SECTION 9 ALTERNATIVES ANALYSIS AND RECOMMENDATIONS FOR SMALL RESERVOIRS

Section 9 discusses the sediment management alternatives for the small reservoirs - Big Dalton, Eaton, Live Oak, Puddingstone Diversion, and Thompson Creek. The small reservoirs are not only characterized by the smaller size of the dam, reservoir, drainage area, and sediment quantity, but also limited base flows during the dry season. Due to the limited amount of base flows, sediment removal, and transportation alternatives that require water such as sluicing, dredging, and slurry pipeline are not feasible for small reservoirs. Thus, those alternatives are not discussed in this section.

9.1 BIG DALTON RESERVOIR

9.1.1 BACKGROUND

Big Dalton Dam, shown in Figure 9-1, is a multiple arch concrete dam that was constructed in 1929 by the Los Angeles County Flood Control District (Flood Control District) and is operated for flood risk management and water conservation. With a drainage area of 4.5 square miles, Big Dalton Reservoir had an original storage capacity of approximately 1.7 million cubic yards (MCY). Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-1 Big Dalton Dam

9.1.1.1 LOCATION

Big Dalton Reservoir is located in the Big Dalton Canyon of the San Gabriel Mountains, approximately four miles northeast of the City of Glendora in the Angeles National Forest, as shown in Figure 9-2.

Big Dalton Canyon has relatively gentle side slopes that vary from roughly 2:1 to 3:1 (horizontal vertical) in the immediate vicinity of the reservoir. The canyon opens out into the upper alluvial fan of the Los Angeles Basin, with Big Dalton Dam near the mouth of the canyon. Big Dalton Reservoir is roughly arc shaped, with a length of approximately 1,300 feet and an average width of 400 feet. Figure 9-3 shows the topography of Big Dalton Canyon at the dam and reservoir.

Figure 9-2 Big Dalton Dam Vicinity Map

Figure 9-3 Big Dalton Reservoir Topography

9.1.1.2 ACCESS

Access to the dam is available off Big Dalton Canyon Road, a small two-lane road until it enters Angeles National Forest jurisdiction where it transitions to a single-lane, paved, private road. This fully paved access road runs by a narrow parking area just upstream of the west abutment of the dam. Beyond, at the top of the dam, Big Dalton Canyon Road changes to an unpaved road that loops around the body of the reservoir. Approximately, 0.4 miles north of the dam abutment, an unpaved access road runs down into the body of the reservoir. Figure 9-4 shows the approximate location of the access roads.

Figure 9-4 Location of Access Road to Big Dalton Reservoir

9.1.1.3 DAM OUTLETS

In addition to being equipped with a variety of valves, Big Dalton Dam is also equipped with a sluiceway controlled by a 3-foot by 3-foot sluice gate.

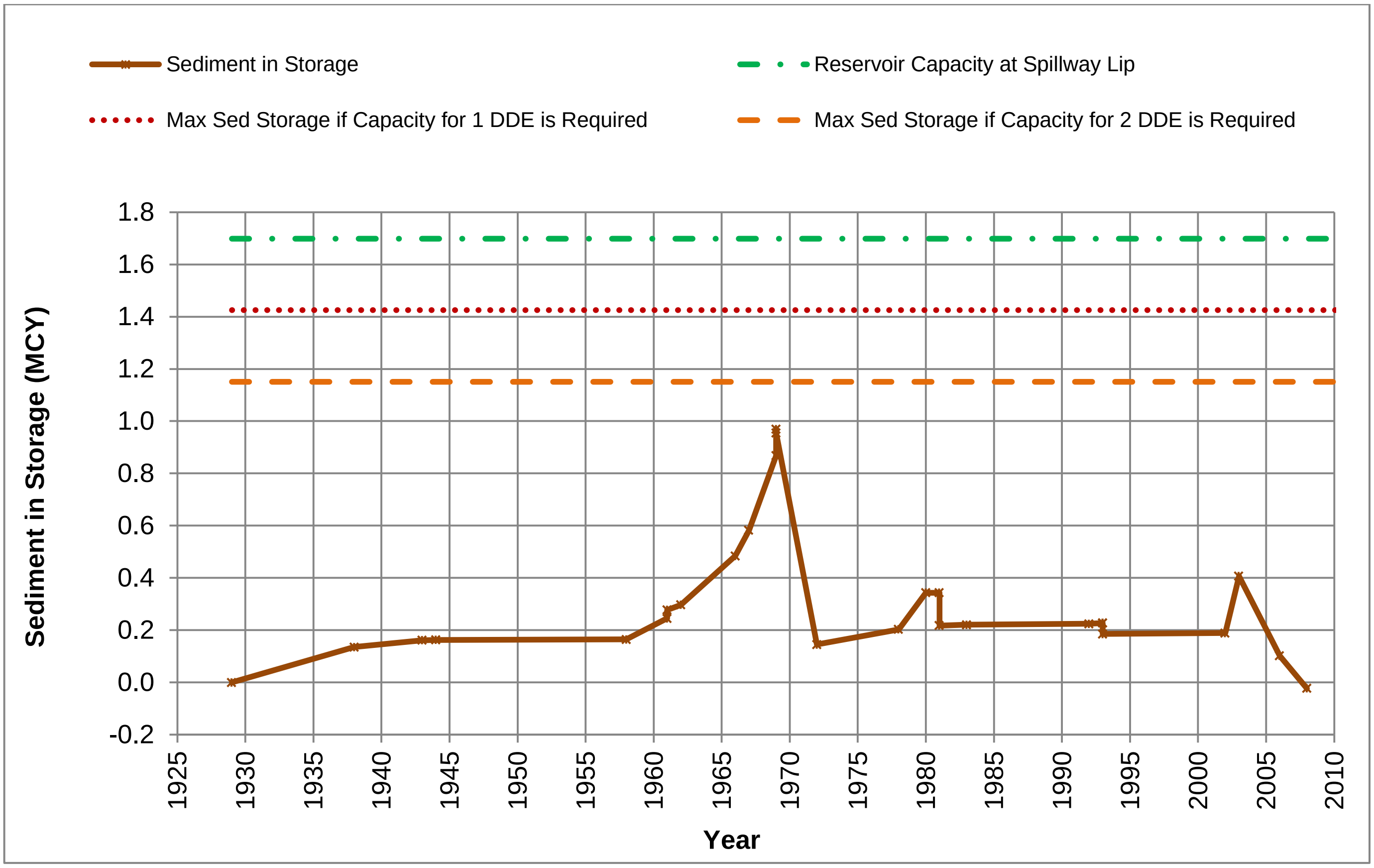
9.1.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Big Dalton Dam travels through Big Dalton Wash to Big Dalton Debris Basin and then the Big Dalton Spreading Grounds. San Dimas Wash and Little Dalton Wash feed into Big Dalton Wash, which connects to Walnut Creek and eventually flows to the San Gabriel River.

9.1.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 9-5 shows the approximate sediment storage in Big Dalton Reservoir since 1929. It is the Flood Control District's policy to retain enough storage capacity within a reservoir for two design debris events (DDEs), which are calculated and determined for each specific reservoir. For reference purposes, Figure 9-5 shows the original reservoir capacity at spillway lip and the maximum sediment storage that allows for the storage of both one and two DDEs. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Big Dalton Reservoir on numerous occasions, even before reaching the threshold capacity.

Figure 9-5 Graph of Historical Sediment Storage at Big Dalton Reservoir



Sediment has been removed 6 times in the 84-year life of the reservoir. Table 9-1 shows that both excavation and sluicing have been used to remove sediment from Big Dalton Reservoir in the past, although sluicing has only been done once.

Table 9-1 Summary of Historic Sediment inflows and Cleanouts – Big Dalton Reservoir

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (MCY)	Quantity Excavated (MCY)	Sediment Accumulated Between Records (MCY)	Sediment in Storage (MCY)
October	1929	1.70	-	-	-	-
March	1938	1.56	-	-	0.14	0.14
October	1943	1.54	-	-	0.03	0.16
September	1944	1.54	-	-	0.00	0.16
October	1958	1.53	-	-	0.00	0.16
September	1961	1.45	-	-	0.08	0.25
November	1961	1.42	-	-	0.03	0.28
January	1962	1.40	-	-	0.02	0.30
August	1966	1.21	-	-	0.19	0.48
April	1967	1.12	-	-	0.10	0.58
January	1969	0.83	-	-	0.29	0.87
March	1969	0.73	-	-	0.10	0.97
December	1969	0.74	0.015	-	-	0.96
January	1972	1.55	-	0.81	-	0.15
October	1978	1.50	-	-	0.06	0.20
March	1980	1.36	-	-	0.14	0.34
August	1981	1.36	-	-	-	0.34
October	1981	1.48	-	0.13	-	0.22
April	1983	1.48	-	-	0.00	0.22
December	1992	1.47	-	-	0.00	0.22
March	1993	1.47	-	-	0.00	0.23
July	1993	1.47	-	-	-	0.23
September	1993	1.51	-	0.04	-	0.19
November	2002	1.51	-	-	0.00	0.19
September	2003	1.29	-	-	0.22	0.41
November	2006	1.60	-	0.48	0.18	0.10
July	2008	1.72	-	0.13	0.01	(0.02)

Historically, excavated material has been placed at Big Dalton Sediment Placement Site (SPS), which is immediately downstream of the reservoir. However, Big Dalton SPS has almost no remaining capacity and is unable to store additional sediment.

9.1.2 PLANNING QUANTITY

As described in Section 5, the 20-year planning quantity for sediment inflow into Big Dalton Reservoir is 0.8 MCY.

9.1.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

9.1.3.1 BIG DALTON SEDIMENT PLACEMENT SITE

Big Dalton SPS could be used as a temporary sediment storage area and the sediment could be gradually transported to a permanent placement site. However, due to the agreement between the USFS and the Flood Control District, the SPS must be re-vegetated and restored to its natural condition.

9.1.3.2 BIG DALTON DEBRIS BASIN

Big Dalton Debris Basin, shown in Figure 9-6, is approximately 2 miles downstream of the reservoir and is owned and operated by the Flood Control District. The debris basin can be used as a staging area to transition between transportation methods.

Figure 9-6 Big Dalton Debris Basin

Big Dalton Debris Basin - Environmental Impacts

Additional environmental permitting may be required to use the debris basin as a staging area during the dry months as it is heavily vegetated. Impacts to water quality and conservation are not expected.

Big Dalton Debris Basin - Social Impacts

The debris basin itself is not adjacent to any residential properties. However, the road leading up to the west side of the debris basin, Glendora Mountain Road, passes through a residential area and if trucks were to be used for the removal of sediment, it would increase traffic and noise near the debris basin. The hours of operation could be limited to minimize disturbance to the residents.

Big Dalton Debris Basin – Implementability

Big Dalton Debris Basin can be used as a staging area, but the availability will be limited to the dry season due to the need to use the debris basin to capture sediment during the storm season. Environmental regulatory permits would also be required to use this site for staging or temporary sediment storage.

Big Dalton Debris Basin – Performance

The debris basin has a capacity of 580,000 CY, which would be sufficient to stage sediment.

Big Dalton Debris Basin – Cost

There is no additional cost to use Big Dalton Debris Basin as it is already owned by the Flood Control District. However, if the debris basin is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the debris basin ($2/CY) and place the material in trucks ($7.50/CY).

9.1.3.3 DALTON SPS

Dalton SPS, shown in Figure 9-7, is approximately 0.2 miles west of Big Dalton Debris Basin and 2.2 miles downstream of Big Dalton Dam and has been used in the past to place sediment from debris basin cleanouts. The SPS can be used as a temporary storage location where the sediment can be placed there initially then gradually transported out at a rate that reduces impact to the surrounding communities.

Figure 9-7 Dalton SPS

Dalton SPS - Environmental Impacts

If the open spaces that have been cleared of vegetation are used as a staging or temporary sediment storage area then there will be minimal habitat impact. Air quality will be minimally impacted due to equipment used when spreading and compacting the sediment.

Dalton SPS - Social Impacts

Dalton SPS is in a residential area that can be accessed with the same roadways that are used to access Big Dalton Debris Basin. The road leading up to the SPS, Glendora Mountain Road, is within a residential area and if trucks were used for the removal of sediment to a pit in the Irwindale area, it would impact traffic and noise.

Dalton SPS - Implementability

Dalton SPS has been used to place sediment from Big Dalton and Little Dalton Debris Basin cleanouts in the past. However, environmental permits may be required for modifications to the SPS. The SPS does not have any remaining capacity. However, the existing material at Dalton SPS can be excavated, gradually transported out, and placed at an alternative placement site in order to increase capacity at the SPS, so that the SPS can be used as a temporary sediment storage area for Big Dalton Dam cleanout projects.

Dalton SPS – Performance

Dalton SPS has been used to place sediment from debris basin cleanouts, but does not have any remaining capacity. In order to create capacity, existing material at the SPS would need to be removed prior to the reservoir cleanout. If material were removed, it can be gradually transported at a rate that reduces impact to the community.

Dalton SPS – Cost

There is no additional cost to use Big Dalton SPS as it is already owned by the Flood Control District. However, if the SPS is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the SPS ($2/CY) and place the material in trucks ($7.50/CY).

9.1.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, wet removal methods such as sluicing or dredging are not possible. Without water, the only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Big Dalton Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.1.5 and 9.1.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.1.7.

9.1.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Big Dalton Reservoir. Due to the small watershed and limited inflows, Big Dalton Reservoir can be dewatered very quickly, if it is not already dry during the dry months.

Excavation - Environmental Impacts

Emissions from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impacts on water quality. As discussed in Section 6, dewatering a reservoir in order to excavate it could impact water conservation, if the water is released faster than spreading facilities downstream of the reservoir can handle.

