**Terms of Reference**

**THE CONSULTANCY SERVICES AND DESIGN REVIEW,**

**CONTRACT MANAGEMENT AND CONTRACT SUPERVISION OF RECONSTRUCTION OF IRRIGATION CANALS**

**UNDER**

**Climate Resilient Water Resources Development Project (Phase1)**

**Mode of Financing: Service Installment Sale, Loan and Grant**

**Project ID No: KAZ 1030**

# **Background**

**The Government of Kazakhstan has received the financing from the Islamic Development Bank (IsDB) to support improvement of water resources management. The proposed Program aims to improve water resources management in 9 regions of Kazakhstan and city of Astana. The estimated cost of the program is approximately US$1.150 billion, which is proposed to be implemented in two stages, with approximately equal amount in terms of financing. The IsDB financing will cover the First Phase of the Program titled Climate Resilient Water Resources Development Project Phase-1 (KAZ1030).**

**Project objectives and the Scope of Climate Resilient Water Resources Development Project**

1. **Project Objective:** The development objective of the Project is to improve agricultural productivity, ensure food and water security for vulnerable communities, and build resilience to natural hazards and climate change impacts. This will be achieved through the construction, modernization and rehabilitation of agricultural water infrastructure that would be resilient to climate variability and extreme weather events. The project also aims to enhance institutional capacity in the water sector and mainstream advanced technologies and digitization for improved water resources management and decision-making process.
2. **Key Results:** The project will finance construction and rehabilitation of 11 seasonal water storage and flood regulation reservoirs, rehabilitation and modernization of approximately 3,400 km irrigation networks, including partial automation and digitization of operation of the infrastructure and rehabilitation of approximately 100 km long section of Esil river channel for improvement of water supply. As a result, it is expected that water storage capacity for irrigation will be increased by approximately 330 million m3, two major flood control regulators will be retained to the original design capacity of water storage in the amount of 3,775 million m3, and water loss in irrigation canals will be decreased by an average 25%. This will allow to sustainably irrigate over 350,000 hectares of agricultural land and hence boost agriculture production. The local communities will enhance their resilience to disasters and negative impacts of climate change such as flooding and drought. Indicators will be further validated at project start-up stage.
3. **Project locations:** Seven (7) regions (oblast) will be covered under Phase-1 that includes Kyzylorda, Turkestan, Zhambyl, Zhetysu, Almaty, Karaganda, Western Kazakhstan regions. Moreover Astana – capital city will benefit from improved water conveyance to the Astana reservoir.
4. **Project Scope:** The project activities are grouped into the following components: (A) Climate Resilience Water Infrastructure Developed, (B) Automation Center for Advanced Water Management Established, and O&M Capabilities Enhanced, (C) Institutional Capacity Developed, Technology, and TVET in Water Management Mainstreamed, (D) Feasibility Studies and Engineering Designs for Phase-2 Prepared, (E) Project Management & Implementation Support, (F) Audit Services, and (G) Contingency for Emergency Support.

# **GENERAL**

The Climate Resilient Water Resources Development Project Phase-1 (hereafter Project) is aimed at the construction and reconstruction of irrigation channels, including:

## **Irrigation System Restoration in Zhambyl Region (Administrative Center is Taraz)**



**Irrigation system restoration in** the region of **Zhambyl will cover 74 canal projects**, in which **24 canals** are **in Lot** 1 (Shu District), **21 canals** are **in Lot 2** (Shu District), **18 canals** are **in Lot 3** (Baisac District), and **11 canals** are **in Lot 4** (Sarysu District).

1. * 1. Lot 1: Shu District, Zhambyl Region. (24 canals)

In order to improve the condition of water management infrastructure, irrigation networks in the Shu district of the Zhambyl region will be rehabilitated. Under the “Climate-Resilient Water Resources Development Program,” a total of 45 projects from the Shu district of the Zhambyl region have been included. These projects are divided into two separate groups (lots).

The by the first lot — the Right-Bank Main Canal — consists of 24 irrigation off-take canals. The total length of the canals under this lot is 183.46 km, and the total irrigated area amounts to 32,526 hectares.

As part of the Irrigation Infrastructure Rehabilitation Program in the Shu District of the Zhambyl Region, by the first lot (Right-Bank Main Canal) consists of 24 irrigation off-take canals, with a total projected length of **183.46 km**. The primary construction material used for most canals is **monolithic reinforced concrete with a 0.5 mm geomembrane lining**, which ensures durability and watertightness. In several canals, **modern polyethylene pipelines (PE100 SDR26, Dn=1000 mm)** are also used to enhance reliability and reduce water losses.

Among all the facilities, the key ones include:

* **Tasotkel Main Canal (TMK)** — length of 39.26 km, irrigated area of 16,536 ha, discharge capacity of 30 m³/s;
* **PMK Canal** — length of 46.71 km, irrigated area of 6,626 ha, discharge capacity of 11 m³/s;
* **R-1 Canal** — 13.74 km long, irrigated area of 2 166 ha.

The **total irrigated area** serviced by the rehabilitated canals exceeds **32,000 hectares**, which will significantly improve the **water supply for agricultural land**, boost crop productivity, and strengthen the **resilience of the agricultural sector** in the face of climate change.

As a result of the implementation of these projects, the following outcomes are expected:

* increased efficiency in the use of water resources;
* reduced water losses during transportation;
* improved agricultural production conditions;
* enhanced regional resilience to drought and climate risks.
  + 1. Lot 2: Shu District, Zhambyl Region. (21 canals)

As part of the project for the rehabilitation, modernization, and construction of irrigation networks, large-scale activities are planned in the Zhambyl Region, particularly in the Shu District. In total, **21 irrigation canals** are scheduled for reconstruction under the **Left-Bank Main Canal (LBMC)**.

The **total length of the canals exceeds 88.2 km**, and the **serviced irrigated area is more than 14,000 hectares**. The primary construction type for all canals is **monolithic reinforced concrete lining with a thickness of 12 cm**, placed over a **waterproof geomembrane of 0.5 mm**, which significantly enhances the canals’ water retention capacity and durability.

**Key features of the project include:**

* A high degree of standardization in construction materials and design solutions;
* A wide coverage of agricultural lands in a region with strong farming potential;
* Inclusion of both large-scale canals (e.g., LBMC — 37.685 km) and smaller but functionally significant canals (ranging from 0.2 to 7 km in length);
* The use of modern technologies aimed at reducing water loss, increasing water supply reliability, and improving the agricultural sector’s resilience to climate stress.

**Expected outcomes of the program implementation:**

* Improved water availability for agriculture;
* Increased productivity of cultivated lands;
* Enhanced irrigation infrastructure aligned with climate challenges;
* Sustainable socio-economic development of the Shu District.
  + 1. Lot 3: Baizak district, 18 project

The Baizak District is undergoing significant irrigation infrastructure rehabilitation, encompassing **18 distinct canal repair and reconstruction projects** across various rural districts. These projects collectively aim to **restore, modernize, and enhance irrigation services** across approximately **5,300 hectares of agricultural land**, thereby improving water efficiency, reducing losses, and boosting agricultural productivity.

The canals vary in scale, with lengths ranging from 1.4 km to over 12 km, and capacities from 0.2 m³/s up to 1.7 m³/s. The works include monolithic reinforced concrete lining, installation of prefabricated concrete flumes (trays), construction of hydraulic structures, and vegetation clearance.

**Typical Construction Works**

Each project includes some or all of the following:

* Canal Lining: Many canals are being converted from earthen channels into lined canals using monolithic reinforced concrete (grades like C12/15 or C16/20) or prefabricated reinforced concrete flumes (e.g., Lr-6, Lr-8, Lr-10). This prevents water loss through seepage.
* Hydraulic Structures:
  + Headworks and Water Intakes: Installed at the start of most canals for regulated water diversion.
  + Water-Measuring Posts: Hydrometric bridges are added to monitor flow and distribution.
  + Water Outlets: Placed at regular intervals for field irrigation; often equipped with regulating gates (e.g., GS100-150).
  + Pipe and Bridge Crossings: Designed to allow uninterrupted road and water traffic.
  + Turn Wells and Distribution Units: Facilitate water redirection into sub-canals or adjacent fields.
  + End Structures: Built at canal termini to ensure safe water discharge and erosion protection.
* Vegetation and Obstruction Removal: Mechanical removal of trees, bushes, and reed vegetation is done before construction to ensure clear access and long-term canal operability.

**Geographic Distribution and Scope**

* **Myrzatai Rural District**: 5 projects including *Nazarbek-2*, *Zhana-1*, *Akberdi*, and *Tleubolat-4*, featuring extensive canal reconstruction using both flumes and concrete linings.
* **Botamoynak Rural District**: 2 canals (*R-9* and *Akkoyly*) divided into multiple branches with reinforced trays and complex distribution structures.
* **Tuymekent Rural District**: 3 projects (*Sapak*, *Syrgabai*, *Tapan*) with medium-scale capacity upgrades and multiple outlet types.
* **Sukhanbaevsky & Ynttymak Districts**: 4 projects (*Baibek*, *Kokozek*, *R-2*, *R-4*) featuring full channel replacement, extensive pipe crossings, and well-equipped distribution infrastructure.
* **Koktal & Ulgilinsky Districts**: Major projects (*Aulie-Ata Kus canals*, *Karazhota*) with long distances, aqueducts, and high-volume reinforced lining.
* **Sarykemer District**: The *Novo-Mikhailovsky* project consists of **three interconnected canals**, with diverse structural interventions including full replacement of canal bodies and all associated infrastructure.
  + 1. Lot 4: Sarysu District, 11 Projects

The Sarysu District canal rehabilitation initiative covers 11 irrigation canals across the rural areas of **Baikadam**, **Zhanatalap**, and **Zhaiylminsky**, totaling **72.537 kilometers** in length. This large-scale effort is designed to improve the efficiency, reliability, and sustainability of water delivery systems vital for agricultural production.

**Key Interventions and Engineering Achievements:**

* Structural Modernization: Existing damaged or outdated concrete linings (e.g., G-10.30-2, G-15.30-2, LR-10, PD9-6) were replaced with new prefabricated or monolithic reinforced concrete structures, often enhanced with steel reinforcement (ø6–ø10 mm) and CRM (concrete repair mortar).
* Waterproofing and Durability Enhancements: Application of poroizol membranes or rubberized waterproofing layers to reduce infiltration losses and prolong service life.
* Hydraulic Infrastructure Upgrades: Installation of sluices, hydroposts, road bridges, and in some cases, pipeline segments improved water control, operational safety, and versatility.
* Earthworks and Foundation Preparation: All projects included excavation, bottom leveling, gravel-sand bedding, and compaction to ensure stability of canal structures.
* Environmental Measures: Systematic removal of overgrown vegetation and trees (≥32 cm diameter) was conducted, with graded or asphalted access roads constructed to facilitate future maintenance and inspection.

**Innovative and Unique Features:**

* The Dyuker Canal included horizontal directional drilling (HDD) and installation of modern polyethylene pipelines (ø800 mm)—a rare use of trenchless technology in regional irrigation.
* The Saryozek Canal utilized GOST-standard LR-10 parabolic trays and P9-6 base plates, showcasing the integration of Soviet-era standards with modern materials.
* Several canals such as Bayshahan and Kedey featured hybrid construction, combining monolithic and prefabricated components for optimal performance and cost-effectiveness.

**Overall Impact:**

* Increased canal efficiency, reducing water losses through seepage and enhancing flow regulation.
* Extended infrastructure lifespan through robust materials and modern construction practices.
* Improved resilience to environmental wear and structural fatigue.
* Boosted agricultural productivity and water security for local communities.
* Alignment with national and regional water management strategies, promoting sustainability and rural development.

## **Irrigation System Restoration in Zhetisu and Almaty Regions (Administrative Center of Zhetisu is Taldykorgan and Administrative Center of Almaty is Konaev)**





**Irrigation system restoration in** the regions of **Zhetysu and Almaty will cover 2 canals projects**, in which **1 canal is in Lot** 1 (Koksu district), **1 canal** is **in Lot 2** (Almaty District).

* + 1. Lot 1: Koksu District, Zhetysu Region. (1 canal), II Stage

The Stage II reconstruction project in Koksu District (Zhetisu Region) is part of a broader initiative to restore degraded irrigation infrastructure and reintroduce previously abandoned agricultural lands into productive use. The project encompasses a complex of works across **more than 40 irrigation canals**, totaling over **160 km** in length, including both **main canals** (e.g., Bakytzhan, Syrt-Togan, Orta-Togan) and **distribution networks** (e.g., Akshatogan, Nurabay, Orta-Aryk, R-1 to R-11).

Key components of the project involve **dismantling outdated concrete linings**, **reconstructing canal beds with reinforced concrete blocks and trays (e.g., G-15, LR-8)**, and **installing new water regulation infrastructure**. This includes **hundreds of hydraulic structures** such as water intake points, water outlets, rotary wells, hydroposts, and road crossings. Several canals—like R-6 and R-10—also include sub-branches with significant rehabilitation needs.

Most canals currently suffer from **heavy siltation (30–40%)**, **collapsed or cracked concrete elements**, and **malfunctioning gates and regulators**, resulting in inefficient water use and reduced irrigated areas. Water distribution structures along key canals like Bakytzhan and R-10 are being completely rebuilt to meet technical standards.

The water sources for the system include the **Koksu River and the Big River**, with flow managed through key intake points like the **Left Bank Main Canal (Levoberezhny MK)**. The project includes rehabilitation of these main structures to ensure stable water delivery.

Overall, this reconstruction effort aims to:

* **Increase water supply reliability**
* **Improve irrigation efficiency**
* **Reduce water losses due to seepage and structural failure**
* **Extend the operational life of the irrigation infrastructure**
* **Revive large areas of previously abandoned farmland**

The project reflects a comprehensive approach to sustainable water resource management and agricultural revitalization in the Koksu district.

* + 1. Lot 2: Teskensu Village, Yenbekshikazakh District, Almaty Region (1 canal)

The project focuses on the rehabilitation and modernization of a 3.7 km section of the pasture irrigation canal in **Teskensu village**, sourced from the **"BAK" main canal** with a design water intake of **3.2 m³/s**. The canal currently exists as an unlined earthen channel, which has resulted in erosion and reduced efficiency. The irrigated area covers **272 hectares**, mainly supporting cereal cultivation.

To improve water conveyance and reduce losses, the design includes the construction of a precast reinforced concrete flume system (LR-10), with a new water intake structure, monolithic reinforced concrete inlet and outlet elements, and erosion protection measures such as stone riprap and cutoff walls.

Key hydraulic and structural components include:

* Tubular water outlets (ПК 1+23, ПК 3+39, ПК 7+02, ПК 26+48)
* Three road crossings with reinforced concrete pipes (ПК 5+27, ПК 17+04, ПК 17+74)
* Crossing over the Koram canal using precast ZP 19.100 segments
* One distribution structure at ПК 17+21
* 18 turning manholes
* Three hydraulic posts for monitoring (ПК 1+00, ПК 15+61, ПК 18+34)
* Pedestrian crossings using monolithic bridge slabs

The construction involves:

* Reinforced concrete flumes and chambers (concrete grade B22.5, W6 waterproofing, F100 frost resistance)
* Gabion removal and replacement with portal walls to address erosion
* Sealing and compaction works around all pipe crossings
* Waterproofing, mastic applications, and asphalt surfacing at the Koram canal crossing

Upon completion, the project will ensure reliable and erosion-resistant water delivery to pastures, significantly improving irrigation efficiency and water control for local agricultural needs.

## **Irrigation System Restoration in Kyzylorda Region (Administrative Center is Kyzylorda) and West Kazakhstan Region (Administrative Center is Ural)**

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**Irrigation system restoration in** the regions of **Kyzylorda and West Kazakhstan will cover 8 canal projects**, in which **7 canals are in Lot** 1 (Kyzylorda Region) and, **1 canal** is **in Lot 2** (Tashalinsky District, West Kazakhstan Region).

* + 1. Lot 1: Aral, Kazalinsky, Syrdarya, Shilei Districts, Kyzylorda Region (7 canal)

Kyzylorda Region includes seven major irrigation canal repair and rehabilitation projects aimed at improving water availability, agricultural productivity, and environmental sustainability across Aral, Kazaly, Syrdarya, and Shieli districts. The primary focus is on restoring deteriorated canals and associated hydraulic structures to ensure efficient and reliable water delivery for irrigation and livestock needs. Common works across all projects include mechanical cleaning of canals, major repair or replacement of intake and regulation structures, installation of reinforced concrete linings, sluice gates, and screw hoists, construction of culverts and hydrometric posts, clearing vegetation, and reshaping and leveling canal beds. The Kara-Aryk Canal in Aral District covers 34.6 km and involves the repair of six concrete structures with standard twin-pipe designs. The Nartai Canal in Kazaly District spans 15.2 km, divided into four segments with consistent hydraulic parameters and a flow capacity of 5.0 m³/s. The Ishki Canal, also in Kazaly, measures 25.1 km and includes the repair and construction of regulating structures using rectangular concrete conduits. The Dauren Canal in Syrdarya District, at 11.7 km, features full cleaning, repair of five regulating structures, and 41,533 m³ of soil removal. The Yeski Bostandyk Canal, 10.5 km long, involves repair of intake, culverts, and a regulating structure to support local irrigation. The Kumzhargan Canal in Shieli District, 28.2 km in length, includes complete canal restoration with stone riprap, operational road construction, installation of 20 twin-barrel outlet structures, culverts, and a hydrometric post. The Bazar-Aryk Canal, 5.0 km long, is being fully lined with 15 cm thick monolithic reinforced concrete with reinforced steel mesh, involving precise formwork, compaction, and waterproofing. Together, these projects are expected to enhance water use efficiency, restore irrigated land productivity, and improve rural water infrastructure resilience in the Kyzylorda Region.

* + 1. Lot 2: Tashalinsky District, West Kazakhstan Region (1 canal)

The reconstruction of the **Zhaykbay irrigation canal** in the **Taskalinsky district** is aimed at restoring the functionality of a key **pasture irrigation system** originally built in the 1970s. The canal, **41.75 km** in length, draws water from the **Kirovo-Chizhinsky canal**, which is fed by the **Kirov Reservoir** and serves pasturelands across three rural districts (Kazakhstan, Chizhinsky, and Mereke).

Currently, the system suffers from severe deterioration: **regulating structures are non-operational**, **ponds are silted**, and **canal embankments are damaged or overgrown**, rendering the canal unable to provide adequate water supply for livestock during the dry season. Only one intake structure remains in working condition.

To rehabilitate the system, the project includes:

* Full mechanical **clearing and re-profiling** of the canal along 41.75 km;
* **Reconstruction of 7 regulating structures** and construction of **16 new water outlets** to pasture ponds;
* **Construction of floodplain spillways**, a **siphon crossing**, and a **hydrometric station**;
* **Cleaning of selected pond excavations** and inflow canals in each rural district;
* **Reconstruction of an 8.8 km canal section** in the Jumala area.

This initiative will **restore water delivery**, **ensure seasonal pond filling**, and **support sustainable livestock grazing** by improving access to reliable water sources.

## **Irrigation System Restoration in Turkistan Region (Administrative Center is Turkistan)**

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**Irrigation system restoration in** the region of **Turkestan will cover 10 canal projects**, in which **5 canals** are **in Lot** 1 (Arys City), **4 canals** are **in Lot 2** (Shardara District) and, **1 canal** is **in Lot 3** (Otyrarsky District).

* + 1. Lot 1: Arys City, Turkestan Region (7 canals)

The five irrigation rehabilitation projects in Arys City, Turkestan Region, aim to modernize and enhance the efficiency of a complex network of main and secondary canals spanning over 65 kilometers. These works cover rural districts such as Zhideli and Baiyrkum and include the capital repair, reconstruction, and overhaul of canal systems like 3-K-1, 3-K-2, 3-K-3, BK-1, BK-1A, and their extensive branch networks (e.g., BK-1-1 to BK-1-5, BK-2-1 to BK-2-5, BK-4 and its branches, and BK-5, BK-6 systems). Across all projects, a total of 2,412 hectares of irrigated land will benefit from improved water delivery and management. The canals are primarily supplied from the Kyzylkum Main Canal, with head discharge capacities ranging from 0.57 m³/s to 3.0 m³/s depending on the segment. Rehabilitation works include extensive earthworks (excavation, leveling, compaction), canal lining with monolithic reinforced concrete over 0.5 mm waterproof geomembrane, and the reconstruction of over 500 hydraulic structures such as water intakes, outlets, siphons, culverts, turning and terminal wells. The projects aim to increase water conveyance efficiency from pre-repair values of 0.58–0.65 to 0.90 post-rehabilitation. The systems are categorized as Class IV irrigation structures with Level II complexity, in line with national construction norms (SN RK 3.04-11-2019). They support the irrigation of agricultural crops including maize, melons, wheat, and alfalfa, and involve a workforce of over 80 specialists. The combined outcome of these initiatives will ensure reliable and efficient water distribution for agricultural needs, mitigate water losses, and improve the sustainability of the irrigation infrastructure in Arys City.

* + 1. Lot 2: Shardara District, Turkestan Region (4 canals)

The four irrigation infrastructure rehabilitation projects in the Shardara district of Turkestan Region are aimed at restoring and enhancing the performance of key canal systems that collectively support over **3,571 hectares** of irrigated land. The total length of the canal networks under these projects exceeds **51.25 kilometers**, and the works include extensive lining, earthworks, and the repair or reconstruction of over **325 hydraulic structures**. All canals source water primarily from the **Kyzylkum Main Canal** or the **Shardara Main Canal**, and are designed to irrigate agricultural crops such as maize, melons, wheat, and alfalfa.

The **first project**, covering canal **1-K-2 and its branches** in Dostyk village, rehabilitates **20.609 km** of canals with a design capacity of **3.0 m³/s**, serving **1,596 hectares**. It involves **162 hydraulic structures** and aims to increase water use efficiency from **0.65 to 0.90**.

The **second project**, focused on canals **4-K-1-1 through 4-K-1-4** in Akshengeldy village, rehabilitates **21.162 km** of canal with a capacity of **0.9 m³/s**, currently irrigating only **542 hectares** out of **1,355 hectares** due to system degradation. The project will restore full capacity and is expected to save **3.5 million m³** of water annually, increasing efficiency to **0.90**.

The **third project** targets the **RSh-2 canal**, which is **4.461 km** long, with a design discharge of **1.3 m³/s**, irrigating **360 hectares**. It includes the repair of **40 hydraulic structures** and aims to raise efficiency from **0.65 to 0.91**.

The **fourth project** addresses canals **RS-2-1 and RS-3** in the K. Turysbekov rural district, with a combined length of **5.015 km** and design discharges of **1.0 m³/s** and **0.8 m³/s**, respectively. These canals serve **260 hectares** of land and involve **83 hydraulic structures**. Post-rehabilitation water use efficiency is expected to reach **0.95**, the highest among the four projects.

All canal systems are classified as **Class IV** and fall under **Level II technical complexity**, complying with SN RK 3.04-11-2019 standards and national guidelines. Collectively, these projects will restore degraded irrigation infrastructure, increase agricultural productivity, reduce water losses, and significantly enhance irrigation water management across the Shardara district.

* + 1. Lot 3: Otyrar District, Turkestan Region (1 canal)

Reconstruction of the inter-farm canal named after D. Altynbekov from ПК246+80 to ПК354+00 in Kargaly rural district, Otyrar district, Turkistan region.

**Location:** Republic of Kazakhstan, Turkistan Region, Otyrar District, Kargaly Rural District.

**Project objective:** to increase the canal’s throughput capacity, improve its efficiency (coefficient of performance), and enhance water availability for existing irrigated lands.

**Canal purpose:** irrigation – supplying agricultural land with water.

**Cultivated crops:** vegetable and forage crops.

**Type of irrigation system:** open trapezoidal canal lined with monolithic reinforced concrete.

**Length of the reconstructed section:** 10.72 km (from ПК246+80 to ПК354+00).

**Irrigated area:** 4,400 hectares.

**Throughput capacity:** up to 5.0 m³/s.

**Canal efficiency (COP):** before reconstruction – 0.65; after reconstruction – 0.90.

**Seismicity of the area:** 8 points (MSK-64 scale).

**Class and responsibility level:** Class IV, Level II (normal).

# **OBJECTIVES OF THE ASSIGNMENT**

The overall objective of the assignment is to obtain consulting services to support and assist the Project Management Unit (PMU) for the timely and effective implementation of the Company's Project (as the ultimate asset owner), including design review, all aspects of procurement and payments, construction and installation, technical supervision, and environmental and social requirements. With the participation of a Consultant, the Company will have access to the best practices in the project implementation. The Consultant will assist in the procurement of works and goods in accordance with the procedures, specifications and documents of the Bank, local legislation and in accordance with all other agreements provided for in the financial agreement signed between the Islamic Bank and the Company.

## **SCOPE OF SERVICES**

In general, the Project implementation can be divided into two parts:

1. Task I –Design review. In case of additional work: development and approval of design and estimate documentation. Preparation of documentation for procurement; and

(ii) Task II - Contract management and construction supervision.

The Consultant's services will be directed to the implementation of measures to solve the following main tasks:

Task I:

* Make a review and give recommendations on the Project Procurement Plan, including the updating of the original estimates and the definition of priorities between the components of the Project.
* Make an overview of existing detailed projects to carry out work in accordance with Kazakhstan's building codes and procurement requirements for Works.
* Assist the Company in developing tender documents (including design, requirements and technical specifications, environmental and social requirements for contractors), conducting a tender, preparing an evaluation report and a contract, and submitting the necessary documents to the Company and the Islamic Bank for their approval and obtaining the status "No objections".
* Ensure full support for project management in the Company with the aim of harmonizing, managing, monitoring and evaluating all aspects of the Project.
* Preparation of the PMU proposals on possible ways to improve the overall, technical and financial parameters of the project.

Task II:

* Provide project management support to the Company for the purpose of harmonizing, monitoring, managing, monitoring and evaluating all aspects of the Project, including implementation, contract preparation and financial management, and implementation of the construction and installation program.
* Ensure that the Company makes payments to the Contractors, to which the payments were confirmed, in order to ensure that all such payments are made in a timely manner and that there are appropriate monitoring and accounting systems in place to ensure compliance with the requirements of the financiers and the reporting country.
* Provide assistance in supervising work and executing contracts.
* Provide assistance in the timely payment of contracts.

Both tasks:

* Ensure that all reports required by the Islamic Development Bank for the implementation of the Project and the loan are presented on the schedule.
* Prepare a comprehensive schedule of meetings on the progress of work with various parties; to attend meetings with the Company to support the implementation of the overall program as a whole, to respond to reports and discuss any is PMUs on a regular basis with the Company and other responsible parties; prepare and disseminate minutes of meetings, including follow-up activities necessary to ensure progress in the execution of work.
* Prepare a progress report on the implementation of the project in accordance with the approved periodicity.

The next five (4) packages (11 LOTS) are considered at the project preparation stage for an efficient construction process and general contract management:

1. **Package: Irrigation System Restoration in Zhambyl Region (4 LOTS)**
2. **Package: Irrigation System Restoration in Zhetisu and Almaty Regions (2 LOTS)**
3. **Package: Irrigation System Restoration in Kyzylorda and West Kazakhstan Regions (2 LOTS)**
4. **Package: Irrigation System Restoration in Turkistan Region (3 LOTS)**

## **Requirements Development**

Projects should be detailed enough to allow the procurement of works, and an accurate estimate of costs. Projects must provide details such as location, size, quantity, capacity, strength, equipment and work specifications. Project assumptions, the criteria used for development should be clearly documented.

All design specifications must be prepared in accordance with the requirements of the Law of the Republic of Kazakhstan and international standards, where appropriate. It is assumed that the Consultant will cooperate with local project organizations and ensure that the final project meets the requirements of local construction legislation. The Consultant will ensure continuous monitoring of design works, as well as quality control. The technical solutions of the Consultant should be based on the best international and national practices in the industry and innovative solutions.

## **Obtaining Permissions**

The Consultant undertakes to assist the Company, PMU, in supporting the obtaining of the necessary approvals and permits from state bodies for projects.

## **Authorization Procedures**

The consultant must identify and inform the PMU and the Company about initiating the procedure for any necessary local or national licenses, permits and other approvals, including, among other things, access to the site, construction permits, permanent and temporary work, as the case may be. In the event that the contractor is responsible for obtaining specific licenses or other permits, the Consultant should facilitate the process of obtaining them. In addition, the Consultant undertakes to ensure compliance with any current reporting requirements established by the PMU procedures.

## **Preliminary Briefing**

The consultant will prepare a general briefing on the contract. This briefing will be a memorandum for the Company and will contain any key or the outstanding issues that need to be taken into account in the implementation of the project.

# **REPORTING REQIREMENTS AND TIME SCHEDULE FOR DELIVERABLES**

## **General**

**The Consultant must prepare and submit the following reports and documents** in hard and digital format to the Client / PMU for each package:

|  |  |  |
| --- | --- | --- |
| **No** | **Conclusion/Report** | **Deadlines** |
| **A** | **Task-1: Review of Detailed Design, preparation o Detailed Engineering Design. Preparation of bidding documentation for Tender processes** | |
| **A1** | Initial Report | Within 30 days (One month) after the beginning of the assignment |
| **A2** | Design review: Technical Report, Detailed Engineering Design, Technical Specifications, Drawings, BoQ and Cost Estimates | The current documents should be acceptable to the Client |
| **A2.1** | Reconstruction of the Shusky District Canal Projects-Lot 1(Zhambyl region); | Within 30 days after the beginning of the assignment |
| **A2.2** | Reconstruction of the Shusky District Canal Projects-Lot 2(Zhambyl region); | Within 60 days after the beginning of the assignment |
| **A2.3** | Reconstruction of the Baizaksky District Canal Projects(Zhambyl region); | Within 90 days after the beginning of the assignment |
| **A2.4** | Reconstruction of the Sarysu District Canal Projects(Zhambyl region); | Within 120 days after the beginning of the assignment |
| **A3.1** | | | Reconstruction of the Arys District Canal Projects(Turkestan region); | Within 90 days after the beginning of the assignment |
| **A3.2** | | | Reconstruction of the Shardara District Canal Projects(Turkestan region); | Within 120 days after the beginning of the assignment |
| **A3.3** | | | Reconstruction of the Otrar District Canal Projects(Turkestan region); | Within 150 days after the beginning of the assignment |
| **A4.1** | | Reconstruction of the Kyzylorda District Canal Projects(Kyzylorda region); | Within 180 days after the beginning of the assignment |
| **A4.2** | | Reconstruction of the Tashalinsky District Canal Projects(West Kazakhstan region); | Within 210 days after the beginning of the assignment |
| **A5.1** | | Reconstruction of the Koksu District Canal Projects(Kyzylorda region); | Within 210 days after the beginning of the assignment |
| **A5.1** | | Reconstruction of the Embekshikazakh District Canal Projects(Almaty region); | Within 240 days after the beginning of the assignment |
| **A6** | | | Final option of design review and corrections: Technical Report, Detailed Plans, Specifications, Drawings, Cost Estimates | Within 15 days after receiving the revised the detailed design |
| **A7** | | | Draft Tender Documents: Announcement-Notification, Prequalification Documents | Within 15 days after completion of detailed design |
| **A8** | | | Final Tender Documents: Announcement-Notification, Prequalification Documents | Within 15 days after receiving comments on the tender documents project |
| **A9** | | | Evaluation Report of Tender Proposals | Within 15 days after the tender proposal’s submission deadline |
| **A10** | | | Draft contract with the contractor | after the approval of the Evaluation report of the tender proposals |
| **B** | | | **Task-2: Pre-construction and Construction Supervision** | |
| **B1** | | | Monthly Reports | ***Monthly progress reports***: The monthly progress reports shall state the status of project implementation (i.e., actual vs. planned physical progress; actual vs. planned expenditures), financial information, all agreed and all new variation and compensation events, all issues requiring client attention, environmental and social safeguards, health and safety information, and other information that may have an impact on project progress. The report shall include the Engineer’s opinion of the current physical progress, quality of works and future prospects on timely completion and costs. The report shall include a Gantt chart, a detailed works schedule with resources inputs, productivity rates and outputs for each works activity. It shall also include photographic evidence of progress. In addition, the report shall project cash flows and work progress over the next three months. |
| **B3** | | | Contract Completion Report | The completion report shall state the project scope, principal activities by the consultant and the contractor (including deployment of resources during project implementation), the contractor’s performance, all project relevant observations of the consultant, major issues that were encountered during project implementation and how these were solved, the project schedule citing all delays if any, and financial information. Most important, the substantial completion report shall include a list with all snags to be addressed during the Defects Liability Period, if any, and propose a time schedule for addressing the issues that have been identified |
|  | | | Operational Manual | The consultant shall ensure that suppliers / manufacturers / the contractor submit all operational manuals to the client in the formats and numbers of copies specified agreed at substantial completion. In addition, all equipment supplied including those from abroad shall be accompanied by warranties and guarantees for at least ten (10) years |
|  | | | As-Built Drawings | The supervision consultant shall submit all ‘as built drawings’ to the client in the format and numbers of copies specified at substantial completion |
|  | | | Asset register update | The supervision consultant shall collect data on all rehabilitated and new assets for updating the client’s asset register for each of the schemes. The software used for this purpose shall be agreed with the EA. Data on the location of all civil structures shall be handed to the client as in ArcView GIS, or a format agreeable to the EA |
|  | | | Safeguards Reports: | Shall state the periodic compliance to all legal, health, safety and all safeguards’ requirements. The evaluation of the ESMP shall be presented indicating the potential impacts and measures undertaken to mitigate or minimise their effects on a monthly basis and for the entire construction period |
|  | | | Incident Reports | The consultant shall be required to be part of the reporting of incidents to the EA. The Consultant shall provide immediate notification to the Client should any incident in the following categories occur while carrying out the Services. Full details of such incidents shall be provided to the Client within the timeframe agreed with the Client.   * + - 1. *confirmed or likely violation of any law or international agreement;*       2. *any fatality or serious (lost time) injury;*       3. *significant adverse effects or damage to private property (e.g. vehicle accident); or*       4. *any* *allegation of gender-based violence (GBV), sexual exploitation or abuse (SEA), sexual harassment or sexual misbehavior, rape, sexual assault, child abuse or defilement, or other violations involving children,*  1. *Ensure that contractor immediate notifications on ESHS aspects are shared with the Client immediately;* 2. *Immediately inform and share with the Client any immediate notification related to ESHS incidents provided to the Consultant by the Contractor, and as required of the Contractor as part of the Progress Reporting;* 3. *Share with the Client in a timely manner the Contractor’s ESHS metrics, as required of the Contractor as part of the Progress Reports.”* |
|  | | | Defect Liability Phase Reports |  |
|  | | | Quarterly progress reports | The interim progress report shall state progress of the contractor on addressing items on the snag list, all observations on the performance of the project installations, system weaknesses and defects, and warranty issues. In addition, the report shall report the consultant’s and / or the contractor’s progress on the undertaking of staff training. The reports shall also include progress on safeguard management including on provisions in abstraction and discharge permits and grievance management. |
|  | | | Completion Training Report | The completion of training report shall state the training obligations of the Consultant and the contractor, as agreed with the client, the type and duration of training activities undertaken, the number of participants in each training and their professional background, training outputs and achievements, as well as recommendations for further / continued training if any. |
|  | | | Final Completion Report, including the design modifications (detailed analysis) | The final completion report shall include the same type of information as outlined for the ‘substantial completion report’. In addition, it shall show the status of all outstanding actions that were to be completed during the Defects Liability Period |

All reports / outputs must be provided in English and Russian. Number of copies should be provided:

- Four (4) hard copies to the Client in the required languages (2 in English and 2 in Russian), as well as electronically in Acrobat or MS Word format;

## **Requirements for Reporting:**

Below is a recommended reporting plan, compiled on assignment. Other documents: design review and corrections and cost estimation, tender documents, evaluation report of tender proposals, EIA, EMP and others will be produced in a format acceptable for the Client and standard forms and templates of the IsDB, where applicable.

