PROJECTS & FACILITIES

PROJECTS & FACILITIES

Colorado River Front Work and Levee System

State: Arizona and California and Nevada
Region: Lower Colorado

Related Documents

Related Facilities

Related Links
Yuma Area Office
Hoover Dam
Hoover Dam Website

General	History	Construction	Plan
General	History	Construction	Plan

GENERAL

The Colorado River Front Work and Levee System extends from Lees Ferry, Arizona, the division point between the Upper and Lower Colorado River Basins, to the Southerly International Boundary between the United States and Mexico, a distance of about 700 river miles. Its purpose is to control floods, improve navigation, and regulate the flows of the Colorado River. The work consists of constructing, operating, and maintaining the Colorado River Front Work and Levee System in Arizona, California, and Nevada; it includes controlling the river, improving, modifying, straightening, and rectifying the river channel, and conducting investigations. The lower Colorado River extends about 280 river miles from Davis Dam to the boundary, and traverses three wildlife refuges, five Indian Reservations, and six irrigation districts. For administrative purposes, this reach of the river has been divided into 10 operational divisions. These divisions, starting at Davis Dam and proceeding in order downstream, are: Mohave Valley, Topock Gorge, Havasu, Parker, Palo Verde, Cibola, Imperial, Laguna, Yuma, and Limitrophe. Major project facilities include the off stream Senator Wash Dam and Reservoir, a pumping plant, access roads, water crossing facilities, and flood control levees. Regulation of river channel meandering by use of bankline structures with riprap protection, or a riprap-protected dredge channel, has been provided for the Mohave Valley, Upper Parker, Palo Verde, Cibola, and Yuma Divisions. Settling basins for trapping sediment have been built upstream from Topock Bridge and Laguna Dam. Salinity control features include the Main Outlet Drain (MOD) and the Main Outlet Drain Extension (MODE). These features convey the drainage flows from the Wellton-Mohawk Main Conveyance Channel (Drain) to the Bypass Drain below Morelos Dam. The Gila River Pilot Channel was constructed to convey return flows from the irrigated lands in the Lower Gila River Valley to the Colorado River. Water salvage activities along the Lower Colorado River include controlling the size of open water areas, selective clearing of phreatophytes, draining the river valley, and establishing deeper backwater areas. Major ground-water recovery programs have been undertaken by development of well fields and conveyance systems in the South Gila and Yuma Valleys, and on the Yuma Mesa. Fish and wildlife features have been enhanced and wildlife losses have been mitigated by the development of Topock Marsh, Deer Island and other backwater improvements, Cibola Lake, and Mittry Lake. Park Moabi, McIntyre Park, Welters Camp, Laguna South recreation area, and several marinas have been developed for recreation purposes.

