WALSH ENGINEERING
& SURVEYING, INC.

May 21, 2008

Valerie Walsh
Department of Planning & Land Use
County of San Diego
5201 Ruffin Road, Suite B
San Diego, CA 92123

Subject: LID addendum to SWMP
Project: TPM 20716 – Kemerko

Dear Valerie:

Pursuant to your request in your letter dated May 1, 2008 (attached), we are providing you with this letter to address DPW's comments re: the Preliminary Grading Plan. In addition to the BMPs described in the Storm Water Management Plan dated 7-5-06, the project has been designed to meet the County's LID guidelines and techniques to effectively preserve water quality and to mitigate the project's potential water quality impacts to the maximum extent practical. The following summarizes the LID design techniques that will be implemented as part if this development per the County LID Handbook (LIDH):

- Conserves natural areas, soils, and vegetation (per 2.2.1.)
- Minimizes disturbance to natural drainages (per 2.2.2.)
- Minimizes and disconnects impervious surfaces (per 2.2.3)
- Minimizes soil compaction (per 2.2.4.)
- Drains runoff from impervious surfaces to pervious areas (per 2.2.5.)
- Residential Hillside Site (2.3.1.4.)
    - Avoidance of Steep Slopes
    - Building pads aligned with topography to reduce grading
    - Preservation of existing trees and indigenous vegetation
    - Preservation of riparian vegetation (drainages with native plants/soils)
    - Narrow rural roads
    - Combination parking and driveway area
    - Detention basin connected to roof downspout (down slope from building)
    - Swale along road collects street runoff (with appropriate slopes)
    - Culvert to carry parkway swale under cross street
    - Catch basin runoff directed to infiltration area

Attachments:
- Low Impact Development – Table 8 of the County's LID checklist
- LID and Treatment BMP Location Map by Walsh Engineering & Surveying, Inc.

Regards,

James Green, P.E.
Project Engineer

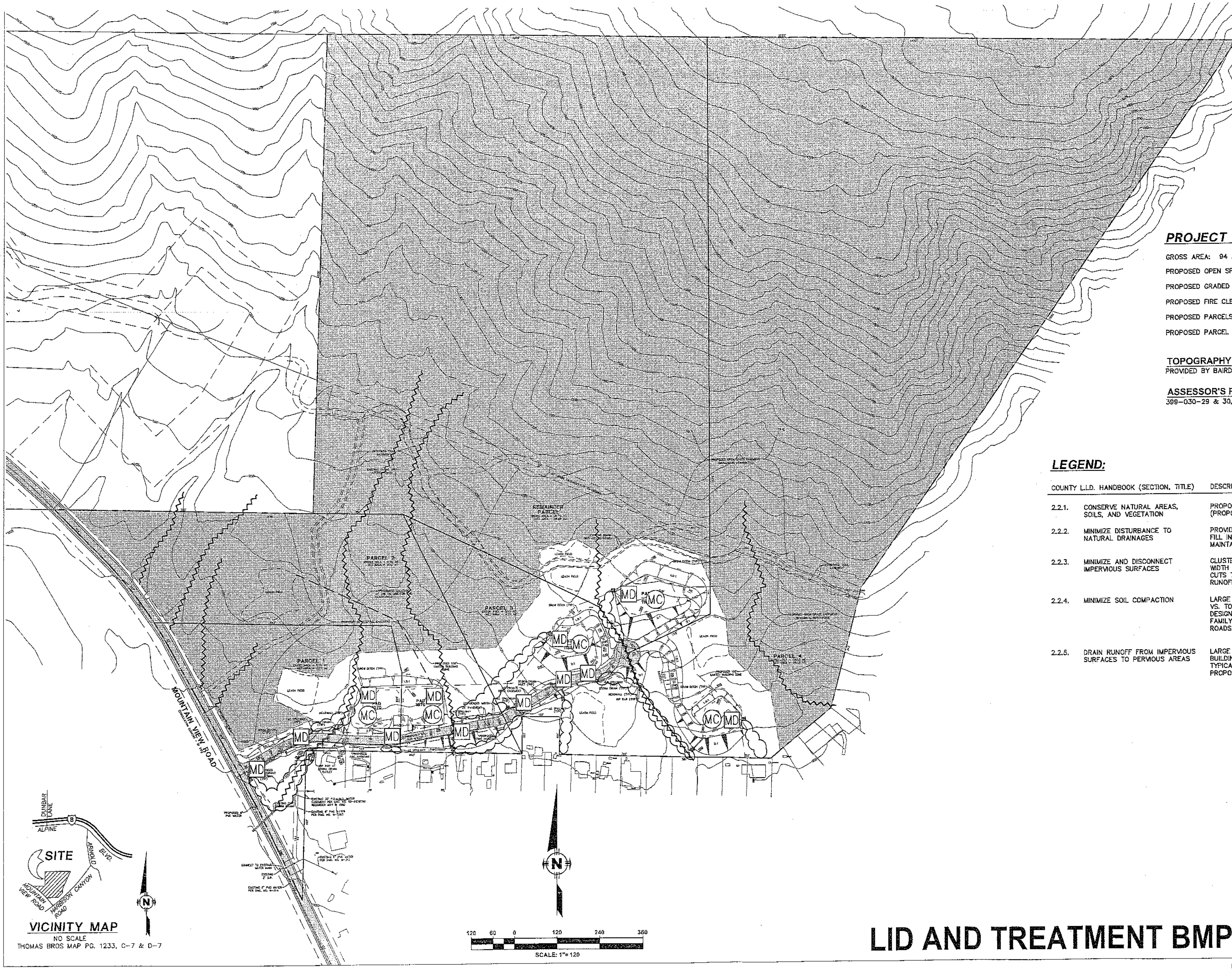
**LOW IMPACT DEVELOPMENT (LID)**

Each numbered item below is a LID requirement of the WPO. Please check the box(s) under each number that best describes the Low Impact Development BMP(s) selected for this project.

