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Specification for Charleville Flood Mitigation

Charleville Flood Mitigation – Levee Remediation works

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Prepared for Murweh Shire Council

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1 DESCRIPTION OF WORKS

1.1 THE REQUIREMENT

This Specification is for the construction of remediation works to the existing Flood Mitigation Measures in Charleville for Murweh Shire Council, Queensland (QLD), Australia. It includes the supply of all labour, plant, equipment and materials necessary for the construction of remediation works to earthen levees, diversion channels and associated works between Bradleys Gully and the Warrego River, as shown or implied in the drawings, specification and schedules.

1.2 DESCRIPTION OF THE SCHEME

Charleville is located in south west Queensland on the eastern banks of the Warrego River. Bradleys Gully traverses through the middle of the town and joins the Warrego River approximately 6 km south of the town. It is part of the Murweh Shire local government area and is located some 740 km west of Brisbane and 200 km north of Cunnamulla.

Flood mitigation infrastructure in Charleville was built in two stage. An earthen and concrete levee on the eastern bank of the Warrego River was constructed in 2007-2008. The Bradley's Gully Scheme was constructed in 2012-2013 and comprises 4 levees and a diversion channel with a new bridge (Alfred Street Bridge) over it.

1.3 DESCRIPTION OF WORKS

The principal items of work to be executed under this Contract as described herein and as shown on the drawings, include the following:

1. Remediation of earthen levees
2. Remediation of earthen embankments/channels in Bradleys Gully.

The work conducted shall be conducted in accordance with this specification.

1.4 STANDARDS

All materials, equipment and fittings supplied shall be new, and in accordance with the requirements of the relevant Australian Standard. Throughout this Specification, "AS" shall mean Australian Standard.

If any requirement of this Specification conflicts with the Standard requirements, then the specified requirements shall apply.

Wherever an Australian Standard or Code is specified herein, it shall mean the latest edition and/or amendment of that standard/code irrespective of the particular edition referred to in this Specification. The Standard Specification referred to in this Specification shall be considered to be part of the Contract Documents insofar as they apply to the works of this Contract.

1.5 WORK EXCLUDED

Remediation to existing concrete structures (eg. Alfred Street Bridge, concrete wall portions of River Levee) is excluded from the scope. LOCATION OF WORKS

1.6 MATERIALS

All materials used in the works shall be handled, transported and stored in accordance with the relevant Australian Standard and the manufacturer's recommendations. Wherever any material or equipment is specified

by a proprietary name or by the name of the manufacturer, such Specification is used for the purpose of describing the required standard and shall be considered as if followed by "or approved equivalent".

1.7 DRAWINGS

The following Drawings are issued with this Specification and shall be read in conjunction with this Specification and shall form part of the Contract Documents:

Table 1.1 – Drawing Schedule

Drawing Number	Drawing Title
30032562-00-LP-001	FLOOD LEVEE REMEDIATION – COVER SHEET AND LOCALITY PLAN
30032562-00-DI-001	FLOOD LEVEE REMEDIATION – DRAWING INDEX
30032562-00-SW-001	FLOOD LEVEE REMEDIATION - SCOPE OF WORKS
30032562-10-GA-101	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 1 OF 7
30032562-10-GA-102	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 2 OF 7
30032562-10-GA-103	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 3 OF 7
30032562-10-GA-104	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 4 OF 7
30032562-10-GA-105	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 5 OF 7
30032562-10-GA-106	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 6 OF 7
30032562-10-GA-107	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 7 OF 7
30032562-10-TC-101	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 1 OF 3
30032562-10-TC-102	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 2 OF 3
30032562-10-TC-103	FLOOD LEVEE REMEDIATION - GENERAL ARRANGEMENT SHEET 3 OF 3

The Drawings issued with this Specification may be supplemented or superseded by such additional general and detailed Drawings as may be necessary as the work progresses.

Such additional general and detailed Drawings will show dimensions and details necessary for construction purposes more completely than are shown on the attached Drawings for all features of works. The Contractor will be required to perform the work on these features and in accordance with the additional general and detailed Drawings mentioned above, at the lump sum prices tendered for such work or work of a similar nature as determined by the Principals Representative.

The Contractor shall check all Drawings carefully before construction and advise the Principal's Representative of any discrepancies, errors or omissions, and full instructions will be furnished to the Contractor should any

discrepancies, errors or omissions be found. The Contractor shall allow at least 8 working days for the Principals Representative to issue his instruction.

1.8 SERVICES

It is the responsibility of the contractor to ensure all services are located, position marked, and hand excavated as appropriate prior to undertaking any works at the site. It shall be sole responsibility of the Contractor to locate all existing buried services prior to and during works in the area and to assess and design protection measures as required. The Contractor must seek the assistance from Authorities in confirming the location and depth of all services.

While not all services require augmentation under this contract, the Contractor is advised that as a minimum the following services are known to exist at the site:

- Telstra – Telecommunications underground cables throughout the works area;
- Ergon Energy - Overhead power lines and overhead fibre optic cable; and
- Murweh Shire Council – Pressurised water mains, pressure sewer, gravity sewer mains and sewer rising mains throughout the works area.

1.9 SURVEY

The Contractor shall, where applicable, engage qualified surveyors to undertake the setouts under this Contract and be satisfied that the setout is correct and in accordance with that required in the drawings prior to commencing works.

1.10 SITE SECURITY

The site shall be secured at all times from unauthorised access during the currency of the contract.

2 EARTHWORKS MATERIALS

2.1 GENERAL

This section identifies specification for acceptance of use of the following material types in the placement of earthworks for the works:

1) Type A: Topsoil
2) Type B: General Fill
3) Type C: Structural Fill
4) Type D: Rock Fill

No earthworks materials other than specified above shall be used on this project, unless formally agreed in writing with the Designer and approved by the Principal's Representative.

Placement of the above type materials shall occur at locations shown on the drawings.

Earthworks Materials management shall be undertaken by the Contractor. The Contractor shall be responsible for estimation of and placement of the relevant:

- Quantities of site won material available for use in the earthworks
- Quantities of material required to be imported from offsite to balance cut/ fill requirements

Materials compliance testing, documentation and facilitation of review shall be undertaken by the contractor in accordance with this specification and the design documentation.

Note that this specification does not include provision for consideration or compliance testing relating to environmental issues. Refer to relevant Environmental reports/ specifications for guidance.

2.2 TYPE A - TOPSOIL

Topsoil shall be fertile, friable soil containing organic matter which is reasonably free from subsoil, refuse, tree roots larger than 20 mm in diameter and 300 mm in length, noxious weeds, clay lumps and stones larger than 50 mm diameter.

The Contractor shall manage available quantities of topsoil to meet placement requirements.

Topsoil shall be spread over the embankments to achieve the design minimum thickness measured normal to the slope as shown on the drawings. Topsoil shall be placed at moisture content which will allow for uniform spreading and compaction.

2.3 TYPE B - GENERAL LEVEE FILL

Type B material shall be used for placement in areas specified in the drawings.

The contractor must demonstrate that any Type B material placed meets the minimum material classification (refer Clause 2.6) and placement requirements in accordance with this specification.

It is preferred that Type B materials comprise naturally formed material won from cuttings or borrow pits. If material mixing or treatment is required to allow material to conform to this specification, the contractor shall submit details to the Designers Site Geotechnical Representative (DSGR) for review and approval. Review and approval of mixed or treated material to be used as Type B material shall constitute a **HOLD POINT**.

The fill shall not contain any organic material, rocks, stones or any other hard materials that can retain on 75mm sieve size or any other unsuitable material, which could prejudice the integrity of the levee.

