APPENDIX A

Hydrology Consultation

NARRABRI TO NORTH STAR—PHASE 2 PREFERRED INFRASTRUCTURE REPORT

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Table of Contents

1 Consultation requirements 2

2 Consultation strategy 2

3 Consultation timing 3

4 Key messages 3

5 Identifying stakeholders 4

5.1 Stage 1 (Dec 2023) 4

5.2 Stage 2 (March–April 2024) 4

6 Consultation outcomes 5

6.1 Stage 1 Outcomes 5

6.2 Stage 1 Key issues 6

6.3 Stage 2 Outcomes 6

6.4 Stage 2 Key issues 7

6.5 Stage 2 Mitigation measures agreed with stakeholders 7

7 Ongoing consultation 8

8 Register of stakeholder meetings 9

9 Community enquiry and complaints management 9

The Narrabri to North Star Phase 2 (N2NS SP2) project (the proposal) Environmental Impact Statement (EIS), went out on public exhibition for 49 days from 2 September 2022. Following this, the Department of Planning Housing and Infrastructure (DPHI) requested further information, including specific information around hydrology, to be included in a Preferred Infrastructure Report (PIR).

The request required:

- extending the flood model to Ashley, including undertaking Quantitative Design Limits (QDL) assessments
- modelling floodwater distribution mitigation scenarios, including retention of the Camurra Hairpin
- assessing rail raising/a low bund north of Moree Station to mitigate potential residential flooding in town.

During this period, Inland Rail also further refined the existing hydrological model via:

- undertaking an enhanced culvert blockage sensitivity analysis
- integrating agricultural levee data supplied by the Moree Plains Shire Council (MPSC)
- updating the statistical hydrological model to account for the two significant flood events in Moree in October 2022 and March 2021 (i.e. updating the Gravesend Flow Gauge Flood Frequency Analysis to account for recent events)
- incorporating updated LiDAR imagery, which provided a more accurate representation of the current topography adjacent the rail corridor within the Moree area.

Inland Rail notes that some of the above items had been identified by the peer reviewers for action during the detailed design period; however, Inland Rail chose to proactively undertake these updates/refinements at the PIR stage to support/enhance the PIR hydrology work.

It should be noted that, outside of the hairpin area, changes to hydrological impacts were primarily a result of the statistical influence of the March 2021 and October 2022 events (i.e. increased overall floodplain flows) rather than from design changes to the N2NS Phase 2 proposal.

1 Consultation requirements

The DPHI did not explicitly ask for a consultation process with landowners regarding the additional hydrology work/information; however, Inland Rail devised a consultation strategy to proactively engage with affected landowners advising of the modifications to the Phase 2 hydrology modelling and resultant outcomes. This ensures transparency and provides an opportunity for stakeholders to provide feedback on the mitigation options identified at this stage of design.

The hydrology consultation process also incorporated providing updates to stakeholders/agencies with an assumed interest in the updated hydrology modelling, including Moree Plains Shire Council and the Moree Local Emergency Management Committee.

2 Consultation strategy

Inland Rail took a two-staged approach in its consultation with landowners during the PIR hydrology refinement period, which included:

Stage 1—Post-EIS hydrology consultation

- Post EIS, preidentified impacts were discussed. These conversations took into consideration the revised LIDAR and flood impacts assessment and the revised Quantitative Design Limits (QDLs).
- Consultation was also undertaken for stakeholders marginally below the QDLs.
- Advice was provided on future requirements for Stage 2 consultation, including floor-level survey works and levee bank investigations set to be undertaken.

Stage 2—Floor and levee survey outcomes consultation

- The second round of consultation spoke to the outcomes of the levee height and floor level surveys, and subsequent mitigation options:
  - Inland Rail conducted floor-level surveys at 15 properties
  - Levee bank surveys at 4 properties that had pre-identified levee banks
  - Eight (8) additional stakeholders were identified by Inland Rail and added to the consultation and survey schedule, due to their close proximately to the Phase 2 proposal area
  - One (1) stakeholder was removed from the engagement schedule due to the dwellings on the property being uninhabitable, which was established post Stage 1
- Refined culvert designs were re-tested in the flood model to improve compliance, when compared to the EIS. Stakeholders were advised of the additional design work undertaken within the Camurra hairpin bypass, resulting in approximately 180 new culvert structures included in the design.
- Inland Rail closed out communication with stakeholders who were identified as no longer having an impact, post survey being undertaken.

