

Mr. Mick Fallon
Team Leader, Transport Assessment
NSW Department of Planning, Industry and Environment
Locked Bag 5022
PARAMATTA NSW 2124

**Re: Submission on Inland Rail – Narromine to Narrabri Project Environmental Impact
Statement**

Dear Mr. Fallon,

Please accept this as my submission on the Inland Rail Narromine to Narrabri (N2N)
Environmental Impact Statement (EIS).

I am a Chartered Professional Engineer (Civil) number 370036. I have forty years of experience as a civil engineer and the last thirty-eight years as an owner/operator of my own consulting business in Narrabri, NSW. My detailed CV is attached for your information.

I am also a voluntary technical member of the Narrabri Shire Council Floodplain Risk Management Committee. That Committee is also making a submission on this project.

I have reviewed the Summary of Findings for this project prepared by the Australian Rail Track Corporation (ARTC) dated 2020.

Basis of Submission

(a) Rail Line Route

For reasons known only to IR and ARTC they have selected the proposed route for the new train line to pass through Narrabri Township, immediately on the North-western side. This location is the immediate downstream side of the Namoi River and Narrabri Creek floodplain on which Narrabri is built.

This proposed route directly cause the following issues:

1. An increase in flood levels and flood flow velocities upstream of the proposed rail bridge in Narrabri town;
2. Increased noise from up to 10 trains per day (2025) and 14 trains per day (2040);
3. Access issues into the Narrabri Shire Sewage Treatment Plant from the Newell Highway;
4. Stock movement along the Travelling Stock Route next to the sewage treatment works;
5. Land and house devaluation along the full line length from Boundary Street (small land holdings), Yarrie Lake Road and Bohena Lane (residential), The Island Road (residential), Millicent Drive, Leora Close, Isabell Close and Elizabeth Street (all residential) and Kamilaroi Highway (residential and commercial/industrial); and
6. The route means that the 3,650 to 5,110 trains per year then have to climb up over Knights Hill on the northern side of Narrabri opposite the Wheat Research Station on the Newell Highway.

Given that the Inland Rail trains **do not stop in Narrabri**, it makes no sense at all and there is no need for the line to take this proposed route with all the above issues for Narrabri Township.

Attached is a Google Earth image as a .pdf file and also as a .kmz file to allow an interactive view of the proposed route (coloured yellow).

These files also show an alternative line route (coloured red) which removes all the above issues from the proposed route and replaces them with minimal issue for rural landholders and has the following benefits:

1. No flooding issues for Narrabri Town;
2. No noise or vibration for Narrabri Town residents;
3. No house resumption or purchases required;
4. No land/house devaluations on the edge of Narrabri;
5. No access issues for the Narrabri Sewage Treatment Works;
6. No access issues for the Travelling Stock Route; and
7. No disruption to the irrigation farm on the northern edge of town.

The alternative route also offers significant benefits for the project:

1. There is no need for a bridge across Bohena Creek beside the Newell Highway near Westport Road;
2. There is no need to squeeze past Bohena Creek and the Newell Highway 5.7kms north of the above Bohena Creek Bridge;
3. The proposed 4-kilometre-long over bridge starting before Yarrie Lake Road on the south and passing over the Namoi River, the Island Road Floodway, Narrabri Creek, and the Kamilaroi Highway finishing near the "Auscott Sheds" on the northern side can be replaced by an over bridge of approximately half the length, 7 kilometres downstream, where Bohena Creek, Namoi River, Narrabri Creek and Spring Creek all meet just upstream of Mollee Weir;
4. The alternate proposed route follows Kiandool Lane from Nuable Road north across Yarrie Lake Road all the way to Culgoora Road (14kms) to minimize disruption to landholders.
5. The route stays west of Knight's Hill and meets the Newell Highway North of Murrumbilla Lane meaning the 1.8 Kilometre long trains do not have to climb up and over Knight's Hill or follow the 6 or 7 bends in the existing rail line over Knight's Hill.

(b) Flood Modelling by Inland Rail

In the process of assessing the serious existing flooding issues in Narrabri while serving on the Narrabri Shire Council Floodplain Risk Management Committee, I have become aware of flood modelling issues with the work completed by IR/ARTC.

