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HYDRAULIC PROJECTS AND THEIR ROLE IN GENERAL IMPROVEMENT
OF LAND IN THE SOVIET UNION

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According to peculiarities of natural zones and requirements of farming all reclamation measures carried out in the U.S.S.R. may be referred to as irrigation, drainage of swamps and water-supply of arid and semi-arid zones.

Drainage has already been done on an area of a little over 8 million ha: mostly, drainage was effected through cutting open ditches, ploughing the drained land and removing from it vegetation and stones. If necessary, resort was made to banking and regulation of river-beds that were collecting water. Now, that greater bogged-up areas are to be reclaimed building of reservoirs as well as regulation and banking of river-beds have to be started on a grand scale. No less import will be attached to closed drainage.

Some 40 million ha of arid and semi-arid land have been supplied with water through boring and digging wells and ponds and also through building water-supply canals, for which purpose among other things, use was made of dry river-beds, gullies, depressions, etc.

Yet, the bulk of hydraulic projects have been undertaken in the U.S.S.R. in the sphere of irrigation. We, therefore, would rather limit ourselves to problems of irrigation so as to give the broad engineering circles represented here a more detailed account of what is most important in Soviet hydraulic engineering

IRRIGATION IN THE USSR1. General.

As of 1955 /12.4 million ha of land were covered by irrigation network, of which 10,3 million ha were under crop.

The following table specifies irrigated area for each of the Soviet Republics:

	<u>Irrigated area under crop in million ha</u>		
U.S.S.R. (total)	10.3		
Russian Federation	1.4	1.5	+1
Kazakh S.S.R.	2.6	2.1	-5
Uzbek S.S.R.	2.5	2.8	+3
Turkmenian S.S.R.	0.4	0.7	+3
Tajik S.S.R.	0.4	0.4	
Kirgizian S.S.R.	1.1	1.1	
Azerbaijan S.S.R.	1.2	1.6	+4
Georgian S.S.R.	0.3	0.3	
Armenian S.S.R.	0.2	0.2	
Ukrainian S.S.R.	0.2	0.2	
Moldavian S.S.R.	0.03	0.03	

In the zone always short of precipitations /Central-Asia and Transcaucasia/ irrigation is an indispensable condition for agriculture. The percentage share of irrigation in that zone is 72.6 while in Turkmenian and Kirgizian SSR tillage without irrigation is virtually impossible.

From 1917 to 1955 the total area under irrigation more than doubled.

Together with this, much better use is now made of the area under irrigation: valuable industrial crops are being sown on an ever-wider massives. Thus, the area under cotton expanded in the period from 1928 to 1955 2.25 times.

2. Natural Conditions in Various Zones of the USSR with regard to Irrigation

In Central Asia and Transcaucasia big rivers like the Amu-Darya, Syr-Darya, Chu, Murgab, Kura, and in the European Soviet Union - the Dnieper and the Don serve the main source of irrigation.

The Amu-Darya irrigating, together with its tributaries (the Vakhsh, Kafirnigan, Pyanj and others), the lands of Tajikistan, Turkmenistan and Uzbekistan, has an average vegetal flow of 3075 cu.m.p.sec., its total discharge being 64,000,000,000 cu.m; about 1,700,000 ha are irrigated in its basin.

The Syr-Darya irrigating, together with its tributaries, up to 1,900,000 ha in Tajikistan, Kirgizia, Kazakhstan and Uzbekistan, has a vegetal flow of 380 cu.m/sec, its total discharge being equal to 21,300,000,000 cu.m.

A large-scale project has been undertaken of late to irrigate newly-reclaimed lands in the basin of the Dnieper and Don. In the Russian Federation 160,000 ha have now been irrigated from the Tsimlyanskaya Reservoir on the Don River. On the Dnieper (the Ukraine) the Kamenka Pod Irrigation Project has already been put into operation to irrigate 17,000 ha of land, besides, within 1956-1957 another 60,000 ha will be irrigated when the Ingulets Irrigation Project is commissioned.

The hydrographies of the rivers used for irrigation are heterogeneous, which depends on the predominance of this or that component in the general system of feeding.

