

ENVIRONMENTAL ASSESSMENT

Newcastle Gas Storage Facility Project

Major Project Application Number 10-0133

Volume 2: Appendices 1 – 4

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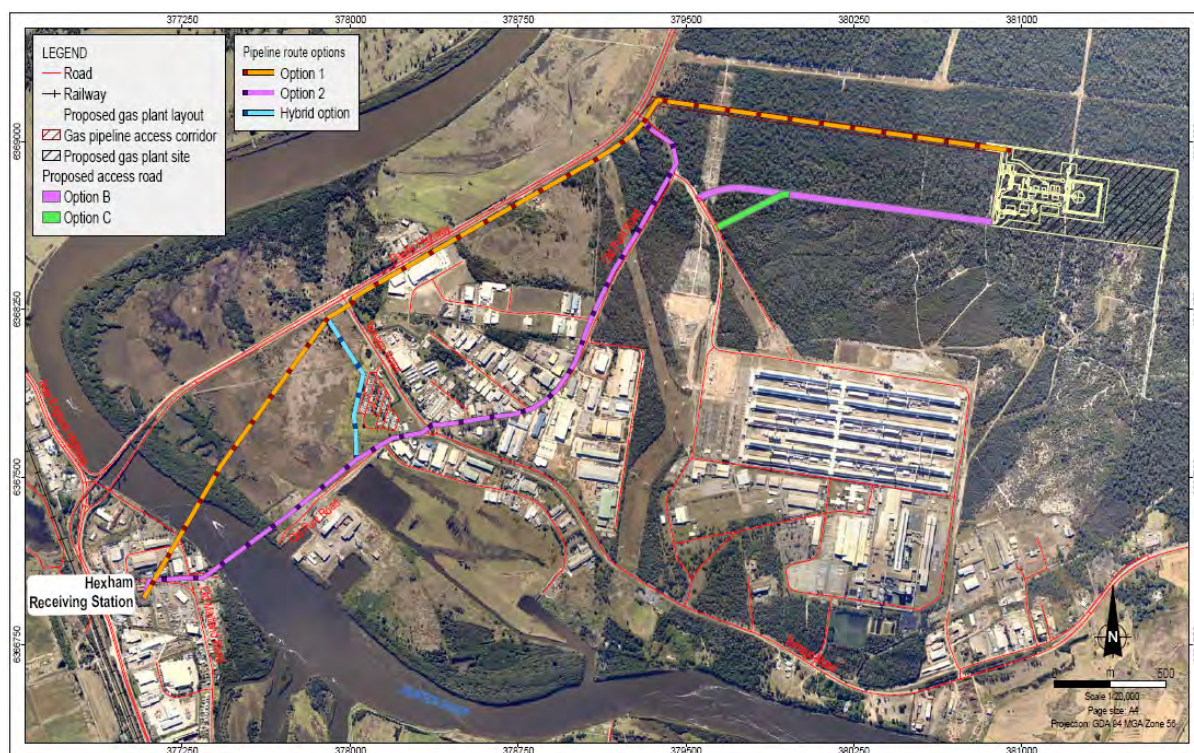
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Newcastle Gas Storage Facility Project