Sensitive wildlife may be present during cleanout operations and could impact operations. Procedures would need to be put in place to protect sensitive species.

Excavation - Social Impacts

Excavation will have minimal social impacts due to the remote location of Big Dalton Dam. Recreational users that hike in the vicinity of the reservoir may be subject to air quality and noise impacts.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using excavation as a removal method.

Excavation - Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 0.8 MCY of sediment would cost approximately $2.4 million over a 20-year period.

9.1.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Big Dalton Reservoir by means of trucking and conveyor belt. Discussion of the removal alternatives was presented in Section 9.1.4. The placement alternatives are presented in 9.1.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.1.7.

9.1.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along existing roads. Once out of the reservoir, trucks could travel along Big Dalton Canyon Road to Glendora Mountain Road and then to Interstate 210 via North Valley Center Avenue, Foothill Boulevard, and North San Dimas Avenue. The distance to Interstate 210 is approximately 7 miles.

Trucking - Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact traffic and noise for the residents with properties facing Glendora Mountain Road and North Valley Center Avenue. Big Dalton Canyon Road also serves recreational uses, and truck operations would impact recreational users.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir and no major implementability issues are anticipated. The access road along Big Dalton Canyon Road may not be suitable for the amount of traffic created by the cleanout project and may need to be improved. Single dump trucks should be used for this operation due to the limited and sinuous access to the reservoir. Double dump trucks can be used, if sediment is transported from Big Dalton Debris Basin or Dalton SPS.

Trucking – Performance

Single dump trucks, which have the capacity for approximately 8 CY, can operate for 6 months and transport 400,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 0.8 MCY.

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.65/CY-Mile for a single dump truck, and assuming the sediment is taken to the a pit in the Irwindale area which is 16 miles away (one way), the total cost for the 20-year period for 0.8 MCY of transport is approximately $16.8 million.

If sediment is transported from Big Dalton Debris Basin or Dalton SPS, then double dump trucks can be used, which cost $0.30/CY-Mile. The total cost for the 20-year period to transport the material 14 miles (one way) to a pit in the Irwindale area is approximately $6.8 million.

9.1.5.2 CONVEYOR BELTS

A conveyor system could be used to transport excavated material 1.5 miles from Big Dalton Reservoir to along Big Dalton Canyon Road to the Big Dalton Debris Basin, which could serve as a staging area from which the sediment could be trucked out.

Conveyor Belts - Environmental Impacts

Since existing roads would be used for the conveyor system from the reservoir to the debris basin, no particular impacts would be expected on habitat, water quality, or water conservation. A conveyor system would have very minimal air quality impacts unless generators are used as discussed in Section 6. If Big Dalton Canyon Road has to be widened in order to stage the conveyor system, there would be significant environmental impacts.

Conveyor Belts - Social Impacts

The conveyor system would impact recreational use of Big Dalton Canyon Road. Use of a conveyor belt system may result in visual and access issues to residents or recreational users along the conveyance route.

The conveyor system may impact vehicular access along Big Dalton Canyon Road as a five feet width footprint will be required for the conveyor belt system and may encroach upon the roadway.

Conveyor Belts – Implementability

Big Dalton Canyon Road is fairly narrow. Nonetheless, a small ground-level conveyor may be feasible. However, due to the narrowness of Big Dalton Canyon Road, during times when a conveyor system were located on the road, the road would not be able to be used for two-way traffic. Because of the infrequent need for cleanouts, a conveyor would be installed on a temporary basis. Conveyor systems have the ability to handle relatively circuitous alignments as long as the turning radii are no less than approximately 300 feet.

Conveyor Belts – Performance

Assuming a conveyor system can operate at 500 CY per hour and operate for 6 months, a conveyor operation can be performed twice during the 20-year period and remove the total 20-year quantity of 0.8 MCY.

Conveyor Belts – Cost

Conveyor costs are approximately $800/LF for installation and operating cost. The cost for 1.5 miles of conveyor would be approximately $6.3 million.

9.1.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Big Dalton Reservoir.

9.1.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Big Dalton Reservoir at a distance of 27 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.1.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale (16 miles) and Claremont (13.5 miles) areas that could accept material from Big Dalton Reservoir as discussed in Section 6.5.2.

It is assumed that one-third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

9.1.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities managed by the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Big Dalton Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.1.6.4 SEDIMENT PLACEMENT SITES

Big Dalton SPS

Big Dalton SPS, which served Big Dalton Dam, currently holds 3 MCY of sediment and does not have any remaining capacity. The existing material at the SPS cannot be transported out gradually because the SPS needs to be revegetated once the SPS is full in accordance with the permit obtained from the USFS.

Dalton SPS

Dalton SPS, which serves Little Dalton and Big Dalton Debris Basins, currently holds 1.6 MCY of sediment and does not have any remaining capacity. The existing material at the SPS can be transported out gradually to restore capacity at the SPS.

9.1.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.1.7.1 COMBINED ALTERNATIVE 1: EXCAVATION > TRUCKING > IRWINDALE PITS

Combined Alternative 1 would involve excavating sediment from Big Dalton Reservoir and transporting it via single dump trucks to a pit in the Irwindale area as shown in Figure 9-8. Residents along the haul route and recreational users of Big Dalton Canyon Road would be impacted during the cleanout. If this alternative were employed, cleanout would be expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $20 million, as shown below in Table 9-2. It is assumed that only one-third of the material will be subject to a tipping or acquisition fee as discussed in Section 9.1.6.

Figure 9-8 Big Dalton Reservoir Management Alternative 1

Table 9-2 Big Dalton Management Alternative 1 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Big Dalton Reservoir			$ 3.00	CY	$ 2.4
Single Dump Truck from Reservoir to Irwindale Pit	0.8	32	$ 0.65	CY-MI	$16.8
Pit Placement Fee			$ 3.00-9.70	CY	$ 0.8-2.6
				Total	**$20**

9.1.7.2 COMBINED ALTERNATIVE 2: EXCAVATION>TRUCKING>DALTON SPS> EXCAVATION>TRUCKING>IRWINDALE PITS

Similar to the previous option, sediment can be excavated and placed directly into a single dump truck and transported to the SPS, as shown in Figure 9-9. The material can be gradually removed via trucks at a rate that reduces social impacts and taken to either a pit in the Irwindale area or a landfill. The excavation is expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $20-25 million, as shown below in Table 9-3. It is assumed that only one-third of the material will be subject to a tipping or acquisition fee as discussed in Section 9.1.6.

Figure 9-9 Big Dalton Reservoir Management Alternative 2

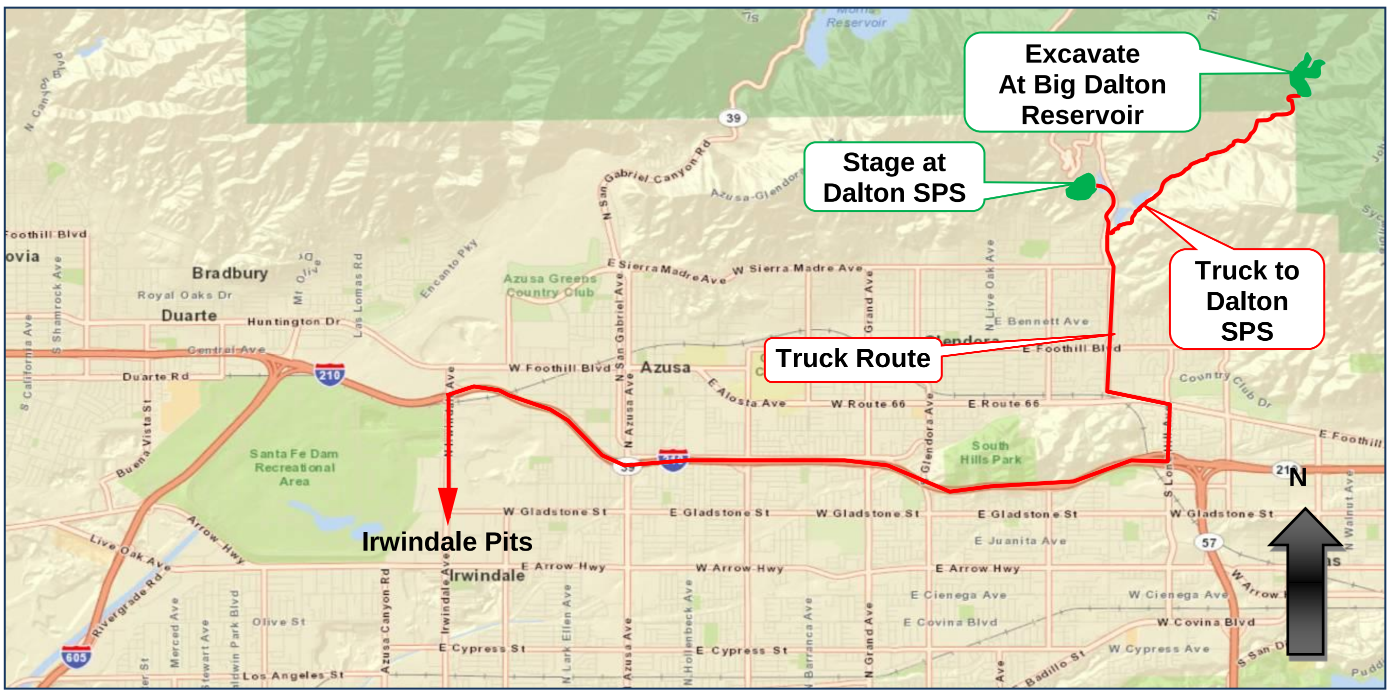


Table 9-3 Big Dalton Management Alternative 2 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Big Dalton Reservoir			$ 3.00	CY	$ 2.4
Single Dump Truck from Reservoir to Dalton SPS		4.4	$ 0.65	CY-MI	$ 2.3
Spreading at Dalton SPS			$ 2.00	CY	$ 1.6
Excavation at Dalton SPS	0.8		$ 7.50	CY	$ 6.1
Double Dump Truck to Pits/Landfills		32 -54	$ 0.30	MI-CY	$ 7.8 – 9.5
Pit/Landfill Placement Fee			$ 3.00 - $ 7.00	CY	$ 0.8 - 1.9
				Total	**$ 20-25**

9.1.7.3 Combined Alternative 3: Excavation > Conveyor > Big Dalton DB > Excavation > Trucking > Irwindale Pits

In order to reduce social impacts along Big Dalton Canyon Road, the excavated material can be placed along a 1.5 mile long conveyor down Big Dalton Canyon Road and staged at the Big Dalton Debris Basin, where the sediment will be trucked with double dump trucks to a pit in the Irwindale area, as shown in Figure 9-10. A cleanout is expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $25 million, as shown below in Table 9-4. It is assumed that only one-third of the material will be subject to a tipping or acquisition fee as discussed in Section 9.1.6.

Figure 9-10 Big Dalton Reservoir Management Alternative 3

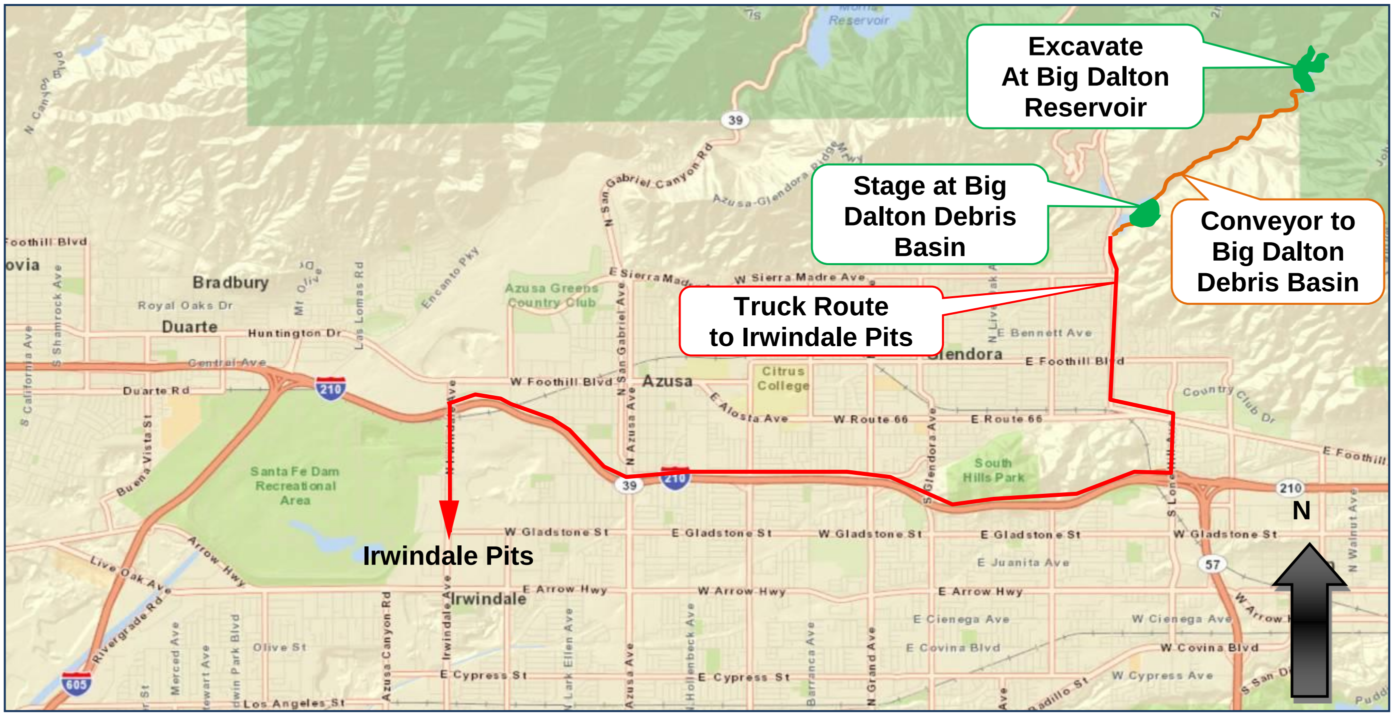


Table 9-4 Big Dalton Management Alternative 3 Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Big Dalton Reservoir	0.8		$ 3.00	CY	$ 2.4
Conveyor from Reservoir to Debris Basin		1.5	$ 800.00	LF	$ 6.3
Spreading at Debris Basin			$ 2.00	CY	$ 1.6
Excavation at Debris Basin			$ 7.50	CY	$ 6.1
Double Dump Truck from Debris Basin to Pit		28	$ 0.30	MI-CY	$ 6.8
Pit Placement Fee			$ 3.00-7.00	CY	$ 0.8-1.9
				Total	**$25**

9.1.8 SUMMARY AND RECOMMENDATIONS

9.1.8.1 SUMMARY

Over the next 20 years, 0.8 MCY of sediment is planned to be removed from Big Dalton Reservoir. The different management alternatives are briefly explained below and the impacts are shown in Table 9-5.

