

= Merced River =

The Merced River ( pronounced m??s?d ) , in the central part of the U.S. state of California , is a 145 @-@ mile ( 233 km ) -long tributary of the San Joaquin River flowing from the Sierra Nevada into the San Joaquin Valley . It is most well known for its swift and steep course through the southern part of Yosemite National Park , and the world @-@ famous Yosemite Valley . The river 's character changes dramatically once it reaches the foothills and the lowlands , becoming a slow @-@ moving waterway meandering through irrigated fields .

When tectonic activity first led to the uplift of the Sierra , the river formed as a steep stream eroding into the range 's western flank , carrying sediments that would later help form the floor of the Central Valley . A rich riparian zone around the Merced once supported millions of migratory birds along the Pacific Flyway , and the river had one of the southernmost runs of salmon in North America . Indigenous people , including the Miwok and Paiute tribes , lived along the river for thousands of years , thriving on the bountiful flora and fauna supported by the river and its diverse lower course , aided by fertile soils eroded from the mountains .

Military expeditions during the Mexican Era history of California passed through the Merced River region in the early 19th century . The California Gold Rush brought many people into California and some settled leading to the establishment of a railroad along the river , bringing minerals and lumber to towns that had been established on the lower Merced , and later provided tourism to the now @-@ national park area . Conflicts between whites and indigenous peoples prompted wars , resulting in the expulsion of the Ahwahnechee from Yosemite Valley . In the 20th century , the river saw further development that would change its state forever .

Large @-@ scale irrigated agriculture was introduced to the Central Valley in the late 19th century , and led to the construction of numerous state , federal and privately owned dams . Water demand has often been higher than the river 's environment can sustain . Salmon have been blocked from migrating and riverside habitat has declined dramatically . Recent years have seen habitat conservation work , mimicking of historic streamflow patterns , and the establishment of a salmon hatchery , in the hopes that the river 's health can be protected from further damage .

= = Course = =

The headwaters of the Merced River are at 8 @,@ 017 feet ( 2 @,@ 444 m ) at the foot of the Clark Range , a subrange of the Sierra Nevada , rising at the confluence of the Triple Peak Fork and Merced Peak Fork after they cascade down glacially polished slopes from the high country in the southeastern corner of Yosemite National Park. the Merced River flows for 145 miles ( 233 km ) westward through a series of canyons , gorges and finally the flat plains of the Central Valley . From its headwaters , the river flows north for a short distance and collects the Lyell Peak Fork . The course of the Merced then turns to the north west and flows through a steep walled canyon for 2 @.@ 5 miles ( 4 @.@ 0 km ) where the river receives the Red Peak Fork and then collects into Washburn Lake at 7 @,@ 612 feet ( 2 @,@ 320 m ) elevation . The Merced continues to the northwest for 3 miles ( 4 @.@ 8 km ) where collects into Merced Lake . Leaving Merced Lake , the river continues to the west northwest for 2 @.@ 3 miles ( 3 @.@ 7 km ) where the canyons open up into Echo Valley . The river then turns generally westward for another 3 miles ( 4 @.@ 8 km ) , where it snakes through a spectacular narrow gorge between massive , glacially resistant granite cliffs . The gorge opens up after Bunnell Point and Sugarloaf Dome confine the river to form Bunnell Cascade , before turning southward through the Lost Valley of the Merced , and then spills over an unnamed granite cascade into Little Yosemite Valley , a glacial valley that sits 2 @,@ 000 feet ( 610 m ) feet above the more famous Yosemite Valley at approximately 2 / 3 scale . The Merced River then drops over Nevada Falls and Vernal Falls , receives Illilouette Creek , and passes into the main Yosemite Valley , where it meanders between pine forests that fill the valley floor .

