PRELIMINARY HYDROMODIFCATION MANAGEMENT PLAN

CASTLEROCK

CITY OF SAN DIEGO, CALIFORNIA

PardeeHomes

PROJECT NO. 10046
W.O. NO. 42-1653

MARCH 2012
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6/11/12

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Expires 09/30/13

BACKGROUND

The Castlerock development project is a priority development project as defined by the city of San Diego's stormwater standards. Hydrology study and water quality technical reports were previously prepared to address flood control design and water quality standards. This document is a supplement to the water quality technical report in order to address hydromodification management.

SCOPE OF ANALYSIS

Hydromodification management will be provided for Areas 3 through 8 as shown on the project exhibit. Areas 1 and 2 directly connect to a storm drain system (hardened conveyance) which discharges to the San Diego River, a waterway which is exempt from hydromodification requirements per the City's stormwater standards. The remaining project drainage areas (areas 3-8) will drain to the basins or a treatment option which will outlet into a storm drain system which discharges to Sycamore Channel, which eventually discharges to the San Diego River. Sycamore Channel is an engineered channel system which is currently vegetated, but has not been determined to be exempt from hydromodification management.

MANAGEMENT PLAN

Four options are presented for the project to comply with the city's hydromodification requirements. Option 1 includes detention basins in conjunction with bio-retention. Sizing of the bio-retention facilities is based on the March 2011 Hydromodification Management Plan document. Option 2 utilizes detention basins sized using the pond sizing calculator provided on the project cleanwater website. Option 3 incorporates underground storage capacity to regulate runoff discharge to meet HMP requirements. Option 4 proposes maximal utilization of LID concepts with on-lot treatment, bio-retention within the public ROW and shallow, passive park bio-retention facilities prior to outfall in the sub-basins. Impacts to the current site design for each option are discussed below.

SIZING

Sizing requirements for the four options of basins and HMP measures are outlined in the Sizing Appendix.

PROJECT INFORMATION

Project variables were defined as follows for the calculations: the site is located in the Oceanside rain gage (for options 1, 2 and 3 which utilize the model SUSMP and online calculator) , consists of Type D soils and the existing terrain is steep (greater than 10%). The Oceanside rain gauge is used for the calculations as outlined on page 7-17 of the HMP document. The site is located east of the 12" isopluvial contour line that delineates the Lindbergh and Oceanside basins. Figure 4-1 of the HMP document on page 4-16 shows the 12" isopluvial line and this project is located east of the line. In the event that final engineering elects to utilize continuous simulation modeling, then an alternate, localized gauge may be selected. The online calculator method of HMP compliance also yields a consistent result of the project being located within the Oceanside rain gauge.

For the purposes of this study, a channel susceptibility analysis was not performed and the default rate of 0.1Q2 is used for the low flow threshold and sizing factor determination. Based on these values, the surface area sizing factor for the bio-retention facilities per table 7-1 of the HMP document is 0.065. At a future date, the project may elect to perform a susceptibility analysis for the channel in order to use a lower sizing factor in determining the size of the flow control facilities. A preliminary analysis of the channel is supportive of a larger factor for the flow control threshold, but no calculations have been performed at this point, so the default value is used.

OPTIONS

These options will be further evaluated during final engineering to determine which will be incorporated into the final design. The water quality technical report during final engineering will determine which option provides the most value and function for the site and incorporates BMP's and HMP mitigation features approved for use within the public Right of Way. The various options will have the following impacts to the current site design.

Option 1 – Combination Bio-retention and detention basin – this option utilizes detention basins and supplemental bio-retention areas to meet hydromodification compliance. Preliminary sizing calculations are shown on Table 1. The detention basins would be configured with an outlet control structure to ensure compliance with HMP flow thresholds and drawdown requirements. The outlet structure would incorporate a small orifice or other restricted inlet near the lower portion of the basin which will be designed to match the required low flow threshold requirements. Overflow weirs or alternate heights of inlet openings would ensure that the project meets drawdown requirements during larger storm events. The basins would still function as flood control devices as designed in the final hydrology report. This option may require an additional shallow storm drain system in order to route runoff to the bio-retention areas. Impacts to the proposed housing project are estimated at 14 single family lots and 6 multi-family units, subject to final engineering calculations.

Option 2 – Detention Ponds – This option would rely on expanded detention basins to meet hydromodification criteria. Additional volume would be added to the basins and sizing of the basins would be determined by the online sizing calculator via the Project Cleanwater website or an approved alternate methodology. The ponds would be designed with outlet structures to meet flow control thresholds with small orifice openings or restricted flow inlet pipes. Larger opening located higher in the outlet structure would be designed to ensure compliance with drawdown time requirements. Higher flows beyond the 10 year storm would fall under the flood control criteria as outlined by the final hydrology report. This option may require additional storm drain to route offsite flows around the treatment facilities. This option has several design challenges to be addressed in final design including liability and safety issues due to ponded water depth, vector control and potential for seepage to affect surrounding soil stability. This scenario would result in a displacement of approximately 10 single family lots and 4 multifamily units. Final sizing and configurations could potentially reduce the number of units displaced. Preliminary sizing calculations are shown on Table 2.

Option 3 – Underground Storage – This option would allow for the design of underground detention structures which would store the increased runoff volumes and regulate the amount of runoff that flows from the site. Potential vaults would be located beneath the proposed park areas as an alternative to the deep ponds. Storm drain points of connection are deep enough downstream to allow for significant depth of the vault system. By designing the storage underground and reducing the required basin volume, the overall pond footprint would decrease because of the reduced area required for the basin side slopes. Similar design challenges to Option 2 regarding seepage and issues related to access and maintenance would need to be addressed in final design. Due to the reduction in surface area associated with detention ponds, the number of displaced units would potentially be reduced to approximate 8 single family and 4 multifamily units.

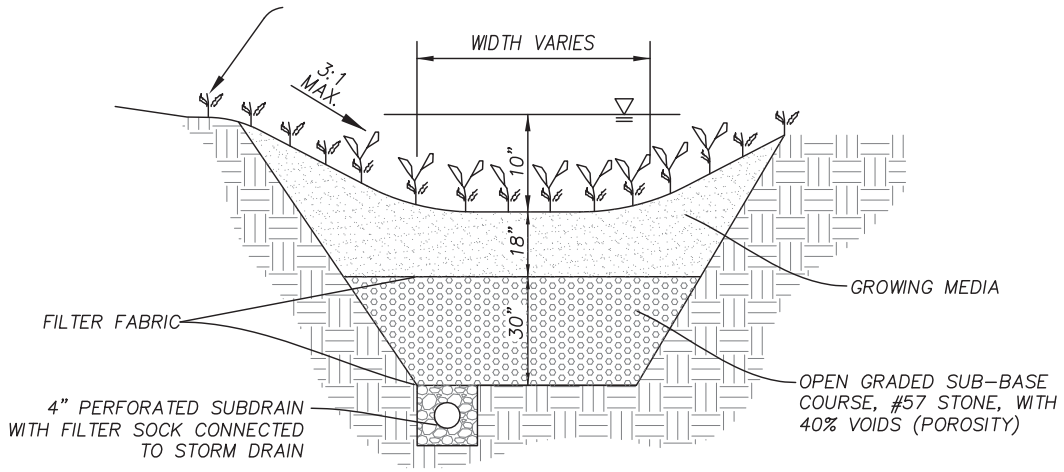
Option 4 – This option focuses mitigation opportunities at a lot and local street level in lieu of more regional basins. Low impact development (LID) concepts would be integrated at the lot level for both single and multi-family uses. Alternative driveway designs and criteria for hardscape to be partially pervious would be used. Roof drainage would be by gutter system to the swales within the yards. The swales would flow overland to a front-yard biofiltration area. The front yard biofiltration area would consist of a lined excavation back-filled with engineered media and underlain by a subdrain system. The subdrain system would outlet through a curb-core, or for locations where the grades make this infeasible, would outlet to the storm drain system in the street. Utilization of the sizing factors provided in the City's storm water standards (see attached sizing) has indicated that bio-retention areas are required to meet the HMP requirements.

Based on this approach, street runoff would be treated in biofiltration areas constructed as curb popouts and passive park areas. Street biofiltration areas would be connected to the site storm drain system. The bio-retention areas would occupy a portion of the street and sidewalk area, and would require a narrowing of travel lanes, similar to traffic calming measures allowed in the City Street Design Manual. Hydromodification and 100-year mitigation will be achieved through sizing the on-lot, street biofiltration systems and passive park bio-retention systems. There would be no loss of dwelling units in this alternative HMP option.

An alternative continuous simulation modeling software (ClearCreek Solutions, approved by the County and included in the sizing appendix) has yielded results showing that the on-lot bioretention volumes would eliminate the need for additional measures to meet HMP compliance for every basin except basin 3. Treatment control BMPs would need to be incorporated to meet requirements outlined in the water quality technical report. Results of the continuous simulation model are presented in the Sizing Appendix.

CONCLUSION

This analysis demonstrates that the Castlerock project will comply with Hydromodification Management requirements onsite without impacts to MHPA Open Space or without adversely affecting downstream receiving water bodies. This analysis includes 4 optional solutions to satisfy HMP requirements. A reduction in the architectural footprints, additional LID measures, varying the depth and volumes of the basins or bio-retention areas, the addition of pervious pavement in the public ROW and a downstream susceptibility analysis are all variables that could be refined during final design that would cause a reduction in the size and area required for bio-retention and detention storage. Option 4 which includes curb popouts and biofiltration within the Public Right of Way is subject to review and approval by the City Engineer prior to permit and construction. Final selection of one of the options and sizing calculations will occur during final engineering and be included in a revised hydraulics analysis and Water Quality Technical report as part of the review of construction documents.



BIO-RETENTION FACILITY- TYPICAL DETAIL

NO SCALE

LEGEND:

