WATER MANAGEMENT AUDIT REPORT
FOR
Poornima Institute of Engineering and Technology
ISI-2, RIICO Institutional Area, Goner Road,
Sitapura, Jaipur - 302022

Carried On
30th Jun, 2021

Carried Out By

ELION TECHNOLOGIES & CONSULTING PVT LTD

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1. INTRODUCTION

Poornima Institute of Engineering & Technology, was established in 2007 with the aim of imparting pragmatic technical education. In its magnificent journey of 12 years, PIET has set benchmarks and reached at new pinnacles in Engineering Education with dedication, perseverance and devotion. PIET is spearheading its outstanding voyage with the motto 'Success is not a destination, it's a journey'.

Vision

To create knowledge based society with scientific temper through cutting-edge technologies, innovative research and to become valuable resource for enriching mankind.

Mission

1. To provide an environment that will allow students and faculty members to be skilled in creation and implementation of new ideas.
2. To provide platform to improve questioning, observing, testing, analyzing and communication skills.
3. To provide qualitative education and generate new knowledge with integration of emerging technologies and research.
4. To practice and promote high standard of potential ethics, transparency and accountability.

Elion Technologies and Consulting Pvt Ltd (Elion) team carried out remote audit of premises on 30th June, 2021. The audit was carried out using online meeting platform google hangout, prior to Audit questionnaire and checklists was shared with the client. During the audit Elion team carried out virtual visit of entire campus i.e. classrooms, library, washrooms, staff rooms, administration department, accounts department and hostels.

Campus Information

The college is offering courses in following fields:

Number of course/Programs: 3

- Computer Science
- Civil Engineering
- Artificial Intelligence & Data Science

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List of courses/Programs applied for closure (2020-21)

- Electrical Engineering (EE)
- Electronics & Communication (EC)
- Mechanical Engineering (ME)

Details of the infrastructure of Poornima Institute of Engineering & Technology is as per below:

Total Area: 96267.19 sq.ft
Green Area**:** lawn area(Front) 2300 sq.feet & lawn area(Back) 1014 sq.feet

Building Name	Areas (sq.ft)	Number of Floors
Block A	11142.5	4
Block B	4902.16	3
Block C	31938.11	4
Block D	10620.42	4
Gurushikhar Boys Hostel – GS-1	4412	5
Gurushikhar Boys Hostel – GS-2	5730	5
Gurushikhar Boys Hostel – GS-3	4416	5
Gurushikhar Boys Hostel – GS-4	4416	5
Gurushikhar Boys Hostel – GS-5	4416	5
Gurushikhar Boys Hostel – GS-6	4416	5
Gurushikhar Boys Hostel – GS-7	4416	5
Faculty Apartment	5442	5

During Audit, ELION team interacted with following stakeholders:

Name	Designation
Dr. Gautam Singh	Registrar & Chief Proctor
Dr. Sama Jain	Professor & HOD First Year
Mr. Ashwani Lata	Director(Student Welfare)

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2. ENVIRONMENTAL SETTING

The land use around the campus is mainly mix of residential and commercial area. There are educational institutes such as Apex Institute of Engineering and Technology and Swasthya Kalyan Institute, Garden and Hospital.

Poornima Institute of Engineering and Technology Campus

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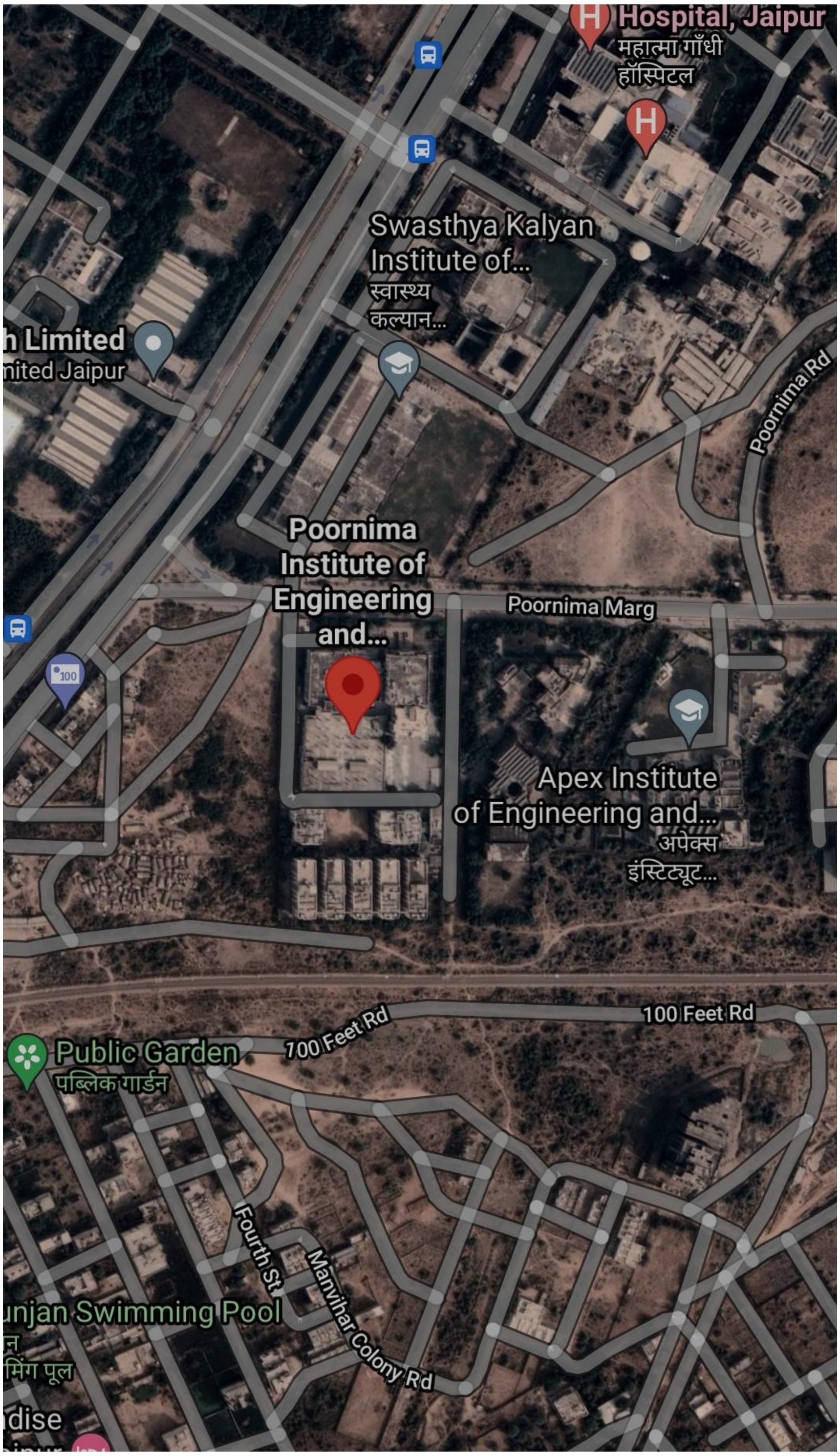