**Table 8**

| |
|---|
| 1. Conserve natural Areas, Soils, and Vegetation-County LID Handbook 2.2.1 |
| ☐ Preserve well draining soils (Type A or B) N/A - On-site Soils are C & D |
| ☑ Preserve Significant Trees |
| ☑ Other. Description: Total Project Area = 94 acres, Proposed Open Space On-Site = 81 acres, impacted areas will be mitigated off-site per the BMO. |
| ☐ 1. Not feasible. State Reason: |
| 2. Minimize Disturbance to Natural Drainages-County LID Handbook 2.2.2 |
| ☑ Set-back development envelope from drainages |
| ☑ Restrict heavy construction equipment access to planned green/open space areas |
| ☑ Other. Description: Use existing dirt roads where applicable. Impacted areas will be mitigated off-site per the BMO. |
| ☐ 2. Not feasible. State Reason: |
| 3. Minimize and Disconnect Impervious Surfaces (see 5) -County LID Handbook 2.2.3 |
| ☑ Clustered Lot Design |
| ☑ Items checked in 5? |
| ☑ Other. Description: Frequently provide AC spillways from proposed road to bio-swales to disconnect impervious areas. |
| ☐ 3. Not feasible. State Reason: |
| 4. Minimize Soil Compaction-County LID Handbook 2.2.4 |
| ☑ Restrict heavy construction equipment access to planned green/open space areas |
| ☑ Re-till soils compacted by construction vehicles/equipment |
| ☑ Collect & re-use upper soil layers of development site containing organic materials |
| ☐ Other. Description: Only the area for proposed buildings, driveways and roads should be graded to dense compaction. |
| 4. Not feasible. State Reason: |
| 5. Drain Runoff from Impervious Surfaces to Pervious Areas-County LID Handbook 2.2.5 |

| LID Street & Road Design |
|---|
| ☑ Curb-cuts to landscaping |
| ☑ Rural Swales |
| ☐ Concave Median |
| ☐ Cul-de-sac Landscaping Design |
| ☐ Other. Description: |
| LID Parking Lot Design N/A |
| ☐ Permeable Pavements |
| ☐ Curb-cuts to landscaping |
| ☐ Other. Description: |
| LID Driveway, Sidewalk, Bike-path Design |
| ☐ Permeable Pavements |
| ☑ Pitch pavements toward landscaping |
| ☐ Other. Description: |
| LID Building Design |
| ☑ Cisterns & Rain Barrels |
| ☑ Downspout to swale |
| ☐ Vegetated Roofs |
| ☐ Other. Description: |
| LID Landscaping Design |
| ☐ Soil Amendments |
| ☑ Reuse of Native Soils |
| ☑ Smart Irrigation Systems |
| ☐ Street Trees |
| ☐ Other. Description: |
| ☐ 5. Not feasible. State Reason: |




VICINITY MAP
NO SCALE
THOMAS BROS MAP PG. 1233, C-7 & D-7

## PROJECT SUMMARY:

GROSS AREA: 94 ACRES

PROPOSED OPEN SPACE: 81 ACRES

PROPOSED GRADED AREA (PADS, DRIVEWAY AND ROADS): 5 ACRES

PROPOSED FIRE CLEARING (EXCLUDING GRADED AREA): 8 ACRES

PROPOSED PARCELS: 4 & 1 REMAINDER (5 TOTAL)

PROPOSED PARCEL SIZES (ACRES): 1: 5.7, 2: 8.4, 3: 5.1, 4: 36.7, REM.: 38.1

### TOPOGRAPHY
PROVIDED BY BAIRD ENGINEERING

### ASSESSOR'S PARCEL NUMBER
399-030-29 & 30, 399-040-11

## LEGEND:

| COUNTY L.I.D. HANDBOOK (SECTION, TITLE) | | DESCRIPTION | SYMBOL |
|---|---|---|---|
| 2.2.1. | CONSERVE NATURAL AREAS, SOILS, AND VEGETATION | PROPOSED PLANNED GREEN SPACE (PROPOSED OPEN SPACE EASEMENT) | |
| 2.2.2. | MINIMIZE DISTURBANCE TO NATURAL DRAINAGES | PROVIDE CULVERTS AND MINIMIZE FILL IN EXISTING DRAINAGE SWALE, MAINTAIN SWALE CONTINUITY | |
| 2.2.3. | MINIMIZE AND DISCONNECT IMPERVIOUS SURFACES | CLUSTERED LOT DESIGN, MINIMUM WIDTH ROADS AND DRIVEWAYS, CURB CUTS TO LANDSCAPING, ROOF RUNOFF TO LANDSCAPING, ETC. | MD |
| 2.2.4. | MINIMIZE SOIL COMPACTION | LARGE OPEN SPACE DESIGN, GRADED VS. TOTAL AREA = 5%, BUILDING PAD DESIGN TO FIT ONE TYPICAL SINGLE FAMILY RESIDENCE, USE EXISTING DIRT ROADS FOR CONSTRUCTION ACCESS | MC |
| 2.2.5. | DRAIN RUNOFF FROM IMPERVIOUS SURFACES TO PERVIOUS AREAS | LARGE OPEN SPACE DESIGN BUILDING PAD DESIGN TO FIT ONE TYPICAL SINGLE FAMILY RESIDENCE PROPOSED TREATMENT BMPS | |


OWNER
SAM KEMERKO
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# LID AND TREATMENT BMP LOCATION MAP

TPM 20716 - LID AND TREATMENT BMP LOCATION MAP

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**Storm Water Management Plan**
**For Priority Projects**
**(Major SWMP)**

| | |
|---|---|
| Project Name: | KEMERKO TPM |
| Permit Number (Land Development Projects): | TPM 20716 RPL1, ER 03-14-002 |
| Work Authorization Number (CIP): | |
| Applicant: | Sam Kemerko |
| Applicant's Address: | 4669 Charest Drive; Waterford, MI 48327 |
| Plan Prepare By (*Leave blank if same as applicant*): | Walsh Engineering & Surveying, Inc. |
| Date: | July 5, 2006 |
| Revision Date (If applicable): | |

The County of San Diego Watershed Protection, Storm Water Management, and Discharge Control Ordinance (WPO) (Ordinance No. 9424) requires all applications for a permit or approval associated with a Land Disturbance Activity must be accompanied by a Storm Water Management Plan (SWMP) (section 67.804.f). The purpose of the SWMP is to describe how the project will minimize the short and long-term impacts on receiving water quality. Projects that meet the criteria for a priority project are required to prepare a Major SWMP.

