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HIGHWAYS DEPARTMENT

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Agreement No. CE 56/2000
Design and Construction Assignment for Deep Bay Link

Technical Note No. 18 – Habitat Creation and Management (HCM) Plan

(Report Ref. 23506-REP-078-03)

Ove Arup & Partners Hong Kong Limited

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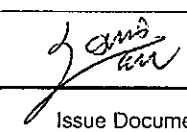
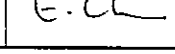
		Signature	-		

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1. THE ORIGINAL DEEP BAY LINK EIA MITIGATION PLAN

Deep Bay Link is a 5.4-km trunk road connecting R10 and the Shenzhen-Hong Kong Western Corridor across the boundary at Deep Bay near Ngau Hom Shek. The approved mitigation plan for 0.73 ha of wetland losses was detailed in Table 7.32 of Section 7.5 of the Deep Bay Link Final EIA (hereafter "DBL EIA"). Table 7.32 is self-explanatory and is reproduced here as ***Annex I*** for ease of reader reference. The two sites where pond losses were predicted are shown in ***Figure 1*** and described below.

1.1 Pond 24

A temporary loss of 0.24 ha was predicted at Pond 24 (***Figure 2***). This was to be the lower one-third of the abandoned pond that was located within the works limit or land resumption limit. The area was to be reinstated on completion of the highway project with the result that no net permanent wetland loss would occur.

1.2 Pond 15

A permanent loss was predicted to cover a part of Pond 15 measuring 0.49 ha. That loss included four of the 12 sub-ponds that had been formed by sub-division of Pond 15 by fish farmers. Those four ponds are collectively referred to in this report as Pond 15. The other eight ponds are disregarded because they are not affected by the Deep Bay Link project. For individual reference the four ponds have been named Pond 15A, 15B, 15C, and 15D (***Figure 3***).

The loss of 0.49 ha of fishpond at Pond 15 was to be mitigated by construction of a marsh-pond contiguous with the reinstated Pond 24 (***Figure 2***). The area of the constructed pond/marsh was to be 0.49 ha, equivalent to the area of predicted loss. Thus there was no net loss of pond area.

1.3 Construction Schedule

Condition No. 2 of the approval of the DBL EIA states that:

"The project proponent shall provide on-site or off-site compensation for the loss of 0.73 ha of fishpond during the construction stage or advance the section of work near Pond no. 24 as described in the approved Deep Bay Link EIA report ahead of other sections of the project so that the proposed fishpond could be created earlier to provide compensation."

Compensation was to be provided on-site (***Figure 2***), and at the outset of construction to comply with this approval condition.

1.4 Post-Construction Pond Management

Post-construction management of Pond 24 was to be undertaken by Agriculture, Fisheries & Conservation Department (AFCD) on behalf of Highways Department (HyD) (see ***Annex I***, Table 7.32, paragraph 1).

2. REASONS TO MODIFY THE MITIGATION PLAN

The advantages of reducing the extent of pond losses, increasing the compensation ratio, and reducing the scale of earthworks and disturbance to the existing habitat near Pond 24 are the key reason for modifying the mitigation plan. It was found during the detailed design stage of DBL that the total area of pond loss as presented in the approved DBL EIA could be further

reduced by adoption of a minimum disturbance approach. Limitation on pond filling will be imposed during construction stage. Although that will limit the works space and impose more site constraints to the construction activity, the approach will protect parts of the undisturbed ponds and maintain their naturalness. According to the original design presented in the approved DBL EIA, there would be a permanent loss of 0.49 ha. in Pond 15 and a temporary loss of 0.24 ha. in Pond 24 (i.e. total area affected would be 0.73 ha.). Further assessment during the detailed design stage revealed that the permanent loss in Pond 15 and the short-term loss in Pond 24 could be further reduced to 0.17 ha. and 0.018 ha. respectively (i.e. total area affected could be reduced from 0.73 ha. to 0.188 ha.). As the loss in Pond 24 has been significantly reduced, and the majority of the new wetland, which requires measures to accelerate the establishment of aquatic communities, would be located at Pond 15, the location of the Wetland Compensation Area was also changed from Pond 24 to Pond 15. Details of pond losses, pond designs and modified mitigation plan are presented in Section 3 of this Technical Note.

3. THE CURRENT PROPOSED PLAN

3.1 Pond 24

The proposed plan represents a substantial reduction in the extent and intensity of impact to Pond 24 from the prediction in the DBL EIA. The reason for the reduction of impact is that it was found during the detailed design stage to be unnecessary to fill the entire portion of Pond 24 within the works area. Rather Pond 24 would not be altered except for construction of one of the bridge piers near the south perimeter of the pond and a temporary access platform supported by 11 nos. 900mm diameter tubular pipes for in-situ launching of bridge segments. Prior to pier construction the pond perimeter would be extended for advance compensation due to construction impacts. The area to be affected by the construction of the substructure and segment launching of HK-SWC viaduct (including working space, access for equipment etc) is about 180m². This area is for the working space and access for the manoeuvre of construction vehicle for transportation of construction equipment and materials. Pier construction and segment launching would cause short-term impacts (about sixteen weeks) on about 180m² followed by permanent loss of 15m² (due to the pier) of pond shoreline habitat (***Table 1***). The modified mitigation plan would contribute to a net gain of 244m² in wetland area at Pond 24 after project construction.

The alternative, reduced impact, wetland mitigation project at Pond 24 would consist of the following steps as shown in ***Table 2*** and ***Figure 4***:

1. extension of the pond perimeter to compensate for the pier construction;
2. piling for 1 pier column;
3. construction of a pile cap beneath the soil surface;
4. construction of a single pier column on top of the pile cap;
5. construction of temporary access platform for in-situ launching of bridge segments; and
6. recontouring of any disturbed portion of the pond bed.

At Pond 24 advance mitigation would be carried out to extend the pond perimeter downstream to cover an area of 259m² to compensate for the predicted permanent loss of an area of 15m² that is to be occupied by a pier. The downstream bund of the pond measures approximately 42m in length. This bund will simply be dozed downstream a distance of 6.2m to enlarge the pond. The compensation ratio for permanent habitat loss would be 259:15, or nearly 17:1. This is in line with the spirit of the DBL EIA Report approval condition 2 in providing advance compensation. Pier construction would cause a short-term disturbance on some 180m² of the pond bed near the shoreline. Reinstatement and recontouring of the disturbed

area of 180m^2 would be carried out after completion of segment launching. The compensation ratio for short-term habitat loss would be 259:180 or 1.4:1.

Table 1 Predicted habitat losses and gains in Pond 24 based upon the revised mitigation plan.

Activity	Short-term Habitat Loss (m^2) (A)	Permanent Habitat Loss (m^2) (B)	Reprovision or Extension (m^2) (C)	Net Change in Area (m^2) A+B+C
Extend pond perimeter			+259	+259
Temporary access road	-69 (7.7 x 9 m)			-69
Piling	-104 (10.2 x 10.2 m)			-104
Pile cap construction	no additional loss			0
Construct pier column	no additional loss	-15 (1 column with cross-sectional area of 2.5 x 6 m, or 15 m^2)		-15
Construct temporary access platform for segment launching	-7			-7
Reinstate & recontour the disturbed portion			+180	+180
Total	-180	-15	+439	+244

Table 2 Tentative Construction Programme for Pond 24

Construction Activities	Year 2004							Year 2005								
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
Stage 1 Extension of pond perimeter to compensate for the pier construction		■														
Stage 2 Piling for 1 pier column			■													
Stage 3 Construction of a pile cap beneath the soil surface				■												
Stage 4 Construction of a single pier column on top of the pile cap					■											
Stage 5 Construction of temporary access platform for in-situ launching of bridge segments									■	■	■					
Stage 6 Recontouring of any disturbed portion of the pond bed												■				

3.2 Pond 15

Pond 15 covers an area of approximately 4,900 m^2, which includes 4 sub-divided ponds that are named Ponds 15A, 15B, 15C, and 15D in this report (see ***Figure 3*** **and** ***Table 3***). Approximately 1700 m^2 of the existing Pond 15 will be permanently lost due to construction of a haul road and foundations for the bridge piers, followed by construction of a village access road. That pond area loss will be mitigated by excavation of new ponds, namely Ponds 15X and 15Y as discussed below and presented in ***Figure 5***.

Pond 15A covers an area of approximately 1,600 m^2. It will remain intact. A short portion of the bund in the northwest corner of the pond will be replaced by a constructed slope beneath the eastern viaduct, but the area of the pond will not change (see ***Figure 5***, Stage 1).

Pond 15B covers an area of approximately 900 m^2. There will be only a loss of 100 m^2 from its southeast corner (see ***Figure 5***, Stage 2).

Pond 15C covers an area of approximately 1,400 m^2. Approximately 800 m^2 will be permanently lost to construction of a haul road and foundations for the bridge piers, followed by construction of a village access road (see ***Figure 5***, Stage 2). The remaining 600 m^2 of Pond 15C will be reinstated as Pond 15C1 (see ***Figure 5***, Stage 3).

Pond 15D measures 1,000 m^2. It will be occupied during the construction project thus there will be a short-term loss of the entire pond area (see ***Figure 5***, Stage 2). On completion of the roadway part of Pond 15D measuring 200 m^2 will be reinstated and joined with the unaffected Pond 15A and the remaining Pond 15B to form Pond 15ABD by removal part of the bund separating them (see ***Figure 5***, Stage 3). The total area of Pond 15ABD after construction will be 2,600 m^2 (1,600 m^2 from Pond 15A, 800 m^2 from Pond 15B, and 200 m^2 from Pond 15D).

The permanent loss of 100 m^2 of Pond 15B, 800 m^2 of Pond 15C and 800 m^2 of Pond 15D will be mitigated by excavation of Ponds 15X and 15Y. Pond 15X will measure 900 m^2 in area. Pond 15Y will measure 1,000 m^2 in area. Their contributions to mitigating pond losses are shown in ***Table 3***. The proposed new Ponds 15X and 15Y will measure 1,900 m^2 in total area.

Excavation of Pond 15X will be completed in September 2004 in advance of commencement of the road construction project in the Pond 15 vicinity (see ***Table 4*** and ***Figures 5, Stage 1 and Figure 8***). This will ensure that Pond 15X is available for wildlife use during the course of construction of the highway project. Similarly, Pond 15A will not be filled and will be available for waterbird use during the entire course of the construction project. Hoardings will be erected along the southern shores of Pond 15A and 15X to reduce the disturbance to wildlife from construction works. This will increase the probability that wildlife will use the ponds during the construction period.

Pond 15ABD will be constructed in April 2005. Ponds 15Y and 15C1 will be excavated / reinstated in July 2005 near the end of the road construction project (see ***Figure 5***, Stage 3 and ***Figure 8***).

The modified mitigation plan would contribute to a net gain of 200m^2 in wetland area at Pond 15 after project construction, an increase from 4,900 m^2 to 5,100 m^2 (4% net gain).

Table 3 Wetland habitat losses due to construction and gains due to mitigation at Ponds 15 and 24.

Pond Number, Activity	Existing Area (m^2) (A)	Short-term Loss (m^2) (B)	Permanent Loss (m^2) (C)	Reprovision, Restoration Area (m^2) (D)	Final Area (m^2) (A-B-C+D)
15A, no loss	1,600			0	1,600
15B, partial loss	900		100		800
15C, partial loss	1,400		800		600
15D, partial loss	1,000	200	800	200	200
15X, excavate				900	900
15Y, excavate				1,000	1,000
POND 15 SUB-TOTAL	4,900	200	1,700	2,100	5,100
24, partial loss	2,400	180	15	439	2,644
TOTAL	**7,300**	**380**	**1,715**	**2,539**	**7,744**

The sequence of excavation, filling and reinstatement of Pond 15 is illustrated in ***Figure 5*** and the programme is shown below in ***Table 4***. Excavation of Pond 15X prior to loss of other ponds is noteworthy in that it represents 900 m^2 of advance mitigation.

Table 4 Tentative Construction Programme for Pond 15

Construction Activities	Year 2004							Year 2005											Year 2006					
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
Stage 1 Construct Pond 15X		■	■																						
Stage 2 Fill Pond 15B, 15C & 15D Construct foundation and haul road				■	■	■		■	■	■	■														
Stage 3 Construct Pond 15ABD Construct Pond 15Y & reprovide Pond 15C1											■			■	■	■	■								

Note: When the construction / reinstatement of each pond is completed, the individual pond will be filled up with water followed by hydroseeding and fish stocking (except for planting of bamboos and wetland plants which will be performed at the beginning of 2006 wet season).

3.3 Additional Gain

All losses of wetlands at Ponds 15 and 24 would be less than the currently proposed compensation area. The ratio of final pond area to existing pond area would be approximately 7744:7300 or 1.06:1 in the modified plan as compared to the compensation ratio of 1:1 in the original plan reported in the DBL EIA. The net change in wetland area would be a gain of some 444m^2 according to the new proposal.

4. POND DESIGN AND CREATION

4.1 Ecological Value of Ponds 15 and 24 Before the Works

The ecological value of Pond 15 before the works was assessed in part based on the results of sampling Transect 3 (Ling To Monastery Road), as documented in the DBL EIA (see Appendix 7, Ecology Field Data). Of the reported 42 bird species, the only documented wetland-associated species of conservation concern was the Red-billed Starling. One individual was seen over 4 sampling days spanning 2 seasons "around the ponds by the road to Ling To Monastery".

The ecological value of Pond 24 before the works was assessed mainly based on the presence of breeding amphibians, in particular the Two-striped Grass Frog *Rana taipehensis*, which was considered to be locally rare at the time of the baseline studies for the DBL EIA. This species has since proven to have a wider geographic distribution and larger local population than previously thought.

Based on these baseline study results there is little risk of loss of ecological conservation value due to construction or operation disturbance. There is high probability that the baseline levels of ecological function will be restored following implementation of proposed mitigation measures.

4.2 The Needs of Enhancement Measures

Two factors must be considered during the design of the Wetland Compensation Area, i.e. the size and the ecological functions. It was confirmed that mitigation for the loss of fishpond area in the original Pond 15 could be provided, mainly by the creation of two new ponds (15X and 15Y). As Ponds 15X and 15Y are to be newly excavated, it may take a long time for vegetation and aquatic communities to establish. Fragmentation effects on the Wetland Compensation Area are expected from the village access road which would go through the middle of Pond 15 Complex. Disturbance impacts from the above Deep Bay Link and the village access road are also expected.

Given the above considerations, enhancement measures are needed to ensure the ecological functions of the Pond 15 Complex.

While in Pond 24, the new wetland area would be extended from the original pond and no division of the pond would be resulted, therefore enhancement measures are not needed.

4.3 Pond Configuration and Topography

The DBL EIA requires that areas of shallow water should be included in the new wetland area. Because there are only limited areas that will be suitable for provision of shallow water in the two new ponds (Pond 15X and 15Y), some such areas are provided in Pond 15ABD which will be formed from the combination of the unaffected Ponds 15A, the remaining portion of 15B and the reinstated portion of 15D as stated above (***Figure 5***).

The small total water area, of only 0.51 ha spread over 4 ponds (***Table 5***), dictates that bund slopes cannot grade too gently toward the centre of the pond. However, from a conservation perspective gentler bund slopes are better because they provide a larger foraging area for wading birds. The optimum shoreline foraging habitat for ardeids would be a mosaic of mud flat and shallow water partially with emergent vegetation. Deeper and permanent water at the centres of the ponds would encourage development of resident fish and amphibian communities that would be important as prey for waterbirds. Therefore, in general the bund slopes should be regraded not to gradients that would be suitable for commercial fish farming (1:2 to 1:3), but rather to more gentle gradients such as 1:5 to 1:10. To achieve this mix of conditions, a gentle bund slope of 1:5 to 1:10 would provide at about 50% of the pond area, while the pond centres would be remained unchanged.

The area of each pond will be small, but existing footpaths and the planned village access road will preclude further removal of bunds. Part of the bund between Ponds 15B and 15D and some of the section of bund between Pond 15A and 15D would be removed. The combined Pond 15ABD at 2,600 m^2 would be the largest pond in Pond 15 Complex. Part of the surplus material from removal of the bunds separating Ponds 15A, 15B, and 15D will be used to build a headland, with gentle slopes and areas of shallow water along the shoreline, in the new Pond 15ABD. This method would involve small-scale earthworks and thus less disturbance to the existing habitat than would re-profiling of Ponds 15A, 15B and 15D. To further minimize the need for earth moving the headland will be modified from the original bund between Ponds 15A and 15B. This will enhance habitats for amphibians and birds, and could encourage nesting by rails such as the Moorhen (*Gallinula chloropus*) or White-breasted Waterhen (*Amaurornis phoenicurus*), thereby increasing the potential wetland conservation value of Pond 15ABD. The headland will be about 140 m^2 in area (***Figure 6b***). The maximum elevation of the island will be no more than 0.75 m above the water line. The slopes of the island at the shoreline will be at a gentle gradient from 1:5 to 1:10.

This measure can also increase the total water surface area. Larger overall bodies of water combined with the continuous water supply through the proposed pipe will reduce the fluctuation of water quality in the absence of active management. Larger wetland areas will

also reduce the potential for disturbance impacts at the wetland perimeter due to presence of people, vehicles and other human activities.

Removing part of the bund will also save the cost of installing piping to transfer water (see below sections) between Ponds 15A, 15B and 15D. Only one inlet will be required for water transfer from Pond 15X to Pond 15ABD, and only one outlet will be required to drain water from Pond 15ABD to the stream.

Table 5 Final areas of individual ponds at the Pond 15 Complex.

Pond No.	Final Area (m^2)
15ABD	2,600
15C1	600
15X	900
15Y	1,000
Total	5,100

4.4 Water Depth

About 50% of the pond area would be gentle bund slope with water depth less than 0.3 m, and the target maximum water depths at the pond centres in all ponds should range between 1-1.5 m throughout the year. This will result in development of permanent wetland habitat that will attract wildlife. This will enhance foraging habitat suitability for wading birds at the pond shorelines where the water will be shallower, and the development of fish communities in the ponds, which will eliminate most of the nuisance from mosquitoes.

It will not be necessary to vary the water level by management and the design of the drainage facilities should facilitate a natural achievement of the suitable water levels without manual operations.

4.5 Hydrological & Ecological Connections

4.5.1 Water Supply to Pond 15C1

The permanence of water in the Pond 15 Complex will depend upon the reliability of patterns of rainfall, supply from surface water, and the porosity of the pond bed material. The excavated/reinstated areas would be lined with at least 150 mm of silty-clay material which would waterproof the excavation and also provide a suitable substrate for colonisation by wetland species. Water supply during operation phase will be mainly from surface water and rainfall.

In addition to rainfall, a permanent stream flowing along the south of Pond 15C1 (Pond 15 Stream), and overflow from surrounding fishponds at southwest of Pond 15C1 will supply surface water to Pond 15C1.

The most important component of any wetland restoration project is provision of a connection to the existing hydrologic regime. Such a connection not only ensures adequate supply of water, it also introduces aquatic biota including vegetation, invertebrates and vertebrates such as fish. The permanent stream is part of the existing surface water regime. No treatment facility is required for water entering the pond. A manually operated diversion gate will be

installed upstream of Pond 15C1 together with a channel leading to Pond 15C1 for control on supply of water as needed.

4.5.2 Connecting Ponds 15 Complex

In the post-construction situation at the Pond 15 complex ponds would lie on either side of village access road HA2 (***Figure 6b***). Although separated by the access road, Ponds 15C1, 15Y, 15X, 15ABD will be connected by pipes. These ponds would be hydraulically linked to enable exchange of water from Ponds 15C1 to 15ABD, and ecologically linked to enable movement of aquatic and amphibious organisms between the ponds. The depth from ground surface to which the pipes are installed should be appropriate to maintain the desirable water levels in the ponds during dry season. A catch pit with shut-off board shall be installed between Pond 15C1 and Pond 15 stream.

Freshwater flow from Pond 15 Stream will be diverted initially to Pond 15C1 (***Figure 6b***). Surplus water in Pond 15C1 can then be used to supply Pond 15Y, from which water will flow via culvert to Pond 15X. From Pond 15X surplus water will flow via pipe to Pond 15ABD (***Figure 6b***).

These pipes will allow overflow from Pond 15C1 to 15ABD at downstream direction during wet season. Fish will also be able to use the pipes to move between ponds during the wet season. Reptiles and amphibians will be able to use the pipes to move between ponds throughout the year.

4.5.3 Filling up Pond 15 Complex

Surface water and rainfall may not be adequate at the outset if pond preparation is completed in the dry season. Should surface water supplies be inadequate for filling of newly constructed ponds, water will be supplied to such ponds by water truck as needed to achieve the in-advance mitigation schedule.

Each pond in Pond 15 Complex will be filled with water by diversion from a stream or by a water-truck upon completion of excavation or modification work, followed by fish stocking and hydroseeding (see Section 4.6 below).

The water level will be maintained throughout the DBL construction period by stream diversion or other means until such time as permanent facilities for water management are installed in all mitigation ponds.

4.5.4 Pond Drainage

As Pond 15ABD, 15C1, 15Y and 15X will be connected by corrugated pipes, water level regulation within Pond 15 Complex will depend upon flows from pond to pond and to or from the Pond 15 Stream (***Figure 6b***).

Pond 15ABD will be equipped with an overflow drain to the existing stream. This will preclude flooding at the Pond 15 Complex.

4.5.5 Water Quality

Stream flows will deposit sediments and be partially purified as they pass through the ponds and vegetation (for plant species list refer to ***Annex III Appendix 2***). This will improve the quality of the freshwater in the Pond 15 Complex, and enhance the wetland function of surface water purification for downstream users (fish farmers, crop irrigators, Inner Deep Bay wildlife).

Surface runoff from the Deep Bay Link roadway will be collected in standard road drains and then will pass through the drainage system. Thus the highway runoff will be isolated from Pond 15, therefore will have no impact upon contaminant concentrations in Pond 15.

4.5.6 Pond 24

The existing hydrological regime at Pond 24 would not be altered.

4.6 Other Enhancement Measures

4.6.1 Enhancement Measures at Pond 15 Complex

Major enhancement measures include:

(1) installing pipes connecting Ponds 15ABD, 15X, 15Y and 15C1;

(2) creation of shallow water-depth area;

(3) gentle bund slopes, for example 1:5 to 1:10;

(4) hydroseeding;

(5) planting of wetland plants (see ***Annex III Appendix 2***);

(6) bamboo planting;

(7) fish stocking; and

(8) removal of internal fences and installation of perimeter fence.

Item (1) was discussed in Section 4.5.2 whereas items (2) and (3) have been addressed through the designed pond topography (Section 4.3).

Hydroseeding and planting wetland vegetation are measures to accelerate the establishment of aquatic communities. Without such measures the recontoured ponds would be colonized by undesirable weedy vegetation that would contribute little to restoration of indigenous biodiversity, and could even impede the process.

The bunds of Pond 15 Complex will be hydroseeded using the standard hydroseed mix by the contractor immediately after the individual created / modified pond is filled with water, while native wetland plant species selected from the list in ***Annex III Appendix 2*** will be introduced to Pond 15 Complex at the beginning of 2006 wet season (April to May 2006) after all excavation and reinstatement are complete. A footway path of about 0.5m to 1m will be reserved along the bunds (***Figures 6c and 7***). The planting matrix and profile of wetland plants on each pond are shown in ***Figure 6c***.

In addition to restoration of aquatic vegetation that will provide habitats for aquatic organisms that will in turn provide prey sources for birds, other measures are required to enhance habitat suitability for birds. These include provision of gentle bund slopes and pond areas of shallow water depth, both of which will encourage use of the ponds by wading birds such as herons and egrets, which are the focal groups for restoration of the pond wetlands. Areas of shallow water at the base of gently sloping pond bunds have proven to be preferred by birds over the typical, steeply-sloping fish pond bunds. The bunds surrounding each pond and the headland inside Pond 15ABD would have gentle slope profiles where possible in the interest of achieving this benefit for wading birds.

