naturally occur is unlikely.

If attempted, there would be great difficulties in establishing the required conditions in areas that have an unstable water level. Widely fluctuating water levels in the impoundment and lower tributaries will create unpredictable conditions for establishing habitat. It is most unlikely that Riparian vineforest and gallery rainforests could be established on soils that are not adjacent to water sources or on soils that do not naturally support such ecosystems at present. Without a complex forest structure with adequate moisture levels the Giant barred frog will not be provided with:

- Adequate cover (both immediate cover and general canopy cover)
- Adequate moisture levels
- Food sources
- Adequate water source for breeding
- Reduction in available territorial areas
- Inability to travel unthreatened along watercourses

If undercut banks are created these could only be utilised if:

- The water was located directly below or very close to the undercut so that emerging tadpoles could enter the water quickly.
- There was adequate vegetation cover (difficult to establish with fluctuating water levels) providing the correct micro-climate, leaf litter, food sources.
- Soil moisture levels could be maintained to recreate the whole ecosystem and food web on which he frog relies.

What is needed before mitigation measures can be considered?

- Detailed surveys during ideal weather conditions to better determine local and broader distribution
- Genetic studies to assess contemporary mixing vectors
- Assessment of suitability of upland and riverine areas for frog migration between sub-catchments
- Suitability of proposed revegetation areas for recreation of habitat
- Determination of time required for recreated forests to become habitat suitable for sustaining populations of Giant barred frog
- Likelihood of recreation of suitable ecosystems in areas where there is temporary or nil water in the near vicinity

General concerns with the EIS in relation to Threatened Species of the Mary River Catchment

Terrestrial Fauna Gap Analysis

Table 4.1- *Litoria pearsoniana* is Vulnerable under the NCA not Endangered.

Terrestrial Environments Version E, Chapter 7

- Where is any mention of Cod, Lungfish and Turtles in this chapter???
- Table 7.21 – *Litoria pearsoniana* has been located within the project area on Blackfellow Creek.
- 9.4.2 – Grey headed flying fox colony within project area. Shows limitations of 6 months worth of surveying.
- 9.5.3.2 – This distribution of Giant barred frog is derived from old data and not even based on ESS's (Morgan Thomas) research!

Appendix F4.3 A4

- Pg ii – Table of contents in error – *M. iteratus* information not on page 90.
- Pg 4, Table 2.2
  - *Ornithoptera richmondia* – Recommended survey approach – MRCCC and CSIRO already conducting *Pararistolochia praevenosa* and *O. richmondia* surveys.
  - Litoria pearsoniana noted as Endangered under the NCA – Is Vulnerable under the NCA
  - *Elusor macrurus* and *Elseya albagula* – Tiaro Greening Australia should read Tiaro Landcare and UQ.
  - *Elseya albagula* – status to be advised

- Pg 25, para 3 – *Litoria lesueuri* is now known as *L. wilcoxii.*
- Pg 29, Table 5.4 – as above.
- Pg 76, last paragraph – as above.
- Pg 33 – check map with records provided to Morgan
- Pg 79, Table 9.1 – *Ornithoptera richmondia* – Likelihood of occurrence in the project area should be 'Likely' due to the recent discovery of butterfly and vine in Belli Creek at Crossing No. 1 and of the butterfly along Happy Jack Creek just outside the inundation area.

- Pg 80, Table 9.1 – *Litoria pearsoniana* is found within the inundation area. Has been found on Blackfellow Creek near the confluence with Belli Creek and on Belli Creek at Crossing No. 3.
- Pg 85, Table 9.1 - *Pteropus poliocephalus* Grey-Headed Flying Fox noted as 'likely' in the project area however there is a known colony in the Tuchekoi area within the inundation area.

EPBC requirements for EIS

The EIS recommends mitigation measures throughout the document, but crucially, there is not any performance criteria attached to the mitigation measure or consequences for non-implementation or performance. It is evident that such a performance-based program was not applied (or at least not adhered to) for the Paradise Dam and many of the proposed mitigation measures either do not work or have not been implemented.

The Paradise Dam Audit needs to be released to the public, in order for the Coordinator General to properly assess the proponent's (QWIPL) fitness to abide by the conditions contained in the Traveston Crossing Dam EIS.

National Biodiversity and Climate Change Action Plan 2004 - 2007

The National Action Plan for Biodiversity & Climate Change is not referred to in the EIS, however this plan recognises "*that climate change will increase the risk of extinction for species that are already vulnerable (p.14, National Biodiversity and Climate Change Action Plan 2004 - 2007* " . Therefore species such as the endangered Mary River Cod and Turtle and the vulnerable Lungfish, who have limited ranges and are currently already at risk of extinction are the most likely to be severely effected by climate change. Therefore it is disappointing that this fact is not recognised in the EIS.

The Action Plan recognises that current stresses on aquatic and semi-aquatic ecosystems, such as modified flow regimes (from dams, weirs and irrigation) will increase the vulnerability of freshwater biodiversity to climate change (p. 22, National Biodiversity and Climate Change Action Plan 2004 – 2007).

Strategy 3.2 of the National Biodiversity and Climate Change Action Plan (p.23) states that all jurisdictions (State & Federal Governments) should be "*integrating consideration of the impacts of climate change on biodiversity into water allocation and management strategies that deal with hydrological systems*".

The EIS does not attempt to model climate change scenarios into the dam yields, and the environmental flow objectives (EFO) downstream of the proposed dam, which is in direct conflict with the National Biodiversity and Climate Change Action Plan (2004 – 2007)..

National Agriculture & Climate Change Action Plan 2006 - 2009

The EIS does not refer to the National Agriculture & Climate Change Action Plan 2006 – 2009, although the Queensland State Government is a signatory to this plan. The plan recognises that changing rainfall patterns combined with higher temperatures could reduce water availability and add pressure on water allocation systems (p.7).

Therefore it would be prudent for the EIS to model climate change scenarios on the effect of rainfall on dam yields, and the likelihood of impact to downstream water allocation security objectives contained in the WRP under a series of climate change scenarios. However the EIS does not model for climate variability or climate change.

Great Sandy Strait Australian Heritage Commission listing

The EIS has not considered potential Australian Heritage Commission implications (as an EPBC Act trigger) if the Great Sandy Strait / Cooloola region nomination proceeds. At present the AHC is considering nomination of the Great Sandy Strait / Cooloola region for heritage listing.

An Integrated Catchment Management evaluation of the EIS

Review of the cumulative impacts assessment in the EIS

One of the problems with the way the EIS has been structured is the piecemeal approach to investigating the impacts and risks of the project, which makes it difficult to integrate what the implications of the project are likely to be for the river system and the communities of the Mary Valley as a whole. Even though a formal methodology has been used in the Cumulative Impacts Analysis presented in Chapter 17, the basic information that was used as input to this process, as presented in Appendix F12, is severely lacking in credibility. Much of the information is internally inconsistent, makes assumptions not supported by the scientific data in the EIS and is clearly at odds with local knowledge of the catchment. Some of the mistakes may just be the result of a lack of professional diligence in the editing of the information, such as the example on page 13 (which lists the risk of nutrient enhancement in the storage as a high benefit ascribed to the project!) However some of the statements are just incomprehensible, such as the statement on page 20 that the predicted downstream flow regulation will have an immediate high local benefit to downstream habitats, and then somehow relating this statement to a comment about para grass control by allowing increased cattle grazing in the river. In many cases, the mitigation strategies mentioned bear no relationship to the risks being tabulated.

In addition to the lack of credibility of the information included in the analysis, it is also instructive to examine some of the major predictable and relevant risks that have been left out of the analysis. Nowhere does this analysis mention the Ramsar wetlands or the Great Sandy Strait in general – one of the Matters of National Environmental Significance that the EIS is supposed to specifically examining. This analysis does not once refer to risks associated with climate change. The analysis does not mention salinity (the Mary is a priority catchment under the National Action Plan for Salinity and Water Quality). The analysis nowhere refers to assessing human health risks such as methyl mercury accumulation or increased mosquito populations. The analysis does not address the problems caused by the large areas of bare soil that will be exposed during extreme draw-down events like that which would have occurred in 2002. The analysis does not even address the risk of dam failure.

It seems that the entire risk and opportunity analysis outlined in Appendix F12, which provides the base information for the cumulative impacts assessment, appears to be nothing more than a box-ticking exercise, conducted in the expectation that no-one would actually attempt to read the miniscule fine print and examine the credibility of the underlying information being presented. Certainly, none of this information was prepared in consultation with the local community or anyone with specific expertise in the functioning of Mary Catchment, and the information was obviously not adequately checked before being published in the EIS. This completely undermines the credibility of this part of the EIS and the whole section is an insult to the intelligence of anyone seriously investing time in attempting to assess the overall risks that this project poses to the Mary Catchment.

Traveston Crossing Stage 1 in context with current and proposed future water infrastructure development in the Mary catchment.

Currently, not all water allocated from the Mary is actually taken from the river. Therefore, the levels of flow that are currently observed and measured in the river are somewhat better than what would occur in the 'current allocations' scenario presented in the flow modelling in the EIS.

In particular, the 'current allocations' scenario includes the effect of extracting approximately 50% more water from Baroon Pocket dam than what is currently being taken (via the Northern Pipeline Interconnector Stage 1) as well as taking any unused existing water allocations from Borumba Dam via the Goomong Pocket pump station (via the Northern Pipeline Interconnector Stage 2).

It is also important to note that State Government has planned and legislated for the intent to extract 150GL/year from the river at the Traveston Crossing, as outlined in the strategic reserve written into the Mary Basin Water Resource Plan. The proposed 70 GL/yr extraction assessed in this EIS is merely the first stage of the ultimate intent to operate the proposed storage at a full supply level of 79.5 m AHD and ultimately extract 150GL from the river via this dam. This is clearly written into the water supply portfolios evaluated in Chapter 2 of the EIS document and the proponent has already commenced land purchase needed for this later stage.

The river and estuary already experience periods of considerable stress at the existing level of extraction. This is borne out by the poor water quality in data presented in Chapter 6 of the EIS, and the evidence of rampant weed infestation and fish kills in the river during periods of low flow, as illustrated in Figure 8.1 and 8.2 of the EIS. It is also borne out by comments in Appendix F 6.1 regarding the current effects of infrastructure on the estuary. This current state of the river and estuary corresponds to a situation where the predicted Mean Annual Flow at the dam site has only been reduced to 6% below the pre-development state. With this in mind, even the crude Mean Annual Flow predictions offered by the proponent paint a grim picture for the river if this project is allowed to proceed.

Reduction in mean annual flow compared to predicted pre-development flows

(#Data from Report 17 in the EIS and *IQQM modelling conducted for the Mary Basin Water Resource Plan)

(* at this level the river already periodically suffers from flow-related stresses, significantly worse than ‘natural’)

	Current situation*	Full allocations (NPI stage 1 & 2)#	Traveston S1 (70GL/year)#	Traveston S2 (150GL/yr)
Dagun Pocket	6%	10%	23%	
Fisherman’s Pocket	9%	9%	18%	>27% *
Mary River Barrage	7%	8%	12%	

The implications of the proponent’s flow and storage predictions for the health of the Mary catchment.

To make a better attempt at understanding what implications the proposal is likely to have for the catchment, we took an integrated catchment health approach, looking at what the proponent predicts the project will do to the flow regime and physical characteristics of the river, and putting that in context with local data, observations and knowledge to examine the likely impacts on river health. This approach should have been the first step in properly evaluating the risks the project poses to MNES such as the Great Sandy Strait and the threatened biodiversity in the catchment. If the basic health of the river, riparian zone and the estuary are compromised with respect to key processes at key locations and times for the survival or reproduction of significant species in the river, then biodiversity conservation in the catchment as a whole is at risk, irrespective of what other piecemeal mitigation measures are taken with respect to specific impacts here and there.

The 2007 International River Symposium produced the ’Brisbane Declaration’ on environmental flows. This declaration outlines an internationally agreed framework for current world’s best practice in ecologically sustainable river management. It is reproduced in the appendix to this submission. For the reasons outlined in this Declaration, we have paid very close attention to the proponent’s predictions of the impacts that this project would have on flows in the river if it were to proceed.

It is our experience that the most significant threats to river health in the Mary occur in times of extremes of flow (either extended periods of low flow or in major flood events), or at times when water levels fluctuate rapidly. The Mary is an extraordinarily variable river, in terms of flow rate, stream depth and water quality, and the unique ecosystems that it supports have evolved partially in response to this unique pattern of spatial and temporal variability. To properly examine the impacts that the dam proposal is likely to have on the river, it is important to examine the proposal's likely impact under these extreme conditions, rather than merely using mean or median statistics, which will not adequately reflect the impacts on important ecological process. It is important to examine the risk of causing major 'threshhold' events which may push some aspects of river health (such as localised breeding populations of important species) beyond their ability to recover.

With this in mind, we chose three particular sections of the river for which we have good observations and data and that we consider to be important locations when evaluating the impacts of the proposal. These are:

- the Mary River Barrage (the interface between the river and the estuary)
- the reach between Dagun Pocket and Fishermans Pocket (where the most extreme downstream freshwater impacts will be felt). This includes the river in the vicinity of the City of Gympie
- the proposed impounded area (where obvious major changes to the valley as a whole will occur).

At each location we investigated the specific impacts the proposal would have caused had it been in operation over the period from late 1999 to 2007, based on the flow and storage data presented by the proponent in the data for Report 17, the geometry of the storage outlined in Report 15 and the evaporation and seepage models assumptions presented in Chapter 6. (In one analysis of the barrage, we also used data from 1996 to 2002, because we did not have access to suitable measured data from the barrage from 2002 onwards.) We compared these impacts with actual observations of the state of the river over the same period. This period includes an extreme flood event (1999), several periods of low flow and several periods where the water levels changed rapidly. It is also within the accurate memory of people living in the catchment, so it is possible to relate the data presented directly to people's experiences.

The results of these analyses are published in an MRCCC technical report "Hydrological analysis of the flow and storage data presented in the Environmental Impact Statement for the Proposed Traveston Crossing Dam", which accompanies and forms part of this submission.

According to the objectives of the National Water Initiative and the EPBC Act, the onus is on the proponent to make the scientific case that the river will not be pushed beyond the limits of ecologically sustainable water extraction by the project, and that the project will pose no residual risks to the survival of the listed threatened species associated with the river and to the ecological processes which support the biodiversity of the Great Sandy Strait. In assessing these risks, the proponent is bound to comply with the broader principles of ecologically sustainable development, and apply the precautionary principle in particular.

Our analyses of the predicted flow and storage data presented by the proponent leads to the conclusion that the project is likely to push the flow and water quality regime at crucial times and locations in the river to states that are significantly beyond the range of conditions currently experienced in the river. We are concerned that if Traveston Crossing Dam proceeds, critical thresholds for ecosystem resilience may be crossed, leading to irreversible impacts on the ecological processes in the catchment which currently support the Mary River's significant threatened species and the biodiversity of the Great Sandy Strait. This is a fundamental change from its current state, where there is still a degree of ecosystem resilience remaining which allows the river to recover from extreme events. Some of these concerns are specifically outlined in the following sections.

Catchment impacts upstream of Traveston Crossing

Direct effect on the community and land holders

The map on the next page gives an insight into the extent of the impact that the proponent has already had on the landholders and communities in the proposed inundation area. This figure shows a map of properties that had been purchased for the project up to mid September 2007. It can be seen that the proponent had already targeted properties outside their stated land purchase plan and well outside the Stage 1 project area defined in the EIS. In fact, the land purchased already amounts to more than 7265ha at a cost of more than 275 million dollars, involving more than 400 properties. This compares with the figure of 241 million dollars quoted for the total stage 1 land purchase cost in the chapter 2 of the EIS, a figure of 334 properties 'affected' by stage 1 quoted in chapter 4 of the EIS and the total stage 1 project area quoted as 7277 ha., including all roads and infrastructure.

It is clear that the description in the EIS of the area of land, number of properties and cost of land acquisition directly required by stage 1 of the project understates the scale of the actual impact that the proponent has already had on land holders in the Mary Valley. This level of impact is quite extraordinary considering the project has not yet been subjected to a social or environmental impact assessment and it has not been granted approval to proceed under either State or Federal law.

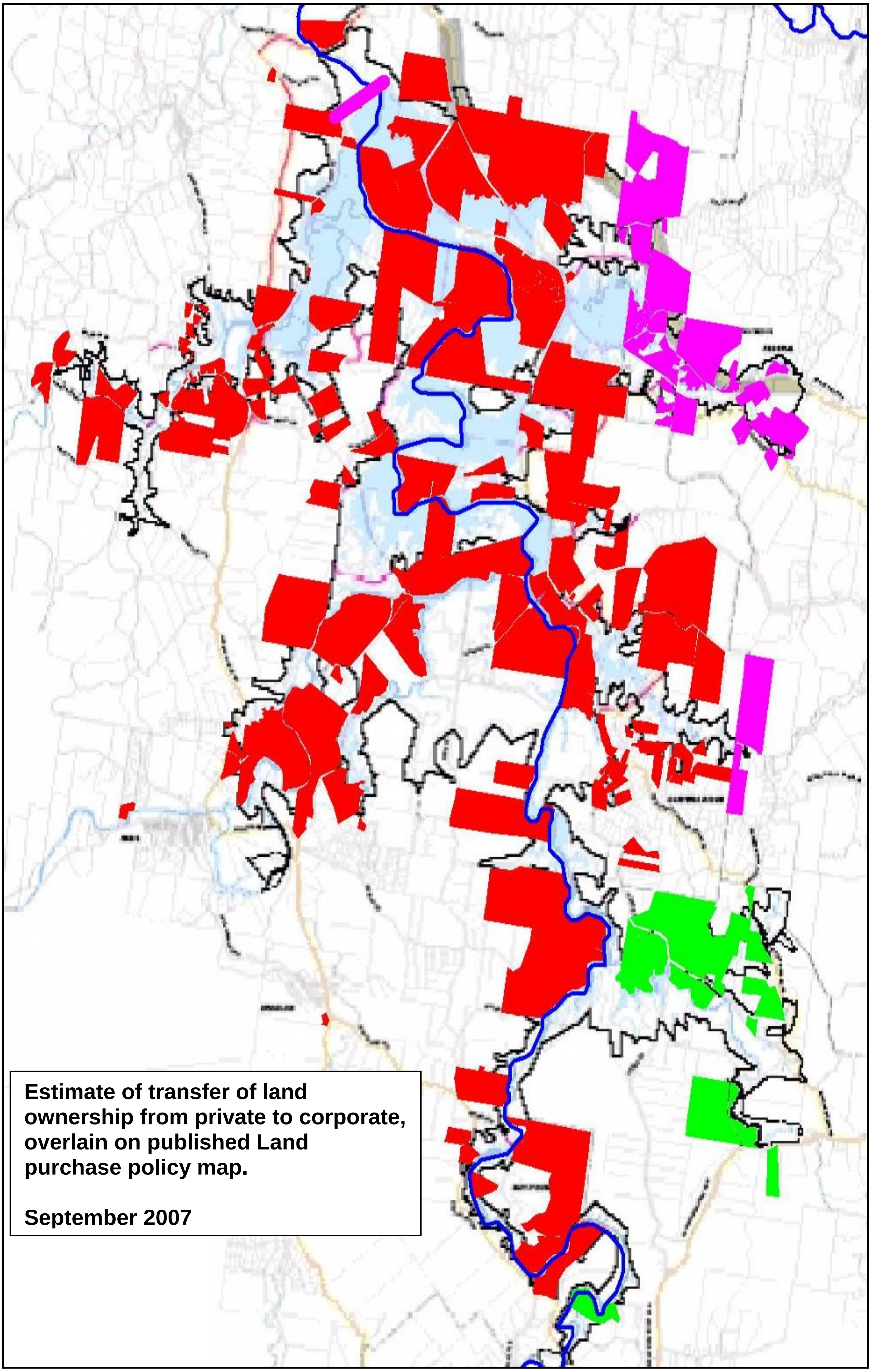
The effect of this level of social disruption in a short space of time on the character of local communities in the Mary Valley cannot be overstated. The effect on attitudes to land management within this environmentally sensitive part of the valley also needs to be emphasized. The EIS itself points out that most of the land in the project area is class A good quality agricultural land. However, there are specific land and water management issues in this part of the catchment relating to the intensity of past farming practices. These issues include high nutrient levels in run-off and groundwater, stream bank collapse caused by loss of riparian veg, cattle access and past sand and gravel extraction and groundwater salinity and pesticide contamination. These issues can only be solved or mitigated through the active participation and goodwill of active landholders

This large area of prime agricultural land already purchased by the proponent is now being temporarily managed by tenants with no incentive for investment in long term rehabilitative land or riparian management practices. In fact the expectation being promoted by the proponent that the land will be destroyed by a future dam actively encourages exploitative land use practices and neglect. The manner in which the proponent has been permitted to proceed with this land purchasing activity in such an aggressive manner in advance of the project receiving the necessary approvals under State or Federal Law has already been very destructive to the community and has impacted on attitudes towards long-term land management and stewardship throughout the valley.

Flood impacts

The flood modelling presented by the proponent does not match historical observations of flood behaviour in the area upstream of the proposed dam, particularly in the upstream tributaries. The predicted no-dam 1:100 flood levels are up to 2m below historically recorded flood heights at Imbil, and the no-dam predicted flood extents are many hundreds of metres in error in some places, most notably in the vicinity of CoonoonGibber Creek. The proponent has persistently mislabelled and mis-mapped some of the upstream tributaries, and the structure of the hydraulic model used did not accurately represent the structure of the catchment, leaving out many important tributaries and flow structures. A full technical description of the many problems found with the flood analyses presented in the EIS has been prepared by the SaveTheMaryRiver Coordinating Group, one of the active community groups in the catchment, and we refer to the detailed analysis contained in their submission.

A crucial finding is that the proponent's own data show that the 1893 flood event would have delivered enough water to abundantly overtop the dam crest in the event of a spillway blockage. This is important because the proponent proposes to allow upstream areas of the Mary Valley at elevations lower than the dam crest height to remain inhabited (including the townships of Imbil



Estimate of transfer of land ownership from private to corporate, overlain on published Land purchase policy map.

September 2007

and Kandanga) thus inundating these people in the lake itself should such an event occur.

