

**Appendix I**  
**Sea Level Rise Technical Memorandum**

# Technical Memorandum



## Malibu Civic Center Wastewater Treatment Facility Project

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**Subject:** Sea Level Rise Analysis

**Prepared For:** City of Malibu

**Prepared by:** Leslie Dumas

**Reviewed by:** Steve Clary

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### 1 Introduction

On-site wastewater disposal systems (OWDS) have allegedly contributed to the non-point source pollution of Malibu Creek and Lagoon, resulting in the Los Angeles Regional Water Quality Control Board (RWQCB) adopting Resolution R4-2009-007 in November 2009. This resolution approved an amendment to Chapter IV of the Water Quality Control Plan for the Coastal Watersheds of Los Angeles and Ventura Counties (Basin Plan) prohibiting OWDS and OWDS discharges in the Malibu Civic Center Area. In 2010, the State Water Resources Control Board (SWRCB) adopted Resolution 2010-0045 which approved the amendment and established a phased schedule for compliance. The resolutions prohibit all new OWDSs and discharges from existing systems based on a phased schedule to cease discharges from Phase 1 systems by November 5, 2015 and Phase 2 systems by November 5, 2019. A third phase may be implemented, if necessary, following operation of Phase 1 and 2, and upon completion of a water quality sampling program to determine if implementation of Phases 1 and 2 have resulted in a meaningful decrease in Bacteria and Nitrogen in Malibu Lagoon.

The Phase 1 and 2 OWDS systems were defined in the resolutions and have become known as “The Prohibition Zone.” An August 2011 Memorandum of Understanding (MOU), signed by both the City of Malibu (City) and the LA RWQCB, memorializes the requirements of the resolutions and defines the Prohibition Zone areas. Following execution of the MOU, the City embarked on a program to design and construct a centralized wastewater collection, treatment and disposal system for the Civic Center area of the City and a small portion of unincorporated Los Angeles County. This program includes the construction of the Civic Center Wastewater Treatment Facility (CCWTF), where wastewater from the Prohibition Zone will be collected and treated to a standard set forth in Title 22 of the California Code of Regulations (CCR) for unrestricted reuse of disinfected tertiary recycled water. The resultant recycled water will be used for landscape irrigation within the Civic Center and surrounding areas to the maximum extent possible; however, anticipated irrigation demands are not expected to utilize all recycled water generated by the CCWTF. Recycled water not used for landscape irrigation will be injected into the underlying Malibu Valley Groundwater Basin for disposal or percolated into the aquifer in Winter Canyon.

### 2 Project Design

The CCWTF Project is located within the lower Malibu Creek watershed area and includes the Civic Center area of the City of Malibu and portions of unincorporated Los Angeles County (Figure 1). The project area overlies the Malibu Valley Groundwater Basin, which includes a shallow alluvial layer, a lower aquifer called the Civic Center Gravels, and a hydraulically-separate alluvial zone contained within Winter Canyon to the west of and adjacent to the Malibu Valley Groundwater Basin. Groundwater is not used as a municipal drinking water supply in either the groundwater basin or Winter Canyon.

Figure 1: Regional Location Map



The entire City of Malibu is located within the Coastal Zone, as defined by the California Coastal Act. On September 13, 2002, the City's Local Coastal Program (LCP), was certified by the California Coastal Commission. The LCP consists of a Land Use Plan and a Local Implementation Plan. The LCP is intended to protect, maintain, and where feasible, enhance and restore the overall quality of the Coastal Zone environment.

Land uses in the Civic Center area generally consist of a mix of commercial, residential, and institutional uses, along with open space/undeveloped public lands. Low density commercial shopping centers, City and county government buildings, three multi-family condominium developments and schools comprise the central portion of the Area. Areas along the coast consist of higher density single-family residential developments, such as the Malibu Colony, and open space/undeveloped land uses such as the Malibu Lagoon State Park, while lower density residential neighborhoods such as the Malibu Knolls and Serra Retreat communities are located in the northern and eastern portions of the study area. As shown on Figure 2, Malibu Creek and Malibu Lagoon are located in the central portion of the Prohibition Area. The area north and west of the Prohibition Area is predominantly occupied by open space/undeveloped and public land uses. Pepperdine University, located immediately west of and outside the Prohibition Area, is the largest single development in the vicinity.

