APPRAISAL ON THE KNOWLEDGE OF WATER CODE AND PERCEPTION OF WATER MANAGEMENT PRACTICES AND WASTEWATER MANAGEMENT OF THE DEPARTMENT OF PHYSICAL SCIENCES

Vic Marie I. Camacho
Philippine Normal University

ABSTRACT

This study appraised the respondents' knowledge of water code and perception of water efficiency practices and wastewater management in the Department of Physical Sciences at PNU. Results showed that respondents were knowledgeable in the general provisions of the Water Code of the Philippines; however, the university needs to revisit the provisions on appropriations, and control of water. The respondents perceived that there is enough supply of water in their homes, but not in the university, and are willing to pay for water services. They practice water conservation at home and in the university as much as perceive that the university has done efforts in water conservation. The study recommends that wastewater be treated since the respondents are willing to pay for such service. Also the university must actively pursue a vigorous campaign on water conservation as well as create an Environmental Management Division to address environmental issues including water management. Finally, water conservation be included in the Earth and Environmental Science curriculum.

Keywords: *water management, conservation, curriculum, utilization of water*

BACKGROUND OF THE STUDY

Water management is the activity of planning, developing, distributing, managing, and using water resources under defined water polices and regulations. It may mean directing or controlling water resources to the optimum, water treatment of drinking water, industrial water, sewage or wastewater, irrigation and water table.

The recent approach to water law internationally includes establishment of guiding principles based on sustainable management of water resources and equitable allocation, conservation of water resources, water for the environment and related principles. It also includes comprehensive coverage of water resources and water sector management that may include, to varying degrees, the management of water supply schemes but which emphasizes the management of water as a natural resource. In addition, the

introduction or closer definition of water rights schemes and clarification of the relationship between land ownership or occupation and the right to take and use water and the institutional set-up and functions of government agencies with water-related responsibilities; and regulatory powers, enforcement and control mechanisms, for the protection of water resources and the application of water rights.

The UN-Water conducted a study that aimed to illustrate progress made on meeting the target to develop integrated water resources management and water efficiency plans by 2005, with support to developing countries, through actions at all levels, as agreed upon at the World Summit on Sustainable Development in Johannesburg in 2002, through the Johannesburg Plan of Implementation (JPoI). The Report is based on a survey covering 104 countries of which 77 are developing or countries in transition and 27 developed (OECD and EU member states), including the Philippines as subject of this study. Stated in this report is that the Philippines has a well-laid foundation for its plans, but has some gray areas in implementing the water management program.

The Philippines, through PRESIDENTIAL DECREE NO. 1067 signed on December 31, 1976 also known as THE WATER CODE OF THE PHILIPPINES, proved that the government was already aware of the importance of water management in the state thirty-three years ago. It is a decree instituting a water code, thereby revising and consolidating the laws governing the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources**.** This Presidential decree served as the basis for the water management procedures in the Philippines.

Institutional managers, whether in the government or private sectors, have to make appropriate decisions on water allocation by apportioning diminishing supplies between ever-increasing demands. Demographic and climatic changes further increase the stress on water resources in the state and also affect the water supply in the different sectors of the community such as an institution like the Philippine Normal University. A more holistic approach to water management is essential as the way forward for managing efficient, equitable and sustainable development of the limited water resources and for coping with conflicting demands. Institutions have very different water demands and supply and are at very different stages in economic and social development. Hence, there is a need for approaches suitable to the individual circumstance of a locale, in this instance the Philippine Normal University.

A simple framework was developed in Australia to provide a consistent approach to conjunctive water management in line with the principles of the Australia National Water Initiative. This general process can be followed when taking a conjunctive water management approach regardless of the size and nature of a catchment and the water issues that need to be

addressed. In the first phase – Identify Management Setting, key features that define the management of land and water resources in the catchment should be identified. In the second phase, Investigate and Assess, baseline information to describe the characteristics of surface water and groundwater systems of the catchment, and their interactions, both spatially and temporally are acquired. In the third phase, Understand and Predict, the current understanding of the processes, dependencies and impacts on the water resource in a conceptual model is summarized and can be used as the foundation for a mathematical model or a predictive tool. In the fourth phase, Set Management Targets, goals and objectives to be achieved for water management in the catchment are identified. In the fifth phase, Develop and Implement Management Options - appropriate mix of policy and on-ground investment options for conjunctive water management are evaluated and implemented. In the last phase, Monitor and Review Performance, monitoring of key indicators is done as the basis to review catchment conditions and the performance of conjunctive water management undertaken. As part of the framework, resources have been collated to help water managers, water authorities, policy makers, catchment groups, industry groups and others implement a more integrated approach to water management. These resources include information on data sources for the key catchment datasets required for conjunctive water management decisions, tools for stakeholder engagement, and a schema for categorizing connectivity. Moreover, such resources cover assessment tools to investigate groundwater-surface water interactions, conjunctive water management options in terms of policies or on-ground works that link groundwater and surface water resources; finally, an outline of the potential roles and responsibilities associated with conjunctive water management.

In line with the serious purpose of managing the environment as well, this water management framework could be adapted in an institutional level, such as the Philippine Normal University as a starting point. Together with the knowledge of Presidential Decree No. 1067, management setting can be identified, then targets and options devised to address the issue in water management. More so, the institution is geared towards training future teachers not only as mentors but also as environmental managers, thus knowledge on the Presidential Decree No. 1067 ensures an efficient use and management of water as much as gives the faculty, administrators, students a preview on a long term vision of a water-saving society.

Water management includes water efficiency that depends on access to water, price of water, user habits for purposes such as drinking, cooking, washing, cleaning, watering the gardens and whether people give attention to saving water (Farida, 2010). Good water efficiency can be equated to the conservation of a finite and precious resource to the benefit of future generations. A positive appraisal of water efficiency of faculty and students

implies that the PNU students are ready to be transformative educators who are changed agents in improving society through effective water saving practices. This water efficiency includes water practices at home and in the university, the two major places where the students and faculty are spending most of their time.

Water management includes water treatment practices – septic tank emptying and septage treatment, sewage treatment systems and community sanitation projects. The Department of Natural and Environmental Resources (2007) reported that there are three existing sewerage system in the Greater Manila Area: the Taguig Sewerage System, the Riverbanks Sewerage System and Quezon-Marikina Sewerage System. Operating these systems and constructing additional plants need capital investment in billions. A perception of the faculty and students on water treatment practices may serve as basis for the continuing practice of restoring non-revenued water to become usable again.