Patches of young Verdant Bamboo *Bambusa tultoides* will be planted at each of the three locations around Pond 15 perimeter for habitat enhancement purpose because of the potential importance of bamboo stands to birds including herons and egrets. (***Figure 6a***), but not to mitigate loss of bamboos at the Ngau Hom Shek Egretry. Bamboo stands serve as roost sites and nest sites, as well as screening human disturbance from the adjacent areas. Bamboo clusters (at least three shoots in each cluster) of at least 1.5m in height will be planted at 1 m spacing. The planting is to be conducted during early wet season (April or May 2006).

Many streams in Hong Kong support at least some fish that are capable of colonizing pond or marsh habitats. The DBL EIA noted that the upper reaches of streams in the project area were rich in aquatic wildlife. Therefore, it is probable that the Pond 15 Stream supports fish that would colonize the Pond 15 Complex over time. It is also possible to supplement natural colonisation by stocking fish in the interest of increasing prey abundance for birds and enhancing mosquito control. At least 100 individuals of juvenile (less than 10 cm in total length) Tilapia (*Oreochromis* sp.) and 2500 Mosquito Fish (*Gambusia* sp.) would be released for each pond by the contractor once immediately after the created / modified pond is filled with water and stabilised, and once prior to handover of the ponds to the management authority. Both these two species are naturalized and have a high level of adaptability. They will be able to establish self-sustainable populations and no further stocking is anticipated.

Removal of any internal fencing from bunds will remove visual barriers between ponds and enhance habitat suitability for ardeids, while the perimeter fence will be installed according to specifications in the DBL EIA. The perimeter fence should be aligned at the property boundary wherever possible rather than atop the bunds (***Figure 7***). This will avoid placement of visual and flight barriers between wildlife and the ponds. There will be a space of about 10 to 15 cm between the ground surface and the bottom of the fence to allow passage of wildlife.

4.6.2 Enhancement Measures at Pond 24

At Pond 24 advance mitigation would be carried out to extend the pond perimeter downstream to cover an area of 259m^2. The downstream bund of the pond measures approximately 42m in length. This bund will simply be dozed downstream a distance of 6.2m to achieve two objectives. The first objective is enlargement of the pond and the second is lowering the internal slope gradient to approximately 1:10. This mitigation would be like-for-like.

4.7 Post-Construction Management

4.7.1 Pond 24

This pond would merely be reinstated to its original condition. There will not be a need for post-construction management of this pond.

4.7.2 Ponds 15 Complex

Ponds 15ABD, 15C1, 15X and 15Y will be managed by AFCD upon completion of the works. Prior to handover of the ponds to AFCD there will be a 12-month establishment period as described in ***Annex III*** (Section 5.1). The ponds will be managed as ecological mitigation measures for the DBL project to compensate for the loss of wetland. A habitat management plan for Pond 15 is included in this report as ***Annex III***.

5. RE-ALIGNMENT AND DIVERSION OF STREAM COURSES

Condition 3.3 of Environmental Permit No. EP-163/2003/B states that:

"The HCM Plan shall include details on re-alignment and diversion of stream courses shown in Figure 4.2 of the DBL EIA report at locations where the Project alignment intersects with streams and details of measures for protecting the streams from adverse impacts due to construction site runoff pollution." Figure 4.2 of the DBL EIA report is reproduced here as ***Annex IV*** for ease of reader reference.

The details on re-alignment and diversion of stream courses are given in ***Annex IV*** whereas the measures for protecting the streams from adverse impacts due to construction site runoff pollution are as follows.

- the hydrology of the streams is monitored monthly during construction phase;
- the streams and channels are inspected and cleaned regularly;
- wastewater generated from bored piling work are recycled;
- wastewater discharged from other site operation and surface runoff is treated by de-silting facilities or WetSep to ensure the quality and composition of any discharge from the site to be in compliance with the conditions specified in the Effluent Discharge License issued by the EPD;
- rocky material is formed on the haul road to ensure the surface runoff from upstream can flow through the haul road to avoid disturbance to the flow paths of existing surface runoff;
- a steel or precast concrete pipe with an area greater than the exiting cross sectional area of the stream will be provided to ensure the flow is not disturbed; and
- a half round surface channel will be formed at the side of the temporary haul road for collection of surface runoff from the haul road during rainy time.

6. CONCLUSIONS

The new mitigation design proposed in this report would lead to minimal loss of pond and would reduce ecological impacts to levels below those predicted in the DBL EIA. According to the new design, the wetland functions of Pond 24 will be retained because impacts to that pond have largely been eliminated and the hydrologic regime will be unaffected. Wetland functions of Pond 15 will be restored in-kind with fishponds similar and adjacent to those that were affected by construction. The pond losses due to the new design were predicted and mitigation measures were proposed in this report. The proposed plan shows a net wetland gain of approximately 4% after the project construction. Although that will impose site constraints and limit the works space to the contractors during construction stage, it is considered environmentally more friendly in comparison with the original design developed in the DBL EIA stage.

FIGURES

Figure 1 Location plan of fishponds
Figure 2 Mitigation for wetland losses in the DBL EIA (reproduced from Figure 7.9 of the DBL EIA)
Figure 3 Layout of Pond 15
Figure 4 Sequence of construction stages for mitigation project at Pond 24
Figure 5 Sequence of construction stages for fishpond reprovision at Pond 15
Figure 6a Bamboo planting sites
Figure 6b Diagram of water flow through the four ponds of Pond 15 Complex
Figure 6c Planting plan
Figure 7 Layout and details of perimeter fence and concrete footway
Figure 8 Programme of pond reinstatement

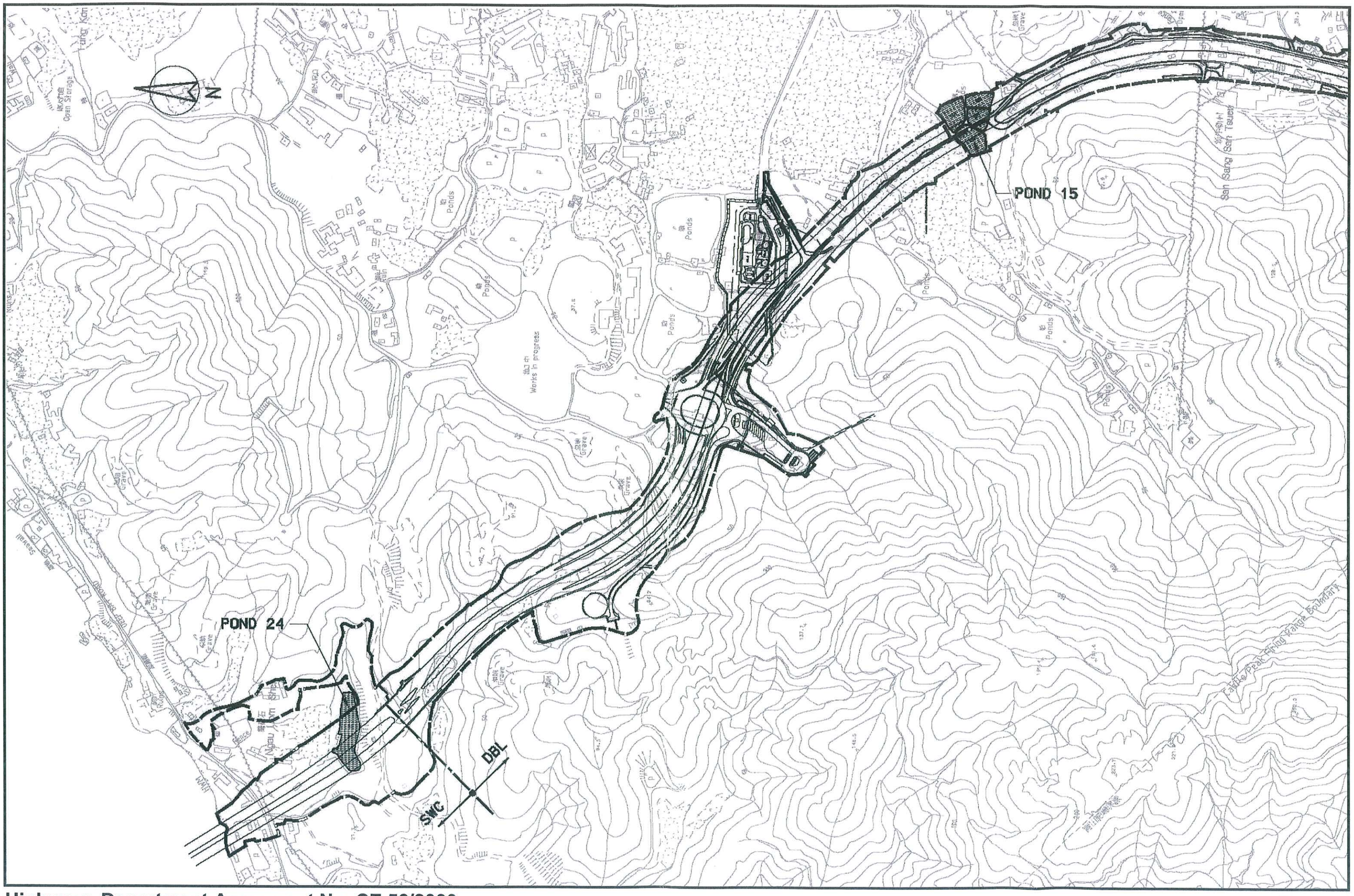

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Figure 1
Location plan of fishponds

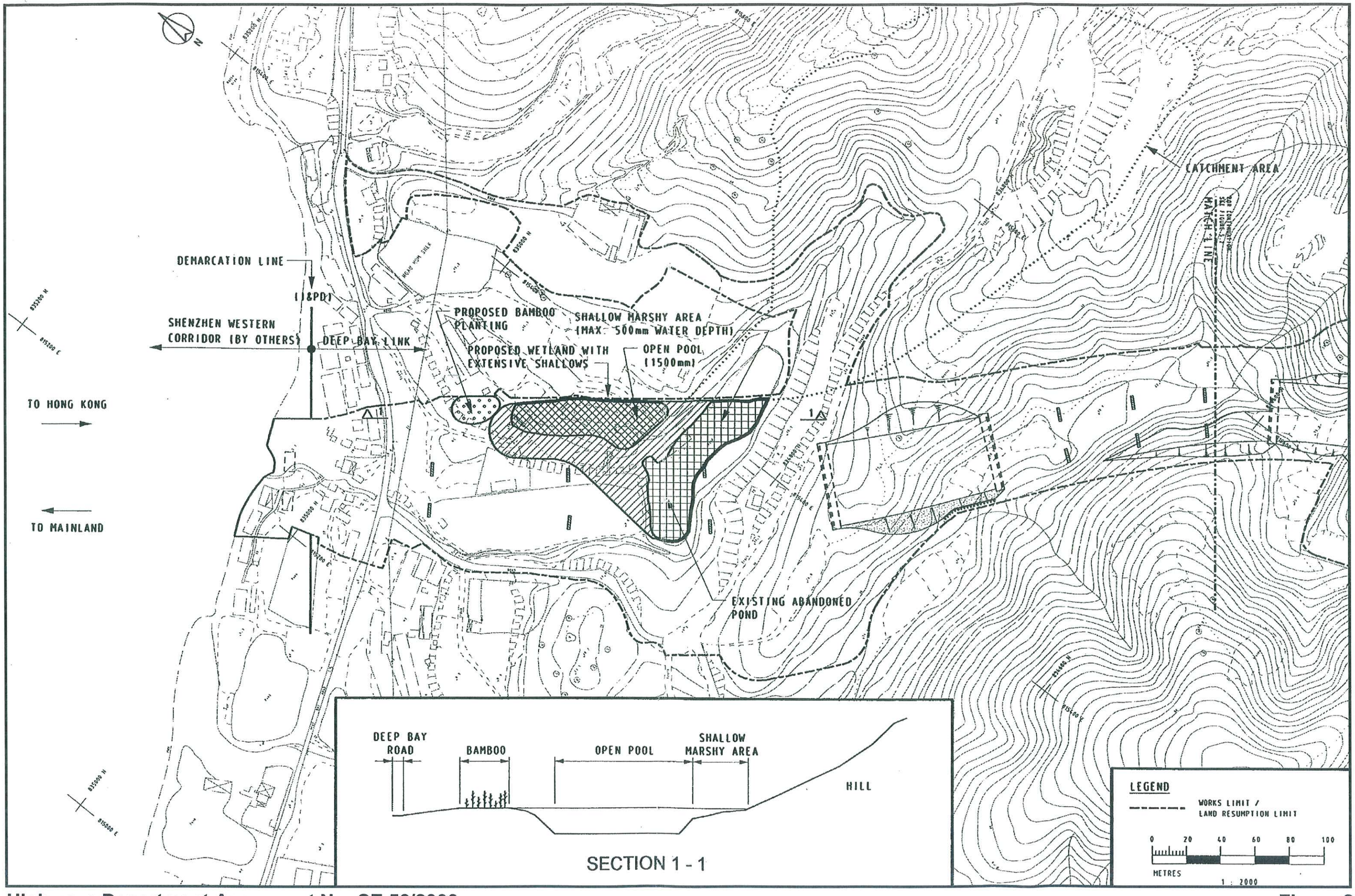

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Figure 2
Mitigation for wetland losses in the DBL EIA

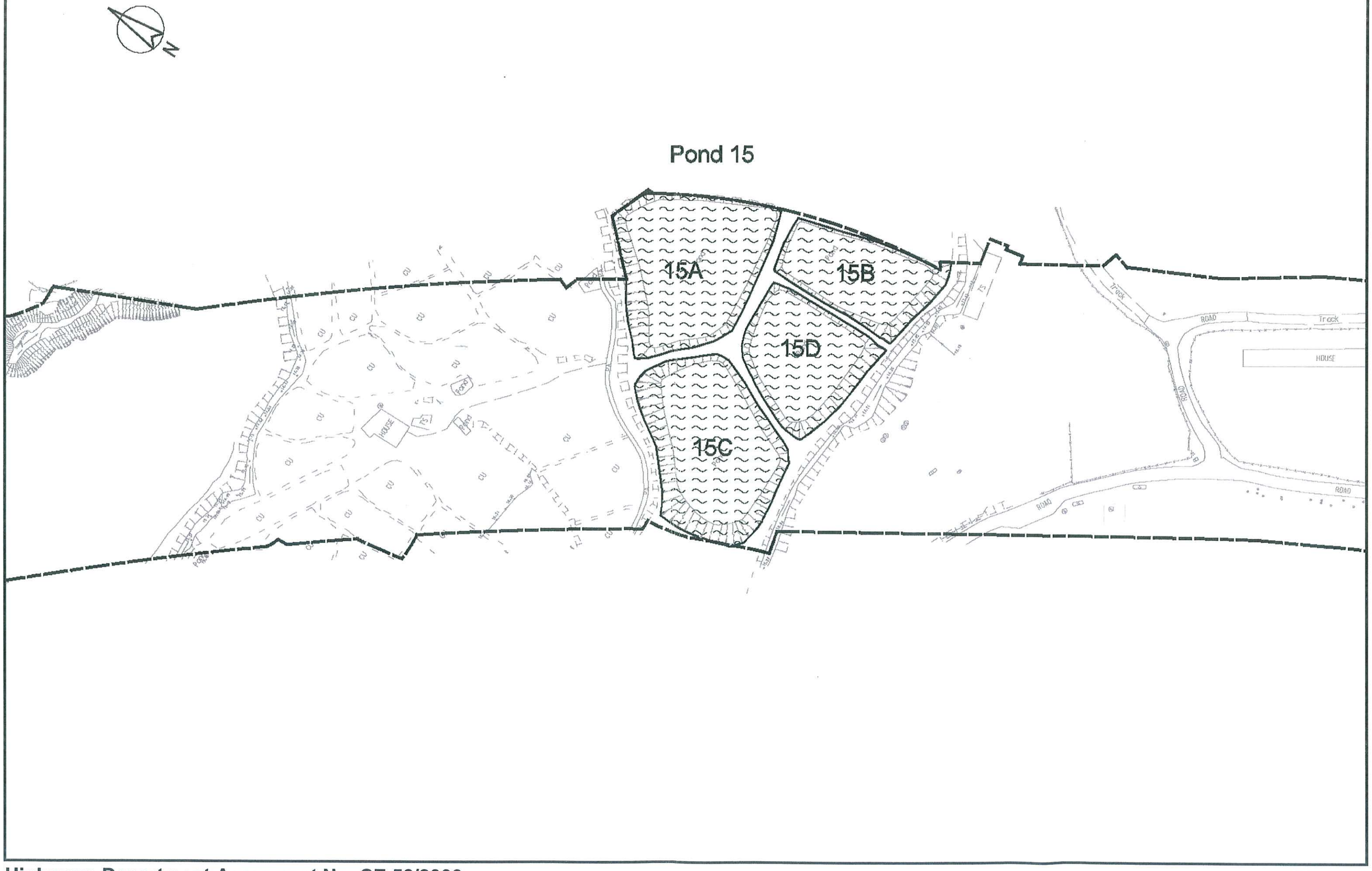

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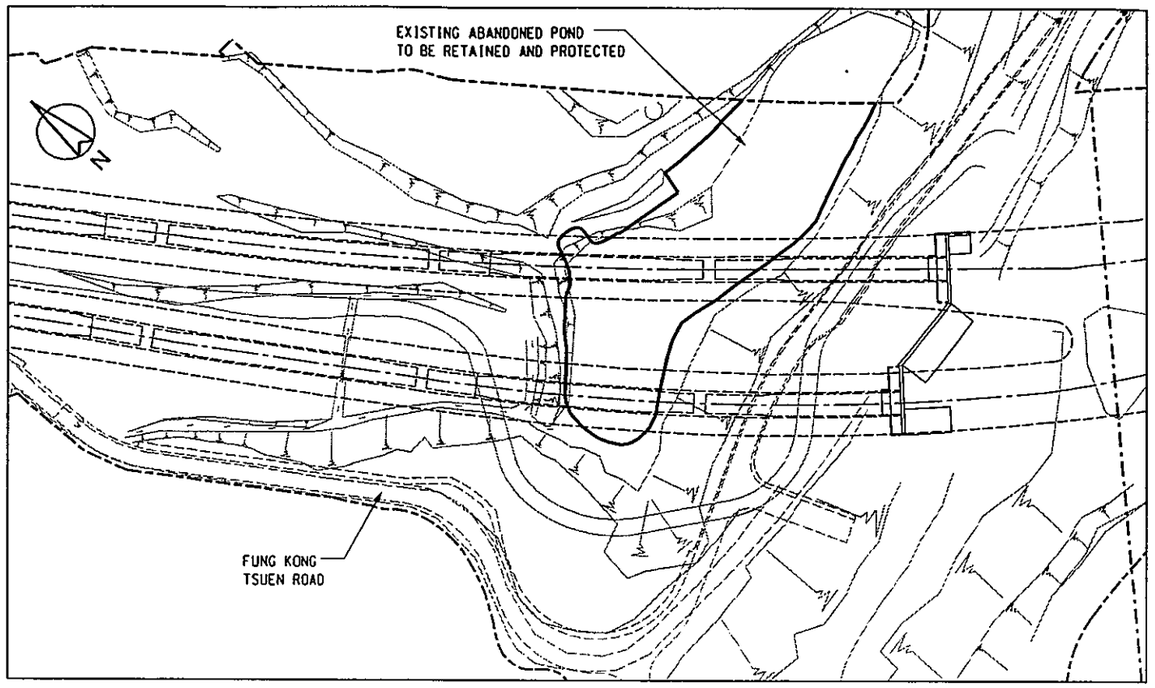
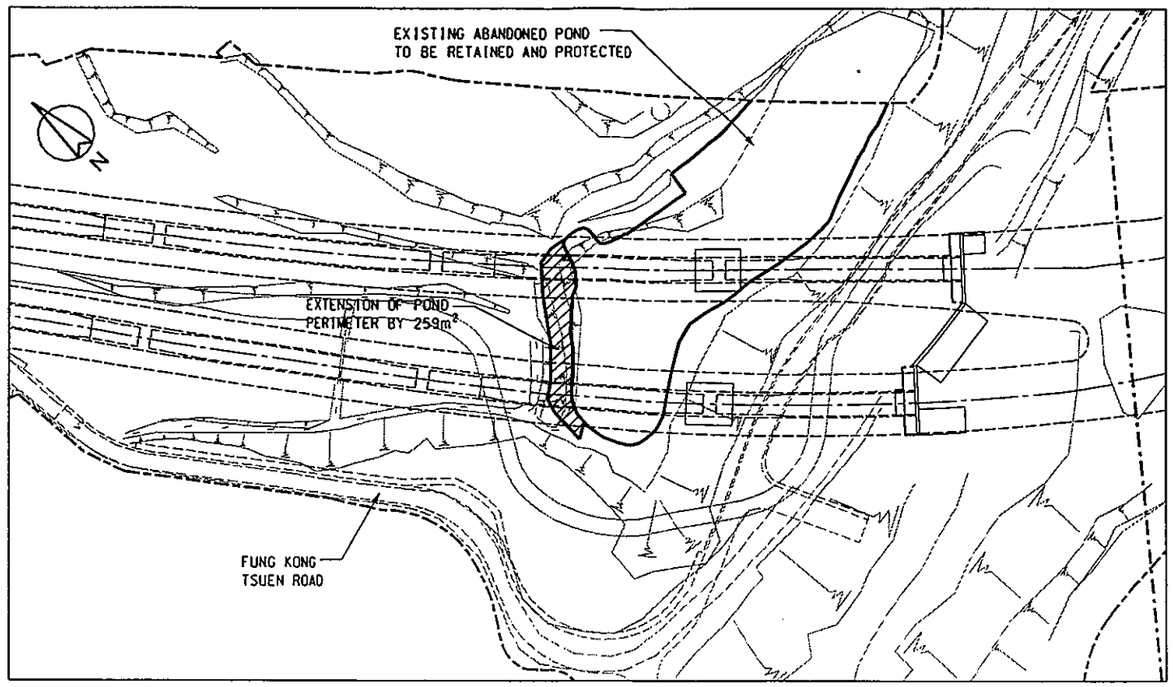
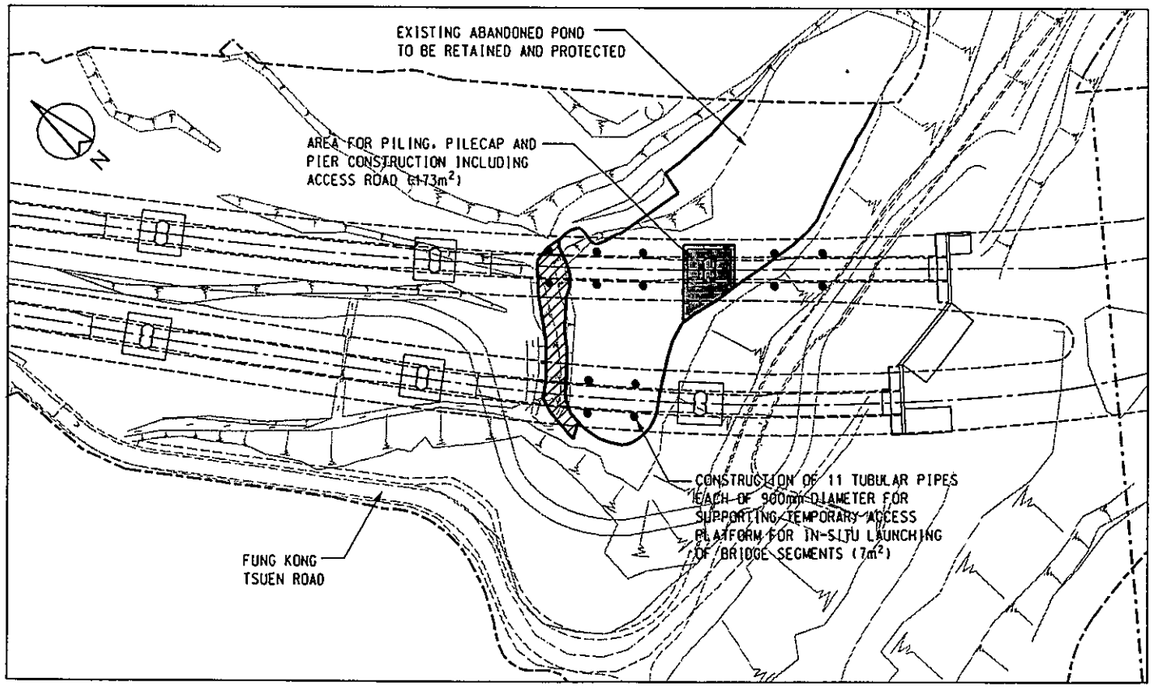
Figure 3
Layout of Pond 15



