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PHASE 1 SUMMARY REPORT:

Phileo Property - PSP 42 North

March2011

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1 Introduction

Alluvium has been engaged by Phileo for the preparation of a drainage options study for the Phileo property located with the PSP 42 North in Wyndham Vale.

1.1 Project method

This project consists of three phases:

- Phase 1: Identification of existing drainage conditions
- Phase 2: Options development for mitigating post development conditions
- Phase 3: Integrated stormwater management plan

This report summarises the drainage issues identified as part of Phase 1.

2 Data compilation and review

It is understood that the assessment of various environmental values and threats, as well as cultural heritage constraints in the study area is currently underway. This information would ordinarily be taken into account when developing drainage issues however no literature was available at the time of this study. This information is considered necessary for the development of a comprehensive drainage strategy and will be included as it becomes available throughout subsequent phases of this project:

- Vegetation: knowledge of ecological vegetation classes and their hydrological requirements
- Soil: soil types, estimated infiltration rates, groundwater flows (if any), extent of salinity (if any)
- Cultural heritage values: knowledge of any cultural heritage values and their hydrological requirements (in particular, scarred trees)
- Fauna: knowledge of fauna species already inhabiting or likely to inhabit the area under the proposed developed condition

LiDAR survey data of the study area previously obtained from GAA was used in conjunction with contour data provided by Phileo to develop a digital terrain model of the study area.

3 Site inspection

A field inspection was conducted by Alluvium on the 27 January 2011 to identify site features relevant to the hydraulic modelling and from a drainage, geomorphic, or environmental perspective:

- An unnamed tributary of Lolly Pop Creek dissects the Phileo property, running west to east before exiting through the north-eastern corner of the property (Figure 4)
- The unnamed tributary has been heavily degraded through agricultural practices including vegetation clearance and re-grading to allow wheat cropping within the property (Photos a - c, Figure 1). There appears to be no significant riparian vegetation or ecological habitat along the tributary (flora and fauna assessment still to be completed)
- The degraded the tributary appears to be fairly stable, with no signs of erosion or scour. However, this may be largely due to the cover of wheat at the time of the inspection
- The channel geometry appears to be shallow and at a flat grade, which indicates that significant flood events will be largely unconfined with floodplain widths varying across the property, reliant on the

topography. Prior to European settlement this tributary would have been characterised by a series of pools and riffles and a stand of healthy riparian vegetation

- Two large farm dams, one located immediately upstream of the property boundary (Photo d, Figure 1) and the other located within the Phileo property at downstream boundary (Photo e, Figure 1) are both located on the unnamed tributary, and would be providing a level of retardation to flows
- Downstream of the property the boundary the channel grade steepens and flood flows become more confined. This section of the tributary appears to be also heavily degraded
- An additional smaller sub catchment drains the south eastern corner of the property (Figure 4). Due to small size of the sub-catchment there are no definitive drainage lines traversing the site. Downstream of this sub-catchment a low lying depression would have previously been characterised by swampy marshlands/wetlands. This area has been heavily impacted by agricultural practices such as clearing, cropping and draining and as such little environmental values remain.

Figure 1. *Site inspection photos*

4 Hydrology

The runoff routing (RORB) hydrological model previously developed by GHD (2006) for the Wyndham Vale area was adapted to include the study area. RORB modelling is an interactive runoff and streamflow routing program that enables calculation of surface water discharge from catchments based on a range of hydraulic parameters. Model parameters used to simulate a range of flow events are shown in Table 1 (adapted from previous work by GHD 2006).

Table 1. RORB model parameters

Parameter	Value
Rainfall location	PSP 42 North (37°54'10" S 144°39'30" E)
Temporal pattern	AR&R87 Vol 2 for zone 1 (unfiltered)
Spatial pattern	Uniform
Aerial reduction factor	Siriwardena and Weinmann formulation
Loss factors	Constant with ARI
k_c	23
m	0.7
Initial loss (mm)	15
Constant loss (mm/h)	2.05

The existing peak flows (undeveloped scenario) for a range of average recurrence intervals (ARI) was investigated using the adapted RORB model (Table 2, Figure 2).

