# FINAL

## Channel Maintenance Special Study – Murphy Canyon

*Prepared for:*

**City of San Diego**
2781 Caminito Chollas
San Diego, California 92015
*Contact: Christine Rothman*

*Prepared by:*

**D-Max Engineering, Inc.**
7220 Trade Street #119
San Diego, California 92121

*and*

DUDEK
605 Third Street
Encinitas, California 92024
*Contact: Bryn Evans, P.E.*

**JUNE 2015**

**REVISED: OCTOBER 2015**

INTENTIONALLY LEFT BLANK

# TABLE OF CONTENTS

**Section** **Page No.**



## FIGURES

# TABLE OF CONTENTS (CONTINUED)

**Page No.**

## TABLES

# 1 INTRODUCTION

The City of San Diego (City) developed the Master Storm Water System Maintenance Program (MMP) (City of San Diego 2011) to govern channel operation and maintenance activities in an efficient, economic, environmentally and aesthetically acceptable manner to provide flood control for the protection of life and property. A lawsuit was filed regarding the MMP (*San Diegans for Open Government et al v. City of San Diego*, San Diego Superior Court Case No. 37-2011-00101571), and the City entered into a settlement agreement (Settlement Agreement), which requires the City to conduct a special study (Channel Maintenance Special Study) to evaluate the purpose, need and alternatives to channel maintenance activities for each channel maintained during the first two years of MMP implementation in City Fiscal Years 2014-2015 and 2015-2016 (FY 14-15).

The current phase of the Murphy Canyon Channel maintenance project includes the mechanized removal of sediment, vegetation, trash, and debris from a drainage channel in the San Diego River watershed using heavy equipment during FY 14-15. The Murphy Canyon Channel area is displayed on MMP Map 58: This special study fulfills Section 1.8 of the Settlement Agreement for channel maintenance activities occurring within the Murphy Canyon Channel.

## 1.1 Background

This Channel Maintenance Special Study summarizes the suite of channel assessment and retrofit opportunities for channels maintained during FY 14–15. Within the framework of the MMP, channel assessment and retrofit evaluation requires consideration of a number of factors including maintenance practices, environmental avoidance and minimization measures, adjacent infrastructure, and project alternatives. Combined, these elements address the specific terms of the underlying legal agreement for each focal channel. Table 1 provides a summary of the channel assessment and retrofit opportunity elements addressed in this Channel Maintenance Special Study.

**Table 1**
**Channel Maintenance Special Study Overview Based on Settlement Agreement Item 1.8**

| Settlement Agreement Requirements | Section of Special Study |
|---|---|
| *Evaluate Current Maintenance Level* | |
| Purpose of conveyance system location | 2.1 |
| Need for conveyance system | 2.1 |
| Need for maintenance at individual locations | 2.2 |
| Potential to modify maintenance practices | 2.2 |
| A comparison of vegetation trimming and vegetation removal by roots | 2.2 |
| Frequency of maintenance | 2.3 |
| Need for herbicide treatment | 2.4 |
| Vegetation analysis – native/ non-native | 2.5 |
| Potential to support endangered or threatened species, or regionally sensitive species | 2.6 |

**Table 1**
**Channel Maintenance Special Study Overview Based on Settlement Agreement Item 1.8**

| Settlement Agreement Requirements | Section of Special Study |
|---|---|
| Infrastructure opportunities surrounding the channel | 2.7 |
| *Retrofit Opportunities to Reduce Maintenance Needs* | |
| Daylighting concrete channels | 3.1 |
| Preserving habitat that is a wildlife corridor and habitat for special-status species | 3.2 |
| Discharges into 303(d) listed water body, reduce downstream flooding through localized Low Impact Development (LID), including land acquisition for conversion to wetlands | 3.3 |

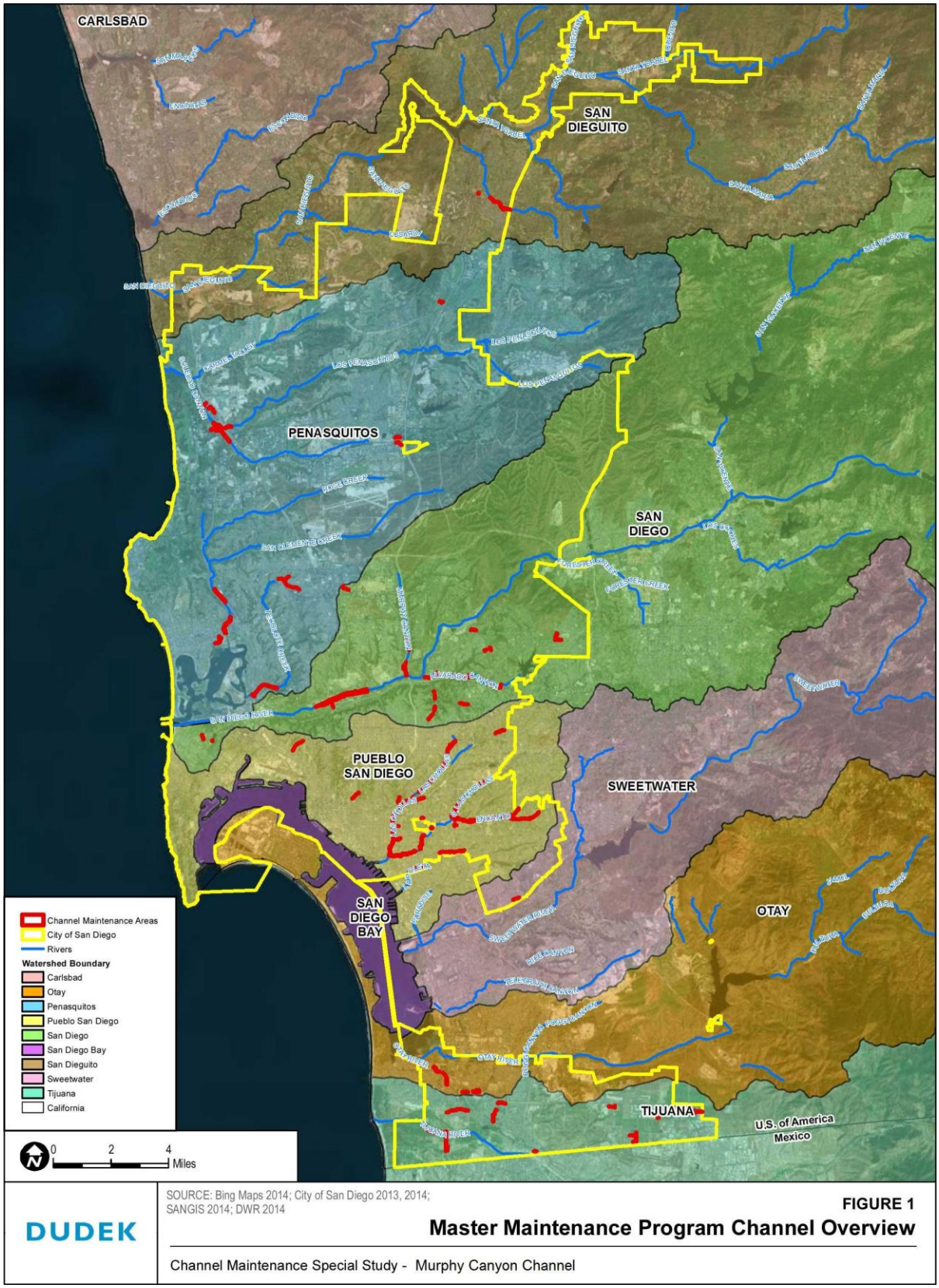
This Channel Maintenance Special Study evaluates the purpose,- need and alternatives to channel maintenance activities in the Reaches 1 and 2 of the Murphy Canyon Channel.