The spring flood is common for the rivers feeding on the ample water-discharge caused by snow melting in spring; here belong the rivers of the European Soviet Union (the Don, Dnieper, Volga and others), rivers of Siberia as well as the mountain rivers whose feeding zone is situated below the glacial border.

The summer flood (June-July) is characteristic of the rivers which are basically fed in the period of high temperatures when snow and ice are melting in the Alpine zone. For example, the Syr-Darya and Amu-Darya have summer floods which likens their hydrographic pattern to the graphic of water-consumption by irrigation. These rivers also have spring floods of smaller size.

The above regularities are somewhat violated by irregular floods of pluvial origin which is important only for small rivers whose regime in the periods of showers often takes on the form of destructive mud torrents ("sils").

The rivers of Central Asia and Transcaucasia used for irrigation are noted for their high turbidity of water reaching its peak during floods. The highest turbidity is observed in the Amu-Darya.

In the zone of foothills besides suspensions, a good many bottom depositions are carried downstream, dimensions of which are decreasing from the mountains down to the valleys where pebbles and gravel are being replaced by sand, and in

and delta-by sub-aquatic depositions.

Freezing observed almost in all the rivers of the Soviet South is usually preceded by formation of fine ice ("shuga" /sludge/) which is not so easy to dispose of because huge accumulations of ice, and floods due to halts in ice-movement /"nashora" (ice-pack)/ create serious obstacles. On such rivers as the Amu-Darya and Syr-Darya the freezing goes upstream, i.e. against the sludge-current which produces serious complications. In spring the situation is no less difficult for the freezing starts in the upper reaches meeting on the way with a thick ice cover, which also causes rather high floods.

So on the rivers used in the U.S.S.R. for purposes of irrigation the hydraulic engineer is faced with peculiar regimes determined by the nature of feeding, suspended and bottom depositions, instability of channels and by floods and ice-packs

Areas under irrigation in the U.S.S.R. are situated in the Southern climatic zone with a rather prolonged frostless season and with a sum-total of vegetal-period temperatures sufficient to grow cotton, grapes, fruit, rice, industrial and other valuable crops. These favourable conditions are sometimes broken by late-spring and early-autumn frosts which mostly occur in the Northern zone of the cotton belt /near 43-d degree of Northern Latitude/; a serious damage to agriculture is also caused in some regions by harmseals.

These unfavourable factors have to be considered not only by the agronomist but also by the hydraulic engineer to determine a regime of irrigation, to pick out a system of wind-breaking forest shelterbelts, etc.

In the U.S.S.R. regions mostly placed under irrigation are those with highly fertile soils developed on deluvio-proluvial depositions of foothill terraces or on alluvial depositions of flooded and delta plains. When evaluated from the reclamation stand soils should be treated together with grounds and ground waters underlaying them.

This many-sided evaluation provides grounds for dividing the whole multiformance of soil conditions in the irrigated zone of the Soviet Union into two principal categories:

1) regions characterized by rather steep slopes of terrain, cleft relief, presence of draining grounds in the subsoil horizons, favourable conditions for outflow of ground waters, absence of high primary salinity of soils and grounds inherited from their paternal rock; the above conditions are observed in most of the irrigated regions in Central Asia and Transcaucasia;

2) regions characterized by flat relief without slopes, absence of natural draining factors, zero or weak outflow of ground waters with a high degree of salinity, paternal mineralization of soils and grounds; the above traits unfavourable for reclamation are met with in this or that combination in some regions under irrigation, e.g. in the middle and lower reaches of the Amu-Darya, in Kura-Araks Lowland of Azerbaijan S.S.R., in the lower reaches of the Zeravshan, the Golodnaya Steppe and in some other regions.

Sometimes lands of the first category are turned into second-category lands after incorrect exploitation of irrigation projects, excessive water-consumption, and incorrect agrotechnics. As a result, good soils are affected with the

second mineralization, converted into "solonchaks" until the ground water table remains high, next, when such lands are no longer cultivated, the ground water table going down, the solonchak-type mineralization develops into a more complex stage—the so-called "solontsi" (soil with a rather deep lying slightly mineralized layer) which require more complex work to be reclaimed.

