PROCEDURE

for

EROSION AND SEDIMENT CONTROL

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APA Group – Young to Wagga Wagga Looping Pipeline

Project No: Q8291

Doc. No. PR-010
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1 Purpose

The purpose of this procedure is to provide guidelines for the soil erosion and sediment control during the construction of the Young to Wagga Wagga Looping Pipeline Project.

It should be noted that the pipeline is to be constructed parallel to an existing pipeline easement. The majority of the pipeline route traverses broad-acre cropping country which is already quite degraded and has some considerable erosion problems.

2 References

2.1 Legislation

Refer: HSE046 HSE Legal and Other Requirements

2.2 Standards, Codes and Guidelines


Guidelines for Controlled Activities – Laying Pipes and Cables in Watercourses (February 2008 - Water Management Act, 2000)

Guidelines for Controlled Activities – In-stream Works (February 2008 – Water Management Act, 2000)


3 Definitions

Some environmental terms used in this document are defined below:

**Soil erosion**  Soil erosion consists in the removal of soil material by water or wind. It is a natural phenomenon but it can be accelerated by human activities.

**Sediment**  Any material transported by water which will ultimately settle to the bottom after the water loses its transporting power.

**Contaminant**  Any physical, chemical, biological or radiological substance or matter that has an adverse affect on air, water or soil.
Pollution  Generally, the presence of a substance in the environment that because of its chemical composition or quantity prevents the functioning of natural processes and produces undesirable environmental and health effects.

Groundwater  Water that occupies pores and crevices in rock and soil, below the surface and above a layer of impermeable material. It is free to move gravitationally, either downwards towards the impermeable layer or by following a gradient.

Runoff  Portion of rainfall, melted snow or irrigation water that flows across the ground's surface and is eventually returned to streams. Run-off can pick up pollutants from air or land and carry them to receiving waters.

Windrow  A continuous mound of loose material. This may refer either to vegetable matter, such as cleared material, or excavated material such as top soil or trench spoil.

Sheet erosion  Also called sheet wash. Erosion of thin layers of earth-surface material, more or less evenly, from extended areas of gently sloping land by broad continuous sheets of running water, without the formation of rills, gullies, or other channelised flow.

WDS  WDS Limited

APA (the Client)  East Australian Pipelines Pty Ltd. (APA Group)

YWL (the Project)  Young to Wagga Wagga Looping Pipeline Project

4 Responsibility

4.1 Construction Supervisor

Overall responsibility for programming and resourcing of works, and ensuring —

• Implementation of environmental awareness training; and
• All potential environmental impacts identified and addressed.

4.2 Area Supervisor/Line Management

Responsible for supervising work crew activities and ensuring erosion and sediment controls are in place and properly maintained.

4.3 Personnel

Both WDS employees and subcontractor employees are responsible for complying with requirements that minimise potential erosion due to work activities, and the installation and maintenance of erosion and sediment controls.
4.4 HSE Personnel

Responsible for:
- conducting HSE awareness training;
- advising on HSE hazards, risks and controls;
- reporting HSE incidents and follow-up of actions arising from those incidents;
- inspecting and auditing HSE compliance.

5 Contributing Factors and Work Activities

5.1 Contributing Factors

Erosion occurs when the susceptible soil particles are subjected to external forces of sufficient magnitude to dislodge and carry the particles away. The susceptibility of the soil particles to erosion and degree of erosion is dependant on the following:
- soil types and the associated soil cohesiveness;
- particle size;
- ground cover;
- type of ground disturbance (eg. access tracks, clear and grading the ROW, trenches, stockpiles);
- size of the area concerned;
- the time the soil is exposed to erosion;
- the erosion medium (eg. water or wind);
- the volume, speed and forecasted duration of erosion medium entering the area concerned (eg. prevailing winds, sources of runoff);
- the orientation of the area concerned to the erosion medium (eg. gentle or steep slopes, natural barrier, waterways);
- the control measures put in place (eg. type, capacity, effectiveness, location [upstream or downstream of the area concerned], condition and maintenance); and
- for water erosion, existing water drainage structures (eg. entry points, capacity, choke points, settlement areas).

5.2 Work Activities

Work activities that may contribute to erosion susceptibility include:
- clear and grade of the ROW;
- establishment of access roads;
- creation of windrows and stockpiling of soils;
- excavation, trenching, and construction of borrow pits;
- boring and directional drilling;
- pipelaying and backfilling;
- diversion/changing of existing waterways or drainage channels/structures;
waterway / drainage crossings;
work beside waterways;
hydrotesting;
clean up, revegetation and restoration.

