CHAPTER 07

Construction of the Proposal

NORTH STAR TO NSW/QUEENSLAND BORDER ENVIRONMENTAL IMPACT STATEMENT

The Australian Government is delivering Inland Rail through the Australian Rail Track Corporation (ARTC), in partnership with the private sector.

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7. Construction of the proposal

7.1 Scope of chapter

In conjunction with Chapter 6: The Proposal, the purpose of this chapter is to provide a consolidated description of the scope of construction works for which approval for the North Star to NSW/Queensland Border (NS2B) project (the proposal) is sought. Chapters 6 and 7 are the basis for the environmental impact assessments contained in chapters 11 to 25.

7.1.1 Secretary's Environmental Assessment Requirements

This chapter has been prepared in response to the Secretary's Environmental Assessment Requirements (SEARs) requirements as detailed in Table 7.1.

TABLE 7.1 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS COMPLIANCE

	Item 2: Environmental Impact Statement
Desired performance outcome	The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.
Current guidelines	*EPBC Act Environment Assessment Process* (SEWPaC, 2010)

SEARs requirement		EIS section
Item 2.1		
The EIS must include:		
b)	a description of the project, including all components and activities (including ancillary components and activities, borrow pits, construction camps and rail sidings) required to construct and operate it.	Addressed throughout chapter
i)	demonstration of how the project design has been developed to avoid or minimise likely adverse impacts.	Addressed throughout chapter

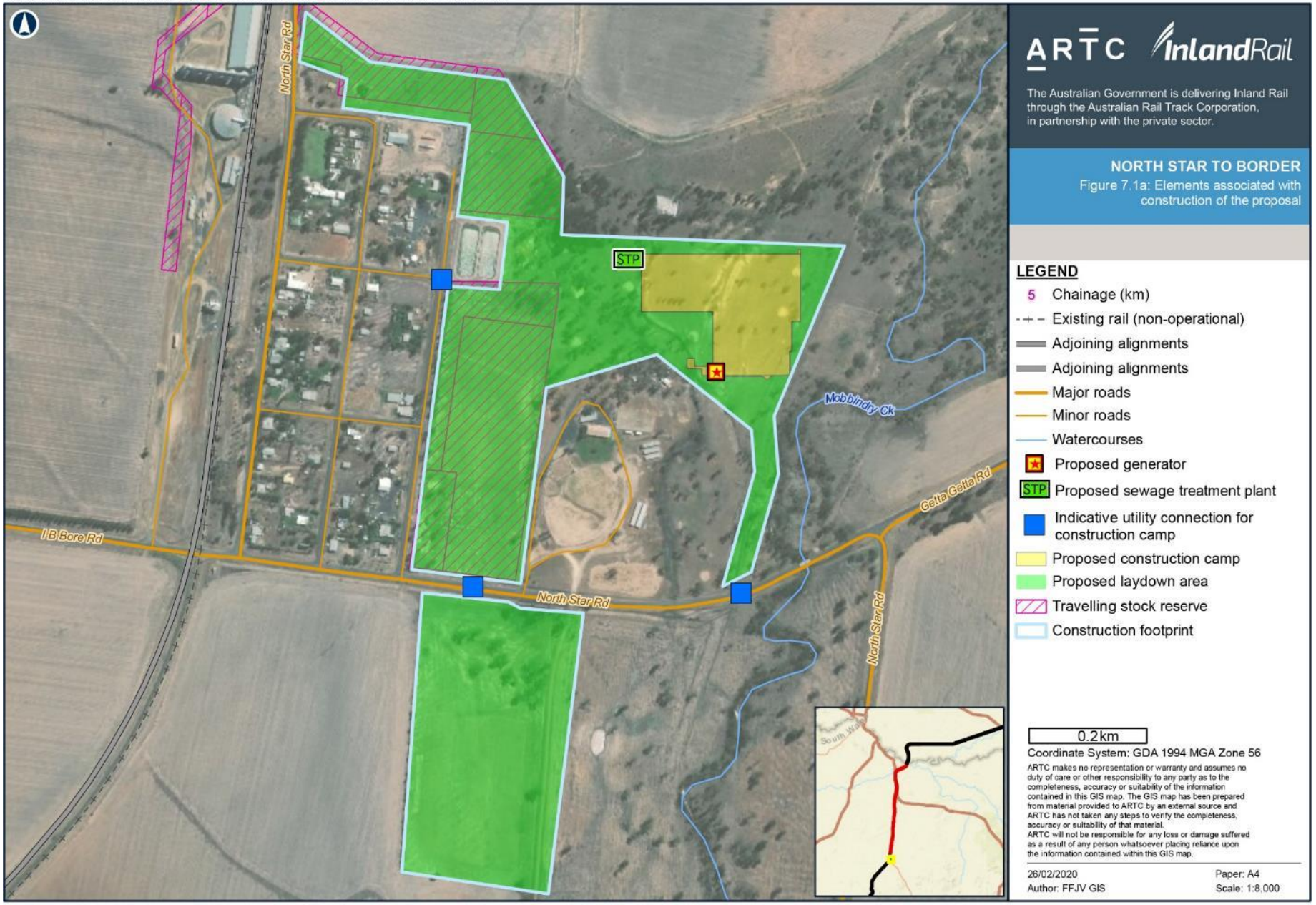
7.1.2 Key features of construction of the proposal

Construction of the proposal will consist of key features listed in Table 7.2. Elements associated with construction of the proposal are mapped in Figure 7.1. This figure is referred to throughout this chapter.

TABLE 7.2 KEY FEATURES OF CONSTRUCTION OF THE PROPOSAL

Aspect	Description
Construction works	▸ The main construction works will primarily consist of earthworks, track works, drainage works, bridge works and road works ▸ Utility diversions and adjustments.
Land	▸ The temporary construction footprint encompasses land needed to construct the proposal, including borrow pits ▸ Temporary laydown areas will be established at regular intervals along the alignment ▸ Temporary access tracks will be used to access construction sites. Where possible, they will be retained to serve as rail-maintenance access roads during the operation phase of the proposal.
Materials	▸ Significant material requirements for the proposal include general and structural fill, steel rails, ballast, water, precast concrete sleepers and precast bridge and culvert elements ▸ Eleven borrow pits with the potential to provide general fill, structural fill, ballast and/or capping have been identified ▸ Subject to availability, capping and ballast could be sourced from local, licensed quarries.

Aspect	Description
Schedule	▸ Construction is expected to occur between 2021 and 2025.
Hours of construction	▸ Primary hours of construction will be 6.30 am to 6.00 pm Monday–Sunday ▸ Extended working hours would be considered permissible if there are no nearby sensitive receptors, or if negotiated agreements have been reached with sensitive receptors ▸ Blasting is unlikely; however, if required, blasting would generally only be permitted between the hours of 9.00 am to 5.00 pm, Monday to Saturday. Blasting would not occur on Sundays or public holidays and would generally only be permitted once per day.
Workforce	▸ The construction workforce is expected to peak at approximately 350 workers in Q3 2022 ▸ A construction camp is proposed in North Star to house the construction workforce.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North Star Rd
STP
Mobbindry Ck
Getta Getta Rd
I B Bore Rd
North Star Rd
North Star Rd
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1a: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
Adjoining alignments
Adjoining alignments
Major roads
Minor roads
Watercourses
Proposed generator
STP Proposed sewage treatment plant
Indicative utility connection for construction camp
Proposed construction camp
Proposed laydown area
Travelling stock reserve
Construction footprint
0.2km
Coordinate System: GDA 1994 MGA Zone 56
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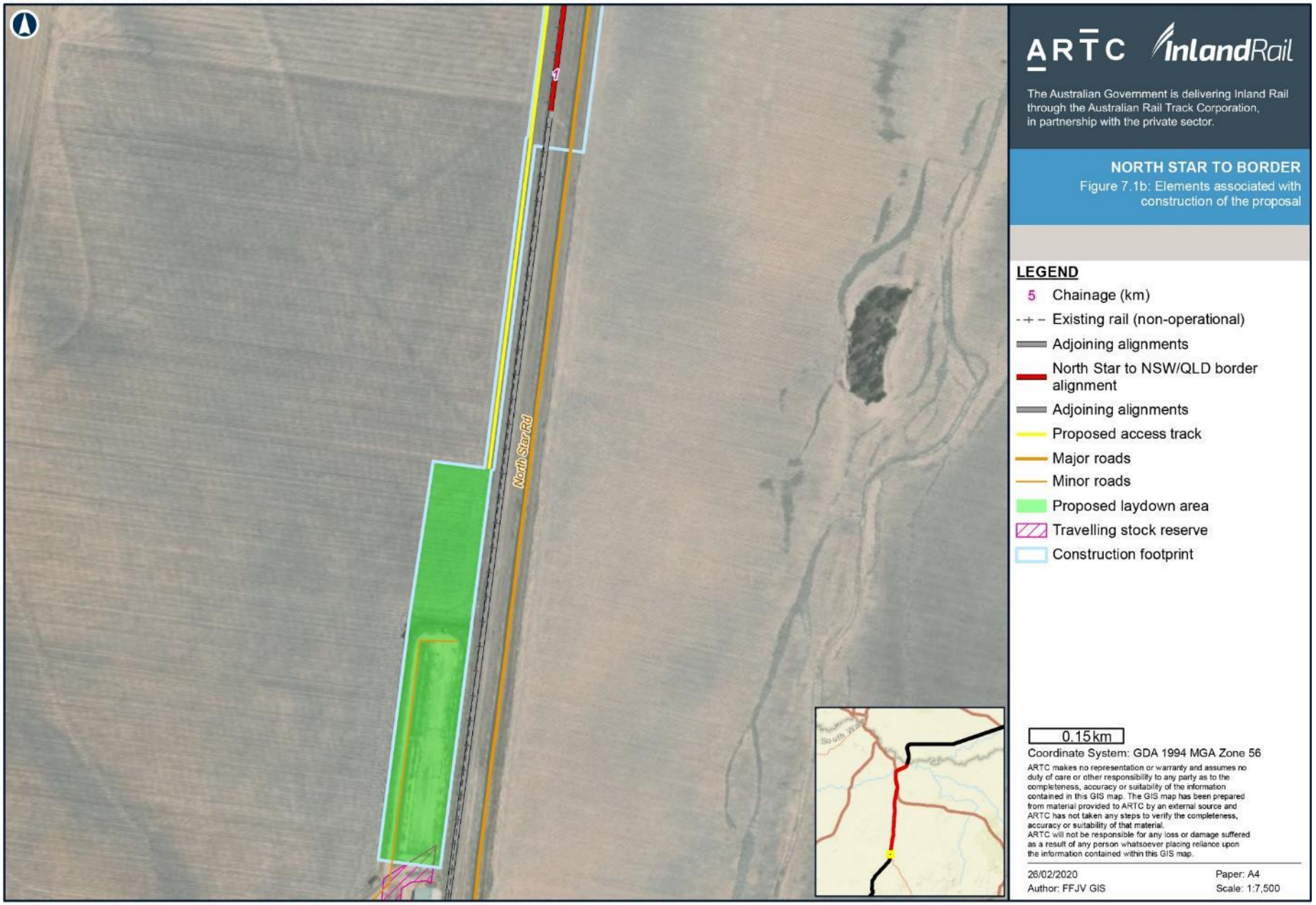
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North Star Rd
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1b: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
Adjoining alignments
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Minor roads
Proposed laydown area
Travelling stock reserve
Construction footprint
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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NORTH STAR TO BORDER

Figure 7.1c: Elements associated with construction of the proposal

LEGEND

- 5 Chainage (km)
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Adjoining alignments
- Proposed access track
- Major roads
- Construction footprint

0.15 km

Coordinate System: GDA 1994 MGA Zone 56

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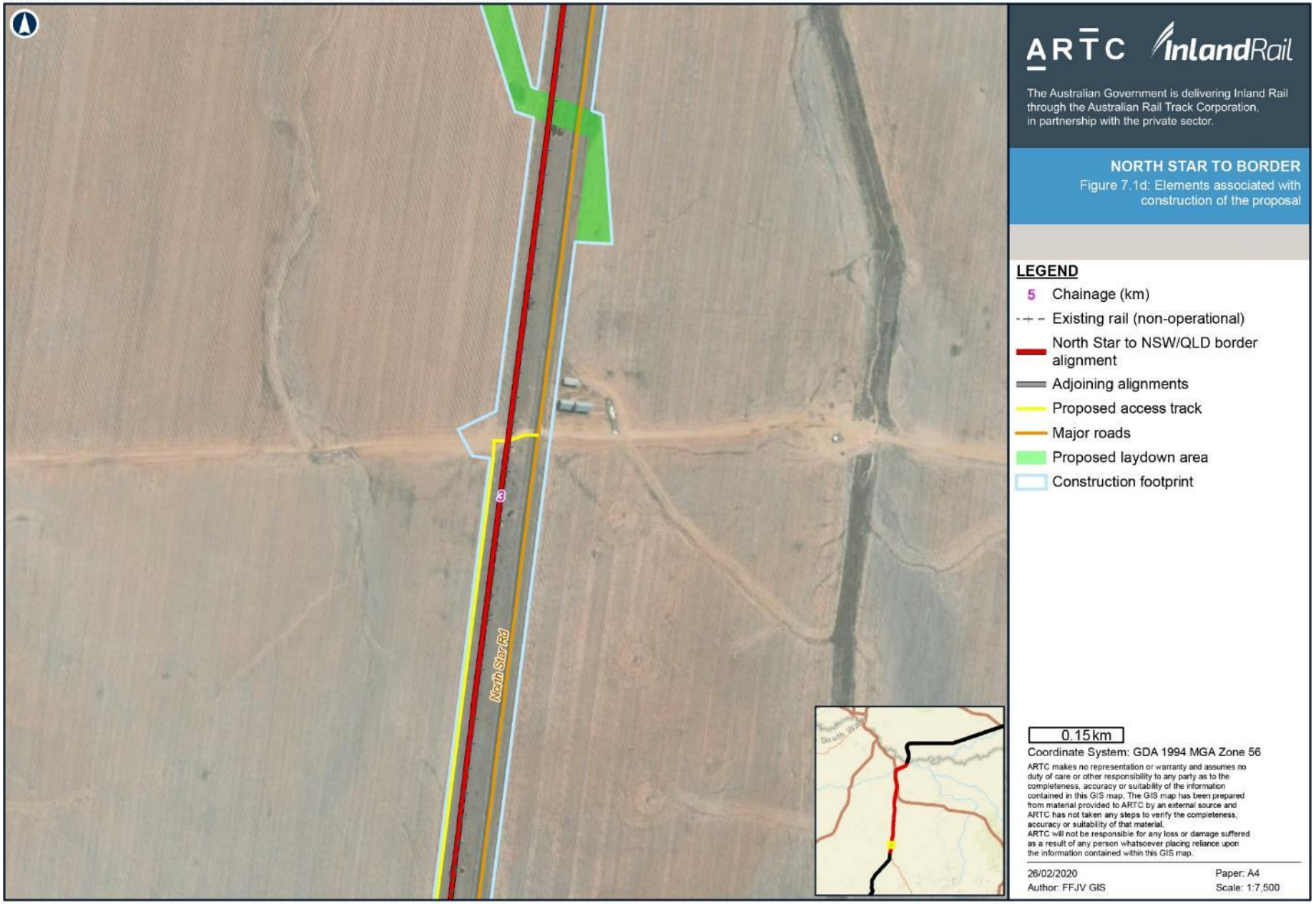
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Figure 7.1d: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Proposed laydown area
Construction footprint
North Star Rd
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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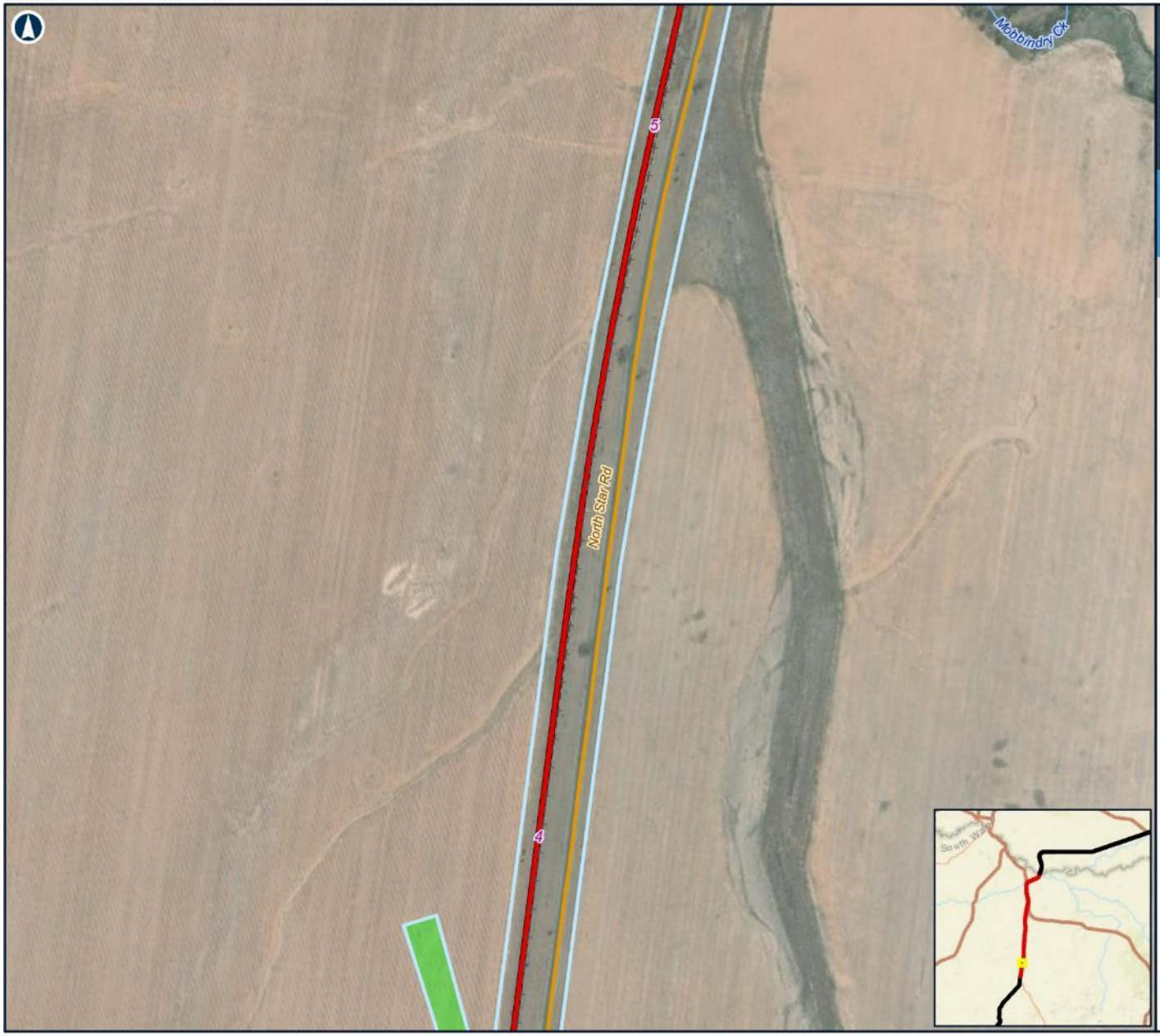

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NORTH STAR TO BORDER

Figure 7.1e: Elements associated with construction of the proposal

LEGEND

- 5 Chainage (km)
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Adjoining alignments
- Major roads
- Watercourses
- Proposed laydown area
- Construction footprint

0.15 km

Coordinate System: GDA 1994 MGA Zone 56

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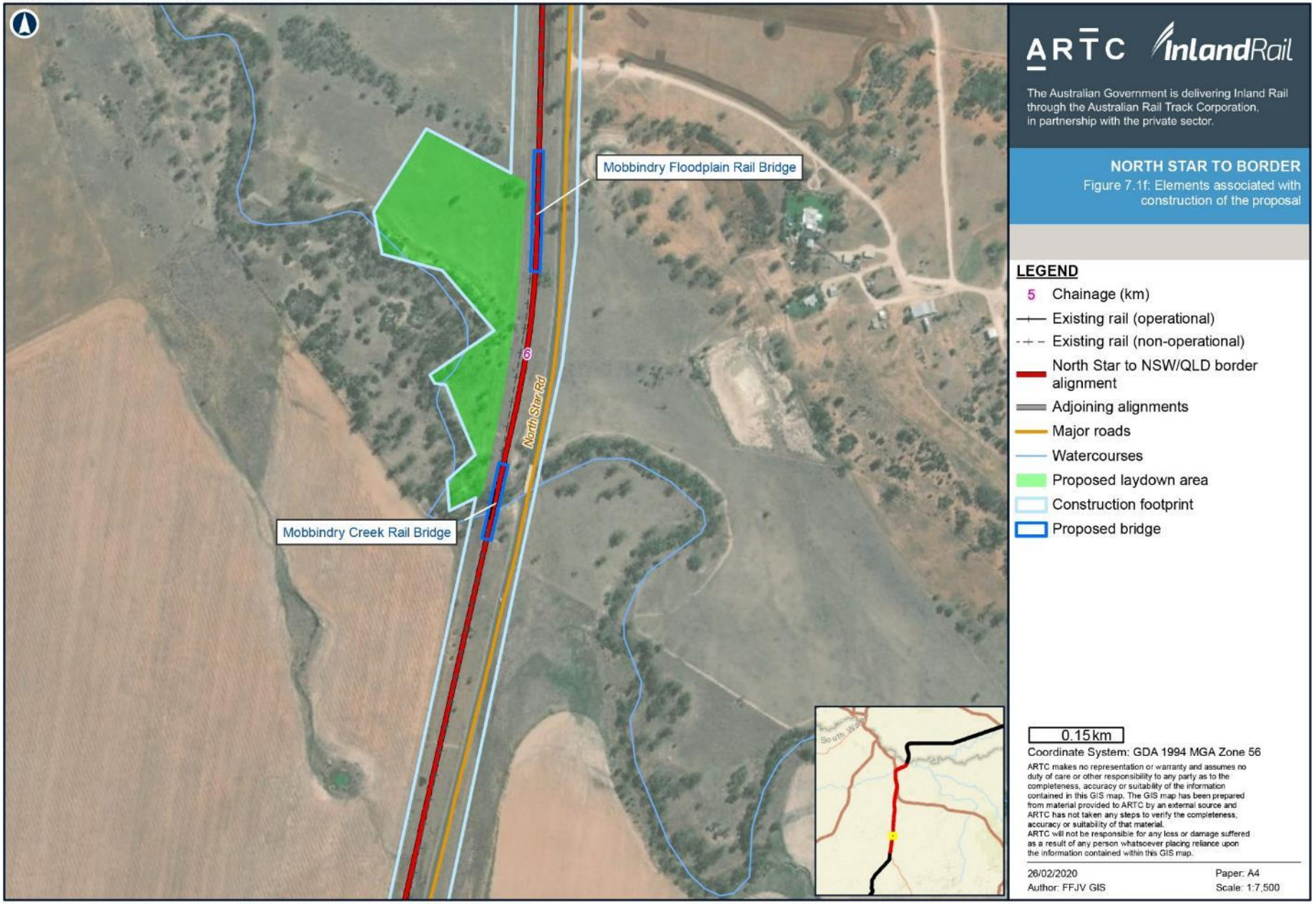
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Mobbindry Floodplain Rail Bridge
Mobbindry Creek Rail Bridge
North Star Rd
6
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Figure 7.1f: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (operational)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Major roads
Watercourses
Proposed laydown area
Construction footprint
Proposed bridge
0.15 km
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Figure 7.1g: Elements associated with construction of the proposal