Dayrit (1999) reported that the national water vision is a world-class, affordable and sustainable water supply, sanitation and sewerage system accessible to every Filipino. He further mentioned that by the year 2025, water resources in the Philippines shall have been used efficiently, allocated equitably and managed in a sustainable way (Appendix B). After almost a decade when this national water vision was stated, it is but only imperative that a local research made on water management be done. Thus, a study on the appraisal on the knowledge of water code and perception of water efficiency practices and wastewater management of the Department of Physical Sciences community is undertaken.

STATEMENT OF THE PROBLEM

This study was conducted to appraise knowledge of water code and perception of water efficiency practices at home and in the university as well as wastewater management of the students and faculty members of the Department of Physical Sciences at the Philippine Normal University. Specifically, the study sought to answer the following questions:

1. What is the respondents' extent of knowledge in the following general provisions of the Water Code of the Philippines?
    A. utilization of water,
    B. conservation of water, and
    C. ownership and water use preference
2. What are the respondents' perceptions of water management at home and in the university?
3. How do they perceive wastewater management?

CONCEPTUAL FRAMEWORK

In consonance with the national water vision for a world-class, affordable and sustainable water supply, sanitation and sewerage system accessible to every Filipino by the year 2025, it is imperative to conduct a local research on the extent of knowledge of water resources in the Philippines through the Water Code of the Philippines and the respondents' perception of water management at home, in the university and in the country (Fig.2). Result of this study will provide baseline data on the extent of water conservation drive and effective water efficiency practice by the PNU students and faculty members.

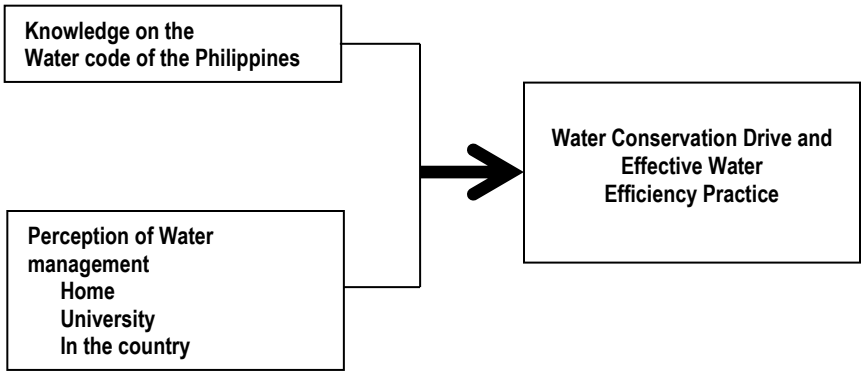

Figure 2. Conceptual Framework

METHODS

Research Variables

Student and Faculty responses are considered variables on the knowledge of the water code in terms of appropriation, water use preference, ownership, utilization, control and conservation of water. Several water management issues in the home and in the university were considered for this investigation such as water quality, supply, conservation and general respondents' perception of water management. Similarly, perception of water treatment and treatment payment are the variables considered for waste treatment.

Research Instrument

The two-part survey questionnaire was developed by the researcher and content validated by three experts. While the questions for the knowledge on water code were lifted and adopted from the PD 1067, the survey questions for the home, university and water treatment adopted from existing studies on water management. Table 1 categorically describes the respondents' mean

ratings on the five-response instrument which was based on Ochave's and Abulon's, as cited in Orleans (2010).

Table 1. Categorical Description of the Mean in the Likert Scale Survey

Description	Mean Rating
Strongly Agree	1.00 -1.50
Agree	1.51-2.50
Undecided	2.51-3.50
Disagree	3.51-4.50
Strongly Disagree	4.51-5.00

The data were further validated using triangulation, as suggested by McDermaid (2000), backed up by person-to-person interviews with respondents and selected key officials in the university to corroborate and complement the survey findings.

Samples

Thirty (30) respondents from the Department of Physical Sciences were involved in this investigation, eighteen (60%) of which are students and twelve (40%) faculty members. The students used as samples in this investigation had taken classes which discussed the Water Conservation and the Water Code of the Philippines.

Respondents' Demographic Profile

Thirty (30) respondents from the Department of Physical Sciences were involved in this investigation – sixty percent (60%) of which are students and forty percent (40%) faculty members. Figure 2 below shows the frequency distribution of the respondents.

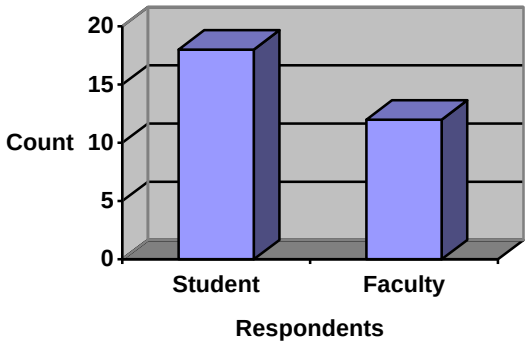

Figure 2a. Frequency Distribution of Respondents

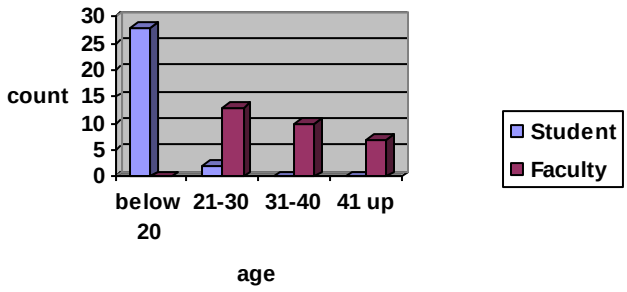

Figure 2b. Age Distribution of Respondents

In terms of the respondents' age distribution, as shown in Figure 2b, ninety-four percent (94%) of the students are in the 20's and below bracket and only six percent (6%) falls in the 21 to 30 age bracket. For the faculty age distribution profile, forty-two percent (42%) of the faculty are in the 21 to 30 age bracket, thirty-three percent (33%) in the 31 to 40 age bracket.

The respondents' distribution in terms of gender is shown in Figure 3. Seventeen females accounting for fifty-seven (57%) of the population and thirteen males forty-three (43%) of the population.

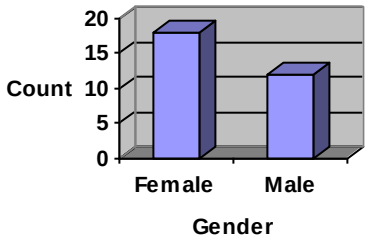

Figure 3. Distribution of Respondents by Gender

Table 2. Distribution of Respondents in Household

Household	Frequency	Percent
1	2	6.7
2-3	6	20.0
4-5	15	50.0
6	7	23.0
Total	30	100.0

As to number of people in the household shown in Table 2, two respondents are living alone, six respondents in a household with two to three people, fifteen respondents in a household of four to five people, and seven respondents in a household of six or more people.

