Water Supply Engineering
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Lecture - 04
Water Supply : Key Issues and Concerns

Hello friends and welcome back. So we have been talking about the some basics of the water supply engineering. And in the last couple of lectures we did talk about the various water sources, its availability, its distribution and its uses.

So we did discuss about how much water is available in the different continents and particularly in India how much water is available, what are the status of the surface water resources and groundwater resources and how it is concentrated in some sectors, the state wise availability of the surface and groundwater resources. And in last lecture, we discussed about the various uses of the water, uses in the industrial sector, uses in the domestic sector and agricultural sector.

Of course, there is a uses in the environmental sector as well, but the competing uses, we focused more on to these three competing uses domestic, agricultural, industrial sector and how much consumption is basically required from the different sectors, what is the demand arising from the different sectors and we did discuss some trends how there has been predictions how these are demands are going to change in the future. So which sector is going to see what kind of shoot up in the demand, okay.

Like we did see that industrial sector is probably the sector which will be like showing the maximum growth in terms of percentage increase in the demand and agricultural sector will be actually the lowest growing sector but the total overall demand still is much higher from the agricultural sector and will remain high as opposed to the industrial and domestic demands.

So this class, we will be basically discussing some of the key issues and concerns related to the water supply.

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What we are going to cover is what are the major challenges in water sector in India and then we will be discussing issues in water quantity management, water quality management, some of the issues in governance and what are a few other major issues that our water sector is going to face in the future.

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So to begin with, if we see the water quantity management perspective, so one of the major threats or challenge that we are going to face is on the resource protection, okay. So our surface water sources is depleting. The rivers are drying. The lakes are drying like for example, if you see this is a lake in Chennai, okay.

So if you see the last year around June 15 2018, this was the size of the lake then it reduced in April 6 of this size and then by June 15 after an year, only this much

amount of water remained in the lake. So this kind of gives us an idea that how and at what pace we are actually losing our water resources, okay. I am sure all of you have seen that various rivers which used to run at very high flow earlier are now getting more and more narrow, okay. A few has dried up completely.

There is substantial water comes during the flood and monsoon but otherwise in dry phase the rivers are merely turning into the nullah kind of thing, okay. So that is one point of concern. The various, this is like we just saw an example of the water reducing in a lake in Chennai in just a span of one year.

But we have witnessed in several cities that many lakes that used to exist has actually completely vanished now due to urbanization or other things various lakes and even to some extent a few reservoirs also, natural reservoirs have completely kind of vanished and the place the land use has completely changed now. So there is no more space for storing water. So that way we are actually losing lot of surface water sources, which is a point of concern.

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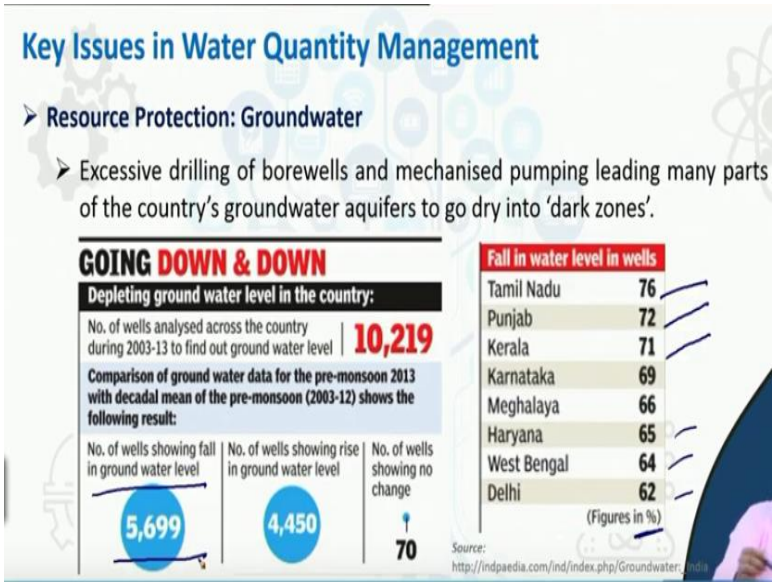

Similar is the condition in terms of the groundwater. In fact probably more threatening because our major requirement is fulfilled from the groundwater sources and not the surface water sources. The major reason for depletion of the groundwater is excessive drilling of the bore wells and mechanized pumping, which leads many part of the country's groundwater aquifer to go dry into the dark zone.