LEGEND

- 5 Chainage (km)
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Adjoining alignments
- Major roads
- Minor roads
- Watercourses
- Proposed laydown area
- Construction footprint

0.15 km

Coordinate System: GDA 1994 MGA Zone 56

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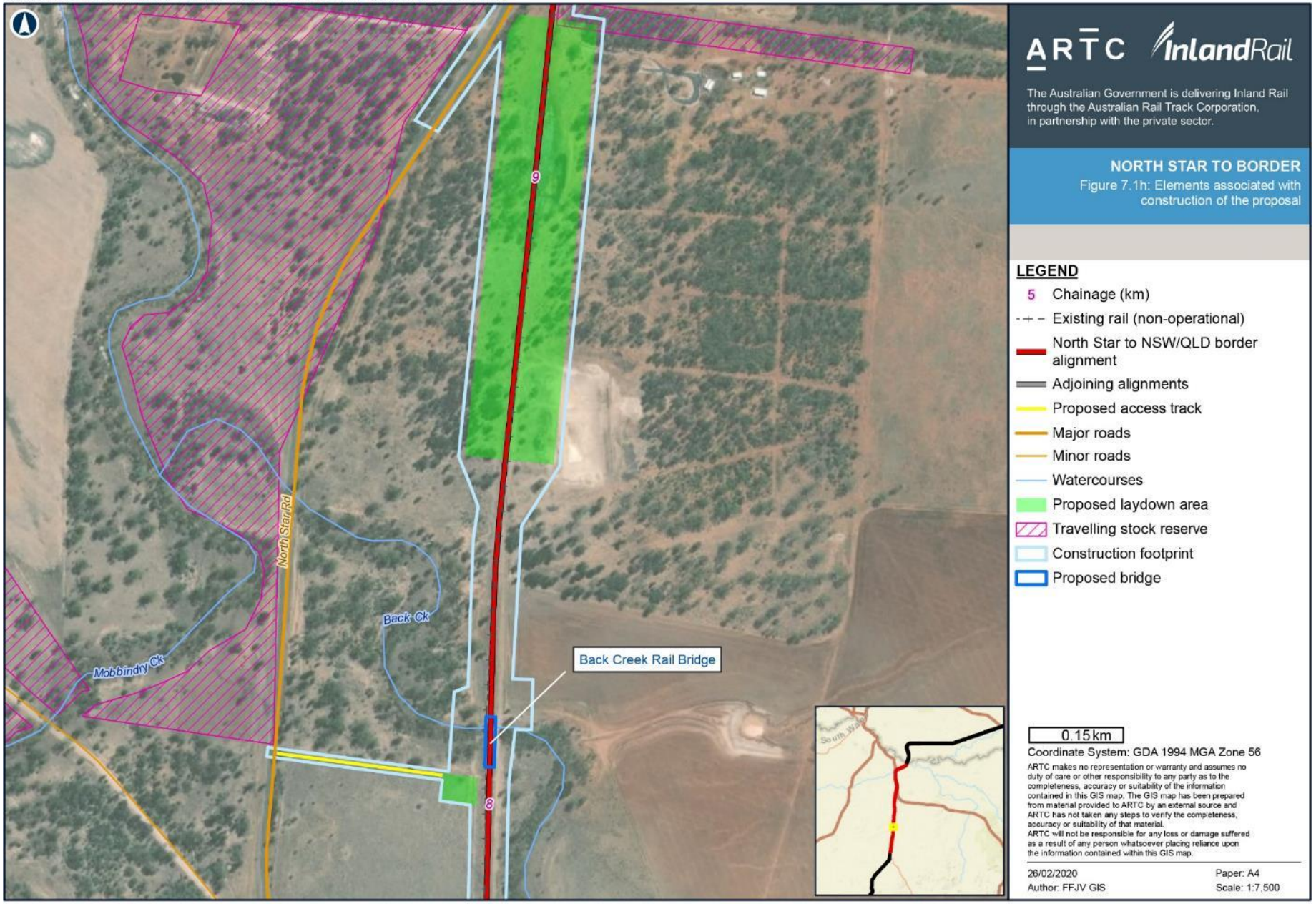
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Figure 7.1h: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Minor roads
Watercourses
Proposed laydown area
Travelling stock reserve
Construction footprint
Proposed bridge
North Star Rd
Back Ck
Mobbindry Ck
Back Creek Rail Bridge
9
8
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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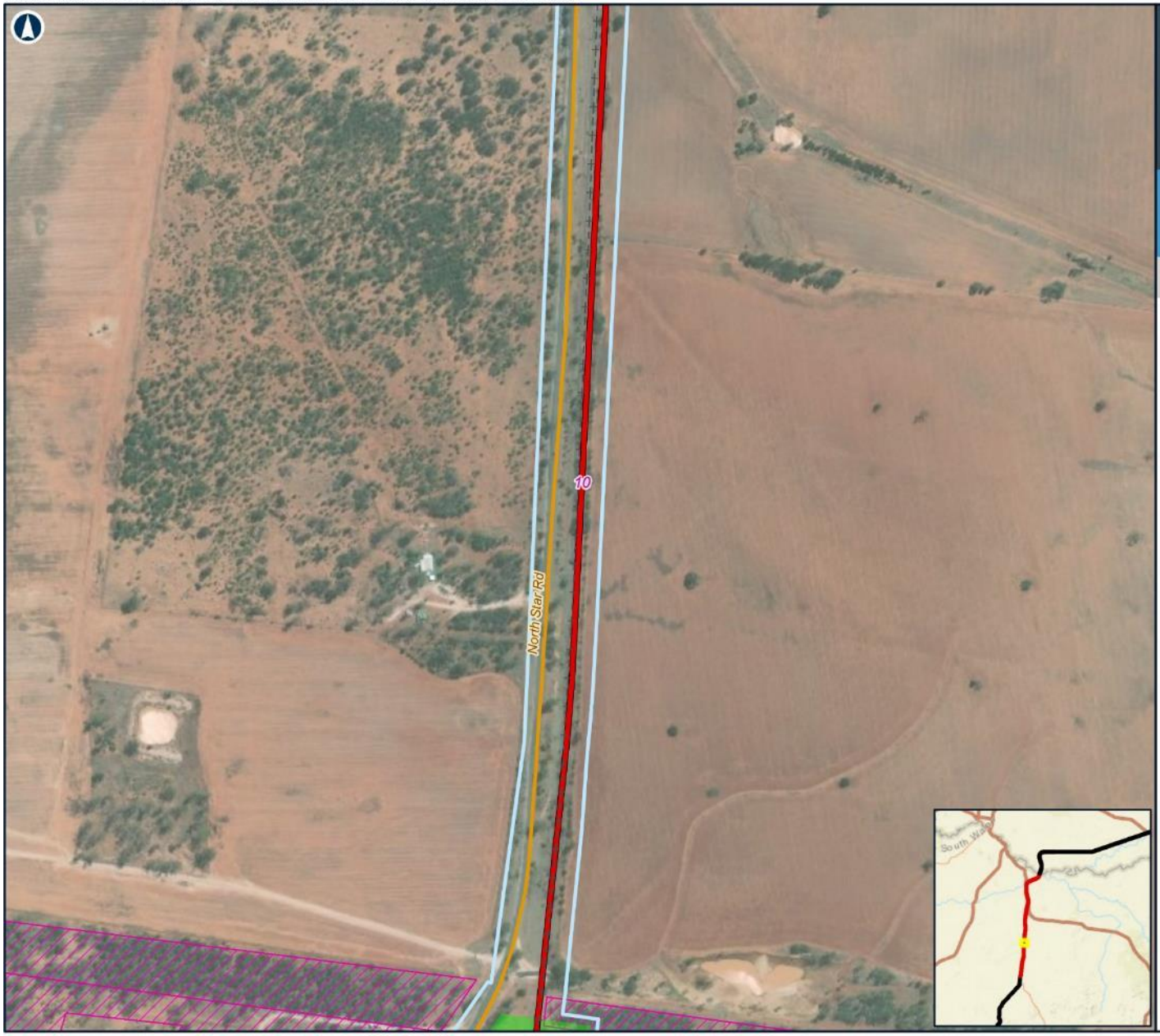

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NORTH STAR TO BORDER

Figure 7.1i: Elements associated with construction of the proposal

LEGEND

- 5 Chainage (km)
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Adjoining alignments
- Major roads
- Proposed laydown area
- Travelling stock reserve
- Construction footprint

0.15 km

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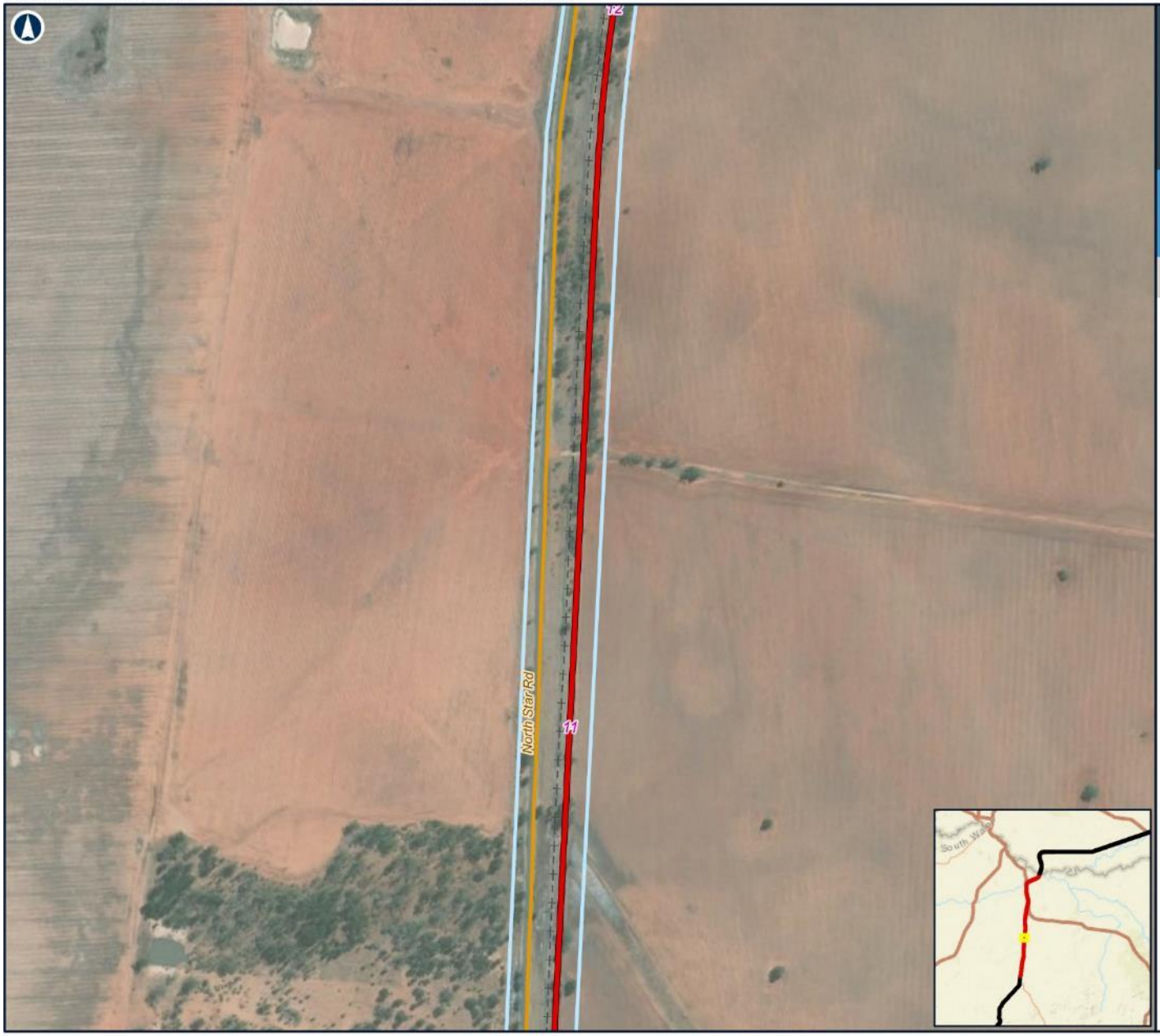

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NORTH STAR TO BORDER

Figure 7.1j: Elements associated with construction of the proposal

LEGEND

- 5 Chainage (km)
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Adjoining alignments
- Major roads
- Construction footprint

0.15 km

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NORTH STAR TO BORDER

Figure 7.1k: Elements associated with construction of the proposal

LEGEND

- 5 Chainage (km)
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Adjoining alignments
- Major roads
- Minor roads
- Construction footprint

0.15 km

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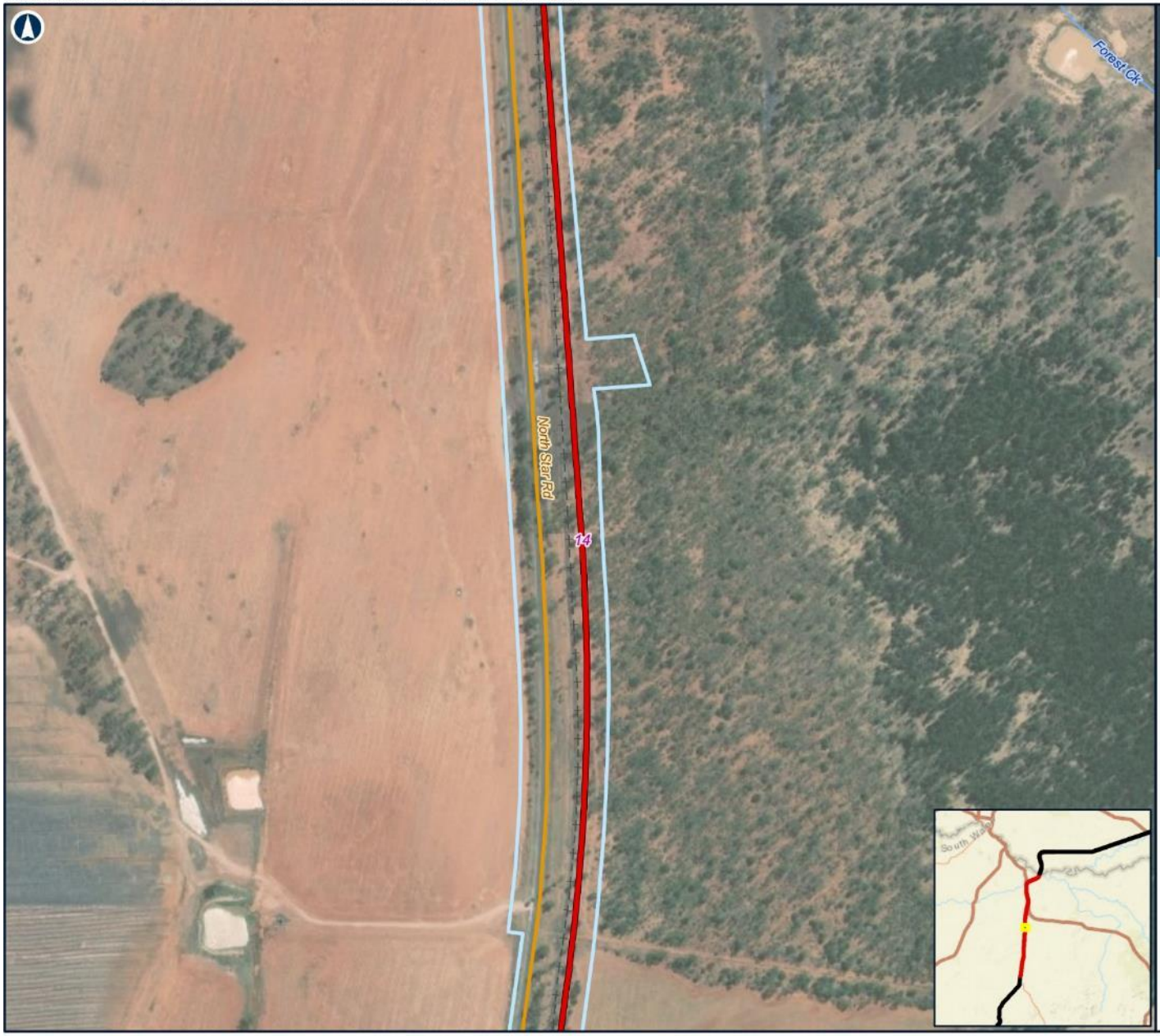

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Figure 7.1I: Elements associated with construction of the proposal

LEGEND

- 5 Chainage (km)
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Adjoining alignments
- Major roads
- Watercourses
- Construction footprint

