Bare discharge (seepage) area alongside flowline

Department of Water & Environmental Regulation

R10407 AA DAM 360
Drainage Assessment

19 September 2019

Soak

WHEATBELT HYDROLOGY

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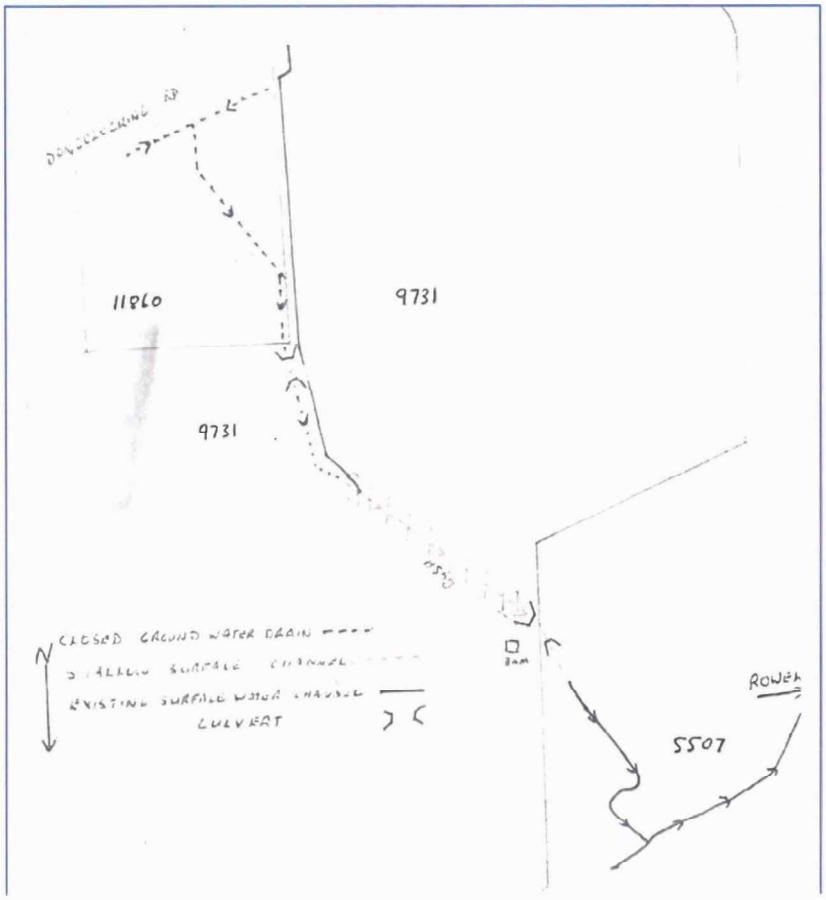
1 BACKGROUND

Crown Reserve 10407 (lot 11860 on plan 145020), which is vested with the Department of Water and Environmental Regulation for the purposes of water supply is becoming degraded. The reserve originally had a well for supply to horses along Dongolocking Rd. The reserve was assessed in 2012 and the well and bore could not be found. The remaining infrastructure is a shallow soak and tank on a stand.

Neighbouring farmers propose to do some drainage work in the area, and wish to protect the remaining trees and restore vegetation cover in the reserve. The original proposal is shown in Figure 1.

Figure 1. Reserve 10407 original drainage proposal.



