Drainage Study
CARDENAS RESIDENCE

LOT 2, MAP NO. 2615
APN 346-050-02-00

Prepared for:
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Introduction

This project involves the demolition of the existing residence on Lot 2 of Map 2615 at 8466 El Paseo Grande (except for the existing deck and drainage improvements, including sump pump) and construction of a new residence and improvements.

The attached drainage area maps are from a topographic survey by K & S Engineering, Inc, prepared in December 2003. A small offsite area conveys runoff onsite while a small onsite area conveys runoff offsite. The majority of the site conveys runoff to the deck and landscaped area where it is collected and conveyed to an existing sump pump. From there it is pumped in a PCV pipe along the southerly boundary to an area near the easterly boundary where it terminates, above ground, and permits runoff to flow over the surface of the ground to El Paseo Grande. The remainder of the site conveys its runoff westerly. Following construction the same general pattern will persist with the offsite runoff now be maintained on the adjacent property northerly, The small area of onsite runoff that was previously conveyed to the southerly property will now be collected and conveyed to the existing sump pump. From there it will now be conveyed to a Filterra Biofiltration unit and then to catch basin with pump and to a gravity catch basin onsite and from there it will flow by gravity through a sidewalk underdrain to El Paseo Grande. The remainder of the site will continue to flow westerly.

The area of imperviousness remains nearly the same (6,019 sf pre-construction, 6,458 post-construction) before and after construction. The imperviousness changes from 50.7 % to 54.4%. A runoff coefficient of 0.63 was selected from the County of San Diego Hydrology Manual, Page 3-6 for 50% imperviousness and Soil Type "D".

Since the project is a priority project due to being located in a Water Quality Sensitive Area.

The Rational Method was used to calculate the anticipated flow for the 100-year storm return frequency event using the method outlined in the City of San Diego Drainage Design Manual.

Antony K. Christensen
RCE 54021 Exp. 12-31-17

06-10-16
Date

JN A2015-38

Calculations

1. *Intensity Calculation*

(From the City of San Diego Drainage Design Manual, Page 86)
Tc = Time of concentration

$Tc = (1.8\ (1.1-C)D^{1/2})/S^{1/3}$

Since the difference in elevation is 12' (26'-14') and the distance traveled is 158', S=7.6%. C = 0.63
Tc = 5.4 minutes.

From table on Page 83

I_{100} = 4.3 inches

2. *Coefficient Determination*

Pre-Construction and Post-Construction:

From Page 3-6 from the County Hydrology Manual with 50% imperviousness and Soil Type "D"

C= 0.63

Percent imperiousness
Pre Construction = 50.7%
Post-Construction = 54.4%

3. *Volume calculations*

Q = CIA

Areas of Drainage

The area of this study is set to the same location occupied by the proposed improvements because the rest of the area will remain unchanged and will not affect runoff. Runoff from the area

northerly of the site, conveyed to it by the 18" and 36" drain will not change.

Pre-Construction

Area offsite draining onsite	A = 0.004 Ac
Area onsite draining offsite southerly	B = 0.005 Ac
Area onsite draining to sump	C = 0.183 Ac
Area onsite draining westerly	D = 0.085 Ac

Post-Construction

Area onsite draining to sump	E = 0.188 Ac
Area onsite draining westerly	D = 0.085 Ac

Pre-Construction

Q_{100A} = (0.63) (4.3) (0.004)
Q_{100B} = (0.63) (4.3) (0.005)
Q_{100C} = (0.63) (4.3) (0.183)
Q_{100D} = (0.63) (4.3) (0.085)

Q_{100A} = 0.01 cfs
Q_{100B} = 0.01 cfs
Q_{100C} = 0.50 cfs
Q_{100D} = 0.23 cfs

Post-Construction

Q_{100E} = (0.63) (4.3) (0.188)
Q_{100D} = (0.63) (4.3) (0.085)

Q_{100E} = 0.51 cfs
Q_{100D} = 0.23 cfs

Water Quality Flow Rate

For Proprietary BMPs for treating impervious surface runoff flow rate use I = 0.2 in/hr and multiply Q by 1.5 to arrive at the flow rate to be treated.

