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# Analysis and Design of Natural Spring Water Preservation and Monitoring System Using Rapid Application Development

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**Abstract**

Climate change in Indonesia has resulted in droughts in several regions, affecting both ecological conditions and the livelihoods of local communities in accessing clean water sources. Therefore, natural spring water preservation and monitoring are needed to identify and analyze the factors contributing to ecological changes. This research utilizes the Rapid Application Development method through the Oracle Apex instrument in designing the database and information system for natural spring water preservation and monitoring. The stages of designing this application are requirements planning, user design, construction, and cutover. Each stage has its challenges, namely the relevance of data to user needs in identifying and analyzing the sustainability of natural spring waters. The findings of this study demonstrate that information on natural spring water location, water quality, local community activities, and observer data play a crucial role in the decision-making process. Through this application, natural spring waters can be identified and protected through appropriate policies, thus contributing to Indonesia's sustainable water resource management and environmental conservation efforts. Additionally, the analysis and design results reveal insights into the structural framework and functionalities of the developed system, highlighting its potential to effectively address the complexities of natural spring water preservation and monitoring.

**Keywords**: Natural Spring, Water, Quality, Preservation, Monitoring

## 1. INTRODUCTION

Natural spring waters play a crucial role in maintaining ecosystem sustainability; however, climate change, mining activities, and deforestation have led to significant alterations, impacting natural spring waters in inland regions [1]. The intricate interplay between natural and anthropogenic factors underscores the vulnerability of natural spring waters to environmental disturbances, necessitating urgent attention and strategic interventions [2]. The observed changes in natural spring water dynamics highlight the need for comprehensive conservation measures and adaptive management strategies to mitigate the adverse effects of environmental stressors and safeguard these vital resources [3]. Addressing the multifaceted challenges of natural spring waters requires a concerted effort

involving stakeholders, policymakers, and scientific communities to ensure their long-term resilience and ecological integrity [4].

This research aims to design a database and information system for natural spring waters to monitor natural spring waters in inland areas. The primary objective is to develop a comprehensive system capable of collecting, storing, analyzing, and disseminating data related to natural spring water dynamics, hydrological parameters, and environmental variables. The research endeavors to formulate a database and information system tailored to monitor natural spring waters in inland regions. This initiative is driven by the overarching goal of constructing a robust system proficient in gathering, archiving, scrutinizing, and disseminating diverse datasets of the dynamics of natural spring waters, encompassing hydrological metrics and environmental factors. The significance of such a system lies in its potential to enhance our understanding of natural spring water dynamics, facilitating informed decision-making processes and fostering sustainable water resource management practices. In conclusion, developing a comprehensive database and information system is poised to significantly contribute to preserving and prudent utilization of natural spring waters in inland areas.

Developing a database and information system for natural spring waters is imperative as a strategic measure for preserving water resources in inland regions. Such a system is a foundational tool for effective water resource management, facilitating the collection, organization, and analysis of crucial data related to natural spring water characteristics, hydrological dynamics, and usage patterns [5]. Additionally, an integrated information system fosters enhanced collaboration and communication among stakeholders involved in water conservation efforts, thereby optimizing resource allocation and conservation strategies [6]. Such a system is essential for enhancing our understanding of natural spring water behavior and informing evidence-based decision-making processes regarding water resource management and conservation strategies in inland regions [7]. Consequently, establishing an effective database and information system is critical to ensuring the sustainable preservation and management of natural spring waters in remote areas [8].In conclusion, implementing a comprehensive database and information system for natural spring waters is vital in ensuring the sustainable preservation of water resources in inland areas.

Several previous studies have indicated the necessity of protecting natural spring waters to uphold ecosystem sustainability, particularly for local communities reliant on clean water sources for their livelihoods in settlement areas categorized as inland regions [9]–[13]. The empirical evidence underscores the fundamental importance of natural spring waters as a vital natural resource and a lifeline for human populations inhabiting remote areas [14]. As such, prioritizing the conservation and management of natural spring waters is imperative to ensure the continued well-being and resilience of ecosystems and local communities in inland

regions [15]. In conclusion, recognizing and addressing the significance of natural spring waters in sustaining ecological balance and supporting human populations underscores the urgency of concerted efforts toward their preservation and protection [16].