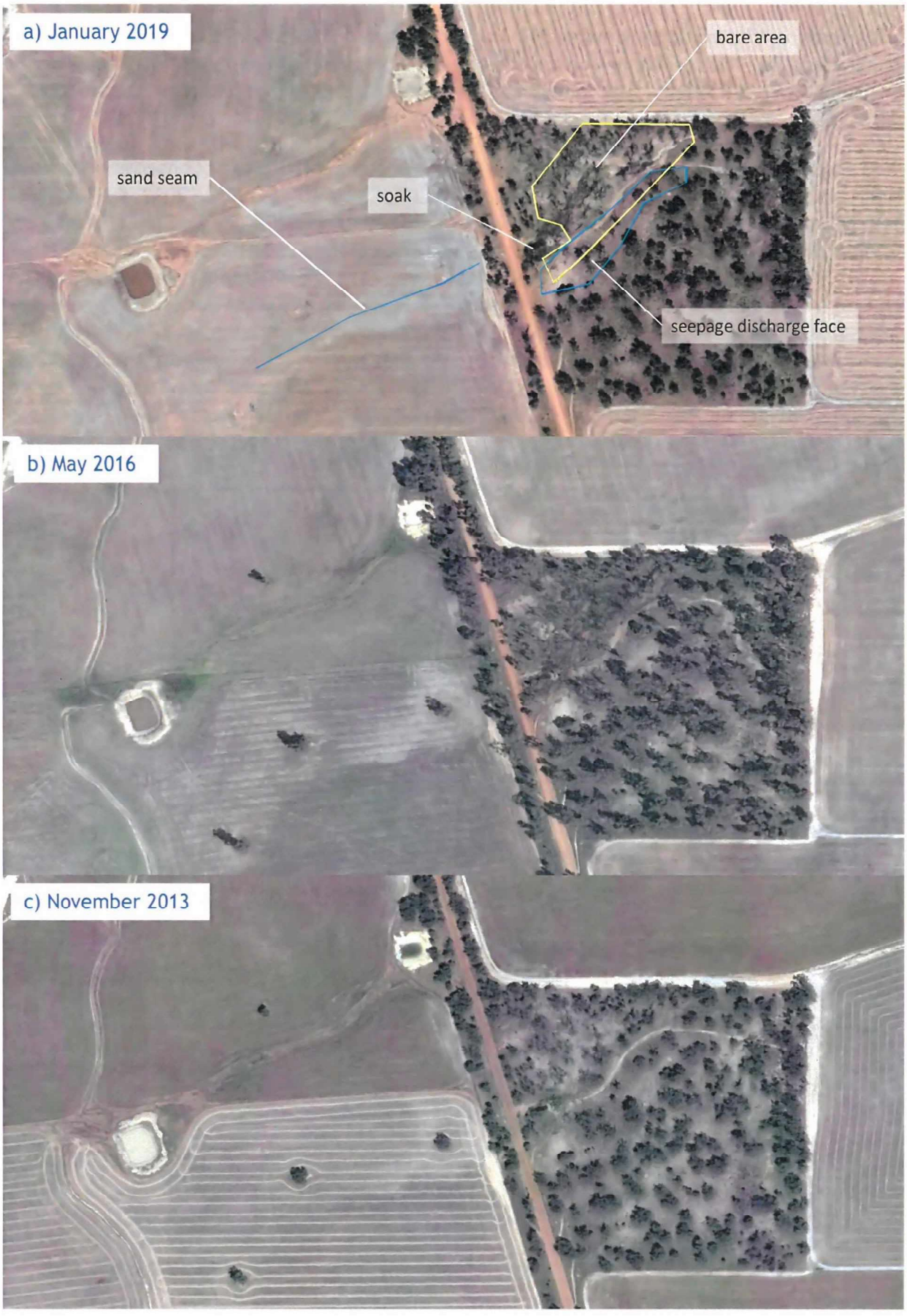
2 OBSERVATIONS

The reserve is located approximately 32 km north east of Wagin on the north side of the Dongolocking Rd. The reserve lies on a slope of a minor tributary of the upper Buchanan River in the Arthur River catchment. The immediate catchment of the reserve (including the reserve) is approximately 31 ha.

