CONONDALE RANGE COMMITTEE
PO BOX 150, KENILWORTH 4574

The Secretary
Senate Rural and Regional Affairs and Transport
Parliament House
CANBERRA ACT 2600

April 1 2007

RE: INQUIRY INTO ADDITIONAL WATER SUPPLIES FOR SOUTHEAST QUEENSLAND—TRAVESTON DAM/ MARY RIVER INFORMATION

Dear Sir /Madam

We wish to provide information for the forthcoming Senate Inquiry into southeast Queensland water supplies and in particular the construction of the Traveston Crossing Dam.

<u>Chronology</u>

On April 27 2006, the Premier flew over the dam site on the Mary River with the Cooloola Mayor and the then Minister for Natural Resources and announced the construction of the Traveston Crossing Dam. At this stage the government had announced no water saving incentives, no tank rebate scheme and had not publicly entered into the possibility of water recycling.

The Traveston decision, it would soon emerge, had not been studied in any great detail and was the result of a rather cursory desktop study of possible dam sites. Its possibility had not been mentioned to the Community Reference panel engaged on the Water Resource Plan, nor had it been mentioned to Mayors in the region. Indeed as recently as January 2006, the state government had published **“**The South East Queensland Regional Water Supply Strategy Interim Report” which listed a number of short, medium and long-term options for the supply of water in southeast Queensland. Short and medium-term options, out to 2020 included a number of initiatives and while it mentioned “Mary River water storage improvements” as a possible longer-term measure (beyond 2021), it did not refer to major dams on the Mary River.

It had been assessed previously. Back in 1994 “An Appraisal Study of Water Supply Sources for the Sunshine Coast and Mary Valley” (Table 8.2) determined that the site was “considered unsuitable because of high capital cost, inundation of prime agricultural land and displacement of rural population”. The site was not chosen for further investigation.

Although the government seemed firm in its resolve to build the dam, it had done very little further homework as to the social or environmental impacts, nor even of the geology. Test drilling commenced after the April announcement quickly found the original site unsuitable and a possible alternative was identified several hundred metres further upstream.

At least three sets of different inundation maps were prepared. A number of property owners who had been informed that their properties would be needed for the dam would later be advised this was no longer the case. Some, in the meantime, under understandable stress, had already reluctantly sold.

In some government publications the dam announcement seems to have been altered to July 2006 when the Premier provided some details that had been sketched out in the intervening months. The major difference, that of dividing it into Stage 1 and Stage 2, would appear not to have been made out of compassion but more as a means of seeking incremental rather than total environmental approval from the federal government. Despite only referring Stage 1 for federal approval, QWIPL continues to purchase properties for both stages 1 and 2 while the Premier appears to vacillate as to whether Stage 2 will be necessary or not.

The Traveston Dam decision was a hasty, ill-researched decision that was announced well prior to other demand management and water supply options that have much greater community support and far less impact. The dam decision needs to be revisited in light of more recent water supply decisions such as recycling and the apparent failure of yet another "wet" season.

Community condemnation

The Traveston Crossing Dam has been widely condemned. The councils along the length of the river came out in opposition and took the unprecedented initiative of engaging a consultant to do the work the state government should have done. When a Mary River WRP was announced that was significantly altered from the draft, the members of the Community Reference Panel unanimously condemned it and dissociated themselves from it.

The Queensland Farmers' Federation has expressed grave concerns (see Attachment 1 and, interestingly, note the discrepancy between the dam's touted cost at the time of the media release and the current figure of almost $2 billion). Even the State Moderator of the Uniting Church has spoken publicly and in the Courier Mail, condemning not only the dam but also the way in which the government was treating residents of the Mary Valley.

In one of its largest responses, an ABC poll on Brisbane radio showed only 23% supporting more dams (see attachment 2) while the Sunshine Coast Daily recently found 87% of respondents saying that "Traveston dam should not be built" (SCD March 24 2007, p17).

It is already widely suggested that Traveston dam will become a benchmark for how NOT to engage with a community.

Environmental Concerns.

We see the construction of this dam as placing additional environmental stress on a number of threatened species, but principally the Queensland Lungfish (*Neoceratodus forsteri*) and the Mary River Turtle (*Elusor macrurus*).

With the recent construction of the Paradise Dam being added to the nearly 40 weirs, dams and impoundments on the Burnett River, the Lungfish's only other natural habitat, the role of the Mary becomes even more critical for lungfish survival.

I attach an excellent summary (Attachment 3) of the Lungfish's ecology and environmental threats from the federal Department of Environment and Heritage website. There is also a comprehensive summary of the dam proposal and the threats it poses in an article in the CSIRO's Ecos magazine (attachment 4). Mention is made in both attachments of the state government report that urges no further construction of dams or weirs on Burnett or Mary Rivers until Lungfish ecology is better understood.

We have watched the apparent extinction of two frog species, *Rheobatrachus silus* and *Taudactylus diurnus* in totally unexpected circumstances from the Conondale Ranges. We are concerned that the additional destruction of suitable spawning habitat for the Queensland Lungfish, Mary River Turtle and Mary River Cod could well push those species beyond their present position on the brink of extinction.

The apparent attempt to lever the dam, in stages, through the federal approval process is particularly worrying given that the construction would be to full Stage 2 height, but for a few floodgates. We are also concerned that environmental features of Paradise Dam such as the Lungfish ladder and turtle hatchery appear to be beset by problems.

The dam footprint itself, and the area both up and downstream, contain a number of species already on the edge of extinction. The ecology of many of these species is not well understood but there is agreement that habitat destruction is a major threatening factor. For the Lungfish in particular, the cumulative impact of storages on the Burnett (and particularly the most recent Paradise Dam) must be taken into account.

Moreover, reduction in environmental flows and major alterations in flow regimes would impact on wetlands in the Great Sandy Straits.

The Traveston Dam would have significant, potentially irreversible effects on a number of threatened species as well as on the complex ecology of the Great Sandy Straits. These are matters of national and international significance.

<u>Suitability of dams in a climate change environment</u>

Historically, southeast Queensland has been quite reliant on dams as a means of ensuring water supply. Within the last 50 years many Councils have actively eliminated urban rainwater tanks, opting for centralised water supplies.

An examination of SEQWater and Sunwater (attachments 5 and 6) data shows that many of these dams are at very low levels. (Data attached)

Last year, at our own expense, we visited many of these storages and were surprised to find that the low levels of dams was not a recent phenomenon, they had been getting lower and lower for years. (see www.stoppress.com.au) Nine months and one "wet" season after our visit, they are lower still.

An explanation for the failure of these dams and dams in WA lies in reduced catchment rain, but particularly run-off " rain. In WA, a 21% reduction in rainfall has led to more than 60% reduction in runoff into dams. The same dams are now supplying only about one third of the water they used to.

The drought in southeast Queensland isn't a drought along the coast but rather a drought in the dam catchments. Interestingly, Cooloola Shire, the shire that surrounds much of the Mary and would house the Traveston Dam, was recently drought-declared.

Construction of a dam does not guarantee a consistent water supply. In any event, construction of a dam that couldn't be completed until at least 2011 is an inappropriate response the present set of circumstances in southeast Queensland.

<u>Climate Change</u>

At a Natural Resources Conference last year, we were told by the eminent Professor Peter Cullen that our response to climate change events (like the current SEQ dam catchment drought) should not <u>add</u> further to the greenhouse problem.

An expansive shallow dam like that proposed for Traveston will generate significant quantities of greenhouse gases, not just in the initial stages as remnant vegetation becomes submerged and rots, but from a continual cycle as sprawling flats such as those at Bollier become emergent, regrassed then submerged again.

