APPENDIX I
PALEONTOLOGICAL RESOURCES TECHNICAL REPORT

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Paleontological Resources Technical Report

L101 Storm Drain Improvement
North Coast Highway 101 Streetscape Improvement Project
Encinitas, California

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Introduction & Project Description

This report provides a summary of findings concerning the paleontological resource potential of the corridor crossed by the proposed L101 Storm Drain Improvement portion of the North Coast Highway 101 Streetscape Improvement Project, Encinitas, California. The proposed improvements would enhance the existing storm drain system in this area by providing additional storage capacity during storm events, thereby reducing the frequency of existing flooding events within the project corridor.

The proposed storm drain pipe would be installed within the corridor along North Coast Highway 101 between Basil Street (approximate southern extent) and La Costa Avenue (approximate northern extent). The project description is as follows (provided by Michael Baker International):

> *This storm drain system would be designed to convey runoff from the project's drainage area west of the NCTD Railroad tracks, north of Basil Street, and south of La Costa Avenue. The total tributary drainage area is approximately 200 acres. Stormwater flows would continue to be discharged north towards existing facilities located near the Batiquitos Lagoon. The proposed storm drain pipe would join three existing outfalls in this area: a 24-inch and an 18-inch outlet at the basin west of North Coast Highway; and a 24-inch outlet east of North Coast Highway. A junction box (splitter structure) would be designed to convey flows from the main storm drain system into these three outfalls. No construction is proposed at these three outfalls.*
>
> *Overall, the revised drainage system is estimated to consist of the following size conduits:*
>
> - *300 linear feet of 36-inch diameter pipe (trenchwork varying in depth 15 to 20-feet)*
> - *200 linear feet of 42-inch diameter pipe (trenchwork varying in depth 10 to 15-feet)*
> - *1,500 linear feet of 48-inch diameter pipe (trenchwork varying in depth 10 to 15-feet)*
> - *6,300 linear feet of 60-inch diameter pipe (trenchwork varying in depth 15 to 30-feet)*
>
> *Construction of this system would include some trenching utilizing a trench box. This construction method of these size and depth of pipes produce a construction footprint ranging between 10 and 30 feet in width.*

Paleontological Resources

As defined here, paleontological resources (i.e., fossils) are the remains and/or traces of prehistoric plant and animal life. Fossil remains such as bones, teeth, shells, and leaves are found in the geologic deposits (rock formations) within which they were originally buried. For the purposes of this report, paleontological resources can be thought of as including not only the actual fossil remains, but also the collecting localities and the geologic formations containing those localities.

It is important to point out that many fossil collection sites presently on record in San Diego County were discovered during paleontological monitoring of residential development construction projects, highway and freeway construction projects, and pipeline and other utility construction projects. This close correlation between fossil collection sites and construction is related to the fact that surface weathering quickly destroys most fossils, and it is not until fresh, unweathered exposures are generated by construction-related earthwork that well-preserved fossils are often recovered. In general, larger volumes of earthwork typically generate more extensive previously unweathered exposures, and are therefore more likely to uncover fossil rich stratigraphic horizons.

Methods

Because of the direct relationship between fossils and the geologic units within which they are entombed, knowing the geology of a particular area and the fossil productivity of particular geologic units, one can reasonably predict where fossils will (or will not) be encountered. Paleontological resource assessment of the project corridor is based upon a review of existing published and unpublished geological literature (Wilson, 1972; Kennedy and Tan, 2005) and a review of museum paleontological records (San Diego Natural History Museum).

Results

The project corridor is underlain by a layer cake series of geologic units (Figure 1) including, from top to bottom and youngest to oldest, Pleistocene-age (approximately 220,000 to 85,000 years old) old paralic deposits (Qop, Kennedy and Tan, 2005) (broadly equivalent to the Bay Point Formation) and Eocene-age (approximately 46 to 40 million years old) strata of the Santiago Formation (Tsa, Kennedy and Tan, 2005). Although the contact between these two geologic units in the subsurface is not precisely known, based on exposures of this contact in the sea cliffs at Beacon's Beach, it is estimated that the contact lies closer to 28' above sea level (asl), or approximately 30' below the existing ground surface near the intersection of Leucadia Boulevard and Coast Highway 101.

