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Department of Planning Industry and Environment
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Dear Prity

Sikh Grammar School SSD 9472 and associated subdivision of Lots 42 & 43 DP30186

1.1 Introduction

Further to DPIE's request on 13 Dec 2020, Alluvium has completed an initial assessment of key stormwater issues associated with the above SSD development application. The assessment includes a review of the concurrent subdivision development consent. Our review has focused primarily on the following key queries requested for consideration by DPIE:

- The stormwater concept plans, and flood assessment provided by the applicant to provide comment on the general feasibility of the strategy.
- Consistency of the development application for the school with the concurrent subdivision application for the site where the school is to be located.
- Draft development consent conditions issued by Blacktown City Council (Council) (as modified by DPIE) to provide an opinion on whether the proposed school would remain feasible to construct considering the proposed subdivision application.

Our review considered key sections of the following documents relevant to the queries above:

- Notice of Determination of Development Application No. 19-01597 provided by Council on 9/12/20 (subdivision application).
- Plan of Proposed Subdivision of Lots 42 & 43 DP30186 dated 5/8/2019 and stamped by Council for development consent on 9/12/2020.
- Concept grading and stormwater plans prepared by Martens and Associates dated 7 October 2020 for the subdivision application.
- Concept Stormwater Management Plan and Preliminary Flood Study: Sikh Grammar School prepared by Martens and Associates dated August 2020.
- Proposed Sikh Grammar School EIS prepared by Willow Tree Planning (including associated appendices) dated September 2019.

- Blacktown City Council response to SSD 9472 - 151-161 Tallawong Road, Rouse Hill – Sikh Grammar School dated 1 December 2020.

Our comments on the key flooding and stormwater management issues are provided below for DPIE's review and consideration.

1.2 Feasibility of proposed stormwater drainage and flood management concept

Upstream hydrology from the north-east
An upstream catchment of approximately 6.7 ha drains through the site from the north-east above Tallawong Road. Under existing conditions, stormwater runoff would drain into the site through an existing box culvert under Tallawong Road and then along an existing overland flow path draining through the development site from north-east to south-west. The site filling and building works associated with the proposed development would block this overland flow path and therefore the development applicant is proposing to manage the upstream catchment flows through a combination of pit capture, pipe and culvert conveyance and diverted overland flow path. Both the drainage system and overland flow path are proposed to be diverted through the north-east extents of the site and this represents a significant redirection of the existing overland flow path.

The proposal to significantly alter the natural drainage flow path in our opinion is inconsistent with current best practice. Best practice would be to maintain the current overland flow path through the site (consistent with current guidelines for protecting waterways) in a manner that includes consideration of the safety of the future school community. Although, we appreciate that discussions are likely to have been held with the appropriate state governmental authorities to agree on the proposed filling and diversion approach proposed.

Table 2 in the *Concept Stormwater Management Plan and Preliminary Flood Study* (Martens and Associates, 2020) indicates that a DRAINS hydrologic model has been developed for the upstream catchment and that the estimated 1% AEP flows from this model are consistent with those estimated previously by others for the approved upstream residential subdivision. Table 2 (Martens and Associates, 2020) indicates a 1% AEP flow (without climate change) of 41.8 m^3/s for this upstream catchment. This flow estimate is inconsistent with Section 7.5.4 (Table 30) of the EIS that states a 1% AEP peak flow rate of 3.22 m3/s from the same upstream catchment. This conflicting information on the estimated flows from the upstream eastern catchment should be resolved by the applicant as there would be significant implications for future flood risks to the community associated with adopting the incorrect flow estimates and associated drainage infrastructure. An initial review by Alluvium suggests that the higher estimated 1% AEP flow rates reported by the applicant exceed the estimates we would expect considering the upstream catchment area and critical storm durations considered. The higher estimates would require an extreme rainfall depth to fall on the upstream catchment during the 10-minute storm duration. Flood maps for all events (1% AEP and PMF) that were prepared by the applicant appear to be based on the same flow rate of 3.22 m^3/s.

The applicant should confirm the correct estimated 1% AEP and PMF flow rates. It is considered that requesting the applicant to modify and provide the DRAINS and TUFLOW models and provided these for review is not an onerous deferred development consent condition considering the proposal to divert major flows from the existing flow path. The relevant reporting and maps should also be updated accordingly.

Proposed major drainage system
We understand that a 1800mm x 600mm box culvert has been approved and is being constructed at the existing sag point in Tallawong Road immediately upstream of the site to manage stormwater from a separate approved residential subdivision on north-eastern side of Tallawong Road. This box culvert would ultimately be connected to the drainage system constructed as part of the proposed school development.

