Abstract
The use of an abandoned quarry for depositing clean fill from road construction activities demonstrates that past liabilities can become a high value resource for state and local governments experiencing the increasing demands from the coastal migration or seachange phenomena. The Quarry Rehabilitation Project has resulted in positive economic benefits from reduced disposal costs, improved site safety and increased biological activity on the site.

Introduction
The Queensland Department of Main Roads has a series of abandoned hard rock quarries around the state. Most of the quarries were abandoned in the 1970s and 1980s when the state government began outsourcing the supply of materials for road construction activities (1).

The Coombabah Quarry (Figure 1), located in the Gold Coast hinterland, was abandoned around 30 years ago (2) and the site remained relatively unused until the commencement of the rehabilitation project in December 2003. The quarry void posed a risk to the community as local children were accessing the site after hours. Environmental concerns were also raised due to runoff from historic dumping in the top bench. A project team was established to resolve the safety and environmental issues of the site and it was determined that the pit needed to be filled in order to address the above concerns.

Challenges for a growing community
The “seachange phenomenon” has been occurring for around the last five years. This phenomena is the movement of people to the coasts of Australia for either retirement or lifestyle change. The movement has obvious social and environmental impacts, including increased demand on roads, schools, hospitals, water, open space and in particular, waste disposal facilities. The combination of waste produced by the growing
population and increased development means the region’s waste disposal facilities are filling fast. RoadTek, the commercial business division of Main Roads, deposits approximately 20,000 tonnes of waste in Gold Coast landfill sites each year.

RoadTek established an innovative solution for the Coombabah Quarry which addressed the identified environmental, social and safety concerns. The plan proposed filling the quarry with clean, inert materials from Main Roads construction sites in the Gold Coast area.

Key stakeholders and community interests were taken into consideration when scoping the environmental and safety constraints impacting on the solution. The final solution was negotiated and supported by the Environmental Protection Agency (EPA), the Department of Primary Industries (DPI) and the Gold Coast City Council (GCCC) prior to its implementation. The project demonstrated the development of an innovative solution to better utilise an undervalued resource and achieve outcomes for government and the community.

**Environmental benefits**
The completion of the Quarry Rehabilitation Project has delivered a number of positive environmental outcomes including:

- Increased biodiversity with native plantings attracting birds and mammals back to the site
- Increased habitat areas. Large logs have been placed to protect the edges from vehicle access and provide habitat for small mammals and reptiles
- Reduced edge effects of bushland. In the future these plants will mature and will reduce the edge effects of the bushland which is adjacent to the quarry
- A stable landscaped environment to replace the void, which has reduced leachate and runoff and improved downstream water quality
- Native vegetation species were selected and planted by Greening Australia volunteers (3)

**Social benefits**
The Quarry Rehabilitation Project has provided employment opportunities in the local community through a partnership with Greening Australia for the revegetation of the quarry’s degraded top bench.

Gold Coast City has a growth rate of 2.9%, and a current population of around 469,210. An estimated 254 people migrate to the Gold Coast area each week (4). With the annual average of 299 kg of waste per person (5) going to landfill, the GCCC will need to fully utilise all of its landfill resources to manage this influx.
RoadTek’s use of the quarry has reduced the load on existing GCCC fill sites. This is equivalent to an additional 67,000 peoples’ rubbish per annum, assisting the local community by increasing the life of local land fill sites. With appropriate controls in place, other abandoned quarries or mines may be useful for road and building clean fill disposal.

**Economic benefits**
The increased demand on the region’s finite resources, such as space for landfill, has recently caused disposal fees for contaminated waste (general construction and demolition waste) to rise to $55/t. The quarry void has over 75,000m³ (6) or around 120,000 t (7) of valuable void space available and means potential savings to the state of between $2 to $5M over the life of the project, and a significant reduction in load on local waste disposal sites.

Up to 20,000t of clean fill will be deposited each year and RoadTek expects the rehabilitation project to be completed by 2010. To date the quarry has received around 40,000t of fill at a cost of around $600,000 for earthworks and environmental management. RoadTek Asset Services currently charges $25/t to manage the site and meet Environmental Management Plan (EMP) requirements. With offsite disposal fees at GCCC landfills are currently $55/t and considering around 10% is concrete, the project has saved the Main Roads around $1.4M in disposal fees as at December 2006.

**Regulatory considerations**
The project involved negotiations with the Department of Natural Resources and Water (DNRW), EPA and the GCCC.

The storage of construction and demolition waste is an Environmentally Relevant Activity under the *Environmental Protection Act 1994* (the EP Act). However, inert materials can be used for filling activities (6). Inert materials include bricks, pavers, ceramics, concrete < 300mm and reinforcing steel, and clean earthen fill (6).

When undertaking waste management activities under s369A of the EP Act approval from local government was not required as the site is not within the local government plan area (8). The EPA (9) advised that as the filling activities were incidental, when associated with road construction activities, and the fill was ‘clean fill’, that an environmental authority was not required as long as the annual fill amount was less than 20,000t and the site was managed under an EMP. The EPA (9) advised that the crushing of concrete for fill and reuse on the site, was ancillary to the fill activities and a permit was not required. The concrete is currently being reused on site for erosion control and access roads.

Consultation with the EPA and DNRW led to the installation of a 100m long bund wall, forming an impermeable barrier between the clean water coming from upstream and water coming from the project site. Leachate and surface runoff is collected in a settlement pond before discharge to a further two ponds and then released off site. Current sample data indicates that no contaminants are leaving the site.

Under the *Water Act 2002*, activities that impact a water course may require a permit. After consultation, DNRW (10,11) advised that permits would not be required due to past activities fragmenting the creek and filling activities would add no further fish barriers nor impact on the water flow rates in the creek.

**An innovative solution**
The use of the void for clean, inert fill has reduced environmental and safety risks and provided significant cost and time savings for landfill disposal. Safety and environmental problems were turned into advantageous environmental, social and economic outcomes.

Community interests were very important for the success of the project. The local community fully supported the rehabilitation. The rehabilitation means the safety and environmental burden is not passed on to future generations as RoadTek has taken on the role to rehabilitate the site to a viable self-sustaining bushland community.
Conclusion

The innovative solutions developed as part of the Coombabah Quarry Rehabilitation Project have provided economic savings for the Queensland government and positive outcomes for the community. Through innovation and creativity, RoadTek has turned safety and environmental threats into opportunities for RoadTek and Main Roads. Rehabilitation of the site has resulted in a self-sustaining ecosystem that has reduced pressure of the local communities’ landfill sites and will save Main Roads millions of dollars in disposal fees over the life of the project.

References

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