

MEMORANDUM

TO: STEPHEN JONES
FROM: AZURE DEE SLEICHER, PE
SUBJECT: 20 RAYMOND STREET, DARIEN, HEC-RAS ANALYSIS
DATE: DECEMBER 14, 2016
CC: TOWN OF DARIEN, TIGHE & BOND

RACE Coastal Engineering (RACE) has been retained by the Applicant, Dr. David Pereira, to provide professional engineering design services for the proposed dwelling at 20 Raymond Street. The proposed single family dwelling will be adjacent to the Five Mile River and located within the floodplain ("AE Zone" BFE 12.1' NAVD) and regulatory floodway as defined by FEMA on Flood Insurance Rate Map (FIRM) panel 09001C0529G dated July 8, 2013.

The Town of Darien Zoning Regulations prohibit encroachment, including fill and new construction, that would result in any increase in flood level during the occurrence of the base flood discharge. The provision of proof that there shall be no (0.00 feet) increase in flood levels during occurrence of the base flood discharge due to the proposed construction or encroachment shall be the responsibility of the applicant and shall be based on hydrologic and hydraulic studies, performed in accordance with standard engineering practice, and certification, with supporting technical data, by a Connecticut Registered Professional Engineer. RACE has performed this analysis and it is described below.

The proposed work includes clearing and grubbing the existing lot and constructing a proposed dwelling that will be elevated above the 1% base flood elevation of 12.1' (NAVD) and the 0.2% base flood elevation of 16.8' on four (4) reinforced columns, with a maximum diameter of 36 inches. The first floor of the proposed dwelling will be set to an elevation of 22.0'.

RACE prepared a HEC-RAS model (Version 5.0 (Sept. 2016)) to analyze the effects that the proposed work will have on the flood levels during the base flood discharge as given in the Fairfield County FEMA Flood Insurance Studies No. 09001CV002C and 09001CV004C dated October 16, 2013. Topography from the existing site plan was supplemented with 2012 LIDAR data the U.S. Army Corps of Engineers to determine the geometry of the river. The model for the existing conditions utilized a Manning's N = 0.04, typical for light brush and trees. For the proposed condition, the proposed dwelling and 36 inch columns were included, and the Manning's N was reduced to N = 0.03 due to the clearing and grubbing. The model showed that the base flood did not increase due to the proposed work, and even slightly decreased due to the clearing of the floodway in this area. Based on these results, additional "compensatory" storage is not required.

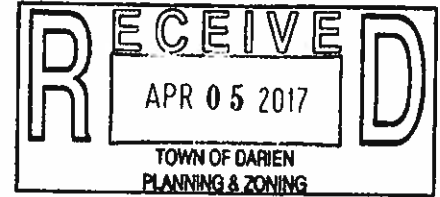
RACE requests that the results be reviewed by the Town's Engineer, Tighe & Bond, for concurrence in advance of the filing. Output tables from the HEC-RAS model are enclosed. RACE can provide the model files in electronic format upon request.

Proposed Condition - 3' Columns, N = 0.03

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	219	PF 1	5170	3.7	12.09		12.6	0.002503	5.91	907.7	169.71	0.43
1	210.14*	PF 1	5170	3.69	12.09		12.58	0.00139	5.61	921.61	170.7	0.43
1	201.29*	PF 1	5170	3.67	12.09		12.56	0.001343	5.53	934.63	170.26	0.42
1	192.43*	PF 1	5170	3.66	12.09		12.54	0.001266	5.39	959.75	176.59	0.41
1	183.57*	PF 1	5170	3.64	12.1		12.52	0.001216	5.24	986.96	183.72	0.4
1	174.71*	PF 1	5170	3.63	12.1		12.5	0.001194	5.11	1011.41	185.16	0.39
1	165.86*	PF 1	5170	3.61	12.12		12.48	0.000996	4.83	1070.63	193.02	0.36
1	157	PF 1	5170	3.6	12.12		12.46	0.001727	4.69	1101.42	191.34	0.34
1	134.57*	PF 1	5170	2.87	12.12		12.45	0.000857	4.64	1114.09	190.69	0.34
1	112.14*	PF 1	5170	2.14	12.11		12.44	0.000825	4.63	1116.35	186.65	0.33
1	89.71*	PF 1	5170	1.41	12.1		12.44	0.000788	4.62	1120.12	181.94	0.33
1	67.29*	PF 1	5170	0.69	12.1		12.43	0.000745	4.59	1125.8	176.57	0.32
1	44.86*	PF 1	5170	-0.04	12.1		12.42	0.000685	4.55	1135.22	168.72	0.31
1	22.43*	PF 1	5170	-0.77	12.1		12.41	0.000589	4.48	1153.15	155.68	0.29
1	0	PF 1	5170	-1.5	12.1	6.9	12.4	0.000954	4.4	1175.75	151.85	0.28