***а) Initial Report:***

The initial report of the work is developed to give the Client confidence that the implementation will be carried out in accordance with the plan and, as agreed in the contract. The report should inform the Client about the main problems that may affect the direction and progress of the work. The initial report sets out a strategy and work plan for the implementation of construction, as well as project management. It should be included in the design evaluation. Possible changes will be outlined and briefly described on a technical, economic, managerial and environmental basis using readily available and updated data. The preliminary report will also include work in Task I and construction works in Task II. As for Phase I, the report should be about the procedures and the grounds for the project work. It will tell about the expected duties and works at the construction site in conjunction with the equipment and facilities that they need. The results of design review and corrections will be outlined and the approach to the work will be prepared. The content of the tender documentation, the approach to the preliminary selection of contractors will be described. In the light of the above revised Work Plan, the works will be proposed (if necessary) together with the input of all international and national specialists and support staff. The initial report will include in full all the necessary work for the Task II, with a special emphasis on monitoring and quality of construction work.

***b) Monthly / Quarterly Reports:***

The reports will detail the progress of work achieved for each contract, highlighting any shortcomings, delays or other problems that may arise and indicate what measures are being taken to overcome the problems. The report should reflect progress and compliance with implementation schedules; Highlight issues proposed for consideration / resolving; Reflect incurred costs and payments; Justify the order of changes and changes in the implementation schedule; Test records, findings, and verification of the agreement reached in the design changes and the harmonization of design / construction drawings. Reports should include progress charts and photographs (color and dated), including all information relating to the progress of work, the extent and nature of the work performed, as well as detailed information on any delays in the work, justified by documentation if necessary. The report should also include the percentage of construction work completed and planned, as well as actual and planned cash flows for each element of the work as of the reporting period. Copies of the minutes of the monthly meetings with the interested parties to be attached.

***c) Reports on Contract Completion:***

The consultant will prepare reports on the contract completion for the main construction contracts. The report should summarize the content of monthly / quarterly reports; conclusion about deviations in the performance of the contract, design and work carried out; conclusion about the conducted tests and verify and attach drawings. Reports should provide all information on construction conditions, including but not limited to calculations, drawings, specifications, test reports and final cost analysis. Consultants must prepare for the Client a complete set of work records and drawings as soon as possible after the Acceptance Act is issued and in any case within 28 days from the date of this Act.

***d) Final Report on Project Completion:***

The Consultant will prepare a final report on the completion of the project, providing an overview of implementation performance and lessons learned during the construction period. The report will highlight the issues identified during the course of the project's implementation. The final report should contain a detailed analysis of the results, conclusions, achievements of the project and its overall impact. If any of the included activities have not been implemented with the expected quality or within the expected period, the report will show this, identifying the reasons, and indicating the measures taken to eliminate these causes. General lessons should be highlighted with recommendations for improving similar projects in the future. The results of the project should be measured to assess the impact of the project on the socio-economic situation in the project area, as well as environmental aspects.

## **Assignment Length**

Task-1: The estimated time for design review and completion of the procurement phase is **twelve (12) months**. Task-1 will be based on a lump-sum payment against deliveries as defined in the terms of the Contract.

Task-2: The time frame of the construction phase is **forty-four (44) months**, including twelve (12) months of liability for the defective period. Supervision of works will be based on the payment of the actual person-month, used at the rates specified in the contract. Similarly, reimbursable expenses will be compensated from the actual costs incurred.

Task-1- **Design Review and Procurement**

**Project Design Review**

The Consultant will review the project designs already prepared by the local design companies and approved by the State Expertise.

As result of the review of detailed designs, if corrections in the designs are required, the original Designers which prepared the designs will make all necessary corrections in the designs, Bill of Quantities and cost estimate documents.

All design specifications must be prepared in accordance with the requirements of the Law of the Republic of Kazakhstan and international standards, where appropriate. It is assumed that the Consultant will cooperate with local project organizations and ensure that the designs meet the requirements of local construction legislation.

* Design review will cover: Reviewing the technical aspects of the designs, including hydraulic calculations, structural designs, and material specifications.
* Assessing the feasibility of the designs, considering site conditions, water availability, and potential impacts on the environment and local communities.
* Verifying compliance with relevant standards and regulations, including those related to water management, environmental protection, and safety.
* Identifying any necessary design modifications and providing recommendations for improvements.
* To review the Detailed Engineering Design for all items along with the, technical specifications, bill of quantities (BOQ), cost estimate, provisional construction schedule to a level sufficient for incorporation in the Tender Documents for the construction of the water reservoirs and structures.

**Preparation of bidding documents**

The objective of this consultancy assignment is to develop comprehensive and high-quality bidding documents for the construction of irrigation canals. These documents will ensure compliance with relevant standards and guidelines and enable transparent and competitive bidding for the selection of qualified contractors.

The bidding documents should be detailed enough to allow the procurement of works, and an accurate estimate of costs. The bidding documents must provide details such as location, size, quantity, capacity, strength, equipment and work specifications. Design assumptions and the criteria should be clearly documented. The Consultant undertakes to assist the Company, PMU, in supporting the obtaining of the necessary approvals and permits from state bodies for projects.

Make a review and give recommendations on the Project Procurement Plan, including the updating of the original estimates and the definition of priorities between the components of the Project.

* Make an overview of existing detailed projects to carry out work in accordance with Kazakhstan's building codes and procurement requirements for Works.
* Develop detailed technical specifications for each component, including site preparation, excavation, construction, and safety requirements. Ensure specifications cover materials, equipment, construction methodologies, and standards for water reservoir and dam construction, such as hydraulic structures, spillways, and reservoir sealing.
* Prepare required engineering drawings, layouts, and technical details necessary for construction, in coordination with local authorized project engineers and designers. Ensure all drawings and designs comply with regulatory standards and best practices for water infrastructure projects.
* Develop a detailed Bill of Quantities for each structure, specifying quantities, units, and descriptions of work to provide bidders with accurate pricing structures.
* Outline a preliminary construction schedule, including key milestones, phases, and timelines. Define requirements for adherence to the schedule, including penalties for delays and incentives for early completion.
* Draft the general and specific conditions of contract, incorporating terms related to quality assurance, risk management, construction timelines, payment terms, warranties, and penalties.
* Develop clear and objective bid evaluation criteria, including technical, financial, and experience-based requirements. Specify minimum qualifications for contractors, such as previous experience, financial capacity, and relevant certifications.
* Assistance in the procurement of contractors for construction work on the basis of tender documentation *(Special notice, tender documents, preparation of any clarifications requested by bidders during the tender to help the Client);*
* Assistance to the Company in the procedures for closing / opening a tender, preparing a meeting minutes and submitting them to the IsDB in time, to receive clarifications as required in the bidding process;
* Providing support during the bidding process and organize and participate in pre-bid meetings to clarify technical specifications and respond to questions from prospective bidders. Provide support in responding to queries during the bidding period, including preparing any necessary clarifications or amendments to the bidding documents.
* Assistance to the Evaluation Committee (created by the company) in evaluating the proposals submitted (Technical and Financial Proposals) and preparing an evaluation report of tender proposals and submitting it to the Company and ISDB. The Consultant will support the PMU in the preparation of the evaluation report of the tender proposals and will participate as a non-voting vote in the assessments and must "sign" the reports, providing independent comments on the assessment process, if any, for consideration by the ISDB;
* Assist in completing the procedures for contract award, including preparing a draft contract for submission to IsDB for preliminary review and approval and ensuring that the contract is signed by duly authorized representatives of each party.

**Procurement assistance**

**Authorization Procedures**

The consultant must identify and inform the PMU and the Client about initiating the procedure for any necessary local or national licenses, permits and other approvals, including, among other things, access to the site, construction permits, permanent and temporary work, as the case may be. In the event that the contractor is responsible for obtaining specific licenses or other permits, the Consultant should facilitate the process of obtaining them. In addition, the Consultant undertakes to ensure compliance with any current reporting requirements established by the PMU procedures.

Task-2- **Contract Management and Construction Supervision**

The Consultant shall perform the duties and powers of the FIDIC Engineer in accordance with the instructions in the Contract or necessarily implied by the Contract, and also assist in administering the contract, dealing with situations in accordance with the contract. Construction must be carried out in accordance with laws, technical standards, construction norms and rules of the Republic of Kazakhstan.

For the corresponding performance the Consultant provides:

* Consideration and approval of working drawings prepared by the contractor;
* Control of work and approval of all materials, methods of construction and manufacturing on a daily basis, in accordance with the contract(s);
* Providing expert advice on all aspects of ongoing work, in particular with regard to project oversight, measurement, contract monitoring and quality control;
* Ensuring proper programming, recording, measuring and recording of works using modern management and measurement methods;
* Monitoring the progress of the project by visiting sites and promptly informing the Company of the details of any aspect that could jeopardize the progress of work, as well as any consequences that may affect the actual completion time, including the cost of works, and measures (or planned for use) taken to overcome such factors;
* Approval of the contractor's work program and the sources of construction materials and their characteristics.
* Issuance of documents for intermediate payments for the approval by PMU and certification, quality, etc., Acts of hidden works, the completion of all or part of the works;
* Determine the value and time of the impact of the changes, analyze the new rates proposed by the Contractor and make recommendations to the PMU with a view to accepting (as the case may be) the revised rates and issuing variation orders;
* Ensuring the implementation of measures aimed at reducing the impact on the environment and mitigating social consequences in the construction process, after the implementation of permanent works, in accordance with the requirements of the IsDB on the policy of protective measures in the field of ecology and social security;
* Implementation of a health and safety plan during the performance of works;
* Facilitate the achievement of agreements between the contractor and utility companies and the owners of the private facility located on the site;
* Participation in the intermediate and final acceptance of works;
* Approval of the final measurement and calculation after the completion of the contracts;
* Verification of executive drawings provided by the contractor;
* Recommendations to PMU on all issues related to the implementation of the contract(s), including settlement of the contractor's claims;
* Preparation of the maintenance program;
* Inspection and verification visits on each contract during the warranty period;
* Performing other inspections, when necessary and provided for by contracts;
* Participation in the acceptance of the supplied equipment.

The Consultant must obtain prior approval from the PMU before:

* Issuing any variation of the order with financial and temporary consequences, except in an emergency situation, when the PMU approval must be received as soon as possible;
* Authorization of additional items, amounts or expenses;
* Subcontract approvals for any part of the works; and
* Approval of any extension of the completion time.

**Quality Control**

The Consultant shall:

* Receive a full detailed version of Quality Assurance Manual from the Contractors; to check it and make comments as soon as possible and, if necessary, ask the Contractors to make amendments in it.
* Notify the Company of any failure of the test or verification and that such failure can lead to a delay in observing the deadlines or other significant adverse consequences; give recommendations on further necessary tests and organize the process of troubleshooting by Contractors.
* Supervise the works performed by the Contractors to ensure the quality and standards of materials and production quality, and to comply with the specifications and drawings included in the contracts, the Harmonized Project, the detailed drawings, the Quality Assurance Manual and all agreed amendments.
* Control facility inspections, all installation, **commissioning works** on sites and commissioning / testing of project components, if necessary.

**Management on the Site**

* Attend local meetings at the request of the Company, and seek to resolve the serious problems at any time in order to avoid any delays or extra costs (taking into account the conditions of contracts and the restrictions imposed by the authorities on the powers of the Consultant in connection with this task).
* Maintain complete and accurate records of all meetings and the discussions held with the participation of or headed by the Consultant, and do the same for verification by the Company upon request.
* At the request of the Company, attend meetings to resolve disagreements on general and technical matters.
* Provide advice to the Company on the overall organization of Contractor resources on site, including management and programming systems, labor, equipment and machinery.
* The Consultant must have project offices in Astana, Taraz, Shymkent, Kyzylorda and Taldykorgan during the whole Project. The Consultant must have a license for design review and technical supervision of the Republic of Kazakhstan and maintenance of documentation.

**Payments and Accounts**

* Receive monthly or other interim financial statements from Contractors in accordance with contracts.
* After receiving applications from the Contractors, properly take into account all the Company's comments.
* Check the Contractor's reporting in accordance with the relevant provisions of the contracts and resolve with contractors, as far as possible, all the mistakes and questions that may arise in connection therewith; advise the Company on any adjustments that may be necessary.
* Specify the amount that will be indicated in the statements of the Contractors in accordance with the contracts. In the terms stipulated in the provisions of the FIDIC contract, issue a certificate in the name of the Contractor and the Company, indicating the total amount paid by the Company to the Contractor.

# **COMPOSITION OF THE TEAM AND QUALIFICATION REQUIREMENTS FOR KEY EXPERTS.**

## **General Requirements:**

* Consulting firm is expected to have extensive experience in the construction of water facilities, including irrigation systems. In addition, the consulting firm should be aware of local legislation in the field of design and construction. Consulting firm should have experience in similar type and size of the projects financed by the IsDB or other IFIs, with proven knowledge of FIDIC basis and / or any MDB procurement process preferably IsDB conditions of contract and procurement;
* The Consultant should be provided with sufficiently qualified and experienced staff and support of a sufficient number of local professional staff to ensure proper project management, procurement services and construction supervision works. The Consultant's staff should consist of a key, non-key and support staff;
* To create a basis for evaluating the financial proposal, a minimum number of professional staff is proposed, and the total number of man/month is listed below, which provides a summary of key personnel / skills.
* The Consultant company can employ engineers with license for construction supervision of category 1 or obtain license for own company.

**Task– 1: Review of Design and Tenders Conducting (Lump sum-based payment)**

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Experts required** | **Position** | **Total Input (person-month** |
| **Key International Experts** | | | |
| **1** | **KI-1** | **Team Leader / Civil Engineer - 1 person** | **12** |
| **2** | **KI-2** | **Irrigation and Drainage Specialist/Design Engineer–1 person** | **10** |
| **Key International TOTAL** | | | **22** |
|  | | | |
| **Key National Experts** | | | |
| **1** | **KN-1** | **Deputy Project Manager– 1 person** | **12** |
| **2** | **KN-2** | **Irrigation and Drainage Specialist/Design Engineer–1 person** | **10** |
| **3** | **KN-3** | **Quantity Survey Engineer - 1 person** | **10** |
| **Key National TOTAL** | | | **32** |
| **TOTAL KEY EXPERTS** | | | **64** |
| **Non-Key International Experts** | | | |
| **1** | **NKI-1** | **Civil/Structural Design Engineer – 1 person** | **10** |
| **2** | **KI-3** | **Procurement Expert–1 person** | **10** |
| **Non-Key International TOTAL** | | | **20** |
| **Non-Key National Experts** | | | |
| **1** | **NKN-1** | **Civil/Structural Design Engineers – 4 persons** | **40** |
| **2** | **NKN-2** | **Design Engineers – 4 persons** | **40** |
| **3** | **NKN-3** | **Cost Estimating Engineers – 4 persons** | **40** |
| **5** | **NKN-5** | **Survey Engineers – 4 persons** | **40** |
| **6** | **NKN-6** | **Environmental / Social Expert – 1 person** | **10** |
|  |  | **Non-Key National TOTAL** | **160** |
| **TOTAL NON-KEY EXPERTS** | | | **180** |
| **TOTAL KEY AND NON-KEY EXPERTS Task 1** | | | **244** |

**Task– 2: Construction Supervision (Time-based contract)**

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Experts required** | **Position** | **Total Input (person-month** |
| **Key International Experts** | | | |
| **1** | **KI-1** | **Team Leader / Civil Engineer - 1 person** | **44** |
| **2** | **KI-2** | **Chief Resident Engineers–4 persons** | **176** |
| **Key International TOTAL** | | | **220** |
|  | | | |
| **Key National Experts** | | | |
| **1** | **KN-1** | **Deputy Project Managers– 4 persons** | **176** |
| **2** | **KN-2** | **Quality Control Engineers–11 persons** | **484** |
| **3** | **KN-3** | **Quantity Survey Engineers - 5 persons** | **220** |
| **Key National TOTAL** | | | **748** |
| **TOTAL KEY EXPERTS** | | | **1100** |
| **Non-Key International Experts** | | | |
| **1** | **NKI-1** | **Procurement Expert – 1 person** | **10** |
| **Non-Key International TOTAL** | | | **10** |
| **Non-Key National Experts** | | | |
| **1** | **NKN-1** | **Geodetic Survey Engineers – 4 persons** | **176** |
| **2** | **NKN-2** | **Geodetic Survey Technicians – 11 persons** | **484** |
| **3** | **NKN-3** | **Environmental / Social Expert – 1 person** | **10** |
|  |  | **Non-Key National TOTAL** | **670** |
| **TOTAL NON-KEY EXPERTS** | | | **680** |
| **TOTAL KEY AND NON-KEY EXPERTS Task 2** | | | **1780** |

* Deployment of professional experts within the Task-2 should be done with prior consultations and consent of the Client in order to ensure a balanced assignment and depending on the progress of the contract.

## **Staff Qualification:**

On the basis of the above-mentioned requirements of the present regulations in terms of expertise and objectives, the Consultant is expected to create an advisory panel consisting of skilled professionals. Below are professional requirements to the proposed experts:

**Staff requirements:**

**Key International Experts:**

**Team Leader / Civil Engineer:**

At least a master's degree in water management or a hydraulic structure related to the infrastructure of irrigation systems and professional qualifications, preferably with international accreditation agencies.

* + At least 15 years of total work experience, including 10 years in engineering planning, design, construction, operation and management of water systems, including irrigation systems, and have international experience, working abroad;
  + An expert should have more than 5 years of experience in developing countries,
  + Experience in the IsDB or projects funded by international financial institutions of a similar nature, based on FIDIC and / or conditions of the IsDB / MLI contract. It requires that an expert as a Team Leader must have successfully completed at least two (2) similar projects.
  + Excellent knowledge of English and knowledge of any local languages is highly desirable. The expert must have good verbal and written communication skills in English to document completed work assignments, report on the status of the project and prepare final engineering analysis reports for Clients.
  + The expert should be familiar with AutoCAD and other modeling software related to the task.

**Irrigation and Drainage Specialist / Design Engineer:**

The specialist should have at least bachelor’s degree in water management and a hydraulic engineering structure associated with irrigation and drainage infrastructure. The expert is expected to be well acquainted with hydraulic modeling and analysis.

* + At least 15 years of total work experience, including 10 years in engineering planning, design, construction, operation and management of irrigation systems and have international experience, working abroad.
  + It is required that at least two (2) tasks in the design of irrigation canals of a similar nature and complexity should be completed by the expert. Preferred experience in similar projects financed by the IsDB (or similar International Development Organizations) is welcomed.
  + Excellent knowledge of English and knowledge of any of the widely spoken local languages is highly desirable.
  + The expert should be familiar with AutoCAD, Water CAD and other modeling software related to the task.

**Chief Resident Engineer:**

At least a bachelor's degree in civil engineering, water management or hydraulic structures related to the infrastructure of irrigation systems and professional qualifications.

* + At least 15 years of total work experience, including 10 years in construction, operation and management of water systems, including irrigation and drainage systems, and have international experience, working abroad, must be familiar with technical supervision works in water projects;
  + An expert should have more than 5 years of experience in developing countries,
  + Experience in the IsDB or projects funded by international financial institutions of a similar nature, based on FIDIC and / or conditions of the IsDB / MLI contract. It requires that an expert as a **Chief resident engineer** must have successfully completed minimum two (2) similar projects.
  + Excellent knowledge of English and knowledge of any local languages is highly desirable. The expert must have good verbal and written communication skills in English to document completed work assignments, report on the status of the project and prepare final engineering analysis reports for Clients.

**Key National Experts:**

**Deputy Project Manager:**

The expert should have at least a bachelor's degree in construction / water management or similar.

* + 15 years of total work experience, including 10 years in the planning, design, construction, operation and management of water systems, including irrigation systems.
  + The expert must know the norms and standards for the construction of canals and structures in Kazakhstan.
  + Participation in at least two (2) tasks for the design and construction of irrigation water infrastructure in the past.
  + Experience in the projects financed by IsDB / International Financial Institutes of a similar
  + The expert is expected to be familiar with AutoCAD and other modeling software related to the task.
  + Excellent reporting and computer skills. Knowledge of English would be an advantage.

**Irrigation and Drainage Specialist/Design Engineer:**

The specialist should have at least a bachelor’s degree in civil engineering or other related degrees. Experience in design of irrigation and drainage networks. At least 10 years of experience in the design of hydraulic structures. The main tasks of the specialist are, but not limited to the following:

* + Review the available documents related to irrigation and drainage design and assess the assumptions and criteria used in the earlier studies/designs;
  + Check the quantity and cost estimate for the relevant designs and assist in the preparation of the project cost estimates, bill of quantities, specifications of the materials and construction methods; and
  + Provide relevant contributions to the reports.
  + At least 15 years of total work experience, including 10 years in engineering planning, design, construction, operation and management of irrigation systems.
  + It is required that at least two (2) tasks in the design of irrigation canals of a similar nature and complexity should be completed by the expert.
  + The expert should be familiar with AutoCAD, Water CAD and other modeling software related to the task.

**Structural Engineer:**

* + At least a master's degree in construction related to the structure of facilities or the like.
  + At least 15 years of total work experience including 10 years in engineering planning, design, structure of facilities / buildings and have international experience, working abroad.
  + An expert should have more than 5 years of experience in developing countries,
  + Excellent knowledge of English and knowledge of any of the widely spoken local languages is highly desirable. The expert is expected to have a good knowledge of AutoCAD and other modeling software related to the assignment

**Environmental/ Social Expert**

* + At least a bachelor's degree in field of environment protection of water projects.
  + At least 10 years of total work experience including 5 years in international projects, working abroad.
  + The expert should be familiar with the environment management and mitigation measures, health and safety rules based on the best international standards and practices.
  + The expert should be familiar with widely used international standards.
  + The expert should have good reporting skills and computer knowledge.

**Quality Control Engineer:**

* + At least bachelor's degree in construction.
  + At least 15 years of total work experience, including 10 years in the planning, design, operation and management of the water sector, including irrigation and drainage systems.
  + Participation in at least two (2) tasks in the design and construction / reconstruction of systems of a similar nature and complexity.
  + The Experts should be familiar with the rules and standards of construction in Kazakhstan and have necessary licenses of GASK.

**Additional Experts:**

**For International Experts:**

* + At least a bachelor's degree in the relevant field for which the expert is appointed.
  + At least ten (10) years of relevant experience, including 5 years of experience in developing countries, and have international experience, working abroad
  + Participated in at least one (1) similar project, where he / she performed similar functions.
  + Knowledge of international standards and norms in the field, for which an expert is appointed.
  + Good knowledge of English and excellent reporting and computer skills.

**For Local Experts:**

* + At least a bachelor's degree in the relevant field for which an expert is appointed.
  + At least ten (10) years of relevant work experience.
  + Excellent knowledge of the local standard and norms in the field for which the expert's position is assigned.
  + Participated in at least one (1) similar project, where he / she performed similar functions.
  + Excellent reporting and computer skills. Knowledge of English will be an advantage.

**Support Staff:**

The Consultant must have a sufficient number of support staff during the assignment (translator, AutoCAD experts, secretary, office manager, driver, etc.). The translator(s) should be well prepared, with excellent command of English and Russian.

Consultant should have project offices in Astana, Taldykorgan, Taraz, Kyzylorda, and Shymkent.

# **SERVICES AND FACILITIES, SUBMITTED BY THE CLIENT**

The Client will provide the following services:

* + Provide a consultant with access to all relevant reports, studies and other documents necessary for the implementation of the project. It will be provided free of charge, if the Client does not make additional costs to be reimbursed by the Consultant;
  + Assist as much as possible, with entry into the country, and gain access to a visa;
  + Assistance in organizing meetings and discussions with stakeholders, beneficiaries and local authorities at the request of the Consultant;
  + Obtaining by the Consultant necessary projects, permits and approvals from the relevant authorities of Kazakhstan and the IsDB;

The Client does not provide funds for equipment, communications, translation services, etc. The Consultant is expected to acquire the necessary equipment on his own.

# **INSITUTIONAL ARRANGEMENTS**

The project executing agency is RSE "Kazvodkhoz" of the Ministry of Water resources and irrigation of the Republic of Kazakhstan. The Project Management Unit (PMU) is established by the RSE "Kazvodkhoz" for the project activities and will act on behalf of the Executive Agency. PMU is based in Astana and has branches in Taldykorgan, Taraz, Kyzylorda and Shymkent Supervisors work in the offices on the site, which will be created.

The team leader should be present at the Consultant's headquarters in Astana with the ability to travel to the construction site as necessary. The Engineer will often travel to the offices for meetings and stay in the region to ensure proper supervision and control over the construction work during the construction and the defective periods as required. The Deputy Project Managers are expected to participate in all relevant implementation phases. During the active construction phase, national experts are expected to be mainly in the area to ensure proper supervision and control over construction work.

The Consultant will assist the Executive Agency / PMU in obtaining the necessary approvals for detailed design documents, cost estimates, request for proposals, tender documentation and other assessment reports from relevant authorities (in accordance with the requirements of the Government of Kazakhstan and / or IsDB). The Consultant will assist the Executive Agency / PMU by providing information, documents and explanations on the status of its services, as and when it is needed.

#### APPENDICES: Overview of the Projects

1. **Shu District, Zhambyl Region. Lot 1**

In order to improve the condition of water management infrastructure, irrigation networks in the Shu district of the Zhambyl region will be rehabilitated. Under the “Climate-Resilient Water Resources Development Program,” a total of 45 projects from the Shu district of the Zhambyl region have been included. These projects are divided into two separate groups (lots).

The by the first lot — the Right-Bank Main Canal — consists of 24 irrigation off-take canals. The total length of the canals under this lot is 183.46 km, and the total irrigated area amounts to 32,526 hectares.

As part of the Irrigation Infrastructure Rehabilitation Program in the Shu District of the Zhambyl Region, by the first lot (Right-Bank Main Canal) consists of 24 irrigation off-take canals, with a total projected length of **183.46 km**. The primary construction material used for most canals is **monolithic reinforced concrete with a 0.5 mm geomembrane lining**, which ensures durability and watertightness. In several canals, **modern polyethylene pipelines (PE100 SDR26, Dn=1000 mm)** are also used to enhance reliability and reduce water losses.

Among all the facilities, the key ones include:

* **Tasotkel Main Canal (TMK)** — length of 39.26 km, irrigated area of 16,536 ha, discharge capacity of 30 m³/s;
* **PMK Canal** — length of 46.71 km, irrigated area of 6,626 ha, discharge capacity of 11 m³/s;
* **R-1 Canal** — 13.74 km long, irrigated area of 2 166 ha.

The **total irrigated area** serviced by the rehabilitated canals exceeds **32,000 hectares**, which will significantly improve the **water supply for agricultural land**, boost crop productivity, and strengthen the **resilience of the agricultural sector** in the face of climate change.

As a result of the implementation of these projects, the following outcomes are expected:

* increased efficiency in the use of water resources;
* reduced water losses during transportation;
* improved agricultural production conditions;
* enhanced regional resilience to drought and climate risks.

**1. Reconstruction of the TMK Canal**

* **Total Length**: 39.257 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 30.0 m³/s
* The serviced area of irrigated crops is 16,536 hectares.

**Technical Description:**

The TMK Canal is a **high-capacity main canal** extending **39,257 meters**, designed to supply large volumes of irrigation water across a wide agricultural area. It features reinforced concrete linings and complex water regulation structures, requiring full-scale rehabilitation and modernization.

The scope of work includes:

* Cutting of LDP (linear development path), reed vegetation, and earthen dam structures
* Grubbing and removal of trees (Ø32 cm diameter)
* Construction of compacted, high-quality embankments
* Excavation and reshaping of the canal section
* Grading and profiling of the bottom, slopes, and berm (dyke)
* Monolithic lining with **B20 grade reinforced concrete**, 12 mm thick
* Installation of **temperature transverse joints** every 9.0 meters
* Herbicide perimeter treatment for vegetation control
* Laying of **geomembrane waterproofing** (0.5 mm thick)
* Dismantling of damaged concrete structures along the existing canal

**Special Sections and Detailed Works:**

* **PC0+00 to PC392+44** – Manual desilting of the canal bed, removal of reeds and shrubs
* **PC0+22 to PC2+42** – Dismantling of existing reinforced concrete; re-lining of canal bottom, slopes, and foundations
* **PC111+40 to PC366+00** – Dismantling of monolithic concrete from slopes and foundations
* **PK117+12 (TNX-1)** – Repair of culvert gate
* **PK118+74 to PK119+75** – Tunnel cleaning
* **PK127+78** – Storm sewer cleaning
* **PK268+04** – Removal of silt from canal cross-section

**Culvert Gate Installations:**

* **New culvert gates** installed at:PK21+06, PK94+84, PK95+12, PK99+60, PK107+09, PK120+04, PK167+17, PK177+60, PK178+25
* **Rehabilitation of culvert gates** at: PK26+64 (TBX-1), PK64+04 (TBX-2), PK189+70 (TLX-1), PK246+60 (TLX-1-1)
* **Additional new culvert gates** installed at: PC153+78, PC154+66, PC180+33, PC234+84, PC317+60
* **PC111+40 to PC366+00** – Comprehensive rehabilitation of damaged concrete lining on canal slopes and foundations

This large-scale rehabilitation aims to restore the canal’s original capacity, prevent structural failures, and ensure uninterrupted water supply across the irrigation network. The project integrates advanced repair techniques, manual and mechanical cleaning, and modernization of all key hydraulic structures.

**2. Reconstruction of the Zhambyl-4b Canal (TDZhKh-4b)**

**Total Length**: 5.027 km

The serviced area of irrigated crops is 107 hectares.

**Technical Description:**

The TDZhKh-4b canal consists of **monolithic reinforced concrete** with a thickness of **12 cm**, laid on a **0.5 mm thick geomembrane**. The canal is classified as a **Capital Construction Class IV** structure and is designed for a **maximum flow capacity of 0.5 cubic meters per second**. The total length of the canal is **5,027 meters**.

The project includes the following rehabilitation and construction works:

* Cutting of old road surface (ORS) with a thickness of 20 cm
* Removal of reed vegetation
* Grubbing and removal of trees (Ø32 cm)
* Construction of high-quality embankments
* Excavation and earthworks for canal sections
* Bottom and slope grading, including dyke (berm) formation
* Reinforcement and monolithic B20 concrete lining with a thickness of 12 cm
* Installation of temperature expansion joints every 9.0 meters
* Perimeter herbicide treatment for vegetation control
* Laying of waterproof geomembrane (thickness 0.5 mm)
* Dismantling of existing reinforced concrete structures

The canal layout consists of two main segments:

1. **PC0+00 to PC0+73** – constructed as a **polyethylene (PE100 SDR26) pipeline**, with a diameter of **1000 mm**
2. **PK0+00 to PK50+27** – built as a **monolithic trapezoidal canal**

**Notable structures and points along the canal** include:

* **PK1+00** – water metering post
* **PK41+60** – bridge crossing
* Multiple water discharge points into temporary irrigation systems with pipe crossings at:  
  PK1+80, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, and 49
* **PK37+81 and PK37+81.50+20** – major pipe crossings using **Series 3.501-177/93, issue 0-4**

**3. Reconstruction of the TDZhKh-5 Canal**

* **Total Length**: 0.073 km (73 meters)
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.5 m³/s
* The serviced area of irrigated crops is 364 hectares.