PLAN

This multiple-purpose program includes control of sediment movement, protection of communities and transportation facilities, maintenance of agricultural land by controlling the bed and banks of the river, and preservation and enhancement of the fish, wildlife, and recreation resources of the area. Channel alinement rectification, control structures, levees, revetment, and flood control levees are used to confine the river to the designed channel during variations of discharge. The Mohave Valley Division is located on the reach of the Colorado River from Davis Dam to Topock, Arizona. The area through which the river flows is an alluvial valley from 2 to 5 miles wide. It traverses the Fort Mohave Indian Reservation and that portion of the Havasu National Wildlife Refuge that lies upstream from Topock. Prior to the channelization program, there was a wide meandering of the river accompanied by general aggradation of the valley floor. The definable channel in the lower part of the valley was almost lost and the river flowed through a series of swamps and sloughs. Stabilization was initiated in 1949 by dredging to improve a channel between Needles and Topock. This work was completed January 5, 1953, and, along with associated levee construction, minimized the immediate flooding threat to Needles, California. In January 1953, channel dredging, levee construction, and associated work were initiated on the reach of the river from Needles upstream to the Big Bend, 10 miles below Davis Dam. Riverflows in the Mohave Division average 15,000 cubic feet per second in the summer and 7,000 cubic feet per second in the winter. The average depth of the channel during dredging was about 18 feet below the water surface at a flow of 15,000 cubic feet per second. Maximum depth dredged was about 25 feet. The average design width is about 450 feet. The total dredge excavation in the Mohave Valley Division was 52,531,728 cubic yards. The total borrow for riverbanks, structures, and levees was 26,602,055 cubic yards. The design floods for levee construction in this reach of the river are: 50,000 cubic feet per second downstream of Davis Dam to Piute Wash, and 70,000 cubic feet per second downstream of Piute Wash. Topock Marsh is located on the Arizona side of the Colorado River midway between Davis Dam and Parker Dam. The northern portion of the marsh lies opposite Needles, while the southern extremity connects with the Colorado River at Topock. The marsh is almost entirely in the Havasu National Wildlife Refuge, which was established in 1941. Topock Marsh was created by backwaters resulting from the construction of Parker Dam. Features constructed by the Bureau of Reclamation in Topock Marsh consist of inlet and outlet structures, a canal, and dikes. These structures make possible the maintenance of optimum water surface elevations in the marsh and permit diversion of water to the marsh from the Colorado River. The Topock Marsh Dike was constructed with a crown elevation of 460.0 feet. It impounds a water surface area of 4,000 acres. The materials to construct the dike were excavated by dredge from the bottom of the marsh. The highest portion of the fill rises 14 feet above the bottom of the marsh. A section of the fill northwest of the outlet structure was constructed to elevation 459.0. The purpose of this special section is to localize and control damage which would result from floods on the local drainage area or on the river itself. The Topock Gorge Division starts at Topock, Arizona, and extends downstream to Lake Havasu, a distance of about 12 miles. After the closure of Parker Dam in 1938, the rise in water surface elevation (adjusted to a standard flow of 15,000 cubic feet per second) was accelerated and increased from 443 feet to nearly 452 feet by 1948. During correction of the high water conditions which existed at Needles prior to 1951, it was recognized that sediment deposits in the Topock Gorge were an important factor leading to the high water levels that existed from Topock north beyond Needles. The Havasu Division covers all of Lake Havasu and the river between Parker and Headgate Rock Dams. A navigational hazard of submerged trees existed in Lake Havasu because the reservoir area was not cleared prior to closure of Parker Dam in 1938. In recent years, developments along the Colorado River have attracted thousands of visitors to Lake Havasu, with boating and water skiing replacing fishing as the dominant recreational activity. A number of accidental deaths have occurred on the lake. In several instances, the snags were a factor in