NOTE: The assessment identified mitigation measures proposed to treat flooding impacts identified at the PIR stage, which may be refined or reduced during detailed design (i.e. the impacts and mitigations are not 100 per cent confirmed but are subject to detailed design and the Flood Design Verification Review, and will require future consultation with landowners).

3 Consultation timing

Each of the consultation stages were delivered as follows:

- Stage 1: Undertaken following the inclusion into the hydrology modelling of additional LiDAR mapping and calibration of the model to the recent Moree flood events (2021, 2022):
  - consultation was completed in December 2023
- Stage 2: Undertaken following the completion of the floor level and levee bank level surveys, and amendments to the design, to include new culvert structures:
  - consultation was completed between March and April 2024.

4 Key messages

The following messages were included during this consultation process:

- Flooding is a key consideration of the N2NS Phase 2 proposal.
- Inland Rail will be designed in accordance with the ARTC guidelines, which specify Inland Rail is to be built to 1% AEP flood immunity.
- The Narrabri to North Star Phase 2 EIS, was put on public exhibition in late 2022. Following a review of the submissions received, DPHI requested further information, specifically around noise and hydrology, to be submitted within a PIR.
- The current design will be submitted for the PIR but it is not the final construction design.
- Inland Rail will aim to further refine the hydrology modelling during the detailed design process, which will commence once government approval is received.
- Inland Rail will aim to refine/reduce any hydrology impacts exceeding QDLs during the detailed design phase; however, if this can't be achieved, mitigation will be provided as a design outcome for the proposal.
- The most recent hydrology modelling and stakeholder consultation outcomes will be included in the PIR, which will be submitted to DPHI in around Q2, 2024.

- It is unknown if the PIR will go on public exhibition. The DPHI will advise Inland Rail of their requirements post PIR submissions. In any case, stakeholders are encouraged to provide feedback to DPHI at any stage during design consultation or the proposal's delivery.
- Hydrology mitigation options may include raising existing levee banks or increasing small bunds on several properties. If the impact can't be rectified during detailed design, Inland Rail will be required to provide further mitigation.
- Inland Rail's objective is to reduce alterations to existing flood patterns. To achieve this, culverts and designated areas within culverts have been engineered to channel floodwaters to mirror existing flooding patterns.
- Comprehensive flood modelling has been conducted to assess various flood scenarios. This modelling process integrates diverse data sources, such as historical rainfall records, topographic information, and both present and future infrastructure plans. These inputs are utilised to forecast the flow patterns of different flood events across the broader proposal region.

5 Identifying stakeholders

A targeted stakeholder engagement strategy was undertaken to support the PIR; specifically:

- targeted engagement with landowners adjacent to the Phase 2 proposal and therefore directly impacted by updated hydrology outcomes
- targeted engagement with Moree stakeholders, for which the Phase 2 hydrology modelling would be essential knowledge (Moree Plains Shire Council and Local Emergency Management Committee).

5.1 Stage 1 (Dec 2023)

Inland Rail assessed all Phase 2 properties against duration, velocity and afflux QDLs as based on the updated PIR hydrology modelling. To communicate the impacts or change of flood behaviour clearly and concisely with stakeholders, Inland Rail shared the model update process, modelling outputs and impact mapping including flood afflux impact maps for 1%, 10%, 20% AEP events. Updated PIR flood impact mapping was provided to stakeholders for their records.

During Stage 1, nine landowners were identified who were placed into the following categories:

- landowners receiving impacts that didn't comply with the QDLs
- landowners who did comply with QDLs but whom the model predicted may receive new hydrology impacts as an outcome of the Phase 2 proposal.

5.2 Stage 2 (March–April 2024)

Floor level and levee bank surveys were undertaken, and resulting data was updated within the PIR hydrology model. This data was used to accurately determine/confirm the predicted impact to each of the properties and the flood immunity of each of the existing levee banks.

Stage 2 of the consultation also included further refinement of the cross-drainage design (i.e. approximately 180 additional culvert structures were included within the hairpin bypass area).

Copies of the updated design and modelling outputs (i.e. inclusive of the levee/floor level survey data and additional hairpin culverts) were used during consultation and passed on to all landowners for their record. These included:

- flood afflux impact maps for 1%, 2%, 5%, 10%, 20% AEP events
- where applicable, a concept drawing of the levee that was proposed to provide a 1% AEP immunity.