A considerable portion of the land to be inundated is well vegetated and forested.

The heavy greenhouse cost of pumping water considerable distances with coal-sourced electricity must also be considered.

Construction of the dam and its subsequent operation will be a significant contributor to greenhouse gases.

We submit that the Traveston Dam proposal was a hastily made decision made without adequate assessment of social, environmental or indeed economic considerations. Subsequent announcements seem to have been more tailored to justify the decision rather than to provide unbiased information.

Since the April announcement, the government has announced a number of commendable demand management strategies and supply options (most notably the far more extensive use of recycled water). (See also ABC Poll 169 in Attachment 2). The overwhelming uptake of the rainwater tank rebate scheme suggests a public that is far more prepared to place small water storages (tanks) in areas of higher rainfall.

The Traveston Dam announcement is not an appropriate solution to the present low level of southeast Queensland's dams. Dam statistics only underscore the folly of reliance on dams in this time of climate change.

The dam places enormous threat to the reproductive success of a number of threatened species whose ecology is currently not well understood. The EIS process allows only months to gather vital data. Reports already done are urging "no further impoundments" and "further research needed".

The dam would seem likely to exacerbate salinity problems in a catchment identified as a priority area in the National Salinity Plan. Given our present knowledge of the enormous cost of attempting to deal with increasing salinity, we should apply the Precautionary Principle on proposed new works.

These are matters of national and international significance

Yours

Ian Mackay (President)

The Conondale Range Committee is one of the longest serving Sunshine Coast environment groups. Formed in 1976 to press for an expanded National Park in the Conondales, the Committee has worked closely with successive state governments in the Conondales Consultation process, the Agricola Mine Rehabilitation process as well as the South East Queensland Forest Agreement.

Our on-going work has been recognized with two Sunshine Coast Environment Awards.

Attachments

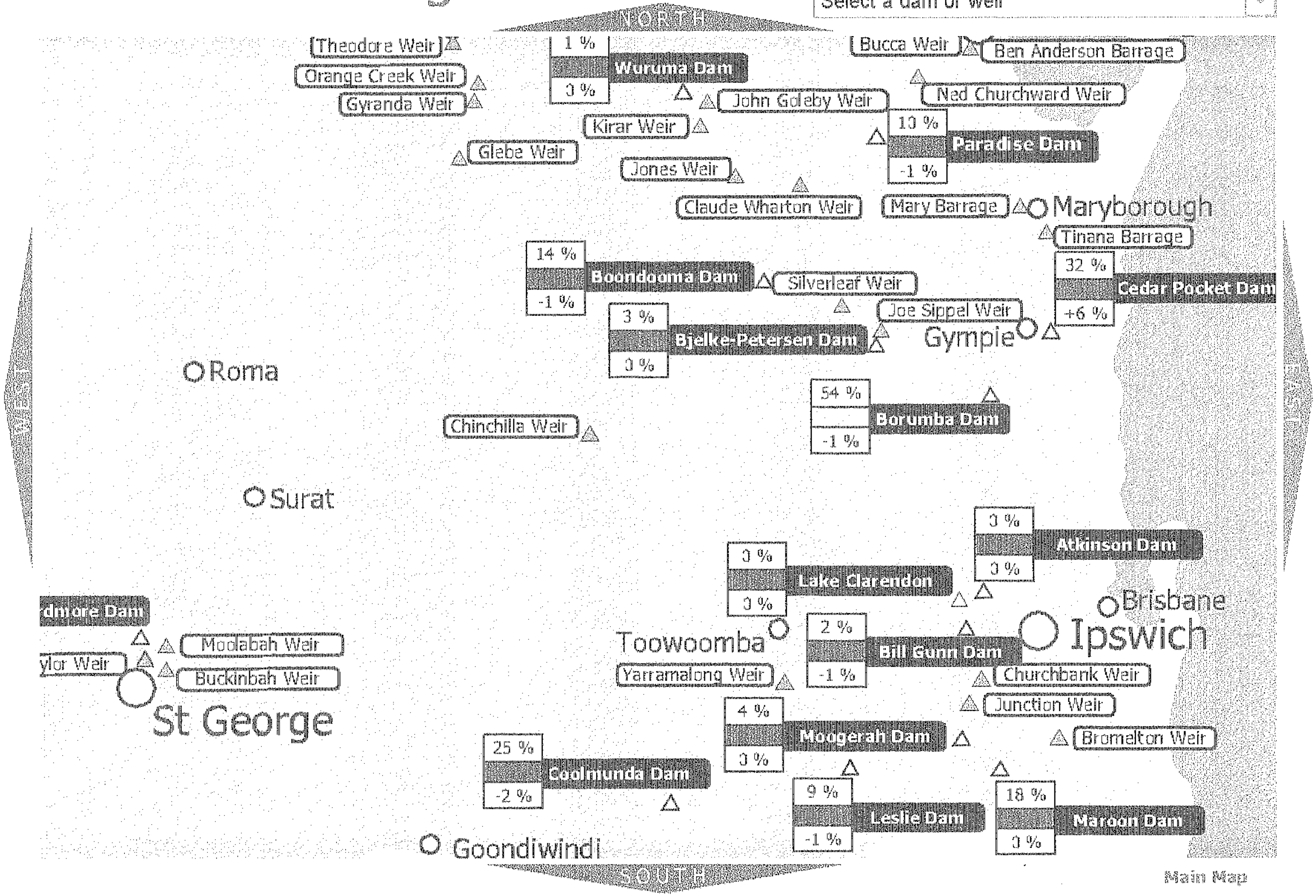
1. QFF media release
2. Results of surveys from ABC radio 2006
3. Lungfish information from DEH website.
4. Ecos article (CSIRO publication)
5. Current dam statistics from Sunwater website
6. Current dam statistics from SEQwater website.

Attachment 5

SunWater Storage Levels

Current Storage Summary   Map Legend

Select a dam or weir



Main Map

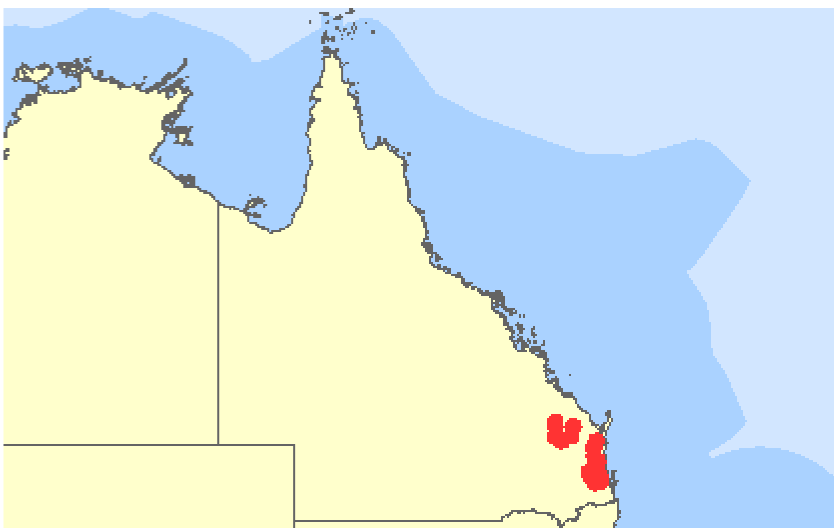
Neoceratodus forsteri

Australian Lungfish, Queensland Lungfish

EPBC Act Status	**Listed as Vulnerable**
Listing Advice	View Commonwealth Listing Advice on *Neoceratodus forsteri* (Australian Lungfish).
Guidelines,	View Information Sheet - Australian Lungfish (*Neoceratodus forsteri*).