Location of Poornima Institute of Engineering and Technology Campus

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3. WATER MANAGEMENT AUDIT

For Water Management Audit following 2 major areas (including their subsections) were covered and compliance/ initiatives under these areas were verified/ validated.

a) Water Efficiency
b) Wastewater Management

3.1 Water Efficiency:

a) Submersible Pumps is used for water supply in the campus.
b) For drinking water, water coolers are used at various location in the campus.
c) Rain water harvesting system is installed in all the campus.
d) Water conservation faucets in washrooms were not seen. Installation of such faucets can save water and will help in minimizing the water footprint of the institute,
e) Water Policy is adopted by the college to improve water usage within the campus.
f) Normally mops are used for floor cleaning and hose is used for cleaning once a week
g) Dual flushing system is provided in the washrooms.
h) Signage are provided in washrooms emphasizing water conservation.
i) Water from air conditioning unit and reject water from water purifiers is reused for irrigation.

Water conservation Signage in Restrooms

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Water conservation Signage in Restrooms

3.2 Wastewater Management:

a) Wastewater/ sewage recycle is not practiced in the College as grey water/ sewage treatment/recycle facility is not provided.

b) Sewage Treatment plant should be provided and all the water should be recycled.

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4. RECOMMENDATIONS/ SUGGESTIONS

- Provide information on water usage and savings to students/ staff through notices, screen savers in computer labs.
- Dry sweep or use a sponge broom when possible, instead of using a hose to clean floors, sidewalks, or other hard surfaces.
- Minimize/ reduce water usage by installing water saving faucets such as pressmatic taps, tap aerators, jet sprays etc.
- Grey water/ sewage recycling system can be installed for flushing toilets. This will reduce the fresh water footprint.
- Installation of waterless urinals can be considered to reduce water consumption.
- Water balance diagram can be prepared to quantify the water consumption by installing water meters at key points. Based on data gathered, appropriate measures can be taken to reduce the water consumption.

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Water ManagementPolicy

Of

POORNIMA
INSTITUTE OF ENGINEERING & TECHNOLOGY
Affiliated to RTU, Kota • Approved by AICTE & UGC under 2(f) • Accredited by NAAC and NBA

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“Scientific management of water is increasingly recognized as being vital to India’s growth and ecosystem sustainability. The Government of India is being proactive about water management and has created the Ministry of Jal Shakti to consolidate interrelated functions pertaining to water management. The newly formed Jal Shakti Ministry under the guidance of Hon’ble Prime Minister has strived to over bridge the water challenge by launching the Jal Shakti Abhiyan - a campaign for water conservation and water security in 1592 water stressed blocks in 256 districts, to ensure five important water conservation interventions. These will be water conservation and rainwater harvesting, renovation of traditional and other water bodies/tanks, reuse, bore well recharge structures, watershed development and intensive afforestation. These water conservation efforts will also be supplemented with special interventions including the development of Block and District Water Conservation Plans, promotion of efficient water use for irrigation. Inspired by the Hon’ble Prime Minister’s impetus on Jal Sanchay, the Jal Shakti Abhiyan is a time-bound, mission-mode water conservation campaign. Government is advocating the adoption of best practices in water sector across India and recognizes that data-based decision making is going to be key to effective water management.”

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Executive Summary

Higher education institutions (HEIs) enjoy tremendous autonomy in terms of managing their natural resources. They are virtually independent and are internally regulated, while civilians, businesses, industries and others are subjected to, with close external monitoring and accountability. This opportunityofself-regulationavailabletothemwiththeirownheadsof universities presiding over their internal resource management system as the final authority can be the springboard to water conservation. Water conservation needs to be ingrained in not only the consciousness but also practicesofevery citizen and system. HEIs have to make unremitting efforts through faculty, staff and students to make the Jal Shakti Abhiyan successful. Key Water challenges include Water Conservation, Water Quality Management, Watershed Management, Storm water Management and Wastewater Management.