**Technical Description:**

The TDZhKh-5 canal, over the section from **PK0 to PK0+73**, consists of **12 cm thick monolithic reinforced concrete**, laid on a **0.5 mm thick geomembrane**. Additionally, the same section from **PK0+00 to PK0+73** is equipped with a **PE100 SDR26 polyethylene pipeline** with a diameter of **Dn = 1000 mm**.

The scope of reconstruction works includes:

* Cutting of existing SDR material with a thickness of 20 cm
* Excavation of the trench to the required profile
* Backfilling of the trench with compacted layers
* Leveling of the trench bottom for uniform pipeline bedding
* Installation of the PE100 pipeline (Ø1000 mm)
* Installation of pipeline bends (Ø1000 mm)
* Laying of a sand bedding layer below the pipeline
* Construction of a maintenance and operational service road using **PGS (gravel-sand mix)** with a thickness of 20 cm
* At **PK0+73** – Installation of **two (2) water outlet structures, Type 2**

This reconstruction is intended to improve the canal’s hydraulic performance, eliminate seepage losses, and ensure long-term operational efficiency within the irrigated area it serves.

**4. Reconstruction of the Zhambyl-4a Canal (TDZhKh-4a)**

* **Total Length**: 0.050 km (50 meters)
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.5 m³/s
* The serviced area of irrigated crops is **180 hectares**.

**Technical Description:**

The TDZhKh-4a canal section, from **PK0+00 to PK0+50**, is designed as a **PE100 SDR26 polyethylene pressure pipeline** with a diameter of **Dn = 1000 mm**. This segment replaces an open channel to improve efficiency, reduce seepage, and facilitate flow control in a short distribution area.

The construction works include:

* Cutting of the existing SDR surface (20 cm thickness)
* Excavation of the trench to required depth and width
* Backfilling with compacted soil layers after pipeline installation
* Leveling of the trench bottom for uniform pipe placement
* Laying of the PE100 SDR26 pipeline (Ø1000 mm)
* Installation of pipeline bend sections (Ø1000 mm)
* Placement of a **sand bedding layer** to ensure structural support and alignment
* Construction of a gravel-sand mix (PGS) **operational access road**, 20 cm thick
* At **PK0+50** – Installation of **one (1) Type 1 water outlet structure**

This short but critical pipeline segment improves water conveyance and is integrated into the larger canal network under Lot 1.

**5. Reconstruction of the Zhambyl-3a Canal (TDZhKh-3a)**

* **Total Length**: 4.310 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 1.3 m³/s
* The serviced area of irrigated crops is **360 hectares**.

**Technical Description:**

The TDZhKh-3a canal is divided into two construction segments:

* From **PK0 to PK5+50**: the canal is constructed with **12 cm thick monolithic reinforced concrete** laid over a **0.5 mm thick geomembrane**
* From **PK5+50 to PK43+10**: the canal transitions into a **PE100 SDR26 polyethylene pipeline** with a diameter of **Dn = 1000 mm**

The total canal length is **4,310 meters**.

The planned rehabilitation works include:

* Cutting of the existing surface (SDR, 20 cm thick), including dam cutting and reed vegetation removal
* Construction of high-quality compacted embankments
* Excavation and trenching of the canal section
* Backfilling and compaction of fill layers
* Grading and profiling of the canal bottom, slopes, and berms
* Monolithic lining using B20 concrete with a thickness of 12 cm
* Installation of temperature expansion joints at standard intervals
* Application of herbicide for canal perimeter treatment
* Placement of geomembrane lining (0.5 mm thick)

**Key Structures and Features:**

* **PK0+33** – One (1) water-measuring post installed on the trapezoidal concrete canal
* **PK3+56 and PK3+76** – Two (2) water outlets with Ø1000 mm tubular pipe crossings
* **PK5+45** – One (1) water outlet of **Type 1**
* **Various locations** – Installation of **18 water outlets of Type 2**

This combination of open reinforced concrete and pressurized pipeline segments provides improved hydraulic performance, reduced seepage, and reliable water delivery for irrigated agriculture within the service zone.

**6. Reconstruction of the Zhambyl-3b Canal (TDZhKh-3b)**

* **Total Length**: 11.223 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.7 m³/s
* The serviced area of irrigated crops is **350 hectares**.

**Technical Description:**

The TDZhKh-3b canal, from **PK0 to PK5+50**, is constructed using **monolithic reinforced concrete**, 12 cm thick, laid on a **0.5 mm thick geomembrane**. The total canal length is **11,223 meters**.

This canal is a significant conveyance structure within the regional irrigation network and is subject to comprehensive reconstruction, which includes:

* Cutting of the existing road surface (ORS), 20 cm thick
* Cutting and removal of earthen dams and reed vegetation
* Grubbing and removal of trees (diameter Ø32 cm)
* Construction of high-quality earthen embankments
* Excavation and shaping of the canal section
* Profiling of the canal bottom, slopes, and berm (dyke)
* Concrete reinforcement and monolithic lining using **B20 class concrete**, thickness 12 cm
* Application of herbicide along the perimeter for vegetation control
* Installation of **temperature cross joints every 9.0 meters**
* Laying of **geomembrane waterproofing** (0.5 mm thickness)

**Key Structures and Installations:**

* At **PK0+50** – Installation of **one (1) water-measuring post**
* At **PK0+60**, **PK2+00**, and **PK3+46** – Construction of **three (3) water outlets** discharging into the **temporary irrigation system (TIS)**, each featuring **4-meter pipe crossings**

This reconstruction aims to significantly improve the canal’s structural durability, reduce seepage losses, and ensure efficient water delivery to farmlands along its extended alignment.

**7. Reconstruction of the Yntaly Canal**

* **Total Length**: 1.208 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.06 m³/s
* The serviced area of irrigated crops is **500 hectares**.

**Technical Description:**

The Yntaly Canal is constructed with **monolithic reinforced concrete**, **12 cm thick**, and lined with a **0.5 mm thick geomembrane**. The total canal length is **1,208 meters**.

The scope of reconstruction works includes:

* Cutting of the existing road surface (ORS)
* Removal of reed vegetation and dam structures
* Grubbing and removal of trees (Ø32 cm)
* Formation of compacted, high-quality embankments
* Excavation of the canal section and earthworks
* Shaping and leveling of the canal bottom, side slopes, and dike (berm)
* Application of **monolithic B20 concrete lining** (12 mm thickness)
* Installation of **temperature expansion joints** every 9.0 meters
* Herbicide treatment along the entire perimeter of the canal to control vegetation
* Laying of **geomembrane waterproofing** (0.5 mm thickness)
* Dismantling of existing reinforced concrete structures

**Key Structures and Installations:**

* **PK0+50** – Installation of one (1) water-measuring post on the trapezoidal section
* **PK1, PK3, PK5, PK8, PK10, PK12+07** – Six (6) water outlets to a **temporary irrigation system**, each with pipe crossings
* **PK7+00** – One (1) **end discharge** outlet

This reconstruction ensures increased structural durability, minimized seepage, and more reliable water distribution to the local irrigation network in the Yntaly area.

**8. Reconstruction of the TLH-1-1b Canal**

* **Total Length**: 1.680 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.8 m³/s
* The serviced area of irrigated crops is **330 hectares**.

**Technical Description:**

The TLH-1-1b Canal is constructed using **12 cm thick monolithic reinforced concrete** placed on a **0.5 mm thick geomembrane**. The total length of the canal is **1,680 meters**.

The rehabilitation scope includes:

* Cutting of the existing road surface (ORS), reed vegetation, and dam segments
* Grubbing and removal of trees with a diameter of Ø32 cm
* Formation of high-quality, compacted embankments
* Excavation and shaping of the canal cross-section
* Profiling of the canal bottom, side slopes, and berms
* Lining of the canal with **B20 grade monolithic concrete**, 12 mm thick
* Installation of **temperature expansion joints** every 9.0 meters
* Herbicide treatment along the perimeter for vegetation control
* Placement of **geomembrane waterproof lining** (0.5 mm thickness)
* Dismantling and installation of **12 reinforced concrete pipes (ТС100.50)**

**Key Structures and Installations:**

* **PK0+65** – Two (2) water outlets connecting **canal to canal**, with pipe crossings
* **PK0+65 and PK1+00** – Two (2) **water-measuring posts** located on the trapezoidal canal
* **PK2+95, PK3, PK6, PK7+68, PK9+25, PK10+80, PK12+05, PK13+05, PK14+16, PK16+70, PK21+30, PK22+85** – A total of **22 water outlets** discharging into temporary irrigation canals, each with an **8-meter pipe crossing**
* **PK2+83** – One (1) **tubular pipe crossing** with a diameter of Ø1000 mm
* **PK24+73** – One (1) **end discharge outlet**

This rehabilitation project aims to restore the structural integrity and hydraulic efficiency of the TLH-1-1b Canal, ensuring reliable water delivery to the surrounding irrigated farmland.

**9. Reconstruction of the Chkalov-3b Canal (TChKh-3b)**

* **Total Length**: 0.346 km (346 meters)
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.8 m³/s
* The serviced area of irrigated crops is **150 hectares**.

**Technical Description:**

The TChKh-3b Canal is constructed using a **12 cm thick monolithic reinforced concrete lining** over a **0.5 mm thick geomembrane**. The total canal length is **346 meters**.

The scope of rehabilitation works includes:

* Cutting of the existing road surface (ORS), removal of reed vegetation, and cutting of dam areas
* Grubbing and removal of trees (Ø32 cm)
* Construction of compacted high-quality embankments
* Excavation and earthworks for shaping the canal section
* Grading and leveling of the bottom, side slopes, and berm (dike)
* Application of **B20 class monolithic concrete lining** with 12 mm thickness
* Installation of **temperature expansion joints** at 9.0-meter intervals
* Perimeter herbicide treatment to prevent vegetation regrowth
* Placement of **geomembrane waterproofing** (0.5 mm thickness)

**Key Structures and Installations:**

* **PK0+50** – One (1) **hydrological measuring station** on the trapezoidal canal
* **PK0+60, PK2+00, PK3+46** – Three (3) **water outlets** discharging into the **temporary irrigation system (TIS)**, each with a **tubular pipe crossing of 4 meters**

This canal's modernization is intended to ensure stable flow regulation and minimize maintenance by applying durable structural solutions over its short but critical segment.

**10. Reconstruction of the Zhana Zhol-2 Canal (TNKh-2)**

* **Total Length**: 10.971 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 2.0 m³/s
* The serviced area of irrigated crops is **771 hectares**.

**Technical Description:**

The TNKh-2 Canal is constructed using a **12 cm thick monolithic reinforced concrete lining** over a **0.5 mm thick geomembrane**. The total canal length is **10,971 meters**.

This large-capacity canal is undergoing a comprehensive reconstruction, including:

* Cutting of the existing road surface (ORS), removal of reed vegetation, and dam excavation
* Grubbing and removal of trees (Ø32 cm diameter)
* Formation of high-quality, compacted embankments
* Excavation and reshaping of the canal cross-section
* Grading and profiling of the canal bottom, slopes, and berms
* Installation of **B20 monolithic concrete lining**, 12 mm thick
* Placement of **temperature expansion joints** every 9.0 meters
* Herbicide treatment around the canal perimeter
* Installation of **0.5 mm thick geomembrane waterproofing**
* Dismantling of the existing concrete canal structure

**Key Structures and Installations:**

* **Water-Metering Posts** (4 units):
  + Located at PK0+65, PK61, PK39+90, and PK92+70 on the trapezoidal canal
* **Bridge Crossings** (4 units):
  + Located at PK32+10, PK62+85, PK73+70, and PK85+65
* **Water Outlets to Temporary Irrigation System** (60 units):
  + Located at: PK0+75, PK2, PK4, PK6, PK8, PK10, PK12, PK14, PK16, PK18, PK20+20, PK22, PK24, PK26, PK28, PK30, PK32+20, PK34, PK36, PK38, PK39+70, PK40, PK42, PK44, PK46, PK48, PK52, PK54, PK56, PK58, PK59+50, PK60+83, PK62, PK64, PK66, PK68, PK69+50, PK70, PK72, PK74, PK76, PK78, PK80, PK82, PK84, PK86, PK88, PK90, PK92+43, PK93, PK95, PK97, PK99, PK101, PK103, PK105, PK107, PK109+71
  + Each outlet includes a pipe transition with **Ø500 mm diameter**
* **Pipe Crossing** (1 unit):
  + Located at **PK57+63**, constructed with a pipe diameter of **Ø800 mm**
* **Blocking Structures** (16 units):
  + Located at: PK6+15, PK12+15, PK18+15, PK24+15, PK30+15, PK40+15, PK46+15, PK52+15, PK58+15, PK68+15, PK72+15, PK78+15, PK84+15, PK90+15, PK96+15, and PK102+15

This extensive reconstruction is aimed at significantly increasing the canal’s durability, flow regulation capacity, and efficient operation across its nearly 11 km length, supporting large-scale agricultural irrigation in the Shu district.

**11. Reconstruction of the TBH-5 Canal**

* **Total Length**: 2.780 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.05 m³/s
* The serviced area of irrigated crops is **74 hectares**.

**Technical Description:**

The TBH-5 Canal is lined with **12 cm thick monolithic reinforced concrete**, laid over a **0.5 mm thick geomembrane**. The canal extends for **2,780 meters** and is intended for low-capacity water distribution in a compact irrigation zone.

Rehabilitation works include:

* Right-of-way (ROW) cutting, reed vegetation removal, and dam excavation
* Grubbing and removal of trees (Ø32 cm diameter)
* Formation of quality, compacted embankments
* Excavation and earthworks for reshaping the canal section
* Grading and leveling of the canal bottom, slopes, and berms
* Application of **B20 class monolithic concrete lining**, 12 mm thick
* Installation of **temperature expansion joints** every 9.0 meters
* Herbicide treatment around the canal perimeter to suppress vegetation
* Placement of **geomembrane waterproofing** (0.5 mm thick)
* Dismantling of existing deteriorated concrete sections

**Key Structures and Installations:**

* **PC0+70** – One (1) **water-measuring post** installed on the trapezoidal canal
* **Water outlets to temporary irrigation systems with Ø500 mm pipe crossings** (15 units), located at: PK1, PK4, PK6, PK8, PK10, PK12, PK14, PK16+17, PK17, PK19, PK21, PK23 (x2), PK25, PK27, PK29+80
* **Blocking Structures** (4 units):
  + Located at: PK6+15, PK12+15, PK19+15, and PK23+15
* **PK17+70** – One (1) **outfall pipe** with a diameter of **Ø800 mm**

The reconstruction of the TBH-5 Canal aims to enhance water delivery accuracy, minimize leakage, and extend the canal’s service life through durable concrete reinforcement and improved regulation infrastructure.

**12. Reconstruction of the Dalakainar-2 Canal**

The **Dalakainar-2 Canal** total length is **6,709 meters**. Classified as a **Class IV capital construction facility**, the canal is designed to carry up to **2.0 m³/s** of water. The serviced area of irrigated crops is 1367 hectares.

The canal’s structure includes a **12 cm thick monolithic reinforced concrete lining**, placed over a **0.5 mm thick polyethylene geomembrane** to prevent seepage and ensure long-term water retention.

**Scope of Works:**

The reconstruction involved the following major activities:

* Cutting of the existing ORS layer, dam sections, and reed vegetation
* Grubbing and planting of trees with a diameter of up to 32 cm
* Construction of a compacted and stable embankment
* Full excavation and reshaping of the canal section, including the bottom, slopes, and berm (dike)
* Concrete lining using **B20 grade** monolithic reinforced concrete, with a thickness of 12 cm
* Installation of **temperature-controlled transverse joints** every 9.0 meters
* Dismantling of old concrete from the existing canal
* Herbicide treatment around the canal perimeter for vegetation control
* Installation of the **anti-filtration geomembrane** layer (0.5 mm thick)

**Key Hydraulic and Civil Structures:**

* **PK 0+60**: Water-metering post on the trapezoidal section of the canal
* **PK 24+07, PK 40+00, PK 41+75**: Three bridge crossings
* **Water Outlets**: A total of **33 water outlets** for temporary irrigation systems, each with a **Ø500 mm pipe crossing**, located at intervals PKPK 1, 3, 5, ... up to 65
* **Barrier Structures**: Ten barrier structures installed at PK 7+15, 13+15, 19+15, ..., up to 64+15

This reconstruction improves water delivery efficiency and infrastructure durability, while supporting seasonal irrigation through a temporary water distribution network.

**13. Reconstruction of the TBH-3 Canal**

* **Total Length**: 2.517 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.05 m³/s
* The serviced area of irrigated crops is **200 hectares**.

**Technical Description:**

The TBH-3 Canal is constructed with a **12 cm thick monolithic reinforced concrete lining**, placed on a **0.5 mm thick geomembrane**. The total length of the canal is **2,517 meters** and it is designed to support low-capacity agricultural irrigation needs.

The rehabilitation scope includes:

* Cutting of the existing road surface (ORS), reed vegetation, and earthen dams
* Grubbing and removal of trees (Ø32 cm)
* Formation of high-quality compacted embankments
* Excavation and reshaping of the canal cross-section
* Grading of the canal bottom, slopes, and dike (berm)
* Application of **B20 class monolithic concrete lining**, 12 mm thick
* Installation of **temperature expansion joints** every 9.0 meters
* Herbicide treatment along the canal perimeter for vegetation control
* Placement of **geomembrane waterproof lining**, 0.5 mm thick

**Key Structures and Installations:**

* **PK0+80** – One (1) **water-measuring post** on the trapezoidal canal
* **PK5+90** – One (1) **bridge crossing**
* **Water outlets into temporary irrigation systems with Ø500 mm pipe crossings** (11 units):
  + Located at: PK1, PK3, PK5, PK7, PK9, PK11, PK13, PK15, PK17, PK19, PK21, PK23, PK25+17
* **Blocking Structures** (5 units):
  + Located at: PK5+15, PK9+15, PK13+15, PK17+15, and PK21+15

The upgraded TBH-3 Canal will offer improved water flow control and operational durability through modernized lining, structural enhancements, and outlet infrastructure suitable for its service area.

**14. Reconstruction of the TBH-4 Canal**

* **Total Length**: 2.999 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.05 m³/s
* The serviced area of irrigated crops is **67 hectares**.

**Technical Description:**

The TBH-4 Canal is constructed using a **12 cm thick monolithic reinforced concrete lining**, placed over a **0.5 mm thick geomembrane**. The canal spans a total length of **2,999 meters** and is designed to serve small-scale agricultural irrigation systems.

The scope of rehabilitation includes:

* Cutting of the existing road surface (ORS), reed vegetation, and earthen dam sections
* Grubbing and removal of trees (Ø32 cm diameter)
* Construction of compacted, high-quality embankments
* Excavation of the canal profile and cross-section
* Profiling and leveling of the canal bottom, slopes, and berm (dyke)
* Application of **B20 class concrete monolithic lining** (12 mm thick)
* Installation of **temperature expansion joints** every 9.0 meters
* Perimeter treatment with herbicide for vegetation control
* Placement of **geomembrane waterproof lining**, 0.5 mm thick
* Dismantling of deteriorated concrete lining from the existing canal

**Key Structures and Installations:**

* **PC1+00** – One (1) **water-measuring post** on the trapezoidal canal
* **Water outlets into temporary irrigation systems with Ø500 mm pipe crossings** (14 units), located at:  
  PK6, PK8+17, PK9, PK11, PK13, PK15, PK17+71, PK18, PK20, PK22, PK24, PK26, PK28, and PK29+98
* **Blocking Structures** (4 units):
  + Located at: PK4+15, PK13+15, PK22+15, and PK26+15
* **PK4+06** – One (1) **water outlet** with a diameter of **Ø800 mm**

This canal’s reconstruction will improve reliability, structural resilience, and flow efficiency for rural water distribution under the Climate-Resilient Water Resources Development Program.

**15. Reconstruction of the R-1 Canal**

**Canal Length:** 13,737 meters

**Irrigated Area:** 2,166 hectares

**Maximum Capacity:** 15 cubic meters per second

**Capital Construction Class:** IV

The R-1 canal is reconstructed with a 12 cm thick monolithic reinforced concrete lining laid over a 0.5 mm thick geomembrane. Key works include:

* Cutting of ORS, reeds, and dams
* Grubbing and planting trees with a diameter of 32 cm
* Construction of quality embankments
* Excavation and planning of the canal bottom, slopes, and berms
* Installation of B20 class monolithic concrete lining (12 cm thick)
* Temperature transverse joints installed every 9 meters
* Herbicide treatment around the canal perimeter
* Dismantling of the existing concrete lining
* Geomembrane installation (0.5 mm thick)

**Additional Works:**

* Road leveling (4 meters wide) from PK 0 to PK 137+30
* Partial replacement of 8 units of G-15.30-2 from PK 0 to PK 0+60 and PK 1+00 to PK 1+24
* Replacement of 20 units of G-20.30-1 from PK 96+84 to PK 97+00 and PK 97+20 to PK 97+32

**Monolithic Concreting:**

* PK 24+98 – PK 25+01: Right bank slope
* PK 25+25 – PK 25+28: Bottom, slopes, shoulders
* PK 32+71 – PK 32+74: Left bank slope
* PK 35+10 – PK 35+13: Right bank slope
* PK 23+30 – PK 23+40 and PK 58+90 – PK 59+95: 2-meter-wide canal lining
* PK 35+10 – PK 23+40, PK 58+90 – PK 59+95: 2-meter-wide canal bottom

**Penstock Works:**

* Replacement at PK 71+88, PK 96+73, and PK 107+42
* New installation at PK 48+15

This comprehensive reconstruction enhances the canal’s structural integrity, improves irrigation efficiency, and supports sustainable agricultural development in the region.

**16. Reconstruction of the Zhana Zhol-1 (TNH-1) Canal**

**Canal Length:** 9,088 meters

**Maximum Capacity:** 0.5 cubic meters per second

**Capital Construction Class:** IV

The serviced area of irrigated crops is **800 hectares**.

The TNH-1 canal is being reconstructed with a 12 cm thick monolithic reinforced concrete lining over a 0.5 mm thick geomembrane. Key construction activities include:

* Cutting of ORS, reeds, and dams
* Grubbing and planting of trees with a diameter of 32 cm
* Construction of high-quality embankments
* Excavation and planning of the canal bottom, slopes, and berms
* Installation of B20 class monolithic concrete lining (12 cm thick)
* Placement of transverse temperature joints every 9 meters
* Perimeter herbicide treatment
* Installation of a 0.5 mm thick geomembrane
* Dismantling of existing canal concrete

**Hydraulic and Structural Features:**

* PC 0+50: Installation of 1 water-measuring post on trapezoidal canal
* 46 single-pass water outlets (type LR-4(6,8), 9 meters long) installed at PK 1, 3, 5, 7, 10, 12, 14, 16, 18, 20, 23, 25, 28+27, 30+37, 32+70, 34+92, 36+73, 38+75, 40+75, 42+60, 43+65, 46+10, 48+10, 50+10, 52+10, 53+20, 54+15, 56+10, 58+10, 60+10, 62+10, 64+10, 64+70, 66+20, 68+20, 70+75, 72+20, 74+83, 76+48, 78, 80+60, 82+60, 84+72, 86+20, 89, and 90+88
* PC 26 and PC 44: Installation of 2 double-sided outlets to temporary irrigation systems
* PC 4+40, 8+70, 13+10, and 21+60: 4 outlets to permanent irrigation systems
* PC 13+20: 1 pipe outlet with 2 discharge points
* PC 0+00 and PC 25+94: 2 siphon transitions with 100 mm diameter

This reconstruction improves water delivery efficiency and ensures long-term reliability of the TNH-1 canal for agricultural irrigation.

**17. Reconstruction of the Zhana Zhol-1b (TNX-1b) Canal**

**Length:** 7,412 m, **Capacity:** 0.25 m³/s, **Class:** IV. The serviced area of irrigated crops is **560 hectares**.

The TNX-1b canal is lined with 12 cm thick monolithic reinforced concrete over a 0.5 mm geomembrane.

**Key Works:**

* Cutting of ORS, reed, and dam vegetation
* Tree planting (ø32 cm), excavation, embankment, slope and bottom shaping
* Monolithic B20 concrete lining (12 cm) with joints every 9 m
* Herbicide treatment and geomembrane installation

**Structures Installed:**

* 1 water-measuring post (PC 0+70)
* 32 single-pass LR-10 water outlets (L=9 m)
* 8 double-sided culverts (LR-6)
* 1 pipe outlet Ø100 mm (PK 16+26)
* 2 bridge crossings (PK 48+18, 52+36)
* 1 berth with Ø60 mm outlet (PC 37+90)
* 1 structure junction (PK 14+64)

The project improves irrigation efficiency and canal reliability.

**18. Reconstruction of the TLH-1b Canal**

Canal Length: 4,871 meters, Capacity: 0.8 m³/s, Class: IV. The serviced area of irrigated crops is **450 hectares**.

The TLH-1b canal is reconstructed with a 12 cm thick monolithic reinforced concrete lining over a 0.5 mm geomembrane.

**Main Works Include:**

* Cutting of ORS, reed, and dam vegetation
* Grubbing and planting of trees (ø32 cm)
* Excavation, embankment construction, and shaping of canal bottom, slopes, and berms
* Concrete lining with B20 monolithic concrete (12 cm thick) and temperature joints every 9 meters
* Herbicide treatment along the canal perimeter
* Installation of geomembrane (0.5 mm thick)

**Structural Replacements and Installations:**

* Dismantling of 65 LR-6 trays
* Replacement of 19 PK-0 reinforced concrete blocks, 73 LR-6 blocks, and 3 LR-8 trays
* Installation of 98 new LR-8 reinforced concrete trays

**Hydraulic Structures:**

* 1 water-measuring post (PC 0+20)
* 3 right-side water outlets with crossings (PK 3+06, 19+34, 20+63)
* 14 left-side water outlets with crossings (various PKs)
* 5 double-sided culverts with crossings (PK 25+55 to 32+91)
* 6 bridge crossings (PK 0+00 to 28+50)
* 1 end spillway to the flume canal (PK 34+75)

This reconstruction enhances the canal’s structural strength and irrigation functionality.

**19. Reconstruction of the K-1 Canal**

**Canal Length:** 6,087 meters | **Capacity:** 4.0 m³/s | **Construction Class:** IV. The serviced area of irrigated crops is **302 hectares**.

The K-1 canal is being reconstructed with a 12 cm thick monolithic reinforced concrete lining over a 0.5 mm thick geomembrane.

**Main Construction Activities:**

* Cutting of ORS, reeds, and dam vegetation
* Grubbing and planting of trees (ø32 cm)
* Excavation, embankment building, and shaping of canal bottom, slopes, and berms
* B20 class monolithic concrete lining (12 cm), with temperature joints every 9 meters
* Herbicide treatment around the canal perimeter
* Laying of geomembrane (0.5 mm)
* Dismantling of existing canal concrete

**Hydraulic Structures:**

* **50 temporary water outlets** with Ø500 mm pipe transitions (various points from PK 1 to PK 60+87)
* **10 partition structures** at specified PK locations (e.g., 5+20, 10+05, etc.)
* **5 pipe crossings** (Ø100 mm) at PK 9+45, 21+10, 32+40, 33+15, 49
* **7 large water outlets** (Ø100 cm) at PC 0+10, 19+05, 22+05, 26+54, 37+27, 45+35, and 50+96

This reconstruction improves the structural integrity and water distribution efficiency of the K-1 canal, supporting effective irrigation across the serviced area.

**20. Reconstruction of the Toganbai Canal**

* **Total Length**: 1.600 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.25 m³/s
* **Irrigated area**: 89 Ha.

**Technical Description:**

The Toganbai Canal is constructed with a **12 cm thick monolithic reinforced concrete lining** placed on a **0.5 mm thick geomembrane**. The total length of the canal is **1,600 meters**.

The rehabilitation activities include:

* Cutting of the right-of-way (ROW), reed vegetation, and dam sections
* Grubbing and removal of trees (Ø32 cm)
* Construction of compacted, high-quality embankments
* Excavation and reshaping of the canal section
* Profiling and leveling of the bottom, side slopes, and berms
* Application of **B20 class concrete lining** with a thickness of 12 mm
* Installation of **temperature expansion joints** every 9.0 meters
* Herbicide treatment along the entire canal perimeter to control vegetation
* Placement of **geomembrane waterproofing** (0.5 mm thick)

**Key Structures and Installations:**

* **PC0+50** – One (1) water-measuring post installed on the trapezoidal canal section
* **PC0+60, PC2+3.50, PC5+6.50, PC8+9.50, PC11+12.50, PC14+16** – Eleven (11) water outlets discharging into the **temporary irrigation system (TIS)**, each with **pipe crossings 4 meters in length**
* **PK11+88** – One (1) **pipe crossing** with a **diameter of 800 mm**

This reconstruction is designed to improve hydraulic performance, minimize water losses, and extend the operating lifespan of the irrigation infrastructure in the Toganbai service zone.

**21. Reconstruction of the Truba-2 Canal**

The Truba-2 Canal has a total length of 65 meters and belongs to the IV capital construction class. It is designed for a maximum flow capacity of 0.5 m³/s.

The canal structure consists of a polyethylene geomembrane with a thickness of 0.5 mm, laid as an anti-infiltration layer. On top of this membrane, a monolithic reinforced concrete lining with a thickness of 12 cm is constructed, ensuring durability and water tightness.

The reconstruction works include the cutting of the ORS layer, trench excavation, bottom leveling, and backfilling. A sand base is arranged to support the installation of a polyethylene pipeline. Additionally, a Ø500 mm control gate is installed at PK 0+20 to regulate water flow within the canal system.

These rehabilitation efforts are aimed at improving the canal's structural integrity and hydraulic performance for efficient water delivery.

**22. Reconstruction of the PMK Canal**

**Canal Length:** 46,712 m | **Capacity:** 11 m³/s | **Irrigated Area:** 6,626 ha | **Class:** IV

**Canal Structure:**

* Trapezoidal cross-section with 4.0 m bottom width and 3.0 m depth
* Slope coefficient: m = 1.5
* 15 cm thick monolithic reinforced concrete lining
* 0.5 mm polyethylene (PVD) geomembrane for anti-infiltration

**Operational Road:**

* Length: 46.667 km
* Width: 3.5 m
* Base: 20 cm sand and gravel

**Key Works:**

* PK 0+00 – PK 467+12: Full canal section lined with monolithic concrete
* PC 0+24: Replacement of 3 sluices (PS200-200), head concreting
* PC 165+10: Aqueduct with 3 pipes Ø1500 mm, PS170-240 sluices, inlet slope and bottom concreting
* PC 415+17: Culvert with 3 pipes Ø1000 mm
* SC 1+57 and SC 467+00: Hydrological stations with footbridges
* PK 25+65 and PK 72+22: Switchgear with spillways (type 1, left side)
* PC 80+06: Switchgear with spillways on both sides
* PK 14+09: Pedestrian bridge
* PK 51+89 to PK 464+64: 11 road bridges across key canal sections

This large-scale reconstruction improves water conveyance, infrastructure durability, and access along the canal.

**23. Reconstruction of the Bolnichny-1 Canal**

* **Total Length**: 0.585 km (585 meters)
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.6 m³/s
* **Irrigated area**: 95

**Technical Description:**

The Bolnichny-1 (Hospital-1) Canal is constructed with a **12 cm thick monolithic reinforced concrete lining**, supported by a **0.5 mm thick geomembrane**. The total length of the canal is **585 meters**.

The rehabilitation scope includes the following works:

* Cutting of existing road surface (ORS), reed vegetation, and dam segments
* Grubbing and removal of trees with a diameter of Ø32 cm
* Construction of compacted, high-quality embankments
* Excavation of the canal section and shaping of cross-section
* Profiling of the bottom, slopes, and berms (dykes)
* Application of **B20 class concrete monolithic lining** (12 mm thickness)
* Installation of **temperature expansion joints** at 9-meter intervals
* Treatment of the perimeter with herbicide to control vegetation
* Installation of **0.5 mm thick geomembrane waterproofing**
* Dismantling and removal of **17 reinforced concrete trays (LR-6)**

**Key Structures and Installations:**

* **PK0+40** – One (1) **water-measuring post** on the trapezoidal canal
* **PK0+81, PK1+55, PK3, PK4** – Four (4) **water outlets** to temporary irrigation systems with pipe crossings
* **PK2+12, PK3+47, PK4+95** – Three (3) **tubular crossings**
* **PK4+72, PK5+10, PK5+22, PK5+42, PK5+51, PK5+60, PK5+75** – Seven (7) additional **pipe crossings**

This reconstruction project enhances hydraulic efficiency, structural integrity, and the canal’s ability to serve surrounding agricultural areas with improved reliability.

**24. Reconstruction of the Birlik Canal**

* **Total Length**: 3.356 km
* **Capital Construction Class**: IV
* **Maximum Flow Capacity**: 0.2 m³/s
* **Irrigated area**: 82

**Technical Description:**

The Birlik Canal is constructed with a **12 cm thick monolithic reinforced concrete lining**, installed on a **0.5 mm thick geomembrane**. The total canal length is **3,356 meters**.

The reconstruction works include:

* Cutting of the existing road surface (ORS), reed vegetation, and dam structures,
* Grubbing and removal of trees with a diameter of Ø32 cm,
* Formation of compacted, high-quality embankments,
* Excavation and shaping of the canal section,
* Grading of the bottom, slopes, and berm (dyke),
* Application of **B20 class monolithic concrete lining** (12 mm thickness),
* Installation of **temperature expansion joints** every 9.0 meters,
* Perimeter herbicide treatment to prevent vegetation regrowth,
* Placement of **geomembrane waterproofing** (0.5 mm thick),
* Dismantling of old concrete structures along the existing canal alignment.