2.4 TYPE C - STRUCTURAL FILL – NOT USED

Type C material (Structural fill) shall be used for placement in areas specified in the drawings where special performance is required. Such areas include backfill around culverts and pipes penetrating through the levee. At these locations, low permeability, non- dispersive, fill shall be used to limit and mitigate preferential flow of water along the line of the pipe and through the levee. If non-dispersive fill is unable to be sourced economically, consideration may be given to using type B fill modified with 2-3% lime. If this option is desired, the contractor shall submit a proposal to the designer detailing mixing trials, validation and testing proposed to demonstrate acceptability of the revised material.

The contractor must demonstrate that any Type C material placed meets the minimum material classification and placement requirements in accordance with this specification.

2.5 TYPE D - ROCK FILL

Type D material (rock fill) shall be used for placement in areas specified in the drawings where it is sought to provide erosion/ scour resistance for the works. Type D fill shall comprise material that is clean, hard, dense, durable, resistant to weathering, free from overburden, spoil, shale and organic matter. Laminated, fractured porous or physically weak rock shall not be used.

The contractor must demonstrate that any material placed in designated Type D area meets the minimum material classification and placement requirements in accordance with this specification.

2.6 TYPE E- SAND BLANKET – NOT USED

Type E material (Sand blanket) shall be used for placement in areas specified in the drawings where it is sought to provide a vapour barrier for the cohesive apron on the water side of type C, D and E levees.

The contractor must demonstrate that any material placed in designated Type E area meets the minimum material classification. Type E fill shall comprise material that is free from spoil, topsoil and organic matter. Placement shall involve pushing fill in place in 2 layers followed by compaction with earthmoving machinery to achieve a minimum 70% relative density. It is anticipated that flooding will be required to achieve the minimum density, which shall be verified on site. The minimum frequency of testing to validate the minimum density shall be 1 test per 10m along the apron. Correlation by the DSGR via dynamic cone penetrometer testing is deemed an acceptable assessment method.

2.7 MATERIALS CLASSIFICATION

This Section defines acceptability criteria for the various types of earthworks materials that will be used in the works, based on material classifications. Materials used in the earthworks shall conform to the requirements shown in Table A1 (Appendix A).

3 EXCAVATION

3.1 GENERAL REQUIREMENTS

Prior to commencement of clearing or excavation the Contractor shall make all enquires and investigations for the protection of services from damage and construct all temporary or permanent re-arrangements required under any of the relevant clauses of the General and Special Conditions of Contract and the relevant Authorities. The Contractor shall indemnify the Principal and the Principals Representative relating to the Contractor's failure to undertake necessary arrangements, which result in damage to the services.

3.2 PROGRAM

The Contractor shall not commence excavation for the Works, until in the opinion of the Principals Representative, sufficient plant and material are available at the site to ensure satisfactory, safe and uninterrupted progress of the works.

Some of the work is to be undertaken on private property. The Principal's Representative shall make all necessary enquiries and obtain relevant approvals to facilitate the proposed works within private property. At least seven days' notice to the Principal's Representative of the requirement to commence work within each property is required as a minimum.

3.3 PROTECTION OF SERVICES

In preparation for any excavation work, the Contractor shall carry out field investigation in association with the relevant Authorities and property owners to locate and mark the exact positions and routes of all services in the area of works. It is the Contractor's responsibility to gain accurate information regarding the depth, size, alignment and other services that may be in close proximity. Special precautions shall be taken where excavations are made near any other services. These include overhead power cables, underground power and telecommunication cables, drains, sewers and water mains and the like. For these assets and any other services not specifically mentioned, the Contractor shall:

- Comply with the notification requirements of the construction conditions on the Design Drawings.
- Take special care to ensure that the services are protected in accordance with the conditions specified by the controlling Authority.

- Arrange for a representative from the controlling Authority to be present, unless the Authority directs otherwise, whenever the Contractor is:
  - Proving the locations of services.
  - Excavating within one (1) metre of the service.
- Arrange with the appropriate Authority for the closure and subsequent restoration of any service that must be shut down while the Works are in progress.
- Adopt a method for uncovering and protecting the service from damage if the service must be uncovered and left exposed, to the satisfaction of the controlling Authority.
- Immediately inform the owner or controlling authority of any damage or interference to any service, structure or property.
- Carry out any temporary bypass and restoration of the services to the satisfaction of the respective Authorities and property owners.

It shall be noted that the assessment and location of services does not comprise part of the specification. Accordingly, the contractor shall take all necessary measures to assess, measure control and mitigate impacts of services on the works and vice versa.

Existing services passing under or through the proposed levee shall be excavated and backfilled in accordance with the design drawings.

Hand excavation shall be used in close proximity to all such services until the exact location is determined.

Excavations containing underground services shall be backfilled so that the sub-grade is restored as nearly as possible to its original state of compaction. Where selected backfill has been placed by other utilities and has had to be removed, it shall be replaced by the same type of selected material. All backfill shall be carefully deposited in the trench and around the utility service in layers and adequately compacted by appropriate hand rammers and tampers, or by use of effective mechanical equipment.

Extra care shall be taken by the Contractor to re-compact excavations near existing underground pipework, so that foundations of that pipework are restored.

The Contractor shall be responsible for any damage caused to existing services. The Contractor shall notify owners of utility services that are damaged by construction activities.

Before commencing excavation, the Contractor shall ensure adequate measures are taken to protect or to temporarily remove any obstructions which may exist on or adjacent to the service centreline.

3.4 PROTECTION OF PROPERTY

The Contractor shall protect the property and infrastructure outside the limits of the works.

All care shall be taken to ensure that all properties etc. within and adjacent to the construction site shall not be damaged during the contract. The Contractor shall be responsible for any damage caused and costs incurred.

3.5 ALIGNMENT AND SETTING OUT

Setout for the components of the Remediation Works is provided on the drawings.

3.6 CLEARING AND GRUBBING

Materials removed in the clearing operations shall be mulched or otherwise disposed of as approved by the Principals Representative and relevant local statutory Authorities. All materials to be mulched shall be piled, cut and split if necessary and when in a suitable condition shall be mulched.

Grub holes formed in the foundation area of any items in (1) above shall be filled and compacted using the material and method of compaction specified for the embankment as described in this specification.

3.7 STRIPPING

The entire area where fill is to be placed shall be stripped to remove all topsoil and unsuitable materials. The unsuitable materials shall include all debris, very loose, loose, soft or firm material, clean sand and gravel, topsoil, vegetation and root affected material and all other perishable and or objectionable materials that may be unsuitable for use for permanent construction required under this Specification or support the proper compaction of the materials in the embankments.

Topsoil so stripped shall be temporarily stockpiled to be spread on newly filled and compacted surfaces to establish a vegetative cover.

Other material so stripped and excavated shall be stockpiled for rehabilitation of the borrow pits or offsite disposal as directed by the Principals Representative.

Stockpiles shall be in maximum 2 metres high, with 2 horizontal to 1 vertical slopes or disposal of as directed.

3.8 SECURING EXCAVATIONS

The Contractor shall be responsible for securing all excavations against movement by means of:

- Stable batters
- Timbering
- Sheet Piling
- Protective Shields

or such other methods or combination of methods that will ensure the safety of all employees, the Public, animals and the protection of the Works, and public and private property. Should the Principals Representative determine that any excavation requires timbering, sheet piling or shields as necessary for security then the Contractor shall provide such measures as the Principals Representative may direct.

The Contractor shall provide protection for persons and animals as set out in the General and Special Conditions of Contract.

The Contractor shall make adequate provision for the protection of persons and livestock from injury liable to arise from the presence of the open excavation.

Removal of trench supports shall be carried out in a safe manner.

