

## **Technical Memorandum**

То:	City of Portland Bureau of Development Services
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Date:	January 6, 2020
Subject:	LU 19-225732 DZM GW Bank Stabilization and Enhancement at the South Waterfront Blocks 41, 42, 44, and 45; No Rise Analysis
Project No.:	19050.200



### EXPIRES: 12/31/2020

This Technical Memorandum documents an analysis of potential floodway impacts resulting from proposed bank stabilization associated with development of Blocks 41, 42, 44, and 45 in Portland's South Waterfront (NE corner of SW Bond Avenue and SW Lowell Street, Figure 1). The proposed



development includes four multistory mixed-use buildings. Willamette Greenway improvements are required to be constructed adjacent to the river bank as part of the currently entitled project's conditions of approval and will be dependent on bank stabilization and enhancement. Bank work will involve the removal of old pilings and miscellaneous fill and re-grading the bank with riprap and natural materials to provide stabilization and protection.

As shown on Figure 2, the proposed bank stabilization project is in the Special Flood Hazard Areas (SFHA, 100-year floodplain) along the Willamette River and therefore must meet floodplain development

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### City of Portland Bureau of Development Services AM Blocks Bank Stabilization No Rise Analysis

requirements as documented in Chapter 24.50 of the City of Portland Code. In addition, because the project will occur in the mapped regulatory floodway along the river, it must also meet the requirements of Section 24.50.060D of the code that prohibits encroachments into the floodway unless it is demonstrated by technical analysis from a registered engineer that the development will result in no increase in the base flood (100-year) elevation. This is known as the "no-rise" requirement and must be satisfied to avoid a more involved process to revise the SFHA through the Conditional Letter of Map Revision (LOMR) process. The technical analyses presented here documents that the "no-rise" requirement will be met by the proposed project.



The potential impacts to 100-year water-surface elevations were evaluated by performing a hydraulic analysis of the Willamette River in the vicinity of the project. The analysis was carried out by modifying the hydraulic model developed for the LOMR for TriMet's Tilikum Crossing bridge that is located about 0.75 miles downstream of the proposed bank stabilization project. As the upstream extent of this model ends at the upstream face of the Ross Island bridge, the model was extended upstream through the project reach with five (5) additional cross sections that are spaced close enough to reflect proposed changes associated with the project and one (1) additional cross section

approximately 250 ft upstream of the project, for a total of six (6) additional cross sections. The new cross sections were developed by cutting from a terrain model developed using the following sources of information:

- Site Survey
- 2014 LiDAR obtained from the Oregon Department of Geology and Mineral Industries (DOGAMI)
- 2005 Willamette Bathymetry as 5 ft contours available from the City of Portland

Manning's n values for the new cross sections were set to be consistent with the downstream cross sections. This included a Manning's n value for the main channel equal to 0.03 and an overbank n value of 0.05. Where cross sections traverse Ross Island the n value was set to 0.08 to reflect the dense

#### City of Portland Bureau of Development Services AM Blocks Bank Stabilization No Rise Analysis

vegetation on the island. The updated model extended upstream through the project reach with six new cross sections forming the Corrected Effective (Existing Conditions) model for the no-rise analysis.

A Project Conditions model was created by updating the cross sections in the vicinity of the project to reflect the preliminary proposed grading as of December 17, 2019. The proposed final grading will be used and modified as needed to confirm the no-rise condition when final design occurs, and permits are issued. Any grading revisions will result in additional bank removal and this preliminary design is presented as a worst-case scenario for flow obstruction as it represents the local fill of the potential overlook. The project will lay back the bank from approximately ordinary low water to the existing top of bank resulting in a net removal of material from the river. There will be one location at the proposed Abernathy Overlook that will result in local fill within the floodway. Cross section 14.48 is located to represent the overlook at the location where it most protrudes into the flow (Southeast corner of overlook), see Figure 3. The bank will be laid back and armored with riprap below ordinary high water (approximately elevation 20.3, NAVD88) that will have a similar roughness to the existing channel and bank material with a Manning's n of 0.03. Above Ordinary High Water, the bank will be laid back and planted with dense riparian vegetation in accordance with the City of Portland development standards. The dense vegetation above Ordinary High Water will result in a similar roughness to the existing overbank with a Manning's n of 0.05. To capture this break in roughness, the bank stations for the proposed cross sections were adjusted to ordinary high water, which is the top of riprap armoring. Appendix A shows the cross sections comparing the Project and Effective Corrected conditions.