the accident. Snag removal operation, begun in 1965 with underwater cutting, clearing, and disposition of tree snags from boating areas on Lake Havasu, was accomplished under three separate contracts. The final contract was completed in 1971. The design flood downstream of Parker Dam for this division is 50,000 cubic feet per second. The Parker Division begins at Headgate Rock Dam and extends downriver about 33 miles to the Palo Verde Diversion Dam. The channel throughout this reach has been subjected to scouring action by clear water releases from Parker Dam. Headgate Rock Dam, constructed for the Bureau of Indian Affairs by the Bureau of Reclamation in 1942, stabilized the channel below the dam. The area is protected from floods by the levee system built in conjunction with the construction of the Palo Verde Diversion Dam. The plan of development divided Parker Division into two sections. Section I lies within the Colorado River Indian Reservation and extends about 16 miles downstream from Headgate Rock Dam to Alligator Bend. Section II embraces the river from Alligator Bend to Palo Verde Diversion Dam, a distance of 28.3 miles. The Arizona side and the northern part of this section that is in California lie within the Colorado River Indian Reservation. Stabilization of the river in section I was accomplished by confining reaches of the river between training structures or stabilized bank lines. The basic channel improvement work was completed in 1967. In 1969, a comprehensive plan for channel stabilization in section II was approved by the Department of the Interior. However, the work was deferred pending the location of the western boundary of the Colorado River Indian Reservation. In 1971, a task force appointed to review the River Management Program recommended that additional plans for the Parker Division below Alligator Bend be considered to reduce the environmental impact of the work. Several alternative plans involving a reduced program were evaluated but none have been adopted . In the early 1990's a plan was developed again and implemented. It included bankline armoring as well as the placement of training structures and jetties. In addition to the river work a backwater was created at Aha Quinn with two new channels created by dredging and a third channel in an existing drain was cleaned out. The completion of this work contributed significantly to the reduction of sediment originating from the Parker II Division. The design flood for this area is 50,000 cubic feet per second . The Palo Verde Division includes about 28 miles of river channel between Palo Verde Diversion Dam and Taylor`s Ferry. Channelization by land-based equipment began in May 1962 and, except for routine maintenance and repair of constructed features, the channel stabilization was completed in September 1968. The work consisted primarily of earthfill training structures and bank protective riprap designed to prevent future meandering of the river. Many of the backwater areas created by the training structures were improved to benefit fish and wildlife. The Bureau of Reclamation also participated in the development of the Blythe Marina and McIntyre Park. Both are administered by Riverside County, California. Dredging of the Blythe Marina began in June 1966 and was completed in February 1966. A 10-inch dredge was moved to McIntyre Park in July 1972 where it was used to deepen the backwater for recreation purposes. This work was completed in December 1972. In addition to providing channel stability and 10,000 acre-feet of annual water salvage, the completed river stabilization work resulted in a reduction of the sediment load originating in the Palo Verde Division, thereby reducing the amount of material carried downstream. The design flood for this section of the river is 75,000 cubic feet per second. The Cibola Division adjoins the Palo Verde Division at Taylor`s Ferry and extends downstream about 24 miles to the Adobe Ruin gage at the lower end of Cibola Valley, Prior to any Reclamation activities in the area, the channel through this division was characterized by a transition from degradation at the upper end to aggradation at the lower end, resulting from the adjustments that had taken place since construction of the storage dams upstream. The river had acquired a sizable sediment load in passing through the Parker and Palo Verde Divisions and the erosive force of the flow was reduced greatly by the time it arrived at the upstream end of this division. Immediately following the closure of Parker Dam, a balance point formed near the mouth of the

