Fortescue

Report

North Star Extension Hydrological Cumulative Impact Assessment

Water Planning

15 April 2025

NS-5700-RP-WM-0002

Rev: 0

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1 BACKGROUND

North Star is an active operational mine site located approximately 110 km south of Port Hedland in the Pilbara Region of Western Australia. FMG Iron Bridge (Fortescue) is in the process of seeking approval to expand the existing North Star operations (approved North Star) with additional pits and associated mining infrastructure. This proposal is known as North Star Magnetite Project Extension (NSE). The development envelope (DE) for the proposed NSE and approved North Star is illustrated in Figure 1-1.

The approved and proposed mining areas extend across the Turner River, Strelley River, and Shaw River catchments. The DE is situated at the headwaters of these catchments. The objective of this assessment is to undertake a cumulative hydrological impact assessment accounting for both the approved North Star and the proposed NSE development.

The proposed NSE development was referred to the Minister for the Environment (the Minister) on 30 January 2023 under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A delegate to the Minister determined that the proposal would be assessed by a Public Environment Report (PER). In the Guidelines for the Content of a draft Public Environment Report, DCCEEW (Guidelines for the Content of a draft Public Environment Report. North Star Magnetite Project Extension, Pilbara, WA (EPBC 2023/09466), 2024) stated that the PER should include information about the proposed action and its relevant impacts. The relevant statements from this document pertaining to cumulative impacts is summarised in Table 1-1. This report aims to address DCCEEW's comments regarding cumulative impacts of the approved North Star and NSE operations from surface water hydrological regime perspective.

Table 1-1 Relevant DCCEEW statements and applicable sections in this study

Item	DCCEEW Statement
43 (b)	Impacts discussed in the PER must include: cumulative impacts should be identified and addressed, where potential proposal impacts are in addition to existing impacts of other activities (including known potential future expansions or developments by the proponent and other proponents in the region and vicinity).

The cumulative impacts assessment documented in this study is used to inform the inland water outcomes on surface water hydrological regime. The proposed outcomes are described in Section 4.

