VIII. STORMWATER SYSTEM

A. Topography and Precipitation

The existing elevations at Alameda Point are generally quite low. The highest existing elevations, just over 8 feet are located in the southeast portion of the site. The lowest elevations are less than 1 foot and are generally found in the northern portions of the site. These relatively low elevations have important implications in the design of stormwater and flood control infrastructure as discussed below.

Precipitation patterns along the central California coast are strongly influenced by a number of factors, with a marked tendency to greater rainfall intensities and associated high mean annual precipitation values in locations with higher elevations that are exposed to incoming storms, with the opposite effect in areas of low elevation. The low elevations at Alameda Point result in a mean annual precipitation of approximately 18 inches/year, which is much less than in the neighboring City of Oakland where rainfall totals are impacted by the East Bay Hills. In fact, isohyetal mapping by the Alameda County Flood Control and Water Conservation District shows that storm intensity and magnitude at Alameda Point can be expected to be among the lowest in the County, the only lower totals being found in the southern bayside areas that lie in the lee of the highest mountains of the San Francisco Peninsula.

Design storm information provided in the Storm Drain Master Plan (SDMP) for the City is based on a mean annual precipitation of 19 inches/year, slightly higher than that expected at Alameda Point. However, preliminary stormwater infrastructure design for Alameda Point uses the information from the SDMP for consistency, noting that the result will tend to be slightly conservative. On this basis, the design precipitation for the 10-, 25-, and 100-year 24-hour duration storm events are 3.2, 3.8 and 4.7 inches respectively.

B. Impervious and Development Areas

The eastern portions of the Project Site were densely developed, with the most intensely used areas located around the Seaplane Lagoon. Overall impervious cover is very high at approximately 83%, with large blocks of land having nearly 100% impervious coverage. Therefore, overall impervious coverage at the site is expected to decrease with redevelopment.

With respect to stormwater management planning at the site, it is important to distinguish between Development and Reuse Areas. In Development Areas, existing structures and facilities will be completely replaced. This allows ground elevations to be elevated during the redevelopment process. The greater difference in elevation between the ground surface in these areas and tailwater elevations in the Bay gives greater flexibility in stormwater system design and buffers the impact of potential sea level rise on such systems. This contrasts with the Reuse Areas, where constraints such as historical preservation, preclude completely replacing existing structures and modifying the existing street pattern and elevations. Therefore, Reuse Areas will generally be constrained to the existing elevations which in some areas are low, imposing immediate design considerations with respect to meeting prevailing storm drain standards and adaptively responding to sea level rise.

C. Soil Characteristics and Groundwater

The soils at the site are characterized by a shallow depth to groundwater, consistent with the low existing ground elevations. These high groundwater elevations significantly restrict the use of infiltration of stormwater into the ground as a stormwater management option at Alameda Point.

D. Tidal Characteristics

As pointed out previously, tidal characteristics are an important consideration at Alameda Point. The very highest tide levels associated with storm surge events can be high enough to cause localized flooding of the lowest-lying portions of the site under existing conditions. Additionally, all storm drain systems have to discharge to the Estuary or Bay against the tide elevations that prevail during any given storm event. This is generally not a problem for low tide conditions, but can be a significant factor limiting the conveyance capacity of existing and proposed storm drain lines during high tides.

Alameda Point experiences a diurnal tidal cycle that is typical of coastal California with two high and two low tide periods occurring each day. Important tidal datum information is included in Table 8 below, which shows the range between mean lower low water and mean higher high water is 6.6 feet. Several of the datum values are of direct relevance in stormwater infrastructure design. Most importantly, mean higher high water elevations are only slightly below the lowest ground elevations at the site. Therefore, localized flooding is a potential issue along much of the northern perimeter of the site whenever any significant rainfall coincides with the higher high tide peak, even without consideration of storm surge effects.

Higher tide elevations are also of concern. For example, the SDMP presents a thorough derivation of high tide values to be used in storm drain system design to account for the joint probability of very large storm events coinciding with storm surge events in the vicinity of Alameda. The calculated 25-year coincident peak tide elevation for this case is 1.7 feet, which is well above the lower lying elevations at the site. Likewise, the 100-year stillwater tide elevation is 3.6 feet, an elevation high enough to put portions of the site in a FEMA designated Special Flood Hazard Area (100-year floodplain).

Low tide elevations can also be important with respect to storm drain design. For example, constructing storm drain outfalls above the lowest tide elevations allows for easier routine maintenance inspections. For Alameda Point this would mean having outfall structure pipe inverts no lower than -5 feet, and preferably even higher.

Table 8 - Tidal Datum Elevations for Alameda Point

Tidal Datum	City of Alameda Datum
Mean Higher High Water	0.3
Mean High Water	-0.4
Mean Tide Level	-2.8
Mean Low Water	-5.2
Mean Lower Low Water	-6.3
Highest Observed Tide	3.3
100-Year Tide	3.6
25-Year Coincident Peak Tide	1.7

E. Existing Stormwater Management System

Stormwater runoff at Alameda Point is currently conveyed directly to outfalls by a storm drain system. The portions of the storm drain system within land owned by the City of Alameda are also owned and maintained by the City of Alameda. Whereas, the remainder of the existing storm drain system within land still owned by the Navy is owned by the Navy. The existing stormwater system was installed by the Navy starting over 70 years ago.

The system is currently operable, but does not meet current standards in several regards. These include notable capacity limitations and the fact that there is no stormwater quality infrastructure in place at present.

The majority of the existing system within Alameda Point is a gravity system that consists of pipelines, ranging in size up to 48-inches in diameter, inlets, junction boxes / manholes and outfalls to surrounding waters. See Figure 37 depicting the existing stormwater collection system and outfalls within Alameda Point. There are over 30 existing outfalls discharging stormwater runoff from the Project Site to the surrounding waters of the Seaplane Lagoon, Oakland / Alameda Estuary, and San Francisco Bay. Much of the existing infrastructure has deteriorated and has components that are in a state of disrepair. Many of the existing outfalls have missing or non-functioning flap gates allowing the tidal influences of the surrounding waters to impact the on-site system, causing flooding of low-lying areas as previously discussed. The existing low-lying areas that flood due to extreme high tides and/or storm events coinciding with high tides include areas along the northern shoreline and Main Gate, north and west edges of the Seaplane Lagoon and the Main Street / Ferry Terminal Parking Lot Entrance intersection. In fact, the exception to gravity drainage at the site is an existing stormwater pump station that was installed approximately 15 years ago to address flooding of the low lying portions of Main Street. This pump station is located at the northeast corner of the Project Site.

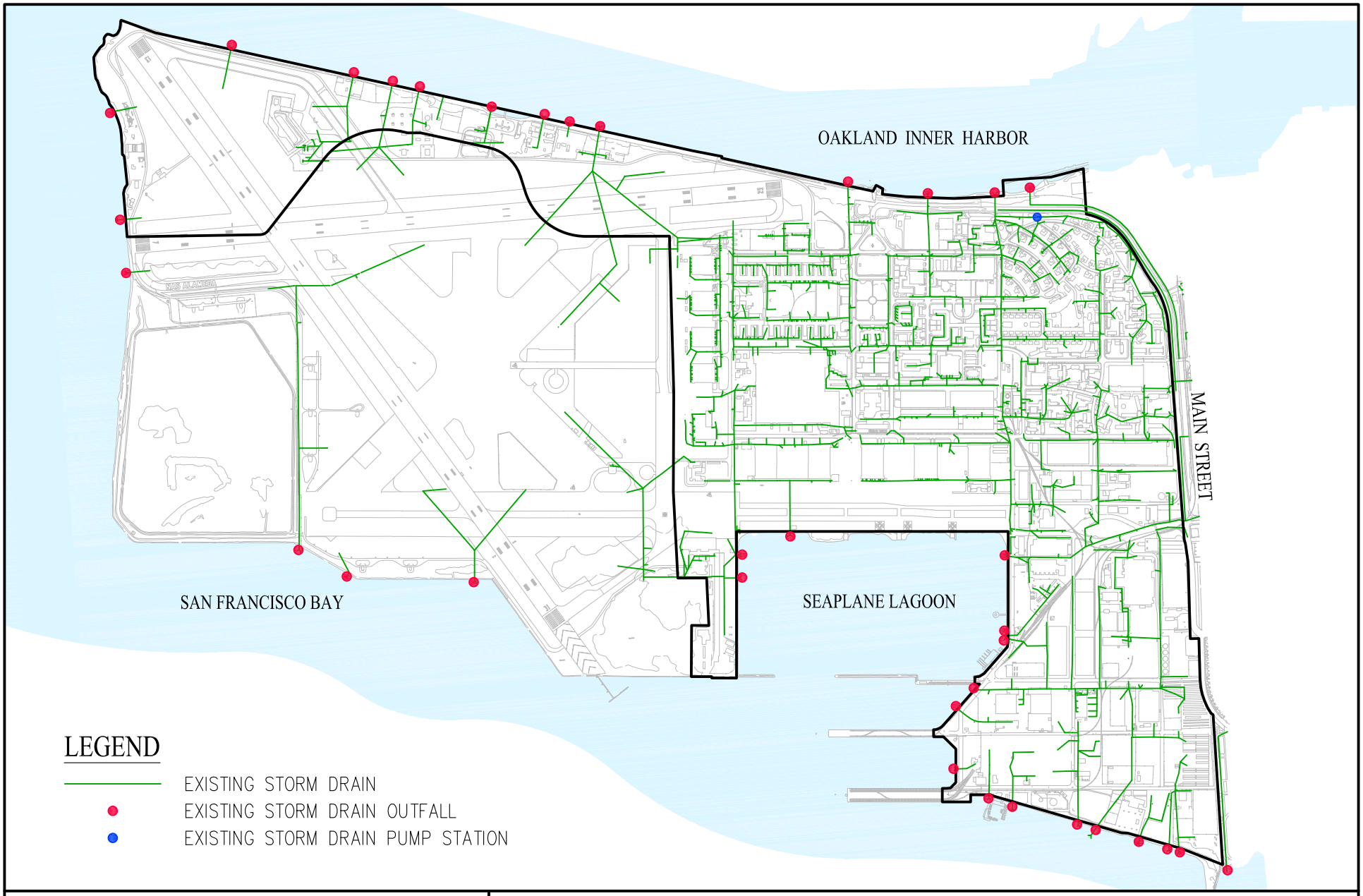
The existing drainage patterns of the Project Site are consistent with the existing topography. See Figure 38 depicting the existing drainage pattern and associated existing watersheds within Alameda Point. Stormwater runoff from the northern half of the Project Site, generally north of West Midway Avenue, is collected and conveyed by the existing system and discharged to the Oakland / Alameda Estuary through multiple outfalls along the northern shoreline. Stormwater runoff from the southeastern portion of the site is collected and conveyed by the existing system and discharged to San Francisco Bay through multiple outfalls along the southern shoreline. Stormwater runoff from the central portions of the Project Site is collected and conveyed to the Seaplane Lagoon through multiple outfalls along the Lagoon shoreline.

