3. Description of the proposal

This section describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

Transport proposes to upgrade the Great Western Highway between Little Hartley and Lithgow, NSW (the proposal). The proposal forms part of the broader Greater Western Highway Upgrade Program that aims to reduce congestion and deliver safer, more efficient and reliable journeys for those travelling in, around and through the Blue Mountains, while also better connecting communities in the Central West to Sydney.

The Great Western Highway Upgrade Program is packaged into separate East, Central and West Sections. The West Section (ie this proposal), has been developed based on the concept design publicly displayed in 2012 and its further refinement. It would include:

- Upgrade of about 14 kilometres of the Great Western Highway between Little Hartley and Lithgow to a four lane divided highway
- Embankment work and median adjustment in the Forty Bends section (upgraded in 2017) to provide a fourth lane
- Provision of service roads, where feasible and reasonable, to minimise direct access to the Great Western Highway from adjacent properties
- Upgrade and/or adjustment of existing intersections at local roads
- Provision of two vehicle rest areas, one eastbound and one westbound, near Mid Hartley Road and Carroll Drive
- Temporary and permanent water quality treatment basins
- Provision of five new bridges, including twin bridges over River Lett and Jenolan Caves Road
- Upgrade of the existing bridge over River Lett as part of a local service road network
- Extension of existing drainage culverts at Rosedale Creek and Boxes Creek
- Provision of three combined drainage and fauna crossing culverts
- Establishment and use of temporary ancillary facilities during construction
- Property works including acquisition, demolition and adjustments to accesses
- Adjustment of existing utility infrastructure, including overhead powerlines, poles and underground communications cables
- Rehabilitation of disturbed areas and landscaping, where required.

The proposal has been designed in four sections to allow flexibility in construction staging and delivery and includes:

- Little Hartley to River Lett Hill
- Coxs River Road
- River Lett Hill to Forty Bends
- Forty Bends to Lithgow.

A description of the key features of each section is provided below and are shown in Figure 3-1, along with the proposed construction footprint.

3.1.1 Little Hartley to River Lett Hill

The Little Hartley to River Lett Hill section involves the realignment of about three kilometres of the Great Western Highway with two lanes in each direction from the base of Victoria Pass, where it would tie into the Great Western Highway Upgrade – Central Section, to east of the River Lett, excluding the Coxs River Road Section (see Section 3.1.2). Key features include:

- Two span 'Super T' bridges over the new Great Western Highway east of Coxs River Road and west of Mid Hartley Road to maintain the local road connection
- Realignment of the highway to improve alignment and provide two lanes in each direction. The existing highway would become a local service road
- Upgrade at the intersection of the Great Western Highway and Carroll Drive
- Eleven temporary construction sediment basins and three permanent operational water quality control basins (noting three of the temporary basins would be converted to permanent basins at completion for construction)
- Adjustment, protection and/or relocation of overhead distribution powerlines and underground communications assets
- Construction of two Hartley Valley rest areas near Mid Hartley Road and Carroll Drive, connected by a service road.

3.1.2 Coxs River Road

The Coxs River Road section involves the realignment of about 2.4 kilometres of the Great Western Highway with two lanes in each direction from east of the Coxs River Road to near the Hartley Cemetery. Key features include:

- A grade separated interchange at Coxs River Road, supplemented by new sections of connecting roadway to create a local service road network
- Realignment of the existing highway near Browns Gap Road to create a local service road
- Upgrades to the intersections at Browns Gap Road and Baaners Lane, including a vehicle turning facility on Baaners Lane
- Six temporary construction sediment basins and four permanent operational water quality control basins (noting two of the temporary basins would be converted to permanent basins at completion of construction)
- Adjustment, protection and/or relocation of overhead distribution powerlines, underground communications assets and water utility infrastructure
- Retaining walls on the Great Western Highway eastbound adjacent to the Lolly Bug.

3.1.3 River Lett Hill to Forty Bends

The River Lett Hill to Forty Bends section involves the realignment and/or widening of about four kilometres of the Great Western Highway to at least two lanes in each direction between the River Lett and Forty Bends Road (eastern junction). Key features include:

- Twin bridges over Jenolan Caves Road (about 370 metres long) to form a grade separated interchange
- Twin Bridges over River Lett (about 80 metres long)
- Retention of the existing bridge over River Lett on the existing Great Western Highway as part of a local road connection from the new highway, including barrier upgrade works.

- Realignment of the existing highway from Jenolan Caves Road to about 250 metres south of Forty Bends Road (eastern junction) to reduce the gradient of the road on River Lett Hill and provide for an climbing (third) lane westbound. The existing highway in this section would be converted to a local service road where feasible
- Upgrade to the intersection at Blackmans Creek Road and Kelly Street, including a realignment of Kelly Street
- Five temporary construction sediment basins and seven permanent operational water quality control basins (noting four of the temporary basins would be converted to permanent basins at completion of construction)
- Construction of retaining walls at Off Ramp 1 and between River Lett twin bridges and Jenolan Caves Road intersection
- Extension of the existing box culverts at Boxes Creek
- Extensive cuts and fills at River Lett Hill, the abutments for the bridge over Jenolan Caves Road and between Service Road 8 and Forty Bends Road (eastern junction)
- Adjustment, protection and/or relocation of overhead transmission powerlines and underground communications assets
- Three 3.3 meter wide x 3.3 metre high box culverts providing both drainage and a fauna crossing.

3.1.4 Forty Bends to Lithgow

The Forty Bends to Lithgow section involves widening about 4.5 kilometres of the Great Western Highway to two lanes in each direction from Forty Bends Road (eastern junction) to Magpie Hollow Road. Key features include:

- Embankment work and median adjustment in the existing Forty Bends Section of the highway (upgraded in 2017) to provide a fourth lane
- Upgrades to intersections at McKanes Falls Road, Old Bathurst Road and Mudgee Street
- Modifications to the intersection at Forty Bends Road (western junction)
- Two temporary construction sediment basins and five permanent operational water quality control basins (noting the two temporary basins would be converted to permanent basins at completion of construction)
- Four retaining structures on the eastbound alignment and one westbound
- Six drainage culverts traversing under the proposed highway, as well as additional minor culverts under local service roads and/or property access.

