RETENTION BASIN REPORT June 13, 2013
by Tom Atkins

I am happy to announce that the Kuau Bayview Retention Basin Management Plan is in the final stage of completion, and ready for review and ratification by the Board of Directors. The development of this management plan has taken one full year of independent research, and analysis of test data along with consultation with specialists in fields related to the management of such a storm water basin. A document has been created in the form of a "Maintenance Policy and Procedures Manual" which consists of the following 4 items:

1. The "Retention Basin Maintenance Plan"
2. The Supplementary addendum consisting of relevant procedures and exhibits
3. A 3-ring Binder containing the documents, to be kept in the KB Association's office.
4. A digital copy of the documents, to be kept on the Website.

These 4 components of the Management Plan are described below:
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1. "Retention Basin Maintenance Plan" consisting of the following provisions, as stated in the Table of Contents:

Table of Contents

goal (12) "control of invasive species of plants"
goal (13) "evaluate the need for "trash rack" grate cover for OUTLET Culvert"
goal (14) "Rodent control and Insect vector control"
goal (15) "Ground cover"
goal (16) "Avoid soil "compaction"
goal (17) Monitor the basin's water handling capacity performance over time

C. NFPA Fire Code
goal (18) Monitor and Evaluate Risk of Fire
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2. <u>Supplementary addendum</u> consisting of the following documents:

SECTION A: MAINTENANCE PLAN

SECTION B: INFILTRATION GAUGE LOG

SECTION C: SCHEMATICS and MAPS

SECTION D: HISTORY & DOCUMENTS

SECTION E: EXHIBITS A-I

exhibit A: REFERENCES

exhibit B: Herbicide Application Technique

exhibit C: Invasive Species/Noxious Weeds
List of plants in KB Retention Basin

exhibit D: Trash Rack Evaluation

exhibit E: Retention Basin Inspection Checklist <u>(</u>forms<u>)</u>

exhibit F: KUAU BAYVIEW Reserve Study

exhibit G: Infiltration Gauge Log (Recording Procedure)
Example
Picture of Infiltration Gauge

exhibit H: Infiltration Gauge Log (forms)

exhibit I: Fire Prevention and Suppression

SECTION F: NOTES
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To keep this report as short as possible, I will touch on only the highlights of the Retention Basin Committee's work over the past year. I will report on specific components of the Management Plan in future reports to the Association.

My research has shown that the 1.7 acre, 20 foot deep hole in the ground, located at the NW corner of the subdivision, and which is referred to in all our governing documents as the *Retention Basin*, is in actuality an *Infiltration Basin*, the technical difference being very important to an understanding of exactly

how the Basin is designed to function. The fact that the Basin is an *Infiltration Basin* means that the preservation of its ability to function properly demands a management style radically different from the type of management which would be appropriate for a *Retention Basin*. This fact has been taken into consideration, and reflected in the policies and procedures in the proposed plan. The key difference between a typical "retention basin" and an "infiltration basin", like our basin… is that our infiltration basin has NO outlet, and this means that the bulk of the storm water, which enters our basin through 2 large culverts, must leave our basin, by filtering downward through the top soil, by the natural forces exerted by gravity and capillary action… a process called "percolation" or "infiltration". The water is dispersed into the geological substructure, which forms the natural foundation of the floor of the basin. The storm water seeps down into this subterranean geological structure of cracked lava, coral, clay and sand, and then settles downward into water table, where the surging action of the tides pull the resultant naturally filtered water, into the littoral zone of the ocean. The floor of our basin is only about 4 feet in elevation, above the average level of the sea.

The rain that falls on the roof-tops, sidewalks, roads and other impervious surfaces of our subdivision is channeled into the curb-side drains and into the system of drainage culverts, flowing into the "basin", where it remains, until dispersed by the process of "infiltration", along with some help from the natural processes of "evaporation" and "plant transpiration". The evaporation process is aided by the wind, for which the North Shore of Maui is famous.

Our management plan takes into consideration 2 out of the 3 means, by which water leaves the basin, and while there is nothing that can be done to control the rate at which water "evaporates", certain tools are at our disposal to help increase the rate of drainage of the water from the basin.

The first tool is that of caring for the plants, which, by their nature, act to remove water from the flooded soil of the basin and to release the water into the atmosphere through the phenomenon of "transpiration". This process occurs because the roots of the plants soak up water and transport the water up the stem of the plants and out to the leaves, where the water exits the stomata of the leaves, and enters the atmosphere, as water vapor. The species of plants which best perform the function of "transpiration" are to be selected, cared for, and allowed to dominate the ecosystem.

