

**INDICATIVE SITE SPECIFIC
ENVIRONMENTAL MANAGEMENT PLAN (SSEMP)**

**Kenepuru Interchange Focus Area
(from Chainage 26100 to 27500)**

This Document, that is in the form of an SSEMP, is one of a number that have been developed for key focus areas along the Transmission Gully Project Alignment. The focus areas were chosen to be representative of the range of sites along the route and to have between them the full range of environmental management issues likely to be encountered during construction of the route.

The aims in producing these documents are to:

- Provide confidence in design;
- Provide an indication as to how works can be staged and programmed;
- Assist in assessing effects;
- Assist in developing mitigation strategies; and,
- Assist in consultation with stakeholders regarding construction management issues.

The SSEMP for Linden Interchange specifically explores the following issues:

- Constructability of the road which includes;
- Construction of Interchange;
- Traffic Management works on existing State Highway;
- Bridge construction;
- Major fill disposal site works; and
- Erosion and sediment control.

The SSEMPs have been prepared using the best information available and are not intended to be final. They will be refined further during the specimen and detailed design stages and will be to relevant local authority as required by conditions.

July 2011
Version 5. FINAL

1 INTRODUCTION

This SSEMP relates to those construction matters that have potential or actual effects on aspects of the local natural and human environment.

It covers the upgrading of the existing farm access road, establishment of erosion and sediment control structures, installation of culverts, the formation of stream diversion, formation of a four lane highway (six lanes in places), including cut slopes and batter fills, installation of a variety of stormwater treatment devices, and post construction landscape and mitigation planting. This SSEMP covers a length of alignment of approximately 1.4 kilometres.

Note that the CEMP contains generic details common to the route standard details and methodologies for a range of activities such as diversions, culvert installation, sediment and erosion control, monitoring and mitigation which are not repeated in this SSEMP.

This SSEMP relates to those matters that are unique to this section of the alignment.

1.1 Consents

The following consents are relevant to this SSEMP

CONSENT	CONDITION
Greater Wellington Regional Council	
Porirua City Council	
Wellington City Council	

The following activities relevant to this SSEMP are permitted.

ACTIVITY	RULE
Greater Wellington Regional Council	
xxx	xxxx
Porirua City Council	
xxx	xxx
Wellington City Council	
xxx	xxx

1.2 Key Considerations

Special attention needs to be paid to:

- Construction of Fill Sites (over 600,000 m³ of fill);
- Traffic management on SH1, maintaining four lanes during peak periods and lowering of highway by 3m;
- Works associated with Kenepuru Link Bridge (demolition of building, working over rail, stream and SH1); and,
- Site clearance and limiting the removal of existing pine trees and native vegetation in particular.

2 PREPARATION OF DOCUMENT

The draft SSEMP has been prepared by the following people:NAME	ORGANISATION	ROLE
Peter Ward	NZTA	Project Manager
Mark Edwards	Opus	Civil Engineering design
Craig Martell, Nic Conland	SKM	Hydrology, sediment and erosion control
Wade Robertson	Isthmus	Landscape Architecture Inputs
Stephen Fuller, Vaughan Keesing	BML	Ecology inputs
Lucie Desrosiers	Beca	Urban design inputs
Stephen Chiles	URS	Noise inputs

3 CONTACT DETAILS

NZTA

POSITION	NAME	ORGANISATION	CONTACT DETAILS
Project Engineer			
Project Manager			
Site Supervision			
Site Environmental Management Auditor			
Project Ecologist			

CONTRACTOR

POSITION	NAME	ORGANISATION	CONTACT DETAILS
Contractors Representative			
Site Supervisor			
Site Safety Supervisor			
xxx			

4 PLANS

Attached to this SSEMP are the following drawings:

- F1 General Arrangement Plan
- F2 Construction Access Plan
- F3 Landscape Plan
- F4 to F5 Construction Details
- F6 to F9 - Erosion and Sediment Control Plans
- F10 to F11 Fill Sites staging Details
- F12 Long and Cross Sections

5 ENVIRONMENTAL CONSIDERATIONS

5.1 Erosion & Sediment Control & Stormwater treatment

The area covered by this SSEMP falls within the wider watershed of Te Onepoto Inlet, the southern arm of Porirua Harbour. This harbour is recognised as nationally significant. It is the ultimate receiving environment, via Porirua Stream and Kenepuru Stream, for any discharges from site. Considerable care is therefore essential in the management of sediment and contaminants.

5.2 Stream Works

This section of the alignment will cross tributaries of Porirua Stream with 1 bridge and 4 culverts. It will also cross Porirua Stream proper with a bridge. Care will be needed during construction of these structures to protect the streams from contaminants and in particular the use of cement (e.g. for bridge construction), as this is toxic to freshwater fauna.

- Bridge 22 at chainage 26100
- Bridge 28 on the Kenepuru Link

There will be 4 permanent culverts installed in tributaries of Porirua Stream. All tributaries are isolated from Porirua Stream by urban stormwater systems and culverts and none require fish passage.

5.3 Indigenous Fish

There are no indigenous fish issues for this SSEMP.

5.4 Habitats / Flora / At Risk - Threatened plant species

During construction one area of terrestrial vegetation and habitat has been identified as requiring protection and monitoring.

- Mature lowland forest remnant in gully below Bridge 22 at chainage 26100.

5.5 Terrestrial Fauna / at risk-threatened fauna species

There are no fauna issues for this SSEMP.

5.6 Landscape

The key landscape consideration relates to the final form of the proposed fill areas and specifically how they reflect and tie in to the existing landform to be retained (in accordance with Technical Report 5). The primary mechanisms used to address this issue include placement; staging/ progression; contouring and revegetation of fill areas.

5.7 Visual

The potential visual effects resulting from site clearance and modification during the construction period is a key consideration. Those residential dwellings adjacent to the existing SH1 and Ranui Heights (Ribbonwood Tce) are located in close proximity to the identified area of works. Views from the broader urban landscape (e.g. Linden, Porirua East/ Cannons Creek and Tawa) also require specific consideration. The primary mechanisms used to address these issues include retention of existing vegetation in key locations; additional visual mitigation planting and revegetation of cut/ fill slopes and fill areas.

5.8 Social & Amenity

The project is close to a number of residential areas. Construction methods and approaches will need to be developed in order to minimise effects on these areas. Particular aspects are covered above and below.

5.9 Historical & Cultural Sites

There are no issues for this SSEMP.

5.10 Dust

Dust control is necessary to assist with sediment management and to protect residential and commercial areas that lie in close proximity to the area covered by this SSEMP. Dust generation will occur through bulk earthworks, transportation, and any pine extraction that is carried out as part of enabling works.

5.11 Noise & Vibration

Management of noise will be an important environmental consideration for this SSEMP given its close proximity to residential areas. A Construction Noise Management Plan (CNMP) forms part of the CEMP. Issues specific to this SSEMP include:

- Harvest of pine plantations, chipping, mulching and log transport
- Transport of heavy and oversized structural components
- Bulk earthworks including formation and compaction of fill sites.

5.12 Traffic

Management of traffic will be an important environmental consideration for this SSEMP, given the staging issues around SH1. Accordingly a Site Specific Traffic Management Plan has been prepared for this area and is in the Construction Temporary Traffic Management Plan. The Plan has been prepared in accordance with the NZ Transport Agency "Code of Practice for Temporary Traffic Management, Third Edition, 2008" to mitigate any actual or potential traffic effects associated with construction of the Transmission Gully project.

5.13 Restricted Areas

There are no restricted areas within the proposed designation covered in this SSEMP.

5.14 Utilities

Overhead power lines (local service distribution) and a Vodafone cell tower will need to be relocated.

5.15 Forestry

Forestry clearance will be an important consideration for this SSEMP given the close proximity to residential and commercial areas.

Forestry clearance at the Kenepuru Interchange will be kept to a minimum beyond the earthworks footprint or to where access tracks, stream diversions or temporary sediment ponds are required.

5.16 Water Abstraction

No water abstraction from streams is currently proposed within this SSEMP. Should the contractor want to abstract water for construction and dust management purposes then relevant consents will be sought that time. Harvesting of treated water from sediment ponds for dust management may occur.

6 WORK PROGRAMME

6.1 Staging

The exact timing and construction staging is still to be confirmed. However, generally the construction process includes:

- Site establishment.
- Establishment of Erosion and Sediment Control measures.
- Earthworks.
- Re-vegetation of exposed earthworks areas (to be undertaken as work areas are completed).
- Pavement works.
- Removal of Erosion and Sediment Control measures after agreement with GWRC.

6.2 Indicative Programme

The works will be undertaken in a sequential manner. All stream works will be completed prior to commencement of bulk earth works to form the proposed road and fill areas. The road works will probably be divided into three sections.

A detailed work programme will be prepared in due course by the constructor but may be undertaken in the following sequence:

No.	ACTIVITY	INDICATIVE DURATION	PRECEDING ACTIVITY
	STAGE 1		
1.1	Construct SH1B E&S control devices	3 weeks	start
1.2	Construct Site Compound	1 week	start
1.3	Construct Stage 1 Culvert and Stream Diversion	1 month	1.1
1.4	SH1B Motorway N/B Lane Earthworks	4 months	1.3
1.5	SH1B Motorway N/B Lane Pavement	2 months	1.4
1.6	Construct Kenepuru Link Bridge (Bridge 26)	6 months	
1.7	Construct Collins Avenue East Bridge and demolish existing	4 months	1.1
1.8	SH1B S/B Lane (switch traffic)	1 week	1.5
1.9	Construct SH1B Motorway Overbridge – North Abut)	3 months	1.8
1.10	Construct Collins Avenue West Bridge and demolish existing	4 months	1.7
1.11	Stage 1 Forestry clearance	2 weeks	
1.12	Complete Stage 1 offline construction	4 months	1.13
	STAGE 2 – PHASE 1		
2.1	Construct SH1B Motorway S/B Lane	4 months	Start
2.2	Transmission Gully Project/SH1B West Bridge	4 months	2.1
2.3	Construct Stage 2 culvert and stream diversion (Culvert#5)	2 weeks	Start
2.4	Stage 2 Forestry clearance	2 weeks	Start
2.5	Construct Stage 2 E&S control devices	2 weeks	2,4
2.6	Complete Stage 2 Earthworks – Interchange	4 months	2.5
2.7	Construct Kenepuru Link Bridge (Bridge 26B)	6 months	Start
2.8	Complete Stage 2 Pavements	2 months	2.1 and 2.6
2.9	Construct Kenepuru Drive roundabout	1 months	2.7
	STAGE 2 – PHASE 2		

2.10	Construct Transmission Gully Project N/B Lane	2 months	1.11
2.11	Transmission Gully Project/SH1B East Bridge	3 months	2.4
	STAGE 3		
3.1	Construct Stage 3 E&S control devices	2 weeks	
3.2	Construct Stage 3 culvert and stream diversions	1 month	3.1
3.3	Stage 3 Forestry Clearance	1 month	3.2
3.4	Stage 3 Earthworks	6 months	3.3
3.5	Stage 3 Pavements	2 months	3.4

The critical path for each stage is likely to be as follows:

- Stage 1 - Tasks 1.1, 1.4, 1.5, 1.8 and 1.9, approximate duration = 10.0 months
- Stage 2 - Tasks 2.1, 2.2, 2.9, 2.10 and 2.11 approximate duration = 14.0 months
- Stage 3 - Tasks 3.1, 3.2, 3.3, 3.4, 3.5, approximate duration = 10.5 months
- Minimum duration would be Stage 1 + Stage 2 = 24.5 months with stage 3 running concurrent with stage 1 with some overlap into stage 2.

7 ENABLING WORKS

The following works will be carried out prior to bulk earthworks commencing.

The Contractor's working/establishment areas will involve site clearance, stripping of topsoil (if any), localised contouring and placement of hardfill. The locations of the Contractor's working/establishment areas will be to the southeast of the proposed Kenepuru Interchange.

7.1 Site Access

The construction access plan for the Linden area is shown in attached plan F2.

For the establishment of the site compound at the southern end of the approach to the Linden tie in, initial access to site will be through the existing SH1. As stage 1 of construction progresses a temporary track for construction will follow the path of the cut into the valley. Temporary tracks will also be used when cut material is deposited to fill sites.

As construction progresses into stage 2, there will also be access to site from Kenepuru Drive via the new link bridge upon its completion. There are two existing access tracks on site that link to Ribbonwood Tce that will be used to access the area where stage 3 of construction will occur for initial establishment of crews and equipment. This access will need to be used until alternative access is able to be obtained from off the state highway.

Turning movements across the existing SH1 will be prohibited. However, the site compound could be used as a turning bay for construction vehicles.

7.2 Traffic

The contractor shall prepare a Site Specific Traffic Management Plan (SSTM). The Plan shall be prepared in accordance with the NZ Transport Agency "Code of Practice for Temporary Traffic Management, Third Edition, 2008" to mitigate any actual or potential traffic effects associated with construction of the Transmission Gully project. The Plan requirements are identified in the CTMP:

7.3 Noise

The Contractor shall prepare a Construction Noise and Vibration Management Plan (CNVMP) prior to commencement of the works. The CNMP shall set out the methods proposed to control and mitigate noise during construction. An example of a CNMP is included in the Noise and Vibration Report, Volume 3.

