



National Institute of Urban Affairs



Sanitation Capacity
Building Platform



ECOSAN
SERVICES
FOUNDATION

Online Advanced Training Programme on

Integrated Wastewater and Septage Management (IWSM) Design Module

TRAINING REPORT
AUGUST 20TH – AUGUST 28TH, 2021

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CONTENT

This report summarizes the online pilot training program conducted under Sanitation Capacity Building Platform during the 2nd year of COVID 19 pandemic. It elaborates the online training given to technical experts as well as practitioners from local or state government organizations, PMU's or private consulting firms in India, on all aspects of Integrated Wastewater and Septage Management (IWSM) – Design Module on the concept of City-Wide Inclusive Sanitation and SBM 2.0 Program. The report aims to bring together the learnings from this intensive online training program on IWSM-Design Module, so that organizing agencies can understand the impact and feasibility of continuing such an online training program.

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Abbreviations

ABR	Anaerobic Baffled Reactor
AF	Anaerobic Filter
BIS	Bureau of Indian Standards
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSP	City Sanitation Plan
CW	Constructed Wetlands
CWIS	City Wide Inclusive Sanitation
DEWATS	Decentralized Wastewater Treatment Systems
DPR	Detailed Project Report
DTS	Decentralised Treatment System
FSSM	Faecal Sludge and Septage Management
FSTP	Faecal Sludge Treatment Plant
GoI	Government of India
IHHL	Individual Households Latrine
IWSM	Integrated Wastewater and Septage Management
MLD	Million Litre per Day
NIUA	National Institute of Urban Affairs
NGT	National Green Tribunal
O&M	Operation & Maintenance
PCB	Pollution Control Board
SCBP	Sanitation Capacity Building Program
SeTP	Septage Treatment Plant
SOP	Standard Operating Procedure
STP	Sewage Treatment Plant
SWM	Solid Waste Management
ULB	Urban Local Body
UDDT	Urine Diversion Dehydration Toilet

1. Introduction

After the success of Swachh Bharat Mission (SBM) launched in 2014, the Union Cabinet, chaired by Prime Minister, Shri. Narendra Modi announced the Phase II of the SBM-Urban (SBM-U 2.0) and Jal Jeevan Mission Urban (JJM-U). The mission goes beyond the aim of eliminating open defecation in the country, by focusing on ODF+, ODF++ and Water+ protocols as laid down by the Ministry of Housing and Urban Affairs, Govt.

Faecal Sludge and Septage Management as a solution to sanitation issues got traction after the National Policy on FSSM was released in 2017. The SBM-U 2.0 and JJM-U supplement this policy by focusing on pollution abatement through Interception of Drain (I&D) projects to transfer the wastewater generated in cities to Sewage Treatment Plants (STP). Under the SBM-U 2.0 and JJM-U financing component, the wastewater treatment funds would be allocated for desludging vehicles, interception & diversion of drains and for STPs with co-treatment of faecal sludge and septage at the STP.

I&D projects linked to STPs have been implemented in India before and although it takes less time for implementation of the project, it has its own challenges. Understanding the city profile, drains and the change in the seasonal discharge of the drains and rivers is critical.

The Tier 2 and below cities (also classified as semi-urban centres) face the problem in planning and execution of projects. They do not have adequate resources and technical know-how on planning, executing and maintaining such projects. Moreover, these projects should not be treated as civil engineering projects but regional planning projects as well. Only then the economic feasibility and the true benefits of such projects can be realized.

There are many successful and not so successful I&D projects in India which need to be studied diligently in order to avoid mistakes and mitigate risks associated with project planning and execution.

This online course focused on SBM-U 2.0 and JJM-U. The course provided a framework for feasibility and assessment, technology options, construction monitoring, operation and maintenance, and site investigation for the wastewater treatment in towns. The content of the module has been prepared specifically for Tier 2 and below towns, however, the concept can be extrapolated to larger cities as well.

Course Objective

To build the capacities of ULB and state officials on planning, implementation and management of wastewater treatment solutions. It will allow the officials to prepare/assess the wastewater management plans.

An 8-day course with a total duration of 12 hours was designed for online delivery. To engage the participants and ensure that capacity is built to the level of practicing IWSM or conducting similar training, the course was developed using a case methodology and had a mix of presentations, exercises, live quiz and session quizzes. The online session totalled to 12 hours, of duration whereas additional hours were dedicated to the quiz and exercise which the participants had to attempt offline. A final online quiz was conducted where the learning impact assessment was done.

In order to successfully complete the course with certification, the participants had to attend all the sessions, attempt at least six out of the eight session quizzes (75%), complete all the exercises and attempt the final online quiz.

2. Agenda

Following is the day-wise agenda of the training. A detailed minute to minute agenda is available in the annexure (Annexure 3).

Agenda of the Training

Date	Session	Topic	Contents	Duration
Friday 20 August 2021	1	Introduction to IWSM	Natural and built environment Environmental sanitation Sources of Pollution - Point and Non-point Pollution Waste products and its characteristics	45 Min
Saturday 21 August 2021	2	Missions and Programs	Swachh Bharat Mission 2.0 Urban Jal Jeevan Mission Water Plus Protocol Convergence and Financing Options	45 Min
	3	Planning Approach	City Sanitation Plan City Wide Inclusive Sanitation Centralized and Decentralized Approach Sanitation Systems Approach Stages in DPR preparation	45 Min
Monday 23 August 2021	4	Baseline Surveys & Assessment	Project area and geographical features Use of Remote Sensing and GIS Demographics Access to water Access to sanitation Soil investigation Groundwater investigation Commercial, industrial and agricultural pollution Sources of Data	60 Min
Tuesday 24 August 2021	5	Design Aspects	Developing options for schemes Site selection- land acquisition & energy requirements Intermediate solutions - In situ remediation, FSSM Design periods Population projections Rate of water supply Reuse options- Circular Economy	60 Min
Wednesday 25 August 2021	6	Collection and Conveyance	Sewage generation Interception factor Groundwater infiltration Design flows Interception and Diversion components	60 Min
Thursday 26 August 2021	7	Wastewater Treatment	Treatment mechanism and chain Non mechanized treatment units Mechanized treatment units Sludge management units	60 Min
Thursday 26 August 2021	8	Project Management	DPR components and review Life Cycle Cost of ProjectType of tenders Project monitoring and standards	60 Min
Saturday 28 August 2021	9	O&M and Sustainability	O&M of drains, I&D works, STPs Public awareness & participation Reducing combined sewer overflow Best Management Practices for Nonpoint Pollution	45 Min

3. Sessions

3.1 Day 1, August 20th, 2021

The online training program commenced with a formal introduction of the Sanitation Capacity Building Platform by Ms. Jyoti Dash, Senior Program Manager, NIUA. She elaborated on the objectives of the platform and the different types of training which are conducted through the platform. Ms. Mahreen Matto, Program Manager, NIUA then began the session with an introduction to the course, course outline, structure and objectives of the online advanced training program on Integrated Wastewater and Septage Management (IWSM) under Sanitation Capacity Building Platform (SCBP). Introduction of the lead trainers and facilitators was carried out, followed by setting the ground rules for all the participants and explaining the mandatory criteria for the successful completion of the course. Ms. Sreevidya Satish introduced participants to few other platforms namely, Mentimeter, Classmarker and Google forms that were to be used during the training for recording the feedback of the participants, attempting the exercises and quizzes.

Figure 1: Snapshots of the Introduction session

Course Outline

Day	Topic	Icon
Day 6	Wastewater Treatment	Water drop with gear
Day 7	Project Management	Building with people
Day 8	O&M and Sustainability	Recycling symbol
Day 8	Q&A, Discussion and Final Assessment	Microscope

Integrated Wastewater and Septage Management

Participants List:

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A	Aparajita
AU	Aparna Unni
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AS	Arjun Sharma
BI	Berna Ignatius
BA	Binu Arickal (Wateraid)
DS	Devendra Singh
Dr	Dr. Amit Mishra
DN	Dr. Nasruddin
DA	Dr. Alka Singh
E	Er.G.Naresh
GT	Gaurav Thapak

3.1.1 Session 1: Sustainable Sanitation and Water Management

Mr. Saurabh Kale, Sr. Resource Person from ESF presented the first session on Introduction to Integrated Wastewater and Septage Management. The session was to introduce the basic concepts of IWSM to the participants.

The following aspects were discussed during the session:

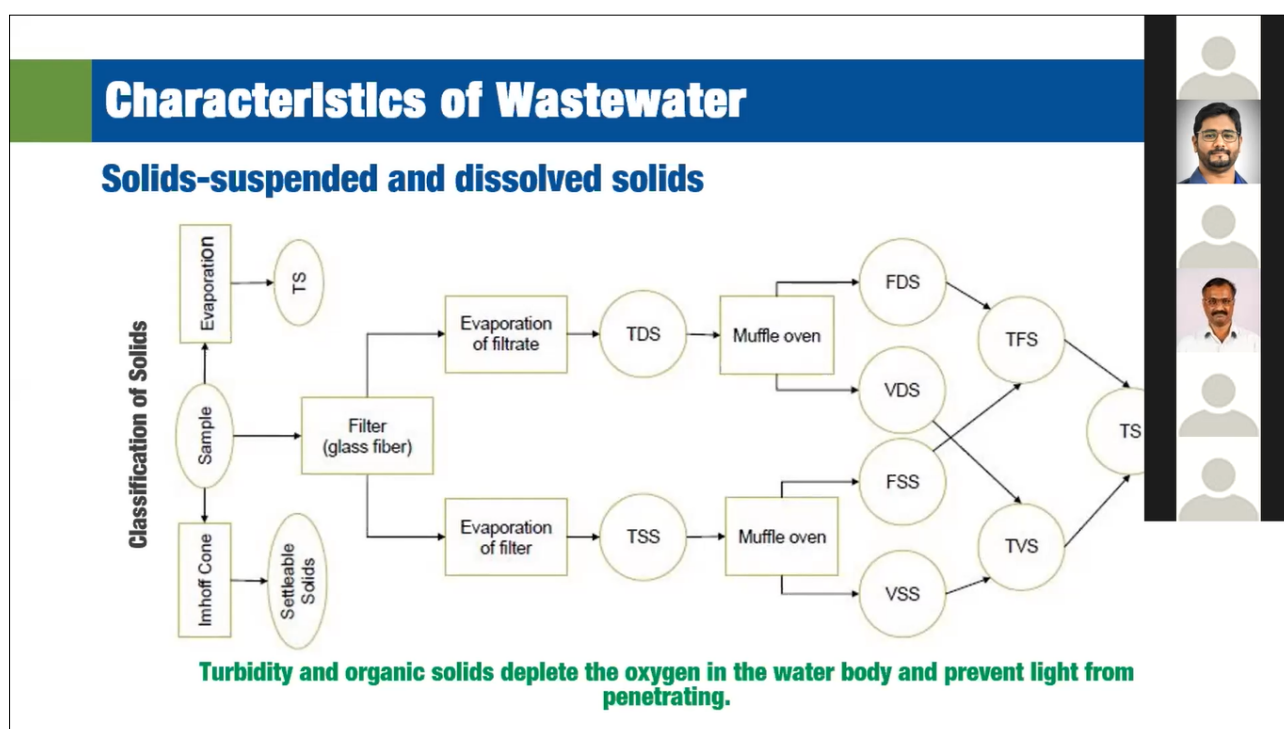
1. Environmental sanitation
2. F - Diagram
3. Natural and built Environment
4. Point and non-point source of pollution
5. Effect of pollutants
6. Characteristics of waste products

Summary- This session acted as an introduction for understanding environmental sanitation and various wastewater and septage characteristics. The importance of managing point and non-points source of pollution was conveyed to the participants. Finally, an outlook of designing projects that look at processes and management across the flow was explained in the participants.

The following queries were raised during the session:

1. Many households use cleaning material on a daily basis, so when this septage is used as bio-solids do these chemicals have any effect on it?
 - If these products are used in appropriate quantities, then these chemicals do not have considerable effect on septic tanks or the effluent coming out of it or on the bio-solids. However as observed most of the CT/PT cleaners use cheap cleaning material which are strong acids due to which the digestion in septic tanks does not occur properly and hence the pathogens may be still active.

Figure 2: Snapshot from the first session



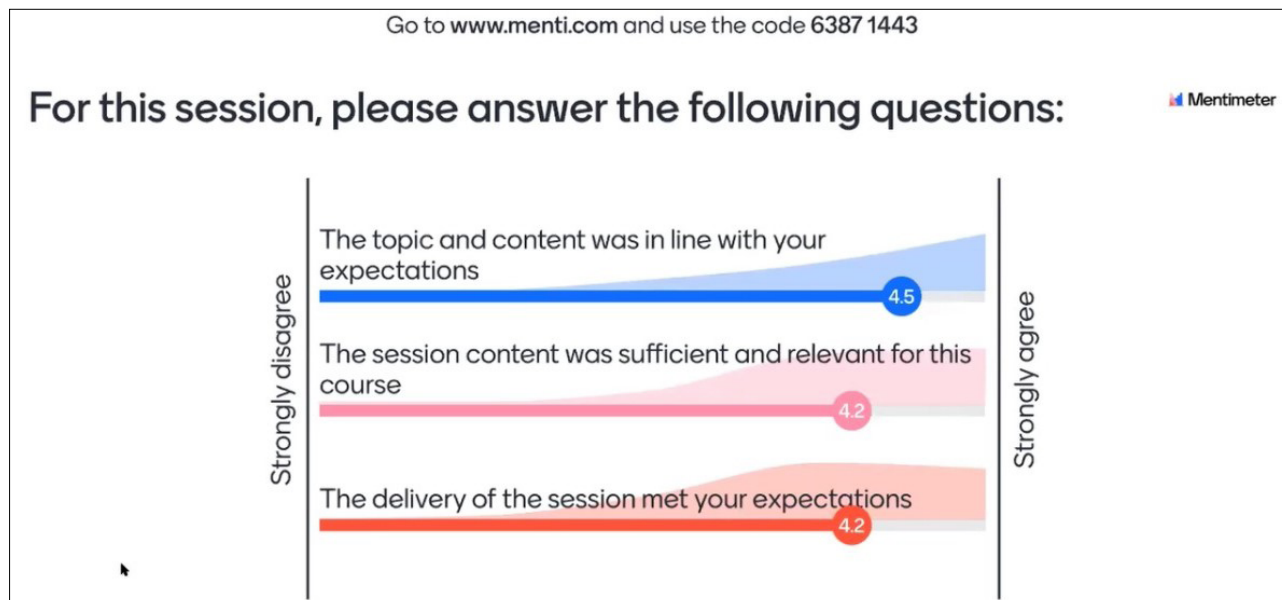
Mr. Akshay Agarwal, Program Officer, NIUA, then briefed the participants on the session quiz. He introduced the Classmarker platform to the participants. This platform would be used for conducting the online quiz throughout this training.