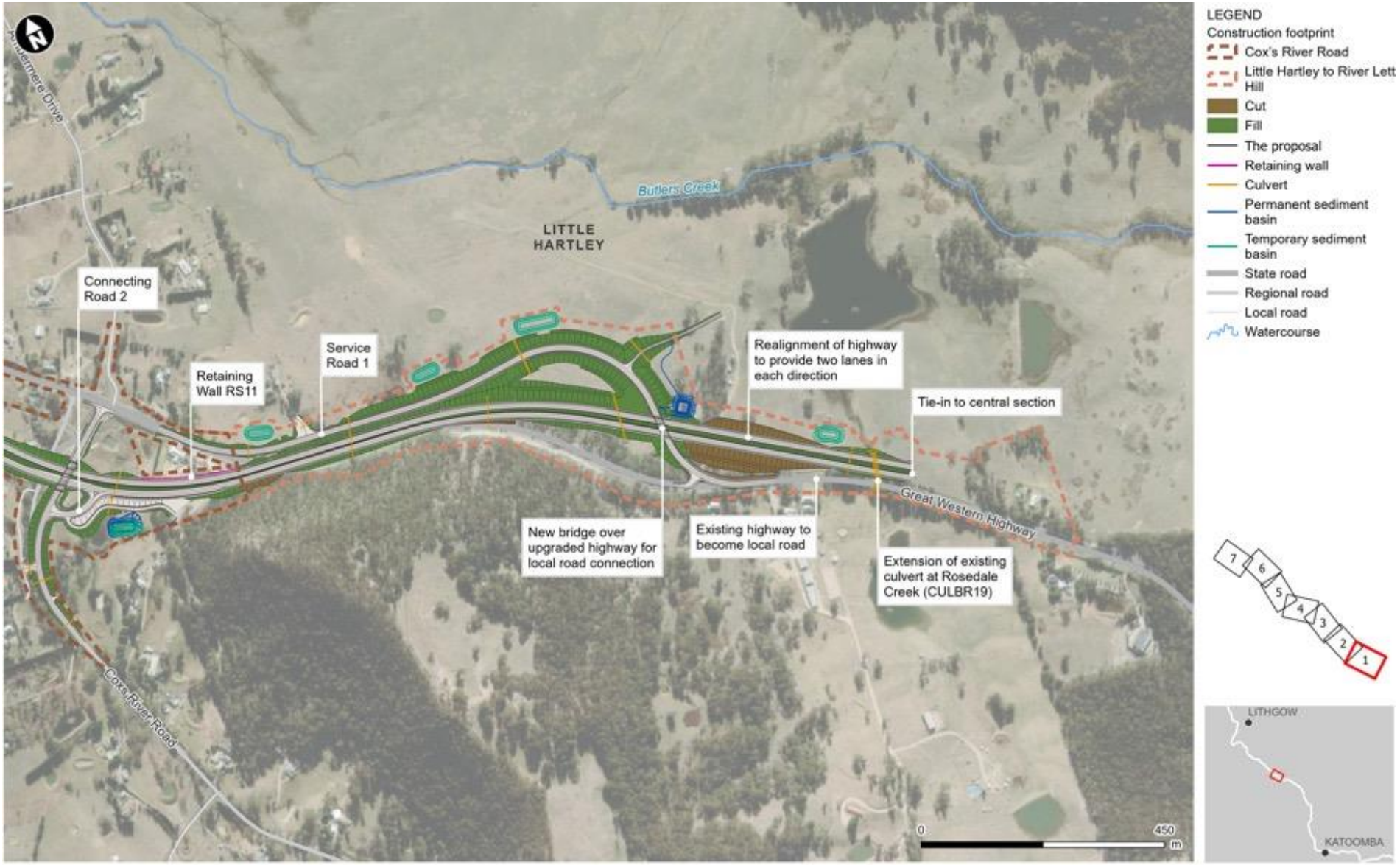

Figure 3-1 a Key features of the proposal

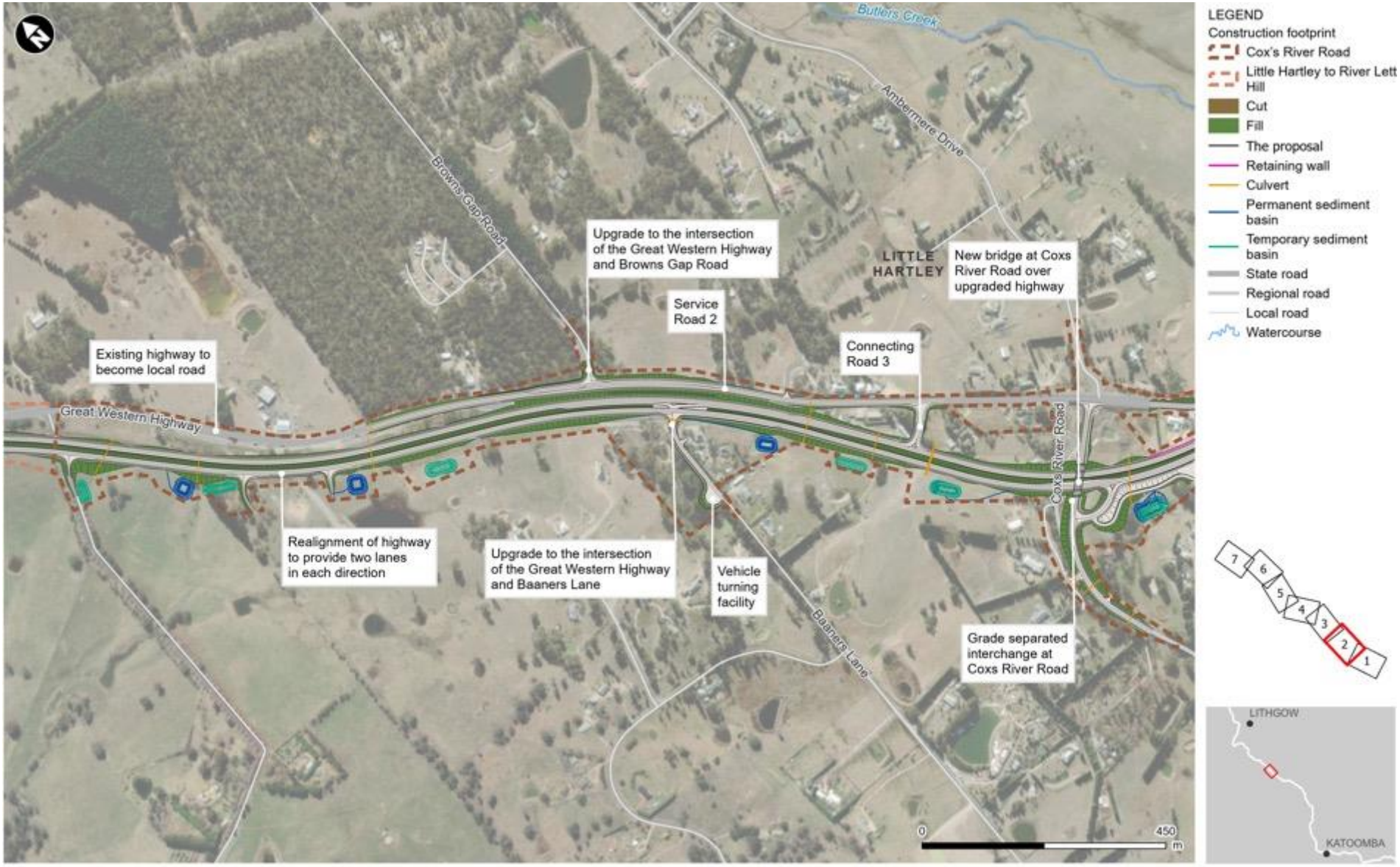

Figure 3-1 b Key features of the proposal

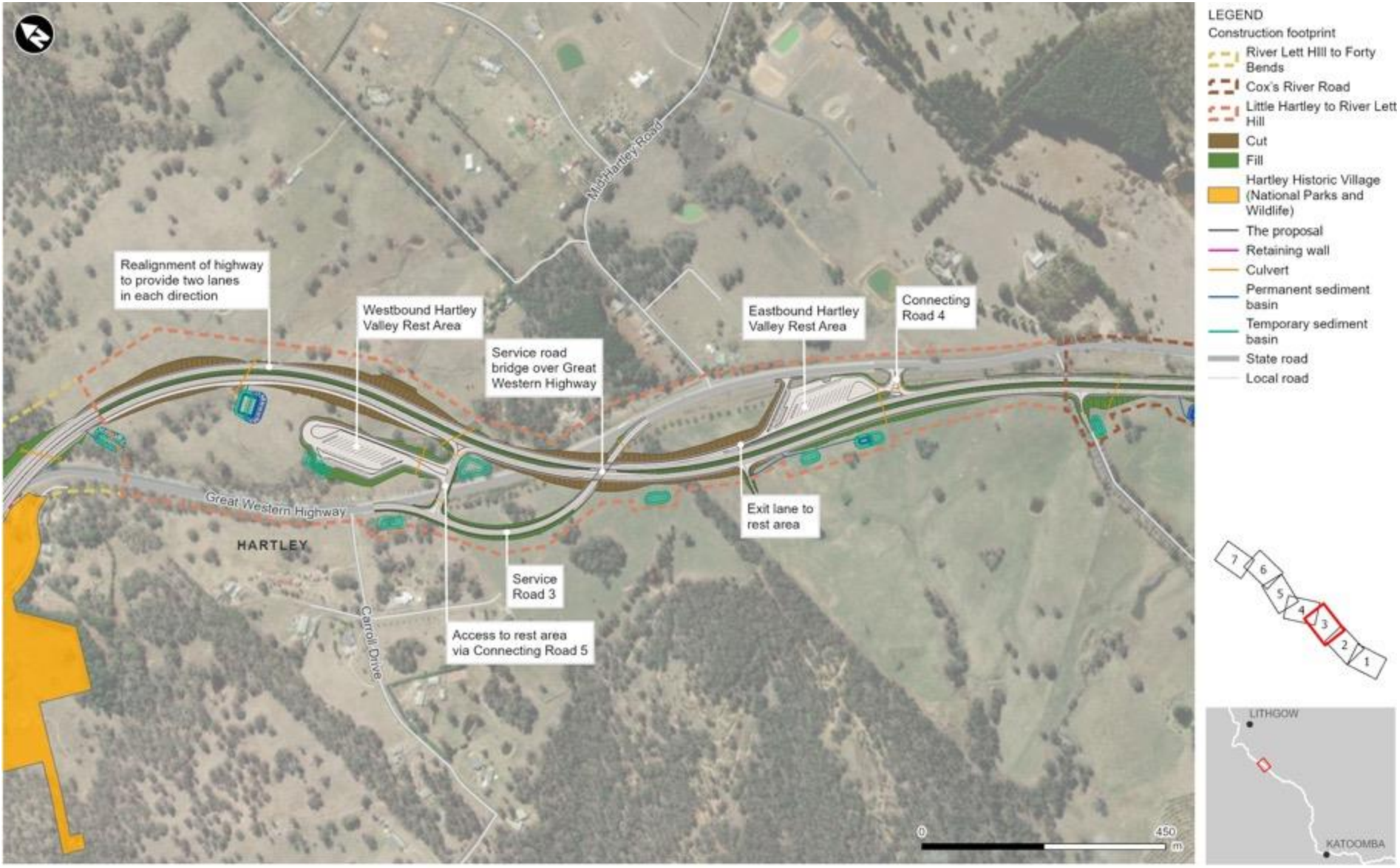

Figure 3-1 c Key features of the proposal

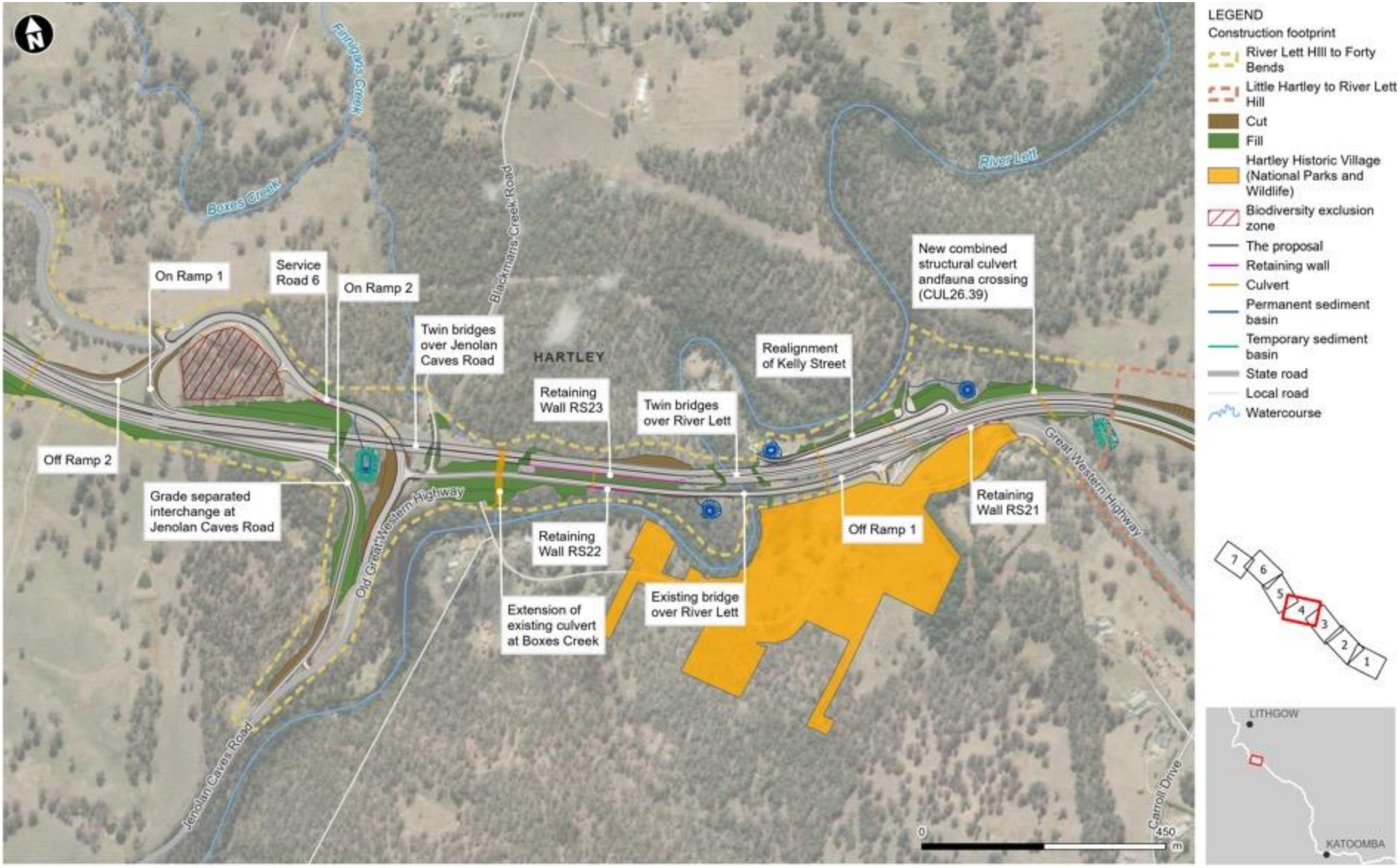

Figure 3-1 d Key features of the proposal

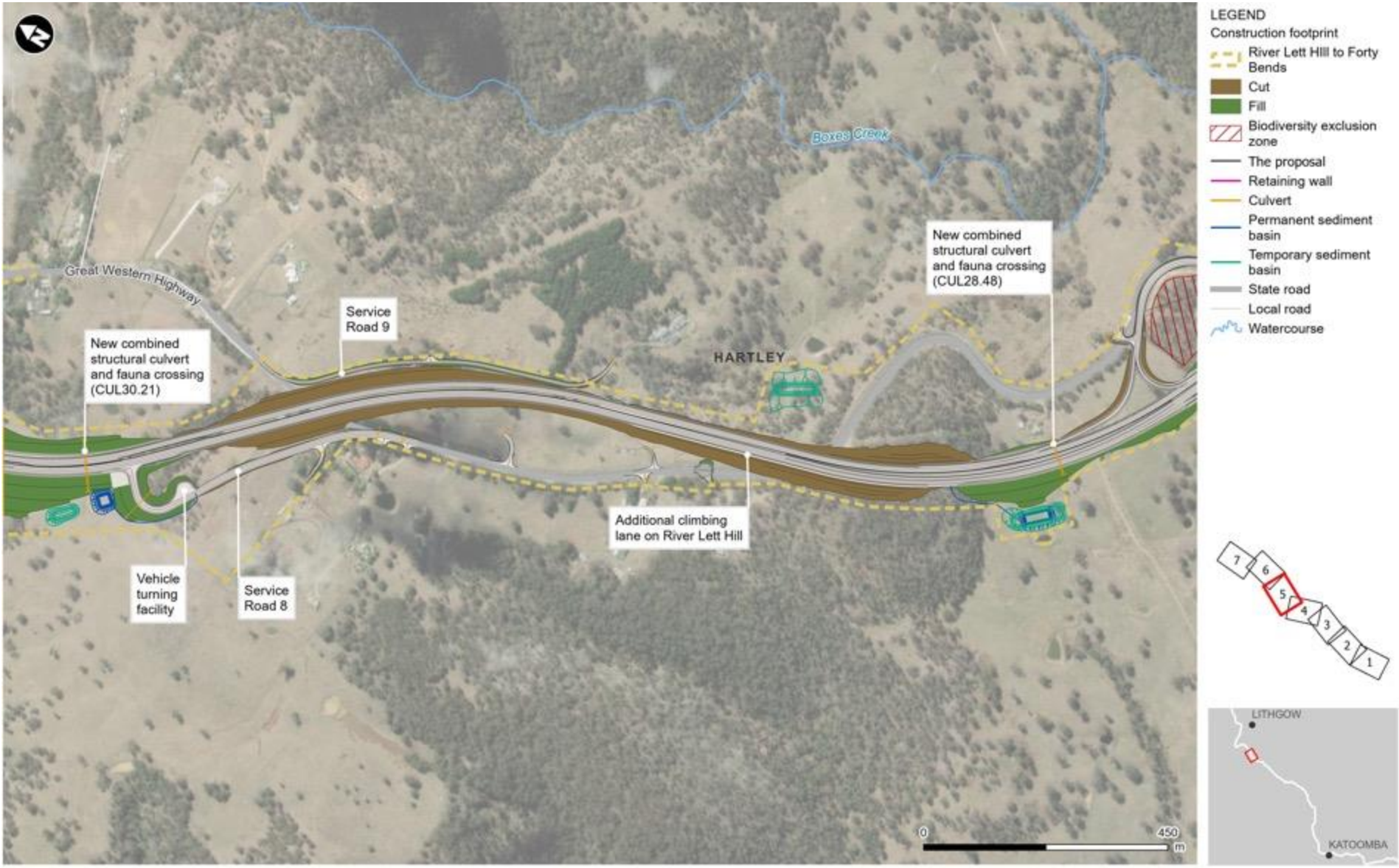

Figure 3-1 e Key features of the proposal

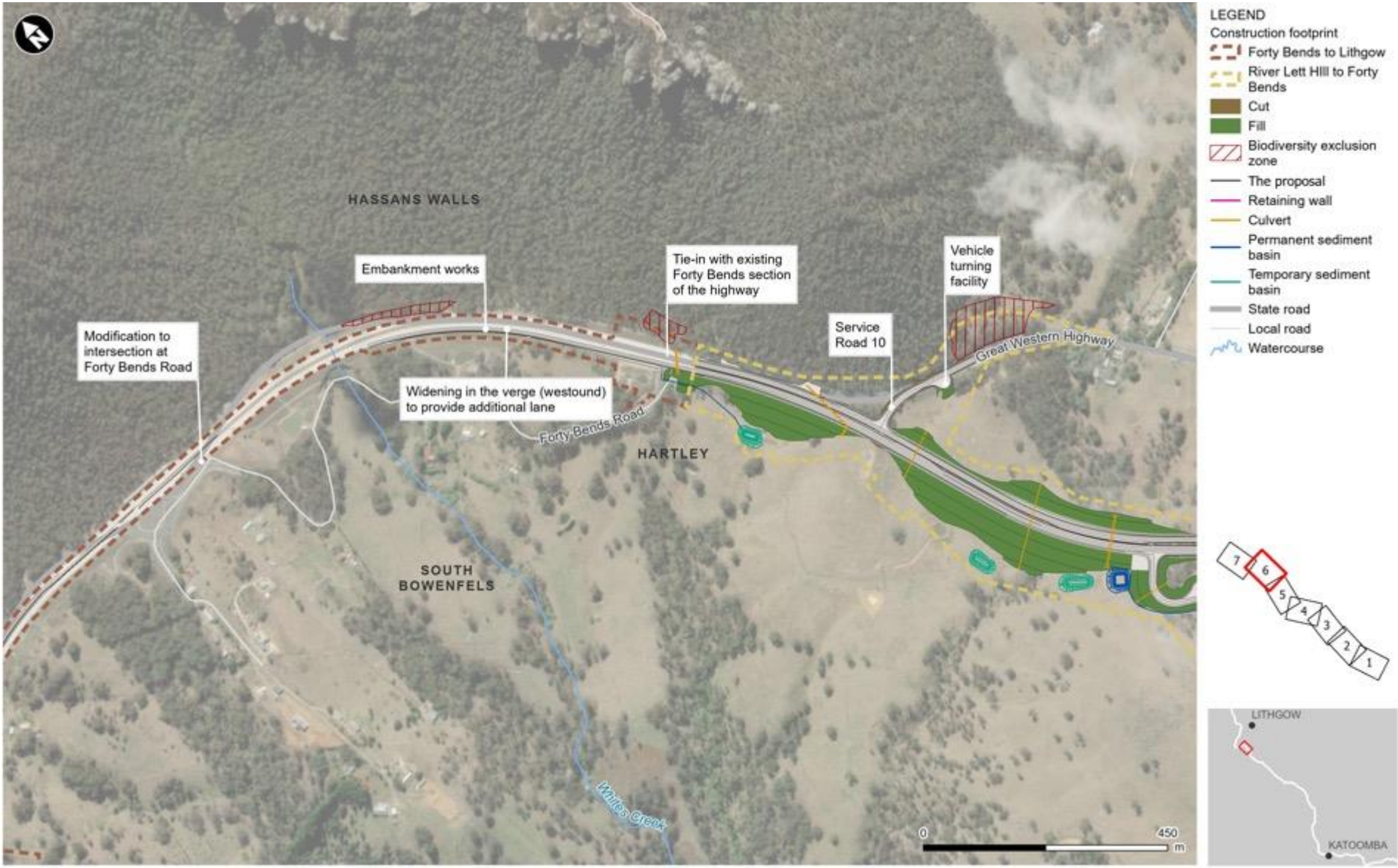

Figure 3-1 f Key features of the proposal

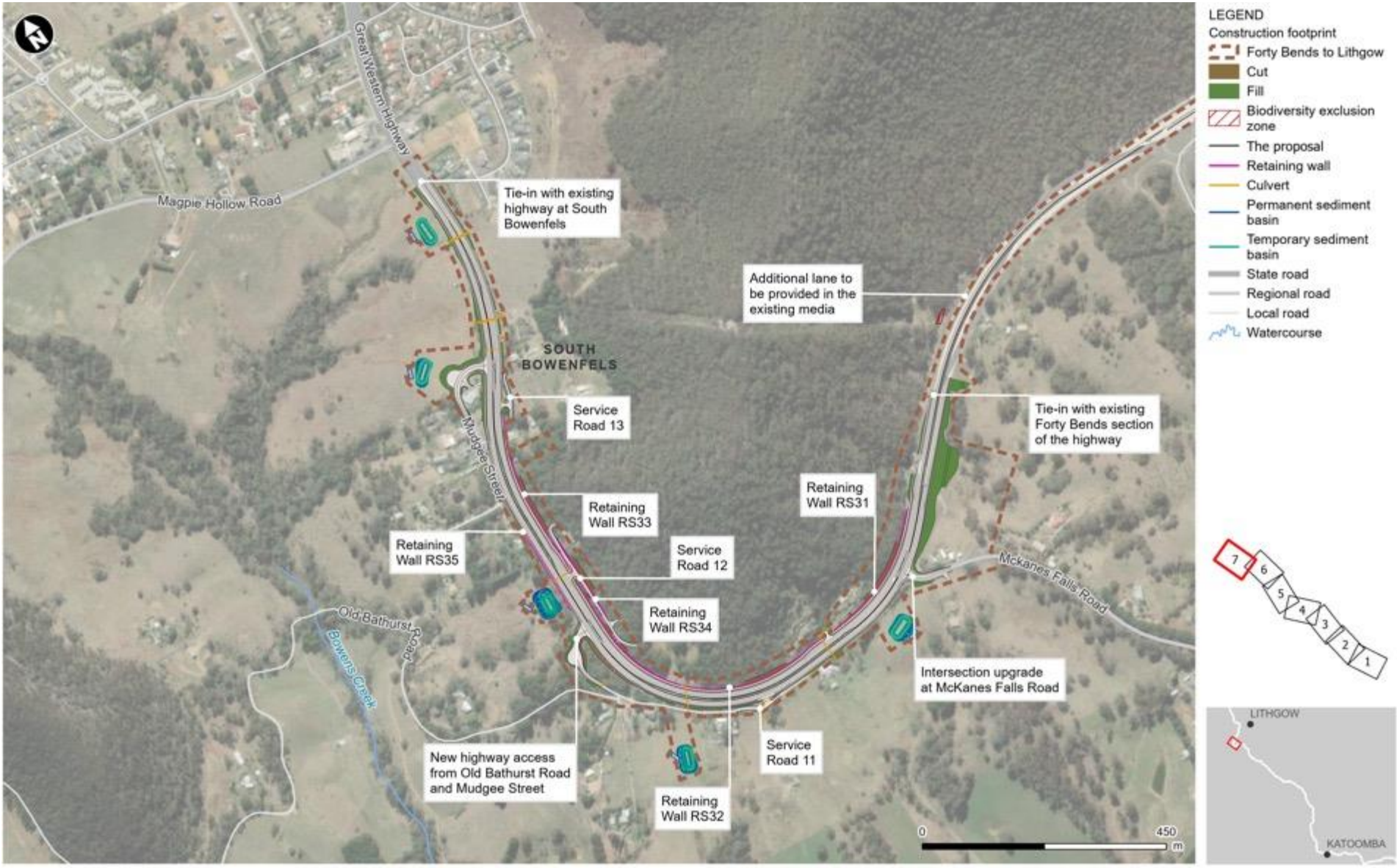

Figure 3-1 g Key features of the proposal

3.2 Design

The design is being prepared in accordance with Transport's project specifications and design standards and guidelines as follows:

- Austroads Guides
- Australian Standards
- Transport supplements to Austroads Guides and Australian Standards
- Technical directions and quality alerts
- Other current Transport publications.

3.2.1 Design criteria

The key design criteria for the proposal are summarised in Table 3-1. The infrastructure design life is provided in Table 3-2.Typical cross sections for the proposal are presented in Figure 3-2.