Table 2. RORB modelled flows (existing conditions – Phileo property undeveloped)

Location	10 year ARI flow (m^3/s)	100 year ARI flow (m^3/s)
A	11.5	21.6
B	9.9	21.0
C	10.0	20.9
D	8.6	20.7

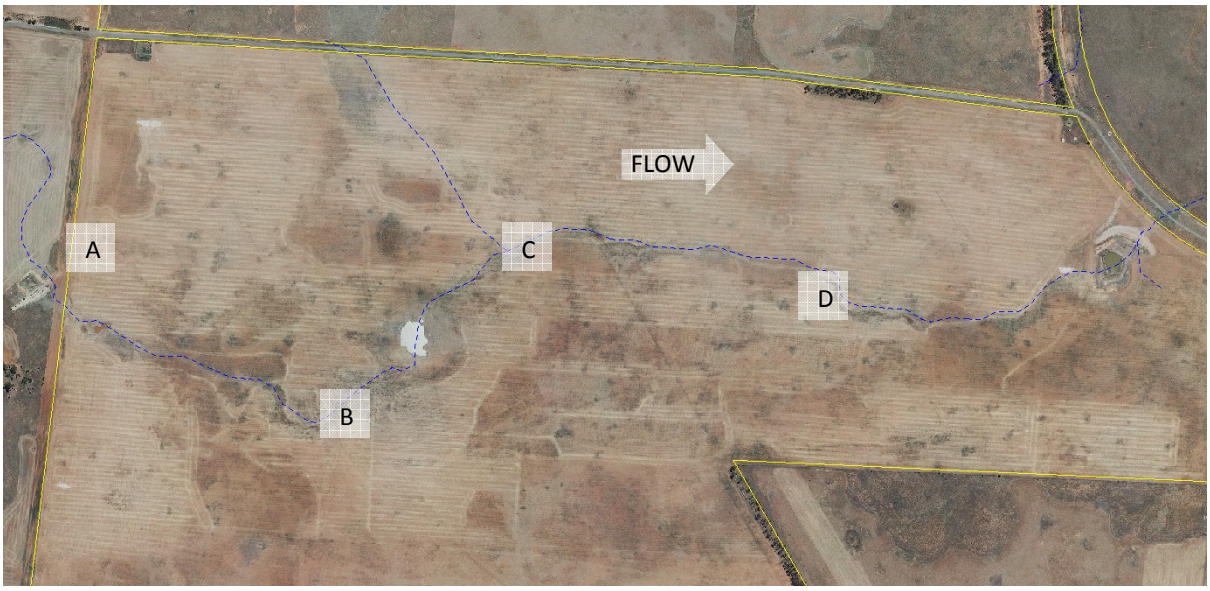


Figure 2. *RORB modelled flow change locations*

5 Hydraulics

The one-dimensional steady state (HEC-RAS) hydraulic model previously developed by GHD (2006) was adapted to include the study area. Cross-section survey was imported into the digital terrain modelling package 12D, which was then used to generate the hydraulic model (HEC-RAS). HEC-RAS hydraulic modelling enables the determination of a range of hydraulic parameters including flood levels, velocities and flow depth for a given flood event.

Model parameters were based on experience with similar waterways and the site inspection. The model was used to determine the 100 and 10 year ARI flood levels and extents for the existing (no development in the Phileo property) catchment condition (Figure 4).

Additionally, channel stream power was calculated for the 50 year ARI flood event for the existing catchment condition (Figure 3). Stream power is the rate of energy dissipation against the bed and banks of a waterway. Sections of waterway that have high stream power are more likely to be subject to erosion or scour. This stream power assessment involved identifying locations with high stream power and comparing results to available empirical reference data.

HEC-RAS results were checked against reference thresholds from the Technical Guidelines for Waterway Management (DSE 2007) and our developing database of stream stability data. The results show that for the 50 year ARI flood event the stream powers are generally below the reference threshold. This indicates that the tributary is in stable condition and is not currently prone to erosion or scour.