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Background, Needs and Trends

Less than one percent of the Earth's water is easily-accessible freshwater. As a result, water conservation and quality are global issues, and will become ever more important in the coming decades. Water is a renewable resource but with uneven distribution; changes in the water cycle 4 and increasing water quality problems are beginning to take severe tolls in many regions. Over 1.1 billion people do not have access to safe drinking water and 2.6 billion people lack adequate sanitation (2002 estimate by WHO/UNICEF JMP, 2004). Over 3,900 children die every day from water-borne diseases and 1.8 million people die every day from diarrheal diseases. The average person in North America and Japan uses about 100 gallons of water each day, the average European uses 50 gallons each day, and the average for a Sub-Saharan African is 2 to 5 gallons a day. Our potential for conservation is enormous. Overuse has the potential to adversely affect human health and can endanger ecosystems, particularly aquatic systems. Worldwide, as demand for water grows and large dams are often built, conflicts may arise, non-native species can invade, mosquito-borne illnesses often increase, and communities that have relied on natural water flow can find themselves high and dry. As water becomes scarcer throughout the world and water quality is depleted, people in many regions will covet it more than oil.

Universities around the nation, regardless of local precipitation amounts, are addressing their impact on the water sources around them.

Dozens of schools have created wetlands for wastewater treatment. Many universities who have changed practices to protect their water sources are marketing those changes with great success. Poornima Institute has done this on a limited scale, but can learn from the universities as it explores new and inventive ways to protect our water, promote and share our successes, and connect with the natural landscape around Jaipur. In addition to colleges and universities, hundreds of municipalities across the nation have undertaken innovative projects to reduce water demand and increase quality.

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About the Institute

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Highlights:

- State of Art of Infrastructure for innovative Teaching Pedagogy and ICT based learning
- Offering five streams of Engineering (CE, ECE, EE,ME & Civil) at UG level.
- Ranked 4th by Rajasthan Technical University under Quality Index Value Framework
- Accredited with NBA for B.Tech CSE & B.Tech EE in 2018
- NAAC Accredited institute from 2019
- Arbuda Convention Center: A Multimedia Auditorium with 500+ seating capacity.
- PBIC: The Entrepreneurship & Innovation Cell
- Six Industries started by PIET students under entrepreneurship named as MADTY Trips, Rashion Baf, DIFF THINK Initiatives & SHOPIENO.
- Campus oriented for Techno Managers.
- IEEE, ISTE, IE (I) and ISLE Student chapters.
- Organized workshops on various Technical and Non-Technical topics.
- Completely Wi-Fi enabled campus.
- Several projects sponsored by AICTE & DST, Govt. of Rajasthan.
- Collaboration with IBM for research on Business Intelligence and Cloud Computing.
- Hands on Learning with Project Oriented Lab & Non Syllabus Projects
- Focus on outcome based education with proper mapping through, CO's PO's, & PSO's
- More than 10 SCI/Scopus & around 80 UGC Publications in 5 years
- Research Grants of more than 30 Lac in 5 years
- Regular and quality placements in all Major MNC's like Infosys, Capgemini. IBM, Adani, etc.
- Industry oriented labs for quality education IBM, Oracle, FACE, Redhat, CESA etc.
- Activities in association with NEN, AICTE, DST, RTU
- Regular conduct of National & International Conference/Workshop/Seminar etc.
- Students oriented activities through Clubs & Student council

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- Placement oriented initiatives for skill development and Outcome of quality placements
- Rigorous and transparent Continuous Internal Examination System
- Within in the ambit of University Syllabus, offering quality academic flexibility
- Tutor Mentor system for support & Stress management
- Faculty Felicitation & Reward system and similar systems for students
- Concerned for Environment & sustainability, Waste Management, Rain Water Harvesting,
- Value Added courses & Certification courses offered across all disciplines
- Well laid down Teaching Learning Process, with extreme focus of quality delivery
- Established ERP system for Feedback mechanism
- Catering to diverse category of students from all regions of nation
- Faculty members getting recognised at National & International level
- Catering to society under CSR activities
- Facilities for Sports, Gymnasium, Cultural Activities, Auditorium
- Rich library with IEEE subscription
- Quality hostel & accommodation facility

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Role of Higher Education Institutions in Water Conservation

- Build consensus on the need for water conservation on campus with students, administration, faculty and other internal as well as external stakeholders
- Facilitate design of specific interventions for making the campus water sufficient and water efficient by following best available standards and accepted parameters
- Monitor the existing water management in the campus with participation and transparency
- Present a step-by-step guide for conserving water on the campus
- Generate case studies on best water conservation practices adopted on the campus. These instances can serve as models for other institutions and villages to adopt
- A core team consisting of the leadership of the institution along with key stakeholders may be formed. The team shall work as "Campus Water Management Team".
- The team that would be involved in all aspects of exploring, surveying, fact-finding, recording, planning, taking action and monitoring will also include all relevant stakeholders viz., citizens, student teams, their teachers, apart from administrative officials concerned in both campuses.
- One or two interested or environmentally-concerned-inclined faculty members may be given the responsibility to lead the water conservation movement in the respective realms. This team henceforth will select a group of enthusiastic students starting from their own departments to be part of the core campaign team.
- The "Campus Water Management Team" will report to a team of campus officials representing accounts, administration and maintenance divisions, with an avid interest in the water conservation initiatives.
- The entire programme will run under direction from the designated authority that will set the policies, rules and directives for bringing change.
- Water Conservation Initiative can be a successful only if the Head of the Institution ignites the spirit of everybody in the organization. S/he needs to direct the departments, pay attention to the findings of student teams and ensure that their valuable suggestions are followed in letter and spirit by all students, faculty members as well as administrative, non- teaching and support staff. A motivated leader can bring a sea-change in the system and therefore s/he is the cornerstone of this campaign. An advisory committee may be constituted to guide the initiative.

