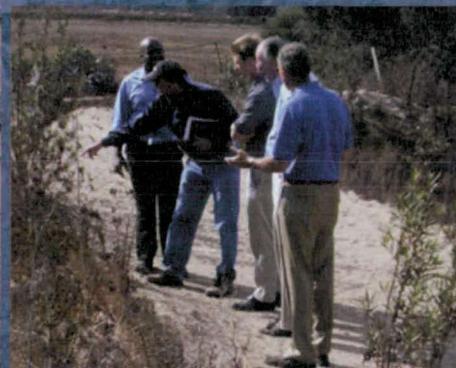


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EXCAVATION AND POST-STORM OBSERVATIONS IN TJ RIVER VALLEY

FINAL REPORT

TASK ORDER #10 DOC ID# CSD-RT-10-URS10-03



APRIL 9, 2011

PROGRAM ASSESSMENT SERVICES
BMP DEVELOPMENT & ENGINEERING
ASSET MANAGEMENT SERVICES
ENVIRONMENTAL ASSESSMENT & PERMITTING
STRATEGIC PLANNING
MONITORING & INVESTIGATIONS



CITY OF SAN DIEGO

URS

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List of Acronyms and Abbreviations

BMP	Best Management Practice
CD	Compact Disk
cfs	Cubic Feet per Second
City	City of San Diego
COPC	Chemical of Potential Concern
ERL	Effects Range - Low
GIS	Geographic Information System
GPS	Global Positioning System
No.	Number
OCPs	Organochlorine Pesticides
PCBs	Polychlorinated Biphenyls
PAHs	Polynuclear Aromatic Hydrocarbons
RWQCB	Regional Water Quality Control Board
SP-SM	Poorly Graded Sand – Sand with Silt
SVOCs	Semi-volatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
URS	URS Corporation Americas
USACE	U.S. Army Corps of Engineers



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SECTION 1 INTRODUCTION

This report has been prepared for the City of San Diego (City), Storm Water Department to document observations during the emergency excavation of sediment and trash from Smuggler's Gulch and the Pilot Channel in the Tijuana River Valley, San Diego, California. The location of the area included in the excavation program is shown on Figure 1-1. Following termination of excavation activities, URS Corporation Americas (URS) personnel additionally observed the condition of the channel following a series of storm events. The conditions of the channel sidewalls following excavation and the condition of the channel following storm events are documented through photographs provided in this report in Appendices A, B and C. Appendix D includes project documentation. The documentation is provided on compact disk (CD) that includes an electronic pdf file of this report, photographs, videos and an interactive map.

1.1 Purpose

The purpose of the documentation was to evaluate the nature and quantity of trash and sediment that had accumulated in Smuggler's Gulch and the Pilot Channel since it was last excavated in 2003. Once excavation was completed, observations were made to document sediment and trash accumulation following storm events (Figure 1-2). This information may be used in the future to estimate trash and sediment accumulation rates.

1.2 Scope of Work

The following scope of work was conducted to accomplish the objectives of this project:

- Periodic observation of excavation activities
- Documentation of the excavation process and nature of the sediment and trash in the sidewalls of the channels through photographs
- Coordination with City staff to perform targeted site visits
- Documentation of sediment and trash accumulations after storm events through photographs
- Preparation of a project report that documents URS' field methods and observations during excavation and following storm events.

1.3 Background

The Smugglers Gulch drainage basin is approximately 3,532 acres (5.52 square miles), situated mostly in Tijuana, Mexico (Figure 1-1). Surface water in the basin flows from south to north across the international border and is calculated to convey peak discharges for the 2-, 10-, 50- and 100-year storms as presented in Table 1-1.



Table 1-1. Smugglers Gulch Peak Discharge Frequency Distribution

Recurrence Interval	2-Year	10-Year	50-Year	100-Year
Peak Discharge (cfs)	653	1,668	3,081	3,626

Source: USACE 2008.

cfs = cubic feet per second

According to a letter submitted by the City to the Regional Water Quality Control Board (RWQCB) in May 2004, the City has maintained an approximately 1,500-foot portion of the Smugglers Gulch Channel north of the Monument Road “Arizona Crossing” since 1999. The channel clearing activities have been conducted under a series of permits filed with a number of regulatory oversight agencies. Information provided below regarding these maintenance activities appears in the May 2004 correspondence between the City and the RWQCB. These maintenance operations have been conducted to facilitate the flow of runoff to the Tijuana River and the Tijuana River Valley area, and to reduce the potential of flooding. The need to remove sediment from Smugglers Gulch channel is evaluated based on an engineering survey of the channel depth compared to the required design depth on as-needed basis.

The removal operations utilized backhoes, excavators, scrapers, and bulldozers to remove trash, tires, sediment, and debris that have accumulated from Disney Bridge to the end of the Pilot Channel during wet weather flows. Grading was limited vertically by design grade and horizontally by established channel banks, and according to established engineering plans. Trash, sediment, debris, and vegetation removed from the Tijuana River Valley were previously disposed at the Miramar Landfill. There are records of the types and volumes of materials excavated and disposed from various locations maintained by the City beginning in 1999, but information specific to each area was not documented until 2001. In that year, the Smugglers Gulch channel was excavated from September 2 - 29. Approximately 10,644 cubic yards of trash, sediment and debris was removed and disposed. In the following year, considerably less sediment was removed from the channel between October 30 and November 1, 2002 and approximately 668 cubic yards of trash, sediment and debris was removed. A flow line was re-established in the Smuggler’s Gulch channel through simple grading in 2003, and no material was removed.

In late 2008, City maintenance staff removed and stockpiled approximately 600 cubic yards sediment from Smuggler’s Gulch between Monument Road and the Disney Bridge. The sediment was placed in a stockpile on City property adjacent to Monument Road, east of the channel. URS conducted sampling of a portion of the remaining stockpile in April 2009 to characterize chemicals of potential concern (COPCs) that may be present in these materials so that possible disposal and/or reuse scenarios could be evaluated (URS, 2010). Grain-size analyses were also conducted to evaluate whether the materials might be suitable for beach replenishment. Based on the size of the remaining stockpile, five samples were collected for the following analyses: Title 22 metals, total petroleum hydrocarbons (TPH), semi-volatile organic compounds [SVOCs, including polynuclear aromatic hydrocarbons (PAHs)], organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs).

The analytical results were compared to human health and ecological risk screening and hazardous waste criteria. Certain metals, PAHs and OCPs were detected in one or more of the samples. None of these



constituents were present at concentrations above human health screening criteria for residential property use. Residential use is the most conservative exposure scenario and as such, unrestricted use of the sediment could be possible. From an ecological perspective, the data were compared to Effects Range-Low (ERLs) values. There was only one compound, 4,4'-DDT that was present in 4 of 5 of the samples analyzed that exceeded its screening level. It was concluded that the presence of this compound may restrict its reuse particularly if it were to be used in the marine environment. Comparison of the data to hazardous waste criteria indicated that the sediment in the stockpile was non-hazardous. As such, it would appear that the sediment is suitable for unrestricted reuse, provided that it were free of trash and other debris. Grain-size analyses revealed that the materials consisted of poorly graded sand with silt (SP-SM). Based on the grain-size distribution, these materials could be suitable for beach replenishment, considering the characteristics of a receiving location. It was concluded that the sand may have other possible beneficial uses since it does not contain considerable fines.