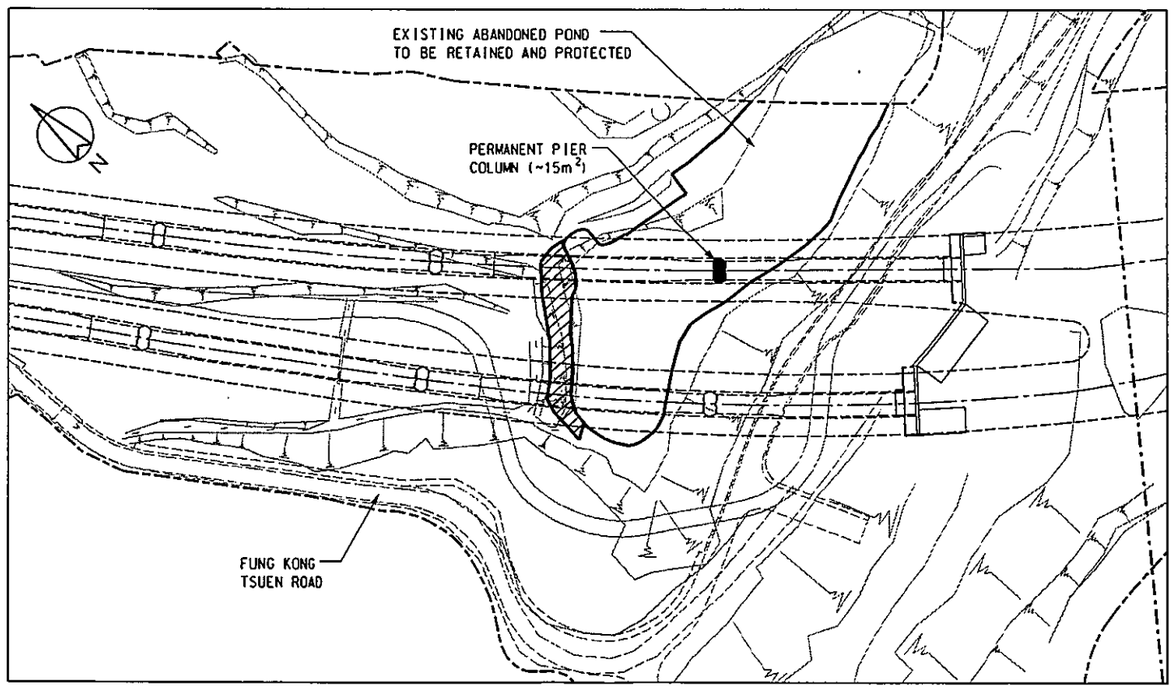
EXISTING CONDITION



STAGE 1 - EXTENSION OF POND PERIMETER



STAGES 2-5 - PILING, CONSTRUCTION OF PILECAP, PIER COLUMN & TEMPORARY ACCESS PLATFORM FOR LAUNCHING OF BRIDGE SEGMENTS



STAGE 6 - REINSTATEMENT & RECONTOURING OF DISTURBED POND AREA

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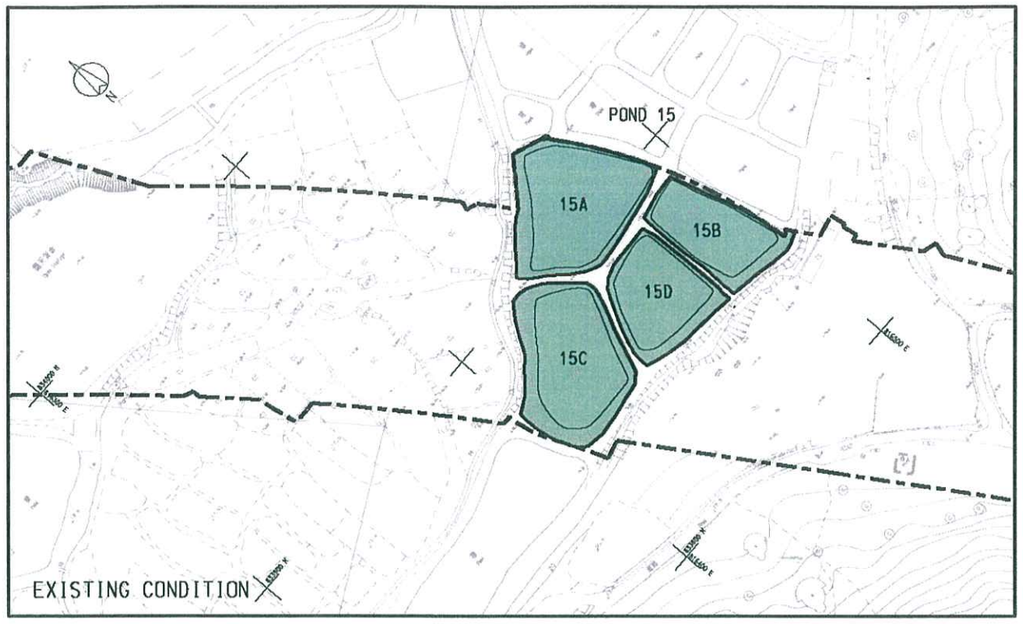
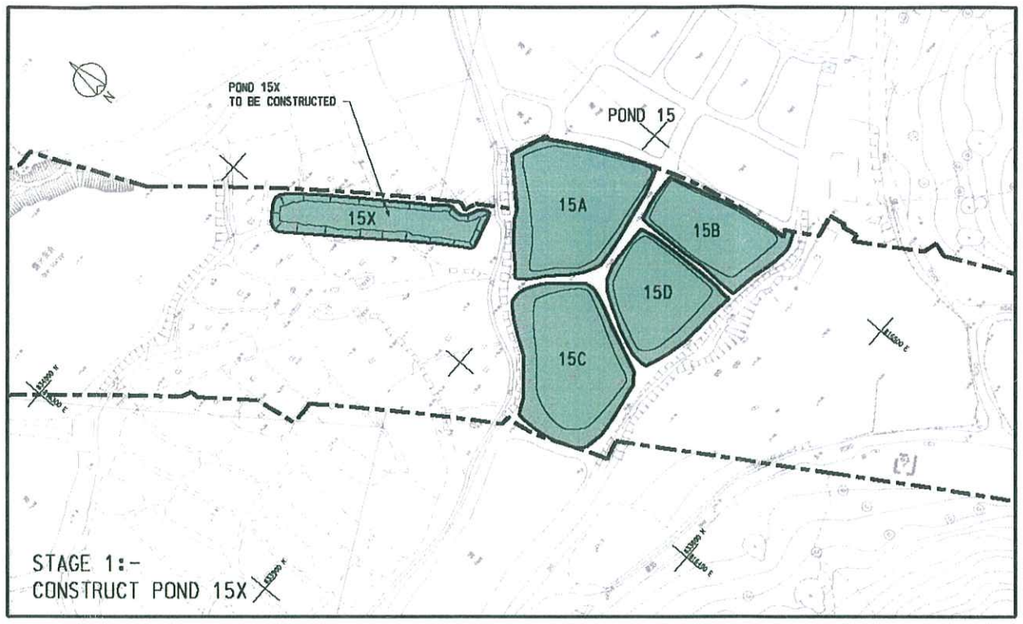
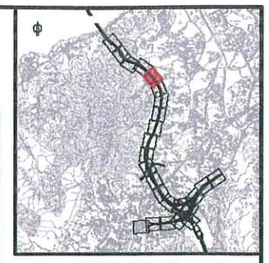
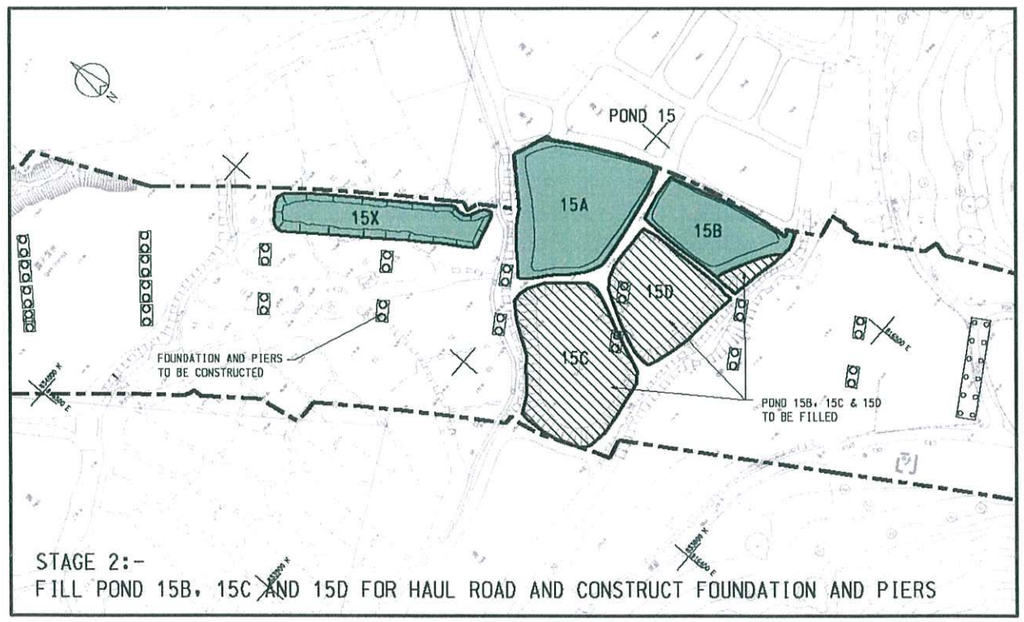
Figure 4
Sequence of construction stages for mitigation project at Pond 24






KEY PLAN



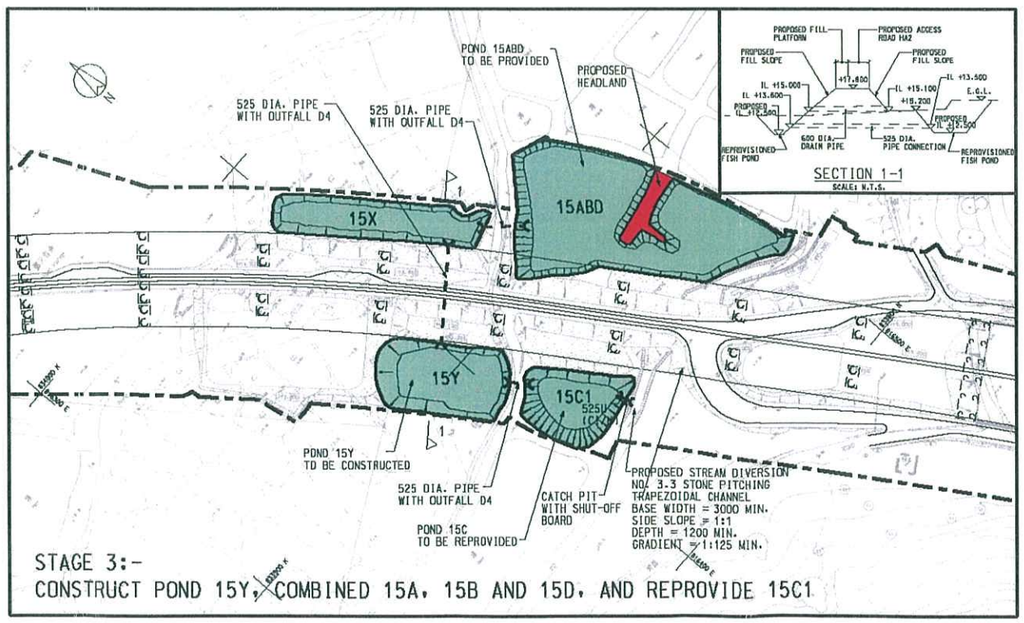


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Figure 5
Sequence of Construction Stages for
Fishpond Reprovision at Pond 15

834100 N

816500 E

816400 E

834000 N

816300 E

833900 N

WOODLAND PLANTING
w/ HYDROSEEDING
MIX_A 979.61 sq.m

WOODLAND PLANTING
w/ HYDROSEEDING
MIX_A 2718.43 sq.m

BAMBOO PLANTING
203 sq.m

WOODLAND PLANTING
w/ HYDROSEEDING
MIX_A 217.64 sq.m

WOODLAND PLANTING
w/ HYDROSEEDING
MIX_A 770.00 sq.m

HYDROSEEDING
MIX_A 69.93 sq.m

A

B

C

KEY PLAN

LEGEND:

FISHPOND

BAMBOO PLANTING SITES
A: 270m²
B: 120m²
C: 100m²

WOODLAND PLANTING WITH HYDROSEEDING MIX A

EXISTING TREE GROUP RETAINED ON SITE

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Figure 6a
Bamboo Planting Sites

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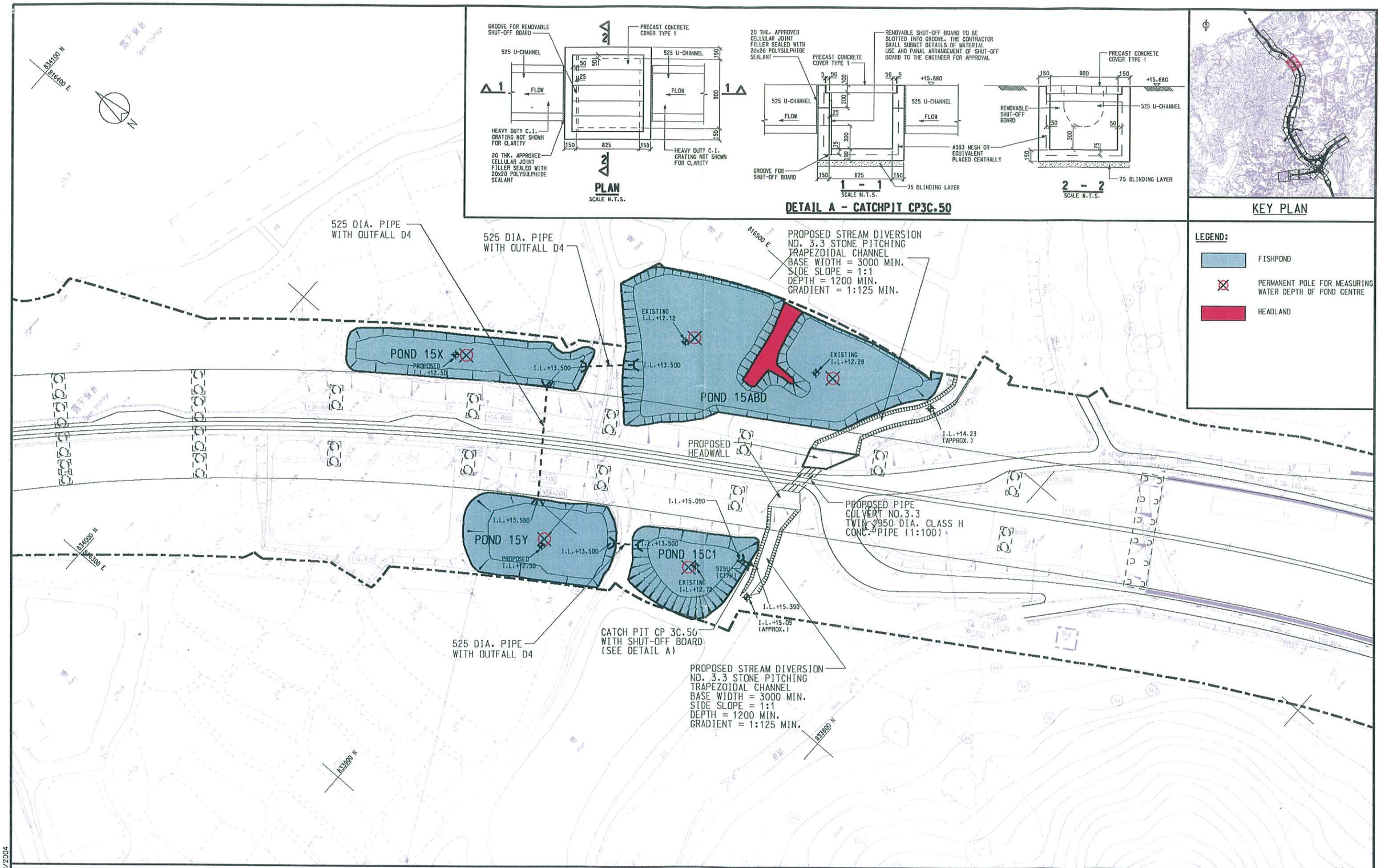

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Figure 6b
Diagram of Water Flow Through the Four Ponds of Pond 15 Complex

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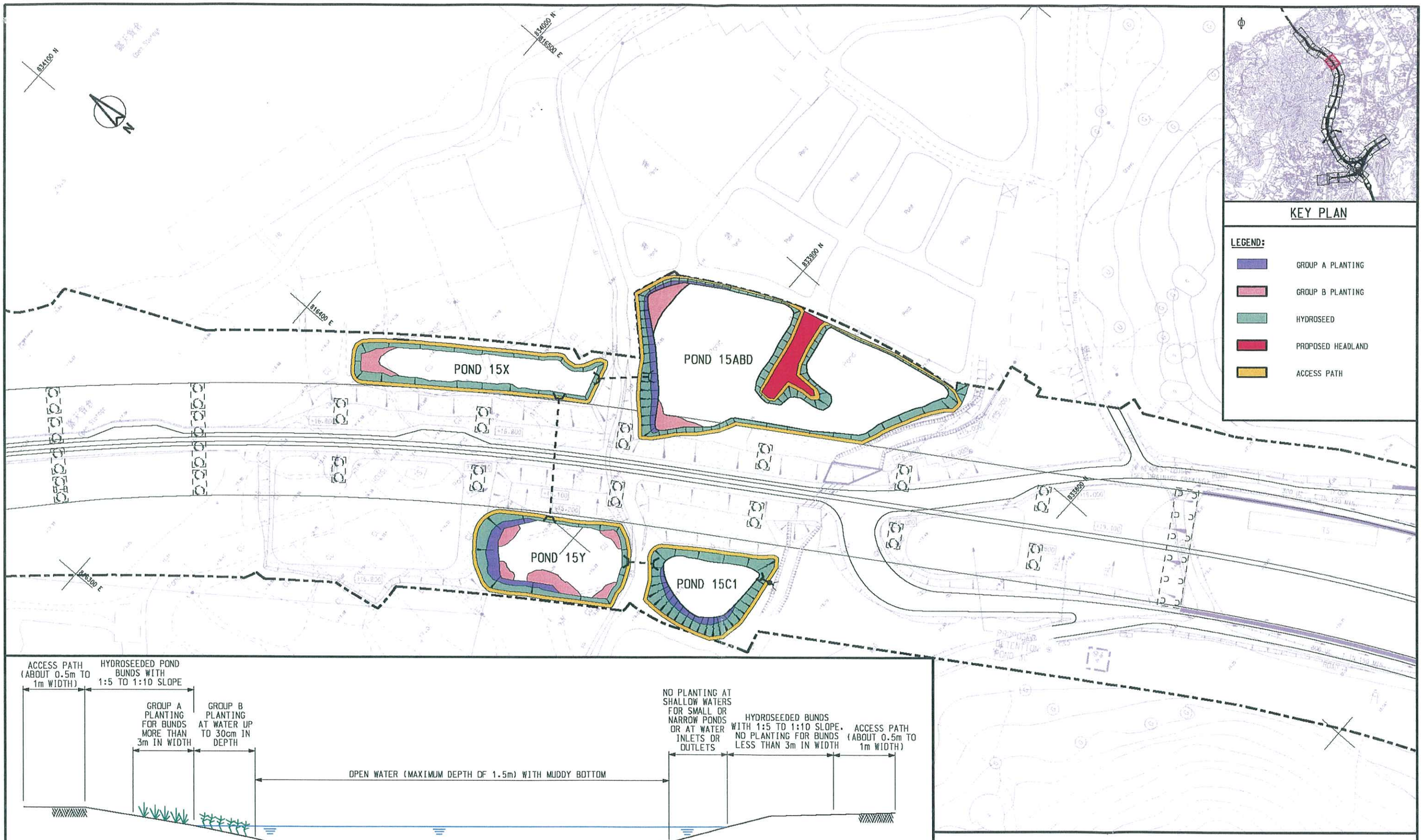

SCHEMATIC POND PROFILE SHOWING PLANTING SCHEMES AND GUIDELINES FOR PLANTING

SCALE : N.T.S.

