Watershed Characteristics and Water Quality in Suburban River in Tokyo: Asakawa River

1. Introduction
Many Japanese rivers were polluted due to economic growth in the past. Although many have since been improved, there are still some areas where local pollution remains. In the Asakawa River, a suburban river in Tokyo, there are issues with water quality, such as wastewater problems or substance runoff from the forest ecosystem. To understand the water quality and characteristics of the river basin, comprehensive studies combining various methods are required, not only field surveys. This study aims to clarify the characteristics of the Asakawa River watershed based on the results of field surveys, water quality analysis, and statistical analysis using the obtained results.

II. Region Overview
Asakawa Riv is one of the tributaries of the Tamagawa Riv, which is a major river that flows through Tokyo. It has its source in Hachioji City, the largest city in western Toky, and flows through the city before joining the Tamagawa Riv in Hino City. Asakawa Riv is considered the most urbanized tributary of theclassified as unique points. The upper reaches are covered with forests, the lower reaches are characterized by urban areas. The geology of the upper reaches consists of accretionary wedge deposits, while the lower reaches are composed of loam, which is the volcanic ejecta layer. Since it is difficult to lay sewage pipes in the upper areas, septic tanks have been installed.

III. Research method
1. Field survey
Monthly survey at 34 points in the Asakawa Riv watershed (EC and pH)
2. Water quality analysis
The major dissolved components analysis (K, Ca, Mg, CL, HCO3, SO4, NO3) using ion chromatography (June and October, 2020, January and September 2021)
3. Water quality index calculation using GIS Extract waterbodies for each of the 34 survey points using DEM and calculated 24 watershed indicators, including land use, geology, population, and sewage treatment status, within each watershed
4. Cluster analysis
Making groups using the Ward method for both the water quality indexes and watershed index
5. Comparison with previous studies
EC value comparison in each tributary

IV. Results and Discussion
1. Field survey (Fig. 1)
- EC and pH values were low at upstream and high at downstream.
- Influence of ground water, water-irrigation interaction or waterwater
- High coefficient of variation at YMI (because of drainage inflow from sewage treatment plant)
2. Water quality analysis (Fig. 4)
- Cations were high at upstream and low at downstream (water-lock interaction)
- SDs was high at YJ due to inflow of groundwater.
- NO3s were high at Yudonogawa Riv(YD) and Kawaguchigawa Riv(YK).
- NO3s were high at upstream (due to nitrogen saturation), NH4 and NO3 were also high at upstream (due to septic tank influent)
- COD was high at tributaries
3. Watershed indexes calculation using GIS
- EC and mean slope of watershed showed highest correlation.
- NEC value were low at upstream and high at downstream.
- Loan rate was high at tributaries and downstream watershed
4. Cluster analysis (Fig. 9-12)
(1) Clustering by water quality indexes
- YMI and YJL classified as unique points. (low pH, high SDs, and NO3)
- HCO3s were high at middlestream points (due to inflow of groundwater)
- Water quality of downstream were similar with tributary’s.
- Influence from tributary were high.
(2) Clustering by watershed indexes
- YJL and K classified as unique points. (high paddy and farming field rate.
- The overall trend is similar with water quality clustering.
5. Comparison with previous studies
- EC values decreased in all tributaries, (due to installation of sewage line)
- Not much changed in Yamanigawa Riv and Yudonogawa Riv.
- Yamanigawa Riv had little land use change.
- Building site rate in septic tank installation area is high at Yudonogawa Riv.

V. Conclusion
From this study, four issues in the Asakawa Riv. watershed were identified: the pollution caused by septic tank effluent in upper stream, nitrate runoff due to nitrogen saturation in the forest ecosystem, upstream, pollution caused by the inflow of sewage treatment plant effluent into the small tributary named Yudonogawa Riv, and pollution caused by domestic wastewater from the Yudonogawa Riv. watershed which locates in southern part of its basin. To solve these problems, improvement of the watershed environment is required.