

ANGAT WATER TRANSMISSION IMPROVEMENT PROJECT (AWTIP) (Construction of New Ipo-Bigte Tunnel No. 4)

Eng'r. Jose D. Dorado, Jr.
Project Manager - AWTIP
Metropolitan Waterworks and Sewerage System



PROJECT OVERVIEW

- Design and Construction of 6.4 kilometers x 4.3 meters diameter raw conveyance tunnel (Tunnel No. 4)
- Project Cost = PhP 3.29 Billion (USD76.50 Million)
- Rationale: old existing system; needs to be improved for security of raw water supply
- Impact: long-term security and efficiency of raw water
- Outcome: Capacity of the raw water system increased
- Output: new Tunnel, capacity = 1900 million liters per day (1900 mld)



Project Design & Scope

- Design and Built Contract
- Contract Duration = 52 months
 - *Detailed Engineering Design = 6 months*
 - *Construction = 46 months*
- The Tunnel was designed following international and local design standards (NSCP, ASTM, AWWA) with seismic consideration. Tunnel excavation using a Tunnel Boring Machine (TBM) equipped with segmental lining.
- Once completed, it will ensure the continuous flow of raw water that will benefit around 2 million households.
- Project must be completed as scheduled in order to attain its intended purpose of water security and efficiency.