Surface Water Assessment

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FIGURES

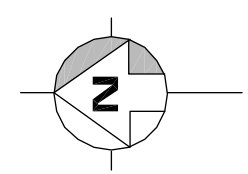
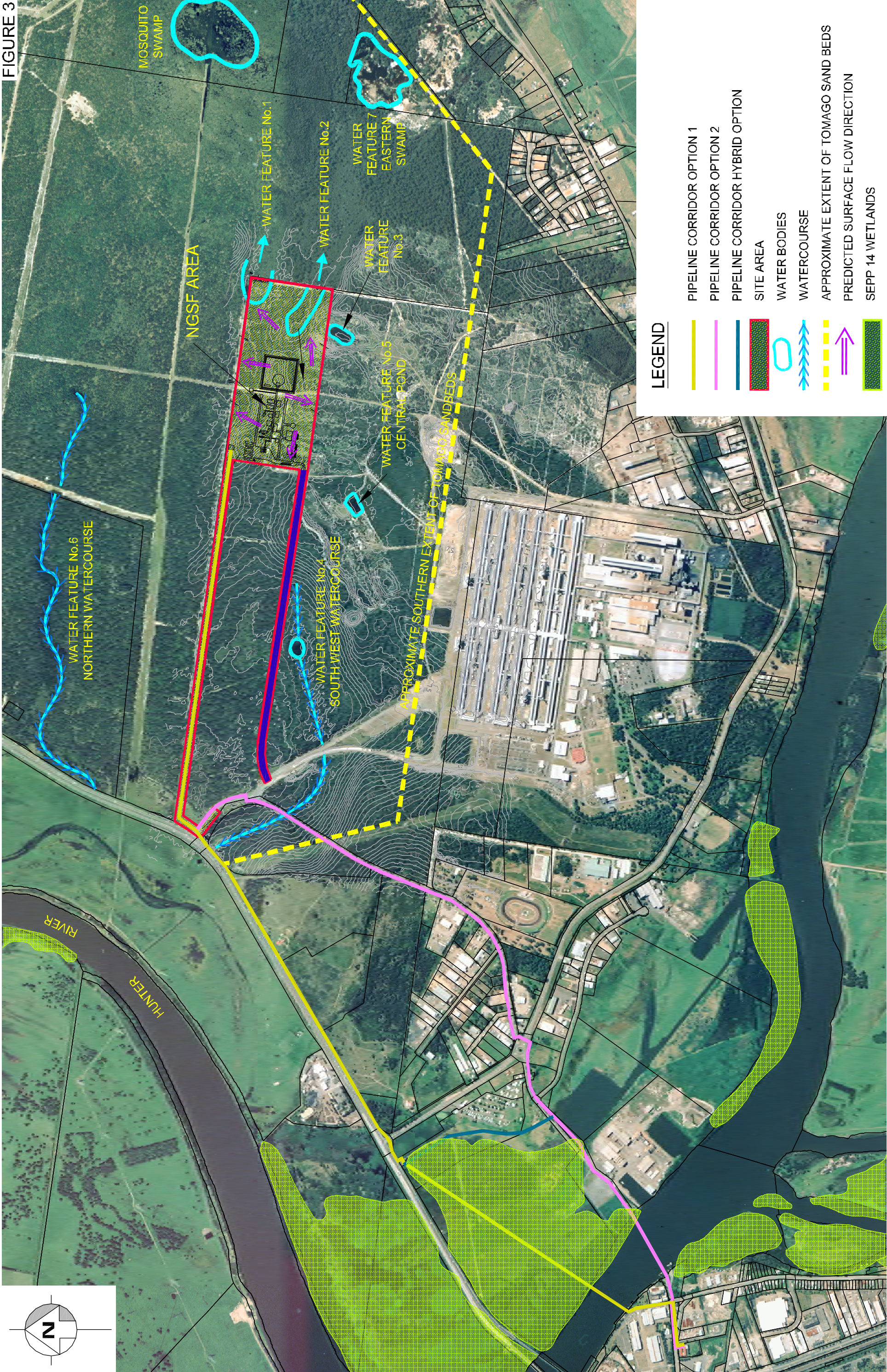


FIGURE 3



LEGEND

- PIPELINE CORRIDOR OPTION 1
- PIPELINE CORRIDOR OPTION 2
- PIPELINE CORRIDOR HYBRID OPTION
- SITE AREA
- WATER BODIES
- WATERCOURSE
- APPROXIMATE EXTENT OF TOMAGO SAND BEDS
- PREDICTED SURFACE FLOW DIRECTION
- SEPP 14 WETLANDS
- PROPOSED ACCESS ROAD & UTILITIES CORRIDOR