## 1.2 Master Maintenance Program Overview

The MMP identifies a specific planning, impact assessment, and mitigation process for channel maintenance activities within portions of the jurisdiction of the City (Figure 1). For each channel maintenance project, an Individual Maintenance Plan (IMP) and related Individual Technical Assessments (IAs) were prepared (City of San Diego 2011). The IMP identified the scope of work, maintenance methodology and procedures, equipment, and duration for maintenance activities planned in the channels. The IAs consist of an Individual Biological Assessment (IBA), Individual Historical Assessment (IHA), Individual Hydrologic and Hydraulic Assessment (IHHA), Individual Water Quality Assessment (IWQA), and Individual Noise Assessment (INA). The IMP also included a comprehensive list of best management practices (BMPs), maintenance protocols and mitigation measures derived from the applicable permits and regulations that were implemented to avoid, minimize, and/or mitigate potential environmental effects to sensitive resources.

As part of the IMP process, the IHHA and IWQA provide data that allows for evaluation of the purpose, need and alternatives to channel maintenance activities and serve as a basis for this special study. The IWQA also provides a suite of water quality and soil monitoring activities that may be used to evaluate the potential water quality benefits of channel maintenance projects that remove sediment and pollutants from channel areas. The IMP and IAs were compiled into a Substantial Conformance Review (SCR) package for review and approval by the City's Development Services Department (DSD) under the provisions identified in the MMP Programmatic Environmental Impact Report (PEIR).In addition to the City's SCR process, the City was also required to obtain permit authorization for maintenance of the Murphy Canyon Channel from the California Department of Fish and Wildlife (CDFW), San Diego Regional Water Quality Control Board (RWQCB), and U.S. Army Corps of Engineers (ACOE) for approval under the terms and conditions of their respective regulatory authorities.

Figure 1 Master Maintenance Program Channel Overview



INTENTIONALLY LEFT BLANK

## 1.3 Project Channels

The maintenance channel discussed in this special study is the Murphy Canyon Channel, commonly known as Murphy Creek, in southern San Diego County within the San Diego River watershed. The Murphy Canyon Channel is composed of five channel segments, referred to as Reaches. The northern-most portion of Reach 2 is located in the Caltrans right-of-way and was not included in the maintenance area. Reach 2, unless otherwise specified, will refer to the segment of the Reach maintained by the City. This special study focuses on the City maintained portions of Reach 1 and Reach 2 of the Murphy Canyon Channel, hereafter referred to as the Murphy Canyon Channel (Figure 2). The Murphy Canyon Channel is located in the Mission Valley Community Planning Area (City of San Diego 2011). The downstream end of Reach 1 begins near the southeast corner of the Qualcomm Stadium parking lot, approximately 315 feet north of the of the confluence to the San Diego River. Reach 2 is located north of Reach 1. The Kinder Morgan Mission Valley Terminal (MVT), a fueling facility, is located northwest of Reach 2. Residential and commercial development is situated to the east of I-15.

The San Diego River watershed, hydrologic unit (HU) 907, has a drainage area of approximately 440 square miles, and is the second largest HU in San Diego County. The San Diego River watershed also supports the largest population of any of the watersheds in San Diego County, at approximately 475,000. The lower portion of the watershed is more highly urbanized then the eastern portion of the watershed (Project Clean Water 2015). Reaches 1 and 2 of the Murphy Canyon Channel are located in hydrologic subarea 907.11 of the San Diego River watershed (IBA 2013).

Flows from the Murphy Canyon Channel drain to the lower portion of the San Diego River. The San Diego River is an environmentally sensitive area and has multiple beneficial use designations (RWQCB 2011). Flows from the San Diego River eventually discharges to the Pacific Ocean at the river mouth in Ocean Beach.

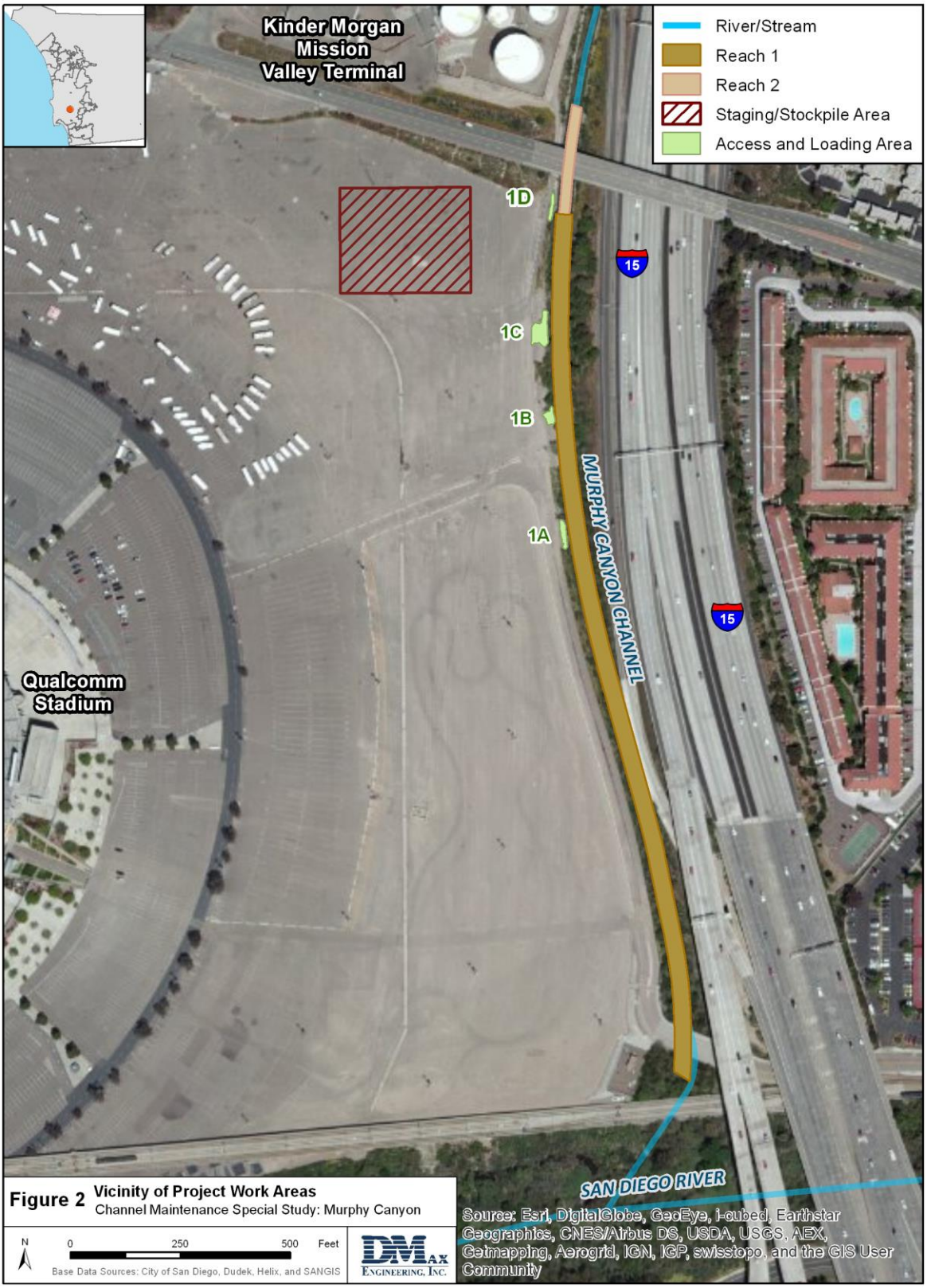
As a result of National Pollution Discharge Elimination System (NPDES) regulatory and other drivers, the City has prepared both jurisdictional and watershed scale plans that detail operational, administrative and structural activities for compliance with requirements. In 2015, the City updated its Jurisdictional Runoff Management Plan (JRMP) and is working collaboratively with stakeholders in the San Diego River to complete a watershed plan, known as Water Quality Improvement Plan (WQIP). The City's dual responsibility for water quality management and operation and maintenance of the storm drain system are integrated by implementation of the MMP, JRMP and WQIP. The City therefore performs operation and maintenance activities in the Murphy Canyon Channel within the context of the integrated water quality improvement and flood control risk management approach identified in the MMP, JRMP and WQIP documents.

## 1.4 Maintenance Activity

The Murphy Canyon Channel maintenance project IMP and IA package received a Notice of Decision approving the Substantial Conformance Review on April 24, 2014. Approriate environmental permits were also issued by the CDFW, RWQCB, and ACOE in 2013 and 2014 (IMP 2013c; City of San Diego 2014; Dudek 2015aa).