This is the main things about natural conditions in the irrigated zone in the USSR. These conditions rather favourable, as they are, brought about the appearance of irrigation in Central Asia and Transcaucasia which is known there from times immemorial to which testify numerous records of material culture left from the pre-historic period.

3. Main Tasks and Trends in Soviet Irrigation

Construction.

Ever since the first years of Soviet Power, development of irrigation projects have been indissolubly linked with the restoration and ever-higher development of national economy and culture in the Socialist Republics of Central Asia and Transcaucasia.

Already before the irrigation projects were undertaken in the first years of Socialist construction another task of no less import had been put forth - to supply the cotton and paper-fabricating industries of the U.S.S.R. with domestic raw material, to insure a cotton independence of the Soviet Union.

The third task, urged by the water and land reform aiming to abolish the landlord's estates and grant land to landless

farmers and to those short of land, consisted in building irrigation projects and taking new lands under cultivation so as to expand the total area under irrigation. This task still confronts the water-economy workers though it has now assumed a greater scope - to make the best use of the water and land resources of the country and secure, thus far, a rapid development of agriculture and to create an abundance of farm produce in the U.S.S.R.

and, finally, the water-economy workers have been and still are faced with the problem of a radical reconstruction of the old irrigation projects to meet the requirements of large-scale mechanised farms of state and communal type - the state and collective farms and also to conform to the standards of the state, planned system of management of our national economy.

These tasks have determined the basic trends in irrigation construction in the U.S.S.R.

1. Irrigation projects have been chiefly constructed in the national Republics of Central Asia and Transcaucasia - in the Uzbek S.S.R., Tajik S.S.R., Turkmenian S.S.R., Kazakh S.S.R., Kirgizian S.S.R., Azerbaijan S.S.R., Georgian S.S.R. and Armenian S.S.R. On a far smaller scale and mainly in the last decade irrigation construction has developed in the semi-arid zone of the Russian Federation, Ukrainian S.S.R. and Moldavian S.S.R.

2. Irrigation construction has had it as a primary object to promote cotton - breeding. Therefore, already towards the close of the first Five-Year Plan the task of winning a cotton independence for the Soviet Union was solved.

3. Irrigation construction has pursued a double purpose: reconstruction of the old irrigation projects and extension of irrigation to new areas. The reconstruction of the old irrigation projects; as a rule, resulted in an expansion of irrigated area at the expense of fallow and virgin lands.

4. Irrigation construction has never been a departmental, limited undertaking barred from the other tasks of national economy; it was going on hand-in-hand with solving problems of hydropower (above all—problems of rural electrification), municipal water-supply, flood control, water-supply on grazing sites, etc.

We deem it necessary to dwell in more detail on the problem of reconstruction of the old irrigation projects and to try to define just what is meant by it.

Before the Revolution the bulk of the irrigation projects were technically rather primitive. They were built by the population for many centuries and bore the impact of patrimonial and feudal social relations and of petty owners' farming. The pre-revolutionary irrigation was peculiar for: absence of head and distribution structures with a multitude of intake points; parallelism of main and lateral canals especially in their idle part, huge dumps of depositions extracted for many years of exploitation, head parts of canals fallen into disuse; excessive length and meanderiness of canals; too small irrigated plots bordered by canals, roads and trees which curbed mechanization of tillage.

In many regions rich with free unused lands a fallow system of tillage was practised, which resulted in rapacious exploitation and damages of land resources. Repairs of irrigation canals,

removing depositions, flood control and other maintenance work were carried out exclusively by water-tenants themselves by way of labour conscription (gratis) without any machines, just a regular burden to the population. Thus, in the lower reaches of the Amu-Darya the farmer spent up to 100 days a year toiling on irrigation canals.

To properly manage water economy it had to be organized on production basis, i.e. to set up production-type enterprises responsible for obtaining water from irrigation sources, delivering it to the consumer and for planned distribution of it among the consumers. Irrigation projects in our business answer all these requirements. So the most urgent task in conditions of Socialist construction was to create irrigation projects instead of small scattered irrigation canals attached to isolated small home-steads or a group of such homesteads. This task called for a large-scale and mass effort to pull intake points together, to build head structures with simultaneous regulation of rivers, to liquidate extra canals raising at the same time the capacity of remaining canals and equipping them with necessary structures, to level dumps and fill dead canals, to enlarge irrigated plots in conformity with mechanization requirements, to improve current planning, to transplant old and plant new trees along canals and roads, and, finally, to remake all the irrigation and collector-draining network erecting on it the necessary structures.

