6.9 SURFACE WATER MANAGEMENT ASSESSMENT AND MONITORING PROGRAM

6.9.1 Surface Water Management Assessment

SINCLAIR KNIGHT MERZ

SKM

pacificnational

Greta Train Support Facility

Detailed Design

Detailed Design Report

Pacific National

SURFACE WATER MANAGEMENT ASSESSMENT

- Revision C
- GTSF-RP-NZR-DR-0002

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1. Executive Summary

SKM are contracted by Pacific National (PN) to undertake the detailed design for Train Support Facility at Greta on Pacific National's property.

The scope and extent of the design is to provide the services for the external infrastructure works within the new facility and also to provide all necessary services required for each building component which form part of the proposed design extent.

The impact of the proposed facility has taken into account "User Requirement Specification" for Pacific National, and also all requirements under all statutory and government regulations.

This Design Report summarises the proposed drainage culverts and stormwater management design at the 50% stage of the detailed design of the Greta Train Support Facility (TSF) project. Design components addressed in this report include cross drainage structures, stormwater detention, stormwater quality management facility requirements and Erosion and Sediment Control requirements.

2. Introduction

2.1 Objectives

The purpose of this Design Report is to provide a description of the proposed drainage culverts design and stormwater management at the nominal 50% stage.

It serves to demonstrate that the proposed design is in general compliance with the project requirements including the adopted hydrologic, hydraulic and stormwater management design criteria.

2.2 Scope of the Design Package

The scope of works for the proposed hydrologic design includes the following:

- Extension and augmentation of the existing waterway crossings under the Main Northern Railway formation, located immediately to the north-east/downstream of the Greta TSF site;
- A new bridge crossing for the proposed access road over Sawyers Creek on the site;
- Stormwater detention facilities, where required, to mitigate any marked increases in site runoff;
- Stormwater quality treatment facilities to mitigate impacts resulting from contamination in site runoff during the operational phase;
- Erosion and sediment control measures for construction phase activities.

3. Design Criteria

3.1 Design Input from Others

- Greta Train Support Facility - User Requirement Specification – Draft Rev B
- Train Support Facility at Greta Environmental Assessment – Draft Statement of Commitments (Monteath and Powys, May 2010).
- Hunter Alliance – Maitland to Minimbah – Third Track – Track Alignment Drawings.
- Hunter Alliance – Maitland to Minimbah – Third Track – Environmental Assessment Report (GHD, 2010).
- Greta Train Servicing Facility – Surface Water Management Assessment (Worley Parsons and EcoNomics, 2010)
- Third Track alignment, grading, surface details.
- Survey of existing surface.
- Survey of boundary
- Engineering Brief – Greta Train Support Facility – 1st September 2009
- Greta Value Engineering 28-6-10.xls – rationalised hydrology and drainage engineering values.
- Bureau of Meteorology – design rainfall intensities for Greta.

3.2 Standards, Codes and Guidelines

- Guidelines adopted in the hydrologic design of the Greta TSF include:
- Australian Rainfall and Runoff Volume 1 – A Guide to Flood Estimation
- DECCW, Environmental Targets, Managing Urban Stormwater, October 2007

3.3 Design Criteria

- Specific design criteria adopted for the hydrologic design include:
- Capacity for the proposed waterway crossings to convey up to the 100 year Average Recurrence Interval (ARI) flood without overtopping the TSF formation and impacting on operations.
- No adverse impact on upstream properties due to afflux in the 100 year ARI flood and Probable Maximum Flood (PMF) events resulting from the proposed development.
- No adverse flooding impact on downstream properties due to increased peak flow rates from the proposed development for events ranging from the 2 year ARI to the 100 year ARI events. At this stage a detailed assessment of any potential increased downstream flood risk is outside the scope.
- No adverse water quality impact on downstream waterways

3.4 Additional Design Considerations

Further hydrologic design considerations were made with regard to the proposed Hunter Expressway (HEX) highway project for the NSW Roads and Traffic Authority (RTA). The proposed highway is to be situated immediately to the south-west/upstream of the Greta TSF site. The proposed cross drainage design for the TSF accounts for the potential hydrologic impacts resulting from the HEX project.

The impact on flooding conditions resulting from the proposed parallel rail underbridge over Sawyers Creek for the proposed third railway track have been considered in the TSF hydrologic design.

3.5 Independent Peer Review Comments

Engineering consultants Worley Parsons have undertaken a peer review of the Greta TSF 50% detailed design hydrology and stormwater management report. Their feedback and comments have been considered in this final report submission.

4. Design Description

4.1 Proposed Waterway Crossings

4.1.1 Methodology

The proposed waterway crossings have typically been adequately sized to convey the 100 year ARI flow. The approach adopted was to determine the 100 year ARI flood flows for the catchment upstream of each existing culvert crossing in the XP-RAFTS hydrologic model, and subsequently estimate the flooding conditions upstream of each crossing using the HEC-RAS hydraulic model. The proposed case flooding conditions were then determined with the TSF site formation in place. The proposed culverts were sized to achieve the design criteria described in **Section 3**, where practical.

This approach was adopted for the four main waterway crossings on the site, which include Sawyers Creek and crossings at sub-catchments EC2, EC4 and EC5. The site is in fill at these locations and hence there is potential for afflux in these waterways, thus requiring the detailed flood backwater analysis in HEC-RAS. Further, more detailed analysis was undertaken for EC4 and EC5 using the TUFLOW 2D hydraulic model, and this is discussed in **Section 4.1.3**.

A minor crossing in sub-catchment EC3, has been addressed differently. The site is in cut at this location and the local sub-catchment is relatively small. Flows from upstream of the site will be captured by catch drains and conveyed to a drop pit inlet. Flows will then be conveyed via pipe culvert under the site. This crossing has been designed to the 20 year ARI storm event.

The hydrologic performance of the existing waterway crossings has also been assessed for the 100 year ARI flood event and is summarised in Table 1.

4.1.2 Proposed Culvert Crossings

The proposed crossing dimensions and associated features are summarised in **Table 1**. Significant design constraints and outcomes are outlined for further discussion.

Issues relating to the limited capacity of the existing culverts at EC4 and EC5 have implications on the hydrologic design outcomes, which are summarised in **Table 1**. EC4 and EC5 require special consideration and is discussed in **Section 4.1.3**.

Table 1 Proposed Waterway Crossings

Crossing Name	Catchment Area[2]	Peak 100 year ARI Event Flow	Existing Structure	Existing Structure Performance and Impact to TSF Site	Proposed Structure and Associated Works	Key Hydrologic Design Outcomes
Sawyers Creek (Preferred access road alignment – western portion of site)	492.3 ha	$37.3m^3/s$	N/A at access road. Existing 2 x 6m span underbridge at Main Northern Railway.	Existing underbridge at Main Northern Railway able to convey 100 year ARI flood with negligible impact on TSF site.	**3 x 3.6m x 3.6m RCBC.**	Proposed culvert provides greater than 500mm freeboard above 100 year ARI flood level of 51.6m AHD. Zero afflux[1] at upstream site boundary.
EC2	33.3 ha	$4.7m^3/s$	1.5m brick arch culvert	Sufficient capacity to convey 100 year ARI flood without overtopping existing railway formation.	Extend existing culvert with **1.5m dia RCP**. Open connection between existing and proposed culverts[3]. **Diversion drain** on upstream side of proposed embankment. 1:1 batters, 1.5m deep, 1% long slope. Lined with reno mattress.	Greater than 500mm freeboard to access road finished road level. Zero afflux at upstream site boundary.
EC3	7.6 ha	$1.7m^3/s$	0.9m brick arch culvert	Sufficient capacity to convey 100 year ARI flood without overtopping existing railway formation.	Extend existing culvert with **0.9m dia RCP**. Inlet consists of high inlet capacity **drop pit structure** upstream of access road turning head (in cut). Catch drains to capture and divert upstream sub-catchment runoff to pit.	Zero afflux at upstream site boundary due to steepness of upstream terrain.
EC4	49.9 ha	$6.2m^3/s$	0.9m brick arch culvert	Culvert is a significant constraint to flow. Updated modelling indicates existing formation is not overtopped, however the proposed formation would be overtopped by floodwaters in the 100 year ARI flood if the existing culvert capacity is not increased.	**Augment existing culvert with 1.2m dia RCP** under Main Northern Railway formation. **Proposed 0.9m dia RCP** under TSF formation. Open connection between upstream and downstream culverts.	Greater than 500mm freeboard to access road finished road level. Zero afflux at upstream site boundary.
EC5	203.9 ha	$18.8m^3/s$	2.5m sandstone arch culvert	Culvert is a significant constraint to flow, however, the 100 year ARI flood can be conveyed without overtopping the existing railway formation.	Extend existing culvert with **3m x 2.1m RCBC**. Connection via junction pit.	Updated modelling of proposed case flooding indicates approximately **1.5m afflux** resulting from the proposed development. This is due to existing culvert being a constraint plus raising of the culvert inlet. Very limited opportunity for mitigating this impact due to constrained site boundary. Increasing the capacity of the culvert in order to mitigate the afflux is likely to result in unacceptable increase in flood risk downstream of the site. Upstream increase in flood risk could potentially be incorporated into the proposed HEX highway design, which will require coordination with RTA.

[1] Afflux refers to the increase in design flood level resulting from the proposed structure.

[2] Upstream of existing railway.

[3] Open connection between existing and proposed culverts: Existing culvert inlet to be retained. Proposed culvert outlet to discharge into the open in the cess between existing and proposed formations. Smooth transition to be formed between culverts.

4.1.3 Special Consideration of EC4 and EC5

The initial HEC-RAS modelling of EC4 and EC5 indicates that some of the design criteria outlined in **Section 3.2** may not be achieved. The steady flow HEC-RAS models are based on coarse 2m contour data outside of the site and does not account for flood storage and attenuation effects, and the potential resultant lower flood level estimates. They therefore provide a conservative estimate of upstream flooding conditions for the 50% detailed design stage.

Detailed unsteady flow 2D modelling using the TUFLOW model and utilising Aerial Laser Survey (ALS) data with a vertical accuracy of +/- 0.15m was therefore undertaken to provide a better estimate of upstream flooding conditions. The model was set up using a 4m grid to a distance of 600m upstream of the site to 100m downstream of the ARTC formation, and included both EC4 and EC5 waterways. The existing and proposed cases were modelled as 1D elements in the 2D model. The 100 year ARI flood event was simulated for a range of storm durations from 30 minutes to 9 hours.

The TUFLOW modelling outcomes are summarised in **Table 1** for EC4 and EC5.

4.1.4 Consideration of Culvert Blockage

The culvert dimensions provided in **Table 1** assume zero debris blockage. Flood flows during large events may convey debris including fallen trees and branches which can cause blockage of culvert inlets.

Any requirements to consider culvert blockage would require an increase in design culvert capacity. For example, 50% culvert blockage would require duplication of the culverts proposed on the TSF site. Alternatively, appropriate debris control/deflection structures may be implemented, or a maintenance regime implemented to regularly clear inlets from any accumulated debris and sediments.

4.1.5 Consideration of Proposed Upstream Development

The hydrologic impact of the proposed HEX project on catchment flows was assessed in XP-RAFTS by representing the increased impervious area in each sub-catchment upstream of the Greta TSF site and comparing the existing case 100 year ARI event peak flows with the post HEX peak flows. The HEX project was assumed to have not provided any stormwater detention.

The assessment indicates that the HEX project will result in a minimal (< 1%) increase in the 100 year ARI peak flood flows at the existing culverts, and hence would not adversely impact on the Greta TSF development.

4.2 Stormwater Detention

Stormwater detention requirements were determined for the Greta TSF development in XP-RAFTS. Proposed impervious areas (access roads, roof areas) were represented for each sub-catchment in the model. Proposed road/site regrading and on-site drainage arrangements resulted in some sub-catchment boundaries and surface areas being adjusted.

The assessment indicates that the Greta TSF development will result in insignificant (<1.5%) increases in peak flood event flows at the existing culverts for events ranging from the 2 year to 100 year ARI events. Hence, stormwater detention is not considered to be required for areas within the site.

4.3 Water Quality Treatment

There are a number of water pollution sources on site that would require water quality treatment controls to avoid discharge of polluted runoff into the downstream waterways.

4.3.1 Sources of water pollution

The main sources of potential water pollution from the TSF site are the proposed access road, the car park area, the building structures and the rail tracks.

Atmospheric deposition on the site's developed areas has the potential to quickly mobilise through the proposed drainage system and be discharged into downstream waterways. Generally, paved areas on the site have the potential to generate Suspended Solids (SS), Oil & Grease (O&G) and Heavy Metals (HM) which are sediment bound.

Oil drippings from the rail tracks are primarily intercepted by the ballast. Small amounts of O&G would discharge into the drainage system would require treatment to capture them before discharging off site. Any accidental spill of hydrocarbons would also be discharged into the drainage system and would also need to be captured before leaving the site.

4.3.2 Proposed Water Quality Treatment

4.3.2.1 Description of Concept

The proposed water quality treatment controls for the operational phase of the TSF site will improve the water quality generated from the site by targeting the removal and capture of SS and O&G.

The simplest most efficient method of removing these pollutants from stormwater runoff is to provide a water quality pond that promotes the settlement of SS and the isolation of any O&G or any accidental spills through a baffle and underflow arrangement. The minimum capture of any accidental spill will be $20m^3$.

There is a slight risk that, under drought conditions whereby pond levels may be lowered below the bottom of the baffle by prolonged evaporation and hence captured O&G may bypass the baffle (but still be trapped in the pond), a sudden storm event could occur and cause the ponds to overfill and begin to discharge, resulting in captured O&G to be released from the ponds. However, this scenario is considered to be highly unlikely under normal operating conditions and the risk of occurrence may be further mitigated by a maintenance program which considers drought-lowered pond levels and any impending severe rainstorm events.

4.3.2.2 Water Quality Control Dimensions

Water quality ponds are proposed to treat approximately half of the site and are provided where space permits, typically in the southern portion of the site. HumeCeptor devices (or an equivalent proprietary water quality improvement device) are proposed for drainage line outlets in the northern portion of the site, where space is limited.

There are five proposed water quality ponds for the TSF site. The dimensions of these ponds are given on **Table 2.**

Table 2 – Proposed Water Quality Control Ponds for TSF

Water Quality Pond ID	Description of the catchment	Proposed pond water volume (m^3)
WQ1	Access Road 1 from approx. Ch 260m to Sawyers Creek	160
WQ2	Access Road 1 from Sawyers Creek to crest at approx. Ch 1050m	165
WQ3	Rail Track 1 from Ch 211,200m to 211,500m	450
WQ4	Access Road 1 from approx. Ch 1050m to approx. Ch 1400m, and Rail Track 1 from Ch 211,500m to 211,800m	520
WQ5	Access Road 1 from approx. Ch 1400m approx. Ch 1860m, Administration Centre and car park, wagon maintenance and road vehicle service centre and fuel farm.	600

The drainage lines where HumeCeptors are proposed and the device model is summarised below

Table 3 – Proposed GPT (HumeCeptor) Sizes for TSF

Drainage Lines	Catchment Size (ha)	Recommended System
1 & 2	0.53	STC9
3, 4, 17 & 18	3.66	STC40
5 & 6	2.20	STC27
19, 20, 21, 22 & 23	0.99	STC14

4.3.2.3 MUSIC Modelling of Water Quality Ponds

Modelling of the water quality ponds in the MUSIC model demonstrates that average annual SS loads from the site would be reduced by at least 80%. The model used 6 minute rainfall data from Station 061242 (Cessnock (Nulkaba)) for the period 1962 – 2007. Average monthly evaporation was also derived for this station as input into the model. The following catchment impervious fractions were adopted in the MUSIC model:

Table 4 – Adopted Catchment Imperviousness in MUSIC

Water Quality Pond ID	Catchment Area (ha)	Impervious Fraction
WQ1	0.495	0.8
WQ2	0.92	0.8
WQ3	2.425	0.8
WQ4	2.785	0.85
WQ5	3.825	0.7

The relatively high impervious fractions reflect the fact that each catchment surface is dominated by paved surfaces or railway yard, where the underlying clay capping is fully impervious.