Management Alternatives

1. Excavate → Trucks → Irwindale Pits
   Excavate the sediment and truck it to a pit in the Irwindale area.

2. Excavate → Trucks → Dalton SPS → Dry Excavation → Trucks → Irwindale Pits & Landfills
   Excavate the sediment and truck it to Dalton SPS, where the material can be trucked out gradually to a pit or a landfill to reduce the truck frequency.

3. Excavate → Conveyor → Big Dalton Debris Basin → Dry Excavation → Trucks → Irwindale Pits
   Excavate the sediment then place it on a conveyor system where the material will be transported to the Big Dalton Debris Basin. The material at the debris basin will be excavated and transported via trucks to a pit in the Irwindale area.

Table 9-5 Big Dalton Reservoir Summary Table

Alternative		Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality(a)	Traffic	Visual	Noise	Special Permit/Agreement Required(b)	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	0.8				●	●	●	●		Yes	2	20
	Irwindale Pits									Yes			
	Excavate		◑		○	◑		○	○				
	Trucks					●	●	◑	◑				
2	Dalton SPS	0.8	◑			◑		◑	◑		Yes	2	20-25
	Trucks					●	●	●	●				
	Irwindale Pits/Landfills									Yes			
	Excavate		◑		○	◑		○	○				
	Conveyor		○				○	◑	○				
3	Big Dalton DB	0.8				◑		◑	◑		Yes	2	25
	Trucks					●	●	●	●				
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes:
(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

9.1.8.2 RECOMMENDATION

It is recommended that all the alternatives be investigated further for Big Dalton Reservoir.

9.2 EATON WASH RESERVOIR

9.2.1 BACKGROUND

Eaton Wash Dam, shown in Figure 9-11, is a clay-core earth-fill embankment dam located in the City of Pasadena that was constructed by the Army Corps of Engineers and transferred to the Flood Control District in February 1937. The dam functions as flood risk management and water conservation facility. With a drainage area of 12.4 square miles, Eaton Wash Dam had an original storage capacity of 1.5 MCY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-11 Eaton Wash Dam

9.2.1.1 LOCATION

Eaton Reservoir is located on Eaton Wash in the City of Pasadena, approximately 0.8 miles south of where the wash exits the foothills as shown in Figure 9-12. Eaton Reservoir is located on the alluvial fan created by sediment moving down from the San Gabriel Mountains. It is in a mixed-use residential and light industrial area adjacent to the intersection of New York Drive and Altadena Drive. Eaton Reservoir is roughly square, with a width and length of approximately 1,000 feet. Figure 9-13 shows the topography of Eaton Wash at the dam and reservoir.

Figure 9-12 Eaton Wash Dam Vicinity Map

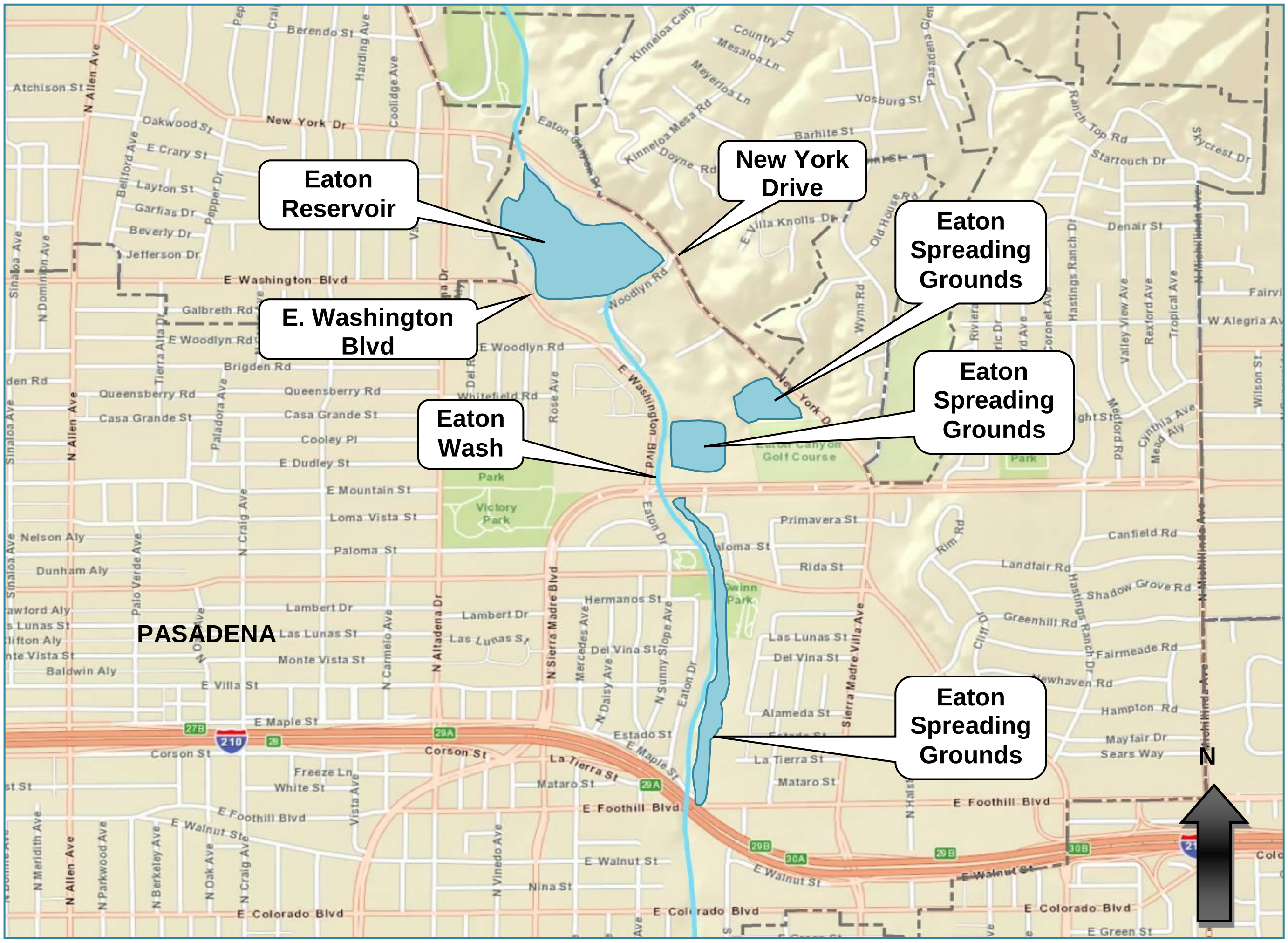


Figure 9-13 Eaton Wash Reservoir Topography

9.2.1.2 <u>ACCESS</u>

Ready access to both the dam and reservoir body is available off New York Drive. There is also access to the west side of the reservoir off East Washington Boulevard. Both of these are major roadways with excellent access to Interstate 210, as shown in Figure 9-14.

Figure 9-14 Location of Access Road to Eaton Reservoir

9.2.1.3 DAM OUTLETS

Eaton Wash Dam is equipped with four slide gates that are all 5 feet by 7 feet.

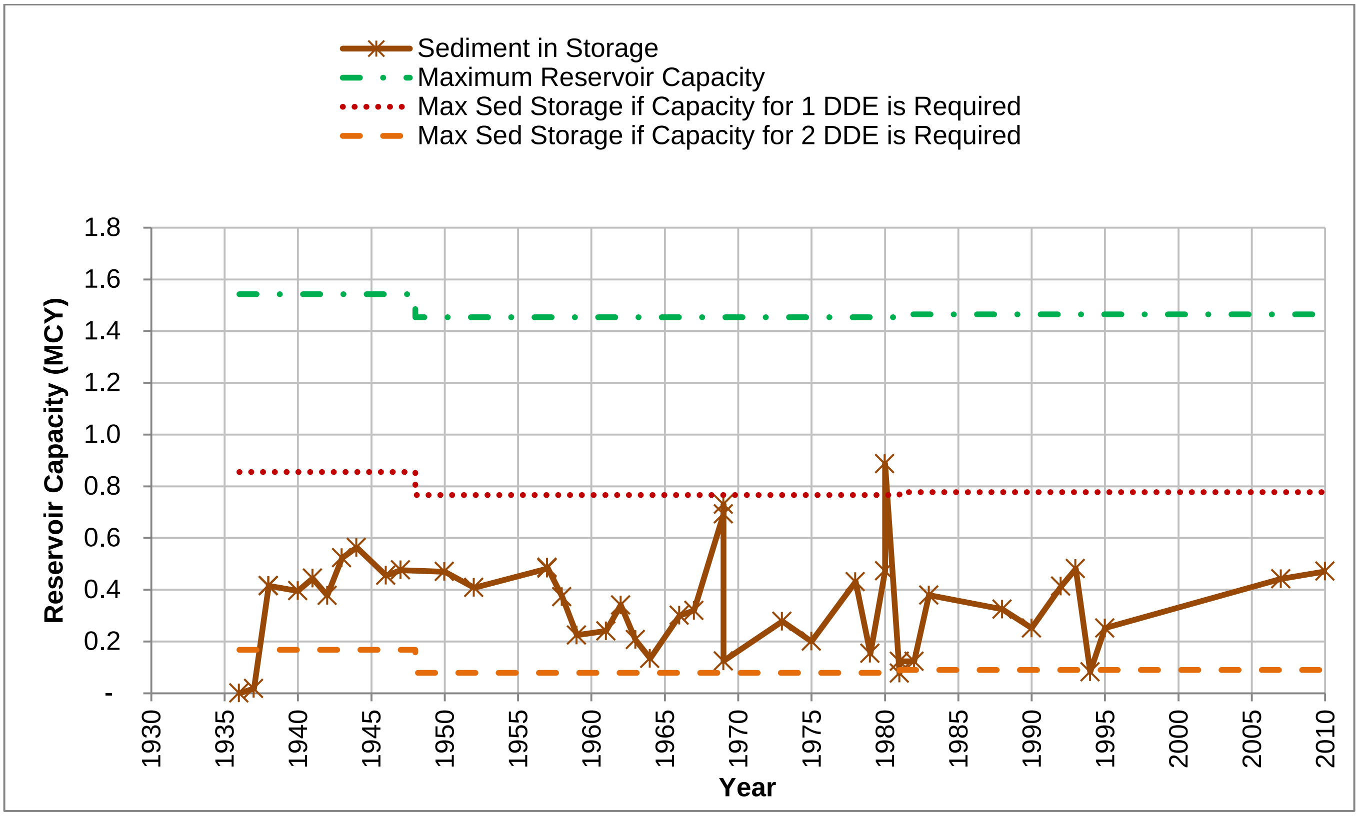
9.2.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Eaton Wash Dam travels along Eaton Wash, which serves the Eaton Wash Spreading Grounds, then to the Rio Hondo, which eventually discharges into the Los Angeles River.

9.2.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 9-15 shows the approximate sediment storage in Eaton Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Eaton Reservoir on numerous occasions.

Figure 9-15 Graph of Historical Sediment Storage at Eaton Reservoir



Note:
The maximum storage capacity changed from 1.54 MCY to 1.45 MCY in the 1940s due to an 88,000 CY blanket fill placed at the face of the dam between the spillway and the outlet tower sometime after 1947.

Sediment has been excavated from the Eaton Reservoir 21 times in the 75-year life of the reservoir. Sediment has never been sluiced from the reservoir.

Table 9-6 gives a summary of these removals.