For reasons explained in the flood analysis contained in the SaveTheMaryRiver submission, the flood modelling presented by the proponent also systematically underestimates the upstream area that will be affected by increased risk of flooding and does not accurately predict flooding duration in the closely settled upstream tributaries. This cast doubts on the accuracy of predictions of property purchase requirements, the planning of linear infrastructure replacement, and the true social and economic cost of the project.

The effect and management implications of fluctuating water levels in the storage on aquatic and edge habitat

Analyses 8 to 10 in the MRCCC hydrology report illustrate the effect of fluctuating water levels in the proposed storage on the area of different aquatic and edge habitats that would be created in the project area. These data are derived directly from the volume/depth/surface area relationship presented in report 15 and the modelled daily storage data presented in report 17. The creation of large areas of new vacant aquatic habitat in the valley creates a risk of invasion and colonization by the opportunistic weedy species that are already present in the valley, but whose distribution is currently limited by the amount of suitable habitat.

Analysis 8 shows the area of exposed soil and mud flats that would have been created by the operation of the storage along with the area of very shallow swampy habitat less than half a metre deep. The highly variable, and occasionally very large (thousands of hectares) area of periodically exposed bare soil is very likely to be colonized by opportunistic noxious weed species such as parthenium, castor oil plant and noogoora burr, all of which already occur on disturbed land in the Mary Valley. Regularly creating such large areas at risk of this invasion, in a situation where any seed set will be distributed downstream following periodic inundation would create a situation totally outside of usual state of affairs in the valley. It is hard to see how this risk could be effectively managed other than by extraordinary diligence and the repeated use of herbicides in the storage area. If this was the case, the bare soil itself poses a significant risk of erosion during runoff and a resultant adverse impact on water quality with every exposure/inundation cycle. The soils in the impounded area are very deep, and many of them are dispersible (as outlined in chapter 5 of the EIS). This recurring risk is not likely to diminish during the life of the storage.

The relatively constant area (several hundred hectares) of shallow swampy margins less than knee deep are likely to create ideal habitat for other invasive exotic species such as para grass and hygrophila, both of which cause problems in the catchment already. This fairly constant-sized zone of still, warm, shallow water, colonized by emergent weed species, migrating backwards and forwards across the floodplain with the fluctuating shoreline is also likely to create ideal habitat for the increased breeding of mosquitoes and cane toads. This is a totally different edge habitat regime to what currently occurs within the channel of the river, where stream margins are generally well defined spatially and water levels fluctuate greatly with time.

Analysis 9 shows the amount of still water habitat less than 2 metres deep. This is about the limit of what can be colonized by emergent plants. This area of approximately 700 hectares constitutes a major increase in this habitat in the catchment, and presents an ideal opportunity for invasion by plants such as hymenachne, which has already appeared in limited outbreaks in the catchment nearby.

Analysis 9 also shows the area of still water habitat less than 4 metres deep. This provides the ideal habitat for the submerged water plants that already cause major problems in the existing storages in the Mary Valley, namely dense water weed (Egeria), Cabomba and hydrilla. This relatively constant additional 1400 ha of vacant habitat being made available for these species needs to seen in the context of the annual expense of controlling cabomba alone in nearby Lake Macdonald. About

70% or approximately 182 ha of Lake Macdonald is infested with cabomba, and management (by continuous mechanical harvesting) costs $140,000 per year. An equivalent costing would place the ongoing management cost of submerged weeds in the first stage of the proposed Traveston Crossing dam in excess of 1 million dollars per annum.

Perhaps the most significant new habitat to be created is the extensive (up to 3000ha) of virtually non-flowing, unshaded surface water habitat. This is almost certain to be colonized by salvinia and water hyacinth, which already cause major problems throughout the catchment in low-flow situations. The proponent makes the outrageous statement in the EIS that infestation by these species will be able to be controlled by early management intervention and that they do not cause problems in any other storages in South East Queensland! The photograph below shows the resident hyacinth infestation in the Mary River Barrage storage in late 2006. It was not under control, and was causing extreme ecosystem health problems at the time. This infestation was eventually flushed out by the August 2007 flow event, the same event that would have been captured by the Traveston Crossing Dam had it been built. The photograph also gives an indication of the mass of floating plant material that the spillway gates, off-take works and fish and turtle way works will need to be designed to cope with.

Drought impacts

Analyses 8 to 13 all indicate how severe the draw down event would have been during the period of low flow that the river experienced in 2002. In fact analysis 10 indicates that this event would have seen the storage retreat back into the original stream channel, if it had still been in place. One aspect that is not explained in the EIS at all is how the proponent intends to extract water out of the storage and deliver it to the water treatment plant at these low levels of storage. In fact the dead storage information in chapter 6 the EIS suggests that the modelling of storage yield was based on the assumption that the storage could be drawn down to less than 2.5% of full supply capacity for water supply purposes.

However, there is little description of the new water supply intake works that will allow this to occur in the EIS at all, except for their position being shown in figure 4-3 and 4-25 well away from the dam wall in Coles Creek. Section 11-47 of the EIS mentions that the pump station is intended to be 30m below the level of the water surface. This would indicate that the offtake works would need to be built during construction of the dam, are likely to have environmental impacts during construction and may indicate an intention to extract water from the groundwater basin under the proposed storage. It is a major flaw in the EIS that full details of this structure and its potential impacts are not disclosed in the EIS.

In any case, surface water quality is likely to decline to unacceptable levels long before storage levels fall this low, and there is not enough depth in the storage at these low storage volumes for a multiple level offtake to offer much choice about where to draw water from.

Riparian Vegetation Re-classification

The re-mapping of endangered riparian rainforest (12.3.1) has resulted in a significant reduction in the vegetation community effected by the dam proposal, and re-classified this vegetation community as either 12.3.2 or 12.3.7.

There is no question that these 3 RE's do exist or coexist in similar circumstances (ie predominantly riparian vegetation on alluvium) and often overlap. As a consequence it is difficult to define the edge of each vegetation community.

Regional Ecosystems were formulated to map vegetation and geology on a regional scale. Slicing these up on the property level is certainly not the way RE assessment was designed, and can lead to conflicting information (Russell, 2007).

The methodology for re-classifying the vegetation community is dubious, and is based on measuring forest heights (in particular the dominant species - *Waterhousea floribunda*) of the 12.3.1 vegetation community in a situation which could be considered 'atypical' of the 12.3.1 vegetation community (e.g. site T6 on Belli Ck). Waterhousea rarely reaches heights of 33m and forest heights of 40-45 metres tall are uncharacteristic (Russell, 2007).

Using this methodology will be significantly affecting figures for remnant / non-remnant ecosystems that have been mapped in conflict with EPA data.

The methodology used for the EIS seems to conflict with the EPA standards for establishing benchmark sites, according to the "methodology for surveying and mapping of regional ecosystems and vegetation communities in Queensland". According to page 30 of the methodology (section 3.3.3 Reference Sites) "reference sites should occur as close as possible to the area to be assessed and have similar environmental conditions, i.e. the same regional ecosystem and vegetation community and similar climate (same sub-region), landscape condition (soil, slope, position in the landscape, geology etc) and natural disturbance (cyclone impacts or fire history).

The MRCCC cannot stress enough that the vegetation communities need to be accurately mapped, to minimise environmental impacts and maximise ecological outcomes. The original EPA Vegetation Management Act 1999 mapping that has been provided for the EIS should be used.

The vegetation mapping inaccuracies contained in the EIS will have an adverse effect on the long term ecological outcomes for this area, both in assessing what is present and converting this to offsets.

Water Quality and Aquatic Ecosystems

The MRCCC greatly contributed to and fully supports the information present in sections 6 and 8 of the SaveTheMaryRiver Coordinating Group submission on Water and Aquatic ecosystems. We wish the points raised in those sections to be considered the view of the MRCCC on those matters.

3 Evaluation of alternatives

As part of it's role the MRCCC has consistently promoted water efficiency and a forward–looking approach to using a wide range of water supply technologies, as outlined in the MRCCC publication "Water for the Future"

We support the range of innovative water supply technologies being developed by the State Government and believe they offer the hope for more sustainable management of water resources in the Mary Catchment and in SE Qld in general. We also support the analysis of water supply options undertaken by the ISF and Cardnos on behalf of the Mary Valley Council of Mayors and the general economic investigation of water supply alternatives undertaken by Marsden Jacobs for the ACF.

We are disappointed that the EIS for the Traveston Crossing Dam proposal did not encompass a wider range of options, did not look at all aspects of the relative advantages and disadvantages of proposed water supply portfolios for South East Queensland, and did not look at the wider regional implications for future water supply security for the future demand within the Mary Catchment. As such, we believe that the EIS does not comply with the TOR.

We have included a summary multiple-criterion comparison of a number of water supply options against the Traveston Crossing proposal, looking at some of the issues that we believe should be considered in the assessment of this proposal against alternatives

The MRCCC would like to propose an example of the type of alternative water supply scenario that could have been investigated in the EIS. Scenarios like this allow more scope for achieving a balance between providing for future urban water demands and maintaining the health and biodiversity of the Mary River and the Great Sandy Strait.

Consider this scenario for 2020 :

"Brisbane and all major urban centres have best practice water efficiency and reuse facilities. Direct rainwater and stormwater harvesting are utilized to their maximum extent, particularly being built into new developments. More than half the time, there is sufficient water in existing storages to meet demand without limiting economic activity and without the need to run the desal plants connected to the Sunshine Coast , the northern suburbs of Brisbane and Brisbane River (integrated with the state of the art urban stormwater collection and potable recycling schemes). These plants come on line to supply reliable water in dry times - at a cost far cheaper than the Traveston Crossing idea that caused so much uproar when it was proposed more than a decade ago. The water quality in Moreton Bay and in most urban streams is already improving dramatically since this approach was adopted. Unfortunately, the North Pine River still gets a regular D report card for water quality, but there is little that can be done to compensate for the effect of the dam upstream.

In fact, because of the designed efficiency in water use and availability of backup desal in the new developments in Manoosaloundra, the water that was once diverted from the Mary River to the Sunshine coast has been allowed to flow back down the river from the dams in the wet headwaters of Obi Obi , Yabba and Six Mile Creeks, providing an extra 50GL /year of water supply for the recent well-planned growth in the Mary Valley and the large urban centres from Maryborough to Hervey Bay. So far, the well-planned option of raising Borumba Dam has not had to be brought on stream, although a new multi level off-take was fitted 5 years ago which has greatly improved water quality.

Benefiting from the return of flows to the river, the previously endangered iconic species of the Mary River are well on the road to recovery, and the estuary is starting to recover after the adoption of much more enlightened operation rules for the barrages at the river mouth. In fact, researchers are investigating the best methods for decommission the barrages, in favour of using a system of harvesting into off-stream storages during high flow events, a move which is still controversial but has growing local support. "

Multi-criterion comparison of water supply alternatives

	Demand management	Rain water tanks	Stormwater harvesting	Non-potable recycling	Potable recycling	Desalination	Traveston Crossing Dam
Biodiversity	No direct impact	No direct impact	Possible positive impacts –improved stream water quality	Possible risks in case of system failure. Possible waste stream impacts.	Possible risks in case of system failure. Possible waste stream impacts.	Possible waste stream or local infrastructure impacts.	Many certain direct adverse impacts on threatened and protected species and ecosystems
Energy	Saves energy	Energy use dependent on pump efficiency and use of gravity (tank stands)	Energy requirement for local pumping and treatment	Energy requirement for local pumping and treatment	High energy requirement for multiple water treatment stages and long distance pumping (if pumped back to dams)	High energy cost - but produces high-quality water under pressure. Able to be positioned close to demand thus reducing energy required for pumping.	Very high energy requirement for long distance pumping and water treatment. Energy cost comparable to desalination.
Climate change	Essential first response to climate change.	Rainfall will be significantly less affected than streamflow or runoff with predicted climate change. Tanks provide efficient storage	Urban hard surface stormwater runoff will be less affected than streamflow with predicted climate change. Cisterns provide efficient storage.	Will operate under drought conditions but supply gradually decreases	Will operate under drought conditions but supply gradually decreases	Will operate under drought conditions. Supply remains constant and reliable throughout.	Based on the capture and highly inefficient storage of surface water streamflow, - the most unreliable fresh water resource under predicted climate change. Will fail within 18 months of commencement of drought conditions.
Social equity	Some risk of the pricing impact not being equitably distributed	Not available as an option for all members of society	Local infrastructure impacts, but does not displace communities	Local infrastructure impacts , but does not displace communities	Local infrastructure impacts , but does not displace communities	Local infrastructure impacts , but does not displace communities	Unacceptable levels of social disruption and displacement of entire communities. Removes a regional water resource and associated environmental services from one community for the benefit of another with no compensation.
Potential for growth	Essential in the face of growing demand	Resource increases with increased roof area	Resource increases with increased urban hard surface	Resource increases with increasing consumption	Resource increases with increasing consumption	Resource only limited by suitable locations, no volume limitation	Stage 1 proposal already beyond ecologically sustainable level of extraction

	Demand management	Rain water tanks	Stormwater harvesting	Non-potable recycling	Potable recycling	Desalination	Traveston Crossing Dam
Economics *(Marsden Jacobs The economics of rainwater tanks and alternative water supply options 2007)	*Most cost-effective option	*Highly variable – depending on installation details. Competitive with expensive options like Traveston Crossing Dam and desalination	*Comparable to demand management	*Variable – depending on pipeline and pumping costs	*Variable – depending on pipeline and pumping costs	Less expensive than Traveston Stage 1 when delivery costs are taken into account.	More expensive than desalination when all costs (including long distance pipeline, pumping and treatment) are taken into account
Estuarine and marine impacts	No foreseeable impacts	No foreseeable impacts	Beneficial water quality impacts	Possible reduction of nutrient loads in streams	Possible reduction of nutrient loads in streams	Removal of fresh water yield only from source waters. Local infrastructure impacts (tunnels/ pipes). No change to freshwater, nutrient or sediment inflow regime in estuary	Removal of freshwater yield + evaporation and seepage losses from receiving waters. Disruption of freshwater, nutrient and sediment inflow patterns.
Health Risks	No foreseeable impacts	Possible water quality and mosquito risks from un-maintained tanks	Possible insect risks	Possible risks of cross contamination with potable supply	Possible risks in the case of multiple barrier breakdown. (Needs to be viewed in context of comparison with current water and sewage treatment practices)	No obvious impacts. High quality treated water.	Risks associated with poor water quality – algal toxins, mercury, manganese and other metals. Local health risks from greatly increased mosquito habitat.
Landscape impacts	No impacts	Minor visual impact	May have positive impact on degraded urban landscapes	Minor- associated with works and pipelines.	Minor impacts associated with works and pipelines	Minor impacts associated with works and pipelines. Small land area footprint for treatment plant	Major change to landscape, loss of large area of good quality agricultural land, major riverine ecosystem changes for 200 km downstream.
Irreversibility of impacts	No adverse impacts	Disposal problem of used tanks and pumps.	Storage structures may be difficult to decommission. Not likely to have large scale irreversible impacts	Easy to switch off and/or decommission. May be long term impacts associated with waste stream	Easy to switch off and/or decommission. May be long term impacts associated with waste stream	Easy to switch off and/or decommission. No long-term ecosystem or biodiversity impacts likely.	Difficult to decommission. Large scale and long-term ecosystem and biodiversity impacts may be effectively irreversible

Appendix

Hydrological Analysis of the Flow and Storage Data Presented in the Environmental Impact Statement for the Proposed Traveston Crossing Dam.

S. Burgess

MARY RIVER
CATCHMENT COORDINATING COMMITTEE

Technical Report

January 2008

INTEGRATED CATCHMENT MANAGEMENT

Resource Centre – 37 Nash St, Gympie.
Postal - PO Box 1027, Gympie, Qld. 4570
Telephone: - (07) 5482 4766;
Fax: - (07) 5482 5642
E- mail – mrccc@ozwide.net.au
Website – www.mrccc.org.au

Acknowledgements

The MRCCC would like to thank Mr Darren Edward from the Save The Mary River Coordinating Group for considerable assistance with data preparation and the statistical and mathematical analysis of data.

The MRCCC would also like to thank Dr. David Deeley from Acacia Springs Environmental for the independent checking and verification of hydrographs derived for the river from the raw gauging station data provided by NRW and Sunwater, and for independent checking and verification of modelling calculations.

The MRCCC acknowledges the professional assistance received from Queensland Natural Resources and Water technical staff with respect to the maintenance and provision of the public data services used in these analyses, and in their professional engagement with the MRCCC in supporting the science of managing the Mary River.

Disclaimer

The data used in these analyses were sourced from

- the information published by the proponent in the EIS,
- information provided by the Queensland Government to the 2007 Senate Inquiry into Water Supplies in South East Queensland, as published by the Senate.
- Data made publicly available on SunWaterOnline, subject to the following disclaimer: *Sunwater do not accept and expressly disclaim all liability and responsibility of any kind (including through negligence) for and in respect of any claim, loss, damage, cost or expense which you may suffer or incur (directly or indirectly) in connection with: (a) your use of SunWaterOnline or any linked website; (b) your use of or reliance on, information contained on or accessed through SunWaterOnline, including (without limitation) any information received from Our customer information or enquiry services.*
- Data from the NRW Watershed database, subject to the following disclaimer:
  This document is based on or contains data provided by the Department of Natural Resources and Water, Queensland[2007] which gives no warranty in relation to the data (including accuracy, reliability, completeness or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of the data.

The materials presented in this document are provided in good faith as a contribution to public debate, and are derived from sources believed to be reliable and accurate at the time of publication. However, the information is provided solely on the basis that readers will be responsible for making their own assessment of the matters discussed herein and are advised to verify all relevant representations, statements and information. The MRCCC gives no warranty in relation to the information and conclusions (including accuracy, reliability, completeness or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of this document.

Introduction

The analyses presented in this document underpin many of the comments contained in the Mary River Catchment Coordinating Committee's public submission to the Queensland Coordinator General in response to the EIS for stage 1 of the proposal to dam the Mary River at Traveston Crossing.

The MRCCC considers that this proposal is not consistent with the Integrated Catchment Management goals outlined in the Mary River Catchment Strategy and the Mary River and Tributaries Rehabilitation Plan, the documents which provide the major operational framework under which the MRCCC operates. An analysis of the data presented also clearly demonstrates that the proposal will push flows at some locations in the river further away from compliance with the Environmental Flow Objectives outlined in the Mary Basin Water Resource Plan than they are under the current resource allocation scenario. This is clearly against the intent of the National Water Initiative with respect to environmentally sustainable water allocations.

This document takes the form of a number of discrete analyses, summarized in graphical or tabular form, with accompanying brief explanatory comments. All analyses are based of the proponent's data presented in the EIS, Queensland Government data presented to the 2007 Senate Inquiry into Water Supply for South East Queensland and public data published by the Queensland Government. The analyses investigate overall information about the nature of the streamflow resource being targeted by the proponent, predicted impacts upstream of the proposed damsite, predicted impacts in the reach between the proposed damsite and the vicinity of Gympie and predicted impacts on freshwater flows to the lower river and estuary. The analyses also include some data on historic flood behaviour and the implications for risks posed to the river during construction, important data which was not well represented in the EIS.

Special focus has been given to the time period from 1999 onwards, a period which fortuitously encompasses both major flood events and significant periods of low-flow. There are good scientific measurements and observations of the river during this time to compare against the proponent's predicted flow and storage impacts, and it is possible to relate the numerical data presented in the EIS to the public's recollection and observations of the state of the river during these times. This is a powerful interpretive tool when trying to relate the likely consequences of the flow impacts presented by the proponent to the community's direct experiences of river health.

This document has been published as a separate report as a contribution to the public scrutiny of this proposal.

Contents

10. Area of deep water habitat, surface area and average depth
11. Location of the interface between main trunk inflows and the lake body.
12. Modelled effect of evaporation on concentration of contaminants.
13. Illustration of storage losses in context with streamflow during drought.
14. Effect on mean monthly streamflow just downstream of the proposed damsite. (1890-1999)
15. Annual streamflows and storage losses.
16. Illustration of altered flow regime downstream of damsite.
17. Illustration of downstream impact during extreme low-flow periods.
18. Effect on mean monthly streamflow just downstream of Gympie.
19. Interaction between flow rate and water quality (electrical conductivity) at Fisherman's Pocket.
20. Illustration of predicted further attenuation of 'flushing' flows near Gympie.
21. Illustration of the effect on major flood flows near Gympie and comparison with measured data.
22. Illustration of the two different sets of assumptions used for modelling the operation of the barrage by the proponent for the WRP assessment period 1890-1999.
23. Effect on mean monthly freshwater flow to the estuary past the Mary River Barrage (1890-1999).
24. Illustration that flows do not comply with median flow objectives in the full allocation scenario, and that TCD stage 1 increases the level of non-compliance.
25. Illustration that flows do not comply with low flow objectives in the full allocation scenario, and that TCD stage 1 increases the level of non-compliance.
26. Interaction between flow rate and water quality (electrical conductivity) at The Mary River Barrage.
27. Illustration of the effect on the low-flow regime at the Barrage.
28. Illustration of the attenuation of medium flow pulses at the Barrage.
29. Illustrating the effect on major flood flows past the Barrage.
30. Analysis of historical flood heights in Gympie
31. The historical probability of experiencing a flood that causes a 12m or more peak in Gympie within a given time window, starting at different months.