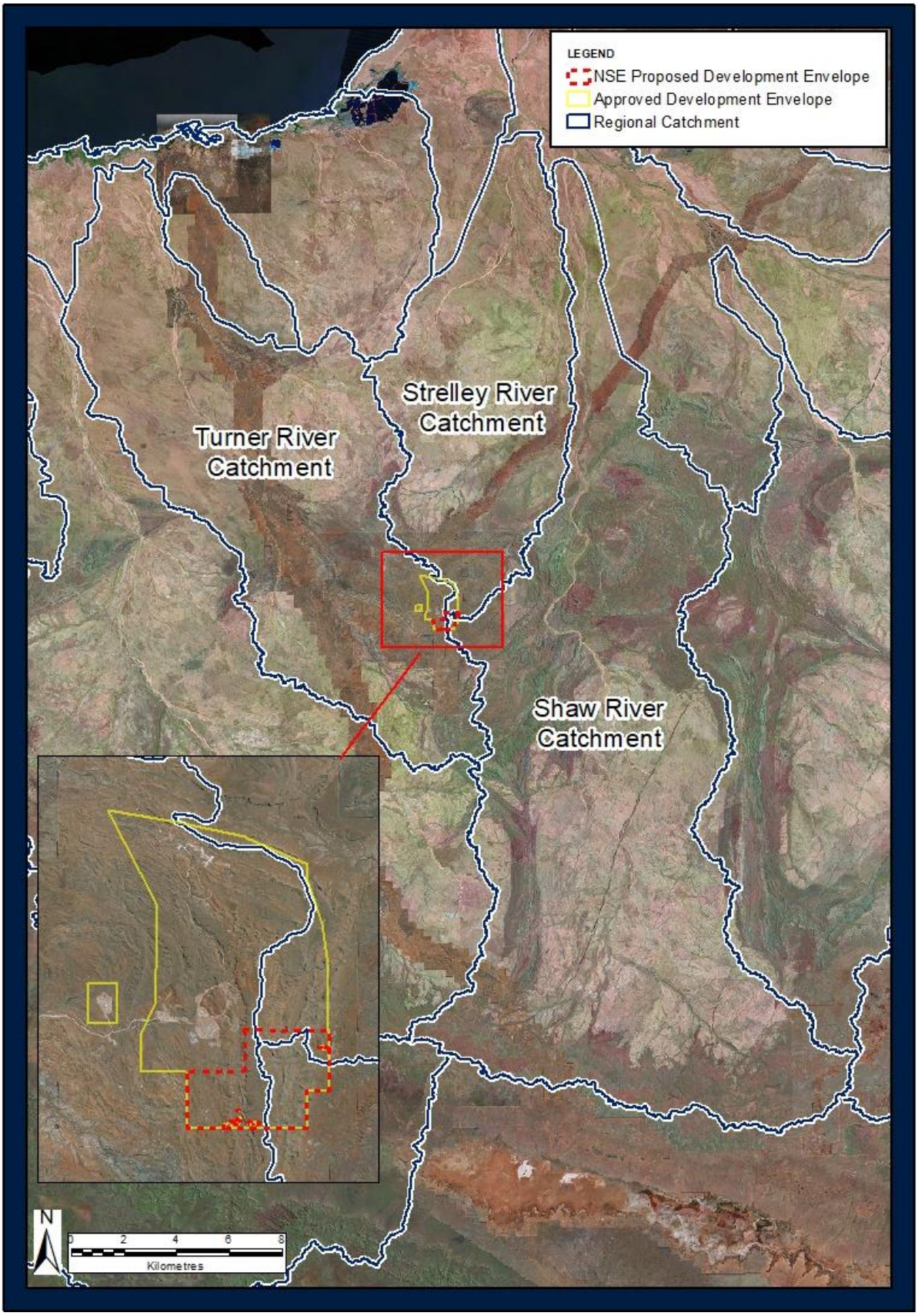

Figure 1-1 Catchments of interest

1.1 Relevant Studies

The latest relevant hydrological studies for NSE development include:

- North Star Magnetite Project Extension – Baseline Hydrology Report (Worley, 2024 (a));
- North Star Magnetite Project Extension – Hydrological Impact Assessment Report: Waterways (Worley, 2024 (b));
- Site 12 Pool Catchment Waterways Assessment (Fortescue, 2025); and
- North Star Extension Public Environment Review — Inland Waters: Pool Hydrological and Water Quality Assessment (Worley, 2025).

A baseline hydrological assessment for NSE development within Turner River and Shaw River catchments was completed by Worley (2024 (a)) that included regional hydrological characterisation of these catchments through reviewing available data and hydrological and hydraulic modelling. This study has assessed the catchments characteristics under approved North Star conditions (Baseline scenario). The study area consists of the upper reaches of Shaw River and Turner River catchment, where the proposed NSE development will occur. The methodology adopted in this study is in line with ARR 2019 (Ball, et al., 2019), which is the widely used industry guideline in Australia on the derivation of hydrological estimates and flood risk.

The findings from the baseline hydrological study were used as inputs in the hydrological impact assessment (Worley, 2024 (b)). Using a combination of hydrological and hydraulic modelling, the impact assessment compared incremental changes in both peak flow and volume across a range of design events, ranging from frequent to extreme, between the approved North Star and NSE scenarios. The greatest impact is estimated to be at the head of the catchment where most of the proposed mining activities will take place. The assessment has also found that the reduction in flow volume is a direct function of the reduction in catchment area between the approved North Star and NSE scenarios.

A separate waterways assessment was undertaken for the Strelley River catchment where the approved North Star and proposed NSE development, as well as downstream Site 12 Pool are located (Fortescue, 2025). This assessment has adopted a similar approach to the other two studies mentioned above. The hydrological regime of Strelley River was assessed under approved North Star and proposed NSE conditions.

Worley (2025) has completed an inland water impact assessment of pools that are potentially impacted by Fortescue's mining activities at NSE. The scope of this study includes identifying and conceptualising the hydrological regimes of pools within the study area, hydrological and water quality assessment of these pools and assessing the likelihood and severity of inland water impacts to these pools from the proposed NSE activities.

2 METHODOLOGY

This assessment quantifies the incremental and cumulative impacts of Fortescue's activities within the catchment of interest. Existing studies listed in Section 1.1 only considered the incremental impact between approved North Star and NSE conditions.

This study has adopted a high-level desktop analysis using catchment reduction as a proxy to understand the impacts of mining activities on catchment hydrological regime. A reduction in catchment area would reduce the peak flow and volume of a catchment. In general, the change in peak flow between an undeveloped and developed catchment is not linear to catchment area reduction. However, the relationship between catchment area reduction and runoff volume can be simplified to a mass balance exercise, where the key variables are catchment area, design rainfall and empirical losses (Worley, 2024 (b)). Since the design rainfall and loss parameters under the various scenarios remains unchanged, the reduction in catchment area directly infers the change in volume produced by a catchment.

