

AGREEMENT FOR MAINTENANCE OF STORM WATER DETENTION SYSTEM

This agreement is made on October 4th, 2022, by VDG Walton, LLC, a Michigan limited liability company, whose address 36400 Woodward Ave, Suite 240, Bloomfield Hills, Michigan 48304, (Developer) and the CITY OF ROCHESTER HILLS (the City), whose address is 1000 Rochester Hills Drive, Rochester Hills, MI 48309.

RECITALS:

WHEREAS, Developer owns and occupies the property described in attached **Exhibit A**; and

WHEREAS, Developer has proposed, and the City has approved, a storm water drainage and detention system (the system) for the property as described and depicted in the attached **Exhibit B**; and

WHEREAS, the parties will benefit from the proper use and maintenance of the System and desire to enter into this agreement to provide for the same.

THEREFORE, the parties agree:

1. **Use of the System:** Components of the System, including any and all water conveyance, detention and water quality treatment facilities and devices, storm sewer pipe, catch basins, manholes, and swales, shall be used solely for the purpose of detaining storm and surface water on the property until such time as: (i) The City may determine and advise (Developer), or (Developer's) successors, grantees or assigns, in writing that it is no longer necessary to use the detention system to detain storm or surface water; and (ii) An adequate alternative for draining storm and surface water has been provided which is acceptable to the City and which includes the granting of such easements to the City or third parties for the alternative drainage system as may be necessary.

2. **Maintenance:**

A. Developer shall be responsible for the proper maintenance, repair and replacement of the System and any part thereof as detailed in the Maintenance Plan attached as **Exhibit C**.

B. Proper maintenance of the System shall include, but not limited to: (i) Removing accumulated sediment, trash and debris from the detention system and at inlet pipes; (ii) Maintaining storm sewer and structures; (iii) Controlling the effects of erosion; (iv) Inspection and cleaning of the water quality treatment device; (v) Inspection of inlet and outlet pipes for structural integrity; (vi) Inspection and cleaning of the storm sewer and catch basins upstream from the detention system; and (vii) Any other maintenance that is reasonable and necessary to facilitate and continue the proper operation and use of the System.

3. **Action by City:** In the event Developer or Developer's successors, grantees, or assigns, neglects or fails at any time to properly maintain the System or any part thereof, the City may notify Developer or Developer's successors, grantees or assigns, in writing, and the notice shall include a listing and description of maintenance deficiencies and a demand that they must be corrected within thirty (30) days.

The notice shall further specify the date and place for a hearing to be held at least fourteen (14) days after the date of the notice before the City Council, or such other board or official to whom the City Council may delegate responsibility. At the hearing, the City Council (or other board or official) may endorse or modify the listing and description of deficiencies to be corrected and, for good cause, may extend the time within which the deficiencies must be corrected.

Thereafter, if the maintenance deficiencies are not corrected within the time allowed, the City may undertake and make the necessary corrections, and may maintain the System for a period not to exceed one (1) year. Such maintenance of the System by the City shall not be deemed a taking of the property, nor shall the City's actions be deemed to vest in the public any right to use the property. If the City determines maintenance of the system by the City should continue beyond one year, the City shall hold, and provide advance written notice of, a further hearing at which Developer or Developer's successors, grantees or assigns, will not or cannot properly maintain the System, the City may continue to maintain the System for another year, and subject to a similar hearing and determination, in subsequent years.

In the event the City determines an emergency condition caused by or relating to the System threatens the public health, safety or general welfare, the City shall have the right to immediately and without notice enter the property and undertake appropriate corrective action.

4. **Charges:** The City shall charge to the current owner of the property the cost of maintenance or other corrective action undertaken by the City in accordance with this agreement, plus a ten percent (10%) administrative fee. If not timely paid, the City may assess the charges on the City's tax roll, which charges shall be a lien on the real property and shall be collectable and enforceable in the same manner general property taxes are collected and enforced.

5. **Notice:** Any notices required under this agreement shall be sent by certified mail to the address for each party set forth below, or to such other addresses as such party may notify the other parties in writing:

To Developer:

VDG Walton, LLC
36400 Woodward Ave, Suite 240
Bloomfield Hills, Michigan 48304

To the City:

Clerk
City of Rochester Hills
1000 Rochester Hills Drive
Rochester Hills, MI 48309

6. **Successors and Assigns:** This agreement shall bind and inure to the benefit of the parties and their respective successors, grantees and assigns. The rights, obligations and responsibilities hereunder shall run with the land and shall bind all current and future owners of the property.

