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Memorandum

date 5/17/2011

- Mary Small, California State Coastal Conservancy to Diana Hurlbert, Santa Monica Bay Restoration Commission
- Nick Garrity, P.E. from
- Ballona Wetlands Restoration Project (1793.13) subject Task 13: Technical Support for Environmental Review & Permitting Preliminary assessment of Alternative 4 culverts to Marina del Rey (Task 13.18)

1. INTRODUCTION

This memorandum provides hydrology and engineering information on the Ballona Wetlands Restoration Alternative 4 (Figures 1 and 2). Specifically, the purpose of this memorandum is to assess technical issues associated with constructing new culvert tidal connections between Area A and Marina del Rey (MDR) under Fiji Way. This memo is organized as follows:

- Section 2. Tidal connection criteria and opportunities •
- Section 3. Considerations and constraints •
- Section 4. Conclusions and discussions.

Alternative 4 from the Ballona Wetlands Restoration Feasibility Report (PWA and others 2008) proposes to restore subtidal and intertidal habitat in Area A (north of Ballona Creek and west of Lincoln Blvd.) (Figures 1 and 2). The restored subtidal habitat would be tidally connected to MDR through culverts under Fiji Way with a total estimated cross-section area of approximately 500 square feet (e.g., approximately five 10-ft by 10-ft box culverts). Area A would not be connected to Ballona Creek. The existing culvert connecting the Fiji Ditch to MDR Basin H north of Area A would not be changed, however the existing culvert would provide tidal flows to the larger restored habitat area (see Figures 3 and 7).

The Management Team selected Alternative 4 as one of two preferred alternatives based on the Feasibility Report, Science Advisory Committee Recommendations, and agency and stakeholder input. The following documents contain additional information and background on Alternative 4, including planning, habitat, and other infrastructure considerations:

- Ballona Wetlands Feasibility Report (PWA and others 2008) •
- Preferred Alternatives Memorandum (PWA and others 2010) •

Proposed culverts from Ballona Wetlands Area A to Marina Del Rey (MDR) and MDR • sea wall constraints memorandum (PWA 2010).

2. TIDAL CONNECTION CRITERIA AND OPPORTUNITIES

2.1 CULVERT SIZING

Previous hydrodynamic modeling of Alternative 4 (PWA and others 2008) indicates that the new open culverts would require a minimum total cross-sectional area of approximately 500 square feet (e.g., approximately five 10-ft by 10-ft box culverts). The culvert lengths would be approximately 400 ft long. Based on the modeled water levels and flows, these culverts would provide a full tide range, with an estimated tidal prism of approximately 350 acre-feet (total flow volume exchanged over a tide cycle). It is estimated that tidal flow velocities in the culverts would be about twice that of a natural tidal channel. A full tide range indicates that the intertidal volume would be exchanged on each tide cycle (on average). The subtidal volume of the basin would be approximately 200 acre-feet. Using the modeled tidal prism and the estimated total volume of the Area A restored wetlands, the residence time of the wetland habitats would be at least one day (assuming complete mixing), and would likely be higher in areas farther from the culverts.

The culverts would ideally be at intertidal elevations, with an invert below low tide levels, to improve fish passage and habitat function. The culvert bottom and top elevations (corresponding to 10-ft by 10-ft box culverts) could be approximately -4 ft NAVD to +6 NAVD, respectively, which is approximately 4 ft below mean lower low water (MLLW) and 1 ft above mean higher high water (MHHW). A lower elevation culvert bottom may be preferable for circulation and fish passage, and a higher culvert top elevation may be preferable for accommodating future sea-level rise (see Sections 3.1 and 3.6). The culvert shown in Figure 2 is drawn within this range of elevations. As discussed below, the new culverts could consist of one or more banks of culverts.

Further modeling and assessment would be required to refine the culvert sizing in future phases of the project.