Below is a typical section through a Right of Way work area. The brush either side is the cleared vegetation. A top soil windrow may also be placed near the brush on the Work Side. On the YWL Project the existing pipeline may constrain to a degree the ability to utilise the spoil side of the ROW.

![Figure 1: Typical Right of Way Layout](image)

6 Control Method Assessment

6.1 Risk Assessment

All work areas are different. It is essential to assess each work area individually to see if practices described in this document are suitable, or need to be modified to suit.

The hierarchy of controls may be used. These are:

1) **Eliminate** – eg. Directional drill under waterways to eliminate the need to disturb it (eg: Billabung Creek).

2) **Substitute** – Not applicable

3) **Isolate** – Erect diversions or barriers around the work area to isolate the area from the erosion medium.

4) **Engineer** – The most common form of risk control. eg. The construction of diversion channels and erection of silt barriers.

5) **Administrative** – Limited use of access tracks; proper training and supervision to minimise soil disturbance and duration of exposure; selection of the most suitable controls; maintenance of new and existing controls (eg. Cleaning of silt fences after significant rainfall events).
6.2 Assessment Principles

a) Safety – Do not install a control that introduces a safety hazard. Eg. Diversion drains running across access tracks; installation of culverts on access tracks that are too small and are prone to flooding.

b) Upstream Issues – Where does the erosion medium come from, and can it be safely and practically diverted around the work area? Will this diversion cause increased problems in another area?

c) Site Considerations – Access, disturbed land areas, stockpiled materials, work activities involved, and the duration of exposure.

d) Downstream Issues – Where does the eroded material go, what happens to the sediment load, and will settled sediment cause problems?

e) Effectiveness and Maintenance – The selected controls should be suitable for the anticipated erosion events. The drainage paths should be in the right location, of a suitable capacity and with sufficient falls. The controls should also be able to be adequately maintained. eg. silt fences must be able to be cleaned after significant rain events; otherwise they will eventually become ineffective.

6.3 Control Options

Controls can be either aimed at:

- **Drainage** – eg. Perimeter/diversion banks and channel etc.
- **Erosion** – eg. erosion control blankets/ mats/ geotextiles; trench breakers; outlet protection; revegetation; surface roughening, etc.
- **Sediment** – eg. Buffer zones; grassed filter strips; construction exit structures; sediment fences and barriers; sediment traps etc.
- **Channel Lining** – eg. geotextiles; erosion control mats; rock lining; impervious lining, etc.
- **Velocity** – eg. Dams; drop structures; longer or rougher flow paths; etc.

Due to the temporary nature of the YWL project, only those relevant to the works shall be considered in the Table below.
6.4 Comparison of Erosion and Sediment Controls