Table 9-6 Summary of Historic Sediment Inflows and Cleanouts – Eaton Reservoir

Survey Date		Reservoir Capacity (MCY)	Quantity Excavated (MCY)	Sediment Deposited (MCY)	Sediment in Storage (MCY)
October	1936	1.54	-	-	-
April	1937	1.52	-	0.02	0.02
May	1938	1.13	-	0.40	0.42
December	1938	1.13	0.00	-	0.41
October	1940	1.15	0.02	-	0.40
August	1941	1.10	-	0.05	0.44
September	1942	1.16	0.19	0.13	0.38
October	1943	1.02	0.07	0.21	0.52
October	1944	0.98	-	0.04	0.56
October	1946	1.09	0.11	-	0.45
June	1947	1.07	-	0.02	0.48
June	1950	1.07	0.01	-	0.47
January	1952	1.13	0.06	0.00	0.41
May	1957	1.06	-	0.07	0.48
October	1957	1.06	-	0.00	0.49
November	1958	1.17	0.11	-	0.37
December	1959	1.32	0.15	-	0.22
September	1961	1.30	-	0.02	0.24
May	1962	1.20	-	0.10	0.34
October	1963	1.34	0.13	-	0.21
February	1964	1.41	0.07	-	0.13
April	1966	1.24	-	0.17	0.30
July	1967	1.22	0.00	0.02	0.32
January	1969	0.85	-	0.37	0.69
February	1969	0.81	-	0.04	0.73
December	1969	1.42	0.60	-	0.12
September	1973	1.26	0.00	0.15	0.28
July	1975	1.34	0.08	-	0.20
March	1978	1.11	-	0.23	0.43
September	1979	1.39	0.28	-	0.15
February	1980	1.07	-	0.32	0.47
February	1980	0.66	-	0.41	0.89
January	1981	1.46	0.81	-	0.08
July	1981	1.42	-	0.05	0.12
October	1982	1.42	-	-	0.12
April	1983	1.16	-	0.26	0.38
March	1988	1.22	0.05	-	0.32
June	1990	1.29	0.07	-	0.25
May	1992	1.13	-	0.16	0.41
March	1993	1.06	-	0.07	0.48
January	1994	1.46	0.40	-	0.08
June	1995	1.29	-	0.17	0.25
July	2007	1.10	0.11	0.30	0.44
May	2010	1.07	-	0.03	0.47

9.2.2 PLANNING QUANTITY

As described in Section 5.3, the 20-year planning quantity for sediment inflow into Eaton Reservoir is 1.6 MCY.

9.2.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

There are no downstream areas available for a potential staging or temporary sediment storage area.

9.2.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, in addition to the lack of a staging or temporary storage area, wet removal methods such as sluicing or dredging are not possible. The only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Eaton Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.2.5 and 9.2.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.2.7.

9.2.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Eaton Reservoir as it is usually dry during the summer months due to the limited inflow.

Excavation - Environmental Impacts

Emissions from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to impact water quality. If the water released while draining the reservoir is able to be captured and infiltrated in downstream spreading grounds, then there would be no adverse impact on water conservation either.

Excavation - Social Impacts

Excavation equipment will increase noise for the residents in the proximity of the excavation site. The west side of the reservoir is bordered by many residential and commercial properties. There are a few residential properties on the east of the reservoir also that will be impacted by the excavation operations.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 1.6 MCY of sediment would cost approximately $4.8 million over a 20-year period.

9.2.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Eaton Reservoir by means trucking. Discussion of the removal alternatives was presented in Section 9.2.4. The placement alternatives are presented in 9.2.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.2.7.

9.2.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along both New York Drive and East Washington Blvd, which are major roadways. Trucks can continue South until North Sierra Madre Blvd and then to Interstate 210. The distance to Interstate 210 is approximately 1.5 miles.

Trucking - Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact the traffic and noise for the residents with properties near the proximity of the haul route. However, residential properties do not immediately face the major roadways. In addition, Pasadena High School is directly adjacent to the haul route and modifications may be needed to accommodate the school.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir. Double dump trucks can be used for this operation since the haul route is through major roadways and the reservoir is very accessible.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 1.6 MCY.

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts.

Trucking - Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 12 miles away (one way), the total cost for the 20-year period for 1.6 MCY of transport is approximately $11.5 million.

9.2.5.2 CONVEYOR BELTS

A conveyor system would only be feasible if a staging or temporary storage area is available. Since there are no feasible locations nearby, conveyor systems are not a viable transportation method for Eaton Reservoir.

9.2.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Eaton Reservoir.

9.2.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Eaton Reservoir at a distance of 8.7 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.2.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale area, 12 miles away, which could accept material from Eaton Reservoir as discussed in Section 6.5.2.

It is assumed that one third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

9.2.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities maintained by the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Eaton Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.2.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.2.7.1 COMBINED ALTERNATIVE 1:

EXCAVATION > TRUCKS > PLACEMENT SITE

Excavation and trucking to a pit in the Irwindale area is the only viable method to remove sediment from Eaton Reservoir, as shown in Figure 9-16. A cleanout is expected to be performed every 10 years to remove the expected 20-year quantity. The total cost is estimated to be approximately $20 million, as shown in Table 9-7. It is assumed that only one third of the material will be subject to a tipping fee or acquisition fee as discussed in Section 9.2.6.

Figure 9-16 Eaton Reservoir Management Alternative

Table 9-7 Eaton Reservoir Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Eaton Reservoir	1.6		$ 3.00	CY	$ 4.6
Double Dump Truck from Reservoir to Irwindale Pit		24	$ 0.30	CY-MI	$ 11.5
Pit Placement Fee			$ 3.00-7.00	CY	$ 1.5 - 3.7
				Total	**$ 20**

9.2.8 SUMMARY AND RECOMMENDATIONS

Over the next 20 years, 1.6 MCY of sediment is planned to be removed from Eaton Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Eaton Reservoir.

Table 9-8 indicates the impacts of this alternative.

Table 9-8 Eaton Reservoir Summary Table

			Environmental				Social			Implementability	Performance		Cost
	Alternative	Quantity Removed (MCY)	Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	1.6	◑		○	◑		○	○		Yes	2	20
	Trucks					●	●	◑	◑				
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes:
(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

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9.3 LIVE OAK RESERVOIR

9.3.1 BACKGROUND

Live Oak Dam, shown in Figure 9-17, is an arched concrete gravity dam that was built by the Flood Control District in 1922 and functions as a flood risk management and water conservation facility. With a drainage area of 2.3 square miles, Live Oak Dam had an original storage capacity of 400,000 CY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream facilities to recharge groundwater.

Figure 9-17 Live Oak Dam

9.3.1.1 LOCATION

Live Oak Dam is located in Unincorporated Area of the County of Los Angeles about 2 miles north of the City of Claremont and 2.5 miles northeasterly of the City of La Verne in the Southern foothills of the San Gabriel Mountains adjacent to the Pomona Valley, as shown in Figure 9-18.

Located on the Live Oak Creek, approximately 0.9 mile north of West Baseline Road, the dam and reservoir are the initial flood control component in Live Oak Canyon. The reservoir is short and narrow with a length of approximately 0.2 miles and an average width of 200 feet, with relatively flat side slopes.

The side slopes of the reservoir and canyon downstream of dam are heavily vegetated with trees and brush. Downstream of the dam, the watercourse passes across several private properties. Figure 9-19 shows the topography of Live Oak Reservoir

Figure 9-18 Live Oak Reservoir Vicinity Map

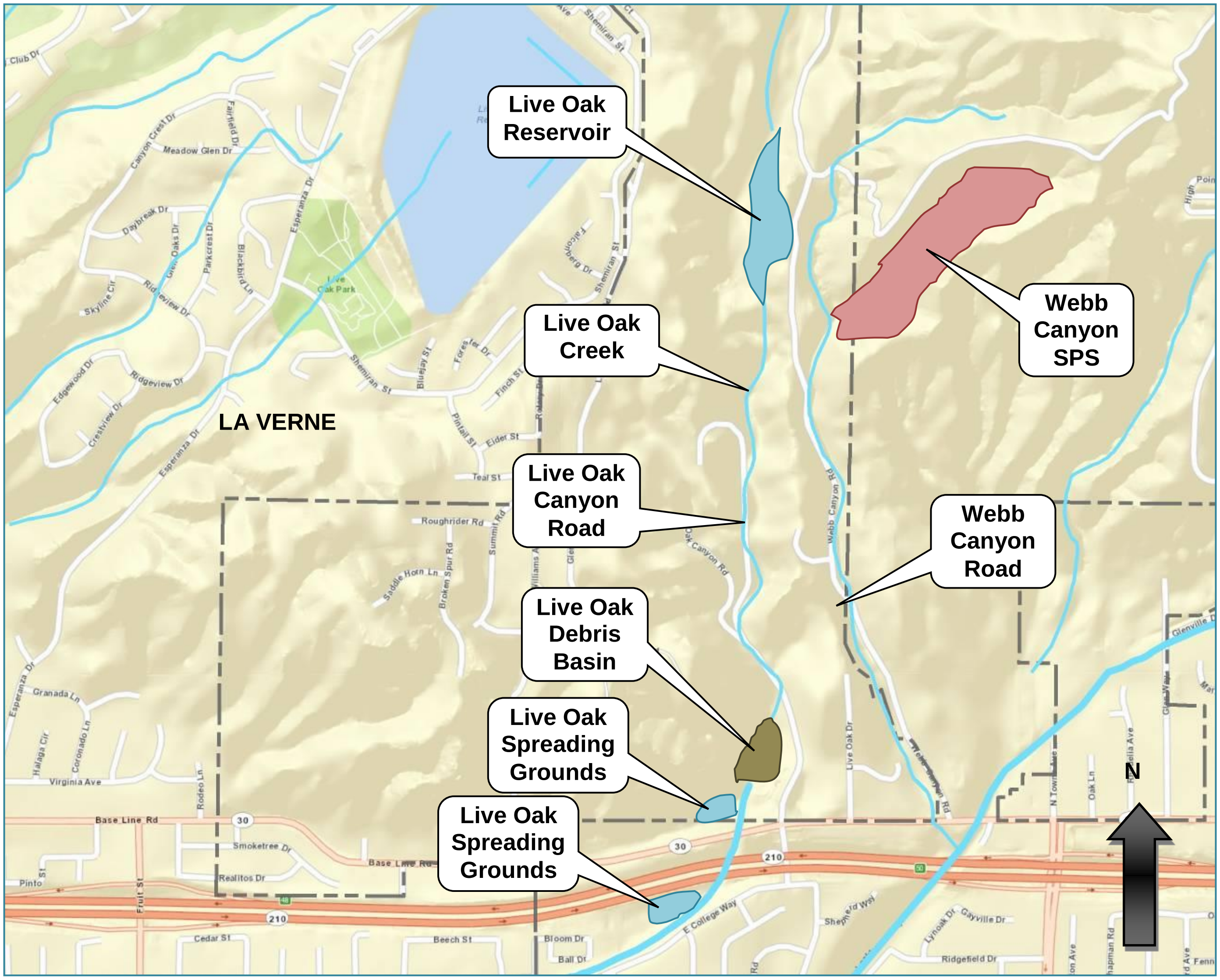


Figure 9-19 Live Oak Reservoir Topography

9.3.1.2 <u>Access</u>

Access to the dam and reservoir is limited to Webb Canyon Road. The road can accommodate two-way traffic for its entire length. On the east abutment of the dam, there is unpaved access into the body of the reservoir.

Live Oak Canyon Road approaches the west abutment of the dam, but there is only a foot trail connecting the Live Oak Canyon Road to the dam. Additionally, Live Oak Canyon Road is very narrow and sinuous. Figure 9-20 shows the dam vicinity and access roads of Live Oak Reservoir.

Figure 9-20 Live Oak Dam Access

9.3.1.3 Dam Outlets

Live Oak Dam is equipped with 2 valves and a 36-inch by 42-inch sluice gate.

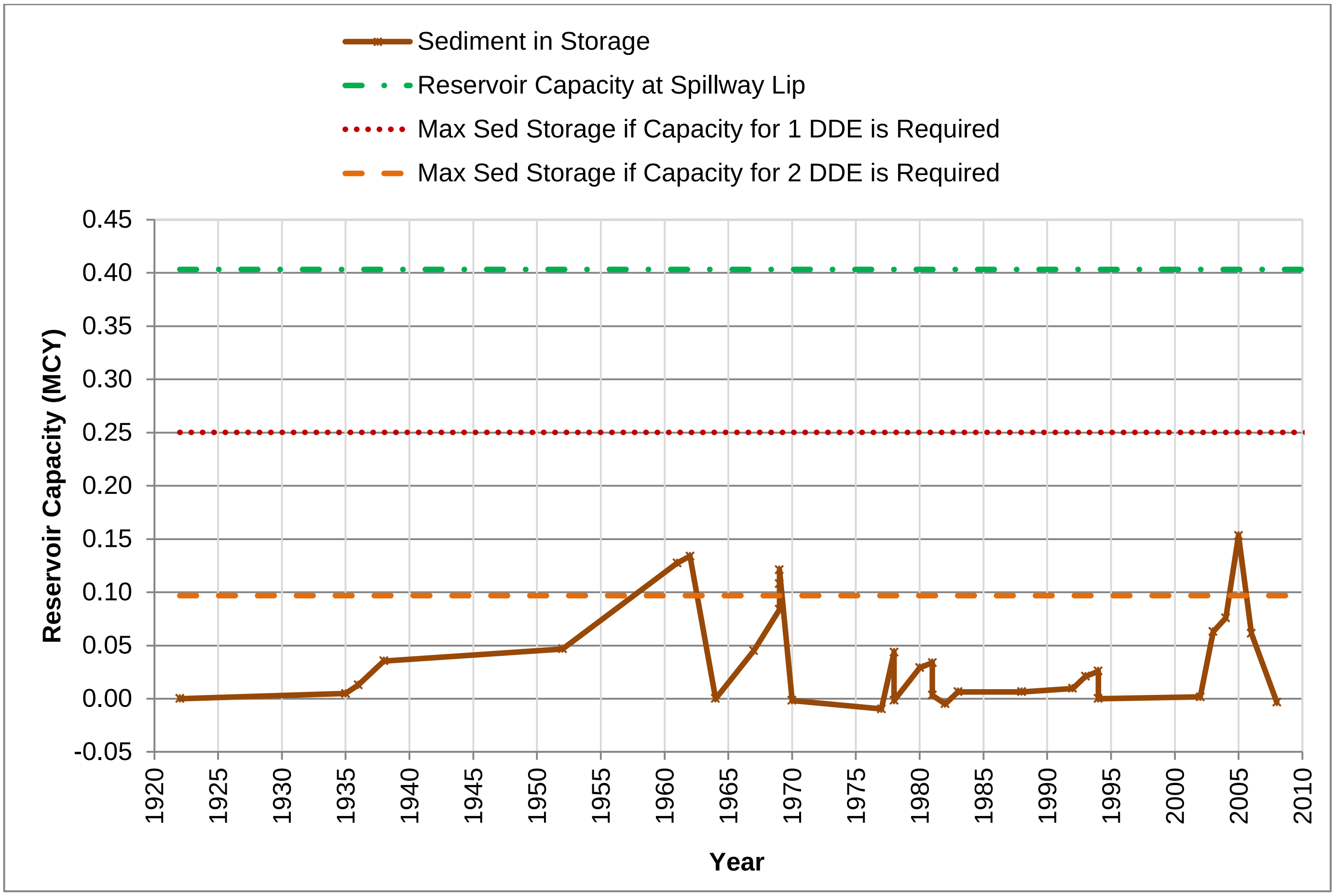
9.3.1.4 Downstream Flood Control and Water Conservation System Components

Water that passes through Live Oak Dam travels along a watercourse through private properties, and then flows through the Live Oak Debris Basin, which is adjacent to the Live Oak Spreading Grounds. Live Oak Wash eventually discharges into the Puddingstone Reservoir, which is tributary to Walnut Creek and then the San Gabriel River.