Table 3-1 Design criteria

Design element	Criteria
Great Western Highway	
Design speed	• 80 to 110 kilometres per hour
Posted speed	• 80 to 100 kilometres per hour
Lane width	• 3.5 metres
Turn auxiliary lane width	• 3.5 metres
Nearside (outside) shoulder width	• 2.5 metres
Offside (median) shoulder width	• 0.5 to 1 metre
Maximum grade	• 6 per cent for the overall proposal. This criterion could not be achieved on River lettt Hill and a grade of 6.75 per cent has been adopted for this design element.
Design vehicle	• 26 metre B-double • (Checking vehicle 36.5 metre A-double (12 axle))
Vertical clearance to overpass	• 5.4 metres
Flood immunity	• 1 in 100 year annual recurrence interval (ARI)
Service Roads	
Posted speed limit	• Service Road 1, 3, 6 and 8: 60 kilometres per hour

Design element	Criteria
	• Service Road 2: 80 kilometres per hour during construction, 60 kilometres per hour during operation • Service Road 9, 10, 11, 12 and 13: 50 kilometres per hour
Lane widths	• Service Road 11, 12 and 13: 3 metres • Service Road 1, 2, 3, 6, 8 and 10: 3.5 metres • Service Road 9: 2 metres
Nearside (outside) shoulder width	• Service Road 1 and 3: 2 to 3 metres • Service Road 2, 6, 8 and 10: 2 metres • Service Road 9: 0.5 metres • Service Road 11, 12 and 13: 1.5 metres
Design vehicle	• 19 metre semi-trailer • (Checking vehicle 26 metre B-double)
Connecting Roads	
Posted speed limit	• 50 kilometres per hour
Lane widths	• Connecting Road 1, 2 and 4: 4.5 metres • Connecting Road 3, 4 and 5: 3 metres
Nearside (outside) shoulder width	• Connecting Road 1: 1 to 1.5 metres • Connecting Road 2: 2 metres • Connecting Road 3, 4 and 5: 3 metres
Design vehicle	• 19 metre semi-trailer • (Checking vehicle 26 metre B-double)
Local Roads	
Posted speed limit	• Baaners Lane and Coxs River Road: 60 kilometres per hour • Blackmans Creek Road: 40 kilometres per hour • Browns Gap Road, Jenolan Caves Road and McKanes Falls Road: 80 kilometres per hour • Forty Bends Road, Kelly Street, Mudgee Street and Old Bathurst Road: 50 kilometres per hour
Lane widths	• Baaners Lane, Browns Gap Road, Coxs River Road, Forty Bends Road, Jenolan Caves Road and McKanes Falls Road: 3.5 metres • Blackmans Creek Road Mudgee Street and Old Bathurst Road: 3 metres • Kelly Street: 2 metres

Design element	Criteria
Nearside (outside) shoulder width	• Baaners Lane, Blackmans Creek Road, Browns Gap Road and Forty Bends Road: 1 metres • Coxs River Road and Jenolan Caves Road: 2 metres • Kelly Street: 0.5 metres • McKanes Falls Road: 2 metres • Mudgee Street: 1.5 metres • Old Bathurst Road: 0.5 to 1.5 metres
Design vehicle	• 19 metre semi-trailer • (Checking vehicle 26 metre B-double)

Table 3-2 Design life

Design Element	Design Life
Inaccessible drainage elements	100 years
Drainage elements that are accessible for refurbishment and maintenance including sedimentation and detention basins	40 years
Sign faces	10 years
Sign support structures and other roadside furniture	40 years
Fences included fauna fences	20 years
Lighting and electrical equipment	20 years
Bridge and tunnel structures, including underpasses, overpasses and wildlife tunnels	100 years
Retaining walls including reinforced soil walls	100 years
Noise barriers, noise attenuation devices and headlight screens	50 years
Pavements – main carriageway including ramps	40 years
Pavements – local roads	20 years
Local road embankment and support structures	100 years
Embankments, including reinforced embankments	100 years
Cut batters, including batter treatments	100 years
Timber furniture	30 years
Intersection capacity improvements	10 years

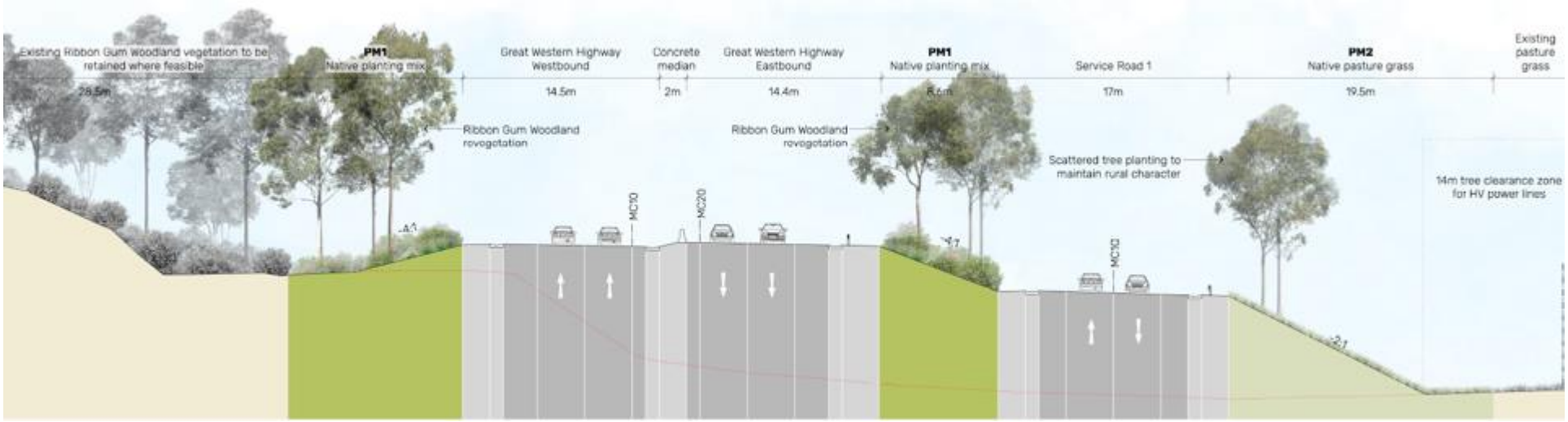

Figure 3-2 a Typical cross section of the Great Western Highway near Service Road 1

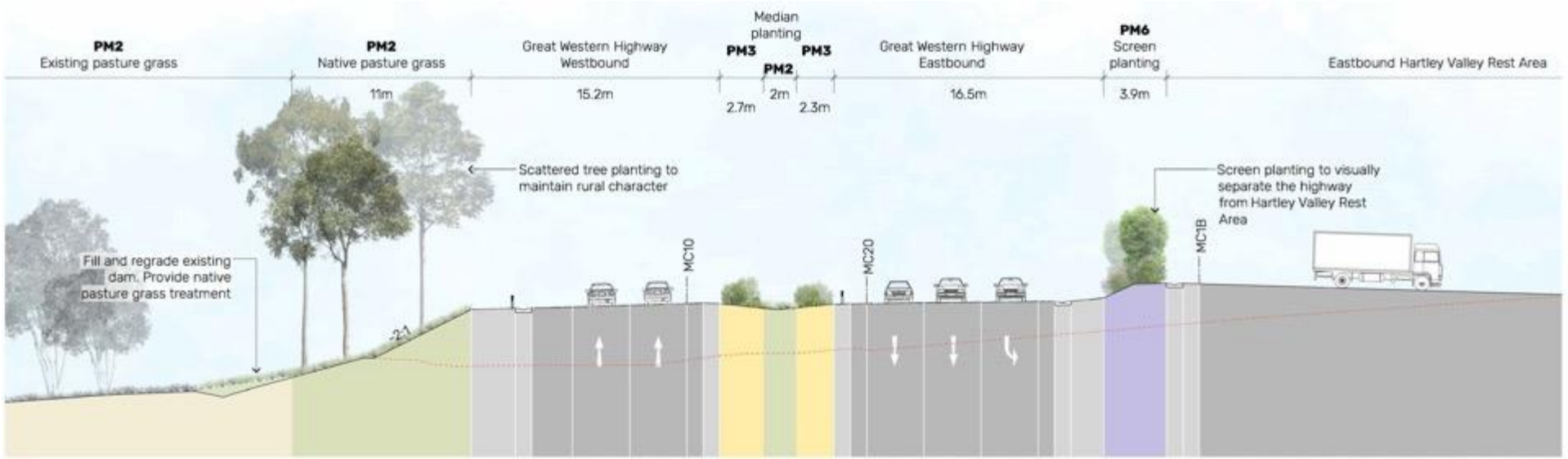

Figure 3-2 b Typical cross section of the Great Western Highway near Eastbound Hartley Valley rest area

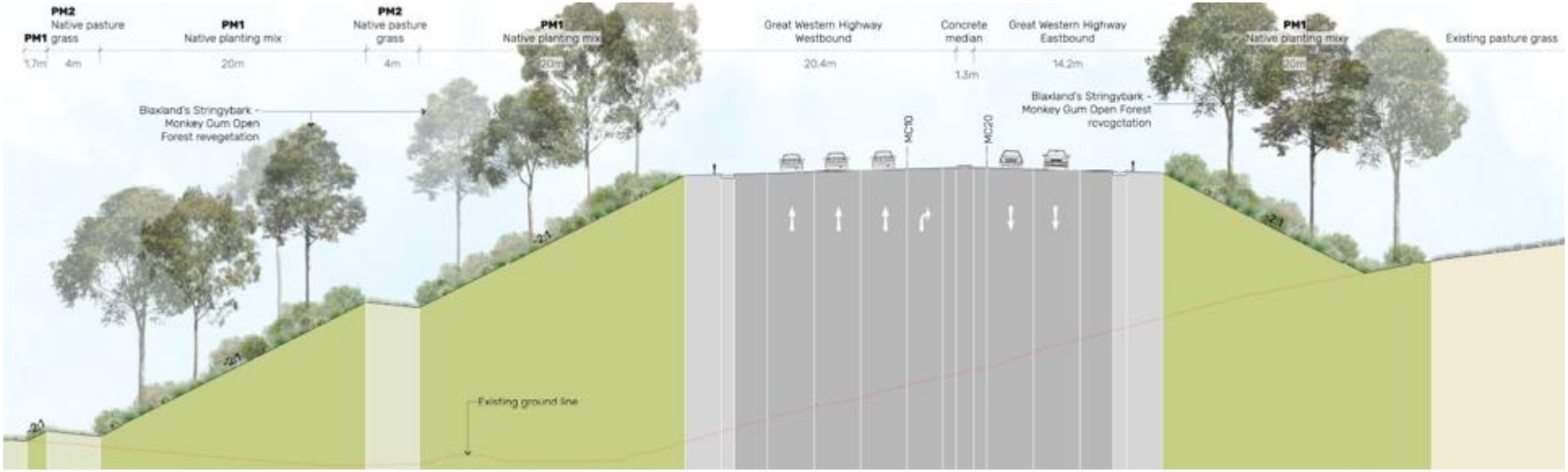

Figure 3-2 c Typical cross section of Great Western Highway requiring deep fill

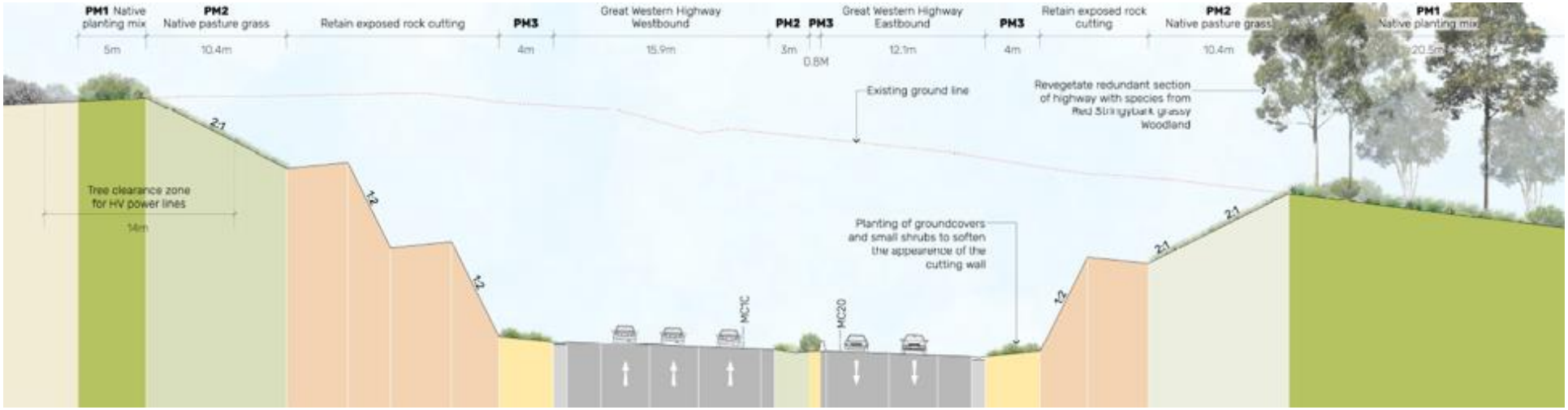

Figure 3-2 d Typical cross section of Great Western Highway requiring deep cut

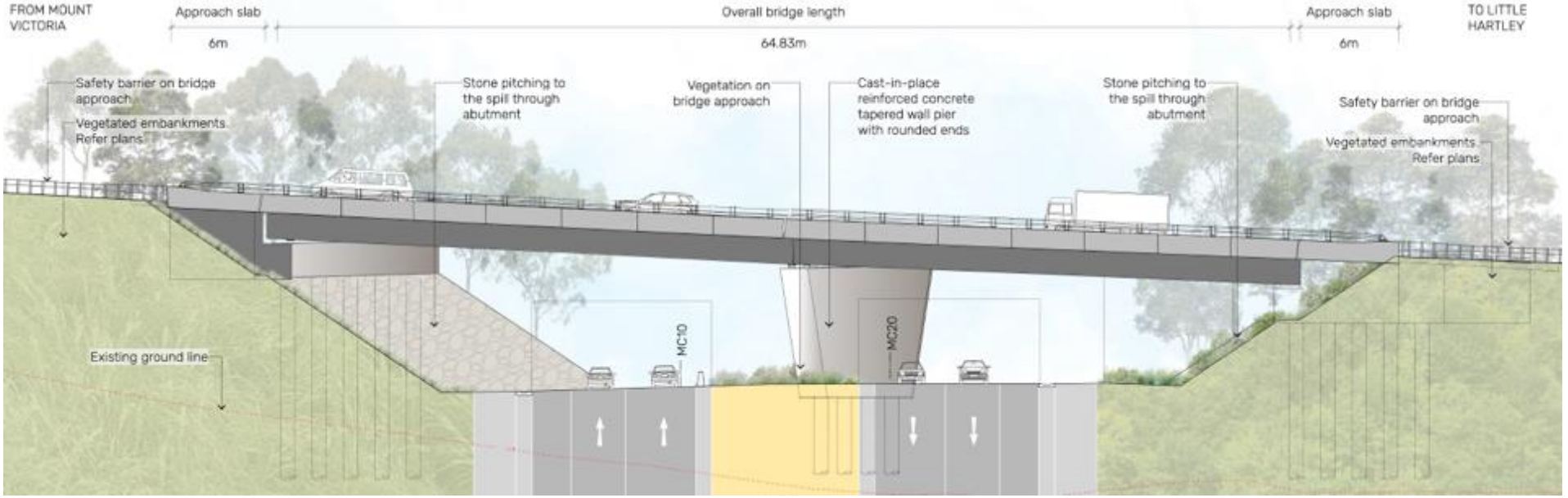

Figure 3-2 e Long section of Service Road 1 bridge over the Great Western Highway

Figure 3-2 f Long section of the Great Western Highway twin bridges over River Lett

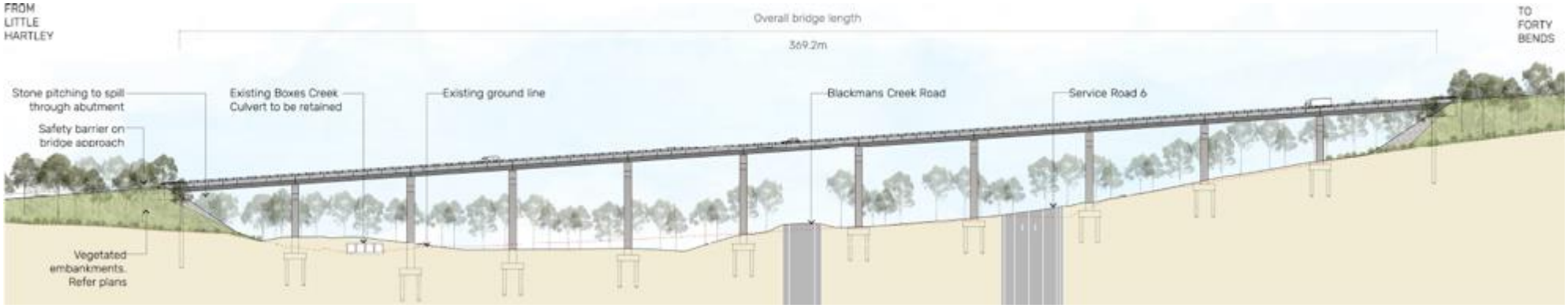

Figure 3-2 g Long section of the Great Western Highway twin bridges over Jenolan Caves Road

3.2.2 Engineering constraints

Engineering constraints have been identified for the proposal. The key constraints include:

- Existing natural features, including topography (steep and varying terrain) and existing watercourses/drainage lines and associated flood levels (in particular River Lett). Large cuts and fills would be required to construct the proposal in accordance with the design criteria
- Tie-ins. There are multiple tie-in requirements for the proposal, including tie-ins to:
  - The existing highway, in particular at the eastern extent of the proposal adjoining future highway upgrades that are subject to separate environmental assessment and approval
  - Existing local road intersections. There are 12 local road intersections that would require modification or tie-in to the proposal, including Coxs River Road, Baaners Lane, Browns Gap Road, Carroll Drive, Old Great Western Highway, Kelly Street, Jenolan Caves Road, Blackmans Creek Road, Forty Bends Road, McKanes Falls Road, Old Bathurst Road and Mudgee Street
  - Existing properties. There are multiple properties that would require property access adjustments or upgrades as a result of the proposal
- Construction staging. The proposal construction staging strategy needs to be structured to be feasible and meet proposal needs, with particular consideration of managing earthworks across the project and maintaining existing highway traffic flows in both directions
- Geotechnical issues and risks within the proposal construction footprint. There are geological risks, including presence of Acid Sulfate Rock, and slope failure risks associated with the Forty Bends to Lithgow Section and the eastern end of the Little Hartley to River Lett Section. The risks primarily include remobilisation of small to large boulders residing on steep slopes as a result of erosion, slump failures and debris flows
- Formation of black ice. Black ice formation, largely due to cold air flowing down from Hassans Walls, has been identified as a hazard along the highway at Forty Bends.
- Key environmental constraints, including:
  - Avoiding impacts to the existing non-Aboriginal heritage items within or adjacent to the proposal construction footprint, in particular impacts to the Lolly Bug and the Harp of Erin properties
  - Avoiding impacts to the number of known Aboriginal heritage sites and potential archaeological deposits
- Avoiding and/or minimising impacts native vegetation and threatened fauna habitat, in particular threatened ecological communities listed under the BC Act and/or EPBC ActProperty acquisition. The proposal has minimised local property acquisition where feasible, including impacts to private properties, National Park and to Crown land subject to an Aboriginal land claim
- The presence of existing utility infrastructure. The proposal would require the protection and/or relocation of electricity, telecommunications and water infrastructure
- Visual impact of the proposal, in particular bridge structures associated with the Coxs River Road Section and Jenolan Caves Road.