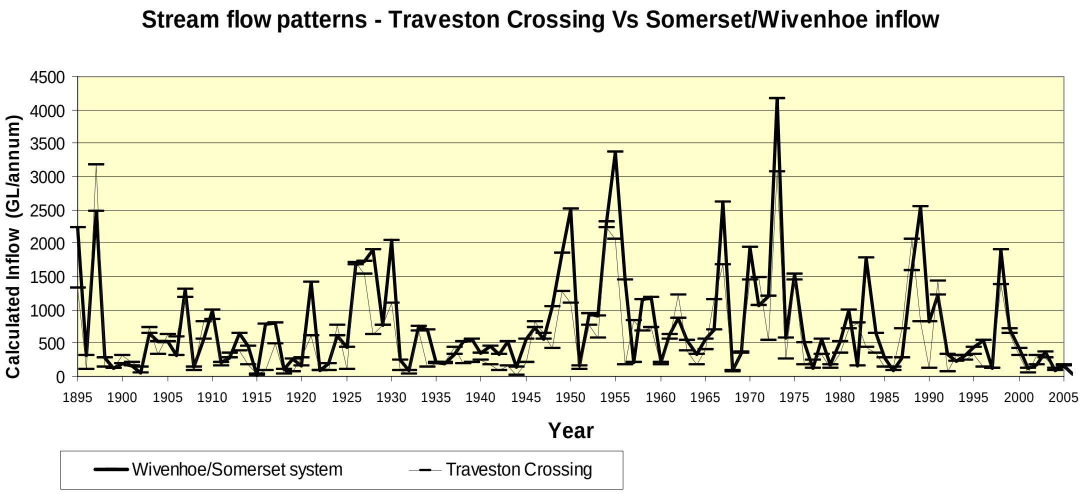
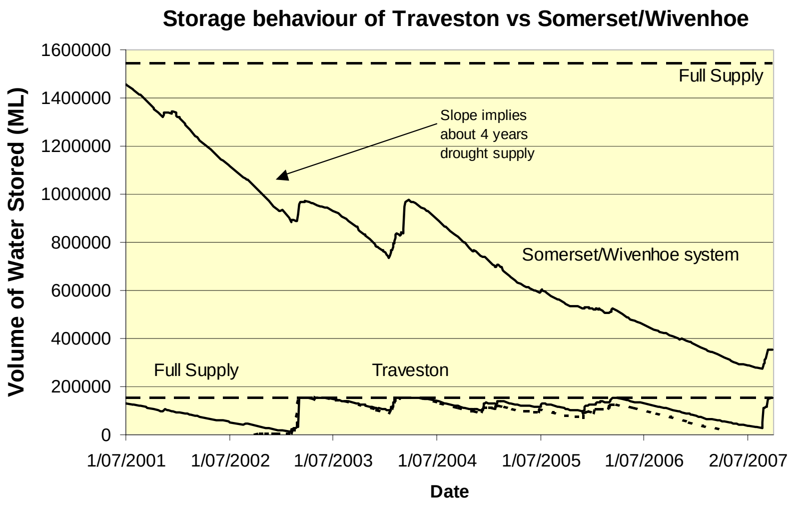


Figure 1. **Calculated Historic Stream Flow Patterns in the Brisbane/Stanley and Mary Rivers.**
(Data from Qld Gov. evidence to 2007 Senate Inquiry)

Comments on proposed Traveston Crossing Dam EIS

Figure illustrates that annual streamflow figures for the Somerset/Wivenhoe system follow the same pattern as streamflow figures at Traveston Crossing, and that streamflow into the Somerset/Wivenhoe system generally exceeds streamflow at Traveston Crossing. **Conclusion**: when annual streamflow in the Brisbane/Stanley system is low, annual streamflow at Traveston Crossing is even lower, and in years where there is good streamflow at Traveston Crossing, annual inflows to the Somerset/Wivenhoe system are even better again.

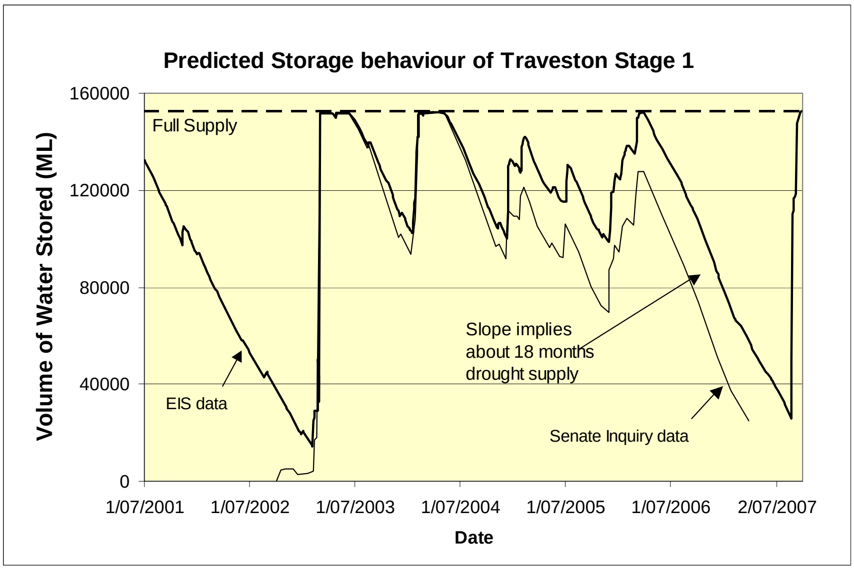


MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 2. Volume of water stored in Somerset/Wivenhoe system compared to Traveston.
(Proponent's data digitized from EIS Figure 2.3)

Comments on proposed Traveston Crossing Dam EIS

Figure puts the actual storage of the two systems in context with each other. Stage 1 Traveston does not promise a large or reliable water source in context with existing sources. In periods of continued low inflow, the Somerset/Wivenhoe system can provide water for about 4 years. In a similar period of low inflows, Traveston Stage 1 would be empty in 18 months.



MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 3. Comparison between storage behaviour presented in the EIS with the data presented to the 2007 Senate Inquiry. (Proponent's data digitized from EIS figure 2.3 and Qld Gov. evidence published in Senate Inquiry)

Comments on proposed Traveston Crossing Dam EIS

Shows discrepancy between storage data presented by the proponent to the senate inquiry and storage data presented in the EIS. Slope indicates how quickly the storage would be drawn down in periods of low inflows.

Mean Annual Flow (ML)

Location	AMTD km	WRP Simulation Period 1890- 1999	Extended Simulation Period 1890 -2007	% reduction	Post WRP Simulation Period *1999-2007*	*% reduction*
Yabba	-10	157000	152000	3%	74143	**53%**
Dam Site	205	***606000#***	584000	4%	241429	**60%**
Fisherman's Pocket	170	***909000***	879000	3%	411857	**55%**
Home Park	89	***1643000***	1583000	4%	648714	**61%**
Estuary	0	***2355000***	2273000	3%	996143	**58%**

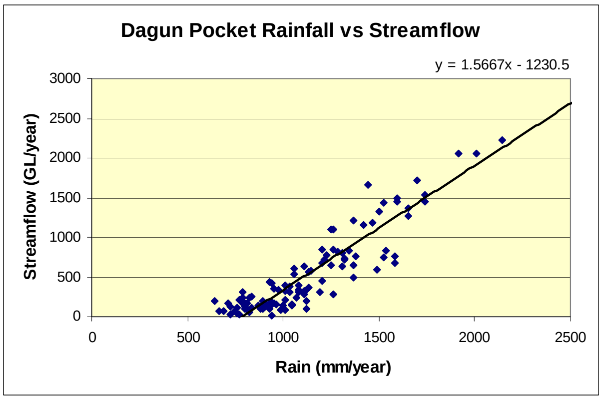
#Correct figures sourced from Fig 6.2 in the EIS

Corrected calculation of reduction of streamflows in the extended simulation period (Table 6.3 in EIS)

Figure 4. True calculation of the effect of the extended simulation period on mean annual flows (Proponent's data with table errors corrected, EIS tables 6.2 & 6.3)

Comments on proposed Traveston Crossing Dam EIS

Table shows the correct figures that should have been presented in figure 6.3 of the EIS. The analysis as attempted to be portrayed in figure 6.3 does clearly communicate the effect of recent dry years on the streamflow resource at the damsite. It is useful to consider that stopping all streamflow absolutely for the period 2000-2007 could only reduce the 1890 to 2007 average by 6%. However, the proponent's figures show that streamflow since the end of the simulation period used to formulate the WRP has been greatly reduced (53-61% reduction)



Mean annual flow at damsite: 572 GL

Mean annual rainfall at damsite : 1151 mm

Regression suggests that 115mm decrease in rainfall relates to 1.5667 x 115 = 180GL decrease in stream flow.

Ie:10% decrease in average annual rainfall relates to 31% decrease in average annual streamflow.

MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 5. Rough estimate of effect of predicted climate change (10% decrease in average annual rainfall) on streamflow resource at the damsite.
(Qld Gov streamflow and rainfall data presented to 2007 senate inquiry))

Comments on proposed Traveston Crossing Dam EIS

Figure makes a rough estimate of the effect of a 10% decrease in mean annual rainfall on mean annual flow at the damsite. Uses the composite of IQQM modelled and gauged flow and rainfall data presented by the State Government to the 2007 senate inquiry.

Analysis of continuous low-flow spells (less than 25ML/day) ('drainpipe' analysis)

	Mary River Barrage		Fisherman's Pocket		Dagun Pocket	
Time period analysed	21/11/96 to 21/01/2002		01/01/1999 to 10/10/2006		01/01/1999 to 19/04/2007	
Data set	**TCD scenario**	**Measured flow**	**TCD scenario**	**Measured flow**	**TCD scenario**	**Measured flow**
Total Low Flow duration (% of days)	20.23%	15.84%	8.06%	6.93%	11.09%	4.12%
Length of low flow spells (days)						
Minimum	4	2	2	2	3	2
25th percentile	8	4	4	3	5	3
Median	23	15	6.5	4	7	6
75th percentile	50	25.5	13	11	34	12
Max	158	53	76	25	137	33
Start date of longest spell	7/06/2001	6/12/1997	12/10/2002	11/11/2003	11/10/2002	29/07/2004
Number of low flow spells	9	16	18	26	13	13

MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 6 Low-flow spell analysis. Investigating the length of continuous spells where daily flow is less than 25ML/day. (25 ML/day will comfortably flow through a standard 375mm concrete drainpipe) (Proponent's data from report 17 compared to gauged flows)

Comments on proposed Traveston Crossing Dam EIS

This analysis looks at continuous periods of time for which the entire flow of the river could be passed through a standard 375mm concrete drain pipe. These are periods of extreme stress in the river, and the severity of problems that arise are related to the length of such events. Based on the flow data presented by the proponent, the proposal would greatly increase the maximum length of these stressful and damaging events.

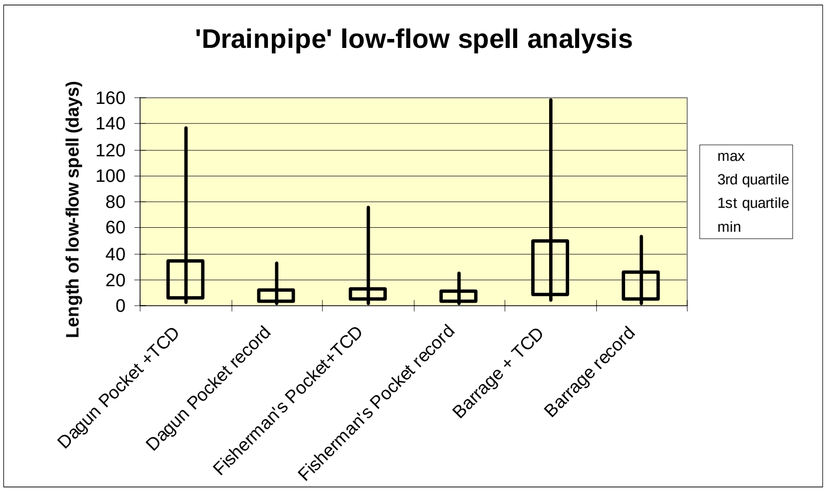
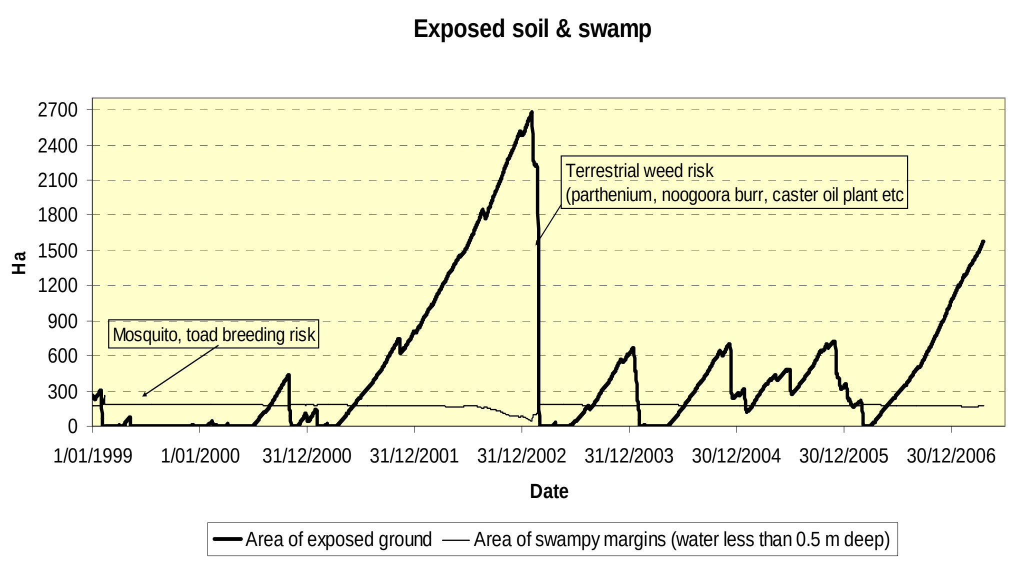


Figure 7. Box and whisker plot illustrating the distribution of lengths of continuous low-flow spells from the 'drainpipe' analysis.

Comments on proposed Traveston Crossing Dam EIS

A graphical representation of the low-flow spell analysis. The lines represents the range of lengths of continuous low flow spells. The boxes represent the interquartile range (half of the low flow spells in each case fall within the box). This illustrates the effect of the proposal on greatly increasing the length of the extreme events.

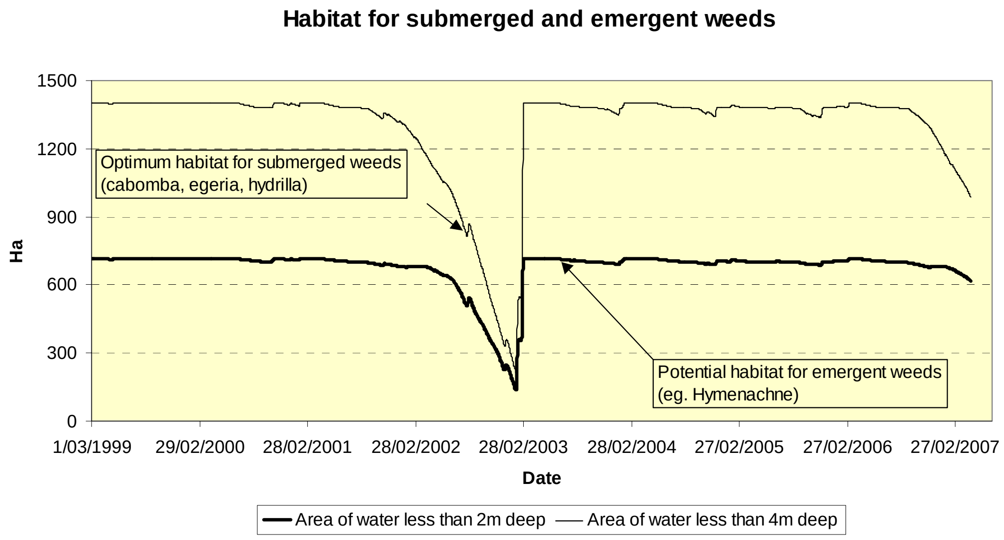


MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 8. Area of land between FSL and shoreline, area of shallow lake margins.
(Proponent's storage data from report 17, storage geometry as described in EIS figure 4.22.

Comments on proposed Traveston Crossing Dam EIS

Figure shows how the area of bare ground between the FSL and the shoreline changes with storage levels, and shows the large extent of such land in times of low flow. This land presents a huge terrestrial weed and erosion risk. The graph also shows the relatively constant area of non flowing shallow swampy margins, presenting a risk of increased mosquito and toad habitat, and new habitat for invasive emergent weed species such as hygrophila and para grass.



MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 9. Area of shallow water habitats.
(Proponent's storage data from report 17, storage geometry as described in EIS figure 4.22.

Comments on proposed Traveston Crossing Dam EIS

Figure shows relatively constant areas of new non-flowing shallow water habitat (except during extreme draw-down). Areas less than 2m deep provide habitat for tall invasive emergents such as hymenachne and areas less than 4m deep provide ideal habitat for the invasive submerged species already in the catchment, most likely egeria, cabomba and hydrilla.

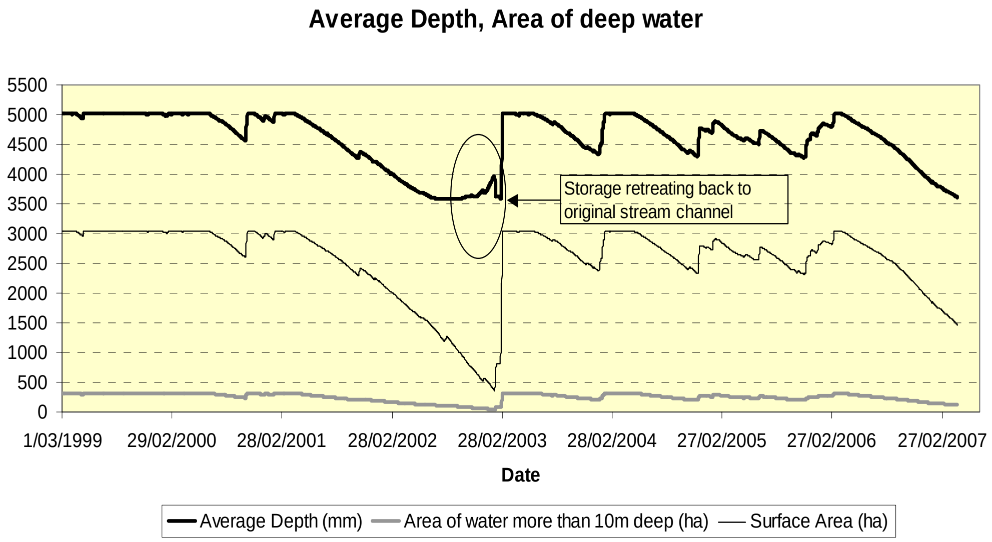
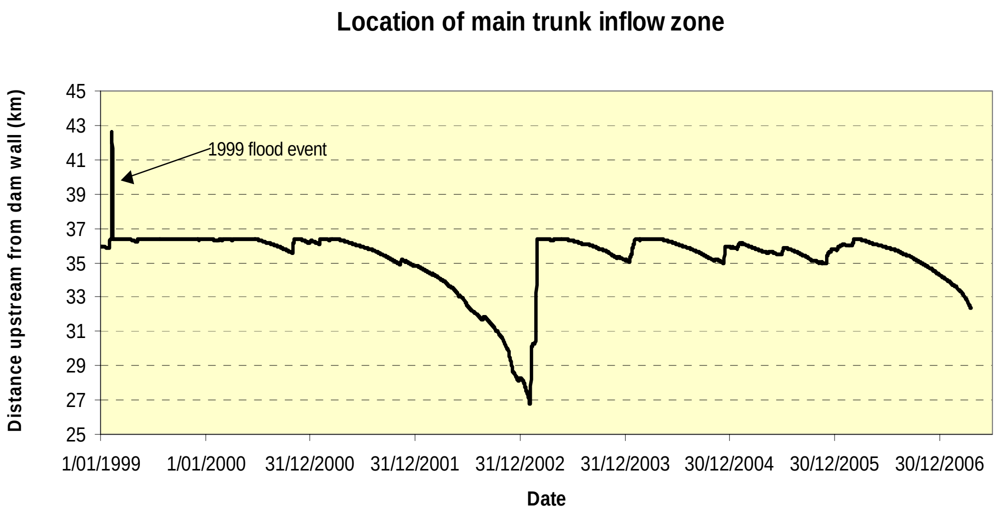


Figure 10. Area of deep water habitat, surface area and average depth
(Proponent's storage data from report 17, storage geometry as described in EIS figure 4.22.

Comments on proposed Traveston Crossing Dam EIS

Figure shows the relatively small and variable area of deep water habitat , with scope for differentiation of water quality with depth and suitability for water based recreation. Figure also shows relatively constant average depth of less than 5m. The surface area shown represents new habitat of still, open water surface ideal for invasion by the floating weed species already in the catchment such as water hyacinth, salvinia and water lettuce.

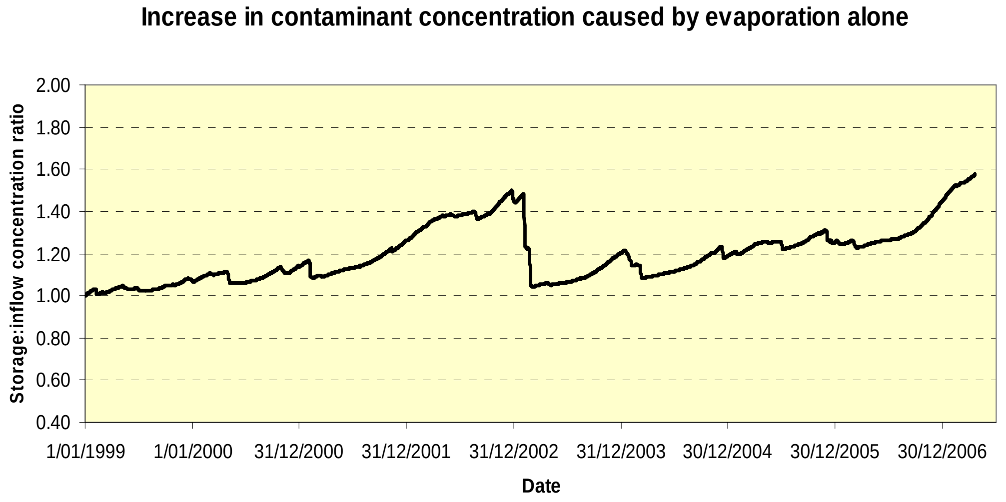


MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 11. Location of the interface between main trunk inflows and the lake body.
(Proponent's storage data from report 17, storage geometry as described in EIS figure 4.22, stream bed profile from report 19)

Comments on proposed Traveston Crossing Dam EIS

Figure shows the location of the zone where inflow from the main trunk meets the lake body. This is a zone of low water quality related to sediment deposition and resuspension, and as the figure shows, would move up and down the river channel over a distance of several kilometres, creating a constantly moving zone of disturbance. This would also occur in all the inflowing tributaries.



MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 12. Modelled effect of evaporation on concentration of contaminants.
(Ratio of concentration in storage to concentration in inflow. Calculated from data from report 17, evaporation and seepage from EIS section 6.1.2.3, storage geometry from figure 4.22)

Comments on proposed Traveston Crossing Dam EIS

This figure shows one aspect of the water quality problems that would result from long residence times in the storage. Just accounting for the concentrating effect of evaporation from the storage shows concentrations of contaminants in the storage (and downstream releases) could quickly exceed the concentration in the inflow by 60%. This is important, considering that water quality in the streamflow at the damsite already often falls outside water quality guidelines.

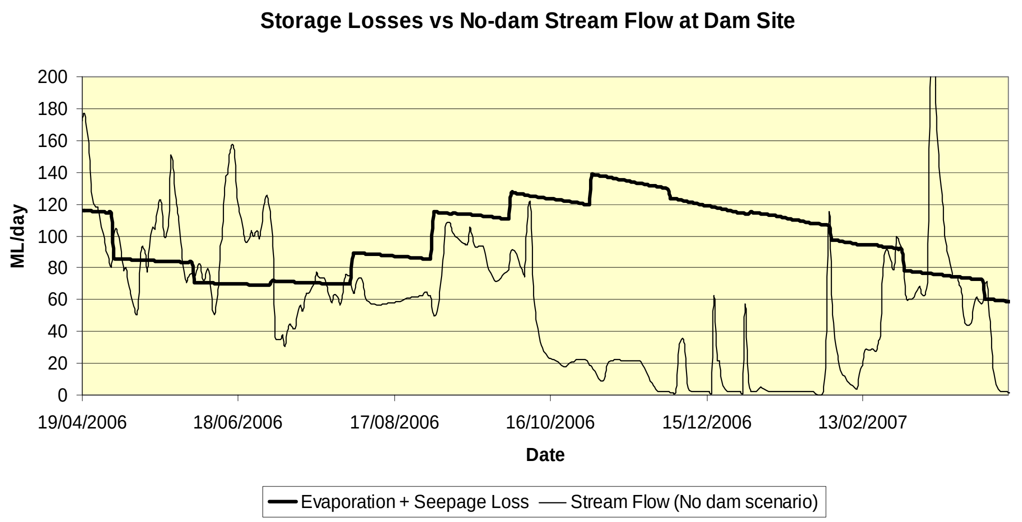


Figure 13. Illustration of storage losses in context with streamflow during drought.
(Proponent's data from report 17, evaporation and seepage as defined in EIS section 6.1.2.3, storage geometry as described in EIS figure 4.22)

Comments on proposed Traveston Crossing Dam EIS

This figure puts the storage losses (evaporation and seepage) as calculated by the proponent in context with streamflow at the site during periods of low flow. For extended periods of time in dry conditions, more water would being lost to storage inefficiencies than what would normally be flowing in the river without the dam. In addition, the proponent's evaporation and seepage losses are likely to be underestimates of actual losses because of a number of factors not accounted for in the model used.

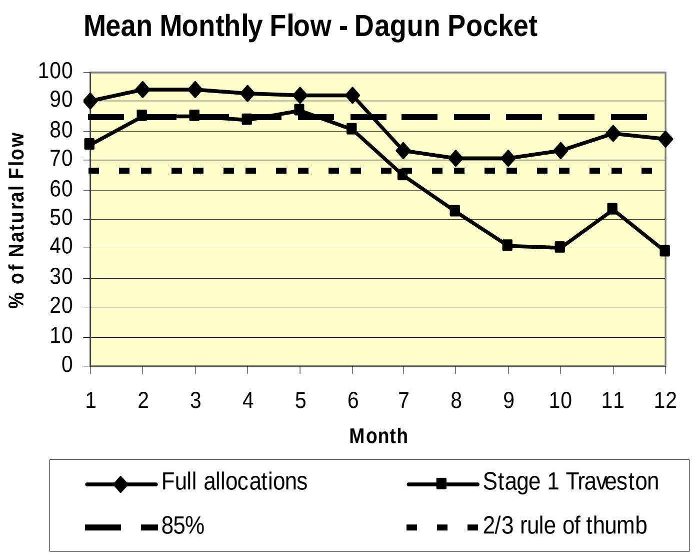


Figure 14. Effect on mean monthly streamflow just downstream of the proposed damsite. (1890-1999). (Proponent's data from report 17)

Comments on proposed Traveston Crossing Dam EIS

Shows the severe effect on downstream flows predicted in the outlined in the proponent's data during the low-flow JASON months, where average monthly flows would be reduced to less than half of the pre-development flows. These months are the crucial months for reproduction of the EPBC listed threatened species in this reach of the river, as well as time for peak demand from irrigation users in this part of the river.

Effect on the surface water resource in the river at Dagun Pocket

	Gauged flow: Current usage. (GL/annum)	Modelled flow : full extraction of current allocations & no dam (GL/annum)	Modelled flow: Stage 1 TCD (GL/annum)	Reduction from gauged flows: S1 TCD %	Modelled storage losses from Stage 1 TCD Seepage (GL/annum)	Evaporation (GL/annum)	Total (GL/annum)
1999	1660	1586	1481	11%	9	39	48
2000	355	333	254	28%	9	38	47
2001	232	215	174	25%	8	35	43
2002	43	26	16	64%	4	18	23
2003	330	300	130	61%	7	30	38
2004	303	288	175	42%	8	35	44
2005	122	113	32	74%	8	34	42
2006	98	83	32	67%	8	34	42

MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 15. Annual streamflows and storage losses.
(Proponent's data from report 17, proponent's evaporation and seepage model, proponent's storage geometry, NRW Watershed data, Sunwater Online data with MRCCC corrections)

Comments on proposed Traveston Crossing Dam EIS

Shows the effect on annual streamflows in the reach downstream of the dam. The proponent's data indicates that total annual streamflow would be reduced by up to 74% compared to the current flow situation in the river downstream of the dam. This figure also puts the proponents calculations of annual storage losses in context with annual stream flows and an annual storage yield of 70GL.

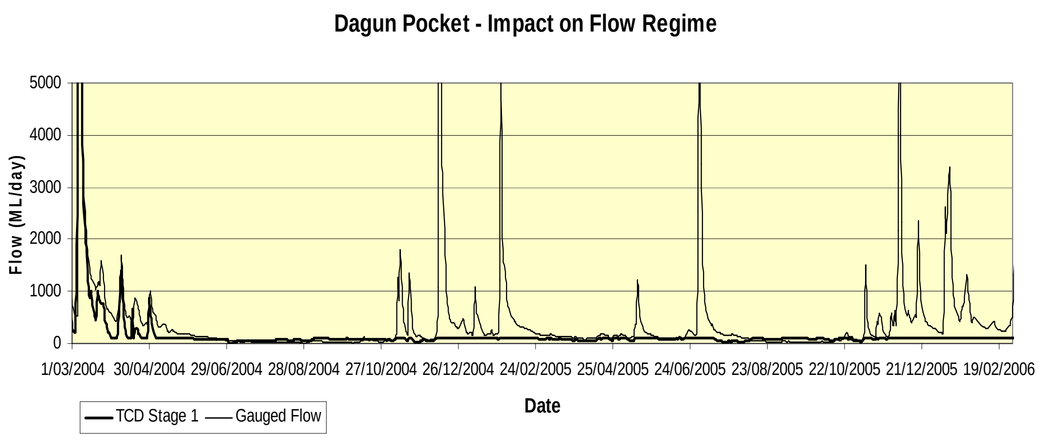
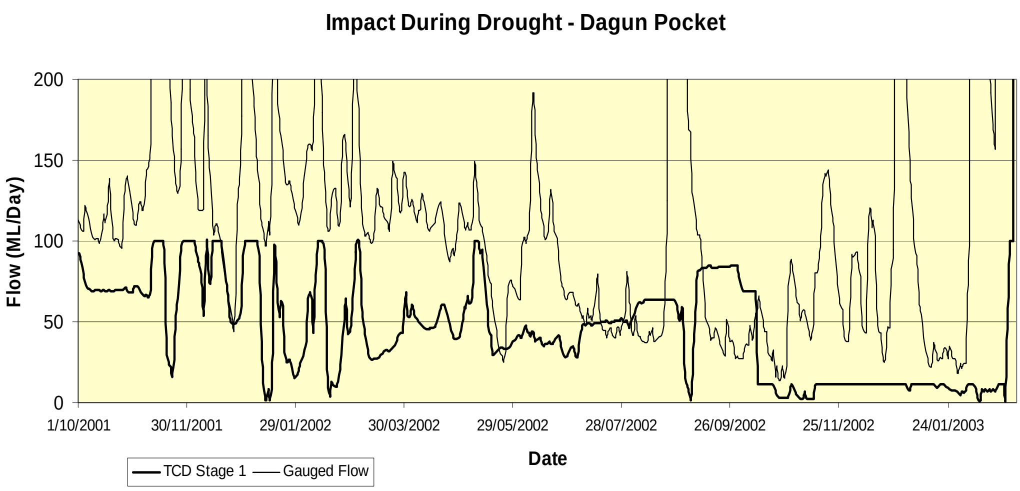


Figure 16. Illustration of altered flow regime downstream of damsite.
(Proponent's data from report 17 and NRW Watershed data)

Comments on proposed Traveston Crossing Dam EIS

Illustrates the extreme effect on stream flow regime that the proponent predicts will occur from time to time compared to what is currently experienced in the river downstream of the dam. If the remaining aquatic habitat of this stretch of the river is not suitable for the aquatic species impacted by the dam, then all the proposed biopassage mitigation measures like fishlocks and turtle ramps proposed for the structure would be a complete waste of time and money



MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 17. Illustration of downstream impact during extreme low-flow periods.
(Proponent's data from report 17 and NRW Watershed data)

Comments on proposed Traveston Crossing Dam EIS

In times of low flow, when the health of the river is already under extreme stress, the proposed dam would make matters far worse, as illustrated by the predicted flow sequence provided by the proponent compared to recorded flows. At the time illustrated above, Gympie's water supply was in crisis and poor water quality and aquatic weeds caused major problems in the river.

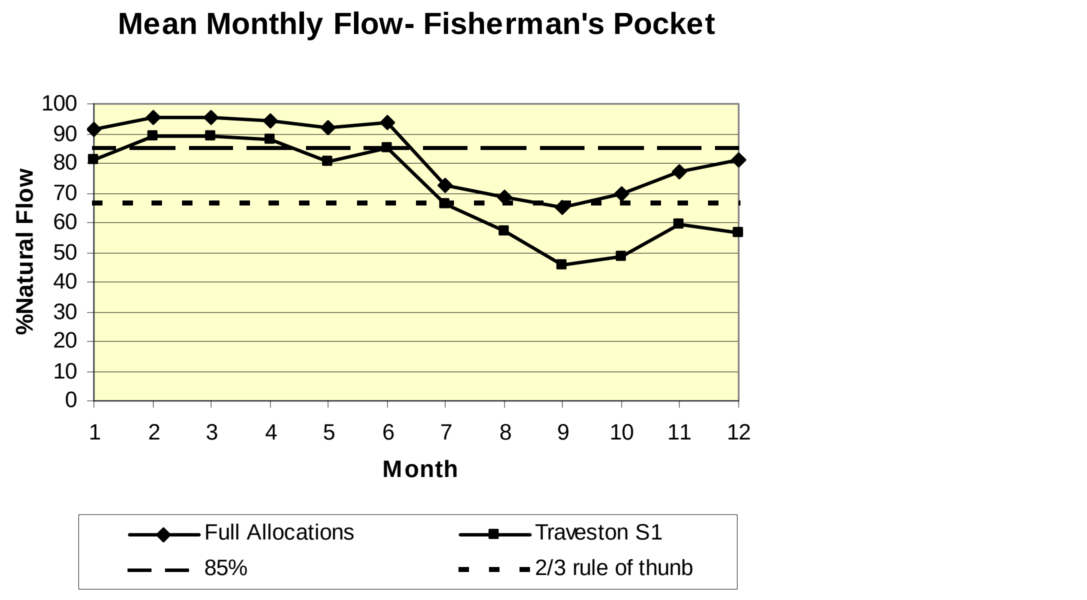
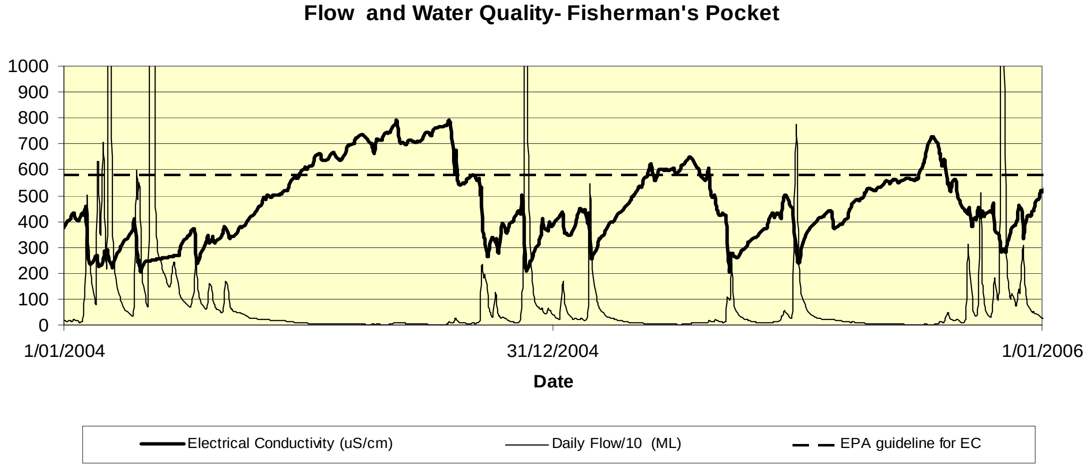


Figure 18. Effect on mean monthly streamflow just downstream of Gympie. (1890-1999) (Proponent's data from report 17)

Comments on proposed Traveston Crossing Dam EIS

Contrary to the proponents claims that the adverse flow effects on the river are effectively attenuated by inflows from downstream tributaries as you move downstream from the site, this analysis of the proponent's flow data shows that monthly flows during the critical JASON months would be still reduced to about a half of natural flows at Fisherman's Pocket, downstream from Gympie.



MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 19. Interaction between flow rate and water quality (electrical conductivity) at Fisherman's Pocket. (Qld. NRW Watershed Data)

Comments on proposed Traveston Crossing Dam EIS

One of the problems that arises during periods of low flows is a decline in water quality. This can be illustrated by Electrical Conductivity data from Fishermans Pocket. During low flow periods, EC rises to levels over the EPA guidelines for the Mary, and is brought back to more acceptable by freshwater flow events. It is important to note that the area of the Mary Valley downstream of the damsite is already mapped and recognized as a salinity hazard area under the National Action Plan for Salinity and Water Quality.

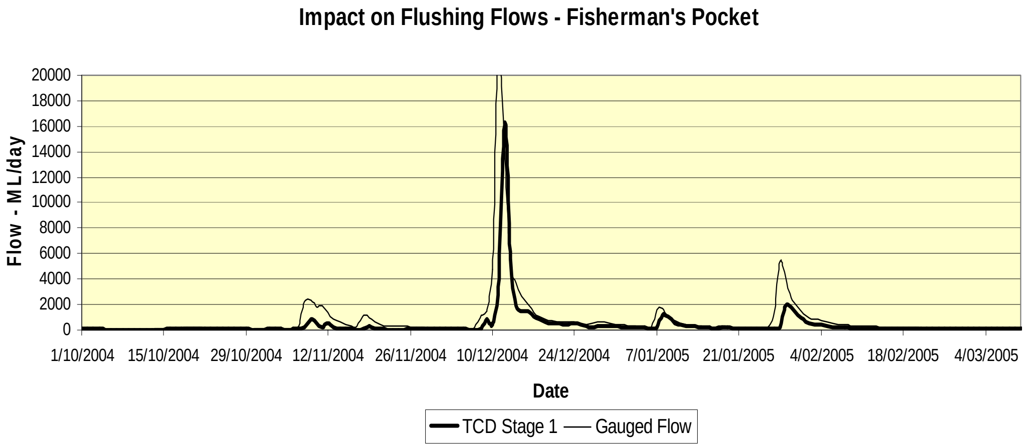


Figure 20. Illustration of predicted further attenuation of 'flushing' flows near Gympie.
(Proponent's data from report 17 and NRW Watershed data)

Comments on proposed Traveston Crossing Dam EIS

This figure illustrates the predicted effect of the proposed dam on attenuating beneficial flushing flow events downstream of Gympie. This is a 'trouble spot' in the river, often suffering from severe weed outbreaks and water quality problems when it doesn't receive a periodic flushing event.

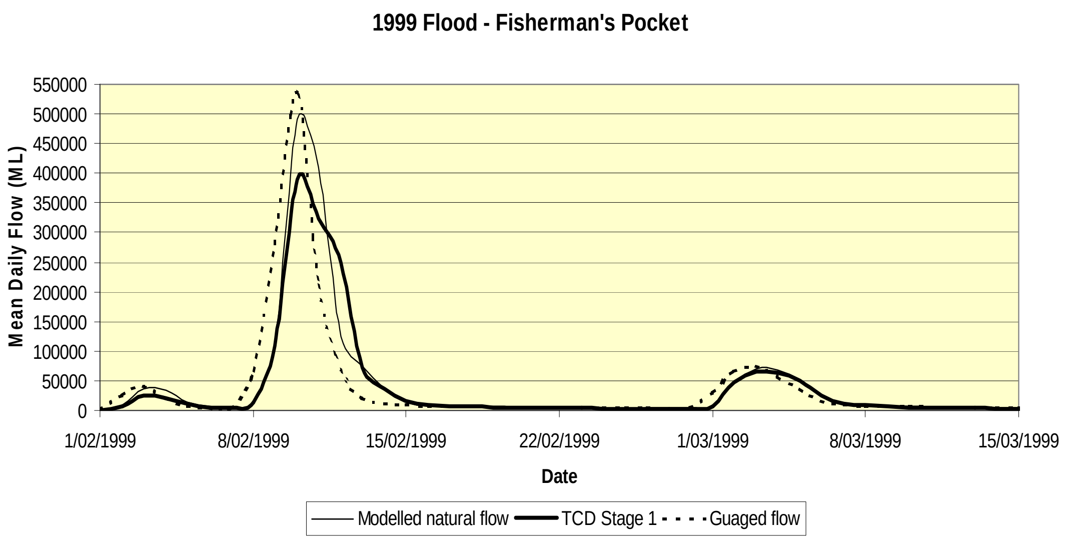


Figure 21. Illustration of the effect on major flood flows near Gympie and comparison with measured data. (Proponent's data from report 17 and NRW Watershed data)

Comments on proposed Traveston Crossing Dam EIS

Shows the predicted effect on large flood flows in the vicinity of Gympie. This figure illustrates the general effect of reducing peak flows by increasing flood duration. This may not be an entirely beneficial outcome and is likely to significantly increase bank erosion and the length of time that important transport links are cut (eg Normanby Bridge). It is interesting that the dam was not predicted to have any significant impact on the minor flood event in March which followed the February event

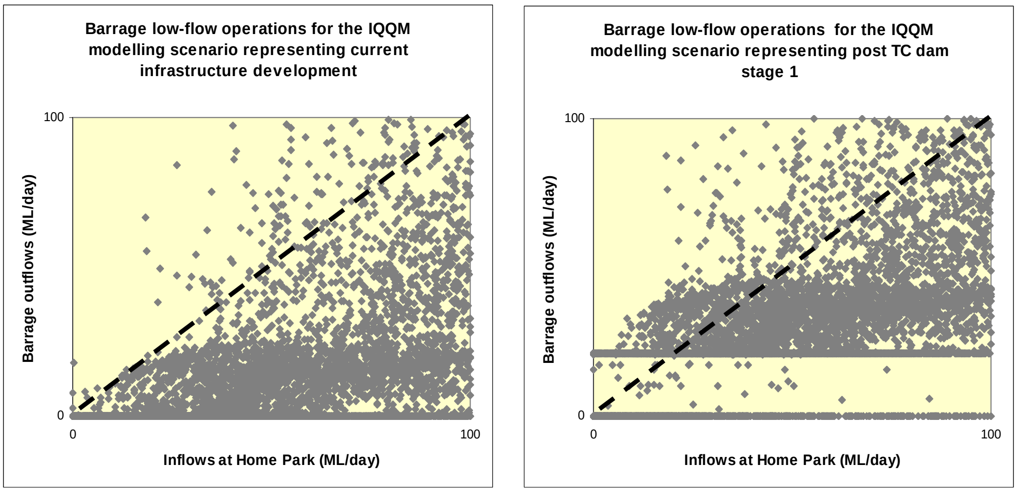
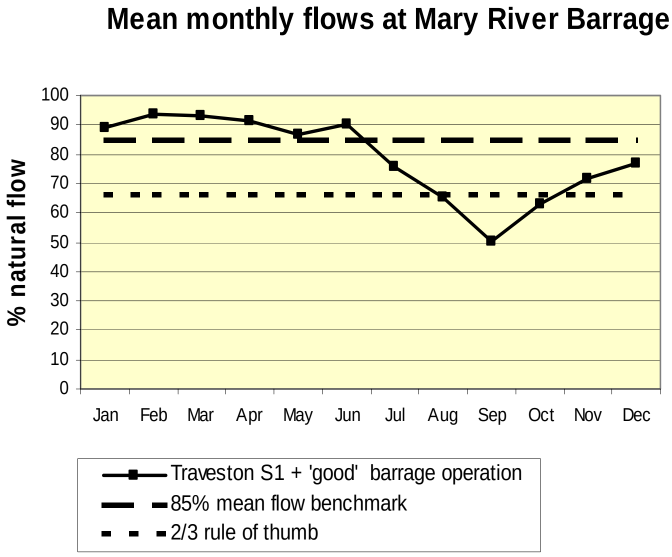


Figure 22. Illustration of the two different sets of assumptions used for modelling the operation of the barrage by the proponent for the WRP assessment period 1890-1999. (Proponent's data from report 17)

Comments on proposed Traveston Crossing Dam EIS

The proponent used two different methods for modelling the operation of the barrage in the comparison of the current infrastructure scenario and the TCD scenario over the WRP simulation period of 1890 to 1999. This is illustrated from the proponents data, showing the different relationships between what flows into the barrage storage at Home Park to what flows out past the barrage. The main difference seems to be maintaining a 21ML/day fishway flow in the 'with dam' scenario, but not incorporating this same flow into the 'current infrastructure scenario. This invalidates any comparison between the two modelling scenarios of the low-flow statistics from the river to the estuary over the WRP simulation period.