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LEGEND

- Approximate Path of Channel Excavated by City
- Approximate Path of Channel Cleared by City
- U.S./Mexico Border

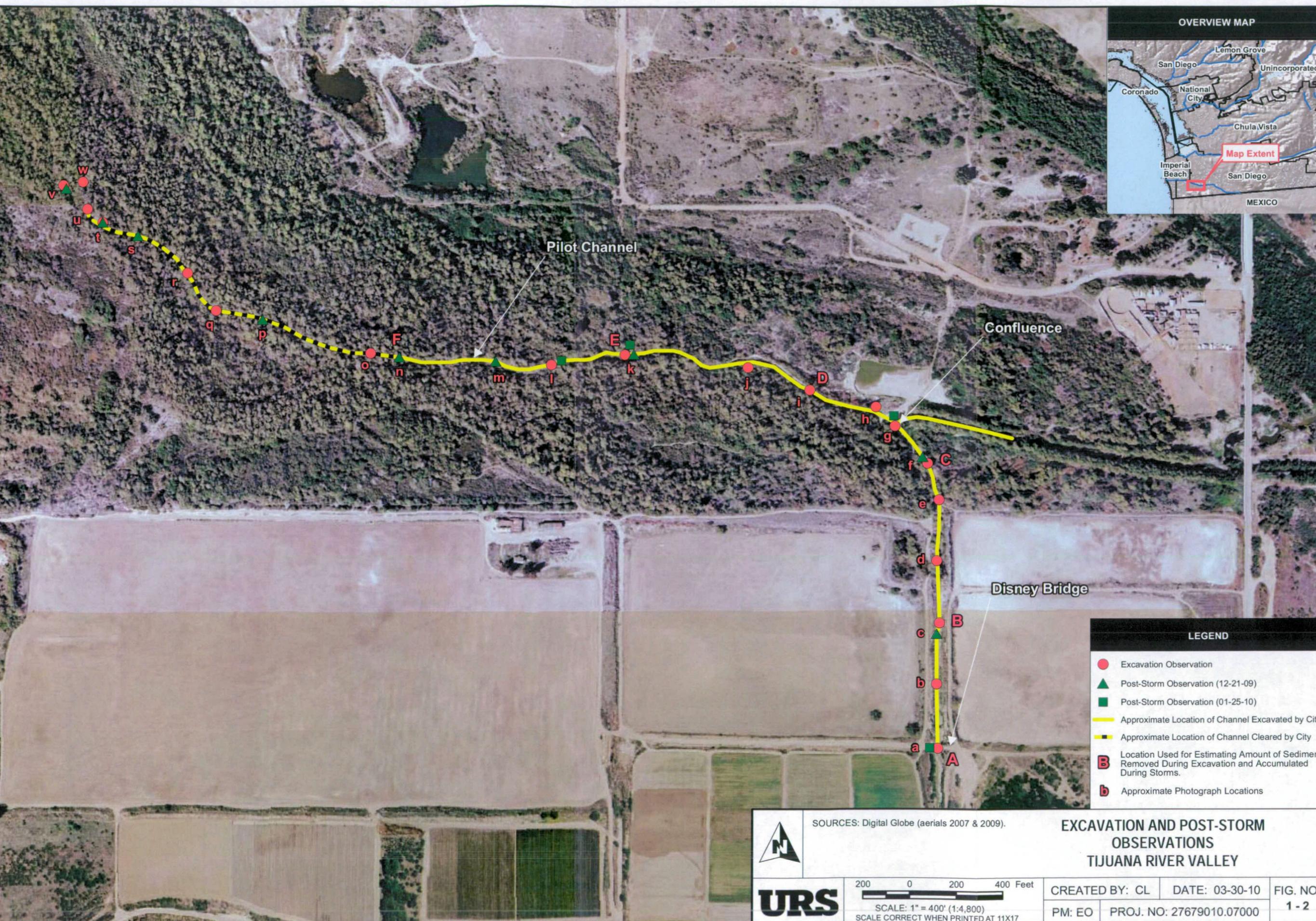


SOURCES:
 Aerial photo from Digital Globe, 2009, 2007.
 FEMA, 1997

**SITE LOCATION MAP
 TIJUANA RIVER VALLEY**

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	SCALE: 1" = 2000' (1:24,000) SCALE CORRECT WHEN PRINTED AT 11X17	PM: EO	PROJ. NO: 27679010.07000	1 - 1

Portions of this DERIVED PRODUCT contains geographic information copyrighted by SanGIS. All Rights Reserved.



LEGEND	
●	Excavation Observation
▲	Post-Storm Observation (12-21-09)
■	Post-Storm Observation (01-25-10)
—	Approximate Location of Channel Excavated by City
- - -	Approximate Location of Channel Cleared by City
B	Location Used for Estimating Amount of Sediment Removed During Excavation and Accumulated During Storms.
b	Approximate Photograph Locations

SOURCES: Digital Globe (aerials 2007 & 2009).

**EXCAVATION AND POST-STORM OBSERVATIONS
TIJUANA RIVER VALLEY**

CREATED BY: CL DATE: 03-30-10 FIG. NO: 1 - 2

PM: EO PROJ. NO: 27679010.07000

URR

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SCALE: 1" = 400' (1:4,800)
SCALE CORRECT WHEN PRINTED AT 11X17



SECTION 2 PILOT CHANNEL EXCAVATION PROGRAM

In the summer 2009, weather forecasts were predicting an El Niño-type winter for San Diego County with above-normal precipitation, some very large storm events and heavy rain. Based on this forecast and the fact that the Smuggler's Gulch and the Pilot Channel were filled with sediment and trash, the City took action to obtain an emergency permit to excavate these materials from these areas. The purpose of the excavation was to mitigate potential flooding that could result from strong El Niño storm events that would adversely affect the residents of the Tijuana River Valley and pose a risk to the public's health and safety. The U.S. Army Corps of Engineers (USACE), RWQCB and other resource agencies granted the City an emergency permit to excavate the Pilot Channel starting early October 2009. The northern portion of Smuggler's Gulch and the Pilot Channel were excavated by the City between early October and November 27, 2009. The permit limited excavation to a 23-foot wide corridor from the Disney Bridge and along the centerline of a previous excavation of the Pilot Channel shown on drawings prepared in 1999 for similar activities. The approximate location of the excavated areas is shown on Figure 1-1.

A sediment staging area was constructed on a City-owned parcel, immediately north of Monument Road on the east side of Smuggler's Gulch (Photographs 1 and 2 in Appendix A). Onsite storm water best management practices (BMPs) included a berm constructed on the perimeter of the stockpile to contain potential stormwater runoff that could accumulate within the stockpile area. A silt fence was also placed around the perimeter of the stockpile, and plastic sheeting was used to cover the stockpile during storm events. The sheeting was held in-place using waste tires.

The centerline of the portions of the channel within the heavily vegetated areas north of Disney Bridge were surveyed and marked. Orange security fencing was placed at the edge of the 23-foot wide corridor to mark the area to be excavated and limit access and disturbance to other areas (Photograph 16). Surveying, clearing and excavation were conducted by City personnel using the City's equipment. Biological monitoring was conducted by Helix Environmental in accordance with the excavation permit. Because the activities were conducted during the wet weather season, there was concern that excavation would have to be terminated in the case of significant storm events. To maximize the extent excavated, clearing was conducted in phases so that excavation could begin and then follow into the areas cleared. Excavation activities began early October 2009, starting at the Disney Bridge and proceeded northward to the confluence of Smuggler's Gulch with the Pilot Channel (the Confluence) and then proceeded westward. The City planned to excavate the Pilot Channel east of the confluence as a final phase, weather permitting. Approximately three feet of sediment that accumulated in the channel from Disney Bridge to the Confluence was excavated between January 9 and 17, 2010. During this time, five feet of sediment was excavated from the Confluence eastward for approximately 500 feet of the Pilot Channel (Bill Tamargo, pers. comm.). The westernmost 2,000 feet of the Pilot Channel was cleared, but not excavated due to the rain events that occurred in late November 2009.



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SECTION 3 FIELD PROCEDURES

URS personnel documented excavation activities and the characteristics of the excavated areas approximately twice per week from October 16 to November 24, 2009. Observations were conducted based on regular updates from City personnel regarding the progress of the excavation activities. Observations of conditions during and after storm events were documented by URS between November 30, 2009 and January 25, 2010. The approximate depths of the excavated channel were measured, and photographs taken at locations were recorded using a Global Positioning System (GPS) device. Post-storm observations were made at these locations to identify the degree to which sediment and trash had been redeposited in the excavated areas. The sediment and trash removed from Disney Bridge to the end of the Pilot Channel were characterized and quantities were estimated, while the abundance (approximate percentage) and type of trash in the channel walls were surveyed and photographed. Data collected during the observations (including photographs) were uploaded to Geographic Information System (GIS). This information is provided on CD in Appendix D. Additionally, the data are included on multiple layers on the CD that can be queried using ArcReader. Figures provided in this document have been generated from this database.