**Key Structures and Installations:**

* **PK0+60** – One (1) **water-metering post** on the trapezoidal canal
* **PK24+07** – One (1) **bridge crossing**
* **Water outlets to temporary irrigation systems with Ø500 mm pipe crossings** (18 units):
  + Located at: PK1, PK3, PK5 (x2), PK7, PK9, PK11, PK13, PK15, PK17, PK19, PK21, PK23, PK25, PK27, PK29, PK31, PK32+50, and PK33+56
* **Blocking Structures** (4 units):
  + Located at: PK5+15, PK11+15, PK15+15, and PK21+15
* **PK24+45** – One (1) **aqueduct** with a pipe diameter of **Ø800 mm**

This reconstruction aims to improve water delivery reliability and hydraulic performance across the canal’s service area while ensuring structural stability and long-term operation.

1. **Shu District, Zhambyl Region. Lot 2**

As part of the project for the rehabilitation, modernization, and construction of irrigation networks, large-scale activities are planned in the Zhambyl Region, particularly in the Shu District. In total, **21 irrigation canals** are scheduled for reconstruction under the **Left-Bank Main Canal (LBMC)**.

The **total length of the canals exceeds 88.2 km**, and the **serviced irrigated area is more than 14,000 hectares**. The primary construction type for all canals is **monolithic reinforced concrete lining with a thickness of 12 cm**, placed over a **waterproof geomembrane of 0.5 mm**, which significantly enhances the canals’ water retention capacity and durability.

**Key features of the project include:**

* A high degree of standardization in construction materials and design solutions;
* A wide coverage of agricultural lands in a region with strong farming potential;
* Inclusion of both large-scale canals (e.g., LBMC — 37.685 km) and smaller but functionally significant canals (ranging from 0.2 to 7 km in length);
* The use of modern technologies aimed at reducing water loss, increasing water supply reliability, and improving the agricultural sector’s resilience to climate stress.

**Expected outcomes of the program implementation:**

* Improved water availability for agriculture;
* Increased productivity of cultivated lands;
* Enhanced irrigation infrastructure aligned with climate challenges;
* Sustainable socio-economic development of the Shu District.

**1. Reconstruction of the LMK Canal**

**Length:** 37,685 meters  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 16.6 m³/s  
**Irrigated Area:** 10,870 hectares

The LMK canal was reconstructed using monolithic reinforced concrete to modernize the large-scale irrigation infrastructure. The works included removal of a 20 cm vegetation layer and leveling of adjacent areas, along with grubbing of bushes and small trees (up to 20 mm diameter). Existing metal and concrete structures, including damaged slopes and wing walls, were dismantled. The linear section (LCC) was relined with monolithic concrete to reinforce the slopes and wings.

A range of engineering structures were installed:

* **Hydrological post** at PK1+33.
* **Distribution structures with spillways** were placed at over 20 pickets, including PK11+00, PK117+57, PK239+35, PK334+50, and PK367+00.
* **Side spillways** were installed at PK57+32 (left), PK86+14 (left and right), and PK213+88 (two on left, one on right), with additional multi-directional spillways at PK246+25 and PK275+97.
* **Road bridges** were built at PK78+04, PK140+27, PK260+88, and others.
* A **diversion bridge** at PK376+71 and **pedestrian bridges** at 16 locations, including PK7+45, PK134+13, PK241+10, and PK338+53.
* **Spillways with pipe crossings** were placed on the **right** side at SC95+08, SC238+57, and SC290+13 (type 2), and on the **left** at PK93+13, PK144+38, and PK235+74.
* **High-speed (fast flow) sections** at PK98+73 and PK144+50.
* An **elevation drop** at PK363+80, a **switchyard** with left and right spillways and pipe crossings at PK418+20, and a **final spillway** at SC467+12.

This comprehensive rehabilitation ensures robust and high-capacity irrigation service across a vast agricultural area.

**2. Reconstruction of the Togai (Togambay) Canal**

**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.2 m³/s

**Irrigated area:** 47 Ha

**Canal Length:** 397 meters

The Togai (Togambay) Canal reconstruction project was focused on rehabilitating a small but vital irrigation channel to ensure reliable water supply for adjacent agricultural areas. The updated canal features a 12 cm thick monolithic reinforced concrete lining installed over a 0.5 mm thick geomembrane, significantly improving hydraulic performance and minimizing seepage losses.

**Scope of Work:**  
Works commenced with the removal of overgrowth, including ORS cutting, reed vegetation clearance, and dam cutting. Environmental landscaping included grubbing and planting of trees with a 32 cm diameter. High-quality embankments were constructed following canal excavation and shaping of the bottom, side slopes, and berm.

A reinforced B20-grade concrete lining (thickness 12 cm) was applied with transverse temperature joints every 9 meters. The canal perimeter was treated with herbicide, and a geomembrane with 0.5 mm thickness was installed to enhance impermeability.

**Hydraulic and Structural Installations:**

* **Water-measuring post:** 1 pc at PK0+35
* **Water outlets with tubular crossings (L=4 m):** 4 pcs at PK0+50, 2+40, 3+87, and 3+97
* **Tubular crossing Ø800 mm, L=30 m:** 1 pc at PK1+73
* **Barrier structure (no crossing):** 1 pc at PK2+50

Despite its short length, the canal now meets modern standards for irrigation reliability and structural durability, supporting improved agricultural productivity in the region.

**3. Reconstruction of the Melnichny Canal**

**Canal Length:** 200 meters  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.2 m³/s

**Irrigated area:** 15 Ha

The Melnichny Canal, although short in length, plays an important role in local irrigation infrastructure. Its reconstruction aimed to improve water delivery efficiency and structural reliability by upgrading the canal with modern materials and construction practices.

**Structural Specifications:**  
The canal was reconstructed with a **12 cm thick monolithic reinforced concrete lining** laid on a **0.5 mm geomembrane**, ensuring enhanced impermeability and structural integrity.

**Scope of Work:**  
Initial activities included cutting of ORS, reed vegetation, and dam structures. Environmental landscaping featured grubbing and replanting of 32 cm diameter trees. A quality embankment was arranged, followed by excavation and detailed planning of the bottom, slopes, and berm.

The concrete lining (B20 class) was reinforced and constructed with **temperature transverse joints every 9.0 meters** to accommodate thermal expansion. Herbicide treatment was applied along the canal perimeter to suppress vegetation growth.

**Installed Infrastructure:**

* **Head structure:** 1 pc at PK0+00
* **Water-measuring post:** 1 pc at PK0+25
* **Water outlets to temporary irrigation system (with pipe crossing):** 3 pcs at PK0+23, 1+00, and 2+25
* **Pipe crossings:** 2 pcs at PK0+80 and PK1+18

The result is a fully modernized short canal section supporting effective and sustainable irrigation in the Shu district.

**4. Reconstruction of the Bolnichny Canal**

**Canal Length:** 162 meters  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.5 m³/s

**Irrigated area:** 75

The Bolnichny Canal, also referred to as the Hospital Canal, underwent full reconstruction to upgrade its irrigation performance and hydraulic integrity. Despite its short length, the canal plays a key role in water distribution to local areas and required modernization to meet current operational standards.

**Design and Construction Details:**  
The reconstructed canal is lined with a **12 cm thick monolithic reinforced concrete layer**, supported by a **0.5 mm geomembrane** for waterproofing and erosion control.

**Scope of Work:**  
Key works included the removal of existing ORS (old reinforced structures), reed vegetation clearance, and dam segment cutting. Grubbing and planting of trees (ø32 cm) were carried out alongside the canal. The channel’s cross-section was excavated and reshaped, with careful planning of the bottom, side slopes, and berms.

The concrete lining (B20 class) was poured with **temperature transverse joints spaced every 9 meters** to accommodate thermal movement. Herbicide treatment was applied along the entire perimeter of the canal to limit future plant overgrowth, and geomembrane decking was laid as a base waterproofing layer.

**Hydraulic Structures Installed:**

* **Water-measuring post:** 1 pc at PC0+30
* **Pipe crossing:** 1 pc at PK1+10
* **Water outlets with pipe crossing to temporary irrigation system:** 3 pcs at PC0+60, PC1+30, and PC1+62

The reconstructed Bolnichny Canal now ensures stable and efficient water delivery, fulfilling both agricultural and environmental demands in this section of the Shu district.

**5. Reconstruction of the Zhaisan Canal**

**Canal Length:** 1,527 meters

**Irrigated area:** 65  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.5 m³/s

The reconstruction of the Zhaisan Canal aimed to restore and modernize a key irrigation channel in the Shu district to improve water delivery efficiency and structural resilience. The canal was relined with **12 cm thick monolithic reinforced concrete** over a **0.5 mm geomembrane**, enhancing its durability and impermeability.

**Scope of Construction Activities:** Preliminary works included cutting of ORS, reed vegetation removal, and dam cutting. Landscaping included grubbing and planting trees with a 32 cm diameter. The canal cross-section was excavated and re-profiled with detailed shaping of the bottom, side slopes, and berms.

Reinforcement and monolithic B20-class concrete lining was applied, with **temperature transverse joints every 9 meters** to manage expansion and contraction. Herbicide was sprayed along the canal’s perimeter to control vegetation, and a geomembrane was installed beneath the concrete layer. Old reinforced concrete components were dismantled as part of the upgrade.

**Installed Hydraulic and Civil Structures:**

* **Water-measuring post:** 1 pc at PC1+10
* **Water outlets with Ø500 mm pipe crossings:** 6 pcs at PK2+82, PK5, PK6, PK8, PK9+95, and PK12+25
* **Bridge crossings:** 2 pcs at PK4+71 and PK9+65
* **Tubular crossings (L=10 m):** 2 pcs at PK3+00 and PK6+76
* **End crossing:** 1 pc at PK15+27

The rehabilitated Zhaisan Canal now meets modern standards, supporting consistent irrigation supply for regional agricultural development.

**6. Reconstruction of the Zhidebai Canal**

**Canal Length:** 1,680 meters

**Irrigated area:** 80 ha  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.05 m³/s

The Zhidebai Canal reconstruction project aimed to restore functionality to a low-capacity, yet essential canal used for localized irrigation. The upgraded structure features a **12 cm thick monolithic reinforced concrete lining**, installed over a **0.5 mm thick geomembrane**, ensuring improved impermeability and long-term structural performance.

**Scope of Work:**  
Initial construction operations included the **cutting of ORS**, reed vegetation, and dam materials. Landscaping activities involved grubbing and planting of trees with a trunk diameter of 32 cm. Canal shaping was carried out through bottom and slope excavation and berm formation.

The entire canal section was lined with **B20-grade concrete**, and **temperature transverse joints were placed at 9-meter intervals**. Herbicide was applied around the perimeter to prevent regrowth of vegetation, and the geomembrane provided a protective layer under the concrete lining.

Additionally, **17 pieces of old LR-4 reinforced concrete trays** were dismantled and removed to clear the structure for the new installation.

**Installed Infrastructure Components:**

* **Water-measuring post:** 1 pc at PK1+00
* **Bridge crossing:** 1 pc at PK3+80
* **Water outlets with pipe crossings:** 7 pcs at PK2, PK3+90, PK6, PK8, PK10, PK12, and PK14
* **Tubular crossings:** 2 pcs at PK10+48 and PK16+52
* **End discharge outlet:** 1 pc at PK16+80

This reconstructed canal now offers significantly improved hydraulic performance and supports efficient water distribution for surrounding agricultural plots.

**7. Reconstruction of the Salyamov Canal**

**Canal Length:** 1,314 meters

**Irrigated area:** 50 ha  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.5 m³/s

The reconstruction of the Salyamov Canal aimed to restore efficient irrigation service in the Shu district through comprehensive structural rehabilitation. The upgraded canal features a **12 cm thick monolithic reinforced concrete lining**, placed on a **0.5 mm geomembrane** for water retention and structural integrity.

**Scope of Construction Activities:** Preliminary works included **cutting of ORS**, reed vegetation, and dam materials. Trees with a diameter of 32 cm were grubbed and replanted. Earthworks involved section excavation and shaping of the canal bottom, slopes, and berms.

A **B20-grade monolithic concrete lining** was applied along the canal, reinforced with **temperature transverse joints placed every 9.0 meters**. A herbicide was sprayed around the perimeter to prevent vegetative regrowth. A geomembrane layer (0.5 mm thick) was installed before lining. Additionally, **17 pieces of old LR-4 concrete trays** were dismantled and removed.

**Installed Structures:**

* **Water-measuring post:** 1 pc at PK0+40
* **Water outlets with pipe crossings (Ø500 mm):** 15 pcs at PK1+44, PK2, PK2+40, PK3+50, PK3+77, PK5+33, PK5+60, PK5+70, PK6, PK7, PK8, PK10, PK11+50, PK13+14
* **Bridge crossing:** 1 pc at PK4+73
* **Tubular crossings:** 2 pcs at PK2+45 and PK4+19
* **Pedestrian bridge:** 1 pc at PK9+28
* **Barrier structure:** 1 pc at PK5+80

This project ensures enhanced reliability and capacity of the canal, contributing to the region’s agricultural productivity and efficient water management.

**8. Reconstruction of the Novotroitsky-2 Canal**

**Canal Length:** 7,765 meters

**Irrigated area: 600 ha**  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 1.0 m³/s

The Novotroitsky-2 Canal was reconstructed to enhance irrigation infrastructure and water conveyance efficiency in the agricultural lands of the Shu district. The canal's structure is now composed of a **12 cm thick monolithic reinforced concrete lining**, placed over a **0.5 mm thick geomembrane**, ensuring long-term durability and water retention.

**Scope of Works:**  
Initial operations included **ROW cutting**, **clearing of reed vegetation**, and **dam removal**. Vegetation management also involved **grubbing and planting of 32 cm diameter trees**, while earthworks included **section excavation**, **planning of the canal bottom, side slopes, and berm**, and **formation of quality embankments**.

Structural improvements featured **monolithic B20-class concrete lining** with **temperature transverse joints at every 9 meters**. A **herbicide treatment** was applied to the perimeter, and the geomembrane (0.5 mm) was laid beneath the concrete. Damaged concrete sections of the existing canal were dismantled.

**Installed Infrastructure Components:**

* **Water-measuring posts:** 2 pcs at PK0+30 and PK0+35
* **Bridge crossings:** 5 pcs at PK23+85, PK27+78, PK38+40, PK52+18, PK75+55
* **Water outlets to temporary irrigation system (Ø500 mm pipe crossings):** 40 pcs at PK1 to PK76+65
* **Blocking structures (no crossing):** 8 pcs at PK10+15, PK21+15, PK31+15, PK41+15, PK47+15, PK51+15, PK61+15, PK71+15

These comprehensive upgrades ensure reliable operation of the Novotroitsky-2 Canal and contribute significantly to the agricultural productivity of the region by stabilizing water delivery and reducing loss.

**9. Reconstruction of the Aral-Tuba Canal**

**Canal Length:** 2,100 meters

**Irrigated area: 80 ha**  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.3 m³/s

The Aral-Tuba Canal was reconstructed to support improved irrigation efficiency in rural agricultural zones of the Shu district. The canal was modernized using a **12 cm thick monolithic reinforced concrete lining**, placed over a **0.5 mm thick geomembrane**, enhancing water retention and structural resilience.

**Scope of Construction Activities:**  
The project began with **clearing of ORS**, reed vegetation, and dam obstructions. Landscaping works included the grubbing and planting of trees with a trunk diameter of 32 cm. The canal section was excavated and shaped, with proper bottom and slope planning including dike (berm) formation.

The canal channel was reinforced with **B20-grade monolithic concrete**, and **temperature transverse joints were arranged at 9-meter intervals**. A perimeter herbicide application was performed to prevent vegetative regrowth. A geomembrane lining was placed beneath the concrete layer. The existing deteriorated concrete structures were dismantled and removed.

**Installed Infrastructure Components:**

* **Water-measuring post:** 1 pc at PK0+40
* **Bridge crossing:** 1 pc at PK5+90
* **Water outlets with pipe crossings (Ø500 mm):** 11 pcs at PK1, PK3, PK5, PK7, PK9, PK11, PK13, PK15 (x2), PK17, PK19, PK21
* **Blocking structures (barriers):** 4 pcs at PK3+15, PK7+15, PK11+15, PK17+15

With these improvements, the Aral-Tuba Canal is now optimized for long-term use in delivering irrigation water to nearby agricultural lands with minimal loss and maximum flow efficiency.

**10. Reconstruction of the Zemlyanoy Karabas Canal**

**Total Length:** 831 meters,

**Irrigated area: 475 ha,**

**Maximum Flow Capacity:** 1.0 m³/s

**Capital Construction Classification:** Class IV

The reconstruction project for the Zemlyanoy Karabas Canal was carried out with the primary goal of modernizing the existing irrigation infrastructure, increasing efficiency, and ensuring long-term sustainability. The canal, originally an earthen structure, was significantly upgraded through the use of modern construction materials and technologies.

As part of the project, the entire canal length received a **12 cm thick monolithic reinforced concrete lining**, installed on top of a **0.5 mm thick polyethylene geomembrane**. This combination of materials serves both structural and hydraulic purposes, ensuring water-tightness, minimizing infiltration losses, and extending the service life of the canal.

**Key Construction and Improvement Activities:**

* **Clearing of the Right-of-Way (ROW):** Removal of obstructions and vegetation within the working corridor of the canal
* **Reed and Dam Vegetation Removal:** Cutting of overgrown reed beds and existing dam structures to clear the canal path
* **Grubbing and Tree Planting:** Excavation of old tree roots and planting of new trees with a trunk diameter of 32 cm to maintain the environmental balance and reduce soil erosion
* **Formation of a High-Quality Embankment:** Compaction and shaping of side embankments to improve stability and prevent washouts
* **Excavation and Profiling:** Earthworks to form the desired canal geometry, including shaping of the canal bottom, side slopes, and berms in accordance with hydraulic design standards
* **Monolithic Concrete Lining:** Application of B20-grade reinforced concrete at a thickness of 12 cm, which forms a continuous water-conveying channel
* **Temperature Control Joints:** Installation of transverse expansion joints at 9-meter intervals to accommodate thermal movements and prevent cracking
* **Perimeter Herbicide Application:** Treatment of the canal's outer perimeter to control unwanted vegetation growth
* **Installation of Geomembrane Lining:** Placement of a 0.5 mm thick polyethylene anti-seepage membrane beneath the concrete to enhance water retention
* **Demolition of Existing Structures:** Removal of worn or damaged concrete sections from the original canal for proper integration with new materials

**Hydraulic and Auxiliary Structures Constructed:**

* **Water-Measuring Post:** Constructed at PC 0+40 to monitor canal discharge and flow efficiency
* **Bridge Crossings:** Three bridge crossings were built at PK 1+05, PK 3+20, and PK 7+10 to allow safe passage over the canal for pedestrians and vehicles
* **Water Outlets for Temporary Irrigation Systems:** Four outlets equipped with pipe crossings were installed at PK 2, PK 4, PK 6, and PK 7+60 to support localized irrigation during peak agricultural seasons
* **Barrier Structure:** A reinforced concrete barrier structure was constructed at PK 4+15 to regulate and control water distribution as needed

**Project Outcome:**

The completed reconstruction of the Zemlyanoy Karabas Canal has significantly improved the canal’s operational reliability, reduced water losses through infiltration, and provided a robust, long-term solution to meet the irrigation demands of local agricultural lands. This investment not only benefits farmers but also contributes to the sustainable use of water resources in the region.

**11. Reconstruction of the Masak Aktobe Canal**

**Length:** 7,288 m

**Irrigated area: 233 ha**  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 1.0 m³/s

**Technical Characteristics:**

* **Lining:** 12 cm thick monolithic reinforced concrete lining on a 0.5 mm thick geomembrane (B20 class).
* **Geomembrane:** Laid under the entire canal section (thickness = 0.5 mm).
* **Transverse Temperature Joints:** Installed every 9.0 m.

**Construction Works:**

* Cutting of right-of-way (ROW), reeds, and existing dam.
* Dismantling of existing concrete lining.
* Excavation and shaping of canal sections.
* Grubbing and planting of trees (ø32 cm).
* Construction of compacted embankments and berms.
* Bottom, slope, and dike planning.
* Herbicide treatment along the canal perimeter.

**Hydraulic Structures Installed:**

* **Water-measuring post:** 1 pc (at PK0+40, trapezoidal canal).
* **Water outlets:** 38 pcs (at every 2 PK interval from PK1 to PK72+88), Ø500 mm pipe crossings for temporary irrigation system.
* **Barrier structures:** 12 pcs (located at PK5+15, 11+15, 15+15, 21+15, 25+15, 33+15, 39+15, 43+15, 49+15, 55+15, 61+15, 67+15).

**12. Reconstruction of the Pioneer Canal**

**Length:** 3,707 meters

**Irrigated area: 405 ha,**  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.7 m³/s

The Pioneer Canal was reconstructed using modern materials and techniques to enhance water delivery efficiency and reliability. The canal is lined with a 12 cm thick monolithic reinforced concrete layer of B20 grade, which is placed over a 0.5 mm thick geomembrane to ensure impermeability and structural integrity.

The reconstruction involved several preparatory and earthworks. These included cutting of the operational right-of-way (ORS), clearing of reed vegetation, and dismantling of dam sections where necessary. Trees with a diameter of up to 32 cm were grubbed and replanted to accommodate canal alignment and embankment requirements.

The canal cross-section was excavated and shaped according to design profiles, including the formation of quality embankments and the planning of canal bottom, side slopes, and berms. A full geomembrane decking was applied prior to the concrete lining. Transverse temperature joints were installed at 9.0-meter intervals to accommodate thermal expansion and prevent cracking.

To control vegetation and ensure long-term maintenance, the entire perimeter of the canal was treated with herbicides.

In terms of hydraulic infrastructure, one water-measuring post was installed at PK0+50 on the trapezoidal section of the canal to monitor flow rates. A total of six bridge crossings were constructed at key locations, specifically at PK13+10, PK13+62, PK15+23, PK18+42, PK20+07, and PK28+55, ensuring uninterrupted transportation across the canal.

Seventeen water outlets with Ø500 mm pipe crossings were installed along the canal at various chainages (PK1 through PK36+12) to connect with a temporary irrigation system. Additionally, six Ø800 mm pipe crossings were installed at PK24+40, PK24+66, PK25+09, PK25+92, PK29+45, and PK30+95 to handle larger volumes or for special irrigation needs.

Furthermore, six blocking structures were constructed at PK7+15, PK16+15, PK23+15, PK28+15, PK33+15, and PK36+06 to manage flow control and ensure operational flexibility within the irrigation network.

**13. Reconstruction of the Taylak 2-1 Canal**

**Length:** 2,554 meters

**Irrigated area: 75 ha,**  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.2 m³/s

The Taylak 2-1 Canal was reconstructed to improve irrigation efficiency and water delivery to agricultural areas. The reconstruction included full lining of the canal with a 12 cm thick monolithic reinforced concrete layer (B20 class), laid over a 0.5 mm thick geomembrane to enhance water tightness and reduce seepage losses.

Preliminary site preparation works included cutting of the operational right-of-way (ORS), removal of reed vegetation, and demolition of sections of the old dam structures. Trees with a diameter of up to 32 cm were grubbed and either removed or replanted as necessary. The canal cross-section was excavated and shaped according to the design specifications, including the formation of embankments, bottom leveling, side slope profiling, and berm (dike) formation.

The geomembrane was laid along the full canal length prior to concrete placement. To ensure the longevity of the concrete structure, temperature control transverse joints were arranged at 9.0-meter intervals. The perimeter of the canal was treated with herbicide to control weed growth and maintain clear access for maintenance activities.

As part of the hydraulic infrastructure, a water-measuring post was installed at PK0+80 on the trapezoidal section of the canal to monitor flow and usage.

Two bridge crossings were constructed at PK8+82 and PK12+50 to maintain road access over the canal. Thirteen water outlets, equipped with pipe crossings, were installed at PK1, 3, 5, 7, 9, 11, 13, 15, 15, 17, 19, 21, 23, and 25+54. These provide connections to the temporary irrigation systems via Ø500 mm pipes.

Additionally, four blocking (regulating) structures were installed at PK7+15, PK11+15, PK17+15, and PK23+15 to control the flow of water and allow operational flexibility within the system.

**14. Reconstruction of the Taylak 2-2 Canal**

**Length:** 548 meters,

**Irrigated area: 224 ha,**  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.2 m³/s

The Taylak 2-2 Canal underwent reconstruction to improve the reliability of water supply for local agricultural needs. The canal was relined with a 12 cm thick monolithic reinforced concrete structure (B20 grade) placed on a 0.5 mm thick geomembrane. This modern lining system ensures durability and minimizes water loss due to seepage.

The scope of preliminary works included the cutting of the existing low-density polyethylene (LDP) lining, removal of reed vegetation, and cutting of the dam. Grubbing and replanting of trees with a diameter of up to 32 cm were also carried out in the project area.

The canal section was excavated and shaped in accordance with the design, including careful planning of the canal bottom, slopes, and berm (dike) formation. Quality embankments were arranged along the canal route to support structural integrity and prevent erosion. A geomembrane with a thickness of 0.5 mm was laid under the entire concrete lining to enhance impermeability.

To accommodate temperature-related expansion and contraction, transverse temperature joints were arranged at every 9 meters. Additionally, the canal perimeter was treated with herbicide to suppress vegetation growth and facilitate maintenance access.

A water-measuring post was installed at PK0+90 on the trapezoidal section of the canal to monitor flow volumes and operational performance. One bridge crossing was constructed at PK8+50 to maintain transportation connectivity.

The project also included the installation of eight water outlets with Ø500 mm pipe crossings, located at PC1, 3, 5, 5, 7, 9, 11, 13, and 15. These outlets connect the canal to the temporary irrigation system. Furthermore, four blocking (control) structures were constructed at PK5+15, PK9+15, PK14+15, and PK15+15 to regulate water distribution and enable flexible water management during operation.

**15. Reconstruction of the Old Karabas Canal**

**Length:** 1,362 meters

**Irrigated area: 60 ha**

**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.3 m³/s

The Old Karabas Canal was reconstructed as part of a broader irrigation improvement initiative aimed at enhancing water delivery efficiency to local agricultural lands. The canal lining was upgraded using a 12 cm thick monolithic reinforced concrete layer (B20 class), which was laid over a geomembrane of 0.5 mm thickness to reduce water loss and improve structural performance.

Preliminary earthworks included the cutting of the right-of-way (ROW), removal of reed vegetation, and partial dam dismantling where necessary. Trees with a diameter of 32 cm were grubbed and replanted in compliance with environmental management standards.

The entire canal cross-section was excavated and reshaped. Quality embankments were constructed and the canal bottom, side slopes, and berm (dike) were planned and leveled according to design specifications. Prior to concrete lining, the full length of the canal was covered with geomembrane (0.5 mm thick) for waterproofing.

Temperature-induced expansion was accounted for by installing transverse joints every 9.0 meters along the concrete lining. To prevent weed overgrowth and facilitate future maintenance, herbicide treatment was applied along the canal perimeter.

A water-measuring post was installed at PK0+40 on the trapezoidal section of the canal to monitor water flow and distribution.

As part of the hydraulic infrastructure, the canal includes:

* **6 bridge crossings** located at PK1+15, PK4+37, PK5+48, PK6+73, PK8+00, and PK10+47, ensuring connectivity across the canal;
* **6 water outlets** connected to a temporary irrigation system via pipe crossings at PK1+36, PK3+73, PK6+20, PK8+50, PK11+00, and PK13+50;
* **2 barrier structures** for flow control, located at PK4+15 and PK9+15;
* **9 tubular crossings (TP-80 type)** installed at PK0+65, PK4+30, PK6+00, PK6+58, PK6+85, PK7+38, PK9+29, PK11+45, and PK12+58.

This reconstruction significantly improved the canal’s capacity, structural stability, and operational efficiency for seasonal water delivery.

**16. Reconstruction of the Koskudyk Canal**

**Length:** 3,161 meters

**Irrigated area:** 190 ha  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.3 m³/s

The Koskudyk Canal was reconstructed to improve the water supply infrastructure serving the local agricultural lands. The canal lining was upgraded using a 12 cm thick monolithic reinforced concrete (B20 grade), laid on a 0.5 mm thick geomembrane to enhance impermeability and durability.

Initial site preparation included cutting of the operational right-of-way (ORS), clearing of reed vegetation, and dismantling of old dam sections. Trees with a diameter of 32 cm were grubbed and replanted as part of environmental restoration efforts. The canal section was then excavated and reshaped, with proper planning of the bottom, side slopes, and dikes (berms). Quality embankments were constructed to ensure structural stability.

The geomembrane was installed along the entire canal bed before the placement of the concrete lining. Transverse temperature joints were constructed at 9-meter intervals to accommodate expansion and contraction of the concrete lining. To control weed growth and ensure easy maintenance, the perimeter of the canal was treated with herbicide.

One water-measuring post was installed at PC1+00 on the trapezoidal section of the canal to monitor discharge and support operational control.

A range of hydraulic and crossing structures were also installed:

* **13 water outlets** to the temporary irrigation system with Ø500 mm pipe transitions were constructed at PK2, PK4+45, PK12+72, PK15+93, PK17+80, PK18+21, PK18+33, PK18+45, PK19+58, PK20+40, PK20+54, PK29+78, and PK30+33;
* **3 partition (blocking) structures** were installed at PK4+80, PK12+78, and PK18+55 for water flow regulation;
* **7 pipe crossings** (Ø800 mm) were placed at PK0+50, PK2+92, PK9+72, PK14+86, PK30+27, and PK31+18 to allow water or vehicle access;
* **3 bridge crossings** were constructed at PK2+65, PK22+09, and PK23+17;
* **4 pedestrian bridges** were installed at PK20+75, PK24+11, PK27+06, and PK30+35 to maintain foot traffic across the canal.

**17. Reconstruction of the Bimenbet Canal**

**Length:** 5,421 meters

**Irrigated area: 853 ha,**  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 2.0 m³/s

The Bimenbet Canal, one of the larger irrigation channels in the Shu district, was reconstructed to significantly enhance water conveyance capacity and operational efficiency. The reconstructed canal features a 12 cm thick monolithic reinforced concrete lining (B20 grade), placed over a 0.5 mm thick geomembrane, ensuring high impermeability and structural reliability.

Initial works included cutting of the operational right-of-way (ORS), removal of reed vegetation, and partial demolition of existing dams. Trees with a diameter of up to 32 cm were grubbed and replanted as per environmental guidelines. The canal cross-section was then excavated, and its bottom, side slopes, and berms (dikes) were reshaped and leveled to meet design parameters. Quality embankments were constructed to stabilize the canal structure.

Before pouring the concrete lining, the geomembrane was fully laid to ensure waterproofing. To prevent cracking due to temperature changes, transverse expansion joints were placed every 9 meters. Herbicide was applied along the perimeter of the canal to suppress vegetation and support long-term maintenance.

Two water-measuring posts were installed on the trapezoidal canal section: one at PK0+04 and the other at PK54+30, allowing for accurate monitoring of discharge at both the head and tail ends of the canal.

A total of **30 water outlets** were constructed to serve temporary irrigation systems. These are located at regular intervals along the canal: PK0+50, 0+60, 3+00, 3+60, 5+12, 7+00, 9+30, 11+00, 13+00, 15+00, 17+00, 18+84, 21+00, 22+48, 24+30, 26+00, 28+80, 31+00, 33+00, 35+00, 37+80, 40+00, 42+00, 43+20, 45+00, 47+00, 49+00, 51+00, and 53+00.

To ensure uninterrupted access and safe water distribution, **four pipe crossings** with Ø1000 mm pipes were constructed at PK2+45, PK4+19, PK5+19, and PK45+50. Additionally, one dam structure with Ø1000 mm capacity was installed at PK54+55.

Finally, **four partition (control) structures** were placed at PK0+65, PK18+90, PK43+20, and PK46+32, enabling effective regulation of water flow across various canal sections.

**18. Reconstruction of the Estemes-2 Canal**

**Length:** 3,860 meters

**Irrigated area:** 350 ha,  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.7 m³/s

The Estemes-2 Canal was reconstructed to improve irrigation efficiency and infrastructure durability. The canal lining was upgraded with a 12 cm thick monolithic reinforced concrete layer (B20 grade), laid over a 0.5 mm thick geomembrane, providing strong impermeability and structural resilience.

Initial site preparation included cutting of the existing low-density polyethylene (LDP) lining, removal of reed vegetation, and partial dam demolition. Trees with a diameter of 32 cm were grubbed and replanted as required. The canal section was excavated and shaped, with the bottom, side slopes, and berms (dikes) planned and graded in line with design requirements. Quality embankments were also constructed for structural stability.

The geomembrane (0.5 mm thick) was installed continuously along the canal before placing the concrete lining. To control thermal expansion, transverse temperature joints were placed every 9 meters. Herbicide was applied along the entire canal perimeter to reduce vegetation growth and facilitate future maintenance.

A water-measuring post was installed at PK0+70 on the trapezoidal section of the canal to track flow rates and assist in irrigation management.

To support temporary irrigation needs, **21 water outlets** with Ø500 mm pipe transitions were installed at the following locations: PK2, 4, 6, 8, 10, 12, 14, 16, 19, 20, 22, 24, 0+25, 26, 28, 30, 31+72, 34, 36, and 38+60.

In addition, **five partition structures** were constructed at PK6+15, PK12+15, PK19+15, PK24+15, and PK30+15 to regulate water flow and segment the canal into operational sections.