Palo Verde Drain, with degradation above and aggradation below. The aggradation conditions caused a rise in the water surface in the Palo Verde Drain, thus raising the groundwater table through the lower third of the Palo Verde Valley. The Bureau of Reclamation provided some relief to this situation in 1947 by moving the confluence of the river and the drain downstream about 2 miles. This was accomplished by constructing a pilot cut across a bend in the river and letting the drain use the old channel down to the new channel. This cutoff was successful in dropping the water surface at the drain gage by about 1.5 feet. However, the pilot cut could not lower the water surface elevations in the drain enough to completely solve the problem. Through much of the Cibola Division, the natural channel was shallow due to sediment deposition. A program to correct channel deficiencies by dredging and constructing levees was initiated in 1964 and completed in 1970. The dredged channel begins 2.2 miles downstream from Taylor`s Ferry and ends at the lower end of Cibola Lake near Adobe Ruins. Major features constructed to preserve fish and wildlife in the area include the backwater improvement of the Palo Verde Oxbow Lake south of Palo Verde. Another area improved for fish and wildlife is Cibola Lake, in the Cibola National Wildlife Refuge that was established in August 1964. The work in the Cibola Division provides an estimated 36,000 acre-feet of water salvage yearly, and has substantially reduced the sediment passing into the Imperial Division. The design flood for this division is 80,000 cubic feet per second. The Imperial Division extends from the Adobe Ruin gaging station at the lower end of Cibola Valley to Imperial Dam, The channel length, including Imperial Reservoir, is about 36 miles. This division consists of the diversion pool and associated backwater areas above Imperial Dam. It is the recipient of the sediment generated in the Parker, Palo Verde, and Cibola Divisions. The sediment load arriving in Imperial Division is deposited in areas outside the main channel. About 50 percent is deposited on sandbars or in backwater lakes. The remainder is diverted at Imperial Dam. Most of the diverted sediment is removed from the water by the desilting works in the All-American Canal, returned to the river below Imperial Dam, and dredged to permanent dry land storage areas near the Laguna Settling Basin just above Laguna Dam. Since closure of Imperial Dam, sedimentation has filled a number of the backwater areas, particularly in the upper end of the division. Others have been isolated from the river by natural, river-formed dikes. This condition is causing serious deterioration of the water quality and fish and wildlife values in these isolated backwater areas. Generally, the remaining deeper backwater areas are located in the lower one-third of the division where the water was initially deeper and sediment deposition is less advanced. However, a short reach of the diversion pool immediately upstream from the dam is full of sediment and it occasionally has been difficult to divert water into the headworks of the Gila Gravity Main Canal. Some maintenance dredging has been accomplished immediately upstream from Imperial Dam to improve these diversions temporarily. The design flood for this reach of the river is 80,000 cubic feet per second. Senator Wash Dam, Reservoir, and Pumping Plant -- Imperial Division Senator Wash Dam and Reservoir, an offstream pumping facility, is located about 18 miles northeast of Yuma, Arizona, on the California side of the Colorado River 2 miles upstream from Imperial Dam and at the river-end of Senator Wash. The purpose of this strategic off stream retention reservoir is to improve water scheduling of the Colorado River, with resulting salvage. This is accomplished by storing part of the riverflow upstream of Imperial Dam when it is not needed and releasing it to the river for downstream use when needed since 3 days are required for water released at Parker Dam to reach Imperial Dam. The principal features are an earth dam, three dikes, a spillway, an outlet works, a pumping plant, a switchyard, and access and service roads. A 69-kilovolt transmission line, about 18 miles long, constructed separately by the Parker-Davis Project, is now operated and maintained by the Western Area Power Administration of the Department of Energy. Senator Wash Dam is a three-zone rolled earth embankment structure 2,342 feet long, with a maximum structural height of 93.6 feet. Squaw Lake Dike is a three-zone rolled earth embankment structure 3,795 feet long, with a maximum structural height of 95.3 feet. North Dike is a two-zone rolled earth embankment structure 613 feet long, with a maximum structural height of 67.2 feet. A small single-zone rolled earth embankment structure was constructed in a small saddle on the right abutment of Senator Wash Dam and is included in the dimensions for the dam. A 3-foot layer of riprap was placed on the upstream slope of all the earth embankments. A 24-inch-thick impervious blanket, extending from the upstream toe of the dam, was