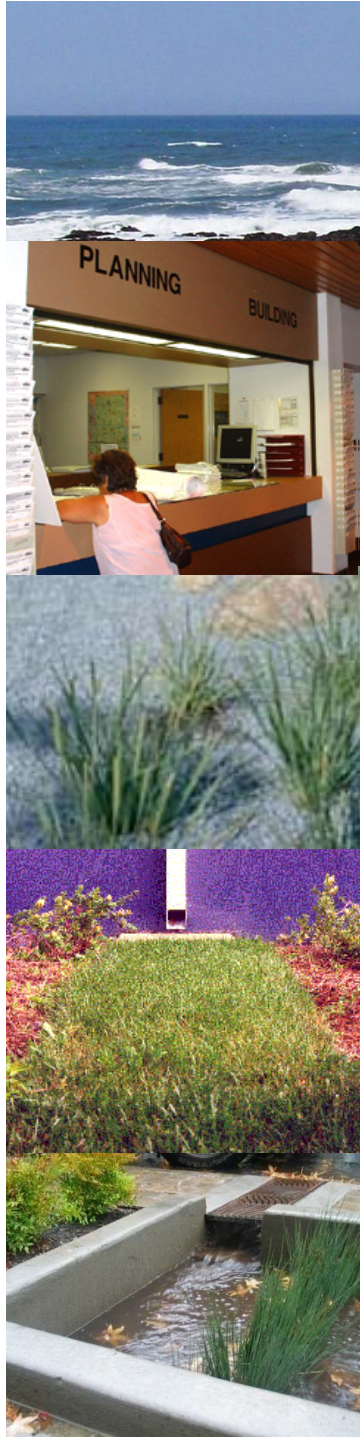


Exercises: Using LID Feasibility Worksheets

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*Thanks to Lisa Austin, Geosyntec, for help with
Case Studies*

November 17, 2011



Case Studies

1. Fremont Commercial Project

- Screening Worksheet
- Rainwater Harvesting/Use Worksheet

2. Unincorporated San Mateo County Subdivision

- Screening Worksheet

Case Study 1 – Fremont Screening Worksheet

► Neighborhood Commercial Infill

- NOT Pedestrian Oriented,
- NOT within ½ mi. of transit hub or within Priority Development Area

► Area of Project

- Total Project: 0.36 acre (15,700 sq.ft.)
- Existing impervious surface (IS): 0.18 acre (7,800 sq.ft.)
- Replaced IS: 0.18 acre (7,800 sq.ft.)
- New IS: 0.14 acre (6,100 sq.ft.)
- Post-project landscaping: 0.04 acre (1,800 sq.ft.)

► Ksat within 0.3-0.4 range





Fremont: LID Feasibility Screening Worksheet

- Is project potentially a Special Project?

Special Projects Category A: Infill

Must Meet All Criteria to be a Special Project

- ☐ Located in central business district or comparable pedestrian oriented district.
- ☐ Built as part of objective to preserve or enhance pedestrian-oriented environment.
- ☐ Creates or replaces ½ acre or less of impervious surface.
- ☐ No surface parking except for emergency access, ADA or loading requirements.
- ☐ 85% of lot is covered by buildings; remaining 15% is for safety access, trash/recycling, public uses, etc.

If ALL criteria are met, receives 100% LID treatment reduction credit.



Special Projects Category B: High Density

Must Meet All Criteria to be a Special Project

- ☐ Located in central business district or comparable pedestrian oriented district.
- ☐ Built as part of objective to preserve or enhance pedestrian-oriented environment.
- ☐ Creates or replaces $> \frac{1}{2}$ acre, but no more than 2 acres, of impervious surface.
- ☐ No surface parking except for emergency access, ADA or loading requirements.
- ☐ 85% of lot is covered by buildings; remaining 15% is for safety access, trash/recycling, public uses, etc.

If ALL criteria are met, a graduated system of LID treatment reduction credit is applied.



Special Projects Category C

Transit Oriented Development

- ❑ Non-auto oriented project. (No stand-alone surface parking lots, car dealerships, auto and truck rental facilities with onsite surface storage, etc.)
- ❑ Within ½ mile radius of existing or planned transit hub, or within a Priority Development Area.
- ❑ For commercial or mixed use projects, a minimum floor area ratio of 2:1 is required.
- ❑ For residential projects, min. density is 25 dwelling units/acre.

If above criteria are met, a graduated system of LID treatment reduction credit applies.

- Location credit
- Density credit
- Minimize surface parking credit





Fremont: LID Feasibility Screening Worksheet

- Is the project potentially a Special Project?