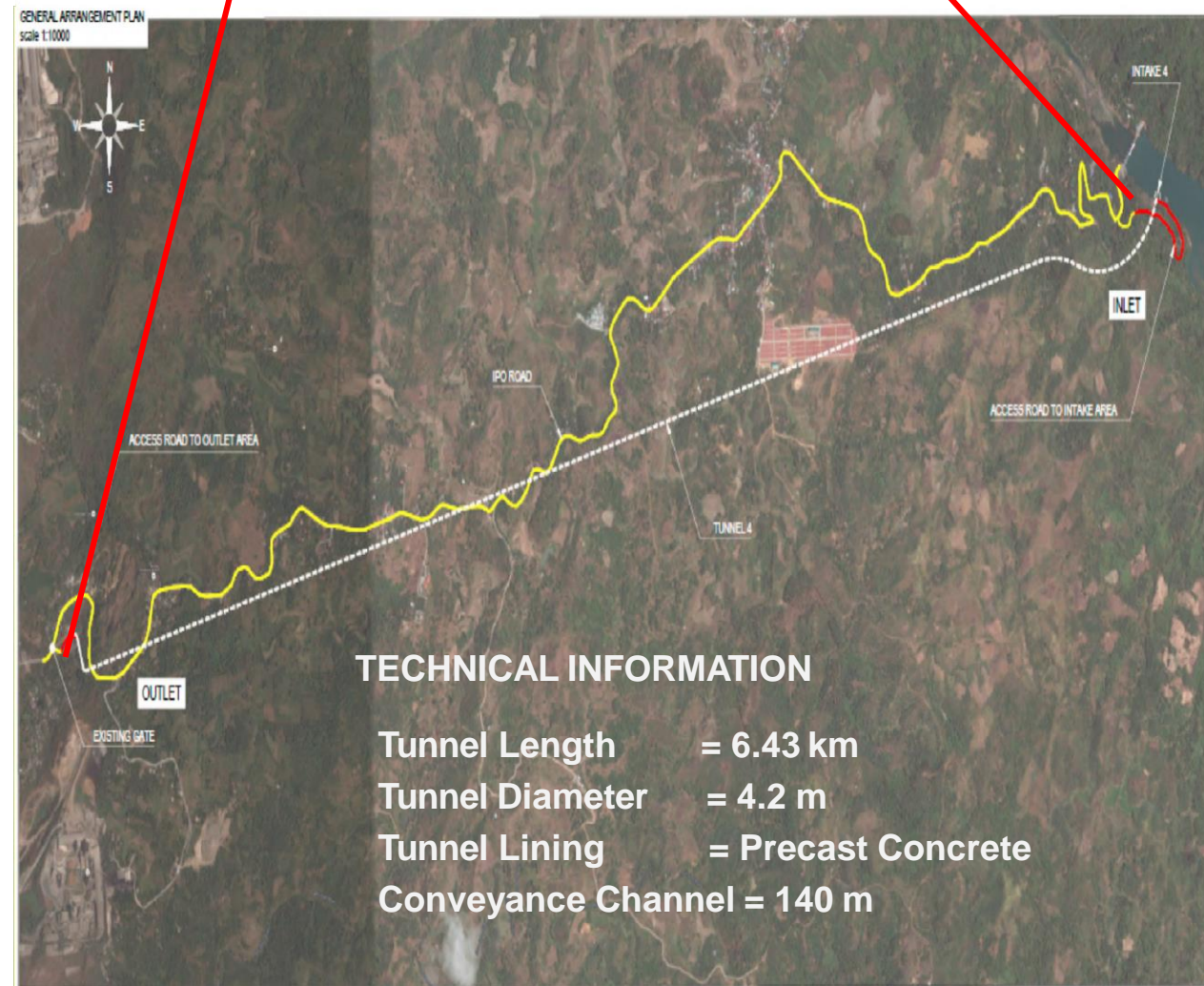


Project Location

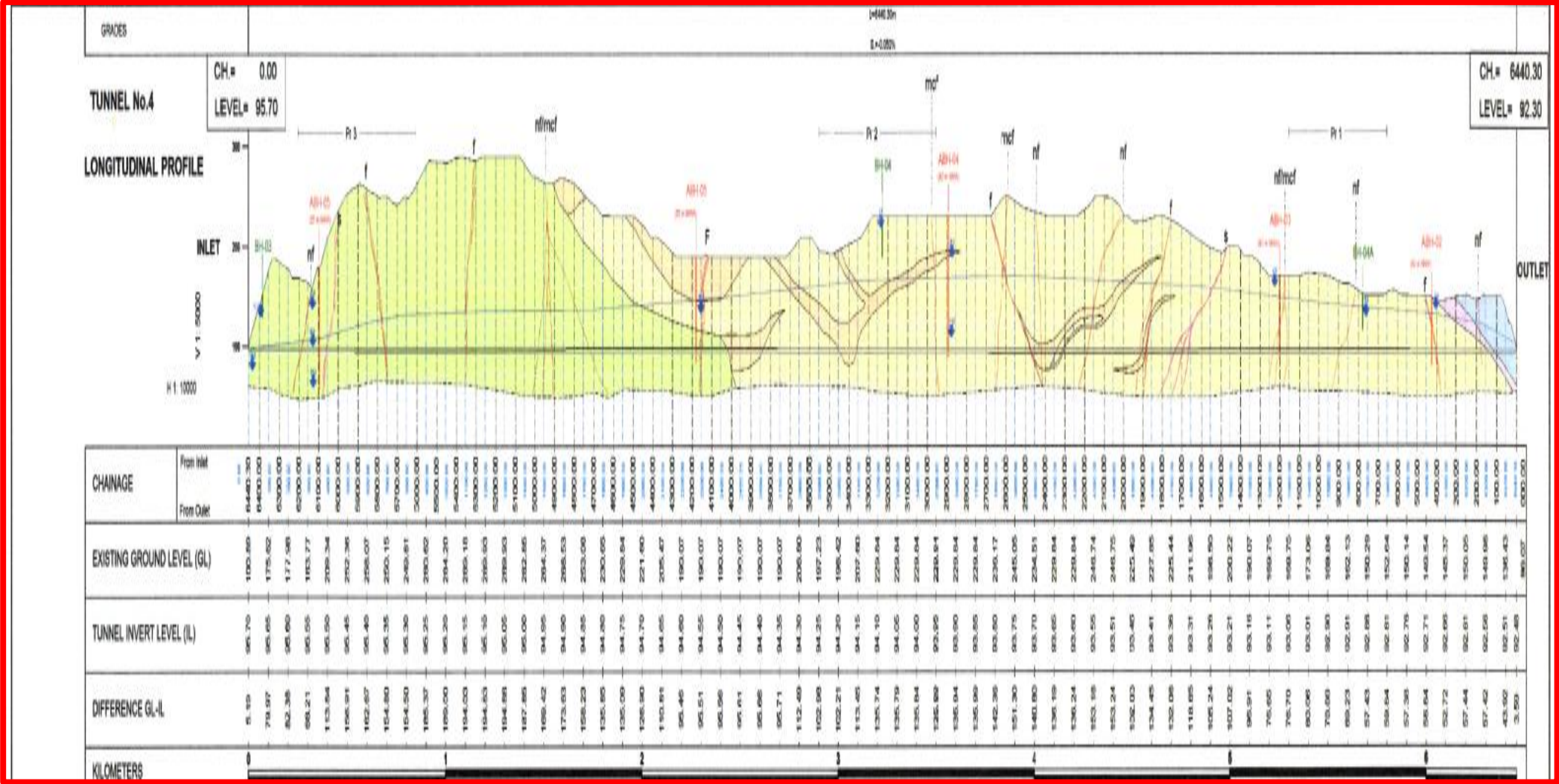