3.1.2 Session Feedback

Day 1 of the training ended with a feedback session, Mr. Akshay Agarwal gave an introduction regarding the feedback session and introduced participants to the Mentimeter platform.

The figure below represents the level of agreement with regards to learning outcomes of the course.

Figure 3: Learning Outcomes of First Session



3.2 Day 2, August 21st, 2021

3.2.1 Session 2: Missions and Programs

Mr. Saurabh Kale, Sr. Resource Person, was the lead trainer for this session. The session was delivered with an aim to enlighten the participants regarding national schemes and policies launched by the government to provide funding at various levels of the sanitation chain. The session started with briefing the participants regarding how FSSM is fast gaining traction in India and the immense opportunity this change brings with it. Further in this session, Mr Saurabh Kale introduced the policies successively with a special emphasis on objectives of mission, budget allocation and key focus of every mission. National missions, programmes and schemes covered under this session were:

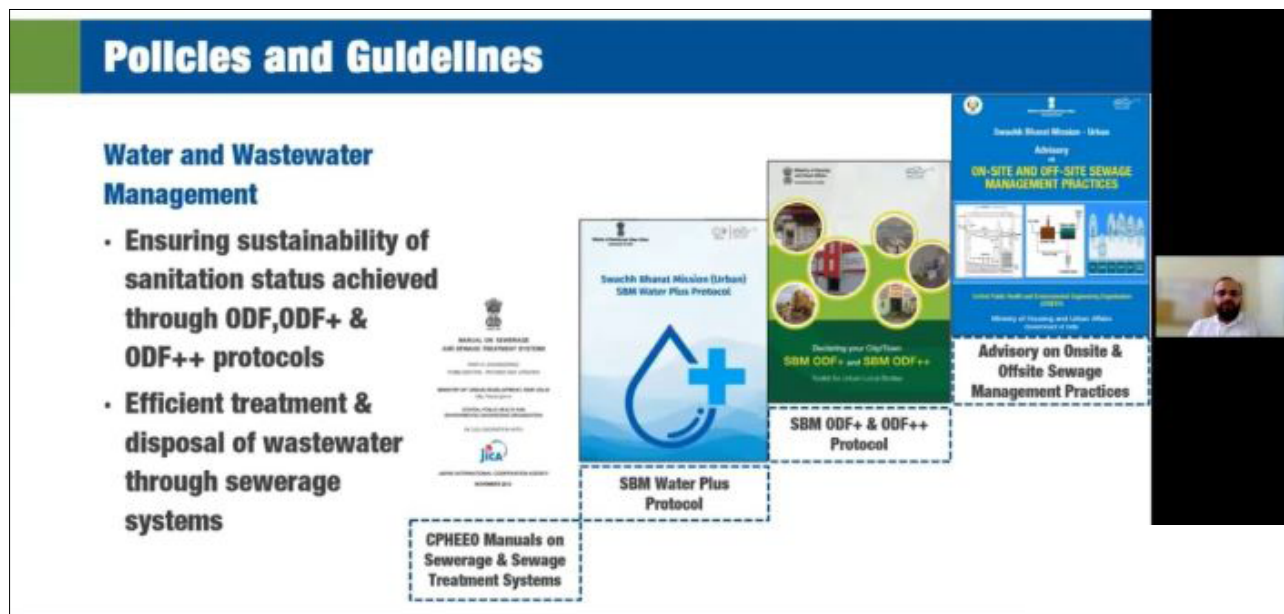
1. Swachh Bharat Mission- Urban (SBM-U) 2.0
2. Jal Jeevan Mission- Urban
3. Smart Cities Mission
4. The Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
5. Recommendations of the 15th Finance Commission
6. The Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013
7. National Policy on FSSM.

Summary: Fund allocation for various treatment processes, proper management of fund and adequate planning for setting up the distribution system were some key points of the session. Finally, the participants were encouraged to pull funds under various schemes and also combine various available technologies while planning for FSSM.

Following queries were raised during the session:

1. The fund distribution for Jal Jeevan Mission provides only 20% for developing FSTP/STP, how to manage with such distribution of funds?
 - Trying to pull funds under various schemes and also planning FSSM by using a combination of various available technologies can be tried. Also, the state government can write to the central government addressing the issue.
2. Can FSTP be constructed under SBM(U) 2.0?
 - No, FSTP cannot be commissioned under SBM(U) 2.0

Figure 4: Snapshot From Session 2



3.2.2 Session 3: Planning Approach

Mr. Dhawal Patil carried forward the training by introducing the participants to various approaches for IWSM planning. This session was designed to deliver the concept and principles of CWIS in planning the sanitation system. It also explained CWWIS and DPR concepts under SBM(U) 2.0 to the participants. A detailed knowledge of following topics was delivered through this session:

1. CWIS principles of planning
2. Components of CWIS
3. Wastewater Management processes: Centralised, de-centralised systems, clustered and onsite system
4. Level of liquid waste management
5. Sanitation system and its types
6. Components of sewerage network
7. DPR preparation

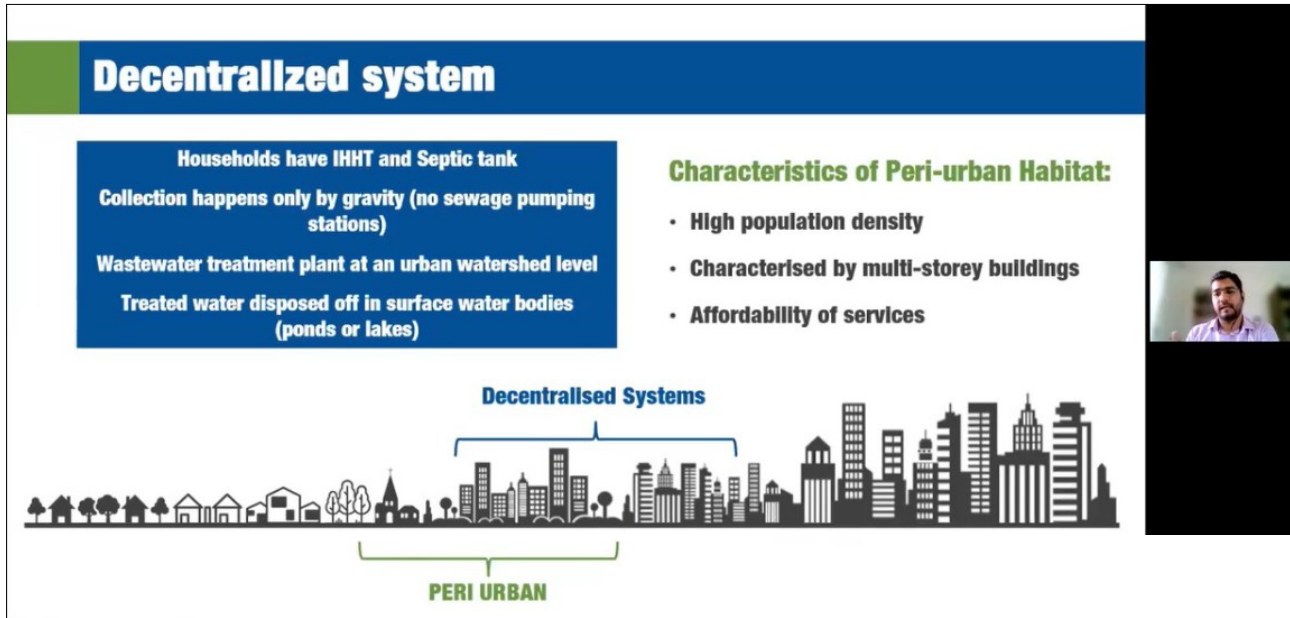
Summary – According to SBM(U) 2.0 guidelines, CWIS focuses mainly on wastewater management along with FSSM. The CWIS approach emphasizes the whole sanitation service chain for safe management of human waste. DPR under SBM(U) 2.0 includes data collection, survey, treatment options, designs and financial aspects.

Following queries were raised during the session:

1. Is there any numeric value of population density that is required for planning a centralised system?
 - No one has a clear idea for exact population density required for centralised system as it depends on various factors like economy, terrain etc. But we can say that population density is actually a link between technical and economical aspects.

- In Kerala flood people were provided with a bucket system for sanitation but it was noticed that the waste is dumped back in water bodies, how to dispose of this waste during such adverse conditions?
- While providing such a system during adverse condition care must be taken that filled buckets are emptied at regular intervals for emptying of the buckets. Typically, for a household of five people the bucket needs to be emptied every week.

Figure 5: Snapshot From Session 3



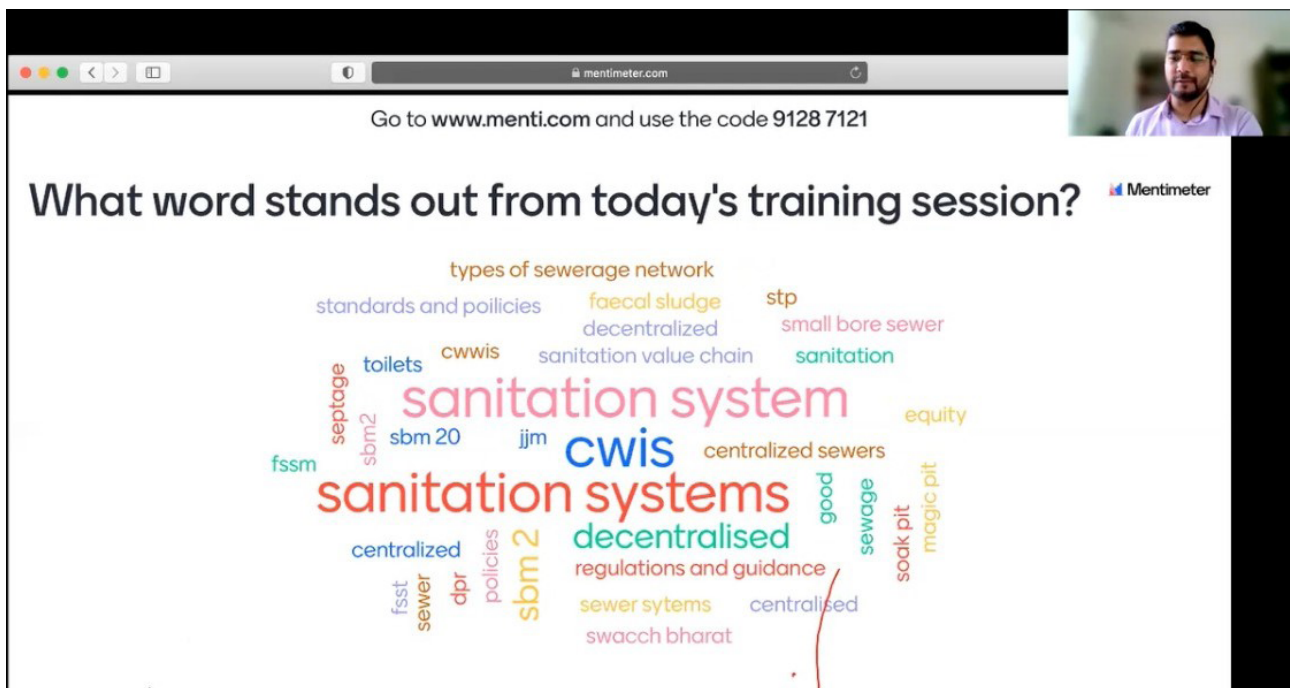
3.2.3 Session Feedback

The moderator then asked the participants to log in to Mentimeter and provide feedback.

Overall content feedback

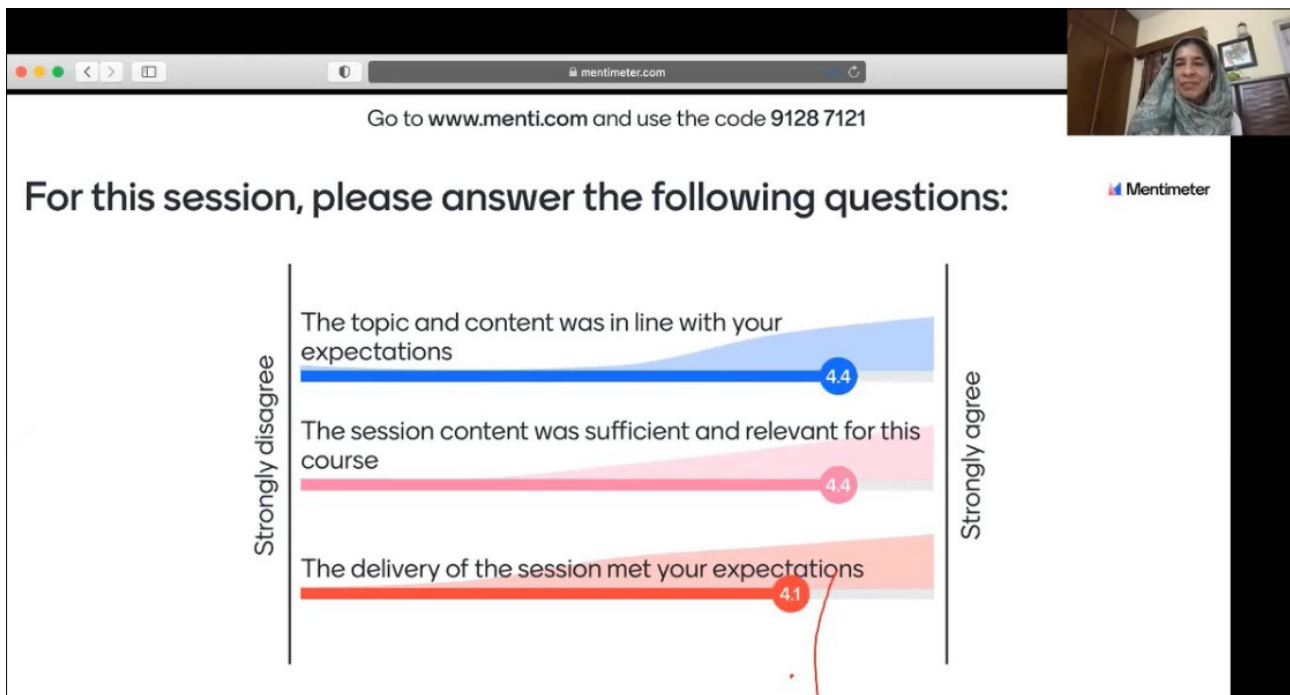
The figure below depicts the word that stood out from today's session.

Figure 6: Standout Words From Day 2 Of Training Session



The figure below represents the level of the agreement with regards to learning outcomes of the course.

Figure 7: Learning Outcomes For Session 2 and 3



3.3 Day 3, August 23rd, 2021

The moderator started day 3 with an introduction to the session of the day. She also explained the technical details to operate the online platform with some ground rules.