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The Master Plan

It addresses conservation as well as quality and addresses PIET need to conserve and protect its water resources. The Master Plan and the Blueprint complement each other very well as PIET enacts ever-stronger water policies in future years. For more information,

Sources of Water

Ground Water

Groundwater is the water present beneath Earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water. The depth at which soil pore spaces or fractures and voids in rock become completely saturated with water is called the water table. Groundwater is recharged from the surface; it may discharge from the surface naturally at springs and seeps, and can form oases or wetlands. Groundwater is also often withdrawn for agricultural, municipal, and industrial use by constructing and operating extraction wells. The study of the distribution and movement of groundwater is hydrogeology, also called groundwater hydrology.

Rainwater Recharging

Groundwater is recharged naturally by rain and snow melt and to a smaller extent by surface water (rivers and lakes). Recharge may be impeded somewhat by human activities including paving, development, or logging. These activities can result in loss of topsoil resulting in reduced water infiltration, enhanced surface runoff and reduction in recharge. Use of groundwater's, especially for irrigation, may also lower the water tables. Groundwater recharge is an important process for sustainable groundwater management, since the volume-rate abstracted from an aquifer in the long term should be less than or equal to the volume-rate that is recharged.

Recharge can help move excess salts that accumulate in the root zone to deeper soil layers, or into the groundwater system. Tree roots increase water saturation into groundwater reducing water runoff. Flooding temporarily increases river bed permeability by moving clay soils downstream, and this increases aquifer recharge.

Artificial groundwater recharge is becoming increasingly important in India, where over-pumping of groundwater by farmers has led to underground resources becoming depleted. In 2007, on the recommendations of the International Water Management Institute, the Indian government allocated
₹1,800 crores (equivalent to ₹44 billion or US$610 million in 2019) to fund dug-well recharge projects (a dug-well is a wide, shallow well, often lined with concrete) in 100 districts within seven states where water stored in hard-rock aquifers had been over-exploited. Another environmental issue is the disposal of waste through the water flux such as dairy farms, industrial, and urban runoff.

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Rainwater storage

Although close to three-fourths of our planet is made of water, not all of it is suitable for use. The water in the oceans and seas cannot be used as drinking water, and little of it can be utilized for other purposes. As a result, there is a constant shortage of water that is either good for drinking or home and industrial use.

Areas on the planet that have long faced water shortage were able to combat this problem by harvesting what little rainwater they received and storing it for daily usage.

Water QualityStandards

Water is usually tasteless, odorless, colorless and, a liquid in its pure state. But water is one of the best naturally occurring solvents on earth and almost any substance will dissolve in it to some degree. This is why it is seldom found in its "pure" state and it usually contains several impurities (gases, solids,color). Water falling to earth as rain dissolves some of the gases in the atmosphere and when it falls on the earth and percolates through it, it dissolves the minerals present in the earth.

Water Sources

Surface waters are those that come from rivers, streams, ponds, lakes and reservoirs, while ground waters come from wells, mines and springs. Ground water usually contains large amounts of dissolved substances (minerals) because it percolates (slowly filters) through rock and soil formations. The greater the depth below ground from which the ground water comes, the higher the level of dissolved minerals in the water. However, since it percolates through the earth, ground water contains relatively small quantities of suspended impurities and very little color. In contrast, surface waters contain lower levels of dissolved minerals, but higher suspended impurities, color and industrial pollutants.

Physical Impurities

These are usually in the form of suspended impurities and color which can be separated from the water by filtration. Suspended impurities are usually due to soil erosion and this silt gives the water a hazy appearance. This is referred to as 'turbidity' and will often settle out slowly in reservoirs or tanks when this water is retained in these for some time. Odor and taste in water are due to the presence of dissolved gases such as sulfides, microorganisms, natural organic contaminants such as lignins, tannins and humic acids, and, increasingly now, due to industrial contaminants. Color and turbidity are usually measured by instruments available for these purposes and are expressed in "Hazen units" for color and in "Nephlometric Turbidity Units (Ntu)" for turbidity.

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Mineral impurities

Water dissolves the minerals present in the strata of soil it filers through in the case of ground water and, in the case of surface water, the minerals present in the soil over which it flows (rivers/streams) or over which it stands (lakes, ponds, reservoirs). The dissolved minerals in water are commonly referred to as Total Dissolved Solids (TDS). The TDS content of any water is expressed in milligrams/litre (mg/l) or in parts per million (ppm).

