Parliamentary Standing Committee on Public Works

REPORT

relating to the

132kV SUBTRANSMISSION DEVELOPMENT, EAST TUGGERANONG, A.C.T.

(Tenth Report of 1986)

THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA
1986

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PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS

R E P O R T

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(Tenth Report of 1986)

Canberra 1986

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS
(Twenty-Eighth Committee)

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	John Saunderson, M.P.(2)

(1) Resigned 13 February 1986
(2) Appointed 18 February 1986

PUBLIC WORKS COMMITTEE ACT 1969
ORDER UNDER SUB-SECTION 18(4)

I, SIR NINIAN MARTIN STEPHEN, the Governor-General of the Commonwealth of Australia, acting with the advice of the Federal Executive Council, in pursuance of sub-section 18(4) of the Public Works Committee Act 1969, hereby, by this order, declare that the public work described in the schedule be referred to the Parliamentary Standing Committee on Public Works for consideration and report.

SCHEDULE

132kV SUBTRANSMISSION DEVELOPMENT,
EAST TUGGERANONG, A.C.T.

L.S.

Given under my Hand and the
Great Seal of Australia
on 30 July 1986

N.M. STEPHEN

Governor-General

By His Excellency's Command,

Stewart West

Minister of State for
Housing and Construction

C O N T E N T S

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS

132kV SUBTRANSMISSION DEVELOPMENT, EAST TUGGERANONG, A.C.T.

REPORT

On 30 July 1986 the Governor-General referred to the Parliamentary Standing Committee on Public Works for consideration and report the proposed 132kV Subtransmission Development, East Tuggeranong, A.C.T.

The Committee is pleased to report as follows:

THE REFERENCE

1 The works proposed under this reference involve the construction of a zone substation and associated 132kV substransmission lines for electricity supply to the South Tuggeranong Valley, A.C.T. to cater for the final planned extent of urban expansion in the Tuggeranong area.

2. The project comprises:

- the addition of two 132kV line bays at the Gilmore zone substation;
- twin 132kV subtransmission lines along a 7 kilometre route, from the Gilmore zone substation to a new zone substation site on the common boundary of the suburbs of Theodore and Conder;

- a zone substation consisting of a switch yard and control building on a 1.75 hectare site in a saddle between Theodore and Conder.

3. The estimated cost of the proposed works when referred to the Committee was $6.24 million at March 1986 prices.

THE COMMITTEE'S INVESTIGATION

4. The Committee received a written submission and supporting plans from the A.C.T. Electricity Authority (ACTEA). Evidence was taken at a public hearing held in Canberra on Friday, 26 September 1986.

5. Prior to the hearing the Committee inspected the proposed site in East Tuggeranong and drove along the proposed route of the subtransmission lines. A list of witnesses who appeared at the public hearing is at Appendix A.

6. The Committee's proceedings will be printed as Minutes of Evidence.

BACKGROUND

7. Role of ACTEA The distribution of electricity in the Territory is the responsibility of the ACTEA, which is a statutory Commonwealth body established under the Australian Capital Territory Electricity Supply Act 1962.

8. Electricity Distribution in the A.C.T. Electricity for use in the A.C.T. is drawn from the 330kV New South Wales, Snowy Mountains and Victorian interconnected transmission system. This is transferred to 132kV at the Electricity Commission of N.S.W. (ECNSW) Canberra bulk supply substation near Holt to supply the ACTEA subtransmission system and surrounding areas of N.S.W. A further transformation to 66kV is carried out by ECNSW at its

Oaks Estate bulk supply substation to supply both ACTEA and the Southern Tablelands County Council. The ACTEA 66kV system is being phased out and will take less than 25MW by the late 1980s.

9. The ACTEA purchases a reserved annual fixed block of energy from the Snowy Mountains Hydro Electric Authority and pays the ECNSW to carry that electric energy from the Snowy region to the A.C.T. All additional power, over 60 per cent of the total requirement, is purchased from the ECNSW at its current bulk tariff rate.

10. Zone Substations A zone substation receives power at 132kV from subtransmission lines and reduces the voltage to 11kV for distribution. It comprises transformers to reduce the voltage, switchgear for the protection and disconnection of lines or equipment and busbars to connect them together.

11. It is necessary for each zone substation to be located as near as practicable to the load centre. In Canberra, this requires the majority of consumers to be within approximately 5 kilometres of a substation. There are presently six 132kV zone substations in service. These are Latham, Belconnen, Civic, City East, Woden and Wanniassa. The Bruce switching station is in service while the Kingston zone and Causeway switching station is almost completed. The Gilmore substation is currently under construction and is expected to be completed by winter 1987.

12. Each zone substation is fed by at least two subtransmission lines to ensure that the supply to a large area does not fail in the event of damage or a technical fault occurring on one line. This also permits one line at a time and its associated switchgear to be periodically taken out of service for routine maintenance.

13. Subtransmission Lines The initial distribution of power throughout the A.C.T. is through a system of high voltage subtransmission lines (at 132kV or 66kV) to zone substations. These lines consist of aluminium electrical conductors, with a steel core wire for strength, supported on steel, concrete or wooden structures. These structures must be high enough to maintain safe clearance above the ground. The conductors become longer and sag under heating by sunlight and high power loads. They tighten in cold conditions and become sideways imbalanced under windy conditions. The structures supporting these wires must be strong enough to withstand these conditions. Where lines change direction or terminate, stronger structures are required. Straight line routes are sought to reduce the number of expensive angle structures and improve the visual appearance of lines.

14. Steel lattice towers are used for lines of high electrical or mechanical load, but poles can often be used for lines of lower capacity with smaller conductor sizes, lower tension and shorter spans. Pole support, angle and termination structures have neither the height nor the strength of towers. Two to three times the number of poles are required for an equivalent line. They are therefore more obvious to the eye than the more sparsely-sited steel towers. Poles may be wood for light lines, but steel or concrete poles are now used for medium capacity lines.