3.9 DISPOSAL OF SURPLUS SPOIL

Notwithstanding the requirements of this “Specification”, any material surplus after completion of all earthworks, backfilling and site grading, together with any rejected or unsuitable material shall be disposed of at locations approved by the Principals Representative. Dumped spoil shall be placed, spread, levelled and compacted.

4 GROUND PREPARATION – NOT USED

4.1 PROOF ROLLING

The following areas shall be proof rolled:

- All foundations for embankments prior to placement of any fill material

- Over all of the formation at design cut floor level
- Over cut-fill transition zones

Proof rolling for cut and fill areas:

- Shall be conducted prior to any hauling or further material placement over the prepared area
- Shall be conducted within 2 days of stripping

Equipment nominated for use in test rolling procedures shall comply with the following requirements:

- Static smooth steel wheeled rollers shall have a mass of not less than 12 tonne and load intensity under either the front or the rear wheels of not less than 6 tonne per metre width of wheel.
- Pneumatic tyred plant shall have a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre. The area over which this ground contact pressure shall be applied shall not be less than 0.035 m^2 per tyre.
- Compliance with the test rolling requirements shall be when an area withstands test rolling without visible deformation or springing. Material which is observed to deform or spring under loading is deemed unsuitable material.

4.2 UNSUITABLE MATERIAL

Where unsuitable material is encountered the Contractor shall submit to the DSGR and Principals Representative for review the proposed in-situ treatment or extent of excavation required based on as encountered ground conditions.

Unsuitable material is defined as material which, in its current position and state, is unsuitable for the support of layers of fill or pavement. It is identified by:

- Deformation, rutting, softness, yielding, distress, or instability under proof rolling or the loading from construction machinery

- A visual assessment of its properties, such as organic content or moisture content, which indicates that it will be unsuitable for its intended use

- Material that is of variable strength and/or compaction, loose, wet, soft, firm, containing high permeability layers, organics, roots, fissuring

5 PLACEMENT AND COMPACTION OF EARTHWORKS

Each load of the materials placed, whether from excavation or stockpile, shall be placed so as to secure, in the levee, the best distribution of the material and avoid pockets of non-homogeneous materials.

Layers of material shall not differ substantially from the surrounding material in the zone and the density shall be uniform throughout each compacted layer.

When each layer of material has been prepared in accordance with this sub clause, it shall be compacted and tested.

Delivery of imported material shall comprise a **HOLD POINT**.

Verification of conformity of selected material shall comprise a **HOLD POINT**.

Placement and compaction of earthworks shall be completed in accordance with Table A2 (refer Annexure A).

Appropriate dust suppression measures shall be implemented by Contractor.

6 TESTING AND ACCEPTANCE OF EARTHWORKS

The contractor shall supply written verification that the minimum requirements have been complied with and supply the verification with the lot package. All testing shall be conducted and verified by a NATA accredited NATA Geotechnical testing authority. Level 1 supervision of the works shall be undertaken in accordance with the requirements of AS3798-2007. Verification details shall be submitted to the Principals Representative for review and acceptance of each lot.

The minimum requirements are presented in respect to material properties, earthworks levels and position, and earthworks placement and compaction. All test results and associated verification reports shall be submitted to the Principals Representative for review prior to completion of the contract. This shall constitute a **HOLD POINT**.

At least 2 working days prior to commencement of earthworks, the contractor shall submit an inspection and testing plan to the Principals Representative for review and approval. This shall constitute a **HOLD POINT**.

Minimum Testing and Acceptance criteria for Earthworks Materials shall be undertaken in accordance with Table A3 (Appendix A).

Earthworks Levels and Positions shall be constructed to levels as shown on the Drawings. Acceptable tolerances for Earthworks Levels and Positions are as per Table A4 (Appendix A).

Testing and acceptance of Earthworks with respect to placement and compaction, shall be undertaken in accordance with Table A5 (Appendix A).

7 HOLD POINTS

Table A6 (Appendix A) summarises requirements for Hold Points that are relevant to this specification.

8 LANDSCAPING

8.1 GENERAL

The batters of the levee are to be covered with topsoil and hydromulched so as to provide low maintenance, long term stabilization of the surface against erosion and to provide acceptable appearance to the area.

The restoration works includes, but is not limited to:

- Supply of topsoil (or reuse of stockpiled topsoil as appropriate), topsoil, hydromulching and water.
- Spreading, fertilising and cultivating topsoil.
- Temporary stabilisation of surfaces prior to grass growth.
- Maintenance of grassed areas for the duration of the Defects Liability Period. Maintenance will include, but not limited to, watering, application of fertiliser and cultivating the grass as appropriate.

8.2 GRASS TYPE

Grass seeds shall comprise endemic species suitable for the local climate, with preference given to non-clumping varieties. Application shall occur at a rate of 1.5 kg per 100 m^2.

8.3 FERTILISER

All fertilisers shall be pre-packed and certified commercially prepared mix, having a N:P:K ratio of 8:4:10 (commonly known as 'orchard fertiliser') and shall be delivered to the site in standard bags showing weight, composition and vendor's name and be available for inspection on site.

Fertiliser shall be applied at a rate of 50 g/m^2.

8.4 SUB-GRADE PREPARATION

The Contractor shall prepare sub-grades prior to the spreading of topsoil as specified below.

Spray existing weeds with herbicide Glyphosate in any of its registered formulations at the maximum rate specified on the label for the control of weed(s) two weeks before cultivation. Areas to be ripped shall not be worked when sub-soil is wet or plastic.

Allow for clearing and removing stones exceeding 25 mm and any rubbish brought to the surface during cultivation.

Trim surfaces to shape after cultivation.

9 EROSION PROTECTION

Where specified on the drawings additional erosion protection is required above the protection provided by a grassed surface. Two different erosion protection treatments have been specified:

1. Rock Protection (Type D material)
2. Geotextiles

9.1 ROCK PROTECTION

Rock protection shall be constructed in the locations and in accordance with the Drawings.

Rock shall have a uniform appearance overall and shall not have noticeable overall irregularities in horizontal and vertical alignments.

The overall thickness as installed shall not be less than twice the D_{50} of the rock.

Rock shall be placed in a manner which ensures that the larger rocks are uniformly distributed throughout the protection works and that the smaller rocks effectively fill the spaces between the large rocks without leaving any large voids. The layers of placed rock shall be of even thickness and of even grading.

The placing operations shall minimise the chances of rock running loose and damaging adjacent areas. Rock deposited in areas outside the rock protection zone shall be recovered.

9.2 GEOTEXTILES

9.2.1 General

Two different types of geotextiles have been specified on the drawings:

1. TEXCEL R (Geofabrics) Marine grade non-woven geotextiles – 400R or equivalent
2. Concrete Canvas (Geofabrics) – CC5^{TM} or Equivalent

9.2.2 Submittals

1. Certification
    a. The Contractor shall provide the Principals Representative a certificate stating the name of the geotextiles manufacturer, product name, style, chemical compositions of filaments or yarns and other pertinent information to fully describe the geotextile.
    b. The Manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request.

c. The manufacturer's certificate shall state that the furnished geotextiles meets MARV requirements of the specification as evaluated under the manufacturer's quality control program. The certificate shall be attested to by a person having legal authority to bind the Manufacturer.

2. Manufacturing Quality Control (MQC) test results shall be provided upon request.
3. Independent Performance Test Results shall be provided upon request.

9.2.3 Delivery, Storage, And Handling

1. Geotextile labelling, shipment and storage shall follow ASTM D 4873.
2. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number.
3. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.
4. Each geotextile roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants.
5. The protective wrapping shall be maintained during periods of shipment and storage.
6. During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: Site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, chemicals that are strong acids or strong bases, flames, sparks, temperatures in excess of 71 deg C (160 deg F)m and any other environmental condition that might damage the geotextiles.