No

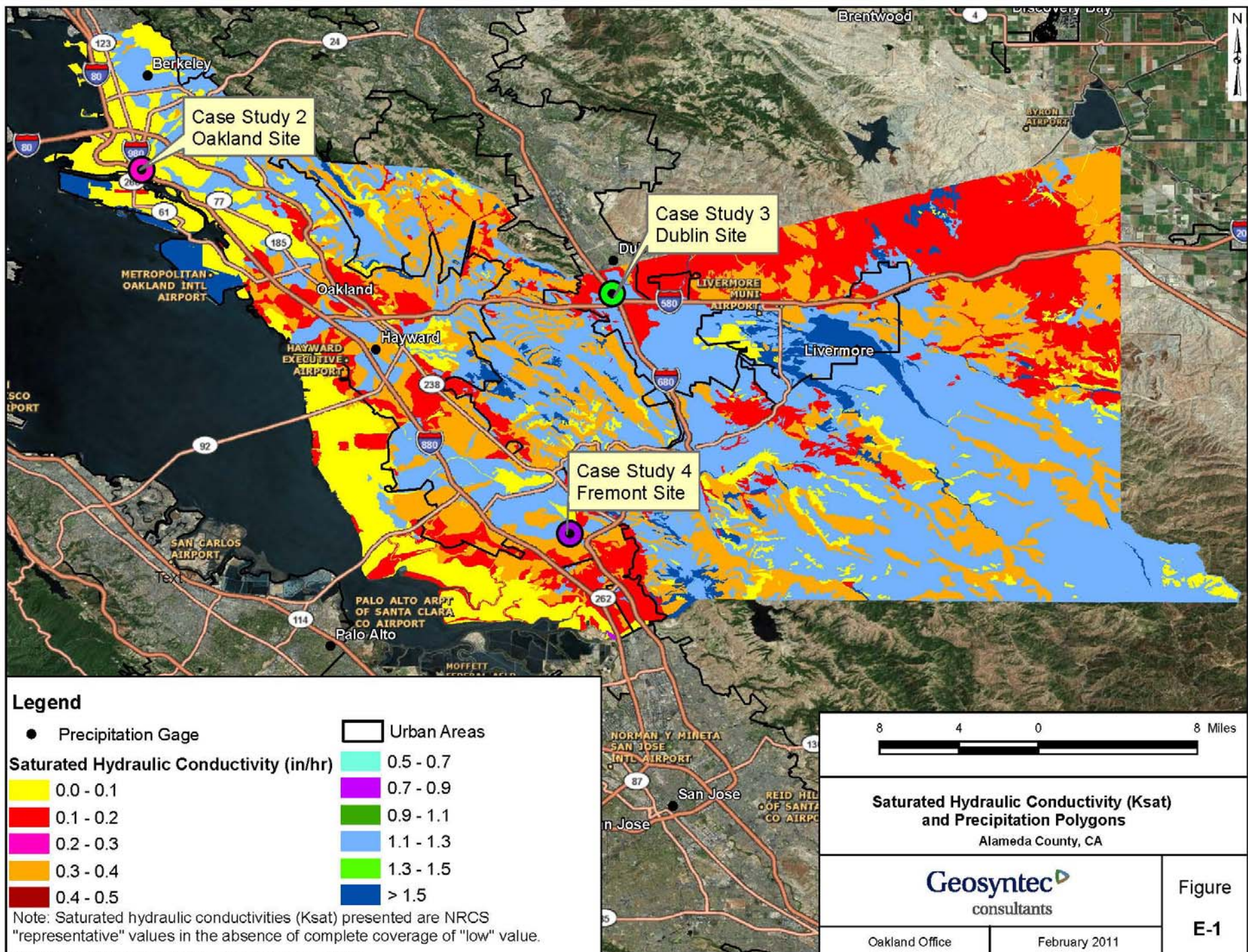
- Project is not in a pedestrian-oriented district,
- Is not built as part of a stated objective to preserve or enhance a pedestrian-oriented area, and
- Is not within ½ mile of a transit hub, or within a priority development area



Fremont: LID Feasibility Screening Worksheet

- 2. Do site soils either:
 - Have a Saturated Hydraulic Conductivity (Ksat) rate of LESS THAN 1.6 inches/hour, or
 - Consist of Type C or D soils?

Yes





Fremont: LID Feasibility Screening Worksheet

- ▶ 3. Check box if the project is installing and using a recycled water plumbing system for indoor non-potable use

☐ If recycled water system will be used, rainwater harvesting is infeasible

Box not checked.

Screening Worksheet Table 1 (sq.ft.)

	1	2	3	4
	Pre-Project Impervious Surface	Proposed Impervious Surface		Post-Project landscaping
		Replaced	Created	
a. Enter totals for the area to be evaluated	7,800	7,800	6,100	1,800
b. Sum of replaced and created impervious surface	N/A	13,900		N/A
c. Area of existing impervious surface that will NOT be replaced	0	N/A		N/A

Fremont: LID Feasibility Screening Worksheet

- ▶ 4.2 Is the amount of impervious surface replaced or added by the project equal to 50% or more of the existing area of impervious surface?