As of today, the total length of canals of irrigation projects exceeds 400,000 km. On the irrigation projects there are over 100,000 large and medium hydraulic structures.

As of 1955 reconstruction of irrigation network on collective

work was carried out on an area of 3,042,000 ha, i.e. almost all the area to have been in need of reconstruction. The number of irrigated plots in that area reduced from 280,000 to 58,000. Liquidation of permanent irrigation network within irrigated plots, of extra field roads, boundaries resulted in a 2-per cent increase as against the reconstructed area.

The reconstruction of the irrigation projects is far from being completed. To make up for that, at the present stage we are able already to manage water economy as a concert of industrial enterprises, organized in the shape of irrigation projects, we are able to use water and land resources in accordance with the requirements of large-scale and highly productive enterprises - collective and state farms, and, at last, we can do all irrigation work by the machine without distracting rural population from their own work in view of the fact that our water-economy organisations are armed with equipment sufficient to mechanize 95 per cent of all the principal irrigation works. The total volume of mechanized excavations in Soviet water economy was in 1956 equal to 400,000,000 cu.m.

Here is the principal irrigation projects undertaken in the USSR according to the three enlarged zones: 1) Central Asia, 2) Transcaucasia, 3) The Russian Federation and the Ukraine.

4. Principal Irrigation Projects Undertaken in Central Asia

Much has been done to improve the head intake on the irrigation canals in Central Asia. A number of reservoirs have been constructed, here is the biggest of them: the Parkhad and Kairak-Kum ones-on the Syr-Darya River; Tash-Keprin-on the Murgab; Urta-Tokov-on the Kakan-sai River; Tejen-on the Tejen;

Jah-Kizil - on the Surkhan-Darya; Katta-Burgan and Kuyu-Manar - on the Zeravshan. Construction is underway of the Orto-Tokoy Reservoir on the Chu River; Sary-Yasin- on the Murgab; Bugun - on the Bugun River with an intake from the Arys River; Tyuya-Buguz - on the Angren River; and Chim-Kurgan- on the Kashka-Darya River. The reservoirs that are now being designed/construction is to be started within 1957-1960/: Tejen /the second one/, Surkhan-Darya - on the Surkhan-Darya River, Chardarin - on the Syr-Darya and others.

All the above reservoirs have earthen dams with a head of some 15-50 m and spillway structures made of concrete and reinforced concrete with the exception of the Urta-Tokoy Reservoir on the Kasansai River where the dam about 90-m-high is built of piled up stones strengthened on the pressure side with reinforced-concrete screen. To take water into irrigation canals a number of water-lifting dams have been also built in Central Asia. We should like to mention just a few of them: the Chirochik Dam - on the Chirochik River, Pervomai, Dam-Khoja and Vabkent - on the Zeravshan; four dams on the Chu-River; Karatal - on the Karatal River; Kayl-Orda- on the Syr-Darya; Kamppr-Ravat and Kuigan-Yar - on the Kara-Darya River; Sary-Kurgan - on the Sokh River; Dyushambe - on the Dushambe River and others. The average head of such dams is 5-10 m; the dams are mostly of dismantable type with flat or sectional curtains /not so often with a concrete spillway or of mixed type/.

Into some of the main canals of Central Asia water is taken not through a dam but through head gates - regulators.

Such gates are installed on big canals with considerable flows: the Vakhsh Canal (150 cu.m/sec), Tash-Sakin (320), Kyz-Ketken (170), Lenin Canal (50), Big Fergana (150), Northern Fergana (100), and many others..

As we have already said, to establish big irrigation projects instead of many small scattered irrigation canals much has been done in Central Asia to increase capacities and lengths of the old canals. Along with this many new main canals have been cut. The comparatively favourable topographic and geologic conditions gave an opportunity to cut canals without much excavation and banking so in view of lack of machinery wide use was made of hand labour. Later on as the water-economy organizations were equipped with machines we could afford to undertake bigger tasks of cutting canals in rocky grounds requiring more excavation and banking.