0.15 km

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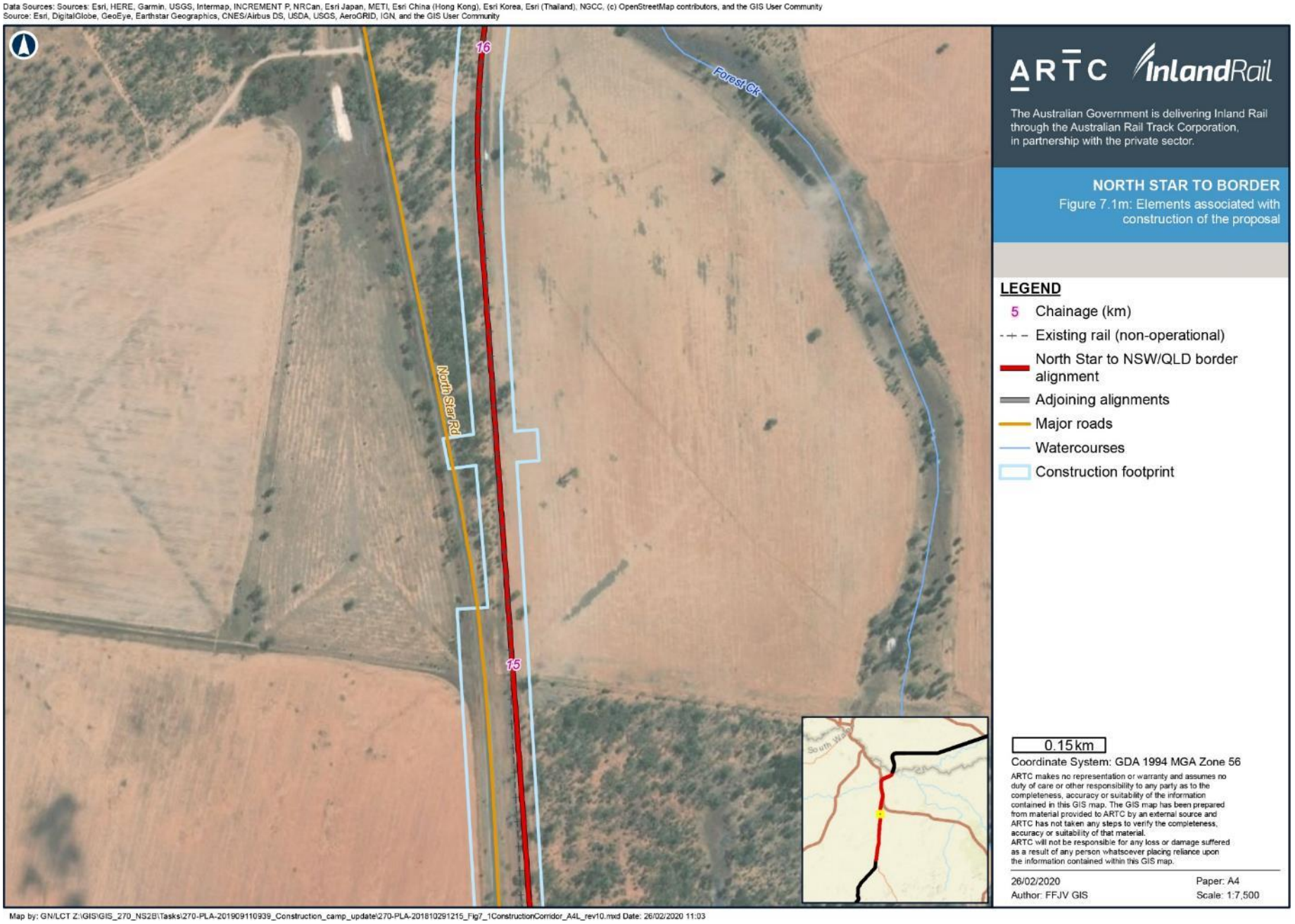
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
16
15
Forest Ck
North Star Rd
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1m: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Major roads
Watercourses
Construction footprint
0.15 km
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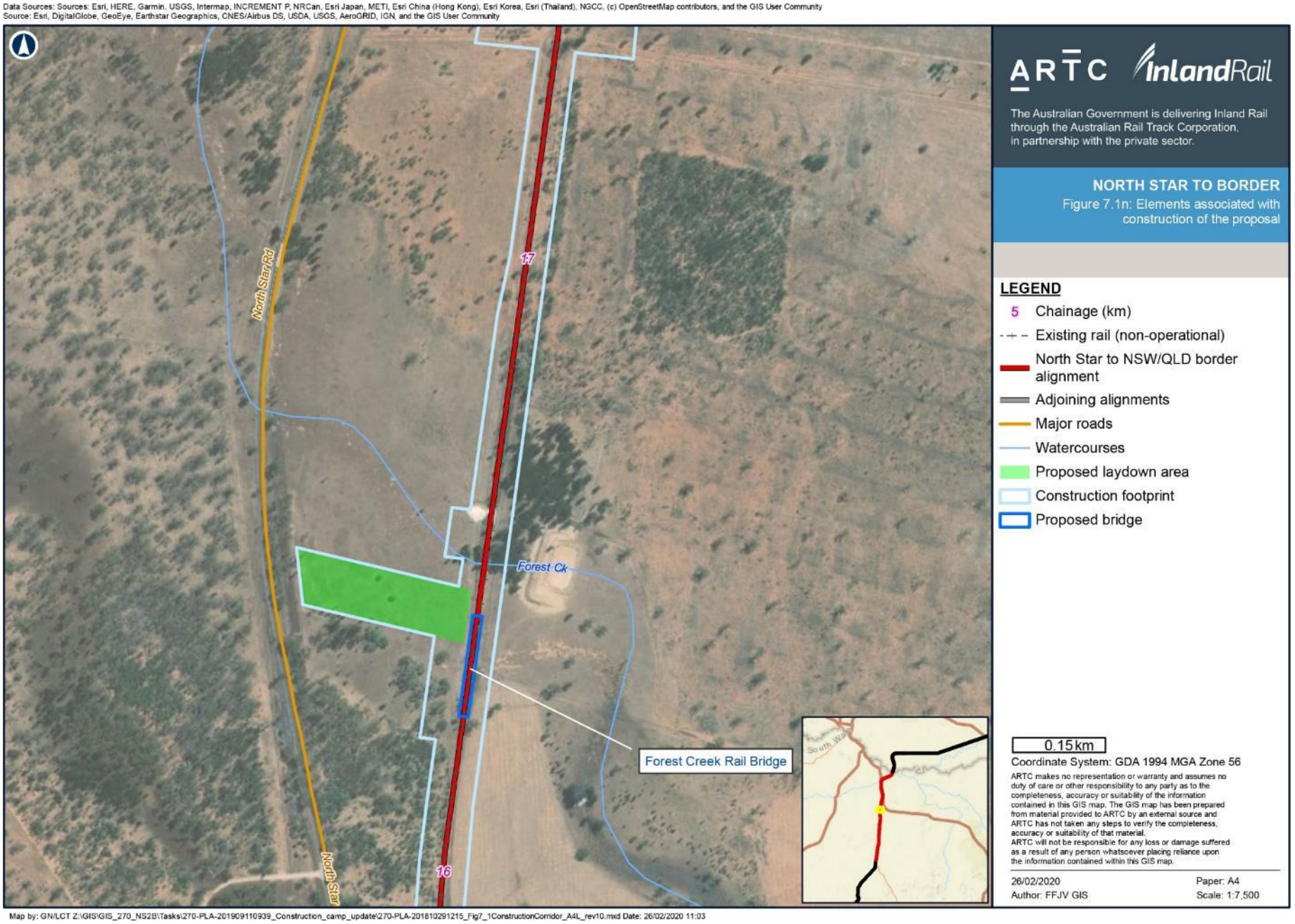
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
North Star Rd
17
Forest Ck
Forest Creek Rail Bridge
16
North Star
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1n: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Major roads
Watercourses
Proposed laydown area
Construction footprint
Proposed bridge
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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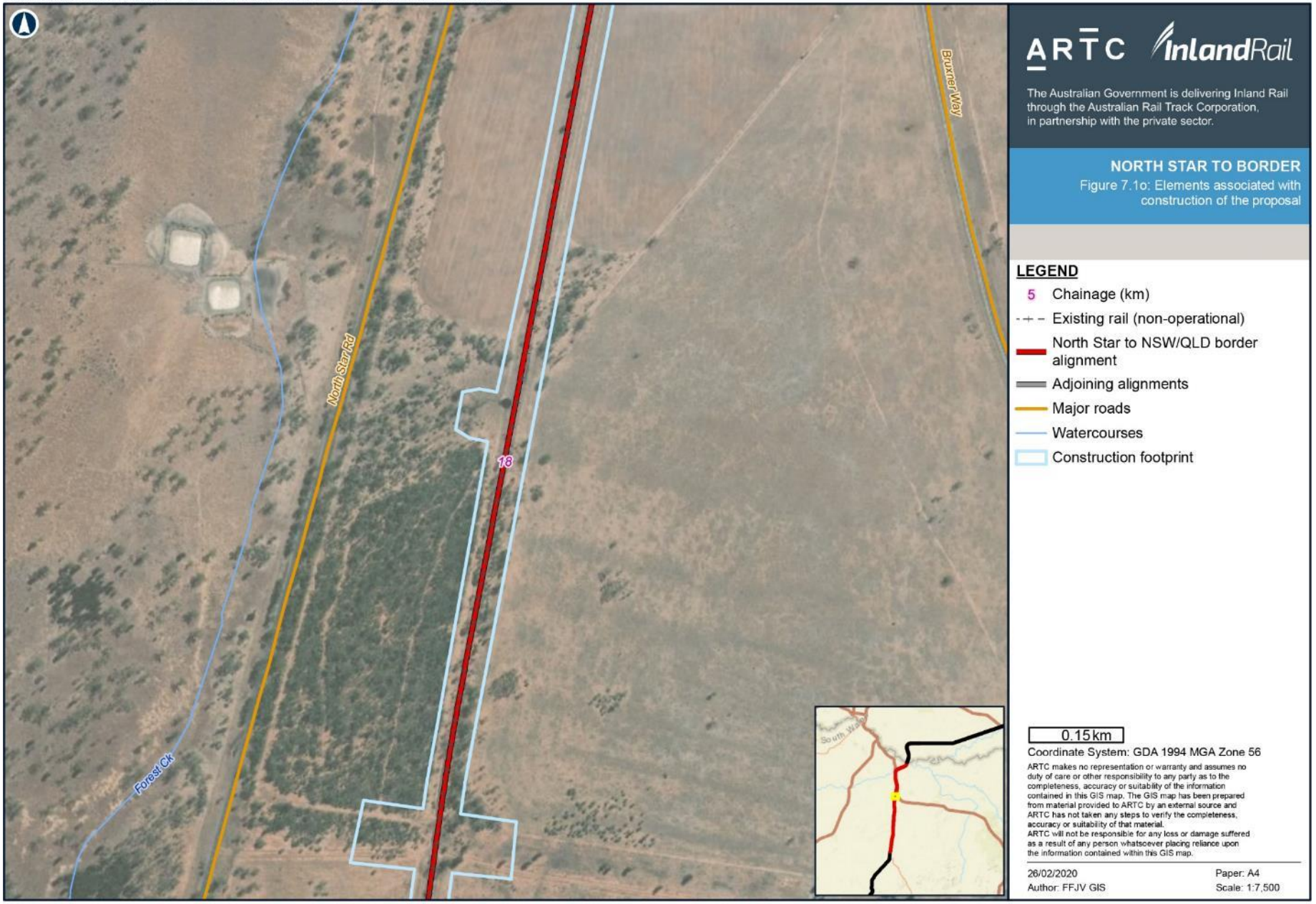
Paper: A4
Scale: 1:7,500
Map by: GN/LCT Z:\GIS\GIS_270_NS2B\Tasks\270-PLA-201909110939_Construction_camp_update\270-PLA-201810291215_Fig7_1ConstructionCorridor_A4L_rev10.mxd Date: 26/02/2020 11:03


Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
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North Star Rd
Bruxner Way
Forest Ck
18
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1o: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Major roads
Watercourses
Construction footprint
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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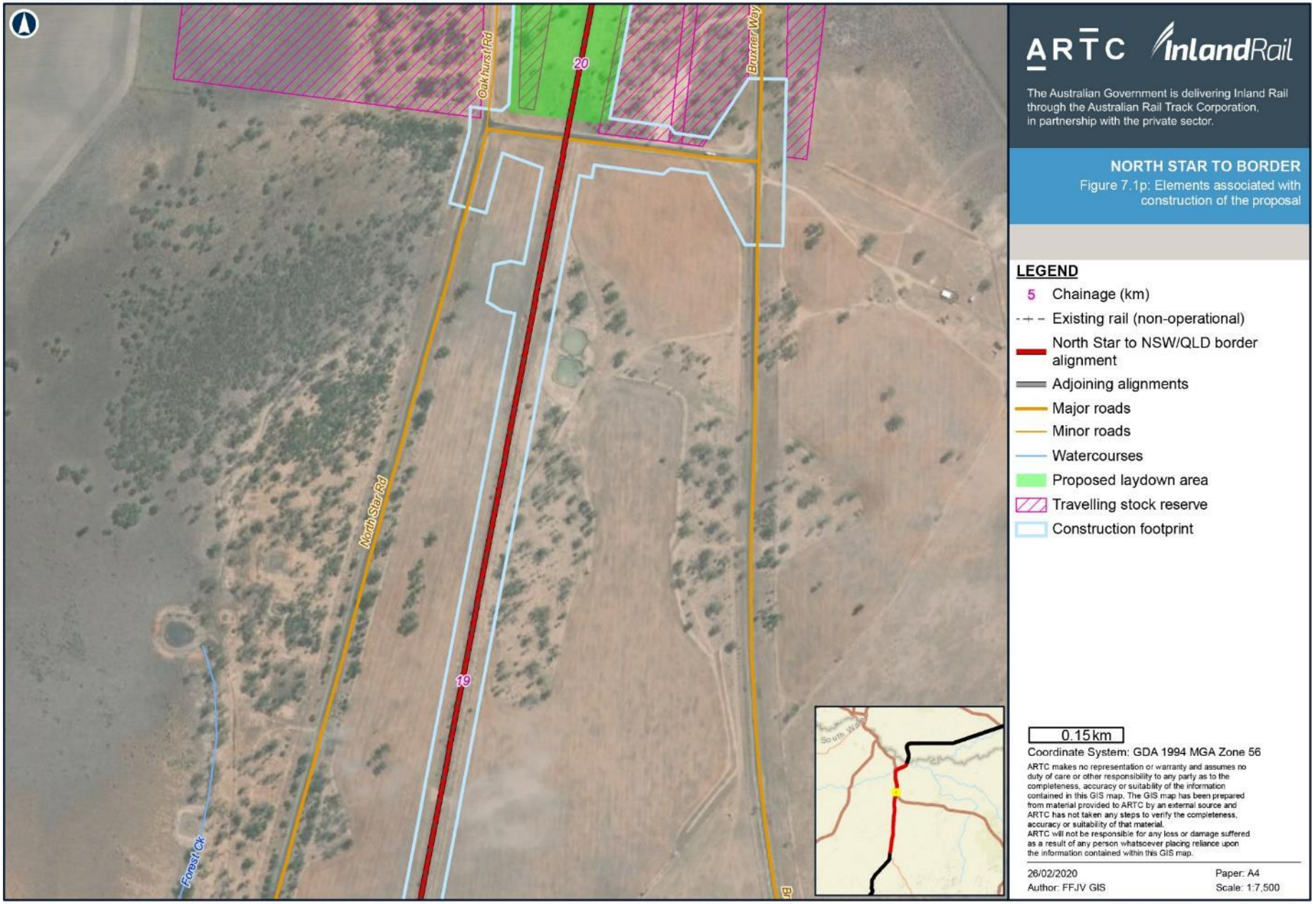
Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Oakhurst Rd
Brunner Way
North Star Rd
Forest Ck
20
19
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1p: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Major roads
Minor roads
Watercourses
Proposed laydown area
Travelling stock reserve
Construction footprint
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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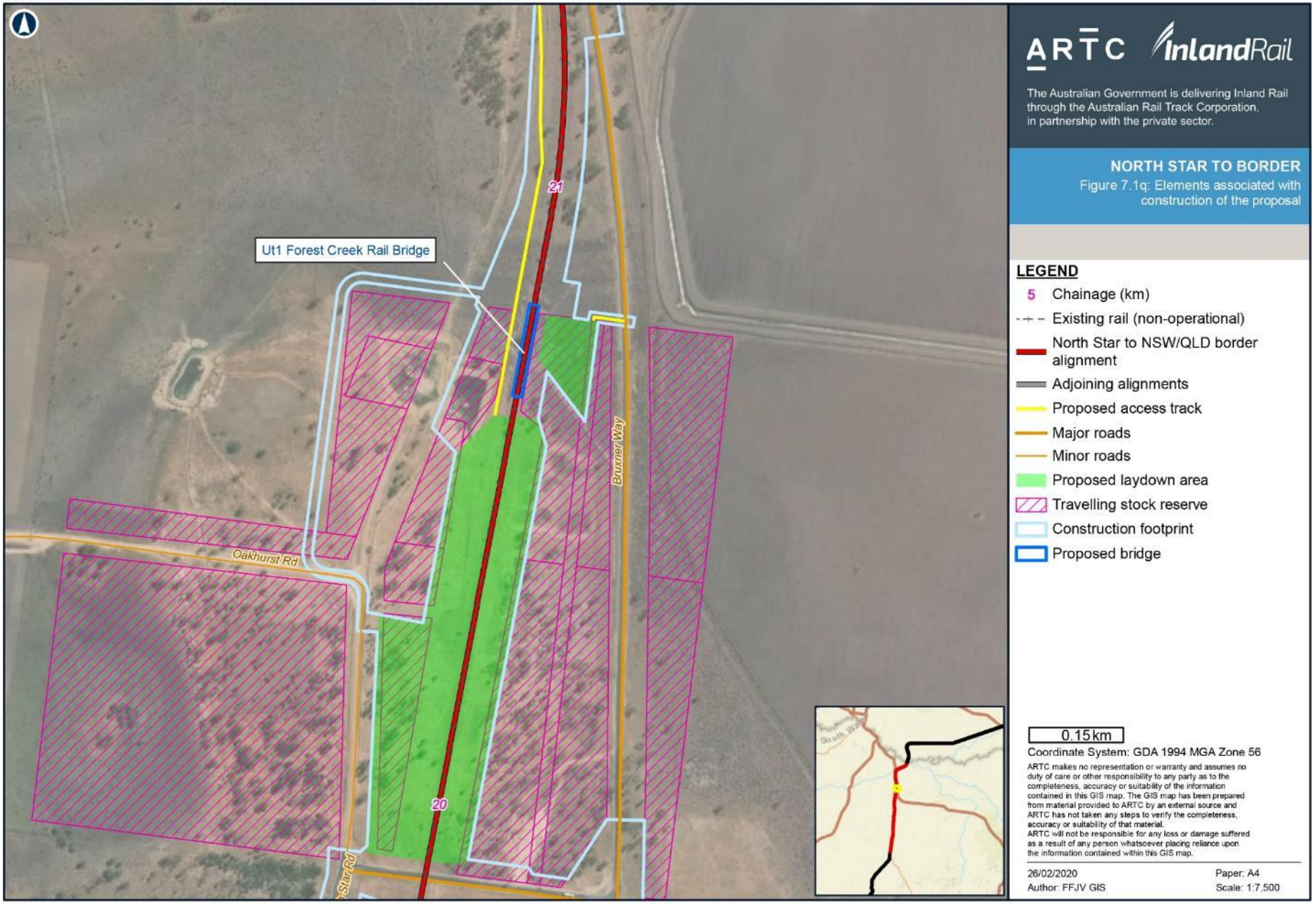
Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Ut1 Forest Creek Rail Bridge
21
20
Bruxner Way
Oakhurst Rd
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1q: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Minor roads
Proposed laydown area
Travelling stock reserve
Construction footprint
Proposed bridge
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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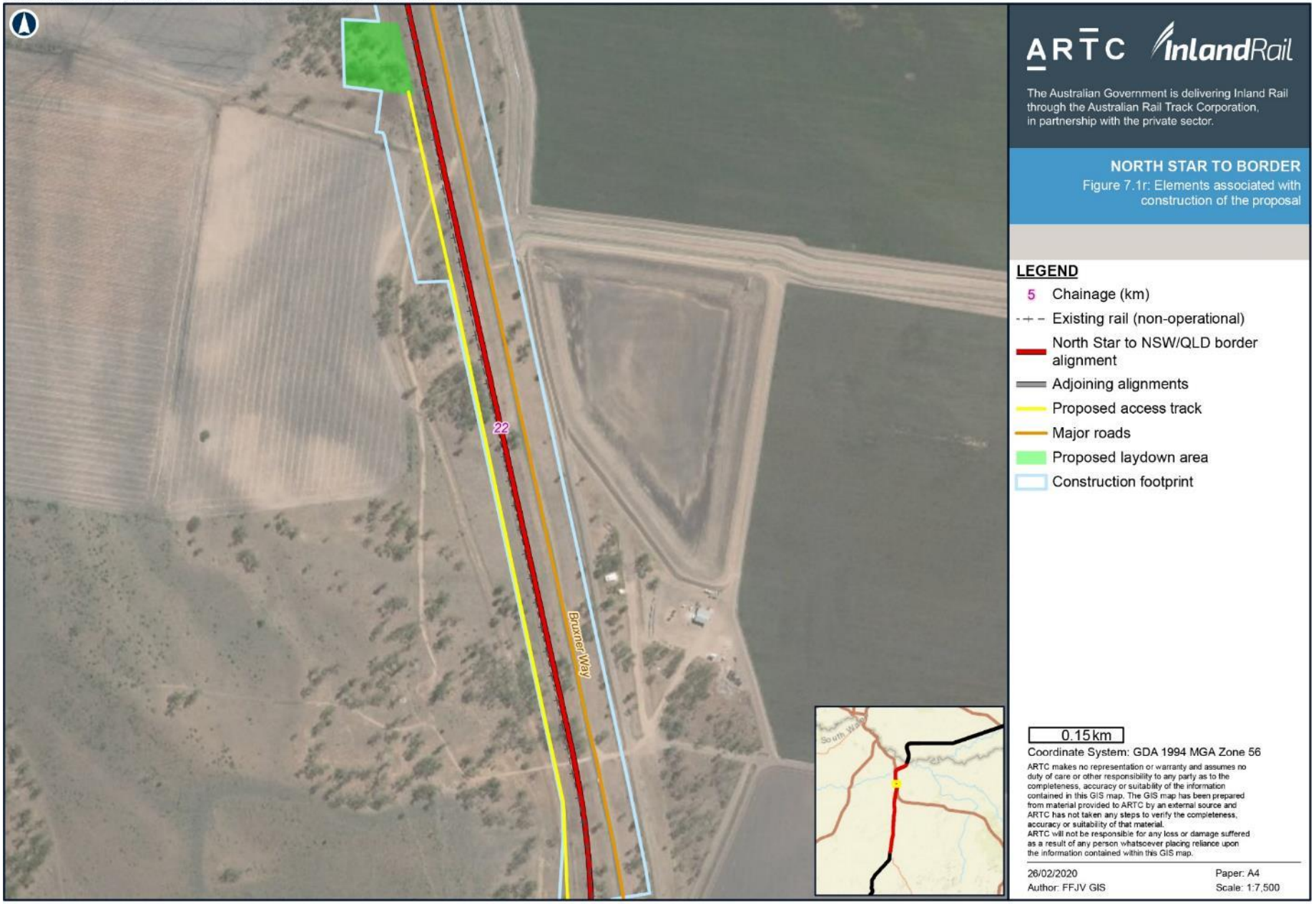
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22
Bruxner Way
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1r: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Proposed laydown area
Construction footprint
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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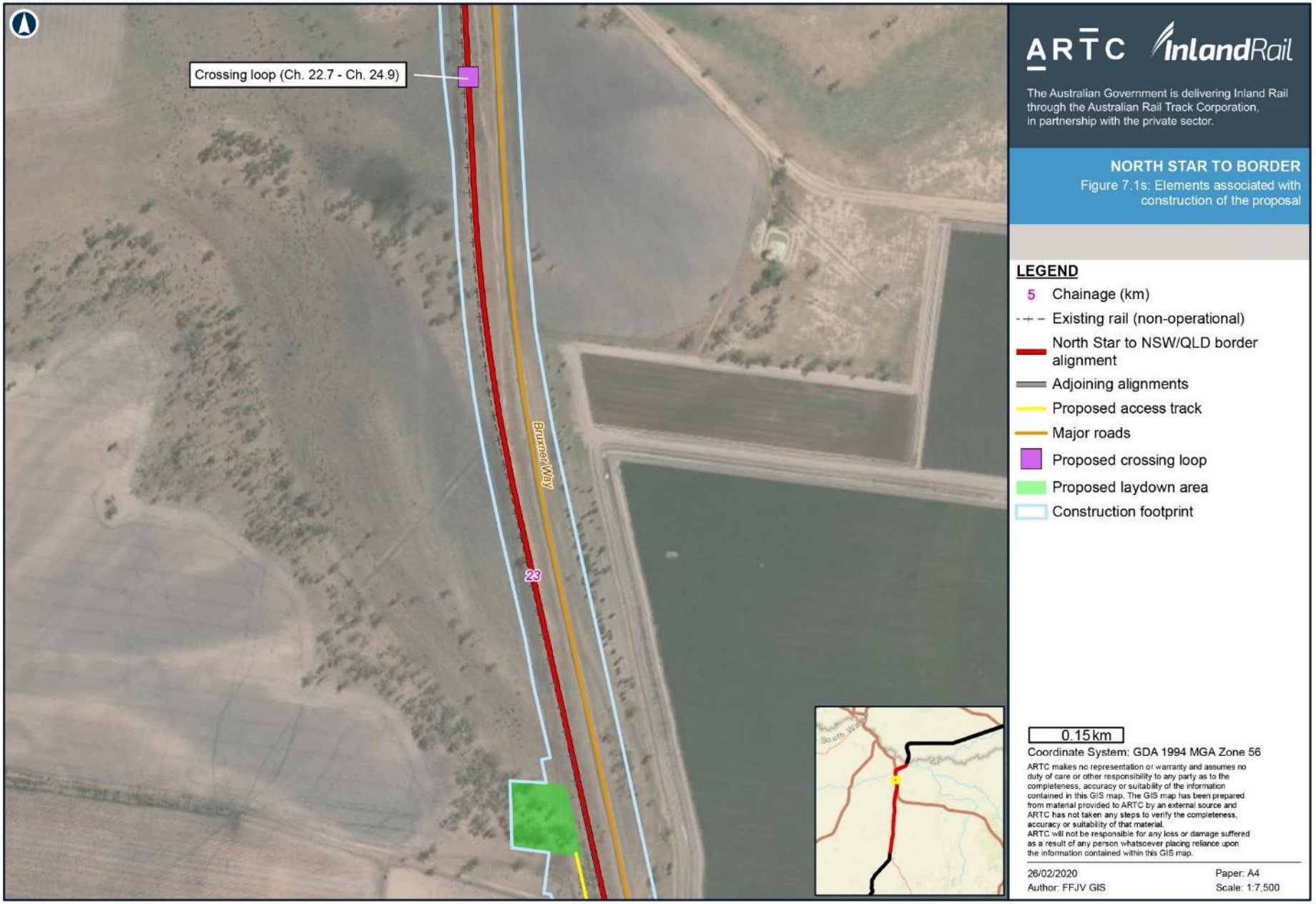
Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
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Crossing loop (Ch. 22.7 - Ch. 24.9)
Bruxner Way
23
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1s: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Proposed crossing loop
Proposed laydown area
Construction footprint
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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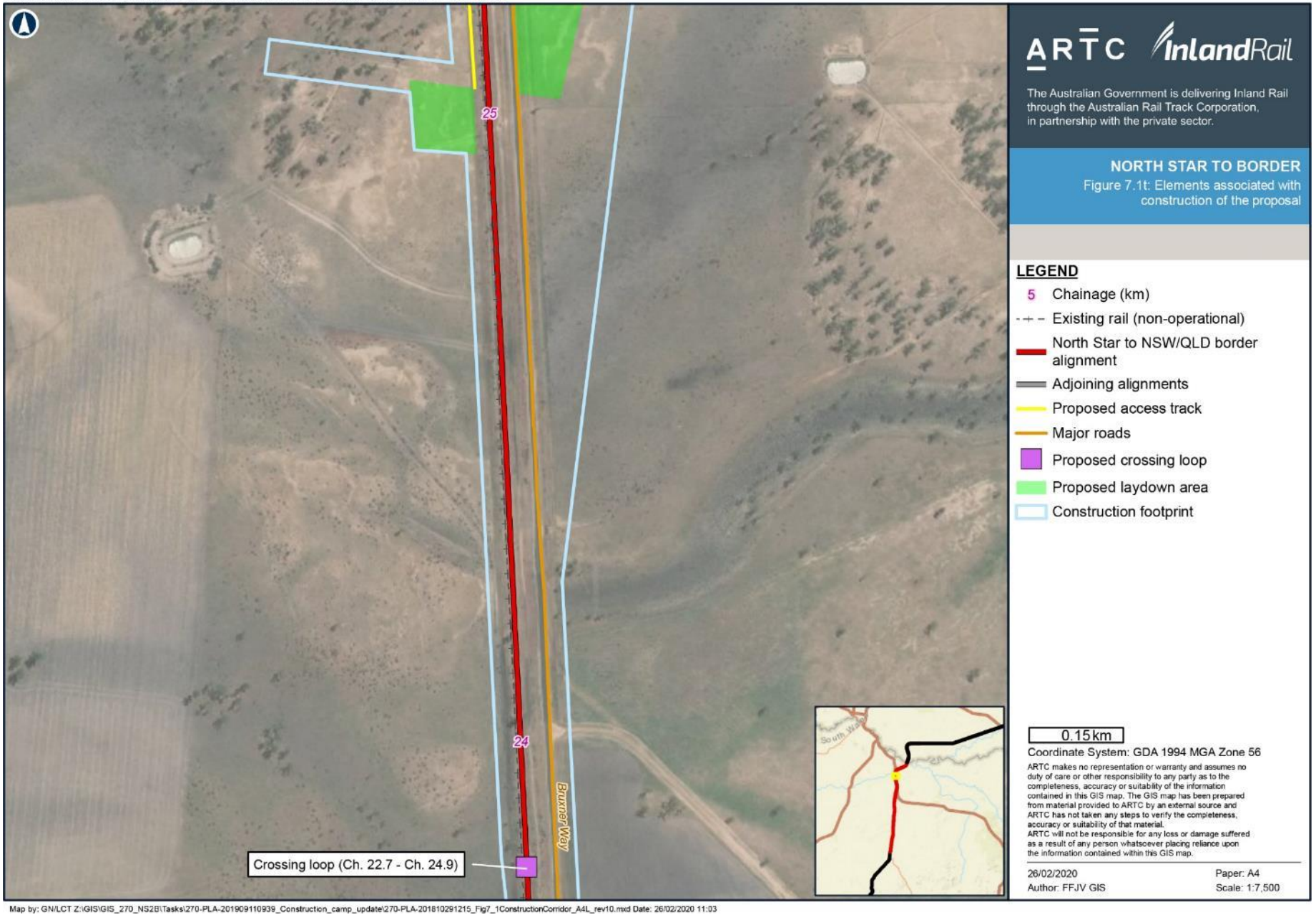
Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
25
24
Brunner Way
Crossing loop (Ch. 22.7 - Ch. 24.9)
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1t: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Proposed crossing loop
Proposed laydown area
Construction footprint
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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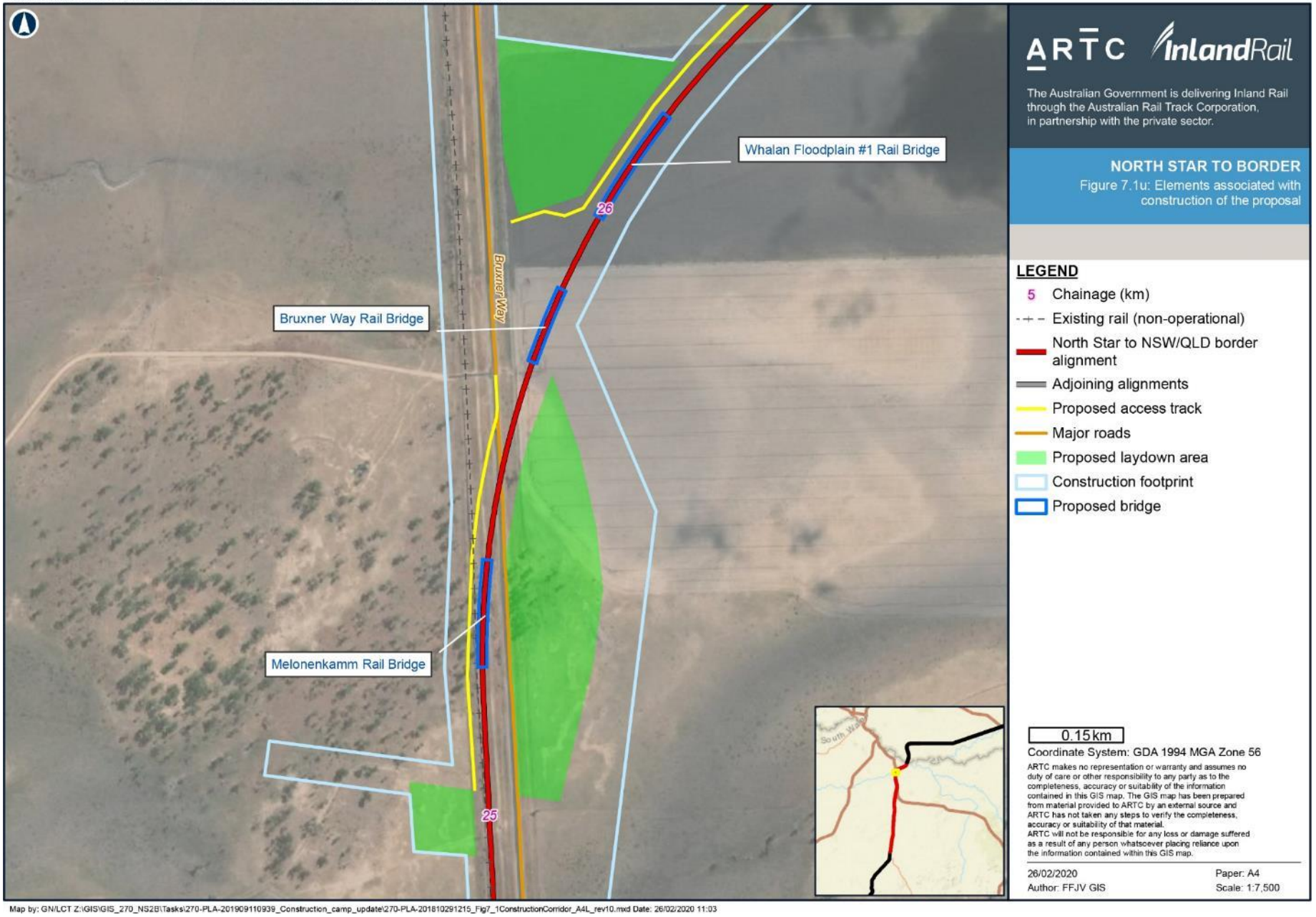
Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
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Whalan Floodplain #1 Rail Bridge
Bruxner Way Rail Bridge
Melonenkamm Rail Bridge
Bruxner Way
26
25
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1u: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Proposed laydown area
Construction footprint
Proposed bridge
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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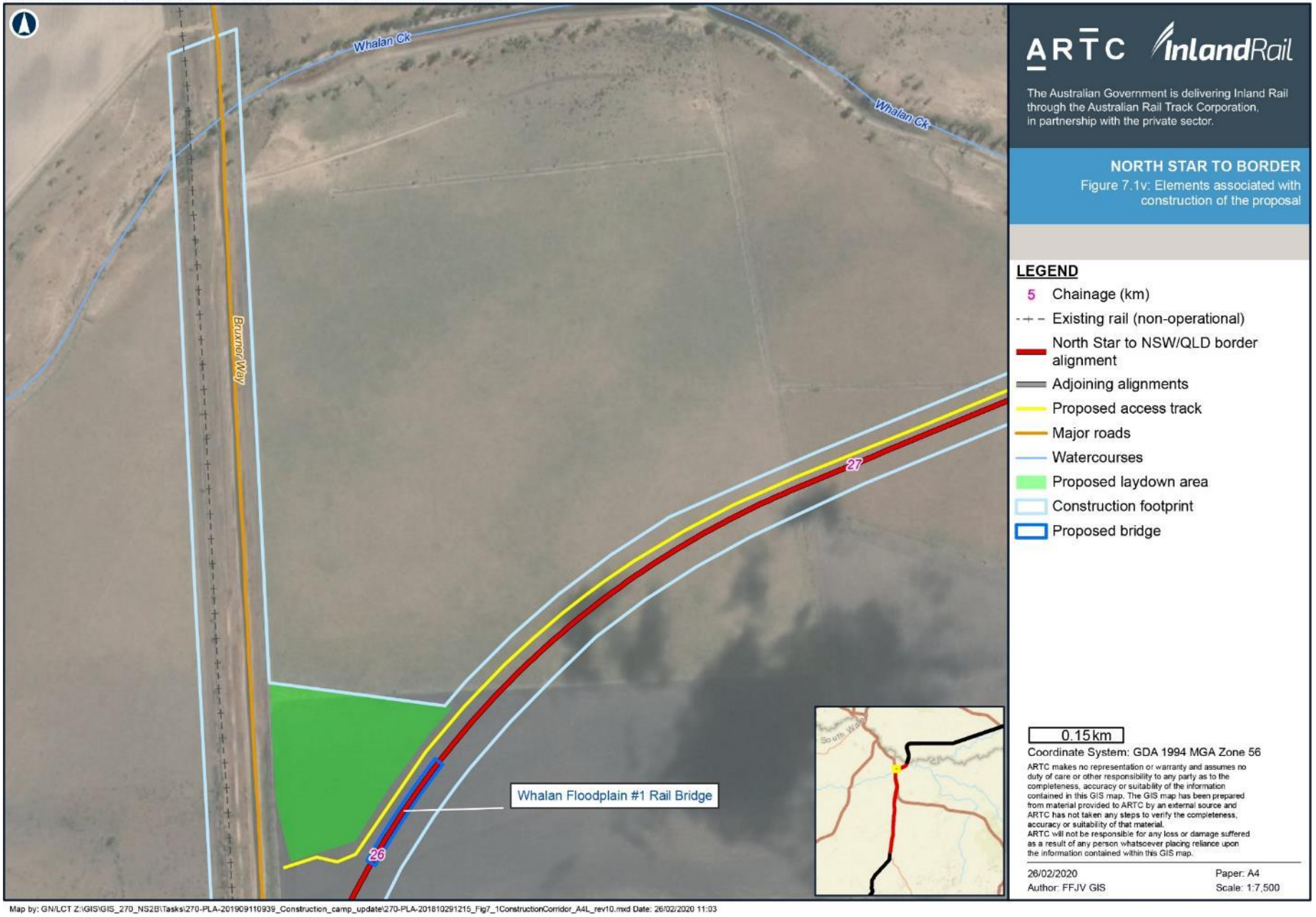
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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Whalan Ck
Whalan Ck
Bruxner Way
27
26
Whalan Floodplain #1 Rail Bridge
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1v: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
Watercourses
Proposed laydown area
Construction footprint
Proposed bridge
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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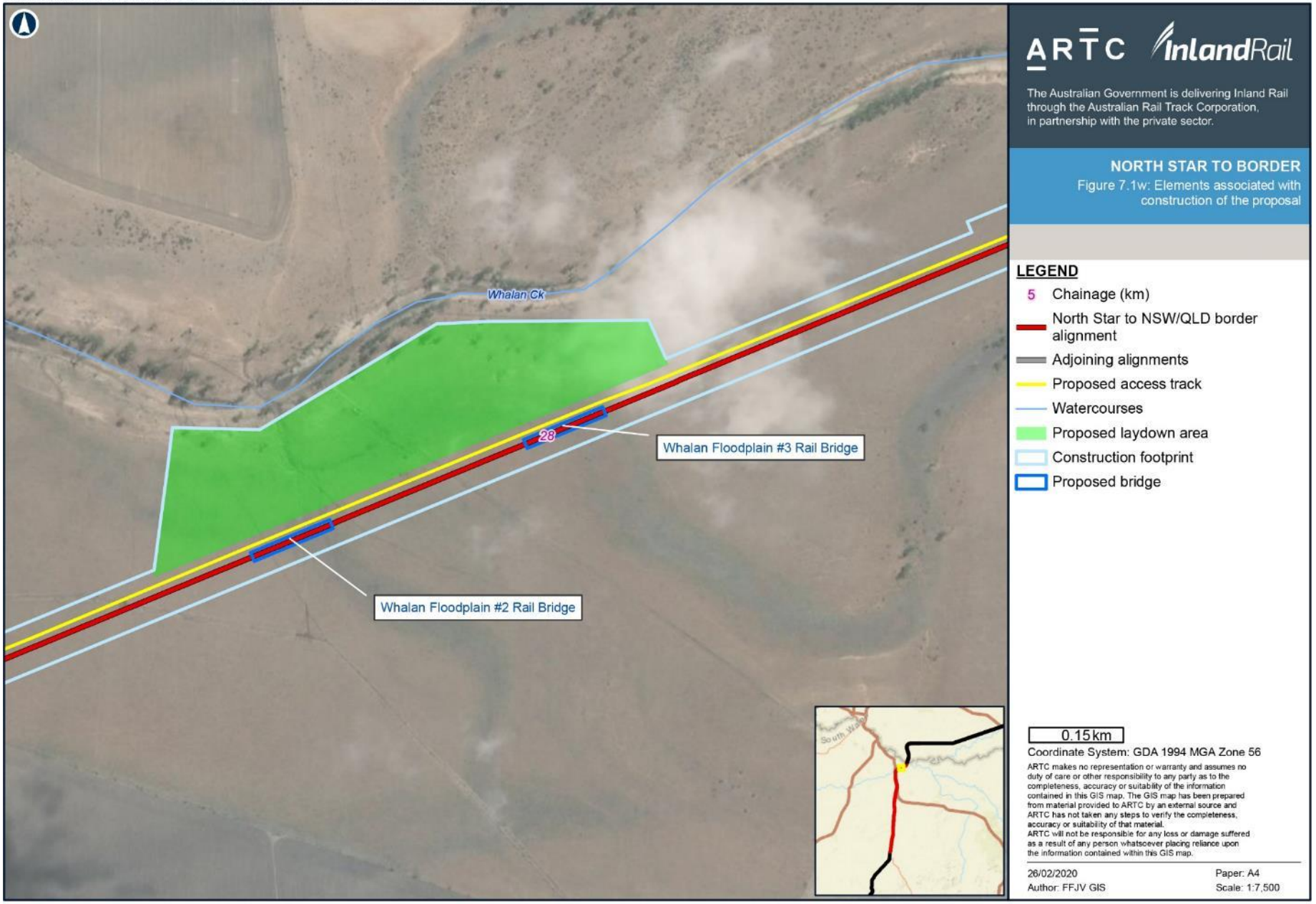
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Whalan Ck
28
Whalan Floodplain #3 Rail Bridge
Whalan Floodplain #2 Rail Bridge
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1w: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Watercourses
Proposed laydown area
Construction footprint
Proposed bridge
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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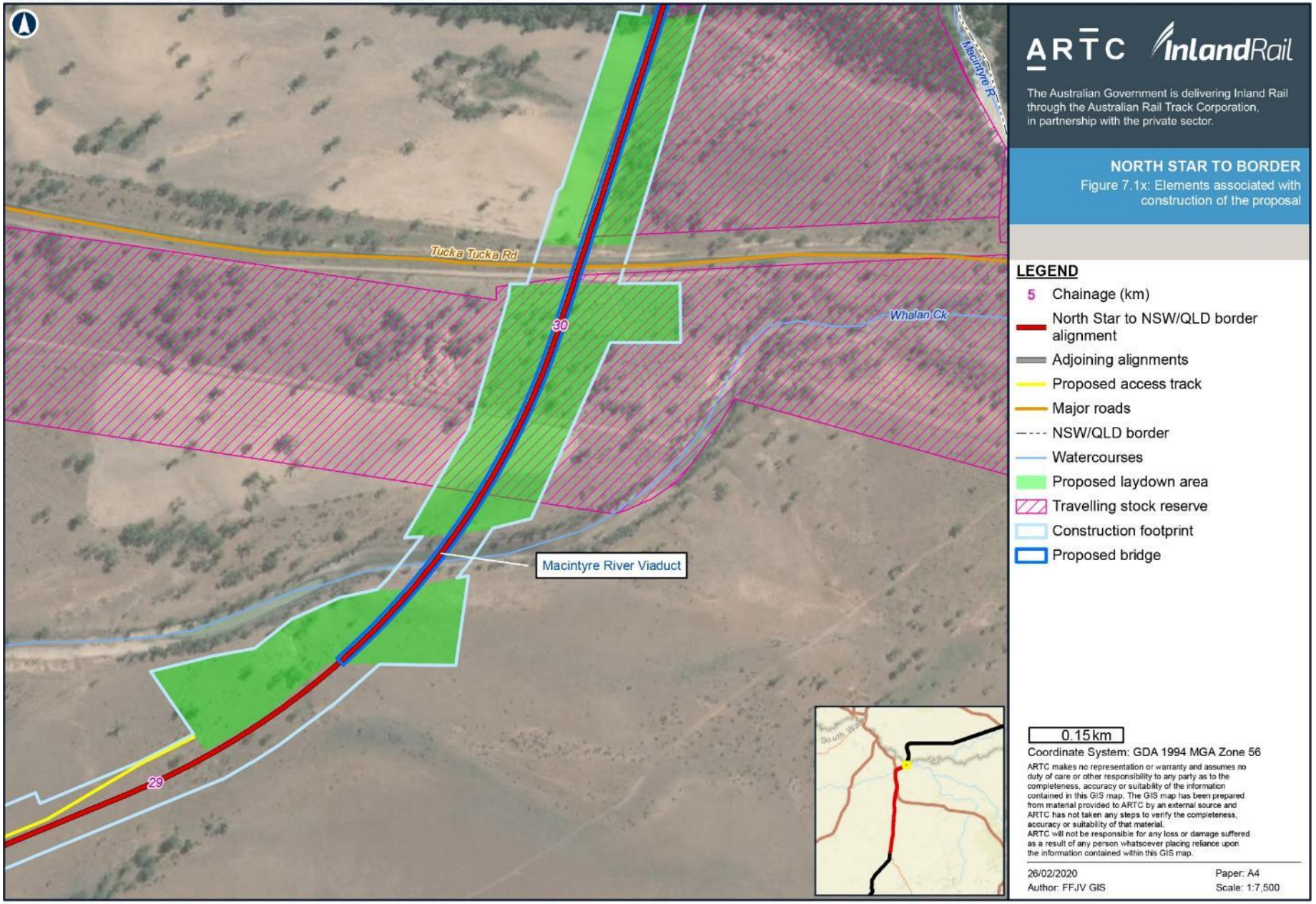
Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Tucka Tucka Rd
Macintyre R
Whalan Ck
30
29
Macintyre River Viaduct
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1x: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
North Star to NSW/QLD border alignment
Adjoining alignments
Proposed access track
Major roads
NSW/QLD border
Watercourses
Proposed laydown area
Travelling stock reserve
Construction footprint
Proposed bridge
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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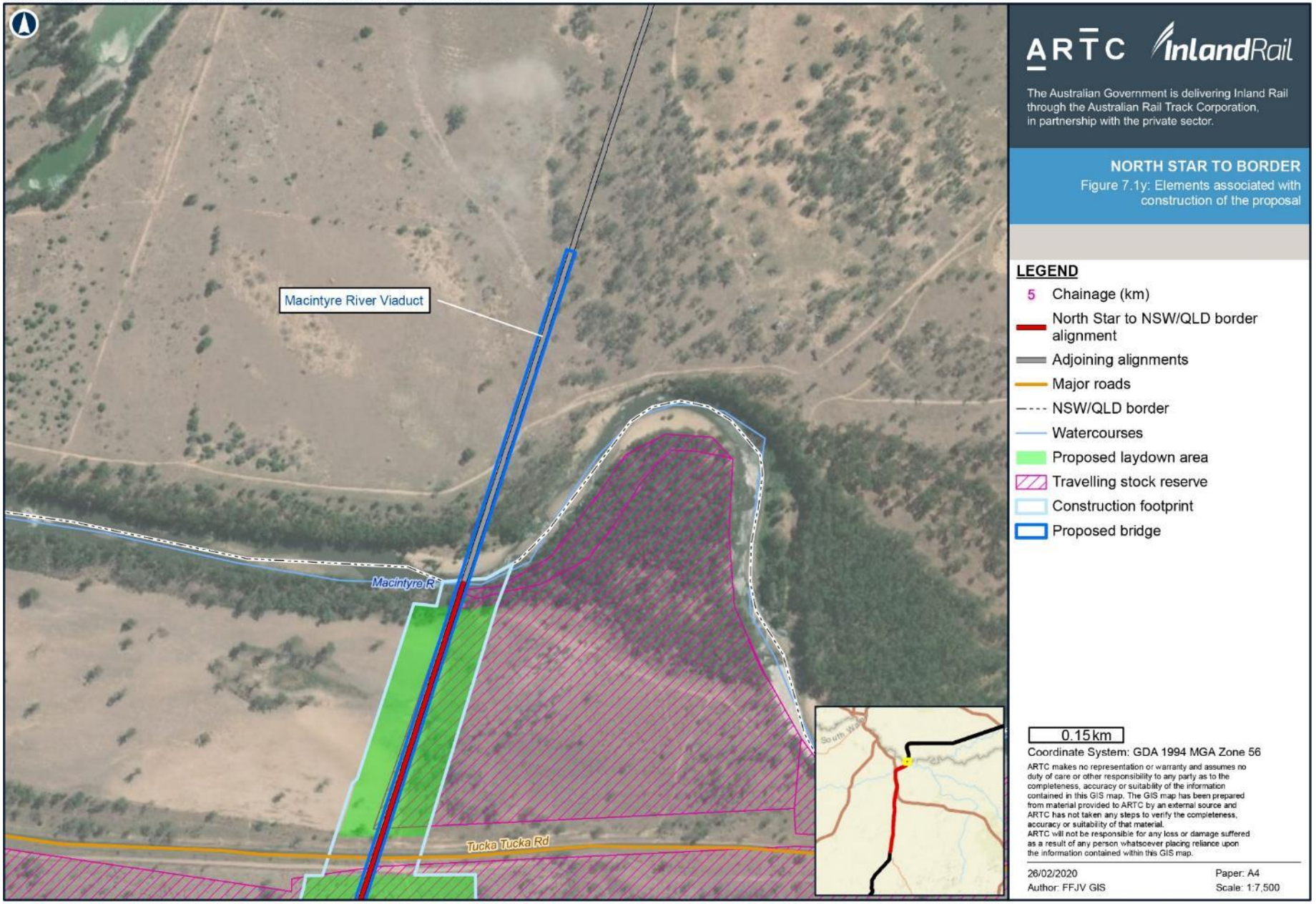
Data Sources: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Macintyre River Viaduct
Macintyre R
Tucka Tucka Rd
ARTC
InlandRail
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NORTH STAR TO BORDER
Figure 7.1y: Elements associated with construction of the proposal
LEGEND
5 Chainage (km)
North Star to NSW/QLD border alignment
Adjoining alignments
Major roads
NSW/QLD border
Watercourses
Proposed laydown area
Travelling stock reserve
Construction footprint
Proposed bridge
0.15 km
Coordinate System: GDA 1994 MGA Zone 56
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7.2 Construction staging

Figure 7.2 is an overview of how the construction phase will be staged for the proposal.