$Q = C*I*A*(1.5)$

$Q_{WQX} = (0.63)\ (0.2)\ (0.188)\ (1.5)$

$Q_{WQX} = .036$ cfs

The 6 x4 Filterra unit is capable of conveying 0.055 cfs and so is adequate. The 4 x 4 unit is capable of conveying 0.037 cfs but the 6 x 4 unit is selected for this project to provide a factor of safety to treatment.

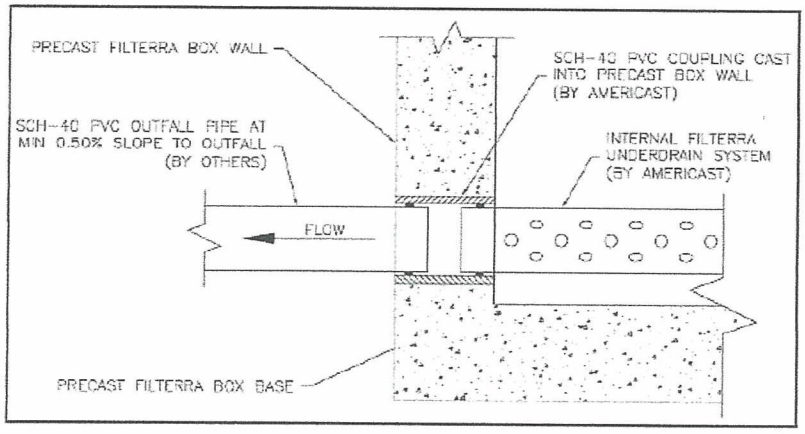
4. Discussion

Some offsite runoff that flows onto the site before construction will be retained on the neighboring property, from which it originates, following construction. A portion of the site that flows offsite, before construction will be retained onsite, following construction. The total runoff that flows from the site to El Paseo Grande before and after construction will remain unchanged. The flow to the west will remain unchanged. Following construction, runoff that currently is pumped from the existing sump is discharged onto the surface of property at the southeast corner. Following construction that discharge will be directed to a Filterra Biofiltration unit and then to a catch basin with pump that will convey the treated runoff to a gravity catch basin, that will allow it to flow to a sidewalk underdrain and then onto El Paseo Grande.

APPENDIX

Filterra® Piping Technical Details

Filterra® is supplied with an internal underdrain system that exits a wall in a perpendicular direction. Most efficient drainage is accomplished when the drain exits on the lower side of the Filterra®, i.e. nearest the overflow bypass. This is more important when using the larger sized Filterra® Systems.



Drawing DP1:
Section View through Filterra Precast Box Wall at Outfall Pipe Connection

All units are supplied with the drainage pipe coupling precast into the wall, at a depth of 3.50 feet (INV to TC). Drawing DP1 is a detail of the coupling. The coupling used is SCH-40 PVC.

Typically, a minimum slope of 0.5% is adequate to accommodate the flow of treated water from the Filterra®, but each site may present unique conditions based on routing of the outfall pipe (elbows). The pipe must not be a restricting point for the successful operation of Filterra®. All connecting pipes must accommodate freefall flow. Table 3 lists approved treatment sizing flow rates of the various size Filterra® units. A safety factor of at least two should be used to size piping from the Filterra based on these conservative approved treatment flow rates.