9.3.1.5 Sediment Deposition and Removal History

Figure 9-21 shows the approximate sediment storage in Live Oak Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Live Oak Reservoir on numerous occasions.

Figure 9-21 Graph of Historical Sediment Storage at Live Oak Reservoir



Sediment has been removed 9 times in the 89-year life of the reservoir. Table 9-9 gives a summary of these removals and shows that only excavation has been used to remove sediment from Live Oak Reservoir in the past.

Table 9-9 Summary of Historic Sediment Inflows and Cleanouts – Live Oak Reservoir

Survey Date		Reservoir Capacity (CY)	Quantity Sluiced (CY)	Quantity Excavated (CY)	Sediment Deposited (CY)	Accum. Sediment Production (CY)	Sediment in Storage (CY)
October	1922	403,333	-	-	-	-	-
December	1935	398,493	-	-	4,840	4,840	4,840
March	1936	390,427	-	-	8,067	12,907	12,907
May	1938	367,840	-	-	22,587	35,493	35,493
November	1952	345,253	-	-	11,293	46,787	46,787
December	1961	264,587	-	-	80,667	127,453	127,453
December	1962	258,133	-	-	6,453	133,907	133,907
January	1964	392,040	-	133,907	-	133,907	-
March	1967	346,867	-	-	45,173	179,080	45,173
January	1969	308,147	-	-	38,720	217,800	83,893
February	1969	283,947	-	-	24,200	242,000	108,093
December	1969	271,040	-	-	12,907	254,907	121,000
October	1970	393,653	-	141,973	19,360	274,267	(1,613)
October	1977	401,720	-	8,067	(0)	274,267	(9,680)
March	1978	348,480	-	-	53,240	327,507	43,560
December	1978	393,653	-	46,787	1,613	329,120	(1,613)
March	1980	363,000	-	-	30,653	359,773	29,040
May	1981	358,160	-	-	4,840	364,613	33,880
Septembe	1981	388,813	-	30,653	-	364,613	3,227
Septembe	1982	396,880	-	6,453	(1,613)	363,000	(4,840)
April	1983	385,587	-	-	11,293	374,293	6,453
Septembe	1988	385,587	-	-	-	374,293	6,453
July	1992	382,360	-	-	3,227	377,520	9,680
May	1993	371,067	-	-	11,293	388,813	20,973
August	1994	366,227	-	-	4,840	393,653	25,813
October	1994	392,040	-	25,813	-	393,653	-
December	2002	390,427	-	-	1,613	395,267	1,613
August	2003	329,120	-	-	61,307	456,573	62,920
April	2004	316,213	-	-	12,907	469,480	75,827
May	2005	238,773	-	-	77,440	546,920	153,267
November	2006	330,733	-	88,733	(3,227)	543,693	61,307
November	2008	395,267	-	90,347	25,813	569,507	(3,227)

9.3.2 PLANNING QUANTITY

As described in Section 5, the 20-year planning quantity for sediment inflow into Live Oak Reservoir is 210,000 CY.

9.3.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

9.3.3.1 WEBB SEDIMENT PLACEMENT SITE

Webb SPS could be used as a temporary sediment storage area and the sediment could be gradually transported to a permanent placement site. However, due to the small amount of sediment to be removed combined with the high environmental impacts associated with expanding Webb SPS, this alternative will not be investigated further.

9.3.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, wet removal methods such as sluicing or dredging are not possible as the reservoir is dry during the summer months. Without water, the only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Live Oak Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.3.5 and 9.3.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.3.7.

9.3.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Live Oak Reservoir.

Excavation – Environmental Impacts

Emissions from heavy equipment used during dry exaction will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to dry excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

There is some sensitive vegetation near the back of the reservoir, however, they can be worked around, or if unavoidable, a reservoir plan can be completed to reduce further impacts.

Excavation – Social Impacts

The excavation equipment will increase noise for the residents in the proximity of the excavation site. There are a few residents that overlook the reservoir from the west side and will be visually impacted. There are also many residents on the downstream side of the dam that will be affected.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using dry excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 210,000 CY of sediment would cost approximately $630,000 over a 20-year period.

9.3.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Live Oak Reservoir by means of sluicing, trucking, conveyor belt, and slurry pipeline. Discussion of the removal alternatives was presented in Section 9.3.4. The placement alternatives are presented in 9.3.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.3.7.

9.3.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along Webb Canyon Road. Trucks can access Interstate 210, which is one mile away, via Baseline Road and Towne Avenue.

Trucking – Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking – Social Impacts

The haul route that travels through Webb Canyon Road is in a remote area with only a minimal number of residential properties that use Webb Canyon Road to access their property. The haul route through Baseline Road and Towne Avenue are major roadways and will have minimal impact. The overall air quality, noise, and traffic impact is expected to be minimal.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir and no implementability issues are anticipated. Double dump trucks should be used for this operation since Webb Canyon Road is very accessible with minimal social impact and the remaining haul route is through major roadways.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 210,000 CY.

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 17 miles away (one way), the total cost for the 20-year period for 210,000 CY of transport is approximately $2.1 million.

9.3.5.2 CONVEYOR BELTS

A conveyor system is not practical at this location. Webb SPS is the only accessible staging location, but is less than 0.5 miles from the reservoir, with minimal increased impact for trucks to drive directly to the reservoir.

9.3.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Live Oak Reservoir.

9.3.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Live Oak Reservoir at a distance of 29 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.3.6.2 QUARRIES WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale area (17 miles) and Claremont area (5 miles) which could accept material from Live Oak Reservoir, but require a tipping fee as discussed in Section 6.5.2.

It is assumed that one third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one third of the material that will be placed at the pit will be subject to a tipping fee.

9.3.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities under the management of the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Live Oak Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material could be placed at the acquired quarry.

9.3.6.4 SEDIMENT PLACEMENT SITES

Webb SPS is approximately 0.5 miles away from Live Oak Dam along Webb Canyon Road. The SPS has approximately 510,000 CY of remaining capacity and 304,000 CY of deposited sediment. The existing material at the SPS could be removed and gradually transported out in order to restore the capacity at Webb SPS. In order to maintain capacity and create long term solutions, this analysis will assume that Webb SPS will not be available.

9.3.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.3.7.1 COMBINED ALTERNATIVE 1:

EXCAVATION > TRUCKS > IRWINDALE PITS

Excavation and trucking to an Irwindale Pit is the only viable option for Live Oak Reservoir, as shown in Figure 9-22. A cleanout is expected to be performed twice during the 20-year period to remove the expected 20-year quantity.

The estimated cost to place the material to an existing pit in Irwindale is approximately $3.0 million, as shown below in Table 9-10. It is assumed that only one-third of the material will be subject to a tipping fee or acquisition fee as discussed in Section 9.4.6.

Figure 9-22 Live Oak Reservoir Management Alternative

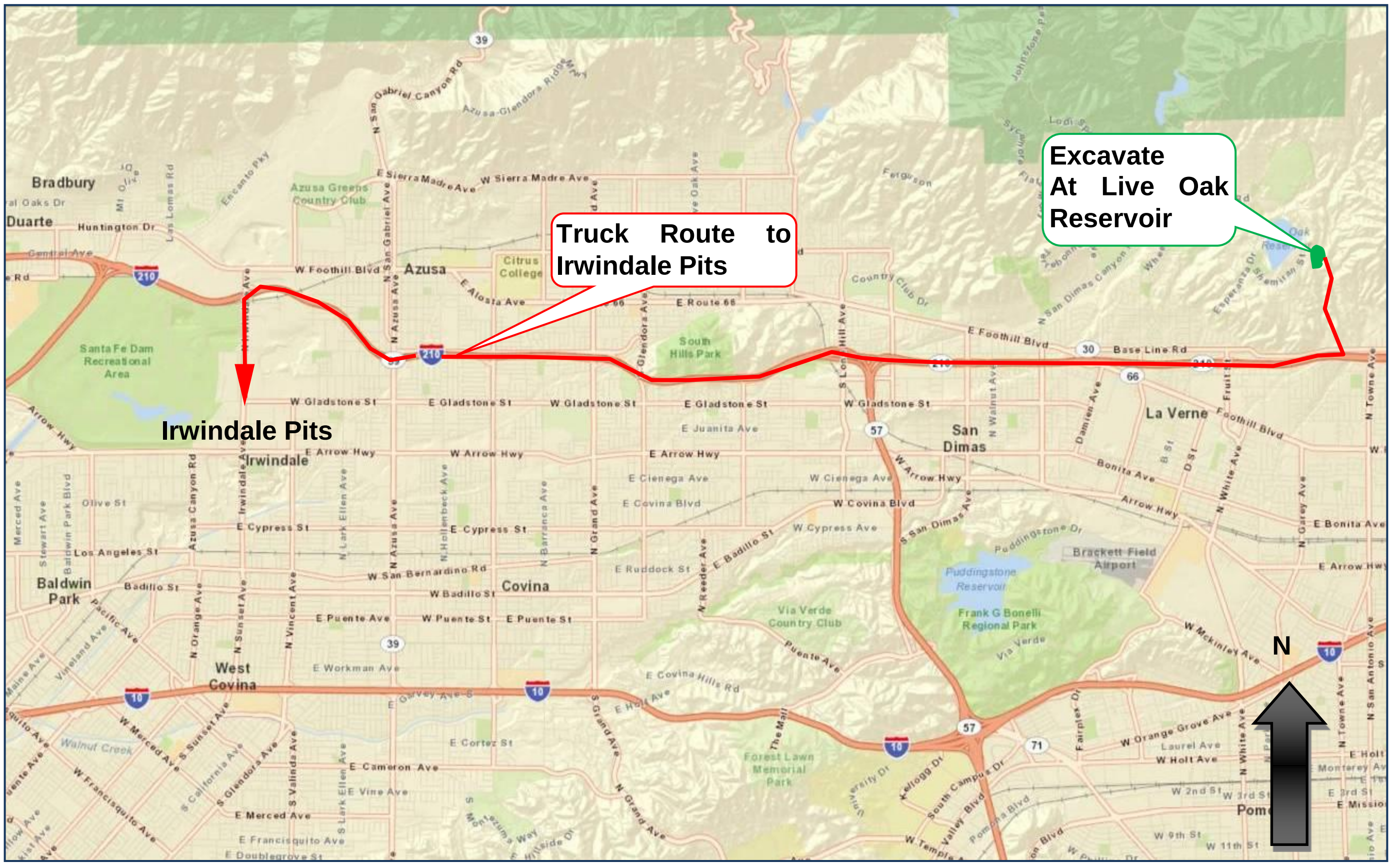


Table 9-10 Live Oak Reservoir Management Alternative – Cost Estimate

Activity	Amount (CY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Excavation at Live Oak Reservoir	210,000		$ 3.00	CY	$ 0.6
Double Dump Truck from Reservoir to Irwindale Pit	210,000	34	$ 0.30	CY-MI	$ 2.1
Pit Placement Fee	210,000		$ 3.00 - 7.00	CY	$ 0.2 - 0.5
				Total	**$ 3.0**

9.3.8 SUMMARY

Over the next 20 years, 210,000 CY of sediment is planned to be removed from Live Oak Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Live Oak Reservoir. Table 9-11 shows the impacts of this alternative.

Table 9-11 Live Oak Reservoir Summary Table

Alternative		Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality(a)	Traffic	Visual	Noise	Special Permit/Agreement Required(b)	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	210,000				●	●	◑	◑		Yes	2	3.0
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

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9.4 PUDDINGSTONE DIVERSION RESERVOIR

9.4.1 BACKGROUND

Puddingstone Diversion Dam, shown in Figure 9-23, is an earth embankment dam with a 4-inch concrete facing slab, which was constructed in 1928 by the Flood Control District and functions as a flood risk management, water conservation, and water diversion facility. With a drainage area of 3.67 square miles, Puddingstone Diversion Dam had an original storage capacity of 239,000 CY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-23 Puddingstone Diversion Dam

9.4.1.1 LOCATION

The dam and adjoining reservoir are located on the San Dimas Creek, approximately 2.1 miles northeast of the City of San Dimas, as shown in Figure 9-24. Located downstream of the San Dimas Reservoir, Puddingstone Diversion Dam is the final flood control component in San Dimas Canyon before water is discharged into a concrete channel. The reservoir is short and narrow, with a length of approximately 1,500 feet and an average width of 400 feet, with relatively flat sided slopes. Figure 9-25 shows the topography of Puddingstone Diversion Reservoir.