These include:

1. Differences between the extensive modelling completed for Narrabri Shire for the Town Flood Study and Flood Management Plan and the modelling completed by IR/ARTC;
2. Assumptions about the modelling of the proposed 4.0 kilometre bridge immediately downstream of the town;

3. A lack of modelling of the local flooding from Mulgate/Horsearm Creek and Long Gully by IR/ARTC;
4. The potential of over estimation of flooding in Bohena Creek by IR/ARTC.

These issues are well covered in the submission by the Narrabri Shire Council Floodplain Risk Management Committee and I will not repeat them in this submission.

Conclusion

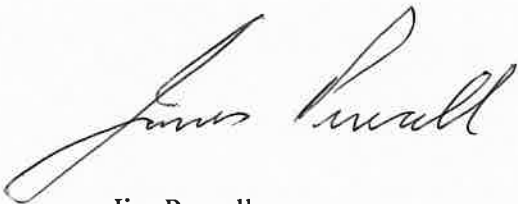
There are significant issues detailed above with proceeding with the proposed IR route through Narrabri.

There is no good reason why the rail line needs to pass immediately downstream of Narrabri. The trains do not stop at Narrabri.

Based on my training and 40 years' experience and help from other local professionals, an alternative route is detailed for consideration. This route is the same length as that proposed by IR and will be cheaper to build and causes less issues and disruption to Narrabri residents.

I hope this submission is of assistance and please do not hesitate to call and discuss this submission.

Thanks

A handwritten signature in black ink, appearing to read 'Jim Purcell', written in a cursive style.

Jim Purcell

Chartered Professional Engineer

Aquatech Consulting Pty Ltd

0429 902 584

Jim Purcell Detailed CV

NAME: JAMES D PURCELL (Jim)
BE (Civil) Cert. FWS
MIE Aust.
MASABE RPEQ
Chartered Professional
Engineer
CID

DATE OF BIRTH: 1st November, 1953

NATIONALITY: Australian

EMAIL: jim@aquatechconsulting.com.au

MOBILE: 0429 902 584



QUALIFICATIONS:

Certificate in Farm Water Supplies, Technical Correspondence School, Brisbane (1975)
Bachelor of Engineering (Civil), Capricornia Institute of Advanced Education, Rockhampton, 1980.
National Registered Professional Engineer- Civil N° 370036 - 1996
Registered Professional Engineer Queensland (Civil Division) No. 1837 – 1985
Certified Agricultural Surface Irrigation Designer No. ASUR2101 - 1998

AFFILIATIONS:

- Member, Engineers Australia and Registered Professional Engineer
- Member, American Society of Agricultural & Biological Engineers
- Registered Professional Engineer, Board of Professional Engineers of Queensland
- Irrigation Australia Limited
 - Life Member 2004
 - North West NSW Regional Committee Member 1983-2003 (Chairman 1986-1992)
 - National Board Member 1992-2000
 - Deputy Chairman 1994-95, 1995-96
 - Chairman 1996-97, 1997-98
 - Member of National Certified Irrigation Designer Management Committee 1999-2003 (Chairman 1999-2000).

LANGUAGES: English

EMPLOYMENT HISTORY:

Aquatech Consulting Pty Ltd, Narrabri, NSW
August, 1999 to Date:

Managing Director and Principal Engineer of consulting engineering practice at Narrabri NSW, specialising in water resources and irrigation engineering.

Barrett Purcell & Associates Pty Ltd, Narrabri, NSW

1983 to 1999

Director of consulting engineering practice Narrabri, specialising in water resources and irrigation engineering.

Sinclair Knight & Partners Pty Ltd

1983 Irrigation Engineer, Ayr, QLD

1982 Irrigation Engineer, Narrabri, NSW

1981 Project Engineer, Brisbane, QLD

Central Queensland University, Rockhampton

1977-1980 Full-time study – Bachelor of Engineering (Civil)

Queensland Water Resources Commission

1977 Farm Advisory Officer, Brisbane, QLD

1976 Farm Advisory Officer, Biloela, QLD

1972-1975 Cadet Farm Advisory Officer, Rockhampton, QLD

EXPERIENCE:

Over forty years' experience in Australia, Mongolia, China, Papua New Guinea and East Africa in all aspects of engineering for water resources and irrigation development projects. Work included planning, surveying, soil testing, investigation, detailed design and construction supervision and project management. Thirty-five years' experience in flood modelling and analysis of river systems and rural floodplains using one- and two-dimensional modelling. Thirty-five years' experience acting as Expert Witness in irrigation, farming operations and floodway and flooding issues. One year's experience in urban development projects; four years' experience in light structures design; and two years' experience in the engineering for saltwater prawn farms.