Info	View Information Sheet - Australian Lungfish (*Neoceratodus forsteri*).
Scientific name	*Neoceratodus forsteri* [67620]
Family	Ceratodontidae:Ceratodontiformes:Sarcopterygii:Chordata:Animalia
Species Author	(Krefft, 1870)
Image	http://www.amonline.net.au/fishes/fishfacts/fish/nforsteri.htm http://www.fishbase.org/Summary/SpeciesSummary.cfm?ID=4512&genusname=Neoceratodus&speciesname=forsteri

Distribution Map



This is an indicative distribution map of the present distribution of the species based on best available knowledge. See caveat for more information.

Legal Status

The current conservation status of the Australian Lungfish, *Neoceratodus forsteri*, under Australian and State/Territory Government legislation is as follows:
National: Listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999*.
Queensland: In Queensland, the Australian Lungfish is not listed as threatened under the state's *Nature Conservation Act 1992*, however, the taking of Australian Lungfish has been prohibited since it was declared a protected species under the Queensland *Fish and Oyster Act 1914*. The species is currently protected from fishing, and collection requires a permit under the *Fisheries Act 1994*.
The Australian Lungfish has been listed under CITES since 1977 (Kemp 1995).

Taxonomy

Scientific name: *Neoceratodus forsteri* Common name: Australian Lungfish Other

common name: Queensland Lungfish
Populations of Lungfish exist in the Mary and Burnett Rivers and are not genetically distinct from one another. Genetic evidence suggests that a translocated population in the Brisbane River is derived from the Mary River (Frentiu et al. 2001).

Description

The Australian Lungfish is a long, heavy-bodied freshwater fish. The species has five pairs of gills and its fins resemble flippers. Adult Lungfish can weigh up to 48 kg and grow to around 2 m (Environment Australia 2003; Grigg 1975), but commonly reach 1.3 m. In the Burnett River, the mean length was 906 ± 199 mm, and the mean weight 7573 ± 4563 g (Brooks & Kind 2002). Adult Lungfish are olive-green or grey-brown above, and yellow-orange below, with some whitish colour on the belly and underside of the head. They have large, overlapping scales and a small mouth with large, crushing teeth on the palate and lower jaw (Allen 1989; Grigg 1975). Juveniles are dark olive, brown or yellow with a mottled pattern above and a dull pink belly (Kemp 1995; Kind 2002).
The species is able to breathe aquatically using its gills, and aerially using its single lung. It usually uses its gills, but surfaces to breathe when it is active and requires more oxygen. For example, it breathes air more often at night while foraging, when swimming in floodwaters, and when spawning (Grigg 1964, 1975; Kemp 1984; Merrick & Schmida 1984).

Australian Distribution

The Australian Lungfish is restricted to south-eastern Queensland (Wager 1993). It currently occurs in the Burnett River, the Mary River, the North Pine River (including Lake Samsonvale) the Brisbane River (including Lake Wivenhoe), and Enoggera Reservoir (Brooks & Kind 2002; Johnson 2001; Kemp 1995). Its natural distribution is the Mary and Burnett River systems. It was translocated and persists at a number of other sites, and the Condamine River west of the Great Dividing Range, where it did not persist (O'Connor 1897). In 1995 Kemp reported that there were Lungfish in the Gold Creek Reservoir and Lake Manchester, in the Brisbane River drainage area. By 2001, Johnson found there was no evidence that they persisted in these dams, in the Coomera River, in the Logan River or its tributary, the Albert River.

Burnett River

The distribution of Lungfish within the Burnett River is from Ben Anderson Barrage to a point around 10 km upstream of the John Golby Weir (around 335 km from the mouth of the river). It is most abundant between Ben Anderson Barrage and a point 275 km upstream. It also occurs in tributaries of the Burnett River:

- In Three Moon Creek to around Mulgildie.
- 20 km up the Boyne River from its junction with the Burnett River as far as Boondooma Dam, including the waterhole directly below the dam wall.

- Barambah Creek, but not in the upper reaches above Barambah Gorge. Brooks (1995) suggested that they may occur above the gorge to at least the Joe Sippel Weir, but Books & Kind (2002) found no evidence of the species above Barambah Gorge.
- The lower reaches of the Auburn River below the falls/gorge.

(Brooks 1995; Brooks & Kind 2002).
Kind (2002) caught and observed Lungfish on the Burnett River at sites including Ben Anderson Barrage, Bingera Weir, Lee's Waterhole, Drinan's Crossing, Walla Guaging Weir, Booyal Crossing, Mingo Gorge, Grey's Waterhole, Booyal Crossing (immatures), and Jones Weir. Grigg (1975) observed Lungfish spawning at Bon Accord Crossing over Barambah Creek, in 1964.

Mary River

The distribution of Lungfish within the Mary River is from the Mary River Barrage (59.3 km from the mouth of the river) to the town of Conondale (220 km from the mouth of the river). It also occurs in large tributaries of the Mary River:

- Yabba Creek, which flows into the Mary River between Kenilworth & Gympie.
- Tinana Creek, Coondoo Creek, Wide Bay Creek, Obi Obi Creek, and Munna Creek (Brooks and Kind, as cited in Kind 2002; Simpson 1994).

Kind (2002) caught and observed Lungfish on the Mary River at sites including Kenilworth Homestead, Kenilworth Quarry, Moy Pocket, Traveston Crossing, and Widgee Crossing at Gympie. He also caught them at Imbil Bridge and near Imbil Weir (a subadult) on Yabba Creek, Bungawatta on Tinana Creek, and in Condoo Creek.
O'Connor (1897) translocated 78 Lungfish from the Mary River at Miva to:

- North Pine River (eight fish),
- a lagoon near the Albert River (five fish),
- a dam near Cressbrook on the upper Brisbane River (eight fish),
- Enoggera Reservoir (18 fish),
- the Condamine River (21 fish),
- the Coomera River (16 fish), and
- the Botanic Gardens in Brisbane (two fish).

Surveys Conducted

The Australian Lungfish was comprehensively surveyed in the Burnett and Mary River systems between 1997 and 2002, but the status and distribution of the translocated populations is based on anecdotal information and sporadic records (Brooks & Kind 2002, Kind 2002).

Population Information

The total Australian Lungfish population is fewer than 10 000 individuals (*Catalyst* 2006).
There are two major populations of the Australian Lungfish, occurring naturally in the Burnett and Mary Rivers.

Anecdotal information suggests that there is also a large translocated population in the Brisbane River. Numerous large individuals are seen in the Wivenhoe dam on the Brisbane River, downstream to the Mt Crosby Weir. There are two further moderate populations that show irregular evidence of recruitment; the Enoggera Reservoir, and the North Pine River. There are 'moderate numbers' in the North Pine River, and Lungfish are often caught and reported by anglers downstream at Young's Crossing after water flows over the top of the dam. In the 1980's and 1990's, Lungfish were regularly found at the base of the Enoggera dam wall after floods. The status of translocated populations of Lungfish in the Logan River, Coomera River, Gold Creek and Lake Manchester is uncertain; it is likely to be very rare or extinct at these sites. It is almost certainly absent from the Condamine River (Johnson 2001).

Habitat

The Australian Lungfish requires still or slow-flowing, shallow, vegetated pools with clear or turbid water in which to spawn and feed (Allen 1989; Merrick & Schmida 1984). The species is restricted to areas of permanent water (Brooks & Kind 2002).