The other tool that we have at our disposal to be used to maintain the health of our "Basin", is that of preserving the capacity of the soil of our basin to disperse the storm water, through the process of percolation downward through the top soil, where the water can flow into the subterranean infrastructure. It should be emphasized that the most important management tool we have at our disposal is that of PREVENTING the COMPACTION of the soil of the basin. It is essential to preserve the "macropores" inherent in the soil, which are small "sponge-like" holes in the ground, created by the natural plant and animal life, present in the basin, and which maintain the natural openings in the soil through which the water travels to leave the basin. These "macropores" are created by living and dead plant roots, earthworms, insects and the decaying action of microorganisms, such as bacteria and fungi. It is therefore, essential to the preservation of the basin's ability to function, that a balanced ecosystem be maintained through careful and selective culling of the plants, which grow in the basin. Hawaiian plant experts have been consulted, and with their help, we have completed the identification and inventory of the 55 species of plants found in the basin. Our website will soon have available for viewing, the completed study. It already has some of the descriptive details, including pictures of the 55 plants.

So, in conclusion, the essential element in our maintenance plan is that of preventing the compaction of the soil, specifically, that which would be caused by the use of motorized, wheeled vehicles, such as mowing rigs, which may damage the soil through the concentration of force by the contact of their wheels on the soil. This wheel contact is especially damaging when the soil is damp. The work that needs to be done in order to control the growth of plants on the flat surface of the basin should be done by hand labor. Fortunately, there is little that needs to be done on the flat surface of the basin, where the water is absorbed. We are fortunate to have the species of plants, which are presently growing there, in that, most of these plants have a growth height self-limited to 3 feet, and therefore, it is not necessary to

routinely control the height the plants, by mowing. The less that is done to these plants, the better. Hand culling of a few larger species of plants, such as the cane grass clumps and the Haole Koa trees, appears to be all that is needed in order to manage the plant growth.

A system of monitoring the ability of the basin to remove the storm water has been initiated and baseline data is now being recorded. It is essential that this monitoring continue throughout the life of the basin, for the purpose of detecting a pattern indicative of the decline of the ability of the basin to handle the expected water load. Our Manual contains a description of the "infiltration gauge", which has been positioned in the basin, and the sections of the manual, listed as Exhibit G and Exhibit H, contain the procedural methodology and the forms for recording the data and calculating the "infiltration rate". This data-collection and analysis procedure will be performed, following any significant rainstorm.

When it is noted that the infiltration rate of the basin is on a downward spiral, indicative of the impending failure of the basin, we will have adequate notice to plan ahead for the inevitable and expensive soil removal and "resurfacing" procedure, which may be needed in order to restore the basin to a functional state.

According to the literature, the type of storm water basin that we own… the "infiltration basin"… has a high rate of failure, compared to other types of storm water basins. The infiltration style basin is vulnerable to damage from "sedimentation", which may block the "pores" in the soil, and is also vulnerable to "compaction" of the soil, whereby the "pores" in the soil are crushed. For this reason, debris from mowing, culling and pruning the plants should always be removed from the basin, as the breakdown products of such debris may act to "glue" these "pores", and prevent the storm water from percolating downward.

Our basin must not be allowed to fail, or a health hazard will be created, due to the accumulation of stagnant water, and the resultant breeding of mosquitoes, which will in turn, act as a "vector" in the transmission of a number of tropical diseases, such as Dengue Fever and Malaria. If our basin fails to adequately disperse the storm water, and water accumulates and remains in the basin for too long a time period, following rain storm events, problems will occur, creating a great deal of expense for our Association. Solutions needed to these problems might involve the necessity to spread larvicides and spray insecticides, or to have the basin pumped dry. Prevention of such problems is the best management practice available to us, and is, therefore, an integral part of our Management Plan.

There is much more to be noted in our management plan, such as the section developed in conjunction with the Maui County Fire Prevention Marshal which deals with protecting from fire the four homes on Lots 26 to 29. I have already followed the fire marshal's recommendation by taking measures to establish a safe area between the trees in the basin and the exterior walls of the homes in accordance with the provision in the NFPA fire code.

I look forward to presenting further reports on this subject at future Association meetings.

Secretary Tom Atkins
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