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Figure 6c:
Planting Plan

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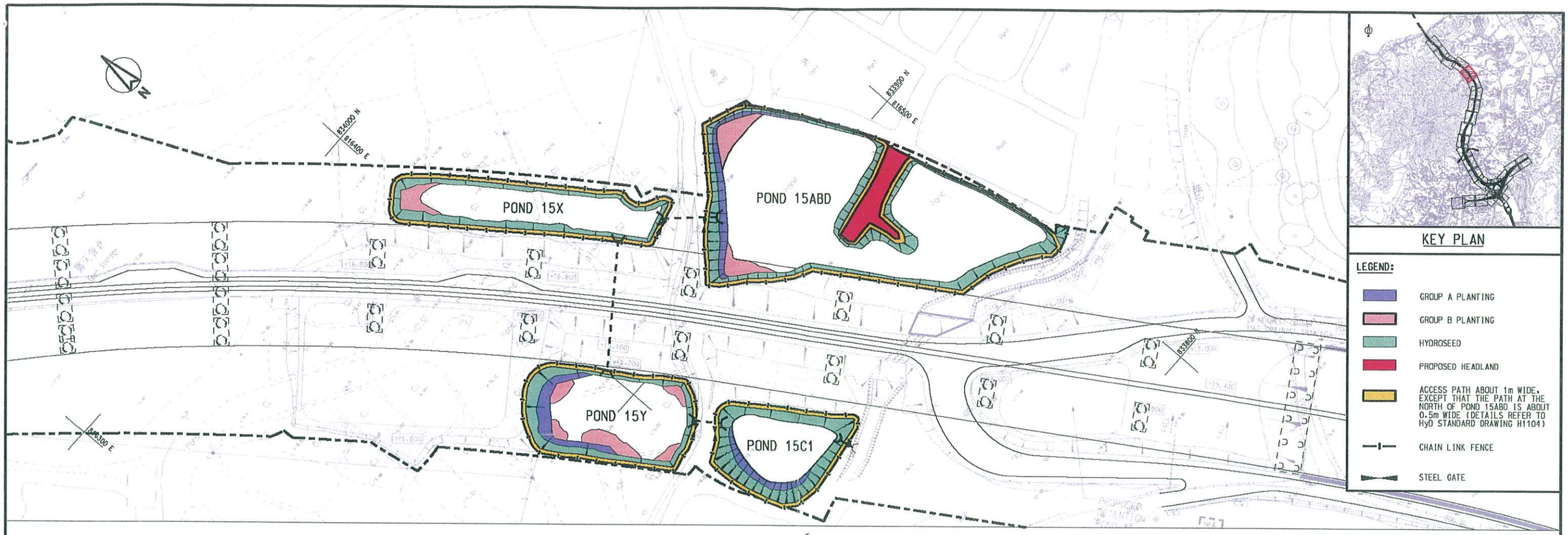
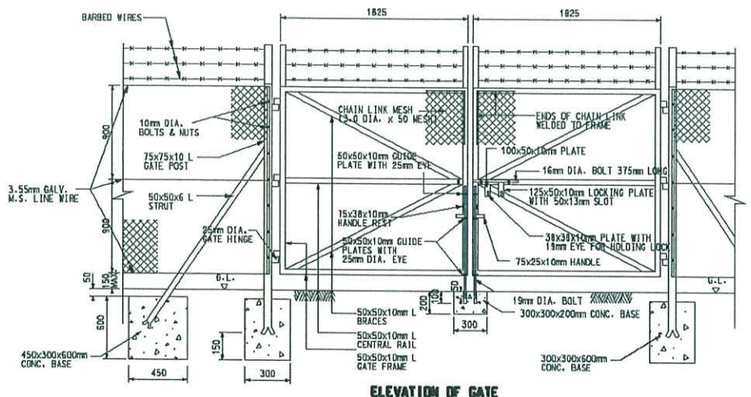


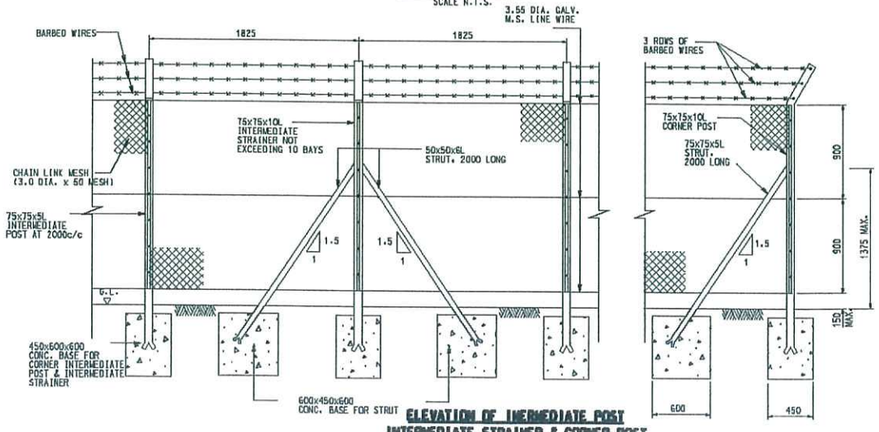
KEY PLAN

LEGEND:

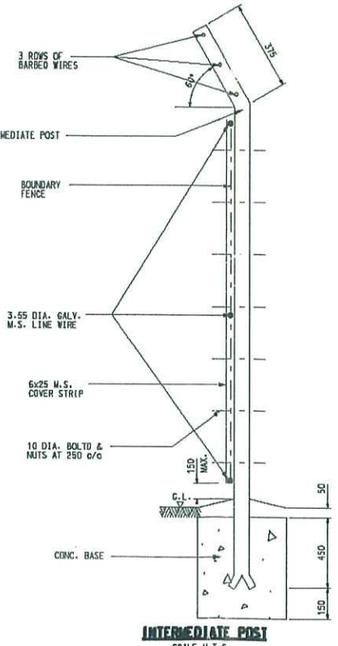
- GROUP A PLANTING
- GROUP B PLANTING
- HYDROSEED
- PROPOSED HEADLAND
- ACCESS PATH ABOUT 1m WIDE, EXCEPT THAT THE PATH AT THE NORTH OF POND 15ABD IS ABOUT 0.5m WIDE (DETAILS REFER TO HyD STANDARD DRAWING H1104)
- CHAIN LINK FENCE
- STEEL GATE



ELEVATION OF GATE
SCALE N.T.S.



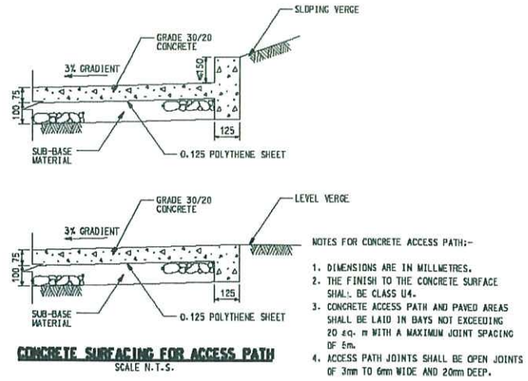
ELEVATION OF INTERMEDIATE POST
INTERMEDIATE STRAINER & CORNER POST
SCALE N.T.S.



INTERMEDIATE POST
SCALE N.T.S.

NOTES FOR CHAIN LINK FENCE AND GATE:-

1. DIMENSIONS ARE IN MILLIMETRES.
2. ALL WELDS TO BE GROUND SMOOTH.
3. STEEL TO BE GRADE 43 BS4360.
4. ALL SITE WELDS TO BE TREATED WITH TWO COATS OF ZINC RICH PAINT BEFORE APPLICATION OF PAINT SYSTEM.
5. STEELWORKS FOR FENCING INCLUDING WIRES TO BE HOT DIP GALVANIZED TO BS729 TO A COATING THICKNESS AT LEAST 500g/m.
6. CHAIN LINK MESH TO BE ZINC COATED TYPE GLS180 OF BS1722 PART 1.
7. CONCRETE TO BE GRADE 30/20.
8. WHERE THE CONCRETE FOOTING IS LOCATED IN BLOCK PAVED FOOTPATH, THE FOOTING SHOULD BE LOWERED TO ALLOW FOR THE PAVING BLOCKS ANF THE SAND COURSE.



CONCRETE SURFACING FOR ACCESS PATH
SCALE N.T.S.

NOTES FOR CONCRETE ACCESS PATH:-

1. DIMENSIONS ARE IN MILLMETRES.
2. THE FINISH TO THE CONCRETE SURFACE SHALL BE CLASS U4.
3. CONCRETE ACCESS PATH AND PAVED AREAS SHALL BE LAID IN BAYS NOT EXCEEDING 20 sq. m WITH A MAXIMUM JOINT SPACING OF 5m.
4. ACCESS PATH JOINTS SHALL BE OPEN JOINTS OF 3mm TO 6mm WIDE AND 20mm DEEP.

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Figure 7:
Layout & Details of Perimeter Fence and Concrete Footway

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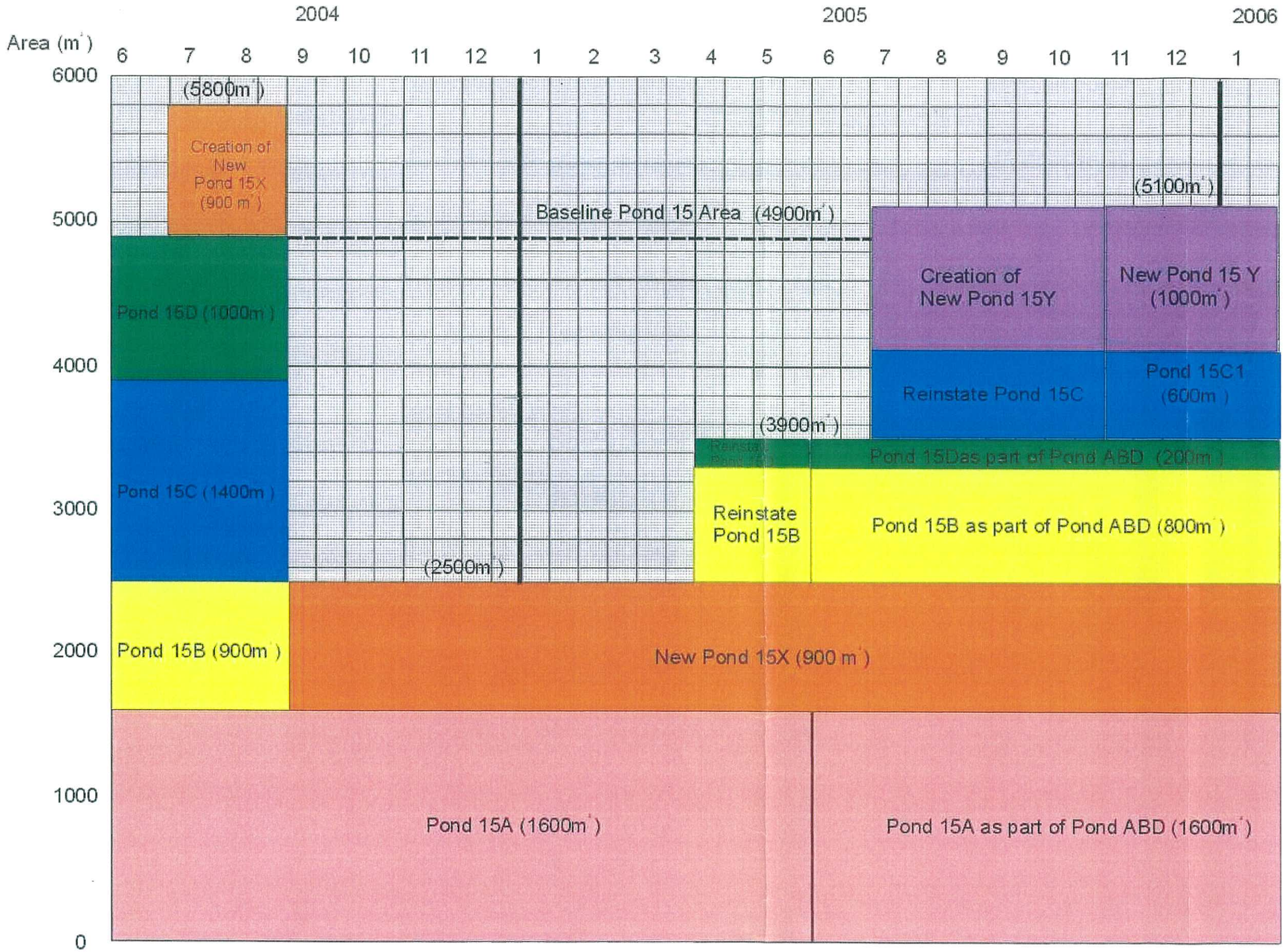

Figure 8. Programme of pond reinstatement

Annexes

Annex I Proposed Mitigation for Ecological Impacts as Presented in the DBL EIA

Table 7.32 of the DBL EIA

Impact	Mitigation
Construction Phase	
Habitat Loss Pond loss	To mitigate for the loss of fishponds (Part of pond 15 at Ha Tsuen 0.49 ha. permanently lost, part of pond 24 at Ngau Hom Shek 0.24 ha resumed: total area affected 0.73 ha.), an equivalent area to that lost would be re-created on agricultural or degraded land which has been made available adjacent to pond 24. The compensation would be 0.73 ha. in extent – equivalent to a 1:1 compensation ratio for the loss of ponds. Approximately 50% of the new wetland would be a shallow marshy area (maximum of 500mm of water depth) and the remaining area a deeper (about 1500mm) open pool. The area would be lined with at least 150mm of silty-clay material which would waterproof the excavation and provide a suitable substrate for colonisation by wetland species. The feature would receive run-off from adjacent areas. Shallow wetlands are attractive to Little Egret and Chinese Pond Heron, the two species of conservation concern recorded from the affected ponds. This proposed wetland is capable of supporting the small numbers of Little Egret (max. 1) and Chinese Pond Heron (max. 10) associated with the affected wetland areas. It is suggested that AFCD manage the wetland on behalf of HyD. A location plan, proposed layout and proposed section are shown in Figure 7.9. Further details of the wetland mitigation area are provided in table 7.33below.
Tree, woodland, plantation, orchard and scrub loss	1.2 ha of woodland, 3.2 ha of plantation, 3.3 ha of scrub and 1.0 ha. of orchards would be lost (total = 8.7 ha). Native, ornamental and exotic pioneer tree planting would be undertaken on verges to compensate for losses of these habitats. About 6473 seedlings with suitable native, ornamental and exotic pioneer species, covering 12.7 ha would be planted in compensation. The overall trees within the proposed limit of work after DBL works would be about 8144 as compared to existing trees within the proposed work limit of 5829.
Inter-tidal habitats	These areas would not be directly affected by DBL. Therefore no mitigation was proposed.
Streams	No valuable sections of stream course would be directly affected.
Other habitats (e.g grassland, ephemeral etc)	No mitigation was proposed – these habitats would be of limited conservation interest.
Loss of Breeding Sites	
Ngau Hom Shek Egretry	Various alignments for the DBL have been considered. Alignments that avoid the Ngau Hom Shek egretry would result in greater losses of wetland or bring the road closer to other features of high ecological value (e.g. Pak Nai SSSI). There are also constraints associated with the terrain above Ngau Hom Shek which preclude alternative alignments. The present alignment was determined to have the least ecological impact. The potential loss of the Ngau Hom Shek Egretry was considered minor in territory-wide terms (4 Little Egret and 6 Chinese Pond Heron nests in 2002 <1% of HKSAR breeding population), because of the mobility of the Ngau Hom Shek egretry and others in the

Impact	Mitigation
	HKSAR (e.g. Tsim Bei Tsui, Shan Pui River, Tong Shing Lei, and others) and the small number of nests involved. However, because of the rarity of ardeid breeding sites in the Pearl River Delta including the HKSAR, loss of ardeid breeding sites is a concern. It is recommended that the existing trees and bamboos used by the herons and egrets are removed after the breeding season in 2002 has finished (September) and before the breeding season begins in 2003 (February at the latest) to avoid unnecessary mortality of ardeid birds when construction works begin. It is probable that they will find alternative nesting sites nearby. In order to provide an alternative potential egretry all of the mature bamboo (*Bambusa sp*) growing in the existing egretry at Ngau Hom Shek should be transplanted to the western edge of the wetland compensation area at Ngau Hom Shek.
Habitat fragmentation	The key to minimising fragmentation effects would be to maintain or restore connectivity between habitat fragments. The road would be crossed by stream culverts (stream 4 and stream 2 at Ha Tsuen interchange (see Figure 7.10). and in some places the road would be elevated. The culverts should include dry shoulders at least 1m wide to enable terrestrial species to pass under the road. These features would help to maintain ecological connectivity between similar habitats on either side of the road. The preliminary design of a typical dry shoulder in a culvert is shown in Figure 7.10.
Impacts on species of conservation concern (see also section on habitat loss above)	The wetland compensation area (see habitat loss above) would include shallow wetlands targeted for Little Egret and Chinese Pond Heron. It may also be visited by other birds of conservation concern associated with wetlands.
Disturbance	Standard measures designed to reduce noise impacts on local residents would be sufficient to protect wildlife from serious disturbance during construction. The verges would be thickly planted with trees and shrubs, which coupled with noise barriers would provide a visual screen. Disturbance to the proposed HSKNDA to reduce by screening by 200m length of semi-enclosure and cantilever barriers.
Water-borne pollution	Details of mitigation measures designed to protect water quality are provided in Chapter 4.
Operational Phase	
Habitat fragmentation	See under construction phase above.
Impacts on species of conservation concern	See under construction phase above.
Water quality degradation-	Details of mitigation measures designed to protect water quality are provided in Chapter 4.
Disturbance	Disturbance to adjoining habitats would be reduced by the proposed roadside planting programme and through the provision of noise barriers

Annex II Approach to the Design of Pond 15 Complex

It is an EP requirement to submit a Habitat Creation and Management Plan (HCMP) to EPD for approval.

As stipulated in the EP, the HCMP, with reference to the DBL EIA findings and recommendations, shall include a compensation package with the creation of a Wetland Compensation Area for the fishpond loss caused by the Project.

As the loss in Pond 24 has been significantly reduced, and the majority of the new wetland, which requires measures to accelerate the establishment of aquatic communities, would be located at Pond 15, the Wetland Compensation Area was relocated from pond 24 to Pond 15 at Ha Tsuen.

Two factors must be considered during the design of the Wetland Compensation Area, i.e. the size and the ecological functions. It is well accepted that when the "loss" of a habitat is discussed both "area" and "function" must be considered. This approach has been documented in official documents such as TPB PG-No.12B which provides guidelines on wetland habitats.

It was confirmed that mitigation for the loss of fishpond area in the original Pond 15 could be provided, mainly by the creation of two new ponds (Ponds 15X and 15Y).

The ecological functions of the new Pond 15 Complex, however, might not be the same as before the Deep Bay Link construction. This is because Ponds 15X and 15Y are to be newly excavated, therefore fish culture operations will not have been conducted in the newly excavated ponds. For this reason it could take a long time period for the establishment of vegetation and aquatic communities.

A village access road would go through the middle of Pond 15 Complex and divide the original adjacent pond cluster into two parts (Ponds 15X, 15A, 15B, and 15D on one side, and Ponds 15Y and 15C on the other side). Fragmentation impacts on the habitat are expected. Disturbance impacts from the above Deep Bay Link and the village access road are also expected.

Given the above considerations, enhancement measures are needed to mitigate the impacts and to compensate the ecological functions of the Pond 15 Complex.

The major enhancement measures proposed include:

1) pipes to connect the Pond 15 Complex
2) hydroseeding
3) planting of wetland plants
4) gentle bund slopes
5) creation of shallow water-depth area
6) bamboo planting
7) fish stocking
8) removal of internal fences and installation of perimeter fences

Under fish culture operation, aquatic organisms and vegetation would be introduced into the fishponds via diverting water into the ponds from nearby streams, releasing fish fry and flooding. The ponds are under active management to maintain the water quality. Under these conditions aquatic communities can be quickly established to provide food sources for birds.

The most important component of any wetland restoration project is provision of a connection to the existing hydrologic regime. Such a connection not only ensures adequate supply of water, it also introduces aquatic biota including vegetation, invertebrates and vertebrates such as fish. This enables the restored wetland environment to develop biological communities that naturally restore ecological functions including provision of forage and prey items for organisms at higher levels in the food chain. Thus connection to the surrounding hydrologic regime enables restoration of ecological functions that cannot be restored in any other way. The pipe connections will enable introduction to the restored pond system of larvae of aquatic fauna from the upper reach of the stream via pipes and Pond 15C. As Pond 15 Complex would be separated by the village access road HA2 into two parts (i.e. Pond 15ABD & Pond 15X at one side while Ponds 15Y, & Pond 15C1 on the other side). The pipe connections could hydrologically link, up the two parts of Pond 15 Complex and would mitigate the fragmentation impacts caused by the road. Removal of bunds that would unnecessarily fragment the ponds will result in larger overall bodies of water. The larger water area combined with the continuous water supply through the proposed pipe will also reduce the fluctuation of water quality in the absence of active management.

Hydroseeding and planting wetland vegetation are measures to accelerate the establishment of aquatic communities. Without such measures the recontoured ponds would be colonized by undesirable weedy vegetation that would contribute little to restoration of indigenous biodiversity, and could even impede the process.

In addition to restoration of aquatic vegetation that will provide habitats for aquatic organisms that will in turn provide prey sources for birds, other measures are required to enhance habitat suitability for birds. These include provision of gentle bund slopes and pond areas of shallow water depth, both of which will encourage use of the ponds by wading birds such as herons and egrets, which are the focal groups for restoration of the pond wetlands. Areas of shallow water at the base of gently sloping pond bunds have proven to be preferred by birds over the typical, steeply-sloping fish pond bunds. The bunds surrounding each pond and the headland inside Pond 15ABD would have gentle slope profiles where possible in the interest of achieving this benefit for wading birds.

The DBL EIA requires that areas of shallow water should be included in the new wetland area. Because there are few areas in the two new ponds that will be suitable for provision of shallow water, some such areas are provided in the combined Pond 15ABD.

An additional important concept in wetland restoration is wetland area: Larger wetland areas reduce the potential for disturbance impacts at the wetland perimeter due to presence of people, vehicles and other human activities. Such disturbances can effectively reduce the overall wetland area if target wildlife species do not use habitats near the wetland perimeter.

In combination with wetland area a second important feature of a quality wetland restoration project for wading birds is the length of the wetland edge or shoreline. In situations such as Deep Bay Link, where the length of shoreline cannot be increased by simply increasing the overall area of the wetland (because additional lands are not available), it is necessary to seek other options. These include creation of a sinuous edge (curving in the shape of the letter S), or partially removing bunds separating wetlands while converting the remaining bund fragments into a elongated headland. Creation of a sinuous pond perimeter is not practicable at the subject ponds due to their small size and the resulting difficulties of contouring and later management. Therefore, the best remaining option is to increase total water area by partially removing bunds while retaining parts of the bunds as a headland. This option enables conservation gains on three fronts: (i) increased water area; (ii) increased wetland edge beyond a potential zone of disturbance; and (iii) provision of additional shallow water habitat for use by foraging wading birds.

To achieve the above multi-win scenario part of the bunds between Ponds B and D and the section between Pond A and D, would be partially removed. The remaining soil would be used to construct a headland with gentle slopes and areas of shallow water. This method would involve small-scale earthworks and thus less disturbance to the existing habitat than would re-profiling of Ponds A, B and D. This measure can also increase the total water surface area of the Pond 15 Complex.

Bamboo planting is proposed on the pond perimeters because of the potential importance of bamboo stands to birds including herons and egrets. Bamboo stands serve as roost sites and nest sites, as well as screening human disturbance from the adjacent areas. While it is recognized that conservation of wetland foraging areas is critical to the survival of Hong Kong's heron and egret populations, it is also important to restore stands of bamboo near wetlands with the objective of providing long-term roost and nest sites.

Fish stocking is proposed primarily a mosquito control measure. However, it will also serve to quickly restore wetland function by enabling the Pond 15 Complex to provide prey for wading birds and other vertebrates within a short period of time. While it could be argued that proper connections to the surrounding hydrologic regime would be adequate to restore fish communities in the re-provided ponds, this may not provide the level of mosquito control required by the public and may not result in rapid replacement of a prey base for foraging birds. The latter issue (timely restoration of wetland habitat) was expressed at the Deep Bay Link ACE review as a serious concern, therefore it was considered a key issue in drafting of the HCMP.

The perimeter fence will be installed according to specifications in the DBL EIA, while a removal of any internal fencing from bunds will remove visual barriers between ponds and enhance habitat suitability for ardeids.

The above measures are proposed based on the growing body of local and international experience with wetland restoration projects and critical reviews of their effectiveness. On the basis of this extensive background the Consultants submit that the measures proposed for the Pond 15 Complex are adequate and necessary for meeting the EIA requirements.

Annex III Habitat Creation Management Plan for the Pond 15 Complex During Deep Bay Link Operation

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List of Abbreviations

AFCD	Agriculture, Fisheries & Conservation Department
CITES	Convention on International Trade in Endangered Species of Fauna & Flora
DSD	Drainage Services Department
EA	Environmental Assessment
HMP	Habitat Management Plan
HKSAR	Hong Kong Special Administrative Region
IUCN	International Union for Conservation of Nature & Natural Resources
MDC	Main Drainage Channels for Ngau Tam Mei, Yuen Long & Kam Tin
TDD	Territory Development Department

1 INTRODUCTION

1.1 Background

This habitat management plan was developed for fishponds to be reinstated to mitigate fishpond losses caused by the Deep Bay Link project in Hong Kong's North West New Territories (NWNT). The Deep Bay Link project will connect highways in the Tuen Mun and Yuen Long areas with the Shenzhen Western Corridor, which will provide road access across Deep Bay to the Shenzhen Special Economic Zone district of Shekou. The Deep Bay Link project site was historically dominated by crop and fish farming, but has recently become a focus of urbanisation due to massive investments in transport infrastructure (Castle Peak Road of Highways Department and West Rail of the Kowloon-Canton Railway Corporation).

The proposed development area lies outside the protective Wetland Buffer Areas (WBA) and Wetland Conservation Areas (WCA) of Hong Kong's Mai Po Ramsar Site. However, losses of wetlands outside the WBA and WCA are normally mitigated in the NWNT because of their biodiversity conservation values, particularly for waterbirds, and their flood attenuation values.

The existing wetland area affected by Deep Bay Link is 0.49 ha. Short-term (construction phase) wetland losses would be 0.02 ha, and permanent losses would total 0.17 ha. Wetlands would be reprovided over an area of 0.21 ha. The wetland area on completion of the project would be 0.51 ha, resulting in a gain of 4% from the baseline wetland area of 0.49 ha. All wetland impacts are to be mitigated on-site.