The CNVMP shall also address the following as a minimum:

- Construction sequence.
- Machinery and equipment to be used.
- Hours of operation, including times of the day when noisy construction work would occur.
- The design of noise mitigation measures such as temporary barriers or enclosures.
- Construction Noise Limits for specific areas.
- Development of alternative strategies where compliance with recommended criteria cannot be achieved.
- Procedures for consultation with residents and other occupiers to keep them informed of construction noise and any special night works.
- Methods of receiving and responding to complaints about construction noise.

Noise mitigation measures specific to this SSEMP are, as follows:

- Operational noise barriers to be installed at an early stage. Locate temporary spoil disposal sites where practicable to provide additional noise attenuation.

- Schedule particularly noisy activities which need to occur during night works as early as possible in the evening
- Provide respite periods by limiting the number of consecutive nights worked near residences
- Identify any particularly sensitive times for activities such as schools, and avoid nearby works during those times. Works near schools may be best during weekends or school holidays
- Use quiet reversing alarms/methods
- Avoid conflicts with community events

7.4 Site Clearance / Forestry

7.4.1 Forestry Area

The sequencing of the removal of the existing vegetation (native and exotic vegetation) is outlined under 6.2 above and will provide for both site access and commencement of construction works. In both instances the extent of vegetation to be removed shall be kept to a minimum to reduce visual effects associated with open earthworks, access tracks and general construction traffic. The following control shall be applied:

Vegetation clearance will be limited to 10m (max) beyond the required footprint of any cut/ fill batter or fill area and 5m (max) beyond the required footprint of any access track. Clearance of vegetation beyond these limits will require sign off by the Site Environmental Management Auditor.

7.4.2 Existing Buildings

Demolition / removal of building at 37 Kenepuru Drive

7.5 Laydown Areas

Any laydown areas will be contained within the site compound area to the south of the Kenepuru interchange

7.6 Stockpile Areas

Any temporary stockpile areas will be contained within the site compound area to the south of the Kenepuru interchange.

7.7 Utilities

Vodafone Cell Tower relocation.

7.8 Fencing

One site has been identified for temporary fencing to provide protection during pine extraction and bulk earthworks. It is a small forest remnant below bridge 22.

The location of the fence is to be decided by the Site Environmental Manager and fencing contractor. The fencing will be undertaken prior to any earthworks commencing.

7.9 Species translocations

There are no species translocation issues for this SSEMP

7.10 Stream Works

Work will be required within a number of small existing streams for the diversion and construction of five new culverts and the alteration of an existing culvert entrance.

7.10.1 Diversions

There will be small permanent diversions to a number of small streams to realign these into culverts beneath the new highway.

7.10.2 Culverts

Chainage	Pipe reference	Pipe diameter (mm)	Culvert length (m)	Indicative gradient (m/m)	Catchment (ha)	Q10 Design Flow (m3/s)	Height below pipe soffit in Q10 (m)	Q100 Design Flow (m3/s)	Height below road level in Q100 (m)
26200	Po2	600	115	1 in 12.7	2	0.25	0.1	0.39	19.4
26325	Po3	825	83	1 in 8.3	5	0.60	0.13	0.94	6.04
26425	Po4	900	115	1 in 8.29	10	0.91	0.15	1.44	-0.65
26675	Po5	1200	130	1 in 26.7	24	1.54	0.10	2.76	2.40
27000	Po6	975	100	1 in 71.4	13	0.82	0.08	1.56	38.2

None of the culverts mentioned require any fish passage.

7.11 Erosion Control

In the first phase of works the existing streams from the Porirua catchment will be diverted in four places beneath the main Kenepuru interchange at chainage 26700. This is to allow for the offline construction of two new culverts. The watercourses will then be directed through the new culverts and the old channels cleaned out and backfilled.

The existing culvert beneath SH1 at chainage 26700 requires a new entrance; prevention of erosion during this procedure will include use of a coffer dam and over-pumping during construction. Clean water diversion bunds will be formed up gradient of the earthworks areas.

Phase 2 will involve ongoing stream diversions and infilling of old watercourses and further construction of clean water diversion bunds in preparation for bulk earthworks. During the third phase a new cross culvert will be installed across an existing gully as fill levels reach the correct height.

During the final phase the existing streams will be diverted through the cross culvert.

CHAINAGE	ELEMENT	COMMENT
26150 - 27000	Stream diversion and offline culvert construction	Two culverts constructed offline. Once complete streams will be diverted through these culverts to channel water away from the earthworks during construction.
26700	Coffer dam	Installed on a small existing stream while a new culvert entrance is constructed, with water pumped.
26150 - 27000	Clean water diversion bunds	Constructed around all aspects of the earthworks site where undisturbed land lies up gradient. The diversion bunds will lead to existing small watercourses.

7.12 Sediment Control Measures

The initial stage of earthworks primarily focuses on prevention of erosion during stream diversions. During the second phase, the first sediment diversion bunds / channels will be constructed to convey sediment-laden water to treatment facilities. These chemically treated sediment retention ponds have been sized on the basis of 3% (by area) of the contributing catchment (see sediment calculations in the Appendix for further details).

In the third phase further chemically treated sediment ponds will be installed as bulk earthworks commence. Smaller areas will be treated with container sediment tanks (either one or two at each location), with the addition of chemical treatment to increase settlement efficiency.

During the final phase the chemically treated sediment ponds and tanks will be relocated to suit the new contours and changing construction catchments. The sediment controls will remain in place until all earthworks are complete and all areas are stabilised.

CHAINAGE	ELEMENT	COMMENT
26450 & 26675 - 26800	Sediment diversion bunds and channels	Installed down gradient of earthworks areas to direct sediment-laden water to silt ponds and sediment tanks.
26450 & 26675 - 26800	Silt fences	Installed between small streams and earthworks to prevent sediment laden water or dust entering the watercourses.
26675 - 26800	Five sediment ponds	Located downstream of each discrete work area / catchment. An additional low lying area at chainage 26675 will also be utilised as a sediment pond.
26450 & 26675 - 26800	Up to nine sediment tanks	Installation of either one- or two-tank systems to treat small volumes of sediment-laden runoff from diversion bunds during the last phases of earthworks.
26450 & 26675 - 26800	Chemical treatment	Installation of chemical treatment sheds, adjacent to and for use in sediment ponds and sediment tanks.

7.12.1 Chemically Treated Sediment Retention Ponds

CHAINAGE	CATCHMENT AREA (ha)	POND SIZE m ³	POND NUMBER	COMMENTS
26500	*	*	A	
26600	*	*	B	
26675	*	*	-	Low lying area used as a sediment pond
26675	*	*	-	
26675	*	*	C	
26675	*	*	D	

* See Technical Report 15.

The sediment retention pond size has been calculated on the basis of 3% of the contributing catchment by area and is detailed in Technical Report 5

8 CONSTRUCTION WORKS

8.1 Earthworks

During construction the area of earthworks open will be restricted to the road corridor and fill sites. Construction will be staged to reduce the area of earthworks open concurrently. Material cut during stage 1 of the construction will be transported to fill area 6. The majority of the cut volume will come from the area where the Transmission Gully Project alignment joins the existing alignment and in the approach to the new Kenepuru interchange. There will be small cut slopes along the existing SH1 alignment. The earthworks will be staged to begin adjacent to the site compound and move along the Transmission Gully Project alignment as further access is gained.

Construction during stage 2 will focus on a small area in the immediate vicinity of the interchange with the cut material used to build the embankment for the Kenepuru link approach, with any excess cut material going to fill site 6. The embankment at the interchange will be constructed from the adjacent cut material.

Concurrent to this a large volume cut will be undertaken to the north of the interchange along the new Transmission Gully Project alignment. The cut material will be transported to the nearby fill sites. A steep cut is required so the cut will be staged with benches.

Once closed, fill sites will not be required to be reopened. Closure will occur with the completion of the stage 2 earthworks as stage 3 will run concurrently to stage 1. The earthworks in the area are self contained with any excess material going to fill sites. No material is anticipated as being needed to be brought to the fill sites in this SSEMP area from other construction areas.

The final form and treatment of cut and fill batters has a significant bearing on resultant visual effects. In order to manage these effects and positively contribute to the overall appearance of the road corridor the following actions will be undertaken (see Technical Report 5):

- Both cut and fill batters to receive final landscape treatment (see 8.5.2 – Revegetation below) at earliest possible time following completion of construction *provided* this timing is conducive to vegetation growth. If the Site Environmental Management Auditor finds that conditions are not acceptable an interim treatment (hydroseeded grass) will be applied prior to the implementation of final landscape treatment at an appropriate time.
- Benches where practical will be spaced evenly *except* for the first bench which will be a minimum of 15m above finished road level.
- Faces will be left with a rough surface to facilitate vegetation growth.
- Tops and ends of cuts rounded off to reduce hard edges.
- Soil material will be left on benches to aid revegetation (where practicable).
- Benches shaped to retain water and facilitate vegetation growth.

8.2 Proposed Fill Sites

Stage 1 and 3 earthworks will run concurrently. Excess cut material from stage 1 construction will be transported to fill site 6 which will be filled and closed.

Excess cut material from stage 3 construction will be transported to fill sites. These fill sites will be closed at the completion the earthworks, with the smaller fill sites likely to be the first of the two sites to close.

Excess material from stage 2 of the construction will be transported to the last fill site to close.

The final form and treatment of proposed fill sites has a significant bearing on resultant landscape and visual effects. In order to reduce the degree of these effects and positively contribute to the overall appearance of the road corridor and adjoining landscape, the following actions will be undertaken (see Technical Report 5):

- The extent of the proposed fill areas shall be kept to a minimum.
- The extent of existing vegetation removal associated with fill areas shall be in accordance with 7.2.1 – Forestry Area above.
- The removal of vegetation associated with Fill Area 5 shall be staged in a manner that retains the maximum distance between the edge of the fill area and those dwellings located on Ribbonwood Tce.
- The final form/ surface profile of the proposed fill areas shall reflect the profile of adjoining existing/ ‘natural’ landform. Flat geometric profiles should be avoided. However, one of the fill sites is proposed to be sculptured to provide a feature.
- Fill areas to receive final landscape treatment at earliest possible time following completion of construction *provided* this timing is conducive to vegetation growth. If the Site Environmental Management Auditor finds that conditions are not acceptable an interim treatment (hydroseeded grass) will be applied prior to the implementation of final landscape treatment at an appropriate time.

8.3 Revegetation

8.3.1 Soil Recovery

CHAINAGE	MATERIAL	ACTION
26100 - 27100	Loess and colluviums between 1m to 2m thick over greywacke bedrock	Windrow on downhill side of track or remove to spoil areas and store what is practical for rehabilitation purposes.

8.3.2 Revegetation

CHAINAGE	CURRENT VEGETATION	PROPOSED VEGETATION	METHOD
26100 - 27100	Pine Plantation and native vegetation	Pine Plantation and native vegetation	Avoidance. Maximum clearance restrictions beyond cut/ fill batter; fill area; and access road footprint.
26100 - 26650	Pine Plantation	Grass/ native seed mix on cut and fill batters and fill areas	Hydroseeding on cut/fill batters and fill areas
26650 - 27100	Pine Plantation	Amenity planting (Fill area and immediate surrounds)	Hand planting of native trees and shrubs
26500 - 27400	Pine Plantation; native vegetation; existing SH1.	Amenity planting (Minor cut/ fill batters; between main alignment and slip lanes)	Hand planting of native trees and shrubs
27100 - 27500	Grass – Existing SH1	Amenity planting	Hand planting of native trees and shrubs
Kenepuru Underpass - 27100	Grass – Existing SH1	Visual mitigation	Hand planting of exotic/ native trees and shrubs

8.4 Quarrying

No aggregate sourcing will occur outside the road footprint within this SSEMP.

8.5 Dust Control

Where dust control is identified as a specific issue, an investigation by the Construction Supervisor into the cause will be required. When the cause has been identified the specific controls can be applied to the problem area(s). The following controls are to be deployed on the construction sites as required.

- Water (water cart irrigation), provides good short term solution. Caution is required to avoid erosion from the over application of water. All areas identified as dust sources including roads are to be kept dampened during dry weather periods to minimise public nuisance from windborne dust.
- Chemical adhesive sprays, provide longer term solutions to small areas which aren't able to be treated by water such as hill slopes or long term stock piles. Need to check use is a permitted activity in terms of the district and regional plans and over spray risks are managed.
- Wind fences, are good for small areas and provide for effective control.
- Mechanical treatment, such as slopes rolled with mulch or aggregate provide effective control for wind erosion. However, these can't be used in active work areas, so require careful planning for installation.
- Cover blankets for stock piles.

8.6 Transporting of Materials

All materials transported to and from the sites will need to be assessed for the risk of dust release during transit. Where the load is identified as being a potential dust nuisance such as crushed concrete or topsoil, etc., then the load will need to be covered or dampened down prior to transporting. The Construction Supervisor will be responsible for keeping a record of:

- Date and time of movement;
- Transport provider;
- Material moved on and off site;
- Potential for dust release;
- Actions taken to control the material.