3.2.3 Major design features

Great Western Highway realignment and widening

The proposed alignment would follow the general alignment and grade of the existing highway, however would diverge in places to ease tightly curved sections. It also provides new junctions and retains sections of the existing highway as service roads to property accesses.

The main points of divergence from the existing road alignment would include:

- Coxs River Road. This section of about 850 metres would allow for the intersection to be constructed predominantly offline and traffic flow along the highway to be maintained. The proposed divergence would also avoid impacts to hreeheritage listed/potential buildings, the Lolly Bug, the Harp of Erin and Ambermere
- Coxs River Road to Hartley. This section would follow adjacent to the highway on the southern side for about 1.5 kilometres, allowing space for the eastbound rest area and for the existing highway to be used as a service road for access to properties and Mid Hartley Road. The following 1.2 kilometres would diverge to the north, allowing space for the westbound rest area and for the turning curve to be increased
- Jenolan Caves Road intersection. The proposed alignment would diverge to allow the existing highway to be used as a service road to access Jenolan Caves Road, Old Bathurst Road and Blackmans Creek Road
- Jenolan Caves Road to Forty Bends. This section of about three kilometres would reduce the number of and ease thecurves as well as reduce the steep grades on a new alignment, allowing the existing highway to be used as a service road for access to properties.

The proposed alignment would be constructed to a design speed of 110 kilometres per hour from Little Hartley to about 750 metres east of the Service Road 8 connection, then 100 kilometres per hour to McKanes Falls Road and 80 kilometres per hour to Lithgow. The posted speed limit would be 100 kilometres per hour from Little Hartley to about Forty Bends Road (eastern junction), then 90 kilometres per hour to McKanes Falls Road and 80 kilometres per hour from McKanes Falls Road to Lithgow.

The proposed alignment would have 3.5 metre wide lanes, with shoulders of about 2.5 metres and a maximum grade of 6.75 per cent. The central median would be of varying widths from three to 11 metres, and would consist of both pavement or vegetated areas along the alignment.

Bridges

The proposal would require the construction of seven bridges structures and the upgrading of one bridge, as summarised in Table 3-3.

Table 3-3 Proposed bridges

Bridge	Description
Little Hartley to River Lett Hill	
Service Road 1 bridge	The bridge is located where the proposed Service Road 1 crosses over the proposed new highway. The bridge would be about 70 metres long and 12 metres wide and one lane in each direction, comprising a two span precast Super T girder with a central pier located in the Great Western Highway median.
Service Road 3 bridge	The bridge is located where the proposed Service Road 3 crosses over the proposed new highway. The bridge would be about 75 metres long and 13 metres wide and one lane in each direction, comprising a two span precast Super T girder with a central pier located in the Great Western Highway median.
Coxs River Road	
Coxs River Road bridge	The bridge is located where the proposed Great Western Highway alignment crosses under Coxs River Road. The bridge would be about 80

Bridge	Description
	metres long and 11 metres wide and one lane in each direction, comprising a two span precast Super T girder with a central pier located in the Great Western Highway median.
River Lett Hill to Forty Bends	
River Lett twin bridges	The twin bridges are located where the proposed new highway passes over River Lett. The bridges would be about 80 metres long and 12 metres wide and provide two lanes each direction, comprising three span precast Super T girders with piers located outside of the watercourse.
River Lett existing bridge refurbishment	The existing bridge over River Lett would be retained for use as a local service road connected to Off Ramp 1. The existing fascia panels would be removed and barriers upgraded.
Jenolan Caves Road twin bridges	The twin bridges are located where the proposed new highway passes over Boxes Creek, Blackmans Creek Road and Jenolan Caves Road. The bridges would be about 370 metres long and 12 metres wide and two lanes each direction, comprising eleven span precast Super T girders.

Intersections

The proposal would require the construction, upgrade and/or adjustment of local road, service road and connecting road intersections, as summarised in Table 3-4.

Table 3-4 Proposed intersection upgrades

Intersection	Description
Little Hartley to River Lett Hill	
Great Western Highway and eastbound rest area	Single eastbound exit lane into rest area. Exist via Connecting Road 4 T intersection.
Great Western Highway and Connecting Road 4	Left in movement with dedicated left hand turn lane from Great Western Highway eastbound. Left out movement to dedicated lane, then merge onto Great Western Highway eastbound.
Connecting Road 5 and Service Road 3	T intersection with all movements permitted.
Connecting Road 5 and westbound rest area	T intersection with all movements permitted.
Coxs River Road	
Great Western Highway and Connecting Road 2	Left in movement with dedicated left hand turn lane from Great Western Highway westbound. Left out movement to merge onto Great Western Highway westbound.
Coxs River Road and Connecting Road 2	T intersection with all movements permitted.
Great Western Highway and Connecting Road 3	Left in movement with dedicated left hand turn lane from Great Western Highway eastbound. Left out movement to merge onto Great Western Highway eastbound.

Intersection	Description
Connecting Road 3 and Service Road 2	T intersection with all movements permitted.
Great Western Highway and Baaners Lane	Seagull intersection with all movements permitted.
Service Road 2 and Browns Gap Road	T intersection with all movements permitted.
River Lett Hill to Forty Bends	
Great Western Highway and Kelly Street	Left in movement with dedicated left hand turn lane from Great Western Highway eastbound. Left out movement to merge onto Great Western Highway eastbound.
Great Western Highway Off Ramp 1	Single lane off ramp from Great Western Highway westbound.
Great Western Highway Off Ramp 1 and Old Great Western Highway	Left in movement with dedicated left hand turn lane from Great Western Highway Off Ramp 1 westbound. Right in movement from Great Western Highway Off Ramp 1 eastbound.
Great Western Highway Off Ramp 1 and Blackmans Creek Road	T intersection with all movements permitted.
Great Western Highway and Service Road 6	Single eastbound exit lane into Service Road 6.
Great Western Highway On Ramp 1	Single lane on ramp from Service Road 6 to Great Western Highway eastbound.
Great Western Highway Off Ramp 1 and Service Road 6 / Jenolan Caves Road	T intersection with all movements permitted.
Great Western Highway On Ramp 2	Single lane on ramp from Jenolan Caves Road to Great Western Highway westbound.
Great Western Highway and Service Road 8	Left in movement with dedicated left hand turn lane from Great Western Highway westbound. Left out movement to merge onto Great Western Highway westbound. Right in movement from dedicated lane on Great Western Highway eastbound.
Great Western Highway and Service Road 10	Left in movement with dedicated left hand turn lane from Great Western Highway eastbound. Left out movement to merge onto Great Western Highway eastbound. Right in movement from dedicated lane on Great Western Highway westbound.
Forty Bends to Lithgow	
Great Western Highway and Forty Bends Road (eastern junction)	Left in, left out movement from Great Western Highway westbound.
Great Western Highway and Forty Bends Road (western junction)	Seagull intersection with all movements permitted.

Intersection	Description
Great Western Highway and McKanes Falls Road	Seagull intersection with all movements permitted.
Great Western Highway and Service Road 11	Left in, left out movement from Great Western Highway westbound.
Great Western Highway and Old Bathurst Road	Seagull intersection with all movements permitted.
Great Western Highway and Service Road 12	Left in, left out movement from Great Western Highway eastbound.
Great Western Highway and Service Road 13	Left in, left out movement from Great Western Highway eastbound.
Great Western Highway and Mudgee Street	Seagull intersection with all movements permitted.

Service roads and property access

The proposal would involve creation of 10 service roads, as summarised in Table 3-5, to minimise direct access to the Great Western Highway from adjacent properties.

Property access would be maintained throughout construction and operation of the proposal, although some access may be relocated or reinstated to tie into new road levels, as shown in Figure 3-1.

Table 3-5 Proposed service roads

Service Road	Description
Little Hartley to River Lett Hill	
Service Road 1	New road. Accessed via Coxs River Road. Aligned adjacent to the Great Western Highway on the northern side.
Service Road 3	New road. Accessed via Connecting Road 4 for eastbound traffic and Connecting Road 5 for westbound traffic. Allows for Mid Hartley Road and Carroll Drive intersections to remain in their current state.
Coxs River Road	
Service Road 2	New road with some overlap of the existing Great Western Highway alignment. Accessed via Connecting Road 3. Aligned adjacent to the Great Western Highway on the northern side. Allows for Brows Gap Road intersection upgrade.
River Lett Hill to Forty Bends	
Service Road 6	Existing Great Western Highway alignment. Accessed via Great Western Highway Off Ramp 1, Jenolan Caves Road and Great Western Highway Off Ramp 2. Allows for maintained property access.
Service Road 8	New tie in to Great Western Highway westbound, then utilises existing Great Western Highway alignment to allow for maintained property access. Cul-de-sac proposed at eastern end of service road.

Service Road	Description
Service Road 9	New road. Adjoins the existing Great Western Highway alignment north of the proposed highway to allow for property access.
Service Road 10	New tie in to Great Western Highway, then utilises existing Great Western Highway alignment to allow for maintained property access.
Forty Bends to Lithgow	
Service Road 11	New tie in to Great Western Highway westbound to allow for maintained property access.
Service Road 12	New road. Adjoins the existing Great Western Highway alignment eastbound north of the proposed highway to allow for property access.
Service Road 13	New road. Adjoins the existing Great Western Highway alignment eastbound north of the proposed highway to allow for property access.

Batters and retaining walls

Batter slopes and earthworks have been designed in accordance with the proposal design criteria. Batter slopes are predominantly 2:1 except in areas of low cut and fill where 4:1 batters can be accommodated. The development of the road design has considered cut and fill earthworks balance and the need to provide an alignment that is well suited to the undulating topography. Benches for earthworks (i.e. a series of horizontal steps) would be provided where:

- A cut or fill batter steeper than 2:1 is higher than seven metres
- A cut or fill batter of 2:1 or flatter is higher than 10 metres.

There are nine retaining walls required for the proposal, as summarised in Table 3-6.

Table 3-6 Proposed retaining walls

Retaining wall	Description
Coxs River Road	
RS11	Located on the Great Western Highway eastbound. Soldier piled wall with precast concrete facing panel about 5 metres high and 150 metres long.
River Lett Hill to Forty Bends	
RS21	Located on the Great Western Highway westbound. Soldier piled wall with precast concrete facing panel about 3 metres high and 75 metres long.
RS22	Located on the southern side of Off Ramp 1. L-shape concrete cantilever wall about 4.5 metres high and 80 metres long.
RS23	Located on the Great Western Highway westbound, east of the Jenolan Caves Road twin bridges. Reinforced soil wall about 8.5 metres high and 270 metres long.
Forty Bends to Lithgow	

Retaining wall	Description
RS31	Located on the Great Western Highway eastbound at the intersection with McKanes Falls Road. Soil nail wall with gabion basket facing about 285 metres long.
RS32	Located on the Great Western Highway eastbound, west of the McKanes Falls Road intersection to the Service Road 12 intersection. Soil nail wall with gabion basket facing about 600 metres long.
RS33	Located on the Great Western Highway eastbound, west of the Service Road 12 intersection to the Service Road 13 intersection. Soil nail wall with gabion basket facing about 315 metres long.
RS34	Located on the eastern side of Service Road 12. Soil nail wall with gabion basket facing about 200 metres long.
RS35	Located on the Great Western Highway westbound, north of the Old Bathurst Road intersection. Reinforced concrete cantilever fill wall with designer block facing about 225 metres long.

Drainage

Provision of cross and longitudinal drainage would be required for the proposal. This would include upgrades to existing pipes and culverts where feasible, as well as new drainage infrastructure for new sections of road, provision of scour protection and pit and pipe drainage where gutters are proposed. Structural culverts are described in Table 3-7. Drainage outlets would discharge to open channels, water quality basins or existing waterways depending on the quality of the runoff.

Table 3-7 Proposed structural culverts

Culvert	Description
Little Hartley to River Lett Hill	
CULBR19	Extension of the existing two cell 3.6 metre by 2.4 metre box culvert at Rosedale Creek.
River Lett Hill to Forty Bends	
CUL26.39	Single 3.3 metre by 3.3 metre reinforced concrete box culvert that is a combined fauna crossing and culvert located about 180 metres east of Off Ramp 1.
CULBR20	Extension of the existing four cell 2.7 metre by 2.7 metre box culvert at Boxes Creek.
CUL28.48	Single 3.3 metre by 3.3 metre reinforced concrete box culvert that is a combined fauna crossing and culvert located at Off Ramp 2.
CUL30.21	Single 3.3 metre by 3.3 metre reinforced concrete box culvert that is a combined fauna crossing and culvert located about 65 metres west of the Service Road 8 intersection.

Water quality treatment infrastructure

Construction phase sediment basins and permanent dry biofiltration basins are proposed to ensure runoff meets the relevant water quality criteria. ISome temporary sediment basins would be converted to permanent dry biofiltration basin at the completion of construction.

Sediment and biofiltration basins are shown in Figure 3-1 and summarised in Table 3-8.

Table 3-8 Temporary sediment basins and permanent biofiltration basins

Basin	Description
Coxs River Road	
B22400L	520 cubic metre construction sediment basin that would be converted to a 600 square metre (base) permanent dry biofiltration basin after construction is completed
B22780L	700 cubic metre construction sediment basin that would be converted to a 500 square metre (base) permanent wet biofiltration basin after construction is completed
B22925L	720 cubic metre construction sediment basin.
B23080L	250 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B23740L	620 cubic metre construction sediment basin.
B23900L	300 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B24125L	480 cubic metre construction sediment basin.
B24210L	250 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B24400L	300 cubic metre construction sediment basin.
River Lett Hill to Forty Bends	
B26550R	100 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B26920R	100 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B27040L	100 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B27680L	1300 cubic metre construction sediment basin that would be converted to a 350 square metre (base) permanent dry biofiltration basin after construction is completed.
B28400L	2975 cubic metre construction sediment basin that would be converted to a 670 square metre (base) permanent dry biofiltration basin after construction is completed.
B30220L	685 cubic metre construction sediment basin.
B301150L	400 square metre (base) permanent dry biofiltration basin.

Basin	Description
B30400L	540 cubic metre construction sediment basin.
B30880L	485 cubic metre construction sediment basin that would be converted to a 200 square metre (base) permanent dry biofiltration basin after construction is completed.
Forty Bends to Lithgow	
B3470L	200 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B3442L	175 square metre (base) permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B3398L	510 cubic metre construction sediment basin that would be converted to a 200 square metre (base) permanent dry biofiltration basin after construction is completed.
B3362L	460 square metre construction sediment basin that would be converted to a 300 square metre (base) permanent dry biofiltration basin after construction is completed.
B3330L	220 square metre permanent dry biofiltration basin. Basin would be utilised as a sediment basin during construction.
B3182L	Existing 1980 cubic metre permanent dry biofiltration basin. The existing 35 metre long swale would require widening of its base width to 4 metres.
B3142L	Existing 900 cubic metre permanent dry biofiltration basin. The existing 70 metre long swale would require widening of its base width to 4 metres.
B3112L	Existing 350 square metre (base) permanent dry biofiltration basin may be upgraded. This would be determined as design progresses.

Fauna crossing structures

There are three proposed fauna crossing culverts within the River Lett Hill to Forty Bends Section, as described in Table 3-7 and shown in Figure 3-1. Existing fauna crossings within the Forty Bends to Lithgow Section would be maintained.

Design of underpasses would be in accordance with *Wildlife Connectivity Guidelines: Managing wildlife connectivity of road projects (draft)* (Roads and Maritime, 2011) and best available knowledge from other Transport projects.

Roadside furniture

Roadside furniture, including safety barriers, fencing, signposting, line marking and lighting, that would be installed or modified for the proposal are described below.

