Mr. Peter R. Ono, P.E.
Brown and Caldwell
119 Merchant Street
Suite 200
Honolulu, Hi. 96813

Attn: Mr. Peter R. Ono, P.E.

Subject: Percolation Test, Inarajan Sewer Treatment Plant

Mr. Ono,

At Brown and Caldwell's (B&C) request Duenas, Bordallo & Associates, Inc. (DB&A) conducted a series of percolation tests at the Inarajan Sewer Treatment Plant (ISTP). This memo presents the results of the percolation tests as well as site conditions encountered while conducting the field tests.

On Wednesday, January 25, 2006 DB&A personnel Ken Rekdahl and Danny Tablan conducted a series of three percolation tests at the ISTP. Arrangement for access to the ISTP was made prior to the percolation test through Mr. Bernie Sadler of GWA. The test was conducted in accordance with the guidance documents provided by B&C. The following equipment was used:

- 12-inch diameter fabricated steel cylinder
- 24-inch diameter fabricated steel cylinder
- 36-inch yard stick (graduated to 1/8-inch)
- Pick, shovel & hammer
- Flashlight, tape, marker, camera & watch (w/ second hand)
- 100 gallon container with two buckets

Site conditions

The two northern percolation basins (basins 1 and 2) were in operation during the percolation tests. A percolation test was attempted within the third (southern most) percolation basin. A consistent steady head above the ground surface was not attainable due to the rapid infiltration (100 gallon within 10 minutes) of the percolation basin. The percolation basins all contained drain rock (~2-inch diameter) bottoms. Due to the rapid infiltration through the imported material within the basins, the three percolation tests were conducted outside and adjacent to the three basins in what appeared to be native material. See Attachment 2.

The soil outside and adjacent to the percolation basins was rocky with clayey sand (See Attachment 3 Photo 1). Due to the rocky nature of the soils surrounding the percolation basins, the project team was unable to hammer in the outer cylinder to the desired depth of 6 inches. As a result the project team dug earthen bunds which were approximately 21 inches in diameter and 6 inches deep.

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Methodology

The methodology provided by B&C was used to determine the percolation rates at the ISTP. As mentioned above an earthen bund was used. A 12-inch diameter cylinder was placed within the earthen bund. A measuring rod was placed within the 12-inch cylinder. Water was then added to the earthen bund and 12" cylinder. The water level was kept at approximately 4 inches but no greater than the daylight elevation of the earthen bund. Measurements were taken every 2-10 minutes and additional water was added to the 12-inch cylinder and earthen bund after every measurement. This was repeated until consistent measurements were obtained over the same time period.

Results

The following results were obtained from each of the percolation test:

1. Percolation pit 1: 2.5 in/hr
2. Percolation pit 2,: 2.25 in/hr
3. Percolation pit 3,: 3.75 in/hr

Attachment 1 presents the logs for each percolation test. Attachment 2 presents the locations of the three percolation tests. Attachment 3 presents photos taken during the field tests.

This concludes the percolation test requested by B&C for the Inarajan Sewage Treatment Plant.

Regards,

Ken Rekdahl
Environmental Engineer

Attachments

Attachment 1 Percolation pit logs
Attachment 2 Percolation pit locations
Attachment 3 Photos

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Appendix 3D: Inarajan Percolation

Percolation pit 1

Time	Time diff (min)	Cumulative time	Water Level (in) Before filling	After filling	Infiltration (in)	Infiltration rate in/min	Infiltration rate in/hr	Cumulative infiltration
2:04	0	0	-	4.5	0.5	0.125	7.5	0.5
2:08	4	4	4	4.875	0.625	0.052083	3.125	1.125
2:20	12	16	4.25	5	0.5	0.041667	2.5	1.625
2:32	12	28	4.5	5.125	0.5	0.041667	2.5	2.125
2:44	12	40	4.625	5.25	0.625	0.041667	2.5	2.75
2:59	15	55	4.625	5.125	0.5	0.041667	**2.5**	3.25
3:11	12	67	4.625					