Yes [C.3 requirements apply to whole site, including areas of impervious surface that will remain in place]

- ▶ 4.3/ 4.4 Enter the square footage and acreage of the Potential Rainwater Capture Area: **13,900 square feet**
0.32 acre



Fremont: LID Feasibility Screening Worksheet

- 5.1 Is landscaped area LESS THAN 3.2 times the acreage of Potential Rainwater Capture Area

Landscaping & open space = 1,800 s.f.

3.2 * rainwater capture area =

3.2 * 13,900 = 44,480

1,800 is LESS THAN 44,480

Yes

Irrigation Demand Feasibility Threshold

Table 11: EIATIA Ratios for Rain Gauges Analyzed

Rain Gauge	Required Daily Demand ¹ (gal/day)	ET Data Location ²	Conservation Landscaping			Demand per Irrigated Acre ³	Turf Areas	
			Demand per Irrigated Acre ³	EIATIA	Resultant Imper-viousness (%)		EIATIA	Resultant Imper-viousness (%)
Palo Alto	2,900	Redwood City	450	6.4	13%	900	3.2	24%
San Francisco	4,600	San Francisco	360	12.8	7%	720	6.4	14%
San Francisco Oceanside	4,300	San Francisco	360	11.9	8%	720	6.0	14%

Footnotes:

¹ To achieve 80 percent capture within maximum allowable drawdown time (Table 9).

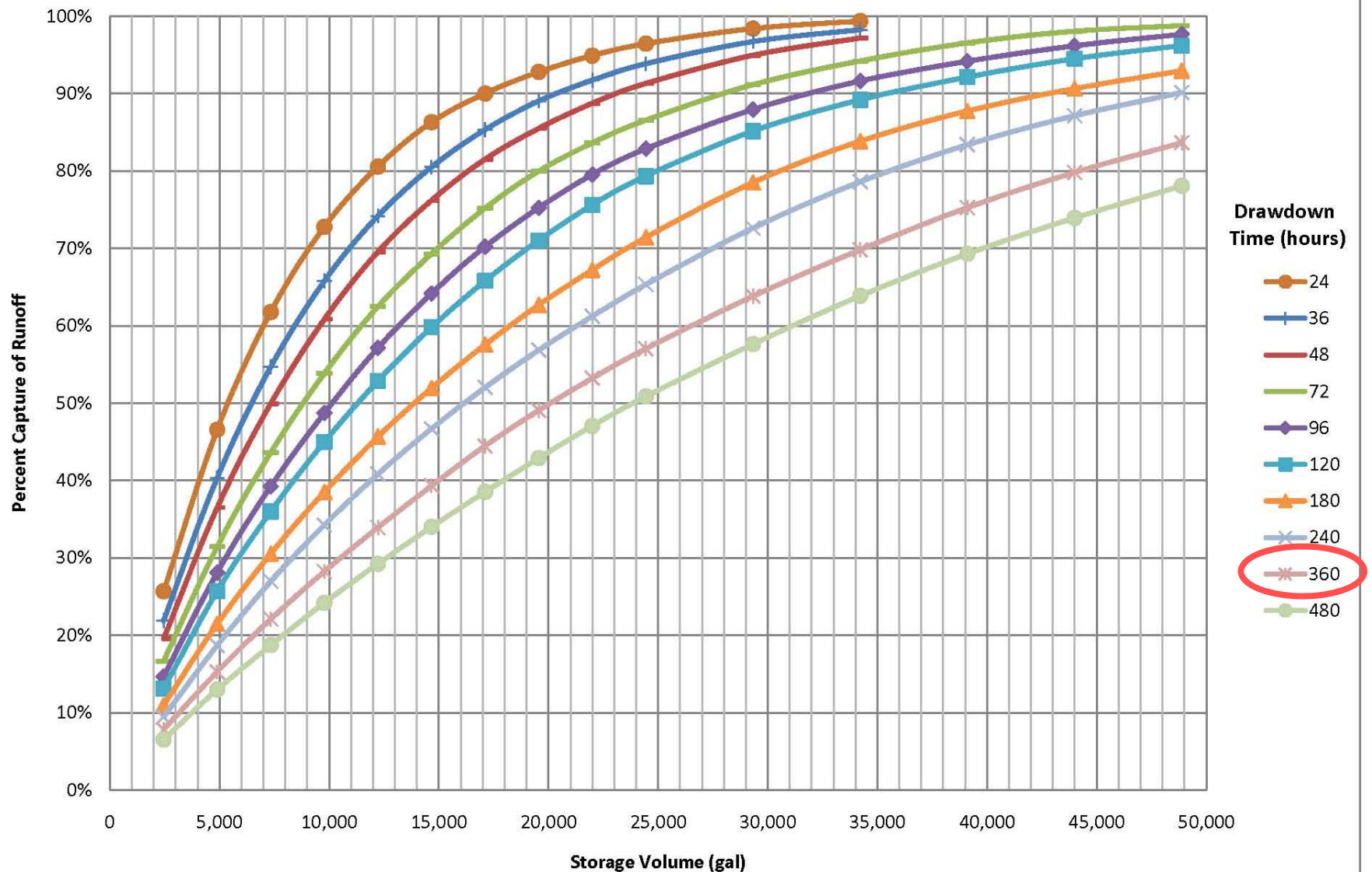
² Closest location selected, from Table F-1.