8.7 Stormwater Treatment Devices

There are three proprietary stormwater treatment devices for the capture and treatment of road runoff within the Linden area. Details of these devices are as follows:

CHAINAGE	DEVICE NUMBER	CATCHMENT AREA (ha)	TYPE OF TREATMENT	COMMENTS
26690	P24	15,500 m ²	Proprietary device	-
27290	P25	15,000 m ²	Proprietary device	-
27790	P26	17,500 m ²	Proprietary device	-

Proprietary devices have been used for stormwater treatment due to the nature and constraints of the Linden SSEMP area. Other treatment methods such as wetlands and swales have been considered but have been deemed not appropriate for this area.

9 TRAINING

Within this SSEMP site, all contractors will receive a full briefing on the Environmental Considerations including avoidance of restricted areas.

10 MONITORING

Performance monitoring of the proposed ESC devices is intended to ensure that they operate as designed and that their performance is maintained over the lifespan of their use on the project. The discharges from the site works and the proposed treatment devices will enter watercourses throughout the catchments. The following monitoring of the receiving environment is proposed to check whether the effects of the discharges are as anticipated.

Monitoring of erosion and sediment control measures will be as follows:

Control Measure	Routine Inspection	Wet Weather And Incident Inspections		Performance Measures	Management Action	Reporting
			Inspect For			
Control and retention of disturbed soil at earthwork sites (Improve Soil Health)	Weekly	During heavy rain (Q10 event) and after all rain	Soil loss Rill erosion Surface water flow pathways	Retention of soil	Rectify any erosion or channel formation Re-grade surface as required	Inspection, outcomes and management action in site log
Provide Short Term Soil Cover	Weekly	When rainfall predicted through weather monitoring. After all rain	Surface water pathways / erosion	Design specifications	Undertake straw mulching Hydro seeding	Inspection, outcomes and management action in site log
Provide Long Term Soil Cover	Weekly	During heavy rain (Q10 event) and after heavy rain (Q10 event)	Damage / erosion Growth of plantings (including gaps)	90% cover or stabilised	Rectify and repair damage to blankets/netting Replant gaps/dieback	Inspection, outcomes and management action in site log
Steep Slope Techniques	Weekly till 90% stabilised (i.e. 90% gassed or equivalent)	During heavy rain (Q10 event) and after heavy rain (Q10 event)	Damage / erosion Growth of plantings (including gaps)	Design specifications	Rectify and repair damage to blankets/netting Replant gaps/dieback	Inspection, outcomes and management action in site log
Clean water diversion bund	Weekly	During heavy rain (Q10 event) and after all rain	Damage / erosion Blockages Sediment build-up	Design specifications	Rectify any damage / erosion or blockages Remove accumulated sediment in diversion channel.	Inspection, outcomes and management action in site log
Rock check dam	Weekly	After all rain	Damage / erosion Blockages Sediment build-up	Design specifications	Rectify any damage / erosion or blockages Remove accumulated sediment behind dams when 50% full	Inspection, outcomes and management action in site log

Control Measure	Routine Inspection	Wet Weather And Incident Inspections		Performance Measures	Management Action Reporting	
			Inspect For			
Pipe drop structure/ flume	Weekly	After all rain	Damage / erosion Blockages	Design specifications	Rectify any damage / erosion or blockages	Inspection, outcomes and management action in site log
'Pinned' Silt socks or gravel check dams	Weekly	During heavy rain (Q10 event) and after heavy rain (Q10 event)	Damage / erosion Sediment build-up	Design specifications	Rectify and damage / erosion or blockages Replace/ repair gaps	Inspection, outcomes and management action in site log
Sediment Retention Pond	Daily	After all rain. During heavy rain (Q10)	Sediment build up	Measure depth of sediment versus pond volume	Remove sediment when 20% full	Inspection, outcomes and management action in site log
			Damage/ Function of the decants/ Level Spreaders / Fore bay	Design Specifications	Rectify any damage / blockages to fore bay	Inspection, outcomes and management action in site log Advise GWRC within 24hrs of significant damage and management actions
Chemical treatment System	Weekly	After all rain. During heavy rain (Q10)	Damage, low dosing supply	Design Specifications	Rectify any damage or blockages. Replace flocculent	Inspection, outcomes and management action in site log
Sediment Fence / Silt Socks	Weekly	After all storm events (Q2-Q10)	Sediment build-up	Measure depth of sediment versus fence height	Remove sediment when 20% of height occupied	Inspection, outcomes and management action in site log
			Damage/ erosion/ water bypass	Design Specifications	Rectify any damage / erosion. Relocate devices to deal with bypass	Inspection, outcomes and management action in site log
Decanting Earth Bund	Weekly	After all rain events During heavy rain (Q10)	Sediment build-up	Measure depth of sediment versus pond volume	Remove sediment when 20% full	Inspection, outcomes and management action in site log

Control Measure	Routine Inspection	Wet Weather And Incident Inspections		Performance Measures	Management Action Reporting	
			Inspect For			
			Damage/ erosion Blockages	Design Specifications	Rectify any damage / erosion or blockages	Inspection, outcomes and management action in site log Advise GWRC within 24hrs of significant damage and management actions
Stormwater Inlet Protection	Weekly	After all rain	Damage/ erosion Blockages	Design Specifications	Rectify any damage / erosion or blockages	Inspection, outcomes and management action in site log
Works in watercourses	Weekly	After all rain	Visual release of sediment into the water above that envisaged for works	Documented method for works	Investigate source of sediment and rectify works/modify method	Inspection, outcomes and management action in site log

11 REPORTING

No reporting above and beyond the requirements of the CEMP are required for this SSEMP section.

12 APPENDIX - CALCULATIONS

12.1 Quantities

All works and Erosion and Sediment Control measures will be contained within the designation.

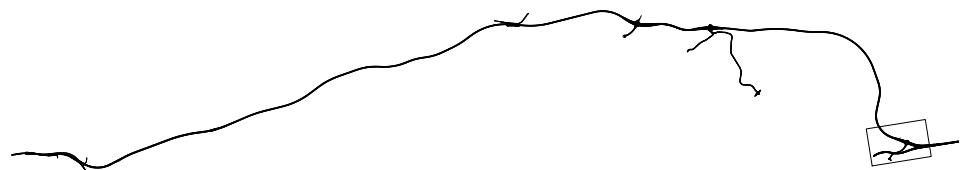
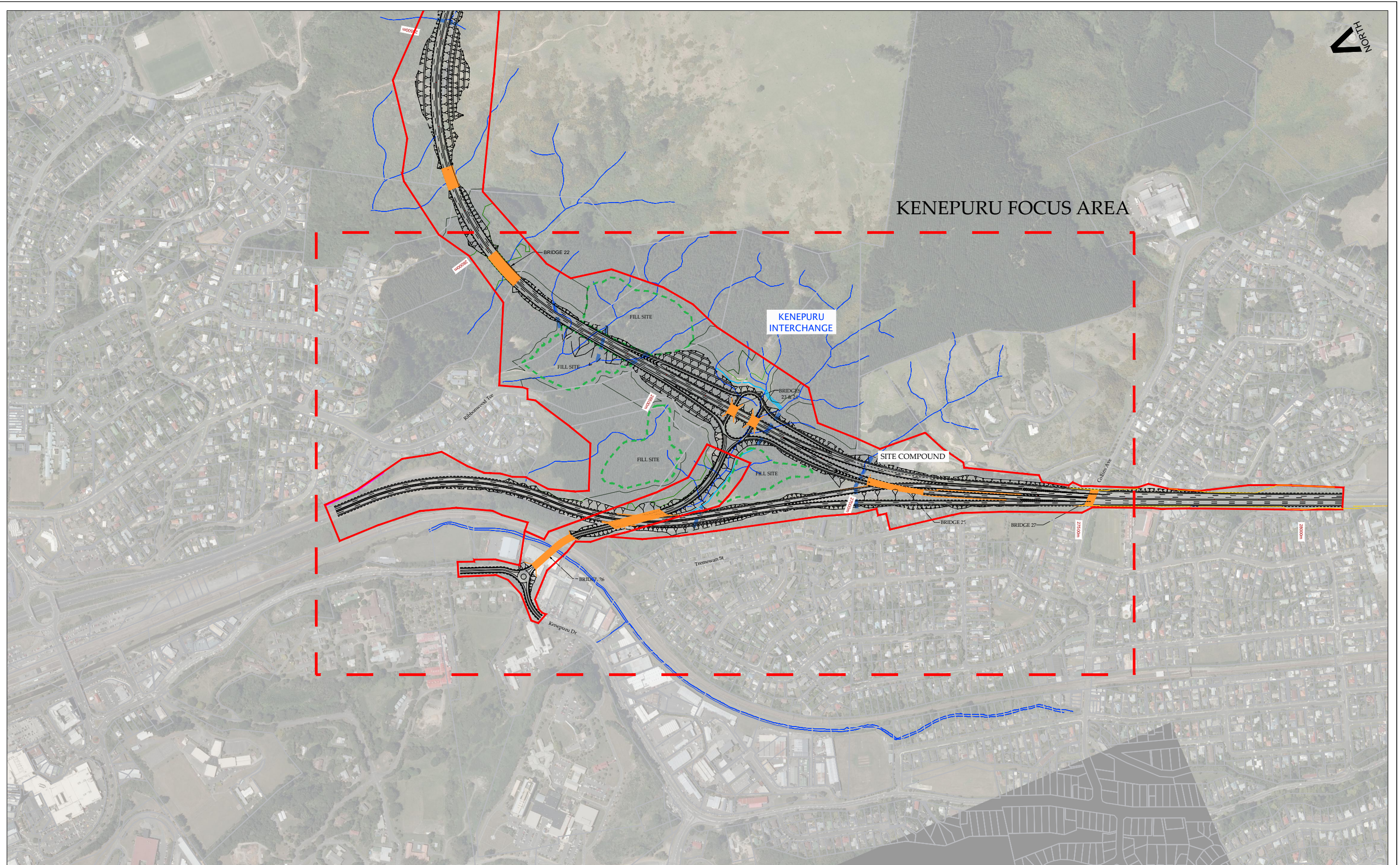
The indicative earthworks quantities for the Linden SSEMP are summarised in the table below.

EARTHWORKS CATEGORY	AREA (m ²)	QUANTITY (m ³)
TOTALS		
Earthworks Cut from 26100m to 27700m	52000	783,000
Earthworks Fill from 26100m to 27700m	99500	230,000
BREAKDOWN		
Earthworks Cut from 26400m to 26700m	22,000	472,000
Lowering of existing state highway	30,000	130,000
Kenepuru link fill	10,500	70,000
Fill Sites	89,000	614,000

12.2 Proposed Fill Sites

There are four sites proposed to be used for disposal of cut material. The indicative quantities are summarised in the table below.

SITE	AREA (m ²)	QUANTITY (m ³)
Fill Area 3	18,000	151,500
Fill Area 4	41,000	394,000
Fill Area 5	12,000	31,000
Fill Area 6	18,000	38,000