constructed on the floor and slopes of the reservoir to elevation 210.0, the top of inactive storage. An equalization channel uses the storage capacity of a small isolated basin behind North Dike. The outlet works consist of an intake structure, a 10-foot-inside-diameter concrete conduit, a 6.5- by 10-foot-high pressure gate in a gate chamber, a 10-foot-inside-diameter steel pipe installed inside a 15-foot-inside-diameter concrete conduit, an access house, a concrete-encased steel manifold, and six 54-inch steel branchlines leading to the pump turbines. The Senator Wash Pumping Plant is of the indoor type with a reinforced concrete substructure and steel framed superstructure. Six (including one spare) vertical-shaft, single-suction, centrifugal, Francis-type pump-turbines with fixed-vane diffuser-type casings are installed in the plant. Each pump-turbine is directly connected to a vertical shaft, 360-revolution-per-minute, synchronous motor-generator designed to operate either as a motor or as a generator. A 20-ton, fiber-operated overhead traveling crane is provided for installing and maintaining the unit. Although originally conceived as a pumping-generating plant, it was designated as a pumping plant in 1977. When operating as a pumping plant, each 1,750-horsepower pump is designed to operate from 31 feet of head to shut-off head and will deliver not less than 100 cubic feet per second at a total head of 74 feet while operating at 360 revolutions per minute. Under normal operations, each unit pumps about 200 cubic feet per second. Normal starting and stopping of the unit is controlled from the remote control panel at Imperial Dam, which includes all the electrical control equipment (switching, alarm, and indicating) required for remote operation of the pumping plant. A 17.7-mile, 69-kV transmission line between Gila Substation and Senator Wash Substation brings power for pumping to Senator Wash, about 10,000 kVA when all six pumps and all station loads are in operation. The Laguna Division was designated to facilitate the construction and operation of the Laguna Settling Basin and the appurtenant channels leading to and from the basin. It includes the 4.7-mile reach of river between Imperial and Laguna Dams. The settling basin operation in the Laguna Division was originally adopted as a result of a general complaint lodged by Mexico that the United States was reintroducing sediment into the river in amounts that represented higher concentrations than were present in the river as it entered the Imperial Dam Reservoir area. At the same time, it was apparent that water was not available for sluicing operations of the size and type conducted in the past. Mechanical removal of the sediment by dredging rectified this situation. Dredging of Laguna Settling Basin began in 1963 and was completed in 1965. About 1.2 million cubic yards of material were excavated. The settling basin operation has been satisfactory and its two primary objectives, removing the sediment and not wasting deliveries of water to Mexico during sluicing flows, have been achieved. Dredging operation in the settling basin will be required on a continuing basis and new areas eventually will be needed to store sediment taken from the basin. Operation of the dredge in Mittry Lake for the development of a fish and wildlife management area in the Laguna Division was hindered by extremely heavy tule (bulrush) growth in the area. Herbicide sprays and burning were used in an effort to prevent the accumulation of extensive floating mats of the growth; however, mechanical removal was required. Dredging of the Gila Sluiceway began in 1970 and was completed in 1973. The purpose of this sluiceway is to carry sediment flushed from the Gila Main Canal Desilting Basin to the Laguna Settling Basin. The Yuma Division of the Colorado River Front Work and Levee System includes 21 miles of river channel between Laguna and Morelos Darns. The city of Yuma is on the south bank of the river, approximately in the center of the division. The channel in the Yuma Division reflects changes resulting from construction of storage dams and diversion of water for irrigation purposes upstream. It consists of a small active channel situated within a larger, older riverbed which is entrenched below the historic level of the unregulated river. The flow into the upper end of the Yuma Division is regulated primarily by Laguna Dam. It normally consists of water used to flush sediment from the desilting works into the Laguna Settling Basin and from sluice-gate leakage and intermittent sluicing flows below Imperial Dam. Laguna Dam is used to reregulate the flows originating at Imperial Dam. About 9 miles downstream from Laguna Dam, the Gila River enters the Colorado River from the east. The flow from the Gila River is the result of returns from canal wasteways, drainage from irrigation areas, and occasional floodflows, Since 1977, flows from the Wellton-Mohawk drainage wells, which were frequently discharged into the Colorado River downstream of Morelos Dam, are now carried to the Santa Clara Slough in Mexico by the bypass