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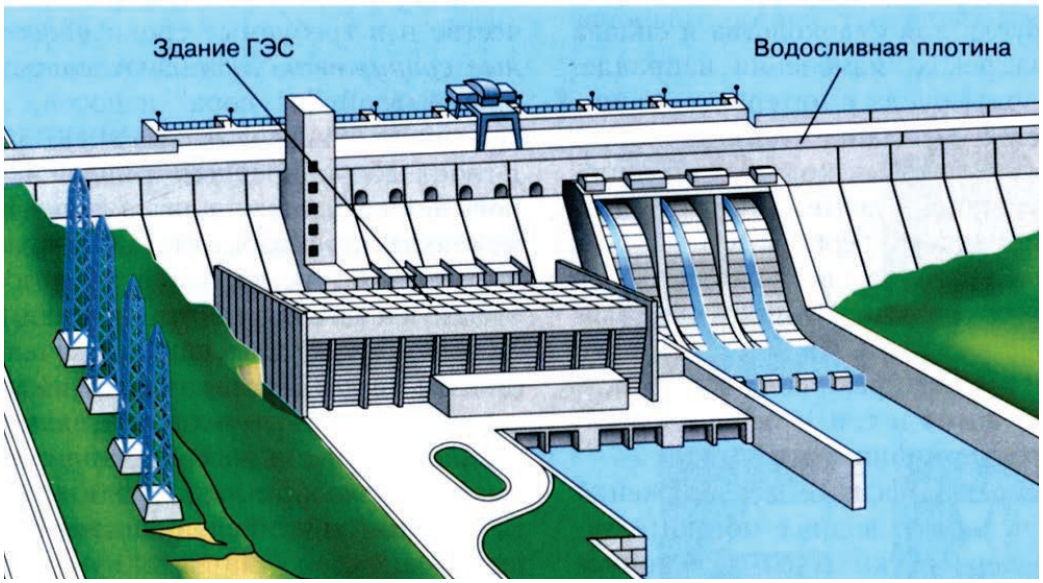
ГИДРОТЕХНИЧЕСКОЕ СТРОИТЕЛЬСТВО

HYDRAULIC ENGINEERING

Пособие по английскому языку для аспирантов



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Пособие предназначено для подготовки аспирантов к экзамену на кандидатский минимум по иностранному языку по направлениям 05.23.07 «Гидротехническое строительство» и 08.06.01 «Техника и технологии строительства». В пособии представлены тексты по гидротехническому строительству, лексико-грамматические упражнения, интегративные задания с применением электронных ресурсов, переводческие задания, научные статьи для обсуждения.

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ВВЕДЕНИЕ

Авторское пособие «Гидротехническое строительство. Hydraulic engineering» адресовано аспирантам 1 и 2 курсов технических вузов, изучающих дисциплину «Иностранный язык» уровня B2, и представляет собой практический материал для работы с техническим английским языком с целью повышения иноязычной компетенции студентов и подготовки к экзамену на кандидатский минимум по английскому языку.

Основные разделы пособия посвящены истории развития гидротехнического строительства, различным видам плотин, проблемам безопасности дамб, а также описанию известного американского проекта строительства дамбы Гувера. Каждый тематический раздел пособия, посвящённый определённой предметной области гидротехники, начинается с глоссария по теме, чтения, перевода и обсуждения соответствующего текста в режиме парной работы. После текста представлены многочисленные лексико-грамматические упражнения на времена действительного и страдательного залогов, неличные формы глагола, союзные слова, фразеологические глаголы и т.д. Все грамматические темы снабжены небольшим теоретическим комментарием, примерами и ключами, что поможет аспирантам эффективно подготовиться к переводческим аспектам предстоящего экзамена. Прилагаемые научные статьи предназначены для перевода и обсуждения в аудиторном режиме работы.

Выполнение заданий на перевод предложений, содержащих изучаемую лексику, с английского языка на русский и с русского на английский является эффективным способом ее закрепления. Задания на перевод являются неотъемлемым компонентом пособия, поскольку студенты часто сталкиваются с необходимостью переводить научные труды и аннотации в рамках программы обучения в аспирантуре. Переводческие упражнения представлены заданиями на пост-редактирование фрагментов машинного перевода и заданиями на перевод технического текста с русского языка на английский.

В каждый урок пособия включены также интегративные задания, в которых аспирантам необходимо просмотреть аутентичный видеофильм на английском языке по теме урока, ответить на вопросы по сюжету видео и написать эссе по сопоставлению содержания текста урока и видео. Эти задания для тренировки таких видов речевой деятельности обучающихся как аудирование и письмо рекомендуется выполнять в режиме самостоятельной работы.

Написание сравнительно-сопоставительного эссе по видео-контенту стимулируют мыслительный процесс аспирантов и заставляют их подвергать материал критическому осмыслению. Возможность использования субтитров при просмотре видео с сервиса *YouTube* облегчает процесс выполнения задания для аспирантов с недостаточно сформированной иноязычной компетенцией. Аудиовизуальный режим самостоятельной работы студентов способствует повышению их интереса к иностранному языку и мотивации. В целом профессионально-ориентированные дидактические материалы способствуют формированию коммуникативных навыков, а также навыков чтения, аудирования, письма и перевода.

Авторы пособия выражают благодарность магистрантам направления *Лингвистика* Санкт-Петербургского политехнического университета Петра Великого, которые приняли участие в составлении упражнений для данного пособия.

Пособие рассчитано на два семестра.

Unit 1. Hydroelectricity

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Average – средний, обычный; **artificial lake –** водохранилище; **capacity –** мощность, выработка; **competitive –** конкурентоспособный; **consume –** потреблять; **demand –** потребность, спрос; **domestic –** внутренний, отечественный; **eclipse –** затмить; **elevation –** высота (геодезическая) ; **excess –** избыток**; extract –** извлекать; **grid –** сеть; **factor –** коэффициент; **fossil fuel –** ископаемое топливо; **head –** напор; **greenhouse –** теплица**; lack –** нехватка; **means –** средство; **renewable –** возобновляемый; **steam –** пар; **supply –** подача, поставка; **tide –** прилив; **upstream –** верхний бьеф, вверх по течению; **volume –** объём

1. ***Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах.***

1. Turbine is the essential component of all types of power plants.
2. Nuclear energy is rather expensive.
3. Construction of hydropower plants often results in people's moving house.
4. Hydroelectricity is a kind of renewable energy sources.
5. Alternative power sources are bound to replace conventional ones soon.
6. Hydroelectricity does not require waste disposal.
7. Fossil fuel burning is the major source of carbon dioxide emissions.
8. Hydroelectricity accounts for a minor part of power supply in the USA.
9. Large dams are indispensable for large – scale power generation.
10. Tidal stations considerably contribute to covering grid power demands.

There are three main ways how we can generate electricity, as well as some newly developed technologies that we will come to rely on in the future. They all have one thing in common, that is, they use fuel to turn a turbine, a large wheel. The three common means to generate are firstly by burning fuel to make steam. Another way is to use nuclear reaction to heat water to make steam. And the third way is to use the force of moving water to turn the turbine **–** hydroelectricity.

All have advantages and disadvantages. Burning is cheap and fuel, usually coal, is easily available. However, burning does cause pollution. Nuclear energy is the cheapest way to make electricity, once the costs of building the nuclear power station are taken away. The waste, however, stays radioactive foe a very long time, so there is a problem of storage. Hydroelectricity is the cleanest way to generate power as there is no pollution. But not everywhere there are fast-running rivers and creating artificial lakes is very expensive and often means taking people from their homes. Other, newer ways of generating electricity, for example, the use of wind power do not pollute the atmosphere, but they also do not yet produce enough electricity for the needs of a modern city.

Hydroelectricity is electricity produced from hydropower. In 2015, hydropower generated 16.6% of the world's total electricity and 70% of all renewable electricity, and was expected to increase about 3.1% each year for the next 25 years. Hydropower is produced in 150 countries, with the Asia-Pacific region generating 33 percent of global hydropower in 2013. China is the largest hydroelectricity producer, with 920 TWh of production in 2013, representing 16.9 percent of domestic electricity use.

The cost of hydroelectricity is relatively low, making it a competitive source of renewable electricity. The hydro station consumes no water, unlike coal or gas plants. The average cost of electricity from a hydro station larger than 10 megawatts is 3 to 5 U.S. cents per kilowatt-hour. With a dam and reservoir it is also a flexible source of electricity since the amount produced by the station can be changed up or down very quickly to adapt to changing energy demands. Once a hydroelectric complex is constructed, the project produces no direct waste, and in many cases, has a considerably lower output level of greenhouse gases than fossil fuel powered energy plants.

The technical potential for the growth of hydropower around the world are 71% Europe, 75% North America, 79% South America, 95% Africa, 95% Middle East, 82% Asia Pacific. The political realities of new reservoirs in western countries, economic limitations in the third world and the lack of a transmission system in undeveloped areas, result in the possibility of developing 25% of the remaining potential before 2050, with the bulk of that being in the Asia Pacific area. A few countries are highly developed and have very little room for growth, Switzerland 12% and Mexico 20%.

Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator. The power extracted from the water depends on the volume and on the difference in height between the source and the water's outflow, this height difference referred to as the head.

Pumped-storage method produces electricity to supply high peak demands by moving water between reservoirs at different elevations. At times of low electrical demand, the excess generation capacity is used to pump water into the higher reservoir. When the demand becomes greater, water is released back into the lower reservoir through a turbine. Pumped-storage schemes currently provide the most commercially important means of large-scale grid energy storage and improve the daily capacity factor of the generation system.

Run-of-the-river hydroelectric stations are those with small or no reservoir capacity, so that only the water coming from upstream is available for generation at that moment, and any oversupply must pass unused. A constant supply of water from a lake or existing reservoir upstream is a significant advantage in choosing sites for run-of-the-riverpower plants. In the United States, run- of- the- river hydropower could potentially provide 60,000 megawatts (80,000,000 hp) (about 13.7% of total consumption in 2011 if continuously available).

A tidal power station makes use of the daily ocean water rise and fall due to tides; such sources are highly predictable, and if conditions permit construction of reservoirs, can also be practicable to generate power during high demand periods. However, tidal power is viable in a relatively small number of locations around the world. In Great Britain, there are only eight sites that could be developed, which have the potential to generate 20% of the electricity used in 2012.

2. Найдите в тексте 12 пар синонимов.

1. produced 2. egion 3. practicable 4. eclipsed 5. change up 6. at present 7. considerably 8. onstant 9. available 10. locations 11. output 12. supply

3. Найдите соответствия между словами в группах A и B

A 1. relatively 2. bulk 3. average 4. domestic 5. demand 6. construct 7. adapt 8. output 9. funding 10. room 11. viable 12. currently

B a) majority b) requirement c) adjust d) build e) generation f) comparatively money allocation h) space j) Internal, home, home-produced i) typical, mean j) plausible k) at present

4. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

construct – construction – constructor
consume – … – … **cost –** … **increase –** … **demand –** …
generate – … – … **produce –** … – … **provide –** …
supply – … – … **permit –** …

5. А. Переведите следующие словосочетания.

1. domestic electricity use **2.** excess generation capacity **3.** large-scale grid energy storage **4.** run-of-the-river power plants **5.** changing energy demand **6.** fossil fuel powered energy plants **7.** the daily ocean water rise and fall

Б. ***Используйте принцип номинативной атрибутивной цепочки для большей лаконичности и переведите следующие словосочетания.***

1. daily capacity factor of the generation system **2.** source of renewable electricity **3.** the force of moving water **4**. costs of building the nuclear power station **5.** potential energy of dammed water **6.** lower output level of greenhouse gases **7.** the most commercially important means of energy storage

Confusables

6. Выберите подходящее слово.

Water

Water is one of our most **(1)** ___ resources. To put it simply: where there is no water there would be no life. **(2)** ___, many of us seem to have forgotten this fact. And as a result of this, the world is facing the danger of running out of water. The actual **(3)** ___ of water on the earth has changed little since the time of dinosaurs. The problem has been caused by people's **(4)** ___ of our water supply. This not only means that we have polluted our rivers and seas but also that we are wasting a great deal of this precious **(5)** ___. Unfortunately, the **(6)** ___ of rainforests has made this problem worse, since much of the rain that falls is missed because it runs off onto the sea. The population of the earth is increasing daily, so it is **(7)** ___ that we find a **(8)** ___ be-

fore it is too late. The first step is to educate people, especially by **(9)** ___ them of the value of water. For most of us water is **(10)** ___ whenever we require it, whether to bathe or drink, so we seldom **(11)** ___ to think about it. People then need to be taught how to **(12)** ___ or recycle water. One of the simplest ways of doing it is to reuse bath water for **(13)** ___ or watering the garden. Ponds which filter used water are also becoming popular, whatever **(14)** ___ we might (15) ___ to use, we must realize the worth of water and how we can reserve it.

1	**A** expensive	**B** precious	**C** worth
2	**A** Unluckily	**B** Unhappily	**C** Unfortunately
3	**A** amount	**B** number	**C** magnitude
4	**A** use	**B** abuse	**C** misuse
5	**A** source	**B** resource	**C** resort
6	**A** abolishment	**B** destruction	**C** elimination
7	**A** vital	**B** necessary	**C** vivid
8	**A** salvation	**B** solution	**C** resolution
9	**A** reminding	**B** learning	**C** memorizing
10	**A** available	**B** valuable	**C** viable
11	**A** worry	**B** anxious	**C** bother
12	**A** reuse	**B** dispose	**C** employ
13	**A** cleansing	**B** cleaning	**C** clearing
14	**A** methods	**B** methodology	**C** skills
15	**A** elect	**B** select	**C** choose

Word Families

7. Заполните пробелы данными словами.

a) **conceived** b) **concept** c) **conception** d) **deceived** e) **imperceptibly** f) **inconceivably** g) **perceive** h) **perception** i) **perceptive** j) **received**

1) Bohr applied his complementarity _____ both in science and in other spheres of life.

2) For the work in developing the CAT scanner the American physicist A. Cormack _____ a share of Noble Prize for physiology and medicine.

3) Biblical catastrophes were not required to transform the earth; _____ slow alterations sufficed.

4) Albert Einstein and Paul Dirac were especially_____ about the role of mathematics in science.

5) Science is littered with the remains of theories that were once _____ as beautiful but turned out to be wrong.

6) In a single blinding pulse the singularity assumed heavenly dimensions, space beyond _____.

7) Shakespeare could no more ____ the multiple meanings readers have seen in his poems than Einstein could have predicted the myriad consequences of his equations of relativity.

8) Archimedes's law of water displacement proved that the goldsmith had _____ the king.

9) Supenovae are so _____ distant that their light reaches us as the faintest twinkle.

10) Modern advanced instruments can be described as extending our senses of _____.

Phrasal Verbs

8. ***Вставьте соответствующие послелоги:***

across, in, on (2), out (3), around, through, up

1. After finishing her degree, R. Franklin spent a year in research at Cambridge, but **gave** it **…** to work in industry studying the physical structure of coal.

2. And it is in his biology that Aristotle's genius **shines … .**

3. Our lungs **take …** the oxygen we need from the air and expel carbon dioxide.

4. The first certitude Descartes discovered was his famous ***cogito ergo sum,*** and on the basis of this, the existence of everything, he **worked …**his philosophy.

5. I. Newton applied the law to the Moon, showing that the Moon tries to **carry …** in a straight line, but gravity pulls it into an orbit.

6. When Michelson **carried …** his experiment, in Chicago in 1887, all the streetcars in the city were stopped in order to avoid the slightest disturbance.

7. Helicopter toys had actually **been …** for centuries, but Leonardo was the first to try and design one as a means for lifting people.

8. As Babbage was poring over statistic tables, he **came…** error after error made by the 'computers', the poorly paid human calculators who **worked out** such figures.

9. While electrical hysteria was **going …,** rapid and serous advances were being made by experimental scientists towards understanding the true nature of electricity.

10. It **turned …** that Kelvin was mistaken about how fast the earth is cooling; further calculations showed that the world was over 4 billion years old.

Linking Words: while, still

9. Переведите следующие предложения.

functions of *while*

1. Through conservation agriculture practices, farmers contribute to reducing emissions **while** combating land degradation.

2. Local populations could therefore mitigate climate change **while** combating desertification and protecting biological diversity.

3. By being creative, we can reduce greenhouse gas emissions **while** promoting economic growth.

4. That would preserve the forests and the Pygmy culture **while** ensuring long-term revenues.

5. The mapping template was developed by UN-Oceans **while** JIU added specific questions.

6. We must combat climate change **while** promoting development.

Functions of still

7. Major operational challenges **still** remain, given the nature of the Commission, and those have **still** to be overcome.

8. The issue is **still** being discussed and various options are **still** under consideration.

9. The specific content of the Rio+20 conference could **still** be influenced, as the draft text was **still** being discussed.

10. The quantification of these relationships and effects **still** remains difficult, mainly due to methodological limitations in this **still** young field.

Grammar: *Present Simple или Present Progressive (Continuous)*

Глаголы, не употребляющиеся в формах *Continuous* (Non-continuous verbs)

believe	hate	prefer
elong	hear	possess
care	include	refuse recognize
concern	involve	refuse
consist	know	remember
contain	like	require
cost	love	seem
depend	matter	sound
dislike	mean	suppose
doubt	mind	trust
exist	need	understand
fear	notice	want
forget	owe	wish
forgive	own	

Глаголы, имеющие разное значение во временах *Simple* и *Continuous*

verb	***Simple***	***Continuous***
think	I think that I need a new car. *(= suppose)*	He's thinking *of /about* buying a car. *(= He is considering)*
see	1. I **can see** John getting out of his car. 2. I **see** what you mean. *(=understand)*	I **am seeing** John tonight.*(= I am meeting)*

smell*	The **rose** smells good. *(пахнуть)*	Why **is** she **smelling** the flowers? *(нюхать)*
taste*	The cake **tastes** delicious. *(иметь вкус)*	She**'s tasting** the cake to see if it's ready. *(пробовать)*
feel*	1. I **feel** tired. *(чувствовать себя)* 2. I **feel** you are right. *(считать)* 3. What **do** you **feel** about this plan? *(относиться к …)*	She **was feeling** the baby's forehead. It was hot. *(трогать)*
expect	I **expect** him to come soon. *(= suppose)*	I'**m expecting** a telephone call from France. *(= wait)*
appear	He **appears** to know the secret. *(казаться)*	The new computer **is** soon **appearing** on the market. *(появляться)* He **is appearing in** a new play. *(выступать/играть)*
be	He **is** always **rude** to his younger brother. *(быть)*	He **was being rude** to his teacher yesterday.*(вести себя)*
have	I **have** an interesting book on history. *(обладать)*	I can't speak. I'**m having** a meeting. (a bath/a shower/lunch/a good time/fun ....)
look*	He looks strange. *(выглядеть)* She **looks like** a teacher. *(быть похожим)* It looks as if	What **are** you **looking** at? *(смотреть)*
weigh	He **weighs** 90 kg. *(весить)*	He **is weighing** potatoes. *(взвешивать)*
measure	The room **measures** 12 ft by 15 ft. *(иметь размер)*	The satellite **is measuring** greenhouse gases. *(измерять)*
fit	The coat **fits** perfect. *(подходить, сидеть)*	The workers **are fitting** the carpet in the drawing room. *(подгонять, устанавливать)*

10. Заполните пробелы глаголами в Present Simple или Present Continuous.

Образец: **A:** I *am thinking* about buying a Suzuki SX4.
B: I *think* you might have problems with it. It doesn't hold the road well.

1. **A:** I _____ (have) a very efficient personal assistant.
   B: Lucky you are. I _____ (have) a lot of problems with mine.
2. **A:** Our new suppliers _____ (be) very helpful at the moment.
   B: No wonder. Everyone says they _____ (be) reliable.

3. **A:** I _____ (see) Ann tonight. It's ten years since our last meeting.
   B: I _____ (see) what you mean. You must be nervous.

4. **A:** Why _____you _____ (smell) the cooker?
   B: Because it _____ (smell) of gas. I wonder if there are any leaks.

5. **A:** Why _____ you _____ (weigh) the envelope?
   B: I want to make sure that it _____ (weigh) under 100g. Otherwise I have to pay extra.

6. **A:** This board _____ (feel) very smooth.
   B: Be careful! You can scratch your hand while you _____ (feel) it.

7. **A:** What's wrong? Why _____ (look) at me?
   B: It _____ (look) as if you've put you T-shirt inside out.

8. **A:** Anna Netrebko _____(appear) at the Mariynsky Theatre in May.
   B: It _____(appear) all the tickets were sold two months in advance.

9. **A:** _____you (feel)_____ like going out tonight?
   B: I'd rather not. I _____ (feel) tired.

10. **A:** John, your wedding suit _____ (fit) perfect. What about Mary's dress?
    B: I haven't seen it yet. The dressmaker _____ (fit) it at the moment.

11. Некоторые предложения содержат ошибку. Найдите и исправьте её.

1. Who is this idea belonging to?
2. That's ridiculous – I am not believing it!
3. I'm sorry, I'm not following what you are saying.
4. Pardon, I'm not understanding what you are saying.
5. This building is getting old – we are planning to pull it down and construct a new one.
6. Who is driving the black Volvo that is parked outside?
7. How many chapters is this book containing?
8. At the moment I am having all the details of this case.
9. John is being irresponsible though normally he is a reliable person.
10. I'm thinking we owe them an apology.

12. Выберите подходящую глагольную форму.

1. I **write / am writing** in response to your advertisement in *the Milford Times*.
2. I am furious as they **never reply / are never replying** to my e-mails.
3. Normally many items **cost / are costing** much less in duty-free shops.
4. David **is speaking / speaks** on another line. He will call you back.
He **speaks / is speaking** three languages.
5. We **produce / are producing** a full range of consumer electronics, from TVs to cameras.
6. What a mess! What **is going on / goes on**?
7. Most of the time we **correspond / are corresponding** via e-mails.
8. I often **get / am** often **getting** junk e-mail from companies I haven't heard of.

9. I **delete / am deleting** my junk e-mail/spam about once a month.
10. We **deliver / are delivering** the equipment that you've ordered within two days.
We **deliver / are delivering** the equipment within two days.
11. Banks **make/ are making** decisions about loans depending on a customer's income.
The Bank **makes/ is making a** decision about a loan depending on his income.
12. Currently our R&D department **develops / is developing** a new computer model.
R&D departments **develop / are developing** new products.

13. Выберите подходящую глагольную форму: Present Simple или Present Continuous.

Образец:: Where_____ you _____ **(go)** to? → Where ***are*** you ***going*** to?

Two passengers on board the plane to St. Petersburg are talking about their visit to the trade fair.

1. **A:** What _____ you _____ **(do)**?
   B: I _____ **(work)** as a civil engineer for *Strabag*.

2. **A:** What _____ this company _____ **(produce)**?
   B: It's a construction company which _____ **(design)** and _____ **(construct)** residential and industrial buildings across Europe.

3. **A:** I know it's an Austrian company. _____ you _____ **(come)** from Austria?
   B: Actually, at the moment I _____ **(come)** from Austria, but in fact, I am Swiss, I _____ **(come)** from Switzerland.

4. **A:** _____ you _____ **(attend)** the trade fair held by *Peter Expo* this week?
   B: Yes**,** I _____ . I always _____ **(try)** to attend fairs and exhibitions held in St. Petersburg. Especially during the so-called *White Nights* period.

5. **A:** _____ you _____ **(mean)** *Midnight Sun* period?
   B: Exactly, but *White Nights* _____ **(sound)** more romantic.

6. **A:** _____ you _____ **(speak)** Russian?
   B: Just what you _____ **(call)** 'survival' Russian.

7. **A:** What hotel _____ you _____ **(stay)** at?
   B: At the Astoria. I always _____ **(book)** there when I _____ **(come)** to St. Petersburg.

8. **A:** What a coincidence! I _____ **(stay)** at the Astoria too. I _____ **(like)** service there.
   B: So _____ I. Many new hotels _____ **(not / justify)** their 5-star status, it but does.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Hydroelectricity

Integrated task to Unit 1. Read the text **Hydroelectricity**, watch the video, complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250–300 words.

VIDEO Hydropower

https://www.youtube.com/watch?v=q8HmRLCgDAI

Answer the following questions:

1) How do the text and the video correlate? What do they have in common? What is different?
2) What are two main types of hydroelectricity production? Describe how they work.
3) What are the benefits of hydropower?
4) What are the main concerns with hydropower?

Unit 2. History of Hydroelectricity

Helpful vocabulary

Read the new words and make up 5 sentences of your own

To couple – соединять, связывать, **demand** – потребность, спрос, **to eclipse** – затмить, **arc lamp** – дуговая лампа, **flood control** – борьба с наводнениями, **federally owned** – находящееся в федеральной собственности, **funding** – фонд, капитал, **output** – мощность, производительность, **The U.S. Army Corps of Engineers** – Американский корпус военных инженеров, **recognize** – признавать, **to set up** – создавать, **to surpass** – превосходить, превышать, **throughout** – на всем протяжении, **coal –** уголь; **plenty –** изобилие, **slide rule** – логарифмическая линейка, **punched card** – перфокарта, **on site** – на площадке (на месте)

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах.

1. Hydropower was used by people many centuries ago.
2. The first hydroelectric power scheme was invented by American scientist William Armstrong.
3. Up to nowadays the greatest number of hydroelectric power stations in the world are located in the USA.
4. In the 20th century some companies constructed hydroelectric power stations in mountains.
5. Hydropower is sometimes referred to as white coal because of its ecological safety.
6. Nowadays the biggest Dam is located in China.
7. The U.S. Army corpus was recognized as the premier federal flood control agency.
8. In the early 20th century about 1 million people visited exhibition of hydropower in France.
9. The more hydropower stations were built, the more additional functions of a dam were developed.
10. The first hydroelectric power station was built near Niagara Falls.

Hydropower has been used since ancient times to grind flour and perform other tasks. By the late 19th century, the electrical generator had been developed and could now be coupled with hydraulics. The growing demand for the Industrial Revolution would drive development as well. In 1878 the world's first hydroelectric power scheme was developed at Cragside in Northumberland, England by William Armstrong. It was used to power a single arc lamp in his art gallery. The old Schoelkopf Power Station No. 1 near Niagara Falls in the U.S. side began to produce electricity in 1881. The first Edison hydroelectric power station, the Vulcan Street Plant, began operating September 30, 1882, in Appleton, Wisconsin, with an output of about 12.5 kilowatts.

By 1886 there were 45 hydroelectric power stations in the U.S. and Canada. By 1889 there were 200 in the U.S. alone.

At the beginning of the 20th century, many small hydroelectric power stations were being constructed by commercial companies in mountains. Grenoble, France held the International Exhibition of Hydropower and Tourism with over one million visitors. By 1920 as 40% of the power produced in the United States was hydroelectric, the Federal Power Act was enacted into law. As the power stations became larger, their associated dams developed additional purposes to include flood control, irrigation and navigation. Federal funding became necessary for large-scale development and federally owned corporations, such as the Tennessee Valley Authority (1933) were set up. Additionally, the Bureau of Reclamation which had begun a series of western U.S. irrigation projects in the early 20th century was now constructing large hydroelectric projects such as the 1928 Hoover Dam. The U.S. Army Corps of Engineers was also involved in hydroelectric development, completing the Bonneville Dam in 1937 and being recognized by the Flood Control Act of 1936 as the premier federal flood control agency.

Hydroelectric power stations continued to become larger throughout the 20th century. Hydropower was referred to as white coal for its power and plenty. Hoover Dam's initial 1,345 MW power station was the world's largest hydroelectric power station in 1936; it was eclipsed by the 6809 MW Grand Coulee Dam in 1942. The Itaipu Dam opened in 1984 in South America as the largest, producing 14,000 MW but was surpassed in 2008 by the Three Gorges Dam in China at 22,500 MW. Hydroelectricity would eventually supply some countries, including Norway, Democratic Republic of the Congo, Paraguay and Brazil, with over 85% of their electricity. The United States currently has over 2,000 hydroelectric power stations that supply 6.4% of its total electrical production output, which is 49% of its renewable electricity.

Fifty years ago, working practices were very different from those today. Design generally involved hand calculations with slide rules, design charts and seven figure log tables. Drawings were done by hand, and there were no scientific pocket calculators. Computers were the size of rooms and had to be fed by punched cards. The UK still worked in imperial units. Written communications were by letter and sometimes by telex. There were no faxes or emails, and of course no mobile phones. Design decisions often had to be made on site.

Over 50 years there have been many changes in working methods and advances in the various fields which together constitute dam engineering.

2. Найдите в тексте 12 пар синонимов.

1. provide 2. persist 3. multitude 4. decree 5. king-size 6. antique

7. trade 8. production 9. tie together 10. Send 11. strength 12. outshine

3. Найдите соответствия между словами в группах A и B

A 1. development 2. connect 3. perform 4. design 5. company 6. dam 7. supplementary 8. eventually 9. surpass 10. necessary 11. supply 12. total

B a) sketch b) additional c) growth d) afford e) levee f) essential g) entire h) couple i) excel j) ultimately k) fellowship l) execute

4. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

Example: construct – construction – constructor

begin – … – … continue – … develop – … – … enact – …
include – … involve – … make – … open – …– …
operate – … – … produce – … – …

5. А. Переведите следующие словосочетания.

1. Hydroelectric power scheme **2.** Flood control, irrigation and navigation **3.** Large-scale development **4.** seven figure log tables **5.** electrical production output **6.** the premier federal flood control agency **7.** western U.S. irrigation projects

Б. Переведите следующие словосочетания и используйте принцип номинативной атрибутивной цепочки для большей лаконичности.

1. With an output of about 12.5 kilowatts **2.** Federal power act **3.** Working practices **4.** Drawings done by hand **5.** imperial units still used in he UK **6.** Growing demand for the industrial Revolution

Confusables

6. Выберите подходящее слово.

Water pollution

Nowadays the high **1)** _____ of industry leads the inevitable **2)** _____ of the environment all over the world. First of all, it has a negative **3)** _____ on the hydrosphere because, anyway, waste falls into a reservoir or goes into the ground water **4)** _____ it. The problem of water pollution is a global one. So, it **5)** _____ complicates the ways of its solution, because different countries have to **6)** _____in solving such problems. However, there are some problems connected with such cooperation. For example, the Mediterranean Sea is the **7)** _____ polluted sea in the world, perhaps, because 22 different countries have their coastlines in the Mediterranean Sea. The **8)** _____ problem is observed with the Atlantic Ocean. A huge **9)** _____ of countries using it for the transportation of goods. Besides, oil tankers sometimes release thick oil **10)** _____ causing pollution and endangering sealife. There have also been a number of major accidents on oil offshore rigs. It should be **11)** _____ that industry also has a negative effect on the hydrosphere. The common problem is the pollution of fresh water. People must understand that polluted drinking water is not only **12)** _____for people's health and the environment, but also causes **13)** _____ problems, because its purification requires a lot of money. In this **14)** _____, it is necessary to say a few words about Lake Baikal. It is the largest natural **15)** _____of fresh water. We must do everything to keep this lake pure.

1	**A** growth	**B** development	**C** evolution
2	**A** pollution	**B** soiling	**C** dirtying
3	**A** influence	**B** effect	**C** impact
4	**A** pollute	**B** pollution	**C** polluting
5	**A** much	**B** noticeably	**C** considerably
6	**A** cooperate	**B** organise	**C** work
7	**A** much	**B** most	**C** more
8	**A** similar	**B** same	**C** alike
9	**A** amount	**B** number	**C** quantity
10	**A** splits	**B** spots	**C** spills
11	**A** said	**B** observed	**C** mentioned
12	**A** dangerous	**B** risky	**C** unsafe
13	**A** economical	**B** profitable	**C** economic
14	**A** relation	**B** respect	**C** aspect
15	**A** vessel	**B** reservoir	**C** pool

Word Families

7. Заполните пробелы данными словами.

a) **electric** b) **electricity** c) **electrical** d) **developed** e) **development**
f) **pollution** g) **pollutants** h) **polluted** i) **dump** j) **dumping**

1**)** The development of _____ started with the great discovery of this power source made by William Gilbert.

2) If people from _____ countries do not have problems with water, they do not have to take it for granted.

3) The supply of clean water is getting less every day because of its useless consumption and _____.

4) The start of the _____ industry began in 1881 when the first power station in the world was constructed at Godalming in England.

5) Air _____ can be deposited on land and water, sometimes at great distance from their original sources.

6) There is no sea, which is not used as a _____.

7) But what is the _____? From the scientific point of view, it is a particular set of physical phenomena which is characterized by the presence and the distinctive flow of _____ charge.

8) Fish and shellfish harvested from _____ waters may be unsafe to eat.

9) Many seas are used for _____indusrial waste..

10) _____of new types of turbines is the responsibility of hydraulic engineers.

Phrasal Verbs

8. ***Вставьте соответствующие послелоги:***

back, off, on , out (2), over (2), up (3)

1. The discovery of electricity as a source of energy dates _____ to the late 17th century.

2. The government does not want people to find ____ about the level of air pollution in their city.

3. We have to keep **____** with the delivery schedule.

4. We are planning to **set ___** a branch of our company in Siberia in the nearest future.

5. The lecture was **called** ____and students went to the nearest cafe.

6. Fortunately, we **got** ____ the problem in time of the project submission.

7. You should **sort** that problem ____ as quickly as you can.

8. I wonder who's going to be sent ____ to our subsidiary next month..

9. It annoyed me that the deputy manager just **went** _____ talking on trivial things.

10. There is a tradition in Russia – to **pick** _____ garbage and collect old leaves in spring to make lawns clean.

Linking Words: *yet, since*

9. ***Переведите следующие предложения:***

1. Dam have been used **since** ancient times to confine river flow and irrigate farming lands

2. Scientists have not **yet** come up with the explanation why many physical laws hold.

3. Descartes came up with celebrated, **yet** ultimately unsuccessful vortex theory of the solar system.

4. **Yet** for all this progress in the early 18th century, no one knew just what an element was – and no one had thought to connect them with atoms in any way.

5-6. It is perfectly possible to imagine a universe in which mathematical equations have nothing to do with the workings of nature. **Yet** the marvelous thing is that they do. Better **yet**, it seems to have held good since the beginning of time.

7. The table had gaps, but Mendeleyev predicted that these gaps would be filled by elements **yet** to be discovered.

8. Newer ways of generating electricity, for example, the use of wind power do not pollute the atmosphere, but they also do not **yet** produce enough electricity **for** the needs of a modern city.

9. With a dam and reservoir it is also a flexible source of electricity **since** the amount produced by the station can be changed up or down very quickly to adapt to changing energy demands.

Grammar: *Present Perfect или Present Perfect Continuous.*

Present Perfect Simple обычно употребляется с:

For	She's taught German here for over five years.
Since	Mr Gray has taught French here since 2006.
Just	We've just done this exercise.
Already	We've already done this exercise.
Yet	We haven't checked the answers yet.
Ever	Have you ever had guitar lessons?
Never	I've never understood why they give us so much worked.
It's the first time	It's the first time we've watched a video in class.

Present Perfect Simple не употребляется, если точно указано время совершения действия. В таких случаях употребляется **Past Simple.**
Present Perfect Simple используется в том случае, когда важен результат, а не время совершения действия.

Present Perfect Continuous обычно употребляется с:

For	I've been learning English for over three years.
Since	He's been learning Chinese since 2004.
Just	I've just been reading the school newspaper.

Present Perfect Continuous употребляется для описания действий, которые начались в прошлом и продолжаются в настоящее время либо завершились к моменту речи.

Заполните пробелы глаголами в Present Perfect или Present Perfect Continuous.

A: Are Jane and Steve still in negotiation room? They ___1. (discus) the terms of the contract for an hour now.

B: Yes, they ___2. (go) over the figures for more than an hour.

A: ___ you ___ 3. (do) a lot of training this year?

B: I ___ 4. (train) six times a week all year.

A: What ___ they ___5. (write) since three o'clock?

B: They ___ 6. (write) an article for the scientific journal.

A: ___ you ___7. (hear) from Melisa recently?

B: No, she ____8. (go) to China for a seminar and ___(not come back) yet.

A: How long ___ Mr John ___9. (speak) with the customer?

B: He ___10. (do) it for more than an hour now.

A: How long ___ you ___11. (travel) around the country?

B: I ___12.(travel) for two weeks.

11. Некоторые предложения содержат ошибку. Найдите и исправьте её.

1. Molly has been receiving her exam results from refreshment course. She is very happy.
2. I have already finished my quarterly report.
3. Luckily, our customers haven' t complained about our the price rise.
4. It is the first time I have been on a business trip to India. I never done this before.
5. Billy is calling our Dutch counterparts. This is the third time he phones them this evening.
6. I have looking for these documents since last Saturday.
7. I have been to this conference. It was attended by many outstanding scientists.
8. I have been wanting this to do it all my life.

12. Выберите подходящую глагольную форму.

1. I think I've **heard/ been hearing** that information nbefore.
2. They haven't **arrived/ been arriving** yet, but they should be here soon.
3. You've **written/been writing** that e-mail for over an hour. How long is it going to take you?
4. Have you **talked/been talking** on the phone for an hour?
5. The CEO has already **invited/been inviting** the delegation to dinner.
6. I've **read/been reading** an interview with the head of the investigation commission, but I haven't finished yet.
7. Have the boys **done /been doing** computer simulations since the morning?

13. Выберите подходящую глагольную форму: Present Perfect или Present Perfect Continuous.

1. **A:** What _____ **(you/do)** recently?

   B: Well _____ **(I/study)** for my PHD exam.

2. **A:** How long _____ **(you/write)** your PHD thesis?

   B: For three years already. _____ **(I/make)** a lot of experiments as well.

3. **A:** How many chapters _____ **(you/write)** so far?

   B: 2 chapters! And _____ **(I/already/do)** some computer simulations.

4. **A:** _____ **(you/work)** hard recently?

   B: Very! Basically, _____**(I/just/sit)** at my desk for the past three weeks and _____ **(I/not/go)** out at all.

5. **A:** _____ **(you /ever/meet)** professor Smith?

   B: Yes, _____ **(we/meet)** recently on the Ice Congress.

6. **A:** _____ you (finish) on this task?

   B: _____ **(we/work)** on this task for 50 minutes.

7. **A:** _____ (I not have) a cup of coffee since morning. _____ **(It/be)** so busy today.