³ From Table 7.

- Source: Table 11, LID Feasibility Report (page 33)
- EIATIA = Ratio of “Effective Irrigated Area to Impervious Area”

Curves from Appendix F, for Palo Alto Rain Gauge (drawdown time = 360 hrs)

Figure F-8: Percent Capture Achieved by BMP Storage Volume with Various Drawdown Times for 1-Acre, 100% Impervious Tributary Area - Palo Alto





Fremont: LID Feasibility Screening Worksheet

- 5.2.b. Commercial Projects: What is the square footage of interior floor area per impervious acre?

Proposed interior floor area: 6,000 sq.ft.

Acres of impervious surface: 0.32 acre

Interior floor area/acre = 6,000/0.32
= 18,750 sq.ft.

- LESS THAN 84,000 sq.ft./impervious acre?

Yes



Fremont: LID Feasibility Screening Worksheet

- Sections 6 and 7. Are all questions in Sections 2 and 5 answered Yes?

Yes

Implement biotreatment



Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 1.6. Enter square footage of non-residential interior floor area

6,000 square feet





Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 1.7. To calculate potential rainwater capture area, start with total area of project:

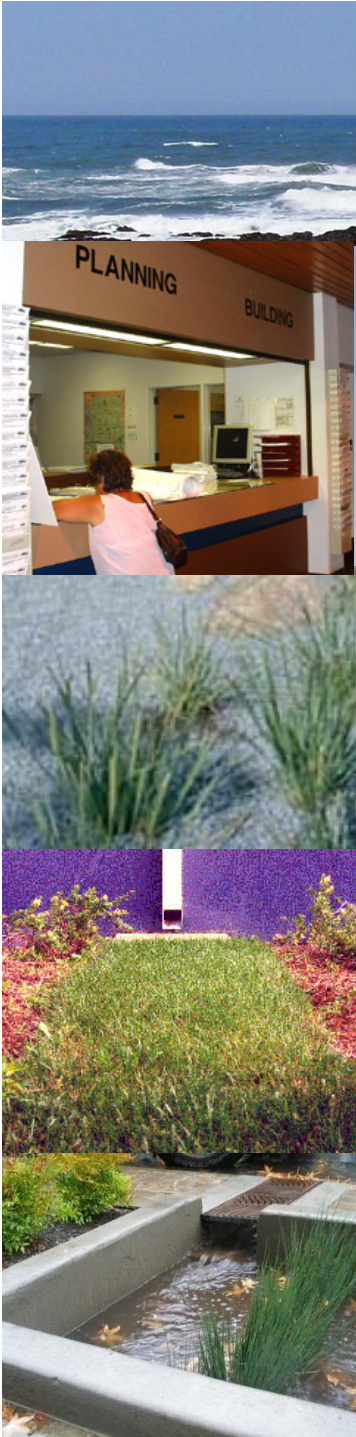
15,700 square feet

- ▶ 1.8 & 1.9. Account for any Special Project LID treatment reduction:

No Special Project LID treatment reduction

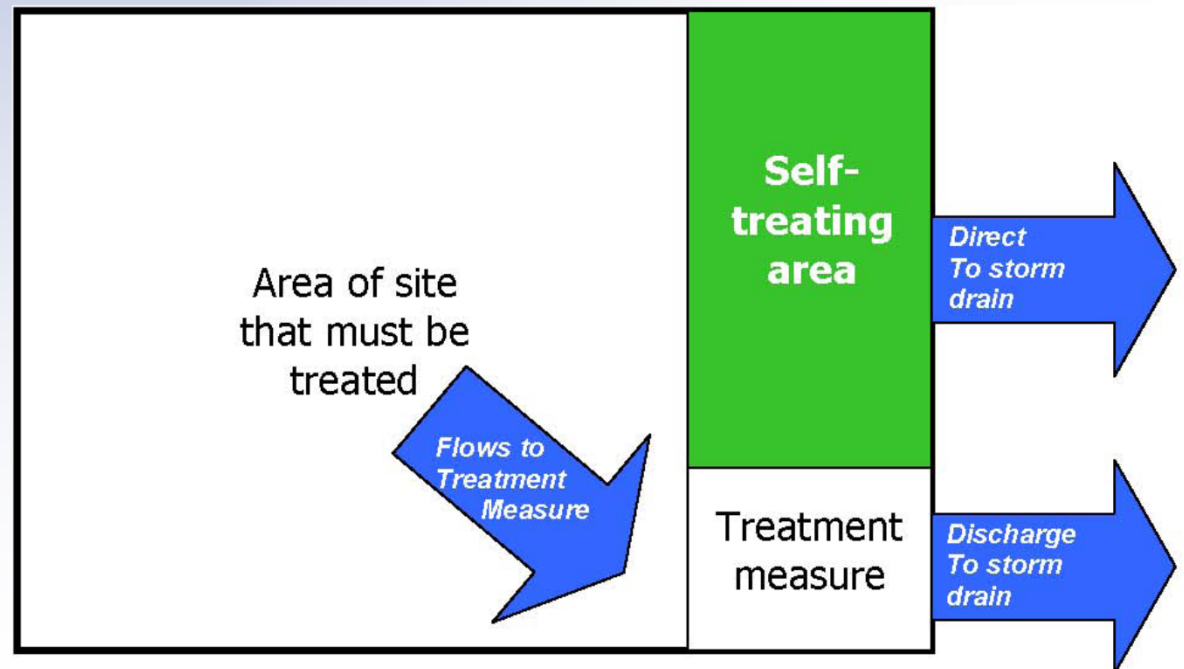
Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 2.1. Enter square footage of self-treating area:



Self-Treating Areas Reduce the Area that Requires Treatment

- Stormwater from **pervious** portions of the project can flow directly to the storm drain (no mixing with runoff from impervious areas):
 - Landscaping
 - Green roof
 - Properly-designed pervious paving



Fremont: Rainwater Harvesting/Use Worksheet

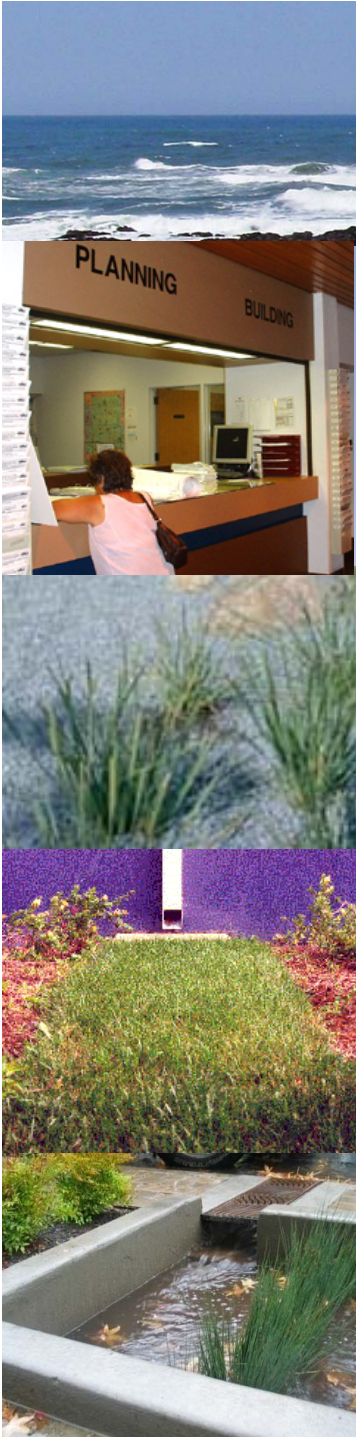
- ▶ 2.1. Enter square footage of self-treating area:

1,800 square feet



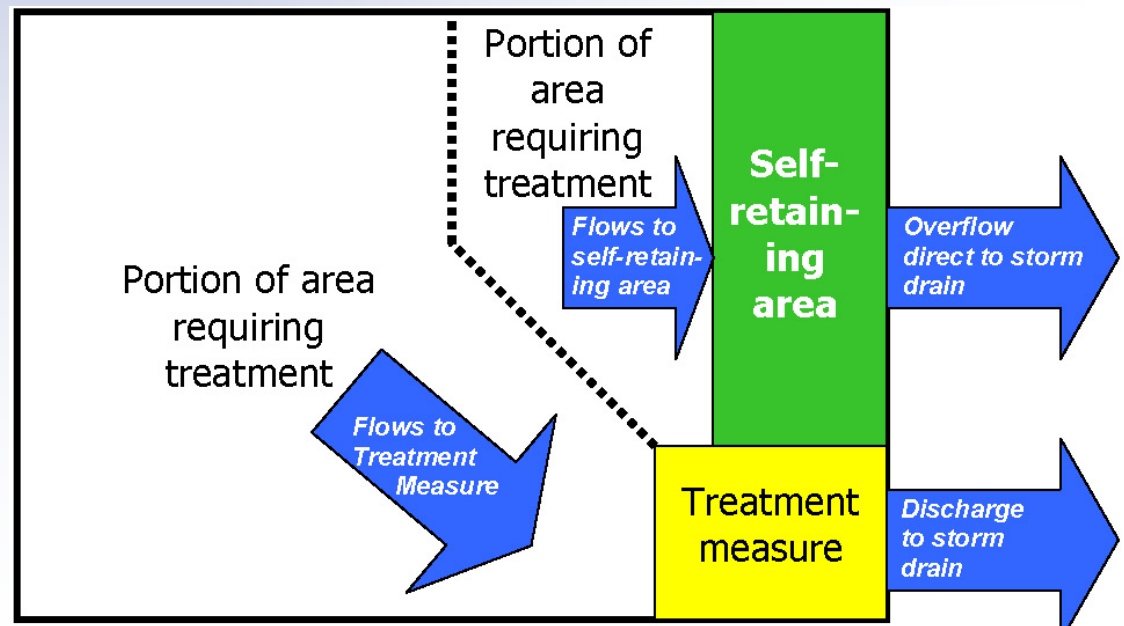
Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 2.2. Enter square footage of any self-retaining area:
- ▶ 2.3 Enter the square footage of the area contributing to the self-retaining area (if any):