Note that the proposed size and number of the water quality ponds has changed from the 50% design stage to reflect updates in the site design, including bulk earthworks, access road and building locations and associated stormwater drainage.

4.4 Erosion and Sediment Control

As with all construction projects, the construction phase of the TSF site presents a potential risk to water quality. Construction activities for the access road, car park area, building structures and rail tracks will include stripping of topsoil and excavation to proposed earthwork levels. The primary risk occurs when soils are disturbed and exposed during earthworks. During this time, if adequate erosion and sediment control measures are not adopted, suspended sediment and associated pollutants can be washed into Swayers Creek and the other unnamed tributaries flowing through the TSF site. This can cause silting of waterways, a decline in water quality and potential damage to ecosystems. To prevent this degradation, construction works are subject to various controls, which are documented prior to commencement of the works in a Soil and Water Management Plan (SWMP) to be prepared by the contractor. A SWMP documents the controls that both limit movement of sediment (erosion controls), and remove sediment from runoff prior to discharge to downstream creeks and waterways (sediment controls).

A summary for a range of environmental protection measures are presented in this report for the protection of water quality values during the construction phase of the project. The earthworks activities for the proposed TSF site will be undertaken in several phases and will involve land disturbance of an area estimated to be approximately 18 ha. The soils on this site are generally finely grained with some localised coarsely grained soils, with moderate to high erodibility. This will require the implementation of adequate erosion and sediment control measures during the construction stages of the development.

The following erosion and sedimentation control structures should be used on site:

- Stabilised entry/exit point;
- Sediment filter fences;
- Barrier fences;
- Weed free straw bale sediment filters wrapped in geotextile fabric;
- Level spreaders;
- Diversion drain banks/channels;
- Check dams;
- Sediment basins;
- Top soil stockpiles; and
- Other site controls (as needed).

These control structures are described in the following sections.

4.4.1 Stabilised Entry/Exit Point

A stabilised entry/exit structure will need to be be installed at the entrance to the site from Mansfield Street. This is needed to reduce the likelihood of vehicles tracking soil materials onto public roads. The gravel stabilised entry/exit point will have a minimum length of 25m which will be 150mm deep and consist of 50mm to 90mm size gravel. A shaker ramp (cattle grid) shall also be used in addition to the stabilised gravel access.

(Ref: Attached standard drawing **SD 6-14** of "*Soils & Construction,* Landcom, 2004", which have been included in **Appendix A** of this report.

4.4.2 Sediment Filter Fences

Sediment filter fences will be installed to contain the coarser sediment fraction (including aggregated fines) as near to their source as possible.

For all filter fences, a trench of approximately 150mm depth should first be dug, then star pickets driven in at 3m intervals. Chain wire will then run between the star pickets and a proprietary filter will be suspended from it. The height of the fence will be approximately 600mm.

(Ref: Attached at **Appendix A** standard drawing **SD 6-8** of "*Soils & Construction,* Landcom, 2004".

4.4.3 Barrier Fences

Barrier mesh fences will be installed to define those areas on site that should not be entered, to avoid unnecessary soil/land disturbance. Prior permission from the Site Superintendent will be required before entering any of these areas.

4.4.4 Weed Free Straw Bale Filters Wrapped with Geotextile Fabric

Straw bale sediment filters wrapped with geotextile fabric may need to be installed instead of sediment fences in areas where higher sheet flows are expected.

Installation will involve excavating a trench a few centimetres wider than the straw bales. The bales will then be placed against the down slope side of the trench, and securely anchored by driving at least two stakes through the bale. The first stake in each bale will be driven toward the previously laid bale to drive them together. The stakes should be driven at least 0.6 m into the ground.

Appropriate geotextile filter fabric should be placed against the upstream face of the bales and extended it into the trench. The fabric should be stapled to the bales with 0.15 to 0.2 m u-shaped wire pins. The trench should be backfilled and the soil should be compacted against the fabric and bales.

(Ref: Attached at **Appendix A** standard drawing **SD 6-7** of "*Soils & Construction,* Landcom, 2004"). The geotextile filter to be used is not shown on the standard drawing **SD 6-7**.

4.4.5 Level Spreaders

Level spreaders will be installed on the earth bank's downstream end of the diversion drains to convert concentrated runoff to sheetflow runoff at locations shown on the SWMP.

(Ref: Attached at **Appendix A** standard drawing **SD 5-6** of "*Soils & Construction,* Landcom, 2004").

4.4.6 Diversion Drain Banks/Channels

Diversion banks intended to remain effective for more than 2 weeks will be rehabilitated when possible. Hessian cloth can be used if tacked with an anionic bitumen emulsion (0.5 L/m^2). Foot and vehicular traffic will be kept away from these areas.

(Ref: Attached at **Appendix A** standard drawings **SD 5-5** for low flows and **SD5-6** for high flows, from "*Soils & Construction,* Landcom, 2004").

4.4.7 Check Dams

Check dams will be installed at intervals of 50m on diversion drains that are laid on longitudinal slopes greater than 2.5% to reduce runoff velocities.

(Ref: Attached at **Appendix A** standard drawing **SD 5-4** from "*Soils & Construction,* Landcom, 2004").

4.4.8 Sediment Basin

Sediment basin will be constructed where shown on the layout plan. The sediment basins have been designed to suit type D soils which are fine and dispersible soils.

The dimensions of the sediment basins are given in **Table 5.**

- **Table 5- Sediment Basin sizes for the construction phase**

Sediment Basin No	Min Volume (m^3)
SB1	160
SB2	165
SB3	450
SB4	335
SB5	500
SB6	400
SB7	400
SB8	1200
SB9	250
SB10	600

* refer to the plans for location,, side slopes for basin V:H = 1:2, max depth is 2m

5. Value Engineering and Concluding Comments

A value engineering session was undertaken involving various key representatives from the design and construction teams, along with various stakeholders from PN. Several ideas / options to be further investigated in the design development stage were identified.

The hydrologic design and stormwater management specific ideas are tabulated below, along with the description and status of the item.

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Priority
1 – High
2 – Medium
3 - Low

Greta Project Value Engineering

Number	Title	Description	Impact	Discipline	Project Zone	Priority	Action / close out	Who	When	Status	Open/Closed	Benefit
40	hydrology study of land from RTA land - current backup not critical but may be once facility there			Drainage	Drainage	1	Assessment has demonstrated that there will be negligible impact from RTA project on peak flows from each sub-catchment	JC	30-Jun	Adopted	Closed	Part of Scope
41	Erosion & Sediment Controls	The current budget does not contain any cost for erosion and sediment control beyond the final retention basins.	Allow $10,000 per watercourse	Environment	Drainage	2	detailed design	JC		In Progress	Open	
42	Number of detention basins	Rationalise the numbers of basins for the better control of site water.		Drainage	Drainage	2	Assessment has indicated that only one stormwater detention basin is required (in sub-catchment EC4). Runoff from paved and roof areas to be isolated for detention to reduce volume required to 700m^3.	JC	30-Jun	Adopted	Closed	Part of Scope
43	construct a maintainable hydrocarbon pond - be able to drain fluids from one to another so can clean out			Water Treatment	Y - Applies to Multiple Zones	3	to be implemented	JC	25-Jun	In Progress	Open	
44	Sediment pond weir	Weir at sediment pond catches sediment and does not allow it to reach pond		Drainage	Drainage	3	Ensure design of water ways to sediment ponds do not restrict flow into pond	JC		In Progress	Open	
45	drainage around facility at Antiene - sprayed colour coded to communicate what can be poured where - use more durable method			Drainage	Drainage	3	to be managed as part of detailed design	JC	30-Jun	In Progress	Open	
46	minimise stormwater treatment by separating surface and sub-surface			Drainage	Drainage	3	to be considered as part of detailed design	JC	30-Jun	In Progress	Open	
47	Helcor Pipes	Investigate the use of Helcor Pipes to reduce drainage cost. This relates to the design life and not the capacity.		Drainage	Drainage	3		JC		In Progress	Open	

6. Drawings

Refer to the drainage layout plan dwg no: GTSF-DG-DRA-DR-0101 to 0111 and the basin typical detail: GTSF-DG-DRA-DR-0050

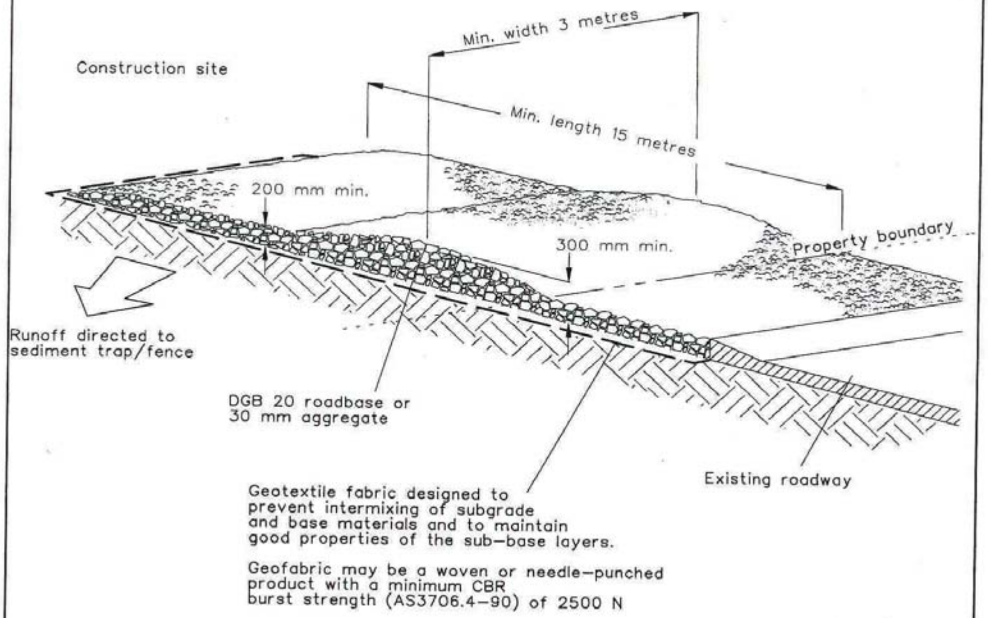
7. Safety In Design

7.1 Risk Assessment Workshop

A risk assessment workshop (HAZID) was undertaken involving various key representatives from the design and construction teams, along with various stakeholders from PN to examine all the risks associated with the Train Support Facility.

Several risks across the various disciplines of the project were found and tabulated in Appendix B. These risks were then assessed and a treatment measure assigned either through design or procedures to reduce the overall residual risk.

Appendix A Standard details of erosion and sediment controls (Soils and Construction Manual, 2004)

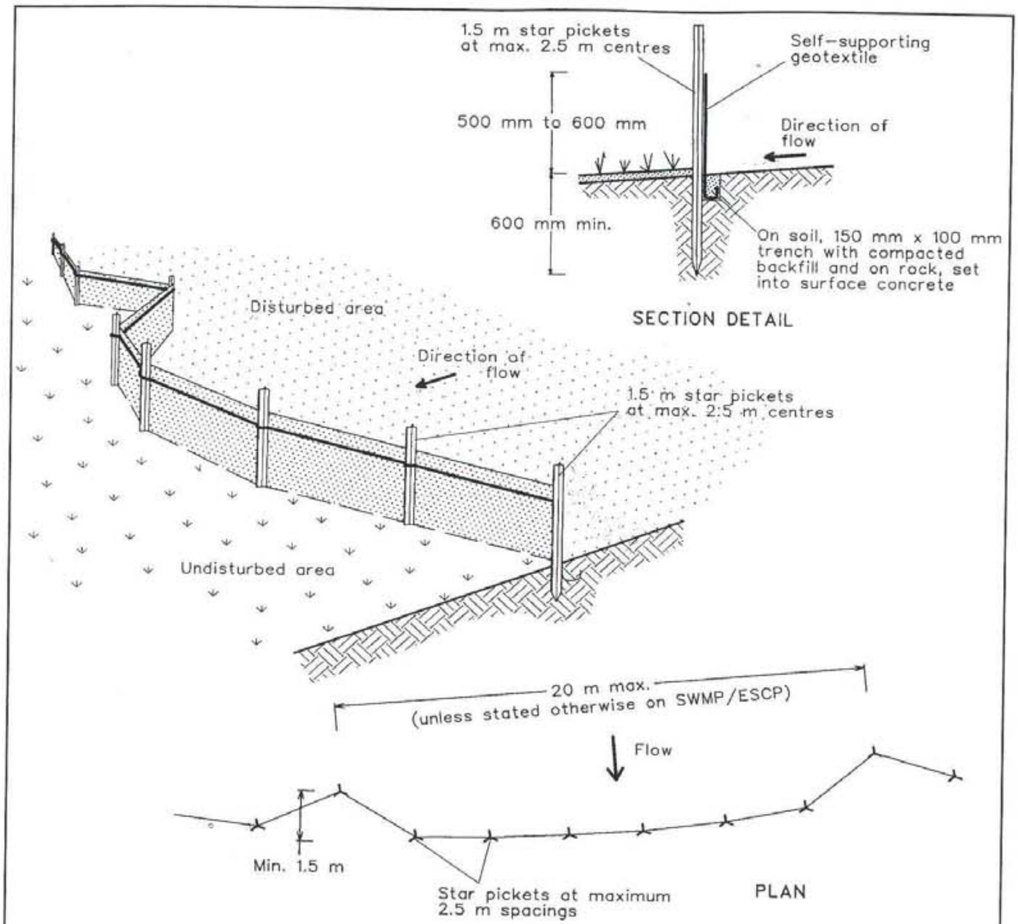


Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS **SD 6-14**

6-48

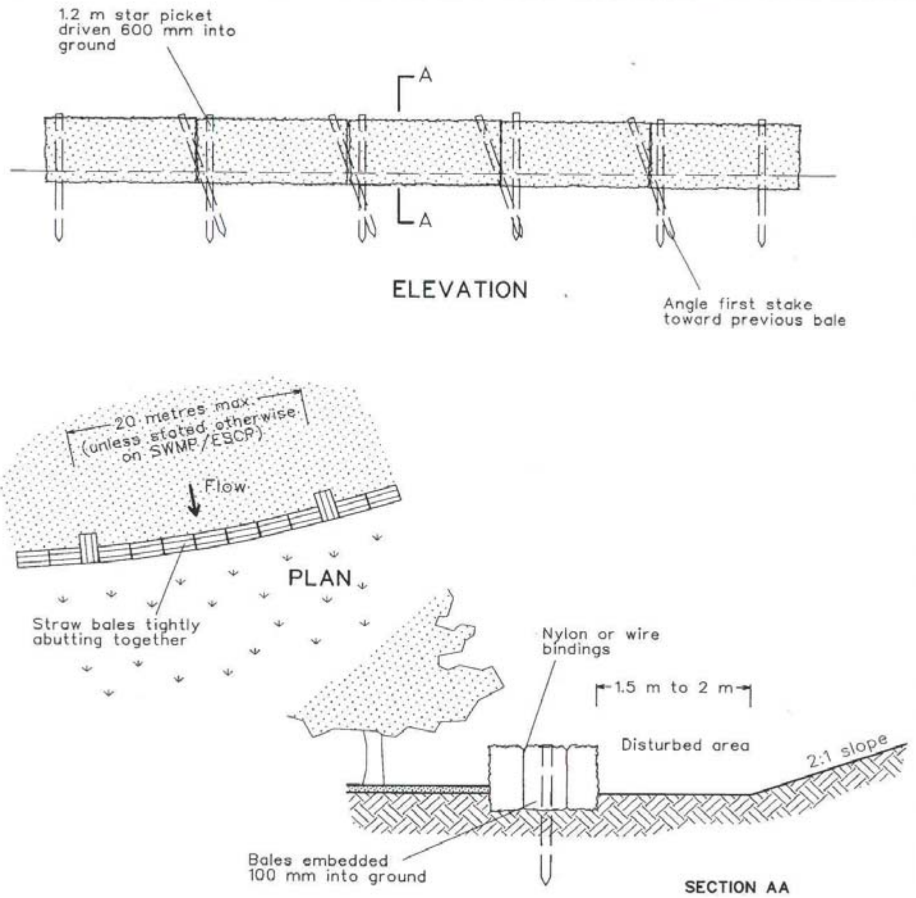


Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE **SD 6-8**

6-36



Construction Notes

1. Construct the straw bale filter as close as possible to being parallel to the contours of the site.
2. Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
3. Ensure that the maximum height of the filter is one bale.
4. Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
5. Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
6. Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