The biggest canals in Central Asia are: the Big Fergana Canal, Northern and Southern Fergana Canals, Big Gissar Canal, Big and Northern Tashkent Canals, Kirov Canal, Tash-Sakin Canal, Lenin Canal, Kyz-Ketken, Vakhsh, Dargom, Narpai, Akhun-Babaev Canal, Big Chu Canal, Dalverzin and others. The construction of so many big canals were aimed not only to irrigate new areas but also raise the water-level in the irrigation projects short of water at the expense of water-abundant sources. Such "through" canals raising the water-level served in a way as a substitute for reservoirs. For the same purpose an extremely big Kara-Kum Canal is now under construction with a length of 500 km (the first stage) to take water from the Amu-Darya into the water-lacking basin of the Murgab River and then (at the second stage) into the Tejen River-Basin.

In addition to this, construction is underway of the Arys-Turkestan, South and Central Golodnaya-Steppe Canals, the Kirov and Big Fergana Canals are being widened and Leninabad and Beshkent Canals designed, etc.

5. Principal Irrigation Projects Undertaken in Transcaucasia.

In Transcaucasia the main construction site of irrigation projects is the valleys of the Kura and Araks Rivers, the so-called Kara-Araks Lowland.

The newly-built Mingechaur Reservoir on the Kura with a volume of 16,000,000,000 cu.m. serves the main base for irrigation development in this lowland. From this reservoir two canals are being cut: rightbank Upper-Karabakh with a flow of 140 cu. m/sec and left-bank Upper-Shirvan Canal with a flow of 50 cu. m/sec. These canals will feed water to the water-lacking networks and expand the area under irrigation in the Karabakh, Khl and Shirvan Steppes.

Up to 50 cu. m/sec of water will be let into the upper waters of the Bagram-Tapin Dam, now under construction on the Araks River.

From this dam provided with a sediment basin the Main Mugan Canal will receive clarified water, which will irrigate the Northern Part of the Mugan Steppe.

On the mountain rivers of the Kura Basin both on the right and left banks small reservoirs and intake plants are being designed and built to supply with water the existing irrigation projects.

On the Samur River a dam has been built with a two-chamber sediment basin which is purified by an electric-driven sucking dredge. From the Samur Dam the Samur-Divlobin Canal runs to the South, parallel to the Caspian Sea Coast. This canal is feeding the water-lacking irrigation projects, and at the end of it the Jalrau-Datan Reservoir has been constructed. The Samur-Divlobin Canal irrigates the Apsheron Peninsula, the supplier of Baku-City with food.

In Armenia irrigation is chiefly represented by small plots in the mountain valleys with the exception of the Ararat Valley irrigated by the Raxda River. On this river a cascade is under construction of hydro-power plants from the Sevan lake dam to Erivan-City. As part of the project the Arzni-shanlian and Nork Irrigation Canals are being constructed, etc.

In Georgia the main object is to irrigate the Sangori Steppe near Tbilisi, the scheme is undertaken along these lines: the Iori River serves the source of irrigation on which the Sion Reservoir is built to store the summer floods and a water-lifting dam has already been completed a little way downstream. From the latter runs the Upper-Sangori Main Canal on which three power plants are already at work. The Sion Reservoir is used in winter to put out additional electric power, the water being stored in the Tbilisi Reservoir which is taken in summer into the Lower-Sangori Canal for purposes of irrigation. The two canals together are to irrigate up to 40,000 ha under orchards, vineyards, truck and fodder crops to provide Tbilisi with food.

6. Irrigation Schemes in the Russian Federation
and the Ukraine.

In the river-valleys of the North Caucasus primitive irrigation is deeply rooted in the past. But not until the Revolution was this business switched over to the engineering rails. The biggest irrigation schemes were started in the valleys of the Kuban and Terek Rivers where the Tshoik and Shapsug Reservoirs were commissioned. Besides, a Krasnodar Reservoir is being designed for the Kuban with a volume of 2,000,000,000 cu.m. to expand the rice plantations up to 100,000 ha. The Kuban is to be the main rice producer for the whole Soviet Union.