The development application for the school includes a proposal to capture surface runoff from Tallawong Road in 5 x 900mm x 900mm v-grate pits located at the natural sag point in the road adjacent to the school. A 1500mm diameter pipe is proposed to connect these pits to a box culvert proposed under the at-grade carpark in the north-east corner of the site. An overland flow path would also be formed across this carpark.

The box culvert under the carpark is then proposed to be connected to a 1500mm diameter pipe in the proposed road located north-west of the school site. We understand that this 1500mm diameter pipe forms a component of the separate subdivision application that has been approved by Council to create the lots for the school and adjacent residential lots.

It is unclear from the provided documents the reasoning behind the proposed major drainage arrangement and proposed size of the drainage conduits due to conflicting details provided. Our main comments on the proposed major drainage system are summarised below:

1. The DA documents provide conflicting dimensions for the proposed box culvert under the proposed north-eastern carpark. One section of the *Concept Stormwater Management Plan and Preliminary Flood Study* states dimensions of 2000mm x 1800mm and another states dimensions of 2000mm x 1500mm. The correct proposed size should be confirmed.

2. The proposed 2000mm x 1500mm (or 2000mm x 1800mm) box culvert exceeds the size of the proposed downstream 1500mm diameter pipe (to be constructed as a component of the related subdivision works) that the culvert would connect to. The proposed box culvert has a capacity that Council has estimated would be more than double that of the downstream pipe. The proposed arrangement creates a potential 'choke' point in the system that could lead to surcharging at this location if blockages occur where the larger box culvert reduces to the smaller pipe, or where flows along the box culvert exceed the capacity of the pipe.

3. It is unclear from the application why a larger box culvert is proposed upstream of the smaller 1500mm diameter pipe proposed as a component of the related subdivision works. If the 1500mm diameter pipe has sufficient capacity to convey the 1% AEP flow it is unclear why a larger box culvert is being proposed upstream. The applicant should confirm the reasoning for the size difference.

4. The applicant should provide hydrologic and hydraulic calculations and models for the entire major drainage line between Tallawong Road and the natural discharge point downstream of the development site to confirm the feasibility of the proposed system. It is unclear if the drainage line has been sized considering only flows from the upstream north-eastern catchment. The applicant should confirm that the system has been designed to also account for flows from the north-western catchment adjacent to the site (refer below) and from the proposed development site.

5. The application assumes that surface runoff from Tallawong Road during the 1% AEP event draining to the sag point adjacent to the site would be captured by 5 x 0.9m x 0.9m flush v-grated pits. It is considered that this arrangement is likely to readily become blocked by organic debris and other matter during large runoff events due to the small openings provided in the flush grates. Typically, sag points should be provided with larger raised inlets (e.g. kerb inlets or raised grates) that are less susceptible to blockage. Additional inlets formed in the kerb at a higher level to the v-grate inlets may assist to mitigate impacts of potential blockage.

Comments provided by Council suggest they view the proposed mitigation works as being significantly undersized, although it appears this conclusion assumes that the estimated 1% AEP flow rate is 41.8 m^3/s. Council has also expressed concern that flows exceeding the capacity of the flood mitigation drainage works would enter the property. The applicant has stated that the eastern boundary of the property would be raised to 52.5m AHD to avoid inundation of the buildings by floodwater. Modelling of the PMF event indicates that flows ponded in the trapped sag point within the Tallawong Road reserve would overtop the north-eastern side of the carpark and flow through the carpark to the northern road. The depth of ponding in the 1% AEP event was estimated to be less than 0.2m. Provided the overland flow path is kept clear, and the inlets in Tallawong Road are designed to minimise the potential for blockages and prevent overland flow in events up to the 1% AEP flow, this approach to managing PMF flows is considered reasonable in principle.

The flooding behaviour should be verified by providing the respective DRAINS and TUFLOW models for review to demonstrate that each drainage element has sufficient capacity for the final design configuration.

Upstream hydrology from the north-west

The application considers the upstream catchment to the north-east but does not mention the catchment to the north-west of the development. The catchment is smaller than the north-eastern catchment but is not insignificant. The drainage system for the road north-west of the development (proposed as a component of the related subdivision works) would capture flow from this catchment in events up to the design flow (understood to be the 1% AEP). The applicant should confirm that contributing flows from this catchment have been accounted for in the flood modelling and design of the major drainage system.