STRAW BALE FILTER **SD 6-7**

6-35

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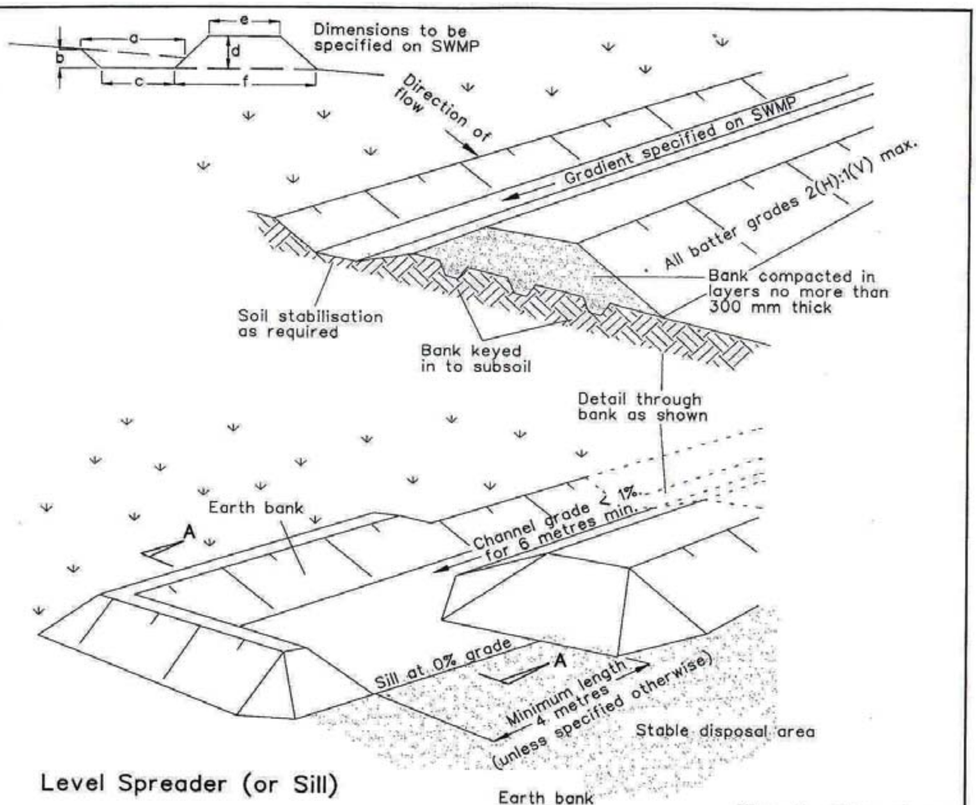
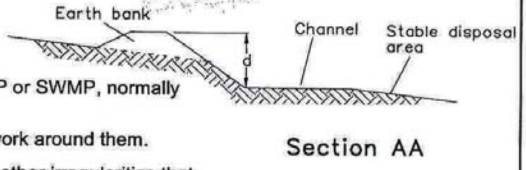


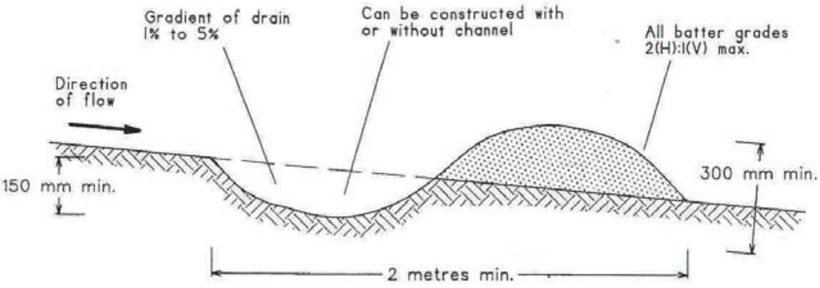


Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

EARTH BANK (HIGH FLOWS) **SD 5-6**

5-26



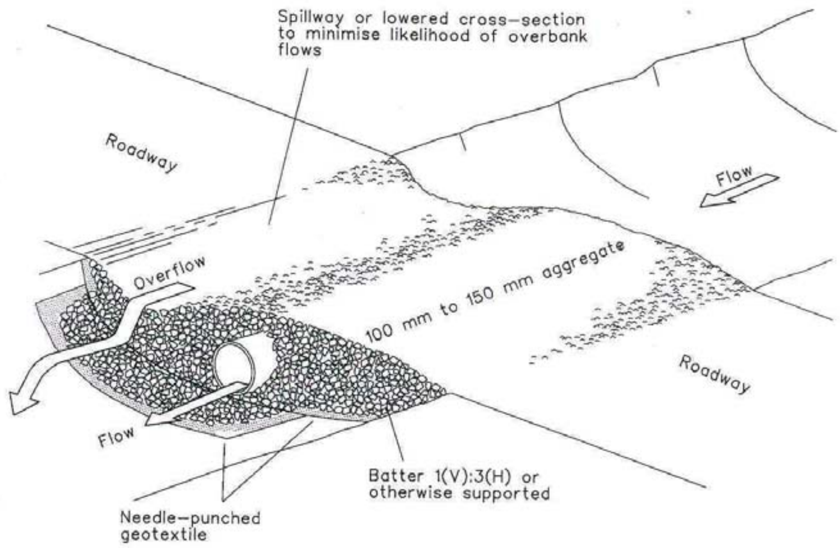
NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW) **SD 5-5**

5-25

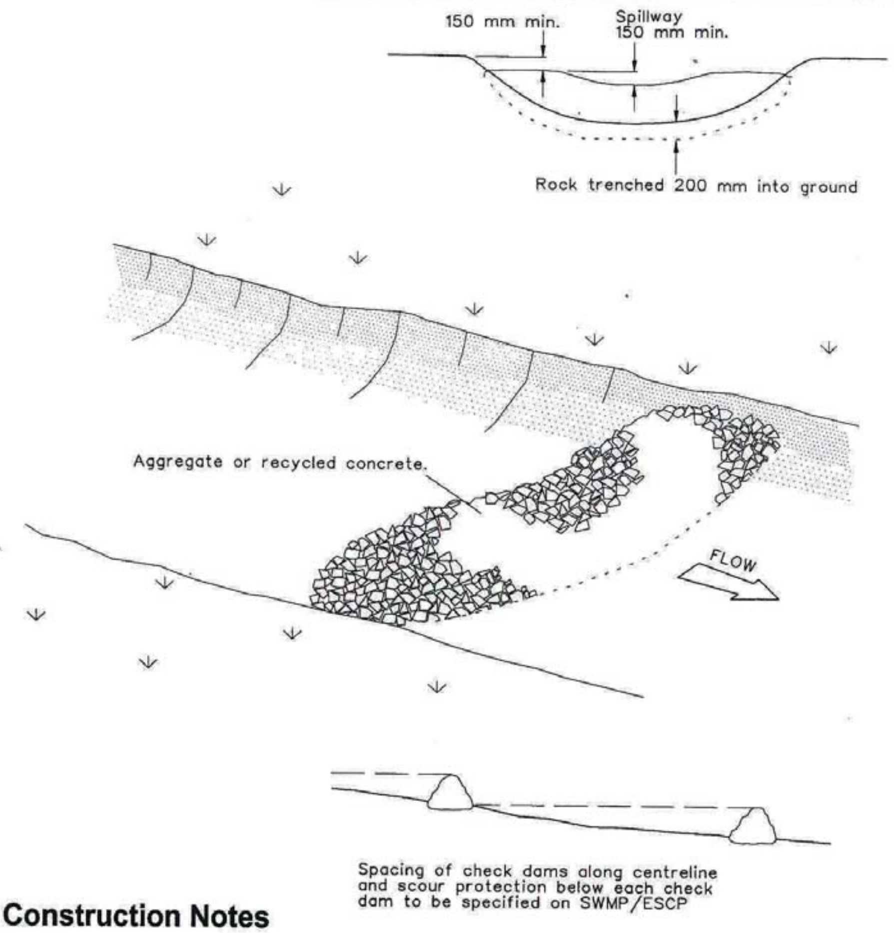


Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

TEMPORARY WATERWAY CROSSING **SD 5-1**

5-14



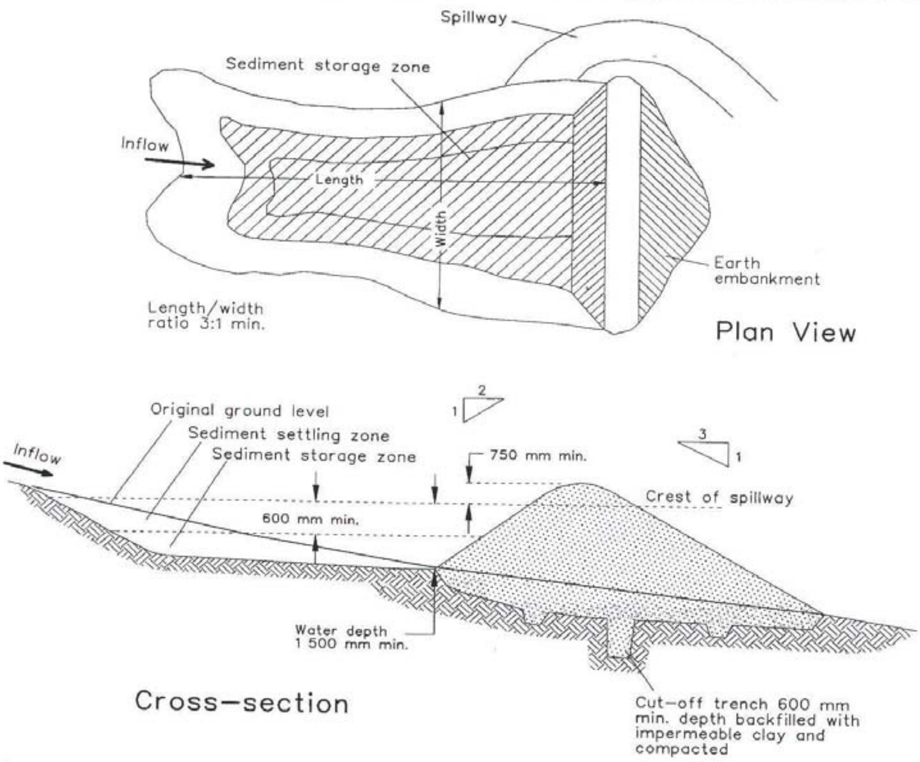
Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.
3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.
4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM

SD 5-4

5-22



Construction Notes

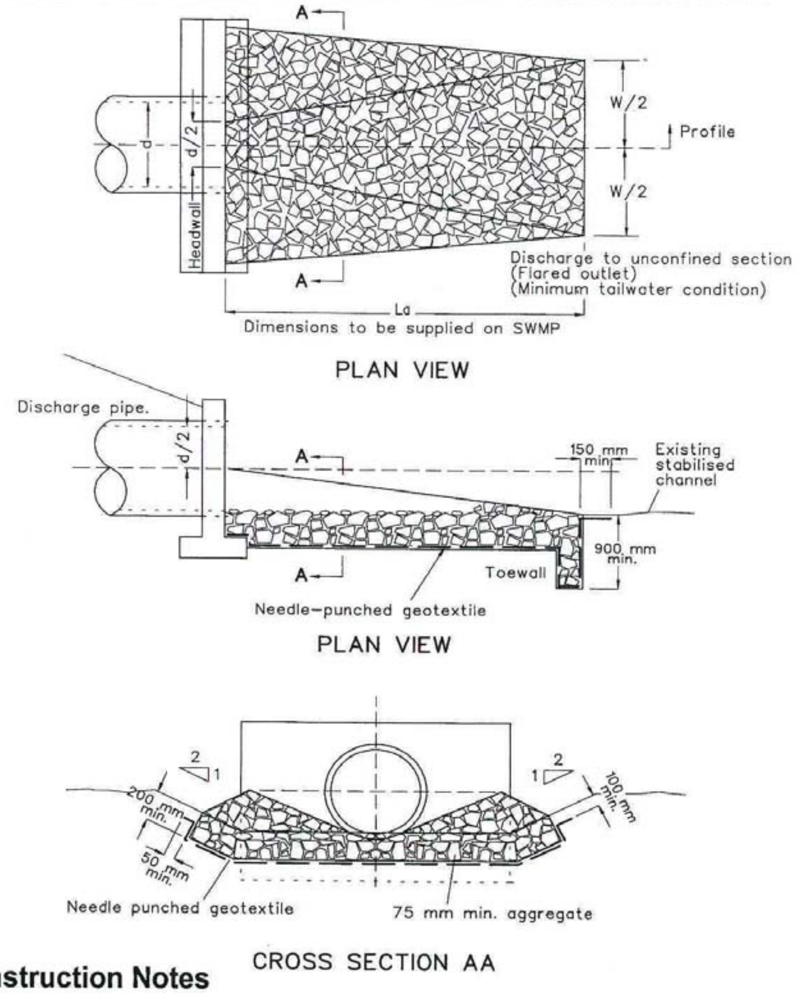
1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

SD 6-4

6-19

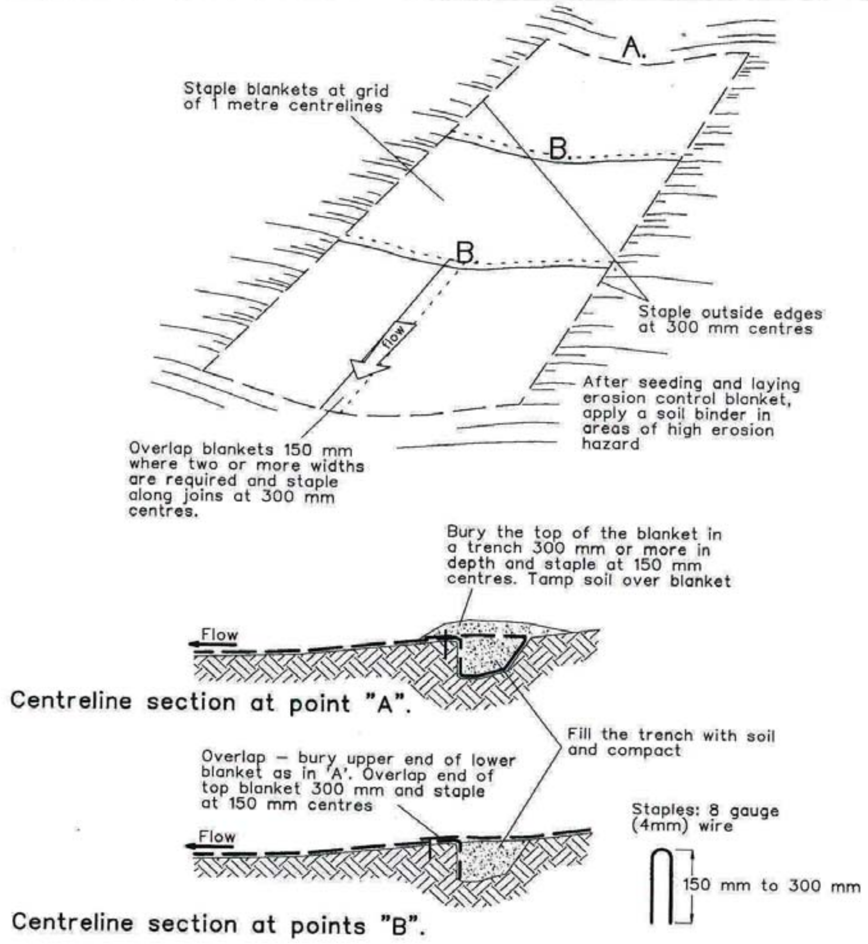


Construction Notes

1. Compact the subgrade fill to the density of the surrounding undisturbed material.
2. Prepare a smooth, even foundation for the structure that will ensure that the needle-punched geotextile does not sustain serious damage when covered with rock.
3. Should any minor damage to the geotextile occur, repair it before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.
4. Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm.
5. Ensure that any concrete or riprap used for the energy dissipater or the outlet protection conforms to the grading limits specified on the SWMP.