The research gap identified from previous studies highlights the need for research that offers theoretical and practical implications in the ecology and technology [17]. This study proposes an innovative approach to comprehensively analyze digital innovation as a strategic step for monitoring and preserving natural spring waters in inland areas. This research aims to advance knowledge and develop effective, sustainable water resource management strategies by bridging the gap between theoretical concepts and practical applications. Thus, addressing this research gap enriches academic discourse and offers tangible benefits for environmental conservation and community well-being in remote regions [18].

The limitation of this research lies in the methodology and instrument utilized, namely Rapid Application Development (RAD) through the oracle-apex instrument. While RAD offers advantages such as rapid prototyping and flexibility in accommodating changing requirements, its suitability for complex and large-scale projects may be questioned [19]. Additionally, the reliance on Oracle-apex as the primary tool may constrain the scalability and customization potential of the developed database and information system [20]. Despite these limitations, using RAD and Oracle-apex provides valuable insights into the feasibility and efficiency of employing such methodologies and tools for similar projects in the future [21]. Thus, acknowledging and addressing these limitations enhances the rigor and applicability of the research findings.

The theoretical implications of this research emphasize the role of digital innovation in preserving natural spring waters as a strategic step towards achieving ecological sustainability and supporting community livelihoods in remote areas [22]. This study highlights the potential for enhancing conservation efforts and promoting sustainable water resource management practices by leveraging digital technologies such as database systems and information platforms [23]. Furthermore, integrating digital innovations facilitates real-time monitoring, data analysis, and decision-making processes, empowering stakeholders to proactively address environmental challenges and ensure the resilience of ecosystems and local communities in remote regions [24]. In essence, recognizing the transformative potential of digital innovation underscores its significance in advancing conservation agendas and fostering sustainable development initiatives in remote areas [25].

The practical implications of this research demonstrate the contribution of developing a GIS-based database and information system, which all stakeholders can utilize in monitoring natural spring waters and designing environmental

preservation programs near natural spring waters [26]. By integrating geographic information systems (GIS) into the database and information system, this study offers a powerful tool for spatial analysis, visualization, and decision-making, enhancing the effectiveness and efficiency of conservation efforts [27]. Furthermore, the accessibility of this system to various stakeholders facilitates collaboration and coordination in implementing targeted preservation initiatives, thereby fostering a holistic approach toward safeguarding water resources and surrounding ecosystems [28]. In conclusion, the practical implications underscore the instrumental role of GIS-based solutions in promoting integrated and sustainable management practices for natural spring waters and their surrounding environments.

## 2. METHODS

The method employed for designing this study's database and information system involves Rapid Application Development (RAD), which comprises four key stages: requirement planning, user design, construction, and cutover [29]. This iterative approach prioritizes active user involvement and continuous feedback integration throughout the development process, ensuring that the resulting natural spring water preservation and monitoring system is tailored to meet user needs effectively. By systematically progressing through these stages, the RAD methodology facilitates the creation of a user-centric system that aligns closely with stakeholder requirements and operational objectives [30]. Consequently, this methodological framework enhances the efficiency and effectiveness of the system development [31]. It fosters greater user satisfaction and system usability, ultimately contributing to successfully implementing natural spring water preservation initiatives in inland areas.

Figure 1 illustrates the research flow that adheres to the RAD process, encompassing the phases of requirement planning, user design, construction, and prototype. The objective of this study is the Analysis and Design of Water Spring Preservation and Monitoring System. This diagram visually represents the systematic approach employed in developing the proposed system, emphasizing the structured progression from initial planning to creating a functional prototype. By following the RAD methodology, researchers aim to streamline the development process and ensure alignment with project objectives, thereby enhancing the efficiency and effectiveness of the water spring preservation and monitoring system.

One of the critical advantages of Rapid Application Development (RAD) lies in its flexibility to accommodate changes in data construction required by users, thus enabling continuous application development to evolve alongside user needs. This feature allows for iterative refinement and enhancement of the system, ensuring its alignment with evolving user requirements and technological advancements.

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Consequently, RAD facilitates rapid system deployment and promotes ongoing adaptation and improvement, enhancing user satisfaction and system effectiveness over time. In conclusion, the inherent flexibility of RAD empowers organizations to respond swiftly to changing demands and maintain the relevance and usability of their applications in dynamic environments.