Safety barriers

The following types of safety barriers are proposed:

- Wire rope safety barrier for nearside shoulder treatments and mainline median consistent with existing conditions where earthworks are not constrained
- Steel rail safety barrier for nearside shoulder treatments in constrained locations and bridge barrier transitions
- Type F concrete barrier in constrained locations in the mainline median such as narrow medians and bridge abutments
- High containment safety barrier compliant with MASH TL4 load rating in areas of the Forty Bends to Lithgow Section that are narrow with a known risk of black ice formation
- Temporary safety barriers are to be used as part of the staging strategy to control access and delineate the construction work area in accordance with the staging arrangements.

Fencing

Rural boundary fencing is proposed around the carriageway. Where the existing boundary fencing of adjacent properties is impacted, it would be reinstated in consultation with property owners.

Fauna fencing would be installed in wildlife connectivity areas to reduce the risk of vehicle strike and fauna mortality as well as guide fauna towards fauna crossing structures.

Signposting

The signposting scheme for the proposal would provide clear and unambiguous direction and information to motorists, achieving a safe and compliant design. Signs would be installed to enforce road rules and regulations, indicating items such as the direction of travel, posted speed limits, and parking restrictions. Directional signs would also be provided to advise of key destinations, places of interest and through routes.

Line marking

Line marking would be provided in accordance with Transport's design and construction specifications. The proposed line marking would comprise of longitudinal markings (lane lines, edge lines, continuity lines), transverse markings (stop/hold lines, give way lines), posted speed numerals and pavement arrows to provide clear driver information. Symbols, lettering and numerals would be clearly drawn at a size that is easily readable from a distance while travelling at the nominated speed limit.

Lighting

Lighting is not required on the main carriageway but would be provided at intersections and connecting roads for safety reasons as required. In the Forty Bends to Lithgow Section, lighting provided in the 2017 road upgrade will be upgraded from 150 Watt HPS luminaires to 100 Watt LED luminaires.

Hartley Valley Rest Areas

There are two rest areas included as part of the proposal, referred to as the Hartley Valley Rest Areas. The rest areas are located within the Little Hartley to River Lett Section, one eastbound and one westbound as seen in Figure 3-1. These rest areas will have provisions for both light and heavy vehicles, as well as facilities including restrooms and picnic tables with seating.

Intelligent Transport Systems infrastructure

The existing communications infrastructure would be utilised for the Intelligent Transport Systems (ITS) power and communications, however conduits have been provided for the full extent of the Great Western Highway to facilitate the future provision of ITS infrastructure.

Shared paths

Design development has considered the future development of shared paths in the vicinity of the proposal. The alignment and structure of the future shared paths would be developed and finalised during future design development and in consultation with Lithgow City Council and other relevant stakeholders. An indicative route is provided in Appendix R.

3.3 Construction activities

This section describes how the proposal would be constructed. The methodology presented in this section would be refined during further design development.

The proposal construction footprint is shown in Figure 3-3. The areas highlighted in orange would be used as ancillary facilities, as detailed in Section 3.4.

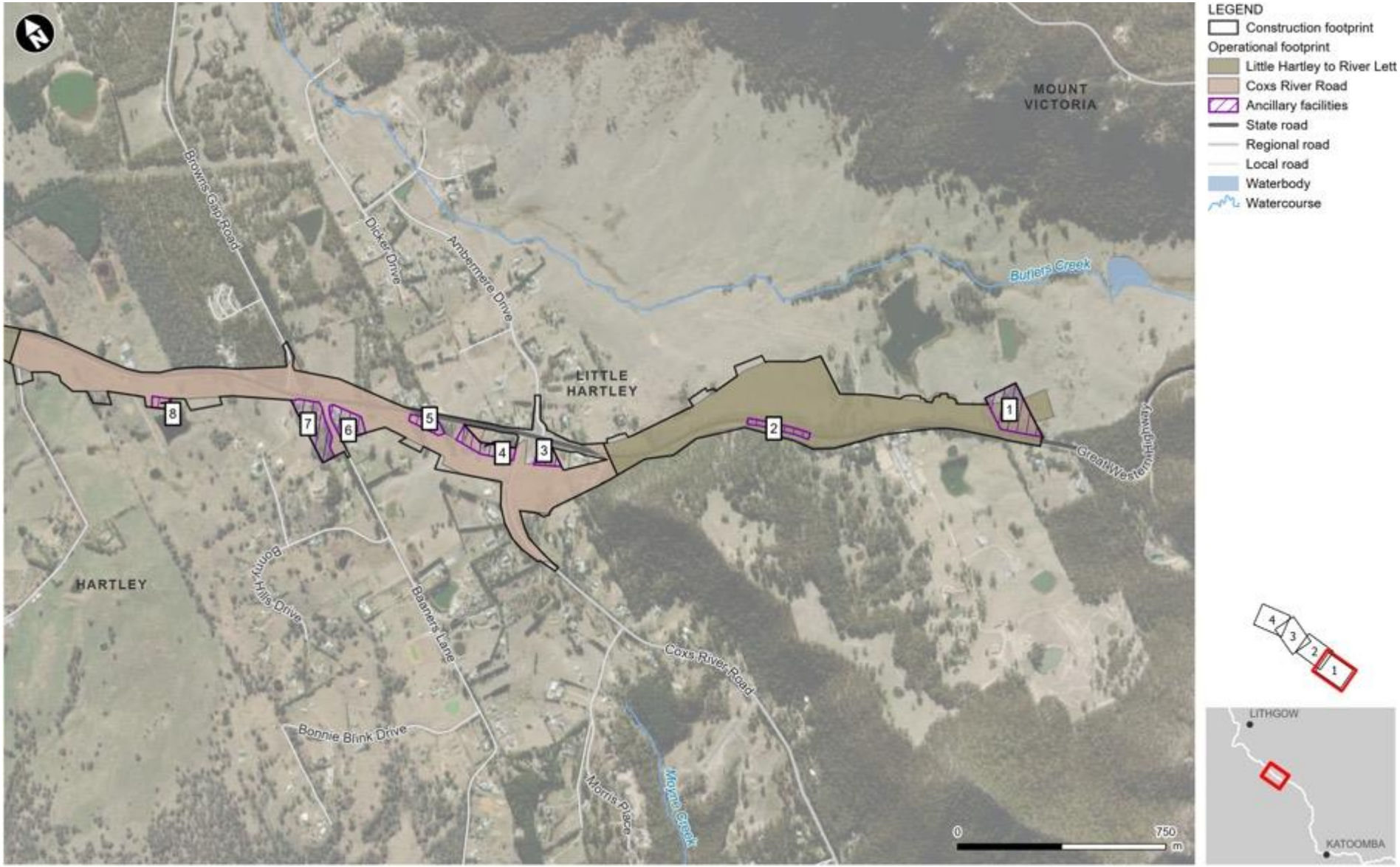

Figure 3-3 a Proposal construction footprint

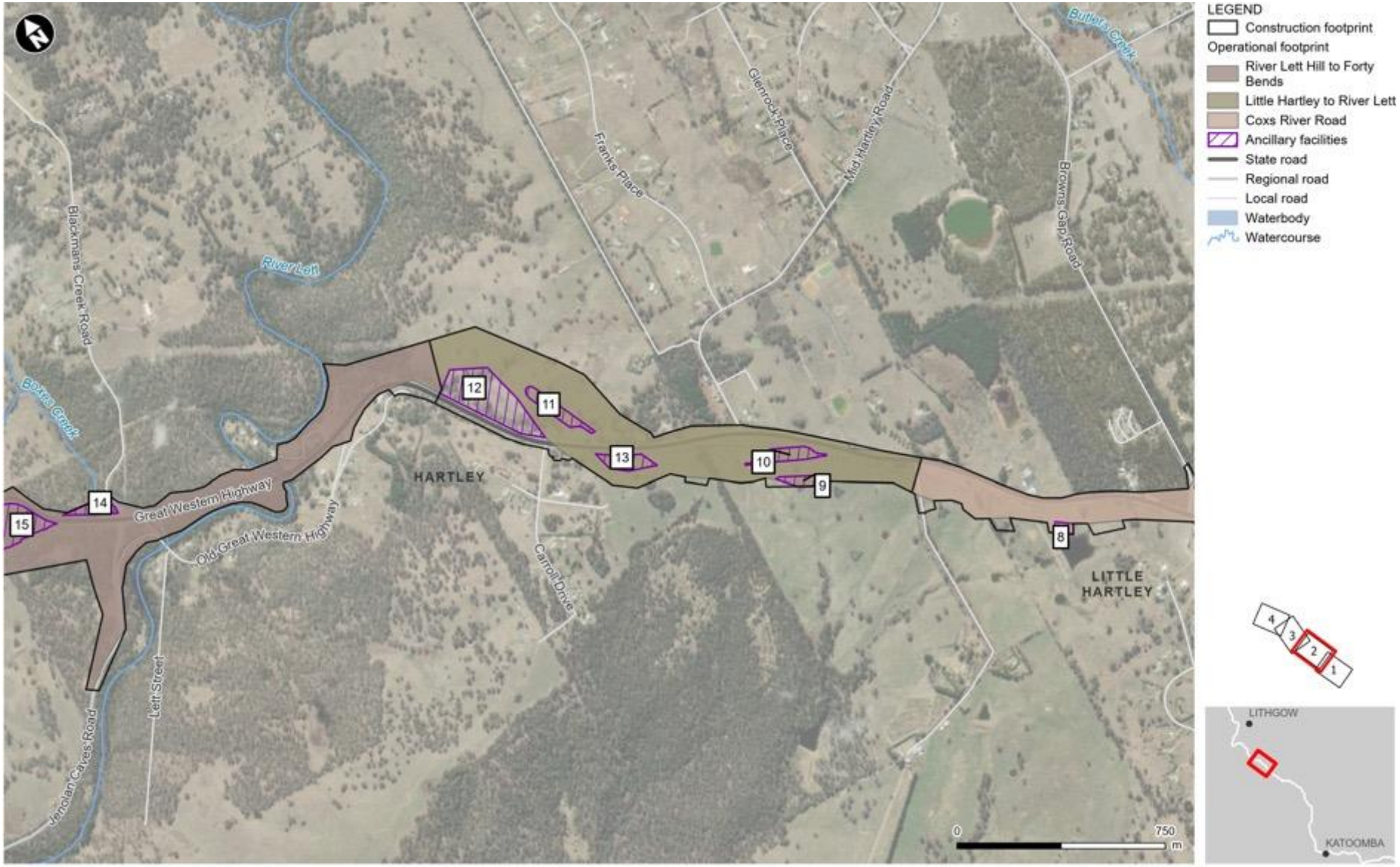

Figure 3-3 b Proposal construction footprint

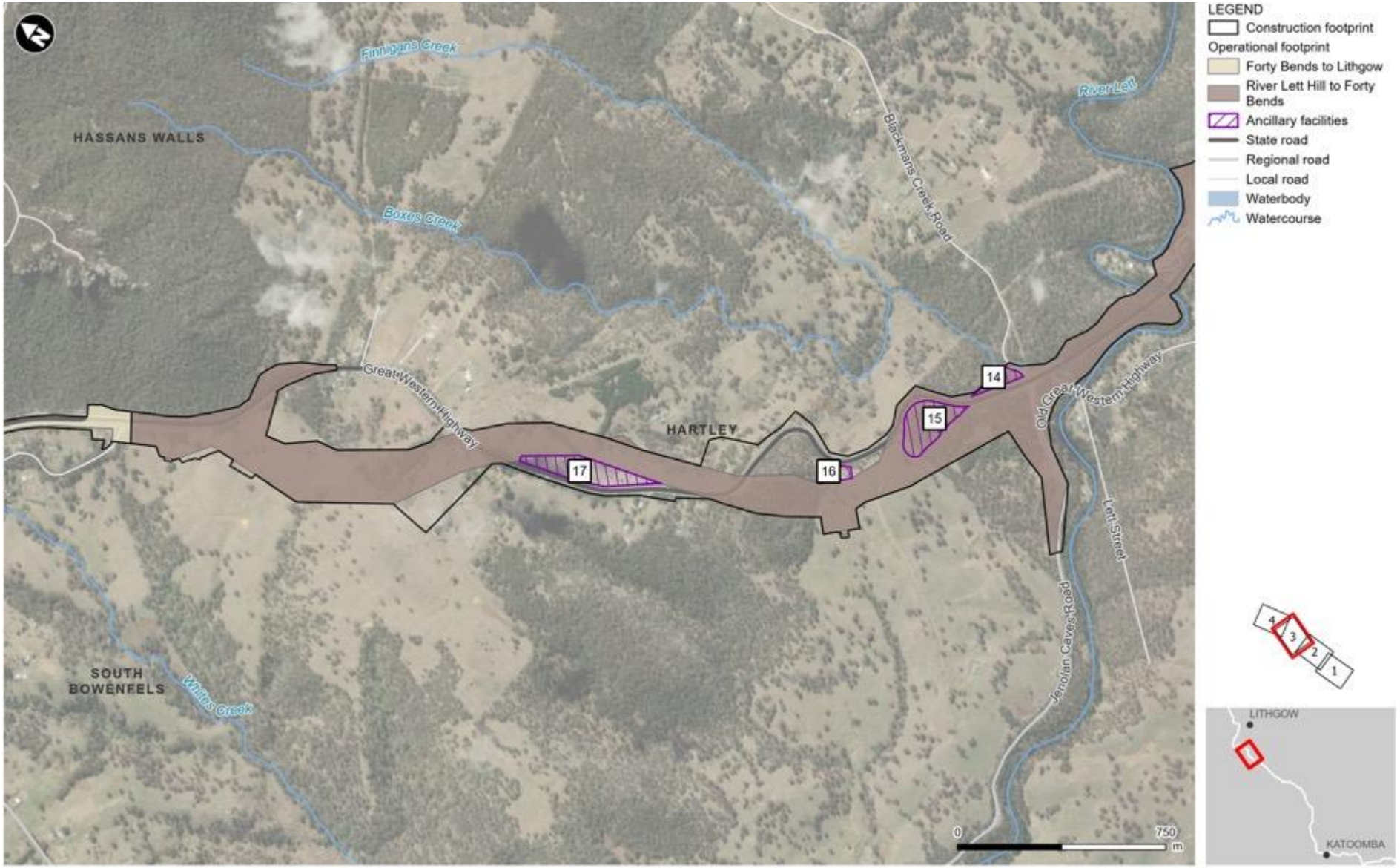

Figure 3-3 c Proposal construction footprint

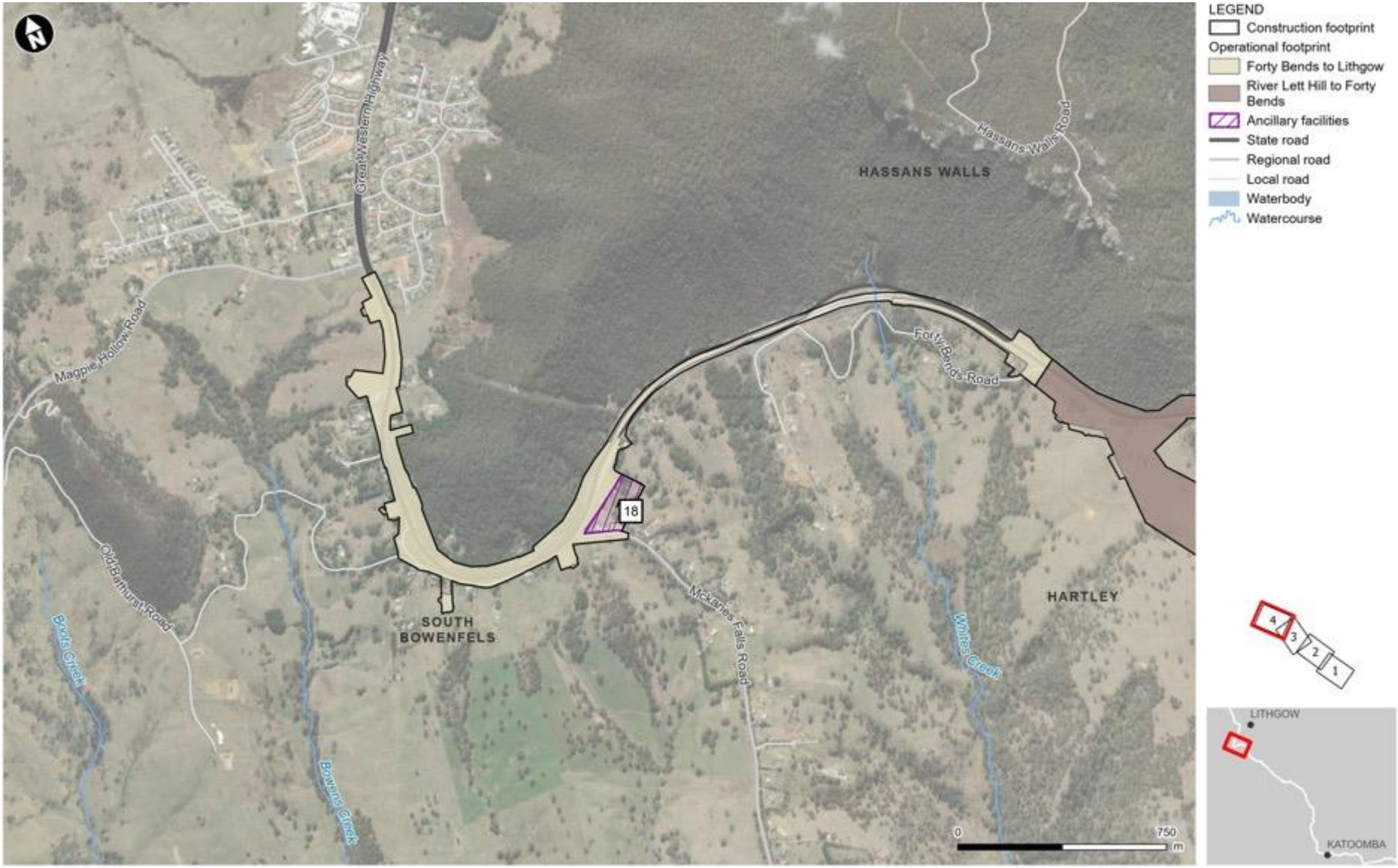

Figure 3-3 d Proposal construction footprint

3.3.1 Work methodology

Indicative construction work methodologies are provided below. Detailed construction work methodologies would be identified by the construction contractor following award of the tender. Construction activities would be carried out in accordance with a Construction Environmental Management Plan (CEMP) to ensure work complies with Transport's commitments and legislative requirements.