The maintenance project consisted of excavating accumulated vegetation, sediment, trash, and debris that significantly restrict the capacity of the Murphy Canyon Channel to convey storm flows and increase the risk of flooding. As prescribed by the MMP's requirements, the Murphy Canyon Channel required vegetation and sediment removal to retain the design storm water conveyance capacity (IHHA 2013). The City was permitted to use heavy equipment to collectively remove 8,000 to 11,500 cubic yards of material including sediment and vegetation within a project area of approximately 2.66 acres designated as channel maintenance areas, access/loading areas, and staging/stockpiling areas (Figure 2) (IBA 2013). Throughout the project there were no construction-related road closures (Dudek 2015a).

Figure 2. Vicinity of Project Work Areas



INTENTIONALLY LEFT BLANK

# 2 CHANNEL ASSESSMENT

This section summarizes current maintenance practices, avoidance and minimization measures, and existing adjacent infrastructure and constraints for the Murphy Canyon Channel.

## 2.1 Current Maintenance Level

The Murphy Canyon Channel is located in a natural flood plain. The Murphy Canyon Channel and the adjacent stadium parking lot area are within the Federal Management Agency (FEMA) Special Flood Hazard Areas Subject to Inundation by the 1-percent Annual Chance Flood (100 year floodplain) designated Zone A (Figure 4). Before maintenance, the Murphy Canyon Channel did not have the capacity to completely convey the 2-year storm flows without overtopping the banks of the channel (IHHA 2013). The Qualcomm parking lot has a history of flooding issues due to the limited capacity in the Murphy Canyon Channel. The most recent flooding occurred in late December 2014 when the stadium's parking lot flooded during a heavy storm (ABC 10 News 2014). In 2010, more severe flooding occurred and the Qualcomm football field was covered by 1.5 million gallons of water due to overflow of storm water in the San Diego River (Kenney 2014).

### 2.1.1 Past Maintenance

Reach 1 of the Murphy Canyon Channel was originally permitted and constructed in 1965, and maintenance has been inconsistent since its establishment. In 1978, a redesign was submitted, and a berm was installed along the west banks of the Reaches 1 and 2. The channel has been maintained on an as needed basis up until 2003, when the City received an emergency authorization through Regional General Permit 63 for maintenance activities, which were then conducted in 2005. In 2011, the City applied for additional emergency authorizations, but only a draft Streambed Alteration Agreement from the CDFW was issued. No maintenance activities were conducted at that time (IWQA 2013).

### 2.1.2 Purpose and Location

The Murphy Canyon Channel is located in an extensively developed area between Qualcomm Stadium and I-15. The purpose of periodic maintenance of the Murphy Canyon Channel is to restore capacity to the channel and prevent flooding to surrounding infrastructure by removing accumulated sediment, trash, and debris prior to transport downstream to the San Diego River. In March of 2013, URS evaluated the pre-maintenance channel conditions to determine the vegetation, sediment, and debris level from a hydrological and hydraulic standpoint. Little information was available on the hydrologic and hydraulic design of the channels; consequently, the hydrologic estimations in the IHHA report are based on the FEMA Flood Insurance Studies for San Diego County (IHHA 2013; FEMA 2014).

Reach 1 was not thoroughly assessed prior to maintenance during the site visit due to limited access and visibility from high vegetation density. Indirect methods such as topography, aerial photos, and limited recent survey data were used to supplement site observations and data. It was determined that the Murphy Canyon Channel was highly vegetated throughout, except at the bridge crossings. The sediment deposition amount for the analysis was estimated based on a site visit, visual observations, and as-built information. It was estimated that Reach 1 contained approximately one to three feet of sediment deposition. Based on subsequent field investigations actual sediment depths may have been as high as six to seven feet in localized portions of the channel. The maintained portion of Reach 1 was approximately 1,554 feet long and occupied a total of 0.87 acres (Dudek 2015a). Reach 2 of the Murphy Canyon Channel is a concrete-lined, trapezoidal channel which contained approximately one foot of sediment deposition (IHHA 2013). The portion of the Reach 2 maintained by the City was approximately 206 feet long, was an average of 20 feet wide, ranged from 1-3 feet deep, and occupied approximately 0.08 acres (IHHA 2013; Dudek 2015a).

The pre-maintenance peak average flow rates for Reaches 1 and 2 were 510 cubic feet per second (cfs) in the 2-year storm, 1,050 cfs for the 5-year storm, 2,000 cfs for the 25-year storm, and 2,700 cfs for the 50-year storm (IHHA 2013). Channel maintenance has enabled the channel to convey a higher flow rate in a storm, and has provided flood relief for surrounding properties including the Qualcomm stadium parking lot, roadways, and infrastructure. In the pre-maintenance condition, a low point in the west channel berm also impacted channel conveyance capacity (IHHA 2013). Reach 1 had low spots along the west berm which would have prevented the segment from containing the 5-year storm flow post-maintenance. With full repair to the damaged berm, the Reach 1 segment can convey the 10-year storm. After maintenance, Reach 2 can convey the 20 year storm with vegetation and sediment removed.

## 2.2 Maintenance Practice Modification Evaluation

Current maintenance practices include sediment and vegetation removal. This section evaluates the efficacy of these practices.

### 2.2.1 Maintenance Practices

Channel maintenance included sediment and vegetation removal, but did not include modification to the character, slope, or size of the original designs of the Murphy Canyon Channel. The general maintenance procedure used within the channels consisted of mechanized earth-moving equipment. The approach used to maintain the Murphy Canyon Channel is described below.

The Murphy Canyon Channel receives perennial flow due to year-round runoff from groundwater treatment and discharge activities (IWQA 2013). Prior to maintenance, a berm, visqueen, and pumps were installed at the northern limits of the channel maintenance area to divert dry weather flows downstream prior to and during maintenance activities. The diverted dry weather flows were discharged to a location south of the maintenance area near the confluence of Murphy Canyon Channel and San Diego River. Four access areas and loading areas (1A through 1D shown on Figure 2) were selected based on efficiency of maintenance and location of exotic invasive species on the channel banks (Dudek 2015a). Maintenance began within the upstream portion of Reach 1 to dredge the channel north of access and loading area 1D to gain access to Reach 2 (Figure 2). Maintenance work then began in Reach 2 and continued access in and out of the channel via access and loading area 1D within Reach 1 (IMP 2013). Fiber mulch and visqueen were used to contain sediment stored in the stockpile area which was located approximately 200 feet west of the channel in the Qualcomm Stadium parking lot (Dudek 2015c). The permit authorized the excavation of a total maximum of 15,000 cubic yards of material and sediment to be removed from the Murphy Canyon Channel (IMP 2013).

Once Reach 2 was maintained, the remaining portion of Reach 1 was dredged south towards the San Diego River confluence. The bulldozer and loader entered the channel pushed the accumulated material to the closest access and loading area, where an excavator was stationed just outside of the berm (IMP 2013). The excavator scooped material from the channel and load it into a rock truck waiting along the paved parking lot adjacent to the channel. The material trucks then hauled the material to Miramar Landfill (Dudek 2015a). Approximately 0.02 acres of Reach 1 was cleared of vegetation only since inundation of the channel prevented equipment from removing sediment. Additionally, approximately 0.25 acres of Reach 1 could not be maintained due to logistics (Dudek 2015a).

Based on a review of the pre-maintenance and design conveyance capacity of Murphy Canyon Channel Reaches 1 and 2 areas, current maintenance practices provide limited flood protection for surrounding areas. Reduced maintenance practices such as hand trimming of vegetation and leaving root structures and accumulated sediment in the channels would further reduce this limited level of flood protection to surrounding property and infrastructure by providing a mechanism for additional sediment accumulation and vegetation growth. Leaving the roots in place would likely result in rapid regrowth of aboveground biomass, reducing channel capacity and negatively affecting adjacent habitats and the flood capacity within the adjacent areas.

### 2.2.2 Alternatives

This section describes alternative maintenance approaches.