Table 3 presents the distribution of respondents in terms of ownership of residence. Twenty of the respondents owned the houses they are residing in, while ten respondents are renting their current abode. As to respondents' service water provider, the frequency distribution in Table 4 shows that nineteen respondents are under the Maynilad concessionaire, five respondents with Manila Water, one respondent is using deep well and five respondents are using private agencies as their water concessionaire. Graphical presentation is also shown in Figure 4.

Table 3. Distribution of Respondents of Ownership of Residence

Residence	Frequency	Percent (%)
Owned	20	66.7
Rent	10	33.3
Total	30	100.00

Table 4. Distribution of Respondents' Water Provider

Water Provider	Frequency	Percent (%)
Manila Water	5	16.7
Maynilad	19	63.3
Deepwell	1	3.3
Private Agency	5	16.7
total	30	100

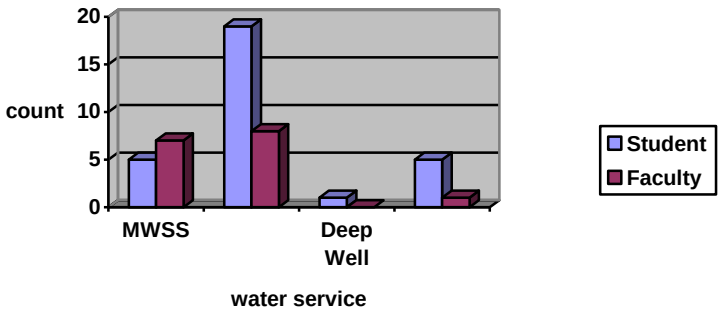

Figure 4. Distribution of Respondents' Water Provider

Data Gathering

Data gathering for this investigation was paperless in that the survey questionnaire was sent to fifty respondents via e-mail, but only thirty (30) respondents submitted their response.

Data Analysis

Descriptive and inferential analyses were performed to generate results from the expected outcomes of this investigation. The t-test for independent samples was employed to determine the differences in means for variables. All statistical values were tested at 95% confidence interval level.

RESULTS

I. Knowledge on the Water Code

The knowledge on the water code is divided into facets of appropriation, water use preference, ownership, use, control and conservation of water.

I.A. Appropriation

Overall, the respondents considered the water provider as the group responsible for the appropriation of water, followed by the local government, then national government and the consumer.

As shown in Figure 5, eighty-three percent (83%) of the faculty perceived that the water provider is responsible for the appropriation of water, while seventeen percent (17%) deemed the local government as the responsible agency. The students perceived that the national government, local government and water provider shared equal twenty-eight percent each as the agencies responsible for water appropriation, followed by the consumers.

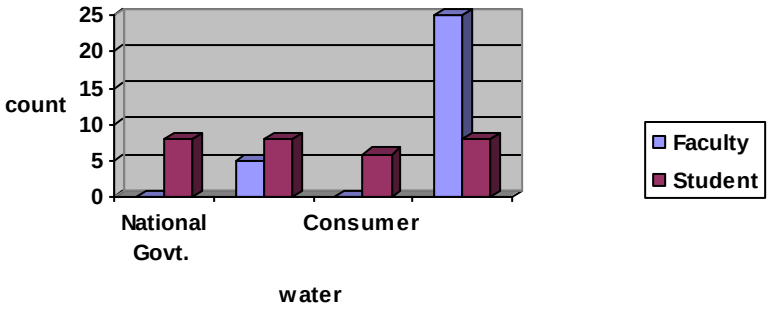

Figure 5. Distribution of Respondents' Water Provider

The t-test in Table 5 shows that the average rating given by the students is 2.39 higher than the faculty mean by 0.47. This 0.47 value does not depict a significant difference based on the t-value of 1.39 at a 0.05 confidence level.

Table 5. T-test for Responses in Appropriation

Variable	Group	Mean (SD)	Mean Difference	t-value
Water Service Provider	Students	2.39 (0.99)	0.47	1.39
	Faculty	1.92 (0.79)		

*Significant at 0.05 confidence level (p<0.05)

As cited in Article 13 of PD 1067, "Except as otherwise herein provided, no person, including government instrumentalities or government-owned or controlled corporations, shall appropriate water without a water right, which shall be evidenced by a document known as a water permit." Article 9 clarifies further that "appropriation of water, as used in this Code, is the acquisition of rights over the use of waters or the taking or diverting of waters from a natural source in the manner and for any purpose allowed by law." Basing on the respondents responses, one sees that they do not clearly know that it is the role of the national government to responsibly appropriate water. The high response on the water concessionaire must be due to the rampant announcement of concessionaires on different media on the schedule of allocating water in some parts of the Greater Manila Area.

I.B. Water Use Preference

In the survey questionnaire, the respondents were asked to rank the given water use preference. Table 6a below showed the mean results of the students and faculty respondents whose answers are found to be not significantly different from one another, as indicated in the t-values at a confidence interval of p<0.05.

Table 6a. Water Use Preference of Respondents

Water Use	Mean Student/Faculty	Mean Difference	t-value
Domestic	2:39/1.58	0.81	1.27
Irrigation	3.33/3.09	0.25	0.40
Power Generation	3.61/3.42	0.19	0.241
Industrial	3.5/5.25	-1.75	-2.58
Municipal	5.67/5.17	0.5	0.59
Fisheries	5.98/4.92	0.36	0.5
Aesthetics	7.78/8.83	-0.56	-0.85
Livestock	5.94/5.08	0.86	1.53
Resorts	5.94/8.17	-2.22	-2.62

Combining the repondents' answers, one sees that the water use preference favored domestic use as the most important, followed by irrigation, power generation, industrial, fisheries , municipal, livestocks, resorts and aesthetic use respectively, as table 6b below points out.

Table 6b. T-test for Responses in Appropriation

Water Use	Mean (SD)	Rank	PD 1067 Preference in Rank
Domestic	2.07 (1.7)	1	1.5
Irrigation	3.23 (1.65)	2	3
Power Generation	3.53 (2.12)	3	4
Industrial	4.2 (1.99)	4	7
Fisheries	5.13(1.97)	5	5
Municipal	5.47 (2.2)	6	1.5
Livestock	5.6 (1.54)	7	6
Resort	6.83 (2.49)	8	8.5
Aesthetics	8.00 (1.74)	9	8.5

Article 95 of PD 1067 states that when priority in time of appropriation from a certain source of supply cannot be determined, the order of preference in the use of the waters shall be as follows :a. Domestic and municipal use; b. Irrigation; c. Power generation; d. Fisheries; e. Livestock raising; f. Industrial use; and g. Other uses.