The proposed CCWTF project consists of a wastewater treatment facility, designed to produce treated effluent meeting Title 22 standards for unrestricted reuse, plus a wastewater collection system, recycled water distribution system, and groundwater injection/percolation system for dispersal of unused recycled water.

Figure 2: Proposed CCWTF Project



## 2.1 Wastewater Treatment Facility

The proposed wastewater treatment facility site is located within the Prohibition Area on an approximately 4.8-acre site at 24000 Civic Center Way, between Civic Center Way on the north, Pacific Coast Highway on the south, and vacant land on the west. The site is currently developed, in part, with the existing Winter Canyon Wastewater Treatment Facility, a small scale, privately owned and operated wastewater treatment facility serving the Malibu Colony Plaza shopping center located on the south side of Pacific Coast Highway.

The proposed wastewater treatment facility has been designed to accommodate the full build-out wastewater flow projections for all phases of the Prohibition Area; however, the facility is designed to utilize modular components so that installation can be phased to accommodate capacity as it is needed. At full build-out, the proposed wastewater treatment facility would be a 507,000-gallon-per day (gpd) capacity membrane bioreactor (MBR) facility. Capacity of the facility was determined based on existing wastewater flow rates, winter water use records, and projections of infill development based on existing City land use documents.

The treatment facility site consists of an upper terrace and a lower terrace, generally descending from northwest to southeast. The site is zoned Commercial Visitor Serving-2 (CV-2) in all City land use documents. A drainage channel connected to Winter Canyon Creek is located along the southeastern edge of the site. Wetland features line the drainage, and the area is considered an environmentally sensitive habitat area (or ESHA). Process areas within the site would be designed so that runoff would be captured within the site and returned to the headworks for treatment. The treatment processes would also be designed with redundancy to minimize the potential for spills or upsets at the facility and back-up power generation equipment.

## 2.2 Collection and Distribution Systems

A collection system would be constructed to convey wastewater flows within the Civic Center Area to the proposed wastewater treatment facility, and a recycled water distribution system would be constructed to distribute the treated effluent (recycled water) from the treatment facility to various land uses for reuse purposes, as well as to groundwater injection wells for injection into the Malibu Valley Groundwater Basin. The collection and distribution systems would consist of underground pipelines that would generally run beneath public rights-of-way or within easements. For Phase 1 of the project, both the collection and recycled water distribution systems would follow along existing street alignments, including Civic Center Way, Stuart Ranch Road, Cross Creek Road, Webb Way, Malibu Road, and a small portion of Pacific Coast Highway, Malibu Canyon Road, and Winter Canyon Road.

Figure 2 depicts the expected extent and locations of the wastewater collection and recycled water distribution systems for the project, and Table 1 describes pipeline characteristics for each phase. Note that the two pipeline systems (wastewater collection and recycled water distribution) would be placed in the same trench along the same pipeline alignment at most locations.

**Table 1: Collection and Distribution System**

| Project Phase/Facility              | Construction Method | Pipe Length (Linear Feet) | Pipe Diameter (inches) |
|-------------------------------------|---------------------|---------------------------|------------------------|
| Phase 1 Collection System (CS)      | Open Cut            | 15,500                    | 4 – 10                 |
|                                     | PTGAB <sup>1</sup>  | 3,500                     | 8 – 10                 |
|                                     | Jack & Bore         | 1,400                     | 4 – 30 <sup>2</sup>    |
| Phase 2 Recycled Water System (RWS) |                     | 14,500                    | 8                      |
| Phase 2 CS and RWS                  | Open Cut            | 26,000                    | 4 – 8                  |
|                                     | PTGAB               | 2,000                     | 8                      |
| Phase 3 CS and RWS                  | Open Cut            | 24,000                    | 4 - 8                  |
| <b>Total</b>                        |                     | <b>72,400</b>             |                        |

Notes:

1. Pilot Tube Guided Auger Boring
2. Includes about 800 feet of 4- to 8-inch pipe and 600 feet of 24- to 30-inch casing.
3. Pipeline for recycled water system would be constructed in the same trench as collection system piping, and is thus not included in total length of pipeline.