3.3.1 Session 4: Baseline Survey and Assessment

The objective of the session was to increase awareness among participants regarding baseline survey and assessment. This session aimed to help participants to identify gaps in systems and to select technology accordingly. Mr. Saurabh Kale was the lead trainer for this session.

The following aspects were discussed in the session:

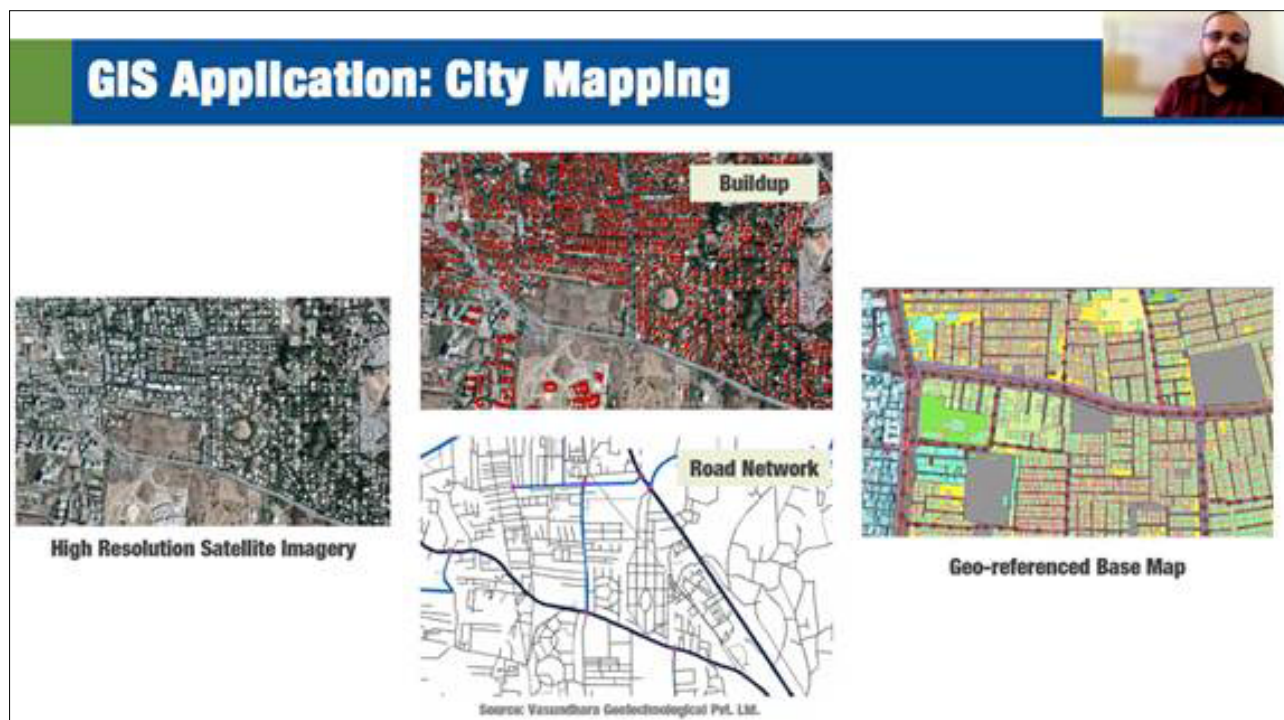
1. Components of baseline survey
2. Identification of project area, baseline information
3. Pre-existing sources of baseline data
4. GIS application in IWSM planning
5. Technicalities regarding soil and groundwater investigation

Summary- Appropriate baseline data collection and assessment is an important step in identification of project area and selection of technical solutions. Application of GIS for sanitation and water management projects can play a crucial role in rapid decision making. GIS mapping can simplify the process of visualizing and understating the project area. Baseline data of existing infrastructures, gaps identification and site investigation are the necessary aspects for the preparation of detailed project report on wastewater management systems

Following queries were discussed in the session:

1. What questions can be part of an environmental and community survey?
 - Questionnaire hugely depends on the reason for the survey. Questions such as awareness regarding byelaws can be included.
2. How to make maps for small ULBs/ population less than 2 lakhs for Nagar Panchayats and Nagar Parishads?
 - GIS is a powerful tool and remotely a lot of data can be accessed. Few companies use a very high-resolution satellite imagery and process to identify, building outlines, roads, streams etc. with high accuracy. The whole process can be completed within 2-3 week. Alternatively, nowadays drone surveys are done. However, they tend to be quite cost intensive.
3. How much should we be concerned about the industrial waste(sludge)?
 - FSTPs are designed to remove domestic waste. It is efficient for organic pollutants removal. Industrial waste contains heavy metals and inorganic waste and the designed system is inefficient for removal of such impurities. Also, there are huge chances that the heavy metals present in industrial waste may change pH and the microbial in the system are very pH sensitive so the industrial waste may affect the whole biological environment of the plant. Hence there is a huge chance that the plant will require complete recommissioning.
4. How to do geotagging for septic tanks?
 - What can be done is while doing the baseline survey collect information about septic tank size and other features, that information can be fed as an attribute in geotagged location. Geotagging can be done using tools like SaniTab. In this app you can geotag the infrastructure also.

Figure 8: Snapshot From Session 4



3.3.2 Exercise: Baseline Survey and Sssessment

Mr. Dhawal Patil then introduced the participants to the first exercise for the training. In the first exercise participants were provided with a GIS map of an area containing both natural and artificial environments. Various other characteristics of the area like its population, socio-economic data, economy of town, household- drain data, access to water etc. were provided. Although the exercise was mainly the reading part, this exercise aimed to introduce the concepts of baseline survey to the participants as it lays the foundation for planning of wastewater and septage management.

3.3.3 Session Feedback

Overall content feedback

The figure below depicts the word that stands out from this session.

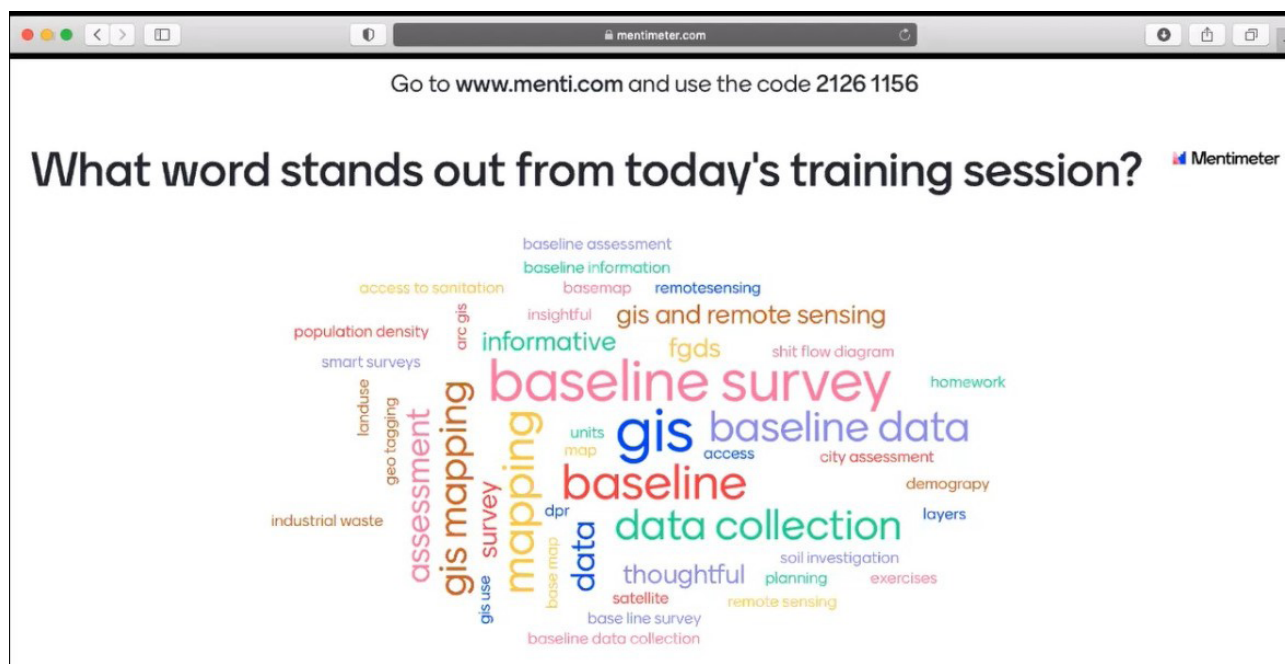
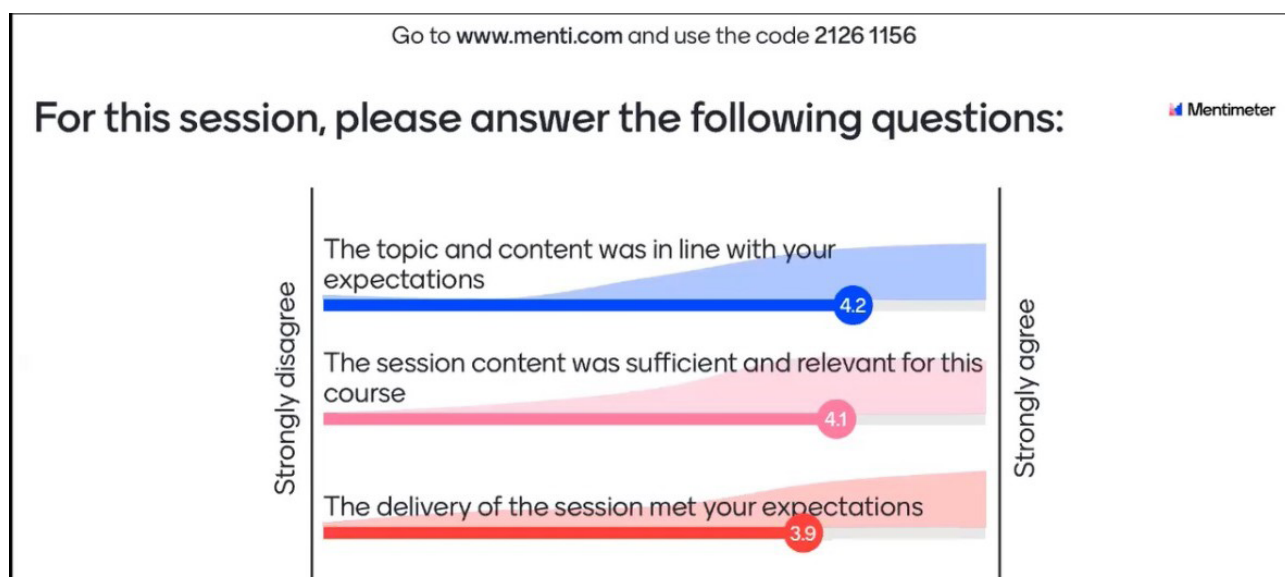


Figure 9: Standout Words From Day 3 Of Training Session

The figure below represents the level of the agreement with regards to learning outcomes of the course.

Figure 10: Learning Outcomes for Session 4



3.4 Day 4, August 24th, 2021

Day 4 began with Mr. Dhawal Patil and Mr. Saurabh Kale clearing the doubts of participants regarding quiz and exercise from the previous day. The moderator then began the session by giving the participants an idea regarding the content for the day's session and the importance of the topic covered.

3.4.1 Session 5: Design Aspect

Mr. Dhawal Patil, Sr. Resource Person and the lead trainer began the session by giving a brief insight of the design stage in IWSM systems. This insight was followed by a quick introduction to current wastewater management systems and problems faced by it. Some important contents and point of discussion in the session were:

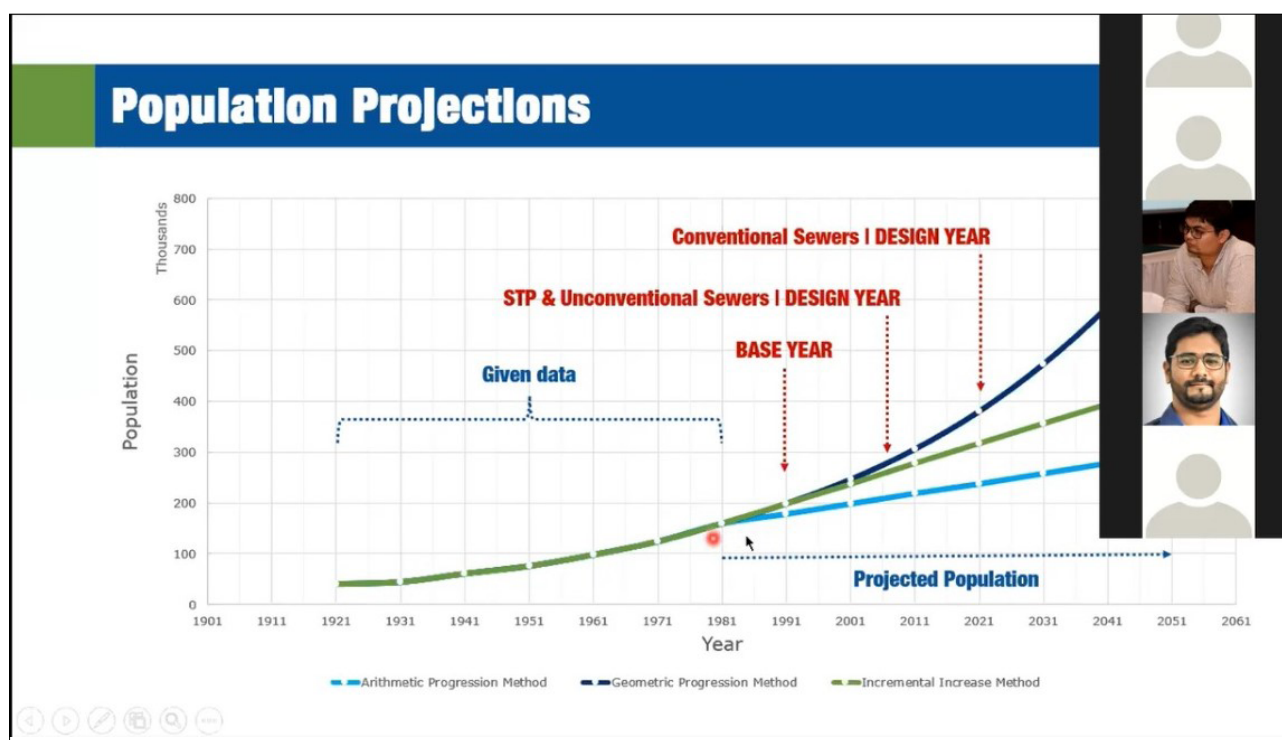
1. Technicalities pertaining to types of sewerage system.
2. Quantification of the water consumption and supply.
3. Population forecasting methods.
4. Intermediate solutions
5. End products of treated wastewater.

Summary- Different technical options are available in the sewerage sanitation approach. Land and Power availability plays an important role while selection of a sanitation system for a region. Access to water and wastewater generation impacts sustainability of wet infrastructure. Intermediate solutions can be planned until the base year.