***Vegetation Clearing.*** Vegetation clearing is identified in the MMP as a maintenance alternative to minimize habitat and/or water-quality impacts in sensitive channel areas. In the pre-maintained condition, as much as 6-7 feet of sediment accumulated in some areas of the Channel (IHHA 2013). Vegetation trimming alone cannot restore the design capacity of the Murphy Canyon Channel due to the accumulated sediment, trash, and debris in the channel. Vegetation trimming by hand without sediment removal allows for Reach 1 to convey approximately the 2-year storm. Sediment and vegetation removal that includes the vegetative root system allows for Reach 1 to convey approximately the 10-year storm. Further, vegetation clearing of the channel by hand has the same biological impact as removing both sediment and vegetation. Accordingly, vegetation trimming alone would result in an insignificant increase in channel conveyance capacity. More frequent maintenance is needed if only vegetation is removed since the original design capacity of the channel is not restored.

***Frequency***. Observational evidence indicates that even relatively small storm events can result in sediment accumulation and allow vegetation establishment in the San Diego area channel areas. Maintenance frequency is discussed in detail in Section 2.3.

***Native Species Recruitment***. A mixture of native and non-native species were removed from the Murphy Canyon Channel (Dudek 2015b; Dudek 2015c). A mixture of native, non-native, and invasive species reduced the capacity of the channel which lead to flooding of the surrounding areas. A significant portion of the plants present in the channel were native species, however, the presence of native vegetation reduced the capacity of the channel to below acceptable levels. Since both native and non-native species contribute to flood control issues there would still be flooding impacts if only non-native species were removed from the Murphy Canyon Channel. Removal of non-native species, and recruiting or leaving native vegetation intact, would not prevent the need for maintenance to reduce flood risk to surrounding areas. In order to reestablish native species in disturbed upland areas, the access and loading areas were revegetated using a native erosion control seed mix. These areas will be monitored by City staff for 25 months after seeding to ensure establishment of species to provide adequate erosion control (Dudek 2015a). Maintenance of existing vegetation has been performed and should be continue to be conducted periodically to ensure flood protection for the surrounding areas.

***Enhance Channel Capacity***. The Murphy Canyon Channel area is constrained by surrounding development, including existing transportation, industrial, and commercial uses. There are limited opportunities to enhance the channel capacity unless significant infrastructure changes are considered. Existing infrastructure and the proximity of the channels to the FEMA floodway provide significant constraints to channel capacity enhancements. The IHHA discusses four potential alternatives to improve channel capacity: raising the channel banks by constructing walls or berms along the top of the channels, diverting storm water in pipes around constrained segments, widening channels to accommodate vegetation, and reducing off-site runoff (IHHA

2013). Of the discussed alternatives, off-site runoff reduction may provide a long-term option for reducing flow volumes and localized flooding in the Mission Valley area. However, watershed-based projects that result in measurable runoff reduction to the Mission Valley area may take decades to implement. The physical constraints of the channels are discussed in more depth in Section 2.7, and opportunities for enhancing channel capacity are elaborated on in Section 3.1

## 2.3 Maintenance Frequency Assessment

Over the past decade, maintenance within the Murphy Canyon Channel has been inconsistent and sporadic. Channel maintenance has been conducted on an as needed basis due to hydrological conditions, sensitive biological resource protections, environmental permitting challenges, and weather constraints. This section analyzes the results of the current frequency of maintenance, and evaluates the potential impacts of changes in maintenance frequency.

In its pre-maintenance condition, the capacities of Reaches 1 and 2 can accommodate less than the 2-year storm. Material likely accumulates within the two channels at different rates, which depend on a variety of environmental factors, including the intensity of rain events, the timing of rain events during the wet season, the quantity of trash that is mixed in with sediment, and other environmental factors. Moving forward, the MMP process provides a framework to document maintenance effort, sediment accumulation, and vegetation establishment rates. The City may use current maintenance effort documentation processes and other data such as local precipitation and large scale climactic information to estimate optimum frequency of maintenance activities in the Murphy Canyon Channel area.

Given annual rainfall averages approximately nine inches in the San Diego region, it is anticipated that even limited accumulation of sediment and trash from the contributing watershed area will reduce the conveyance capacity of the Murphy Canyon Channel. After maintenance was performed, the channel conveyance capacity for Reach 1 increased to approximately the 10-year storm. The 10-year storm provides limited flood protection for the infrastructure adjacent to the Murphy Canyon Channel. During wet years, annual maintenance may be required to maintain design capacity of the Murphy Canyon Channel.

## 2.4 Herbicide Needs Assessment

The Murphy Canyon Channel, during post-maintenance periods, could be characterized by recruitment and growth of non-native species. The IMP for Murphy Canyon Channel maintenance did not include the use of herbicides to eradicate Arundo and other invasive species nor were any used during maintenance (Dudek 2015a). Non-natives were removed using mechanized equipment removing the roots and sediment from the channel. Herbicide usage may be considered for future maintenance activities depending on site conditions including channel flow.

## 2.5 Vegetation Assessment

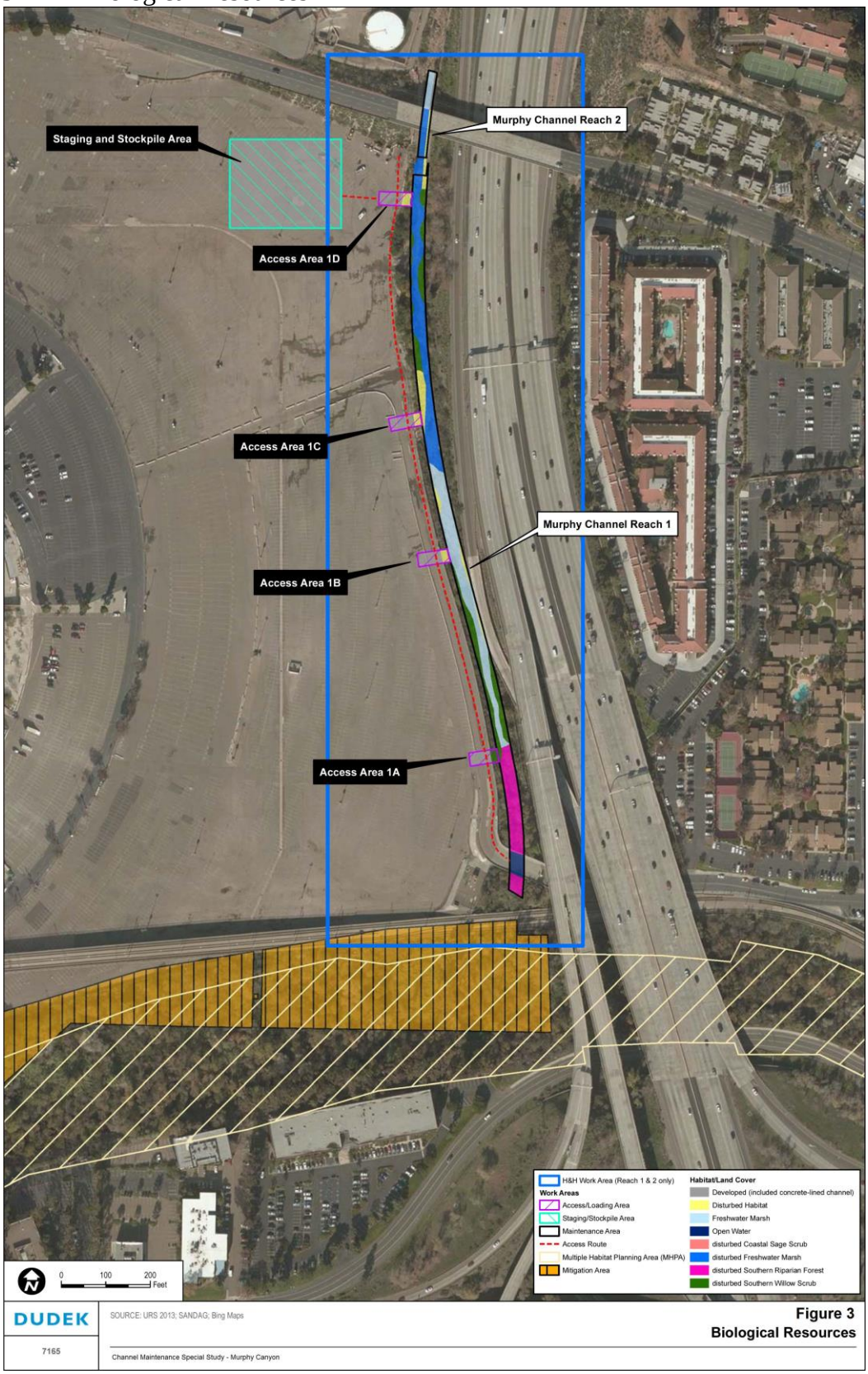
In the pre-maintenance condition, three vegetation communities (including disturbed forms) and four land cover types were present in the maintenance area, including access and staging areas (Table 2). The vegetation communities are identified as freshwater marsh, southern willow scrub, southern riparian forest, open water, disturbed/ruderal habitat, developed land, and developed/concrete channel (Figure 3).