Pump stations would be located along pipeline alignments, below ground and on public rights-of-way and/or easements (see Figure 2). Phase 1 pump stations would be located at Legacy Park and Bluffs Park. Phase 2 and Phase 3 pump stations have been positioned in the general location where required. The only above-ground features of the collection and distribution infrastructure would be air release valves along pipelines at high or low elevation points, vent pipes at the pump stations, and backup generators, transformers, switchboards/meters and electrical panels, which would be fenced and screened for security and aesthetic reasons.

In addition to pump stations, the Phase 2 and 3 recycled water distribution systems are also expected to include storage tanks and booster pump stations, which would be constructed somewhere in the higher elevation areas so as to ensure adequate pressure is provided to recycled water users. Locations for these Phase 2 and 3 tanks have not yet been determined.

### 2.3 Reuse and Dispersal Facilities

To accommodate the projected build-out flow of 507,000 gpd, the City is planning to use a combination of reuse (recycled water irrigation) and dispersal (either injecting the treated effluent in the lower Civic Center Gravels of the Malibu Valley Groundwater Basin or percolating treated effluent in Winter Canyon at the treatment plant site) to manage treated effluent disposal. The ultimate combination of methods would depend on annual demand for recycled water. While recycling treated effluent for reuse is the preferred method of disposal, annual demand for recycled water in and around the Prohibition Area is estimated to reach approximately 125,000 gpd. Due to the siting and cost issues of storing excess recycled water during seasons of low demand (i.e., the winter rainy season), it is expected that only a portion of the treated effluent produced by the treatment facility could be reused for irrigation. Taken together, a combination of maximized reuse, Malibu Valley groundwater injection and/or Winter Canyon percolation would accommodate the full build-out effluent disposal needs and would provide a total disposal capacity of more than 507,000 gpd.

Groundwater dispersal will occur when there is unused recycled water. Groundwater injection will be the primary mode for dispersal.

### **Groundwater Injection into the Malibu Valley Groundwater Basin**

Portions of the Malibu Valley Groundwater Basin in the Civic Center area are underlain by two aquifers - an upper shallow alluvial layer and the lower Civic Center Gravels formation. While both aquifers are designated in the LARWQCB Basin Plan for beneficial use as a municipal drinking water supply, neither is currently used for potable water supply. The Malibu Valley Groundwater Basin has not been used as a drinking water source since the 1960's due to saltwater intrusion from the ocean resulting from basin overdrafting. Due to their hydrogeologic characteristics and the presence of a confining layer that overlies them, the lower Civic Center Gravels represent a potential destination for disposal of tertiary effluent using injection wells.

To predict potential groundwater injection capacity for the project, the City used a numerical groundwater flow model of the Malibu Valley Groundwater Basin to identify potential injection well locations and to estimate the number of injection wells required and the acceptable amount of groundwater level change at multiple points as a constraint. The model was calibrated with data from extensive hydraulic testing of the groundwater basin aquifers and by using geologic borings to bedrock throughout the Civic Center area.

To meet the injection requirements for Phase 1 of the project, it was determined that three injection wells situated along Malibu Road (Figure 3) would meet injection capacity requirements with a sufficient factor of safety. An additional one to three wells would be added in the same general location or on the west side of Legacy Park between Civic Center Way and Pacific Coast Highway, as Phases 2 and 3 of the project are constructed. It is assumed that each injection well would be situated adjacent to the recycled water pipeline, be approximately 150 feet deep and would inject water in the Civic Center Gravels at depths ranging from 30 to 140 feet below ground surface. Well head facilities are anticipated to be in screened, above-grade structures at each injection well location.