In addition, flows from these catchments should be considered when designing any flood protection works along the north of the development, where structures will be used to protect below ground structures from flooding in events up to and including the PMF. If they have not already, the applicant should include flows from these catchments in the DRAINS and TUFLOW modelling. Design of the major drainage, flood protection works, and hazard mapping should be updated to account for these flows.

Internal site drainage and on-site detention

The site under pre-development conditions has limited impervious area. For developed conditions, the applicant has estimated that the imperviousness will increase to 65% and this estimate is considered reasonable. Without mitigation, peak stormwater discharges from the internal site drainage system to downstream properties would increase significantly up to the 1% AEP design storm event. To mitigate peak discharges during this range of events, the applicant would be installing on-site detention (OSD) works to manage stormwater discharges in this flow range. The applicant has provided concept design drawings and calculations for the OSD basins and tanks and committed to meeting Council's requirements which require 455m^3 of OSD provided per hectare of development. The concept OSD designs have been reviewed and appear to comply with Council requirements and are able to feasibly be incorporated into the development layout.

The application includes allowance for temporary and permanent OSD works. The temporary OSD works would initially be sized for the Stage 1 development footprint. It appears that the applicant is proposing to progressively upgrade the size of the OSD system as each of the nine development stages proceed until such time as the ultimate footprint is achieved. Council has indicated their desire that OSD provisions should be constructed during Stage 1 to cater for the ultimate development state (i.e. sized based on completion of all nine development stages). It is considered that multiple staged upgrades of the OSD system should be avoided (potentially up to nine upgrades if the OSD system is upgraded for each development stage). We would have concerns with particular staged upgrades being inadvertently overlooked as the development proceeds. It is considered that an acceptable compromise may be to reduce the staged upgrades of the OSD system to two or three agreed development stages.

The OSD tanks would assist with managing flows during events captured by the internal drainage system. The internal drainage system (including inlet structures and pipes) would be designed to contain the 1% AEP event. Neither details of the internal drainage system or the DRAINs model prepared to assist with the design have been provided for review. Although, it is expected that these details will be available for review as a component of the detailed design in response to the development consent conditions. Based on a high-level review of the concept drainage plan (refer Martens & Associates Drawing PS05-E101) for the school development, it appears that a significant internal sub-catchment would drain to the pit at low point/sag near the north-west corner of the OSD tank. This pit provides a critical element of the drainage network and is subject to blockage due to the vegetated catchment. The detailed design of drainage works should consider the impact of this pit and any other pits at trapped low points becoming blocked. The application should consider providing additional overflow pits to accept ponded flow in the instance that the primary sag pit becomes blocked. The pit system should be designed to ensure adjacent property, infrastructure or critical access is not inundated, and unattenuated flows are not released from the site even after failure of one drainage pit, for events at least up to the 1% AEP event to achieve the required targets.

The detailed design of the development should also consider overland flooding behaviour within the site during events exceeding the 1% AEP. The potential for any ponding to present safety concerns to the future school community or damage to infrastructure should be considered. One specific area for consideration is whether ponding at the low point near the OSD tank would potentially result in any inundation of adjacent below ground carparking, and in that case ensure appropriate flood protection is provided.

Water conservation and reduced stormwater runoff volumes
The plans provided indicate that the imperviousness of the site would increase significantly following development. The increased imperviousness would result in increased magnitude and frequency of runoff volumes generated on the site. During regular storm events more frequent pulses of stormwater would drain to the downstream site than would have occurred under existing conditions. Whilst these frequent flows would be contained within an area bounded by flooding extents during large storm events, these areas would be more frequently wetted. In circumstances where critical habitats sensitive to hydrological changes occur this is of concern. In other locations, more frequent wet periods can hinder maintenance and use of the land.

The OSD provisions would mitigate the potential increase in peak flow rate from these events, though would not mitigate the impact of increased total discharge volumes. Council has indicated that the application should include consideration of water conservation and has indicated that rainwater tanks should be provided to assist with achieving a goal of 80% non-potable water reuse. This would provide some mitigation of increased stormwater runoff volumes from the site and is recommended to be adopted for appropriate non-potable uses.

Potential impacts on downstream waterway and properties
The applicant should confirm that the proposed 2.5m drainage easement through the residential lot downslope of the school site will have sufficient capacity to manage any overland flow from the school site for all events up to the 1% AEP event without impacting on the use of that lot and adjacent lots.

