



October 16, 2015

VIA E-MAIL

Mr. John Iacoangeli, Principal
Beckett & Raeder, Inc.
535 West William, Suite 101
Ann Arbor, MI 48013

**RE: SEPTEMBER 2015 RESULTS
POST CONSTRUCTION ACME CREEK MONITORING
GRAND TRAVERSE TOWN CENTER, ACME, MICHIGAN**

Dear Mr. Iacoangeli:

The purpose of this letter is to transmit the results of post-construction surface water monitoring of Acme Creek completed by Horizon Environmental Corporation ("Horizon") in September 2015 on behalf of the Village at Grand Traverse, LLC ("VGT") at the Grand Traverse Town Center ("GTTC") site in Acme Township, Grand Traverse County, Michigan.

As you are aware, VGT has been conducting interim monitoring of the creek on a monthly basis since November 2014 to evaluate water quality during site construction activities. With construction activities winding down and stabilization of the site progressing, VGT, in conjunction with Township staff, determined that it was appropriate to transition from the interim construction-phase monitoring to post-construction monitoring. This report summarizes the findings of the first post-construction monitoring event.

Post-construction stream sampling recommendations were outlined in the site development plan for the GTTC (Site Plan Approval for Phase I of the SUP)¹ and later incorporated into a site monitoring, inspection and maintenance plan submitted to the Township in September 2015 (Monitoring Plan).² The goal of the post-construction monitoring program is to evaluate water quality in Acme Creek over time. To facilitate the monitoring program, two fixed testing locations--one at the upstream point where Acme Creek enters the property and one at the downstream point where Acme Creek leaves the site--have been established (see Figure 1). Baseline (pre-construction) water quality samples were collected from both locations on July 26, 2011.

¹ The Village at Grand Traverse Phase 1, Stormwater Management Recommendations, King & MacGregor Environmental, Inc., December 22, 2011

² Inspection, Monitoring and Maintenance Plan for the Storm Water Management System, Horizon Environmental Corporation, September 2015

The Monitoring Plan calls for the receiving water for the GTTC site (Acme Creek) to be monitored for dissolved oxygen concentration, water temperature, specific conductivity, pH, volatile organic compounds (VOCs), total organic carbon (TOC), eColi, total dissolved solids (TDS), total suspended solids (TSS), water velocity and elevation. The monitoring is scheduled to be performed on a monthly basis for a period of one year following the completion of construction, on a quarterly basis during post-construction years 2 through 4 and on a semi-annual basis for post-construction years 5 and beyond. The first monthly, year 1 post-construction monitoring event was completed on September 18, 2015. The results of this sampling along with the results of the pre-construction (baseline) sampling are provided on Table 1.

DATA SUMMARY/EVALUATION

Dissolved oxygen, water temperature, specific conductivity and pH were measured at both of the stream gauges using an YSI 556 multi-parameter water quality meter. The data collected at each stream gauge was compared to the baseline values and available water quality standards in the Part 4 Water Quality Standards of Part 31, Water Resources Protection (MCL 324.3101) of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 4). The following provides a summary of these results:

- The dissolved oxygen concentrations at both the upstream (12.4 mg/L) and downstream (12.4 mg/L) stream gauges were slightly higher than the baseline upstream (11.4 mg/L) and downstream (11.6 mg/L) readings and significantly higher than the Part 4 minimum standard of 7.0 mg/L.
- The water temperature at both the upstream (49.1°F) and downstream (49.0°F) stream gauges were lower than the baseline upstream (56.1°F) and downstream (55.6°F) readings, which was as expected based on the time of year the baseline sampling was completed (July 26) versus this first post-construction monitoring event (September 18). Both the water temperature readings collected on September 18, 2015 were below the maximum Part 4 maximum temperature in September for streams supporting cold water fish (63°F).
- The specific conductivity at the upstream (294 µs/cm) and downstream (293 µs/cm) stream gauges were slightly lower than the baseline upstream (334.3 µs/cm) and downstream (334.2 µs/cm). The lower conductivity is likely the result of the lower stream temperature since there is a direct relationship between temperature and conductivity (i.e., the warmer the water, the higher the conductivity). During both events the specific conductivity did not change significantly between the upstream and downstream readings.
- The pH readings at both the upstream (7.70 S.U.) and downstream (6.95 S.U.) stream gauges were significantly lower and much closer to neutral than the baseline upstream (8.36 S.U.) and downstream (8.39 S.U.) readings. Both the pre-construction and post-construction pH readings were within the Part 4 pH range of 6.5 to 9.0 S.U.