Tenaya , Yosemite , Bridalveil and Pigeon Creeks join the Merced before it breaches the glacial moraine at the valley 's end . From there the river picks up Cascade Creek and turns south near El Portal , flowing through Merced River Canyon . State Route 140 follows the river out of the west

entrance to the national park , a few miles before the South Fork Merced River , the largest tributary , joins from the left . The river arcs northwest to receive the North Fork , and a few miles after it enters Lake McClure , formed by New Exchequer Dam . Below New Exchequer , the river flows west through a heavily irrigated region of the Central Valley , passing through McSwain and Crocker @-@ Huffman Dams and the cities of Hopeton , Delhi and Livingston . It joins the San Joaquin River at Hills Ferry , a few miles south of Turlock .

= = Watershed = =

The drainage basin of the Merced River is located in the central Sierra Nevada , spreading across 1 @, @ 726 square miles ( 4 @, @ 470 km<sup>2</sup> ) . It can be characterized as the slightly smaller southern companion of the Tuolumne River , the major Sierran river just north of the Merced . On the south , the basin borders on the headwaters of the San Joaquin River itself . The Merced River watershed includes the subwatersheds of Illilouette , Echo , Tenaya , Yosemite , Bridalveil , Cascade , and Dry Creeks , as well as the South and North forks of the river , of which the South Fork , at 43 miles ( 69 km ) long , is the largest . Tributaries to the South Fork include Bishop , Rail , Alder and Chilnualna Creeks . There are also many lakes in the watershed of the Merced River , including Merced Lake , Tenaya Lake , the Chain Lakes , May Lake , Lake McClure , and Lake McSwain .

Much of the basin of the Merced River is characterized by an alpine climate . The upper basin of the river receives heavy snowfall in the winter , which is usually enough to feed the river and its tributaries year round . However , most of the snowpack melts by the late autumn , reducing flows in the main stem and its tributaries significantly , and causing some smaller tributaries to dry up altogether . Snowmelt constitutes a majority of the river 's springtime and early summer flow , and provides up to 85 % of the flow above Happy Isles . The dry season depends more on groundwater to supply the river 's flow . The middle and lower basin are dominated by an arid , Mediterranean or even semi @-@ desert climate .

The Merced River is the third largest tributary of the San Joaquin River . Before irrigation started in the Central Valley and dams were constructed , the river 's natural flow at the mouth was much higher than the current average of 661 cubic feet per second ( 18 @. @ 7 m<sup>3</sup> / s ) , or about 479 @, @ 000 acre feet ( 591 @, @ 000 @, @ 000 m<sup>3</sup> ) per year . Upstream on the river , at Happy Isles , the average flow is 355 cubic feet per second ( 10 @. @ 1 m<sup>3</sup> / s ) . The United States Geological Survey has river gauges at three locations along the Merced River : at Happy Isles , above Lake McClure , and at the mouth . The first two record flows unaffected by dams and human intervention , but discharge at the mouth is chiefly controlled by New Exchequer Dam . The Lake McClure gauge , located at the former mining town of Bagby , is probably the most accurate gauge for flows overall . The average annual flow recorded there was 1 @, @ 185 cubic feet per second ( 33 @. @ 6 m<sup>3</sup> / s ) from 1923 to 1966 . A peak of 92 @, @ 500 cubic feet per second ( 2 @, @ 620 m<sup>3</sup> / s ) was reported there on December 23 , 1955 . For the mouth gauge , the highest flow was only 13 @, @ 600 cubic feet per second ( 390 m<sup>3</sup> / s ) in 1950 . Finally , for the gauge at Happy Isles , the largest flow ever recorded was 10 @, @ 100 cubic feet per second ( 290 m<sup>3</sup> / s ) in the 1997 Yosemite floods , which destroyed many campgrounds , roads , paths , and bridges in the valley .