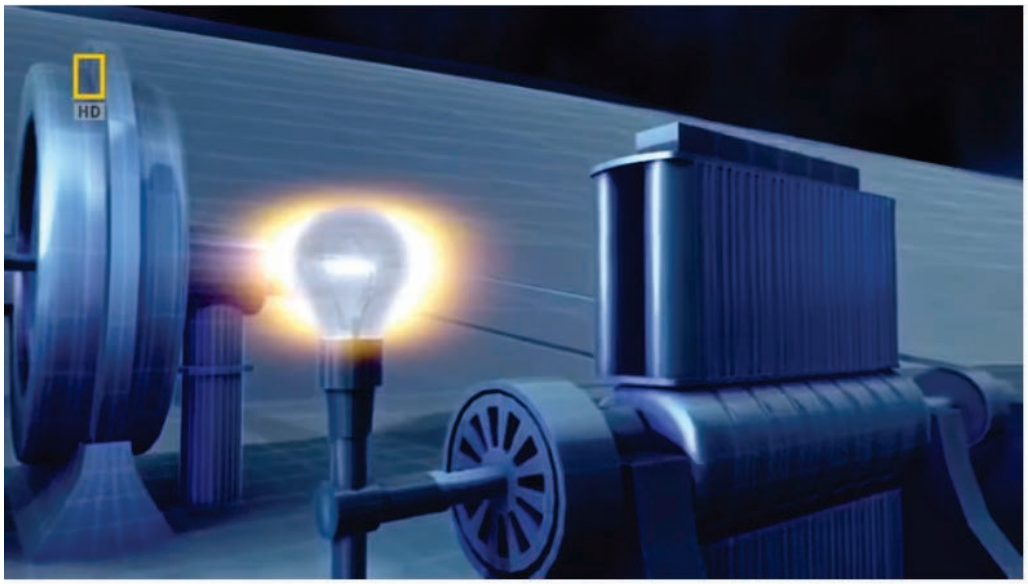
   B: Same problems. _____ **(I/write)** so many letters today for my boss. I need a rest.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

History of Hydroelectricity

Integrated task to Unit 2. Read the text ***History of Hydroelectricity***, watch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.



World's First Hydro-Electric Dam (Debdon Dam)

VIDEO: World's First Hydro-Electric Dam
https://www.youtube.com/watch?v=J6rA-EmZh_U

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?

2. During the Medieval and early modern periods water wheels played an important role in many economic activities. Can you give examples of the industries which relied on water power in those pre-industrial days?

3. Who was Lord Armstrong? Why do you think contemporaries called his country house the “palace of a modern magician”?

4. What is Cragside best known for?

5. How do you understand the metaphor “white coal” based on your knowledge about energy sources? Do you think the metaphor is relevant for today’s world? If no, could you suggest an alternative metaphor to describe hydroelectricity?

6. Why do you think during the 1920s Americans supported the idea of public ownership of utilities, particularly hydroelectric power facilities?

Unit 3. Hydraulics

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Dissipating the energy – рассеивание энергии, **stilling basin –** отстойный резервуар, **slab –** плита, **stainless steel liner –** корпус из нержавеющей стали, **slit-laden –** забитый илом, **super-saturation –** перенасыщение, **spillway chute –** затвор водосброса, **debris –** обломки, мусор, **concrete –** бетон, **tolerance –** допуск**,** устойчивость, **sluicing –** сброс, **to seal –** герметизировать, **зокупорить**; **joint –** стык, **plunge pool –** ковш, погружной резервуар, **downstream flow –** вниз по течению, **deflector –** отражатель, **gorge –** ущелье, **dam crest –** гребень дамбы, **basin –** бассейн, **design head –** расчётный напор, **high-head –** поверхностный, **computational fluid dynamic (CFD) –** вычислительная гидродинамика, **proceedings –** труды, **civil engineer –** инженер-строитель, **high-head chute –** высоконапорный быстроток,**tunnel spillway –** туннельный водосброс, **air trough –** воздушный карман

1. ***Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах.***

1. Cavitation can be highly destroying for stilling basins.
2. Slit-laden flows lead to lifting up of heavy slabs of a dam.
3. Cavitation damage isn't a severe threat now.
4. High tolerance of concrete surface finish is able to solve the problem of cavitation.
5. Well-sealed wall joint is the substantial part of hydraulic performance of spillway
6. Tekezi dam in Ethiopia was partly demolished by massive downstream flows
7. Several thousand fish were dead in the result of super-saturation with flow gases
8. Fish also suffered seriously in Site C dam in Canada
9. Hydraulic brake is one of essential innovations of last years
10. Roberts Crest Splitter was designed to lower dam crest vibration.

Having established the size of flood, it is then necessary to be able to dissipate its energy before releasing it into the river downstream. In the 1960s, designing a stilling basin for dissipating the energy of flood releases was straightforward. Many standard arrangements were developed in various countries, with many following the United States Bureau of Reclamation practice as encapsulated through publications such as the "Design of Small Dams".

But then things started to go wrong. Cavitation partly demolished the teeth in the stilling basins on some of the Pit river dams, USA. At Tarbela dam in Pakistan, slabs weighing more than 800 tonnes were lifted out of position by pressure differentials. The same happened at the Nezahualcoyotl dam in Mexico. Ball-mill action by circulating debris ground down the surfaces of the stilling basins at a number of dams the USA, such as Libby, Dvorsak and Kinzua. Forty years of sluicing silt-laden flows led to the erosion and virtual loss of the 40 mm-thick stainless steel liners to the deep sluices at Roseires dam in Sudan. The unplanned erosion of the plunge pools downstream of the two Tarbela spillway chutes in Pakistan led repair costs of approxi-

mately US$ 200 million. In most cases the problems were the effects of scale Arrangements that worked well on small models were extrapolated up to design heads, velocities and forces beyond those which the construction materials or systems could resist. In 1982 the author studied the prototype histories of more than 300 hydraulic energy dissipaters from a number of countries. The resulting paper, published in the Proceedings of the UK Institution of Civil Engineers, included a design chart on the preferred use of the different types. This has appeared in a number of textbooks, although in many others the standardized solutions developed in the 1950s are still all too often repeated without qualification.

At the same time, cavitation damage was proving to be a problem on a number of high-head chutes and large tunnel spillways. Again the problem was one of scale. High velocity flows were vaporizing at irregularities and the subsequent high-intensity bubble collapses were literally excavating the concrete. The solution came in the form of attention to concrete surface finish tolerances, and also air troughs which have now been embraced by many designers almost to the point of over-use.

But the challenges and need for innovation continue. Old solutions to minimizing flood rise using labyrinth weirs have resurfaced in the form of piano key or PK weirs. Failures of the Ulley and Boltby stepped masonry spillway chutes in the UK led to research funded by the UK Environment Agency which has provided a far better understanding of their hydraulic performance, and especially the vulnerability of poorly sealed wall joints.

Massive downstream flow deflectors have been used to focus gated outflows into narrow downstream gorges, such as at the 185 m-high Tekezi dam in Ethiopia. A multi-jet arrangement for the Dasu dam in Pakistan achieved a similar outcome. In other cases, dam crest vibration has been induced by the instability of crest overflows. This in turn has been linked to a sympathetic acoustic resonance between the overflowing sheet and the trapped air pocket beneath it. It is still an issue solved more by trial and error than design prediction.

When the massive Yacyreta dam on the border of Argentina and Paraguay discharged one of its first major floods in 1994, several thousand fish were killed by the super-saturation of the flow with dissolved gases in the deep stilling basins. When the air came out of solution in fish, in the shallows downstream, they got severe bends and died. In recent years the author worked with BC hydro advising on ways to avoid this at the Site C dam in Canada. Here low flows will be directed only to the upper surface of the water in the downstream stilling basin. This avoids diving jets and hence the problems at Yacyreta. The interesting thing about the Site C modification is that it also produced a better hydraulic performance in the basin at probable maximum flows, and so represents a modification that should be considered on all simple stilling basins.

Vortex drop shafts, hydraulic brakes and orifices to control large tunnel flows are all innovations that have emerged in recent years, and which are expanding the ranges of options available to hydraulic engineers. Another innovation worth mentioning is the Roberts Crest Splitter. If the arrangement had been developed in the USA it would almost certainly now be a universally adopted and standard solution for dissipating energy from high-head overflows; but it was developed by Col Roberts in South Africa. Awareness and usage is, however, spreading and is likely to continue. The author has been involved in the successful use of the arrangement on major dams in South Africa, Sri Lanka and at the Wadi Dayqah dam in Oman.

What of the future? Here the solution almost certainly hinges on one thing: the increased use of computational fluid dynamic (CFD) modelling. The models are, in many cases, currently still best used in conjunction with physical models, but the ability to model changes quickly, and also

to model fluid dynamics at full prototype scale, including air entrainment, will increasingly make the use of CFD modelling a fundamental part of any major design. In fact this is already happening. The writer would expect this to develop still further with CFD becoming the definitive way of producing the most economic arrangements in future, and in a way that will also ensure safe and secure operation.

2. Найдите в тексте 12 пар синонимов.

1. flow 2. epitomize 3. destroy 4. factual 5. generalize 6. proficiency

7. cover 8. variability 9. amendment 10. spread 11. link 12. position

3. Найдите соответствия между словами в группах A и B

A 1. releasing 2. downstream 3. dissipating 4. arrangements 5. ifted 6. literally 7. challenge 8. narrow 9. modification 10. innovation 11. conjunction 12. secure

B a) problem b) current c) inventiveness d) safe e) connection f) lever up g) word for word h) scattering j) deal i) limited l) change k) output

4. Переведите словосочетания:

flood energy dissipating	large tunnel spillways
high-intensity bubble collapses	narrow downstream gorges
better hydraulic performance	sympathetic acoustic resonance
prototype scale	focus gated outflows

5. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

extrapolate – … –-… encapsulate – … – … involve – …–

produce – …–… dissipate – …–… represent – …

adopt – …– emerge – … excavate – …–… expect – …–

Confusables

6. Заполните пробелы наиболее подходящими словами

Hydropower

Hydropower or water power is power **(1)____** from energy of **f**alling or fast running water, which may be **(2)_____** for useful purposes. Since ancient times, hydropower from many kinds of **(3)____** has been used as a renewable energy source for **(4)____** of various mechanical devices, such as gristmills, dock cranes. In the late 19th century, hydropower became a source for **(5)____** electricity. Since the early 20th century, the term has been used almost exclusively **i**n conjunction with the modern **(6)____** of hydroelectric power. International institutions such as

the World Bank view hydropower **(7)____** for economic development without adding substantial **(8)_____** of carbon to the atmosphere, but dams can have **(9)_____** negative social and environmental **(10)_____**.

1. A. Derived	B. Produced	C. Obtained
2. A. Utilized	B. Harnessed	C. Used
3. A. Watermills	B. Irrigators	C. Waterwheels
4. A. Performance	B. Action	C. Operation
5. A. Production	B. Generating	C. Manufacturing
6. A. Modification	B. Development	C. Innovation
7. A. As a means	B. In a way	C. In terms
8. A. Amount	B. Number	C. Quantity
9. A. Severe	B. Significant	C. Substantial
10. A. Impacts	B. Affects	C. Issues

Word families

7. Заполните пробелы в предложениях приведенными ниже словами:

a. Construct b. Constructive c. Construction d. Tolerate e. Tolerant f. Toleration g. Tolerance h. Subsequent i. Sequence j. Subsequently

1. Both meetings of the committee were _____, substantive and forward-looking.
2. These villages are included in comprehensive plans to _____ satellite water systems.
3. Such work includes subdivision, road _____ and basic infrastructure development.
4. _____ and respect for people who have their own beliefs are necessary to preserve an enlightened world.
5. Modern societies cannot and should not _____ extremism and violence.
6. This coating is highly _____ to water and sun exposure.
7. Salt _____ may be defined as an inherent ability of plants to withstand the effects of high salt concentrations.
8. Two staff members were immediately suspended, one of whom was _____ reinstated.
9. Companies may download the supplier registration package for _____ electronic submission.
10. The information carried by DNA is held in the _____ of pieces of DNA called genes
11. In order to _____ dam large groups of residents are tom be moved.

Phrasal verbs

8. ***Используйте следующие послелоги в предложениях:***
around, across, away, by, out , off , up (4)

1. Failing to tackle the deficit would be throwing ___ an opportunity
2. Governments should in this regard build____ the capacity to enforce these regulations.

3. Frankly speaking, I have never come___ such a situation.

4. Banca di Roma set ____ on-line banking service with Telecom Italia.

5. He went to the bank to take____ a loan for a new apartment last week

6. Here are some figures to back ___my point of view.

7. It's great having you in the team. I don't know how we'd get ____ without you.

8. We need to carry_____ a proper evaluation of the new control system on our plant.

9. Water power in various forms has been around for centuaries.He urged donors to step ____ their efforts to send aid to Somalia.

Linking Words: once

9.*Переведите следующие предложения с английского на русский язык*

1. **Once** water power was used mostly in mills to grind wheat and rye.

2. Nuclear energy is the cheapest way to make electricity, **once** the costs of building the nuclear power station are taken away.

3. **Once** a hydroelectric complex is constructed, the project produces no direct waste, and in many cases, has a considerably lower output level of greenhouse gases than fossil fuel powered energy plants.

4. **Once** geological surveillance is carried out the dam designing is normally started.

5. **Once in a while**, "a new paradigm" – a revolutionary new model – is put forward, which offers a dramatically changed view of the underlying reality

6. Science is littered with the remains of theories that were **once** perceived as beautiful but turned out to be wrong.

7. **Once** Galileo directed his telescope at heavens he saw **at once** the Moon was not a perfect sphere it was supposed to be, but had mountains, valleys, cliffs, and maybe even seas.

8. Scientists began mathematically to wind back the clock of the expanding universe, and they realized that, although it is now big, it **once** must have been very small.

Grammar: Past tenses

Past Simple, Past Continuous, Past Perfect

	Past Simple	**Past Continuous**	**Past Perfect**
Usage	Past action	Past action	Past action before another past action
Differences	Simple	Progressive (specific time period)	Completed action in the past + another action/span of time

Signal words	Yesterday, in 1989, last week, 2 days ago	From 2 till 5, for 2 hours, whole day, while	Before, by
Form	Regular: Infinitive+ed Irregular:2nd column of the irregular forms table	Was/were +Infinitive+ing	Had+past participle (3rd column)

10. Поставьте глагол в скобках в правильное время: Past Simple or Past Continuous

1. When the explosion happened, hundreds of people ___ (pass) through the airport.
2. When I heard the phone ring, I ___ (stop) writing to answer it.
3. Amy ____ (read), so she didn't see me walking past.
4. We ____ (decide) to leave the beach because it is an important part of the recreation area.
5. The Industrial Revolution ___ (attract) many people from the country to the city.
6. Sorry I couldn't call you immediate , because I ____ (have) a meeting.
7. While she _____ (explain) her proposal the head of the department _____ (interrupt) her.
8. Jessica _____ (find) the missing file while she _____ (clear) the file cabinet.
9. The government _____ (create) the national park to protect local wildlife.
10. By the time we _____ (arrive), the chairman ____ (go) through the agenda..

11. Некоторые предложения содержат ошибку в использовании времени. Найдите и исправьте ее.

1. Had you meet last July while you were both backpacking around Europe?
2. Rick should know about the meeting because I told him about it yesterday.
3. I had no idea you were such a good chess player.
4. We had done everything we had to do by five, so we had decided to go out for a coffee.
5. This company had been established in 1889.
6. The project was having two objectives: to irrigate farming lands and provide water supply.
7. The company began activities in the area of civil construction back in the 1970s.
8. In the next two decades they made a number of merges and equisitions.
9. The company took a controlling stake in a major international corporation.
10. They put the Hubble Space Telescope into orbit around the Earth in 1990.

12. Выберите подходящую форму глагола:

1. When I **saw/was seeing** Marty, he was chatting to someone outside the bank.
2. Jason wasn't interested in the film because he already **saw/had already seen.**
3. I was shocked because it was the first time I **heard/had heard** the details of the accident.
4. The dog played/was playing in the mud, so he was absolutely filthy.
5. -Did I wake you up? -No, I didn't sleep/wasn't sleeping.
6. They **built/had built** this dam before this area was developed.
7. She opened the bag and **took/had taken out** what looked like a hand-held computer.

8. Although there was no reasons to doubt the figures I **was ringing/rang** the accountant to check.

9. The scientists **had conducted/conducted** an experiment to prove their theory.

10. I **was trying/tried** to fix the instrument yesterday, but I'm not done with the repairs yet.

13. ***Выберите подходящую форму глагола в вопросительном предложении***

1. ____ you _____(chat) to Matt at midnight last night?

2. ____the ancient Egyptians _____(have) more advanced technology than other civilizations?

3. ____ you ____ (enjoy) your visit to the Science Museum last summer?

4. ____ Thomas Edison ____ (invent) a number of things that changed everyday life by the time of his death?

5. ____ Democritus _____ (talk) that matter is composed of indivisible atoms?

6. ____ Archimedes _____ (discover) the laws of behavior of floating bodies?

7. ____ you _____ (have) your computer long before it broke down?

8. _____ you _____ (write) e-mails all yesterday morning?

9. What concept ____ Kelvin ____ (introduce)?

10. What _____ Sony and Philips _____ (invent) in the early 1980s?

14. Выберите подходящую форму глагола: Present simple, Past Simple, Past Perfect.

Pangea

Pangaea **(be)** a single landmass, **made up** of all present day continents, which as scientists believe **(exist)** between 300 and 200 million years ago. The Panthalassa Ocean **(cover)** the rest of the earth.

This ancient supercontinent under plate tectonic action (**split up)** and **(form)** two landmasses – Gondwanaland in the south and Laurasia in the north. In turn, these, too, **(divide)** to form our modern continents. These then slowly (**drift)** to their present position.

Stratigraphic and fossil evidence (**suggest)** that the hypothetical southern hemisphere supercontinent, Gondwanaland, **formed** after Pangaea's splitting (**comprise)** what is now Antarctica, Australia, India, South America and other smaller units. Later, it **(break up**) into several continents.

Laurasia, the ancient northern hemisphere supercontinent, **(consist)** of present Europe, North America and North Asia. German meteorologist Alfred Wegener first (**propose)** the existence of the supercontinents in 1912.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Hydraulics

Integrated task to Unit 3. Read the text **Hydraulics,** watch the video, complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250–300 words.

How Dams Work (Hydro Dams)

VIDEO How dams work
https://www.youtube.com/watch?v=ztM6tL6LtFs&t=4s

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. What are the advantages of hydroelectric dams? (name at least 2)
3. What are the disadvantages? (name at least 2)
4. Where does mechanical energy from turbine runners go to?

Unit 4. Concrete and Masonry Dams

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Concrete and masonry dams – бетонные и каменные плотины, **alkali aggregate reaction** (AAR) – взаимодействие щелочной составляющей цемента и заполнителя бетона, **serviceability** – эксплуатационная надежность, **swelling of the concrete** – набухание бетона, **jamming** – заедание, заклинивание, **roller compaction** – укатывание, **reinforced concrete** – железобетон, **faced symmetrical hard fill dams (FSHD)** – облицованные насыпные дамбы, **s-dug material** – имеющийся под рукой материал, **rebar** – арматура, **stiff soil** – жесткая почва, **concrete slab** – бетон плита, **to seal** – герметизировать, **spillway** – гидрослив, **grouted rockfill** – насыпка, Rock-Filled Concrete (RFC) – бетонная насыпная дамба, **chute** – скат, желоб, **dissipate** – рассеивать, **aporize** – испаряться, **decommissioning** – выведение из строя

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах.

1. The alkali aggregate reaction has a great impact on cement dams.
2. Changing in dam geometry and concrete intumescences are not crucial factors in dam carrying capacity.
3. A major improvement of the economics of concrete was using waterproofing mixes.
4. High paste and dry lean mixes are similar mixtures.
5. Faced symmetrical hard fill dams are prepared with reliable, climate-resilient technology.
6. The UK innovation grouting technique was used for constructing about 80 dams.
7. Rock-Filled Concrete technique is characterized by bad heating indicators.
8. In term of multiple arch masonry dams the labour seems to be cost-effective in Africa.
9. There is a difference between Faced symmetrical hard fill dam's and a 50 m-high concrete gravity dam's pressure rate.
10. It is likely that in future there will be used more complex concrete mixtures in dam construction.

One of the most significant phenomena affecting concrete at dams in the past 50 years has been the effect of alkali aggregate reaction (AAR). Generally the issue is not serious and involves a slow, gradual swelling of the concrete. Problems emerge when the swelling or expansion is significant, when the geometry of the dam leads to structural cracking and/or when the tolerances on mechanical parts such as gates, are lost leading to jamming and seizure. Some major dams, such as Kariba and Cahora Bassa, have been affected, along with many others worldwide. One dam in the UK, Maentwrog in North Wales, has been replaced as a result of AAR and it is possible that over the next 50 years some others around the world will also come to the end of their useful life. However, in most cases the next 50 years will see the serviceability of such dams being maintained through careful monitoring and management.

Perhaps the largest ‘revolution’ for concrete dams over the last 50 years has related to concrete placement. The economics of concrete dams was significantly improved by the use of roller compaction, to the extent that for any new, mass concrete dam, roller compacted concrete (RCC) is now the default option. To date more than 700 dams of this type have been completed worldwide. There are still some differences in approach between high paste and dry lean mixes, but even these are becoming less. Specific techniques have developed to the extent that many, such as the Chinese, will vibrate reinforcement into the RCC, effectively producing reinforced concrete around internal spaces and on surfaces where rebar is required.

More recently still, roller compaction techniques have been used to develop faced symmetrical hard fill dams (FSHD). This form of construction comprises cement stabilized as-dug material into a trapezoidal shape which is then faced upstream for waterproofing. It is a simple and robust technique with good seismic characteristics and the structures can be safely overtopped. The method is also suitable for stiff soil foundations, and not only rock.

The author designed one of the first of these, the Can-Asujan dam in the Philippines. Both Japanese and Chinese engineers have now standardized the technique in their own ways, and an ICOLD Bulletin on these techniques is under preparation. Most examples are sealed upstream, using a slip-formed, reinforced concrete slab but more recently the Filiatrinos FSH dam in Greece was completed and sealed upstream, using just a geomembrane.

Perhaps the very latest innovation is the Chinese use of grouted rockfill to form mass concrete dams or Rock- Filled Concrete (RFC), as the technique is termed in China. Something similar was attempted in the UK in the 1950s, called ‘Colcrete’, but the results were variable. The Chinese approach comprises placing 300 mm or more of rockfill in shutters and effectively grouting it using a small diameter aggregate, super-plasticized concrete. So far about 80 dams have either been completed or are under construction using this technique. The structures feature particularly good thermal characteristics with net temperature rises on hydration of the order of only 5 to 8 " C, as the hydration heat of the cement paste is absorbed into the rockfill. Interlock and shear transfer between layers is excellent.

In parts of Africa, multiple arch masonry dams suit the availability of low-cost labour, and when combined with modem finite element analyses, are proving to be a very cost effective option. The way forward in the future may be governed more by simplicity as a way of driving down costs and also not over-specifying. For example, a 50 m-high concrete gravity dam will develop foundation stresses in the order of 1 MPa. A similar FSHD will produce only 0,5 MPa. Implied concrete cube strengths of either are only in the order of 5 MPa and certainly in the case of the FSHD this does not change much under earthquake. Clearly such low stresses do not require conventional concrete or even hard rock foundation. Perverse as it may seem, the future may see a return to much weaker and simpler mixes as being all that is needed and with minimal associated Qa/Qe, requirements. This may also be advantageous in a future where decommissioning also has to be addressed as part of lifecycle design.

2. Найдите в тексте 10 пар синонимов.

1. bloat 2. operationality 3. compression 4. fortify 5. pour 6. blend 7. adhesion 8. hift 9. conforming 10. retirement

3. Найдите соответствия между словами в группах А и В.

A. 1. expansion 2. maintain 3. compaction 4. comprise 5. rise 6. surface 7. construction 8. conventional 9. lifecycle

B. a) support, keep up b) building c) increase d) facade, exterior e) standard f)spread, g) process h) sealing j) include

4. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

maintain – maintenance **reinforce –** **absorb –**
emerge – **improve –** **require –**
lead – **compact –** **comprise –**

5. Переведите следующие словосочетания.

А. 1. gradual swelling, 2. structural cracking, 3. concrete placement, 4. default option, 5. high paste, 6. internal spaces, 7. robust technique, 8. hydration heat, 9. shear transfer, 10. simpler mixes

Б. 1. mass concrete dam 2. roller compaction techniques 3. faced symmetrical hard fill dams (FSHD). 4. net temperature raises thermal characteristics 5. cement paste hydration heat 6. modem finite element analyses 7. 50 m-high concrete gravity dam 8. concrete cube strengths 9. alkali aggregate reaction 10. Rock- Filled Concrete (RFC)

Confusables

6. Выберите подходящее слово.

Raw Materials for Dams

Concrete itself is made of cement, water, and materials collectively called aggregate that consist of sand or (1) _____. Cement has unique properties that must be considered in selecting the cement, designing the dam, and timing construction. (2) _____ of cement and water causes a chemical (3) _____ that makes concrete hard but that also (4) _____ heat. This causes a distinct rise in the temperature inside a mass of concrete, and, when the concrete begins to cool, it shrinks and cracks, potentially causing leaks. To limit these (5) _____, concrete can be (6) _____ when the air temperature is low, low-heat cement can be used, and water can be circulated through pipes in the concrete. (7) _____, the concrete has to be placed in shallow lifts (i.e., only a few feet or meters are added at a time) and in narrow blocks; then it has to be allowed to cure (8) _____ a specified minimum time so the heat (9) _____. Depending on the design of the dam, engineers will choose the concrete mix (including the cement and type of aggregate) very carefully; a thin arch dam is designed with a different concrete mix than a (10)_____ gravity dam.

1.	A stone	B gravel	C rock
2.	A formula	B mixture	C mixing
3.	A protection	B reaction	C recreation
4.	A releases	B realises	C relates
5.	A affects	B profits	C effects
6.	A placed	B misplaced	C implaced
7.	A However	B Furthermore	C Despite
8.	A down	B over	C up
9.	A dissipates	B disappear	C disconnect
10.	A large	B massive	C broad-based

Word Families

7. Заполните пробелы данными словами.

a) placeability b) misplace c) emplaced d) placing e) replacement f) replacer g) displaced h) implacable i) placate i) displacement

1. Fly ash has been commonly used as cement _____ material.

2. The innovate system of Slat _____ can help livestock producers quickly and easily substitute worn cement slats.

3. It is required to obtain a high-quality sulfur concrete for mixture _____.

4. A section of a concrete dam _____ within forms or contained between upstream and downstream forms and adjacent sections of the dam is a block.

5. The committee faces _____opposition on the issue of using limestone aggregates.

6. Despite the circumstances, there was no cause to _____the blocks.

7. The concept of _____is related to the effort needed to compact the mix in a given volume.

8. Concrete slabs were _____ because of the structure deformation.

9. It is worth to _____ board of directors because of the upcoming transaction.

10. During dam construction massive water _____ should be provided additional outlets.

Phrasal Verbs

8. Вставьте соответствующие послелоги:
about, down(2), on, through with, up(4), off, apart

1. They have **shut** _____ water and electricity throughout the city's neighbourhoods.

2. The resources were **used**_____ for maintenance of engineering structures.

3. The light has to be **turned**_____ during the manufacturing process on the work site.

4. The economic crisis has **brought** _____ lower prices for the materials.

5. The worker was fired because of **looking** _____ on rules and negligence in equipment maintenance.

6. The total equipment expenses **added**_____ to 500000 dollars.

7. In order to ascertain the reason for the breakage they need to **take**_____ a fuel injector.

8. The company has to **get** _____ all construction and assembling works on time.

9. A lot of houses there were **put** _____ by construction firms under the government programme.

10. The installation was **broken** _____ because of the weather impact.

Confusables

10.*Выберете подходящее слово.*

Floods and flood control

River floods are one of the worst _____ **(1)**. of mankind**.** In 1887, when the Hwang Ho _____ **(2)**, around 900, 000 people lost their lives. In 1970, 200,000 people died in Eastern Pakistan when a cyclone struck the Ganges delta. Clearly the development of ways to control and contain floods must be a_____ **(3)** of man.

Often floods are caused by usually rapid_____ **(4)** of winter snows; the river, unable to hold the increased_____ **(5)** of water, bursts its banks. Heavy rainfall may have a similar_____ **(6)**. Coastal flooding may result from exceptionally high tide combined with onshore winds, or, of course, from a tsunami.

River floods can be forestalled by _____ **(7)** deepening and broadening river channels or by the construction of suitably_____ **(8)** dams. Artificial levees may also be built (in nature, levees occur as a result of sediment_____ **(9)** while the river is in flood; they take the form of built-up banks). _____**(10)** planted on uplands helps to reduce surface runoff.

Flood control can create new problems to_____ **(11)** the old ones. In Egypt the Aswan Dam has halted the once regular flooding of the Nile, thus robbing farming lands of a _____**(12)** annual deposit of silt. But flood control made possible the civilizations of ancient Mesopotamia and plays a vital role in modern water conservation.

1.	a) adversary	b) opponents	c) enemies
2.	a) overflew	b) flow	c) outflew
3.	a) occupation	b) preoccupation	c) concerns
4.	a) thawing	b) warming	c) melt
5.	a) size	b) volume	c) quantity
6.	a) affectation	b) affect	c) effect
7.	a) artificial	b) artful	c) man-made
8.	a) placed	b) situated	c) positioned
9.	a) deposited	b) disposed	c) displaced
10.	a) Vegetate	b) Vegetation	c) Vegetable
11.	a) displace	b) misplace	c) replace
12.	a) valuable	b) available	c) precious

Linking Words:

as/ since/ for/because/because of/due to/ owing to/in spite of/despite

10. Переведите следующие предложения

1. It's **because of** chemical reactions that human beings reproduce, digest, grow, heal, and think.

2. People are concerned about the increase in the building of hydroelectric dams, **because** it may cause potential displacement of indigenous people.

3. Microeconomic performance was set back in 2000 and 2001 mainly **owing to** the severe floods.

4. Developing countries should not be prevented from industrializing **due to** environmental concerns.

5. **In spite of** the obvious constraints, the distribution of construction materials to the governorates has been observed to be efficient.

6. **Despite** those measures, much still remained to be done to reverse the ongoing destruction of natural resources.

7. **Regardless** these complexities, concrete progress was made at different levels of the three tiers of government.

8. The risk of destroying environment clearly still remains, **in spite of** national protection. measures.

Grammar: Future Tenses

11. Choose the correct verb form.

1. We will be **moving/will have moved** to our new premise in August.

2. We will be **moving/will have moved** to our new premise by August.

3. What time **does /will** your train **leave**?

4. Don’t forget to turn off the lights before you **leave/will leave**.

5. We will not send the spare parts until **we've received/will receive** the payment.

6. We will **repay/will have repaid** the bank loan by December.

7. Unless they **are/will be** more reasonable we'll break off the negotiations.

8**.** Our visitors are due **to arrive/to be arriving** at 10 a.m.

9. I'm afraid I **will arrive/will have arrived** a bit late.

10. I can't talk now. I **am/will be** about to leave for the airport.

11. I've been working for about three hours. **Shall/Will** we break for coffee?

12. I wonder when he **gets/will get used** to our requirements.

12. Write a letter on Anticipating Problems using expressions:

I hope/hopefully, I expect, I'm afraid, I wonder, I don't think, I doubt;

In case, if you wish/choose/intend… let me know (in advance);

I would like to remind that…

The first one is done for you.

Conference preparation. Anticipating Problems

A Research Institute of Solar Energy is planning a big international conference. The organizing committee is analyzing the list of things that might go wrong during the event.

Discuss the action plan in case of emergencies and arising problems.

Example: *I hope you will take part in the conference to be held in May. I do not think you will have problems getting a visa. I suppose it is a good idea to check up whether there are some extra days off due to the national holidays. If there are any, you will have to submit your documents in advance.*

Problems Cause Solution

1. Getting a Russian visa: national holidays in May

2. Delayed arrivals to St. Petersburg: emergency situation

3. Accommodation: shortage of hotels with central location at reasonable price.

4. Catering: welcome buffet, coffee breaks, lunch, special dietary requirements of the participants.

5. Venue of the conference: provision of shuttle

6. Required equipment: OHPs, whiteboard

7. Translation: reports to be published in the Proceeding, simultaneous translation

8. Cultural program: sightseeing, theatre

9. ala party: venue, dress code

10. Participant's kit with a logo:content

11. Participants' departure: bus schedule, ordering a taxi.

12. Further information: organizing committee

13 . Match the two parts of the sentences.

A	B
1. Please take a seat until	a) you leave
2.They won't accept our order unless	b) Dr. Repin is ready to see you.
3. Ann wants to speak to you before	c) you'll have left.
4. You won't see Alex. By the time he arrives	d) we give a bank guarantee.
5. As soon as he comes	e) have finished and we can talk.
6. I can't wait. This time next week	f) I'll ask him to phone you.
7. Sorry about this. In a few moments I'll	g) the technical staff sort out the problem.
8. Sorry for the delay. We'll have to wait until	h) I'll be lying on the beach in Greece.

14. Use the suitable verb form.

PhD Exams

The PhD exams are to be held in June. You may **(take**) some training courses, either philosophy or English, or both after you **(come back**) from your summer holidays. There probably **(be**) no classes in December when we (be**)** really very busy preparing end-of- the-year reports.

I would like to get some feedback from you concerning PhD courses as the number of participants **(be**) limited. You need not apply for a place in the refreshment courses unless you **(take**) an English or philosophy exam this year. You **(have**) four hours of English every week. If your classes **(coincide**) with public holidays the teacher **(cancel)** them and **(make)** it **up** for you in May. By May it is expected you **(read)** 100 pages of technical articles in your field. Make sure they are written by English-speaking authors, otherwise you **(have**) problems at the exams.

The exam **(proceed)** as follows: while the examiner **(listen)** to the first examinee, the other applicants **(have)** time to get ready with their texts.

15. Use the suitable verb form.

Professional Development

The Human Resources Manager of a large company **is explaining/explains** (1) the appraisal system to a group of new employees. "Your appraisal interviews **will be taking/take** (2) place in March. During February your line managers **will have collected/will collect** (3) all the information they need from you. And by the time you **will meet/meet** (4) for an interview, they **will be producing/will have produced** (5) all the checkpoints to discuss.

In the interview you **are discussing/are going to discuss** (6) your performance during the past year and any issues relating to your future needs, such as training. By the end of the interview I hope that you and your line managers **will be agreeing/will have agreed** (7) upon your personal objectives for next year, both in terms of your tasks within the project and your personal development. Of course there is some flexibility in the deadlines in case something **happens/will happen** (8) that we can't predict.

The company **is going to offer/ will be offering** (9) a choice of courses in August before the work **will get/gets** (10) really busy in September.The next time we **will meet/meet** (11) will be October. By that time your courses you **will be finishing/will have finished** (12) and I will expect some feedback from you on your training.

Unless you **have/will have** (13) any questions I say that will do for today. I will also appreciate if you **e-mail/will e-mail** (14) your suggestions about your training courses as soon as you **have made up/will have made up** (15) your mind."

Grammar: *Noun Attribute*

16. Перепишите предложения и измените подчеркнутые словосочетания на словосочетания типа **Noun Compound**

Образец: **A.** Concrete is among the most used <u>materials for construction</u> around the world.

B. Concrete is among the most used <u>construction materials</u> around the world.

1. **A**. Damming has been an important <u>practice in engineering</u> sphere for thousands of years.

B. Damming has been an important _____for thousands of years

2. **A.** Concrete is an agglomerate of stone and <u>paste with cement</u>.

B. Concrete is an agglomerate of stone and_____.

3. **A.** The dam wall itself blocks <u>migrations of fish</u>, which in some cases and with some species completely separate spawning habitats from rearing habitats.

B. The dam wall itself blocks_____, which in some cases and with some species completely separate spawning habitats from rearing habitats.

4. **A.** Concrete precast in factories is also "green" and can contribute to LEED certification in part because it uses local materials that are in abundant supply.

B. _____is also "green" and can contribute to LEED certification in part because it uses local materials that are in abundant supply.

5. **A.** Changing in climate is one of some reasons of destroying dams

B. _____is one of some reasons of destroying dams

6. **A.** Dams are built to block the flow of water, creating a reservoir behind the dam that can be used for control of flood.

B. Dams are built to block the flow of water, creating a reservoir behind the dam that can be used for _____.

7. **A.** As a technology of building, precast concrete offers a wide variety of details and finish options.

B. As a_____, precast concrete offers a wide variety of details and finish options.

8. **A.** Thin veneer which is made of brick has a three to six percent absorption rate.

B. Thin_____has a three to six percent absorption rate.

16. Некоторые предложения содержат ошибку. Найдите и исправьте ее.

1. Gravitation dams are so named because they are held to the ground by gravity – they weigh a lot, and are typically made from concrete or stone.

2. Factory fabrication allows precise, all-weather manufacture and finishing, which offers a quality advantage in concrete building construction.

3. Such building materials are also favored by general contractors and construction managers who work in precast concrete.

4. We now know that we cannot predict water levels and required reservoired capacity based on historical data.

5. Most reservoirs, especially those in the tropics, are significant contributors to greenhouse gasal emissions.

6. You can buy a bag of cement from your local hardwaric store

7. The result is a structure where the traces of the timber moulds of its concrete give it the feeling of an unusually exalted wooden shack.

8. Such constructions, despite being made of a masonryl form, are required to be coated with a special combination.

9. They used equipment in order to make many tonnes of concrete into mineral origami.

10. He takes a concreting sheet and drops it like a pocket handkerchief between two rectangular blocks.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASKS

Concrete and masonry dams

Integrated task to Unit 4. Read the text ***Concrete and masonry dams,*** watch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

Dam - Teesta Low Dam Stage IV

VIDEO RCC Dam - Teesta Low Dam Stage IV

https://www.youtube.com/watch?v=EBG3CiY7LAI

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. What was the biggest problem and the biggest challenge in constructing this Dam on Teesta River in India?
3. How was the process of this dam constructing organized?
4. What is the future of the RCC technologies in constructing dams?

Unit 5. Embankment Dams

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Embankment dam – земляная плотина, каменно-набросная плотина, напорная дамба**; slip circle analysis** – анализ скользящего круга; **earthfill (dams)** – земляные плотины; **severe settlement** – сильная усадка; **concrete faced rockfill dam (CFRD)** – насыпные дамбы с бетонным покрытием; **finite boundary methods -** метод конечных границ; **internally sheared clays** – глины с внутренним сдвигом; **event trees** – причинно-следственная схема событий; **retain –** сохранять, удерживать**; reinforced concrete slab** – железо-бетонный блок; **tremendous advance** – огромный прогресс; **embankment –** набережная; **grouting technique** – метод намывания; **feedback systems** – системы обратной связи; **degree of compaction** – степень уплотнения

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах.