A site assessment was undertaken on 17th September, with John Firth (Land Conservation Officer, DPIRD) and the proponent farmers, Scott Angwin and Anthony Rowell. Since 2012, the health of the vegetation in the lower part of the reserve has declined significantly (Figure 3). Aerial imagery indicates that the reserve has only become degraded since around 2006 (Figure 2). Spiny rush has infested the soak and wet areas downslope. Bare areas have become more extensive above the flow line. Active seepage was observed along the slope in and just above the flowline, with a shallow hole dug being saline (in the order of 77 mS/cm). This appears to be hillside seepage from a perched water table derived from recharge on the slope to the east on a very firm clay base and is confined to within the reserve. Waterlogging in this area is exacerbated by runoff from Dongolocking Rd being directed into the reserve, however topsoil has not yet been eroded to any extent.

Figure 2. Reserve 10407 with 2 m DEM contours (imagery February 2006).

Figure 3. Aerial Imagery from Google Earth of R10407 at 3 times since inspection in 2012.



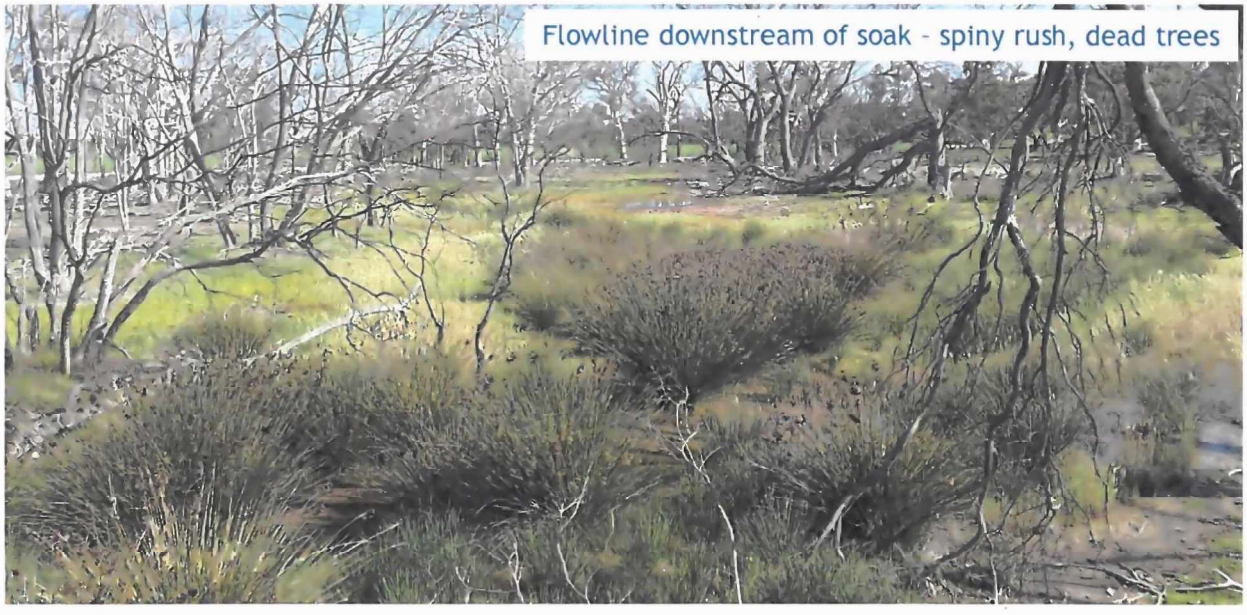
Salinity of the soak was in the order of 7 mS/cm (in Sept. 2012 it was 19 mS/cm, but not actively seeping). It is likely that the old well intersected a sand seam running from the south, visible in aerial imagery.

2.1 Photos

The following images (and cover images) were taken during the site assessment.