Notably, in comparing the respondents ranking to the PD 1067 preference, one recalls that in PD 1067, industrial use was ranked as 7th, while in the current study, it stood as 4th. The municipal use was ranked 1.5 in the PD 1067, but in the current study, 6th. Thirty-four years after PD 1067 was promulgated, the nation veers toward industrialization, thus water preference has also changed. Moreover, in the national water vision (2000), domestic and other water supply use, irrigation and hydropower are still prioritized for water preferences.

I.C. Utilization

When asked to determine which among the consumers, farmers, industries, small business, public parks and resorts uses the most water, the respondents chose only four categories – consumers, farmers, industries and resorts, as shown in the data (see Fig.6). The student response showed that consumers and industries use the most water, followed by resorts and farmers, while the faculty response showed that consumers are the most water users followed by resorts, farmers and industries.

From a more holistic view, the respondents signify that the most water users are in the order of the consumers, the industries, resorts and then farmers. This finding also reflects the global industry water use where 20 % of the world's water supply is spent in industry preferably by the US which utilizes 46 %, China 25 %, and India 5 %. The UN report showed that agriculture uses 70 % of all freshwater withdrawals to irrigate crops.

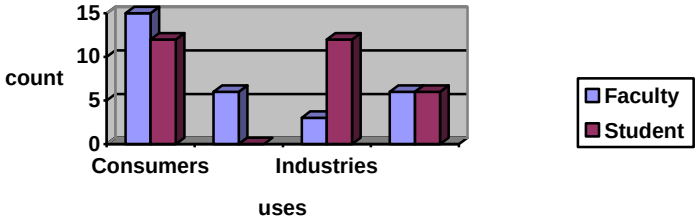

Figure 6. Utilization of Water

Besides utilization, article 41 of PD 1067 states that no person shall develop a stream, lake, or spring for recreational purposes without first securing a permit from the council. Two items in the questionnaire reflect this statement. The results in Table 7 showed that the mean scores for responses for students and faculty are not significantly different from one another with a t-value of 1.931 and 1.31 respectively with a descriptive meaning of disagree.

Table 7. T-test for Responses in Utilization

Utilization Statement	Students/Faculty Mean	Mean difference/ t-value	Total Mean (SD)
Springs in my property can be utilized for business purposes without securing any permit from the government.	S: 4.50 (Disagree) F: 3.58 (Disagree)	0.92 1.931	4.13 (1.33) Disagree
I can develop a stream, lake, or spring for recreational purposes in my property without first securing a permit from the government.	S: 4.33 (Disagree) F: 3.67 (Disagree)	0.67 1.31	4.07 (1.39) Disagree

The respondents' mean with a descriptive meaning of disagree is congruent to the statement in article 41. Thus, it can be deduced from these responses that the student and faculty are knowledgeable in properly utilizing water source in their property.

I.D. Ownership

Some articles in the PD 1067 describe the ownership of water. Two of those articles are detailed in Articles 3 and 4, while Chapter 2 focuses on the ownership of water. Article 3 states the underlying principles of this code: (a) All waters belong to the State, (b) All waters that belong to the state cannot be the subject to acquisitive prescription. Article 4 states that waters, as used in this Code, refers to water under the grounds, water above the ground, water in the atmosphere and the waters of the sea within the territorial jurisdiction of the Philippines. In Chapter 2…***it solely described that all waters are owned by the state***. Two of the questions in the survey refer to ownership of water.

Table 8. T-test for Responses in Ownership

Ownership Statement	Student/Faculty Mean	Mean difference/ t-value	Total Mean (SD)
I can use water anyway I like because it is my right.	S:3.11 (Undecided) F:3.42 (Undecided)	0.306 -0.622	3.23 (1.30) Undecided
Springs and rivers in my property are solely for my own use.	S: 4.28 (Disagree) F: 3.33 (Undecided)	0.94 2.522	3.9(1.30) Disagree

The result in Table 8 revealed that students' and faculty responses on the statement that pertains to using water anyway they like has no significant difference, as shown in the t-value of -0.622. Furthermore, the total mean of 3.23 has an equivalent description of *undecided* to mean that the students and faculty were not really sure what to answer on this question.

For the second statement on ownership of water, the students response is 4.28 with a qualitative description of Disagree, in contrast to the faculty response that borders in the undecided range. Such responses showed that there is no significant difference between the two responses – the total mean reveals further that all respondents disagree with the statement. Thus, the respondents acknowledged that springs in the property are not solely for their own use, as stated in Articles 3 and 4.

I.E. Control of Water

Three statements from the control of water were lifted from PD 1067 and included in the questionnaire. The first statement taken from article 57 states that "any person may erect levees or revetments to protect his property from flood, encroachment by the river or change in the course of the river, provided that such constructions not cause damage to the property of another." Article 58 encompasses the two statements shown in bold letters to the effect that when a river or stream suddenly changes its course to traverse private lands, **the owners or the affected lands may not compel the government to restore the river to its former bed**; **nor can they restrain the government from taking steps to revert the river or stream to its former course**. The landowners thus affected are **not entitled to compensation for any damage sustained thereby**. However, the former owners of the new bed shall be considered the owners of the abandoned bed proportioned to the area lost by each. The owners of the affected lands may undertake to return the river or stream to its old bed at their own expense; provided, that a permit is secured from the Secretary of Public Works, Transportation and Communication and work pertaining thereto are begun within two years from the changes in the course of the river or stream.

Table 9. T-test for Responses in Control of Water

Control Statement	Student/Faculty Mean	Mean difference/ t-value	Total Mean (SD)
Any person may erect structures to protect his property from flood, encroachment by the river or change in the course of the river, provided that such constructions do not cause damage to the property of another.	S: 2.22(Agree) F: 2.5(Agree)	0.28 t-value = -0.507	2.3 (1.4) Agree
When a river or stream suddenly changes its course to traverse over your property, you can restrain the government from taking steps to revert the river or stream to its former course.	S: 2.8 (Undecided) F: 3.08(Undecided)	0.25 t-value =0.596	2.93(1.11) Undecided
When a river or stream suddenly changes its course to traverse over your property, you are entitled to compensation from the government for any damage sustained thereby.	S: 2.94 (Undecided) F. 3.17 (Undecided)	0.22 t-value = 0.612	3.03 Undecided

The result in Table 9 showed that the students and faculty agree to the first statement with no significant difference in their responses. This finding has a positive relation to the statement from PD 1067. For the second and third statements, the students and faculty responses revealed a qualitative answer of Undecided to imply that the respondents were not really knowledgeable on the last two statements.

I.F. Conservation of Water

Conservation statement 1 lifted from article 68 states that "it shall be the duty of any person in control of a well to prevent the water from flowing on the surface of the land, or into any surface water, or any porous stratum underneath the surface without being beneficially used." While the second statement generally concerns on conservation of water, the last statement refers to the perception of the national government's effective water management system.