The proposed development would result in alteration of the flow regimes in the waterway downstream of the site. The capturing and discharging of flows at a single point from the site at the proposed outlet headwall will concentrate flows that under existing conditions would be more dispersed over the downstream floodplain. This would result in increased flows and velocities in the waterway downstream of the headwall outlet and could impact the stability of the channel downstream and the waterway ecology.

The outlet headwall is being constructed as part of the subdivision and the consent conditions require written approval from the downstream landowner to discharge concentrated stormwater and carry out works on the land to construct the headwall. It should be made clear to the landowner the extent of catchment/development areas that will ultimately drain through their land.

1.3 Development application consistency with concurrent subdivision application

Development consent for the subdivision creating the lots for the proposed school and adjacent residential development was issued by Council on 9 December 2020. The subdivision application included creation of 12 lots, comprising 11 Torrens Title lots along the south-western boundary, and one large lot for the proposed school. The subdivision application included engineering drawings detailing filling works and diversion swales within the large lot. The consent was issued with a number of deferred commencement conditions requiring further information from the applicant before development consent become operational. A development application was also prepared separately for the large lot and submitted for the proposed Sikh Grammar School.

The approved subdivision plan incorporates a 2.5m drainage easement linking the proposed school lot to the downstream public road reserve. The subdivision plan also included allowance for a temporary on-site detention easement that we understand will ultimately be converted for residential use following construction of the downstream regional detention basin.

Alluvium has completed a review of the consistency between the proposed Sikh Grammar School State Significant Development Application (SSDA) and the associated subdivision Development Application (DA).

Council's comments on the subdivision DA that are relevant to the scope of works for this review are similar to many of the consent conditions associated with the school SSD application and attempt to forge consistency between the projects. The works to be constructed under the subdivision DA approval include critical elements for the development of the following school, such as:

- Adjacent road infrastructure with associated surface drainage;

- Site filling;
- Major drainage infrastructure; and
- Drainage outlet works.

The engineering drawings included with the subdivision application detail the proposed filling works and temporary diversion swale to be constructed across the school lot to enable the residential lots to be formed in advance of the school construction works proceeding. The temporary diversion swale within the lot is proposed to divert overland flows from regular runoff events up to the 1% AEP event in a northerly direct towards the adjacent road reserve. Limited detail is provided on how the overland flows would drain into the adjacent road reserve and it is envisaged that the proposed arrangement could cause nuisance in areas where flows discharge from the site overland into the footway area. It is recommended that a temporary stormwater retention basin/depression with a constructed inlet pit be provided within the site to intercept overland flow before it enters the public road reserve. This drainage pit should be connected to the proposed major drainage line in the adjacent road. The temporary basin/depression (and diversion swale) should also be configured to prevent the discharge of sediment from the school site.

The school development will be connecting drainage works to those constructed as a component of the subdivision works. It will be imperative that appropriate capacity is present in the subdivision drainage system for receiving of future drainage from the school. Without access to detailed drawings of the two drainage systems, or the respective DRAINs models, we have not been able to provide a detailed review of whether the subdivision has allowed sufficient capacity for the school development. However, the proposed subdivision drainage strategy in principle proposes a system that has the potential to pass stormwater flows from catchments within and upstream of the site. Detailed comments outlining our concerns with the proposed major drainage system are outlined in Section 1.2.

1.4 Draft development consent conditions

A document titled "Council response to DPIE_SSD 9472_ Sikh Grammar School – 151-161 Tallawong Road, Rouse Hill.docx" was provided to Alluvium for review on 14 December 2020. This document includes conditions proposed by Blacktown City Council for inclusion in the SSD application. The drainage conditions were reviewed by Alluvium and draft comments are provided below for consideration.

Blacktown City Council response to SSD 9472 - 151-161 Tallawong Road, Rouse Hill – Sikh Grammar School dated 1 December 2020.

The relevant consent conditions for the scope of this review and the proposed school development are primarily listed in Section 8 Development Engineering conditions and Section 9 Drainage Engineering conditions of Council's response.

- **Section 8 Development Engineering conditions**
    - 8 (d)(vii) Drainage – Application does not include proposal to pipe/channelise the existing watercourse through the site. Applicant is proposing to fill the watercourse and divert flows.
    - 8 (e) (iii) Adjoining owners – Requires written approval for applicant to discharge stormwater. This is considered an important condition to resolve to ensure the development is not delayed.
- **Section 8 Section 9 Drainage Engineering conditions**
    - 9 (a) Deferred commencement conditions
        - (v) Reasonable requests considering conflicting information in the application.
        - (vi) Reasonable requests considering conflicting information in the application.
        - (vii) Reasonable requests considering missing and conflicting information in the application that have a potential to impact significantly on major drainage outcomes. Construction of the Stage 1 OSD basins to a size based on the ultimate

development footprint potentially is onerous. It is considered that a compromise condition could be included where the number of temporary basin modifications is limited to two or three interim configurations at nominated hold points aligned with different stages.

