

Design of the Manakarra Stadium Area as an Integrated Disaster Evacuation Facility to Reduce Disaster Risk in Mamuju Regency, West Sulawesi

Arwansyah Arwansyah¹, Muhammad Chaerul², Sri Gusty²

¹Mahasiswa Magister Rekayasa Infrastruktur dan Lingkungan Universitas Fajar Makassar, INDONESIA

²Magister Rekayasa Infrastruktur dan Lingkungan Universitas Fajar Makassar, INDONESIA

E-mail: arwansyah@gmail.com

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ABSTRACT

Mamuju Regency, located in West Sulawesi, is a region highly vulnerable to various types of natural disasters, including earthquakes, floods, and landslides. However, following the earthquakes in January and June 2021, using Manakarra Stadium as a gathering point for evacuees revealed significant social issues due to the poorly organized placement of facilities. In this context, Manakarra Stadium is being proposed as an integrated disaster evacuation facility, serving not only as a sports venue but also as a center for protection and recovery for the community. This study aims to design Manakarra Stadium as an effective and efficient evacuation facility in the context of disaster risk reduction. Utilizing a data-driven approach and community needs analysis, the proposed design is expected to make a significant contribution to enhancing disaster resilience in the region. The design of this evacuation facility at Manakarra Stadium could serve as a model for both government and community disaster responses in the aftermath of future events.

Keywords: Mamuju Regency; facility design; Manakarra Stadium; disaster evacuation; disaster risk.

INTRODUCTION

Mamuju Regency, located in West Sulawesi, is an area that is prone to various natural disasters, such as earthquakes, tsunamis, and floods. According to data from the National Disaster Management Agency (BNPB), Mamuju has experienced several significant earthquakes in the last decade, including a 6.2 SR earthquake in January 2021 that caused infrastructure damage and loss of life (BNPB, 2021). According to a report from the Geological Agency of the Ministry of Energy and Mineral Resources, in June 2022, Mamuju experienced a fairly significant earthquake, which reminded us of the importance of disaster mitigation in this region (Geological Agency, 2022). In addition, climate change also contributes to the increasing frequency and intensity of disasters in this region. Data from the Meteorology, Climatology, and Geophysics Agency (BMKG) shows that extreme rainfall and unpredictable weather patterns are increasingly occurring in West Sulawesi, which has the potential to increase the risk of flooding and landslides (BMKG, 2022). Therefore, the design of Manakarra Stadium as an integrated disaster evacuation facility is very relevant to reduce disaster risks and increase community resilience. In this context, it is important to design facilities that can function as safe and effective evacuation sites for communities during disasters. Mamuju Regency in West Sulawesi is an area prone to disasters, especially earthquakes and tsunamis. Manakarra Stadium, located in the center of Mamuju City, has great potential to be developed as an integrated evacuation facility. With a large enough capacity, this stadium can accommodate thousands of evacuees in emergency situations. However, currently the stadium is mostly used for sports and entertainment activities, so it has not been optimally utilized for disaster management. Given the importance of disaster preparedness, the design of the stadium as an evacuation facility needs to be carried out by considering various aspects, including accessibility, infrastructure, and community needs. With a growing population and rapid urbanization, the need for adequate evacuation facilities is very urgent. Manakarra Stadium, as one of the strategic public buildings, is expected to function as an integrated evacuation facility that can accommodate residents

in emergency situations. In this context, it is important to understand that evacuation facilities do not only function as temporary shelters, but must also be designed with accessibility, comfort, and safety in mind. Previous research has shown that good design can improve evacuation effectiveness and reduce disaster risks (Fatimah et al., 2019). Therefore, the design of Manakarra Stadium must consider various aspects, including infrastructure, communication systems, and the provision of basic needs for evacuees.