15. Structures are often grey in colour for environmental reasons as this blends well with the horizon in open country. Steel structures may be painted green in areas where they will blend into particular vegetation. Natural wood poles will weather or may be treated with a green preservative. The conductors are supported on the structures by insulators which prevent power leakage. Insulators may be grey or brown to help them blend into the landscape. Conductors for lines built in urban or frequently viewed areas may be treated to reduce the shiny appearance that

makes new aluminium visually obtrusive. In less sensitive areas untreated aluminium will naturally weather to a dull state after a few years.

16. Line Reservations or Easements ACTEA lines conform to all standards of the Standards Association of Australia. However, mechanical line failure is possible and therefore 132kV lines are installed in specially designated line reservations. The reservation acts as a buffer zone to prevent development in an area where there could be a risk of damage to people or property. The reservation ensures that collapsed structures would end up inside the buffer area. The ACTEA installs sensitive monitoring devices to rapidly detect line failures and automatically turn off the power on a faulty line.

17. Distribution A large number of 11kV feeder lines are associated with each zone substation and run from the substation to the load areas. Feeders may be underground cables or lines carried on wooden poles approximately 11 metres high. Up to 30 feeders may emanate from a zone substation and run underground for varying distances. Each feeder supplies a peak load of about 5MW or two thirds of an average suburb. In order to backup supply to allow for maintenance or plant failure it is necessary for three circuits to be installed for every two standard-sized suburbs. Each feeder supplies twenty to thirty distribution substations which transform the voltage to 415/240V and supply an ultimate load of 250-300kV or about 45 houses.

THE NEED

18. Development of Tuggeranong The town of Tuggeranong is extending southwards and is expected to peak at approximately 92,000 people in the late 1990s. The ACTEA tabled projected population figures to show this proposed increase. The National Capital Development Commission (NCDC) is proposing the

development and occupation of the suburbs of Theodore, Stranger, Conder and Tuggeranong Hill in the late 1980s and the suburbs of Banks, Barneys Hill and Gordon in the early 1990s. Substantial development will continue to occur in the existing suburbs of Kambah, Monash, Fadden, Chisholm, Oxley, Gilmore, Calwell and Isabella Plains.

19. As a result of this urban development the number of homes in the area will more than double thus increasing the demand for electrical power. The continuing growth of the Hume industrial area and the establishment of the Tuggeranong Town Centre will also contribute to the demand for electricity. The ultimate power demand for Tuggeranong based on development intentions is estimated to be 170 to 200MW, based on 1.8 to 2.0kW per head of population and 10 to 20MW of coincident commercial and industrial load.

20. Existing Electricity Supply to Tuggeranong The sole source of supply for the Tuggeranong Valley is the Wanniassa zone substation. This substation also provides approximately 40 per cent of the electrical power requirements of the Woden Valley and Weston Creek areas.

21. The Gilmore substation, which was a reference to the Committee in 1984 (Report No. 19), is due for commissioning before the winter of 1987. This substation will provide 60MW of additional capacity for the area but will not cater for the ultimate load.

22. Further augmentation of these substations would require uneconomic extensions of the 11kV feeder lines to remote loads. There are practical limitations to such extension due to the supply voltage fluctuations incurred in feeding over long distances. However, the provision of two additional 132kV line bays at the Gilmore substation is required to connect with the proposed subtransmission line.

23. Committee's Conclusion Due to the development of suburbs in East Tuggeranong an additional supply of electrical power is essential and there is a need for a zone substation at Theodore and associated subtransmission network.

THE PROPOSAL

24. The proposal comprises:

- the addition of two 132kV line bays at the Gilmore zone substation;

- twin 132kV subtransmission lines from Gilmore to Theodore; and

- a zone substation at Theodore.

GILMORE ZONE SUBSTATION AUGMENTATION

25. The existing substation is located on a 1.85 hectare site near the intersection of the Monaro Highway and Isabella Drive, 12 kilometres south of Parliament House.

26. It is centred on a triangle of land between the two roads and the Gilmore residential area. With the exception of the Rose Cottage Inn about 400 metres to the north of the site, this land is currently used for rural purposes. Future land use is being examined by the NCDC, who anticipate that the area surrounding the substation will be allocated to broad acre developments of a rural character compatible with the substation, and that an open space hilltop buffer zone would be retained adjacent to the residential area half a kilometre south west of the site.

27. The substation is screened from the north by existing vegetation around Rose Cottage Inn, and will be less visible from the major roads as existing planting along these matures. The Australian Heritage Commission considers that the proposal is not likely to affect Rose Cottage, which is on the Register of the National Estate.

28. One section of home sites in north east Gilmore has a 600-700 metre distant view of the site while planting is being established in the intervening land.

29. Space has been allocated within the existing switchyard for the additional switchgear required for the connection of the proposed lines which will be similar to that existing. Appendix B (Illustration B-2) shows the extent of work included in the present and previous submissions. Some minor associated work will also be needed in the existing substation building and yard.

GILMORE TO THEODORE SUBTRANSMISSION LINES

30. Alternative Routes A wide range of alternative line routes was examined by the ACTEA, the NCDC and their consultants over a 4-year period. These alternatives are shown at Appendix B (Illustration B-4).

31. Two incoming lines are required for security of supply. Due to space restrictions some routes were only usable by a single line, while others could accommodate twin lines. Had a single line route been chosen, another line route would have also been required into the substation.

32. Two twin line route alternatives were considered:

33. The first of these would run from Gilmore substation into New South Wales, then through Melrose Valley to the ridge south of Theodore. This route was rejected because of its impact on the environment as well as legal difficulties due to its entry into N.S.W. ACTEA advised that the lines would have been on steep terrain running through dense native forest. The lines would have been more apparent from the suburbs if they were close, or would have affected large areas of very rugged bushland in N.S.W. if they were placed further to the east. The Committee requested the ACTEA provide the advice from the Attorney-General's Department that the ACTEA does not have the power, without amendments to the Australian Capital Territory Supply Act 1962 to run the lines through N.S.W. This advice has been received and has been incorporated in the Minutes of Evidence.

