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9 October 2012

Mr. Dale Bowyer
Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

SUBJECT: **Supplemental Materials in Response to Incomplete Application**
Section 401 Certification
Oakland Zoo California Exhibit Expansion Project
Knowland Park, Oakland, California

Dear Mr. Boyer:

This letter serves as our formal response to the Regional Water Control Board (RWQCB) incomplete JARPA determination letter dated March 1, 2012 regarding the Section 401 Certification for the Oakland Zoo California Exhibit Expansion Project, and serves as a transmittal for the comprehensive materials our consultants on the project have prepared in response to your determination letter. These attached materials consist of the following:

1) Mitigation and Monitoring Plan (MMP) prepared by Environmental Collaborative (dated June 2012) addressing the proposed modifications to Arroyo Viejo Creek vicinity of the project area.
2) Cover letter from Aliquot (dated May 29, 2012) to me detailing the responses to the RWQCB incomplete application determination letter.
3) Preliminary Stormwater Control Plan prepared by Aliquot (dated May 29, 2012).
4) Draft Stormwater Inspection and Maintenance Plan by Aliquot (dated May 2012.
5) Revised Arroyo Viejo Outfall materials by Aliquot (dated April 10, 2012).

Please note that based on the updated calculations performed by Aliquot, the size of the culvert outfall into Arroyo Viejo Creek has been reduced from the 36 inch indicated in our JARPA of February 1, 2012 to 27 inches. No other changes to the JARPA have been made in response to the additional review and analysis performed to address the incomplete determination letter from the RWQCB.

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Our consulting team is available to meet with you and Brian Wines of your staff to review the comprehensive materials contained in this package. This may be a very useful meeting given the volume of material requested by the RWQCB and provided in this response package.

Please let me know if you have any questions, need any other additional information, or would like to set up a time when staff from Aliquot could meet at the RWQCB offices to review the attached materials.

We look forward finally making progress in obtaining the 401 Certification for this project.

Sincerely,

Nik Dehejia
Director, Strategic Initiatives
East Bay Zoological Society

cc: Holly Costa, U.S. Army Corps of Engineers
Marcia Grefsrud, California Department of Fish and Game
Darin Ranelletti, City of Oakland
Jim Martin, Environmental Collaborative

ATTACHMENTS:

1. Mitigation and Monitoring Plan, Environmental Collaborative, June 2012
2. Cover letter from Aliquot to Nik Dehejia, East Bay Zoological Society, May 29, 2012
3. Preliminary Stormwater Control Plan, Aliquot, May 29, 2012
4. Draft Stormwater Inspection and Maintenance Plan, Aliquot, May 2012
5. Revised Arroyo Viejo Outfall, Aliquot, April 10, 2012

MITIGATION AND MONITORING PLAN

FOR THE
STORM DRAIN OUTFALL REPLACEMENT AND ARROYO VIEJO CREEK ENHANCEMENT COMPONENT OF THE OAKLAND ZOO EXPANSION PROJECT CITY OF OAKLAND, ALAMEDA COUNTY, CA APN 048-5655-003

Prepared for:

East Bay Zoological Society
9777 Golf Links Road
PO Box 5238
Oakland, CA 94605

Prepared by:

Environmental Collaborative
1268 64th Street
Emeryville, CA 94608
510/654-4444

June 2012

MITIGATION AND MONITORING PLAN
STORM DRAIN OUTFALL REPLACEMENT AND ARROYO VIEJO CREEK ENHANCEMENT COMPONENT OF THE OAKLAND ZOO EXPANSION PROJECT
OAKLAND ZOO, ALAMEDA COUNTY, CALIFORNIA
APN 048-5655-003

PROJECT DESCRIPTION

Location of Project

The Oakland Zoo in Knowland Park is located in south Oakland, immediately east of Interstate 580 near the base of the Oakland Hills (**Figure 1**). It is within Township T2S and Range R3W of the Oakland East U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle map, located at the western extent of the East Bay Hills. Knowland Park contains a total of approximately 490 acres, of which approximately 93 acres comprise the existing arboretum, zoo, and related support facilities, and an additional 57 acres comprise the remainder of Lower Knowland Park. The California Exhibit would be developed in an approximately 62-acre portion of Knowland Park (Project Area), immediately upslope of the existing zoo, in an area that is characterized by grassland, chaparral and oak woodland. Upper Knowland Park, excluding the California Exhibit, contains approximately 278 acres of open space, vegetation, public trails, and fire roads.

The project reach of the new stormdrain culvert outfall and riparian enhancement is located near the entrance to the Oakland Zoo off of Golf Links Road (**Figure 1**).

Project Background

In 1998 the Oakland City Council approved a Master Plan for the Oakland Zoo. The approved Master Plan included plans by the East Bay Zoological Society for locating the California 1820 exhibit to the east of the existing zoo in an undeveloped portion of Knowland Park. The central theme of the exhibit is to focus on regional extinction, featuring native California species present before the Gold Rush. The animal exhibits provided for in the original approved Master Plan included a River Exhibit, Grizzly Bear Exhibit, Canyon Exhibit, and Woodland Exhibit. Other features included an off-site breeding activity, a California Interpretive Center, a loop road and shuttle bus system, and paving of the existing service road.

On June 21, 2011, the Oakland City Council approved an amendment to the Oakland Zoo's Master Plan, focusing on the California 1820 exhibit area. The Master Plan amendment refines and make certain changes to the site plan for the approved California 1820 exhibit, which has been renamed the California Exhibit. **Figure 2** shows an overview of the approved site plan and location of the culvert outfall replacement.

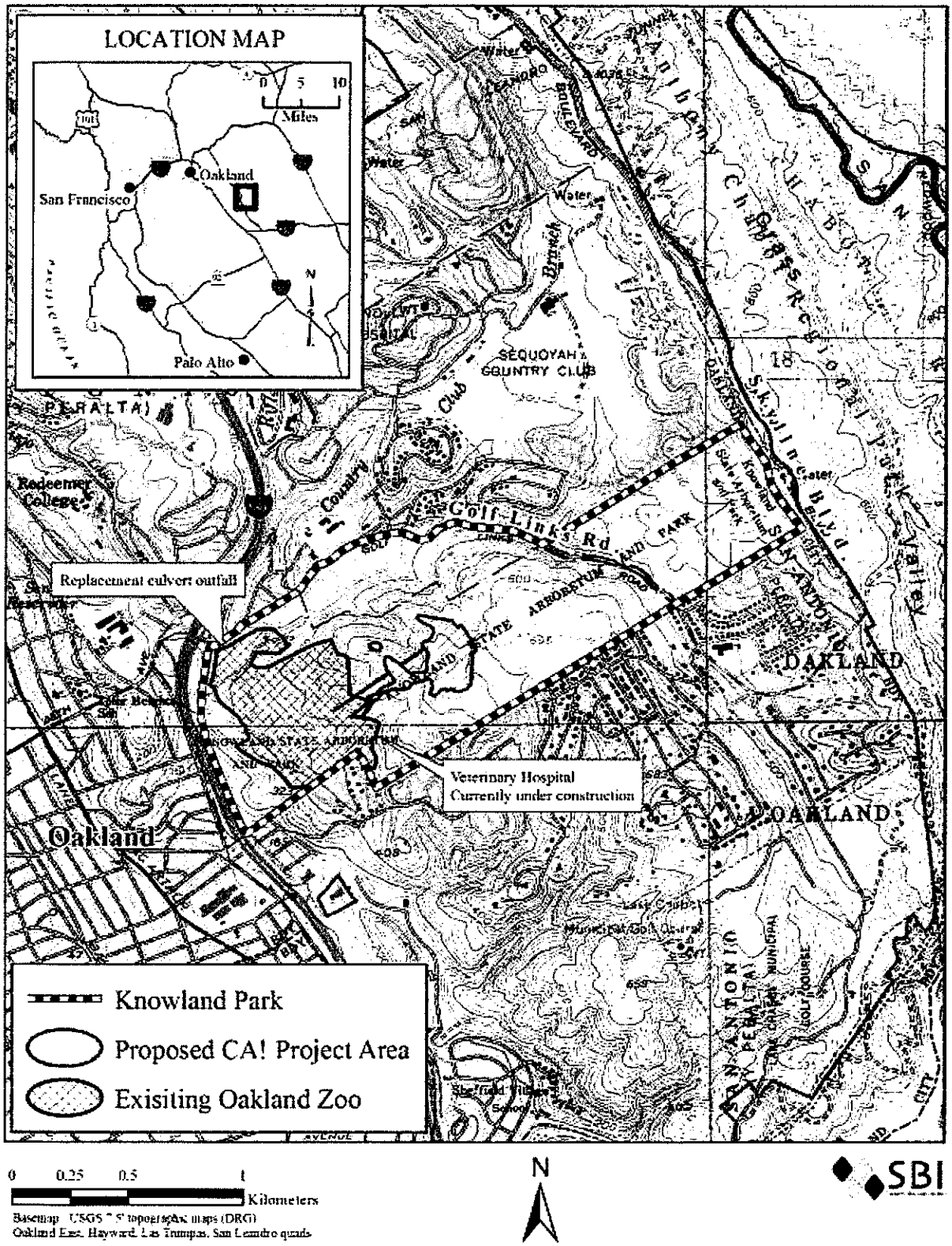


Figure 1. Site Location

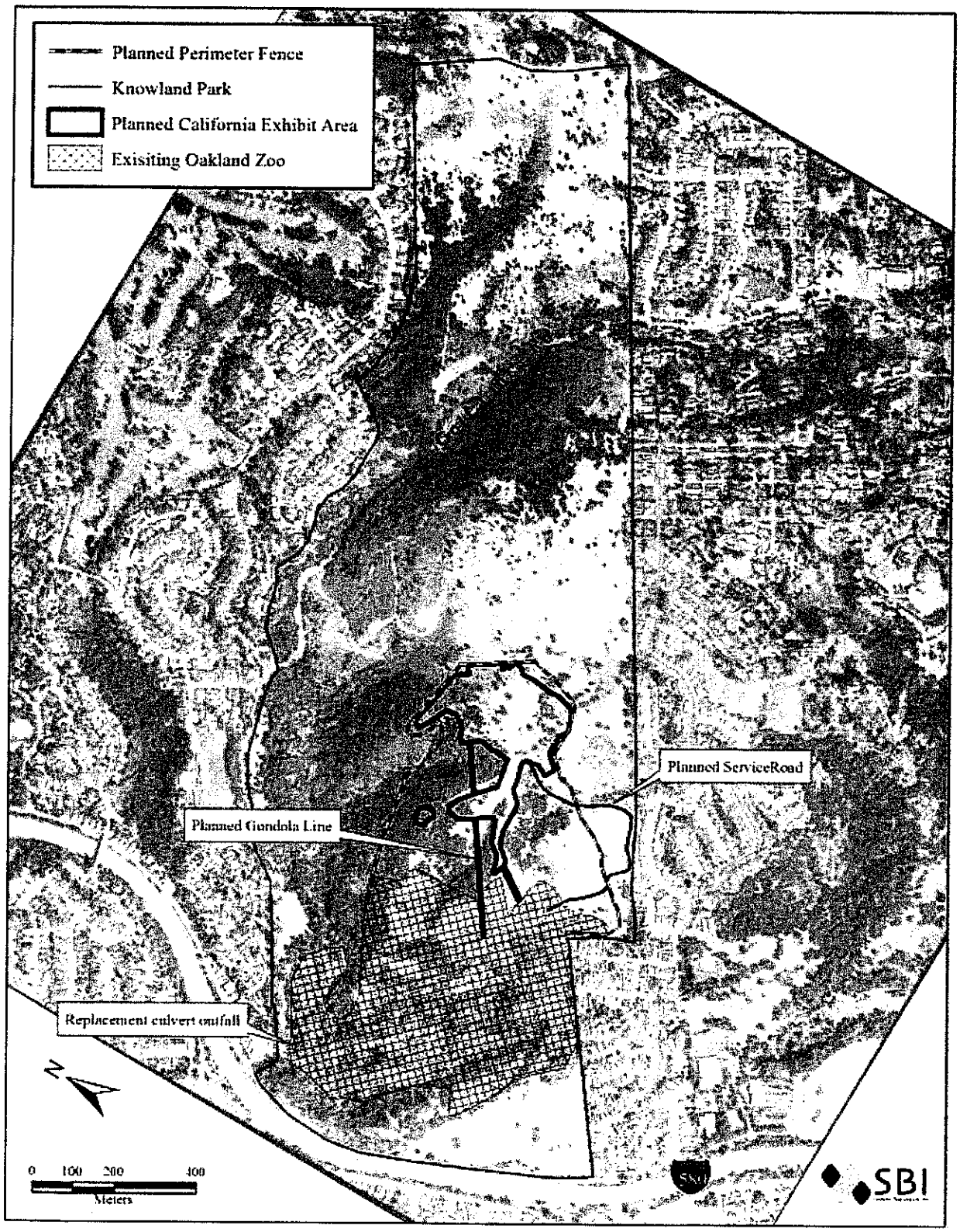


Figure 2. California Exhibit Project Overview

Attachment 1 shows the improvements at the culvert outfall replacement and riparian enhancement along Arroyo Viejo Creek. The existing culvert at the current outfall is an 18-inch clay pipe that is breaking off at the exposed end, contributing to further erosion and collapse of the near vertical creek bank.

Riparian vegetation generally is absent along the south bank of Arroyo Viejo Creek at the project reach, limited to young willow cuttings installed in 2007, and sapling invasive black acacias. A single Fremont cottonwood with a trunk diameter of 12 inches occurs at the downstream end, and the branch of a mature coast live oak extends along the vertical bank of the upstream end of the project reach. Both the cottonwood and oak branch will be avoided by any bank modifications associated with the project. For a distance of about 75 feet south of the top-of bank, vegetative cover is relatively sparse within the area of proposed bank modifications, consisting of scattered non-native grasses and forbs and a single flowering currant shrub planted as part of the 2007 creek restoration effort. Specimen tree plantings from the original State Botanical Gardens occur outside the limits of proposed bank modifications, including a valley oak, coast redwood and palms, with extensive turf areas beyond.

Details of Project Improvements

The existing storm drain outfall will be replaced with a new outfall and the affected reach of Arroyo Viejo Creek enhanced as part of the California Exhibit Project. The bank erosion at the existing outfall is aggravated by the undersized 18-inch pipe, causing increased velocity during high runoff events, and the position of this outfall in the creek bank. In its current state the 18-inch clay pipe protrudes from the bank at an opposing angle to the direction of creek flow. Judging by the age of this clay pipe and the near vertical slope of the bank, erosion has been occurring at the outlet for years. Its location at a bend in the creek exacerbates the opposing currents due to the creek flow velocity increase around the concave bed and bank. The bank has been sliding at the outfall location due to erosion caused by turbulence with no bank protection. As the toe of the bank recedes the pipe has been cracking and breaking off. Clay pipe was a poor choice for a storm drain outfall and its direction opposing the direction of creek flow was a poor design.

The proposed outfall repair and replacement would relocate the outfall downstream of its current location, and replace the pipe with a standard pipe type used for storm drainage conveyance (see **Attachment 1**). The proposed storm drain pipe construction would abandon or remove approximately 35 feet of the existing pipe, install a manhole, and install a 27-inch pipe directed to the northwest that would outlet to the creek onto an existing concrete apron at the existing culvert under the vehicle entrance to the Zoo. The 27-inch pipe would be angled to outlet consistent with the direction of creek flow. This was originally designed to be a 36-inch pipe but was reduced to 27 inches based on refined calculations by the project engineer, Aliquot Associates.

To repair the bank at the location of the former existing outfall, a minimum of 10 feet of the existing clay culvert would be removed. A two-foot-diameter bank log would be keyed in along the toe of the eroded bank for biostabilization. Recently planted willows exist at the toe of this bank, installed as part of the creek restoration project in 2007. The bank excavation and fill would begin behind the willows to minimize disturbance and avoid the need for their removal; the bank would be graded at a 2:1 slope. The existing willows would remain and additional willow cuttings would be planted on the new slope intermittently to approximately five feet up the slope and placed eight feet on-center. Common rush would be installed at the Ordinary High Water Mark (OHWM) at either end of the anchored log to further stabilize the lower bank of the creek. Plug plantings of creeping wild rye would be installed one foot on-center above the willows to the top of the 2:1 slope. A broader area disturbed during construction from the concrete lining to the newly graded bank, would be broadcast with a seed mix containing native California brome, meadow barley, California poppy, and lupine. These improvements would curtail future erosion and enhance existing habitat values in this area.

The creek-related improvements downstream of the new outfall would alter jurisdictional other waters along Arroyo Viejo Creek regulated by the U.S. Army Corps of Engineers (Corps), the Regional Water Quality Control Board (RWQCB), and the California Department of Fish and Game (CDFG). Modifications within the limits of jurisdictional waters in the vicinity of the culvert outfall would include: dewatering of the project reach through installation of a temporary coffer dam system, grubbing of existing invasive cover along the south bank of the creek and installation of flagging and fencing to protect native vegetation to be retained, installation of the new manhole and realigned 36-inch storm drain pipe, recontouring of the creek bank, installation of the anchored log, willow cuttings, and grass plugs, and seeding of the graded bank and disturbed areas with native grass and forb seed. A Stormwater Pollution Prevention Plan (SWPPP) will be implemented to address construction-related water quality, erosion control, and sedimentation issues associated with the drainage-related improvements.

The project reach of the unnamed tributary will be dewatered during construction, and a temporary cofferdam system installed to by-pass the construction zone. The contractor will provide excavation dewatering in accordance with the City's Standard Conditions of Approval and be overseen by the biological monitor for the project (see pages 3.3-11 and 3.3-12in Attachment C of JARPA). All construction will be performed during the dry weather season, minimizing concerns over winter flows and aquatic habitat. The Contractor will be required to direct creek water around the construction zone using a procedure acceptable to the City through installation of a temporary cofferdam with appropriate screening if any pump system is required. The intake would be screened to prevent entrainment by aquatic species, including amphibians, and will be monitored by the biological monitor.

Following completion of grading and installation of the replacement outfall and anchored log, native species would be installed throughout the south bank of the project reach as part of the MMP for the project. **Attachment 1** shows the *Proposed Outfall Modifications and Planting Plan* to be implemented as part of the MMP. The matrix in

Attachment 1 lists the species to be used in the planting and seeding of the project reach, along with quantities, spacing, and other details. Once established, the MMP will serve to increase the acreage and enhance the habitat values along this reach of the creek. Native plantings would serve to replace the limited number of non-native saplings removed as part of regarding the project reach, providing greater species diversity, protective cover, and additional foraging, roosting, and nesting substrate for birds and other wildlife associated with the area.

Plantings would be self-sustaining and not require supplemental irrigation. Willow cuttings and spreading rush plantings would be installed close enough to surface flows in Arroyo Viejo Creek that supplemental irrigation will not be necessary. And grass plugs and native seed installed in the fall months will become established in the first winter rainy season and should not need supplemental irrigation.