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SECTION 4 DISCUSSION

City personnel have indicated that approximately 30,000 cubic yards of material was removed, including approximately 3,000 tires, from the Disney Bridge to the end of the Pilot Channel; a distance of approximately 5,300 feet (Bill Tamargo, per. comm.). Subsequent sediment removal from Disney Bridge to the Confluence and then eastward along the Pilot Channel in January 2010 removed an additional 3,000 cubic yards of sediment and debris. Recorded measurements of channel depth, length and width estimate an amount of nearly 30,000 cubic yards of material removed from the Pilot Channel throughout the excavation process (Table 4-1). A storm on November 28 and 29, 2009 filled the channel with water, and standing water remained for several weeks from the Confluence to the west end of the Pilot Channel as a result of successive storm events. The excavation process at the end of the Pilot Channel therefore ended November 27, 2009. A major storm occurred on December 7 to 8, 2009, eroding the walls of the channel in the vicinity of the Confluence. This resulted in the accumulation of several feet of sediment on the channel floor. However, the channel walls throughout the entire excavated area showed little evidence of slumping. On December 21, 2009 approximately 266 cubic yards of trash and wood debris were photographed and documented at the end of the Pilot Channel.

A subsequent major storm event occurred from January 18 to 23, 2010 with 2.23 inches of rain recorded at Chula Vista. Post-storm observations were recorded on January 25, 2010.

Table 4-1. Quantity of Excavated Sediment October 2009 to January 2010

Locations ¹	Approximate Date of Excavation	Approximate Distance Between Locations (feet)	Approximate Average Depth (feet)	Approximate Average Width (feet)	Approximate Volume Excavated (cubic yards)
A to B	Mid October	547	8	23	3,728
B to C	Late October	707	10	23	6,023
C to D	Early November	622	12	23	6,358
D to E	Early November	850	6	23	4,344
E to F	Mid November	995	5	23	4,238
F to Western End of Pilot Channel	Mid to Late November	1,580	0	0	0 ²
Section East of Confluence	Mid January 2010	500	5	23	2,130
Re-excavated section north of Disney Bridge	Mid January 2010	1,000	3	23	2,556
Total Material Removed Before November 28, 2009					24,691
Total Material Removed including January re-excavation					29,376

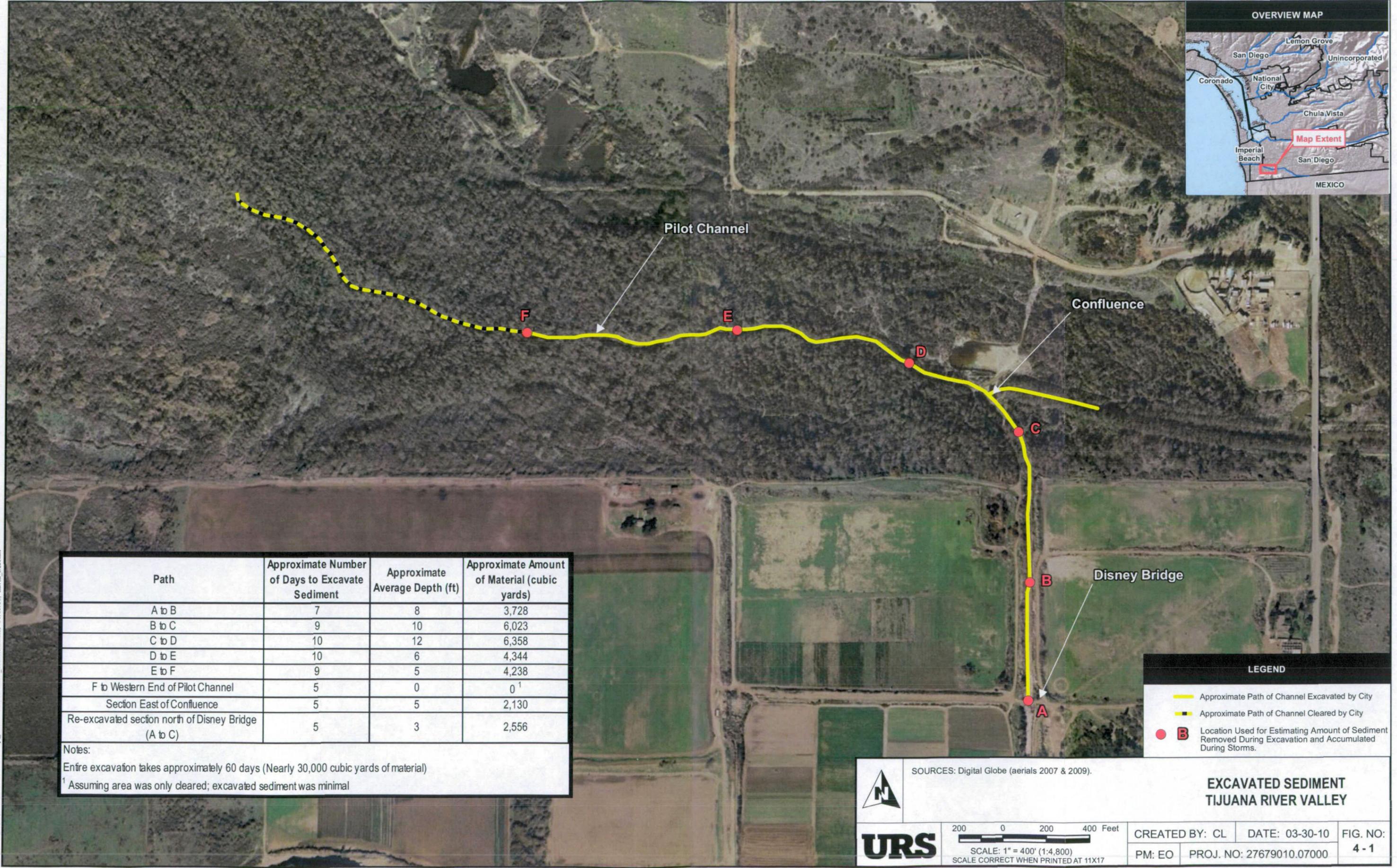
Notes:

¹ Refer to Figure 1-2 for identification of the channel segment excavated.

² Assumes area was only cleared; excavated sediment was minimal



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Path	Approximate Number of Days to Excavate Sediment	Approximate Average Depth (ft)	Approximate Amount of Material (cubic yards)
A to B	7	8	3,728
B to C	9	10	6,023
C to D	10	12	6,358
D to E	10	6	4,344
E to F	9	5	4,238
F to Western End of Pilot Channel	5	0	0 ¹
Section East of Confluence	5	5	2,130
Re-excavated section north of Disney Bridge (A to C)	5	3	2,556

Notes:
 Entire excavation takes approximately 60 days (Nearly 30,000 cubic yards of material)
¹ Assuming area was only cleared; excavated sediment was minimal

LEGEND

- Approximate Path of Channel Excavated by City
- - - Approximate Path of Channel Cleared by City
- B Location Used for Estimating Amount of Sediment Removed During Excavation and Accumulated During Storms.

SOURCES: Digital Globe (aerials 2007 & 2009).

EXCAVATED SEDIMENT TIJUANA RIVER VALLEY

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200 0 200 400 Feet
 SCALE: 1" = 400' (1:4,800)
 SCALE CORRECT WHEN PRINTED AT 11X17

CREATED BY: CL DATE: 03-30-10 FIG. NO: 4-1
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4.1 Excavation Observations

From October 16 to November 24, 2009, the excavation process was documented by a URS geologist approximately twice a week. A summary of excavation observations is presented in Table 4-2 and on Figure 1-2. The channel was excavated a width of approximately 23 feet to a maximum depth of 0-12 feet. From the Disney Bridge northward to the Confluence, the depth ranged from 6 to 12 feet. The excavated channel was approximately 12 feet deep at the Confluence to approximately five feet about half way along the excavated distance to the west. The depth remained at approximately five feet for the remainder of the channel to the west, so that the floor of the excavation remained above the level of groundwater. The westernmost 2,000 feet of the Pilot Channel were cleared of vegetation and trash only. No excavation was conducted due to a rain event that began on November 28, 2009.

The trash abundance in the channel walls ranged from none to approximately 15 percent (Photographs 3 through 21). The trash was present in discontinuous layers, ranging from approximately two inches to two feet thick, which represents deposition of materials as the velocity of the storm water flows decreased. Typically this trash layer is overlain by approximately one to five feet of trash-free sediment consisting of silty and coarse sand, and occasional gravel. The sequences fined upward with floatable plastics, styrofoam, and fabric found above silt and clay layers. Plastic primarily in the form of plastic shopping bags and sheeting, and fabric constituted the majority of this trash. From the Disney Bridge to the Confluence, the trash abundance ranged from none to five percent (Photographs 3 through 9). At the Confluence, thick layers of trash were observed in the excavation sidewalls, where the trash constituted 5 to 15 percent of the deposited materials (Photographs 10 and 11). Upon entering the Confluence, it is likely that flow velocities would decrease, and trash and debris would drop out of suspension. Trash in the walls gradually decreased westward in the Pilot Channel. The grain size also appears to decrease to the west and the deposited materials primarily consist of silt westward in the Pilot Channel.