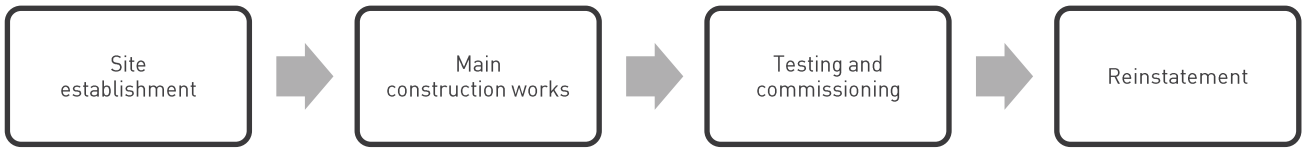


FIGURE 7.2 CONSTRUCTION STAGING

The proceeding sections describe activities that will occur within each stage of construction. Construction activities are conventional in nature; however, in some locations, certain activities may be modified to account for site–specific environmental and/or engineering constraints.

The activities are not necessarily presented in order. Some activities may occur concurrently or in a different order, due to environmental and/or engineering constraints. The final construction activities, sites and sequencing will be determined during the detailed design phase, taking into account the construction contractor's chosen methodologies and relevant conditions of approval.

The proposal is currently in the project approval phase. During the detailed design phase (2020 to 2021), the proposal will be further refined to minimise impacts. All future refinements will be constrained to the maximum parameters and impacts identified in this EIS. In this way, construction (occurring between 2021 and 2025) and operation (occurring after 2025) of the proposal will be within the parameters and impacts approved through this EIS.

7.2.1 Site establishment and enabling works

Site establishment and enabling works will occur in advance of the main construction works. This includes, but is not limited to, the following low-impact work:

- Survey work, including carrying out general alignment surveys, installing survey controls (such as global positioning system (GPS)), installing repeater stations, carrying out surveys of existing and future utilities and infrastructure, archaeological monitoring and road-dilapidation surveys
- Investigations, including investigative drilling and excavation
- Treatment of contaminated sites
- Establishing construction ancillary facilities, such as laydown areas, access tracks and water supply infrastructure
- Establishing the construction camp
- Utility diversions and adjustments
- Minor clearing and relocation of vegetation for the purpose of establishing laydown areas, access tracks and the construction camp, and undertaking low-impact utility relocations and adjustments
- Erection of prefabricated site offices and portable amenities
- Delivering and stockpiling construction materials
- Installing mitigation measures, including erosion and sediment controls, temporary exclusion fencing around sensitive areas and at–property acoustic treatments
- Some property adjustment works, including installing property fencing
- Archaeological testing under the *Code of Practice for Archaeological investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010) and salvaging Aboriginal artefacts
- Demolition and/or maintenance of existing structures needed to facilitate construction of the proposal.

A Site Establishment Management Plan will be prepared to manage safety and environmental risks arising from high-impact site establishment and enabling works.

Existing bridges and culverts within the non-operational Boggabilla rail corridor are considered unsuitable for reuse as part of the proposal. They will be demolished and relocated clear of works or offsite.

Prior to commencing work, a detailed demolition plan will be prepared for each bridge structure so that demolition proceeds in a controlled manner and safety and environmental risks are minimised. Demolition will occur in accordance with relevant waste-management requirements.

7.2.2 Main construction works

Following site establishment activities, the main construction works will commence, primarily consisting of:

- Earthworks
- Track works
- Drainage works
- Bridge works
- Road works.

The construction activities presented in this section are not necessarily in order. Some activities may occur concurrently or in a different order due to environmental and/or engineering constraints. The final construction activities, sites and sequencing will be determined during the detailed design phase, taking into account the construction contractor's chosen methodologies. Final methodologies will allow for:

- Site-specific environmental and engineering constraints
- Maintaining sufficient water flow
- In the event of flooding, critical plant and equipment can be quickly evacuated to higher ground.

A Construction Environmental Management Plan will be prepared to manage key environmental and public amenity risks arising from main construction works.

7.2.2.1 Earthworks

The anticipated construction methodology for earthworks is:

- Clearing and grubbing:
  - To be preceded by pre-construction ecology and heritage surveys
  - Clearing and grubbing will occur progressively during the construction phase in order to minimise soil exposure where practicable
  - Protective measures will be in place in downstream areas to prevent erosion and sedimentation.
- Stripping topsoil and stockpiling it for later use
- Excavation of cuttings, including stockpiling cutting material that is unsuitable for reuse:
  - Topsoil stripping and excavations will occur progressively during the construction phase in order to minimise soil exposure
  - Surplus material will be assessed for re-use as fill material
  - Surplus material that is unsuitable for re-use as fill material may be used to rehabilitate disturbed areas, or it may be formed into permanent spoil mounds within the rail corridor. Spoil mounds will be neatly formed to prevent erosion and sedimentation. They will not be located in areas where they would impact on flooding or drainage.
- Hauling embankment materials (general fill, structural fill and capping) from borrow pits and local quarries to embankment locations and/or stockpiling areas
- Construction of embankments:
  - The embankment foundation will be inspected and tested as it is exposed. Depending on the condition of the foundation, it will either be compacted, dug out and replaced, or treated in situ (e.g. with lime) to ensure the subgrade meets the design requirements. Some locations may be subject to preloading before final placement
  - Embankment materials will undergo moisture conditioning. The material will then be spread, compacted, trimmed and profiled
- Stabilising batter slopes.

Within the construction footprint, some sections of track within the existing non–operational Boggabilla rail corridor are raised on embankments. There may be an opportunity to reuse these existing embankments for the proposal, resulting in material and time savings.

The anticipated methodology for reusing existing embankments is:

- Removing track, sleepers and ballast from the existing embankment
- Clearing, grubbing and topsoil stripping
- Inspecting the consistency and strength of the existing embankment. If the consistency and strength are acceptable, the embankment may be reused for the proposal. In some cases, the embankment material may need to be blended with other material prior to reuse. If the consistency and strength are still not acceptable, the embankment will be dug out and replaced.

7.2.2.2 Track works

As per Section 7.2.1, existing bridges and culverts within the non–operational Boggabilla rail corridor are considered unsuitable for reuse as part of the proposal. Therefore, in advance of track works, bridges and culverts within the Boggabilla rail corridor must be demolished and relocated clear of work or offsite.

There are two widely accepted options for constructing new sections of rail track: using a track–laying machine or using an excavator with octopus attachments. During the feasibility design phase, an excavator with octopus attachments was identified as the preferred option. This option can pick up to six sleepers up at once and spread them to the correct spacing.

An indicative construction methodology for track works is:

- Placing the bottom layer of ballast
- Laying the sleepers at the required spacing
- Placing the rail:
  - A rail-handling yard is proposed near North Star (Ch 0.2 km). Rails delivered in short lengths (13.7 m to 27.5 m) can be flash-butt welded into longer lengths within the rail-handling yard.
- Clipping and welding of the rail
- Placing the top layer of ballast
- Tamping and profiling the ballast under and around the sleepers
- Rail adjustments and stressing.

Turnouts for the crossing loop will be constructed in–situ to avoid having to lift the switch and panels.

7.2.2.3 Drainage works

Two main types of drainage are associated with the proposal: culverts and track drainage.

Culverts

Culverts associated with the proposal will be a mix of reinforced concrete pipe culverts and reinforced concrete box culverts. Culvert installation will generally involve:

- Temporarily damming or diverting any water flows
- Excavating to the required depth
- Placing and compacting the culvert bedding material
- Placing the pre-cast culvert structures, including the headwalls and aprons, on the bedding material and fastening them together
- Placing compacted backfill around and over the culvert
- Placing scour protection around the culvert
- Track works over the top of the culvert
- Restoring and revegetating disturbed areas.

Once installed, either side of the culverts will be backfilled with support material for the culvert. Scour protection measures may also be installed upstream and downstream of culverts, on disturbed stream banks and around waterfront land to avoid erosion. The placement of scour-protection measures will minimise obstructions to fish passage.

Track drainage

Embankment and catch drains will be constructed along the proposed alignment, generally involving:

- Preparing survey control points for planned excavations
- Excavating material from the drain location
- Trimming and compacting the base and sides of the drain
- Lining the drain to prevent erosion (if required).

7.2.2.4 Bridge works

A total of 11 new bridges are proposed, including an approximately 1.8 km viaduct that crosses Whalan Creek, Tucka Tucka Road and the Macintyre River. The anticipated methodology for bridge construction works is:

- Establishing bridge laydown areas:
  - Protective measures will be installed in downstream areas to prevent erosion and sedimentation of watercourses. The placement of protective measures will minimise obstructions to fish passage
- Establishing working platforms for piling rigs and cranes
- Constructing substructure components, including piles, pile caps, piers, headstocks and abutments
- Lifting pre–cast concrete girders and deck components into place:
  - As all bridges are less than 20 m high, cranes will be used to lift the pre–cast components into place
- Earthworks needed to connect the main track to either end of the bridge
- Installing scour protection
- Placing ballast, sleepers and rail on top of the bridge
- Installing permanent fencing and signage
- Restoring and revegetating disturbed areas.

7.2.2.5 Road works

Construction works will be undertaken on the six roads listed in Table 7.3 to accommodate level crossings and rail-over-road bridges. During construction, road drainage will be installed so existing flood immunity of these roads will be maintained.

TABLE 7.3 SUMMARY OF PROPOSED ROAD WORKS

Chainage (km)	Road	Infrastructure proposed	Description of proposed works
Ch 7.1	North Star Road	Level crossing	The vertical alignment will be amended to suit the rail level at this location. Access to the adjacent private properties will be re-configured to suit the level crossing and provide safe access across the corridor and to North Star Road.
Ch 12.2	Forest Creek Road	Level crossing	The vertical alignment will be amended to suit the rail level at this location. Safety upgrades are also proposed to bring the intersection with North Star Road up to the current Austroads standard.
Ch 19.9	North Star Road	Level crossing	The vertical alignment will be amended to suit the rail level at this location. Access to the adjacent private properties will be re-configured to suit the level crossing and provide safe access across the corridor, North Star Road and the TSR to the north.
Ch 25.6	Bruxner Way	Bruxner Way rail bridge	Realignment of Bruxner Way is required to accommodate the Bruxner Way rail bridge. Bruxner Way will be realigned to the east and then back to the existing Bruxner Way on a slight curve.
Ch 30.1	Tucka Tucka Road	Macintyre River viaduct	No changes to the existing Tucka Tucka Road alignment are proposed; however, minor pavement works may be required to accommodate the Macintyre River viaduct.

The anticipated methodology for road works is:

- Implementing traffic-management measures
- Earthworks to establish the road formation, which may involve topsoil stripping, excavating, placing fill, compaction and/or subgrade treatment
- Installation of culverts, headwalls and aprons
- Placing a select layer of earthworks materials on top of the road formation
- Placing and compacting the pavement layer (road base/gravel) over the select layer. This pavement layer may need to be sealed with bitumen.

Once paving is completed, road furniture, such as guard fencing, guideposts and traffic signs, will be installed and lines will be marked on the road. Around active level crossings, flashing lights and boom barriers will also be installed.

7.2.3 Testing and commissioning

Testing and commissioning of the proposal will ensure that all infrastructure and systems have been designed, installed and operated according to the Proponent's requirements.

7.2.4 Reinstatement

All temporary construction sites, including laydown areas, access tracks and borrow pits, will be rehabilitated having regard to their pre-construction condition and any arrangements with affected landowners. Reinstatement activities will occur progressively during the construction phase, usually involving:

- Demobilising laydown areas and associated facilities
- Removing all materials, waste and redundant structures from construction sites
- Decommissioning temporary fencing and access tracks that will not be used during the operation phase
- Installing permanent fencing
- Restoring disturbed areas, including revegetation where required.

A Reinstatement and Rehabilitation Plan and an Erosion and Sediment Control Plan will be prepared to guide the approach to reinstatement following the completion of construction.

7.3 Plant and equipment requirements

Indicative plant and equipment for construction of the proposal are listed in Table 7.4 The final plant and equipment will be determined during the detailed design phase.

TABLE 7.4 INDICATIVE PLANT AND EQUIPMENT FOR CONSTRUCTION OF THE PROPOSAL

Construction activity	Indicative plant and equipment	
Site establishment	▸ Trucks ▸ Cranes ▸ Graders ▸ Excavators ▸ Water carts	▸ Clearing equipment such as slashers, mulchers and grinders ▸ Concrete mixers ▸ Compactors
Utility relocations	▸ Excavators ▸ Rigid and articulated trucks ▸ Jackhammers ▸ Cranes ▸ Concrete pumps ▸ Wielding equipment ▸ Compactors	▸ Concrete saws ▸ Light vehicles ▸ Concrete trucks ▸ Generators ▸ Oxy–cutting equipment ▸ Backhoes ▸ Directional drilling rig
Drainage works and earthworks	▸ Excavator ▸ Jackhammers ▸ Rigid and articulated trucks ▸ Compactors ▸ Water carts ▸ Generators ▸ Crushing plants ▸ Scrapers	▸ Bulldozers ▸ Boring machines ▸ Graders ▸ Vibrating rollers ▸ Trucks and trailers ▸ Loaders ▸ Backhoes
Bridge and road works	▸ Excavators ▸ Rigid and articulated trucks ▸ Drilling rigs and boring machines ▸ Cranes ▸ Concrete trucks and pumps ▸ Generators ▸ Wielding equipment ▸ Trucks and trailers	▸ Compactors ▸ Graders ▸ Seal spray rig ▸ Vibrating rollers ▸ Water carts ▸ Road line-marking machine ▸ Piling machines
Track works	▸ Excavators ▸ Dump trucks ▸ Vibratory roller ▸ Water cart ▸ Crane ▸ Trucks and trainers ▸ Ballast trains ▸ Tamper and regulator ▸ Dynamic Track Stabiliser	▸ Graders ▸ Bulldozers ▸ Lighting ▸ Skid steer loader ▸ Front end loader ▸ Flash butt welders ▸ Clip–up machine ▸ Rail rake
Testing, commissioning and reinstatement	▸ Milling machines ▸ Trucks ▸ Rollers ▸ Water carts ▸ Excavators	▸ Generators ▸ Oxy–cutting equipment ▸ Sprayers trucks ▸ Graders

7.4 Land requirements

7.4.1 Construction footprint

The temporary construction footprint for the proposal is shown in Figure 7.3. The temporary construction footprint defines the likely extent of the area needed to construct the proposal.

The basis for determining the construction footprint is:

- Generally, it aligns with the existing non–operational Boggabilla rail corridor between North Star (Ch 0.9 km) and the greenfield deviation (Ch 25.7 km)
- A strip of land approximately 10 m wide has been allowed on either side of the earthworks footprint to accommodate track–side infrastructure such as fencing, drainage, etc.
- Sufficient area to construct:
  - New track and associated earthworks
  - Bridge and drainage structures, including installing scour protection
  - Level crossings
  - Road realignments
  - Utility relocations
  - Possible upgrades to adjacent roads and infrastructure
  - Construction camp
  - Rail-maintenance access roads, including access points, passing bays and turnarounds
  - Fencing and signage.
- General construction laydown areas, as well as bridge–specific laydown areas.

Areas outside of the permanent footprint that are needed for the construction phase of the proposal, but not for operation, will generally be leased or licensed from the landowner for the required amount of time.

The construction footprint shown in Figure 7.3 is indicative only. It will be refined during the detailed design phase, considering the construction contractor's chosen methodologies and any negotiated agreements reached with affected landowners.

7.4.2 Laydown areas

During construction, temporary laydown areas will be established at regular intervals along the alignment, including at proposed bridge locations (minimum area of 2,500 square metres (m^2)). Laydown areas will be used to store infrastructure, equipment and materials used during construction. If required, laydown areas at bridge locations may also include crane pads.

The general criteria used to locate and size laydown areas during the feasibility design phase were:

- Located near the proposed alignment, particularly near major construction sites, such as bridges
- Good access to public roads and direct access to the proposed alignment
- Suitable and safe intersections with local public roads
- Located on land that is relatively flat and with low ecological and cultural heritage value
- Located above the 20–year average recurrence interval flood level
- Located away from waterways (at least 50 m is desirable) and sensitive noise receptors.

Three laydown areas have been nominated for storing diesel fuel. The storage and handling of diesel fuel will be in accordance with Australian Standard (AS) 1940:2017. The same three laydown areas have also been nominated to contain prefabricated site offices and portable amenities. Temporary security fencing will be erected around laydown areas to prevent trespass and stock from accessing the laydown areas.

Laydown areas identified during the feasibility design phase are listed in Table 7.5 and mapped in Figure 7.1.

TABLE 7.5 PROPOSED LAYDOWN AREAS

Approximate Chainage	Indicative size (m^2)	Purpose and access	Fuel storage and site office
1.5 km south east of Ch 0	126,000	General laydown, access from North Star Road	
Ch 0.1 km	57,000	Plant and material laydown, access from North Star Road	
Ch 0.2 km	57,000	Will be used to offload construction materials transported to the site via rail. Rails delivered in short lengths (12.7 m to 27.5 m) may be flash-butt welded into longer lengths within this laydown area. This laydown area will also be used to store and maintain construction plant and equipment. Access is provided from North Star Road, which requires crossing the proposed alignment.	
Ch 3.6 km	22,000	Utility relocations, access from North Star Road	
Ch 5.8 km	61,000	Bridge laydown, access via a dirt (unsealed) track	
Ch 7.6 km	44,000	Road interface and track works, access via North Star Road	✓ < 10,000 litres (L) fuel Satellite site office
Ch 8.1 km	2,500	Bridge laydown, a new access track adjoining North Star Road will be provided	
Ch 8.6 km	99,000	General laydown, access from North Star Road	
Ch 16.3 km	24,000	Bridge laydown, access from North Star Road	
Ch 20.0 km	103,000	General laydown, access from North Star Road	✓ < 20,000 L fuel Main site office
Ch 20.8 km	10,000	Bridge laydown, access from Bruxner Way (unsealed)	
Ch 22.6 km	11,000	Crossing loop, access from Bruxner Way (unsealed)	
Ch 25.0 km	11,000	Crossing loop, access from Bruxner Way (unsealed)	
Ch 25.4 km	70,000	Bridge laydown, access from Bruxner Way (unsealed)	
Ch 26.0 km	50,000	Bridge laydown, access from Bruxner Way (unsealed)	
Ch 27.8 km	137,000	Bridge laydown, access from Bruxner Way (unsealed)	
Ch 29.3 km	56,000	Bridge laydown, access from Bruxner Way (unsealed)	
Ch 29.8 km	90,000	Bridge and track work, access from Tucka Tucka Road	✓ < 20,000 L fuel Satellite site office
Ch 30.5 km	50,000	Bridge laydown, access from Tucka Tucka Road	

Establishing temporary laydown areas will generally involve:

- Clearing
- Grubbing
- Topsoil stripping
- Installing environmental controls
- Establishing construction parking areas and access tracks.

Temporary laydown areas may include isolated cut-to-fill levelling and placement of a gravel-layer hardstand.

Infrastructure associated with the proposal will either be constructed in–situ (e.g. welded sections of rail) or prefabricated offsite (e.g. precast concrete culverts and bridge girders). Therefore, activities within the laydown areas will generally involve:

- Site office operations
- Delivery and stockpiling of construction materials
- Assemblage of adjacent infrastructure, such as culverts and turnouts
- Movement and refuelling of plant and equipment
- Installation and maintenance of environmental controls.

The laydown areas mapped in Figure 7.1 will be reviewed during the detailed design phase to ensure that they meet the needs of the construction contractor and any conditions of approval for the proposal. If additional laydown areas are required, they will meet the criteria listed earlier in this section.

7.4.3 Access tracks

Access tracks are needed to access construction sites and borrow pits. To minimise property impacts, existing access tracks and already disturbed areas (e.g. the rail formation) will be used wherever possible. If required, upgrades to existing access tracks will be undertaken in consultation with affected landholders.

The criteria used to design access tracks during the feasibility design phase were:

- Provision of a suitably wide road
- Provision of adequate turning circles for construction vehicles and cranes (if required)
- Pavement type can support construction vehicles and cranes (if required)
- Where practicable, provision of more than one access point to construction sites
- Designed and located to minimise potential environmental impacts.

Table 7.6 lists access tracks that were identified during the feasibility design phase.