The project is basically considered to be "self-mitigating" through implementation of this MMP, SWPPP, and other construction-related controls to protect and enhance the existing aquatic and riparian habitat. Minimum performance standards and success criteria will be applied to the MMP to ensure successful establishment of vegetative cover along the project reach, providing for enhancement of an estimated 0.04 acre and 65 linear feet of creek channel (see **Table 1**). Project controls and measures incorporated into the Subsequent Mitigated Negative Declaration/Addendum for the project (see Attachment C of JARPA) will be implemented to mitigate significant impacts to a level of less-than-significant.

This MMP has been prepared to define the annual monitoring provisions, performance standards, and success criteria. As-built plans and subsequent monitoring over a five-year period would serve to confirm the effectiveness of bank stabilization and success of revegetation efforts associated with the MMP. Annual monitoring reports will be provided to jurisdictional agencies for the minimum five years of monitoring. The MMP is a benefit project that will improve and enhance the existing habitat values of the riparian corridor through the project reach.

Responsible Parties:

The East Bay Zoological Society (EBZS) is responsible for all creek mitigation and revegetation monitoring for this project. The contact person and relevant information for EBZS is as follows:

Nik Dehejia, Director
Strategic Initiatives
9777 Golf Links Road
PO Box 5238
Oakland, CA 94605
510-632-9525 x 138

This MMP has been prepared by Environmental Collaborative, under contract to EBZS. The contact person and relevant information for Environmental Collaborative is as follows:

James Martin, Principal
Environmental Collaborative
1268 64th Street
Emeryville, CA 94608
Tel: (510) 654-4444
Fax: (510) 655-4444

Jurisdictional Areas to Be Filled

Modifications will occur to jurisdictional waters along the project reach of Arroyo Viejo Creek where the culvert outfall replacement and habitat enhancement component of the project are to be implemented. These consist of: the bed and bank below the OHWM regulated by the Corps under Section 404 of the Clean Water Act; the bed and bank regulated by the RWQCB under Section 401 of the Clean Water Act and waters of the State under the Porter-Cologne Act; and the bed and bank regulated by CDFG under Section 1600 of the Fish and Game Code. The limits of waters regulated by the Corps extend to the OHWM and State jurisdictional waters extend to the top of bank along this stretch of Arroyo Viejo Creek. At this location the bank is vertical from the approximate OHWM to the top of bank and native vegetation is generally limited to willow cuttings installed at the OHWM in 2007 as part of the larger creek restoration plan. The total horizontal distance between the OHWM and the top of bank varies from zero to two feet, with a bank height of about five feet.

A summary of potential impacts to jurisdictional waters is provided in **Table 1**. A temporary coffer dam will be installed to dewater the construction reach of Arroyo Viejo Creek and prevent any adverse impacts on the aquatic habitat and downstream water quality during construction. All construction work within the creek channel will follow the City of Oakland Standard Conditions of Approval, as incorporated into the Subsequent Mitigated Negative Declaration/Addendum for the project (see Attachment C of JARPA). The existing partially collapsed clay culvert outfall will be removed, and the existing culvert realigned to outfall onto an existing concrete apron approximately 30 feet downstream. Invasive black acacia will be removed from the project reach and approximately 65 linear feet of eroded bank will be recontoured and revegetated with native willow cuttings, wetland plants, and native grass plugs and seed. Existing willow cuttings installed at the OHWM in 2007 as part of a creek restoration plan will be avoided. A natural tree trunk will be partially installed and anchored below the OHWM, representing fills of estimated 10 cubic feet within the existing active channel, which will serve to prevent further bank erosion at the outside meander in the creek channel. An estimated 48 cubic yards of material will be excavated and removed from the recontoured creek bank and adjacent uplands, and will be temporarily stored in the paved compost recycling area to eventually be used elsewhere in the Zoo.

Construction will occur within 5 feet of willow cuttings installed along bottom of creek bank as part of a creek enhancement plan in 2007. Regrading of the creek bank has been designed to avoid removal of existing willow cuttings, and additional willow cuttings and other wetland and upland species will be installed as part of the culvert outfall modification and habitat enhancement work along Arroyo Viejo Creek.

A temporary coffer dam will be installed in Arroyo Viejo Creek during construction, following the City of Oakland Standard Conditions of Approval for in-channel construction activities. Mylar plastic will be laid across the channel bed and lower banks upstream of the construction reach, and sand bags filled with washed gravel installed to temporarily dam and allow for dewatering. A gravity flow by-pass will be installed to allow for continued flows through the project reach. All material will be removed following completion of construction, and no vegetation will be removed to accommodate the temporary coffer dam.

Table 1. Summary of Impacts to Jurisdictional Waters

LOCATION	REASON FOR ACTION	AMOUNT / TYPE OF MATERIAL (cubic yards)	SURFACE AREA AFFECTED (acres and linear feet; **P** = permanent, **T** = temporary)
New outfall at existing concrete apron	Install new outfall where no erosion issues will occur	Breach in concrete lining bank	0.0002 acre (**P**) and 3 linear feet (**P**)
Upstream end of project reach	Install coffer dam to dewater reach during construction	Bags of clean gravel or sand, plastic sheeting, plastic bypass pipe	0.001 acre (**T**) and 5 linear feet (**T**)
Old outfall location and associated south bank of Arroyo Viejo	Correct severe erosion, remove invasive species, and enhance existing habitat	An estimated 48 CY of soil removed from bank to create a 2:1 slope. Salvaged log, willow cuttings, and rush plugs installed at OHWM. Additional willow cuttings, native grass plugs, and native seed mix installed to revegtate bank.	0.04 acre (**P**) and 65 linear feet (**P**)

Surface runoff from upgradient areas of the California Exhibit expansion and related improvements will be pretreated in rain gardens, bioswales and other treatment areas and then detained in stormwater detention facilities before entering the existing storm drain system and discharging into Arroyo Viejo Creek at the new outfall location. No increase

in stormwater runoff volumes or degradation of water quality is anticipated with implementation of the treatment and detention facilities incorporated into the larger California Exhibit Project.

Types, Functions, and Value of the Jurisdictional Areas

The project reach of Arroyo Viejo Creek functions as a perennial drainage, supported by irrigation runoff in the summer months. The north bank of the project reach contains a mixture of native and non-native trees and shrubs which will remain undisturbed, but the south bank where improvements are proposed has only limited woody riparian cover. Wetland vegetation is absent along the channel, and woody species on the south bank are limited to recently established willow cuttings, a single Fremont cottonwood, and sapling non-native black acacia.

GOAL OF MITIGATION AND REVEGETATION

Type of Habitat to be Created

The MMP is considered to be "self-mitigating", providing for removal of invasive non-native species and creation of native riparian habitat along the south bank of the project reach through planting of native willow, common rush and groundcovers. These improvements will serve to revegetate and create approximately 65 linear feet of riparian habitat along the south bank of Arroyo Viejo Creek disturbance associated with the culvert outfall relocation.

The program native revegetation and enhancement plantings along the creek will greatly improve existing habitat values of the project reach. The native species diversity will be increased, and shrubs and groundcover vegetation will provide protective cover to wildlife. Minimum performance standards and success criteria will be applied to the project to ensure successful establishment of vegetative cover on the restored drainage corridors. The goal of this MMP is to correct the erosion and sedimentation problems created by the existing outfall, ensure avoidance of possible sensitive biological resources in the remote instance that they are present within the construction reach, provide for the revegetation of disturbed areas, and ultimately to improve the existing habitat values of the creek corridor.

Functions and Values to Habitat to be Created

Native replacement and habitat enhancement plantings will eventually serve to improve the overall habitat value of the project reach. The replacement and enhancement plantings will continue to function as a natural riparian corridor, with greater habitat values than the existing habitat which is dominated by non-native species.

Time Lapse

The native revegetation component of this MMP will be implemented as part of Phase 1 of the larger California Exhibit Project. Phase 1 of the California Exhibit Project is scheduled for initiation in early summer 2012, assuming agency authorizations can be secured. The culvert relocation and bank enhancement work would be installed during the dry period in summer of 2012, with replacement plantings and seeding installed in the fall of 2012, before the onset of rains. Appropriate sedimentation and erosion control measures will be installed as part of the SWPPP for the culvert replacement component of the project, which will control any adverse localized affects of site grading, and as necessary will include the use of straw wattle, straw bales, silt fencing, loose straw, and seeding. Best Management Practices will also be implemented as part of the SWPPP for the improvements associated with the California Exhibit, upgradient of the existing Zoo.

FINAL SUCCESS CRITERIA

Target Functions and Values

The target functions and values are to create replacement and enhanced riparian habitat acreage and improved habitat values using native species in the revegetation program. No specific target functions and values are proposed, beyond the control of invasive species and successful establishment/restoration of native riparian species along the project reach.

Target Hydrological Regime

The project reach will continue to function without interruption or alteration of the existing regimes, and will be vegetated with native species. The new relocated outfall installed as part of the project will be designed to prevent erosion and downstream sedimentation, discharging onto a concrete apron just upstream of the existing culvert under the vehicle entrance to the Zoo. Surface hydrology will be improved by relocating the existing outfall which contributes to bank instability, expanding areas of rooted native willow and ruches along the edge of OHWM and lower channel bank, and establishment of vegetative cover on the recontoured bank. The increased extent of wetland and riparian vegetation will improve the natural filtration functions along the creek channel.

Target Jurisdictional Acreage to be Created

No additional jurisdictional acreage will be created as part of the MMP along the 65 linear feet of the south bank of Arroyo Viejo Creek, although riparian canopy will be expanded with additional willows established along the lower recontoured bank. Relocating the existing culvert outfall will allow for restoration of the segment of creek bank currently occupied by the clay pipe and the eroded bank. The aerial extent of native plantings will extend beyond the limits of the recontoured bank, including upland areas of native grassland and forb cover.

PROPOSED REVEGETATION AREA OF SITE

Location and Size of Mitigation Area

The entire south bank of Arroyo Viejo Creek in the project reach (see **Attachment 1**) will be treated as part of the invasive removal and native revegetation program proposed under the MMP. The focus of the habitat enhancement will be along the south bank, which currently has only limited native cover because of the steep slope and eroded condition.

Ownership Status

The parcel encompassing the outfall improvements (AP 048-5655-003) is part of Knowland Park, held by the City of Oakland. Long-term protection of the mitigation plantings and other environmental enhancements at the project reach of Arroyo Viejo Creek is assured through the fact that the parcel is designated as Open Space, and through application of the City's Municipal Code, which regulates alteration of watercourses and prohibits, among other things, adverse impacts to riparian corridors and native trees.

Existing Functions and Values of Mitigation Area

The south bank of the project reach of Arroyo Viejo Creek has only limited value as riparian habitat due to the eroded, vertical bank, limited extent of native woody cover, and general absence of grassland cover in the upland areas away from the creek corridor. Invasive sapling black acacia and Himalayan blackberry further compromise the existing habitat values of the project reach, which will be removed as part of the enhancement component of the project.

Present and Proposed Uses of Mitigation Area

The property is currently designated as Open Space as part of Knowland Park, and will remain as Open Space, allowing for future protection, maintenance and management of the project reach of Arroyo Viejo Creek. Additional enhancement and restoration efforts may be taken in the future as part of the on-going restoration work on the Knowland Park, as part of long-term goals defined in the Habitat Enhancement Plan for Knowland Park (see Appendix B of Attachment D to the JARPA). The area will continue to function as natural habitat, with only limited access anticipated for monitoring and maintenance. Any future enhancement and restoration will be restricted to use of native species to provide more valuable habitat for wildlife.

Jurisdictional Delineation

A preliminary wetland assessment was conducted during preparation of the Biological Resources section into the Subsequent Mitigated Negative Declaration/Addendum for the project (see Attachment C of JARPA). A formal wetland delineation was completed by Environmental Collaborative on 2 January 2012 (see Attachment B of JARPA) and

submitted to the Corps for verification. The wetland delineation was verified by the Corps with no modifications in the vicinity of the Arroyo Viejo outfall location. The assumed limits of jurisdictional waters regulated by the Corps are limited to the unvegetated other waters below the OHWM along the project reach of Arroyo Viejo Creek. As described above and summarized in **Table 1**, there is little difference between the limits of Corps jurisdictional waters and State regulated waters on the south side of the creek because the bank is basically vertical with little woody riparian vegetation beyond the top of bank.

Present and Proposed Uses of All Adjacent Areas

The property is currently designated as Open Space as part of Knowland Park, and will remain as Open Space, allowing for future protection, maintenance and management of the project reach of Arroyo Viejo Creek.

IMPLEMENTATION PLAN

Rationale for Expecting Implementation Success

The native vegetation restoration has been designed using accepted practices in the field of habitat restoration. Native species used in restoration are relatively common in the area. Temporary irrigation will not be necessary given their installation on the lower banks of Arroyo Viejo Creek and use of native grass plugs and seed in upland areas. Willow cuttings and common rush plantings will be installed on the lower banks and bed of the creek, where soil saturation will ensure successful reestablishment. Winter rains will allow for root establishment of native grass plugs and native grass and forb seed.

Responsible Parties

The EBZS will be responsible for implementing this MMP. A contractor will be retained to perform invasive species removal, native plant protections, site dewatering and grading, culvert installation and removal, and native plant installation and seeding.

Mitigation Measures and Construction Avoidance Measures

A number of mitigation measures and relevant Standard Conditions of Approval required by the City were identified in the Subsequent Mitigated Negative Declaration/Addendum for the project to ensure avoidance of sensitive resources. These are contained in Attachment C of the JARPA (see pages 3.3-6 through 3.3-13 of Biological Resources Section in Attachment C of JARPA).

Site Preparation and Planting Plan

Following the initial preconstruction surveys, installation of protective fencing, and dewatering of the unnamed tributary creek, culvert relocation and bank recontouring will be performed. Initial grubbing and any in-channel construction shall be performed under

the supervision of a qualified biologist to ensure adequate controls are in place to protect sensitive resources. Planting and seeding of native species will follow completion of the culvert relocation and bank grading as indicated in the Planting Plan.

Schedule

The schedule for construction of the habitat avoidance and enhancement plantings is as follows:

- Perform preconstruction survey and oversee installation of protective flagging, fencing and other controls necessary to protect sensitive habitat areas (early summer 2013).

- Conduct worker training and identify invasive species to be removed and native plants to be avoided and retained (early summer 2013)

- Oversee installation of temporary coffer dam and dewatering of surface water in project reach of creek (early summer 2013).

- Inspect bank regarding activities (summer 2013) and oversee installation of native willow cuttings, rush plantings, and reseed graded slopes prior to on-set of winter rains (early fall 2013).

- Begin monitoring of enhancement plantings in spring of 2013 (May/June). Monitor same time each year for five (5) years.

Irrigation Plan

Plantings would be self-sustaining and not require supplemental irrigation. Willow cuttings and spreading rush plantings would be installed close enough to surface flows in Arroyo Viejo Creek that supplemental irrigation will not be necessary. And grass plugs and native seed installed in the fall months will become established in the first winter rainy season and should not need supplemental irrigation.

MAINTENANCE AND MONITORING PERIOD, MONITORING PLAN, COMPLETION OF MITIGATION AND CONTINGENCY MEASURES

Maintenance Activities and Responsible Parties

Maintenance activities will include the following:

- Repair any destabilized areas along the south bank of the project reach. Inspect channel bank after the initial major winter storm events for any signs of localized erosion that may be due to changes in stream hydraulics as a result of project

implementation. Where additional work involved dewatering, appropriate authorizations and required preconstruction surveys will be performed.

- Hand removal, mowing and other mechanical treatments, and possibly supplemental chemical treatment of any invasive species will be performed as part of on-going maintenance. Most invasive species treatment will occur in the spring, summer and fall months. Any weeds removed as part of on-going maintenance will be disposed of properly in the appropriate refuse location.

- Removal of trash or other debris would occur at least once in the fall (October). All trash or debris will be removed and disposed of properly in the appropriate refuse location.

- Routine inspection of willow cuttings and rush planting, with replacement plantings and seeding provided in fall or winter months to ensure successful establishment.

The EBSZ will be responsible for all maintenance activities along the project reach for the mitigation site.

Success Criteria:

Following construction, planting, and seeding, the monitoring program will determine whether success criteria have been achieved, and whether modifications to site design or contingency measures are necessary. The performance criteria defined in this MMP to determine successful implementation consists of the following:

Year 1

- Modified creek channel will function properly for conveyance of water and sediment flows.
- There shall be no substantial bank erosion along treated areas that could threaten channel stability. Any installed bank stabilization material, such as the anchored log will remain in place.
- Willow cuttings installed along the channel bank will have a net 80 percent survival rate in the planting area.
- Common rush plantings installed along the channel bank will have a net 80 percent survival rate in the planting area.
- Revegetated upland areas along the creek corridor will support at least 50 percent absolute cover of seeded and plug planted groundcover species in overall planting area.
- Introduced target invasive species include: English ivy (*Hedera helix*), Himalayan blackberry (*Rubus discolor*), and acacia (*Acacia spp.*) will represent less than 5 percent absolute cover in the overall planting area. Invasive species rated "high" in the Invasive Plant Inventory by the California Invasive Plant Council shall not exceed 5 percent absolute cover.

Year 3

- Modified creek channel will function properly for conveyance of water and sediment flows.
- There shall be no substantial bank erosion along treated areas that could threaten channel stability. Any installed bank stabilization material, such as the anchored log will remain in place.
- Willow cuttings installed along the channel bank will have a net 80 percent survival rate in the planting area.
- Common rush plantings installed along the channel bank will have a net 80 percent survival rate in the planting area.
- Revegetated upland areas along the creek corridor will support at least 70 percent absolute cover of seeded and plug planted groundcover species in overall planting area.
- Introduced target invasive species include: English ivy (*Hedera helix*), Himalayan blackberry (*Rubus discolor*), and acacia (*Acacia spp.*) will represent less than 5 percent absolute cover in the overall planting area. Invasive species rated "high" in the Invasive Plant Inventory by the California Invasive Plant Council shall not exceed 5 percent absolute cover.

Year 5

- Modified creek channel will function properly for conveyance of water and sediment flows.
- There shall be no substantial bank erosion along treated areas that could threaten channel stability. Any installed bank stabilization material, such as the anchored log will remain in place.
- Willow cuttings installed along the channel bank will have a net 80 percent survival rate in the planting area.
- Common rush plantings installed along the channel bank will have a net 80 percent survival rate in the planting area.
- Revegetated upland areas along the creek corridor will support at least 80 percent absolute cover of seeded and plug planted groundcover species in overall planting area.
- Introduced target invasive species include: English ivy (*Hedera helix*), Himalayan blackberry (*Rubus discolor*), and acacia (*Acacia spp.*) will represent less than 5 percent absolute cover in the overall planting area. Invasive species rated "high" in the Invasive Plant Inventory by the California Invasive Plant Council shall not exceed 5 percent absolute cover.