Table 1: Control Option Summary

<table>
<thead>
<tr>
<th>Control</th>
<th>Uses</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
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<tbody>
<tr>
<td><strong>Drainage Controls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diversion/Perimeter</td>
<td>Used to:</td>
<td>Generally no formal design required</td>
<td>Can cause sediment &amp; flow problems in high water volume conditions (flooding)</td>
</tr>
<tr>
<td>Banks with Channels</td>
<td>• limit the flow path length down steep grades;</td>
<td>• Speed of construction</td>
<td>Vehicle safety issue if installed across a Right of Way</td>
</tr>
<tr>
<td></td>
<td>• divert flow around disturbed areas &amp; stockpiles;</td>
<td>• Low cost</td>
<td>Outlet flows may increase the risk of erosion</td>
</tr>
<tr>
<td></td>
<td>• direct contaminated water to sediment traps.</td>
<td>• Low maintenance</td>
<td></td>
</tr>
<tr>
<td>Temporary Watercourse</td>
<td>Keeps traffic out of small or low flow waterways.</td>
<td>Minimises the waterway disturbance</td>
<td>May cause contamination during construction</td>
</tr>
<tr>
<td>Crossings</td>
<td>• Restricts the number of waterway crossings.</td>
<td>Improves vehicular access</td>
<td>Restriction of water flow may cause flooding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduces risk of safety and environmental incidents</td>
<td></td>
</tr>
<tr>
<td><strong>Erosion Controls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trench Breakers</td>
<td>• Reduces subsurface erosion in backfilled trenches</td>
<td>Easy to construct</td>
<td>Steep slopes require a number of trench breakers to be installed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reduce tunnel erosion</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Help stabilize the pipe during backfilling</td>
<td></td>
</tr>
<tr>
<td><strong>Sediment Controls</strong></td>
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<td></td>
</tr>
<tr>
<td>Buffer Zones</td>
<td>• Intercepts overland flow</td>
<td>Reduce the need for other sediment controls</td>
<td>Limited sediment control of finer particles especially during high volume flows</td>
</tr>
<tr>
<td></td>
<td>• Impedes runoff &amp; filters coarser sediments</td>
<td>Reduces need for re-vegetation</td>
<td>Easily disturbed</td>
</tr>
<tr>
<td></td>
<td>• Increases soil permeability</td>
<td></td>
<td>Restricted to gentler slopes</td>
</tr>
<tr>
<td>Construction Exits</td>
<td>• Removal of soil and dust from vehicles leaving disturbed soil areas</td>
<td>Treats all vehicles leaving the site (except for</td>
<td>Crushed rock pads require maintenance</td>
</tr>
<tr>
<td></td>
<td>• Minimises off-site traffic hazards caused by contaminated road surfaces</td>
<td>manually operated wash-down types)</td>
<td>Cattle grids require construction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Steel vibration grids (cattle grids) can be re-used on</td>
<td>All types require removal on completion of works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>other projects</td>
<td></td>
</tr>
<tr>
<td>Sediment Fences – Filter</td>
<td>• Reduces velocity to remove sediment</td>
<td>Easy to install</td>
<td>Easily damaged</td>
</tr>
<tr>
<td>Fabric</td>
<td>• May be used at regular intervals down slopes</td>
<td>Highly visible</td>
<td>Require proper installation</td>
</tr>
<tr>
<td></td>
<td>• Control of runoff from exposed land, access track &amp; stockpiles</td>
<td></td>
<td>Requires maintenance after significant rain events</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>May concentrate flows if not maintained</td>
</tr>
<tr>
<td>Sediment Fences – Straw</td>
<td>• As above, however less efficient than sediment fences</td>
<td>Easy to repair</td>
<td>Hay bales are not recommended</td>
</tr>
<tr>
<td>Bale</td>
<td>• May be used in conjunction with filter fabric as support</td>
<td>Can provide temporary support for filter fabric</td>
<td>Bales are subject to theft, vandalism (including being set on fire)</td>
</tr>
<tr>
<td></td>
<td>instead of stakes/posts</td>
<td>sediment fences in soft waterlogged ground</td>
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7 Control Method Construction/Installation

7.1 Drainage Control

7.1.1 Diversion and Perimeter Banks

Perimeter banks (or contour banks) are constructed to divert water away from work areas.

Perimeter banks and perimeter/diversion bank and channels are constructed across a slope to convey runoff at a non-erosive velocity. The channel may be combined with an embankment on the downhill side to increase its capacity. The drains intercept the sheet runoff and divert it to a stabilised outlet.

1 To reduce erosion, earth banks may be compacted by the track or wheel rolling, and shaped as in Figure 2.

2 Channels/drains should be clear of vegetation as capacity/efficiency is best when there is none.

3 Topsoil shall not be used for the banks of any drain.

4 Where a pipeline traverses a side slope, these diversion drains may extend across the ROW. To reduce impact on vehicles, these drains should be relatively shallow and, where necessary, clearly indicated. However, they may still be a hazard for vehicles using the ROW.

5 Runoff shall be dispersed at a place where it is unable to affect the ROW or create significant erosion.

6 To facilitate dispersion, and minimise erosion potential, track-rolled litter and mulch from stockpiled vegetation may be placed at the outlet end to slow and disperse runoff.

7 Contour banks with 3% crossfall should be placed over trench breakers (refer §7.2.1 Trench Breakers).

As simple contour/perimeter banks are usually uncompacted, they are susceptible to erosion until the slopes become vegetated or consolidated. They may be compacted by running the wheels of a grader over them as mentioned in step 1 above.
7.2 Erosion Controls

7.2.1 Trench Breakers

Trench breakers are used to prevent subsurface water running down trenches eroding the backfill around pipes.

1. Trench breakers shall be constructed out of:
   - bagged sand or stabilised sand (bags to be plastic not hessian);
   - polyurethane (not to be used in areas prone to inundation and as directed by the client).

2. Width to be determined according to the trench profile and height and location to be determined by the slope (see Figure 3).

3. All loose dirt shall be removed from the key, which shall be excavated before lowering in the pipe.

4. Backfill shall be placed concurrently on each side of the trench breaker to avoid differential pressure.

5. Contour banks shall be positioned on the surface above trench breakers.
7.3 Sediment Fences and Filters

7.3.1 Silt Fences

Silt fences are preferred over straw bales being more effective and without the possibility of spreading unwanted seeds downstream.