The Bay Point Formation is known to preserve fossils of marine invertebrates (clams, snails, crustaceans, and echinoderms) and marine vertebrates (sharks, rays, and bony fishes), but has also yielded fossils of Ice Age land mammals (rodents, dire wolf, horses, tapirs, camels, deer, bison, mastodon, mammoth, and ground sloths) (Deméré, 1980; Deméré and Walsh, 1993). Based on this proven fossil record, the Bay Point Formation is typically assigned a moderate to high paleontological sensitivity.

In Leucadia, as exposed in the sea cliffs, the Bay Point Formation is represented by up to 75 feet of friable to compact sandstones, while along the North Coast Highway 101 corridor it is probably between 20 and 30 feet thick. The difference in thickness is due to the occurrence of a linear "beach ridge" that lies west of the highway and has been breached by modern sea cliff erosion (Eisenberg, 1985). At Beacon's Beach, this beach ridge sequence can be subdivided into four informal units, including, from bottom to top, a 7 foot thick basal marine unit, a 8 foot thick lower B-lamination unit, a 15 foot thick paleo-dune sand unit, and a 45-foot thick upper B-lamination unit. The contact with the underlying Eocene-age Santiago Formation here occurs at approximately 24 feet above sea level. This contact represents an elevated marine abrasion platform (sea floor) that was eroded into the Santiago Formation during a Pleistocene interglacial high sea stand.

The Santiago Formation is known to preserve fossils of marine invertebrates (corals, bryozoans, clams, snails, crustaceans, and echinoderms) and marine vertebrates (sharks, rays, and bony fishes), as well as fossils of early turtles, snakes, lizards, crocodiles, birds, and land mammals (opossums, hedgehogs, bats, primates, rodents, early carnivorans, tapirs, brontotheres, protoreodonts, and leptoreodonts) (Deméré and Boettcher, 1985; Golz, 1976; Irwin, 1985; Walsh, 1996). Based on this proven fossil record, the Santiago Formation is typically assigned a high paleontological sensitivity.

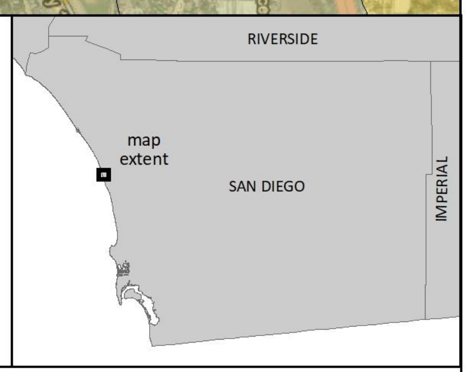
In Leucadia, as exposed in the sea cliffs, the Santiago Formation is represented by approximately 25 feet of interbedded dark olive gray laminated mudstones, massive siltstones, and very fine-grained sandstones (Irwin, 1985). Deméré and Boettcher (1985) and Irwin (1985) reported the occurrence of well-preserved marine mollusks and sharks from these exposures (Figure 1; SDSNH Localities 2815, 2816 2961, 3266).

Geologic Map Units

- Qmb — marine beach deposits (late Holocene)
- Qya — young alluvial flood plain deposits (late Pleistocene to Holocene)
- Qls — landslide deposits (Pleistocene and Holocene)
- Qop — old paralic deposits (middle to late Pleistocene)
- Qop2-6 — old paralic deposits, Units 2-6 (middle to late Pleistocene)
- Qvop — very old paralic deposits (early to middle Pleistocene)
- Tsa — Santiago Formation (middle Eocene)

Geologic Map Symbols

- contact, certain
- fault, certain
- Project limits of work
- SDSNH fossil localities, existing



PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

FIGURE 1

Geologic Map of Project Alignment
North Coast Highway 101 Streetscape
Storm Drain Improvement
City of Encinitas, San Diego County, California

0 0.5
scale in miles

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Analysis

Paleontological resources (fossils) are the remains of prehistoric animal and plant life, and are considered to be nonrenewable. Adverse effects to paleontological resources occur when earthwork activities, such as mass grading and/or trenching, cut into the geologic units within which fossils are buried. These direct effects are in the form of physical destruction of fossil remains and the loss of original stratigraphic context.