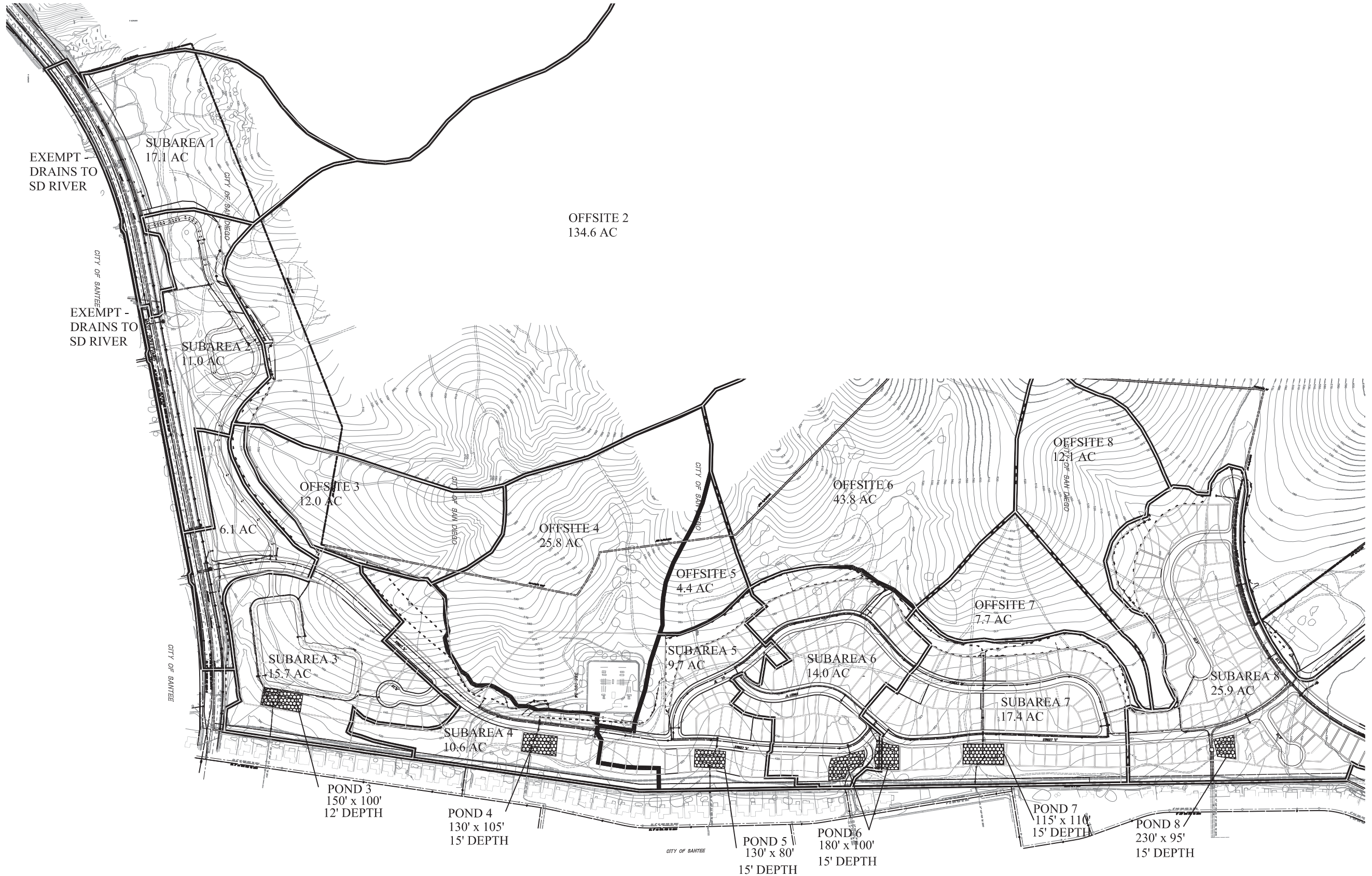
PROJECT LIMITS

SUBAREA LIMITS

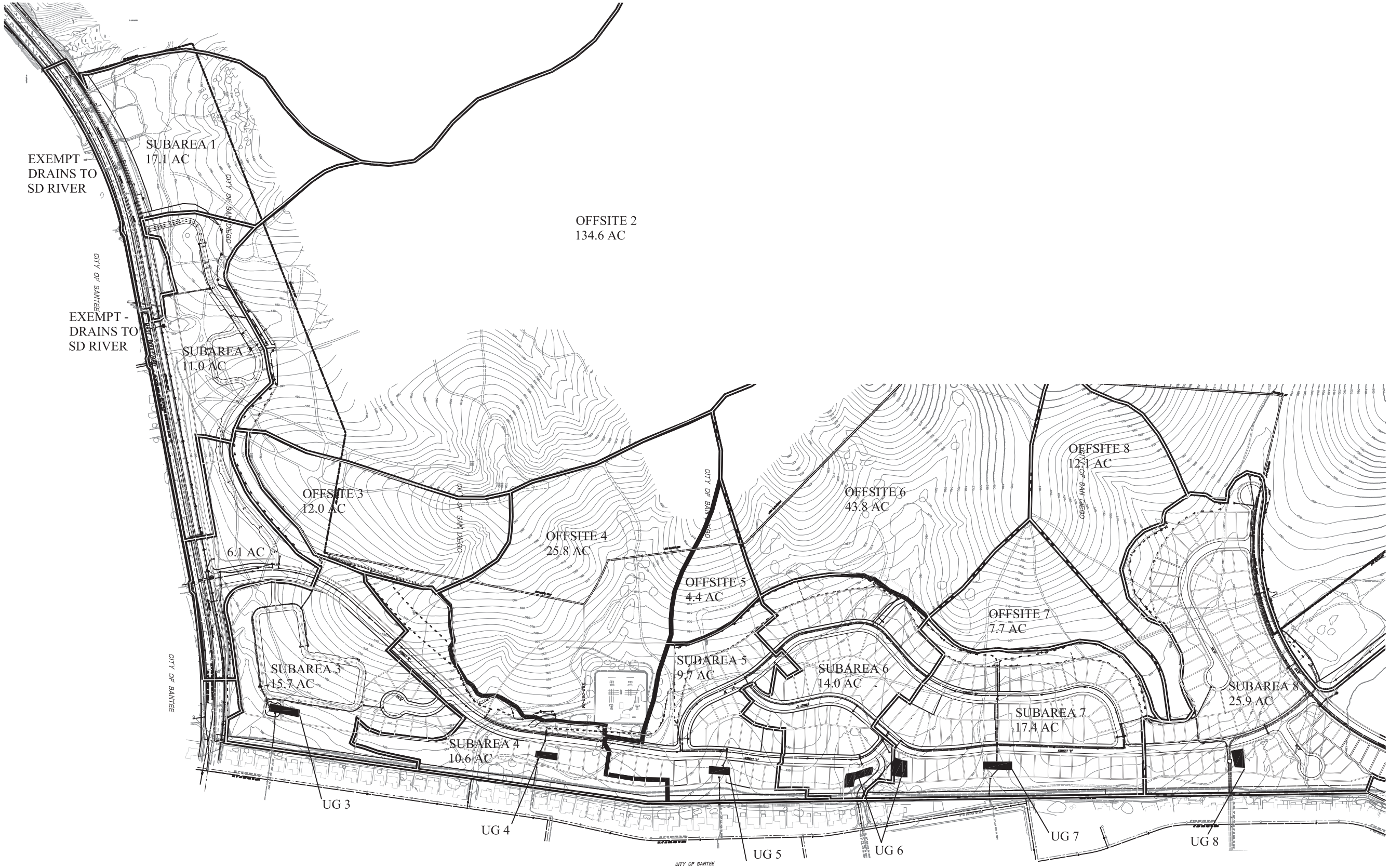
BIORETENTION BASIN

DETENTION BASIN

CASTLEROCK HYDROMODIFICATION MANAGEMENT EXHIBIT OPTION 1 – COMBINATION DETENTION BASIN/BIORETENTION



CASTLEROCK HYDROMODIFICATION MANAGEMENT EXHIBIT OPTION 2 – DETENTION PONDS



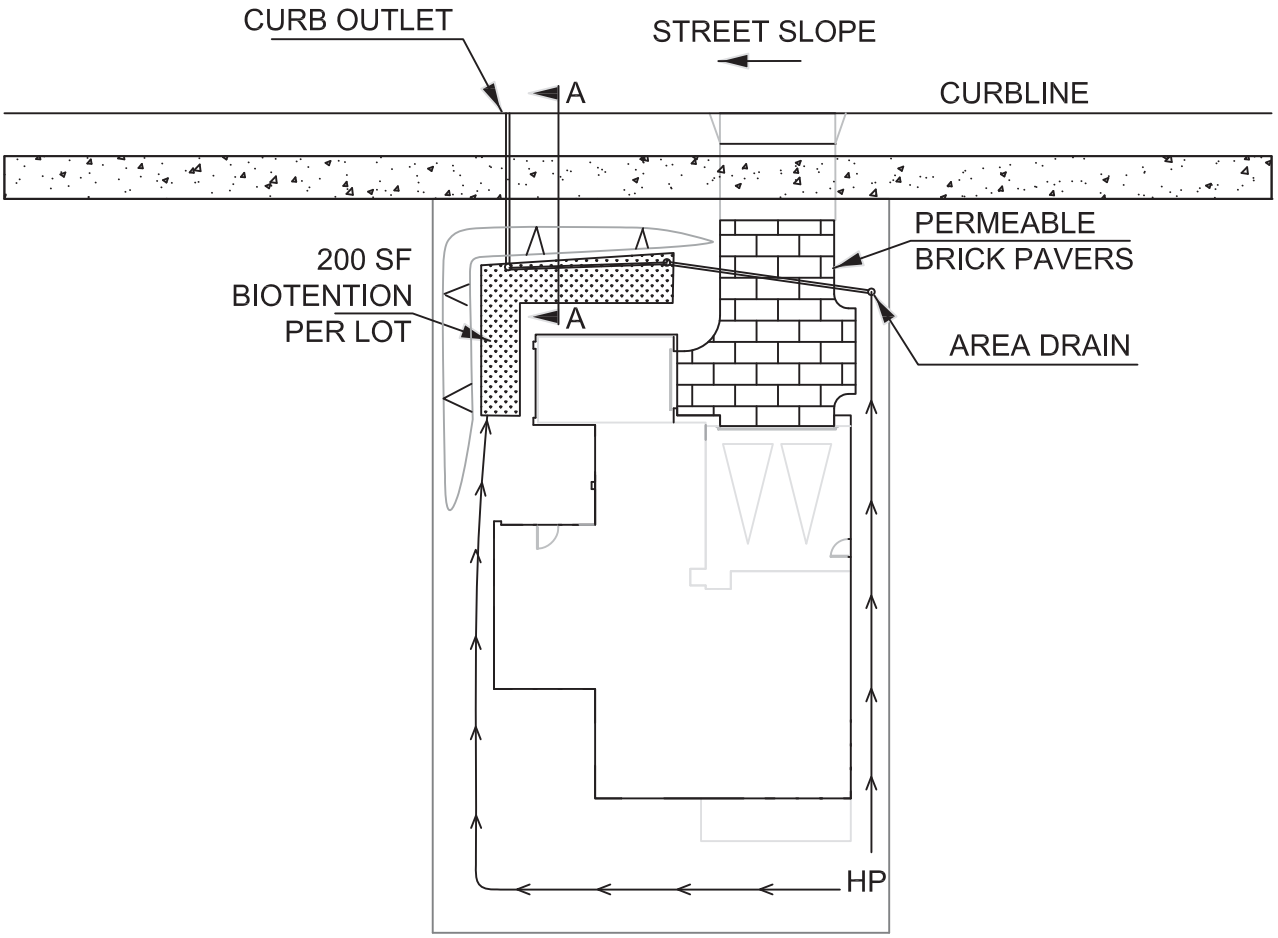
LEGEND:

PROJECT LIMITS

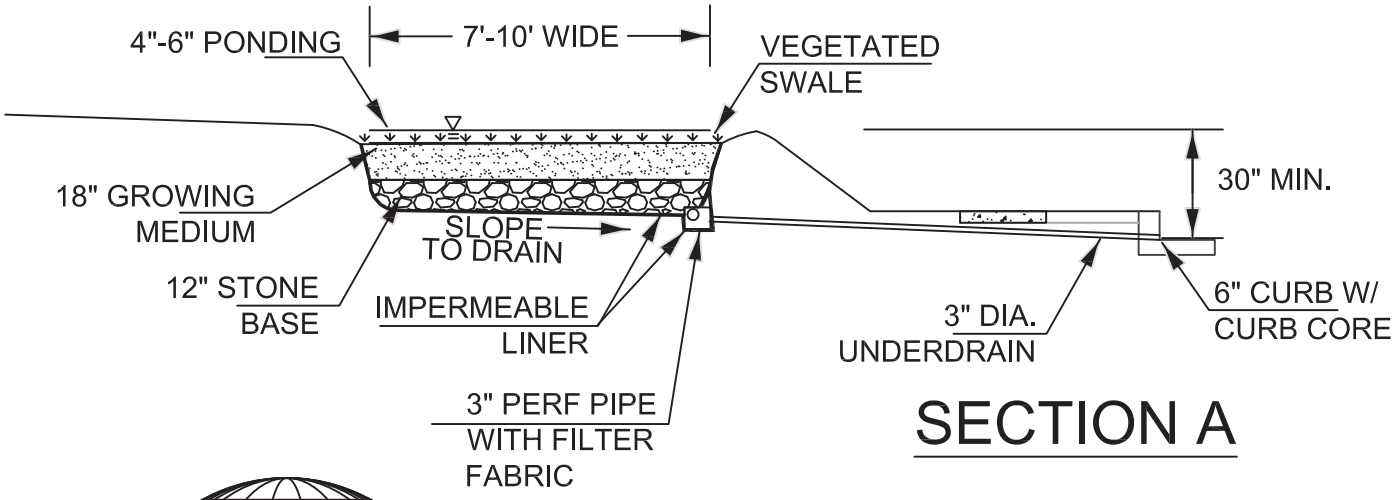
SUBAREA LIMITS

UNDERGROUND STORAGE

CASTLEROCK HYDROMODIFICATION MANAGEMENT EXHIBIT OPTION 3 – PONDS/UNDERGROUND



TYPICAL LOT PLAN



SECTION A

LATITUDE 33
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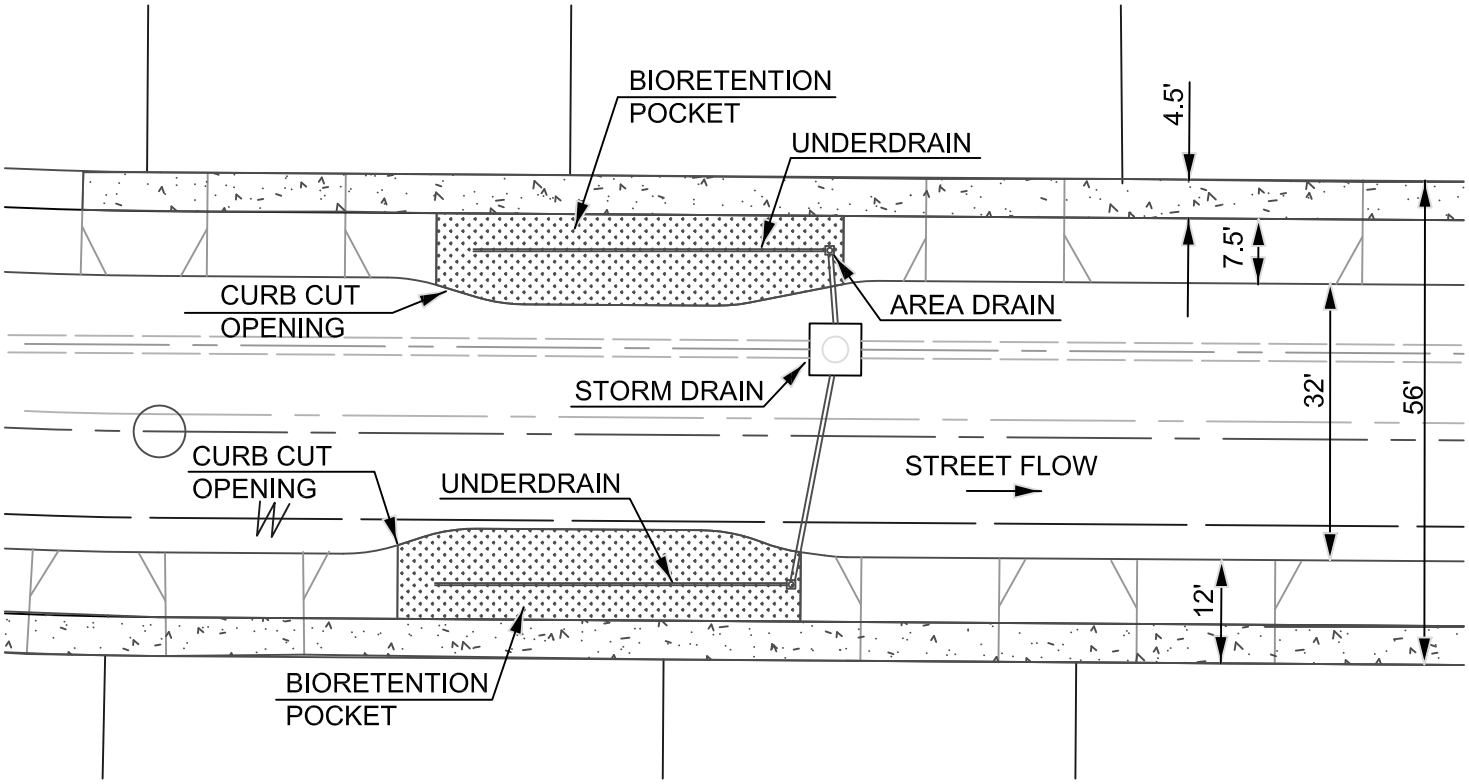
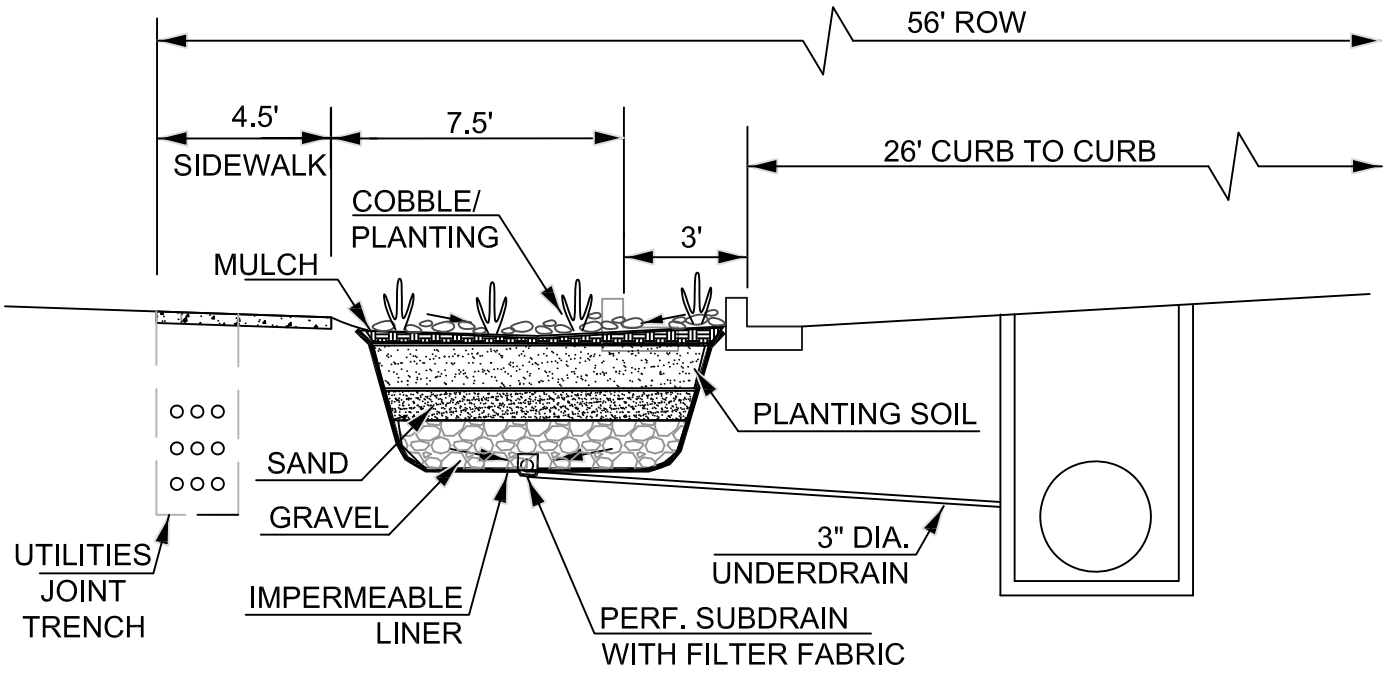
CASTLEROCK HMP BIORETENTION ON SINGLE FAMILY LOT OPTION 4





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CASTLEROCK HMP BIORETENTION - STREET POPOUTS

PRELIMINARY HYDROMODIFCATION MANAGEMENT PLAN

CASTLEROCK

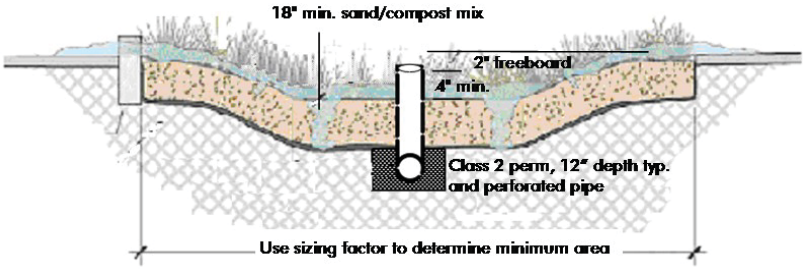
CITY OF SAN DIEGO, CALIFORNIA

OPTION 4 DOCUMENTATION

REFERENCE DOCUMENTS BY:

CITY OF SAN DIEGO STORM WATER MANUAL
JANUARY 20, 2012

4.7 Bioretention Facilities



Bioretention facility configured for treatment-only requirements. Bioretention facilities can rectangular, linear, or nearly any shape.