- (viii) Reasonable requests for some items. It is considered that some of the more detailed requirements could reasonably be addressed during preparation of Construction Certificate documentation rather than as deferred commencement conditions.
- (ix) Reasonable requests as modified MUSIC modelling may require additional space to be allocated within the development layout and size of measures may change.
- (x) Reasonable requests to confirm that space and appropriate locations are feasible within the site to position any additional/modified measures required.
- (xi) EIS indicates that a groundwater assessment was completed by a geotechnical engineer – this should be reviewed by a suitably experienced consultant.
- (xiii) – (xv) Reasonable requests

1.5 Conclusions

We have completed an initial review of the proposed stormwater management and flooding assessment provided for the proposed development. Our main comments on the proposed stormwater management system are associated with the major drainage system being designed to divert major flows around the proposed development site. There is conflicting data and design information presented by the applicant that has created some confusion, and it may be that provision of clarifying information from the applicant may resolve some of the concerns we have raised. The major drainage system as currently planned comprises:

- An approved 1800mm x 600mm box culvert at the existing sag point in Tallawong Road immediately upstream of the site to collect stormwater from a separate approved residential subdivision and transfer this across Tallawong Road to a proposed 1500mm diameter pipe.
- A proposed 1500mm diameter pipe in the Tallawong Road reserve collecting road runoff from v-grate pits installed at the sag that is connected to a box culvert proposed under the at-grade carpark within the development.
- A proposed 2000mm x 1500mm (or 2000mm x 1800mm?) box culvert installed under the at-grade carpark and connected to a 1500mm diameter pipe in the adjacent road reserve.
- The 1500mm diameter drainage line in the public road reserve conveying stormwater to a headwall outlet discharging into the downstream, private land.

The proposed drainage arrangement is quite unusual with the size and capacity of the drainage elements not logically increasing as the system proceeds downstream. It appears that the proposed system increases and decreases in capacity at two stages in this relatively short section of the drainage system. It is unclear from the provided reports and plans the reasoning behind these distinct changes in size and capacity. It is considered that the locations where the size of the system (and capacity) reduces are susceptible to localised blockages and/or surcharge where the capacity is restricted. Resolving the queries about this proposed major drainage line is considered to be the most pressing issue to ensure that a potential choke point in the system is not constructed leading to localised surcharging and flooding events. This is particularly important considering that the applicant is proposing to divert flows during flooding events away from the current natural drainage pathway through the site. In the event that issues arise with the proposed drainage system, any impacts are likely to occur at locations away from the current flow path.

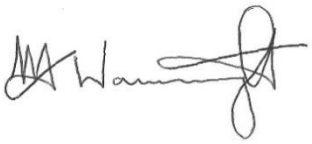
The Concept Stormwater Management Plan and Preliminary Flood Study also presents conflicting data on the estimated 1% AEP flows for the development that differ by an order of magnitude. This should be clarified by the applicant and updated hydrologic and hydraulic models and associated results provided. The applicant should also provide a suitable hydraulic grade line analysis along the major drainage line (as proposed or

revised from the conduit dimensions above) to demonstrate that the proposed arrangement is appropriate. This analysis should include consideration of reasonable blockage factors along the drainage line.

The hydraulic design of the major stormwater drainage lines also assumes that stormwater is able to enter the system and is not limited by the inlet capacity of the drainage system during the 1% AEP event. The proposed system relies somewhat on surface runoff being able to enter the drainage system at the proposed trapped sag point in Tallawong Road during the 1% AEP event. It is considered that the arrangement of 5 x 0.9m x 0.9m flush v-grated pits at this sag point is likely to be readily blocked by organic debris and other matter during large runoff events (or extended wet periods) due to the small openings provided in the flush grates. It is considered that this inlet arrangement should be reconsidered to minimise the potential for future frequent excessive ponding in Tallawong Road and frequent overland flows through the adjacent proposed carpark. This has the potential to become a frequent nuisance to the community at this location during wet weather due to the high use of this area. It is recommended that an alternative more reliable concept for capturing surface runoff at this sag point be provided by the applicant for consideration.

If you have any questions on the above, please do not hesitate to contact the undersigned.

Sincerely



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