The Merced River 's primary human use is irrigation . The Merced Irrigation District ( MID ) operates most of the irrigation infrastructure , which supplies water to 154 @, @ 394 acres ( 624 @. @ 81 km<sup>2</sup> ) of farmland . As a whole , the system includes about 4 @, @ 000 sets of control gates and 793 miles ( 1 @, @ 276 km ) of canals . Irrigation has taken most of the water out of the lower river , which now rarely reaches the sea . Water that does return to the river does so in for form of irrigation return flows , which carry pesticides , fertilizer and other pollutants . The MID is federally required to allow at least 15 @, @ 000 acre feet ( 19 @, @ 000 @, @ 000 m<sup>3</sup> ) of water annually to flow continually down the river , not including flooding . The water has allowed the San Joaquin River below the Merced River confluence to contain water , while above the confluence all of its water is usually diverted for irrigation .

= = Ecology = =

According to a study in 2006 , there were 37 species of fish , 127 bird species , and 140 insect and invertebrate species found in the Merced River watershed . Most of these species are divided between the upper and lower watershed , which is usually defined by Lake McClure , formed by New Exchequer Dam .

Of the fish , there were 26 species found in the lower Central Valley portion of the river , including Sacramento sucker , smallmouth bass , largemouth bass and carp , all but three of which are resident species , and some of which were intentionally introduced by humans . The three anadromous fish species that still use the lower Merced are the chinook salmon , Pacific lamprey and striped bass . The upper section of the river , defined as the stretch from Lake McClure to the headwaters , had 11 species of fish . Historically , the range of anadromous fish extended to the head of Yosemite Valley , but by the 1950s and 1960s , except in the wettest years , not enough water flowed down the Merced and San Joaquin Rivers at all to allow them to spawn in significant numbers . New water use requirements have allowed many anadromous species to revitalize , from a low of 500 chinook salmon in the mid @-@ 20th century to a high of 30 @,@ 000 fish in 1984 . After the 1970s , the annual run was about 5 @,@ 300 fish .

Of the one hundred and twenty @-@ seven bird species found along the Merced River , only 35 occur along the entire length of the river . Many of these birds are migratory and only pass the area a few times every year , while 109 species of birds are found only in the breeding season . However , despite the more extensive modifications to the lower part of the river , there are more species of birds found in the lower watershed , due to the slow @-@ flowing nature of the river that forms marshes and riparian zones . Common species of bird throughout the basin include ruby @-@ crowned kinglet , cedar waxwing , American robin , yellow @-@ rumped warbler , tree swallow and European starling , and several endangered species , including white @-@ tailed kite and Swainson 's hawk . Birds that occur commonly in the middle and upper sections of the Merced River include mourning dove , Cassin 's finch , California quail , dark @-@ eyed junco , woodpecker , dipper , great blue heron , scrub jay , red @-@ winged blackbird , red @-@ tailed hawk , turkey vulture , cliff swallow , canyon wren , merganser , and rarely , bald eagle . Of the 140 insect and invertebrate species , which include mayflies , stoneflies and caddisflies , there are also three major exotic species : Asiatic clam , Chinese mitten crab , and New Zealand mud snail .

Many species of plants are found throughout the middle and upper basin , including California poppy , white alder , Oregon ash , oak , poison oak , bigleaf maple , Indian rhubarb , buttonbush , willow , whiteleaf manzanita , and historically , sugar pine , before logging began in the late 19th century . Squirrels , raccoon , jackrabbits , bats , skunks , beavers , mule deer , coyote , bobcat and black bear are among the mammal species found in the middle and upper watershed .

One species of interest is the limestone salamander , an extremely rare amphibian whose only habitat is in the Merced Canyon downstream of Yosemite Valley . The limestone salamander depends on the granite walls of the Merced Canyon to survive . To protect the species , a 20 @-@ mile ( 32 km ) segment of the canyon covering 1 @,@ 600 acres ( 6 @.@ 5 km<sup>2</sup> ) was designated in 1986 an " Area of Critical Environmental Concern " .