2.2 POSSIBLE CULVERT LOCATIONS

Several possible locations for new culverts were identified (see Figure 3) in coordination with the Los Angeles County Department of Beaches and Harbors (Beaches & Harbors) in meetings on October 28, 2008 and June 23, 2010. Beaches & Harbors owns fee title to the land that the culverts would have to cross. In order to install these culverts, easements would have to be negotiated with LA County and various utilities, as discussed below.

These locations include:

1. Parcel 56/Parcel W (Figure 4). The culverts would be located under the new promenade proposed for the Fisherman's Village redevelopment plan at northwest corner of Fiji Way. The culverts would exit at the proposed public transient boat operations dock, which includes slips for rental boats, dingey docks, fuel docks, and water taxi access. These culverts have the potential to affect navigation as discussed in Section 3.4. Culverts at this location would also have to cross the MDR sea wall and multiple underground utilities (See Sections 3.2 and 3.3).

Also note that Parcel 55, the area immediately north of Parcel 56 at the northwest corner of Fiji Way, was previously identified by Beaches & Harbors and considered as a possible culvert location. However, the Fisherman's Village redevelopment project planned by LA County/Beaches & Harbors currently includes a new building with basement parking on this parcel. As currently proposed, the redevelopment plans for Parcel 55 would not be consistent with the installation and maintenance of the new culverts at Parcel 55.

- 2. Beaches & Harbors north parking lot (Figure 5). The culverts would be located under the existing Beaches & Harbors north parking lot. This location would require consideration of the MDR sea wall, underground utilities, and navigation constraints (see Sections 3.2, 3.3, and 3.4).
- 3. Via Venetia (Figure 6). The culverts would be located under the end of Fiji Way and the existing Via Venetia apartment parking lot. The Via Venetia apartments are proposed for redevelopment. The Villa Venetia redevelopment plans and planned boat docks downstream of this location would need to be considered, as well as navigation at the Coast Guard Station immediately to the north. The existing MDR shoreline in this location is rock revetment. It is downstream of the sea wall and existing docks, and therefore may reduce potential sea wall and navigation constraints. This location would also require consideration of utilities constraints (see Section 3.3).
- 4. Existing Fiji Ditch-Basin H culvert at Parcel 52 (Figure 7). The existing culvert connection at this location would be maintained and incorporated in Alternative 4. Beaches & Harbors did not believe that additional new culverts were consistent with the planned redevelopment of this site (boat storage facility). In addition, directing all of the Alternative 4 culvert flows through Basin H would potentially cause significant water quality and navigation impacts. This option was therefore not pursued.

2.3 PREFERRED TIDAL CONNECTION OPTIONS

Two banks of culverts in different locations are preferred for the restoration to enhance circulation and tidal exchange. A single bank of culverts is likely preferable from an engineering and cost perspective. A single culvert structure would function for the restoration, with the potential for reduced circulation and water quality compared to two culvert structures (e.g., greater potential for hydraulically isolated or stagnant areas with longer residence times, decreased flushing). Based on this preliminary assessment, the new culvert locations preferred for the purposes of the restoration are, in order of decreasing preference:

1. Parcel 56 and Via Venetia: these two locations are preferred for the restoration. The Parcel 56 location requires consideration of the MDR sea wall, underground utilities, and navigation constraints and associated potential impacts. The Via Venetia location would require reconfiguration of the Alternative 4 habitats, but may avoid or reduce the MDR sea wall and navigation constraints. Consideration of the constraints of (and potential impacts to) underground utilities and the proposed redevelopment at Via Venetia would be required. It is likely that the Alternative 4 restored habitats in Area A could be reconfigured to achieve similar habitat acreages; however, further assessment would be required to compare the benefits and tradeoffs of the different habitat configurations.