Table 3: Filterra Flow Rates & Pipe Details

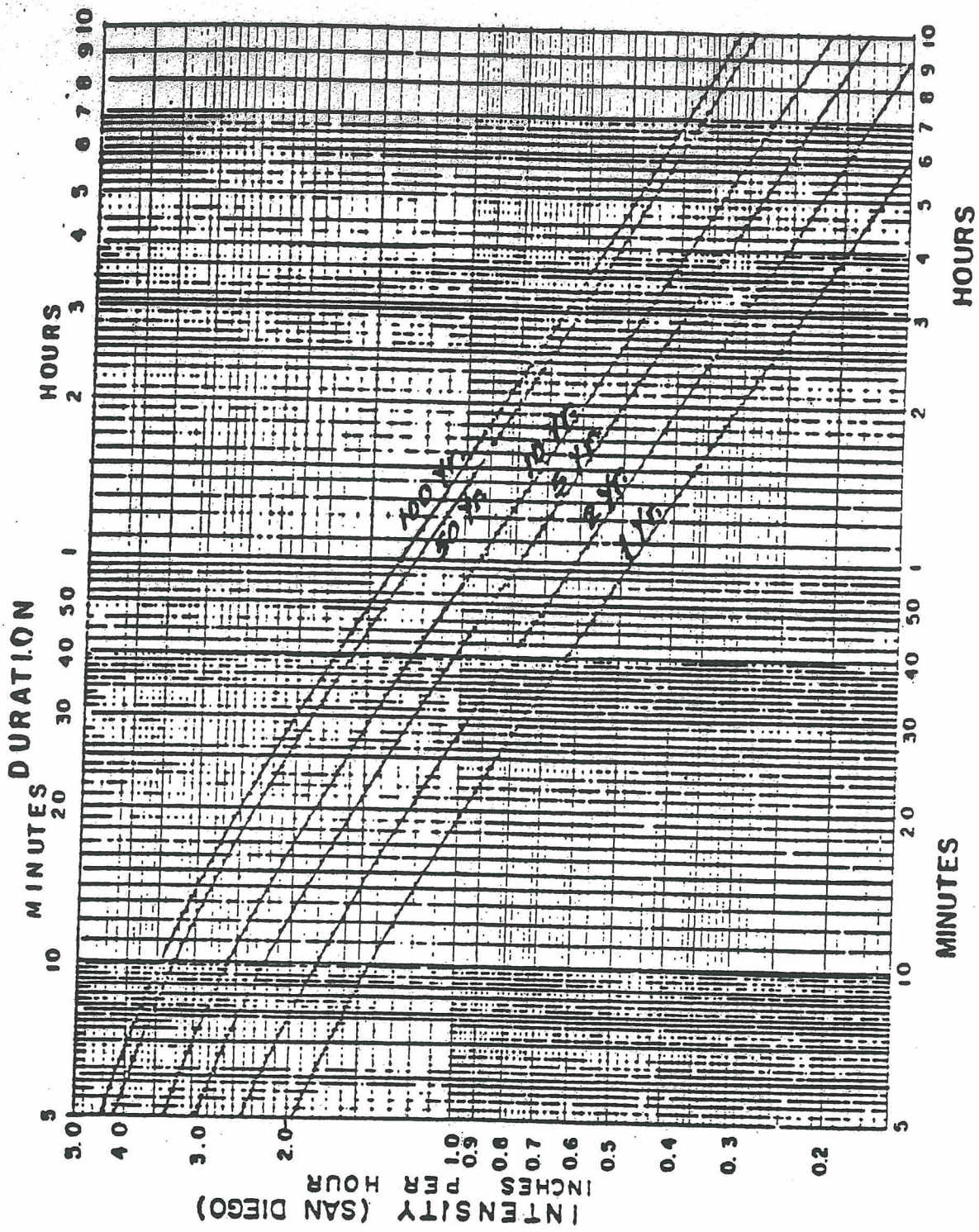
Important Note: Actual flow rate may be more than double rates below.

Filterra® Size (feet)	Expected Flow Rate (cubic feet/second)	Connecting Drainage Pipe
4x4	0.037	4" SCH-40 PVC
4 x 6 or 6 x 4	0.055	4" SCH-40 PVC
4x6.5 or 6.5x4	0.061	4" SCH-40 PVC
4 x 8 or 8 x 4	0.075	4" SCH-40 PVC
4x16 or 16x4	0.150	6" SCH-40 PVC
6 x 6	0.084	4" SCH-40 PVC
6 x 8 or 8 x 6	0.112	4" SCH-40 PVC
6 x 10 or 10 x 6	0.140	6" SCH-40 PVC
6 x 12 or 12 x 6	0.168	6" SCH-40 PVC
8x12 or 12x8	0.224	6" SCH-40 PVC
8x16 or 16x8	0.297	6" SCH-40 PVC
8x18 or 18x8	0.337	6" SCH-40 PVC
8x20 or 20x8	0.374	6" SCH-40 PVC