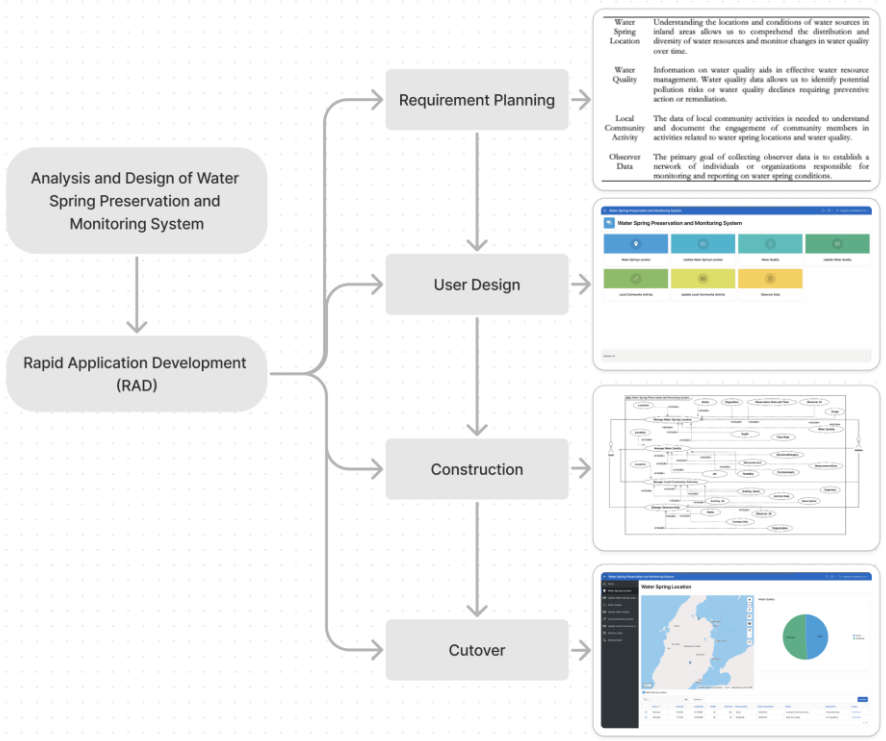


**Figure 1.** Implementation of Rapid Application Development (RAD) [20].

## 2.1. Requirement Planning

During the requirement planning stage, user needs related to data concerning natural spring water location, water quality measurement, and observer data are identified. This phase involves engaging stakeholders to gather insights into the information required for effective water resource management and conservation efforts. By comprehensively understanding the needs and preferences of users, the development process can be tailored to ensure that the resulting database and information system align closely with user expectations and operational requirements. Therefore, the requirement planning stage is a crucial foundation for successfully designing and implementing a system that meets the diverse needs of stakeholders involved in natural spring water preservation initiatives.

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**Table 1.** Data Requirement for Natural Spring Water Preservation and Monitoring System

| | |
|---|---|
| Natural spring water Location | Understanding the locations and conditions of water sources in inland areas allows us to comprehend the distribution and diversity of water resources and monitor changes in water quality over time. |
| Water Quality | Information on water quality aids in effective water resource management. Water quality data allows us to identify potential pollution risks or water quality declines requiring preventive action or remediation [32]. |
| Local Community Activity | The data of local community activities is needed to understand and document the engagement of community members in activities related to natural spring water locations and water quality. |
| Observer Data | The primary goal of collecting observer data is to establish a network of individuals or organizations responsible for monitoring and reporting on natural spring water conditions. |

Based on the data related to natural spring water location, water quality, local community activities, and observer data, this application can identify factors influencing the sustainability of natural spring waters in a particular area. By integrating information from these diverse sources, the application offers a comprehensive understanding of the ecological, social, and environmental dynamics impacting natural springwater ecosystems. Analyzing the interactions between water quality, community engagement, and observer reports enables identifying key drivers affecting natural spring water sustainability. Consequently, this holistic approach facilitates evidence-based decision-making and targeted interventions to mitigate threats and preserve the long-term viability of natural spring waters.

### 2.2. User Design

During the user design stage, the instrument utilized is Oracle Apex, configured by the use case diagram to facilitate understanding of actors and data processing rights within the application. This phase emphasizes user-centric design principles, ensuring the application interface is intuitive and aligned with user requirements. By leveraging Oracle Apex, which offers robust capabilities for rapid application development and customization, developers can streamline the design process and create a user-friendly interface that enhances user experience and efficiency. Consequently, this approach enhances user engagement and contributes to the

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overall success of the application in effectively addressing the needs of stakeholders involved in natural spring water preservation efforts.