Burnett River and tributaries

The Burnett River flows for around 420 km from its source to the sea. Brooks & Kind (2002) reported that Lungfish were often found in freshwater reaches of the Burnett River up to 310 km inland from the river mouth, and less frequently found upstream of this point. At sites between 50 and 350 km upstream, the abundance of Lungfish was negatively correlated with the distance from the mouth of the river (fewer lungfish further away from the sea), except for the relatively small population in Ben Anderson Barrage pond near the river mouth. Based on the catch rate per unit effort, Brooks and Kind (2002) concluded that Lungfish were less likely found in impoundments than in flowing stretches of the Burnett River.

In the lower Burnett River, Ben Anderson Barrage pool is the closest water storage to the sea (26 km away). It usually consists of 41 km of impounded slow-flowing water surrounded by steep banks (Kind 2002). Bingera Weir is 42.5 km from the sea, so it is usually inundated by Ben Anderson Barrage pond. When it is not submerged, it impounds 19 km of the river above Ben Anderson Barrage. There is a section of the river upstream of Ben Anderson Barrage pond consisting of 7 km of flowing water with shallow runs up to 32 m wide, and riffles around 4m wide, up to Ned Churchward Weir (formerly called Walla Weir). Ned Churchward Weir (74.5 km from the river mouth) impounds water 34.5 km upstream to a point 109 km from the mouth of the Burnett River. Within the Ben Anderson Barrage pond, there were more Lungfish in the headwater section, where there were shallow areas and more complex habitat (Berghuis & Broadfoot 2004a; Brooks & Kind 2002).

The central Burnett River area contains three irrigation storages that are impassable to lungfish in normal flow conditions (John Goleby Weir, Jones Weir and Claude Wharton Weir). Unimpounded sections of the river include many shallow pools and runs with a width of less than 10m, containing submerged logs and branches (Brooks & Kind 2002). Rocks are more common in the Burnett River than the Mary River, and are used as shelter by Lungfish in the Burnett River (Kind 2002). Between Claude Wharton Weir (202.4 km from the river mouth) and the Burnett River Dam (131 km from the river mouth, with an impoundment extending to a point 176 km from the river mouth) is a section of flowing river, riffles, shallow runs and pools within the Goodnight Scrub, which approaches the natural state of the river (Kind 2002; Sinclair Knight Mertz 2001).

Mary River and tributaries

The Mary River flows for around 250 km from its source in the Conondale Range to the sea. In the Mary River, Kind (2002) found that shallow pools, runs and riffles were common, and there were few waterfalls. Areas where Lungfish were studied consisted of 67% pools 21% runs, 11% riffles and glides, and 1% backwaters. The average pool depth is 1.8m, the average run depth 1.2 m, and the average stream width less than 30 m. In pools where adult Lungfish were studied, macrophytes (water plants that are large enough to be seen with the unaided eye) covered 37 to 55% of the habitat (mean 47%), around 40% was open water, and the rest was stream bank vegetation (including grass growing into the water), rocks, eroded banks and woody debris. The substrate was typically sandy. Macrophytes were most abundant at depths of 0.9 to 2.1m.

Yabba Creek is regulated by water releases from Borumba Dam (31.1 km from the junction with the main channel of the Mary River) and Imbil Weir (10.9 km from the junction). The average depth of Yabba Creek is 1.7 m and there is abundant overhanging vegetation, submerged macrophytes and rocky cover. Lungfish in the Mary River catchment were also less abundant in the impounded waters than further upstream. Tinana Creek is 140 km long. It flows into the Mary River downstream of the Mary River Barrage. The lower section is regulated by Tallegalla Weir (37.5 km from the junction), Teddington Weir (15.8 km from junction), and Tinana Barrage (1.5 km from the junction). The average depth of Tinana Creek is 1.7 m, and it is generally less than 10m wide. It comprises a series of pools, runs and riffles, and there is abundant overhanging vegetation and submerged woody debris, but little macrophyte vegetation in the water (Kind 2002). Coondoo Creek is 70 km long, and flows into Tinana Creek 75 km from it's junction with the main channel of the Mary River.

Adult Lungfish in the Mary River are associated with overhanging riparian (riverside) vegetation, woody debris in the water, and dense macrophyte beds. They shelter in complex, shaded habitat. They most prefer habitat with overhanging vegetation and macrophytes in relation to their availability, and often use habitat with woody debris, although adults are not as reliant on submerged branches as some other Australian freshwater fish. The species avoids open water, and very seldom uses rocky habitat and eroded banks, which are uncommon in the Mary River. Lungfish are usually inactive when located in overhanging riperian vegetation and woody debris, especially during the day. They occur in water that is 1.86 m ± 0.61m deep on average, and in deeper water in winter than in summer (2.07 ± 1m m versus 1.81 ± 0.82 m). They use shallower water in the spawning season than at other times (1.77 ± 0.95 m), and slightly deeper water during the day than at night. Adult lungfish use water depths of two to three metres. Two macrophytes, Vallisneria *Vallisneria gigantea* and Hydrilla *Hydrilla vertillata* were used by all Lungfish radio-tracked in the Mary River, but Kind (2002) did not find any adult Lungfish using the macrophytes Baby Tears *Bacopa monniera*, Nitella *Nitella sp.*, watermilfoils *Myriophyllum spp.*, or hornwort *Ceratophyllum demersum*. In relation to their availability, Lungfish preferred some species of macrophytes over others; they preferentially used two species that form very dense submerged banks and occur in a range of water depths; dense water weed *E. densa* and Hydrilla. They also prefer multi-species mixtures of floating and submerged macrophytes, and two species with floating leaves; water primrose *L. peploides* and waterlilies *Nymphoides sp*. (Kind 2002).

Enoggera Reservoir

Enoggera Reservoir is a permanent body of water around 60 ha in area and 18 m deep. It is filled by springs in the D'Aguillar Ranges and drains into Enoggera Creek, which drains into the Brisbane River estuary. The bottom of the dam is mainly mud, covered with detritus from water lilies and Eucalyptus leaves. The water is clear, but stained brown by tannins from decomposing leaves, and slightly acidic (pH 5). It has steeply sloping sides with Para grass *Brachiaria mutica* growing out from the edges to a water depth of around 2 m, forming a dense floating mat along with some aquatic macrophytes. Macrophytes are generally absent from the reservoir except at the edges. Water hyacinth has been controlled in the Reservoir since 1974 (Kemp 1986). Kemp (1986) considered that Enoggera Reservoir is a poor environment for Lungfish.

Brisbane River

The upper reaches of the Brisbane River consist of two water storages, the Somerset and Wivenhoe dams (Kemp 1986). Below these dams, the river forms wide, slow-flowing permanent reaches with a maximum depth of around 4.5 m, and occasional shallow riffles. The riverbed consists mainly of sand, gravel and rocks, and the water is clear to turbid (after rain), with a nearly neutral pH (8). Red Bottle-brush *Callistemon saligna* and She-oak *Casuarina* sp. trees overhang the banks, and their root masses grow in the water, contributing to spawning and shelter habitat for Lungfish. Aquatic macrophytes are abundant (Kemp 1986).