ENERGY DISSIPATER **SD 5-8**

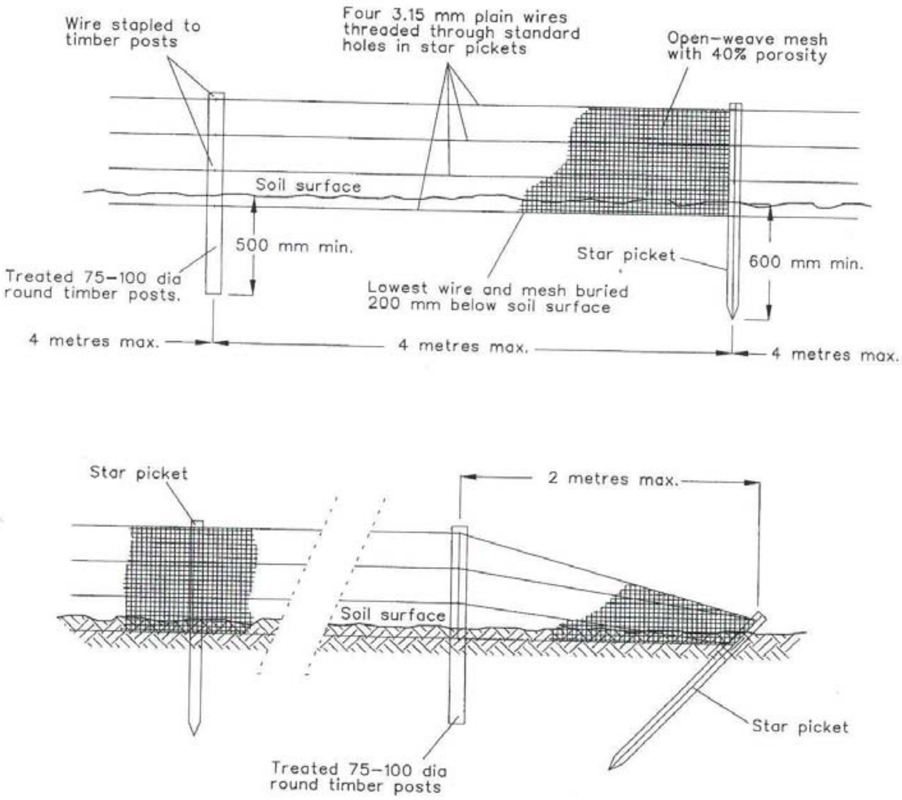
SKM



Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

RECP : CONCENTRATED FLOW **SD 5-7**

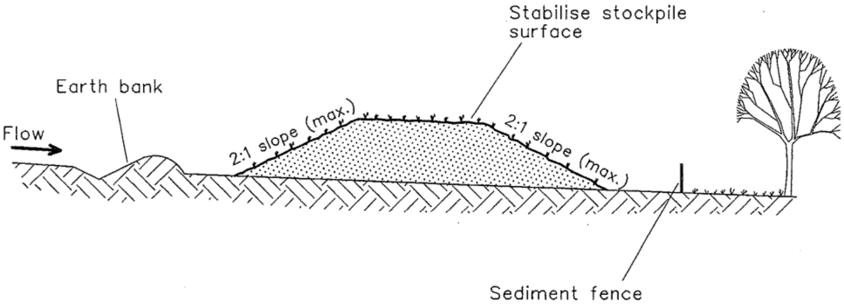


Construction Notes

1. Install the fence to the height specified in the ESCP/SWMP.
2. Cut a channel 200 mm deep along the fence line.
3. Place wire and light resistant, open-weave polymer mesh with 40 percent porosity on the prevailing wind side of fence.
4. Fasten the mesh to all wires using ring fasteners at 100 mm to 150 mm intervals on top wire and 300 mm intervals on other wires.
5. Use one 75-mm to100-mm diameter treated round timber post every 20 metres.
6. Where star pickets are used, ensure they are fitted with safety caps.

CONTROL OF WIND EROSION **SD 6-15**

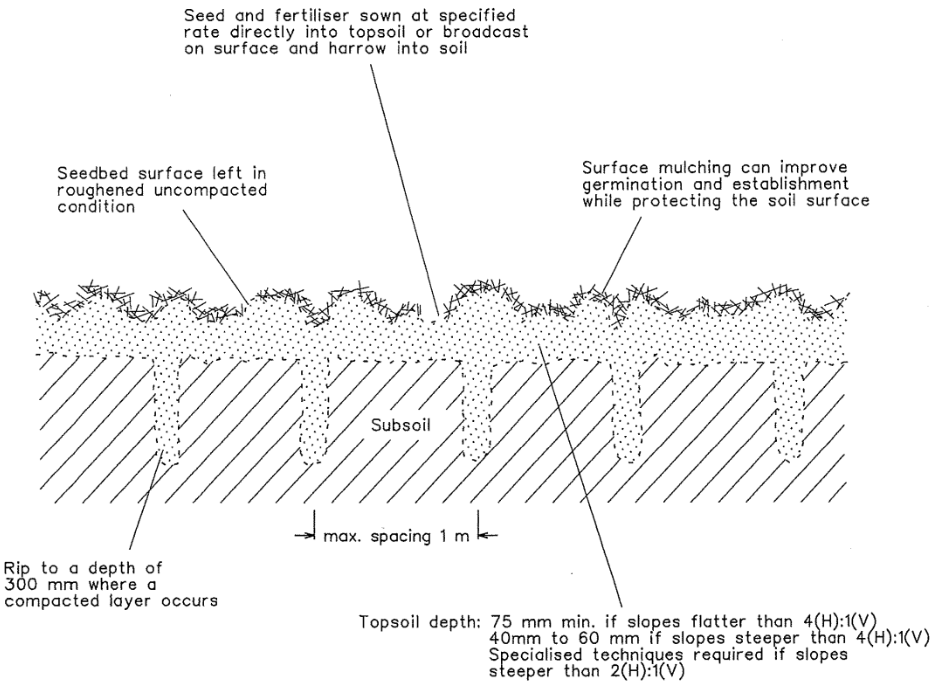
6-49



Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES **SD 4-1**



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

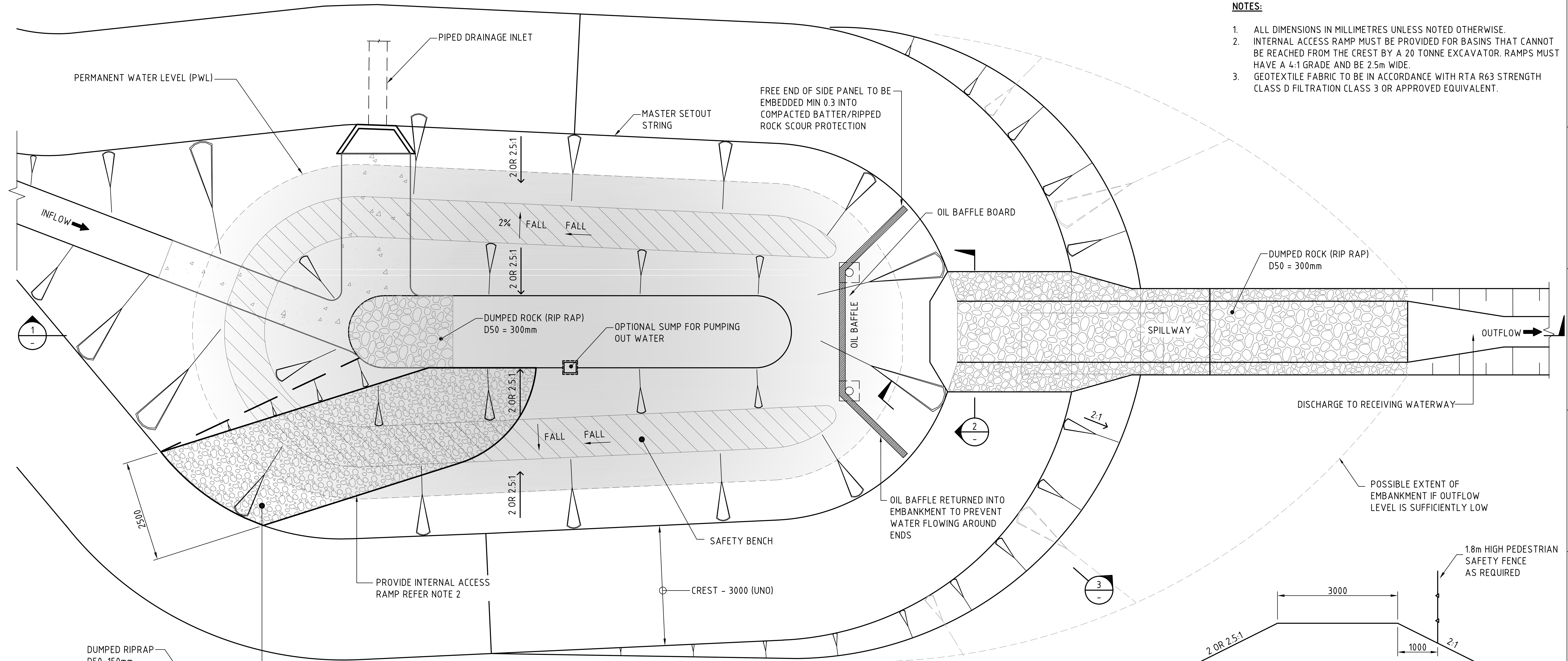
SEEDBED PREPARATION **SD 7-1**

7-7

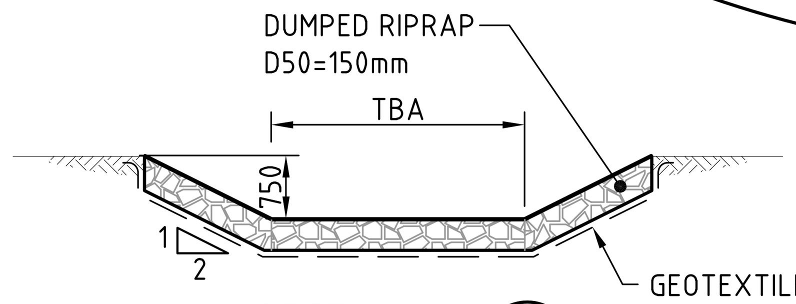
6.9.2 Surface Water Management Drawings

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. INTERNAL ACCESS RAMP MUST BE PROVIDED FOR BASINS THAT CANNOT BE REACHED FROM THE CREST BY A 20 TONNE EXCAVATOR. RAMPS MUST HAVE A 4:1 GRADE AND BE 2.5m WIDE.
3. GEOTEXTILE FABRIC TO BE IN ACCORDANCE WITH RTA R63 STRENGTH CLASS D FILTRATION CLASS 3 OR APPROVED EQUIVALENT.



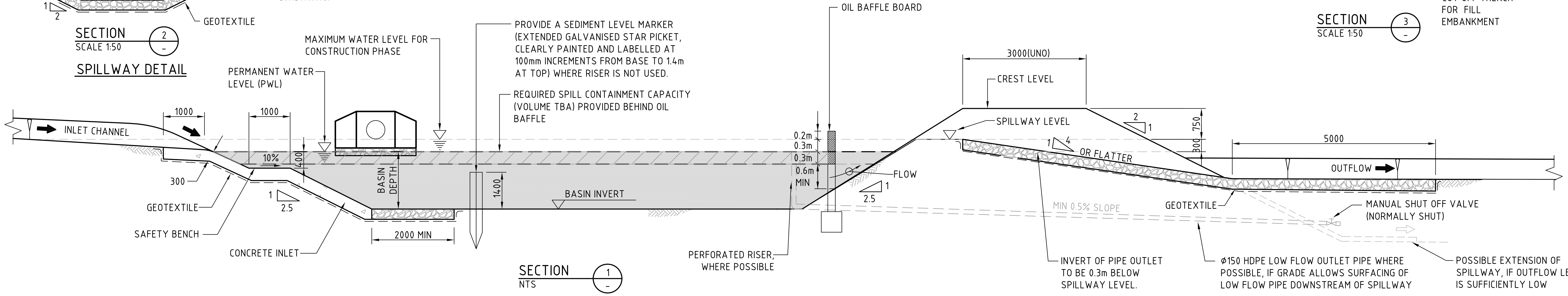
PLAN
NTS



SECTION 2
SCALE 1:50

SPILLWAY DETAIL

SECTION 3
SCALE 1:50



SECTION 1
NTS

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CLIENT: PACIFIC NATIONAL
PROJECT: GRETA TRAIN SUPPORT FACILITY
DRAFTER: GKG | DRAFTING CHECK: SP | REVIEWED PROJECT MANAGER | APPROVED PROJECT DIRECTOR
DESIGNED: SP | DESIGN REVIEW: LM

TITLE: DRAINAGE DETAILS
TYPICAL WATER QUALITY CONTROL BASIN

SCALE	SKM PROJECT No	DRAWING No	AMDT
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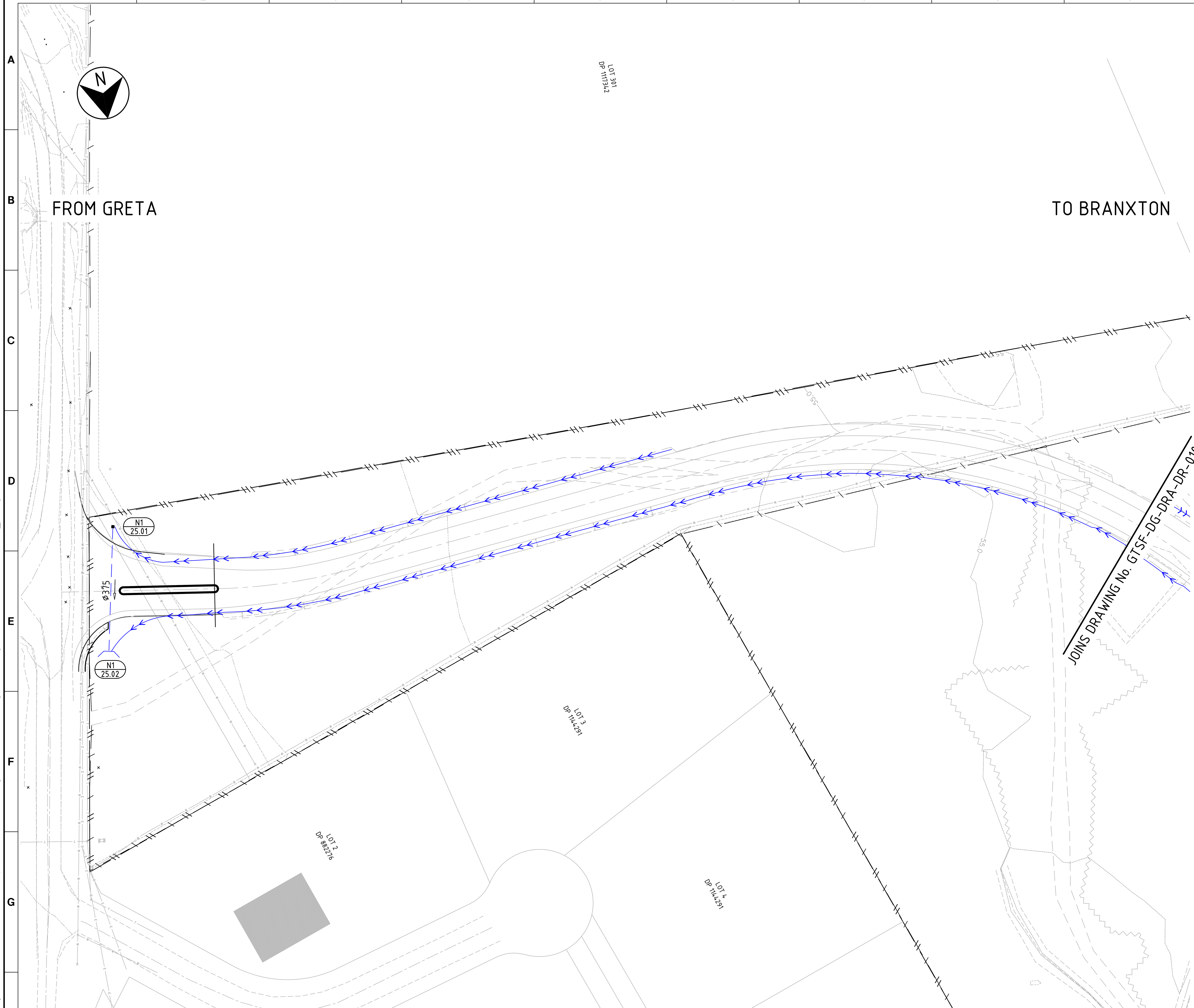