Table 10. T-test for Responses in Conservation of Water

	Conservation Statement	Student/Faculty Mean	Mean difference/ t-value	Total Mean (SD)
1.	It shall be the duty of any person to prevent water from flowing on the surface of the land, when there is no beneficial use.	S: 2.33 (Agree) F:2.17 (Agree)	0.17 t-value = 0.434	2.27(1.01) Agree
2.	Water conservation is a concern for everybody.	S: 1.38 (Strongly Agree) F: 1.0 (Strongly Agree)	0.39 t-value = 1.37	1.23(0.774) Strongly Agree
3.	The national government has an effective water management system.	S: 3.11 (Undecided) F: 3.41 (Undecided)	-0.306 t-value = -0.759	3.23(1.07) Undecided

The result in Table 10 showed that the students and faculty gave a qualitative description of Agree to the first statement and their responses do not have any significant difference at a t-value of 0.434, a finding in consonance with the PD article 68. On the second statement, the faculty and students strongly agree to the statement that water conservation is a concern for everybody. On the third statement, the students and faculty responses yielded a qualitative description of Undecided to imply that the respondents did not see the government's role in water management, much less had any idea on the water management system of the government. This result is backed up by a paragraph in the national water vision report (2000) to the effect that there is a Non-systematic approach to water resources management. An integrated and holistic approach to water resources management is simply missing because the sheer number of agencies involved compounded with the ambiguous definition of their responsibilities resulting in overlapping work, lack of comprehensive data and a fractional water resources management plan that is grossly inadequate in satisfying the requirements for sustainability.

II. WATER MANAGEMENT AT HOME

Water Management at home revolves around three categories – supply of water, conservation practices, and general observations.

II.A. Supply of Water

Seven questions from the questionnaire refer to the respondents' perception of the water supply at home. Results in Table 11 showed that the students and faculty responses in the first four statements agree with one another, the next two statements, their disagreement, with both groups agreeing on the last statement.

In statement one, the respondents strongly agree that there is enough water supply in their home with no significant difference in the responses at t-value =0.406. In the second statement, the students and faculty qualitatively agree that the water supplied in their homes is of good quality with no significant difference in the responses at t-value equal to -0.656. In the third statement on the fitness of tap water at home for drinking, the student and faculty responses revealed a qualitative answer of Undecided with no significant difference among responses. In the fourth statement whether drinking water should be purchased always, their responses revealed a qualitative answer of Undecided with no significant difference in the responses at t-value equal to -0.598.

Table 11. T-test for Responses in Supply Water

	Supply Statement	Student/Faculty Mean	Mean difference/t-value	Total Mean (SD)
1.	There is enough water supply in our home at the moment	S: 1.44 (Strongly Agree) F:1.33(Strongly Agree)	0.11 t-value = 0.406	1.4 (0.724) Strongly Agree
2.	The water supplied in our home is of good quality.	S:1.78(Agree) F: 2.0 (Agree)	-0.22 t-value = -0.656	1.87 (0.90) Agree
3.	The tap water is fit for drinking.	S: 3.22 (Undecided) F: 3.08 (Undecided)	0.139 t-value = 0.285	3.16(1.29) Undecided
4.	Drinking water should always be purchased.	S:3.00 (Undecided) F:3.08(Undecided)	-0.33 t-value = -0.598	3.13 (1.48) Undecided
5.	The water supply is not a problem in our community.	S: 2.11(Agree) F:2.92 (Undecided)	-0.806 t-value = -1.606	2.36 (1.03) Agree
6.	The tap water is the sole source of water in our home.	S:2.39 (Agree) F:2.83 (Undecided)	-0.44 t-value = -0.952	2.57(1.25) Undecided
7.	There will be enough water supply in our home in the next ten years	S:2.72 (Undecided) F:3.17 (Undecided)	-0.44 t-value =-1.308	2.9(0.92) Undecided

In the fifth statement about the water supply being not a problem in the community, the student response showed a qualitative response of Agree, while that of the faculty an Undecided response. However, the t-value of the responses yields that there is no significant difference among the responses, thus in getting the total mean, all responses result in Undecided. Similarly, responses to question number six about the tap water being the sole source of water in the home, follows the same trend. The student response showed a qualitative response of Agree, while that of the faculty Undecided. There was no significant difference among the responses, thus, in getting the total mean for all respondents, the study showed an Undecided response.

For the seventh question on the possibility of having enough water for the next ten years, the students and faculty have similar qualitative response of Undecided, with no significant difference on their answers at the t-value of -1.308.

Looking at the results, one notes that the supply of water is perceived by the respondents as more than enough to supply their needs. This is verified by the agreement of responses to the first and fifth questions. However, based on the respondents response to question number 7, they remain undecided if the supply of water is more than enough after ten years. Neither were they decided on the tap water as their sole source of water, in that they perceived

that the tap water at home is of good quality, but they remain undecided if this water is fit for drinking.

II.B. CONSERVATION PRACTICES AT HOME

Six items in the questionnaire refer to the respondents' perception of water conservation practices at home. Results in Table 12 showed that the students and faculty qualitative responses to the six statements were all Agree with no significant difference in their responses.

Table 12. T-test for Responses in Conservation Practices at Home

	Water conservation Statement	Student/Faculty Mean	Mean difference/t-value	Total Mean (SD)
1.	Every member of my family minimizes personal water use.	S: 2.28(Agree) F:2.5 (Agree)	-0.222 t-value = -0.570	2.36(1.03) Agree
2.	Leaky faucets and water tubes are readily replaced.	S:1.61 (Agree) F: 2.17 (Agree)	-0.56 t-value = -1.975	1.83(0.79) Agree
3.	Recycling of water is practiced at home.	S: 1.61(Agree) F: 2.4 (Agree)	-0.805 t-value = -2.611	1.93 (0.907) Agree
4.	Rain water is intended for garden use and other water needs.	S:2.00 (Agree) F:2.4 (Agree)	-0.805 t-value = -2.611	2.27(1.41) Agree
5.	Used water is allotted for draining the toilets.	S: 1.78 (Agree) F: 1.92(Agree)	-1.38 t-value = -0.348	1.83(1.05) Agree
6.	I practice water conservation daily	S: 2.00 (Agree) F: 2.08(Agree)	-0.08 t-value = -0.288	2.03(0.765) Agree

The respondents' responses showed that the students and faculty practice water conservation somehow to mean that it is not regularly practiced, as seen in the respondents' numerical rating which does not border near the Strongly Agree response. The responses simply suggest that the respondents are not habitually practicing water conservation at home.

General Statements

Two general statements in terms of water conservation are included in the questionnaire. The result on Table 13 showed that the students and faculty qualitatively responded Agree with no significant difference in their responses.