This was not the case in the extended simulation period from 2000 to 2007

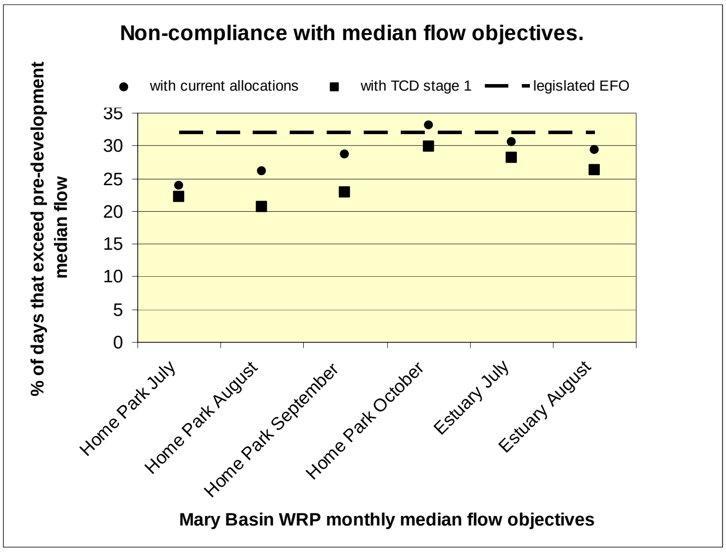


MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 23. Effect on mean monthly freshwater flow to the estuary past the Mary River Barrage (1890-1999). (Proponent's data from report 17)

Comments on proposed Traveston Crossing Dam EIS

The proponent's data shows that, even as far downstream from the damsite as the entrance to the estuary at the barrage, the proposal is predicted to reduce September flows to about half of their natural state and generally significantly reduce flows during the JASON months.



MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 24. Illustration that flows do not comply with median flow objectives in the full allocation scenario, and that TCD stage 1 increases the level of non-compliance.
(Proponent's data, EIS tables 6.37 & 6.38)

Comments on proposed Traveston Crossing Dam EIS

This figure illustrates the extent to which median ('typical') flows in the lower river would not comply with the environmental flow objectives in the Mary Basin Water Resource Plan if all existing water allocations were fully utilized. It also shows how much further outside compliance the flows would be if Stage 1 of the Traveston Crossing Dam came into operation. It is difficult to see how this intent to make matters worse than they currently are could be interpreted as 'minimizing' the extent to which flows don't meet the objectives, as required under the plan. It is also hard to see how current allocations can be supported and the operation of the dam optimized to bring these figures into compliance without reducing the stated yield of the dam by making specific environmental flow releases.

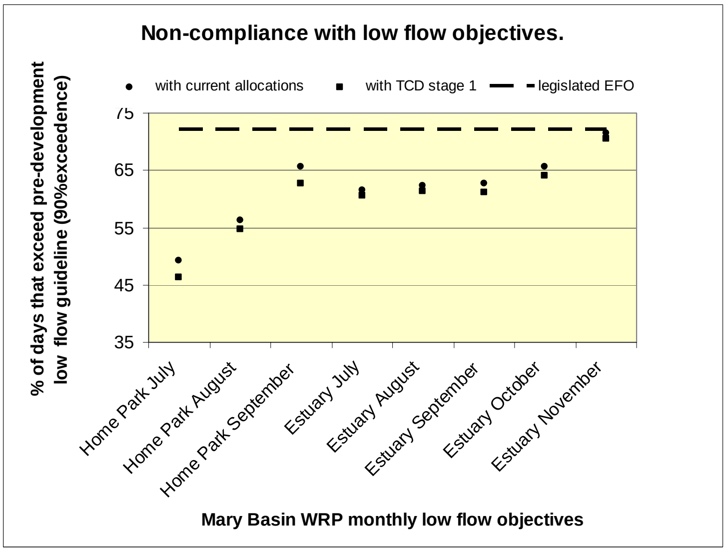


Figure 25. Illustration that flows do not comply with low flow objectives in the full allocation scenario, and that TCD stage 1 increases the level of non-compliance.
(Proponent's data, EIS tables 6.37 & 6.38)

Comments on proposed Traveston Crossing Dam EIS

This figure illustrates the extent to which the low flow regime in the lower river would not comply with the environmental flow objectives in the Mary Basin Water Resource Plan if all existing water allocations were fully utilized. It also show how much further outside compliance the flows would be if Stage 1 of the Traveston Crossing Dam came into operation. It is difficult to see how this intent to make matters worse than they currently are could be interpreted as 'minimizing' the extent to which flows don't meet the objectives, as required under the plan. It is also hard to see how current allocations can be supported and the operation of the dam optimized to bring these figures into compliance without reducing the stated yield of the dam by making specific environmental flow releases.

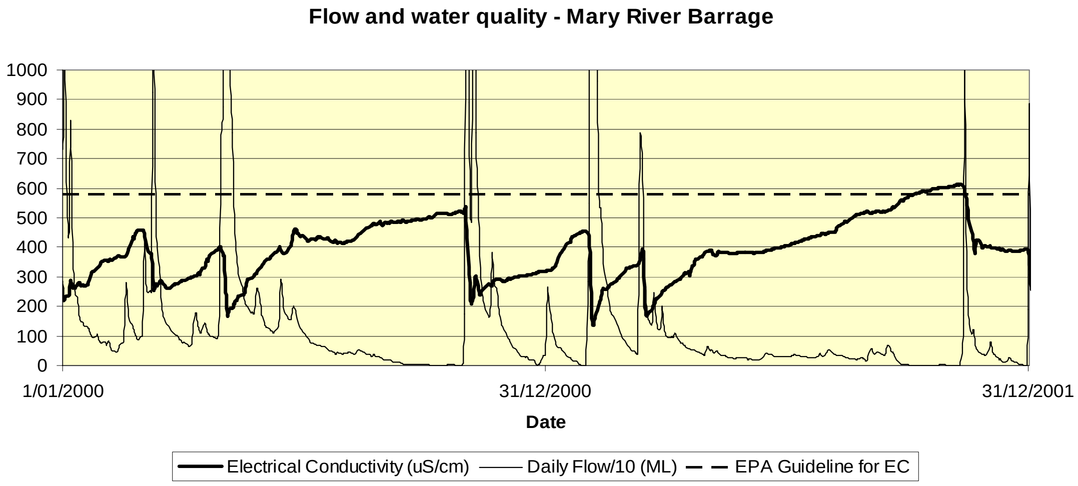


Figure 26. Interaction between flow rate and water quality (electrical conductivity) at the Mary River Barrage. (Qld. NRW Watershed Data)

Comments on proposed Traveston Crossing Dam EIS

The type of relationship between flow regime and water quality observed in the river near Gympie is also evident within the barrage storage, and therefore also exists in the flows past the barrage to the estuary.

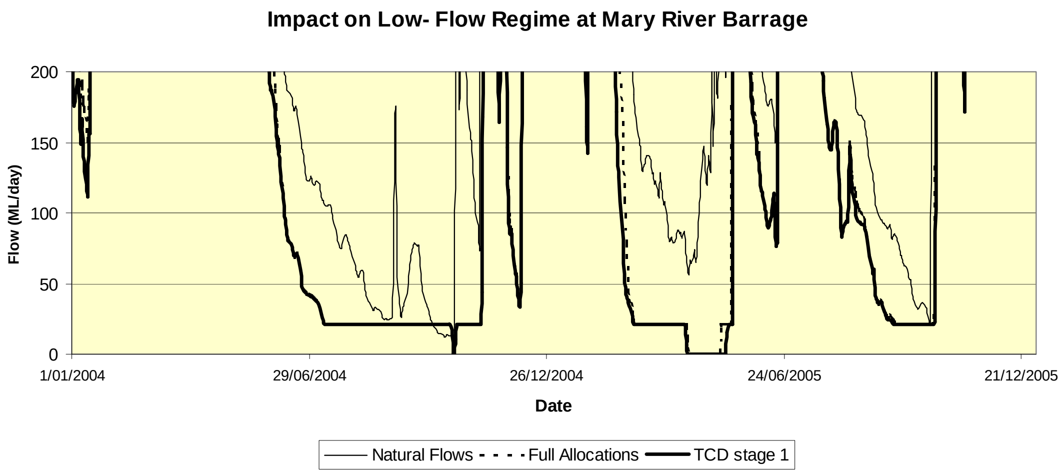


Figure 27. Illustration of the effect on the low-flow regime at the Barrage.
(Proponent's data from report 17)

Comments on proposed Traveston Crossing Dam EIS

This figure illustrates the proponent's modelled operation of the fishway at 21 ML/day, and a period of draw down where flows stop altogether.

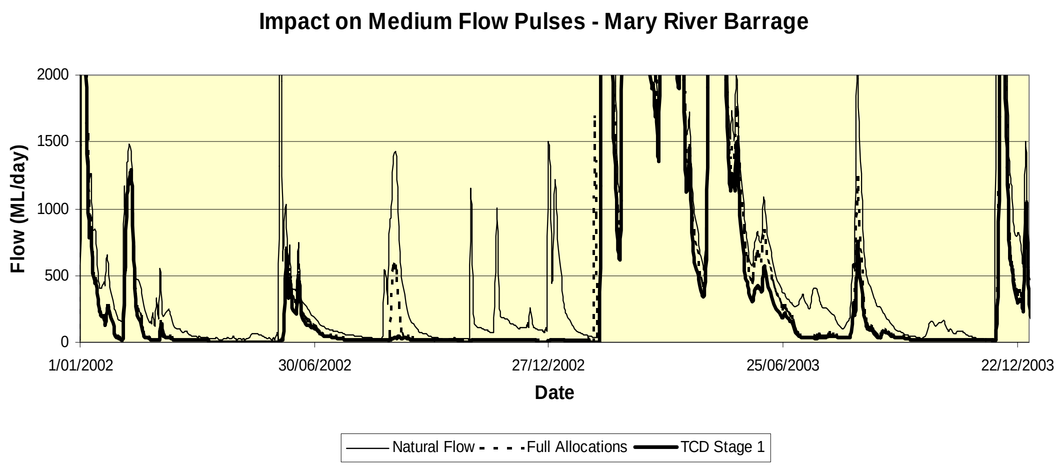
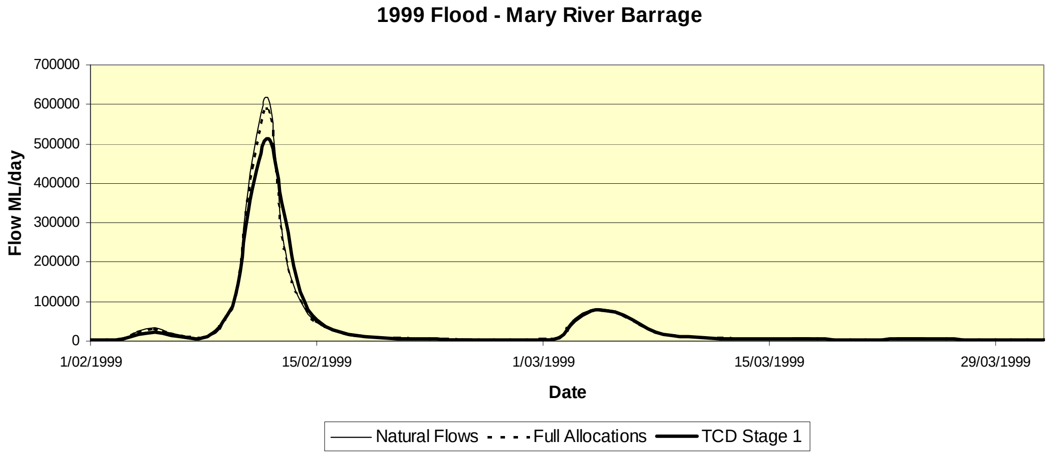


Figure 28. Illustration of the attenuation of medium flow pulses at the Barrage.
(Proponent's data from report 17)

This figure shows the significant effect that the proposal is predicted to have on creating long periods in which the natural freshwater pulses over the barrage are effectively removed.

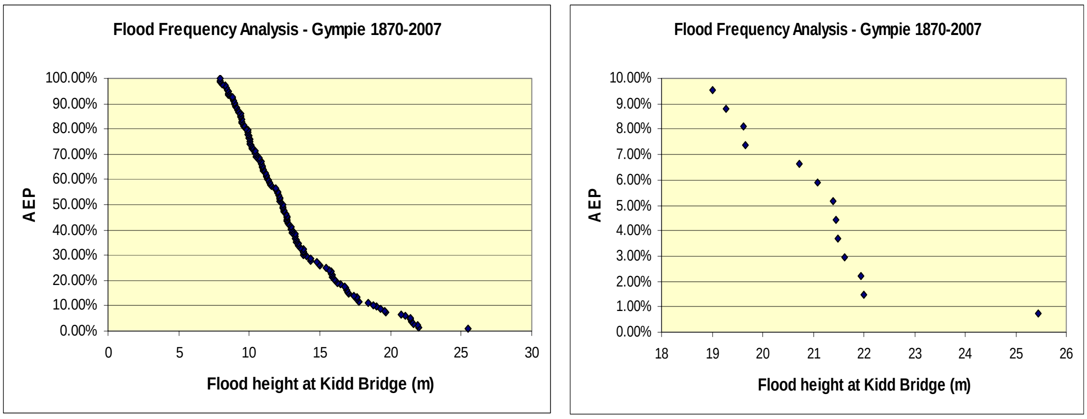


MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 29. Illustrating the effect on major flood flows past the Barrage.
(Proponent's data from report 17)

Comments on proposed Traveston Crossing Dam EIS

This figure illustrates the negligible effect that the proposal is predicted to have on attenuating very large flood flows to the estuary.



MARY RIVER CATCHMENT COORDINATING COMMITTEE

Figure 30. Analysis of historical flood heights in Gympie
(BOM gauge data and Moriarty, L (1992) *Gympie's Greatest Floods)*

Comments on proposed Traveston Crossing Dam EIS

This shows an AEP analysis of the recorded flood heights in Gympie, and illustrates the reasonable precision for calculating up to 1:50 events, but the very poor basis for estimation of events rarer than this. (There is a gap in the record between 22 and 25 metres flood height)

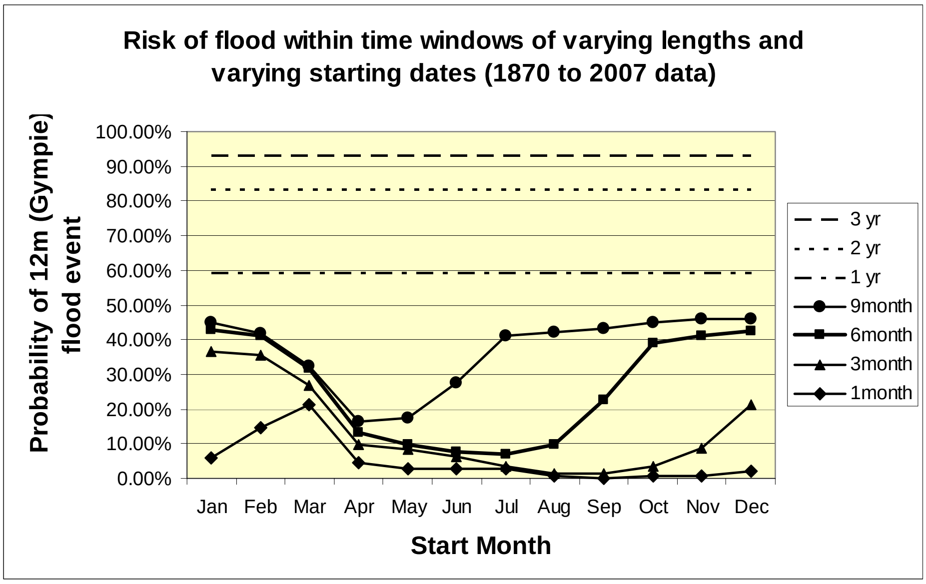


Figure 31. The historical probability of experiencing a flood that causes a 12m or more peak in Gympie within a given time window, starting at different months.
(BOM gauge data and Moriarty, L (1992) *Gympie's Greatest Floods)*

Comments on proposed Traveston Crossing Dam EIS

Shows an analysis of 12m-flood-height-in-Gympie (moderate flood) events in the river. Many of the risks of adverse impacts associated with the construction of the project are closely associated with the risk of a flood event. In particular, activities associated with excavation of the flood plain below the level of the stream bed, dewatering and concrete construction in the resultant underground pit are particularly at risk from this sort of flood event.

The risk of bio-accumulation of Mercury in the Mary River.

Steve Burgess Dec 2007

Mary River Catchment Coordinating Committee.

Mercury is a highly toxic heavy metal which has a tendency to bio-accumulate in some environments and is well known as a significant human health risk where this occurs. Queensland Health have produced an information sheet which provides a good summary of background information about the environmental health risks of Mercury

In natural soils and river systems, inorganic mercury does not normally pose any significant environmental or human health risks. However, under certain environmental conditions, inorganic mercury can be transformed into a number of soluble and highly toxic organic Mercury compounds. The best understood of these compounds is methylmercury, which is a powerful neurotoxin that is readily absorbed by plants and animals and tends to biomagnify in aquatic ecosystems. This is what occurred in the famous case of Minamata Bay disease in Japan.

Methyl mercury production occurs widely in natural waters and is particularly favoured by low-oxygen, nutrient-rich conditions with a great deal of biological activity in the presence of a source of mercury. These conditions already occur in times of low flow in the Mary River, and often occur in new water storages. Increased mercury bioaccumulation by aquatic organisms following the formation of dams is widely reported around the world and is generally recognized as one of the environmental health risks that needs to be addressed as part of the assessment of new dam projects. (McCartney et al. 2001).

There are two major sources of Mercury in the Mary catchment:
-naturally occurring Mercury in the soils and sediments of the Mary Valley. In some places these occur in highly concentrated sedimentary deposits such as those at Cinnabar near Kilkivan. (The locality was named after the deposit).
-Mercury released into the environment as part of the gold extraction process during historic gold mining and processing activities.

Mercury levels in the soil, air and water in the vicinity of Gympie are high as a result of past gold mining activities. This is documented in the study by Dhindsa et al. (2003), which estimated that 1902 tonnes of mercury from gold processing were released into the environment in the Gympie area alone between 1867 and 1926, and found mercury levels in sediments as high as 6.12 ug/g (Langtons Gully), which is more than 60 times the upper limit of typical background level for soils. This study recommended that Mercury concentration in air around Gympie and fish in the Mary River should be monitored.

In addition to gold mining in the vicinity of Gympie, there have been less well documented historic gold processing activities in the Mary Catchment upstream of Gympie, at Jones Hill, the Dawn and Mt Kelly, and in the upper tributaries of Yabba Creek (Imbil, Yabba and Jimna goldfields) and on Booloumba and Little Yabba Creek (Agricola mine and other minor prospects).

Bore sample data from near the proposed Traveston Crossing Dam site published in the EIS for that project show high levels of mercury in the groundwater at that site, with 9 out of 10 of the samples well above the ANZECC (1992) guidelines for fresh water. One sample (bore hole MA01) recorded a concentration 0.0021 mg/L, which is more than twice the Australian Drinking Water Guideline and more than 20 times the ANZECC freshwater guideline. In addition, soil leachate samples which were taken as part of an investigation into cattle deaths at the dam site also showed levels of Mercury which exceeded the guideline level. Some of this evidence was submitted by the Queensland Government to the 2007 senate inquiry on Traveston Crossing Dam and has since been published by the senate. The following professional advice was given to Queensland Water Infrastructure (QWI) on the matter by Golder and Associates. (QWI 2007 – response to question on notice).

'We found that concentrations of Mercury in the leachate of the 10 samples were elevated when compared with the Australian Drinking Water Guidelines, indicating that there are potential environmental and human health risks with respect to Mercury. We think that this potential environmental concern may be better quantified through further investigations"

The proposed dam at Traveston Crossing poses a significant risk of creating ideal conditions for the production of methylmercury in the storage, and the subsequent biomagnification of this mercury throughout the food web in the Mary River. The proposed dam would provide a wide, shallow, warm, exposed body of water in a sub-tropical environment, inundating very fertile soils, with high carbon and nutrient levels and high biological productivity, prone to anaerobic conditions. These conditions are clearly recognized in section 6 of the EIS for the project. In storages under similar climatic conditions, significant increases in methyl mercury concentrations have been reported in the scientific literature. (Hylandera et al 2006). The high levels of mercury recorded in the soils of the impounded area and those likely to be in the catchment upstream of the dam site from past gold extraction activities adds considerable weight to these concerns.

In fact, evidence of mercury biomagnification has already been reported by the Chief Health Officer of Queensland Health in South East Queensland at Hinze Dam. (ABC 2006). In the Mary Catchment, there is also evidence of bio-accumulation of Mercury in the Cabomba harvested from Lake Macdonald. (Lake Macdonald Catchment Group 2000)

Although the water extracted from the storage for urban water supply may be able to be treated to remove undesirable levels of methylmercury, the possible requirement for this treatment needs to be recognized in advance. However, the main problem would result from the release of untreated water downstream from the storage downstream and the ecosystem effects within the food webs of the freshwater ecosystem in the river both upstream and downstream of the dam site. In fact, past experience suggests that the main impact of elevated Mercury levels could be expected to be felt in the river downstream of the storage (Hylandera et al 2006). In other rivers with upstream mercury sources the effect has caused health risks hundreds of kilometres downstream and in receiving estuaries and tidal wetlands. Davis et al (2003), Harada et al (2001).

It is absolutely astounding that a comprehensive assessment of the risks associated with biomagnification of mercury in the Mary Catchment as a result of the proposed Traveston Crossing Dam has been deliberately left out of the draft EIS for the project. The pre-existing knowledge within the Queensland State Government of the levels of mercury in the catchment and the widely recognized effect of new storages on increasing mercury levels in aquatic ecosystems suggests that a credible, independent and thorough assessment of this risk should form an important part of the EIS.

References

Australian Broadcasting Commission (2006) High mercury levels found in Hinze Dam fish. Sunday, 5 November 2006. www.abc.net.au/news/stories/2006/11/05/1781379.htm

Dhindsa, H, Battle A, Prytz S. (2003) Environmental Emission of Mercury During Gold Mining by Amalgamation Process and its Impact on Soils of Gympie, Australia. Pure and Applied Geophysics, Volume 160, Issue 1-2, pp. 145-156 (2003).