On completion of the Deep Bay Link construction project, the mitigation ponds will revert from control by the works contractor to management by the Agriculture, Fisheries & Conservation Department (AFCD). At the time when construction works are completed, Pond 15X will have been in use for about 1 year. Pond 15ABD and 15C1 will have been converted / modified from existing ponds. Pond 15Y is to be excavated near the completion of the highway construction project. Prior to handover of the ponds to AFCD there will be a post-works establishment period of 12-month duration during which the contractor will ensure that all ponds and associated infrastructure and plantations are in place and functioning as planned. The contractor will also conduct ecological monitoring on the mitigation ponds for two years following construction.

This plan is to provide guidance to the AFCD managers in the subject of wetland habitat and biodiversity conservation management after AFCD takes over the ponds.

1.2 Description of the Site

The subject ponds are referred to in this plan as the Pond 15 Complex. On the Lands Department 1:5000 series topographic map Edition 3 Sheet Number 6-NW-A the original Pond 15 was shown as a single pond. By August 2000 the original Pond 15 had been sub-divided into 12 ponds by formation of new bunds. Lands resumed by government for the Deep Bay Link project include 4 of these 12 ponds. The 4 affected ponds are individually labelled Ponds 15A through 15D (collectively referred as Pond 15 Complex hereafter) for the purpose of this management plan (***Figure 3 in Technical Note 18 main text***).

The Pond 15 Complex lies at an elevation of approximately 20 m and covers an area of some 0.49 ha. Hong Kong Grid coordinates are 816450E by 833850N. The superficial deposits at the site are classified as terraced alluvium and principal materials are clay, silt, and gravelly sand (GCO 1988).

Lands north and east of Pond 15 Complex have been urbanised and are used for container handling and storage. Lands south and west of Pond 15 Complex are the foothills of the Castle Peak range and they remain largely undeveloped except for small agricultural plots in the drainages and designated burial grounds on the hillsides.

1.3 Description of the Catchment

The catchment of the original Pond 15 covers approximately 1.5 km^2 and drains southwest to northeast. Maximum elevation is 158 m on a foothill southwest of the site, and minimum elevation approaches sea level near the confluence of Pond 15 Stream and engineered nullahs west of Tin Shui Wai. Primary land uses in the catchment are crop farming and fish farming, small village residences and container handling and storage. The upper catchment is largely deforested and the shrub-grass habitats are degraded by frequent hillfires originating at gravesites. The lower catchment hydrology has been modified by construction of highways and nullahs.

1.4 Objective & Components of the Plan

The primary objective of this plan is to ensure that wetland ecological resources at Pond 15 Complex are managed during operation of the Deep Bay Link in such a way as to replace those documented on the site prior to highway construction. This is referred to as habitat restoration. The following 7 components of the plan describe the measures to be implemented to achieve these objectives.

- **Component 1: Guiding Concepts of Wetland Mitigation**

Seven principles of wetland mitigation that guide the development and implementation of this plan are listed and discussed in Component 1.

- **Component 2: Pond Configuration and Topography**

In place of the 4 ponds on the site prior to construction there are to be 4 ponds post-construction. Guidance for construction of these 4 ponds is provided in ***Annex II of main report***. Component 2 of this plan reviews the pond restoration project and proposes options.

- **Component 3: Hydrological Issues**

The stream referred to earlier in this document as Pond 15 Stream drains the catchment in which the original Pond 15 is located. The stream will provide part of the water supply for Pond 15 Complex. Water control structures are to be installed by the Deep Bay Link works contractor as described in ***Annex II of main report***. Component 3 of this plan reviews the proposed water control structures and proposes options.

- **Component 4: Target Species and Their Habitat Requirements**

The two waterbird species of regional concern reported near Pond 15 during the Deep Bay Link EIA studies were Chinese Pond Heron *Ardeola bacchus* and Little Egret *Egretta garzetta*. While pond management should address the needs of these species, other waterbirds can also be attracted to Pond 15 for the benefit of waterbird conservation in NWNT. Component 4 of this plan lists those species and their habitat requirements.

- **Component 5: Fish Management**

Although Pond 15 Complex was used for fish farming prior to resumption, it will be targeted at wetland conservation when managed by government (detailed in ***Section 4.6.1 of main report)***.

- **Component 6: Management Regime (prior to and after handover)**

Mitigation of wetland losses is a maturing science in Hong Kong and around the world. A vast body of literature guides the science of habitat restoration in professional journals, books, and various forms of guidelines. Component 6 of this plan specifies routine management measures that have proven useful in global experience for enhancing the conservation performance of ponds.

- **Component 7: Monitoring**

Quantitative sampling will be required to ensure that this plan meets its objective. Component 7 of this plan describes a sampling programme to document the performance of the ponds as wetland biodiversity conservation sites.

2 GUIDING CONCEPTS

1. **Wetlands are the habitats of conservation priority in the NWNT.** Although the natural climax habitat throughout the NWNT is broad-leaved evergreen forest with a complex and multi-layered canopy (Dudgeon and Corlett 1994), and although this habitat type supports more avian biodiversity than any other on earth (ICBP 1992), wetlands have been the subject of most conservation concern. This is mainly because NWNT forests have been replaced by man-made habitats, many of which are fresh water wetlands that support fauna of conservation concern. In the interest of reversing declines in wetland-dependent fauna due to declines in the extent of freshwater wetlands, habitats to be managed at Deep Bay Link will be wetlands.
2. **Hydrology is the key to enhancement of wetland habitat.** Most successful wetland restoration projects have been on sites where wetlands naturally occurred, but were drained for other uses for a period of time. Examples include coastal wetlands and freshwater wetlands drained for crop farming but later restored (Scodari 1997). Pond 15 fits this model, i.e. it was formerly a lowland seasonal wetland site fed by a small stream that occasionally flooded. It was converted to crop or fish farming and is now to be restored to pond habitat for conservation management.
3. **Hydrological changes for wetland conservation must not disadvantage other basin users.** Supplying water to ponds for the benefit of waterbirds must not increase flood risks to residential users or decrease water availability to farmers in the catchment.
4. **Enhanced habitats will be mainly self-sustaining.** The ponds will be simple in design and will require minimal maintenance. Filling and draining of managed wetlands will rely on existing water sources/outlets and gravity to the extent possible. Vegetation and fauna management will rely mainly on natural colonization and succession except in the event of outbreaks of invasive plants or animals.
5. **Species of conservation concern will be the focus of conservation management.** Selection of target species for conservation management will address those species most in need of increased availability or quality of habitat.
6. **Habitat management will be adaptive.** The body of information describing habitat management techniques for conservation is voluminous, but local experience is limited. Thus there will be a requirement to adapt management regimes to local conditions as time passes and experience is gained.
7. **Monitoring will test hypotheses.** Monitoring will be designed and conducted from the perspective of hypothesis testing rather than simple data recording. The goal of monitoring will be to inform and guide management decisions.

3 TARGET SPECIES OF HABITAT MANAGEMENT

For the purpose of this plan "conservation concern" is defined as inclusion in a list of protected species on the basis of small population size, real or potential population decline, or dependence on a habitat that is limiting population size or distribution and may also be in decline. Species of conservation concern under this definition are those listed by IUCN World Conservation Union and BirdLife International among the Threatened Birds of Asia (see www.rdb.or.id), those listed as protected in Mainland China (Wang Song *et al.* 1998), and those listed by the Convention on International Trade in Endangered Species (CITES).

3.1 Review of Deep Bay Link Biodiversity

Deep Bay Link avian species were listed based on surveys carried out in January and April 2000. The bird species recorded along the survey transect at Ling To Monastery Road are shown in ***Appendix 1*** (DBL EIA, Arup 2002). Applying the above definition to the species listed in ***Appendix 1***, no species recorded during baseline surveys can be considered of conservation concern. However, target species for conservation can be selected on the basis of regional population declines and the suitability of the proposed Pond 15 Complex habitat, as discussed below.

3.2 Selection of Target Species

Little Egret and Chinese Pond Heron were both recorded in small numbers near Pond 15. These two species are commonly seen in fishpond habitats in NWNT. Both species are resident in Hong Kong. Both species are often seen in association with other herons and egrets (members of the avian family Ardeidae), whose habitat preferences they share. For this reason Little Egret and Chinese Pond Heron at Pond 15 can be considered representative of the Ardeidae family, and we can conclude that protection will lead to benefits for other ardeid species as well.

Other species recorded on the Ling To Monastery transect that would be expected to benefit from the mitigation project are common and widespread species that typically occupy fishpond habitats. These include White-breasted Waterhen *Amourornis phoenicurus*, White-throated Kingfisher *Halcyon smyrnensis*, Barn Swallow *Hirundo rustica*, Yellow-bellied Prinia *Prinia flaviventris*, and Dusky Warbler *Phylloscopus fuscatus*.

3.3 Habitat Requirements

Little Egret and Chinese Pond Heron are relatively common resident species in Hong Kong and are known to nest here. They rely on wetland habitats for foraging, as do most other ardeids. The main conservation issue for both species in Hong Kong is availability of foraging habitats. Shallow-water wetlands including marshes, active and abandoned fishponds, active and abandoned wet farmlands, and streams or rivers are all suitable foraging habitats. Thus any losses of wetland habitats due to Deep Bay Link construction are priorities for mitigation with respect to Little Egret and Chinese Pond Heron.

4 IMPLEMENTATION OF MITIGATION MEASURES

The EIA requirements and the habitat requirements of the target species have been taken into account during the design of the pond configuration and topography, and hydrological regime (see ***Technical Note 18 main text***). It is also concluded that some enhancement measures are needed in Pond 15 Complex due to the disturbance and fragmentation impacts.

Major enhancement measures include:

(1) pipes to connect the Pond 15 Complex

(2) creation of shallow water-depth area

(3) gentle bund slopes, for example 1:5 to 1:10;

(4) hydroseeding

(5) planting of wetland plants;

(6) bamboo planting

(7) fish stocking

(8) removal of internal fences and installation of perimeter fence

These measures would be implemented by the Contractor upon completion of Pond 15 Complex.

5 MANAGEMENT PRIOR TO HANDOVER

5.1 Programme

Following completion of construction/restoration of the Pond 15 Complex and the mitigation measures there will be a 12-month establishment period during which the contractor remains responsible for management of all ponds in the Pond 15 Complex prior to handing them over to AFCD. During the 12-month establishment period the contractor will:

- ensure that the water control infrastructure functions as planned;
- monitor water levels in the ponds per the monitoring protocols in Section 7 of this report;
- remove colonising *Mikania* and *Urochloa* as needed;
- at the end of the establishment period replant bamboo as needed to replace mortality of planted stems at the planting sites;
- at the end of the establishment period replant/re-introduce aquatic vegetation as needed to replace earlier plantings that died; and
- remove accumulated litter/rubbish as needed.

5.2 Hydrology

The Contractor will monitor the water levels (***Figure 6b of main text***) and hydrological regime of Pond 15 Complex to ensure the water control infrastructure functions as planned, i.e. the water depths at the centres of all ponds range between 1-1.5m and those at the shallow areas less than 0.3m. A continuous water flow at downstream direction from Pond 15 Stream to the outlet at Pond 15ABD will also be inspected. If the natural surface water supply is not sufficient for maintaining the suitable water levels, the Contractor will seek other water sources such as pumping from nearby stream or by water trucks.

At the time of handover of the ponds to AFCD all ponds will be filled to optimal water depths and all drainage and water supply infrastructure will be in place and functioning properly.

5.3 Vegetation

Vegetation on the baseline fishpond bunds consisted of species that colonized naturally, most of which are pan-tropical weeds. The post-construction Pond 15 Complex bunds would be hydroseeded using the standard hydroseeding mix, and selected wetland plants would be

planted on the pond banks and in the pond (***Figure 6c*** and ***Appendix 2***) after the pond system is finished by the contractor and would be maintained for 12 months prior to handover to AFCD. However, colonizing species normally out-compete the hydroseeded or planted species over a short period of time. It is difficult to manage bund vegetation to discourage growth of aggressive invasive species.

The primary management action should be to periodically remove the invasive exotics Mikania *Mikania micrantha* and Blunt Signalgrass *Urochloa mutica*. The frequency of removal will depend upon growth rates. Bunds should be inspected at monthly intervals, at which time all Mikania should be removed and Blunt Signalgrass should be mown to near ground level as needed. The frequency of inspection and vegetation removal can be reduced to bi-monthly from November through March.

Woody vegetation should not be planted on the bunds. Any colonizing exotic trees or shrubs should be removed. Colonizing native trees and shrubs should not be removed.

Note that the probability of survival of aquatic plants is relatively lower than hydroseeding, therefore it will probably be necessary to replant/re-introduce some aquatic vegetation at the end of the establishment period.

Bamboo plantations will be inspected for the conditions and survival. The contractor will replant bamboo as needed to replace mortality of planted stems at the planting sites.

5.4 Fauna

The contactor will retain deep water areas near the pond centres. This will ensure that some water is retained in the pond even during extended periods without rainfall. This will help ensure survival of some fish species that are prey for ardeids.

If there is a mass death of the released Tilapia and Mosquito fish due to accidental dry-out in the ponds, the contractor will conduct re-stocking of fish.

6 MANAGEMENT AFTER HANDOVER

6.1 Programme

At the end of the 12-month Contractor's establishment period the water control infrastructure will function properly, there will be water at appropriate depths in the ponds, *Mikania* and *Urochloa* will have been removed, planted bamboos will be growing, aquatic vegetation will be visible in the ponds, and no litter or rubbish will be visible in the fenced Pond 15 Complex area.

Following the 12-month establishment period, the Pond 15 Complex will be handed over to AFCD. As the management authority, AFCD will :

- monitor water levels in the ponds per the monitoring protocols in Section 7 of this report;
- remove colonising *Mikania* and *Urochloa* as needed;
- monitor the wildlife use of the Pond 15 Complex; and
- remove accumulated litter/rubbish as needed.

6.2 Vegetation

Vegetation on the baseline fishpond bunds consisted of species that colonized naturally, most of which are pan-tropical weeds.

Large-scale planting of vegetation will not be required because initial planting would be conducted by the contractor before the handover and wetland vegetation will naturally colonize other space on the re-contoured former fishponds where the substrate and water regime will be suitable.

The primary management action should be to periodically remove the unwanted invasive exotic vegetation. Examples of undesirable exotic genera include *Mikania*, *Casuarina*, *Acacia*, *Melaleuca*, *Eucalyptus* and others.

All Mikania *Mikania micrantha* should be removed and Blunt Signalgrass *Urochloa mutica* should be mown to near ground level as needed. Woody vegetation should not be planted on the bunds. Any colonizing exotic trees or shrubs should be removed. The frequency of removal will depend upon growth rates.

Removal of these species by hand weeding will increase availability of habitat for desirable native species. A list of desirable native species is provided in ***Appendix 2***.

Colonizing native trees and shrubs should not be removed.

6.3 Fauna

It is anticipated that fauna will be naturally colonised and utilised Pond 15 Complex once the suitable hydrological regime and vegetation communities have established. No active management measures for fauna will be required.

7 MONITORING

As stipulated in the EM&A Manual for Deep Bay Link Project, the Contractor will be responsible for the ecological monitoring during construction and planting and during the first two years following completion of construction. Scope of the ecological monitoring programme are given in the said EM&A Manual, detailed monitoring methodology will be submitted to AFCD for agreement about one month prior to conducting the first ecological monitoring in the first year.

A second ecological monitoring programme will be implemented by AFCD, as the management authority, or its appointed specialists for another two years after the Contractor has finished the first two-year monitoring programme. The scope of the second ecological monitoring programme basically follows the first one, but with some modifications which are considered more suitable for an established pond system. The major change is to replace the benthos survey by dragonfly survey. The first two-year period should be sufficient for the establishment and stabilisation of benthic communities. It would be more valuable to shift the efforts to other fauna groups such as dragonflies. The details of the monitoring programme conducted by AFCD are provided in sections below.

The need on any further ecological monitoring programme will be reviewed by AFCD upon the completion of the second monitoring programme.

7.1 Hydrology

Quarterly hydrological monitoring and management will be required to:

- periodically measure and record water levels and keep long-term logs of water levels (***Figure 6b of main text***);
- maintain desired water levels in all 4 ponds (maximum 1-1.5 m depth);
- maintain and repair install equipment and facilities;

- ensure that water management at Pond 15 Complex does not deprive neighbouring fish farmers of water; and
- ensure that water management at Pond 15 Complex does not increase flood risk to villages.

During each monitoring visit water levels should be measured and recorded at fixed monitoring stations. The stations should consist of metal measuring stakes installed in the pond bed. Readings should be taken and recorded for each pond.

Long term water level data should be correlated to bird monitoring results to develop water level management guidelines for waterbirds. This should lead to management of water levels by draining or filling ponds to optimize habitat suitability for waterbirds.

All piping, inlets, outlets and other water management equipment should be inspected and arrangements made for repair during each monitoring session.

Neighbouring farmers should be consulted during each monitoring session to determine whether Pond 15 management causes adverse impacts to their operation. Concerns to be addressed are flooding and reduced water availability.

7.2 Vegetation

Monitoring of vegetation will be required at quarterly intervals to:

- Inspect the conditions of the plant communities at Pond 15 Complex (including the three bamboo planting areas); and
- Determine the need for removing exotic species.

7.3 Fauna

Fish and aquatic invertebrates will be monitored by the same method as stated in the Deep Bay Link EM&A Manual.

Dragonflies will be monitored by fixed point count method twice a year (wet and dry seasons).

Amphibians will be monitored by active searching and vocal identification methods at night during spring to summer.

Monitoring of avifauna is suggested to determine how populations of target species respond to the habitat restoration project and to test hypotheses regarding relationships of fauna to water levels and vegetation cover or species. These baseline quantitative data obtained from environmental impact assessment will be used in statistical comparisons of post-construction species richness and population density.

Water depths recorded during hydrology monitoring would enable correlation with results of avifauna sampling.

Table A3-1 Monitoring of Wetland Compensation Area

Group or Parameter	Method	Frequency/timing
Water level	Fixed yardstick	Quarterly
Water quality: BOD and	Collect sample for BOD measurement in	Quarterly

dissolved oxygen	laboratory, DO probe in field.	
Flora	Recording of % cover for each species within a fixed 1m wide belt transect starting on dry bank and ending in open water. The transect is to be permanently marked. Vegetation height to be measured and photographs taken.	Wet season and dry season.
Pelagic fauna – fish and invertebrates	Netting for standard period with standard net. Samples to be identified and numerical abundance and biomass to be determined	Wet season and dry season
Dragonflies	Fixed point counts	Wet season and dry season
Amphibians	Survey of breeding amphibians using nocturnal torch-light searches and listening for calls.	Once between April – May, preferably following raining
Birds	Fixed point counts in the morning	Summer (breeding birds); autumn migration period; winter (wintering birds) and spring migration.

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Appendix 1 Bird data from the Deep Bay Link EIA site nearest to Pond 15 (ARUP 2002)

Transect 3 — Lin To Monastery Road				
Date	**14 Jan**	**15 Jan**	**11 April**	**12 Apr**
	No.	No.	No.	No.
Species				
Little Grebe			2	2
Black-crowned Night-Heron			1	
Chinese Pond Heron	3	6	2	1
Black Kite	2			
Chinese Goshawk				1
Chinese Francolin				1
White-breasted Waterhen	3			
Common Moorhen	2	1	1	1
Green Sandpiper	1	1		
Oriental Turtle Dove			1	
Spotted Dove	9	5	1	2
Large Hawk Cuckoo			1	1
Plaintive Cuckoo			1	1
Common Koel			2	3
Greater Coucal	1		1	1
Lesser Coucal			1	1
Common Kingfisher	1			1
Olive-backed Pipit	4	5	1	5
Grey Wagtail	2			
White Wagtail	1	5		
Red-whiskered Bulbul	2	9	4	2
Chinese Bulbul	8	6		2
Sooty-headed Bulbul			2	
Oriental Magpie Robin	2	8	2	7
Common Stonechat		2		
Grey-backed Thrush		1		
Yellow-bellied Prinia	2		1	3
Common Tailorbird	2	5	3	4
Yellow-browed Warbler	2	1	1	1
Dusky Warbler	4	2		1
Masked Laughing-thrush	4	3+	4+	4+
Black-throated Tit	2			
Great Tit	1		2	2
Fork-tailed Sunbird		1		
Scarlet-backed Flowerpecker		2		
Japanese White-eye	4	7	2	1
Long-tailed Shrike	1	2	1	1
Common Magpie	2			2
Large-billed Crow	2			
Red-billed Starling		1		
Black-collared Starling	1	2	2	2
Crested Myna	2	6	2	

Appendix 2 Plant species list for planting and revegetation of ponds

Species to plant on bund:

standard hydroseed mix

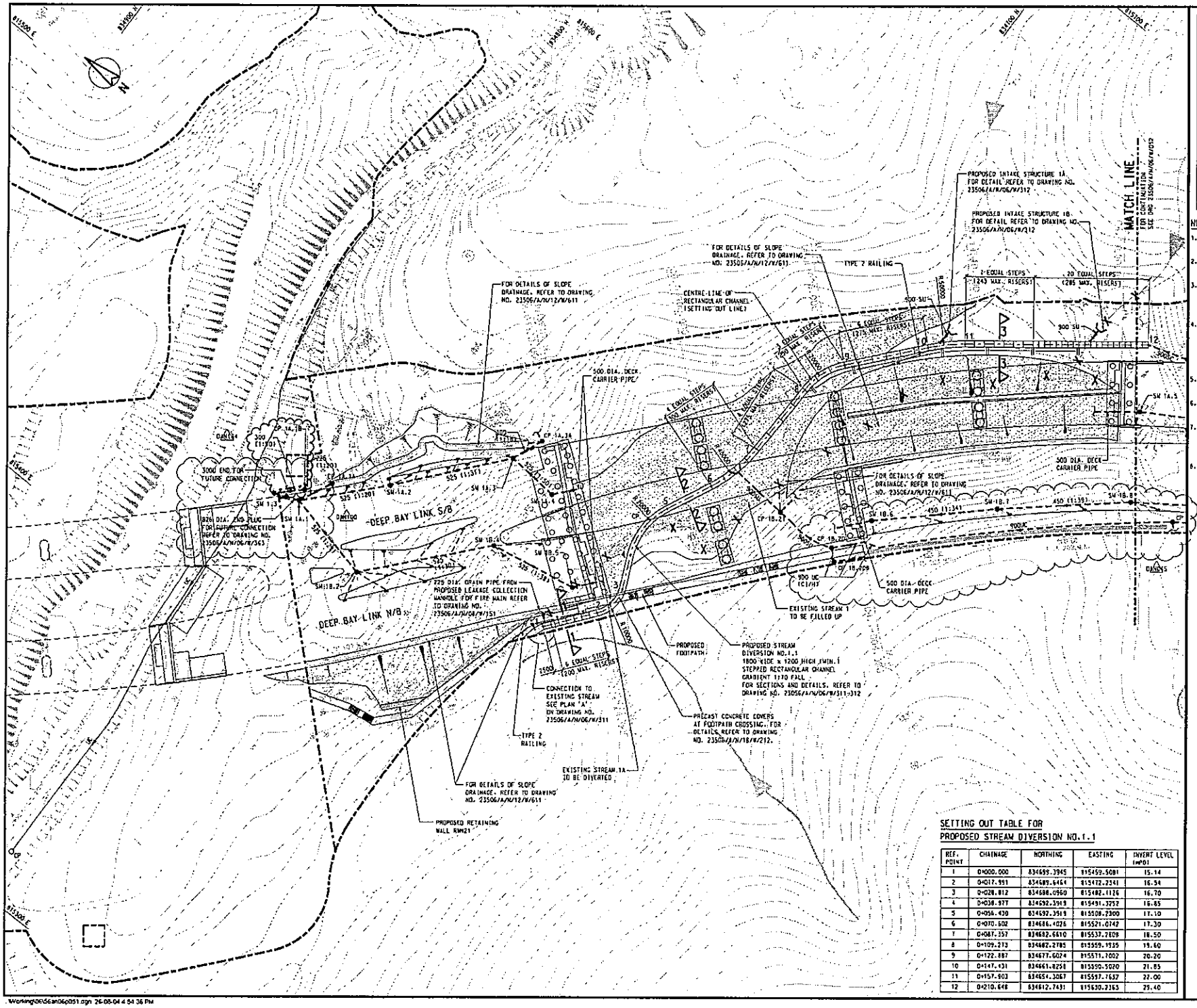
Species to plant on pond bank (Group A plants in Figure 6c):

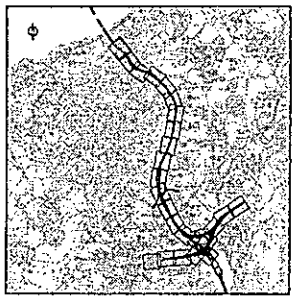
Cyperus exaltatus	Tall-culm Galingale
Cyperus pilosus	Pilose Galingale
Alopecurus aequalis	Short-awned Foxtail
Scirpus juncoides	Rush-like Bulrush
Commelina diffusa	Diffuse Dayflower
Ludwigia adscendens	Water-dragon

Species to plant at shallow water (Group B plants in Figure 6c):

Blyxa aubertii	Aubert's Blyxa
Marsilea quadrifolia	Pepperwort
Ceratopteris thalictroides	Water Fern
Azolla pinnata	Mosquito Fern

Annex IV Re-alignment and Diversion of Stream Courses





NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/N/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/N/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING OUTLETS, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/N/10/W/731-744.
4. PROPOSED U-CHANNELS ACROSS FOOTPATH TO BE PROVIDED WITH LIGHT DUTY C.I. GRATING COVER. PROPOSED U-CHANNELS ALONG VERGE TO BE PROVIDED WITH DUTY C.I. GRATING COVER UNLESS OTHERWISE STATED. THE MINIMUM FALL OF PROPOSED U-CHANNELS SHALL BE 1:100 FOR 225mm AND 1:150 FOR 300m OR GREATER.
5. FOR DETAILS OF PROPOSED HEADWALL REFER TO DRAWING NO. 23506/A/N/06/W/357-358.
6. FOR DETAILS OF OUTFALL REFER TO DRAWING NO. 23506/A/N/06/W/354-356.
7. FOR DIVERSION OF EXISTING STREAMS/CHANNELS, THE ALIGNMENTS SHOW ON THESE DRAWINGS ARE INDICATIVE ONLY. EXACT ALIGNMENTS AND INVERT LEVELS SHALL BE DETERMINED ON SITE AND AGREED BY THE ENGINEER.
8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/N/06/W/359.