1. Many new developments in science and technology have led to the construction of ever higher and more elaborate embankments dams.

2. The Mangla dam was one of the first in the UK to be analysed using slip circle analysis.

3. The Mangla dam was raised by another 100 m.

4. The design of the filters between the cores and shells of such dams was built on empirical relationships.

5. While the results may be represented to two decimal places, in fact engineers mostly can approximate to a general order of magnitude.

6. Early rockfill dams used to be subject to severe settlement as a result of heavy rain.

7. The dam weight, valley shape, the type of rock and the number of movement joints in the slabs are found to determine the condition of the dam.

8. Earth sciences have made great breakthroughs in the last 50 years.

9. Rockfill dams with central concrete core walls don't have have a safety record as good as CFRDs.

10. In the future monitoring and control may be done distantly.

A number of things have come together over the years which have favoured the construction of embankment dams. They have included the continued development and understanding of soil mechanics as a science, the widespread availability of computers, appropriate software for complex analysis and the development of large, heavy earthmoving machinery. These have led to the construction of ever higher and more elaborate embankments. One especially notable achievement was the 147 m-high Mangla dam in Pakistan. This dam was one of the first in the UK to be analysed using slip circle analysis, something which is now routine. It was also the first

to have its design dominated by considerations of internally sheared clays. From 1997 to 2007, the dam was raised by another 10 m.

Mangla and its neighbour Tarbela were both classic earthfill dams built of, and on, some materials that were potentially highly credible. The design of the filters between the cores and shells of such dams had long been built on empirical relationships. While safety factors could be calculated for slip circle failures and for mechanical performance in general of these dams, no similar safety factors could be identified for internal erosion, although this was one of the main causes of earth dam failure. In recent years this has been addressed by applying event trees and statistical risk assessments to the individual events themselves.

There are now internal erosion toolbox systems and also new ICOLD guidelines. These have represented a big step forward, but even now individual probabilities have to be assessed hugely based on guesswork, albeit experienced guesswork using carefully crafted guidance documents. While the results may be represented to two decimal places, one is really only likely to be able to approximate to a general order of magnitude. Risk assessments are now being increasingly applied to many aspects of dam engineering, although similar cautions apply. Points which appear on 'ALARP' diagrams should perhaps be more realistically represented as vaguely shaded zones.

Perhaps the most major embankment dam development in the past 50 years has been that of the concrete faced rockfill dam (CFRD). Early rockfill dams suffered from severe settlement. This became especially apparent when one such rockfill dam in the USA slumped by several metres during construction as a result of heavy rain. Sluicing rockfill into position became the norm, until it was largely replaced by controlled compaction in layers, using heavy plant. These dams are sealed with upstream membranes, and eventually the use of a thin reinforced concrete slab became the norm. Confidence grew when the 110 m-high Cethana dam was completed in Tasmania in 1971, which doubled the height of previous CFRDs.

Nowadays, especially when rockfill is plentiful and core material is not, the CFRD is the favoured choice of dam and many of these structures now extend to around 200 m in height. However, with increased confidence also came over-confidence. Leakage along the plinth joint became a common problem, and then several high dams such as Mohalc in Lesotho, Tianshengqioa in China and Barra Grande and Campos Novos in Brazil, all constructed with basalt aggregate, featured serious face slab failures. The problem was traced to a combination of dam height, valley shape, the type of rock and a reduction in the number of movement joints in the slabs. Lessons were learned and, in particular, more movement joints have now been reintroduced in the slabs and with both internal and external seals. It is interesting that rockfill dams with central concrete core walls have a statistically much better safety record than CFRDs, or indeed any other type of dam, although these have largely fallen out of fashion.

Advances in earth sciences generally have also been notable in the last 50 years. One example of this has been the tremendous advance in the understanding of rock mechanics brought about by the work of Evert Hoek and others, and the use of techniques such as finite boundary methods, non-linear analyses and programmes such as FLAC and RockLab. There have been similar advances in foundation treatment, such as the advent of GIN grouting techniques, colloidal mixers and new options for improved, stable, grout mixes.

So what of the future? In the case of earth embankments, soil properties are still accessed based on a whole range of empirical indices and tests, which have been developed over the years. Perhaps it will be possible at some point to redefine and derive the properties of most soils

just from the soil chemistry and a few basic geometric parameters. When it comes to construction, compaction of soils on site can now be monitored by feedback systems into the cabs telling drivers when the required degree of compaction has been achieved. There is no longer a need to define an arbitrary number of passes. In fact, the driver no longer needs to be in the cab. Remote control of driverless construction machinery is now established and used. We are moving towards a time when the complete construction of an embankment could perhaps be preprogrammed and automated much in way that assembly factories work, with site staff required principally to monitor and maintain the plant. Nowadays the monitoring and control does not even have to be done in the same country. All this is possible now, and while not the norm, it could be so 50 years ahead.

2. Найдите в тексте 8 пар синонимов

1. Main 2. Hugely 3. Around 4. Introduced 5. Constructed
6. Advances 7. Heavy 8. Same

3. Найдите соответствия между словами в группах A и B

A. 1) development 2) availability 3) notable 4) otentially 5) ealistically 6) previous 7) settlement 8) apparent 9) indeed 10) property

B. a) remarkable b) accessibility c) growth d) former e) perhaps f) reliably g) community h) obvious i) in fac j) feature

4. ***Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель)***

elaborate-elaboration-elaborator

combine – … – …, settle – … – …, construct – … – …,
aggregate – … – …, reduce – … – …, introduce – … – …,
advent – … – …, develop – … – …

5. A. Переведите следующие словосочетания.

1. widespread availability of computers
2. internally sheared clays
3. major embankment dam development
4. finite boundary methods
5. serious face slab failures

B. Преобразуйте следующие словосочетания в номинативые атрибутивные цепочки согласно модели и переведите их:

Causes of earth dam failure – earth dam failure causes – причины сбоев земляных дамб

1. an arbitrary number of passes
2. understanding of rock mechanics

3. the properties of most soils
4. remote control of driverless construction
6. a whole range of empirical indices and tests
7. appropriate software for complex analysis

Confusables

6. Выберите подходящее слово.

Soils

Within a river valley a cross-section of soils may be available. The valley 1)……, where less leaching has occurred, can 2)…….soils with a higher proportion of clay. The more heavily leached areas can provide amounts of sands, gravels and or silts. The streambed 3)…… should be a source for silts, sands and gravels, the 4)… being useful for drains and concrete work. Of great economic importance is the need to find such materials 5)……to the dam site, 6)…….within the reservoir area, and in large enough quantities to justify their 7)….. Avoid complete removal of impervious materials, as 8)……of more permeable layers beneath could lead to seepage problems in later years, 9) …….when under pressure of several metres of water. Investigation of proposed areas is a necessary feature of any dam 10)…. This is carried out using auger holes, soil pits, boreholes and utilizing existing features such as wells and animal burrows to gain an extensive knowledge of the area.

1.	A) aside	b) sides	c) sites
2.	A) provoke	b) provide	c) promote
3.	A) proper	b) property	c) properly
4.	A) latter	b) later	c) litter
5.	A) clothes	b) close	c) closed
6.	A) principally	b) previously	c) preferably
7.	A) removal	b) replacement	c) extraction
8.	A) exposure	b) explosion	c) explode
9.	A) specially	b) specifically	c) especially
10.	A) survey	b) surveillance	c) survival

Word Families

7. Заполните пробелы данными словами.

a) **assume** b**)assumed c) assumption** d) **consume** e) **consumer**
f) **consuming** **g) consumption** h) **presumed** j) **presumption** i) **resumed**

1. It might be refreshing to ____a new attitude towards science and religion – to let them go their separate ways.

2. In scientific studies _____, reasoning and estimations are normally complemented by evidence from controlled experiments.

3. During the Big Bang the singularity _____ heavenly dimensions, space beyond conception.

4. Guinea pigs, or cavies, are almost never used for vivisection these days, but Peruvians _____ an estimated 65 million of them each year.

5. A lot of spin-offs in space research resulted in new_____ products.

6. Three Rs of the green technology and waste management include reduction of all types of____.

7. The_____ of innocence implies that a person is not considered guilty unless proved to be so.

8. Back when computers first came on the scene, scientists and sci-fi writers alike _____ that they would soon be put to work as the electronic brains of household robots. It did not work out that way though.

9-10. "Challenger" exploded in midair a few seconds after having been launched, ____ 8 members of its crew. The flights much later were____ with the redesigned engine.

Phrasal Verbs

8. Вставьте соответствующие послелоги:
away, down (2), in, , off (2), on (2) up

1-2. Fill … the form, please and put … all the details of the case.

3. The music is too loud. Could you turn …. the volume, please?

4. Quick, get … the bus or you will have to walk home.

5. Turn …. the lights when you go to bed.

6. Do you mind if I switch … the TV? I'd like to watch the news.

7. The dinner was ruined. I had to throw it …….

8-9. When you enter the house, take … your shoes and put … your slippers.

10. If you do not know this word, you can look it … in a dictionary.

Linking words: neither…nor/ either…or/ both…and

9. Переведите следующие предложения.

1) All things I really like to do are **either** immoral, illegal **or** fattening. (*A. Woolcott*)

2) It is the goodness of god that in our country we have those three unspeakably precious things: the freedom of speech, the freedom of conscience, and the prudence never to practice **either** of them. (*M. Twain*)

3) Learned conversation is **either** the affectation of the ignorant **or** the profession of the mentally unemployed. (*Oscar Wilde*)

4) All science is **either** physics **or** stamp collection.)*Lord Rutherford*)

5) Science and technology are simply two different responses to the forces of nature and progress in **either** can be the source of progress in the other.

6) Darwin **neither** rested on his authority **nor** permitted himself to react angrily to attacks from the forces of religious fundamentalists. 'We are confessedly ignorant; **nor** do we know how ignorant we are,' he wrote.

7) Einstein's relativity played a key role in **both** the 'Big Bang' **and** Black Boles theory..

8) Matter and energy can be viewed as **both** particles **and** waves, even though particles and waves have mutually exclusive properties.

9) The rediscovery of ancient learning by Arabs certainly provided a launch pad. But it needed something from outside science to propel science into orbit: something **neither** the Greeks, **nor** the Arabs, **nor** the Chinese had. That something was the right technology.

10) Newton and Einstein have much in common: **both** are the greatest scientists ever lived and **both** experienced an extremely fruitful creative period known as *annus mirabilis.*

Grammar: Participle

Tenses	Active	Passive
Indefinite I	giving	being given
Indefinite II		given
Perfect	having given	having been given

Функции причастия

Обстоятельство

Вид	Действительный залог	Страдательный залог
Несовершенный	**While interviewing Ann** the manager asked a lot of questions. *Проводя интервью с Анной, менеджер задавал ей много вопросов.*	**While being interviewed** Ann was asked a lot of questions. *Когда с Анной проводили интервью, ей задавали много вопросов.*
Совершенный	**Having interviewed Ann** the manager wrote a report. *Проведя интервью с Анной, менеджер написал отчёт.*	**Having been interviewed** Ann filled the form. *После того, как с ней провели интервью, Анна заполнила бланк.*

Определение

Несовершенный	The lab assistant **checking the data** fills the table. *Лаборант, проверяющий данные, вносит их в таблицу.*	The data **being checked** by the lab assistant will be entered into the table. *Данные, проверяемые лаборантом, будут вносится в таблицу.*

Вид	Действительный залог	Страдательный залог
Совер-шенный	**–**	The data **checked** by the lab assistant are entered into the table. *Данные, проверенные лаборантом, вносятся в таблицу.*

The lab assistant **who had checked the data** entered them into the table. *Лаборант, **проверивший данные**, внёс их в таблицу.*

The data **to be checked by the lab assistant** are entered into the table. *Данные, **которые будут проверяться лаборантом**, вносятся в таблицу.*

Независимый причастный оборот (НПО)

Независимый причастный оборот отделяется от главной части предложения запятой. Если НПО в начале предложения, то он переводится обстоятельственным придаточным предложением с союзами *так как, после того как, когда, если* и др. Если НПО после запятой, то он переводится самостоятельным предложением с союзами *а, и, причем.* Например:

The data checked, the lab assistant entered them into the table. ***После как данные были проверены**, лаборант внёс их в таблицу.*

We checked the equipment, **with our assistants helping us**. Мы проверили оборудование, **причем** наши ассистенты нам помогали.

10. Выберите причастие I/II, выражающее оценку или состояние.

1. The task is very complicated but interesting. It is **challenging/ challenged**.
2. Power supply failed during my experiment. I was **frustrating/ frustrated.**
3. I've lost the point and can't follow the explanation. I am **confusing/ confused.**
4. The food store falsified the validity dates on some cans. It is **disgusting/ disgusted.**
5. I was carried away by this book. I am **fascinating/ fascinated.**
6. His habit of speaking so loudly gets on my nerves. It is **irritating/ irritated.**
7. John told very funny jokes at the party. I was **amusing/ amused.**
8. I can't find the answer and have no clue to this problem. It is **puzzling /puzzled.**
9. We heard a loud explosion in the lab. Everyone was **scaring/ scared**.
10. I met my teacher at the night club. It was **embarrassing/ embarrassed** for both of us.

11. Употребите причастие I/II.

Glaciers are large masses of ice **surviving/survived (1)** for many years. Glaciers form wherever conditions are such that annual precipitation of snow, sleet and hail is greater than the

amount **losing/lost (2)** through evaporation or otherwise. Glaciers can slide **causing/caused (3)** considerable damage.

Ice age is any period of glaciation **occurring/occurred(4)** in the earth's history, but particularly that in the Pleistocene epoch, immediately **preceding preceded (5)** historic times. Formerly there were thought to have been only three or four glacial advances, but research **conducting/ conducted (6)** recently has shown about 20 major incidents. The generally **accepting/accepted (7)** term Ice age was first used by bonanist Karl Schimper in 1837.

A hurricane is a revolving storm **originating /originated (8)** at latitudes between 5 and 29 degrees north or south of the equator. *Tsunami* are ocean waves **generating /generated (9)** by vertical movement of the sea floor **resulting/resulted (10)** from earthquakes or volcanic activity. In contrast to Tsunami, *tornado* is an extremely violent **revolving/revolved (11)** storm with swirling, funnel-**shaping/shaped (12)** clouds, **causing/ caused (13)** by a **rising/risen (14)** column of warm air p**ropelling/propelled (15)** by strong wind.

12. Раскройте скобки, употребив причастие I/II.

1. One of the most acute problems is changes to the atmosphere **(lead)** to the greenhouse effect, thus **(make)** most climates warmer. It has already affected several areas of the world with unusual weather **(cause)** droughts and severe storms.
2. Fossil fuel such as oil and coal (**extract)** from the Earth cannot last forever, so using other forms of energy **(include)** wind, sun, water, and sea waves would preserve our planet.
3. Gasses **(pollute)** the atmosphere are produced too quickly to be cleared away naturally by rain, winds or plantlife.
4. These harmful gases **(refer)** to as greenhouse gases are mostly emitted by vehicles and factories **(burn)** fossil fuels
5. Some of them are caught by rain clouds and fall as acid rain **(damage)** the environment.
6. **(Accumulate)** amounts of carbon dioxide form a cover over the earth **(keep)** warmth of the Sun close to the earth's surface.
7. Deforestation primarily **(cause)** by cutting down rainforests resulted in **(increase)** amounts of carbon dioxide.

13. Переведите на русский язык, обращая внимание на причастия настоящего времени.

1. **Having been built** of concrete, the house was always cold in winter.
2. **Realizing** the environmental damage that dams have caused perhaps humanity will one day innovate even further and bring forth the restoration of these natural wildlife ecosystems.
3. Dams occasionally break **causing** catastrophic damage to communities downstream. Dams break due to engineering errors, attack or natural disaster.
4. The large building **being built** in our street is a new research center.
5. **Having finished** the experiment the students cleaned the laboratory.
6. Having been written long ago, the manuscript was impossible to read.
7. Concrete is a construction material **used** for foundation walls, concrete slabs, patios, and many other masonry structures.
8. The sulphates and some of the gypsum dissolve almost instantly, **giving** rise to a highly alkaline solution.
9. Many factors impact wildlife survival, **including** the blockage of **migration** routes.

10. Water and cement make a **reacting** medium**,** since components of the **slag** admixture became reactive **when wet.**

14. Раскройте скобки, употребив причастие настоящего времени в активной и пассивной форме.

1. (To lose) the mobile phone, the student couldn't remember any phone numbers.
2. When (reconstruct) the theatre looked more beautiful than before.
3. When (burn), coal produces heat and carbon dioxide.
4. (To show) the wrong direction, the travelers soon lost their way.
5. The question (to discuss) now is very important. .
6. When (to complete) the new building will accommodate 3000 students.
7. (To reject) by recruitment agencies he became self-employed.
8. (To make) the report, Tom left the room.
9. When (to offer) to work abroad, he refused.
10. When (to use) for building purposes, concrete is very important.

15. Переведите предложения с независимым причастным оборотом (НПО), вставив необходимые по смыслу союзные слова после, когда, поскольку ***и т.п. если НПО в первой части предложения. См. пример перевода в (1). Если НПО во второй части предложения, то вставьте союзы*** а, и, причем, при этом.

1. **The experiment finished**, they wrote an article based on their findings.

После окончания эксперимента они написали статью по результатам исследования.

2. **Economic justification approved**, the dam designing started.
3. **Unexpected problems arising during the excavation**, the dam construction schedule had to be changed.
4. **The necessary adjustments having been made,** the project was finalized.
5. Dams are one of the earliest known man-made structures, **with records existing from c 2900 BC of a 15 m-high dam on the Nile.**
6. Construction methods were largely empirical, **with the first scientifically designed dam built in France only in 1866.**
7. Hydropower is produced in 150 countries, **with the Asia-Pacific region generating 33 percent of global hydropower in 2019.**
8. The political realities of new reservoirs in western countries, economic limitations in the third world and the lack of a transmission system in undeveloped areas, result in the possibility of developing 25% of the remaining potential before 2050, **with the bulk of that being in the Asia Pacific area.**
9. China is the largest hydroelectricity producer, **with 920 TWh of production in 2013, representing 16.9 percent of domestic electricity use.**
10. The power extracted from the water depends on the volume and on the difference in height between the source and the water's outflow, **this height difference referred to as the head**.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Embankment dams

Integrated task to Unit 5. Read the text *Embankment dams*, watch the video, complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

VIDEO Embankment dam

https://www.youtube.com/watch?v=ULPwMghyGLA&t=48s

Answer the following questions:

1. How do the text and the video correlate? What do they have in common?

What is different?

2. What compositions are used in a complex semi-plastic mound to create an embankment dam?

3. Describe the types of embankment dams.

4. What factors can cause an eventual failure of a dam? What measures are usually taken to avoid them?

Unit 6. Dam Safety

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Maintenance – обслуживание, **risk assessments –** оценка риска, **legislation** – регулирующая база, **seepage rates –** скорость просачивания, **to impound reservoir –** наполнять резервуар, **elevation –** высота, **curvature –** изгиб, **flexure –** сгиб, **double curvature arch dam –** плотина с аркой двоякой кривизны, **grout curtain –** цементационная завеса, **remedial grouting –** корректирующая цементация, **foundation crack –** трещина в фундаменте, **crest –** гребен**ь, failure event tree** – дерево событий возникновения неисправности, **continuous real time monitoring –** непрерывный контроль в реальном времени, **buttress dam –** контрфорсная плотина, **embedded cells –** встроенные сенсоры

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах

1. The monitoring of the dam involves consideration of every event occurred.
2. The matter that settles to the bottom of a reservoir is often the reason for seepage increasing.
3. The Wimbleball buttress dam in the UK extremely needed to be grouted.
4. At the time the Dinas dam in Wales had been built the expansion rate was lower.
5. The sequential events in a failure event tree enable to predict the possible failure.
6. In 50 years major dams in the world will not need constant human assistance.
7. Embedded temperature, pressure and strain cells for continuous monitoring fail to be used by unmanned equipment.
8. The uniqueness and idiosyncrasies of the dam engineer are appropriate when assessing the dams.
9. According to the author, the dam engineer should employ personal questions considering the happiness of people while assessing the dams.
10. In the nearest future, the dam safety will comprise a great diversity.

There are numerous aspects of dam safety, but key ones include: maintenance, monitoring, inspection, risk assessments and legislation. A key aspect of monitoring is interpretation of any results as they occur, and understanding what they mean in terms of dam behavior. This cannot be over-emphasized.

It is not uncommon to find dam owners monitoring and filing data, but otherwise doing nothing with it. In fact such owners are assembling evidence which could be used against them at a public enquiry should anything go wrong. The whole point of taking instrumentation readings is to enable them to tell the engineer something about the way the dam is behaving.

In the case of the Victoria dam in Sri Lanka, seepage rates increased rapidly once the reservoir had reached a certain elevation on first impounding. This is not unusual in a double curvature arch dam where the flexure of the dam can cause a localized foundation crack at the upstream heel. It is why the grout curtain in arch dams is often located centrally rather than upstream. In the case of Victoria, the seepage decreased as sedimentation started to seal the foundations.

In the case of the Wimbleball buttress dam in the UK, seepage initially seemed broadly proportional to the reservoir level, however when plotted with the seepage points joined as a time-line, a hysteresis effect could be seen with seepage increasing every time reservoir levels increased and decreased. This indicated that material was being lost, and that the foundation materials were unstable, leading to an extensive programme of remedial grouting.

A similar hysteresis effect can be seen with the crest length of the Dinas concrete arch dam in Wales. The dam is affected by AAR in the concrete, and so is expanding. However the length changes caused by annual temperature changes need to be plotted and compared for the underlying AAR-based expansion changes to be revealed. Recent plots show that overall underlying expansion rates are now much lower than in the early years after construction.

As mentioned earlier, risk analyses are playing an increasingly important role in assessing dam safety. We will be likely to see many more changes in future regarding what is accepted as current best practice; however, all sequential events in a failure event tree will end with one assessing the likelihood of detecting potential failure, followed by another assessing the likelihood of being able to intervene to prevent it. Clearly the more the certainty of these last two events can be guaranteed, the more the rest of the event tree will become redundant and the risk of failure vanishingly small. It is also likely that this is where attention to risk is actually, quite correctly, taking us.

There are a number of major dams in the world with continuous real time monitoring of key failure indicators with links to alarms and telephones to 24 hour monitors. In 50 years this is likely to become routine for high consequence dams where significant human life or economic loss would be threatened in the event of a failure. Could yet another step be to make the results available in real time on the internet, so that interested members of the public could take part and be reassured, much in the way one can dial in now to many public web cams? Before objections are raised, the author would ask: why not?

Embedded temperature, pressure and strain cells for continuous monitoring could be coupled to the use of unmanned drones and surveillance cameras, to enable routine regular inspections even in the remotest of locations.

Monitoring naturally has to be focused on key failure mechanisms which have been identified, and so also assumes that the dam safety engineer will have sufficient time to review the results of monitoring and assess what it indicates. Ideally one would also hope that any dam safety legislation is compatible with that notion, or even that it encourages it. This can be the case, but is not universally so. There is a case for standardizing many aspects of reservoir engineering, but this must be coupled with sufficient freedom and flexibility to use the experience and judgement that dam and reservoir engineers bring, which they have built up during their careers and which is especially appropriate when assessing dams where each one will have its own uniqueness and idiosyncrasies.

Experienced judgement can be an indefinable thing, but when inspecting dams and reservoirs the author finds that it can be enhanced by three reflective questions:

The inspecting engineer should ask: “If my family was living downstream of this dam would I be happy?"

If a dilemma emerges which calls for difficult judgement, the engineer might ask himself what his early senior mentors might have done in similar circumstances.

The last question is, “If a serious incident occurs in future at the reservoir and I am standing in court in five years’ time giving evidence, could I defend the decisions and recommendations I have made?”

So what of the future? Increasing standardization is inevitable, at least in terms of basic principles, and in 50 years one would hope for an increasing international consensus on what reservoir safety control should comprise. It is an area where organizations such as ICOLD, major funders such as the World Bank and some well known professional journals and organizations already play a valuable role.

2. Найдите в тексте 12 пар синонимов.

1. deposit; 2 lawmaking; 3 oozing; 4 to fill up; 5 bend; 6 cementation; 7 defectiveness; 8 to enlarge; 9 corrective; 10 indescribable; 11 basin 12 agreement

3. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

1. to maintain – …
2. to inspect – …
3. to assess – …
4. to fail – …
5. to behave – …
6. to locate – …
7. to expand – …
8. to analyze – …
9. to indicate – …
10. to standardize – …
11. to interpret – …
12. to own –

4. Вставьте в предложения подходящие лексические единицы из текста.

1. Maintenance, monitoring, inspection, risk assessments and legislation are the key points of ….
2. The results of the dam monitoring enable to understand the influence in the terms of ….
3. … helps the engineer to understand how the dam is behaving.
4. … in arch dams is often located centrally rather than upstream.
5. The seepage … when sedimentation seals the foundations.
6. The loss of material led to an extensive programme of **….**
7. Recent … show that expansion rates are now much lower than before.
8. Risk analyses are playing an important role in … dam safety.
9. All sequential events in **…** enable to assess the possibility of detecting potential failure and being able to intervene to prevent it.
10. The dam engineer can observe the dam behavior 24 hour round with the help of …

5. Переведите предложения с русского языка на английский язык.

1. Ключевыми аспектами безопасности плотины являются обслуживание, контроль, проверка, оценка риска и нормативная база.
2. Инструментальные данные позволяют понять поведение плотины.
3. Скорость просачивания резко увеличилась при первом наполнении.
4. Изгиб плотины может стать причиной трещины основания.
5. Отложение осадков уменьшает скорость просачивания воды.
6. Обширная программа по корректирующей цементации может быть единственным решением проблемы.
7. Недавние графики показывают увеличение скорости расширения.
8. Оценка безопасности плотины может быть произведена при помощи анализа рисков.

9. Мы можем оценить вероятность обнаружения возможного дефекта при помощи дерева событий возникновения неисправности.

10. В настоящее время во многих странах уже существуют плотины с непрерывным контролем в реальном времени.

Confusables

6. Выберите подходящее слово.

What's the difference between safety and security?

a) Safety / b) Security (1) stands for **a) incident / b) accident (2)** avoidance, and security for crime prevention. The best way to explain it is to use an example: if you think of an emergency exit, on the one hand you have the **a) safety / b) security (3)** aspect. In safety terms you need to be able to get out of the building at any time, and the door should preferably always be open. As far as **a) safety / b) security (4)** – with a focus on building **a) prevention / b) protection (5)** – is concerned, this door would ideally not be there at all, so that no-one can get in. The goals and values of safety and security are in some places contradictory, which is what makes the subject so intriguing. In the field of classic a) **safety / b) security (6)**, functions are enabled in potentially dangerous machinery to **a) prevent / b) protect (7)** people and the environment. When it comes to **a) safety / b) security (8)**, however, you're no longer protecting people from machines – in fact it's quite the reverse: You have to **a) prevent / b) protect (9)** the machine to ensure that people can't bring it to a juddering halt or switch off relevant **a) safety / b) security (10)** functions.

Word Families

7. Выберите и вставьте пропущенное слово в правильной грамматической форме. К какой части речи относится выбранное слово?

1. Practice and patience are the keys to _____.

succeed success successful successfully

2. Our suppliers never let us down. We _____ on them many times in the past.

relied reliability reliable reliably

3. I can't see what's _____ in the second version of this document.

differ difference different differently

4. _____ speak louder than words.

act action active actively

5. After failing to deliver the spare parts on schedule our suppliers _____.

apologized apology apologeticapologetically

6. Please show me your _____ and your insurance papers.

identify identification identifiable identifiably

7. He was _____ upset when he heard about the accident.

understand understanding understandable understandably

8. There were so many _____ issues that they called in a mediator.

divide division divisive divisively

9. Because the manager reacted _____, the problem didn't spiral out of control.

decide decision decisive decisively

10. This document was a _____ resource for the project.

benefit (Noun) benefit (Verb) beneficial beneficially

Phrasal Verbs with "go"

go about
1) to move or travel around: *The quickest way to go about the city is by underground train.*
2) to start (smth or doing smth): *I wanted to make a dress but didn't know how to go about it.*

go along
to proceed, make progress: *You may have some difficulties at first, but you'll find it easier as you go along.*

go at (smth or smb)
to rush at, attack (not fml): *They went at each other furiously.*

go back
1) to return: *Shall we go back there for our holiday next year?*
2) to go back to – to return as in conversation to something; *He wants us to go back to the old and tried methods.*
3) to go back on – to fail to fulfil (a promise, agreement, etc.): *You should never go back on your promise to a child.*

go down
1) to be received, esp. with approval, to be liked (by someone): *How did your speech go down (with the public)?*
2) to be considered less worthy: *He went down in my opinion.*

go easy
1) to behave calmly: *Go easy, dear, there's nothing to get excited about.*
2) to treat someone kindly not severely (on, with): *Go easy on the child, will you, she is too young to understand what she did.*

go as / so far as (not fml)
to be bold or direct enough (to do smth), to declare the truth: *I wouldn't go so fa r as to say she is a liar.*

go into
to examine: *The police went into the man's story to see if he was telling the truth.*

go round to move around, to be publicly noticed (doing smth): *You can't go round saying nasty things like that about him.*

8. Замените выделенные слова соответствующими фразовыми глаголами.

1. I'll have to *examine* those papers closely before I can say anything definite. 2. I had the idea of making a raft but couldn't figure out how to *start*. 3. In his report the speaker *attacked* the hedgers who were forever trying to shift the responsibility onto somebody else. 4. As you *get better* in English, you'll find it easier to communicate. 5. He didn't *fulfil* his promise to work harder. 6. How did your pupils *accept* your first lesson? 7. My opinion of him *dropped cons iderably* when I found out the truth. 8. *Be kind to* on the dog, he didn't mean to hurt you. 9. I wouldn't *dare* as criticise him to his face. 12. You shouldn't *make* your feelings so obvious to everyone.

Linking Words: additionally/ besides/ in addition to/ furthermore/ moreover/ as well/as well as

9. Переведите следующие предложения.

additionally/ besides/ in addition to/ furthermore/ moreover

1. Many hydroelectric projects supply public electricity networks, **besides**, some are created to serve specific industrial enterprises. **In addition to** this, hydroelectric projects are often built to provide the substantial amounts of electricity needed for aluminium electrolytic plants.
2. Now more and more ecological organizations appear that try to struggle for pure water. **Furthermor**, they make protests against big factories that pollute rivers, seas and lakes.
3. Scientists **additionally** convene and participate in national and international processes relating to the achievement of sustainable development of hydropower.
4. Egypt had **additionally** made proposals designed to improve follow-up according to the Flood Control Act.
5. **Beside** general rules and regulatios the management of hydropower station has a set of rules for emergency situations.
6. We should try to recycle water. **Moreover**, we can try to reduce the amount of water when washing or taking a bath – that will help us to decrease water pollution.

***as well* / as well as**

7. There are three main ways how we can generate electricity, **as well as** some newly developed technologies that we will come to rely on in the future.
8. The growing demand of the Industrial Revolution would drive hydropower development **as well**.
9. I saw the Three Gorges Dam in China. Now I want to visit The Itaipu Dam **as well as** Hoover Dam.

Grammar: Passive Voice and Causation

We have repaired the device.	Мы отремонтировали устройство.
We have the device repaired.	Нам отремонтировали устройство.
The device has been repaired.	Устройство было отремонтировано.
The technician has repaired the device.	Техник отремонтировал устройство.

Passive Voice

	Present	**Past**	**Future**
Simple	It is repaired.	It was repaired	It will be repaired
Progressive	It is being repaired.	It was being repaired.	
Perfect	It has been repaired.	It had been repaired.	It will have been re-paired.

Causation

	Present	**Past**	**Future**
Simple	We have it repaired.	We had it repaired.	We will have it repaired.
Progressive	We are having it repaired.	We were having it repaired.	We will be having it repaired.
Perfect	We have had it repaired.	We had had it repaired.	We will have have it repaired.
Perfect Progressive	We have been having it repaired.	We had been having it repaired.	We will have been having it repaired.

10. Выберите правильный вариант ответа.

1. All levels of the aquatic ecosystem — from tiny macroinvertebrates to large trout. negatively **impact/ are impacted** by an altered temperature regime**.**

2. Creation of artificial lakes often **results/is resulted** in moving residents to new areas, thus causing considerable extra expenses.

3. Changes in chemical composition of a reservoir **affect/ are affected** the aquatic plants and animals that **evolved** with a given river system.

4. In a slump test an inverted, bottomless cone **fill/ is filled w**ith the concrete mixture.

5. Single source fabrication and erection **reduces/ is reduced** delays and defects that **result/are resulted** from the coordination of multiple trades.

6. The Muela Hydropower Station **completed/was completed** recently in Lesotho, a country thought to have considerable potential for hydropower resources.

7. A small dam called a cofferdam **build /is built** upstream of the construction zone to help funneling water into the diversion tunnel.

8. Maximum design flexibility with regard to color, texture, form and structure **ensures/is ensured** by concrete construction.

11. Трансформируйте предложения из Active Voice в Passive Voice.

1. Engineers ca**n calculate** safety factors for slip circle failures and for mechanical performance in general of dams.
2. They **could not identify** similar safety factors for internal erosion.
3. Internal erosion often **causes** of earth dam failure.
4. In recent years engineers **have addressed** this problem in the following way.
5. They **apply** event trees and statistical risk assessments to the individual events.
6. Hydraulic engineers have achieved great improvement in in foundation treatment,

such as the advent of GIN grouting techniques, colloidal mixers and new options for improved, stable, grout mixes.

7. Over the years hydraulic engineers have developed a whole range of empirical indices and tests for soil properties.

8. Perhaps it will be possible at some point to redefine and derive the properties of most soils just from the soil chemistry and a few basic geometric parameters.

9-10. When it comes to construction, it is now possible to monitor compaction of soils on site by feedback systems into the cabs telling drivers when they has achieved the required degree of compaction.

12. Поставьте глаголы в скобках в правильную форму, образуя Active /Passive Voice.

Dams **(construct 1)** for confining and checking the flow of a river, stream or estuary.

They **(use 2)** to divert the river flow, improve navigation conditions. Water stored in the resultant reservoirs **(provide 3)** irrigation or supplies cities. Sometimes the river level **(raise 4)** for use in power generation. Often a recreation area **(make 5)** as a by-product of dam construction.

Dams **(consider 6)** to be one of the earliest known man-made structures. The records (**exist 7)** that c 2900 BC **(be 8)** a 15 m-high dam on the Nile. Construction methods were largely empirical until 1866, when the first scientifically designed dam **(erect 9)** in France.

Dams **(classify 10)** by profile and building material, which **(determine 11)** by availability and site. They must be strong enough so that they **(hold 12)** back water; **withstand (13)** ice, silt and uplift pressures, and stresses from temperature changes and earthquakes.

The site must have stable earth or rock foundation that **(not compress 14)** unduly, squeeze out or let water seep under the dam. Boring, seismic tests, structural models and computer simulations **(apply 15)** as design aids.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Dam Safety

Integrated task to Unit 6. Read the text ***Dam Safety,*** watch the video **(1:02 – 4:26)**, complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

MMWD Dam Safety Program

VIDEO MMWD Dam Safety Program
https://www.youtube.com/watch?v=OVCnnsV8k2w

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. What does the Dam Safety Program include?
3. What is the purpose of the survey between the two benchmarks?
4. What are the response measures in the event of an earthquake?

Unit 7. Green Concrete: The Future of Sustainable Construction

Helpful vocabulary
Read the new words and make up 5 sentences of your own

Shortcoming – недостаток, **depleted –** истощенный, **scarred –** покрытый шрамами, **quarry –** каменоломня, **mining waste –** отходы горного производства, **slag –** шлак, **combustor ash –** зола камеры сгорания, **saw dust –** опилки**, foundry sand –** формовочная смесь, **benefit –** преимущество, **shrink –** сокращаться в размерах, **ancient –** древний, **in the long run –** в долгосрочной перспективе, **cut back on –** сократить, **limestone –** известняк, **account for –** служить причиной, **carbon dioxide –** углекислый газ, **shifting –** переход, переключение, **suitable –** подходящий, **sustain –** поддерживать, **environmental pollution –** загрязнение окружающей среды, **subsequently –** впоследствии

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах

1. Wood is a better material for construction than concrete.
2. Green concrete is an alternative option in construction.
3. Green concrete consists of recycled materials only.
4. Green is a synonym to “environmental friendly”.
5. Green concrete is more long-lasting.
6. Mixtures similar to green concrete were discovered in 1920 walls.
7. Green concrete has lower resistance to heat.
8. Use of green concrete helps to maximize profit.
9. Ordinary cement production emits 10% of the total CO2.
10. Heat expenses may be reduced owing to green concrete usage.

One of the shortcomings of man’s mastery of construction is the pollution it has caused to both air and land. While concrete is seen as a better alternative for building when compared to wood, it too can lead to excessive CO_2 emissions, leave mines depleted, and the earth scarred with huge craters. To this end, the construction industry has started turning towards using green concrete as an alternative to regular concrete. So, what is green concrete and how is it different from ordinary concrete?

Green Concrete Defined

Green concrete is all about recycling and innovation. Its most common definition is concrete that incorporates at least one form of recycled waste materials in its components. Waste materials that are often recycled and used to produce green concrete include used concrete, quarry and mining waste, slag, burnt clay, power plant waste, combustor ash, saw dust, foundry sand, and waste glass, among others. The term “green concrete” can be used broadly to refer to any

concrete that is environmental friendly. Sometimes this may involve rehabilitating mines and quarries to put the wasteland to better use. The main purpose of using green concrete is to conserve the environment. However, this form of concrete has financial and health benefits too. Here are some of the benefits of green concrete:

It is stronger and more long-lasting

Mixtures similar to green concrete have been discovered in walls of the impressive Roman-era buildings and structures that are still standing to this day. Unlike structures made from ordinary concrete, buildings made from green concrete have a lower rate of corrosion and higher resistance to heat. What's more, green concrete does not shrink as quickly as ordinary concrete. As a result, buildings made from green concrete can last longer just like ancient Roman buildings. In the long run, it helps cut back on losses and maximize profit.

It Reduces CO_2 Emission

Using ordinary concrete can also lead to the emission of high levels of CO_2. Ordinary cement is produced by heating limestone, sand, and clay, a process that accounts for about 8% of all CO_2 emissions in the world. Green concrete, on the other hand, has significantly lower levels of carbon dioxide and has been shown to produce up to 80% less gas. Since 1972, the construction industry in the U.S. has reduced the emission of CO_2 by up to 30% from shifting to green concrete. As you may imagine, the benefits are much bigger on a global scale.