Outlet Area -
Barangay Bigte,
Sitio Spar,
Norzagaray,
Bulacan

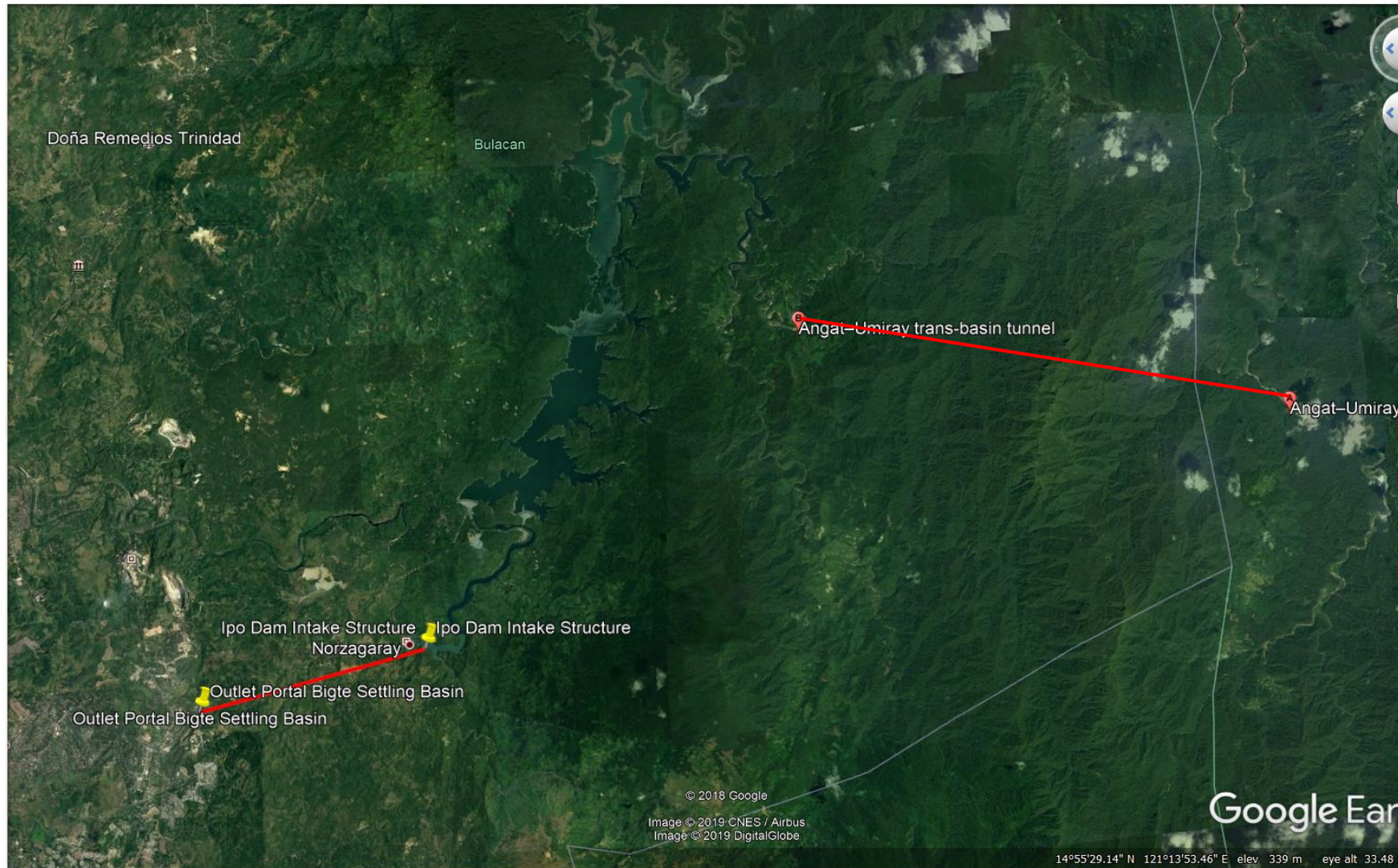
Intake Area -
Ipo Dam, San
Mateo,
Norzagaray,
Bulacan