Appendix 3D: Inarajan Percolation

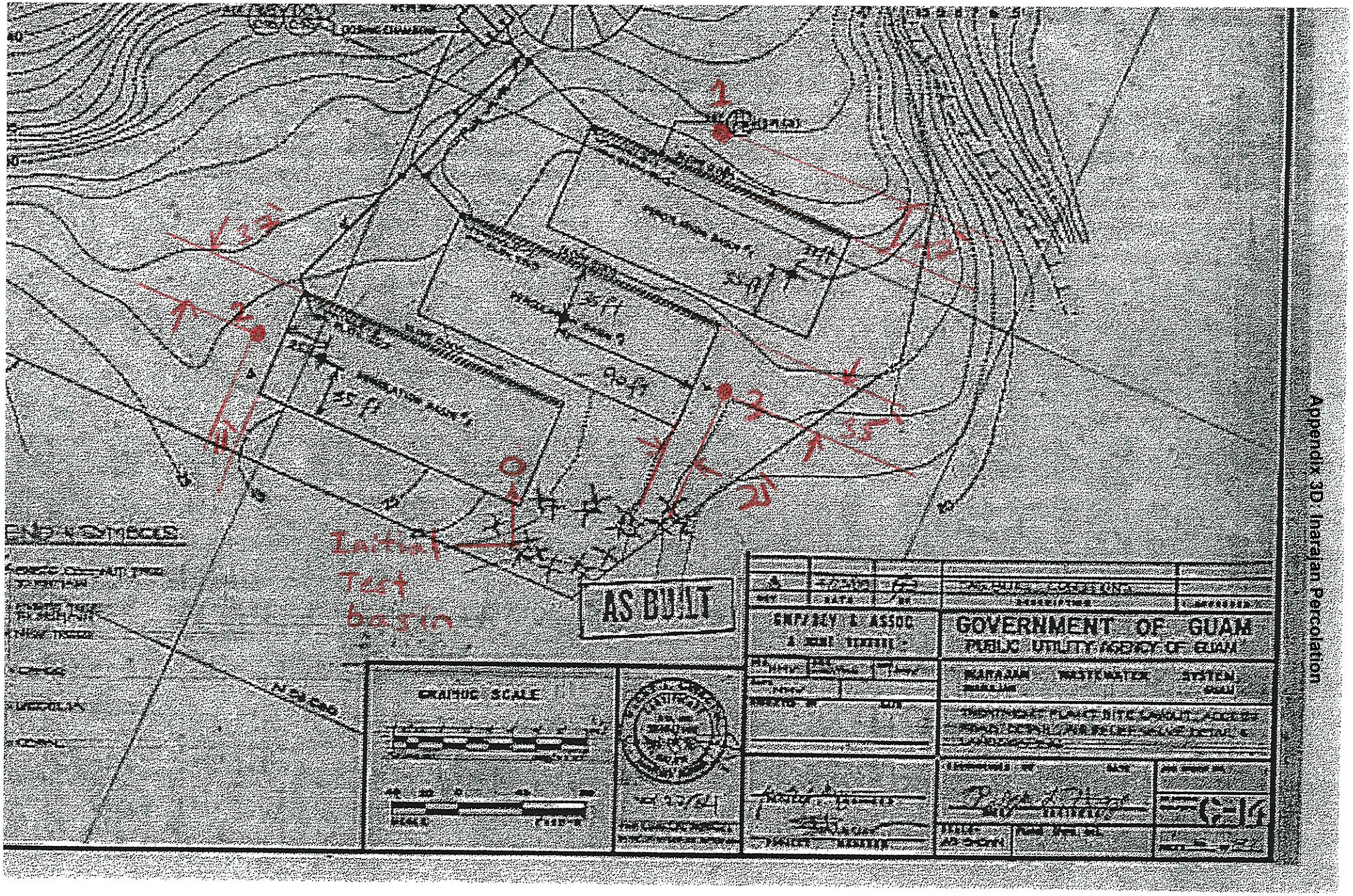
Percolation pit 2

Time	Time diff (min)	Cumulative time	Water Level (in) Before filling	After filling	Infiltration (in)	Infiltration rate in/min	Infiltration rate in/hr	Cumulative infiltration
4:16	0	0	-	3.875	0.375	0.1875	11.25	0.375
4:18	2	2	3.5	4	0.5	0.05	3	0.875
4:28	10	12	3.5	4	0.5	0.05	3	1.375
4:38	10	22	3.5	4	0.5	0.05	3	1.875
4:48	10	32	3.5	4	0.375	0.0375	2.25	2.25
4:58	10	42	3.625	4	0.375	0.0375	**2.25**	2.625
5:08	10	52	3.625					

Appendix 3D: Inarajan Percolation

Percolation pit 3

Time	Time diff (min)	Cumulative time	Water Level (in) Before filling	After filling	Infiltration (in)	Infiltration rate in/min	Infiltration rate in/hr	Cumulative infiltration
3:24	0	0	-	3.875	0.75	0.1875	11.25	0.75
3:28	4	4	3.125	4	0.75	0.083333333	5	1.5
3:37	9	13	3.25	4	0.75	0.068181818	4.090909091	2.25
3:48	11	24	3.25	4	0.625	0.0625	3.75	2.875
3:58	10	34	3.375	4	0.625	0.0625	**3.75**	3.5
4:08	10	44	3.375					



Attachment 2: Percolation pit Locations

Appendix 3D: Inarajan Percolation

Photo 1: Soils Encountered

Photo 2: Percolation pit 1

Appendix 3D: Inarajan Percolation

Photo 3: Percolation pit 2

Photo 4: Percolation pit 3