Data from the National Disaster Management Agency (BNPB) shows that during the period 2000 to 2020, more than 500 natural disasters occurred in Indonesia, most of which were caused by earthquakes and tsunamis (BNPB, 2021). In facing this threat, designing effective and efficient evacuation facilities is very important to protect the community. Considering the potential for disasters, Manakarra Stadium is expected to be a model for designing evacuation facilities in other areas with similar risks. Furthermore, the design of Manakarra Stadium as an evacuation facility also needs to involve community participation. Community preparedness in facing disasters is greatly influenced by their understanding and knowledge of existing risks and correct evacuation methods (Wicaksono, 2019). Therefore, socialization and education regarding the function of the stadium as an evacuation site need to be carried out periodically so that the community is ready and knows what to do when a disaster occurs. The design of effective disaster evacuation facilities not only considers physical aspects, but must also consider social, economic, and environmental factors. Previous studies have shown that community awareness and preparedness for disasters greatly influence the success of evacuation (Winda J. Arcegon et.al, 2024). Therefore, a holistic approach in designing evacuation facilities is needed to ensure that all elements of society are involved and benefit from the facilities. In designing evacuation facilities, it is important to consider strategic locations that are easily accessible to the community. These facilities must be built in areas that are safe from the threat of disaster, and have supporting infrastructure, such as good access roads and adequate public transportation. Statistics show that the accessibility of evacuation facilities can increase the speed and efficiency of evacuation, which in turn can save more lives (Vicente et.al, 2023). Furthermore, the design of evacuation facilities must also integrate modern technology to improve their functionality. For example, the use of natural ventilation systems and UV-C technology in shelter design can improve air quality and reduce the risk of disease spread during evacuation (Ndaru Nuridho Alfian et.al, 2021). By utilizing this innovation, evacuation facilities can be more comfortable and safe for evacuees.

With this background, this study aims to design Manakarra Stadium as an integrated disaster evacuation facility that can contribute to disaster risk reduction efforts in Mamuju Regency City. This study will discuss various aspects of the design, including physical design, evacuation management system, and community involvement in the design and implementation process. According to previous studies, a good evacuation facility must be able to provide sufficient space for various activities, such as beds, public kitchens, and areas for social activities (Widiyana, 2019). Therefore, it is important to conduct a survey and analysis of the capacity of Manakarra Stadium in order to meet these needs. In this context, it is important to understand that the effectiveness of evacuation is highly dependent on how well the management system is implemented (Latief, 2000). Therefore, this study will identify weaknesses in the existing system and provide recommendations for improvement. Good education and socialization can increase community participation in the design and implementation process of evacuation facilities (Wicaksono, 2019). By involving the community, it is hoped that they will be better prepared to face disasters and understand the role of Manakarra Stadium as a place of shelter. Finally, this study aims to provide design recommendations that can be applied not only to Manakarra Stadium, but also to other public facilities in disaster-prone areas. Thus, the results of this study are expected to contribute to disaster risk reduction efforts more broadly in Indonesia.

RESEARCH METHODS

The methodology of this study will use qualitative and quantitative approaches to obtain comprehensive data on the design of Manakarra Stadium as a disaster evacuation facility. Data collection will be carried out through surveys, interviews, and relevant literature studies. Surveys will be conducted with local communities to identify their needs and expectations regarding

evacuation facilities. In addition, in-depth interviews will be conducted with related parties, including the local government, the Regional Disaster Management Agency (BPBD), and non-governmental organizations engaged in disaster mitigation. Through these interviews, it is hoped that information can be obtained regarding the policies and strategies that have been implemented in disaster management in Mamuju.