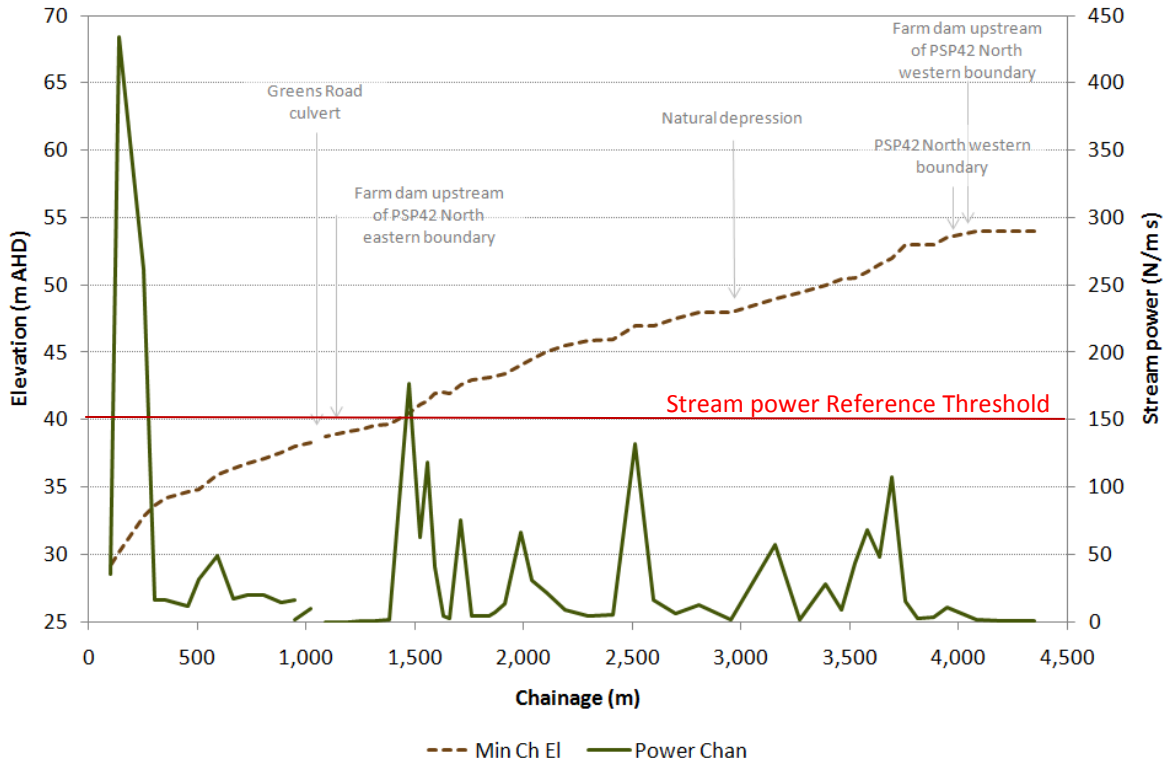
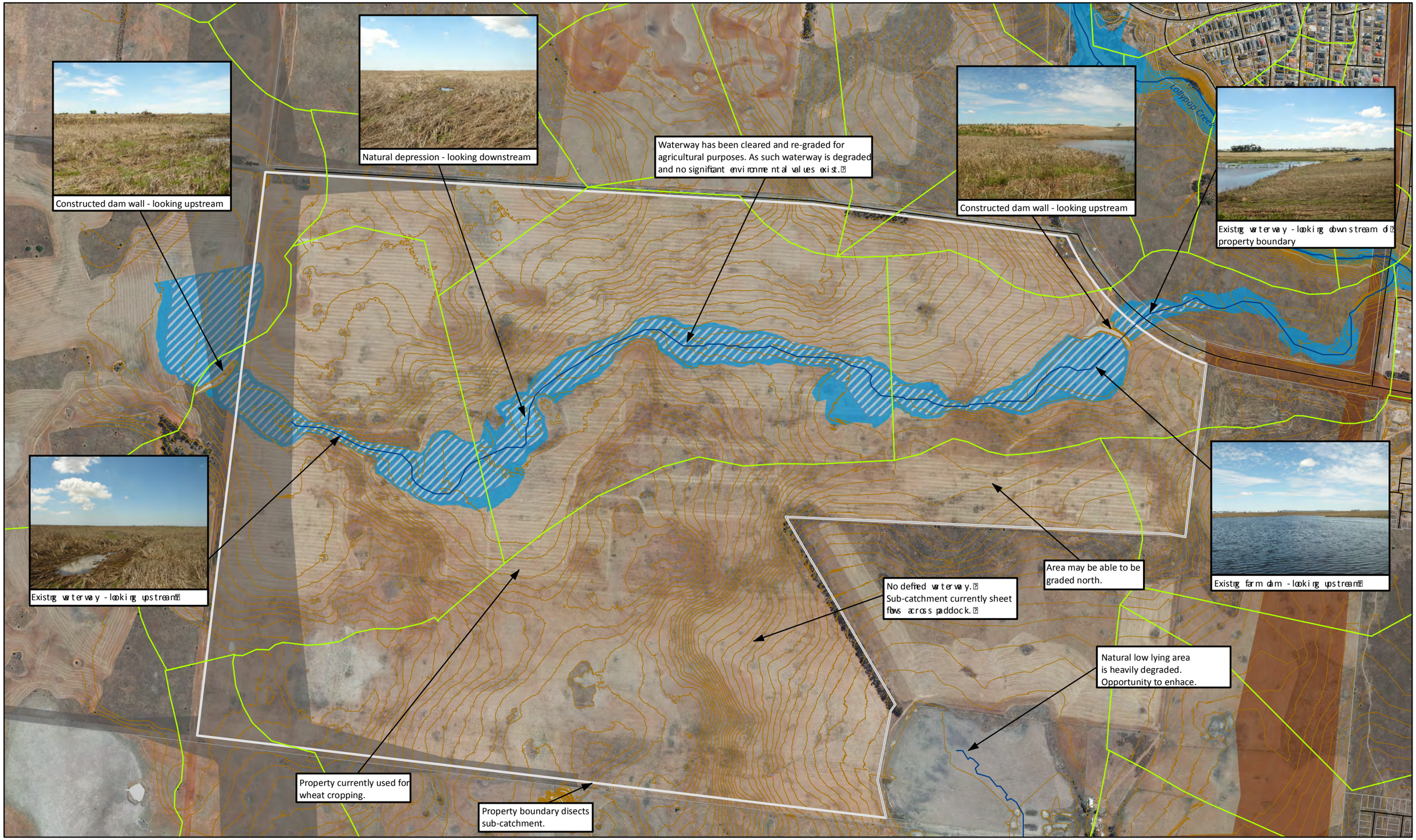