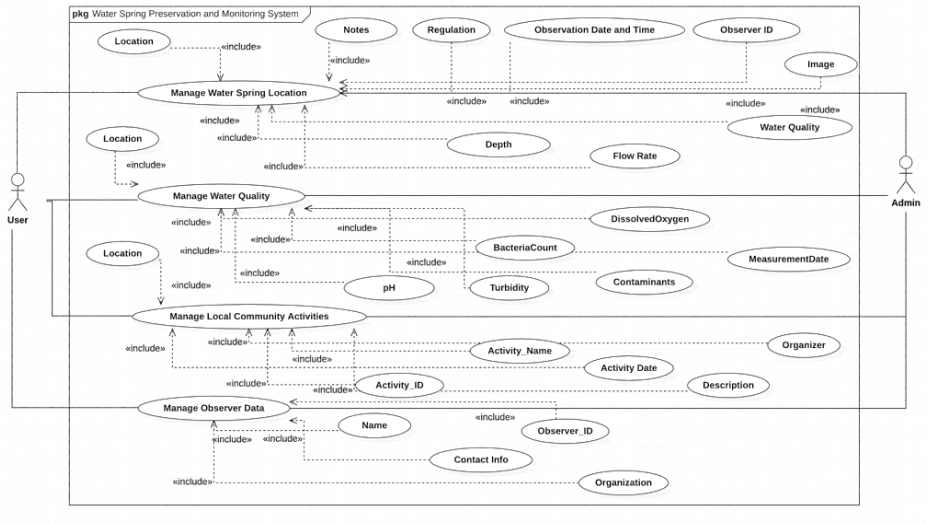


**Figure 2.** Use Case of Natural Spring Water Preservation and Monitoring System

Based on the configuration results in Oracle Apex, every page displaying locations will be integrated with GIS, and the database showing crucial information will be presented in the form of charts. This integration enhances the visual representation of natural spring water locations and associated data, facilitating a more comprehensive understanding of spatial relationships and trends. The application provides users with actionable insights into water resource management and conservation by incorporating GIS functionality and visualizations such as charts. Ultimately, this approach enhances the usability and effectiveness of the application in supporting decision-making processes related to natural spring water sustainability.

### 2.3. Construction

During the construction phase, the design of the Oracle APEX database takes precedence, marking a critical step in the development process. This stage involves meticulously configuring database structures within the Oracle environment to support the envisioned application functionalities. The construction phase also entails defining data relationships, establishing data integrity constraints, and implementing security measures to safeguard sensitive information. Furthermore, this phase fosters seamless database integration with the Oracle APEX application framework, ensuring cohesive functionality and optimal performance. In

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conclusion, the construction phase is the foundation for Oracle APEX applications' robust and efficient operation, emphasizing the significance of meticulous database design in the development lifecycle.

**Table 1.** Database Design of Natural Spring Water Preservation and Monitoring System

| Natural spring water Location | Water Quality |
|---|---|
| CREATE TABLE WaterSpringLocations (<br>LocationID NUMBER PRIMARY KEY,<br>Name VARCHAR2(100),<br>Latitude NUMBER,<br>Longitude NUMBER,<br>Depth NUMBER,<br>FlowRate NUMBER,<br>WaterQuality VARCHAR2(50),<br>ObservationDate DATE,<br>ObserverID NUMBER,<br>Notes VARCHAR2(255),<br>Regulation VARCHAR2(255),<br>Image, BLOB,<br>CONSTRAINT fk_observer FOREIGN KEY (ObserverID) REFERENCES Observer(ObserverID)<br>); | CREATE TABLE WaterQuality (<br>QualityID NUMBER PRIMARY KEY,<br>LocationID NUMBER,<br>pH NUMBER,<br>Turbidity NUMBER,<br>DissolvedOxygen NUMBER,<br>BacteriaCount NUMBER,<br>Contaminants VARCHAR2(100),<br>MeasurementDate DATE,<br>CONSTRAINT fk_location FOREIGN KEY (LocationID) REFERENCES WaterSpringLocations(LocationID)<br>); |
| **Local Community Activities** | **Observer Data** |
| CREATE TABLE LocalCommunityActivities (<br>ActivityID NUMBER PRIMARY KEY,<br>ActivityName VARCHAR2(100),<br>Description VARCHAR2(255),<br>Location VARCHAR2(100),<br>ActivityDate DATE,<br>Organizer VARCHAR2(100),<br>LocationID NUMBER,<br>CONSTRAINT fk_location FOREIGN KEY (LocationID) REFERENCES WaterSpringLocations(LocationID)<br>); | CREATE TABLE ObserverData (<br>ObserverID NUMBER PRIMARY KEY,<br>ObserverName VARCHAR2(100),<br>ContactInfo VARCHAR2(100),<br>Organization VARCHAR2(100)<br>); |