The watersheds for the existing stormwater system are almost exclusively limited to areas within the Project Site. However, there is one notable exception. Off-site runoff from a small watershed located along Main Street immediately to the north of Ralph Appezzato Memorial Parkway is collected and conveyed to the southwest where it outfalls the Seaplane Lagoon.

F. Proposed Stormwater Management System

A new stormwater collection system, owned and operated by the City of Alameda, will be installed at Alameda Point. The proposed system will integrate new pipelines, pump stations, multi-purpose basins, and outfalls with water quality treatment features designed to meet current City of Alameda, County of Alameda, and Regional Water Quality Control Board design criteria. The new stormwater management system will also be designed to address the potential impacts of future sea level rise through forward planning of adaptation strategies and infrastructure.

The proposed stormwater collection system will maintain the existing drainage patterns of the Project Site. Additionally, the proposed system will significantly reduce the number of outfalls to the surrounding waters in order to facilitate and minimize future maintenance obligations of the City of Alameda. Preliminary system design calls for a total of five outfalls, down markedly from over 30 outfalls at present. The proposed outfalls will be constructed at existing outfall locations to minimize potential environmental impacts associated with installation and operation of these facilities. Where used, stormwater pump stations will include redundant pump systems, alarms, and emergency backup power supplies to reduce the risk of flooding by ensuring high levels of reliability.



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CITY OF ALAMEDA ALAMEDA COUNTY CALIFORNIA
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FIGURE 37
EXISTING STORM DRAIN & OUTFALLS

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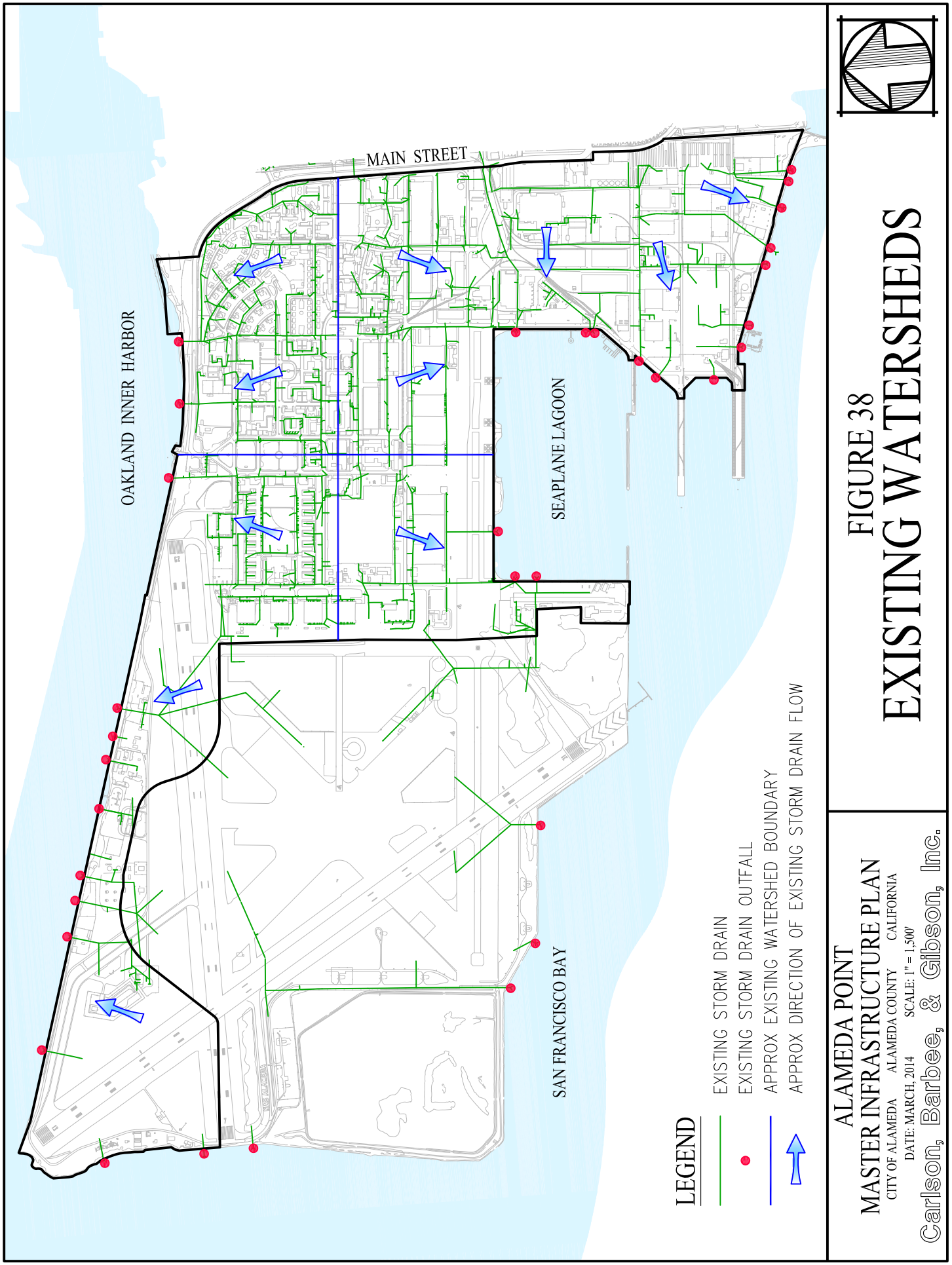
MAIN STREET
OAKLAND INNER HARBOR
SEAPLANE LAGOON
SAN FRANCISCO BAY
LEGEND
EXISTING STORM DRAIN
EXISTING STORM DRAIN OUTFALL
APPROX EXISTING WATERSHED BOUNDARY
APPROX DIRECTION OF EXISTING STORM DRAIN FLOW
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CITY OF ALAMEDA ALAMEDA COUNTY CALIFORNIA
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FIGURE 38
EXISTING WATERSHEDS
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The new stormwater system will be built within all Development Areas. In the Reuse Areas, the existing system will initially remain in service with rehabilitation improvements such as repair or reinstallation of tide gates at existing outfalls. Eventually, as soon as there are available funds from development projects within the Reuse Areas, the existing system will be incrementally replaced. The installation of the downstream components, including trunk stormwater lines, multi-purpose basins, pump stations, and outfalls, will be prioritized. Ultimately, new stormwater management infrastructure will be incrementally installed over time throughout the Reuse Areas as well.