In the North Caucasus boundless are indeed the vast expanses of the Stavropol Border Region, the principal provider of fine-fleeced sheep. To supply water to the arid steppes with a view to creating a stable forage base from the Kuban the Nevinomyssk Canal takes water into the water-lacking Egorlyk River. On this river there is a Novotroitsk Dam from which runs to the North the Right-Egorlyk Canal to be completed this year. Through the canal water is delivered to the end part of the dry bed of the Kalans River to proceed further up to the Manyoches, lakes stretching like a chain from the Black to the Caspian Sea.

Works have already begun on the scheme to divert the Kuban waters to the place where the Kalans starts, which will be, thus far, supplied with water all over its length.

The Egorlyk, Right-Egorlyk Branch and Kalans will serve the water arteries to establish a basis for further irriga-

tica development schemes in various parts of the Stavropol Border Region.

The similar irrigation and water-supply measures to promote the development of animal husbandry on a large scale are now being taken in the Caspian Lowland. The main basis for this development scheme is furnished by the canal from the Terek River to the Kuma River to be put into operation this year. The water-lifting dams are now under construction on both rivers at the head and tail of the canal. From the Kuma Dam a Kuma-Manych Canal will be cut which will extend the Terek-Kuma Canal. At the end of the Kuma-Manych Canal a Chegrai Reservoir will be constructed on the basis of one of the Manych Lakes. From the reservoir it will be possible to deliver water further to the North to meet the canals designed to issue from the Volga. Thus, the vast cattle-ranges now devoid of water located on the borders of the Nogai Steppe, Black Lands and Sarpin Lowland will have water from the artery stretching from the Terek to the North in the direction of the Volga. The territory enclosed between this water artery and the Caspian Sea can be irrigated through letting water into the natural depressions and hollows and also by means of artificial canals.

Supplying water to the Stavropol Steppes and Caspian Lowland will open up vast prospects for further development of fine-fleece sheep reproduction on these now waterless grazing areas.

In the postwar years a good deal has been done to solve the multipurpose problem of the Volga-Den Project; the Volga-

Don Navigation Canal was built; Tsimlyanskaya Reservoir with a volume of 22,000,000,000 cu.m.; Tsimlyanskaya Hydro-Power Plant and irrigation of lands in the Rostov Region, the Russian Federation. At the first stage 100,000 ha was irrigated soon another 60,000 ha will be.

Owing to the unfavourable topographic conditions in the Ukrainian South self-flow irrigation had to be abandoned in preference to machine one so as to use irrigated area under the crops that pay off very well: orchards, vineyards, vegetables, beet, industrial crops and indian corn which in the Ukrainian and Russian South, when irrigated may yield up to 100 centners per ha and more. The lands under irrigation in that region may be also used with good returns to develop a forage base in view of shortages in natural hay meadows and pastures.

In 1955 the Kamenka Pod Irrigation Project was commissioned with an area of 17,000 ha under machine irrigation from the Dnieper River. In 1958 machine irrigation will be available for another 60,000 ha from the Ingulets River. The work on the construction site of the Kakhevska Dam nearing completion, a self-flow Krasnoznamenka Canal is being out to irrigate 30,000 ha of land. At a distance of 64 km from that canal another canal will branch out through which up to 30 cu.m./sec will flow from the Dnieper to the Crimea. Along the North-Crimean Canal it will go up to Kerch and Pheodosia.

In the South of the Crimean Peninsula a Salgir Irrigation scheme is being built on the basis of the already completed Simferopol Reservoir.

On a smaller scale irrigated farming is being extended for the first time further to the North: to the Central-

Chernomozh Region, Trans-Volga Region and Stalingrad, Astrakhan, Chkalov Regions. Irrigation of truck crops and orchards is applied even in the Moscow, Stverdlovsk and Chelyabinsk Regions, the irrigated plots being located near urban communities and factories to be used mainly under vegetables and fodder crops to feed milk cattle. Sometimes, double-purpose reclamation schemes are undertaken: irrigation-drainage; the Irpen Project near Kiev may serve the example of such undertakings.