Best Uses

- Commercial areas
- Residential subdivisions
- Industrial developments
- Roadways
- Parking lots
- Fit in setbacks, medians, and other landscaped areas

Advantages

- Can be any shape
- Low maintenance
- Can be landscaped

Limitations

- Require 4% of tributary impervious square footage
- Typically requires 3-4 feet of head
- Irrigation typically required

Bioretention detains runoff in a surface reservoir, filters it through plant roots and a biologically active soil mix, and then infiltrates it into the ground. Where native soils are less permeable, an underdrain conveys treated runoff to storm drain or surface drainage.

Bioretention facilities can be configured in nearly any shape. When configured as linear **swales**, they can convey high flows while percolating and treating lower flows.

Bioretention facilities can be configured as in-ground or above-ground planter boxes, with the bottom open to allow infiltration to native soils underneath. If infiltration cannot be allowed, use the sizing factors and criteria for the Flow-Through Planter.

4.7.1 Criteria

For development projects subject only to runoff treatment requirements, the following criteria apply:

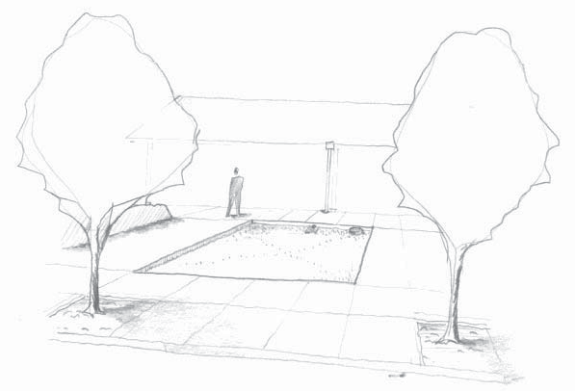
Parameter	Criterion
Soil mix depth	18 inches minimum
Soil mix minimum percolation rate	5 inches per hour minimum sustained (10 inches per hour initial rate recommended)
Soil mix surface area	0.04 times tributary impervious area (or equivalent)
Surface reservoir depth	6 inches minimum; may be sloped to 4 inches where adjoining walkways.

4.7.3 Applications

Multi-purpose landscaped areas. Bioretention facilities are easily adapted to serve multiple purposes. The loamy sand soil mix will support turf or a plant palette suitable to the location and a well-drained soil.

Example landscape treatments:

- Lawn with sloped transition to adjacent landscaping.
- Swale in setback area
- Swale in parking median
- Lawn with hardscaped edge treatment
- Decorative garden with formal or informal plantings
- Traffic island with low-maintenance landscaping
- Raised planter with seating
- Bioretention on a terraced slope

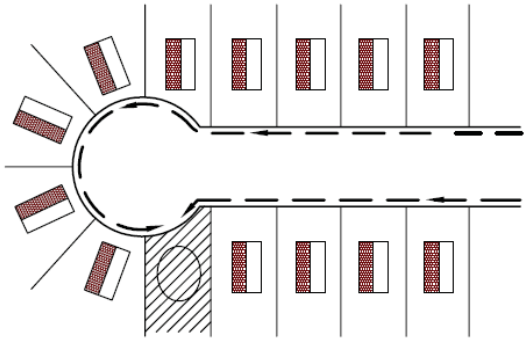


Bioretention facility configured as a recessed decorative lawn with hardscaped edge.

Bioretention facility configured and planted as a lawn/ play area.

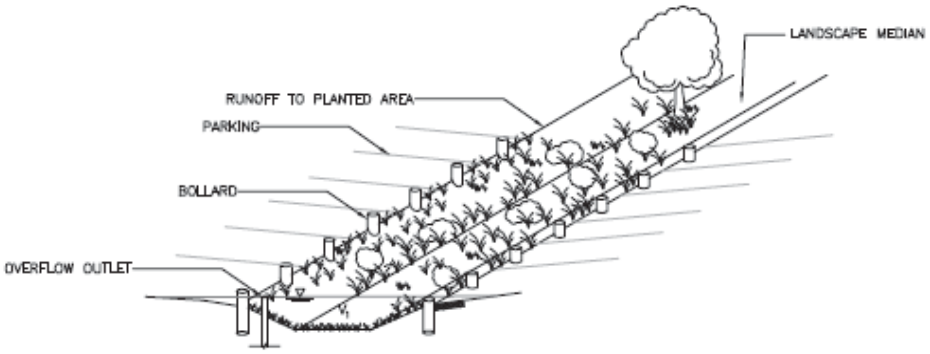
Residential subdivisions. Some subdivisions are designed to drain roofs and driveways to the streets (in the conventional manner) and then drain the streets to bioretention areas, with one bioretention area for each 1 to 6 lots, depending on subdivision layout and topography.

If allowed by the local jurisdiction, bioretention areas can be placed on a separate, dedicated parcel with joint ownership.



Bioretention facility receiving drainage from
individual lots and the street in a residential subdivision.

Sloped sites. Bioretention facilities must be constructed as a basin, or series of basins, with the circumference of each basin set level. It may be necessary to add curbs or low retaining walls.



Bioretention facility configured as a parking median.
Note use of bollards in place of curbs, eliminating the need for curb cuts.

4.7.4 Design Checklist for Bioretention

- ❒ Volume or depth of surface reservoir meets or exceeds minimum.
- ❒ 18" depth “loamy sand” soil mix with minimum long-term percolation rate of 5"/hour.
- ❒ Area of soil mix meets or exceeds minimum.
- ❒ Perforated pipe underdrain bedded in “Class 2 perm” with connection and sufficient head to storm drain or discharge point (except in “A” or “B” soils).
- ❒ No filter fabric.
- ❒ Underdrain has a clean-out port consisting of a vertical, rigid, non-perforated PVC pipe, with a minimum diameter of 6 inches and a watertight cap.
- ❒ Location and footprint of facility are shown on site plan and landscaping plan.
- ❒ Bioretention area is designed as a basin (level edges) or a series of basins, and grading plan is consistent with these elevations. If facility is designed as a swale, check dams are set so the lip of each dam is at least as high as the toe of the next upstream dam.
- ❒ Inlets are 12" wide, have 4"-6" reveal and an apron or other provision to prevent blockage when vegetation grows in, and energy dissipation as needed.
- ❒ Overflow connected to a downstream storm drain or approved discharge point.
- ❒ Emergency spillage will be safely conveyed overland.
- ❒ Plantings are suitable to the climate and a well-drained soil.
- ❒ Irrigation system with connection to water supply.
- ❒ Vaults, utility boxes, and light standards are located outside the minimum soil mix surface area.
- ❒ When excavating, avoid smearing of the soils on bottom and side slopes. Minimize compaction of native soils and “rip” soils if clayey and/or compacted. Protect the area from construction site runoff.

PRELIMINARY HYDROMODIFCATION MANAGEMENT PLAN

CASTLEROCK

CITY OF SAN DIEGO, CALIFORNIA

OPTION 4 DOCUMENTATION

REFERENCE DOCUMENTS BY:

RBF CONSULTING
May 16, 2012

SIZING INPUT PROVIDED FROM RBF CONSULTING

OPTION 4 ESTIMATION OF HMP AREAS AND STORAGE REQUIREMENTS

Stormwater quality, hydromodification and 100-year flow control mitigation were each assessed to determine the mitigation volume for the selected BMPs. The stormwater quality treatment volume was computed using a residential runoff coefficient and a design rainfall depth of 0.6 inches. The hydromodifcation volume requirement was computed using the San Diego Hydrology Model (SDHM). The SDHM is based on the USEPAs HSPF program, modified for local rainfall and loss parameters. The SDHM was used to compute flow duration curves for the pre-development condition and the post-development condition. Mitigation requirements were assessed by ensuring that there was no appreciable change between the pre- and post- development flow duration curves.

The 100-year flood control mitigation requirement was computed by subtracting the predevelopment 100 year runoff hydrograph form the post-development 100-year runoff hydrograph. The total mitigation volume estimates are based on the largest volume computed for the three conditions: Water quality, hydromodification, and 100-year mitigation. For the Castlerock development, the 100-year flow mitigation volume generally governs the storage requirement.

Watershed 30 – 0.40 acres (or 0.53 ac-ft)

Watershed 8 – 1.02 acres (or 1.36 ac-ft)

Watershed 7 – 0.69 acres (or 0.92 ac-ft)

Watershed 6 – 0.53 acres (or 0.71 ac-ft)

Watershed 5 – 0.37 acres (or 0.49 ac-ft)

Watershed 4 – 0.26 acres (or 0.35 ac-ft)

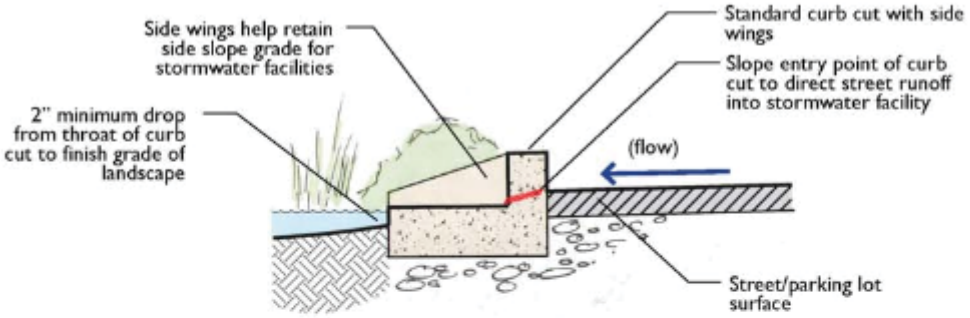
Watershed 3 – 0.71 acres (or 0.95 ac-ft)

Watershed 2 – 0.72 acres (or 0.96 ac-ft)