Stream samples were collected for analyses of VOCs, TOC, TDS, TSS and E. Coli at both the upstream and downstream stream gauges. Laboratory data sheet are provided in Attachment I. A summary of the results compared to the baseline values and available water quality standards under Part 4 is provided as follows:

- VOCs were below laboratory detection limits for both the baseline and September 18, 2015 sampling event at both the upstream and downstream gauges.
- TOC can be sourced from natural organic substances, insecticides, herbicides and other agricultural chemicals that enter waterways in rainfall runoff. The September 18, 2015 TOC results at both the upstream (<1.0 mg/L) and downstream (1.0 mg/L) stream gauges were nearly identical to the baseline upstream (1.3 mg/L) and downstream (1.0 mg/L) readings.
- The TDS concentrations at both the upstream (250 mg/L) and downstream (260 mg/L) stream gauges were slightly higher than the baseline upstream (204 mg/L) and downstream (180 mg/L) concentrations. This is likely attributable to the September 18, 2015 event being conducted during a 0.13 inch rainfall event. Both the baseline and post-construction TDS concentrations are significantly lower than the Part 4 maximum TDS standard of 500 mg/L.
- The TSS concentrations at both the upstream and downstream stream gauges for the post-construction sampling were below laboratory detection limits (<5.0 mg/L). The baseline upstream TSS concentration (11.2 mg/L) was slightly higher than the post-construction results. The downstream baseline TSS (4.4 mg/L) was nearly identical to the post-construction TSS results.
- The baseline upstream E. coli concentration (100 colonies/100ml) was significantly higher than the post-construction upstream (55 colonies/100ml) stream gauge concentration. This is likely attributable to the different times of year when the samples were collected (i.e., agricultural growing versus harvesting season). The baseline downstream E. Coli concentration (72 colonies/100 ml) was similar to the post-construction downstream concentration (81 colonies/100 ml). Both the baseline and post-construction E. Coli concentrations were lower than the Part 4 maximum E. Coli concentration of 130 colonies/100 ml.

Additional stream data including turbidity, water velocity and water elevation were collected as part of this monitoring event to provide a comparison to the baseline stream monitoring event. Field analyses for turbidity were completed using a Hach 2100P portable turbidimeter. Stream velocities were measured using a Global Water FP201 probe. A summary of the results is provided below:

- The upstream turbidity reading was 1.99 NTU and the downstream turbidity reading was 1.48 NTU on September 18, 2015. The stream was visibly clear during the sampling event at both locations. Turbidity readings were not collected as part of the baseline sampling.
- The water velocity at the upstream (0.9 feet/second) stream gauge was slightly higher than the water velocity at the downstream stream gauge (1.6 feet/second) on September

Mr. John Iacoangeli

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18, 2015. This slight increase in velocities may be attributable to trees that fell into Acme Creek just upstream of the downstream gauge during a late summer straight line wind storm event. The post-construction range of velocities was similar to the baseline upstream (1.3 feet/second) and downstream (1.2 feet/second) water velocities.

- There was very little difference in the elevations at the stream gauges during the baseline sampling (upstream 609.97, downstream 606.04) compared to the post-construction sampling (upstream 610.01, downstream 606.11).

CONCLUSIONS

The results of the first post-construction monitoring event indicate that water quality in Acme Creek adjacent to the GTTC site meets or exceeds the Part 4 Water Quality Standards prescribed under Part 31 of the Water Resources Protection Section of NREPA (MCL 324.3101) and/or are consistent with background and baseline (pre-construction) test results.

If you have questions or require additional information regarding this sampling event, please contact me at 616.554.3210.

Sincerely,

HORIZON ENVIRONMENTAL



Allen J. Reilly, Jr.