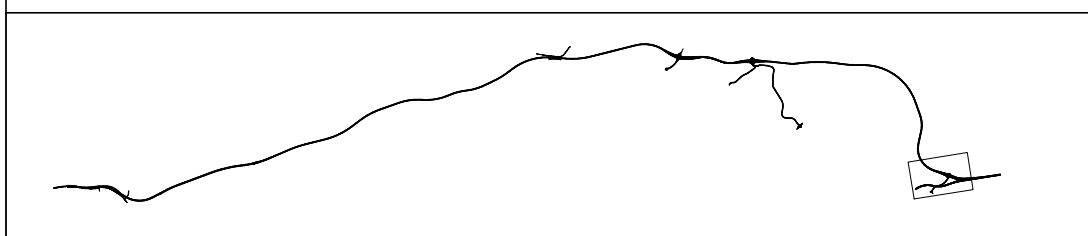
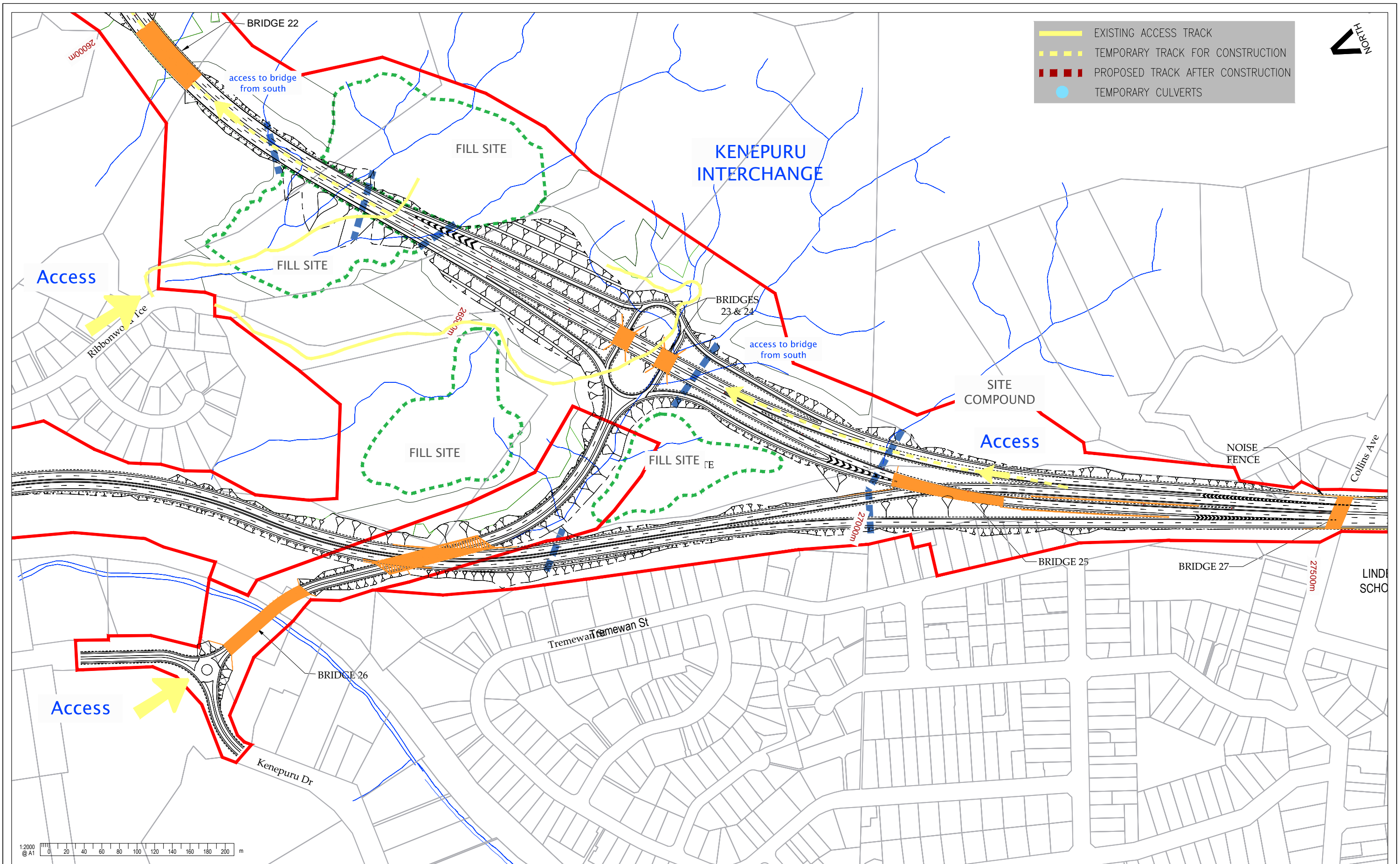
Revision	Amendment	Approved	Date



Project: TRANSMISSION GULLY PROJECT

Title: Site Environmental Management Plan
Kenepuru Link
General Arrangement Plan

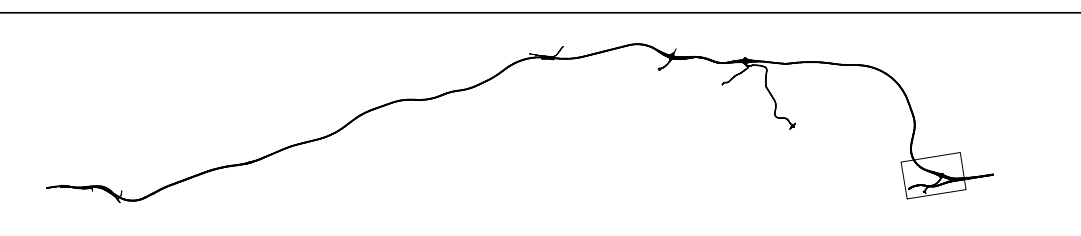
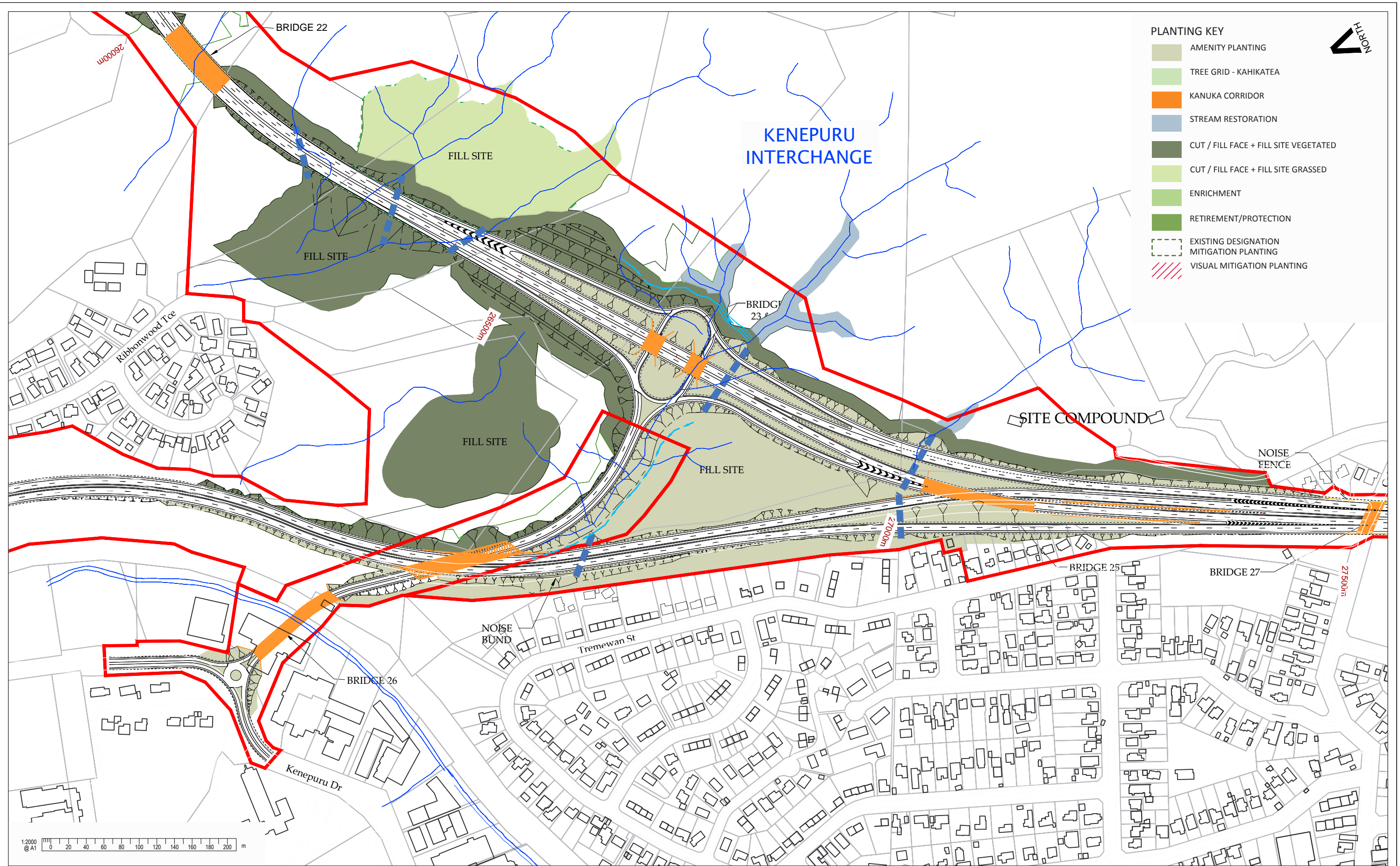
Status:	For Consenting
Sheet No.	SSEMP/F1
Version No.	A



Revision	Amendment	Approved	Date



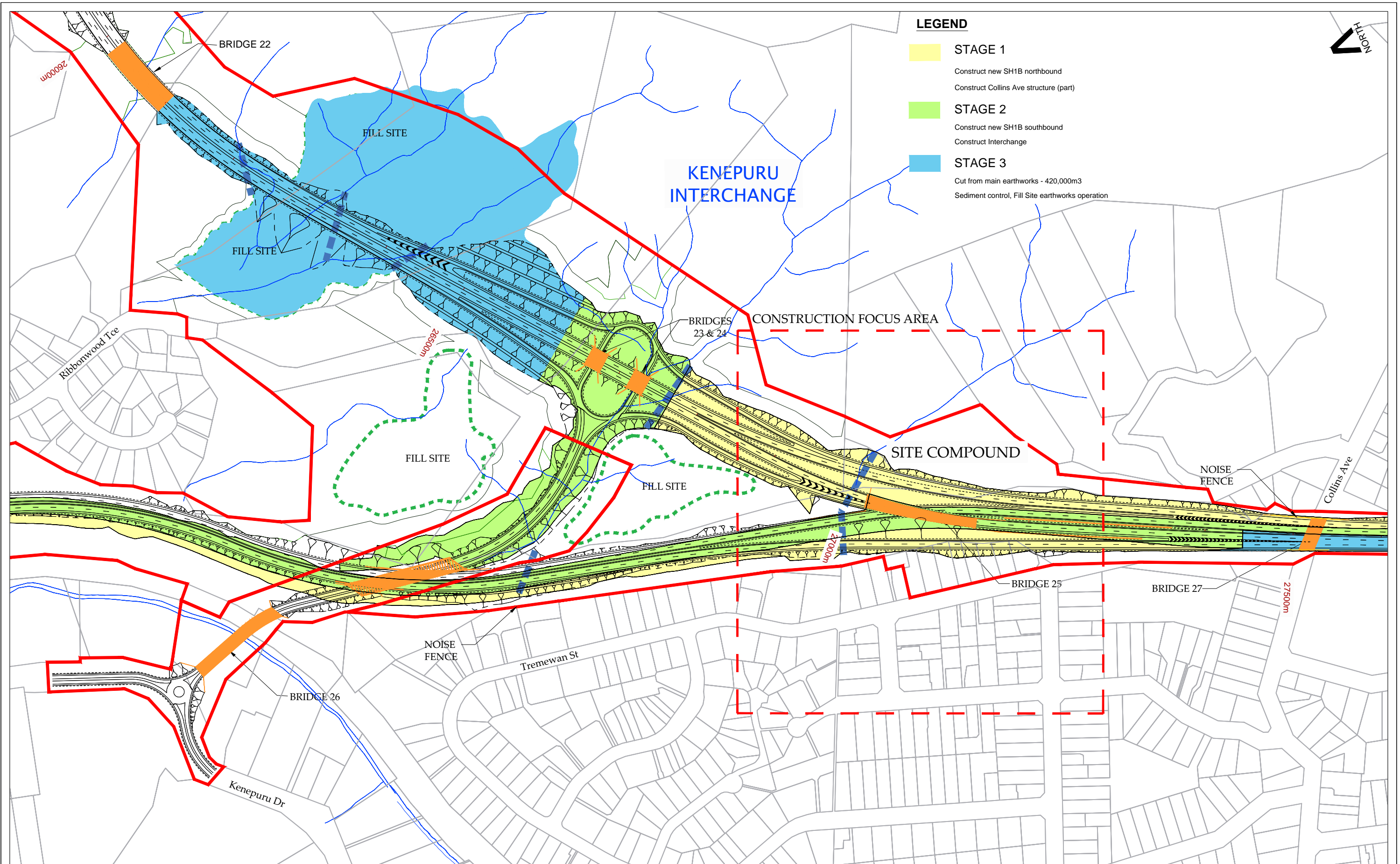
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Title: Site Environmental Management Plan Kenepuru Link Construction Access Plan	Status: For Consenting
Sheet No. SSEMP/F2	Version No. A



Revision	Amendment	Approved	Date



Project: TRANSMISSION GULLY PROJECT	
Title: Site Environmental Management Plan Kenepuru Link Landscape Plan	Status: For Consenting
Sheet No. SSEMP/F3	Version No. A