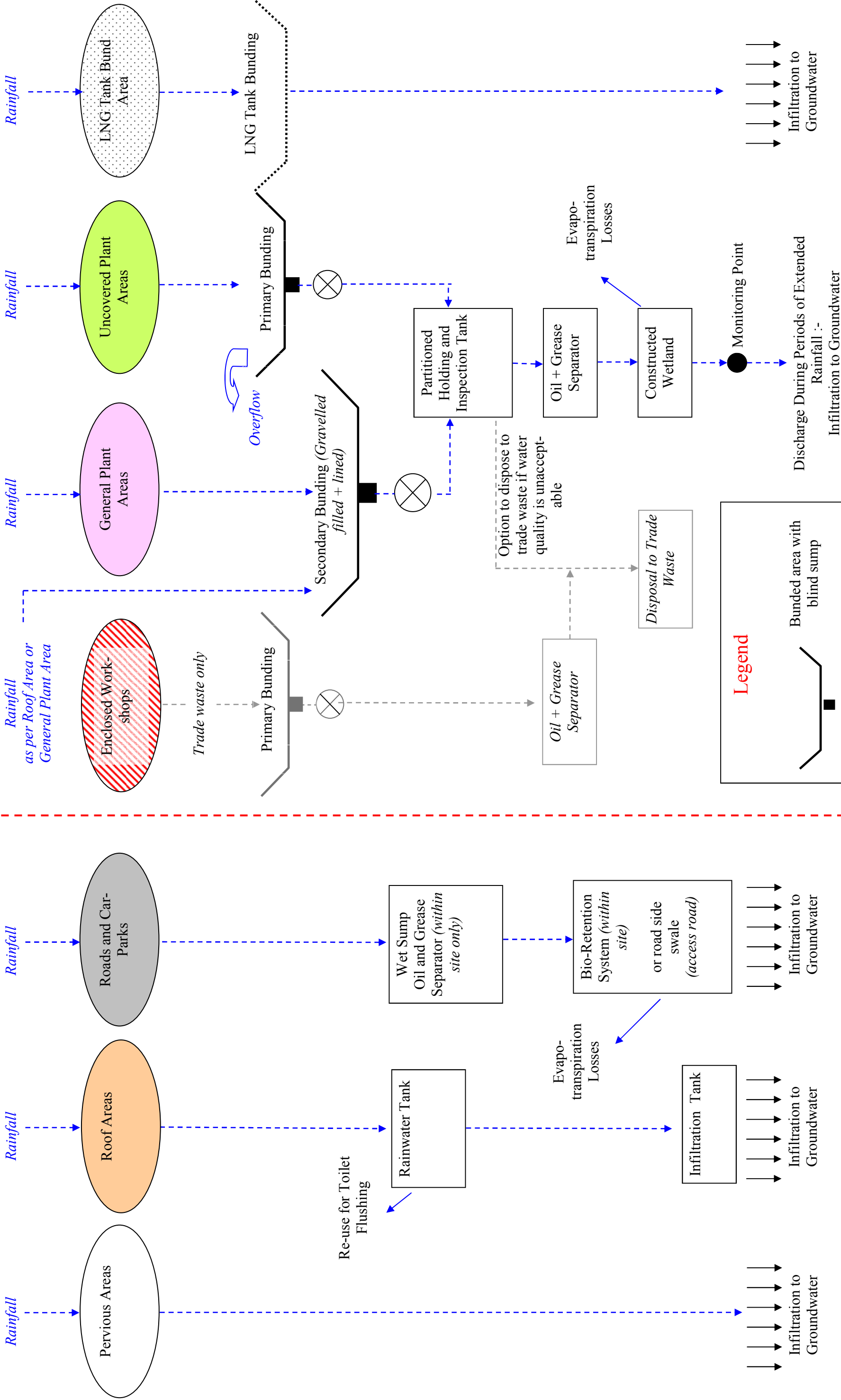
PLAN



FIGURE 5

Ancillary Site Areas

LNG Plant Area



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SURFACE WATER MANAGEMENT FLOW CHART

