Belgenny Farm is part of the Camden Park Estate, centre of the Macarthur family’s agricultural interests in New South Wales. The Belgenny buildings date from the first quarter of the eighteenth century, and are the oldest on the property. A conservation plan for the site is now being prepared, and the Department of Environment and Planning, N.S.W., which owns Belgenny Farm, has commissioned architects and conservation planners, Howard Tanner and Associates, to record and stabilise the farm buildings, which in some areas are suffering from timber decay.

The Belgenny farm buildings and surrounds - thirteen structures in all - are unusually intact, despite the recent suburban development pressures and the fact that the site has been virtually dormant for almost twenty years. Timber decay is severe in some areas, generally as a result of poor water dispersal and insect infestation. The decay is isolated, however, and the general condition of the site is outstanding. Our stabilisation programme is based on preservation and minimum intervention as deemed necessary to assure personal

1. Belgenny stables, east elevation, ground floor plan and north-south section.
safety and structural stability and to avoid other­wise imminent collapse.

The main buildings at Belgenny are centred around a large courtyard. The stables are the largest and oldest. Their original floor plans have been altered over time, and as larger machinery became essential in farm operation, an extension was built to the south-west c1900. This is the engine room, which links the once separate stables and mill.

The engine room and annex

The stabilisation programme is focused on the engine room and annex. This area is exemplary of rude timber construction boasting its original oversized post and beam structure.

The roof system is supported on the large posts. The main roof principals are trusses which span across the centre of the building in two directions. Purlins are supported on these, then rafters and hip members. All roof members are supported on a stud framed wall which has a very heavy lower member (tie beam), spanning between the timber posts. The posts average 350 mm diameter and the beams are of similar dimension. The timber shingles and battens are in situ, now externally covered by galvanized iron sheeting. All structural timbers in these areas were carefully coded, and the coding legend given to all project participants, reducing any potential confusion.

Structural assessment

Structural upgrading is required. Failure of original timbers is due to pest infestation, natural decay and water penetration. Splicing is occurring only as necessary, with replacement timbers of similar grade. Matching with like species of similar size was not economically feasible and salvaged timber from demolished structures was used in most instances.

Interestingly, although most timbers are damaged by insects or water, because of the quality hardwood originally used many continue to perform adequately. The large member dimensions are characteristic of these buildings. It was determined that an external shell width of 20 mm was all that was structurally required on the main posts, above and below ground level.

Insect infestation

Termite attack was widespread, affecting posts, tie beams and roof members. The coptotermes have been active throughout the Belgenny site in the past, badly damaging the engine room in particular. In October 1983, all the buildings were treated by pest control specialists and no action has been necessary since this time.

The extent of termite attack was not easy to determine by visual inspection, as these insects attack the inside of the member and leave an external shell for protection of their runways. After thorough investigation, mainly by tapping and drilling, it was estimated that approximately one-third of the engine room required structural intervention.

Water damage

Water damage and associated fungal attack is the direct result of badly damaged box gutters. The engine room depends on such gutters on three of its four sides. Failure of these has initiated the decay of surrounding beams, top plates, hip rafters, studs and weatherboards. Many of the affected timbers must now be replaced and all box gutters require reconstruction.

Repair of the building envelope is essential to retard deterioration. Improvements to the water dispersal system at ground level is also an important part of the work. Poor water dispersal has accelerated the rotting of several structural posts. During heavy rain the water freely flows directly through the building, saturating foundations. Subsoils are dense red clays and it is evident from the large deposits of infill materials, such as red and riverine sand, that water dispersal has long been a difficulty on the site.

Natural decay

There has been a natural process of decay over the past century. The crude technique used to embed timber posts in the ground has caused a degree of rot, which has been aggravated by water saturation of the foundations. Measures have been taken to retard this deterioration and an efficient water dispersal system has been designed. The dense hardwood used has excellent natural resistance to rot.
Work Programme

Drainage

Stabilisation works are undertaken from the 'ground up.' The drainage in the stables area is of primary concern. Regrading of the courtyard was required because of decades of topsoil-accumulation at the building's edges. Run-off had been channelled into the building for more than two decades; a former ground slope and level, based on historical information and practical requirements, and determined collaboratively by the project architect, archaeologist and engineer, has now been reinstated. Natural contours have been used to channel water away from the stables area, and the ground cover is now shale, reconstructing the past condition and replacing the grass/foam cover that had filtered in over past decades.

No subsoil drain had previously existed in the vicinity of the stables, and the installation of this was considered a necessity. A Nylex strip drain has been laid, and a backfill of coarse river sand has been used, as the existing clays have low permeability, reducing the drainage effectiveness. The east, or courtyard, elevation of the stables has a brick spoon drain to catch and channel the roof run-off, as shown. The drain was uncovered during preliminary inspections and required restoration. The falls were no longer consistent and numerous bricks had been lost. To enable installation of the subsoil drain, recording, removal and restoration/reconstruction of the spoon drain was required. Replacement sandstock bricks were purchased to complete the drain, these being of a similar composition and vintage.