- 2. Parcel 56 and Beaches & Harbors parking lot: these two locations are also preferred for the restoration, and require consideration of the MDR sea wall, underground utilities, and navigation constraints and associated potential impacts.
- 3. Via Venetia: this is the preferred location for a single culvert to avoid or reduce the MDR sea wall and navigation constraints, but this location would require reconfiguring the orientation of the Alternative 4 habitats as discussed above. Consideration of the constraints of (and potential impacts to) utilities and the proposed redevelopment would be required.
- 4. **Parcel 56**: this is the preferred location for a single culvert to provide circulation within the current configuration of Alternative 4 habitats. This location requires consideration of the MDR sea wall, utilities, and navigation constraints and associated potential impacts.
- 5. Beaches & Harbors parking lot: this location may reduce circulation somewhat compared to Parcel 56, and requires consideration of the above constraints and potential impacts.

Note the preference for two culvert connections to improve restoration function requires addressing the constraints in two locations. This would likely increase planning, design, and construction costs and complexity (as discussed in Section 3) relative to a single culvert location. Also note that the above preferences are for the purposes of the restoration, and do not fully account for the considerations and constraints discussed further below. The degree to which these locations reduce constraints, and preferences based on these constraints, will require further assessment and coordination.

3. CONSIDERATIONS AND CONSTRAINTS

3.1 HABITAT FUNCTION

The Feasibility Report (PWA and others 2008) includes a full discussion and comparison of habitat, hydrology, and water quality considerations for Alternative 4 and other alternatives. This section includes a brief summary and discussion of Alternative 4 habitat acreages, fish passage, and water quality.

Habitat acreages. Table 1 summarizes estimated habitat acreages for Alternative 4.

Habitat Type	Area A	Area B	Area C	Total
Subtidal wetland	26	0	0	26
Intertidal wetland ¹	59	208	2	268
Transition zone	21	28	5	53
Upland	30	101	59	191
Total	136	337	65	538

Table 1. Summary of Alternative 4 habitat acreages.

1 - Intertidal wetland acreages include intertidal mudflat, vegetated wetlands, and subtidal portions of channel networks through mudflat and vegetated wetlands.

Fish passage. Flow velocities through the culverts are expected to be about two to three times higher than flow velocities in natural tidal wetland channels. The culverts may also flow full

during certain stages of the tide, depending on the invert elevation and dimensions of the culverts. The high velocities and confined flow through the approximately 400-ft long culverts is expected to provide less desirable habitat conditions for fish and fish passage, compared to natural tidal channels. We recommend further assessment of fish habitat conditions by project biologists and the National Marine Fisheries Service (NMFS), including consideration of target species and habitat criteria.

Water quality. Per the Feasibility Report (PWA and others 2008), the oceanic water quality is generally better than in MDR or Ballona Creek. Water in MDR exceeds water quality objectives for bacteria indicators, metals and other constituents; however, the magnitude and frequency of these exceedances are lower in comparison to Ballona Creek. The main channel of MDR, where the new Alternative 4 culvert connections would intake water, has better water quality than the MDR back basins due to greater circulation, proximity to the ocean, and less direct input from urban runoff.

3.2 MARINA DEL REY SEA WALL

The MDR sea wall presents a constraint to the construction of new culverts in many of the potential locations. The sea wall constraint was reviewed in a previous memorandum (PWA 2010) and discussed with Beaches & Harbors and other LA County staff on June 23, 2010.

Based on our review of the select design documents from the LA County Department of Public Works provided by Beaches & Harbors (PWA 2010), we understand the following about the MDR sea wall:

- The original MDR sea wall consisted of a pile-supported bulkhead wall, with the wall • footing supported by battered (angled) wood piles spaced 3 ft on center.
- The MDR sea wall was refurbished according to the 1996 design by installing caisson "strongback" supports with tie anchors to the wall to provide additional support, with caisson spacing of approximately 13 to 22 ft. The caissons are not aligned with the wood piles.
- The elevation of the bottom of the wall footing is at approximately mean lower low • water.

In the June 23, 2010 meeting with Beaches & Harbors, their staff emphasized that the structural integrity of the sea wall system will need to be maintained and carefully considered in any potential culvert design and construction. It is apparent that culvert construction would require completely removing the sea wall at the culvert location and constructing a new structure, including the culverts and a rebuilt sea wall section. These requirements would likely complicate design and construction and increase construction costs.