Self-Retaining Areas Reduce the Area that Requires Treatment

- Concave area of landscaping that retains runoff from adjacent impervious surface (e.g, roof)
 - Sized at 2:1 ratio (area of tributary impervious surface: area of landscaping)
- 3-inch ponding depth
- No special soils required





Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 2.2/2.3. Enter square footage of any self-retaining area & area contributing to the self-retaining area (if any):

None / None

- ▶ 2.4. Pre-set formula will total the self-treating and self-retaining areas & areas that drain to self-retaining area.

Total = 1,800 sq. ft.



Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 3.1/3.2. Subtract self-treating and self-retaining area & contributing area from “potential rainwater capture area”:

$$\begin{aligned} 15,700 - 1,800 &= 13,900 \text{ square feet} \\ &= 0.32 \text{ acre} \end{aligned}$$

Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 4.2 Divide the non-residential interior floor area by the adjusted potential rainwater capture area.

$$6,000 / 0.32 = 18,750$$

- ▶ 4.4 Refer to Worksheet Attachment 2 and identify the square feet of non-residential interior floor area per impervious acre needed in your Rain Gauge Area to provide the toilet flushing demand needed for rainwater harvest feasibility

Palo Alto Rain Gauge: 84,000 square feet

Office/Industrial Toilet Flushing Demand Feasibility Threshold

LID Feasibility Worksheet

Attachment 2: Toilet-Flushing Demand Required for Rainwater Harvesting Feasibility

Table 1 – San Mateo County:

Rain Gauge ³	Required Demand (gal/day/IA) ⁴	Residential		Office/Retail ⁵		Schools ⁶	
		No. of residents per IA ⁷	Dwelling Units per IA ⁸	Employees per IA ⁹	Interior Floor Area (sq.ft./IA) ¹⁰	Employees ¹¹ per IA	Interior Floor Area (sq.ft./IA) ¹²
Palo Alto	2,900	340	124	420	84,000	90	27,000
San Francisco	4,600	530	193	670	134,000	140	42,000
SF Oceanside	4,300	500	182	620	124,000	130	39,000

- Office/Retail also applies to industrial toilet use.
- Square footage derived from State plumbing code occupant load factors for toilet use.
- IA = Impervious Acre

Fremont: Rainwater Harvesting/Use Worksheet

- ▶ 4.6. Is the project's square footage of non-residential interior floor area per acre of adjusted Potential Rainwater Capture Area LESS than 84,000 square feet?

Yes.



Fill Out the LID Feasibility Screening Worksheet:

Case Study 2 – San Mateo County

- ▶ Residential development: 12 single-family homes
- ▶ Includes landscaping & private road
 - 7.5 acre site
 - New impervious surface (buildings, driveways, private roadway): 2.6 acres (113,256 sq.ft.)
 - No existing impervious surface
 - Post-project landscaping: 4.9 acres (213,444 sq.ft.)
- ▶ Ksat is less than 1.6 inches/hour

San Mateo County: LID Feasibility Screening Worksheet

- Is project potentially a Special Project?



Special Projects Category A: Infill

Must Meet All Criteria to be a Special Project

- ☐ Located in central business district or comparable pedestrian oriented district.
- ☐ Built as part of objective to preserve or enhance pedestrian-oriented environment.
- ☐ Creates or replaces ½ acre or less of impervious surface.
- ☐ No surface parking except for emergency access, ADA or loading requirements.
- ☐ 85% of lot is covered by buildings; remaining 15% is for safety access, trash/recycling, public uses, etc.

If ALL criteria are met, receives 100% LID treatment reduction credit.



Special Projects Category B: High Density

Must Meet All Criteria to be a Special Project

- ☐ Located in central business district or comparable pedestrian oriented district.
- ☐ Built as part of objective to preserve or enhance pedestrian-oriented environment.
- ☐ Creates or replaces $> \frac{1}{2}$ acre, but no more than 2 acres, of impervious surface.
- ☐ No surface parking except for emergency access, ADA or loading requirements.
- ☐ 85% of lot is covered by buildings; remaining 15% is for safety access, trash/recycling, public uses, etc.

If ALL criteria are met, a graduated system of LID treatment reduction credit is applied.



Special Projects Category C

Transit Oriented Development

- ❑ Non-auto oriented project. (No stand-alone surface parking lots, car dealerships, auto and truck rental facilities with onsite surface storage, etc.)
- ❑ Within ½ mile radius of existing or planned transit hub, or within a Priority Development Area.
- ❑ For commercial or mixed use projects, a minimum floor area ratio of 2:1 is required.
- ❑ For residential projects, min. density is 25 dwelling units/acre.