Director, Environmental Risk Management

cc: J. Zollinger, Acme Township
S. Schooler, VGT
S. Smith, VGT

enclosures

TABLE 1
 ACME CREEK MONITORING RESULTS
 GRAND TRAVERSE TOWN CENTER SITE
 ACME TOWNSHIP, GRAND TRAVERSE COUNTY, MICHIGAN

Study Parameter	Part 4 Water Quality Standards	July 26, 2011 Baseline Pre-Construction		September 18, 2015 Post-Construction	
		Upstream	Downstream	Upstream	Downstream
Macroinvertebrates	NA	-5			
e Coli (colonies/100 ml)	130	100	72	55	81
Dissolved Oxygen (mg/L)	7 (minimum)	11.4 ⁽¹⁾	11.6 ⁽¹⁾	12.4	12.4
Water Temperature (°F)	63 ⁽²⁾	56.1	55.6	49.1	49.0
Specific Conductivity (µs/cm)	NA	334	334	294	293
pH (S.U.)	6.5 to 9.0	8.36	8.39	7.70	6.95
Volatile Organic Compounds	Various	(3)	(3)	(3)	(3)
Total Organic Carbon (mg/L)	NA	1.3	1	<1.0	1.0
Total Dissolved Solids (mg/L)	500	204	180	250	260
Total Suspended Solids (mg/L)	Visual Standard	11.2	4.4	<5.0	<5.0
Turbidity (NTU)	Visual Standard			1.99	1.48
Water Velocity (ft/sec)	NA	1.3	1.2	0.9	1.6
Water Elevation (NAVD 88)	NA	609.97	606.04	610.01	606.11

Notes:

- 1) Baseline sample reported as percent saturation. Value converted to mg/L utilizing reported temperature, specific conductivity and standard barometric pressure
- 2) Temperature varies seasonally
- 3) EPA 8260 scan. All compounds below laboratory detection limits

ATTACHMENT I

LABORATORY DATA SHEETS



4125 Cedar Run Rd., Suite B
 Traverse City, MI 49684
 Phone 231-946-6767
 Fax 231-946-8741
 www.sosanalytical.com

COMPANY: BARR ENGINEERING

SOS PROJECT NO: 154388

NAME:

SAMPLED BY: MIKE POTTER/BARR
 ENGINEERING

PROJECT NO: VGT

WSSN:

DATE SAMPLED: 9/18/2015

WELL PERMIT:

TIME SAMPLED: 9:45 AM

TAX ID:

SAMPLE MATRIX: SURFACE WATER

LOCATION: 4771 50TH ST SE

DATE RECEIVED: 9/18/2015

GRAND RAPIDS

TIME RECEIVED: 11:15 AM

MI

COUNTY:

TWP:

INORGANICS

No:	Analysis	Concentration	LOD	Units	Analyst	Date Completed	Drinking Water Reg Limit(MCL)
SAMPLE ID: ACME CR DOWNSTREAM							
1	E.COLI SM9223-B MPN	81		Colonies/100 mL	KMJ	9/19/2015	
1	RESIDUE, FILTERABLE(TDS)/SM2540C	260	10	mg/L (PPM)	KMJ	9/24/2015	
1	TOTAL ORGANIC CARBON EPA 415.1	1.0	1.0	mg/L (PPM)	FT	9/28/2015	
SAMPLE ID: ACME CR UPSTREAM							
2	E.COLI SM9223-B MPN	55		Colonies/100 mL	KMJ	9/19/2015	
2	RESIDUE, FILTERABLE(TDS)/SM2540C	250	10	mg/L (PPM)	KMJ	9/24/2015	
2	TOTAL ORGANIC CARBON EPA 415.1	ND	1.0	mg/L (PPM)	FT	9/28/2015	

ND = NOT DETECTED
 LOD = LIMIT OF DETECTION
 SMCL = FEDERAL NON-ENFORCEABLE LIMIT
 MCL = MAXIMUM CONTAMINANT LEVEL
 s.u. = STANDARD pH UNITS REPORTED AT 25 C
 DISS = DISSOLVED

APPROVED BY: *Shanna Shea*
 SHANNA SHEA
 LAB MANAGER



4125 Cedar Run Rd., Suite B
 Traverse City, MI 49684
 Phone 231-946-6767
 Fax 231-946-8741
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COMPANY: BARR ENGINEERING
 NAME:
 PROJECT NO: VGT
 WSSN:
 LOCATION: 4771 50TH ST SE