Construction staging

Detailed construction staging strategy reports have been prepared for each section of work (JAJV, 2021). Construction at each section of the proposal would generally involve the sequence of activities described in Table 3-9. A summary of the construction staging for each section are provided in Table 3-10 to

Table 3-13. The staging presented has been prepared to demonstrate that the works can feasibly and practically undertaken but may well be modified by the construction contractor following award of tender.

Table 3-9 Indicative construction activities

Construction phase	Typical activities
Pre-construction and early works	• Demarcation of construction footprint with construction fencing and
Site establishment	• Pre-clearing biodiversity surveys • Vegetation clearing and grubbing • Mobilisation and establishment of ancillary facilities as described in Section 3.4 and shown in Figure 3-3.
Construction	• Works as described in Table 3-10, Table 3-11, • • Table 3-12 and • Table 3-13.
Finishing work	• Rehabilitation of disturbed areas and landscaping in accordance with the urban design and landscape plan • Installation of safety barriers, street lighting, fencing and other roadside furniture • Decommission and rehabilitation of ancillary facilities

Table 3-10 Little Hartley to River Lett Hill Section construction staging

Stage	Site	
	East	West
1	Construction of Service Road 1 and sections of the new Great Western Highway that are offline from the existing Great Western Highway. • Clearing and grubbing • Environmental management measures implementation • Bulk Earthworks, including importing large fill volumes • Drainage and pavements for the Great Western Highway and Service Road 1 • Bridge over the Great Western Highway on Service Road 1 • Culvert extension of existing two cell 2.4 metre by 3.6 metre wide box culvert (CULBR19) Stage 1 East works would ideally commence during the Coxs River Road section works.	Construction of Service Road 3 and sections of the new Great Western Highway that are offline from the existing Great Western Highway. • Clearing and grubbing • Environmental management measures implementation • Bulk Earthworks, including excess excavated material • Drainage and pavements • Bridge over the Great Western Highway on Service Road 1 Stage 1 West works would commence concurrently with Stage 1 East works.
2	Construction of the section of the new Great Western Highway that overlaps the existing Great Western Highway. • Switch traffic to Service Road 1 • Clearing and grubbing • Environmental management measures implementation • Bulk earthworks • Drainage and pavements for the Great Western Highway.	Construction of the section of the new Great Western Highway that overlap the existing Great Western Highway. • Switch traffic to Service Road 1 • Clearing and grubbing • Environmental management measures implementation • Bulk earthworks • Drainage and pavements for the Great Western Highway.
3	• Final traffic switch only new Great Western Highway • Tie-in to River Lett Hill to Forty Bends Section and Coxs River Road Section • Landscaping • Final pavement markings.	

Table 3-11 Coxs River Road Section construction staging

Stage	Site			
	Overall	Coxs River Road	Browns Gap Road	Banners Lane
1	• Clearing and grubbing • Environmental management measures implementation • Provide access to Hartley Café from Browns Gap Road • Bulk earthworks • Drainage and pavement • Construction of Service Road 2 to facilitate offline construction of the proposal. At the completion of Stage 1, traffic would be switched onto Service Road 2 with connections to Browns Gaps Road and Baaners Lane.	No works occurring.	• Construct Service Road 2 to final levels with the exception of Browns Gap Road alignment • Temporary road closure at Browns Gap Road would be required to construct the new Browns Gap Road connection. Traffic would be detoured via Mid Hartley Road • Switch traffic onto new Browns Gap Road and Service Road 2.	• Temporary connection between Baaners Lane and Service Road 2.
2	• Clearing and grubbing • Environmental management measures implementation • Bulk earthworks • Drainage and pavement • Construct bridge over the Great Western Highway on Coxs River Road • Retaining wall works adjacent to the Lolly Bug • Maintain property accesses.	• Maintain connectivity with the existing highway and properties • Construct offline sections of new Coxs River Road and bridge • Construct temporary side-track adjacent to Coxs River Road • Switch traffic onto temporary side-track and reduce posted speed to 40 kilometres per hour to construct Coxs River Road connection	No works occurring. All works completed.	• Construct new Great Western Highway to final levels with the exception of Baaners Lane alignment • Construct temporary side-track in adjacent lot • Switch traffic onto temporary side-track and reduce posted speed to 40 kilometres per hour to construct Baaners Lane connection

Stage	Site			
	Overall	Coxs River Road	Browns Gap Road	Banners Lane
	At the completion of Stage 2, the traffic would continue on Service Road 2.	• Switch traffic onto new Coxs River Road.		• Switch traffic onto new Baaners Lane.
3	Provide local road and property access across the Coxs River Road Section to the existing Great Western Highway or Service Road 2. The completed Great Western Highway mainline would remain closed to traffic until the Little Hartley to River Lett Hill Section is completed.			

Table 3-12 River Lett Hill to Forty Bends Section construction staging

Stage	Site			
1	1 Hartley Historic Village	2 River Lett to Jenolan Caves Road	3 River Lett Hill	4 Top of River Lett Hill
	• Retaining wall works adjacent to the Royal Hotel (RS21) • Pavement works adjacent to RS21 • New access to Hartley Historic Village • Adjustment to westbound lane and shoulders to provide additional width for adjacent construction.	• Off Ramp 1 construction • Retaining wall works adjacent to Off Ramp 1 (RS22) • Extension of existing culvert at Boxes Creek (CULBR20) • Temporary connection between Off Ramp 1 and the existing Great Western Highway north of Blackmans Creek Road • Piles and pile capes for piers 7 and 8 of the twin bridges over Jenolan Caves Road (BR32)	Construction of a temporary connection road and supporting retaining wall on the northern side of the proposed Great Western Highway to be used during Stage 2 to divert traffic off the existing highway, permitting the decommissioning of the existing highway and allowing unimpeded construction access along the new highway corridor.	Construction of Service Road 8 Temporary access road between the existing Great Western Highway and Service Road 8
2	1		2	

Stage	Site	
	East of Jenolan Caves Road	**West of Jenolan Caves Road**
	• Embankment construction • Excavation of various cuttings on approaches to bridges • Temporary median pavement for cross over to be used during Stage 3 • Temporary pavement/access road for left turn into Hartley Historic Village and access to Off Ramp 1 • Retaining wall works on the eastern approach of the twin bridges over Jenolan Caves Road (RS23) • Construction of the twin bridges over River Lett (BR31) • Construction of the twin bridges over Jenolan Caves Road (BR32) • Construction of combined drainage and fauna culvert (CUL26.39).	• Embankment construction • Excavation of large cuttings on River Lett Hill • On Ramp 1 and On Ramp 2 construction • Off Ramp 2 construction • On Ramp • Retaining wall works adjacent to Service Road 6 (RS34) • Construction of combined drainage and fauna culverts (CUL28.48, CUL30.21) • Temporary pavement connection between Service Road 6 and the Great Western Highway ramps.
3A	**1** **Eastern limit of works to River Lett**	**2** **Service Road 10 to Forty Bends**
	• Off Ramp 1 construction • Construction of the westbound carriageway	• Construction of Service Road 10 • Construction of the eastbound carriageway. Once completed, these works would allow access for the construction of Service Road 9 in Stage 3B.
3B	**1** **Hartley Historic Village**	**2** **River Lett Hill**
	• Construction of the westbound carriageway • Removal of the temporary pavement	• Removal of the temporary Great Western Highway connection • Construction of Service Road 9
3C	**1** **Twin bridges over Jenolan Caves Road**	

Stage	Site
	• Removal of temporary Off Ramp 1 connection • Construction of Jenolan Caves Road • Construction of Off Ramp 1 between the box culverts and Jenolan Caves Road • Construction of Service Road 6 and final pavement connections to the on and off ramps • Construction of Blackman's Creek Road • Removal of abandoned pavements, leveling and finishing works at the Jenolan Caves Road intersection.

Table 3-13 Forty Bends to Lithgow Section construction staging

Stage	Site			
	1 Forty Bends: Added lane in verge	2 Forty Bends: Added lane in median	3 South Bowenfels: Eastern Section	4 South Bowenfels: Western Section
1	All proposed works within Site 1 would be completed in Stage 1. • Construction of temporary median crossover would be constructed to allow for general traffic to flow onto the westbound carriageway (ie into Site 2) and allow single lane traffic flow in both directions • Concrete pavement reconstruction and widening along the westbound verge	No works occurring. Site 2 would be used for single lane traffic flow in both directions to allow for construction at Site 1.	• Construction of about 225 metres of new permanent pavement and gutter and about 155 metres of temporary pavement to allow for traffic diversion and enable Stage 2 and 3 works to be completed safely • Offline construction of the new eastbound carriageway, including earthworks to enable carriageway widening and securing cut retaining walls with a gabion facing (ie wire mesh cage with rocks or stones).	• Construction of two sections of temporary pavements pavement to allow for traffic diversion and enable Stage 2 and 3 works to be completed safely • Earthworks, drainage and full pavement construction for the new westbound carriageway • Construction of the Mudgee Street intersection pavement and widening works • Sediment basins and erosion control provisions.

Stage	Site			
	1 Forty Bends: Added lane in verge	2 Forty Bends: Added lane in median	3 South Bowenfels: Eastern Section	4 South Bowenfels: Western Section
	• Construction of the new intersection island at Forty Bends Road • Construction of new pit and pipe drainage. Following the completion of Stage 1 at Site 1, the dual lane carriageway would be opened to traffic.			
2	No works occurring. All works completed.	• Concrete pavement reconstruction and widening along Great Western Highway eastbound median • Utilities relocation works • Construction of new island at the intersection of Forty Bends Road through the median • Construction of new pit and pipe drainage and culvert extensions.	• Traffic reduced to a single lane in each direction along the existing Great Western Highway • Completion of excavation and cut retaining walls that commenced in Stage 1 • Drainage works associated with the eastbound carriageway • Asphalt pavement works on the eastbound carriageway.	• Completion of the eastbound carriageway earthworks and property accesses • Drainage works on the eastbound carriageway • Asphalt pavement works on the eastbound carriageway.
3	No works occurring. All works completed.	No works occurring.	• Completion of westbound carriageway earthworks and property accesses • Construction of McKanes Falls Road and Old Bathurst Road intersection works	• Completion of westbound carriageway earthworks • Completion of westbound carriageway asphalt pavement works

Stage	Site			
	1 Forty Bends: Added lane in verge	2 Forty Bends: Added lane in median	3 South Bowenfels: Eastern Section	4 South Bowenfels: Western Section
			• Drainage works on the westbound carriageway • Asphalt pavement works on the westbound carriageway.	• Final pavement course and line marking.
4	No works occurring. All works completed.	Stage 4 works are proposed to be undertaken with a single lane open to traffic on each carriageway. Works would be undertaken with reduced traffic speed depending on conditions during this period. Stage 4 is the final stage of works and involve the following: • Final signage • Median island and barrier works • Remaining intersection pavement within the median • Removal of any temporary median cross overs. At the completion of Stage 4, all carriageway and intersections are completed and can be fully opened to traffic at their final posted speed.		

3.3.2 Construction workforce

The indicative construction workforce that would be required at each stage of works is described in Table 3-14.

Table 3-14 Indicative construction workforce

Section	Indicative maximum workforce required (number of full time equivalents)
Little Hartley to River Lett Hill	60 to 100
Coxs River Road	60 to 100
River Lett Hill to Forty Bends	120 to 200
Fort Bends to Lithgow	60 to 100

3.3.3 Construction hours and duration

Subject to planning approval, construction of the proposal is planned to commence in 2022 and is expected to be open by the end of 2026.

A high-level construction program has been developed during concept design development that would be refined during further design development.

The current construction staging starts with the Coxs River Road section, with a construction program of about 14 months. the Little Hartley to River Lett Hill (West) section would be constructed concurrently with the River Lett Hill to Forty Bends section, and would take about three years to complete. The Forty Bends to Lithgow section would take about 18 months to complete.

Construction hours would be in accordance with the standard construction hours as defined in the *Interim Construction Noise Guideline* (DECCW, 2009):

- 7 am to 6 pm Monday to Friday
- 8 am to 1 pm Saturday
- No work on Sundays and public holidays.

Certain construction activities that may result in traffic restrictions including bringing in oversized equipment and materials such as bridge girders and pavemnt resurfacing are likely to be carried out outside of Standard Construction Hours during night-time periods to minimise disruption to traffic and provide a safer working environment for construction workers. Any work outside of standard construction hours would be undertaken in accordance with the *Interim Construction Noise Guideline* (DECC 2009), the *Construction Noise and Vibration Guidelines* (Roads and Maritime, 2016), any road occupancy licence requirements and the environmental management measures listed in Section 7.

Potential construction work that would be carried out outside of standard construction hours is described in Table 3-15. Consultation with the community would be carried out before any work proposed to be carried out outside of standard construction hours in accordance with the proposal's community consultation strategy.

Table 3-15 Potential work outside of standard construction hours

Activity	Justification
Temporary median crossover construction	A temporary median crossover would be constructed during the Forty Bends to Lithgow section construction works to allow for general traffic to flow onto the westbound carriageway. This work would be completed out of standard construction hours to minimise road users disruption.
Utility adjustments	Some utility relocations would require work near the carriageways and crossing the carriageways. This work would need to be completed outside of standard construction hours to minimise road users disruption and maintain the safety of construction personnel.
Delivery and placement of large precast concrete components	The delivery and placement of large precast concrete components (eg bridge girders) would take place outside of standard construction hours to minimise disruptions to highway and local traffic flows and maintain the safety of construction personnel. Due to the potential safety risks to road users and construction personnel associated with operating over the existing alignment, these works would need to be undertaken at night when there are lower traffic flows. Avoiding peak periods would also minimise the disruption to traffic.
Construction of major drainage structures	Major drainage structures located beneath or near the carriageways may need to be undertaken during out of hours work to minimise the impact on road users and ensure the safety of workers involved.
Completion of tie-ins, and completion of temporary diversions and traffic switches	Large parts of the proposal would be built offline. The tie-ins would require some level adjustments and new pavement construction which would need to be built outside of standard construction hours to minimise performance and safety impacts for Great Western Highway and local road traffic.

3.3.4 Plant and equipment

The following equipment are likely to be used during construction of the proposal:

- Air compressors
- Asphalt pavers
- Asphalt profiling machines
- Backhoes
- Bitumen sprayers
- Bobcats
- Boggie trucks
- Bulldozers
- Chainsaws
- Cherry pickers
- Chipping machines
- Compactors
- Compressors
- Concrete agitator trucks
- Concrete mixers
- Concrete pavers
- Concrete pumps
- Concrete saws
- Concrete-cutting saws
- Cranes
- Crushing and screening plant

- Dewatering pumps
- Drill/boring rigs
- Dump trucks
- Elevated working platforms
- Excavators
- Flatbed trucks
- Front-end loaders
- Generators
- Graders and rollers
- Hand tools
- Hydraulic hammer
- Jack hammers
- Kerb extrusion machine
- Light commercial and passenger vehicles
- Lighting units
- Line marker
- Milling machines
- Pre-splitting equipment
- Road headers
- Road rollers
- Road sweepers
- Rock breakers
- Rock crushers
- Scrapers
- Semi-trailers and large haulage trucks
- Trenching machine
- Side Tripping Trucks
- Under-bore equipment
- Vibratory rollers
- Water carts
- Welding equipment

The plant and equipment listed would be subject to refinement of design and during the construction planning phase. Not all of the above plant and equipment would be in use at any one time, and some would only be used on an intermittent or temporary basis.

Further details of construction plant and equipment will be determined during the detailed design.

3.3.5 Earthworks

Due to the topography of the local area, a series of cut and fill earthworks would be required for each stage, as described below and summarised in Table 3-16. The majority of cuttings will be excavated by ripping, however in areas where high strength rock is encountered, blasting will be required. There are two large cuts in the River Lett to Forty Bends Section that will require blasting, as described below.

The proposal has been designed to minimise excess spoil and the need to import large quantities of fill. Overall, earthworks would require (to the nearest 1,000 cubic metres) about 1,547,000 cubic metres of excavation and about 2,273,000 cubic metres of fill. The current design would therefore require the importing of about 726,000 cubic metres.

