7

Construction

This chapter describes aspects related to construction of the Project. These include options for the contractual arrangements for project delivery, anticipated construction techniques, methodologies and timeframes, as well as material requirements and management. It also addresses construction traffic and access arrangements to the site and identifies a range of ancillary infrastructure necessary to support the construction, the expected energy and fuel usage and strategies for waste minimisation and disposal.

7.1 Project delivery

Should the Project be approved, the most appropriate construction delivery method would be finalised by HWC following completion of the approval process. It is currently anticipated that the major construction aspects of the Tillegra Dam project would likely be procured in separate works packages comprising the following:

- watercourse crossings: structures over the Williams River and Moolee Creek above and below the inundation area and including approaches, all as part of the relocation of Salisbury Road
- dam and associated infrastructure: dam, associated structures and necessary detour/access roads and landscaping
- Salisbury Road: new 16.8 kilometre road to complete relocation of Salisbury Road including relocation of utilities services
- new access to Quart Pot Creek locality: a new three and a half kilometre sealed road plus four kilometres of unsealed access road to replace Quart Pot Creek Road
- pipeline connection to the CTGM: this would follow separately and at a later date when water becomes available from the dam.

Delivery options for each of the separate works packages may include:

- a conventional design contract, followed by a separate construction contract. A competitive tendering process to select a suitable contractor would be undertaken for both the final design and subsequent construction phases.

- design and construction awarded through a competitive tendering process to select a contractor and its nominated design team.

Short listing of tenderers and early tenderer involvement may be considered for some of the larger work packages such as the dam.

The timeframe for the construction of the Project would be subject to the ultimate staging approach and tender process but is anticipated to be in the order of four to five years. To meet the construction program, contracts for the watercourse crossings and Salisbury Road works may be combined depending on the progress of pre-construction and planning approval work. Following construction, HWC would be responsible for all ongoing maintenance aspects and operational requirements relevant to the dam and infrastructure located on HWC–owned land. The new section of Salisbury Road and the new Quart Pot Creek Road would be owned and maintained by Dungog Shire Council.

In addition to the above major components, the Project involves numerous other components including development of a new cemetery site, establishment of a habitat corridor and construction of a new RFS station. Contracts for the management of the cemetery would be undertaken pursuant to the Proposed Cemetery Relocation Plan (refer Working Paper H). The majority of the other necessary works would suit simple minor works contracts and could be performed by local contractors and tradesmen. Procurement of these would be in accordance with HWC's tendering and purchasing policy whereby selected or open tenders can be invited depending on the value of work.

7.2 Construction program and sequencing

This section outlines a typical construction methodology in sufficient detail to allow an assessment of the likely nature and extent of environmental impacts associated with construction. The final staging and/or construction methodology selected by the successful contractor(s) may vary from the description provided in this chapter but in any case would be in accordance with any Conditions of Approval. Stakeholder submissions may also influence the final construction methodology.

As indicated in Section 7.1, it is anticipated that separate contracts would be let for construction of the dam, the watercourse crossings, the realignment of Salisbury Road and the new access to the Quart Pot Creek locality. To allow the Project to be progressed in a timely manner, these contracts are currently being drafted by HWC and administrative processes for tenders formalised. Contracts would not be finalised nor would work commence until the planning approval process is completed. If the Project is approved, all relevant conditions of approval would be incorporated into the contract management process.

Figure 7.1 illustrates the major construction sequences for the dam and road works. Dam construction activities have been separated into three broad phases while road construction has been separated into two broad phases. The first road construction phase may be adjusted to commence in Year 2 to accommodate changes in changes or delays in either the detailed design phase or planning assessment process. Construction of the new access to the Quart Pot Creek area would be programmed to ensure the new road is in place prior to inundation of the existing road. Further details of activities within these phases are provided in Sections 7.4.1 and 7.4.2.

One of the main constraints to the programming of construction works is the existing section of Salisbury Road which passes through the site of the dam embankment at Tillegra Bridge and up the centre of the proposed inundation area. It would be necessary to maintain connectivity with properties and the settlement of Salisbury further up the Williams River valley. Two potential options were identified which would achieve this:

- construction of the entire length of the replacement section of Salisbury Road prior to

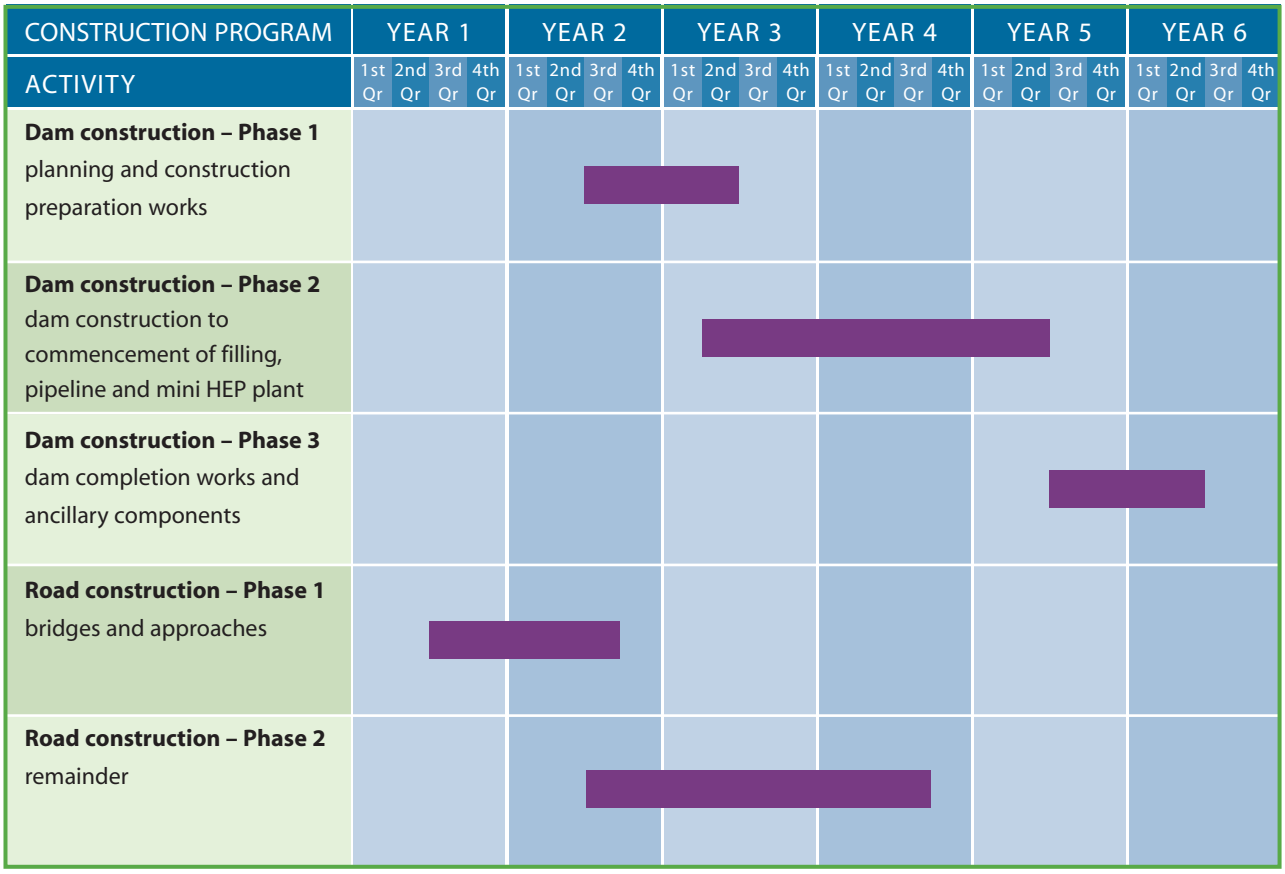

FIGURE 7.1 CONSTRUCTION PROGRAM

commencement of dam construction works

- provision of a temporary road around the dam construction site (with part of the route potentially forming part of the permanent realignment of Salisbury Road).

The second option is preferred as it would.

- avoid extended travel times during construction for residents living just upstream of the dam who would otherwise have to travel some distance north before returning along the new road
- allow the dam contractor (who would be responsible for constructing the detour) to work independent of construction of the new section of Salisbury Road
- reduce the risk of delays to dam construction from delays on road construction.

Various other preliminary works (pre-construction activities) would be required as part of the Project. Project. These may include establishment of construction compounds, vegetation clearing, etc. Should the Project be approved, pre-construction activities would occur as early as possible within the construction program. Details of these activities are provided in the following section.