GEOLOGICAL PROFILE



The Umiray- Angat Transbasin Tunnel and The Ipo-Bigte Tunnel



The Umiray-Angat Tunnel was completed in year 2000, with a carrying capacity of 30 CMS (2,592 MLD). Observed average flow is about 13 CMS (1,123 MLD)

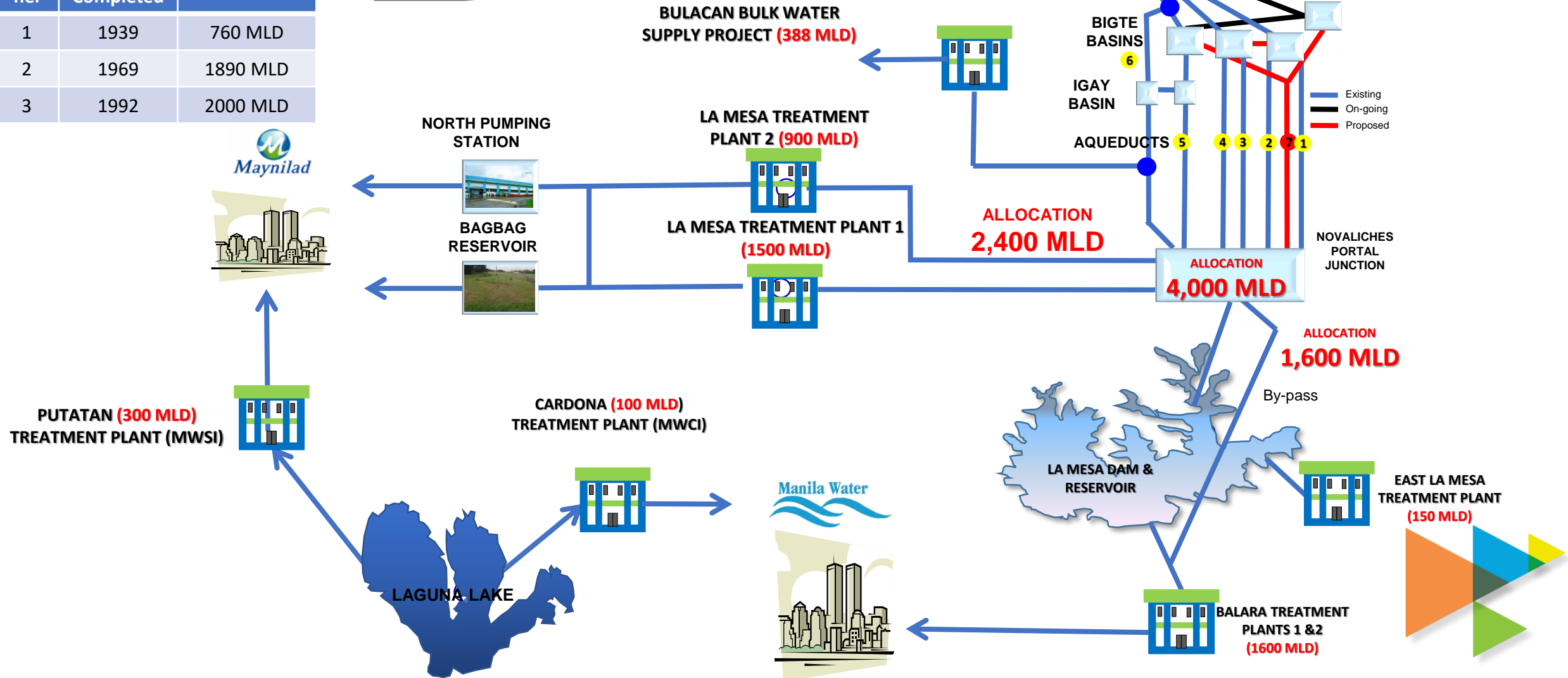




Existing MWSS Water Sources & Conveyance System



Tunnel	Date Completed	Capacity