Per the initial concept for intertidal culverts (PWA 2010), new culverts would be installed through the MDR sea wall at intertidal elevations by removing a section of sea wall and installing the culverts in a rebuilt sea wall section (Figure 8a and 8b). The top of the culverts would be in the middle of the wall, with the culverts extending through the sea wall. The bottom of the culverts would be below the bottom of the wall (below MLLW) to provide subtidal/low tide fish access. The sea wall and footing would need to be removed and rebuilt, and the wood piles would need to be removed or cut to open up space for the culverts. The culverts would be pile supported and the rebuilt sea wall section would be supported by these pile supports (e.g., the wall could sit on top of the culverts). The caissons would either be removed/cut, or framed into the culverts.

The new structure would extend beyond the sides of the culverts (along shore, beneath, and above) in order to transition structurally from the new culvert to the existing seawall and control the potential for scour and soil piping. The alongshore length of the transition sections has not been determined; however, the design criteria would likely include limited differential settlement, dynamics associated with seismic (earthquake) loadings, and prevention of backfill loss due to piping at joints. The design and construction will require careful attention and will include a costpremium beyond that typically associated with culvert construction.

Issues of liability for the project partners associated with construction of a new sea wall that serves to protect the development in MDR are potentially very significant, especially in light of projected sea level rise. However, these issues are beyond the scope of this document.

New culverts at Via Venetia would be located just beyond the sea wall terminus, where the MDR embankment is a rock revetment (Figure 6). This location would avoid the sea wall constraint, but would also require reconfiguring Alternative 4 habitats to be consistent with this culvert location.

3.3 EXISTING FIJI WAY UTILITIES

There are multiple underground utilities running under Fiji Way, which constrain new culvert construction. We reviewed utilities shown in as-built construction drawings gathered from LA County and provided by the Santa Monica Bay Restoration Commission. Table 2 below summarizes existing utilities at each of the possible culvert locations (see Section 2.2) from our review of the documents provided. Elevations for the 8 to 10-in sanitary sewer line and the 12-in water line (LA County Waterworks) were available from the information reviewed for this memo. Elevations were not available for other utilities to assess potential conflicts with culvert construction, and the potential impact of the culverts on the other utilities is therefore not known at this time. Note that additional utilities may be present in Fiji Way and this summary should not be used for construction purposes or any purpose other than the assessment provided in this memorandum. Many of these utilities have easement rights that would have to be renegotiated in order to install the proposed culverts.

Culvert construction would require excavation of a trench from MDR to Area A. The minimum dimensions of the trench (corresponding to the culvert dimensions) would be approximately: 400 ft long, 18 ft to 22 ft deep, and 60 ft wide (or two 30-ft wide trenches in two locations). Each utility would need to be avoided or reconfigured. Given the number of existing utilities, it is unlikely that all utilities could be avoided during culvert construction. Some or all utilities would need to be rerouted during construction. Further assessment and coordination with utility agencies is required to identify which utilities (if any) could be avoided during constructing by boring the culverts underneath the utilities. This constraint is likely to complicate design and construction and increase construction costs.

The gravity sanitary sewer line may be the most problematic utility because the slope of the pipes must be maintained to function properly. The sanitary sewer elevation ranges from about 10.5 ft NAVD at Via Venetia, 7.5 ft NAVD at the Beaches & Harbors parking lot, 6.5 ft NAVD at Parcel 56, to 3.5 ft NAVD at Basin H. As discussed in Section 2.1, the culvert bottom and top elevations would be within the range of approximately -4 ft NAVD to +6 NAVD, respectively. The sewer line is therefore within the range of culvert elevations and/or the likely range of construction work. The sewer line would likely need to be temporarily relocated during construction. It may be possible to replace the sewer line above the culverts (except at Basin H). If this is not possible, a section of the sewer line may need to be raised and a pump may need to be installed for lift.