7. **Recording of Agreement:** This agreement shall be recorded at the Oakland County Register of Deeds.

VDG Walton, LLC
a Michigan limited liability company

By:


Frank Arcori
Its: Manager

CITY OF ROCHESTER HILLS

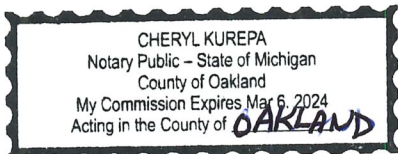
By:

Bryan K. Barnett, Mayor

STATE OF MICHIGAN

COUNTY OF OAKLAND

This agreement was acknowledged before me on OCTOBER 4, 2022,
By Frank Arcori, who is the manager of VDG Walton, LLC, a Michigan limited liability company




_____, notary public
OAKLAND County, Michigan
My commission expires: 3-6-24

STATE OF MICHIGAN
COUNTY OF OAKLAND

This agreement was acknowledged before me on _____, 2022,

by Bryan K. Barnett, Mayor, of the City of Rochester Hills, on behalf of the City.

Drafted By:
Frank Arcori
36400 Woodward, Suite 240
Bloomfield Hills, Michigan 48304

_____, notary public
_____, County, Michigan
My commission expires: _____

When Recorded Return to:
Clerks Dept.
City of Rochester Hills
1000 Rochester Hills Drive
Rochester Hills, MI 48309

10/19/22 John Staron
Approved

EXHIBIT A

LEGAL DESCRIPTION:

THE LAND IS DESCRIBED AS FOLLOWS: CITY OF ROCHESTER HILLS,
COUNTY OF OAKLAND, STATE OF MICHIGAN

TOWN 3 NORTH, RANGE 11 EAST, SECTION 9, PART OF SOUTHEAST 1/4
BEGINNING AT POINT DISTANCE NORTH 89 DEGREES 51 MINUTES 40
SECONDS WEST 551.20 FEET FROM SOUTHEAST SECTION CORNER,
THENCE NORTH 89 DEGREES 51 MINUTES 40 SECONDS WEST 120 FEET,
THENCE NORTH 00 DEGREES 04 MINUTES 20 SECONDS EAST 330 FEET,
THENCE SOUTH 89 DEGREES 51 MINUTES 40 SECONDS EAST 120 FEET,
THENCE SOUTH 00 DEGREES 04 MINUTES 20 SECONDS WEST 330 FEET TO
BEGINNING, EXCEPT SOUTH 60 FEET IN ROAD.