LEGEND (DRAINAGE):

N1 / 10.06	LINE NUMBER / PIT STRUCTURE NUMBER
WQ1	BASIN TAG
	PROPOSED HEADWALL
	PROPOSED DRAINAGE PIT
	PROPOSED GPT
Ø375	PROPOSED DRAINAGE PIPE, FLOW ARROW & SIZE
	PROPOSED OPEN CHANNEL - TYPE J
	PROPOSED OPEN CHANNEL - TYPE C
	PROPOSED OPEN CHANNEL - TYPE D
	PROPOSED OPEN CHANNEL - TYPE R
	PROPOSED LEVEL SPREADER
SO	PROPOSED SO KERB
	PROPOSED DIVERSION DRAIN
	SA KERB INVERT LINE
	PROPOSED WATER QUALITY POND
	EXISTING DRAIN
	CADASTRAL BOUNDARY
	SITE FENCE

REFERENCES

1. FOR WATER QUALITY POND DETAILS REFER TO DWG GTSF-DG-DRA-DR-0050.
2. FOR DRAINAGE LONGITUDINAL SECTION REFER TO DWG GTSF-DG-DRA-DR-0201 TO 0207
3. FOR DRAINAGE DETAILS REFER TO DWG GTSF-DG-DRA-DR-0010 TO 0014
4. FOR DRAINAGE SCHEDULES REFER TO DWG GTSF-DG-DRA-DR-0151 TO 0154

SCALE 1:500 (A1) 5 0 5 10 15 20 25
SCALE 1:1000 (A3)

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DESIGNED	DESIGN REVIEW		
SP	LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 1 OF 13

SCALE	SKM PROJECT No	DRAWING No	AMDT
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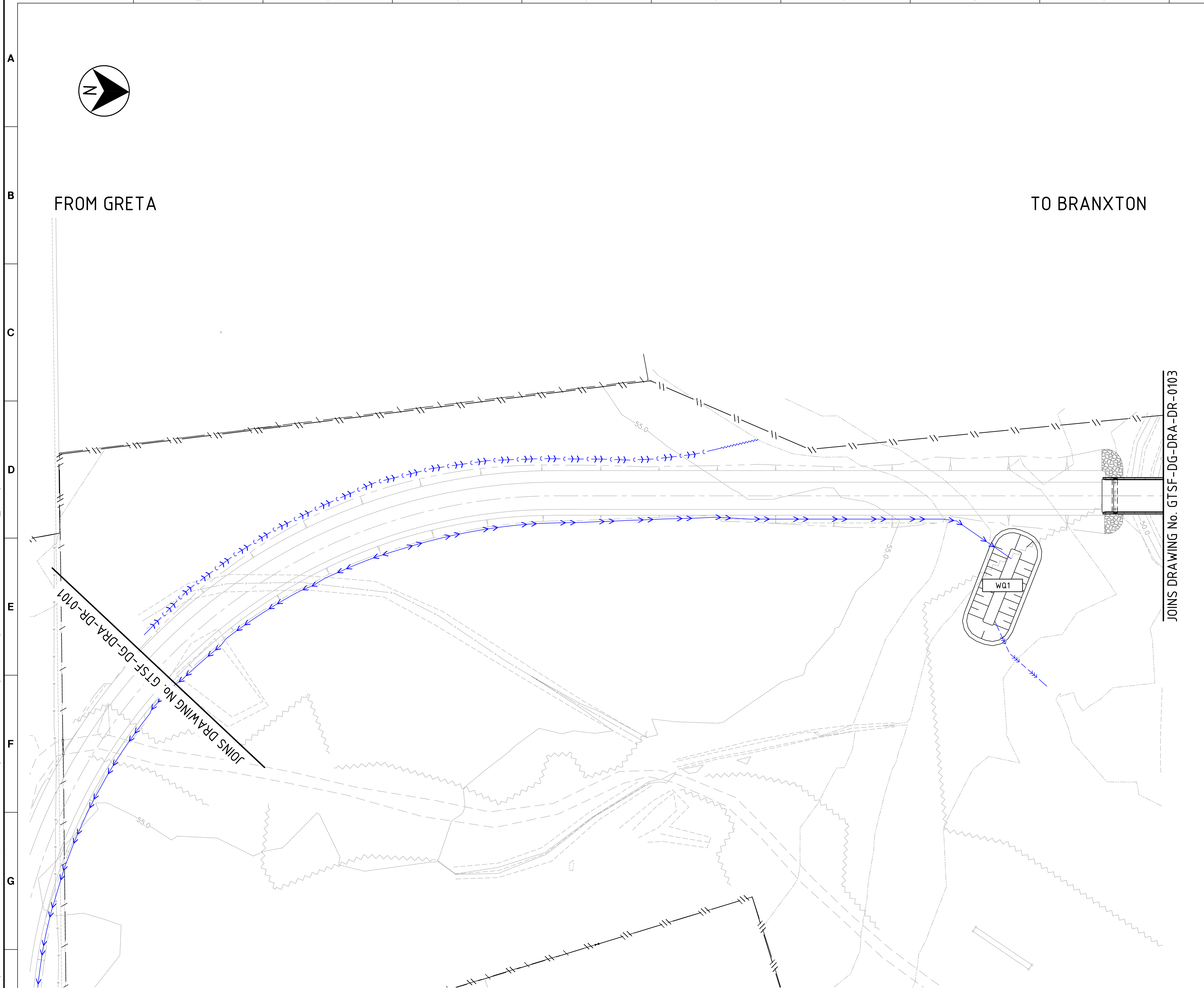

LEGEND (DRAINAGE):

- N1 / 10.06 — LINE NUMBER / PIT STRUCTURE NUMBER
- WQ1 — BASIN TAG
- PROPOSED HEADWALL
- PROPOSED DRAINAGE PIT
- PROPOSED GPT
- Ø375 — PROPOSED DRAINAGE PIPE, FLOW ARROW & SIZE
- PROPOSED OPEN CHANNEL - TYPE J
- PROPOSED OPEN CHANNEL - TYPE C
- PROPOSED OPEN CHANNEL - TYPE D
- PROPOSED OPEN CHANNEL - TYPE R
- PROPOSED LEVEL SPREADER
- SO SO SO — PROPOSED SO KERB
- PROPOSED DIVERSION DRAIN
- SA KERB INVERT LINE
- PROPOSED WATER QUALITY POND
- EXISTING DRAIN
- CADASTRAL BOUNDARY
- SITE FENCE

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4. FOR DRAINAGE SCHEDULES REFER TO DWG GTSF-DG-DRA-DR-0151 TO 0154

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SCALE 1:1000 (A3)

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TITLE: DRAINAGE LAYOUT PLAN
SHEET 2 OF 13

SCALE	SKM PROJECT No	DRAWING No	AMDT
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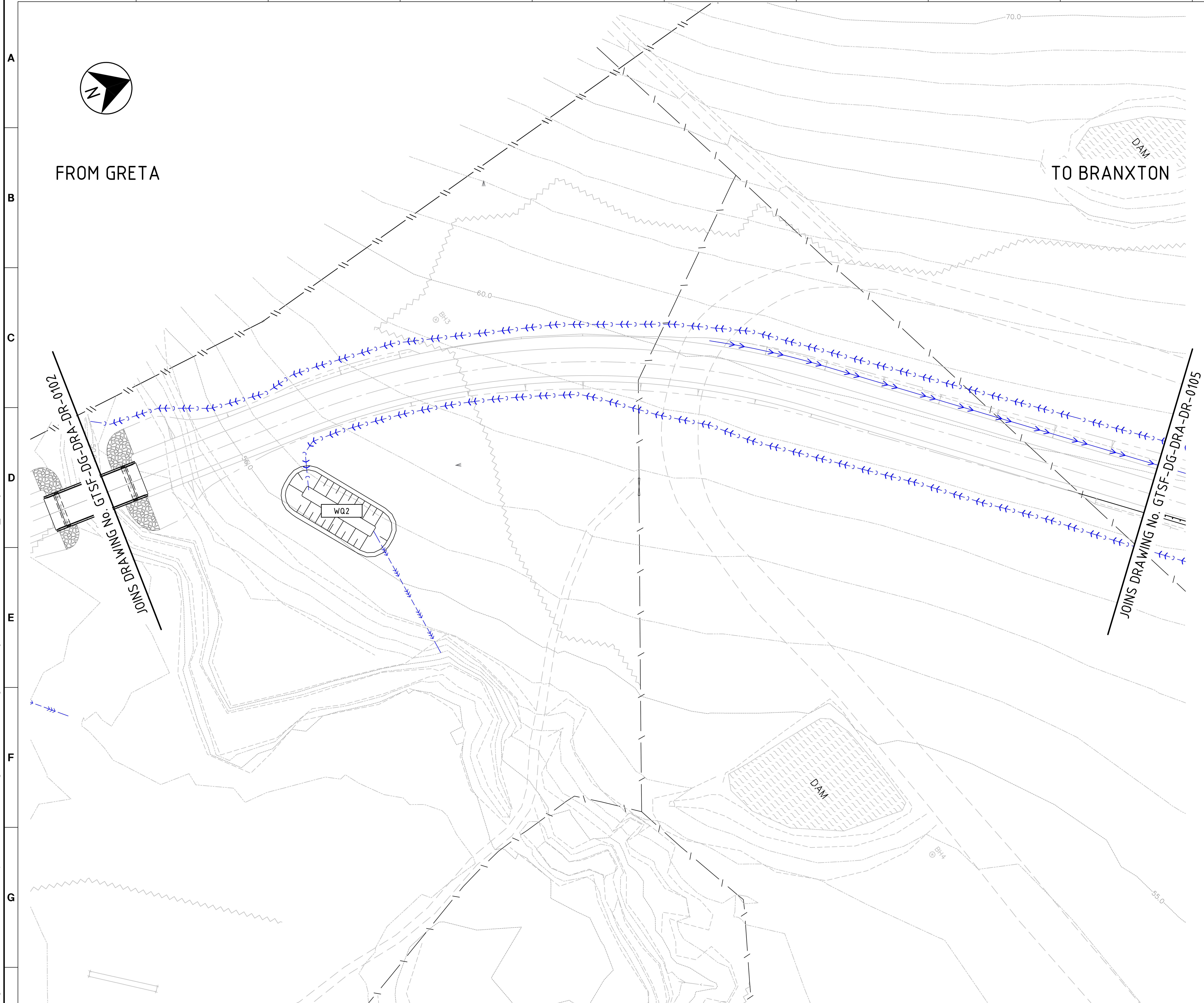

LEGEND (DRAINAGE):

N1 / 10.06	LINE NUMBER / PIT STRUCTURE NUMBER
WQ1	BASIN TAG
	PROPOSED HEADWALL
	PROPOSED DRAINAGE PIT
	PROPOSED GPT
Ø375	PROPOSED DRAINAGE PIPE, FLOW ARROW & SIZE
	PROPOSED OPEN CHANNEL - TYPE J
	PROPOSED OPEN CHANNEL - TYPE C
	PROPOSED OPEN CHANNEL - TYPE D
	PROPOSED OPEN CHANNEL - TYPE R
	PROPOSED LEVEL SPREADER
SO	PROPOSED SO KERB
	PROPOSED DIVERSION DRAIN
	SA KERB INVERT LINE
	PROPOSED WATER QUALITY POND
	EXISTING DRAIN
	CADASTRAL BOUNDARY
	SITE FENCE

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FR	SP		
DESIGNED: SP	DESIGN REVIEW: LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 3 OF 13

SCALE	SKM PROJECT No	DRAWING No	AMDT
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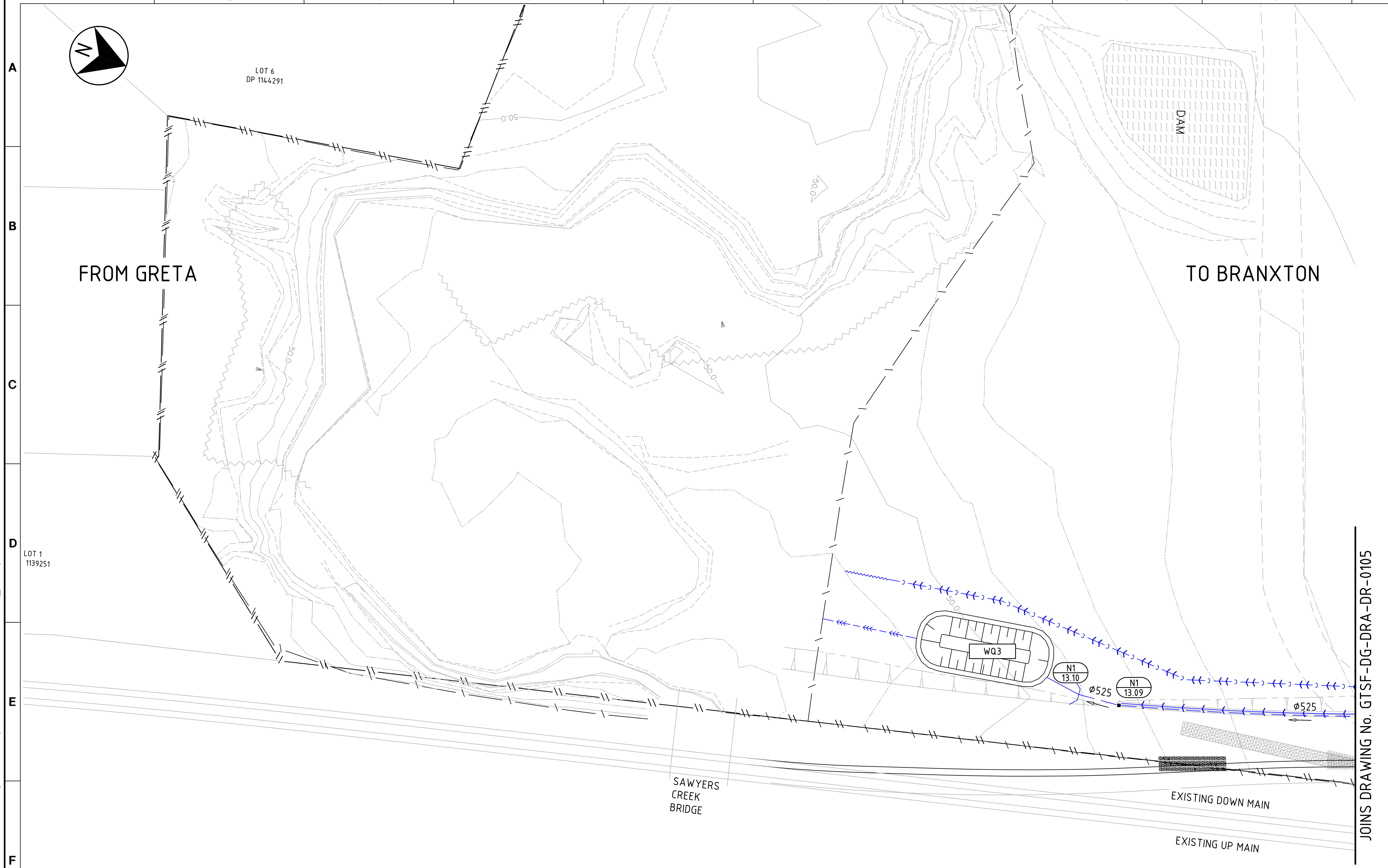