An extensive area of trash was present at the end of the Pilot Channel on the ground surface. This area, more than 750 feet long, consisted of 90 to 100 percent cover of trash that was at least one foot thick (Photographs 24 through 30). The trash consisted of plastic bottles, tires, styrofoam, and wood debris. A refrigerator was also present. The extent and percentage of trash on the ground surface beyond the Pilot Channel decreased rapidly with distance, such that there was none to five percent trash present on the ground surface within 150 feet of the channel (Photographs 31 through 33). It appears that existing vegetation, particularly those areas with dense stands of arundo, serve as traps for trash and debris to accumulate.



Table 4-2. Excavation Observations

Approximate Photograph Location ¹	Approximate Distance from Disney Bridge (feet)	Approximate Date Excavated or Cleared of Vegetation and Trash	Depth of Channel (feet)	Nature of Channel Walls		
				Estimated % Trash	Trash Types	Photograph No.
Smugglers Gulch						
a	0-30	Early October	6	0-3	plastic, tires	3, 4
b	280	Mid October	8	3-5	plastic, wood debris, fabric, tires	5
c	547	Mid October	9	0-5	plastic, wood debris, fabric, tires	No photograph
d	820	Late October	8	0-5	plastic, wood debris, fabric, tires	No photograph
e	1,086	Late October	11	0-5	plastic, fabric	6
f	1,254	Late October	12	0-3	plastic, fabric	7, 8, 9
Confluence						
h	1,584	Late October	12	15 on South side ; 5 on North side	fabric, plastic, tire	10, 11
Pilot Channel, west of Confluence						
i	1,876	Early November	12	3 south side; 0-1 north side	fabric, plastic	12, 13
j	2,178	Early November	7	0-1; 10 at 4' below top	fabric, plastic, tire	14, 15, 16, 17
k	2,726	Mid November	5	0-1	plastic	18, 19
l	3,052	Mid November	5	3	fabric, tire	20, 21
o	3,845	Mid November	0	5	tires	22, 23
q	4,547	Mid November	0	90	plastic bottles, tires, styrofoam	24, 25
r	4,760	Mid November	0	100	plastic bottles, tires, styrofoam	26
t	5,201	Late November	0	100	plastic bottles, tires, styrofoam	27, 28
u	5,301	Late November	0	100	plastic bottles, tires, styrofoam	29, 30
Beyond Pilot Channel, west of Confluence						
v	5,465	No work	0	5	plastic bottles	31
w	5,481	No work	0	0-1	plastic bottles	32, 33
Pilot Channel, east of Confluence						
g	1,513	Mid January	5	3	plastic, fabric	No photos. Refer to 56, 58, 59

Notes:
¹ refer to Figure 1-2



4.2 Post-Storm Observations

Sedimentation and trash accumulation were observed along the excavated areas after storm events on December 21, 2009 and January 25, 2010. A chart showing precipitation for a rain gauge north of the valley in Chula Vista (station KCACHULA3) is provided on Table 4-3 and Figure 4-2. Two major storms occurred in the valley on December 7 to 8 and December 11 to 13, 2009, with a total recorded rainfall of approximately 2.30 inches. Successive storms from January 18 to 23, 2010 resulted in approximately 2.23 inches of rainfall in the region.

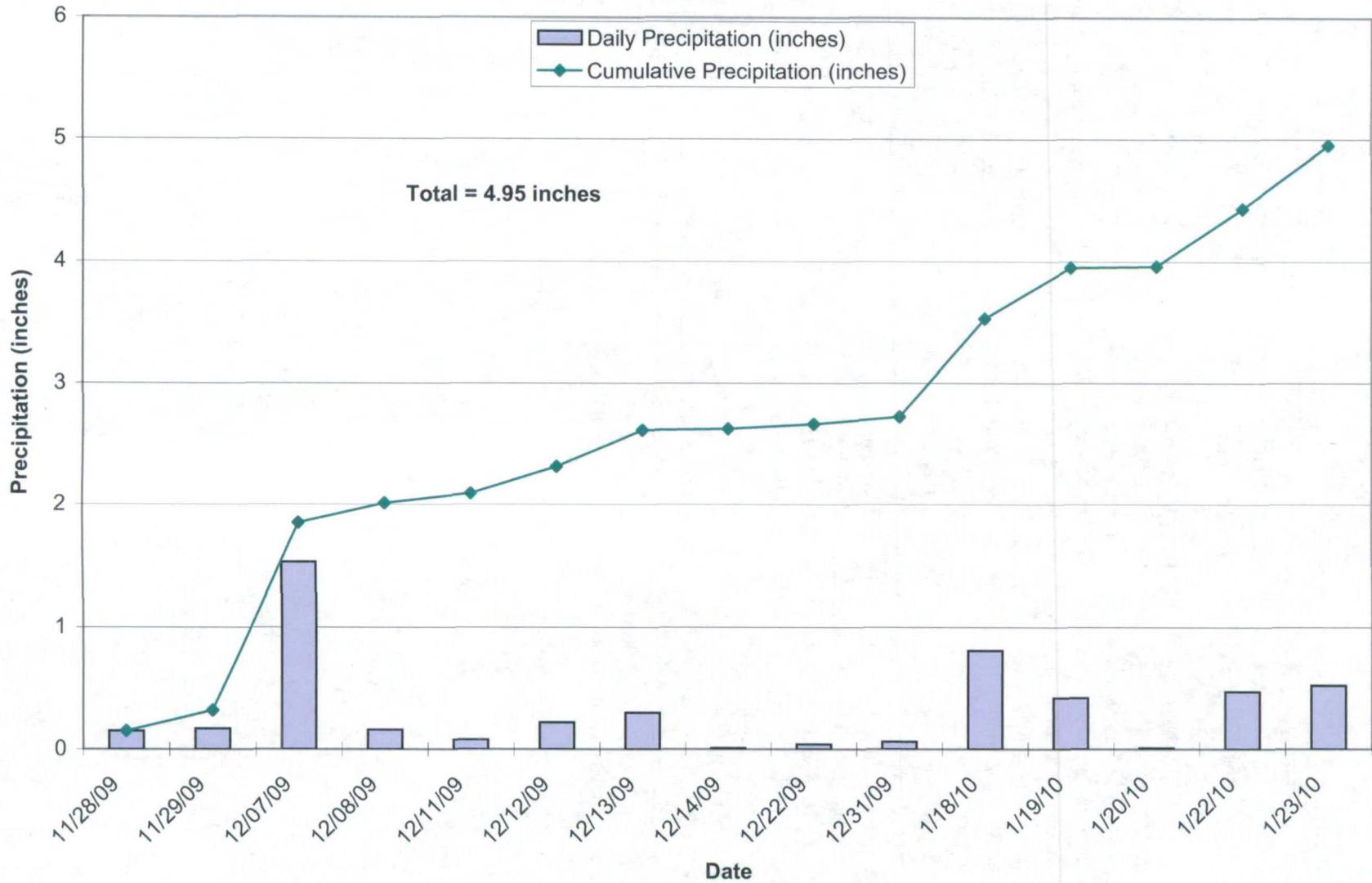
Table 4-3. 2009-2010 Rainfall Data

Date	Daily Precipitation (inches)	Cumulative Precipitation (inches)
11/28/09	0.15	0.15
11/29/09	0.17	0.32
12/07/09	1.53	1.85
12/08/09	0.16	2.01
12/11/09	0.08	2.09
12/12/09	0.22	2.31
12/13/09	0.30	2.61
12/14/09	0.01	2.62
12/22/09	0.04	2.66
12/31/09	0.06	2.72
1/18/10	0.81	3.53
1/19/10	0.42	3.95
1/20/10	0.01	3.96
1/22/10	0.47	4.43
1/23/10	0.52	4.95



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Figure 4-2. Daily & Cumulative Precipitation Recorded at Rain Gauge KCACHULA3