7. Prospects of Irrigation in the U.S.S.R.

The total area of land in need of either permanent or periodical /only in dry years/ irrigation is estimated in the U.S.S.R. as approximately 40,000,000 ha, i.e. 4 times as much in comparison with the area under irrigation as of today. The Soviet designing and planning organizations are engaged in working out prospective problems of irrigation development.

To illustrate we will mention some of the schemes which have already been elucidated technically and economically.

Among the biggest schemes to be undertaken with a view to promoting cotton-breeding we should like to dwell on the problem of irrigation of unused lands in the valleys of the Amu-Darya and Zeravshan Rivers with a total area of approximately 500,000 ha.

In view of the lack of local water resources in order to irrigate this area it is proposed to cut a canal from the Amu-Darya to the Zeravshan River about 500 km in length and to supply water from the Amu-Darya to the lower part of the Zeravshan-River valley /Bukhara Region, Uzbek S.S.R./ . In that case the unused water may be delivered from the Zeravshan

to the valley of the Kashka-Darya River through a canal about 250 km long. On the Ama-Darya at the head of the so-called Ama-Bukhara Canal a dam will be put up /near Kelif/. From the Kelif Dam or from the second dam to be built a little way down Kelif an intake may be arranged into the Kara-Kum Canal now under construction to solve the problem of irrigation of the unused lands in the lower reaches of the Tejen and at the foothills of the Kopet-Dag with a total area of 500,000 ha. The first part of the irrigation project to be completed in 1958 /90,000 ha in the lower reaches of the Murgab/ will have an intake without a dam into the Kara-Kum Canal with a flow of 130 cu.m/sec.

The third dam is to be constructed at the Tyua-Muyun to develop irrigation at the upper part of the delta plain of the Ama-Darya. With the completion of this dam it will be possible to create a reservoir 10-15 thousand million cu.m. which is to reduce the constant threat of floods both from summer inundations and in the periods of ice-packs in winter. In addition, at the dam there will be a power plant which means a great deal in the electrification of agriculture and especially in the electrification of the numerous pumping stations which have taken the place in these parts of scores of thousands of ancient "ohigirs" (wheels with scoops on them to take water from the river into the network). The water to be taken from the reservoir into the irrigation canals will be clarified which will cut sharply the exploitation costs of the irrigation canals now suffering from silting. Thus, the Tyua-Muyun problem is a vivid example of multipurpose use of water resources by a Socialist national economy.

In the lower delta of the Amu-Darya a Takhya-Tash Dam is planned which will make for a very considerable expansion of the area under irrigation. In this region over 1,000,000 ha of land are not cultivated and may be irrigated. In conformity with the conditions of drowning, this dam is designed with a minimum head so it can be used only for purposes of irrigation. In the course of time it will be possible to deliver water from this dam to the dead bed of the Kunya-Darya opening into the enormously big dried Mary-Kamysh Lake /over 80-100 m deep/. At the inlet into the lake a power plant may be installed provided the inflow of water has been equalized with the volume of water evaporating from the surface of the lake.

The Syr-Darya, second river in size in Central Asia, has already been used for purposes of irrigation to a greater extent than the Amu-Darya. As we know from the above the Farhad and Kayl-Qarda Dams have already been constructed, Kairak-Kum Dam is under construction and Chardarin Dam is being designed to be constructed on the Syr-Darya. The completion of these dams will provide for expansion of the area under irrigation in the Syr-Darya basin by 500-600 thousand ha and still the water-land resources will ^{be} by no means exhausted. It is planned in the lower reaches of the river or rather on its biggest tributary - the Maryn to build a large reservoir, approximately 20,000,000,000 cu.m in volume so as to maintain a multi-seasonal regulation of the flow. This will provide for further increase in irrigated area by 1.5-2.0 million ha.