LEGEND (DRAINAGE):

- LINE NUMBER / PIT STRUCTURE NUMBER (N1 / 10.06)
- BASIN TAG (WQ1)
- PROPOSED HEADWALL
- PROPOSED DRAINAGE PIT
- PROPOSED GPT
- PROPOSED DRAINAGE PIPE, FLOW ARROW & SIZE (Ø375)
- PROPOSED OPEN CHANNEL - TYPE J
- PROPOSED OPEN CHANNEL - TYPE C
- PROPOSED OPEN CHANNEL - TYPE D
- PROPOSED OPEN CHANNEL - TYPE R
- PROPOSED LEVEL SPREADER
- PROPOSED SO KERB
- PROPOSED DIVERSION DRAIN
- SA KERB INVERT LINE
- PROPOSED WATER QUALITY POND
- EXISTING DRAIN
- CADASTRAL BOUNDARY
- SITE FENCE

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DESIGNED: SP	DESIGN REVIEW: LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 4 OF 13

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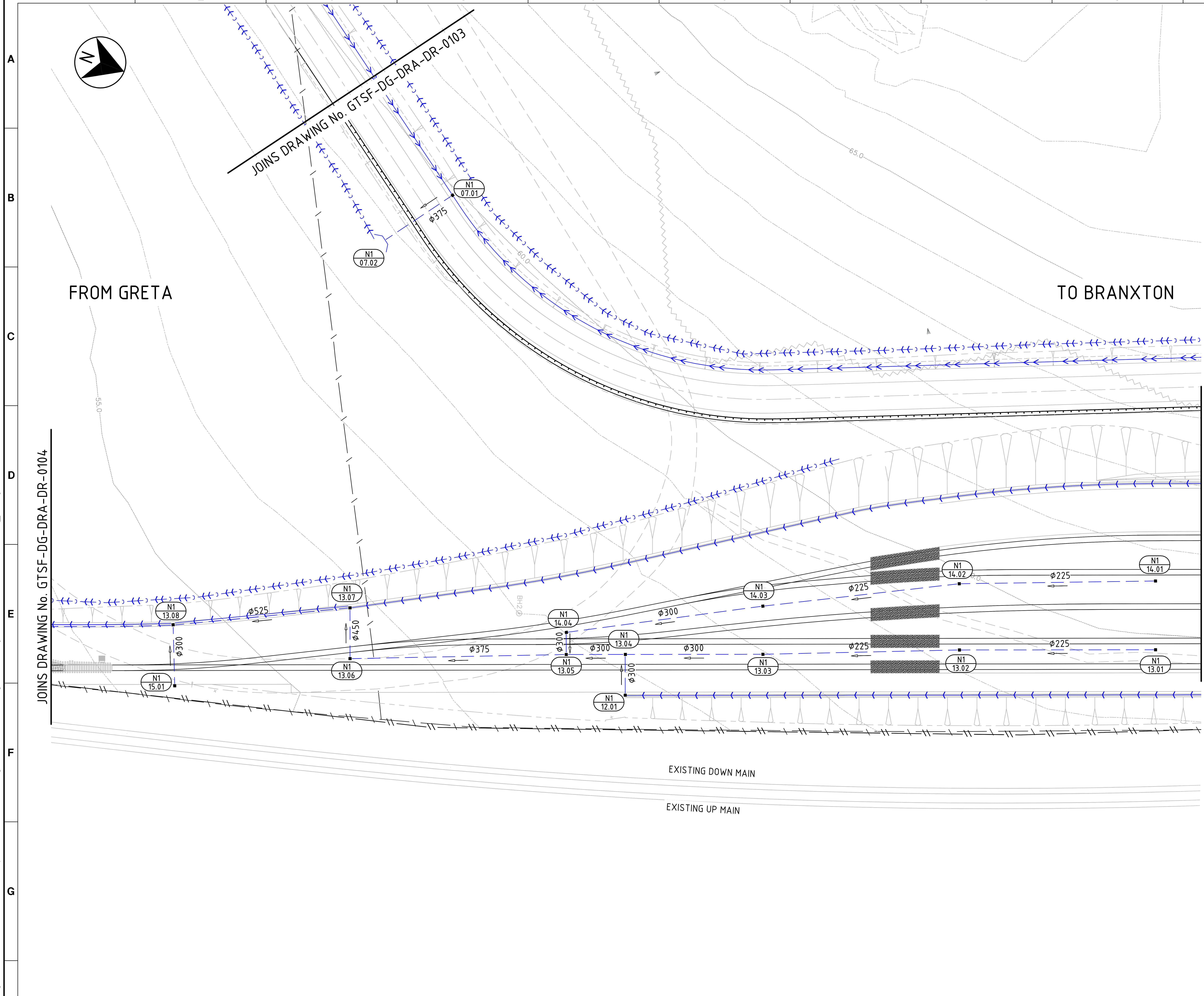

LEGEND (DRAINAGE):

- N1 / 10.06 — LINE NUMBER / PIT STRUCTURE NUMBER
- WQ1 — BASIN TAG
- PROPOSED HEADWALL
- PROPOSED DRAINAGE PIT
- PROPOSED GPT
- Ø375 — PROPOSED DRAINAGE PIPE, FLOW ARROW & SIZE
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- PROPOSED OPEN CHANNEL – TYPE R
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FR	SP		
DESIGNED: SP	DESIGN REVIEW: LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 5 OF 13

SCALE	SKM PROJECT No	DRAWING No	AMDT
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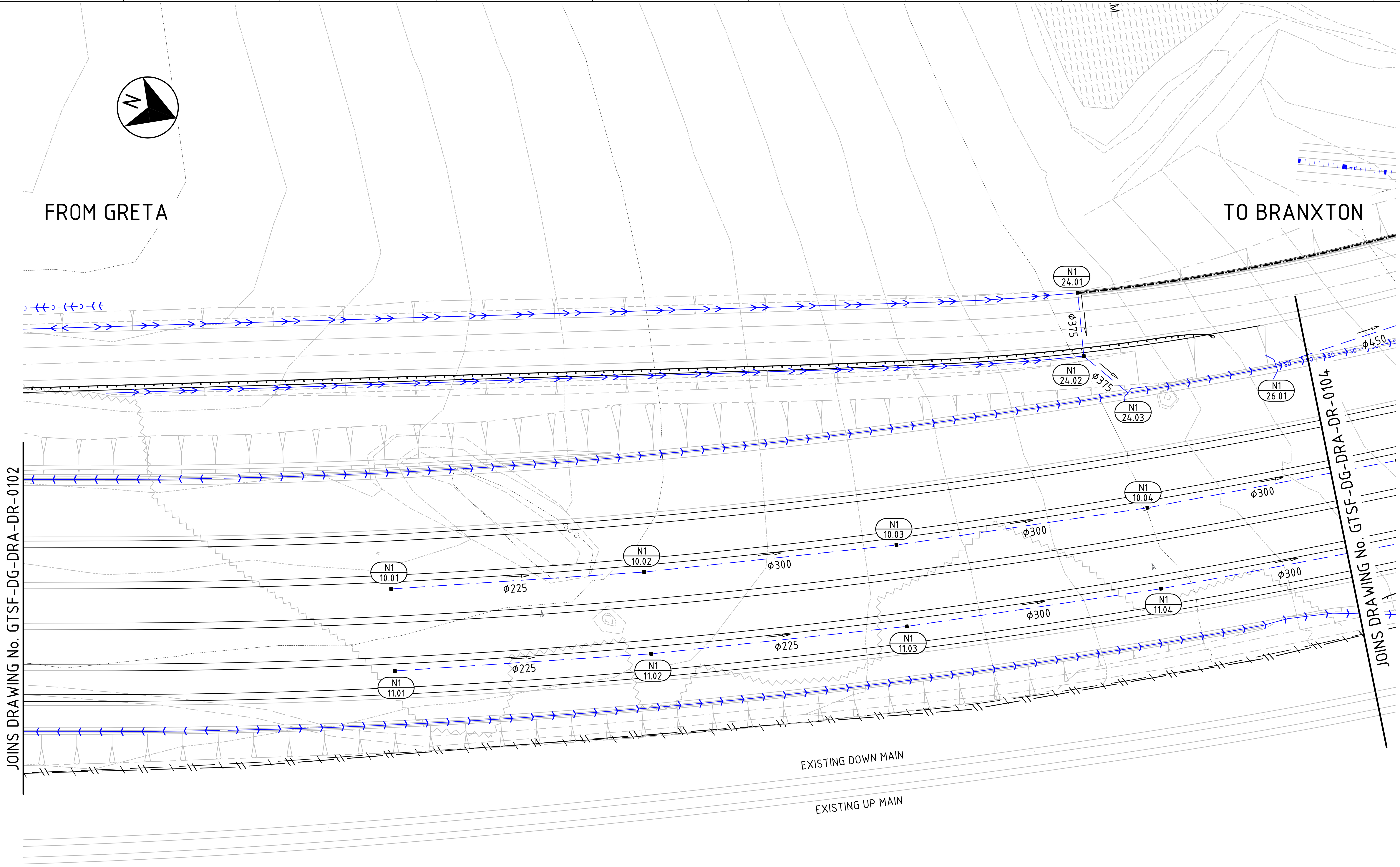

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	PROPOSED DRAINAGE PIT
	PROPOSED GPT
Ø375	PROPOSED DRAINAGE PIPE, FLOW ARROW & SIZE
	PROPOSED OPEN CHANNEL - TYPE J
	PROPOSED OPEN CHANNEL - TYPE C
	PROPOSED OPEN CHANNEL - TYPE D
	PROPOSED OPEN CHANNEL - TYPE R
	PROPOSED LEVEL SPREADER
	PROPOSED SO KERB
	PROPOSED DIVERSION DRAIN
	SA KERB INVERT LINE
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	EXISTING DRAIN
	CADASTRAL BOUNDARY
	SITE FENCE

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A	30.09.10					80% DETAIL DESIGN

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CLIENT: PACIFIC NATIONAL
PROJECT: GRETA TRAIN SUPPORT FACILITY

DRAFTER	DRAFTING CHECK	REVIEWED PROJECT MANAGER	APPROVED PROJECT DIRECTOR
FR	SP		
DESIGNED	DESIGN REVIEW		
SP	LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 6 OF 13

SCALE	SKM PROJECT No	DRAWING No	AMDT
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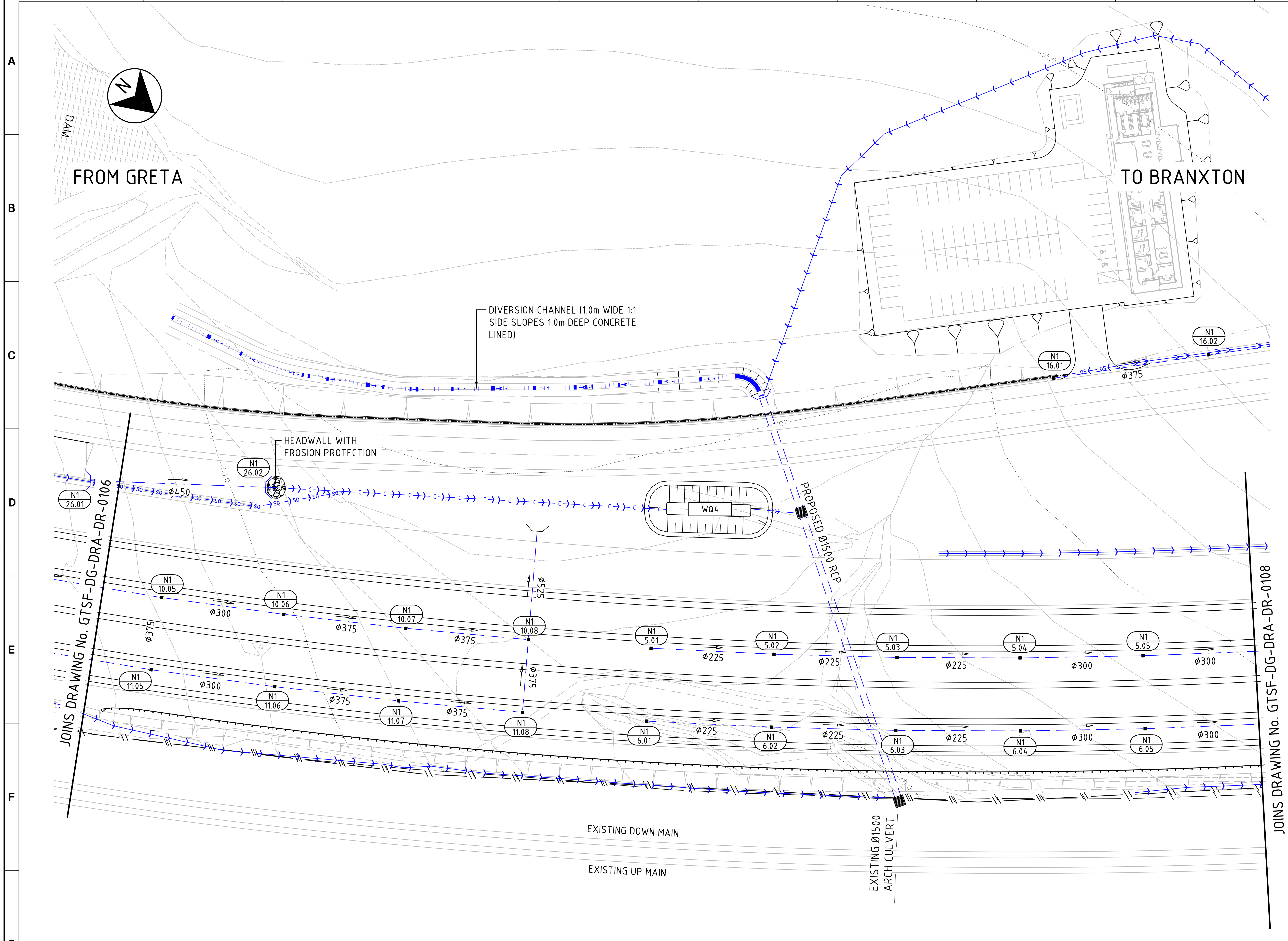

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	PROPOSED DRAINAGE PIT
	PROPOSED GPT
Ø375	PROPOSED DRAINAGE PIPE, FLOW ARROW & SIZE
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DESIGNED	DESIGN REVIEW		
SP	LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 7 OF 13