The proposal would need to source additional earth fill material from off site to meet this deficit. The quantity and quality of required material is available from other projects and/or established quarries in the local area (refer to Section 3.3.6).

A Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the *Protection of the Environment Operations (Waste) Regulation 2014* for excavated natural material would be required to meet the conditions for excavated natural material that is, or is intended to be, for use in earthworks for the proposal.

Blasting

Construction of the deep cut through River Lett Hill will require a significant amount of blasting to remove the large volume of hard rock. A blasting specialist has been engaged and would further inform the blasting methodology, including times, road closures and diversions, as detailed design progresses. Blasting would only occur during standard construction hours (as described in Section 3.3.3) and, for safety reasons, would require all Great Western Highway traffic to be stopped for five to 15 minutes at a time for each blast. A blasting management plan would be prepared to mitigate and manage impacts of blasting as discussed in Section 6.3 Noise and vibration and Section 6.6 Soils and surface water. There is also the potential for flyrock (rock that is ejected from the blast site) to impact areas up to 500 metres from the point of each blast. A Flyrock management plan would be developed in consultation with technical specialists, as discussed in Section 6.3 Noise and vibration.

Table 3-16 Cut and fill requirements

Stage	Cut (cubic metres)	Fill (cubic metres)	Difference (cubic metres)
Little Hartley to River Lett Hill	534,000	688,000	154,000
Coxs River Road	177,000	225,000	48,000
River Lett Hill to Forty Bends	793,000	1,272,000	479,000
Forty Bends to Lithgow	43,000	88,000	45,000
Total	1,547,000	2,273,000	726,000

3.3.6 Source and quantity of materials

Construction would require various resources and materials. Typical materials that would be used for the construction of the proposal and estimated quantities are presented in Table 3-17.

The source of materials required to construct the proposal would be finalised during detailed design through the development of a construction materials and resources plan. Material source would comply with relevant Transport material quality specifications.

Table 3-17 Typical construction materials and approximate quantities

Material	Approximate quantity
Imported fill material	726,000 m^3
Imported select material	180,000 m^3
Asphalt	344,850 m^2
Concrete	339,000 m^3
Steel	4,400 T

Earthworks materials

Imported earthworks material would be required. The source of materials required to construct the proposal would be finalised by the construction Contractor through the development of a construction materials and resources plan. Where possible, materials would be sourced from the surrounding area. There are numerous quarries in Little Hartley and Lithgow, which is located within 30 kilometres of the proposal, as well as the proposed Great Western Highway Upgrade – Central Package which requires substantial excavation, that could provide suitable material.

Asphalt pavement materials

Asphalt pavement materials would be sourced from existing batch plants operating within the Lithgow City local government area and beyond. If batching plants are needed closer to the proposal, they would be established within ancillary facilities located on land owned by Transport.

Reinforced steel

Reinforcing steel for structures would be sourced from suppliers throughout Australia. The construction contractor would select a source that conforms to the quality and performance requirements of the proposal.

Concrete

A number of concrete batching plants are located near the proposal. Concrete for the bridge, pavement sub-bases and other proposal elements would be sourced from local batch plant facilities selected by the construction contractor with agitator trucks delivering to the work fronts via the haulage routes presented in Section 6.2 Traffic and Transport. If batching plants are needed closer to the proposal, they would be established within ancillary facilities located on land owned by Transport.

3.3.7 Traffic management and access

Construction of the proposal would result in a temporary increase in heavy vehicle movements along the Great Western Highway and nearby local roads. Construction traffic associated with the proposal at all construction stages would generate a range of vehicle type movements including cars, light and heavy trucks and concrete trucks. Construction vehicle traffic would be greatest during the main earthworks and road pavement construction stages, and would comprise vehicles transporting equipment, materials and spoil and construction workers accessing the work sites.

Construction of the proposal would be subject to comprehensive traffic management measures to ensure the ongoing functionality of the Great Western Highway and local roads, and the safety of members of the public, motorists and construction workers.

Temporary Traffic management arrangements

Temporary construction traffic management arrangements would be required in each section of the proposal. The construction staging strategy reports prepared for each section of work (JAJV, 2021) provide an overview of the temporary construction traffic management arrangements. In particular, there are two road closures required during certain stage of construction:

- Coxs River Road - road closure of Browns Gap Road would be required to construct the new pavement at the intersection of Service Road 2 and Browns Gap Road. Detoured traffic would utilise Mid Hartley Road to reconnect to the Great Western Highway northwest of the Browns Gap Road and Great Western Highway intersection
- River Lett Hill to Forty Bends - blasting would require temporary closures of the existing highway to maintain safety. All Great Western Highway traffic would be stopped for five to 15 minutes at a time for each blast.

Detailed arrangements would be developed during construction planning and described in a traffic management plan.

Construction vehicle movements and haulage routes

High level estimated daily construction light and heavy vehicle movements are presented in Table 3-18.

Mass haulage of materials would be undertaken within the construction site by off-road vehicles. Where it is not feasible to use off-road vehicles, mass haulage will be carried out with on-road vehicles using the existing Great Western Highway. Some haulage would take place on local roads between the ancillary facilities. Internal access roads would provide vehicle access between work sites and ancillary facilities.

Controlled construction would use controlled construction traffic entry and exit points and these would be minimised. The use of the existing highway would be restricted at peak hours, especially during holiday periods. This may require the introduction of temporary traffic management measures, which would be determined in the construction traffic management plan for the proposal (as discussed in Section 6.2 Traffic and Transport).

Table 3-18 High-level estimated daily construction vehicles movements

Section	Estimated daily construction vehicle movements in the Great Western Highway		
	Light vehicles	Heavy vehicles	Total
Little Hartley to River Lett Hill	200	320 to 420	520 to 620
Coxs River Road	200	167 to 487	367 to 687
River Lett Hill to Forty Bends	400	218 to 450	618 to 850
Forty Bends to Lithgow	200	88 to 450	288 to 650

Public and active transport arrangements

Existing public and active transport provisions would be maintained throughout construction of the Little Hartley to River Lett Hill stage of the proposal.

Property access arrangements

Access to residences, businesses and roads would be maintained during construction of the proposal. Any unavoidable temporary access closures would only be carried out following appropriate planning and consultation with the property owners.

3.4 Ancillary facilities

A number of ancillary facilities would be required to support the proposal construction. These ancillary facilities would include, but not be limited to:

- Portable buildings with amenities (such as lunchrooms and toilets)
- Secure and bunded storage areas for hazardous materials, including fuels and chemicals
- Dedicated stockpile sites
- Plant and equipment laydown areas
- Concrete and asphalt batching plants

- Office space
- Parking.

The selection criteria used to identify ancillary facility locations included, in order of priority:

- Sites located within or directly adjacent to the proposal construction footprint
- Sites to be located on land owned/acquired by Transport
- Sites that can be leased from Lithgow City Council
- Sites that can be leased from private property owners.

Eighteen locations have been identified for ancillary facilities, as summarised in Table 3-19 and shown in Figure 3-4. The potential environmental impacts associated with the ancillary facilities are assessed in Section 6. The location of any batching plants (if required) would be identified during construction planning and further assessment of potential impacts undertaken at this stage.

Table 3-19 Ancillary facilities

Ancillary facility	Lot and DP	Area (square metres)	Proposed use
Little Hartley to River Lett Hill (east)			
1	Lot 360 DP 751644	20,000	• Construction Compound • Stockpile • Eastern turnaround area
2	Existing Road Reserve	500	• Stockpile • Laydown and Storage
Coxs River Road			
3	Existing Road Reserve	5,000	• Construction Compound • Stockpile • Laydown and Storage
4	Lot 23 DP 837440	9,500	• Construction Compound • Stockpile • Laydown and Storage
5	Lot 1 DP 416067	9,500	• Construction Compound • Stockpile • Laydown and Storage
6	Lot 6 DP 1192566	10,000	• Construction Compound • Stockpile • Laydown and Storage
7	Lot 7 DP 1192566	16,600	• Construction Compound • Stockpile

Ancillary facility	Lot and DP	Area (square metres)	Proposed use
			• Laydown and Storage
8	Lot 14 DP 1192566	2,500	• Stockpile • Laydown and Storage
Little Hartley to River Lett Hill (west)			
9	Lot 15 DP 880798	5,100	• Stockpile • Laydown and Storage
10	Lot 15 DP 880798	8,650	• Stockpile • Laydown and Storage
11	Lot 11 DP 1192695	42,000	• Stockpile • Laydown and Storage • Batching plant
12	Lot 11 DP 1192695	10,800	• Stockpile • Laydown and Storage • Batching plant • Western turnaround area • Future use as the westbound rest area
13	Lot 15 DP 880798	8,100	• Main Site Compound • Stockpile • Laydown and Storage • Batching plant • Future use as the eastbound rest area
River Lett Hill to Forty Bends			
14	Lot 7035 DP 1057030 Lot 7030 DP 1057700	6,200	• Stockpile • Laydown and Storage
15	Existing Road Reserve	22,600	• Stockpile • Laydown and Storage
16	Lot 11 DP 734662	6,000	• Stockpile • Laydown and Storage
17	Lot 11 DP 1134053 Lot 3 DP 1187719	12,400 15,400	• Stockpile • Laydown and Storage
Forty Bends to Lithgow			

Ancillary facility	Lot and DP	Area (square metres)	Proposed use
18	Lot 1 DP 378232	22,000	• Stockpile • Laydown and Storage

3.5 Public utility adjustment

Some major public utilities are located within the proposal construction footprint. For any utilities where potential for relocation has been identified, further consultation with utility asset owners would be undertaken to determine opportunities for protection, rather than relocation, of utility assets.

A summary of the major utilities that would be impacted by the proposal are presented in Table 3-20 and shown in Figure 3-4. The main utilities considerations include the realignment or adjustment of overhead powerlines, overhead and underground communications assets and water mains. Separate Utilities Management Plans have been prepared for each section of work that would be refined during further design development.

Table 3-20 Major public utilities impacted by the proposal

Asset owner	Asset type	Stage	Relocation required?
Endeavour Energy	11kV and low voltage distribution overhead powerlines	Little Hartley to River Lett Hill Coxs River Road Forty Bends to Lithgow	Some sections would require relocation of the overhead powerline and poles. Protection is proposed for other sections. Additional survey may be required to confirm treatment in some areas.
	132kV transmission overhead powerlines	River Lett Hill to Forty Bends	Some sections would require relocation of the overhead powerline and poles. Disconnection and demolition is proposed for other sections. Connection points may require modification or relocation.
Telstra	Conduit and direct buried communication lines	Little Hartley to River Lett Hill Coxs River Road River Lett Hill to Forty Bends	Relocation and/or demolition would be required in some sections. Protection is proposed for other sections.
Lithgow City Council	Water mains	Forty Bends to Lithgow	Relocation would be required.