FIGURE 6

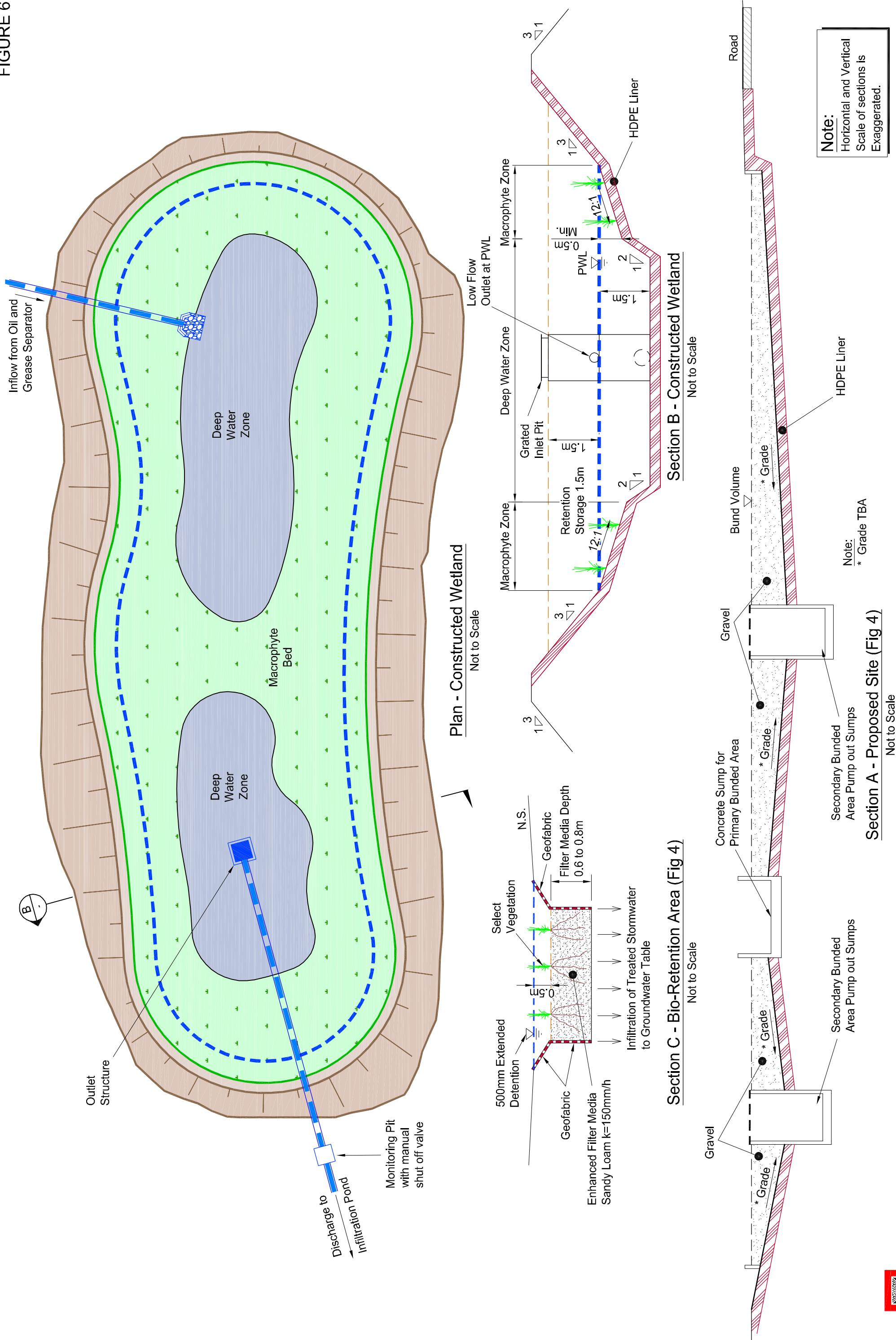