Conflicts with the sanitary sewer line may therefore require a redesign of the sewer line (e.g. new locations, addition of pumps and installation of pressure pipe) well beyond the limits of the culvert. Modifications to the sewer line would require agreement with and approval by the LA County sewer district. Any operation and maintenance costs to the project for any sewer pump would need to be determined. Note that the existing depth of cover above the sewer line is approximately 5 to 9 ft¹ (and deeper at Basin H). Any decrease in the depth of cover would need to be approved by the sewer district.

The water line elevation ranges from about 10.5 ft NAVD to 14.5 ft NAVD. The water line may need to be temporarily relocated during construction, but could likely be replaced above the culverts. The depth of cover of the water line would not likely change.

In summary, the existing utilities pose a substantial constraint to culvert design and construction. Conceptually, the culverts would run across and through the utility corridors, and the extent of required modifications is expected to substantial. The challenges increase project complexity, uncertainties, the need for easements and agreements with multiple entities, and both construction and long-term maintenance costs (see below for further discussion).

¹ Note that the Fiji Way existing grade ranges from about 13 ft NAVD to 16.5 ft NAVD at the culvert locations identified in this memo.

Location	Owner	Description	Elevation (ft NAVD)	Source
Parcel 56	LA County Waterworks	12"A.C. Pipe 2.5' E.W.	11.5' +/-	LA Co. DR-28
	LA County Waterworks	4"	NA	LA Co. DR-28
	Theta Cable	3" Conduit 4.5' E.W.	NA	LA Co. DR-28
		48"x19" Vault	NA	LA Co. DR-28
		2" Vault Drain	NA	LA Co. DR-28
	Southern Counties Gas Company of	4" 5' E.W.	NA	LA Co. DR-28
	California			
	Southern CA Edison	DU.29'W.E.	NA	LA Co. DR-28
	S. Cal Ed or Gen Tel.	Marina 7-Ducts- 35.75' W.E.	NA	LA Co. DR-28
		8'x22' Vault	NA	LA Co. DR-28
	Gen Tel	3-TR.D 32'W.E.	NA	LA Co. DR-28
		4'x7' M.H.	NA	LA Co. DR-28
	Sanitary Sewer	8" V.C.P.	6.5' +/-	J.N. 8910.76 Page 37
Beaches & Harbors Parking Lot	S. Co. Gas Company	4" G.0.5'E.W.	NA	LA Co. DR-28
	LA County Waterworks	12"A.C. Pipe 2.5' E.W.	14.5' +/-	LA Co. DR-28
	Theta Cable	3" Conduit 4.5' E.W.	NA	LA Co. DR-28
	S. CA Edison	DU.28'W.E.	NA	LA Co. DR-28
	S. CA Ed or Gen Tel.	Marina 7-Ducts- 35.75' W.E.	NA	LA Co. DR-28
	O.R. light-	C.C.41160	NA	LA Co. DR-28
	Sanitary Sewer	8" V.C.P.	7.5'+/-	J.N. 8910.76 Page 37

Table 2. Summary of existing Fiji Way utilities.

Notes: NA = Not available

A.C. pipes = Asbestos Cement Pipe A.C. = Asphaltic Concrete M.H. = Man Hole V.C.P. = Vitrified Clay Pipe E.W./W.E. = east-west/west-east R.C. = Reinforced concrete C.I.P. = Cast Iron Pipe

