

MEASURES TO IMPROVE THE RECLAMATION CONDITION OF THE LOWER ZARAFSHAN NATURAL-GEOGRAPHICAL DISTRICT

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Abstract: *This article scientifically analyzes measures to improve the reclamation condition of the Lower Zarafshan natural-geographical district. The reclamation status of the region is a complex system directly related to irrigation water requirements, soil salinization, groundwater mineralization, drainage system efficiency, and irrigation infrastructure. The article examines methods for improving reclamation conditions through water resource management, drainage system modernization, soil restoration, and socio-technological measures. Statistical data, scientific research, and national accounting are analyzed, providing recommendations for stabilizing the agrarian potential of the region.*

Keywords: *Lower Zarafshan, reclamation, soil salinization, groundwater, drainage system, irrigation, water-saving technologies, agrarian development, ecological sustainability.*

**QUYI ZARAFSHON TABIIY-GEOGRAFIK OKRUGI MELIORATIV
HOLATINI YAXSHILASH CHORA-TADBIRLARI**

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Annotatsiya: *Ushbu maqolada Quyil Zarafshon tabiiy-geografik okrugi meliorativ holatini yaxshilash chora-tadbirlari ilmiy jihatdan tahlil qilinadi. Hududning meliorativ holati sug‘orish suvi talablari, tuproq sho‘rlanishi, yer osti suvlarining mineralizatsiyasi, drenaj tizimi samaradorligi va sug‘orish infratuzilmasi bilan bevosita bog‘liq murakkab tizimdir. Maqolada suv resurslarini boshqarish, drenaj tizimini modernizatsiya qilish, tuproqni tiklash va ijtimoiy-texnologik tadbirlar orqali meliorativ holatni yaxshilash usullari o‘rganiladi. Statistik ma‘lumotlar, ilmiy tadqiqotlar va milliy hisob-kitoblar tahlil qilinib, hududning agrar salohiyatini barqarorlashtirish bo‘yicha tavsiyalar beriladi.*

Kalit so‘zlar: *Quyil Zarafshon, melioratsiya, tuproq sho‘rlanishi, yer osti suvlari, drenaj tizimi, sug‘orish, suvni tejash texnologiyalari, agrar rivojlanish, ekologik barqarorlik.*

МЕРОПРИЯТИЯ ПО УЛУЧШЕНИЮ МЕЛИОРАТИВНОГО
СОСТОЯНИЯ НИЖНЕГО ЗАРАФШАНА

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Аннотация: В данной статье научно анализируются меры по улучшению мелиоративного состояния Нижнего Зарафшана. Мелиоративное состояние региона представляет собой сложную систему, напрямую связанную с потребностями в оросительной воде, засолением почв, минерализацией подземных вод, эффективностью дренажной системы и ирригационной инфраструктурой. В статье рассматриваются методы улучшения мелиоративного состояния через управление водными ресурсами, модернизацию дренажной системы, восстановление почв и социально-технологические меры. Анализируются статистические данные, научные исследования и национальная отчетность, а также даются рекомендации по стабилизации аграрного потенциала региона.

Ключевые слова: Нижний Зарафшан, мелиорация, засоление почв, подземные воды, дренажная система, орошение, водосберегающие технологии, аграрное развитие, экологическая устойчивость.

The Lower Zarafshan natural-geographical district is located in the desert zone of Uzbekistan, encompassing the Bukhara and Qorako‘l oases. The reclamation condition of the region is a complex system directly related to irrigation water demand, soil salinization, groundwater salinity, drainage system efficiency, and irrigation infrastructure. The flow of the Zarafshan River depends on geographical conditions and seasonal dynamics. In the upper reaches, the average flow is 1,155 m³ per second, but in the lower reaches, especially in the Lower Zarafshan district, the volume of water significantly decreases due to usage, reaching only 10–15 m³ per second. This situation leads to a shortage of water for irrigation systems while simultaneously increasing the demand for intensive irrigation in the region. A large portion of water in the upper reaches is consumed by agriculture, industry, and other consumers upstream, while only a small fraction reaches the lower reaches, making it one of the main factors causing soil salinization. According to 2025 statistics, 35–40% of the soil area in the Lower Zarafshan district is salinized, with 10–12% of the territory experiencing very high salinity levels, negatively affecting the agrarian potential. Without reclamation measures, these processes reduce soil fertility, degrade land resources, and exacerbate socio-economic problems, as farmers earn less due to reduced yields and competition for water resources increases.