Since the SWMP is a living document, revisions may be necessary during various stages of approval by the County. Please provide the approval information requested below.

| Project Review Stage | Does the SWMP need revisions? | | If YES, Provide Revision Date |
|---|---|---|---|
| | YES | NO | |
| | | | |
| | | | |
| | | | |

Instructions for a Major SWMP can be downloaded at http://www.co.san-diego.ca.us/dpw/stormwater/susmp.html.

Completion of the following checklist and attachments will fulfill the requirements of a Major SWMP for the project listed above.

## PROJECT DESCRIPTION

Please provide a brief description of the project in the following box. For example:
The 50-acre RC Ranch project is located on the south side of San Miguel Road in the County of San Diego (See Attachment 1). The project is approximately 1.0 mile east of the intersection of San Miguel Avenue and San Miguel Road and 1 mile south of the Sweetwater Reservoir. This project will consist of a planned residential community comprising of 45 single-family homes 72 and multi-unit dwellings.

If you answered **YES** to any of the questions, please continue.

The following questions provide a guide to collecting information relevant to project stormwater quality issues. Please provide a description of the findings in text box below.

| | QUESTIONS | COMPLETED | NA |
|---|---|---|---|
| 1. | Describe the topography of the project area. | ✓ | |
| 2. | Describe the local land use within the project area and adjacent areas. | ✓ | |
| 3. | Evaluate the presence of dry weather flow. | ✓ | |
| 4. | Determine the receiving waters that may be affected by the project throughout the project life cycle (i.e., construction, maintenance and operation). | ✓ | |
| 5. | For the project limits, list the 303(d) impaired receiving water bodies and their constituents of concern. | ✓ | |
| 6. | Determine if there are any High Risk Areas (municipal or domestic water supply reservoirs or groundwater percolation facilities) within the project limits. | ✓ | |
| 7. | Determine the Regional Board special requirements, including TMDLs, effluent limits, etc. | ✓ | |
| 8. | Determine the general climate of the project area. Identify annual rainfall and rainfall intensity curves. | ✓ | |
| 9. | If considering Treatment BMPs, determine the soil classification, permeability, erodibility, and depth to groundwater. | ✓ | |
| 10. | Determine contaminated or hazardous soils within the project area. | ✓ | |

Please provide a description of the findings in the following box. For example:
The project is located in the San Diego Hydrologic unit. The area is characterized by rolling grassy hills and shrubs. Runoff from the project drains into a MS4 that eventually drains to Los Coches Creek. Within the project limit there are no 303(d) impaired receiving water and no Regional Board special requirements.

> The site is relatively steep, with average slopes ranging between 24 percent and 63 percent with rock outcroppings completely covering the site. Several dirt roads and utility lines cross the site. Three well-defined, densely vegetated swales collect surface runoff from the site and flow southerly to the adjacent subdivision and to an un-named natural swale. Currently vacant, the project site is surrounded by vacant land to the east and west with high-density single-family residential homes to the south and low density single-family residential homes to the north. Within the project, limits dry weather flow does not occur, High Risk Areas do not exist and their are no 303(d) impaired receiving water and there are no Regional Board special requirements. Average Rainfall for the area equals 15 to 18 inches per year. Soil Type within the site consist of Type "C" at the southerly portion and Type "D" at the northerly portion of the site; both being erosive soils. Contaminated or hazardous soils are not known to exist nor have their presence within the project site been determined.

Complete the checklist below to determine if Treatment Best Management Practices (BMPs) are required for the project.

| No. | CRITERIA | YES | NO | INFORMATION |
|---|---|---|---|---|
| 1. | Is this an emergency project | | X | If YES, go to 6.<br>If NO, continue to 2. |
| 2. | Have TMDLs been established | | | If YES, go to 5. |

| SURFACE WATERS | Hydrologic Unit Basin Number | MUN | AGR | IND | PROC | GWR | FRESH | POW | REC1 | REC2 | BIOL | WARM | COLD | WILD | RARE | SPWN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Inland Surface Waters** | | | | | | | | | | | | | | | | |
| | 909.23 | X | X | X | X | | | | X | X | | X | | X | | |
| | | | | | | | | | | | | | | | | |
| **Ground Waters** | | | | | | | | | | | | | | | | |
| | 909.20 | X | X | X | X | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |

X Existing Beneficial Use
0 Potential Beneficial Use
* Excepted from Municipal

## POLLUTANTS OF CONCERN

Using Table 1, identify pollutants that are anticipated to be generated from the proposed priority project categories. Pollutants associated with any hazardous material sites that have been remediated or are not threatened by the proposed project are not considered a pollutant of concern.

**Table 1. Anticipated and Potential Pollutants Generated by Land Use Type**

| | *General Pollutant Categories* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ***Priority Project Categories*** | Sediments | Nutrients | Heavy Metals | Organic Compounds | Trash & Debris | Oxygen Demanding Substances | Oil & Grease | Bacteria & Viruses | Pesticides |
| Detached Residential Development | X | X | | | X | X | X | X | X |
| Attached Residential Development | X | X | | | X | $P^{(1)}$ | $P^{(2)}$ | P | X |
| Commercial Development >100,000 $ft^2$ | $P^{(1)}$ | $P^{(1)}$ | | $P^{(2)}$ | X | $P^{(5)}$ | X | $P^{(3)}$ | $P^{(5)}$ |
| Automotive Repair Shops | | | X | $X^{(4)(5)}$ | X | | X | | |
| Restaurants | | | | | X | X | X | X | |
| Hillside Development >5,000 $ft^2$ | X | X | | | X | X | X | | X |

YES is checked, it is assumed that the measure was used for this project. If NO is checked, please provide a brief explanation why the option was not selected in the text box below.

| | OPTIONS | | YES | NO | N/A |
|---|---|---|---|---|---|
| 1. | Can the project be relocated or realigned to avoid/reduce impacts to receiving waters or to increase the preservation of critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soil conditions? | | ✓ | | |
| 2. | Can the project be designed to minimize impervious footprint? | | ✓ | | |
| 3. | Conserve natural areas where feasible? | | ✓ | | |
| 4. | Where landscape is proposed, can rooftops, impervious sidewalks, walkways, trails and patios be drained into adjacent landscaping? | | ✓ | | |
| 5. | For roadway projects, can structures and bridges be designed or located to reduce work in live streams and minimize construction impacts? | | | | ✓ |
| 6. | Can any of the following methods be utilized to minimize erosion from slopes: | | ✓ | | |
| | 6.a. | Disturbing existing slopes only when necessary? | ✓ | | |
| | 6.b. | Minimize cut and fill areas to reduce slope lengths? | ✓ | | |
| | 6.c. | Incorporating retaining walls to reduce steepness of slopes or to shorten slopes? | ✓ | | |
| | 6.d. | Providing benches or terraces on high cut and fill slopes to reduce concentration of flows? | ✓ | | |
| | 6.e. | Rounding and shaping slopes to reduce concentrated flow? | ✓ | | |
| | 6.f. | Collecting concentrated flows in stabilized drains and channels? | ✓ | | |

Please provide a brief explanation for each option that was checked N/A or NO in the following box.