Masazumi Harada, Junko Nakanishi, Eiichi Yasoda, Maria da Conceicâo N. Pinheiro, Teiichi Oikawa, Geraldo de Assis Guimarâes, Bernardo da silva Cardoso, Takako Kizaki & Hideki Ohno Mercury pollution in the Tapajos River basin, Amazon. Environment International Volume 27, Issue 4, 2001, Pages 285-290

Hylandera L, Gro J, Troppa M, Vikstro A, Wolpherc H, de Castro E, Meilie M, Oliveirac L. (2006) Fish mercury increase in Lago Manso, a new hydroelectric reservoir in tropical Brazil. Journal of Environmental Management 81 (2006) 155–166

Lake Macdonald Catchment Care Group (2000) Cabomba Pilot Study Prepared for Noosa Shire Council Report March 2000 mrccc.org.au/downloads/publications/Lake Macdonald Catchment Care and Cabomba Projects/Cabomba Pilot Study.pdf

McCartney M, Sullivan C and. Acreman M (2001). Ecosystem Impacts of Large Dams. Background Paper Nr. 2 Prepared for IUCN / UNEP / WCD

Queensland Health (2002). Mercury - Public Health Guidance Note www.health.qld.gov.au/phs/Documents/ehu/2666.pdf

Queensland Water Infrastructure (2007) Traveston Crossing Overview Cattle Deaths Downstream of Dam Site in June/July 2006. Appendix B, Appendix D www.aph.gov.au/SEnate/committee/rrat_ctte/traveston_dam/qon/qgattach3.pdf

Davis J, Yee D, Collins J, Schwarzbach S, Luoma S. (2003) Potential for Increased Mercury Accumulation in the Estuary Food Web. San Francisco Estuary and Watershed Science. Volume 1, Issue 1, October 2003 Article 4

MARY RIVER
WATER WEEK CATCHMENT CRAWL
24th & 25th OCTOBER 2007

Report Prepared by Brad Wedlock

Catchment Crawl Participants:
Graeme Elphinstone, Glenda Pickersgill & Steve Burgess

Mary River Water Week Catchment Crawl
24th & 25th October 2007

Acknowledgments

- **Graeme Elphinstone (DPI&F)**
- **Glenda Pickersgill**
- **Steve Burgess**

Introduction

As part of the Mary River Catchment Coordination Committee's calendar of events celebrating the 2007 National Water Week the Mary River Catchment Crawl was held.

The Catchment Crawls are designed to provide a 'snap shot' of water quality along the Mary River.

On this Catchment Crawl 14 freshwater sites are sampled along the main Mary River trunk, from its headwaters in the Conondale Ranges, downstream to the Mary River barrage (see figure 1). Creek junctions were targeted for sampling in order to gather information on the effects of tributaries flowing into the Mary River. This year as part of the Catchment Crawl eight (8) tributary sites of the Mary River were sampled. A new innovation for this Catchment Crawl was the sampling of six (6) sites for pesticide residues.

By measuring water quality parameters along the Mary River, trends associated with cumulative effects and any other changes along the catchment area can be recorded. October Water Week Catchment Crawls have been held since 2002.

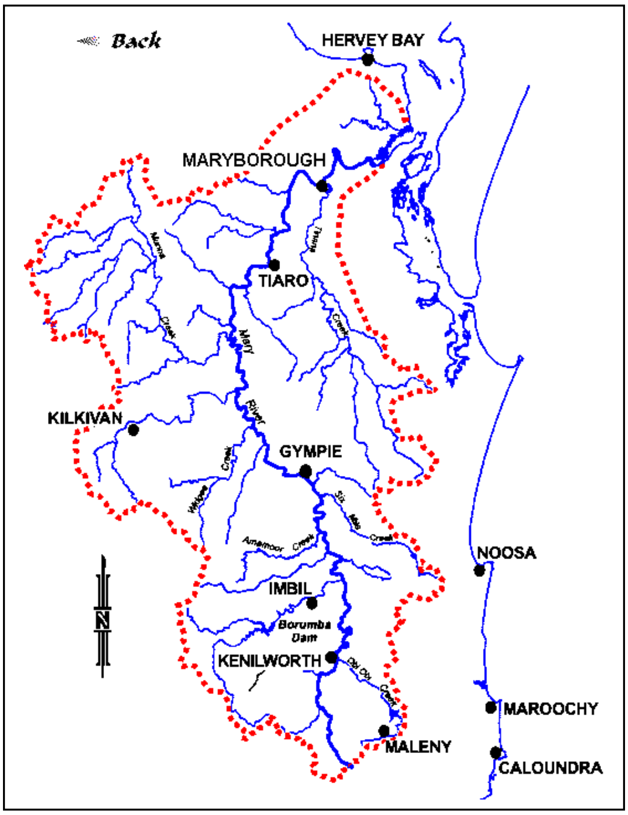


Figure 1: the Mary River Catchment

Itinerary

Water Week Catchment Crawl (24 & 25 October 2007)

Wednesday 24th October 2007 - Mary River Catchment - Gympie South

Depart Gympie at 8:30am

Tributary	Site	Crawl Site Number	Monthly Sampling Program	Arrival Time	Departure Time	Transport Time	Shire
Mary	Policemans Spur Rd - Geraghty Ck junction	Site 1	No	9:30	10:00	15 mins	Caloundra
Mary	Fords Crossing - d/s of Kilcoy Ck	Site 2	No	10:15	10:45	15 mins	Caloundra
Mary	Grigor Bridge - Conondale d/s of Harper Ck	Site 3	No	11:00	11:30	15 mins	Caloundra
Mary	Eastern Mary River Rd - d/s of Elamon Ck	Site 4	No	11:45	12:15	15 mins	Caloundra
Mary	Little Yabba Picnic Area - Little Yabba Ck	Site 5	Yes - Site 1	12:30	1:00	15 mins	Caloundra/Maroochy
Mary	Pollys Island - Obi Obi Ck (Lunch)	Site 6	No	1:15	2:00	30 mins	Maroochy
Mary	Pickering Bridge - d/s Gheerulla Ck	Site 7	Yes - Site 2	2:30	3:00	30 mins	Maroochy
Yabba	Imbil Township - Yabba Ck		Yes - Site 5	3:30	4:00	30 mins	Cooloola
Mary	Traveston Crossing - d/s Yabba Ck		Yes - Site 6	4:30	5:00	30 mins	Cooloola

Arrive Gympie at 5:30pm

Thursday 25th October 2007 - Mary River Catchment - Gympie North

Depart Gympie at 7:30am

Tributary	Site	Crawl Site Number	Monthly Sampling Program	Arrival Time	Departure Time	Transport Time	Shire
Mary	Mary River Barrage, Antigua		Yes - Site 15	8:30	9:00	15mins	Woocoo
Myrtle	Pioneer Rest Rd bridge, Pioneers Rest		Yes - Site 14	9:15	9:45	30mins	Tiaro
Mary	Armstrongs, Tiaro		Yes - Site 13	10:15	10:45	45mins	Tiaro
Tinana	Missings bridge, Tinana Ck		Yes - Site 10	11:30	12:00	45mins	Tiaro
Mary	Wooloolga Rd u/s of Munna Ck	Site 14	No	12:45	1:15	15mins	Tiaro
Munna	Glen Echo Rd bridge, Munna Ck		Yes - Site 12	1:30	2:00	15mins	Tiaro
Mary	Dickabram Bridge d/s of Wide Bay Ck	Site 13	No	2:15	2:45	15mins	Tiaro
Wide Bay	Wilson bridge, Carmyle Rd - Wide Bay Ck		Yes - Site 11	3:00	3:30	15mins	Kilkivan
Mary	Scotchy Pocket u/s of Wide Bay Ck	Site 12	No	3:45	4:15	30mins	Kilkivan
Mary	Widgee Crossing @ Eel Ck junction	Site 10	Yes - Site 8	4:45	5:15	15mins	Cooloola

Arrive Gympie at 5:30pm

Friday 26th October 2007 - East Mary Catchment

Tributary	Site	Crawl Site Number	Monthly Sampling Program	Arrival Time	Departure Time	Transport Time	Shire
Six Mile	Victor Giles bridge, Cooran		Yes - Site 7	8:00	8:30	45mins	Noosa
Tinana	Tagigan Rd, Goomboorian		Yes - Site 9	9:15	9:45	15mins	Cooloola

Arrive Gympie at 10am

Crystal Waters – Mary River

Weather Conditions
Wednesday 24th October was a sunny and fine day, with good weather conditions experienced from Conondale to Gympie. No significant rainfall was recorded during the day, or the week before the crawl in the area sampled.

Thursday 25th October was sunny and fine, but with storms threatening in the afternoon. No significant rainfall was recorded during the day, or the week before the crawl in the area sampled.

River Flow
River flow at most sites was barely discernible particularly in the pools and to some extent the glides. Water velocities recorded were consistently between 0.05 m/sec and 0.1 m/sec in the pools.

At Pollys Island, Kenilworth the Mary River flow rate was 0.2 m/sec – possibly due to the Obi Obi Creek flowing.

Equipment
The following equipment was needed for the day's activities:

- A TPS WP82 Dissolved Oxygen & Temperature meter (YSI DO probe) & TPS WP81 EC / pH meter.
- A Horiba U-10 Multi-probe to measure pH, conductivity, salinity, temperature, dissolved oxygen and turbidity (as back-up).
- Digital camera
- Garmin hand held GPS unit
- Turbidity (clarity) tube
- 10 L bucket
- Catchment map
- Waders, hat, sunscreen, first aid kit
- Folder, data sheets, equipment instructions, itinerary

TPS WP82 & TPS WP81 meters – Calibration and Percent Drift

The TPS WP82 & TPS WP81 meters were calibrated prior to the Catchment Crawl on Tuesday 23/10/07. After the first day of testing (24/10/07), and after the final day of testing (25/10/07) the TPS meters were calibrated and equipment drift recorded. This allowed the 'drift' of the parameter readings to be calculated for the two days of testing.

October 2007 Catchment Crawl Equipment Data Calibration & Drift

Date	Temp % drift	0% sat % drift	100% sat % drift	pH4 % drift	pH6.88 % drift	1.413ms/cm % drift
Actual	23.1	1.6	103.7	4	7.35	1.412
Reference	23.4	-0.1	100.1	4.04	6.89	1.413
After Day 1	**-1.3%**	**1.7%**	**3.6%**	**-1.0%**	**6.7%**	**-0.1%**
Actual	25	3.2	100.6	3.91	6.69	1.404
Reference	25	0	100.1	4.01	6.88	1.413
After Day 2	**0%**	**3.2%**	**0.5%**	**-2.6%**	**-2.8%**	**-0.6%**

Table 1: TPS WP82 & TPS WP81 calibration and drift data

The percent drift values for all standard solutions are considered to be acceptable.

RESULTS & DISCUSSION

Temperature (°C) and pH

Water temperatures during the October 2007 Catchment Crawl were influenced by weather conditions. On the 2 days of the Catchment Crawl the weather was fine and sunny.

As a consequence water temperatures varied according to the degree of riparian shade provided within the river reach.

Like last year, the hottest water temperature recorded on the October 2007 Catchment Crawl was taken at Kenilworth, at a staggering 29.6 degrees – this is a record for the site (last year was 29.2 degrees – which was a record). The maximum ambient temperature recorded in Nambour on Wednesday 24th October was 27.5 degrees.

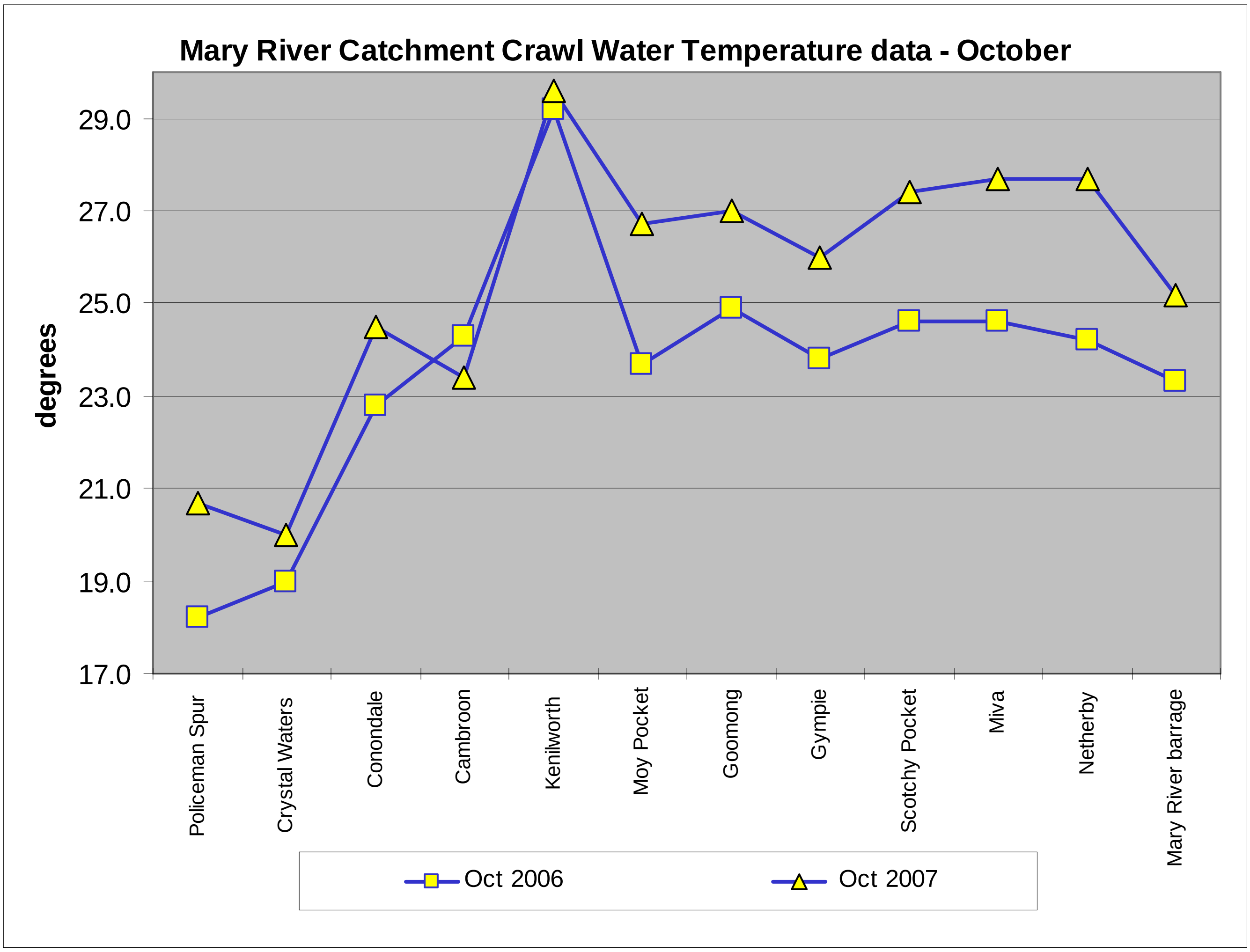


Figure 2: Water temperature recorded on 2007 & 2006 Catchment Crawls

The October 2007 Catchment Crawl also recorded quite high pH levels. As Figure 3 shows, three (3) Mary River sites were non-compliant with EPA water quality guidelines:

- Pollys Island, Kenilwoth - Mary River
- Pickering Bridge, Moy Pocket – Mary River
- Traveston Crossing – Mary River

Yabba Creek recorded an exceptionally high pH reading of 9.2, which far exceeds the EPA water quality guideline for the Mary Catchment. The eastern tributaries of the Mary River catchment of

Tinana & Six Mile Creeks recorded pH values that were in conflict with the EPA water quality guidelines, however the readings are natural for these acidic waterways of the Mary Catchment.

Unlike the October 2006 Catchment Crawl the 2007 results show that the Mary River is now much healthier after the August / September flood events. Last year at some sites unprecedented pH levels were recorded during the lowest flows, namely:

- Emerys Crossing – Gundiah
- Dickabram Bridge – Miva
- Widgee Crossing – Gympie
- Gympie Weir - Gympie

These higher than expected pH values can possibly be attributed to the relationship between temperature, pH and slow moving water. Temperature is directly associated with sunlight intensity. Increased sunlight increases temperature which stimulates photosynthetic activity of aquatic plants and algae. Algae thrives in nutrient rich, slow moving warm water. Exploding algae growth quickly uses dissolved carbon dioxide in the water (removal of carbonic acid in water), which in turn increases the alkalinity of the water, thus the reason for high pH levels. Mid to late afternoon, when water temperatures are highest, is generally when the highest pH levels are recorded.

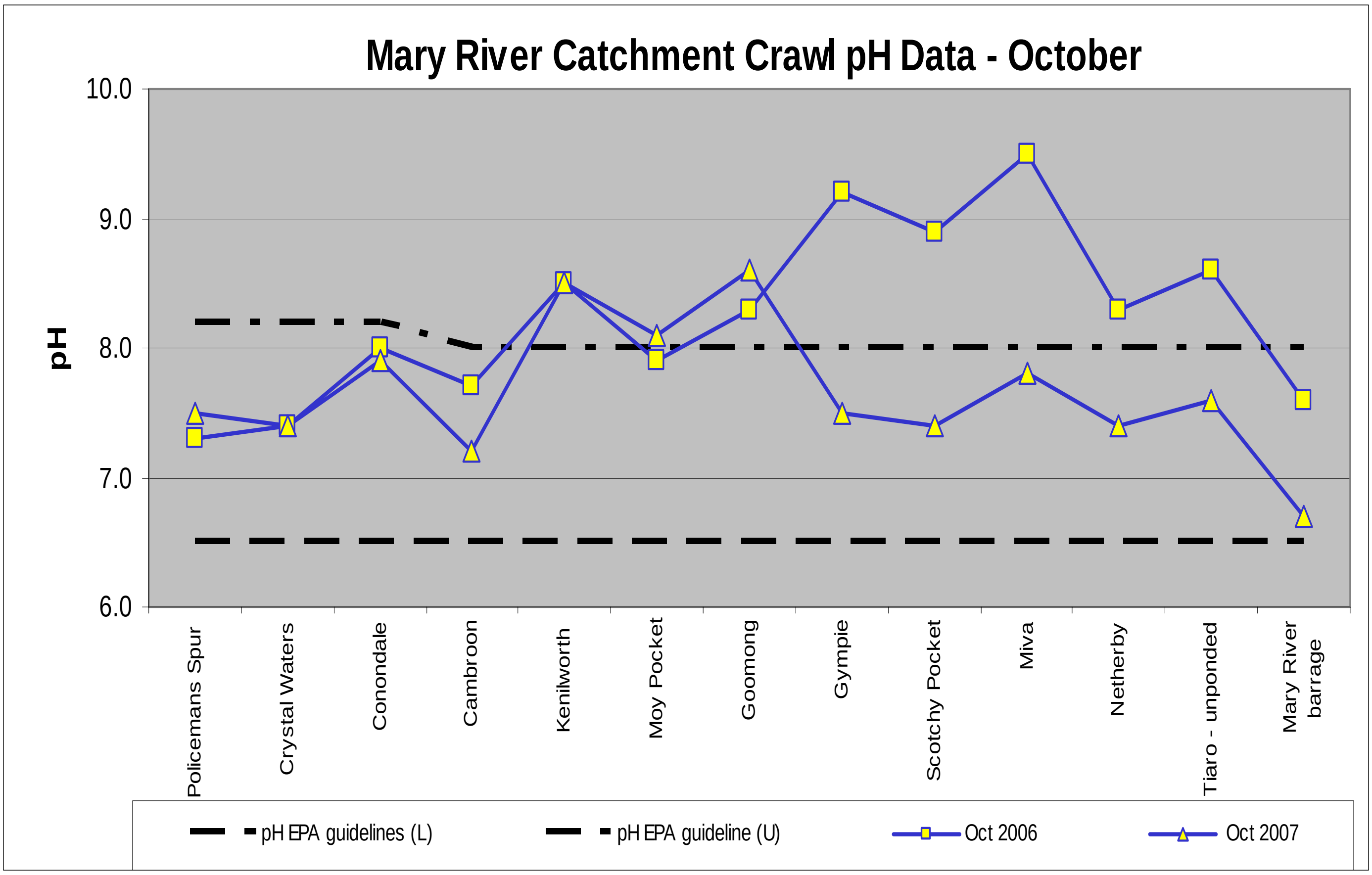


Figure 3: pH values recorded during the 2007 & 2006 Catchment Crawls

Electrical Conductivity (uS/cm) – Salinity

Electrical Conductivity (EC) is a measure of waters ability to conduct electricity. EC values increases as the amount of dissolved salt content in water increases.

Unlike the October 2006 catchment crawl the 2007 October Catchment Crawl readings were within EPA guidelines for salinity

As in previous years, the most intriguing aspect of the October 2007 EC data is the steady increase of EC levels from Gympie downstream peaking in the Sexton to Miva area (see Figure 4).

The EC level from the upper catchment virtually doubles by the time it reaches Miva. Similar to the pH results for the October 2007 Catchment Crawl period, EC readings follow the same trend as the October 2002, 2003, 2004, 2005 results.