The databases about natural spring water location, water quality, local community activities, and observer data are constructed into an integrated and responsive database. This phase involves the development of a cohesive infrastructure that consolidates disparate data sources into a unified platform, enabling seamless data retrieval, analysis, and visualization. By integrating diverse datasets, the construction phase lays the foundation for a comprehensive information system capable of providing stakeholders with valuable insights into natural spring water dynamics and facilitating informed decision-making processes. Consequently, this integrated and responsive database enhances the effectiveness of water resource management initiatives and contributes to the sustainable preservation of natural spring waters in the area.

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### 2.4. Cutover

During the cutover phase, a comprehensive test of the Create, Read, Update, Delete (CRUD) process is conducted using the configured forms. This stage marks a crucial milestone in the implementation process as it ensures the functionality and reliability of the developed system. Conducting thorough CRUD operations testing identifies and addresses potential issues or discrepancies in data processing and management before the system is fully deployed. The rigorous testing conducted during the cutover phase enhances the overall robustness and effectiveness of the system, thereby contributing to its successful integration into operational workflows.

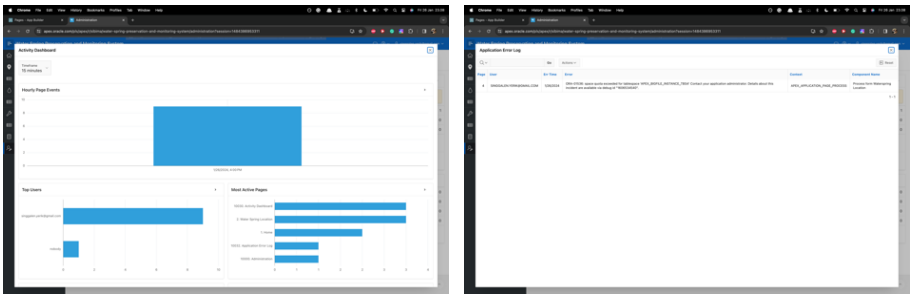

**Figure 3.** Activity Dashboard and Error Log of the Application

Based on the test results, errors were identified during the configuration phase; however, they have been successfully resolved, enabling the application to be fully utilized without any constraints. This outcome underscores the significance of thorough testing procedures in software development projects, as it allows for detecting and resolving issues before deployment. The successful resolution of errors demonstrates the efficacy of the development team in addressing challenges and ensuring the functionality and reliability of the application. Consequently, users can confidently utilize the application without impediments, enhancing overall user satisfaction and system performance.

## 3. RESULTS AND DISCUSSION

Climate change in Indonesia has led to droughts in several regions, impacting ecological conditions and the livelihoods of local communities in accessing clean water sources [33]. The increasing frequency and severity of drought exacerbate water scarcity, posing significant challenges to environmental and human well-being [34]. This phenomenon underscores the urgent need for comprehensive mitigation and adaptation strategies to address the adverse effects of climate change on water resources and ensure the resilience of ecosystems and communities in Indonesia.

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The significance of the Analysis and Design of the Water Spring Preservation and Monitoring System lies in its pivotal role in addressing the pressing need for effective management and conservation of water resources, particularly natural spring waters. This system enables stakeholders to gain comprehensive insights into water spring ecosystems' ecological dynamics and sustainability through meticulous analysis and design processes. By systematically identifying and analyzing various factors influencing water spring preservation, such as location, water quality, local community activities, and observer data, this system facilitates informed decision-making and strategic interventions to ensure the long-term viability of water resources. Thus, the Analysis and Design of the Water Spring Preservation and Monitoring System is crucial in promoting sustainable water management practices and environmental conservation efforts.

This research designs an application to document the locations of natural spring waters in various regions to take strategic steps in sustainably preserving and managing water resources. The application aims to provide valuable insights for practical conservation efforts and resource management practices by systematically documenting natural spring water locations. The strategic utilization of technology in documenting natural spring water locations underscores the importance of leveraging innovative solutions to address environmental challenges and promote sustainability. Consequently, the application serves as a vital tool in facilitating informed decision-making processes and fostering proactive measures towards preserving and conserving water resources.