Existing Conditions N = 0.04

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	219	PF 1	5170	3.7	12.1		12.6	0.002265	5.71	909.05	169.75	0.41
1	210.14°	PF 1	5170	3.69	12.09		12.58	0.001386	5.61	922.29	170.72	0.43
1	201.29°	PF 1	5170	3.67	12.09		12.56	0.001328	5.5	939.41	173.31	0.42
1	192.43°	PF 1	5170	3.66	12.09		12.54	0.001264	5.38	960.48	176.61	0.41
1	183.57°	PF 1	5170	3.64	12.1		12.53	0.001213	5.23	987.72	183.77	0.4
1	174.71°	PF 1	5170	3.63	12.11		12.51	0.00111	5.05	1024.59	188.22	0.38
1	165.86°	PF 1	5170	3.61	12.12		12.49	0.000996	4.84	1067.34	191.67	0.36
1	157	PF 1	5170	3.6	12.13		12.47	0.001487	4.72	1112.84	194.37	0.34
1	134.57°	PF 1	5170	2.87	12.12		12.46	0.000854	4.64	1115.22	190.71	0.34
1	112.14°	PF 1	5170	2.14	12.12		12.45	0.000822	4.63	1117.47	186.68	0.33
1	89.71°	PF 1	5170	1.41	12.11		12.44	0.000785	4.61	1121.2	181.97	0.33
1	67.29°	PF 1	5170	0.69	12.11		12.43	0.000743	4.59	1126.86	176.61	0.32
1	44.86°	PF 1	5170	-0.04	12.1		12.42	0.000684	4.55	1136.23	168.82	0.31
1	22.43°	PF 1	5170	-0.77	12.1		12.42	0.000587	4.48	1154.08	155.69	0.29
1	0	PF 1	5170	-1.5	12.1	6.92	12.41	0.000791	4.59	1175.75	151.85	0.26



January 17, 2017

Town of Darien
Planning & Zoning Department
2 Renshaw Road
Darien, CT 06820

Attention: Mr. Jeremy Ginsberg
Planning & Zoning Director

Reference: 20 Raymond Street Development
Five Mile River, Darien, CT
Section 810 and 820 Compliance Certification
RACE Project No. 201677

Dear Mr. Ginsberg:

RACE COASTAL ENGINEERING ("RACE") has been retained by the Applicant, Dr. David Pereira, to provide professional engineering design services for the proposed dwelling at 20 Raymond Street. The proposed single family dwelling will be adjacent to the Five Mile River and located within the floodplain and regulatory floodway as defined by the Federal Emergency Management Agency (FEMA) and within the Coastal Boundary per the State of Connecticut's Coastal Area Management Act.

RACE has reviewed the proposed site improvements, depicted on drawings entitled "Zoning Location Survey 20 Raymond Street Prepared for David Pereira, Darien, CT" prepared by William W. Seymour & Associates, P.C., and dated November 9, 2016, "ZBA Application for 20 Raymond Street Development" prepared by Jones Green Design and dated August 17, 2016, and "Site Plan Prepared for David Pereira" prepared by LBM Engineering, LLC dated January 17, 2017 for general compliance with FEMA and Town of Darien requirements under Section 820, Flood Damage Protection, as well Section 810, Coastal Area Management.

The purpose of Section 820 is for the preservation, protection, maintenance, or use of flood hazard and floodway areas. The purpose of Section 810 is to achieve the goals, objectives and policies of the State-wide Coastal Area Management Program as set forth in Chapter 444 Section 22a-90 through 22a-112 of the General Statutes and known as "The Coastal Management Act". All buildings, uses and structures within the Coastal Boundary are subject to the Coastal Site Plan Review requirements and procedures set forth in "The Coastal Management Act" and also with requirements of the Darien Zoning Regulations.

Coastal Resources

RACE has reviewed the coastal resources and use policies and goals including FEMA flood zone designations applicable to the proposed project. A Coastal Resource Map is provided as an Attachment to depict the coastal resources that occur on the site. A summary of the evaluation of the potential adverse impacts as well as potential beneficial impacts follows below.

Flood Hazard Area [CGS Sec 22a-93(7)(H)]: The site is located in the floodplain ("AE Zone" BFE 12.1' NAVD) and regulatory floodway as defined by FEMA on Flood Insurance Rate Map (FIRM) panel 09001C0529G dated July 8, 2013. The Town of Darien Zoning Regulations prohibit encroachment, including

fill and new construction, that would result in any increase in flood level during the occurrence of the base flood discharge. The provision of proof that there shall be no (0.00 feet) increase in flood levels during occurrence of the base flood discharge due to the proposed construction or encroachment shall be the responsibility of the applicant and shall be based on hydrologic and hydraulic studies, performed in accordance with standard engineering practice, and certification, with supporting technical data, by a Connecticut Registered Professional Engineer. RACE has performed this analysis and it is described below.