Item 5. Live Streams do not exist within the project that would be affected by its construction.

If the project includes work in channels, then complete the following checklist. Information shall be obtained from the project drainage report.

| No. | CRITERIA | YES | NO | N/A | COMMENTS |
|---|---|---|---|---|---|
| 1. | Will the project increase velocity or volume of downstream flow? | | | ✓ | If YES go to 5. |
| 2. | Will the project discharge to unlined channels? | | | ✓ | If YES go to 5. |
| 3. | Will the project increase potential sediment load | | | ✓ | If YES go to 5. |

| | | BMP | YES | NO | N/A |
|---|---|---|---|---|---|
| | 2.b. | Hazardous materials with the potential to contaminate urban runoff shall either be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the storm water conveyance system; or (2) protected by secondary containment structures such as berms, dikes, or curbs. | | | ✓ |
| | 2.c. | The storage area shall be paved and sufficiently impervious to contain leaks and spills. | | | ✓ |
| | 2.d. | The storage area shall have a roof or awning to minimize direct precipitation within the secondary containment area. | | | ✓ |
| 3. | **Design Trash Storage Areas to Reduce Pollution Introduction** | | | | ✓ |
| | 3.a. | Paved with an impervious surface, designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash; or, | | | |
| | 3.b. | Provide attached lids on all trash containers that exclude rain, or roof or awning to minimize direct precipitation. | | | |
| 4. | **Use Efficient Irrigation Systems & Landscape Design** | | | | |
| | The following methods to reduce excessive irrigation runoff shall be considered, and incorporated and implemented where determined applicable and feasible. | | | | |
| | 4.a. | Employing rain shutoff devices to prevent irrigation after precipitation. | ✓ | | |
| | 4.b. | Designing irrigation systems to each landscape area's specific water requirements. | ✓ | | |
| | 4.c. | Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines. | ✓ | | |
| | 4.d. | Employing other comparable, equally effective, methods to reduce irrigation water runoff. | ✓ | | |
| 5. | **Private Roads** | | | | |
| | The design of private roadway drainage shall use at least one of the following | | | | |
| | 5.a. | Rural swale system: street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings. | | ✗ | |
| | 5.b. | Urban curb/swale system: street slopes to curb, periodic swale inlets drain to vegetated swale/biofilter. | ✓ | | |
| | 5.c. | Dual drainage system: First flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder, high flows connect directly to storm water conveyance system. | | ✗ | |
| | 5.d. | Other methods that are comparable and equally effective within the project. | ✓ | | |
| 6. | **Residential Driveways & Guest Parking** | | | | |
| | The design of driveways and private residential parking areas shall use one at least of the following features. | | | | |
| | 6.a. | Design driveways with shared access, flared (single lane at street) or wheelstrips (paving only under tires); or, drain into landscaping prior to discharging to the storm water conveyance system. | ✓ | | |
| | 6.b. | Uncovered temporary or guest parking on private residential lots may be: paved with a permeable surface; or, designed to drain into landscaping prior to discharging to the storm water conveyance system. | | ✗ | |
| | 6.c. | Other features which are comparable and equally effective. | | | |
| 7. | **Dock Areas** | | | | ✓ |

| | | BMP | YES | NO | N/A |
|---|---|---|---|---|---|
| | 12.b. | Overflow parking (parking stalls provided in excess of the County's minimum parking requirements) may be constructed with permeable paving. | | | |
| | 12.c. | Other design concepts that are comparable and equally effective. | | | |
| 13. | **Fueling Area** | | | | ✓ |
| | Non-retail fuel dispensing areas shall contain the following. | | | | |
| | 13.a. | Overhanging roof structure or canopy. The cover's minimum dimensions must be equal to or greater than the area within the grade break. The cover must not drain onto the fuel dispensing area and the downspouts must be routed to prevent drainage across the fueling area. The fueling area shall drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system. | | | |
| | 13.b. | Paved with Portland cement concrete (or equivalent smooth impervious surface). The use of asphalt concrete shall be prohibited. | | | |
| | 13.c. | Have an appropriate slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of urban runoff. | | | |
| | 13.d. | At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less. | | | |

Please list other project specific Source Control BMPs in the following box. Write **N/A** if there are none and briefly explain.

N/A - The above-checked Source Control BMP's adequately fulfill this type of project's requirements. However, rain barrels or other effective measures for treating roof runoff should be implemented.

## TREATMENT CONTROL

To select a structural treatment BMP using Treatment Control BMP Selection Matrix (Table 2), each priority project shall compare the list of pollutants for which the downstream receiving waters are impaired (if any), with the pollutants anticipated to be generated by the project (as identified in Table 1). Any pollutants identified by Table 1, which are also causing a Clean Water Act section 303(d) impairment of the receiving waters of the project, shall be considered primary pollutants of concern. Priority projects that are anticipated to generate a primary pollutant of concern shall select a single or combination of stormwater BMPs from Table 2, which **maximizes pollutant removal** for the particular primary pollutant(s) of concern.

Priority projects that are **not** anticipated to generate a pollutant for which the receiving water is Clean Water Act Section 303(d) impaired shall select a single or combination of stormwater BMPs from Table 2, which are effective for pollutant removal of the identified secondary pollutants of concern, consistent with the "maximum extent practicable" standard.