So we hear like we hear that by 2020, Delhi is going to be a dry city. So there would not be groundwater available in Delhi. Similarly, we were actually listening for Bangalore this year only that Bangalore is going to run dry. So that is basically in terms of the groundwater availability. And the groundwater depletion is a prominent problem almost throughout the country, okay.

It is basically if we see some figures, so the fall in the water level in percentage in Tamil Nadu is around 76%, Punjab 72% Kerala 71%, Haryana, West Bengal, Delhi. So there is substantial fall in the groundwater tables, okay. There is basically number of wells which show fall in the groundwater levels are as high as around more than 5.5 thousand okay.

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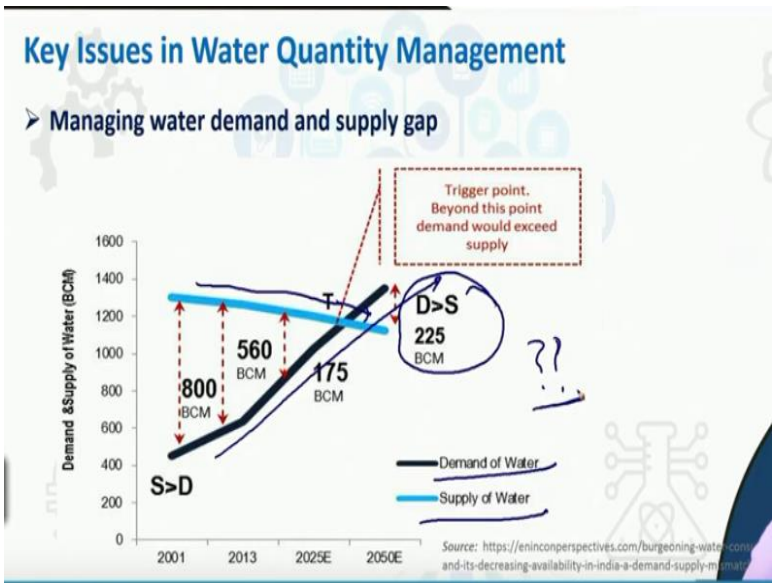

So there is like there is enough data available on this which suggest that various places, various states are actually going to run dry and the groundwater is depleting very fast, okay. So the Central Water Commission assessment says around 2.5 meter fall in the groundwater table in many areas of the country is seen in one year time.

So in one year the groundwater level falling 2.5 meter means one can imagine that what is the extent of water or groundwater that we are actually losing through this way, okay. So that is one of the major concerns how we protect our groundwater resources. Then there is issues on the managing water demand and supply gap.

So like last week, when we were discussing the water consumption or water demand from the different sectors, so we did discuss that the water demand is going to shoot up from all the sector. There would be rise in the demand from agricultural sector, there would be rise in demand from domestic sector due to population growth and there is going to be huge rise in the industrial sector demand because of the industrialization and urbanization.

So estimate kind of suggest that the demand is going to basically get increased whereas the available is going to get down as we were just discussing because of the depletion of surface and groundwater resources. So with decreasing availability or decreasing supply of the water and increasing demand of the water, we are going to actually see a point when there would be actually inverse deficit.

So how we are going to tackle this situation when our demand is higher than the total supply or total availability of the water. So that is one big question that is going to come in future to us, okay.