1 Silt fences (see Figure 4 below) are a temporary sediment control measure constructed from wire fencing mesh and filter fabric to intercept sediment laden runoff and retain sediment.

   Note: If good quality heavy duty geofabric is used, the layer of wire mesh may not be required.

2 Posts should be spaced at:
   • 2m without wire mesh backing;
   • 3m with wire mesh backing;
   • 0.5m when installed in a U-shape across minor drains.

3 Filter fabric should be securely attached to posts (eg. with cable ties) and where joined, it should be lapped 300mm and sewn, or securely attached to twin posts.

4 To be effective, filter fabric should be embedded into the ground by about 150-200mm, and straw bales by about 100mm, to reduce the risk of contaminated water running under them.

5 Excavated spoil should be deposited on the upstream side of the fence. When on rock, a layer of gravel a minimum of 200mm wide should be placed on the upstream side of the fence.

6 Fences should be located:
   • 2m from the base of an embankment or stockpile;

7 Straw bales are effective at supporting filter fabric when the fence is subjected to the high volumes of water. Note that straw bales only have effective life-span of
about three months, whilst the life-span of a sediment fence depends on the ultraviolet light resistance but averages about six months.

Figure 4: Sediment Fences and Filters

7.3.2 Vegetation Buffers

Vegetation corridors are strips of vegetation retained in order to slow water velocity and thereby assist in sediment settlement. The wider the buffer, the better the control.

1. Vegetation buffers are suitable for slopes between 1% and 10%.

2. Generally, the length of the buffer should be:
   - for broad soil disturbance areas, 5 x (%) slope with a minimum length of 15 metres
   - for narrow disturbances, length = 1.5 x width of upslope disturbance.

3. Overland flow should remain as sheet flow and must not be allowed to concentrate in rills or gullies.

7.3.3 Construction Exits

Pipeline construction requires access for work crews and materials deliveries. The following controls are applicable:

1. Reduce the number of access routes and points – use existing roads or tracks wherever possible.
Consult with landholders, regulatory authorities and community groups.

Clearly define all access areas and advise all personnel, subcontractors and transport companies.

Avoid (eg. re-route rather than remove trees) or minimise (eg. trim trees rather than remove) vegetation clearance.

Install construction exits if necessary (see Figure 5).

**Figure 5: Construction Exit – Cattle Grid Type installed in Crushed Rock**

8 **Specific Work Activity Controls**

8.1 **Land Disturbance**

The main activity disturbing land is clear and grade of the ROW. The following measures will reduce the disturbance.

1 **Clearing Vegetation**

1.1 Cleared vegetation to be stockpiled for re-spreading after works completed.

1.2 Disturbance to tree canopy shall be minimised.
2 Topsoil

2.1 Topsoil shall be separated from trench spoil and vegetation and will not be stored in drainage lines or on the banks of watercourses.

2.2 Topsoil windrows shall be positioned such that they do not impede stock movement or vehicle access, with breaks for access roads, stock routes, drainage channels and waterways.

3 Stockpiles

3.1 Stockpiles will be shaped to prevent erosion from surface water runoff, or have a diversion channel or sediment fence installed in appropriate locations.

8.2 Watercourse Crossings

There are two types of waterway crossings to applicable to pipeline construction; namely vehicle or access crossings and pipeline crossings.

Location of the pipeline crossing is determined by the Client. If a vehicle or access crossing is required, a vehicle crossing at this location may, or may not, be suitable.

8.2.1 Vehicle or Access Crossings

8.2.1.1 General

Vehicle or access crossings, which may be:

- At grade (ie. a ford) if the flows are low and banks are navigable, which require no other work than the removal of waterway obstacles and the filling in of potholes. Fords are wet crossings, and suitable for waterways with little or no defined drainage channel, no lasting ponds and little or no vegetation.

- A temporary vehicular crossing (refer Figure 6) or causeway, which is a structure that raises the base of the stream bed and allows water to flow through a culvert or over the structure in times of high flows. This type is suitable for waterways with intermittent flows and for wide shallow streams with gravel beds where it is not economically feasible to construct a temporary bridge.

The other alternative is to use an existing route that already has a waterway crossing.