= = Geology = =

When the North American Plate on its slow journey westwards encountered the Pacific Plate approximately 250 million years ago during the Paleozoic , the latter began to subduct under the North American continent . Intense pressure underground caused some of the Pacific Plate to melt , and the resulting upwelling magma pushed up and hardened into the granite batholith that makes up much of the Sierra Nevada . Extensive layers of marine sedimentary rock that originally made up the ancient Pacific seabed were also pushed up by the rising granite , and the ancestral Merced River formed on this layer of rock . Over millions of years , the Merced cut a deep canyon through the softer sedimentary rock , eventually hitting the hard granite beneath . The encounter with this resilient rock layer caused the Merced River to mostly stop its downcutting , although tributary streams continued to widen the ancient canyon .

Over about 80 million years , erosion caused the transportation of massive amounts of alluvial sediment to the floor of the Central Valley , where it was trapped between the California Coast Range on the west and the Sierra Nevada on the east , forming an incredibly flat and fertile land surface . The present @-@ day form of the upper Merced River watershed , however , was formed by glaciers , and the lower watershed was indirectly but significantly affected .

When the last glacial period or Ice Age arrived , a series of four tremendous valley glaciers filled the upper basin of the Merced River . These glaciers rose in branches upstream of Yosemite Valley , descending from the Merced River headwaters , Tenaya Canyon and Illilouette Creek . Tenaya Canyon was actually eroded even deeper by an arm of the Tuolumne Glacier , which formed the Grand Canyon of the Tuolumne and Hetch Hetchy Valley on the Tuolumne River in the north . Little Yosemite Valley formed as a result of the underlying rock being harder than that below the Giant Staircase , the cliff wall containing Vernal Fall and Nevada Fall . These three branches of each glacier combined to form one large glacier about 7 @,@ 000 feet ( 2 @,@ 100 m ) thick at maximum , stretching 25 miles ( 40 km ) downstream past the mouth of Yosemite Valley , well into Merced Canyon . These glaciers formed the granite cliffs that now constitute landmarks such as Half Dome , El Capitán , and Cloud 's Rest .

The first and largest glacier was the Sherwin or Pre @-@ Tahoe glacier , which eroded the upper Merced watershed to an extent close to its present form . Three stages followed during the Wisconsinian glaciation ; these were the Tahoe , Tenaya and Tioga stages , of which the Tioga was the smallest . The Tioga glacier left at the mouth of Yosemite Valley a rocky moraine . This moraine was actually one of several moraines deposited by the four glaciations , which include Medial Moraine and Bridalveil Moraine . After the Tioga Glacier retreated this moraine formed a lake that flooded nearly the entire valley . Gradual sedimentation filled Lake Yosemite , creating a broad and flat valley floor . Sediments of glacial origin continued to travel down the Merced River following then , helping to form the flat floor of the Central Valley .

= = History = =

Of the many Native American tribes that have lived on the Merced River the most prominent were the Miwok ( consisting of Plains Miwok and Sierra Miwok ) , Paiute , and Ahwahnechee . Many Plains Miwok settled in the lowlands along the lower Merced River . The Sierra ( or Mountain ) Miwok lived in the upper Merced Canyon and in Yosemite Valley , and at the time the first white explorers came to the area , there were about 450 Sierra Miwok split among ten permanent villages . Paiute , of origin from the eastern Sierra near the Mono Lake area , also lived in the upper watershed of the Merced River . The Sierra Miwok and Mono Lake Paiute eventually , through cultural interaction over time , formed a new culture , the Ahwahnechee , derived from Ahwahnee , meaning " the valley shaped like a big mouth " ( referring to U @-@ shaped Yosemite Valley ) .

In the early 19th century , several military expeditions sent by Spanish colonists from coastal California traveled into the Central Valley . One of these trips , headed by lieutenant Gabriel Moraga , arrived on the south bank of the Merced River on September 29 , 1806 . They named the river Rio de Nuestra Señora de la Merced ( River of Our Lady of Mercy ) , who is the patron saint of Barcelona and is celebrated on September 24 . Another expedition to the Central Valley in 1805 also named the Kings River upon reaching it on January 6 , 1805 , which is the feast of the Magi or Epiphany . Moraga 's expedition was part of a series of exploratory ventures , funded by the Spanish government , to find suitable sites for missions in the Central Valley and the Sierra Nevada foothills . In 1808 and 1810 , Moraga led further expeditions along the lower Merced River below Merced Canyon , each time coming to nothing . Eventually , plans to establish a mission chain in the Valley were abandoned . In 1855 , Merced County was created , named after the Merced River .