1. Development Areas

As discussed previously, large-scale areas of new construction are anticipated in the Development Areas. This will allow high existing ground elevations to be maintained, and even increased somewhat, and for early construction of an entirely new stormwater management system. The proposed system will include gravity storm drain pipes ranging in size from 12 to 60 inches in diameter and new outfall structures. These facilities will be installed within all backbone streets in the Development Areas. See Figure 39 depicting the proposed on-site stormwater collection system schematic within the Development Areas.

The installation of updated infrastructure, along with the higher ground surface elevations in the Development Areas, will allow for collection and conveyance of the 25-year design storm event consistent with City standards. Storm drain lines will drain by gravity to the respective outfall locations, which will be equipped with flap gates and energy dissipation to control discharge to the receiving waters. Storm drain pipes will be designed to accommodate settlement at locations where long-term differential settlement is considered possible.

Development Areas may also require future pump stations and/or multi-use stormwater basins as an adaptive response measure to future sea level rise . The pump station and multi-use basin sizes are inversely related, meaning that with a larger pump station the multi-purpose basin could be smaller or with a larger multi-purpose basin the pump station could be smaller. Additionally, the locations of the multi-purpose basins and pump stations depicted in the MIP are flexible and can be adjusted as the land use and open space plans for these areas are advanced.

2. Reuse Areas

The Reuse Areas, with their constraints on building and street replacement, will require a stormwater management system that can function effectively with many areas of low ground elevation. These low elevations will require stormwater pump stations to meet City design standards. See Figure 40 depicting the ultimate stormwater collection system schematic within the Reuse Areas.

The Reuse Areas will initially continue to utilize the existing on-site stormwater collection system .The existing stormwater management system will be progressively improved through an enhanced maintenance program. The enhanced maintenance program will rehabilitate the existing system in a step-wise manner to address deficiencies. Specifically, the enhanced maintenance program will prioritize the installation of new tide valves on the existing outfalls. Additionally, each proposed development within the Reuse Areas will be responsible for investigating and documenting the condition of the existing stormwater infrastructure within that specific site. Any deficiencies identified will be addressed at that time and funded by that development project, to the satisfaction of the Public Works Director. Anticipated enhanced maintenance improvements include cleaning and lining of existing pipelines and manholes as well as required replacement of existing pipelines to address adverse flow conditions in areas that have settled. Additionally, each development project within the Reuse Areas will replace the stormwater facilities

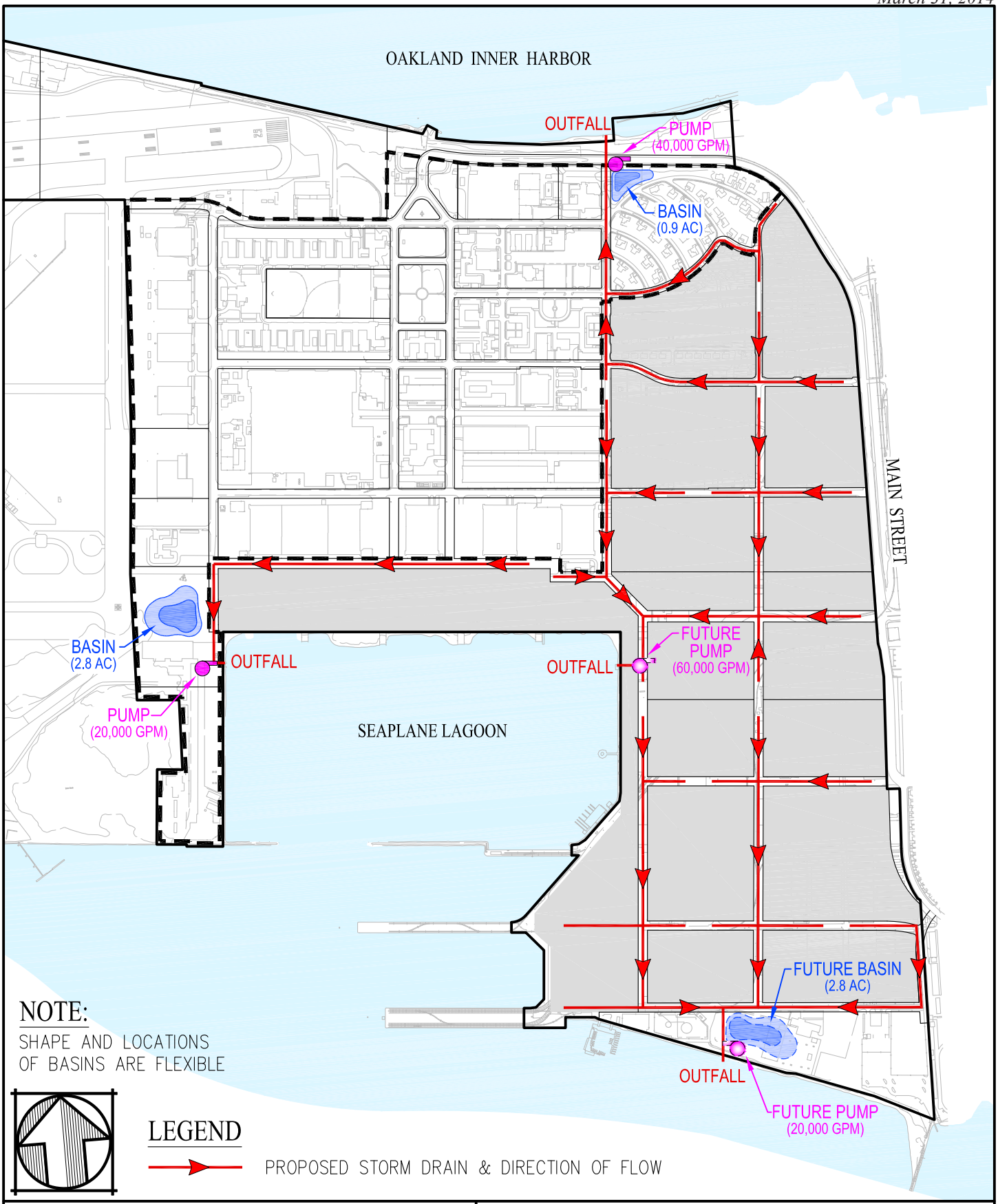

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FIGURE 39
PROPOSED STORM DRAIN IN DEVELOPMENT AREAS

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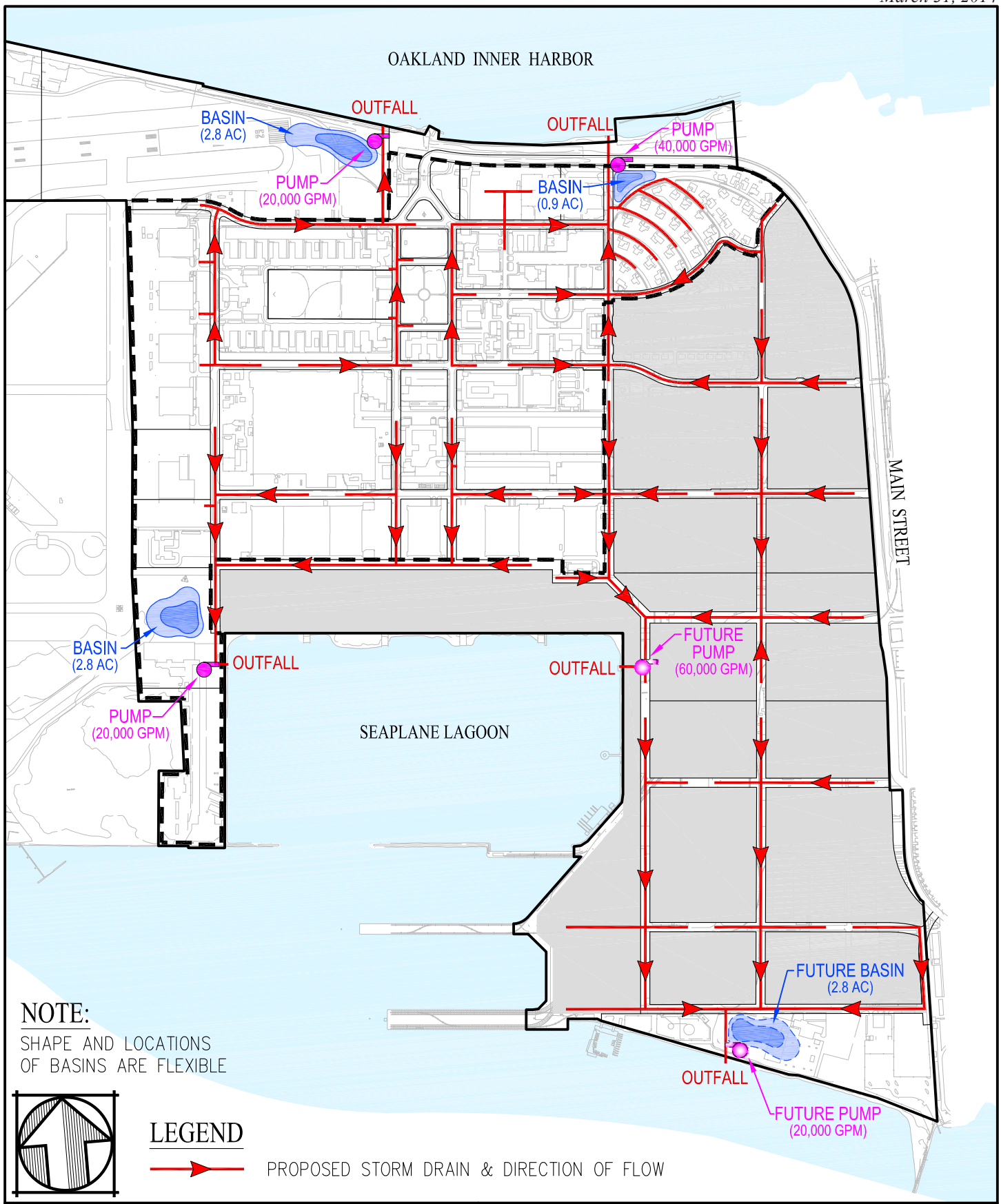