drain. The California Wasteway of the Yuma Main Canal is about 4 miles downstream from the mouth of the Gila River, across the river from Yuma. This wasteway returns to the river the water which is used to fulfill the United States Water Treaty obligation to Mexico. Under normal operating procedures, the return through this wasteway varies from about 20 cubic feet per second gate leakage to about 1,000 cubic feet per second. If flows greater than 1,000 cubic feet per second are required for release into the river, the water is transferred for discharge at the Imperial Irrigation District`s Pilot Knob Powerplant. Rockwood Heading, an old intake structure on the Alamo Canal, is about 2 miles upstream from Morelos Dam. It is no longer used for an intake structure but is used as a point of return for the Pilot Knob Powerplant and Wasteway from the All-American Canal. The powerplant is operated on a minimum flow of 1,000 cubic feet per second; the maximum capacity is 8,000 cubic feet per second. The return to the river at Rockwood Heading may vary between these minimum and maximum values. About 5 months of the year, there is no release made at this point because the 1,000-cubic-foot-per-second minimum flow required by the Mexican Treaty is in excess of Mexico`s water order. Prior to the completion of the Laguna Settling Basin in 1965, a comparatively heavy load of sediment was carried by the river into the upper end of the Yuma Division. The load was caused by the operation of the All-American Canal Desilting Works and periodic sluicing of Imperial Reservoir. The Laguna Settling Basin now intercepts the sediment below Imperial Dam and the trapped sediment is dredged out of the basin and pumped onto adjacent land. As a result, the water entering the Yuma Division is relatively sediment-free, The early history of the Yuma Division shows that lateral movement of the river occurred infrequently. A major channel change occurred in 1920 and created what is commonly known as Yuma Island. Located about 3 miles northeast of Yuma, the island is a flood plain partially encircled by the pre-1920 river channel. This channel is filled with sediment except for the two small depressions which constitute Haughtelin and Bard Lakes. The completion of Imperial Dam had an immediate effect upon the river in the Yuma Division. The reservoir behind the dam was comparatively small; however, it retained much of the sediment picked up downstream from Parker Dam and relatively clear water flowed through Laguna Dam into the upper reach of the Yuma Division. This caused severe scouring action and degradation downstream from Laguna Dam. The degradation was most severe immediately following the closure of Imperial Dam but diminished as the reservoir silted up and the sediment concentration in the water passing Imperial Dam increased. By 1945, the sediment concentration in the flow diverted at Imperial Dam for irrigation purposes had increased to an objectionable level, and the desilting works for the All-American Canal were placed in operation. The sediment returning to the river from the desilting works increased the sediment concentration in the water below Imperial Dam to such proportions that degradation ceased, except for occasional scour. By 1947, the channel below Laguna Dam had degraded from 3 to 6 feet down to Yuma, and 5 to 8 feet downstream from Yuma. From 1947 to 1953, the channel remained relatively stable; with the generally lower flows since 1953, the channel has been slowly aggrading. Sediment samples have been taken by the International Boundary and Water Commission at the Northerly International Boundary since 1956. Since the completion of the Laguna Settling Basin in 1965, the average sediment load arriving at this station has been 143,000 tons annually for normal flows. Protection from flooding in the low-lying valley lands has been provided throughout most of this division by an arrangement of levees which were constructed during the early activities of the Colorado River Front Work and Levee System and rehabilitated in 1951 and 1952 under international agreement subsequent to the Mexican Water Treaty of 1944. During the rehabilitation of the Yuma levee system, the Upper Reservation Levee was relocated parallel to the river channel as it existed. This change reestablished the levee closer to the active channel of the river and left a fairly large area of land between the 1905 alinement of the levee and the relocated levee. Studies conducted in 1948 by the International Boundary and Water Commission, the Corps of Engineers, and the Bureau of Reclamation established a design flood for use in the lower river. The flows accepted were 103,500 cubic feet per second from Imperial Dam to the mouth of the Gila River and 140,000 cubic feet per second below the mouth of the Gila River. Additional studies were made by the International Boundary and Water Commission concerning the effect of Morelos Dam on upstream water stages as related to levee design in the Yuma Division. The existing levee system in the Yuma Division was designed using the data from these studies. The effectiveness