### **Winter Canyon Groundwater Dispersal**

Based on hydrogeological studies, Winter Canyon has been determined to be a separate groundwater system from the Malibu Valley Groundwater Basin underlying the majority of the Civic Center area. For Winter Canyon groundwater dispersal, existing Winter Canyon Wastewater Treatment Plant seepage pits on the proposed treatment facility site would be used, along with new percolation ponds at the facility site, as percolation facilities.

Figure 3: Location of Proposed Phase 1 Injection Wells



### 3 Regulatory Guidance

The California Coastal Commission (Commission) issued a draft sea level rise policy guidance document on October 14, 2013 to provide guidance on how to address sea level rise in Local Coastal Programs and Coastal Development Permits. In this document, the Commission require the use of ‘best available environmental science’ to evaluate the coastal impacts of sea level rise, and references sea level rise projections published in the National Research Council’s 2012 report entitled *Sea Level Rise for the Coasts of California, Oregon and Washington: Past, Present and Future*. These projections for the portion of California south of Cape Mendocino (including the City of Malibu) are summarized in Table 2, below.

**Table 2: NRC Sea Level Rise Projections for California (NRC, 2012)**

| Time Period | Sea Level Rise South of Cape Mendocino |
|-------------|--|
| 2000 - 2030 | 1.56 – 11.76 inches                    |
| 2000 - 2100 | 16.56 – 65.76 inches                   |

### 4 Sea Level Rise Analysis

In order to evaluate the potential impacts of sea level rise on the City of Malibu, elevation contours were plotted to represent current conditions (0 feet mean sea level), near-future (Year 2030) mean sea level conditions (0 foot present mean sea level plus anticipated 2030 sea level rise as shown in Table 2), and near-future (Year 2030) mean sea level conditions plus average high tide conditions (anticipated 2030 sea level rise as shown in Table 2 plus the 2.6 foot high tide fluctuation currently experienced in Malibu). Figure 4 shows the projected impacts of sea level rise by 2030 for a sea level rise condition of 1.56 inches, whereas Figure 5 shows the same for a sea level rise condition of 11.76.

Figures were also prepared to show the range of impacts that could occur within the City of Malibu by the Year 2100, should the NRC sea level projections shown in Table 2 occur. These projections can be seen in Figure 6 for a sea level rise projection of 16.56 inches and Figure 7 for a sea level rise projection of 65.76 inches.