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FIGURE 40
PROPOSED STORM DRAIN
ULTIMATE SYSTEM

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and construct water quality facilities inside each respective parcel. Until the existing system is replaced, existing low lying structures within the Reuse Areas may be required to obtain flood insurance if the existing structure is below the 100-year flood elevation. Any new construction of structures within the Reuse Areas during this interim period shall be required to be constructed 1-foot above the 100-year flood elevation.

As funds become available through a fee program, the existing backbone stormwater systems will be replaced. The installation of the new stormwater system within the Reuse Areas will be incremental. The City of Alameda will coordinate these incremental improvements to ensure they are implemented orderly. The downstream improvements, including multi-purpose basins, pump stations and outfalls shall be prioritized, in order to provide flood protection for the Reuse Areas that can address climate change. The remainder of the backbone system shall be installed from the downstream portions to the upstream portions of the system and connect to the adjacent on-site systems. See Figure 41 depicting the existing on-site stormwater collection system schematic within the Reuse Areas to initially to be installed.

Ultimately, the enhanced maintenance program will lead to replacement of the entire stormwater management system and the construction of the flood protection facilities, including perimeter levees and floodwalls, new outfalls, multi-purpose basins and pump stations, within the Reuse Areas. The ultimate stormwater system will provide a system that full complies with the City's 25-year stormwater design criteria as discussed below.

3. Proposed Stormwater System Design Criteria

The design criteria used for the proposed stormwater system is consistent with the criteria specified in the City of Alameda's Standard Specifications and Design Criteria, dated April 1961, and the Storm Drain Master Plan (SDMP), dated August 2008. Specifically, Chapter 4 of the SDMP includes the design criteria for new stormwater systems within the City of Alameda. The following is a summary of the design criteria for the proposed stormwater collection system within Alameda Point:

Design Storm Event =	25-year design storm based on the balanced storm hydrograph developed in the SDMP
Beginning Water Surface Elevation =	25-year coincident tide based on the SDMP
Freeboard =	Hydraulic grade line within the system shall be no higher than 0.5-foot above the gutter elevation at any manhole or inlet
Minimum Cover to Pipelines =	Minimum cover to pipelines of 2 feet with approved pipeline materials

Additional design criteria will be followed to assure that the stormwater management system provides interior drainage protection for the 100-year storm event (in concert with exterior levees and floodwalls) consistent with FEMA requirements. This will include analyses and modeling demonstrating that runoff from the 100-year event (including longer durations than 24-hours) can be contained and conveyed to the Bay without flooding of structures. A detailed Operations and Maintenance Plan will need to be prepared as part of the design of any downstream facilities, such as outfalls, multi-purpose basins or pump stations. This plan will describe the interior drainage system with details regarding the associated infrastructure,

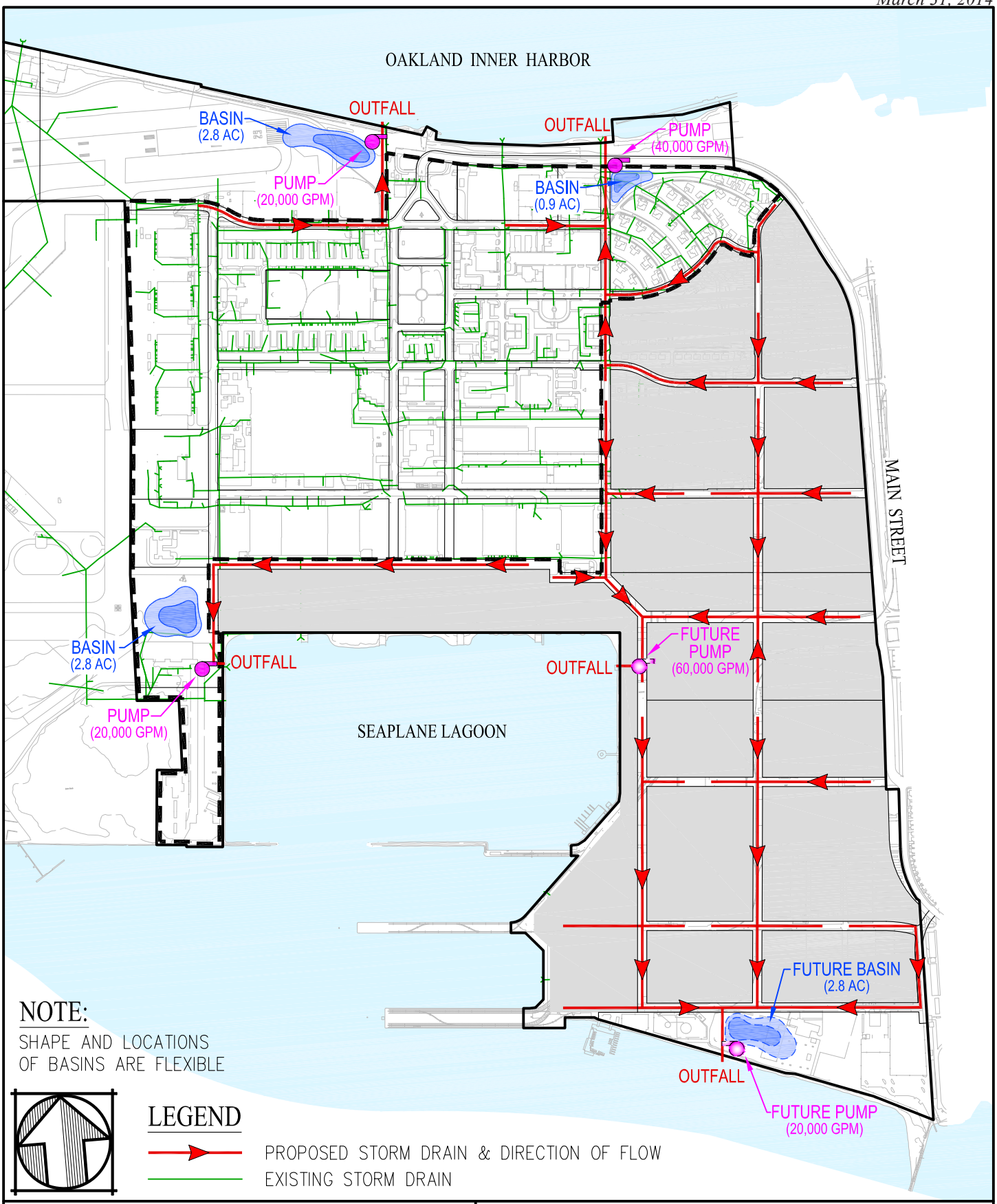

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FIGURE 41
PROPOSED STORM DRAIN
REUSE AREAS INITIAL CONSTRUCTION

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maintenance plans and schedules, back-up facilities, and emergency protocols. Design to these criteria will remove the Alameda Point site from the Special Flood Hazard Area (100-year floodplain) in future FEMA flood hazard mapping efforts.

4. Adaptation to Sea Level Rise

As presented earlier in Section IV, adaptation strategies for potential sea level rise will be an integral part of stormwater management planning at Alameda Point. Consistent with other infrastructure improvements at the Project Site, the following governing criteria will apply:

Flood Protection Measures =	24-inches of sea level rise shall be added to the beginning water surface elevation
Adaptive Measures =	Shall be capable of accommodating up to 55-inches of future sea level rise

Several aspects of the planning process are important to note with respect to stormwater infrastructure design and sea level rise. First and foremost among these is the understanding that, with significant enough increases in sea level, safely and effectively discharging stormwater to the Bay will require some combination of on-site detention storage and pump capacity. Storage and pump capacity are complimentary infrastructural components. That is to say, larger on-site detention storage capacity reduces the required pumping needs and vice versa. In fact, with sufficiently large storage capacity (e.g. equal or nearly equal to the total design storm runoff), stormwater pumping would not be required at all. Conversely, where space and land use constraints prevail, large detention storage facilities may not be practical and increased pump capacity will be required.