The minerals are basically compounds (salts) of Calcium(Ca), Magnesium(Mg) and Sodium(Na) What is commonly called as 'hardness in water' is due to the compounds/salts of Ca and Mg such as Calcium or Magnesium Chloride, Calcium or Magnesium Sulphate (CaSo4, MgCl, etc). In some areas of India, there are ground waters which contain fluoride salts of Ca and Mg. Fluoride in water above 1.5mg/l is dangerous and causes a disease called 'Fluorosis' which affects the teeth and the bones of humans who consume water with high levels of fluoride. Iron is another contaminant/impurity which is not safe for human consumption if it is present in water in excess of 0.3mg/l. In several parts of eastern India, Arsenic is an impurity which has been found in ground water and needs to be removed as it is a slow poison.

Organic Impurities

The upper layer of the earth's crust contains residual vegetable and animal matter along with bacteria and other micro-organisms. Surface waters therefore usually contain some organic matter (tannins, lignins, humic acid, fulvic acid) and are more readily exposed to biological contamination. Surface waters are subject to seasonal changes because of rainfall and also due to domestic as well as industrial pollution. Agricultural run offs which bring with its pesticides and fertilizer residues are starting to cause serious problems with the use of surface waters. The constituent nutrients of fertilizers such as phosphorus and nitrogen can cause rapid, wide spread growths called "algal blooms" in lakes, ponds and reservoirs

Ground waters were relatively free from such contamination because of the filtering effect of the strata of soil through which the water percolates, but, over the decades industrial contaminants have begun to show up even in ground waters. This is because of the laxity in implementing/enforcing pollution control laws as a result of which untreated domestic and industrial effluents which has been discharged into open land has over the years percolated down to the water table and contaminated the ground water. This shows up in water in the form of BOD (biodegradable/biochemical oxygen demand) and COD (combined oxygen demand). These are two important parameters normally associated with effluents which are an indication of the extent of contamination which have now begun to show up in ground water and to a greater extent in surface water.

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Standards of Water for Human Consumption

Drinking water for human beings should contain some level of minerals (TDS), but these levels should not be excessive. The standard that applies to India is the BIS 10500-1991 standard (refer to attached table for the important parameters).This standard used the WHO standard as the basis and has been amended subsequently to take into account the fact that over exploitation of ground water which has the largest share of water supplied for human use has deteriorated to such an extent that the crucial parameters such as TDS, hardness, Chlorides, etc. usually exceed the desirable levels substantially. Consequently, a higher permissible limit has been specified. Water used for drinking becomes

unpalatable when the TDS level is above 500 mg/l, but lack of any better source enables people consuming such water to get used to its taste.

The BIS standard applies to the purity level acceptable for human beings to drink. For practically all industrial and some commercial uses, the purity levels required are very much higher and in most cases demand water with virtually no residual dissolved solids at all.

Water Testing

The one certainty about ground water today is that its quality will continue to deteriorate over a period of time. The rate of deterioration will depend on the rate at which the water is extracted from the source and the levels of pollution that enter the source from time to time. Testing water samples regularly is advisable to keep track of the changes (deterioration). Water testing facilities are available with most Boards/Authorities that are responsible for supplying water to cities and towns as well as industrial estates. Increasingly stringent enforcement of pollution control laws has resulted in a substantial demand for laboratory facilities for water and effluent testing. There are numerous private water testing agencies in the field who, if they are assured of a steady flow of samples, will provide service that includes their personnel visiting the place for collection of samples to be taken for analysis.

Like the ISO-9000 quality system, an NABL accredited laboratory's results are acceptable to any government authority (particularly Pollution Control boards). NABL is the National Accreditation Board for Laboratories and is a very stringent quality system involving regular surveillance audits to retain the NABL certification or for renewing it. This quality system involves testing methods which are clearly specified and standardized for consistent, accurate results.

Laboratories run by the water supply boards/authorities usually carry out tests only for a few important parameters relevant for water used for human consumption. Laboratories other than these offer the full spectrum of service and offer to test a select few or all the parameters for which they charge accordingly. Where bacteriological tests are involved to check if the water is safe for drinking, specially sterilized bottles are to be used (provided by the lab), sampling procedures are to be followed and the sample is to be returned to the lab within a fixed period of time, as the

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tests have to be carried out within a specific period of time to ensure accurate results are obtained. Somewhat similar procedures are necessary for getting the BOD/COD figures for a sample of water or effluent.

If neither of the above two types of tests are to be carried out, a sample of water can be given to the laboratory in a PET/Polythene bottle of at least 2 liters volume. The bottle should be thoroughly rinsed in the water/effluent which has to be tested before filling it, properly sealed and labeled with date of collection, source and type of sample, name of the person/agency that requires the test report and then given to the laboratory.

Purification Processes

Depending on the end use of water, the analyses report of a sample of that water gives a clear indication of the type of purification that is required. In brief, the following are the purification processes available in India.

a) Water with turbidity in excess of limit specified in BIS 105000

-Pressure filtration with addition of a coagulant.

-Pressure filtration with chlorination/ozonisation if bacteria are present.

b) Water with total hardness in excess of limit specified by BIS 105000

-Sodium Base Exchange water softening or nano filtration.

c) Water with TDS level in excess of limit specified in BIS 105000

- Reverse Osmosis desalination or electro dialysis depending on the level of TDS present.

d) Water with iron content in excess of limit specified by BIS 105000

-If iron is in the dissolved form, aeration of water to oxidize and precipitate the iron, coagulant dosage followed by pressure filtration. OR

-Using an iron removal filter containing iron removal media.

e) Water with Fluoride content in excess of the limit specified by BIS 105000

- Using a Deflouridation unit containing fluoride removal media.

f) Water with only bacteriological contamination (for domestic use)

- Boiling for 20 minutes, exposure to ultra violet light, iodination, ultra filtration. There are companies with substantial and proven expertise in water purification using all the above purification processes that can assess the user's requirement accurately and select appropriate treatment systems which they can supply, install and service.