Location	Owner	Description	Elevation (ft NAVD)	Source	
Via Venetia	O.R. Light	C.C. 41160	NA	LA Co. DR-28	
	L.A. Co.	10".11'E.W.	10.5' +/-	LA Co. DR-28	
	Waterworks	8". 8'E.W.	NA	LA Co. DR-28	
	S. Co. Gas	4" Condensate	NA	LA Co. DR-28	
	Company	Line			
	of	6"	NA	LA Co. DR-28	
	California	6"	NA	LA Co. DR-28	
		6" (Oil)	NA	LA Co. DR-28	
	S.CA	2"	NA	LA Co. DR-28	
	Edison	DU. 4.5' W.E.	NA	LA Co. DR-28	
		4-Ducts- 35.75'W.E.	NA	LA Co. DR-28	
	18" RCP	C.C. 41160	NA	LA Co. DR-28	
	S.CA Ed or Gen. Tel.	Marina 7-Ducts- 20' +/- E.W.	NA	LA Co. DR-28	
	Gen. Tel.	Marina 4'x7' M.H.	NA	LA Co. DR-28	
		3-TR.D 32'W.E.	NA	LA Co. DR-28	
	Sanitary Sewer	8" V.C.P.	10.5' +/-	J.N. 8910.76 Page 37	
Basin H	General Telephone	Marina 4'x7' M.H.	NA	LA Co. DR-21	
		3-TR.D32'N.S.	NA	LA Co. DR-21	
	S. CA	DU.39'S.N.	NA	LA Co. DR-21	
	Edison	Marina 8'x18' Vault	NA	LA Co. DR-21	
		2" Vault Drain	NA	LA Co. DR-21	
		4-Ducts- 35.75'N.S.	NA	LA Co. DR-21	
	Drainage Culvert	7.25'x8.5' R.C. Box Culvert	NA	LA Co. DR-21	
		20' Storm Drain Easement	NA	LA Co. DR-21	
	Theta Cable	3" Conduit	NA	LA Co. DR-21	
	S. Co. Gas	4" Line	NA	LA Co. DR-21	
	Sanitary Sewer	10" C.I.P.	3.5' +/-	J.N. 8910.76 Page 35	
	Water	12" A.C.Pipe	10.5' +/-	LA Co. DR-21	

Table 2 (continued). Summary of existing Fiji Way utilities.

See notes on preceding page.

3.4 NAVIGATION AND PUBLIC SAFETY

Flows through new culverts have the potential to affect navigation in MDR. Previous modeling of Alternative 4 (PWA and others 2008) indicates that peak velocities through the culverts may be on the order of 4 to 10 feet per second (ft/s). Culvert flows are expected to affect velocities within an area around the culverts. Velocities and turbulence in this area may be greater than is desirable for small craft navigation and docking, and it is possible that the area affected by culvert flows would not be suitable for small craft navigation or docking.

For new culverts located at Parcel 56, the Beaches & Harbors parking lot, and Via Venetia, the culvert flows may likely affect small craft navigation and docking in the marina near the culvert outlet. Small craft docking in front of the culverts may therefore not be possible. This would be considered a significant impact by Beaches & Harbors. Existing docks are located at Parcel 56 and the Beaches & Harbors parking lot, and the Coast Guard Station is located adjacent to Via Venetia. New docks are planned at Parcel 56 (i.e., docks for transient public boat operations, fueling, and rental) and at Via Venetia. New culvert design and construction would need to consider existing and planned docks and navigation affects, and may require that the area affected by the culvert flows have no docks or limited navigation. Fenders and signage could be used to prevent navigation in high velocity and turbulent areas. Flow deflectors could possibly be used to partially offset the affect of culvert flows; however, doing so may also reduce culvert flows and require additional culverts, which would create a larger impact to the MDR sea wall and Fiji Way utilities.

In the main MDR channel, far away from the area affected by the culvert flows, the previous modeling indicates that tidal flows to Area A would not significantly increase average velocities or affect navigation in the main channel.

The culvert design would also need to consider potential public safety risks to kayaks, swimmers, etc. A floating boom or other measures may be required to reduce the risk of swimmers and boaters from coming to close to the culverts and the zone of high velocity and turbulence.

Additional modeling and assessment of potential navigation and public safety affects may be required for planning and design.

3.5 MAINTENANCE REQUIREMENTS

The culverts would require periodic maintenance, including cleaning/clearing sedimentation or biofouling, removing any blockages, and periodically removing trash buildup from any trash racks. Further design is required to identify features to facilitate culvert inspection, maintenance and renovation. We anticipate that the culvert structure(s) would consist of multiple culverts (boxes or pipes), and that individual culverts could be closed (e.g., with stop logs or gates to block flow) for maintenance. This would allow access to manholes and work during all tide ranges while maintaining flow in other (open) culverts. Additional culvert capacity would be needed to allow maintenance while maintaining tidal exchange.