Habitat requirements for juvenile and immature Lungfish

With one exception (a juvenile caught in 1 m of clear water, Kind et al. 2005), juvenile Lungfish have always been found in dense cover such as beds of macrophytes in water 500 mm deep or less. Observations of captive-bred juveniles

showed that they prefer macrophytes over other shelters, and use the densest macrophyte cover available, especially if it is shaded. It appears that wild juveniles remain in the same type of cover as that used for spawning for many months or years after hatching (Kind 2002). One was found sheltering amongst river macrophytes (Semon 1899, as cited in Brooks & Kind 2002), and seven were recovered from the roots of water hyacinth plants removed from Enoggera Reservoir (Longman 1928, as cited in Brooks & Kind 2002). Brooks & Kind (2002) caught 21 juveniles and saw nine others at Drinan's crossing on the Burnett River, in macrophytes near where they found 293 hatched Lungfish eggs. They also caught two juveniles at Gayndah on the Burnett River, where they found three hatched eggs. All of these juveniles were in dense macrophytes in water less than 500 mm deep. Kind et al (2005) caught two juvenile Lungfish in dense aquatic vegetation and debris in 300 mm of water in the upper reaches of Jones Weir. Brooks & Kind (2002) caught two juvenile lungfish at Traveston Crossing on the Mary River amongst *Hydrilla* and *Nymphaena* plants in 500 mm deep water, and one at Twin Bridges on the Brisbane River amongst *Vallisneria gigantea* and woody debris. All juveniles smaller than 100 mm were caught in habitat suitable for spawning.
The largest juveniles were found in a macrophyte species that are rarely used for spawning (*H. verticillata*), in the largest macrophytes, and in the deepest water. Larger juveniles inhabited larger macrophytes at greater depths. Immature Lungfish between 300 and 700 mm long were found most often associated with overhanging streamside vegetation, in areas of dense woody debris, undercut banks and dense macrophytes. The average water depth used by immature Lungfish during the day was around 1.5m (Kind 2002).

Brooks & Kind (2002) reported that Lungfish gathered in deeper water within the Burnett River in autumn, possibly in preparation for the dry season. Unlike the African and South American Lungfish *Protopterus* and *Lepidosiren*, the Australian Lungfish does not use stagnant mud as a refuge during dry seasons or droughts. It cannot live in stagnant water or bury itself in mud. Surveys conducted before major impoundments were built showed that even during prolonged drought, parts of the Mary and Burnett Rivers inhabited by Lungfish still flowed slowly and pools were well-oxygenated (Grigg 1965).

Life Cycle

The Australian Lungfish first breeds at around 15 years of age in males and 20 years in females (Kind 2002). Hatchlings and juveniles are vulnerable to predatory insect larvae, shrimps, fish (e.g. jewfish), and wood ducks (Bancroft 1928; Illidge 1894; Kemp 1987). Adults have few or no natural predators (Kind 2002). They are difficult to age accurately, because growth rings on scales become difficult to interpret as growth slows in old fish, and otoliths (structures in the inner ear, from preserved specimens) are very difficult to extract (Brooks & Kind 2002). One female Lungfish spawning for the first time was 810 long, and one was 820 mm long (Brooks & Kind 2002).

Timing of spawning

The Australian Lungfish spawns at night between August and December, with peak activity in late October. In the Burnett River, spawning occurs between mid August and early November (Brooks & Kind 2002). In the Brisbane River and Enoggera Reservoir, eggs have been found between mid August and December (Kemp 1984). The breeding season in the Enoggera reservoir was usually shorter than that in the Mary, Burnett or Brisbane River (Kemp 1986). Lungfish delay or skip breeding if their spawning habitat is disrupted. Following severe winter flooding on the Brisbane River, spawning was reduced and delayed until October in one year, and there was no evidence of spawning after a second flood the next year (Kemp 1993). Spawning was also delayed when water hyacinth had not yet regrown after it died back during winter in the Enoggera Reservoir. Spawning is triggered by increasing daylength, and is not related to rainfall or water chemistry (Kemp 1984).

Conditions required for spawning

Lungfish pairs spawn amongst aquatic macrophytes. In the Brisbane river, eggs have also been recorded on submerged roots of Red Bottle-brush Callistemon saligna (Kemp 1984). Water depth, substrate, macrophyte species, macrophyte density and macrophyte height were all important in a model testing which sites were suitable for Lungfish spawning in the Burnett River (Brooks & Kind 2002).

Lungfish will spawn in both still and flowing water, but their spawning behaviour is different in the two environments. Brooks (1995) found that in areas of still water, egg densities were highest at water depths of 50 to 100 mm, and fewer eggs were found in deeper water. In still water, Lungfish prefer to spawn where the river bed is sandy, in water that is very shallow (less than 100mm deep). In flowing water, which contains more oxygen, Lungfish eggs may be found in depths of more than a metre. They usually use sites between 200 and 600 mm deep. In flowing water, they will spawn over a variety of river bed substrates. Lungfish spawned in shallow river sections between impoundments. No spawning was observed in Jones Weir or Ned Churchward Weir pools between 1997 and 2000, but fish in reproductive condition were caught once near an island in Ben Anderson Barrage Pool. Spawning Lungfish choose clear water and avoid turbid (muddy) water.

Lungfish eggs die before completing development at temperatures below 10° or above 30° C (Kemp 1981). A clutch consists of between 50 and 100 eggs (Kemp 1986). The eggs are around 3 mm in diameter, with an adhesive jelly coating around 1 cm wide. They sink when first laid (Kemp 1986). Lungfish thrash their tails at the end of spawning, apparently to disperse the eggs, which adhere to the surfaces of submerged macrophytes, and occur singly, in pairs, or very rarely in clumps (Brooks 1995). If suitable macrophyte species are not available, Lungfish will not spawn (Kemp 1984). Suitable macrophytes grow in a dense mass in shallow water in a variety of substrates from gravel to mud, and contain a complex community of algae, protozoa, worms, small molluscs and crustaceans (Brooks 1995; Kemp 1993). Suitable species include Vallisneria gigantea (the most commonly used), Hydrilla verticillata, Nitella sp., Potamageton perfoliatis, Milfoil Myriophylum sp., Najas tenuifolia, Water Couch Grass Paspalum distichum (a terrestrial grass that grows in a dense mat from the water's edge across the surface), Baby Tears Bacopa monniera, Curly Pondweed Potamageton crispus, Chara sp., Carex sp., Slender Knotweed

Persicaria decipiens, Ludwigia peploides, Cladophera sp., various species of filamentous algae, and the introduced water hyacinth Eichhornia crassipes, which floats on the surface (Bancroft 1911, Brooks 1995; Grigg 1965a; Kemp 1993; Roughley 1951). In the Enoggera Reservoir, Lungfish clutches are laid in an area of one to five square metres on the roots and partly submerged floats of Water Hyacinth up to 1 m deep (Kemp 1984). Brooks & Kind (2002) also collected Lungfish eggs from partially submerged Para grass (Urochloa mutica) in the Brisbane River and the Mary River. Spawning always occurs in river sections where the cover of macrophyte algae is very high (usually exceeding 90%), and Lungfish choose the densest macrophytes available in which to lay their eggs. The highest densities of eggs were on macrophytes that were 160 mm tall, and fewer eggs occurred on taller water plants. Lungfish use macrophyte species with complex branching or leaf whorls rather than strap-like leaves, perhaps because eggs that detach from the surface of these are less likely to fall to the bottom (Brooks & Kind 2002).

In 1999 and 2000, Lungfish spawning was observed on the lower Boyne River, upper Burnett River at the junction with the Auburn River, at several riffle and glide sections between the Ned Churchward Weir wall and the Isis pumping station, and an area of Ben Anderson Barrage. Spawning on the Burnett River was recorded within a 7 km riffle and glide section of the river between Ned Chruchward Weir and the impoundment of Ben Anderson Barrage, where there was a steady flow of water, and abundant macrophytes. Spawning habitat on the lower Boyne River and the area 7 km downstream of Ned Churchward Weir was improved by releases of water from the weir and Boondooma Dam during 1999 and 2000. Large numbers of Lungfish congregated there during spawning, e.g. more than 500 individuals were counted within the 7 km on one day in October 2000. This area is the only remaining spawning habitat in the lower 80 km of the main channel of the Burnett River (Kind 2002). Lungfish also spawned above the influence of Ned Churchward Weir in the Goodnight Scrub area (which was then a flowing reach of the river between 80 and 200 km from the river mouth). Suitable macrophyte density for Lungfish spawning was rare in the Mary river between 1999 and 2002, as a result of a record high flow event that scoured the banks in 1999 (Brooks & Kind 2002).