SOS PROJECT NO: 154388 - 1
 DATE SAMPLED: 9/18/2015
 TIME SAMPLED: 9:45 AM
 SAMPLE MATRIX: SURFACE WATER
 SAMPLE ID: ACME CR DOWNSTREAM

SAMPLED BY: GRAND RAPIDS
 MIKE POTTER/BARR ENGINEERING

DATE RECEIVED: 9/18/2015
 TIME RECEIVED: 11:15 AM

EPA 8260 VOLATILE ORGANICS

Units= ug/L (PPB) Analyst= RS Date Extracted= Date Completed= 9/22/2015 Prep Method= EPA 5030B

Analyte	Concentration	LOD	Analyte	Concentration	LOD
ACETONE	ND	5	cis-1,3-DICHLOROPROPENE	ND	1
BENZENE	ND	1	trans-1,3-DICHLOROPROPENE	ND	1
BROMOBENZENE	ND	1	DIETHYL ETHER	ND	5
BROMOCHLOROMETHANE	ND	1	ETHYLBENZENE	ND	1
BROMODICHLOROMETHANE	ND	1	IODOMETHANE	ND	1
BROMOFORM	ND	1	ISOPROPYLBENZENE	ND	1
BROMOMETHANE	ND	1	ISOPROPYLTOLUENE	ND	1
n-BUTYLBENZENE	ND	1	METHYL ETHYL KETONE	ND	5
s-BUTYLBENZENE	ND	1	METHYL-t-BUTYL ETHER	ND	5
t-BUTYLBENZENE	ND	1	METHYLENE CHLORIDE	ND	5
CARBON DISULFIDE	ND	1	MIBK	ND	5
CARBON TETRACHLORIDE	ND	1	2-METHYLNAPHTHALENE	ND	5
CHLOROBENZENE	ND	1	NAPHTHALENE	ND	5
CHLOROFORM	ND	1	n-PROPYLBENZENE	ND	1
CHLOROETHANE	ND	1	STYRENE	ND	1
CHLOROMETHANE	ND	1	1,1,1,2-TETRACHLOROETHANE	ND	1
DIBROMOCHLOROMETHANE	ND	1	1,1,2,2-TETRACHLOROETHANE	ND	1
DIBROMOMETHANE	ND	1	TETRACHLOROETHENE	ND	1
1,2-DIBROMO3CHLOROPROPANE	ND	5	TOLUENE	ND	1
1,2-DIBROMOETHANE	ND	1	1,2,3-TRICHLOROBENZENE	ND	1
1,2-DICHLOROBENZENE	ND	1	1,2,4-TRICHLOROBENZENE	ND	1
1,3-DICHLOROBENZENE	ND	1	1,1,1-TRICHLOROETHANE	ND	1
1,4-DICHLOROBENZENE	ND	1	1,1,2-TRICHLOROETHANE	ND	1
DICHLORODIFLUOROMETHANE	ND	1	TRICHLOROETHENE	ND	1
1,1-DICHLOROETHANE	ND	1	TRICHLORFLUOROMETHANE	ND	1
1,2-DICHLOROETHANE	ND	1	1,2,3-TRICHLOROPROPANE	ND	1
1,1-DICHLOROETHENE	ND	1	1,2,4-TRIMETHYLBENZENE	ND	1
cis-1,2-DICHLOROETHENE	ND	1	1,3,5-TRIMETHYLBENZENE	ND	1
trans-1,2-DICHLOROETHENE	ND	1	VINYL CHLORIDE	ND	1
1,2-DICHLOROPROPANE	ND	1	XYLENE (TOTAL)	ND	3

ND = NOT DETECTED
 LOD = LIMIT OF DETECTION

APPROVED BY: *Shanna Shea*
 SHANNA SHEA / LAB MANAGER
 R. SIMMERMAN / ANALYTICAL CHEMIST



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COMPANY: BARR ENGINEERING
 NAME:
 PROJECT NO: VGT
 WSSN:
 LOCATION: 4771 50TH ST SE