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



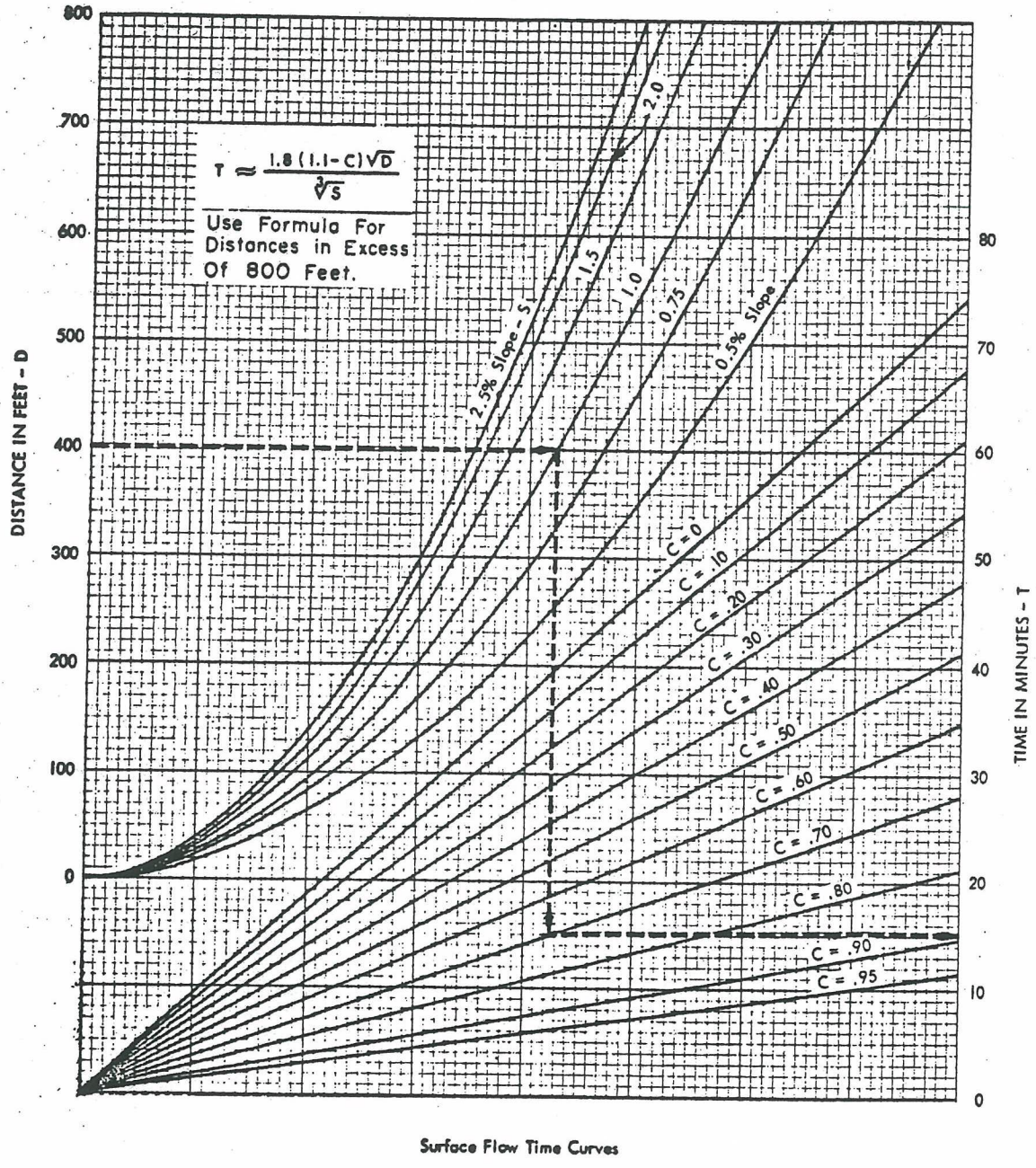
ELEV.	FACTOR
0–1500	1.00
1500–3000	1.23
3000–4000	1.42
4000–3000	1.60
3000–6000	1.70
DESERT	1.25

To obtain correct intensity, multiply intensity on chart by factor for design elevation.