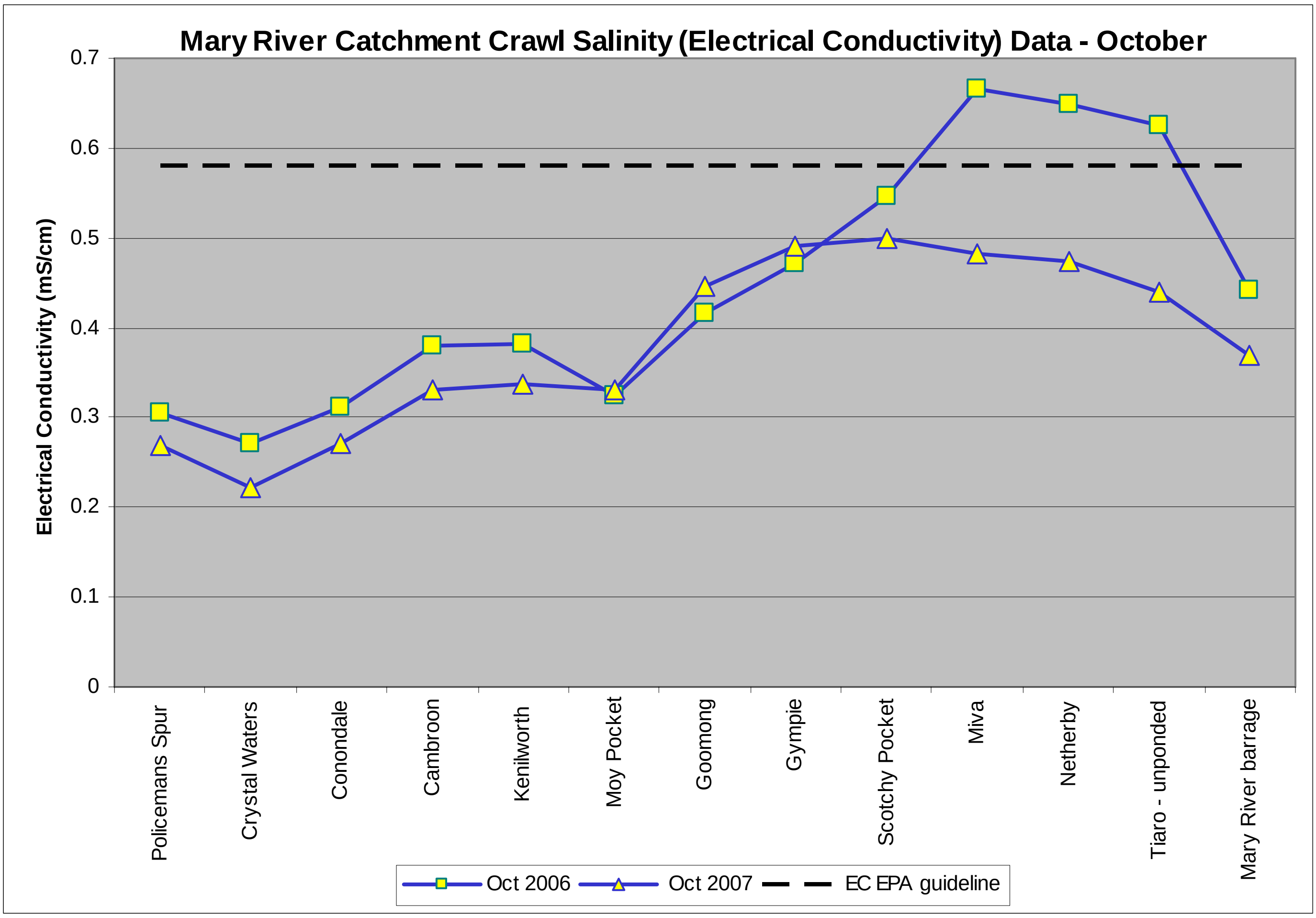


Figure 4: Electrical conductivity levels recorded during the 2007 & 2006 Catchment Crawls

Dissolved Oxygen (% saturation)

The dissolved oxygen (DO) % saturation levels of the October 2007 Water Week Catchment Crawl, was again generally not compliant with the EPA DO guidelines for the Mary River (see Figure 5), with 72% of sites non-compliant.

The maximum level recorded was 145% saturation at Traveston Crossing, which indicates that the water column is super-saturated with oxygen, possibly as a consequence of high nutrient loads. At Pollys Island, Kenilworth the dissolved oxygen level was the second highest recorded at 133%, which correlates with the high water temperature recorded at the same site.

The lowest % saturation level recorded was at Cooran on the Six Mile Creek with 38% saturation, which is well below EPA guidelines. This DO level correlates with a large fish-kill below Lake Macdonald during the same week as the Catchment Crawl. Apparently an environmental flow release valve had been accidentally shut-off leading to a large fish kill due to oxygen depletion in the creek below the Lake Macdonald spilway.

A significant quantity of filamentous green algae was again observed at the Pollys Island, Kenilworth site which would be the cause of the over-elevated % saturation levels. This level of dissolved oxygen would be unsustainable, with a major drop-off in the early hours of the morning, possibly down to 30% saturation.

A filamentous alga was present at most sites recorded. This is indicative of excessive nutrient levels which cause major peaks and troughs in the % saturation of dissolved oxygen. This is not conducive to the sustainability of aquatic ecosystems.

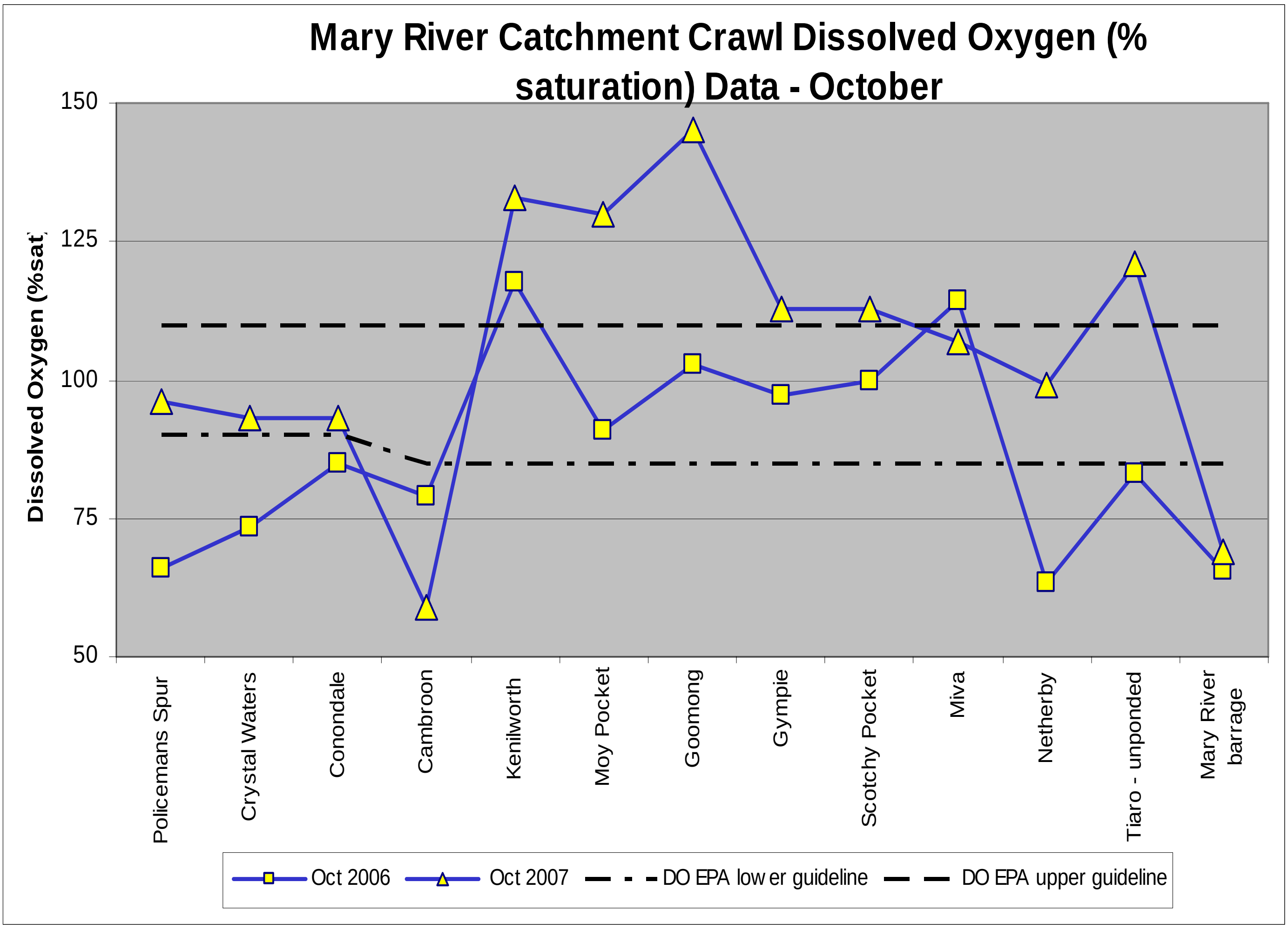


Figure 5: Dissolved oxygen (% saturation) level recorded during the 2007 & 2006 Catchment Crawls

Turbidity (NTU)

Turbidity is a measure of suspended sediments within the water, predominately from erosion within the catchment and streambank erosion.

The clarity of the water in the Mary River during the October 2007 Catchment Crawl was exceptionally good. At all sites turbidity was not detectable to the eye using the clarity tube. A number of people tested the turbidity level with the clarity tube as a quality control measure, and for each person turbidity was virtually undetectable. A number of sites displayed tannin stained water, but this is a natural variation of the water in the eastern tributaries, such as Tinana & Six Mile Creeks.

This is a good indication that the flushing flows during August / September were essential to maintain good water quality in the Mary River. This good water quality will have turned the river around from dying in October 2006 to thriving in October 2007.

Aquatic Weeds

As in previous years, aquatic weeds were recorded at each site on the Catchment Crawl.

To date no Cabomba (WONS Top 20 weed) has been recorded at any site on the Mary River. However Salvinia (WONS Top 20 weed) was present at most sites, particularly in the middle reaches of the Mary River from Kenilworth to Gympie. The largest concentration of Salvinia was recorded in the Mary River barrage. Most of the Salvinia was however only in the 2-leaved (juvenile) stage; but will be increasing. At Glen Echo Rd, on the Munna Ck, the Salvinia had matured to the second phase of its growth.

Water Hyacinth was found as far up the catchment as Conondale, and along the length of the Mary River, but only individual plants of juvenile nature. Within the Mary River barrage some small rafts of hyacinth were accumulating on the river edge, of approx. 0.5 sq metre.

Dense Waterweed (*Egeria densa)* is not a declared plant, but it is an aquatic weed that the CSIRO is investigating closely due to its explosive growth in a short period of time. It is still a popular aquarium plant due to its robustness.

Dense Waterweed was recorded at Pickering Bridge, Moy Pocket in large patches. There was no Dense Waterweed recorded above Kenilworth on the Mary River. It appears as though the Dense Waterweed infestation is coming out of Obi Obi Ck, and infesting downstream.

No aquatic plants were detected in Tinana or Six Mile Creeks, but the sampling site on Yabba Creek had a very dense infestation of Hydrilla (a native submerged plant).

Filamentous algae at Conondale

Conclusion

The most striking observation made during the October 2007 Catchment Crawl was how healthy the river looked compared to the 2006 Catchment Crawl. The flushing flows in August have had a remarkable effect on the health of the entire length of the river.

River flow was at the usual level experienced this time of year, and water clarity was exceptionally good. Very few aquatic weeds were recorded. Hyacinth and Salvinia were found along the entire length of the river, but mostly only individual plants. After the flushing flows in August and September masses of Dense Waterweed has been removed from the river and caught in the riparian vegetation fringing the Mary River. It would be interesting to estimate the cost of harvesting this quantity of aquatic weed from the Mary River. The recent floods have provided incalculable environmental services, and brought the river back to life.

This is in stark contrast to the 2006 Catchment Crawl were there was very little flow in the Mary River along its entire length. At the time of the 2006 Catchment Crawl the river was slowly dying from lack of flow, nutrients, fish kills and aquatic weed infestations. The August 2007 flushing flows were essential for the recovery of the river and the ecology of the Great Sandy Strait.

The highest water temperature recorded during the October 2007Catchment Crawl was again recorded at Kenilworth. The water temperature was a staggering 29.6 degrees.

Interestingly, the tributaries that were sampled with dams in their upper catchment showed signs of ill-health. The sample site at Cooran on Six Mile Creek had very low dissolved oxygen levels, apparently due to the environmental flow valve at the Lake Macdonald had accidentally been turned off. While the Yabba Ck site at Imbil had super-saturated dissolved oxygen levels, due mainly to high aquatic plant growth as a consequence of virtually no water releases at present from Borumba Dam. Apparently there is no flow over the weir on Yabba Creek at present.

The Catchment Crawl data presented in this report can only be interpreted as a ‘snapshot’ of the health of the Mary River during the sampling period. Water quality will alter substantially during ‘events’ such as flooding and drought, and these events will have considerable short-term and long-term effects on the condition of water quality within the Mary River Catchment.

MARY RIVER

CATCHMENT
COORDINATING
COMMITTEE

Water for the Future

A discussion paper produced by the

Future Water Options Sub-Committee

of the

Mary River Catchment Coordinating Committee

July 2005

2nd EDITION

Water for the Future Discussion Paper

Introduction

The Mary River Catchment Coordinating Committee (MRCCC) aims to stimulate debate on long term, sustainable water supply strategies and highlight that water is a finite resource, which needs to be carefully managed. Unless major changes are implemented in the way water is managed, competition between urban water users and irrigators will intensify in the Mary Basin. The community needs to be aware that there are alternatives to building more dams.

This document provides information on sustainable options for reticulated urban water supply including rainwater tanks, recycling and desalination.

The Mary Basin incorporates the whole of the Mary Catchment from Maleny to Hervey Bay, the Sunshine Coast catchments (Mooloolah, Maroochy and Noosa), the Burrum River catchment, and the Cooloola Coast (Rainbow Beach and Tin Can Bay).

Recent figures compiled by the MRCCC show that the current population of the Mary Basin is close to 400,000. Some of the towns in this region are among the fastest growth-rate localities in Queensland. Projections by the Department of Local Government and Planning indicate the population of this region will double in 20 years. This growth is already placing significant pressures on the catchment's natural resources and the provision of community services.

The MRCCC is dedicated to achieving a sustainable and productive catchment. In achieving this vision, our members hope to ensure that we will not be judged by what we take from the catchment, but by how we leave the catchment so that it's capacity to support our future generations is enhanced.

Mary River Catchment Coordinating Committee

PO Box 1027, Gympie 4570

Phone: 07 5482 4766

Fax: 07 5482 5642

Email: mrccc@ozwide.net.au

Website: www.wb2020.qld.gov.au/icm/mrccc

Water for the Future

TABLE OF CONTENTS

Dams are letting us down.
We are polluting our rivers & wasting our resources

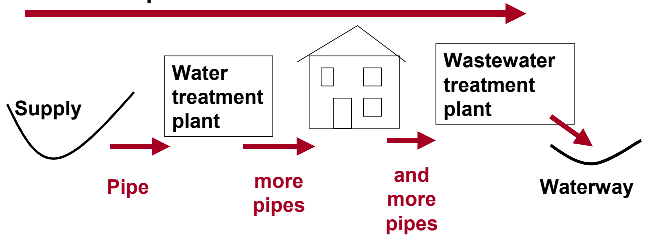
Water supply sources

- dams and weirs provide most of the water supplied for urban use on the Sunshine Coast
- their catchments are unprotected
- groundwater is not a major contributor
- little is known about groundwater

Water Treatment Plant

- water is treated so that it is safe to drink
- amount of treatment required (and cost) depends on raw water quality
- risk should be identified and managed
- technology is available to treat water of any quality to virtually pure

The current Urban Water Cycle is a straight line from dam to disposal with a shortage of water at one end and pollution at the other



Water at work

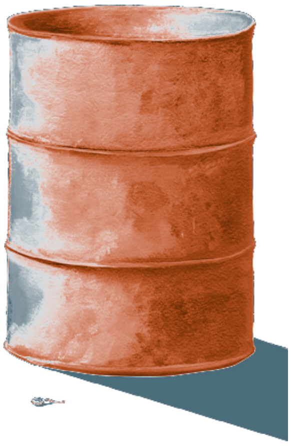
- drinking water is used in industry, institutions and in our homes where half is used inside the house and half outside
- only 1% of the drinking quality water we are supplied with is consumed

Demand management

- demand management is a cost effective way of making existing water supplies go further
- more efficient appliances are needed - changes to community behaviour are difficult to maintain
- it can provide “breathing space” but will not be sufficient to provide for projected populations in the longer term

Demand management includes:

- WaterWise programs and education
- unaccounted-for water and leakage reduction
- pricing incentives
- restrictions
- water-efficient appliances
- pressure management



Wastewater management

- wastewater contains one tablespoonful of dirt in a 44 gallon drum of water
- it is treated to separate the water (effluent) from the dirt (biosolids)
- the amount of treatment depends on how the effluent is to be managed
- effluent is disposed of in a waterway or the ocean in accordance with an EPA licence
- EPA licences are becoming more rigorous
- pollutants of concern to the receiving environment are carbon containing chemicals and nutrients

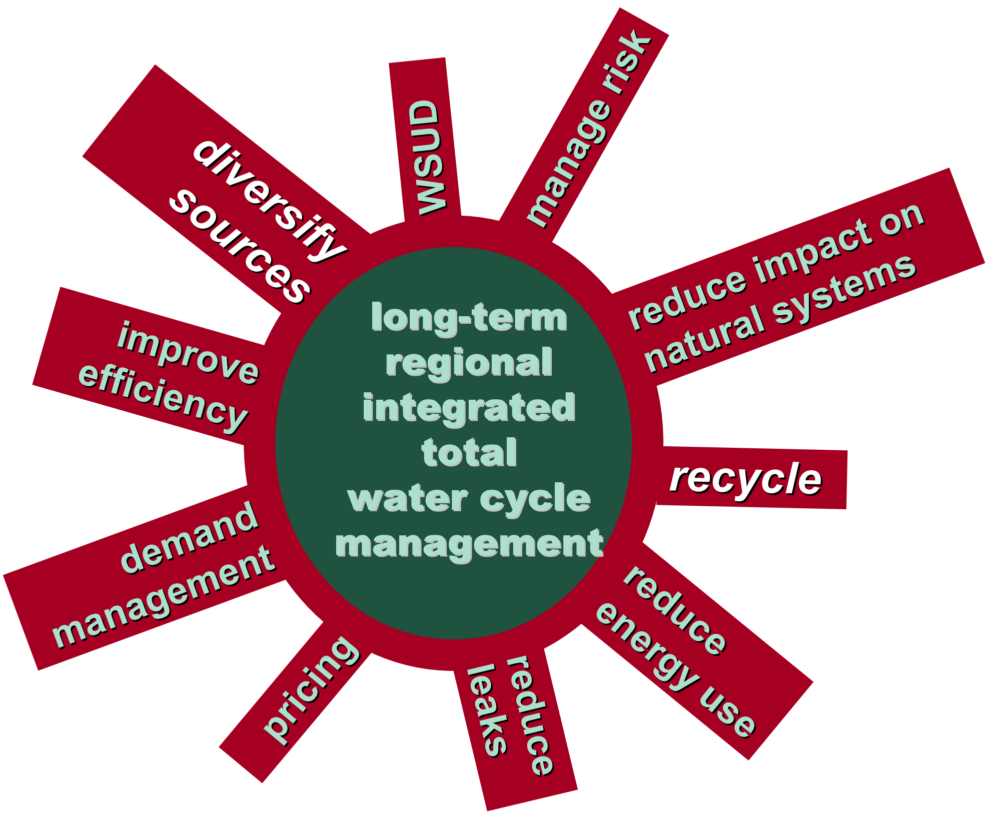
Senate Inquiry into Urban Water Management 2002

- we do not use water sustainably
- we know we have to change
- we have the technology and expertise

but we are not doing it !

Sustainable urban water management involves:

- quality fit-for-purpose - safeguarding public health
- the security of a diversity of sources
- water-use efficiency
- reducing impact of waste discharge
- reducing energy use



Water supply options

- dams
- rainwater tanks
- desalination
- recycled water

Dams

- dams have been a traditional strategy to cope with our unpredictable and uncertain climate – but they are letting us down
- are a barrier to the flow of water, sediments, oxygen and energy
- inundate good agricultural land
- have social and cultural impacts
- change a river's hydrology
- the best dam sites have already been developed
- new sites are in lower rainfall areas and further from where the water is needed
- yield of dams is less than previously thought due to environmental flow requirements and lower rainfall
- building a dam doesn't make it rain
- an advantage of dams is that they are a "short term" political fix
- some dams provide a source of power, flood mitigation and recreational opportunities

Rainwater tanks

- If rainwater is the only source of quality water, the bigger the rainwater tank, the better – limited only by the size of the roof catchment and rainfall
- If a trickle-top-up system is used, models are available to work our the optimum size.

Advantages of rainwater tanks

- tanks in coastal urban towns are generally in a higher rainfall area than more inland dams
- they fill from small and medium rain events as opposed to dams that require larger events before run-off into the dam is significant especially after a dry spell

Optimum use of rainwater tanks

- they must be used constantly and regularly – not just on the garden
- studies on the Gold Coast show 25 – 30% of household demand can be provided by a 10,000 litre tank with a trickle top-up system

Rainwater tank size

Choice of tank size is determined by a number of factors:

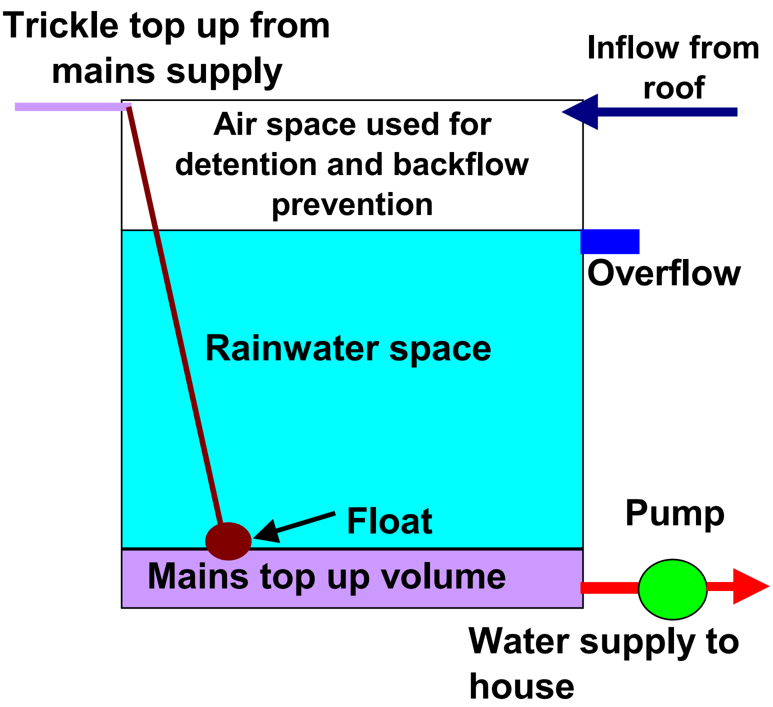
- the volume of water required each day
- the rainfall
- the size of the roof
- the security of supply required – if there is a prolonged drought the amount of water stored in the tank may not be sufficient to avoid buying water

There is a point at which additional increases in tank capacity will have only a marginal effect on yield but significantly increase cost.