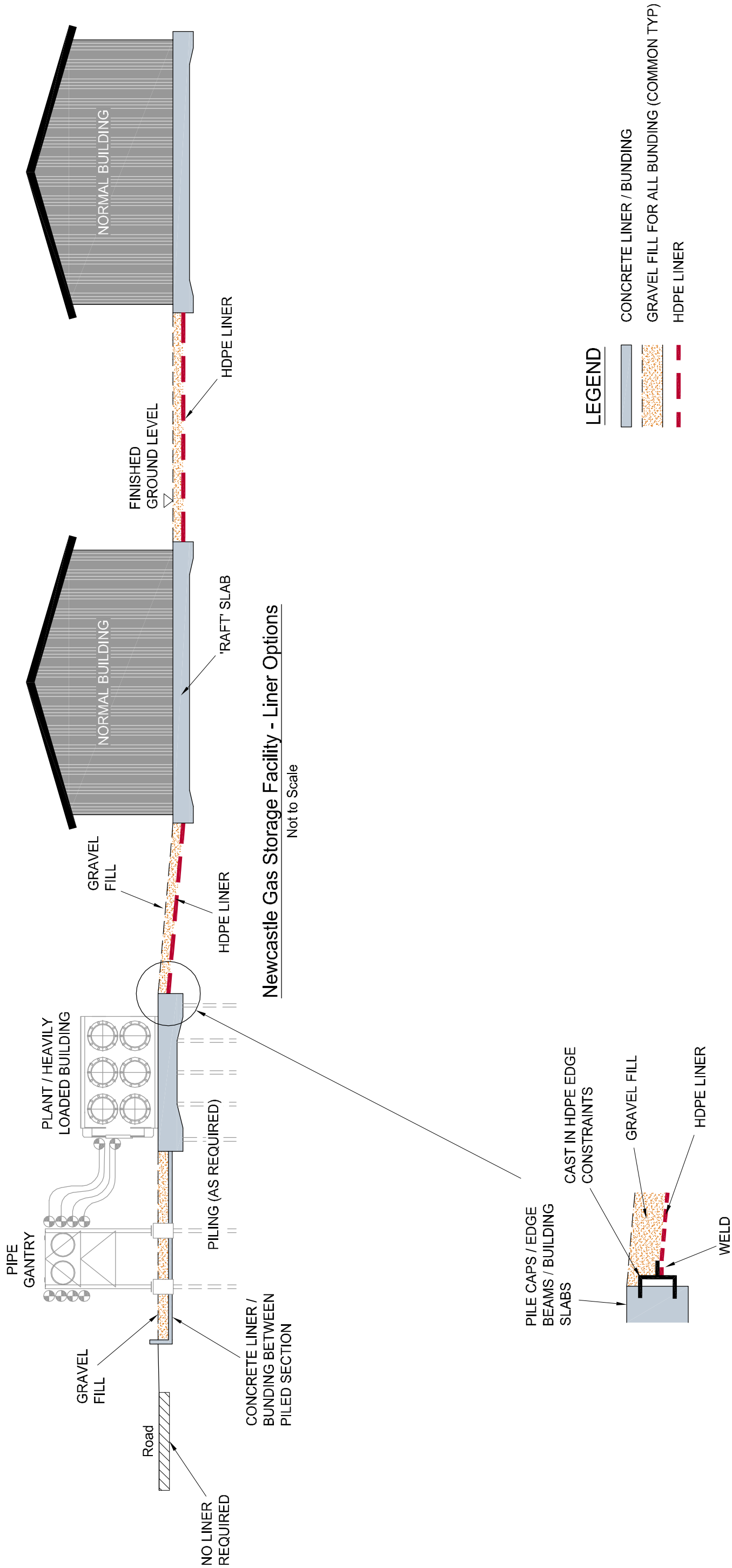