AUSTRALIA

- **Water Management and Water Use Efficiency Measurement.**

Managed the project “**Determining the National Framework, Terms and Definitions for Water Use Efficiency in Irrigation**” in 1999 for the Land and Water Resources Research & Development Corporation which has become the standard for Australia. In 2003 completed the next stage of the project “**Gaining Acceptance of Water Use Efficiency Framework, Terms and Definitions**”.

- **Introduced and commercialised the Irrimate™ surface irrigation evaluation service** in 2000 to measure and optimise surface irrigation application. The Irrimate™ range of products currently also includes Storage Meters for measurement and recording of storage volumes and surface area and Seepage & Evaporation Meters which measure seepage and evaporation losses from storages, channels and drains.
- **Introduced and jointly developed the WaterTrack™ whole farm water balance software** products in 2003. The combination of the Irrimate™ and WaterTrack™ products has led to a commercial Whole Farm Water Management service.

- **Total Water Resource and Irrigation Development:**

- **Surface Irrigation**

Tasks included project planning, determination of water requirements and availability, detailed design, specification, tenders, construction supervision and contract administration. Works included pumping stations from 0.5 to 2.5 cubic metres per second (cumecs), earthfill ring tank dams, earth supply canals and tailwater drains with reinforced concrete control structures, laser controlled landforming and levee banks for flood protection. Recent examples include:

- 455 ha furrow irrigated cotton at "Cubbaroo", Wee Waa, NSW;
- 1100 ha furrow irrigated cotton and maize at "Drayton", Gunnedah, NSW;
- 630 ha furrow irrigated cotton at "Warilea", Narrabri, NSW;
- 600 ha furrow irrigated cotton at "Barwon", Walgett, NSW.

- **Sprinkler Irrigation**

Tasks including project planning, determination of water requirements and availability, detailed design and performance specification, tender analysis and limited construction supervision. Recent examples include:

- 16 centre pivot machines servicing 600 ha for effluent reuse Tamworth Regional Council, NSW
- Two 65 ha centre pivots for fodder at "Kildonan", Goondiwindi, QLD;
- 90 ha centre pivot for fodder at "St Aubins Without", Scone, NSW.
- 4 x 220 ha lateral moves for cotton at "Auscott", Narrabri, NSW
- 4 x 10 ha pilot schemes for hand move sprinkler of vegetables in Central Mongolia.

- **Drip irrigation**

Identification, planning, detailed design, costing and evaluation of existing systems. Projects include:

- 30 ha above ground drip for banana and nut trees at Yeppoon, QLD
- 3 x 150 ha sub surface drip for jojoba at Gladstone, QLD
- 4.5 ha trial of sub surface drip for cotton at Narrabri, NSW
- evaluation, hydraulic design check and report for existing faulty 200 ha sub surface drip for cotton at Narramine, NSW
- evaluation of soils, lateral and emitter spacing and detailed hydraulic check of sub surface drip for 30 ha of cotton at Narrabri, NSW

- **Identification and feasibility studies for irrigation potential.** Tasks included identification of irrigable land, system layout, preliminary design, costing and reporting. Recent examples include:

- 450 ha furrow and 150 ha lateral move for cotton and wheat at "Eurone", Goondiwindi, QLD;
- 400 ha border check for fodder at "Dowra", Forbes, NSW;