34. The second twin line alternative would run from the existing 132kV lines on Mt Taylor, passing between the suburbs of Weston Creek and Kambah. It would then run parallel with the Murrumbidgee River past the Tuggeranong Town Centre. This route would have had an adverse impact on the Murrumbidgee River corridor, which has a number of recreational, geological, ecological and historical features of interest in this section. This section of the river corridor was entered in the Register of the National Estate in March 1986 by the Australian Heritage Commission.

35. Most urban line routes considered were restricted to single line use and were rejected due to their visual impact on the area. They would traverse urban areas of Tuggeranong which are currently being developed or are built-up. The routes investigated were as follows:

- from the existing Wanniassa substation, along Sulwood Drive and then following an existing single line easement through the suburbs of Fadden, Gowrie and Monash to Isabella Drive. Although this easement pre-existed building development, many present residents may be unaware of its originally intended use and it is likely that there would be extreme public reaction to any proposal to now use this route for a subtransmission line.

- from the new Gilmore substation along Isabella Drive and then Drakeford Drive. Only a single line could be accommodated, and no easement exists through the present built-up area. Although a pine forest provides a strong backdrop and some screening to part of the line, strong public reaction would be expected to use of this route adjacent to established suburbs.

- from the Gilmore substation along the Monaro Highway and then along Johnson Drive. It would be difficult to screen the latter section due to existing residential development. The visual impact along Johnson Drive and to Tuggeranong Homestead would be high.

- variations on the above two routes, using Ashley Drive or a nearby floodway were also examined but showed no great advantages.

- from Gilmore substation along the Monaro Highway and then along Tharwa Drive. Although moderately suitable, as adjacent vegetation reduces the visual impact of the line, this alignment proposal was rejected as inappropriate for the substation site chosen.

- from Gilmore substation, along the Monaro Highway and then along the southern slopes of the high ridge south of the suburb of Theodore. The last section of this route would be on steep terrain and would be difficult to screen from the future suburb of Conder.

36. The Committee requested the ACTEA to provide a costing of alternative line routes, and these estimates have been included in the Minutes of Evidence.

37. The following table gives comparative costs for the proposal as well as the major alternatives examined:

- <u>The Twin Line Alternatives to the Proposal</u>

Notional New South Wales route, twin lines to Theodore (total line length approximately 16 kilometres, more costly access in rugged terrain)	$1.95m
Notional Murrumbidgee route, twin lines to to Isabella (total line length approximately 18 kilometres)	$2.20m
Monaro Highway route to Barneys Hill South (line length 19.4 kilometres)	$2.35m

- Some Single Line Urban Alternatives

Wanniassa-Isabella-Johnson Drive-Monaro Highway (with access eased by proximity of suburbs)	$1.85m
Isabella Drive-Drakeford Drive-Tharwa Drive-Monaro Highway (with some access from suburbs)	$2.00m

- The Proposed Route

Monaro Highway route, twin lines (total line length 14.4 kilometres, access tracks shared by both lines)	$1.75m

38. The Proposed Route The proposed route commences at the Gilmore substation. It crosses the Monaro Highway and then runs close to the highway for several kilometres, separating briefly only where it passes through the pine plantation while the highway deviates around a steep hill (Melrose Trig). The power line will be unavoidably visible over much of this section of highway, depending on the local topography and road alignment.

39. Gilmore to Chisholm Section After its intersection with the Monaro Highway, the line travels south and will be visible as it proceeds to the Tuggeranong pine plantation. It will be seen against the backdrop of the forested hill and will be visible against the skyline where it crosses a prominent spur. Due to a cutting on the left hand side of the road the lines will be visible only from certain sections. However, the cutting will have little effect for people travelling north and the power line will be more obvious. ACTEA advise that there are no practical measures for obscuring the line in this location or diverting attention away from it. The line will be visible against the backdrop of the forested hill from parts of Gilmore and Chisholm.

It will also be visible as it passes through the upper part of the pine forest. The line will be prominent from the adjacent railway line over a distance of approximately 2 kilometres, as the traveller looks out over Tuggeranong. However, this view is broken as the railway passes through several small cuttings.

40. Tuggeranong Pine Plantation The line will require a corridor through the pine plantation wide enough to reduce the risk from falling trees. In the longer term the whole plantation would normally be clearfelled for timber. However, this would be undesirable as the power line would then be exposed to view from the highway. The retention of some of the mature pines between the power line and the highway is desirable. The pine plantation was originally established for soil erosion control with softwood production being a secondary function. In the long term it is possible that following clearfelling, the area may be rehabilitated with native vegetation, in which case a different landscape treatment would be necessary.

41. The Committee questioned the compensation which would be payable to the Territorial Forestry Account for the loss of softwood removed for the corridor. The ACTEA agreed to obtain this estimate and this has been included in the Minutes of Evidence. The clearfelling of 3 hectares of pines would result in a loss of production of $1680 out of an estimated clearfelling return on maturity of $15,600. ACTEA advised that pine trees will not be replanted under the line as their height could prove to be a safety hazard.

42. Melrose Valley Section South of the Tuggeranong Pine Plantation the power line will traverse strongly dissected terrain where it will be visible from the road. From the south the traveller would look directly up the line where it emerges from the pines to cross the ridge. The line, poles and access tracks would be visible as the line descended to the valley.

43. Wrights Drive Section Where the twin transmission lines cross the Monaro Highway appropriate landscaping and strategic placement of poles will reduce the visual impact of the lines. After crossing the highway the line will run up the side of a gully. This gully, as well as plantings along this section, will reduce the prominence of the line.