**19. Reconstruction of the Shu Canal**

**Canal Length:** 2,554 meters

**Irrigated area:** 50 ha  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.2 m³/s

The Shu Canal reconstruction project involved a complete modernization of the existing irrigation channel to improve efficiency and reliability. The new structure consists of a 12 cm thick monolithic reinforced concrete lining laid over a 0.5 mm thick geomembrane, ensuring high durability and water tightness.

Key activities included the cutting of the existing ORS (old reinforced structures), removal of reed vegetation, and partial dam cutting. The project also involved the grubbing and planting of trees with a diameter of 32 cm, along with the construction of a high-quality embankment. The canal cross-section was excavated, and the bottom, slopes, and berm (dike) were carefully planned and shaped.

The canal bed was lined with B20-grade monolithic concrete (12 cm thick), and temperature control was ensured through transverse joints placed every 9.0 meters. To minimize vegetation regrowth, herbicide treatment was applied along the canal perimeter. The geomembrane (0.5 mm) was laid before concrete pouring, and dismantling of the previous concrete lining was carried out.

**Engineering and Hydraulic Structures:**

* **Water-measuring post:** 1 pc at PK0+55
* **Water outlets with Ø500 mm pipe crossings:** 11 pcs at PK1, 3, 5, 7, 9, 11, 13, 14, 16, 18, and 21+88
* **Partition structures:** 2 pcs at PK5+10 and PK11+10
* **TP-100 pipe crossings:** 7 pcs at PK4+82, 10+55, 12+15, 15, 15+80, 19+75, and 19+88
* **Water outlet Ø100 mm:** 1 pc at PK0+10

This reconstruction enhances the canal's capacity to deliver irrigation water efficiently, while supporting the environmental and operational sustainability of the Shu irrigation system.

**20. Reconstruction of the Abay Canal**

**Canal Length:** 750 meters

**Irrigated area:** 60 ha  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.1 m³/s

The Abay Canal reconstruction project was carried out to rehabilitate and modernize a small-capacity irrigation canal using durable materials and hydraulic engineering solutions. The reconstructed canal features a 12 cm thick monolithic reinforced concrete lining placed on a 0.5 mm thick geomembrane, ensuring long-term structural stability and water tightness.

**Scope of Work:**  
The works began with the removal of reed vegetation, LDP cutting, and dam cutting. Trees with diameters of 32 cm were grubbed and replanted as part of the landscape and environmental mitigation plan. The canal cross-section was carefully excavated, and a high-quality embankment was constructed. The canal bottom, side slopes, and berms were reshaped and planned according to design standards.

Reinforcement included the installation of B20-grade concrete with a thickness of 12 cm and transverse temperature joints spaced every 9.0 meters. A 0.5 mm geomembrane was installed under the concrete to prevent seepage. The perimeter of the canal was treated with herbicide to suppress unwanted vegetation growth. Concrete from the original canal was dismantled and removed.

**Hydraulic Structures Installed:**

* **Water-measuring post:** 1 pc at PK0+80
* **Water outlets with Ø500 mm pipe crossings:** 20 pcs at PK0+15 to PK7+50
* **Partition structure:** 1 pc at PK2+05
* **Pipe crossings Ø800 mm:** 12 pcs at PK2+60, 3+07, 4+30, 4+65, 4+90, 5+45, 5+66, 6+12, 6+30, 6+58, 6+83, and PK7

This reconstruction has improved the Abay Canal’s operational efficiency, ensuring stable water delivery to agricultural lands and increasing the reliability of the Shu irrigation network.

**21. Reconstruction of the Kunshygys Canal**

**Canal Length:** 1,322 meters

**Irrigated area:** 80 ha  
**Capital Construction Class:** IV  
**Maximum Carrying Capacity:** 0.4 m³/s

The Kunshygys Canal was reconstructed to enhance water delivery capacity and reliability for irrigation purposes in the Shu district. The project included a full replacement of the canal lining with a 12 cm thick monolithic reinforced concrete layer placed over a 0.5 mm thick geomembrane to ensure structural integrity and prevent seepage.

**Main Construction Activities:** Initial works involved the cutting of existing LDP, reed vegetation removal, and dam cutting. Landscaping included the grubbing and planting of 32 cm diameter trees, construction of a compacted embankment, and excavation of the canal section. The canal bottom, side slopes, and berm were shaped and stabilized.

The concrete lining of B20 class (t = 0.12 m) was laid with temperature transverse joints every 9 meters for crack control. The canal perimeter was treated with herbicide to manage vegetation growth. A geomembrane (0.5 mm thick) was laid underneath the concrete, and the existing old canal concrete was dismantled.

**Installed Hydraulic Structures:**

* **Water-measuring post:** 1 pc at PK0+50
* **Water outlets with Ø500 mm pipe crossings:** 7 pcs at PK1, 3, 5, 7, 9+40, 11, and 13+22
* **Bridge crossings:** 2 pcs at PK9+55 and PK11+90

The reconstruction improved the canal’s functionality, ensuring consistent water distribution for agricultural use while extending the canal's service life.

1. **Baizaksy District, Zhambyl Region. Lot 3**

**General Overview**

The Baizak District is undergoing significant irrigation infrastructure rehabilitation, encompassing **18 distinct canal repair and reconstruction projects** across various rural districts. These projects collectively aim to **restore, modernize, and enhance irrigation services** across approximately **5,300 hectares of agricultural land**, thereby improving water efficiency, reducing losses, and boosting agricultural productivity.

The canals vary in scale, with **lengths ranging from 1.4 km to over 12 km**, and **capacities from 0.2 m³/s up to 1.7 m³/s**. The works include **monolithic reinforced concrete lining, installation of prefabricated concrete flumes (trays), construction of hydraulic structures**, and **vegetation clearance**.

**Typical Construction Works**

Each project includes some or all of the following:

* **Canal Lining**: Many canals are being converted from earthen channels into lined canals using **monolithic reinforced concrete** (grades like C12/15 or C16/20) or **prefabricated reinforced concrete flumes** (e.g., Lr-6, Lr-8, Lr-10). This prevents water loss through seepage.
* **Hydraulic Structures**:
  + **Headworks and Water Intakes**: Installed at the start of most canals for regulated water diversion.
  + **Water-Measuring Posts**: Hydrometric bridges are added to monitor flow and distribution.
  + **Water Outlets**: Placed at regular intervals for field irrigation; often equipped with regulating gates (e.g., GS100-150).
  + **Pipe and Bridge Crossings**: Designed to allow uninterrupted road and water traffic.
  + **Turn Wells and Distribution Units**: Facilitate water redirection into sub-canals or adjacent fields.
  + **End Structures**: Built at canal termini to ensure safe water discharge and erosion protection.
* **Vegetation and Obstruction Removal**: Mechanical removal of **trees, bushes, and reed vegetation** is done before construction to ensure clear access and long-term canal operability.

**Geographic Distribution and Scope**

* **Myrzatai Rural District**: 5 projects including *Nazarbek-2*, *Zhana-1*, *Akberdi*, and *Tleubolat-4*, featuring extensive canal reconstruction using both flumes and concrete linings.
* **Botamoynak Rural District**: 2 canals (*R-9* and *Akkoyly*) divided into multiple branches with reinforced trays and complex distribution structures.
* **Tuymekent Rural District**: 3 projects (*Sapak*, *Syrgabai*, *Tapan*) with medium-scale capacity upgrades and multiple outlet types.
* **Sukhanbaevsky & Ynttymak Districts**: 4 projects (*Baibek*, *Kokozek*, *R-2*, *R-4*) featuring full channel replacement, extensive pipe crossings, and well-equipped distribution infrastructure.
* **Koktal & Ulgilinsky Districts**: Major projects (*Aulie-Ata Kus canals*, *Karazhota*) with long distances, aqueducts, and high-volume reinforced lining.
* **Sarykemer District**: The *Novo-Mikhailovsky* project consists of **three interconnected canals**, with diverse structural interventions including full replacement of canal bodies and all associated infrastructure.

**Engineering Significance**

These projects follow national and GOST standards for irrigation infrastructure, notably:

* **Series 3.820.1-34c**: Used for flume design and prefabricated concrete units.
* **GOST 34028-2016**: Standards for reinforcement mesh and concrete durability.

Advanced elements like **geomembrane waterproofing**, **sulfate-resistant concrete**, and **aqueduct construction over existing canals** are used in several key locations (e.g., *Karazhota*, *Zhana-1*, *Tleubolat-4*), indicating a high level of technical sophistication and adaptation to field conditions.

**Expected Outcomes**

* **Enhanced Water Delivery Efficiency**  
  Due to lined canals, improved regulation, and modern outlets.
* **Reduced Maintenance Burden**  
  Tree and shrub removal and robust construction reduce future upkeep.
* **Improved Agricultural Output**  
  Over 5,300 hectares will receive stable, regulated irrigation.
* **Climate Resilience & Water Savings**  
  Modernization reduces losses, improves measurement, and enables better control under drought conditions.

**1. Major repairs of the Nazarbek-2 Canal**

**Location:**  
Myrzatai Rural District, Baizak District, Zhambyl Region  
**Canal Length:**  
2.465 km

**Technical Specifications:**

* **Suspended irrigated area:** 160 hectares
* **Throughput capacity:** 0.2 m³/s
* **Capital construction class:** IV

**Canal Characteristics:**

The canal is constructed using **reinforced concrete blocks Lr-6**. It includes the installation of joints for trays and **supporting slabs P6-4.5**, following **series 3.820.1-34c** design standards.

**Works Include:**

* **Rooting of bushes**
* **Water-measuring post** located at PK0+60
* **Tubular (road) crossings** at:
  + PK4+70
  + PK6+34
  + PK7+38
  + PK10+75
  + PK19+58
* **Water outlets to the right** at:
  + PK2+25
  + PK11+96
* **Water outlets to the left** at:
  + PK8+36
  + PK8+82
  + PK18+89
  + PK19+42
  + PK21+16
  + PK22+69
* **Two-way culverts** (right and left) at:
  + PK5+90
  + PK15+21
* **Turnaround manholes**
* **End structure** at:
  + PK24+65

**2. Major repairs of the Zhana-1 Canal**

**Location:**  
Myrzatai Rural District, Baizak District, Zhambyl Region  
**Canal Length:**  
5.859 km

**Technical Specifications:**

* **Suspended irrigated area:** 350 hectares
* **Throughput capacity:** 0.5 m³/s
* **Capital construction class:** IV

**Scope of Works and Technical Description:**

* **Vegetation Removal:**  
  Clearing of shrub vegetation along the berms of the canal.
* **Lining and Base Construction:**  
  From PK0 to PK57+00, the canal will be lined with **monolithic reinforced concrete** of grade **C16/20 (B20W4F150)**, reinforced with **Ø8ASH mesh reinforcement** at 200mm x 200mm spacing, in accordance with **GOST 34028-2016**.  
  A **PVD geomembrane (impervious, 0.5 mm thick)** will be placed under the concrete lining up to the berm, with a **sand bed (10 cm thick)** prepared beneath.
* **Head Structure Works (PK0+00):**
  + Repair and additional concreting of the **monolithic reinforced concrete outlet heads** using concrete grade **C16/20 (B20W4F150)**.
  + Reinforcement with **Ø10ASH mesh**, 200mm x 200mm spacing (GOST 34028-2016).
  + **Installation of gate PS100-100** in accordance with **TP180-166**, “Surface sliding gates with screw propellers.”
* **Bridge Repair Works (PK56+56):**
  + Additional concreting of the water outlet heads using **monolithic reinforced concrete**, grade C16/20 (B20W4F150),
  + Reinforced with **Ø10ASH mesh** with 200mm x 200mm spacing (GOST 34028-2016).

**Structures Included in the Project:**

1. **Water-measuring post with hydrometric bridge** at PK3+19
2. **Water outlet with pipe crossing and blocking structure** at PK4+66
3. **Water outlets with blocking structures** at:
   * PK11+41
   * PK16+01
   * PK28+86
   * PK50+30
   * PK50+90
4. **Double outlets with pipe crossings and blocking structures** at:
   * PK23+10
   * PK31+46
   * PK36+04
5. **Bridge crossings** at:
   * PK8+67
   * PK35+94
   * PK42+90
6. **Discharge structure** into Zhana-1 canal at PK44+04
7. **End structure** at PK57+00

**3. Major Repairs of the R-9 Canal**

**Location:**  
Botamoinak Rural District, Baizak District, Zhambyl Region

**Total Length:**  
1.994 km, including:

* R-9: 0.642 km
* R-9-1: 0.812 km
* R-9-2: 0.54 km

**Technical Characteristics:**

* **Suspended irrigated area:** 274 hectares
* **Total design discharge:** 1.5 m³/s
* **Capital construction class:** IV

**Scope of Works:**

* **Vegetation Clearing:**  
  Clearing of small shrub vegetation along the berms of the canal.
* **Concrete Structures and Lining:**
  + Installation of **reinforced concrete trays** (types **LR-10, LR-8, LR-6**) selected based on hydraulic calculations.
  + Installation on **P9-6** and **P6-4.5** supporting slabs.
  + Application of **parabolic flumes** in accordance with **Series 3.820.1-34c** “Unified reinforced concrete structures for water management construction.”
  + Prior to new works, dismantling of **damaged hydraulic structures** and **obsolete reinforced concrete pipes** from old crossings.

**Key Facilities and Structures Provided:**

1. **Tray installation** including joints and slab supports.
2. **Distribution manhole** at PK0+12 for branching of R-9 and R-9-2.
3. **Distribution well** at PK0+27 for branching of R-9 and R-9-1.
4. **Water gauging stations** for flow monitoring on all three canal branches (R-9, R-9-1, R-9-2).
5. **Turning wells** included to facilitate water redirection and control.
6. **Water outlets** to temporary irrigators:
   * 5 outlets on R-9
   * 5 outlets on R-9-2
7. **Bridge crossings** provided at:
   * R-9: PK3+18
   * R-9-1: PK0+80
   * R-9-2: PK0+85 and PK3+09
8. **Aqueduct crossing** over the Toregeldi canal on R-9-1 at PK7+99, with a **switchyard** at the canal’s end.
9. **End discharges** on R-9 and R-9-2 canals to facilitate:
   * Tree removal
   * Ease of construction and installation
   * Simplified operation and maintenance in the future.

**4. Major Repairs of the Akkoyly Canal**

**Location:**  
Botamoynak Rural District, Baizak District, Zhambyl Region

**Total Length:**  
2.328 km, including:

* **Akkoyly (1st line):** 2.224 km
* **Akkoyly-1 (2nd line):** 0.858 km

**Technical Characteristics:**

* **Suspended irrigated area:** 220 hectares
* **Throughput capacity:** 0.5 m³/s

**Scope of Works**

**Vegetation Clearing:**

* Removal of shrub vegetation along the berms of both branches.

**Akkoyly Canal (1st Branch): PK0+00 to PK22+41**

**Tray Installation:**

* **PK0+09 to PK1+32 and PK1+27 to PK3:**  
  Installation of **38 reinforced concrete trays type Lr-8** on **foundation slabs P9-6**, per Series 3.820.1-34c.
* **PK3 to PK14+32 and PK14+51 to PK22+09:**  
  Installation of **306 Lr-6 trays** on **P6-4.5 slabs** (306 pcs).

**Structures Provided:**

1. Outfall well for existing pipe crossing – PK0+10
2. Water-measuring post with hydrometric bridge – PK0+40
3. Water outlets with pipe crossings (4 pcs): PK0+65, PK1+35, PK2+06, PK2+72
4. Tubular crossing – PK1+20
5. Bridge crossing – PK3+11
6. Outfalls without tubular crossings:
   * Type 1 – PK4+00
   * Type 2 – PK13+80
7. Turning wells:
   * Type 2 – PK0+98
   * Type 1 (5 pcs): PK3+04, PK3+20, PK3+83, PK14+23, PK14+99
8. Aqueduct – PK14+42
9. **Double outlet** with outlet to **Akkoyly-1 canal (2nd branch)** – PK14+59 (includes **1 Lr-8 tray**)
10. Double outlet without pipe crossing – PK15+10
11. Distribution unit – PK22+09

**Akkoyly-1 Canal (2nd Branch): PK0+00 to PK8+58**

**Tray Installation:**

* Installation of **143 trays total**, including:
  + **142 Lr-6 trays** on **P6-4.5 slabs**, according to Series 3.820.1-34c
  + **1 Lr-8 tray** (accounted on the structure at PK14+59 of Akkoyly 1st branch)

**Structures Provided:**

1. **Type 1 turning wells (3 pcs):**
   * PK1+55
   * PK7+60
   * PK8+23
2. **Inlet well** for existing pipe crossing – PK8+57

Environmental Measures:

* **Herbicide treatment** is provided **along the entire alignment** of both canal branches to combat reed vegetation.

**5. Major Repairs of the R-4 Canal**

**Location:**  
Ynttymak Rural District, Baizak District, Zhambyl Region

**Length:**  
4.033 km

**Technical Characteristics:**

* **Suspended irrigated area:** 390 hectares
* **Throughput capacity:** 0.5 m³/sec

**Scope of Works**

**Canal Construction:**

* The R-4 canal is designed as an **earth canal** reinforced with **prefabricated reinforced concrete trays** of type **Lr-8**, selected based on hydraulic calculations.
* These trays are installed on **foundation slabs P9-6**, with full structural joints. All components follow the standardized design **Series 3.820.1-34c** – *Unified Reinforced Concrete Structures for Water Management Construction*.

**Vegetation Management:**

* The project includes **shrub removal** along the alignment for:
  + Easier execution of construction and installation works
  + Improved accessibility for future canal maintenance and operation

**Structures Provided Along the Canal:**

1. **Head Structure:**
   * Located at **PK0**, serving as a **distribution unit** connecting with the **Sagyndyk canal**
2. **Water-Measuring Post:**
   * Installed at **PK0+40**, equipped for hydrometric monitoring
3. **Water Outlets:**
   * **Right-side outlets:** PK9+78, PK10+57, PK31+99, PK39+41
   * **Left-side outlets:** PK1+38, PK33+38
4. **Pipe Crossings (Tubular Crossings):**
   * PK10+85
   * PK33+18
5. **Outfall Structures:**
   * Located on both **left and right sides** at **PK20+42**
6. **Turnaround Manholes:**
   * Provided at key points to allow for inspection and control of flow direction
7. **End Structure:**
   * Positioned at **PK40+35**, serving as a terminal hydraulic structure for controlled discharge

**6. Major Repairs of the R-2 Canal**

**Location:**  
Ynttymak Rural District, Baizak District, Zhambyl Region

**Length:**  
2.218 km

**Technical Characteristics:**

* **Suspended irrigated area:** 162 hectares
* **Throughput capacity:** 0.40 m³/sec

**Scope of Works**

**Canal Rehabilitation Works:**

* Clearing of **shrub vegetation** along the **canal berms** to ensure access and improve hydraulic conditions.
* Installation of **reinforced concrete trays (Lr-8)** along the entire length from **PK0 to PK22+02**.
  + Trays are installed on **foundation slabs P9-6**
  + Use of **ST17.5 supports**, and **cup-type foundations F-18-9** as per **Series 3.820.1-34s** – *Unified Reinforced Concrete Structures for Water Management Construction*

**Hydraulic and Auxiliary Structures:**

1. **Distribution Unit:**
   * Located at **PK0**, connecting canal R-2 with the **Sagyndyk canal**
2. **Water-Measuring Post:**
   * Installed at **PK0+40**, equipped with a **hydrometric bridge** for flow monitoring
3. **Turning Wells:**
   * **Type 2 turning wells**, total of **12 units** distributed along the canal
4. **Livestock Passage (Cattle Drive):**
   * Located at **PK10+90**, allowing for safe animal crossing
5. **Pipe Crossings (Tubular Crossings):**
   * At **PK17+79**
   * At **PK22+08**
6. **Water Outlet Structure:**
   * Positioned at **PK22+18**, for field irrigation discharge

**7. Major Repairs of the Tore Canal**

**Location:**  
Temirbek Rural District, Baizak District, Zhambyl Region

**Length:**  
5.075 km

**Technical Characteristics:**

* **Suspended irrigated area:** 150 hectares
* **Throughput capacity:** 0.2 m³/sec

**Scope of Works**

**Canal Rehabilitation and Civil Works:**

* **Tree removal** along the entire route (from PK0 to PK50+75) to ensure accessibility for construction and ease of future maintenance.
* From **PK0 to PK50+75**, construction of a **monolithic reinforced concrete lining**:
  + **Concrete grade:** C16 (equivalent to B20W4F150)
  + **Reinforcement:** Welded mesh Ø8ASh with 200mm x 200mm spacing according to **GOST 34028-2016**
  + **Base layer:** Gravel-sand preparation, **thickness: 10 cm**

**Headworks Rehabilitation:**

* At **PK0+00**, repair of the **existing head structure**:
  + Replacement of destroyed parts using **C16 monolithic concrete**
  + Installation of **GS120-300 deep sliding gates** in accordance with **TP180-167/77** (featuring screw-type lifting mechanisms)

**Water Management and Auxiliary Structures:**

1. **Water-Measuring Facility:**
   * Installed at **PK0+40**, includes a **hydrometric bridge** for flow monitoring
2. **Water Outlets with Pipe Crossings (to the right and left):**
   * Located at:  
     **PK10+84, PK17+82, PK21+57, PK28+43, PK35+45, PK41+03, PK43+28, PK44+79, PK47+78, PK42+63, PK43+56, PK49+77**
3. **Double Culverts with Pipe Crossings:**
   * At **PK25+18**, **PK41+80**, and **PK42+40**
4. **Bridge Crossings:**
   * Installed at **PK15+40** and **PK21+76**
5. **End Structure:**
   * Located at the **end of the canal at PK50+75**, serving as a terminal hydraulic structure

**8. Major Repairs of the Sapak Canal**

**Location:**  
Tuymekent Rural District, Baizak District, Zhambyl Region

**Length:**  
1.460 km

**Technical Characteristics:**

* **Suspended irrigated area:** 100 hectares
* **Throughput capacity:** 0.2 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Vegetation Clearing:**

* **Grubbing of small bushes** from **PK0+30 to PK14+60** to facilitate construction activities and ensure smooth future operation and maintenance of the canal.

**Canal Lining and Civil Works:**

* Installation of **LR-6 type precast reinforced concrete trays**.
  + Includes proper arrangement of **joints between trays** and their **base plates** according to standard hydraulic design specifications.

**Structures and Facilities**

1. **Water Intake:**
   * Located at **PK0**, taking water from the **Baizak canal** into the Sapak canal.
2. **Water-Measuring Station:**
   * Installed at **PK0+30**, designed to monitor flow volume and control distribution.
3. **Bridge Crossing:**
   * Constructed at **PK0+38** for local transportation over the canal.
4. **Water Outlets to Temporary Irrigators (without pipe crossings):**
   * **6 outlets** provided at:
     + **PK0+11**
     + **PK3+08**
     + **PK4+53**
     + **PK8+41**
     + **PK11+73**
     + **PK13+48**
5. **Culvert at Existing Crossing:**
   * Located at **PK10+51**, ensuring continued connectivity and water flow at the existing access point.

**9. Major Repairs of the Syrgabai Canal**

**Location:**  
Tuymekent Rural District, Baizak District, Zhambyl Region

**Length:**  
4.498 km

**Technical Characteristics:**

* **Suspended irrigated area:** 300 hectares
* **Throughput capacity:** 0.25 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Vegetation Clearing:**

* Tree removal is performed **along the entire route (PK0 to PK44+98)** to facilitate construction and improve long-term operational reliability.

**Canal Lining and Installation:**

* Installation of **prefabricated reinforced concrete trays LR-6 and LR-8**, with appropriate joints between trays and **base plates** according to hydraulic design standards.

**Structures and Facilities Provided**

1. **Connection with Head Structure:**
   * At **PK0+00**, linking Syrgabai Canal to the upstream water source.
2. **Water-Measuring Station:**
   * Installed at **PK0+50** using LR-6 flumes for precise flow monitoring.
3. **Tubular Crossings:**
   * Located at **PK0+12** and **PK27+39** for road or utility access.
4. **Turning Manholes:**
   * Constructed at **PK4+81**, **PK7+29**, **PK7+75**, and **PK41+27** for maintenance access and flow redirection.
5. **Coupling with Existing Tubular Crossings:**
   * Integration points at **PK7+38** and **PK7+52**, ensuring system continuity.
6. **Outfalls Without Tubular Crossings:**
   * Installed at **PK8+49**, **PK10+21**, and **PK11+71** for direct discharge into nearby fields or drainways.
7. **Outfalls with Tubular Crossings – Type 1:**
   * Installed at:
     + **PK5+00**
     + **PK15+05**
     + **PK17+12**
     + **PK19+91**
     + **PK20+84**
     + **PK22+40**
     + **PK26+10**
8. **Outfalls with Tubular Crossings – Type 2:**
   * Located at:
     + **PK27+51**
     + **PK36+80**
9. **Twin Culverts with Tubular Crossings:**
   * Constructed at:
     + **PK29+32**
     + **PK34+85**
     + **PK40+00**
     + **PK42+00**
10. **Flume Canal Coupling:**
    * Coupling point for the **Syrgabai and Sapak Canals** at **PK27+07**, allowing hydraulic connection or flow sharing.
11. **End Structure:**
    * Located at **PK44+98**, marking the end of the rehabilitated canal and providing controlled discharge.

**10. Major Repairs of the Tapan Canal**

**Location:**  
Tuymekent Rural District, Baizak District, Zhambyl Region

**Length:**  
3.514 km

**Technical Characteristics:**

* **Suspended irrigated area:** 120 hectares
* **Throughput capacity:** 0.25 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Vegetation Clearing:**

* Removal of trees and shrubbery is carried out **along the entire length (PK0 to PK35+14)** to facilitate construction and future maintenance.

**Canal Lining and Installation:**

* Installation of **prefabricated reinforced concrete trays LR-6**, with the formation of joints between trays and **base plates**, according to standard series 3.820.1-34c for water infrastructure.

**Structures and Facilities Provided**

1. **Water-Measuring Post:**
   * Constructed at **PK0+16** using LR-6 trays to monitor canal flow rates.
2. **Double Water Outlet with Tubular Crossing:**
   * Installed at **PK0+30**, allowing simultaneous diversion of water and vehicular/pedestrian crossing.
3. **Tubular Crossings:**
   * Located at:
     + **PK0+55**
     + **PK11+58**
     + **PK13+10**
     + **PK14+00**
     + **PK17+95**
4. **Outfalls with Tubular Crossings – Type 1:**
   * Installed at:
     + **PK3+10**
     + **PK5+86**
     + **PK8+00**
     + **PK10+72**
     + **PK11+08**
     + **PK12+32**
     + **PK19+32**
     + **PK25+50**
     + **PK27+50**
5. **Outfall with Turn and Pipe Crossing:**
   * At **PK17+41**, combining discharge, directional shift, and pipe crossing functionality.
6. **Coupling with Tubular Crossing:**
   * Provided at **PK16+70**, ensuring smooth integration with existing infrastructure.
7. **Turning Manholes – Type 1:**
   * Strategically placed at:
     + **PK0+38**
     + **PK0+58**
     + **PK7+56**
     + **PK12+32**
     + **PK16+30**
     + **PK16+52**
     + **PK17+87**
     + **PK18+49**
     + **PK18+75**
     + **PK28+10**
8. **End Structure:**
   * Located at **PK35+14**, providing regulated termination of the canal flow.

**11. Major Repairs of the Baibek Canal**

**Location:**  
Sukhanbaevsky Rural District, Baizak District, Zhambyl Region

**Length:**  
2.284 km

**Technical Characteristics:**

* **Suspended irrigated area:** 142 hectares
* **Throughput capacity:** 0.2 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Canal Modernization:**

* The existing **earth canal** is replaced with a **flume canal**, constructed from **prefabricated reinforced concrete trays (Lr-6)** installed on **foundation base plates P6-4.5**, in accordance with **hydraulic calculations** and standard **Series 3.820.1-34c**.

**Vegetation Clearing:**

* **Shrubbery removal** is planned to ensure unimpeded construction, facilitate maintenance, and improve canal operation efficiency.

**Structures and Facilities Provided**

1. **Headworks:**
   * At **PK0+00**, providing water intake from the **Sambet Main Canal** (MK).
2. **Water-Measuring Post:**
   * Installed at **PK0+40** to control and monitor water distribution.
3. **Twin Water Outlets with Pipe Crossings (Left):**
   * Located at:
     + **PK0+91**
     + **PK3+85**
     + **PK5+90**
     + **PK8+71**
4. **Water Outlets (Left):**
   * Located at:
     + **PK12+15**
     + **PK13+62**
     + **PK15+22**
     + **PK17+69**
     + **PK20+03**
     + **PK21+30**
5. **Tubular Crossings (Road Crossings):**
   * Located at:
     + **PK8+47**
     + **PK16+49**
     + **PK19+85**
6. **Turning Manholes:**
   * Positioned at:
     + **PK1+63**
     + **PK6+72**
     + **PK10+85**
     + **PK11+23**
7. **End Structure:**
   * Constructed at **PK22+84**, completing the canal’s discharge system.

**12. Major Repairs of the Kokozek Canal**

**Location:** Sukhanbaevsky Rural District, Baizak District, Zhambyl Region

**Length:** 3.203 km

**Technical Characteristics:**

* **Suspended irrigated area:** 220 hectares
* **Throughput capacity:** 0.30 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Canal Modernization:**

* The project replaces the existing **earth canal** with a **flume canal** constructed using **prefabricated reinforced concrete trays LR-8 and LR-6**.
* Installation is carried out on **foundation slabs P9-6 and P6-4.5**, in compliance with **Series 3.820.1-34c “Unified Reinforced Concrete Structures for Water Management Construction”**.

**Vegetation Clearing:**

* **Shrubbery and bush removal** is included to ensure access for construction and maintenance, and to extend the operational life of the infrastructure.

**Structures and Facilities Provided**

1. **Head Structure:**
   * Located at **PK0+00**, with an outlet to the right.
2. **Water-Measuring Post:**
   * Installed at **PK0+40**.
3. **Outfalls (Right):**
   * To Kokozek-1 and Kokozek-2 at **PK1+50**
   * Additional right-side outfalls at:
     + **PK6+02**
     + **PK11+53**
     + **PK13+28**
     + **PK14+66**
     + **PK16+01**
     + **PK18+13**
     + **PK23+09**
4. **Water Outlets (Left and Right):**
   * At:
     + **PK16+51**
     + **PK20+06**
     + **PK24+56**
5. **Water Outlet (Left only):**
   * At **PK16+80**
6. **Pipe Crossings (Some with Stilling Wells):**
   * Located at:
     + **PK1+35**
     + **PK4+88** (with stilling wells)
     + **PK9+31**
     + **PK11+76**
     + **PK16+70**
7. **Tubular Road Crossing:**
   * At **PK31+95**
8. **Turning Manholes:**
   * Installed at:
     + **PK0+34**
     + **PK4+32**
     + **PK4+45**
     + **PK5+60**
     + **PK31+31**
     + **PK31+71**
9. **End Structure:**
   * Located at **PK32+03**, ensuring proper drainage and structural closure of the canal.

**13. Major Repairs of the Lotkovy Canal**

**Location:** Zhalgyztobinsky Rural District, Baizak District, Zhambyl Region

**Length:** 1.722 km

**Technical Characteristics:**

* **Suspended irrigated area:** 150 hectares
* **Throughput capacity:** 0.30 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Canal Modernization:**

* **Partial replacement** of **prefabricated reinforced concrete trays (LR-6)**.
* Installation includes **proper jointing with base plates**, according to **Series 3.820.1-34c “Unified Reinforced Concrete Structures for Water Management Construction.”**

**Vegetation Clearing:**

* **Tree removal** is provided along the alignment **from PK0 to PK13+36** to enable construction access and ensure long-term maintenance.

**Structures and Facilities Provided**

1. **Water-Measuring Post:**
   * Installed at **PK0+40** for monitoring flow volumes.
2. **Pipe Crossings:**
   * Located at:
     + **PK9+20**
     + **PK9+56**
     + **PK10+00**
     + **PK10+22**
     + **PK10+50**
     + **PK10+87**
     + **PK11+36**
     + **PK14+47**
3. **Turning Wells:**
   * Installed at:
     + **PK13+95**
     + **PK14+33** (for changes in canal axis direction)
4. **Two-Sided Outlets to Temporary Sprinklers:**
   * Located at **PK11+98** (left and right outlets)
5. **Pipe Crossing with Stilling Well:**
   * Located at **PK16+13**
6. **Distribution Unit:**
   * Located at **PK17+22**, providing **left, right, and straight water outlets** to the irrigation system.

**14. Major Repairs of the Akberdi Canal**

**Location:**  
Myrzatai Rural District, Baizak District, Zhambyl Region

**Length:**  
6.945 km

**Technical Characteristics:**

* **Suspended irrigated area:** 100 hectares
* **Throughput capacity:** 1.0 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Canal Modernization:**

* **Mechanical cleaning** of the existing earthen canal to prepare for structural rehabilitation.
* **Tree removal** along the canal route for construction access and long-term maintainability.
* Construction of a **monolithic reinforced concrete lining** along the entire 6.945 km canal section (from PK0 to PK69+45) using:
  + **Concrete:** Sulfate-resistant grade C12 (B15), W4, F150
  + **Reinforcement:** Mesh Ø8 mm, AIII class, spacing 200x200 mm (GOST 34028-2016)
  + **Lining thickness:** 12 cm
  + **Canal width (bottom):** 0.6 m

**Structures and Facilities Provided**

1. **Water-Measuring Post:**
   * Located at **PK1+00**
2. **Water Outlets:**
   * **Right side:** PK4+72, PK42+32
   * **Left side:** PK33+44
3. **Two-Sided Outlets with Barrier Structures:**
   * PK11+60
   * PK15+75
   * PK28+41
   * PK47+63
   * PK53+79
4. **Pipe Crossings:**
   * PK33+20
   * PK69+10
5. **End Structure:**
   * Located at **PK69+45**

**15. Major Repairs of the Tleubolat-4 Canal**

**Location:**  
Myrzatai Rural District, Baizak District, Zhambyl Region

**Length:**  
3.473 km

**Technical Characteristics:**

* **Suspended irrigated area:** 120 hectares
* **Throughput capacity:**
  + From **PK0+00 to PK15+06** – 1.7 m³/s
  + From **PK15+06 to PK28+53** – 0.7 m³/s
  + From **PK28+53 to PK34+73** – 0.4 m³/s
* **Capital construction class:** IV

**Scope of Works**

**Canal Modernization and Construction:**

* Mechanical **cleaning of the existing earthen canal** (Tleubolat-4).
* **Tree grubbing** to ensure access and facilitate long-term maintenance.

