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# Gobernadora Multi-Purpose Basin

## Integrated flood management facility planning and design

**R**ancho Mission Viejo (RMV), in partnership with Santa Margarita Water District (SMWD) and Orange County Public Works (OCPW), developed an innovative multi-functioning water infrastructure system that reclaims an urban stormwater waste stream and provides regional flood control benefits.

The 26-acre Gobernadora Multi-Purpose basin provides multiple functions including:

- Groundwater recharge
- Groundwater recovery
- Non-potable water reclamation
- Flood mitigation
- Urban stormwater treatment
- Stream stabilization and habitat restoration
- Wetlands and open water habitat
- Regional trail connection

This system is successful due to its dynamic hydraulic operating system design incorporating fully automated controls that can respond to both low-flow and high-storm flow conditions in Gobernadora Creek. The system provides flexibility through multiple hydraulic systems including a dry-weather nuisance runoff diversion structure featuring a rubber inflatable dam system to divert flows into water-quality treatment cells, an elevated side weir to capture storm flows for peak flow storage, a secondary rubber dam for large flood flow water level control, and a pump station to transport treated flows for recycled water applications. The system's design accommodates a projected 350 to 800 acre-foot per year of dry-weather flow recovery, and provides storm flow detention up to the 100-year storm event.

### Background

The Cañada Gobernadora watershed has an 11.1-square mile drainage area located within the larger regional San Juan Creek Watershed. The basin is also part of the San Diego Regional Water Quality Control Board (SDRWQCB) jurisdiction. The upper portion of the watershed has been developed over the past two decades primarily as the community of Coto de Caza, a private community with more than 4,000 dwelling units and several golf courses. Water service in the community is provided by SMWD. Coto de Caza was developed prior to the current water-quality regulations; therefore, no onsite detention, retention, or water-quality treatment facilities are located within the community. All urban runoff and storm flows from Coto de Caza are directed toward Gobernadora Creek, which is the main watercourse within the Gobernadora sub-basin. Urban

runoff and storm flows from this development have resulted in downstream erosion and sedimentation, excessive surface and groundwater flow, and degraded water quality. Additionally, the creek has experienced erosion damage from changes in surface runoff characteristics as well as increased continuous nuisance flows. Ongoing water-quality monitoring associated with the San Juan Creek Watershed/Western San Mateo Creek Watershed Special Area Management Plan (SAMP), as well as the Southern Sub-Region Natural Communities Conservation Plan (NCCP), has provided extensive documentation of degraded water quality of both urban runoff and storm flows.

To address these issues, meet runoff capture and reuse goals, and meet various regulatory guidelines, SMWD in partnership with RMV agreed to construct the Gobernadora Multipurpose Basin as



a measure to respond to the existing erosion and sedimentation problems along Gobernadora Creek, as well as to provide detention to the high storm flows damaging downstream restoration habitat areas, arrest the excessive surface and groundwater originating upstream, and improve the degraded water quality along Gobernadora Creek. OCPW became a project partner to maintain operations of the lower basin for flood control functions.

The 26-acre Gobernadora Multipurpose Basin is located within an unincorporated portion of southeastern Orange County, approximately 2.5 miles north of Ortega Highway and 1 mile south of the eastern end of Oso Parkway. The basin is situated adjacent to Cañada Gobernadora, just downstream of its confluence with Wagon Wheel Creek and immediately south of the Coto de Caza community. The basin has a total drainage area of 7.8 square miles (approximately 5,000 acres), most of which is completely urbanized.

### Basin Features

The multipurpose Gobernadora Basin is composed of several key elements, each of them fulfilling unique functions in terms of flood control, water-quality treatment, urban nuisance water recovery, and groundwater recovery. The facility is divided into two basins: a 10.9-acre upper basin and a 15.3-acre lower basin. The combined maximum flood control storage is approximately 120 acre-feet. The lower basin is further divided into two independent sub-basins connected to the upper basin via two 95-foot-long spillways. The upper basin is subdivided further into four interconnected water-quality cells that include a side weir alongside the east embankment for peak flow diversion and bypass of sediment to the natural alluvial channel, and a low-water diversion structure for the collection of nuisance flows generated from the upper watershed during dry-weather conditions.