7.3 Pre-construction activities

7.3.1 Access route improvements

While the vast majority of materials for construction of the Project would be sourced from within the storage area, it would still be necessary to transport a substantial quantity of construction materials

to the dam and Salisbury Road construction sites. It is anticipated the majority of imported construction materials would be sourced from the greater Newcastle area and would be transported to the construction site via either or both of:

- Dungog Road (MR101)
- Seaham Road–Clarence Town Road (MR301)

to Dungog, through Dungog via Lord Street and Hook Street, and then to the site via Chichester Dam Road and Salisbury Road. The principal route for construction traffic would be along MR301, particularly for heavy vehicle traffic, however, the occasional use of MR101 by normal registered road vehicles cannot be discounted. These two routes are shown in Figure 7.2.

A road safety audit was undertaken for the Project. This included collection of information on the existing condition of the abovementioned routes. In general, pavement condition was found to be poor (due to the presence of various pavement defects including potholes, excessive rutting and shoulder drop-off) while line/pavement marking was found to be faded and/or completely missing at some locations on most routes. Other safety issues were also identified. A copy of the report has been provided to Dungog Shire Council as the local roads authority.

The audit included a review of structural and safety conditions of key watercourse crossings on potential haulage routes. At the time of the field inspections, none of the crossings were observed to have any posted load restrictions in place. While it is assumed that they would be capable of accommodating construction traffic, it is expected that the construction contractor would conduct an assessment of relevant crossings (including their approaches) immediately prior to the start of construction, particularly in relation to the transport of heavy items of construction plant or materials.

The average number of construction vehicle movements (two way) is expected to peak at approximately nine per day (over a six–day working week) though at times, depending on the nature of construction activities, this could be higher. Overall however, construction traffic is expected to increase daily heavy vehicle movements by less than one per cent on both MR101 and MR301. Further discussion on traffic impacts is provided in Section 16.3.

While the contribution of construction traffic to overall vehicle movements is not expected to be significant, it is acknowledged that construction traffic, principally heavy vehicles, could still contribute to further pavement deterioration, particularly on sections of roads where the pavement is already in a poor condition. This in turn could have implications for general road safety.

The existing condition of Dungog Shire's access routes is currently one of a number of matters being examined through the Whole of Government Taskforce (whose membership includes HWC) established to coordinate the State government's efforts toward minimising the impact of the Project on Dungog Shire and to facilitating delivery of beneficial outcomes to the community. This is also discussed further in Section 16.3.

7.3.2 Establishment of construction compounds and ancillary facilities

Construction activities would take place on a number of fronts and at different times with some dam and road construction phases overlapping. This would require the establishment of a number of construction compounds to service the workforce. The principal construction compound would require an area of about nine hectares. It is anticipated that this would be located downstream of the right abutment of the dam on land owned by HWC (refer Figure 7.3).

The site is as close as physically possible to the proposed construction site while providing an adequate separation distance from the direct work area for occupational health and safety

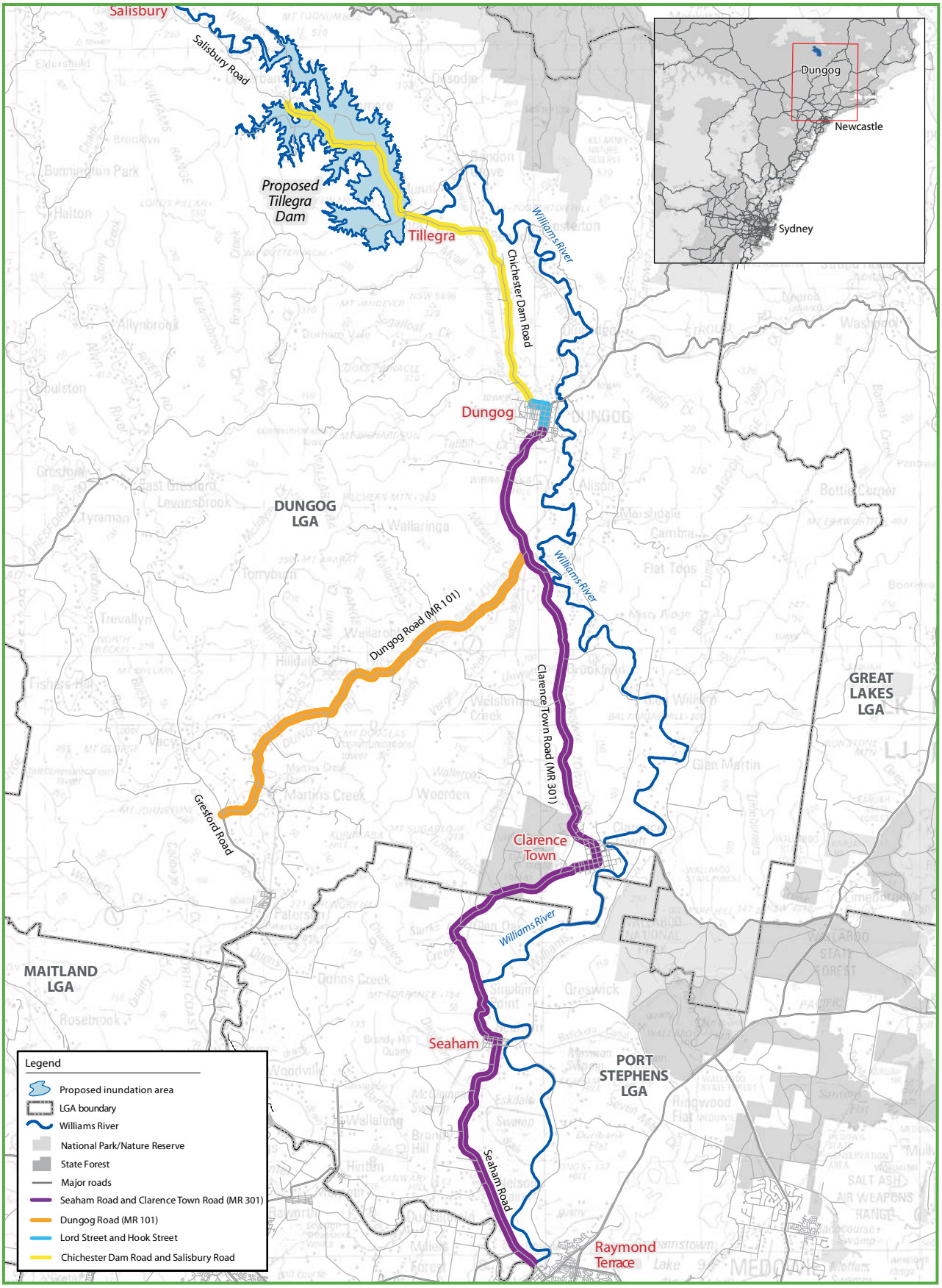

FIGURE 7.2 PROPOSED MATERIALS HAULAGE ROUTES

requirements. Facilities at this location would likely include offices, staff facilities, ablution blocks and changing rooms as well as materials storage and plant maintenance areas. Parking for contractors and staff would also be provided.

Primary access to the construction compound would be from Salisbury Road. Appropriate screening, landscaping and ongoing management of the site would be undertaken to reduce visual noise, dust and general impacts on the neighbouring amenity.

Secondary temporary facilities would be provided within the proposed inundation area to service the construction work force working on the main dam embankment. Heavy machinery may also be parked overnight in a designated area within the inundation area, reducing but not eliminating the movement of machinery between the construction site and primary construction compound.

The construction site boundary shown in Figure 7.3 encloses an area of about 610 hectares. This includes the dam wall construction site and the three identified quarry sites. In addition to the major compound, smaller compounds would be required for the construction of the new section of Salisbury Road, particularly the northern half where use of the principal compound would not be time effective. These would be sited based on their proximity to more specialist areas of construction such as bridge sites.

TABLE 7.1 LOCATION CRITERIA FOR CONSTRUCTION COMPOUNDS AND ANCILLARY FACILITIES

LOCATION CRITERION	CONSTRUCTION COMPOUND[1]	BATCH PLANT	STOCKPILE AREA
Environmental			
More than 100 m from waterway	Yes	Yes	Yes
Areas of low ecological and heritage conservation significance	Yes	Yes	Yes
Distance from dwellings or other activities that may be affected by noise or other plant impacts	200 m	200 m	100 m
Construction			
Easy and safe access to the main road network	Yes	Yes	N/A
Relatively level ground elevated to assist drainage and allow treatment of runoff	Yes	Yes	Yes
Minimum preferred area	1 ha	1 ha	N/A

[1] Other than the major compound which would require approximately 9 ha

The locations of the minor compound sites would be determined by the successful contractor based on the adopted construction method and/or phases of construction works. This would, however, be guided by the general principle that it is important to locate ancillary works in areas that facilitate efficient and cost-effective construction of the Project while minimising biophysical and social impacts. This would be achieved through consideration of location criteria listed in Table 7.1. Site security and public safety would also be considered in determining appropriate locations.