SOS PROJECT NO: 154388 - 2
 DATE SAMPLED: 9/18/2015
 TIME SAMPLED: 10:15 AM
 SAMPLE MATRIX: SURFACE WATER
 SAMPLE ID: ACME CR UPSTREAM

SAMPLED BY: GRAND RAPIDS
 MIKE POTTER/BARR ENGINEERING

DATE RECEIVED: 9/18/2015
 TIME RECEIVED: 11:15 AM

EPA 8260 VOLATILE ORGANICS

Units= ug/L (PPB) Analyst= RS Date Extracted= Date Completed= 9/22/2015 Prep Method= EPA 5030B

Analyte	Concentration	LOD	Analyte	Concentration	LOD
ACETONE	ND	5	cis-1,3-DICHLOROPROPENE	ND	1
BENZENE	ND	1	trans-1,3-DICHLOROPROPENE	ND	1
BROMOBENZENE	ND	1	DIETHYL ETHER	ND	5
BROMOCHLOROMETHANE	ND	1	ETHYLBENZENE	ND	1
BROMODICHLOROMETHANE	ND	1	IODOMETHANE	ND	1
BROMOFORM	ND	1	ISOPROPYLBENZENE	ND	1
BROMOMETHANE	ND	1	ISOPROPYLTOLUENE	ND	1
n-BUTYLBENZENE	ND	1	METHYL ETHYL KETONE	ND	5
s-BUTYLBENZENE	ND	1	METHYL-t-BUTYL ETHER	ND	5
t-BUTYLBENZENE	ND	1	METHYLENE CHLORIDE	ND	5
CARBON DISULFIDE	ND	1	MIBK	ND	5
CARBON TETRACHLORIDE	ND	1	2-METHYLNAPHTHALENE	ND	5
CHLOROENZENE	ND	1	NAPHTHALENE	ND	5
CHLOROFORM	ND	1	n-PROPYLBENZENE	ND	1
CHLOROETHANE	ND	1	STYRENE	ND	1
CHLOROMETHANE	ND	1	1,1,1,2-TETRACHLOROETHANE	ND	1
DIBROMOCHLOROMETHANE	ND	1	1,1,2,2-TETRACHLOROETHANE	ND	1
DIBROMOMETHANE	ND	1	TETRACHLOROETHENE	ND	1
1,2-DIBROMO3CHLOROPROPANE	ND	5	TOLUENE	ND	1
1,2-DIBROMOETHANE	ND	1	1,2,3-TRICHLOROBENZENE	ND	1
1,2-DICHLOROBENZENE	ND	1	1,2,4-TRICHLOROBENZENE	ND	1
1,3-DICHLOROBENZENE	ND	1	1,1,1-TRICHLOROETHANE	ND	1
1,4-DICHLOROBENZENE	ND	1	1,1,2-TRICHLOROETHANE	ND	1
DICHLORODIFLUOROMETHANE	ND	1	TRICHLOROETHENE	ND	1
1,1-DICHLOROETHANE	ND	1	TRICHLORFLUOROMETHANE	ND	1
1,2-DICHLOROETHANE	ND	1	1,2,3-TRICHLOROPROPANE	ND	1
1,1-DICHLOROETHENE	ND	1	1,2,4-TRIMETHYLBENZENE	ND	1
cis-1,2-DICHLOROETHENE	ND	1	1,3,5-TRIMETHYLBENZENE	ND	1
trans-1,2-DICHLOROETHENE	ND	1	VINYL CHLORIDE	ND	1
1,2-DICHLOROPROPANE	ND	1	XYLENE (TOTAL)	ND	3

ND = NOT DETECTED
 LOD = LIMIT OF DETECTION

APPROVED BY:

Shanna Shea
 SHANNA SHEA / LAB MANAGER
 R. SIMMERMAN / ANALYTICAL CHEMIST



INDEPENDENT TESTING LAB

830 ROBINWOOD COURT, TRAVERSE CITY, MI 49686

PH: 231-929-0905

FAX: 231-929-0894

www.gtanalytical.com

Company: BARR ENGINEERING
Name:
ClientProj: WNJ-1401
GTA ProjNo: 091815-1

Site Addr: VGT

Sampled By: MIKE POTTER/BARR
Date Rec: 9/18/2015
Time Rec: 1:40 PM

Sample No.	Sample ID	Date Sampled	Time Sampled	Sample Matrix
1	UPSTREAM	9/18/2015	10:15 AM	WATER
2	D-1	9/18/2015	9:45 AM	WATER
3	D-2	9/18/2015	12:30 PM	WATER

ELECTRONIC SIGNATURE REPORT. This is a final report for the following pages of data for the samples specified above. All analysis was performed by the methods stated and all quality control measures required were completed. All quality control information is available upon request.