Table 13. T-test for Responses in General Statement for Water Conservation

	General Statement	Student/Faculty Mean	Mean difference/ t-value	Total Mean (SD)
1.	Water is of great value and should be readily available.	S: 1.27 (Agree) F:1.08(Agree)	0.194 t-value = 1.08	1.2 (0.484) Agree
2.	I am in favor of paying for water utility.	S:1.83 F: 2.58	-0.75 t-value = -2.41	2.1(0.891) Agree

The results showed that the respondents believed that water supply should be readily available and they are ready to pay for any water services provided them.

III. WATER MANAGEMENT IN THE UNIVERSITY

Water Management in the university revolves around three categories: supply of water, conservation practices, and general observations.

III.A. Supply of Water

Seven questions from the questionnaire refer to the respondents' perception of water supply in the university. Results in Table 14 showed that the students and faculty responses to the statements 1, 3, 5 and 6 did not show agreement in their qualitative answers; however, the responses to statements 2 and 4 yielded that the students and faculty were in agreement.

In statement 1 on whether there is enough water in the university, the student response falls under the category of undecided, while that of the Faculty Agree. There is no significant difference in the responses as reflected in the t-value of 1.165, thus the total mean of both respondents showed a qualitative answer of Undecided. In statement 3 about the fitness of tap water for drinking, the student qualitative response is Disagree, while that of the faculty is Undecided. The responses have no significant difference at t-value equal to 1.113, thus the total mean score for both respondents showed a qualitative answer of Disagree.

In statement 5 on the readily available water in the comfort rooms, the student qualitative response is Undecided, while that of the faculty Disagree. There is no significant difference on the responses of the two groups at t-value equal to -1.340, thus the total mean for both groups is Undecided. In statement 6 on the possibility of having enough water supply in the university for the next ten years, the student response is Undecided, while that of the Faculty Disagree. There is no significant difference between the responses with a t-value of -2.87, and the resulting total mean of the respondents is Undecided. For the seventh statement where the respondents were asked about their awareness of the university plans to meet future needs, the student response is Undecided, while that of the faculty is Disagree. There is no significant difference in both the responses at t-value of -1.79, thus the total mean showed a qualitative answer of Undecided.

In the second statement whether the water supply in the university is of good quality, both student and faculty response showed Undecided with no significant difference in the responses at t-value of 1.192. In the fourth statement, about the purchase of water, both the student and faculty response showed Agree with no significant difference in the responses at t-value of -0.604.

Table 14. T-test for Responses in Supply of Water in the University

	Supply Statement	Mean Student/Faculty	Mean difference/t-value	Total Mean (SD)
1.	There is enough water supply in the university at the moment	S: 2.78 (Undecided) F:2.25 (Agree)	0.528 t-value = 1.165	2.57(1.23) Undecided
2.	The water supplied in the university is of good quality.	S: 3.22(Undecided) F: 2.67 (Undecided)	0.55 t-value = 1.192	3.00(1.26) Undecided
3.	The tap water is fit for drinking.	S: 3.78 (Disagree) F: 3.25 (Undecided)	0.528 t-value = 1.113	3.57(1.27) Disagree
4.	Drinking water should always be purchased.	S: 2.17 (Agree) F:2.5 (Agree)	-0.333 t-value = -0.604	2.3 (1.47) Agree
5.	There is readily available water in the comfort rooms.	S: 2.94 (Undecided) F:3.58 (Disagree)	-0.639 t-value = -1.340	3.2(1.30) Undecided
6.	There will be enough water supply in the university for the next ten years	S:2.61 (Undecided) F:3.58(Disagree)	-0.97 t-value = -2.87	3.00(1.02) Undecided
7.	I am aware of the plans of the university to meet future water needs.	S:2.94 (Undecided) F:3.92(Disagree)	-0.694 t-value =-1.79	3.5(1.07) Undecided

From the responses of the student and faculty, the result showed that the water supply in the university is insufficient at the moment. Furthermore, the respondents cannot decide on quality of water at the university as good; thus, they perceived that the tap water at the university is unfit for drinking and that they prefer to purchase their drinking water. The respondents are undecided on the supply of water in the comfort rooms, on the supply of water ten years from now and on the plans of the university to meet future water needs.

These results should be an eye opener to the managers in the institution. A periodic water quality testing might be done to ensure that water in the university is safe to drink. An information campaign maybe established, too, to assure the community of the periodic water quality testing to prove that the university is concerned about the health of the community. The university must also provide access to free and clean drinking water and to supervise the supply of water in the comfort rooms. All these concerns need, however, the

involvement of the whole community in the University plans for meeting future water needs.

III.B. CONSERVATION PRACTICES IN THE UNIVERSITY

Five items of the questionnaire refer to the respondents' perception of water conservation practices in the university. Results in Table 15 showed that the students and faculty qualitative responses to four out of five statements were on the same qualitative response.

In statement 1 where the respondents are asked if they minimize personal water use in the university, the student and the faculty qualitative response is Agree with no significant difference in the two group responses at t-value 0.160. In statement 2 where the leaky faucets and water tubes are readily replaced, the students and faculty response is Undecided with no significant difference in their responses at t-value equal to -0.479. In statement 4 where water conservation should be included in the curriculum, students and faculty qualitative response is Agree with no significant difference at t-value equal of 0.606. In statement number 5 on the university investment on water conservation, the student and faculty qualitative response is Agree with no significant difference at t-value of -0.458.

Table 15. T-test for Responses in Conservation Practices in the University

Water conservation Statement	Mean Student/Faculty	Mean difference/t-value	Total Mean (SD)
1. I minimize personal water use in the university.	S: 2.05(Agree) F:2.25 (Agree)	0.25 t-value = 0.160	2.4 (1.07) Agree
2. Leaky faucets and water tubes are readily replaced.	S:3.05 (Undecided) F: 3.25(Undecided)	-0.194 t-value = -0.479	3.13(1.07) Undecided
3. Recycling of water is practiced in the university.	S: 3.38 (Undecided) F: 3.67(Disagree)	-0.277 t-value = -0.790	3.5(0.94) Undecided
4. Water conservation should be included in the curriculum.	S:1.94 (Agree) F:1.75(Agree)	0.194 t-value = 0.606	1.87 (0.78) Agree
5. I believe that the university should invest on water conservation campaign activities.	S: 1.61(Agree) F: 1.75(Agree)	-1.39 t-value = -0.458	1.67(0.802) Agree

The result showed that the respondents practice water conservation in the university which is congruent to their answer on water conservation practice at home. It must be noted nevertheless, that the respondents did not clearly perceive the university's water conservation practice, as shown in their

undecided response for repair of leaky faucets and recycling of water. Both groups of respondents agree that the university makes investments on water conservation campaign activities. This may mean that the respondents also would like to see the stand of the university on environmental issues including water conservation. Both groups of respondents also agree that water conservation may be included in the curriculum. Looking at the lukewarm response of the science students who were already taught water conservation as part of their lesson in a subject, it must also be projected that other students in the university may not be compelled to practice water conservation, if they are not taught about it in a proper forum.