Should a site(s) be identified that complies with most but not all of the identified criteria, and where suitable management measures could be applied to effectively ameliorate potential impacts, it would still be considered for use.

7.3.3 Other pre-construction activities

Other pre-construction activities include the development of the construction EMP and supporting plans, together with preparatory activities required by those plans. Initial activities may also include:

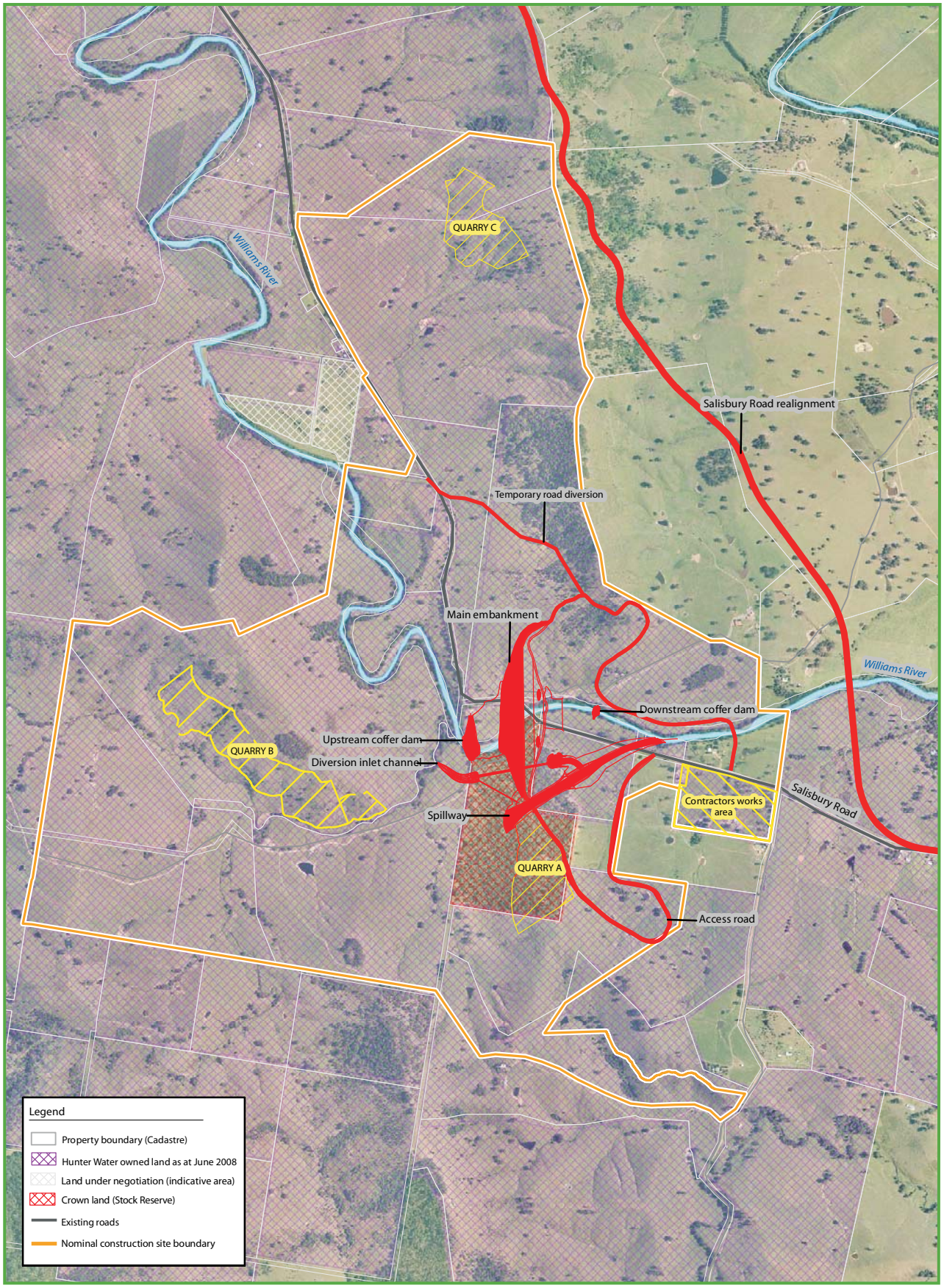

FIGURE 7.3 DAM CONSTRUCTION AREA

- undertaking baseline environmental monitoring
- preparation of environmental performance reporting templates
- establishment of erosion and sedimentation controls at key early works locations
- implementing necessary traffic and access arrangements
- vegetation clearing at key early works locations such as watercourse crossing (bridge) sites
- relocation of immediately affected utilities

7.4 Construction activities

7.4.1 Roads

As As previously noted, road construction would be split into two broad phases:

- construction of waterway crossings (bridges) and their associated approaches (and may include construction of the temporary access around the dam construction site)
- remaining works (including construction of the replacement access to the Quart Pot Creek locality).

The basic approach to road construction would be to focus on a number of discrete sections of the alignment concurrently with the total road works package taking approximately 156 weeks. The number and location of sections would be determined during detailed design and would be based on identification of logical break points associated with the mass haulage of materials. Haul roads would be required to provide temporary access to these intermediate sections. These would be located within the inundation area to minimise long term visual and environmental impacts. At the completion of construction, these would be rehabilitated to avoid the need for ongoing management. Some haulage routes or sections of them above FSL may be converted to access tracks around the storage perimeter.

A period of approximately six weeks would be required from the date of award of the contract to undertake program management planning and to best position and construct construction compounds and introduce major items of plant and equipment. Each section of construction would require the following typical activities to be undertaken:

- confirming and defining property boundaries and locations of environmentally sensitive areas
- implementation of necessary safeguards in accordance with relevant conditions of approval to protect sensitive areas
- establishment of construction compounds, batch plants (as required) and access roads for the major elements of construction
- clearing of vegetation and processing (including recycling) of materials for reuse in landscaping activities
- earthworks including excavation, movement and placement of materials along the alignment from cuttings to fill embankment areas. This would include ripping of weathered and weak rock and blasting of strong rock. If necessary, rock would be crushed and graded, and selected materials stockpiled. Potential blasting locations for the roads are identified in Figure 7.4[1]

[1] Note that additional drilling and blasting would be required for spillway construction and for quarry operations related to the construction of the dam embankment. Refer to Figure 7.3 for the locations of the spillway and quarries.