Most of the treated dry-weather flow is captured by SMWD in the Gobernadora Basin and reclaimed back into an offsite non-potable water reservoir via a pump in the upper basin connected to an existing SMWD force main. To ensure a continued irrigation source for the Gobernadora Ecological Restoration Area, 0.3 cubic feet per second (cfs) of flows are purposely bypassed downstream. In addition, two

groundwater wells are located within the perimeter of the upper basin to capture part of the recharged groundwater that is conveyed to the basin pump station. The flood control function of the Gobernadora Basin is provided during wet-weather conditions by storing a portion of the storm hydrograph inside the upper and lower basins. Gravity outlets and emergency spillways are located along the south embankment of each lower cell to attenuate the downstream outflow into the Gobernadora Creek with the ability to facilitate a 1,500-year storm event.

### Upper Basin

This facility occupies the northern half of the Gobernadora Basin footprint, and its main purpose is to improve the degraded urban nuisance flows and provide groundwater recharge for flows originating from the upper Gobernadora watershed, particularly during the dry season. The basin consists of four interconnected water-quality cells of varying shapes and areas. These cells have 2:1 side slopes, are separated by 3-foot-high, 20-foot-

wide internal earthen embankments (berms), and are hydraulically connected by means of 18-inch pipes located underneath the internal embankments. In addition to the 18-inch culverts, the cells are equipped with intermediate overpour spillways in case the culverts become plugged. The four cells have a combined area of approximately 11 acres and have a minimum and maximum depth of 3.5 feet and 4.8 feet, respectively, with nearly 24 acre-feet of storage volume. Maintenance ramps are also included at specific locations along the internal embankments to allow access to the floors of the water-quality basins.

Dry-weather flows are conveyed into the upper basin from the creek through a 24-inch diversion culvert and sluice gate structure located near the southeast corner of cell 1. Because all four cells are hydraulically connected and their floor elevations gradually decrease from cell 1 to cell 4, the flow is forced to meander through each basin with a flowpath length of about 2,000 feet and terminates at a surface water pump station

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at the southeast corner of cell 4. The first three cells have planted vegetation such as cattails and bulrush to provide treatment of the surface water. The final cell provides a final sedimentation polishing basin for the surface water as well as surface area for groundwater infiltration. Flows are able to percolate through the soil throughout the upper basin. Percolating flows are treated in the vadose or unsaturated zone of the aquifer before reaching the groundwater table.

A portion of this naturally treated flow is subsequently pumped into an existing 14-inch force main and conveyed to the SMWD Portola non-potable water reservoir. To ensure a continued irrigation source for downstream sensitive habitats, 0.3 cfs of the treated nuisance flow is bypassed using a variable height weir and a 24-inch outfall pipeline back into Gobernadora Creek.

#### **Dry-Weather Flow Diversion**

**System.** An in-creek control structure consists of an inflatable rubber dam (north air dam) designed to impound and redirect the nuisance flows toward the nuisance flow intake structure, which consists of a 24-inch, high-density polyethylene (HDPE), 75-foot-long culvert equipped with a 24-inch by 24-inch sluice gate and manhole structure. The north air dam is 70 feet long by 4 feet high when fully inflated. The dam remains inflated during dry-weather flows in order to convey these into the upper basin for water-quality treatment. Flows in the creek are allowed to spill over the rubber dam as long as the water depth above the crest does not exceed 6 inches. When this depth is reached, the dam automatically deflates and water is able to continue flowing downstream.

#### **Wet-Weather Flow Management**

**System.** Wet-weather flows are diverted into the upper basin by means of a 200-foot-long concrete, sharp-crested weir located along the upper basin east embankment and adjacent to the Gobernadora Creek. The purpose of this side weir is to intercept the peak flows from upper portion of the storm hydrograph for the 10-year through 100-year events



Gobernadora basin, March 2017

PAGE

only and convey them into the upper basin. The facility consists of three main elements: the foundation structure, the weir crest, and an energy dissipator/stilling basin.

To optimize the performance of the side weir and provide adequate flood control during high flow events, a second in-channel inflatable rubber dam is located at the downstream end of the channel side weir. This facility consists of a 100-foot-wide, 6-foot-high air dam that will be inflated only for flood events greater than the 10-year flood. The goal of this structure is to increase the water levels upstream at the side weir so sufficient flow spills over. Downstream of the inflatable dam, a concrete apron transitions into a 3-foot-high hydraulic drop structure specially designed to dissipate the energy from the jet flow.

#### **Lower Basin**

The lower basin occupies the southern portion of the Gobernadora Basin footprint and has, as its main function, the storage of flood water volume during the passing of larger flow events. The basin is subdivided into two smaller sub-basins, cell 5 and cell 6. Each cell is connected to the upper basin via an independent 95-foot, wide-crested interconnec-

tion spillway. Each basin discharges back into Gobernadora Creek through a 36-inch reinforced concrete pipe gravity outlet structure with orifice plate for flood attenuation, and through a 95-foot-long emergency spillway. Both of these outfall elements are located along the south embankment of each cell, with the emergency spillway located above the outlet structure. The storage volumes of cell 5 and cell 6, at 49.4 acre-feet and 49.7 acre-feet, respectively, justify their classification as non-DSOD dams (thus not under the jurisdiction of the California Division of Safety of Dams).