Water quality parameters are added in "Addenda 1".

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Individual Goals

1. Conduct all on campus research using upgraded machinery and technology that conserves water and protects water quality. Researchers should be mindful of the natural resources supporting that research and conservation should be a priority in proper laboratory technique. Research and laboratory use on campus is important but must be done as efficiently as possible.
2. Decrease potable water use by converting to ditch water where possible.
3. Educate students, faculty, staff, and visitors about the semi-arid climate where PIET is located. Ensure every student knows campus water sources and ways to conserve those sources before leaving the Institute. Keep students involved in all water conservation efforts PIET takes-on.
4. Increase xeriscaping on campus and decrease water and energy intensive turfs.
5. Improve campus infrastructure.
6. Coordinate with the city of Jaipur, state of Rajasthan, other campuses, corporations, and governments to be a leader in water conservation and quality efforts. Use other case studies and success and failure stories to make the best decisions and provide support for efforts.
7. Continue to publicize and encourage student, faculty, and staff to report water waste on campus.
8. Use the wide range of campus and off-campus expertise in various fields including law, geography, geology, environmental studies, ethnic studies, economics, engineering, and architecture to implement a program for every department to participate in and strategize for the best water practices.
9. Protect the quality of water released downstream.
10. Provide research for other campuses. PIET is setting the standard for campus water conservation nation-wide and it will be important to share lessons learned here as well as learning from others.
11. Obtain at least three out of five possible LEED points for water use in all future building construction.

Further Planning and Research Needs

- Research new, efficient technologies for laboratories and their costs and savings.
- Research greywater systems and current law regarding greywater.
- Research efforts particularly in Jaipur and other arid regions.
- Research costs and savings of replacing all remaining water inefficient fixtures with efficient ones.
- Survey students, faculty (including housekeeping), and staff about how they can report or fix water waste.
- Research departmental interest in water conservation and quality issues and plan forums to discuss them.
- Research water pollution sources and target areas for improvement.
- Research cost savings of obtaining LEED points in water conservation.

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Challenges

- The education system is hard to change. Currently traditional, non-systematic, specialized approaches to education are embraced and taught. This linear thinking does not emphasize how students' individual actions, such as water use, fit into the greater context of resource use. It also allows students to leave this Institute without knowing how their actions affect the foundation of resources they rely on to survive. Future legislators, politicians, activists, teachers, businesspersons, and scientists leave this Institute and change the way we are required and expected to behave toward our environment. Without a systematic education linking business, economics, law, human rights, and science to water quality and use, the future ability of this Institute to grow in its efforts to conserve and protect its resources, may be limited.
- Infrastructure is costly to overhaul on a large scale. Changing one large cause of water waste is usually much less costly than making many, smaller changes, such as faucets and other small parts, due to the necessity of more manual labor and the cooperation of different departments and buildings.
- Continual decreases in funding for the campus make it financially difficult to pay initial costs of conservation programs.
- Structural problems of older buildings and designs make new technologies difficult to incorporate.
- Meters will be updated by the city and may cause some problems initially in comparing and tracking data before and after the update, but new meters will benefit accuracy in measurement in the future.

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- Mindset of water use is hard to change. For example, after some major upgrades to campus facilities, some residents removed low-flow showerheads and other water-saving technology because they were not used to the low flow pressure. These residents remain unaware of or chose to ignore the problems associated with using precious water resources and proper conservation practices.
- Legislators and industry leaders typically have access to plenty of clean water to use while a growing population in our country and the world does not have adequate sanitary water. This imbalance keeps water issues on the backburner while many people are struggling to survive. Focusing on human rights and equality will help bring water to the forefront of policy and business practices while creating a balance in safe water access.

Social Impacts

Water issues are strongly tied into socio-economic issues particularly regarding environmental justice. Worldwide, lack of enough water and abundance of unsafe water and water-borne illnesses exist mostly in poorer areas. In India, contaminated water from industry and waste disposal also disproportionately affects poorer people and people of color. Addressing this serious problem in conjunction with the environmental impacts of poor water quality and drought make issues surrounding water even more pertinent and pressing.

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Water Conservation

Additional opportunities for water conservation include process cooling and conversion of additional areas to non-potable water irrigation.

Goal

Limit environmental impacts and costs through water conservation.

Guidelines

- Identify opportunities to reduce use of treated water to cool equipment through process cooling.
- Convert additional irrigated areas to the use of non-potable water.
- Optimize raw water resources on all of PIET.