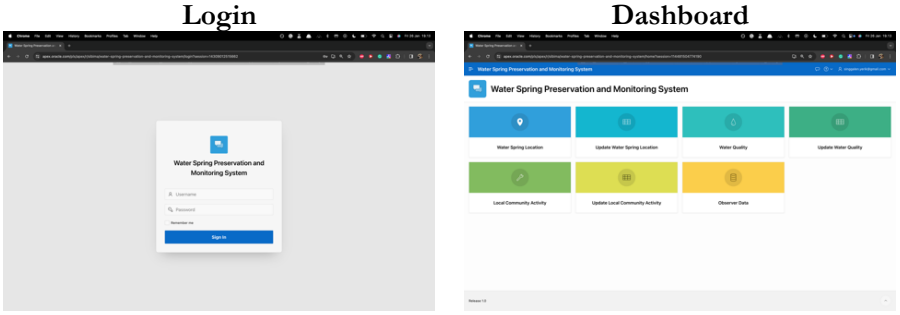


**Figure 4.** Login Page and Dashboard of Natural Spring Water Preservation and Monitoring System

The natural spring water preservation and monitoring application is designed exclusively for users, necessitating login credentials for accessing Create, Read, Update, and Delete data functionalities. Admin privileges are required to grant users access rights, with verified observers receiving their designated usernames and passwords. This approach ensures data security and integrity by restricting access to authorized personnel only, enhancing accountability, and facilitating

efficient management of water resource information. Consequently, implementing user authentication protocols underscores the commitment to maintaining confidentiality and safeguarding sensitive data within the application.

Researchers or non-government organizations can utilize the application to analyze data related to natural spring water locations, water quality, and local community activities surrounding natural spring water areas. Its multifaceted functionality enables comprehensive data analysis and facilitates informed decision-making processes for sustainable water resource management and community engagement initiatives. Thus, the versatility and accessibility of the application position it as a valuable tool for stakeholders committed to enhancing environmental stewardship and promoting the well-being of local communities reliant on natural spring water ecosystems [35].

Furthermore, this application can serve as a repository for data and information about natural spring waters in remote areas, facilitating the establishment of regulations for preservation and monitoring efforts. By consolidating diverse datasets and providing a centralized platform for data storage and analysis, the application enhances the capacity of regulatory bodies and stakeholders to formulate evidence-based policies and interventions. Consequently, its role as a comprehensive data hub underscores its significance in advancing initiatives to safeguard water resources and promote sustainable development in remote regions.

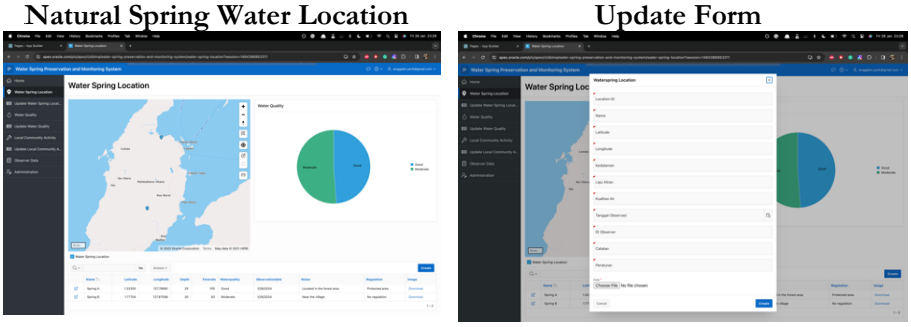


**Figure 5.** Natural Spring Water Location Page

The natural spring water location page configuration involves mapping the locations based on their coordinates alongside specific information regarding depth, flow rate, water quality, observation notes, surrounding area regulations, images, and observation dates. This comprehensive setup ensures a detailed depiction of each natural spring water's characteristics and environmental context, facilitating efficient data visualization and analysis. Such meticulous configuration

enhances the user experience and enables stakeholders to make informed decisions regarding water resource management and conservation efforts. Therefore, including diverse data elements on this page signifies its importance in providing a holistic understanding of natural spring water dynamics and supporting evidence-based decision-making processes.

The importance of mapping water spring locations lies in its crucial role in optimizing the monitoring process. Through accurate mapping, stakeholders can precisely identify the geographical distribution of water springs, facilitating efficient monitoring and assessment of their ecological status. Additionally, mapping enables the visualization of spatial relationships between water springs and surrounding environmental features, aiding in identifying potential threats and vulnerabilities. By leveraging mapping technologies like Geographic Information Systems (GIS), stakeholders enhance their understanding of water spring ecosystems and devise targeted conservation strategies. Thus, the meticulous mapping of water spring locations is essential for ensuring effective monitoring and sustainable management of water resources.