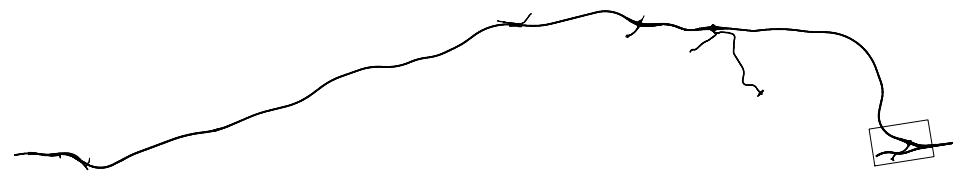
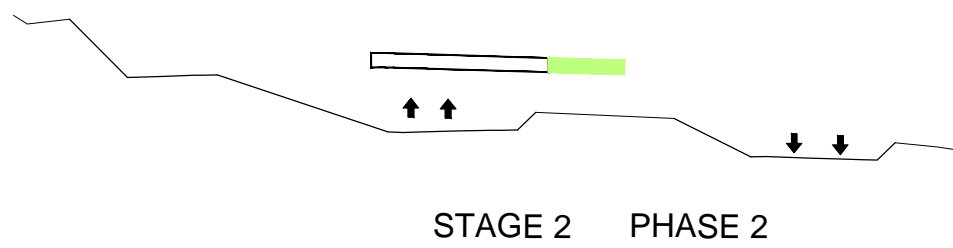
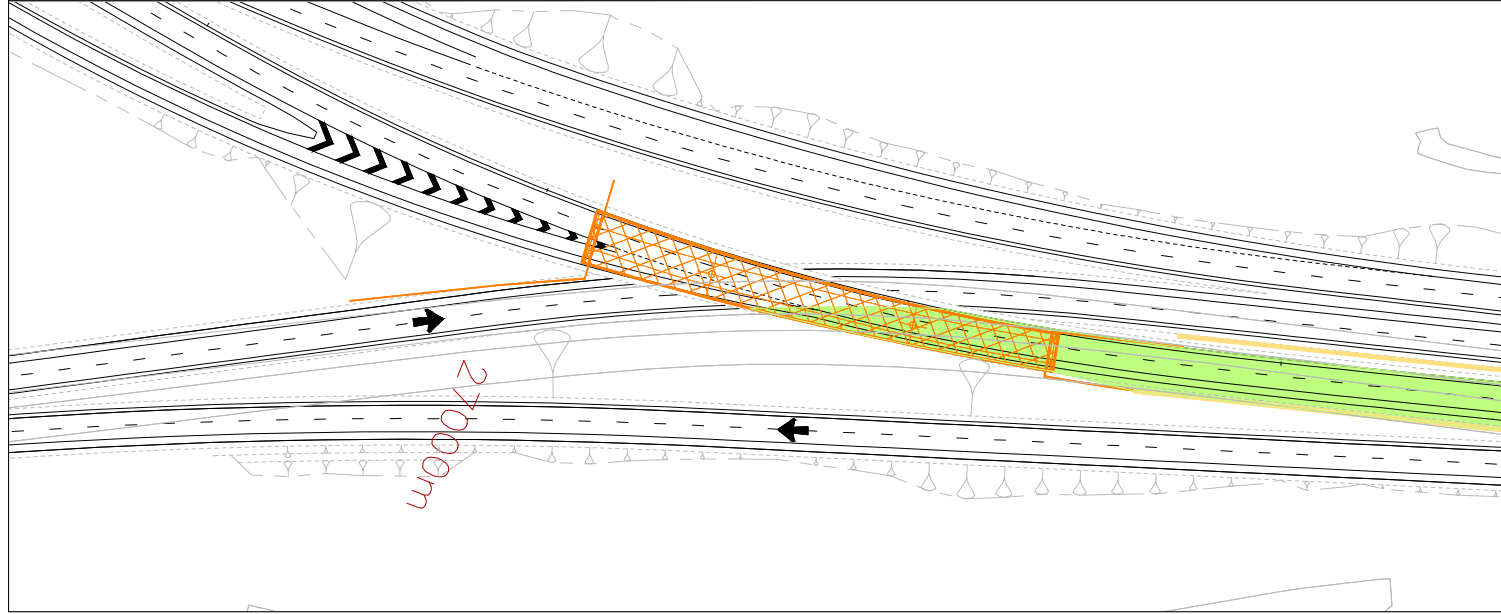
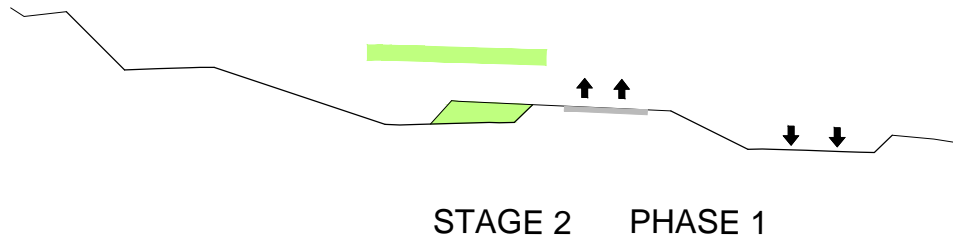
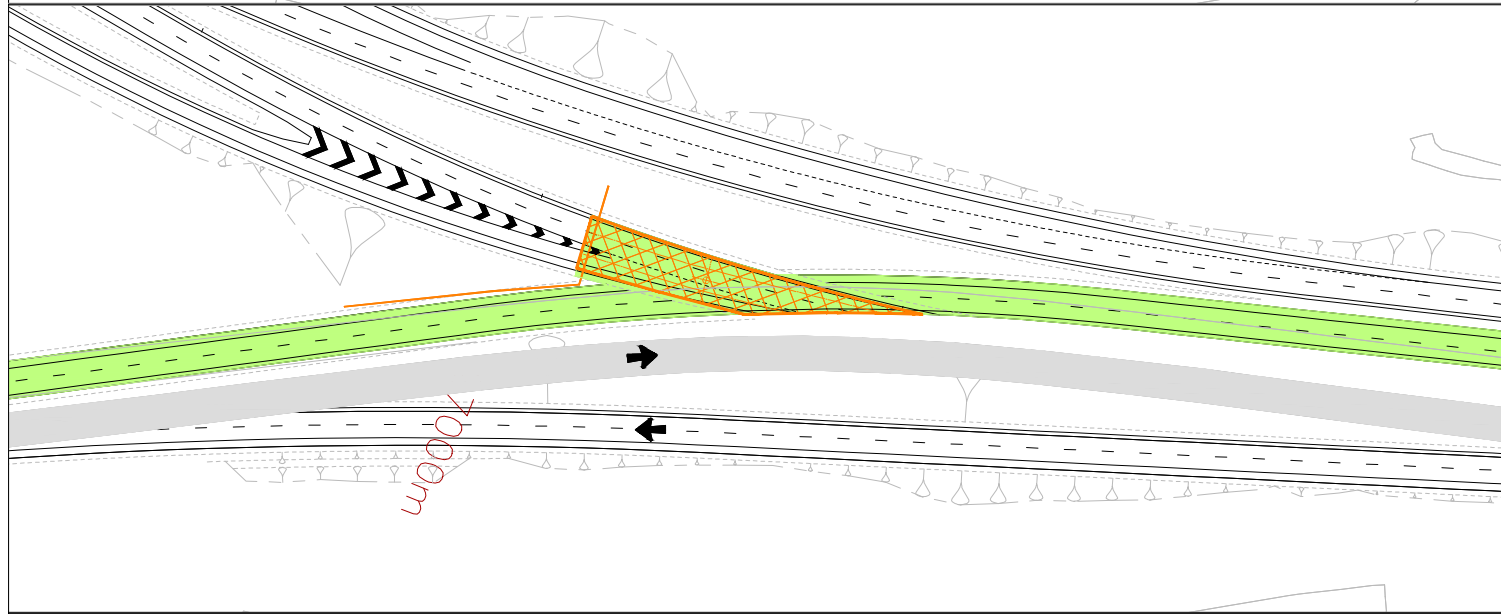
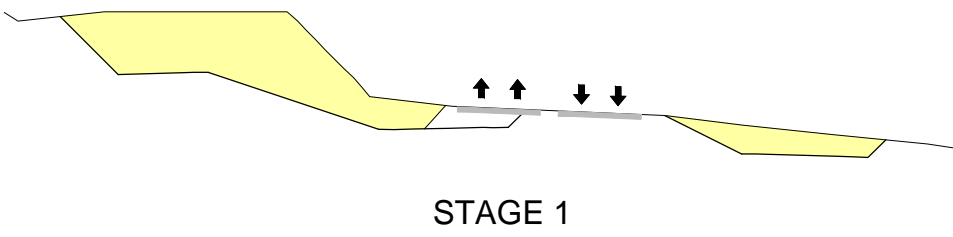
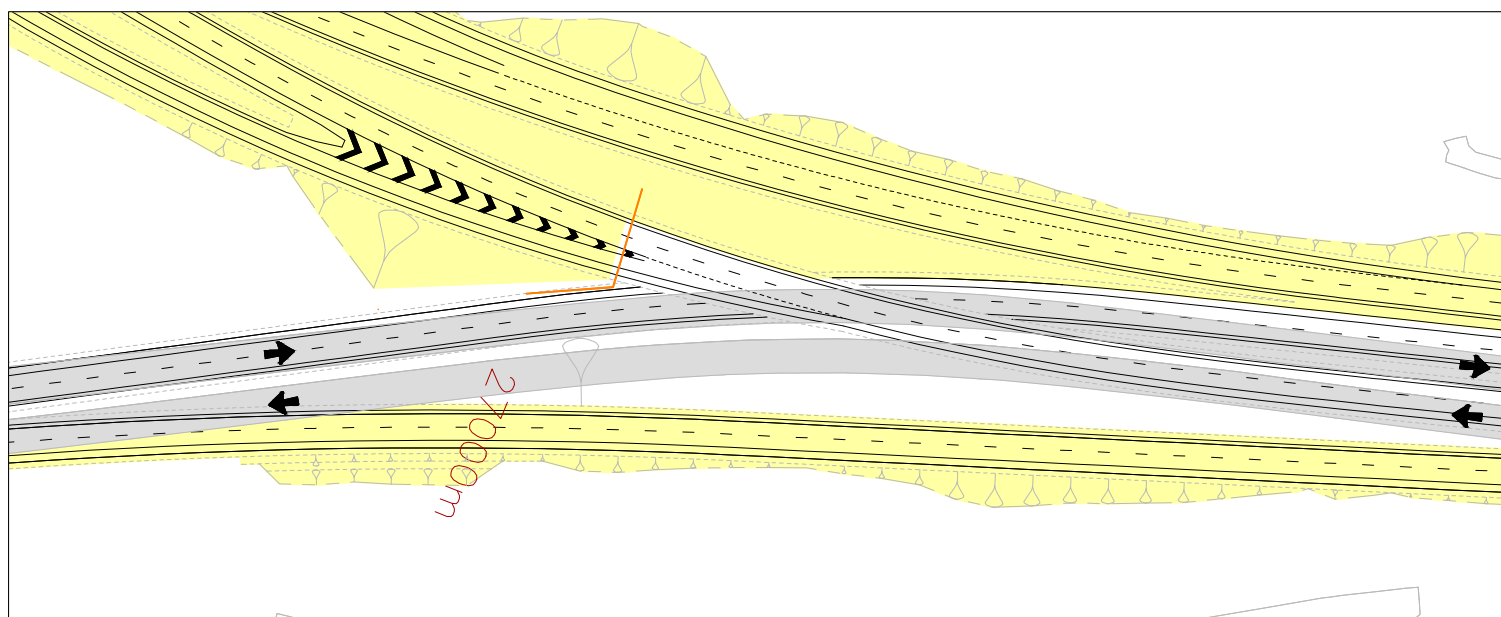
Revision	Amendment	Approved	Date



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Title: Site Environmental Management Plan Kenepuru Link Construction Details - Sheet 1 of 2	Status: For Consenting
Sheet No. SSEMP/F4	Version No. A

Notes:

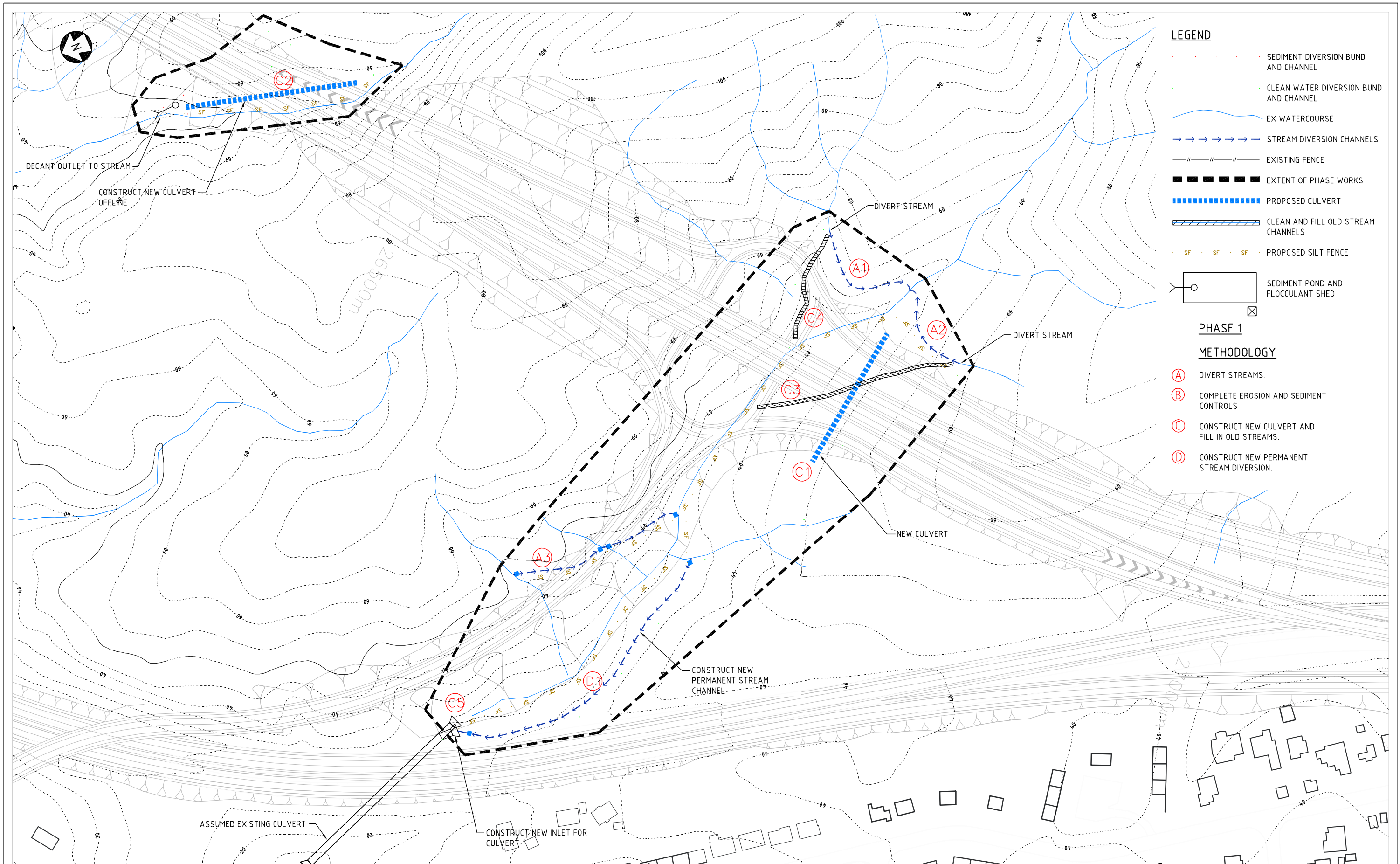
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Revision	Amendment	Approved	Date