Monitoring Methods

Vegetation monitoring will be performed once a year by a qualified biologist or wetland mitigation specialist in late May or early June and will involve a routine inspection of the drainage outfall, creek channel, and larger restoration area of the site. Two monitoring

transects will be established along the project reach of the creek corridor. Data collection will include photographs of the site at transect and representative locations. A total of two (2) permanent photo locations will be established at each of the transects. The photos will be included in the annual reports to provide a visual evaluation of the site.

A minimum of three 1-meter quadrats will be established at each monitoring transect. Cover values will be recorded for each of the dominant plant species within the quadrat and for the associated species. Data will be recorded in absolute cover values. All of the data points will be averaged by species and by total vegetation cover. This information will be used to determine cover values of establishing plants and how closely the site is conforming to the performance criteria established previously. Observations and notes will be recorded on species composition, replacement planting condition and survival, and success of invasive species control and revegetation.

Annual Reports

An annual report will be prepared that will include an Introduction, Methods, and Results sections that discusses monitoring results. The Annual Report may also make recommendations on improvements, adaptive management practices, or modifications to the mitigation program based on the existing site conditions. The Annual Report will be submitted to the CDFG, Corps, RWQCB and City of Oakland each year for the three years of scheduled monitoring, but will be extended as necessary if success criteria are not met by Year 5. A report will be due by December 31 of each year following the data collection for Years 1 through 5.

Completion of Mitigation

The CDFG, Corps, RWQCB and City of Oakland will be notified upon the completion of all the monitoring activities. After the fifth year of data collection and submittal of the final annual report, all agencies will be contacted for a site visit. The purpose of the site visit will be to verify that the mitigation has been successful and that the EBZS has complied with all the terms and conditions of the MMP.

Contingency Measures

Contingency measures, if needed, could include:

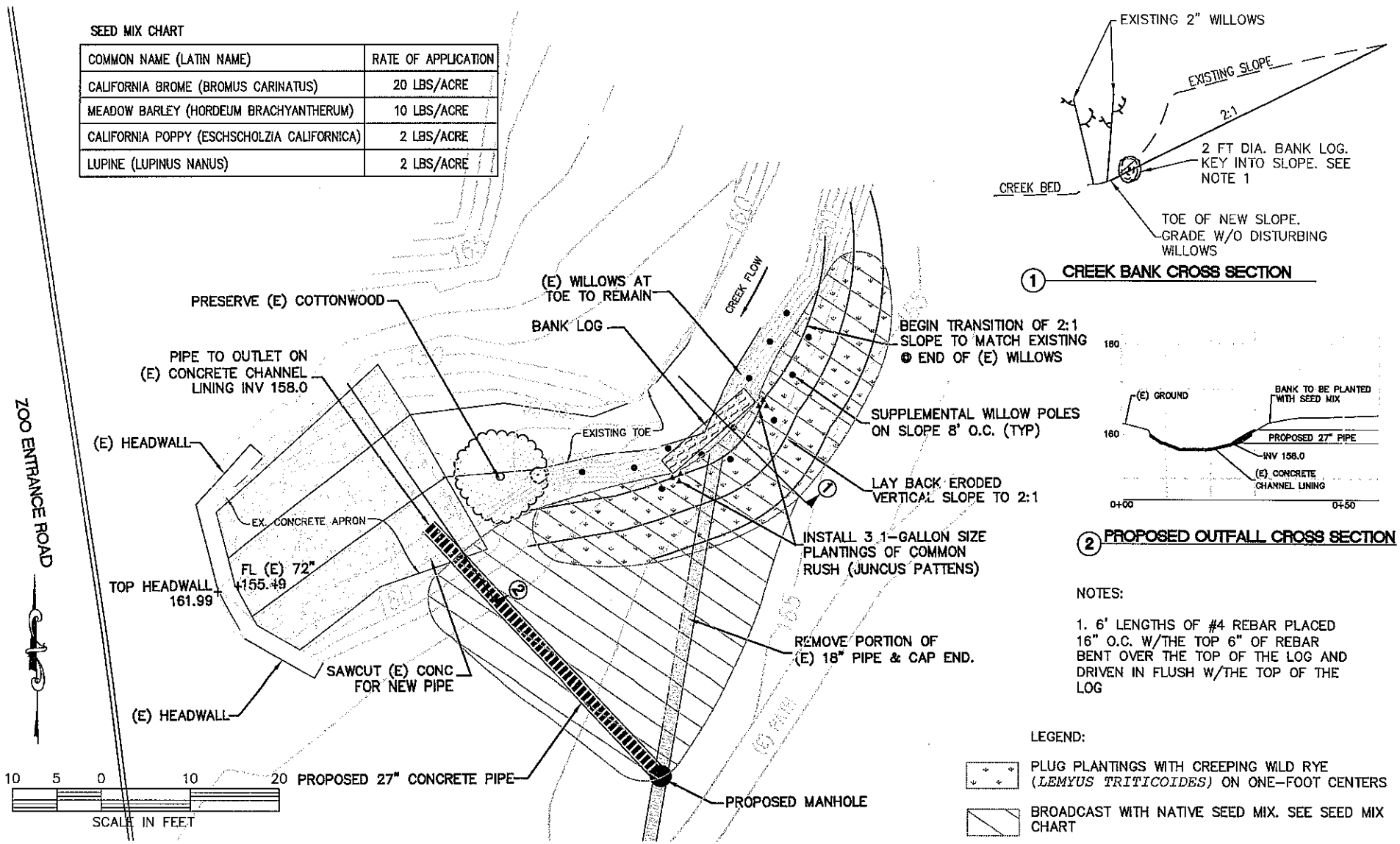
- Additional grading or site modification to correct severe erosion along the recontoured creek channel.
- Additional seeding or planting if plant cover is not establishing quickly enough or if survival and cover rates are too low.
- If the site restoration efforts do not meet success criteria, the EBZS will work with the CDFG, Corps, RWQCB, and City of Oakland to provide adequate mitigation on the site.

ATTACHMENT 1

Proposed Outfall Modification at Arroyo Viejo Creek

SEED MIX CHART

COMMON NAME (LATIN NAME)	RATE OF APPLICATION
CALIFORNIA BROME (BROMUS CARINATUS)	20 LBS/ACRE
MEADOW BARLEY (HORDEUM BRACHYANTHERUM)	10 LBS/ACRE
CALIFORNIA POPPY (ESCHSCHOLZIA CALIFORNICA)	2 LBS/ACRE
LUPINE (LUPINUS NANUS)	2 LBS/ACRE



1 CREEK BANK CROSS SECTION

2 PROPOSED OUTFALL CROSS SECTION

NOTES:

1. 6' LENGTHS OF #4 REBAR PLACED 16" O.C. W/THE TOP 6" OF REBAR BENT OVER THE TOP OF THE LOG AND DRIVEN IN FLUSH W/THE TOP OF THE LOG

LEGEND:

PLUG PLANTINGS WITH CREEPING WILD RYE (*LEMYUS TRITICOIDES*) ON ONE-FOOT CENTERS

BROADCAST WITH NATIVE SEED MIX. SEE SEED MIX CHART

Planners
Civil Engineers
Surveyors

Aliquot Associates, Inc.
1390 S. Main St. - Ste. 310
Walnut Creek, CA 94588
Telephone (925) 476-2300
Fax (925) 476-2356

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PROPOSED OUTFALL MODIFICATION AT ARROYO VIEJO CREEK
KNOWLAND PARK-OAKLAND ZOO

OAKLAND — ALAMEDA COUNTY — CALIFORNIA

Date	4/10/2012
Scale	1"=10'
Design	
Drawn	
Approved	
Job No.	208022

No.	Revisions

Drawing Number: 1

1 OF 1

Y:\208022\Exhibits\Arroyo Viejo Exhibit.dwg, 11X17, 4/11/2012 4:16:35 PM, Taktoid

ALIQUOT

May 29, 2012

Nik Haas-Dehejia
Director, Strategic Initiative
East Bay Zoological Society / Oakland Zoo
9777 Golf Links Road
Oakland, CA 94605

RE: Oakland Zoo JARPA-RWQCB Incomplete Application for Site No. 02-01-C1130(bkw)

Dear Nik,

Our firm prepared the documents and figures enclosed in this submittal in response to the RWQCB incomplete determination letter dated March 1, 2012. RWQCB Staff expressed concerns as to the completeness of the design and were unable to determine the effects of the project downstream of the site. The preliminary Stormwater Control Plan that RWQCB staff reviewed was submitted in conjunction with the August 10, 2010 Drainage Report and was prepared as part of an updated environmental document to demonstrate that hydromodification and water quality treatments could be addressed on-site. The design of the California Exhibit has now progressed towards completion and been refined in its design detail since that first submittal, satisfying all requirements of Water Quality and Hydromodification. To demonstate compliance with NPDES MRP requirements and address RWQCB concerns we prepared:

- A Stormwater Control Plan w/associated figures and calculations
- An Arroyo Viejo Outfall plan with the proposed design and associated hydrologic calculations
- A Stormwater Inspection and Maintenance Plan.
- Full sized figures/drawings that illustrate the overall drainage area, and deliniate the location of the California Exhibit with respect to Arroyo Viejo Creek, and
- Construction details of Integrated Management Practices (IMP)'s to meet C.3 requirements for runoff entering drainage channels.

RWQCB staff should take note that this project is in its Design Development (DD) stage. Design Development is an advanced plan which locates the buildings and roadways of the project. This plan will not change appreciably so the storm water plan, although it will have some refinements, will employ the IMPs set forth in the immediate areas as shown in the plan. Locations of bio-retention planters, bio-swales, pervious pavements, may change in shape and in some cases

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OAKLAND 460 Boulevard Way, 2nd Floor | Oakland, CA 94610

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location. However, any changes will remain in their respective drainage areas with full compliance with C.3 of the MRP.

The materials, we prepared, address comments 1 through 3 from the RWQCB incomplete letter. Our direct responses (**in bold**) to the RWQCB staff comments (*in italics*) are shown below.

Comment 1
Box 8B of the San Francisco Bay Area Joint Aquatic Resource Permit Application (JARPA) Waterway Impacts: Placement of Structures and/or fill in Waters of the State.

Based on the Project application materials, Water Board staff are not yet able to assess whether or not the Project will impact waters subject to state jurisdiction in addition to the impacts identified for Arroyo Viejo in the application materials and supplemental application materials received February 27, 2012. Based on the application materials received to date, there is a possibility that proposed new outfall A-1 may impact a seasonal creek that is subject to state jurisdiction. Even if the outfall and its associated armoring are placed slightly above the beginning of the currently visible extent of a defined bank and bed, outfall A-1 may result in erosion of the seasonal channel (which appear to be identified as channel "I" in the Project documents). **Runoff from the planters for all drainage areas, including A-1, will be dissipated through perforated spreader pipes with emitters. The spreader pipe in A-1 is now located near the top of the swale, far from the seasonal channel and out of jurisdictional waters. Please see Figure 2 for location of spread/dissipater.**

It appears that areas that currently drain to other channels in the undeveloped Project site, may discharge to Channel I after the project is completed. Even if the impervious areas are treated for water quality and hydromodification management, the increase in the effective watershed at the head of Channel I may have a destabilizing impact on the channel. It is also not clear whether or not any areas that will remain pervious after Project development, but which do not currently drain to Channel I, will contribute runoff to Channel I via outfall A-1 after Project implementation. **No drainage will be diverted from one sub-drainage area to another on any part of the Project including in A-1 to Channel I. All runoff will be treated for water quality and hydromodification management therefore there will be no destabilizing impact on any channel including Channel I. Please see Figures 2 and 3; all pre-project drainage remains within in its historical drainage boundaries or is balanced accordingly.**

Channels are often destabilized by increases in the volume and duration of flows on the order of the 1-year to 2-year storm event. Please provide an assessment of pre- and post-Project flows to the top of Channel I for the range of flows from 10% of the 2-year flow event to the 10-year flow

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event. Use of the Bay Area Hydrology Model (BAHM) is one tool that is sufficient for this requirement. Use of this model tool can be arranged through assistance from the City of Oakland staff. A similar analysis should be performed for any outfalls that will contribute flows to Arroyo Viejo for which impervious surface is increasing or new watershed area is being added or any of the other seasonal channels at the Project site. **BAHM is used in this report to assess all IMP's for the Project. The summary tables on Figures 2 and 3 show the Drainage Management Areas (DMA's) of the project and the routing of the associated runoff through Integrated Management Practices (IMP's). The BAHM print-outs showing the results for each DMA are found in Appendix A of the Stormwater Control Plan. The following IMP's are used to mitigate the improvements; a green roof, porous pavements, bioretention planters, and rainwater harvesting.**

Comment 2
Box 12 of the JARPA, Mitigation

The Project includes the removal of an existing 18-inch diameter stormdrain outfall to Arroyo Viejo Creek, which is contributing to bank failure at the location of the existing outfall. A new 36-inch diameter outfall will be constructed to replace the failing outfall. The Project will use bio-technical bank stabilization techniques to stabilize 65-linear feet of creek bed that are currently eroding at the location of the existing, 18-inch diameter outfall. Water Board staff concur with the Project's approach to bank stabilization, but the application materials currently lack a mitigation monitoring and maintenance plan (MMP) for the stabilized bank. An MMP must be developed for use in tracking the successful establishment of the biotechnical bank stabilization. The MMP should include maintenance activities (including removal/control of invasive species), a maintenance schedule, monitoring activities, a monitoring schedule, interim performance criteria, final success criteria, and contingency measures. Performance criteria should include, at a minimum, plant survival, plant cover, cover by invasive species, and any evidence of bank instability. Monitoring and maintenance should be conducted for a minimum of five years, until the final success criteria are attained. **See MMP provided by Environmental Collaborative.**

The Project will include many modifications to the stormwater infrastructure at the Project site. Based on the application materials that the Water Board has received to date, it is difficult to determine which portions of the post-Project site will discharge to the new outfall in Arroyo Viejo Creek. Please provide Water Board staff with annotated site maps and a narrative description to guide Water Board staff in understanding the proposed changes in stormwater flows associated with the Project. In addition, please provide an assessment of pre- and post-Project flows discharging to the outfall to Arroyo Viejo Creek for the range of flows from 10% of the 2-year flow event to the 10-year flow event using methods described above.

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Figure 1 of the Stormwater Control Plan is a drainage area map of the entire Zoo and surrounding area that contributes runoff to the Arroyo Viejo outfall. The California Exhibit and its proximity to Arroyo Viejo Creek are illustrated. The proposed development of the California Exhibit will not impact the outfall. Runoff from the project will be mitigated for 10% of the 2-year storm to the 10-year storm before it enters the upper channels and therefore flow at all downstream locations, including Arroyo Viejo Creek, will not be impacted by the development of this project. The Arroyo Viejo Outfall material enclosed provides a plan of the proposed outfall as well as calculations for the pipe system upstream of the outfall for the 10 year storm event. The proposed outfall pipe size is 27" and the new location requires a manhole and a change in pipe alignment. The energy loss as a result of the manhole junction offsets the increase in pipe size from 18" to 27". The pipe will be 27" instead of 36" as previously proposed. The calculations dictate the pipe size be 27" to create no increase in peak flow. Please note the outfall discharges onto an existing concrete apron in the bed of the stream, which was placed years ago at the inlet side of the large culvert under the road for erosion protection. This new location of the 27" outfall pipe mitigates two potential impacts: 1) by realigning the culvert from its existing location, flow is directed more parallel to flow, and 2) the outfall needs no further energy dissipation and eliminates the need for additional rock riprap, which would be required if the existing outfall location was used.

Comment 3
Box 12 of the JARPA, Mitigation

When reviewing applications for new or rebuilt stormwater outfalls to waters of the state, Water Board staff review the proposed stormwater management infrastructure at the Project site to ensure that proposed stormwater treatment is consistent with the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Regional Permit (MRP) for the management of stormwater runoff (Order R2-2009-0074; NPDES Permit No. CAS612008). Please provide detailed descriptions of the Project's proposed stormwater water quality and hydromodification control treatment measures. Due to the complex nature of the Project, please annotate any maps and figures to highlight stormwater management measures (e.g., bioretention basins, detention vaults, green roofs, pervious pavement, outfalls) and provide an accompanying narrative description to facilitate Water Board review. For any portion of the site in which the effective size of a watershed is altered (i.e., by piping stormwater from one sub-drainage to another sub-drainage), the potential impact on the geomorphic stability of receiving water bodies (i.e., Arroyo Viejo Creek and seasonal drainages at the Project site) should be assessed for the hydrologic regime analyzed for compliance with the hydromodification management requirements of the MRP. **We believe we satisfied the Board's request, by going further than what was**

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requested, by designing a fully compliant Stormwater Control Plan. The Stormwater Control Plan guides the reader through the design of the projects stormwater IMP's. Figures 2 and 3 of the Stormwater Control Plan are full sized drawings with descriptions of the methods by which the water will be routed, treated, and released back to its natural drainage area. The effective size of the watersheds are not altered anywhere on the project therefore no additional runoff will enter any of the channels and the potential to impact the geomorphics of each drainage and its stability has been eliminated.

The current applications materials include proposed surface areas and locations for bioretention cells (a.k.a. rain gardens) and detention basins for hydromodification purposes. Please provide designs for each of these stormwater treatment measures so that Water Board staff can review the sufficiency of the proposed designs. These designs should include plan views, cross-sections, and all material specifications. Similar levels of detail must also be provided for any proposed media filters or commercial treatment units, such as Filterra ^{TM} *units.* **Figure 4 of the Stormwater Control Plan contains construction level details of the IMP's. A summary table of the exact dimensions, pipe sizes, freeboard, etc. of the IMPS is provided on Figures 2 and 3. We employed the BAHM software to size the IMP's for compliance with treatment and hydromodification requirements.**

Water Board staff should also be provided with the proposed maintenance program for stormwater treatment measures and the mechanism that will be used to ensure and fund long-term maintenance of the stormwater treatment measures. **We went further to satisfy this request and provided an advanced draft Operations and Maintenance plan enclosed with this submittal.**

Please contact me with any questions regarding the material provided.

Sincerely,

Robert C. Wong, P.E.
RCE No. 43748

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DRAFT
STORMWATER
INSPECTION AND MAINTENANCE PLAN

FOR

CALIFORNIA EXHIBIT
KNOWLAND PARK - OAKLAND ZOO
Oakland, California

ALAMEDA COUNTY

PREPARED FOR:

City of Oakland

PREPARED BY:

Aliquot Associates, Inc.
460 Boulevard Way – 2nd Floor
Oakland, CA 94610

Job No. 208022.10

May 2012

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TABLE OF CONTENTS

ALIQUOT

I. Inspection and Maintenance Logs

Inspection and maintenance logs shall be kept in this section and signed and dated by the individual that performed the inspection and/or maintenance in reverse chronological order.

ALIQUOT

II. Updates, Revisions and Errata

Updates, Revisions and Errata shall be kept in this section maintenance in reverse chronological order.

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III. Introduction

A. The following is a narrative overview describing the site; drainage areas, routing, and discharge points; and treatment facilities

This project has been designed so as to minimize, to the maximum extent practicable, the introduction of pollutants and conditions of concern that may result in significant impacts, generated from site runoff to the stormwater conveyance system.