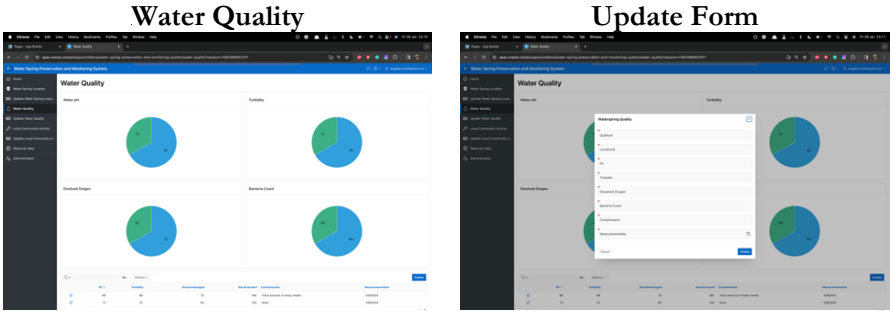


**Figure 6.** Water Quality Page

On the water quality page, the configuration includes information on water pH, turbidity, dissolved oxygen, bacteria count, contaminants, and measurement dates to analyze the water quality of the springs. This setup aims to provide a comprehensive overview of various parameters influencing water quality, thereby enabling thorough analysis and assessment of the health and suitability of the water sources. By incorporating such detailed information, stakeholders can gain valuable insights into potential environmental risks and take appropriate measures to preserve and manage water resources effectively. Hence, the water quality page configuration facilitates informed decision-making and promotes sustainable water management practices.

The significance of water quality data in the monitoring process cannot be overstated. As a fundamental component of environmental assessment and management, water quality data provides crucial insights into the health and safety of water resources. By systematically collecting and analyzing water quality parameters such as pH, turbidity, dissolved oxygen, and contaminants, stakeholders can assess the suitability of water for various purposes, identify potential pollution sources, and mitigate risks to public health and ecosystems. Moreover, water quality data is a cornerstone for evidence-based decision-making, enabling policymakers and resource managers to implement targeted interventions and regulatory measures to preserve and enhance water quality. Therefore, the comprehensive monitoring of water quality is essential for ensuring the sustainability and resilience of water ecosystems and safeguarding human well-being.

The challenge in monitoring water quality lies in the availability of resources and the consistency of measurements over time. While ensuring accurate and reliable data is essential for practical water quality assessment, limited resources and fluctuating measurement practices pose significant obstacles. Ensuring access to adequate funding, trained personnel, and advanced monitoring equipment is crucial for maintaining the consistency and reliability of water quality data collection. Additionally, establishing standardized protocols and quality assurance measures can help mitigate variability in measurement techniques and ensure the comparability of data over time. Addressing these challenges requires collaborative efforts between stakeholders, including government agencies, research institutions, and local communities, to develop sustainable monitoring programs prioritizing data quality and long-term monitoring objectives. Thus, overcoming the challenges in monitoring water quality necessitates proactive measures and strategic investments to enhance the reliability and effectiveness of water quality assessment efforts.

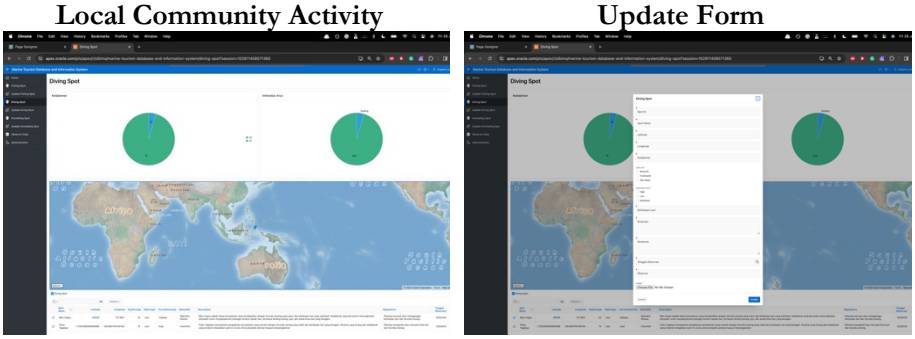


**Figure 7.** Diving Site and Update Form Page

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The local community activity page contains information regarding the name of the activity, location, description, organizer, and date, aimed at monitoring each activity around the natural spring water area. This comprehensive setup serves as a platform for documenting and tracking various community engagements and initiatives near natural spring waters, facilitating a better understanding of the interactions between local communities and water resources. By monitoring such activities, stakeholders can assess community involvement, identify potential environmental impacts, and implement targeted interventions to promote sustainable practices and community engagement in water resource management. Hence, diverse information on the local community activity page fosters environmental stewardship and promotes stakeholder collaboration for practical natural spring water preservation and management.