of the present levee system is influenced by sediment disposal below Morelos Dam. The dredged spoil excavated from the Alamo Canal and deposited in the flood plain below Morelos Dam has constricted the channel to the extent that it, rather than the dam, has often controlled upstream water stages. Normal channel flows have been affected only temporarily, as there have been either occasional periods when normal flow below Morelos Dam was adequate to reopen the channel or the channel was reopened by a special flushing flow. However, these flows have removed sediment principally from the active channel and, except for the use of bulldozers to move sediment deposits into the river during the special flushing in 1960, they have not removed an appreciable amount of spoil from overbank areas. As a result, the spoil has continued to accumulate in the overbank areas between the flood levees. Flood protection is provided for the division by the Reservation and Yuma Valley Levees. The Reservation Levee protects the lands to the west of the river from Laguna to the high lands below Yuma. The Yuma Valley south of Yuma is protected by a levee on the south and east side of the river from Prison Hill to the Southerly International Boundary. The South Gila Levee provides protection to the lands to the south of the river from the mouth of the Gila River to Prison Hill, and an extension east along the south side of the Gila to the siphon of the Gila Gravity Main Canal, where it joins the Gila Levee System of the Corps of Engineers, gives full flood protection to lands in the South Gila Valley. The design floods used to establish the required levee heights are for a discharge of 103,500 cubic feet per second from Imperial Dam to the mouth of the Gila River and 140,000 cubic feet per second downstream of the mouth of the Gila River, The need for an improvement of the drainage of both Indian and non-Indian lands in the Reservation Division has long been recognized. Representatives of both the Quechan Tribal Council and the Bureau of Indian Affairs have indicated that such improvement work would be practicable as the result of the channel improvements currently proposed. The water table in much of the Bard and Reservation areas is too high for maximum productivity and efficient utilization of the agricultural lands. There are many washes in the area which contribute large quantities of runoff after rains during certain periods of the year. The primary outlet for the subsurface drainage water and storm runoff water from lands in the Bard and Reservation areas is the Reservation Main Drain. This drain crosses under the Southern Pacific Railroad, the old highway, and the Yuma Main Canal through culvert structures which control the drain outlet flows. The outlet flows have been limited by the invert grades and size of the culverts. Consequently, under normal conditions the Main Drain has operated marginally. Significant storm runoff water from the washes in the area has formed a large lake above the outlet culverts, and some local flood damage has occurred. The backwater effect has further aggravated the drainage problems in the upper portions of the area served by the Main Drain. In 1962, the Congress appropriated funds for initial investigation of a plan for ground-water recovery and drainage relief in the Yuma Valley that would also assist, to a small degree, in regulating flows in the Colorado River. The ground-water recovery plan was enlarged in scope to include the entire Yuma area groundwater basin and to increase the river regulation aspects. A study was completed and a plan developed in July 1964. Construction of the first phase, Valley Division, Conduit No. 1, was initiated in 1965. Mexico objected to the ground-water program in Yuma Valley on the grounds that it would increase the salinity of waters delivered to Mexico and replace Colorado River water entitlement to Mexico with pumped ground water. As a result of a conference with Mexico on October 12, 1965, the Bureau of Reclamation revised its groundwater recovery plan in Yuma Valley. The wells were relocated along the east side of the valley near the toe of the Yuma Mesa, thereby minimizing interference by ground-water pumping with the underflow to Mexico. The plan, as revised, provided for the conveyance of part of the water north to the Colorado River, and the remainder by Yuma Valley drains to Mexico at the Southerly International Boundary. Under all conditions, the plan provided for drainage improvement and substantial ground-water recovery and river regulation benefits. To conduct the recovery program with minimum impact upon Mexico, alternative well locations were studied to determine the feasibility of relocating the well field on the Yuma Mesa near its western edge. Because additional drainage in Yuma Valley was badly needed, six drainage wells were constructed by the Bureau of Reclamation in addition to the seven wells developed by the Yuma County Water Users` Association along the eastern toe of the Mesa. The discharge from these wells is conveyed through a conduit system to the Yuma Valley Division of the