Following the establishment of Merced County and the independence of California from Mexico , many settlers came to the Merced River area and established small towns on the Merced River . One of the first was Dover , established in 1844 at the confluence of the Merced River with the San Joaquin River . Dover functioned as an " inland seaport " where boats delivered supplies from the San Francisco Bay area to settlers in the San Joaquin Valley . Some towns that followed were

Hopeton , Snelling and Merced Falls , the latter named for a set of rapids on the Merced River near the present @-@ day site of McSwain Dam . In the late 1880s a flour mill , woolen mill and a few lumber mills were constructed at Merced Falls . The Sugar Pine Lumber Company and Yosemite Lumber Company operated lumber mills at Merced Falls for over thirty years , relying on narrow @-@ gauge railroads to ship lumber from the Sierra Nevada along the Merced River . Following the construction of the Central Pacific and Southern Pacific Railroads , many of the river towns on the Merced River were deserted . Several cities that did achieve prominence , however , include Merced and Turlock , both located on the railroad .

The California Gold Rush in the 1850s saw gradually increasing mining in Merced Canyon and Yosemite Valley . Many Native Americans in the area revolted , leading to conflicts between miners and the Ahwahnechee . In 1851 the Mariposa Battalion was formed to drive the remaining Ahwahnechee out of the valley into reservations . The Battalion fought an Ahwahnechee group led by Chief Tenaya over the South Fork of the Merced River . Eventually , they succeeded in driving most of the Indians out of the Yosemite Valley , first into a reservation near Fresno . Following the gold rush , the Ahwahnechee were allowed back into Yosemite Valley , but further incidents prompted a second battalion to drive them out , this time to the Mono Lake area . Many place names in the valley have their origin from the Mariposa Battalion .

Even before the establishment of Yosemite National Park , tourists began to travel into the Merced Canyon and Yosemite Valley as early as 1855 . The first roads were constructed into Yosemite Valley in the 1870s . The first was Coulterville Road , followed by Big Oak Flat Road , a trading route from Stockton to Merced Canyon . Environmental movements led by John Muir and Robert Underwood Johnson convinced the U.S. Congress to establish Yosemite National Park in 1890 . With the creation of the national park tourism to the Valley and the Merced River increased significantly , leading to many other roads being built throughout the upper Merced River watershed . Other national forests protecting more of the Merced River upper basin followed , including Sierra National Forest and Stanislaus National Forest .

The Yosemite Valley Railroad , originally established with the discovery of mineral deposits in Yosemite Valley and Merced Canyon , continued functioning through the early 20th century carrying tourists to Yosemite Valley along the Merced River . El Portal Road , constructed through Merced Canyon in 1926 , put an end to passenger service on the railway , but operations continued until the mid @-@ 1940s , when major flooding occurred , destroying sections of the railroad . In the early 20th century , when the upper Merced River basin lay mostly protected , the lower river was the subject of dam @-@ building and irrigation diversions by the Merced Irrigation District . The District proposed the Exchequer Dam , completed in the mid @-@ 1920s and raised in the 1960s , as a water storage facility on the Merced River .

Irrigation with water from the Merced River continued to grow substantially until most of the arable land around the river , some 120 @, @ 000 acres ( 490 km<sup>2</sup> ) , was under cultivation . By the late 1950s and early 1960s , irrigation in the San Joaquin Valley was to such an extent that many of the rivers ran dry in sections . Upriver of the Merced River confluence with the San Joaquin , the latter river was usually dry , only regaining flow where the Merced River enters . In the mid @-@ 20th century , the flow in the Merced River diminished to such a degree that very few salmon returned to spawn in the lower section of the Merced River . In 1991 , a fish hatchery , the Merced River Hatchery , was built beside the Merced River just downstream of the Crocker @-@ Huffman Diversion Dam , the lowermost Merced River dam . Fall chinook salmon travel up a fish ladder into the hatchery 's pools , which are supplied with water diverted from the Merced River .