Jenny M.
Approved 10/18/22

EXHIBIT A: OVERALL LEGAL DESCRIPTION

PROPOSED STARBUCKS

15-09-476-030
1360 WALTON BOULEVARD
CITY OF ROCHESTER HILLS
OAKLAND COUNTY, MICHIGAN

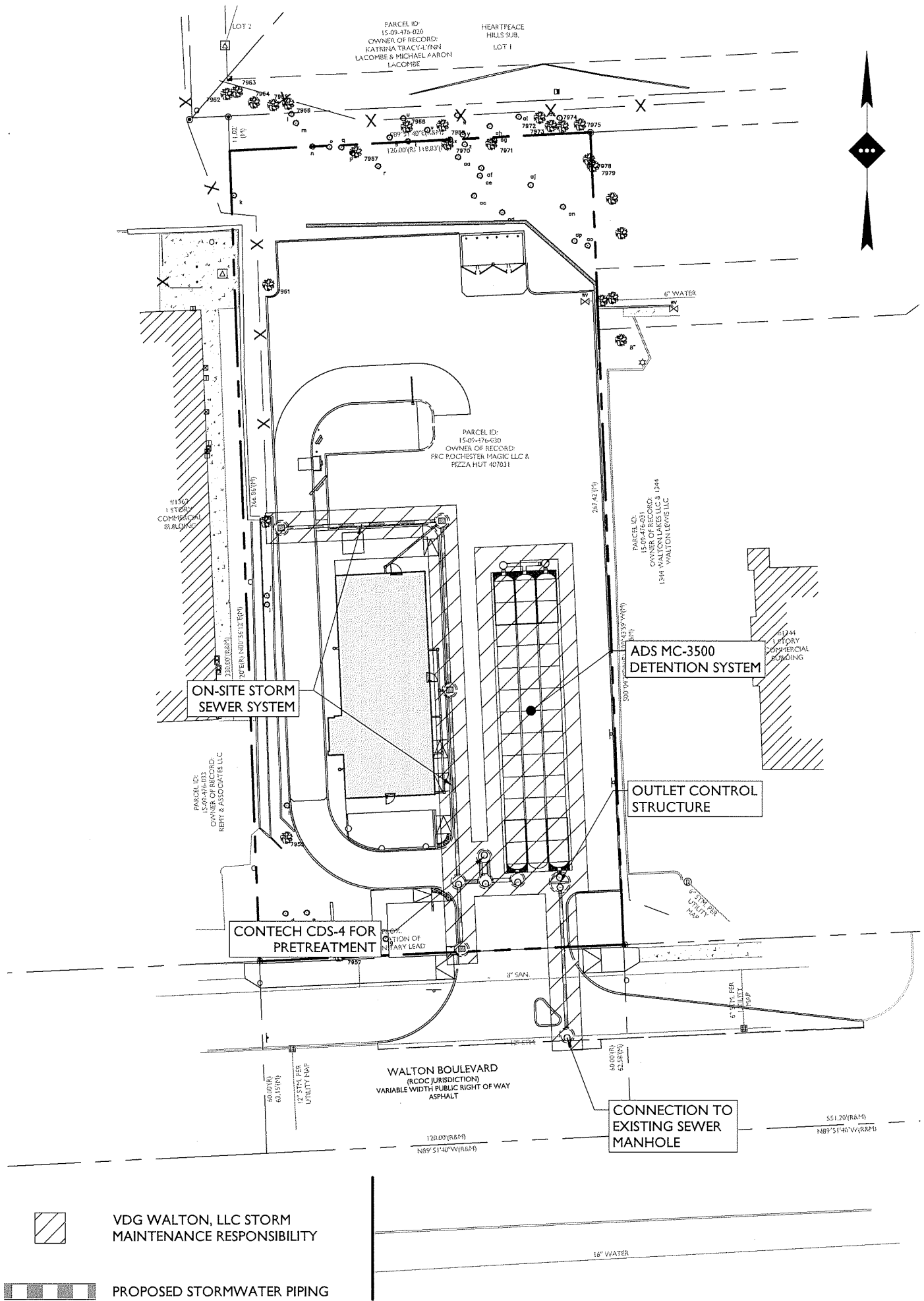
DRAWN BY:	JRC
CHECKED BY:	JRC
DATE:	9/21/2022
SCALE:	N/A
PROJECT ID:	DET-200412



Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
www.stonefieldeng.com

607 Shelby Suite 200, Detroit, MI 48226
Phone 248.247.1115

EXHIBIT B





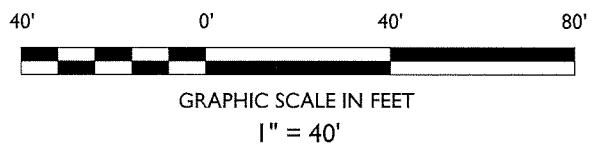
-  VDG WALTON, LLC STORM MAINTENANCE RESPONSIBILITY
-  PROPOSED STORMWATER PIPING

EXHIBIT B: STORM WATER SYSTEM PLAN



PROPOSED STARBUCKS

15-09-476-030
1360 WALTON BOULEVARD
CITY OF ROCHESTER HILLS
OAKLAND COUNTY, MICHIGAN

*OK ARS
10/10/22*

DRAWN BY:	JRC
CHECKED BY:	JRC
DATE:	9/21/2022
SCALE:	1" = 40'
PROJECT ID:	DET-200412



STONEFIELD
engineering & design

Rutherford, NJ · New York, NY · Boston, MA
Princeton, NJ · Tampa, FL · Detroit, MI
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607 Shelby Suite 200, Detroit, MI 48226
Phone 248.247.1115

V:\DET\20\DET-200412\Year Development Group-1360 Walton Boulevard, Rochester Hills, MI\CADD\Exhibits\SYM Exhibits\City of Rochester Hills SYM - Exhibit B.dwg