9.2.4 Quality Assurance Sampling, Testing, And Acceptance

1. Geotextile shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with ASTM D 4354.
2. Acceptance shall be in accordance with ASTM D 4759 based on testing of either conformance samples obtained using Procedure A of ASTM D 4354, or based on manufacturer's certifications and testing of quality control samples obtained using Procedure B of ASTM D 4354.
3. Quality Assurance Sampling and Testing will be waived for ISO 9001:2000 Certified Manufacturing Facilities. Documentation of ISO 9001:2000 Certification shall be provided upon request.

10 LEVEE MONITORING AND MAINTENANCE

10.1 MONITORING

Prior to the end of the Defects Liability Period, an inspection of the entire levee system should be undertaken by the Designer and Principals Representative. From consideration of the significance that the role the levee and diversion system play in protecting the community of Charleville, it is recommended that the Principal arrange for a maintenance strategy to be developed to ensure adequate performance of the levee system. It is recommended that this strategy comprises development of an operations manual in combination with regular inspections and maintenance.

Regular yearly inspections are recommended to be carried out by experienced personnel and cover all associated works and identification of any issues that may affect the serviceability or performance of the levee system (burrow holes, trees, scouring, piping, seepage, weed build up etc.). Particular attention should be paid to drainage structures, valves etc. and associated earthworks, to ensure the system is functioning correctly. The documented results from the annual inspection can then be used as an input for a maintenance program, which will facilitate timely levee maintenance.

Maintenance operations to be undertaken include repair of batter slumps, revegetation, mowing, and removal of trees, filling of burrow holes and depressions and crest maintenance. Particular monitoring and maintenance of the surface protection system immediately following construction is particularly important, at a time when a thick vegetative mattress has not fully established. Replanting and other associated maintenance will likely be required following the initial wet season. Crest maintenance is recommended to maintain design levee height and to prevent development of ruts and potholes, which avoids water ponding and potential development of pipes.

Grazing of vegetation on the levees or diversions is not recommended as this will impact on the coverage of vegetation.

It is recommended that during exposure of the works to a flood event (and particularly during first exposure), the Principal arrange for the following monitoring inspections to be conducted by appropriately qualified personnel:

1. Daily inspections of town side foundations and batters to detect potential failure mechanisms (for example seepage, boiling, piping and heaving)
2. Inspection of downstream culvert inlets/ outlets to detect potential failure mechanisms (scouring, seepage, boiling, piping and heaving)

It is recommended that relevant details are recorded and photographed for use in the development of remediation and/ or maintenance plans.

Following receding of the flood event, a detailed inspection and condition assessment is recommended to be undertaken by appropriately qualified personnel.

Remediation of scoured areas will be required to be undertaken by the Principal, particularly if flooding occurs prior to full establishment of vegetation.

10.2 TURF MAINTENANCE

The Contractor shall maintain all grassed areas for the whole of the Contract Period and the Defects Liability Period.

Such maintenance shall include:

- Irrigation
- Mowing to encourage a spreading habit of growth. Generally, grass shall be kept at a height of less than 150 mm
- Such practices or work as are necessary to eliminate pests, disease or weed infestations
- Fertilising

Levee grasses should be inspected for healthy growth and treated for any deficiency in topsoil or chemical imbalance. (This assumes that sufficiently regular watering for enhancing growth has been maintained).

All water used for watering of seed as appropriate shall be obtained from approved sources and be free of chemicals or compounds toxic to plant growth.

11 GENERAL TESTING REQUIREMENTS

11.1 GENERAL

1. All materials, equipment, installation and workmanship included in the works of this Contract, shall be tested and inspected to prove compliance with the Contract requirements. An approved alternative to testing to the specification and relevant codes will be the furnishing of a certificate of compliance with the specification or code.

2. Tests and inspections, unless otherwise specified or accepted shall be in accordance with the following order of precedence:
   a. This specification
   b. Relevant TMR standard
   c. Relevant Australian Standards
   d. If no AS standards are applicable, then those of the British Standards Institution shall be used).

3. The Contractor shall at all times give to the Principals Representative a minimum of one day's prior notice of all tests and inspections.

4. Specific test requirements for the various items of work and equipment are covered in the relevant sections of this Specification and design drawings.

5. At all times when tests are in progress the Contractor shall have at least one suitably qualified and NATA or equivalent approved representative present.

6. All test results shall be suitably signed by a suitably qualified and NATA or equivalent approved representative and submitted to the Principals Representative within 5 days of the completion of the testing.

11.2 EQUIPMENT FOR TESTING

1. The Contractor shall carry out all tests nominated in the Specification and the design drawings and all labour, materials, temporary works and equipment necessary for the tests shall be provided by and at the expense of the Contractor. It will also be the Contractor's responsibility to make any necessary temporary connections in order properly to carry out all specified testing procedures.

2. NATA or other approved authority shall certify measuring and metering equipment. The Contractor at his expense shall provide all electrical power, compressed air or chemicals required for testing purposes.

12 ABORIGINAL ISSUE MONITORING

12.1 GENERAL

The Contractor shall develop the Project Environmental Management Plan (PEMP) and detail the provisions and requirements for Aboriginal Project monitoring during construction within this document.

The provision of all works necessary for monitoring for Aboriginal significance at the site is the responsibility of the Contractor.

13 ENVIRONMENTAL MANAGEMENT

13.1 GENERAL

The Contractor shall develop and implement a Project Environmental Management Plan (PEMP) which shall comply with the Environmental Management Systems Guidelines as outlined in the Preliminaries and the following sections of this Specification. It is noted that this may include development of a Review of Environmental Factors (REF) for the project site to ensure all relevant legislative and other requirements are identified by the construction team.

13.2 IMPLEMENTATION

The Principals Representative is responsible for:

- Ensuring that the Contractor’s PEMP meets the requirements of the Contract Documents.
- Auditing the Contractor's implementation of the PEMP and for issuing corrective action requests to the Construction Contractor as appropriate.
- The Construction Contractor is responsible for preparation of a PEMP, which states the Contractor's policy and methods of implementation for:

- Compliance with all relevant local, state and Commonwealth environmental legislation, guidelines, permits and licences and industry codes of practice.
- Design of temporary environmental measures to mitigate any unfavourable environmental impacts.
- Construction, operation, maintenance and monitoring of all environmental measures during construction and the relevant defects liability period.
- Reporting and correcting non-conformances during construction and the relevant defects liability period.
- Correcting matters raised by the Principals Representative on corrective action requests.

The PEMP must be submitted by the Contractor and approved by the Principals Representative at least seven (7) days prior to the commencement of construction works.

The Principals Representative will be responsible for periodic monitoring and auditing, reporting the results and issuing Corrective Action Requests (CAR).

CAR will specify the non-conformance and require the person/organisation responsible to state the corrective action being taken and its time of completion and, in addition will require a statement of preventive actions to ensure that similar non-conformances do not occur.

13.3 REPORTING

An Environmental Management File (EMF) is to be maintained by the Construction Contractor and should contain all documentation pertaining to environmental management of the project. The EMF should take the form of a traditional correspondence file and/or are readily retrievable, upgradeable and suitably protected computer file. The Construction Contractor shall undertake weekly inspections of the construction area to identify non-conformance with construction phase actions. A report providing details of these inspections is to be maintained on the EMF.

The Construction Contractor shall prepare a monthly report including a description of monitoring activities, non-conformance notices and corrective action notices (both completed and pending). A monthly report shall be made available to Principals Representative for review and comment.

During construction, the Construction Contractor's Environmental Representative will make daily visual inspections of the site and any discharges from the site.