In the Lower Zarafshan region, groundwater depth and salinity are among the most important indicators determining reclamation conditions. The average depth of groundwater

in the Lower Zarafshan is 0.5–1.0 meters, with some areas experiencing very shallow levels near the surface. Groundwater mineralization is high, sometimes reaching 15 grams of dissolved salts per liter. This high degree of salinity disrupts the soil’s mineral balance, increases the concentration of harmful ions, and negatively affects crop root development. Statistical data show that in areas with high groundwater salinity, crop yields decrease by 25–30% compared to normal areas. This significantly impacts the profitability of agricultural production and creates economic difficulties for local residents, especially small-scale farmers.

To improve reclamation conditions, numerous integrated measures have been developed in the Lower Zarafshan region, including the optimization of water resource management and efficient water use. By implementing water-saving irrigation technologies, water consumption can be significantly reduced, and soil salinity can be prevented. For example, drip irrigation systems reduce water consumption by approximately 30–35%, increasing efficiency compared to traditional canal irrigation.

Currently, drip and sprinkler irrigation systems are being implemented in the region, allowing efficient management of water resources and preventing excessive soil moisture from causing salinization. Additionally, scientific projects are being carried out to plan water distribution in the Zarafshan River and monitor it in real time. These projects measure river flow using smart monitoring sensors and record data in statistical databases, optimizing water allocation.



Figure 1. Melioration measures

Source: <https://arxiv.uz/uz>

Drainage systems play a key role in improving reclamation conditions in the Lower Zarafshan. Directing groundwater through drainage and removing excess groundwater, as well as increasing the depth of drainage channels, can slow the soil salinization process. The modernization of additional drainage networks has increased the efficiency of the drainage system from 65% to 72% according to 2025 statistics, indicating a positive trend in preventing soil salinization. Drainage networks in the Zarafshan district—such as the

Dengizko‘l, Northern Bukhara, and Qorako‘l networks—play a crucial role in removing excess groundwater from the soil, reducing soil salinity and restoring land fertility. Statistical indicators show that improving drainage systems enhances the hydro-technical condition of the soil, thereby increasing the efficiency of land use.

Soil restoration and the maintenance of its biogeochemical health are also integral parts of the reclamation strategy. The addition of organic matter—such as compost, humus, and other biological fertilizers—improves the soil’s water retention capacity by approximately 15–20%, enhances soil structure, and slows erosion processes. Chemical amendments, such as gypsum or calcium nitrate, are applied to manage soil pH and salinity. Bioremediation approaches using soil microorganisms are also employed to biologically rehabilitate saline soils, representing an innovative approach to restoring ecological balance.

To monitor reclamation conditions in the Lower Zarafshan region, geoinformation systems and remote sensing technologies are used to create soil salinization maps, analyze groundwater distribution, and evaluate the condition of drainage networks with statistical data. For example, in 2025, statistical results showed that the proportion of salinized soil decreased from 35–40% to 32–34%, drainage system efficiency reached 72%, the area under water-saving irrigation increased from 29% to 37%, and the average groundwater depth rose from 1.2 to 1.3 meters. These figures demonstrate the positive impact of integrated reclamation measures. Statistical analyses, soil salinity indices, and water resource data are collected according to international standards and incorporated into the national accounting system.

Socio-economic measures are also a critical part of the reclamation strategy, as local residents must actively participate in reclamation works, implement new technologies, and acquire the necessary knowledge to use them effectively. Training programs are conducted for farmers on water-saving irrigation methods, and modern agrarian technologies are taught and incentivized. Financial incentives, such as subsidies or tax benefits, are provided to farmers who adopt water-saving technologies, optimizing overall water distribution and improving reclamation conditions. Social statistical surveys are conducted among the local population to gather opinions on the use of reclamation resources, and the results are used to evaluate the effectiveness of measures.

When implemented as a comprehensive package, measures to improve the reclamation condition of the Lower Zarafshan natural-geographical district reduce soil salinization, increase drainage efficiency, and optimize water resource use, thereby stabilizing the agrarian potential of the region. Statistical data, water-saving technologies, drainage modernization, soil restoration methods, and socio-economic incentives collectively contribute to a significant improvement in reclamation conditions.

In this way, scientifically grounded and statistically supported measures represent a key strategy for the sustainable agrarian development and reclamation potential of the Lower Zarafshan natural-geographical district.

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