Figure 9-24 Puddingstone Diversion Reservoir Vicinity Map

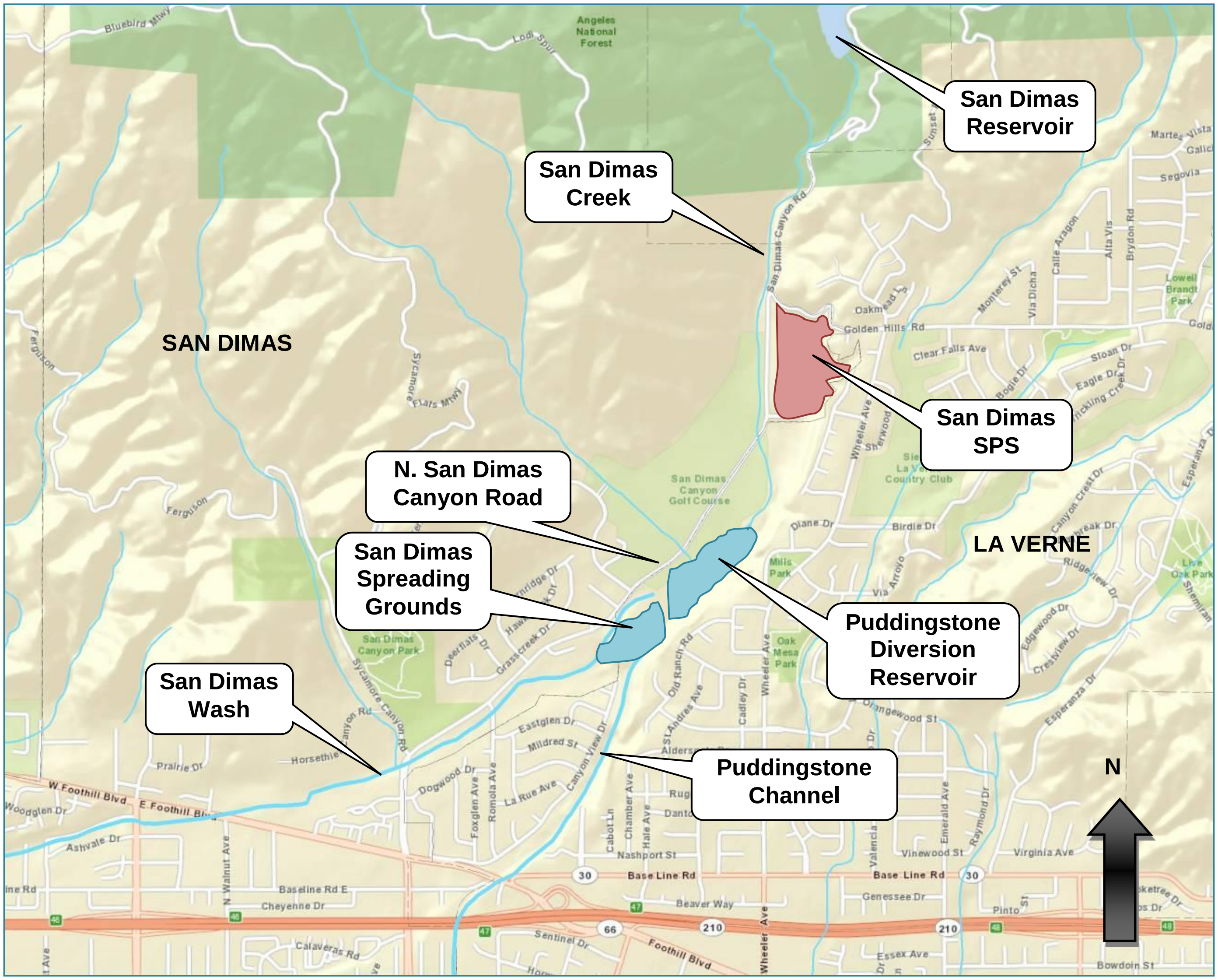


Figure 9-25 Puddingstone Diversion Reservoir Topography

9.4.1.2 ACCESS

Access to the dam and reservoir is limited to North San Dimas Canyon Road. The road can accommodate two-way traffic for its entire length. There is a single-lane, unpaved, access road to the body of the reservoir from North San Dimas Canyon Road. Figure 9-26 shows the dam vicinity and access roads of Puddingstone Diversion Reservoir.

Figure 9-26 Puddingstone Reservoir Access

9.4.1.3 <u>DAM OUTLETS</u>

Puddingstone Diversion Dam is equipped with four radial gates and a 24-inch gate valve.

9.4.1.4 <u>DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS</u>

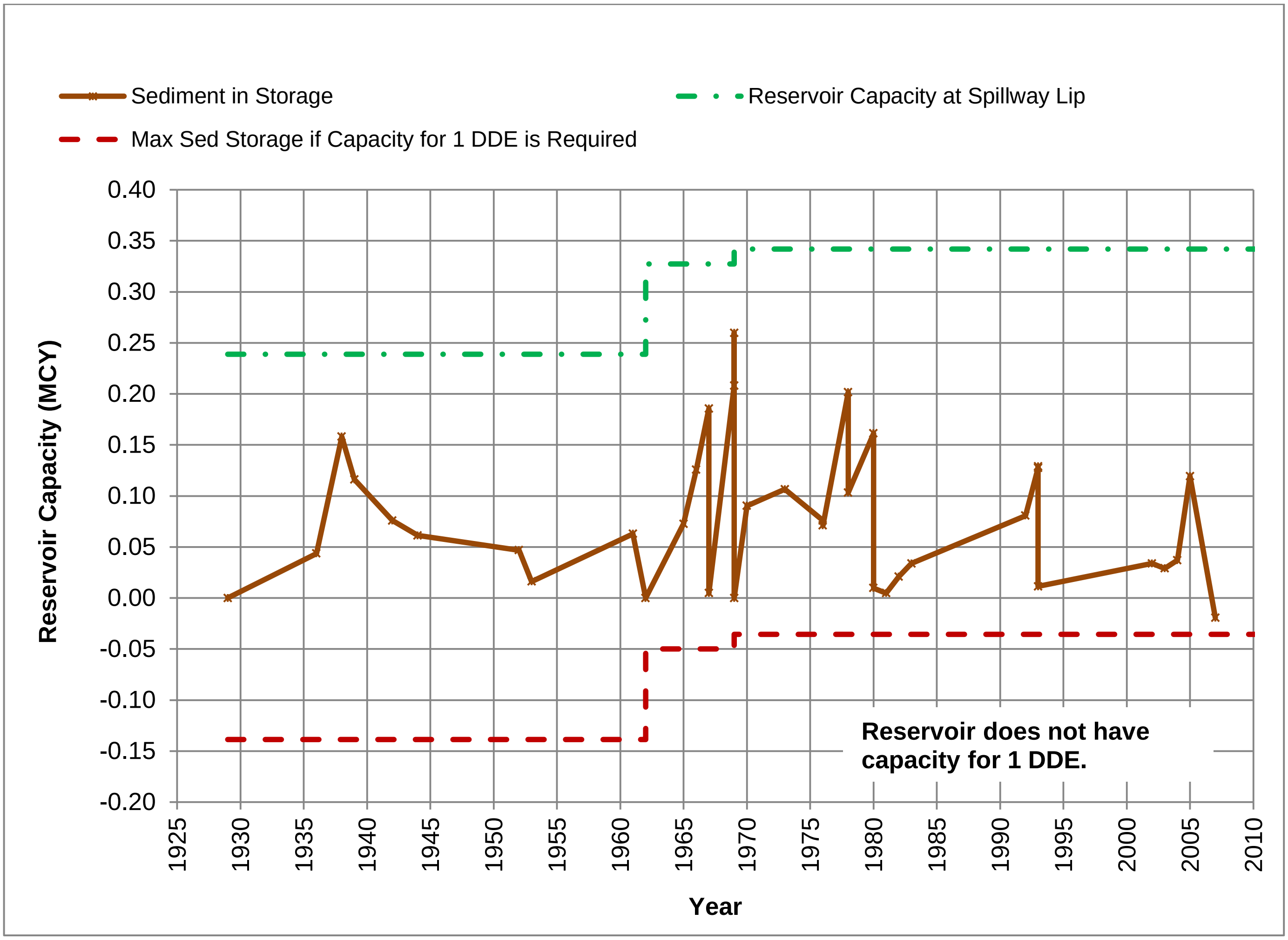
Puddingstone Diversion Reservoir receives and stores flow from San Dimas Wash. Once in the reservoir, up to 3,000 cubic feet per second can be sent to Puddingstone Diversion Channel, which eventually discharges to Puddingstone Dam. It is considered a diversion because flows to Puddingstone Diversion Dam are not tributary to Puddingstone Dam. The flow is diverted to alleviate San Dimas Wash, which does not have the capacity to handle the entire capital storm event from the upstream watershed. All flows over the dam spillway flow into San Dimas Wash. A 24-inch gate valve can be opened to allow the flows into the San Dimas Spreading Grounds, which are immediately downstream of the dam along San Dimas Wash. Puddingstone Diversion Dam is tributary to the San Gabriel River watershed.

9.4.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

The main purpose of Puddingstone Diversion Dam is to divert the flow to Puddingstone Dam to alleviate San Dimas Wash. Sediment storage is an additional side benefit due to the diversion.

Figure 9-27 shows the approximate sediment storage in Puddingstone Diversion Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. However, the graph shows that Puddingstone Diversion does not have enough capacity for even one DDE. The inability to capture a DDE is not a major concern for this reservoir due to the fact that the upstream San Dimas Dam captures most of the sediment from the undeveloped watershed and the reservoir's main purpose is flood diversion.

Figure 9-27 Graph of Historical Sediment Storage at Puddingstone Diversion Reservoir



Sediment has been removed 16 times in the 82-year life of the reservoir. Table 9-12 gives a summary of these removals and shows that only dry excavation has been used to remove sediment from Puddingstone Diversion Reservoir in the past.

Table 9-12 Summary of Historic Sediment Inflows and Cleanouts – Puddingstone Diversion Dam

Survey Date		Reservoir Capacity (MCY)	Quantity Sluiced (<CY)	Quantity Excavated (MCY)	Sediment Deposited (MCY)	Accumulated Sediment Production (MCY)	Sediment in Storage (MCY)
October	1929	0.24	-	-	-	-	-
June	1936	0.20	-	-	0.04	0.04	0.04
March	1938	0.08	-	-	0.11	0.16	0.16
November	1939	0.12	-	0.04	0.00	0.16	0.12
October	1942	0.16	-	0.04	-	0.16	0.08
September	1944	0.18	-	0.06	0.04	0.20	0.06
February	1952	0.19	-	0.01	-	0.20	0.05
September	1953	0.22	-	0.04	0.01	0.21	0.02
November	1961	0.18	-	-	0.05	0.26	0.06
October	1962	0.33	-	0.18	0.03	0.29	-
October	1965	0.25	-	-	0.07	0.36	0.07
May	1966	0.20	-	-	0.05	0.41	0.13
March	1967	0.14	-	-	0.06	0.47	0.19
October	1967	0.32	-	0.18	-	0.47	0.00
January	1969	0.12	-	-	0.20	0.68	0.21
March	1969	0.07	-	-	0.05	0.73	0.26
October	1969	0.34	-	0.27	-	0.73	-
November	1970	0.25	-	-	0.09	0.82	0.09
June	1973	0.24	-	-	0.02	0.84	0.11
January	1976	0.27	-	0.03	-	0.84	0.08
November	1976	0.27	-	0.00	-	0.84	0.07
March	1978	0.14	-	-	0.13	0.97	0.20
November	1978	0.24	-	0.10	-	0.97	0.10
March	1980	0.18	-	-	0.06	1.02	0.16
November	1980	0.33	-	0.15	-	1.02	0.01
August	1981	0.34	-	0.00	-	1.02	0.00
September	1982	0.32	-	-	0.02	1.04	0.02
April	1983	0.31	-	-	0.01	1.05	0.03
June	1992	0.26	-	-	0.05	1.10	0.08
January	1993	0.21	-	-	0.05	1.15	0.13
March	1993	0.21	-	-	0.00	1.15	0.13
October	1993	0.33	-	0.12	-	1.15	0.01
November	2002	0.31	-	-	0.02	1.17	0.03
October	2003	0.31	-	0.14	0.13	1.30	0.03
April	2004	0.30	-	-	0.01	1.31	0.04
May	2005	0.22	-	-	0.08	1.39	0.12
October	2007	0.36	-	0.14	-	1.39	(0.02)

Notes: 1. Excavation created an additional 89,000 CY of capacity
2. Excavation created an additional 14,520 CY of capacity

9.4.2 PLANNING QUANTITY

As described in Section 5.3, the 20-year planning quantity for sediment inflow into Puddingstone Diversion Reservoir is 0.6 MCY.

9.4.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

9.4.3.1 SAN DIMAS SPS

The San Dimas SPS, as shown in Figure 9-28, is currently owned by the Flood Control District and was originally developed for the receipt of sediment form San Dimas and Puddingstone Diversion Reservoirs. It is located 0.7 miles north, upstream of the reservoir along North San Dimas Canyon Road.

Figure 9-28 San Dimas SPS Looking Southwest

San Dimas SPS - Environmental Impacts

If the open spaces that have been cleared of vegetation are used as a staging or temporary sediment storage area then there will be minimal habitat impact. Air quality will be minimally impacted due to equipment used when compacting and spreading the sediment.