1	1939	760 MLD
2	1969	1890 MLD
3	1992	2000 MLD



Technology Used for the Tunnel Excavation



Tunnel Boring Machine

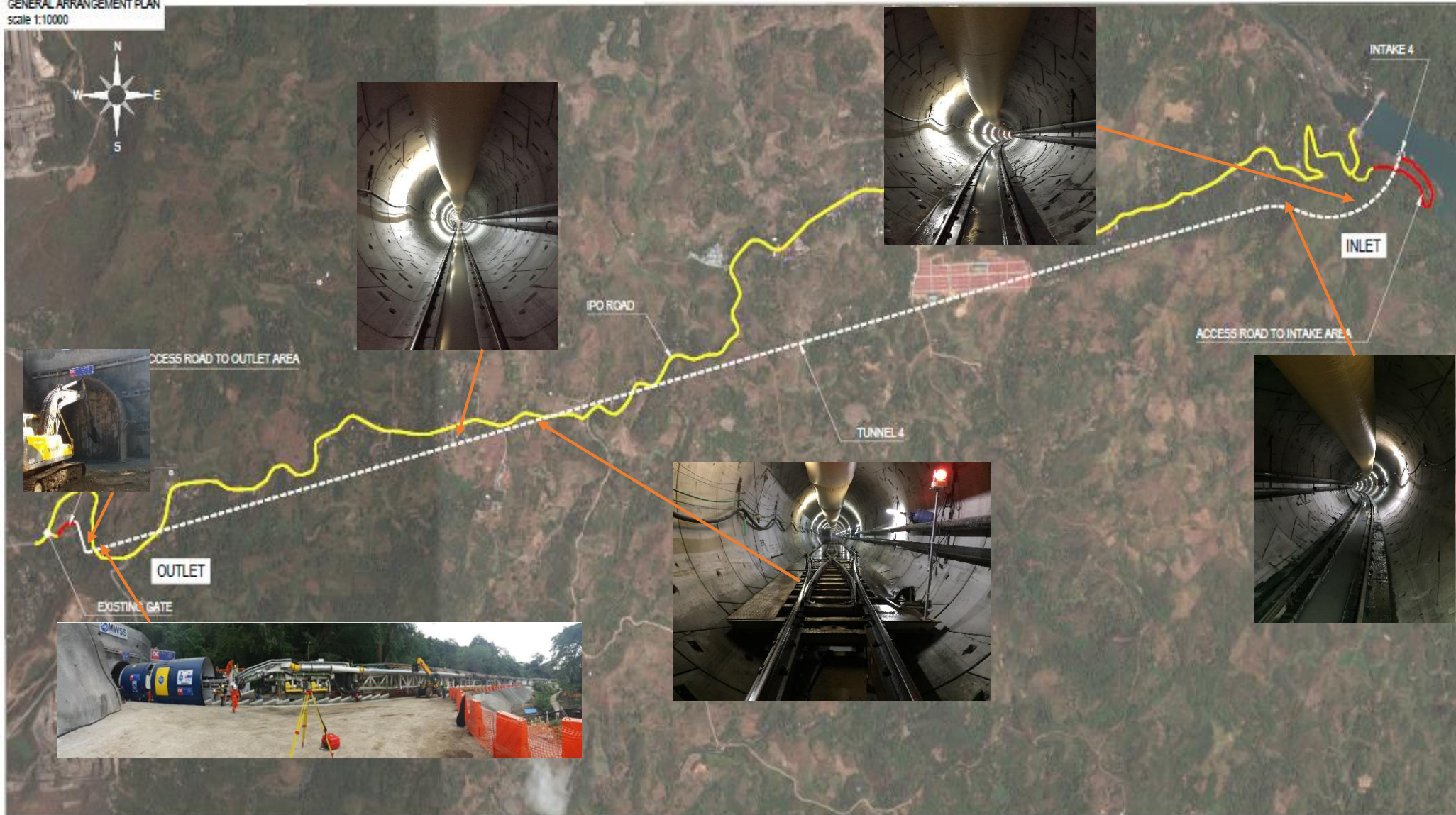
is a machine used to excavate [tunnels](#) with a circular cross section through a variety of soil and [rock strata](#). They can [bore](#) through anything from hard rock to [sand](#).