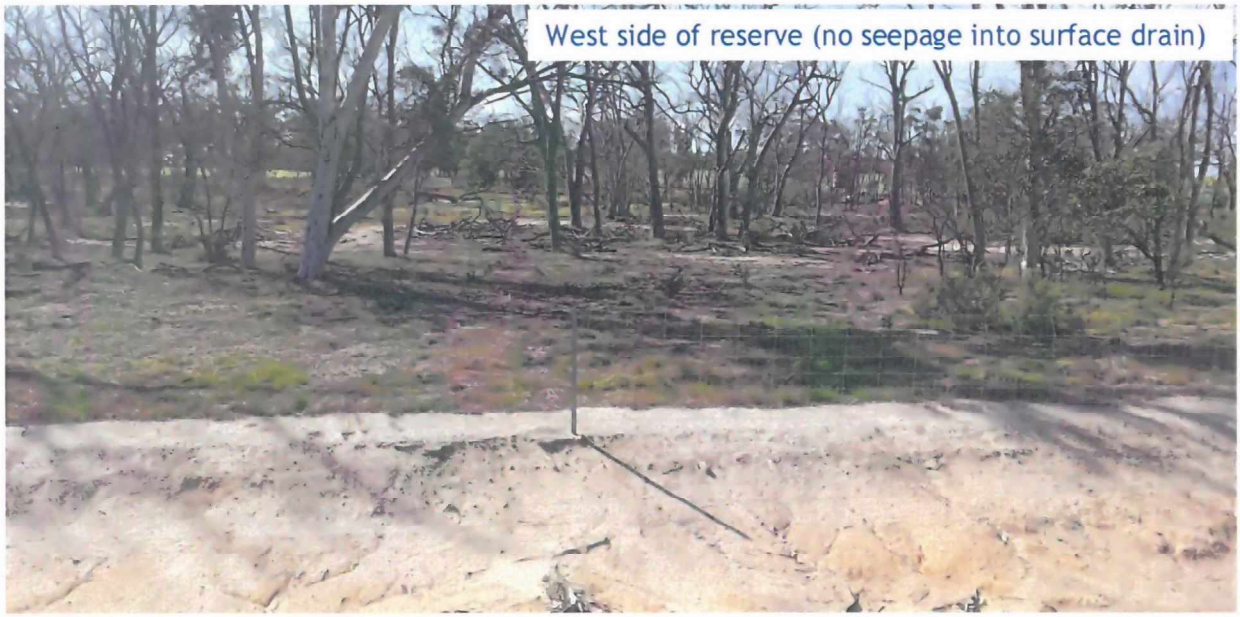
Reserve from Dongolocking Rd - road runoff, seepage face on right

Auger hole in discharge area ≈2 hours after drilling



Flowline downstream of soak - spiny rush, dead trees

Surface drain below (west) of reserve looking toward Dongolocking Rd



West side of reserve (no seepage into surface drain)

3 REQUIREMENTS

The key requirement is to encourage vegetative cover of the bare soils. In order to allow natural vegetation to re-establish, the site needs to be dewatered. Once the soil profile is no longer saturated, leaf fall from the remaining trees and accumulation of other vegetative debris will mulch the area and there appears to be sufficient stock of existing understorey vegetation and herbs to gradually recolonise the degraded areas.

Surface water needs to be excluded from the discharge area in order to reduce the risk of erosion on wet, bare soils. Road runoff needs to be diverted away from the reserve – the roadside drainage should be continued down the road to the existing surface water drain on the western boundary of the reserve.

Varied extent of dewatering can be achieved, depending on the depth of drainage used. To dewater the topsoil only, a shallow drain around 0.5 m deep (to the depth of clay on which the perched water table sits) would be required. However, this is not likely to provide sufficient dewatered profile to allow any live trees to recover or new trees to re-establish and survive. In addition, the recovery

may be limited in area (it may not sufficiently dewater the actual flowline area) and will not provide sufficient enhanced discharge to match inflow from the sand seam which supplies the soak and may be providing upward groundwater pressure on the reserve.

A groundwater drain through the reserve should dewater the reserve sufficiently to allow recovery of trees and establishment of other vegetation. However, the discharge needs to be managed and the drain itself will create an unsightly scar as it will be up to 10 m wide (including spoil banks). Any groundwater drain needs to exclude surface water to prevent erosion of the drain.