**Table 2. Treatment Control BMP Selection Matrix**

**Infiltration Basins**
☐ Infiltration basin
☐ Infiltration trench
☐ Porous asphalt
☐ Porous concrete
☐ Porous modular concrete block
**Wet Ponds or Wetlands**
☐ Wet pond/basin (permanent pool)
☐ Constructed wetland
**Drainage Inserts** (See note below)
☐ Oil/Water separator
☐ Catch basin insert
☐ Storm drain inserts
☐ Catch basin screens
**Filtration**
☐ Media filtration
☐ Sand filtration
**Hydrodynamic Separator Systems**
☐ Swirl Concentrator
☐ Cyclone Separator
☐ Baffle Separator
☐ Gross Solids Removal Device
☐ Linear Radial Device

**Note:** Catch basin inserts and storm drain inserts are excluded from use on County maintained right-of-way and easements.

| Include Treatment Datasheet as Attachment E. The datasheet should include the following: | COMPLETED | NO |
|---|---|---|
| 1. Description of how treatment BMP was designed. Provide a description for each type of treatment BMP. | ✓ | |
| 2. Engineering calculations for the BMP(s) | ✓ | |

Please describe why the selected treatment BMP(s) was selected for this project. For projects utilizing a low performing BMP, please provide a detailed explanation and justification.

| |
|---|
| The above-mentioned treatment BMP's were selected due to the type of project (i.e. single-family residential lots) and efficiency/effectiveness of the BMP removing pollutants of concern from runoff. See Attachment E for Data and Attachment F for Operation & Maintenance Schedule. |

**MAINTENANCE**

Please check the box that best describes the maintenance mechanism(s) for this project.

# ATTACHMENT A

## LOCATION MAP

# ATTACHMENT B

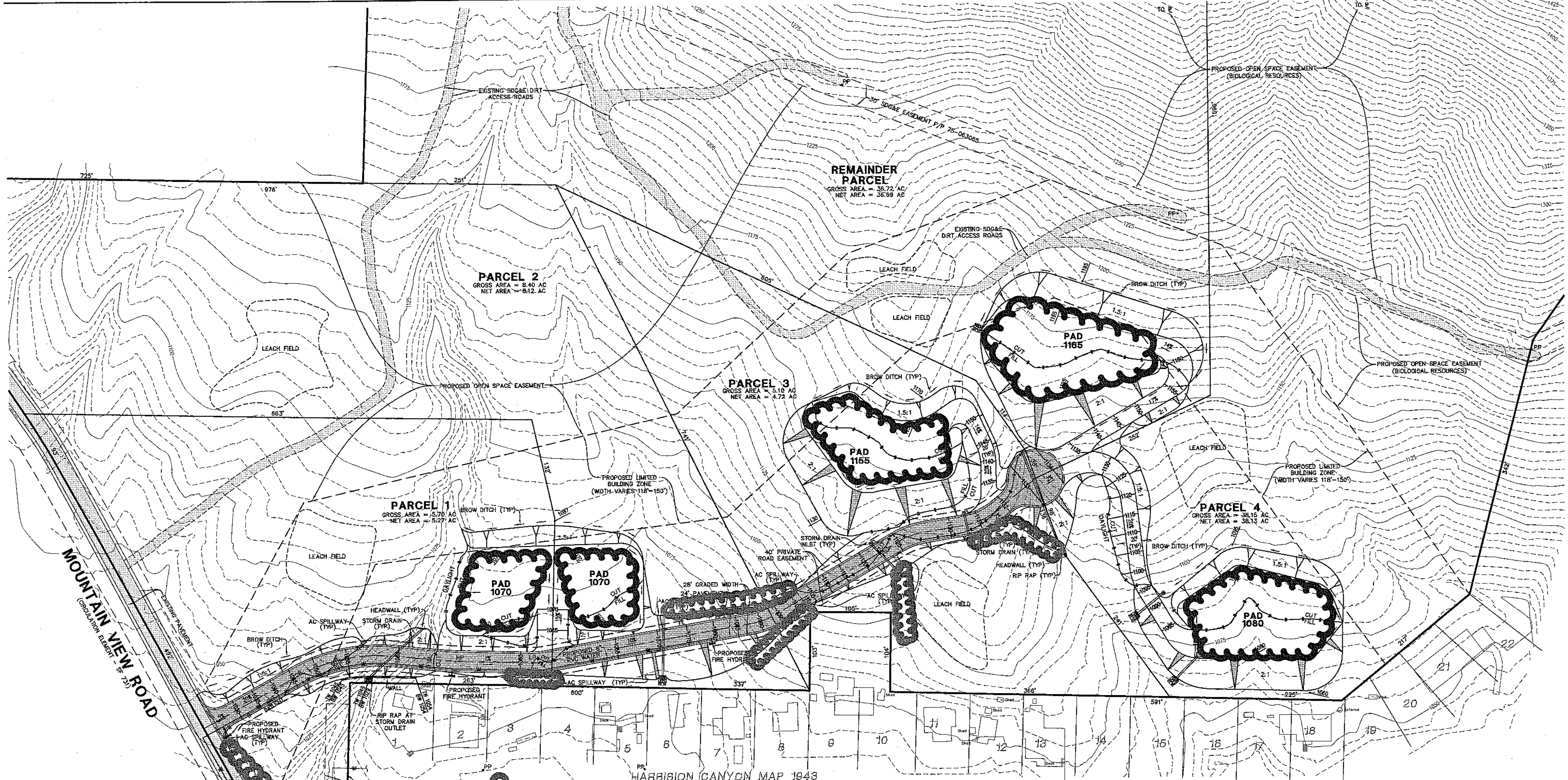
## PROJECT SITE MAP

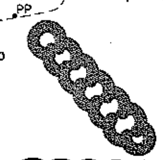
# ATTACHMENT C

## RELEVANT MONITORING DATA

*(NOTE: PROVIDE RELEVANT WATER QUALITY MONITORING DATA IF AVAILABLE.)*

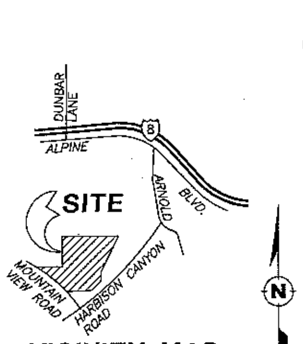
**NONE AVAILABLE**



**TREATMENT BMP - VEGETATED SWALE OR STRIP**

**TREATMENT BMP - VEGETATED SWALE OR STRIP (DURING BUILDING PERMIT PHASE)**




**VICINITY MAP**
NO SCALE
THOMAS BROS MAP PG. 1233, C-7 & D-7

CONNECT TO EXISTING WATER MAIN
EXISTING 2" S.P.
EXISTING 8" PVC WATER PER DWG. NO. W-314
EXISTING 6" PVC WATER PER DWG. NO. W-312