44. Electromagnetic Radiation The Committee queried possible adverse effects from electromagnetic radiation. ACTEA advised that the World Health Organisation had completed a study on electromagnetic radiation. The ACTEA tabled a two page summary on this topic and this summary has been included in the Minutes of Evidence. They stressed that research is still very inconclusive and there is no agreed world standard of levels for exposure to electromagnetic radiation from power lines. However, the ACTEA has been able to achieve a figure of 500 volts per metre at the edge of the easement. The proposed line route has no back fences of suburban blocks closer than 100 metres to a line. Therefore, the electric field to be expected in back gardens of dwellings is expected to be substantially less than that normally experienced in houses due to wiring of lights, electric blankets, etc. The ACTEA confirmed that the lines would have no adverse effect on radio or television reception in the area.

45. Underground Lines The possibility of locating the wires underground was raised by the Committee. The ACTEA advised that because overhead lines are exposed to the atmosphere and cooled by the surrounding air, heat dissipation from an overhead line can occur more readily that from a line which is buried underground. Extra cost is involved, as a line buried underground requires a larger conductor cross section to reduce the heating. Whereas synthetic insulation is needed at the points of support on an overhead line, an underground line requires continuous insulation. It is important that underground cables will not be disrupted in the future. The cost is approximately 10 to 20 times greater to put the lines underground. Instead of disturbing the

ground at pole locations 150 metres apart it is necessary to place 3 cables into trenches the whole length of the line route. The ground is therefore permanently disturbed. The type of vegetation along the cable route would need to be altered so that nothing larger than a small wattle would grow there. Overhead cables are therefore considered more suited for these transmission lines.

46. Landscaping and Restoration Landscaping will be undertaken to alleviate the visual intrusion of line structures. Selective felling of trees and supplementary planting will ensure that construction of the line does not result in large areas being devoid of vegetation. Supplementary planting will be carried out not later than the planting season following construction of the line. Disturbance to soil, vegetation and animal habitat along the easement will be kept to the minimum necessary to enable construction of the line and permit its safe operation. No clearing will be undertaken without the prior approval of the NCDC and the Department of Territories (DOT). Periodic clearing of trees will be undertaken to avoid the development of a potential fire hazard. Where the power lines cross areas managed for nature conservation purposes by DOT, ongoing clearing underneath the lines will be undertaken by DOT to ensure that this is done in the optimum manner from a nature conservation viewpoint.

47. Access and Construction Tracks Access tracks will be minimised by:

- avoiding following the line closely where this would accentuate the impact of the line on the landscape;

- utilising existing roads and tracks with spur access where this is practicable and desirable;

- avoiding steep slopes and gullies, poorly drained areas and areas of significant vegetation as far as practicable; and

- rehabilitating construction tracks to leave the minimum standard of track required for maintenance of the line.

48. Consultations will take place with NCDC and DOT staff and the contractor to determine access tracks. These will take place during the design of the lines as well as at the time of construction. A track would probably follow the line north of the pine plantation. Within the plantation, access could be obtained from existing forest roads by constructing short spur tracks to support structure sites. The steep terrain further south makes access difficult, and several short tracks from convenient locations are required. West of the Monaro Highway it is likely that an access track will follow the approximate route of the line with deviation to avoid steep or unstable slopes. Some soil disturbance will result from erection of poles on the steep slopes. This will be rehabilitated after construction.

49. Construction Activities The NCDC and DOT will endeavour to confine the movement of construction vehicles to the most suitable access tracks. In residential areas, blasting for footings will only be carried out during normal working hours. Dust suppression through watering or the application of rock scalpings will be undertaken at the substation site to avoid local problems of dust disturbance on windy days.

50. NCDC Design and Siting Control Final approval for construction of the line will be subject to NCDC design and siting approval. This applies to all buildings and structures in the A.C.T. The ACTEA assured the Committee that the site for the

Theodore substation has been selected in consultation with the NCDC. It is unlikely that there will be major variations to the project as details of the design are refined.

51. Effects on Other Land Use Cranes will be required for the maintenance of the water reservoir east of Gilmore. The possible future alignment of Wrights Drive from Lanyon to the Monaro Highway has not yet been established in detail. The line route has been kept higher on the sides of the spur to avoid the likelihood of conflict.

52. Committee's Conclusion The route of the 132kV subtransmission line from Gilmore to Theodore is satisfactory. Measures will be taken to minimise the visual impact of the subtransmission line on the landscape.

THEODORE ZONE SUBSTATION

53. Alternative Sites The early development of the Tuggeranong Town Centre, restrictions on urban growth to the west and south and changes in the sequence of suburb development led to the choice of a site in a saddle between the suburbs of Theodore and Conder. Alternative sites considered were:

- A site at Isabella Plains, south of Isabella Drive. However, this site is now required for storm-water works.

- East of Drakeford Drive between Isabella and Johnson Drives. This and the above site were rejected partly because of their association with undesirable line routes.

- East of Tharwa Drive near the Point Hut Road intersection. This site is not now favoured by the NCDC.

54. The Proposed Site and Location The 1.75 hectare site, 17 kilometres south of Parliament House is in open woodland, on a slope falling gently to the south. The site location in the saddle maximises natural shielding from most proposed built-up areas. It lends itself to more effective screening from public view than any of the alternatives considered on the open plains or lower hillsides. Functionally, it is located in close proximity to the urban land which it will supply.

55. A 200 metre access road will be constructed from the nearest surburban street in Theodore. This reservation will also be used for 11kV underground cables feeding northwards while feeder lines from the substation will be run underground to at least the suburb boundary.

56. Substation Building The proposed substation building is a single-storey structure approximately 45 metres in length and is centrally located along the west face of the switchyard. The building will contain a control room and a switchroom, with associated battery and communication rooms. Its character is largely determined by the need for the 11kV switchroom to be 36 metres long with 3.3 metre headroom. Cable tunnels will run from a trench underneath the 11kV switchgear under the roadway to connect with the power transformers. Over fifty 150mm diameter conduits will be laid from this trench to a cable reservation for the 11kV feeder cables.