Yosemite Valley saw significant amounts of damage when the river flooded the valley in 1997 .

= = River modifications = =

Despite its partial status as a National Wild and Scenic River , the Merced River has been the subject of dam @-@ building and irrigation diversions . The dams on the Merced River are New Exchequer Dam , McSwain Dam and the Crocker @-@ Huffman Diversion Dam . New Exchequer Dam is the largest dam on the river and forms Lake McClure , which holds 1 @, @ 032 @, @ 000

acre feet ( 1 @. @ 273 × 109 m<sup>3</sup> ) . This modern structure was preceded by the old Exchequer Dam forming Exchequer Reservoir , with a capacity of 281 @, @ 000 acre feet ( 347 @, @ 000 @, @ 000 m<sup>3</sup> ) . The old concrete arch dam , completed in 1926 , has since been inundated by a new rockfill structure .

Many small diversion dams block the Merced River downstream , many of which were built by the Merced Irrigation District to supply water to farms in the Central Valley . The lowermost , the Crocker @-@ Huffman Diversion Dam , was built just before 1907 , and completely blocks the passage of anadromous fish up the Merced River . McSwain Dam , the other major lower dam , also serves as a forebay ( regulating dam ) for New Exchequer Dam . Aside from controlling flows in the lower river the dam also produces some hydroelectricity . Because of the nearly desiccated flow of the river as it nears the mouth , like most other rivers in the San Joaquin Valley , little water in the Merced River actually reaches the Pacific Ocean .

Cascades Diversion Dam was a timber crib dam built in 1917 near where the Merced River flows out of Yosemite Valley . Because of its impact on the environment and damage from floods , the dam , originally built to generate hydropower , was decommissioned in 1985 and removed in the 1990s . The U.S. Bureau of Reclamation surveyed the dam site in 1997 and found that the dam was in danger of failure . Classified as a " high hazard " structure , it was originally considered for inclusion on the National Register of Historic Places but was deemed too dangerous to keep . Today , the Merced to Lake McClure is completely free @-@ flowing and unobstructed by any dams .

= = Recreation = =

The Merced River and its tributaries are a popular recreational area in part because of Yosemite National Park . There are many activities within the watershed , including boating , fishing , camping and hiking . Whitewater rafting is permitted throughout Merced River Canyon from the downstream half of Yosemite Valley to the entrance of Lake McClure . The most difficult rapids in this segment rate Class III and Class IV , mostly upstream of El Portal . There is also boating on Lake McClure . Camping throughout the upper Merced watershed is generally only permitted in designated campgrounds . Campgrounds along the Merced River and its tributaries include ones at Railroad Flat , McCabe Flat , Willow Placer , Merced Lake , Vogelsang Lake , Sunrise Creek , May Lake , Bridalveil Creek , and a ski hut at Ostrander Lake , the source of Bridalveil Creek .

The name " Railroad Flat " originates from the Yosemite Valley Railroad , which once travelled up Merced River Canyon into Yosemite Valley . The old railroad grade still exists , and is now the site of a public trail . Many other trails lead throughout the Merced River watershed , notably the John Muir Trail , which starts near Happy Isles and climbs the Giant Staircase , past Vernal and Nevada Falls , into Little Yosemite Valley and north along Sunrise Creek to join the Pacific Crest Trail near Tuolumne Meadows . Trails also follow the river through Little Yosemite Valley to the headwaters area , and along Illilouette , Bridalveil , Yosemite , Alder and Chilnualna Creeks , and the lower South Fork of the Merced River . There are no trails along some segments , including the lower Bridalveil Creek , upper South Fork , and specifically Tenaya Canyon , which is extremely dangerous .