**Lining Works by Segment:**

1. **From PK0 to PK15+06** (1.7 m³/s capacity):
   * Monolithic reinforced concrete lining
   * **Concrete:** Sulfate-resistant C12 (B15), W4, F150
   * **Reinforcement:** 8 mm mesh, 200x200 mm spacing, AIII class, GOST 34028-2016
   * **Lining thickness:** 12 cm
   * **Canal bottom width:** 1.0 m
2. **From PK15+06 to PK25+81** (0.7 m³/s capacity):
   * Same concrete and reinforcement specifications
   * **Canal bottom width:** 0.6 m
3. **From PK25+81 to PK34+73** (0.4 m³/s capacity):
   * Installation of **LR-6 prefabricated trays** on base slabs **P6-4.5**, per Series 3.820.1-34c.

**Planned Structures and Facilities**

1. **Water-Measuring Post:**
   * Located at **PK0+40**
2. **Hydraulic Structures:**
   * **Culvert (pipe under canal):** PK7+19 (to pass irrigation water from a crossing canal)
   * **Bridge Crossings:** PK3+85, PK25+30
   * **Pipe Crossing:** PK33+82
3. **Distribution Units:**
   * At **PK15+06**:
     + With outlet to the **Akberdi Canal**
     + Equipped with **GS100-150 gates**
     + Includes a pipe crossing over both **Tleubolat-4** and **Akberdi** canals
   * At **PK25+81** (double unit):
     + **Outlet to the Tray Canal** and to a section of Tleubolat-4 in trays
     + **Gates:** GS60-130u
     + Additional outlet to the Akberdi Canal (also with GS100-150 gates)
4. **End Structure:**
   * Located at **PK34+73**
   * Includes outlets to **temporary irrigators**, regulated by **GS40-100u gates**

**16. Major Repairs of Canals from the Lands of "Aulie Ata Kus"**

**Location:** Koktal Rural District, Baizak District, Zhambyl Region

**Length:** 2.248 km

**Technical Characteristics:**

* **Suspended irrigated area:** 175 hectares
* **Throughput capacity:** 0.5 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Vegetation and Site Preparation:**

* **Tree grubbing** from **PK0+16 to PK22+48** to facilitate construction and ensure long-term maintenance.

**Canal Lining and Structural Work:**

* Installation of **LR-8 reinforced concrete trays** with corresponding base plate joints (Series 3.820.1-34c).
* Construction of a **connection well** at **PK0+16** to link the existing pipeline to the new LR-8 tray system.

**Planned Structures and Facilities**

1. **Water-Measuring Infrastructure:**
   * **Water-measuring post** at **PK0+40**
2. **Turning and Distribution Wells:**
   * **Turning wells:**
     + PK0+97
     + PK3+45
     + PK7+45 (with outlet)
   * **Distribution well:** PK22+48
3. **Water Outlets to Temporary Irrigators:**
   * 9 outlets with pipe crossings at:
     + PK1+52
     + PK8+71
     + PK9+90
     + PK11+18
     + PK12+41
     + PK13+23
     + PK14+95
     + PK16+24
     + PK19+32
4. **Crossings and Bridges:**
   * **Bridge crossings** at:
     + PK2+97
     + PK14+26
5. **Rehabilitation Works:**
   * Repair of the **existing outlet** at **PK14+36**

**17. Major Repairs of the Karazhota Canal**

**Location:** Ulgilinsky Rural District, Baizak District, Zhambyl Region

**Length:** 12.065 km

**Technical Characteristics:**

* **Suspended irrigated area:** 250 hectares
* **Throughput capacity:** 1.0 m³/sec
* **Capital construction class:** IV

**Scope of Works**

**Vegetation and Earthworks:**

* **Mechanical cleaning** of the existing earthen canal
* **Cutting of reed vegetation** for ease of construction and future maintenance

**Canal Lining and Construction:**

* **From PK0+07 to PK6+21:** Monolithic reinforced concrete lining with the following specifications:
  + **Concrete:** Sulfate-resistant grade C12 (B15), W4, F150
  + **Reinforcement:** Ø8 mm mesh, 200x200 mm spacing (AIII, GOST 34028-2016)
  + **Lining thickness:** 12 cm
  + **Canal bottom width:** 1.0 m
* **From PK6+21 to PK120+65:** Installation of **LR-10 trays** on:
  + Base slabs P6-4.5
  + Posts ST11.5
  + Cup-type foundation blocks F15-9  
    (All elements per Series 3.820.1-34s)

**Planned Structures and Facilities**

1. **Head and Control Structures:**
   * **Head structure** at PK0
   * **Damper well** at PK1+40 (used as a water flow regulator)
   * **Two-way outfall** at PK83+05
     + Outfall pipe: TS30.25-2 (GOST 6482-2011)
     + **Stone embankment** for erosion control: 30 cm thick, 2.0 m long
2. **Measurement and Monitoring:**
   * **Water-measuring post** at PK0+70
3. **Bridges and Crossings:**
   * **Bridge crossing** at PK3+00 (PR60-1 slabs)
   * **Double outlet with pipe crossing** at PK6+21
   * **Multiple bridge crossings** along the parabolic section with PR60-1 slabs (Series 3.820-13, Issue 2)
     + Equipped with **concrete wheel bumpers** (25 cm height and width) for transport safety
4. **Wells and Springs:**
   * **Spring connection** at PK2+58 (spring “Kainar”) via pipe TS50-25.2
   * **Spring water well** at PK13+80, made of monolithic reinforced concrete (C12/15, W4, F150)
5. **Aqueduct Structure:**
   * **Aqueduct** over the Karas Canal at PK69+09
     + Pipe: Steel, Ø1020×8 mm
     + Supports: Monolithic reinforced concrete (C16/20, F150, W4)
     + Pipe reinforced and anchored with embedded parts
     + **Trash screen:** Ø10 mm AIII mesh at the inlet (spacing 200×200 mm)
6. **Turn Wells and Outlets:**
   * **Turning manholes** of Types 1 and 2 (see Volume 3 Drawings)
   * **Water outlets** to temporary irrigators (Type 1 and 2) – refer to technical drawings

**18. Novo-Mikhailovsky Main Canal (2,038 m)**

**General Information**

* **Total Length:** 3,995 m
* **Suspended Area (Irrigated):** 860 hectares
* **Total Throughput Capacity:**
  + **Main Canal (PK0+00 to PK20+38):** 1.0 m³/s
  + **Novo-Mikhailovsky-1 Branch Canal:** 0.1 m³/s
  + **Novo-Mikhailovsky-2 Branch Canal:** 0.1 m³/s

**Canal Type & Materials**

* Constructed using prefabricated reinforced concrete blocks G10-30-2 (rectangular cross-section).
* Mechanical cleaning of the existing earthen canal.
* Clearing and removal of obstructive tree vegetation along the entire canal route for improved access during construction and maintenance.

**Dismantling Works**

* Dismantling of obsolete infrastructure, including:
  + Bridge crossings at: PK7+49, PK9+90, PK10+70, PK14+45, PK17+72
  + Reinforced concrete pipes at: PK12+02, PK12+92
  + Monolithic reinforced concrete structures at: PK16+48, PK19+87
  + Existing gauging station at: PK7+54

**New Structures and Facilities**

* **PK0+00:** Head intake unit with blocking structure on the diversion canal
* **PK0+40:** Hydropost (water-measuring station) with a hydrometric bridge
* **PK7+95 – PK8+15:** Canal section crossing under a road with installation of turning wells for hydraulic control
* **PK14+47:** Distribution unit including outlet to Novo-Mikhailovsky-1 canal and a blocking structure for flow regulation
* **PK16+48:** Newly constructed bridge crossing
* **PK19+98:** Junction point with outlet to Novo-Mikhailovsky-2 canal; includes a pipe crossing to the right bank

**18.2. Novo-Mikhailovsky-1 Branch Canal (984 m)**

**Canal Type & Materials**

* Replacement of the entire earthen canal with a lined canal composed of LR-6 reinforced concrete trays.
* Base plates: P6-4.5 slabs manufactured as per Series 3.820.1-34c.

**Structures and Facilities**

* **PK0+80:** Hydropost (water-measuring station)
* **Turn Wells:**
  + PK0+54
  + PK3+76
  + PK4+11
  + PK8+58
* **Outlets:**
  + PK6+23: Left-side outlet to a temporary irrigator
  + PK9+84: Two-way outlet (left and straight) to temporary sprinkler fields

**18.3. Novo-Mikhailovsky-2 Branch Canal (973 m)**

**Canal Type & Materials**

* Similar to the -1 branch, constructed from LR-6 trays on P6-4.5 base slabs.
* Designed for 0.1 m³/s capacity.

**Structures and Facilities**

* **PK0+40:** Hydropost (water-measuring station)
* **Water Outlets:**
  + PK0+21 and PK7+67: Left-side outlets into temporary irrigation channels
  + PK2+02 and PK4+47: Right-side outlets into temporary irrigation channels
* **PK7+53:** Tubular road crossing using 600 mm diameter reinforced concrete pipe (TS60.25-2) per GOST 6428-2016
* **PK9+73:** Two-way outlet (right and straight) into temporary irrigators

**Summary of Key Features**

* Extensive hydraulic infrastructure modernization with standardized prefabricated reinforced concrete elements.
* Improved flow control via distribution units and multiple outlet points.
* Enhanced measurement and monitoring through new hydroposts and hydrometric bridges.
* Modern engineering solutions implemented for compatibility with existing irrigation systems and future maintenance needs.

1. **Sarysu District, Zhambyl Region. Lot 4**

**Conclusion on Major Canal Rehabilitation Works in Sarysu District (Baikadam, Zhanatalap, Zhaiylminsky Rural Areas)**

The comprehensive rehabilitation program across **11 irrigation canals** in the **Sarysu district** represents a large-scale infrastructural initiative aimed at improving agricultural water delivery systems, increasing hydraulic efficiency, and ensuring sustainable operation of irrigation infrastructure. The cumulative **canal length 72.537 kilometers**, encompassing multiple rural districts—**Baikadam, Zhanatalap, and Zhaiylminsky**—with varying canal throughput capacities from **1.0 m³/s to 5.0 m³/s**.

**Key Achievements and Common Features:**

**Structural and Hydraulic Rehabilitation:**

* Most canals involved the **dismantling and replacement of outdated or damaged reinforced concrete blocks** (types G-10.30-2, G-15.30-2, LR-10, PD9-6), transitioning to more durable prefabricated or monolithic reinforced concrete linings.
* Many canals saw the addition of **monolithic concrete canal bottoms and walls**, reinforced with **steel mesh (ø6, ø10)**, to improve structural integrity.
* Use of **CRM (Concrete Repair Mortar)** and **poroizol or rubber waterproofing layers** enhanced durability and reduced infiltration losses.

**Hydraulic Infrastructure Modernization:**

* Installation of **sluices** (ranging from 1 to 4 units per canal) was a consistent feature, contributing to better water flow control and distribution efficiency.
* Selected canals included **bridges**, **hydroposts**, and even **pipeline segments** (e.g., Dyuker Canal), demonstrating integration of multipurpose hydraulic structures.

**Earthworks and Ground Preparation:**

* All projects included thorough **excavation and backfilling operations**, typically using **0.4 m³ excavators** and bulldozers.
* **Trench bottom leveling and gravel-sand bedding (10 cm)** were systematically applied before block installation to ensure structural uniformity.

**Environmental Clearing and Maintenance Access:**

* Vegetation removal was consistently included, notably:
  + **Grubbing of trees** with diameter ≥32 cm
  + **Clearing of dense shrubs and reeds**
* The addition of **grader or asphalted access roads** ensures future maintenance feasibility.

**Innovative Elements and Unique Interventions:**

* The **Dyuker Canal** included **horizontal directional drilling (HDD)** for the installation of modern polyethylene pipelines (ø800 mm), indicating advanced utility integration.
* The **Saryozek Canal** was uniquely reconstructed using **GOST-compliant parabolic trays (LR-10)** and base plates P9-6, showcasing adaptation to standardized Soviet-era canal profiles.
* Some canals (e.g., Bayshahan, Kedey) featured **mixed construction types**, combining monolithic and prefabricated elements for cost and performance optimization.

**Overall Impact:**

The rehabilitation works collectively:

* Improve water distribution efficiency and flow regulation.
* Reduce water losses through seepage.
* Extend the lifespan and reliability of the irrigation system.
* Enhance resilience to structural degradation and environmental impacts.
* Support sustainable agriculture and rural development in Sarysu District.

This integrated approach reflects sound engineering, environmental management, and infrastructure sustainability practices, aligned with regional water management priorities.

**1. Major repairs of the Karitogan Old and Karitogan New Canals**

**Location:**  
Baikadam Rural District, Sarysu District  
**Total Canal Length:**  
11.763 km

**Scope of Work Includes:**

* **Demolition and Dismantling:**
  + Dismantling of reinforced concrete blocks type G-10.30-2
  + Dismantling of concrete class B15
  + Dismantling of existing reinforced concrete blocks type G-15.30-2
  + Additional dismantling of concrete B15
* **Construction and Installation:**
  + Concrete repair mortar (CRM) layer, 2 cm thick, grade B10
  + Gravel and sand foundation preparation, thickness 10 cm
  + Construction of monolithic reinforced concrete canal bottom (grade B15)
  + Steel reinforcement works
  + Application of waterproof paint to concrete surfaces
  + Installation of structural joints
  + Installation of temperature control joints
* **Structures and Facilities:**
  + Sluices – 1 to 2 units
  + Bridges – 2 units
  + Construction of a grader-access road
* **Earthworks:**
  + Excavation of soil to a length of 10 meters using an excavator (0.4 m³ volume)
  + Backfilling of excavated areas using a bulldozer (4 m³ volume)
  + General backfilling using a bulldozer
* **Clearing and Land Preparation:**
  + Grubbing (removal) of trees with diameter ≥32 cm (storage and disposal over 100 meters)
  + Grubbing of dense shrubs (storage and disposal over 100 meters)
  + Mowing of reeds (storage and disposal over 100 meters)

**2. Major Repairs of the Tasaryk Canal**

**Location:** Baikadam Rural District, Sarysu District  
**Total Length:** 8,783 meters  
**Throughput Capacity:** 3.0 m³/s

**Scope of Work and Technical Specifications:**

* **Canal Lining and Structural Works:**
  + Installation of reinforced concrete blocks **G-15.30-2**
  + Cement-sand repair mortar (CRM) **2 cm thick**, class **B10**
  + Gravel and sand bedding layer **10 cm thick**
  + Construction of a **monolithic reinforced concrete bottom**, class **B15**
  + Installation of **reinforcement mesh**
  + Application of **paint waterproofing** on concrete surfaces
  + Installation of **structural** and **temperature joints**
  + Construction of **monolithic canal sections** (length: **6.7 running meters**)
* **Hydraulic Structures:**
  + Installation of **2 sluices**
* **Earthworks:**
  + Excavation over a length of **10 meters** using **0.4 m³ capacity excavator**
  + **Backfilling** with a bulldozer
* **Vegetation and Site Clearing:**
  + **Grubbing of trees** with diameter ≥32 cm (storage length: 100 m)
  + **Grubbing of dense shrubs** (storage length: 100 m)
  + **Mowing of reed vegetation** (storage length: 100 m)

**3. Major Repairs of the Nizhniy Berkutty Canal**

**Location:** Baikadam Rural District, Sarysu District  
**Total Length:** 6,778 meters

**Canal Construction Overview:**

* From **PK 1+00 to PK 25+57**: canal lined with **reinforced concrete blocks G-15.30-2**
* From **PK 26+00 to PK 67+78**: canal constructed with **precast reinforced concrete elements LR-10 and PD9-6**

**Scope of Work and Technical Specifications:**

* **Concrete Works:**
  + Assembly of **reinforced concrete blocks G-15.30-2**
  + Dismantling and removal of **precast elements**:
    - **LR-10**
    - **PD9-6**
  + Installation of new **precast reinforced concrete LR-10 and PD9-6**
  + **Trench bottom leveling** prior to block installation
  + Cement-sand mortar (CRM) **2 cm thick**, class **B10**
  + Gravel and sand bedding layer **10 cm thick**
  + Construction of **monolithic reinforced concrete bottom**, class **B15**
  + Installation of **steel reinforcement**
  + Application of **paint waterproofing** on concrete surfaces
  + Construction of:
    - **Structural joints**
    - **Temperature joints**
    - **Joints in LR-10 blocks**
  + Construction of **monolithic canal sections** (6.7 linear meters)
* **Hydraulic Structures:**
  + Installation of **2 sluice gates**
* **Earthworks:**
  + Excavation over **10 meters** using a **0.4 m³ excavator**
  + **Backfilling** with a bulldozer
* **Vegetation and Land Clearing:**
  + **Grubbing of trees** (diameter ≥32 cm, storage length: 100 m)
  + **Grubbing of dense shrubs** (storage length: 100 m)
  + **Mowing of reeds** (storage length: 100 m)

**4. Major Repairs of the Kedey Canal**

**Location:** Baikadam Rural District, Sarysu District  
**Total Length:** 4,737 meters  
**Throughput Capacity:** 1.0 m³/s

**Scope of Work and Technical Specifications:**

* **Canal Structure Works:**
  + **Dismantling** of existing **reinforced concrete blocks G-10.30-2**
  + Installation of new **reinforced concrete blocks G-15.30-2**
  + Cement-sand mortar (CRM) **2 cm thick**, class **B10**
  + Gravel and sand preparation layer **10 cm thick**
  + Construction of **monolithic reinforced concrete bottom**, class **B15**
  + Steel reinforcement installation with diameters **ø6 and ø10 mm**
  + **Paint waterproofing** of concrete surfaces
  + Installation of **structural** and **temperature joints**
* **Hydraulic and Supporting Structures:**
  + Installation of **2 sluices**
  + Construction of **1 bridge**
  + Construction of **grader access road** for maintenance
* **Earthworks:**
  + **Excavation** of soil over 10 meters using **0.4 m³ excavator**
  + **Backfilling** with bulldozer
* **Vegetation and Land Clearing:**
  + **Grubbing of trees** with diameter ≥32 cm (storage length: 100 m)
  + **Grubbing of dense shrubs** (storage length: 100 m)
  + **Mowing of reed vegetation** (storage length: 100 m)

**5. Major Repairs of the Bayshahan Canal**

**Location:** Baikadam Rural District, Sarysu District  
**Total Length:** 9,160 meters

**Canal Construction Overview:**

* **PK 1+00 to PK 18+00**: Lined with **reinforced concrete blocks G-15.30-2**
* **PK 18+00 to PK 91+60**: Constructed with **precast reinforced concrete blocks LR-10 and PD9-6**

**Scope of Work and Technical Specifications:**

* **Demolition and Replacement:**
  + Dismantling of existing **G-10.30-2** concrete blocks
  + Installation of **G-15.30-2** concrete blocks
  + Dismantling and removal of precast elements:
    - **LR-10**
    - **PD9-6**
  + Installation of new **precast concrete blocks LR-10 and PD9-6**
* **Canal Bed Preparation and Concrete Works:**
  + **Vapour barrier** installation (ø4 cm)
  + Cement-sand mortar (CRM) **2 cm thick**, class **B10**
  + **Gravel and sand bedding** layer **10 cm thick**
  + **Trench bottom planning** (measured in square meters)
  + Construction of **monolithic reinforced concrete bottom**, class **B15**
  + **Steel reinforcement ø6 mm and ø10 mm**
  + **Paint waterproofing** of all concrete surfaces
  + Construction of:
    - **Structural joints**
    - **Temperature joints**
    - **Joints in LR-10 blocks**
* **Hydraulic and Supporting Structures:**
  + Installation of **4 sluice gates**
  + Construction of **3 bridges**
  + **Asphalted service/access road**
* **Earthworks:**
  + Soil **excavation** over 10 meters using a **0.4 m³ excavator**
  + **Backfilling** with bulldozer
* **Vegetation and Site Clearing:**
  + **Grubbing of trees** (diameter ≥32 cm, storage length: 100 m)
  + **Grubbing of dense bushes** (storage length: 100 m)
  + **Mowing of reed vegetation** (storage length: 100 m)

**6. Major Repairs of the Otes Canal**

**Location:** Baikadam Rural District, Sarysu District  
**Total Length:** 5,664 meters  
**Throughput Capacity:** 1.0 m³/s

**Scope of Work and Technical Specifications:**

* **Concrete and Structural Works:**
  + **Dismantling and removal** of existing **precast reinforced concrete blocks LR-10 and PD9-6**
  + **Installation** of new **precast reinforced concrete blocks LR-10 and PD9-6**
  + Application of **porosol lining**, thickness **4 cm**
  + **Gravel and sand bedding** preparation
  + **Trench bottom planning**
  + Construction of **seams/joints in LR-10 blocks**
* **Hydraulic and Auxiliary Structures:**
  + Installation of **1 hydropost**
  + Installation of **1 sluice gate**
  + Construction of **grader access road**
* **Earthworks:**
  + **Excavation of soil** over 10 meters using a **0.4 m³ excavator**
  + **Backfilling** with bulldozer
* **Vegetation and Site Clearing:**
  + **Grubbing of trees** (diameter ≥32 cm, storage length: 100 m)
  + **Grubbing of dense bushes** (storage length: 100 m)
  + **Mowing of reed vegetation** (storage length: 100 m)

**7. Major Repairs of the R-1 Canal**

**Location:** Zhanatalap Rural District, Sarysu District  
**Total Length:** 1,330 meters  
**Throughput Capacity:** 1.0 m³/s

**Scope of Work and Technical Specifications:**

* **Concrete and Structural Works:**
  + **Dismantling and removal** of existing **precast reinforced concrete blocks LR-10 and PD9-6**
  + **Installation** of new **precast reinforced concrete LR-10 and PD9-6 blocks**
  + Construction of **monolithic concrete bottom and walls**
  + Application of **porosol lining**, thickness **4 cm**
  + **Gravel and sand bedding** preparation
  + **Trench bottom planning**
  + Sealing and connection of **joints in LR-10 blocks**
* **Earthworks:**
  + **Excavation of soil** over 10 meters using a **0.4 m³ excavator**
  + **Backfilling** with bulldozer
* **Vegetation and Land Clearing:**
  + **Grubbing of trees** (diameter ≥32 cm, storage length: 100 m)
  + **Grubbing of dense shrubs** (storage length: 100 m)
  + **Mowing of reeds** (storage length: 100 m)

**8. Major Repairs of the Kyzyl Tu Canal**

**Location:** Zhaiylminsky Rural District, Sarysu District  
**Total Length:** 1,106 meters  
**Throughput Capacity:** 1.0 m³/s

**Scope of Work and Technical Specifications:**

* **Concrete and Structural Works:**
  + **Dismantling and removal** of existing **precast reinforced concrete LR-10 and PD9-6 blocks**
  + **Installation** of new **precast reinforced concrete LR-10 and PD9-6 blocks**
  + Construction of **monolithic concrete bottom and walls**
  + Application of **porosol lining**, thickness **4 cm**
  + **Gravel and sand bedding** preparation
  + **Trench bottom planning**
  + Sealing of **seams in LR-10 blocks**
* **Earthworks:**
  + **Excavation** over 10 meters using a **0.4 m³ excavator**
  + **Backfilling** with bulldozer
* **Vegetation and Land Clearing:**
  + **Grubbing of trees** (diameter ≥32 cm, storage length: 100 m)
  + **Grubbing of dense shrubs** (storage length: 100 m)
  + **Mowing of reeds** (storage length: 100 m)

**9. Major Repairs of the Kirov Canal**

**Location:** Zhaiylminsky Rural District, Sarysu District  
**Total Length:** 1,106 meters  
**Throughput Capacity:** 1.0 m³/s

**Scope of Work and Technical Specifications:**

* **Concrete and Structural Works:**
  + **Dismantling and removal** of existing **precast reinforced concrete LR-10 and PD9-6 blocks**
  + **Installation** of new **precast reinforced concrete LR-10 and PD9-6 blocks**
  + Construction of **monolithic concrete bottom and walls**
  + Application of **porosol lining**, thickness **4 cm**
  + **Gravel and sand bedding** preparation
  + **Trench bottom planning**
  + Sealing of **seams in LR-10 blocks**
* **Hydraulic and Support Structures:**
  + Installation of **2 sluice gates**
  + Construction of **grader access road**
* **Earthworks:**
  + **Excavation** over 10 meters using a **0.4 m³ excavator**
  + **Backfilling** with bulldozer
* **Vegetation and Land Clearing:**
  + **Grubbing of trees** (diameter ≥32 cm, storage length: 100 m)
  + **Grubbing of dense shrubs** (storage length: 100 m)
  + **Mowing of reeds** (storage length: 100 m)

**10. Major Repairs of the Dyuker Canal**

**Location:** Zhanatalap Rural District, Sarysu District  
**Total Length:** 3,815 meters  
**Throughput Capacity:** 5.0 m³/s

**Scope of Work and Technical Specifications:**

* **Concrete and Structural Works:**
  + **Installation** of **precast reinforced concrete blocks LR-10 and PD9-6**
  + Construction of **monolithic reinforced concrete bottom and walls**
  + Application of **poroizol lining**, thickness **4 cm**
  + **Gravel and sand bedding** preparation
  + **Trench bottom planning**
  + Sealing of **joints in LR-10 blocks**
* **Hydraulic and Auxiliary Structures:**
  + Installation of **3 sluice gates**
  + Construction of **grader access road**
* **Pipeline Works:**
  + **Dismantling** of existing **ø600 mm pipe** (25 meters)
  + **Installation** of new **PE100 SDR 17 S8 PN10 pipe (800×47.4 mm)** using **Horizontal Directional Drilling (HDD)** method
* **Earthworks:**
  + **Excavation** over 10 meters using a **0.4 m³ excavator**
  + **Backfilling** with bulldozer
* **Vegetation and Site Clearing:**
  + **Grubbing of trees** (diameter ≥32 cm, storage length: 100 m)
  + **Grubbing of dense bushes** (storage length: 100 m)
  + **Mowing of reeds** (storage length: 100 m)

**11. Major Repairs of the Saryozek Canal**

**Location:** Zhanatalap Rural District, Sarysu District  
**Total Length of Canal:** 4,257 meters

**Overview of Works:**

The project involves the reconstruction of the Saryozek canal using **parabolic precast concrete trays (LR-10)** in accordance with **GOST 21509-76** and series **3.820.1-34 Issue 1**.

**Scope of Work and Technical Specifications:**

* **Demolition and Removal:**
  + **Dismantling of LR-10 parabolic trays** – **133 pieces** (total length: 802 m)
  + **Dismantling of base plates P9-6** (900×600×100 mm) – **133 pieces**
* **Earthworks:**
  + **Excavation volume** – **2,887.5 m³**
  + **Excavation layout area** – **5,959 m²**
* **Preparation and Installation:**
  + **Gravel and sand bedding preparation:**
    - General volume – **5,213 m³**
    - For base plates – **27.67 m³**
  + **Installation of LR-10 trays** – **710 pieces** (total length: 4,257 m)
  + **Installation of base plates P9-6** (900×600×100 mm) – **710 pieces**
  + Application of **rubber lining** – **2,172.6 running meters**

1. **Koksu District, Zhetysu-Almaty Region. Lot 1**

This project provides for a complex of works on the reconstruction of the irrigation system of the Koksu district. The planned activities of the II stage include:

Reconstruction of canals of the irrigation system of the Koksu district: to provide for the implementation of the entire complex of design and survey (geodetic and geological) works, according to the design assignment.

Design and survey work for the construction includes an explanatory note, drawings and estimates in basic and current prices, price lists: perform reconstruction work on the following channels:

1. Inter-farm canal "Akshatogan" -6.742km;

2. Distribution channel "Nurabay" - 11.2km;

3. Distribution channel "Orta-aryk" 7,136km;

4. Channel "R-11-3-4 " - 13.465km, channel "R-11-6-8 " - 4,132km;

5. Distribution channel R-3, vhk R-3-1-4,483 km;

6. Distribution channel R-4 with a length of 3,216km;

7. Distribution channel R-5 with a length of 5,637km;

8. Distribution channel R-6 with a length of 13.473km;

9. Distribution channel R-7 with a length of 3,847km;

10. Distribution channel R-8 with a length of 3,925km;

11. Distribution channel R-9 with a length of 2,361km;

12. Distribution channel R-10 with a length of 15.691km;

13. Main canal "Syrt-Togan"-1.81km, repair of water distribution facilities;

14. Main canal "Orta-Togan"-1.01km, repair of water distribution facilities;

15. Bakytzhan main canal -24.718km;

16. The main canal "Mambet"-3.577km;

17. Karazhyryk main canal -9.654km;

18. Ortalyk main canal repair of structures;

19. Zhartogan main canal - 3,875km;

20. Kok-Moyin distribution channel -17.81km;

21. Karakoy distribution channel - The project of the main structure;

22. Bel-Aryk distribution channel - The project of the main structure;

23. Tentek-togan distribution channel - The project of the main structure;

24. Distribution channel "R-1" - The project of the main structure;

25. Distribution channel "R-2" - The project of the main structure;

26. Distribution channel "R-3"- Sushch.gol.construction.

**Current state**

The main water source for providing irrigation water to water consumers in the Koksu district are the Koksu River and the Big River.

The main channels Syrt-Togan, Orta-Togan, and Mambet originate from the Koksu River.

The main channels Bakytzhan, Karazhyryk, and Ortalyk originate from the river.

The Levoberezhny main canal with a minimum capacity of 18.0 m3/s originates from the existing frontal dam on the Koksu River, located above the village of Mambet.

The distribution channels Akshatogan, Nurabai, Orta-Aryk, channel R-4, R-5, R-6, R-7, R-8. R-10, R 11-6-8, R-11-3-4, P-12, as well as the main channel "Right branch".

The distribution channels "Kok-moyin", "Zhartogan", "Karakoy", "Bel-aryk", "Tentek-Togan", "Tote-Togan", "Korey-Togan", "Tentek-Korey", R-1, R-2, P-3.

Many irrigated lands have fallen out of agricultural circulation due to a decrease in water availability, i.e. many earth channels are silted up by 30-40%, channels running in reinforced concrete trays, L-shaped blocks are partially destroyed.

The water distribution facilities on the main channels, made of monolithic concrete and reinforced concrete, do not meet the technical requirements. For many years, without major repairs, the walls of structures have significant cracks, chips, etc.

The lifting and lowering equipment is unsuitable for further long-term operation, i.e. many shutters have curved frames or lack shutter shields and screw lifts.

Almost all distribution channels do not have hydraulic posts at the outlet to the utility channels.

The main objective of this project is the restoration and reconstruction of existing canals to increase the water availability of irrigated lands and to involve previously discarded irrigated lands in agricultural turnover.

**Design solutions**

Inter-farm channel "Akshatogan"

The length of the Akshatogan canal is 6.742 km. The canal runs through an earthen channel. The project provides for the lining of the canal from the G-15 railway blocks.

The project provides for:

1. Construction of the head structure.

2. Construction of a water post-2 pcs. On PC 1+42, PC 26+90

3. Construction of a crossing over the canal-8 pcs.

4. Construction of a water outlet-16 pcs.

**Nurabay Distribution Channel**

The length of the Nurabai distribution channel is 11.2 km. Nurabai RC is 5,357 km long. Nurabai RC Right-hand branch-4,437km. The project provides for the lining of the canal from the G-10 railway blocks.

The project provides for:

1. Construction of a water distribution facility of the Republic of Kazakhstan "Nurabai" on PK 20+01.

2. Construction of a hydraulic post-4 pcs. On PC 0+75, PC 52+13.

3. Construction of a slab crossing over the Nurabai canal Right branch-2 pcs. On PC 12+03, PC 18+97.

4. Construction of the Nurabai water outlet facility Right branch-20 pcs.

5. Construction of a tubular crossing over the Nurabai canal Right branch-1 pc. On PC 8+14.

**Orta-Aryk distribution Channel The Orta-Aryk**

distribution channel, with a length of 7,136km, originates directly from the water distribution hub No. 2 at MK Levoberezhny. The channel consists of two branches. The project provides for lining the channel from railway trays.

The project provides for:

"Branch-1"

1. Construction of a tubular water outlet on the branch-1 quantity- 5 pcs.

2. Construction of a double-sided tubular water outlet on the branch line-1 quantity- 9 pcs.

3. Construction of a tubular water outlet on a branch line-1 quantity- 1 pc.

4. Construction of a crossing over the highway quantity-4 pcs.

5. Construction of a hydraulic post-1 pc.

6.Construction of a rotary well-3 pcs.

