

## **Recommendation for: Overbank Manning's "n" Values in Harris County (Revised 12/11/2002)**

**Goal:** To identify appropriate Manning's "n" values for overbank areas containing residential subdivisions in which cedar picket fences are typical (see Figure 1). The problem associated with these types of fences is severe conveyance restrictions that they cause.

**Figure 1: Typical Cedar Fence in Residential Subdivision**



**Recommended Procedure:** It is recommended that in overbank areas where this type of development is prevalent that a Manning's "n" value of 0.99 be used in the hydraulic modeling.

**Assumptions:** Significant restrictions to flow can occur in areas where these types of fences (typical to Harris County residential development) are present. While this is likely a two-dimensional flow problem, the use of HEC-RAS (and formerly HEC-2), which is a one-dimensional model, is the hydraulic model of choice. Adjustments to "n" values in the overbanks of the various streams can provide a reasonable compensation for the problems encountered by these restrictions.

**Testing Procedure:** Significant testing was performed using the White Oak Bayou HEC-2 model and calibrating it to the September 1998 flood event. Data collected after this event included high water marks at various bridges along White Oak Bayou and in the residential neighborhoods between North Houston-Rosslyn Road and Jersey Village. Using a hydrologic model which had been calibrated to reproduce discharges associated with the event, "n" values were adjusted until energy grade elevations reasonably matched the high water marks. Energy grade

elevations were chosen since velocities in the overbanks were likely close to zero making the water surface and the energy grade nearly identical.

Additional testing was performed using HEC-RAS to determine the sensitivity of “n” values of 99, 0.99, 0.90, and 0.12. The base HEC-RAS model for these tests was created by importing the reach of the aforementioned HEC-2 model where high water marks were of the highest concentration.

**Test Results:** From the calibration to the September 1998 flood event, the flood profile appeared to be very consistent with high water marks, not only in the reach of concern, but all along the length of White Oak Bayou. This consistency was achieved using a Manning’s “n” value of 0.99 in the overbanks where the cedar fences were prevalent between North Houston-Rosslyn and Jersey Village.

From the sensitivity analysis, it was found that using a value of 99 produced a 0.26-foot maximum increase over the 0.99 value (this impact was greater than 0.10-foot for approximately 3000 feet). Using a value of 0.90 instead of 0.99 produced a maximum reduction of 0.03-foot. Finally, using a value of 0.12 produced a 0.89-foot maximum decrease from the 0.99 value (this impact was greater than 0.10-foot for approximately 12,000 feet). Table 1 shows the differences in elevations produced by the different “n” values.

**Final Notes:** For consistency, since the 0.99 was tested against observed water surface elevations, the use of 0.99 is recommended (although 0.90 or 99 would seem to be reasonable) for these residential subdivisions that back to the channel. However, considerable engineering judgment is reasonable in defining this parameter.