Sub surface drainage is likely to be saline, at least during initial dewatering. Thus, the discharge will need to be managed to avoid downstream impacts. The surface water flows (and current saline wash-off) enters the surface drain running along the west boundary of the reserve which discharges into a treed creekline about 1.4 km from the Buchanan River. None of these areas are saline and the Buchanan River does not become significantly waterlogged or saline until 1.8 km further downstream. Ideally, saline discharge should be stored in a detention basin until larger flow events, when it can be diluted and flushed downstream.

An alternative option raised by Mr Angwin was to re-establish the well and pump from it. However, this was dismissed as it is likely that this would not intercept the more extensive shallow discharge, as well as incurring on-going costs of pumping, though would be a neater, more contained option.

3.1 Proposed Works

A groundwater drain is to be constructed from the old well, following the flowline to the west boundary of the reserve, then along the existing surface water drain, grading out to approximately ground level north of the reserve (Figure 4). The section following the west boundary should be constructed *outside* the reserve. A detention basin should be constructed to ensure the discharge of saline water into a non-degraded environment only occurs when there is reasonable surface flow occurring in the discharge waterway. The location of the detention basin and discharge end of the groundwater drain will be determined by the slopes to obtain a depth where it crosses the reserve boundary of around 1.5 m deep (which will achieve a depth of 2 m through the critical section below the soak).

The drain should have an effective life of around 5 to 10 years, by which time the sides will have slumped to some extent and the bed sedimented. However, by this time, ground cover vegetation should have re-established, live trees will have regenerated, and new tree seedlings established themselves.

3.2 Design Criteria

The groundwater drain must exclude all surface water to prevent erosion, and must be constructed to ensure minimal maintenance requirement. Details of the groundwater drain cross section are shown in Figure 5. If a second soft layer is intersected below the clay/sand interface, a second bench should be constructed, of the same width as the top bench. Spoil banks should be placed on both sides of the drain along its whole length, and around the top end. The top of the spoil bank should be shaped to slope down away from the drain to shed water outside of the drain. If possible, topsoil should be spread over the spoil banks to encourage vegetative growth on them and thus reduce erosion.

Most of the vegetation along the proposed alignment is dead, or are weeds.

Figure 4. Proposed Works on and near reserve 10407.