San Dimas SPS - Social Impacts

Visual and noise impacts may affect local residents directly on the east side of the SPS, and recreational users at the golf course directly to the west.

San Dimas SPS – Implementabilty

San Dimas SPS has been used to place sediment from past Puddingstone Diversion Reservoir cleanouts in the past. Environmental permits would be required for any modifications to the SPS.

San Dimas SPS – Performance

The San Dimas SPS is an active facility with an area of approximately 25 acres and a total remaining capacity of approximately 201,000 CY (about 50 percent of its total capacity). The existing material at the SPS can be excavated, gradually transported out, and placed at an alternative placement site to restore capacity at the SPS and be used for future cleanout projects.

San Dimas SPS – Cost

There is no additional cost to use San Dimas SPS as it is already owned by the Flood Control District. However, if the SPS is used to transition between different transportation methods, it will incur additional costs to manage and spread the sediment at the SPS ($2/CY) and place the material in trucks ($3/CY).

9.4.4 REMOVAL

Even though Puddingstone Diversion Dam has a small watershed and limited inflows during the dry season, flows could be discharged from the upstream San Dimas Dam in order to provide water to sluice or dredge sediment. However, due to the fact that there are no downstream areas for potential staging or temporary storage, wet removal methods such as sluicing or dredging are not possible.

The following section discusses the impacts and costs of sediment removal at Puddingstone Diversion Reservoir by means of dry excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.4.5 and 9.4.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.4.7.

9.4.4.1 EXCAVATION

Excavation has been the only method for sediment removal used at Puddingstone Diversion Reservoir, as it is usually dry during the summer months due to the limited inflow.

Excavation - Environmental Impacts

Emissions from heavy equipment used during exaction will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

Sensitive wildlife inhabits the area and procedures would need to be put in place to protect the sensitive species.

Excavation - Social Impacts

The excavation equipment will increase noise for the residents in the proximity of the excavation site. The south side of the reservoir is bordered by many residential properties while the San Dimas Canyon Golf Course borders the north side of the reservoir.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation: however, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 0.6 MCY of sediment would cost approximately $1.8 million over a 20-year period.

9.4.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Puddingstone Diversion Reservoir by trucking. Discussion of the removal alternatives was presented in Section 9.4.4. The placement alternatives are presented in 9.4.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.4.7.

9.4.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along North San Dimas Canyon Road, which can access Interstate 210.

Trucking - Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would reduce air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact the traffic and noise for the residents with properties near the proximity of the haul route. However, residential properties do not immediately face North San Dimas Canyon Road.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir. Double dump trucks can be used for this operation since the haul route mainly uses major roadways and the reservoir is very accessible.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 16 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 0.6 MCY

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 11 miles away (one way), the total cost for the 20-year period for 0.6 MCY of transport is approximately $4 million.

9.4.5.2 CONVEYOR BELTS

A conveyor system can be combined with excavation in order to transport the material 0.7 miles upstream to the San Dimas SPS. One option is to place the conveyor system on the North San Dimas Canyon Road shoulder to the SPS. Another option is to place the conveyor inside San Dimas Creek to the SPS.

Conveyor Belts - Environmental Impacts

A conveyor system would have very minimal air quality impacts unless generators are used as discussed in Section 6. No environmental impacts are expected if the conveyor was placed on the roadway. If the conveyor was placed inside San Dimas Creek, it would impact habitat and sensitive species along the creek.

Conveyor Belts - Social Impact

Use of the conveyor belt system may result in visual intrusion issues to the residents and recreational users of the golf course.

If the conveyor was placed along North San Dimas Canyon Road, it would significantly impact recreational users of the golf course as golf carts need to cross San Dimas Canyon Road in order to access the south side of the course. In addition, residents who live on Caballo Ranch Road, just south of the SPS may be subject to traffic and access impacts.

If the conveyor was placed inside the creek, the conveyor would need to cross North San Dimas Canyon Road to access the SPS, which could impact traffic along the roadway.

Conveyor Belts – Implementability

Due to North San Dimas Canyon Road being a residential street, an overhead conveyor system will be required at driveways and intersections, as residents may not be able to access their properties and recreational users of the golf course may be impacted due to the ground level conveyor system. Additional right-of-way and use agreements may be required to implement conveyor systems.

If the conveyor was placed inside San Dimas Creek, it would require environmental permitting.

Conveyor Belts – Performance

Assuming a conveyor system can operate at 500 CY per hour, a conveyor operation would be required every 10 years to remove the total 20-year quantity of 0.6 MCY.

Conveyor Belts – Cost

Conveyor costs are approximately $800/LF for installation and operating costs. The cost for 0.7 miles of conveyor would be approximately $2.9 million.

9.4.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Puddingstone Diversion Reservoir.

9.4.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Live Oak Reservoir at a distance of 27 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.4.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Irwindale area (11 miles) and the Claremont area (7 miles), which could accept material from Puddingstone Diversion Dam as discussed in Section 6.5.2.

It is assumed that 10 percent of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining 80 percent of the material that will be placed at the pit will be subject to a tipping fee.

9.4.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities under the jurisdiction of the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Puddingstone Diversion Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.4.6.4 SEDIMENT PLACEMENT SITES

San Dimas SPS is the closest sediment placement site to Puddingstone Diversion Reservoir; it is approximately 0.7 miles north of the reservoir along North San Dimas Canyon Road. San Dimas SPS is also close to San Dimas Reservoir, which is approximately a mile north of the SPS along North San Dimas Canyon Road. San Dimas SPS has total remaining capacity of approximately 200,000 CY. However, it is proposed that San Dimas SPS not be used as a sediment placement alternative for sediment from Puddingstone Diversion Reservoir. Because the planning quantity for San Dimas Reservoir is much larger than the planning quantity for Puddingstone Diversion Reservoir (2.1 MCY versus 0.6 MCY) and San Dimas Reservoir is farther from alternative sediment placement locations, it seems best to use San Dimas SPS for San Dimas Reservoir. In any case, this Strategic Plan proposes to reserve the capacity at San Dimas SPS for emergency purposes; this is stated in Section 8.5.6.4.

9.4.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.4.7.1 COMBINED ALTERNATIVE 1: EXCAVATION > TRUCKING > IRWINDALE PITS

This combined alternative would involve excavating and trucking sediment from Puddingstone Reservoir to a pit in the Irwindale area, as shown in Figure 9-29. A cleanout is expected to be performed every 10 years during the 20-year period to remove the expected 20-year quantity. The estimated cost for this alternative is approximately $7-9 million, as shown below in Table 9-13. It is assumed that 80 percent of the material would be subject to a tipping or acquisition fee as discussed in Section 9.4.6.

Figure 9-29 Puddingstone Diversion Reservoir Management Alternative

Table 9-13 Puddingstone Diversion Management Alternative - Cost Estimate

Activity	Amount (MCY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ millions)
Excavation at Puddingstone Diversion Reservoir			$ 3.00	CY	$ 1.8
Double Dump Truck from Reservoir to Irwindale Pits	0.6	22	$ 0.30	CY-MI	$ 4.1
Placement at Pits			$ 3.00-7.00	CY	$ 1.4 - 3.4
				Total	**$ 7 – 9**

Given the minimal social impacts associated with trucking sediment between Puddingstone Diversion Reservoir and Irwindale Reservoir, there seems to be no major advantage to installing a conveyor system to transport sediment from Puddingstone Diversion Reservoir to San Dimas SPS so that sediment could be trucked out of the area gradually. Therefore, that combined alternative is not included in this Strategic Plan.

9.4.8 SUMMARY

Over the next 20 years, 0.6 MCY of sediment is planned to be removed for Puddingstone Diversion Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that excavation and trucking continue as the main removal method for Puddingstone Diversion Reservoir. Table 9-14 shows the impacts of this alternative.

Table 9-14 - Puddingstone Diversion Reservoir Summary Table

			Environmental				Social			Implementability	Performance		Cost
Alternative		**Quantity Removed (MCY)**	Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
	Excavate		◑		○	◑		○	○				
1	Trucks	0.6				●	●	◑	◑		Yes	2	7-9
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes:
(a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.

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9.5 THOMPSON CREEK RESERVOIR

9.5.1 BACKGROUND

Thompson Creek Dam, shown in Figure 9-30, is a concrete-core, gravel-fill dam, which was constructed in 1928 by the Flood Control District and functions as a flood risk management and water conservation facility. With a drainage area of 3.51 square miles, Thompson Creek Dam had an original storage capacity of 1.0 MCY. Water impounded during the storm season behind the dam is gradually released and diverted into the downstream spreading facilities to recharge groundwater.

Figure 9-30 Thompson Creek Dam

9.5.1.1 LOCATION

The dam and adjoining reservoir are located on Thompson Creek, approximately 3 miles north of the City of Claremont, as shown in Figure 9-31.

Figure 9-31 Thompson Creek Reservoir Vicinity Map

Thompson Creek Reservoir and Dam are the initial flood control components in Thompson Creek. The reservoir is short and broad, with a length of approximately 500 feet and an average width of 600 feet, with relatively flat-sided slopes around the reservoir. Figure 9-32 shows the topography of Thompson Reservoir.

Figure 9-32 Thompson Creek Reservoir Topography

9.5.1.2 <u>ACCESS</u>

Access to the dam is available off North Mills Avenue, which runs past the east abutment of the dam. An unpaved road provides access to the west side of the reservoir from North Mills Avenue. Beyond the top of the dam, North Mills Ave extends approximately 0.2 mile and then changes to the unpaved Coble Canyon Mountain Way.

There is also unpaved access to the toe and top of the dam from North Mills Avenue or Thompson Creek Channel maintenance access road. Figure 9-33 shows the dam vicinity and access roads of Thompson Reservoir.

Figure 9-33 Thompson Creek Access

9.5.1.3 DAM OUTLETS

Thompson Creek Dam is equipped with four slide gates that vary in dimension.

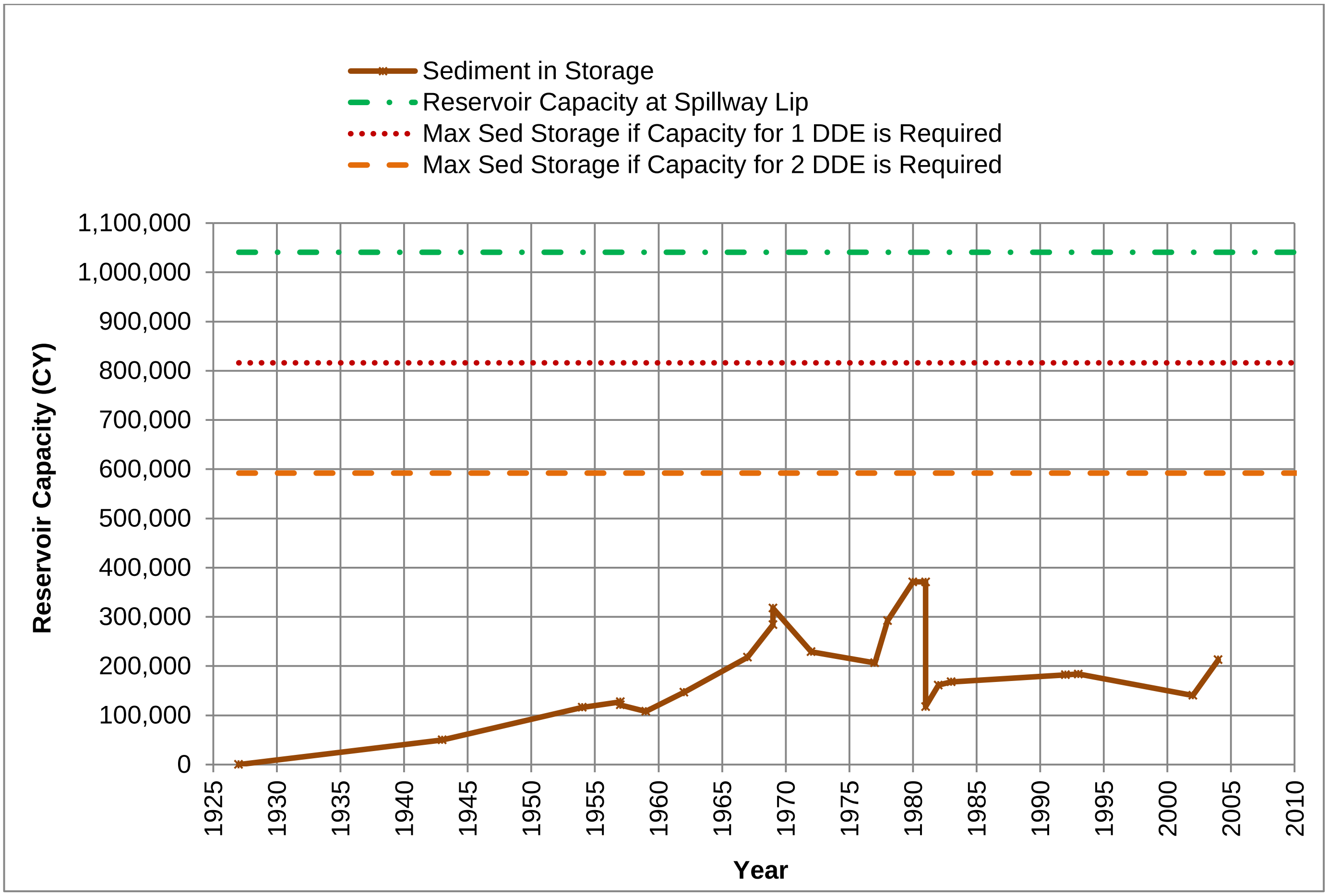
9.5.1.4 DOWNSTREAM FLOOD CONTROL AND WATER CONSERVATION SYSTEM COMPONENTS

Water that passes through Thompson Dam travels along Thompson Creek, which serves the Thompson Creek Spreading Grounds, which are immediately downstream of the dam. Thompson Creek flows continue on to San Jose Creek, which eventually discharge into the San Gabriel River.