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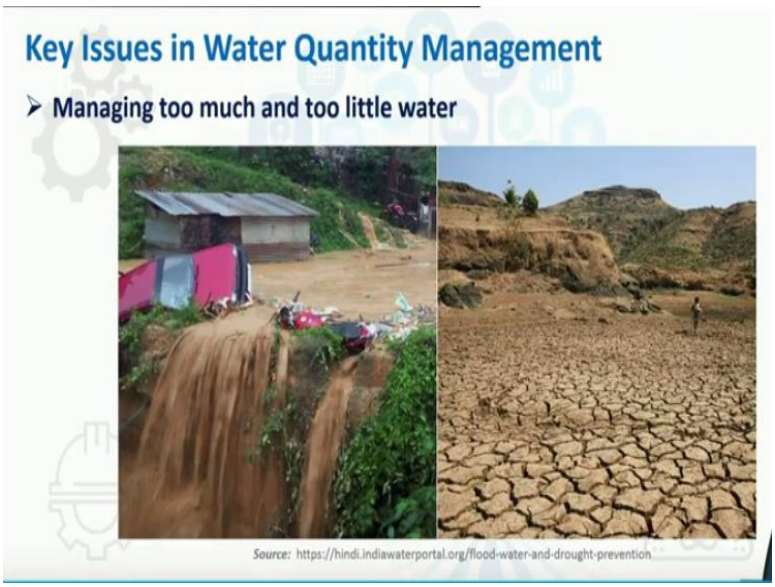

The other prominent problem in water quantity management is managing too much and too little water. This means India being a country such that in a same almost similar time period, in one part, we see the drought while in another part, we see the flood. So at one place there is too little water. People do not have even the substantial or sufficient amount of water to meet their basic domestic requirements.

Whereas in other place there could be devastating floods, where there is too much of water and there is no way to basically take that out water safely from the region with limiting destructions. So how we are going to deal with flood and droughts is another big question. And with advent of the climate change, we are seeing this phenomena is more apparent.

Earlier there was like limited cases of droughts and floods, but now what we see, we did discuss this in earlier lecture as well when we were talking about the availability of water that at least a few months, or at least a month in dry season we seem like a large part of country goes under the drought. Whereas in monsoon period when there is a lot of rainfall we recently this year only we saw that entire eastern and substantial southern part has actually badly affected by the floods, okay.

So North Eastern, Eastern and these parts were badly affected by the floods. So that is another problem, how we are going to deal with the too little or too much of the water.

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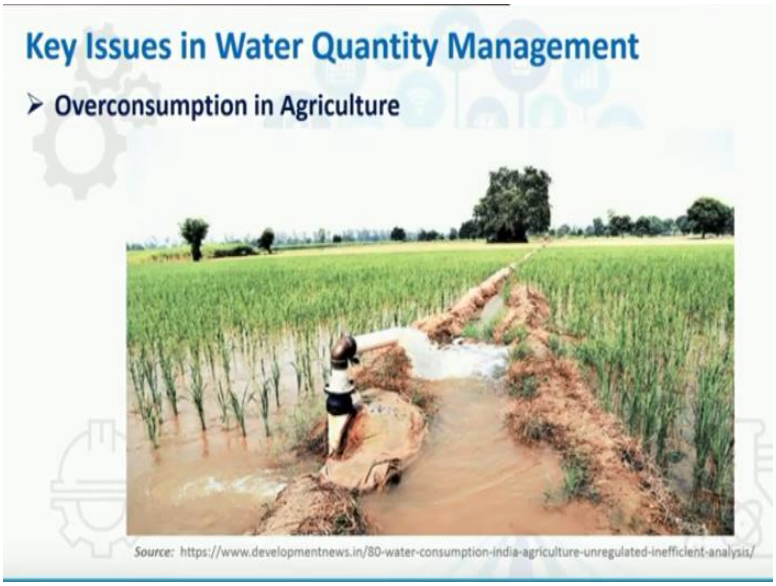

Then another problem, this also we had a brief discussion in the earlier lecture is over consumption of water in agriculture, okay. So agriculture, there are technologies, there are methods available for providing water directly to the root at optimum requirement, but those kind of systems are very rarely adopted and what we often see is the flood irrigation for majority of the crops particularly rice, sugarcane those kind of thing and lot of water gets wastage in this process.

The irrigation is often more than actual water requirement of the crop. So there is a huge over consumption in the agricultural sector. This is also kind of promoted by various government schemes where the farmers are kind of made water available for free from the canals or those kind of systems or the electricity is free or subsidized for agricultural consumption.