It Saves Energy

Normal cement is heated for long periods by vast resources of gas and coal before it can be suitable for use. This means that, apart from emitting CO_2, concrete made from this cement also uses up a lot of energy, which leads to other forms of environmental pollution. Green concrete does not require as much effort to produce, which subsequently saves energy. What's more, since green concrete is stronger and more stable than the ordinary one, it has a higher resistance to temperature changes. This means that indoor temperatures can be sustained easily without using too much energy on heaters and coolers as the seasons change.

2. Найдите в тексте 12 пар синонимов

1. ordinary 2. include 3. ingredient 4. generally 5. protect 6. identical 7. find 8. Reckon 9. enormous 10. acceptable 11. damage 12. firm

3. Найдите соответствия между словами в группах A и B

A a) depleted b) huge c) common d) produce e) purpose f) form g) shrink h) result j) normal i) require j) save k) change

B 1. make 2. well-known 3. usual 4. empty 5. shorten 6. aim 7. spare 8. need

9. very large 10. variation 11. sort 12. outcome

4. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

Build – builder-building; **pollute** –…; **emit** – …; **recycle** –…; **use** –…;

heat –…; **conserve** –…; **mix** –…; **discover** –…; **make** –…; **require** –… .

5. А. Переведите следующие словосочетания.

1. power plant waste **2.** excessive CO_2 emissions **3.** financial and health benefits **4.** recycled waste materials **5.** lower corrosion rate **6.** impressive Roman-era buildings **7.** indoor temperatures 8. construction industry

Б. ***Преобразуйте следующие словосочетания в номинативные атрибутивные цепочки согласно модели:***

1. man's mastery **of** construction – man's construction mastery

2. vast resources of gas and coal **3.** a better alternative for building **4**. all CO_2 emissions in the world **5.** emission of high levels of CO_2 **6.** vast resources of gas and coal **7.** a higher resistance to temperature changes

Confusables

6. Выберите подходящее слово.

Recyclable Materials [1][1]

Steel

With an overall recycling rate of 88% in 2012, steel is North America's (1)_____ recycled material. More steel is recycled each year (2) _____aluminum, paper, glass and plastic combined. (3)_____ January 1, 2016, it is estimated that 25,482,452 tons of steel have already (4)_____ recycled, and this number continues to rise each day.

Obtained mainly from products (5)_____ cans, cars, appliances and construction materials, scraps of steel can either be re-melted in an electric arc furnace or a basic oxygen furnace for recycling (6)_____.

Aluminum Cans

Aluminum cans are (7)_____ of the most recyclable materials, as they are 100% recyclable and (8)_____ be reprocessed over and over (9)_____. Turning recycled aluminum cans into new cans uses 95% (10)_____ energy than making new ones. The energy saved (11)_____ recycling a (12)_____ aluminum can is equivalent to what is needed to run a television for 3 (13)_____. In 2015, 54 billion aluminum cans (14)_____ recycled in the United States, of (15)_____ the energy saved is equivalent to 15 million barrels of crude oil.

1	**A** biggest	**B** most	**C** more
2	**A** than	**B** since	**C** then
3	**A** In	**B** Until	**C** Since
4	**A** been	**B** was	**C** had
5	**A** consisting	**B** containing	**C** including
6	**A** goals	**B** aims	**C** purposes
7	**A** first	**B** one	**C** single
8	**A** can	**B** may	**C** need

[1] B.Cuffari. What are the Most Recyclable Materials? – URL: https://www.azocleantech.com/article.aspx?ArticleID=585 (Reference date 08.04.2019)

9	**A** out	**B** until	**C** again
10	**A** less	**B** few	**C** least
11	**A** bye	**B** buy	**C** by
12	**A** single	**B** lonely	**C** alone
13	**A** ours	**B** hours	**C** honours
14	**A** wore	**B** where	**C** were
15	**A** witch	**B** which	**C** with

Word Families

7. Заполните пробелы данными словами.

a) emit b) emittance c) admission d) emission e) emitting f) emitted g) remission h) emissive i) mission j) transmit

1) Her illness has been in _____for several years.
2) _____is the property of a beam that characterizes its size.
3) A company's _____ statement should clearly correspond to what it is that they do.
4) The _____ spectrum shows two lines – the red and the violet one.
5) How does the diminution of the _____power operate between the two positions?
6) When the motion leverage is upwards gas is _____.
7) An insurrection led to the _____ of the gilds to a share in the government.
8) There are different ways that people _____ their values.
9) The factory is _____ grey smoke.
10) A forest can take in as much carbon dioxide as some entire countries _____.

Phrasal Verbs [2]

8. ***Вставьте соответствующие послелоги:***
apart, off, out (3) ahead, up(2), up to, back

1. When a leak in a storage tank or pipeline occurs, petroleum products can also get into the ground, and the ground must be **cleaned**… .

2. If population size **adds**…the carrying capacity, N/K = 1, so 1 – N/K = 0, population growth rate will be zero.

3. A valid hypothesis must be **tried**….

4. All the components fit within the ecosystem concept as a way to **set..** all of the factors and processes that make up the environment.

5. In these atoms, the positive and negative charges **call** each other…, leading to an atom with no net charge.

6. The ore is crushed and ground into fine powder that is then reacted with chemicals to **come**.. from the uranium and other minerals.

[2] По материалам «Introduction to Environmental Science: 2nd Edition» by Caralyn Zehnder at.al URL: https://oer.galileo.usg.edu/cgi/viewcontent.cgi?article=1003&context=biology-textbooks.

7. One Monday morning, a student arrives in class and quickly **finds**… that the classroom is too warm.

8. The carbon that came from the burning biomass is **got**…and used to produce the biomass in the first place.

9. ClO reacts with another oxygen atom, it frees up the Cl atom which then **goes**… to destroy another ozone molecule.

10. For example, gasoline sometimes drips onto the ground when people are filling their gas tanks, when motor oil gets thrown away after an oil change, or when fuel **breaks**… of a leaky storage tank.

Linking Words: however, although[3]

9. Переведите следующие предложения.

Functions: ***however***

1. There are numerous aspects of dam safety, **however,** the essential ones include: maintenance, monitoring, inspection, risk assessments and legislation.
2. It is not uncommon to find dam owners monitoring and filing data, **however**, most of them do nothing with it.
3. **However**, such evidence could be used against them at a public enquiry, should anything go wrong.
4. Scientists are working on ways to take the sulfur out of coal because when coal burns, the sulfur is released in to the atmosphere as an air pollutant. Some coal deposits, **however,** were formed from freshwater swamps which had very little sulfur in them.
5. Historically, human prosperity has been directly correlated with energy use. The health and vitality of world societies critically depends on energy, most of which comes from fossil fuels. Energy resources, **however,** are unevenly distributed throughout the world, and so are the consumption rates.
6. After the mining is finished, the disturbed area can be re-covered with topsoil, and the area is replanted. **However,** the topography of the mountain is permanently altered.

Functions: although

7. The atmosphere is rich in nitrogen and oxygen but contains little carbon and hydrogen, while the earth's crust, **although** it contains oxygen and a small amount of hydrogen, has little nitrogen and carbon.
8. The scientific method may seem too rigid and structured. It is important to keep in mind that, **although** scientists often follow this sequence, there is flexibility.
9. **Although** the report did not technically invent the term sustainability, it was the first credible and widely disseminated study that used this term in the context of the global impacts of humans on the environment
10. The fuel mix has changed over the years but now is dominated by oil, **although** natural gas and solar contributions are increasing.

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[3] По материалам «Introduction to Environmental Science: 2nd Edition» by Caralyn Zehnder at.al URL: https://oer.galileo.usg.edu/cgi/viewcontent.cgi?article=1003&context=biology-textbooks.

Grammar: *MODAL VERBS*

Present	Past	Future
1. He must do that. Он должен это сделать.	He had to do that. Он должен был это сделать.	He will have to do that. Он должен будет это сделать.
He has to do that. Ему приходится это делать.	Ему пришлось это сделать.	Ему придётся это делать.
3. He mustn't do that. Ему нельзя это делать.	He should not have done that.Ему нельзя было это делать.	
4. He does not have/need to do that. He needn't do that. Емуне нужно (нет необходимости) это делать.	He did not have/need to do that. Ему не пришлось (не было необходимости) это делать. He need not have done that. Ему не нужно было бы это делать.	He won't need/have to do that. Ему не придётся это делать.
5. He must be doing it now. Конечно, он делает это сейчас.	He must have done that already. Несомненно, он это уже сделал.	He is sure/certain /bound to do that. Несомненно, он это сделает.
6. He can't be doing that now. Конечно, он не делает это сейчас.	He can't have done that. Несомненно, он это не делал.	He is certain not to do that Конечно, он это не будет делать.
7. He may/might be doing it now. Вероятно, он делает это сейчас.	He may/might have done that. Вероятно, он это сделал.	He may /might do that. He is likely to do that. Вероятно, он это сделает.
8. He should be doing it now. Ему следовало бы делать это сейчас.	He should have done that already. Ему следовало бы сделать это уже.	He should do that. Ему следует сделать это.
9. He ought to be doing that now. Ему следовало бы делать это сейчас.	He ought to have done that. Ему следовало бы сделать это уже.	He ought to do that. Ему следует сделать это.
10. He can do that. = He is able to do that. Он может (умеет) это делать.	He could do that. Он мог (умел) это делать. He was able to do that. Он смог (сумел) это сделать. He could have done that. Он смог (сумел) бы это сделать.	He will be able to do that. Он сможет (сумеет) это сделать.

Present	Past	Future
11. He is to do that at 5 o'clock today. Он должен делать это сегодня в 5 часов. (по плану/договорённости)	He was to do that at five o'clock yesterday. Он должен был делать это вчера в 5 часов.	He is to do that at 5 o'clock tomorrow. Он должен будет делать это завтра в 5 часов.
12.He dares (not) do it.Он (не) смеет делать это.	He did not dare (to) do it.	He will dare do it.

10. Заполните пробелы подходящими модальными глаголами.

Образец: I *can* buy a Suzuki SX4.

1. I_____ open the door, it is stuck.
2. _____ Jane use your car for today?
3. You _____ finish the essay as soon as possible.
4. Amy does not_____keep to her diet anymore.
5. The plate is full, I _____take more food
6. Ann _____ finish the University the next year
7. My colleague_____sign the agreement
8. Don't wait for John, he_____ be late
9. You look very tired. I think you_____stay at home
10. What time do we_____be at the buss station

11.Некоторые предложения содержат ошибку. Найдите и исправьте её.

1. You should stop smoking.
2. I didn't can play the piano a year ago.
3. Translators may speak several languages.
4. We have to work on Monday.
5. My friend can to play football.
6. She can do whatever she wants.
7. You can solve the problem.
8. Your plate is empty. Must I refill it?
9. We should not have hurried.

12.Выберите подходящее отрицание: Mustn't /Don't have to.

1. You **mustn't/don't have to** leave your kids on the platform.
2. You **mustn't/don't have to** be late for the performance.
3. You **mustn't/don't have to** drink all the tea if don't want to.
4. You **mustn't/don't have to** shout at me.

5. We **mustn't /don't have to** run, because there is a plenty of time before the show.
6. You **mustn't/don't have to** pay now. You may do it later.
7. The exhibition is free, we **mustn't/don't have to** buy any tickets.
8. This is my favorite pen, you **mustn't/don't** have to lose it.
9. You **mustn't /don't have to** make noise. The child is sleeping.
10. It is Saturday today, I **mustn't/don't have to** get up early.
11. I **mustn't/don't have to** fly to Australia the next month.
12. I **mustn't/don't have to** water the plant every day.

13. Выберите подходящий модальный глагол.

1. You **must/can** work now, it is 9 o'clock.
2. Students **may/should** read this textbook.
3. He **can/may** speak German.
4. Students **may/must** use a calculator on Mathematics lessons.
5. My Grandma **can/should** cook delicious meals.
6. My sister **must/can** ride a bicycle.
7. Randy **can/must** play the violin very well.
8. You **should/must** ask his advice

14.Переведите следующие предложения.

1 It **can** be hoped that hydrology will **dare** to become more predictive, with computer software increasingly guiding hydraulic and structural designs and analyses

2. The sequential events in a failure event tree **can't** predict the possible failure. This **cannot** be over-emphasized.

3. The whole point of taking instrumentation readings **is to enable** engineers to tell the something about the way the dam is behaving.

4. In the United States, run of the river hydropower **could** potentially provide 60,000 megawatts (80,000,000 hp) (about 13.7% of total use in 2011 if continuously available).

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Green Concrete: The Future of Sustainable Construction

Integrated task to Unit 7. Read the text *Green Concrete: The Future of Sustainable Construction*, watch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

VIDEO Green Concrete – Geopolymer Green Concrete

https://www.youtube.com/watch?v=vPZ8cGher7I

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?

2. What is the geo cement?

3. The second problem in the world is cement. Why?

4. How can Global Green Geo Cement help to provide our environment?

Unit 8. Hoover Dam

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Ingenuity – изобретательность; **precipitation** – осадки; **unequalled –** непревзойденный, **awe inspiring** – впечатляющий; **cliff dwellings** – жилища на скалах; **achievement** – **mankind –** человечество; **annually –** ежегодно; **enormous –** огромный; **exception –** исключение; **thunder storm –** гроза; **precipitation –** осадки; **reconnaissance** – разведка; **survey** – обзор, обследование; **unpredictable** – непредсказуемый; **accessibility** – доступность; **capacity** – вместимость; **concrete aggregates** – бетонные заполнители; **supplement** – дополнять; **availability** – наличие; **retain** – сохранять; **bedrock –** основание, фундамент; **prior legislation** – предшествующее законодательство.

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах

1. Hoover Dam is a monument that must surely be counted among the great achievements of mankind.

2. Hoover Dam and Lake Mead are located in the Black Canyon of the Colorado River about 135 miles southeast of Las Vegas, Nevada.

3. The area around Hoover Dam and Lake Mead is the one of coldest and rainiest regions in the United States.

4. The Bureau of Reclamation began studying construction of dams to control the Colorado River in 1992.

5. Early studies involved investigations throughout the entire Colorado River Basin. The basin is divided into three sections.

6. E. T. Perkins made a number of topographical surveys in the Lower Basin for the Geological Survey.

7. Homer Hamlin and Edward T. Wheeler reported to the Secretary of Interior, John B. Payne, that both the Boulder and Black Canyons contained several unsuitable sites.

8. The Bureau of Reclamation didn't recommended construction of a high concrete dam at a site in the Black Canyon.

9. The Black Canyon site was chosen for several reasons including accessibility, better foundation material, depth to bedrock, and a greater reservoir capacity.

10. The name Boulder Canyon Project wasn't retained.

The Boulder Canyon Project

Throughout human history, mankind has built monuments to its ingenuity and skill. In Egypt it was the Pyramids. Rome, built the Colosseum. The Greeks built the Acropolis. The great cathedrals of Europe raised the skills of their builders to unequalled heights, creating awe inspiring structures. In the Americas, the cliff dwellings of Mesa Verde and the high mountain city of Machu Picchu speak to the skill and ingenuity of their builders. In the modern era, it's buildings that reach near half a mile into the sky, bridges that stretch enormous distances in a single span, and machines that extend mankind's reach far into space. One monument that must surely be counted among the great achievements of mankind is Hoover Dam.

Location

Hoover Dam and Lake Mead are located in the Black Canyon of the Colorado River about 35 miles southeast of Las Vegas, Nevada. Located on the Arizona-Nevada State line, the dam and reservoir are in the counties of Mohave, in Arizona, and Clark, in Nevada. In all, some 15,000,000 acre feet (af) of water annually flows down the Colorado River on it's journey to the Gulf of California. The area around Hoover Dam and Lake Mead is the one of hottest and driest regions in the United States. The sun shines almost every day of the year and temperatures may reach as high as 125 degrees. With the exception of an occasional thunder storm, very little precipitation, only about 4 inches per year, falls in the area. The winter months are mild with an average December temperature of 45 degrees.

Construction History

Investigations

The Bureau of Reclamation began studying construction of dams to control the Colorado River in 1902. Early studies involved investigations throughout the entire Colorado River Basin. The basin is divided into two sections. The Upper Basin is that portion above Lee Ferry, Arizona, or roughly the drainage areas in Wyoming, Colorado, Utah, and New Mexico. The Lower Basin includes the area below Lee Ferry containing drainage areas in California, Arizona, Nevada, and a small portion of Utah and New Mexico. In 1902, while on a reconnaissance boat trip through Boulder and Black Canyons, U.S. Geological Survey hydrologists J. B. Lippincott and Jeremiah Ahern noted several potential dam sites and suggested that surveys be conducted. In 1902 and 1903, E. T. Perkins made a number of topographical surveys in the Lower Basin for the Geological Survey.

Over the next 15 years, investigations continued throughout the entire basin. These studies later served as the basis of a comprehensive plan of development for the entire basin. The increasing demand for water in California's Imperial Valley and nearby cities, and the need to control the unpredictable habits of the river led to in-depth studies in the Lower Basin. In 1918, Director of the Reclamation Service, Arthur P. Davis, ordered a thorough investigation of Boulder and Black Canyons as sites for a high dam for storage and flood control. In the years that followed, many sites were mapped and several potential dam sites were located. In 1920, Homer Hamlin and Edward T. Wheeler reported to the Secretary of Interior, John B. Payne, that both the Boulder and Black Canyons contained several suitable sites.

Their study was supplemented by Geological Survey studies conducted in 1919 and 1920. In 1920, as a result of the Reclamation Service and Geological Service studies, Congress passed

the Kincaid Act authorizing Secretary Payne to fully investigate the potential of a large dam on the lower Colorado River. Exploratory drilling at potential dam sites began in late 1920 and continued for three years. Detailed topographic surveys were conducted in 1920 and 1921 with geologic surveys being conducted from 1921 to 1923. Also during the period of 1921 to 1923, studies into the availability of materials for concrete aggregates were made and investigations were conducted to determine the locations of railroads and highways for transporting supplies and equipment to construction sites.

In 1924, after several years of investigations, the Bureau of Reclamation recommended construction of a high concrete dam at a site in the Black Canyon. The Black Canyon site was chosen for several reasons including accessibility, better foundation material, depth to bedrock, and a greater reservoir capacity. Although the Black Canyon site was chosen, the name Boulder Canyon Project was retained because of prior legislation under that title.

2. Найдите в тексте 12 пар синонимов.

1. however 2. humanity 3. approach 4. as well 5. researches 6. a few 7. expand 8. headline

9. places 10. quantity 11. keep 12. close to

3. Найдите соответствия между словами в группах A и B.

A.

1. dwellings 2 construction 3 during 4. conducting 5. although 6. high 7. reasoning 8. after

9. result 10. interior 11. basin 12. study

B.

a) building b) tall c) housing d) while e) discourse f) management

g) though h) following i) outcome ` k) pool l) survey m) inside

4. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

Build –	Investigate –
Raise –	Dwell –
Create –	Demand –
Control –	Locate –
Conduct –	Retain –

5. Переведите следующие словосочетания.

A. 1. Prior legislation 2. a reconnaissance boat 3. a comprehensive plan 4. the cliff dwellings 5. very little precipitation 6. depth of bedrock 7. a large dam 8. the entire basin 9. topographical surveys 10. average temperature 11. thunder storm 12. recommended construction

Б. 1. Greater reservoir capacity 2. construction of a high concrete dam 3. the locations of railroads and highways for transporting supplies and equipment 4. a reconnaissance boat trip 5. with the exception of an occasional thunder storm 6. awe inspiring structures 7. bridges that stretch enormous distances in a single span

Confusables

6. Выберите подходящее слово

Every year about 6 million hectares of _____ (1) become a desert. The cause _____ (2) be global warming - five of the worlds _____ (3) years were in the 1980s and 1990s - but it might be the way we use the land. One - third of the world's land _____ (4) is at risk from this increasing problem.

Another serious problem in all the big countries is air pollution. It _____ (5) from factories, power stations and cars. It kills forests and lakes, and can _____ (6) people ill. Some countries are starting to _____(7) this problem, but it is still happening world wide.

1	a) soil	b) ground	c) earth	d) land
2	a) must	b) has to	c) might	d) should
3	a) best	b) hottest	c) longest	d) coldest
4	a) district	b) region	c) space	d) area
5	a) goes	b) comes	c) runs	d) flies
6	a) do	b) allow	c) get	d) make
7	a) recycle	b) reuse	c) reduce	d) replace

Word Families

7. Заполните пробелы данными словами.

basin	**system**	**pollutes**	**drainage area**	**ecosystem**
gases	**carbon**	**pollution**	**carbonate**	**gaseous**

1. Ecology can be broadly defined as the study of the interactions between the abiotic and the biotic components of a _____.

2. The _____, the basin or catchment area, of the Baltic Sea is the entire land area from which water flows into the Baltic Sea.

3. The Baltic _____, with some 85 million inhabitants, covers the whole or parts of 14 countries, and accounts for a large part of Northern Europe, 15% of all of Europe.

4. From this we can see the distinct difference between the transfer of energy and nutrients in the _____.

5. Every year world industry _____the atmosphere with about 1000 million tons of dust and other harmful substances.

6. Greenhouse _____ in the atmosphere are part of the biogeochemical cycles on Earth.

7. Sulphur has a complex chemistry and is available both as dissolved substance in water, and in _____form in atmosphere.

8. An important part of the carbon flow is the formation of calcium _____ in the seas especially as shells in marine organisms.

9. The _____ cycle starts when carbon dioxide in the atmosphere is formed from carbonated in the lithosphere.

10. The _____ of air and the world's ocean, destruction of the ozone layer is certain to be the result of man's careless interaction with nature, a sign of the ecological crises.

Phrasal Verbs

8. Вставьте соответствующие фразовые глаголы:

come up with	find out	die out	make up for	make up	get out	take up
slow down	go on with	go back				

1. It is important to _____ solutions to ecological problems.

2. Vegetation____ the built-up of carbon dioxide.

3. Water is our life and we should _____measures to keep it clean.

4. The rain forests have ability to _____ the green house effect since during photosynthesis trees trap carbon from carbon dioxide.

5. As a result some rare species of animals, birds, fish and plants disappear forever, a number of them _____.

6. Together, they _____ the complex world of nature, some being rivals or enemies while others depending on each other for survival.

7. Oceans include a variety of environments, and we should try to _____ more about each of these environments considering depth, nature of bottom and concentration of nutrients.

8. It works like this: sunlight gives us heat, some of the heat warms the atmosphere, and some of the heat _____ into space.

9. It lets heat get in, but it does not let much heat _____**.**

10. As such it is _____ by plants and bacteria and incorporated in several kinds of biomolecules.

Linking Words: thus, therefore

9. Переведите следующие предложения.

Function*s of *thus

1. Through conservation agriculture practices, farmers contribute to reducing emissions, **thus** combating land degradation.

2. By using renewable power, we can reduce greenhouse gas emissions, **thus** contributing to preserving the environment..

3. Planting vegetation on river banks ensures prevention of soil wash-out, **thus** ensuring long-term soil stability.

Functions of therefore

4. A waterfront is an attractive space which allows us to have contact with nature. **Therefore**, for a large densely built city of today, it determines the degree of its attractiveness.

5. As a result of irrigation agriculture tends to develop more intensely, **therefore** climate changes are mitigated.

Grammar: *the Infinitive*

Таблица 1. Образование основных форм инфинитива.

Forms of Infinitive

	Active	**Passive**
Simple	to repair	to be repaired
Progressive	to be repairing	
Perfect	to have repaired	to have been repaired
Perfect Progressive	to have been repairing	

*Обратите внимание, что формы пассивного залога есть только у переходных глаголов.
**Обратите внимание, что некоторые глаголы в английском языке не могут принимать форму Continuous (например, глаголы умственной деятельности *to know, to seem, to mind,* и другие).

Таблица 2. Употребление основных форм инфинитива

Инфинитив (Infinitive)	**Активный залог (Active Voice)**	**Пассивный залог (Passive Voice)**
Неопределенный (Indefinite) обозначает действие (или состояние), одновременное с действием (или состояни-	I like to photograph my children – Я люблю фотографировать своих детей. I want to listen to her – Я хочу	My children like to be photographed – Мои дети любят, чтобы их фотографировали.

ем), выраженным глаголом в личной форме	послушать ее. She can't tell her the truth – Она не может сказать ей правду.	She wants to be listened to – Она хочет, чтобы ее послушали. She can't be toldthe truth – Ей нельзя говорить правду.
Длительный (Continuous) – действие, выраженное инфинитивом, обозначает текущее время, одновременно происходящее с действием, выраженным глаголом в личной форме	He seems to be looking for something – Кажется, он что-то ищет. It is wonderful to be sitting here in the sun – Как хорошо сидеть здесь, на солнце. She must still be writing this letter – Должно быть, она все еще пишет это письмо.	
Совершенный (Perfect) – действие, выраженное инфинитивом, обозначает прошедшее время относительно действия, выраженного глаголом в личной форме	They should have finished this project by now – Они уже должны были закончить этот проект. He seems to have forgotten about this deal – Похоже, что он забыл об этой сделке. I am sorry not to have phoned you – Мне жаль, что я тебе не позвонил.	This project should have been finishedby now – Этот проект уже должен был быть закончен. This deal seems to have been forgotten about – Похоже, что об этой сделке забыли. I am glad you have been contacted by them – Я рад, что они связались с тобой.
Совершенный длительный (Perfect Continuous) – действие, выраженное инфинитивом, происходило на протяжении определенного времени перед действием, выраженным глаголом в личной форме	They turned out to have been preparing for the exam – Оказалось, что они готовились к экзамену. She seems to have been looking after him for a long time – Кажется, что она присматривала за ним на протяжении долгого времени. I must have been watching TV when you knocked on the door – Должно быть, я смотрела телевизор, когда ты постучал в дверь.	–

Таблица 3. Употребление инфинитива без частицы to

Случай	*Примеры*
1. После модальных глаголов	You should have called her – Ты должен был позвонить ей. She may join us later – Может быть, она позже присоединится к нам.
2. После конструкций would rather, had better	I'd rather check the weather forecast now – Я лучше сейчас проверю прогноз погоды. You'd better get off the bus here – Вам лучше выйти из автобуса здесь.
3. После глагола do, используемого для усиления действия	I do know what you mean – Я действительно знаю, что ты имеешь в виду. I did try! – Я в самом деле старался!
4. После глаголов чувственного восприятия (to see, to hear, to feel, to watch, etc.), а также глаголов to let и to make **Запомните! При употреблении этих глаголов в пассивном залоге перед инфинитивом ставится частица to.*	I heard somebody knock on the door – Я слышал, как кто-то постучал в дверь. Let me buy you a cup of coffee – Позволь, я куплю тебе чашку кофе. I will make him change his mind – Я заставлю его поменять свое мнение. She was seen to leave the house – Видели, как она выходила из дома. He was made to clean all the mess – Его заставили убрать весь беспорядок.
5. После why и why not в вопросительных предложениях	Why not do it straight away? – Почему бы не сделать это сразу? Why hurry up? We will be there soon – Зачем торопиться? Мы скоро будем там.

Таблица 4. Роль инфинитива в английском предложении.

В английском языке инфинитив может выступать в качестве части составного именного сказуемого, а также выполнять роль других членов предложения.

Член предложения	**Примеры**
Подлежащее	To have a car is one of the requirements – Иметь машину – одно из требований.

Именная часть составного именного сказуемого	All I need is to cut my hair – Все, что мне нужно – это подстричь волосы.
Часть составного глагольного сказуемого	You must read this article – Ты должен прочитать эту статью.
Сложное дополнение	I wanted you to meet my friend – Я хотел, чтобы ты познакомился с моим другом.
Определение	What will be the best way to begin with? – С чего лучше начать?
Обстоятельство	I called her to ask this question – Я позвонила ей, чтобы задать этот вопрос.

Сложное дополнение / Complex Object

I know him
- to write articles.
- to be writing a new article now.
- to have written it already.
- to have been writing it for a month.
- to be written about in newspapers.
- to have been written to already.

1) ***verbs of perception*: see, observe, notice, watch:**

2) *verbs of thinking:* think, believe, suppose, assume, know

3) *verbs of wish:* want, wish, would like

Сложное подлежащее / Complex Subject-I

He is known
- to write articles.
- to be writing a new article now.
- to have written it already.
- to have been writing it for a month.
- to be written about in newspapers.
- to have been written to already.

Примеры перевода: Известно, что он пишет статьи / Он, как известно, пишет статьи

1) ***verbs of perception*****: see, observe, notice, watch:**

2) ***verbs of thinking:*** **think, believe, suppose, assume, know**

3) ***verbs of reporting:*** **say, announce, report**

Сложное подлежащее / Complex Subject-II

English	Russian
1. He **seems to have had** little sleep.	*Кажется, он мало спал.*
2. This information **appears to have caused** a lot of response.	*Кажется, она вызвала большую реакцию.*
3. The samples **may happen to have got damaged.**	Возможно, случилось так, что образцы были повреждены.
4. The suppliers **claimed to have checked** the equipment before selling it.	*Поставщики заявили, что проверили оборудование перед его продажей.*
5. He **proved/turned out to have copied** it from his friend.	*Оказалось, что он списал это у своего друга.*
6. He **tends to read** more than he used тою	*Он теперь читает больше, чем раньше.*
7. He **pretends to be reading**	*Он делает вид, что читает.*

Сложное подлежащее / Complex Subject-III

Present	Past	Future
1. He **is sure/certain /bound** to be doing that. = He must be doing it now. Конечно, он делает это ейчас.	He **is sure/certain /bound** to have done that. = He must have done that already. Несомненно, он это уже сделал.	He **is sure/certain /bound** to do that. Несомненно, он это сделает.
2. He is sure not to be doing that now. = He can't be doing that now. Конечно, он не делает это сейчас.	He is certain not to have done that. = He can't have done that. Несомненно, он это не делал.	He is certain not to do that Конечно, он это не будет делать.

3. He is likely to be doing that now. = He may/might be doing it now. Вероятно, он делает это сейчас.	He is likely to have done that already. = He may/might have done that. Вероятно, он это сделал.	He is likely to do that. = He may /might do that. Вероятно, он это сделает.

For-to-Infinitive Construction

English	Russian
1. Everyone waited for him to check the results.	Все ждали, чтобы он проверил результаты.
2. The results were brought for him to check.	Ему принесли результаты для проверки.

Grammar Practice: the Infinitive

10. Translate into Russian.

1. The buyers want to know our terms of payment.
2. This is for you to decide.
3. The plan of our work will be discussed at the meeting to be held on May 25.
4. To walk in the garden was a pleasure.
5. Jane remembered to have been told a lot about Mr. Smith.
6. I felt him put his hand on my shoulder.
7. This writer is said to have written a new novel.
8. She seems to be having a good time at the seaside.
9. They watched the boy cross the street.
10. To advertise in magazines is very expensive.
11. He proved to be one of the cleverest students at our Institute.
12. He knew himself to be strong enough to take part in the expedition.
13. All types of fuel are sure to have advantages and disadvantages.
14. Burning is known to be cheap and fuel, usually coal, is easily available.
15. Scientists expect newer ways of generating electricity not to pollute the atmosphere.
16. A tidal power station makes use of the dail tides, which appear to be highly predictable.
17. The cost of hydroelectricity is known to be relatively low.
18. There is a tendency for dam designers to separate embankment dam and concrete dam specialists, without an integrated approach.
19. The length changes caused by annual temperature changes need to be plotted and compared for the underlying AAR-based expansion changes to be revealed.
20. Burning is supposed to cause pollution.

11. Put "to" before the infinitive where it is necessary.

1. My son asked me … let him … go to the club.

2. You must make him … practice an hour a day.
3. She was made … repeat the song.
4. He is not sure that it can … be done, but he is willing … try.
5. Let me … help you with your work.
6. She asked me … read the letter carefully and … write an answer.
7. You ought … take care of your health.
8. I looked for the book everywhere but could not … find it.
9. He was seen … leave the house.
10. We had … put on our overcoats because it was cold.
11. The man told me not … walk on the grass.
12. Have you heard him … play the piano?
13. You had better … go there at once.
14. I would rather not … tell them about it.
15. We shall take a taxi so as not … miss the train.

12. Use the appropriate form of the infinitive.

1. They want (to take) to the Hoover dam by their father.
2. I am glad (to do) all the calculations yesterday.
3. This plant is known (to produce) tractors.
4. He wants his son (to become) a hydraulic engineer.
5. The enemy army was reported (to overthrow) the defense lines and (to advance) towards the suburbs of the city.
6. He seems (to know) French very well: he is said (to spend) his youth in Paris.
7. You had better (to call) our distributors at once.
8. We are happy (to invite) to the Hoover Dam museum.
9. That firm is reported (to conduct) negotiations for the purchase of green concrete.
10. It seemed (to snow) heavily since early morning: the ground was covered with a deep layer of snow.
11. He didn't hear me (to knock) at the door.
12. I want (to inform) of her arrival.
13. Our sportsmen are proud (to win) the cup.
14. He is known (to work) on the problem for many years.
15. The representative of the firm asked for the documents (to send) by air mail.

13. Put "to" where necessary.

1. I think you ought … apologize.
2. Make him … speak louder.
3. Help me … carry this bag.
4. My son asked me … let him … go to the theatre.
5. I must … go to the country.
6. It cannot … be done to-day.

7. She asked me … read the letter carefully and … write an answer.

8. The man told me not … walk on the grass.

9. Let me … help you with your work.

10. She ought … take care of her health.

11. We had better … stop to rest a little.

12. I don't know what … do.

13. He was seen … leave the house.

14. We have come … ask whether there is anything we can … do.

15. We heard the siren … sound and saw the ship … move.

16. I cannot … go there now, I have some work … do.

17. During the crossing the passengers felt the ship … toss.

18. You must make him … practice an hour a day.

19. He is not sure that it can … be done, but he is willing … try.

20. I looked for the book everywhere but could not … find it.

14. Make infinitives (add "to") or gerunds (add "-ing") of the verbs in brackets to make the following sentences grammatically correct.

1. When I'm tired, I enjoy ... television. It's relaxing. (watch)

2. It was a nice day, so we decided ... for a walk. (go)

3. It's a nice day. Does anyone fancy ... for a walk? (go)

4. I'm not in a hurry. I don't mind ... (wait)

5. They don't have much money. They can't afford ... out very often. (go)

6. I wish that dog would stop ... It's driving me mad. (bark)

7. Our neighbour threatened ... the police if we didn't stop the noise. (call)

8. We were hungry, so I suggested ... dinner early. (have)

9. Hurry up! I don't want to risk ... the train. (miss)

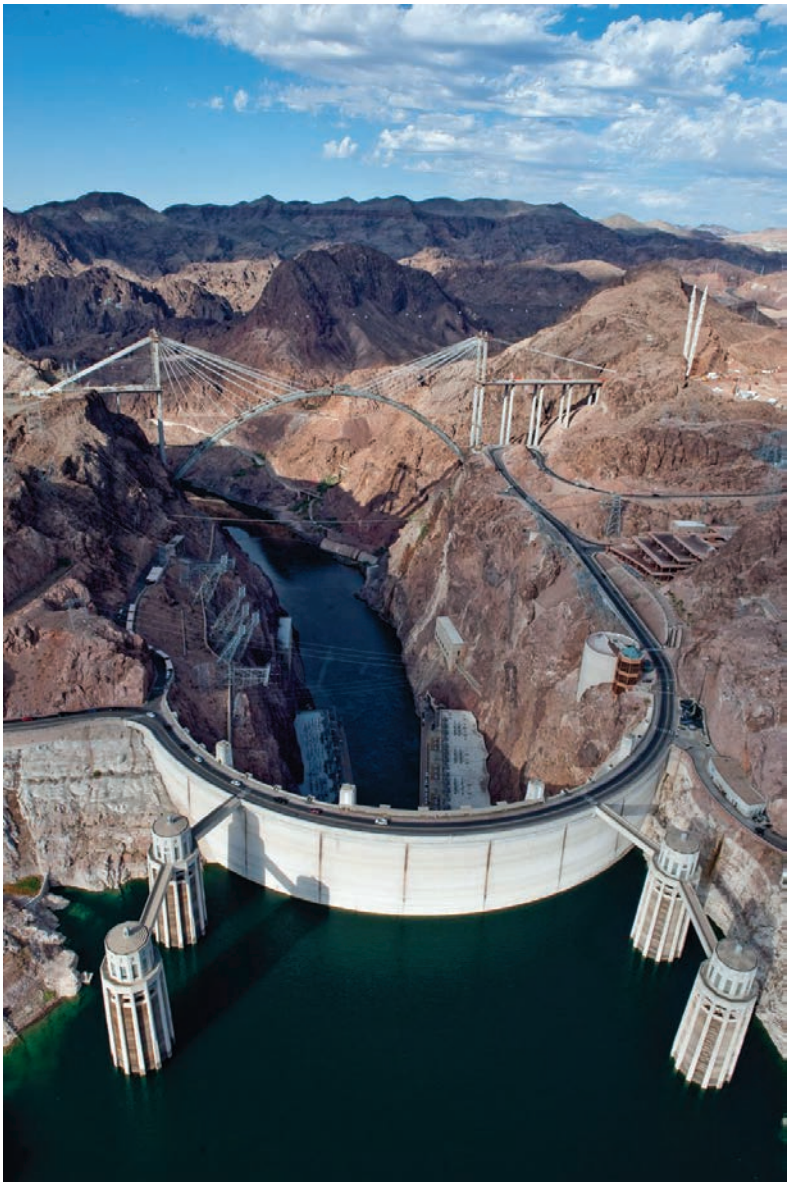
10. I'm still looking for a job but I hope ... something soon. (find)

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Hoover Dam

Integrated task to Unit 8. Read the text about the Hoover Dam from the Unit and watch the video, complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.



Building the Hoover Dam

https://www.youtube.com/watch?v=n9Gy_1Ppw5U&t=14s

Answer the following questions:

1. How do the text and the video correlate? What do they have in common?

2. Why was the project of building the dam important for the government?
3. What is the Boulder City?
4. What is the Hoover dam design?
5. What is the total volume of concrete was used? How many pipes were used? What is the total high of the dam?
6. When was the building completed and how did it correlate with the plan?