EXHIBIT C

STONEFIELD

STORMWATER OPERATIONS & MAINTENANCE MANUAL

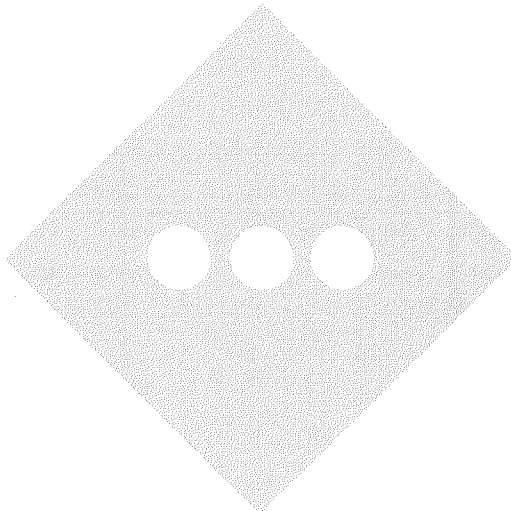
PROPOSED RESTAURANT
PID: 15-09-476-030
1360 WALTON BOULEVARD
CITY OF ROCHESTER HILLS
OAKLAND COUNTY, MICHIGAN

PREPARED FOR:
VERUS DEVELOPMENT GROUP
36400 WOODWARD AVE, SUITE 240
BLOOMFIELD HILLS, MI 48304

PREPARED BY:
STONEFIELD ENGINEERING & DESIGN, LLC
92 PARK AVENUE
RUTHERFORD, NEW JERSEY

REPORT DATE:
OCTOBER 4, 2022

LAST REVISED:
-



*Jason D.
Approved 10/11/22*

A handwritten signature in black ink, appearing to read "Reid Cooksey".

REID COOKSEY, PE

STONEFIELDENG.COM
201.340.4468 T. 201.340.4472 F.

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1.0 PROJECT DESCRIPTION

Verus Development Group is proposing the construction of a 2,219 SF restaurant and supporting improvements inclusive of 18 parking spaces, landscaping, utilities, site lighting, and stormwater management measures. Access to the site will be provided via one (1) driveway on Walton Boulevard.

The subject property is designated parcel identification number: 15-09-476-030, located on Walton Boulevard between South Livernois Road and Rochdale Drive North. The site is bound by a residential area to the north, Walton Boulevard to the south, fast-food restaurant to the east, and commercial retail use the west.

The existing site is pre-developed as an existing restaurant. The existing development will be demolished under the proposed development plans.

The project site is 0.73 acres, the extent of land disturbance is 0.72 acres (including areas within the public right-of-way).

This Stormwater Operations & Maintenance Manual has been prepared to delineate operational and maintenance responsibilities for the stormwater best management practices (BMPs). To mitigate the effects of the proposed stormwater quantity and quality the proposed on-site storm drainage system will capture and convey the majority of the site's runoff including all impervious areas to an underground detention system providing 80% TSS Removal with a mechanical water quality unit.

2.0 STORMWATER MANAGEMENT OPERATIONAL PROCEDURES

Operation and maintenance of the permanent stormwater control BMPs shall be the responsibility of the operator of the project site at the time that the applicable maintenance is required. The current owner and responsible agent of the project is:

Responsible Agent:

Verus Development Group
36400 Woodward Ave, Suite 240
Bloomfield Hills, MI 48304

Engineer of Record:

J. Reid Cooksey, PE
Stonefield Engineering & Design
607 Shelby Street Suite 200 Detroit, MI 48226
Phone: 248-247-1115

A copy of this report shall be kept on-site at all times both during and after construction. Upon reviewing agency approval, the title and date of the maintenance plan as well as the contact information of the current agent responsible for maintaining the stormwater management measures for the project shall be recorded on the deed of the property on which the measures are located. Any future change in this information such as change in property ownership shall also be recorded on the deed.

The Applicant is responsible to maintain a detailed log of all preventative and corrective maintenance actions for the constructed stormwater facilities incorporated into the design, including record of all inspections and copies of all maintenance-related work orders. The Applicant is also responsible for maintenance to evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and deed as needed. The Applicant shall retain a copy of this report onsite should a public entity request this report or documentation of said maintenance in the future.