Following queries were raised during the session:

1. Why are vents required in solid free sewers?
 - When solid free sewers work at 100% capacity there is a chance that an air pocket is created between two water pockets and this air needs to be vented out because when water flows through the pipe and any valve is closed suddenly there are chances of water hammering.
2. What is the difference between lift stations and pumping stations?
 - Pumping station is used to transfer the water from one sewerage zone to another sewerage zone whereas lift station is used in the sewerage zone itself to lift the water at higher elevation.
3. Is it possible to combine simplified sewers with conventional sewers in a centralised system in a city?
 - Yes, it is feasible in fact in many cities they are practicing it. However, the maintenance of the simplified sewer must take place at proper intervals and an SOP must be made for maintenance purposes. Advantage is, it is affordable to the ULB as its operation cost is less and hence can be managed easily.
4. For a small town where we know that the sewerage system will not get any funding in next few years, but has some kind of contaminant system though not a proper septic tank. Is a solitary sewer system or simplified sewers a best option for them?
 - A solitary sewer system is recommended as you have an intercepting tank and you only need to convey the liquid effluent and solitary sewer does that job really well.

Figure 11: Snapshot From Session 5



3.4.2 Exercise: Population Progression

Mr. Dhawal Patil, lead trainer introduced the participants to the exercise for today's session. The exercise needed the participants to predict the population by using all 3 forecasting methods. Area information was provided with the help of a GIS map. Other information such as population, socio economic data, economy of town, household drain data were provided in the form of numeric values. The participants were also requested to raise doubts related to exercise on the WhatsApp group chat for further clarification.

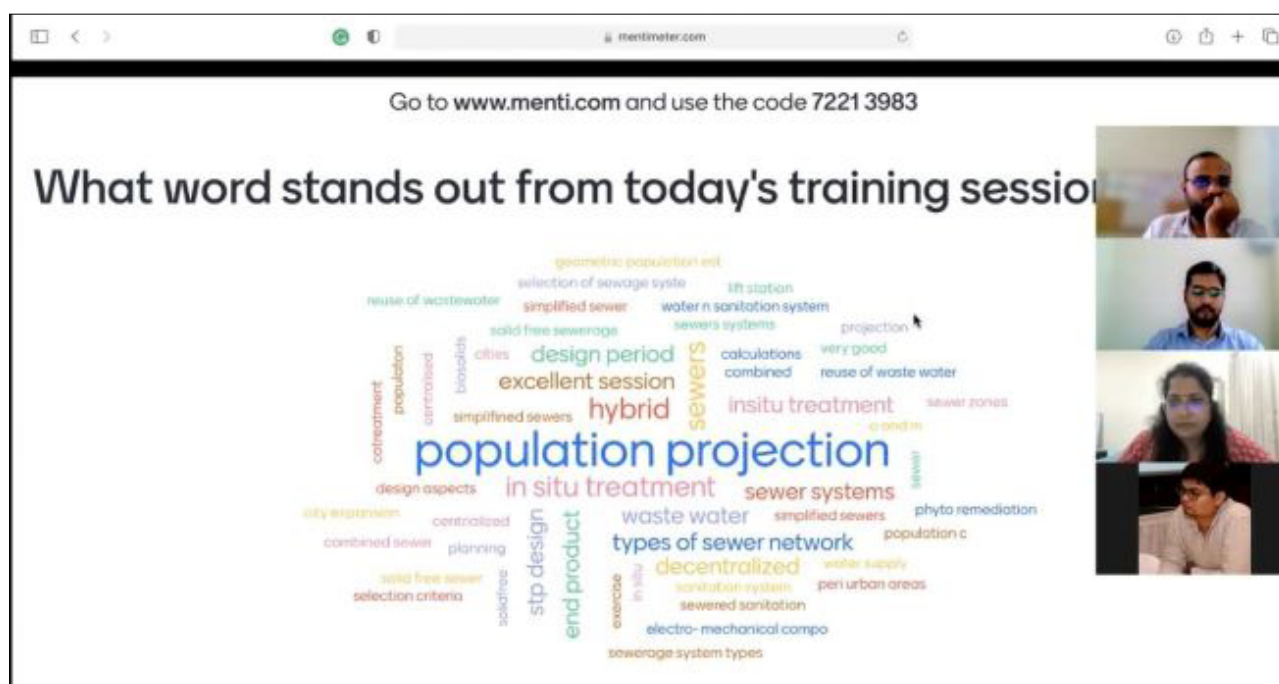
3.4.3 Session Feedback

Day 4 ended with a feedback session; the moderator asked the participants to provide feedback for the day through Mentimeter.

Overall content feedback

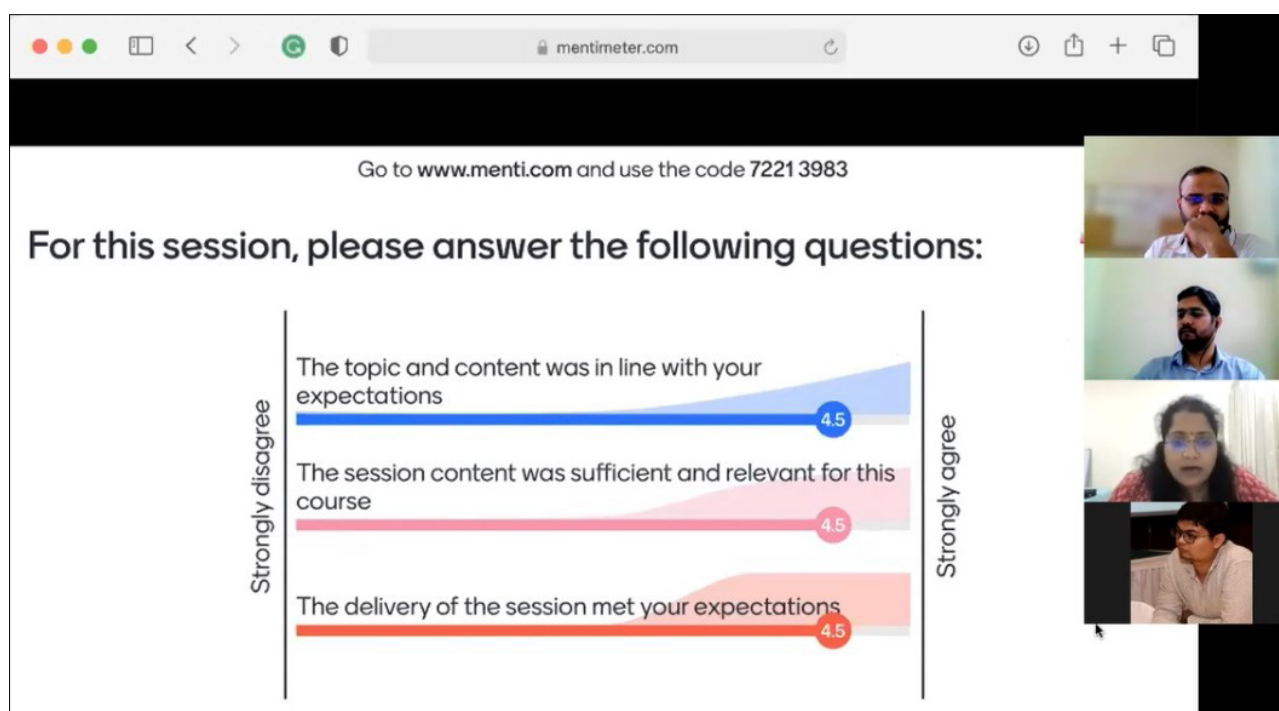
The figure below depicts the words that stand out from today's session.

Figure 12: Standout Words From Day 4 of Training



The figure below represents the level of the agreement with regards to learning outcomes of the course.

Figure 13: Learning outcomes For Session 5



3.5 Day 5, August 25th, 2021

Initially some of the queries of participants from the previous day's quiz were addressed. The regulations on how to attempt the quizzes & exercises and its importance was reinstated. The moderator then began the session by giving a brief idea to the participants about the contents of the session.

3.5.1 Session 6: Collection and Conveyance

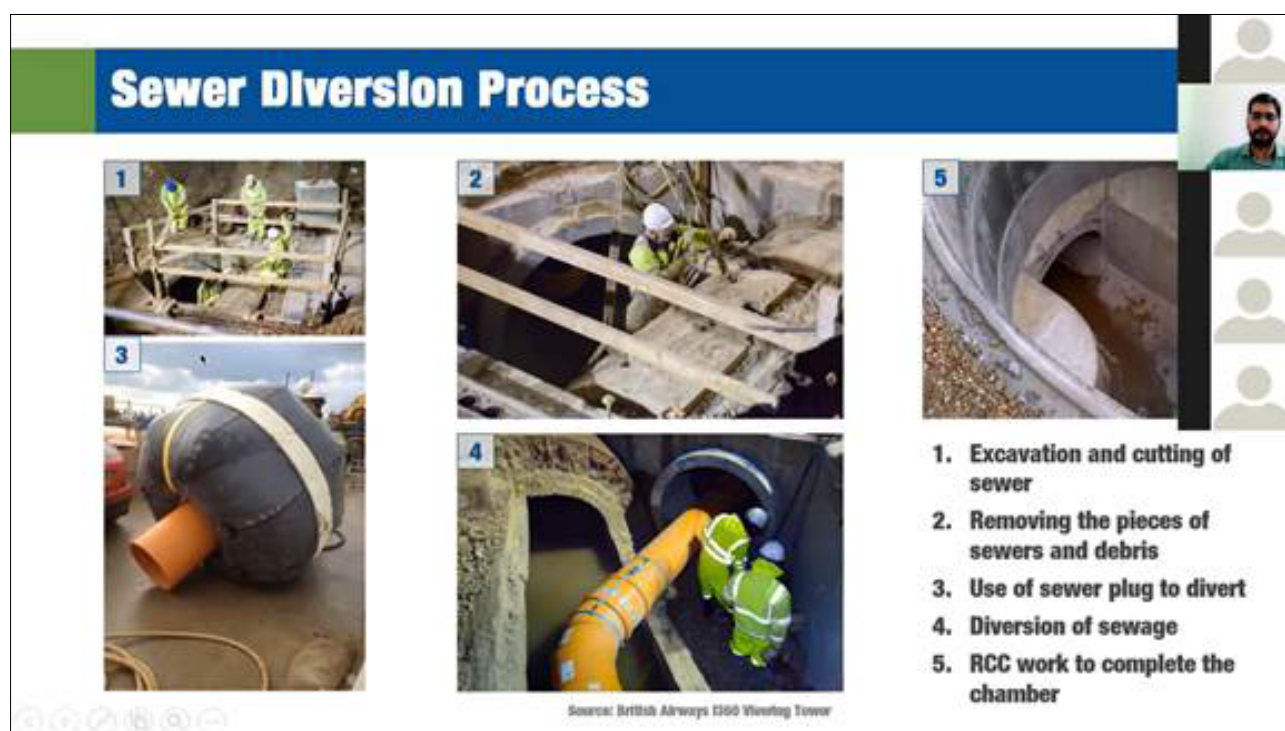
Mr. Dhawal Patil was the lead trainer for this session. The aim of this session was to introduce the participants with the concept of interception and diversion for surface drains and sewers. The session also conveyed the knowledge of flow computation using available data and confirming the same using actual measurements at rains.

Following aspects were covered in this session:

1. Computational methods to estimate design flow
2. Methods of actual measurement of flow
3. I&D projects and its components
4. Necessity of FSSM in I&D
5. Design aspects of I&D components

Summary: Computational method for design flow estimation is based on statistical data and assumption, hence can lead to inaccurate estimates therefore actual measurement on surface drains and sewers should be used to confirm the estimate through computation method. Data collection throughout the year is key to avoid risk of failure of the system. I&D approach might possess operational challenges to STP and lead to urban flooding. Infrastructural projects might be required to manage the wet weather overflow to avoid urban flooding in future.

Figure 14: Snapshot From Session 6



Question addressed during the session were:

1. There is presence of solid waste in the drains which will affect the velocity of the flow so is there any factor that we need to consider while measuring the flow for installation of notches?
 - No, there is no such factor, what we need to do is install a screen before such notches so that all the solid waste is intercepted and only liquid flows through the notch. Even SBM(U) 2.0 drafted guidelines state that there should be screens at every 100m.

3.5.2 Exercise: Collection and Conveyance system

Mr. Dhawal Patil then explained the 3rd session to the participants. For this exercise the participants were provided with certain assumptions which were derived from extensive reading of different DPRs. The thumb rules or assumptions made were to make the participants understand the effect of certain characteristics or parameters on the cost of the project. The participants had to do the calculations on the collection and conveyance system for the further sections. Guidelines and formulas required for calculation purposes were provided in Part C of the training module and using those they had to find attributes of centralized and Decentralised approaches.

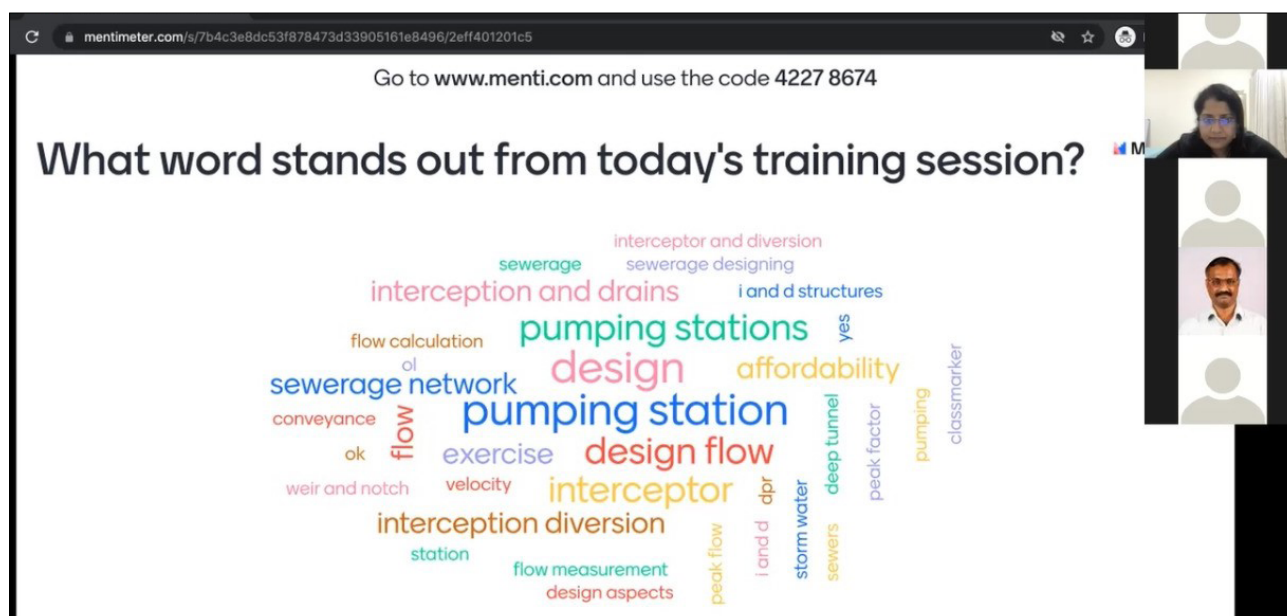
3.5.3 Session Feedback

Day 6 ended with a feedback session. The moderator requested participants to log in to Mentimeter platform and give their feedback for today's session.