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- 1500 ha furrow and border check for cotton and fodder at "Carlton", Walgett, NSW;
 - 75 ha centre pivot for fodder at "Dunmore", Manilla, NSW.
 - 3 x 150ha sub-surface drip for jojoba, Gladstone, QLD.
- **Repair and redevelopment of existing irrigation systems.** Determination of existing system problems, redesign for repair and/or redevelopment of surface and sprinkler irrigation systems. Recent examples include:
 - Redevelopment of 600 ha of furrow irrigated cotton at "Oakville", Narrabri, NSW;
 - Redevelopment of 36 ha of furrow irrigation into five research blocks at Myall Vale Agricultural Research Station, Narrabri, NSW
 - Replacement of big gun travelling irrigator with single span linear move for 65 ha of fodder at "Dbar", Goondiwindi, QLD;
 - Repair of 1200m of leaking 5 cumec earth supply canal by reconstruction using clay lining for Tenandra Group Irrigation Scheme, Trangie, NSW;
 - Investigation and reporting on leaking earthfill ring tank storage at "Moreton Plains", Moree, NSW.
 - **Design of the supply infrastructure for group irrigation schemes** for the Yambocully Creek (10,000ML per year at 4.5 cumecs) and the Callandoon Creek (6,000ML per year at 3 cumecs) west of Goondiwindi, QLD.
 - **Repair and upgrading of existing group irrigation schemes infrastructure:**
 - Murrumbidgee Irrigation Area, NSW
 - Buddah Lakes, Narromine, NSW
 - Tenandra, Trangie, NSW
 - Emerald Irrigation Area, QLD
 - Ord River Irrigation Project, Kununurra, WA
 - **Appraisal of existing irrigation systems.** Determination of methodology and development of a standard pro forma for registration of asset details, including assessment of condition and effectiveness. Carried out a detailed appraisal and reported on seven Auscott farms at Warren, Narrabri and Moree, NSW covering 11,400 ha of furrow irrigation.
 - **Construction of new compacted earthfill dams.** Predominantly ring tank dams with zoned embankments 4 to 8 metres (m) high. Tasks included planning and site selection, soils investigation and testing, embankment design and specification, tender analysis, construction supervision and compaction testing and contract administration. Recent examples include:
 - 447,000 cubic metre (m³) embankment storing 4250 megalitres (ML) at "Auscott", Narrabri, NSW;
 - 309,000 m³ storing 2800 ML at "Elengerah", Warren, NSW;
 - 155,000 m³ storing 1950 ML at "Broso", Narrandera, NSW;
 - 3 million m³ storing 24,500 ML at "Hortonvale", Cunnamulla, QLD.
 - **Repair of existing earthfill dams:** repair of damage caused by wind generated waves to a ring tank embankment storing 15,000 ML over 600 ha. Specified repairs included rebuilding the inside batter with zoned, compacted earthfill, establishment of African star grass and installation of a mini-spray irrigation system. Investigation and repair of failed embankments (mainly piping

failure). Specified repairs included excavation and rebuilding of embankment sections, construction of upstream cut-offs and clay blanketing.

- **Complete pumping station design and specification** including conceptual and detailed design, pump and motor selection, tender analysis, construction supervision and contract administration for river, canal relift and tailwater pumping stations. Recent examples include:
 - 660mm volute centrifugal river pump and 500mm vertical axial flow canal relift pump, both 900 litres per second (L/s) at "Oakville", Narrabri, NSW;
 - 610mm sloping axial flow river and 660mm and 300mm volute centrifugal relift pumps, both 850 L/s at "Glenelg", Narrabri, NSW;
 - 500mm plus 350 mm vertical axial flow river pump and 660mm volute centrifugal relift and storage pump, both stations 1500 L/s at "Drayton", Gunnedah, NSW.
 - 4 x 500mm + 2 x 400mm + 1 x 300mm in four pumping stations for "Cubbaroo", Wee Waa, NSW; and
 - 1 x 900mm + 1x750mm axial flow pumps with a combined capacity of 350 ML/day for Willewa North, Carinda, NSW.
- **Effluent re-use by irrigation** involving identification, water balance, preliminary design and costing of options and selection of the most appropriate irrigation method. Projects include:
 - Layout, technical specification, tender preparation and evaluation and assistance with construction for sixteen centre pivot irrigation machines for Tamworth Regional Council Effluent Reuse Project;
 - Project Management of construction of Narrabri Effluent Re-use Farm;
 - Review and evaluation of Troy Junction Effluent Reuse Project works, Dubbo City Council, NSW;
 - Design and evaluation of reuse water project for irrigation at Ponderosa, Walgett, NSW; and
 - Evaluation of effluent reuse options for Merinda Meatworks, Bowen, Qld.
- **Canal Structures.** Hydraulic and structural design of check, flow measurement and access structures in earth canals of 0.5 to 10 cumecs capacity. Recent examples include:
 - Reinforced concrete cut-throat flume with ultrasonic water level detection and automatic recording for flow measurement up to 7 cumecs for Buddah Lake Group Irrigation Scheme, Narromine, NSW;
 - Intake, control and measuring structures for gravity diversion of up to 9 cumecs at "Cubbie Station", Dirranbandi, Qld; and
 - Reinforced concrete check and control structure for a 6 cumec main supply canal for Trangie Nevertire Irrigation Scheme, Trangie, NSW.
- **Precast irrigation structures.** Structural design using computer modelling for precast irrigation structures for standard culvert headwall units for Humes Ltd, Melbourne, for a range of soil loads and headwall heights. Tasks included determination of design conditions, modelling with structural software (in conjunction with specialist structural engineer), connection details and construction specification. Headwalls ranged from 1.0 to 4.5m high for pipes from 900 to 1800mm in diameter.
- **Weirs.** Hydraulic and structural design, specification and construction drawings for:

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- 2m high steel pile and timber weir on the Balonne River and 2m high reinforced concrete weir on the Culgoa River for "Cubbie Station", Dirranbandi, QLD;
 - 1.5m high x 300m long reinforced concrete weir across an urban floodway at Narrabri, NSW;
 - 3m high x 26m long reinforced concrete weir in main canal, "Auscott", Moree, NSW;
 - 4m high x 50m wide reinforced concrete weir on Ewenmar Creek, Trangie, NSW; and
 - 4m high x 50m wide reinforced concrete weir for bywash on Ewenmar Creek, Trangie, NSW.
- **Flood Studies.** Location and height of levee banks and determination of floodway capacity and impacts of works using one- and two-dimensional computer modelling. Recent examples include:
 - analysis of the flooding effects of constructing a 300m long reinforced concrete weir across an urban floodway to form a recreational lake in Narrabri, NSW;
 - design of alternative culvert and roadway sections for Glencoe floodway culvert across the Wee Waa-Narrabri road, NSW;
 - levees to protect 1100 ha of irrigated cotton at "Sunnyside", Wee Waa, NSW;
 - relocation of levees for improved irrigation layout while maintaining floodway capacity at "Woomerah", Wee Waa, NSW;
 - extension of existing Wee Waa Airport levee, NSW;
 - relocation of floodway at "Auburn", Merah North, NSW;
 - many detailed Flood Studies for individual large flood protected farms for Part 8 Licences and modifications to floodways for WaterNSW and NSW Natural Resources Access Regulator;
 - Completion of a Floodway Bypass feasibility study for the Narrabri town;
 - Assessment of the cause of flood damage to Industrial Operations in Narrabri;
 - Assessment of the impacts of proposed residential developments on flooding in Narrabri Town;
 - Technical member of the Narrabri Shire Council Floodplain Risk Management Committee for the Narrabri and Wee Waa Flood Management Plans.
 - **Infrastructure modernisation for private and public group irrigation schemes.** Assisted with the scheme water balance and water loss assessment, completed the engineering planning, investigation, detailed design and costing and assisted with the detailed PIOP funding applications and reports for the Tenandra Irrigation Scheme and Marthaguy Irrigation Scheme, Macquarie Valley, NSW.
 - Preparation of draft "**Environmental Guidelines for the Management of Irrigation Farms**" for the Environment Protection Authority of New South Wales. The guidelines describe best irrigation management practices to minimise the potential for environmental contamination, including the management of stormwater and tailwater runoff. Guidelines are given also for siting, design and construction of irrigation layouts.
 - **Preparation of Environmental Impact Statements and Review of Environmental Factors** for proposed and existing irrigation projects involving large scale surface irrigation, above ground water storages, canals, levees, etc