The second aspect of note has previously been discussed; the relationship of ground elevations and tidal tailwater elevations. Where ground elevations are high enough, conventional gravity storm drain systems can be designed to meet City conveyance criteria. However, as the difference between ground and coincident tide elevations decreases, the aforementioned need for storage/pumping becomes increasingly necessary if City criteria are to be met. The direct implication for Alameda Point is that sea level rise criteria (24-inches above current levels) will require storage/pumping facilities for the lower-lying Reuse Areas.

Finally, it is important to understand that adaptive management with respect to stormwater conveyance is not unbounded. Progressively more storage/pump capacity will be required for all the project watersheds as sea levels rise. However, once sufficient storage and/or pump capacity is in place to handle the entire runoff from the design storm without gravity outflow, tide levels in the Bay no longer matter significantly and further increases in sea level (even above the maximum adaptive criteria) can be readily addressed.

5. Preliminary Stormwater Modeling

In order to better define stormwater infrastructure needs as part of the MIP, preliminary stormwater modeling was completed for representative portions of the Project Site. The modeling was carried out using the MIKE-URBAN software package (DHI, Inc.), the same modeling platform that was used to develop the City's SDMP. Watershed parameterization and analysis explicitly followed the guidelines in the SDMP, including non-steady state routing of the balanced 25-year, 24-hour design storm against the variable 25-year coincident tidal tailwater conditions. This approach assures that stormwater infrastructure design at Alameda Point is consistent in all respects with that being applied elsewhere in the City.

The preliminary modeling focused on Watersheds B and E (see detailed discussions below) to bracket the range of anticipated constraints. See Figure 44 depicting the locations of Watersheds B and E. Watershed B is a prototypical Reuse Area watershed characterized by the lowest ground elevations within the Project Site, while Watershed E is representative of a Development Area watershed with markedly higher ground elevations. Model runs were carried out for a range of sea level rise conditions ranging from current levels and incrementing by 1 foot up to the higher adaptive management criterion of 55-inches above existing conditions. The model runs confirmed that the Reuse Areas such as Watershed B will need storage and pumping infrastructure to meet even the criteria. The addition of incremental sea level rise model runs provided an adaptive response infrastructure matrix, Table 9 that defines the various storage and pumping capacities associated with increasing sea level rise and identifies thresholds at which storage/pumping would be necessary for higher elevation areas such as Watershed E. The values presented in Table 9 are the total storage volume in acre-feet for the multi-purpose basins correlated to the pump capacity and varying amounts of sea level rise.

Table 9 - Preliminary Multi-Purpose Basin & Pump Sizes with Adaptive Measures

SLR (ft. above 2012)		Pump Capacity (GPM)						
Watersheds A-C	**Watersheds D & E**	**None**	**10,000**	**20,000**	**30,000**	**40,000**	**50,000**	**60,000**
0.0	3.0	0.7	0.3	0.2	0.1	No Basin	No Basin	No Basin
1.0	4.0	3.5	2.2	1.2	0.3	0.3	No Basin	No Basin
2.0	5.0	7.5	4.5	2.8	1.3	0.9	No Basin	No Basin
3.0		8.3	4.5	2.8	1.3	1.0	No Basin	No Basin
4.6		10.6	4.5	2.8	1.3	1.0	No Basin	No Basin

6. Proposed Multi-Purpose Basins and Pump Stations

The preliminary modeling efforts confirmed that multi-purpose stormwater basins and pump stations will be integral components necessary to ensure the reliability of the system and achieve the specified design criteria, effectively minimizing the risk of flooding within the Project Site.

The multi-purpose basins are only proposed for watersheds that include parks / open spaces uses near the downstream portion of the system. Basins will function in an “off-line” manner to enhance their multi-use functionality. Stormwater runoff will be routed to a vault structures at the downstream ends of the storm drain systems. Each vault structure will function as the wet well for the stormwater pumps in that system and will have an overflow weir connecting to the multi-purpose basin. The vault structures will be connected to the outfalls by both gravity lines and a force main from the pumps. This will allow discharge by gravity flow when storm events coincide with lower tide conditions. In this configuration, stormwater runoff will only enter the basins via the overflow weir when inflow to the vault exceeds the combined gravity and pumped discharge capacity. The off-line configuration will markedly reduce the frequency and quantity of runoff directed to each basin.

The basins will be designed to have two tiers, allowing for public use of the upper tier, potentially including active recreation facilities such as sports fields. The lower tier will be occupy roughly one quarter of the basin area and will be subject to more frequent inundation than the upper tier area, the latter can be managed such that it is flooded in only the largest storm events. Preliminary design calls for the floor elevation of the lower tier in each basin to generally be set 5 feet below the adjacent grade. The upper tier will encompass the remaining 75% of the basin area and will generally be only 3 feet deep in comparison to adjacent grade elevations outside the basin. See Figure 42 depicting a schematic of the two-tier multi-

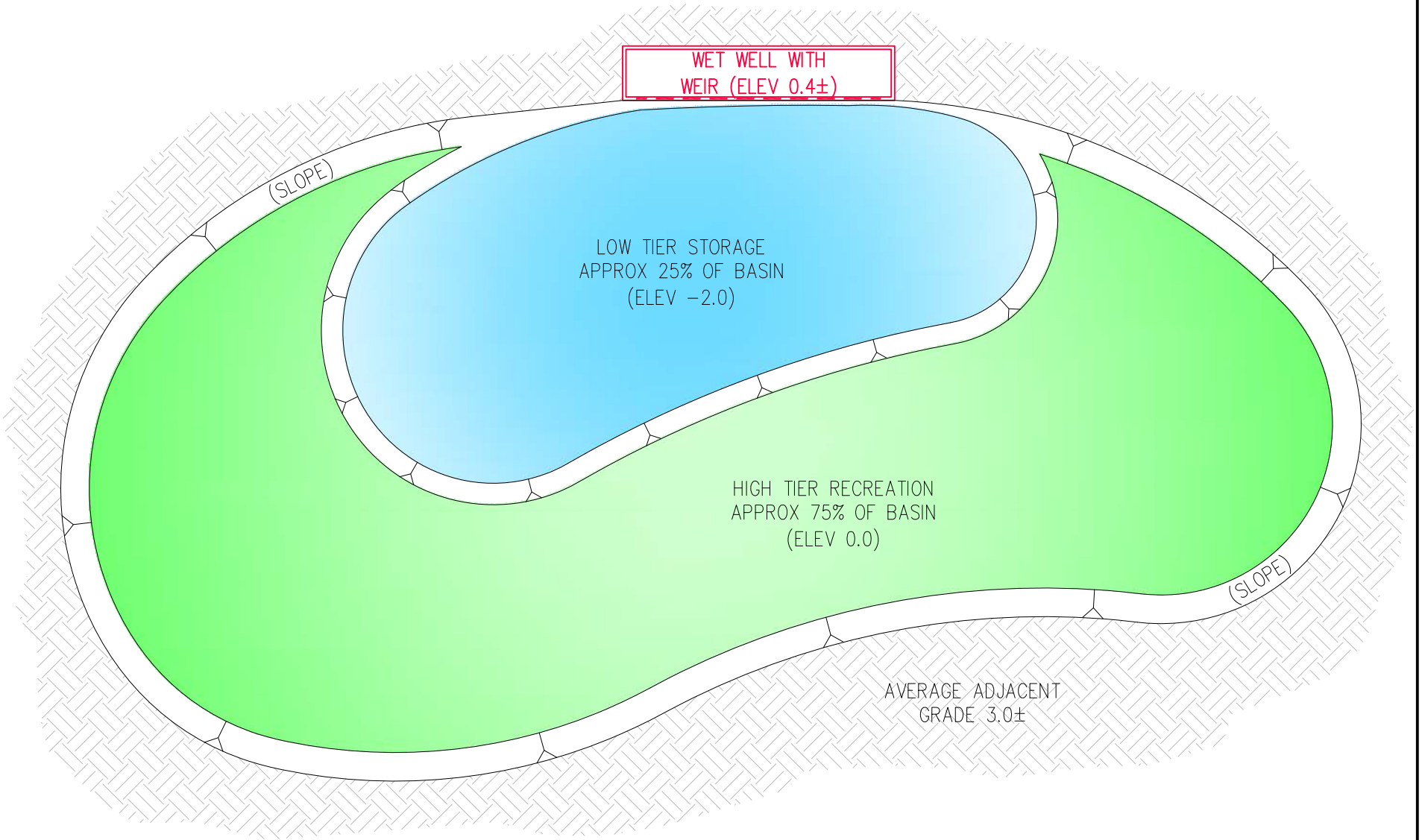

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FIGURE 42
CONCEPTUAL TWO-TIER MULTI-PURPOSE BASIN

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purpose basin. There will need to be appropriate signage and management of these areas to prohibit public uses during times of anticipated large storm events. Each basin will be drained (by gravity flow and/or pumping via the vault structures) within 24-hours of each storm event, limiting the periods of inundation to only a couple of days even if back to back storms occur. The multi-purpose basins are intended to be landscaped and under-drained to create a usable amenity for the community. The following design criteria will also be applied to the multi-purpose basins:

Maximum Side Slopes =	4:1
Freeboard =	1-foot to the 100-year water surface elevation

As mentioned previously, the vault structures will serve as the wet wells for required stormwater pumps. In areas where there is insufficient space available for a multi-purpose basin, the vaults and pumps will be sized to handle the peak design storm flow, necessitating much larger pumps. Future pump capacity needs are included in the sea level adaptation matrix. The southeast portion of the Development Areas (Watersheds D and E) will be at high enough elevations that they will only require a pump station and multi-purpose basin if sea levels rises more than approximately 3-feet. These facilities are to be planned as future improvements and will be implemented as part of the adaptive management of the site to address more than 24-inches of sea level rise.