The proposed work includes clearing and grubbing the existing lot and constructing a proposed dwelling that will be elevated above the 1% base flood elevation of 12.1' (NAVD) and the 0.2% base flood elevation of 16.8' on four (4) reinforced columns, with a maximum diameter of 36 inches. The first floor of the proposed dwelling will be set to an elevation of 22.0'. As discussed in a letter to the Town on August 14, 2016, RACE will be responsible for design of these foundation columns, including footings and grade beams, which will include provisions for potential scour as well as hydrodynamic and debris loads associated with the 1% base flood of the Five Mile River in accordance with FEMA's standard methodology and applicable design codes and standards including the 2016 Connecticut State Building Code and relevant adopted and referenced publications including the 2012 International Building Code and the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE 7) and ASCE 24-05 for *Flood Resistant Design and Construction*.

A HEC-RAS Version 5.0 (Sept. 2016) model was built to analyze the effects that the proposed work will have on the flood levels during the base flood discharge as given in the Fairfield County FEMA Flood Insurance Studies No. 09001CV002C and 09001CV004C dated October 16, 2013. Topography from the existing site plan was supplemented with 2012 LIDAR data the U.S. Army Corps of Engineers to determine the geometry of the river. The model for the existing conditions utilized a Manning's $N = 0.04$, typical for light brush and trees. For the proposed condition, the proposed dwelling and 36 inch columns were included, and the Manning's N was reduced to $N = 0.03$ due to the clearing and grubbing. The model showed that the base flood did not increase due to the proposed work, and even slightly decreased due to the clearing of the floodway in this area. Output tables from HEC-RAS model are enclosed.

In addition to the proposed clearing and grubbing, the Applicant also plans to include a rain garden of 300 cubic feet to manage storm water on site. This improvement will help to manage storm water during periods when the River is not in flood stage and will provide additional compensatory storage at a minimum of 1:1 ratio during the base flood discharge. For the reasons discussed above, no adverse impacts are anticipated to the flood hazard area or regulatory floodway as a result of the propose project.

Tidal Wetlands [CGS Section 22a-93(7)(E)]: This means those areas which border on or lie beneath tidal waters, such as, but not limited to banks, bogs, salt marsh, swamps, meadows, flats, or other low lands subject to tidal action, including those areas now or formerly connected to tidal waters, and whose surface is at or below an elevation of one foot above local extreme high water; and upon which may grow or be capable of growing some [vegetation]. There is a narrow band of tidal wetland vegetation along the shoreline as depicted on the Coastal Resources Map.

No structures or site improvements are proposed within the tidal wetland area. Further, appropriate sedimentation and erosion control measures will be employed to protect these resources during construction. No adverse impacts are anticipated.

Island [CGS Section 22a-93(7)(J)]: This means land surrounded on all sides by water. There is an island parcel located within the Five Mile River adjacent to the parcel where the proposed dwelling is to be constructed.

No buildings are allowed to be constructed on the island per Map 3333 of the Darien Land Records and no other work is being proposed on this parcel. Sedimentation and erosion control measures will be



employed on the mainland property which will serve to protect the island during construction. No adverse impacts are anticipated.

Estuarine Embayment (Five Mile River) [CGS Section 22a-93(7)(G): This means a protected coastal body of water with an open connection to the sea in which saline sea water is measurably diluted by fresh water including tidal rivers, bays, lagoons and coves. The Five Mile River in this area can be considered an estuarine embayment due to its protected nature, salinity and tidal influence.

No work is proposed seaward of the mean high water line and sedimentation and erosion control measures will be utilized to protect the Five Mile River resources. No adverse impacts are anticipated.

Evaluation of Impacts to Coastal Resources

The Connecticut Coastal Management Act (CCMA) identifies the following potential adverse impacts to coastal resources:

Degrading water quality through the significant introduction into either coastal waters or groundwater supplies of suspended solids, nutrients, toxics, heavy metals or pathogens, or through the significant alteration of temperature, pH, dissolved oxygen or salinity [Connecticut General Statutes (CGS) section 22a-93(15)(A)].

The proposed single family dwelling project is not anticipated to degrade coastal or groundwater quality through introduction of pollutants or alteration of physical or chemical characteristics.