The design life of the culverts (e.g., concrete box culverts or similar) would be limited to about 50 years. The culverts would therefore likely need to be renovated within 50 years time. Culverts would likely need to be constructed in areas that would allow construction access and excavation above the culvert for future renovation. The culverts are therefore not consistent with locations where buildings are located or planned. Parcel 56/Parcel W, which is planned as a promenade,

and the parking lot and turnaround at Via Venetia may allow for future construction; however, future maintenance plans would need to be coordinated with the Fisherman's Village and Via Venetia redevelopment plans. The Beaches & Harbor parking lot would also allow for future construction. In all locations, culverts would likely preclude placing any building on top of the culverts in the future, and may therefore be considered a significant impact by Beaches & Harbors. Future culvert renovation and associated construction activities would need to address the utility constraints described above.

In summary, the maintenance requirements for the culverts are such that the site constraints should be considered as ongoing/future constraints, in addition to initial construction constraints.

3.6 SEA-LEVEL RISE

The culverts would become increasingly submerged with future projected sea-level rise. The culverts may function more as siphons as sea level rises (i.e., the culverts would be below the tide levels for a greater portion of the tide cycle), which may be less desirable for fish access. For example, 10-ft by 10-ft box culverts with bottom and top elevations that are 4 ft below MLLW and 1 ft above MHHW, respectively, would be 8.5 ft below MLLW and 3.5 ft below MHHW with 4.5 ft of sea-level rise (projected for 2100). The culverts would be submerged and function as siphons for tide levels above about mean tide level (i.e., about half the time).

This affect could be partially offset by constructing taller culverts; however, as discussed in Section 3.3, the sewer line (as well as the water line and possibly other utilities) would be close to the elevation of the top of the culverts. Increasing the height of the culverts would require sewer line modifications and a lift pump at the Parcel 56 and Beaches & Harbors parking lot locations (and also possibly at the Via Venetia location). If sewer line modifications and pumps are required in either case (shorter or taller culverts), then constructing taller culverts may be preferable to accommodate sea level-rise. Taller culverts would increase initial construction costs, as would any additional utility modifications that may be required for taller culverts.

Note that reviewing any MDR sea-level rise vulnerability assessment or adaptation plan is not within the scope of this memorandum. The project partners would need to further investigate any liability issues associated with reconstruction of the MDR sea wall as related to future flooding of development due to sea level rise.

3.7 LIKELY CONSTRUCTION COSTS

As discussed above, the MDR sea wall and Fiji Way utilities constraints are expected to increase likely culvert construction costs. The Feasibility Report (PWA and others 2008) estimated Alternative 4 Area A culvert construction costs of approximately \$7.5 million (\$5.1 million plus 8% for mobilization and a 35% contingency). The sea wall and utility constraints are expected to increase constructions costs estimates. The increased construction costs could exceed \$7.5 million. (Note that the total contingency included for Alternative 4 was \$40 million). A more detailed evaluation of one or more alternative culvert locations would be required to estimate the increased construction costs. Any property and easement costs, including property boundary surveys and other planning and design costs should be estimated. Maintenance costs should also be considered. The revised total construction cost estimate for Alternative 4 (including contingency) is expected to be higher than previously estimated.

Given the extensive development along Fiji Way, special actions to avoid impacts to adjacent structures would likely be required. In addition to shoring of excavation limits, documentation of pre-construction and post construction conditions would probably be necessary. A geotechnical analysis would be necessary to detail the criteria.

3.8 AGREEMENTS AND EASEMENTS

New culvert construction at Fiji Way will require agreements and easements with LA County Department of Beaches & Harbors, as the land owners/managers of MDR. In addition, the project partners would need to negotiate access rights in accordance with the existing utility easements. Utility modifications will require a range of agreements, design reviews and easements. Further assessment and coordination with both Beaches & Harbors and the multiple utility agencies would be required to determine whether these entities would be willing to allow this use of their property.