The Oakland Zoo is located in Knowland Park in the Oakland foothills off of Interstate 580 at Golf Links Road. Current development at the Zoo encompasses approximately 45 acres. The proposed California Exhibit will develop an approximate additional 15 acres of previously undeveloped land. The project includes 8 new animal exhibits and associated animal holding buildings, a new visitor center, and a 2,000 ft maintenance access road from the existing Zoo parking lot. Visitors will access the California Exhibit via a proposed gondola therefore no new parking will be created. Much of the 15 acres to be developed will remain native and will be used for the animals to roam in fenced pens. The developed area is a light footprint on the land.

The California Exhibit will be developed on top of a hill that is approximately 250 feet above the existing parking lot. The peak elevation throughout the proposed exhibit area is 626. The natural hillside slopes are steep ranging from 10% to 30% and greater with the majority being 20% or greater. Runoff from the project is primarily in 4 separate drainage areas that all eventually flow to Arroyo Viejo Creek with the exception of drainage area M which ends up in San Leandro Creek. The drainage areas run off into natural drainage channels created by the peaks and valleys of the hills. There is no existing storm drain system. The site is in a hydromodification management area.

The topography of the site and the fact that the area is undeveloped with no storm drain system limits what can be implemented for stormwater control facilities. Although the site is limited, many stormwater controls are designed to mitigate flow on-site. Steep slopes limit the opportunities to use porous pavements, but they are used wherever road slopes are 5% or less. The portion of the service road used by visitors as a pedestrian walk along the west side of the project (DMA K1) will not be porous, but it will have open gaps in the gutter pan to allow runoff to infiltrate underneath to its 30" open graded base layer. The base layer allows the runoff to infiltrate and creates sufficient storage to detain enough water to meet the hydromodification requirement. A green roof and storm water harvesting are implemented into this plan. The rainwater harvesting system collects roof runoff by gravity flow in sumps. The sumps are pumped to a 30,000 gallon irrigation tank. The irrigation tank is filled year-round by its own dedicated fill line, but during the rainy season has 7,000 gallons of storage space for the harvested rainwater. The tank is used for irrigation as well as cleaning the animal night houses on a regular basis. Along the meandering pedestrian pathways, bioretention planters collect and treat the surface runoff. The IMPs satisfy hydromodification management (HM) requirements.

Stormwater flows from the roofs of the animal night houses, trails and pathways into bioretention facilities and swales, cistern/irrigation tanks, porous pavement and a green roof before the treated stormwater is discharged to landscape areas.

See Section V for Summary of Drainage Areas and Stormwater Facilities.

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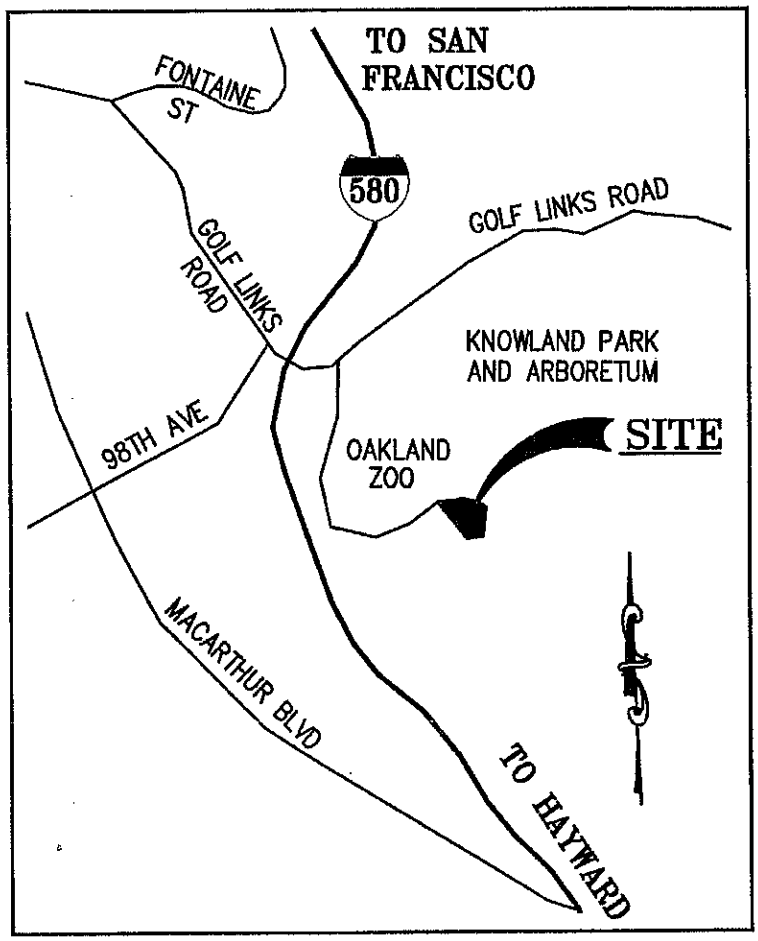
B. Vicinity Map



VICINITY MAP

NOT TO SCALE

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IV. Responsibility for Maintenance

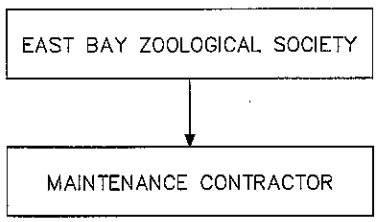
The property owner accepts responsibility for interim operation and maintenance of storm water treatment facilities until such time as this responsibility is formally transferred to a subsequent owner.

A. General

(1) Name and contact information for responsible individuals

Joel Parrott
East Bay Zoological Society
9777 Golf Links Road
Oakland, CA 94605
(510) 632-9525

(2) Organization chart showing organization of the maintenance function



(3) Operation and Maintenance Agreement
See Attachment A

(4) Maintenance Funding
(a) Sources of Funds for Maintenance
The funds for maintenance will be provided by East Bay Zoological Society.

(b) Budget Category
The budget category will be:
City of Oakland (Creek Protection, Stormwater Management and Discharge Control) Municipal Code Chapter 13.16.

B. Staff Training Program

Responsible individuals shall be required to read and keep a copy of the Stormwater Control Plan and the Stormwater Operation and Maintenance Plan.

C. Records

All records shall be kept in Section I Inspection and Maintenance Log and, if applicable, in Section II Updates, Revisions and Errata

Maintenance items that arise but do not appear on the list of routine maintenance activities shall be categorized as Non-routine maintenance operations. A written description of non-routine activities shall be completed at the bottom of the Inspection Checklist or as an attachment thereof.

Moreover, the inspecting party shall confirm, by field observation, that all corrective maintenance directives have been completed in a timely fashion, and in particular, prior to October 1st, the official start of the rainy season shall indicate, by signature, satisfactory completion.

The completed and signed checklist shall constitute an inspection record. Inspection records shall be maintained for a period of at least 5 years. Inspection checklists are

included in this plan in Section I. Note: The City may require separate/additional forms to be completed to verify/certify operation and maintenance by property owners.

D. Safety
Responsible individuals shall be required to attend safety meeting and briefings.

V. Summary of Drainage Areas and Stormwater Facilities
A. Drainage Areas
(1) See drawings below in Figure 1A and Figure 1B showing pervious and impervious areas.

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FIGURE 1A:

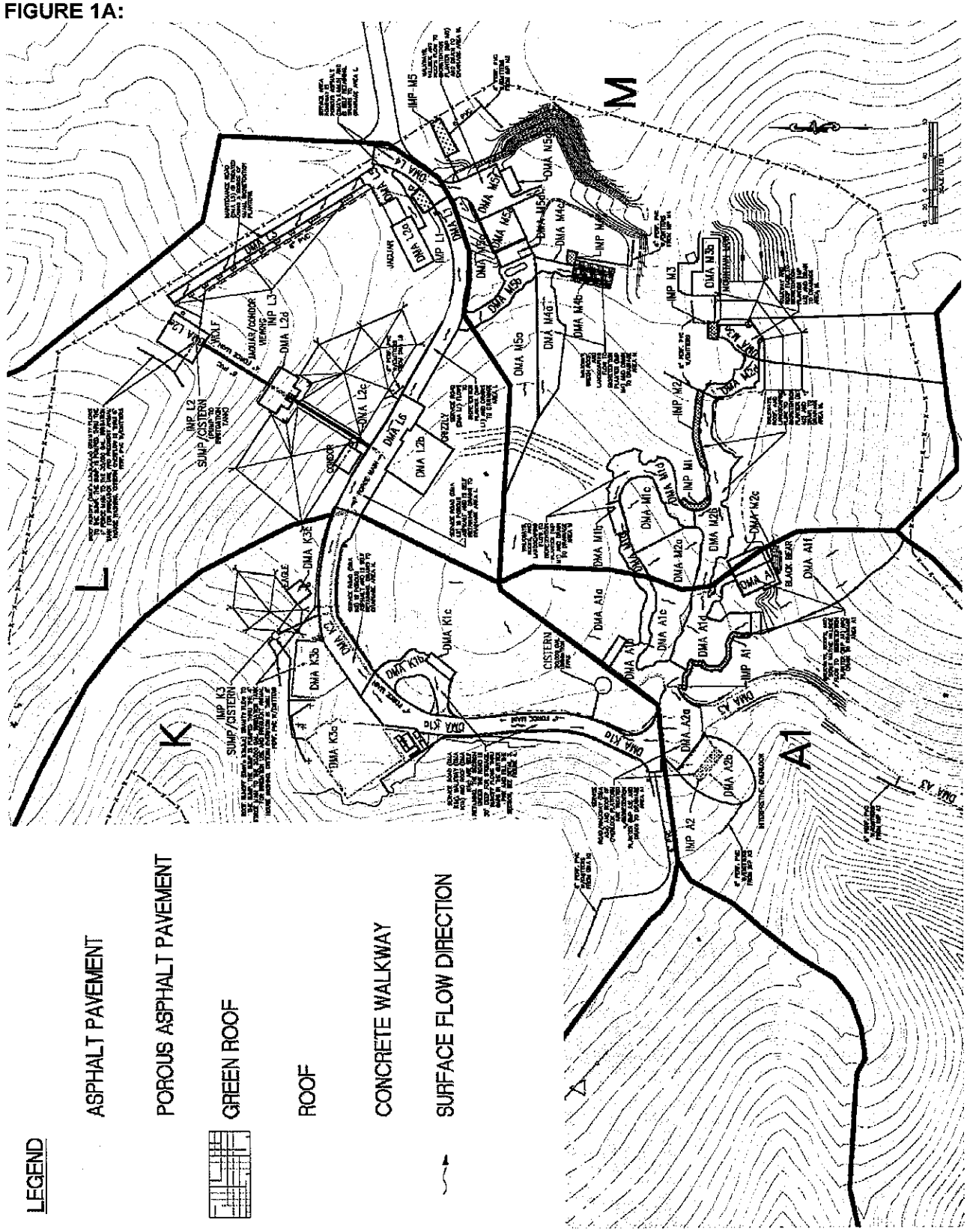

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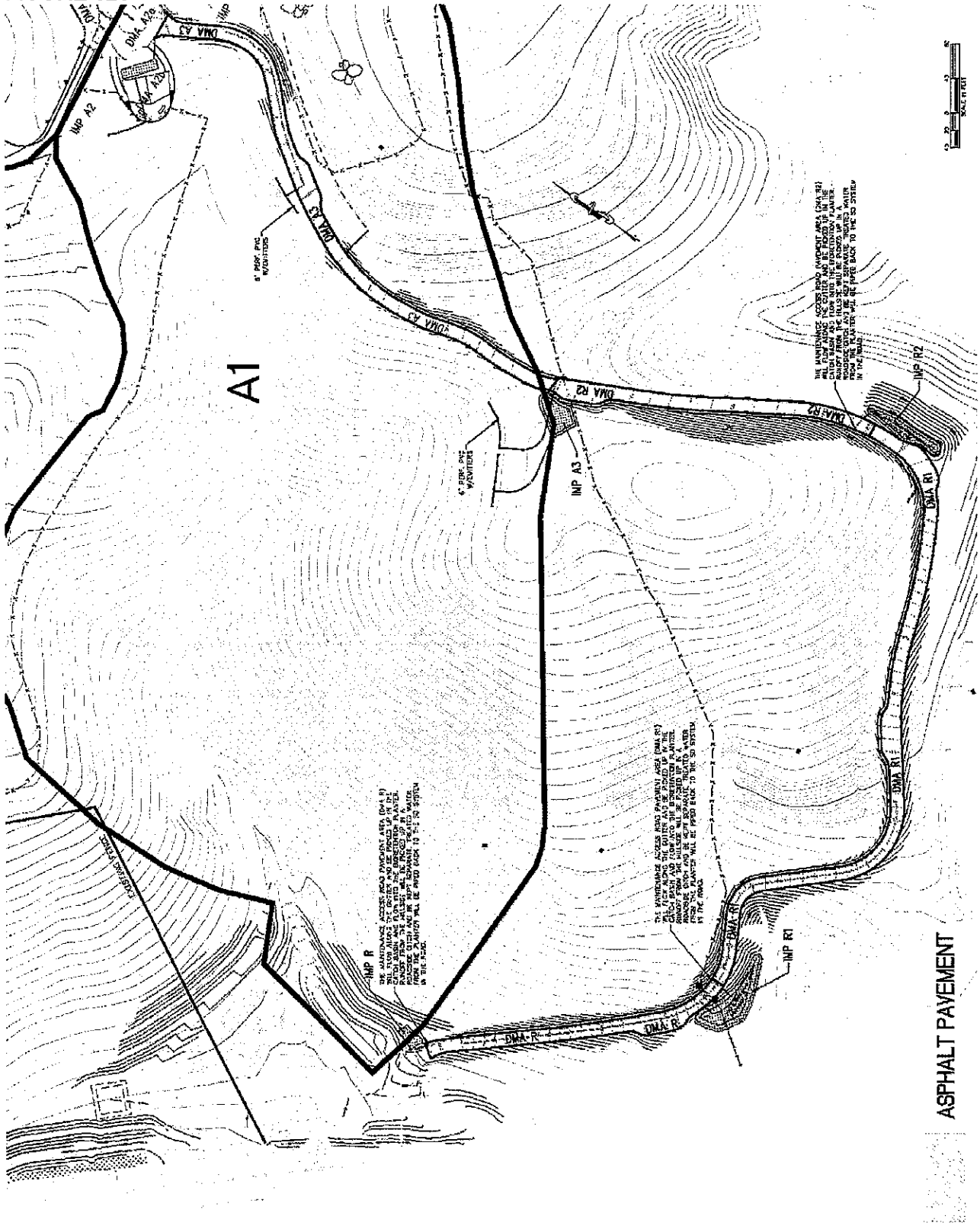
FIGURE 1B:



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(2) Designation and Description of Each Drainage Management Area (DMA)

DMA Name	Surface Type	Area (square feet)	IMP
A1a	Native ground	12,018	Bioretention Planter (IMP A1)
A1b	Concrete Walkway	3,749	
A1c	Landscaping	3,644	
A1d	Concrete Walkway	5,288	
A1e	Roof	1,262	
A1f	Native ground	14,280	
A2a	Concrete Walkway	3,736	Bioretention Planter (IMP A2)
A2b	Roof	5,000	
A3	AC Pavement	11,190	Bioretention Planter (IMP A3)
M1a	Concrete Walkway	763	Bioretention Planter (IMP M1)
M1b	Roof	573	
M1c	Landscaping	3,928	
M1d	Concrete Walkway	3,598	
M2a	Landscaping	3,854	Bioretention Planter (IMP M2)
M2b	Concrete Walkway	5,701	
M2c	Roof	928	
M2d	Concrete Walkway	1,437	
M3a	Concrete Walkway	1,315	Bioretention Planter (IMP M3)
M3b	Roof	1,717	
M4a	Native Ground	4,022	Bioretention Planter (IMP M4)
M4b	Green Roof	1,213	
M4c	Concrete Walkway	656	
M5a	Native Ground	8,849	Bioretention Planter (IMP M5)
M5b	Concrete Walkway	2,469	

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M5c	Landscaping	3,704	
M5d	Roof	760	
M5e	Roof	1,693	
M5f	AC Pavement	3,205	
M5g	Roof	420	
L1	AC Pavement	5,106	Bioretention Planter (IMP L1)
L2a	Roof	1,658	Self-Retaining. Flows to Cistern/Sump MH w/Pump (IMP L2)
L2b	Roof	3,718	
L2c	Roof	593	
L2d	Roof	1,395	
L2e	Roof	2,000	
L3	AC Pavement	3,203	Bioretention Planters (IMP L3)
L4	Porous AC Pavement	2,246	Self-Retaining
L5	Porous AC Pavement	2,042	Self-Retaining
L6	Porous AC Pavement	4,817	Self-Retaining
K1a	AC Pavement	9,446	Self-Retaining
K1b	Concrete Walkway	2,642	Flows to Self-Retaining (K1a)
K1c	Roof	423	Flows to Self-Retaining (K1a)
K2	Porous AC Pavement	5,638	Self-Retaining
K3a	Roof	11,619	Self-Retaining. Flows to Cistern/Sump MH w/Pump (IMP K3)
K3b	Roof	3,021	
K3c	Roof	428	
R1	AC Pavement	13,500	Bioretention Planer (IMP R1)
R2	AC Pavement	6,391	Bioretention Planter (IMP R2)