Figure 4: Projected Sea Level Rise of 1.56 inches by 2030

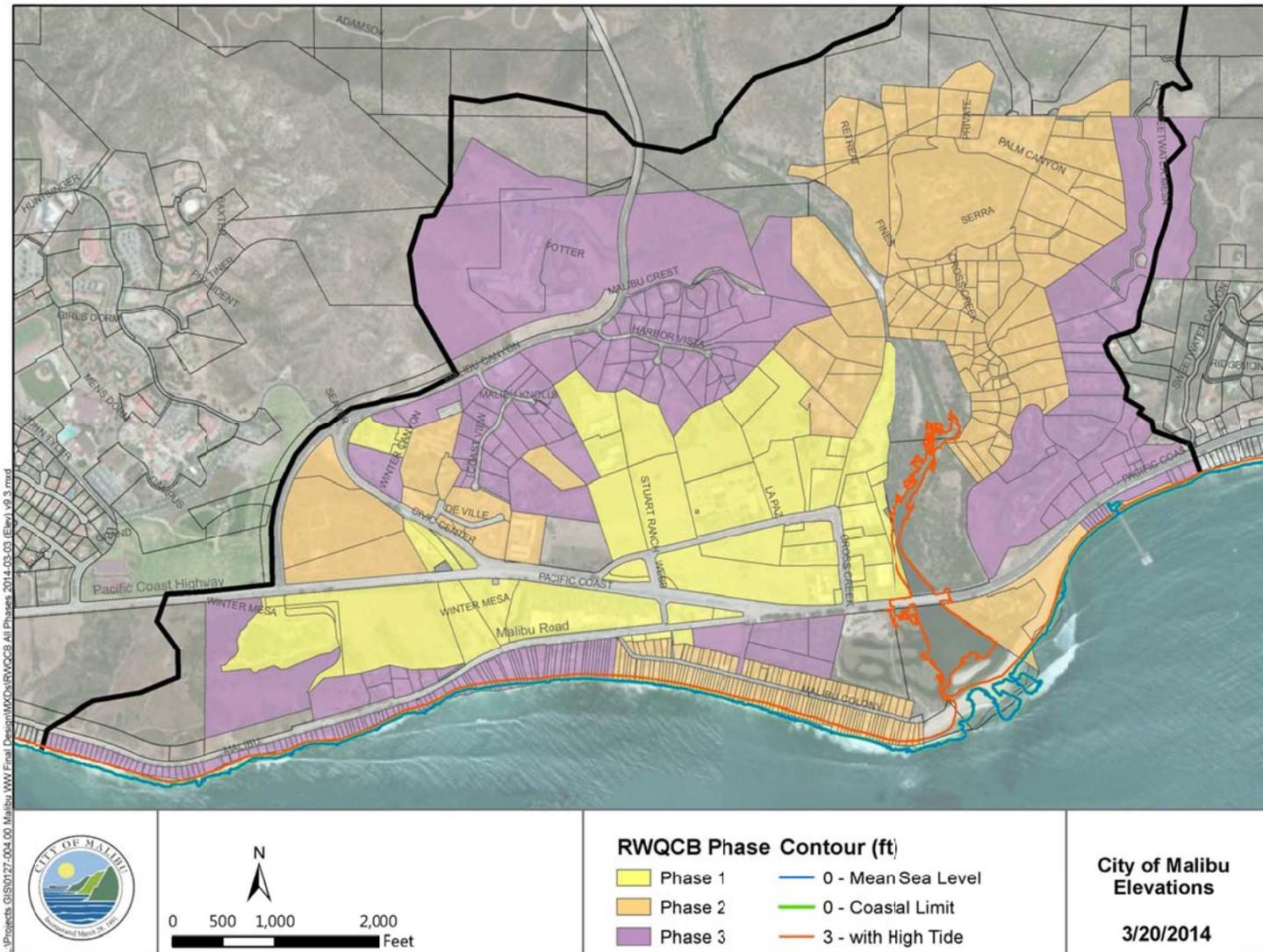