57. A mess room, shower and toilet facility will be located at the building entry point. ACTEA advised that although the substation will not be manned, it is necessary for these facilities to be provided for repair crews, adjustment crews and maintenance crews. The facilities will also be used by field staff working in the general area. The Committee was advised

that the shower facility is considered a safety aspect as alkaline solution and oil are present on the site. Should an accident occur it would be essential to have access to a shower.

58. The floor and cable tunnels of the building will be constructed in reinforced concrete. The double skin cavity brick walls and roof will be steel framed and a pitched metal deck roof will ensure a dry interior in the most severe storm conditions. External finishes will be subdued in tone with an 'autumn red' colourbond for the roof and cream brick for the walls. To avoid damage by vandals, the windows are mainly placed facing the switchyard. The internal finishes are intended to be low maintenance. Walls will be unpainted brick and floors vinyl tiled in the control room, lobby and mess. Other floor surfaces will be treated concrete.

59. Switchyard The switchyard accommodates all the 132kV switchgear and busbars, together with two 50MW power transformers. Space has been allocated for a future third power transformer.

60. The 70 x 80 metre switchyard will be enclosed by the substation building on the western side and a 2.4 metre high chain wire fence. The yard will be cut into the hillside and spoil mounded to the north to reduce the visual impact of the facility. The mounding and line support structures will be landscaped and screened with a variety of native plants to develop a casual and natural grouping with vegetation.

61. Services Since the substation will not normally be staffed, many operations will be automatic or may be remotely controlled from the ACTEA System Control Room. Local control and maintenance will be carried out by small crews. As a result, parking will be provided for only three vehicles. A low loader turning bay is required for the delivery of power transformers.

62. Electrical heating will be installed in the control and mess rooms and the building pressurised by means of a filtered fan to discourage the entry of dust. An electric hot water service will supply the mess room, shower and toilet facilities.

63. Normal indoor lighting will be designed in accordance with Australian Standard 1680. Emergency control power and lighting will be supplied by batteries. Switchyards may be floodlit for night operation or emergency maintenance, but will normally be left unlit to reduce the night-time visual impact of the substation on the adjacent suburbs. The Committee was advised that on average the lights may be turned on for one week in a year.

64. The switchyard fire-fighting water supply will be supplemented by two 70kg dry powder fire extinguishers on hand trolleys. These will be stored in small brick kiosks adjacent to the roadway. Interior equipment will be protected by carbon dioxide extinguishers and a fire detector system with remote alarm.

65. Roof and surface drainage will be directed to the Conder suburban stormwater system and an oil interceptor tank with capacity to hold the oil content of a single power transformer (30,000 litres) will be installed on a separate drainage line from the transformer pools. The toilet and mess room will be connected to a septic tank system.

66. Committee's Conclusion The Theodore site is well suited for a zone substation to efficiently provide electricity to present and future consumers. The zone substation area will be landscaped to minimise its visual impact.

ENVIRONMENTAL CONSIDERATIONS

67. Measures will be taken to avoid adverse environmental impacts. These will include:

- non-reflective 'shadowline' conductors along the entire length of the lines will minimise visual intrusion;

- no more than 6 poles will be permitted at each angle location;

- special attention will be given to ridge crossings. Structures will be located so as to minimise conflict with skyline views;

- poles supporting the adjacent lines will be paired where possible;

- where adjacent land use is residential, reservation width will allow for pole failure;

- where adjacent land is predominantly non-urban, the reservation width will be reduced in accordance with safety/maintenance guidelines.

68. Historical and Archaeological Features Aboriginal archaeological sites have been found near where the line will cross Tuggeranong Creek. The Australian Heritage Commission, in March 1986, gave notice that it intends to include one of these sites, the Tuggeranong Axe Grinding Grooves in the Register of the National Estate. This site is approximately 350 metres to the west of the line, on the western side of the Monaro Highway. The ACTEA advised that the main concern is that access tracks avoid these sites. They will therefore be flagged as a precaution

against accidental damage. A consultant has been engaged to carry out an archaeological survey in the southern portion of the line route. This section has not been previously investigated.

CONSULTATIONS

69. The ACTEA submitted a Notice of Intention under the *Environment Protection (Impact of Proposals) Act 1974* to the Department of Arts, Heritage and Environment. The Department determined that, on the basis of this notice and the previous Environmental Impact Statement submitted in 1984 for the Gilmore substation, the preparation of an EIS for the present proposal was unnecessary.

70. The ACTEA engaged an environmental consultatant (David Hogg Pty Ltd) to carry out a preliminary environmental evaluation of the route and his report has been incorporated in the Minutes of Evidence.

71. Consultations also took place with the Attorney-General's Department, the Department of Aviation, the Department of Housing and Construction, the Australian Survey Office, the Australian Heritage Commission, the Electricity Commission of N.S.W. and the State Railway Authority of N.S.W.

LIMIT OF COST

72. The limit of cost estimate is $6.24 million at March 1986 prices. This figure has been arrived at as follows:

Gilmore-Theodore subtransmission		$1.75m
Gilmore zone substation augmentation		$0.39m
Theodore zone substation		
civil and structural work	$1.10m	
building and landscaping	$0.65m	
indoor electrical works	$1.15m	
outdoor electrical works	$1.20m	
Sub-total		$4.10m
TOTAL		$6.24m

73. Committee's Recommendation The Committee recommends construction of the work in this reference.

RECOMMENDATIONS AND CONCLUSIONS

74. The recommendations and conclusions of the Committee and the paragraph in the report to which each refers are set out below:

		Paragraph
1.	DUE TO THE DEVELOPMENT OF SUBURBS IN EAST TUGGERANONG AN ADDITIONAL SUPPLY OF ELECTRICAL POWER IS ESSENTIAL AND THERE IS A NEED FOR A ZONE SUBSTATION AT THEODORE AND ASSOCIATED SUBTRANSMISSION NETWORK.	23
2.	THE ROUTE OF THE 132kV SUBTRANSMISSION LINE FROM GILMORE TO THEODORE IS SATISFACTORY.	52
3.	MEASURES WILL BE TAKEN TO MINIMISE THE VISUAL IMPACT OF THE SUBTRANSMISSION LINE ON THE LANDSCAPE.	52
4.	THE THEODORE SITE IS WELL SUITED FOR A ZONE SUBSTATION TO EFFICIENTLY PROVIDE ELECTRICITY TO PRESENT AND FUTURE CONSUMERS.	66
5.	THE ZONE SUBSTATION AREA WILL BE LANDSCAPED TO MINIMISE ITS VISUAL IMPACT.	66
6.	THE LIMIT OF COST ESTIMATE IS $6.24 MILLION AT MARCH 1986 PRICES.	72

Paragraph

7. THE COMMITTEE RECOMMENDS CONSTRUCTION OF THE WORK IN THIS REFERENCE. 73

D. J. Foreman.

(D.J. FOREMAN)
Chairman

Parliamentary Standing Committee
on Public Works
Parliament House
CANBERRA

23 October 1986

APPENDIX A

LIST OF WITNESSES

Jarman, Mr R.H., Executive Engineer, Australian Capital Territory Electricity Authority, 221 London Circuit, Canberra, Australian Capital Territory

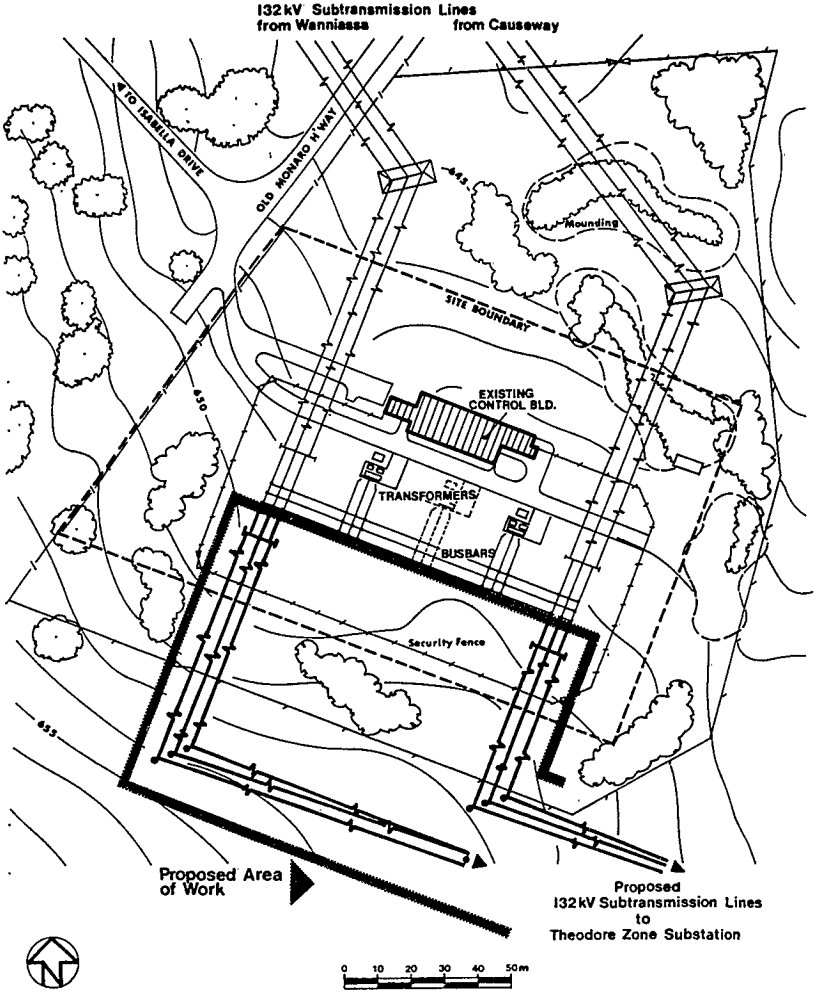
Johnson, Mr M.K., Australian Capital Territory Electricity Authority, 221 London Circuit, Canberra, Australian Capital Territory

Kain, Mr J.M., Chief Engineer, Australian Capital Territory Electricity Authority, 221 London Circuit, Canberra, Australian Capital Territory