Recruitment levels, and conditions required for successful reproduction

Lungfish eggs hatch after 30 days (Kemp 1981, 1986). Egg survival is best in shallow water that has a dense cover of macrophytes. Brooks & Kind (2002) found that the proportion of live Lungfish eggs increased with the density of macrophytes at the spawning site, up to a density of 40% (all macrophyte densities above 40% are equally suitable for egg survival). A lower proportion of live eggs occurred on taller macrophytes and in deeper water. The highest egg survival is between 200 and 800 mm water depth. Kemp (1986) reported that around 5% of eggs laid in the wild are unfertilised.

Young larvae look like tadpoles and are initially poor swimmers, resting on the bottom of the water on their sides until they have digested the yolk (Kemp 1995). Newly hatched Lungfish retreat from light (J. Joss, as cited in Brooks & Kind 2002). They first breathe air when they are 27 mm long and around 110 days old, and resemble adult fish when they are six or seven months old (Kemp 1981). They begin to feed four to six weeks after hatching (Kemp 1995), and reach 6 cm after eight months and 12 cm after two years (Allen 1989). Growth curves of wild Lungfish on the Burnett River show that they reach around 40 cm at five years of age (Brooks & Kind 2002).

Juvenile Lungfish smaller than 300 mm long have been collected from the Burnett and Mary Rivers, Enoggera Reservoir, and Mt Crosby Weir, 62 km downstream from Wivenhoe Dam in the Brisbane River (Longman 1928, as cited in Kind 2002; Johnson 2001; Kemp 1987; Semon 1899). One was found in the Boyne river (a tributary of the Burnett River) in 1892, and 20 in Enoggera Reservoir between 1928 and 1932. Six juvenile Lungfish were caught in the strainer of the water treatment works at Mt Crosby Weir in the Brisbane River in 1961, and eight in 1982 (Grigg 1965c; Kemp 1987). 'Numerous' juveniles were caught in the Burnett and Mary Rivers in 1981 and 1982. Brooks & Kind (2002) caught two juveniles at Traveston Crossing on the Mary River in 1998, and one at Twin Bridges in the Brisbane River in 1999. They also caught 23 juveniles in 1997 in the Burnett River. The size distribution of Lungfish between 1997 and 2001 indicated that recruitment of juvenile fish into this population was extremely poor, and there was a lack of fish under ten years old (fish up to 500 mm long were virtually absent from samples). This lack of successful recruitment was probably due to poor breeding conditions for several years (Brooks & Kind 2002). Three juveniles less than 200 mm long were caught in the upper reaches of Jones Weir in the Burnett River in 2004, and must have hatched in 2003 or 2004 (Brooks et al. 2005). Data on the frequency of different size classes of 2770 Lungfish in the Burnett River were collected by the Queensland Department of Primary Industries**. They confirmed that recruitment for at least the five years prior to 2003 was lower than previously, and that there was a long period in the recent past where few juveniles survived.** Kemp (1986) and Brooks & Kind (2002) suggested that Lungfish recruitment may be successful only in a small minority of years, when breeding conditions are good throughout much of the river (i.e. there are abundant macrophyte algae in shallow water, and high concentrations of microcrustaceans and invertebrates for juveniles to eat (Kemp 1977)). Kemp (1986) stated that successful breeding seems to have occurred at intervals of around twenty years since before 1900.

Juvenile lungfish are found only sporadically despite the fact that effective sampling techniques have been used at times when none were caught. For example, Bancroft (1911) failed to find any juveniles in the Burnett River despite exhaustive liming, dynamiting and dredging of spawning habitat (Kemp 1986). None were caught in the Mt Crosby water treatment works filters between 1961 and 1982, and none were caught in Enoggera Reservoir by electrofishing in the early 1980s (Kemp 1986). **Brooks & Kind (2002) failed to find juvenile Lungfish in the Burnett River between 1998 and 2001, despite intensive and widespread sampling of spawning habitat using frame nets and electrofishing, which were previously effective. There is no recent evidence of successful Lungfish breeding in impoundments outside the Burnett River, Mary River, and the Brisbane River downstream of Wivenhoe Dam. All records of Lungfish in Lake Samsonvale and Lake Wivenhoe are of mature adults. There has been no evidence of spawning or recruitment in Enoggera reservoir since the control of Water Hyacinth began**

there in 1974 (Kemp 1987; Illidge 1893, as cited in Kind 2002). Water Hyacinth forms a floating mat, so it can provide complex habitat for Lungfish eggs and juveniles close to the surface, even in deep water bodies with steep banks that are unsuitable for other macrophytes. Water hyacinth is also used as a substrate for successful captive breeding (Joss & Joss 1995). However, it is not recommended for management of breeding habitat because it is a declared pest plant (Sinclair Knight Mertz 2001). In some years Water Hyacinth dies back during the winter (Kemp 1984), so it would not be available as juvenile habitat in those years. When Lungfish bred in the Enoggera Reservoir, it may have provided better spawning habitat than do impoundments on the Burnett River, because it supplies drinking water, so the water level changes slowly compared with the rapid changes in flow associated with irrigation supplies for sugar cane and other seasonal agriculture on the Burnett River (Brooks & Kind 2002).

Feeding

Adult Lungfish are benthic omnivores (eating both animal and plant matter on the bottom of the river). They eat frogs, tadpoles, fishes, shrimps, prawns, earthworms, aquatic snails, bivalve molluscs (pelecypods) such as mussels, moss, fallen flowers from *Eucalyptus* trees and aquatic plants. Some of the plant material eaten is probably ingested incidentally while foraging for small crustaceans and molluscs, and is not digested. Young Lungfish feed on a variety of soft-bodied small prey including insect larvae and crustaceans (Allen 1989; Illidge 1884, as cited in Kind 2002; Joss & Joss 1995; Kemp 1986).

Lungfish forage mainly at night. In the Mary River, adults forage predominantly where there are macrophyte beds in shallow water (less than 2 m deep). Juveniles ambush their prey in the structurally complex habitat of aquatic plants, catching and holding them with sharp, cone-shaped teeth (Kind 2002). Lungfish detect the vibrations of prey, and are capable of perceiving the weak electric fields generated by animals. Experiments have shown that they can accurately locate buried prey using electroreception (Watt et al. 1999).

Movement Patterns

In rivers with natural flows of water, the Australian Lungfish is largely sedentary. In flowing (unimpounded) sections of the Burnett River and the Mary River, adults usually move around one or two pools at night and return each day to a certain habitat feature such as a submerged log, rock or patch of macrophytes in one particular pool, where they rest. Individuals are routinely found resting in the same daytime retreat over many consecutive months. Movements exceeding one kilometre are rare, and only four of the 20 Lungfish radio-tracked were ever found more than 5 km from their original site (Kind 2002). Berghuis & Broadfoot (2004a) captured 42 of the same individuals that were originally tagged by Brooks & Kind (2002), and most were still in the same areas as they had been five years previously.