SETTING OUT TABLE FOR
PROPOSED STREAM DIVERSION NO.1.1

REF. POINT	CHAINAGE	NORTHING	EASTING	INVERT LEVEL (mPD)
1	0+000.000	834699.3945	815459.5081	15.14
2	0+017.951	834689.6454	815472.2341	16.54
3	0+028.812	834688.0960	815482.1176	16.70
4	0+038.977	834692.3913	815491.3252	16.85
5	0+056.430	834692.3913	815508.7300	17.10
6	0+070.602	834686.4026	815521.0742	17.30
7	0+087.357	834682.6610	815537.7809	18.50
8	0+109.213	834682.2785	815559.1935	19.60
9	0+122.887	834677.6024	815571.7002	20.20
10	0+147.431	834661.8258	815590.5020	21.85
11	0+157.903	834654.3067	815597.7637	22.00
12	0+210.648	834612.7431	815630.2365	25.40

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Job Title: HY/2002/24 Deep Bay Link - Northern Section
Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN
Sketch No.: HY/2002/24-DAN/013/SK01
Part Plan of DWG No.: 23506/A/N/06/W/351 (Rev. -)
Scale: As Per Drawing
Prepared by: TY | Date: June 2004
Checked by: GL | Date: June 2004

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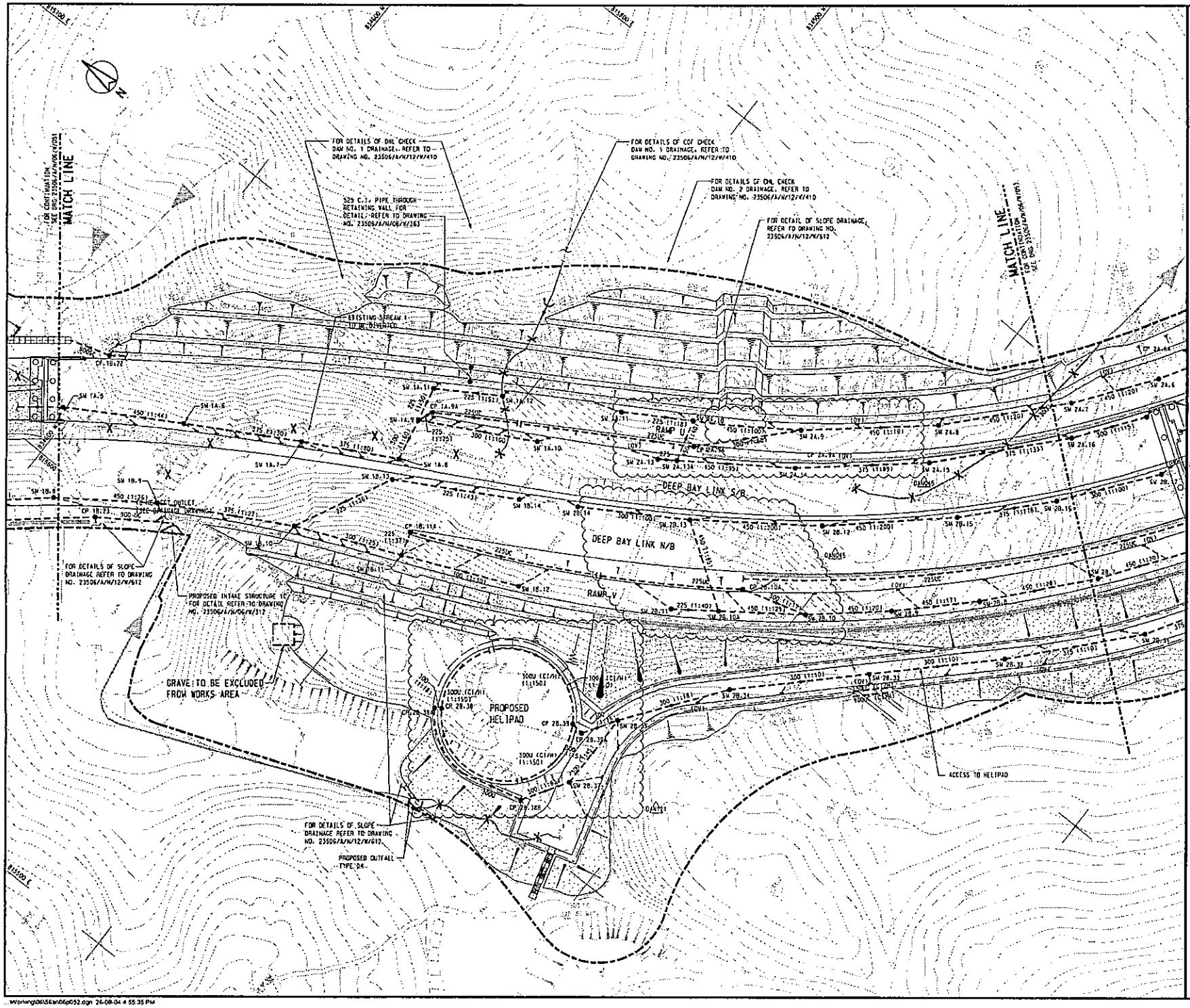

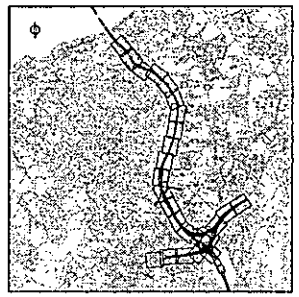

NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/N/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/N/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/N/12/W/731-744.
4. PROPOSED U-CHANNELS ACROSS FOOTPATH TO BE PROVIDED WITH LIGHT DUTY C.I. GRATING COVER. PROPOSED U-CHANNELS ALONG VERGE TO BE PROVIDED WITH DUTY C.I. GRATING COVER, UNLESS OTHERWISE STATED. THE MINIMUM FALL OF PROPOSED U-CHANNELS SHALL BE 1:100 FOR 225mm AND 1:150 FOR 300m OR GREATER.
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6. FOR DETAILS OF OUTFALL REFER TO DRAWING NO. 23506/A/N/06/W/354-356.
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8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/N/06/W/359.

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Ove Arup & Partners Hong Kong Limited

Job Title: HY/2002/24
Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 2)

Sketch No.: HY/2002/24-DAN/0103/SK01
Scales: 1:500 on A1
Date: AUG 04
Checked by: GL
Date: AUG 04

Part Plan of DWG No.: 23506/A/N/06/W/052 (Rev. -)
Prepared by: TY

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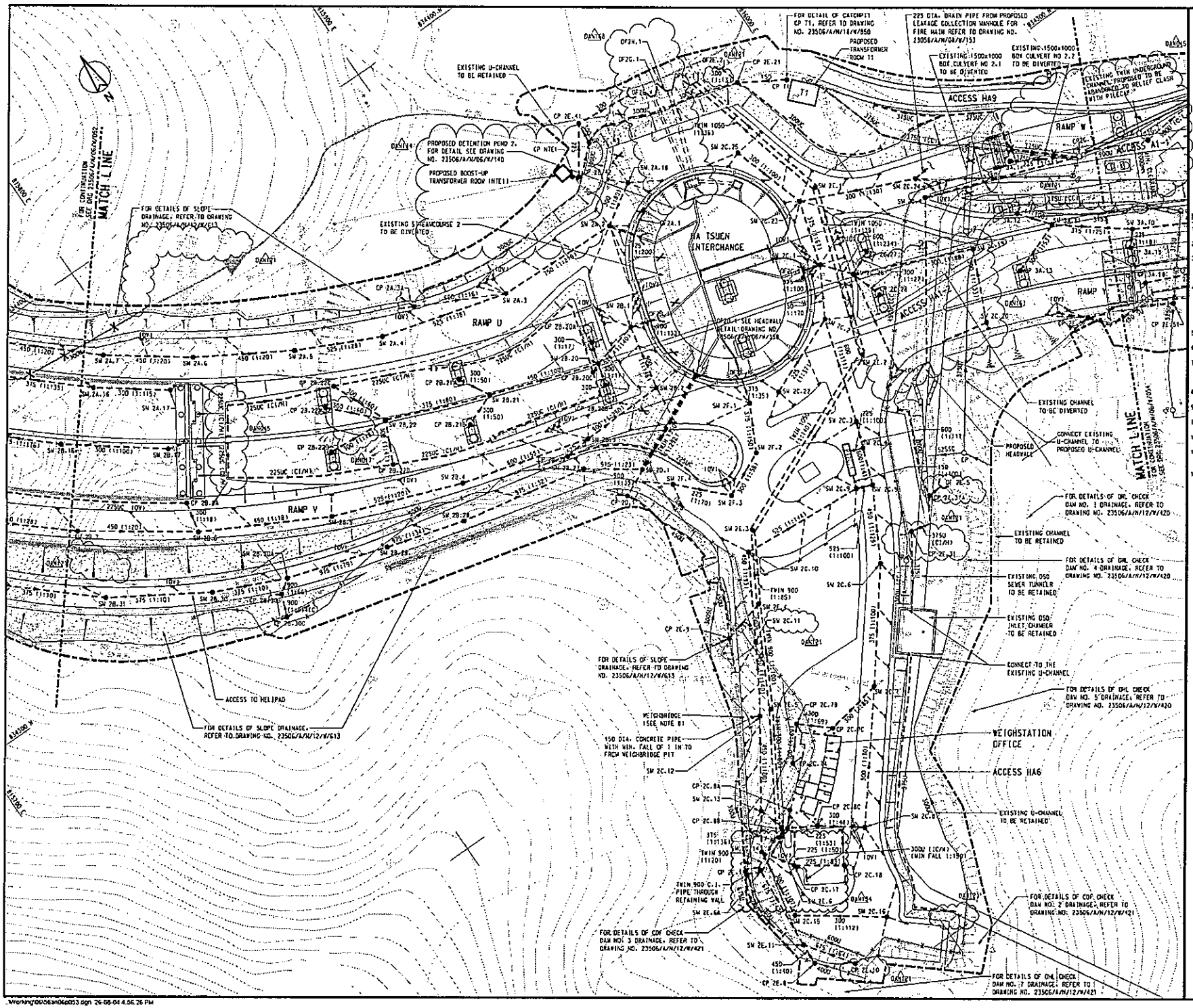

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1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/N/D6/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/N/D6/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/N/10/W/731-744.
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8. FOR DRAINAGE DETAILS OF WEIGHBRIDGE PIT, REFER TO DRAWING NO. 23506/A/N/18/W/612.
9. FOR DRAINAGE LAYOUT OF WEIGHSTATION OFFICE, REFER TO DRAWING NO. 23506/A/N/13/W/621.
10. FOR DETAILS OF PETROL INTERCEPTOR, REFER TO HyD STANDARD DRAWING NO. H3134 - H3144.
11. FOR TRANSFORMER ROOM DRAINAGE PLAN, REFER TO DRAWING NO. 23506/A/N/18/W/850.
12. FOR DRAINAGE ARRANGEMENT OF PROPOSED BOOST-UP TRANSFORMER ROOM AND PILLAR HOUSE FOR TCSS UPS, REFER TO DRAWING NO. 23506/A/N/18/W/886 AND 888.
13. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/N/D6/W/355.

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Job Title: HY/2002/24 Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN

Sketch No.: HY/2002/24-DAW/018/SK01

Scale: 1:500 ON A1

Date: AUG 04

Checked by: GL

Date: AUG 04

Prepared by: TY

Date: AUG 04

Part Plan of DWG No.: 23506/A/N/W/653 (Rev. A)

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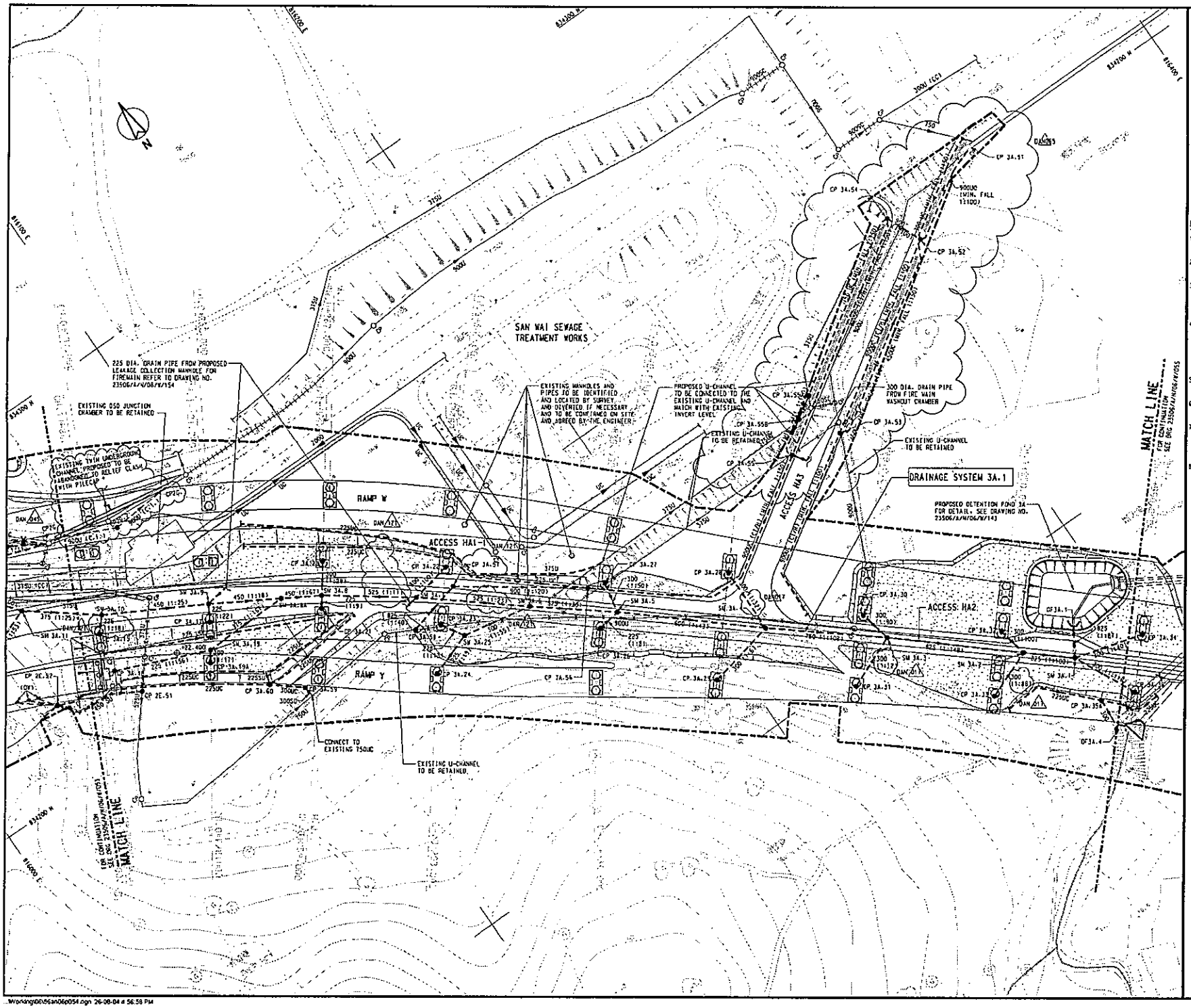

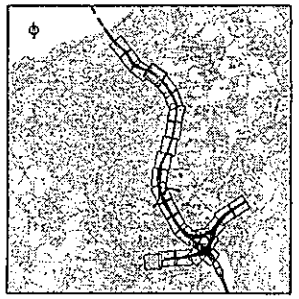

NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/H/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/H/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/H/06/W/731-744.
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8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/H/06/W/353.

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Ove Arup & Partners Hong Kong Limited

Job Title: HY/2002/24 Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 4)

Sketch No.: HY/2002/24-DAN/0121/SKG4

Scale: 1:1000 on A3

Date: May 04

Part Plan of DWG No.: 23506/A/H/06/W/054 (Rev. -)

Prepared by: TY

Date: May 04

Checked by: CL

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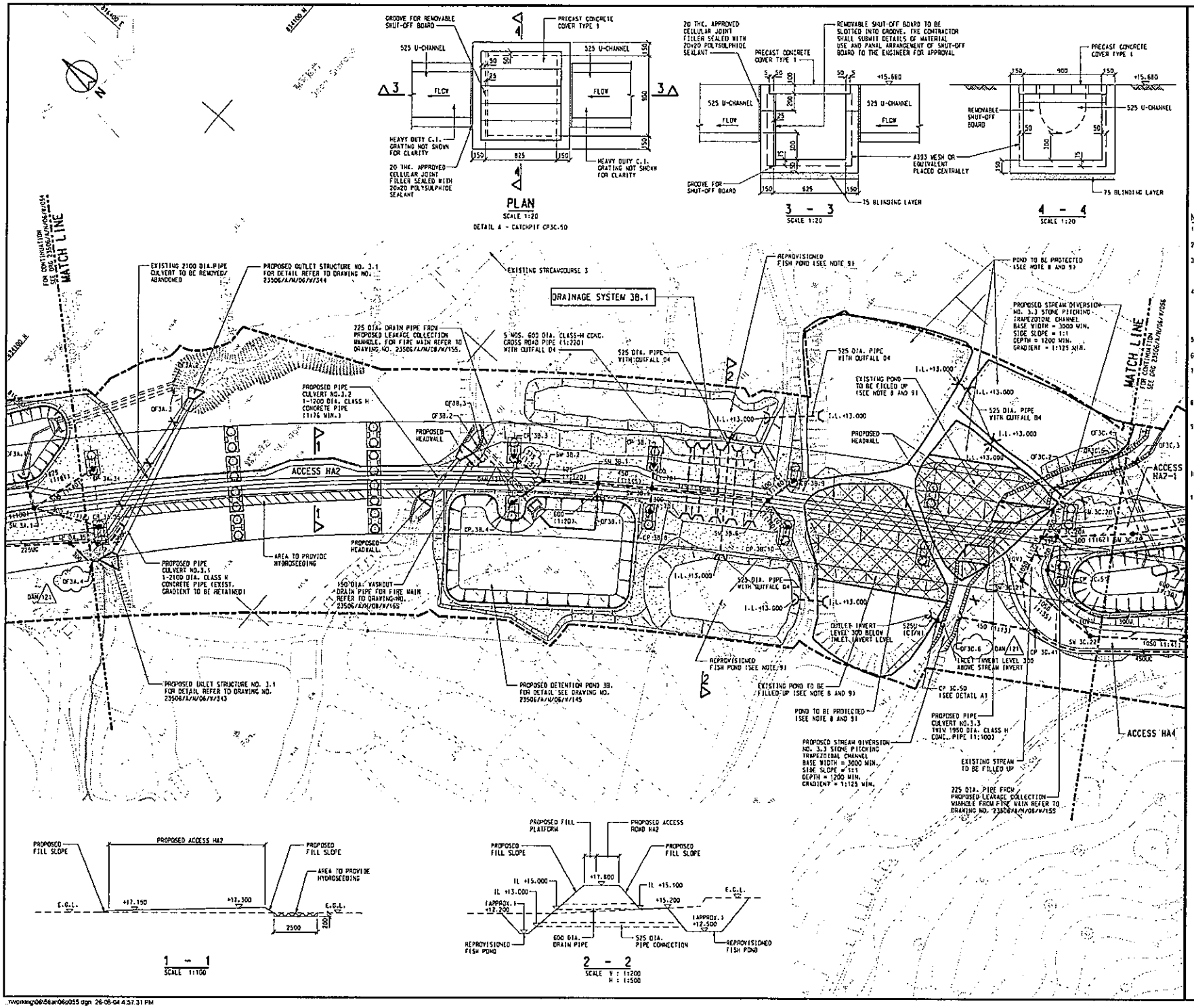

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1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/H/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/H/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING DOWNPIPES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/H/10/W/731-744.
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8. THE CONTRACTOR SHALL INVESTIGATE ON SITE AND CONFIRM WHETHER THERE ARE PIPE DRAINAGE CONNECTIONS BETWEEN EXISTING FISH PONDS OR NOT.
9. PRIOR TO FILLING OF THE EXISTING PONDS, THE PONDS WILL BE DRAINED AND THE SILTY CLAYEY MATERIAL ON THE BOTTOM OVER THE EXTENT OF POND TO BE FILLED IS TO BE REMOVED AND STORED FOR REUSE IN THE BASE OF REPROVISIONED FISH PONDS. THE PROPOSED EXCAVATED MATERIAL FOR THE LINING WILL BE SUBJECT TO APPROVAL BY THE ENGINEER.
10. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/H/06/W/359.
11. REPROVISIONED FISH POND LEVELS AND CONNECTING PIPE LEVELS AND DETAILS TO BE CONFIRMED BY THE ENGINEER BASED ON CONTRACTOR'S TOPO SURVEY OF THE EXISTING PONDS

ARUP
Ove Arup & Partners Hong Kong Limited

Job Title: HY/2002/24 Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 5)

Sketch No.: HY/2002/24-DAN/012/SK05

Scale: 1:1000 on A3

Checked by: CL

Date: May 04

Prepared by: TY

Date: May 04

Plot Plan of DWG No.: 23506/A/H/06/W/055 (Rev. A)