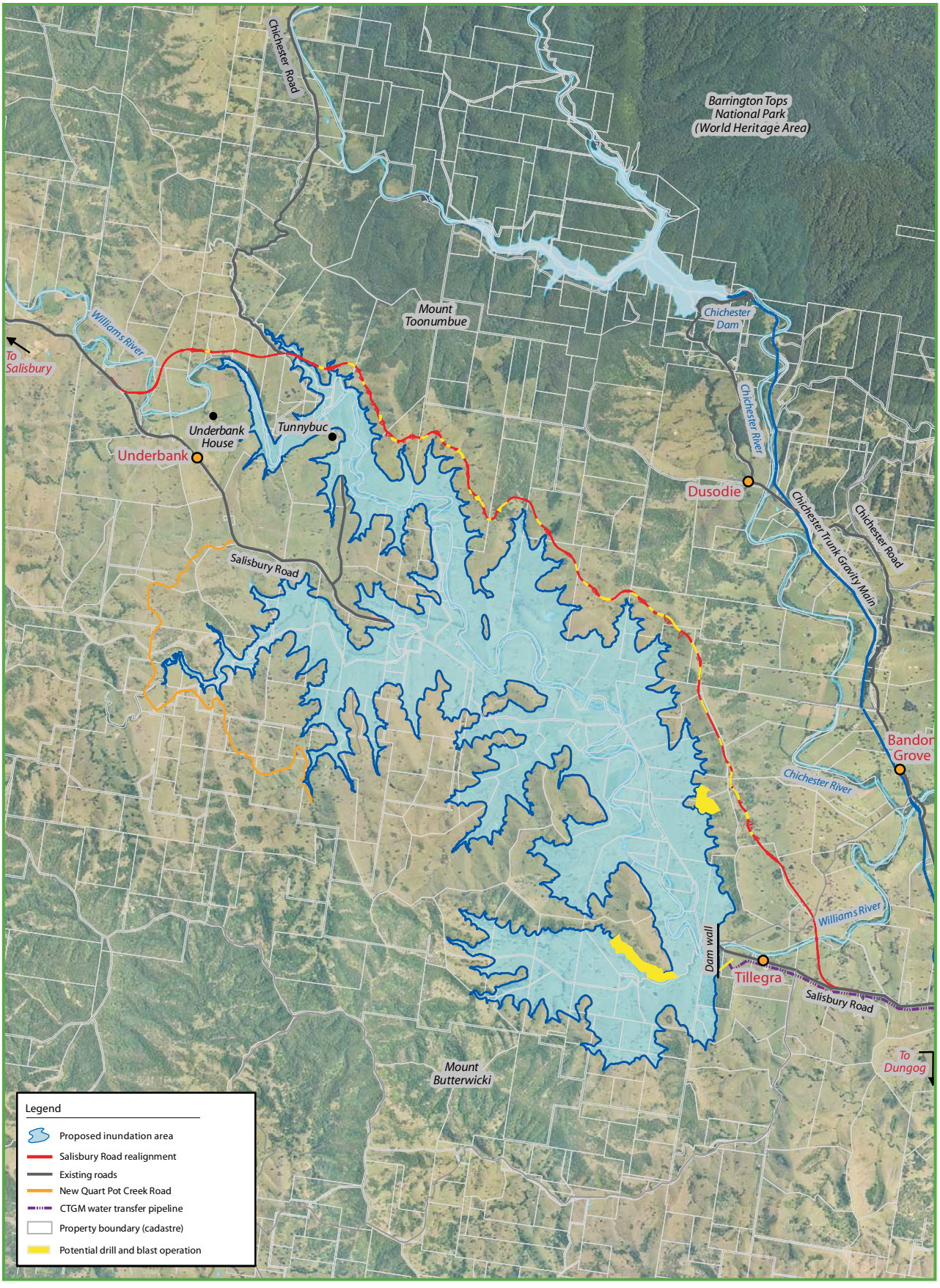

FIGURE 7.4 POTENTIAL DRILL AND BLAST OPERATIONS

- construction of haul roads and stripping of topsoil and placement into stockpiles for reuse
- services adjustments
- installation of drainage culverts when the road level reaches an appropriate level at each culvert
- load, haul and placement of both natural materials (crushed rock) and manufactured materials, (concrete and asphalt) mix (if necessary) and construct pavement
- bitumen spray seal the road in practical lengths as the work is finished
- installation of roadside furniture including traffic barriers such as guard fencing, line marking and signposting (this is likely to occur in a single operation over the entire road length)
- landscaping activities.

The realignment of Salisbury Road would largely occur 'off line' and as such there would be minimal disruption to traffic using the existing Salisbury Road apart from during construction of the temporary detour around the dam construction site.

Haulage of materials between areas of cut and fill would take place along the proposed road corridor or on defined haul roads. Appropriate traffic management measures would be implemented to minimise any traffic-related impacts from crossovers or access points to construction activity areas from public roads.

7.4.2 Dam

The main activities comprising each of the three broad phases of dam construction are summarised as follows together with indicative durations.

Phase 1: Award of Contract to being ready to cut Salisbury Road (48 weeks)

1A Management planning, location of major items of plant and equipment

1B Clearing the site and quarries above river level. Establish site access roads, quarries and associated crushing and concrete batching plants. Excavate:

- inlet and outlet channels
- the lower spillway (except where it crosses Salisbury Road because public access would need to be maintained along Salisbury Road until the detour around the site is completed in 1D)
- the embankment foundations above river level
- foundations for the upstream coffer dam

Minimal or no blasting would be required during this stage

1C Excavate the diversion tunnel and upper spillway with blasting required throughout this stage, initially for the tunnel and subsequently for the upper spillway (refer Figure 7.4). Follow bulk excavations for the embankment foundations above river level in Phase 1D with fine trimming and removal of unsuitable material (no blasting required)

1D Start construction of the intake tower, concrete lining of the upper spillway and concrete lining of the diversion tunnel. Complete left abutment access road and extend back on to Salisbury Road upstream of the dam embankment site to provide a detour around the site for public traffic)

Phase 2: From cutting Salisbury Road to starting to fill the dam (108 weeks)

2A Excavate lower spillway through Salisbury Road (no blasting required) and complete the offtake

tower and lining of the diversion tunnel

2B Construct coffer dams and divert river through tunnel

2C Excavate and prepare embankment foundations in the river bed (no blasting required). Install grout curtain along the upstream toe of embankment

2D Construct rockfill dam embankment and the concrete embankment facing (this would include about six months of regular blasting in the quarry for embankment rockfill followed by six months of less frequent blasting for concrete aggregates). Close the river diversion and start to fill the dam

Phase 3: Finishing off (24 weeks)

3A Construct a valve block, including mini HEP plant, and install outlet pipework in the tunnel

Construct parapet wall and roads on top of the embankment, amenities, landscaping, etc

Construction of the four kilometre pipeline linking Tillegra Dam to the CTGM would take approximately 45 weeks. This, however, would be deferred until the storage had filled to an appropriate level. The exact level has yet to be determined and would form part of an overall consideration of broad system strategies. However, an indicative level is RL135 mAHD which equates to approximately 40 per cent of FSL. This would allow water to be delivered to Dungog WTP under gravity.

The general sequencing of construction of the dam is illustrated in Figures 7.5a to 7.5f which broadly correspond to the above phases as follows:

- Figure 7.5b – Phases 1A, 1B
- Figure 7.5c – Phases 1C, 1D
- Figure 7.5d – Phases 2A, 2B, 2C
- Figure 7.5e – Phases 2D, 3A
- Figure 7.5f – finished dam including CTGM water transfer pipeline.

7.5 Plant

Construction would require a substantial inventory of construction plant. A provisional list is provided in Table 7.2. The final list would be subject to construction programming needs.

TABLE 7.2 CONSTRUCTION PLANT

PLANT TYPE	DAM	ROAD
Bulldozer	5	4
Excavator	8	4
Truck	8	6
Grader	1	4
Roller	2	4
Concrete batching plant	1	
Rock crushing plant[1]	1	1
Asphalting plant	–	2
Water cart	6	4
Scraper	2	2

[1] May be able to be shared between dam and road construction; subject to final programming.