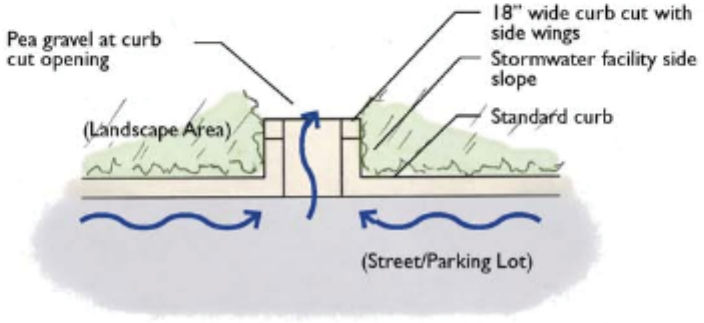
Watershed 1 – N/A - undeveloped

Street Bioretention Photos and Schematics

PROVIDED BY RBF CONSULTING



Standard Curb With Side Wings Cut Section View

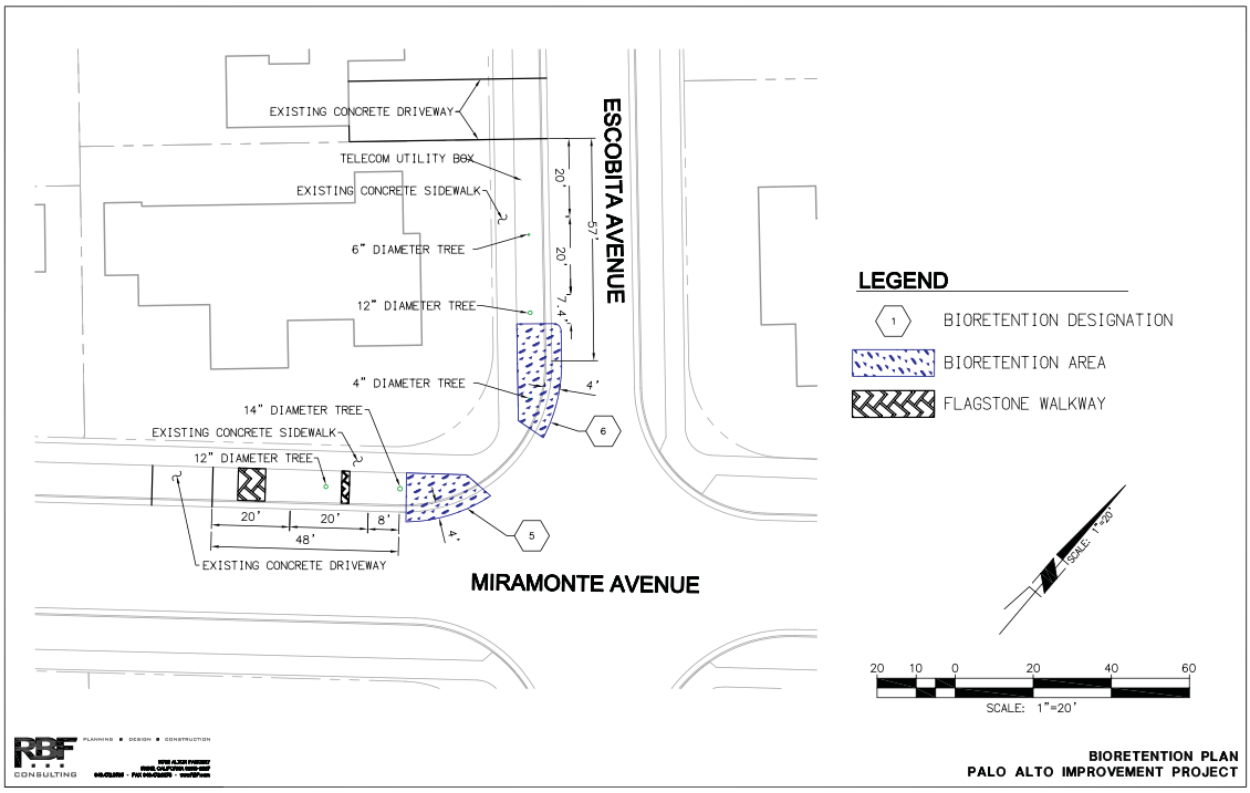


Standard Curb Cut With Side Wings Plan View

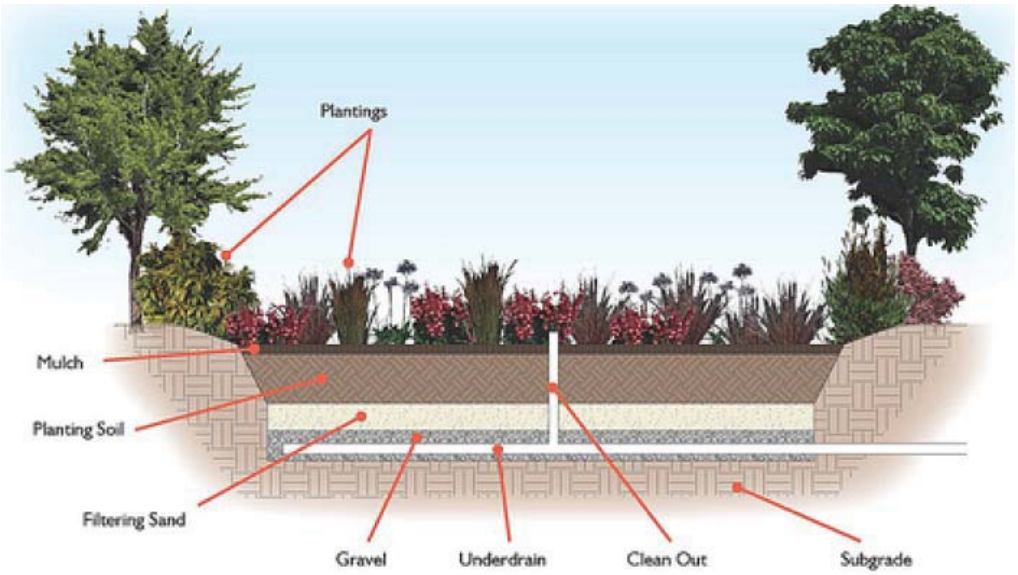
- Opening should be at least 18 inches wide
- Works well with stormwater facilities that have steeper side slope conditions
- Need to slope the bottom of the concrete curb cut toward the stormwater facility
- A minimum 2 inch drop in grade should occur between the curb cut entry point and the finish grade of the stormwater facility
- Pea gravel can be used as a stable mulch material at the curb cut opening to prevent erosion

SOURCE: KEVIN ROBERT PERRY / CITY OF PORTLAND

Figure 5-33: *A standard curb with wings allows stormwater runoff to enter a stormwater facility. The wings help retain the side slope grade on each side of the curb cut opening.*



BIORETENTION PLAN
PALO ALTO IMPROVEMENT PROJECT



BIORETENTION

Metals	**H**
Nutrients	**M**
Oil and Grease	**H**
Organics	**H**
Pathogens	**H**
Sediment	**H**
Trash	**H**

Description: Bioretention BMPs function as a soil and plant-based filtration device that removes pollutants through physical, biological, and chemical treatment processes. They can exist as in-ground devices or as infiltration or flow-through planter boxes.

Source: Portland Bureau of Environmental Services

Objective:

Bioretention BMPs collect and filter storm water runoff by allowing pollutants to settle and filter out as water percolates through a specifically designed soil matrix. Bioretention BMPs can reduce flow rates and volumes in addition to reducing pollutant loadings.

Suitable Applications:

These BMPs are relatively small and can easily be incorporated into landscape designs for residential, commercial, and industrial projects. They are versatile and can be used in many applications such as next to foundation walls, adjacent to property lines, median strips, and parking lot islands.

Design Considerations:

- When bioretention is to be used in median islands or other concentrated areas the following design considerations should be followed:
  1. Design bioretention to separate low flow from high flow event.
  2. Sub-surface system must have a minimum 1-foot cover.
  3. No pumps may be used.
- Listed below are plants suitable for use in bioretention cells, planter boxes and rain gardens.

Trees	
Cornus nuttallii	Pacific Dogwood
Platanus racemosa	California Sycamore
Shrubs	
*Arctostaphylos, various	Manzanita
*Baccharis pilularis	Dwarf Coyote Brush
*Mahonia pinnata	California Holly Grape
Spiraea, several	Spiraea
Strelitzia reginae	Bird of Paradise
Ground covers, Perennials	
*Achillea millefolium	Yarrow
Agapanthus africanus	Lily of the Nile
*Aquilegia hybrids	Columbine
Campanula, various	Bellflower
Dietes bicolor	African Iris
Fragaria chiloensis	Ornamental Strawberry
Hemerocallis hybrids	Daylily
Vinca minor	Periwinkle
Grasses and Grass like Plants	
*Achnatherum hymenoides	Indian Rice Grass
*Carex barberae	Santa Barbara Sedge
Distichlis spicata	Saltgrass
Festuca, various (except Tall)	Fescue Grass
Liriope, various	Lily Turf

*California Native

Bioretention Cells

Bioretention BMPs can be designed to accommodate most site restrictions and requirements. Typical installations consist of a storage area for the water quality volume over a matrix of soil and organic material, underlain by a subdrain system that is connected to the municipal storm drain. Bioretention may also be implemented as a planter box, which is a smaller, contained unit that can be used adjacent to structures. Design of bioretention cells depends on site constraints

such as treatment volume, available hydraulic head, depth to groundwater and area. Key design considerations are:

- Bioretention BMPs are not recommended for areas with slopes greater than 20% or where mature tree removal would be required
- Bioretention BMPs are not suitable at locations where the surrounding soil is unstable.
- Size the bioretention cell to capture the water quality volume based on the method described in section **Error! Reference source not found.** of this manual.
- Size area required for the bioretention cell area based on the following equation:

$$A = \frac{WQV}{h_f}$$

Where:

A = Bioretention cell area, ft^2

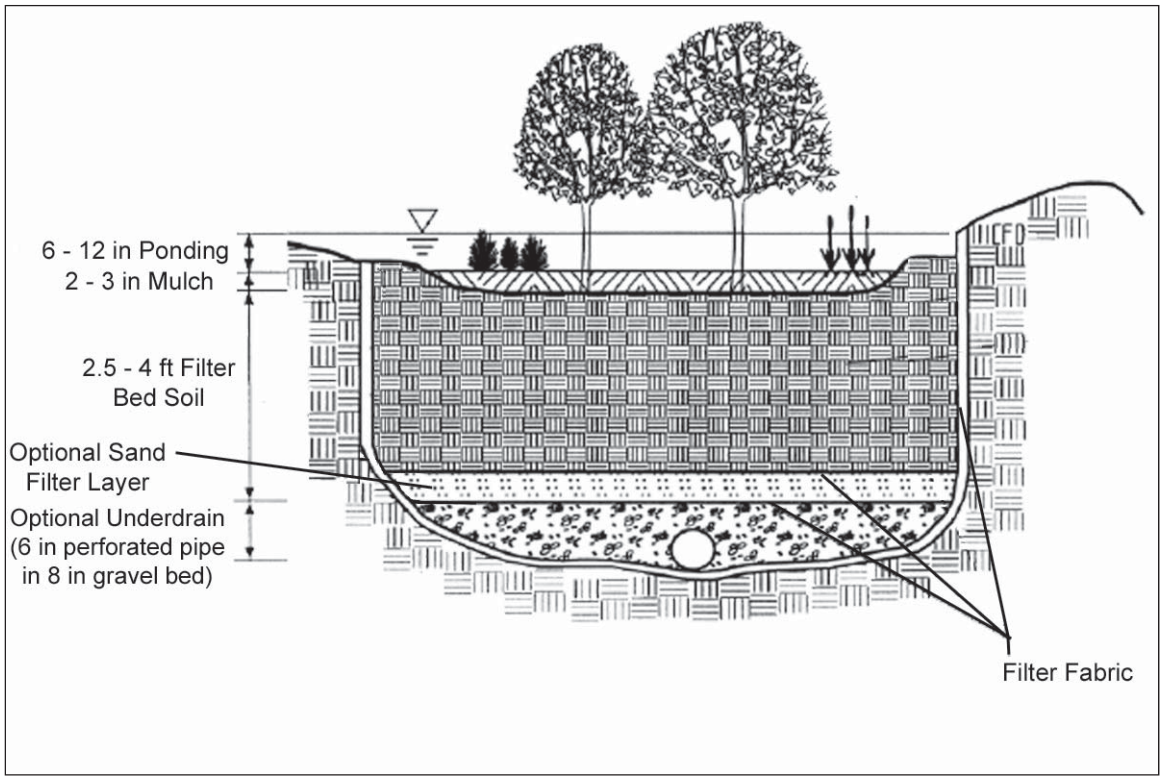
WQV = Water quality volume, ft^3 (calculated from Chapter 4-Volume Based (Method A or B) of the C.3 Stormwater Handbook by SCVURPPP)

h_f = Average design ponding depth, ft (traditionally a maximum 6" of ponding, CSJ allows up to 12" of ponding.)

- Filter bed depth should be between 2.5 and 4 feet.
- Filter bed soil should consist 50-60% sand, 20-30% topsoil and 20-30% compost. The filter bed soil must be a uniform mix, free of stones, stumps, roots or other similar objects larger than two inches. No other materials or substances shall be mixed or dumped within the bioretention area that may be harmful to plant growth, or prove a hindrance to the planting or maintenance operations.
- Apply 2-3 inches of recycled chipped or shredded wood mulch or sheet mulching over the topsoil to reduce erosion. To further reduce the chance of mulch clogging the stormdrain inlets, erosion control mulch mats are recommended.
- An 18 inch sand filter layer may be provided beneath the filter bed soil to provide aeration and drainage
- The facility should drain completely within 72 hours. Provide a perforated pipe underdrain placed in a gravel bed if the surrounding soil permeability is less than 0.5 in/hr.
- If underdrain is needed the underdrain piping should consist of the main collector pipe(s) and perforated lateral branch pipes. The piping should be reinforced to withstand the weight of the overburden. Internal diameters of lateral branch pipes should be six (6) inches or greater and perforations should be three-eights (3/8) inch. All piping is to be schedule 40 polyvinyl chloride (PVC) or greater strength. The maximum spacing for the laterals should be ten (10) feet between laterals and five (5) feet from a wall or side.

Lesser spacings are acceptable. The maximum spacing between rows of perforations should not exceed six (6) inches.

- The minimum grade of piping shall be one-eights (1/8) inch per foot. Access for cleaning all underdrain piping is needed. Cleanouts are required within fifty (50) feet of every portion of lateral and collector drain lines and at every bend. In addition, at least one lateral must be accessible for cleaning when the bioretention cell is full.
- Approximately one tree or shrub should be provided per 50 ft^2 of bioretention area.



Source: Adapted from Maryland Stormwater Design Manual

Treatment Performance:

In the paper "Water Quality Improvement through Bioretention Media: Nitrogen and Phosphorus Removal[1]," nutrient removal within a Bioretention was studied. Results indicated good removal of phosphorus (70-85%) and TKN (55-65%). Nitrate reduction was poor (<20%) and in several cases, nitrate production was noted. Captured nitrogen can be converted to nitrate between storm events and subsequently washed from the system. Analysis of the fate of nutrients in bioretention suggests that accumulation of phosphorus and nitrogen may be controlled by carefully managing how vegetation is grown and harvested.

In the paper "Water Quality Improvement through Bioretention: Lead, Copper, and Zinc[2]," metal removal within a Bioretention was studied. Removal rates of lead, copper and zinc (based on

[1] Davis, A.P., Shokouhian, M., Sharma, H., and Minami, C. *Water Quality Improvement through Bioretention Media: Nitrogen and Phosphorus Removal,* Water Environ. Res., 78(3), 284-293 (2006).
[2] Davis, A.P., Shokouhian, M., Sharma, H., Minami, C., and Winogradoff, D. *Water Quality Improvement through Bioretention: Lead, Copper, and Zinc,* Water Environ. Res., 75(1), 73-82 (2003).

concentration and total mass) were excellent, reaching close to 100% for all metals under most conditions, with effluent copper and lead levels mostly less than 5 ug/L and zinc less than 25 ug/L. Somewhat less removal was noted for shallow bioretention depths. Runoff pH, duration, intensity, and pollutant concentrations were varied, and all had minimal effect on removal. Overall, excellent removal of dissolved heavy metals can be expected through bioretention. Although the accumulation of metals is a concern, buildup problems to toxic levels are not expected over the life of the project.

Field studies at the University of Virginia have indicated 86% removal for Total Suspended Solids (TSS), 97% for Chemical Oxygen Demand (COD), and 67% for Oil and Grease. Additional work with laboratory media columns at the University of Maryland has demonstrated potential bioretention cell removal efficiencies greater than 98% for total suspended solids and oil/grease.

Results of these studies are summarized in **Table 5-7** below.

Table 5-7: Removal Efficiencies for Bioretention

Pollutant	Removal Rate
Phosphorus	70–85%
TKN	55–65%
Nitrate	20%
Pb	+95%
Cu	+95%
Zn	+95%
TSS	86%
COD	97%
Oil and Grease	67%

Operation and Maintenance:

Facility components and vegetation shall be inspected for proper operation and structural stability quarterly for the first two years from the date of installation and as recommended below afterwards. The facility owner must keep a log of all inspection dates, activities, and observations. The following items must be addressed as part of the operations and maintenance of bioretention BMPs.

- Annually inspect topsoil layer to ensure storm water is filtering uniformly through the planter, correct as needed.
- Inspect for trash and debris once during the wet season. Remove any trash and debris.
- Perform general maintenance inspection of the planter, inlet structures, outlet structures, side slopes and other features once during the wet season and once during the dry season. Take corrective action as needed to correct any problems. Repair any structural deficiencies in the planter including rot, cracks, and failures.

- Inspect bioretention standing water annually, 72 hours after a storm event 0.50 inches or greater. Drain facility if needed, identify source of clogging and correct. Notify engineer if immediate solution is not evident.
- Once during dry season and once during wet season, inspect vegetation to ensure it is healthy and dense to maintain good soil permeability while protecting underlying soils from erosion. Correct as needed. Inspect for nuisance and prohibited vegetation and remove. Prune vegetation, large shrubs or trees that limit access or interfere with bioretention operation. Irrigate planter vegetation as needed to ensure survival.
- Inspect for adequate mulch coverage annually during the dry season; remulch void areas.
- Inspect annually for pest control issues; address issues as appropriate to repair any damage and eradicate the pests.

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City of Portland. *Stormwater Management Manual*. September 2004

Additional Sources of Information:

Davis, A.P., Shokouhian, M., Sharma, H., and Minami, C. *Water Quality Improvement through Bioretention Media: Nitrogen and Phosphorus Removal,* Water Environ. Res., 78(3), 284-293 (2006).

Davis, A.P., Shokouhian, M., Sharma, H., Minami, C., and Winogradoff, D. *Water Quality Improvement through Bioretention: Lead, Copper, and Zinc,* Water Environ. Res., 75(1), 73-82 (2003).

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Yu, S.L., X. Zhang, A. Earles and M. Sievers, 1999: *Field testing of ultra-urban BMPs. Proceedings of the 26th Annual Water Resources Planning and Management* Conference ASCE, 6-9 June, Tempe, Arizona.