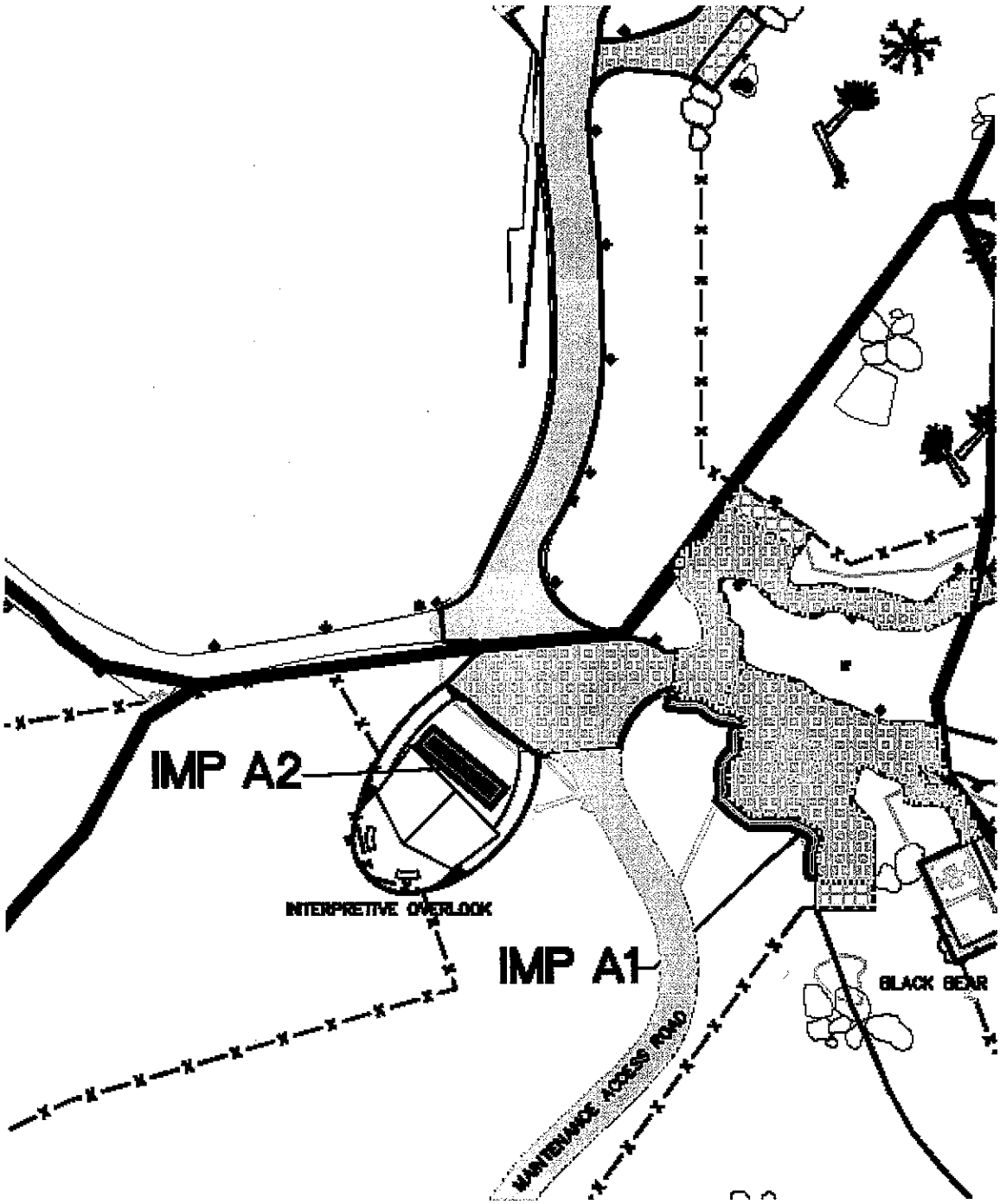
Drainage Management Area Descriptions

DMA A1a, totaling 12,018 square feet, drains native hillside in the grizzly exhibit. DMA A1a drains to IMP A1.
DMA A1b, totaling 3,749 square feet, drains concrete walkway and a viewing shelter for the grizzly bear exhibit. DMA A1b drains to IMP A1.
DMA A1c, totaling 3,644 square feet, drains landscaped area. DMA A1c drains to IMP A1.
DMA A1d, totaling 5,288 square feet, drains concrete walkway and the viewing shelter for the black bear exhibit. DMA A1d drains to IMP A1.
DMA A1e, totaling 1,262 square feet, drains half of the black bear holding roof. DMA A1e drains to IMP A1.
DMA A1f, totaling 14,280 square feet, drains native hillside in the black bear exhibit. DMA A1f drains to IMP A1.
DMA A2a, totaling 3,736 square feet, drains concrete walkway. DMA A2a drains to IMP A2.
DMA A2b, totaling 5,000 square feet, drains the roof of the interpretive overlook. DMA A2b drains to IMP A2.
DMA A3, totaling 11,190 square feet, drains a portion of the AC Pavement maintenance access road. DMA A3 drains to IMP A3.
DMA M1a, totaling 763 square feet, drains concrete walkway. DMA M1a drains to IMP M1.
DMA M1b, totaling 573 square feet, drains a grizzly viewing shelter roof. DMA M1b drains to IMP M1.
DMA M1c, totaling 3,928 square feet, drains landscaping. DMA M1c drains to IMP M1.
DMA M1d, totaling 3,598 square feet, drains concrete walkway. DMA M1d drains to IMP M1.
DMA M2a, totaling 3,854 square feet, drains landscaping. DMA M2a drains to IMP M2.
DMA M2b, totaling 5,701 square feet, drains concrete walkway. DMA M2b drains to IMP M2.
DMA M2c, totaling 928 square feet, drains half of the black bear holding roof. DMA M2c drains to IMP M2.
DMA M2d, totaling 1,437 square feet, drains concrete walkway. DMA M2d drains to IMP M2.
DMA M3a, totaling 1,315 square feet, drains concrete walkway. DMA M3a drains to IMP M3.
DMA M3b, totaling 1,717 square feet, drains the roof of the mountain lion holding. DMA M3b drains to IMP M3.
DMA M4a, totaling 4,022 square feet, drains native hillside in the grizzly exhibit. DMA M4a drains to IMP M4.
DMA M4b, totaling 1,213 square feet, drains a green roof on a grizzly viewing shelter. DMA M4b drains to IMP M4.
DMA M4c, totaling 656 square feet, drains concrete walkway. DMA M4c drains to IMP M4.
DMA M5a, totaling 8,849 square feet, drains native hillside in the grizzly exhibit. DMA M5a drains to IMP M5.
DMA M5b, totaling 2,469 square feet, drains concrete walkway. DMA M5b drains to IMP M5.
DMA M5c, totaling 3,704 square feet, drains landscaping. DMA M5c drains to IMP M5.
DMA M5d, totaling 760 square feet, drains the roof of the restrooms. DMA M5d drains to IMP M5.
DMA M5e, totaling 1,693 square feet, drains the LSS enclosure roof. DMA M5e drains to IMP M5.
DMA M5f, totaling 3,205 square feet, drains AC pavement. DMA M5f drains to IMP M5.
DMA M5g, totaling 420 square feet, drains a maintenance shed roof. DMA M5g drains to IMP M5.
DMA L1, totaling 5,106 square feet, drains a portion of the AC pavement service road. DMA L1 drains to IMP L1.
DMA L2a, totaling 1,658 square feet, drains the jaguar holding roof. DMA L2a drains to IMP L2.
DMA L2b, totaling 3,718 square feet, drains the grizzly holding roof. DMA L2b drains to IMP L2.
DMA L2c, totaling 593 square feet, drains the condor holding roof. DMA L2c drains to IMP L2.
DMA L2d, totaling 1,395 square feet, drains the condor/jaguar viewing roof. DMA L2d drains to IMP L2.
DMA L2e, totaling 2,000 square feet, drains the wolf holding roof. DMA L2e drains to IMP L2.
DMA L3, totaling 3,203 square feet, drains an AC pavement driveway to the wolf holding. DMA L3 drains to IMP L3.

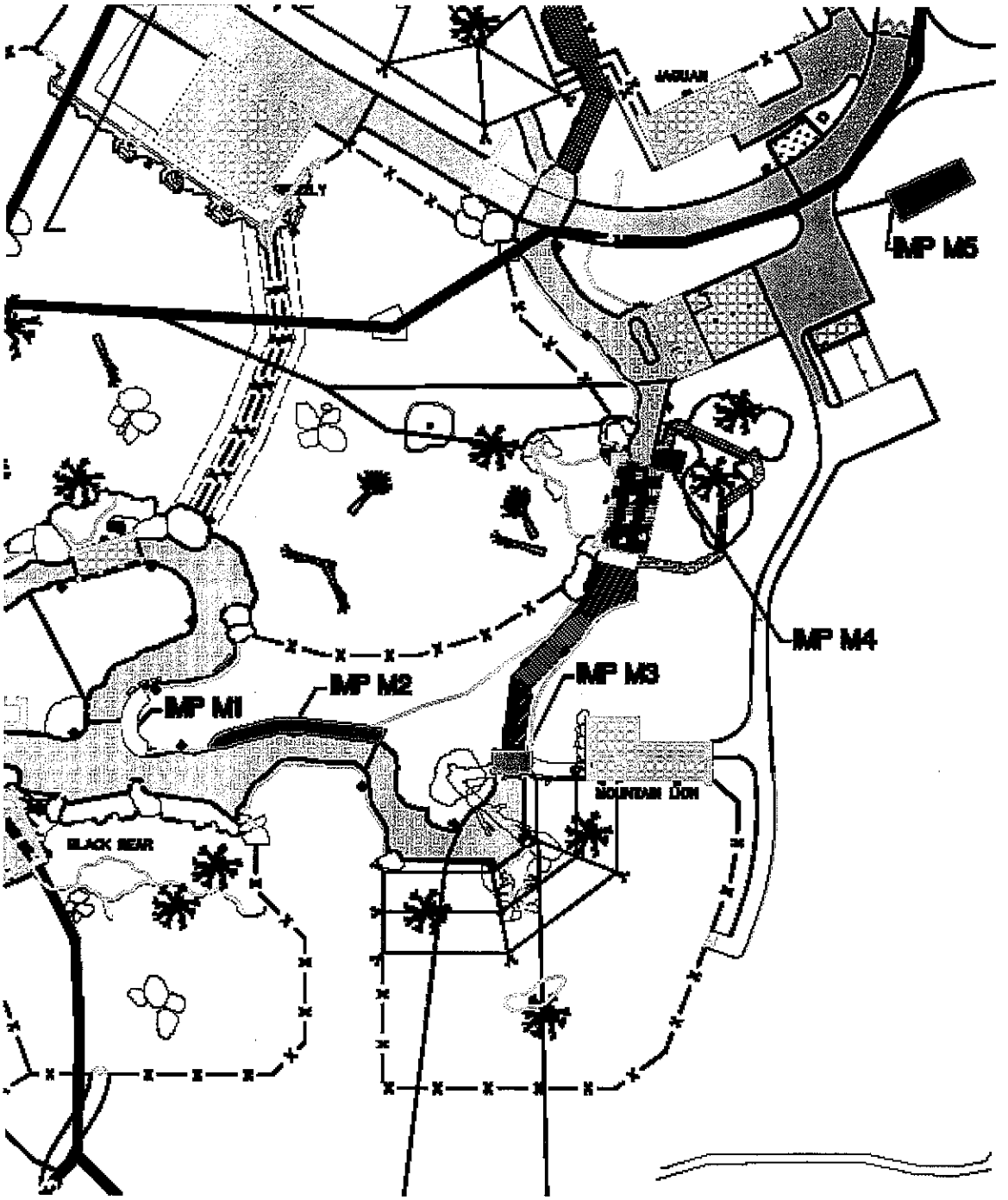
DMA L4, totaling 2,246 square feet, is porous AC and drains a portion of the service road. DMA L4 is Self-Retaining.
DMA L5, totaling 2,042 square feet, is porous AC and drains a portion of the service road. DMA L5 is Self-Retaining.
DMA L6, totaling 4,817 square feet, is porous AC and drains a portion of the service road. DMA L6 is Self-Retaining.
DMA K1a, totaling 9,446 square feet, drains a portion of the AC pavement service road. DMA K1a has gaps in the gutter pan so the water will drain underneath the road and fill up the 30" section and therefore is Self-Retaining. See detail 3, Figure 4.
DMA K1b, totaling 2,642 square feet, drains concrete walkway. DMA K1b drains to Self-Retaining DMA K1a. K1a is sized accordingly.
DMA K1c, totaling 423 square feet, drains a grizzly viewing shelter. DMA K1c drains to Self-Retaining DMA K1a. K1a is sized accordingly.
DMA K2, totaling 5,638 square feet, is porous AC and drains a portion of the service road. DMA K2 is Self-Retaining.
DMA K3a, totaling 11,619 square feet, drains the interpretive center roof. DMA K3a drains to IMP K3.
DMA K3b, totaling 3,021 square feet, drains the interpretive center roof. DMA K3b drains to IMP K3.
DMA K3c, totaling 428 square feet, drains the eagle holding roof. DMA K3c drains to IMP K3.
DMA R1, totaling 13,500 square feet, drains a portion of the AC Pavement maintenance access road. DMA R1 drains to IMP R1.
DMA R2, totaling 6,391 square feet, drains a portion of the AC Pavement maintenance access road. DMA R2 drains to IMP R2.

B. Treatment Control Facilities
(1) Drawings showing location and type of each facility.

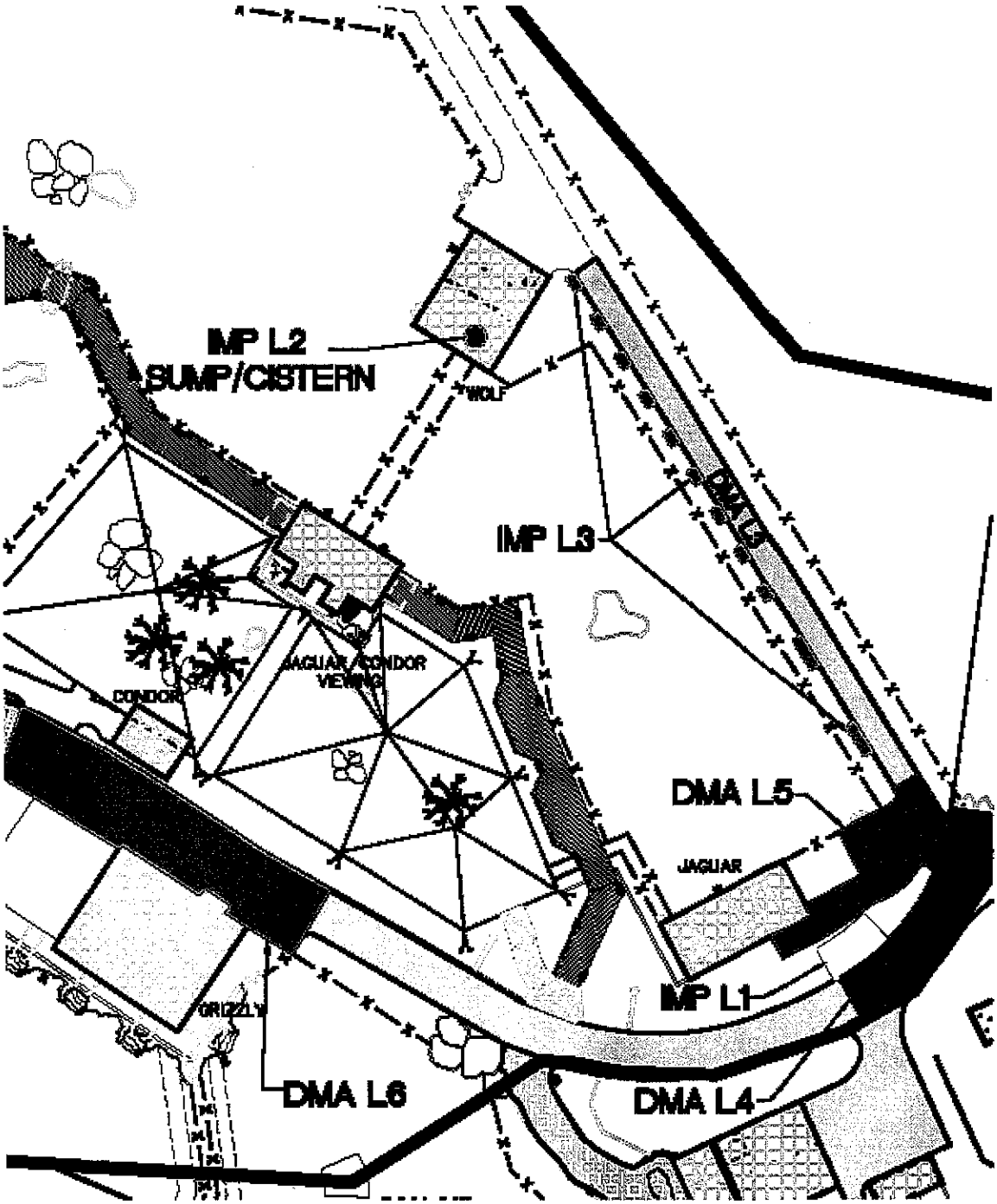
ALIQUOT


IMP A2
INTERPRETIVE OVERLOOK
IMP A1
BLACK BEAR
MAINTENANCE ACCESS ROAD

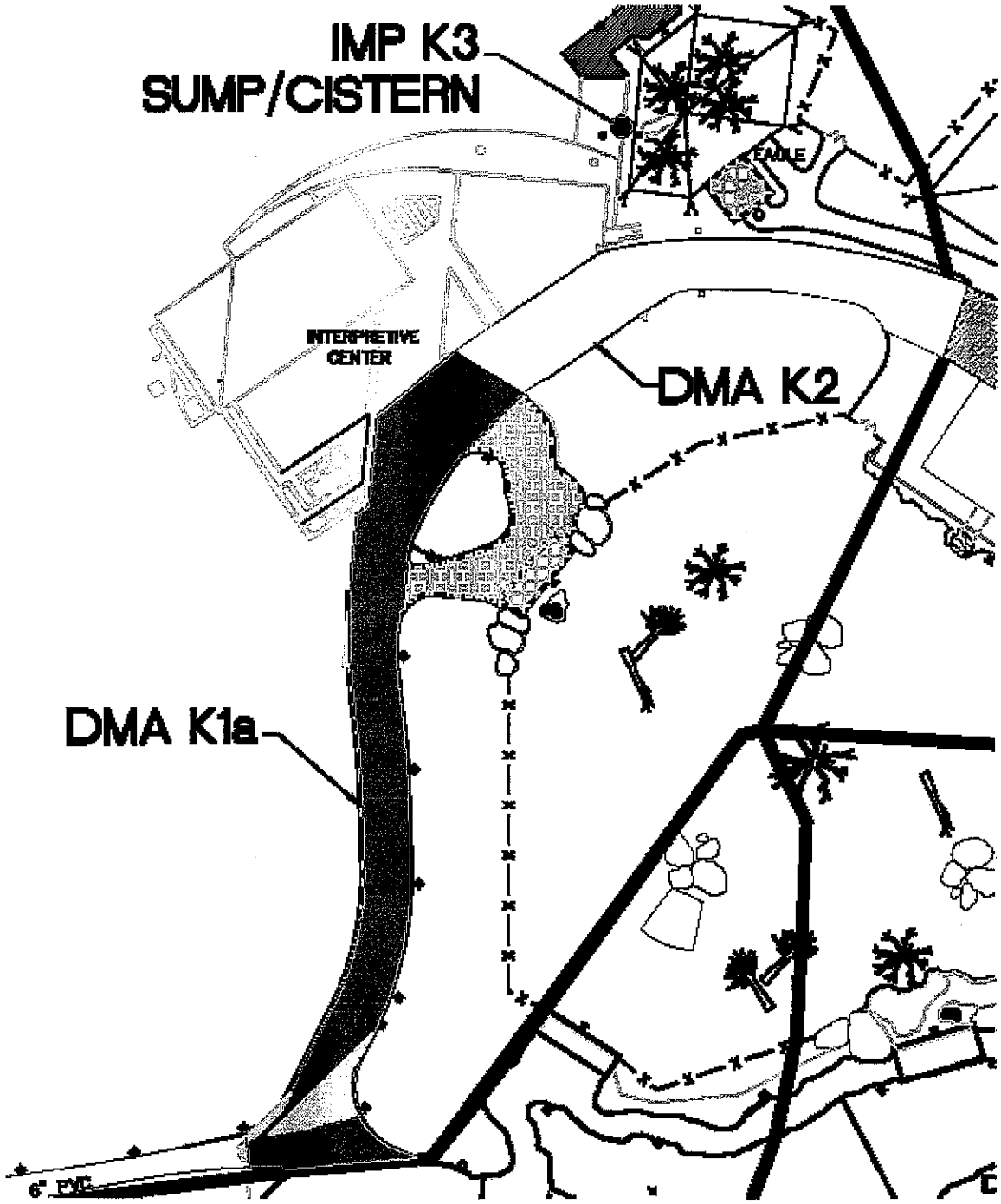
ALIQUOT



ALIQUOT


IMP L2
SUMP/CISTERN
WOLF
IMP L3
DMA L3
JAGUAR/CONDOR
VIEWING
CONDOR
DMA L5
JAGUAR
IMP L1
GRIZZLY
DMA L6
DMA L4

ALIQUOT



ALIQUOT

(2) General Description of Each Facility with Details (see table and details below)