Unit 9. The Boulder Canyon Project

Part 1. Boulder Dam Design

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Encounter – встречать, **solution** – решение, t**entative** – пробный, **gravity dam** – гравитационная плотина, **diversion plan** – план водоотвода, **siphons** – гидравлический затвор, сифон, **multiple arch concrete** — бетонно-арочная плотина, **concrete gravity** – гравитационная бетонная плотина, **rock-fill with concrete face** – камненабросная плотина, облицованная бетоном, **spillway** – водослив плотины, **outlet conduit** – водосточная труба, **appoint** – назначить, **feasibility** – целесообразность, осуществимость, **power penstock** – напорный трубопровод, **crest** – гребень плотины, **discharge** – выпуск сточных вод, **powerhouse** – электростанция, **downstream portion** – нижняя часть потока, **supply** – снабжать, **intake tower** – заборная башня

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах

1. Prior to the design of Boulder Dam, the highest dam in the world was Arrowrock Dam on the Boise Project in Idaho.

2. In 1920'S provisions for a powerhouse were not included in the plan

3. The 1924 design was for a concrete arch structure.

4. In 1924 Diversion would be handled via five 35-foot diameter tunnels through the Nevada side of the canyon.

5. In 1928 the best design from the standpoints of economy, safety, and engineering feasibility was determined.

6. In 1928 Studies into the best arrangement for the power plant and dam led to three designs.

7. The initial appropriation for construction was made in July 1935.

8. The final design called for the diversion of the river via four, 50-foot diameter tunnels driven through the walls of the canyon, two on each side.

The design of Boulder Dam evolved during several years of study that involved the efforts of some 200 engineers and other workers in Reclamation's design office in Denver and several consulting firms that were retained during the design process. Prior to the design of Boulder Dam, the highest dam in the world was Arrowrock Dam on the Boise Project in Idaho. At just over 348 feet high, Arrowrock Dam was less than half the height of the proposed dam in the Black Canyon. It was clear from the beginning that many new problems in design and construction would be encountered and solutions would have to be found before the dam could be built.

A tentative design produced in 1920 called for a straight, concrete gravity dam with a cross section similar to the design later adopted for construction. The diversion plan for the 1920 design was similar to the design adopted in the final plan: four large diversion tunnels, two on either side of the canyon. Spillway provisions included thirty-two, 16-foot by 16-foot siphons discharging into the diversion tunnels. Similar to the design of Arrowrock Dam, there were three banks of outlets running through the dam. When the 1920 designs were drawn up, there were no plans for power development, so provisions for a powerhouse were not included in the plan.

In 1924, a report on the development of the Colorado River Basin included a preliminary design for a concrete dam at the lower Black Canyon site. Prior to this time, several types of dams were considered, including earth and rock-fill, rock-fill with concrete face, multiple arch concrete, concrete gravity, and concrete arch. By the time the 1924 report was issued, all but the rock-fill with concrete face and concrete gravity or arch designs had been eliminated. Further studies determined that a concrete gravity or arch structure would be best.

The 1924 design was for a concrete arch structure. Although a preliminary design, it was selected as representing a reasonable estimate of the final design for use in cost estimates. Unlike the 1920 design, the 1924 design eliminated the spillways and was designed to be overtopped during maximum floods. Diversion would be handled via three 35-foot diameter tunnels through the Nevada side of the canyon. The design retained the outlet conduits through the dam structure and still did not have provisions for power development, although designs for future power development were considered. In 1928, the Secretary of Interior appointed a board of engineers and geologists to review all designs and determine the best design from the standpoints of economy, safety, and engineering feasibility. The board, known as the Colorado River Board, approved the lower Black Canyon site and recommended changes to the diversion plan, doubling the diversion capacity to 200,000 second feet (s/f). The Board also increased the spillway capacity to 400,000 s/f, which would eliminate the possibility of overtopping during maximum flooding.

By 1928, power development had become an essential feature of the project. Studies into the best arrangement for the powerplant and dam led to two designs. The first design placed the powerplants and outlet works on the Nevada side of the canyon with two circular vertical shaft spillways on the Arizona side. The second design called for a "U" shaped powerhouse at the base of the dam with spillway tunnels and double banks of outlet works contained in both canyon walls. Intake towers would supply water to the power penstocks and outlet works. Both designs eliminated the outlet conduits through the dam structure and were designed as gravity-arch structures. The second design would form the basis for the final plan.

The initial appropriation for construction was made in July 1930. At that time the design had been modified to eliminate the two vertical shaft spillways and replaced them with two side channel spillways with uncontrolled crests, with upstream openings controlled by 50-foot by 50-foot gates that would be opened if greater flows were required. Modifications in the tunnel layout and intake towers were added, but the design still retained the double banks of canyon wall that had been part of the 1928 design. In 1931, the contract for construction was awarded, and the final design was determined. In the final design, the side channel spillways were retained, but they would be controlled by drum gates and connected to the diversion tunnels by inclined shafts, and the upper set of canyon wall outlets was eliminated.

The final design called for the diversion of the river via four, 50-foot diameter tunnels driven through the walls of the canyon, two on each side. Following completion of the dam, the outer tunnels would be plugged at about mid-point, and inclined shafts from the spillways would

discharge into the downstream portion of the tunnels. The inner tunnels would also be plugged about one-third of the way downstream from their openings and 30-foot diameter steel penstocks would be placed in the downstream portion connecting the powerhouses to the intake towers. In addition to the diversion tunnels, two additional tunnels, one on each side of the canyon, would be driven to house penstocks that would supply water from the intake towers to the power houses. When not needed for power generation, these tunnels would discharge through the canyon wall outlet works.

2. Найдите в тексте 12 пар синонимов этим словам:

1. meet 2. Decision 3. Experimental 4. Approve 5. Numerous 6. Assessment

7. exclude 8. Preserve 9. Define 10. Expediency 11. Allocation 12. through

3. Проверьте, правильно ли образованы существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

Construct – construction – constructor; consume – consumption – consumer; cost – coster; increase – increasing; demand – demanding; generate – generation – generator; mean – meaning; permit – permission; produce – production – producer; provide – provision – provider; supply – supplition – supplier.

4. А. Переведите следующие словосочетания

1. Siphons discharging into the diversion tunnels, 2. banks of outlets running through the dam 3. provisions for a powerhouse 4. preliminary design for a concrete dam 5. arch designs had been eliminated 6. reasonable estimate of the final design 7. the design retained the outlet conduits 8. initial appropriation for construction was made 9. downstream portion of the tunnels 10. steel penstocks would be placed in the downstream portion.

Б. Переведите следующие словосочетания и используйте принцип номинативной атрибутивной цепочки для большей лаконичности согласно модели:

Estimate **of the** final design **–** final design estimate – конечная оценка дизайна

1. Standpoints of economy and safety 2. Essential feature of the project 3. Banks of canyon walls 4. Diversion of the river 5. Modifications of the tunnel layout 6. Spillways of the vertical shaft 7. Replacement of the vertical shaft

5. Проверьте машинный перевод абзаца из текста *The Boulder Dam Design* и выпишите примеры грамматических, лексических и стилистических ошибок.

The initial appropriation for construction was made in July 1930. At that time the design had been modified to eliminate the two vertical shaft spillways and replaced them with two side channel spillways with uncontrolled crests, with upstream openings controlled by 50-foot by 50-foot gates that would be opened if greater flows were required. Modifications in the tunnel layout and intake towers were added, but the design still retained the double banks of canyon wall

that had been part of the 1928 design. In 1931, the contract for construction was awarded, and the final design was determined. In the final design, the side channel spillways were retained, but they would be controlled by drum gates and connected to the diversion tunnels by inclined shafts, and the upper set of canyon wall outlets was eliminated.

Первоначальные ассигнования на строительство были сделаны в июле 1930 года. В то время проект был изменен, чтобы устранить два вертикальных водосброса шахты, и заменил их двумя боковыми водосбросами с неконтролируемыми гребнями, при этом входные отверстия контролировались 50-футовыми на 50-футовые. ворота, которые будут открыты, если потребуются большие потоки. Были внесены изменения в планировку тунеля и впускные башни, но в конструкции все еще сохранились двойные банки стены каньона, которые были частью конструкции 1928 года. В 1931 году был заключен договор на строительство, и окончательный проект был определен. В окончательной конструкции водосливы боковых каналов были сохранены, но они будут контролироваться затворами барабана и соединяться с отводными туннелями наклонными валами, а верхний набор стенок каньона будет исключен.

Примеры ошибок:

Грамматические	**Лексические**	**Стилистические**

Grammar: The Gerund

Tenses	**Active**	**Passive**
Indefinite	giving	being given
Perfect	having given	having been given

1. Признаки герундия и его перевод

Герундий по форме совпадает с причастием I или перфектным причастием.

Глагольная форма с окончанием -ing является герундием, а не причастием, если перед ней стоит предлог, существительное в притяжательном падеже или притяжательное местоимение.

2. Запомните следующие сочетания слов, после которых употребляется герундий:

(I) cannot help – (я) не могу не

it is worth – ст*о*ит

it is worth while – ст*о*ит

it is no good – не ст*о*ит, бесполезно,

it is no use – нет смысла

3. Переведите следующие предложения с герундием

1. It is worth while discussing this phenomenon.
2. There is one more point worth mentioning.
3. It is no use searching for another approach.
4. It is no good arguing about this issue.
5. The motor went on running.
6. We cannot help acknowledging the importance of this statement.
7. Would you mind answering one more question.
8. In spite of his words I could not help feeling excited.
9. It seems to me the case is not worth mentioning.
10. Go on demonstrating your slides.
11. Avoid mixing these two substances.
12. This paper is worth reading.
13. I can't help regretting it.
14. He had to give up experimenting.
15. The ammeter stopped working because the coil was short-circuited.
16. One cannot keep dividing matter without reaching the stage when further subdivision is impossible.
17. A phosphorescent material is able to continue glowing in the dark.
18. Hardness is the ability to withstand being dented or stretched.
19. Catalysts aid in accelerating reactions.
20. I think of trying another approach.
21. The droplets are capable of being photographed.
22. He succeeded in obtaining reliable results.
23. The book aims at acquainting the readers with modern achievements in astrophysics.
24. Calcium and sodium are alike in being very soft.
25. Selenium and tellurium resemble sulphur in presenting a number of allotropic forms.
26. Archimedes is credited with applying huge lenses.
27. Silicon resembles carbon in forming a series of volatile hydrates.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

The Boulder Dam Design

Integrated task to Unit 9. Part 1. Read the text ***The Boulder Dam Design,*** *w*atch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

HOOVER DAM https://www.youtube.com/watch?v=UVBb_c0P7sk

Answer the following questions.

1. Where is the Hoover (Boulder) Dam located?
2. Why is the Hoover Dam considered to be the largest dam in the world?
3. What were the main challenges of the Hoover Dam construction?
4. What is the secret hidden inside the Hoover Dam?
5. How many stairs does the angled staircase have?
6. Is it possible to avoid leaks? Why? Why not?

Unit 9. Part 2. Boulder City and Pre-Construction

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Boulder – валун; **appurtenant works** – водопроводящие приплотинные сооружения; **anchor** – якорь, фиксатор; **site** – производственный объект, строительная площадка**; to line** – выполнять облицовку; **permanent cableway** – несъемная подвесная канатная дорога; **support features** – подпорки; **water and sewage systems** – водопроводная и канализационная системы; **switchyard** – электрораспределительная подстанция; **temporary camps** – лагеря временного проживания; **subsidiary** – филиал; **loading station** – зона загрузки**; landing platform** – погрузочно-разгрузочная площадка; **hoist house** – здание подъемной машины

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах

1. Support features included transportation and communication facilities, housing, water and sewage systems, power and lighting facilities.

2. The site was in the middle of the field with limited access and no provisions for housing the almost 3,000 people that would work on the project.

3. Work on Boulder City began in September 1930.

4. The city was ready when the first dam workers arrived at the site in early 1931.

5. Most of the town was ready for occupancy by the beginning of 1931.

6. The cableway can be remotely controlled from the control house.

7. The town was planned using the accepted standards for municipal development.

8. The project involved 5,000 workers and officials.

9. The State of Nevada constructed a 24 mile long highway from Los Angeles to Boulder City.

10. The project cost is $172,000.

Activities. Before construction of the dam and appurtenant works could begin, an enormous amount of preparatory work had to be undertaken. The site of the dam is a deep canyon more than 30 miles from the nearest town. The site was in the middle of the desert with limited access and no provisions for housing the almost 5,000 people that would work on the project. Before work on the dam itself could begin, many support features had to be constructed. These included transportation and communication facilities, housing, water and sewage systems, power and lighting facilities, and a 150-ton cable way for handling heavy equipment at the dam site. To house the estimated 5,000 workers and officials involved with the project, the Government designed and built Boulder City. The site for the town, about six miles west of the dam, was chosen because it was at a higher elevation than the surrounding countryside. It was felt that the climate at the higher ground would be more mild and hospitable than at lower altitude were the temperature was often well over 100 degrees, 24 hours a day. The town was planned using the accepted standards for municipal development and was constructed with paved streets, a water and sewer

system, electrical power, a city hall, administrative building, schools, a hospital, and houses for the workers and their families.

Work on Boulder City began in December 1930. The original plan called for completion of the town before work on the dam began, but the construction schedule for the dam was accelerated, and the town was not ready when the first dam workers arrived at the site in early 1931. During the first summer of construction, workers were housed in temporary camps while work on the town progressed. In April 1931, the Boulder City Company was organized as a wholly owned subsidiary of Six Companies to manage the town for the Government, and Sims R. Ely was named city manager by Interior Secretary Ray Lyman Wilbur. By the end of 1931, most of the town was ready for occupancy.

A project of the magnitude of Boulder Dam required an enormous amount of material and equipment. In order to transport the material to the site, it was necessary to construct a 22.7- mile branch railroad from a point about 7 miles south of Las Vegas. The railroad was built and operated by the Union Pacific Railroad, which also built a 400 car switchyard at Boulder City. The railroad issued the contract for construction of the branch line September 10, 1930, and regular service to Boulder City began on April 17, 1931.

The railroad was continued from Boulder City to the rim of the canyon above the dam site. Construction of this section of the line, just over 10 miles, was carried out under contract by the Lewis Construction Company. The final four miles of the line required significant excavation and fill, and construction of five tunnels totaling over 1,400 feet. Work on the line was completed in September 1931 at a cost of $635,000, of which over $460,000 was for labors to facilitate the movement of men and equipment to and from the construction site, the State of Nevada constructed a 24 mile long highway from Las Vegas to Boulder City. The road from Boulder City to the canyon rim, about seven miles, was constructed for the Government by the General Construction Company. Designed to transport men and equipment to and from the dam site, these roads formed a link in the highway between Las Vegas and Kingman, Arizona.

Since it was not practical to transport much of the equipment and material to the canyon floor by means of a roadway, a permanent cableway with a 150-ton capacity was constructed by the government. The cableway spans the canyon near the downstream ends of the powerhouses.

The loading station was constructed on the Nevada side of the canyon near the end of the highway and rail line, and several landing platforms were constructed on both canyon walls. The cableway is supported by a 118-foot high steel tower on the Nevada side, and is anchored into the side of the canyon on the Arizona side. The cableway is 1,580 feet long from anchor to anchor and has a usable span of 1,256 feet. The operating machinery is located in the hoist house on the Nevada side of the canyon. The cableway can be remotely controlled from the control house that overlooks the canyon or from any of the landing platforms. The cableway was uploaded and constructed by the Lidgerwood Manufacturing Company and cost $172,000.

2. Найдите в тексте 12 пар синонимов.

1. preliminary work 2. Machinery 3. Demanded 4. Create 5. Structure 6. Constant 7. some of 8. to carry 9. Essential 10. speed up 11. labors **12.** time-table

3. Найдите соответствия между словами в группах А и В

A 1 Construction 2 Development 3 Link 4 Limited 5 Provisions 6 Housing 7 required 8 excavation 9 site 10 material 11 occupancy 12 form

B a Populating b Necessary c Connect d Building e Conditions f Place g Stuff h Dig i Create j Accommodation k Elaboration l Confined

4. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

construct – construction – constructor

1. Built -…-…
2. Develop -…-…
3. Use -…-…
4. Provide -…-…
5. Accelerate -…-…
6. Organize -…-…
7. Demand -…-…
8. Begin -…-…
9. Produce – … – …
10. Excavate -…-…

1. Переведите следующие словосочетания

1. remotely controlled 2. communication facilities 3. operating machinery 4. significant excavation and fill 5. municipal development 6. lower altitude 7. limited access 8. by means of a roadway 9. construction of the branch line 10. support features

Confusables

6. Выберите подходящее слово.

Construction is the process of preparing for and forming buildings and building systems. Construction starts with planning, design, and financing and continues (1)_____ the structure is ready for occupancy. Far from being a single activity, large scale construction is a feat of human multitasking. Normally, the job is managed by a project manager, and supervised by a construction manager, design engineer, construction engineer or project architect. For the successful (2)_____ of a project, (3)_____ planning is (4)_____. Those involved with the design and execution of the infrastructure in question must (5)_____ the zoning requirements, the environmental (6)_____ (7)_____ and transportation of building materials, logistics, (8)_____ to the public caused by construction delays and bidding, etc.

1.	a) unless	b) until	c) unlikely
2.	a) excavation	b) examination	c) execution
3.	a) effective	b) affect	c) affection
4.	a) essential	b) exceptional	c) flectional
5.	a) confuse	b) conducted	c) consider
6.	a) impact	b) involve	c) invite
7.	a) possibility	b) availability	c) ability
8.	a) evidence	b) innocence	c) inconvenience

7. Заполните пробелы данными выше словами.

1. Wait ____I get back.
2. The _____ of the requisite tools and machinery is needed.
3. However, juridical tools seem increasingly_____.

4. These include_____ arms control monitoring.
5. Some analysts _____Somalia as the failed state par excellence.
6. The evaluation also disclosed certain weaknesses that have limited programme____.
7. Resource _____was essential to the fight against drugs.
8. Excuse the_____, we're just checking documents.

8. Вставьте соответствующие послелоги: into, with, on, in, out, up off

1. There was a radioactive fall___ after Chernobyl Accident.
2. I love catching _____ with friends after I've been away for a while.
3. The electricity was shut ___ due to the turbine failure.
4. Hurricans can cause a total black___.
5. I never got _____ with my neighbours – they were so unfriendly.
6. Engineers consider it an important break____
7. I don't want to fall _____ with you over such a stupid little thing.
8. He opened the door and told her to get ___.
9. I can't make____ the theorem.
10. She decided not to give _____ music, though it wasn't easy to find time for it.

Linking words: *whatever, wherein, whenever, however, whoever*

9. Переведите следующие предложения.

1. Behavioural change must be promoted via awareness campaigns, **whereas** structural changes called for qualitative indicators.
2. Managing migration flows **wherever** and **whenever** it is required while respecting humanitarian obligations consecrated in international law is the most difficult task.
3. All reports presented mainly factual information, but **however** important it may be critical and evaluative analysis is essential as well.
4. **Whoever** can take part in the discussion concerning the recreation area.
5. The residents can choose whichever proposed plan they like.

Participial Constructions

Объектный причастный оборот употребляется:

1. После глаголов чувственного восприятия, таких как: *to see, to hear, to feel, to find* и т.д.

I see him passing my house every day · Did you not hear the clock striking? I felt the car skidding I smelt something burning and saw smoke rising. I watched them rehearsing the play.	Я вижу, как он проходит мимо моего дома каждый день. · Ты не слышал, как били часы? · Я чувствовал, что машина буксует. · Я почувствовал, что что-то горело, и увидел, как поднимался дым. · Я наблюдала, как они репетировали пьесу.

2. После глаголов, обозначающих умственную деятельность: *to consider, to understand.*

I consider him killed.	Я считал, что его убили.

3. После глаголов, обозначающих желание: *to want, to wish, to desire*.

She *wants* the text translated quickly.	Она *хочет*, чтобы текст перевели быстро.

4. После глаголов *to have* и *to get*. После этих глаголов употребляется только Participle II. Каузатив

I *had* my coat cleaned. You *got* my piano tuned.	Я почистила мое пальто (т.е. поручила кому-то почистить его). Мне настроили пианино (т.е. я поручила кому-то настроить его).

Объектный причастный оборот похож на объектный инфинитивный оборот. Конструкция с причастием употребляется обычно тогда, когда мы хотим подчеркнуть, что действие, выраженное причастием, не было завершено, еще длилось в момент действия, выраженного глаголом-сказуемым.

СРАВНИТЕ:

I saw him leaving the house. Я видел, как он выходил из дома. I saw him changing the wheel Я видел, как он меняет колесо (весь процесс или момент)	I saw him leave the house. Я видел, как он вышел из дома. I saw him change the wheel. Я видел, как он сменил колесо. (результат)

10. Дополните предложения, используя Participial Constructions

1. They watched the children ____
2. He didn't see her ____
3. I didn't notice you _____
4. He liked to watch his brother ____
5. He found himself _____
6. I've never heard you ____
7. I didn't see anybody _____
8. The girl saw someone _____
9. She watched the car _____
10. I saw the door _____
11. We heard the students of the second Group_____
12. Did you ever hear them _____
13. The wind sent the leaves _____
14. He felt her_____

11. **Переведите на русский язык. Независимый причастный оборот (НПО: Absolute Participial Construction) вставив необходимые по смыслу союзные слова *после, когда, поскольку* и т.п. если НПО в первой части предложения. См. пример перевода в (1). Если НПО во второй части предложения, то вставьте союзы *а, и, причем, при этом*** (более подробно см. урок 5: функции причастия).

1. **Being very ill**, she couldn't speak. **Поскольку** она была очень больна, она не могла говорить.
2. **Being busy**, he put off the trip.
3. **There being little time left**, they took a taxi.
4. **The hour being late,** she hurried home.
5. **Dinner being over,** they stood up and went into the garden.
6. New technologies are being adopted worldwide, **with CFD becoming** the definitive way of producing the most economic arrangements in future.
7. Many standard arrangements were developed in various countries, **with many following** the United States Bureau of Reclamation practice.
8. Hydropower is produced in 150 countries, **with the Asia-Pacific region generating 33 percent of global hydropower in 2013.**
9. China is the largest hydroelectricity producer, **with 920 TWh of production in 2013 representing 16.9 percent of domestic electricity use.**

12. Раскройте скобки, употребляя Present Participle *(doing)* или Perfect Participle *(having done).*

1. (to translate the text), he was thinking hard.
2. (to translate the text), he went for a walk.
3. (to ride a bike), she fell off and hurt her knee.
4. (to ride a bike), she felt excited and energetic.
5. (to talk to her neighbour in the street), she didn't notice her friend coming to her.
6. (to talk to her neighbour in the street), she went home.
7. (to read a story), she got interested.
8. (to read a story), she closed the book and put it on the shelf.
9. (to chop vegetables), she cut her finger.
10. (to chop vegetables), she put them in the bowl.

13. Раскройте скобки, употребив причастие прошедшего времени **(V^3)**

1. The letter (to write) by him was very long.
2. We are interested in the goods (to produce) by this factory.
3. She didn't understand the word (to say) by him.
4. He didn't see the things (to keep) in her box.
5. I don't like the video (to buy) yesterday.
6. This is the house (to build) many years ago.
7. The question (to put) to the professor was important.
8. The article on agriculture (to publish) in this magazine was written by Smith.
9. You can get the book (to recommend) by our teacher in the library.
10. When (to use) for building purposes, concrete is very important.
11. When (to complete), the new building will accommodate 3000 students.

14. Дополните диалоги, используя Participial Constructions

A: I saw her _____ the house very early this morning.

B: Where did she go?

A: Did you see Bob yesterday?

B: I caught him ____through my drawers.

A: Would you like to come ____with us?

B: Yes, sure! I like skiing!

A: What did you do yesterday?

B: I stayed at home _____TV.

A: What did you do when you saw Elena?

B: _____her on the other side of the road, I quickly tried to hide.

A: Do you know what she did after visiting her boss?

B: _____on her computer, she started work.

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Boulder City and Pre-Construction

Integrated task to Unit 9. Part 2. Read the text ***Boulder City and Pre-Construction,*** *w*atch the video complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

VIDEO: Boulder City Nevada

https://www.youtube.com/watch?v=KjtcBT-jTgM

Answer the following questions:

1. How do the text and the video correlate? What do they have in common? What is different?
2. What were the difficulties to overcome in constructing of Boulder City?
3. How many workers the town was designed to house?
4. For whom Boulder City was originally built as a temporary town?

Unit 10. Consideration of waterfront space use by the sister cities

Helpful vocabulary

Read the new words and make up 5 sentences of your own

Waterfront – берег; **attractiveness –** привлекательность; **mouth of the river –** устье реки; **bless** – благословлять; **sister cities –** города-побратимы; **asset –** актив, ценность; **sightseeing –** осмотр достопримечательностей; **townscape –** городской пейзаж; **extend –** простираться; **spoil –** портить; **temporary** – временный; **mention** – упоминать; **pedestrian walkways –** пешеходные дорожки; **downstream –** вниз по течению; **vehicle** – транспортное средство; **comprise –** содержать; **in terms of** –точки зрения; **vegetation –** растительность; **inconsistent –** противоречивый; **moor –** причалить; **revetment –** облицовка; **flood –** наводнение; **beneficial –** выгодный; **inconsistent –** несоответствующий; **prevention –** предотвращение.

1. Переведите текст и решите, являются ли верными данные утверждения. Обсудите содержание текста в парах

1. Saint Petersburg and Osaka are similar in terms of location.
2. Waterfront spaces in Saint Petersburg and Osaka appear to be regarded as resources for industrial development.
3. Dotombori Canal has a constant space on both sides between the bank and buildings where tourists and vehicles can pass.
4. An urban motorway near the Dojima River spoils the cityscape.
5. Griboedov Canal has business related and residential buildings on both its banks.
6. On the banks of the Fontanka River people can access and have direct contact with river water.
7. In Osaka the rivers have no docks because of flood prevention.
8. People don't have an access to the Fontanka River.
9. Only direct ecosystem services can be beneficial to people.
10. The Dojima River will be improved so that people can have access to it.

A waterfront is an attractive space which allows us to have contact with nature, i.e. water and living creatures. Therefore, for a large densely built city of today, whether it has a waterfront space or not determines the degree of its attractiveness. Being sister cities and similar in terms of location, both Saint Petersburg and Osaka are metropolises blessed with such waterfront spaces consisting of rivers and canals spread through their city centres.

Presently, these spaces in both cities appear to be regarded as resources for tourism to attract visitors. However, although they serve as important assets for tourism in large cities, it is also necessary to develop them as high-quality symbiotic spaces between waterfronts and humankind, by re-examining them as one of the urban resources benefitting those who live there. To this end, introduction of the ecosystem service concept becomes effective. In this study, representative examples of waterfront use in Saint Petersburg and Osaka are considered from the

viewpoint of ecosystem services in four locations; the tourism district, city centre, the district near the mouth of the river, and the mouth of the river.

Waterfront use in the tourism district

Griboedov Canal and Dotombori Canal were selected as representative examples in the tourism district of Saint Petersburg and Osaka respectively. In these districts, sightseeing boats shuttle along the canals, and tourists enjoy the townscape and waterscape on the banks from the boat with a lower viewpoint than ground level. With respect to the difference between the canals of the two cities, Griboedov Canal has a constant space on both sides between the bank and buildings where tourists and vehicles can pass. Dotombori Canal on the other hand has no such space as the buildings extend to its banks, and temporary pedestrian walkways are provided along both banks. However, beneficial the distance between the water surface of Dotombori Canal and tourists, it is closer than that of Griboedov Canal.

Waterfront use in the city centre

A part of Griboedov Canal, downstream from Lion Bridge, and a part of the Dojima River, close to the business quarter were selected as representative examples in the city centre. In these areas, sightseeing boats and pleasure boats shuttle along the rivers and canals, and tourists as well as citizens enjoy the cityscape from the boats. As mentioned above, Griboedov Canal has a constant space between the banks and buildings facing the canal which is designed to allow people and vehicles to pass. While the Dojima River has a pedestrian walkway in some sections on both banks. A road was also built along the Dojima River in some parts, but one cannot see the river from the road. In addition, an urban motorway was constructed above and along the Dojima River which spoils the cityscape, and affects the environment of the river's ecosystem.

With respect to the use of waterfront spaces of the canal and river, having roadside trees along its banks, Griboedov Canal has an apparent ecosystem comprised of water, underwater life and vegetation. Buildings with uniform heights also stand along the canal. As an ecosystem is created in such a way, a cultural landscape service is provided here. On the other hand, in the case of the Dojima River, with the urban motorway running along it, and the height of buildings being inconsistent, it provides no cultural landscape service. This is due to the priority placed on intensive land use, and it will be essential in the future to act upon its ecosystem to create ecosystem services by for example increasing the number of trees.

Waterfront use in the district near the mouth of the river

The Fontanka River and Tosabori River were selected as representative examples in the district near the mouth of the river. In these districts, one finds small transport boats going by and mooring as they are near the sea. The Fontanka River has business related and residential buildings on both its banks. Likewise the Tosabori River has such a mix of buildings, except there are more high-rises compared with the Fontanka River. On the banks of the Fontanka River, there are not only roads for people and vehicles but also docks where people can access and have direct contact with river water. On the other hand, the Tosabori River has no docks and people can only enjoy the view of water from the road. This is because of the high revetment built for flood prevention.

In the case of the Fontanka River, people can benefit from ecosystem services directly from the river, as they have access to it, while in the case of the Tosabori River, people indirectly benefit from ecosystem services as all they can do is to view the river. However, as such indirect

ecosystem services can also be beneficial to those living in high-rises on both sides of the river, its services are wider ranging. In the future, the Tosabori River should be improved so that people can have access to it, and directly benefit from its ecosystem services.

2. Найдите в тексте 12 пар синонимов.

1. Humanity 2. neighbourhood 3. considered 4. severally 5. expand 6. suburban
7. enter 8. overflow 9. valuable 10. tightly 11. continual 12. affect

3. Найдите соответствия между словами в группах A и B

A 1. regarded 2. determine 3. attract 4. develop 5. urban 6. benefit 7. concept 8. representative 9. viewpoint 10. vehicle 11. quarter 12. cityscape

B a) engage b) civic c) considered d) typical e) square f) standpoint g) profit from h) define j) expand i) townscape j) means of transport k) idea

4. Образуйте существительные от данных глаголов. В некоторых случаях возможно два существительных (действие и деятель).

construct – construction – constructor
attract – … **bless -** … **develop** – … - …
build – … – … **appear** – … **introduce** – …
determine – … **serve** – … **consider** – …
create – … - …

5. А. Переведите следующие словосочетания.

1. water and living creatures **2.** spread through city **3.** appear to be regarded as
4. representative examples of waterfront **5.** the district near the mouth of the river
6. the mouth of the river **7.** sightseeing boats

Б. Переведите следующие словосочетания и используйте принцип номинативной атрибутивной цепочки для большей лаконичности.

1. large densely built city of today **2.** mportant assets for tourism **3.** high-quality symbiotic spaces **4**. ecosystem service concept **5.** a lower viewpoint than ground level
6. temporary pedestrian walkways **7.** affect the environment of the river's ecosystem

Confusables

6. Выберите подходящее слово.

Water tourism

Clean water (1) ___ to the recreation and tourism industry (2) ___ by accentuating beautiful beaches, white-water rivers, mountain lakes, and (3) ___ ecosystems such as coral reefs. Wa-

ter has a (4) ___ attraction for people. When people decide to plan (5) ___ and travel for recreation, instruction, and (6) ___, many have a strong tendency to head to the water.

For example, a day at the beach provides recreation, relaxation, and a (7) ___to renew the (8) ___. A third of all Americans visit coastal (9) ___each year, making a total of 910 million trips while (10) ___about $44 billion. Coastal tourism (11) ___businesses like hotels, resorts, restaurants, outdoor outfitters, chartered fishing services, and travel agencies.

One of the largest service industries in the United States is travel and tourism, two broad (12) ___which (13) ___approximately 17 million (14) ___. Total travel and tourism (15) ___ in the United States for the year 2000 reached $582.5 billion, while total revenue was $99.5 billion.

1	**A** promotes	**B** provides	**C** contributes
2	**A** worldwide	**B** global	**C** universal
3	**A** aquatic	**B** water	**C** hydrous
4	**A** forceful	**B** powerful	**C** strong
5	**A** vacations	**B** holiday	**C** trip
6	**A** pleasure	**B** enjoyment	**C** treat
7	**A** possibility	**B** opportunity	**C** chance
8	**A** mind	**B** soul	**C** spirit
9	**A** places	**B** areas	**C** space
10	**A** spending	**B** wasting	**C** losing
11	**A** encourages	**B** supports	**C** maintains
12	**A** categories	**B** groups	**C** classes
13	**A** engage	**B** include	**C** involve
14	**A** tasks	**B** works	**C** jobs
15	**A** expenses	**B** spending	**C** expenditures

Word Families

7. Заполните пробелы данными словами.

a) **representative**	b) **presentation**	c) **extent**	d) **present**	e) **attractive**
f) **attractiveness**	g) **attraction**	h) **attract**	i) **extension**	j) **extensive**

1) This _____ will also explain some of the financial challenges faced by the council and the decisions that must be taken before the budget is finalised next year.

2) After many years of _____ research into this area I have also reached the same conclusion.

3) Getting a _____ sample of such a diverse and unconcentrated industry is difficult but essential.

4) It will highlight the circumstances that led her into her _____ situation.

5) Simple trade procedures lower costs, increase a country's competitiveness in international trade and it's _____ for foreign investors.

6) The _____ of the damage is still unknown.

7) They say these colors are _____ and fresh to the eyes.

8) But gravitational _____ depends on distance and mass.

9) But for most people now, their mobile phone is an **_____** of their arm and they always have it with them.

10) If New Zealand wants to progress and prosper, we must **_____** foreign investment to this country.

Phrasal Verbs

8. ***Вставьте соответствующие послелоги:***
across, over, out (3), back , through, round, off

1. I **found** ____ about this in the newspaper.

2. It urged the delegation to **carry …** the Committee's **plan** as soon as possible**.**

3. I can **show** you___ after the conference.

4. The negotiations were **put** ___ till Tuesday.

5. I **came …** these old photos when I was tidying the closet.

6. I **dropped …** of Science because it was too difficult.

7. We **got …** from our vacation last week.

8. Can you **look …** my essay for spelling mistakes?

9. I'll have to **think** this job offer **…** before I make my final decision.

Linking Words:

like, similarly; unlike, on the contrary

9. Переведите следующие предложения.

functions of *like, similarly* (to)

1. **Like** all other types of power plants hydropower plants use a turbine to produce electricity.
2. Once voltaic panels are installed, power generation is rather cheap, **similarly to** other renewable power sources.
3. **Similarly, in areas with a great number of** sunny days solar energy quite economically viable making it a competitive source of renewable electricity.

functions of **unlike, on the contrary**

1. The hydro station **consumes** no water, **unlike** coal or gas plants.
2. The cost of hydroelectricity is relatively low **unlike** that produced by nuclear power plants.
3. **On the contrary,** creating artificial lakes is very expensive and often means taking people from their homes.

Grammar: *Verbal structures.*

Verb + bare infinitive

We use the **bare infinitive** (an infinitive without to) after certain verbs followed by an object. These verbs include: **let, make, see, hear, feel**.	My parents **didn't let me watch** TV at night. Did you **see anyone enter** the building? He **made me laugh**.
We use the **bare infinitive** after **modal verbs**: can, should, could, might, may, etc.	He **can't sing**. It **might be** a good idea.

Verb + -ing

We use a verb in its **-ing form** after the verbs **avoid, admit, can't stand, deny, dislike, enjoy, hate, like, love, mind and practice**.	I **enjoy going** to the cinema. I **don't like living** in a city.
The **-ing form** is used after **prepositions**.	I'm looking forward **to seeing** you. He insisted **on seeing** the shop manager.

Verb + to + infinitive

We use **to + infinitive** after certain verbs, including **agree, arrange, decide, offer, seem, plan, want, need, promise, hope, refuse**.	I **have decided to lend** him the car. He **offered to help** me. He **promised not to say** anything.
We also use **to + infinitive** after these structures: **ask someone to, tell him to, want her to, etc**.	He **told me to go** there. She **asked me to help** her.

Verb + object + to + infinitive

After some verbs we use the structure **someone + to + infinitive**. Verbs which can be followed by this form include **advise, ask, allow, expect, encourage, force, help, invite, order, persuade, need, tell**.	They **helped their neighbour to fix** his car. She **asked me to give** her some advice. He **told his assistant to send** the parcel. She **persuaded him to have** lunch with her. We **need someone to help** us.
The negative form is **object + not + to + infinitive**.	She **advised me not to sell** my house.

10. Заполните пробелы конструкциями Verb + to + infinitive или Verb + -ing.

1. Would you mind _____ (open) the window?

2. Hello. I'd like _____ (speak) to Mr. Jones, please.

3. We intend _____ (move) to the new offices in June.

4. I don't remember_____ (tell) him to cancel the appointment.

5. I want_____ (learn) to speak Spanish.

6. Are you looking forward to _____ (go) to London?

7. The boy admitted_____ (steal) the computer from the shop.

8. Peter hopes_____ (become) a vet after his studies.

9. Don't forget_____ (put) the cat out before you go to bed.

10. Do you regret _____ (tell) Edward about the contract?

11. Некоторые предложения содержат ошибку. Найдите и исправьте её.

1. My boss told me doing the reports before Friday.

2. My colleague asked me to send a fax to the customer.

3. Tom wanted me help him prepare his presentation.

4. I warned him don’t drive too quickly because of the bad weather.

5. Please remind me call Mr Jones tomorrow morning.

6. Please tell him not to smoke here – it's not allowed.

7. Marta didn't feel too good but we persuaded her coming to the party.

8. Nobody wanted to go to the conference but our boss forced us to go to it.

9. I asked her don’t call so late in the evening. I go to bed early.

10. We showed them how using the new equipment.

12. Выберите подходящую глагольную форму.

1. Let him go/to go.

2. I watched them to play/play.

3. They made me repeat/repeating the whole story.

4. I avoid going/to go to the dentist.

5. I can't imagine live/living in that big house.

6. The doctor generally advised to drink/drinking low-fat milk.

7. She considered move/moving to New York.

8. I don’t want him to go/that he goes.

9. We expect them /turning up/to turn up in time.

10. The job involves travel/traveling to Japan once a month.

11. She likes listening/to listen to music.

12. California does not permit to smoke/smoking in restaurants.

13. Выберите подходящую глагольную форму.