**Committee Resolution:**

**Table 1: Comparison of Elevations**

River Station	0.99nvalue W.S. Elev	99nvalue W.S. Elev	Difference (ft)	0.90nvalue W.S. Elev	Difference (ft)	0.12nvalue W.S. Elev	Difference (ft)
64396	73.73	73.73	0.00	73.73	0.00	73.73	0.00
64496	73.94	73.94	0.00	73.94	0.00	73.94	0.00
65374	75.40	75.40	0.00	75.40	0.00	75.40	0.00
65500	75.51	75.51	0.00	75.51	0.00	75.51	0.00
65560	75.60	75.60	0.00	75.60	0.00	75.60	0.00
65691	75.70	75.70	0.00	75.70	0.00	75.70	0.00
66568	76.30	76.30	0.00	76.30	0.00	76.30	0.00
66653	76.30	76.30	0.00	76.30	0.00	76.30	0.00
66742	77.09	77.09	0.00	77.09	0.00	77.09	0.00
66802	77.15	77.15	0.00	77.15	0.00	77.15	0.00
66901	77.24	77.24	0.00	77.24	0.00	77.24	0.00
66954	77.26	77.26	0.00	77.26	0.00	77.26	0.00
66955	77.17	77.17	0.00	77.17	0.00	77.17	0.00
66958	77.33	77.33	0.00	77.33	0.00	77.33	0.00
66959	77.58	77.58	0.00	77.58	0.00	77.58	0.00
66996	77.60	77.60	0.00	77.60	0.00	77.60	0.00
67208	77.78	77.78	0.00	77.78	0.00	77.78	0.00
67209	77.82	77.82	0.00	77.82	0.00	77.82	0.00
67304	77.94	77.94	0.00	77.94	0.00	77.94	0.00
67399	78.57	78.57	0.00	78.57	0.00	78.57	0.00
67513	78.64	78.64	0.00	78.64	0.00	78.64	0.00
68096	78.93	78.93	0.00	78.93	0.00	78.93	0.00
68097	78.97	78.97	0.00	78.97	0.00	78.97	0.00
68518	79.30	79.30	0.00	79.30	0.00	79.30	0.00
68568	79.34	79.34	0.00	79.34	0.00	79.34	0.00
68578	79.36	79.36	0.00	79.36	0.00	79.36	0.00
68628	79.40	79.40	0.00	79.40	0.00	79.40	0.00
69733	80.21	80.21	0.00	80.21	0.00	80.21	0.00
70199	80.39	80.39	0.00	80.39	0.00	80.39	0.00
70304	80.42	80.42	0.00	80.42	0.00	80.42	0.00
70364	81.00	81.00	0.00	81.00	0.00	81.00	0.00
70600	81.20	81.20	0.00	81.20	0.00	81.20	0.00
70601	81.25	81.25	0.00	81.25	0.00	81.25	0.00
71792	81.94	81.94	0.00	81.94	0.00	81.94	0.00
72742	82.49	82.49	0.00	82.49	0.00	82.49	0.00
72743	82.55	82.55	0.00	82.55	0.00	82.55	0.00
72848	82.67	82.67	0.00	82.67	0.00	82.67	0.00
72933	82.77	82.77	0.00	82.77	0.00	82.77	0.00
72934	82.77	82.77	0.00	82.77	0.00	82.77	0.00
72937	82.77	82.77	0.00	82.77	0.00	82.77	0.00
72938	82.77	82.77	0.00	82.77	0.00	82.77	0.00
72948	82.77	82.77	0.00	82.77	0.00	82.77	0.00
72949	82.88	82.88	0.00	82.88	0.00	82.88	0.00
73025	82.89	82.89	0.00	82.89	0.00	82.89	0.00
73026	82.89	82.89	0.00	82.89	0.00	82.89	0.00
73036	83.01	83.01	0.00	83.01	0.00	83.01	0.00
73037	83.01	83.01	0.00	83.01	0.00	83.01	0.00
73062	83.05	83.05	0.00	83.05	0.00	83.05	0.00
73063	83.12	83.12	0.00	83.12	0.00	83.12	0.00
73394	83.52	83.52	0.00	83.52	0.00	83.52	0.00
73794	84.14	84.14	0.00	84.14	0.00	84.14	0.00
73894	84.26	84.26	0.00	84.26	0.00	84.26	0.00
73994	84.41	84.41	0.00	84.41	0.00	84.41	0.00
74059	84.46	84.46	0.00	84.46	0.00	84.46	0.00
74259	84.52	84.52	0.00	84.52	0.00	84.52	0.00
74459	84.59	84.59	0.00	84.59	0.00	84.59	0.00
74659	84.66	84.66	0.00	84.66	0.00	84.66	0.00
74818	84.72	84.72	0.00	84.72	0.00	84.72	0.00
75018	84.75	84.75	0.00	84.75	0.00	84.75	0.00
75150	84.79	84.79	0.00	84.79	0.00	84.79	0.00
75218	84.82	84.82	0.00	84.82	0.00	84.82	0.00
75283	84.84	84.84	0.00	84.84	0.00	84.84	0.00
75318	84.85	84.85	0.00	84.85	0.00	84.85	0.00
75378	84.87	84.87	0.00	84.87	0.00	84.87	0.00
75408	84.88	84.88	0.00	84.88	0.00	84.88	0.00
75590	84.91	84.91	0.00	84.91	0.00	84.91	0.00
75904	85.10	85.10	0.00	85.10	0.00	85.10	0.00
75973	85.21	85.21	0.00	85.21	0.00	85.21	0.00
75974	85.21	85.21	0.00	85.21	0.00	85.21	0.00
76071	85.33	85.33	0.00	85.33	0.00	85.33	0.00
76072	85.33	85.33	0.00	85.33	0.00	85.33	0.00
76131	85.35	85.35	0.00	85.35	0.00	85.35	0.00