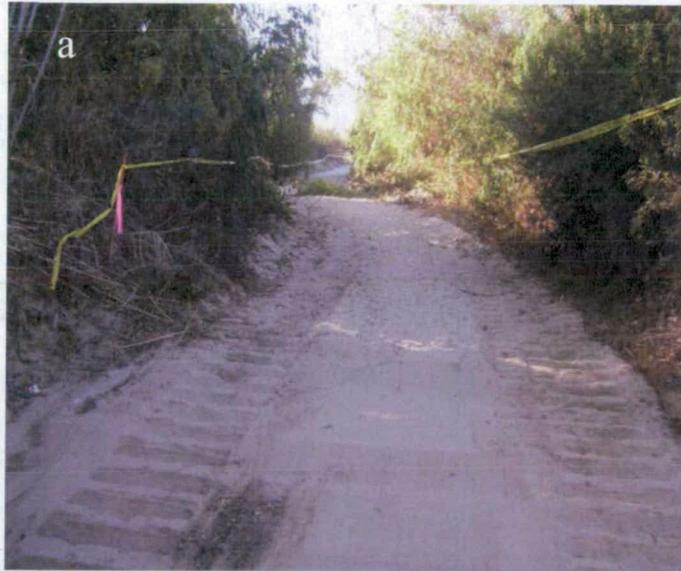
4.2.1 December 21, 2009

On December 21, 2009, URS personnel observed the condition of the channels and documented the presence and nature of the accumulated trash and debris. Locations of the photographs documenting the conditions in the channel after the storm events are presented on Figure 1-2 and in Table 4-4. A narrative summarizing observations is provided below.

Based on the changes in depth of the channel following the storm events, it is estimated that approximately 10,000 cubic yards of sediment accumulated from the Disney Bridge to the end of the Pilot Channel (Table 4-5) as a result of the storm events in early/mid December, 2009. Approximately four to six feet of sediment had accumulated from Disney Bridge to the Confluence, and approximately one to two feet of sediment had accumulated in the eastern and middle portion of the Pilot Channel (Photographs 34 through 43). Observations before the initial excavation, after the excavation, and after the December storm event were photographed approximately 200 feet south of the Confluence at location f (Figure 1-2 and Figure 4-3). The walls of the channel showed little evidence of caving or slumping with the exception of the area to the northeast of the Confluence, where the channel bends approximately 90 degrees to the west (Photograph 36). At this location, the northern sidewall had been eroded and migrated approximately 10 feet to the north. The absence of extensive sidewall slumping along the channel sidewalls suggests that the sediment that accumulated on the floor of the channel as a result of the storms were derived from upstream areas within the watershed. Waste tires were observed on the surface of the channel in many areas, particularly toward the western end of the Pilot Channel. The westernmost 200 feet of the Pilot Channel were filled with trash and wood debris that accumulated as a result of the storm events (Photographs 47 through 51). The trash consisted primarily of recently discarded plastic bottles (evidenced by non-faded and intact labels and clear non-degraded nature of the plastic; Photograph 48) and large pieces of wood debris/lumber that were oriented perpendicular to the direction of flow (Photograph 51). The vegetation surrounding the end of the Pilot Channel appears to have served as a trap since the deposited trash was contained within the channel.



**Figure 4-3. Photographs Portraying Smugglers Gulch Before Excavation,
After Excavation and After December Storm Event**



Notes:

These three photographs were taken approximately 200 hundred feet south of the Confluence at location f (refer to Figure 1-2).

Clockwise from upper right:

- a) Before excavation (October 16, 2010)
- b) After Excavation (October 20, 2010)
- c) After December Storm Event (December 21, 2010)



4.2.2 January 25, 2010

On January 25, 2010, URS personnel observed the condition of the excavated channel. Many areas of the channel were not accessible, since it was filled with standing water from the Confluence westward along the Pilot Channel. Additional sediment had also accumulated in the channel near Disney Bridge toward the Confluence. The excavated channel that was initially 6 to 8 feet deep was 2 to 3 feet deep following the preceding storm events (Photographs 52 and 53). The Confluence area, which was initially excavated to depths ranging from 10 to 12 feet, was approximately 5 feet deep and contained approximately 7 feet of new sediment and debris (Photographs 55 through 58).

URS personnel observed the condition of the Pilot Channel near the horse trail, approximately 2,700 feet from the Disney Bridge. The Pilot Channel was filled with water, but the sidewalls had maintained their integrity with an approximate depth of three feet (Photographs 61 through 64). This area of the Pilot Channel had initially been excavated to a depth of approximately 5 feet. Approximately 2 feet of sediment accumulated in the western portion of the Pilot Channel as a result of the previous storm events.



Table 4-4. Post-Storm Observations

Approximate Photograph Location ¹	Approximate Distance from Disney Bridge (feet)	Approximate Depth of Channel After Excavation (feet)	Approximate Depth of Channel After Storm Events (feet)	Nature of Channel Walls		
				Estimated Appr. % Trash	Trash Types	Photograph No.
December 7-8 and December 11-13, 2009 Storm Events						
Documented December 21, 2009						
Smugglers Gulch						
c	498	9	4	0-3	no trash on ground, only in walls	34, 35
f	1,290	12	6	0-3	no trash on ground, only in walls	36, 37
Pilot Channel, west of Confluence						
k	2,689	5	4	0-3	water, no floatables, some plastic on sides of banks	38, 39
m	3,301	5	3	0-3	water, no floatables, some plastic on sides of banks	40, 41
n	3,721	1	0	0-3	end of water, no trash in sediment, some plastic on sides of banks	42, 43, 44
p	4,343	0	0	2-5	tires in sediment	45, 46
s	5,033	0	0	2-6	tires in sediment	47
t	5,204	0	0	100	plastic bottles, styrofoam, wood debris	48, 49, 50, 51
Beyond Pilot Channel, west of Confluence						
v	5,465	no excavation	0	0-5	(no new trash), plastic bottles	No photos. Refer to 31
January 18-23 Storm Event						
Documented January 25, 2009						
Smugglers Gulch						
a	0	9	2	0-3	no trash on ground, only in walls	52, 53, 54
Confluence						
g	1,513	12	5	0-5	water, no floatables, some plastic on sides of banks	55, 56, 57, 58, 59, 60
Pilot Channel, west of Confluence						
k	2,689	5	3	0-3	water, no floatables, some plastic and tires on sides of banks	61, 62
l	3,039	5	3	0-3	water, no floatables, some plastic on sides of banks	63, 64

Notes:

¹ refer to Figure 1-2

Appr. = Approximate



**Table 4-5. Estimated Sediment Accumulation
Pilot Channel – Tijuana River Valley
December 21, 2009 Observations**

Locations ¹	Approximate Distance Between Locations (feet)	Approximate Average Depth of Excavation Before Storm Events (feet)	Approximate Average Channel Depth ² (feet)	Approximate Average Thickness of Accumulated Material (feet)	Approximate Average Channel Width (feet)	Approximate Volume Accumulated (cubic yards)
A to B	547	8	4	4	23	1,864
B to C	707	10	6	4	23	2,409
C to D	622	12	6	6	23	3,179
D to E	850	6	4	2	23	1,448
E to F	995	5	4	1	23	848
Section East of Confluence	Not yet Excavated	-	-	-	-	-
Estimated Volume of Sediment Accumulation Since Excavation (cubic yards)						9,748

Notes:

¹ Refer to Figure 1-2.

² December 21, 2009 Observation



**Table 4-6. Estimated Sediment Accumulation
Pilot Channel – Tijuana River Valley
January 25, 2010 Observations**

Locations ¹	Approximate Distance Between Locations (feet)	Approximate Average Depth of Excavation Before Storm Events (feet)	Approximate Average Depth from Top of Channel Right Before January 18-23, 2010 Storm Event ² (feet)	Approximate Average Channel Depth ³ (feet)	Approximate Average Thickness of Accumulated Sediment ⁴ (feet)	Approximate Average Channel Width (feet)	Approximate Volume Accumulated (cubic yards)
A to B	547	8	7	2	5	23	2,330
B to C	707	10	8	3	5	23	3,011
C to D	622	12	6	5	1	23	530
D to E	850	6	4	3	1	23	724
E to F	995	5	4	3	1	23	848
Section East of Confluence	500	Not excavated	5	4	1	23	426
Estimated Volume of Sediment Accumulation December 21, 2009 (cubic yards)							7,869
Estimated Volume of Sediment Accumulation Since Excavation (cubic yards)							17,617

Notes:

¹ Refer to Figure 1-2

² Disney Bridge to the Confluence was re-excavated an additional 3 feet after the December storm events (Bill Tamargo, pers. Comm.)