In 2002, Lungfish movements in the (then) flowing section of the Burnett River (the Goodnight Scrub) were independent of temperature and water flow (Brooks & Kind). During a record flood on the Mary River, Lungfish remained in their home ranges and retreated to the shallow banks. After the river broke its banks, several left the channel to shelter amongst flooded vegetation, on the downstream side of large trees, or in a deep vehicle track perpendicular to the flow direction (Kind 2002). Despite their large size, they are capable of traversing very shallow riffle zones (e.g. 120 mm deep) into other pools to find food and spawning habitat (Kind 2002; Brooks & Kind 2002). Immature Lungfish (n = 3) moved up to 200 m from their daytime retreats while foraging at night, but remained close to cover (Kind 2002). The movements of Lungfish are restricted by natural and man-made barriers. Natural barriers include waterfalls and gorges (e.g. on the Auburn River and Barambah Creek, which are tributaries of the Burnett River), and ephemeral (temporary) water (e.g. the Nogo and Perry Rivers, tributaries of the Burnett River which are devoid of Lungfish). Man-made barriers include dams, weirs, barrages and culverts. For example, Lungfish apparently inhabited the Boyne River above the Boondooma Dam before the dam was constructed. They no longer occur there, although they are abundant downstream of the dam to the junction of the Burnett River. Claude Wharton Weir at Gayndah and Jones Weir at Mundubbera block the passage of Lungfish, and the culverts at Booyal Crossing apparently also form barriers to Lungfish movements, except during particularly high flows (Brooks & Kind 2002). In the Burnett river, Lungfish in established impoundments moved much more than those in flowing sections, and Lungfish movements became much more variable at reproductive maturity. Adult Lungfish radio-tagged downstream of the Ned Churchward Weir (in the established Ben Anderson Barrage pond and the shallow zone upstream of this) moved regularly between the weir and the barrage. For example, one individual traversed the 48 km from the weir to the barrage at least four times between 1998 and 2001. There is an annual cycle of movement to and from spawning grounds in this section of the Burnett River, when fish abandon their usual home ranges. Lungfish spawned in the series of shallow riffles and runs immediately below Ned Churchward Weir wall. Some individual females moved upstream to spawn here, then returned to their usual home ranges in the impoundment more than once in a season (Kind 2002). Increases in water discharge from the weir caused Lungfish to move downstream, and downstream movements were significantly related to the river flow rate. These fish were probably not passively washed down the river, but took advantage of the flow to return more easily to their non-breeding season home ranges. Two Lungfish that had been tagged upstream of the weir apparently swam over the top of the wall during flooding in February 2003, and moved 25 and 36 km downstream. They were detected by Berghuis & Broadfoot (2004a) attempting to return upstream in April and May the same year, but they did not successfully pass through the fishlock. Some Lungfish tagged in the Jones Weir moved upstream during the spawning season into shallow sections of the Boyne and Auburn Rivers, which are tributaries of the Burnett River (Brooks & Kind 2002). During the non-spawning season, fish in established impoundments showed strong site fidelity in a restricted area, similar to fish in flowing parts of the river. Lungfish in the Mary River (which contained no substantial impoundments) did not undertake spawning migrations (Kind 2002). Lungfish that were caught and radio-tagged within the Ned Churchward Weir in the Burnett River made only local movements, similar to fish in the unimpounded

section of the river. When the weir was filled, they moved into the flooded areas. Several fish then became stranded in a pool when the water level subsequently dropped, and had to be moved overland to the river before the pool dried. With the exception of one individual that moved out of the impoundment and travelled 11 km upstream, they did not move away from the inundated area to find a spawning site. **During the spawning season, large groups of Lungfish were seen milling around the water surface over previous spawning sites that were now flooded by the weir.** Brooks & Kind (2002) suggested that searching for spawning habitat further afield is a behaviour learned by Lungfish in established impoundments over time. The mean linear range of Lungfish in the Burnett River was 11714 ± 16044 m (n = 29 fish). There was no difference between the sexes. Lungfish in the lower reaches of the river (in the Ben Anderson Barrage pond) downstream of Ned Churchward Weir had larger home ranges and their ranges were proportional to body length, unlike those within the impoundment and in flowing sections of the river (Brooks and Kind 2002). The mean linear range of Lungfish in the Mary river was 4770 m (standard deviation 8400 m, n=20 fish), including two individual males with ranges of 26.1 km and 30.5 km. The average linear range of Lungfish in the flowing section of the Burnett River was 1758 m. Some individuals in flowing river habitat had linear ranges of 300 to 500 m. The linear ranges of Lungfish in the Mary River and the Goodnight Scrub (then flowing) area of the Burnett River were not significantly different, but those in the impounded sections of the Burnett River were larger.
In adults, home ranges of both sexes overlap, and daily ranges are smaller in winter. Three immature fish had linear ranges of 900 to 2400 m. Unlike adults, juvenile Lungfish appear to be territorial, and aggressive to one another. During the day, larger juveniles in captivity pushed and bit smaller ones to exclude them from preferred shelter sites (Kind 2002).

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Attachment 1

Queensland Farmers' Federation

Media release - 15 May, 2006

Economic impact of Mary River Dam needs urgent attention

Queensland's farm lobby has called on the State Government to urgently commission an economic impact statement on the proposed Mary River Dam to ensure that rural industries will have a secure future in the Mary Valley.

Queensland Farmers' Federation Chief Executive Officer John Cherry said the resumption of 900 properties and 7600 hectares of prime agricultural land in the Mary Valley for the Traveston Dam would come at a major cost to the local economy.

"This will have a major impact on rural industry in Gympie, with 18 million litres of milk production and tonnes of fruit and vegetable production ceased," he said.

"Farmers have invested millions of dollars into their farms in the Mary Valley because of the combination of rich soil, water availability and proximity to Brisbane.

"The economic study needs to assess where those farmers can relocate, and what assistance and compensation they will need to get there.

"Water users further down the Mary will be looking for assurance that the diversion of water from the Mary to Brisbane will not impact on their long term farm viability.

"The loss of 7600 hectares of prime agricultural land will also have spin-off effects on service and support industries in Gympie which need to be assessed. It is concerning that none of this important economic assessment work had been done before the Government announced its plans for the dam.

"QFF has called on the Government to establish a joint industry taskforce to start working through the economic and industry consequences of this dam proceeding.

"The Mary River Dam, with the resumption of 7600 hectares of prime land and displacement of roads and rail infrastructure, is likely to cost a lot more than the $200-300 million cost foreshadowed by the Government.

"The cost also included the investment uncertainty now faced by 900 landholders whose investments are now in a state of limbo until the assessment of the dam proposal is concluded.

"QFF, Growcom and the Queensland Dairyfarmers' Organisation, are looking for surety for producers, with a commitment from Government that landholders will be advised of progress with assessment of the dam as soon as possible.

"The public also needs to be assured, before asking 900 landholders and their families to give up their homes and farms, that a full cost-benefit analysis has been completed and the alternatives to the dam fully considered."

Attachment 2

ABC Brisbane | Online Polls

Past Polls:

Question 169

Should rainwater tanks be compulsory in all Queensland households?

Yes 76%

No 24%

219 votes counted

Question 217

The Queensland Government's proposed to build two new dams to secure water supplies for the south-east corner. Is this the answer to a shortage of water in the region? Does south-east Queensland need another dam?

Yes 23%

No 77%

2120 votes counted

Question 233

Queenslanders will vote in a plebiscite on March 17 next year to decide on the use of recycled drinking water as part of our ongoing water supply. If the poll was taken today, how would you vote?