FIGURE 7





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APPENDIX A – MUSIC MODEL



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MUSIC WATER QUALITY MODEL – Assumptions and Methodologies

This section details the methodologies and assumptions adopted for the MUSIC modelling that was undertaken to determine indicative design parameters for the proposed bio-retention systems and constructed wetland.

Water Quality Treatment Targets

Best practice guidelines such as Australian Runoff Quality (*IEAust, 2006*) recommend the following water quality treatment targets for urban and industrial development:

- TSS 80% retention of the developed average annual load;
- TP 65% retention of the developed average annual load; and
- TN 45% retention of the developed average annual load.

A water quality model (*MUSIC*) was used to estimate the likely pollutant loads and assess the water quality treatment provided by proposed water quality controls. The model was used to define the minimum design parameters (*i.e. areas and volumes*) required for water quality control devices to meet the above targets. The following sections describe the modelling methodologies and report the estimated performance and minimum design parameters for the proposed water quality controls.

Model Setup

MUSIC Water Quality Model

MUSIC is a continual-run conceptual water quality assessment model developed by the Cooperative Research Centre for Catchment Hydrology. MUSIC can be used to estimate the long-term annual average stormwater volume generated by a catchment as well as the expected pollutant loads. MUSIC is able to conceptually simulate the performance of a group of stormwater treatment measures (*treatment train*) to assess whether a proposed water quality strategy is able to meet specified water quality objectives.

Meteorological Data

In order to establish a MUSIC model, rainfall and evaporation records in the vicinity of the NGSF were sought.



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Rainfall

In order to develop a model that could comprehensively assess the performance of the proposed SWMP, the use of 6 minute pluviograph data was considered necessary. The nearest BoM weather station with reliable pluviograph data was Williamtown RAAF (*station 061078*). A review of the historical data found that the annual average rainfall depth at Tomago is approximately 1120mm. A selected 5 year period generating an annual rainfall depth of approximately 1120mm was adopted for the purposes of determining the effectiveness of the proposed stormwater quality controls.

Evaporation

Monthly areal potential evapotranspiration (*PET*) rates for the site were estimated from PET data provided by the BoM. The monthly average PET adopted for the MUSIC model was detailed in **Table 7** of the main report.

Catchment Parameters

The proposed development includes the following separate stormwater management areas:

Table A1: Adopted Catchment Areas

Catchments	Total Area (ha)
1. Roof	0.4
2. Road (site road and hardstand area)	1.2
3. General Plant Area	2.1
4. Uncovered Plant Area	0.3
5. Access and Utility Corridor	2.1
6. LNG Tank Bund Area	1.6
7. Enclosed Workshop and Plant Area	0.3
Total	8.0

MUSIC simulates the generation, mobilisation and removal of TSS, TP and TN by generating pollutant loadings for each catchment based on the land-use areas indicated in **Table A1**. Event mean concentrations (*EMCs*) for each of the above land uses were derived from mean loads presented in the Draft NSW MUSIC Modelling Guidelines (*BMT WBM Pty Ltd*, 2010). EMCs were adopted for the following land-uses:

- Industrial;
- Roof; and
- Roads.



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Water Quality Control Measures

The MUSIC model was simplified to include only a 'broad assessment' of the water quality affects of 'final' treatment. That is, bio-retention systems and wetlands were included in the MUSIC model. However, Wet Sump Oil and Grease Separators, Rainwater Tanks, Infiltration Tanks and the removal effectiveness of the Gravel Bunded systems were not included in the MUSIC model. Therefore, the model is seen as conservative as additional treatment would be provided by these stormwater treatment devices. The model arrangement is summarised in **Table A2**.