Figure 5: Projected Sea Level Rise of 11.76 inches by 2030

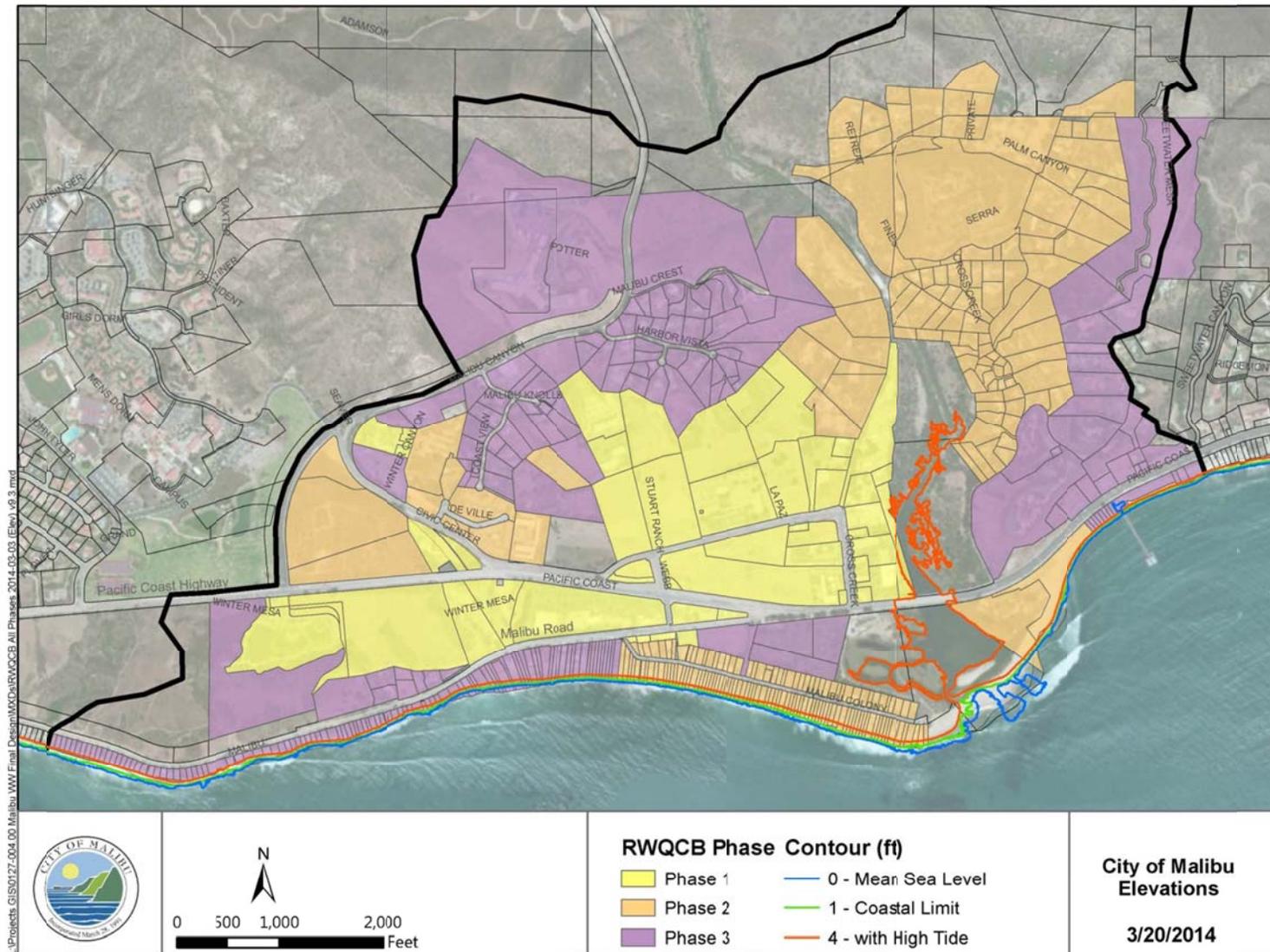


Figure 6: Projected Sea Level