**LEGAL DESCRIPTION**
A PORTION OF THE NE ¼ OF SE ¼ OF THE NW ¼ SECTION 36, T 15 S, R 1 E

**ASSESSOR'S PARCEL NUMBER**
399-030-29 & 30, 399-040-11

**TOPOGRAPHY**
PROVIDED BY BAIRD ENGINEERING

**OWNER**
SAM KEMERKO
4669 CHAREST DRIVE
WATERFORD, MI 48327
(248) 877-6996

| | | | |
|---|---|---|---|
| 4 | 3,350 | 4,200 | 850 F |
| REMAINDER | 5,600 | 2,200 | 3,400 C |
| PRIVATE ROAD | 2,400 | 11,900 | 7,500 F |
| SUBTOTAL | 19,150 | 23,350 | 4,200 F |
| 15% SHRINKAGE | N/A | 2,850 | 2,850 F |
| TOTALS | 19,150 | 26,200 | 7,050 F |

ASSUME 15% SHRINKAGE

SCALE: 1" = 60'

# TREATMENT BMP LOCATION MAP

# ATTACHMENT E

## TREATMENT BMP DATASHEET

*(NOTE: POSSIBLE SOURCE FOR DATASHEETS CAN BE FOUND AT WWW.CABMPHANDBOOKS.COM. INCLUDE ENGINEERING CALCULATIONS FOR SIZING THE TREATMENT BMP.)*

- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

## Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

## Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

**Table 1 Grassed swale pollutant removal efficiency data**

| Study | TSS | TP | TN | $NO_3$ | Metals | Bacteria | Type |
|---|---|---|---|---|---|---|---|
| | Removal Efficiencies (% Removal) | | | | | | |
| Caltrans 2002 | 77 | 8 | 67 | 66 | 83-90 | -33 | dry swales |
| Goldberg 1993 | 67.8 | 4.5 | - | 31.4 | 42–62 | -100 | grassed channel |
| Seattle Metro and Washington Department of Ecology 1992 | 60 | 45 | - | -25 | 2–16 | -25 | grassed channel |
| Seattle Metro and Washington Department of Ecology, 1992 | 83 | 29 | - | -25 | 46–73 | -25 | grassed channel |
| Wang et al., 1981 | 80 | - | - | - | 70–80 | - | dry swale |
| Dorman et al., 1989 | 98 | 18 | - | 45 | 37–81 | - | dry swale |
| Harper, 1988 | 87 | 83 | 84 | 80 | 88–90 | - | dry swale |
| Kercher et al., 1983 | 99 | 99 | 99 | 99 | 99 | - | dry swale |
| Harper, 1988. | 81 | 17 | 40 | 52 | 37–69 | - | wet swale |
| Koon, 1995 | 67 | 39 | - | 9 | -35 to 6 | - | wet swale |

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

## Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

### *Selection Criteria (NCTCOG, 1993)*

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

## Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.
- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.
- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.
- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.
- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

**Table 2 Swale Cost Estimate (SEWRPC, 1991)**

| Component | Unit | Extent | Unit Cost | | | Total Cost | | |
|---|---|---|---|---|---|---|---|---|
| | | | Low | Moderate | High | Low | Moderate | High |
| Mobilization / Demobilization-Light | Swale | 1 | $107 | $274 | $441 | $107 | $274 | $441 |
| Site Preparation | | | | | | | | |
| Clearing[b] | Acre | 0.5 | $2,200 | $3,800 | $5,400 | $1,100 | $1,900 | $2,700 |
| Grubbing[c] | Acre | 0.25 | $3,800 | $5,200 | $6,600 | $950 | $1,300 | $1,650 |
| General Excavation[d] | $Yd^3$ | 372 | $2.10 | $3.70 | $5.30 | $781 | $1,376 | $1,972 |
| Level and Till[e] | $Yd^2$ | 1,210 | $0.20 | $0.35 | $0.50 | $242 | $424 | $605 |
| Sites Development | | | | | | | | |
| Salvaged Topsoil Seed, and Mulch[f] | $Yd^2$ | 1,210 | $0.40 | $1.00 | $1.60 | $484 | $1,210 | $1,936 |
| Sod[g] | $Yd^2$ | 1,210 | $1.20 | $2.40 | $3.60 | $1,452 | $2,904 | $4,356 |
| **Subtotal** | -- | -- | -- | -- | -- | $5,116 | $9,368 | $13,660 |
| Contingencies | Swale | 1 | 25% | 25% | 25% | $1,279 | $2,347 | $3,415 |
| Total | -- | -- | -- | -- | -- | $6,395 | $11,735 | $17,075 |

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right)$ x swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

***Maintenance Cost***

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

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## TREATMENT BMP – ENGINEERING CALCULATIONS

The calculations below represent the maximum water quality flow tributary to any given Vegetated Swale at the maximum allowable slope (2.5%) within this project. Therefore, the flowrates, velocities and slopes will be lower values while the residence time (i.e. filtration time) will increase.

### VEGETATED SWALE:

Given Input Data:

| | |
|---|---|
| Shape | Trapezoidal |
| Solving for | Depth of Flow |
| Flowrate | 0.10 cfs |
| Slope | 0.025 ft/ft |
| Manning's n | 0.25 |
| Height | 1.0 ft |
| Bottom width | 5.0 ft |
| Left slope | 0.50 ft/ft (V/H) |
| Right slope | 0.50 ft/ft (V/H) |

Computed Results:

| | |
|---|---|
| Depth | 0.10 ft |
| Velocity | 0.2 fps |
| Full Flowrate | 5.4 cfs |
| Flow area | 0.5 ft2 |
| Flow perimeter | 5.4 ft |
| Hydraulic radius | 0.09 ft |
| Top width | 5.4 ft |
| Area | 7.0 ft2 |
| Perimeter | 9.5 ft |
| Percent full | 9.9 % |

**VEGETATED SWALE - RESIDENCE TIME:** (5 minutes min.)

5 min (min) * 60 sec/min = 300 sec (min)

0.2 ft/sec * 300 sec (min) = 60 ft (min)

Therefore, the minimum length of a vegetated swale shall be 60 feet given the above-mentioned Vegetated Swale design for this project.