2.1 Catchment Area Removed

The catchment area that would be removed during the operational phase of North Star and NSE was estimated based on the indicative disturbance footprint (IDF) of the approved North Star operations (Registration ID: 118381) and the proposed NSE development. The IDF includes, but is not limited to, the extent of pits, waste rock dump (WRD), stockpiles, tailings storage facility, ore processing facility plant and ROM, as well as various linear infrastructure. The footprint of the IDFs as well as areas upstream of it is assumed to be removed from flow contribution to the downstream catchment. This provides a conservative estimate of catchment reduction as the IDF does not have the level of detail where surface water management infrastructure are considered.

At closure, some infrastructure built to support mining will be rehabilitated. However, some landforms are expected to be left in place post-closure. In addition, the closure strategy assumes that runoff from the top lift of the WRD will be redirected to Site 12 Pool's catchment (Strelley River). An estimate of catchment area under post-closure conditions for NSE were calculated in this assessment.

The extent of the IDFs and the corresponding catchment area removed from flow contribution is illustrated in Figure 2-1, Figure 2-2 and Figure 2-3. The extent of the IDF is located at the headwater of the catchments of interest, across the ridgelines.

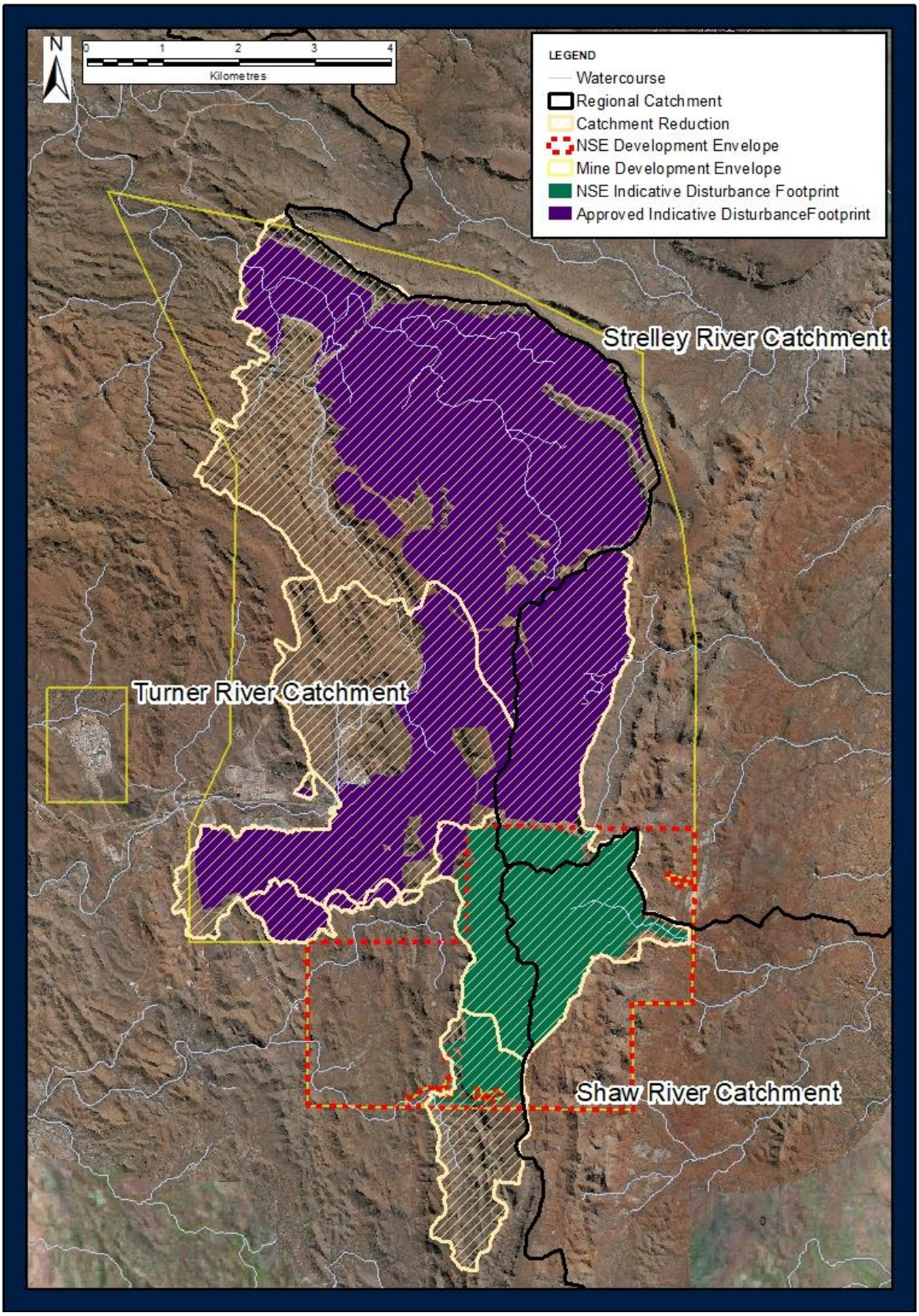

Figure 2-1 Extent of IDF and catchments removed during operation

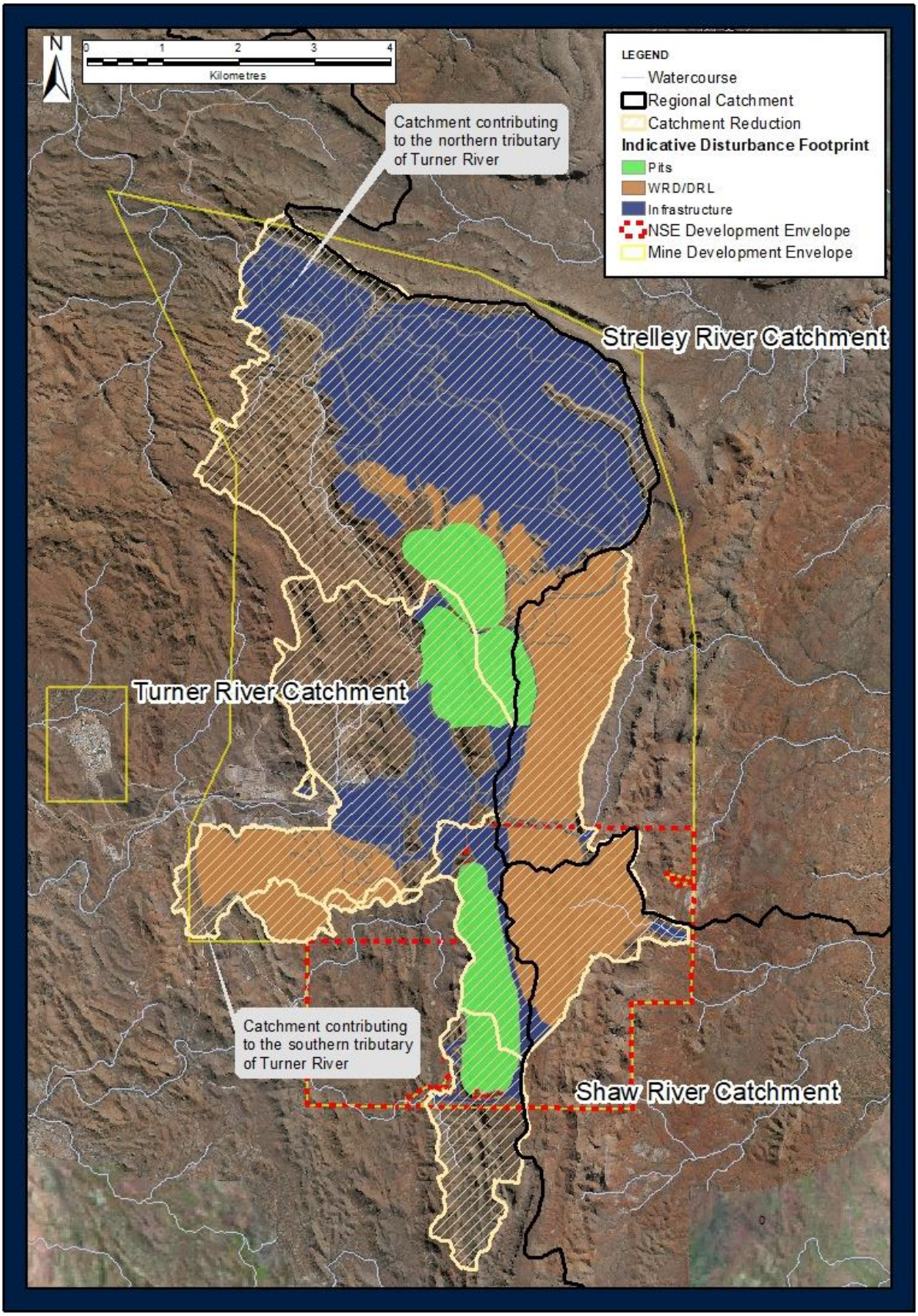

Figure 2-2 IDF land use type

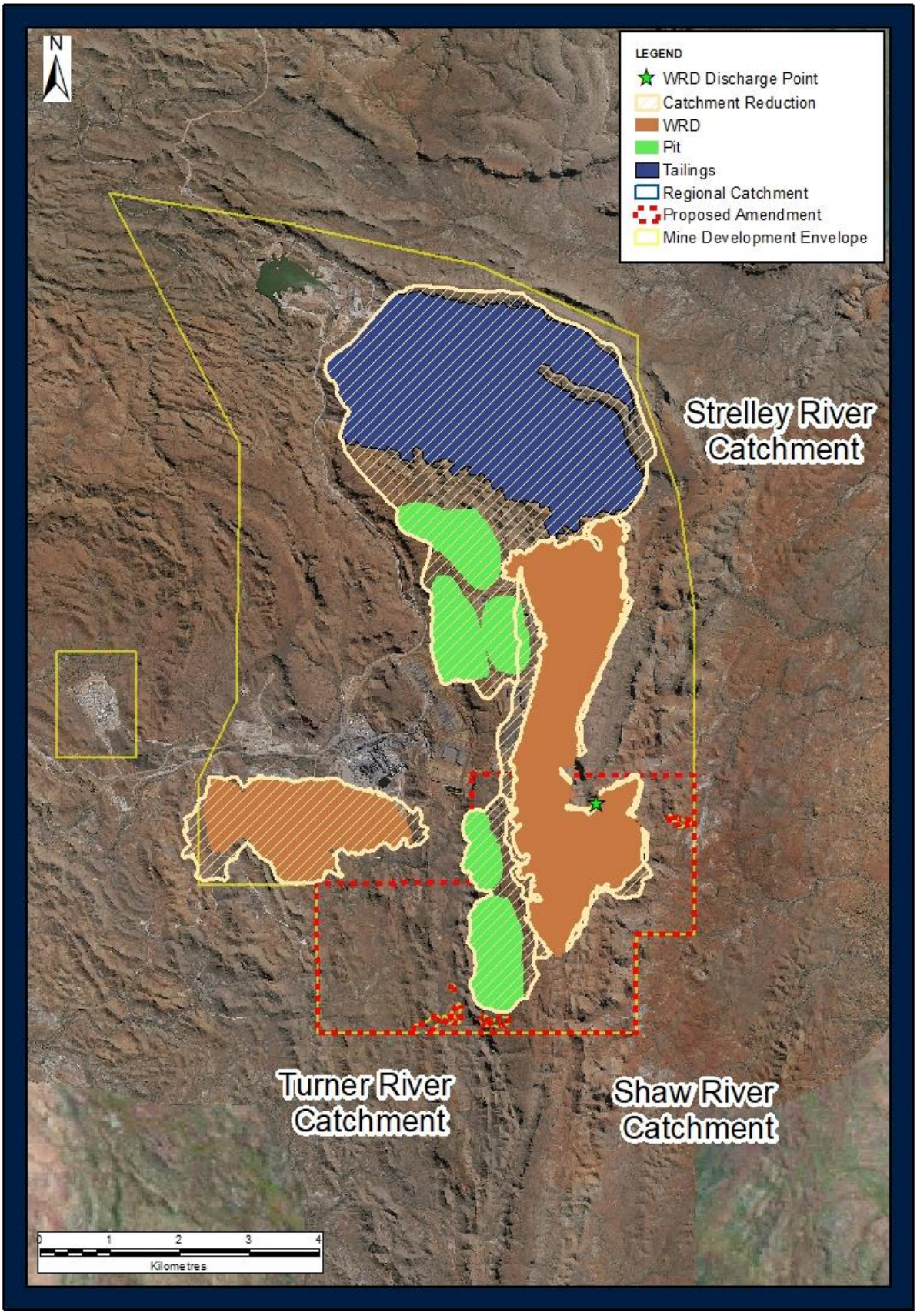

Figure 2-3 Catchment loss estimate at closure for NSE scenario

2.2 Reporting Locations

A series of points along the main drainage pathways downstream of North Star and NSE are assessed in this study. The DE is adopted as the reference point where distance to the reporting location is calculated. The reporting locations are selected based on the proximity to the proposed NSE and approved North Star DE as well as location of confluence and pools.

These reporting locations are summarised in Table 2-1 and their locations are illustrated in Figure 2-4. It is important to note that the reporting location in this assessment is different to the volume runoff reporting location cited in the *North Star Magnetite Project Extension – Hydrological Impact Assessment Report: Waterways* (Worley, 2024 (b)). The catchment area reduction expected for the Shaw River and Strelley River is confined to one main tributary within each of the catchments. As for Turner River, development from Fortescue will impact two tributaries, one on the north side of the catchment (northern tributary) and the other on the south side (southern tributary) of the catchment. These two tributaries flow in a westerly direction and will eventually merge more than 50 km from the NSE DE.