Rise of 16.56 Inches by 2100

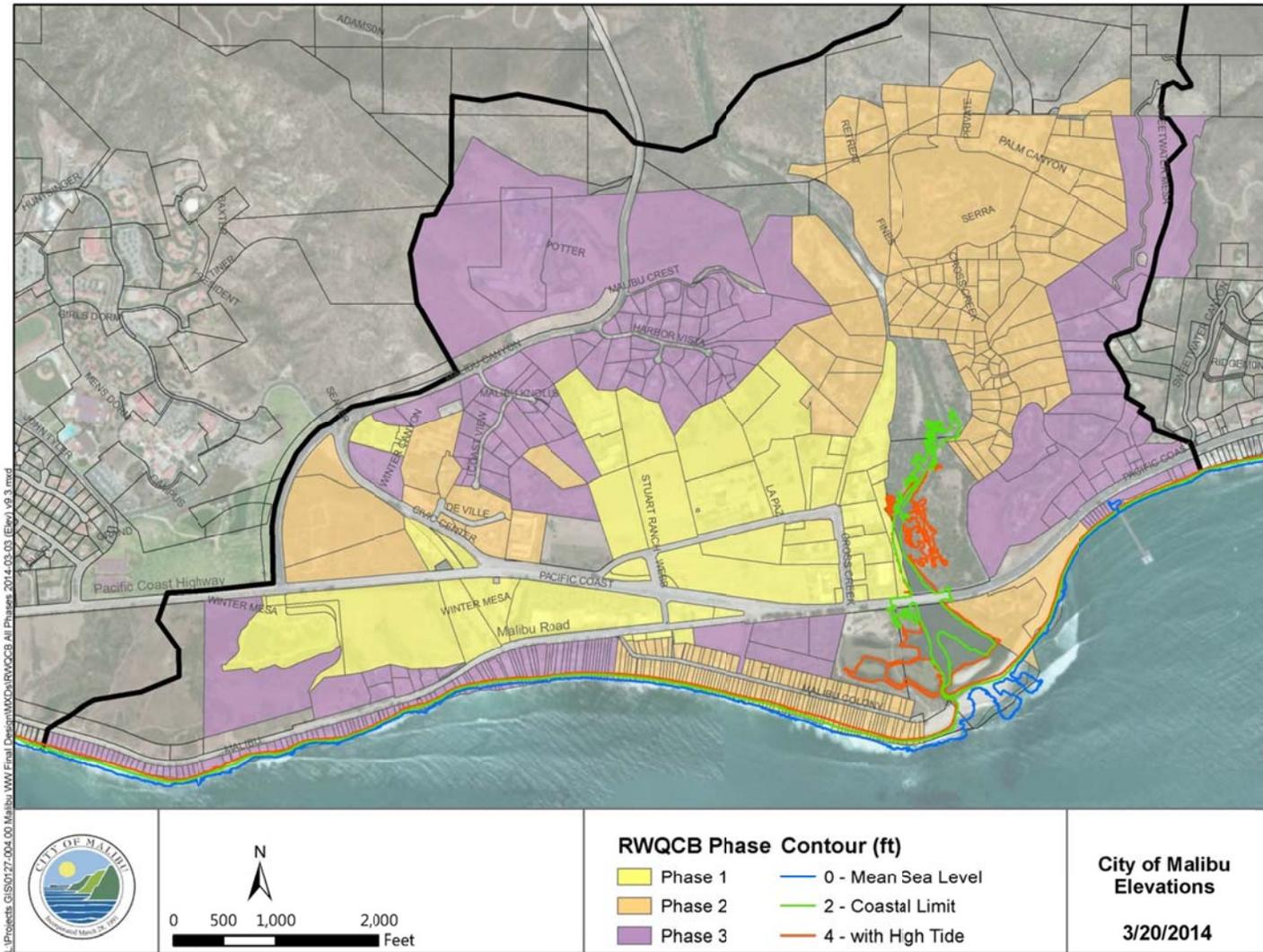
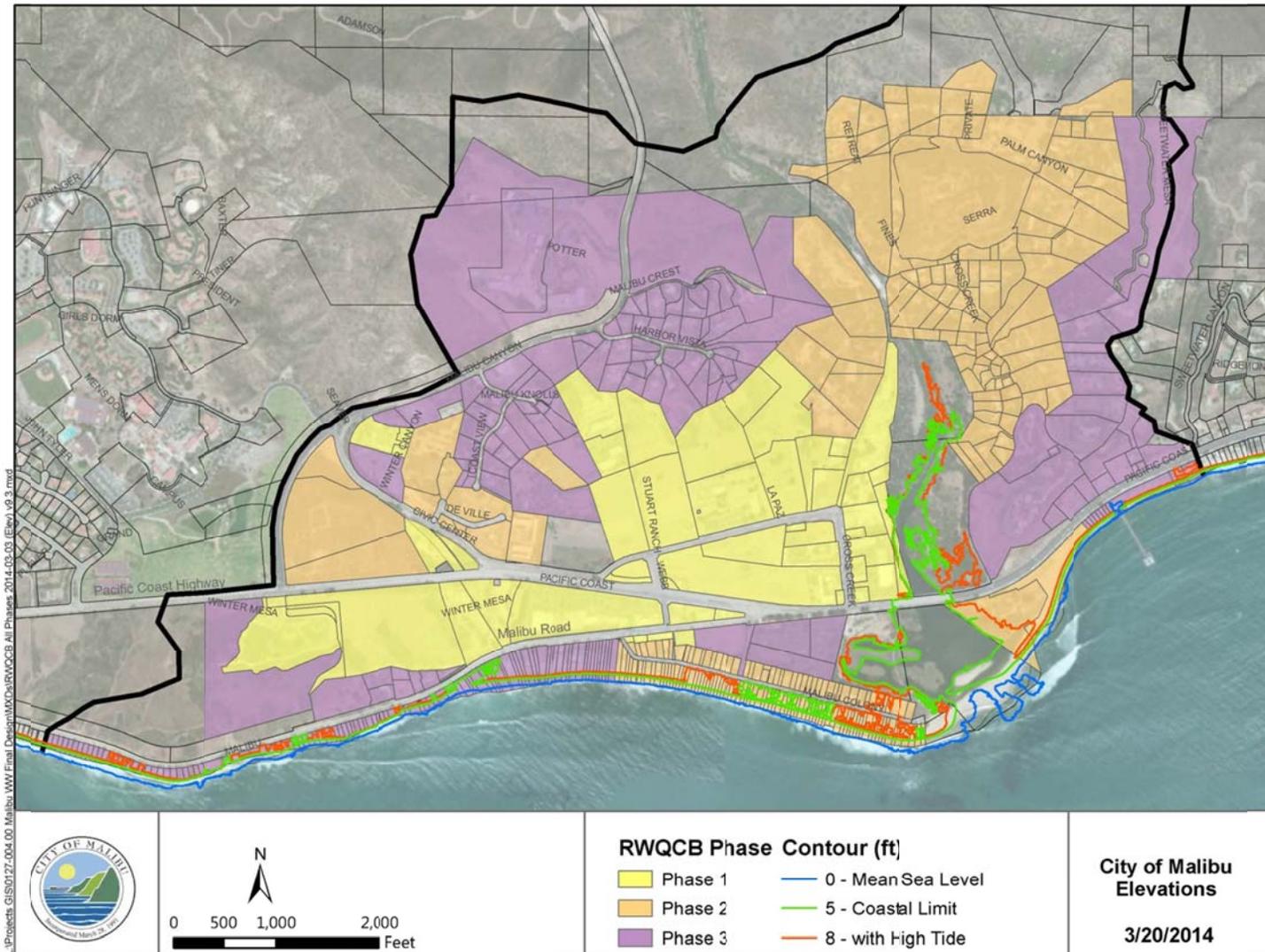