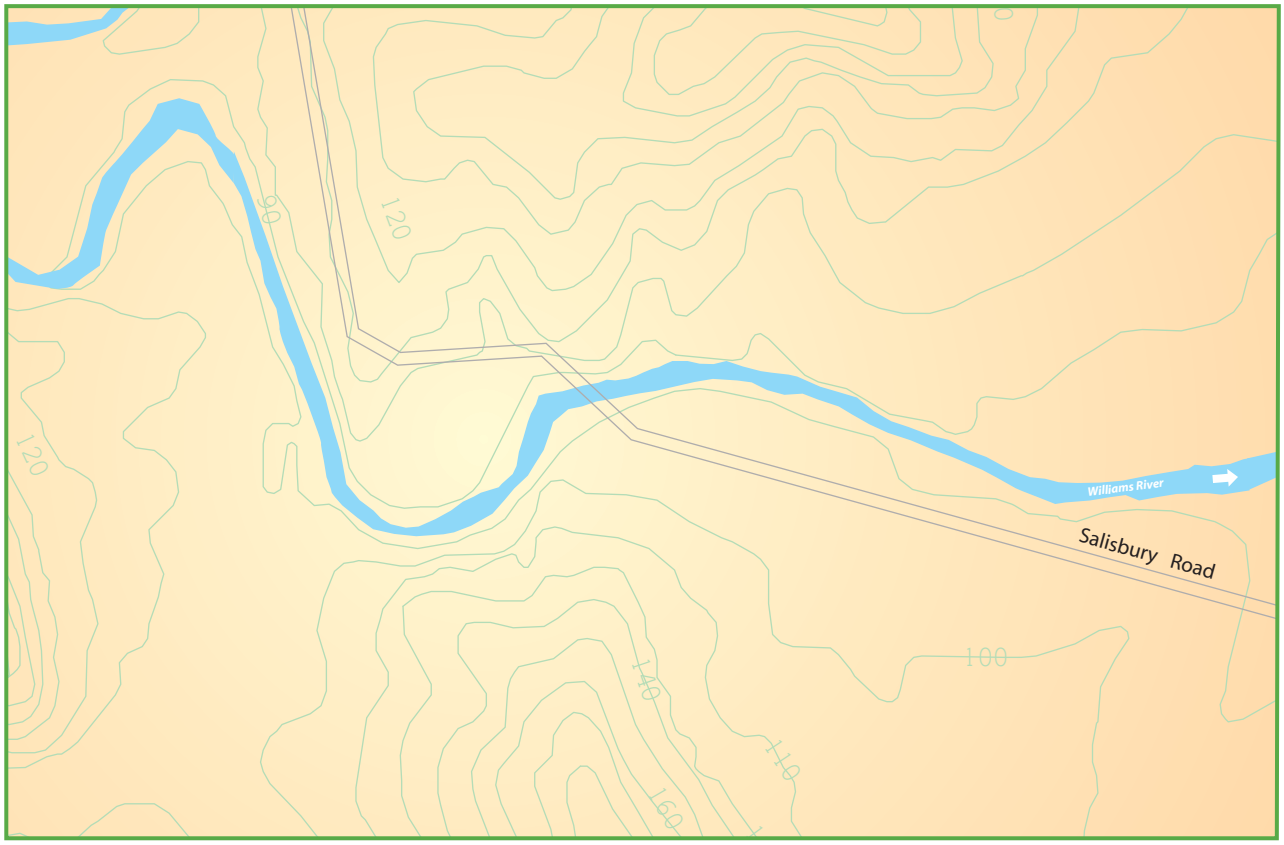

FIGURE 7.5a PRIOR TO CONSTRUCTION

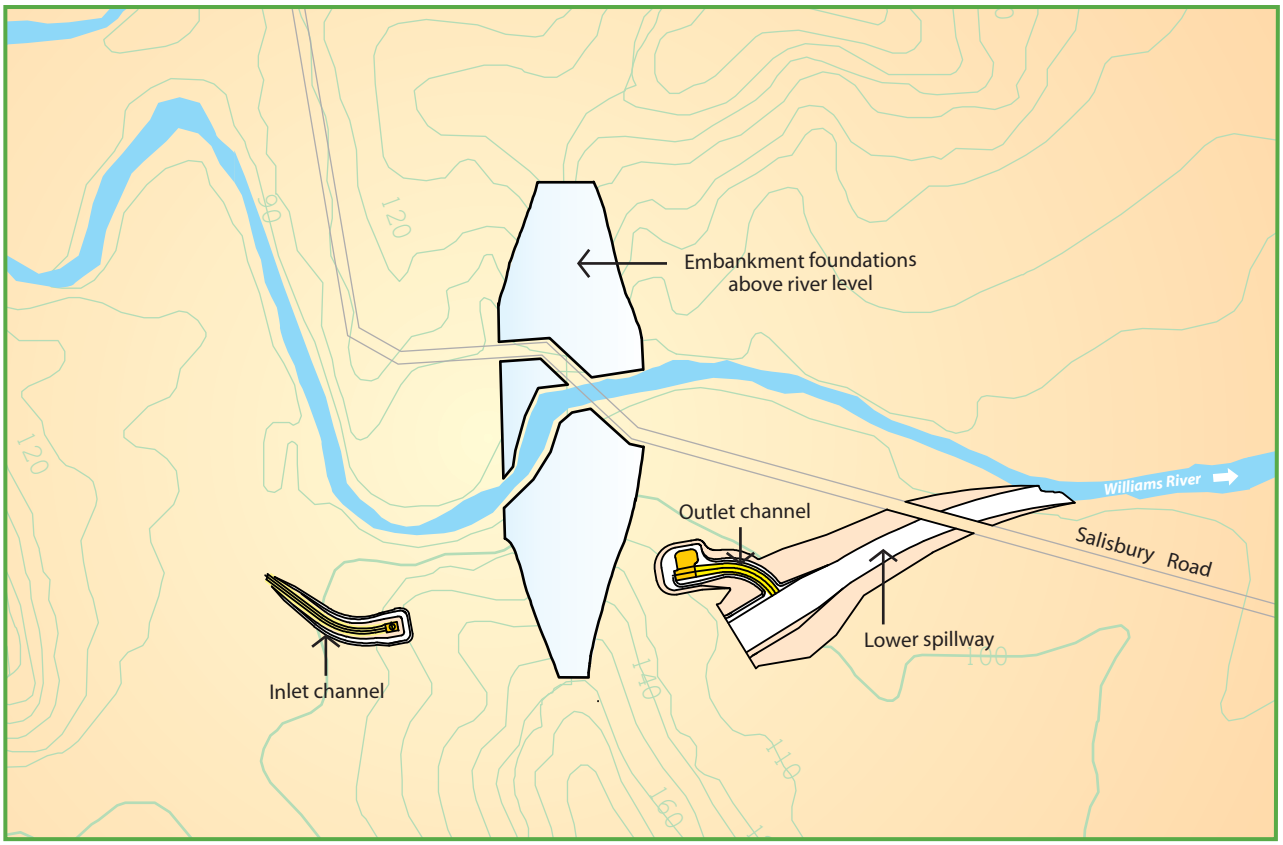

FIGURE 7.5b PHASES 1A, 1B

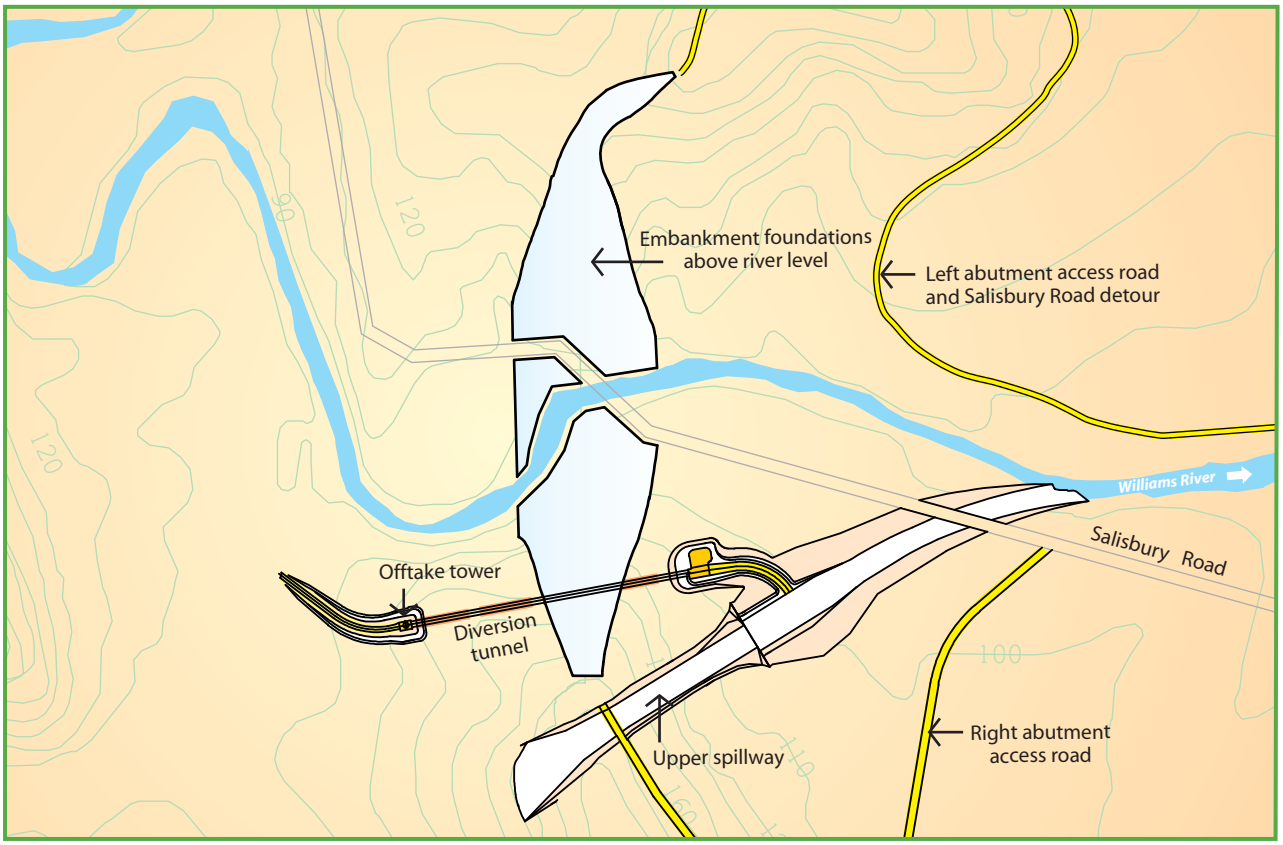

FIGURE 7.5c PHASES 1C, 1D

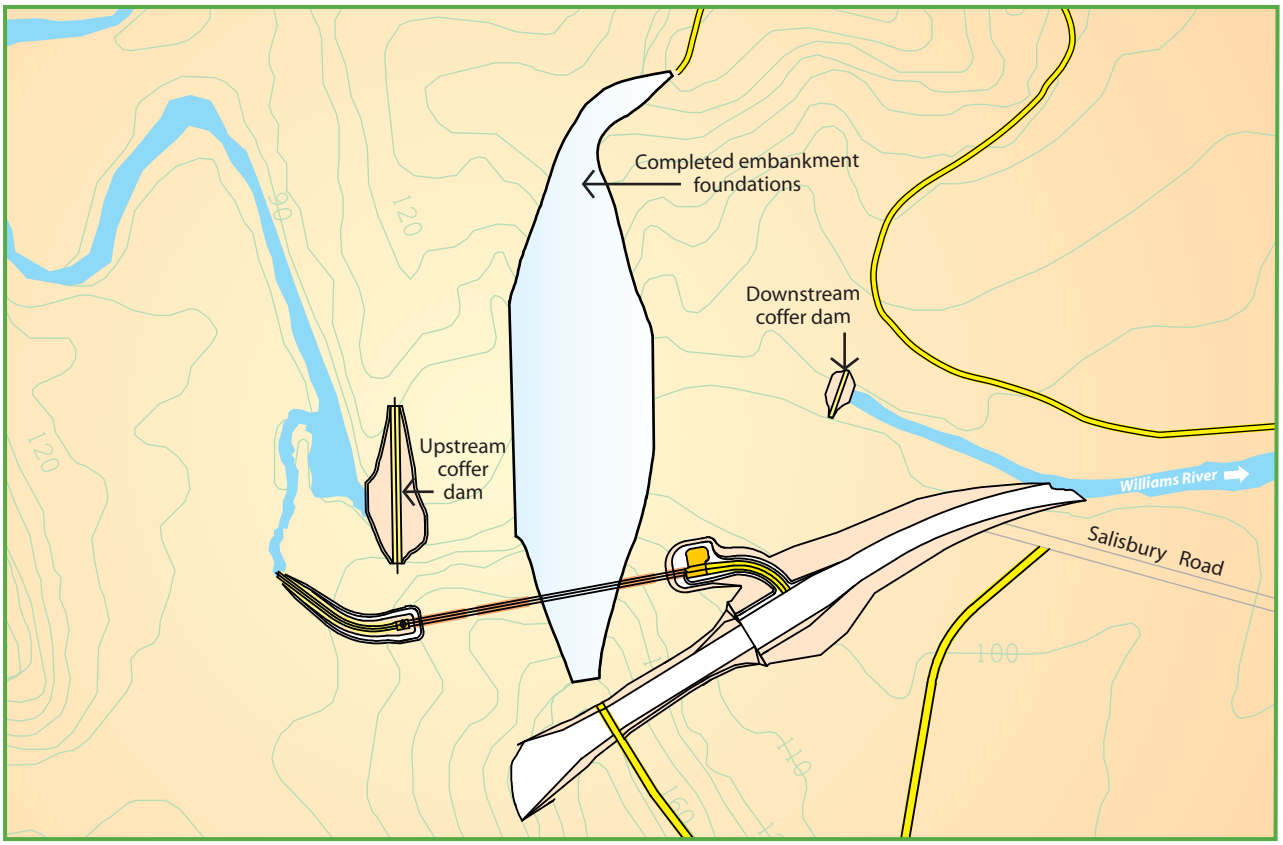

FIGURE 7.5d PHASES 2A, 2B, 2C

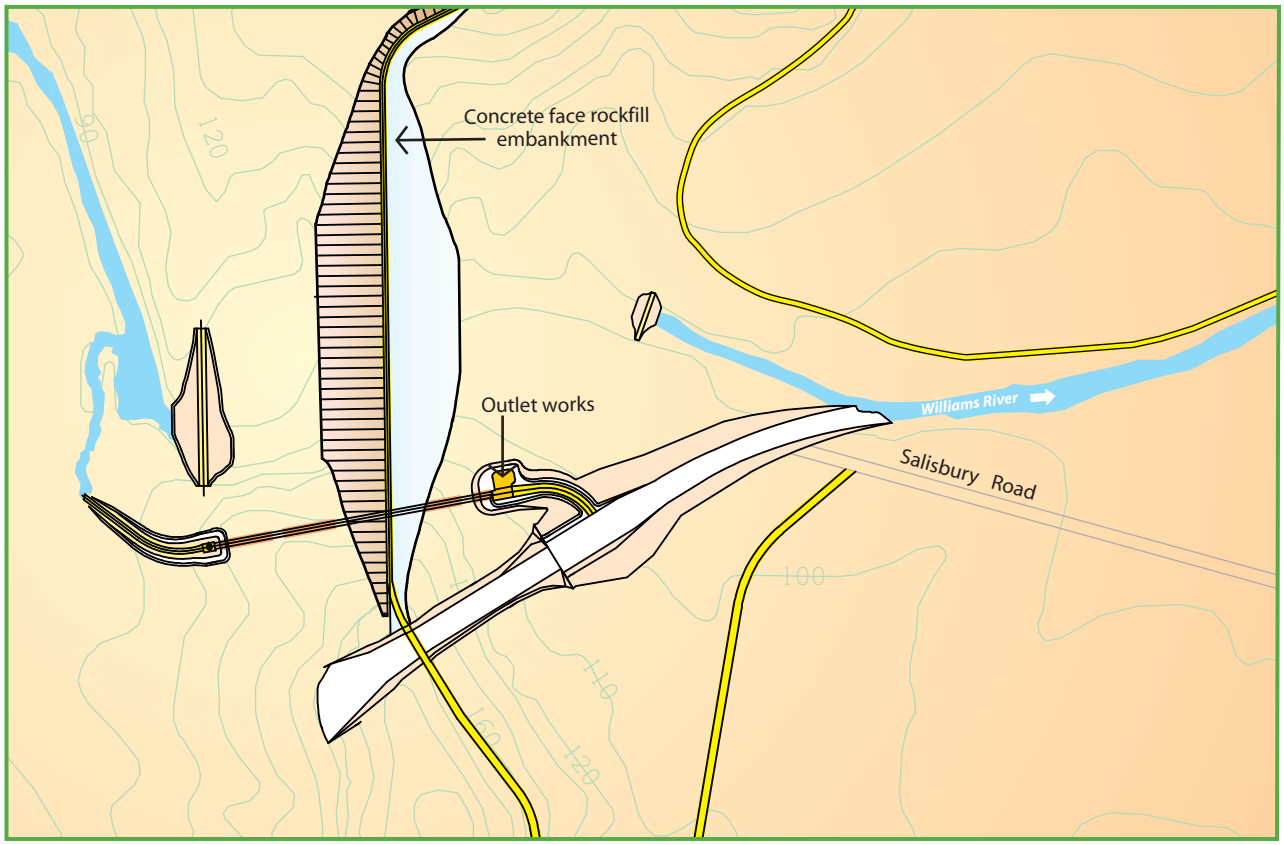

FIGURE 7.5e PHASES 2D, 3A

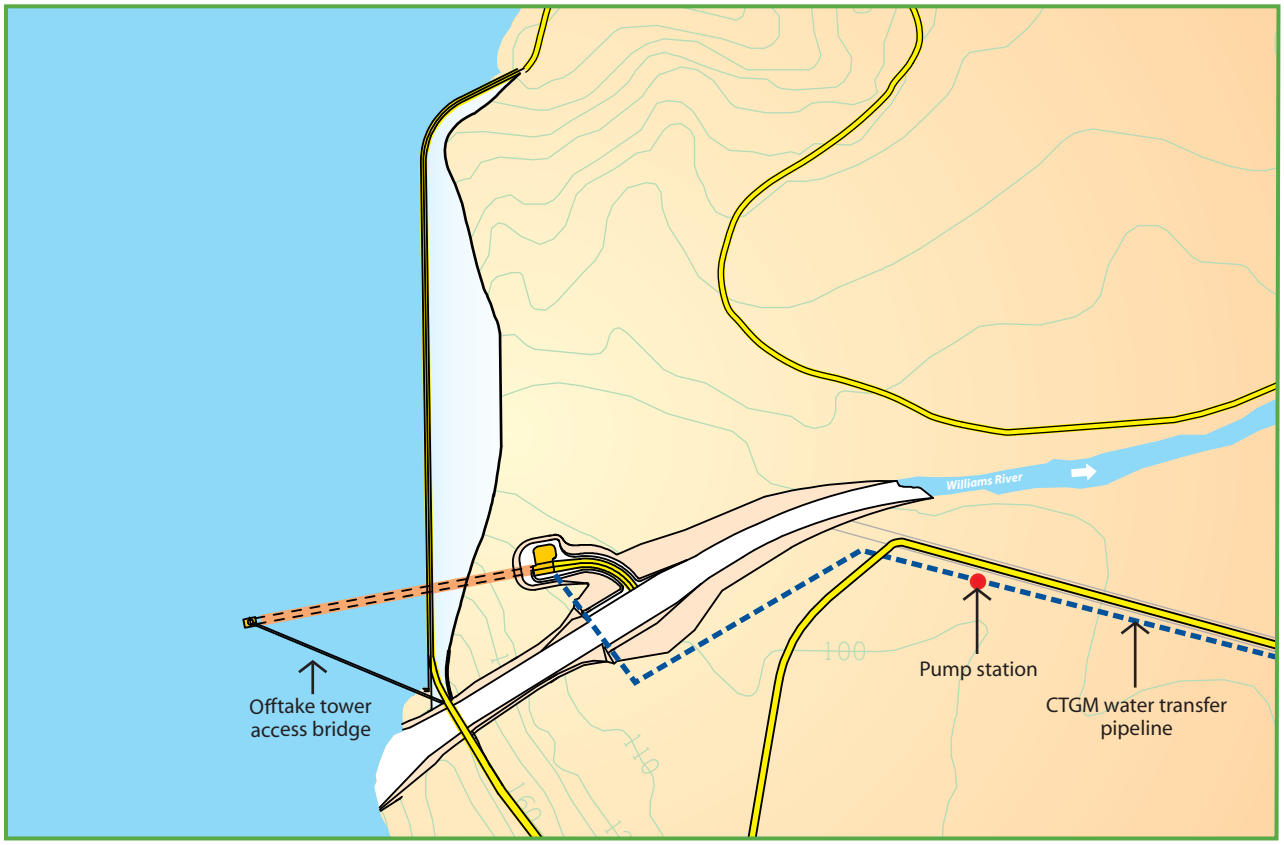

FIGURE 7.5f FINISHED DAM INCLUDING CTGM WATER TRANSFER PIPELINE

7.6 Materials

Construction of the dam and related infrastructure, and the new section of Salisbury Road plus the new access to the Quart Pot Creek locality would consume a range of resources. Preliminary estimates of the types and quantities of these materials are provided in Table 7.3. Final quantities would be determined during detailed design.

TABLE 7.3 CONSTRUCTION MATERIAL TYPES AND QUANTITIES

COMPONENT	MATERIAL TYPE	QUANTITY
Dam wall and associated infrastructure	Fill (rock)	2,128,000 m^3
	Fill (earth)	55,000 m^3
	Cement	10,800 t
	Fly ash	3,630 t
	Steel	3,585 t
	Copper (water stops)	6,120 m
	Reinforcing fabric	21 t
Roads	Pavement materials	6,500 t
	Cement and sand for concrete	850 t
	Steel reinforcement for concrete	480 t
	Pre-cast planks	2,000 t
	Guardrails, guide posts, etc	450 t
	Culvert pipes	1,200 t
	V-channel	4,000 t

This list is not exhaustive with respect to material types. Other materials likely to be required could include, for example, industrial valves, pre-cast concrete beams, seed and other materials for hydroseeding of embankments, ducts, pits and poles for telecommunications and energy services, and general consumables such as fencing materials, fuel, spare parts, general building materials etc. These requirements would similarly be clarified during detailed design.

Local extractive resources

Three potential quarry sites have been identified to provide material for construction of the dam embankment:

- Quarry A, comprising the right hand spillway excavation for the CFRD and a possible extension along the ridge
- Quarry B, comprising the ridge to the west of the dam. Surface mapping indicates that this quarry should be able to work two faces, one in predominantly sandstone and one in predominantly meta-shales
- Quarry C, comprising an extensive area of massive welded tuffaceous sandstone along the storage rim north of the dam. The sequence is relatively flat lying and forms a capping along the Chichester ridge.

The locations of these sites are shown in Figure 7.3.

Seismic investigations indicate that the spillway may yield only small quantities of rockfill for embankment construction and the area of Quarry A may not be able to be used to its full extent. A borehole located in the centre of the crest encountered a zone of highly to moderately weathered inter-bedded tuffaceous sandstone and metashale to a depth of eight metres. A large volume of this rock would be stripped from the crest during spillway construction. However, it would not be able to be used within the dam embankment as highly weathered rock has low strength, making it