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- **Detailed design of surface irrigation schemes** for sugar cane and paddy rice for numerous clients in the Burdekin Irrigation Area, QLD supplied by groundwater and Water Board channels.
 - Selection, design and operation of a portable pump testing rig for **performance testing of pumps and evaluation of aquifer characteristics Ayr, QLD.**
 - **Topographical survey and operation of Gemco rotary drilling rig** for investigation of recharge sites for the Callide Valley aquifer recharge system Biloeld, QLD.
 - Investigation for **sealing leaking distribution canals** in Emerald Irrigation Area.
 - Experimental **sealing of leaking earth dams** using bentonite clay,
 - **Ord River Irrigation Project, Kununurra, WA:**
 - **preliminary design, quantities and cost estimate** for the development of the 1,387 ha Green Swamp area for surface irrigation development into either one, two or four farm units;
 - preparation of the **technical specification for conceptual topographic survey** of the 6,100 ha **Knox Creek Plain** and 1,100 ha **Ord West Bank** by GPS and/or optical methods;
 - **detailed design and construction drawings** for S4 supply culvert to KL399 and heavy-duty machinery crossing of drain H01; and
 - advice on potential for **tailwater and stormwater re-circulation and storage for Stage I Scheme** including selection of pilot farms for assessment.
 - Evaluation of **asset design lives, cycle times and basis of costing for major periodic maintenance and provision for deferred maintenance** for earthen channels and drains for Murrumbidgee, Coleambally and Murray Irrigation Areas for Department of Water Resources, NSW as Irrigation Expert for Australian Water Technology, Sydney.
 - **Pre-feasibility Study** for diversion of **500,000 megalitres per annum via a 4000 kilometre open canal** from the Fitzroy River in northern Western Australia along the coast to Perth providing town and irrigation supplies en route. Factors considered were diversion weir, unlined and lined canal, bridges, culvert crossing, inverted siphons, cross-drainage structures, floodways, relief pumping stations and rising mains. Full capital and operating costs were considered and piped diversions using several alternative materials considered.
 - **Expert Witness, Independent Water Resources and Irrigation Expert and Mediator** for settlement of disputes over banks and floodways, irrigation system performance or construction standards. Tasks included establishment of performance or standards of construction, provision of technical reports, and acting as expert witness in court and land boards. Recent examples include:
 - Mediation for dispute between builder and Principal on Commercial Building;
 - Assessment of water use and crop production with and without a water storage where the approval was revoked and delayed for 7 years. Value of lost production was \$6.5 million. "Hazeldene", Boomi, NSW;
 - Poor performance of 500mm axial flow pump at "Bonoura", Boomi, NSW;
 - Structural failure of reinforced concrete pumping station at "Keytah", Moree, NSW;
 - Poor performance of linear boom sprinkler irrigator at "Traversdale", Forbes, NSW;
 - Failed earthfill dam embankment at "Eumorella", Boggabilla, NSW;

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- Poor performance of 230 ha surface irrigation development at "Kamilaroi", Moree, NSW;
 - Floodway capacity and levee locations, St George, QLD;
 - Joint water authority and 2000ha irrigation development "4G", Walgett, NSW;
 - Failure of 200 ha of sub-surface drip irrigation of cotton at "Maranoa", Narromine, NSW;
 - Failure of 93ha of sub-surface drip irrigation of beans at "Valleyfield", Ayr, QLD;
 - Failure of levee system and flood damage to cotton at "Arcturus Downs", Emerald QLD;
 - Failure of 29ha of drip irrigation of nursery vines for Australian Quality Vines, Griffith, NSW;
 - Damages from flooding caused by an irrigation channel blocking a natural floodway near Berigan, NSW;
 - Damages from illegal levee bank during flooding at Trangie, NSW;
 - Damage to a natural wetland from NSW State Water operation of a regulated irrigation supplies through Yanco Creek at Narrandera, NSW;
 - Damage caused by blockage to stormwater drain from cotton fields at Narrabri, NSW;
 - Damages caused by overspray of crops to neighbour's cotton at Dirranbandi, QLD; and
 - Design and construction review of failed sprinkler irrigation system for international standard artificial turf hockey fields at UQ Brisbane.
- **Training and Adult Education.** Course structure, material preparation and presentation of 20-day heavy machine operators course training 30 men for the Department of Employment Education and Training at Narrabri, NSW. The course consisted of instruction in plan reading, principles of surveying and laser controlled equipment, health and safety, machine operation, servicing and maintenance (dozer, grader, tracked excavator and elevating scrapers); hands-on machine operation (taught by experienced operators); surveying practical; and laser equipment operation. Co-ordinated the construction of the earthworks for a 30 ha recreation lake as part of this project.
 - Preparation of course notes and assessment questions for "**Irrigation Design and Farm Layout Principles**" for the University of New England for a postgraduate course "Cotton Production".
 - Co-ordination, preparation and presentation of seven one day **educational seminar/workshops** for 50 to 200 farmers as Chairman of a ten man committee. Topics included: financial and labour management, design and construction of pumping stations, earthfill storage embankments, irrigation structures and laser controlled land levelling and environmental considerations of surface runoff from irrigated cotton farms.
 - Presentation and **publishing of papers for technical seminars** on 'Development of a Surface Irrigation System' and 'Tailwater and Stormwater Drainage Design for Surface Irrigation'.
 - **Aquaculture.** Redevelopment of an existing six ha saltwater prawn farm and hatchery complex at "Seafarm", Innisfail, North Queensland. Work involved full redesign of salt and fresh water supply system and pumps, design of alternative prawn harvesting structures and re-levelling of pond beds for harvesting and pond drainage. Site evaluation, planning, soil testing, water requirement determination, salt balance, preliminary design and costing of engineering components for proposed prawn farms at Bowen, Qld (300 ha of ponds), Gladstone, Qld (10 ha

