# Eutrophic mapping in Parit Rasipan Drainage System by Using Unmanned Aerial Vehicle (UAV)

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**ABSTRACT:** Drainage system is a natural or artificial system for surface's water and sub-surface water from an area with excess of water. An inefficiency of drainage system can cause many problems such flood, clogging and water pollution. One of major problem in drainage system is eutrophication which accelerate the excessive growth of macrophyte and algae. Previous studies stated that 60% of water bodies in Malaysia were eutrophic. The excessive growth of macrophytes cause by rich nutrient in drainage system that untreatable. Hence this concept paper will explain the proposed method to investigate the eutrophication phenomenon in Parit Rasipan by using unmanned aerial vehicle (UAV). The UAV system will be used for screening the study location; Parit Rasipan. Furthermore, water sample will be collected for nitrogen, phosphorus level and chlorophyll identification compared to Trophic State Index (TSI). Consequently, the land used mapping in Parit Rasipan as well as eutrophication stages in the drainage system will be analysed by using Normalized Difference Vegetation Index (NVDI) and Light Detection and Ranging (LiDaR). In conclusion, the application of UAV as has been discussed and proposed in this study are able to improvise the method of site investigation in more easy-way and practical.

**Keywords:** *Eutrophication; Unmanned aerial vehicle; Drainage system*

## 1. INTRODUCTION

The rural areas in Parit Raja are being occupied with student renting houses in the area as students no longer live in residential colleges causing more buildings and drainage systems to be built to accommodate the number of students as well as others resident living in Parit Raja. The urban sources include domestic sewage, industrial wastes and storm drainage can lead to eutrophication phenomenon [1]. Furthermore, palm oil plantation also one of factors contributes to eutrophication from emission the fertilizer into drainage system [2]. In addition, the goat farm near drainage system can cause the high nutrient level and growth excessive of macrophytes [3]. Hence, the effect of the load on drainage is increasing and causing various problems due to the sluggish flow of water and causing impurities as well as changes in precipitation in the volume of rain also increase rapidly in the drainage system. Due to this problem, manual monitoring of the eutrophication status of drainage system is a great challenge and highly cost.

Therefore, unmanned aerial vehicle (UAV) can be used in assisting the monitoring work of any water bodies. Every person should aware the situation of the drainage system because it is one of the source of water for daily use comes from. As the individual who will be affected by the pollution of water, every person have to take some measures to protect the water because water is the source of life, livelihoods and prosperity as well as an important contribution to nearly all kind of productions. In order to show how UAV work, this paper going to review and summarize the methods of UAV application on Parit Rasipan drainage system where this paper will only focus of eutrophication.

## 2. CASE STUDY AT PARIT RASIPAN DRAINAGE SYSTEM

The study will be conducted in Parit Rasipan, Parit Raja, Johor (1.855427$^{o}$ N, 103.096136$^{o}$ E). This study later will be included field and laboratory works. Field study will be conducted to determine the land used along the Parit Rasipan (number of sampling points) and measurement of selected variables. Activities and land use from upstream to downstream catchment area will be study to determine the point source and non-point source pollution by using UAV. Based on observation, there are four critical points of land use which are palm oil plantation (non-point source), residential area (point source), and goat farm (non-point source) and whereas industrial and domestic zone will be classify as point source pollution. Four sampling points will be identifying based on the land use of catchment area and the coordinates of the sampling points will be confirmed by using GPS equipment.

## 3. DATA COLLECTION AND PROCESSING IN PARIT RASIPAN

In this study DJI Mavic Air 2 drone will be used to capture aerial images of respective sampling area. The drone will be equipped with 48-megapixel camera with 8K hyper lapse 60 fps video. The attached camera are proficient to eliminate rolling shutter distortion when taking images of fast-moving objects or when flying with fast velocity, making that photos and videos become sharp and penetrating. The method of this study was adopted from [4] with some modification and improvement in equipment, photo assist and accuracy. The Light Detection and Ranging (LiDaR) camera will assist on the ground to capture 3D image of the site study. Agisoft PhotoScan software will be used to process the aerial images take from the site. From the geo-referenced ortho-photo, a normalized difference vegetation index (NDVI) image for the entire sample point from an adaptation of the index will be used. The satellite images used in this study will be downloading from the archive of Landsat 8 Operational Land Imager (OLI). This study utilized visible bands (blue, green and red) and near-infrared (NIR) band to determine the correlation between NDVI values and spectral reflectance values. All image data from the Landsat 8 OLI are in GeoTIFF format.

## 4. THE CONCENTRATION OF NITROGEN AND PHOSPHORUS INDICATE LEVEL OF EUTROPHICATION

Water samples from Parit Rasipan drainage system for preliminary assessment will be collected from each sampling points for nitrogen and phosphorus analysis according to Cadmium Reduction Method (Method 8071) and Ascorbic Acid Method (Method 8084) of HACH method DR 6000 Spectrophotometer. At the same time, ecological and environmental conditions surrounding the sample points will be record (temperature, humidity, moisture soil).

The chlorophyll-a referred to Standard Method for Water and Wastewater Examinations, method 10200H Chlorophyll [5] with pigment extraction and spectrophotometric determination of chlorophyll-where water sample was filter and soaked in 90% acetone and 10% of magnesium carbonate and transferred into screw-crap centrifuge. The sample will be left in dark for 4$^{o}$C at least 2 hours. Finally, the sample will be filter to remove any residue, subsequently measure optical density at 664, 647 and 630 nm. In addition, the trophic State Measurement of TSI with the values of Chl-a concentration is as show in Eq.1. Trophic State Index (TSI) describes the algal content in the water bodies [6].

$$\text{TSI Chl} - \text{a} = 10\left[6 - \frac{2.04 - 0.68\ln(Chl - a)}{ln2}\right] \qquad \text{Eq. 1}$$

## 5. CONCLUSION

In conclusion, application of UAV, NVDI and LiDAR in site investigation study would be more interesting as the mapping of land used as well as identification of eutrophication stage by using TSI in the study area. Furthermore, this study aim to produce a map of study area with stating the eutrophication status can be achieved.

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