"Branch-2"

1. Construction of a protective fence of the litter tray.

2. Construction of a water outlet-1 pc.

3. Construction of a double-sided tubular water outlet on the branch line-1 quantity- 4 pcs.

4. Construction of a tubular water outlet on the branch line-1 quantity- 7 pcs.

5. Construction of a crossing over the highway quantity-1 pc.

6. Construction of a hydraulic post-1 pc.

7. Construction of a rotary well-3 pcs.

**The R Channel-11-6-8 ".**

Distribution channel "R-11-6-8 "completely destroyed. The project provides for the restoration of the canal from railway trays and the construction of 13 water outlet structures with relocation.

The R Channel-11-3-4 "

Distribution channel "R-11-3-4 "completely destroyed. The project provides for the restoration of the channel from railway trays.

The project provides for the RC "R-11-3-4":

1) Construction of a water distribution facility 1 pc

2) Construction of a water outlet 1 pc.

3) Construction of crossings.

4) Construction of rotary wells.

5) Construction of hydraulic posts.

Distribution channel R-3, vhk R-3-1

1. The length of the distribution channel is 4,483km. The project provides for:

channel R-3-1

1) Construction of a hydropost-1 pc.

2) Construction of a water outlet-4 pcs.

Channel R-3-1-1

1) Construction of a hydropost-1 pc.

2) Construction of a water outlet-11 pcs.

channel R-3-2

1) Construction of a hydropost-1 pc.

2) Construction of a two-way water outlet facility-1 pc.

3) Construction of a water outlet-20 pcs.

4) Construction of a water outlet-1 pc.

R-4 distribution channel

The R-4 channel

1. Reconstruction of the main water intake structure-1 pc.

2. Construction of a hydraulic post-1 pc.

3. The entity being reconstructed. water outlets in a temporary sprinkler 11 pcs.

Canal "R-4-1"

1. Construction of a hydraulic post-1 pc.

2. Construction of a water outlet-13 pcs.

Distribution channel "R-5"

The R-5 canal is 2,058km long.

The project provides for:

Reconstruction of the main water intake facility-1 pc. Construction of a rotary well-2 pcs.

Construction of a hydraulic post-1 pc.

Construction of a water outlet - 10 pcs.

Construction of a two-way water outlet-2 pcs.

The canal "R-5-1" is 1,666 km

long. 1. Construction of a hydraulic post-1 pc.

2. Construction of a water outlet-11 pcs.

The canal "R-5-2" is 1,913km long. 1.

1. Construction of a hydraulic post-1 pc.

2. Construction of a water outlet-11 pcs.

Distribution channel "R-6"

- - distribution channel R-6 the length of the channel is 13.473km

- Dismantling of existing G-15 blocks 36 pcs

- Dismantling the bottom of the existing G-15 blocks

- Construction of the main water intake

- Reconstruction of water distribution wells

- Construction of water outlets

- Construction of rotary wells

- VKH R-6-1 the length of the channel is 1,101km

- reconstruction of tray networks

- Construction of water outlet facilities-11 pieces

- VKH R-6-2 the length of the channel is 1,162km

- reconstruction of tray networks

- Construction of water outlet facilities-12 pieces

- VKH R-6-5 the length of the canal is 0.598km

- reconstruction of tray networks

- construction of water outlet facilities-6 pcs

- VKH R-6-3 the length of the channel is 0.998km

- reconstruction of tray networks

- construction of water outlet facilities-5 pcs

- VKH R-6-4 the length of the canal is 1,0km

- reconstruction of tray networks

- construction of water outlet facilities-5 pcs

- VKH R-6-6 the length of the channel is 1,079km

- Reconstruction of water distribution facilities

- VKH R-6-6-1 the length of the canal is 0.741km

- reconstruction of tray networks

- construction of water outlet facilities-8 pcs

- VKH R-6-6-2 the length of the canal is 3,061km

- reconstruction of tray networks

- Construction of water outlet facilities in a temporary sprinkler -17 pcs

Distribution channel "R-7"

The R-7 distribution channel is 1,798km long.

The project provides for:

-Reconstruction of tray networks

-Reconstruction of the main water intake structure

-Construction of rotary wells

-Construction of a water post

-Construction of a water distribution well-2 pcs

-Construction of a crossing over the canal

-Construction of a water outlet

-Construction of a rotary well

VKH R-7-1 canal length 2,049 km

-Reconstruction of tray networks

-Reconstruction of the water outlet structure-22 pieces

Distribution channel "R-8"

Distribution channel R-8 with a length of 0.532 km, the project provides for:

Relocation on the channel Distribution well-2 pcs.

VKH R-8-1 canal length 3,393 km Reconstruction of tray networks

Construction of a rotary well For the construction of a crossing through a trough channel, a tubular water outlet in one direction-28 pcs

Distribution channel "R-9"

Distribution channel R-9 with a length of 2,361km, the project provides for:

Reconstruction of the trough network, construction of a hydraulic post

Single-side tubular water outlet-15 pcs

Distribution channel "R-10"

Distribution channel R-10 with a length of 8,722km The project provides for:

Reconstruction of the trough network for the construction of a hydraulic post at PK 0+50 Tubular Vodovyupsk on one side-19 pcs

Tubular water outlet on two sides-14 pcs Double-sided water outlet on PC 23+70 Rotary well-2 pcs

One-way water outlet-2 pcs

VKH R-10-1 channel length 1,297 km Reconstruction of the tray network

Hydropost-1 pc.

Double-sided tubular water outlet-6 pcs Water distribution facility on PC 0+28

VKH R-10-2 channel length 0.673 km Reconstruction of the tray network

Hydropost-1 pc.

Double-sided water outlet-4 pcs

VKH R-10-1 canal length 2,184 km Reconstruction of the trough network

Hydropost-1 pc Rotary Well

Double-sided water outlet-3 pcs

VKH R-10-3 channel length 0.580 km Reconstruction of the tray network

Hydropost-1 pc.

Double-sided water outlet-3 pcs

VKH R-10-4 channel length 1,146 km Reconstruction of the tray network

Hydropost-1 pc.

Double-sided water outlet-7 pcs

VKH R-10-5 channel length 1,089 km Reconstruction of the tray network

Hydropost-1 pc.

Single-side water outlet-7 pcs

Main canal "Syrt-Togan" Main canal "Syrt-Togan" with a length of 1.81km The project provides for:

Reconstruction of the boom in the head of the canal from gabions Reconstruction of 6 water distribution facilities

Main canal "Horta-Togan" Main canal "Horta-Togan" with a length of 1.01km The project provides for:

Reconstruction of the boom in the head of the canal from gabions Reconstruction of 8 water distribution facilities Reconstruction of tubular crossings-3 pcs

Construction of an aqueduct across the Taldy River-1 pc.

Bakytzhan Main Canal

The Bakytzhan main canal in the earthen channel L=3142m, and G-15-30, G-20-30 blocks L=10991m. The total length is 14,133km. The project provides for the restoration of the canal bottom with monolithic w/ concrete, the replacement of destroyed G-blocks, the reconstruction of water outlets and crossings, the reconstruction of the main intake, aqueduct and ducker.

On the Bakytzhan-1 distribution channel, with a length of L=1198m. The project provides for the dismantling of existing LR-8 units and the installation of new LR-8 trays. Reconstruction of water outlets and construction of hydraulic posts.

On the Bakytzhan-1-1 distribution channel, with a length of L=768 m. The project provides for the dismantling of existing LR-8 units and the installation of new LR-8 trays.

Reconstruction of water outlets and construction of hydraulic posts.

On the Bakytzhan-2 distribution channel, with a length of L=2105m. The project provides for the dismantling of existing LR-6 and LR-8 blocks and the installation of new LR-8 trays. Reconstruction of water outlets and construction of hydraulic posts.

On the Bakytzhan-3 distribution channel, with a length of L=1162 m. The project provides for the dismantling of existing LR-8 units and the installation of new LR-8 trays.

Reconstruction of water outlets and construction of hydraulic posts.

On the Bakytzhan-4 distribution channel, with a length of L=1376m. The project provides for the dismantling of existing LR-8 units and the installation of new LR-8 trays.

Reconstruction of water outlets and construction of hydraulic posts.

On the Bakytzhan-5 distribution channel, with a length of L=1338m. The project provides for the dismantling of existing LR-8 units and the installation of new LR-8 trays.

Reconstruction of water outlets and construction of hydraulic posts.

1. **Enbekshikazakh District, Zhetysu-Almaty Region. Lot 2**

**Reconstruction and construction of a pasture irrigation system in the village of Teskensu, Yenbekshikazakh district, Almaty region**

**Current Situation**

The irrigation canal runs in an earthen channel. It originates from the "BAK" main canal in the village of Teskensu, via a water distribution structure with a design water intake of **3.2 m³/s**.  
The length of the designed section is **3.7 km**, after which the canal continues through the Yenbekshikazakh district.  
The irrigated area is **272 hectares**, mainly used for cereal crops.

**Design Solutions**

**Stationing: ПК 0+00 – ПК 37+00**  
This section of the canal is designed with **precast reinforced concrete flumes LR-10**. The project includes the construction of a **water intake structure**.

There is currently no existing head structure at ПК 0+00. The canal originates from the BAK and reaches ПК 0+00 in a **gabion-lined section**.  
The project provides for the **dismantling of 12.8 m³ of gabion structures**, as there was no proper connection between the gabion-lined section and the earthen canal, resulting in erosion over time. The final meters of the gabion section are no longer functional due to elevation mismatch.  
To prevent further soil erosion, the design includes a **monolithic reinforced concrete portal wall**.

Following the inlet, a **water intake chamber** connects to the designed **LR-10 flume**. The bottom and sidewalls are reinforced with **C18/22.5 (B22.5)** class concrete, with **waterproofing grade W6** and **frost resistance grade F100**, thickness **300 mm**.  
The reinforcement uses welded mesh Ø10 mm with 200x200 mm spacing – A400 grade.

**Additional project elements include:**

* **Tubular water outlet structure** at ПК 1+23
* **Tubular water outlets** at ПК 3+39, ПК 7+02
* **Road crossings** at ПК 5+27, ПК 17+04, ПК 17+74
* **Tubular water outlet** at ПК 26+48
* **Distribution structure** at ПК 17+21
* **Turning manholes** – 18 units
* **Hydraulic posts** at ПК 1+00, ПК 15+61, ПК 18+34
* **Road crossing** at ПК 37+00
* **Crossing over the Koram canal**

**Water outlet structures:**

Constructed from **reinforced concrete pipes TS 30-50.25**. The pipes rest on a **monolithic base 10 cm thick**.  
Water intake is regulated by a **gate valve installed in a monolithic reinforced concrete chamber** of **C18/22.5 (B22.5)** concrete, **W6 waterproofing**, **F100 frost resistance**, **300 mm thickness**.  
The outlet part is made from the same grade monolithic concrete (150 mm thick) with **stone riprap** on the bottom and slopes (300 mm thick) to prevent erosion.  
At the end of the concrete lining, a **monolithic concrete cutoff wall** is designed to separate the concrete from the riprap.

**Road Crossings (ПК 5+27, 17+04, 17+74):**

Constructed from **reinforced concrete pipes TS 140.25**, laid on **C-5/8 class monolithic bedding**.  
The project includes:

* Waterproofing of the concrete pipes
* Sand backfilling and compaction around and above the pipes
* Sealing inner rings to prevent pipe joint separation and ensure watertightness

**Koram Canal Crossing:**

Built using **ZP 19.100 precast concrete segments**. The inlet headwall and wing walls are also precast concrete.  
Segments rest on **C18/22.5 (B22.5) class concrete foundations**, **W6 waterproofing**, **F100 frost resistance**, **400 mm thickness**.  
Construction works include:

* Bituminous and mastic waterproofing
* Monolithic concrete sealing of the segment tops
* Asphalt concrete surfacing

**Hydraulic Posts:**

Planned installation of **KCD-10 precast concrete chambers**, equipped with **water level staff gauges**.  
Pedestrian crossings over the flumes are made from **monolithic reinforced concrete bridge slabs**, **C18/22.5 (B22.5)**, **W6**, **F100**, **3 m long**, **200 mm thick**, resting on **monolithic concrete support blocks** of the same class.

1. **Kyzylorda, Kyzylorda-West Kazakhstan Region. Lot 1**

**Kyzylorda region, 7 project**

**1. Kara-Aryk Canal (Zhanakurylys Village, Aral District)**

This project covers the rehabilitation of a 34.6 km long earthen canal with an average width of 4.5–5.5 meters and depth of 2.5–3 meters. The work includes full mechanical cleaning and the overhaul of six hydraulic structures. These include reinforced concrete intake/outlet structures using typical PRT-2x14 pipe systems (with 1.4 m diameter pipes), and slide-type sluice gates for flow control. The project is based on standard hydraulic structure designs and aims to improve water conveyance efficiency and reduce water losses.

**2. Nartai Canal (Kyzylkum Village, Kazaly District)**

The 15.2 km long Nartai Canal connects several lakes (Maryam-Akkol, Altynkol, Akkuduk, and Zhuanbalyk). It has a consistent flow design of 5.0 m³/s across all segments. The project includes full mechanical cleaning of the entire canal, subdivided into four distinct reaches based on geography. The canal has a trapezoidal cross-section with a bottom width of 3.0 meters and a water depth of about 1.79 meters. This rehabilitation will restore water flow between lakes, improve environmental conditions, and support local irrigation.

**3. Ishki Canal (Alga Village, Kazaly District)**

This is a major rehabilitation effort on a 25.1 km canal with an unusually wide cross-section (up to 12.3 meters at the base). The scope includes cleaning 22.16 km of canal and restoring two key water control structures — one existing and one new — designed for 6.5 m³/s and 4.0 m³/s respectively. These reinforced concrete culverts are built using box-type pipes (2x2 m), designed with upper and lower slope protection and flow regulation gates. The rehabilitation aims to ensure reliable water delivery and protect local ecosystems.

**4. Dauren Canal (N. Ilyasov Village, Syrdarya District)**

This 11.7 km canal, with a designed discharge of 2.0 m³/s, is undergoing a comprehensive overhaul that includes mechanical cleaning, repair of five control structures, one water distribution structure, and a hydrometric station. Additional works include the repair of pipe crossings and slope reinforcements. Reinforced concrete culverts (diameter 1.0–1.5 m) are used, and new metal gates with manual hoists are installed to regulate water flow. The project is focused on improving both irrigation reliability and ecological sustainability.

**5. Eski Bostandyk Canal (Kalzhan Akhun Village, Syrdarya District)**

Spanning over 10.45 km, this canal will be cleaned and restored, including the reconstruction of an intake, a pipe crossing, and a regulating structure. The works involve the installation of slide gates and 1.5 m diameter concrete pipes for improved water regulation. Special attention is paid to crossings for agricultural machinery. This project is important for water supply to rotational rice fields and supporting local agriculture.

**6. Kumzhargan Canal (Sultobe Village, Shieli District)**

A significant and technically advanced project, the Kumzhargan Canal spans over 28.2 km and includes comprehensive rehabilitation: reshaping the earthen canal to trapezoidal form, constructing a reinforced concrete headwork using square culverts (2x2 m), and building a service road along the right bank. It includes 20 outlets, new gates, diaphragms, and full concrete cladding. A tubular crossing using concrete tubing, slope reinforcements, and a gauging station are also included. The project is executed to a high engineering standard and addresses both irrigation and environmental needs.

**7. Bazar Aryk Canal (Shieli Settlement, Shieli District)**

This 5.0 km urban canal is being fully reconstructed with monolithic reinforced concrete lining (15 cm thick, B22.5 grade concrete), including complete slope cleaning and reshaping. The works follow SNIP RK standards and include soil stripping, embankment preparation, reinforcement cage assembly, and site-made concrete placement. This urban-focused canal improves water flow in densely populated areas and ensures durability through the use of high-quality materials and construction techniques.

**In Summary:**

These 7 canal projects, totaling **over 130 kilometers**, aim to:

* **Restore degraded irrigation canals** through cleaning and reshaping;
* **Reconstruct hydraulic structures** with reinforced concrete and standard gate mechanisms;
* **Ensure sustainable water delivery** for irrigation, livestock, and environmental needs;
* **Apply modern engineering standards**, including concrete lining, headworks, pipe crossings, and water measurement systems;
* **Support agricultural development** and rural resilience to water scarcity

**Component A2.1.5 – Kyzylorda Region (7 Projects)**

**1. Major Repair of the Kara-Aryk Canal, Zhanakurylys Rural District, Aral District, Kyzylorda Region**

The total length of the Kara-Aryk canal is **34.6 kilometers**. The canal is constructed in a semi-cut and semi-fill profile with an earthen channel bed. It has a gentle longitudinal slope of **-0.0001**. The average bottom width of the canal ranges from **4.5 to 5.5 meters**, and the average depth is **2.5 to 3.0 meters**. The current efficiency coefficient (hydraulic performance) of the canal is estimated at **0.62**.

The current project includes the following key activities:

* **Mechanical cleaning** of the canal along its full 34.6 km length;
* **Major repair of six check and control structures** located at picket points PK-83+28, PK-164+36, PK-235+40, PK-267+35, PK-298+30, and PK-305+25.

The canal includes **hydraulic structures made of reinforced concrete**, designed according to standard project TP 820-01-077.87. These structures use the **PRT-2x14 design**, which consists of two parallel circular reinforced concrete pipes with a **diameter of 140 cm** each. The structures include:

* An **inlet headwork**;
* Two **conveyance pipes** for water flow;
* Reinforced **inlet and outlet channel sections** to stabilize the bed.

The stabilization at both the upstream and downstream ends is achieved using **flat reinforced concrete slabs (type PP 10-15)**, which are laid on a **10 cm gravel foundation**. These slabs are connected at the corners, and the upstream connections are **sealed with monolithic concrete** to ensure water-tightness.

To regulate the water flow, **deep sliding sluice gates** (model GS 140-250), manufactured in accordance with design series 3.820.2-43, are installed at the head of the structure. The gates are operated manually using **5B-type screw hoists**.

**2. Major Repair of the Nartai Canal, Kyzylkum Rural District, Kazaly District, Kyzylorda Region**

The **total length of the Nartai Canal** is **15.248 kilometers**, consisting of the following segments:

* From Lake Maryam-Akkol to Lake Altynkol – **1.6 km**;
* A central section – **5.525 km**;
* From the Kolganat Bridge to Lake Akkuduk – **6.34 km**;
* From Lake Akkuduk to Lake Zhuanbalyk – **1.783 km**.

According to the working project, the following activities are planned:

* **Mechanical cleaning of the Nartai Canal** along its full **15.248 km** length, subdivided as:
  + Section No. 1 (Lake Maryam-Akkol to Lake Altynkol): **1.6 km**
  + Section No. 2 (Lake Altynkol to Kolganat Bridge): **5.525 km**
  + Section No. 3 (Kolganat Bridge to Lake Akkuduk): **6.34 km**
  + Section No. 4 (Lake Akkuduk to Lake Zhuanbalyk): **1.783 km**

**Technical Specifications of Each Canal Section:**

**Section No. 1: Maryam-Akkol to Altynkol**

* Length: **1.6 km**
* Discharge capacity: **5.0 m³/s**
* Flow velocity: **0.3 m/s**
* Bottom width: **3.0 m**
* Side slope coefficient: **2.0**
* Water depth: **1.79 m**
* Longitudinal gradient: **0.0001**
* Roughness coefficient (Manning's n): **0.025**
* Structural (design) depth of the canal: **2.09 m**

**Section No. 2: Altynkol to Kolganat Bridge**

* Length: **5.525 km**
* Discharge capacity: **5.0 m³/s**
* Flow velocity: **0.3 m/s**
* Bottom width: **3.0 m**
* Side slope coefficient: **2.0**
* Water depth: **1.79 m**
* Longitudinal gradient: **0.0001**
* Roughness coefficient: **0.025**
* Structural height: **2.09 m**

**Section No. 3: Kolganat Bridge to Akkuduk Lake**

* Length: **6.34 km**
* Discharge capacity: **5.0 m³/s**
* Flow velocity: **0.42 m/s**
* Bottom width: **3.0 m**
* Side slope coefficient: **2.0**
* Water depth: **1.79 m**
* Longitudinal gradient: **0.0001**
* Roughness coefficient: **0.025**
* Structural height: **2.09 m**

**Section No. 4: Akkuduk Lake to Zhuanbalyk Lake**

* Length: **1.783 km**
* Discharge capacity: **5.0 m³/s**
* Flow velocity: **0.3 m/s**
* Bottom width: **3.0 m**
* Side slope coefficient: **2.0**
* Water depth: **1.79 m**
* Longitudinal gradient: **0.0001**
* Roughness coefficient: **0.025**
* Structural height: **2.09 m**

**3. Major Repair of the Ishki Canal to Improve Water Supply and Environmental Conditions in the Alga Rural District, Kazaly District, Kyzylorda Region**

The Ishki canal has an **earth bed** with a **semi-cut and semi-fill profile** and a **longitudinal gradient of -0.0001**.

* **Total canal length:** 25.1 km
* **Average bottom width:** 5.0 to 12.3 meters
* **Average depth:** 2.7 to 3.7 meters
* **Canal efficiency (coefficient of performance):** 0.62

**The project includes the following major activities:**

* **Mechanical cleaning** of the canal along a **22.16 km** stretch;
* **Major repair** of a regulating and partitioning hydraulic structure at **PK-143+00**, with a **design flow rate of 6.5 m³/s**;
* **Construction** of a new regulating and partitioning hydraulic structure at **PK-175+50**, with a **design flow rate of 4.0 m³/s**.

**Technical Details of Hydraulic Structures:**

The canal will be equipped with **reinforced concrete hydraulic structures** based on **standard design TP 820-01-077.87**, using **PRT-2x20-20-5** type structures made from **rectangular reinforced concrete pipes** with dimensions **2.0 x 2.0 meters**.

Each structure consists of:

* An **inlet headwork**,
* Two parallel flow conduits,
* Upstream and downstream channel lining.

The lining is constructed using **flat reinforced concrete slabs (PP 10-15)** placed on a **10 cm gravel cushion**. The slabs are interconnected at corners and the upstream joints are **monolithically sealed**.

For **water regulation**, **GSh 200-300** type **flat sliding sluice gates** are installed at the inlet structure, following **typical series design 3.820.2-43**.

**4. Implementation of Water Management Works for the Major Repair of the “Dauren” Canal to Improve Water Supply and Environmental Conditions in the N. Ilyasov Rural District, Syrdarya District, Kyzylorda Region**

* **Total canal length:** 11.7 km
* **Mechanical cleaning** of the canal over the full length – **11,700 meters**

**Canal Parameters:**

* **Design flow rate:** 2.0 m³/s
* **Bottom width:** 4.0 meters
* **Side slope coefficient:** 1.0
* **Water depth:** 1.0 meter
* **Longitudinal slope:** 0.0001
* **Manning roughness coefficient:** 0.025
* **Design height of canal cross-section:** varies between 2.0 and 1.4 meters

**Planned Works Include:**

* **Cleaning and reconstruction** of the canal bed;
* **Repair of 5 regulating (retaining) hydraulic structures**;
* **Repair of 1 water distribution structure**;
* **Repair of slopes and headwalls** of culvert crossings;
* **Repair of 1 hydropost**;
* **Vegetation layer removal** up to 20 cm thick, totaling **41,533.75 m³ of soil**.

**List of Key Structures:**

1. **Hydropost at PK 1+21**
2. **Regulating structure at PK 26+75**
3. **Regulating structure at PK 44+91**
4. **Regulating structure at PK 60+50**
5. **Regulating structure at PK 79+00**
6. **Culvert crossing at PK 88+65** (existing)
7. **Regulating structure at PK 89+80**
8. **Water distribution structure at PK 116+00**

**Design of Hydraulic Structures:**

The project includes reinforced concrete **retaining structures**, constructed using **standard design TP 820-1-077.87**, with **VRT-8-0** type elements based on **reinforced concrete pipes with diameters from 1000 mm to 1500 mm**.

Each structure includes:

* An **inlet head**,
* A **single water conveyance pipe**,
* **Upstream and downstream linings**, executed with **monolithic reinforced concrete aprons** laid on a **10 cm thick gravel bed**.

The **retaining wing walls** are tied together using **tarred wooden battens** for expansion joints and are **monolithically sealed** at the upstream.

To **regulate flow** and **maintain water levels**, **metal sluice gates of the GS 160-300 type** are installed. The gates are operated via **manual screw hoists (model 5.0 V)**.

**5. Major Repair of the Yeski Bostandyk Canal to Improve Water Supply and Environmental Conditions in the Kalzhan Akhun Rural District, Syrdarya District, Kyzylorda Region**

* **Total canal length:** 10.453 km
* **Mechanical cleaning** of the canal along its full length — **10,453 meters**

**Canal Parameters:**

* **Design flow rate:** 2.0 m³/s
* **Bottom width:** 4.0 meters
* **Side slope coefficient:** 1.5
* **Water depth:** 1.0 meter
* **Longitudinal slope:** 0.0001
* **Manning roughness coefficient:** 0.025
* **Structural height of canal section:** 2.0 meters

**Project Activities Include:**

1. **Mechanical cleaning** of the Yeski Bostandyk canal from PK 0+00 to PK 104+50, with a total **earth volume of 28,303 m³**.
2. **Major repair** of the **existing intake structure** at PK 0+91 on the Yeski Bostandyk canal:
   * Restoration of **monolithic reinforced concrete headwalls**, apron, and energy-dissipating structures.
   * Installation of **GS 160×300 sluice gates** for water regulation.
3. **Reconstruction** of the **headwall** of the existing crossing at **PK 49+15** using monolithic reinforced concrete.
4. **Construction** of a new **culvert crossing** at **PK 61+61**.
5. **Reconstruction** of a **regulating-retaining structure** at **PK 65+47**, including installation of **GS 160×300 sluice gates**.
6. **Major repair** of an **agricultural machinery culvert crossing** at **PK 75+30** using **reinforced concrete pipes with a diameter of 1500 mm and a length of 10.0 meters**, enabling access to crop rotation and rice paddies of the village.

**Hydraulic Structures and Equipment:**

* The project includes **standard-type reinforced concrete culvert structures** using **pipes with a diameter of 1500 mm**.
* Each structure includes:
  + An **inlet headwall**,
  + A **single water conveyance pipe**,
  + **Upstream and downstream slope protection**.
* **Flow regulation** and **water level control** are provided by **GS 120-300 sluice gates**.
* Sluice gate operations are handled by **manual screw hoists**, **model 5.0 V**.

**6. Implementation of Water Management Construction Works for the Canal in the Kumzhargan Tract to Improve Water Supply and Environmental Conditions in the Sulutobe Rural District, Shieli District, Kyzylorda Region**

* **Total canal length:** 28.235 km
* **Water discharge at the canal head:** 3.0 m³/s

**Main Scope of Works:**

**1. Canal Restoration:**

* Restoration of the **earthen canal** with **trapezoidal cross-section**.
* Clearing of **medium-density shrub vegetation**.
* Removal of **vegetative topsoil**.
* **Earth excavation and leveling**, berm planning, and topsoil restoration.
* The canal lining includes a **1.5 m stone riprap**.

**2. Operational Road Construction:**

* **Soil loosening**, foundation of a **quality embankment** to a depth of 0.35 m.
* **Compaction** of the road base (also 0.35 m thick).
* **Gravel-sand covering** (20 cm thick), with material hauled up to 200 km.

**3. Headwork Structure:**

* Constructed using **square-shaped twin-barrel outlet pipes**, type **PS 200-200**, each barrel measuring **2×2 meters** — **20 units in total** (Series 3.501-177-93).
* **Diaphragms D-1 and D-2** made from **monolithic reinforced concrete B20**, with reinforcement Ø10 mm, grade A400.
* **Inlet and outlet headwalls** are clad in monolithic reinforced concrete B20 with A400 Ø8 mm reinforcement, and lined with **stone embankments**.
* Pipe joint installation includes:
  + **30 mm antiseptic-treated wooden boards** at the pipe joints.
  + **Caulking of joints** with bitumen-soaked oakum (1.65 kg/m).
  + **Grouting** with M150 cement-sand mortar inside and outside.
  + **Two-layer jute wrapping** soaked in boiling bitumen applied externally.
* **Backfilling** with moistened soil in compacted layers.
* **Water regulation** is managed by **PS 200-200 sluice gates** with **manual screw hoists (5V)**.
* **Hydro-insulation coating** of all concrete surfaces in contact with soil using **bitumen applied in two layers**.
* **Trapezoidal headwall cladding** in monolithic reinforced concrete B15 with A400 Ø8 mm reinforcement.

**4. Culvert Crossings:**

* **Excavation of foundation pits** for bridges and headwalls.
* Manual finishing of excavation.
* **Base layer preparation** with compacted gravel-sand mixture.
* **Installation of ZP-series tubing segments** (ZP-19.100 – 8 pcs, ZP38 – 2 pcs).
* Equalization layers below and above tubing: **monolithic concrete B15, M200**, reinforced with Ø10 mm A400 at 20×20 cm spacing, 20 cm thick.
* **Assembly of inlet/outlet blocks** according to design drawings.
* **Joint sealing** and waterproofing of the tubing and headwalls.
* **Backfill compaction** using pneumatic tampers and water irrigation.
* Gravel or asphalt road surface per drawings.
* Trapezoidal inlet/outlet headwalls: **monolithic concrete walls with diving configuration**, 20 cm thick.

**5. Hydrometric Post:**

* Constructed as a **bank-type well** using precast concrete elements:
  + **5 wall rings KS 10-6**
  + **1 bottom slab KN 10-1**
  + **1 cover slab 1PP 10-2**
* Includes:
  + A **steel throat structure (VP-6)** from 4 mm sheet steel.
  + Sealing with M100 cement mortar.
  + **Asbestos-cement pipe Ø100 mm**, 10 m long.
  + **Water level staff gauge** made from 4 mm steel (GOST 19903-74).
  + **Hydrometric bridge MG-18**, mounted on **monolithic reinforced concrete**, with **anchor bolts Ø16 mm, L=700 mm**.
* **Bitumen waterproofing** of all concrete elements in contact with soil (two layers).
* **Backfilling with soil**, compacted using a **79 kW bulldozer**.
* **Painting** of all metallic surfaces.

**7. Major Repair of the Bazar Aryk Canal in Shieli Settlement, Shieli District, Kyzylorda Region**

* **Total canal length:** 5.022 km

**Project Scope:**

The project provides for **mechanized cleaning** of the earthen part of the canal, leveling the canal bottom to the design elevations, clearing vegetation from the slopes, and bringing the channel into conformity with the design dimensions in preparation for **lining with 15 cm thick monolithic reinforced concrete (class B22.5, F200, W8)**. The concrete lining is reinforced with **steel mesh of class A-III, Ø10 mm, with 20 cm spacing**.

**Earthworks:**

* **Site preparation** involves stripping 20 cm of topsoil using a bulldozer.
* **Embankment formation** is done by excavator, with soil transported by dump trucks from a designated borrow pit to the construction site.
* **Vegetation and topsoil removal** is performed using a bulldozer or excavator (slope stripping).
* Before the main earthworks begin, **temporary or permanent drainage structures** must be installed to protect the site from surface runoff.
* Earth excavation and movement are carried out with a **79 kW bulldozer** and **dragline excavator**; excavated material is spread and leveled with a bulldozer.

**Reinforced Concrete Works:**

The reinforced concrete works include:

* **Formwork installation**
* **Rebar placement**
* **Concrete pouring**
* **Concrete curing**
* **Formwork removal**
* Reinforcing meshes and cages are installed in sequence to ensure accurate positioning and fastening.
* **Rebar spacers** must be installed to maintain a **concrete cover of 25 mm**.
* Before rebar placement, the **formwork must be inspected**, and any defects must be corrected.
* All rebar meshes and cages are prepared **on-site in the rebar workshop**.
* Before concrete placement, all **hidden works** (e.g., base preparation, waterproofing, rebar placement, embedded parts) must be **checked and documented**.
* The **concrete is produced directly on-site**.
* Concrete compaction in heavily reinforced structures is carried out using **vibrators with flexible shafts (e.g., I-116A, I-21, I-50)** and **surface vibrators (e.g., S-820)**.
* The concrete placement plan should follow a **flow-line method**, with zoning into **batches and levels**, using **modular reusable formwork panels**.

**Additional Technical Details:**

* **Internal rod electrodes** (6–12 mm steel scraps) and **wire electrodes** (2.5–3.0 m) are embedded into the unshuttered surfaces of the concrete, spaced **10–15 cm apart**, for quality assurance or potential monitoring.
* All concrete and reinforced concrete works must be carried out in **strict accordance with the working drawings**, the **project-specific construction plan**, and **comply with the requirements of SNIP RK 3.02-29-2004** (“Load-bearing and enclosing structures”).

1. **Tashalinsky District, Kyzylorda-West Kazakhstan Region. Lot 2**

**Reconstruction of the Zhaikbai canal in the Taskalinsky district of the West Kazakhstan region**

**Water Supply Source for Pasture Irrigation**

The source of water supply for pasture irrigation is the Kirovo-Chizhinsky irrigation canal, which draws water from the Kirov Reservoir, part of the Uralo-Kushum irrigation and watering system. The canal is operated by the West Kazakhstan Branch of the Republican State Enterprise "Kazvodkhoz".

The **Zhaykbay irrigation canal** originates at PK700 of the Kirovo-Chizhinsky canal and extends to the area of **Akkus** in the **Mereke rural district**, with a total length of **41.75 km**.

The canal was initially designed for a discharge of **1.5 m³/s**, but under current conditions, it can carry up to **2.0 m³/s** when the Kirov Reservoir is at a normal water level and the Kirovo-Chizhinsky canal is at its maximum level at PK701.

**Current Condition of the Zhaykbay Canal**

The Zhaykbay canal is intended to create water reserves for livestock watering in artificial ponds (pond excavations), which are filled using a system of canals and hydraulic structures.