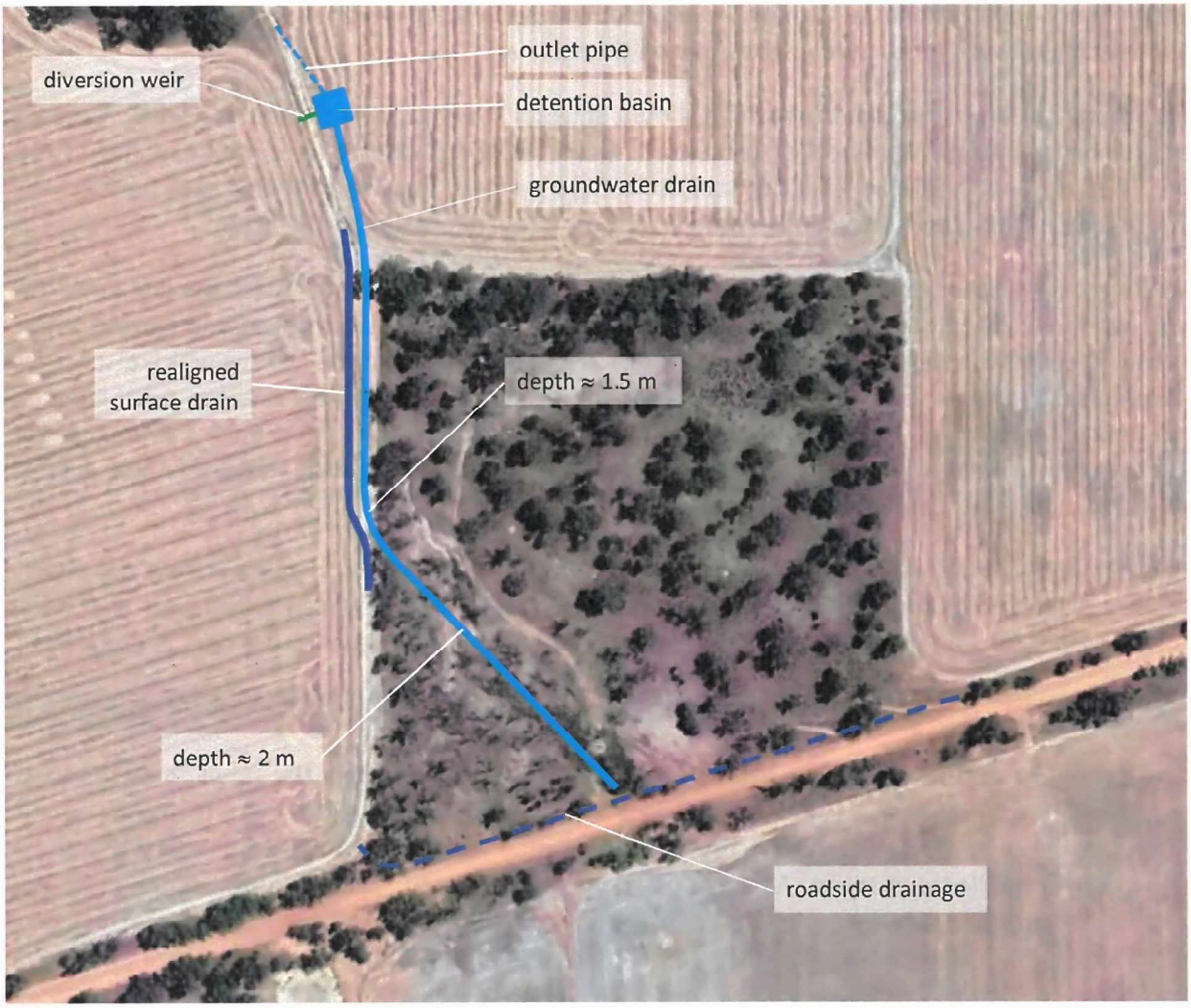
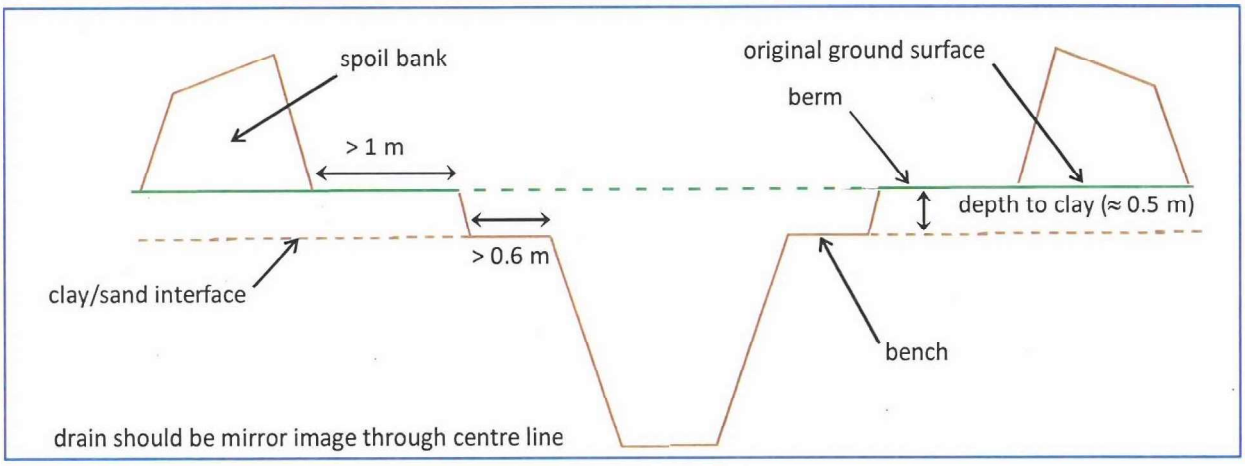


Figure 5. Details of the proposed groundwater drain cross section.