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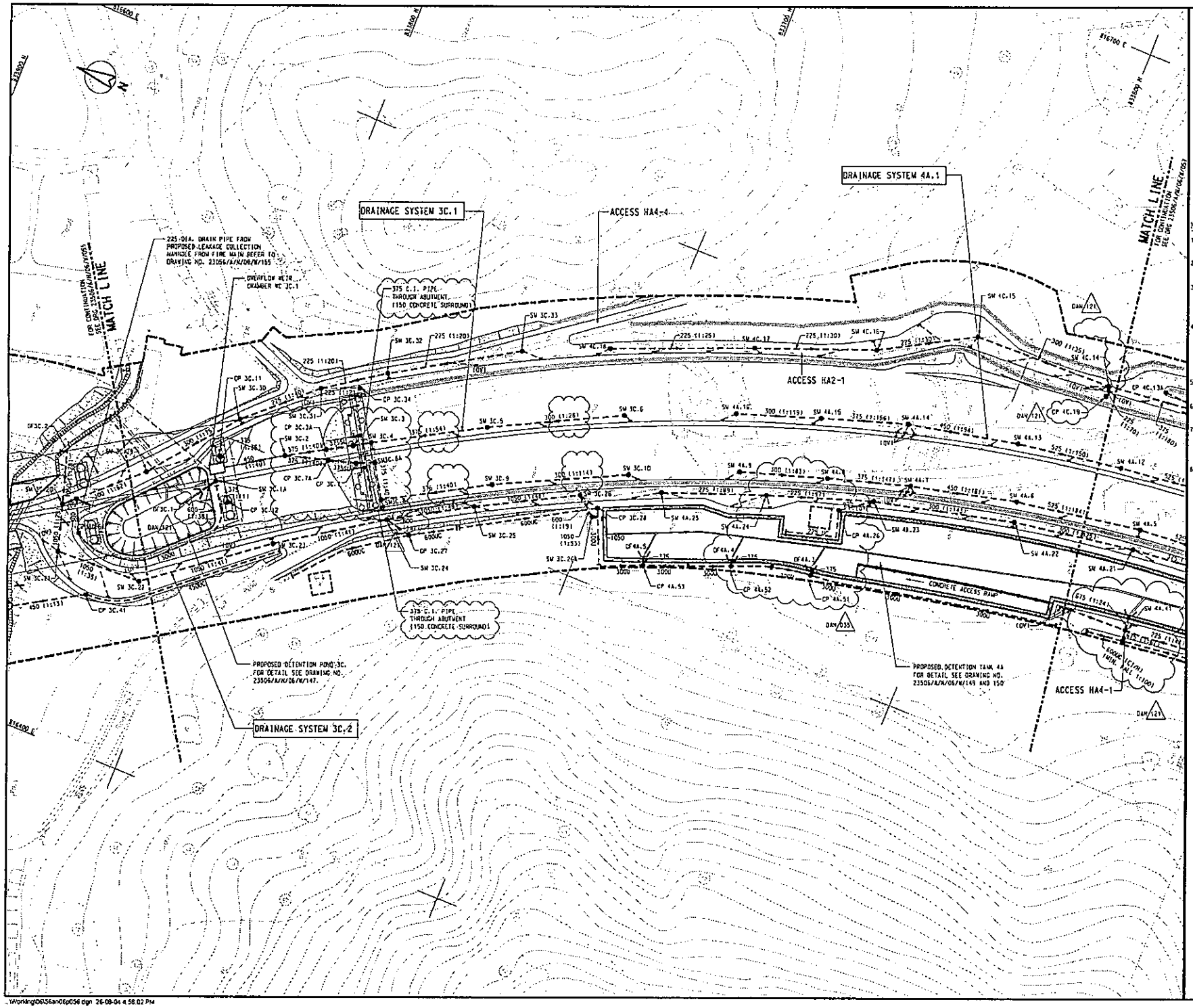

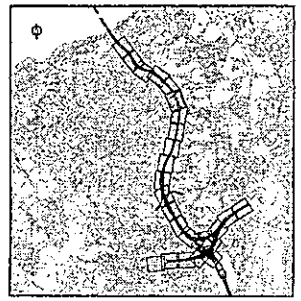

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1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/M/06/M/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/M/06/M/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/M/10/M/731-744.
4. PROPOSED U-CHANNELS ACROSS FOOTPATH TO BE PROVIDED WITH LIGHT DUTY C.I. GRATING COVER. PROPOSED U-CHANNELS ALONG VERGE TO BE PROVIDED WITH DUTY C.I. GRATING COVER UNLESS OTHERWISE STATED. THE MINIMUM FALL OF PROPOSED U-CHANNELS SHALL BE 1:100 FOR 225mm AND 1:150 FOR 300m OR GREATER.
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7. FOR DIVERSION OF EXISTING STREAMS/CHANNELS, THE ALIGNMENTS SHOW ON THESE DRAWINGS ARE INDICATIVE ONLY. EXACT ALIGNMENTS AND INVERT LEVELS SHALL BE DETERMINED ON SITE AND AGREED BY THE ENGINEER.
8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/M/06/M/359.

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Job Title: HY/2002/24
Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN

Part Plan of DWG No.: 23506/A/M/06/M/056 (Rev. -)

Sketch No.: HY/2002/24-DAN 0152/SK02

Scale: 1:1000 on A3

Prepared by: TY | Date: JULY 04

Checked by: GL | Date: JULY 04

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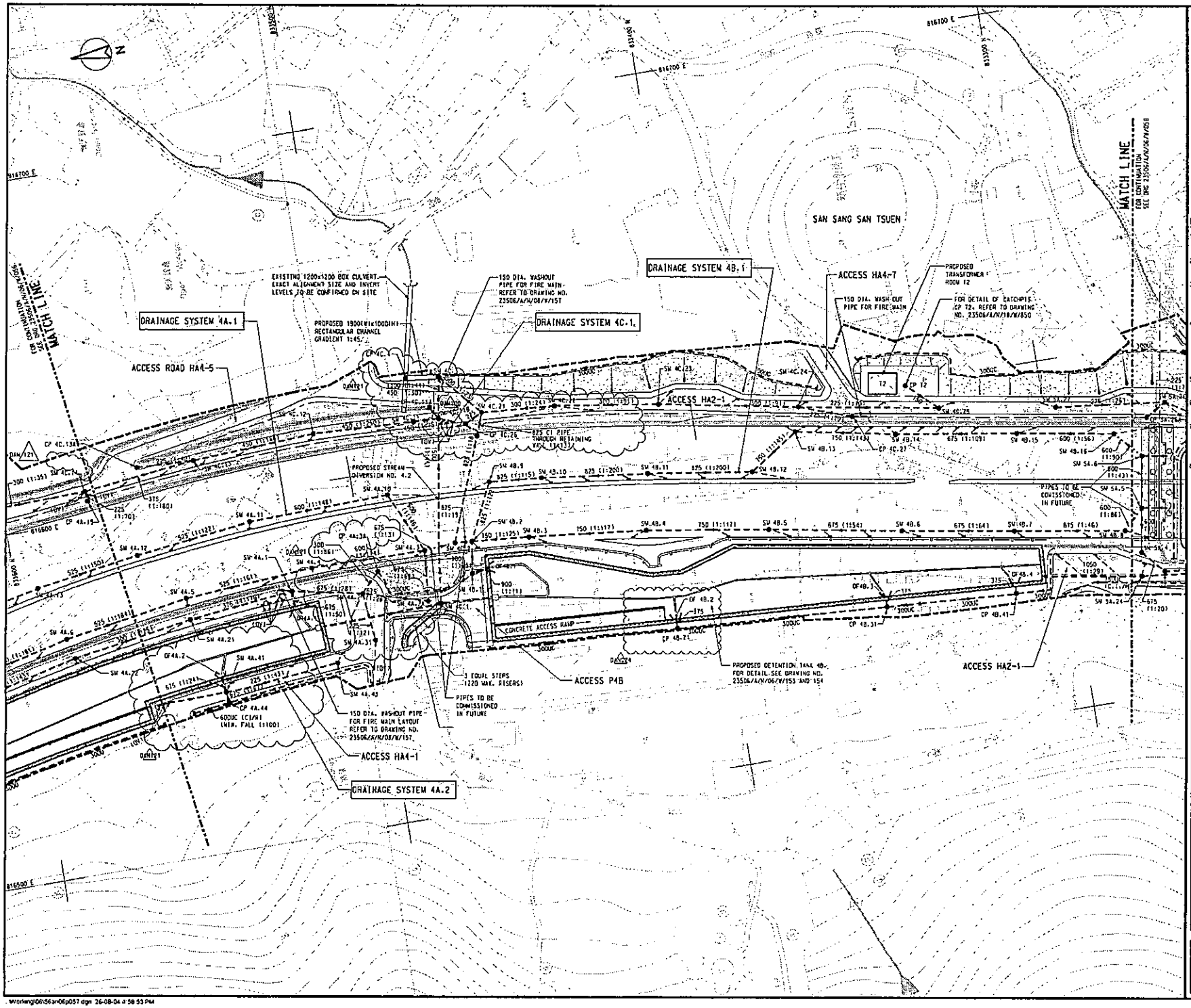

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2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/N/06/W/101-105.
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8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/N/06/W/353.

THIS DRAWING HAD BEEN REDUCED FROM A1 TO A3

Rev	Description	By	Date
-	ISSUE FOR CONSTRUCTION	XX	05/03

Consultant
ARUP 奧雅納工程顧問 Ove Arup & Partners Hong Kong Limited
Supported By :
IBI Group
Urbis Ltd.
ENL

Contract No.
HY/2002/24
Deep Bay Link - Northern Section

Drawing title
PROPOSED STORMWATER DRAINAGE LAYOUT PLAN

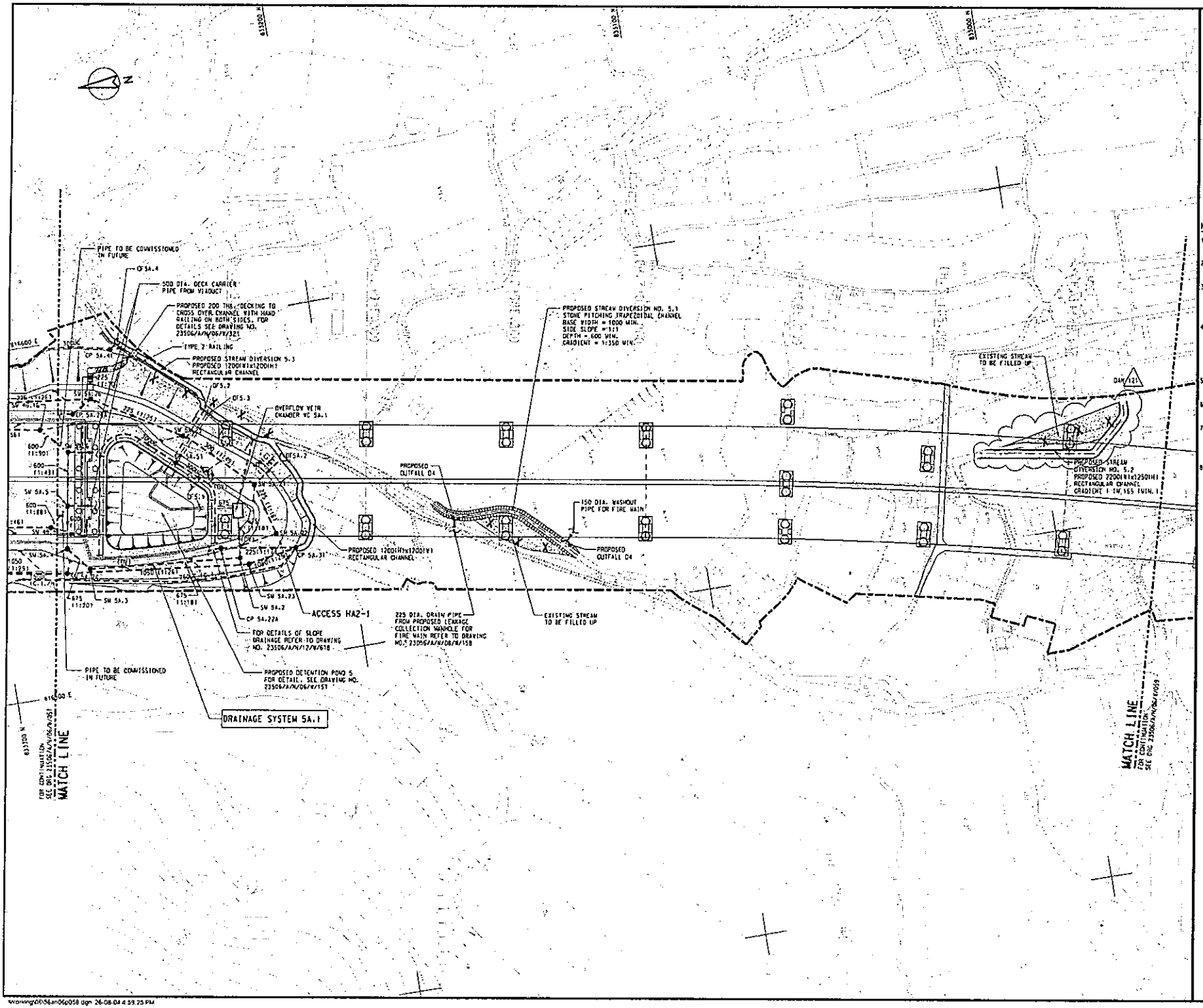
SHEET 7 OF 14

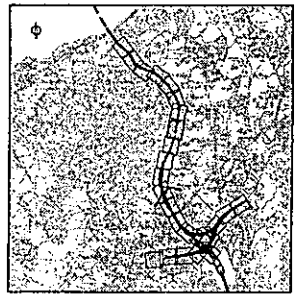
Drawing no.	Rev.
23506/A/N/06/W/057	-

Drawn	Date	Checked	Approved
A.L.	07/02	SGR	E.C.

Scale: 1:500 ON A1
Status: WORKING

HIGHWAYS DEPARTMENT 路政署
Major Works Project Management Office 主要工程管理處





NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/M/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/M/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/M/10/W/731-744.
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8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/M/06/W/359.

ARUP
Ove Arup & Partners Hong Kong Limited

Job Title: HY/2002/24 Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 8)

Sketch No.: HY/2002/24-DAN/0121/SK08

Scale: 1 : 1000 on A3

Part Plan of DWG No.: 23506/A/M/06/W/058 (Rev. -)

Prepared by: TY | Date: May 04

Checked by: GL | Date: May 04

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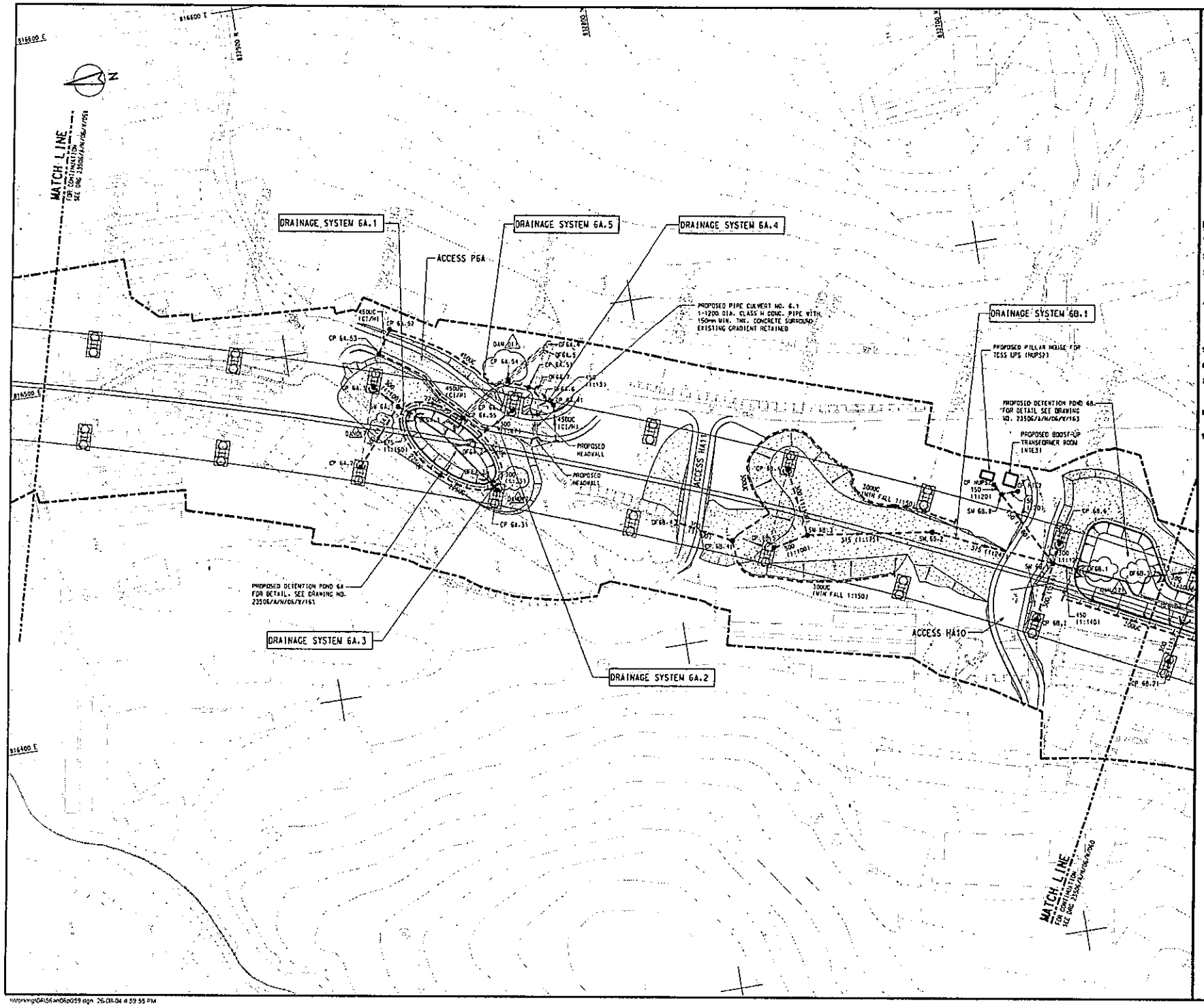

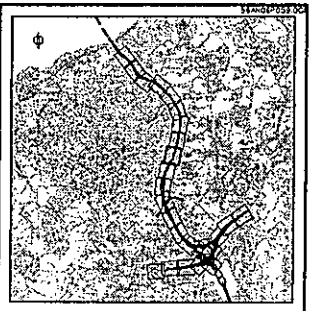

NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/N/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/N/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM, FOR VIADUCT DECK DRAINAGE INCLUDING GOALIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/N/10/W/731-744.
4. PROPOSED U-CHANNELS ACROSS FOOTPATH TO BE PROVIDED WITH LIGHT DUTY C.I. GRATING COVER. PROPOSED U-CHANNELS ALONG VERGE TO BE PROVIDED WITH DUTY C.I. GRATING COVER UNLESS OTHERWISE STATED. THE MINIMUM FALL OF PROPOSED U-CHANNELS SHALL BE 1:1100 FOR 225mm AND 1:150 FOR 300mm OR GREATER.
5. FOR DETAILS OF PROPOSED HEADWALL REFER TO DRAWING NO. 23506/A/N/06/W/357-358.
6. FOR DETAILS OF OUTFALL REFER TO DRAWING NO. 23506/A/N/06/W/354-356.
7. FOR DIVERSION OF EXISTING STREAMS/CHANNELS, THE ALIGNMENTS SHOW ON THESE DRAWINGS ARE INDICATIVE ONLY. EXACT ALIGNMENTS AND INVERT LEVELS SHALL BE DETERMINED ON SITE AND AGREED BY THE ENGINEER.
8. FOR DRAINAGE ARRANGEMENT OF PROPOSED BOOST-UP TRANSFORMER ROOM AND PILLAR HOUSE FOR TCSS UPS, REFER TO DRAWING NO. 23506/A/N/16/W/886 AND 888.
9. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/N/06/W/359.

ARUP

Ove Arup & Partners Hong Kong Limited

Job Title: HY2002/24 Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 8)

Part Plan of DWG No.: 23506/A/N/06/W/058 (Rev. -)

Sketch No.: HY2002/24-DAN/012/SK09

Scale: 1 : 1000 on A3

Prepared by: TY | Date: May 04

Checked by: GL | Date: May 04

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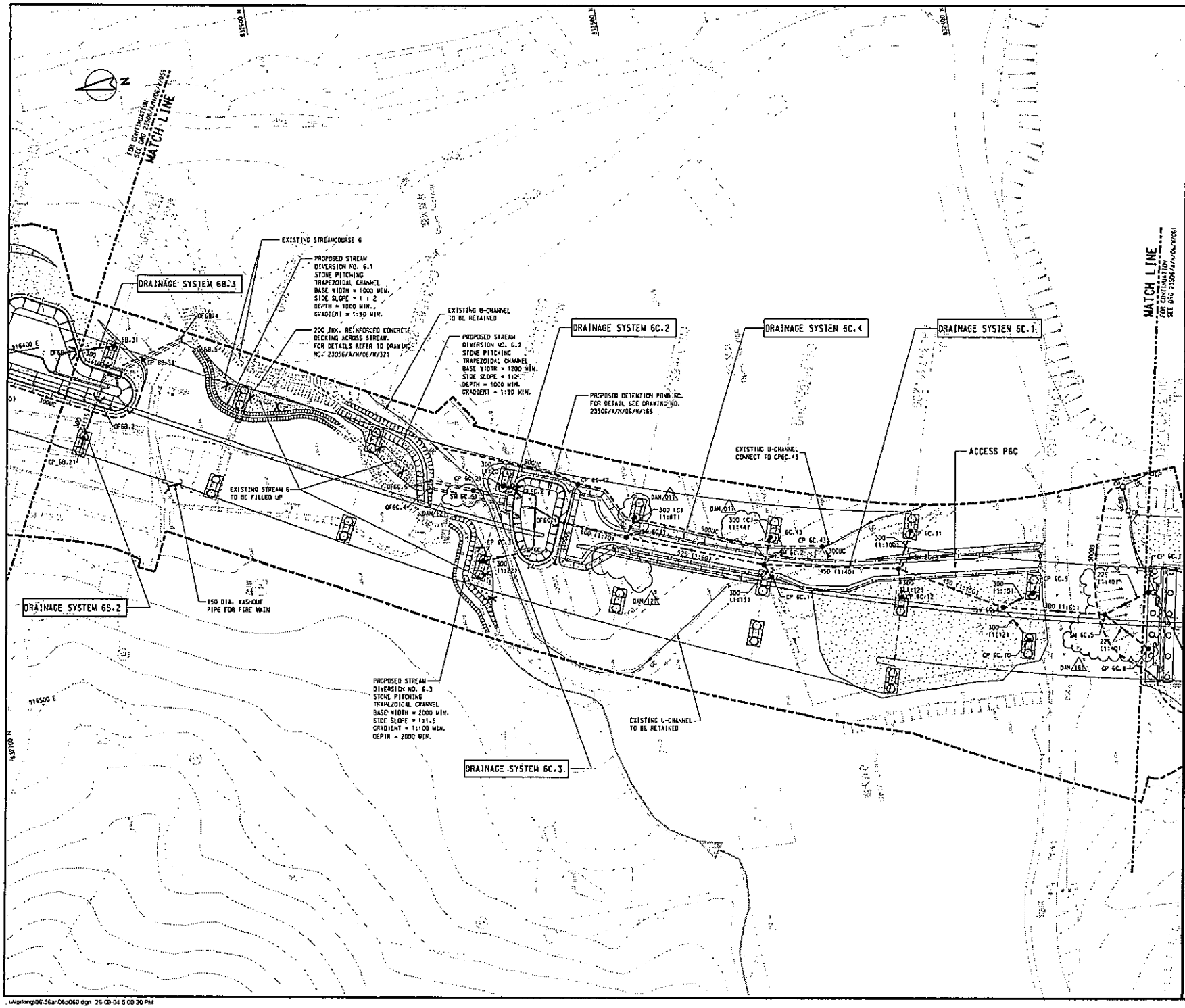

NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/M/06/M/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/M/06/M/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR WYNDCUT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/M/10/M/731-744.
4. PROPOSED U-CHANNELS ACROSS FOOTPATH TO BE PROVIDED WITH LIGHT DUTY C.I. GRATING COVER. PROPOSED U-CHANNELS ALONG VERGE TO BE PROVIDED WITH DUTY C.I. GRATING COVER UNLESS OTHERWISE STATED. THE MINIMUM FALL OF PROPOSED U-CHANNELS SHALL BE 1:100 FOR 225mm AND 1:150 FOR 300m OR GREATER.
5. FOR DETAILS OF PROPOSED HEADWALL REFER TO DRAWING NO. 23506/A/M/06/M/357-358.
6. FOR DETAILS OF OUTFALL REFER TO DRAWING NO. 23506/A/M/06/M/354-356.
7. FOR DIVERSION OF EXISTING STREAMS/CHANNELS, THE ALIGNMENTS SHOW ON THESE DRAWINGS ARE INDICATIVE ONLY. EXACT ALIGNMENTS AND INVERT LEVELS SHALL BE DETERMINED ON SITE AND AGREED BY THE ENGINEER.
8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/M/06/M/359.