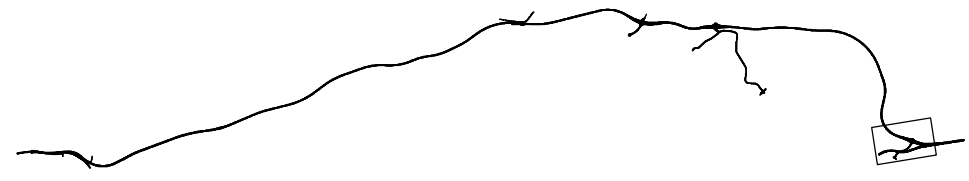
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Title: Site Environmental Management Plan Kenepuru Link Construction Detail - Sheet 2 of 2	Status: For Consenting
Sheet No: SSEMP/F5	Version No: A



LEGEND

- SEDIMENT DIVERSION BUND AND CHANNEL
- CLEAN WATER DIVERSION BUND AND CHANNEL
- EX WATERCOURSE
- STREAM DIVERSION CHANNELS
- EXISTING FENCE
- EXTENT OF PHASE WORKS
- PROPOSED CULVERT
- CLEAN AND FILL OLD STREAM CHANNELS
- PROPOSED SILT FENCE
- SEDIMENT POND AND FLOCCULANT SHED

- PHASE 1**
- METHODOLOGY**
- (A)** DIVERT STREAMS.
 - (B)** COMPLETE EROSION AND SEDIMENT CONTROLS
 - (C)** CONSTRUCT NEW CULVERT AND FILL IN OLD STREAMS.
 - (D)** CONSTRUCT NEW PERMANENT STREAM DIVERSION.



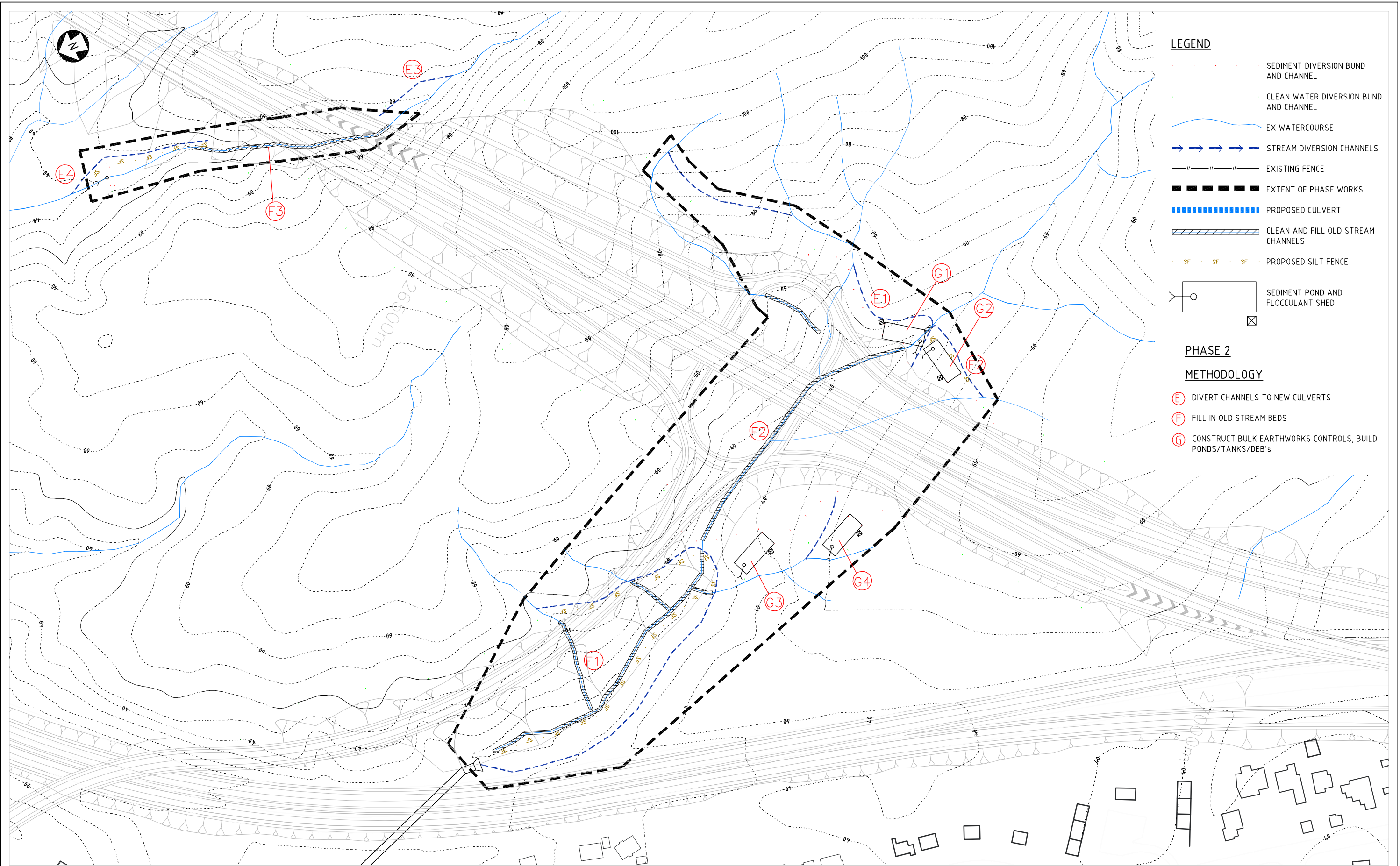
Revision	Amendment	Approved	Date



Project: **TRANSMISSION GULLY PROJECT**

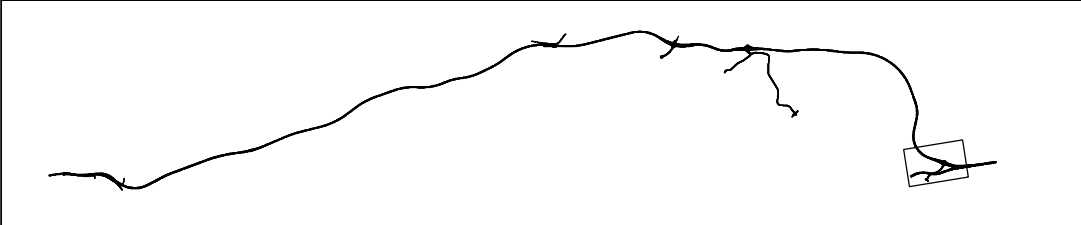
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Kenepuru Link
Erosion & Sediment Control - Sheet 1**

Status: For Consenting	Version No. A
Sheet No. SSEMP/F6	



- LEGEND**
- SEDIMENT DIVERSION BUND AND CHANNEL
 - CLEAN WATER DIVERSION BUND AND CHANNEL
 - EX WATERCOURSE
 - STREAM DIVERSION CHANNELS
 - EXISTING FENCE
 - EXTENT OF PHASE WORKS
 - PROPOSED CULVERT
 - CLEAN AND FILL OLD STREAM CHANNELS
 - PROPOSED SILT FENCE
 - SEDIMENT POND AND FLOCCULANT SHED

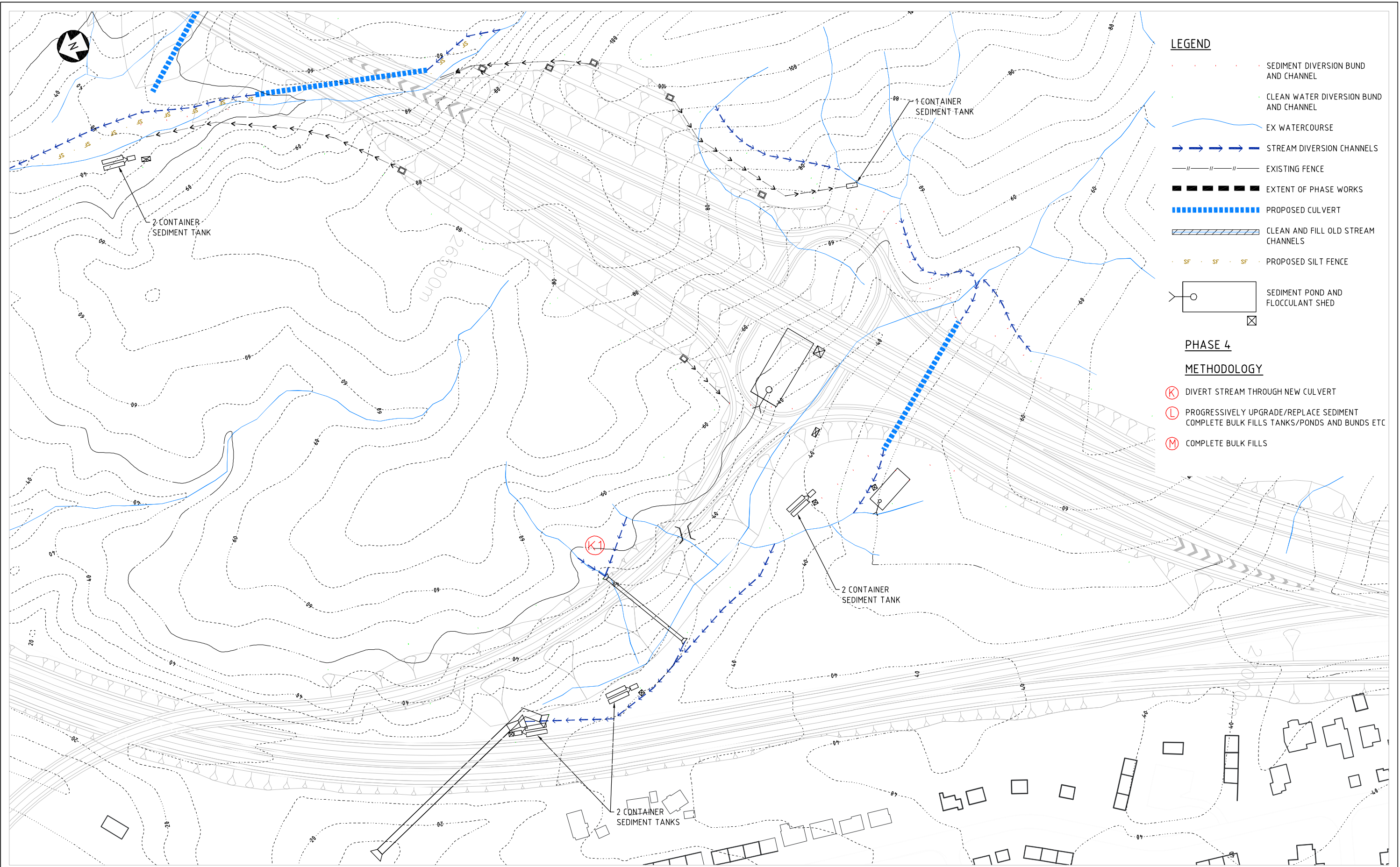
- PHASE 2**
- METHODOLOGY**
- DIVERT CHANNELS TO NEW CULVERTS
 - FILL IN OLD STREAM BEDS
 - CONSTRUCT BULK EARTHWORKS CONTROLS, BUILD PONDS/TANKS/DEB's