PRELIMINARY HYDROMODIFCATION MANAGEMENT PLAN

CASTLEROCK

CITY OF SAN DIEGO, CALIFORNIA

SIZING APPENDIX

Summary of Sizing Options

Option 1 – Bio-retention and detention basin

Sizing of the basin is shown in table 1 and is based on the county Model SUSMP document. Sub-basins have been assigned a runoff factor and a sizing factor based on the Model SUSMP document. A runoff factor of 0.1 is used for offsite areas. Building footprints are assigned a factor of 0.95 and streets are calculated to be 0.8.

The runoff factor for the street area is calculated based on a weighted average of landscape area and impervious street area. The 'Street Area' includes the proposed right-of-way which contains street paving, sidewalks and parkways and was conservatively calculated to be 0.8. This quantity was calculated based on the amount of landscaping proposed within the right-of-way. Street 'A' has a right-of-way width of 66', of which 15' is landscaped. Using a weighted average (15' of width at a factor of 0.1 and 51' of width with a factor of 1.0) yields a runoff factor of 0.75 which was rounded up to 0.8 for a conservative approach. Streets 'B' through 'F' are narrower and have less paving, but the landscape width is the same.

A table of the calculations for each of the project's drainage areas is provided as table 1.

Slope areas, pocket parks and pervious residential areas are considered landscaped and assigned a factor of 0.1.

Sizing factors are based on the table 4-8 of the county model SUSMP as shown in Appendix I of the city's Stormwater standards. Based on the Oceanside rain gauge, steep conditions, soil type 'D' and 0.1Q2 low flow threshold, the sizing factor of 0.065 is used.

The developed area is multiplied by the runoff factor and sizing factor to obtain the 'Treatment area' required. Proposed treatment areas are shown on Option 1 exhibits.

Basin 8 -	Required: 29,206 SF	Provided: 31,200 SF
Basin 7 -	Required: 20, 315 SF	Provided: 21,500 SF (17,500 SF BIO + 4,000 SF DETENTION)
Basin 6 -	Required: 26,162 SF	Provided: 27,000 SF (21,000 SF BIO + 6,000 SF DETENTION)
Basin 5 -	Required: 11,170 SF	Provided: 12,000 SF (9,500 SF BIO + 2,500 SF DETENTION)
Basin 4 -	Required: 15,120 SF	Provided: 16,000 SF (14,000 SF BIO + 2,000 SF DETENTION)
Basin 3 -	Required: 22,099 SF	Provided: 23,500 (22,500 SF BIO + 1,000 SF DETENTION)

TABLE 1 - CASTLEROCK BASIN SIZING - OPTION 1

Basin 8	Acreage	Runoff factor	Sizing Factor	Treatment Area (AC)	SF
Offsite undisturbed area	12.1	0.1	0.065	0.08	3426
Slope Area	4.1	0.1	0.065	0.03	1161
Landscape area (park)	3.4	0.1	0.065	0.02	963
Building footprints	3.3	0.95	0.065	0.20	8876
Pervious Residential	9.8	0.1	0.065	0.06	2775
Streets	5.3	0.8	0.065	0.28	12005
TOTAL	38			**0.67**	**29206**
Basin 7	Acreage	Runoff factor	Sizing Factor	Treatment Area (AC)	SF
Offsite undisturbed area	7.7	0.1	0.065	0.05	2180
Slope Area	4.5	0.1	0.065	0.03	1274
Building footprints	3.1	0.95	0.065	0.19	8338
Pervious Residential	6.9	0.1	0.065	0.04	1954
Streets	2.9	0.8	0.065	0.15	6569
TOTAL	25.1			**0.47**	**20315**
Basin 6	Acreage	Runoff factor	Sizing Factor	Treatment Area (AC)	SF
Offsite undisturbed area	43.6	0.1	0.065	0.28	12345
Slope Area	2.9	0.1	0.065	0.02	821
Building footprints	2.2	0.95	0.065	0.14	5918
Pervious Residential	6.6	0.1	0.065	0.04	1869
Streets	2.3	0.8	0.065	0.12	5210
TOTAL	57.6			**0.60**	**26162**
Basin 5	Acreage	Runoff factor	Sizing Factor	Treatment Area (AC)	SF
Offsite undisturbed area	4.4	0.1	0.065	0.03	1246
Slope Area	3	0.1	0.065	0.02	849
Building footprints	1.5	0.95	0.065	0.09	4035
Pervious Residential	3.4	0.1	0.065	0.02	963
streets	1.8	0.8	0.065	0.09	4077
TOTAL	14.1			**0.26**	**11170**
Basin 4	Acreage	Runoff factor	Sizing Factor	Treatment Area (AC)	SF
Offsite undisturbed area	25.8	0.1	0.065	0.17	7305
Slope Area	5.8	0.1	0.065	0.04	1642
Building footprints	0.6	0.95	0.065	0.04	1614
Pervious Residential	2.5	0.1	0.065	0.02	708
streets	1.7	0.8	0.065	0.09	3851
TOTAL	36.4			**0.35**	**15120**
Basin 3	Acreage	Runoff factor	Sizing Factor	Treatment Area (AC)	SF
Offsite undisturbed area	12	0.1	0.065	0.08	3398
Slope Area	4.1	0.1	0.065	0.03	1161
Building footprints	3.7	0.95	0.065	0.23	9952
Pervious Residential	5.2	0.1	0.065	0.03	1472
streets	2.7	0.8	0.065	0.14	6116
TOTAL	27.7			**0.51**	**22099**

Summary of Sizing Options

Option 2 and 3 – Detention Ponds and Underground storage

The storage volumes required to meet Hydromodification flow controls are calculated using the automated sizing calculator (San Diego Sizing Calculator) as provided on the county's Project Clean Water website. User inputs for the site conditions and proposed pond configurations (pond depth and orifice heights) yield a required volume for the pond along with low flow and upper flow pipe sizes. The calculator also confirms the drawdown time is less than 96 hours.

Preliminary pond configurations are shown on the option 2 exhibit, but a variety of configurations could be used to meet the volume requirements. Option 2 exhibit shows the top dimensions of the pond which include the 2:1 side slopes and the proposed depths required to meet the volume requirements.

Option 3 allows for underground storage instead of surface storage, but the storage volume remains the same.

Basin 8 - Required: 198,317 CF Provided: 208,500 CF (230'x95'x15' DEPTH W/ 2:1 SIDE SLOPES)

Basin 7 - Required: 137,226 CF Provided: 163,500 CF (155'x110'x15' DEPTH W/ 2:1 SIDE SLOPES)

Basin 6 - Required: 140,020 CF Provided: 171,000 CF (180'x100'x15' DEPTH W/ 2:1 SIDE SLOPES)

Basin 5 - Required: 81,021 CF Provided: 88,500 CF (130'x80'x15' DEPTH W/ 2:1 SIDE SLOPES)

Basin 4 - Required: 74,930 CF Provided: 126,000 CF (130'x105'x15' DEPTH W/ 2:1 SIDE SLOPES)

Basin 3 - Required: 115,723 CF Provided: 121,824 CF (150'x100'x12' DEPTH W/ 2:1 SIDE SLOPES)

Project Summary

Project Name	Castlerock
Project Applicant	
Jurisdiction	City of San Diego
Parcel (APN)	
Hydrologic Unit	San Diego

Compliance Basin Summary

Basin Name:	basin 8
Receiving Water:	system 'h'
Rainfall Basin	Oceanside
Mean Annual Precipitation (inches)	13.3
Project Basin Area (acres):	25.90
Watershed Area (acres):	25.90
SCCWRP Lateral Channel Susceptiblity (H, M, L):	Low (Lateral)
SCCWRP Vertifical Channel Susceptiblity (H, M, L):	Low (Vertical)
Overall Channel Susceptibility (H, M, L):	LOW
Lower Flow Threshold (% of 2-Year Flow):	0.5

Drainage Management Area Summary

ID	Type	BMP ID	Description	Area (ac)	Pre-Project Cover		Post Surface Type	Drainage Soil	Slope
17638	Drains to Pond	BMP 1	basin 8	22.5	Pervious (Pre)		Type D (high runoff - clay soi...	Steep (greater 10%)	
17639	Self-Treating	BMP 1	basin 8 park	3.00	Pervious (Pre)		Type D (high runoff - clay soi...	Steep (greater 10%)	

Pond Facility Summary

Scenario	Description	Bottom Area (sqft)	Top Area (sqft)	Depth (ft)	Volume (cft)	Low Orifice (in)	Low Invert (ft)	High Orifice (in)	High Invert (ft)	Weir Length (ft)	Weir Invert (ft)	Facility Soil	Drawdown (hrs)
Design A	basin 8 pond	7687	20643	14	198316.8	5.00	3.00	16.00	12.00	5.00	15.00	D	18.00

Project Summary

Project Name	Castlerock
Project Applicant	
Jurisdiction	City of San Diego
Parcel (APN)	
Hydrologic Unit	San Diego

Compliance Basin Summary

Basin Name:	basin 7
Receiving Water:	system g
Rainfall Basin	Oceanside
Mean Annual Precipitation (inches)	13.3
Project Basin Area (acres):	17.40
Watershed Area (acres):	17.40
SCCWRP Lateral Channel Susceptiblity (H, M, L):	Low (Lateral)
SCCWRP Vertifical Channel Susceptiblity (H, M, L):	Low (Vertical)
Overall Channel Susceptibility (H, M, L):	LOW
Lower Flow Threshold (% of 2-Year Flow):	0.5

Drainage Management Area Summary

ID	Type	BMP ID	Description	Area (ac)	Pre-Project Cover		Post Surface Type	Drainage Soil	Slope
17642	Drains to Pond	BMP 1	basin 7	17.4	Pervious (Pre)		Type D (high runoff - clay soi...	Steep (greater 10%)	

Pond Facility Summary

Scenario	Description	Bottom Area (sqft)	Top Area (sqft)	Depth (ft)	Volume (cft)	Low Orifice (in)	Low Invert (ft)	High Orifice (in)	High Invert (ft)	Weir Length (ft)	Weir Invert (ft)	Facility Soil	Drawdown (hrs)
Design A	pond 7	5387	15724	13	137225.8	5.00	2.00	14.00	11.00	30.00	15.00	D	13.00

Project Summary

Project Name	Castlerock
Project Applicant	
Jurisdiction	City of San Diego
Parcel (APN)	
Hydrologic Unit	San Diego

Compliance Basin Summary

Basin Name:	basin 6
Receiving Water:	system 'f'
Rainfall Basin	Oceanside
Mean Annual Precipitation (inches)	13.3
Project Basin Area (acres):	14.00
Watershed Area (acres):	14.00
SCCWRP Lateral Channel Susceptiblity (H, M, L):	Low (Lateral)
SCCWRP Vertifical Channel Susceptiblity (H, M, L):	Low (Vertical)
Overall Channel Susceptibility (H, M, L):	LOW
Lower Flow Threshold (% of 2-Year Flow):	0.5

Drainage Management Area Summary

ID	Type	BMP ID	Description	Area (ac)	Pre-Project Cover		Post Surface Type	Drainage Soil	Slope
17645	Drains to Pond	BMP 1	basin 6	14.00	Pervious (Pre)		Type D (high runoff - clay soi...	Steep (greater 10%)	

Pond Facility Summary

Scenario	Description	Bottom Area (sqft)	Top Area (sqft)	Depth (ft)	Volume (cft)	Low Orifice (in)	Low Invert (ft)	High Orifice (in)	High Invert (ft)	Weir Length (ft)	Weir Invert (ft)	Facility Soil	Drawdown (hrs)
Design A	pond 6	4625	15377	14	140019.7	4.00	2.00	12.00	11.00	5.00	15.00	D	18.00

Project Summary

Project Name	Castlerock
Project Applicant	
Jurisdiction	City of San Diego
Parcel (APN)	
Hydrologic Unit	San Diego

Compliance Basin Summary

Basin Name:	basin 5
Receiving Water:	system 'e'
Rainfall Basin	Oceanside
Mean Annual Precipitation (inches)	13.3
Project Basin Area (acres):	9.70
Watershed Area (acres):	9.70
SCCWRP Lateral Channel Susceptiblity (H, M, L):	Low (Lateral)
SCCWRP Vertifical Channel Susceptiblity (H, M, L):	Low (Vertical)
Overall Channel Susceptibility (H, M, L):	LOW
Lower Flow Threshold (% of 2-Year Flow):	0.5

Drainage Management Area Summary

ID	Type	BMP ID	Description	Area (ac)	Pre-Project Cover		Post Surface Type	Drainage Soil	Slope
17648	Drains to Pond	BMP 1	basin 5	9.7	Pervious (Pre)		Type D (high runoff - clay soi...	Steep (greater 10%)	

Pond Facility Summary

Scenario	Description	Bottom Area (sqft)	Top Area (sqft)	Depth (ft)	Volume (cft)	Low Orifice (in)	Low Invert (ft)	High Orifice (in)	High Invert (ft)	Weir Length (ft)	Weir Invert (ft)	Facility Soil	Drawdown (hrs)
Design A	pond 5	5648	12356	9	81021.0	4.00	3.00	11.00					

Project Summary

Project Name	Castlerock
Project Applicant	
Jurisdiction	City of San Diego
Parcel (APN)	
Hydrologic Unit	San Diego

Compliance Basin Summary

Basin Name:	basin 4
Receiving Water:	system 'd'
Rainfall Basin	Oceanside
Mean Annual Precipitation (inches)	13.3
Project Basin Area (acres):	10.60
Watershed Area (acres):	10.60
SCCWRP Lateral Channel Susceptiblity (H, M, L):	Low (Lateral)
SCCWRP Vertifical Channel Susceptiblity (H, M, L):	Low (Vertical)
Overall Channel Susceptibility (H, M, L):	LOW
Lower Flow Threshold (% of 2-Year Flow):	0.5

Drainage Management Area Summary

ID	Type	BMP ID	Description	Area (ac)	Pre-Project Cover		Post Surface Type	Drainage Soil	Slope
17651	Drains to Pond	BMP 1	basin 4	10.6	Pervious (Pre)		Type D (high runoff - clay soi...	Steep (greater 10%)	

Pond Facility Summary

Scenario	Description	Bottom Area (sqft)	Top Area (sqft)	Depth (ft)	Volume (cft)	Low Orifice (in)	Low Invert (ft)	High Orifice (in)	High Invert (ft)	Weir Length (ft)	Weir Invert (ft)	Facility Soil	Drawdown (hrs)
Design A	pond 4	5105	11545	10	74929.9	4.00	2.00	12.00	8.00	5.00	11.00	D	15.00

Project Summary

Project Name	Castlerock
Project Applicant	
Jurisdiction	City of San Diego
Parcel (APN)	
Hydrologic Unit	San Diego

Compliance Basin Summary

Basin Name:	basin 3
Receiving Water:	system 'c'
Rainfall Basin	Oceanside
Mean Annual Precipitation (inches)	13.3
Project Basin Area (acres):	15.70
Watershed Area (acres):	15.70
SCCWRP Lateral Channel Susceptiblity (H, M, L):	Low (Lateral)
SCCWRP Vertifical Channel Susceptiblity (H, M, L):	Low (Vertical)
Overall Channel Susceptibility (H, M, L):	LOW
Lower Flow Threshold (% of 2-Year Flow):	0.5

Drainage Management Area Summary

ID	Type	BMP ID	Description	Area (ac)	Pre-Project Cover		Post Surface Type	Drainage Soil	Slope
17654	Drains to Pond	BMP 1	pond 3	15.7	Pervious (Pre)		Type D (high runoff - clay soi...	Steep (greater 10%)	

Pond Facility Summary

Scenario	Description	Bottom Area (sqft)	Top Area (sqft)	Depth (ft)	Volume (cft)	Low Orifice (in)	Low Invert (ft)	High Orifice (in)	High Invert (ft)	Weir Length (ft)	Weir Invert (ft)	Facility Soil	Drawdown (hrs)
Design A	pond 3	5428	16817	14	155723.7	5.00	2.00	13.00	11.00	30.00	15.00	D	12.00

Summary of Sizing Options

Option 4 – On-lot bioretention

Option 4 allows for HMP compliance on each individual single family lot by implementing a bio-retention area in the front yard of each residential lot. The proposed bio-retention area is sized to accommodate the increased impervious area of the roof. Calculations are provided showing the treatment areas required when utilizing the sizing factors shown in the city's storm water standards. These treatment areas could be provided in street popouts or pocket parks.