If above criteria are met, a graduated system of LID treatment reduction credit applies.

- Location credit
- Density credit
- Minimize surface parking credit





San Mateo County: LID Feasibility Screening Worksheet

- Is the project potentially a Special Project?

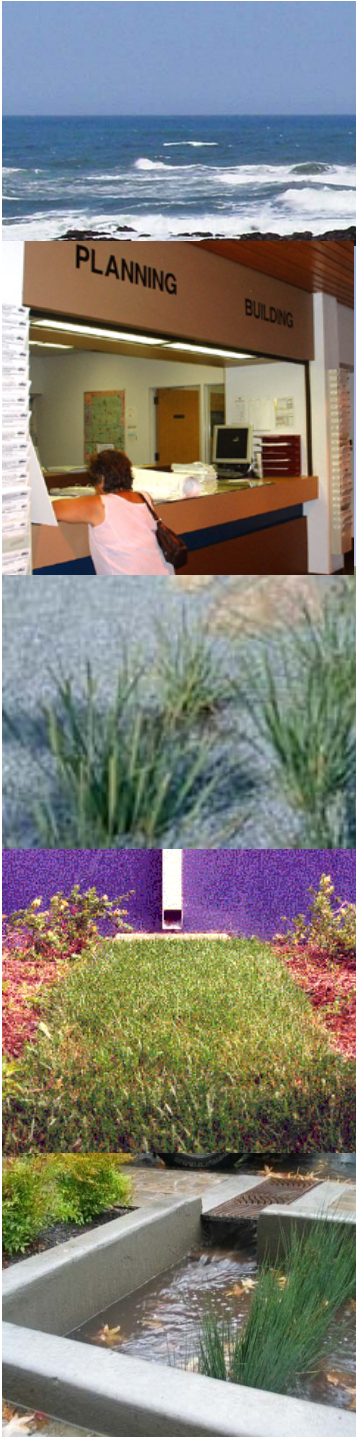
No

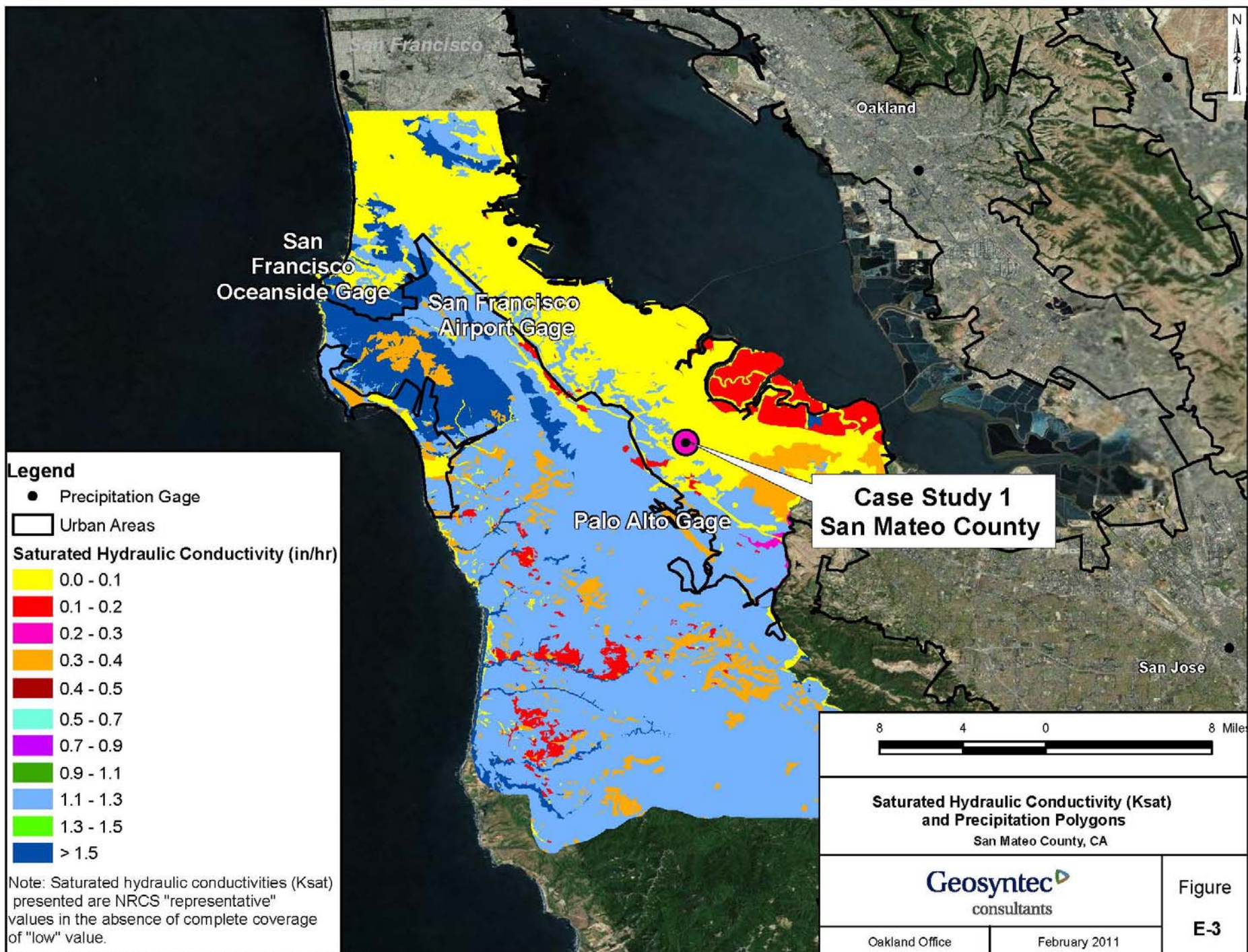
- Project is not in a pedestrian-oriented district,
- Is not built as part of a stated objective to preserve or enhance a pedestrian-oriented area, and
- Is not within ½ mile of a transit hub, or within a priority development area