The Construction Contractor and any Subcontractors shall report any non-conformance with the PEMP to the Principals Representative. Reporting shall be done immediately after the non-conformance has occurred.

The Construction Contractor is responsible for carrying out preventative action and corrective action resulting from a non-conformance.

13.4 TRAINING, AWARENESS, COMPETENCE

All activities on the project which have a potential to cause environmental harm will be identified and personnel competent to carry them out without causing environmental harm will be selected or, alternatively, others will be given specific training and assessed for competency.

All staff will be trained and assessed in environmental responsibilities.

It will also be emphasized that compliance with the PEMP does not remove the responsibility of compliance with the law.

13.5 SAMPLING, ANALYSIS, MEASUREMENTS

The Manuals published by the QLD Environment Protection Authority will be utilised where they apply.

Laboratories will be selected for their certification by NATA or other accrediting body. Samples will be taken, and measurements made by persons with the necessary training and competence.

Control and calibration of measuring equipment will be as set out in the equipment manuals, the EPA manuals or Australian Standards as appropriate. Records of calibrations will be kept.

13.6 STANDARDS, LEGISLATION, GUIDELINES

Compliance with the PEMP shall be made a condition of acceptance of the contract to work on the site by any Contractor or Subcontractor.

The Construction Contractor will plan and execute the construction to prevent or minimise environmental harm and in accordance with best practice environmental management as required by the Protection of the Environmental Operations Act 1997.

The following minimum standards apply to monitoring and auditing of performance. Subject to development of the CEMP by the contractor, additional standards may be required to be adopted.

Table 13-1- List of Statutory Regulations

Item	Regulation
Water	Protection of the Environment Operations (General) Regulation 1998 Australian Water Quality Guidelines for Fresh and Marine Waters – ANZECC. Approved Methods for the Sampling and Analysis of Water Pollutants in QLD
Soils	Contaminated Land Management Acct 1997 Contaminated Land Management Regulations 1998 ANZECC/NHMRC – Guidelines for the Assessment and Management of Contaminated Sites.
Air	Protection of the Environment Operations Act 1997 Protection of the Environment Operations (General) Regulation 1998 AS3580 Methods of Sampling and Analysis of Ambient Air.
Noise and Vibration	Protection of the Environment Operations Act 1997 Protection of the Environment Operations (General) Regulation 1998 QLD EPA Noise Manual AS1055.1 and AS1055.2 Acoustics - Description and Management of Environmental Noise. AS2436 Guide to Noise Control on Construction, Maintenance and Demolition Sites. AS2659.1 Guide to the Use of Sound Measuring Equipment. AS2659 Sound Level Meters.
Flora and Fauna	Threatened Species Conservation Act 1195

	Native Vegetation Conservation Act 1997 Noxious Weeds Act 1993
Cultural Heritage	Heritage Act 1977 Heritage Regulations 1999
Contaminated Land	Contaminated Land Management Act 1997 Contaminated Land Management Regulations 1998
Dangerous Goods	Dangerous Goods Act 1975 Dangerous Goods (General) Regulation 1999 Environmentally Hazardous Chemicals Act 1985 Environmentally Hazardous Chemicals Regulation 1994 AS1216 Classification, Hazard Identification and Information Systems for Dangerous Goods. AS1678 Emergency Procedure Guides - Transport AS1940 Storage and Handling of Flammable and Combustible Liquids. AS2508 Safe Storage and Handling Information Cards for Hazardous Materials. AS2809 Road Tank Vehicles for Dangerous Goods. AS2931 Selection and Use of Emergency Procedure Guides for Transport of Dangerous Goods.
Soil Erosion and Sediment Control	BCC guidelines for erosion and sedimentation control `Urban Erosion Sediment Control' (Department of Conservation and Land Management, 1992). Soil Erosion and Sediment Control – Engineering Guidelines for Construction Sites - Institution of Engineers 1996.

13.7 INTERPRETATION

- Principal means the Murweh Shire Council
- Principals Representative means the person authorized by the Principal, to act with the full authority of the Principal. For the purposes of this Specification, the Principals Representative is Evan O'Brien, or any other engineer appointed by SMEC and as advised to the Principal in writing.
- Defects Liability Period means the period during which the Construction Contractor is responsible for making good defects in a part or the whole of any works. The Defects Liability Period shall also include routine maintenance items.
- The contractor means the companies appointed by Murweh Shire Council under their panel of providers arrangement to complete the works.
- Routine Maintenance comprises:
  - Cleaning signs.
  - Litter collection.
  - Repair of Collateral Road Damage.
  - Repair Eroded Areas.

- Maintenance of revegetated areas (ie. watering, weed control etc)
- Maintenance of temporary fencing
- Maintenance of environmental mitigation devices

- Project Environmental Management Plan (PEMP) means a detailed program of works and measures documented and carried out by the Construction Contractor in accordance with the relevant provisions of the Contract and relevant government and legislative requirements.

13.8 PEMP ELEMENTS

The following elements are considered the minimum requirements for the PEMP.

13.8.1 Erosion Control, Stormwater & River Water Quality Management & Monitoring

The Contractor shall determine the control measures appropriate to the site of the works. Prior to the commencement of the project works, the Contractor shall prepare an Erosion and Sediment Control Plan in consultation with the Murweh Shire Council and the Department of Land and Water Conservation for the project.

Management measures shall incorporate the following items:

- Local stormwater runoff from the undisturbed area upstream of the site should be diverted away from the construction site and discharged to the existing open drain via erosion stabilised locations.
- Filtering devices, silt and sediment traps and other devices shall be utilised to prevent sediment, turbidity and other pollutants which result from the works being discharged into the Warrego River and Bradleys Creek.
- Minimise the alteration of the existing drainage patterns in undisturbed areas.
- Drainage from construction sites shall be passed through sediment traps in the stormwater drainage. Examples of sediment traps include hay bales, geo-textile fabric filter fences and silt traps. Construction of temporary sediment fences and catch drains to be undertaken in accordance with Murweh Shire Council's "Guidelines for the Control of Soil Erosion and Sedimentation on Building and Development Sites" or guidelines from relevant Authorities.
- The extent of disturbance shall be the minimum required for construction activity or that provided in the permit, whichever is the lesser. This can be achieved by construction planning and undertaking the works in stages followed by prompt revegetation and rehabilitation of completed levee sections and the disturbed areas under the old levee sections.
- Identify and delineate no-go or limited access areas.
- Revegetation of completed earth levees, borrow areas and all other disturbed areas should be undertaken immediately after completion of construction.
- The completed earth levees shall be vegetated with a hardy, erosion resistant grass as specified. The vegetation of the batters will include techniques appropriate to earth embankments.
- Topsoil stockpiles shall be located on flat ground at least 5 metres away from areas subject to run-off and away from established flowpaths (eg. drains, gutters, etc.). The height of the stockpiles shall not exceed 2 metres, unless stockpiles are suitably protected from wind erosion. The Contractor shall protect temporary topsoil spoil stockpiles with diversion drains, silt fences and straw bales to prevent sediment loss.
- The Contractor shall be required to clean any machinery which has operated or travelled through an area where declared plants are present in accordance with the guidelines under the Rural Lands Protection Act and to collect this wash down water to allow silt and seeds to settle. The silt and seeds will be buried under at least 1 metre cover. Any declared plants, which emerge in the settling basin, will be destroyed.
- Tracking of sediment from the construction site via construction equipment onto the road shall be minimised. The Contractor shall be required to clean any machinery in a designated washdown area to prevent tracking of sediment off site.
- Washout of concrete trucks and cleaning of equipment and/or vehicles used during construction shall not be undertaken in locations that permit flow of untreated wastewater directly to the open drainage system.