unsuitable for construction purposes. Fresh iron-stained rock below eight metres on the crest is very strong. On this basis, the underlying material may be used for additional construction purposes within the main embankment.

Investigations suggest that beds are sufficiently massive in Quarry B to permit the development of separate quarries in both sandstone and shale material. A surficial moderately weathered zone to a depth of 4.4 metres was encountered in a borehole in this location. Below this level, differentially weathered (moderately/slightly weathered and fresh iron-stained) rock was encountered to a depth of approximately 26 metres. The interval contains fresh iron-stained tuffaceous sandstone which would be suitable for embankment rockfill. Below this depth down to approximately 60 metres, fresh iron-stained tuffaceous sandstone occurs with a strong/very strong rock substance strength.

Geotechnical investigations indicate that both Quarry A and Quarry B have sufficient volumes of material from which to source the required material for construction of the dam embankment. Quarry C, however, remains an important secondary option given its high level location within a reasonable distance of the dam.

Petrographic testing indicates that sandstone material from Chichester and Tillegra are fairly similar and in general the physical characteristics of the rock material indicates that it is suitable for use in construction works. The Chichester sandstone provided good quality aggregate for the construction of Chichester Dam. The fresh sandstone at Tillegra is similarly expected to be suitable for the production of concrete aggregate.

No significant clay borrow areas have been located within the inundation area.

Regional extractive resources

A review of the Department of Mineral Resources *Minview* database indicated the presence of a number of extractive resource sites in the wider locality. While the extractive approval and licensing status for these is not known, the vast majority are not operational.

The only site noted as operational on the *Minview* database was the Williams River sand deposit near Bendolba. The closest major regional hard rock quarry with QA concrete aggregate material is the Railcorp Quarry at Martins Creek about 30 kilometres to the south.

Section 117(2) Direction No. G28–Coal, other Minerals, Petroleum and Extractive Resources of the EP&A Act was gazetted by the Minister for Planning on 6 December 1994. The Direction requires that councils consult with the Department of Mineral Resources when preparing local environmental plans which are likely to prohibit or restrict the mining of mineral and extractive resources. Consultation with the DPI indicated that no such S117 report has been prepared for the Dungog Shire.

Additional telephone enquiries with the DPI (Mineral Resources) indicated that there are no mineral deposits of a significant nature at Tillegra and consequently, the proposal would not impact upon extractive resources. It is noted however that as of 6 June 2008, a petroleum exploration authority was granted for land across the majority of Dungog, Gloucester and Taree LGAs. This authority encompasses the Tillegra Dam site (as well as Chichester Dam catchment area and all of the Barrington Tops National Park). Such authorities are not unusual, often speculative and currently cover large portions of the State. Despite a petroleum exploration licence being issued, it is not considered likely that petroleum reserves of any substantial nature would be found specifically under or near the dam site.