1. I proposed_____ (have) lunch at the beach.

2. Tony recommended _____ (take) the train.

3. I had my mother _____ (do) that for me.

4. I advised him _____ (stop) smoking.

5. I want you _____ (wake up) early.

6. I would like _____ (invite) John.

7. He prefers_____ (sit) at the back of the movie theater.

8. I expected _____ (pass) the exam.

9. I watched the sun_____ (rise).

10. We don't allow people _____ (smoke) in the kitchen.

14. Заполните пробелы конструкциями Verb + to + infinitive
или Verb + bare infinitive:

1. She asked him _____ (send) her a text message.

2. He wanted all his friends _____ (come) to his party.

3. I heard her _____ (type) in the next room.

4. You had better _____ (tell) them everything.

5. What can I do to make you _____ (love) me.

6. My bicycle's been stolen! I forgot _____ (lock) it.

7. Have a good holiday and I hope _____ (hear) all about it when you get back.

8. Do you know how _____ (phone) to the USA?

9. He'd rather dine out tonight. Why not _____ (go) to the Cafe Royal?

10. Her parents won't let her _____ (go) to the dance. It's so unfair!

COMPUTER-ASSISTED LANGUAGE LEARNING:

INTEGRATED TASK

Consideration of waterfront space use by the sister cities

Integrated task to Unit 10. Read the text**,** *w*atch the video on Osaka, complementing the text, twice using subtitles, if necessary, and compare the content of both. Then answer the questions below and write the answers to these questions in the essay of 250-300 words.

#what #things #umeda
TOP 10 Osaka Attractions - Umeda Sky Building, Dotonbori, Osaka Castle, Shitennoji, Shinsekai - 2017

VIDEO Top 10 Osaka Attractions https://www.youtube.com/watch?v=K1y4V6EMZlE

Answer the following questions:

4. What can you say about the architecture of Osaka?
5. What traditional activities are shown?
6. How does the district of Dotonbori in Osaka correlate with the city centre of St.Petersburg?
7. What is the significance of the Castle for Osaka?

ДОПОЛНИТЕЛЬНЫЕ ЗАДАНИЯ ПО ПРАКТИКЕ ПЕРЕВОДА

1) Проверьте машинный перевод (МП) фрагмента из текста *Hydroelectricity* и выпишите примеры грамматических, лексических и стилистических ошибок.

Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator. The power extracted from the water depends on the volume and on the difference in height between the source and the water's outflow, this height difference referred to as the head.

Pumped-storage method produces electricity to supply high peak demands by moving water between reservoirs at different elevations. At times of low electrical demand, the excess generation capacity is used to pump water into the higher reservoir. When the demand becomes greater, water is released back into the lower reservoir through a turbine. Pumped-storage schemes currently provide the most commercially important means of large-scale grid energy storage and improve the daily capacity factor of the generation system.

Большая часть гидроэлектроэнергии поступает из потенциальной энергии воды из плотины, приводящей в движение водяную турбину и генератор. Мощность, извлекаемая из воды, зависит от объема и разности высот между источником и стоком воды, эта разность высот называется напором.

Метод накопительного хранения вырабатывает электроэнергию для удовлетворения высоких пиковых потребностей путем перемещения воды между резервуарами на разных высотах. Во времена низкого спроса на электроэнергию избыточная генерирующая мощность используется для перекачки воды в верхний резервуар. Когда потребность становится больше, вода сбрасывается обратно в нижний резервуар через турбину. Схемы накопительного хранения в настоящее время предоставляют наиболее коммерчески важные средства крупномасштабного накопления энергии в сети и улучшают суточный коэффициент мощности системы генерации.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст по теме *Hydroelectricity* с русского языка на английский и обсудите его в парах

Проблемы и перспективы развития отрасли в России

Необходимость обсуждения проблем гидроэнергетики на государственном уровне обусловлена рядом причин. Для обеспечения развития отрасли необходимо совершенствование нормативно-правовой базы, привлечение инвесторов, чтобы проекты ГЭС были окупаемы. На сегодняшний день наступила некоторая пауза в строительстве крупных ГЭС, есть проекты, судьба которых пока не ясна либо реализация их приостановлена. Наблюдается ситуация, когда при всех преимуществах гидроэнергетики газовая генерация в стране остается более выгодной. При этом размещение экономически целесообразных к освоению гидроресурсов на территории РФ очень неравномерно: 80% приходится на Сибирь и Дальний Восток и только 20% – на европейскую часть России, в отдельных регионах наблюдается переизбыток энергии. Имеют место проблемы тарифообразования, возникают вопросы экономической эффективности модели оплаты мощности. В результате инвесторы не спешат вкладывать средства в развитие гидроэнергетики, в первую очередь, из-за недостаточной урегулированности нормативно-правовых вопросов.

По обеспеченности гидроресурсами Россия занимает второе место в мире после Китая, но значительно уступает в их освоении: в нашей стране это всего 10%, в то время как, к примеру, в США – 52%, в Бразилии – 48%, в Китае – 41%. Особый акцент руководитель «РусГидро» сделал на преимуществах гидроэнергетики перед другими видами генерации и ее роли в экономике страны:

- Системная надежность: ГЭС обеспечивают 95% резерва регулировочной мощности в энергосистеме, являясь ключевым элементом энергосистем России и сопредельных государств.
- Защита от наводнений: гидротехнические сооружения ГЭС играют ключевую роль в борьбе с паводками для защиты населения и объектов экономики от наводнений (Средний Амур, Обь, бассейн р. Волги).
- Обеспечение инфраструктуры: ГЭС обеспечивают функционирование и развитие инфраструктурных объектов — жжелезнодорожный и автотранспорт, судоходство, промышленное и коммунальное водоснабжение, сельское хозяйство, рекреация.
- Низкоуглеродная энергетика: гидроэнергетика обладает наименьшей величиной удельных выбросов CO2, создавая потенциал декарбонизации экономики РФ.
- Энергоэффективность: выработка ГЭС (170 млрд кВт·ч/год, около 20% электроэнергии) позволяет экономить до 55 млн·т условного топлива ежегодно.

1) Проверьте машинный перевод (МП) абзаца из текста *History of Hydroelectricity* и выпишите примеры грамматических, лексических и стилистических ошибок.

At the beginning of the 20th century, many small hydroelectric power stations were being constructed by commercial companies in mountains. Grenoble, France held the International Exhibition of Hydropower and Tourism with over one million visitors. By 1920 **as** 40% of the power produced in the United States was hydroelectric, the Federal Power Act was enacted into law. As the power stations became larger, their associated dams developed additional purposes to include flood control, irrigation and navigation. Federal funding became necessary for large-scale development and federally owned corporations, such as the Tennessee Valley Authority (1933) were set up. Additionally, the Bureau of Reclamation which had begun a series of western U.S. irrigation projects in the early 20th century was now constructing large hydroelectric projects such as the 1928 Hoover Dam. The U.S. Army Corps of Engineers was also involved in hydroelectric development, completing the Bonneville Dam in 1937 and being recognized by the Flood Control Act of 1936 as the premier federal flood control agency.

В начале 20-го века коммерческие компании в горах строили много малых гидроэлектростанций. Гренобль, Франция, провел Международную выставку гидроэнергетики и туризма, которая посетила более миллиона человек. К 1920 году, поскольку 40% электроэнергии, произведенной в Соединенных Штатах, было гидроэлектростанцией, Федеральный закон о власти был принят в качестве закона. По мере того, как электростанции становились больше, связанные с ними плотины развивали дополнительные цели, включая борьбу с наводнениями, ирригацию и навигацию. Федеральное финансирование стало необходимым для крупномасштабного развития и были созданы федеральные корпорации, такие как администрация долины Теннесси (1933). Кроме того, Бюро мелиорации, начавшее серию ирригационных проектов на западе США в начале 20-го века, в настоящее время строит крупные гидроэлектростанции, такие как плотина Гувера 1928 года. Инженерный корпус армии США также принимал участие в разработке гидроэлектростанций, завершив строительство плотины в Бонневилле в 1937 году и получив признание в соответствии с Законом о борьбе с наводнениями 1936 года, в качестве главного федерального агентства по борьбе с наводнениями.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст по теме *History of Hydroelectricity* с русского языка на английский и обсудите его в парах

Из истории гидроэнергетики в России

Первой ГЭС в России, которую можно считать промышленной, т.е. работающей в энергосистеме, являлась гидроэлектростанция «Белый уголь» на реке Подкумок в современном Ставропольском крае. Построена она была в 1903 году управлением Владикавказской железной дороги, с целью энергоснабжения курортов Кавказских Минеральных Вод. Построили её довольно быстро, всего за три с лишним месяца. Примечательно и то, что среди руководителей стройки был академик Генрих Осипович Графтио. Мощность ГЭС «Белый уголь» на момент пуска составляла всего 990 л.с. (примерно 740 кВт). Тем не менее, этой мощности хватало на освещение четырех городов, энергоснабжение трамвайных линий в Пятигорске и Кисловодске, а также насосов, качавших минеральную воду в санатории.

В 1943 году немцы, отступая со ставропольской земли, практически полностью разрушили станцию. Тем не менее, в 1947 году она была восстановлена. Вместо тех первых, исторических гидроагрегатов поставили два новых, мощностью по 350 кВт. После реформы РАО «ЕЭС» ГЭС «Белый уголь», как и ещё три маленьких ГЭС Ставропольского края – Ессентукская, Горячеводская и Орловская оказались на балансе сетевой компании «Ставропольэнерго», для которой они были явно непрофильным активом. В 1913 году параллельно с «Белым углем» была запущена Пятигорская тепловая электростанция и именно с этого момента и началась история создания единой энергосистемы страны.

А в Челябинской области до наших дней сохранилась ГЭС «Пороги». В 1908 году «Уральское электро-металлургическое товарищество графа А. А. Мордвинова» приступило к строительству предприятия в урочище «Пороги» на реке Большой Сатке. Заводской корпус объединил под одной крышей электростанцию, плавильный цех и другие производственные участки. Производство планировалось электроплавильное, потому Сатку перегородили плотиной, смонтировали приплотинную ГЭС. И уже через 2 года – в 1910 году энергия, выработанная ею, создала в местной электропечи жар, необходимый для выплавки ферросплавов, а также снабдила электроэнергией прилегающий посёлок. Конструктивно «Пороги» представляют собой низконапорную малую гидроэлектростанцию, построенную по плотинной схеме, с береговым расположением здания ГЭС.

Сегодня эта плотина, построенная в начале прошлого века, является памятником индустриального зодчества. Комитет ЮНЕСКО по охране памятников истории и культуры в 1993 году присвоил «Порогам» статус памятника международного значения. Между прочим, это единственный в Челябинской области объект такого статуса.

1) Проверьте машинный перевод (МП) фрагмента из текста *Hydraulics* и выпишите примеры грамматических, лексических и стилистических ошибок.

Massive downstream flow deflectors have been used to focus gated outflows into narrow downstream gorges, such as at the 185 m-high Tekezi dam in Ethiopia. A multi-jet arrangement for the Dasu dam in Pakistan achieved a similar outcome. In other cases, dam crest vibration has been induced by the instability of crest overflows. This in turn has been linked to a sympathetic acoustic resonance between the overflowing sheet and the trapped air pocket beneath it. It is still an issue solved more by trial and error than design prediction.

When the massive Yacyreta dam on the border of Argentina and Paraguay discharged one of its first major floods in 1994, several thousand fish were killed by the super-saturation of the flow with dissolved gases in the deep stilling basins. When the air came out of solution in fish, in the shallows downstream, they got severe bends and died. In recent years the author worked with BC hydro advising on ways to avoid this at the Site C dam in Canada. Here low flows will be directed only to the upper surface of the water in the downstream stilling basin. This avoids diving jets and hence the problems at Yacyreta.

Массивные дефлекторы потока вниз по течению использовались для фокусирования закрытых оттоков в узких ущельях вниз по течению, например, на плотине Текези высотой 185 м в Эфиопии. Многоструйная договоренность для плотины Дасу в Пакистане достигла аналогичного результата. В других случаях вибрация гребня плотины была вызвана нестабильностью переполнения гребня. Это, в свою очередь, было связано с симпатическим акустическим резонансом между переливающимся листом и захваченным воздушным карманом под ним. Это все еще проблема, решаемая скорее методом проб и ошибок, чем прогнозированием.

Когда массивная плотина Ясирета на границе Аргентины и Парагвая извергла одно из первых крупных наводнений в 1994 году, несколько тысяч рыб были убиты из-за перенасыщения потока растворенными газами в глубоких спокойных бассейнах. Когда в рыбе на мелководье вниз по течению вышел воздух из раствора, они сильно прогнулись и погибли. В последние годы автор работал с BC hydro, консультируя по поводу способов избежать этого на плотине Зоны С в Канаде. Здесь низкие потоки будут направлены только на верхнюю поверхность воды в нижнем течении спокойного бассейна. Это позволяет избежать подводных струй и, следовательно, проблем в Yacyreta.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст по теме *Hydraulics* с русского языка на английский и обсудите его в парах

Явление кавитации в гидротурбинах

В процессе работы гидроагрегата поверхности деталей проточной части турбин подвергаются своеобразному губчатому разрушению. Эти разрушения вызываются кавитацией, представляющей собой сложное физическое явление, возникающее в потоке при быстром течении жидкости. Явление кавитации может приводить к весьма значительным разрушениям турбины

Кавитация сопровождается шумом, ударами и повышенной вибрацией агрегата. При этом сильно снижаются к. п. д., пропускная способность и мощность турбины. Одной из главных причин возникновения кавитации считается резкая местная пульсация гидродинамического давления в потоке. При очень высоких скоростях течения жидкости сплошность потока нарушается и в зоне наивысших скоростей образуются полости или каверны, заполненные парами жидкости, величина давления которых определяется температурой окружающей среды. Эти полости и каверны переносятся затем потоком в зону более высоких давлений, где происходит конденсация пара в полостях и их разрыв.

Если полости замыкаются на поверхности какой-либо детали, то эта поверхность начинает разрушаться. При кавитации наблюдаются электрические явления, вызывающие свечение кавери, а также начинают протекать химические реакции, приводящие к окислению (коррозии) металла. Одним из способов борьбы с разрушающим действием кавитации является применение кавитационностойких материалов для деталей проточного тракта турбин. Такими материалами в настоящее время являются пока только хромистые нержавеющие стали.

Однако наиболее действенная борьба с кавитацией должна заключаться в обеспечении бескавитационных условий работы турбины. Такие условия могут быть созданы выбором соответствующего типа турбины и напора, ограничениями режимов работы агрегата и расположением турбины относительно нижнего бьефа. В реактивных турбинах избежать или снизить кавитацию можно, расположив рабочее колесо над уровнем нижнего бьефа или ниже его на высоте, не превышающей допускаемой величины по условиям бескавитационной работы турбины.

Для предупреждения возникновения кавитации при проектировании гидроэлектростанций необходимо учитывать, что кавитационный коэффициент турбины должен быть несколько менее кавитационного коэффициента станции.

1) Проверьте машинный перевод (МП) фрагмента из текста *Concrete and Masonry Dams* и выпишите примеры грамматических, лексических и стилистических ошибок.

Perhaps the largest ‘revolution’ for concrete dams over the last 50 years has related to concrete placement. The economics of concrete dams was significantly improved by the use of roller compaction, to the extent that for any new, mass concrete dam, roller compacted concrete (RCC) is now the default option. To date more than 700 dams of this type have been completed worldwide. There are still some differences in approach between high paste and dry lean mixes, but even these are becoming less. Specific techniques have developed to the extent that many, such as the Chinese, will vibrate reinforcement into the RCC, effectively producing reinforced concrete around internal spaces and on surfaces where rebar is required.

More recently still, roller compaction techniques have been used to develop faced symmetrical hard fill dams (FSHD). This form of construction comprises cement stabilized as-dug material into a trapezoidal shape which is then faced upstream for waterproofing. It is a simple and robust technique with good seismic characteristics and the structures can be safely overtopped.

Возможно, самая большая «революция» за бетонные плотины за последние 50 лет связана с укладкой бетона. Экономичность бетонных плотин была значительно улучшена за счет использования уплотнения валками, так что для любой новой, массивной бетонной плотины, уплотненный валиком бетон (RCC) теперь является вариантом по умолчанию. На сегодняшний день более 700 плотин этого типа были построены по всему миру. Между подходами с высоким содержанием пасты и сухих постных смесей все еще существуют некоторые различия, но даже их становится все меньше. Специфические методы были разработаны в той мере, в которой многие, например китайцы, будут вибрировать армирование в RCC, эффективно производя железобетон вокруг внутренних пространств и на поверхностях, где требуется арматура.

Еще совсем недавно, технологии уплотнения валков использовались для разработки граней с симметричным твердым заполнением (FSHD). Эта форма конструкции содержит цементно-стабилизированный выкопанный материал в форме трапеции, которая затем направляется вверх для гидроизоляции. Это простая и надежная техника с хорошими сейсмическими характеристиками, и конструкции могут быть безопасно перегружены.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст по теме *Concrete and Masonry Dams* с русского языка на английский и обсудите его в парах

Каменные плотины

Многие ли из нас видели вблизи плотины ГЭС, сделанные из камня? Ну, вот, к примеру, ГЭС, стоящая на Ангаре – Богучанская, у которой обе части, примыкающие к берегам, сделаны из камня. Что, давненько не катались в городок Кодинск? Ну, тогда вспомним зимние репортажи из США, с плотины Оровилл, к которым стоит присмотреться повнимательнее. Точно такая же конструкция – от берегов сплошной камень, и только в центре, где работают механизмы ГЭС – бетон.

Возможность использования местных материалов определяет экономичность каменных плотин, их широкое применение в различных географических районах.

Каменная плотина - это плотина, основные конструктивные элементы которой выполнены из каменных материалов без применения вяжущих. В практике современного гидротехнического строительства различают каменные плотины каменно-набросные (насыпные), полунабросные, из каменной сухой кладки. Каменные плотины строят, как правило, глухими с пропуском воды через водосбросы в берегах, реже – в теле плотины. Основные материалы для тела каменных плотин: камень рваный (из карьеров), галька, гравий, щебенистые грунты.

В каменной (набросной) плотине экран или центральный водонепроницаемый элемент (диафрагму) выполняют из железобетона, асфальта, дерева, металла, полимерных материалов. Требование малой водопроницаемости распространяется и на основание плотины. Если грунт основания проницаем на большую глубину, его покрывают перед плотиной понуром (например, из глины), образующим с экраном одно целое. Плотина с ядром дополняется устройством в основании стальной шпунтовой стенки или противофильтрационной завесы. Камень в каменнонабросную и каменно-земляную плотину отсыпается слоями большой высоты.

Камень для наброски и сухой кладки должен обладать достаточной прочностью и стойкостью против выветривания, действия мороза и разрушения фильтрационным потоком. Лучшие материалы для наброски – изверженные породы (гранит, сиенит, диорит, базальт и др.), из осадочных пород – плотные известняки и доломиты, кварциты. Существенное значение имеют размеры и формы камня, а также способы уплотнения наброски, влияющие на пустотность наброски, величину осадки тела плотины и крутизну откосов. В качестве основания для каменных плотин пригодны практически все виды скальных пород; из нескальных пород – гравелисто-галечные, крупнозернистые пески, глины и плотные суглинки.

1). Проверьте машинный перевод (МП) фрагмента из текста E*mbankment Dams* и выпишите примеры грамматических, лексических и стилистических ошибок.

Nowadays, especially when rockfill is plentiful and core material is not, the CFRD is the favoured choice of dam and many of these structures now extend to around 200 m in height. However, with increased confidence also came over-confidence. Leakage along the plinth joint became a common problem, and then several high dams such as Mohalc in Lesotho, Tians-hengqioa in China and Barra Grande and Campos Novos in Brazil, all constructed with basalt aggregate, featured serious face slab failures. The problem was traced to a combination of dam height, valley shape, the type of rock and a reduction in the number of movement joints in the slabs. Lessons were learned and, in particular, more movement joints have now been re-introduced in the slabs and with both internal and external seals. It is interesting that rockfill dams with central concrete core walls have a statistically much better safety record than CFRDs, or indeed any other type of dam, although these have largely fallen out of fashion.

В настоящее время, особенно в тех случаях, когда каменная наброска обильна, а материал керна отсутствует, CFRD является предпочтительным выбором плотины, и многие из этих сооружений в настоящее время достигают высоты около 200 м. Однако с ростом уверенности также возникла чрезмерная уверенность. Утечка вдоль цокольного соединения стала распространенной проблемой, и затем на нескольких высоких плотинах, таких как Мохальк в Лесото, Тяньшенцкиоа в Китае и Барра-Гранде и Кампос-Новости в Бразилии, все из которых были построены из базальтового заполнителя, были обнаружены серьезные повреждения лицевой плиты. Проблема была связана с сочетанием высоты плотины, формы долины, типа породы и уменьшения количества подвижных швов в плитах. Уроки были извлечены, и, в частности, теперь в плитах и с внутренними и внешними уплотнениями было вновь введено больше подвижных соединений. Интересно, что каменно-набросные плотины с центральными бетонными стенами с сердцевиной имеют статистически намного лучшие показатели безопасности, чем CFRD или даже любые другие типы плотин, хотя они в значительной степени вышли из моды.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст по теме E*mbankment Dams* с русского языка на английский и обсудите его в парах

Насыпные земляные плотины

Особенности возведения насыпных плотин. Долговечность работы земляных плотин во многом зависит от правильного распределения в теле плотины грунта и его уплотнения. При возведении земляной плотины необходимо так распределять грунты по их физико-механическому составу и укладывать по профилю плотины, чтобы препятствовать проникновению фильтрационной воды в тело плотины до ее середины и всемерно способствовать выходу фильтрационной воды из пределов низовой ее части. Из этого правила следует, что в верховую часть плотины, то есть от ее оси в сторону водохранилища, нужно укладывать менее водопроницаемые грунты (суглинки) с тщательным уплотнением. Низовую же часть плотины, то есть от оси в сторону нижнего бьефа, возводят из более проницаемых грунтов. Доставленный из карьера грунт разравнивают слоем толщиной 20–25 см в рыхлом состоянии. Грунт уплотняют самоходными или прицепными катками – гладкими или шиповыми, иногда гусеничными тракторами или самоходными скреперами.

В последнее время стали применять большегрузы на пневмоходу, уплотняющие слой грунта толщиной до 60 см, и виброкатки, уплотняющие слои грунта до 0,8–1,0 м.

При уплотнении грунта большое значение имеет его влажность, так как сближению частиц грунта препятствует трение между ними. Наилучшее уплотнение грунта происходит при оптимальной влажности, когда заданное уплотнение грунта достигается при минимальной работе уплотняющих снарядов. Эта влажность, в свою очередь, зависит от характера грунта, веса катка. Ее определяют опытным путем в лабораторных и натурных условиях. Например, для суглинков при уплотнении 6-тонным катком она составляет 12–16%. Для более тяжелых катков оптимальная влажность уменьшается, для более легких – повышается.

Степень уплотнения грунта в плотине характеризуется пористостью или объемным весом грунта, причем величину ее задают, исходя из компрессионных свойств грунта и высоты насыпи. Так как нагрузка на грунт в разных частях по высоте плотины различная, то и степень уплотнения грунта следует задавать различную, в зависимости от ожидаемой нагрузки (вес вышележащего грунта).

Степень уплотнения грунта в теле плотины контролируют, определяя лабораторным путем объемный вес проб грунта, взятых из каждого укатываемого слоя в вершинах квадратов со стороной 20–40 м. При высоких темпах возведения насыпи для ускорения контроля, кроме лабораторных исследований, применяют плотномеры.

1) Проверьте машинный перевод (МП) фрагмента из текста *Dam safety* и выпишите примеры грамматических, лексических и стилистических ошибок.

A similar hysteresis effect can be seen with the crest length of the Dinas concrete arch dam in Wales. The dam is affected by AAR in the concrete, and so is expanding. However the length changes caused by annual temperature changes need to be plotted and compared for the underlying AAR-based expansion changes to be revealed. Recent plots show that overall underlying expansion rates are now much lower than in the early years after construction.

As mentioned earlier, risk analyses are playing an increasingly important role in assessing dam safety. We will be likely to see many more changes in future regarding what is accepted as current best practice; however, all sequential events in a **failure event tree** will end with one assessing the likelihood of detecting potential failure, followed by another assessing the likelihood of being able to intervene to prevent it. Clearly the more the certainty of these last two events can be guaranteed, the more the rest of the event tree will become redundant and the risk of failure vanishingly small. It is also likely that this is where attention to risk is actually, quite correctly, taking us.

Подобный эффект гистерезиса можно увидеть с длиной гребня бетонной арки Динас в Уэльсе. Дамба подвергается воздействию AAR в бетоне, и поэтому расширяется. Тем не менее, изменения длины, вызванные ежегодными изменениями температуры, должны быть нанесены на график и сравнены для выявления лежащих в основе изменений расширения на основе AAR. Недавние графики показывают, что общие темпы роста в настоящее время намного ниже, чем в первые годы после строительства.

Как упоминалось ранее, анализ рисков играет все более важную роль в оценке безопасности плотины. В будущем мы, вероятно, увидим гораздо больше изменений в отношении того, что принято считать наилучшей практикой; однако все последовательные события в дереве событий сбоев будут заканчиваться одним, оценивающим вероятность обнаружения потенциального сбоя, за которым следует другое, оценивающее вероятность вмешательства, чтобы предотвратить его. Ясно, что чем больше достоверность этих двух последних событий может быть гарантирована, тем больше остальная часть дерева событий станет избыточной и риск сбоев исчезающе мал. Также вероятно, что именно здесь внимание к риску действительно, совершенно правильно, берет нас.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст по теме *Dam safety* с русского языка на английский и обсудите его в парах

Авария на Саяно-Шушенской ГЭС

Это промышленная техногенная катастрофа, произошедшая 17 августа 2009 года. В результате аварии погибло 75 человек, оборудованию и помещениям станции нанесён серьёзный ущерб. Работа станции по производству электроэнергии была приостановлена. Последствия аварии отразились на экологической обстановке акватории, прилегающей к ГЭС, на социальной и экономической сферах региона. В результате проведённого расследования Ростехнадзора непосредственной причиной аварии было названо разрушение шпилек крепления крышки турбины гидроагрегата, вызванное дополнительными динамическими нагрузками переменного характера, которому предшествовало образование и развитие усталостных повреждений узлов крепления, что привело к срыву крышки и затоплению машинного зала станции.

Авария на данный момент является крупнейшей в истории катастрофой на гидроэнергетическом объекте России и одной из самых значительных в истории мировой гидроэнергетики. «Авария уникальна, – сказал, в частности, экс-министр РФ по делам гражданской обороны, чрезвычайным ситуациям и ликвидации последствий стихийных бедствий С. К. Шойгу. – Ничего подобного в мировой практике не наблюдалось». Тем не менее, оценка последствий катастрофы в экспертном и политическом сообществе неоднозначна. Некоторые специалисты и организации, в том числе сам Сергей Шойгу, сравнивали Саяно-Шушенскую аварию по её значимости и влиянию на экономические и социологические аспекты жизни России с аварией на Чернобыльской АЭС. Другие эксперты утверждали, что эти аварии несравнимы по масштабам. Президент Российской Федерации Д. А. Медведев высказывал мнение, что не следует излишне драматизировать ситуацию и делать «апокалиптические» комментарии. Авария вызвала большой общественный резонанс, став одним из самых обсуждаемых в средствах массовой информации событий 2009 года.

Авария на СШГЭС с многочисленными человеческими жертвами стала следствием целого ряда причин технического, организационного и нормативного правового характера. Большинство этих причин носит системный многофакторный характер, включая недопустимо низкую ответственность эксплуатационного персонала, недопустимо низкую ответственность и профессионализм руководства станции, а также злоупотребление служебным положением руководством станции.

Не был должным образом организован постоянный контроль технического состояния оборудования оперативно-ремонтным персоналом (что должно предусматриваться инструкцией по эксплуатации гидроагрегатов Саяно-Шушенской ГЭС, утверждённой главным инженером СШГЭС от 18.05.2009 г.). Основной причиной аварии стало непринятие мер к оперативной остановке второго гидроагрегата и выяснения причин вибрации.

1) Проверьте машинный перевод (МП) фрагмента из текста *Green Concrete: The Future of Sustainable Construction* и выпишите примеры грамматических, лексических и стилистических ошибок.

Green Concrete Defined. Green concrete is all about recycling and innovation. Its most common definition is concrete that incorporates **at least** one form of recycled waste materials in its components. Waste materials that are often recycled and used to produce green concrete include used concrete, **quarry** and mining waste, **slag**, burnt clay, power plant waste, combustor ash, saw dust, foundry sand, and waste glass, among others. The term "green concrete" can be used broadly to refer to any concrete that is environmental friendly. Sometimes this may involve rehabilitating mines and quarries to put the wasteland to better use. The main purpose of using green concrete is to conserve the environment. However, this form of concrete has financial and health benefits too.

Зеленый Бетон Определен. Зеленый бетон - это все о переработке и инновациях. Его наиболее распространенное определение - бетон, в состав которого входит, по крайней мере, одна форма переработанных отходов. Отходы, которые часто перерабатываются и используются для производства зеленого бетона, включают в себя, среди прочего, отработанный бетон, отходы карьера и добычи полезных ископаемых, шлак, обожженную глину, отходы электростанций, золу сгорания, опилки, литейный песок и отходы стекла. Термин «зеленый бетон» может широко использоваться для обозначения любого бетона, который является экологически чистым. Иногда это может включать реабилитацию шахт и карьеров, чтобы лучше использовать пустырь. Основной целью использования зеленого бетона является сохранение окружающей среды. Тем не менее, эта форма бетона имеет финансовые и медицинские преимущества.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) **Переведите текст по теме *Green Concrete* с русского языка на английский и обсудите его в парах**

Новый "зеленый" бетон на 90% экологичней обычного

Геополимерный (или природный) бетон – это инновационный и экологически чистый строительный материал, разработанный в Технологическом Университете Луизианы, который будет представлен на транспортной выставке, проходящей в Научном Центре Детройта.

Разработанный доктором Эрезом Эллоче и его командой геополимерный бетон, относится к молодому классу цементирующих материалов. В его состав входит зольная пыль – один из самых распространенных промышленных побочных продуктов. Она выступает в роли заменителя портландцемента, который является самым широко производимым человеком материалом на земле.

"Презентация геополимерного бетона на столь посещаемой публичной выставке, позволит представить широкой публике это новое направление в строительной отрасли", - сказал Эллоуче. "Если обществу станет известно о существовании более продвинутых технологий по постройке магистралей и мостов, они потребуют от властей внедрения этих 'зеленых' технологий".

"Подобное политическое давление - очень важно для продвижения новых материалов, таких как геополимерный бетон, ведь это позволит преодолеть бюрократический барьеры, стоящие между лабораторией и стройплощадкой".

По сравнению с обычным цементом, геополимерный обладает большей стойкостью к коррозии, значительно более пожароустойчив и эластичен. Зольная пыль для образца, выставленного на научной выставке в Детройте, была предоставлена угольной электростанцией Cleco Power's Dolet Hills. "Геополимерный цемент, несомненно, будет широко применяться", – сказал Эллоуче. "Мы ожидаем увидеть рост числа коммерческих применений этой инновационной зеленой технологии, как в строительной отрасли, так и в области транспортной инфраструктуры".

По словам Эллоче, данная исследовательская группа относится к числу самых успешных в этой области и будет играть ключевую роль в развитии и коммерциализации геополимерного бетона в будущем. Возможно самое большое преимущество геополимерного бетона, по сравнению с обычным, заключается в значительном меньшем (на 90%) выделении им парниковых газов. Исследователи продолжают работу, над созданием цемента, состоящего из отходов производства. Следующее поколение геополимерного цемента будет в несколько раз более устойчивым к повреждениям, по сравнению с обычным цементом.

1) Проверьте машинный перевод (МП) фрагмента из текста *Hoover Dam* и выпишите примеры грамматических, лексических и стилистических ошибок.

Over the next 15 years, investigations continued throughout the entire basin. These studies later served as the basis of a comprehensive plan of development for the entire basin. The increasing demand for water in California's Imperial Valley and nearby cities, and the need to control the unpredictable habits of the river led to in-depth studies in the Lower Basin. In 1918, Director of the Reclamation Service, Arthur P. Davis, ordered a thorough investigation of Boulder and Black Canyons as sites for a high dam for storage and flood control. In the years that followed, many sites were mapped and several potential dam sites were located. In 1920, Homer Hamlin and Edward T. Wheeler reported to the Secretary of Interior, John B. Payne, that both the Boulder and Black Canyons contained several suitable sites.

В течение следующих 15 лет исследования продолжались по всему бассейну. Эти исследования позднее послужили основой для комплексного плана развития всего бассейна. Растущий спрос на воду в калифорнийской Имперской долине и близлежащих городах, а также необходимость контролировать непредсказуемые привычки реки привели к углубленным исследованиям в Нижнем бассейне. В 1918 году директор Службы мелиорации Артур Дэвис приказал провести тщательное расследование Боулдера и Чёрного каньона как площадки для высокой плотины для хранения и борьбы с наводнениями. В последующие годы было нанесено на карту много участков, и было найдено несколько потенциальных участков дамбы. В 1920 году Гомер Хэмлин и Эдвард Т. Уилер сообщили министру внутренних дел Джону Б. Пейну, что в Боулдере и Черном каньоне есть несколько подходящих мест.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст по теме *Hoover Dam* с русского языка на английский и обсудите его в парах

Общие сведения о плотине Гувера

Плотина названа в честь Герберта Гувера, 31-го президента США, сыгравшего важную роль в её строительстве. Строительство плотины началось в 1931 году, во время депрессии, и закончилось в 1936 году, на два года раньше запланированного срока.

До возведения плотины река Колорадо нередко показывала свой бурный нрав, зачастую во время таяния снегов в Скалистых горах затопляя фермерские угодья, лежащие ниже по течению. Проектировщики плотины рассчитывали, что её возведение поможет сгладить колебания уровня реки. Помимо этого, ожидалось, что водохранилище даст толчок развитию орошаемого земледелия, а также станет источником водоснабжения Лос-Анджелеса и других районов Южной Калифорнии.

Постройка такого масштабного гидротехнического сооружения требовала привлечения значительных средств из государственного бюджета. Законопроект о выделении финансирования не сразу получил одобрение Сената США и Белого дома. Лишь 21 декабря 1928 года президент Калвин Кулидж подписал билль, одобряющий осуществление проекта. Первоначальные ассигнования же на постройку плотины были выделены только в июле 1930 года, когда президентом был уже Герберт Гувер.

Возведение бетонной плотины. Первый бетон был залит в основание плотины 6 июня 1933 года. Для производства бетона были вскрыты местные месторождения нерудных материалов, выстроены специальные бетонные заводы.

Так как работы подобного масштаба ранее никогда не производились, ряд технических решений, применённых в процессе строительства, носил уникальный характер. Одной из проблем, с которой довелось столкнуться инженерам, стало охлаждение бетона. Вместо сплошного монолита, плотина строилась как серия взаимно связанных колонн в форме трапеций – это позволяло рассеяться излишнему теплу, выделявшемуся при застывании бетонной смеси. Инженеры подсчитали, что если бы плотина была сооружена как монолит, для полного охлаждения бетона до окружающей температуры понадобилось бы 125 лет. Это могло бы привести к появлению трещин и разрушению дамбы. Помимо этого, для ускорения процесса охлаждения слоёв бетона каждая форма, в которую осуществлялась заливка, содержала охлаждающую систему из дюймовых металлических труб, в которые поступала речная вода. Процесс отвердевания бетона, из которого построена плотина, не завершён по сей день.

Всего в бетон, потребовавшийся для сооружения тела плотины, замесили 600 тыс. тонн портландцемента и 3,44 млн. м³ заполнителя. Плотина Гувера на момент завершения её строительства стала самым массивным искусственным сооружением на земле, превышающим массу кладки Пирамид Гизы – израсходованного бетона хватило бы для постройки 20-сантиметровой по толщине бетонной дороги шириной 5 м от Сан-Франциско до Нью-Йорка,

1). Проверьте машинный перевод (МП) фрагмента из текста *Boulder City and Pre-Construction* и выпишите примеры грамматических, лексических и стилистических ошибок.

Before construction of the dam and appurtenant works could begin, an enormous amount of preparatory work had to be undertaken. The site of the dam is a deep canyon more than 30 miles from the nearest town. The site was in the middle of the desert with limited access and no provisions for housing the almost 5,000 people that would work on the project. Before work on the dam itself could begin, many support features had to be constructed. These included transportation and communication facilities, housing, water and sewage systems, power and lighting facilities, and a 150-ton cable way for handling heavy equipment at the dam site. To house the estimated 5,000 workers and officials involved with the project, the Government designed and built Boulder City. The site for the town, about six miles west of the dam, was chosen because it was at a higher elevation than the surrounding countryside. It was felt that the climate at the higher ground would be more mild and hospitable than at lower altitude were the temperature was often well over 100 degrees, 24 hours a day. The town was planned using the accepted standards for municipal development and was constructed with paved streets, a water and sewer system, electrical power, etc.

Прежде чем приступить к строительству плотины и вспомогательных работ, нужно было выполнить огромное количество подготовительных работ. Участок плотины - глубокий каньон, расположенный более чем в 30 милях от ближайшего города. Место было посреди пустыни с ограниченным доступом и никаких условий для размещения почти 5000 человек, которые будут работать над проектом. Прежде чем начать работу над самой плотиной, нужно было построить много опорных элементов. К ним относились транспортные и коммуникационные объекты, жилищные, водопроводные и канализационные системы, оборудование для электроснабжения и освещения, а также 150-тонная канатная дорога для перемещения тяжелого оборудования на площадке плотины. Для размещения примерно 5000 рабочих и должностных лиц, вовлеченных в проект, правительство спроектировало и построило город Боулдер. Место для города, примерно в шести милях к западу от плотины, было выбрано потому, что оно находилось на более высоком уровне, чем окружающая сельская местность. Чувствовалось, что климат на более высоком уровне будет более мягким и гостеприимным, чем на более низкой высоте, если температура часто превышает 100 градусов 24 часа в сутки. Город был спроектирован с использованием принятых стандартов для муниципального развития и был построен с мощеными улицами, водопроводной и канализационной системой, электроэнергией, и т.д..

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) Переведите текст на тему *Boulder City* с русского языка на английский и обсудите его в парах

Строительство Боулдер-Сити

Плотина Гувера строилась в годы Великой депрессии, а район Черного каньона был очень далек от больших городов. Лас-Вегас был тогда всего лишь небольшим городком в пустыне, все значение которого определялось проходящей через него железной дорогой. Но именно Лас-Вегас стал перевалочным пунктом для тысяч безработных со всей Америки, устремившихся на строительство новой плотины. Уже в 1930 году было начато строительство железной дороги, связавшей Лас-Вегас со "строительной площадкой" будущей дамбы Гувера.

В строительстве участвовали многие тысячи рабочих (максимальное количество — 5251 человек – в июле 1934 года). Политика правительства была нацелена на увеличение количества рабочих мест, что было сделано для снижения массовой безработицы, ставшей результатом Великой депрессии. Согласно условиям контракта на строительство, не допускался наём на работу выходцев из Китая, а количество чернокожих работников в ходе строительства не превышало тридцати человек, занятых на самых низкооплачиваемых работах.