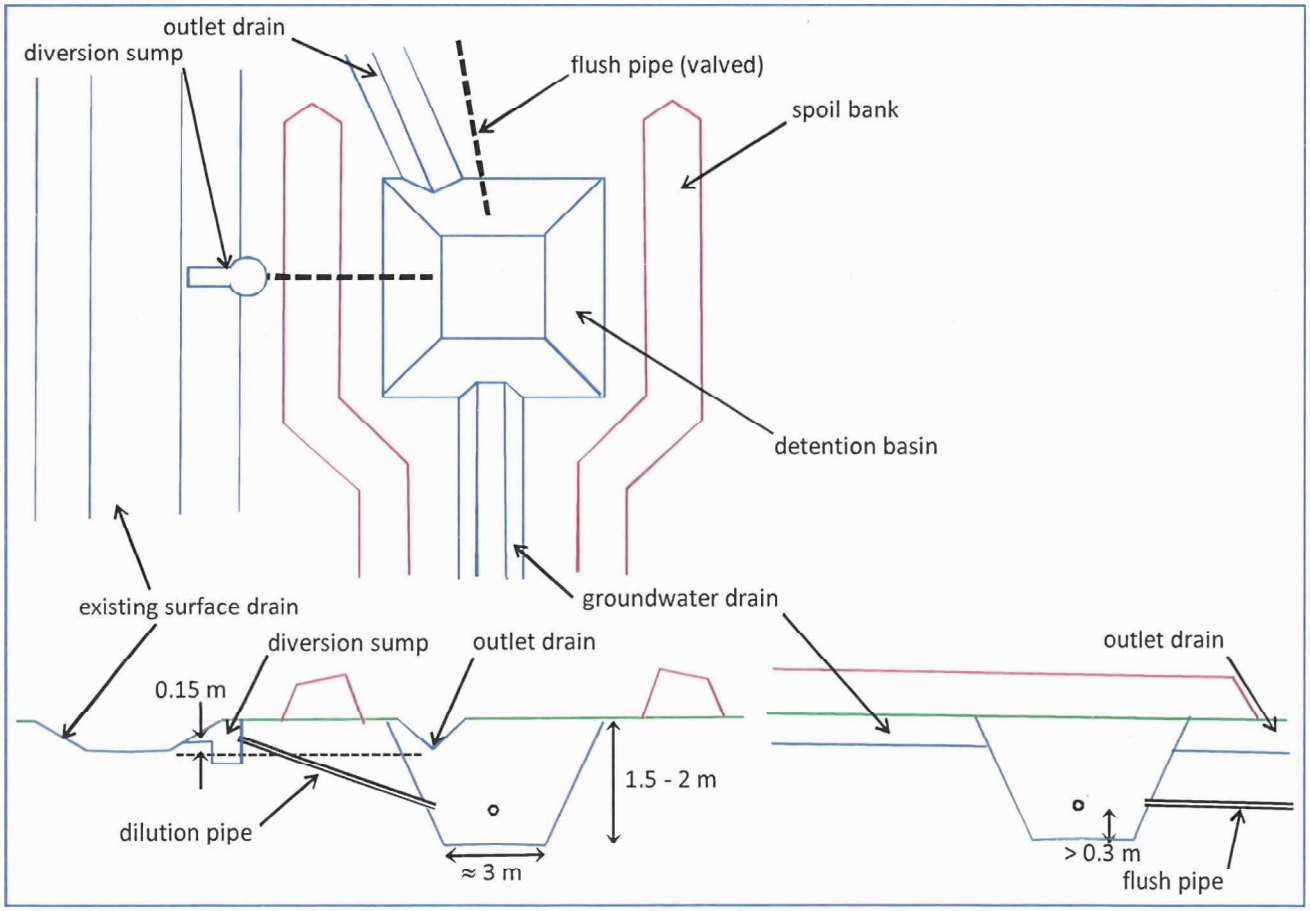
The detention basin is comprised of an earth sump (located on impermeable clay – same suitability as a dam) proximate to the existing surface drain. A small sump should be constructed to the side of the surface drain, with a pipe linking to the detention basin. The dilution pipe should be around 90 – 150 mm PVC (whatever is available), and the invert of the sump connection channel and dilution pipe should be 150 mm above the bed of the surface channel. This is designed to exclude