7. Proposed Outfall Structures

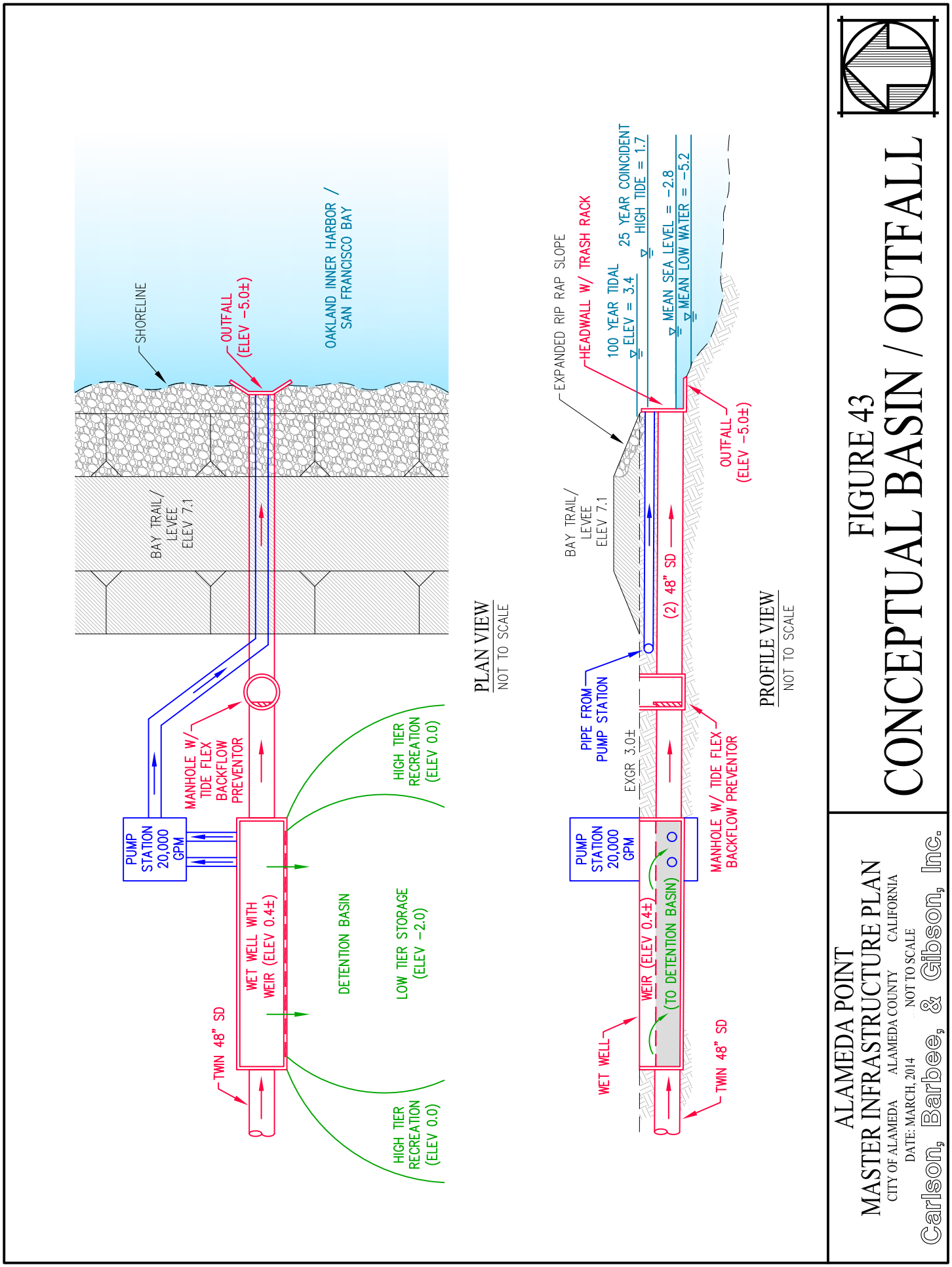
The proposed outfall structures are to be located near existing stormwater outfalls. The outfalls will include provisions for both gravity pipes and the pump station force main pipe to discharge to the receiving waters. The proposed gravity pipeline outfall will be set at an elevation above the current mean low water, -5.0 feet, allowing for the conveyance pipelines to gravity drain at low tides and to facilitate inspection and maintenance activities. The force main pipe outfall will be set above the gravity pipeline at an elevation providing minimum or greater cover over the pipe. Outfall structures will be constructed on the shoreline and include rock slope protection designed to maintain a stable configuration. Interior to the outfall structures will be separate manholes with a backflow prevention tide valves and gate valves. This configuration will protect the tide valves from wave action, allow the manholes to be closed off from the Bay to facilitate maintenance of the tide valves, and prevent high tides from encroaching into the collection systems multi-purpose basins. See Figure 43 depicting the conceptual configuration of the proposed outfall structures.

8. Summary of Proposed Stormwater Systems per Watershed

As discussed previously, the proposed stormwater management strategy will maintain the existing drainage patterns of the Project Site. The overall proposed system will have 6 separate watersheds to encompassing the site. Some watersheds include only Development or Reuse Areas, while others include portions of both. See Figure 44 depicting the proposed watersheds established by the proposed stormwater system. The following is a description of the proposed stormwater management system anticipated for each watershed.

a. Watershed A

Watershed A encompasses the areas immediately to the north and west of the Seaplane Lagoon. This watershed includes approximately 148 acres and will discharge stormwater runoff through a newly refurbished outfall structure near the northwest corner of the Lagoon. The watershed