Table 5B2

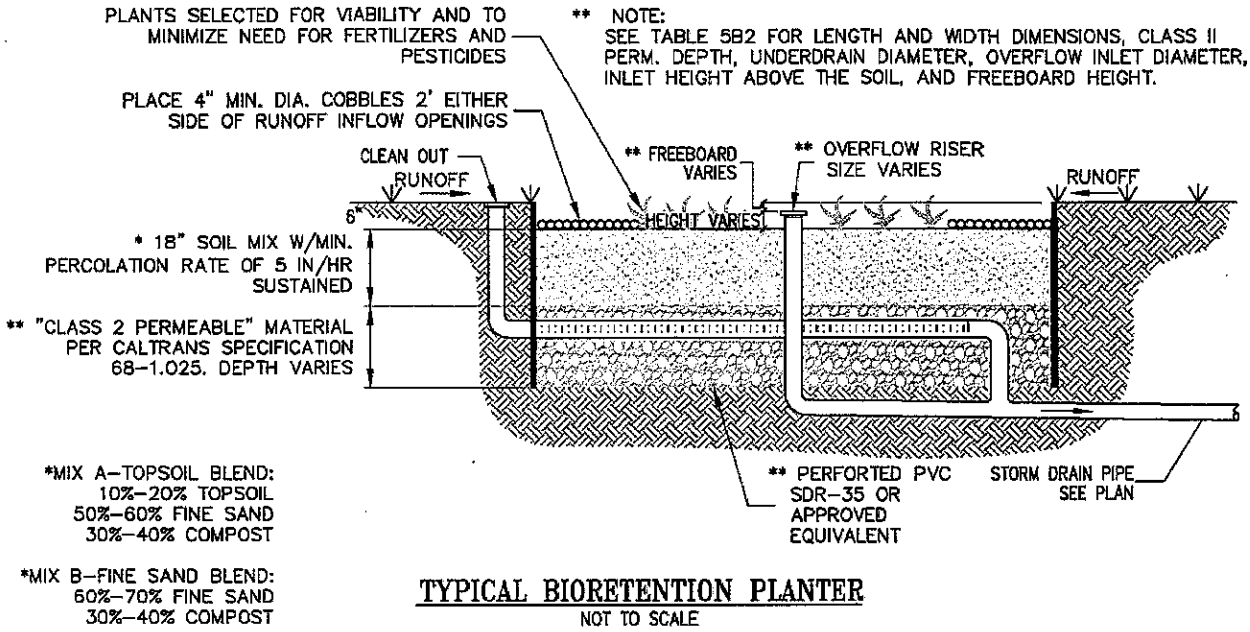
DRAINAGE MANAGEMENT AREA ID	IMPERVIOUS AREA		PERVIOUS AREA		IMP ID	IMP TYPE	IMP SIZE AND DIMENSIONS							
	SF	ACRES	SF	ACRES			L (FT)	W (FT)	SOIL DEPTH	ROCK DEPTH	UNDERDRAIN DIAMETER	RISER DIAMETER	RISER HEIGHT	FREEBOARD
DMA A1	10,300	0.236	29,942	0.687	IMP A1	BIORETENTION PLANTER	131	5	18"	24"	2"	2"	6"	17"
DMA A2	8,737	0.200	0	0	IMP A2	BIORETENTION PLANTER	41	11	18"	18"	2"	1"	6"	12"
DMA M1	4,934	0.113	3,928	0.09	IMP M1	BIORETENTION PLANTER	36	7	18"	18"	3"	1"	5"	12"
DMA M2	8,066	0.185	3,854	0.088	IMP M2	BIORETENTION PLANTER	91	7	18"	18"	3"	2"	6"	12"
DMA M3	3,032	0.070	0	0	IMP M3	BIORETENTION PLANTER	15.8	10.4	18"	12"	2"	.5"	4"	12"
DMA M4	656	0.015	5,235	0.12	IMP M4	BIORETENTION PLANTER	16	10.2	18"	12"	3"	1"	5"	12"
DMA M5	8,547	0.196	12,553	0.288	IMP M5	BIORETENTION PLANTER	44	14.25	18"	18"	3"	2"	6"	12"
DMA L1	5,106	0.117	0	0	IMP L1	BIORETENTION PLANTER	30	15	18"	24"	4"	1"	4"	12"
DMA L2	9,364	0.215	0	0	IMP L2	CISTERN	PUMPED TO IRRIGATION TANK							
DMA L3	3,203	0.074	0	0	IMP L3	BIORETENTION PLANTER (x13)	6.67	4	18"	18"	4"	3"	7"	3"
DMA L4	2,246	0.052	0	0	SELF RETAIN.	POROUS ASPHALT	SEE DETAIL 1/ OC-501 FOR POROUS ASPHALT SECTION							
DMA L5	2,042	0.047	0	0	SELF RETAIN.	POROUS ASPHALT	SEE DETAIL 1/ OC-501 FOR POROUS ASPHALT SECTION							
DMA L6	4,817	0.110	0	0	SELF RETAIN.	POROUS ASPHALT	SEE DETAIL 1/ OC-501 FOR POROUS ASPHALT SECTION							
DMA K1	12,511	0.287	0	0	SELF RETAIN.	GRAVEL TRENCH	SEE DETAIL 3/ OC-501 FOR NON-POROUS ASPHALT SECTION							
DMA K2	5,638	0.129	0	0	SELF RETAIN.	POROUS ASPHALT	SEE DETAIL 1/ OC-501 FOR POROUS ASPHALT SECTION							
DMA K3	15,068	0.346	0	0	IMP K3	CISTERN	PUMPED TO IRRIGATION TANK							

DRAINAGE MANAGEMENT AREA ID	IMPERVIOUS AREA		PERVIOUS AREA		IMP/BMP ID	IMP TYPE	IMP SIZE AND DIMENSIONS						
	SF	ACRES	SF	ACRES			AREA (FT²)	SOIL DEPTH	ROCK DEPTH	UNDERDRAIN DIAMETER	RISER DIAMETER	RISER HEIGHT	FREEBOARD
DMA A3	11,190	0.257	0	0	IMP A3	BIORETENTION PLANTER	908	1.5'	1'	2"	2"	6"	6"
DMA R2	6,391	0.147	0	0	IMP R2	BIORETENTION PLANTER	792	1.5'	1'	4"	4"	6"	6"
DMA R1	13,500	0.310	0	0	IMP R1	BIORETENTION PLANTER	1,292	1.5'	1'	6"	4"	6"	7.2"
DMA R	6,342	0.146	0	0	IMP R	BIORETENTION PLANTER	468	1.5'	1'	2"	1"	6"	8"

DMA# (DRAINAGE MANAGEMENT AREA) FLOWS TO MATCHING IMP#

ALIQUOT

Bioretention Planter Detail (below)

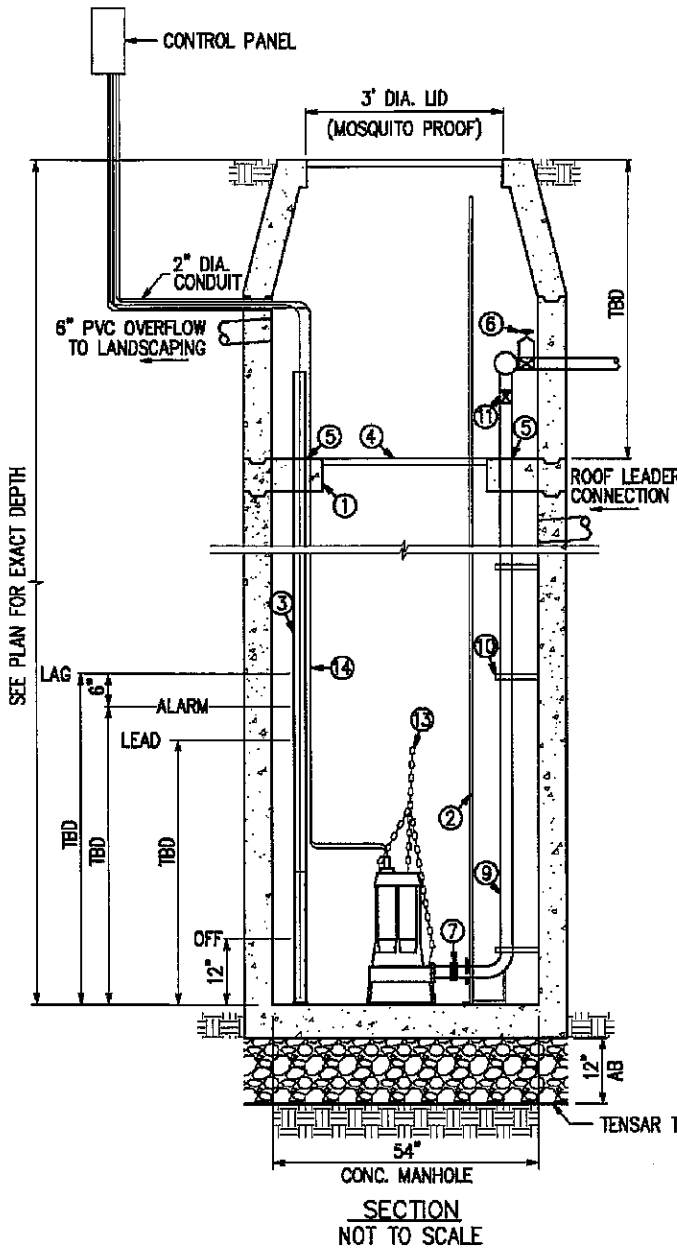


TYPICAL BIORETENTION PLANTER

NOT TO SCALE

ALIQUOT

Cistern System Details (below)



SECTION
NOT TO SCALE

DETAIL NOTES:

① 6" THICK CONCRETE PLATFORM

② MAINTENANCE GUIDE POLE

③ PRESSURE TRANSDUCER SENSOR WITHIN 2" PVC, PERFORATED UP 2 FEET FROM BOTTOM

④ GRATED 30" DIA. MANHOLE LID

⑤ BORED HOLES FOR PIPES WITH 1" MIN. CLEARANCE

⑥ GATE VALVE AT DISCHARGE LINE

⑦ QUICK RELEASE COUPLING

⑧ ONE 2ED51E2BF, 1 HP, 200V 3 PHASE GOULDS EFFLUENT PUMP, 3500 RPM, MAX 73 GPM WITH 40' LIFT

⑨ 2" SCHEDULE 80 PVC DISCHARGE PIPE

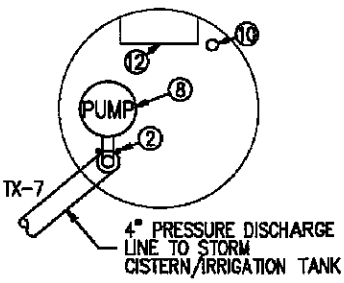
⑩ MOUNTING BRACKETS FOR DISCHARGE PIPES

⑪ CHECK VALVE AT EACH DISCHARGE PIPE

⑫ STEPS SHALL BE STEEL REINFORCED POLYPROPYLENE PLASTIC, SANTA ROSA CAST PRODUCTS CO. DWG NO. PS2-PF OR EQUIVALENT. STEPS TO BE CAST IS PLACE OR PRESS FITTED INTO PROVIDED HOLES AS PER MANUFACTURE. INSTALL STEPS WITH LOWEST RUNG 1.0 FEET ABOVE THE FLOOR AND HIGHEST RUNG NOT MORE THAN 6 INCHES BELOW LID. SPACING BETWEEN STEPS SHALL NOT EXCEED 1.0 FOOT AND SHALL BE UNIFORM THROUGHOUT THE WALL LENGTH

⑬ 3/16" LIFTING CHAIN – 304 STAINLESS STEEL

⑭ WATER PROOF ELECTRICAL CORD



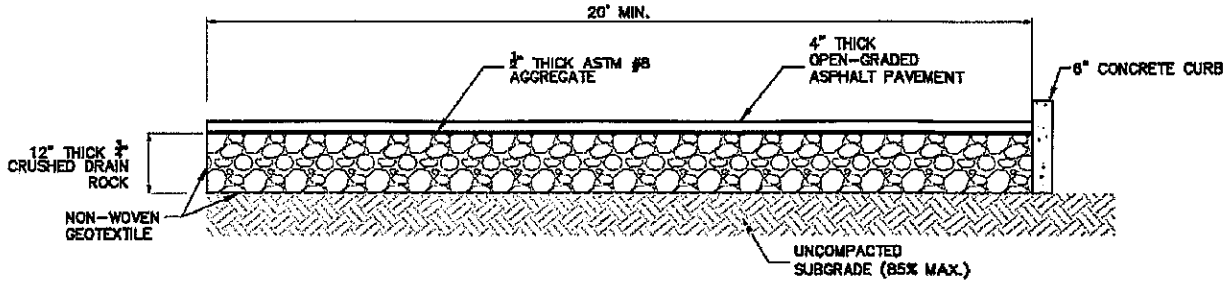
LID DETAIL

SUMP MANHOLE W/ PUMP

NOT TO SCALE

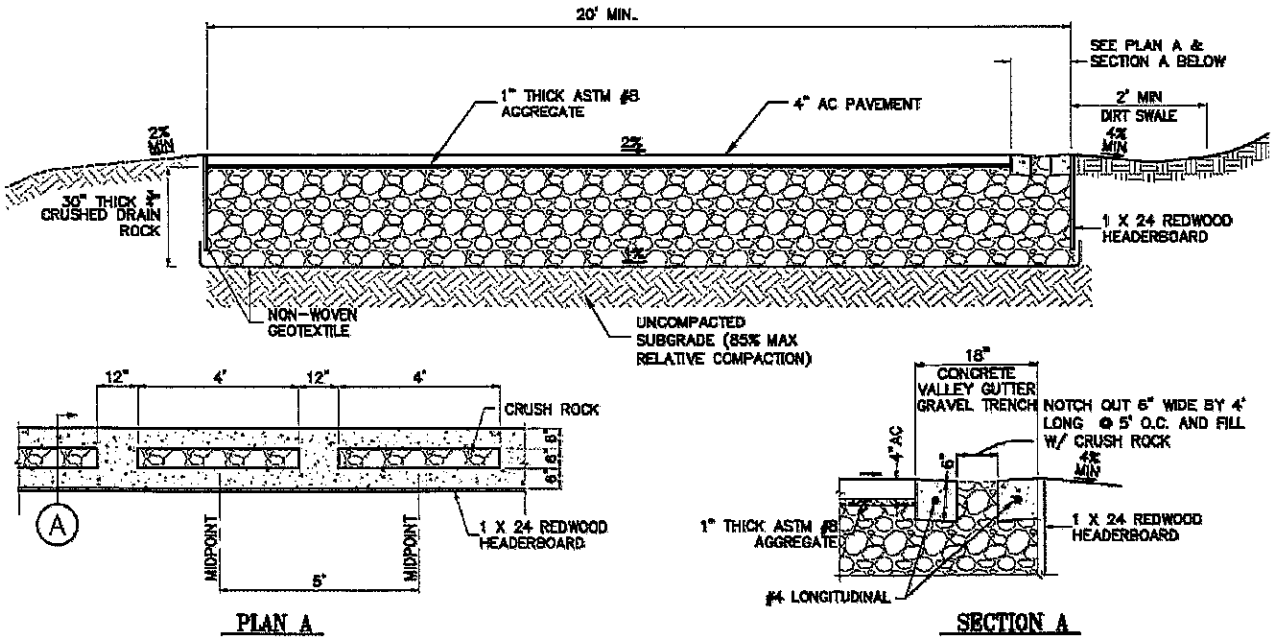
ALIQUOT

Porous Asphalt Detail (below)



POROUS ASPHALT PAVING
NOT TO SCALE

Gravel Trench Detail (below)



PLAN A

SECTION A

NON-POROUS ASPHALT PAVING W/ GRAVEL TRENCH
NOT TO SCALE

(a) Area Drained and Routing of Discharge
IMP-A1 = 40,242 SF, discharge routed to existing lower landscape areas
IMP-A2 = 8,737 SF, discharge routed to existing lower landscape areas
IMP-M1 = 8,862 SF, discharge routed to existing lower landscape areas
IMP-M2 = 11,920 SF, discharge routed to existing lower landscape areas
IMP-M3 = 3,032 SF, discharge routed to existing lower landscape areas
IMP-M4 = 6.091 SF, discharge routed to existing lower landscape areas
IMP-M5 = 21,110 SF, discharge routed to existing lower landscape areas
IMP-L1 = 5,106 SF, discharge routed to existing lower landscape areas
IMP-L2 = 9,364 SF, discharge pumped to cistern/irrigation tank
IMP-L3 = 9,364 SF, discharge pumped to cistern/irrigation tank
DMA-L4 = 2,246 SF, discharge routed to existing lower landscape areas
DMA-L5 = 2,042 SF, discharge routed to existing lower landscape areas
DMA-L6 = 4,817 SF, discharge routed to existing lower landscape areas
DMA-K1 = 12,511 SF, discharge routed to existing lower landscape areas
DMA-K2 = 5,638 SF, discharge routed to existing lower landscape areas
DMA-K3 = 15,068 SF, discharge pumped to cistern/irrigation tank
DMA-A3 = 11,190 SF, discharge routed to existing lower landscape areas
DMA-R2 = 6,391 SF, discharge routed to existing lower landscape areas
DMA-R1 =13,500 SF, discharge routed to existing lower landscape areas
DMA-R = 6,342 SF, discharge routed to existing lower landscape areas

VI. BMP Design Documentation
A. Manufacturer's Data, Manuals, and Maintenance Requirements for Pumps, Mechanical and/or Electrical Equipment, and Proprietary Facilities
(place holder for information not yet available)

B. Specific Operation and Maintenance
See section VII

VII. Maintenance Schedule and Matrix
A. Maintenance Schedule for Each Facility with Specific requirements for:
See below for (1) Routine Inspection and Maintenance, (2) Annual Inspection and Maintenance, (3) Inspection and Maintenance After Major Storms

Inspections

The routine inspection component of the OMP serves as a mechanism to proactively identify potential and existing problems that may impair the intended function of a source control or treatment BMP. Moreover, the recent introduction of the West Nile Virus has prompted the Alameda County Mosquito Abatement District's Mosquito Control Program to increase public awareness of possible locations/sources for vector breeding. Inspectors should always be aware of possible vector concerns.