Literature study will be conducted by reviewing various references related to the design of evacuation facilities and disaster mitigation. These references will include scientific journals, research reports, and relevant policy documents. By collecting data from various sources, it is expected that the analysis conducted will be more accurate and reliable. After the data is collected, an analysis will be conducted to identify various factors that influence the design of Manakarra Stadium as an evacuation facility. This analysis will include technical, social, and environmental aspects that need to be considered in the design. In addition, an analysis will also be conducted on the existing evacuation management system to identify weaknesses and provide recommendations for improvement. Finally, the results of the study will be compiled in the form of a report that includes recommendations for the design of Manakarra Stadium as an integrated disaster evacuation facility. This report is expected to be a reference for local governments and related parties in efforts to reduce disaster risk in Mamuju Regency.

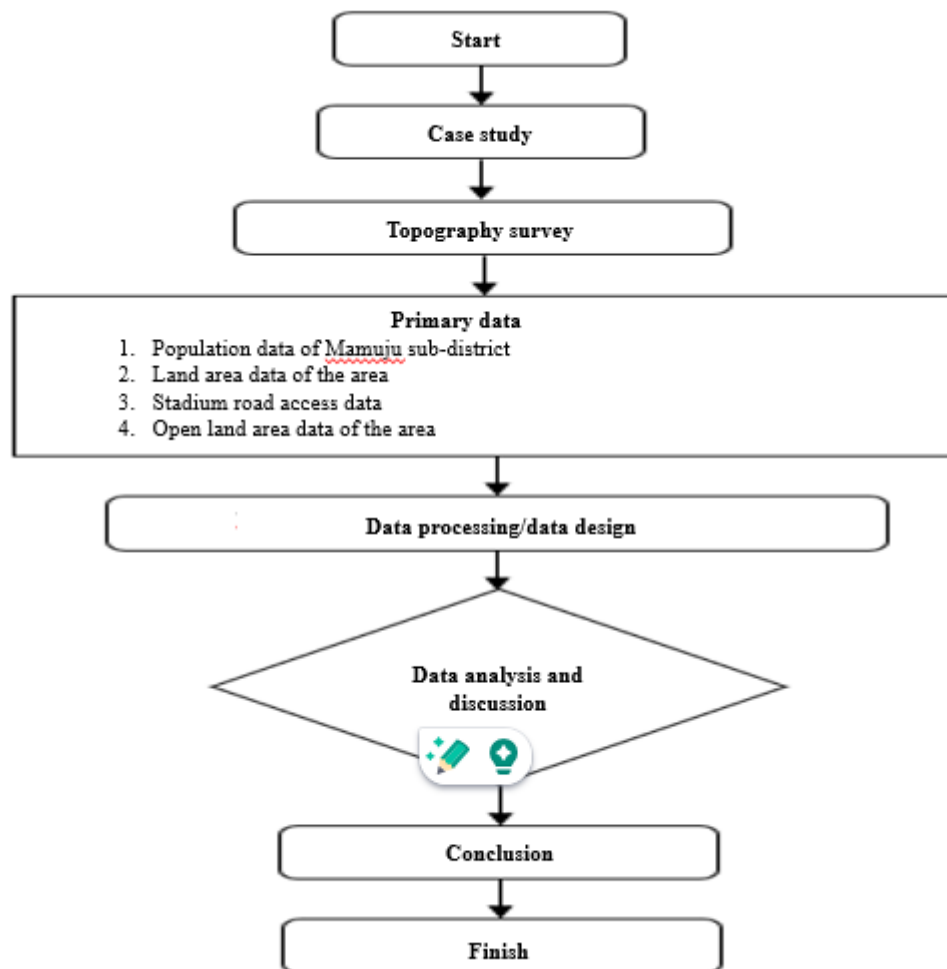


Figure 1. Research Flowchart

RESULT AND DISCUSSION

The results of the study show that the Mamuju community has a high awareness of disaster risks, but there are still shortcomings in terms of adequate evacuation facilities. From the survey conducted, 65% of respondents stated that they did not know a safe evacuation place around them