2.1 MAINTENANCE EQUIPMENT AND PERSONNEL

The current responsible agent shall ensure that adequate equipment and training is provided to maintenance personnel to perform the required maintenance tasks. Confined Space Entry Certification shall be required by personnel entering underground structures and pipes. The material and equipment necessary for inspection and maintenance activities shall include, but not be limited to, the following:

- ◆ *Underground Detention Basin:* Instruments to perform visual inspection of underground chambers and outlet structures, equipment to pump stormwater from the basin in the event of maintenance, vacuum truck, and hose for removal of sediment from basin bottom, and necessary safety equipment
- ◆ *Manufactured Treatment Device Equipment:* Inspection probe, scale to measure filter bags, disposal bags, replacement filter modules, skimmer or net and necessary safety equipment.
- ◆ *Landscape Areas:* Material and equipment customary in landscape maintenance practices.
- ◆ *Street Sweeping:* Litter vacuum or leaf/litter blower to collect sediment from asphalt surface, brooms, and disposal bags.

The estimated cost of routine, scheduled maintenance activities is estimated to be approximately \$6,500 per year. Approximate breakdown of yearly routine maintenance costs are noted below (excludes structural repairs):

MAINTENANCE COST BREAKDOWN

Basin and WQU Inspection / Maintenance	\$3,000 per year
Landscape Areas	\$2,500 per year
Street Sweeping	\$1,000 per year

2.2 MAINTENANCE ACCESS POINTS

Access to the underground detention basin is provided via the inspection manholes at the north end of the basin. See Sheet C-5 of the Site Development Plans prepared by Stonefield Engineering & Design, LLC dated October 4, 2022.

3.0 STORMWATER BMP PREVENTATIVE MAINTENANCE ACTIONS

Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including, but not limited to, repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of non-vegetated linings

Maintenance plans should include specific preventative and corrective maintenance tasks such as removal of sediment, trash, and debris; mowing, pruning, and restoration of vegetation; restoration of eroded areas; elimination of mosquito breeding habitats; control of aquatic vegetation; and repair or replacement of damaged or deteriorated components.

3.1 UNDERGROUND DETENTION BASIN

Underground detention basin inspections shall be performed by entering the basin area via any of the associated inspection manholes along the basin perimeter. The following maintenance tasks shall be performed for the detention basin.

3.1.A QUARTERLY

All detention basin components which receive, or discharge stormwater must be checked for trapped debris and sediment accumulation at least four (4) times annually as well as after storm events exceeding one (1) inch of precipitation. Disposal of debris and sediment shall be done in compliance with all applicable local, state, and federal waste regulations.

3.1.B ANNUALLY

All structural components shall be checked at least once (1) annually for cracking, subsidence, spalling, erosion and deterioration.

3.2 MANUFACTURED TREATMENT DEVICE

Manufactured Treatment Device inspections shall be performed by entering the unit via the associated manhole. The following maintenance tasks shall be performed for the unit.

3.2.A QUARTERLY

All water quality components which receive, or discharge stormwater must be checked for trapped debris and sediment accumulation at least four (4) times annually as well as after storm events exceeding one (1) inch of precipitation. Disposal of debris and sediment shall be done in compliance with all applicable local, state, and federal waste regulations.

3.2.B ANNUALLY

All structural components shall be checked at least once (1) annually for cracking, subsidence, spalling, erosion and deterioration.

Refer to the manufacturer's specifications in the Appendix of this manual for specific requirements for the water quality unit.

3.3 OTHER MAINTENANCE

In addition to the scheduled inspections for the above referenced stormwater BMPs, the following general maintenance tasks shall be performed:

1. All stormwater inlets and manholes shall be inspected for debris and sediment accumulation and structural integrity at least four (4) times annually. Debris and sediment removal shall be scheduled as required to maintain stormwater runoff conveyance efficiency and disposed of in compliance with all applicable local, state, and federal waste regulations.
2. Street sweeping shall occur at least once (1) monthly in all parking lot areas onsite. Regenerative air equipment shall be used.
3. Landscaping within the developed portions of the site shall be trimmed/mowed twice (2) monthly during the growing season. Reforested portions of the site shall be left undisturbed to vegetate naturally.

4.0 STORMWATER BMP CORRECTIVE MAINTENANCE ACTIONS

Depending on many factors, such as the performance of preventative maintenance actions, weather, or unexpected incidents. Corrective requirements may not be precisely anticipated; however, a list of potential corrective maintenance actions may assist the responsible party in planning and estimating costs in advance.