The inspector must assess the condition and effectiveness of each element of a source control or treatment BMP by field observation. The findings of such inspections will subsequently affect maintenance activities.

It is recommended that inspections be performed regularly before each rainy season, after the first heavy rain and monthly. See the Stormwater Treatment Facilities Maintenance Matrix in Section 5.0. Complete inspections should be conducted in September and May of each year. This schedule coincides with the

official rainy season that begins October 1st and ends April 30th of each year. Adoption of this schedule will provide ample time to perform corrective maintenance to structural BMPs, before and after the rainy season. All corrective maintenance shall be completed by October 1st, to coincide with the official beginning of the rainy season. Additional inspection shall be performed after storm events producing greater than 1" of rainfall as reported by the National Weather Service.

Inspection Checklists for each source control and treatment BMP are located in Attachment C. The following sections provide a guideline for inspection of source control and treatment BMPs.

Source Control BMPs

Bioretention Facility

Bioretention facilities remove pollutants by filtering runoff slowly through an active layer of soil. Routine maintenance is needed to insure that flow is unobstructed, that erosion is prevented, and that soils are held together by plant roots and are biologically active. Typical routine maintenance consists of the following:

- Inspect inlets for channels, exposure of soils, or other evidence of erosion
- Clear any obstructions and remove any accumulation of sediment
- Examine cobble or other material used as a splash pad and replenish if necessary
- Inspect side slopes for evidence of instability or erosion and correct as necessary
- Observe soil at the bottom of swale of filter for uniform percolation throughout. If portions of the Bioretention facility or filter do not drain within 48 hours after the end of a storm, the soil should be tilled and replanted. Remove any debris or accumulations of sediment
- Examine the vegetation to ensure that it is healthy and dense enough to provide filtering and to protect soils from erosion
- Confirm that irrigation is adequate and not excessive
- Replace dead plants and remove invasive vegetation
- Abate any potential vectors by filling holes in the ground, in and around the swale and by ensuring that there are no areas where water stands longer than 48 hours following a storm
- If mosquito larvae are present and persistent, contact the Contra Costa County Vector Control District for information and advice
- Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor

Cistern System

The Cistern system is engineered to store a specified volume of water with no discharge until this volume is exceeded. The site cistern is a 30,000 gallon cistern/irrigation tank fed by two below ground sump manholes that incorporate pumps that pump stormwater collected by gravity through a 4-inch diameter force main pipe to the on-site 30,000 gallon cistern /irrigation tank with pump (the collected stormwater will be used for irrigation and for animal holding area wash downs. Holding area wash down areas are in an enclosed area with sanitary sewer drains). The cistern/irrigation tank will be filled 80% during the non-winter seasons by potable water leaving 20% for off-season rain harvesting. During the winter/rainy season it will only be filled 50% to allow for the maximum rain harvest storage. Electronic sensors will be programmed to control each phase and each piece of equipment to work together and maximize rain harvesting. The two below ground sump manholes each have a 6-inch diameter overflow pipe with pop-up drainage emitters to drain overflow to adjacent landscaping downhill from building areas, animal holding areas and walkways. Typical routine maintenance for the designed Cistern System consists of the following:

- Conduct annual inspections of pumps and backflow prevention systems in the cistern and sump manholes
- Review computer generated water level data monthly
- Recalibrate sensors annually and adjust programming as necessary based on previous year's data
- Flush cistern and sump manholes annually to remove sediment
- Regularly inspect for and repair leaks
- Vacuum removal of sediment is required for below ground sump manholes
- Brush the inside surfaces and thoroughly disinfect once a year
- Inspect inlet and oulet pipes for damage or leaks and, if necessary, have them repaired by a qualified contractor
- See section VI B for sump manhole pump specific maintenace requirements

Green Roof

Green roofs are vegetated roof systems that are considered self-treating areas and filter stormwater prior to drainage off building rooftops.

- Inspection is required at least semi-annually. Confirm adequate irrigation for plant health
- Fertilize and replenish growing media as specified by landscape designer and as needed for plant health in compliance with LID.

Porous Asphalt

Porous Asphalt is an open-graded asphalt mix which allows storm water to drain through the pavement surface into a stone recharge bed and infiltrate into the soils below the pavement.

- Keep landscaped areas well maintained and prevent soil from washing onto the pavement
- Remove obstructions, debris and trash from the surface and sides of the porous asphalt and dispose of properly
- Vacuum clean using commercially available sweeping machines and hose down by a high-pressure jet four (4) times a year (End of winter-April, Mid-summer-July, after autumn-November) to keep the pores in the asphalt open
- Inspect to ensure that it drains between storms, annually and within 5 days after rainfall. Check observation downstream drain inlet 2-3 days after storm to confirm drainage

As needed maintenance:

- When vacuum cleaning, inspect for any signs of hydraulic failure. If routine cleaning does not restore infiltration rates, partial reconstruction may be required
- Areas affected by hydraulic failure should be lifted, if possible, for inspection of internal materials to identify the location and extent of the blockage
- Geotextiles may need complete replacement
- Removed silts may need to be disposed of as controlled waste

Gravel Trench

Gravel trenches are long, narrow trenches filled with permeable material (e.g., gravel), designed to store runoff and infiltrate through the bottom and sides into the subsurface soil.

- Remove obstructions, debris and trash from the surface and sides gravel trench and dispose of properly
- Replenish gravel/crush rock as neccessary
- Inspect non-woven geotextile for sediment deposits

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Storm Drain Markers inspection

All storm drain inlets at the California Exhibit project site will be equipped with storm drain markers, to the satisfaction of the City Engineer. The Inspection of the inlet source control BMPs shall include:

- Condition of storm drain markers
- Check for unobstructed view of signage and storm drain markers

Irrigation & Landscape Inspection

The California Exhibit landscape and irrigation system is laid out in such a manner as to provide groundcover and canopy landscape that requires a minimum amount of irrigation. To ensure the proper operation of the irrigation system and to reduce the introduction of non-stormwater flows to the storm drain system, the inspection of landscape and irrigation shall include the following:

- General conditions of landscapes ground cover and canopy
- Check for areas of bare soil within the landscape area
- Check condition of drains within landscape areas, note obstructions
- Check irrigation system for function coverage & damage

Maintenance

Source Control and Treatment BMP maintenance may be classified as routine or non-routine operations. Routine maintenance operations are generally preventative measures. Such activities may be characterized as "good housekeeping" and to a great extent is simply the removal of debris before it has an opportunity to enter the storm drain system.

Non-routine maintenance activities tend to be corrective in nature and become necessary when a portion of a BMP is damaged or not functioning properly. Examples of non-routine maintenance items would include holes, ruts, animal burrows or the presence of standing water (5 days after a storm event) in a stormwater treatment BMP.

Source Control BMP Maintenance

Maintenance of Source Control BMPs shall be performed once every 14 days in conjunction with landscape maintenance, or as necessary and are as follows:

Storm Drain Markers

- Repair or replace storm drain markers that are damaged or illegible
- Remove/trim landscaping if view of storm drain markers is obstructed

Landscape and Irrigation

- Remove weeds, plant debris, and trash
- Replant/reseed denuded areas as necessary to maintain coverage
- Eliminate puddles or standing water by repairing pipe leaks, or by placing minimal fill or by creating a swale, replant as necessary. Warning: standing water may be a vector concern
- Remove obstructions from all area drains
- Check downspout locations or erosion, replace/enhance energy dissipation, replant as necessary, where applicable
- Check irrigation system for leaks and damage
- Check irrigation system for coverage, adjust/replace sprinkler heads as necessary

- Check irrigation for overspray on sidewalks, buildings, and drive aisles, adjust/replace sprinkler heads as necessary
- Check moisture sensor (if installed) for proper function/over watering, adjust/replace sensor as necessary
- Check pressure drop shutoff valve (if installed) for proper function, replace as necessary
- Check general landscape condition and for sources of erosion

Waste Disposal

- Disposal of all waste material shall be in accordance with local, state and federal laws

Fertilizers, Herbicides and Pesticides

- Apply fertilizers, herbicides, and pesticides sparingly and only when necessary
- Utilize least environmentally deleterious products available
- Application should be in accordance with principles of Integrated Pest Management

Treatment Control BMP Maintenance

The bioretention facility BMPs are an integral part of the site landscape and filtration system and, therefore, shall receive inspections to determine the necessity of regularly scheduled maintenance, in conjunction with site landscape maintenance (once every 7-14 days) or as necessary to restore intended function.

Each homeowner shall be responsible for the maintenance responsibilities of the area of the storm water treatment facility within his/her own lot, and collectively with his/her opposite neighbor with respect to the maintenance of the overflow catch basin and piping system beneath the surface area of the bioretention facility.

Stormwater Treatment Facilities Maintenance Matrix

Source Control

Frequency	**Observation**	**Maintenance Activity**
Before each rainy season.	Inspect all catch basins. Look for obstructions, vegetation, debris, litter, sediment, etc. blocking the catch basins	Remove obstructions, etc.
Frequency	**Observation**	**Maintenance Activity**
Before each rainy season and after the first heavy rain	Inspect the entire storm drain system from the upstream end to the outfall, including all catch basins. Observe the flow of water. Any evidence of ponding in the catch basins indicates a blockage.	Find and remove any obstructions. Flushing (with pressurized water) may be necessary.

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Frequency	Observation	Maintenance Activity
Before each rainy season.	Inspect all subdrain cleanouts. Ensure that all cleanout caps are present. Look for obstructions, debris, trash, leaves, vegetation, etc. growing inside the subdrain or covering the cleanout.	Remove any obstructions by hand (if near the cleanout entrance) or by flushing (with pressurized water) if too far down the pipe. Replace missing caps and secure to prevent unauthorized removal or accidental displacement.
Frequency	**Observation**	**Maintenance Activity**
Before each rainy season.	Inspect each subdrain where it enters the catch basin to see whether the subdrain pipe is dry, or is clogged with vegetation. Ensure that the subdrain is flowing by testing with water from the cleanout end	If water does not flow through the subdrain, rod or flush the line to ensure flow.

BIORETENTION FACILITY - GENERAL

Frequency	Observation	Maintenance Activity
Before each rainy season.	Determine whether the bioretention facility is draining correctly (i.e. drains in less than 24 hours after a storm event). Inspect adjacent infrastructure, such as retaining walls, curbs and pavement for signs of failure caused by water intrusion into the surrounding soil. This is a sign of poor drainage from the treatment facility.	Determine the cause of poor drainage (i.e. siltation of engineered soil mix, blocked subdrains, blocked catch basin, blocked storm drain, clogged orifice) and repair.
Frequency	**Observation**	**Maintenance Activity**
After the first heavy rain.	Determine whether the bioretention facility is draining correctly. Look for standing water or soggy, saturated soil. Look for holes containing standing water and permitting mosquitoes. This is a sign of poor drainage from the	Determine the cause of poor drainage (i.e. siltation of engineered soil mix, blocked subdrains, blocked catch basin, blocked storm drain, clogged orifice) and repair. Fill holes containing water with proper soil mix. Tilling of soil mix may be

	treatment facility. Water should drain from bioretention facility within 24 hours. After 24 hours, there should be no patches of standing water. Bioretention facility should drain evenly.	required, After several years, the soil medium may become impermeable because of silt deposition, in which case removal and replacement of the soil mix and class 2 permeable material will be required.
Frequency Each month	**Observation** Inspect the bioretention facility for litter, debris, leaves, dead vegetation and anything else that might interfere with flow, filtration and growth of plantings.	**Maintenance Activity** Remove all such litter, debris, leaves, dead vegetation, etc. By hand or with hand tools. Replace dead vegetation as appropriate.
Frequency Each month	**Observation** Inspect for growth of trees or invasive plants in bioretention facilities.	**Maintenance Activity** Remove invasive plants, weeds, shrubs trees, or anything with a woody stem from bioretention facilities.
Frequency Each month	**Observation** Inspect condition of vegetation in bioretention facilities. Vegetation must be of sufficient density and health to provide filtration and protect from erosion.	**Maintenance Activity** Trim as necessary, fertilize as necessary, note bare spots and reseed as necessary. Fertilization is to be performed by a licensed professional. Only the minimum amount of fertilizer is to be used, to prevent downstream eutrification. Fertilizers used should be the most environmentally benign products available.
Frequency Before each dry season and each month throughout the dry season.	**Observation** Test the irrigation system. Observe whether all ground cover areas within the bioretention facilities are receiving the correct amount of water. Observe whether excessive irrigation is creating flow in the	**Maintenance Activity** Clean out all plugged sprinkler heads and filters. Straighten any displaced sprinkler heads. Replace any damaged sprinkler heads. Adjust for direction and throw distance. Prevent over spray into catch basin.

	subdrains (irrigation should not create any flow in the subdrain).	Set the sprinkler timer to provide enough water depending on the anticipated weather until the next irrigation inspection. Reduce the watering time if excess water flows from the subdrains.
Frequency Each month	**Observation** Inspect for presence of pests which constitute a nuisance and/or threaten the survival of the plantings in the bioretention facility.	**Maintenance Activity** Apply pesticide to the minimum amount necessary to control pests. All application of pesticide is to be performed by a licensed professional pest control contractor trained in Integrated Pest Management (IPM) techniques.
Frequency Ongoing	**Observation** Before making any modification to on-lot downspouts, grading, landscaping or drainage patterns, ascertain what affect such modification will have on the flow of water to the bioretention facility.	**Maintenance Activity** Refrain from any construction, grading, landscaping, piping or any other construction that will affect the flow of water to the bioretention facilities. Correct any changes that divert Stormwater away from treatment facilities or otherwise reduce their effectiveness.
Frequency When treatment facilities are substantially failing to perform (estimated 15 years from installation).	**Observation** Treatment facilities are failing to drain or discharging 'dirty water" into storm drain system. Minor maintenance activities have failed to rectify problem.	**Maintenance Activity** Thorough inspection of Stormwater facility by licensed professional (i.e. landscape contractor, landscape architect, civil engineer, etc.) replacement of failed components and repair of Stormwater facility to design specifications (per Stormwater Control plan).
CISTERN SYSTEM		
Frequency	**Observation**	**Maintenance Activity**

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Semi-annually, prior to rainy season	Inspect gutters and downspouts for leaves and other debris	Remove leaves and debris and dispose of properly
Frequency Annually, prior to rainy season	**Observation** Inspect and clean storage tank sump lids, vents and mosquito screens and overflow pipes	**Maintenance Activity** Repair immediately
Frequency Every third year	**Observation** Inspect tanks/sumps for sediment, clear overhanging vegetation/trees over roof surface, check integrity of backflow preventer, inspect structural integrity of tank/sumps, pumps pipes and electrical system	**Maintenance Activity** Repair immediately
Frequency Quarterly, prior to and after storm events	**Observation** Water stands in the sump manholes with pumps between storms, or there is excessive noise from pump check Pump, wiring, floats malfunction	**Maintenance Activity** Check for clogged overflow pipe, pump malfunction, damaged outlet pipe and repair
Frequency Monthly	**Observation**	**Maintenance Activity**
GREEN ROOF		
Frequency Semi-annually	**Observation** Plants, vegetation in poor health	**Maintenance Activity** Confirm adequate irrigation for plant health
Frequency Semi-annually	**Observation** Plants, vegetation in poor health, soils overly dry	**Maintenance Activity** Fertilize and replenish growing media as specified by landscape designer and as needed for plant health
POROUS ASPHALT		
Frequency Weekly	**Observation** Dirt or vegetated debris on pavement	**Maintenance Activity** Keep landscaped areas well maintained and prevent soil from washing onto the pavement

ALIQUOT

Frequency Weekly	**Observation** Obstructions, debris and trash on pavement	**Maintenance Activity** Remove obstructions, debris and trash from the surface and sides of the porous asphalt and dispose of properly
Frequency Semi-annually	**Observation**	**Maintenance Activity**
Frequency Quarterly, prior to rainy season	**Observation** Standing water above pavement surface	**Maintenance Activity** Vacuum clean using commercially available sweeping machines and hose down by a high-pressure jet to keep the pores in the asphalt open
Frequency Quarterly, prior to rainy season	**Observation** Inspect to ensure that pavement drains within 5 days after rain event. Check that downstream drop inlet drains 2-3 days after storm to confirm drainage	**Maintenance Activity** Remove trash
Frequency As needed	**Observation** Evidence of sedimentation in porous asphalt. Less than 50% storage volume remaining	Material removed and disposed of properly so that there is no clogging or blockage.
GRAVEL TRENCH		
Frequency Weekly	**Observation** Obstructions, debris and trash on pavement	**Maintenance Activity** Remove obstructions, debris and trash from the surface and sides gravel trench and dispose of properly
Frequency Monthly, or as needed after storm events	**Observation** Gravel/crush rock not flush with concrete edges	**Maintenance Activity** Ensure ¾ crush rock is flush with adjacent concrete, replenish as necessary
Frequency Annually as needed	**Observation** Reduced storage capacity	**Maintenance Activity** Remove a small section of

		landscaping at edge of pavement section opposite of gravel trench at low points, shows sediment accumulation that may lead to gravel trench failure
Frequency	**Observation**	**Maintenance Activity**
Annually as needed	Reduced storage capacity	Remove sediment and dispose of properly and replace headerboard, as needed, to restore gravel trench to design condition

VIII. Definitions
A. Source Control BMPs

Storm Drain System Markers

All storm drain inlets in the California Exhibit will be marked with standard storm drain markers "No Dumping-Drains to Creek". This educational measure is intended to prevent unlawful dumping of waste materials, such as motor oil, into the storm drains, and increase awareness that Stormwater does not flow to a treatment facility off-site.

Efficient Irrigation Systems and Landscape Designs

The timing and application methods of irrigation system at the California Exhibit site have been designed so as to minimize the runoff of excess irrigation water into the stormwater conveyance system. Please refer to the Landscape Plans in Attachment D for greater details about irrigation systems and landscape design.

B. Treatment Control BMPs

Functions of Bioretention Facility

Bioretention facilities remove pollutants primarily by filtering runoff slowly through an active layer of soil. Routine maintenance is needed to insure that flow is unobstructed, that erosion is prevented, and that soils are held together by plant roots and are biologically active.

Native Plants and Drip Irrigation System

In order to minimize post construction irrigation requirements, the California Exhibit will be landscaped to the maximum extent possible with native, drought tolerant plants. In addition, necessary irrigation facilities will be designed to keep spray away from impervious areas. See Landscape Plans in Attachment D.

C. Vector Control

The most recent introduction of West Nile Virus to the southern California area has prompted local agencies to heighten public awareness of vectors and vector control. A vector is defined by Merriam-Webster's Dictionary as "an organism (as an insect) that transmits a pathogen (a specific causative agent

(as a bacterium or virus) of disease." Mosquitoes are identified as the world's most significant vectors and are responsible for the transmission of disease to millions of people worldwide. Infections transferred by vectors are referred to as "vector borne diseases".