Another two large reservoirs are designed to be built on the other tributaries of the river: on the Kara-Darya - a

~~Kunyr-Kavat Reservoir~~ and on the ~~Chirchik-Charvak Reservoir~~.
 Either of the reservoirs has a volume of about 1,000,000,000 cu.m

The idea has been also put forward, in addition to Charvak Reservoir to build in the upper reaches of the Chirchik another large reservoir to maintain a multi-seasonal regulation of the flow. The Ili is the third large river in Central Asia opening into the Balkhash Lake. A powerful Kapohigai Hydro-Power Plant and a large reservoir have been designed for this river. Down the Kapohigai Dam a Kulandas Dam is to be constructed also with a reservoir on the Ili River /though of smaller volume/. From this last dam an irrigation and water-supply canal is planned which will go to the lower reaches of the Chu to be extended to the Bek-pak-dala Desert and further along the ancient bed of the Chu to open into the Syr-Darya.

This canal will have a bearing on an area of several millions of ha.

After the flow of Central-Asian rivers is used to the full for irrigation purposes we may undertake realizing the old ideas of turning the Siberian rivers back to the South, in the first place, the Irtysh and Ob. Well, we will dismiss this problem with a cursory mention for the time being as the flows of Central-Asian rivers are enough to expand twice or thrice the area under irrigation.

Large area of land, about 300-400 thousand ha may be put under irrigation now that the Mingochaur Multi-Purpose Project has been completed on the Kura River, Azerbaijan.

With the full use of the Kuban water by building a series of reservoirs the existing area under irrigation may be increased

12-fold, i.e. up to 500-600 thousand ha and another 3-6 million ha may be supplied with water.

On the middle and lower Volga, in the Ukrainian South, in the lower reaches of the Don, in Northern Kazakhstan and in Northern Siberia there are vast areas periodically stricken with droughts.

In these areas hydro-power construction have left behind irrigation developments: as we have already pointed out, on the Don the Tselnyansk Reservoir was built; on the Dniester - the Dnieper and Kakhovka Dams, the Kremenchug Dam nearing completion; on the Volga besides the Ivanovo Uglich and Rybinsk Dams which have nothing to do with irrigation, the Kuibyshev Multi-Purpose Hydro-Project has been already constructed and the Stalingrad one is under construction. Another series of hydro-projects are to be built on the middle and lower Volga.

All these activities pave the way for further irrigation and water-supply development on an area of millions of ha.

This is the picture of irrigation in the Soviet Union. Although in this brief report this picture had to be painted only with rough data, yet it provides an opportunity to obtain some of the typical traits which stand out with particular prominence against the background of the work already performed and still to be performed.

Above all we wish to underline the multi-purpose nature of the hydraulic projects which solve besides irrigation problems those of hydro-power, navigation, flood control, municipal and industrial water-supply, etc.

Sooner or later we cannot but note the steady progress both in quantity and quality of Soviet irrigation which has passed

over from the primitive ancient forms of irrigation to the up-to-date level which is notable for a water-economy set-up organized and managed along the planned Socialist lines; this set-up serves the purpose of encouraging the irrigated farming in the arid zone of the U.S.S.R.

Thirdly, we should like to draw your attention to the multifermance of objects ahead of irrigation construction, according to various natural zones it aims at different targets: cotton-brooding, rice-brooding, fruit and wine-growing, growing of vegetables, industrial and fodder crops.

In the fourth place, it is worth while mentioning that along with a regular irrigation in some regions of the Soviet Union the problem is being solved of water-supply of cattle-ranges, estuarine irrigation which has a great impact on the development of animal husbandry.

And finally, in the fifth place, we note with satisfaction that Soviet hydraulic engineers having begun with rather simple things have always perfected their knowledge and skill with the growth of Soviet industry solving more and more complex technical problems. Thus, for example the water-intake into open canals was replaced for intake without dams through the bank gates-regulators; then a period began of large-scale construction of water-intake dams under low heads; simultaneously with this, also on a large scale construction was started of storage dams - mostly earthen under a head of 10-15 m.

Soviet irrigation is on the threshold of building on massed higher concrete and ferro-concrete dams aimed to turn fully to account of our national economy the flow of the rivers.

Now, in conclusion, we want to call your attention to the fact that as a result of the general development of Soviet heavy industries did it become possible to provide our water economy with building machines, pumping equipment, power for machine irrigation, the first-rate transport facilities, etc.

All this provides grounds for a statement that the serious and complex problems Soviet irrigators are faced with will be overcome with flying colours.