TABLE 7.6 PROPOSED ACCESS TRACKS

Approximate chainage	Adjoining road	Indicative length (m)	Description
Ch 0.4 to 3.1 km	North Star Road	2,700	Located within the existing Boggabilla rail corridor
Ch 8.1 km	North Star Road	270	Located outside the ultimate rail corridor; new access track
Ch 20.8 km	North Star Road	50	Located outside the ultimate rail corridor; new access track
Ch 20.6 to 22.5 km	Bruxner Way	1,900	Located within the existing Boggabilla rail corridor
Ch 25.1 to 25.7 km	Bruxner Way	400	Located within the existing Boggabilla rail corridor
Ch 25.7 to 29.1 km	Bruxner Way	3,400	Located within the greenfield rail corridor
Borrow pit—Site 5	Hohns Road	2,200	Located outside the ultimate rail corridor; new access track
Borrow pit—Site 11	Bruxner Way	1,600	Located outside the ultimate rail corridor; new access track
Borrow pit—Site 1	Minilya Road	850	Located outside the ultimate rail corridor; new access track
Borrow pit—Site 1	North Star Road	1,000	Located outside the ultimate rail corridor; new access track
Borrow pit—Site 2	Croppa Creek Road	750	Located outside the ultimate rail corridor; new access track

As with proposed laydown areas, access tracks will be reviewed during the detailed design phase to ensure that they meet the needs of the construction contractor and any conditions of approval for the proposal. If additional, temporary access tracks are required, they will meet the criteria listed earlier in this section.

7.5 Material requirements

Construction of the proposal will require a variety of materials, including:

- General fill and structural fill for constructing embankments
- Aggregates for capping and scour protection
- Materials for the rail track, including:
  - Steel rails
  - Precast concrete sleepers
  - Ballast
- Steel for bridge girders and concrete reinforcement
- Precast concrete culverts and bridge girders
- Ready mix concrete for bridge and culvert construction
- Water for soil conditioning and dust suppression.

The preceding sections describe major material requirements, quantities and potential sources for the proposal. Note: materials with a long lead time, such as borrow and quarry material, may be delivered to site and stockpiled within the construction footprint during site establishment and enabling works.

7.5.1 Borrow pits

The proposed alignment traverses the Macintyre River floodplain for approximately 14 km. To achieve flood immunity, much of the proposal is elevated on a fill embankment. The embankment height is typically less than 2 m; however, in the lead up to the proposed Bruxner Way realignment and the Macintyre River Viaduct, the embankment height increases to approximately 7.5 m.

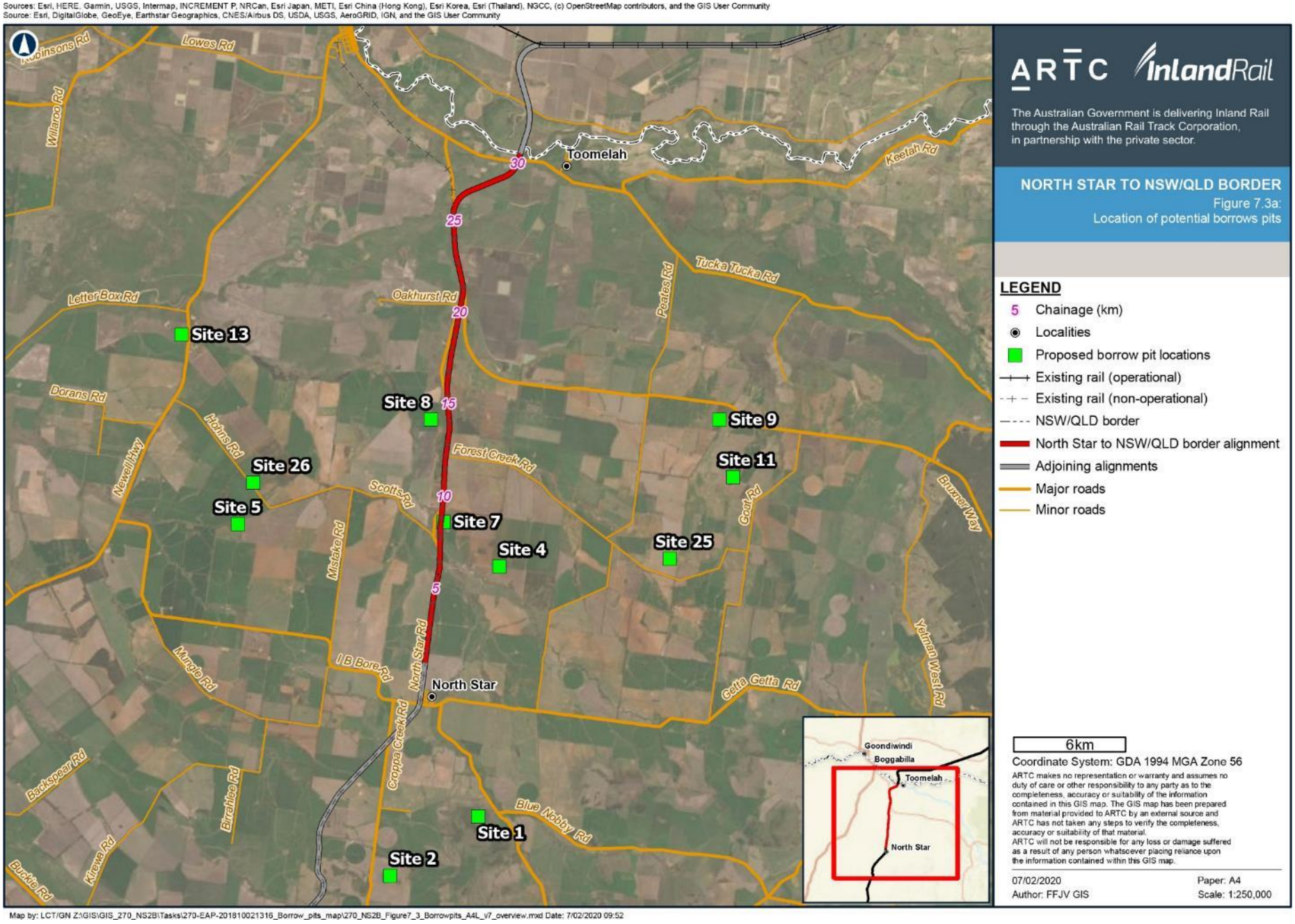
No significant cuttings (> 10 m) are proposed; therefore, there is a significant deficit of general and structural fill for constructing embankments. Currently, the additional required material cannot be sourced from within the investigation corridor or any identified current operational and approved quarry sites in suitable proximity to the proposal. Present estimates indicate that the deficit of general and structural fill is approximately 1,100,000 cubic metres (m^3); however, this is subject to change during the detailed design phase.

During the feasibility design phase, a range of potential borrow pit sites were investigated. To date, 11 borrow pit sites with the potential to provide general fill, structural fill, ballast and/or capping have been identified. The potential borrow pit sites that could provide additional construction materials, which are expected to meet required engineering specifications to help meet anticipated project shortfalls of material are listed in Table 7.7 and mapped in Figure 7.3.

TABLE 7.7 POTENTIAL BORROW PIT SITES AND ESTIMATED MATERIAL POTENTIAL

Borrow pit ID (Figure 7.3)	Potential extraction volume (m^3)[1]	Type of material
Site 4	240,000	General fill
Site 5	483,000	General fill
Site 7	1,100,000	General fill
Site 8	497,000	General fill
Site 9	600,000	General fill
Site 11	315,000	General fill
Site 13	185,000	General fill
Site 25	462,000	General fill
Site 26	112,000	General fill
Site 1	400,000	General fill, ballast and structural fill
Site 2	250,000	General fill, ballast and structural fill
Total	**4,644,000**	

Table note:
1. Volumes do not include overburden. Amounts are volumes of suitable material only.


Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Robinsons Rd
Lowes Rd
Willaroo Rd
Toomelah
Keelah Rd
30
25
Tucka Tucka Rd
Peaties Rd
Letter Box Rd
Oakhurst Rd
20
Site 13
Dorans Rd
Site 8
15
Site 9
Hohns Rd
Newell Hwy
Site 26
Forest Creek Rd
Site 11
Site 5
Scotts Rd
10
Site 7
Goat Rd
Bruxner Way
Site 4
Site 25
Mistake Rd
5
North Star Rd
Yetman West Rd
Mungle Rd
I B Bore Rd
North Star
Getta Getta Rd
Backspear Rd
Croppa Creek Rd
Birrahlee Rd
Blue Nobby Rd
Site 1
Kirewa Rd
Site 2
Buckie Rd
Goondiwindi
Boggabilla
Toomelah
North Star
ARTC
InlandRail
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NORTH STAR TO NSW/QLD BORDER
Figure 7.3a:
Location of potential borrows pits
LEGEND
5 Chainage (km)
Localities
Proposed borrow pit locations
Existing rail (operational)
Existing rail (non-operational)
NSW/QLD border
North Star to NSW/QLD border alignment
Adjoining alignments
Major roads
Minor roads
6km
Coordinate System: GDA 1994 MGA Zone 56
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NORTH STAR TO NSW/QLD BORDER

Figure 7.3b:
Location of potential borrows pits

LEGEND

- Construction footprint
- Proposed borrow pit

0.25 km

Coordinate System: GDA 1994 MGA Zone 56

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Author: FFJV GIS Scale: 1:10,000

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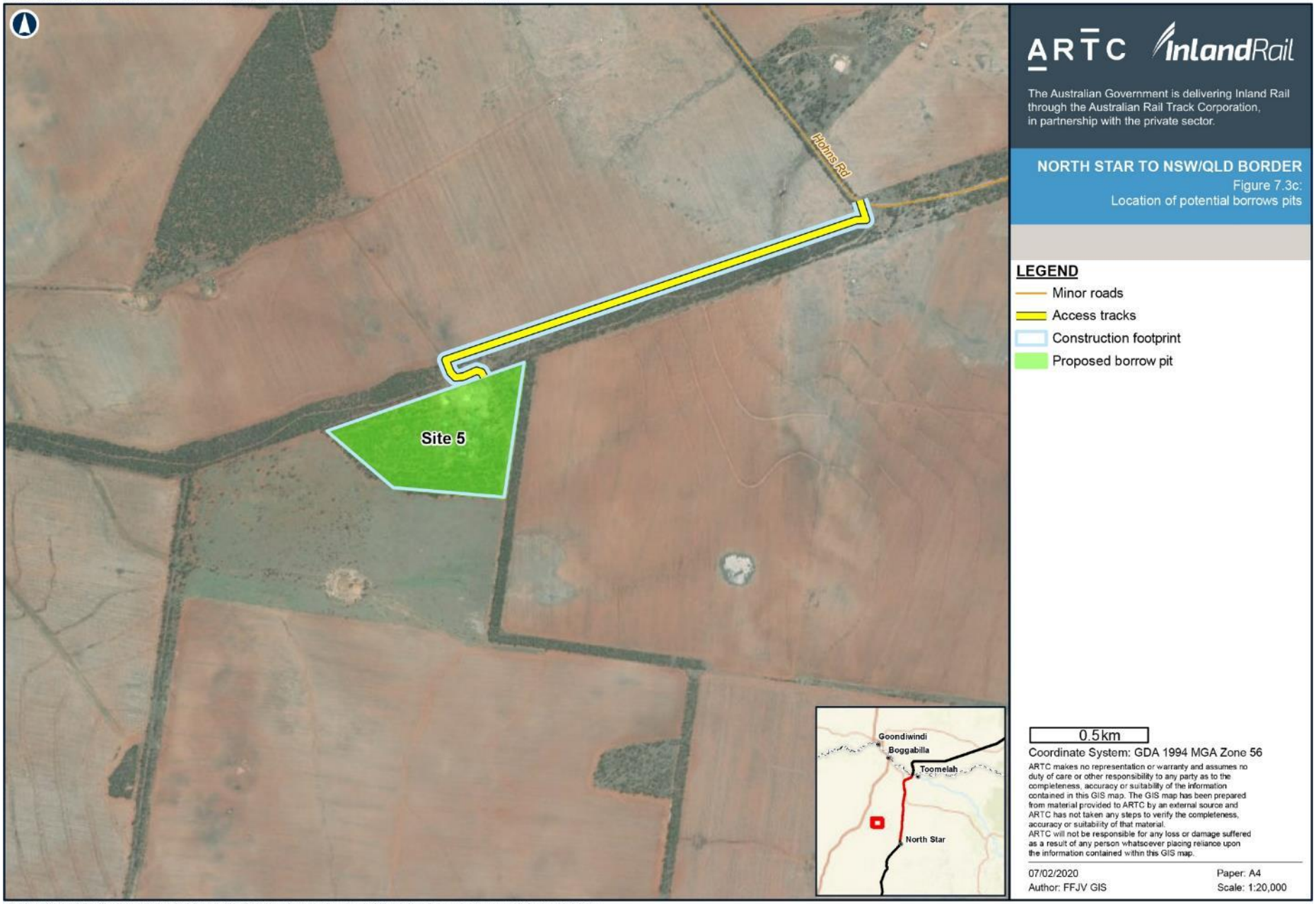
Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Hohns Rd
Site 5
Goondiwindi
Boggabilla
Toomelah
North Star
ARTC
InlandRail
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NORTH STAR TO NSW/QLD BORDER
Figure 7.3c:
Location of potential borrows pits
LEGEND
Minor roads
Access tracks
Construction footprint
Proposed borrow pit
0.5km
Coordinate System: GDA 1994 MGA Zone 56
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Paper: A4
Scale: 1:20,000
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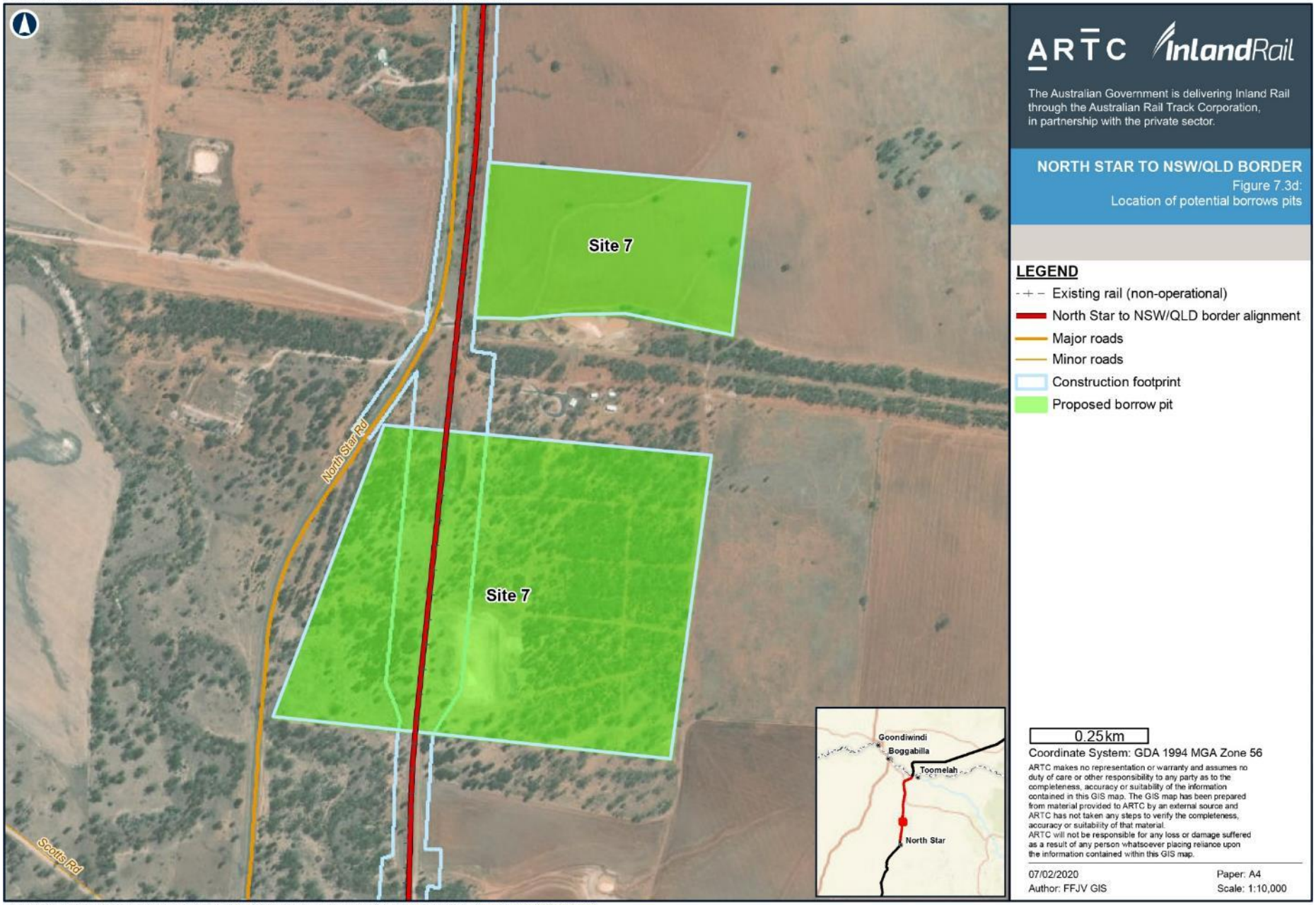
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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NORTH STAR TO NSW/QLD BORDER
Figure 7.3d:
Location of potential borrows pits

LEGEND
- Existing rail (non-operational)
- North Star to NSW/QLD border alignment
- Major roads
- Minor roads
- Construction footprint
- Proposed borrow pit

0.25km
Coordinate System: GDA 1994 MGA Zone 56

07/02/2020 Paper: A4
Author: FFJV GIS Scale: 1:10,000

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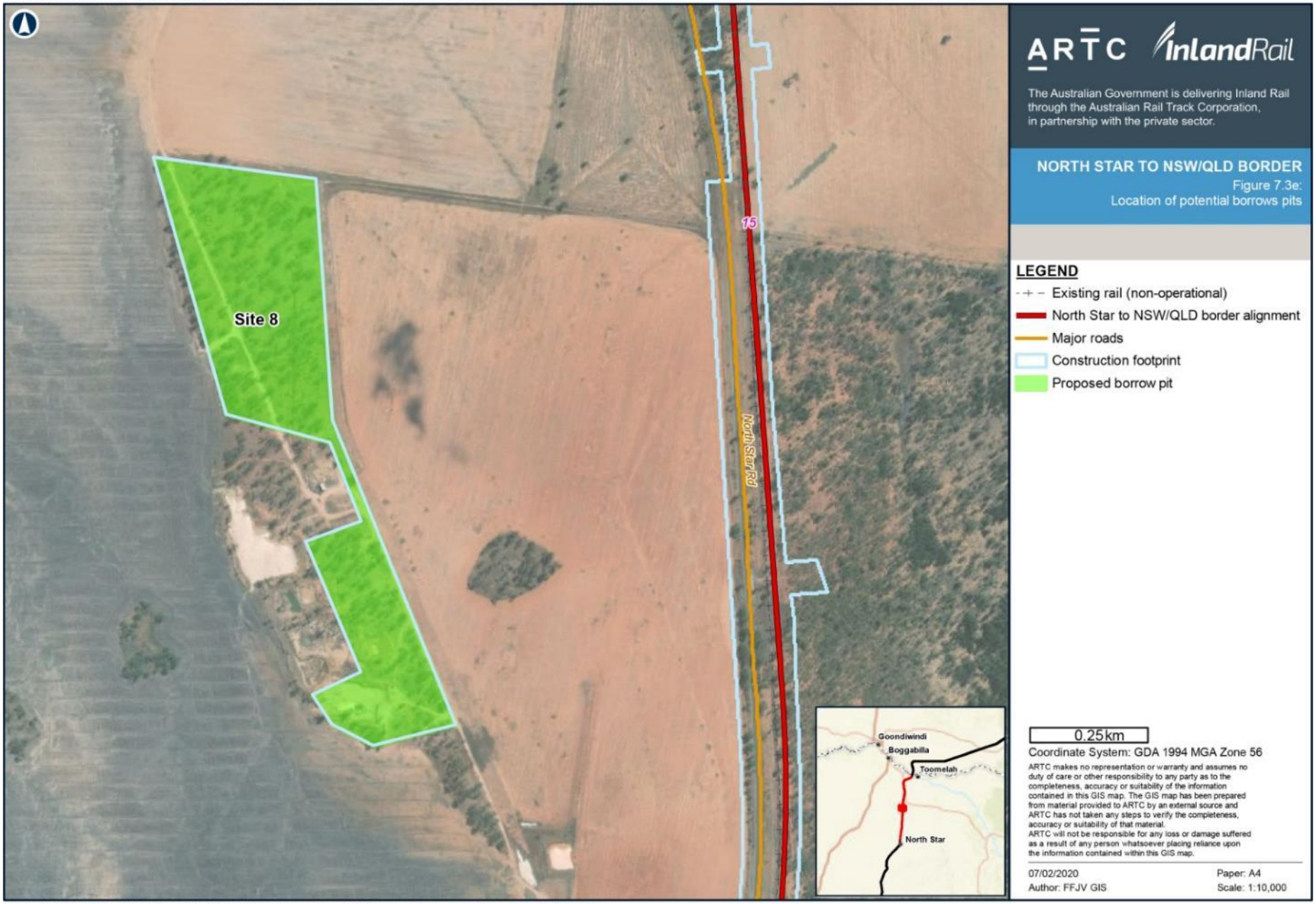
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Site 8
15
North Star Rd
Goondiwindi
Boggabilla
Toomelah
North Star
ARTC
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NORTH STAR TO NSW/QLD BORDER
Figure 7.3e:
Location of potential borrows pits
LEGEND
Existing rail (non-operational)
North Star to NSW/QLD border alignment
Major roads
Construction footprint
Proposed borrow pit
0.25km
Coordinate System: GDA 1994 MGA Zone 56
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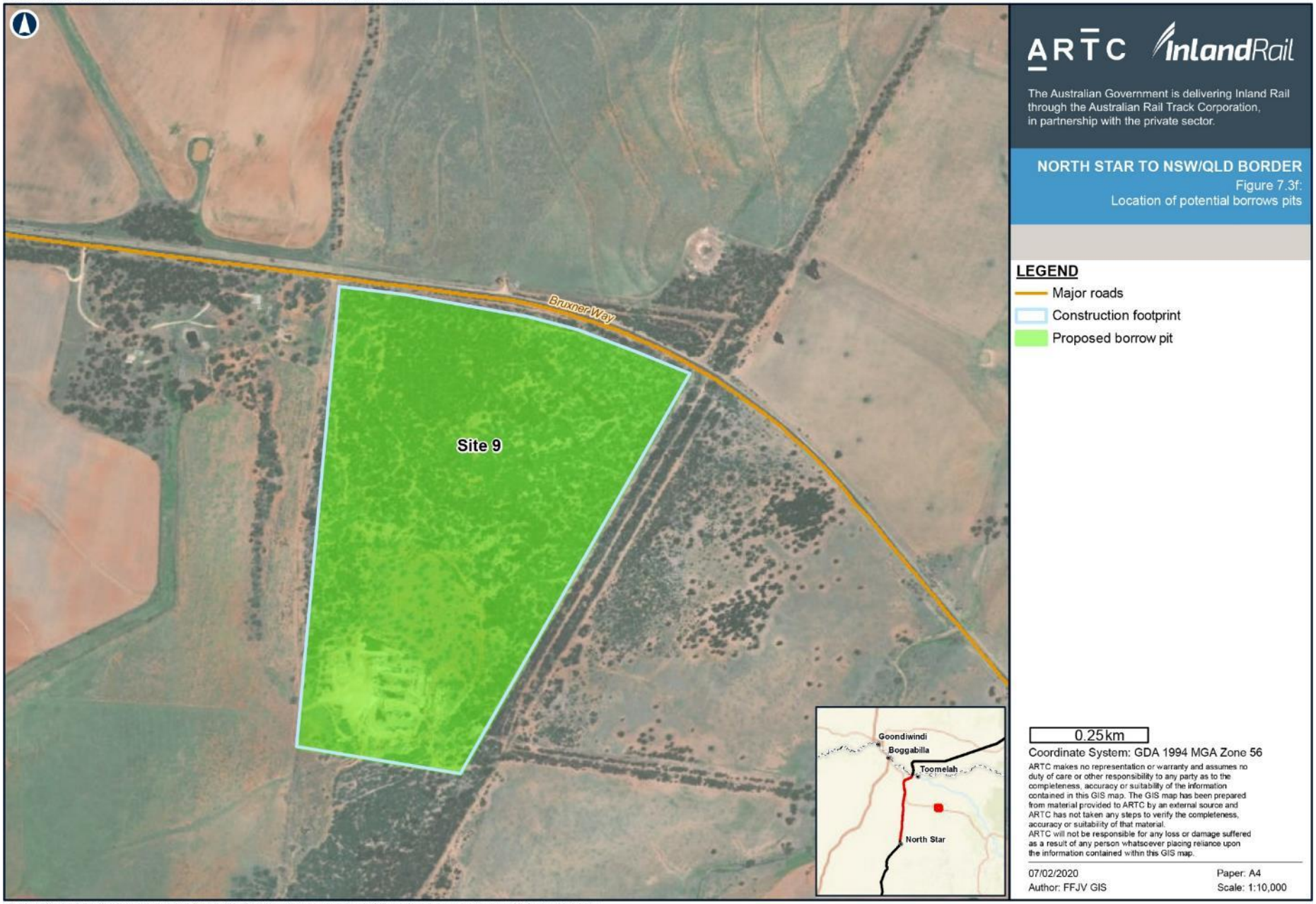