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Class of Water

Classification	Type of use
Class A	Drinking water source without conventional treatment but after disinfection
Class B	Outdoor bathing
Class C	Drinking water source with conventional treatment followed by disinfection.
Class D	Fish culture and wild life propagation
Class E	Irrigation, industrial cooling or controlled waste disposal

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TOLERANCE LIMITS

TABLE-1: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – A

S. No.	Characteristic	Tolerance
(1)	**(2)**	**(3)**
(i)	pH	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l,	6.0
(iii)	Bio-chemical Oxygen Demand	2.0
(iv)	Total Coliform Organisms, MPN/100 ml, Max	50
(v)	Colour, Hazen units, Max	10
(vi)	Odour	unobjectionable
(vii)	Taste	Agreeable taste
(viii)	Total Dissolved Solids, mg/l, Max	500
(ix)	Total Hardness (as $CaCO_3$), mg/l ,Max	300
(x)	Calcium Hardness (as $CaCO_3$), mg/l, Max	200
(xi)	Magnesium (as $CaCO_3$), mg/1,Max	100
(xii)	Copper (as Cu), mg/l, Max	1.5
(xiii)	Iron (as Fe), mg/l,Max	0.3
(xiv)	Manganese (as Mn), mg/1,Max	0.5
(xv)	Chlorides (as Cl), mg/l,Max	250
(xvi)	Sulphate (as SO_4), mg/l ,Max	400
(xvii)	Nitrates (as NO_2), mg/1,Max	20
(xviii)	Fluorides (as F,) mg/l,Max	1.5
(xix)	Phenolic compounds(as C_6H_5OH), mg/l,Max	0.002
(xx)	Mercury (as Hg), mg/l ,Max	0.001
(xxi)	Cadmium (as Cd), mg/1,Max	0.01
(xxii)	Selenium (as Se), mg/l ,Max	0.01
(xxiii)	Arsenic (as As), mg/1,Max	0.05
(xxiv)	Cyanides (as CN), mg/l, Max	0.05
(xxv)	Lead (as Pb), mg/l, Max	0.1
(xxvi)	Zinc (as Zn), mg/l, Max	15
(xxvii)	Chromium (asCr^{6+}), mg/l,Max	0.05
(xxvii)	Anionic detergents, (as MBAS), mg/l ,Max .	0.2
(xxix)	Poly-nuclear aromatic hydrocarbons (PAH),	0.2
(xxx)	Mineral oil, mg/l ,Max	0.01
(xxxi)	Barium (as Ba), mg/l ,Max	1.0
(xxxii)	Silver (as Ag), mg/l Max	0.05
(xxxiii)	Pesticides	Absent
(xxxiv)	Alpha emitters, µc/ml, Max	10^{-9}
(xxxv)	Beta emitters, µc/ml, Max	10^{-8}

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TABLE- 2: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – B

S.	Characteristic	Tolerance Limit
(1)	**(2)**	**(3)**
(i)	pH Value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/1,Max	5.0
(iii)	Biochemical Oxygen Demand (5 days at 20 °C),	3.0
(iv)	Total Coliform Organisms, MPN/100 ml, Max	500
(v)	Fluorides (as F)<mg/l, Max	1.5
(vi)	Colour, Hazen units, Max	300
(vii)	Cyanides (as CN), mg/l, Max	0.05
(viii)	Arsenic (as As), mg/l, Max	0.2
(ix)	Phenolic Compounds (as C_6H_5OH) mg/l, Max	0.005
(x)	Chromium (as Cr^{6+}), mg/l, Max	1.0
(xi)	Anionic detergents (as MBAS), mg/l, Max	1.0
(xii)	Alpha emitters, μc/ml, Max	10^{-8}

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TABLE - 3: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – C

S.No.	Characteristic	Tolerance Limit
(1)	**(2)**	**(3)**
(i)	pH Value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l Minimum	4.0
(iii)	Biochemical Oxygen Demand	3.0
(iv)	Total coliform organisms, MPN/100 ml, Max	5000
(v)	Colour, Hazen units, Max	300
(vi)	Fluorides (as F), mg/l ,Max	1.5
(vii)	Cadmium (as Cd), mg/l, Max	0.01
(viii)	Chlorides (as Cl), mg/l, Max	600
(ix)	Chromium (as Cr^{6+}), mg/l, Max	0.05
(x)	Cyanides (as CN), mg/l, Max	0.05
(xi)	Total Dissolved Solids, mg/l, Max	1500
(xii)	Selenium (as Se), mg/l, Max	0.05
(xiii)	Sulphates (as SO_4), mg/l, Max	400
(xiv)	Lead (as Pb), mg/l, Max	0.1
(xv)	Copper (as Cu),mg/l,Max	1.5
(xvi)	Arsenic (as As), mg/l, Max	0.2
(xvii)	Iron (as Fe), mg/l, Max	50
(xviii)	Phenolic compounds (as C_6H_5OH), mg/l,	0.005
(xix)	Zinc (as Zn), mg/l, Max	15
(xx)	Insecticides, mg/l, Max	Absent
(xxi)	Anionic detergents (as MBAS), mg/l, Max	1.0
(xxii)	Oils and grease, mg/l, Max	0.1
(xxiii)	Nitrates (as NO_3), mg/1,Max	50
(xxiv)	Alpha emititers, µc/mg, Max	10^{-9}
(xxv)	Beta emitters, µc/ml, Max	10^{-8}

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TABLE- 4: TEOLERANCE LIMITS FOR INLAND SURFACE WATERS, CALSS – D

S.No.	Characteristic	Tolerance Limit
(1)	**(2)**	**(3)**
(i)	pH value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l, Min.	4.0
(iii)	Free Ammonia (as N), mg/l, Max.	1.2
(iv)	Electrical Conductance at 25 °C, µS, Max	1000
(v)	Free Carbon Dioxide (as $C0_2$),mg/1, Max	6.0
(vi)	Oils and Grease, mg/l, Max	0.1
(vii)	Alpha emitters, µc/ml, Max	10^{-9}
(viii)	Beta emitters, µc/ml, Max	10^{-8}