RAINFALL
INTENSITY - DURATION - FREQUENCY
CURVES
for
COUNTY OF SAN DIEGO

APPENDIX I

URBAN AREAS OVERLAND TIME OF FLOW CURVES



Surface Flow Time Curves

EXAMPLE:

GIVEN: LENGTH OF FLOW = 400 FT.
SLOPE = 1.0 %
COEFFICIENT OF RUNOFF C = .70

READ: OVERLAND FLOWTIME = 15 MINUTES

DRAINAGE AREA MAPS

PRE-DEVELOPMENT DRAINAGE AREA MAP

PRE-CONSTRUCTION DRAINAGE AREA MAP

AREA "D"
0.085

AREA "A"
0.004

AREA "C"
0.183

AREA "B"
0.005

8470
HT 15.4'

8462
HT 15.6'

8458
HT 14.0'

S 19°09'31" W 61.64'

S 70°51'17" E 193.82'

S 70°50'47" E 191.53'

S 21°17'07" W 61.71'

OBSCURED

TREES

CONC

STAIRS

BRUSH

SHADOWS

GMW

EXIST. CURB & GUTTER

POST-DEVELOPMENT DRAINAGE AREA MAP

POST-CONSTRUCTION DRAINAGE AREA MAP

AREA "D"
0.085

AREA "E"
0.188

7' WIDE EXISTING PRIVATE ACCESS EASEMENT

OVERHANG - TYP.

LINE OF RESIDENCE WALL - TYP.

EXISTING RESIDENCE
LOT 1 OCEAN TERRACE MAP 2615
APN 346-050-010
FF: 24.3'

20.0 TW
14.0 BW

23.5 TW
17.5 BW

26.5 TW
20.5 BW

29.25 TW
22.0 BW
22.83 FG

28.2 TW
21.5 BW

S 70°51'17" E
193.82'

29.25 TW
23.5 BW
22.83 FG

FLAGSTONE STEPPERS
PLANTING BETWEEN

CONCRETE PAVER PATH
W INTEGRAL COLOR

OPEN METAL GATE
6' CMU PRIVACY WALL

29.25 TW
24.5 BW
22.83 FG

TREES

25.83TW
22.83 BW
25.3 FG

25.35 TC
25.20 FL
MATCH EX

EXISTING SEAWALL TO REMAIN - TYP.

17.33 TW
14.5 BW

23.33 FINISH FLOOR
22.67 PAD

EXISTING HOUSE TO BE DEMOLISHED

EXISTING DECK, GLASS RAILS & SITE WALLS TO REMAIN

WALK

LAWN

EXISTING DECK
EXISTING DECK TO REMAIN
(TRELLIS TO BE REMOVED)

23.2 FS

BEACH:
PEDESTRIAN BEACH ACCESS EASEMENT -
SAND TO REMAIN UNDISTURBED

LINE OF MEAN HIGH TIDE
=Westerly Property Line

S 19°09'31" W
61.64'

EXISTING SINGLE FAMILY RESIDENCE & TRELLIS TO BE DEMOLISHED
FF: ELEV=-23.32'

23.16 FS
COURTYARD

PROPOSED TWO-CAR GARAGE

23.25 GFF

PLANTER

6' CMU WALL

EXISTING CONCRETE STAIRS & WALLS TO REMAIN

S 70°50'47" E
191.53'

29.25 TW
23.16 BW

OPEN METAL FENCE & GATE

29.25 TW
21.5 BW
23.16 FS

25.83 TW
23.0 BW
23.16 FS

20.0 TW
14.0 BW

23.5 TW
17.5 BW
16.33 FS

27.0 TW
19.5 BW
21.0 FS

EX WALL TO BE REBUILT AS NEEDED

INTEGRAL COLORED CONCRETE DRIVEWAY W/ SANDBLAST FINISH

EXISTING RESIDENCE
LOT 3 OCEAN TERRACE MAP 2615
APN 346-050-030
FF: 22.2'

BRUSH

CONC

S 21°47'07" W

25.83 TW
24.66 BW

23.67 FL

23.14 TC
22.92 FL
MATCH EX

EL PASEO GRANDE

EX 8" AC WATER PER DWG 18880-8-D

EX 8" PVC SEWER PER DWG 28331-66-D

EX 4" HP GAS SHOWN ON DWG 28331-66-D

10' 15' 15'

25' 25'

50'

EXIST. CURB & GUTTER

EXIST. CURB & GUTTER

3+00

2+00