General Statements

Two general statements in terms of water conservation are included in the questionnaire. The result on Table 16 showed that the students and faculty qualitatively responded Undecided and Disagree to both questions respectively with no significant difference in their responses at t values equal to -1.79 and -2.14.

Table 16. T-test for Responses in General Statements for Conservation of Wwater in the University

	General Statement	Student/Faculty Mean	Mean difference/ t-value	Total Mean (SD)
1.	The university has a water treatment facility.	S: 3.28 (Undecided) F:4.08 (Disagree)	-0.806 t-value = -1.79	3.6(1.25) Disagree
2.	The university has an effective water management system.	S:2.94 (Undecided) F: 3.83 (Disagree)	-0.888 t-value = -2.14	3.3(1.18) Undecided

The respondents perceived that the university has no water treatment facility, let alone undecided on the effective water management system in the university. Admittedly, water is an important commodity to all men and everyone should have an access to water wherever they may be. Thus, the necessity of periodic review on which department in the university sees and practices water quality a responsibility; after all, unclean water intake leads to many diseases enough to disrupt operation of classes on campus.

IV. PERCEPTION ON WASTEWATER MANAGEMENT

Wastewater, when treated, can still be used for other purposes, aside from drinking. Some eight questions in the survey questionnaire focus on this issue. The results in Table 17 showed that among the eight questions, the student and faculty responses have the same qualitative answers for five statements. Statement 1 to the effect that polluted water should undergo treatment, the respondents gave a qualitative response of Strongly Agree with no significant difference in their responses at t-value of -2.89. In the fourth

statement that wastewater treatment payment must be marked on a monthly separate bill, both groups responded Undecided with no significant difference of their response at t-value equal to 1.02. In statement 6 that wastewater treatment payment must be an additional surcharge for real property tax, the respondents gave a qualitative answer of Undecided with no significant difference in both responses based on the t-value of 0.78. In the seventh statement that wastewater treatment payment must be a flat charge, regardless of the type of property and number of residents in a household, the respondents gave a qualitative answer of Undecided with no significant difference in their responses at t-value of -0.74. For the eighth statement that customers who refuse to pay the wastewater treatment will have their water services terminated, both groups of respondents gave a qualitative answer of Agree with no significant difference in their responses at t-value of 0.310.

In statement 2, stipulating that wastewater treatment must be paid for by the consumer, the student response is Undecided, while that of the faculty Agree. There is no significant difference in the responses at t-value of 0.954. The total mean of their responses stresses that the overall perception yields a qualitative answer of Agree. In statement 3 that wastewater treatment payment must be included in the monthly water usage bill, the students response is Undecided, while that of the faculty Agree, with no significant difference in the responses at t-value of 1.96, thus, the overall response is Agree. In the fifth statement, that charges of the wastewater treatment must be based on the value of the property, the student response is Undecided while that of the faculty Agree at t-value of 1.76, with the total mean for both groups answering Agree.

Table 17. T-test for Responses in Perception of Wastewater Management

	Wastewater Statement	Mean Student/Faculty	Mean difference/ t-value	Total Mean (SD)
1.	Polluted water should undergo treatment.	S:1.11 (Strongly Agree) F: 1.17 (Strongly Agree)	-0.56 t-value = -2.89	1.133(0.507) Strongly Agree
2.	Wastewater treatment must be paid by the consumer.	S: 2.55 (Undecided) F: 2.08 (Agree)	0.47 t-value = 0.954	2.36(1.32) Agree
3.	Wastewater treatment payment must be included in the monthly water usage bill.	S: 2.67 (Undecided) F: 1.75 (Agree)	0.92 t-value = 1.96	2.30(1.317) Agree
4.	Wastewater treatment payment must be on a monthly separate bill.	S: 3.22 (Undecided) F: 2.75 (Undecided)	0.47 t-value = 1.02	3.03 (1.25) Undecided
5.	Charges for wastewater treatment must be based on the value of property.	S:2.67 (Undecided) F:1.92 (Agree)	0.75 t-value = 1.76	2.36(1.33) Agree

Table 17. T-test for Responses in Perception of Wastewater Management *(continued)*

Wastewater Statement		Mean Student/Faculty	Mean difference/ t-value	Total Mean (SD)
6.	Wastewater treatment payment must be an additional surcharge for real property tax.	S: 3.00 (Undecided) F: 2.67 (Undecided)	0.333 t-value = 0.78	2.87 (1.25) Undecided
7.	Wastewater treatment payment must be a flat charge regardless of the type of property, and number of residents in a household.	S: 2.61 (Undecided) F:3.00 (Undecided)	-0.38 t-value = -0.74	2.77(1.35) Undecided
8.	Customers who refuse to pay the wastewater treatment will have their water services terminated.	S: 2.39 (Agree) F: 2.25 (Agree)	0.138 t-value = 0.310	2.33 (1.18) Agree

From these results, the student and faculty perceived that wastewater treatment is important and that the payment of such services should be shouldered by the consumers. Notably, as to payment for the services of wastewater treatment, the student response is Undecided to show that they did not believe that it is their right to respond to these questions, because they are not the ones paying for their water bill. Looking at the response of the faculty however, one notes that they agree that wastewater treatment must be shouldered by the consumers. It just showed their eagerness to support the wastewater treatment, a positive attitude that reinforces a similar study done in Bangkok, Thailand (Farid, 2010). Other issues regarding the exact payment and the manner of determining how much to pay for this, both groups responded Undecided. In the Philippine setting, it has to undergo a due process of public hearing and further study by the Lower House and Senate before the payment scheme can be approved.

A person-to-person interview was conducted to get a descriptive perspective on the survey conducted. Among the respondents responses were

"I am familiar with ways of conserving water at home because I learned them at home and in school……."

"I am not familiar with the Water Code of the Philippines and it should be taught in science subjects such as environmental science and science 3…."

"The University must be proactive in its water conservation campaign as well as in the solid waste management…."

"I am now aware of the Water Code of the Philippines and understand that I have no chance of complaining against digging up of Maynilad in highways…."

"There should be rain harvesters on the roof of the buildings at the University…"

"The University should put up wastewater facility to ensure water supply in the rest rooms and to water plants around.."