Using continuous simulation modeling software by ClearCreek Solutions yields a result that demonstrates the project's HMP compliance by adding a detention structure in basin 3 only. Basins will still be required to implement treatment control BMPs to meet water quality standards as outlined in the Water Quality Technical Report. Results of the continuous simulation model are provided.

CASTLEROCK BASIN SIZING - OPTION 4 BIORETENTION POND SIZING- TREATMENT

Basin 8	Acreage	Runoff factor	Sizing Factor	Treatment Area (AC)	SF	ALTERNATE	Treatment area
Offsite undisturbed area	12.1	0.1	0.065	0.08	3426	basin	3426
Slope Area	4.1	0.1	0.065	0.03	1161	basin	1161
Landscape area (park)	3.4	0.1	0.065	0.02	963	self treating	0
Building footprints	3.3	0.95	0.065	0.20	8876	self treating	0
Pervious Residential	9.8	0.1	0.065	0.06	2775	self treating	0
Streets	5.3	0.8	0.065	0.28	12005	basin	12005
TOTAL	38			**0.67**	**29206**	**REV AREA**	**16592**
		Runoff	Sizing			reduction	43%
Basin 7	Acreage	factor	Factor	Treatment Area (AC)	SF		
Offsite undisturbed area	7.7	0.1	0.065	0.05	2180	basin	2180
Slope Area	4.5	0.1	0.065	0.03	1274	basin	1274
Building footprints	3.1	0.95	0.065	0.19	8338	self treating	0
Pervious Residential	6.9	0.1	0.065	0.04	1954	self treating	0
Streets	2.9	0.8	0.065	0.15	6569	basin	6569
TOTAL	25.1			**0.47**	**20315**	**REV AREA**	**10023**
		Runoff	Sizing			reduction	51%
Basin 6	Acreage	factor	Factor	Treatment Area (AC)	SF		
Offsite undisturbed area	43.6	0.1	0.065	0.28	12345	basin	12345
Slope Area	2.9	0.1	0.065	0.02	821	basin	821
Building footprints	2.2	0.95	0.065	0.14	5918	self treating	0
Pervious Residential	6.6	0.1	0.065	0.04	1869	self treating	0
Streets	2.3	0.8	0.065	0.12	5210	basin	5210
TOTAL	57.6			**0.60**	**26162**	**REV AREA**	**18376**
		Runoff	Sizing			reduction	30%
Basin 5	Acreage	factor	Factor	Treatment Area (AC)	SF		
Offsite undisturbed area	4.4	0.1	0.065	0.03	1246	basin	1246
Slope Area	3	0.1	0.065	0.02	849	basin	849
Building footprints	1.5	0.95	0.065	0.09	4035	self treating	0
Pervious Residential	3.4	0.1	0.065	0.02	963	self treating	0
streets	1.8	0.8	0.065	0.09	4077	basin	4077
TOTAL	14.1			**0.26**	**11170**	**REV AREA**	**6172**
		Runoff	Sizing			reduction	45%
Basin 4	Acreage	factor	Factor	Treatment Area (AC)	SF		
Offsite undisturbed area	25.8	0.1	0.065	0.17	7305	basin	7305
Slope Area	5.8	0.1	0.065	0.04	1642	basin	1642
Building footprints	0.6	0.95	0.065	0.04	1614	self treating	0
Pervious Residential	2.5	0.1	0.065	0.02	708	self treating	0
streets	1.7	0.8	0.065	0.09	3851	basin	3851
TOTAL	36.4			**0.35**	**15120**	**REV AREA**	**12798**
		Runoff	Sizing			reduction	15%
Basin 3	Acreage	factor	Factor	Treatment Area (AC)	SF		
Offsite undisturbed area	12	0.1	0.065	0.08	3398	basin	3398
Slope Area	4.1	0.1	0.065	0.03	1161	basin	1161
Building footprints	3.7	0.95	0.065	0.23	9952	self treating	0
Pervious Residential	5.2	0.1	0.065	0.03	1472	self treating	0
streets	2.7	0.8	0.065	0.14	6116	basin	6116
TOTAL	27.7			**0.51**	**22099**	**REV AREA**	**10674**
						reduction	52%

PRELIMINARY HYDROMODIFCATION MANAGEMENT PLAN

CASTLEROCK

CITY OF SAN DIEGO, CALIFORNIA

SIZING APPENDIX

OPTION 4

CONTINUOUS SIMULATION MODEL
WITH SDHM SOFTWARE BY CLEAR CREEK SOLUTIONS
PROVIDED BY RBF CONSULTING

Previous C Factor (D Soils)	**0.35**
100 Year P6 (in)	**3.0**

Basin Number	On Site Area	On Site Impervious Area (Streets and Roofs)	Lawn Area	Total On Site Pervious	Total Weighted C	100 Year Storage Req'd	Planter Area Req'd (Flood Control)	Planter Area Req'd (85th Percentile Treatment)	Governing	% of Lawn Area	% of On Site Watershed
	(ac)	(ac)		(ac)		(ac-ft)	(ac)	(ac)			
30	6.1	3.6	2.5	2.5	0.70	0.53	0.40	0.16	0.40	15.90	6.52
8	25.9	8.6	9.8	17.3	0.55	1.37	1.02	0.53	1.02	10.45	3.95
7	17.4	6	6.9	11.4	0.56	0.92	0.69	0.36	0.69	9.97	3.95
6	14	4.5	6.6	9.5	0.54	0.70	0.53	0.29	0.53	8.00	3.77
5	9.7	3.3	3.4	6.4	0.55	0.50	0.37	0.20	0.37	10.93	3.83
4	10.6	2.3	2.5	8.3	0.48	0.35	0.26	0.19	0.26	10.43	2.46
3	15.7	6.4	5.2	9.3	0.59	0.95	0.71	0.35	0.71	13.65	4.52
2	11.0	6.5	4.5	4.5	0.70	0.96	0.72	0.29	0.72	16.00	6.55
1	17.1	0	0	17.1	0.35	N/A	N/A	N/A	N/A	N/A	N/A
Total	**127.5**	**41.2**	**41.4**	**86.3**	**0.54**	**6.27**	**4.70**	**2.38**			

Notes and Assumptions

1 Area Takeoffs from Latitude 33 HMP Study Dated March 2012, and exclude "Off Site Area".
2 Total On Site Pervious includes Lawn Areas, Slopes, and Parks (where applicable)
3 Cells shaded yellow are "user input"
4 Planter Storage Area Based Upon Required Volume * 0.75 to Account for Sub Surface Storage in 2' of Soil (33% Void)

Off Site Hydrology

Basin Number	Acreage	Watershed Length (ft)	Overall Slope	Effective Slope	H (ft)	L (miles)	Tc (min.)	100 Year Runoff Intensity (in/hr)	100 Year Q (cfs)	Prelim. Pipe Size	Tie-In Pipe Size
8	12.1	953	0.25	0.13	119	0.18	13.42	3.0	12.71	24"	2x72"
7	7.7	600	0.26	0.13	78	0.11	12.36	3.1	8.35	18"	21"
6	43.6	1,270	0.17	0.08	105	0.24	15.01	2.9	44.25	33"	33"
5	4.4	590	0.22	0.11	65	0.11	12.48	3.1	4.77	18"	21"
4	25.8	1,385	0.16	0.08	111	0.26	15.42	2.8	25.28	27"	27"
3	12.0	780	0.27	0.13	105	0.15	12.85	3.1	13.02	24"	27"
2	134.6	3,800	0.15	0.08	285	0.72	22.08	2.4	113.06	48"	48"

Time of Concentration

Pre-Development

Basin Number	Acreage	Watershed Length (ft)	Overall Slope	Effective Slope	H (ft)	L (miles)	Tc (min.)
30	6.1	500	0.100	0.05	25	0.09	12.96
8	25.9	1,400	0.043	0.02	30	0.27	19.06
7	17.4	650	0.111	0.06	36	0.12	13.48
6	14	950	0.076	0.04	36	0.18	15.40
5	9.7	925	0.119	0.06	55	0.18	14.45
4	10.6	935	0.214	0.11	100	0.18	13.58
3	15.7	1,050	0.130	0.07	68	0.20	14.74
2	11	450	0.040	0.02	9	0.09	13.89

Post-Development

Basin Number	Acreage	TI	Street Slope	Velocity	Street Length	Tt (min)	Tc (min)	Δ Tc	RatHydro Δ Volume (ac-ft)	RatHydro Δ Volume (ft^3)
30	6.1	10	1.4%	3.80	850	3.73	13.73	0.77		
8	25.9	10	4.0%	6.50	1,200	3.08	13.08	-5.98	1.37	59,473
7	17.4	10	1.0%	3.25	1,650	8.46	18.46	4.98	0.92	39,958
6	14	10	3.5%	6.00	1,550	4.31	14.31	-1.09	0.70	30,653
5	9.7	10	0.5%	2.25	830	6.15	16.15	1.70	0.50	21,576
4	10.6	10	7.8%	9.00	340	0.63	10.63	-2.95	0.35	15,144
3	15.7	10	2.0%	4.50	400	1.48	11.48	-3.26	0.95	41,238
2	11	10	1.4%	3.80	1,025	4.50	14.50	0.61		

Assume:
100' deep lots
1% back to front
C 0.55 (Single Family Residential)

Full 6" gutter for street flow

SDHM2011
PROJECT REPORT

Project Name: Castle Rock 3
Site Name :
Site Address:
City :
Report Date : 5/29/2012
Gage : SANTEE
Data Start : 10/01/1973
Data End : 09/30/2004
Precip Scale: 1.00
Version : 2012/05/18

Low Flow Threshold for POC 1 : 10 Percent of the 2 Year

High Flow Threshold for POC 1 : 10 year

PREDEVELOPED LAND USE

Name : Basin 3
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	15.7
Pervious Total	**15.7**

Impervious Land Use	Acres
Impervious Total	**0**
Basin Total	**15.7**

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 3 Slope
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	4.1
Pervious Total	**4.1**

Impervious Land Use	Acres
Impervious Total	**0**
Basin Total	**4.1**

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 3 Roofs and Driveways
Bypass: No

Impervious Land Use	Acres
IMPERVIOUS-FLAT LAT	3.7

Element Flows To:

Outlet 1	Outlet 2
Basin 3 Yards	

Name : Basin 3 Yards
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	5.2

Element Flows To:

Surface	Interflow	Groundwater
F T Plante Surface 1	F T Plante Surface 1	

Name : Basin 3 Streets
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
Pervious Total	**0**

Impervious Land Use	Acres
IMPERVIOUS-MOD	2.7
Impervious Total	**2.7**
Basin Total	**2.7**

Element Flows To:
Surface **Interflow** **Groundwater**

Name : F T Planter 1
Bottom Length: 95.00 ft.
Bottom Width : 95.00 ft.
Trench bottom slope 1: 0 To 1
Trench Left side slope 0: 0 To 1
Trench right side slope 2: 0 To 1
Material thickness of first layer : 1.5
Pour Space of material for first layer : 0.436
Material thickness of second layer : 0.5
Pour Space of material for second layer : 0.415
Material thickness of third layer : 0
Pour Space of material for third layer : 0.415
Discharge Structure
Riser Height: 0.5 ft.
Riser Diameter: 8 in.

Element Flows To:
Outlet 1 **Outlet 2**

Flow Through Planter Box Hydraulic Table

Stage(ft)	Area(ac)	Volume(ac-ft)	Discharge(cfs)	Infilt(cfs)
0.0000	0.207	0.000	0.000	0.000
0.0333	0.207	0.003	0.000	0.000
0.0667	0.207	0.006	0.000	0.000
0.1000	0.207	0.009	0.000	0.000
0.1333	0.207	0.012	0.000	0.000
0.1667	0.207	0.015	0.000	0.000
0.2000	0.207	0.018	0.000	0.000
0.2333	0.207	0.021	0.000	0.000
0.2667	0.207	0.024	0.000	0.000
0.3000	0.207	0.027	0.000	0.000
0.3333	0.207	0.030	0.000	0.000
0.3667	0.207	0.033	0.000	0.000
0.4000	0.207	0.036	0.000	0.000
0.4333	0.207	0.039	0.000	0.000
0.4667	0.207	0.042	0.000	0.000
0.5000	0.207	0.045	0.000	0.000

0.5333	0.207	0.048	0.039	0.000
0.5667	0.207	0.051	0.111	0.000
0.6000	0.207	0.054	0.205	0.000
0.6333	0.207	0.057	0.316	0.000
0.6667	0.207	0.060	0.441	0.000
0.7000	0.207	0.063	0.580	0.000
0.7333	0.207	0.066	0.731	0.000
0.7667	0.207	0.069	0.894	0.000
0.8000	0.207	0.072	1.066	0.000
0.8333	0.207	0.075	1.249	0.000
0.8667	0.207	0.078	1.441	0.000
0.9000	0.207	0.081	1.642	0.000
0.9333	0.207	0.084	1.852	0.000
0.9667	0.207	0.087	2.069	0.000
1.0000	0.207	0.090	2.295	0.000
1.0333	0.207	0.093	2.528	0.000
1.0667	0.207	0.096	2.769	0.000
1.1000	0.207	0.099	3.017	0.000
1.1333	0.207	0.102	3.272	0.000
1.1667	0.207	0.105	3.534	0.000
1.2000	0.207	0.108	3.802	0.000
1.2333	0.207	0.111	4.077	0.000
1.2667	0.207	0.114	4.358	0.000
1.3000	0.207	0.117	4.645	0.000
1.3333	0.207	0.120	4.939	0.000
1.3667	0.207	0.123	5.238	0.000
1.4000	0.207	0.126	5.543	0.000
1.4333	0.207	0.129	5.854	0.000
1.4667	0.207	0.132	6.170	0.000
1.5000	0.207	0.135	6.492	0.000
1.5333	0.207	0.138	6.820	0.000
1.5667	0.207	0.141	7.152	0.000
1.6000	0.207	0.144	7.490	0.000
1.6333	0.207	0.146	7.833	0.000
1.6667	0.207	0.149	8.181	0.000
1.7000	0.207	0.152	8.534	0.000
1.7333	0.207	0.155	8.892	0.000
1.7667	0.207	0.158	9.255	0.000
1.8000	0.207	0.161	9.623	0.000
1.8333	0.207	0.164	9.996	0.000
1.8667	0.207	0.166	10.37	0.000
1.9000	0.207	0.169	10.75	0.000
1.9333	0.207	0.172	11.14	0.000
1.9667	0.207	0.175	11.53	0.000
2.0000	0.207	0.182	11.92	0.000
2.0333	0.207	0.189	12.32	0.000
2.0667	0.207	0.196	12.73	0.000
2.1000	0.207	0.203	13.14	0.000
2.1333	0.207	0.210	13.55	0.000
2.1667	0.207	0.216	13.97	0.000
2.2000	0.207	0.223	14.39	0.000
2.2333	0.207	0.230	14.81	0.000
2.2667	0.207	0.237	15.24	0.000
2.3000	0.207	0.244	15.67	0.000
2.3333	0.207	0.251	16.11	0.000
2.3667	0.207	0.258	16.55	0.000
2.4000	0.207	0.265	17.00	0.000