Table 2-1 Reporting locations along main drainage flow paths

Catchment	Reporting Location	Distance from DE (km)
Shaw River	Sh-1	0.0
	Sh-2	2.3
	Sh-3	6.3
	Sh-4	8.6
	Sh-5	11.0
Strelley River	St-1	0.0
	Site 12	0.1
	St-2	3.9
	St-3	8.8
	St-4	13.8
Turner River – Southern Tributary	TR-S-1	0.0
	TR-S-2	0.3
	TR-S-3	5.3
	TR-S-4	7.8
	TR-S-5	9.0
	TR-S-6	10.3
	TR-S-7	15.2
	TR-S-8	20.2
	TR-S-9	25.7
	TR-S-10	28.3
Turner River – Northern Tributary	TR-N-1	0
	TR-N-2	1.2
	TR-N-3	4.7
	TR-N-4	8.7
	TR-N-5	12.2
	TR-N-6	17.1
	TR-N-7	27.6

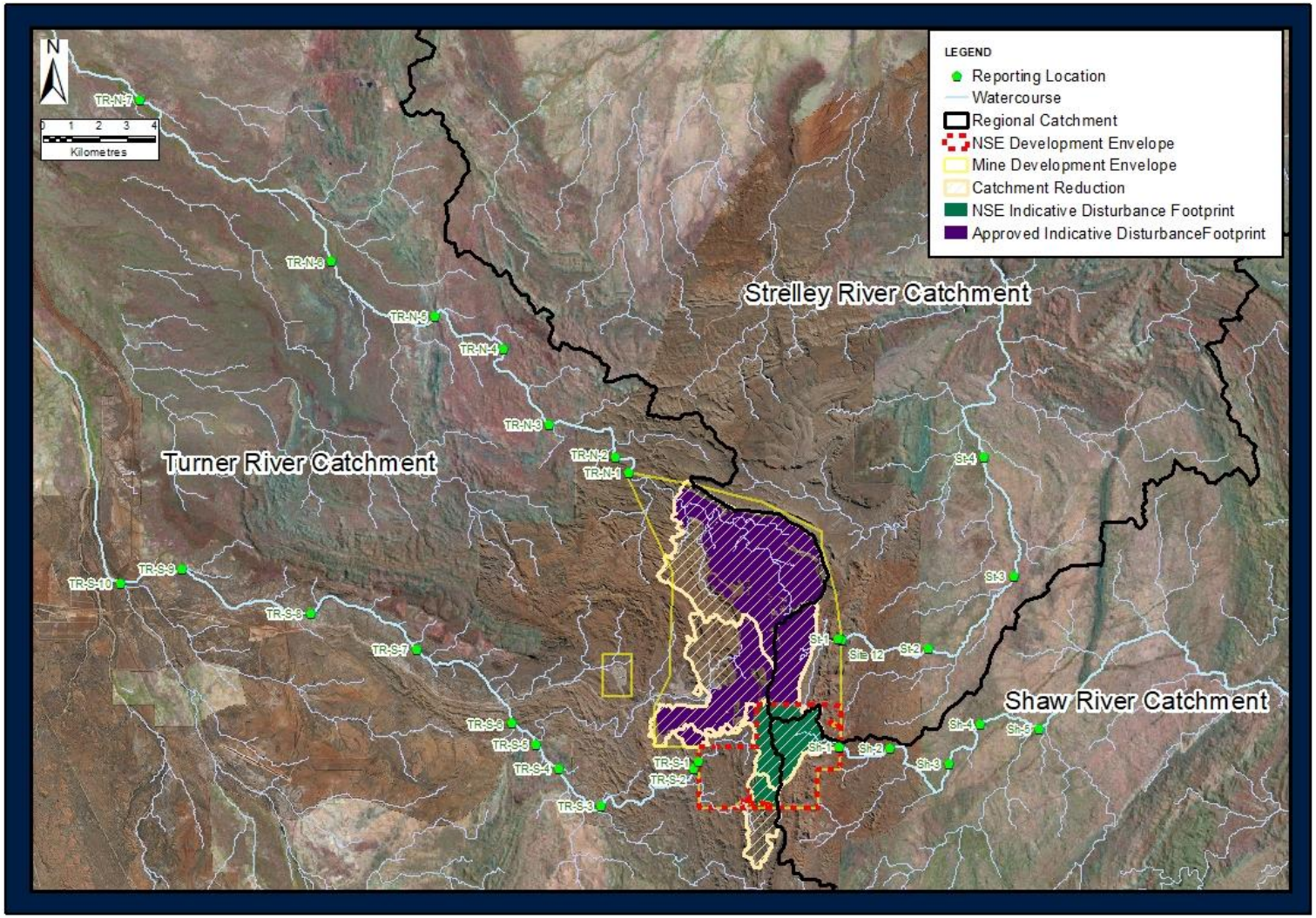

Figure 2-4 Reporting locations

3 RESULTS

It is estimated that Turner River would have the largest reduction in catchment area as a result of the approved North Star and the proposed NSE development, followed by Strelley River and Shaw River catchments. The catchment area reduction estimates are summarised in Table 3-1. The total catchment area impacted by Fortescue's activities is less than 1% of the catchment's overall area for each of the three regional catchments.