Faculty members of the Department of Physical Sciences handling Science 3 (Earth and Environment) as well as those handling Environmental Chemistry were also interviewed on the inclusion of the water code, water management and water conservation in their syllabus. It has been found out that water conservation is thoroughly discussed in the class, however, the water code and water management topics are not given emphasis in class. The Director of Physical Plant and Campus Development was also interviewed on the Waste Management Program of the University, and reported that there are already plans on carrying out the solid waste management on campus.

SUMMARY

This study has been conducted to appraise knowledge of water code and perception of water efficiency practices at home and in the university as well as wastewater management among the students and faculty members of the Department of Physical Sciences.

The following results revealed the knowledge on the water code in terms of appropriation, water use preference, ownership, utilization, control and conservation of water.

a. On appropriation. The result showed that the respondents do not clearly know that it is the role of the national government to responsibly appropriate water. The high response on the water concessionaire must be due to the rampant announcement of concessionaires on different media on the schedule of allocating water in some parts of the Greater Manila Area.
b. Water use preference. Comparing the respondents ranking to the PD 1067 preference, one notes that in PD 1067, industrial use was ranked as 7th, while in the current study ranked it 4th. The municipal use was ranked 1.5 in the PD 1067, but in the current study, 6th. After promulgating PD 1067 for after thirty-four years, the development of the country veers towards industrialization, thus water preference has also changed. It must also be noted that in the national water vision (2000), domestic and other water supply use, irrigation and hydropower are still prioritized for water preferences.
c. Ownership. The respondents did not clearly understand that water is owned by the state so that they cannot use it whenever and however they like. Yet, the respondents are knowledgeable that springs in the property are not solely for their own use, as stated in Article 3 and 4.

d. Utilization. The student and faculty are knowledgeable in the proper use of water source in their property.
e. Control of water. The first statement has a positive relation with the statement from PD 1067 and the respondents clearly know that they can erect structures to protect their property from water encroachment. However, the respondents were not really knowledgeable on the last two statements regarding the government's role when a river crosses a property during a natural disaster and the demand of payment for such.
f. Conservation of water. The faculty and students strongly agreed that water conservation is a concern for everybody, but failed to see the government's role in water management, much less had any idea on the water management system of the government.

The water management practices at home is divided into supply of water, conservation practices and general observations.

a. Supply. As perceived by the respondents, there is more than enough water to supply their needs, yet remain undecided if the supply of water would suffice after ten years. The respondents were also undecided on considering tap water as their sole source of water, perceiving that the tap water at home is of good quality, but remain undecided about its fitness for drinking.
b. Conservation. The respondents' responses showed that the students and faculty practice water conservation somehow. This means that it is not regularly practiced, as seen in the respondents' numerical rating which does not border near the Strongly Agree response. The responses simply suggest that the respondents are not habitually practicing water conservation at home.
c. General Statements. The results showed that the respondents believed that water supply should be readily available and that they are ready to pay for any water services provided them.

The water management practices in the university are divided into supply of water, conservation practices and general observations.

a. Supply. The student and faculty response showed that the water supply in the university is insufficient at the moment. Furthermore, the respondents cannot decide on quality of water at the university as good, thus, they perceived that its tap water is unfit for drinking; thus, they prefer to purchase their drinking water. The respondents are equally undecided on the supply of water in the comfort rooms, on the supply of water ten years from now and on the plans of the university to meet future water needs.

b. Conservation of water. The result showed that the respondents practice water conservation in the university which is congruent to their answer on water conservation practice at home. However, it must be noted that the respondents did not clearly perceive the university's water conservation practice, as shown in their undecided response for repair of leaky faucets and recycling of water.
c. General Statements. The respondents perceived that the university has no water treatment facility and undecided on the effective water management system on campus.

For the wastewater treatment, the results showed that the student and faculty perceived that wastewater treatment is important and that the payment of such services should be shouldered by the consumers. Notably, in terms of payment for the services of wastewater treatment, the student response is Undecided to show that they did not believe that it is their right to respond to these questions, because they are not the ones paying for their water bill. By contrast, the faculty agree that wastewater treatment must be shouldered by the consumers.

CONCLUSIONS

This study sought to appraise the knowledge of PNU's students and faculty at the Department of Physical Sciences about the water code and perception of water efficiency practices at home and in the university as well as wastewater management on campus. Findings revealed that the respondents were knowledgeable in the general provisions of the Water Code of the Philippines on utilization of water, conservation of water, ownership and water use preference. However, there is a need to revisit the provisions on issues regarding appropriations, and control of water. Groups of respondents showed no significant difference in their responses to all question in the survey questionnaire.

The respondents perceived that there was enough supply of water in their homes, but not much in the university and are willing to pay for the water services. They practice water conservation at home and in the university, yet did not perceive that it had done efforts in water conservation. They agreed that water conservation should be included in the curriculum and that the university should invest on water conservation materials.

The respondents both agreed that wastewater must be treated and showed willingness to pay for the wastewater treatment services.

RECOMMENDATIONS

In light of the findings and conclusions arrived at in this study, it is highly recommended that the water code be included in the curriculum, especially in the General Education subject, Science 3, Earth Science. Also the felt need to campaign vigorously and practice conservation of water at home and in the university. Finally, PNU has to create an Environmental Management Division to address issues linked to water management and other related environmental issues in the University system.

REFERENCES

Dayrit, Hector (2001). THE PHILIPPINES: FORMULATION OF A NATIONAL WATER VISION. Environment and Natural Resources Development Division of ESCAP and to the FAO Regional Office for Asia and the Pacific Report retrieved from **http://www.fao.org/docrep/004/AB776E/ab776e03.htm**

Farid, Husnia Luluk (2010). Water use by households in Banjarsari, Surakarta, Center for River Basin Organizations and Management, Solo, Central Java, Indonesia, CRPOM,s.24

Maynilad ppt presentation to DENR

McDermaid, Karyn K. (2000). A Step-by-Step Guide to Conducting a Social Profile for Watershed Planning. Department of Natural Resources and Environmental Sciences, University of Illinois at Urbana-Champaign, University of Illinois Board of Trustees

Murray , Darling Basin Commission Guiding principles for sustainable groundwater management. retrieved from http://www.iah.org.au/pdfs/SY posn paper.pdf

NHT Towards a national framework for managing the impacts of groundwater and surface water interaction in Australia . retrieved from http://www.nht.gov.au/ncc/ground-surface-water.html

Orleans, Antriman V (2010). Exploring student and subject related sources of bias in student's teacher performance ratings. Research Series No. 123, Center for Research and Development in Education, Philippine Normal University, Manila.

UN Status Report on Integrated Water Resources Management and Water Efficiency Plans on Sustainable Development Prepared,16th session of the Commission, May 2008.

Water Management. Retrieved from http://www.ibm.com/smarterplanet/ph/en/water_management/ideas/?&re=spf Water Management. Retrieved from http://www.connectedwater.gov.au/framework/index.html