Overall content feedback

The figure below depicts the words that stand out from today's session.

Figure 15: Standout Words From Day 5 Of Training



3.6 Day 6, August 26th, 2021

Moderator Ms. Sreevidya Satish began the session by reinstating the importance of quizzes & exercises and how to attempt them. She then gave a brief idea to the participants regarding today's session.

3.6.1 Session 7: Wastewater Treatment Technologies

Mr. Dhawal Patil was lead trainer for this session. The objective of the session was to introduce various wastewater treatment technologies, their mechanism and its application at centralised/decentralised level to the participants.

Following aspects were covered in this session:

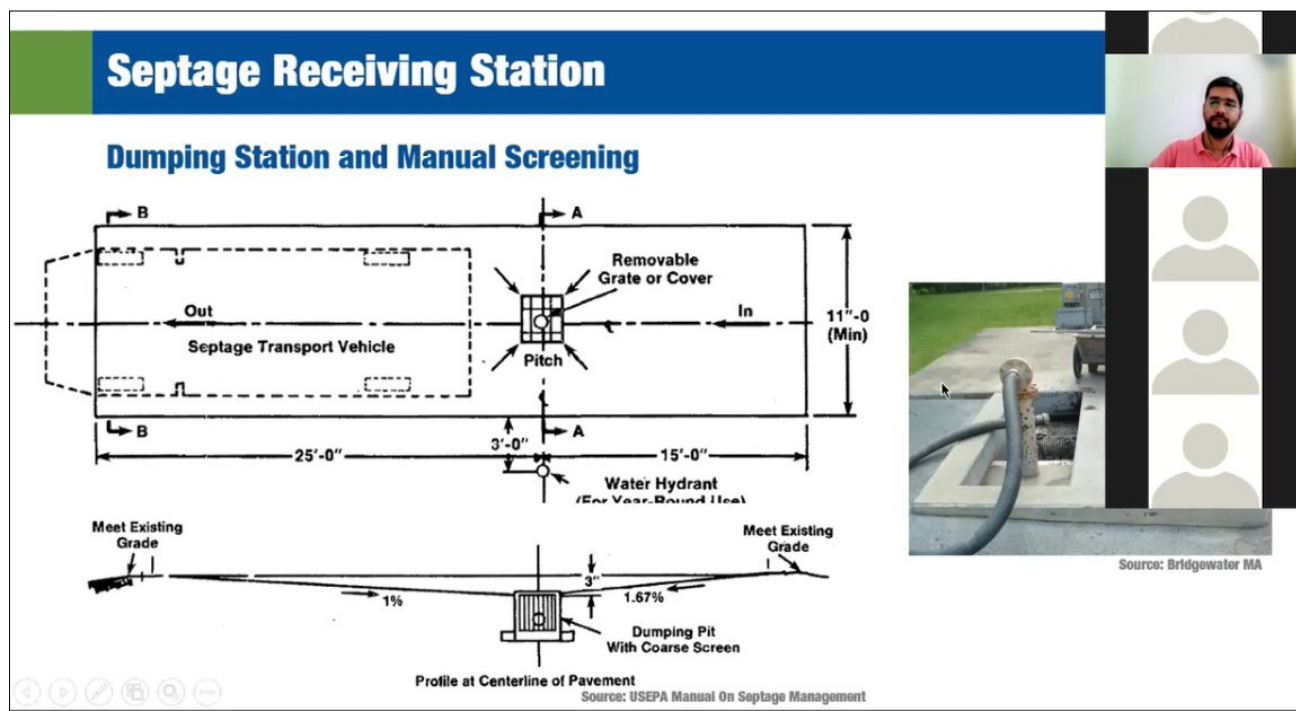
1. Process, objective, stages and mechanism of wastewater treatment
2. Importance of various characteristics of wastewater and effect on treatment process if these characteristics vary significantly.
3. Concepts of HRT and SRT
4. Biological treatment processes and its classification
5. Different mechanised and non-mechanised process, their advantages and disadvantages
6. Parameters for selection of technologies
7. Sewage sludge management units and its feasibility with existing plant

Summary- Objectives of wastewater treatment should be clearly understood before considering different options for treatment. Non-mechanized and mechanized options are possible with respect to feasibility of the wastewater treatment system. Capital cost of the project should not be the driving principle for selection of wastewater treatment technology. Appropriate sewage sludge management is necessary for further reduction of pollution load in the environment

Following queries were raised in the session:

1. Why at the primary treatment stage physical processes are used, then biological and then chemical?
 - Physical processes are easy to implement, design and control, thus cost-benefit ratios are high and hence are preferred over biological and chemical processes.
2. How can we decide sizes of all the three ponds?
 - Whole design is based on HRT. Anaerobic process takes more time thus the HRT for it is great and thus anaerobic pond has more volume than other two. Area wise it is small but is much deeper than the other two. Next comes anoxic pond which has more area but will be shallow as HRT is less than Anaerobic Pond. Finally comes the aerobic maturation pond which will be shallower but area wise will be larger in WSP. Detailed design is available in CPHEEO manual.

Figure 16: Snapshot From Session 7



3.6.2 Exercise: Wastewater Treatment

For the 4th session of the exercise, participants were guided by Mr. Dhawal Patil for determining sewage generation and accordingly the area requirement, CapEx, and OpEx values for all four mentioned treatment technologies. Calculation was to be performed based on centralised and decentralised approach.

3.6.3 Session Feedback

Day 6 ended with a feedback session. The moderator requested participants to log in to Mentimeter platform and give their feedback.

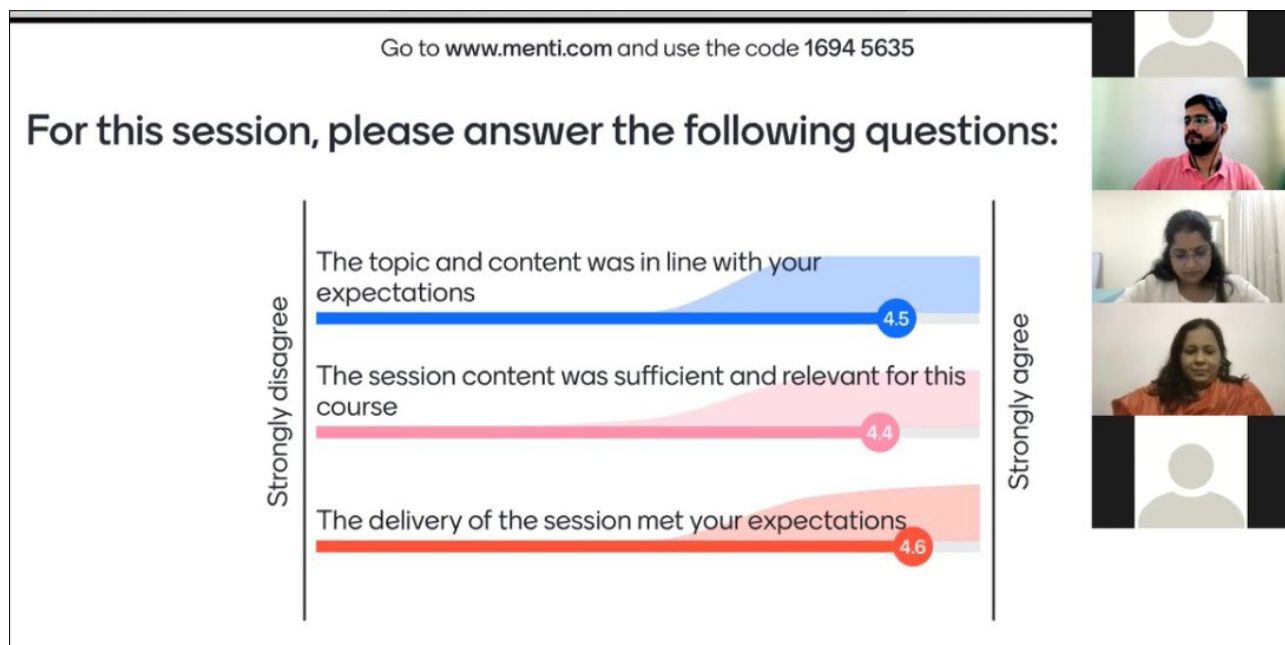
The figure below depicts the words that stand out from today's session.

Figure 17 Standout Words From Day 6 of Training



The figure below represents the level of the agreement with regards to learning outcomes of the course.

Figure 18: Learning Outcome For Session 7



3.7 Day 7, August 27th, 2021

Moderator Ms. Sreevidya Satish began the session by giving a brief idea to the participants about the session. Regulations on how to attempt quizzes & exercises and its importance was reinstated.

3.7.1 Session 8: Project Management

Mr. Dhawal Patil was lead trainer for this session. The main aim of the session was to introduce the participants with components of DPR and the critical points to consider while reviewing the DPR. This session will also work to introduce financial modelling and project delivery methods to the audience.

The following aspects were covered in this session:

1. Project management- Planning processes
2. Components of DPR
3. Stages of the DPR preparation
4. Life cycle cost analysis
5. Project delivery method
6. Risk allocation

Summary- DPR can be broken down into four stages and each stage has its own significance. Each stage consists of certain critical points, which need to be checked before approving the DPR and proceeding with implementation of the project. Financial modelling is key to understanding the financial viability of the project. It is necessary in order to make fair allocation of risks in PPP projects. Project delivery methods play an important role in binding different stakeholders. Its terms and conditions should be drafted as neutral as possible with fair allocation of risks. In order to complete a project in time without cost escalation, choosing the right contractor and method of project delivery is important.

Figure 19: Snapshot From Session 8



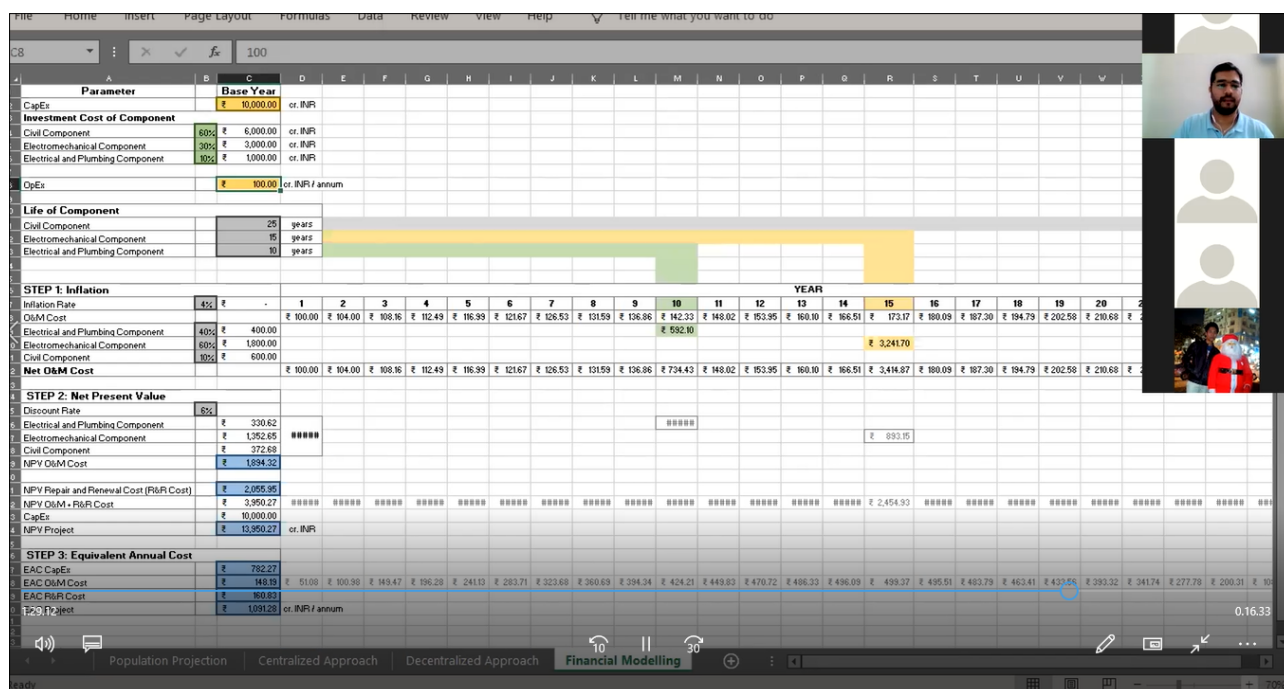
Question addressed during the session were:

1. Do ULBs follow the NPV model?
 - Till now none of the ULB follow the NPV model.
2. How to fix the discount rate for calculation of NPV?
 - You can get the details of the rate of interest of banks from the RBI website.

3.7.2 Exercise: Financial Modelling

In this session, the CapEx and OpEx of two project scenarios i.e., centralized approach and decentralized approach for wastewater management were used for calculating Life Cycle Cost of the project. Mr. Dhawal Patil explained the calculations with the help of an excel sheet. An excel sheet structured as shown in figure below was shared with participants for their own practice.

Figure 20: Excel Sheet For Exercise: Session 5



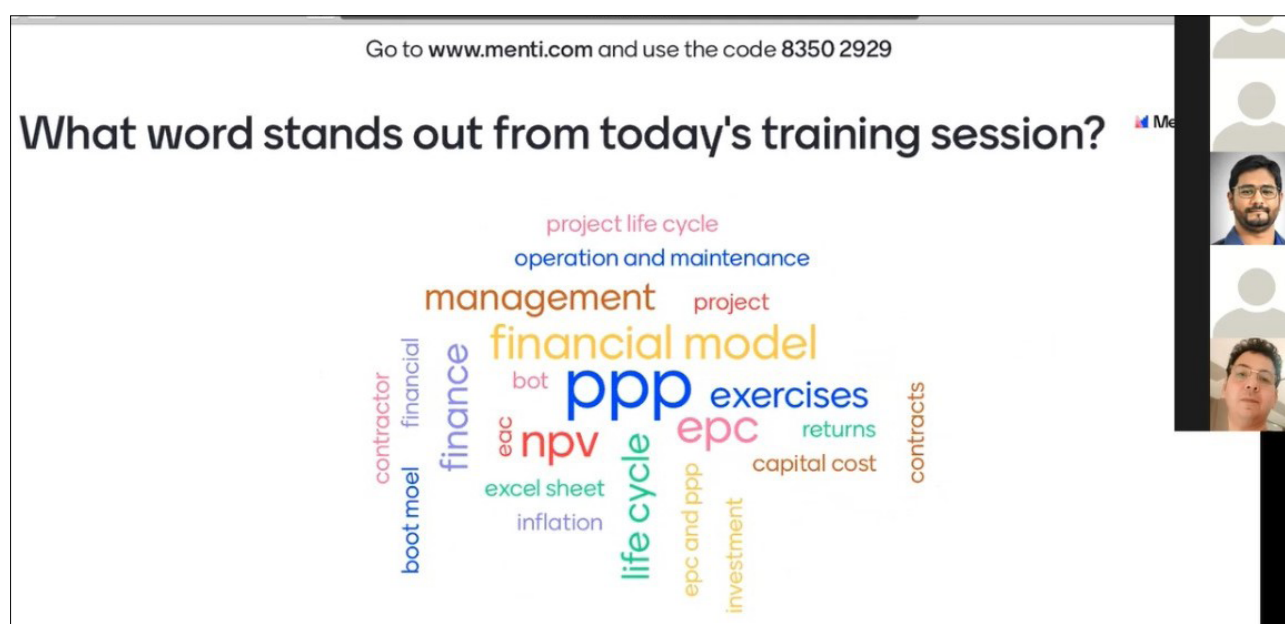
3.7.3 Session Feedback

Feedback was the last session for the day. Moderator requested the participants to log in to the Mentimeter platform and give their feedback.