<i>Potential Corrective Maintenance Actions</i>	<i>Stormwater Management Measures/No.</i>
<ul style="list-style-type: none">▪ Repair/replacement of eroded or damaged riprap apron▪ Repair/replacement of missing or damaged trash racks▪ Repair/replacement of outlet pipes or orifices▪ Revegetation of eroded side slope, aquatic bench, marsh, basin bottom, grass swales, etc.	Detention Basin (B-1)

The corrective maintenance actions should also be listed in the Field Manuals for the specific stormwater management measures on the site.

5.0 INSPECTION AND LOGS OF ALL PREVENTATIVE AND CORRECTIVE MEASURES

The person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

A maintenance plan shall include a schedule of regular inspections and tasks, and detailed logs of all preventative and corrective maintenance performed on the stormwater management measure, including all maintenance-related work orders. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan and associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site. Inspection Checklists in the Field Manual for the stormwater management measures on this site include:

- ◆ Appendix A-1: General Inspection Checklist Log
- ◆ Appendix A-2: General Preventative Maintenance Log
- ◆ Appendix A-3: General Corrective Maintenance Log
- ◆ Appendix A-4: Annual Evaluation Record

All inspection and maintenance activities shall be recorded to document frequency of inspection and maintenance, and implementation of corrective action. All regularly scheduled inspections, inspections following one (1) inch of precipitation, maintenance activities, and repairs shall be recorded. Refer to the Appendix of this Manual for the BMP Inspection & Maintenance Log for this facility. This log shall be considered a minimum standard for recording purposes, the Operator and Inspection/Maintenance Personnel are encouraged to supplement the Log with additional notes and photos.

A consulting Professional Engineer should perform regularly scheduled maintenance inspections of the stormwater facilities at least four times each year. The primary purpose of these inspections is to ascertain the operational condition and safety of the facility, particularly the condition of the outlet structures and other safety-related aspects. Inspections will also provide information on the effectiveness of regularly scheduled preventative maintenance procedures and will help to identify where changes in the extent and scheduling of the procedures are warranted. Finally, the facility inspections should also be used to determine the need for and timing of corrective maintenance procedures.

6.0 ANNUAL EVALUATION OF THE EFFECTIVENESS OF THE PLAN

The person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to,

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan.

APPENDIX A:
INSPECTION CHECKLISTS

**APPENDIX A-I:
GENERAL
INSPECTION
CHECKLIST LOG**

INSPECTION CHECKLIST LOG

1. The responsible party shall report issues to the local authority and mosquito commission as required by local ordinances and regulatory authorities.
2. The maintenance crew should fill out the checklist in the field manual when performing each inspection/maintenance task.
3. After the maintenance task is performed, the checklist should be filed in the Maintenance Plan and recorded in the log below.

<i>Cycle of Inspection</i>	<i>Stormwater Management Measure No.</i>	<i>Checklist No.</i>	<i>Date(s) of Inspection</i>
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4 th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			

Cycle of Inspection	Stormwater Management Measure No.	Checklist No.	Date(s) of Inspection
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4 th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4 th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			

**APPENDIX A-2:
GENERAL
PREVENTATIVE
MAINTENANCE LOG**

PREVENTATIVE MAINTENANCE LOG

MAINTENANCE SCHEDULE	STORMWATER MANAGEMENT MEASURE NO.	PREVENTATIVE MAINTENANCE RECORD NO.	DATE(S) OF MAINTENANCE
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; e.g., after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			

**APPENDIX A-3:
GENERAL CORRECTIVE
MAINTENANCE LOG**

CORRECTIVE MAINTENANCE LOG

<i>Maintenance Schedule</i>	<i>Stormwater Management Measure No.</i>	<i>Corrective Maintenance Record No.</i>	<i>Date(s) of Maintenance</i>
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Maintenance work; e.g., after 1" rain)			
(1st Quarter)			
(2nd Quarter)			
(3rd Quarter)			
(4th Quarter)			
(Unscheduled Inspection; e.g., after 1" rain)			

**APPENDIX A-4:
ANNUAL EVALUATION
RECORD**

ANNUAL EVALUATION RECORD

As per N.J.A.C. 7:8-5.8(g), the person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to,

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan.