Figure 7: Projected Sea Level Rise of 65.76 Inches by 2100



## 5 Conclusions

Sea level rise may have significant impacts on the shoreline infrastructure of the City of Malibu. However, in all cases examined using the NRC's sea level rise projections, the CCWTF facility is located outside the zone of influence as are related pipelines, pump stations and tanks in upland areas. Related project infrastructure located close to the shoreline, Malibu Lagoon and south of Pacific Coast Highway, including subsurface pipelines and pump stations and the injection wells and associated facilities, are at potential risk of impacts from sea level rise. To mitigate these impacts, the City is implementing an adaptive management approach to addressing sea level rise on all its infrastructure (including, but not limited to, that which will be in place as a result of the CCWTF project), and is utilizing a planned retreat approach to managing anticipated impacts on its future injection well system, including identification of additional possible injection locations within the Civic Center area (Figure 8). Groundwater elevations will be monitored before and during Project implementation as part of permit requirements. In addition, Malibu Creek and Lagoon stage (elevation) data are monitored as part of existing programs. These data will provide the City with the information necessary to determine if Project infrastructure, or any other City infrastructure, may be at risk from sea level rise and/or if infrastructure performance is at risk. These periodic analyses of data will provide the City with the tools and methods necessary for making adaptive management decisions.

Figure 8: Future Well Locations for Planned Retreat