- Flow characteristics and vegetation type and density can be closely controlled to maximize BMP effectiveness.
- Roadside shoulders act as effective buffer strips when slope and length meet criteria described below.

### Limitations

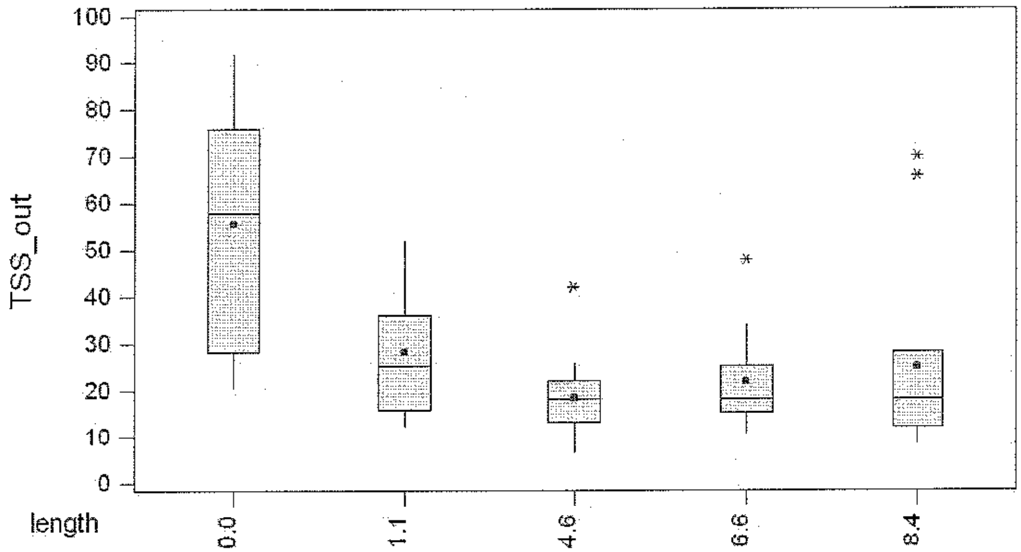
- May not be appropriate for industrial sites or locations where spills may occur.
- Buffer strips cannot treat a very large drainage area.
- A thick vegetative cover is needed for these practices to function properly.
- Buffer or vegetative filter length must be adequate and flow characteristics acceptable or water quality performance can be severely limited.
- Vegetative buffers may not provide treatment for dissolved constituents except to the extent that flows across the vegetated surface are infiltrated into the soil profile.
- This technology does not provide significant attenuation of the increased volume and flow rate of runoff during intense rain events.

### Design and Sizing Guidelines

- Maximum length (in the direction of flow towards the buffer) of the tributary area should be 60 feet.
- Slopes should not exceed 15%.
- Minimum length (in direction of flow) is 15 feet.
- Width should be the same as the tributary area.
- Either grass or a diverse selection of other low growing, drought tolerant, native vegetation should be specified. Vegetation whose growing season corresponds to the wet season is preferred.

#### *Construction/Inspection Considerations*

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install strips at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be required.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.




Filter strips also exhibit good removal of litter and other floatables because the water depth in these systems is well below the vegetation height and consequently these materials are not easily transported through them. Unfortunately little attenuation of peak runoff rates and volumes (particularly for larger events) is normally observed, depending on the soil properties. Therefore it may be prudent to follow the strips with another practice than can reduce flooding and channel erosion downstream.

## Siting Criteria

The use of buffer strips is limited to gently sloping areas where the vegetative cover is robust and diffuse, and where shallow flow characteristics are possible. The practical water quality benefits can be effectively eliminated with the occurrence of significant erosion or when flow concentration occurs across the vegetated surface. Slopes should not exceed 15 percent or be less than 1 percent. The vegetative surface should extend across the full width of the area being drained. The upstream boundary of the filter should be located contiguous to the developed area. Use of a level spreading device (vegetated berm, sawtooth concrete border, rock trench, etc) to facilitate overland sheet flow is not normally recommended because of maintenance considerations and the potential for standing water.

Filter strips are applicable in most regions, but are restricted in some situations because they consume a large amount of space relative to other practices. Filter strips are best suited to treating runoff from roads and highways, roof downspouts, small parking lots, and pervious surfaces. They are also ideal components of the "outer zone" of a stream buffer or as pretreatment to a structural practice. In arid areas, however, the cost of irrigating the grass on the practice will most likely outweigh its water quality benefits, although aesthetic considerations may be sufficient to overcome this constraint. Filter strips are generally impractical in ultra-urban areas where little pervious surface exists.

Some cold water species, such as trout, are sensitive to changes in temperature. While some treatment practices, such as wet ponds, can warm stormwater substantially, filter strips do not consequently, mowing may only be necessary once or twice a year for safety and aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in strip areas, particularly along highways. The need for litter removal should be determined through periodic inspection but litter should always be removed prior to mowing.
- Regularly inspect vegetated buffer strips for pools of standing water. Vegetated buffer strips can become a nuisance due to mosquito breeding in level spreaders (unless designed to dewater completely in 48-72 hours), in pools of standing water if obstructions develop (e.g. debris accumulation, invasive vegetation), and/or if proper drainage slopes are not implemented and maintained.

## Cost

### *Construction Cost*

Little data is available on the actual construction costs of filter strips. One rough estimate can be the cost of seed or sod, which is approximately 30¢ per ft$^2$ for seed or 70¢ per ft$^2$ for sod. This amounts to between $13,000 and $30,000 per acre of filter strip. This cost is relatively high compared with other treatment practices. However, the grassed area used as a filter strip may have been seeded or sodded even if it were not used for treatment. In these cases, the only additional cost is the design. Typical maintenance costs are about $350/acre/year (adapted from SWRPC, 1991). This cost is relatively inexpensive and, again, might overlap with regular landscape maintenance costs.

The true cost of filter strips is the land they consume. In some situations this land is available as wasted space beyond back yards or adjacent to roadsides, but this practice is cost-prohibitive when land prices are high and land could be used for other purposes.