Table 1 compares computed 100-year water-surface elevations between Existing Conditions and Project Conditions for the five cross sections that exhibited a difference (to the thousandth of a foot). The results show that computed water-surface elevations are the same for both conditions (to the nearest hundredth of a foot), demonstrating that the proposed project will not result in any increases in base flood (100-year) water-surface elevations, and thus meets the "no-rise" requirement. Output of the hydraulic model for all cross sections is included in Appendix B.

Table 1: Water Surface Elevation Difference at Project Cross Sections, all other model cross sections had no change							
River Station	Project Conditions	Effective Corrected Conditions	Rise				
	W.S. Elev	W.S. Elev					
	(ft)	(ft)	(ft)				
14.57	33.193	33.192	0.001				
14.53	33.207	33.206	0.001				
14.51	33.165	33.164	0.001				
14.48	33.113	33.116	-0.003				
14.46	33.109	33.109	0.000				
14.43	33.075	33.077	-0.002				

# Appendix A

Figures





Figure A-1, HEC-RAS Geometry



Figure A-2, Cross Section 14.57 (No geometry changes between Effective Corrective and Proposed Conditions)



Figure A-3a, Cross Section 14.53 (Effective Corrective geometry shown in purple, Proposed geometry shown in black)



Figure A-3b, Cross Section 14.53 - left bank grading



Figure A-4a, Cross Section 14.51 (Effective Corrective geometry shown in purple, Proposed geometry shown in black)



Figure A-4b, Cross Section 14.51 - left bank grading



Figure A-5a, Cross Section 14.48 (Effective Corrective geometry shown in purple, Proposed geometry shown in black)



Figure A-5b, Cross Section 14.48 - left bank grading and overlook structure



Figure A-6a, Cross Section 14.46 (Effective Corrective geometry shown in purple, Proposed geometry shown in black)



Figure A-6b, Cross Section 14.46 - left bank grading



Figure A-7a, Cross Section 14.43 (Effective Corrective geometry shown in purple, Proposed geometry shown in black)



Figure A-7b, Cross Section 14.43 – left bank grading

# Appendix B

Tables



Table B-1 HEC-RAS Hydraulic Results. Profile = 100-yr; Q Total = 375,000 cfs. Proj = Project Conditions, Corr Eff = Corrected Effective Conditions

River		Min Ch	W.S.	E.G.	E.G.	Vel Chnl	Flow Area	Тор	Froude
Sta	Plan	El (ft)	Elev (ft)	Elev (ft)	Slope (ft/ft)	(ft/s)	(sq ft)	Width (ft)	# Chl
		(10)	(10)	(10)				(10)	
14.57	Proj	-57.9	33.1932	33.6059	0.000066	5.72	77555.05	2590.36	0.14
14.57	Corr Eff	-57.9	33.1921	33.6048	0.000066	5.72	77552.23	2590.36	0.14
14.53	Proj	-62.86	33.2071	33.5766	0.000059	5.32	80856.69	2570.2	0.13
14.53	Corr Eff	-62.86	33.2060	33.5755	0.000059	5.32	80908.28	2570.14	0.13
14.51	Proj	-62.9	33.1653	33.5673	0.000071	5.54	77016.91	2369.59	0.14
14.51	Corr Eff	-62.9	33.1643	33.5662	0.000071	5.54	76942.02	2479.46	0.14
14.48	Proj	-57	33.1126	33.5497	0.000075	5.74	73274.55	2248.72	0.14
14.48	Corr Eff	-57	33.1160	33.5488	0.000076	5.71	73450.37	2300.63	0.14
14.46	Proj	-55.15	33.1090	33.5402	0.000071	5.71	74101.59	2216.3	0.14
14.46	Corr Eff	-55.15	33.1085	33.5409	0.000072	5.72	73827.8	2273.96	0.14
14.43	Proj	-57.9	33.0746	33.5275	0.000077	5.88	73146.8	2196.31	0.15
14.43	Corr Eff	-57.9	33.0766	33.5283	0.000078	5.87	72842.09	2196.79	0.15
14.02	Proj	-35.5	32.9549	33.36	0.000065	5.11	73445.93	1975.47	0.13
14.02	Corr Eff	-35.5	32.9549	33.36	0.000065	5.11	73445.93	1975.47	0.13
14.01									
14	Proj	-35.5	32.9292	33.3348	0.000065	5.11	73405.27	1959.25	0.13
14	Corr Eff	-35.5	32.9292	33.3348	0.000065	5.11	73405.27	1959.25	0.13
13.93	Proj	-32.9	32.8357	33.2917	0.000065	5.42	69232.72	1594.38	0.13
13.93	Corr Eff	-32.9	32.8357	33.2917	0.000065	5.42	69232.72	1594.38	0.13
13.87	Proj	-49	32.8858	33.2443	0.000044	4.8	78077.98	1619	0.11
13.87	Corr Eff	-49	32.8858	33.2443	0.000044	4.8	78077.98	1619	0.11
13.82	Proj	-51.83	32.8828	33.23	0.000042	4.73	79330.48	1499.82	0.11
13.82	Corr Eff	-51.83	32.8828	33.23	0.000042	4.73	79330.48	1499.82	0.11
13.78	Proj	-42.28	32.7647	33.2082	0.000062	5.34	70191.62	2089.67	0.13