Common examples of vector borne diseases include; canine heartworm, equine encephalitis and West Nile virus. Vector control is processes designed at eradicating or controlling the disease carrying insect or vector.

Mosquitoes typically take 8 days to 2 weeks to develop from an egg to an adult. To prevent mosquito breeding, this Operation and Maintenance Plan recommends that structural BMPs should not contain standing water for more than 5 days after a storm event. Should this occur, implement corrective measures to identify and eliminate the cause(s) of the standing water. For more information, contact the Alameda County Mosquito Abatement District at 23187 Connecticut Street, Hayward, CA 94545, (510) 783-7744, www.mosquitoes.org.

Although the potential for mosquito reproduction exists, the probability is remote and moreover, is significantly reduced with the implementation of maintenance and inspection activities contained in this plan.

ALIQUOT

STORMWATER CONTROL PLAN

for

OAKLAND ZOO-CALIFORNIA EXHIBIT

5/29/2012

prepared by:

Aliquot Associates Inc.
Robert Wong, P.E. 43748

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Appendix A

I. PROJECT DATA

Table 1. Project Data

Project Name/Number	Oakland Zoo California Exhibit
Project Location	9777 Golf Links Road, Oakland
Project Type and Description	Zoo expansion that includes new animal exhibits, a service road, pedestrian path and several buildings.
Total Project Site Area (acres)	Approximately 56 acres.
Total Area of Land Disturbed (acres)	Approximately 15 acres
Total New Impervious Surface Area (sq. ft.)	132,100 sf
Total Pre-Project Impervious Surface Area	0 sf
Total Post-Project Impervious Surface Area	132,100 sf
HMP Compliance	Yes

II. SETTING

II.A. Project Location and Description

The Oakland Zoo is located in Knowland Park in the Oakland foothills off of Interstate 580 at Golf Links Road. Current development at the Zoo encompasses approximately 45 acres. The proposed California Exhibit will develop an approximate additional 15 acres of previously undeveloped land. The project includes 8 new animal exhibits and associated animal holding buildings, a new visitor center, and a 2,000 ft maintenance access road from the existing Zoo parking lot. Visitors will access the California Exhibit via a proposed gondola therefore no new parking will be created. Much of the 15 acres to be developed will remain natural and will be used for the animals to roam in fenced pens. The amount of land required for this project is large, but the permanent disturbance from site improvements is relatively small.

II.B. Existing Site Features and Conditions

The California Exhibit will be developed in an area that is approximately 250 feet above the existing parking lot. The peak elevation throughout the proposed exhibit area is 626 feet. The natural hillside slopes are steep ranging from 10% to 30% and greater with the majority being 20% or greater. Runoff from the project is primarily in 4 separate drainage areas that all eventually flow to Arroyo Viejo Creek with the exception of drainage area M which ends up in San Leandro Creek. All the drainage areas run off into natural drainage channels created by the peaks and valleys of the hills. There is no existing storm drain system up gradient of the existing zoo. The site is in a hydromodification management area.

II.C. Opportunities and Constraints for Stormwater Treatment and Hydromodification

The topography of the California Exhibit and the fact that the area is undeveloped with no storm drain system limits what can be implemented for stormwater control facilities. Although the creation of impervious surfaces is limited, stormwater controls are designed to mitigate flows on-site for

water quality and hydromodification management. Steep slopes limit the opportunities to use porous pavements, but they are used wherever road slopes are 5% or less. The portion of the service road used by visitors as a pedestrian walk along the west side of the project (DMA K1a, Figure 2) will not be porous, but it will have open gaps in the gutter pan to allow runoff to infiltrate underneath to its 30" open graded base layer. The base layer allows the runoff to infiltrate and creates sufficient storage to detain enough water to meet the hydromodification requirement.

A green roof is used on one of the grizzly viewing areas (DMA M4b, Figure 2)

Rainwater harvesting is implemented into this project. The rainwater harvesting system collects roof runoff by gravity flow in sumps. The sumps are pumped to a 30,000 gallon irrigation tank. The irrigation tank is used year-round to irrigate landscaping and wash out the animal night houses. The irrigation tank is filled year-round by its own dedicated, potable water, fill line, but during the rainy season is filled to 23,000 gallons leaving 7,000 gallons of storage space for the harvested rainwater. The roof areas being collected require 7,000 gallons of storage to offset their impact for C3. The sumps will pump rainwater to the 30,000 gallon tank until it is full. When the tank is full alarms will trigger the sump pumps to shut off. Overflow water from the sumps is dispersed onto the hillside through 6" perforated pipes with emitters and does not need to be treated since the C3 prescribed amount of runoff is being stored in the 30,000 gallon tank. The tank is used year-round for irrigation as well as cleaning the animal night houses on a regular basis. The animal night houses are drained to the sanitary sewer system, equivalent to toilet flushing. C3 encourages harvesting water for toilet flushing in buildings, but this project presents a unique opportunity to reuse rainwater for washing out the animal night houses. Water from the tank does not need to be treated as it will either flow directly to the sanitary sewer system or be used as irrigation water where it will infiltrate into the ground.

Along the meandering pedestrian pathways and the Maintenance Access Road from the Veterinary Hospital to the Interpretive Overlook, bioretention planters collect and treat the surface runoff. Self-retaining areas could not be utilized since the project is mostly sloped. The IMPs satisfy hydromodification management (HM) requirements.

III. LOW IMPACT DEVELOPMENT (LID) DESIGN STRATEGIES

III.A. Optimization of Site Layout

III.A.1. Limitation of development envelope

The inherent nature of a zoo requires the site to be fairly expansive, but buildings and structures are at a minimum and are spread out over approximately 15 acres.

III.A.2. Preservation of natural drainage features

The design is for all natural drainage features to remain in their current state. Water from the stormwater facilities is dispersed back onto the hillsides using spreader pipes with emitters so that the water flows down the vegetated hillsides. Spreading the runoff on vegetated slopes avoids concentrated erosive flows.

III.A.3. Setbacks from creeks, wetlands, and riparian habitats

All manmade drainage facilities are located outside of jurisdictional waters.

III.A.4. Minimization of imperviousness

The project employs a green roof and utilizes porous pavement, where it can be effectively utilized, in an attempt to limit imperviousness.

III.B. Use of Permeable Pavements

Porous concrete and porous asphalt were initially considered for all of the walkways and roadways. It was decided that porous asphalt be used only for portions of the roadway that have a slope of 5% or less. All of the walkways will be impervious paving and will be treated using bioretention planters. The walkways incur run-on from adjacent pervious areas and therefore are not ideal for permeable pavement as clogging would be frequent.

The portion of service road that is also used for pedestrian circulation (DMA K1a, Figure 2)willfunction the same as porous pavement, but the water will percolate through gaps in the gutter pan instead of through the pavement. The base section is used for storage and will allow the prescribed amount of water to infiltrate to comply with C3 standards. The surface of the road is paved with impervious pavement and the runoff will enter the base section by percolating through open sections in the gutter pan to a porous open graded base section. The depth of the base section was determined by BAHM modeling.

III.C. Dispersal of Runoff to Pervious Areas

The C3 guidebook encourages dispersing runoff to landscaped areas for treatment. Common practice on flat sites is to allow runoff from impervious surfaces to flow to pervious areas and pond but since the topography of this site is steep, it is not possible to disperse runoff from walkways and roadways to the adjacent ground and comply with the flow control requirements without extensive and impractical grading.

III.D. Harvesting and Use for Treatment and Flow-Control

Although the project was approved prior to the effective date of the LID requirements in the Municipal Regional Permit (MRP), rainwater harvesting is being incorporated into the project. Rainwater harvesting is used to collect roof water from the Interpretive Center (DMA K3) as well as 5 of the animal holding buildings. Roof runoff is directed to sumps via gravity flow and then pumped to a 30,000 gallon holding tank that is also in place as an irrigation tank. The tank will be filled using its own dedicated irrigation line that is pumped from the existing zoo, but will be left partially full during winter to allow the harvested water to fill the tank. The zoo presents a unique opportunity for harvested water use with great demand that does not exist on typical projects. Water from the tank is used to hose out the animal night houses on a regular basis throughout the year. The animal houses require frequent washing and the demand necessary to maintain clean facilities is far greater than the amount of water that will be collected from harvesting. The night house drains are connected to the sanitary sewer system. Underdrains from some of the IMP's and porous pavements are connected to this harvesting system as well.

III.E. Integrated Management Practices

Bioretention planters are used to treat and store much of the sites runoff. Runoff will surface flow or be piped to the planters that are sized using BAHM to meet HM requirements. The planter sizes, soil and rock depths, and outlet pipe sizes vary, see Table on Figure 2 and Figure 3. The planters will be drained to the hillsides in their natural drainage areas using perforated spreader pipes with emitters. The spreader pipes and emitters are used to not concentrate any flow and therefore not create

potential for erosive flow. Water will not be diverted from its natural drainage area so there will be no increase of flow from pre-development conditions.

IV. DOCUMENTATION OF DRAINAGE DESIGN

IV.A. Descriptions of each Drainage Management Area

IV.A.1. Table of Drainage Management Areas

DMA Name	*Surface Type*	*Area (square feet)*	*IMP*
A1a	Native ground	12,018	Bioretention Planter (IMP A1)
A1b	Concrete Walkway	3,749	
A1c	Landscaping	3,644	
A1d	Concrete Walkway	5,288	
A1e	Roof	1,262	
A1f	Native ground	14,280	
A2a	Concrete Walkway	3,736	Bioretention Planter (IMP A2)
A2b	Roof	5,000	
A3	AC Pavement	11,190	Bioretention Planter (IMP A3)
M1a	Concrete Walkway	763	Bioretention Planter (IMP M1)
M1b	Roof	573	
M1c	Landscaping	3,928	
M1d	Concrete Walkway	3,598	
M2a	Landscaping	3,854	Bioretention Planter (IMP M2)
M2b	Concrete Walkway	5,701	
M2c	Roof	928	
M2d	Concrete Walkway	1,437	
M3a	Concrete Walkway	1,315	Bioretention Planter (IMP M3)
M3b	Roof	1,717	

M4a	Native Ground	4,022	Bioretention Planter (IMP M4)
M4b	Green Roof	1,213	
M4c	Concrete Walkway	656	
M5a	Native Ground	8,849	Bioretention Planter (IMP M5)
M5b	Concrete Walkway	2,469	
M5c	Landscaping	3,704	
M5d	Roof	760	
M5e	Roof	1,693	
M5f	AC Pavement	3,205	
M5g	Roof	420	
L1	AC Pavement	5,106	Bioretention Planter (IMP L1)
L2a	Roof	1,658	Self-Retaining. Flows to Cistern (IMP L2)
L2b	Roof	3,718	
L2c	Roof	593	
L2d	Roof	1,395	
L2e	Roof	2,000	
L3	AC Pavement	3,203	Bioretention Planters (IMP L3)
L4	Porous AC Pavement	2,246	Self-Retaining
L5	Porous AC Pavement	2,042	Self-Retaining
L6	Porous AC Pavement	4,817	Self-Retaining
K1a	AC Pavement	9,446	Self-Retaining
K1b	Concrete Walkway	2,642	Flows to Self-Retaining (K1a)
K1c	Roof	423	Flows to Self-Retaining (K1a)

K2	Porous AC Pavement	5,638	Self-Retaining
K3a	Roof	11,619	Self-Retaining. Flows to Cistern (IMP K3)
K3b	Roof	3,021	
K3c	Roof	428	
R1	AC Pavement	13,500	Bioretention Planer (IMP R1)
R2	AC Pavement	6,391	Bioretention Planter (IMP R2)

IV.A.2. Drainage Management Area Descriptions

DMA A1a, totaling 12,018 square feet, drains native hillside in the grizzly exhibit. DMA A1a drains to IMP A1.

DMA A1b, totaling 3,749 square feet, drains concrete walkway and a viewing shelter for the grizzly bear exhibit. DMA A1b drains to IMP A1.

DMA A1c, totaling 3,644 square feet, drains landscaped area. DMA A1c drains to IMP A1.

DMA A1d, totaling 5,288 square feet, drains concrete walkway and the viewing shelter for the black bear exhibit. DMA A1d drains to IMP A1.

DMA A1e, totaling 1,262 square feet, drains half of the black bear holding roof. DMA A1e drains to IMP A1.

DMA A1f, totaling 14,280 square feet, drains native hillside in the black bear exhibit. DMA A1f drains to IMP A1.

DMA A2a, totaling 3,736 square feet, drains concrete walkway. DMA A2a drains to IMP A2.

DMA A2b, totaling 5,000 square feet, drains the roof of the interpretive overlook. DMA A2b drains to IMP A2.

DMA A3, totaling 11,190 square feet, drains a portion of the AC Pavement maintenance access road. DMA A3 drains to IMP A3.

DMA M1a, totaling 763 square feet, drains concrete walkway. DMA M1a drains to IMP M1.

DMA M1b, totaling 573 square feet, drains a grizzly viewing shelter roof. DMA M1b drains to IMP M1.

DMA M1c, totaling 3,928 square feet, drains landscaping. DMA M1c drains to IMP M1.

DMA M1d, totaling 3,598 square feet, drains concrete walkway. DMA M1d drains to IMP M1.

DMA M2a, totaling 3,854 square feet, drains landscaping. DMA M2a drains to IMP M2.

DMA M2b, totaling 5,701 square feet, drains concrete walkway. DMA M2b drains to IMP M2.

DMA M2c, totaling 928 square feet, drains half of the black bear holding roof. DMA M2c drains to IMP M2.

DMA M2d, totaling 1,437 square feet, drains concrete walkway. DMA M2d drains to IMP M2.

DMA M3a, totaling 1,315 square feet, drains concrete walkway. DMA M3a drains to IMP M3.

DMA M3b, totaling 1,717 square feet, drains the roof of the mountain lion holding. DMA M3b drains to IMP M3.

DMA M4a, totaling 4,022 square feet, drains native hillside in the grizzly exhibit. DMA M4a drains to IMP M4.

DMA M4b, totaling 1,213 square feet, drains a green roof on a grizzly viewing shelter. DMA M4b drains to IMP M4.

DMA M4c, totaling 656 square feet, drains concrete walkway. DMA M4c drains to IMP M4.

DMA M5a, totaling 8,849 square feet, drains native hillside in the grizzly exhibit. DMA M5a drains to IMP M5.

DMA M5b, totaling 2,469 square feet, drains concrete walkway. DMA M5b drains to IMP M5.

DMA M5c, totaling 3,704 square feet, drains landscaping. DMA M5c drains to IMP M5.

DMA M5d, totaling 760 square feet, drains the roof of the restrooms. DMA M5d drains to IMP M5.

DMA M5e, totaling 1,693 square feet, drains the LSS enclosure roof. DMA M5e drains to IMP M5.

DMA M5f, totaling 3,205 square feet, drains AC pavement. DMA M5f drains to IMP M5.

DMA M5g, totaling 420 square feet, drains a maintenance shed roof. DMA M5g drains to IMP M5.

DMA , totaling square feet, drains . DMA drains to [Self-Retaining DMA name or IMP

DMA L1, totaling 5,106 square feet, drains a portion of the AC pavement service road. DMA L1 drains to IMP L1.

DMA L2a, totaling 1,658 square feet, drains the jaguar holding roof. DMA L2a drains to IMP L2.

DMA L2b, totaling 3,718 square feet, drains the grizzly holding roof. DMA L2b drains to IMP L2.

DMA L2c, totaling 593 square feet, drains the condor holding roof. DMA L2c drains to IMP L2.

DMA L2d, totaling 1,395 square feet, drains the condor/jaguar viewing roof. DMA L2d drains to IMP L2.

DMA L2e, totaling 2,000 square feet, drains the wolf holding roof. DMA L2e drains to IMP L2.

DMA L3, totaling 3,203 square feet, drains an AC pavement driveway to the wolf holding. DMA L3 drains to IMP L3.

DMA L4, totaling 2,246 square feet, is porous AC and drains a portion of the service road. DMA L4 is Self-Retaining.

DMA L5, totaling 2,042 square feet, is porous AC and drains a portion of the service road. DMA L5 is Self-Retaining.

DMA L6, totaling 4,817 square feet, is porous AC and drains a portion of the service road. DMA L6 is Self-Retaining.

DMA K1a, totaling 9,446 square feet, drains a portion of the AC pavement service road. DMA K1a has gaps in the gutter pan so the water will drain underneath the road and fill up the 30" section and therefore is Self-Retaining. See detail 3, Figure 4.

DMA K1b, totaling 2,642 square feet, drains concrete walkway. DMA K1b drains to Self-Retaining DMA K1a. K1a is sized accordingly.

DMA K1c, totaling 423 square feet, drains a grizzly viewing shelter. DMA K1c drains to Self-Retaining DMA K1a. K1a is sized accordingly.

DMA K2, totaling 5,638 square feet, is porous AC and drains a portion of the service road. DMA K2 is Self-Retaining.

DMA K3a, totaling 11,619 square feet, drains the interpretive center roof. DMA K3a drains to IMP K3.

DMA K3b, totaling 3,021 square feet, drains the interpretive center roof. DMA K3b drains to IMP K3.

DMA K3c, totaling 428 square feet, drains the eagle holding roof. DMA K3c drains to IMP K3.

DMA R1, totaling 13,500 square feet, drains a portion of the AC Pavement maintenance access road. DMA R1 drains to IMP R1.

DMA R2, totaling 6,391 square feet, drains a portion of the AC Pavement maintenance access road. DMA R2 drains to IMP R2.

V. STORMWATER FACILITY MAINTENANCE

V.A. Ownership and Responsibility for Maintenance in Perpetuity

See draft Inspection and Maintenance plan.

VI. CERTIFICATIONS

The selection, sizing, and preliminary design of stormwater treatment and other control measures in this plan meet the requirements of the MRP.

Ranelletti, Darin

From: Ranelletti, Darin
Sent: Thursday, November 08, 2012 2:11 PM
To: 'Ethan Ahlberg'
Subject: RE: ZCA - Response Package

Dear Mr. Ahlberg:

The City has reviewed the package and approves your request to submit the information to the Army Corps of Engineers.

Regards,

Darin Ranelletti

Darin Ranelletti, Planner III
City of Oakland, Planning and Zoning Division
250 Frank H. Ogawa Plaza, Suite 3315
Oakland, California 94612
510-238-3663 direct phone
510-238-6538 fax

From: Ethan Ahlberg [mailto:ethan.ahlberg@NollandTam.com]
Sent: Wednesday, November 07, 2012 5:14 PM
To: Ranelletti, Darin
Subject: ZCA - Response Package

Dear Mr. Ranelletti,

Please find the link to the package of drawings and memo's we've prepared for the US Army Corps of Engineers. Can you review this material and confirm the City approves the package? Thank you and please call with any questions.

Kind regards,

Ethan Ahlberg
Architect

Noll & Tam Architects
Committed to the 2030 Challenge

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From: Ethan Ahlberg [mailto:delivery@yousendit.com]
Sent: Wednesday, November 07, 2012 5:06 PM
To: Ethan Ahlberg
Subject: ZCA - Response Package