Yuma Project drainage system at the Southerly International Boundary as part of Mexico`s entitlement to Colorado River water. Another segment of the Yuma area ground-water and river regulating program is the Drain Pump Outlet Channel (DPOC) drainage system in the South Gila Valley. It consists of 24 drainage wells. The production of the wells ranges from 3 to 9 cubic feet per second. The eastern three conveyance conduits, DPOC Nos. 1, 2, and 3, discharge into the Gila River Pilot Channel, constructed by the Colorado River Front Work and Levee System in 1961. The western conduit, DPOC No. 4, discharges the pumped drainage water into the Colorado River. The purpose of the DPOC drainage well field is to provide adequate drainage for the agricultural lands of the South Gila Valley and return it to the Colorado River to become a part of Treaty water delivered to Mexico above Morelos Dam. The drainage requirement has been 55,000 to 65,000 acre-feet per year. The Yuma Mesa Well Field is located along the western edge of Yuma Mesa. It is a segment of the overall ground-water recovery and river regulation program for the Yuma area. The ground water recovered from the Yuma Mesa Well Field is collected in a conduit system and conveyed to a point in the Colorado River near Yuma. Integrated into the Yuma Mesa Well Field system are six wells which were installed in Yuma Valley in 1965. Currently there a total of seven wells with the last one being installed in 1997. These wells are located along the western toe of Yuma Mesa and their discharge is conveyed through concrete pressure pipelines to the Valley Division drainage system. The principal functions of the ground-water recovery program are to recover from the ground-water basin return flows from irrigation developments in the United States to assist in meeting requirements for delivery of water to Mexico, to provide some drainage relief for the Valley Division of the Yuma Project, and to assist in Colorado River operations by reducing over deliveries to Mexico. The Yuma Mesa Well Field consists of 12 wells, spaced about 0.5 to 1 mile apart, which have a total capacity of about 100 cubic feet per second. Each well is gravel packed and contains a 16-inch stainless steel screen. The depth of the wells ranges from 189 to 286 feet. The conduit consists of 14.7 miles of reinforced concrete pressure pipe, the diameter of which ranges from 18 inches for the collector conduits to 66 inches for the main conduit. The average velocity in the conduit is about 4 feet per second. A baffled outlet structure was installed at the Colorado River end of the conduit. Transmission facilities consist of one substation, 2 miles of 34.5-kV line, and 12.3 miles of 12.47-kV line. The Yuma Mesa Well Field is operated by remote control from Imperial Dam by the use of radio signals to actuate the individual pumping units and monitor the operation through electronic interrogation. The well field is operated on a 24-hour basis throughout the year. It is capable of pumping about 40,000 acre-feet of ground water annually and, in addition, about 9,000 acre-feet of water are pumped annually from the six Bureau of Reclamation drainage wells developed in Yuma Valley. The Colorado River at and downstream of Morelos Dam forms the boundary between the United States and Mexico. Proceeding downstream for a distance of 20 miles, the left bank of the river is in the United States and the right bank is in Mexico. The river has levees on both sides; the levee on the Mexican side is about 4 feet higher than the levee on the United States side. The river conditions prevailing from Morelos Dam to the Southerly International Boundary are not typical of ordinary river conditions in that no degradation exists downstream from the dam. In fact, the gated portion of the structure does not always form the water surface control that would normally be the case. A downstream plug of sediment introduced in the channel below the dam sometimes controls the water surface elevation through the gated structure. This sediment plug is a result of the operation of the Mexican dredge in the settlement basin at the head of the Alamo Canal and the method of disposal of sediment employed by Mexico at Morelos Dam. The Alamo Canal desilting basin is an overwidth and overdepth section of the canal that runs generally parallel to the river. For several years following the completion of Morelos Dam, the method used to dispose of the sediment was simply to pump it out of the desilting basin onto the ground between the basin and the river. Over a period of years, the disposal ground was built up by the deposition of dredge spoil until finally the sediment could be pumped no higher and some other means of disposal had to be found. At this point, Mexico began pumping the sediment into the river and along the bank between the Mexican levee and the river. On occasion, the sediment deposit has deflected the current of the river against and has severely eroded the United States bank. After these periods of bank erosion, Mexico has brought its disposal line across the river on pontoons to deposit spoil on the United States side and thus return the river to the center of the channel. This type of operation has held the river away from the United States levee, but has built up the bed of the river with a sediment plug consisting of several million cubic yards of material. The remainder of the river channel from Morelos Dam to the Southerly International Boundary is choked by sediment carried downstream from the sediment plug and is in generally poor condition. Because Mexico customarily diverts as much of the flow of the Colorado River as is feasible to put into the Alamo Canal, the flow below Morelos is greatly depleted and the channel has become overgrown with vegetation. In effect, this has seriously reduced the flood capacity of the channel and presents a direct threat to the safety of the Valley Division of the Yuma Project. The river in the Limitrophe Division is no longer important as a channel for irrigation water. The inadequacies that have developed in its capacity to convey floodflows are being corrected by work presently underway. Because this division of the river is an International Boundary, all work activity, planning, or construction is coordinated with the International Boundary and Water Commission. The Colorado River Front Work and Levee System is maintained and operated by the Bureau of Reclamation.

Contact

CONTACT

Title: Area Office Manager
Organization: Yuma Area Office
Address: 7301 Calle Agua Salada
City: Yuma, AZ 85364
Phone: 928 343-8100

OWNER

Title: Public Affairs Officer
Organization: Commissioner`s Office
Address: 1849 C Street NW
City: Washington, DC 20240
Fax: 202-513-0575
Phone: 202-513-0305

CONTACT

Title: Public Affairs Officer
Organization: Lower Colorado Regional Office
Address: PO Box 61470
City: Boulder City, NV 89006-1470
Fax: 702-293-8333
Phone: 702-293-8000