Figure 3. *Channel stream power for the 50 year ARI flood event*



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Legend

- Sub-catchment boundary
- Drainage
- Roads
- Contours
- Property boundary
- Road reserve
- Rail link reserve
- Current conditon 10 year ARI flood extent
- Current conditon 100 year ARI flood extent

Study Area

Existing Drainage Conditions

Phelio Property - Wyndham Vale

Figure 4

6 Summary of findings

The unnamed tributary of Lolly Pop Creek has been heavily degraded through agricultural practices including vegetation clearance, re-grading and cropping post European settlement. As result of these practices there appears to be no significant riparian vegetation or habitat for flora and fauna along the tributary and as such no significant environmental values.

While the degraded the tributary appears to be fairly stable, with no signs of erosion or scour, there is potential for the system to become unstable with increased pressures associated with urban development. This includes vegetation removal, stormwater pollution, increased flow volumes and frequencies, alteration of stream form, reduction in the overall floodplain width and decline in stream health.

As part of the Phileo development there is potential to improve and enhance the unnamed tributary. The current lack of environmental values within the tributary provides potential to:

- Improve stormwater conveyance and minimise flooding extents (where suitable)
- Improve/negate stormwater pollution through distributed water quality treatment
- Create suitable habitat for a range of flora and fauna through:
    - Creation of pools and riffles
    - Creation of in channel vegetated benches
    - Creation of a designated low flow channel
    - Creation of a riparian corridor linking to the downstream Lolly op Creek
- Improve channel stability through redesign of the tributary to meet/exceed stability thresholds
- Improved visual amenity and recreational value for the community
- Incorporation of shared paths and boardwalks to encourage community interaction

The development of the constructed waterway should aim to retain the characteristics of a natural waterway within the area. The new waterway, constructed in keeping with contemporary waterway management philosophies, have greater ecological, social and amenity values, which in turn should add value to the development.