- Stormwater from the construction site shall be collected and treated via sediment control structures prior to discharge off site.
- The design of any works by the Contractor shall minimise obstruction to normal and flood flows in the creeks and shall provide for protection against scour by floods.
- Stores of oils, paints, fuel, etc. will be contained in accordance with AS1940 so that no contaminants pollute land or waterways.
- At completion of construction the area shall be cleared of potentially polluting materials.
- Inspections of the construction area and periodic observations of work practices shall be undertaken daily to identify any potential problems.
- A Water Quality Monitoring Program shall be undertaken throughout construction that ensures that any water discharged into the Warrego River or the existing drainage system during the construction phase is of equal or better quality than that flowing in the river at the time. Sampling of local stormwater during and immediately after the event should be undertaken before it discharges from the site into the open channel drain and the Warrego River. Proposed parameters to be included in event monitoring are:

Table 13-2 Water Quality Parameter

Parameter	Exceedance Value	Sampling Frequency
Dissolved oxygen	>6 mg/L or > 80% saturation, unless natural level lower.	Following rainfall events and during discharge of stormwater from the site
Turbidity	<5 NTU or less than 10% increase from background.	
Suspended Solids	50 mg/L or less than 10% above background.	
Oil and grease	no visible film from site activities.	

13.8.2 Traffic and Air Quality

The Contractor is responsible for ensuring that construction traffic and activities result in minimum impact on air quality.

The Contractor shall utilise best management practices and policies to minimise dust from construction including:

- Comply with the POEO Act.
- The contractor shall ensure that dust in the atmosphere complies with Occupational Health and Safety requirements.
- Maintain a water truck on site to wet down working areas and haul routes as required.
- Access roads and earthworks, including spoil heaps and stockpiles of sand, shall be watered or covered as required to minimise dust emissions. The use of waste oil for dust suppression will be strictly prohibited.
- Ensure that all vehicles and equipment are fitted with appropriate exhaust control measures and are adequately maintained in line with manufacturer's requirements.
- Enforce the covering of trucks transporting earth and fill materials where dust could be generated.
- Sealed public roads where trucks leave the construction site are to be checked daily for mud/dust and cleaned as necessary.
- Where practical, a stable surface will be provided for main haul routes in the construction area and maintained to minimise dust. When necessary, the Contractor shall water these surfaces on Sundays and public holidays as required by weather conditions.

- Appropriate speed limits over unsurfaced roads shall be established and enforced.
- Burning of any waste arising from construction activities is prohibited.

13.8.3 Noise and Vibration Management

The contractors shall ensure that noise and vibration on the site are within acceptable limits as set out in the relevant QLD legislation and guidelines.

The contractor shall utilize best practices and policies to minimize noise from construction including:

- All construction plant is to be fitted with current best practice noise control and attenuation devices and maintained and operated to ensure that noise emissions are minimized.
- Permission is to be obtained from the Principals Representative for any work outside the standard hours and the conditions in the permit will be observed.
- Blasting is not expected to be required at the site.
- Noise and vibration levels are to be measured by the Construction Contractor, as required by the Principals Representative.
- Occupational Health and Safety Act requirements for noise and vibration are to be met and appropriate Codes of Practice followed.
- Ensure vehicles and construction equipment is maintained within service guidelines to minimise noise emissions from malfunctioning equipment.

13.8.4 Flora and Fauna Management

The Contractor shall ensure that construction activities are carried out in a manner that minimises the impact on flora and fauna.

The Contractor shall undertake activities including:

- Implementation of the revegetation principles as described in the Specification.
- Minimise area disturbed by construction activity and use temporary fencing to delineate construction areas from protected areas. The extent of disturbance will be the minimum required for the construction activity or that prescribed in the permit whichever is the lesser.
- Contractor shall advise the Principals Representative of any areas the Contractor proposes to clear and to mark the boundaries of clearing.
- Minimising the destruction of flora and interference with fauna.
- Declared plants and exotic flora and fauna shall not be introduced to the site and any that are accidentally introduced will be destroyed, using approved non residual herbicides applied by a licensed operator. Use herbicides as necessary as necessary to control weed growth on site.
- Protected species of plants shall not be removed or interfered with, without the approval of the NPWS.
- The Specification will require the Contractor to advise the Principals Representative of any areas the Contractor proposes to clear and to mark the boundaries of clearing.
- The Contractor will be required to clean any machinery which has operated or travelled through an area where declared plants are present in accordance with the guidelines under the Rural Lands Protection Act and to collect this wash down water to allow silt and seeds to settle.
- The Construction Contractor will be required to prevent injury to, or death of, any native fauna on the construction site and to transport any injured fauna to an animal hospital or refuge.

13.8.5 Dangerous Goods and Waste Management

- Any on site washrooms and toilets shall be provided with waste disposal.
- Waste oil to be collected in drums and transported off site for recycling where possible.
- Petroleum products to be stored, handled, separated and signed as required by the AS1940 Storage and Handling of Flammable and Combustible Liquids.
- Refuelling shall be carried out over contained area to prevent contamination of land from spillage.

- Waste oils shall be collected and transported to recycle depots or designated disposal sites. Major maintenance and repairs shall be carried out offsite.
- Dangerous goods shall be stored and handled on bunded impervious floors and separated and signed as required by the appropriate Australian Standards.
- The Contractor shall prepare an Emergency Response Plan and train employees in the use of equipment, chemicals, and protective clothing and the application of the Emergency Response Plan.
- Any spills of dangerous goods shall be rendered harmless and collected for treatment and disposal at a designated site. This includes cleaning materials, absorbents and contaminated soils.

13.8.6 Road Transport and Sourcing of Materials

- The Construction Contractor shall provide a Traffic Management Strategy and comply with the Traffic Management Plan in the project Specification.
- When suitable alternatives are available, the soil materials and manufactured goods causing minimum adverse environmental effects shall be assessed and used in construction.
- Permission shall be obtained from the relevant Traffic Authority and Council under SEPP No.11 - Traffic Generating Developments (E.P. & A Act, 1979), for transportation of any loads exceeding dimension and weight limits and the Construction Contractor complies with the conditions of the permits.
- The Contractor shall coordinate transport to ensure minimum damage to public and other access roads along the haulage routes.
- The Contractor shall utilise materials sourced locally wherever possible to limit the use of public roads for long distance hauling of bulk construction materials.
- The Contractor shall ensure that the transportation of dangerous goods is in accordance with the regulations and the relevant codes and standards published by Standards Australia.
- The Contractor shall ensure that a regular program of street cleaning within the main road transport routes and associated works areas is undertaken.
- Washout of concrete trucks and cleaning of equipment and/or vehicles used during the road construction shall not be undertaken in locations that permit flow of untreated wastewater directly to the open drainage system.

13.8.7 Restoration and Rehabilitation of Disturbed Areas

- The Contractor shall restore all disturbed areas that result from construction activities. The disturbed areas shall be restored and returned to similar configurations and vegetation conditions to those that existed prior to the commencement of construction.
- The Contractor shall remove all structures used in the construction work that are not a permanent feature from the site together with all wastes.
- The Contractor shall repair all damage to existing roads, drainage and other infrastructure, as may have occurred during the construction work.
- Local drainage systems shall be constructed as per the Drawings and disturbed areas outside the works shall be reinstated to minimise erosion and to avoid changes in the overland flow patterns.
- The Contractor is responsible for rehabilitation maintenance until this responsibility is taken over, by prior arrangement with the Principal, or after the specified Defects Liability Period has expired.

13.8.8 Aboriginal and Historical Archaeology and Monitoring

The contractor shall identify all requirements relating to Aboriginal and Historical Archaeology and Monitoring and implement all measures required to satisfy the relevant Authorities.