SHORELINE
OUTFALL (ELEV −5.0±)
OAKLAND INNER HARBOR / SAN FRANCISCO BAY
BAY TRAIL/ LEVEE ELEV 7.1
PUMP STATION 20,000 GPM
MANHOLE W/ TIDE FLEX BACKFLOW PREVENTOR
WET WELL WITH WEIR (ELEV 0.4±)
DETENTION BASIN
LOW TIER STORAGE (ELEV −2.0)
HIGH TIER RECREATION (ELEV 0.0)
HIGH TIER RECREATION (ELEV 0.0)
TWIN 48" SD
PLAN VIEW
NOT TO SCALE
EXPANDED RIP RAP SLOPE
HEADWALL W/ TRASH RACK
100 YEAR TIDAL ELEV = 3.4
25 YEAR COINCIDENT HIGH TIDE = 1.7
MEAN SEA LEVEL = −2.8
MEAN LOW WATER = −5.2
BAY TRAIL/ LEVEE ELEV 7.1
OUTFALL (ELEV −5.0±)
PIPE FROM PUMP STATION
EXGR 3.0±
(2) 48" SD
PUMP STATION 20,000 GPM
MANHOLE W/ TIDE FLEX BACKFLOW PREVENTOR
WET WELL
WEIR (ELEV 0.4±)
(TO DETENTION BASIN)
TWIN 48" SD
PROFILE VIEW
NOT TO SCALE
FIGURE 43
CONCEPTUAL BASIN / OUTFALL
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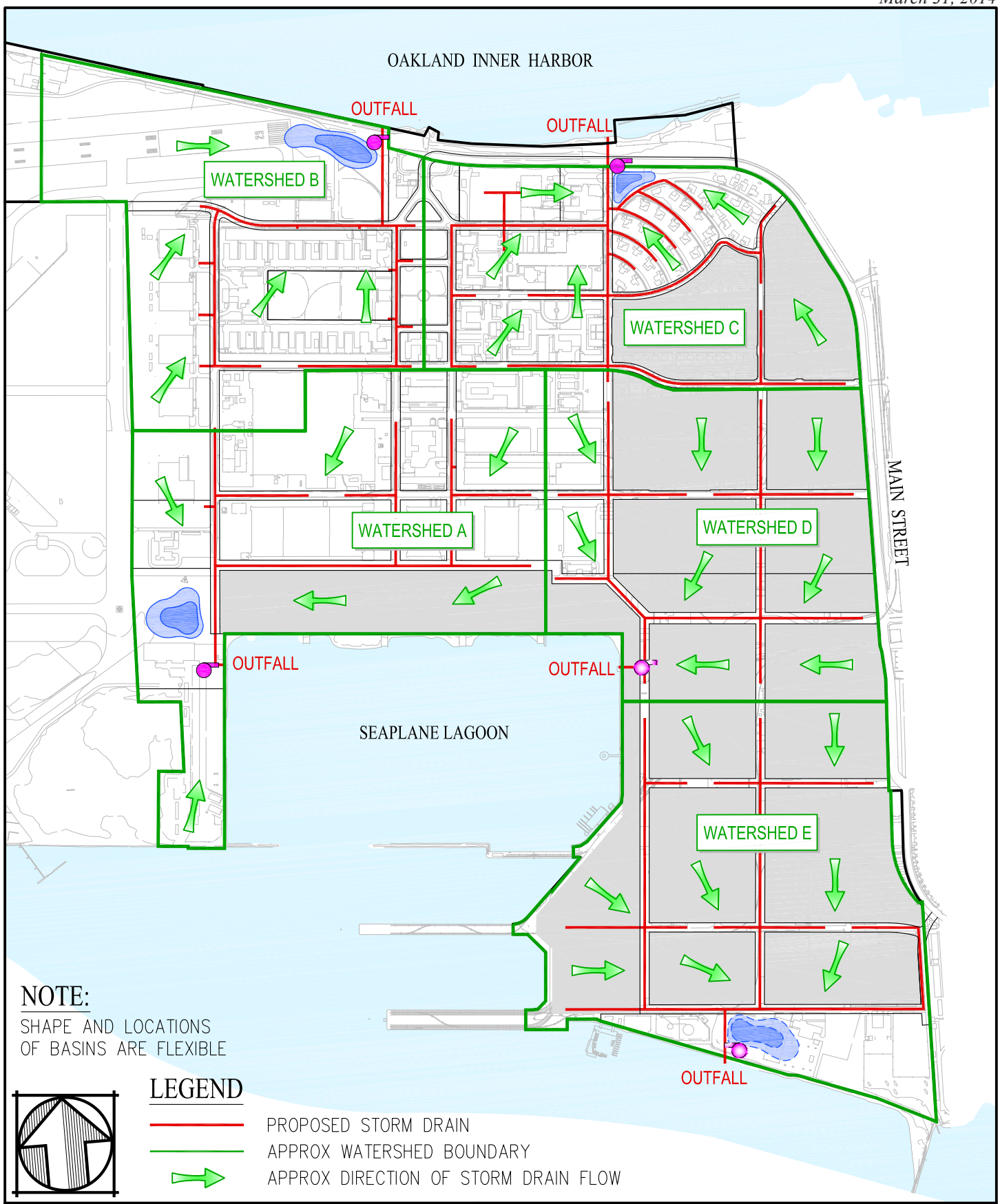

ALAMEDA POINT
MASTER INFRASTRUCTURE PLAN
CITY OF ALAMEDA ALAMEDA COUNTY CALIFORNIA
DATE: MARCH, 2014 SCALE: 1" = 1,000'
Carlson, Barbee, & Gibson, Inc.

FIGURE 44
PROPOSED STORM DRAIN WATERSHEDS

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includes portions of Development Areas along the frontage of the Seaplane Lagoon and Reuse Areas more interior to the Project Site, with the low-lying elevations of the Reuse Areas dictating the infrastructural components that will be needed. The ultimate stormwater system will include the installation of downstream facilities including main storm drain trunk lines, a multi-purpose basin, pump station, and the aforementioned outfall. The storm drain trunk lines will connect to the existing facilities in the Reuse Areas, as well as new storm drain lines within the Development Areas. The multi-purpose basin is proposed along the western edge of the Seaplane Lagoon and will cover an area of approximately 3 acres. The location and shape of this multi-purpose basin are flexible and should be determined in conjunction with the planning for the Seaplane Lagoon waterfront site. A pump station with the diversion vault structure will be installed at the multi-purpose basin and is anticipated to have a capacity of 20,000 gpm. An enhanced maintenance program will be implemented to rehabilitate the existing system within the Reuse Areas prior to the ultimate replacement and installation of the new stormwater collection system. The proposed stormwater system will include the installation of new storm drain lines in all backbone streets. This backbone system will include pipeline stubs to future Reuse parcels and connections to intercept existing on-site pipeline systems within Reuse parcels. Proposed construction within each Reuse parcel will be required to replace the existing stormwater facilities within that parcel, such that ultimately the entire existing system is replaced with a new system that meets current standards.

Providing 20,000 gpm of pumping capacity along with the 3-acre stormwater basin will allow the system to meet City standards and accommodate 55-inches of sea level rise and beyond. Watershed A will be levee protected from the flooding conditions described in the Flood Protection section and sufficient right-of-way will be maintained to increase levee height if sea level rise exceeds 24-inches.

b. Watershed B

Watershed B encompasses the northwestern quadrant of the Project Site. This watershed includes approximately 133 acres and the associated stormwater system will route runoff to a newly refurbished outfall on the Oakland / Alameda Estuary. The entire watershed area is comprised of Reuse Areas and includes the proposed Sports Complex site. As with Watershed A, the multi-purpose basin will have an area of approximately 3 acres and, in this case, is anticipated to be integrated into the Sports Complex site. The pump station is anticipated to have a capacity of 20,000 gpm. An enhanced maintenance program will be implemented to rehabilitate the existing system prior to the ultimate replacement and installation of the new stormwater collection system, which will be installed incrementally over time. The stormwater system will include the installation of downstream facilities including main storm drain trunk lines, a multi-purpose basin, pump station, and the aforementioned outfall, which is proposed for the northern shoreline of the Project Site, just west of the Main Gate. The proposed new stormwater system will include the installation of new storm drain lines in all backbone streets and will include pipeline stubs to intercept existing on-site drain lines within Reuse parcels. Proposed construction within each Reuse parcel will be required to replace the existing stormwater facilities within that parcel, such that the entire existing system is ultimately replaced with a new system that meets the design standards proposed herein.

Providing 20,000 gpm of pumping capacity along with the 3-acre stormwater basin will allow the system to meet City standards and accommodate 55-inches of sea level rise and beyond. Watershed B will be levee protected from the flooding conditions described in the Flood Protection section

and sufficient right-of-way will be maintained to increase levee height if sea level rise exceeds 24-inches.

c. Watershed C

Watershed C encompasses the northeastern quadrant of the Project Site. This watershed includes approximately 112 acres and will route stormwater runoff to a newly refurbished outfall structure on the Oakland / Alameda Estuary. The areas within this watershed include Reuse Areas, including the neighborhood of the Big Whites, as well as Development Areas, but as in the case of Watershed A, the low-lying elevations of the Reuse Areas necessitate storage and pumping from the initial project stages. The ultimate stormwater system will include the installation of downstream facilities including main storm drain trunk lines, a multi-purpose basin, pump station, and the aforementioned outfall, which is proposed for the northern shoreline of the Project Site, just west of the Main Street Dog Park. Space limitations constrain the size of the proposed multi-purpose basin to an area of approximately 1 acre, which will necessitate a somewhat larger installed stormwater pump capacity of 40,000 gpm.

An enhanced maintenance program will be implemented to rehabilitate the existing system within the Reuse Areas prior to the ultimate replacement and installation of the new stormwater collection system. The proposed stormwater system will include the installation of new storm drain lines in all backbone streets. This backbone system will include pipeline stubs to future Reuse parcels and connections to intercept existing on-site pipeline systems within Reuse parcels. Proposed construction within each Reuse parcel will be required to replace the existing stormwater facilities within that parcel, such that ultimately the entire existing system is replaced with a new system that meets current standards.

Providing 40,000 gpm of pumping capacity along with the 1-acre stormwater basin will allow the system to meet City standards and accommodate 55-inches of sea level rise and beyond. The Reuse Areas within Watershed C will be levee protected from the flooding conditions described in the Flood Protection section, with associated options for adaptively raising levee crest as needed to respond to sea level rise greater than 24-inches. The Development Areas within the watershed will be at an elevation above the required flood protection elevations described in the Flood Protection section.

d. Watershed D

Watershed D encompasses the central and eastern areas portions of the Project Site. This watershed includes approximately 130 acres and will discharge runoff to the Seaplane Lagoon through a newly refurbished outfall near the northeast corner of the Lagoon. The majority of the development within the watershed is Development Area, with only a small component of Reuse Areas. The proposed stormwater system will include the installation of new storm drain lines in all backbone streets, as well as pipeline stubs to future Development parcels and stubs to intercept existing on-site pipeline systems within Reuse parcels. The downstream portion of this watershed is within the Waterfront Town Center Sub-District, where plans call for a higher density development. Therefore, it is anticipated that there will not be sufficient land available to construct a multi-purpose basin. However, elevations within the watershed are high enough to meet City design standards (with 24-inches of sea level rise) without construction of a fully equipped pump station. Accordingly, the backbone infrastructure improvements for this watershed will include construction of the pump station vault, which will function through gravity outfall until such time

that sea level rises more than 24-inches above current levels. At that point incremental stormwater pump capacity will be installed up a total of 60,000 gpm to pump the peak system flows to the Lagoon.