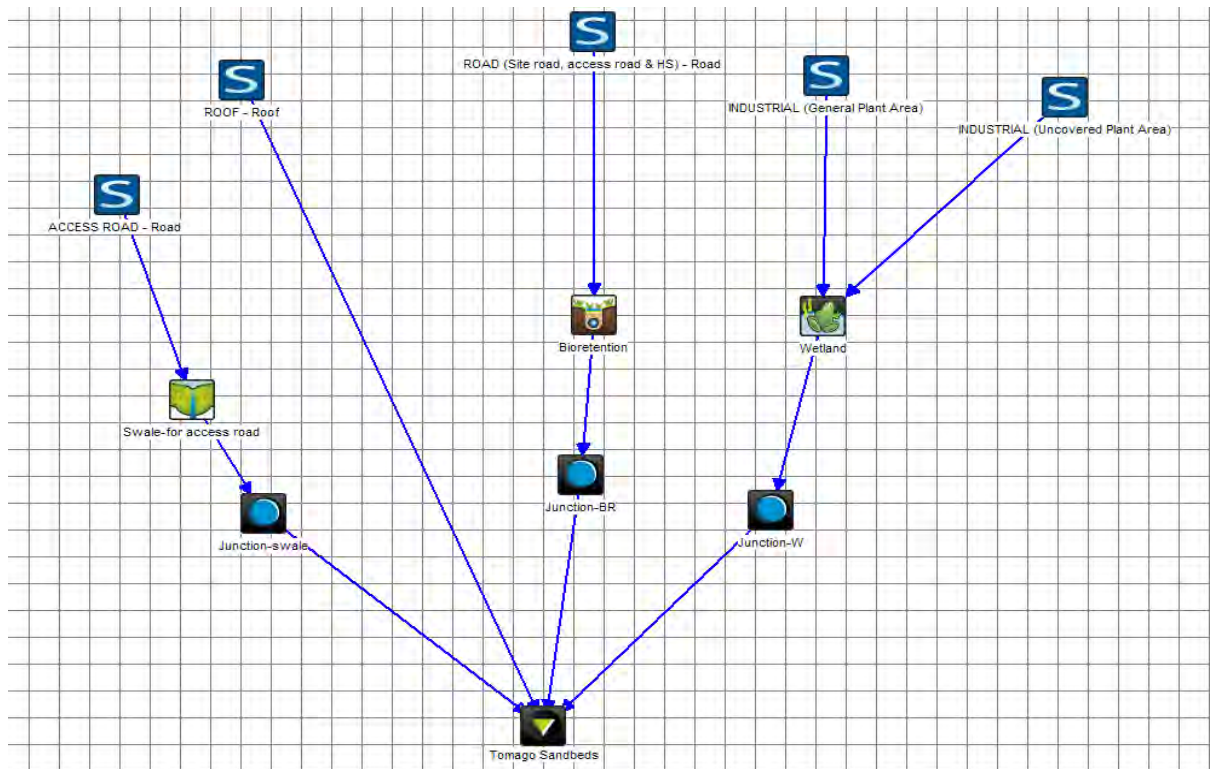
Table A2: Model Arrangement

Node	Catchments	MUSIC treatment device	Excluded water quality treatment
Roof	Roof	n/a	Rainwater tank
Access and Utility Corridor	Access Road	Swale	n/a
Road	Road (site road and hardstand area)	Bio-retention	Oil and grease separator, Infiltration
Industrial	General Plant Area	Constructed wetland	Secondary Bunding, Oil and grease separator, infiltration
Industrial	Uncovered Plant Area	Constructed wetland	Primary bunding, Secondary Bunding, Oil and grease separator, infiltration

A schematic of the MUSIC model is shown below.



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It is noted that the Enclosed Workshop and Plant Area was assumed to go directly to trade waste and hence no water quality treatment for this area was modelled in MUSIC. Rainfall over the LNG tank area infiltrates direct with no treatment, so was also excluded from the model.

Model Results

MUSIC modelling indicated that the following design parameters would be required for the proposed surface water controls:

- **Constructed Wetland:**
 - Surface Area of Wetland – 3,000 m²
 - Permanent Pool Volume – 1,500 m³
- **Bio-Retention System:**
 - Filter Area – 350 m²
 - Filter Depth – 600 mm
 - Total Footprint – 700 m²



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The results from the *MUSIC* water quality assessment are summarised below in **Table A3**.

Table A3: MUSIC model results

Pollutant	Source Load (<i>untreated</i>) (kg/yr)	Residual Load (<i>after treatment</i>)		Removal Efficiency (%)
		(kg/yr)	(mg/L)	
TSS	16,000	861	13	95
TP	25.9	5.5	0.12	79
TN	137	72.7	1.4	47

As shown in **Table A3**, modelling indicates that the water quality control measures specified would meet or exceed the water quality targets defined for TSS, TP and TN.