Tunnel boring machines are used as an alternative to [drilling and blasting](#) (D&B) method. TBMs have the advantages of limiting the disturbance to the surrounding ground and producing a smooth tunnel wall. This significantly reduces the cost of lining the tunnel, and makes them suitable to use in heavily urbanized areas.



Tunnel Alignment

GENERAL ARRANGEMENT PLAN
scale 1:10000



DISPOSAL OF MUCK MATERIAL FROM THE TUNNEL



The total muck material is estimated to be **222,688,12 m3 (loose volume)** will be generated due during the construction of the tunneling works. The method of excavation by TBM has revolutionized the tunneling industry both making tunneling a safer & more environmental friendly process. In order to excavate the rock, the machine needs to utilize **only water**, this makes the spoil material eco-friendly solid.



TBM BREAKTHROUGH





TBM Reaches
Intake Area
(Km 6.4) at Ipo
Dam

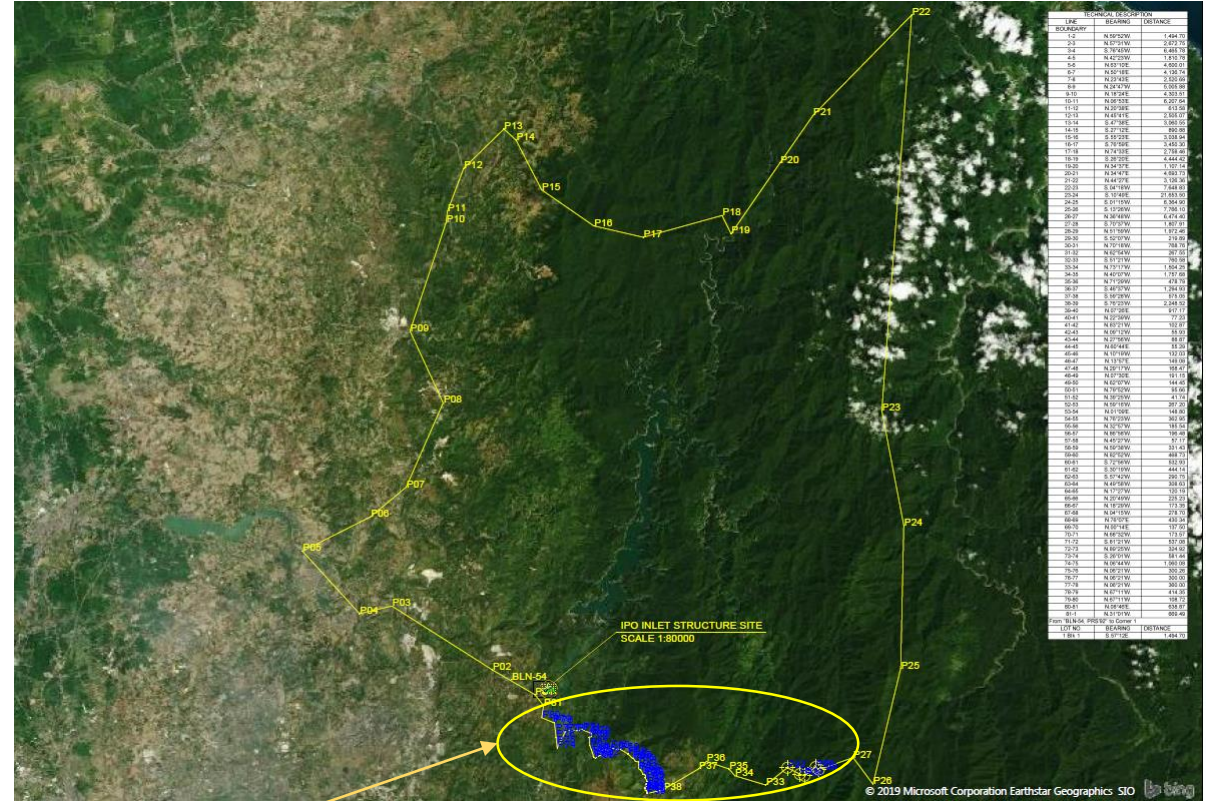


Safeguards Challenges and Mitigation

AWTIP overlapping with the Dumagat IP Ancestral Domain

ADB Safeguard Requirement (SR on Indigenous Peoples) is triggered. This required MWSS for the preparation of an Indigenous People's Plan (IPP) for AWTIP.

AWTIP overlaps only a small portion (0.685 hectares of the 81,566.7771 hectares of the Kabayunan Ancestral Domain which extends as far as the Municipalities of Angat and Dona Remedios Trinidad



Safeguards Challenges and Mitigation

Environmental Monitoring Updates

Activity	Environmental Aspect	Mitigation Measures
CONSTRUCTION STAGE		
1) Site Preparation (Land Clearing, Staking and Grabbing)	Change in land use and aesthetics;	Minimize exposed areas and clearing of vegetation;
	Loss of terrestrial ecology and consequently loss of habitat of fauna in the area	Immediate re-vegetation in areas where construction activities are completed;
		Implement a soil erosion and sediment control plan;
		Use slope stabilization measures along exposed slopes;
		Install silt ponds in areas adjacent to water bodies



Activity	Environmental Aspect	Mitigation Measures
2) Access Road Construction and/or Improvement	Loss of terrestrial ecology;	Replaced trees as per tree cutting permit issued by EMB Region 3
	Occurrence of run-off and soil erosion;	Well graded road design with adequate drainage and stable discharge areas;
	Dust emission	Installation of dikes for soil erosion protection;
	Increase turbidity in river systems	Installation of silt protector on the discharge area/s to minimize turbidity in river systems;
		Daily watering of newly opened areas and/or exposed land & soil to minimize dust emission especially in inhabited areas;
		Avoid burning of removed vegetation. Disposed removed vegetation in designated disposal area. Encourage local people to do composting using removed vegetation.