Overall content feedback

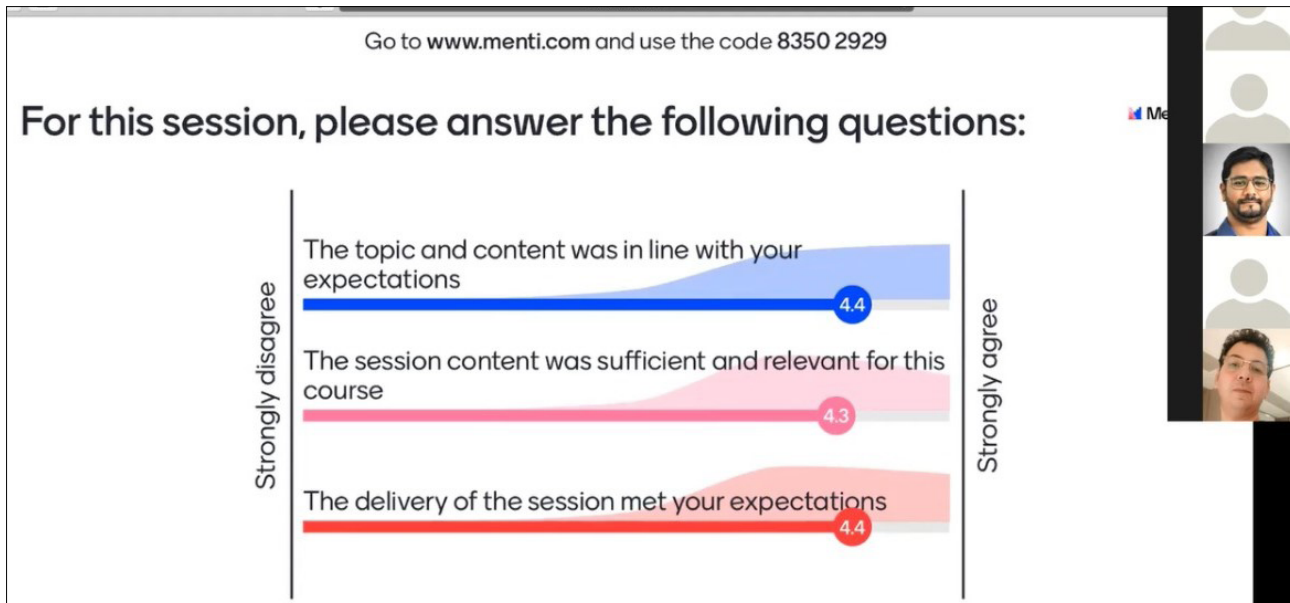
The figure below depicts the words that stand out from today's session.

Figure 21: Standout Word From Day 7 of Training



The figure below represents the level of the agreement with regards to learning outcomes of the course.

Figure 22 Learning Outcome For Session 8



3.8 Day 8, August 28th, 2021

Moderator Ms. Sreevidya Satish began the session with an announcement to attempt quizzes & exercises and its importance was reinstated. The moderator then welcomed Dr. Dayanand Panse, Director, ESF and requested him to welcome the participants for the last session of training.

3.8.1 Opening Remark by Dr Dayanand Panse, Director, ESF

Mr. Dayanand Panse, Director, ESF initially welcomed all the participants for the last session of the training. He then began his opening remark by elaborating on the importance of this training session with respect to government schemes. He encouraged the participants to use the concepts introduced in training for on-field work. He also expressed his gratitude to government institutes and organisations who had sent their participants for the training. Finally, he concluded the remark by congratulating participants for making the training interactive and thoughtful.

3.8.2 Session 9: O&M and Sustainability

Mr Saurabh Kale was the lead trainer for this session.

The following aspects were discussed in the session:

1. Content of O&M plan
2. Planning of maintenance operation
3. O&M requirements
4. O&M of drains, interceptions, diversions, sewer systems and treatment plants.
5. Mechanised devices / vehicles for O&M
6. Monitoring and record keeping
7. Need of public awareness, participants and the target audience
8. Reducing Combined Sewer Overflow (CSO)

Summary - O&M plan is very important and needs to holistically cater to all the tasks that need to be performed by the operator to keep the system operational. Monitoring of the processes at the treatment facility can help in early detection or to completely avoid issues and challenges at the treatment facility. Occupational health and safety will contribute to improving the dignity and social

Following queries were raised during this session:

- Figure 23: Snapshot From Session 9

3.8.3 Closing remark by Mr. Hitesh Vaidya, Director, NIUA

Mr. Hitesh Vaidya, Director, NIUA appreciated the efforts of all participants, NIUA and ESF teams for the training session. He then focused on the need and methods to empower/ spread the learning of

the training to local level i.e., to people who are working on ground. He also introduced challenges in building capacities. He then suggested developing a capacity grid and deemed collective efforts by all stakeholders as the most important step to achieve it. He finally congratulated all participants for successful completion of the training and also encouraged them to be part of further trainings.

3.8.4 Feedback Session

The moderator then requested participants to provide voluntary feedback on the training session, its contents, delivery and also asked for their suggestions. A detailed overview of the obtained feedback is presented in the next session under the title participants testimonies. The overall feedback of the session was positive with few suggestions revolving around the time constraints for the exercise and the quiz.

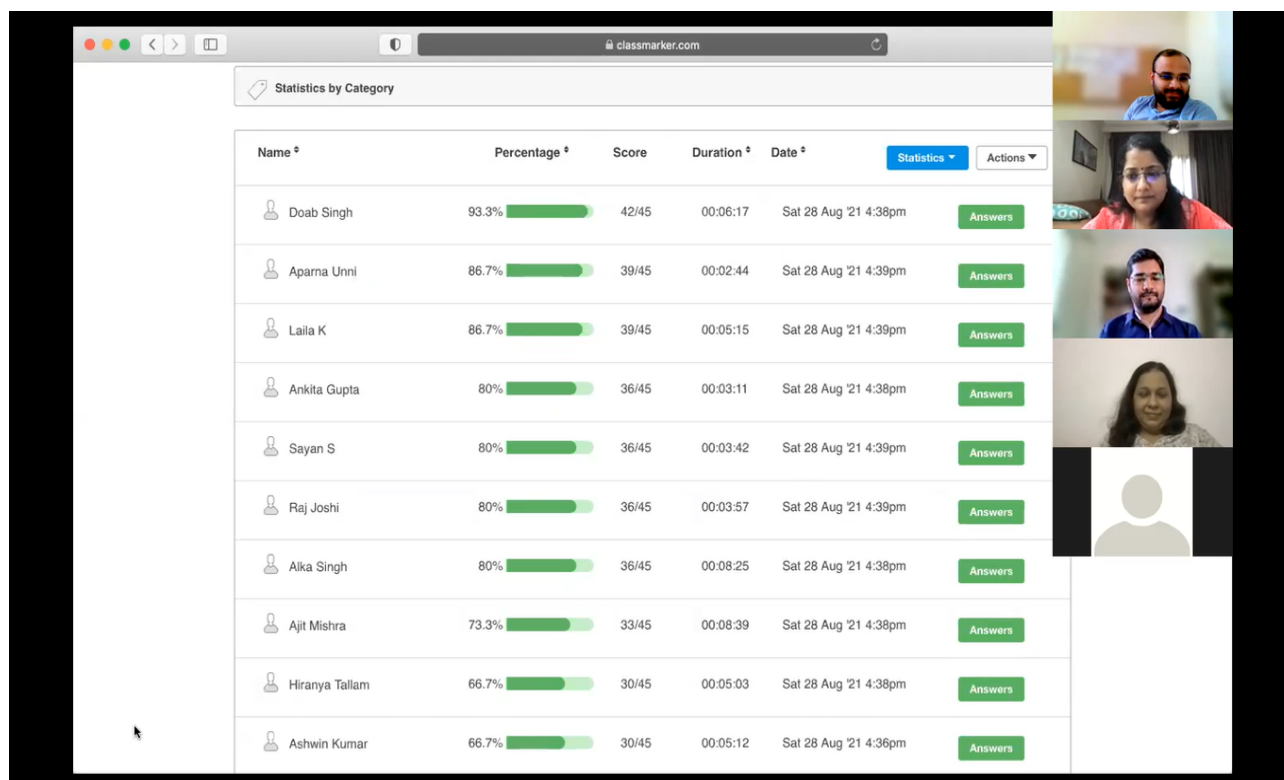
3.8.5 Course Overview

In this session, Ms. Sreevidya Satish gave a short overview of the course and the training platforms. The presentation also showcased the participation of the candidates in various exercises and quizzes. It also showed the feedback mechanism adopted. Details regarding the process to achieve course certificates were then explained.

3.8.6 Live Online Quiz

A live online quiz was conducted. Classmarker was the platform for the quiz. It was attended by 41 participants. The time duration of the quiz was 15 mins and it contained questions from all the topics covered under this training module.

Figure 24: Snapshot For The Live Online Quiz



4. Feedback

Providing feedback towards the training sessions and content during the training and after the training program was voluntary. Up to 49% of the participants shared their feedbacks.

Considering the feedback carried out for contents and level of content and the overall training, following inferences were drawn.

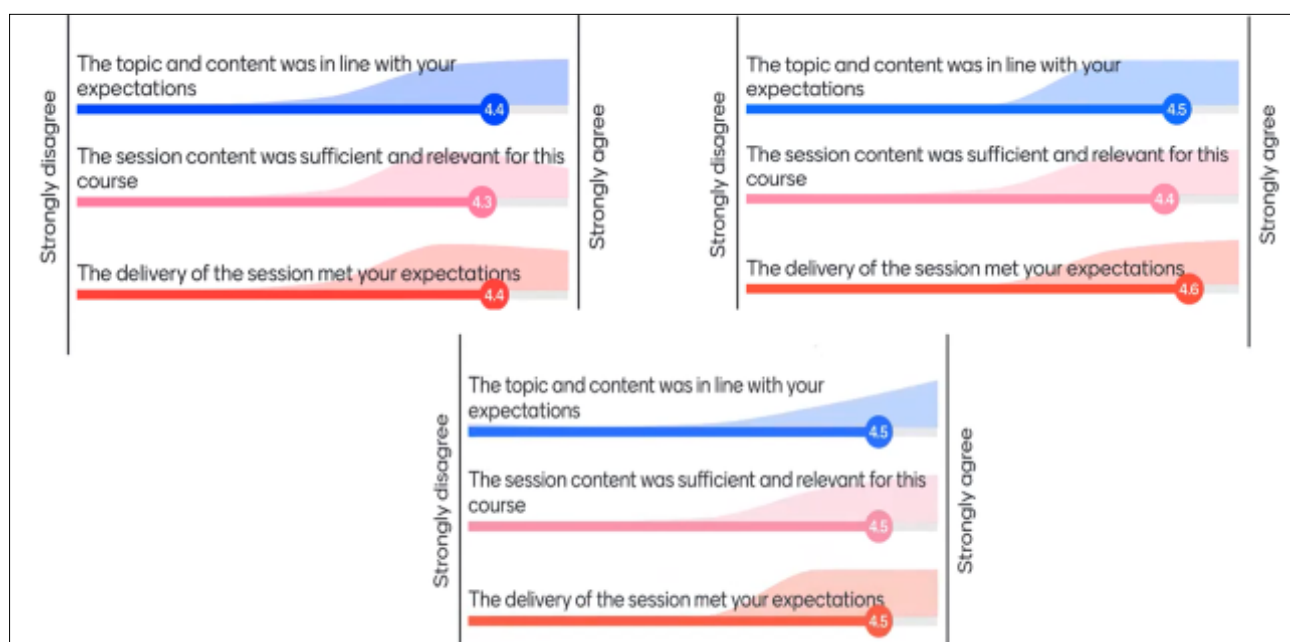
4.1 Online Feedback

Online feedback at the end of each day was obtained from the participants. Mentimeter, an online platform was used for the feedback. Almost all participants gave their feedback for each part of the training.

4.1.1 Mentimeter Feedback

An online platform Mentimeter was used to obtain daily feedback from participants about the sessions. Participants had to log in to the Mentimeter website using the passcode provided at the end of session(s) and answer the feedback questions.

Figure 25: Summary Of Mentimeter Feedback – I



Stand out words from the training session



- Session 1 - Introduction to IWSM
- Session 2 - Missions and Programs
- Session 3 - Planning Approach
- Session 4 - Baseline Survey and Assessment
- Session 5 - Design Aspect
- Session 6 - Collection and Conveyance system
- Session 7 - Wastewater Treatment
- Session 8 - Project Management
- Session 9 - Operation & Maintenance and Sustainability

Sessions	Feedback
1	4.2
2	4.4
3	4.3
4	4.4
5	4.4
6	4.5
7	4.5
8	4.4
9	4.2

24 Sanitation Capacity Building Platform

4.1.3 Complexity of Exercise

The graph below represents exercise feedback on complexity and its understanding from participants out of range from 0-5 (where 5 is the highest and 0 is the lowest value).