(BPS Mamuju, 2020). This shows the need for socialization and development of evacuation facilities that are clear and easily accessible to the community. In the analysis of the Manakarra Stadium area design, it was found that the stadium has great potential to be used as an evacuation facility. With a fairly large capacity, the stadium can accommodate up to 10,000 people. However, adjustments need to be made to the interior design to ensure the comfort and safety of evacuees. For example, the addition of adequate ventilation and sanitation areas will be very important to maintain the health of evacuees while in the stadium. The planned results of capacity development for facilities are in table 1 below;

Table 1. Results of the development of the capacity of the Stadium Area Facilities

No.	Facility	Capacity	Unit	Capacity total
1.	Refugee Tents	30persons/units	335units	10.000persons
2.	Disaster Management Committee Tents	12persons/units	3units	36persons
3.	Logistics and Food Warehouses	5 ton/warehouse	4units	20 ton
4.	Public Kitchens	12persons/units	6units	72persons
5.	Health Posts/Polyclinics	10persons/units	5units	50persons
6.	Guard Posts	2persons/units	3units	6 persons
7.	Information Posts	12persons/units	1unit	12 persons
8.	Portable Toilets	1person/unit	168units	168persons
9.	Clean Water Storage	1.200L/tank	28tank	33.600L
10.	Officer and Assistance Vehicle Parking	-	1node	2.594,99m ²
11.	Public Parking	-	5nodes	4.091,40m ²
12.	Road Access	8m	4access	4road access
13.	Prayer Rooms	80persons/units	6units	480units

The evacuation simulation conducted showed that there were several challenges in the evacuation process. One of them is the lack of clear access routes to the stadium. The simulation results show that evacuation time can increase by up to 30% if the access route is not repaired (BPBD Mamuju, 2023). Therefore, it is necessary to improve the road infrastructure to the stadium so that accessibility can be improved. In addition, the results of interviews with BPBD officers revealed that regular evacuation training and simulations are very important to improve community preparedness. Previous research has shown that areas that routinely conduct evacuation simulations have a better response rate when a disaster occurs (Jurnal Penanggulangan Bencana, 2019). Therefore, recommendations to conduct regular training and simulations should be part of the disaster risk management plan in Mamuju. In the initial analysis, Manakarra Stadium has great potential to function as a shelter for the community during a disaster. However, several aspects need to be considered in its design in order to optimally meet the needs of evacuees. One of the results found was the need to add basic facilities such as toilets, emergency beds, and public kitchens to meet the needs of evacuees. Data from previous studies show that adequate facilities can improve the comfort and safety of evacuees while in evacuation sites (Fatimah et al., 2019). Therefore, the design must consider the number of evacuees that may be accommodated and the basic needs that must be met. In addition, the existing evacuation management system also needs to be evaluated. The results of interviews with the BPBD showed that there were still shortcomings in coordination between agencies during a disaster. This can result in delays in the evacuation process and handling of evacuees (Geological Agency, 2021). Therefore, there needs to be regular evacuation training and simulations to improve preparedness and coordination between agencies. Community involvement is also an important factor in designing evacuation facilities. The survey results showed that the community has a desire to be involved in the design and management process of evacuation facilities. This is in line with research stating that community participation can increase the effectiveness of disaster mitigation programs (Wicaksono, 2019). Therefore, socialization and education regarding the function of the Manakarra Stadium as an evacuation facility need to be carried out periodically.

The function zone of space or Zoning of this gathering point design research will explain about refugee camps, supporting and supporting facility areas. Where as we know that the need for space will utilize the open areas in the Manakarra stadium area such as; Football Field, Parking Area, Public Space, and other open areas. With the hope that the open space after being used as a gathering point will not experience permanent damage so that it changes its previous function, so that it can function as a public space for sports facilities and can also change function as a gathering point if needed when an earthquake and/or tsunami occurs. As in Figure 2.