Проектом предусматривалось еще до начала возведения плотины построить город для ее строителей – Боулдер-Сити. Но с целью как можно быстрее занять работой большее количество людей Президент США Герберт Гувер распорядился начать работы уже весной 1931 года, на полгода раньше, чем планировалось. Город для строителей еще не был готов и люди были вынуждены жить во временных лагерях, очень плохо приспособленных для жаркого климата Невады. Тяжелые и очень опасные условия труда в сочетании с отсутствием нормального жилья и все это в условиях ужасной жары (а тем летом в Неваде температура часто превышала 45°C) – забастовки были неизбежны. В августе 1931 года рабочие предъявили администрации стройки ряд требований. Фрэнк Кроу, руководитель строительства, известный своим очень жестким характером, ответил приказом об увольнении практически всех работников и распорядился набрать на строительство новых. Лишь в конце 1931 года, когда строители начали заселять новые дома в Боулдер-Сити, условия их жизни стали улучшаться.

По официальной статистике на строительстве плотины погибли сто двенадцать человек. Считается, что еще сорок два работника погибли от отравления угарным газом во время прокладки тоннелей.

1) Проверьте машинный перевод (МП) фрагмента из текста *Consideration of waterfront space use by the sister cities* и выпишите примеры грамматических, лексических и стилистических ошибок.

Waterfront use in the tourism district

Griboedov Canal and Dotombori Canal were selected as representative examples in the tourism district of Saint Petersburg and Osaka respectively. In these districts, sightseeing boats shuttle along the canals, and tourists enjoy the townscape and waterscape on the banks from the boat with a lower viewpoint than ground level. With respect to the difference between the canals of the two cities, Griboedov Canal has a constant space on both sides between the bank and buildings where tourists and vehicles can pass. Dotombori Canal on the other hand has no such space as the buildings extend to its banks, and temporary pedestrian walkways are provided along both banks. However, beneficial the distance between the water surface of Dotombori Canal and tourists, it is closer than that of Griboedov Canal.

Использование набережной в туристическом районе

Канал Грибоедова и Дотомбори были выбраны в качестве репрезентативных примеров в туристическом районе Санкт-Петербурга и Осаки соответственно. В этих районах экскурсионные катера курсируют по каналам, а туристы наслаждаются городским пейзажем и водным пейзажем по берегам с лодки с более низкой точкой обзора, чем с уровня земли. Что касается разницы между каналами двух городов, канал Грибоедова имеет постоянное пространство с обеих сторон между банком и зданиями, где могут проезжать туристы и транспортные средства. Канал Дотомбори, с другой стороны, не имеет такого пространства, поскольку здания простираются до его берегов, а вдоль обоих берегов предусмотрены временные пешеходные переходы. Однако, выгодное расстояние между водной гладью канала Дотомбори и туристами, оно ближе, чем у канала Грибоедова.

Примеры ошибок:

Грамматические		**Лексические**		**Стилистические**	
МП	Правка	МП	Правка	МП	Правка

2) **Переведите текст на тему *Consideration of waterfront space* с русского языка на английский и обсудите его в парах**

Прогулка по Осаке

Осака – это «водный город». Сеть водных артерий, проходящих через городские кварталы, способствовала развитию этого города и служила опорой жизни его обитателей. И в наши дни многие популярные туристические места располагаются на речных и морском берегах – это и увеселительный район Минами, где огромные вывески выстроились в первую очередь вдоль канала Дотомбори, и центр сосредоточения общественных объектов Наканосима, и окружённый водяным рвом Осакский замок, и, наконец, район залива, где находятся тематический парк развлечений Universal Studios Japan и Осакский океанариум Кайюкан.

Одним из самых узнаваемых зданий Осаки является Umeda Sky Building. Проектом небоскрёба занимался Хироси Хара, построено оно было в 1993 году. Знаменито же здание своей крышей, на которой располагается красивый сад с фонтанами. Впрочем, в городе можно обнаружить ещё одно здание, на крыше которого находится прекрасный сад – речь идёт о саде, располагающемся на крыше небоскрёба Osaka Merchandise Mart (или OMM, как его называют для простоты и удобства). Непременно стоит прокатиться на аттракционе Tempozan Ferris Wheel – и не только для того, чтобы испытать прилив адреналина, а для того, чтобы восхититься великолепными видами на Осаку.

Город славится и своими прекрасными ультрасовременными мостами, среди которых в первую очередь стоит выделить Ebisu Bridge, необычный тем, что является округлым. Это одно из излюбленных мест у японцев и туристов, где они предпочитают фотографироваться. Также отсюда открываются великолепные виды на реку и город. Интересными для прогулки и наблюдения мостами являются Suisho Bridge и Barazono Bridge. Тем, кто желает прогуляться по самым колоритным улочкам Осаки, следует обратить внимание на Tempozan Market Place и Toki no Hiroba, – и удивит туристов здесь не только шопинг, но и замечательная атмосфера. Тем же, кто предпочитает для прогулки более умиротворённые места, следует отправиться в один из парков города – а их в Осаке предостаточно. Или же можно прогуляться по внутренним дворикам храмов (например, вдоль сада Ryotokuin Temple).

КЛЮЧИ К УПРАЖНЕНИЯМ

UNIT 1. HYDROELECTRICITY

Ex. 1

1. T 2. F 3. T 4. T 5. F 6.T 7.T 8. F 9. T 10. T

Ex. 2

1. produced generated 2. region area 3. practicable viable 4. Eclipsed surpassed
5. increase change up 6. artificial lakes reservoir 7. considerably relatively
8. constant continuous 9. available existing 10. locations sites 11. Output production
12. supply provide

Ex . 3

1. relatively f} comparatively 2. bulk a) majority 3. average i) typical, mean
4. domestic j) internal, home, home-produced 5. demand b) requirement
6. construct d) build 7. adapt c) adjust 8. output e) generation 9. funding
g) money allocation 10. room h) space 11. viable j) plausible 12. k) at present

Ex. 6

1.B 2.C 3.A 4.C 5. B 6. B 7. A 8. B 9. A 10. A 11. B 12. A 13. B 14.A 15.C

Ex. 7

1. b 2. J 3.e 4. i 5.a 6. C 7. C 8. D 9. f 10. h

Ex. 8

1. Up 2. Through 3. In 4. Out 5. On 6.Out 7. Around 8.Across 9. On 10. Out

UNIT 2. HISTORY OF HYDROELECTRICITY

Ex. 1

1. T 2. F 3. F 4. T 5. F 6. T 7. T 8. F 9. T 10. F

Ex. 2

1.Provide – supply 2. Persist – continue 3. Multitude – plenty 4. Decree – enact
5. King-size – large 6. Antique – ancient 7. Trade – commercial
8. Production – output 9. Tie together – associate 10. Send – refer
11. Strength – power 12. Outshine – eclipse

Ex. 3

1 development – c. growth 2. connect – h. couple 3. perform – l. execute
4. design – a. sketch 5. company – k. fellowship 6.dam – e. levee
7. supplementary – b. additional 8. eventually – j. ultimately 9.surpass – i. excel
10. necessary – f. essential 11.supply – d. afford 12.total – g. entire

Ex. 6

1 B 2.A 3.C 4.C 5.C 6. A 7.B
8. A 9.B 10.C 11.C 12.A 13. C 14.B 15. B

Ex. 7

1 b, 2. d 3.f 4. C 5.g 6.i 7.a, b 8.h 9.j 10. e

Ex.8

1.back 2.out 3.up 4. up 5.off 6. over 7.out 8.over 9.on 10.up

UNIT 3. HYDRAULICS

Ex.1.

1. T 2. T 3 F 4. F 5.T 6.T 7.T 8.F 9. T 10.F

Ex. 2

1) downstream; 2) encapsulate; 3) demolish; 4) virtual; 5) extrapolate; 6) qualification;
7) embrace; 8) instability; 9) modification; 10) expand; 11) conjunction; 12) arrangement

Ex. 3

1) k 2)b 3)h 4)j 5)f 6)g 7)a 8)i 9)l 10)c 11)e 12)d

Ex. 6

1 C 2. C 3.c 4. C 5.b 6. B 7. A 8. A 9. B 10. A

Ex. 7

1 b 2. a 3. c 4.g 5. d 6.e 7. f 8. j 9.h 10. i

Ex. 8

1. away 2. up 3. across 4.up 5. out 6. up 7 by 8 out 9. Around 10.up

UNIT 4. CONCRETE AND MASONRY DAMS

Ex.1

1.T 2.F, 3.F, 4.T, 5.T, 6.F, 7.F, 8.T, 9.T, 10.F

Ex. 2

1.swell, 2.serviceability, 3.compaction, 4.reinforce, 5. grout, 6. paste, 7.interlock, 8.shear 9.conventional, 10.decommissioning

Ex.3

1.f, 2.a, 3.h, 4.j, 5.c, 6.d, 7.b, 8.e, 9.g

Ex.6

1.B, 2.C, 3.B, 4.A, 5.C, 6.A, 7.B, 8.B, 9.A, 10.B

Ex. 7

1.replacement, 2. replacer, 3.placing, 4.emplaced, 5.implacable, 6.misplace, 7.placeability, 8.displaced, 9.placate **10.**displacement

Ex. 8

1. off, 2. up, 3. on, 4.about, 5.down, 6. up 7. apart 8. through with, 9.up, 10.down

Ex.10

1.a 2.a 3.b 4.a 5.b 6.c 7.a 8.c 9.a 10.b 11.c 12.a

UNIT 5. EMBANKMENT DAMS

Ex. 1.

T 2. F 3. F 4. T 5. T 6. T 7. T 8. T 9. F 10. T

Ex.2

1) Main – general 2) hugely – increasingly 3) around – approximately 4) introduced – represented 5) constructed – built 6) advances – achievements 7) heavy – severe 8) same – similar

Ex.3

1 – growth 2 – accessibility 3- remarkable 4- perhaps 5- reliably 6 – former 7- community

8. - obvious 9 – in fact 10- feature

Ex. 6

1-b 2-b 3-a 4-a 5-b 6-c 7-c 8-a 9-c 10 -a

Ex. 7

1-a 2- c 3-b 4-d 5-e 6-g7-i 8-h 9-10 –f-j

Ex. 8

1-2 in/down 3-off 4-on 5-off 6-on 7-away 8-9 off/on 10 -up

UNIT 6. DAM SAFETY

Ex. 1

1 – T; 2 – F 3 – T; 4 – F 5 – T; 6 – T; 7 – F ; 8 – F ; 9 – T; 10 – F

Ex. 2.

1 – sedimentation; 2 – legislation; 3 – seepage; 4 – to impound; 5 – curvature, flexure; 6 – grouting; 7 – failure; 8 – to expand; 9 – remedial; 10 – indefinable; 11 – reservoir 12 – agreement

Ex. 3

1 – maintenance; 2 – inspection, inspector; 3 – assessment, assessor; 4 – failure; 5 – behavior; 6 – location; 7 – expansion; 8 – analyses, analyzer; 9 – indicator; 10 – standardization; 11 – interpretation, interpreter; 12 – owner.

Ex. 4

1 – dam safety; 2 – dam behavior; 3 – the instrumentation readings; 4 – grout curtain; 5 – decreases; 6 – remedial grouting; 7 – plots; 8 – assessing; 9 – failure event tree; 10 – continuous real time monitoring.

Ex. 5

1. The key aspects of the dam safety are maintenance, monitoring, inspection, risk assessments and legislation.
2. The instrumentation readings enable to understand the dam behavior.
3. The seepage rates increased rapidly on the first impounding.
4. The flexure of the dam can cause a foundation crack.
5. The sedimentation decreases the seepage rates.
6. An extensive program of remedial grouting can be the only solution of the problem.
7. Recent plots show the increase of expansion rates.
8. The assessment of the dam safety can be done by risk analyses.

9. We can assess the likelihood of detecting potential failure with the help of failure event tree.

10. Recently there are many dams with the continuous real time monitoring around the world.

Ex. 6

1 – a; 2 – b; 3 – a; 4 – b; 5 – b; 6 – a; 7 – b; 8 – b; 9 – b; 10 – a.

Ex. 7

1 – success (noun); 2 – have relied (verb); 3 – different (adjective); 4 - Actions (noun); 5 – apologized (verb); 6 – identification (noun); 7 - understandably (adverb); 8 - divisive (adjective); 9 – decisively (adverb); 10 – beneficial (adjective).

Ex. 8

1) to go into; 2) to go about it; 3) went at; 4) go along; 5) went back on; 6) go down; 7) went down; 8) go easy on; 9) go so far; 10) go round.

UNIT 7. GREEN CONCRETE. THE FUTURE OF SUSTAINABLE CONSTRUCTION

Ex . 1

1F, 2T, 3F, 4T, 5T, 6F, 7F, 8T, 9F, 10T

Ex. 2

1. ordinary **regular** **2.** include **incorporate** **3.** ingredient **component**

4 generally **broadly** **5.** protect **conserve** **6.** identical **similar**

7. find **discover** **8.** reckon **imagine** **9.** enormous **vast**

10 acceptable **suitable** **11.** damage **pollution** **12.** firm **stable**

Ex . 3

a) depleted empty **b) huge** very large **c) common** well-known **d) produce** make

e) purpose aim **f} form** sort **g) shrink** shorten **h) result** outcome **j) normal** usual

i) require need **j) save** spare **k) change** variation

Ex.6.

1B2A 3C 4A 5C 6C 7B 8B 9C 10A 11C 12A 13B 14C 15B

Ex.7.

1) remission **2)** emittance **3)** mission **4)** emission **5)** emissive **6)** emitted

7) admission **8)** transmit **9)** emitting **10)** emit

Ex .8

1. tidy (clean up) **2.** (equal (add up to) **3.** test (try smth out) **4.** organize (set up)

5. cancel (call smth off) **6.** separate (come apart) **7.** discover (find out)

8. return (get back) **9.** proceed (go ahead) **10.** escape (break out)

UNIT 8. HOOVER DAM

Ex.1

1.-T, 2.-F, 3- F, 4-F, 5-F, 6-T, 7-T, 8-F, 9-T, 10-F

Ex.2

1-although, 2-mankind 3-reach, 4-also, 5-investigations, 6-several, 7-extend, 8-title,
9-sites, 10-number, 11-retain, 12-near

Ex.3

1-c, 2-a, 3-d, 4-f,5-g, 6-b, 7-e, 8-h, 9-I, 10-m, 11-k, 12-l

Ex.6

1-land,2-might, 3-hottest, 4-area, 5-comes, 6-make, 7-reduce

Ex.7

1-system, 2-drainage area, 3-basin, 4-ecosystem, 5-pollutes,
6-gases, 7-gaseous,8-carbonate, 9-carbon, 10-pollution

Ex.8

1 come up with 2 slows down 3-go on with, 4-make up for, 5-die out, 6-make up,
7 find out, 8-goes back, 9-get out, 10-taken up

UNIT 9 PART 1. BOULDER DAM DESIGN

Ex. 1.

1T2T 3T 4F 5T 6F 7F 8T

Ex.2

1 meet - encounter 2 decision – solution 3 experimental – tentative 4 approve – adopt
5 numerous – multiple 6 assessment – estimate 7 exclude – eliminate 8 preserve –retain
9 define – determine 10 expediency – feasibility 11 allocation – appropriation
12 through - via

Ex. 3.

Ошибочные варианты: coster, supplition

UNIT 9. PART 2. BOULDER CITY AND PRE-CONSTRUCTION

Ex .1.

1T 2T 3F 4F 5F 6T 7T 8T 9F 10F

Ex. 2

1. preparatory work
2. equipment
3. required
4. formed
7 several
8 to transport
9 necessary
10 accelerate

5 construction
6 permanent
11 workers
12 schedule

Ex. 3.

1 d 2 k 3C 4L 5E 6J 7B 8H 9F 10G 11A 12I

Ex. 6

1B 2C 3A 4A 5C 6A 7B 8C

Ex. 7

1. until
2. execution
3. effective
4. essential
5. consider
6. impact
7. availability
8. inconvenience

Ex. 8.

1.Fall-out 2. Up 3. Off 4. Black-out 5. On
6. Break-through 7 Out 8 Out 9 Out 10 Up

UNIT 10. CONSIDERATION OF WATERFRONT SPACE USE BY THE SISTER CITIES

Ex. 1.

1. T 2. F 3. F 4.T 5. F 6. T 7.T 8. F 9.F 10. F

Ex. 2

1. humanity humankind 2. neighbourhood district 3. considered regarded 4. Severally respectively 5. expand extend 6. suburban residential 7. enter access 8. overflow flood 9. valuable beneficial 10. tightly densely 11. continual constant 12. affect influence

Ex. 3

A 1. regarded c) considered 2. determine h) define 3. attract a) engage 4. develop j) expand 5. urban b) civic 6. benefit g) profit from 7. concept k) idea 8. representative d) typical 9. viewpoint f) standpoint 10. vehicle j) means of transport 11. quarter e) square 12. cityscape i) townscape

Ex. 6

1 – C, 2 – A, 3 – A, 4 – B, 5 – A, 6 – A, 7 – C, 8 – C, 9 – B, 10 – A, 11 - B, 12 – A, 13 – B, 14 – C, 15 – C.

Ex. 7

1 – b, 2 – j, 3 – a, 4 - d, 5 - f, 6 – c, 7 – e, 8 – g, 9 - i, 10 - h

Ex. 8

1 – out, 2 – out, 3 – round, 4 – off, 5 – across, 6 – out, 7 – out, 8 – through, 9 – over

СПИСОК ЛИТЕРАТУРЫ

1. Гидротехническое строительство. Журнал ISSN 0016-9714

2. Михельсон Т.Н. Успенская Н.В. Практический курс грамматики английского языка. 1995. 250 с.

3. Фортов В.Е., Федоров М.П., Елистратов В.В. Гидроэнергетика после аварии на Саяно-Шушенской ГЭС. Научно-технические ведомости СПбГПУ. Наука и образование. №3, 2011. С.17-27.

4. Collins Cobuild Dictionary of Phrasal Verbs. Harper Collins Publishers, 2001. 492 p.

5. Journal of Hydraulic Engineering ISSN (print): 0733-9429 | ISSN (online): 1943-7900.

Электронные ресурсы

6. The history of Hydraulics. URL: https://hcsplating.com/history-of-hydraulics/. (20.04.2020).

7. Информационный ресурс «YourDictionary» [Электронный ресурс]/ LoveToKnow, Corp., // - [https://www.yourdictionary.com/]. 1996–2020. – Режим доступа: URL: https:// sentence.yourdictionary.com/ (11.04.2020).

8. Информационный ресурс «English – сборник эффективных методик» [Электронный ресурс]//[http://pcards.hreminder.com]/ – Режим доступа: URL:http://pcards.hreminder.com/24-spravochnye-materialy/80-modal-verbs-exercises.html (11.04.2020).

9. Информационный ресурс «Английский по скайпу» [Электронный ресурс].//Режим доступа: URL:https://s-english.ru (11.04.2020).

10. Информационный ресурс “English Dom” [Электронный ресурс] // [www.englishdom.com]. 2010-2020 – Режим доступа: URL:www.englishdom.com/blog/morfologiya-kovarnye-modalnye-glagoly/ (11.04.2020).

11. Cuffari B. What are the Most Recyclable Materials? [Электронный ресурс]/ Cuffari, B.//AZoCleantech – информационный портал сообщества Clean Technology [https://www.azocleantech.com/]. – 4.05.2016.– Режим доступа: URL:https://www. azocleantech.com/article.aspx?ArticleID=585 (11.04.2020).

12. Zehnder C. «Introduction to Environmental Science: 2nd Edition»[Электронный ресурс]/Zehnder, C.// База учебной литературы Galileo [https://oer.galileo.usg.edu/]. – Режим доступа: URL: https://oer.galileo.usg.edu/cgi/viewcontent.cgi?article=1003&context=biology-textbooks (11.04.2020).

Видеоматериалы

1. Hydroelectricity. URL: https://www.youtube.com/watch?v=q8HmRLCgDAI (20/04/2020).

2. World’s First Hydro-Electric Dam. URL: https://www.youtube.com/watch?v=J6rA-EmZh_U (20/04/2020).

3. How Dams Work. URL: https://www.youtube.com/watch?v=ztM6tL6LtFs&t=4s (20/04/2020).

4. RCC Dam - Teesta Low Dam Stage IV

URL:https://www.youtube.com/watch?v=EBG3CiY7LAI (18/04/2020).

5. Embankment dam

URL: https://www.youtube.com/watch?v=ULPwMghyGLA&t=48s (20/04/2020).

6. MMWD Dam Safety Program

URL: https://www.youtube.com/watch?v=OVCnnsV8k2w

7. Green Concrete – Geopolymer Green Concrete (11/04/2020).

URL: https://www.youtube.com/watch?v=vPZ8cGher7I

8. Building the Hoover Dam. URL: https://www.youtube.com/watch?v=n9Gy_1Ppw5U&t=14s (20/04/2020).

9. Hoover Dam. URL:https://www.youtube.com/watch?v=UVBb_c0P7sk (20/04/2020).

10. Boulder City Nevada

URL: https://www.youtube.com/watch?v=KjtcBT-jTgM (20/04/2020).

11.Top 10 Osaka Attractions URL:https://www.youtube.com/watch?v=K1y4V6EMZlE (10/04/2020).

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VINGT-CINQUIÈME CONGRÈS DES
GRANDS BARRAGES

Stavanger, juin 2015

COST EFFECTIVE SOLUTIONS FOR SMALL DAM DESIGN AND CONSTRUCTION: THE PINE BROOK DAM CASE STUDY

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UNITED STATES OF AMERICA

1. INTRODUCTION

The design/build approach has been successfully used to expedite the design and construction process of many heavy civil engineering projects, including bridges, highways, and multi-story buildings. One of the first applications in U.S. dam construction was for the Pine Brook Water District (Pine Brook), a small water district located 4 km northwest of Boulder, Colorado with only 400 customers. Pine Brook sought to build a dam within the boundaries of their district with an extremely aggressive schedule and a limited budget. Given these schedule and budget constraints, Pine Brook believed the best way to design and construct a planned roller compacted concrete (RCC) dam was to use the design/build process.

To meet these challenges the design/build team implemented a design process which involved the owner, designer, and contractor at the earliest phases of the project. This included the geotechnical aspects, flood hydrology, RCC mix design, dam layout, seepage cutoff and collection, outlet works, spillway, instrumentation, and even aesthetics. By working as an integrated team all parties were able to quickly address design issues, minimize costly studies and evaluate multiple alternatives. More importantly, the design/build team was able to expedite the schedule and begin construction 8½ months after initiation of the design process.

Because the Colorado State Engineer's Office (the local regulatory authority) regulatory review process for dams is not structured to allow for the review of preliminary designs at intermediate levels of completion, which is essential to the success of the traditional design/build approach, the design/build team worked closely with the Colorado State Engineer's Office to expedite the review process within their regulatory framework and to address their concerns concurrently with the design effort. No other regulatory review was required for the project, which greatly simplified the process.

This approach resulted in an overall schedule (both design and construction) of only 18 months to complete the 28,000 cubic meter RCC Pine Brook Dam and place it into service. The total cost of the project was $4.5 million (USD), which is a savings of approximately 40 percent as compared to the design/bid/build approach.

This paper describes our implementation of the design/build approach for dam construction, identifies areas where we felt it offered significant advantages, and provides suggestions to improve the process with subsequent design and construction efforts.

2. BACKGROUND

Pine Brook Dam is a new dam built to store raw water for treatment and subsequent municipal use by the customers of the Pine Brook Water District. The dam is a roller-compacted concrete (RCC) structure 26 meters high at its maximum section and 180 meters long along its crest. It retains approximately 123,000 cubic meters of water in a reservoir with a surface area of approximately 1.4 hectares.

The dam is located near Boulder, Colorado, USA (see Fig. 1 and 2) on Two Mile Creek. Because of its height and proximity to residences, Pine Brook Dam is classified as a "high-hazard" dam.

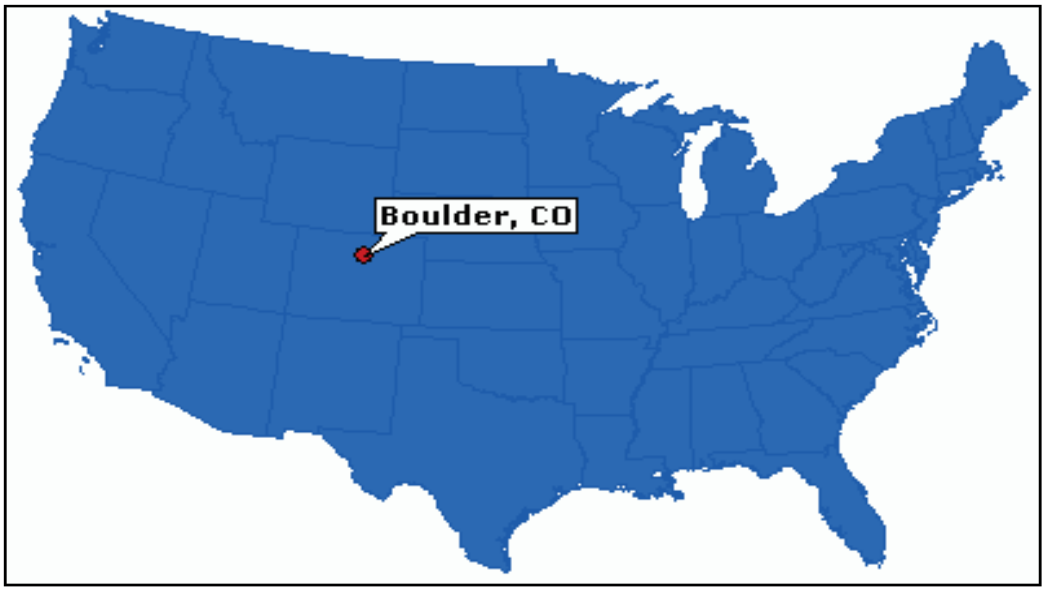

Fig. 1 Project Location, Boulder, Colorado, USA

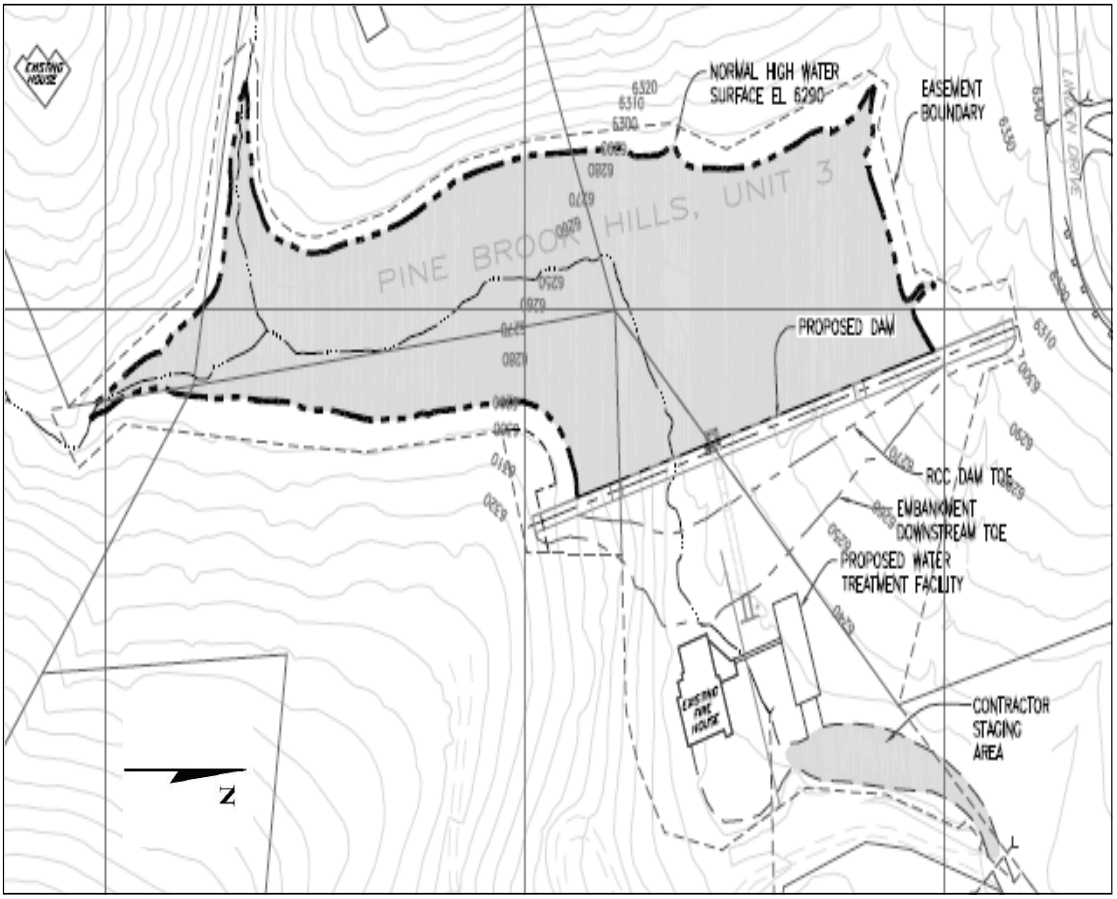

Fig. 2. Pine Brook Dam Site Plan

3. NEED FOR PROJECT

Since 2002, Colorado has suffered from severe drought conditions and the Pine Brook Water District lost their surface water source on Four Mile Creek several times since the start of the drought. The most recent loss of water was a nearly 2 month stretch in August and September 2005. Prior to construction of the dam and reservoir, Pine Brook had only enough storage for four to five weeks. After completion of the dam, Pine Brook now has a full year's storage capacity when the reservoir is full.

The Pine Brook Water District was formed in the 1960s to provide treated water to residents of the Pine Brook subdivision. Located outside the city limits of Boulder, the Pine Brook subdivision is at an elevation above that at which the City of Boulder provides water service. Because of the inability to receive water from the City of Boulder, Pine Brook is allowed to divert water from Four Mile Creek at Four Mile Canyon, a tributary of Boulder Creek, approximately 3 km west of the reservoir. The diverted water is pumped to Sunshine Canyon and then to Pine Brook Hills with an elevation gain of approximately 300 meters. Water from this pipeline is used to fill the reservoir.

Runoff also fills the reservoir in the spring and summer months. The reservoir is slowly drained in the fall and winter months as the water is used. Demand from the reservoir averages 0.75 to 1.0 cubic meters per minute, with peak flows of 3.5 cubic meters per minute required to flush the water treatment plant for short intervals.

4. SELECTION OF DESIGN / BUILD APPROACH

Because of aggressive schedule and budget constraints, Pine Brook determined that the design/build approach would be the most advantageous to complete this project. Pine Brook selected ASI Constructors, Inc./AECOM as the design/build team to accomplish this project, which is believed to be the first formal design/build dam project in the U.S.

The project began in January 2005, and involved the owner (Pine Brook), engineer (AECOM), and contractor (ASI Constructors, Inc.) from the beginning. Representatives from the owner, engineer, and contractor all attended and participated in regular meetings where key design elements were posed, debated, studied, evaluated, and refined. Issues such as RCC design strength, foundation issues, auxiliary and service spillway configurations, outlet works and other elements were discussed and resolved. Out of these meetings the project and its features took shape, and the design progressed until it was finalized in June 2005.

5. PROJECT DESIGN FEATURES AND INNOVATIONS

5.1. SITE GEOLOGY

The bedrock underlying the Pine Brook Dam and Reservoir area consists of the Boulder Creek granodiorite. This light grey, granite-like Precambrian rock is a medium-grained granodiorite to quartz monzonite and is weakly to strongly foliated.

On the north (left) abutment, the borings indicated that a 2 to 8.5-meter- deep surface layer of colluvium overlies weathered and fractured granodiorite. The colluvium consists of clayey sand of loose to medium density mixed with silt and some gravel. In some areas, the colluvium exhibits remnant bedrock structuring. The underlying weathered granodiorite is low strength, with an average unconfined compressive strength of intact rock of 40 to 50 MPa. This weathered zone extends 7.5 to 13 meters below the surface. Relatively fresh (less weathered) granodiorite underlies the weathered zone. Tests on core samples of intact rock show the fresh granodiorite to be of medium strength, with an average unconfined compressive strength of 70 to 80 MPa.

At the center of the valley, a shallow surface deposit of alluvium and/or colluvium adjoins the creek bed. It consists of clayey sand and gravel. The thickness of this layer varies from less than 1 meter to 5.5 meters. The weathered bedrock zone underlies the alluvial deposits and continues down to a depth of approximately 12 meters, where the fresh granodiorite is encountered. The surface colluvium on the steeper south (right) abutment is relatively shallow – about 1.2 meters thick. There are scattered outcrops of the weathered granodiorite in this area of the proposed dam footprint. The weathered rock zone is also shallow, extending to 2.7 meters below the ground surface.

Historically, the area surrounding the proposed Pine Brook Reservoir site has been minimally affected by seismic activity. The largest occurred on November 7, 1882, west of Fort Collins, Colorado. Its estimated magnitude is 6.6. A series of man-induced earthquakes began near Commerce City (approximately 32 to 48 km south-east of the Pine Brook Dam site) during the mid-1960s. The design/build team determined that a Peak Ground Acceleration (PGA) of 0.20g delivered from a 7.0-magnitude earthquake at a distance of 35 km should be used for seismic analysis of the Pine Brook facilities. These parameters are considered very conservative.

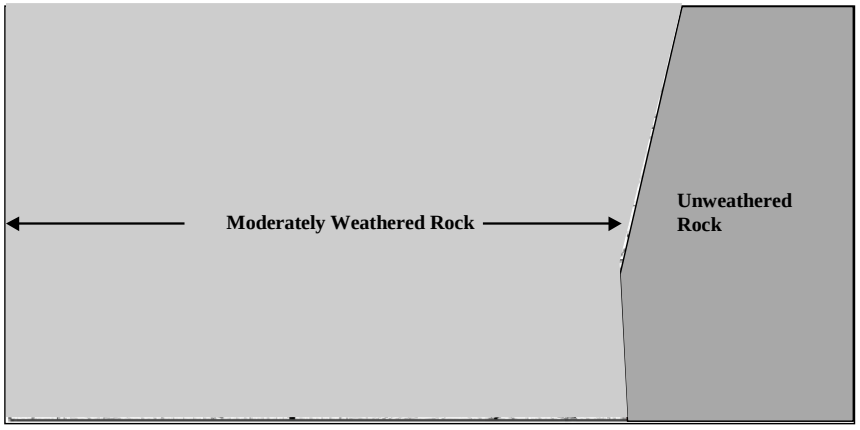

Fig. 3. Generalized Site Geology

5.2. RCC AND EMBANKMENT FILL STRUCTURE AND SPILLWAYS

Pine Brook Dam is an RCC gravity structure with a vertical upstream face and a downstream face of 0.75H:1V (horizontal:vertical). The downstream face of the dam is covered with embankment fill material, which serves as a protective cover of the RCC material. Between the RCC gravity structure and the embankment fill material is a chimney drain that is filter compatible with the embankment fill and collects and safely conveys any seepage through the RCC gravity structure. The chimney drain connects to a blanket drain, consisting of the same material. Seepage PVC collection pipes are installed within the drain material at the downstream toe of the RCC gravity structure, which collect and safely convey seepage water through the RCC gravity structure and foundation material. The outfall of this drain is located on the left and right sides of the service spillway stilling basin located at the downstream toe of the embankment fill (see Fig. 8).

The dam is designed to safely pass the inflow design flood (IDF) equal to the probable maximum flood (PMF) event. The service spillway crest is elevation 6290 (feet), the auxiliary spillway crest, which also corresponds to the top of the parapet wall in the overflow section, is elevation 6295, and the maximum water service elevation during PMF event is elevation 6297. The upstream parapet wall is designed to concentrate the overflow during the IDF to the central 88 meters of the dam crest. This central section is called the ‘auxiliary spillway’ section and is designed to safely pass 115 cubic meters per second of flow. In the non-overflow section the top of the parapet wall is elevation 6297.5, providing 150 mm of freeboard.

Appurtenant structures include a service spillway riser structure at the upstream face and concrete conduit through the dam with an energy dissipater at the downstream end. An uncontrolled drop-inlet service spillway, located near the center of the dam (within the "central section" – see Fig. 7), has been provided to pass normal flood flows up to 14 cubic meters per second before operation of the auxiliary spillway and up to 36 cubic meters per second during the full PMF event. Analysis determined that, along with appropriate seepage cutoff and control measures, a drainage gallery would not be required as the dam would be stable under full uplift conditions during the PMF event.

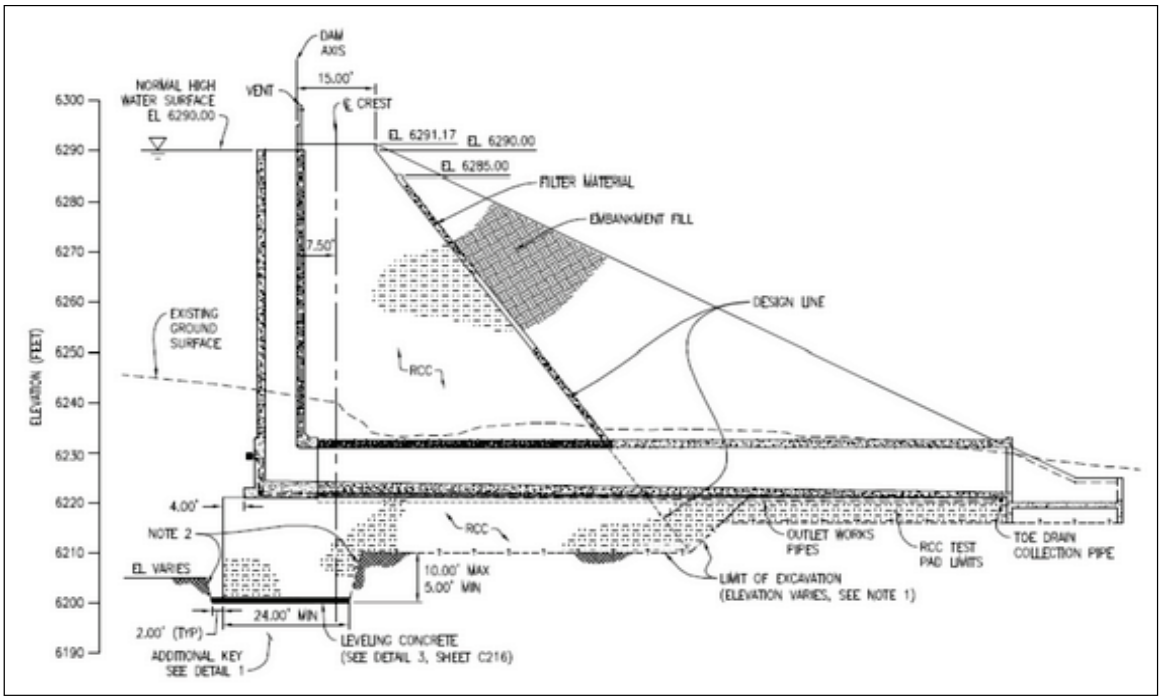

Fig. 4. Pine Brook Dam Cross Section at Service Spillway

Initial filling of the reservoir was initiated in June 2006, and approximately six months after initial filling begin the downstream face of the RCC structure was covered by a 300 mm wide zone of drain material consisting of C33 sand and an embankment fill (soil cover) with an outer slope of 2H:1V. The design/build team wanted to place the embankment fill without restrictions after the RCC placement was completed, but reached this six-month delay compromise with the State Engineer's Office because they wanted to visually inspect the downstream face of the RCC during initial filling. The downstream embankment fill was not incorporated into the structural design of the dam but was important for economic, environmental and aesthetic purposes. A chimney drain was constructed at the RCC/embankment interface to collect, control and monitor any seepage through the RCC structure. The RCC structure is founded on moderately weathered bedrock. A 1.5 to 3-meter-deep and 0.3-meter-wide "key" (see Fig. 4) was built into the weathered bedrock below the base of the RCC structure as a seepage cutoff. The downstream face of the RCC structure is unformed RCC and the upstream face is a 3000 mm thick conventional concrete facing.