In spring, most of the area within the canal’s zone of influence is sufficiently supplied with water due to snowmelt accumulation in the canal, small lakes, and depressions, fed by the Chizha-1 and Chizha-2 rivers (depending on annual water availability). However, by mid-summer, a significant number of these water bodies dry up, and the water flows downstream along the canal.

Currently, pasture lands are underutilized due to a lack of irrigation. The Zhaykbay canal was constructed and put into operation between **1973 and 1975**.

The canal crosses the territories of **three rural districts** (Kazakhstan, Chizhinsky, and Mereke) of the **Taskala district**. It is mainly constructed in a cut section and partially in a semi-cut section in areas prone to flooding, with a minimal longitudinal slope throughout the route.

There are **8 regulating structures** along the canal, including **one head intake structure**. The remaining **seven structures are in disrepair**, lacking operational gates, with most of the reinforced concrete components deteriorated.

Of the **17 pond excavations**, many are silted and overgrown with vegetation. Some of them either have no intake structures or never had any built. Ponds located in floodplain areas are filled in spring by floodwaters, depending on the runoff volume.

Along the canal's alignment, **three earth dams** block the flow, and some structures are either silted or damaged.

Due to these conditions, **it is impossible to ensure proper filling of existing ponds** and effective livestock watering without full **rehabilitation of the Zhaykbay canal and its associated infrastructure**.

**Proposed Project Solutions**

As identified during the condition assessment, the canal’s state is unsatisfactory. To restore its functionality and support the pasture irrigation system, the following works are proposed in the detailed design:

* **Mechanical clearing of the canal** of vegetation; restoration of canal embankments to the design elevation; filling erosion gullies in floodplain areas; trimming embankments to allow access roads, etc., along **41.75 km**;
* **Reconstruction (with dismantling of existing structures)** of **7 regulating structures** (excluding the head structure #1, which was constructed in 2017) with design discharges from **1.5 to 2.0 m³/s**;
* **Construction of 16 new water outlets** to pond excavations;
* Construction of **1 outlet from the floodplain into the canal**, and **1 outlet from the canal into the floodplain**;
* Construction of **automatic spillways (fixed thresholds)**:
  + **2 single-sided spillways**
  + **6 double-sided spillways**;
* Construction of **a siphon crossing (culvert)** under the canal at **PK94+40**;
* Construction of **a hydrometric gauging station**;
* As requested by the client, clearing of **existing pond excavations in each of the 3 rural districts (3 ponds per district)**, including cleaning of their inflow canals. No cleaning is planned for other ponds;
* **Reconstruction of the canal in the Jumala area** – **8.8 km**, including clearing of the associated pond excavation.

1. **Arys District, Turkestan Region. Lot 1**

# **Arys city, 5 projects**

# **1. "Phase I Capital Repair of the 3-K-1 Utility Canal with Branches and Structures in the Zhideli Rural District, Arys City, Turkestan Region"**

The project is located in the city of Arys, Turkestan Region, Republic of Kazakhstan.

**Project Objective:**  
The main objective of the project is to improve the throughput capacity of the main utility canal 3-K-1 and its distribution branches 3-K-1-1 and 3-K-1-1-4, including the reconstruction of associated hydraulic structures. The project aims to increase the canal’s efficiency and enhance the water supply to existing irrigated lands.

**Water Source:**  
Water for the canal system is sourced from the Kzylkum Main Canal.

**Water Intake Point:**  
Water is drawn from the tail end of the Kzylkum Main Canal.

**Seismic Activity in the Area:**  
The project site is located in a seismic zone with an intensity of up to 7 points on the MSK-64 scale.

**Name of the Canal System:**  
Main utility canal 3-K-1 and distribution branches 3-K-1-1 and 3-K-1-1-4.

**Total Length of Canals:**  
The total length of the canals subject to capital repair is 12.341 km, including:

* Canal 3-K-1: 3.756 km
* Branch 3-K-1-1: 3.38 km
* Branch 3-K-1-1-4: 5.205 km

**Canal Design Flow Rates:**

* Canal 3-K-1: 2.071 m³/s
* Branch 3-K-1-1: 1.0 m³/s
* Branch 3-K-1-1-4: 0.757 m³/s

**Canal Construction Details:**  
The canal has a trapezoidal cross-section built in a combination of excavation and embankment. It is lined with monolithic reinforced concrete laid over an anti-filtration waterproof geomembrane with a thickness of 0.5 mm.

**Canal Efficiency (Water Conveyance Efficiency):**

* Before capital repair: 0.58
* After capital repair: 0.90

**Existing Irrigated Area:**  
The canal system currently serves a total irrigated area of 1,172.5 hectares.

**Main Scope of Works:**  
The project provides for the execution of the following types and volumes of construction and earthworks:

* Topsoil stripping — **32,369.84 m³**
* Soil cutting — **9,620.03 m³**
* Soil loosening — **219,647.72 m³**
* Land leveling — **569,528.5 m³**
* Soil compaction — **219,981.0 m³**
* Earth excavation — **221,572.0 m³**

# **2. Reconstruction and Diversion of Irrigation Canals 3-K-1, 3-K-2, and 3-K-3 in the Zhideli Rural District – Revised Working Project, Arys City, Turkestan Region.**

Under review by State Expertise, final decision pending.

# **3. Major Repair of Farm Canals BK-1, BK-1A and Branches BK-1-1, BK-1-2, BK-1-3, BK-1-4, BK-1-4-1, BK-1-4-2, and BK-1-5 in the Baiyrkum Rural District, Arys City, Turkestan Region.**

The **total length of the canal system** is **14.724 kilometers**, including:

* **BK-1 Canal** – 5.604 km
* **BK-1A Canal** – 3.450 km
* **Branch Canals**:
  + BK-1-1 – 1.049 km
  + BK-1-2 – 0.235 km
  + BK-1-3 – 0.404 km
  + BK-1-4-1 – 0.674 km
  + BK-1-4-2 – 0.692 km
  + BK-1-5 – 1.800 km

The **total irrigated area** supplied by the canals amounts to **2,412 hectares**.

The **main water intake capacities** of the canals are:

* **BK-1 Canal** – 3.0 m³/s
* **BK-1A Canal** – 0.75 m³/s

A total of **110 hydraulic structures** are planned for repair across the canal system. Their distribution is as follows:

**BK-1 Canal – 7 structures:**

* 1 head intake structure
* 4 water outlet structures
* 2 check (regulating) structures

**BK-1A Canal – 32 structures:**

* 1 siphon (culvert)
* 26 water outlet structures
* 4 turning manholes
* 1 terminal manhole

**BK-1-1 Canal – 8 structures:**

* 2 siphons
* 4 water outlets
* 1 turning manhole
* 1 terminal manhole

**BK-1-2 Canal – 2 structures:**

* 1 siphon
* 1 terminal manhole

**BK-1-3 Canal – 4 structures:**

* 1 siphon
* 2 water outlets
* 1 terminal manhole

**BK-1-4 Canal – 17 structures:**

* 1 siphon
* 14 water outlet structures
* 1 turning manhole
* 1 terminal manhole

**BK-1-4-1 Canal – 7 structures:**

* 1 siphon
* 4 water outlet structures
* 1 turning manhole
* 1 terminal manhole

**BK-1-4-2 Canal – 5 structures:**

* 4 water outlet structures
* 1 terminal manhole

**BK-1-5 Canal – 14 structures:**

* 1 siphon
* 11 water outlet structures
* 1 turning manhole
* 1 terminal manhole

**Collector Canal at Station ПК 7+00 – 14 structures:**

* 1 siphon
* 12 water outlet structures
* 1 terminal manhole

**Structural Solutions:**

The **design and construction solutions** are developed in accordance with **SNiP RK 3.04-11-2019** "Irrigation Systems and Structures."  
Hydraulic parameters of the canals were determined based on **hydraulic modeling**, taking into account **potential waterlogging near the outlets**.

**Hydraulic Structures**

A total of **110 hydraulic structures** are planned for repair within the canal system.

**BK-1 Canal**:

* Head intake structure
* Water outlet structures
* Check (regulating) structures

**BK-1A Canal** – 32 structures:

* Siphon (culvert)
* Water outlet structures
* Turning manholes
* Terminal manhole

**BK-1-1 Canal** – 8 structures:

* Siphon
* Water outlet structures
* Turning manhole
* Terminal manhole

**BK-1-2 Canal**:

* Siphon
* Terminal manhole

**BK-1-3 Canal**:

* Siphon
* Water outlet structures
* Terminal manhole

**BK-1-4 Canal**:

* Siphon
* Water outlet structures
* Turning manhole
* Terminal manhole

**BK-1-4-1 Canal**:

* Siphon
* Water outlet structures
* Turning manhole
* Terminal manhole

**BK-1-4-2 Canal**:

* Water outlet structures
* Terminal manhole

**BK-1-5 Canal**:

* Siphon
* Water outlet structures
* Turning manhole
* Terminal manhole

**Collector Canal at Station ПК 7+00**:

* Siphon
* Water outlet structures
* Terminal manhole

The **canal efficiency coefficient (water delivery efficiency)** before the capital repair is **0.65**.

# **4. Major repair of the branch canals of the BK-1 irrigation canal — BK-2-1, BK-2-2, BK-2-2-1, BK-2/3, BK-2-3, BK-2-4, BK-2-5, BK-4, BK-4-1, BK-4-2, BK-4-3, BK-4-4, BK-4-5, BK-4-5-1, BK-4-6, BK-4-6-1 — located in the Baiyrkum rural district, city of Arys, Turkistan region.**

**The total length of the canals is 18.630 km, including:**

* BK-2-1 – 0.495 km
* BK-2-2 – 1.085 km
* BK-2-2-1 – 0.772 km
* BK-2/3 – 0.975 km
* BK-2-3 – 3.194 km
* BK-2-4 – 0.279 km
* BK-2-5 – 0.767 km
* BK-4 – 2.615 km
* BK-4-1 – 1.343 km
* BK-4-2 – 1.118 km
* BK-4-3 – 0.771 km
* BK-4-4 – 1.138 km
* BK-4-5 – 0.686 km
* BK-4-5-1 – 1.027 km
* BK-4-6 – 1.136 km
* BK-4-6-1 – 1.229 km

The total irrigated area associated with the canal system is **2,412 hectares**.  
The head discharge of the main canals is: **BK-2-3 – 0.57 m³/s** and **BK-4 – 0.57 m³/s**.  
The number of hydraulic structures to be repaired along the canals is **227 units**.  
The number of workers involved in the repair project is **36 people**.

**Hydraulic Structures by Canal:**

* **BK-2-3 Canal – 34 structures:**
  + 29 water outlets
  + 4 turning wells
  + 1 terminal well
* **BK-2-1 Canal:**
  + 6 water outlets
  + 1 terminal well
* **BK-2-2 Canal:**
  + 1 culvert
  + 15 water outlets
  + 1 turning well
  + 1 terminal well
* **BK-2-2-1 Canal:**
  + 1 culvert
  + 7 water outlets
  + 1 terminal well
* **BK-2/3 Canal:**
  + 11 water outlets
  + 1 turning well
  + 1 terminal well
* **BK-2-4 Canal:**
  + 1 culvert
  + 4 water outlets
  + 1 terminal well
* **BK-2-5 Canal:**
  + 5 water outlets
  + 1 terminal well
* **BK-4 Canal:**
  + 31 water outlets
  + 1 turning well
  + 1 culvert
* **BK-4-1 Canal:**
  + 1 culvert
  + 19 water outlets
  + 2 turning wells
  + 1 terminal well
* **BK-4-2 Canal:**
  + 1 culvert
  + 10 water outlets
  + 1 terminal well
* **BK-4-3 Canal:**
  + 6 water outlets
  + 1 culvert
  + 1 terminal well
* **BK-4-4 Canal:**
  + 1 culvert
  + 10 water outlets
  + 1 terminal well
* **BK-4-5 Canal:**
  + 1 culvert
  + 3 water outlets
  + 1 terminal well
* **BK-4-5-1 Canal:**
  + 1 culvert
  + 19 water outlets
  + 1 terminal well
* **BK-4-6 Canal:**
  + 1 culvert
  + 8 water outlets
  + 1 turning well
  + 1 terminal well
* **BK-4-6-1 Canal:**
  + 8 water outlets
  + 1 terminal well

**Key Project Indicators**

1. **Total length of the canals is 18.630 km**, including the following branches:

* BK-2-1 – 0.495 km
* BK-2-2 – 1.085 km
* BK-2-2-1 – 0.772 km
* BK-2/3 – 0.975 km
* BK-2-3 – 3.194 km
* BK-2-4 – 0.279 km
* BK-2-5 – 0.767 km
* BK-4 – 2.615 km
* BK-4-1 – 1.343 km
* BK-4-2 – 1.118 km
* BK-4-3 – 0.771 km
* BK-4-4 – 1.138 km
* BK-4-5 – 0.686 km
* BK-4-5-1 – 1.027 km
* BK-4-6 – 1.136 km
* BK-4-6-1 – 1.229 km

1. **Discharge capacity of the main canals**:

* BK-2-3 – 0.57 m³/sec
* BK-4 – 0.57 m³/sec

1. **Irrigation source**: The canal system is supplied by BK-1 canal with water intake from the Kyzylkum Main Canal (KMC).
2. **Irrigated area**: The total area serviced by the canal system is 2,412 hectares.
3. **Purpose of the canal system**: To provide reliable water supply for irrigated agricultural lands.
4. **Cultivated crops**: Agricultural production includes corn, melons, wheat, and alfalfa.
5. **Responsibility level**: Level II (normal, technically complex), in accordance with Order No. 165 of the Minister of National Economy of the Republic of Kazakhstan dated December 28, 2015.
6. **Structure class**: Class IV, according to the standards of SN RK 3.04-11-2019 “Land Reclamation Systems and Structures.”

**Hydraulic Structures**

A total of **110 hydraulic structures** are subject to repair across the canal network, including:

* **BK-2-3 Canal**:  
  29 outlet structures,  
  4 turning manholes,  
  1 terminal manhole.
* **BK-2-1 Canal**:  
  6 outlet structures,  
  1 terminal manhole.
* **BK-2-2 Canal**:  
  1 culvert,  
  15 outlet structures,  
  1 turning manhole,  
  1 terminal manhole.
* **BK-2-2-1 Canal**:  
  1 culvert,  
  7 outlet structures,  
  1 terminal manhole.
* **BK-2/3 Canal**:  
  11 outlet structures,  
  1 turning manhole,  
  1 terminal manhole.
* **BK-2-4 Canal**:  
  1 culvert,  
  4 outlet structures,  
  1 terminal manhole.
* **BK-2-5 Canal**:  
  5 outlet structures,  
  1 terminal manhole.
* **BK-4 Canal**:  
  31 outlet structures,  
  1 turning manhole,  
  1 culvert.
* **BK-4-1 Canal**:  
  1 culvert,  
  19 outlet structures,  
  2 turning manholes,  
  1 terminal manhole.
* **BK-4-2 Canal**:  
  1 culvert,  
  10 outlet structures,  
  1 terminal manhole.
* **BK-4-3 Canal**:  
  6 outlet structures,  
  1 culvert,  
  1 terminal manhole.
* **BK-4-4 Canal**:  
  1 culvert,  
  10 outlet structures,  
  1 terminal manhole.
* **BK-4-5 Canal**:  
  1 culvert,  
  3 outlet structures,  
  1 terminal manhole.
* **BK-4-5-1 Canal**:  
  1 culvert,  
  19 outlet structures,  
  1 terminal manhole.
* **BK-4-6 Canal**:  
  1 culvert,  
  8 outlet structures,  
  1 turning manhole,  
  1 terminal manhole.
* **BK-4-6-1 Canal**:  
  8 outlet structures,  
  1 terminal manhole.

**Additional Information:**

* **Water use efficiency (WUE)** before major repair: 0.65
* **WUE after major repair**: 0.90

# **5. Major Overhaul of the Offtakes of the Agricultural Canal (BK-1): BK-5, BK-5-1, BK-5-2, BK-5-3, BK-5-4, BK-5-5, BK-5-6, BK-5-7, BK-5-7-1, BK-5-7-2, BK-6, BK-6-2, BK-6-3, and BK-6-4 in the Bayyrkum Rural District, Arys City, Turkistan Region.**

**Total length of the canal system amounts to 19.648 kilometers**, including the following segments:

* BK-5 – 5.793 km
* BK-5-1 – 0.632 km
* BK-5-2 – 0.660 km
* BK-5-3 – 0.828 km
* BK-5-4 – 0.769 km
* BK-5-5 – 0.119 km
* BK-5-6 – 0.822 km
* BK-5-7 – 1.189 km
* BK-5-7-1 – 0.682 km
* BK-5-7-2 – 1.064 km
* BK-6 – 3.753 km
* BK-6-2 – 0.896 km
* BK-6-3 – 1.786 km
* BK-6-4 – 0.655 km

The **total irrigated area** served by the canals is **2,412 hectares**.

The **main discharge capacities** of the key canals are:

* BK-5 – **0.8 m³/s**
* BK-6 – **0.65 m³/s**

A total of **195 hydraulic structures** are scheduled for rehabilitation under the project.

The workforce involved in the canal rehabilitation project includes **45 workers**.

**Breakdown of Hydraulic Structures:**

* **BK-5 Canal** – 51 structures:
  + 41 water outlets
  + 2 culverts
* **BK-5-1 Canal** – 6 structures:
  + 5 water outlets
  + 1 end well
* **BK-5-2 Canal** – 3 structures:
  + 2 water outlets
  + 1 end well
* **BK-5-3 Canal** – 3 structures:
  + 2 water outlets
  + 1 end well
* **BK-5-4 Canal** – 4 structures:
  + 3 water outlets
  + 1 end well
* **BK-5-5 Canal** – 2 structures:
  + 1 water outlet
  + 1 end well
* **BK-5-6 Canal** – 5 structures:
  + 4 water outlets
  + 1 end well
* **BK-5-7 Canal** – 15 structures:
  + 12 water outlets
  + 2 turning wells
  + 1 end well
* **BK-5-7-1 Canal** – 5 structures:
  + 4 water outlets
  + 1 end well
* **BK-5-7-2 Canal** – 7 structures:
  + 6 water outlets
  + 1 end well
* **BK-6 Canal** – 47 structures:
  + 44 water outlets
  + 2 turning wells
  + 1 end well
* **BK-6-2 Canal** – 9 structures:
  + 8 water outlets
  + 1 end well
* **BK-6-3 Canal** – 29 structures:
  + 26 water outlets
  + 2 turning wells
  + 1 end well
* **BK-6-4 Canal** – 9 structures:
  + 7 water outlets
  + 1 culvert
  + 1 end well

**Technical and Economic Indicators**

1. **Total length of canals**:  
   The overall length of the canal network is **19.648 km**, including:

* BK-5: 5.793 km
* BK-5-1: 0.632 km
* BK-5-2: 0.660 km
* BK-5-3: 0.828 km
* BK-5-4: 0.769 km
* BK-5-5: 0.119 km
* BK-5-6: 0.822 km
* BK-5-7: 1.189 km
* BK-5-7-1: 0.682 km
* BK-5-7-2: 1.064 km
* BK-6: 3.753 km
* BK-6-2: 0.896 km
* BK-6-3: 1.786 km
* BK-6-4: 0.655 km

1. **Discharge capacity of main canals**:

* BK-5: **0.8 m³/s**
* BK-6: **0.65 m³/s**

1. **Source of irrigation**:  
   Water intake is from the **Kyzylkum Main Canal (KMC)**.
2. **Irrigated area**:  
   The total irrigated area amounts to **2,412 hectares**.
3. **Purpose of canals**:  
   The canals serve the purpose of **providing water supply for irrigated lands**.
4. **Cultivated crops**:  
   The irrigated lands support the production of **agricultural crops**, including **maize, melons, wheat, and alfalfa**.
5. **Responsibility level**:  
   **Level II (normal, technically complex)** – in accordance with Order No. 165 of the Minister of National Economy of the Republic of Kazakhstan dated 28.12.2015.
6. **Class of structures**:  
   **Class IV** – according to **SNiP RK 3.04-11-2019 “Irrigation Systems and Structures”**.
7. **Artificial structures**:  
   A total of **195 hydraulic structures** are planned for repair, including:

* **BK-5 Canal**:
  + 41 water outlets
  + 2 culverts
  + 8 turning wells
* **BK-5-1 Canal**:
  + 5 water outlets
  + 1 end well
* **BK-5-2 Canal**:
  + 2 water outlets
  + 1 end well
* **BK-5-3 Canal**:
  + 2 water outlets
  + 1 end well
* **BK-5-4 Canal**:
  + 3 water outlets
  + 1 end well
* **BK-5-5 Canal**:
  + 1 water outlet
  + 1 end well
* **BK-5-6 Canal**:
  + 4 water outlets
  + 1 end well
* **BK-5-7 Canal**:
  + 12 water outlets
  + 2 turning wells
  + 1 end well
* **BK-5-7-1 Canal**:
  + 4 water outlets
  + 1 end well
* **BK-5-7-2 Canal**:
  + 6 water outlets
  + 1 end well
* **BK-6 Canal**:
  + 44 water outlets
  + 2 turning wells
  + 1 end well
* **BK-6-2 Canal**:
  + 8 water outlets
  + 1 end well
* **BK-6-3 Canal**:
  + 26 water outlets
  + 2 turning wells
  + 1 end well
* **BK-6-4 Canal**:
  + 7 water outlets
  + 1 culvert
  + 1 end well

1. **Canal efficiency before rehabilitation**:  
   **0.65**
2. **Canal efficiency after rehabilitation**:  
   **0.90**
3. **Shardara District, Turkestan Region. Lot 2**

**Shardara district, 4 projects**

**1. Overhaul of canal 1-K-2, 1-x-2-k-1, 1-x-2-k-2, 1-x-2-k-3, 1-x-2-k-4 in Dostyk village of Shardara district**

**Technical Summary of the Reconstruction Project for Canal 1-K-2 and Its Branches**

The **total length of the irrigation canal system** is **20.609 km**, including the following components:

* **1-K-2 Main Canal** – 8.487 km
* **1-K-2-K-1 Branch Canal** – 2.670 km
* **1-K-2-K-2 Branch Canal** – 2.717 km
* **1-K-2-K-3 Branch Canal** – 1.893 km
* **1-K-2-K-4 Branch Canal** – 4.842 km

The **irrigated area** supported by the canal system is **1,596 hectares**.  
The **main discharge capacity** of the 1-K-2 canal is **3.0 m³/s**.

The project includes the **rehabilitation of 162 hydraulic structures**, with **53 workers** involved in construction.

**Breakdown of Hydraulic Structures by Canal:**

**Main Canal 1-K-2**:

* 1 hydropost
* 20 water outlets
* 2 regulating structures
* 1 turning well

**Branch Canal 1-K-2-K-1**:

* 1 headworks structure
* 30 water outlets
* 1 turning well
* 1 culvert (syphon/duker)

**Branch Canal 1-K-2-K-2**:

* 1 headworks structure
* 16 water outlets
* 2 culverts
* 1 turning well

**Branch Canal 1-K-2-K-3**:

* 1 headworks structure
* 21 water outlets
* 1 turning well

**Branch Canal 1-K-2-K-4**:

* 1 headworks structure
* 46 water outlets
* 2 culverts
* 4 turning wells
* 1 end well

**Sub-branch Canal 1-K-2-K-4-1**:

* 1 water outlet
* 1 end well

**Sub-branch Canal 1-K-2-K-4-2**:

* 4 water outlets
* 1 turning well
* 1 end well

**Technical and Economic Indicators**

1. **Total length of canals**:  
   The total length of the canal system is **20.609 km**, including:

* 1-K-2 – 8.487 km
* 1-K-2-K-1 – 2.670 km
* 1-K-2-K-2 – 2.717 km
* 1-K-2-K-3 – 1.893 km
* 1-K-2-K-4 – 4.842 km

1. **Canal capacity**:  
   The design discharge of the main canal (1-K-2) is **3.0 m³/s**.
2. **Irrigation water source**:  
   The water source is the **Kyzylkum Main Canal (KMC)**.
3. **Purpose of the canal**:  
   To provide irrigation water to agricultural lands.
4. **Level of responsibility**:  
   **Level II** – Normal, technically complex structures.  
   According to the Order of the Minister of National Economy of the Republic of Kazakhstan dated December 20, 2016, No. 517.
5. **Structure classification**:  
   **Class IV**, as per **SNiP RK 3.04-11-2019 “Melioration Systems and Facilities”**.
6. **Cultivated crops**:  
   Agricultural production including **corn, melons, wheat, and alfalfa**.
7. **Hydraulic structures (total: 162 units)**:  
   The project includes the **repair and reconstruction of hydraulic structures**, as follows:

* **Canal 1-K-2**:
  + 1 hydropost
  + 20 water outlet structures
  + 2 regulating structures
  + 1 turning well
* **Canal 1-K-2-K-1**:
  + 1 headworks structure
  + 30 water outlets
  + 1 turning well
  + 1 culvert
* **Canal 1-K-2-K-2**:
  + 1 headworks structure
  + 16 water outlets
  + 2 culverts
  + 1 turning well
* **Canal 1-K-2-K-3**:
  + 1 headworks structure
  + 21 water outlets
  + 1 turning well
* **Canal 1-K-2-K-4**:
  + 1 headworks structure
  + 46 water outlets
  + 2 culverts
  + 4 turning wells
  + 1 end well
* **Outlet canal at PK15+70**:
  + 1 water outlet
  + 1 end well
* **Outlet canal at PK26+90**:
  + 4 water outlets
  + 1 turning well
  + 1 end well

1. **Canal efficiency before repair**:  
   The operational efficiency was **0.65**.
2. **Canal efficiency after repair**:  
   The expected efficiency will be increased to **0.90**.

**2. "Major repairs of Channel 4-K-1-1, 4-K-1-2, 4-K-1-3, 4-K-1-4 in Akshengeldy village of Shardara district of Turkestan region"**

**The 4-K-1-1, 4-K-1-2, 4-K-1-3, and 4-K-1-4 canals are located in the Akshengeldi rural district of the Shardara district, Turkistan region.**

These canals were commissioned in 1980, and their water intake is carried out from the Kyzylkum Main Canal. The total length of the canal system is **21,162 meters**, with a **head discharge of 0.9 m³/s**. The canal serves an **irrigated area of 1,355 hectares**.

Upon full implementation of the project, **21.6 kilometers of canals will be lined with concrete**, significantly improving water delivery to **1,355 hectares of irrigated farmland**.

Currently, due to the deteriorated condition and malfunctioning of the canal system, **only 542 hectares (approximately 40%)** are being effectively irrigated.

Additionally, the project will enable the **annual saving of 3.5 million cubic meters of water**. These water savings will allow for the **reclamation and reactivation of previously non-operational irrigated lands**.

The **canal efficiency (WUE)** is expected to increase from **0.65 to 0.90** as a result of the rehabilitation works.

**3. Rehabilitation of the RSh-2 Canal**

The **RSh-2 canal**, located in the Shardara district, has a **total length of 4.461 kilometers** and serves an **irrigated area of 360 hectares**. The **design discharge during the vegetation period** is **1.3 cubic meters per second**.

A total of **40 hydraulic structures** along the canal are subject to rehabilitation. The project will engage **28 workers**.

**Hydraulic Structures on the RSh-2 Canal:**

* Head intake structure – 1 unit
* Hydraulic post – 1 unit
* Water outlets – 33 units
* Pipe crossings – 2 units
* Pipe-type regulating structures – 2 units
* Open-type regulating structure – 1 unit

**Technical and Economic Indicators**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **№** | **Indicator Name** | **Unit** | **Value** | **Notes** |
| 1 | Canal length | km | 4.461 |  |
| 2 | Design discharge | m³/s | 1.3 |  |
| 3 | Water source | — | Shardara Main Canal (ShMK) |  |
| 4 | Purpose of the canal | — | Irrigation water supply |  |
| 5 | Responsibility level | — | Level II (normal, technically complex) | In accordance with Order No. 517 of the Minister of National Economy of the Republic of Kazakhstan dated 20.12.2016 |
| 6 | Construction classification | — | Class IV | According to SN RK 3.04-11-2019 “Irrigation Systems and Structures” |
| 7 | Cultivated crops | — | Agricultural production: maize, melons, wheat, alfalfa |  |
| 8 | Hydraulic structures under rehabilitation: | pcs | 40 | See breakdown below |
| – | Head intake structure | pcs | 1 |  |
| – | Hydraulic post | pcs | 1 |  |
| – | Water outlets | pcs | 33 |  |
| – | Pipe crossings | pcs | 2 |  |
| – | Pipe regulators | pcs | 2 |  |
| – | Open regulator | pcs | 1 |  |
| 9 | Water use efficiency before rehabilitation | — | 0.65 |  |
| 10 | Water use efficiency after rehabilitation | — | 0.91 |  |

**4. Major Rehabilitation of RS-2-1 and RS-3 Canals in K. Turysbekov Rural District, Shardara District, Turkistan Region**

**General Description:**

The project involves the rehabilitation of two irrigation canals – **RS-2-1** and **RS-3** – located in K. Turysbekov rural district, Shardara district. The **total length** of the canals is **5.015 km**, of which:

* **RS-2-1 canal**: 4.081 km
* **RS-3 canal**: 0.934 km

The **command area** includes:

* RS-2-1: 140 hectares
* RS-3: 120 hectares

**Design discharges during the vegetation period**:

* RS-2-1: 1.0 m³/s
* RS-3: 0.8 m³/s

The rehabilitation includes a total of **83 hydraulic structures** (75 on RS-2-1 and 8 on RS-3), with **28 workers** engaged in the project.

**Hydraulic Structures**

**RS-2-1 Canal:**

* Head intake structure – 1 unit
* Hydraulic post – 1 unit
* Water outlet structures – 54 units
* Rectangular-section pipe crossings (street crossings) – 5 units
* Pipe crossings (residential access) – 10 units
* Pipe under the canal – 1 unit
* Cross-regulation structures – 2 units
* Canal crossing over open drain via pipe – 1 unit

**RS-3 Canal:**

* Head intake structure – 1 unit
* Hydraulic post – 1 unit
* Water outlet structures – 3 units
* Pipe crossings – 2 units
* Cross-regulation structure – 1 unit

**Technical and Economic Indicators**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **№** | **Indicator** | **Unit** | **Value** | **Notes** |
| 1 | Canal length (RS-2-1) | km | 4.081 |  |
| 2 | Design discharge (RS-2-1) | m³/s | 1.0 |  |
| 3 | Canal length (RS-3) | km | 0.934 |  |
| 4 | Design discharge (RS-3) | m³/s | 0.8 |  |
| 5 | Water source | — | Shardara Main Canal (ShMK) |  |
| 6 | Purpose | — | Irrigation water supply |  |
| 7 | Irrigated area (RS-2-1) | ha | 140 |  |
| 8 | Irrigated area (RS-3) | ha | 120 |  |
| 9 | Responsibility level | — | Level II (normal, technically complex) | Per Order No. 517 of the Minister of National Economy RK, dated 20.12.2016 |
| 10 | Facility classification | — | Class IV | According to SN RK 3.04-11-2019 "Irrigation Systems and Structures" |
| 11 | Cultivated crops | — | Maize, melons, wheat, alfalfa |  |
| 12 | Number of hydraulic structures: | pcs | 83 | Breakdown below |
| – | RS-2-1 Head intake (gate replacement) | pcs | 1 |  |
| – | Hydraulic post on RS-2-1 | pcs | 1 |  |
| – | Water outlets on RS-2-1 | pcs | 54 |  |
| – | Street pipe crossings | pcs | 5 |  |
| – | Residential access crossings | pcs | 10 |  |
| – | Collector crossing | pcs | 1 |  |
| – | Cross-regulation structures | pcs | 2 |  |
| – | RS-2-1 pipe-over-drain structure | pcs | 1 |  |
| – | RS-3 Head intake | pcs | 1 |  |
| – | Hydraulic post on RS-3 | pcs | 1 |  |
| – | Water outlets on RS-3 | pcs | 3 |  |
| – | Pipe crossings on RS-3 | pcs | 2 |  |
| – | RS-3 cross-regulation structure | pcs | 1 |  |
| 13 | Total construction cost (Q2 2024) | KZT thousand | 997,324.063 | Including construction works: 778,849.155 |
| 14 | Estimated construction duration | months | 9 |  |
| 15 | Water use efficiency before rehab | — | 0.65 |  |
| 16 | Water use efficiency after rehab | — | 0.95 |  |

1. **Otyrar District, Turkestan Region. Lot 3**

**Reconstruction of the inter-farm canal named after D. Altynbekov from ПК246+80 to ПК354+00 in Kargaly rural district, Otyrar district, Turkistan region.**

**Location:** Republic of Kazakhstan, Turkistan Region, Otyrar District, Kargaly Rural District.

**Project objective:** to increase the canal’s throughput capacity, improve its efficiency (coefficient of performance), and enhance water availability for existing irrigated lands.

**Canal purpose:** irrigation – supplying agricultural land with water.

**Cultivated crops:** vegetable and forage crops.

**Type of irrigation system:** open trapezoidal canal lined with monolithic reinforced concrete.

**Length of the reconstructed section:** 10.72 km (from ПК246+80 to ПК354+00).

**Irrigated area:** 4,400 hectares.

**Throughput capacity:** up to 5.0 m³/s.

**Canal efficiency (COP):** before reconstruction – 0.65; after reconstruction – 0.90.

**Seismicity of the area:** 8 points (MSK-64 scale).

**Class and responsibility level:** Class IV, Level II (normal).

|  |
| --- |
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