Waste minimisation

Where practicable and cost effective, sourcing of construction materials would consider the reuse

and/or recycling of suitable materials to minimise waste generation and demand on new resources. Strategies could include:

- utilisation of recycled materials wherever possible
- protection of materials from climatic exposure to avoid the need for additional resources being consumed through production, transportation and use
- utilisation of materials with a high recycled content wherever possible
- inclusion of requirements for purchasing of materials with recycled content within the tender process for all construction related activities
- review of ordering strategies to limit potential over–ordering
- seeking expressions of interest for the sale and collection of surplus material and resources currently found within the inundation area
- reuse of cleared vegetation for landscaping purposes and encouraging habitat development
- reuse of excess materials (such as off cuts) where possible in other facets of construction
- futilisation of existing materials in the inundation area to minimise the total quantities of materials sterilised.

These and other measures are discussed further in Working Paper F *Sustainable Resource Use* and in Section 16.4.

Recycling facilities for on-site personnel would also be provided to facilitate recycling of paper, plastic, glass and other reusable materials. Liquid waste such as paints and solvents would be disposed of in accordance with the *NSW Waste Classification Guidelines* (Dept of Environment and Climate Change 2008).

7.7 Water

The most significant water uses relate to concrete batching and dust suppression. Cement is mixed with water at an approximate ratio of 3:1. Batching of 10,000 tonnes of cement would therefore require approximately 3,500 m^3 (3.5 megalitres) of water. The amount of water required for dust suppression cannot be accurately estimated as this would be determined by the extent of bare ground, soil moisture content, local topography and prevailing meteorological conditions.

HWC holds several irrigation licences which collectively have several hundred megalitres of entitlement. With the approval of the DWE, some water from these licences would be diverted for use in construction. Water would generally be taken from the Williams River in accordance with the terms of any permit(s). During times of low flow in the Williams River, water could be sourced from the CTGM and carted to the construction site(s). Opportunities for the reuse of grey water would be investigated as part of pre-construction planning to assist in reducing demand on the Williams River.

It is not anticipated there would be a need for significant temporary on site storage, however, the batching plant would need a small reservoir with a volume of approximately 100 m^3 (0.1 megalitres).