Degrading existing circulation patterns of coastal waters through the significant patterns of tidal exchange or flushing rates, freshwater input, or existing basin characteristics and channel contours [CGS section 22a-93(15)(B)].

All work is proposed landward of the mean high water line such that coastal waters will not be impacted relative to circulation patterns, tidal exchange, contours, etc.

Degrading natural erosion patterns through the significant alteration of littoral transport of sediments in terms of deposition or source reduction [CGS section 22a-93(15)(C)].

All work is proposed landward of the mean high water line. No work is proposed seaward of the mean high water line which may have an impact on littoral transport in the adjacent coastal system.

Degrading natural or existing drainage patterns through the significant alteration of groundwater flow and recharge and volume of runoff [CGS section 22a-93(15)(D)].

Natural and existing drainage patterns and runoff volume will not be adversely impacted by the proposed dwelling. The site will include a storm water management system designed by a professional engineer described in the Engineering Report prepared by LBM Engineering, LLC dated January 17, 2017.

Increasing the hazard of coastal flooding through significant alteration of shoreline configurations or bathymetry, particularly within high velocity flood zones [CGS section 22a-93(15)(E)].

As demonstrated by the HEC-RAS analysis, the proposed project will not have adverse impacts to the flood hazard zone or regulatory floodway. The proposed activities will not result in an increase of flood heights, i.e. increase the BFE, or redirect waves or flood waters on this property or adjacent properties.



Degrading visual quality through significant alteration of the natural features of vistas and view points [CGS section 22a-93(15)(F)].

The proposed dwelling and site improvements are consistent with the character of the neighborhood and are not anticipated to degrade visual quality of or from the site.

Degrading or destroying essential wildlife, finfish or shellfish habitat through significant alteration of the composition, migration patterns, distribution, breeding or other population characteristics of the natural species or significant alteration of the natural components of the habitat [CGS section 22a-93(15)(G)].

The proposed dwelling and site improvement project is not anticipated to degrade, destroy or significantly alter essential habitat for finfish or shellfish. Further, the site is not listed as a potential area for state and federal listed species or significant natural communities.

Degrading tidal wetlands, beaches and dunes, rocky shorefronts, and bluffs and escarpments through significant alteration of their natural characteristics or function [CGS section 22a-93(15)(H)].

As mentioned, the proposed work is landward of the mean high water line. The natural characteristics or function of these resources will not be adversely impacted as a result of the limited scope and location of the proposed activities.

Coastal Uses

To manage uses in the coastal boundary through existing municipal planning, zoning and other local regulatory authorities and through existing state structures, dredging, wetlands, and other state siting and regulatory authorities, giving highest priority and preference to water-dependent uses and facilities in shorefront areas [CGS section 22a-92-(b)(1)(A)].

The site is located in an existing residential neighborhood and in narrow and shallow river conditions which are generally not conducive to public water-dependent uses. The proposed project will not adversely impact currently zoned uses.

To require that structures in tidal wetlands and coastal waters be designed, constructed and maintained to minimize adverse impacts on coastal resources, circulation and sedimentation patterns, water quality, and flooding and erosion, to reduce to the maximum extent practicable the use of fill, and to reduce conflicts with the riparian rights of adjacent landowners [CGS section 22a-92-(b)(1)(D)].

The proposed site improvements have been located and designed to minimize adverse impacts on coastal resources, circulation and sedimentation patterns, water quality, and flood and erosion control. The proposed dwelling will be designed in accordance with FEMA and Town of Darien regulations for the flood hazard zone and demonstrated to have no increase in base flood elevation within the floodway.

Conclusions

It is the opinion of RACE that the proposed dwelling and site improvement project complies with all resource and use policies of the Connecticut Coastal Management Act and is compliant with the requirements of Section 810 Darien Zoning Regulations. Additionally, the project is compliant with FEMA and Town regulations, specifically Section 820, Flood Damage Protection. The project has been designed to reduce or eliminate adverse impacts. Specifically, no adverse impacts are anticipated to the coastal resources on or adjacent to the site as a result of construction landward of the mean high water line and within the FEMA designated flood hazard zone and floodway.



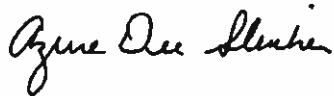
Mr. Jeremy Ginsberg
20 Raymond Street Development

January 17, 2017
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It is anticipated that this document is acceptable for your records. If you have any questions, please do not hesitate to contact the undersigned.

Very truly yours,

RACE COASTAL ENGINEERING



Azure Dee Sleicher, PE
Manager of Coastal Engineering
CT PE #23744

Enclosures: Coastal Resources Map
HEC-RAS Model Map and Output files

Copy: Dr. David Pereira
Mr. Stephen Jones