So there is not much cost involved in fetching the water and that is why there is not adequate value given to the water and people do not actually kind of think of using water to just optimum level. So that is another problem.

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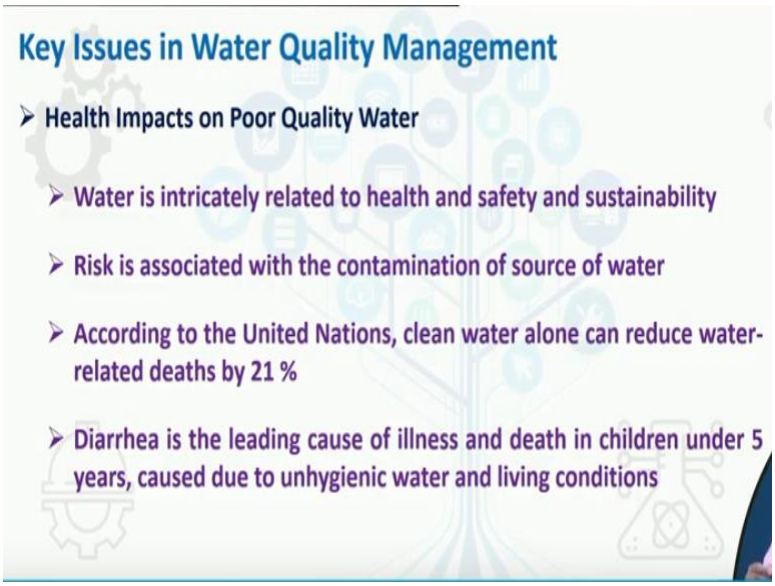

Now if we see the key issues in water quality management, so the first and foremost is the health impact of poor water quality. So how we are going to deal with this. Everyone actually is aware that water is almost directly correlated with health and safety of the consumer. So risk associated with the consumption of the polluted water is very high.

There are lot of waterborne diseases which are known to kind of come into the existence and can actually turn into the epidemics over a much larger area. So according to United Nations clean water alone can reduce water related deaths by 21%. So that is the power of the quality consumption of the water. Diarrhea is the leading cause of the illness and death in the children under five years and which is primarily because of unhygienic water and living condition.

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So that is the importance of the quality management. However, the challenge is how do we manage the quality okay. We see that our surface water sources are highly polluted okay. So you can go to any lake, any river, you will hardly find water clean enough to be consumed directly, okay. So there are apparently visible contaminants visible pollutants, there are lot of non-visible contaminants as well in the water.

So the water almost from all the major rivers, lakes or surface water sources, is not fit for direct consumption as of today.

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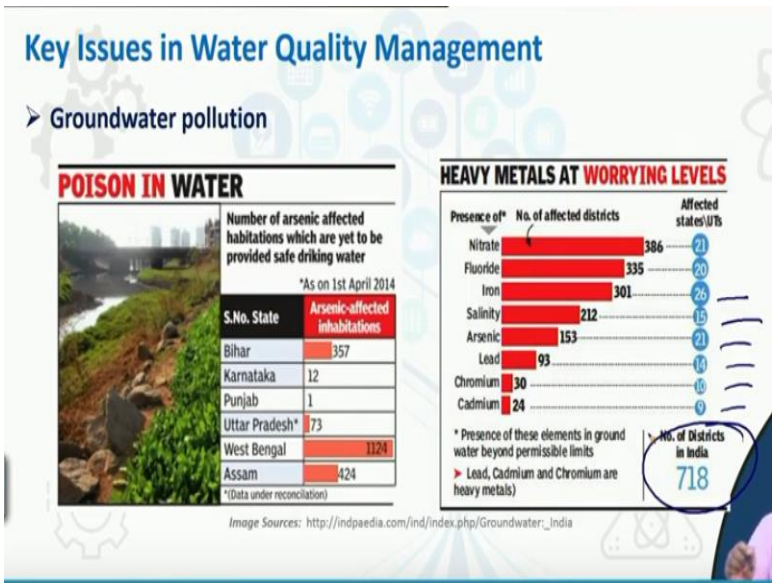

There are issues related to the groundwater pollution as well, okay. Prominent one being the arsenic and fluoride. So those kind of contaminant which are basically the

geogenic pollutants. So many of our states are affected with these kinds of pollutants. West Bengal is a very highly affected region by the arsenic poisoning.