**Table 2**
**Mapped Vegetation Communities Present in the**
**Murphy Canyon Channel Areas Prior to Maintenance**

| Vegetation Community | Reach 1 | Reach 2 | Channel Acreage Impacts |
|---|---|---|---|
| *Wetland* | | | |
| Freshwater Marsh[1] | 0.65 | 0.07 | 0.72 |
| Southern Riparian Forest[1] | 0.21 | - | 0.21 |
| Disturbed Southern Willow Scrub | 0.25 | - | 0.25 |
| Open Water/Natural Flood Channel | 0.04 | - | 0.04 |
| Developed/Concrete Channel | - | 0.02[2] | 0.02 |
| Subtotal | 1.15[1] | 0.09 | 1.2 |
| *Upland* | | | |
| Disturbed/Ruderal Habitat | 0.14 | 0.01 | 0.15 |
| Developed Land | 1.29 | — | 1.29 |
| Subtotal | 1.43 | 0.01 | 1.44 |
| **Total** | **2.58** | **0.10** | **2.68** |

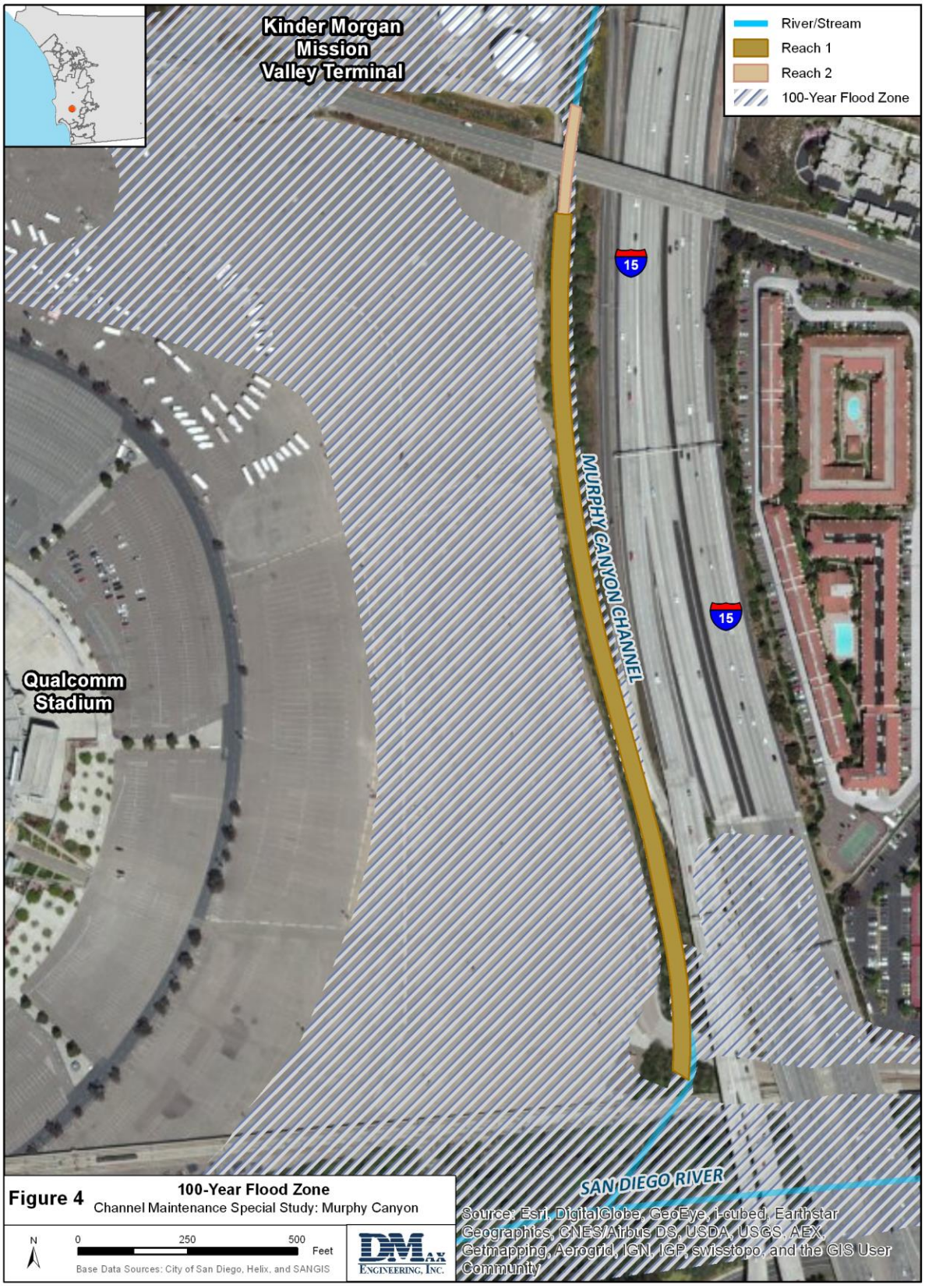
As a result of the maintenance activity, freshwater marsh was the largest vegetation community impacted in the pre-maintenance area for Reach 1. The freshwater marsh in Reach 1 supported native species, non-native species, and invasive species. The three dominant species found in the freshwater marsh community were cattail (*Typha* sp.), arroyo willow (*Salix lasiolepis*), and curly dock (*Rumex crispus*) (IBA 2013). Tule or hardstem bulrush (*Schoenoplectus acutus*) were the primary species removed from the freshwater marsh habitat, while the non-native castor bean (*Ricinus communis*) and giant reed (*Arundo donax*) were present in disturbed areas (Dudek 2015b). Pre-maintenance juvenile arroyo willow trees dominated the disturbed southern willow scrub habitat in Reach 1 (Dudek 2015b).

Figure 3 Biological Resources



INTENTIONALLY LEFT BLANK

Figure 4 100-Year Flood Zone



INTENTIONALLY LEFT BLANK

Freshwater marsh, which includes disturbed freshwater marsh, was the only vegetation community mapped within the maintenance area for Reach 2 and is directly associated with channel flows through the Murphy Canyon Channel. The dominant species identified in Reach 2 were cattail and Arroyo willow (IBA 2013). During maintenance, the primary freshwater marsh species that were removed were tule and hardstem bulrush (*Schoenoplectus acutus*) in Reach 2 (Dudek 2015c).

Pampas grass (*Cortaderia selloana*) was a dominant non-native species supported in Southern Willow Scrub, Southern Riparian Forest, and disturbed Southern Willow Scrub within Reach 1 and the surrounding area (IBA 2013). Approximately 0.06 acres of upland vegetation removed from Reach 1 which included non-native weed species, broom baccharis (*Bacharis sarothroidies*), and ornamental trees (Dudek 2015b).

In Reach 1, disturbed Southern Willow Scrub was the second largest vegetation community and was dominated by the invasive species giant reed (*Arundo donax*) and Pampas grass (*Cortaderia selloana*) (IBA 2013).

The staging and access areas in both Reaches 1 and 2 were been classified as developed. These areas lack native vegetation, mainly attributed to previous development and disturbance. These areas include manmade features including parking lots, streets, and other structures (IBA 2013).

There were no plant species of special status within the maintenance area or in the adjacent area. Based on the field study conducted April 3, 2013, there was a low potential for any vegetation species with special status to occur within the maintenance area prior to or during maintenance, mainly due to lack of substrate and appropriate habitat (IBA 2013).