### *Maintenance Cost*

Maintenance of vegetated buffer strips consists mainly of vegetation management (mowing, irrigation if needed, weeding) and litter removal. Consequently the costs are quite variable depending on the frequency of these activities and the local labor rate.

## References and Sources of Additional Information

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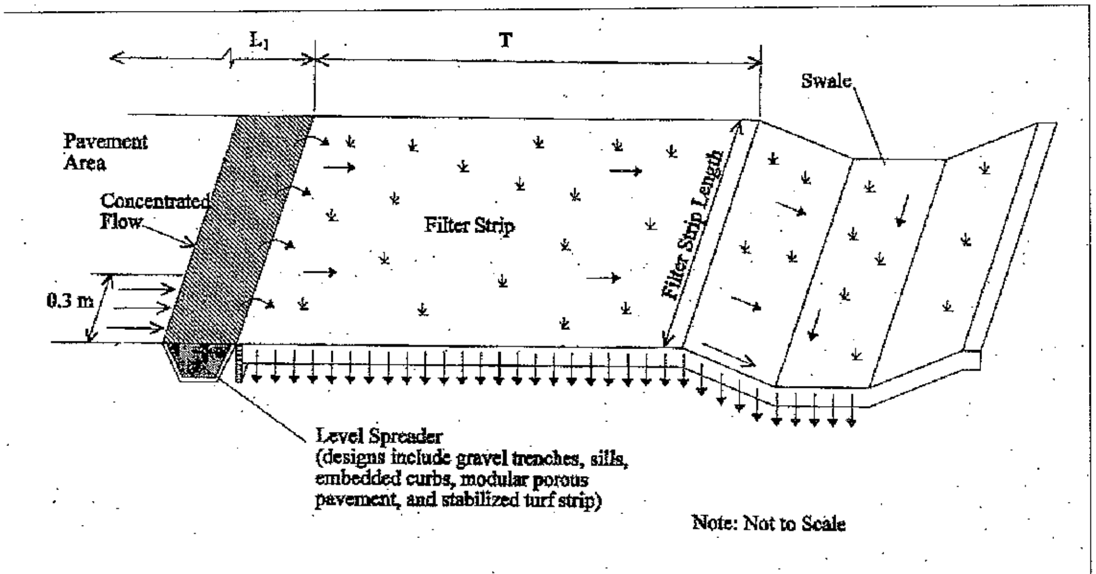
L1
T
Swale
Pavement Area
Concentrated Flow
0.3 m
Filter Strip
Filter Strip Length
Level Spreader
(designs include gravel trenches, sills, embedded curbs, modular porous pavement, and stabilized turf strip)
Note: Not to Scale

**FIRST CATEGORY:**

The County should have only minimal concern for ongoing maintenance. The proposed BMPs inherently "take care of themselves", or property owners can naturally be expected to do so as an incident of taking care of their property

Typical BMPs:

- Biofilters (Grass swale, Grass strip, vegetated buffer)
- Infiltration BMP (basin, trench)

**Mechanisms to Assure Maintenance:**

1. Stormwater Ordinance Requirement: The WPO requires this ongoing maintenance. In the event that the mechanisms below prove ineffective, or in addition to enforcing those mechanisms, civil action, criminal action or administrative citation could also be pursued for violations of the ordinance.
2. Public Nuisance Abatement: Under the WPO failure to maintain a BMP would constitute a public nuisance, which may be abated under the Uniform Public Nuisance Abatement Procedure. This provides an enforcement mechanism additional to the above, and would allow costs of maintenance to be billed to the owner, a lien placed on the property, and the tax collection process to be used.
3. Notice to Purchasers. Section 67.819(e) of the WPO requires developers to provide clear written notification to persons acquiring land upon which a BMP is located, or others assuming a BMP maintenance obligation, of the maintenance duty.
4. Conditions in Ongoing Land Use Permits: For those applications (listed in SO Section 67.804) upon whose approval ongoing conditions may be imposed, a condition will be added which requires the owner of the land upon which the stormwater facility is located to maintain that facility in accordance with the requirements specified in the SMP. Failure to perform maintenance may then be addressed as a violation of the permit, under the ordinance governing that permit process.
5. Subdivision Public Report: Tentative Map and Tentative Parcel Map approvals will be conditioned to require that, prior to approval of a Final or Parcel Map, the subdivider shall provide evidence to the Director of Public Works, that the subdivider has requested the California Department of Real Estate to include in the public report to be issued for the sales of lots within the subdivision, a notification regarding the maintenance requirement. (The requirement for this condition would not be applicable to subdivisions which are exempt from regulation under the Subdivided Lands Act, or for which no public report will be issued.)

**Funding:**

None Required.

# APPENDIX H Estimated O & M Costs for BMP Project

| Estimated vlaues derived from Caltrans Pilot BMP Study. This spreadsheet will change as additional data becomes available. | | | | | | Labor | | | Equipment | | | | Materials | | Total | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Per. Hrs | Rate | Cost | Type | Days | rate | Cost | Item | Cost | Cost | |
| | | | | Notify engineer to determine if regrading is necessary. If necessary, regrade to design specification and revegetate swale/strip. If regrading is necessary, the process should start in May. Revegetate strip/swale in Nov. Target completion prior to wet season. | None | 2 | 43.63 | 87.26 | | | | 0 | | | 87.26 | |
| Inspect for burrows | Burrows, holes, mounds | Visual observation | Annually and after vegetation trimming. | Where burrows cause seepage, erosion and leakage, backfill firmly. | | 0 | 0 | 0 | one-ton truck & hydroseeder | 0 | 26.84 | 0 | | | 0 | |
| General Maintenance Inspection | Inlet structures, outlet structures, side slopes or other features damaged, significant erosion,emergence of trees, woody vegetation , fence damage, etc. | Visual observation | Semi-Annually, late wet season and late dry season. | Corrective action prior to wet season. Consult engineer if an immediate solution is not evident. | Remove any trees, or woody vegetation. | 16 | 43.63 | 698.08 | one-ton truck & hydroseeder | 2 | 26.84 | 53.68 | | | 751.76 | |
| **TOTAL BIO FILTER AND SWALES** | | | | | | 52 | | 2268.76 | | | | 203.66 | | 500 | 2972.42 | |