\footnote{Note: These activities in themselves may have an adverse environmental impact.}
8.2.1.2 Site Selection Criteria for Vehicle Crossings

Consideration shall be given to the following:

- Extent of the ROW.
- Landowner permission.
- Susceptibility to environmental hazards – eg. floods and landslides.
- Location of waterway features – eg. waterfalls and weirs.
- Avoidance of areas of:
  - sensitive riparian vegetation;
  - cultural heritage and aesthetic value;
  - potential adverse impact on domestic and town water supplies (eg. is the crossing upstream);
  - potential adverse impact on public safety, use and enjoyment.
8.2.2 Pipeline Crossings

Figure 7: Typical Pipeline Watercourse Crossing

The crossing of the watercourse by the pipeline (refer Figure 7) is a permanent installation and may be constructed in one of the following methods:

- **Standard trenching**, which involves open cut trenching and installation, usually employed for dry, or shallow, low-flow waterways where the installation is completed in a short time, thereby limiting contamination from sediments created during installation.

- **Stream flow diversion techniques**, where temporary dams are employed to enable excavation and installation of the pipeline in relatively dry conditions. This is best suited where continuous water is required for environmental, social, economic or engineering purposes. The water flow is maintained by means of pumps or a flume pipe between the dams.

- **Horizontal directional drilling** – refer §8.3.

For both temporary vehicle and pipeline crossings, consideration shall be given to bank protection.

8.2.3 Construction of Waterway Crossings

Before construction

1 Preparations

1.1 Plan the works – ideally at the time of least flow.

1.2 Obtain any necessary regulatory, client and landowner approvals.

1.3 Notify persons downstream who may be affected.

1.4 Materials, plant and equipment shall be suitable for the task.

1.5 Brief the work crew on the construction process and potential environmental impacts.

2 Erosion and Sediment Control

2.1 Complete construction in the shortest possible time. Works should be stopped in unsuitable conditions (eg. during heavy rains and floods.)
2.2 Minimise ground disturbance such as clearing, grubbing and grading, and width of access tracks.

2.3 In-stream structures shall be installed in accordance with manufacturer’s specifications.

2.4 Excavated material shall be placed well away from the waterway to minimise sedimentation, and should not be placed in the waterway or stored in flood-prone areas. Sediment and runoff shall be managed as required by using controls listed in this document.

3 Protection of Waterway Banks

3.1 Where necessary, bank protection as shown in Figure 8 shall be installed

3.2 Temporary erosion and sediment controls shall be installed to protect revegetation until suitable vegetation is established before being removed.

Figure 8: Bank Protection for Pipeline Crossings

8.3 Horizontal Directional Drilling

8.3.1 Controls

4 Preparation

4.1 HDD Drilling contractors are to provide a spillage and drilling mud management plan to the Project Manager prior to commencement.

4.2 Rig placement to be behind riparian zones where practicable and safe to do so.

4.3 Approvals to be documented for all work areas additional to the easement and cultural heritage clearances to be provided.

5 Setup and Operation

5.1 Topsoil to be stripped and stockpiled prior to installation of equipment.

5.2 All drill cuttings to be stored in skips or pits and disposed of in accordance with the relevant approvals (e.g. removed to licensed waste facility; contractor to supply documentary evidence). Mud pits to be lines if not naturally sealed with local materials.
5.3 Visual inspection of drill route for drill mud break out (frac outs).
5.4 Drill mud spillage or breakout response materials and equipment to be maintained on-site and personnel trained in use.

Figure 9: Horizontal Directional Drilling

8.4 Dewatering

8.4.1 Trenches, Bell Holes and Other Excavations

There are a number of issues to consider with pumping out water in excavations:

1 Pumping Method

1.1 The method of pumping should not stir up sediment into the discharged water at the inlet or outlet of the pump

1.2 Ensure that an appropriately sized pump is used for the job. A pump, which has too strong suction and/or too forceful discharge, has the potential to stir up sediment at both ends.

1.3 Position the inlet of the pump near the surface of the water to be pumped. This ensures that the pump does not suck up sediment that is settled on the bottom of the ponded water.

1.4 The outlet of the pump should be positioned on land, onto a stabilised area. Ensure that an energy dissipating structure is used at the outlet (e.g., rock, geofab).

8.4.2 Hydrotest Dewatering

Selected erosion and sediment controls shall be used whenever hydrotest water is discharged. Disposal of hydrotest water shall be in accordance with license conditions and acceptable practices, such as storage in retention ponds for suitable treatment or discharge to land.

Where hydrotest water is suitable, disposal options (with suitable controls) may include —

- Pasture irrigation
- Livestock watering
- Discharge onto land
9 Documentation

The following documentation is referenced in this procedure:

HSE046  HSE Legal and Other Requirements

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