## 2.6 Habitat Assessment

The area surrounding the Murphy Canyon Channel is a highly developed area of the City of San Diego. The Murphy Canyon Channel drains two urbanized areas: Mission Valley and Clairemont Mesa. Additionally, the maintenance area was located in close proximity to public and private infrastructure. According to the California Protected Areas Database, there are no conservation easements within or adjacent to the maintenance areas. However, there are conservation easements located in close proximity to the maintenance area. The Serra Mesa Open Space is located 0.17 miles northwest of the maintenance area, and the San Diego River Ecological Reserve is located approximately 0.2 miles to the southwest (CPAD 2012).

During the biological survey conducted April 3, 2013, it was determined that no federally or state-listed plant or animal species were present, including raptors and other species with special-status under the Multiple Species Conservation Program (MSCP). However, habitats present within and surrounding the maintenance impact areas have the potential to support special-status

wildlife species, including raptors. These habitats include riparian and wetland communities, located in riparian forests, southern willow scrubs, and freshwater marshes.

***Reach 1:*** According to the IBA, there was a moderate to high potential to support least Bell's vireo (*Vireo bellii pusillus*), a MSCP and federally and state listed endangered species, and the yellow warbler (*Dendroica petechia brewsteri*), a CDFW State Species of Special Concern in the southern riparian forest and southern willow scrub of Reach 1. Riparian habitat has a moderate potential to support nesting raptors such as red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), and Cooper's hawk (*Accipiter cooperii*), which are MSCP covered and CDFW State Species of Special Concern. Additionally, there is documentation indicating that least bittern (*Ixobrychus exilis*), a CDFW State Species of Special Concern, has been known to breed in the vicinity of the maintenance area within the San Diego River habitat corridor downstream of the proposed maintenance area. Post breeding season light footed clapper rail individuals have also been documented downstream in the San Diego River habitat corridor (IBA 2013).

***Reach 2:*** This Reach did not contain enough substantial habitat and cover to support nesting for least Bell's vireo, and it is also unlikely that raptors would have inhabited this area. The yellow warbler may potentially find enough habitat in the few young willow trees, however this has not been documented. There may be support for least tern in the freshwater marsh habitat, as this species has been documented breeding in the vicinity of the project, downstream of the proposed maintenance area within the San Diego River habitat. Post-breeding season light-footed clapper rail individuals (*Rallus longirostris levipes*), a MSCP covered and federal and state listed Endangered Species, have also been documented in the freshwater marsh habitat downstream of the San Diego River habitat corridor (IBA 2013).

Maintenance did not occur during the least Bell's vireo breeding season, March 15th through September 15th. Part of the City's MSCP Multi-Habitat Planning Area (MHPA) is located approximately 125 feet south of the project maintenance area associated with Reach 1. Maintenance equipment did not enter this area at any time during channel maintenance. Any noise associated with project maintenance did not exceed 60 dbA within the MSCP, consistent with the City of San Diego California Environmental Quality Act (CEQA) Significance Determination Thresholds (CEQA, 2011; INA 2013).

## 2.7 Infrastructure Assessment

A number of watershed configuration, land ownership, and infrastructure components provide limits to channel maintenance alternatives in the Murphy Canyon Channel. The Murphy Canyon Channel borders Qualcomm Stadium to the west, I-15 to the east, and I-8 just south. The San Diego Mission Road bridge is oriented east to west over the center of the channel (Dudek

2015c). The MVT directly borders the channel to the northwest, and the San Diego trolley system rail bridge crosses over the south end of the channel, just before its confluence with the San Diego River. Urban development, agriculture, ranching and residential activities throughout the watershed have significantly changed the hydrology of the river over the past few decades. Berms, bridges, and roadways constructed to direct floodwaters away from existing infrastructure and provide access have reduced the dynamic capacity of the channel system to shift location over time. Accordingly, a multitude of land use, existing infrastructure and climatic factors impacting watershed dynamics serve to affect the feasibility of alternatives to channel maintenance needed to protect life and property in Mission Valley. The adjacent infrastructure indubitably limits the potential for maintenance alternatives, such as widening the channel or installing retention facilities. Additional discussion of channel widening and other approaches to channel reconfiguration is provided in Section 3.1.

A general discussion of infrastructure configuration within and adjacent to the proposed maintenance area must begin with an assessment of the natural flood plain for the approximately 440 square mile watershed (Project Clean Water 2015). Reaches 1 and 2 and the adjacent Qualcomm parking lot are within the area designated as a FEMA Special Flood Hazard Area Subject to the 1-percent Annual Chance Flood (100-year floodplain) Zone A (Figure 3). This land determined as Zone A has a 1-percent or greater chance of flooding in any given year. Special permitting is required for all proposed construction and development within this area, and any installation is to be implemented using methods to minimize flood damage (CFR 2002). Given the San Diego River configuration, property ownership, and infrastructure framework there are limited opportunities to integrate alternative approaches to channel maintenance efforts aimed at reducing flood risk.

The Settlement Agreement references the potential for installing retention systems at Qualcomm Stadium. For a retention system to reduce maintenance needs by any appreciable amount it would have to be prohibitively large. The flow rate within all but the smallest channels is so large that a retention system would be multiple acres in surface area. For large channels such as Murphy, Tijuana, or Sorrento Valley it could impact tens or even hundreds of acres. For this reason, building an above-ground retention system is an infeasible option on all but the smallest channels.

Over longer timescales, infrastructure improvements designed to enhance public safety or improve transportation efficiency can often provide opportunities for examination of drainage and flood control needs. In urbanized areas with undersized channels or sediment- and vegetation-filled drainage features, adjacent roadway and bridge infrastructure improvements regularly allow for evaluation of various alternatives to frequent channel capacity-restoring maintenance. Examples of potential integrated infrastructure and flood control improvement projects include improved access to maintenance areas to reduce habitat impacts, channel widening and integration of LID features to reduce flow velocity and improve water quality.

INTENTIONALLY LEFT BLANK

# 3 RETROFIT OPPORTUNITIES

This section identifies different retrofit opportunities for channel maintenance operations, and includes analyzing the present channel configuration and opportunities to alter the capacity, habitat preservation options in the Murphy Canyon Channel, and channel discharge maintenance opportunities.

## 3.1 Channel Configuration

As discussed in Section 2.7, there are limited opportunities to alter the Murphy Canyon Channel configuration in an effort to abate flooding in Mission Valley due to limited space, adjacent parcel ownership, and projected cost. However, other means of channel modification exist to reduce the risk of flooding in the surrounding maintenance area in addition to vegetation and sediment removal.

One potential retrofit opportunity outlined in the Settlement Agreement is to "daylight" the channels, which aims to restore the channels to a more natural state. Reaches 1 and 2 of the Murphy Canyon Channel are already open channels and consequently no pipes or concrete structures may be removed. To convert Reach 2 to a more natural state, the concrete lining of the channel in reach could be removed. In order to maintain design capacity of a concrete lined Reach 2 as an earthen channel, the width of the channel would need to be increased. It is likely there would not be sufficient space to expand Reach 2 and convert it into a more natural stream due to surrounding gas and sewer main lines. Removal of concrete lining in the highly urbanized Murphy Canyon Channel appears to be relatively infeasible, due to space, cost, and functionality.

As mentioned before, the Murphy Canyon Channel, and surrounding property in Mission Valley, is located within the 100-year flood plain and are subject to periodic riverine flooding. The City has advocated that detailed watershed hydrology and hydraulic modeling be conducted to add to the limited available data that may be used to inform flood control and sediment management policy and project implementation decisions. However, it is anticipated that based on the limited design capacity of the Murphy Canyon Channel, channel configuration changes leading to meaningful conveyance improvements and reduced maintenance are likely limited by adjacent infrastructure and habitat.

Additional channel configuration alternatives originally considered as part of the PEIR and described in the IHHA are discussed below.

***Raising the channel banks by constructing walls or berms along the top of the channels.*** Channel capacity could theoretically be increased by raising the banks along the Murphy Canyon Channel. If the banks were raised in Reach 1, but the sediment and vegetation remained, then upstream areas will be affected by flooding due to the increase in the water surface elevation.