9.5.1.5 SEDIMENT DEPOSITION AND REMOVAL HISTORY

Figure 9-34 shows the approximate sediment storage in Thompson Creek Reservoir. It is the Flood Control District's practice to retain enough storage capacity within a reservoir for two DDEs, which are calculated and determined for each specific reservoir. For reference purposes, Table 9-15 shows the original reservoir capacity at spillway lip and the maximum sediment storage that allows for the storage of both one and two incoming DDEs. The graph shows that the Flood Control District has reduced the quantity of sediment in storage at Thompson Creek Reservoir on numerous occasions.

Figure 9-34 Graph of Historical Sediment Storage at Thompson Creek Reservoir



Sediment has been removed 9 times in the 84-year life of the reservoir. Table 9-15 gives a summary of these removals and shows that only excavation has been used to remove sediment from Thompson Creek Reservoir in the past.

Table 9-15 Summary of Historic Sediment Inflows and Cleanouts – Thompson Creek Reservoir

Date		Reservoir Capacity (CY)	Quantity Sluiced (CY)	Quantity Excavated (CY)	Sediment Deposited (CY)	Accum. Sediment Production (CY)	Sediment in Storage (CY)
October	1927	1,040,598	0	0	0	0	0
January	1943	990,585	0	0	50,013	50,013	50,013
September	1954	924,438	0	3,227	69,373	119,386	116,160
January	1957	913,145	0	8,067	19,360	138,746	127,453
June	1957	919,598	0	6,453	0	138,746	121,000
December	1959	932,505	0	12,907	0	138,746	108,093
July	1962	893,785	0	0	38,720	177,466	146,813
February	1967	822,798	0	0	70,987	248,453	217,800
January	1969	756,652	0	0	66,147	314,599	283,946
February	1969	722,772	0	0	33,880	348,479	317,826
December	1972	811,505	0	88,733	0	348,479	229,093
November	1977	834,092	0	22,587	0	348,479	206,506
August	1978	748,585	0	0	85,506	433,986	292,013
March	1980	669,532	0	9,680	88,733	522,719	371,066
June	1981	672,759	0	0	0	522,719	371,066
October	1981	926,051	0	253,293	0	522,719	117,773
September	1982	882,492	0	0	43,560	566,279	161,333
April	1983	876,038	0	0	6,453	572,732	167,786
June	1992	861,518	0	0	14,520	587,252	182,306
June	1993	859,905	0	0	1,613	588,865	183,920
February	2002	903,465	0	43,560	0	588,865	140,360
June	2004	830,865	0	0	72,600	661,465	212,960

9.5.2 PLANNING QUANTITY

As described in Section 5.3, the 20-year planning quantity for sediment inflow into Thompson Reservoir is 260,000 CY.

9.5.3 POTENTIAL STAGING AND TEMPORARY SEDIMENT STORAGE AREAS

There are no downstream areas available for a potential staging or temporary sediment storage area.

9.5.4 REMOVAL

Due to the small watershed and limited inflows during the dry season, in addition to the lack of a staging or temporary storage area, wet removal methods such as sluicing or dredging are not possible as the reservoir is dry during the summer months. Without water, the only practical means of removing sediment from debris basins is conventional excavation.

The following section discusses the impacts and costs of sediment removal at Thompson Creek Reservoir by means of excavation. Discussion of the transportation and placement alternatives is presented in Sections 9.5.5 and 9.5.6, respectively. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.5.7.

9.5.4.1 EXCAVATION

Excavation has been the primary method for sediment removal used at Thompson Creek Reservoir, as it is usually dry during the summer months due to limited inflows.

Excavation - Environmental Impacts

Emissions from heavy equipment used during excavation will impact air quality within the proximity of the excavation site.

Excavating the reservoir is not expected to have impact on water quality. As discussed in Section 6, dewatering a reservoir in order to dry excavate it could impact water conservation if the water is released faster than spreading facilities downstream of the reservoir can handle.

Excavation - Social Impacts

Excavation equipment will increase noise for the residents in the proximity of the excavation site. There are a few residential properties on the east side of the dam across the street from North Mills Ave.

Excavation – Implementability

Environmental permits may be required prior to the excavation operation; however, there are no implementability concerns with using excavation as a removal method.

Excavation – Performance

This method has performed well in the past and its ability to be used for sediment removal is not a concern for future cleanouts. For additional performance discussion, refer to Section 6.3.1.

Excavation – Cost

The cost to excavate sediment from a reservoir is approximately $3 per cubic yard. Excavating 260,000 CY of sediment would cost approximately $0.8 million over a 20-year period.

9.5.5 TRANSPORTATION

The following section discusses the impacts and costs of transporting sediment removed from Thompson Creek Reservoir by means of trucking. Discussion of the removal alternatives was presented in Section 9.5.4. The placement alternatives are presented in 9.5.6. Combined alternatives that address all phases of the sediment management process are presented and discussed in Section 9.5.7.

9.5.5.1 TRUCKING

Truck access to the dam and the body of the reservoir is available along existing roads. Once out of the reservoir, trucks could use North Mills Road to Interstate 210 via West Baseline Road. The distance to Interstate 210 is approximately 2.4 to 3.4 miles, depending on whether the truck traveled east or west on West Baseline Road.

Trucking – Environmental Impacts

Since existing roads would be used to truck sediment, no particular impacts would be expected on habitat, water quality, or water conservation. Air quality would be impacted due to the truck operations to the residents within proximity of the haul route. Employing low emission trucks would help minimize air quality impacts.

Trucking - Social Impacts

The haul route travels through a residential area and will impact the traffic and noise for the residents with properties near the proximity of the haul route. North Mills Road is also used by residents to access the hiking trail behind Thompson Creek thus the additional truck traffic may impact recreational use.

Trucking – Implementability

Trucking, combined with excavation, has been the primary method to remove sediment from the reservoir. Double dump trucks can be used for this operation since the haul route is through major roadways and the reservoir is very accessible.

Trucking – Performance

Double dump trucks, which have the capacity for approximately 8 CY, can operate for 6 months and transport 800,000 CY of sediment. A cleanout operation can be performed every 10 years and remove the total 20-year quantity of 260,000 CY.

This method has performed well in the past and its ability to be used to transport sediment is not a concern for future cleanouts.

Trucking – Cost

Trucking costs are approximately $0.30/CY-Mile for a double dump truck, and assuming the sediment is taken to a pit in the Irwindale area, which is 12 miles away (one way), the total cost for the 20-year period for 260,000 CY of removal is approximately $1.9 million.

9.5.5.2 CONVEYOR BELTS

A conveyor system would only be feasible if a staging area is available. Since there are no feasible locations nearby, conveyor systems are not a viable transportation method for Thompson Creek Reservoir.

9.5.6 PLACEMENT

This section discusses potential placement alternatives for sediment removed from Thompson Creek Reservoir.

9.5.6.1 LANDFILLS

Scholl Canyon Landfill is the closest landfill to Thompson Creek Reservoir at a distance of 32 miles from the reservoir area. More information regarding the landfill can be found in Section 6.5.1.

9.5.6.2 QUARRY WITH EXISTING OPERATIONS

There are existing operational quarries in the Claremont area (3 miles) or Irwindale area (12 miles) that could accept material from Thompson Creek Reservoir as discussed in Section 6.5.2.

It is assumed that one-third of the material will be high quality material that will be of value to the existing operational quarries. In exchange for this high quality material, it is assumed that the Flood Control District will be allowed to place the same amount of lower quality material in the operational quarry pits. The remaining one-third of the material that will be placed at the pit will be subject to a tipping fee.

9.5.6.3 ACQUIRED QUARRY

As discussed previously, the acquisition of a quarry for placement of sediment from facilities managed by the Flood Control District is being pursued for sediment management. Acquisition of a quarry in the Irwindale area would be most desirable for sediment management operations related to Thompson Creek Reservoir.

It will be assumed that acquiring a quarry could potentially cost the Flood Control District approximately $1 per CY and that placement of sediment would cost $2 per CY.

In order to conserve space in an acquired quarry, the high quality material can still be taken an existing quarry operation where the Flood Control District can place an equivalent volume of lower quality material. The remaining material can be placed at the acquired quarry.

9.5.7 COMBINED SEDIMENT MANAGEMENT ALTERNATIVES

9.5.7.1 COMBINED ALTERNATIVE 1:

EXCAVATION > TRUCKING > IRWINDALE PITS

Excavation and trucking to the Irwindale Pits is the only viable method to remove sediment from Thompson Creek Reservoir, as shown in Figure 9-35. A cleanout is expected to be performed every ten years to remove the expected 20-year quantity. The total cost is estimated to be approximately $3.0-3.5 million, as shown below in Table 9-16. It is assumed that only one third of the material will be subject to a tipping fee or acquisition fee as discussed in Section 9.4.6.

Figure 9-35 Thompson Creek Management Alternative

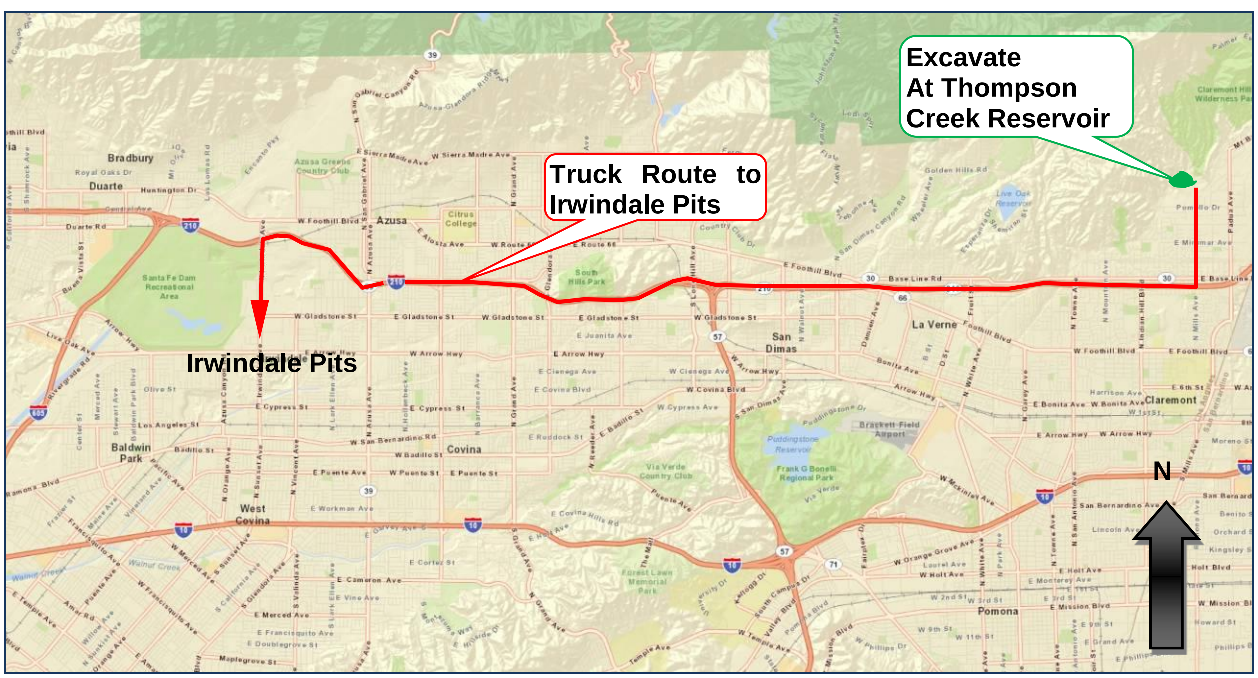


Table 9-16 Thompson Creek Management Alternative - Cost Estimate

	Amount (CY)	Distance (MI)	Unit Cost	Unit	Total Cost ($ Millions)
Activity	260,000		$ 3.00	CY	$ 0.78
Double Dump Truck from Reservoir to Irwindale Pits	260,000	24	$ 0.30	CY-MI	$ 1.87
Pit Placement Fee			$ 3.00 -7.00	CY	$ 0.26 -0.61
				Total	**$3.0 – 3.5**

9.5.8 SUMMARY

Over the next 20 years, 260,000 CY of sediment is planned to be removed from Thompson Creek Reservoir. The only viable option is to excavate the material, transport it via trucks, and place it at a pit in the Irwindale area, which has been the primary removal method in the past. It is recommended that dry excavation and trucking continue as the main removal method for Thompson Creek Reservoir. Table 9-17 shows the impacts of this alternative.

Table 9-17 Thompson Creek Reservoir Summary Table

	Alternative	Quantity Removed (CY)	Environmental				Social			Implementability	Performance		Cost
			Habitat	Water Quality	Groundwater Recharge	Air Quality[a]	Traffic	Visual	Noise	Special Permit/Agreement Required[b]	Previous Experience	# of Operations Required in Next 20 years	$ Millions
1	Excavate	260,000	◑		○	◑		○	○		Yes	2	3.0-3.5
	Trucks					●	●	●	●				
	Irwindale Pits									Yes			

Legend:

●	significant impact
○	possible impact
◑	some impact
	no impact

Notes: (a) Use of low-emission trucks would reduce air quality impacts from significant impact (●) to some impact (◑).
(b) All options require environmental regulatory permit.