of ponds) and "Inkerman", Karumba, North Queensland (120 ha of ponds). Works included pumping stations, supply system, pond embankments, access and harvesting system, control and harvesting structures and drainage system. Engineering components were designed to the marine and biological specifications of the aquacultural biologist.

MONGOLIA

- Six weeks, 2002 – Irrigation engineer / specialist to identify and cost an Asian Development Bank Project for rehabilitation of the irrigation sector of Mongolia's agricultural crop production.
- One month, 1997 - Irrigation engineer responsible for the selection and detailed design of four separate pilot projects in Central Mongolia to demonstrate small scale sprinkler irrigation of vegetables. This project was a Rehabilitation Project for FAO under the Special Programme for Food Security. The tasks also involved detailing the rehabilitation requirements for existing infrastructure.

CHINA

- One month, 1994 - Technical Specialist (Irrigation) for Inner Mongolia Agriculture Machinery Project and Technical Specialist (Environmental) for Jinan Water Supply Project to assist with preparation of appraisal reports for AIDAB.

Note: Could not complete field mission because of family illness but assisted replacement with technical issues and report preparation.

PAPUA NEW GUINEA

- One month, 1993 - Evaluation of five sites and preparation of detailed design and costing for two commercial irrigated rice areas for the Department of Agriculture and Livestock.

ETHIOPIA

- One month, 1986 - Identification of irrigable area and feasibility study of surface irrigation development utilising river water supplies on the 26,000 ha Sheneka State Farm. Tasks included selection of a 2500 hectare (ha) irrigation area, preliminary design and costing of a 800 ha border check pilot irrigation scheme and complete stock watering system for the farm (25,000 sheep and 1500 cattle).

INDIA

- Overseas study tour, 1987 (six weeks). Member of a five man team sponsored by Rotary International to study Southern India. Government and private irrigation projects and private farms growing tea, nut palms, rice, rubber and tropical fruits were inspected.

PUBLICATIONS:

“Design of Surface Irrigation Systems.” Proc. of Seminar in Irrigation Practice, Irrigation Association of Australia and University of New South Wales, 1985, with Barrett.

“Embankment Design Principles for Earthfill Water Storages.” Irrigation Australia, Vol. 4, No. 1, Feb. 1989.

“Tailwater and Stormwater Drainage Design for Surface Irrigation.” Irrigation Australia, Vol. 5, No. 1, Oct. 1989.

“Irrigation Design and Farm Layout Principles” Course notes in Applied Cotton Production, Graduate Certificate in Rural Science, University of New England, Armidale, 1995. Updated 2004.

“Reducing the Environmental Impact of Irrigation” Proc. of Symposium on Irrigation Development and the Environment, Irrigation Association of Australia, 1998.

“Guidelines for Ring Tank Storages”. The Irrigation Association of Australia Ltd, May 1998 with Barrett.

“Design of Pipes for Irrigation”. Course Notes for “Irrigation Fundamentals” National Centre for Engineering in Agriculture, University of Southern Queensland, July 2001

“Improving Efficiency of Water Storages and Water Supply Systems” Proc. 12th Australian Cotton Conference, August 2004

“How to Get More from Your Water”, Cotton Production Seminar, Cotton Consultants Australia Inc, August 2005

“Water – Measure It And Save It”, Farming Systems Forum “Precision Agriculture”, CRDC & Cotton CRC, November 2005

“Surface Irrigation”, Chapter 19 of “Irrigation” Sixth Edition, USA Irrigation Association, Falls Church, VA, 2011 with Phillip Price