ARUP
Ove Arup & Partners Hong Kong Limited

Job Title: HY/2002/24
Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN

Part Plan of DWG No.: 23506/A/M/06/M/060 (Rev. -)

Sketch No.: HY/2002/24-DAN/0161/SK01

Scale: 1:1000 on A3

Prepared by: TIN LAM | Date: 12 AUGUST 04

Checked by: BOND NONG | Date: 12 AUGUST 04

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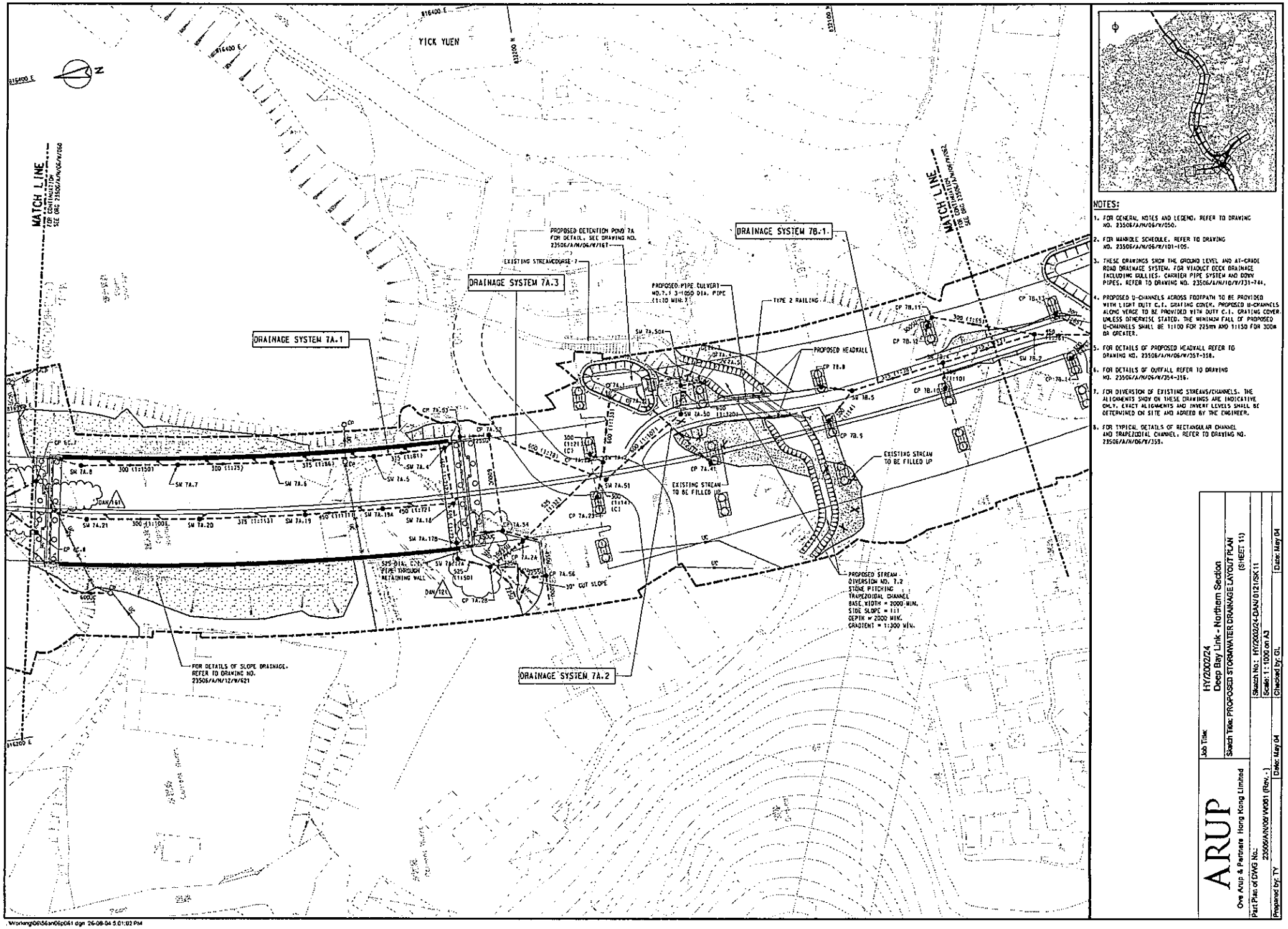

NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/N/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/N/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR WHOLLY DECK DRAINAGE (INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES), REFER TO DRAWING NO. 23506/A/N/10/W/731-744.
4. PROPOSED U-CHANNELS ACROSS FOOTPATH TO BE PROVIDED WITH LIGHT DUTY C.I. GRATING COVER. PROPOSED U-CHANNELS ALONG VERGE TO BE PROVIDED WITH DUTY C.I. GRATING COVER UNLESS OTHERWISE STATED. THE MINIMUM FALL OF PROPOSED U-CHANNELS SHALL BE 1:100 FOR 225mm AND 1:150 FOR 300m OR GREATER.
5. FOR DETAILS OF PROPOSED HEADWALL REFER TO DRAWING NO. 23506/A/N/06/W/357-358.
6. FOR DETAILS OF OUTFALL REFER TO DRAWING NO. 23506/A/N/06/W/354-356.
7. FOR DIVERSION OF EXISTING STREAMS/CHANNELS, THE ALIGNMENTS SHOW ON THESE DRAWINGS ARE INDICATIVE ONLY. EXACT ALIGNMENTS AND INVERT LEVELS SHALL BE DETERMINED ON SITE AND AGREED BY THE ENGINEER.
8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/N/06/W/353.

ARUP
One Arup & Partners Hong Kong Limited

Job Title: HY/2002/24
Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 11)

Sketch No.: HY/2002/24-DAN/0121/SK11
Scale: 1:1000 on A3
Checked by: GL
Date: May 04

Part Plan of DWG No.: 23506/A/N/06/W/051 (Rev. -)
Prepared by: TY
Date: May 04

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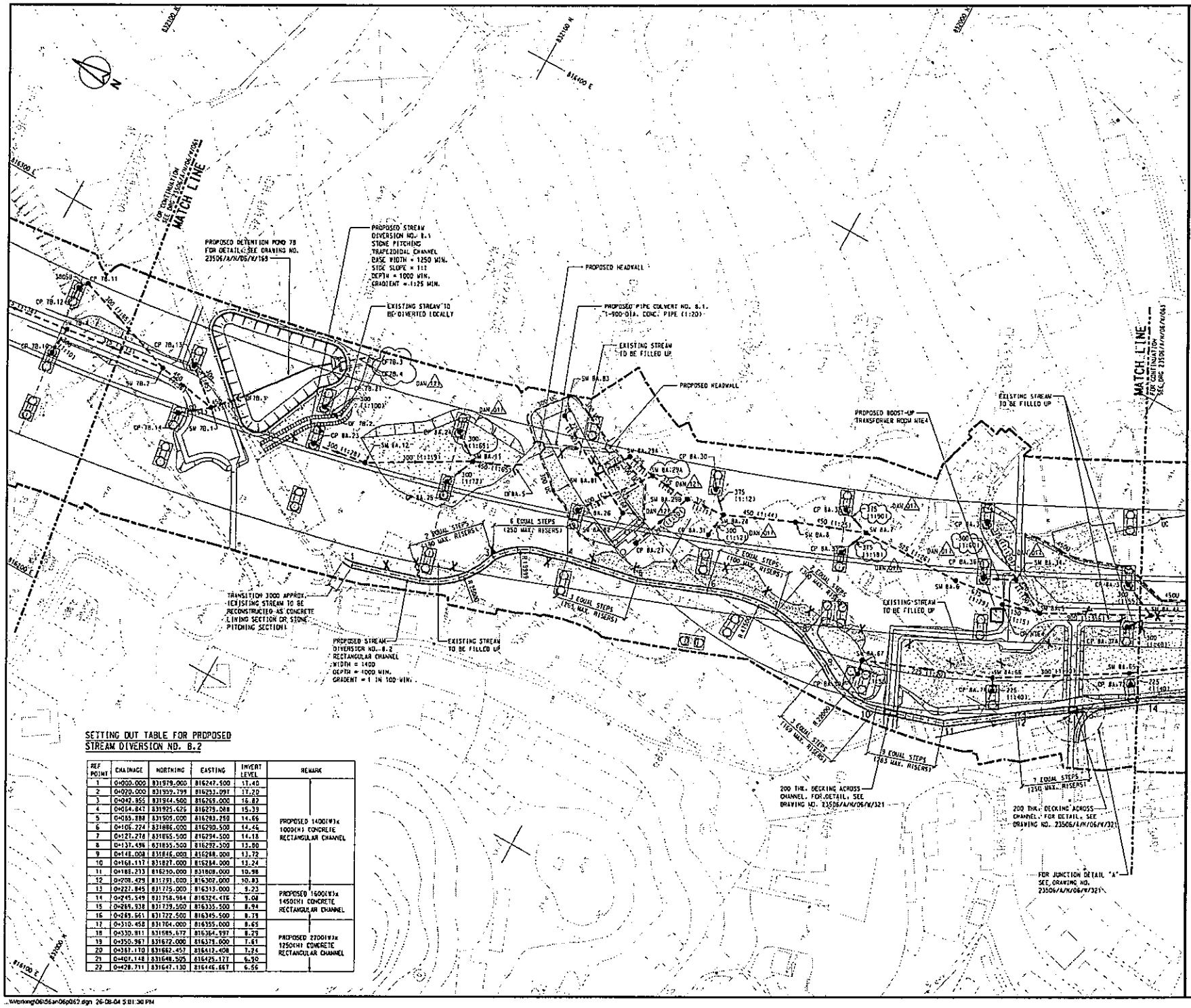
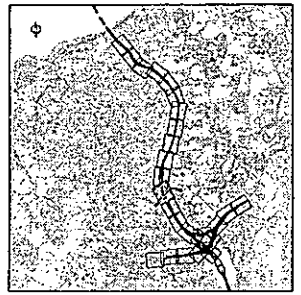


SETTING OUT TABLE FOR PROPOSED STREAM DIVERSION NO. 8.2

REF POINT	CHAINAGE	NORTHING	EASTING	INVERT LEVEL	REMARK
1	0+000.000	831979.000	816247.500	17.40	PROPOSED 1400(W)x 1000(H) CONCRETE RECTANGULAR CHANNEL
2	0+020.000	831959.799	816253.097	17.20	
3	0+042.855	831944.500	816268.000	16.82	
4	0+064.847	831925.625	816278.048	15.39	
5	0+085.888	831905.000	816283.250	14.69	
6	0+105.224	831886.000	816290.500	14.46	
7	0+121.278	831855.500	816294.500	14.18	
8	0+137.496	831855.500	816292.500	13.80	
9	0+148.008	831846.000	816288.000	13.72	
10	0+168.117	831827.000	815284.000	13.24	
11	0+188.213	816250.000	831808.000	10.98	
12	0+208.429	831791.000	816302.000	10.83	
13	0+227.845	831775.000	816313.000	9.23	PROPOSED 1600(W)x 1450(H) CONCRETE RECTANGULAR CHANNEL
14	0+245.549	831758.984	816324.476	9.08	
15	0+269.938	831739.500	816335.500	8.94	
16	0+289.661	831722.500	816345.500	8.79	
17	0+310.458	831704.000	816355.000	8.65	
18	0+330.911	831685.677	816364.997	8.29	PROPOSED 2200(W)x 1250(H) CONCRETE RECTANGULAR CHANNEL
19	0+350.967	831672.000	816378.000	7.61	
20	0+367.170	831662.457	816412.408	7.24	
21	0+401.148	831648.505	816425.177	6.90	
22	0+428.711	831647.130	816446.667	6.56	



NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/N/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/N/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/N/10/W/731-744.
4. PROPOSED U-CHANNELS ACROSS FOOTPATH TO BE PROVIDED WITH LIGHT DUTY C.I. GRATING COVER. PROPOSED U-CHANNELS ALONG VERGE TO BE PROVIDED WITH DUTY C.I. GRATING COVER UNLESS OTHERWISE STATED. THE MINIMUM FALL OF PROPOSED U-CHANNELS SHALL BE 1:100 FOR 225mm AND 1:150 FOR 300mm OR GREATER.
5. FOR DETAILS OF PROPOSED HEADWALL REFER TO DRAWING NO. 23506/A/N/06/W/357-359.
6. FOR DETAILS OF OUTFALL REFER TO DRAWING NO. 23506/A/N/06/W/354-356.
7. FOR DIVERSION OF EXISTING STREAMS/CHANNELS, THE ALIGNMENTS SHOW ON THESE DRAWINGS ARE INDICATIVE ONLY. EXACT ALIGNMENTS AND INVERT LEVELS SHALL BE DETERMINED ON SITE AND AGREED BY THE ENGINEER.
8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/N/06/W/359.
9. FOR DRAINAGE ARRANGEMENT OF PROPOSED BOOST-UP TRANSFORMER ROOM, REFER TO DRAWING NO. 23506/A/N/10/W/806.

ARUP

One Arup & Partners Hong Kong Limited

Job Title: HY/2002/24 Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 12)

Part Plan of DWG No.: 23506/A/N/06/W/062 (Rev. -)

Sketch No.: HY/2002/24-DAN/012/SK 12

Scale: 1:1000 on A3

Prepared by: TY | Date: May 04

Checked by: GL | Date: May 04

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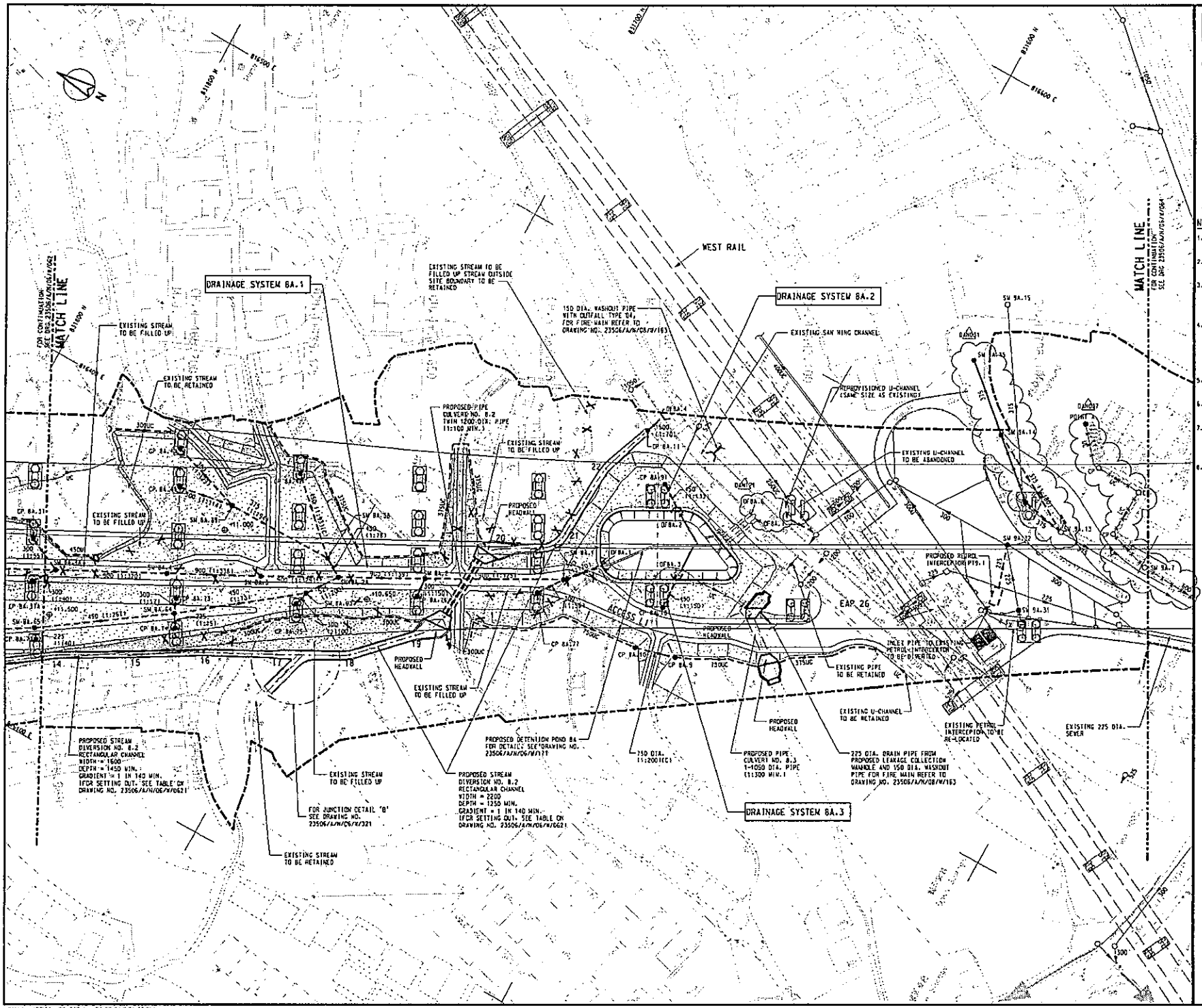

NOTES:

1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/M/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/M/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/M/10/W/731-744.
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5. FOR DETAILS OF PROPOSED HEADWALL REFER TO DRAWING NO. 23506/A/M/06/W/357-358.
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8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/M/06/W/359.

ARUP
Ove Arup & Partners Hong Kong Limited

Job Title: HY/2002/24 Deep Bay Link - Northern Section
Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN (SHEET 13)
Sketch No.: HY/2002/24-DAN/012I/SK13
Scale: 1:1000 on A3
Checked by: GL
Date: May 04
Plan Plot of DWG No.: 23506/A/M/06/W/063 (Rev. -)
Date: May 04
Prepared by: TY

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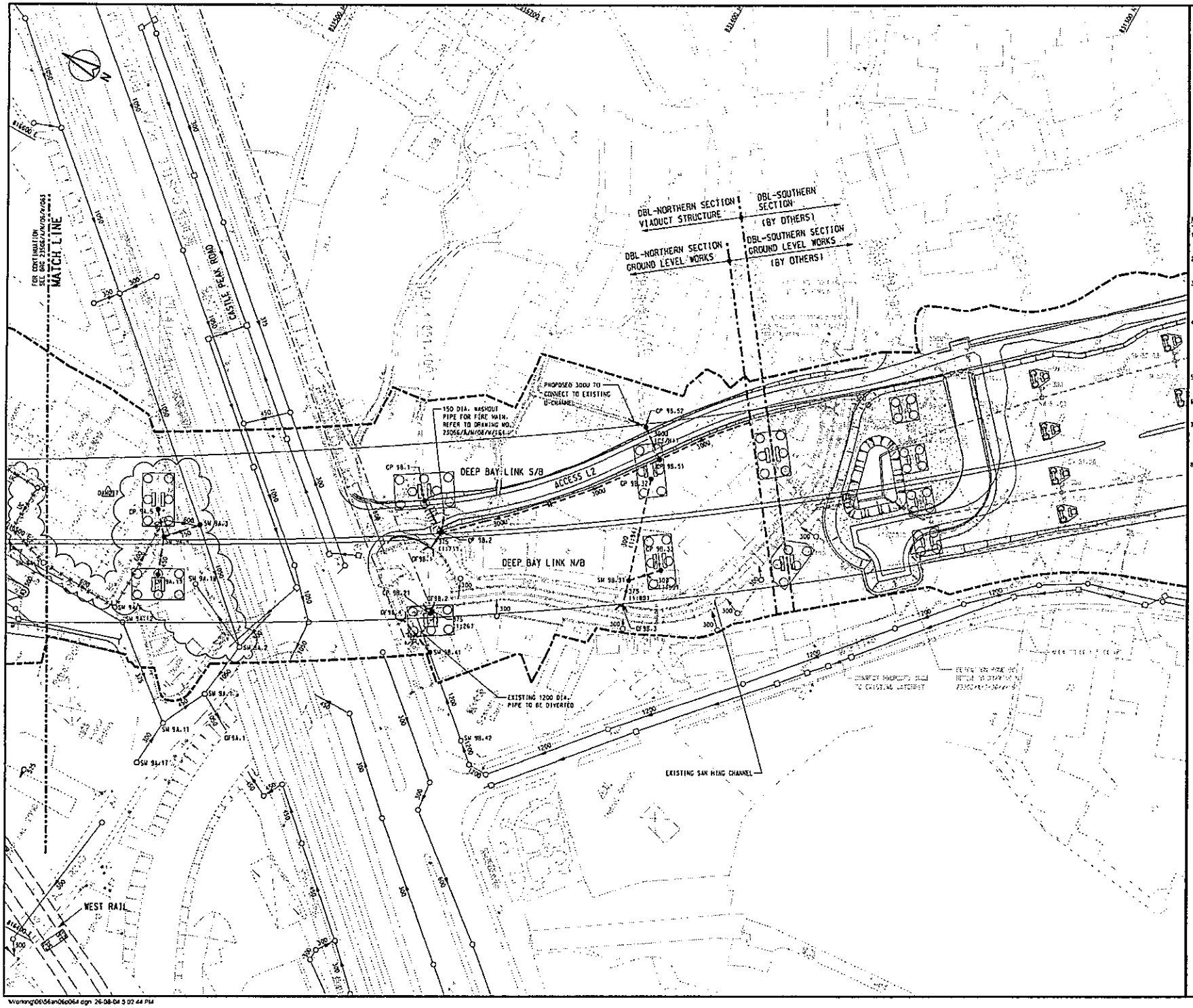

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1. FOR GENERAL NOTES AND LEGEND, REFER TO DRAWING NO. 23506/A/H/06/W/050.
2. FOR MANHOLE SCHEDULE, REFER TO DRAWING NO. 23506/A/H/06/W/101-105.
3. THESE DRAWINGS SHOW THE GROUND LEVEL AND AT-GRADE ROAD DRAINAGE SYSTEM. FOR VIADUCT DECK DRAINAGE INCLUDING GULLIES, CARRIER PIPE SYSTEM AND DOWN PIPES, REFER TO DRAWING NO. 23506/A/H/10/W/731-744.
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8. FOR TYPICAL DETAILS OF RECTANGULAR CHANNEL AND TRAPEZOIDAL CHANNEL, REFER TO DRAWING NO. 23506/A/H/06/W/359.

ARUP

Ove Arup & Partners Hong Kong Limited

Job Index: HY/2002/24
Deep Bay Link - Northern Section

Sketch Title: PROPOSED STORMWATER DRAINAGE LAYOUT PLAN

Sketch No.: HY/2002/24-DRW/ 0021 /SK14

Scale: 1:1000 on A3

Part Plan of DMG No.: 23506/A/W 085 W 864 Rev. I-

Prepared by: IT

Date: May 24

Checked by: CL

Date: May 24