Using the updated model, Inland Rail identified the following stakeholder categories:

- landowners receiving impacts that didn't comply with the QDLs and for whom mitigation was proposed

- landowners receiving an impact marginally within the QDLs, who would conservatively have mitigation proposed (i.e. due to a small margin between the impact and the non-compliance limit)
- landowners receiving an impact compliant with the QDLs, but had changed from the previous consultation on impacts, undertaken for the EIS.

Inland Rail identified 17 stakeholders who fell into the above categories:

- one landowner was removed at this time due to dwellings on the property being determined to be uninhabitable
- one landowner newly identified was unable to be contacted, despite repeated attempts.

Inland Rail conducted floor-level surveys at 15 stakeholder's properties. These stakeholders included 8 already identified and 7 newly identified stakeholders due to the revised PIR modelling footprint.

Inland Rail also conducted levee bank surveys at 4 of the above properties that had pre-identified levee banks.

6 Consultation outcomes

Through both stages of consultation, the Stakeholder Engagement team reached out to all stakeholders through phone calls, emails, and one-on-one meetings. They initially connected via phone, followed up with individual meetings, and then issued emails noting meeting minute records and associated modelling correspondence.

During these one-on-one sessions, landowners were provided with a detailed explanation of hydrology modelling, afflux mapping at various AEPs (1%, 5%, 10%, 20%), and the proposed mitigation measures.

Consultation was undertaken via phone and follow-up letter for the seven landowners who, post PIR hydrology model update, were identified as having no impact. One-on-one meetings were offered in the written communication.

6.1 Stage 1 Outcomes

Key outcomes of the Stage 1 consultation are provided in the table below.

STAKEHOLDER	CONSULTEE	INFORMATION OBTAINED	OUTCOMES/MITIGATIONS
Individual Stakeholders	**Hydrology impacted:** 9 individual landowner one-on-one meetings occurred	Landowners who were deemed as impacted (both existing or new) were offered a one-on-one meeting with engagement and technical staff, including a hydrologist. One-on-one meetings were offered to nine stakeholders in early November 2023. Eight meetings were booked from 21 November 2023. One meeting was unable to be booked until early 2024.	Seven stakeholders were accepting of the presented PIR hydrology model, pending further floor level and levee bank level surveys and noting the model presented is not the final model. Two stakeholders expressed some concern on the modelling shown to them, noting their impact had worsened.
Local government and other interested stakeholders	**Stakeholder meetings:** - Moree Plains Shire Council - Moree Community Reference Group	Summary of PIR hydrology work completed presented to MPSC. Analysis of the post-EIS hydrology activities including: - tender design compliance results - PIR hydrology reporting - additional modelling - peer review - consultation during PIR	MPSC asked if the bund at the Moree Station would be included in the PIR.

6.2 Stage 1 Key issues

FORUM	KEY ISSUE	OUTCOMES/MITIGATIONS
Landowner meeting	Landowner expressed some concern about impact to dwelling despite additional culverts	The N2NS Phase 2 hydrologist advised culverts need to balance the flow of flood waters, and distribution of flow between the Gwydir and Marshall Ponds Creek systems.
Landowner meeting	Landowner expressed some concerns over the proposed mitigation measure of a levee and the impact of water sitting behind the levee	The N2NS Phase 2 hydrologist explained the management of levee systems, using gravity drainage pipes through the levee with a non-return valve.
Landowner meeting	Landowner expressed concern about the increased hydrology impact to agricultural land	The N2NS Phase 2 proposal team advised the impact would be refined during detailed design.
Landowner meeting	Three landowners expressed concern regarding the cumulative impact from the TfNSW Newell Highway upgrade and the Phase 2 proposal	If mitigation is required, it will assist in mitigating the cumulative impact; however, advised mitigation of the Transport for NSW (TfNSW) Highway upgrade impacts is a concern they need to discuss with TfNSW. Inland Rail will manage its impacts in accordance with QDLs and Conditions of Approval. Inland Rail has considered the cumulative impact of the Newell Highway Heavy Vehicle Upgrade in the current cumulative hydrology modelling.

6.3 Stage 2 Outcomes

Key outcomes of the Stage 2 consultation are provided in the table below.