SCALE	SKM PROJECT No	DRAWING No	AMDT
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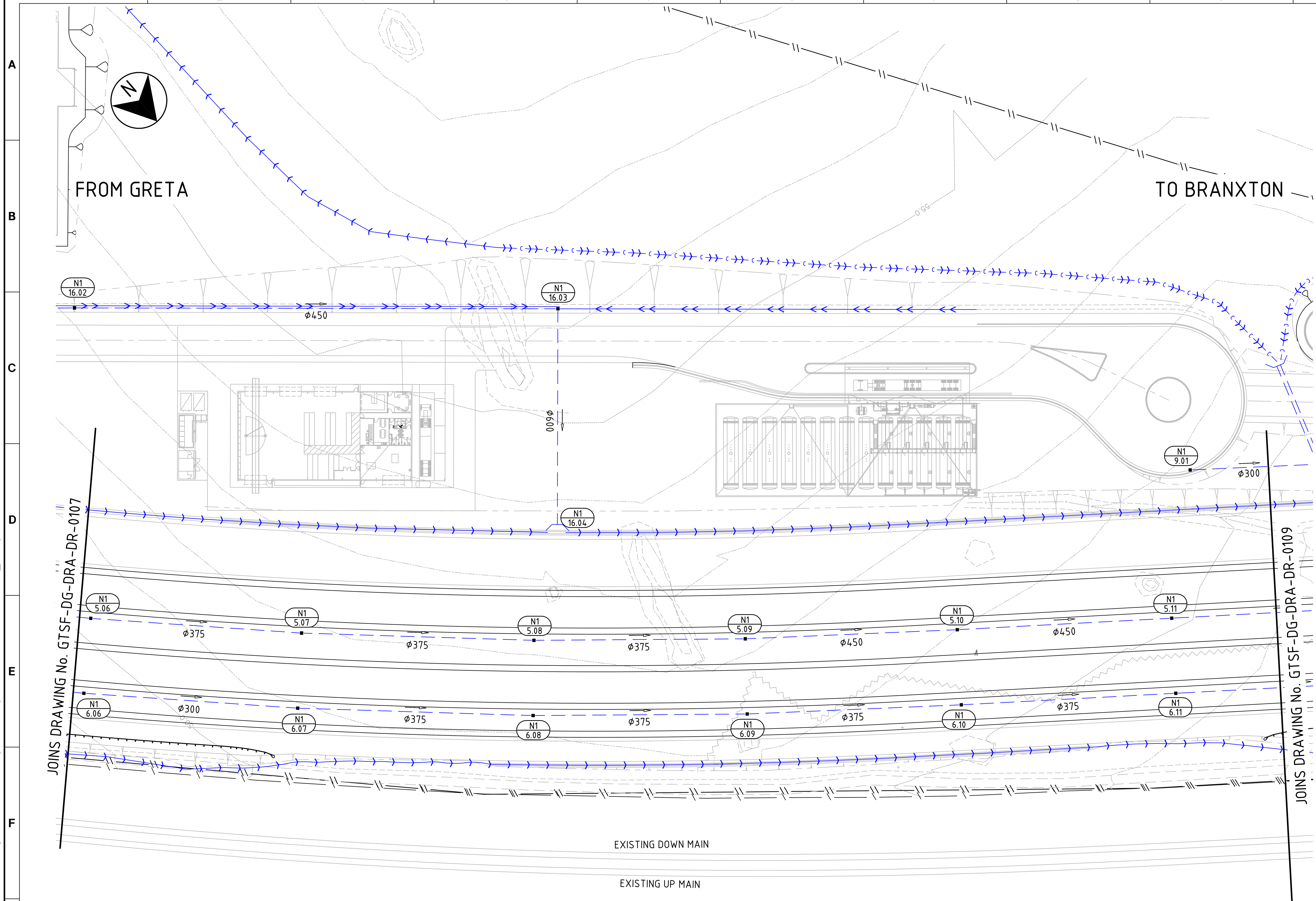

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N1 / 10.06	LINE NUMBER / PIT STRUCTURE NUMBER
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	PROPOSED DRAINAGE PIT
	PROPOSED GPT
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TITLE: DRAINAGE LAYOUT PLAN
SHEET 8 OF 13

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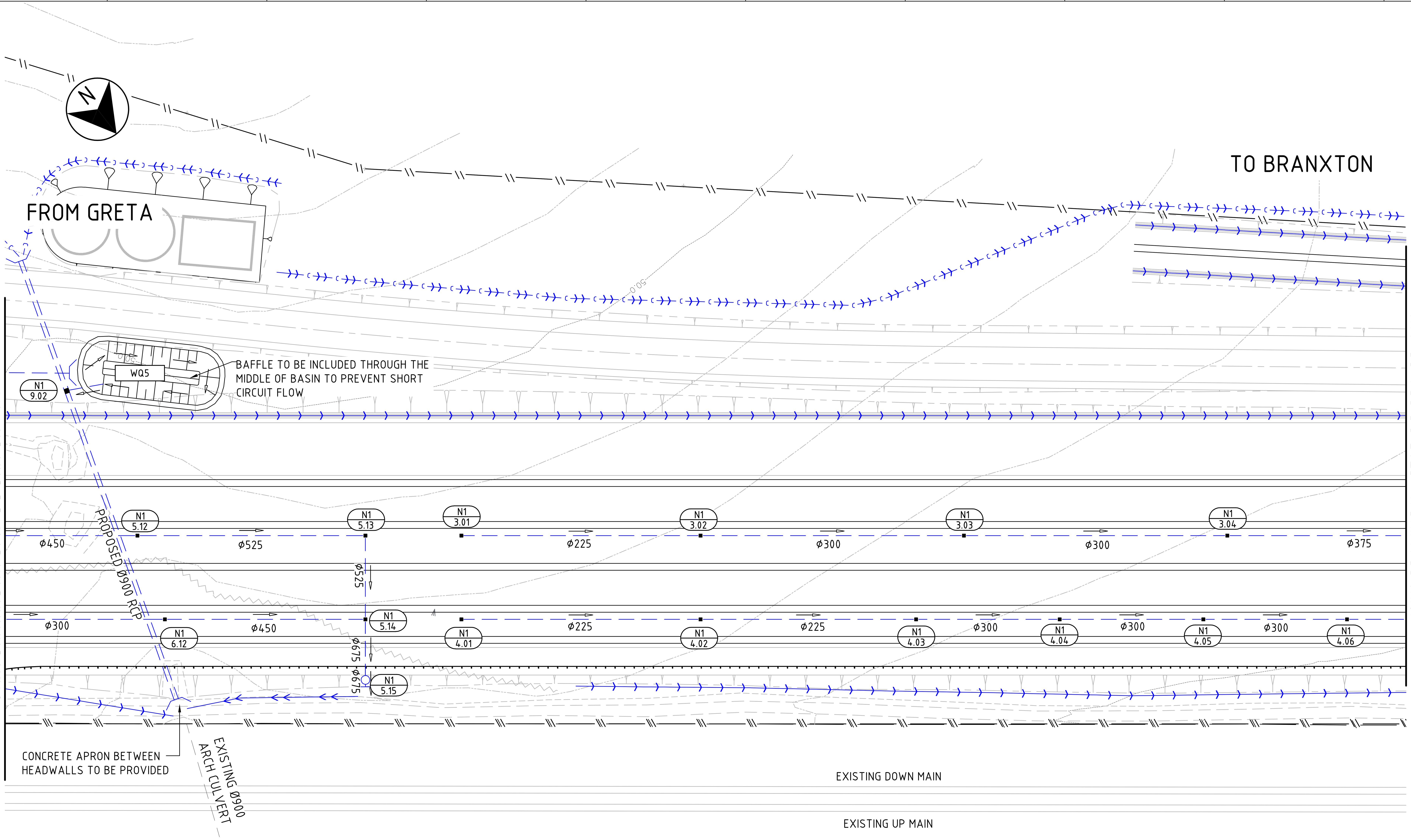

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- WQ1 — BASIN TAG
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FR	SP		
DESIGNED: SP	DESIGN REVIEW: LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 9 OF 13

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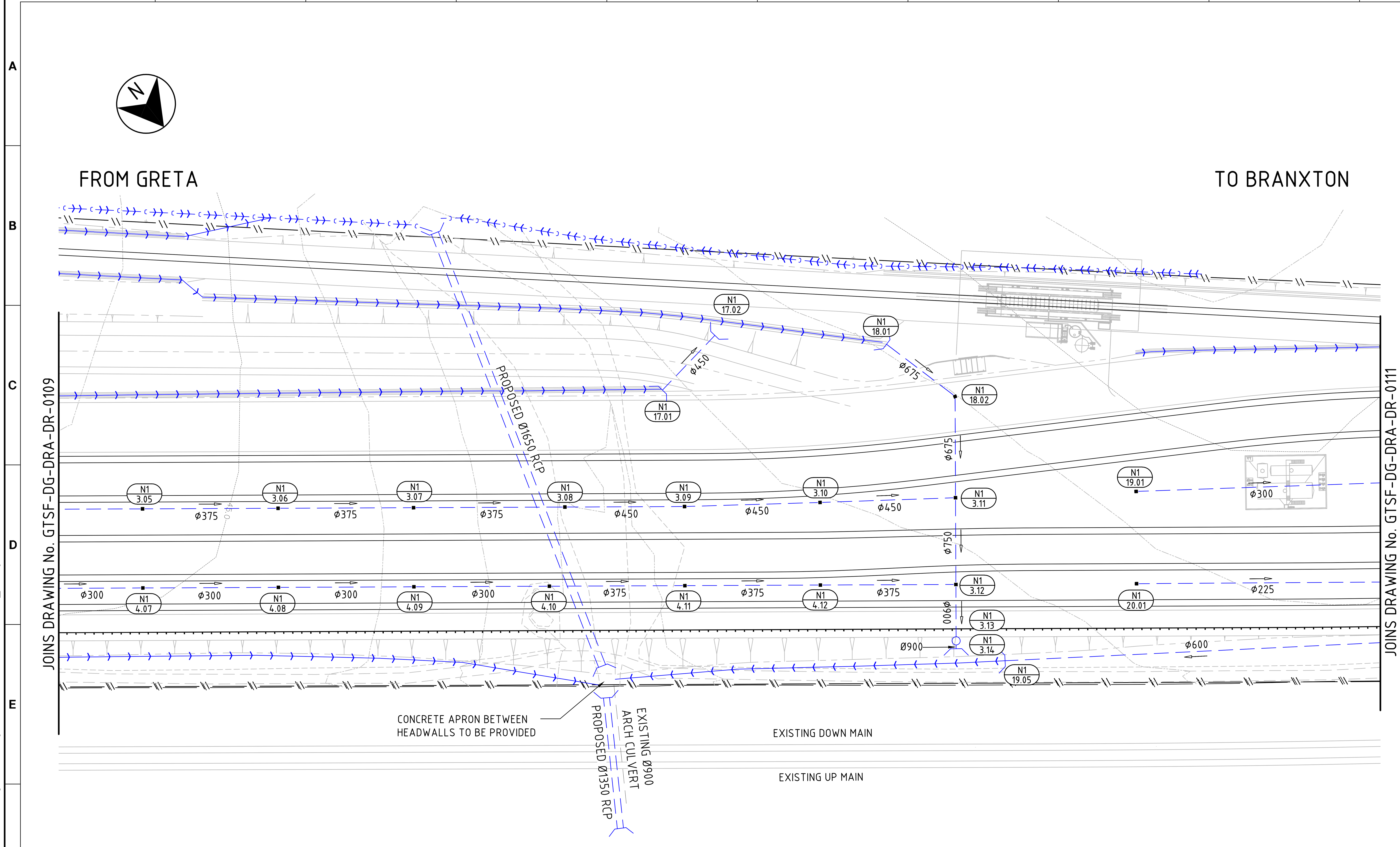

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DESIGNED: SP | DESIGN REVIEW: LM

TITLE: DRAINAGE LAYOUT PLAN
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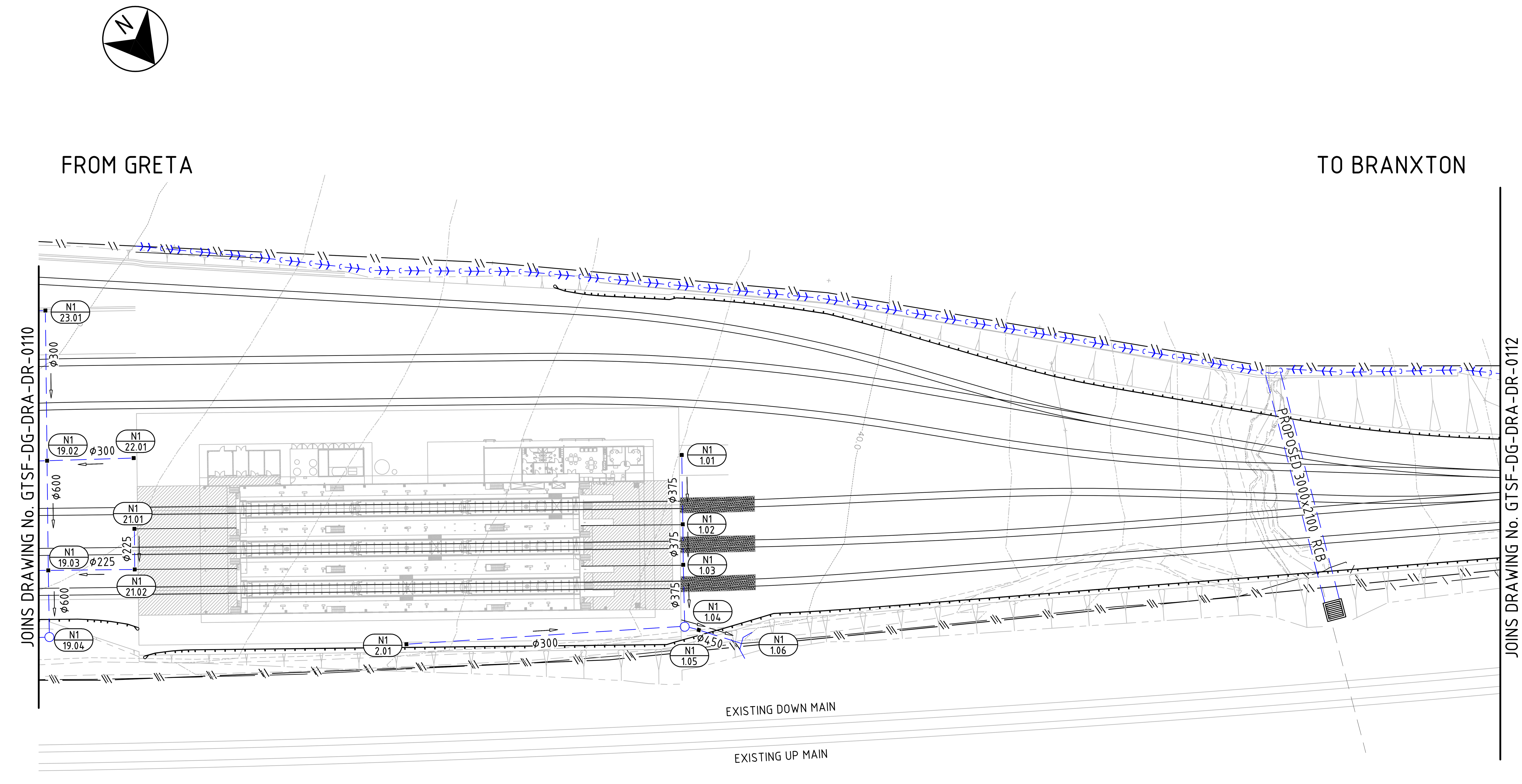

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FR	SP		
DESIGNED: SP	DESIGN REVIEW: LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 11 OF 13