flows less than 1:1 year (depth of flow 150 mm). The outlet of the dilution pipe into the basin should be set near the base of the basin to prevent erosion when the basin is empty, but above any potential sediment (say 0.3 m). The detention basin only needs to be constructed with a base of around 3 m and depth of around 1.5 – 2 m – whatever is practical for the machinery used to construct it. Sides should be battered to maintain stability (1:2 – 1:3), though one slope needs to be shallow enough so that a loader can be used to clean out sediment. The outlet drain invert should be at the same elevation as the floor of the surface drain. Spoil banks should be continued around the sides of the detention basin to prevent inflow of surface water. Details of the basin are shown in Figure 6.

A flushing pipe (say 50 mm diameter) can be installed to allow the sump to be drained when larger surface flows are experienced. The pipe should be set to about 0.3 m above the floor of the basin (to avoid sediment) and graded out to natural surface downslope, with a readily accessible valve. Alternatively, a siphon or pump could be used, not requiring a built-in pipe.

After use for some period, the detention basin needs to be reviewed, and if not performing appropriately, adjustments made. If the detention basin overflows when there is no surface water flow, it needs to be enlarged (by deepening or lengthening). If the detention basin does not overflow sufficiently (ie. whenever there is reasonable flow in the surface drain), then the dilution pipe needs to be lowered slightly or increased in diameter (or an additional pipe installed). Sediment build up in the surface drain sump and in the basin will need to be cleaned out on a regular basis.

Figure 6. Details of the proposed saline water detention basin and discharge.



3.3 Permits

A permit to clear native vegetation will be required for the reserve section of the groundwater drain (approx. 160 m long x 10 m wide).

A Notice of Intent to Drain has been submitted to the Commissioner of Soil and Land Conservation by the farmer proponents and the Commissioner's representative John Firth has seen the proposal and discussed it with the proponents.

The proposed works within and immediately downstream of the reserve are not in a defined waterway, so a permit to interfere with bed or banks of a waterway is not required.

4 SUMMARY

Reserve 10407 is subject to hillside seepage from 2 sources – a perched water table from the slope to the east and a sand seam extending to the south, from which water used to be extracted via a well and is the reason for the reserve being vested for water supply. The former is quite saline and has caused significant decline in vegetation in the last 10 years or so. The latter most likely creates an upward groundwater pressure which reduces any chance of leaching or drainage.

It is desirable to re-establish natural vegetation to increase water use (and prevent further expansion of waterlogging/salinisation) and to also make the area look better. Dewatering is required to allow natural vegetation to recover and recolonise the bare areas. This will best be achieved using a groundwater drain up to 2 m deep. Road drainage currently diverted into the reserve must be continued along the road to the existing surface water drain below/west of the reserve.

The groundwater drain must be enclosed by spoil banks to minimise surface water ingress and should have side benches at the depth of the sand/clay interface to avoid slumping. A detention basin to temporarily store saline discharge water will be required downstream of the reserve to prevent saline flow through the downstream non-degraded environment.