2.4333	0.207	0.272	17.45	0.000
2.4667	0.207	0.279	17.90	0.000
2.5000	0.207	0.286	18.36	0.000
2.5333	0.207	0.292	18.82	0.000
2.5667	0.207	0.299	19.29	0.000
2.6000	0.207	0.306	19.75	0.000
2.6333	0.207	0.313	20.23	0.000
2.6667	0.207	0.320	20.70	0.000
2.7000	0.207	0.327	21.18	0.000
2.7333	0.207	0.334	21.67	0.000
2.7667	0.207	0.341	22.15	0.000
2.8000	0.207	0.348	22.64	0.000
2.8333	0.207	0.355	23.14	0.000
2.8667	0.207	0.361	23.63	0.000
2.9000	0.207	0.368	24.14	0.000
2.9333	0.207	0.375	24.64	0.000
2.9667	0.207	0.382	25.15	0.000
3.0000	0.207	0.389	25.66	0.000
3.0333	0.207	0.396	26.18	0.000

Name : F T Plante Surface 1
Bottom Length: 0.00 ft.
Bottom Width : 0.00 ft.
Material thickness of first layer : 0
Pour Space of material for first layer : 0
Material thickness of second layer : 0
Pour Space of material for second layer : 0
Material thickness of third layer : 0
Pour Space of material for third layer : 0
Discharge Structure
Riser Height: 0 ft.
Riser Diameter: 0 in.

Element Flows To:

Outlet 1	**Outlet 2**
F T Planter 1	

ANALYSIS RESULTS

Predeveloped Landuse Totals for POC #1
Total Pervious Area : 15.7
Total Impervious Area : 0

Mitigated Landuse Totals for POC #1
Total Pervious Area : 9.3
Total Impervious Area : 6.4

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	3.213622
5 year	4.911251
10 year	6.72375
25 year	9.38421

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	2.351719
5 year	3.013788
10 year	5.007031
25 year	6.878041

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.3214	408	363	88	Pass
0.3860	369	309	83	Pass
0.4507	336	278	82	Pass
0.5154	316	251	79	Pass
0.5800	288	229	79	Pass
0.6447	272	214	78	Pass
0.7094	247	204	82	Pass
0.7741	229	184	80	Pass
0.8387	212	165	77	Pass
0.9034	198	150	75	Pass
0.9681	188	145	77	Pass
1.0327	174	143	82	Pass
1.0974	170	128	75	Pass
1.1621	161	118	73	Pass
1.2268	154	107	69	Pass
1.2914	149	100	67	Pass
1.3561	145	93	64	Pass
1.4208	138	81	58	Pass
1.4854	134	78	58	Pass
1.5501	131	72	54	Pass
1.6148	122	66	54	Pass
1.6794	116	60	51	Pass
1.7441	114	55	48	Pass
1.8088	108	51	47	Pass
1.8735	104	46	44	Pass
1.9381	95	44	46	Pass
2.0028	89	40	44	Pass
2.0675	84	39	46	Pass
2.1321	79	39	49	Pass
2.1968	74	36	48	Pass
2.2615	66	34	51	Pass
2.3262	61	29	47	Pass
2.3908	56	28	50	Pass
2.4555	53	27	50	Pass
2.5202	51	23	45	Pass

2.5848	48	20	41	Pass
2.6495	41	19	46	Pass
2.7142	41	17	41	Pass
2.7788	41	15	36	Pass
2.8435	41	13	31	Pass
2.9082	39	11	28	Pass
2.9729	38	11	28	Pass
3.0375	37	11	29	Pass
3.1022	37	11	29	Pass
3.1669	35	11	31	Pass
3.2315	31	11	35	Pass
3.2962	30	10	33	Pass
3.3609	30	10	33	Pass
3.4256	27	10	37	Pass
3.4902	26	10	38	Pass
3.5549	26	9	34	Pass
3.6196	24	8	33	Pass
3.6842	22	8	36	Pass
3.7489	20	8	40	Pass
3.8136	20	8	40	Pass
3.8782	18	7	38	Pass
3.9429	18	6	33	Pass
4.0076	18	6	33	Pass
4.0723	17	5	29	Pass
4.1369	16	5	31	Pass
4.2016	14	5	35	Pass
4.2663	14	5	35	Pass
4.3309	13	5	38	Pass
4.3956	13	5	38	Pass
4.4603	13	5	38	Pass
4.5250	12	5	41	Pass
4.5896	12	5	41	Pass
4.6543	12	5	41	Pass
4.7190	12	5	41	Pass
4.7836	11	4	36	Pass
4.8483	11	4	36	Pass
4.9130	9	4	44	Pass
4.9776	7	4	57	Pass
5.0423	7	4	57	Pass
5.1070	7	4	57	Pass
5.1717	7	4	57	Pass
5.2363	6	4	66	Pass
5.3010	6	4	66	Pass
5.3657	4	4	100	Pass
5.4303	4	3	75	Pass
5.4950	4	3	75	Pass
5.5597	4	3	75	Pass
5.6244	4	3	75	Pass
5.6890	4	3	75	Pass
5.7537	4	3	75	Pass
5.8184	4	3	75	Pass
5.8830	4	3	75	Pass
5.9477	4	3	75	Pass
6.0124	4	3	75	Pass
6.0770	4	3	75	Pass
6.1417	4	3	75	Pass
6.2064	4	3	75	Pass

6.2711	4	3	75	Pass
6.3357	4	3	75	Pass
6.4004	4	3	75	Pass
6.4651	3	3	100	Pass
6.5297	3	2	66	Pass
6.5944	3	2	66	Pass
6.6591	3	2	66	Pass
6.7238	3	1	33	Pass

Drawdown Time Results

Perlnd and Implnd Changes

No changes have been made.

6.6591	3	2	66	Pass
6.7238	3	2	66	Pass

The development has an increase in flow durations from 1/2 predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

SDHM2011
PROJECT REPORT

Project Name: Castle Rock 4
Site Name :
Site Address:
City :
Report Date : 4/27/2012
Gage : SANTEE
Data Start : 10/01/1973
Data End : 09/30/2004
Precip Scale: 1.00
Version : 2012/03/01

PREDEVELOPED LAND USE

Name : Basin 4
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	10.6

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : Basin 4 Slope
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	5.8

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

Name : Basin 4 Roofs and Driveways
Bypass: No

Impervious Land Use	Acres
IMPERVIOUS-FLAT LAT	0.6

Element Flows To:

Outlet 1	Outlet 2
Basin 4 Yards	

Name : Basin 4 Yards
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	2.5

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 4 Streets
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
IMPERVIOUS-MOD	1.7

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	2.169706
5 year	3.315877
10 year	4.539601
25 year	6.335836

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.851847
5 year	2.713771
10 year	3.757797
25 year	5.252714

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.2170	410	343	83	Pass
0.2606	370	293	79	Pass
0.3043	336	263	78	Pass
0.3480	317	233	73	Pass
0.3916	288	214	74	Pass
0.4353	272	199	73	Pass
0.4789	248	181	72	Pass
0.5226	230	169	73	Pass
0.5663	212	161	75	Pass
0.6099	198	151	76	Pass
0.6536	188	149	79	Pass
0.6973	174	143	82	Pass
0.7409	170	137	80	Pass
0.7846	161	130	80	Pass
0.8283	154	126	81	Pass
0.8719	149	120	80	Pass
0.9156	145	113	77	Pass
0.9592	138	108	78	Pass
1.0029	134	102	76	Pass
1.0466	131	94	71	Pass
1.0902	122	87	71	Pass
1.1339	116	81	69	Pass
1.1776	114	78	68	Pass
1.2212	108	69	63	Pass
1.2649	104	64	61	Pass
1.3085	95	56	58	Pass
1.3522	89	55	61	Pass
1.3959	84	53	63	Pass
1.4395	79	48	60	Pass
1.4832	74	44	59	Pass
1.5269	67	42	62	Pass
1.5705	61	39	63	Pass
1.6142	56	38	67	Pass
1.6578	53	37	69	Pass
1.7015	51	35	68	Pass
1.7452	48	35	72	Pass
1.7888	41	34	82	Pass
1.8325	41	34	82	Pass
1.8762	41	28	68	Pass
1.9198	41	26	63	Pass

1.9635	39	25	64	Pass
2.0072	38	24	63	Pass
2.0508	37	21	56	Pass
2.0945	37	21	56	Pass
2.1381	35	19	54	Pass
2.1818	31	18	58	Pass
2.2255	30	18	60	Pass
2.2691	30	17	56	Pass
2.3128	27	15	55	Pass
2.3565	26	15	57	Pass
2.4001	26	14	53	Pass
2.4438	24	13	54	Pass
2.4874	22	12	54	Pass
2.5311	20	12	60	Pass
2.5748	20	12	60	Pass
2.6184	18	11	61	Pass
2.6621	18	11	61	Pass
2.7058	18	10	55	Pass
2.7494	17	8	47	Pass
2.7931	16	8	50	Pass
2.8367	14	7	50	Pass
2.8804	14	7	50	Pass
2.9241	13	6	46	Pass
2.9677	13	5	38	Pass
3.0114	13	4	30	Pass
3.0551	12	4	33	Pass
3.0987	12	4	33	Pass
3.1424	12	4	33	Pass
3.1861	12	4	33	Pass
3.2297	11	4	36	Pass
3.2734	11	4	36	Pass
3.3170	9	4	44	Pass
3.3607	7	4	57	Pass
3.4044	7	4	57	Pass
3.4480	7	4	57	Pass
3.4917	7	4	57	Pass
3.5354	6	4	66	Pass
3.5790	6	4	66	Pass
3.6227	4	3	75	Pass
3.6663	4	3	75	Pass
3.7100	4	3	75	Pass
3.7537	4	3	75	Pass
3.7973	4	3	75	Pass
3.8410	4	3	75	Pass
3.8847	4	3	75	Pass
3.9283	4	3	75	Pass
3.9720	4	3	75	Pass
4.0156	4	2	50	Pass
4.0593	4	2	50	Pass
4.1030	4	2	50	Pass
4.1466	4	2	50	Pass
4.1903	4	2	50	Pass
4.2340	4	2	50	Pass
4.2776	4	2	50	Pass
4.3213	4	2	50	Pass
4.3649	3	2	66	Pass
4.4086	3	2	66	Pass

4.4523	3	2	66	Pass
4.4959	3	2	66	Pass
4.5396	3	2	66	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

SDHM2011
PROJECT REPORT

Project Name: Castle Rock 5
Site Name :
Site Address:
City :
Report Date : 4/27/2012
Gage : SANTEE
Data Start : 10/01/1973
Data End : 09/30/2004
Precip Scale: 1.00
Version : 2012/03/01

PREDEVELOPED LAND USE

Name : Basin 5
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	9.7

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : Basin 5 Slope
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	3

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

Name : Basin 5 Roofs and Driveways
Bypass: No

Impervious Land Use	Acres
IMPERVIOUS-FLAT LAT	1.5

Element Flows To:

Outlet 1	Outlet 2
Basin 5 Yards	

Name : Basin 5 Yards
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	3.4

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 5 Streets
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
IMPERVIOUS-MOD	1.8

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	3.561593
5 year	5.443043
10 year	7.451799
25 year	10.400334

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	1.735819
5 year	2.54979
10 year	3.396915
25 year	4.764384

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.3562	408	230	56	Pass
0.4278	370	202	54	Pass
0.4995	336	178	52	Pass
0.5712	316	163	51	Pass
0.6429	288	156	54	Pass
0.7145	272	147	54	Pass
0.7862	247	135	54	Pass
0.8579	230	124	53	Pass
0.9295	212	110	51	Pass
1.0012	198	93	46	Pass
1.0729	188	86	45	Pass
1.1446	174	67	38	Pass
1.2162	170	60	35	Pass
1.2879	161	56	34	Pass
1.3596	154	52	33	Pass
1.4313	149	47	31	Pass
1.5029	145	43	29	Pass
1.5746	138	40	28	Pass
1.6463	134	38	28	Pass
1.7179	131	32	24	Pass
1.7896	122	26	21	Pass
1.8613	116	23	19	Pass
1.9330	114	22	19	Pass
2.0046	108	20	18	Pass
2.0763	104	20	19	Pass
2.1480	95	16	16	Pass
2.2197	89	16	17	Pass
2.2913	84	13	15	Pass
2.3630	79	12	15	Pass
2.4347	74	12	16	Pass
2.5064	66	9	13	Pass
2.5780	61	8	13	Pass
2.6497	56	7	12	Pass
2.7214	53	5	9	Pass
2.7930	51	5	9	Pass
2.8647	48	4	8	Pass
2.9364	41	4	9	Pass
3.0081	41	4	9	Pass
3.0797	41	4	9	Pass
3.1514	41	4	9	Pass

3.2231	39	4	10	Pass
3.2948	38	3	7	Pass
3.3664	37	3	8	Pass
3.4381	37	3	8	Pass
3.5098	35	3	8	Pass
3.5815	31	3	9	Pass
3.6531	30	2	6	Pass
3.7248	30	2	6	Pass
3.7965	27	2	7	Pass
3.8681	26	2	7	Pass
3.9398	26	2	7	Pass
4.0115	24	2	8	Pass
4.0832	22	2	9	Pass
4.1548	20	2	10	Pass
4.2265	20	2	10	Pass
4.2982	18	2	11	Pass
4.3699	18	2	11	Pass
4.4415	18	2	11	Pass
4.5132	17	1	5	Pass
4.5849	16	1	6	Pass
4.6565	14	1	7	Pass
4.7282	14	1	7	Pass
4.7999	13	1	7	Pass
4.8716	13	1	7	Pass
4.9432	13	1	7	Pass
5.0149	12	1	8	Pass
5.0866	12	1	8	Pass
5.1583	12	1	8	Pass
5.2299	12	1	8	Pass
5.3016	11	1	9	Pass
5.3733	11	1	9	Pass
5.4450	9	1	11	Pass
5.5166	7	1	14	Pass
5.5883	7	1	14	Pass
5.6600	7	1	14	Pass
5.7316	7	1	14	Pass
5.8033	6	1	16	Pass
5.8750	6	1	16	Pass
5.9467	4	1	25	Pass
6.0183	4	1	25	Pass
6.0900	4	1	25	Pass
6.1617	4	0	0	Pass
6.2334	4	0	0	Pass
6.3050	4	0	0	Pass
6.3767	4	0	0	Pass
6.4484	4	0	0	Pass
6.5200	4	0	0	Pass
6.5917	4	0	0	Pass
6.6634	4	0	0	Pass
6.7351	4	0	0	Pass
6.8067	4	0	0	Pass
6.8784	4	0	0	Pass
6.9501	4	0	0	Pass
7.0218	4	0	0	Pass
7.0934	4	0	0	Pass
7.1651	3	0	0	Pass
7.2368	3	0	0	Pass