Evaluator(s)	Date of Evaluation	Decision
		___ Maintain current version OR ___ Revise current version Revision date _____ (also update the last revision date on the cover page) ___ Requires a new deed recording (also update the last recording information on the cover page)
		___ Maintain current version OR ___ Revise current version Revision date _____ (also update the last revision date on the cover page) ___ Requires a new deed recording (also update the last recording information on the cover page)
		___ Maintain current version OR ___ Revise current version Revision date _____ (also update the last revision date on the cover page) ___ Requires a new deed recording (also update the last recording information on the cover page)

APPENDIX B:
WATER QUALITY UNIT
SPECIFICATIONS

Project: 1360 Walton Blvd – Starbucks
Location: Rochester Hills, MI
Prepared For: Stonefield



Purpose: To calculate the first flush runoff flow rate (WQF) over a given site area. In this situation the WQV to be analyzed is the runoff produced by the first 0.5" of rainfall.

Reference: United States Department of Agriculture Natural Resources Conservation Service TR-55 Manual

Given:

Structure Name	A (acres)	A (miles ²)	Runoff Coefficient	Percent Imp. (%)*	t _c (min)	t _c (hr)
WQ-1	0.73	0.00114	0.73	71.67	15.0	0.250

* Assumes runoff coefficient of 0.3 for pervious areas and 0.9 for impervious areas.

Procedure:

The Water Quality Flow (WQF) is calculated using the Water Quality Volume (WQV). This WQV, converted to watershed inches, is substituted for the runoff depth (Q) in the Natural Resources Conservation Service (formerly Soil Conservation Service), TR-55 Gr

1. Compute WQV in watershed inches using the following equation:

$$WQV = P * R$$

where: WQV = water quality volume (watershed inches)
P = design precipitation (inches)
R = volumetric runoff coefficient = 0.05 + 0.009(I)
I = percent impervious cover

Structure Name	Percent Imp. (%)	R	P (in)	WQV (in)
WQ-1	71.67	0.695	0.5	0.348

WQV (CF)
920.84

2. Compute the NRCS Runoff Curve Number (CN) using the following equation, or graphically using Figure 2-1 from TR-55 (USDA, 1986):

$$CN = 1000 / [10 + 5P + 10Q - 10(Q^2 + 1.25QP)^{1/2}]$$

where: CN = Runoff Curve Number
P = design precipitation (inches)
Q = runoff depth (watershed inches)

Structure Name	Q (in)	CN
WQ-1	0.348	98.41

3. Using computed CN, read initial abstraction (I_a) from Table 4-1 in Chapter 4 of TR-55; compute I_a/P , interpolating when appropriate.

Structure Name	I_a (in)	I_a/P
WQ-1	0.041	0.082

4. Compute the time of concentration (t_c) in hours and the drainage area in square miles. A minimum t_c of 0.167 hours (10 minutes) should be used.

Structure Name	t_c (hr)	A (miles ²)
WQ-1	0.250	0.00114

5. Read the unit peak discharge (q_u) from Exhibit 4-II in Chapter 4 of TR-55 for appropriate t_c for type II rainfall distribution.

Structure Name	t_c (hr)	I_a/P	q_u (csm/in)
WQ-1	0.250	0.082	731

6. Substituting WQV (watershed inches) for runoff depth (Q), compute the water quality flow (WQF) from the following equation:

$$WQF = (q_u) * (A) * (Q)$$

where: WQF = water quality flow (cfs)
 q_u = unit peak discharge (cfs/mi²/inch)
 A = drainage area (mi²)
 Q = runoff depth (watershed inches)

Structure Name	q_u (csm/in)	A (miles ²)	Q (in)	WQF (cfs)
WQ-1	731	0.00114	0.348	0.29