³ January 25, 2010 Observation

⁴ Calculated from additional accumulation after the December 21, 2009 Observations



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SECTION 5 CONCLUSIONS

Based on the observations during excavation and following storm events, the following concluding observations can be made:

- Quantity of Trash - The estimated percentage of trash in the excavated channel ranged from none to 15 percent. The percentage of trash west of the Confluence decreases with distance. However, the western end of the Pilot Channel had a considerable amount of trash present on the ground surface, where it is estimated that there was 740 cubic yards of trash present. This material was completely removed during excavation; however, the December 21, 2009 observations revealed that approximately 170 cubic yards of new trash, mainly plastic bottles, had been deposited at the end of the Pilot Channel. Assuming a trash density for uncompacted plastic bottles to be 40 pounds per cubic yard (EPA, 1997), approximately 6,800 pounds (3.4 tons) of trash had accumulated at the end of the Pilot Channel by December 21, 2009.
- Types and Distribution of Trash - The types of trash and debris show variation along the length of the excavation. Trash and debris in the sidewalls consist primarily of plastic shopping bags, sheeting, fabric, tires and heavy debris and is most abundant in the segment from Disney Bridge to 500 feet west of the Confluence. However, trash accumulated at the western 750 feet of the Pilot Channel consisted of approximately surficial accumulation of lighter materials such as plastic bottles, styrofoam and wood debris on the ground surface. It appears that vegetation serves as a trap for trash and debris as evidenced by the end of the Pilot Channel (Photographs 47 through 51) and there is a rapid decrease in trash away from the channel. It is likely that smaller particles of trash and debris move beyond the vegetation into the estuary and to the ocean however, this has not been documented. Once the excavated channel is filled with sediment and trash, other channels in the area serve as migration pathways for trash and sediment during storm events. This is evidenced by the presence of trash and sediment in other areas adjacent to the channel south of the Confluence.
- Origin of Sediment Load - The intact nature of the sidewalls (absence of significant slumping) suggests that the sediment that accumulates in the excavated channel is derived from upstream areas of the watershed.
- Sediment Accretion Rates - There is a considerable volume of sediment that is deposited in the excavated areas of the channel based on observations following storm events. For example, it is estimated that the storm events from late November to mid December resulted in the accumulation of one to six feet of sediment in the channel between Disney Bridge and the Confluence. It is estimated that this would be approximately 7,450 cubic yards. Assuming a conversion factor of 1.3 tons/cubic yard (L. Handfelt, pers. comm.), this would be approximately 9,690 tons of sediment. Similarly, approximately two feet of sediment has accumulated from the Confluence to the western end of the excavated Pilot Channel, a distance of approximately 2,000 feet. It is estimated that approximately 3,400 cubic yards (4,400 tons) of sediment have accumulated in this area since the earliest storm events that occurred in November 2009.
- The excavated channel serves as a sink for the accumulation of sediment and trash, similar to a sedimentation basin. It limits sediment and trash accumulation to a linear area. However, once the excavated channel is filled with sediment and trash, sediment and trash accumulation is no



longer restricted to this area. Observation of trash and sediment on the ground surface south of the Confluence in the adjacent riparian areas indicates that these materials are deposited along other channels that convey storm water and where vegetation serves as traps.



SECTION 6 REFERENCES

City of San Diego, 2009-2010. Personal Communications. Messrs. Ed Rodriguez and Bill Tamargo.

URS Corporation. 2010. Pilot Channel Borings and Sediment Characterization - Initial Report.

URS Corporation. 2009. Smugglers Gulch Channel Excavations Spoils Sediment Characterization - Final Report.

URS Corporation. 2010. Personal Communications. Leo Handfelt.

U.S. Army Corps of Engineers, 2008. Department of Homeland Security Customs and Border Protection San Diego Sector Area V – Smuggler’s Gulch Sta. 73+31.94 to Sta. 180+40.14 Amendments Design Analysis Report Package 1A,1, and 3 Final Updates.

U.S. Environmental Protection Agency, 1997. Measuring Recycling: A Guide for State and Local Governments.



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Appendix A Excavation Observation Photographs



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Photograph # 1

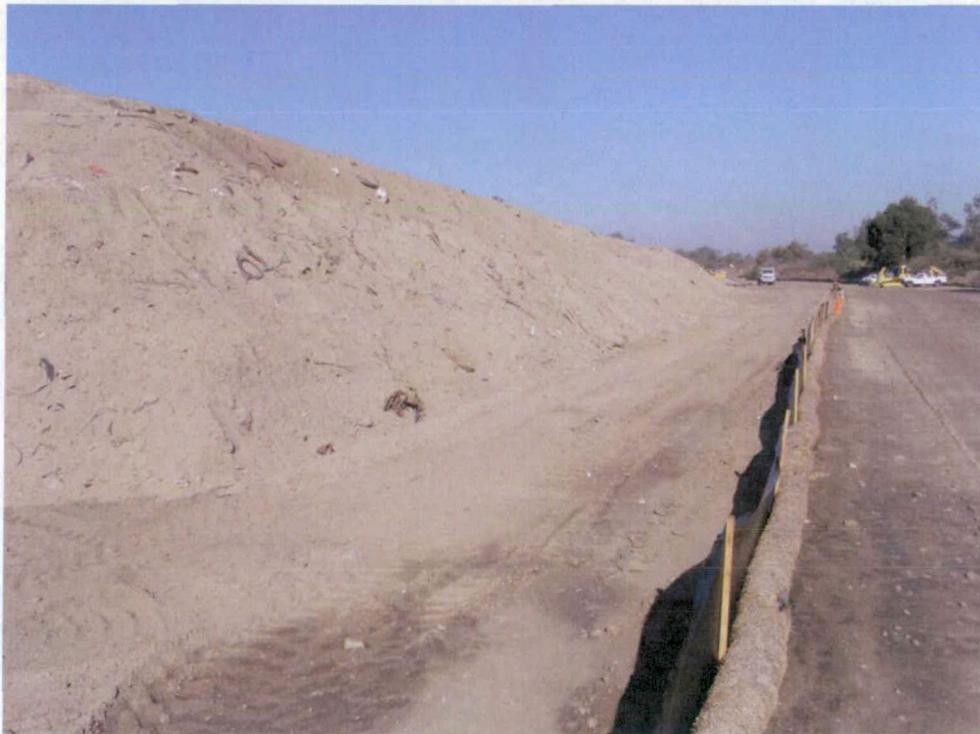
File Name:

(16)11-19.look.S

Date:

11-19-09

Sediment stockpile area on City parcel north of Monument Road and east of Smuggler's Gulch.



Photograph # 2

File Name:

(14)11-19.look.N

Date:

11-19-09

Sediment stockpile.



Photograph # 3

File Name:

(1)10-16.look.N

Date:

10-16-09

**Approximate
Distance from
Disney Bridge:**

0 feet

View looking
north along
channel at Disney
Bridge.



Photograph # 4

File Name:

(2)10-16.LookS

Date:

10-16-09

**Approximate
Distance from
Disney Bridge:**

0 feet

View looking
south of
Smuggler's Gulch
Channel
previously
excavated in early
2009.