Regular monitoring protects the ecological conditions surrounding natural spring water areas from various detrimental activities, such as deforestation and soil excavation near natural spring waters. This proactive approach to monitoring serves as a crucial mechanism for identifying and mitigating potential threats to the ecological integrity of natural spring water ecosystems. By systematically assessing and addressing environmental risks, stakeholders can implement targeted conservation measures to safeguard natural spring water habitats' biodiversity and hydrological functions. Consequently, regular monitoring initiatives are pivotal in promoting the resilience and sustainability of natural spring water ecosystems amidst ongoing environmental challenges.

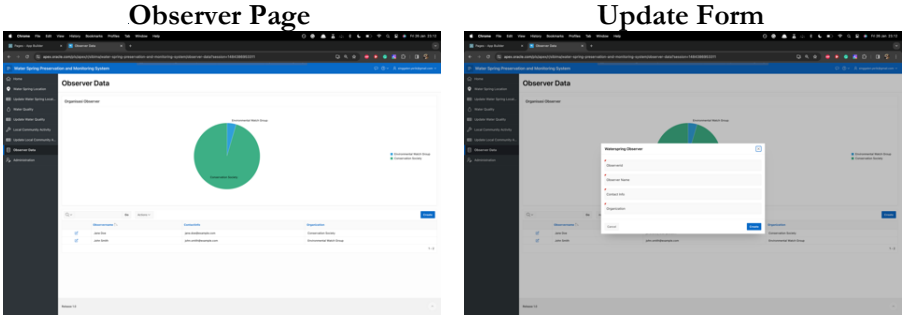


**Figure 8.** Observer and Update Form Page

Information about the data provider is also documented on the observer page to review observation performance based on affiliation. Therefore, this page contains details such as name, contact information in the form of email, and organization. This comprehensive setup facilitates accountability and transparency in data collection processes, allowing stakeholders to assess the reliability and credibility of observation data based on the affiliations of data providers. By documenting such information, the observer page enhances the quality and integrity of the observation data, thereby supporting informed decision-making and promoting

effective water resource management practices. Thus, including data provider details on this page underscores its significance in fostering trust and accountability within the monitoring and preservation framework.

The importance of observer information in the field verification process cannot be understated. As critical data collection and analysis stakeholders, observers are pivotal in providing firsthand accounts and context to validate field findings. Their observations and insights offer valuable perspectives that complement quantitative data, enhancing the credibility and reliability of field assessments. By documenting observer information, including their identity, contact details, and organizational affiliations, the verification process becomes more transparent and accountable, enabling stakeholders to assess the credibility of field observations and make informed decisions based on verified information. Therefore, integrating observer information into the verification process strengthens the integrity and trustworthiness of field findings, ultimately enhancing the effectiveness of environmental monitoring and management efforts.

The findings of this research indicate that the database and information system for documenting natural spring water data play a crucial role in policymaking for environmental protection in the surrounding areas. This assertion is supported by the comprehensive documentation and analysis of natural spring water-related information, which enables policymakers to formulate evidence-based policies and interventions to preserve the ecological integrity of natural spring water ecosystems. By leveraging the insights the database and information system provides, stakeholders can make informed decisions to mitigate environmental threats and promote sustainable management practices. Consequently, establishing robust data documentation mechanisms is a cornerstone for effective policy development and environmental conservation efforts to safeguard water resources and surrounding ecosystems.

## 4. CONCLUSION

Based on the outcome of designing the natural spring water preservation and monitoring system application using RAD through Oracle Apex, the significance of documenting natural spring water locations, water quality, local community activities, and observers becomes evident. This observation is underscored by the comprehensive functionalities incorporated within the application, allowing for the systematic collection, storage, and analysis of critical data about natural springwater ecosystems. Using RAD methodology and the Oracle Apex platform, stakeholders can access and interpret valuable insights from the documented information, facilitating informed decision-making processes and proactive measures toward water resource conservation and sustainable management. Hence, the emphasis on documentation within the application framework

underscores its pivotal role in advancing efforts to preserve natural spring water ecosystems and promote environmental stewardship.

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