**Estimated Net Annual Solids Load Reduction
Based on the Rational Rainfall Method**

1360 Walton Blvd - Starbucks
Rochester Hills, MI
Water Quality Unit (WQ-1)



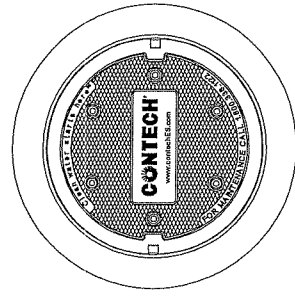
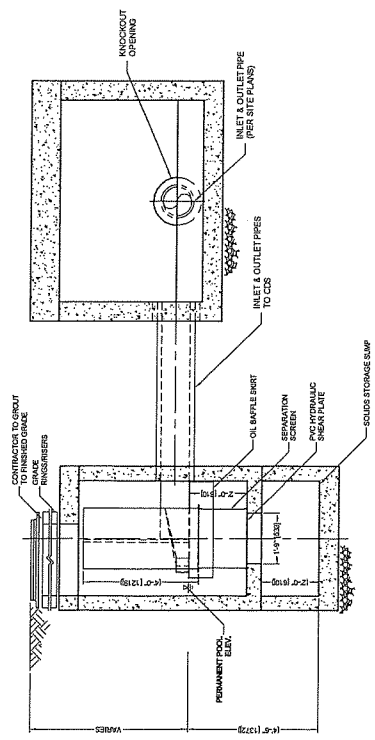
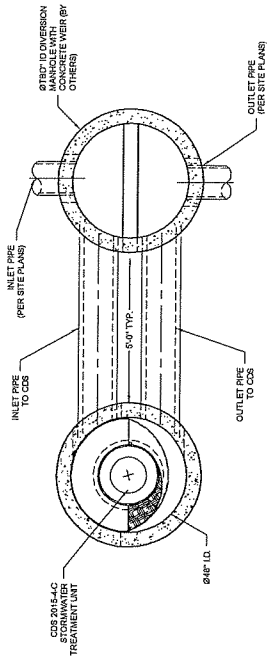
AREA (acres): 0.73
WEIGHTED C: 0.73
Tc (minutes): 15

CDS MODEL: 2015-4
PARTICLE SIZE (µm): 110

Rainfall Intensity ¹ (in/hr)	Percent Rainfall Volume ¹	Cumulative Rainfall Volume	Total Flowrate (cfs)	Removal Efficiency (%)	Incremental Removal (%)
0.02	13.13%	13.1%	0.01	100.00	13.13
0.04	11.36%	24.5%	0.02	100.00	11.36
0.06	10.08%	34.6%	0.03	100.00	10.08
0.08	7.49%	42.1%	0.04	99.93	7.49
0.10	7.01%	49.1%	0.05	99.57	6.98
0.12	5.37%	54.4%	0.06	99.21	5.33
0.14	4.73%	59.2%	0.07	98.85	4.68
0.16	4.13%	63.3%	0.09	98.49	4.07
0.18	3.53%	66.8%	0.10	98.12	3.46
0.20	2.99%	69.8%	0.11	97.76	2.92
0.25	5.50%	75.3%	0.13	96.86	5.33
0.30	4.47%	79.8%	0.16	95.95	4.29
0.35	3.85%	83.6%	0.19	95.05	3.66
0.40	2.16%	85.8%	0.21	94.1	2.0
0.45	2.09%	87.9%	0.24	93.2	1.9
0.50	1.31%	89.2%	0.27	92.3	1.2
0.75	5.07%	94.3%	0.40	87.8	4.5
1.00	2.58%	96.9%	0.53	83.3	2.1
1.50	2.50%	99.4%	0.80	68.0	1.7
2.00	0.51%	99.9%	1.07	51.0	0.3
2.54	0.15%	100.0%	1.35	40.1	0.1
					96.58
					Removal Efficiency Adjustment ² = 6.5%
					Predicted % Annual Rainfall Treated = 93.0%
					Predicted Net Annual Load Removal Efficiency = 90.1%

1 - Based on Rainfall Data from DETROIT METRO AP Station

2 - Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS	
STRUCTURE ID	48"
WATER QUALITY FLOW RATE (CFS OR L/s)	0.29 CFS
PEAK FLOW RATE (CFS OR L/s)	N/A
RETURN PERIOD OF PEAK FLOW (YRS)	OFFLINE
SCREEN APERTURE	2400
PIPE DATA:	I.E. MATERIAL DIAMETER
INLET PIPE	
OUTLET PIPE	
FRIM ELEVATION	

GENERAL NOTES

- CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
- DIMENSIONS MARKED WITH () ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
- FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.conteches.com
- CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
- STRUCTURES SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 209) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.

INSTALLATION NOTES

- ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
- CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
- CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS AND ASSEMBLY STRUCTURE.
- CONTRACTOR TO PROVIDE PROPER INSTALL AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
- CONTRACTOR TO TAKE NECESSARY PRECAUTIONS TO ASSURE UNIT IS WATER TIGHT. HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.



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CDS TREATMENT UNIT
OFFLINE CDS-4
STANDARD DETAIL