Bihar, UP, Assam also has the cases of arsenic affected blocks and those kind of places are also available in few other state though in a smaller regions, restricted in the smaller regions. Fluoride is another widespread problem. So including like places Bihar Rajasthan, West Bengal, UP, MP, Chattisgarh. So there is a lot of states which are highly affected by the elevated fluoride levels.

So kind of geogenic contaminants like arsenic, fluoride and there are few others okay which are available in the predominant numbers. So our groundwater also is having risk associated with it okay. Heavy metals if we see some of the like iron, salinity, then arsenic, lead, chromium. So there are like, if you see total number of around 718 districts in India are affected by some sort of groundwater pollutions. So this is another alarming situation.

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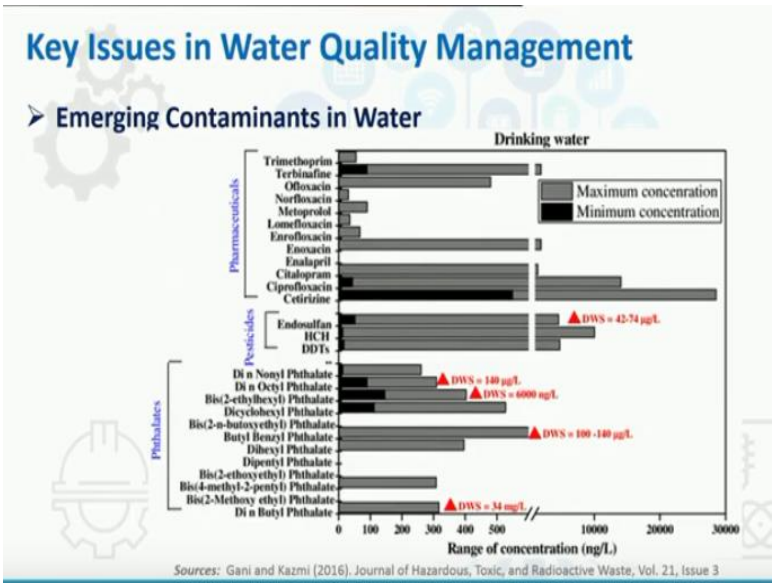

So apart from these traditional contaminants, there are emerging contaminants that are coming in the water okay which could be the pharmaceuticals and personal care products which could be the pesticides which could be the other industrial chemicals.

So if you see the maximum and minimum concentration of some of these such contaminants like a variety of pharmaceuticals or pesticides or other chemicals, so in

drinking water levels, they are available in substantial concentrations. So these again pose a very severe threat.

Why severe threat because the conventional pollutants people are aware with and they do make provisions for let us say, if you are fetching water from a river, you can see that there is a lot of sediments and those kind of things. So conventional process is set up for the treatment or purification of the water before it is used for certain specific purpose, say domestic or other kind of applications.

But these emerging contaminants because people are not aware with this, what kind of contaminant could be there, there is no regular measurement of these contaminants. So when there is no measurement, people are not aware of it. So they do not kind of consider these. They do not bother much about these and they consume water, even if these are present in the drinking waters or water for other applications.

So because of the lack of the awareness because of the lack of the data of the kind of contamination by these emerging contaminants or emerging pollutants, they mostly go unnoticed and people are consuming these. So the issues related to these and mind many of these are actually the carcinogenic. So in the long term, they can actually lead to very severe impacts, that kind of problems are going to come in future.

So that is another, how do we manage these emerging contaminants particularly in the drinking water, most important. So drinking and household or domestic consumption of water, we should ensure that these emerging contaminants or any threatening pollutant is not present. But that is often overlooked.