#### **Basin Interconnection Spillway.**

This facility consists of two identical 95-foot-long spillways located along the internal embankment separating the upper and lower basins. Their main function is to divert excess flows into the lower basin once the storage capacity in the upper basin has been reached. This condition is expected to occur for storm events larger than the 10-year flood event. Under such conditions, flood flows intercepted by the side weir will first fill the available storage volume of the upper basin and later spill into the lower basin's cells 5 and 6. During dry-weather flows, the interconnection spillways will not be engaged. Instead, all nuisance flows will

be collected and treated in the upper basin, and eventually pumped into the SMWD force main and returned back to Gobernadora Creek.

**Lower Basin Outlet Structure and Emergency Spillway.** Two spillways, each 95 feet long, function as broad-crested weirs. An energy dissipation structure consisting of baffle blocks and a rock riprap blanket is located at the toe of each spillway structure for erosion protection. In addition to the lower basin spillway, gravity outlets for cells 5 and 6 of the lower basin consist of two 36-inch reinforced concrete pipe culverts with orifice plates designed to attenuate the outflow from the detention basins into Gobernadora Creek. The selected diameter allows the maximum storage capacity of each cell to be released back to the creek in less than 24 hours if the gate is completely open.

### Basin Flow Management Performance

The Gobernadora Basin system effectively detains and attenuates storm flows before they reenter Gobernadora Creek downstream of the basin. Once a rainfall event causes water to crest more than 6 inches above the top of the upper air dam, the dam automatically deflates, allowing flows to bypass into the creek. Flows less than the 10-year storm event are bypassed downstream, but once a 10-year flowrate is reached, the lower air dam is inflated and the side weir is utilized to route flows into the upper basin. Once the storage volume of the upper basin is reached (24 acre-feet), flows enter the lower basin through the basin interconnection spillway. Bypass of some flows into Gobernadora Creek continue. An additional storage volume of nearly 100 acre-feet is provided in cells 5 and 6 of the lower basin.

### Groundwater and Nuisance Flow Recovery Facilities

Groundwater and nuisance flow recovery is achieved by means of two surface and shallow groundwater production wells and

a surface water pump station. Groundwater is extracted from the shallow perched aquifer to the pump station where it mixes with surface water that has been treated in the wetlands.

#### Groundwater Production Wells.

Well #1 (North Well) is located along the upper basin northern embankment, at the intersection with the internal berm separating cell 1 and cell 2. This production well is connected to the water surface pumping station through a 960-foot-long, 4-inch HDPE force main. Well #2 (South Well) is located along the upper basin southern embankment, to

vertical turbine pumps (one redundant), discharge piping, instrumentation, two wet wells, and several other appurtenant structures.

The intake structure is equipped with a sloped grate to prevent extraneous objects from reaching the pumps. Nuisance flows enter by gravity into the first wet well, where any remaining solids are able to settle out before entering the second wet well, where the suction pipes to the pump are located. A slab covering the first wet well has a manhole to allow access for a truck to remove solids that may accumulate at



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the right of the interconnection spillway looking downstream. This well is also connected to the water surface pumping station via a 794-foot-long, 4-inch HDPE force main. The wells are drilled to a depth of 75 feet and have pumps with a capacity of 200 gallons per minute (gpm) each.

#### Water Recovery Pump Station.

The pump station is located in the southeast corner of the upper basin and is partially buried in the inside slope of the basin embankment. Its main function is to convey the nuisance and groundwater flows collected in cell 4 of the upper basin and the extraction wells into the existing SMWD force main and finally to the Portola Reservoir. The pump station consists of a concrete vault housing two 550-gpm

the bottom of the wet well. The well has an adjustable weir and 24-inch outfall pipe to return treated flows for irrigation of downstream riparian vegetation. The suction pipes to the pumps have strainers installed to provide the final treatment for the system. The strainers have 30 mesh (600-micron) openings and have the ability to automatically backwash using system pressure to prevent clogging of the system. Flows are conveyed through an existing SMWD 14-inch force main to the non-potable Portola Reservoir at a discharge of 5 to 6 cfs. In addition to the pumping equipment, the pump station also houses blowers and control valves for inflating and deflating the two air dams located in Gobernadora Creek. ♠