Photograph # 5

File Name:

(6)10-16.look.NE

Date:

10-16-09

**Approximate
Distance from
Disney Bridge:**

280 feet north



Photograph # 6

File Name:

(1)10-20.look.S

Date:

10-20-09

**Approximate
Distance from
Disney Bridge:**

1,086 feet north



Photograph # 7

File Name:

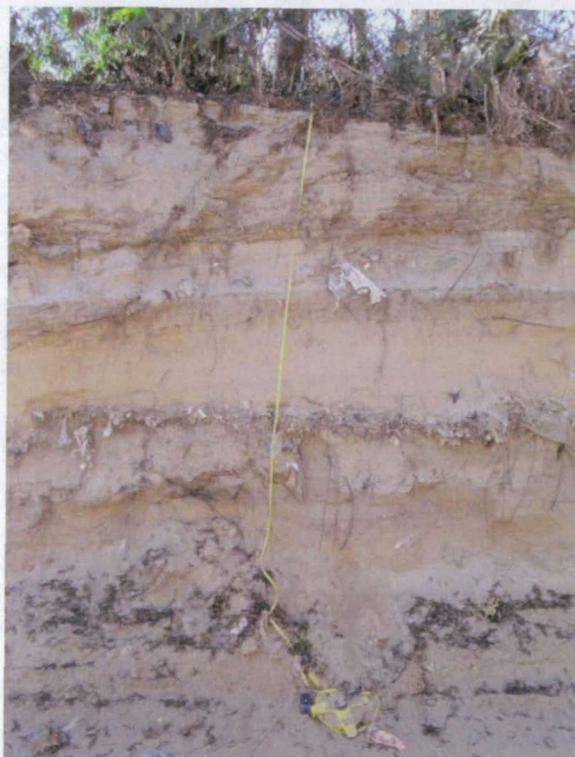
(2)10-20.look.S

Date:

10-20-09

**Approximate
Distance from
Disney Bridge:**

1,254 feet



Photograph # 8

File Name:

(1)10-28.look.W

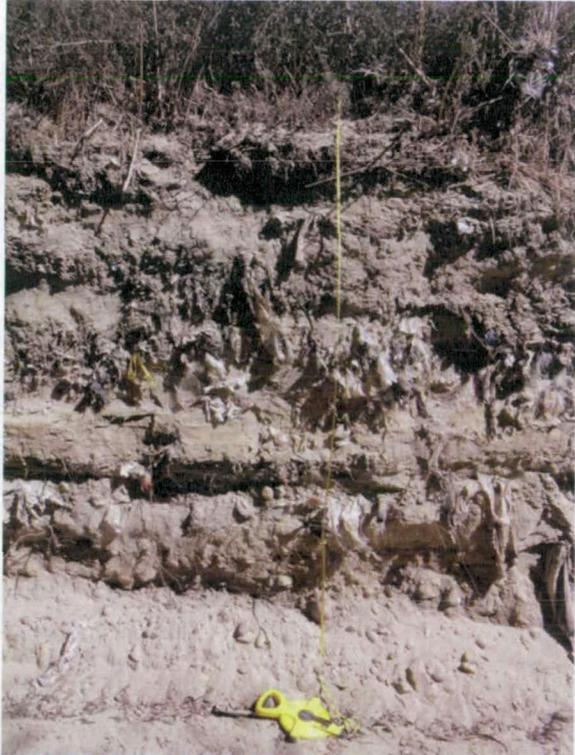
Date:

10-28-09

**Approximate
Distance from
Disney Bridge:**

1,254 feet



	<p>Photograph # 9</p> <p>File Name: (2)10-28.look.E</p> <p>Date: 10-28-09</p> <p>Approximate Distance from Disney Bridge: 1,254 feet</p>
	<p>Photograph # 10</p> <p>File Name: (1)11-19.look.S</p> <p>Date: 11-19-09</p> <p>Approximate Distance from Disney Bridge: 1,584 feet</p>



		<p>Photograph # 11</p> <p>File Name: (2)11-19.look.N</p> <p>Date: 11-19-09</p> <p>Approximate Distance from Disney Bridge: 1,584 feet</p>
		<p>Photograph # 12</p> <p>File Name: (3)11-19.look.S</p> <p>Date: 11-19-09</p> <p>Approximate Distance from Disney Bridge: 1,876</p>



Photograph # 13

File Name:

(4)11-19.look.N

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

1,876 feet



Photograph # 14

File Name:

(9)11-19.look.S

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

2,178 feet



Photograph # 15

File Name:

(10)11-19.look.N

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

2,178 feet



Photograph # 16

File Name:

(11)11-19.look.E

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

2,178 feet



Photograph # 17

File Name:

(12)11-19.look.W

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

2,178 feet



Photograph # 18

File Name:

(7)11-19.look.S

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

2,726 feet



Photograph # 19

File Name:

(8)11-19.look.N

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

2,726 feet



Photograph # 20

File Name:

(5)11-19.look.S

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

3,052 feet



Photograph # 21

File Name:

(6)11-19.lookN

Date:

11-19-09

**Approximate
Distance from
Disney Bridge:**

3,052 feet



Photograph # 22

File Name:

(3)10-28.look.E

Date:

10-28-09

**Approximate
Distance from
Disney Bridge:**

3,845 feet

Comments:

Photo taken before excavation. This area was later cleared of vegetation but not channeled



Photograph # 23

File Name:

(4)10-28.look.W

Date: 10-28-09

Approximate Distance from Disney Bridge:
3845 feet

Comments:
Photo taken before excavation. This area was later cleared of vegetation but not channeled



Photograph # 24

File Name:

(5)10-28.look.W

Date: 10-28-09

Approximate Distance from Disney Bridge:
4,547 feet

Comments:
Photo taken before excavation. This area was later cleared of vegetation but not channeled



Photograph # 25
File Name:

(6)10-28.look.E

Date: 10-28-09

Approximate Distance from Disney Bridge:
4,547 feet

Comments:
Photo taken before excavation. This area was later cleared of vegetation but not channeled



Photograph # 26

File Name:

(7)10-28.lookW

Date: 10-28-09

Approximate Distance from Disney Bridge:
4,760 feet

Comments:
Photo taken before excavation. This area was later cleared of vegetation but not channeled



Photograph # 27

File Name:

(8)10-28.look.SE

Date: 10-28-09

**Approximate
Distance from
Disney Bridge:**
5,204 feet

Comments:
Photo taken before
excavation. This
area was later
cleared of
vegetation but not
channeled



Photograph # 28

File Name:

(9)10-28.look.NW

Date: 10-28-09

**Approximate
Distance from
Disney Bridge:**
5,204 feet

Comments:
Photo taken before
excavation. This
area was later
cleared of
vegetation but not
channeled



	<p>Photograph # 29</p> <p>File Name: (10)10-28.lookNW</p> <p>Date: 10-28-09</p> <p>Approximate Distance from Disney Bridge: 5,301 feet</p> <p>Comments: On top of arundo. This area was not cleared of vegetation.</p>
	<p>Photograph # 30</p> <p>File Name: (11)10-28.look.SE</p> <p>Date: 10-28-09</p> <p>Approximate Distance from Disney Bridge: 5,301 feet</p> <p>Comments: On top of arundo. This area was not cleared of vegetation.</p>



	<p>Photograph # 31</p> <p>File Name: (4)11-2.past.end</p> <p>Date: 11-2-09</p> <p>Approximate Distance from Disney Bridge: 5,465 feet</p> <p>Comments: Past the pilot Channel. This trash was not removed.</p>
	<p>Photograph # 32</p> <p>File Name: (1)11-10.look.w</p> <p>Date: 11-10-09</p> <p>Approximate Distance from Disney Bridge: 5,481 feet</p> <p>Comments: Past the Pilot Channel. Minor trash in area.</p>



Photograph # 33

File Name:

(2)11-10.look.e

Date: 11-10-09

**Approximate
Distance from
Disney Bridge:**
5,481 feet



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Appendix B Post Storm Observation Photographs: December 21, 2009



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Photograph # 34

File Name:

(27)21-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

498 feet



Photograph # 35

File Name:

(28)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

498 feet



Photograph # 36

File Name:

(29)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

1,290 feet



Photograph # 37

File Name:

(30)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

1,290 feet



Photograph # 38

File Name:

(33)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

2,689 feet

Comments:

Horse Trail



Photograph # 39

File Name:

(34)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

2,689 feet

Comments:

Horse Trail



Photograph # 40

File Name:

(35)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

3,301 feet



Photograph # 41

File Name:

(36)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

3,301 feet



Photograph # 42

File Name:

(37)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

3,721 feet



Photograph # 43

File Name:

(38)12-12

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

3,721 feet



Photograph # 44

File Name:

(39)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

3,721 feet



Photograph # 45

File Name:

(47)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

4,343 feet



Photograph # 46

File Name:

(48)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

4,343 feet



Photograph # 47

File Name:

(40)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

5,033 feet

Comments:

Notice the abrupt
start of the trash
pile.