Kirk L. Chase

Digitally signed by Kirk L. Chase
DN: cn=Kirk L. Chase, o=Grand Traverse Analytical,
ou=Head Chemist, email=kirk@gtanalytical.com, c=US
Date: 2015.09.26 11:04:38 -04'00'

Kirk L. Chase/Chemist
Grand Traverse Analytical
830 Robinwood Court
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kirk@gtanalytical.com



INDEPENDENT TESTING LAB

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PH: 231-929-0905

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COMPANY: BARR ENGINEERING
PROJECT NO: WNJ-1401
LOCATION: VGT
MI
SAMPLED BY: MIKE POTTER/BARR

GTA PROJECT NO: 091815-1
GTA SAMPLE NO: 1
DATE SAMPLED: 9/18/2015
TIME SAMPLED: 10:15 AM
DATE RECEIVED: 9/18/2015
TIME RECEIVED: 1:40 PM

SAMPLE RESULTS

<u>No:</u>	<u>Analysis</u>	<u>Concentration</u>	<u>LOD</u>	<u>Units</u>	<u>Analyst</u>	<u>Date Completed</u>	<u>Sample Matrix</u>
SAMPLE ID:	UPSTREAM						
TOTAL SUSPENDED SOLIDS	SM2540D	ND	5.0	mg/L (PPM)	TR	9/23/2015	WATER

ND = NOT DETECTED, RESULT < LOD
LOD = LIMIT OF DETECTION
s.u. = STANDARD pH UNITS REPORTED AT 25 C

COMPANY: BARR ENGINEERING
 PROJECT NO: WNJ-1401
 LOCATION: VGT

GTA PROJECT NO: 091815-1
 GTA SAMPLE NO: 2
 DATE SAMPLED: 9/18/2015
 TIME SAMPLED: 9:45 AM
 DATE RECEIVED: 9/18/2015
 TIME RECEIVED: 1:40 PM

SAMPLED BY: MI
 MIKE POTTER/BARR

SAMPLE RESULTS

<u>No:</u>	<u>Analysis</u>	<u>Concentration</u>	<u>LOD</u>	<u>Units</u>	<u>Analyst</u>	<u>Date Completed</u>	<u>Sample Matrix</u>
SAMPLE ID: D-1							
	TOTAL SUSPENDED SOLIDS SM2540D	ND	5.0	mg/L (PPM)	TR	9/23/2015	WATER

ND = NOT DETECTED, RESULT < LOD
 LOD = LIMIT OF DETECTION
 s.u. = STANDARD pH UNITS REPORTED AT 25 C

COMPANY: BARR ENGINEERING
 PROJECT NO: WNJ-1401
 LOCATION: VGT

GTA PROJECT NO: 091815-1
 GTA SAMPLE NO: 3
 DATE SAMPLED: 9/18/2015
 TIME SAMPLED: 12:30 PM
 DATE RECEIVED: 9/18/2015
 TIME RECEIVED: 1:40 PM

MI
 SAMPLED BY: MIKE POTTER/BARR

SAMPLE RESULTS

<u>No:</u>	<u>Analysis</u>	<u>Concentration</u>	<u>LOD</u>	<u>Units</u>	<u>Analyst</u>	<u>Date Completed</u>	<u>Sample Matrix</u>
SAMPLE ID: D-2							
	TOTAL SUSPENDED SOLIDS SM2540D	ND	5.0	mg/L (PPM)	TR	9/23/2015	WATER

ND = NOT DETECTED, RESULT < LOD
 LOD = LIMIT OF DETECTION
 s.u. = STANDARD pH UNITS REPORTED AT 25 C