Water collected in erosion and sediment controls such as retention basins would be used for dust suppression and landscaping to reduce demand on the Williams River.

Potable water would be sourced external to the site and delivered by tanker to holding tanks. The CTGM is the most likely source for potable water.

7.8 Energy requirements

Construction activities with high energy demands include, in generally decreasing order:

- excavation of earth and rock for dam and road construction
- removal, relocation and compaction of excavated material for dam and road construction
- dam and pavement construction
- clearing vegetation
- haulage of raw materials
- operation of ancillary facilities such as concrete batching plants
- construction of watercourse crossings
- demolition/relocation of existing structures.

Construction phase energy requirements have been considered in detail in Working Paper F *Sustainable Resource Use*. Energy consumption has been considered in terms of electricity and fuel use requirements. With reference to Table 4 of Working Paper F, it is estimated that 300 MWh of electricity (equivalent to the annual usage of 38 average homes) and 13,250 kilolitres of fuel would be required over the construction period for both dam and road construction works. Activities identified as contributing to total energy use are identified in Table 4 of Working Paper F, and include batch plant operation, material extraction and haulage and site office needs.

Electricity needs on the site would be met by connecting the construction site to the local power grid. The need for on-site generators (such as for emergency power supply) would be considered as part of detailed design.

7.9 Construction workforce

The extent and composition of the workforce would vary over construction of the Project, depending on the requirements of particular phases of construction. From about October 2010 through to March 2012, it is estimated there would be approximately 280 people required on site for both dam and road construction activities.

Construction sites along the proposed Salisbury Road alignment would require specialist crews depending on the particular type of activity. These crews would include equipment and plant operators, form workers, steel fixers, concreters, labourers, tradespersons and truck drivers. An on-site workforce (for the realignment of Salisbury Road) of up to 80 people could be engaged during the construction period. Over the anticipated construction period, approximately 1.5 million person hours would be required for the on-site workforce.

Similarly, construction of the dam embankment, spillway and associated infrastructure would require specialist crews including equipment and plant operators, form workers, steel fixers, concreters, labourers, tradespersons and truck drivers. An on-site workforce (for dam construction) of up to 200 people could be engaged during the construction period. Over the anticipated construction period, approximately 5.8 million person hours would be required for the on-site workforce.

The Project would not provide specific workers accommodation either on site or in nearby Dungog. It is anticipated that the construction contractor(s) would bring a core team of specialist workers to the site and would find accommodation locally or in other neighbouring towns such as Raymond Terrace and Maitland. The contractor's core team may be supplemented by workers from the local labour market, including the immediate Dungog locality and further afield.

Subject to the location of the workforce, consideration would be given to providing transport to and from the construction site. This would assist in reducing the number of additional vehicles on local roads and the main access routes.

7.10 Working hours

Construction would be undertaken Monday to Saturday between 7.00 am and 6.00 pm. A six day working week would be adopted to:

- maximise efficiency associated with daily work start up/shut down
- reduce the duration of construction and thereby the duration of the associated impacts.

With the exception of office administration, and vehicle servicing and maintenance, generally no construction work would be undertaken on Sundays or public holidays. As far as practicable, activities likely to generate significant noise emissions and/or vibration (such as blasting) would be limited to the period 9.00 am to 3.00 pm.

Certain construction activities are likely to require works outside of the standard working hours. These may include:

- concrete pours for the dam embankment (approximately 60 slip form pours would be required over a four to six month period with each pour possibly taking up to 24 hours to complete)
- initial establishment of the upstream and downstream coffer dams for construction of the main embankment
- delivery of oversized construction plant and materials.

Approval would be sought from the DECC for any after-hours works. Wherever practicable, this would occur prior to the works taking place, however, for emergency works this may not always be possible. For example, extreme inclement weather may require machinery or equipment to be moved to prevent flood damage. Such work would need to be undertaken at short notice. Should such a case arise, the DECC would be notified as soon as practicable and provided with all necessary information relating to the incident.

Supporting information for any after-hours applications would include:

- full details of the proposed works including location and duration
- identification of affected residences and other sensitive receptors
- notification of affected residences and sensitive receptors
- measures to be implemented to mitigate impacts as far as practicable.

DECC may require additional information in addition to the above.

Consultation with the affected community in relation to the construction works would occur within the framework of a formal consultation strategy for the Project. This would be developed by the construction contractor in consultation with Hunter Water prior to construction. The strategy would:

- identify all likely affected residences
- provide contact details such as daytime and after hours telephone numbers to facilitate contact by affected members of the community
- provide protocols for notification of affected residents and the wider community, for example

newspaper advertisements, letter box drops, project web site, etc

- include a mechanism for recording and responding to complaints.

This list is not exhaustive and other matters may subsequently be identified which could also be incorporated into the strategy.. Additional information on general consultation is provided in Section 7.14.

7.11 Property access and traffic management

As has been noted previously, the footprint of the dam embankment sits squarely across Salisbury Road at Tillegra. This has necessitated development of an alternative permanent route to maintain connectivity to the settlement of Salisbury and individual properties to the north of the inundation area.

Construction of this permanent access would take approximately two years and therefore, as noted in Section 7.2, it would be necessary to provide a temporary detour, including a river crossing, around the dam construction site. This would connect back to Salisbury Road near the existing RFS station.

Access would be maintained to all private properties during construction. In the event that construction activities would affect a permanent access, alternative access would be provided in consultation with the affected property owner or resident. As far as practicable, this would be of a standard equivalent to the permanent access. At the end of construction, the permanent access would be reinstated should this be the preference of the property owner, subject to the final layout of completed works.

At times, there is likely to be a need to use public roads for the movement of construction vehicles to and from locations in and around the dam and road construction sites. All such movements would proceed in accordance with a formal traffic management plan which would be prepared prior to the start of construction activities.

The traffic management plan would also address the movement of traffic on the principal routes to the construction sites (referred to in Section 7.3.1) in order to manage identified safety issues.

7.12 Flood risk management

Construction of the dam would occur within and adjacent to the Williams River channel. As such, much of the construction site would potentially be at risk from flooding. Management of flood risk would occur through a combination of:

- physical infrastructure, including the upstream and downstream coffer dams, the diversion tunnel and associated inlet and outlet works
- programming key construction activities to the statistically drier periods of the year
- proactive and reactive management within the framework of a dam safety emergency plan (DSEP).

Specific details would be further developed and refined during detailed design. Preparation of the DSEP would include all necessary consultation with the NSW Dams Safety Committee.

7.13 Environmental management

A guideline (Working Paper O *Construction Environmental Management Plan Guide*) has been prepared as part of the EA Report to facilitate preparation and implementation of an effective construction EMP for the Tillegra Dam project that addresses all necessary and relevant

environmental management performance requirements.

The expected outcomes from implementation of the construction EMP include:

- impact on the environment is minimised and mitigated to the greatest extent practicable
- satisfactory compliance with the conditions of approval by the Minister for Planning (and any conditions related to the EPBC Act if relevant)
- satisfactory compliance with all other relevant legislation
- robust and verified implementation of the Project's Statement of Commitments
- a responsive and transparent approach to dealing with any adverse and/or unforseen environmental impacts
- effective involvement of key stakeholders and the community in the Project's environmental management
- effective capture and documentation of all relevant environmental management detail throughout construction of the Project.

The guideline has been prepared to reflect the requirements of the *Guideline for the Preparation of Environmental Management Plans* (Dept of Infrastructure, Planning and Natural Resources 2004) and the *Environmental Management Systems Guidelines* (Construction Policy Steering Committee 1998).

7.14 Communication and consultation

As described in Chapter 4, an extensive consultation and stakeholder involvement program has been implemented for the Project. This has involved ongoing communication and consultation with the local community and other diverse stakeholders since commencement of the Project.

Should the Project be approved, community and agency consultation would continue to be an important aspect of the Project with tailored consultation to be undertaken during pre-construction and construction phase activities.

Notwithstanding statutory consultation requirements and any consultation-related conditions of approval, the following activities would be undertaken during construction:

- newsletters and media coverage would be used regularly to outline the proposed works schedule, areas in which works are proposed and the construction hours of those works. The newsletters and media coverage would provide contact names and phone numbers of relevant staff.
- a Project web site would be established and maintained during construction to provide periodic updates of work progress, consultation activities and proposed work schedules. The site would identify relevant approval authorities and their areas of responsibility, and contact names and phone numbers of relevant staff.
- a 24 hour, toll-free complaints telephone number would be established for the Project and advertised. A system to receive, record, track and respond to complaints within a specified timeframe would also be established.
- property owners would be consulted about the implementation of mitigation measures that affect their property and any issues raised would be considered where reasonable and feasible.