APPENDIX B

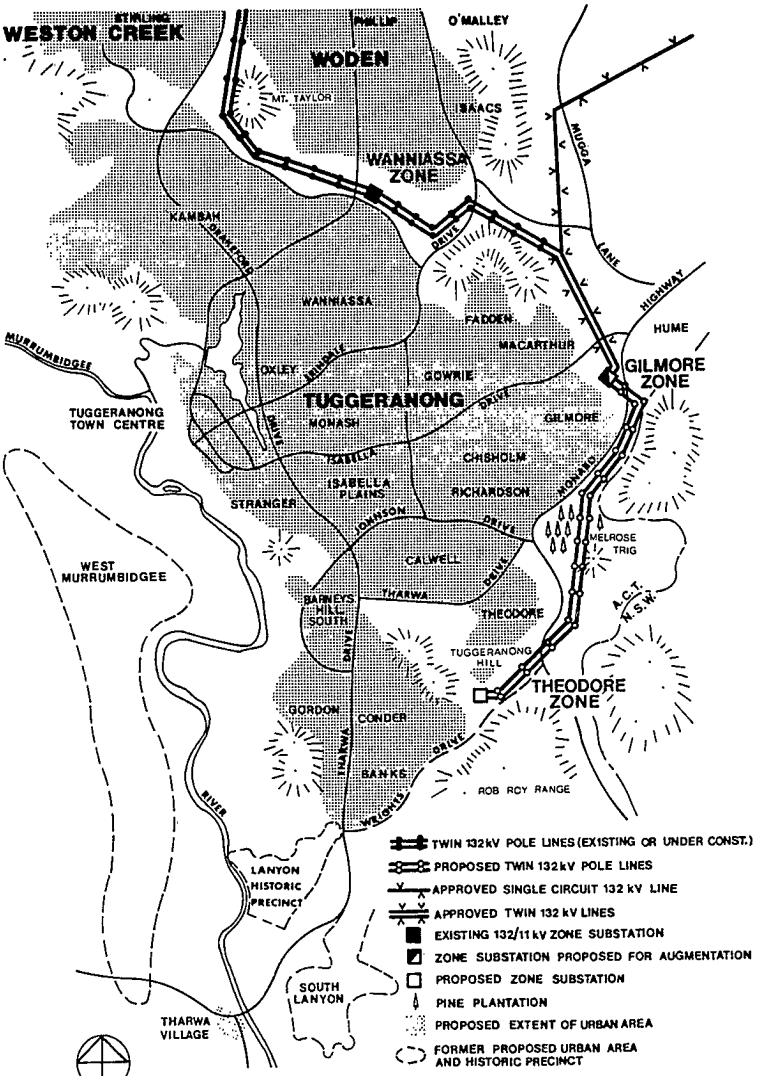
ILLUSTRATIONS

MAJOR ELECTRICITY NETWORK IN THE A.C.T. AND ENVIRONS



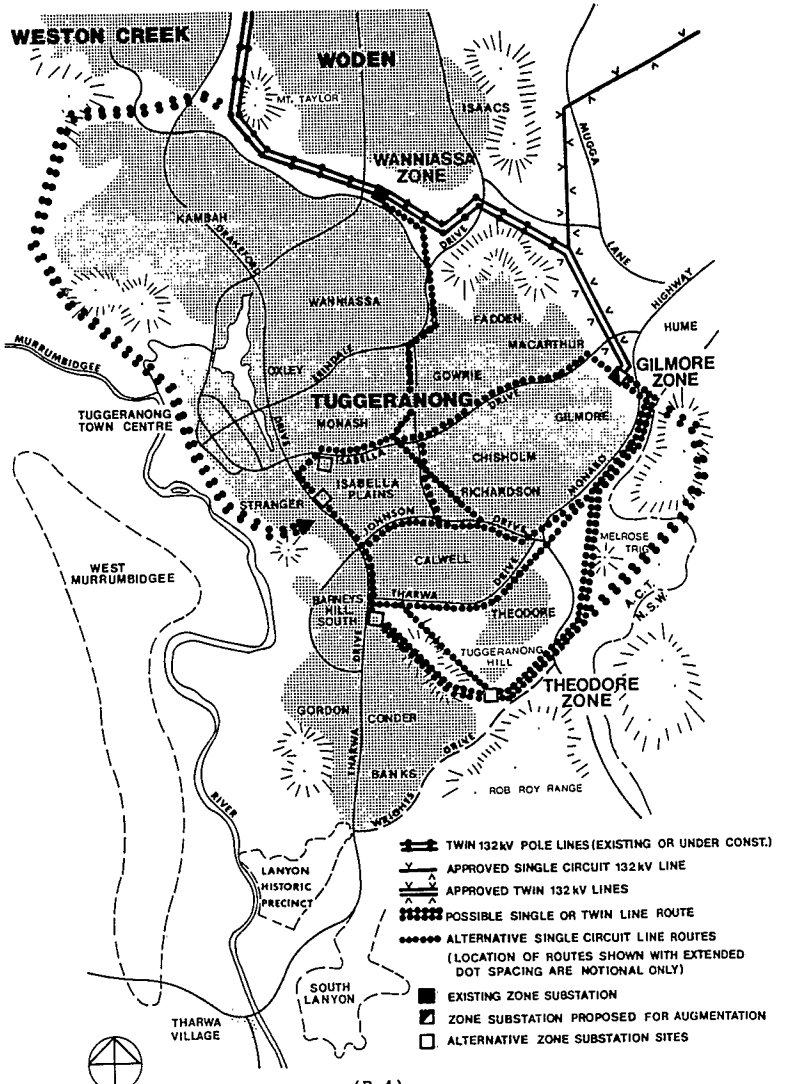
(B-2)

GILMORE ZONE SUBSTATION
SITE PLAN



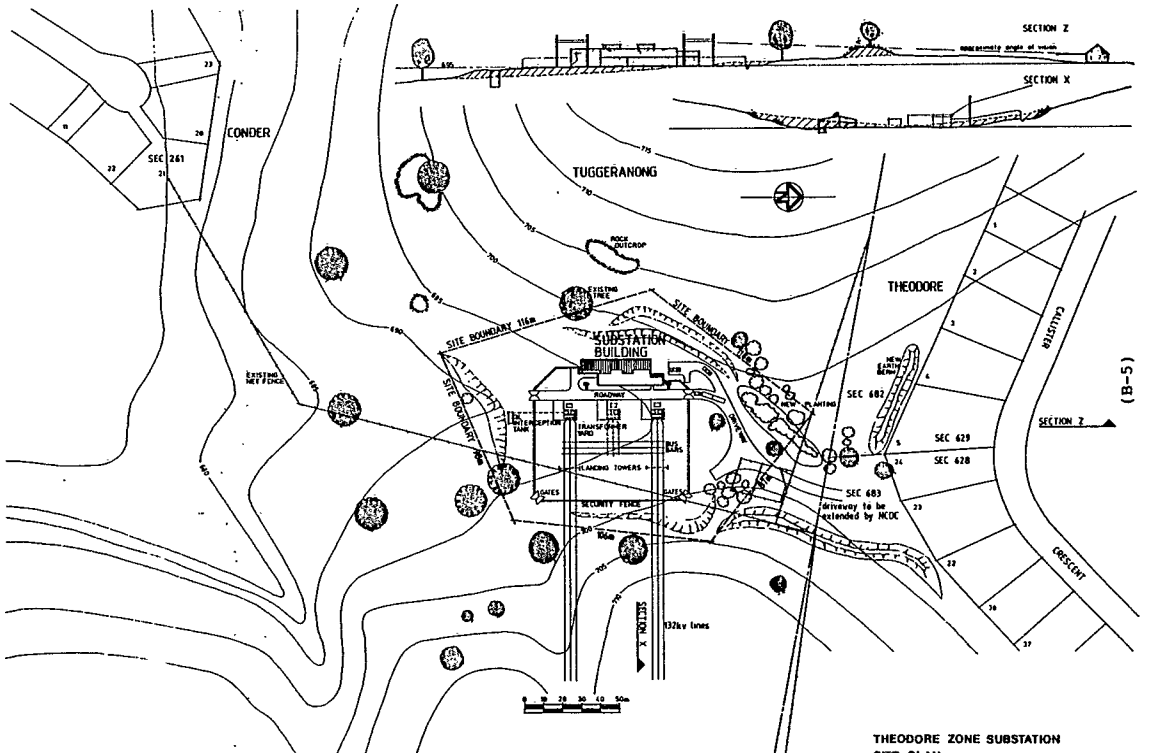
(B-3)