Providing a refurbished outfall and pump station vault will allow for adaptive management of the system to continue to meet the City's 25-year conveyance standard. The Development Areas within Watershed D will have minimum grades above the required flood protection elevations described in the Flood Protection section. However, a levee will need to be raised if sea level rise exceeds 24-inches and a stormwater pump station will need to be installed up to a predicted maximum of 60,000 gpm, which would provide protection up to and beyond a sea level rise of 55-inches.

e. Watershed E

Watershed E encompasses the southeastern quadrant of the Project Site. This watershed includes approximately 158 acres and will route stormwater runoff to a newly refurbished outfall structure San Francisco Bay. The watershed consists entirely of Development Area. The proposed stormwater system will include the installation of new storm drain lines in all backbone streets. The system will also include pipeline stubs to future Development parcels. The construction will only require an outfall to be constructed to the Bay. The elevations of this watershed are higher than other areas within the Project Site, and therefore, do not require a multi-purpose basin or pump station to be installed at the time of initial construction. A pump station with capacity of 20,000 gpm and a roughly 3-acre multi-purpose basin will be required if the sea level rise exceeds approximately 3 feet. The proposed outfall for this watershed will be located along the southern shoreline of the Enterprise Park.

The Development Areas within Watershed E will have minimum grades above the required flood protection elevations described in the Flood Protection section. The stormwater system can be adapted to accommodate sea level rise over 3-feet with the installation a pump station and multi-purpose basin. A perimeter levee will need to be raised if sea level rise exceeds 24-inches and sufficient right-of-way will be maintained for that adaptive measure as well.

f. Northwest Territories / VA Developed Areas

The Northwest Territories / VA Developed Areas encompass the northwestern areas of Alameda Point. This watershed includes approximately 275 acres and discharges storm runoff to the Oakland / Alameda Estuary. It is comprised of open space areas, mostly passive with some active areas, abandoned airplane runways and the VA Developed Area. The VA Developed Area will install new outfalls along the northern shoreline, which will convey runoff from the VA Developed areas, adjacent abandoned runways, and open space areas. The proposed storm drain lines and outfalls from the VA Developed Areas will intercept any existing stormwater facilities and replace existing outfalls within their vicinity. The remaining open space areas within this watershed will utilize the remainder of the existing stormwater facilities, pipelines and outfalls.

The VA Developed Area will have minimum grades above flood protection elevations including 55-inches of sea level rise. The remaining Open Space areas and abandoned runways will remain

at similar elevations as the existing conditions and will therefore not be protected from 100-year coastal flooding hazards or future sea level rise.

g. Off-Site Watersheds

The City's SDMP suggests a number of improvements to the Alameda Northside drainage area lying immediately to the east of Alameda Point. This drainage area is the largest in the City and has been subject to localized flooding issues due to capacity limitations in a number of locations. The prioritized 10-year improvements for the system call for disconnecting the western portions of the system at West Campus Drive and redirecting the runoff to an alternative outfall location to off-load the existing Arbor and Northside (Marina Village) Pump Stations. One proposed alternative outfall location, and the one requiring the smaller amount of new storm drain line, is the northeast corner of the Seaplane Lagoon.

Modeling presented in the SDMP suggests that a new 72-inch diameter storm drain line would be required to meet a 10-year design storm standard to gravity outfall at this location. Construction of this alternative outfall location could be accommodated in the infrastructure planning for Alameda with adequate forethought, although the size of the line would potentially present challenges with respect to right-of-way and locating of other utilities. However, it is important to note that increasing the design standard of system for the off-site watershed to the 25-year event would likely require an additional terminal stormwater pump station (or installation of stormwater pumps earlier than otherwise needed at the Watershed D outfall). Providing 25-year protection including sea level rise of 55-inches would require an additional 60,000 gpm of pumping capacity above and beyond that previously cited for Watershed D.

An alternative to the configuration suggested in the SDMP is to upgrade the existing pump station off-site of Alameda Point at Third Street to improve this off-site watershed. A bio-retention basin could also be constructed near the existing pump station, within the old Alameda Belt Line corridor to provide water quality benefit for this existing watershed. In this alternative a force main would be constructed from this upgraded pump station to the west and entering Alameda Point. This would provide design flexibility within Alameda Point for the pipeline that the force main connects to and accepts this off-site flow.

The City will determine which option is preferred prior to the beginning of the detailed storm drainage design for Alameda Point. The City's Urban Runoff Fund would be required to fund these improvements.

9. Proposed Water Quality Treatment Measures

The Alameda Countywide Clean Water Program oversees the implementation of the Municipal Regional Stormwater NPDES Permit (MRP) that was issued for urban stormwater discharges from Alameda County, including the City of Alameda. The MRP outlines a number of regulatory goals and requirements for stormwater management for new development and redevelopment sites. The permit previsions require the implementation of Low Impact Development (LID) measures as outlined in Section C.3.c of the MRP. These measures include source control, site design, and treatment requirements to reduce the amount of stormwater runoff and improve the quality of the stormwater runoff.

The MRP identifies appropriate LID stormwater management measures such as rainwater harvesting and re-use, infiltration, evapotranspiration, and biotreatment, while emphasizing that biotreatment systems are only to be used where it is practically infeasible to utilize the other three cited measures. Alameda Point

has been identified as practically infeasible for large-scale rainwater harvesting and infiltration by utilizing the Alameda Countywide Clean Water Program's Infiltration/Harvesting and Use Feasibility Screening Worksheet. Accordingly, biotreatment will be the primary method of accomplishing stormwater treatment within Alameda Point. The LID biotreatment measures that will be implemented throughout Alameda Point will include bio-retention planters, street planters, bioswales, subgrade infiltration areas, permeable paving and any other treatment measures approved by the Regional Board. Permeable surfaces (pavement and concrete) have been installed as part of the adjacent Bayport development, however, because of shallow groundwater they were ineffective and had to be removed because they did not function properly. Implementation of these types of surfaces is not allowed unless with approval from the Public Works Director and a determination that the groundwater elevation will not interfere with the functioning of these units. The following describes the water quality plan for the Development and Reuse Areas:

a. Development Areas

The new backbone streets will be constructed with water quality facilities that provide treatment for the runoff from the impervious areas within that street right-of-way. These streets are anticipated to include linear bio-retention planters, bioswales and street planters providing bio-filtration of stormwater within the landscape strips of the street cross section. The water quality improvements within the backbone streets will be phased to closely match the development phasing.

The on-site / in-tract areas of development parcels within the Development Area will be required to be designed with LID principles and treat the runoff interior to that parcel. This treatment can be accomplished by allocating and integrating water quality treatment measures within on-site / in-tract landscape areas. Development parcels also may implement on-site / in-tract rain harvesting systems, where feasible.

With implementation of the water quality measures in the backbone streets and on-site / in-tract development parcels, all runoff from impervious areas within the Development Areas will be treated in compliance with MRP. In case that it is determined by the City of Alameda that it is not feasible or practical for a development parcel to provide all of the necessary treatment for that respective parcel, then that development parcel may implement water quality improvements elsewhere, within Alameda Point, consistent with the "Alternative or In-Lieu Compliance" previsions outlined in Section C.3.e of the MRP.

b. Reuse Areas

Water quality improvements within the Reuse Areas will be implemented incrementally over time. Development applications or long term leases for Reuse parcels will be required to construct on-site water quality improvements to provide treatment for that Reuse parcel. At this time, the water quality treatment of these existing streets is exempt from the requirements of the MRP. However, as backbone streets are improved with the Reuse Areas, water quality improvements will be implemented, to the maximum extent feasible, to treat the runoff from that street.

c. Water Quality Certification

A water quality certification, Section 401, will be required from the Regional Water Quality Board (RWQCB) for activities within wetlands or below the ordinary high water line. This certification will be required for the outfall construction at Alameda Point. The project will need to demonstrate compliance with the water quality regulations of the MRP for the storm runoff from the Project Site. As described above, the implementation of the water quality improvements will be phased in the

Development Areas and incremental in the Reuse Areas. Accordingly, it is anticipated that a site-wide water quality certification will be pursued for all outfalls and waste discharge requirements will be established for the site outlining how the water quality compliance will be achieved over time.