Activity	Environmental Aspect	Mitigation Measures
<p>3) Moving in of heavy equipment such as the TBM, train, railroad tracks and other construction related tools, materials and etc.</p>	<p>Increase dust emission and total suspended particles (TSP) in the atmosphere; Increase disturbances and noise in nearby inhabitants and/or barangays</p>	<p>Daily watering of the access road especially in areas where there are inhabitants; Working hours must be limited during day time;</p>
		<p>Provision of ear plugs or ear protection equipment to workers where noise reaches 80 db.</p>
	<p>Loss of terrestrial ecology; Environmental aesthetics degradation;</p>	<p>Contractor's obligation to restore the area an leaving w/out hazardous materials that will harm both the people and flora & fauna in the area;</p>
		<p>Good camp site and following EHS policy in managing to avoid conflict among workers;</p>



Activity	Environmental Aspect	Mitigation Measures
4) Construction of Contractor's Camp site and facilities	Loss of terrestrial ecology; Environmental aesthetics degradation;	Contractor's obligation to restore the area an leaving w/out hazardous materials that will harm both the people and flora & fauna in the area;
		Good camp site and following EHS policy in managing to avoid conflict among workers;
	Bias in employment policy of local people	Identified potential project beneficiaries as first priority in hiring workers;
		Provide potable water, well balanced and adequate food and recreational activities;
		Contractor to enforce policy and agreement in hiring workers, the strict prohibition of hunting wildlife and plant pouching for sale;
	Prevention of construction related accidents	Appropriate installation of signages and other early warning signs in designated areas especially in too busy areas.



Activity	Environmental Aspect	Mitigation Measures
5) Tunnel Lining Segment repair and grouting	Generation of wastewater from the tunnel	Continuous operation of WTP at Brgy. Bigte
	Accumulation of sludge at the WTP	Desludging for hauling and treatment by EMB-accredited TSD facility <i>(Desludging conducted last June 23, 2019)</i>
	Generation of empty containers of hazardous substances / chemicals for WTP operation and in tunnel repair & grouting	Collection and storage of empty containers at hazwaste storage area for hauling, treatment and disposal by EMB-accredited TSD facility
6) Excavation of sediments at the inlet portal in Ipo Dam	Generation of sludge that could result to increase in turbidity	Siphoning of sludge for temporary discharge to settling pond prior to hauling and donation to interested parties for backfilling
7) Clearing of project areas	Generation of dust from exposed area	Regular water spraying Use of face mask



Activity	Environmental Aspect	Mitigation Measures
8) Storage of tunnel spoils at temporary disposal site	Use of spoils for backfilling of environmentally sensitive area or its vicinity such as waterways, agricultural lands, etc.	Inventory of spoils for backfilling /reuse and conduct of inspection of the area for backfilling to check implementation of measures as stipulated in the EMP.
9) Construction of Tunnel 4	Negative impact on air and water quality	Quarterly air and water quality monitoring, and implementation of additional measures if negative impact is noted. <i>(Completed Quarterly Monitoring last May 7 to 9 for Air Quality and August 2019 for Water Quality)</i>
10) Repair and cleaning of Tunnel 4	Increase in turbidity of influent for treatment at WTP due to mixing with surface runoff in a sump pit	Provision of flexible hose that directly conveys wastewater from Tunnel 4 to the WTP and bypassing the sump pit. Sump pit only collects surface runoff for settling of sediments prior to discharge.



Activity	Environmental Aspect	Mitigation Measures
11) Dredging in Ipo reservoir	return of turbid water in Ipo reservoir as a result of dredging for the construction of inlet structure	<ul style="list-style-type: none"> • Outlet pipes of the settling pond are provided with geotextiles to control the re-deposition of suspended sediments in Ipo reservoir • Put additional layers of geotextiles that is filtering the transport of sediments in the outlet pipes. • Increased the number of outlet pipes since thickening of geotextiles covering the outlet pipes resulted to decrease in discharge and could result to overflow or direct discharge of untreated water to Ipo reservoir • Conducted regular dredging/removal of settled sediments in the settling pond to increase the latter's retaining capacity for sediments and to minimize resuspension due to turbulent flow of dredged fluid.



Activity	Environmental Aspect	Mitigation Measures
12) Operation of WTP	Increase in turbidity and pH of treated effluent due to re-suspension of settled sediments at the outlet canal before discharge to Bigte Creek,	Desludging of drainage canal and storage of collected sludge prior to hauling and treatment by EMB-accredited TSD facility.



Angat Water Transmission Improvement Project (AWTIP)