San Mateo County: LID Feasibility Screening Worksheet

- 2. Do site soils either:
 - Have a Ksat LESS THAN 1.6 inches/hour, or
 - Consist of Type C or D soils?

Yes







San Mateo County: LID Feasibility Screening Worksheet

- ▶ 3. Check box if the project is installing and using a recycled water plumbing system for indoor non-potable use

☐ If recycled water system will be used, rainwater harvesting is infeasible

Box not checked.

Screening Worksheet Table 1 (sq.ft.)

	1	2	3	4
	Pre-Project Impervious Surface	Proposed Impervious Surface		Post-Project landscaping
		Replaced	Created	
a. Enter totals for the area to be evaluated	0	0	113,256	213,444
b. Sum of replaced and created impervious surface	N/A	113,256		N/A
c. Area of existing impervious surface that will NOT be replaced	0	N/A		N/A

San Mateo County: LID Feasibility Screening Worksheet

- ▶ 4.2 Is the amount of impervious surface replaced or added by the project equal to 50% or more of the existing area of impervious surface?

No [There is no existing impervious surface to consider including in calculation of potential rainwater harvesting area.]

- ▶ 4.3/ 4.4 Enter the square footage and acreage of the Potential Rainwater Capture Area:

113,256 square feet
2.6 acres



San Mateo County: LID Feasibility Screening Worksheet

- 5.1 Is landscaped area LESS THAN 3.2 times the acreage of Potential Rainwater Capture Area

Landscaping & open space = 213,444 s.f.

3.2 * rainwater capture area =

3.2 * 113,256 = 362,419 s.f.

213,444 is LESS THAN 362,419

Yes

San Mateo County: LID Feasibility Screening Worksheet

- 5.2.a. Residential Projects: How many dwelling units per impervious acre?

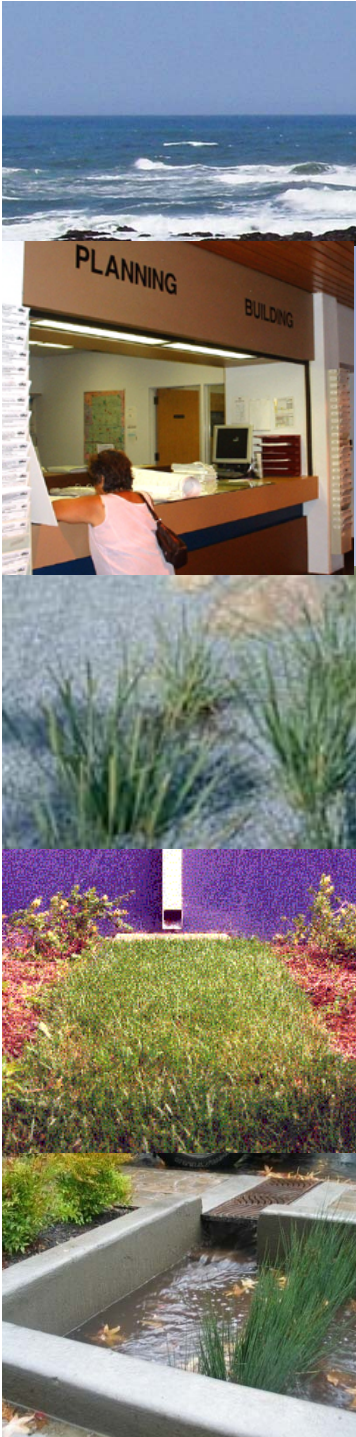
Proposed dwelling units: 12

Acres of impervious surface: 2.6 acres

Dwelling units/impervious acre = $12 / 2.6$
= 4.6

- LESS THAN 124 dwelling units / impervious acre?

Yes





San Mateo County: LID Feasibility Screening Worksheet

- 4. All questions in Sections 2 and 5 answered Yes?

Yes

Implement biotreatment