Revision	Amendment	Approved	Date

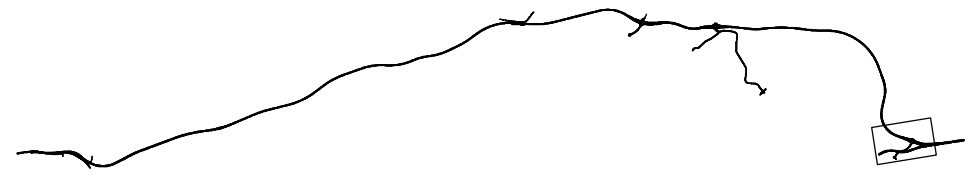


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Title: Site Environmental Management Plan Kenepuru Link Erosion & Sediment Control - Sheet 2	Status: For Consenting
Sheet No. SSEMP/F7	Version No. A



- LEGEND**
- - - - - SEDIMENT DIVERSION BUND AND CHANNEL
 - - - - - CLEAN WATER DIVERSION BUND AND CHANNEL
 - EX WATERCOURSE
 - - - - - STREAM DIVERSION CHANNELS
 - - - - - EXISTING FENCE
 - - - - - EXTENT OF PHASE WORKS
 - - - - - PROPOSED CULVERT
 - - - - - CLEAN AND FILL OLD STREAM CHANNELS
 - - - - - PROPOSED SILT FENCE
 - SEDIMENT POND AND FLOCCULANT SHED

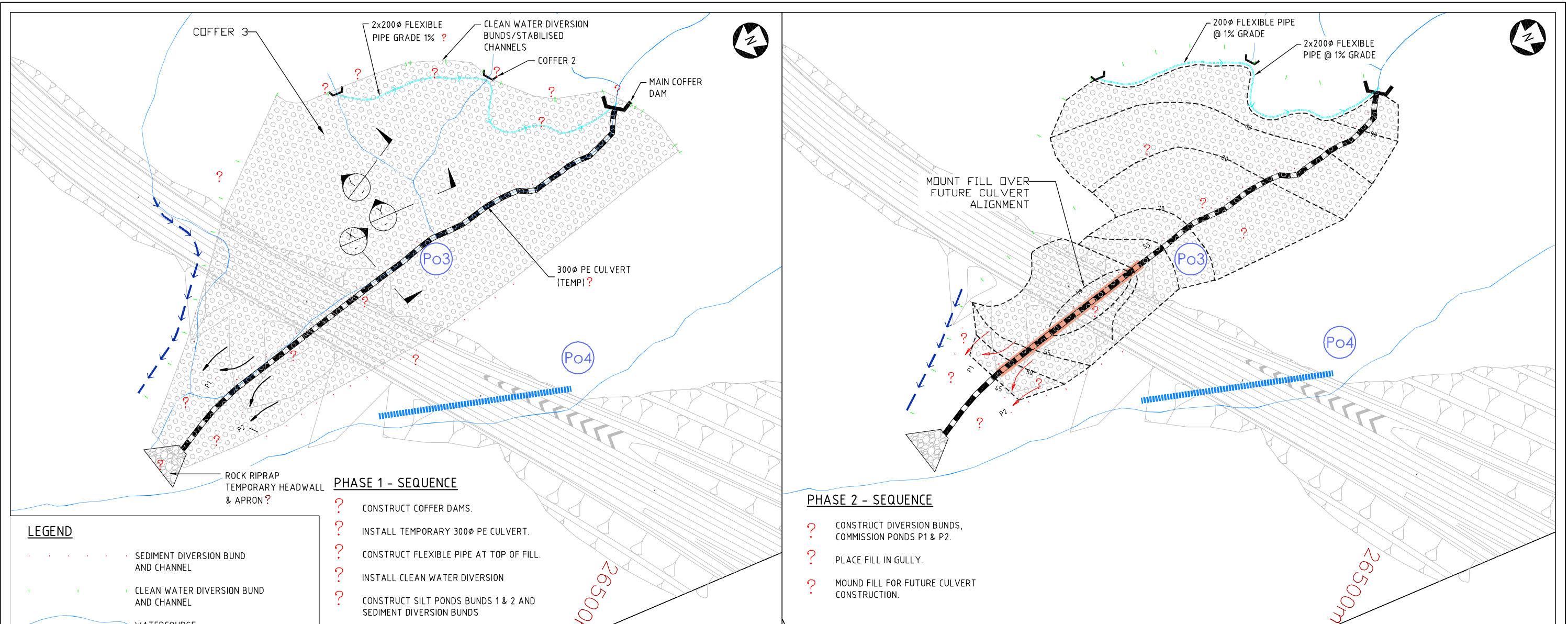
- PHASE 4**
- METHODOLOGY**
- K DIVERT STREAM THROUGH NEW CULVERT
 - L PROGRESSIVELY UPGRADE/REPLACE SEDIMENT COMPLETE BULK FILLS TANKS/PONDS AND BUNDS ETC
 - M COMPLETE BULK FILLS



Revision	Amendment	Approved	Date



Project.		TRANSMISSION GULLY PROJECT	
Title.	Site Environmental Management Plan Kenepuru Link Erosion & Sediment Control - Sheet 4	Status.	For Consenting
Sheet No.	SSEMP/F9	Version No.	A



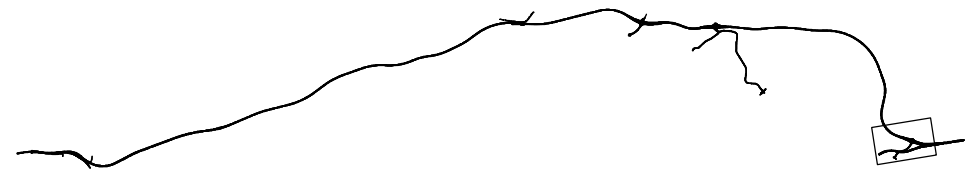
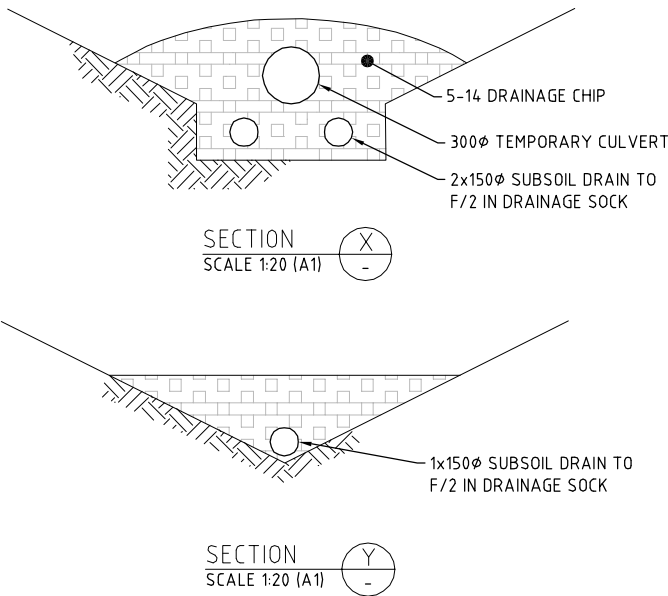
- LEGEND**
- SEDIMENT DIVERSION BUND AND CHANNEL
 - CLEAN WATER DIVERSION BUND AND CHANNEL
 - WATERCOURSE
 - STREAM DIVERSION CHANNELS
 - EXISTING FENCE
 - SEDIMENT POND AND FLOCCULANT SHED
 - PROPOSED CLEAN FILL FINISHED CONTOUR
 - TEMPORARY CULVERT AND UNDERFILL DRAIN
 - 200 ϕ FLEXIBLE PIPE
 - COFFER DAM
 - FUTURE CULVERT ALIGNMENT

PHASE 1 - SEQUENCE

- ? CONSTRUCT COFFER DAMS.
- ? INSTALL TEMPORARY 300 ϕ PE CULVERT.
- ? CONSTRUCT FLEXIBLE PIPE AT TOP OF FILL.
- ? INSTALL CLEAN WATER DIVERSION
- ? CONSTRUCT SILT PONDS BUNDS 1 & 2 AND SEDIMENT DIVERSION BUNDS

PHASE 2 - SEQUENCE

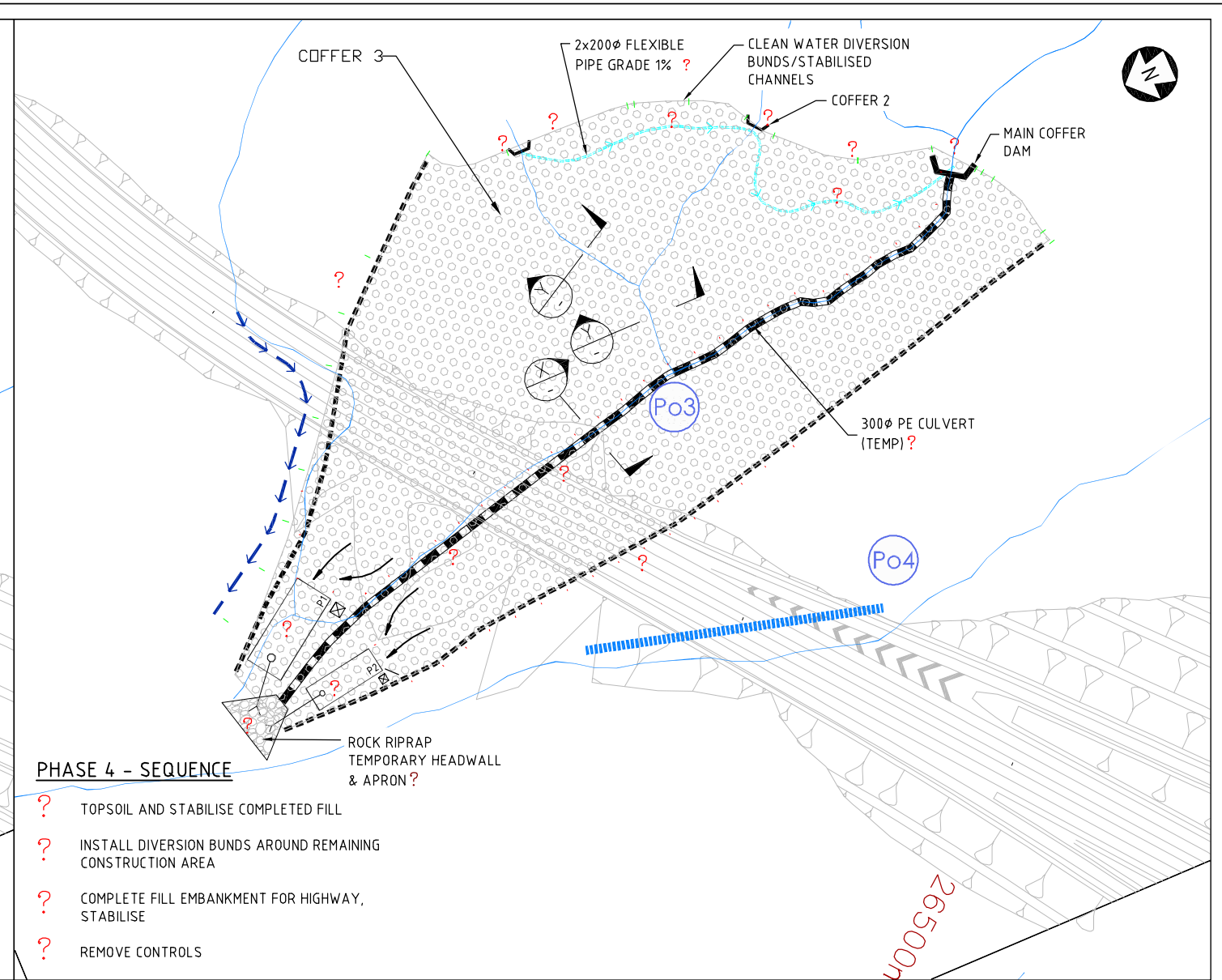
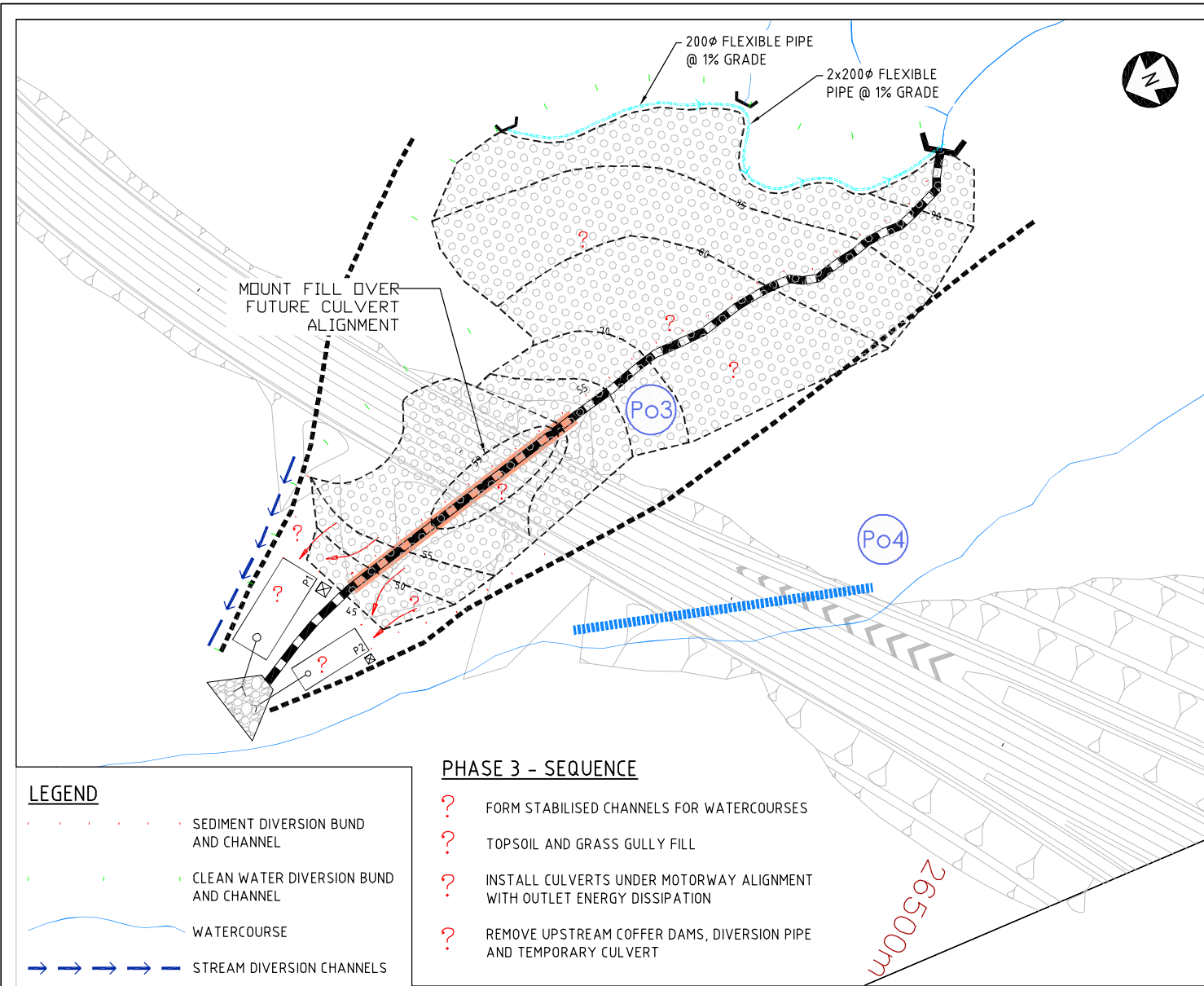
- ? CONSTRUCT DIVERSION BUNDS, COMMISSION PONDS P1 & P2.
- ? PLACE FILL IN GULLY.
- ? MOUND FILL FOR FUTURE CULVERT CONSTRUCTION.