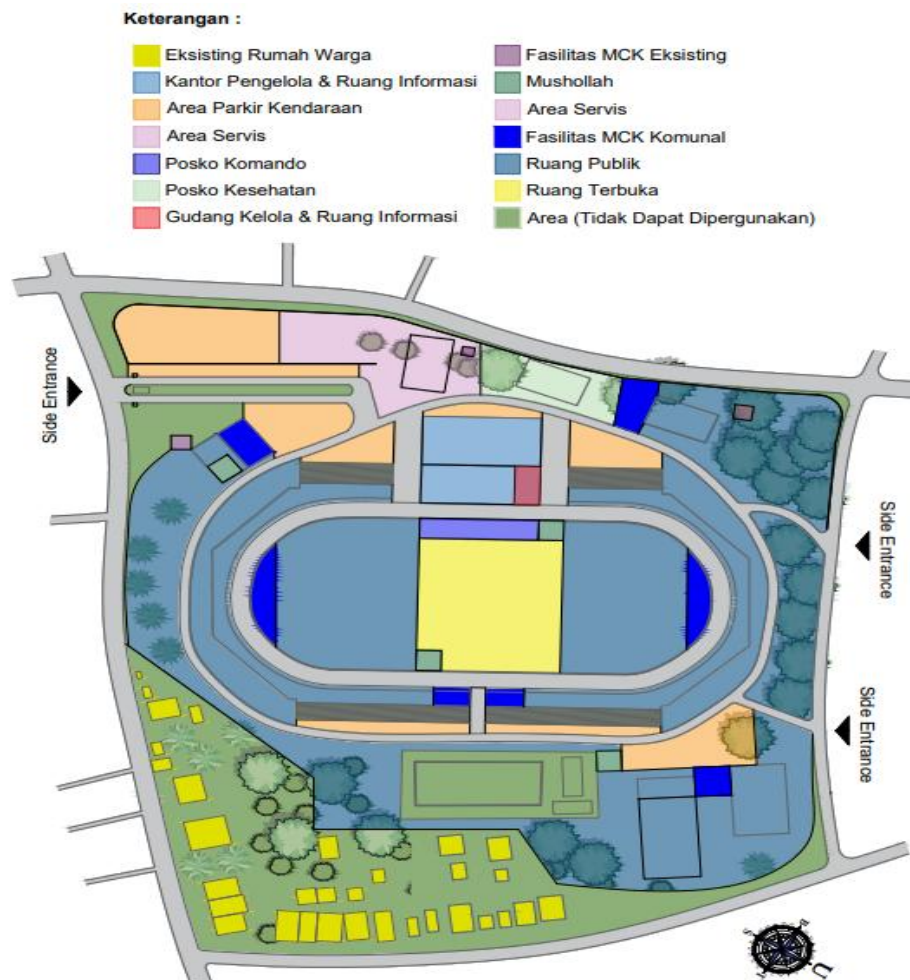


Figure 2. Design of Zoning Design of Manakarra Stadium Area Gathering Point

No less important is the cycle of spatial relationships that must be adjusted to the conditions of the Stadium Area, where the circulation system is a vital connecting infrastructure that connects various activities and uses of land above an area and inside a building that considers functional, economic, flexibility and comfort aspects (Logi Tofani, 2011). The existing condition of the Stadium Area, especially the road, has been well connected so that it makes it easier for us to design the circulation of people both in normal refugee activity conditions and emergency conditions after the earthquake and tsunami in particular. This is illustrated in figure (3) evacuation routes in the Area as follows:

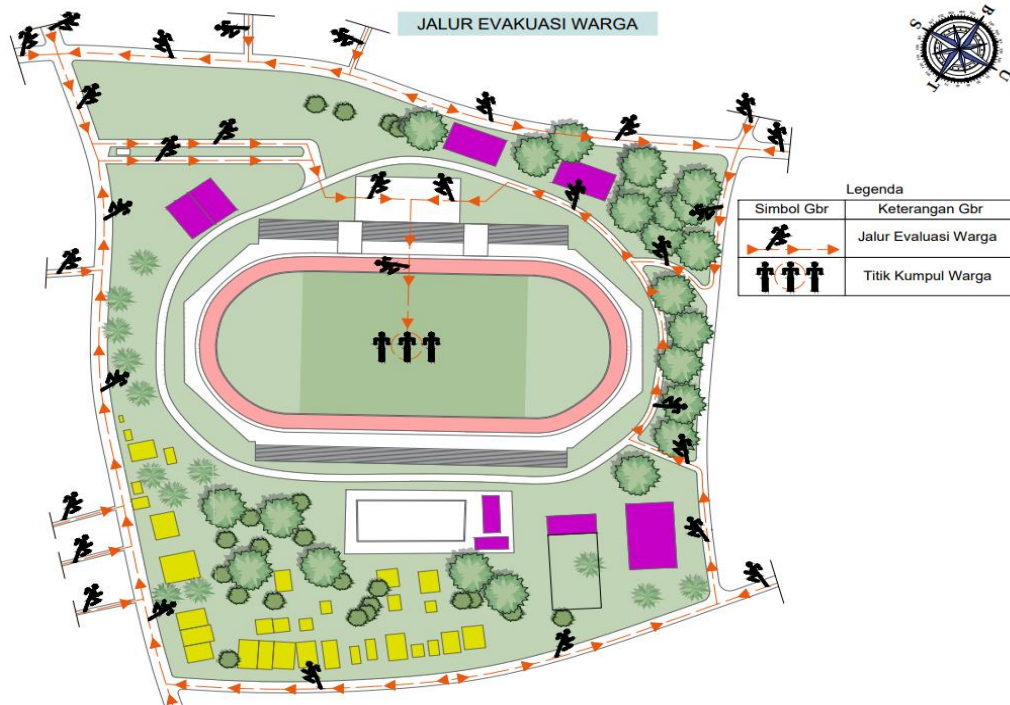


Figure 3. Evacuation Route in the Manakarra Stadium Area

The importance of adequate evacuation facilities cannot be underestimated, especially in disaster-prone areas such as Mamuju. With the increasing frequency of natural disasters, good and systematic design will greatly contribute to protecting the community and reducing the impact of disasters. Therefore, the recommendations resulting from this study are expected to be implemented by local governments and related parties in efforts to reduce disaster risk more broadly.

In the context of design, the stadium must be equipped with sufficient open areas to allow for community movement during evacuation. In addition, it is important to facilitate access for people with disabilities and other vulnerable groups. Previous research has shown that inclusive evacuation facility design can increase the effectiveness of evacuation and reduce the risk of injury (Andika Nico Reonaldy, 2019). In addition to physical aspects, providing information and education to the community regarding evacuation procedures is also very important. Research shows that communities that are well educated about disaster risks and evacuation procedures tend to be better prepared to deal with emergency situations (Wicaksono, 2019). Therefore, Manakarra Stadium can also function as an education and training center for the community. Through collaboration between the government, community, and non-governmental organizations, the development of Manakarra Stadium as a disaster evacuation facility can be carried out effectively. Experience from other areas, such as the design of the Merapi disaster evacuation facility in Yogyakarta, shows that community involvement in planning can increase a sense of ownership and compliance with established procedures (Andika Nico Reonaldy, 2019).

Furthermore, the physical design of the evacuation facility must also consider adequate capacity. Referring to demographic data, the population of Mamuju reaches around 200,000 people, so evacuation facilities must be designed to accommodate a large number of evacuees in emergency situations (BPS Mamuju, 2022). Modular and flexible designs can be a solution to accommodate variations in the number of evacuees that may occur during a disaster. For example, the use of folding tents that can be easily installed and dismantled as needed can be an effective alternative (DCAF, 2020). In addition, it is important to integrate an effective communication system into