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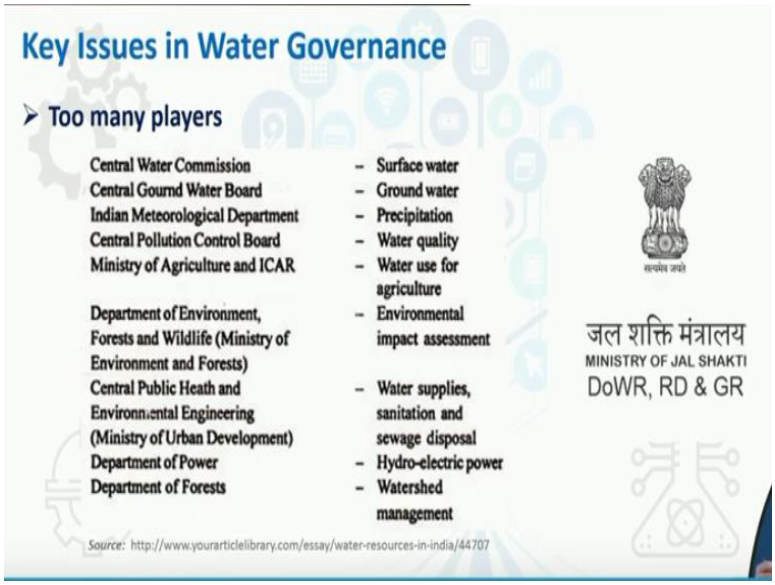

There are issues related to the governance of the water. One of the prominent issues is there are actually too many players to govern the water. We have Central Water Commission for surface waters. We have CGWB, Central Groundwater Board for groundwaters. Then there are meteorological department which takes keep the data for precipitation, those kind of thing.

There are CPCB, Central Pollution Control Board which look for water quality in surface as well as in ground waters. There are Ministry of Agricultural and ICAR which is basically for water use in agriculture. There is a Ministry of Environment, Forests and Wildlife for environmental impact assessment and the environmental sustainability of the water resources.

Then Central Public Health Environmental Engineering Department, which is CPHEEO under Ministry of urban developments, which is for water supplies, sanitation those kind of thing. Then Ministry of Power for hydroelectric power, Department of Forest for forest related watershed management and recently our Ministry of Water Resources was converted to Jal Shakti Mantralaya.

So we have Ministry of Jal Shakti which is for incorporates water for means rural development, Ganga rejuvenation and then Department of Water Resources all this thing is actually incorporated in that.

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There are various other key issues in the water governance or management, okay. We discussed some, but there are far more prominent issues in different forms exist in field of water governance or management. There are basically challenge to assess the sustainable resource availability. This itself is missing.

So we do not know for say a given watershed or for say a given urban catchment, how much water can be withdrawn in a sustainable manner, okay. So what is the exact groundwater quantity available, what is the surface water quantity available, how much precipitation comes, what is the storage capacity of the water coming through rainfall.

So all those information are at some places some of these informations are available but there is no comprehensive method developed to basically compile this information, analyze this information and see what could be the sustainable withdrawal water for a given catchment. So that is one challenge. Water resource planning and sectoral water allocation is another big challenge, because as we see that in governance there are various ministries involved.

So coordination among those and in the planning of water resources, because there is requirement from different sector. So you have a say river, now Irrigation Department would try to fetch a canal from the river for irrigation purpose. Then for drinking water purpose somebody will try to get a pumping station for pumping drinking water. Then where does industrial water going to come?

What is the total amount withdrawal from that source, from that river? So all those information has to be there and it has to be planned in a coordinated way which is actually missing. So right now there is no as such comprehensive planning of how water should be distributed across different sectors. It is just there is a demand from this sector, okay try to supply water there. There is no control over irrigation.

Domestic water coverage is not hundred percent. Rural sector does not get piped water supplies. In urban sector though majority of the urban centers do get piped water supply, but there is no uniformity in that. Some places people get water as high as 600 liters per capita per day, which is in parts of Kolkata and other places. Some places they get even less than hundred liters per capita per day. So that kind of iniquity is there in the water allocation.