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NORTH STAR TO NSW/QLD BORDER

Figure 7.3f:
Location of potential borrows pits

LEGEND

- Major roads
- Construction footprint
- Proposed borrow pit

0.25km

Coordinate System: GDA 1994 MGA Zone 56

07/02/2020 Paper: A4
Author: FFJV GIS Scale: 1:10,000

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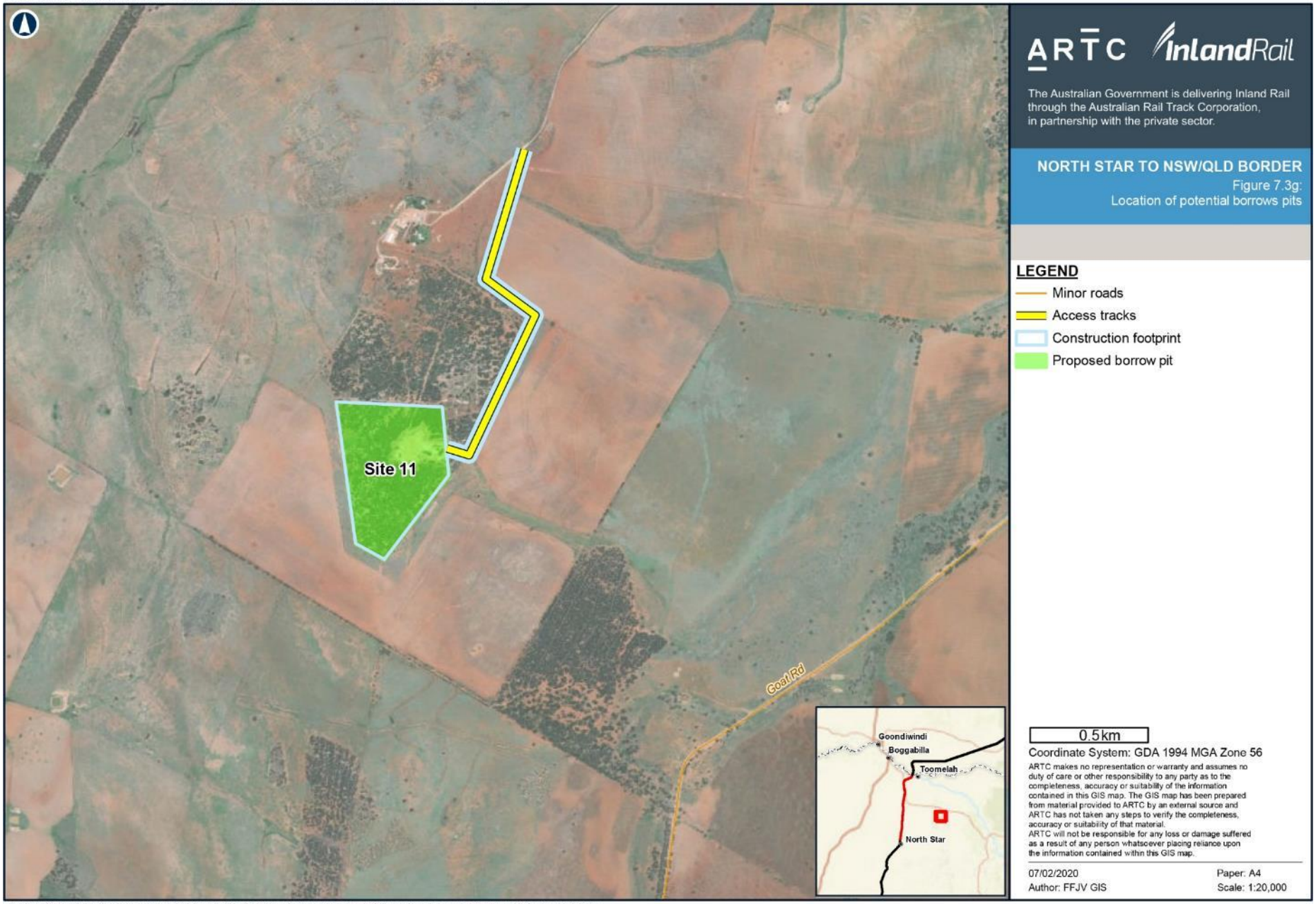
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Site 11
Goat Rd
Goondiwindi
Boggabilla
Toomelah
North Star
ARTC
InlandRail
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NORTH STAR TO NSW/QLD BORDER
Figure 7.3g:
Location of potential borrows pits
LEGEND
Minor roads
Access tracks
Construction footprint
Proposed borrow pit
0.5km
Coordinate System: GDA 1994 MGA Zone 56
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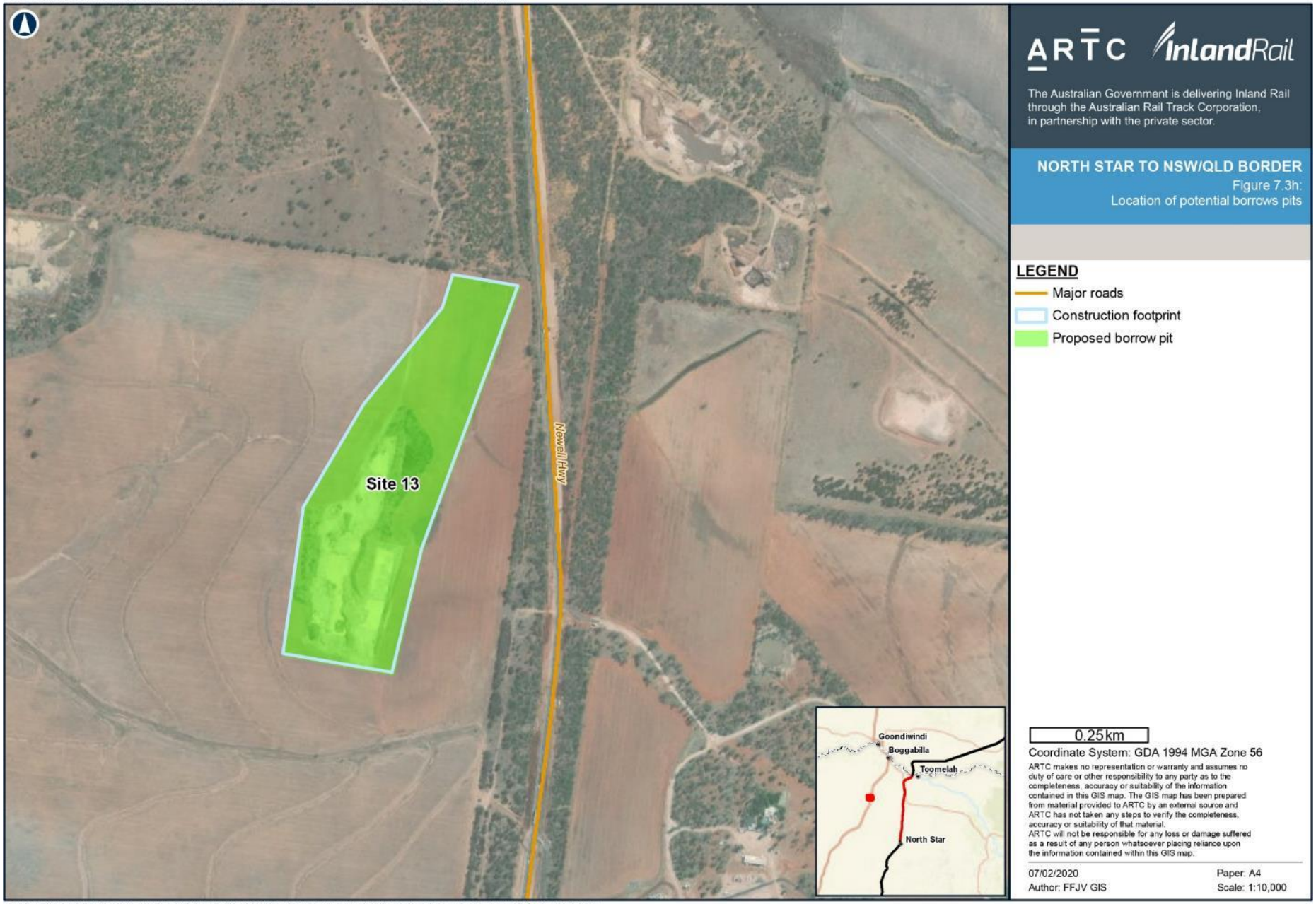

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NORTH STAR TO NSW/QLD BORDER

Figure 7.3h:
Location of potential borrows pits

LEGEND

- Major roads
- Construction footprint
- Proposed borrow pit

0.25km

Coordinate System: GDA 1994 MGA Zone 56

07/02/2020 Paper: A4
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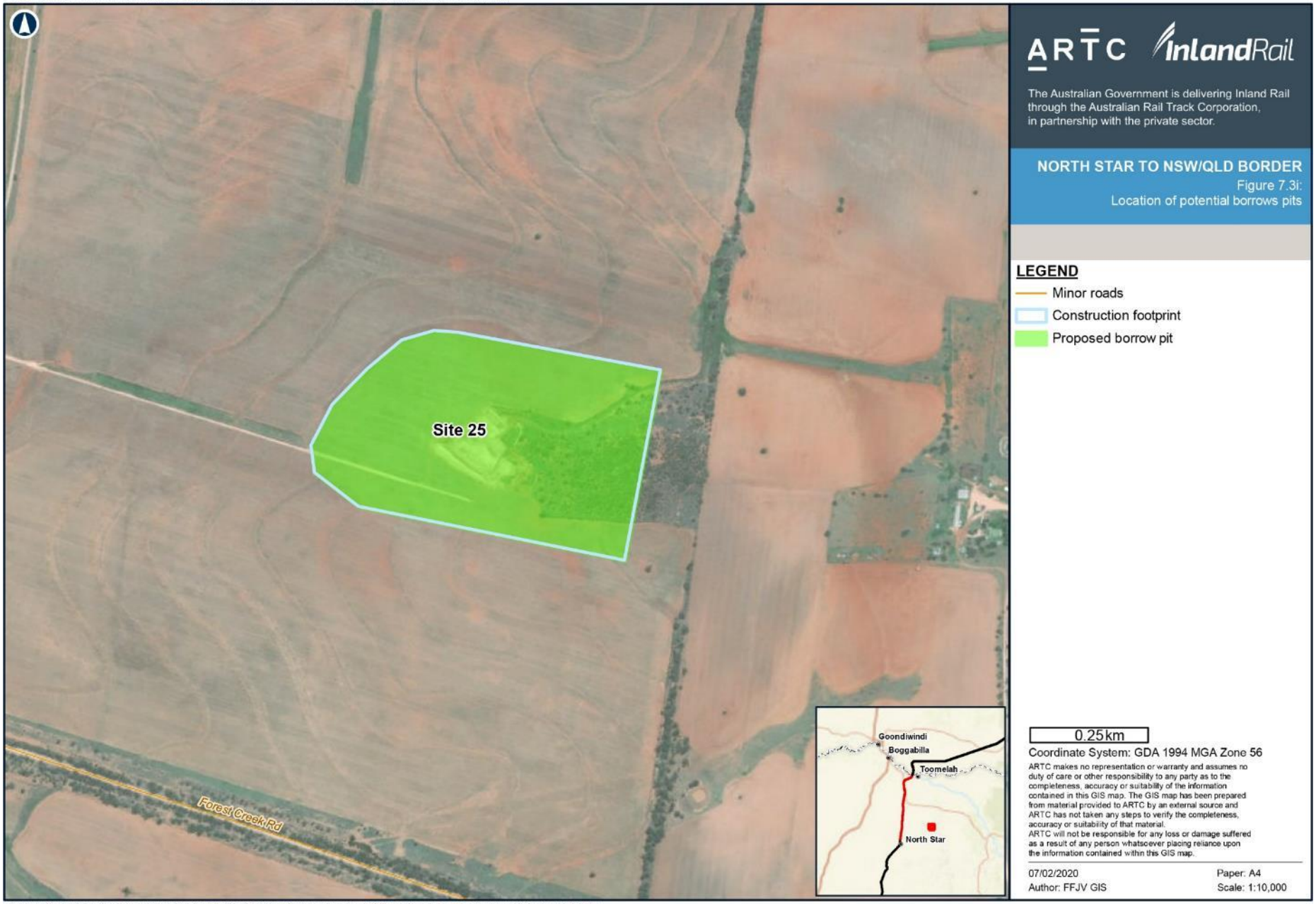

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NORTH STAR TO NSW/QLD BORDER

Figure 7.3i:
Location of potential borrows pits

LEGEND

- Minor roads
- Construction footprint
- Proposed borrow pit

0.25km

Coordinate System: GDA 1994 MGA Zone 56

07/02/2020 Paper: A4
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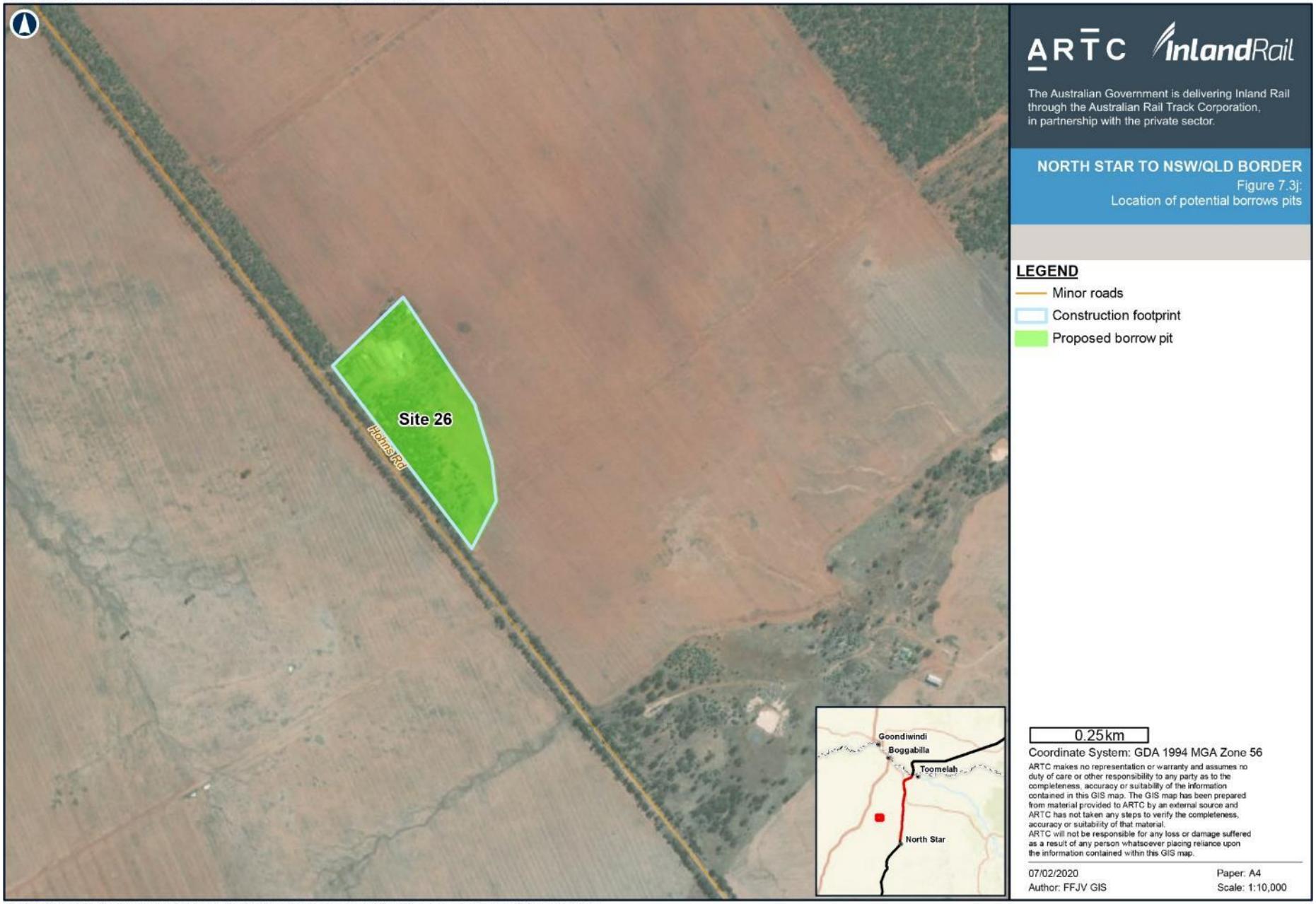

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NORTH STAR TO NSW/QLD BORDER