Appendix A **SPECIFICATION TABLES**

Appendix A Specification Tables	
Table No	Details
Table A1	Material Classification Table
Table A2	Placement and Compaction requirements for Earthworks
Table A3	Testing and Acceptance of Earthworks Materials
Table A4	Acceptable tolerances for Earthworks Levels and Position
Table A5	Testing and acceptance criteria for Placement and Compaction of Earthworks
Table A6	Schedule of Hold Points

Table A1: Material Classification Table

MATERIAL CLASSIFICATION TABLE								
Classification	**TYPE A Topsoil**		**TYPE B General Fill**		**TYPE C Structural fill**		**TYPE D Rip rap**	
	Sieve Size (mm)	**Criteria (1)**	**Sieve Size (mm)**	**Criteria (1)**	**Sieve Size (mm)**	**Criteria (1)**	**Sieve Size (mm)**	**Criteria (4)**
Particle Size Grading Requirements (% passing by mass)		N/A	75 0.075	100% 20%	25 0.075	100% 20%	150mm min dimension 500mm maximum dimension	
Min Plasticity Index	N/A		10 (2)		10 (2)		N/A	
Min/ Max Liquid Limit	N/A		20/60 (2)		20/60 (2)		N/A	
Emerson Class Number (ECN)	N/A		-		>3		N/A	
Acceptable material classification	N/A		SC, CL, CI, CH		SC, CL, CI, CH		N/A	
Other							Min UCS=10 MPa Max wet dry strength variation = 20%	

(1) Criteria = % passing nominated sieve by mass

(2) Refer to table below for acceptable range of values as shown on Atterberg plot

FILL TYPE B AND TYPE C- RANGE OF ACCEPTABLE ATTERBERG LIMITS

PROJECT : **Charleville Levee**
Parameters : **Plasticity Index**
Material Type : ***SOIL***
Area / Location : **All**

	BCD-CH	BCD-S	BCD-N	SD-N	SD-S	SD-CH	PBA	WBL	
Count	5	15	22	18	4	1	4	9	Samples
Mean	17	18	16	19	21	18	14	13	%
Std Dev	7	7	9	9	9	N/A	2	4	%
Min	8	5	1	6	12	18	12	7	%
Max	24	28	29	37	29	18	16	19	%

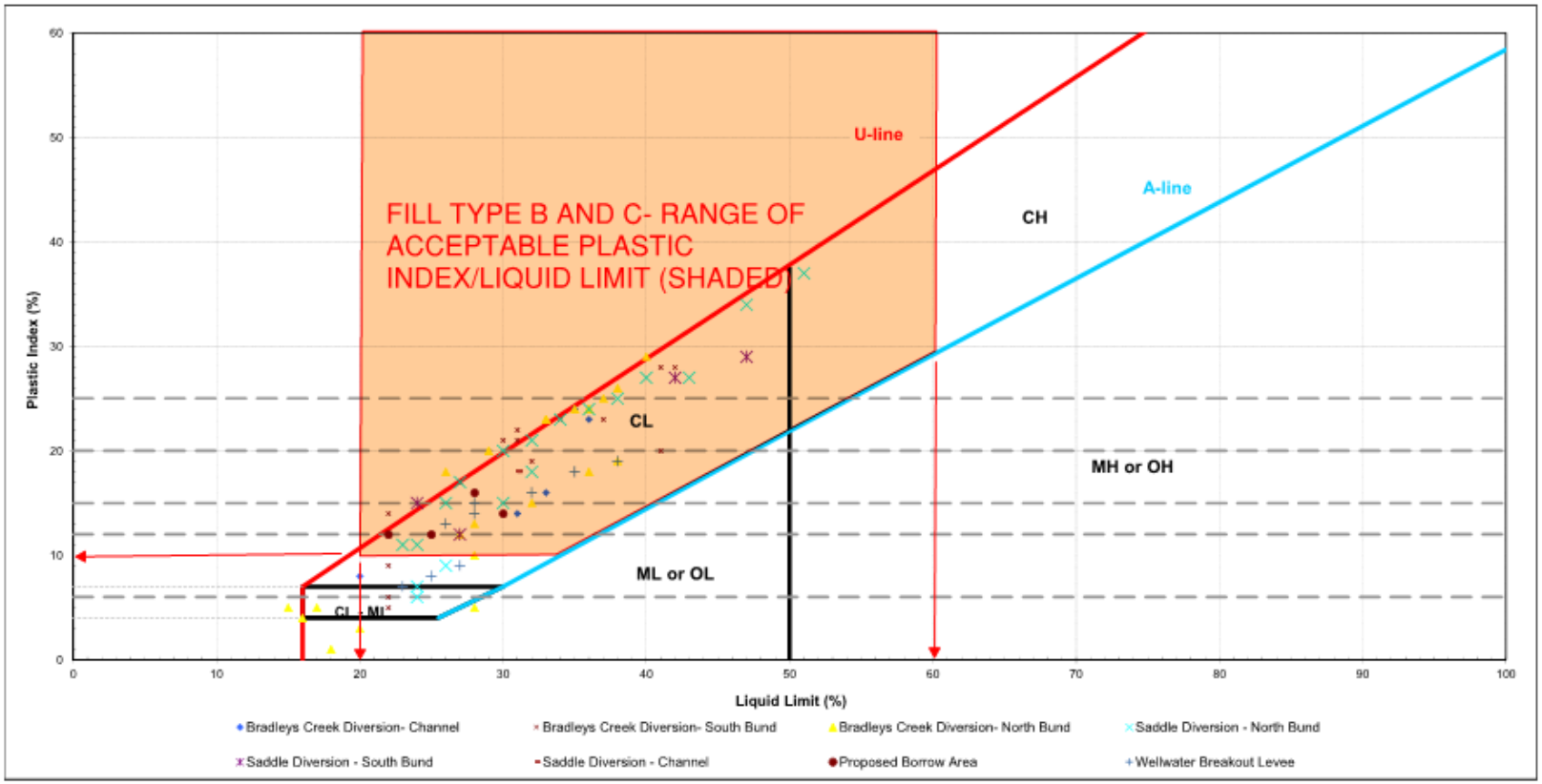

Table A2: Placement and compaction requirements for earthworks

TEST	TEST METHOD	ACCEPTANCE CRITERIA			
		TYPE A TOPSOIL	TYPE B GENERAL FILL	TYPE C STRUCTURAL FILL	TYPE D RIP RAP
Maximum Compacted Layer thickness (mm)	Inspection	N/A	300	300	(3)
Moisture Content	AS 1289.2.1.1 AS 1289.2.1.4	N/A	OMC(1) +/-2 %	OMC(1) +/-2 %	
Compaction	AS 1289.5.1.1 AS 1289.5.8.1	N/A	Min 98 % (Standard)	Min 98 % (Standard)	

1. As determined by AS1289.5.1.1 and AS1289.5.4.1
2. Proposed maximum lift to be submitted to DSGR for review and approval, depending upon type of machinery proposed for use
3. Layer thickness a function of max particle dimension (to be determined on site)

Table A3a: Testing and acceptance requirements for earthworks materials

CLAUSE REF	FILL TYPE	PROPERTY	TEST PROCEDURE	MIN TEST FREQUENCY	ACCEPTANCE LIMITS
Clause 3	TYPE A TOPSOIL	None			Refer to Table A1 for all Acceptance limits for Properties noted in this Table
	TYPE B EARTH FILL	Particle Size Distribution	AS 1289.3.6.1	Min 1 test per 1000 m^3. Min 1 test per lot. (1)	
		Plasticity Index	AS1289.3.1.2 AS1289.3.2.1 AS1289.3.3.1	Min 1 test per 1000 m^3. Min 1 test per lot. (1)	
	TYPE C STRUCTURAL FILL	Particle Size Distribution	AS 1289.3.6.1	Min 1 test per 1000 m^3. Min 1 test per lot. (1)	
		Plasticity Index	AS1289.3.1.2 AS1289.3.2.1 AS1289.3.3.1	Min 1 test per 1000 m^3. Min 1 test per lot. (1)	
		Emerson Class Number	AS 1289.3.8.1	Min 1 test per 1000 m^3. Min 1 test per lot. (1)	
	TYPE D RIP RAP	Particle Size Distribution	AS 1289.3.6.1	1 test per material (quarried material)	
		Wet dry Strength variation	Q205C	1 test per material (quarried material)	

1. Lot size in layered fill placement can be greater than the volume listed above provided the number of tests per volume is achieved and subject to the entire fill from the lot being placed in a single day and being placed in a single layer.
2. Table A3b: Testing and acceptance requirements for ground surface treatments of foundations.