Table 3-1 Total catchment area change based on North Star and NSE IDF during operation

Catchment	Unimpacted Catchment by North Star and NSE – Pre-Mining (km²)	Impacted by North Star Approved IDF (km²)	Impacted by NSE IDF (km²)	Total Impact from North Star and NSE IDF (km²)	Unimpacted Catchment by North Star and NSE – Post Mining (km²)	Net Change in Catchment Area
Turner River	4,802	33.1	4.5	37.6	4,764.4	-0.78%
Strelley River	2,805	4.2	0.7	4.9	2,800.1	-0.17%
Shaw River	7,902	0	3.1	3.1	7,898.9	-0.04%

Table 3-2 shows the change in catchment area at the catchment of interest under post-closure conditions. While it is estimated that Turner River and Shaw River would experience a net decrease in catchment area, the contributing catchment to Strelley River is expected to increase due to redirected flow from the top lift of the WRD. Based on the WRD design proposed for NSE, 0.3 km² and 2.4 km² of catchment area from Turner River and Shaw River respectively would be redirected to Strelley River catchment at closure. As a result, the estimated catchment area contributing flow in Strelley River is expected to increase by 1.8 km² at closure in comparison to pre-mining conditions. Similar to operating conditions, the overall change in catchment area is minimal (less than 1%). It is important to note that these results for the post-closure conditions are sensitive to the landform footprint. Any changes in the closure design footprint would change the results presented in Table 3-2.

Table 3-2 Catchment area change post-closure for NSE scenario

Catchment	Area (km²)				Net Change in Catchment Area
	Unimpacted Catchment by Fortescue's Activities	Impacted by Fortescue's Development	Redirected catchment from WRD	Catchment Post Closure	
Turner River	4802	20.4	0.3	4781.6	-0.42%
Strelley River	2805	0.9	N/A	2806.8	0.06%
Shaw River	7902	2.8	2.4	7899.2	-0.04%

For specific locations along the main watercourses, the reduction in catchment area as a result of the approved North Star and proposed NSE IDF is summarised in Table 3-3. The reporting locations presented in this assessment is only impacted by Fortescue's approved and proposed mining activities. In general, the impacts of catchment reduction caused by the approved and proposed mine development diminishes because the further away from the mining area, the proportion of undisturbed catchment area increases.

For the Shaw River catchment, the estimated impact is entirely caused by NSE because the North Star IDF is outside of this catchment. At the furthest point of assessment, 11 km from the DE (Sh-5), the catchment reduction caused by NSE is estimated to be 4%.

The IDF within the Strelley River catchment is made up of the extent of a WRD. For the majority of the impacted area, the WRD footprint is part of the approved North Star IDF. The proposed NSE development includes an expansion of this WRD, which is reflected in the NSE IDF. This increases the catchment reduction within the Strelley River catchment. At the boundary of the DE (St-1), a total of 65.3% of catchment reduction is expected, of which 55.9% is due to North Star and an additional 9.3% due to the proposed NSE. St- 4 is the furthest point of assessment, 13.8 km from the DE. The total catchment reduction at this point is 8.5%, the majority of which is caused by the approved North Star IDF.

In the Turner River catchment, the impact along the northern tributary is solely due to the approved North Star IDF. The reduction in catchment area decreases from a 67.6% at TR-N-1 which is 1.2 km from the DE to 11.8% at 27.6 km downstream of the DE (TR-N-7). Along the southern tributary, the impacts originate from a combination of approved and proposed IDF. At the confluence upstream of TR-S-5, which is approximately 9 km from the DE boundary, the impact is mostly caused by the proposed NSE IDF. The cumulative impact at TR-S-5 is estimated to be 10.2% catchment reduction. Downstream of the TR-S-5 confluence, the majority of the impacts are from the approved North Star IDF. TR-S-10, located 28.3 km from the DE boundary, is the most distant point assessed along this tributary, with an estimated cumulative catchment reduction of 1.9%.