Revision	Amendment	Approved	Date



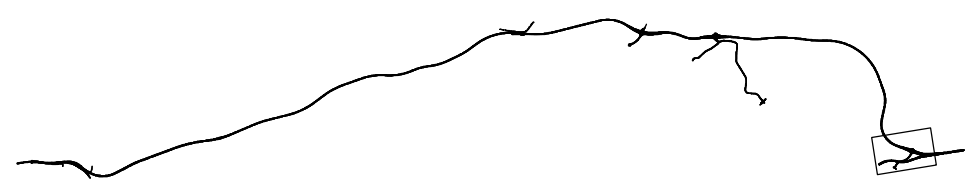
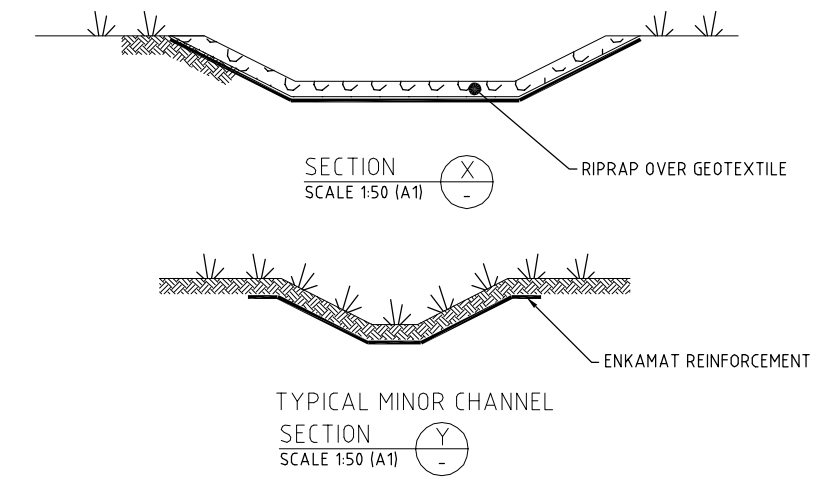
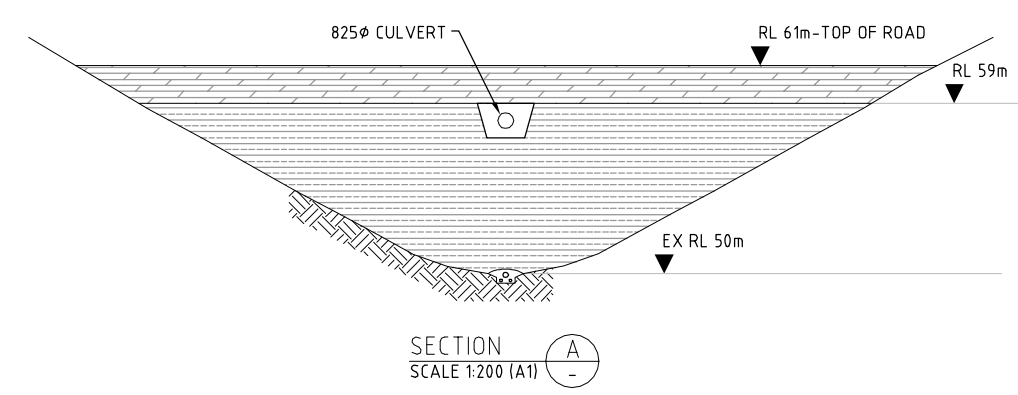
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Title: Site Environmental Management Plan Kenepuru Link Fill Site - E&SC Staging - Sheet 1	Status: For Consenting
Sheet No. SSEMP/F10	Version No. A



- LEGEND**
- SEDIMENT DIVERSION BUND AND CHANNEL
 - CLEAN WATER DIVERSION BUND AND CHANNEL
 - WATERCOURSE
 - STREAM DIVERSION CHANNELS
 - EXISTING FENCE
 - SEDIMENT POND AND FLOCCULANT SHED
 - STABILISED FINISHED CONTOUR
 - PROPOSED CLEAN FILL FINISHED CONTOUR
 - TEMPORARY CULVERT AND UNDERFILL DRAIN
 - 200φ FLEXIBLE PIPE
 - FORMED CHANNEL
 - MINOR CHANNEL
 - PROPOSED CULVERT

- PHASE 3 - SEQUENCE**
- ? FORM STABILISED CHANNELS FOR WATERCOURSES
 - ? TOPSOIL AND GRASS GULLY FILL
 - ? INSTALL CULVERTS UNDER MOTORWAY ALIGNMENT WITH OUTLET ENERGY DISSIPATION
 - ? REMOVE UPSTREAM COFFER DAMS, DIVERSION PIPE AND TEMPORARY CULVERT

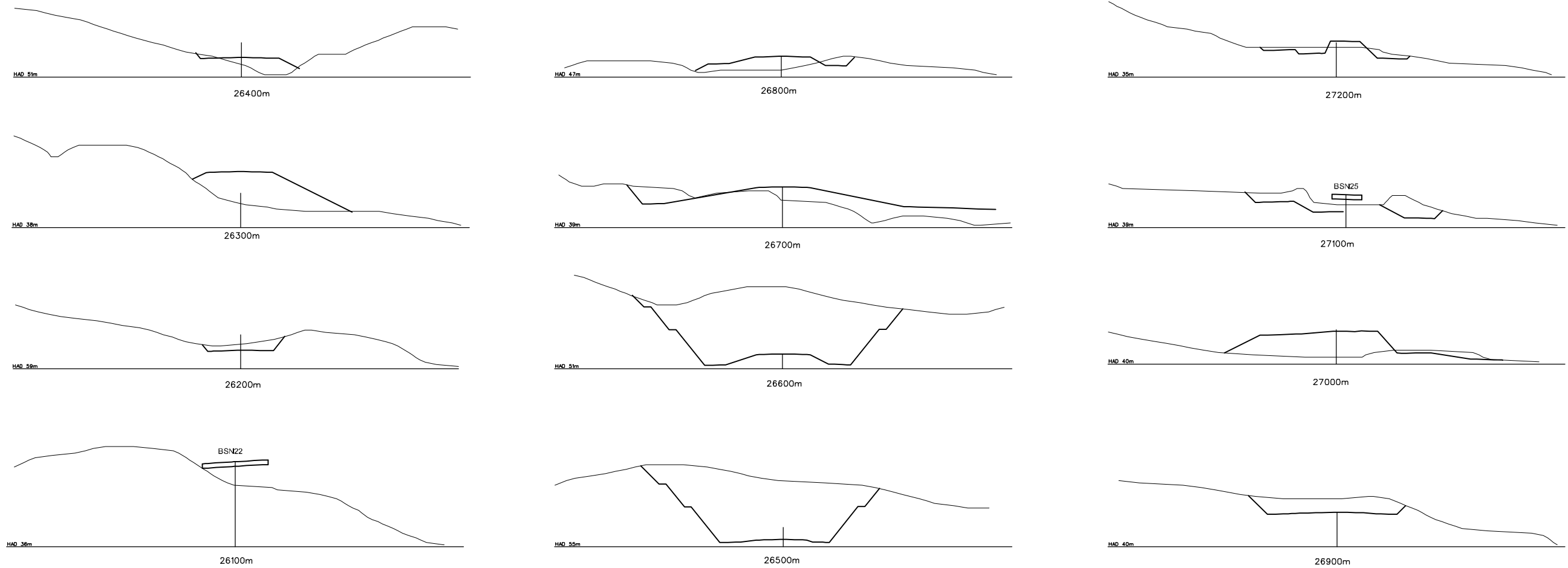
- PHASE 4 - SEQUENCE**
- ? TOPSOIL AND STABILISE COMPLETED FILL
 - ? INSTALL DIVERSION BUNDS AROUND REMAINING CONSTRUCTION AREA
 - ? COMPLETE FILL EMBANKMENT FOR HIGHWAY, STABILISE
 - ? REMOVE CONTROLS



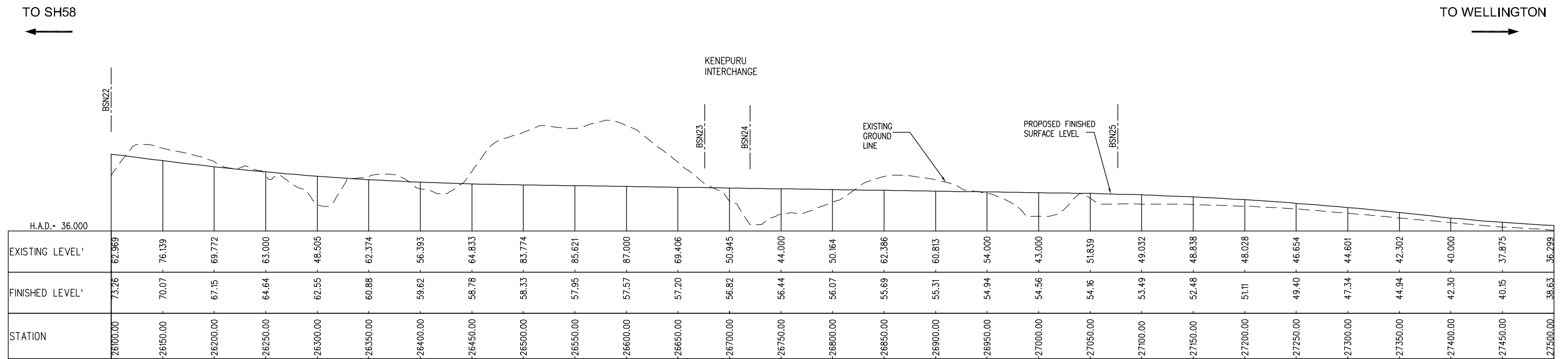
Revision	Amendment	Approved	Date



Project: TRANSMISSION GULLY PROJECT	
Title: Site Environmental Management Plan Kenepuru Link Fill Site - E&SC Staging - Sheet 2	Status: For Consenting
Sheet No. SSEMP/F11	Version No. A



CROSS SECTION - MC00
SCALE (A1): 1:500 Horiz, 1:500 Vert



LONGITUDINAL SECTION - MC00
SCALE (A1): 1:2000 Horiz, 1:1000 Vert

Revision	Amendment	Approved	Date



Project: **TRANSMISSION GULLY PROJECT**

Title: **Site Environmental Management Plan
Kenepuru Link
Long and Cross Sections**

Status:	For Consenting
Sheet No.	SSEMP/F12
Version No.	A