> The size of the tank you will need depends on your roof area, rainfall, how much water you use each day and whether you are prepared to buy water if you run out.

This table shows the tank sizes required to provide 99% security of supply

Volume required (l/d)	Annual rainfall (mm)	Roof area (m^2)						
		100	150	200	300	400	500	600
		Minimum tank size (kl)						
100	200						*40*	
	300				*20*	*17*		
	600	*19*	*12*	*10*	*8*			
	1200	*10*	*8*	*7*				
200	300							*47*
	600			*36*	*26*	*22*	*20*	*18*
	1200	*34*	*24*	*19*	*16*	*14*		
400	500							*51*
	600							*47*
	1200				*47*	*39*	*34*	*31*



The Trickle Top-up system (Diagram courtesy of Dr Peter Coombes)

The trickle 'top up' system

- the tank is topped up by a low flow from the mains when water levels in the tank are low
- the tank tops up to a minimum level until rainfall fills the tank again
- mains supply
- the tank water is used for toilet flushing, the hot water service and outside uses
- a second pipe provides water for drinking
- the constant flow takes the daily peaks out of household demand enabling cost savings at the water treatment plant and the use of smaller pipes

Disadvantages of rainwater tanks

- microbiological quality is not as high as reticulated water
- potential to be a breeding place for mosquitoes
- regular maintenance and cleaning required
- profits of the water providers reduced

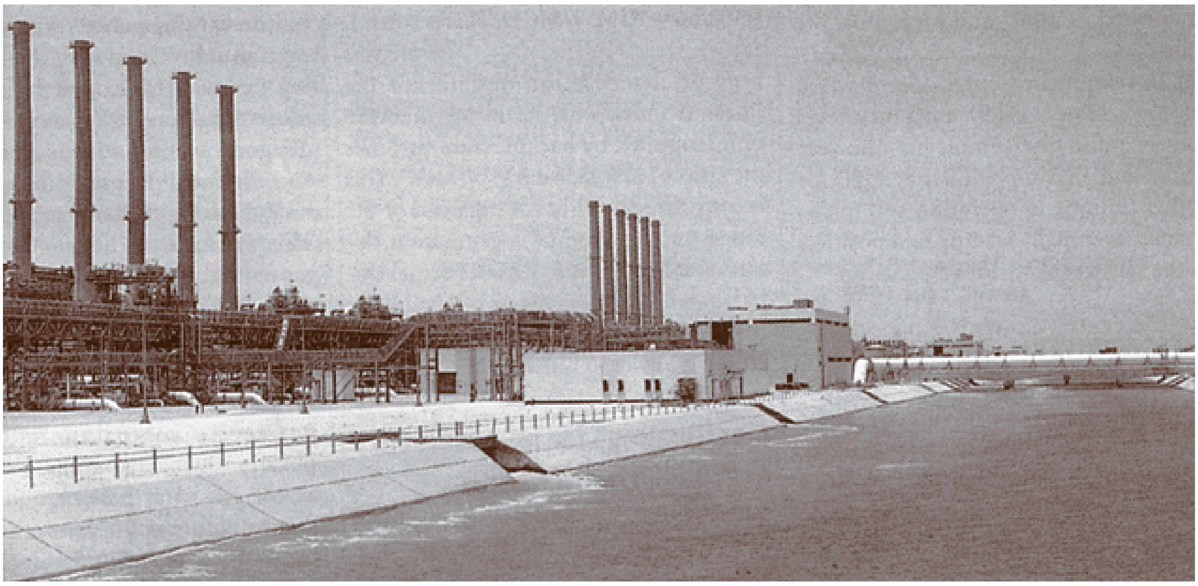
To find out more about rainwater tanks, visit this website:

http://www.dhs.sa.gov.au/pehs/publications/monograph-rainwater.pdf.

Desalination

- fresh water can be recovered from seawater using "multi-stage flash" or membrane technology
- multi-stage flash is used mainly in the Middle East where there is an abundant quantity of energy from oil

The Al-Jubail "multi stage flash" desalination plant in Saudi Arabia is the largest in the world



Desalination – reverse osmosis

- reverse osmosis membranes produce water that is virtually "pure"
- they require a lot of energy and the waste stream is expensive and difficult to manage
- membrane technology has advanced over the last decade. The cost of production has fallen
- the same technology can be used to reclaim wastewater

The reverse osmosis desalination plant at West Basin in California produces 10 mega litres of water daily for use in an oil refinery

Recycled water

- the water we use inside our homes (50% of demand) goes to a wastewater treatment plant where it becomes available for recycling
- water available for recycling increases with population
- a recovery rate of 70 – 80% is technically feasible using nutrient reduction, ozonation and membrane technologies

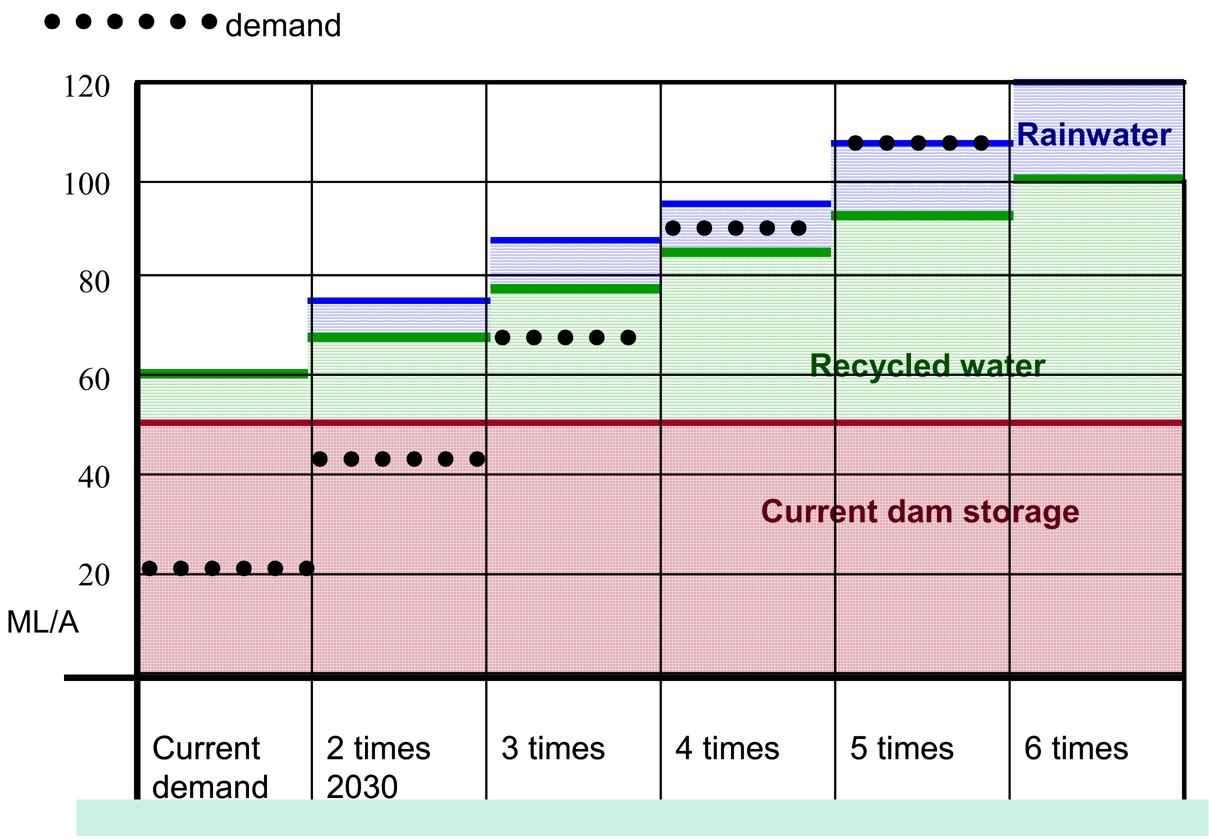
Case Study

Caloundra/Maroochy water cycle management

- the current way of disposing of our waste is unsatisfactory
- the Maroochy River had a D grade (poor) in 2004 due, at least in part, to effluent discharges to the river
- the outfall at Kawana has long been a source of controversy and a waste of water
- current dam storages will meet the needs of Caloundra and Maroochy for approximately another 30 years
- increasing population is occurring at the same time as climate change resulting in decreased run-off to refill dams
- current production from Landershute is 21,000 ML per annum
- over 50% of this goes to a wastewater treatment plant (assume 50%)
- 85 - 90% can be reclaimed (assume 70%)
- expected yield from rainwater tanks with trickle top-up is 25 – 30% on Gold Coast (assume 20%)

Current storage ML/a	52,000	52,000	52,000	52,000	52,000	52,000
demand	21,000 current	42,000 X 2	63,000 X 3	84,000 X 4	105,000 X 5	126,000 X 6
50% at STP	10,500	21.000	31,500	42,000	52,500	63,000
70% recovery	7,000	14,700	21,700	29,400	36,400	44,100
Current + recycled	59,000	66,700	73,700	81,400	88,400	96,700
Rainwater 20%		8,400	12,600	16,800	21,200	25,200
Current + recycled + rainwater		77,100	86,300	98,200	109,600	121,900

Caloundra/Maroochy water supply with recycled water and rainwater tanks



Benefits of recycling at both ends of the pipeline

- recycled water and rainwater could supply four to five times the present population in Caloundra and Maroochy without any restrictions on demand
- it reduces waste and pollution caused by present disposal practices

Benefits of recycling water to the urban supply

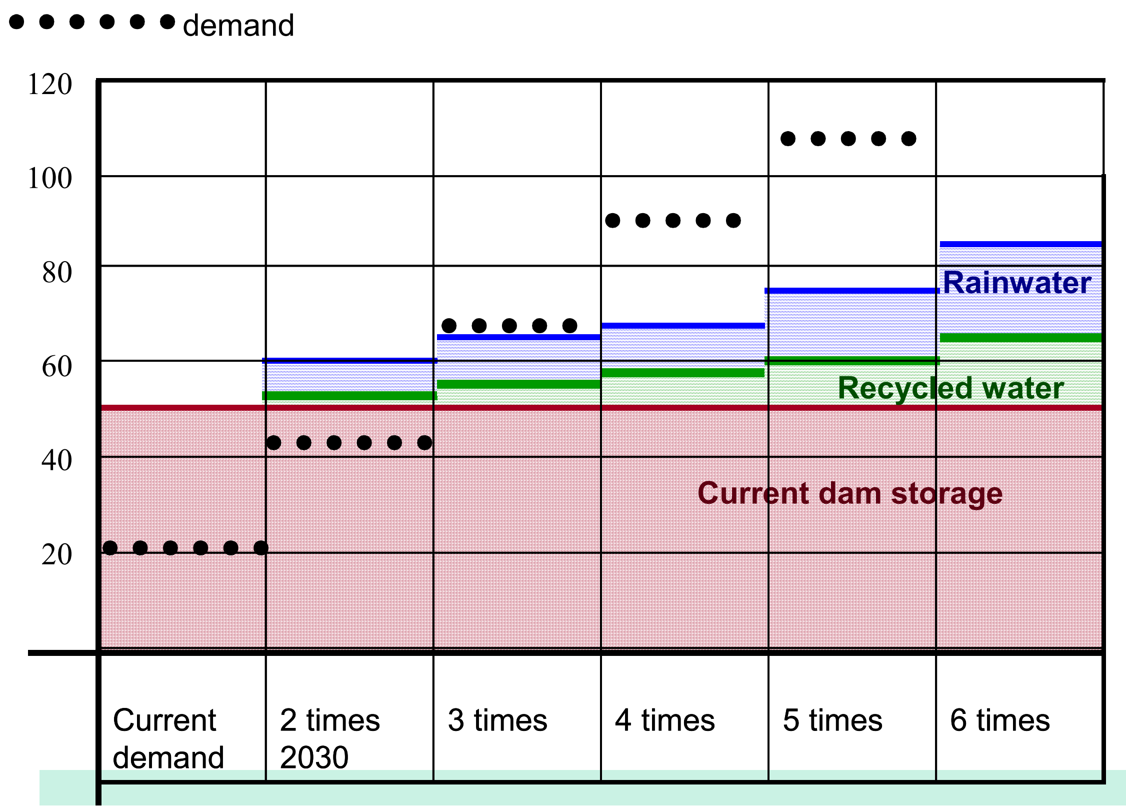
- an alternative *secure* supply that reduces our dependence on dams
- not affected by climate change
- demand and availability coincide – unlike the mismatch when recycled water is used to meet the seasonal needs of plants

Dual reticulation

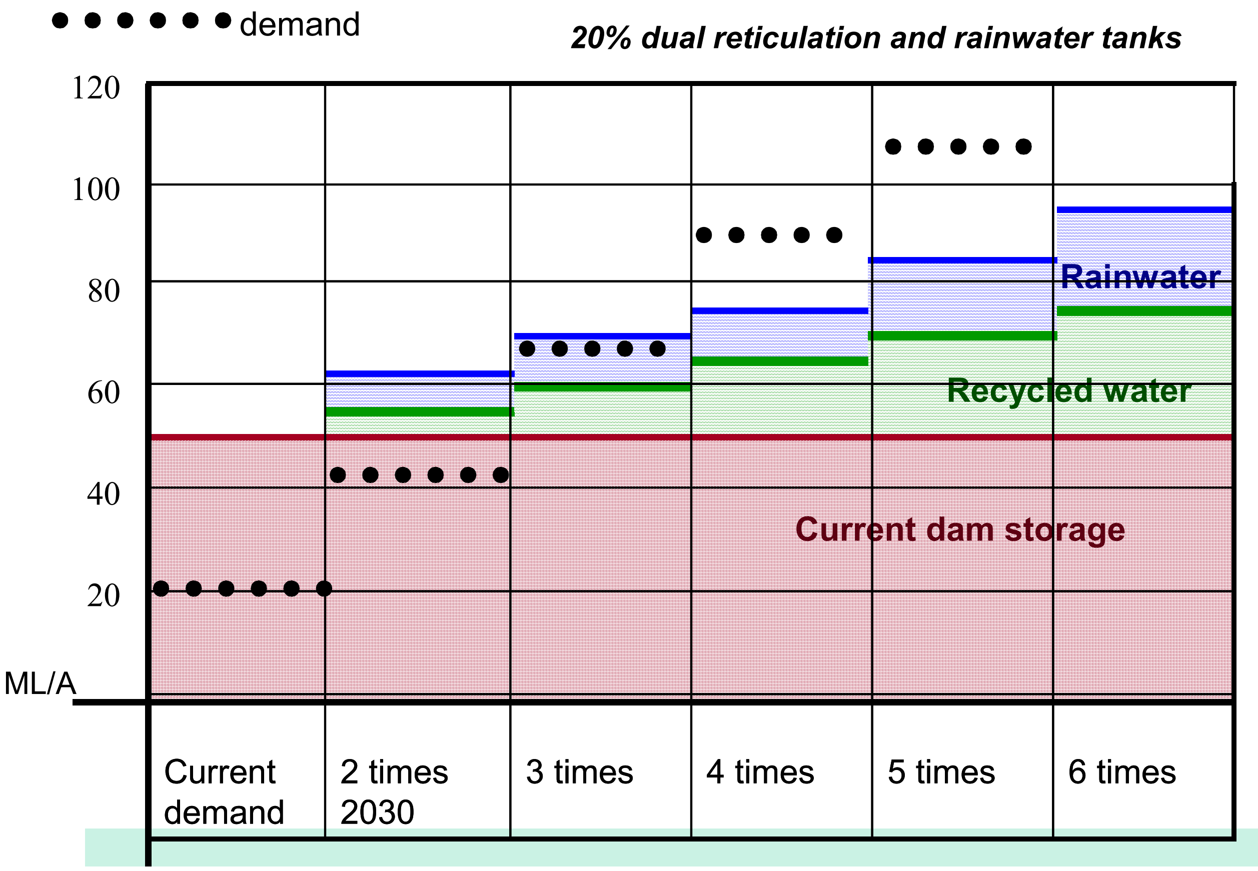
- unacceptably high capital cost to lay the second pipe in areas already developed
- higher infrastructure costs are met by developers
- nutrient management facilities required when excess effluent is discharged to a waterway
- Salinity is a potential problem
- precautions needed to avoid cross-connection
- re-use potential not maximised - 20% of demand supplied by recycled water is very optimistic
- cost of recycled water is higher than current reticulated water
- competes with greywater and stormwater recycling

Current storage	52,000	52,000	52,000	52,000	52,000	52,000
Demand	21,000 current	42,000 X 2	63,000 X 3	84,000 X 4	105,000 X 5	126,000 X 6
10% dual retic. usage		2,100	4,200	6,300	8,400	10,500
20% dual retic. usage		4,200	8,200	12,600	16,800	21,000
70% recovery	7,000	14,700	21,700	29,400	36,400	44,100

Above: Caloundra/Maroochy Water supply with dual reticulation



Above: 10% dual reticulation and rainwater tanks



Desalination v reclamation

- the amount of energy required to purify water depends on the concentration of pollutants in the water
- wastewater contains a lower concentration of pollutants than seawater
- the operating cost, energy use and greenhouse gas emission are three times more for desalination than for reclamation
- desalination does not prevent pollution and waste at the 'other end' of the pipeline
- further expense could be incurred if upgrades to wastewater management are needed

Effluent discharge reduction options for Melbourne (CSIRO)

OPTION	Cost $/kL	Volume used %
Demand management	0.10	1 - 12
Industrial recycling	0.16	<1
Land irrigation	0.20	8 - 10
Aquifer storage	0.31	10 - 20
Cardinia Reservoir	0.39	95
Woodlot irrigation	0.42	2
Constructed wetlands	0.59	2 - 2.5
Sewer mining with local re-use	0.66	0.2
Untreated greywater re-use	0.72	<1
Dual reticulation new lots	0.99	5
Dual reticulation refit	1.99	5
Treated greywater re-use	9.86	<1

If it is clean enough to put in the river, it is clean enough to put in the dam

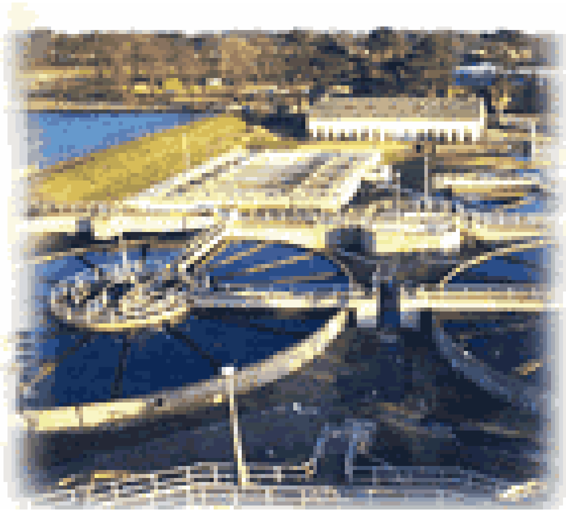
Examples of water recycling

- Upper Occoquan, Virginia
- Hanningfield, Essex
- NEWater, Singapore
- Windhöek, Namibia

Upper Occoquan

- the Occoquan Reservoir is a large water supply source in Northern Virginia
- the Occoquan Watershed was largely rural until the 1960s, when the opening of a highway created a rural/suburban area convenient to people working in Washington, D.C.
- the resulting development led rapidly to water quality problems in the reservoir
- the main culprits were eleven secondary wastewater treatment plants that discharged into the reservoir
- water quality dramatically improved in 1978 when the plants were replaced by a water reclamation plant
- treatment processes include nutrient reduction, filtration, activated carbon and flocculation water has been successfully reclaimed for more than 20 years
- it supplies 50% of the water for the Fairfax Water Authority, which serves a population of 1 million people

Hanningfield



- Essex water supply area is one of the driest in England and currently imports over 50% of its water from outside its shire boundary.
- as no additional water is available, water is recycled
- effluent is taken to a purpose-built recycling plant for further tertiary treatment
- the reclamation plant treats effluent from Chelmsford STP, removing phosphates, nitrates, ammonia, oestrogen and pathogens
- the recycled water is discharged to augment the flow of the Chelmer River upstream of the Essex & Suffolk Water intakes to Hanningfield Reservoir
- water from Hanningfield Reservoir is given further treatment, including ozonation, before it is supplied to customers
- the scheme can provide up to 40Ml of water a day or 8% of additional water resources

NEWater in Singapore

- Water recycling has been successfully introduced in Singapore to reduce their dependence on supplies from Malaysia
- NEWater is treated used-water that has undergone stringent purification processes using dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies
- it was monitored and assessed by a team of experts who unanimously agreed that NEWater is a safe and reliable product, "ready to drink"
- NEWater is used by carbon chip manufacturers who require very pure water and the rest is discharged to the reservoir
- water from the reservoir has conventional treatment before it is supplied to the public
- NEWater currently supplies 1% of total daily water consumption. This will gradually increase
- much of the technology and expertise for the NEWater plants comes from Australia
- the Visitors Centre is an important feature and responsible for the community's wide-spread and enthusiastic acceptance of recycled water

Windhöek, Namibia

- Windhöek, the capital of Namibia, has a population of approx 250,000
- it lies between the Kalahari and Namib deserts
- it has an annual average rainfall of 360 mm and an annual evaporation of 3,400 mm
- The only perennial rivers are 750 and 900 km away on the northern and southern borders of the country
- local springs and dams on ephemeral rivers are insufficient for the town
- Windhöek has been successfully recycling water directly to its reticulated supply for more than 30 years
- water quality in the local dam has been seriously compromised by informal settlements (squatters) in the catchment

- it is sometimes not as good as the effluent from the wastewater treatment plant
- the effluent is therefore discharged to the dam
- a new reclamation plant, completed in 2002, treats the blended water
- the plant was designed on the basis of a multi-barrier system
- it includes ozonation, activated carbon filtration, dissolved air flotation and membrane ultra-filtration

- various safeguards are in place to manage any variation in raw water quality
- water quality monitoring is undertaken in a sophisticated water laboratory
- as well as the final product, the incoming wastewater, treated effluent, water in the dam and the blended water are all frequently tested

Comparitive risks