Exercise 1 - Baseline Surveys and Assessment / Baseline Data Collection

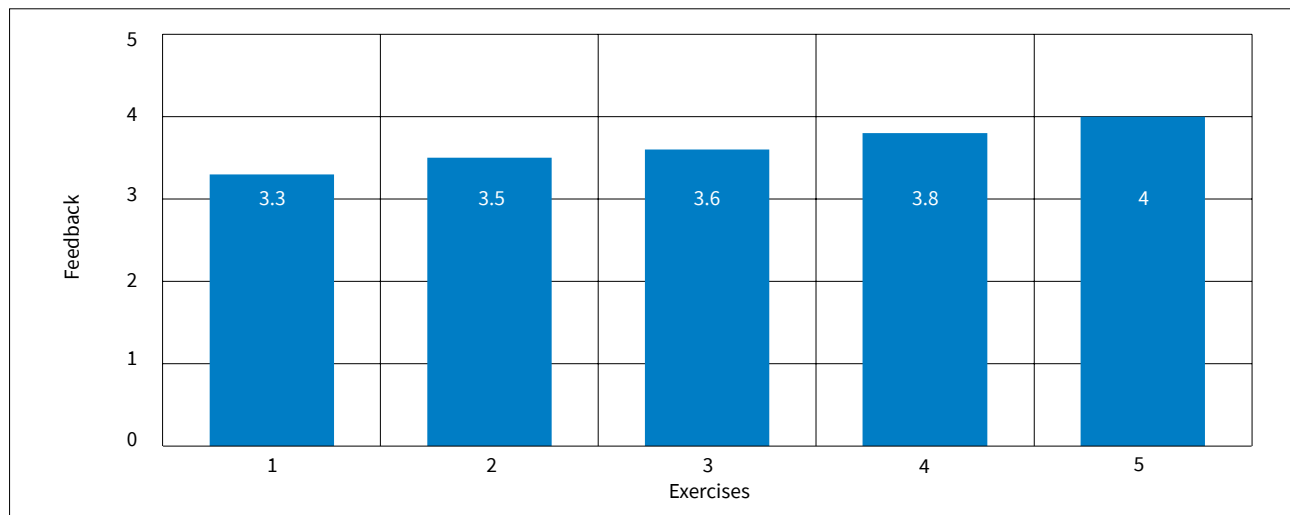
Exercise 2 - Population Projection

Exercise 3 - CapEx and OpEx of Collection and Conveyance System

Exercise 4 - CapEx and OpEx of Wastewater Treatment

Exercise 5 - Financial Modelling and Project Planning

Figure 28: Feedback For Exercise Complexity



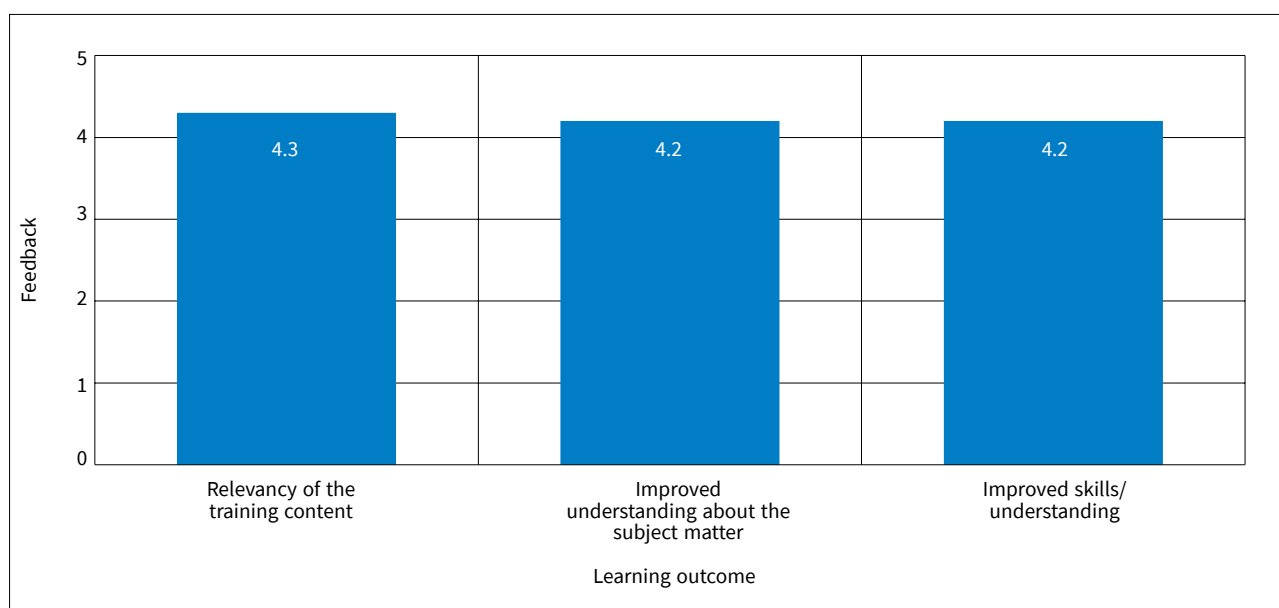
The perception of participants about the exercise is an important parameter to understand whether the exercise is adequately engaging. It is usually observed that oversimplified exercise is uninteresting and does not provide the understanding of fundamentals to the participants. On the contrary, a highly complex and difficult exercise is perceived as tedious by the participants thereby leading to incomplete attempts. A moderately complex and difficult exercise balances all the essential parameters and objectives of the exercise in an online training format.

4.1.4 Learning Outcomes

The graph below represents feedback on learning outcomes of the training program like relevance of the training content, improved understanding about the subject matter, improved skills/understanding about FSSM from participants out of range from 0-5 (where 5 is the highest and 0 is the lowest value).

The average rating for all the parameters was 4.2. Thus, it can be concluded that the participants have gained substantial knowledge about IWSM.

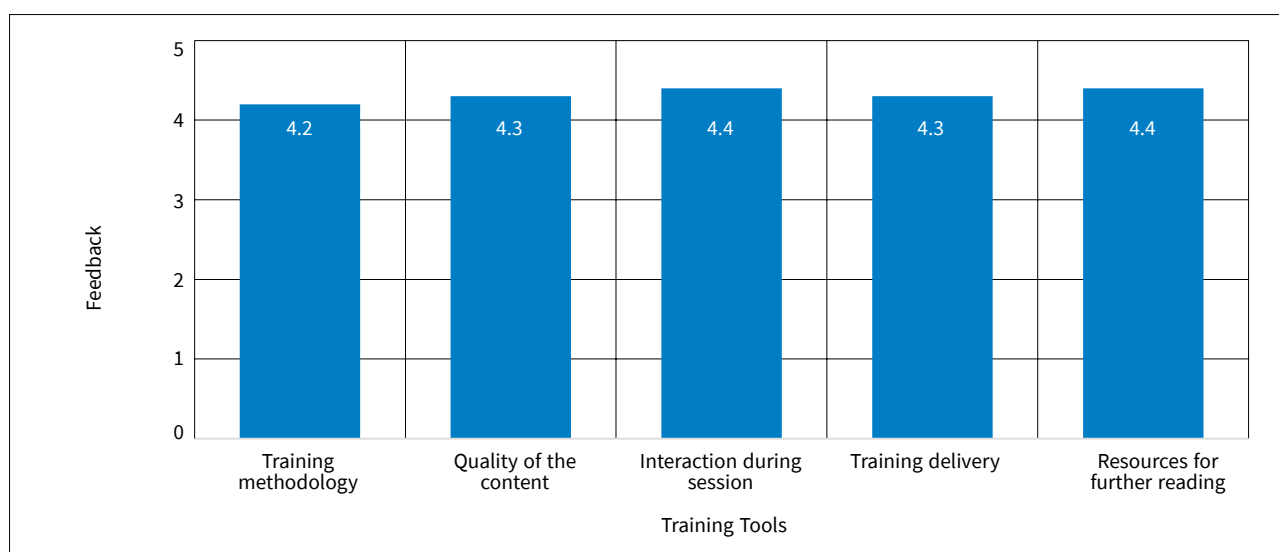
Figure 29: Feedback On Learning Outcomes



4.1.5 Training Tools

The graph below represents feedback on training tools like training methodology, quality of the content, training delivery, interaction during sessions and resources for further learning for participants out of range from 0-5 (where 5 is the highest and 0 is the lowest value).

Figure 30: Feedback On Training Tools



An average rating of 4.3 was given by the participants to all the parameters for assessing the training tools and methodology used in the training program. Combination of different tools for delivering the training program, ensured that the participants were engaged throughout the 8 days, thereby improving their learning experience.

4.1.6 Training Management

The graph below represents feedback on training management, such as duration of course, handling of online platforms, communication from participants out of range from 0-5 (where 5 is the highest and 0 is the lowest value).

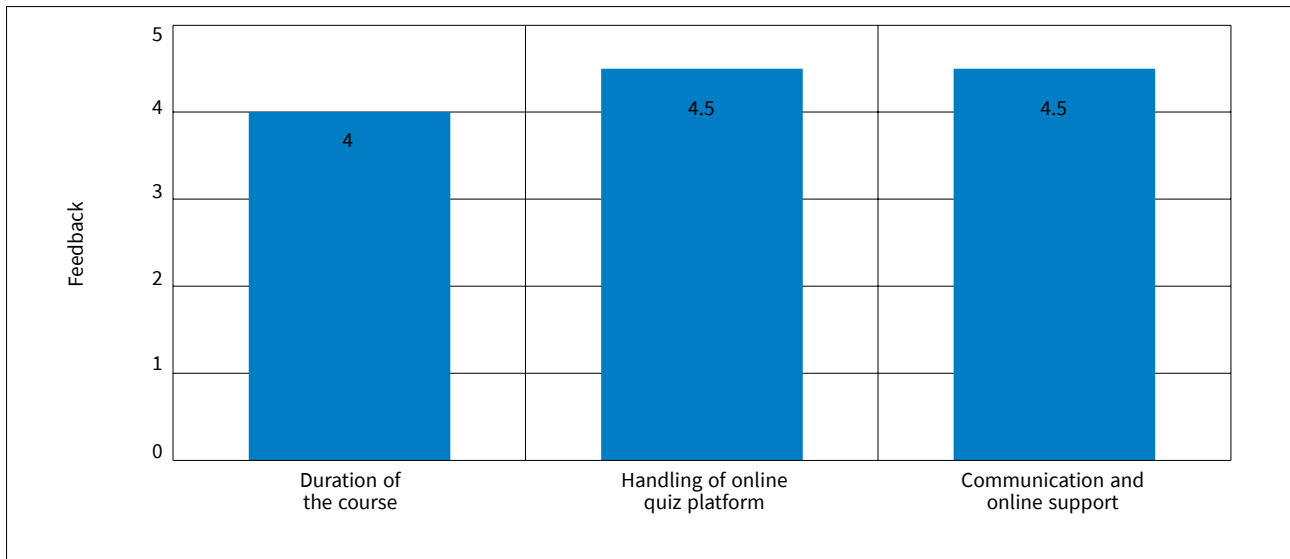


Figure 31: Feedback on Training Management

An average rating of 4.5 was given for handling online quiz platforms, communication and overall. Attending the session during office hours was one of the major challenges faced by the participants, as identified from the feedback. Almost 80% of the participants that provided feedback raised this challenge. Some other issues raised by participants were getting used to the platform (16%) and disruption in the network (23%).

4.2 Module Revision

The online training was a pilot training conducted on the draft module. Thus, the feedback from the participants will be taken into consideration for revision and finalization of the content of the module.

It was also discussed that for online training, restructuring of the session can be done. Certain sessions will be shortened for the online training (if required).

4.3 Participants Testimonials

The training course ended with feedback and experience sharing from a few participants.

Testimonials from participants

Sr. No	Name of the Participant	Organization	Testimonial
1	Mr. Jay Shah	Urban Management Centre, Ahmedabad	Thanks, ESF and NIUA team for the content. We as practicing people got the opportunity to learn from the training, especially the technology session. It is great to know that the ESF and NIUA team will be there to provide technical assistance.
2	Mr Hiranya Tallam	CDD Society	Thank you NIUA and ESF. It was indeed a very helpful training and the course managed to cover a wide range of topics in a short amount of time without compromising the quality. The workbook was also very well curated and gave us an opportunity to have hands-on experience. The trainers have done a wonderful job in explaining the topic as well as clearing our doubts during the session and post session.
3	Mr. Husain Mufaddalbai Hasamwala	Government of Gujarat	Thanks to the NIUA and ESF team for excellent inputs on various topics of IWSM such as ground rules for SBM and Jal Jeevan Mission, baseline data collection, planning approaches, design aspects and O&M. The training has been insightful and really helped us. The inputs obtained from this training are invaluable.
4	Mr. Jitendra Katre	WaterAid	Thanks to the NIUA and ESF team for this training, all training topics are very useful and interesting, the session delivery was also good. I got some new information from the module. Thanks a lot for this wonderful training.
5	Ms. Berna Ignatius	UNICEF	Thanks a lot for this training. I am glad to come and learn. The concept of having a quiz after every session was excellent. The trainers did a great job and provided valuable inputs. Special thanks to trainers for patiently listening and answering.
6	Ms. Shilpy Gupta	NIUA_CITIIS	The training module was well designed and delivery done is excellent. Modern tools were used to make the session more interactive.
7	Mr. Ranjit Kumar	ASCI, Hyderabad	Thanks for NIUA and ESF teams for delivering the course. This is the need of the hour as many states and ULBs are moving towards wastewater management. This course will build the knowledge and I hope we will initiate conversation with the government for better solutions.

5. Learning Impact Assessment

The training program on Integrated Wastewater and Septage Management received a total nomination of 73 participants. Out of the 73, 61 participants attended the training program actively. 62% of participants that attended the training program were male whereas 38% were female.

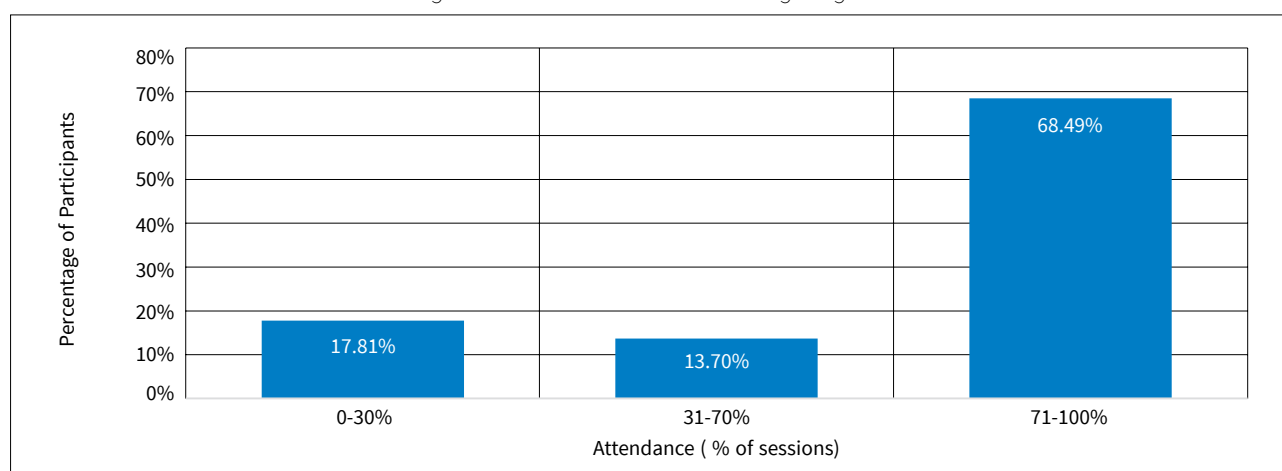
The successful completion of the course was dependent on:

- Attending all the sessions.
- Attending more than 70% of the quizzes.
- Attempting the exercise.

