



| | |
|-------------------------|------------|
| Issued: | Date: |
| A BID SET | 08/23/17 |
| B | |
| C | |
| D | |
| Revisions: | Date: |
| 1 ADDRESS CITY COMMENTS | 05/11/2017 |
| 2 ADDRESS CITY COMMENTS | 07/11/2017 |
| 3 | |
| 4 | |
| 5 | |



| | | |
|------------------|----------------------------|------|
| Seal | PROJECT ARCHITECT/ENGINEER | DATE |
| PROJECT LEAD | | DATE |
| PROJECT DESIGNER | | DATE |

Kimley»Horn
 Kimley-Horn and Associates, Inc.
 1700 Willow Lawn Drive, Suite 200
 Richmond, Virginia 23230
 (804) 673-3882

STORMWATER QUANTITY SUMMARY

| Pre-Development | | | |
|---|------------|-------------|------------------------------------|
| Runoff Curve Number (CN) | 89 | | |
| Drainage Area | 0.61 acres | | |
| Impermeable Area | 0.31 acres | Storm Event | Runoff Volume V _g (cfs) |
| Managed Turf | 0.31 acres | 1-year | 1.93 |
| Forest/Open Space | 0.00 acres | 10-year | 4.54 |
| Time of Concentration (T _c) | 5.0 min | | |

| Post-Development (Prior to Routing) | | | |
|---|-------------|-------------|------------------------------------|
| Runoff Curve Number (CN) | 1 yr: 89 | | |
| Runoff Curve Number (CN) | 10 yr: 89 | | |
| Drainage Area | 0.61 acres | Storm Event | Runoff Volume V _g (cfs) |
| Impermeable Area | 0.398 acres | 1-year | 2.14 |
| Managed Turf | 0.275 acres | 10-year | 4.73 |
| Forest/Open Space | 0.000 acres | | |
| Time of Concentration (T _c) | 5.0 min | | |

Channel Protection Compliance

| | |
|---|-------------|
| Energy Balance Equation, 1-year Storm | 0.3 |
| Improvement Factor | 1.51 |
| $Q_{post} < 1.5 \times Q_{pre} \times RV_{pre}/RV_{post}$ | 2.14 < 1.51 |

10-year storm

| | |
|----------------------|-------------|
| $Q_{post} < Q_{pre}$ | 4.73 < 4.54 |
|----------------------|-------------|

POST DEVELOPMENT ROUTED PEAK FLOWS:

| Storm Event | Peak Flow at (cfs) | ($<$ Required) | 1.51 cfs | ($<$ Required) | 4.54 cfs |
|-------------|--------------------|-----------------|----------|-----------------|----------|
| 1-year | 1.93 | < | 1.51 | < | 4.54 |
| 10-year | 4.73 | < | 1.51 | < | 4.54 |

1-YEAR STORM: PIPE DETENTION: 0.57 CFS
 BYPASS FLOW: 0.20 CFS
 TOTAL: 0.97 CFS + 0.20 CFS = 1.17 CFS

10-YEAR STORM: PIPE DETENTION: 4.06 CFS
 BYPASS FLOW: 0.46 CFS
 TOTAL: 4.06 CFS + 0.46 CFS = 4.52 CFS

PROJECT LAND COVER DETAILS

Pre-Development Land Cover (acres)

| | A Soils | B Soils | C Soils | D Soils | Totals |
|---|-----------|-----------|-----------|-----------|-------------|
| Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested | | | | | 0.00 |
| Managed Turf (acres) -- disturbed, graded 1/4" or other turf to be | | | 0.31 | | 0.31 |
| Impervious Cover (acres) | | | | 0.30 | 0.30 |
| Area Check | OK | OK | OK | OK | 0.61 |

Post-Development Land Cover (acres)

| | A Soils | B Soils | C Soils | D Soils | Totals |
|---|-----------|-----------|-----------|-----------|-------------|
| Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested | | | | | 0.00 |
| Managed Turf (acres) -- disturbed, graded 1/4" or other turf to be | | | 0.21 | | 0.21 |
| Impervious Cover (acres) | | | | 0.40 | 0.40 |
| Area Check | OK | OK | OK | OK | 0.61 |

CONSTANTS AND COEFFICIENTS

Constants

| | |
|---|------|
| Annual Rainfall (inches) | 43 |
| Target Rainfall Event (inches) | 1.00 |
| Total Phosphorus (TP) EMC (mg/L) | 0.26 |
| Total Nitrogen (TN) EMC (mg/L) | 1.86 |
| Target TP Load (lb/acre/yr) | 0.41 |
| P _i (unitless correction factor) | 0.90 |

Runoff Coefficients (Rv)

| | A Soils | B Soils | C Soils | D Soils |
|-------------------|---------|---------|---------|---------|
| Forest/Open Space | 0.02 | 0.03 | 0.04 | 0.05 |
| Managed Turf | 0.15 | 0.20 | 0.22 | 0.25 |
| Impervious Cover | 0.95 | 0.95 | 0.95 | 0.95 |

STORMWATER QUALITY REQUIREMENTS:

Total Phosphorus

| | |
|--|------|
| FINAL POST-DEVELOPMENT TP LOAD (lb/yr) | 0.38 |
| TP LOAD REDUCTION REQUIRED (lb/yr) | 0.25 |
| TP LOAD REDUCTION ACHIEVED (lb/yr) | 0.40 |
| TP LOAD REMAINING (lb/yr) | 0.49 |
| REMAINING TP LOAD REDUCTION REQUIRED (lb/yr) | 0.39 |