River	Plan	Min Ch El	W.S. Elev	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude
Sld		(ft)	(ft)	(ft)	(ft/ft)	(11/5)	(sq it)	(ft)	# CIII
13.78	Corr Eff	-42.28	32.7647	33.2082	0.000062	5.34	70191.62	2089.67	0.13
13.76	Proj	-37.93	32.7306	33.201	0.000068	5.5	68154.77	2116.21	0.14
13.76	Corr Eff	-37.93	32.7306	33.201	0.000068	5.5	68154.77	2116.21	0.14
13.75									
13.74	Proj	-36	32.6739	33.1597	0.000071	5.59	67074.13	2096.13	0.14
13.74	Corr Eff	-36	32.6739	33.1597	0.000071	5.59	67074.13	2096.13	0.14
13.73	Proj	-37	32.6762	33.1518	0.000069	5.53	67787.97	2141.84	0.14
13.73	Corr Eff	-37	32.6762	33.1518	0.000069	5.53	67787.97	2141.84	0.14
13.69	Proj	-35	32.6535	33.136	0.00007	5.57	67303.47	2223.68	0.14
13.69	Corr Eff	-35	32.6535	33.136	0.00007	5.57	67303.47	2223.68	0.14
13.63	Proj	-37.9	32.6058	33.1093	0.000072	5.69	65883.28	2299.85	0.14
13.63	Corr Eff	-37.9	32.6058	33.1093	0.000072	5.69	65883.28	2299.85	0.14
13.59	Proj	-38.9	32.5949	33.0918	0.000069	5.66	66846.5	2437.31	0.14
13.59	Corr Eff	-38.9	32.5949	33.0918	0.000069	5.66	66846.5	2437.31	0.14
13.54	Proj	-34.5	32.6141	33.0708	0.000064	5.42	69178.47	1397.43	0.13
13.54	Corr Eff	-34.5	32.6141	33.0708	0.000064	5.42	69178.47	1397.43	0.13
13.525									
13.51	Proj	-34.5	32.5938	33.0508	0.000064	5.42	69151.22	1397.37	0.13
13.51	Corr Eff	-34.5	32.5938	33.0508	0.000064	5.42	69151.22	1397.37	0.13
42.47	<b>.</b>	24.5	22 5020	22.0274	0.000064	5.44	60000.46	4207.24	0.40
13.47	Proj	-34.5	32.5828	33.03/1	0.000064	5.41	69832.16	1397.34	0.13
13.47	Corr Ett	-34.5	32.5828	33.0371	0.000064	5.41	69832.16	1397.34	0.13
12.22	Duci	24 5	22.4722	22.072.4	0.000077	F 66	66244.96	1070.45	0.14
13.33		-31.5	32.4739	32.9724	0.000077	5.66	66214.96	1378.15	0.14
13.33	Corr Eff	-31.5	32.4739	32.9724	0.000077	5.66	66214.96	13/8.15	0.14
12.47	Drei	25.5	22.4460	22.0026	0.000000	E 40	60252.60	1017 07	0.42
13.17		-35.5	32.4468	32.9036	0.000061	5.42	69253.68	131/.3/	0.13
13.17	Corr Ett	-35.5	32.4468	32.9036	0.000061	5.42	69253.68	1317.37	0.13

River Sta	Plan	Min Ch El (ft)	W.S. Elev (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
13.165									
13.16	Proj	-35.5	32.4191	32.8764	0.000061	5.42	69217.21	1317.3	0.13
13.16	Corr Eff	-35.5	32.4191	32.8764	0.000061	5.42	69217.21	1317.3	0.13
13.1	Proj	-54.7	32.5003	32.8184	0.000035	4.52	82921.77	1316.02	0.1
13.1	Corr Eff	-54.7	32.5003	32.8184	0.000035	4.52	82921.77	1316.02	0.1
12.99	Proj	-45.5	32.3	32.7807	0.000062	5.56	67427.81	1196.92	0.13
12.99	Corr Eff	-45.5	32.3	32.7807	0.000062	5.56	67427.81	1196.92	0.13