4. CONCLUSIONS AND DISCUSSION

Based on this preliminary review of considerations and constraints, new culvert construction from MDR to Area A under Fiji Way for Alternative 4 is significantly constrained by potential impacts to the MDR sea wall, underground utilities, and navigation. These constraints are likely to complicate planning, design and construction and increase construction costs and timelines, as well as long-term maintenance costs. The work would require negotiating agreements and easements with LA County/Beaches & Harbors and utility service providers. The uncertainties around these constraints, agreements, and easements would need to be resolved through further assessment and coordination with Beaches & Harbors, LA County, and utility agencies to fully evaluate the feasibility of installing the new culverts. Future maintenance and refurbishment of the culverts would be required, the constraints should be considered as long-term ongoing constraints in addition to the construction constraints.

In comparison to Alternative 4, Alternative 5 (Figure 9) avoids these culvert constraints and uncertainties by connecting Area A to Ballona Creek. Alternative 5 is ranked as the highest alternative (above Alternative 4) in the Feasibility Report (PWA and others 2010). Given that connecting Area A to Ballona Creek avoids the culvert constraints and is preferred in terms of habitat connectivity, circulation, and other benefits of Alternative 5discussed in the Feasibility Report, variations of Alternative 5 that incorporate other elements of Alternative 4 may be preferable to Alternative 4. For example, variations of Alternative 5 that include additional subtidal habitat and/or maintain the existing alignment of Ballona Creek (as opposed to realigning the channel as shown in Figure 9) may be preferable to Alternative 5 (with Area A Management Team consider pursuing these or other variations of Alternative 5 (with Area A connected to Ballona Creek) as project alternatives in place of Alternative 4 (and MDR culvert connections to Area A).

5. REFERENCES

PWA, 2010. Ballona Wetlands Restoration, Proposed culverts from Ballona Wetlands Area A to Marina Del Rey (MDR) and MDR sea wall constraints. May 3, 2010 memorandum from Nick Garrity to Mary Small.

PWA (Philip Williams & Associates), Santa Monica Bay Restoration Commission, and Nordby Biological Consulting. Ballona Wetlands Restoration, 2010. Preferred Alternatives Memorandum. Prepared for the California State Coastal Conservancy. January 15. PWA Project #1793.

PWA (Philip Williams & Associates), EDAW, Nordby Biological Consulting, Tierra Environmental, and Weston Solutions, 2008. Ballona Wetlands Feasibility Report. Prepared for the California State Coastal Conservancy. PWA Project #1793. Ballona Wetlands Feasibility Report (PWA and others 2008)

6. FIGURES

Figure 1. Habitat Restoration Alternative 4

- Figure 2. Alternative 4 Conceptual Cross-Sections
- Figure 3. Potential Culvert Locations

Figure 4. Parcel 56 Potential Culvert Location

Figure 5. Beaches & Harbors Parking Lot Potential Culvert Location

Figure 6. Via Venetia Potential Culvert Location

Figure 7. Existing Basin H/Fiji Ditch Culvert Location

Figure 8a. Intertidal Culver Concept – Plan & Profile

Figure 8b. Intertidal Culver Concept - Section

Figure 9. Proposed Restoration Plan – Habitat Restoration and Public Access (Alternative 5)

Ballona Wetlands **Restoration Project**

Habitat Restoration Alternative



figure 1



ALTERNATIVE 4 CROSS-SECTION 1



NOTE: EXISTING AND CONCEPTUAL RESTORED GRADES

CROSS-SECTION LOCATION



Figure 3
Potential Culvert Locations





Figure 4
Parcel 56 Potential Culvert Location





Figure 5

Beaches & Harbors Parking Lot Potential Culvert Location





Figure 6
Via Venetia Potential Culvert Location





Figure 7 Existing Basin H/Fiji Ditch Culvert Location







Ballona Wetlands **Restoration Project**

Proposed Restoration Plan - Habitat Restoration and Public Access



Figure 9