5.1 Attendance

Out of 71 participants, 68% of participants attended more than 70% of sessions required for the certification. 18% of participants dropped out from the early stages of the training. The remaining 14% attended particular sessions related to planning approaches, baseline surveys and assessments.

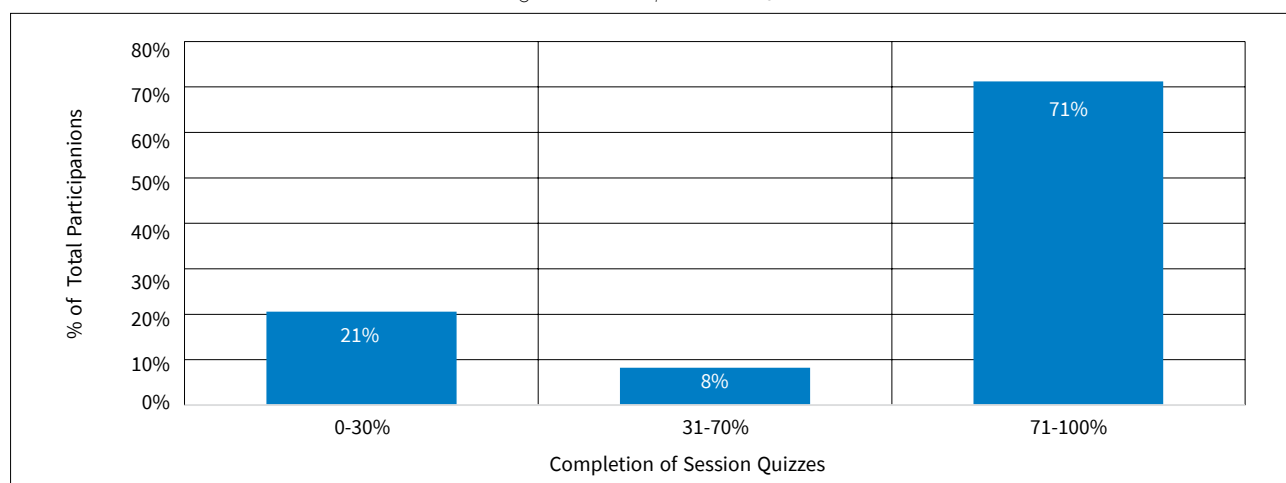
Figure 32 Attendance for the Training Program



5.2 Quiz

In total 71% of participants attended at least 70% of quizzes that were necessary for certification. Whereas, 21% participants did not attempt most of the quizzes. In the feedback forms, certain participants also responded that getting accustomed to online tools was a challenge.

Figure 33: Completion of Quiz

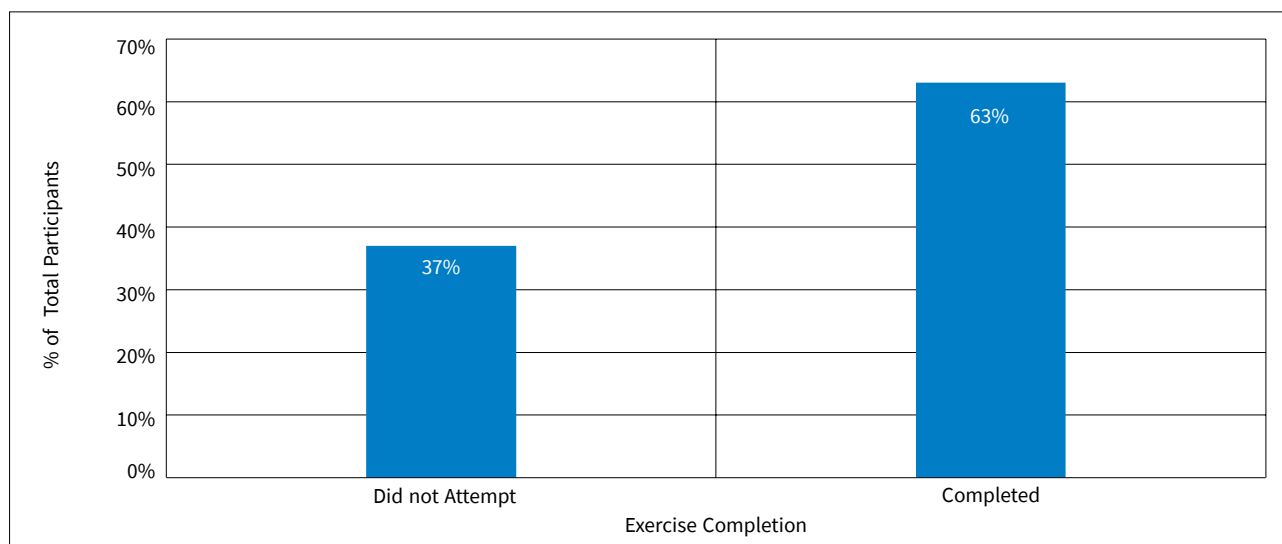


The quiz was designed in a way that the participants had to recall the learnings from the session and apply it in order to find the solution. This reinforced the key take away from each session. Multiple choice questions along with true and false and fill in the blanks based questions were set up in the quiz.

5.3 Exercise

Out of 73 participants, 46 participants (63%) attempted the exercise and submitted the solution for assessment. It was observed that participants who had attended all the sessions and attempted all the quizzes had completed the exercise.

Figure 34: Completion of Exercise

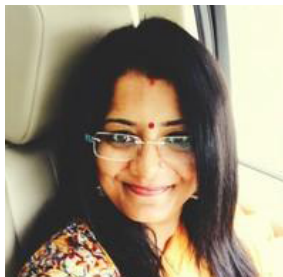




5.4 Certification

46 participants (63%) successfully completed the training program and received a certificate. During the discussion with the participants, it was seen that one of the reasons for such a high success rate of completion was mainly due to live training sessions. The same was also observed through the response provided by the participants.

Annexure 1: List of Resource Persons

List of Resource Persons

Sr No.	Name of The Resource Person	Organization	Role	Profile Photo
1.	Ms. Sreevidya Satish	NIUA	Moderator	
2.	Mr. Dhawal Patil	Ecosan Services Foundation	Lead Trainer	
3.	Mr. Saurabh Kale	Ecosan Services Foundation	Lead Trainer	

Annexure 2: List of Participants

The following table presents the details of the participants who attended the Integrated Wastewater and Septage Management training.

List of Participants

S.R No	Organisation Name	Nominations	Email ID
1	EY	Mr Manu Tyagi	Manu.Tyagi@in.ey.com
2		Mr Biswaroop Ghosh	Biswaroop.Ghosh@in.ey.com
3	ESCI	Ms Anita Aggarwal	em@escihyd.org
4		Mr. Venu	ccc@escihyd.org
5		Er.G.Naresh	wrd@escihyd.org
6	WASHi	Nandita Talukdar	nandita@washinstitute.org
7		Dr. Manikandan	manikandan@washinstitute.org
8	Athena Infonomics	Mr Arjun Sharma	arjun.s@athenainfonomics.com
9		Ms Aanandita Sikka	aanandita.s@athenainfonomics.com
10	CDD Society	Mr Sagar Patil	sagar.p@cddindia.org
11		Hiranya Tallam	hiranya.t@cddindia.org
12	ASCI	Dr Rajarshi Banerjee	rajarshib@asci.org.in
13		Mr Sayan	sayanmondal20013@gmail.com
14		Mr K B Ranjit Kumar	ranjitk@asci.org.in
15	UMC	Jay Shah	jay@umcasia.org
16		Raj Joshi	raj@umcasia.org
17	UNICEF	Ms Ankita Gupta	a.gupta2507@outlook.com
18		Saswat Nayak	saswatnayak85@gmail.com
19		Berna Mary Ignatius	berna.ignatius@gmail.com
20		Reshma Borkar	
21	Urban Development And Housing Department Govt Of Jharkhand	Manzoor Alam	manzoor85ab@gmail.com
22		Shashi Prakash	satyamevbharat@gmail.com
23	AIILSG	Aditi Gupta	Aditi.gupta@aailsg.org
24		Goutam Mahato	iecxpertunicef.bhopal@aailsg.org
25		Pranab Jyoti Sarania	Pranabsarania28@gmail.com
26		B Ashwin Kumar	Fssmexpertunicef.guwahati@aailsg.org
27		Gowthaam S.K.	Fssmexpertunicef.raipur@aailsg.org
28		Rajiv Ranjan	Teamleaderunicef.ranchi@aailsg.org
29		Ritesh Kr Suman	riteshsuman034@gmail.com
30		Shila Matang	iecxpertunicef.ranchi@aailsg.org
31	WaterAid	Binu Arickal	binuarickal@wateraid.org
32		Amar Prakash	amarprakash@wateraid.org
33		Jitendra Katre	jitendrakatre@wateraid.org
34		Lenin Jacob	iamleninjacob@gmail.com

35	PwC	Rajiv Reddy	rajiv.reddy@pwc.com
36	PwC	Vimal Sharma	sharmavimal14@gmail.com
37	Gov of Gujarat through UMC	Mr. Husain Mufaddalbhai Hasamwala	husain.mgsm@gmail.com
38		Mr. Apexkumar Suketkumar Saraiya	apex.mgsm@gmail.com
39		Mr. Smit Dave	gmcenvironment18@gmail.com
40		Mr. Harsh Nitinbhai Patel	harshnpatel105@gmail.com
41	Uttarakhand Urban Sector Development Agency (UUSDA)	Mr. Rahul Yadav	ryadav@tce.co.in
42		Mr. Saravana Velan	svelan@tce.co.in
43		Mr. Devendra Chaudhary	devendreamer@gmail.com
44	RCUES, Lucknow	Dr. Rajeev Narayan	narayanrajeev1963@gmail.com
45		Dr. Alka Singh	alka.rcueslko@gmail.com
46		Mr. Ajit Kumar Mishra	ajit.rcueslko@gmail.com
47		Dr. Nasruddin	nasar.rcueslko@gmail.com
48	KILA	Mr J.R.Raj	rajraghav@gmail.com
49		Ms Shruthy M.L	shruthy.ml@gmail.com
50		Ms Sumitha G.K	sumithagk@gmail.com
51		Mr Sankaran Kutty M	sankarankuttym8@gmail.com
52	ATI, West Bengal	Mr Kaushik Ghosh	kaushik.gh@gmail.com
53	NIUA_CDG	Aparajita Dubey	adubey@niua.org
54	NIUA_SBM	Mr Kaustubh Parihar	kparihar@niua.org
55		Ms Tavishi Darbari	tdarbari@niua.org
56		Ms Sonali Mehra	smehra@niua.org
57		Mr Gaurav Thapak	gthapak@niua.org
58	NIUA_CITIIS	Dr Shilpy Gupta	shilpy@niua.org
59	NIUA_SCBP	Shantanu Padhi	spadhi@niua.org
60		Aparna Unni	aunni@niua.org
61		Laila Khan Khongthaw	lkhongthaw@niua.org
62		Doab Singh	doab@niua.org
63	ESF	Mahima Sunil	mahima.sunil19@gmail.com
64		Kiruthika Prakash	kiruthikapraakash2000@gmail.com
65		Prajwal More	prajwal.more@ecosanservices.org
66	Terran India Foundation	Dr Amit Mishra	mishra.as@gmail.com
67	IPE Global	Sakshi Godara	godarasakshi1990@gmail.com
68		Sumit Kuliya	sumitkuliya@gmail.com
69		Pranshu Kumar	pranshu48@gmail.com
70	Jal Kal, Kanpur MC	Anand Kumar Tripathi	anandwtripathi@gmail.com
71		Kamakhya Prasad Anand	kamakhya.anand@gmail.com
72	Jal Kal, Moradabad MC	Bheem Rao Ashok	bheemraoashok@gmail.com
73		Anil Kumar	anilkumarje02@gmail.com

Annexure 3: Session Agenda

Date	Session & Description	Resource Person	Duration (Min.)
Friday, 20 August 2021	Welcome address	Jyoti Dash	10
	Introduction to training and Ground rules	Mahreen Matto	10
	Session 1: Introduction to IWSM	Saurabh Kale	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	20
	Introduction to Classmarker and Mentimeter	Akshay Agarwal	10
	Session Feedback	Sreevidya Satish	05
	Closing Remark	Sreevidya Satish	05
Saturday, 21 August 2021	Welcome	Sreevidya Satish	10
	Session 2: Missions and Programs	Saurabh Kale	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	5
	Session 3: Planning Approach	Dhawal Patil	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	5
	Session Feedback	Sreevidya Satish	5
	Closing Remark	Sreevidya Satish	5
Monday, 23 August 2021	Welcome	Sreevidya Satish	10
	Session 4: Baseline Survey and Assessment	Saurabh Kale	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	20
	Exercise:	Dhawal Patil	20
	Session Feedback	Sreevidya Satish	5
	Closing Remark	Sreevidya Satish	5
Tuesday, 24 August 2021	Welcome	Sreevidya Satish	10
	Session 5: Design Aspect	Dhawal Patil	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	20
	Exercise:	Dhawal Patil	20
	Session Feedback	Sreevidya Satish	5
	Closing Remark	Sreevidya Satish	5
Wednesday, 25 August 2021	Welcome	Sreevidya Satish	10
	Session 6: Collection and Conveyance system	Dhawal Patil	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	20
	Exercise:	Dhawal Patil	20
	Session Feedback	Sreevidya Satish	5
	Closing Remark	Sreevidya Satish	5
Thursday, 26 August 2021	Welcome	Sreevidya Satish	10
	Session 7: Wastewater Treatment	Dhawal Patil	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	20
	Exercise:	Dhawal Patil	20
	Session Feedback	Sreevidya Satish	5
	Closing Remark	Sreevidya Satish	5

Friday, 27 August 2021	Welcome	Sreevidya Satish	10
	Session 8: Project Management	Dhawal Patil	30
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	20
	Exercise:	Dhawal Patil	20
	Session Feedback	Sreevidya Satish	5
	Closing Remark	Sreevidya Satish	5
Saturday, 28 August 2021	Welcome	Sreevidya Satish	10
	Opening Remark	Dayanand Panse	15
	Session 9: O&M and sustainability	Saurabh Kale	25
	Discussion and Question and Answers	Dhawal Patil & Saurabh Kale	5
	Closing Remark	Hitesh Vaidya	10
	Feedback Session	Sreevidya Satish	10
	Online Quiz	Sreevidya Satish	15

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