7.3085	3	0	0	Pass
7.3801	3	0	0	Pass
7.4518	3	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

SDHM2011
PROJECT REPORT

Project Name: Castle Rock 6
Site Name :
Site Address:
City :
Report Date : 4/27/2012
Gage : SANTEE
Data Start : 10/01/1973
Data End : 09/30/2004
Precip Scale: 1.00
Version : 2012/03/01

PREDEVELOPED LAND USE

Name : Basin 6
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	14

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : Basin 6 Slope
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	2.9

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

Name : Basin 6 Roofs and Driveways
Bypass: No

Impervious Land Use	Acres
IMPERVIOUS-FLAT LAT	2.2

Element Flows To:

Outlet 1	Outlet 2
Basin 6 Yards	

Name : Basin 6 Yards
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	6.6

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 6 Streets
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
IMPERVIOUS-MOD	2.3

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	2.86565
5 year	4.37946
10 year	5.9957
25 year	8.368085

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	2.466668
5 year	3.604988
10 year	4.949267
25 year	7.034119

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.2866	408	308	75	Pass
0.3442	369	268	72	Pass
0.4019	336	233	69	Pass
0.4596	317	213	67	Pass
0.5172	288	199	69	Pass
0.5749	272	188	69	Pass
0.6326	247	176	71	Pass
0.6902	229	170	74	Pass
0.7479	212	166	78	Pass
0.8056	198	156	78	Pass
0.8632	188	149	79	Pass
0.9209	174	143	82	Pass
0.9786	170	139	81	Pass
1.0362	161	136	84	Pass
1.0939	154	132	85	Pass
1.1516	149	128	85	Pass
1.2093	145	123	84	Pass
1.2669	138	112	81	Pass
1.3246	134	104	77	Pass
1.3823	131	98	74	Pass
1.4399	122	91	74	Pass
1.4976	116	86	74	Pass
1.5553	114	80	70	Pass
1.6129	109	72	66	Pass
1.6706	104	64	61	Pass
1.7283	95	59	62	Pass
1.7859	89	56	62	Pass
1.8436	84	54	64	Pass
1.9013	79	53	67	Pass
1.9589	74	49	66	Pass
2.0166	66	46	69	Pass
2.0743	61	42	68	Pass
2.1319	56	42	75	Pass
2.1896	53	39	73	Pass
2.2473	51	39	76	Pass
2.3049	48	37	77	Pass
2.3626	41	35	85	Pass
2.4203	41	34	82	Pass
2.4780	41	31	75	Pass
2.5356	41	29	70	Pass

2.5933	39	24	61	Pass
2.6510	38	24	63	Pass
2.7086	37	23	62	Pass
2.7663	37	22	59	Pass
2.8240	35	21	60	Pass
2.8816	31	20	64	Pass
2.9393	30	20	66	Pass
2.9970	30	19	63	Pass
3.0546	27	17	62	Pass
3.1123	26	15	57	Pass
3.1700	26	15	57	Pass
3.2276	24	14	58	Pass
3.2853	22	13	59	Pass
3.3430	20	13	65	Pass
3.4006	20	12	60	Pass
3.4583	18	11	61	Pass
3.5160	18	10	55	Pass
3.5736	18	9	50	Pass
3.6313	17	8	47	Pass
3.6890	16	8	50	Pass
3.7466	14	8	57	Pass
3.8043	14	8	57	Pass
3.8620	13	7	53	Pass
3.9197	13	6	46	Pass
3.9773	13	5	38	Pass
4.0350	12	4	33	Pass
4.0927	12	4	33	Pass
4.1503	12	4	33	Pass
4.2080	12	4	33	Pass
4.2657	11	4	36	Pass
4.3233	11	4	36	Pass
4.3810	9	4	44	Pass
4.4387	7	4	57	Pass
4.4963	7	4	57	Pass
4.5540	7	4	57	Pass
4.6117	7	4	57	Pass
4.6693	6	4	66	Pass
4.7270	6	4	66	Pass
4.7847	4	3	75	Pass
4.8423	4	3	75	Pass
4.9000	4	3	75	Pass
4.9577	4	3	75	Pass
5.0153	4	3	75	Pass
5.0730	4	3	75	Pass
5.1307	4	3	75	Pass
5.1883	4	3	75	Pass
5.2460	4	3	75	Pass
5.3037	4	2	50	Pass
5.3614	4	2	50	Pass
5.4190	4	2	50	Pass
5.4767	4	2	50	Pass
5.5344	4	2	50	Pass
5.5920	4	2	50	Pass
5.6497	4	2	50	Pass
5.7074	4	2	50	Pass
5.7650	3	2	66	Pass
5.8227	3	2	66	Pass

5.8804	3	2	66	Pass
5.9380	3	2	66	Pass
5.9957	3	2	66	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

SDHM2011
PROJECT REPORT

Project Name: Castle Rock 7
Site Name :
Site Address:
City :
Report Date : 4/27/2012
Gage : SANTEE
Data Start : 10/01/1973
Data End : 09/30/2004
Precip Scale: 1.00
Version : 2012/03/01

PREDEVELOPED LAND USE

Name : Basin 7
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	17.4

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : Basin 7 Slope
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	4.5

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

Name : Basin 7 Roofs and Driveways
Bypass: No

Impervious Land Use	Acres
IMPERVIOUS-FLAT LAT	3.1

Element Flows To:

Outlet 1	Outlet 2
Basin 7 Yards	

Name : Basin 7 Yards
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	6.9

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 7 Streets
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
IMPERVIOUS-MOD	2.9

Element Flows To:

Surface	Interflow	Groundwater

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	3.561593
5 year	5.443043
10 year	7.451799
25 year	10.400334

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	3.186666
5 year	4.859897
10 year	6.244271
25 year	8.753671

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.3562	408	355	87	Pass
0.4278	370	306	82	Pass
0.4995	336	268	79	Pass
0.5712	316	244	77	Pass
0.6429	288	233	80	Pass
0.7145	272	215	79	Pass
0.7862	247	203	82	Pass
0.8579	230	187	81	Pass
0.9295	212	181	85	Pass
1.0012	198	176	88	Pass
1.0729	188	165	87	Pass
1.1446	174	158	90	Pass
1.2162	170	154	90	Pass
1.2879	161	149	92	Pass
1.3596	154	146	94	Pass
1.4313	149	136	91	Pass
1.5029	145	131	90	Pass
1.5746	138	125	90	Pass
1.6463	134	116	86	Pass
1.7179	131	110	83	Pass
1.7896	122	100	81	Pass
1.8613	116	92	79	Pass
1.9330	114	87	76	Pass
2.0046	108	84	77	Pass
2.0763	104	70	67	Pass
2.1480	95	64	67	Pass
2.2197	89	61	68	Pass
2.2913	84	60	71	Pass
2.3630	79	57	72	Pass
2.4347	74	55	74	Pass
2.5064	66	52	78	Pass
2.5780	61	49	80	Pass
2.6497	56	47	83	Pass
2.7214	53	44	83	Pass
2.7930	51	43	84	Pass
2.8647	48	41	85	Pass
2.9364	41	41	100	Pass
3.0081	41	40	97	Pass
3.0797	41	37	90	Pass
3.1514	41	33	80	Pass

3.2231	39	31	79	Pass
3.2948	38	27	71	Pass
3.3664	37	25	67	Pass
3.4381	37	24	64	Pass
3.5098	35	23	65	Pass
3.5815	31	22	70	Pass
3.6531	30	20	66	Pass
3.7248	30	20	66	Pass
3.7965	27	20	74	Pass
3.8681	26	20	76	Pass
3.9398	26	18	69	Pass
4.0115	24	16	66	Pass
4.0832	22	16	72	Pass
4.1548	20	14	70	Pass
4.2265	20	13	65	Pass
4.2982	18	13	72	Pass
4.3699	18	12	66	Pass
4.4415	18	12	66	Pass
4.5132	17	11	64	Pass
4.5849	16	9	56	Pass
4.6565	14	9	64	Pass
4.7282	14	9	64	Pass
4.7999	13	9	69	Pass
4.8716	13	8	61	Pass
4.9432	13	6	46	Pass
5.0149	12	5	41	Pass
5.0866	12	5	41	Pass
5.1583	12	5	41	Pass
5.2299	12	4	33	Pass
5.3016	11	4	36	Pass
5.3733	11	4	36	Pass
5.4450	9	4	44	Pass
5.5166	7	4	57	Pass
5.5883	7	4	57	Pass
5.6600	7	4	57	Pass
5.7316	7	4	57	Pass
5.8033	6	4	66	Pass
5.8750	6	4	66	Pass
5.9467	4	4	100	Pass
6.0183	4	3	75	Pass
6.0900	4	3	75	Pass
6.1617	4	3	75	Pass
6.2334	4	3	75	Pass
6.3050	4	3	75	Pass
6.3767	4	3	75	Pass
6.4484	4	3	75	Pass
6.5200	4	3	75	Pass
6.5917	4	3	75	Pass
6.6634	4	3	75	Pass
6.7351	4	2	50	Pass
6.8067	4	2	50	Pass
6.8784	4	2	50	Pass
6.9501	4	2	50	Pass
7.0218	4	2	50	Pass
7.0934	4	2	50	Pass
7.1651	3	2	66	Pass
7.2368	3	2	66	Pass

7.3085	3	2	66	Pass
7.3801	3	2	66	Pass
7.4518	3	2	66	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

Perlnd and Implnd Changes
No changes have been made.

SDHM2011
PROJECT REPORT

Project Name: Castle Rock 8
Site Name :
Site Address:
City :
Report Date : 4/27/2012
Gage : SANTEE
Data Start : 10/01/1973
Data End : 09/30/2004
Precip Scale: 1.00
Version : 2012/03/01

PREDEVELOPED LAND USE

Name : Basin 8
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	25.9

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

MITIGATED LAND USE

Name : Basin 8 Slope
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
D,Grass,STEEP(10-20	4.1

Impervious Land Use	Acres

Element Flows To:
Surface **Interflow** **Groundwater**

Name : Basin 8 Park
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	3.4

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 8 Roofs and Driveways
Bypass: No

Impervious Land Use	Acres
IMPERVIOUS-FLAT LAT	3.3

Element Flows To:

Outlet 1	Outlet 2
Basin 8 Yards	

Name : Basin 8 Yards
Bypass: No

GroundWater: No

Pervious Land Use	Acres
D,Grass,FLAT(0-5%)	9.8

Element Flows To:

Surface	Interflow	Groundwater

Name : Basin 8 Streets
Bypass: Yes

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
IMPERVIOUS-MOD	5.3

Element Flows To:
Surface Interflow Groundwater

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	5.301452
5 year	8.102001
10 year	11.092045
25 year	15.480957

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	4.222375
5 year	5.957789
10 year	8.522833
25 year	12.058477

POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.5301	408	273	66	Pass
0.6368	370	235	63	Pass
0.7435	336	209	62	Pass
0.8502	316	193	61	Pass
0.9569	288	180	62	Pass
1.0636	272	170	62	Pass
1.1703	247	164	66	Pass
1.2769	230	158	68	Pass
1.3836	212	149	70	Pass
1.4903	198	140	70	Pass
1.5970	188	138	73	Pass
1.7037	174	133	76	Pass
1.8104	170	126	74	Pass
1.9171	161	118	73	Pass
2.0237	154	111	72	Pass
2.1304	149	103	69	Pass
2.2371	145	97	66	Pass
2.3438	138	92	66	Pass
2.4505	134	84	62	Pass
2.5572	131	78	59	Pass
2.6639	122	72	59	Pass

2.7705	116	59	50	Pass
2.8772	114	57	50	Pass
2.9839	108	56	51	Pass
3.0906	104	52	50	Pass
3.1973	95	50	52	Pass
3.3040	89	47	52	Pass
3.4107	84	44	52	Pass
3.5173	79	41	51	Pass
3.6240	74	37	50	Pass
3.7307	66	36	54	Pass
3.8374	61	36	59	Pass
3.9441	56	36	64	Pass
4.0508	53	35	66	Pass
4.1575	51	33	64	Pass
4.2642	48	29	60	Pass
4.3708	41	27	65	Pass
4.4775	41	24	58	Pass
4.5842	41	23	56	Pass
4.6909	41	21	51	Pass
4.7976	39	20	51	Pass
4.9043	38	18	47	Pass
5.0110	37	18	48	Pass
5.1176	37	17	45	Pass
5.2243	35	16	45	Pass
5.3310	31	15	48	Pass
5.4377	30	14	46	Pass
5.5444	30	14	46	Pass
5.6511	27	12	44	Pass
5.7578	26	12	46	Pass
5.8644	26	10	38	Pass
5.9711	24	10	41	Pass
6.0778	22	10	45	Pass
6.1845	20	9	45	Pass
6.2912	20	7	35	Pass
6.3979	18	7	38	Pass
6.5046	18	7	38	Pass
6.6112	18	7	38	Pass
6.7179	17	5	29	Pass
6.8246	16	4	25	Pass
6.9313	14	4	28	Pass
7.0380	14	4	28	Pass
7.1447	13	4	30	Pass
7.2514	13	4	30	Pass
7.3580	13	4	30	Pass
7.4647	12	4	33	Pass
7.5714	12	4	33	Pass
7.6781	12	4	33	Pass
7.7848	12	4	33	Pass
7.8915	11	4	36	Pass
7.9982	11	4	36	Pass
8.1048	9	4	44	Pass
8.2115	7	3	42	Pass
8.3182	7	3	42	Pass
8.4249	7	3	42	Pass
8.5316	7	3	42	Pass
8.6383	6	3	50	Pass
8.7450	6	3	50	Pass

8.8516	4	3	75	Pass
8.9583	4	3	75	Pass
9.0650	4	2	50	Pass
9.1717	4	2	50	Pass
9.2784	4	2	50	Pass
9.3851	4	2	50	Pass
9.4918	4	2	50	Pass
9.5984	4	2	50	Pass
9.7051	4	2	50	Pass
9.8118	4	2	50	Pass
9.9185	4	2	50	Pass
10.0252	4	2	50	Pass
10.1319	4	2	50	Pass
10.2386	4	2	50	Pass
10.3452	4	2	50	Pass
10.4519	4	2	50	Pass
10.5586	4	2	50	Pass
10.6653	3	2	66	Pass
10.7720	3	2	66	Pass
10.8787	3	2	66	Pass
10.9854	3	2	66	Pass
11.0920	3	2	66	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0 **acre-feet**
On-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**
Off-line facility target flow: 0 **cfs.**
Adjusted for 15 min: 0 **cfs.**

Perlnd and Implnd Changes

No changes have been made.