STORMWATER MANAGEMENT ASSUMPTIONS/NOTES:

- THE MAJORITY OF THE SITE DRAINS TO AN EXISTING INFILTRATION BASIN DESIGNED AND CONSTRUCTED WITH THE WILLIS WAYSIDE RETAIL EXPANSION PROJECT (DSC #F07-854). THIS AREA IS CONSIDERED GRANDFATHERED UNDER PART II-C OF THE VIRGINIA STORMWATER REGULATIONS AND IS SHOWN ON SHEET CG-201.
- THE REMAINDER OF THE PROJECT AREA IS CONSIDERED A REDEVELOPMENT AND DESIGNED UNDER PART II-B OF THE VIRGINIA STORMWATER REGULATIONS AND IS SHOWN ON THIS SHEET.
- THE ENTIRE SITE DRAINS TO STORM SEWER SYSTEMS IN VIRGINIA BEACH BOULEVARD AND THALIA ROAD ULTIMATELY OUTFALLING INTO THALIA CREEK TO THE WEST.

LAND COVER DETAILS CONTRIBUTING TO BIORETENTION BASIN

Drainage Area A Land Cover (acres)

| | D Soils | Totals | Land Cover Rv |
|---------------------------|---------|-------------|---------------|
| Forest/Open Space (acres) | | 0.00 | 0.00 |
| Managed Turf (acres) | 0.19 | 0.19 | 0.25 |
| Impervious Cover (acres) | 0.36 | 0.36 | 0.95 |
| Total | | 0.55 | |

STORMWATER QUANTITY COMPLIANCE:
 STORMWATER QUANTITY IS ADDRESSED PER PART II-B OF THE VIRGINIA STORMWATER REGULATIONS.

CHANNEL PROTECTION: THE ENERGY BALANCE WAS UTILIZED AT THE OUTFALL. AN ON-SITE STORMWATER DETENTION DEVICE IS PROPOSED WITHIN STRUCTURE 2. THIS DEVICE CONSISTS OF A WEIR WALL WITH AN ORIFICE THAT WILL DETAIN THE 1-YEAR STORM SO AS NOT TO INCREASE THE RUNOFF UNDER POST-DEVELOPMENT CONDITIONS. DETAILS FOR THE DETENTION SYSTEM ARE SHOWN ON SHEET CG-102. CALCULATIONS ARE PROVIDED ON THIS SHEET AND THE DESIGN REPORT.

FLOOD PROTECTION: THE ENERGY BALANCE WAS UTILIZED AT THE OUTFALL. AN ON-SITE STORMWATER DETENTION DEVICE IS PROPOSED WITHIN STRUCTURE 1. THIS DEVICE CONSISTS OF A WEIR WALL WITH AN ORIFICE THAT WILL DETAIN THE 10-YEAR STORM SO AS NOT TO INCREASE THE RUNOFF UNDER POST-DEVELOPMENT CONDITIONS. DETAILS FOR THE DETENTION SYSTEM ARE SHOWN ON SHEET CG-102. CALCULATIONS ARE PROVIDED ON THIS SHEET AND THE DESIGN REPORT.

STORMWATER QUALITY COMPLIANCE:
 STORMWATER QUALITY IS ADDRESSED PER PART II-B OF THE VIRGINIA STORMWATER REGULATIONS. THE SITE REQUIRES A TOTAL PHOSPHORUS LOAD REDUCTION OF 0.25 POUNDS PER YEAR. A LEVEL 1 BIORETENTION POND IS PROPOSED ON-SITE WHICH PROVIDES 0.49 LBS/YR PHOSPHORUS REMOVAL. REFER TO THE CALCULATIONS SHOWN ON THIS SHEET.

STORMWATER QUALITY TREATMENT:

| Practice | Runoff Reduction Credit (%) | Managed Turf Credit Area (acres) | Impervious Cover Credit Area (acres) | Volume from Upstream Practice (ft ³) | Runoff Reduction (ft ³) | Remaining Runoff Volume (ft ³) | Total BMP Treatment Volume (ft ³) | Phosphorus Removal Efficiency (%) | Phosphorus Load from Upstream Practices (lb) | Untreated Phosphorus Load to Practice (lb) | Phosphorus Removed By Practice (lb) | Remaining Phosphorus Load (lb) |
|---|-----------------------------|----------------------------------|--------------------------------------|--|-------------------------------------|--|---|-----------------------------------|--|--|-------------------------------------|--------------------------------|
| 6. Bioretention (RR) | | | | | | | | | | | | |
| 6.a. Bioretention #1 or Micro-Bioretention #1 or Urban Bioretention (Spec #9) | 40 | 0.19 | 0.36 | 0 | 569 | 854 | 1,423 | 25 | 0.00 | 0.89 | 0.49 | 0.40 |



ALDI Inc.
 Virginia Beach Blvd & Thalia Road
 Virginia Beach, VA
 Project Name & Location:

STORMWATER MANAGEMENT PLAN (PART II-B)

Drawing Name: _____ Project No. 113180024

Date: 02/08/17

Type: _____

Drawn By: SMP CG-202

Scale: As Noted Drawing No. _____

DSC FILE #F07-004902-SP