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TABLE- 5: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – E

S.No.	Characteristic	Tolerance Limit
(1)	**(2)**	**(3)**
(i)	pH value	6.0 to 8.5
(ii)	Electrical Conductance at 25°C, µS, Max	2250
(iii)	Sodium Adsorption Ratio, Max	26
(iv)	Boron (as B), mg/l, Max	2.0
(v)	Total Dissolved Solids, (inorganic), mg/l, Max	2100
(vi)	Sulphates (as SO_4), mg/l, Max	1000
(vii)	Chlorides (as Cl), Mg/l, Max	600
(viii)	Sodium Percentage, Max	60
(ix)	Alpha emitters, µc/ml, Max	10^{-9}
(x)	Beta emitters, µc/ml, Max	10^{-8}

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TEST CHARACTERSTICS FOR DRINKING WATERS

IS — 10500:1991 (Amended)

S. No.	Substance Characteristic	Require-ment*	Undesirable effect outside the desirable limit	Permissible Limit**
A	**Essential Characteristics**			
1.	Colour, Hazen units, Max	5.0	Above 5.0, consumer acceptance decreases	25
2.	Odour	Unobject-ionable	-	-
3.	Taste	Agreeable	-	-
4.	Turbidity, NTU, Max	5.0	Above 5.0, consumer acceptance decreases	10
5.	pH Value	6.5 To 8.5	Beyond this range the water will effect the mucous membrane and/or water supply system	No relaxation
6.	Total Hardness, (as $CaCO_3$) mg/l, Max.	300	Encrustations in water supply structure and adverse effect on domestic use	600
7.	Iron (as Fe), mg/l, Max	0. 3	Beyond this limit taste/appearance are affected, has adverse affect on domestic uses and water supply structures, and promotes iron bacteria	1.0
8.	Chlorides (as Cl), mg/l, Max	250	Beyond this limit taste, corrosion and palatability are affected	1000
9.	Residual free Chlorine, mg/l, Minimum	0.2	-	-
B	**Desirable Characteristics**			
10.	Dissolved Solids, mg/l, Max	500	Beyond this palatability decreases and may cause Gastro intestinal irritation	2000
11	Calcium (as Ca) mg/l, Max.	75	Encrustations in water supply structure and adverse effect on domestic use	200
12.	Magnesium (as Mg) mg/l, Max	30	Encrustations in water supply structure and adverse effect on domestic use	100
13.	Copper (as Cu), mg/l, Max	0.5	Astringent taste, discoloration and corrosion of pipes, fitting and utensils will be caused beyond this	1.5
14.	Manganese (as Mn) mg/l, Max	0.1	Beyond this limit, taste/appearance are affected, has adverse effect on domestic use and water supply structure.	0.3

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15.	Sulphates (as SO_4), mg/l, Max	200	Beyond this causes Gastro intestinal irritation when magnesium or sodium are present	400
16.	Nitrate (as NO_3) mg/l, Max.	45	Beyond this methaemoglobinemia takes place.	100
17.	Fluorides (as F), mg/l, Max	1.0	Fluoride may be kept as low as possible. High fluoride may cause fluorosis	1.5
18	Phenolic compounds (as C_6H_5OH), mg/l, Max	0.001	Beyond this, it may cause objectionable taste and odour	0.002
19.	Mercury (as Hg), mg/l, Max	0.001	Beyond this, the water becomes toxic	No relaxation
20.	Cadmium (as Cd), mg/l, Max	0.01	Beyond this, the water becomes toxic	No relaxation
21.	Selenium (as Se), mg/l, Max	0.01	Beyond this, the water becomes toxic	No relaxation
22.	Arsenic (as As), mg/l, Max	0.2	Beyond this, the water becomes toxic	No relaxation
23.	Cyanides (as CN), mg/l, Max	0.05	Beyond this, the water becomes toxic	No relaxation
24.	Lead (as Pb), mg/l, Max	0.1	Beyond this, the water becomes toxic	No relaxation
25.	Zinc (as Zn), mg/l, Max	5.0	Beyond this limit, it can cause astringent taste and an opalescence in water	15
26.	Anionic detergents (as MBAS), mg/l, Max	0.2	Beyond this limit, it can cause a light froth in water	1.0
27.	Chromium (as Cr^{6+}), mg/l, Max	0.05	May be carcinogenic above this limit	No relaxation
28.	Polynuclear aromatic hydrocarbons (as PAH), mg/l, Max	-	May be carcinogenic	-
29.	Mineral Oil, mg/l, Max	0.01	Beyond this limit, undesirable taste and odour after chlorination take place	0.03
30.	Pesticides mg/l, Max	Absent	Toxic	0.001
31.	Alpha emitters, Bq/l, Max	-	-	0.1

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32.	Beta emitters, pCi/l, Max	-	-	1.0
33.	Alkalinity mg/l, Max	200	Beyond this limit, taste becomes unpleasant	600
34.	Aluminum (as Al) mg/l, Max	0.03	Cumulative effect is reported to cause dementia	0.2
35.	Boron mg/l, Max	1.0	-	5.0

No sample should contain E. Coli in 100 ml.; No sample should contain more than 10 coliform organisms per 100 ml; and Coliform organisms should not be detectable in 100 ml of any two consecutive samples.

* Desirable limit

** in absence of alternate source

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