Fig. 5 and 6 show the downstream face of the dam during RCC construction and after placement of the downstream embankment fill (protective soil cover) with the grass vegetation established, respectively. In the event of operation of the auxiliary spillway the embankment fill material will likely be eroded. In this event, the owner will be responsible for replacement of the embankment fill material.

Cost Savings**:** The removal of the drainage gallery and the removal of conventional concrete as the downstream RCC structure facing and instead using embankment fill as a protective cover for the RCC structure is estimated to have saved the project approximately $1,400,000.

Fig. 5. Downstream Face During RCC Structure Construction


Fig. 6. Downstream Dam Slope with Grass Vegetation - Post Construction

5.3. RCC MIX DESIGN

Stability analyses indicated that an RCC mix design with an ultimate unconfined compressive strength of 10 MPa, tensile strength of 0.5 MPa, and cohesion of 2 MPa would meet all stability and factor of safety requirements for concrete dams designed and constructed in Colorado.

Historically, RCC designs for dams are higher than these values. In the case of the Pine Brook Dam, the upstream face consists of a conventional concrete facing element and the downstream face will be covered with a protective embankment fill cover. As such, the design/build team concluded that an RCC mix with an ultimate unconfined compressive strength of 10 MPa was appropriate and would meet the long-term durability, stability and factor of safety requirements. Grout-enriched RCC was seriously considered as an alternate upstream face material but was judged by the design/build team to be too difficult to control and the risk of freeze/thaw damage was unacceptable.

The selected RCC mix consisted of 55 percent on-site-crushed coarse aggregate, 45 percent imported fine aggregate (Class 4), 95 kg/cubic meter of Type I/II cement, 60 kg/cubic meter of fly ash, and 140 kg/cubic meter of water. The design/build team quickly concluded that an RCC design based on lower design strengths and a conservative cross-section would provide flexibility in aggregate selection and proportions. Pine Brook's concerns and permit restrictions made on-site aggregate development for the RCC very attractive, though not necessary. Space and budget concerns led to simple on-site crushing of locally available rock that produced a minimal coarse aggregate with a maximum diameter of 75 mm that was blended with commercially-produced, imported Class 4 fine aggregate.

After testing the initial RCC mix, the design/build team increased the cement and fly ash contents slightly to provide greater insurance against the known variability of the crushed coarse aggregate product.

Cost Savings: The reduction in the RCC strength and the use of a broad gradation for the coarse aggregate is estimated to have saved the project approximately $300,000.

5.4. NON-OVERFLOW SECTION

The non-overflow section of the dam consists of a vertical upstream concrete face, a 1-meter-high parapet wall, a crest width of 4.5 meters, and a 0.75H:1V RCC downstream face covered by the embankment fill with a 2H:1V downstream slope.

5.5. AUXILIARY SPILLWAY SECTION

The auxiliary spillway (central) section has a crest elevation of 6295 and is similar to the non-overflow section with a 1-meter-high parapet wall and a 4.5 meter

wide crest. The auxiliary spillway crest is 88 meters long. No stilling basin for the auxiliary spillway was designed. Though turbulent flow conditions are expected at the dam toe, foundation erosion or undermining is not expected. Stability analyses demonstrated that the dam will be safe for the PMF event without the embankment fill. As previously stated, in the event of the operation of the auxiliary spillway the embankment fill would likely erode and be transported downstream and the owner would be responsible for replacing the embankment fill material onto the downstream face of the RCC structure. Analysis showed that, while some erosion and scour would occur at the toe of the RCC structure, the relatively short duration of the controlling PMF event (peak flows were anticipated to occur for less than 8 hours) would not cause sufficient damage to destabilize the dam.

A 2-meter-wide by 150-mm-deep low-flow notch was constructed in the top of the auxiliary spillway parapet wall to focus low flows through the spillway at one location so they can be more easily identified and channeled into the area of maximum embankment fill on the downstream face of the dam.

Cost Savings: The use of an auxiliary spillway that safely overtops the dam without training walls and a stilling basin is estimated to have saved the project approximately $500,000.

5.6. SERVICE SPILLWAY

The service spillway is a drop-inlet concrete structure founded on RCC and anchored to the upstream face of the dam. The service spillway safely passes flood flows up to a return interval of approximately the 500 year flood through the RCC structure and embankment fill to an energy dissipation structure at the downstream toe. The flow area of the drop inlet and shaft portion of the service spillway is 1.5 meters by 2 meters. The horizontal conduit from the shaft through the dam is 2 meters by 2 meters and is constructed with cast-in-place concrete with a wall thickness of 450 mm. It has a slope of 1.5 percent. The conduit is designed to discharge service spillway flows as open-channel flow up to 14 cubic meters per second before operation of the auxiliary spillway initiates. During the PMF event, the service spillway is designed to pass flows of approximately 36 cubic meters per second.

Fig. 7 and 8 show the inlet crest and stilling basin of the service spillway during operation in 2013.

Cost Savings: The use of a drop inlet service spillway instead of passing flows up to the 500 year return interval flood over the crest of the dam (requiring extensive erosion protection measures) is estimated to have saved the project approximately $250,000.

Fig. 7. Service Spillway Crest During Operation in 2013

Fig. 8. Service Spillway Stilling Basin During Operation in 2013

5.7. OUTLET WORKS

The outlet works consist of the following:

- An emergency drawdown pipe 300 mm in diameter with a 300 mm butterfly valve and a screen to prevent debris from entering the pipe is attached to the upstream dam face adjacent to the service spillway shaft at elevation 6225. A 300 mm gate valve is located within the service spillway conduit to permit maintenance activities on the butterfly valve. The butterfly valve is operable from the crest of the dam for emergency drawdown of the reservoir and the gate valve is operable from inside the service spillway conduit. Discharge from the outlet works is directly into the service spillway conduit approximately 3 m from the upstream face of the RCC structure.

- Two 150-mm-diameter stainless steel pipes are attached to the service spillway shaft with gate valves at the downstream end of the pipes. These pipes discharge directly to the water treatment plant located at the downstream toe of the dam. There are no upstream guard gates installed for the outlet works.
- Inlet screens are installed at each intake on the upstream face of the RCC structure.
- The outlet works are encased in concrete in the service spillway shaft and 2 meter by 2 meter conduit that penetrate the RCC structure and discharge at the downstream toe of the embankment fill.
- The outlet works are controlled from downstream valves located within the treatment plant downstream from the dam.

5.8. FOUNDATION PREPARATION

Foundation preparation and treatment under the dam consisted of the removal of all overburden material and the highly-weathered bedrock; removal of rock overhangs; shaping of rock foundation; rock cleaning; and dental concrete treatment of cracks and cavities in the rock foundation. In the central valley section and along the left abutment, the depths of weathered rock excavation varied between 0.5 meter and 3 meters. In the right abutment section, the depth of weathered rock excavation was less than 1.5 meters.

No foundation drain holes or grouting were designed for this dam. The structure was designed to resist full hydrostatic uplift, so it was not necessary to install foundation drain holes to relieve uplift pressure. Seepage through the dam foundation drains to the downstream side of the dam and is collected through a drainage system as described in section 5.2. While all dam foundations have some level of seepage, excessive seepage can be a problem and can lead to failure. Modeling results predicted that the seepage through the foundation of the Pine Brook Dam should be too minor (approximately 35 to 55 liters per minute) to erode or damage the rock foundation or lead to dam failure. Actual seepage rates have been much lower, with a high of 1 liter per minute and a low of less than 0.1 liter per minute. Seepage has gradually decreased over time.

As with most new dams, the foundation can pose one of the greatest design and construction risks. The design plan included excavation of the foundation in stages to identify stable foundation material and determine the refusal point for the cutoff key to minimize seepage. This approach could have cost significantly more time and money if it had not been anticipated in the design and planned for during the excavation phase. The ability to plan for this approach was a significant benefit to the design/build process. It also eliminated a considerable interim design phase that would have involved additional foundation exploration.

Cost Savings: Founding the dam on moderately weathered bedrock and removing the grout curtain and foundation drains are estimated to have saved the project approximately $550,000.

Fig. 9. Moderately Weathered Bedrock Foundation and Seepage Cutoff Key

5.9. EEPAGE CONTROL

The *following* provisions were made in the design to control seepage through the RCC:

- Continuous RCC placement allowed for adequate lift bonding and minimized cold joints between RCC lifts. Special cold joint treatment was used when the next RCC lift was not placed within 12 hours, and at the designed cold joint locations. Cold joints were designed for the following locations: at the top of the leveling concrete pad, at the bottom of the concrete encasement of the service spillway conduit, and at the concrete encased water supply pipe.
- Crack-control notches were constructed on the entire upstream and downstream face of the RCC structure to control crack formation on each side of the RCC contraction joints.
- RCC contraction joint locations were adjusted upon completion of the excavation based on the bedrock topography and major grade breaks encountered. A total of six contraction joints were initially planned, but a total of eight contraction joints were eventually installed.

5.10. INSTRUMENTATION

The instrumentation plan for the dam consists of two new permanent bench marks, new brass survey caps, and new standpipe piezometers in the RCC. The new permanent bench marks are concrete monuments founded in bedrock in the right and left abutments above the dam.

These bench marks will be used for future surveys of the dam. Brass caps were drilled and grouted on the non- overflow dam crest and the auxiliary spillway crest to monitor future movements of the structure.

6. STATE ENGINEER'S OFFICE REVIEW

Throughout the design process, regular meetings were held between the design/build team and the State Engineer's Office to discuss the progress of the design and to update the anticipated design completion schedule and review period required by the State. The review process was completed at the end of August 2005 and comments by the State Engineer's Office were received and incorporated into the design by mid-September 2005.

The design of the Pine Brook Dam was initiated in January 2005 and completed in June 2005, when it was submitted to the Office of the State Engineer for review and comment. In July 2005, prior to the State Engineer's approval, excavation activities were initiated and were completed in August, prior to project approval. Comments from the State Engineer's Office were received the last week of August and changes were incorporated and resubmitted on September 15. Authorization for dam construction was received from the State Engineer's Office on September 22, 2005.

The cooperation of the State Engineer's Office in reviewing the plans and specifications in an expedited manner was an essential component to the success of this project. The State Engineer's Office worked in concert with all parties to resolve design issues and find solutions to concerns raised by the design/build team and by the State Engineer's Office. The design agreed to by the State and the design/build team met the goal of all involved, which was to have a safe and reliable dam that the Pine Brook Water District customers could rely on well into the future.

7. CONSTRUCTION

The project was approved for construction on September 22, and permanent concrete placement for the dam began the next week. In order to immediately cover and protect the moderately weathered bedrock anticipated at the left abutment, a top-down construction method was initiated at the left abutment. Excavation of the left abutment began near the crest elevation, continued down to the valley bottom and was then immediately covered with abutment concrete for protection. The seepage cutoff key was excavated simultaneously. The relatively flat slopes of the left abutment (as flat as 5H:1V in places) also allowed for this excavation method.

The right abutment, which was comprised of less weathered bedrock than the left abutment, was also exposed, but abutment concrete was placed concurrent with RCC placement.

RCC placement began the last week of October 2005 and continued until the first week of December when RCC construction was suspended due to cold weather. RCC placement began again in mid-February 2006 and was completed in mid-April

2006. The outlet works and the service spillway tower and conduit were constructed during the cold weather suspension of RCC placement.

8. COST SAVINGS

Balancing cost-effectiveness with the need for a safe structure is always a challenge. However, the design/build team was able to focus on several areas and achieve cost savings without jeopardizing safety.

- The owner and contractor shared the cost liability equally on items such as foundation excavation, construction scheduling, etc. in order to remove "buffers" in the construction budget that were based on unknowns. The owner, engineer and contractor worked together to keep tighter control of the construction budget and achieve cost savings.
- The owner was willing to maintain a relatively flexible working schedule to optimize construction efficiency. When cold weather limited RCC production and placement, the suspension of RCC production until warmer weather resulted in a more efficient RCC production rate and overall cost savings.
- The engineer reviewed and responded to requests for information and change orders extremely promptly (sometimes in less than an hour) to keep construction schedules on track and minimize downtime.
- The entire design/build team worked together and took equal ownership of the project. The understanding that this project was the responsibility of all involved created an atmosphere of trust. No one entity tried to take advantage of the situation; rather, the design/build team created a mutually beneficial environment.

The total project cost (engineering and construction) for the design and construction of the Pine Brook Dam was approximately $4.5 million. It is believed the design/build approach reduced the overall cost of the project by approximately $3 million, which is a reduction in costs of approximately 40 percent. These savings were achieved in the following areas.

Table 1. Cost Savings

Item	Savings
Gallery Removal	$200,000
Downstream Embankment Fill	$1,200,000
RCC Mix Design	$300,000
Removing Training Walls and Stilling Basin from Auxiliary Spillway	$500,000
Drop Inlet Spillway	$250,000
Founding on Moderately Weathered Bedrock	$250,000
Removal of Grout Curtain and Foundation Drains	$300,000
Total Savings	**$3,000,000**

9. POST CONSTRUCTION PERFORMANCE

While designing and constructing economical projects is indeed important, the long-term safe performance of high-hazard dams is even more important. The failure of any high-hazard dam has the potential to kill downstream residents, and this is indeed the case below Pine Brook Dam, which has thousands of residents in north Boulder, living within 3 km downstream of the dam.

In September 2013, a large storm system struck eastern Colorado, dropping over 43 cm of rain in the Boulder area. The rainfall event was estimated to be a 1,000-year storm and the resulting rainfall produced flooding that varied between the 100-year and 500-year return interval events. Pine Brook Dam is located in the area of most significant rainfall activity as shown on Fig. 10.

At its peak, flood flows through the service spillway at the Pine Brook Dam were estimated to be approximately 10 cubic meters per second or 2/3 of its capacity before the dam's auxiliary spillway crest is overtopped. Visual observations of the dam indicated that the reservoir elevation peaked at approximately 45 cm below the crest of the auxiliary spillway.

A visual observation of the dam by both the design engineer and the Colorado State Engineer's Office, along with a structural survey several weeks later, indicated that no movement or damage occurred with any of the features of the dam. This was considered strong and compelling evidence that the cost savings measures implemented at the Pine Brook Dam project did not fundamentally increase its risk of failure or reduce its performance during unusual flood loading events.

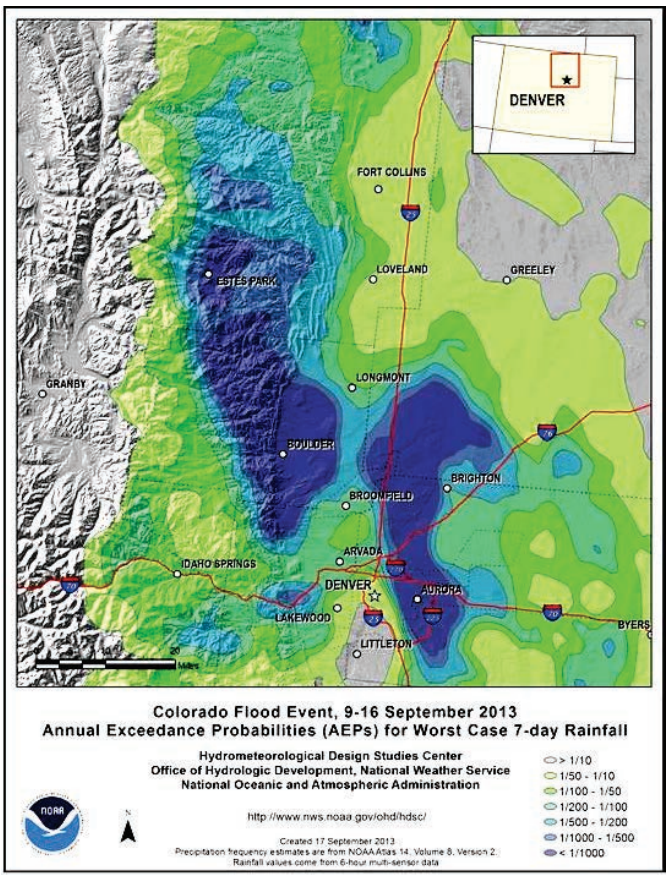

Fig. 10 September 2013 Flood, Rain 7 Day Rainfall Map

10. CONCLUSIONS

Under the right circumstances, the design/build approach can offer significant cost and schedule advantages without compromising long-term dam performance. The successful implementation of the design/build approach for a dam project begins with a committed team and includes:

An educated owner who is willing to take calculated risks, become involved in the process early, and continue to provide input and direction where required

- A contractor with expertise in the design and construction practices required who is also creative and understands the design and construction issues associated with dams
- A competent, decisive and resolute dam design engineer who not only involves the owner and contractor in the design process but also welcomes their input when design challenges are identified
- A permitting agency that remains involved through the design process and allows for creative solutions to conventional and unconventional designs

SUMMARY

In the right application, the design/build approach can be a valuable tool for the owner, engineer and contractor to deliver a dam project at considerable savings in both schedule and budget. The Pine Brook Dam case study provides an example of how the design/build approach might be used on future dam projects where budgetary constraints may have made the project unfeasible. The design/build approach was successfully used by the Pine Brook Water District to provide a reliable and affordable water source for its 400 customers.

To accomplish this task, the design/build team implemented a design and construction process involving the owner, designer, and contractor at the earliest phases of the project. By working as an integrated team all parties were able to quickly address design issues, minimize costly studies and evaluate multiple alternatives. More importantly, the design/build team was able to expedite the schedule and begin construction 8½ months after initiation of the design process.

The involvement of the Colorado State Engineer's Office (the local regulatory authority) in the review process at the earliest phases of the project was also a key factor of the project's success. The design/build team worked closely with the Colorado State Engineer's Office to expedite the review process within their regulatory framework and to address their concerns concurrently with the design effort.

This approach resulted in an overall schedule (both design and construction) of only 18 months to complete the 28,000 cubic meter RCC Pine Brook Dam and place it into service. The total cost of the project was $4.5 million (USD), which is a savings of approximately 40 percent as compared to the design/bid/build approach.

THE USE OF NEW SEEPAGE DETECTION TECHNIQUES TO ASSIST IN SAFETY ASSESSMENT AND REMEDIAL WORK

Dr. A.K. HUGHES
Director of Dams & Water Resources, Atkins Ltd, Vice Chairman, British Dam Society

UNITED KINGDOM

1. LEAKAGE

The collections, measurement and analysis of leakage and seepage flows are one of the best indicators of dam performance. Clearly an increase in flows is often an indicator of a worsening situation.

A reduction in flow could also be serious; it might be as a result of a self healing process but equally it could be due to blockage of a drainage system or water being diverted elsewhere.

A drainage flow that suddenly becomes dirty or turbid is obviously a good indicator that some sort of erosion process is taking place. If there is a deposit of clay the situation is perhaps even more worrying.

Historically we have then had to try to establish where the leakage is usually by guess work. We might know where it so coming out; we might be lucky and find out where it is going in; but we usually don't know what is happening in between. We don't know what tortuous path the flow is taking in whether it be through the dam or the foundation or both. Uncontrolled seepage can be a problem if embankment or foundation material is moved by the water flow or when excessive water pressure build-up in the dam or the foundation. Thus the basic problems is trying to dissect whether the seepage is materially affecting a dam and what measures must be undertaken to ensure the seepage does not adversely affect the safety of the dam i.e. monitoring or major invasive remedial works.

2. HISTORICALLY

Many dams in the UK built before and into the 20th Century are largely based on a design experience, rules of thumb, designers' intuition and judgement and sometimes what was copied from the past.

There have been a number of failures due to seepage/piping failures which have caused loss of life; for example Llyn Eigeau in 1925, or extensive damage
e.g. Warmithens.

Failures and accidents continue to happen for a number of reasons including unrecognised foundation conditions, poor design, inadequate construction and quality assurance, lack of maintenance and in some cases lack of monitoring systems.

Puddle clay core dams became the norm in the United Kingdom with a central core and cutoff, often through poor and fissured rock down to very low level. There was obviously an understanding that seepage through and under these old dams could be a problem and empirical design rules predominated.

It wasn't until 1856 when Darcy published studies that provided a qualitative representation of flow of fluid through a porous medium that work expanded and adapted to provide some basis for the understanding of the effects of seepage through soil and rock materials.

Perhaps the most important milestone in the design and condition of embankment dams was the Terzagh work of 1925 – Soil Mechanics on a Soil-Physical Basis – 'Erdbaumechamk'.

Now we have understood the principles of seepage control we have been able to design guidelines for filters, developed and designed drainage systems, developed methods and equipment to construct seepage cutoffs and developed instrumentation to monitor seepage – but we still haven't been able to trace leakage until now.

3. EVALUATION AND DETECTION

In many cases it may be very obvious that seepage is damaging the dam, its foundation or both and that remedial action is needed and a decision is required to be made on the type and urgency of remedial measurement. Many of the remedial measures used can be expensive and time consuming.

The process of evaluation will often involve firstly obtaining visual evidence from site as well as talking to those persons with an intimate knowledge of the site**.**

Instrumentation data, from piezometers, observation wells, V-notches etc may have helped with the evaluation of the problem but often the zone of influence of these instruments is very limited.

Investigations may proceed to additional field explorations by drilling, sampling and installation of more instrumentation but this process can be very time consuming and costly. Some geophysical based investigations may also be used – some are better than others in defining seepage paths.

4. REMEDIAL WORKS

Remedial works can include upstream blanketing, diaphragm walls, core replacement, slurry trenches, grouting, filters, new cutoffs, sheet pile walls, downstream berms, drainage, drains and relief wells.

Many of these remedial works can be extremely expensive unless the flow paths are well defined and the remedial works targeted. In many cases significant works have been carried out which have involved grout curtains where holes have been drilled but little grout injected but also where projects have not actually cut off the leakage paths. So the track record is one of mixed success.

5. CASE HISTORIES

Atkins, with its association with Willowstick Technologies in the USA have carried out a significant amount of leakage surveys which have enabled the mapping of preferential seepage paths to be carried out – similar to angiogram on the body – both in two and three dimensions i.e. we can map individual paths both in plan and elevation.

The method used is completely unobtrusive in that an electrode is placed in the reservoir, another in the leakage points and then they are joined together and energised to produce a magnetic field across the dam.

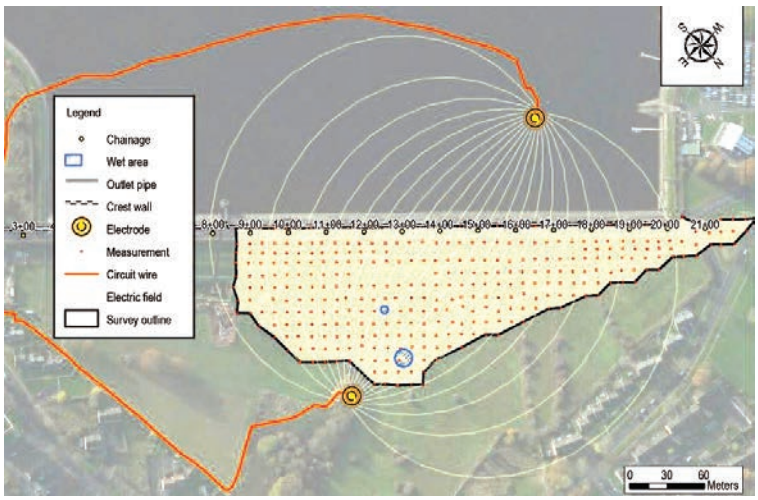

Fig. 1. Survey layout to investigate seepage at a reservoir

The magnetic field is measured on the surface and this includes the earth's magnetic field. In simple terms the magnetic field should be uniform across the surveyed area but it will be disturbed and there will be an increased magnetic field where the water acts as a better conductor than the surrounding soils.

The method has been used to great effect to track individual leakage paths to significant depths (>100 metres) and in some of the recent works done the technique has been 'checked' both before and after projects to validate the methodology by drilling boreholes.

5.1. SHON SHEFFREY

Shon Sheffrey (Siôn Sieffre) reservoir, completed in 1896 in South Wales is impounded by an earthfill embankment with puddle clay core. The dam crest is about 260 metres long, including the main and auxiliary overflow weir crests, with a maximum height above original ground of about 15 metres. The overflow level and the top of the embankment and core wall were raised in 1945–48 by 6ft and 8ft, respectively.

Following a significant amount of seepage observed flowing out of the ground near a bend in the spillway and the tunnel and drainage collection pipes,

Atkins was engaged to undertake seepage study using Willowstick ® geophysical investigation to identify, map and model seepage flow paths.

Atkins was also been contracted to carry out the subsequent detailed design of the remedial works required to stop the leakage considering different suitable options and to prepare contract documents.

Fig. 2 Shon Sheffrey

The concern at Shon Sheffrey was that the flow into the tunnel was known to be carrying fines in the form of clay particles.

A review of all instrumentation was carried out together with a Willowstick survey.

The Willowstick Survey

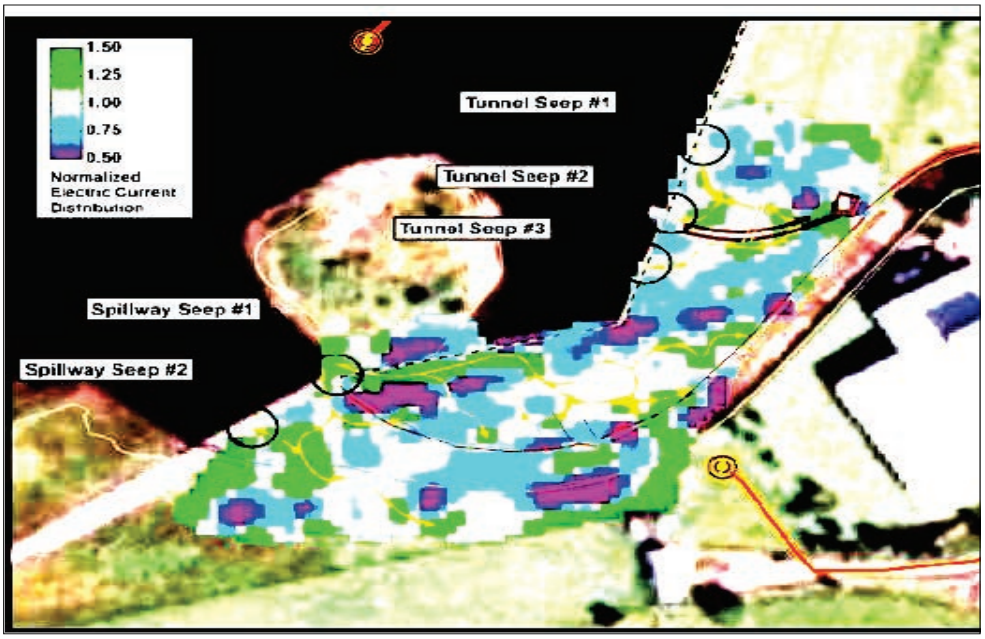

Fig. 3 Modelled Willowstick seepage paths

The Willowstick survey indicated a number of individual leakage paths in the vicinity of the spillway and a number of leakages at the level at which core had been raised.

Fig. 4. Tube-a-manchette grouting works

Leakage into the tunnel was being caused by one or two leakage paths which travelled deep into the embankment and emerged in the tunnel where they had sufficient 'head' to take fines into the tunnel.

A targeted grouting exercise using tube-a-manchette grouting techniques was the preferred remedial option using holes targeted to the known leakage paths at known depths as per the Willowstick survey.

The grouting was carried out and the leakages all stopped. The survey had found no additional areas of leakage, providing the client with the confidence that all seepages had been dealt with. The project value was of the order of £400 K to include the survey and the grouting but without the targeted survey could have been well over £2 M.

5.2. BARTLEY RESERVOIR

The reservoir is retained by an earth embankment with concrete core wall approximately 19.2 metres high and 570 metres long across Sennelley's Brook. The maximum depth of water is 16.35 metres.

The reservoir has a stated capacity of 2,400,000 m^3 and a surface area of 473,000 m^2 when full to its top water level of 184.37 metres AOD.

The reservoir appears to have been completed in 1930. The reservoir has been leaking significantly since its construction.

In the 1930's there was a programme of grouting that used 4254 tonnes of cement and large quantities of ashes and reduced the leakage from 1m gallons to 600k gallons.

In 2010 a Willowstick survey was carried out. The results identified two main leakage paths,

one beneath the centre of the embankment at the location of a known fault

Second beneath the north abutment

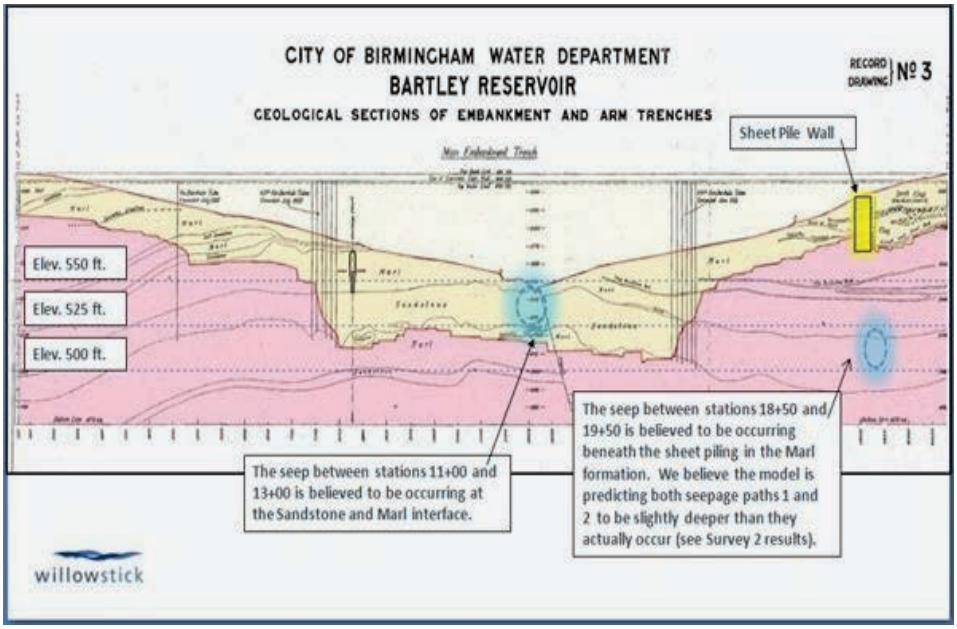

Fig. 5. Results of Willowstick Survey

Atkins carried out initial studies of the embankment leaking sections and has reviewed the outcomes of the Willowstick investigation report to identify the probable sources of seepage observed.

The Willowstick survey identified the exact path of leak through the embankment, which enabled the remedial works to be focused on the affected areas.

As a result of the findings of the investigations grouting was carried out in the four drilled boreholes using TaM technique.

Fig. 6. Drilling & grouting plant

Atkins supervised the grouting works paying particular attention to the amount of grout taken in each port and relating the results to the Willowstick and core analysis exercises.

The owner of the dam wanted to prove the accuracy of the technique and so four boreholes were drilled into the locations identified by Willowstick.

These were subsequently used to install tube-a-manchette pipes and to carry out some limited grouting. The result of this exercise will be used to design a more robust cutoff for the dam in the months to come.

The owners Dams & Reservoirs Manager, Ian Hope, said the following with regard to the Willowstick survey:

"We had a long established leak beneath Bartley Reservoir and sought to locate it with a view to considering options for leak reduction/sealing. We commissioned a Willowstick survey through Atkins, which potentially identified the precise location of two seepage paths. Following expert deliberation and project approval, on the strength of the survey results we drilled four boreholes to prove the location of the seepage paths. The drilling was immediately followed up with trial pressure grouting. I am encouraged to report that the Willowstick survey was sufficiently accurate to track the seepage paths and would have no hesitation in recommending this methodology for similar applications."

5.3. BARRAGE LA COMÉ, BURKINA FASO

Barrage de la Comoé, situated in southwest Burkina Faso provides 38 M m^3 of water storage for irrigation and municipal water supply. It is of central importance to Burkina Faso's sugar cane production as well as presenting a significant risk to vulnerable communities downstream.

Fig. 7. Downstream face of dam

Upon first filling in 1991 significant leakage was observed near both abutments of the 30 m high, 1.2 km long, embankment dam. With increasing leakage flows and settlement on the upstream face the decision was made to pile through the crest of the dam to intercept leakage.

Fig. 8. Leakage flows along the dam toe

A wide range of investigations were used prior to the Willowstick survey including borehole logs, temperature readings and a resistivity survey. With the results to these investigations inconclusive a Willowstick survey was commissioned to detect the exact horizontal and vertical location of the leakage paths.

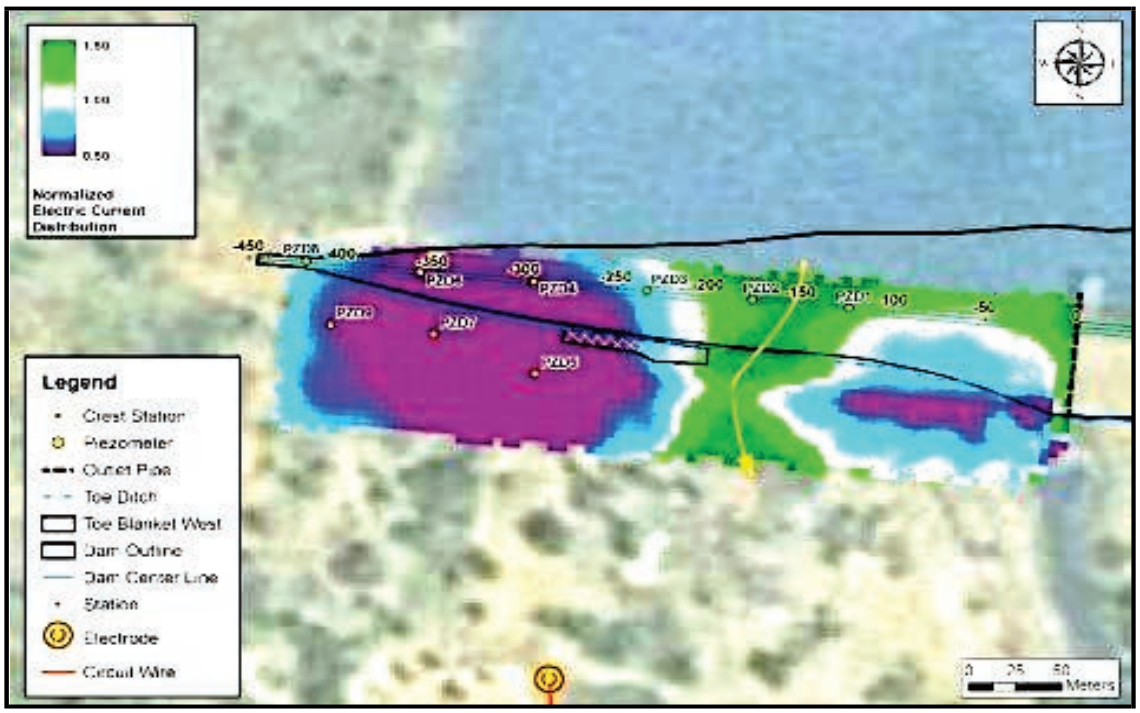

Fig. 9. Modelled seepage path in the right abutment

Critically the results of the Willowstick survey provided the exact locations of leaks/seeps where other techniques could not. This enabled the client to drive the piles to the correct depth to stop the leakage.

However, in the foundation there was a hard band through which the piling had difficulty to pass. With the contract for piling completed and the piling plant was demobilized the owner drilled a hole at the precise point indicated by the Willowstick survey – through that hard layer. Subsequently some 250 m^3 of grout was injected into a single void which, according to the owner's advisors, if it had not been found would have led to failure of the dam.

CONCLUSIONS

As our dams become older some feel that they deteriorate with time. Often our dams are used in different ways we often load them in different ways and in some cases there is at times a long standing erosion process going on which eventually develops to a degree that requires intervention.

Monitoring and surveillance by trained staff and instrumentation remain the foundation of trying to ensure the safety of dams on a day to day basis including those dams that are leaking/seeping.

However, there comes a time when it is necessary to carry out remedial works. At that time it becomes important to have techniques which can identify remedial works both in extent along the dam and to a depth which cuts off the seepage.

The techniques described in this paper has not only ensured the safety of dams, but has given confidence to the owners that no other leakage paths exist – a very useful asset management tool used by some companies at say 5 yearly intervals to decide whether the situation at a particular dam is deteriorating or not.

The targeted remedial works enabled by the Willowstick technique has saved hundreds of thousands of pounds for the client when compared with traditional approaches.

SUMMARY

Dams around the world are getting older. Sites for new dams are becoming more demanding with the 'best' sites having been used. Remedial works and renovation are becoming the staple diet of many dam engineers. The problems faced are many and various from spillway renovation works and projects to increase capacity, to removal of valves and pipework, to improvements associated with stability and works to improve the resistance to internal erosion and piping failures, and works to stem leakage.

This paper looks at a number of projects where leakage and elderly earthfill dams had progressed to a point where some sort of intervention was necessary.

ОГЛАВЛЕНИЕ

Н.В.Попова, О.И.Беляева

ГИДРОТЕХНИЧЕСКОЕ СТРОИТЕЛЬСТВО
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