'Yes' - allowing a small percentage of recycled drinking water to be added to our ongoing supply	10%
'No' - in which case the government still reserves the right to use recycled drinking water in an emergency	19%
Don't worry about the poll - just add the recycled drinking water	71%

- SEQWater's Dams Overview
- Dam Operations & Maintenance
- Dam Safety Program
- Hydro-Electric Power
- SEQWater's Raw Water Users
- Dam Construction
- Wivenhoe Alliance
- Seismic Monitoring

Dam Operations & Maintenance

Print Page

On 30 June 2001, SunWater completed a five-year contract for the operation and maintenance of the three dams. Following a competitive tendering process, SunWater was successful in its bid for a new contract for an eight-year period, commencing on 1 July 2001. The philosophy of the contractual arrangement is one of partnering – working together to achieve desired outcomes – whilst providing SEQWater with a system that allows for 'hands-on' management of our dam assets.

The contract comprises five main activities:

- Routine operation and maintenance
- Planned maintenance
- Unplanned maintenance
- Flood planning
- Flood operations

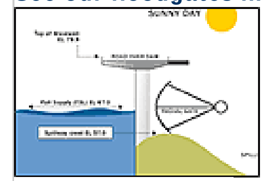
Water Storage Status Table as at 30/03/07

Item	Wivenhoe	Somerset	North Pine	SEQWater Totals
Full Supply Level (m) AHD	67.00	99.00	39.63	-
Storage Volume @FSL (ML)	1,165,240	379,850	214,960	1,760,050
Lake Level (m) AHD	52.08	89.79	25.52	-
Volume Stored (ML)	213,801	116,440	34,083	364,324
Percentage in Storage	18.35%	30.65%	15.86%	20.70%
Change since yesterday	-0.045%	-0.036%	-0.055%	-0.044%
Rainfall at dam site 24 hours to 9am (mm)	0	0	0	

Last Updated: 30th March 2007 8:37am

Dam Levels:

See our floodgates in action

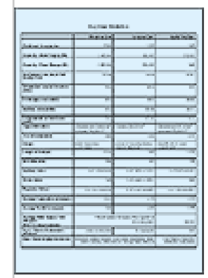


CLICK TO VIEW

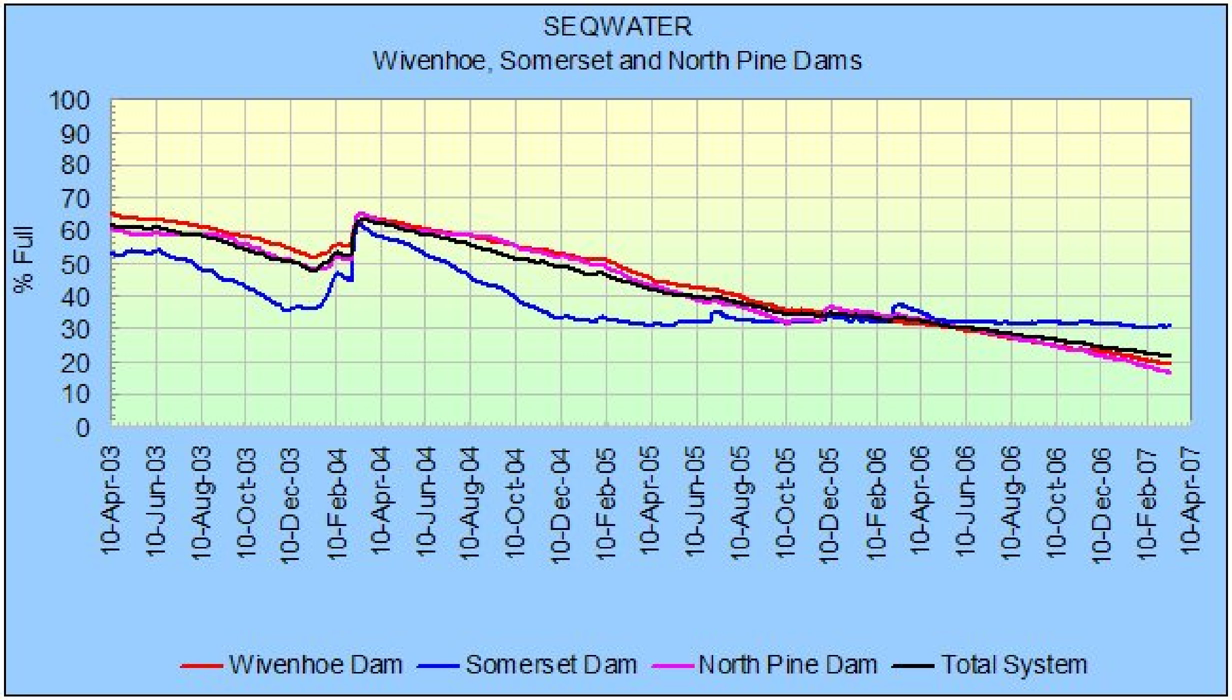
View an animated sequence depicting how we open Flood Gates on the Dams here.

PDF

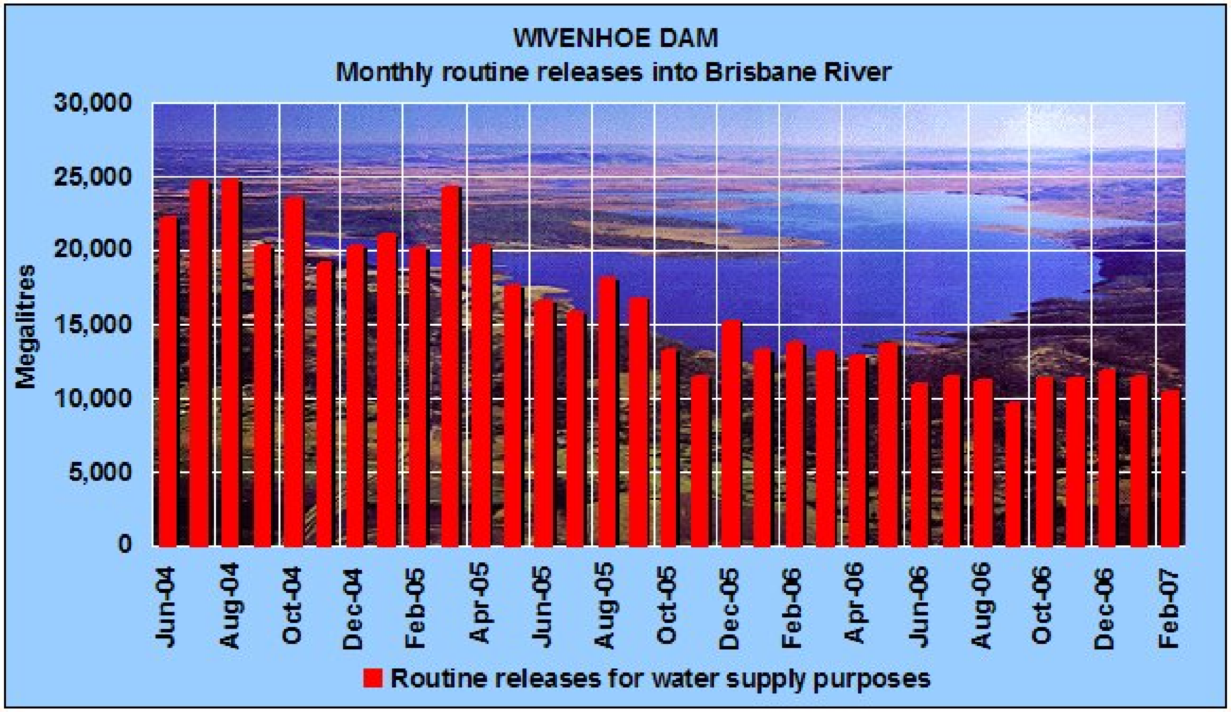
Key Dam Statistics



This chart shows key features of Dams and Storages



Water Releases:



Top