Post base treatment

The contact of timber and soil inevitably introduces the problem of soft rot. The timber posts of the engine room are textbook examples of the phenomenon. The preservation of these original posts began at the bases, using a preservation gel and techniques that, to our knowledge, are not yet commonly employed in architectural conservation practice.

All posts in the engine room and annex, regardless of condition, were 'bandaged' at their bases to prevent further decay - a preservation method used for telegraph poles. The bandage is 1 mm thick plastic, with a preservation gel spread on its inside skin. The gel, Busan 1022, is a formulation of two main ingredients, a fungicide and a penetrating agent. Spread in a band 450 mm wide and 5 mm thick, the gel forms the inside lining of the bandage, directly penetrating and sterilising the timber. More than 600 mm in depth, the bandage was wrapped around the post with about 150 mm above ground level, and shrunk tightly onto the post by heating with a gas torch flame. In the case of partially-rotted posts, the surface was brushed before bandaging, but no rotted timber was removed. The post foundations were excavated to facilitate the application, and subsequently digs were backfilled to the original ground level.

Internal treatment of the posts was also undertaken, and the same preservation gel was injected into their centres. Given its viscous nature, the gel sticks to surfaces and is easily pumped into the prepared holes. The holes are drilled, taking care to ensure that the load carrying capabilities of the post are only minimally affected. As the drill bit reaches the centre rot, the gel is injected into the hole. Once filled, the hole is then tightly plugged with a timber dowel, well soaked in creosote.

Timber replacement

Timber conditions vary in the engine room and annex. As a result of missing and failed structural members, both roof systems are weak and have substantially shifted. The engine room roof will not be 'pushed back' to its original position, but additional supports will be installed and the replacement of deteriorated braces is in progress. The annex roof, hipped at the west end, gabled to the east, is less complex a system and it has been a relatively simple procedure to shift it slowly by propping and easing. A movement of 150 mm has enabled reconstruction of the valley and box gutter linking the two areas.

Trusses: King post truss members are satisfactory, provided 60 per cent of the member area remains, (assuming that the centre is the rotted area). Only one chord in the four main trusses required complete replacement. Another chord had collapsed many years ago. However, it is structurally sound, and was reinstated, packing the new connection at the top plate and replacing its badly deteriorated web member. Where fungal decay had affected the members, the chord joints were
2. Spoon drain and strip drain installed on site.

examined to ensure a 12 mm sound vertical bearing surface. Packing of the joints was necessary in several cases and one top chord required splicing.

Rafters: Rafters are generally in good condition, with approximately 5 per cent replacement required.

Hips: Only one of the four hip members is acceptable structurally. It was determined that the badly damaged hips would be completely replaced. This approach has its difficulties because of the problem of locating adequate bearing/nailing surfaces on the rafters. Further to this, the hip line has notable deflections that may be too substantial to tolerate in the reconstruction proposal. Work has not yet begun and, should problems arise, a second technique has been detailed. It is proposed that new 175 x 50 mm members with 75 x 75 mm spacers would be introduced to strengthen the existing hip, and eliminate the need to remove the rotted member. This is seen as a less desirable method as the original integrity of the roofing system is complicated by these extraneous timbers. To enable replacement of the hip members, temporary plates will be fixed to the rafters, holding them in place 300 mm from the hip. Fixings holding hip/rafter will then be disconnected and the hip removed. Jacks will be used to rectify deflections where possible, and to allow the installation and skew-nailing of the new hip to its rafters.

Purlins: Their condition is acceptable.

Top plates and beams: Essential structurally, several of these large members have been destroyed by termites. Splicing details to match existing original are used and splicing joints centred over posts. Original mortise and tenon jointing techniques are replicated in new work.

Box gutters: One of the box gutters was inadequately designed in the original construction and the sides of the box will be higher to permit the large volumes of water to be carried away. Apart from this instance, the same details will be used on the box gutters.

Shingles/galvanized iron: The shingles and battens are left in situ. Sections of the galvanized iron will need replacing, and the extent of this will be determined on closer inspection. It is presently unsafe to tread on the roof.

Annex: A basic structure of posts, top plates, tie beams, rafters, battens and galvanized iron, the annex has required relatively little detailing. The tie beams were missing and have been reconstructed. These are essential and their absence in past years undoubtedly contributed to the shifting that has occurred. Two posts were also missing, and few of the posts had any substantial base. New timber sections have been spliced and strapped. This approach was economically not sensible in more serious cases of rot, and concrete bases, below ground level, have been proposed.

Belgenny’s future

Approximately two-thirds of the engine room and annex stabilisation programme is now completed. The Department of Environment and Planning intends to extend the scope of the project to include all the buildings on this site. An agricultural display is to be located at Belgenny Farm in 1988 and it is hoped that the buildings will be accessible to the general public for this occasion.