So how the water can be judiciously allocated between and within the sectors, okay. So within one sector how it can be allocated and between the different sectors between say agricultural sector, industrial sector, domestic sector as well as environmental sector because it is important to manage the resources as well, okay, for our future sustainability.

So how the water can be allocated across these different sectors is again a big challenge which we have to face and we are actually facing as well. Then environmental protection; so in terms of the water quality, in terms of the water availability both okay. As we were just discussing that the quality of the resources is deteriorating and the availability of water in the resources is also basically reducing.

So our rivers are drying, lakes are shrinking, groundwater is depleting. So how we can protect our aquifers, how we can protect our rivers, how we can protect our lakes in terms of quality as well as in quantity. Of course, there are technological challenges for better and cost effective tools and techniques in water management, this will always be there.

We do have quite a few technologies, very efficient technologies for managing water, but there is always a scope for doing better in technological terms, okay. So how we

can improve upon the technology for a better and more cost effective approaches for water management. Then financial sustainability of water services is another major challenge.

How we manage the cost and recovery dynamics of the water services okay, because water getting from source and then supplying to consumer does require some investment. So does require some cost, from where that cost is going to come? Is it going to come only from the government sector or it is going to come, there has to be some recovery plan from the end consumers.

If it is totally subsidized coming from government, how the government is going to sustain that okay, particularly in the virtue of the increasing demand and expecting better services by the community, okay. So how the systems can be financed, made financially sustainable, okay? What kind of subsidies are justifiable? So all those thing has to be properly like looked upon.

This is one major challenge, how do we see that. Then overcoming corruptions and political influences. Now the water is a matter of basic human requirements and that is why it is basically a very hot spot for political parties as well. So how basically, we can get over the political influences in managing the water resources.

Because there could be a abrupt political decision that you supply water for free or do not supply water to this sector, put the like water managing in a such a fashion that okay these sectors gets priority, this sector does not get priority. So overcoming all this political influences which could be, there could be different motivations behind that, okay.

There could be the political decision for the societal welfare as well, but there could be political decisions for gaining say the voters or kind of banking upon the vote bank politics. So how do we overcome those kind of decisions and then of course the corruption in the water management. Then the skill deficiencies. This is another major challenge. We need, water is a big sector and we need lot of skilled manpower.

We need lot of skilled and trained human resources in order to kind of smoothly and operately manage and govern the water services. And this has to be at different levels. We need people at decision maker level which have well acquainted with the issues and approaches for managing water. We need people at say basic operation levels, managerial levels, decision maker levels.

So we need skilled, trained and educated people at the different levels and preparing a pool of such people is also a major challenge where academic institution can play a role, okay or various training institutions and those kind of things should come into play and try to develop a skilled human resources for managing water. The data inadequacy and management.

So whenever we try to plan some water services or try to manage or govern water services, we have to have data at hand. And that is one big challenge because there is inadequate data available in the water sector. Most of the time data is not recorded and even if some data is recorded, it is lying as we just saw that there are different agencies responsible for governing.

So the data lies in the different pockets to different people. And for a comprehensive planning, it is very difficult to acquire all those data. So first thing there is like the data might be inadequate at collection terms itself, but even if it is collected, fetching that data on a centralized system is another major challenge. So how we ensure that the appropriate data is collected in the right manner, right fashion and is managed is one another major challenge.

And then of course ensuring stakeholder engagements because otherwise water is managed by a select handful of people and the consumer or the other stakeholders do not have much say in the water management and water governance. So how do we come up with a system where all the stakeholders are involved in the governance and management of the water so that everyone is aware what is happening, how it is happening, with full transparency.

And that would actually enhance the trust in the service provider as well. So these are some of the other key challenges that one need to kind of see through and overcome

in order to get for a good governance and management of the water services. So with this we close the discussion in this lecture. And in the last lecture of this week, then we will have a holistic overview of the water supply systems. And then from the subsequent weeks we will go more on to the specific discussions for fulfilling the content of this course. So thank you for joining and see you in the next class.