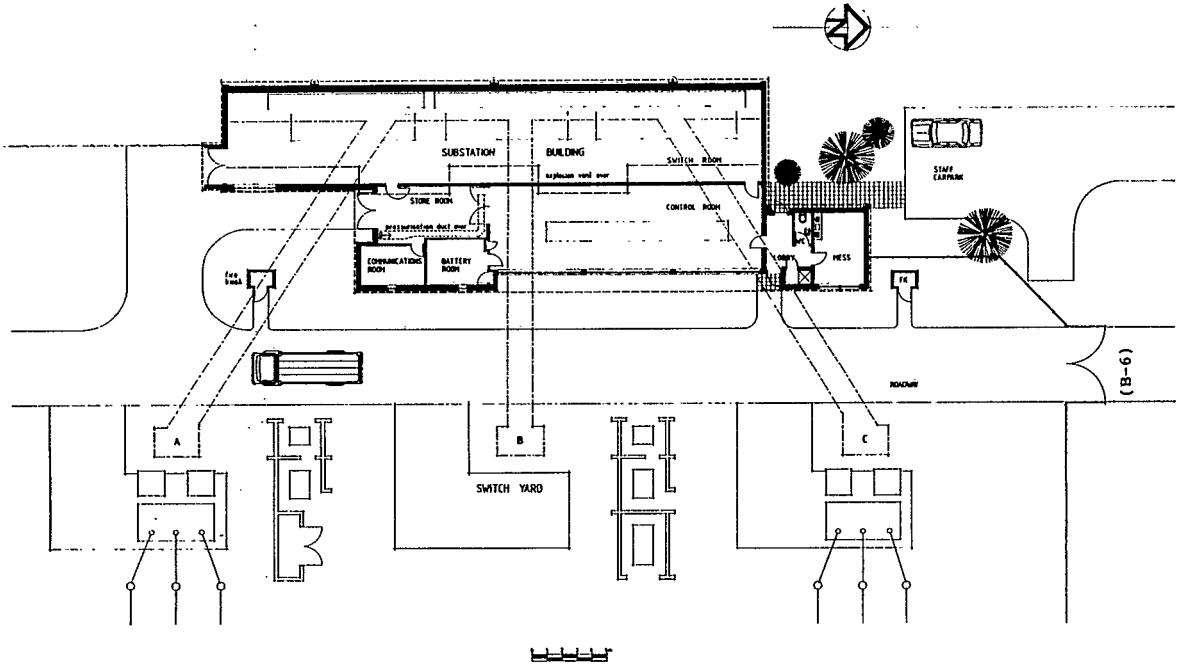
OVERVIEW OF THE PROPOSAL



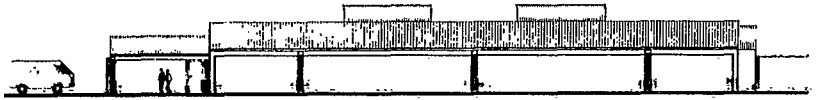
(B-4)

ALTERNATIVES TO THE PROPOSAL


SECTION Z
SECTION X
CONDER
SEC 261
TUGGERANONG
ROCK OUTCROP
EXISTING FENCE
SITE BOUNDARY
SITE BOUNDARY 116m
SUBSTATION BUILDING
ROADWAY
INTERCEPTION TANK
TRANSFORMER YARD
SWITCHING TOWERS
GATES
SECURITY FENCE
132kv lines
NEW PLANTING
THEODORE
SEC 682
SEC 629
SEC 628
SEC 683
driveway to be extended by NCDC
CRESCENT
SECTION Z
(B-5)
THEODORE ZONE SUBSTATION
SITE PLAN



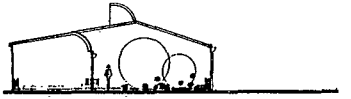
THEODORE CONTROL BUILDING
FLOOR PLAN



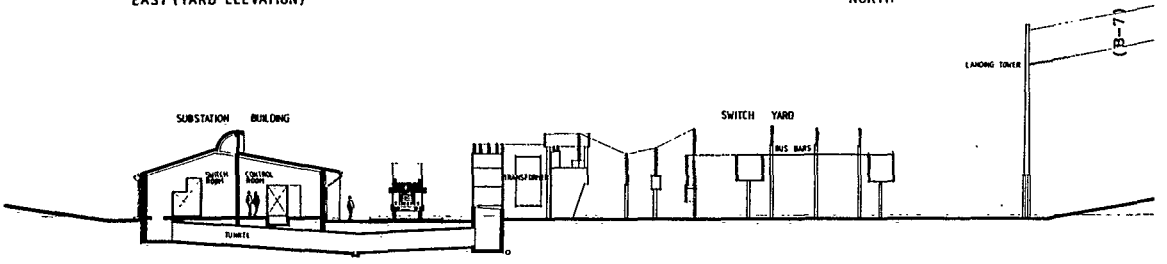
WEST

SOUTH

EAST (YARD ELEVATION)



NORTH



EAST-WEST SECTION

THEODORE CONTROL BUILDING
ELEVATIONS AND SECTION