Existing storm drain pipes that discharge into the channels would be blocked by the buildup of sediment and vegetation which would cause additional flooding impacts to surrounding areas. With this alternative, if flood water does manage to exceed the banks it could result in greater damage to the surrounding infrastructure.

***Diverting storm water in pipes around constrained segments.*** Using pipes around constrained segments to divert storm water does not eliminate the need for channel maintenance. In order to sustain the wetland habitat a diversion structure would need to be designed which maintains a low flow through the existing channel. Without maintenance, sediment and/or vegetation would build up in the existing channel and ultimately block the desired low flows from entering the channel, which would cause the wetland to dry out.

Diverting storm water flows appears to be impractical for Reach 2 due to the limited corridor area between I-15 and Mission Valley Terminal. There are numerous utilities located in this corridor, including sewer and gas main lines that will likely be cost prohibitive to relocate (IHHA 2013).

***Widening channels to accommodate vegetation.*** Qualcomm Stadium's parking lot borders the western side of Reach 1, and an on ramp to I-15 runs along the eastern side of Reach 1. Encroaching on the Caltrans right-of-way for I-15 is not considered a feasible option. Expanding the channel to the west would require demolishing part of the adjacent parking lot and reconfiguring the parking lot's entry road. Qualcomm stadium's parking lot is 122 acres and has a parking capacity of 18,500 spaces, which is approximately 25% of the stadium's capacity of 72,000 attendants (Chargers 2015). A reduction in the size of the parking lot could pose potential problems for stadium operation, and widening the channel in this direction could also impact the trolley bridge. Adjustments to the trolley bridge just past the downstream end of Reach 1, where it joins the San Diego River, might also be necessary. Modifications to the trolley bridge would need to be approved by the San Diego Metropolitan Transit System (MTS). Additional analysis that is beyond the scope of the present study would be necessary to determine the degree of impact to Qualcomm Stadium and MTS facilities and the projected cost of the widening project. As described in Section 2.7, channel widening could potentially become a more feasible option in the context of a large-scale redevelopment of the Qualcomm Stadium property.

Reach 2 is constrained by the bridge over San Diego Mission Road and by the I-15 on-ramp. The I-15 is considered a high priority corridor (AARoads 2015). Since the I-15 is critical transportation infrastructure widening Reach 2 is not a feasible option.

## 3.2 Habitat Preservation

For the proposed project, habitat preservation will predominantly be in the form of mitigation. The mitigation plan proposes a total of 14.1 acres of wetland rehabilitation, 20.7 acres of wetland

enhancement, 5.8 acres of riparian area rehabilitation, and 9.0 acres of riparian area enhancement to compensate for this project and other City of San Diego projects (RWQCB 2014).

Channel maintenance was conducted between December 22, 2014 and March 14, 2015. It was determined that the Murphy Canyon Channel maintenance did not disturb any wildlife corridors or extensive riparian woodland. The maintenance was performed to avoid the breeding season of several special-status species including light-footed clapper rail and least Bell's vireo. In accordance with the PEIR Mitigation Measure 4.3.13, an initial survey for nesting raptors was conducted in the maintenance area and buffer zone when the nesting season began. No nesting raptor species were observed during the initial survey or during subsequent weekly surveys (Dudek 2013).

Portions of the surrounding habitat within the watershed has been set aside as part of the MHPA or other preserve lands, including Mission Trails Regional Park. Reaches 1 and 2 flow directly into the main San Diego River corridor through Mission Valley. Regionally, a number of urban habitat areas within the City of San Diego included in the MHPA provide habitat for native species to continue to reproduce and find new territories, or by providing necessary shelter and forage for migrating species (mostly birds). The south slope of Mission Valley, the San Diego River and other areas are managed pursuant to existing Natural Resource Management Plan and provide habitat for special status species and serve as wildlife corridors. The impact of maintenance in Reaches 1 and 2 of the Murphy Canyon Channel area is negligible relative to these regional areas of preserved habitat in the highly urbanized Mission Valley Area.

## 3.3 Channel Discharge

The discussion of channel discharge is related downstream water quality and flooding. Reaches 1 and 2 from the Murphy Canyon Channel are tributary to the lower San Diego River and have impacts on downstream water quality. Fecal indicator bacteria is the highest priority water quality condition for the San Diego River Watershed Management Area as outlined in the watershed's WQIP (San Diego River Responsible Parties 2015). Additionally, the lower San Diego River is listed on the 303(d) List of Water Quality Limited Segments (303(d) list). The lower San Diego River is 303(d) listed for Enterococcus, fecal coliform, low dissolved oxygen, manganese, nitrogen, phosphorus, total dissolved solids, and toxicity. According to the 303(d) list urban runoff, natural sources, hydromodification, and municipal wastewater are known pollutants sources for the lower San Diego River (SWRCB 2010). Additional pollutants may be a result of unknown point and nonpoint sources, such as wastewater, urban runoff, storm drains, natural sources, and flow regulation and modification (IWQA 2013). Fecal coliform is the only pollutant with a Total Maximum Daily Load (TMDL) in the lower San Diego River (IWQA 2013).

Mission Valley Terminal continually remediates ground water to address the presence of pure-phase, dissolved petroleum hydrocarbons, and fuel oxygenates that lie beneath MVT (Arcadis 2013a). As a result, up to 1.26 million gallons of groundwater per day are pumped, treated, and discharged to Murphy Canyon Creek at a discharge point approximately 2,800 feet north of the San Diego River confluence. This discharge flows through parts of the Murphy Canyon Channel proposed for maintenance in this report. Monitoring of five different locations along the Murphy Canyon Channel and San Diego River began in January 2012. Samples were tested for temperature, pH, salinity, dissolved oxygen, conductivity, and total dissolved solids (Arcadis, 2013b).

As outlined in the IWQA, there is little potential for water quality impacts from channel maintenance that would result from the loss of pollutant assimilative capacity through vegetation removal. Also, during maintenance sediment control measures such as silt fences, temporary sediment basins, berms, fiber rolls, and gravel bags were implemented to prevent sediment from entering the water column. Removing sediment from within the channels and preventing the introduction of soil and sediment to the water column during maintenance results in removal of pollutants that could potentially negatively affect water quality downstream and could contribute to human health complications and native vegetation impacts. Sediment removal prevents the metals and inorganic non-metals present in the sediment from being mobilized during storm events, thus benefiting the overall water quality in the lower San Diego River.

Channel flow is a primary contributing factor to flood risk in the area adjacent to the Murphy Canyon Channel maintenance area. To the general public, localized implementation of Low Impact Development (LID)-type BMP features in the watershed is often considered to be potential solutions to reduce flooding. LID features, such as bioretention areas and other best management practices (BMPs) do not have an impact on the need to perform channel maintenance. Typically retention basins are created to improve water quality, but these features can also reduce runoff volumes and flow rates. However, LID features are usually designed based on the 85th percentile storm, which is much smaller than the 10-, 50-, or 100-year peak storms used for flood control design. For that reason, LID installation would not have a measurable impact on peak flows for large storms, downstream flooding. In addition, LID BMP implementation opportunities are generally associated with new development and redevelopment projects as part of an overall site-specific water quality management strategy. Therefore, the rate of LID BMP implementation in the San Diego River Watershed Management Area is dependent on new and re-development project initiation, site-specific topography and configuration constraints, and LID design standards. It is anticipated that these factors will limit overall LID BMP impacts to channel flows until widespread implementation is accomplished throughout the watershed. Accordingly, in the flood control analysis conducted as part of the IHHA, the benefit

of LID BMPs (e.g., reducing the impermeable area and redirecting runoff to pervious areas) was considered negligible due to the limited implementation opportunities.

Finally, conservation and property acquisition could be utilized to balance property ownership and flood risk through a variety of mechanisms in Mission Valley. Multiple benefits may include expansion of existing riparian corridors and native habitat, improved recreational trails, and reduction of infrastructure requiring flood protection. Accordingly, the City may seek to identify appropriate partnership and grant programs that may provide capital and/or long-term operation and maintenance funding for purchase of property with existing infrastructure that may be restored to native habitat.