STAKEHOLDER	CONSULTEE	INFORMATION OBTAINED	OUTCOMES/MITIGATIONS
Individual stakeholders	**Hydrology impacted:** Eight individual one-on-one meetings occurred with landowners who have either a QDL exceedance or a near exceedance. One landowner has been unreachable, despite several attempts to communicate through email, phone, and door knocks. Seven individual landowners whose impact is within the QDLs were offered a one-on-one meeting but were satisfied with a letter outlining the floor-level survey results.	All landowners (both those with QDL exceedances and QDL compliance) were offered a one-on-one meeting, with engagement and technical staff, including a hydrologist to discuss the results from the levee-bank surveys and floor-level surveys. Eight landowners accepted the meeting offer; these were booked between 5–12 April 2024 to discuss the impact and potential mitigation.	Eight stakeholders were accepting of the presented PIR hydrology model pending further hydrology refinement during the detailed design process. One landowner expressed some concern over the proposed mitigation measure of raising their levee but was accepting of Inland Rail's aim to refine the impact during detailed design. Despite Inland Rail making several attempts via phone, email and door knocking, one landowner has remained unreachable and therefore access was not provided for floor-level surveys and consultation. All seven landowners who have a QDL compliance were accepting of the outcome.

STAKEHOLDER	CONSULTEE	INFORMATION OBTAINED	OUTCOMES/MITIGATIONS
Local government	Local government meetings: ▸ Moree Local Emergency Management Committee (LEMC)	Summary of PIR hydrology work completed presented to Moree LEMC. Analysis of the post-EIS hydrology activities including: ▸ Tender design compliance results ▸ PIR hydrology reporting ▸ additional modelling ▸ peer review ▸ consultation during PIR	Concerns raised over the current culvert blockages but accepting of the measured data used to analyse culvert blockages predicted for the Phase 2 proposal.

6.4 Stage 2 Key issues

FORUM	KEY ISSUE	OUTCOMES/MITIGATIONS
Landowner meetings	Three landowners expressed concern regarding the cumulative impact from the TfNSW Newell Highway upgrade and the Phase 2 proposal.	If mitigation is required, it will assist in mitigating the cumulative impact; however, advised mitigation of TfNSW Highway upgrade impacts is a concern they need to discuss with TfNSW. Landowner advised Inland Rail will manage Inland Rail impacts in accordance with QDLs and Conditions of Approval.
Landowner meeting	Landowner expressed some concerns over the proposed mitigation measure of a levee and not wanting additional height on their existing levee.	The N2NS Phase 2 proposal team explained the additional levee height would be approximately 200 mm but all mitigation would need to be negotiated and agreed to by the landowner.
Landowner meeting	Concerns regarding flood heights shown in modelling.	The N2NS Phase 2 hydrologist advised the hydrology model is consistent with a conservative approach and the Inland Rail Stakeholder team will provide further consultation into how the model was created.

6.5 Stage 2 Mitigation measures agreed with stakeholders

PROPERTY	NON-COMPLIANCE/ DESIGN UPDATES	MITIGATIONS	OUTCOMES	REASONS GIVEN
3//DP1095381	Additional 50 mm behind the existing levee bank in 1% AEP. Compliant impact.	Approximate 200 mm top up of levee recommended due to tight margin of QDL limit and current impact during 1% AEP.	Impact and proposed mitigation accepted during meeting April 2024.	Landowner accepting of stated mitigation.
1//DP1265183	Additional 162 mm behind the existing levee bank during 1% AEP. Non-compliant impact.	Approximate 100 mm top up of levee recommended due to non-compliance on land surrounding residence. Mitigation would provide levee bank immunity in 1% AEP.	Impact and proposed mitigation accepted during meeting April 2024.	Landowner accepting of stated mitigation.

PROPERTY	NON-COMPLIANCE/ DESIGN UPDATES	MITIGATIONS	OUTCOMES	REASONS GIVEN
2//DP1265183	Additional 8 mm behind the existing levee bank during a 1% AEP. Compliant impact.	Approximate 400 mm top up of levee recommended due to the increase in water in land surrounding a residence. Mitigation would prevent overtopping in 1% AEP.	Impact and proposed mitigation accepted during meeting in April 2024.	Landowner accepting of the hydrology modelling but would require further information during detailed design on the proposed bund.
4//DP1265183	Additional 263 mm behind the existing levee bank during a 1% AEP. Non-compliant impact.	Approximate 200 mm top up of levee recommended due to non-compliance on land surrounding residence. Mitigation would provide levee bank with immunity in 1% AEP.	Concerns with additional height of levee bank but acceptance of impact on the basis that Inland Rail will aim to design the impact out during detailed design.	Landowner would consider accepting the proposed mitigation but the preference would be no impact at all.
583//DP822888	Additional 6 mm above floor-level impact during a 1% AEP, which is a compliant impact.	Recommend the raising of the house to provide mitigation due to the tight margin between the QDL limit and current impact. New levee around the house could also be an option but unlikely due to the close location of the boundary to the house.	Concerns over where the levee bank would go due to the proximity of the house to the boundary. Overall accepting of the mitigation.	Landowner accepting of the proposed mitigation.
5//DP1265183	**Main house** No impact to floor level	No mitigation required.	Accepted	Landowner accepting of modelling.
	Covered outdoor living Additional 12 mm on covered outdoor area in 1% AEP. Non- compliant impact.	Recommend the construction of a levee bank, or bund to provide 1% AEP immunity for the outdoor living area.	Impact and proposed mitigation accepted.	Landowner would consider bund if the impact were not designed out.
2//DP582677	Additional 42 mm over the floor level during a 1% AEP. Non- compliant impact.	Recommend the construction of a levee bank. May need to extend around the separate equipment storage sheds and firing range for approx. 900 m with a height of 300 mm.	Impact and proposed mitigation accepted.	Landowner accepting of stated mitigation.