CLAUSE REF	FOUNDATION AREA	FOUNDATION MATERIAL	PROPERTY	TEST PROCEDURE	MIN TEST FREQUENCY	ACCEPTANCE LIMITS	PROCEDURE
Cl 3.6, 3.7, 4.2, 4.3, 4.4, 5.0 & 6.0	Levee Embankment Footprint (Upstream and Downstream)	Clay	Field Density / Compaction Moisture content	AS 1289.5.1.1 AS 1289.5.8.1 AS1289.2.1.1 AS 1289.2.1. Proof Roll	Min 1 test per 100m of trench floor Sufficient coverage of embankment footprint both u/s and d/s of cut off trench	Min 95% MDD (Standard) +-2%OMC No visible deformation or springing	Rip and recompact / moisture condition to 200mm Following approval scarify surface to >50mm depth and moisture condition prior to placement of fill material
		Sand	Field Density / Compaction / Foundation Preparation	Proof Roll	Sufficient coverage of embankment footprint both u/s and d/s of cut off trench	No visible deformation or springing	Following approval scarify surface to >50mm depth and moisture condition prior to placement of fill material
Cl 3.6, 4.2, 4.3, 4.5, 5.0 & 6.0	High Flow Channel Cut Floor	Clay	Field Density / Compaction Moisture content	AS 1289.5.1.1 AS 1289.5.8.1 AS1289.2.1.1 AS 1289.2.1.4 Proof Roll	Min 1 test per 2000m2 Sufficient coverage of lot area	Min 95% MDD (Standard) +-2%OMC No visible deformation or springing	Rip and recompact / moisture condition to 200mm Following approval scarify surface to >50mm depth and moisture condition prior to placement

							topsoil /erosion protection
		Sand	Field Density / Compaction / Foundation Preparation	Proof Roll	Sufficient coverage of lot area	No visible deformation or springing	Following approval scarify surface to >50mm depth and moisture condition prior to placement topsoil /erosion protection
Cl 3.6, 4.2, 4.3, 4.5, 5.0 & 6.0	Low Flow Channel Cut Floor	Clay	Field Density / Compaction Moisture content	AS 1289.5.1.1 AS 1289.5.8.1 AS1289.2.1.1 AS 1289.2.1.4 Proof Roll	Min 1 test per 100m Sufficient coverage of lot area	Min 95% MDD (Standard) +-2%OMC No visible deformation or springing	Rip and recompact / moisture condition to 200mm Following approval scarify surface to >50mm depth and moisture condition prior to placement of compacted clay liner
		Sand	Field Density / Compaction / Foundation Preparation	Proof Roll	Sufficient coverage of lot area	No visible deformation or springing	Following approval scarify surface to >50mm depth and moisture condition prior to placement of compacted clay liner
	Low Flow Channel –Placed Compacted Clay	300mm Type B material placed	Field Density / Compaction	AS 1289.5.1.1 AS 1289.5.8.1	Min 1 test per 50m of channel	Min 98% MDD (Standard)	Following approval scarify surface to >50mm depth and moisture condition

	Liner over Sand Foundation	over sand foundation	Moisture content	AS1289.2.1.1 AS 1289.2.1.4 Proof Roll	Sufficient coverage of lot area	+-2%OMC No visible deformation or springing	prior to placement topsoil /erosion protection.

Table A4: Summary: Acceptable Tolerances for Earthworks Levels and Positions

EARTHWORKS LEVELS AND POSITIONS- ACCEPTABLE TOLERANCES	
POSITION	ACCEPTABLE TOLERANCE
Cut off trench surface prior to filling	-100mm/ +0mm
Levee finished surface	-0 mm / +100 mm
All earthworks for roads and around culverts/ structures	As per TMR specifications

Table A5: Acceptance Criteria for Earthworks Placement and Compaction

CLAUSE REF	FILL TYPE	PROPERTY	TEST PROCEDURE	MIN TEST AND REPORTING FREQUENCY	ACCEPTANCE LIMITS
	TYPE A TOPSOIL				
	TYPE B GENERAL FILL	Maximum Dry Density	Refer Table A2	Min 1 test per 400m^3. Min 4 tests per lot. (1)	
		Field Density		Min 1 test per 400m^3. Min 4 tests per lot. (1)	
		Moisture content		Min 1 test per 400m^3. Min 4 tests per lot. (1)	
		Layer thickness	Measurement (2)	Min 1 measurement per 400m^3. Min 4 tests per lot. (1)	
	TYPE C STRUCTURAL FILL	Maximum Dry Density	Refer Table A2	Min 1 test per 400m^3. Min 4 tests per lot. (1)	
		Field Density		Min 1 test per 400m^3. Min 4 tests per lot. (1)	
		Moisture content		Min 1 test per 400m^3. Min 4 tests per lot. (1)	
		Layer thickness	Measurement (2)	Min 1 measurement per 400m^3. Min 4 tests per lot. (1)	
		Emerson Class	Refer Table A2	Min 1 measurement per 400m^3. Min 4 tests per lot. (1)	
	TYPE D RIP RAP	To be determined			

(1) Lot size in layered fill placement can be greater than the volume listed above provided the number of tests per volume is achieved and subject to the entire fill from the lot being placed in a single day and being placed in a single layer.

(2) Measurement with respect to items with level tolerance in accordance with Table A4. Foreman shall sign off conformance of individual layer thicknesses.

Table A6: Schedule of Hold Points

CLAUSE REF	HOLD POINT		
	PROCESS HELD	SUBMISSION DETAILS	RELEASE DETAILS
Clause 4.2	Presentation of levee, diversion channel and culvert foundation	Notification to DSGR that excavation to foundation level has been attained.	Inspection of foundation by DSGR prior to initial filling. Witness of Proof rolling. Selection of treatment (if required) and direction of removal of unsuitable material and/or further action as required. If unsuitable is removed, DSGR shall inspect stripped foundation prior to further filling operations.
Clause 3.2	Groundwater and/or Seepage found	Notification to DSGR if groundwater and/or seepage is observed in foundation	Inspection by DSGR
Clause 4.3	Replacement of each lot of unsuitable material	Notification to DSGR that unsuitable material has been removed as directed.	Inspection by DSGR Further removal of unsuitable may by directed prior to authorizing release of Hold Point.
Clause 2.0	Material conformance	Submittal to DSGR of conformity of each lot of Material placed, with relevant test and survey reports	Approval or rejection
Clause 6.0	Testing and acceptance of Earthworks	Submittal of all quality/ verification records and tests. Submittal to be issued as packages (per design lot). Submittal to include description of origin/ location of lot.	Approval or rejection

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