Tentative plans for the proposed storm drain improvement project indicate that trenching for pipeline installation will vary in depth for the invert level of the pipe from approximately 31’ to 14’ below existing ground surface. In addition, proposed IE levels along the pipeline decrease in elevation from approximately 52’ asl in the south to approximately 27’ asl in the north (NAVD; J. Tyler, personal communication, 2020).

As described above, proposed pipe diameters will vary from 36” to 60”, with the larger diameter pipe proposed for installation along the northern 6,300 linear feet of the pipeline. These proposed installation depths and pipe diameters indicate that trenching for the pipeline will be extensive and could adversely affect deposits of the Bay Point Formation along the entire pipeline alignment. In addition, in the northern portion of the alignment where trenching will extend below approximately 30’ asl, it is possible that trenching could adversely affect deposits of the underlying Santiago Formation.

However, the Resource Management Element of the Encinitas General Plan provides goals and policies for the preservation of cultural resources in the City. Goal 7 requires the City to make every effort to ensure significant scientific and cultural resources are preserved for future generations. Policy 7.1 “[r]equire[s] that paleontological, historical and archaeological resources in the planning area are documented, preserved or salvaged if threatened by new development.” Consistent with Policy 7.1, the proposed drainage improvement plans include the following standard monitoring and recovery measures that will minimize potential effects to paleontological resources:

> [1] Prior to initiation of construction activities, the project contractor shall retain a qualified paleontologist to carry out the monitoring program outlined here. A qualified paleontologist is defined as an individual with an M.S. or Ph.D. in paleontology or geology who is experienced in paleontological procedures and techniques.
>
> [2] The qualified paleontologist shall be at the pre-construction meeting to consult with the excavation contractor and City staff.
>
> [3] A paleontological monitor shall be onsite during the original cutting of previously undisturbed deposits of moderate and high sensitivity geologic units (the Bay Point Formation and Santiago Formation) to inspect exposures for any contained fossils. A paleontological monitor is defined as an individual who has documented experience in the collection and salvage of fossil materials. The paleontological monitor shall work under the direction of a qualified paleontologist. An adaptive approach is recommended, which involves initial part-time paleontological monitoring (i.e., up to 4 hours per day). As the project proceeds, the qualified paleontologist shall evaluate the monitoring results and, in consultation with the City and subject to the City’s consent, may revise the monitoring schedule (e.g., maintain part-time monitoring, increase to full-time monitoring, or cease all monitoring).
>
> [4] When fossils are discovered, the qualified paleontologist (or paleontological monitor) shall recover them. In most cases, this fossil salvage can be completed in a short period of time. However, some fossil specimens (such as a complete skeleton) may require an extended salvage period. In these instances, the qualified paleontologist (or paleontological monitor) shall be

allowed to temporarily direct, divert, or halt grading/trenching to allow recovery of fossil remains in a timely manner. Because of the potential for the recovery of small fossil remains, such as rodent and primate teeth, it may be necessary to set up a screen-washing operation at the site.

[5] Fossil remains collected during the monitoring and salvage portion of the monitoring program shall be cleaned, repaired, sorted, and cataloged by the qualified paleontologist.

[6] Subject to the approval of the City, the qualified paleontologist shall donate and/or deposit prepared fossils, along with copies of all pertinent field notes, photos, and maps, in a scientific institution with permanent paleontological collections, such as the San Diego Natural History Museum. Donation of the fossils shall be accompanied by appropriate financial support from the City to accommodate initial specimen storage.

[7] The qualified paleontologist shall prepare and submit to the City a final paleontological monitoring report that outlines the results of the monitoring program. This report shall include discussions of the methods used, stratigraphic section(s) exposed, any fossils collected, and significance of any recovered fossils.

Conclusion

Implementation of the foregoing monitoring program pursuant to Policy 7.1 would avoid adverse effects on paleontological resources.

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