7 Ongoing consultation

Inland Rail has met with all landowners impacted by hydrology from the Phase 2 proposal, as well as Moree Plains Local Council and the Moree Local Emergency Management Committee to provide them with the most updated hydrology modelling currently available. It is the aim of Inland Rail to either remove these impacts or reduce the current hydrology impact during the detailed design phase, which will commence if the Phase 2 proposal is approved and funded.

Additional consultation will occur following the detailed design phase, to provide updated hydrology modelling and impacts to stakeholders. In the scenario where a hydrology impact cannot be removed or reduced, Inland Rail will conduct a comprehensive consultation piece to discuss mitigation and seek agreement on mitigation from landowners.

8 Register of stakeholder meetings

A register of meetings with key stakeholders is provided in the table below:

STAKEHOLDER	DATE	SUBJECT	CONTEXT
Moree Plains Shire Council	22 November 2024 27 March 2024	Regular meeting—Hydrology focus—Updated PIR Modelling.	Tender design compliance results, PIR hydrology reporting, additional modelling, peer review, consultation during PIR.
Moree Local Emergency Management Committee	17 April 2024	Presentation on flood modelling outcomes and updates.	Tender design compliance results, PIR hydrology reporting, additional modelling, peer review, consultation during PIR.
Moree Community Reference Group	11 October 2023	Hydrology modelling, hydrology consultation.	Tender design compliance results, PIR hydrology reporting, additional modelling, peer review, consultation during PIR.

9 Community enquiry and complaints management

Enquiries and complaints may be received by Inland Rail via the 1800 number, in person, by email and by letter. The Phase 2 team responds to complaints in line with the Inland Rail Complaints Management Handling Procedure. The timeframes below set out the minimum standards expected to be adhered to by the Engagement Team.

PROCESS FOR MANAGING COMPLAINTS		
ACTION	**TIMEFRAME**	**TEAM MEMBER RESPONSIBLE**
Interaction acknowledged with stakeholder and entered into Consultation Manager (CM). If received via email, file into the relevant Inbox project folder.	Day of receipt	▸ Receiver
Complaint assigned to responsible team member via CM	Day of receipt	▸ Complaints to be assigned to Project Stakeholder Engagement Lead in the first instance. The lead will allocate responsibility for preparing a response as appropriate. ▸ The Stakeholder Engagement Lead will also advise any other team members who may need to be aware of the interaction, including the Stakeholder Engagement Manager, Environment Manager and relevant Project Manager. ▸ It is the Stakeholder Engagement Manager's responsibility to advise other external and internal stakeholders if appropriate.
Prepare and send simple responses (project details etc)	1–2 days	▸ Team member assigned to response
Information gathered for a more complex response	1–2 days	▸ Team Member assigned to response
Draft response	1 day	▸ Team member assigned to response

PROCESS FOR MANAGING COMPLAINTS		
ACTION	**TIMEFRAME**	**TEAM MEMBER RESPONSIBLE**
Response reviewed and approved	1–4 days.	▸ Draft to be reviewed/approved by relevant Stakeholder Engagement Lead in the first instance (content of phone call discussed, if responding to an 1800 hotline contact). ▸ Lead to secure approvals from Project Manager, Environment Manager and Stakeholder Manager as required. ▸ Stakeholder Engagement Manager to advise if additional approvals are required.
Response sent	Upon approval being received	▸ Team member assigned to response
Response recorded in CM and action closed out	Day of reply	▸ Team Member assigned to response
Document any lessons learned and issues that may need to be followed up	2–3 days after response sent	▸ Relevant Stakeholder Engagement Lead and Adviser