INTENTIONALLY LEFT BLANK

# 4 DISCUSSION

The City's MMP is designed to allow flood control channel operation and maintenance activities for the protection of life and property to be conducted in an efficient, economic, and environmentally and aesthetically acceptable manner. This special study evaluated the purpose, need, and alternatives to channel maintenance activities in the Murphy Canyon Channel. This Channel Maintenance Special Study is required under a legal agreement related to the MMP.

As mentioned previously, maintenance has been occurring since 1965 within the two reaches of the Murphy Canyon Channel. The past maintenance practices for the Murphy Canyon Channel have been on an as-needed basis and have consisted of periodic removal of trash, debris, sediment, and vegetation. In the maintained condition, Reach 1 can convey up to the 10-year storm, which does not reach the typical engineering design standard of conveying the 100-year storm. Without maintenance, the level of flood protection provided will be even lower. Channel maintenance is therefore necessary to provide even limited flood protection to the adjacent infrastructure surrounding the Murphy Canyon Channel.

The City recently maintained the Murphy Canyon Channel to reduce flood risk to life and property. The Murphy Canyon Channel conveyance capacity has been improved after maintenance, which will provide flood risk management benefits. The City and resource agencies have reviewed the project impacts and determined a set of compensatory mitigation measures, which include implementing habitat and water quality mitigation measures that are commensurate with the impacts of the project, that the City has committed to implement.

Alternatives to the maintenance activities were also considered, but the alternative approaches were not found to be effective substitutes in achieving the goal of restoring flood protection to the area surrounding the Murphy Canyon Channel. An analysis of the alternatives is provided earlier in this report and is summarized below.

Raising the channel banks in the Murphy Canyon Channel could be an option, but it is the storm drain pipes that discharge into the channel would become clogged, causing flooding elsewhere. Diverting storm water through installed pipes, around the obstructed channel segments, may be another option for eliminating flooding in earthen Reach 1, but this could potentially cause the wetland habitat to dry out, which is not acceptable (IHHA 2013). Installing LID features like bioretention areas throughout the tributary drainage area may benefit water quality but is not likely to have a major effect on flooding for larger storms. Installing a retention basin in the Qualcomm parking lot as a measure to reduce flooding was discussed in the Settlement Agreement, and in the current conditions creation of retention facilities is not feasible given Qualcomm's operations. If redevelopment of the area occurs on a larger scale in the future then retention facilities could be incorporated into that development project to treat runoff generated

from on-site impervious surfaces. Given space and operational constraints, it is unlikely potential retention facilities would be adequately sized to treat off-site runoff. Similar to LID features, therefore, a localized retention facility is unlikely to significantly reduce flood risk. Channel and associated berm configuration, adjacent biological resources, and private property generally limit maintenance practice modifications and alternatives to current activities.

The City is participating with other municipal agency dischargers to develop a WQIP aimed at reducing pollutants in the municipal separate storm sewer system (MS4). Under the current NPDES regulatory framework, dischargers have identified indicator bacteria as the highest priority water-quality condition for the San Diego River Watershed Management Area. The WQIP identifies a suite of water quality improvement strategies to effectively and efficiently eliminate non-storm water discharges to the MS4, reduce pollutants in storm water discharges from the MS4 to the maximum extent practicable, and achieve identified interim and final regulatory numeric goals. The San Diego River WQIP identifies a strategy of implementation of operation and maintenance activities (inspection and cleaning) for MS4 and related structures (catch basins, storm drain inlets, channels as allowed by resource agencies, detention basins, pump stations, etc.) for water quality improvement and for flood control risk management.

Through this and other partnership efforts, the City aims to pursue appropriate operational and multi-agency projects to reduce sediment and non-storm water discharges conveyed by the MS4 prior to discharge to the Murphy Canyon Channel areas. While these activities are anticipated to have ancillary benefits that may reduce the long-term need for channel maintenance activities, the current channel configuration and adjacent infrastructure limits opportunities to reduce channel maintenance in the Murphy Canyon Channel maintenance area.

# 5 REFERENCES

AARoads. 2015. *AARoads' Interstate Guide. Interstate 15*. http://www.interstate-guide.com/i-015.html. Accessed May 2015.

ABC 10 News. 2014. *Flooding: Qualcomm's parking lot under water* http://www.10news.com/news/flooding-qualcomms-parking-lot-under-water. Accessed June 2015.

Arcadis. 2013a. *Groundwater Monitoring and Remedial Progress Report, Fourth Quarter of 2012. Mission Valley Terminal, San Diego, California*.

Arcadis. 2013b. *Semiannual Status Report for Time Schedule Order (TSO) No. R9- 2011-0052, Mission Valley Terminal, San Diego, California*. Accessed May 2015.

California Environmental Quality Act (CEQA) 2011. *Significance Determination Thresholds*, Development Services Department City of San Diego. January 2011.

California Protected Areas Database (CPAD). 2012. *State Agency Level Online Database*. http://www.calands.org/. Accessed April 2013.

California Regional Water Quality Control Board, San Diego Region (RWQCB). 2010. Appendix J. *Final Technical Report Bacteria TMDLs for Beaches and Creeks*. http://www.waterboards.ca.gov/rwqcb9/water_issues/programs/tmdls/bacteria.shtml.

California Regional Water Quality Control Board, San Diego Region (RWQCB). 2011. *Water Quality Control Plan for the San Diego Basin (9).*

California Regional Water Quality Control Board, San Diego Region (RWQCB). 2014. Clean Water Act Section 401 *Water Quality Certification and Waste Discharge Requirements for Discharge of Dredged and/or Fill Materials*.

City of San Diego. 2011. *Master Storm Water System Maintenance Program (MMP).*

City of San Diego. 2014. *Notice of Decision*. Development Services Department. Internal Order No. 21002863.

CFR (Code of Federal Regulations). 2002. *Emergency Management and Assistance*, 44 CFR 1A.59.1 and 44 CFR 1A.60.3. October 1, 2002.

Chargers. 2015. *Qualcomm Stadium Facts & Stats*. http://www.chargers.com/gameday/facts-and-stats. Accessed April 2015.

Coffman, Larry. 2000. *Low-Impact Development Design Strategies, an Integrated Design Approach.* EPA 841-B-00-003. Prince George's County, Maryland. Department of Environmental Resources, Programs and Planning Division.

Dudek. 2013. *Individual Water Quality Assessment Report* (IWQA).

Dudek. 2015a. *Final Monitoring Report for the Murphy Canyon Channel Maintenance Project* (2015).

Dudek. 2015b. *Individual Maintenance Activity Report*. Murphy Canyon Channel: Reach 1.

Dudek. 2015c. *Individual Maintenance Activity Report*. Murphy Canyon Channel: Reach 2.

Federal Emergency Management Agency (FEMA). 2014. *Flood Insurance Rate Map*.

Kenney, K. 2014. The San Diego Union-Tribune. *SDSU Flowered in 2010 Poinsettia Bowl.* Accessed May 2015.

Liddicoat, T. 2013. *Individual Biology Assessment Report* (IBA).

Project Clean Water. 2015. *San Diego River Watershed.* http://www.projectcleanwater.org/html/ws_san_diego_river.html. Accessed March 2015.

Settlement Agreement. *San Diegans for Open Government et al v. City of San Diego* San Diego Superior Court Case No. 37-2011-00101571..

San Diego River Responsible Parties. 2015. *San Diego River Watershed Management Area Water Quality Improvement Plan* (WQIP)

San Diego Stadium Cooperative Coalition. 2015. *Mission Valley Stadium Private Financing Proposal.* http://www.sandiego.gov/real-estate-assets/pdf/stadium/missionvalleystadiumprivatefinancingproposal.pdf. Accessed May 2015.

Storm, M. 2013. *Individual Noise Assessment Report* (INA).

SWRCB (State Water Resources Control Board). 2010. *Impaired Water Bodies. 2010 Integrated Report (Clean Water Act Section 303(d) List / 305(b) Report) – Statewide. San Diego, CA.* http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml. Accessed March 2015.

URS. 2013a. *Individual Hydrologic & Hydraulic Assessment Report* (IHHA*).*

URS. 2013b. *Individual Maintenance Plan Report* (IMP).