“Whole Farm Water Balance” Chapter 10b Australian Cotton Production Manual, 2012


“Whole Farm Water Balance – The Key To Better Water Management” The Australian Cottongrower Magazine December 2017


Revised 5/02/2021

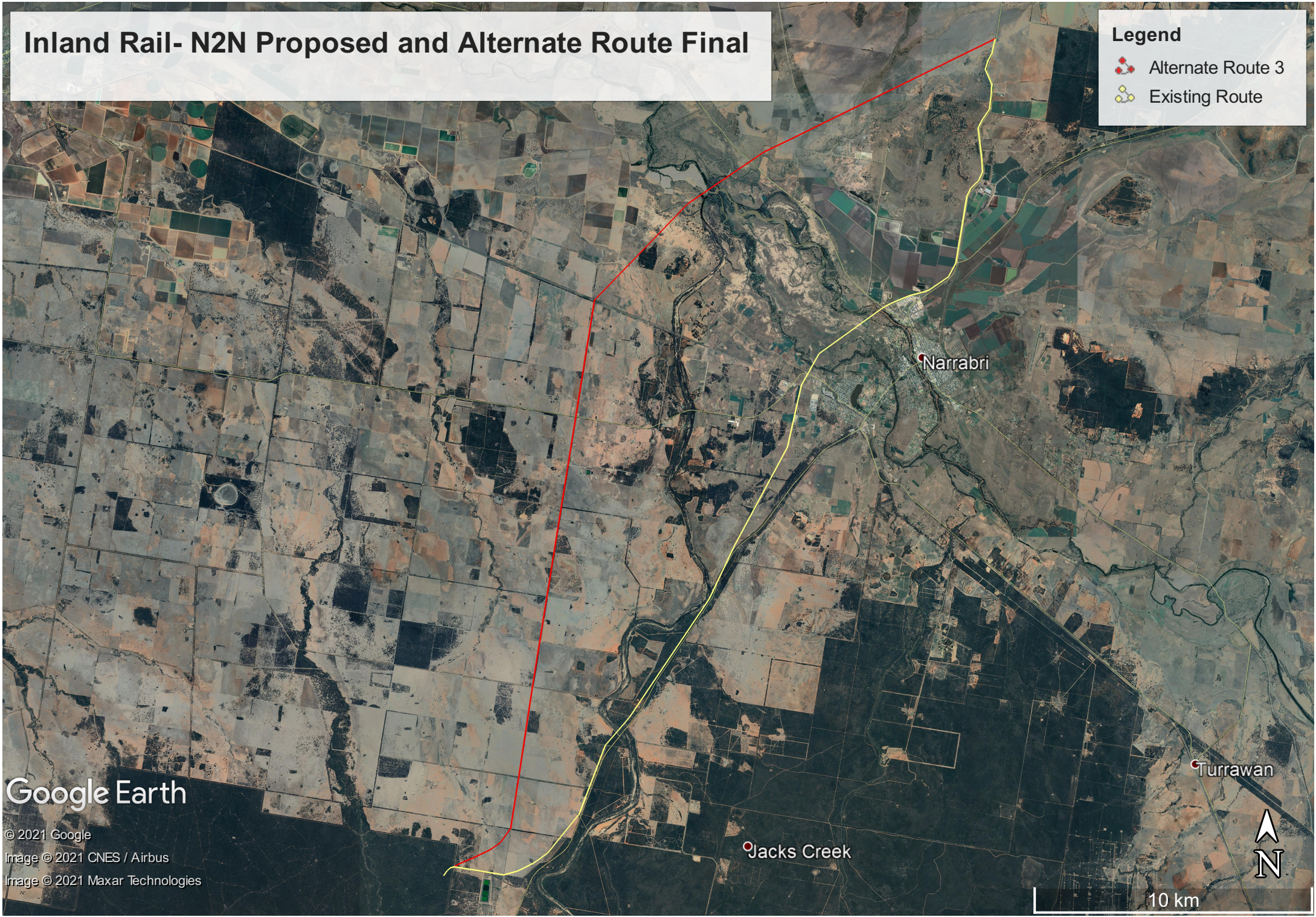
Water Management

Inland Rail- N2N Proposed and Alternate Route Final

Legend

 Alternate Route 3

 Existing Route



Google Earth

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