Photograph # 48

File Name:

(42)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

5,204 feet



Photograph # 49

File Name:

(43)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

5,204 feet



Photograph # 50

File Name:

(44)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

5,204 feet



Photograph # 51

File Name:

(45)12-21

Date:

12-21-09

**Approximate
Distance from
Disney Bridge:**

5,204 feet

Comments:

Notice the wood
debris oriented
perpendicular to
the channel



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Appendix C Post Storm Observation Photographs: January 25, 2010



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Photograph # 52

File Name:

(6)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**
0 feet

Comments:

Looking north
from Disney
Bridge



Photograph # 53

File Name:

(7)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

0 feet

Comments:

Looking south
from Disney
Bridge



Photograph # 54

File Name:

(8)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

0 feet



Photograph # 55

File Name:

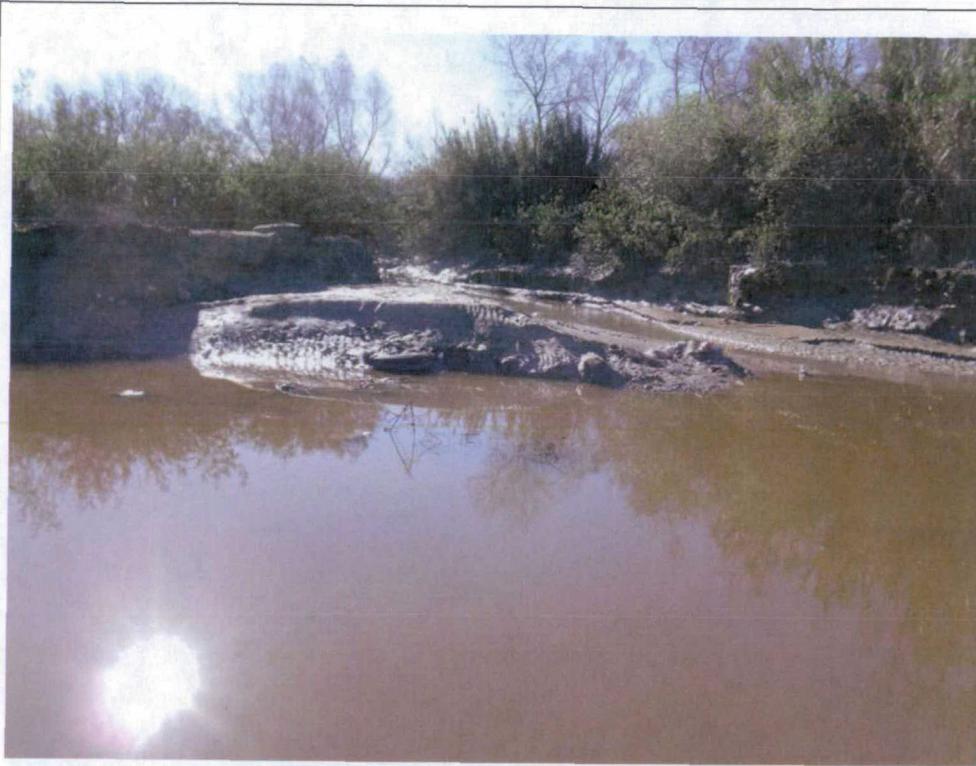
(12)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

1,513 feet



Photograph # 56

File Name:

(13)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

1,513 feet



Photograph # 57

File Name:

(14)1-25

Date: 1-25-10

**Approximate
Distance from
Disney Bridge:**

1,513 feet

Comments:

Looking east at
newly excavated
eastern section of
Pilot Channel (east
of Confluence)



Photograph # 58

File Name:

(15)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

1,513 feet



Photograph # 59

File Name:

(16)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

1,513 feet



Photograph # 60

File Name:

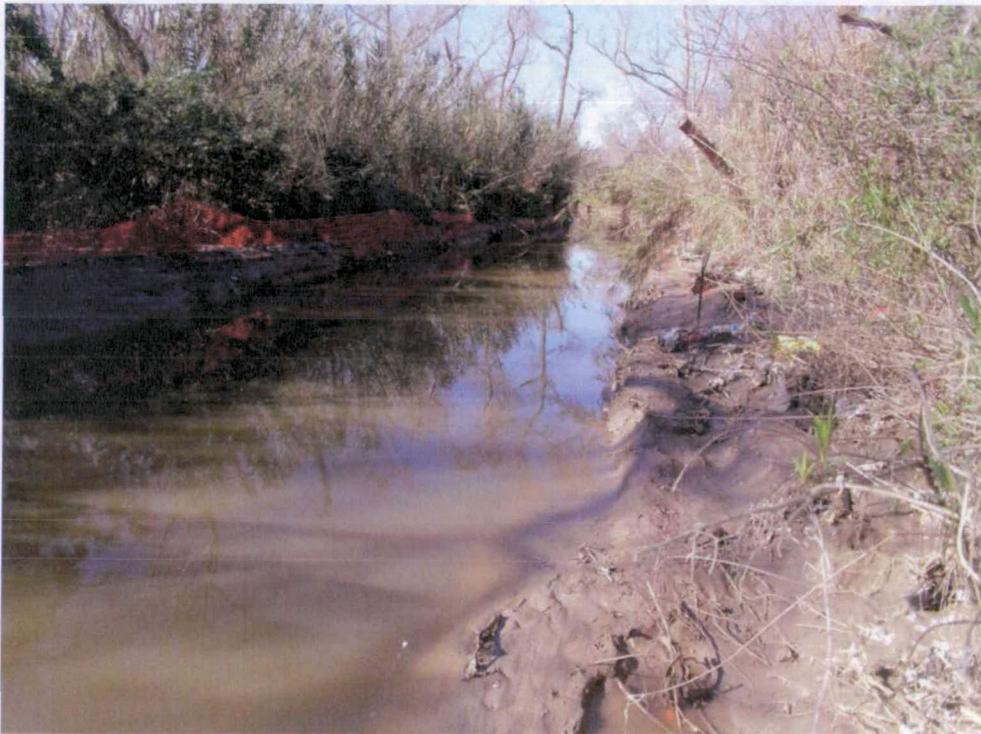
(17)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

1,513 feet



Photograph # 61

File Name:

(18)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

2,689 feet



Photograph # 62

File Name:

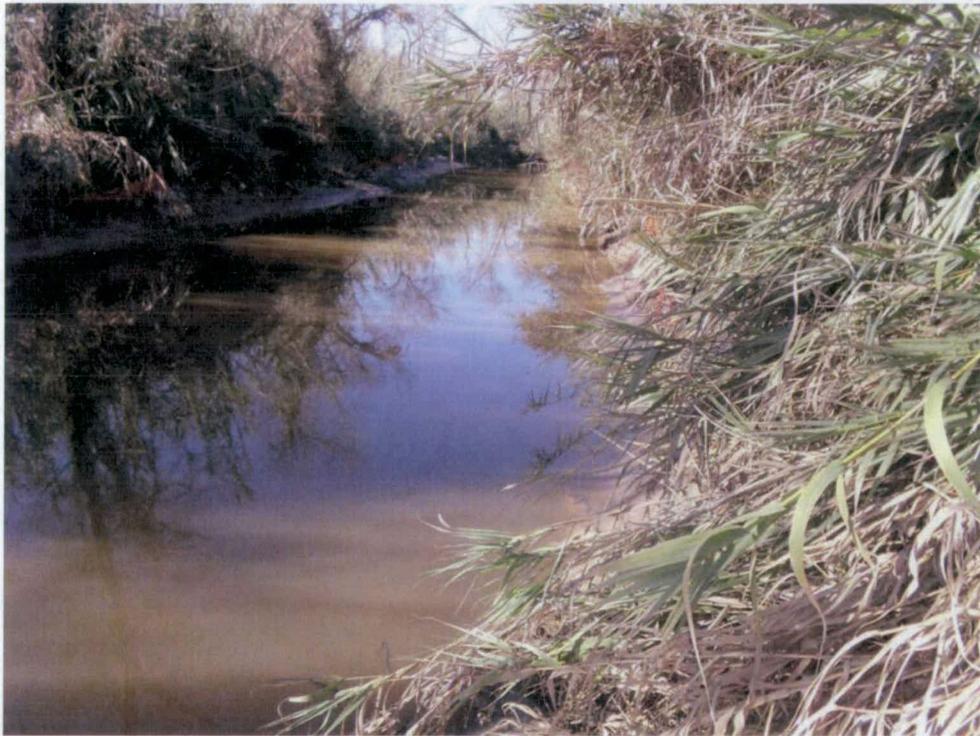
(19)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

2,689 feet



Photograph # 63

File Name:

(20)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

3,039 feet



Photograph # 64

File Name:

(21)1-25

Date:

1-25-10

**Approximate
Distance from
Disney Bridge:**

3,039 feet



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Appendix D Project Documentation (on compact disk)



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