Figure 7.3j:
Location of potential borrows pits

LEGEND

- Minor roads
- Construction footprint
- Proposed borrow pit

0.25km

Coordinate System: GDA 1994 MGA Zone 56

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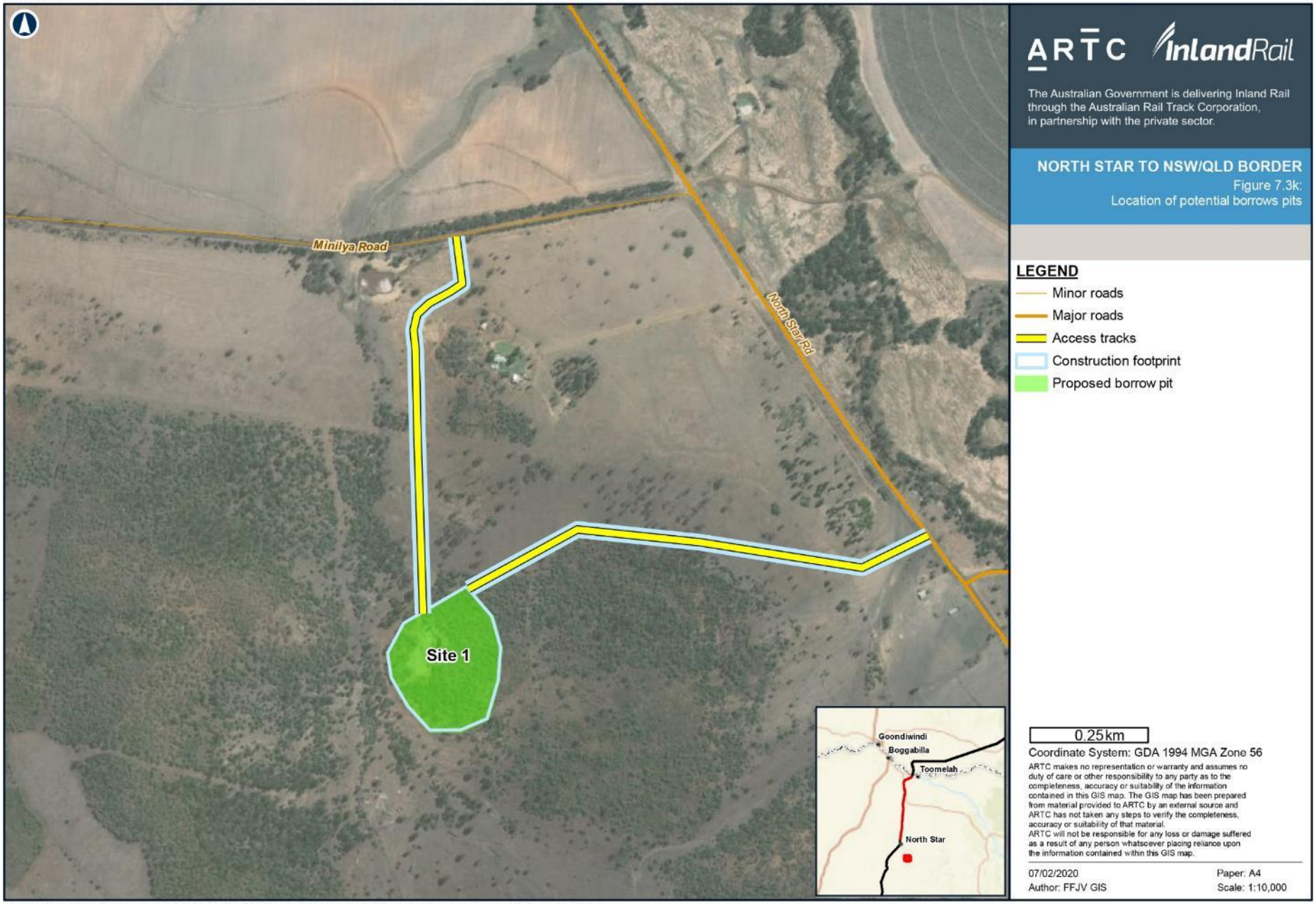
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Minilya Road
North Star Rd
Site 1
Goondiwindi
Boggabilla
Toomelah
North Star
ARTC
InlandRail
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NORTH STAR TO NSW/QLD BORDER
Figure 7.3k:
Location of potential borrows pits
LEGEND
Minor roads
Major roads
Access tracks
Construction footprint
Proposed borrow pit
0.25km
Coordinate System: GDA 1994 MGA Zone 56
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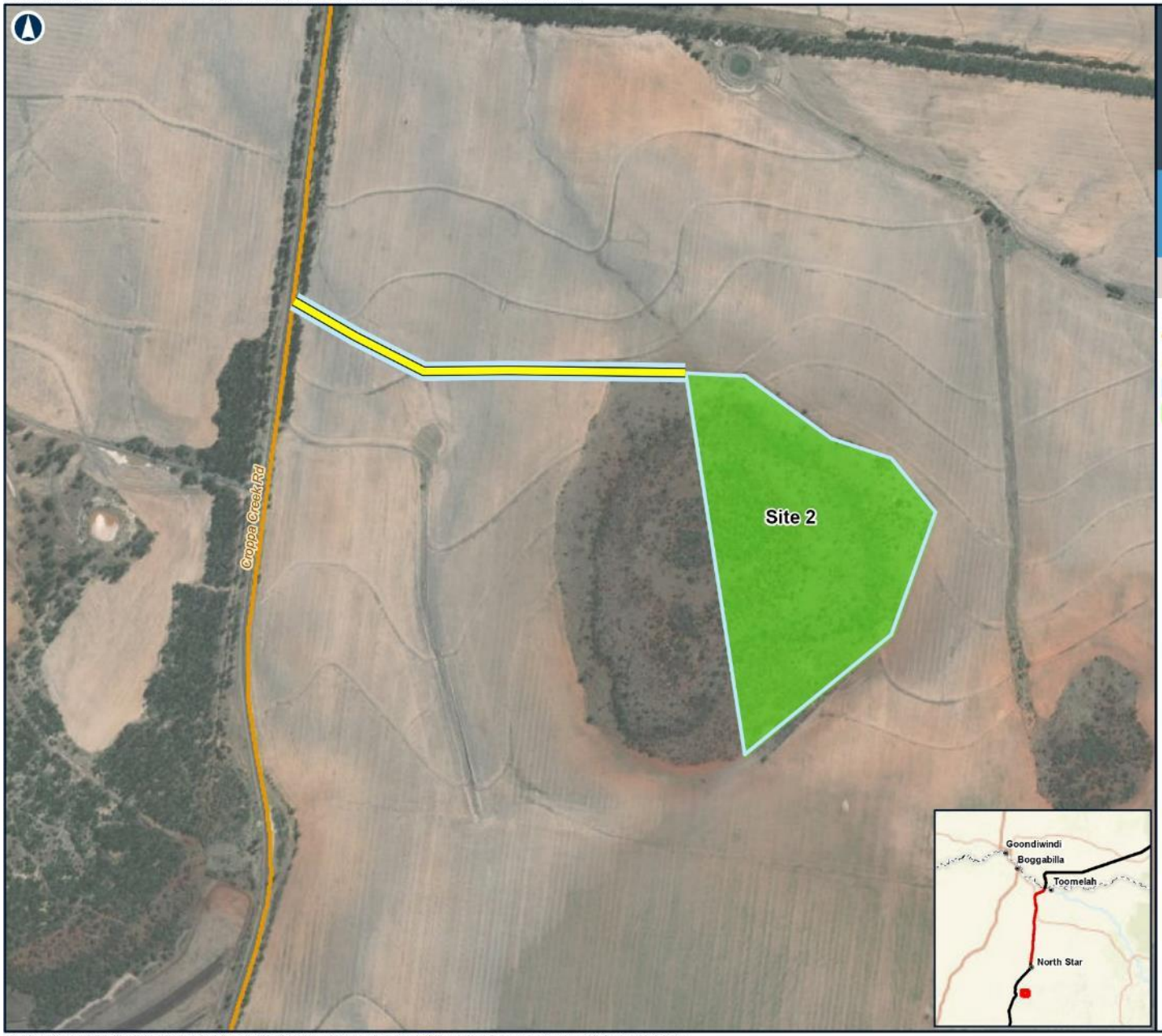

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NORTH STAR TO NSW/QLD BORDER

Figure 7.3l:
Location of potential borrows pits

LEGEND

- Major roads
- Access tracks
- Construction footprint
- Proposed borrow pit

0.25km

Coordinate System: GDA 1994 MGA Zone 56

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Author: FFJV GIS Scale: 1:10,000

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Borrow pits will undergo further investigation during the detailed design phase. The total amount of material extracted is not expected to exceed 1,100,000 m^3 of general fill and 250,000 m^3 of ballast/structural fill and the amount of material extracted from individual borrow pits will not exceed the potential extraction volume in Table 7.7. These volumes do not include overburden, and amounts are volumes of suitable material only—any excess to be extracted will be stockpiled onsite for reinstatement. A volume contingency has been applied to inform the assessment. This contingency allows for appropriate material management for future project processes, while allowing upper limits on total volumes to be extracted. It is anticipated that fill volumes will be optimised from selected borrow pits to source materials from the best possible locations first, including potentially sourcing a vast majority from those near the alignment.

The anticipated method of extracting material from the borrow pits and transporting it to site involves:

- Standard earthmoving equipment, such as trucks and excavators, will be used to extract material from the borrow pits. Depending on the size and composition of material from the borrow pits, crushing plants and/or mechanical screens may also be used to process the material. Blasting may be used to produce fragments from a larger rock body to support excavation; however, this is unlikely.
- Extracted material will be blended, then stockpiled in workable and traceable lots near the extraction site.
- Extracted material will undergo a quality compliance test to determine whether it is suitable for use as embankment fill. Unsuitable material will be returned to the borrow pit.
- If required, suitable material will undergo moisture conditioning. It will then be transported to construction sites using the public road network and tipped directly onto the formation.
- Water carts, graders and compacters will be used to further adjust the moisture content, and spread, compact, trim and profile the material into place.
- The reinstatement of borrow pits will be agreed with affected landowners.

7.5.2 Quarries

Subject to availability, capping and ballast could be sourced from local, licensed quarries. This includes, but is not limited to, the following local quarries:

- Johnstone Concrete and Quarries
- Inglewood Quarry
- Tikitere Quarry.

During the feasibility design phase, the following estimates for capping and ballast required for the proposal were developed:

- 85,000 tonnes of bottom ballast
- 40,000 tonnes of top ballast
- 80,000 tonnes of capping.

The local quarries listed above will be investigated further during the detailed design phase, taking into account the construction contractor's chosen methods. If the above local quarries are unable to supply the required quantity of material within the required timeframe, other licensed material sources near the proposed alignment will be investigated.

7.5.3 Water

Activities during the construction phase with the highest water demand, based on current estimates but subject to change, are:

- Soil conditioning—approximately 130 mega litres (ML) of water
- General dust suppression—approximately 62 ML of water
- Dust suppression and maintenance of laydown areas and haul roads—approximately 49 ML of water
- Construction camp—approximately 18 ML of water
- Track works—approximately 0.4 ML of water.

Construction water sources will be finalised during the detailed design phase, considering:

- Climatic conditions in the lead up to construction
- Access agreements with landowners for sourcing privately owned water
- Access agreements with local governments for sourcing mains water.

The anticipated hierarchy of construction water sources is:

- Public surface water storages (i.e. dams and weirs)
- Permanently (perennial) flowing watercourses
- Privately held water storages (i.e. dame or ring tanks, under private agreement)
- Existing registered and licensed groundwater bores
- Mains water.

An appropriate quality of water will be sourced for each use. For instance, non–potable water is suitable for soil conditioning and dust suppression, while potable water must be sourced for the construction camp.

For the purpose of the EIS, it has been assumed that:

- Non–potable water for construction will be sourced from Boggabilla Weir:
  - Boggabilla Weir is located on the Macintyre River, approximately 9 km upstream of Goondiwindi. The weir has a storage capacity of 5,850 ML, which is 50 times more than Boggabilla's current water entitlement of 120 ML per year
  - Water from Boggabilla Weir will be transported via road to the proposed alignment and laydown areas. This requires crossing the Macintyre River via a bridge on the Newell Highway, south–east of Goondiwindi
  - Prior to sourcing any construction water from Boggabilla Weir, the necessary approvals and licences would be obtained from WaterNSW. This includes compliance with the NSW—Queensland Border Rivers Agreement under the *New South Wales—Queensland Border Rivers Act 1947* (NSW)
- Potable water for the construction camp will be sourced from North Star:
  - Under the current Great Artesian Basin water-sharing plan, North Star has access to 40 ML of water per year from the Great Artesian Basin. To minimise the amount of water that must be sourced from North Star, the construction camp is also likely to include rainwater harvesting and greywater recycling systems
  - It is estimated that, on average, the construction camp will consume approximately 1 ML of water per month and water access arrangements will be developed in consultation with regulators.

Potential sources of water for construction will be investigated further during the detailed design phase. If Boggabilla Weir and/or North Star are unable to supply the required quantity of water within the required timeframe, other sources of water near the proposed alignment will be investigated. Due to uncertainty in water sources, the proposal is considering using groundwater abstracted from landowner bores with existing water allocation licences as a potential contingency for water supplies. Sources of construction water will be dependent on climatic conditions in the lead up to construction and will be investigated further to ensure sustainability and account for reprioritisation of allocations.

7.5.4 Concrete

The main concrete elements used during construction of the proposal (sleepers, girders) will be precast offsite and then transported via the public road network to the proposed alignment and laydown areas. Additional concrete required for bridge and culvert construction will be trucked in ready mixed.

7.6 Construction traffic

Equipment and materials required for construction of the proposal, including material from borrow pits and quarries, will be delivered via the public road network, using standard or over-dimensional loads. Major trunk roads will be used over local roads, considering separation and overtaking requirements, as well as the likely weight of delivery vehicles. Deliveries will be staged to minimise impacts on local traffic, cognisant of construction staging requirements.

The haul routes for construction equipment and materials will be further refined during the detailed design phase. Haul routes will be chosen such that access to private property is maintained throughout the construction period. Temporary access arrangements may be required at times (such as temporary driveways or relocated access roads); however, these arrangements will be developed in consultation with affected landowners and will comply with relevant approvals/permits.

Standard traffic-management measures will be employed to manage the short–term traffic impacts expected during construction. For example:

- Traffic movements on local roads will consider peak traffic hours and periods, particularly during school and public holidays
- Dilapidation surveys will be undertaken on local roads and roads on private property expected to be used by heavy vehicles. If roads are damaged as a result of the proposal, the damage will be rectified, or the relevant party will be compensated. The amount of compensation will be agreed with the relevant party
- Gravel roads may be graded and sprayed to control dust when in use by construction traffic.

More information on haul routes and proposed traffic-management measures can be found in Chapter 20: Traffic and Transport.

During the detailed design phase, the potential to deliver equipment and materials via rail from the south will also be investigated.

7.7 Service requirements

Construction of the proposal will require services, such as:

- Electricity
- Communications
- Waste disposal
- Sewage treatment.

Electricity and communications needs during construction are likely to be minor. If possible, temporary construction offices and the construction camp will be connected to local electricity and communications networks, with generators on hand to provide power supply in emergencies.

The main waste streams generated during the construction phase will be managed:

- Surplus topsoil along with excavated material that is unsuitable for reuse, may be used to rehabilitate disturbed areas or formed into permanent spoil mounds within the rail corridor
- Demolition and construction waste will be transported to licenced waste-disposal facilities and treated in accordance with their governing rules
- Sewage generated at prefabricated site offices and portable amenities will be transported offsite to approved disposal facilities
- Sewage generated at the construction camp will be treated to the required local government standard as guided by the NSW Environment Protection Authority (EPA) *Licensing Guidelines for Sewage Treatment Systems* (NSW EPA, 2003) discussed in Chapter 25: Waste and Resource Management. Wastewater treatment arrangements will be finalised during the detailed design phase; however, two options for wastewater treatment include:
  - A commercial sewage treatment system sourced from an accredited supplier. The sewage treatment system could remain in place for the local township to use once the construction camp has been decommissioned.
  - Connecting to the existing North Star wastewater treatment system.

Relevant approvals will be obtained to install and operate electricity, communications and sewage treatment facilities at the proposed construction camp in North Star (indicative locations for utility connections around the construction camp have been identified in Figure 7.1).

7.8 Construction schedule

Construction of the proposal will commence once the detailed design is complete and all the necessary approvals have been obtained. Construction is expected to occur between 2021 and 2025. It is anticipated that earthworks, bridge works and drainage works will progress on multiple fronts; however, track works will progress on one front, from south to north.

An indicative construction program for the proposal is shown in Figure 7.4.

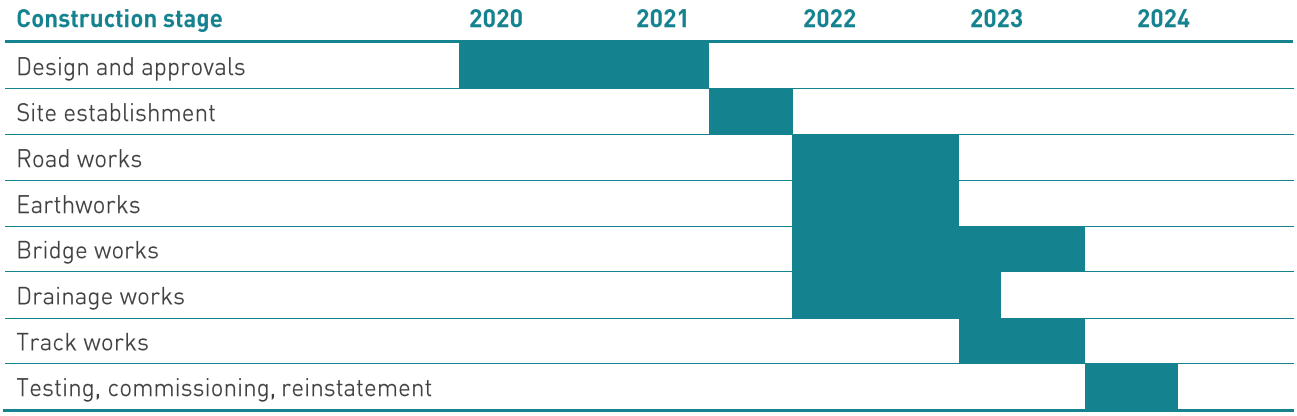

FIGURE 7.4 INDICATIVE CONSTRUCTION STAGING

The construction program in Figure 7.4 is indicative only; it is subject to change during the detailed design and construction phases as a result of:

- Weather conditions
- Changes to construction methods and materials
- Unexpected finds, such as threatened biodiversity species or cultural heritage values
- Community interest in the proposal or issues that need to be addressed.

If the duration and timing of construction were to change, work will be rescheduled, considering site-specific environmental and/or engineering constraints. The schedule of environmental controls, including traffic management and noise controls, would also be adjusted.

7.9 Hours of construction

Construction activities will occur during the following primary proposal construction hours:

- 6.30 am to 6.00 pm on weekdays
- 6.30 am to 6.00 pm on Saturdays
- 6.30 am to 6.00 pm on Sundays and public holidays.

Extended working hours would be considered permissible if there are no nearby sensitive receptors, or if negotiated agreements have been reached with sensitive receptors. Any changes to working hours would be supported by noise and vibration assessment in accordance with the *Interim Construction Noise Guideline* (Department of Environment and Climate Change (DECC), 2009).

Construction activities that might occur during extended working hours include:

- Roadworks on arterial roads
- Delivery of construction materials to site
- Movement of heavy plant, traffic control crews and incident-response vehicles
- Work that is temperature dependent, for example concrete pours and rail stressing
- Arrival and departure of construction workforce during shift changeovers.

Blasting is unlikely; however, it may be required to excavate certain sections of the alignment and/or borrow pits. The working hours and frequency of blasting activities would align with the *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (Australian and New Zealand Environment Council (ANZEC), 1990), which stipulates that:

- Blasting would generally only be permitted during the hours of 9.00 am to 5.00 pm, Monday to Saturday
- Blasting would not occur on Sundays or public holidays
- Blasting would generally only be permitted once per day (i.e. no sensitive receptor would be affected by blasting activities more than once per day).

The recommended working hours and frequency of blasting activities apply to premises where the effects of blasting are likely to be felt.

If track possessions are required, construction activities will proceed on a 24 hours per day, 7 days per week basis to minimise the duration of track possessions.

7.10 Construction workforce

During the construction phase, the size and composition of the construction workforce will vary depending on the construction activities being undertaken and the staging strategy adopted for the proposal. There may be several different work crews working on the proposal at any one time; however, the core construction workforce for the proposal will typically consist of professional staff, supervisors, tradesmen and plant operators.

The construction workforce for the proposal is expected to peak at approximately 350 workers in Q3 2022 (excluding part-time, offsite workers and delivery truck drivers). A portion of the workforce will be sourced from local communities (e.g. North Star, Boggabilla, Toomelah and Goondiwindi); however, most workers will live elsewhere and only reside in the region when rostered to work.

7.10.1 Workforce accommodation

Members of the construction workforce who do not live near the proposal (e.g. in North Star, Boggabilla, Toomelah or Goondiwindi) will be housed in a purpose-built construction camp in North Star, designed to accommodate the peak workforce. Buses would be used to transport workers between the construction camp and work sites at the start and end of shifts.

For the purposes of this EIS and the approval of the construction camp, it is assumed that the construction camp will be demobilised post completion of construction. This assessment does not consider or facilitate any use of this facility beyond the construction phase of the proposal and any use beyond this point will be subject to an appropriate assessment under the *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW), regulations and associated State Environmental Planning Policies (SEPPs).

An appropriate location for the construction camp has been identified (Figure 7.1), considering:

- Proximity of the camp to likely construction sites
- Land tenure and ownership of the site
- Available land area
- Proximity to supporting infrastructure and services, such as water and electricity
- Likelihood of noise, vibration and air-quality impacts originating from the camp
- Likelihood of disturbing significant vegetation communities, threatened species or heritage sites
- Road access
- Potential for planned future developments to impact on the construction camp, or vice versa.

The location will be investigated further in consultation with the North Star Sports Complex during the detailed design phase as a result of the final camp design and environmental constraints. At a minimum, the construction camp will include:

- Accommodation units with kitchen
- Dining
- Ablution and laundry facilities.

Supporting and additional infrastructure associated with the construction camp might include:

- Electricity and communications infrastructure
- Sewage treatment and disposal
- Rainwater harvesting
- Greywater recycling systems
- Back–up power generators
- Fuel and materials storage areas
- Recreational facilities
- Offices and car parking.

An example layout of the construction camp is shown in Figure 7.5. The proposed location of the construction camp, including indicative locations for utility connections, is shown in Figure 7.1. The capacity and layout of the construction camp and associated utility connections will be finalised during the detailed design phase, in conjunction with obtaining all the relevant approvals.

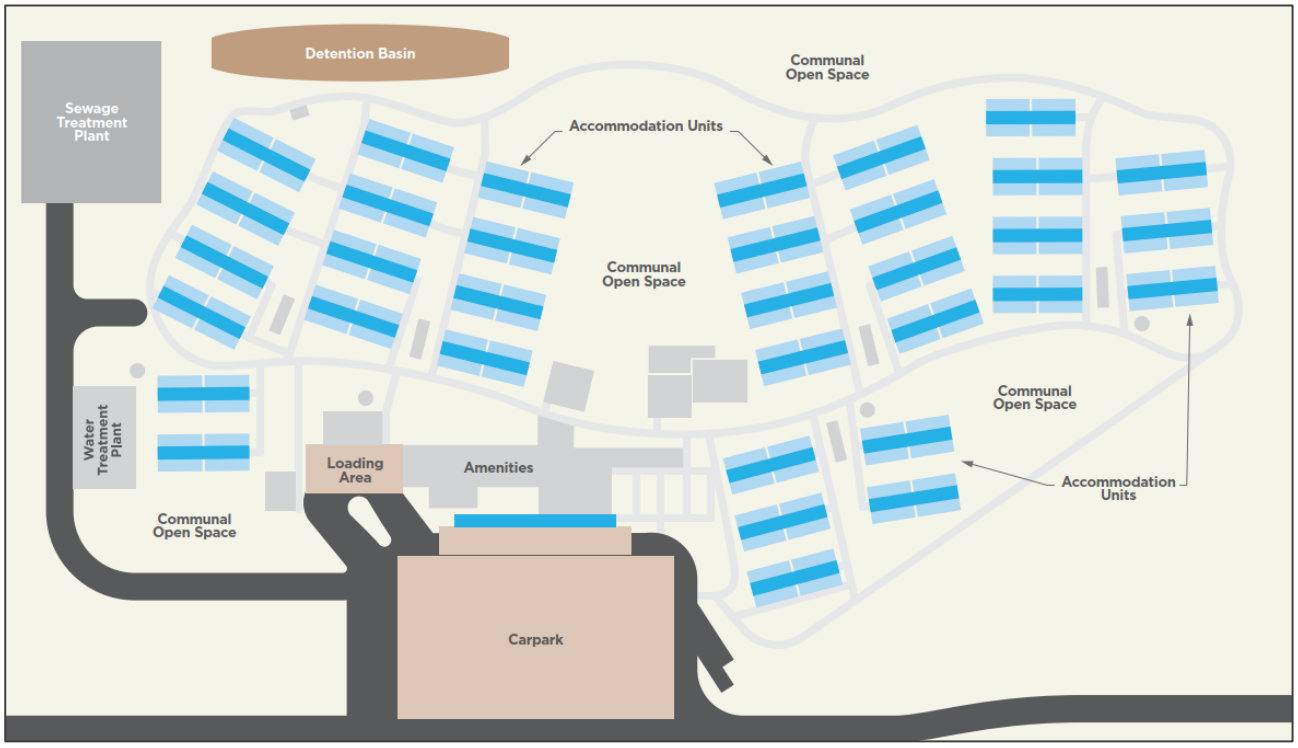

FIGURE 7.5 EXAMPLE CONSTRUCTION CAMP LAYOUT