evacuation facilities. A clear and accurate information system can help evacuees understand the current situation and the steps to be taken during the evacuation process. Research shows that good communication during a disaster can reduce anxiety and increase community compliance with evacuation instructions (Winda J. Arcegono et.al, 2024). Therefore, evacuation facilities must be equipped with adequate communication devices, including radio and public announcement systems. Another aspect that is no less important is the provision of health services in evacuation facilities. In emergency situations, the risk of spreading disease can increase, so it is important to have medical personnel and health facilities ready. Data from WHO shows that refugees living in shelters are at higher risk of health problems, including respiratory infections and other infectious diseases (WHO, 2021). Therefore, the design of evacuation facilities must include space for health services and health education for refugees. This is illustrated in Figure (4) as the result of the Evacuation Gathering Point Design for the Manakarra Stadium area as follows:

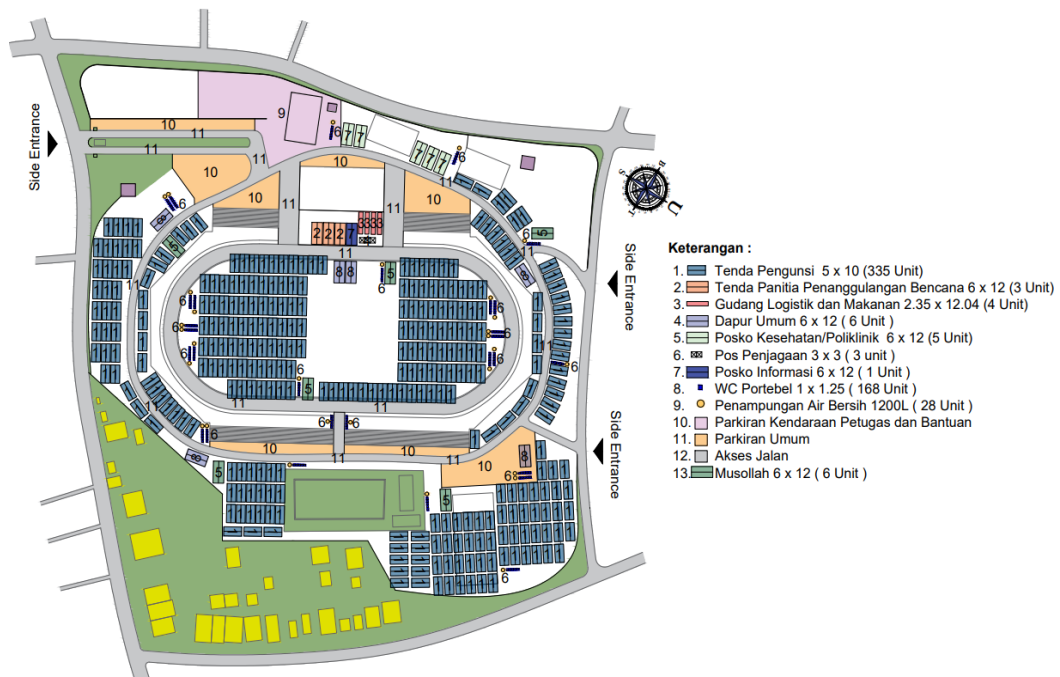


Figure 4. Evacuation Gathering Point Design Results for the Manakarra Stadium Area

CONCLUSION

The conclusion of this study is that the design of the Manakarra Stadium Area as an integrated disaster evacuation facility is very important in efforts to reduce disaster risk in Mamuju Regency City. By considering various aspects, including the need for basic facilities, evacuation management systems, and community involvement, it is hoped that the Manakarra Stadium area can function as an effective shelter for residents when a disaster occurs. As a next step, further research needs to be conducted on the implementation of the recommendations given, as well as an evaluation of the effectiveness of the Manakarra Stadium Area as an evacuation facility after it is operated. Thus, the process of improving and developing evacuation facilities can be carried out sustainably, so that the community can be better prepared to face disaster risks in the future.

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