SCALE	SKM PROJECT No	DRAWING No	AMDT
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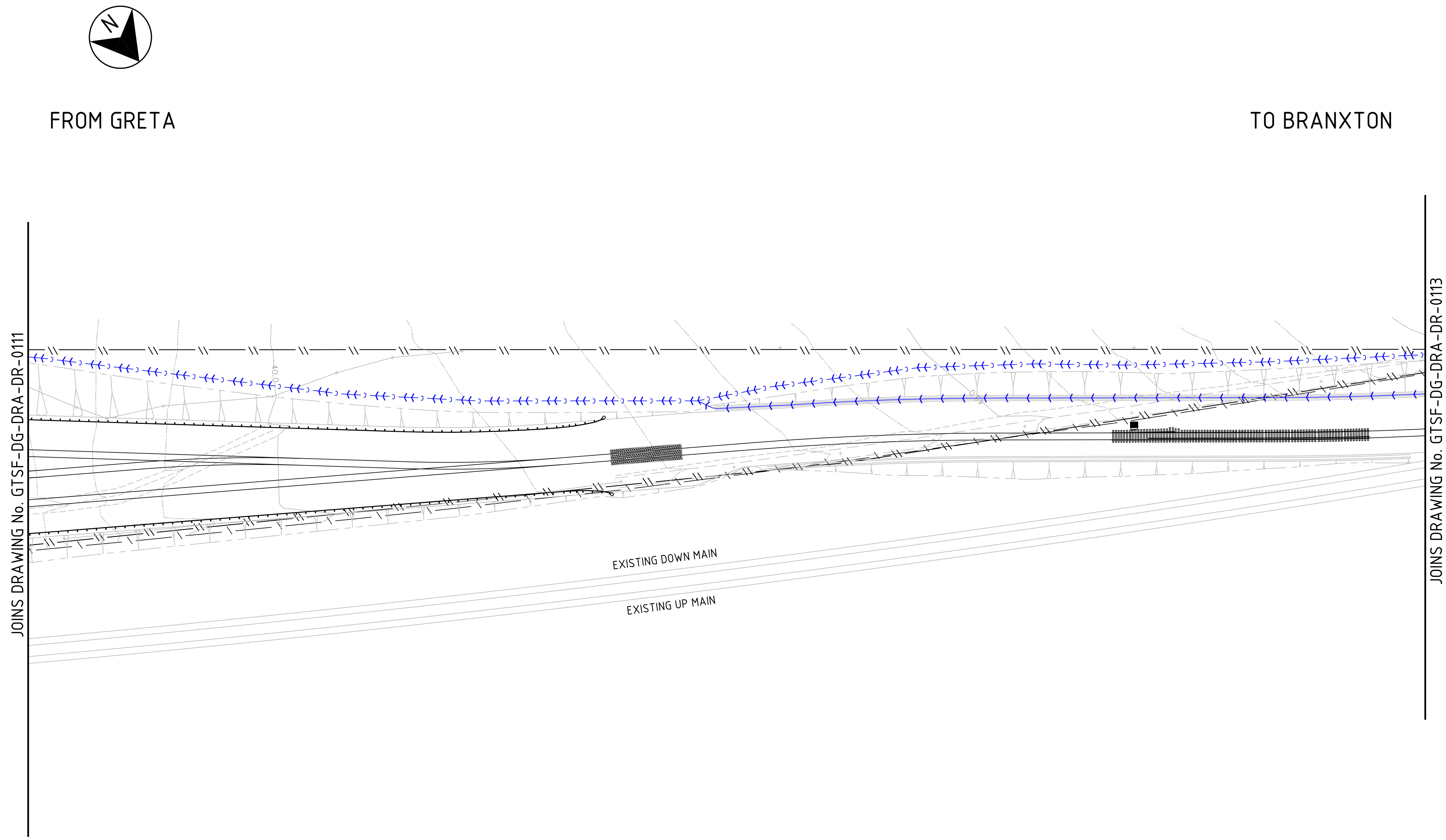

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TITLE: DRAINAGE LAYOUT PLAN
SHEET 12 OF 13

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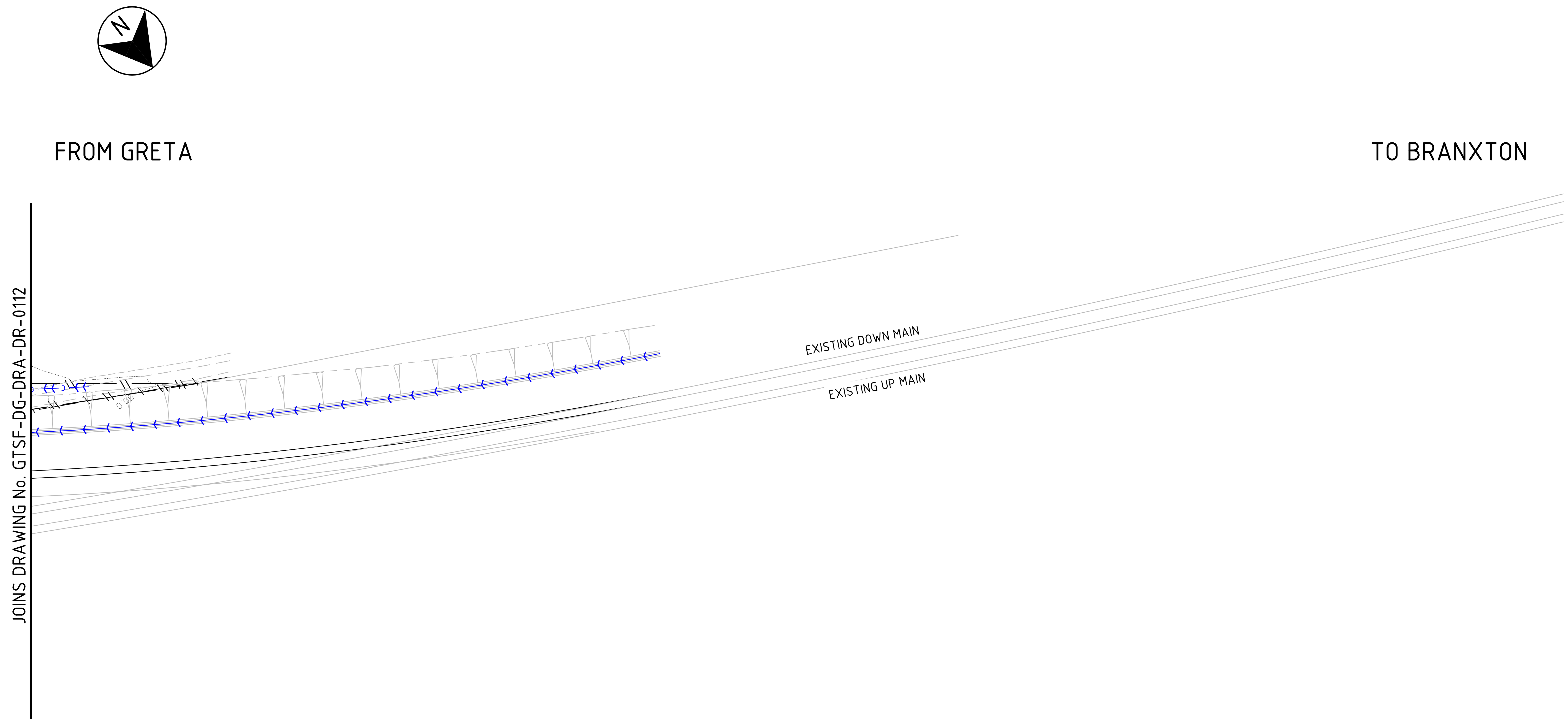

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DESIGNED: SP	DESIGN REVIEW: LM		

TITLE: DRAINAGE LAYOUT PLAN
SHEET 13 OF 13

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6.9.3 Water Quality Monitoring Program

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PACIFIC NATIONAL PTY LTD

Greta Train Servicing Facility

Water Quality Monitoring Program

301020-02473 – Version 0

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Newcastle East NSW 2300 Australia
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PACIFIC NATIONAL PTY LTD
GRETA TRAIN SERVICING FACILITY
WATER QUALITY MONITORING PROGRAM

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PROJECT 301020-02473 - GRETA TRAIN SERVICING FACILITY

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
A	Draft for Internal Review	J. Ford	B. Patterson	N/A			
B	Draft for Client Review	J Ford	B Oberdorf	B Patterson	12-Oct10		14 October 2010
0	Final	JF J.Ford	B. Oberdorf	B. Patterson	14-10-2010		

CONTENTS

1. INTRODUCTION

Pacific National Pty Ltd (*PN*) proposes to establish a Train Servicing Facility (TSF) on a site that is located in the Hunter Valley, near the Township of Greta. The TSF is to provide essential operational services for PN's Hunter Valley rail coal haulage business. Proposed services include locomotive provisioning, locomotive and wagon maintenance, crew changes and administration.

WorleyParsons have previously been engaged by PN to develop a surface water management assessment for the development proposal (*Greta Train Servicing Facility – Surface Water Management Assessment, March 2010*). This strategy formed part of the Environmental Assessment for the development proposal and included an outline for a Water Quality Monitoring Program. The NSW Office of Water reviewed the Environmental Assessment, the recommendations of the review forming part of this revised Water Quality Monitoring Program. The NSW Office of Water has advised that a licence under the *Protection of the Environment Operations Act 1997 (POEO Act)* will be required by PN to discharge water from the site.

2. MONITORING AND RESPONSE PLAN

This report details the proposed revised surface water sampling plan as well as proposed spill response and contingency measures. This monitoring plan supersedes the previous plan documented in the site *Surface Water Management Assessment (WorleyParsons).* Detailed design, modelling and documentation has been carried out by SKM and is detailed in a separate report. Based on the plans provided it is understood that two types of treatment method are proposed:

- Water Quality Control Ponds (WQCP) have been utilised where space permits;
- A proprietary Humeceptor GPT system has been utilised elsewhere.

It is anticipated that the requirements of this plan will be incorporated into the POEO licence for the site, and that the licence will formalise broader aspects such as regulatory requirements, reporting requirements, discharge limits, charges etc.

2.1 Surface Water Monitoring Plan

It is proposed to monitor inflow and outflow from various components of the treatment system and adjacent receiving creeks. The objective of the monitoring is to assess the performance of the SWMP and subsequent design in order to identify any unacceptable water quality. The proposed surface water monitoring plan is detailed in the following sections.

Sampling Locations

It is proposed to collect samples from the inlet and outlet of each treatment system (either a WQCP or proprietary GPT). The objective of the sampling is to assess the water quality of the inflow (*untreated*) and outflow (*treated*) from the treatment systems to determine the effectiveness of the stormwater management measures. A further sample shall be obtained downstream of the site in the receiving waters. Sampling locations at the inlet and outlet of each WQCP and proprietary GPT, as well as the receiving waters, will be determined by PN and SKM during the detailed design phase and outlined on construction documents.

Sampling Methods and Frequency

It is proposed to collect at least one sample from each treatment system every three months from each sampling location (i.e. inlet, outlet and downstream receiving water) during dry weather and further samples during wet weather periods. Wet weather is defined as receiving approximately 50mm or more of rain in the 72hrs prior to sampling. During prolonged wet periods samples should be collected at least daily unless a pattern is established that confirms acceptable water quality and approval is received from the appropriate authority to adopt reduced monitoring. Notwithstanding it is anticipated that weekly samples should still be collected.

Sample Analysis Procedures

Table 2-1 details the proposed sample analysis plan that comprises both in-situ measurements and laboratory analysis.

Table 2-1 - *Watery Quality Sampling Plan*

Analytes	Sample Analysis
Physical Parameters (*In-situ measurement*)	pH and Electrical Conductivity
Physical Parameters (*Laboratory Analysis*)	Total Suspended Solids (*TSS*)
Key Metals (*Laboratory Analysis*)	As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Co, Be, Ba, Mn, Mo, Se, SN, Ag, B
Oils/Grease (*Laboratory Analysis*)	Total Oil and Grease

The following sampling and analysis procedures will be implemented for all samples:

- Collected laboratory samples will be sent to a National Association of Testing Authorities (*NATA*) registered laboratory for analysis. Sample collection, storage and transportation are to be undertaken in accordance with laboratory guidelines.
- All in-situ measurements will be undertaken using a calibrated portable instrument.
- Notes should be recorded for each sampling round that detail the following information:
  - The rainfall over the past 72 hours.
  - Climatic conditions during sampling (*i.e temperature, cloud cover*).
  - Depth of water at each sampling location. A gauge with depth indicators could be installed at each location to facilitate consistent depth measurements.
  - Visual appearance of the water at each sampling location.

All results should be maintained in a database that is available to relevant government authorities at request. Any reporting requirements will be documented in the POEO licence. Site records of daily rainfall should also be recorded.

WATER QUALITY ASSESSMENT CRITERIA

Water quality observations can comprise substantial variance on both temporal and spatial scales. As such, the water quality assessment criteria will focus on water quality trends rather than individual results. **Table 2-2** presents the proposed benchmark mean concentrations for each analyte included in the water quality monitoring programme. These concentrations only apply to samples collected at the outlet of the treatment system. It may be prudent for PN to commence monitoring of existing water quality at the site in order to determine the veracity of the following criteria.

Table 2-2 – *Water Quality Assessment Criteria*

Analytes	Mean Concentration
pH	6.5 to 8.0^
EC	670 µs/cm^^
Total Suspended Solids (*TSS*)	25 mg/l^^^
Key Metals (*As, Cd, Cr, Cu, Ni, Pb, Zn, Hg, Co, Be, Ba, Mn, Mo, Se, SN, Ag, B*)	ANZECC Guideline Trigger values for 80% level of protection for freshwater Species
Total Oil and Grease	10 mg/l^^^

^ Recommended upper and lower limit value for lowland rivers (*ANZECC, 2000*).

^^ Median salinity value reported in the Hunter River at Greta (*Department of Land and Water Conservation, 2003*).

^^^ Typical water quality targets for industrial and urban developments.

If water quality trends (*i.e. average observed concentrations*) exceed the benchmark concentrations presented in **Table 2-2**, then additional treatment measures may be required. Possible contingency measures detailed in **Section 2.3** will be implemented.

MONITORING TIMEFRAME

It is proposed to implement the monitoring programme for the initial two year period of operation. Following this initial period, the monitoring plan will be reviewed in liaison with the relevant government authority (NSW Office of Water / DECCW).

2.2 Spill Response Measures

There is potential for an accidental spill or leakage to occur at any location within the TSF. If a spill does occur, the following response measures will be implemented:

- If possible, the spill will be contained at the spill location and remediated using a spill kit. This may not be achievable in the rail yard areas as any liquid spill will quickly permeate into the ballast.

- If a spill does enter into the drainage system, the drainage system will be sealed (*with sandbags and an impermeable liner*) at either an access pit or the pipe outlet. Flushing may be required to wash any contamination through the drainage system. All collected liquid will be pumped from the piped drainage into the trade waste holding tank. Testing would be undertaken to identify the chemical properties of the spill and determine the most suitable treatment and disposal option. If the spilled material comprises fuel or oil, the collected liquid could be treated in the on-site trade waste treatment facility and disposed under the trade waste agreement. If the spill contains chemicals that are not suitable for discharge under the trade waste agreement, then contaminated liquid would be transported to an appropriate off-site liquid waste disposal facility.

2.3 Contingency Measures

If unforeseen or unacceptable levels of impact are identified, the following contingency measures would be implemented:

- Increased monitoring frequency and sampling points to identify and confirm the source of any suspected degradation to water quality.

- Review the SWMP in order to identify opportunities to improve or rectify any identified problem. The data collected as part of the monitoring programme will enable fully informed decisions to be made. Potential measures that could be implemented are:

  - Applying a mild flocculating agent (e.g Gypsum/Alum) into the inlet section of the pond to enhance the sedimentation rate.

  - If oil and grease concentrations are higher than expected, an oil and grease separator could be installed.

  - Adjust operation procedures to eliminate the source of any identified problem.

  - Provide high flow by-pass

- If any component of the surface water management framework is identified as creating an unacceptable environmental impact, remedial actions will be established in close liaison with the relevant authority.