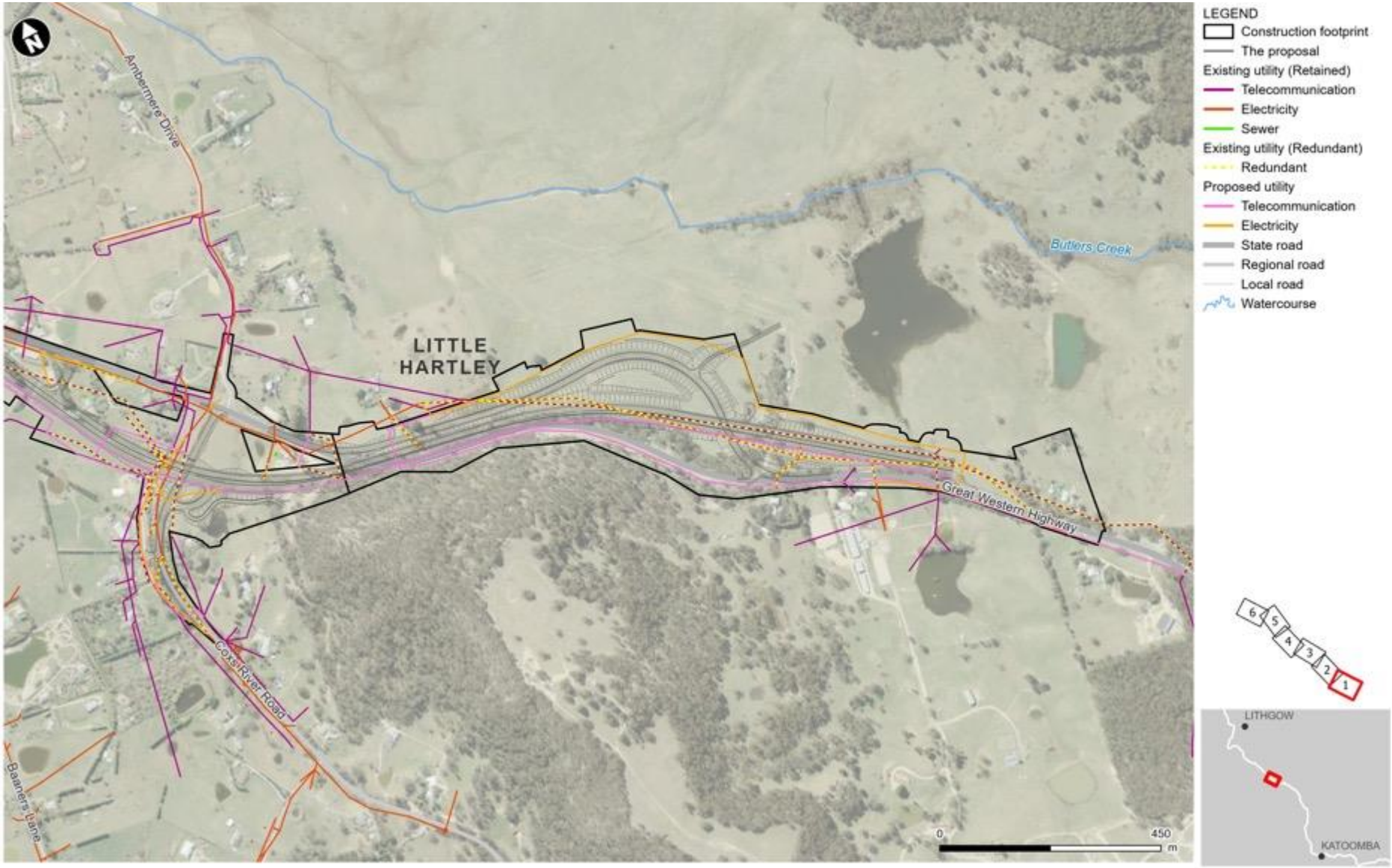

Figure 3-4 a Existing and proposed utilities

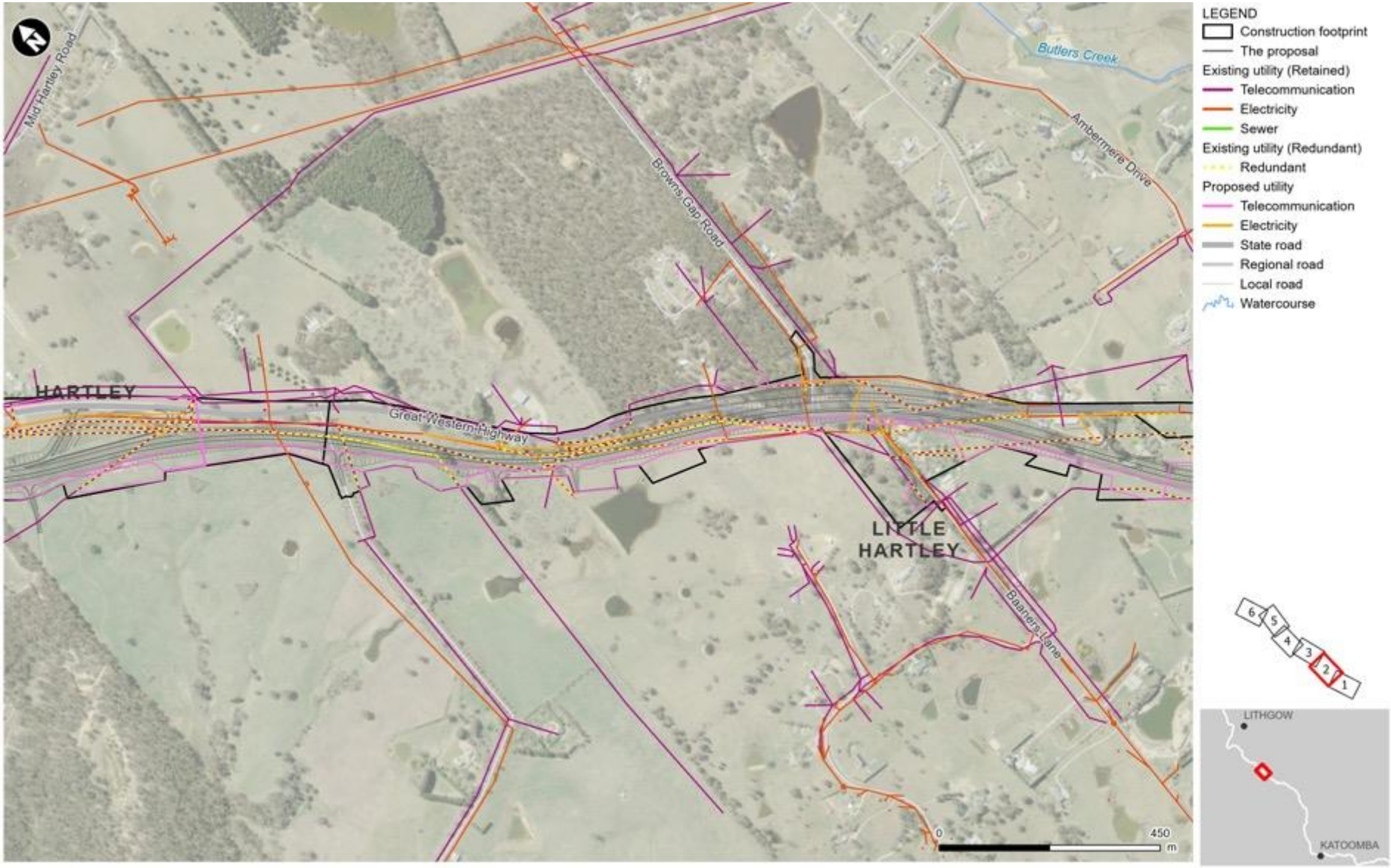

Figure 3-4 b Existing and proposed utilities

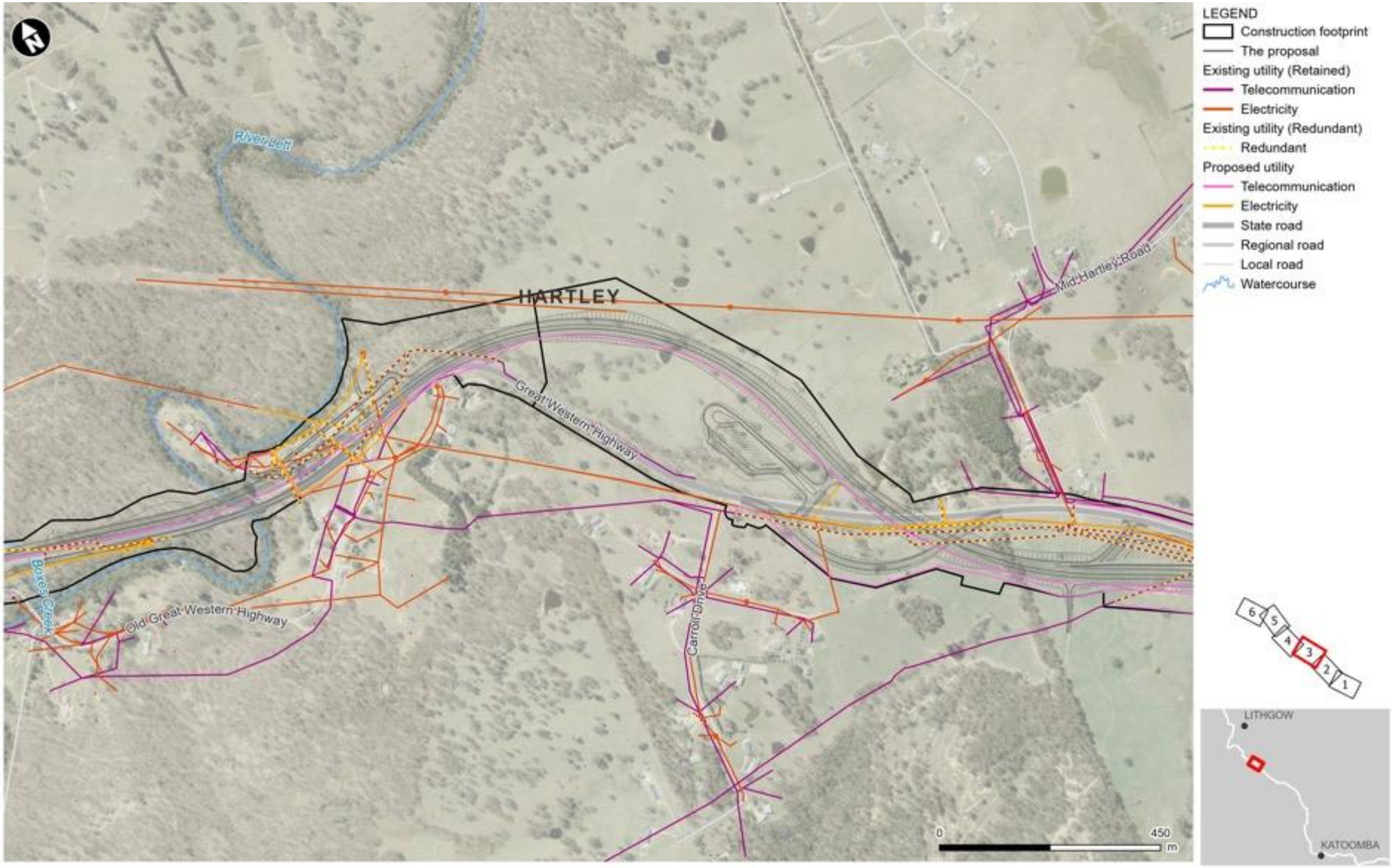

Figure 3-4 c Existing and proposed utilities

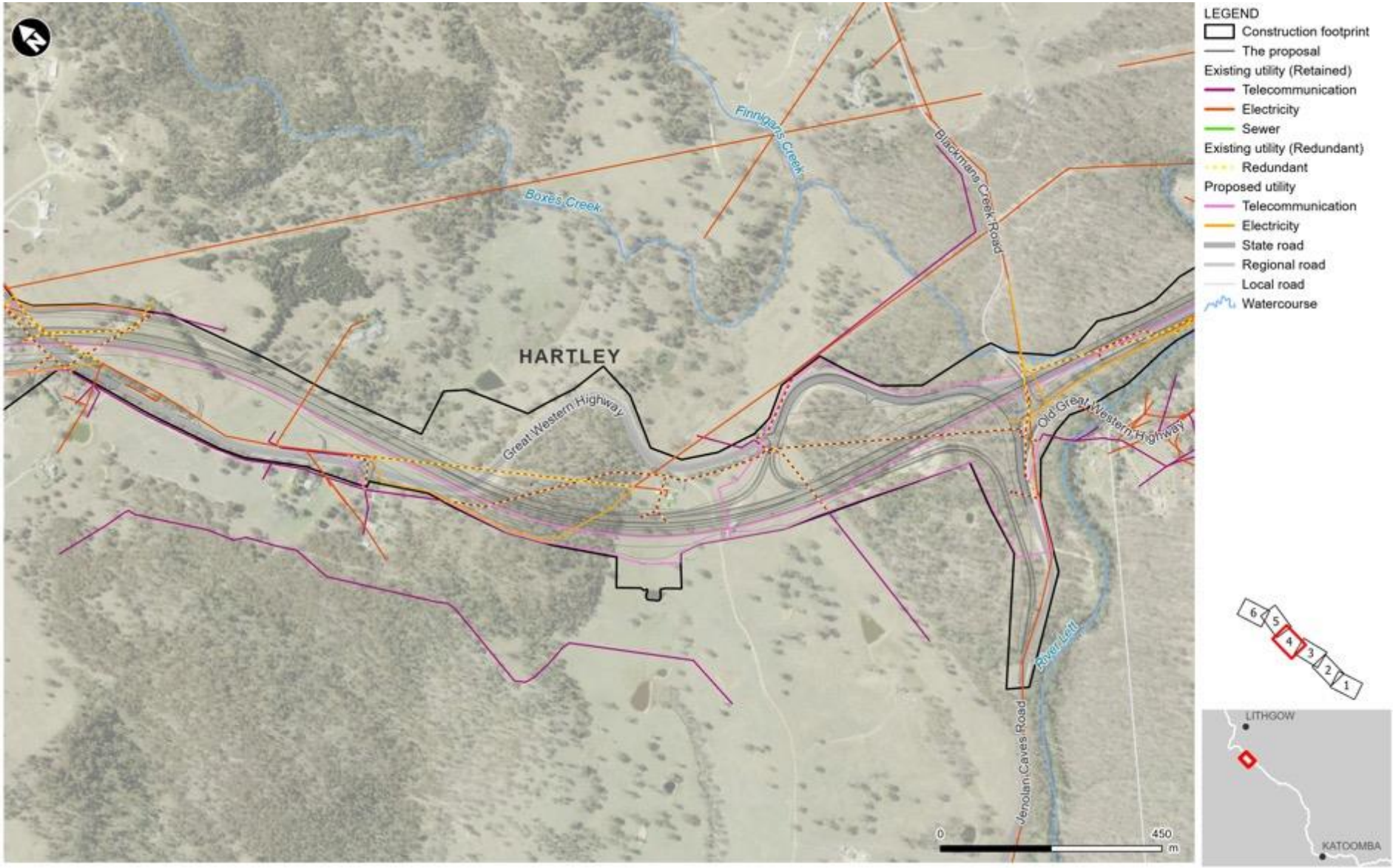

Figure 3-4 d Existing and proposed utilities

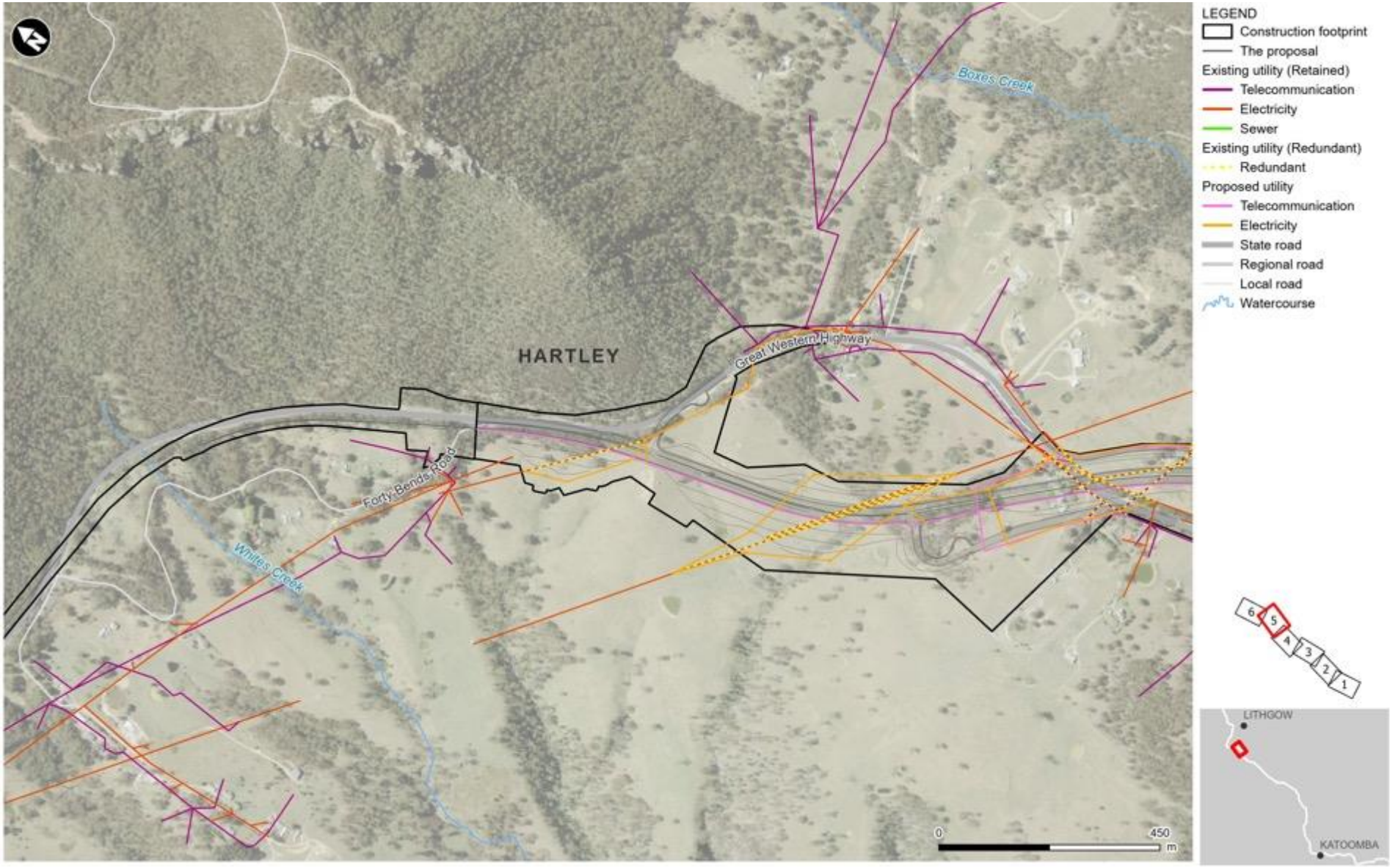

Figure 3-4 e Existing and proposed utilities

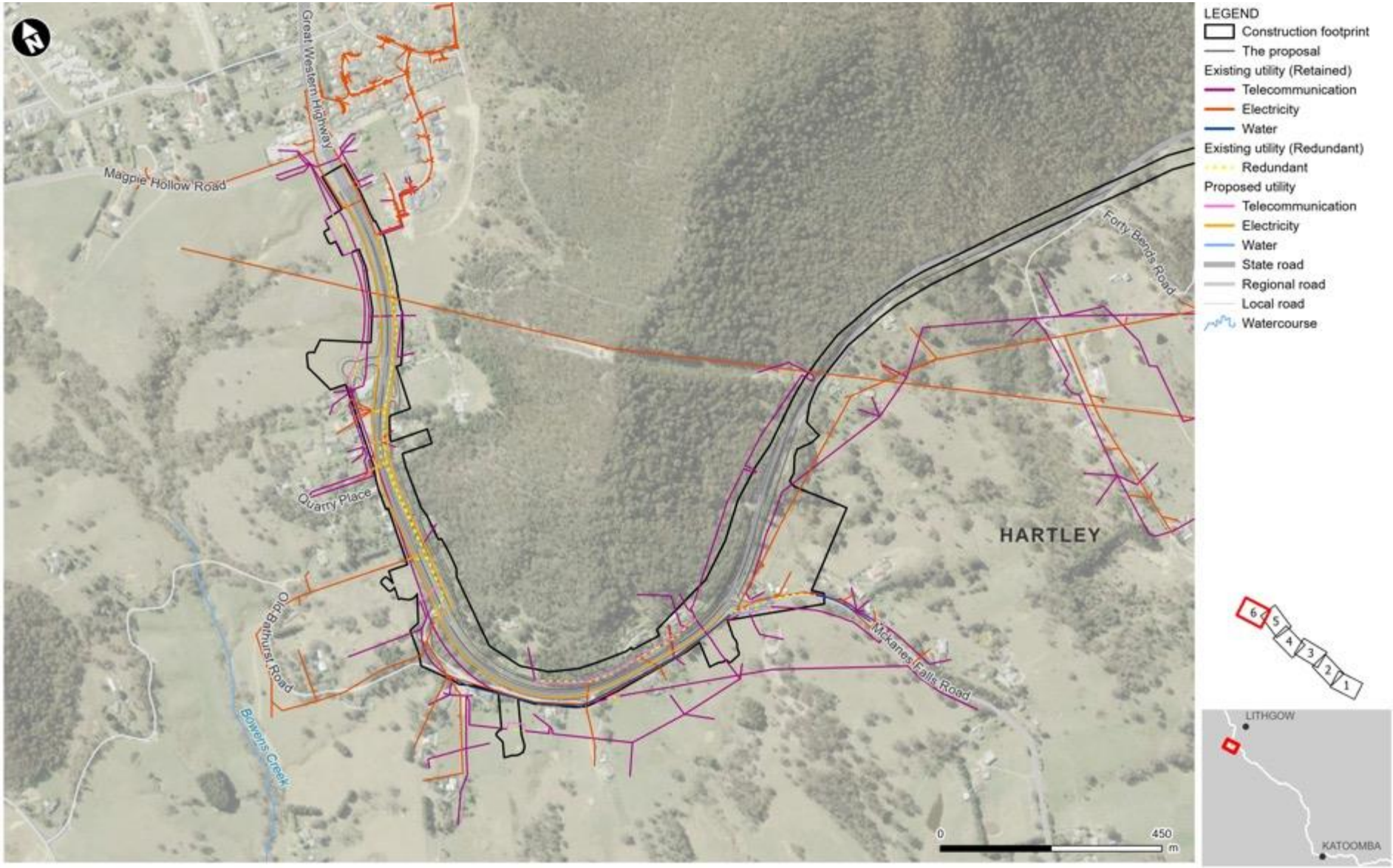

Figure 3-4 f Existing and proposed utilities

3.6 Property acquisition

The proposal has been designed and developed to minimise property acquisitions and has prioritised the use of Transport land. Notwithstanding this, some temporary use and permanent acquisition of properties would be required.

All property acquisitions required for the proposal would be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the Transport Land Acquisition Information Guide (Roads and Maritime Services, 2014).

The proposal would require the full acquisition of 11 lots and the partial acquisition of 50 lots. About 84.6 hectares of privately owned land and 2.6 hectares of National Parks and Wildlife Services land and 4.4 hectares of Crown land would be acquired. Additionally, about 6.3 hectares of land would be temporarily leased for the duration of construction. Refer to Section 6.11 Property and land use for further details on properties to be acquired or leased.