Table 3-3 Catchment reduction during operation along main drainage flow paths

Catchment	Reporting Location	Distance from DE (km)	Pre-development Catchment (km²)	Net Change in Catchment Area (%)		
				North Star	NSE	Total
Shaw River	Sh-1	0.0	3.1	0.0	-100.0	-100.0
	Sh-2	2.3	8.8	0.0	-35.6	-35.6
	Sh-3	6.3	24.9	0.0	-12.6	-12.6
	Sh-4	8.6	30.4	0.0	-10.3	-10.3
	Sh-5	11	78.0	0.0	-4.0	-4.0
Strelley River	St-1	0.0	7.4	-55.9	-9.3	-65.3
	Site 12	0.1	7.7	-53.8	-9.0	-62.7
	St-2	3.9	11.5	-36.0	-6.0	-42.0
	St-3	8.8	35.8	-11.6	-1.9	-13.5
	St-4	13.8	57.1	-7.3	-1.2	-8.5
Turner River – Southern Tributary	TR-S-1	0.0	5.8	-23.4	-28.1	-51.5
	TR-S-2	0.3	6.1	-22.1	-26.5	-48.7
	TR-S-3	5.3	20.5	-6.6	-22.3	-28.9
	TR-S-4	7.8	56.1	-2.4	-8.1	-10.6
	TR-S-5	9.0	58.1	-2.3	-7.9	-10.2
	TR-S-6[1]	10.3	85.1	-14.4	-5.4	-19.8
	TR-S-7	15.2	118.5	-10.3	-3.9	-14.2
	TR-S-8	20.2	132.4	-9.3	-3.5	-12.7
	TR-S-9	25.7	148.1	-8.3	-3.1	-11.4
	TR-S-10	28.3	883.7	-1.4	-0.5	-1.9
Turner River – Northern Tributary	TR-N-1	0.0	33.2	-62.8	0.0	-62.8
	TR-N-2	1.2	34.7	-60.1	0.0	-60.1
	TR-N-3	4.7	54.1	-38.5	0.0	-38.5
	TR-N-4	8.7	62.3	-33.4	0.0	-33.4
	TR-N-5	12.2	72.9	-28.6	0.0	-28.6
	TR-N-6	17.1	124.0	-16.8	0.0	-16.8
	TR-N-7	27.6	176.7	-11.8	0.0	-11.8

[1] Location of Central Creek Pool

4 CONCLUSION

The cumulative impacts of Fortescue's development during operation and post-closure were quantified via a desktop assessment of catchment reduction. This is a conservative high-level desktop assessment. As this analysis is dependent on the extent of the IDF, any changes to the IDF would affect the results presented in this report. The finding shows that the cumulative changes within the regional catchments is minimal (less than 1%) compared to the overall size of the catchments for Shaw River, Strelley River and Turner River.

The IDF's for North Star and NSE affect the catchments of interest in varying proportions. Shaw River catchment is only impacted by proposed NSE development whereas Turner River and Strelley River are impacted by both approved and proposed development.

The proportion of impact caused by North Star or NSE is also dependent on the location of the reporting location and that changes along a creek. This assessment also highlights that the greatest impact is expected closest to the DE. The effect of mining development on catchment reduction diminishes as the reference point is further downstream from the DE.

The proposed inland water outcomes on surface water hydrological regime as a result of NSE development are based on the amount of catchment area reduction on the impacted tributaries. The reporting distance from the DE is approximately 10% catchment reduction from Fortescue's mining activities. The proposed outcomes are described as follow:

- No impact to surface water hydrological regime 11 kms downstream from NSE DE (along a creek tributary specified in Figure 2-3) in the Shaw River catchment.

- No impact to surface water hydrological regime 9 kms downstream from NSE DE (along a creek tributary specified in Figure 2-3) in the Turner River catchment.

Similar outcomes are not proposed for Strelley River because the impact assessment illustrate that majority of the impacts predicted is caused by approved North Star development. Additional catchment reduction caused by NSE on Strelley River is minor in comparison to the approved development.

5 REFERENCES

Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick, M., & Testoni, I. (Eds.). (2019). *Australian Rainfall and Runoff: A Guide to Flood Estimation.* Commonwealth of Australia (Geoscience Australia).

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DOCUMENT CONTROL

North Star Extension Hydrological Cumulative Impact Assessment		
Status	IFU - Issued for Use	15-Apr-25
Summary of Changes	Insert summary of changes IF updating to new revision e.g. Rev 1, 2 etc.	
Author	Hui Min Lee	Signature
Checked or Squad Review# (if applicable)	Insert First Name Surname here OR FMG-SQ#	Signature
Approved	Ying Yu	Signature
Next Review Date (if applicable)	Enter a date	